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Factory Workshop Manual

Make

Ford

Model

Ranger 2wd

Engine and year

V6-3.0L (2008)

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This manual was submitted by

Anonymous

Date

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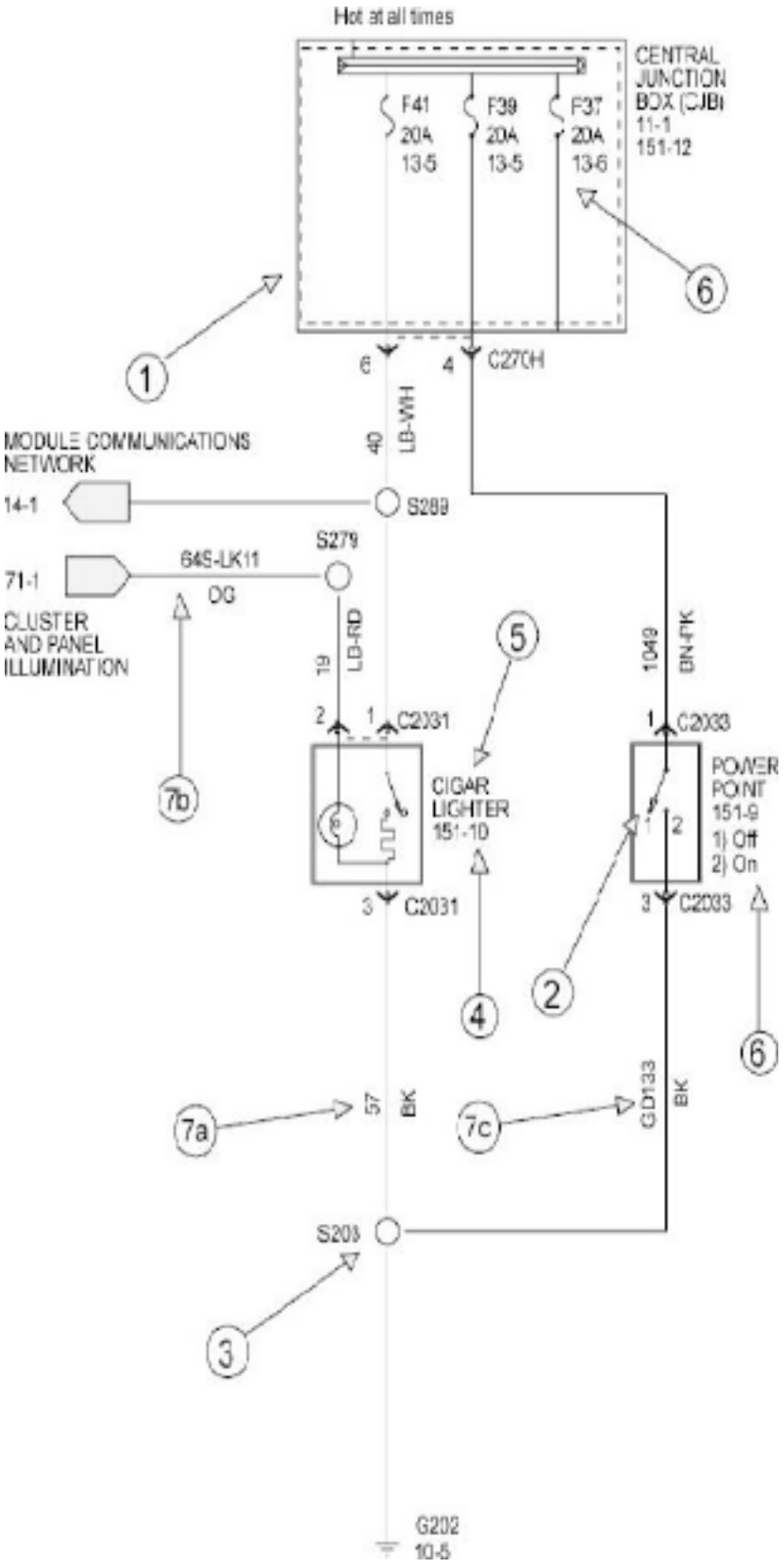
Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Relays and Modules > Relays and Modules - Accessories and Optional Equipment > Accessory Delay Module > Accessory Delay Relay > Component Information > Diagrams > Diagram Information and Instructions



Accessory Delay Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

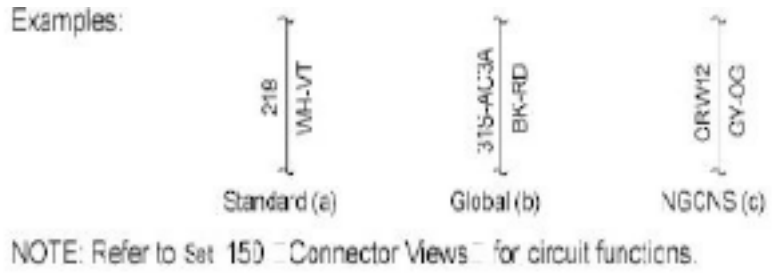
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

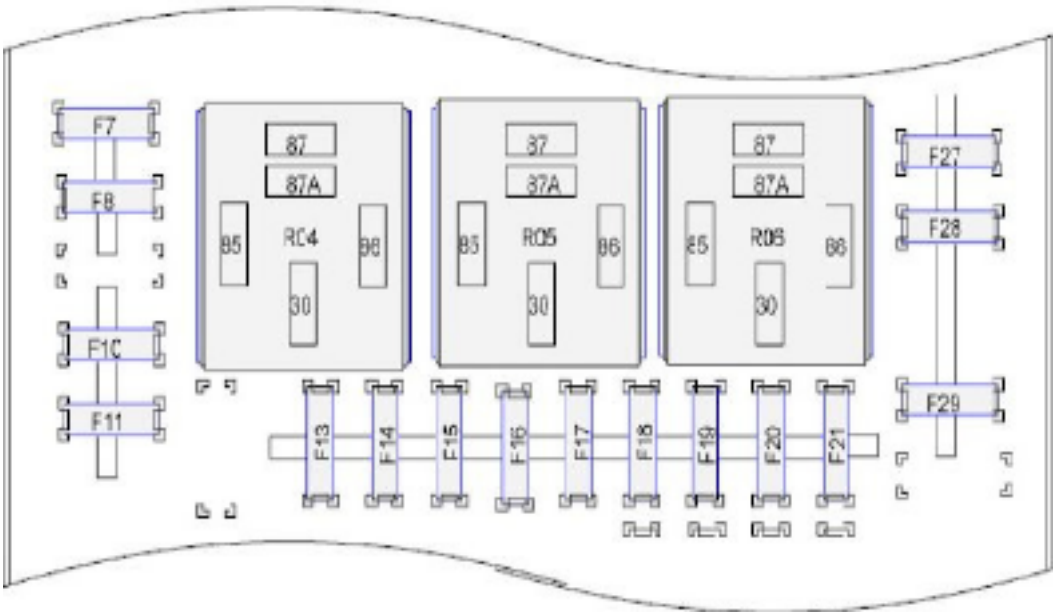
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

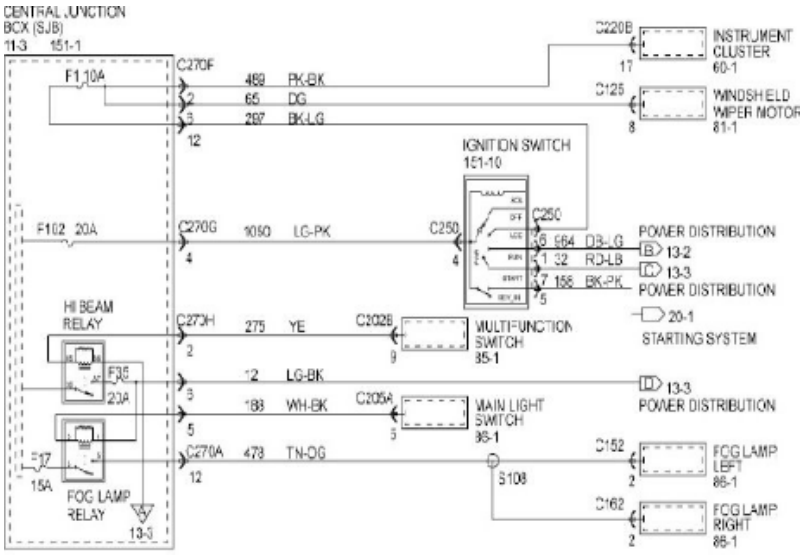
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

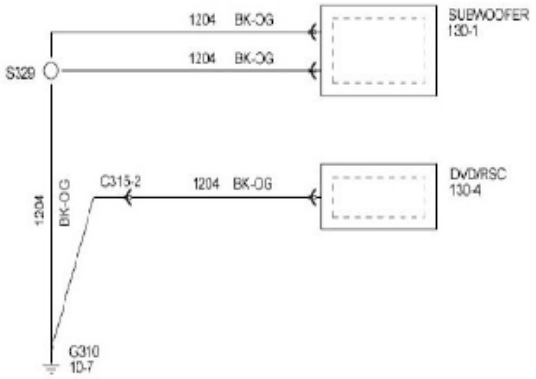
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by

each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

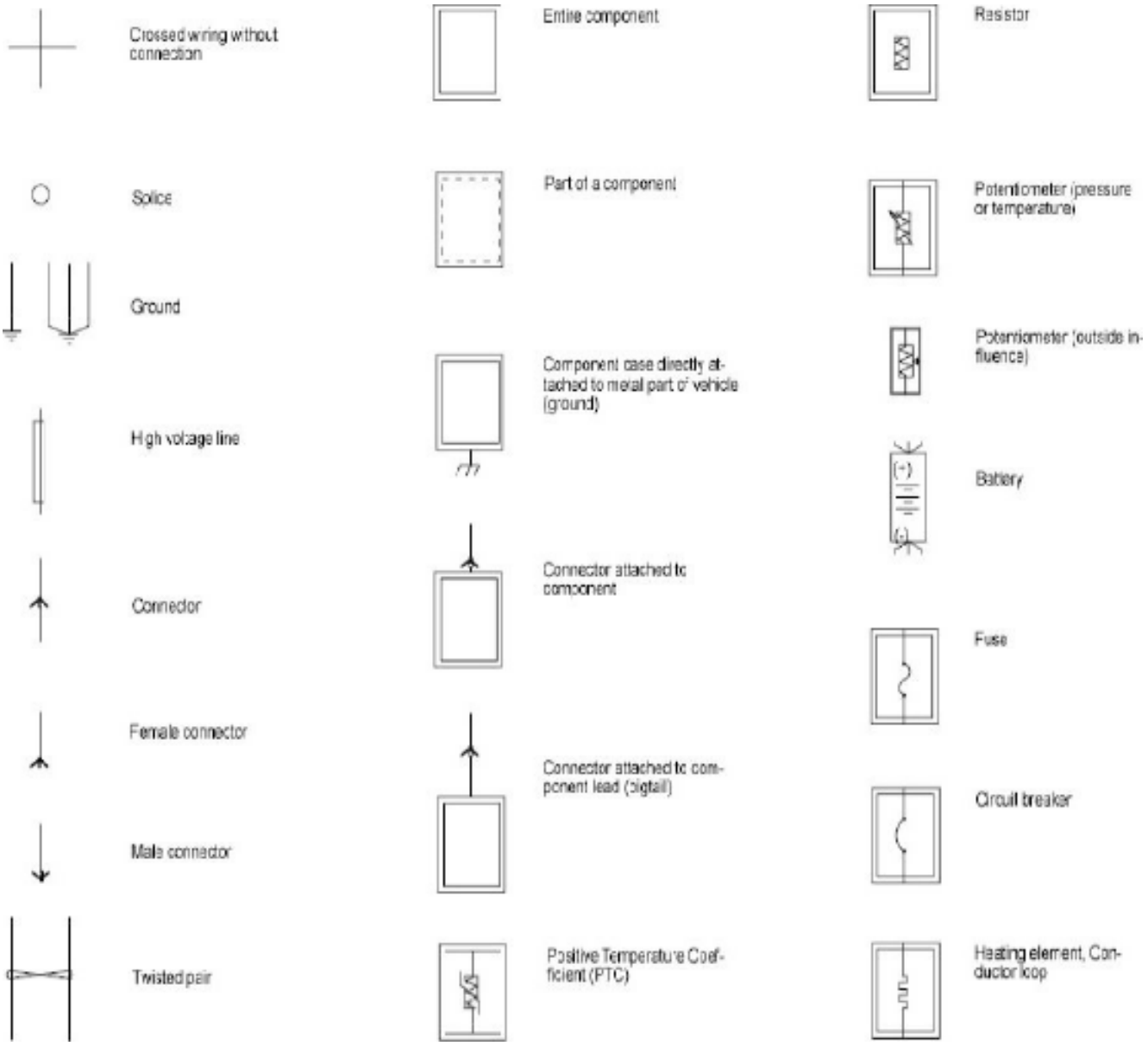
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

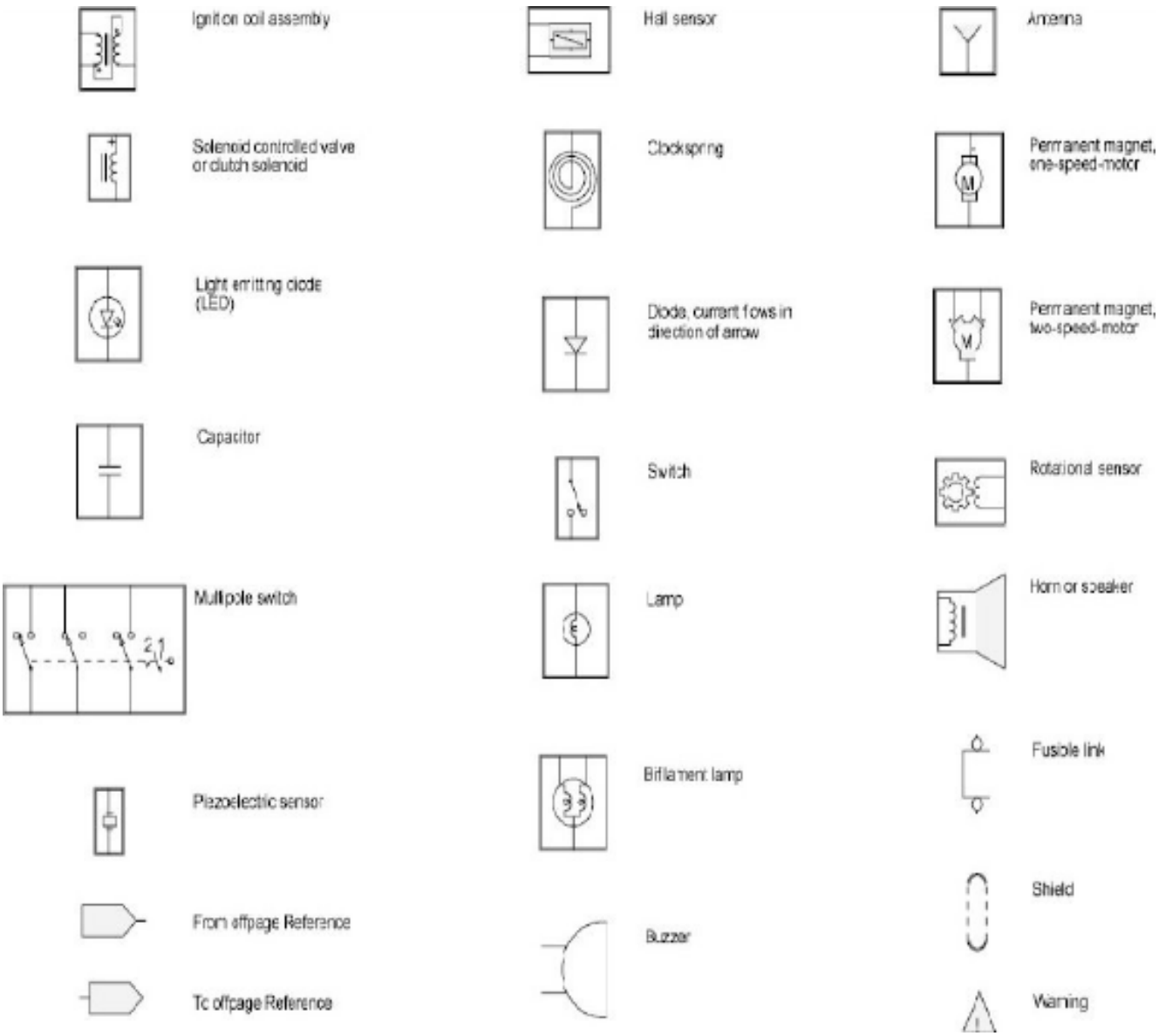
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

Symbols (Part 1)



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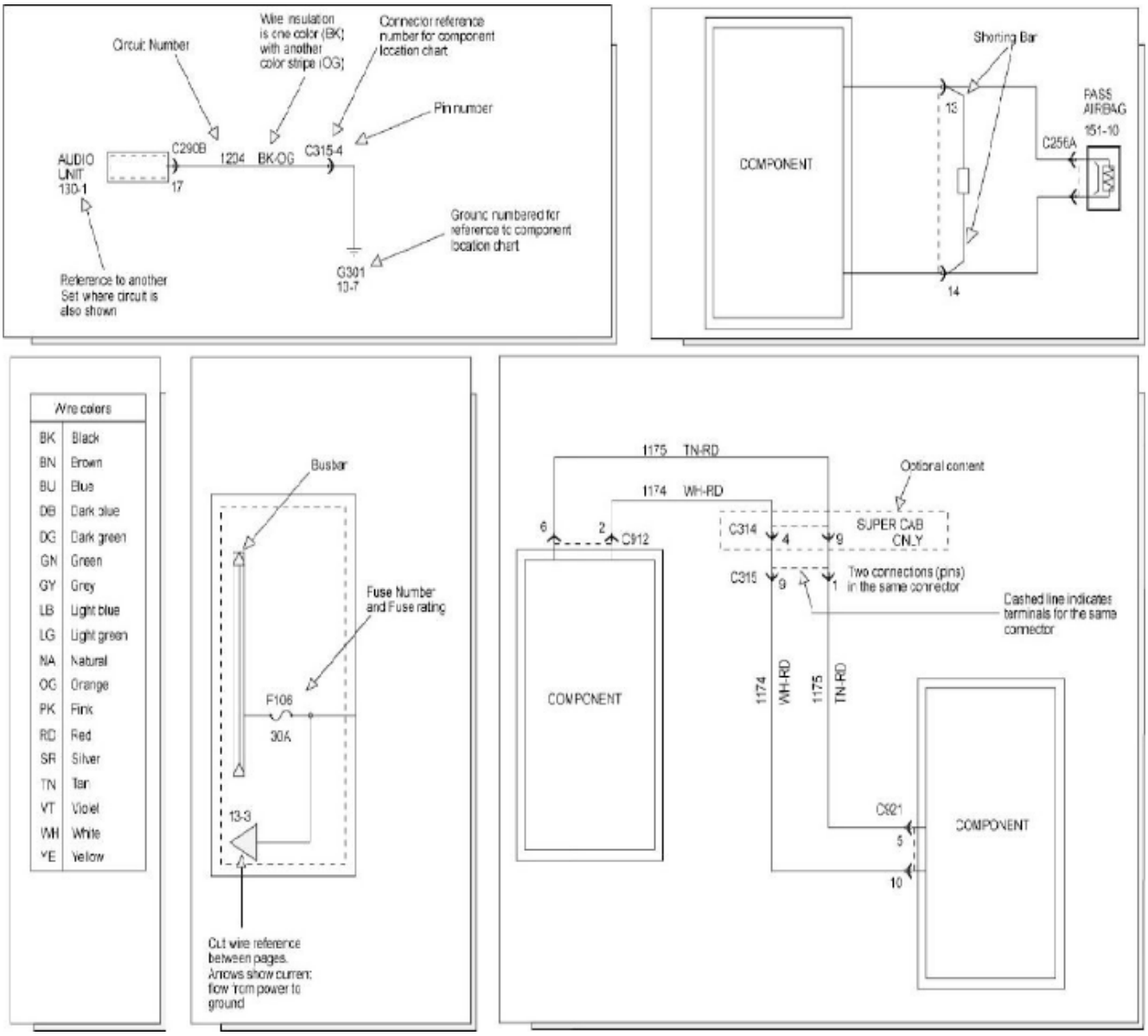
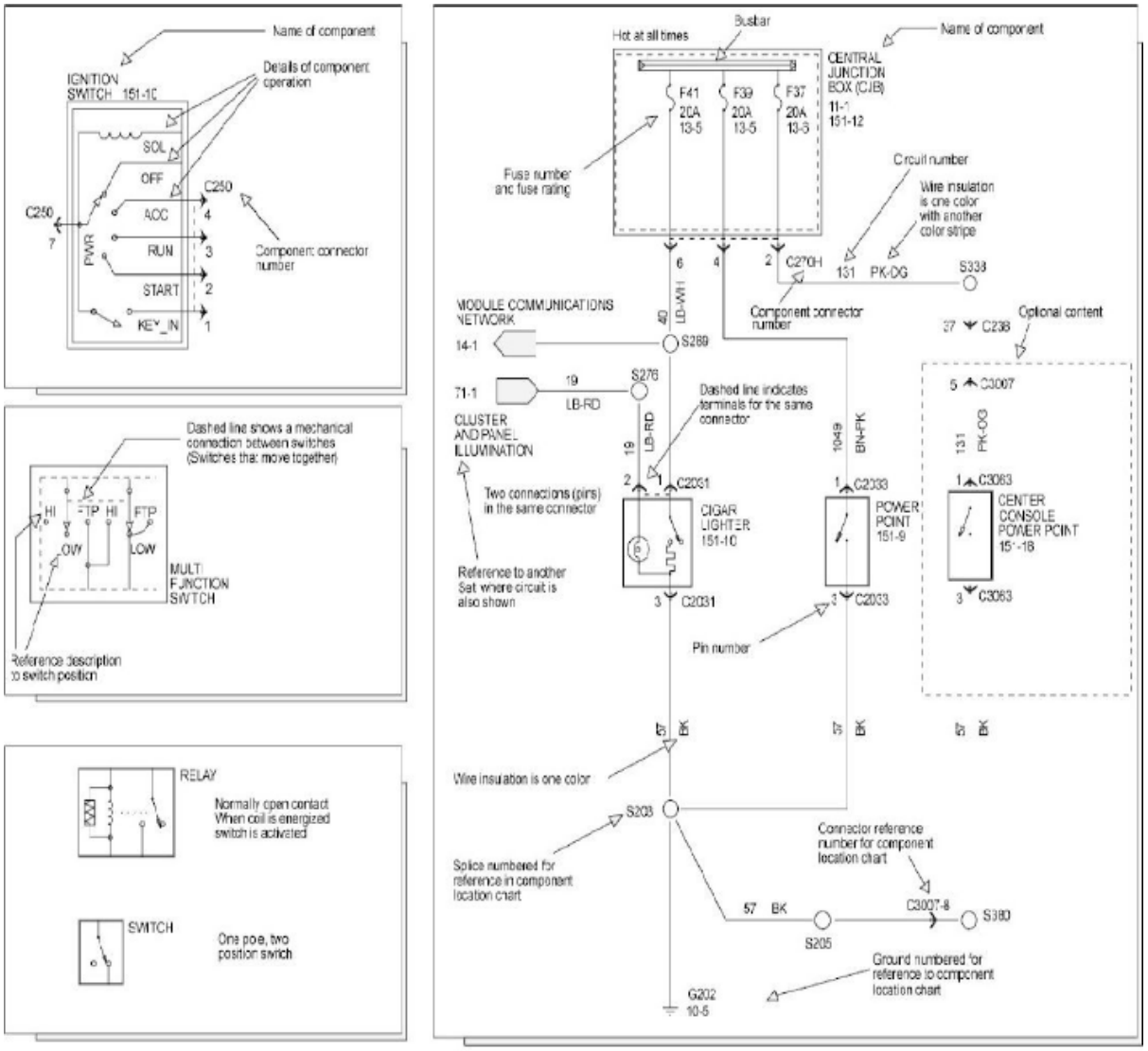


Symbols (Part 3)

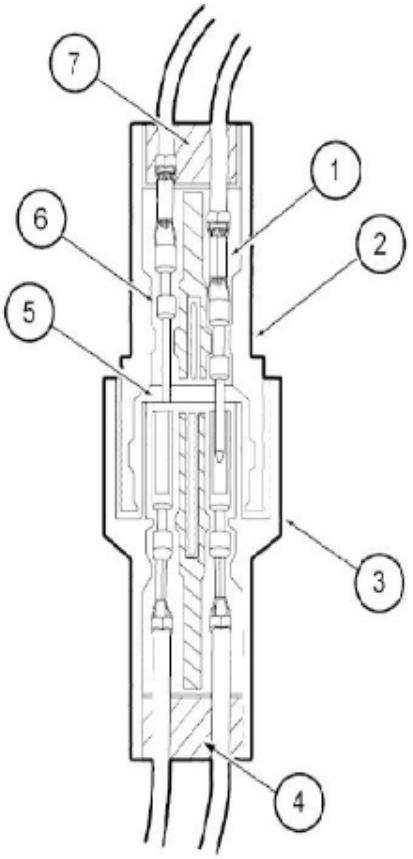


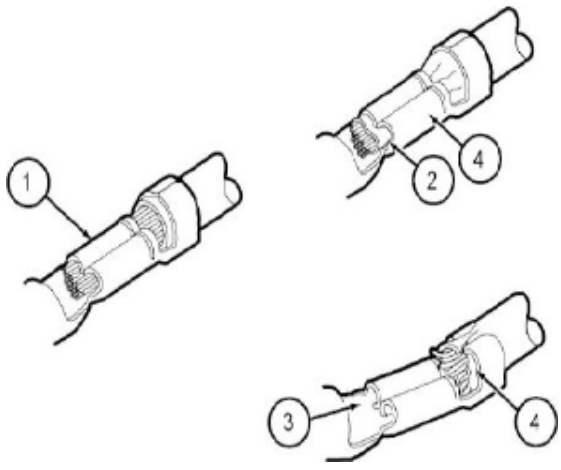
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)





Accessory Delay Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

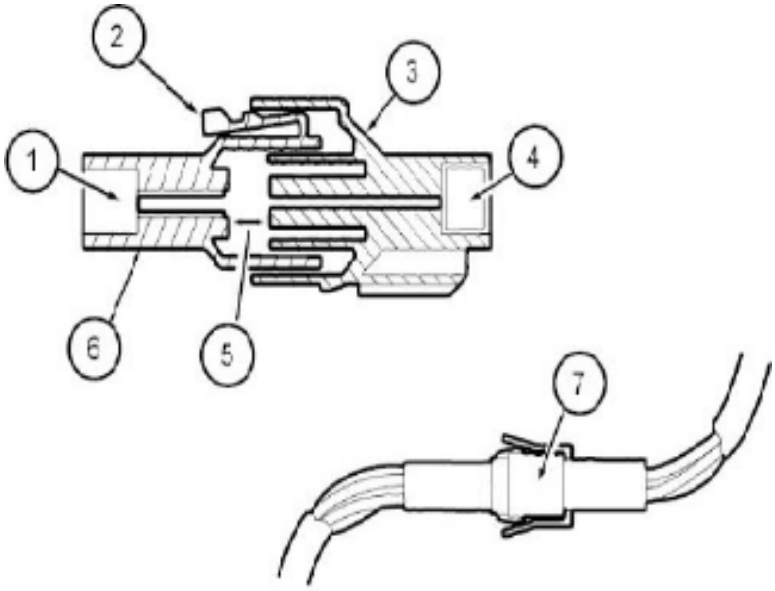
5 = Intermittent contact

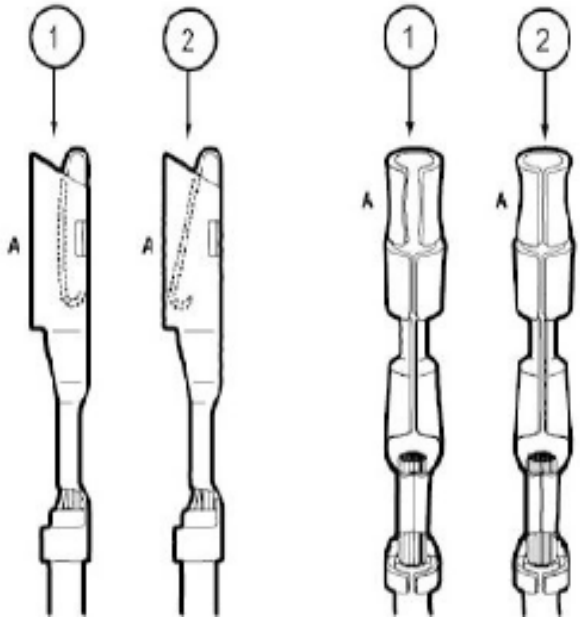
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping





1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

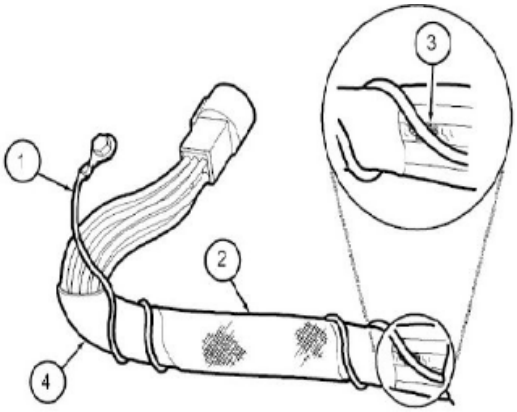
Deformed (enlarged) female terminals

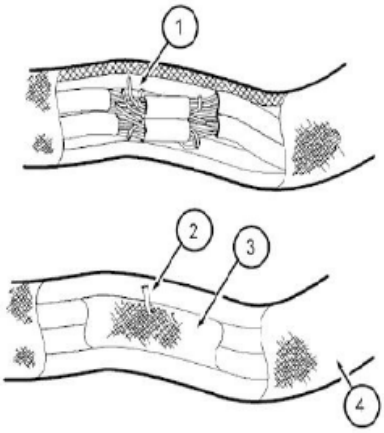
1 = Enlarged

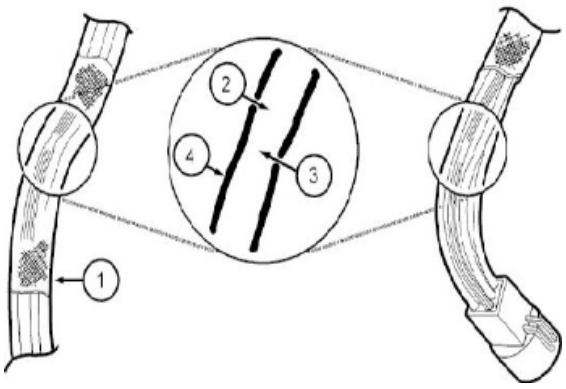
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.







Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

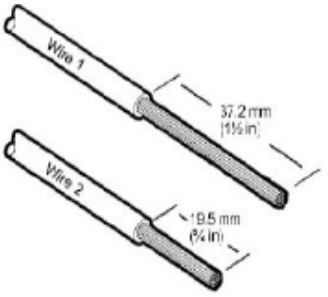
Splice covered 2

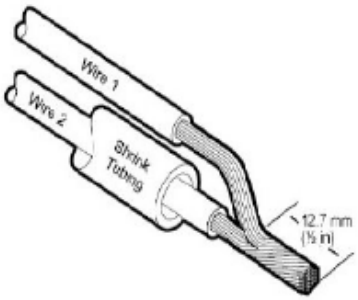
= Wire strand

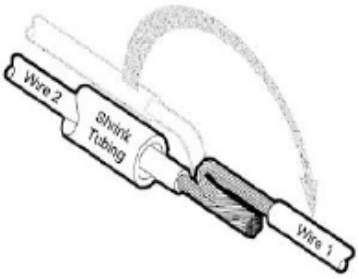
3 = Splice tape

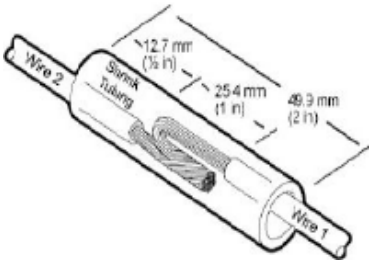
4 = Harness tape

Broken wire strands in harness









1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. lnstall heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

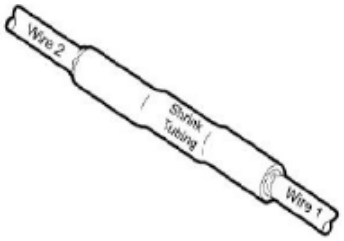
NOTE: -

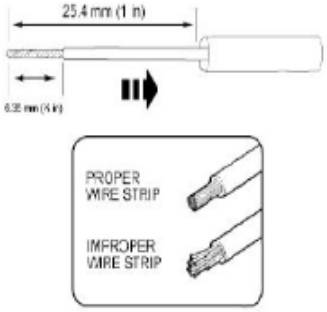
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

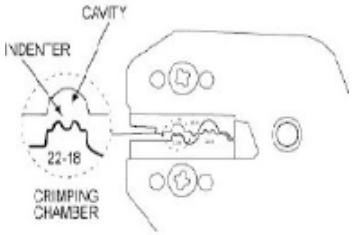
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

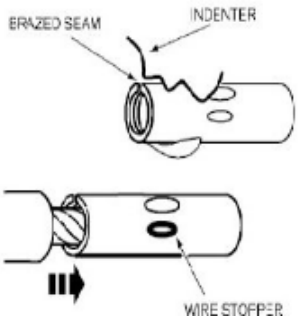
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.









7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

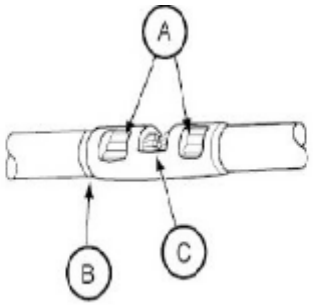
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

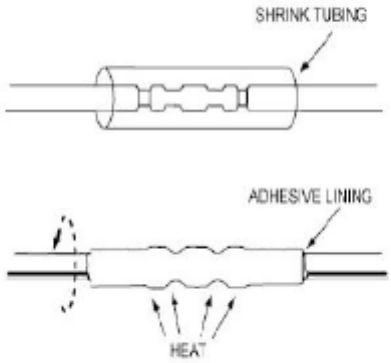
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4 strip, cut 9 strands	* 1/4 strip, cut 2 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip, fold 3x dia.
	16-14	* 1/4 strip, cut 7 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip fold 2x dia	1 strip, fold 3x dia.	1 1/4 strip, fold 4x dia.	Not Recommended
	12-10	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip, fold 3x cia.	1 1/4 strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Pigtail only

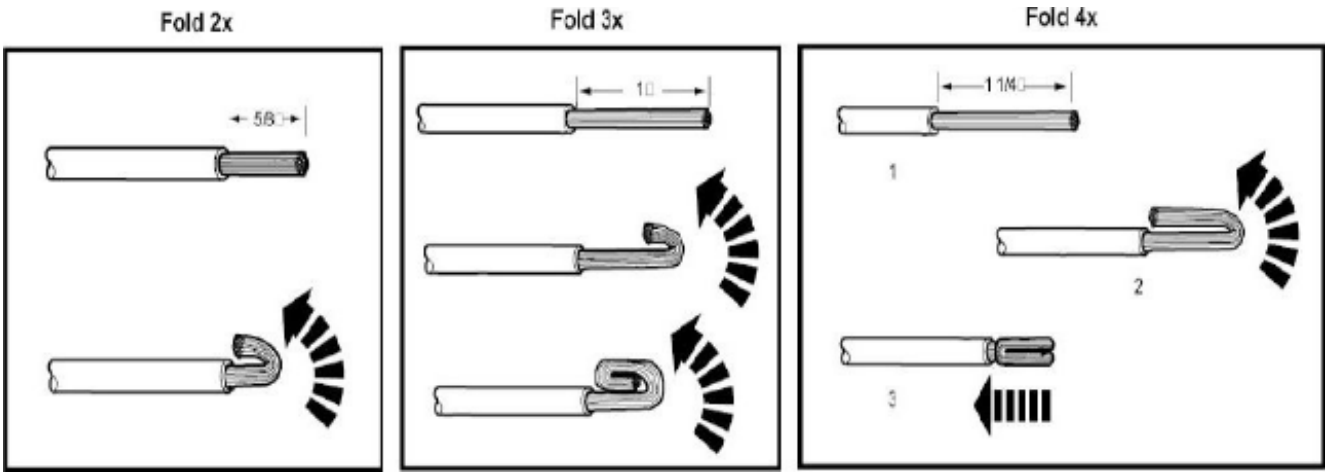
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



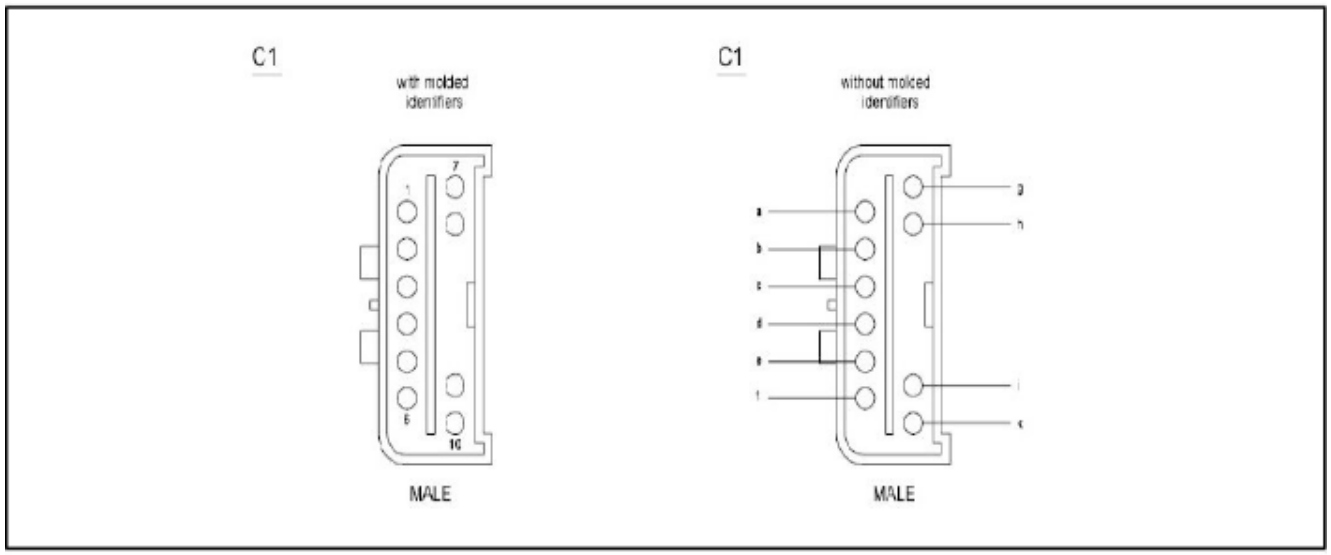
The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



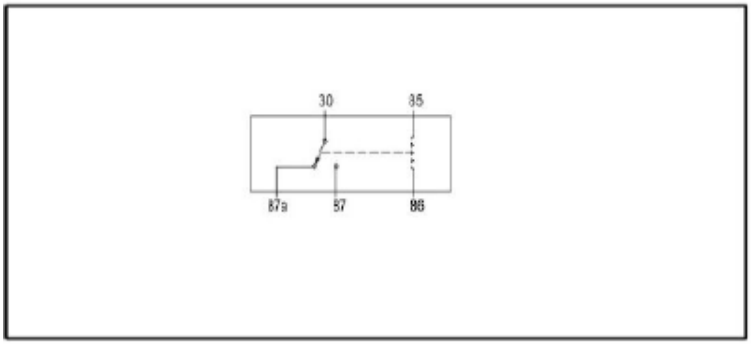
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

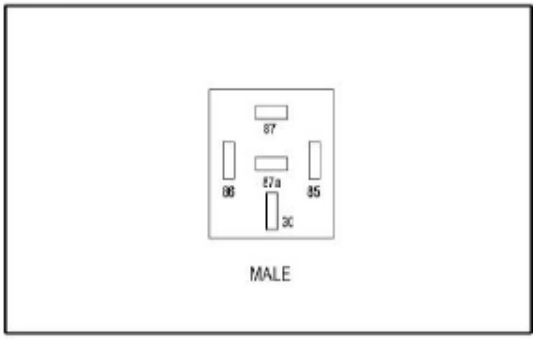
Accessory Delay Relay: Testing and Inspection Mini ISO Relay

Relay □ Mini ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

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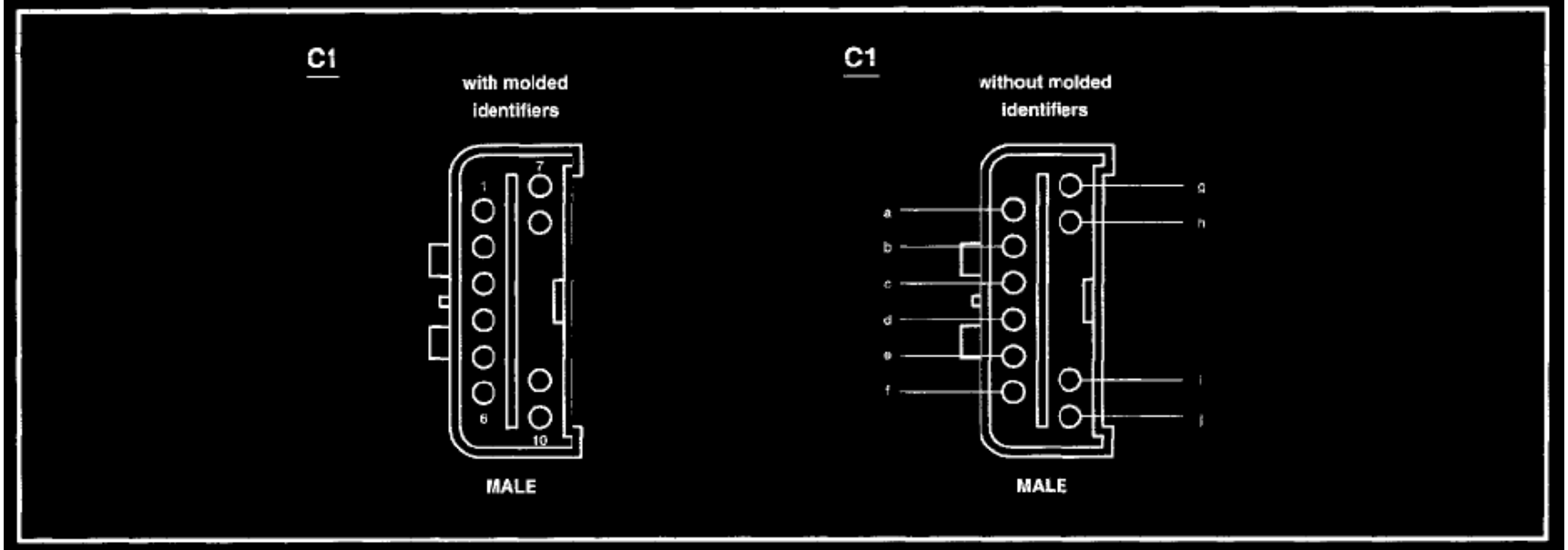
Terminals



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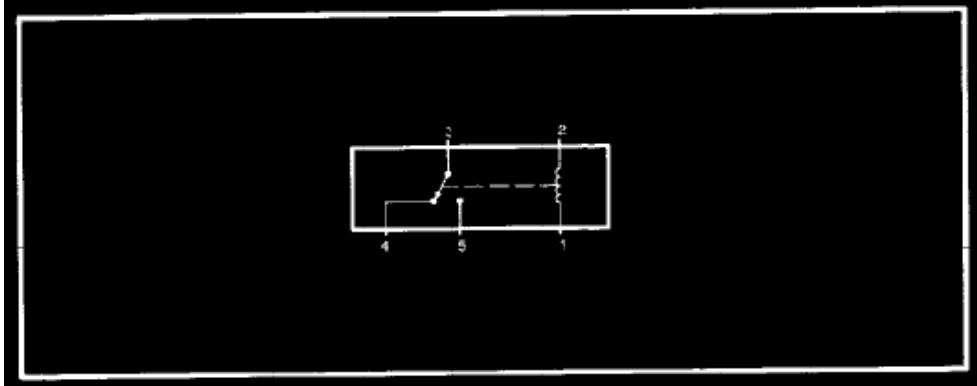
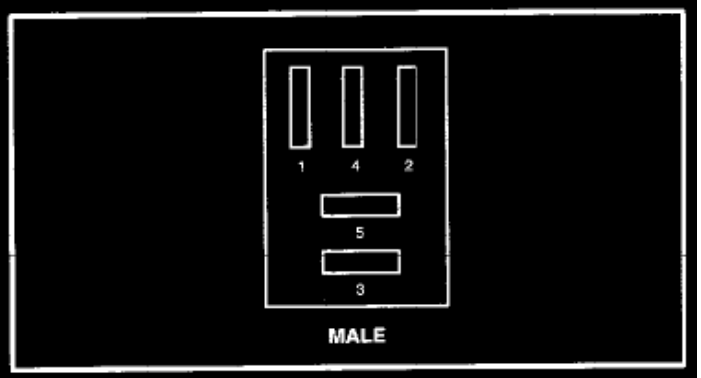
Accessory Delay Relay: Testing and Inspection Micro ISO Relay

Relay – Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63–102Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil – Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

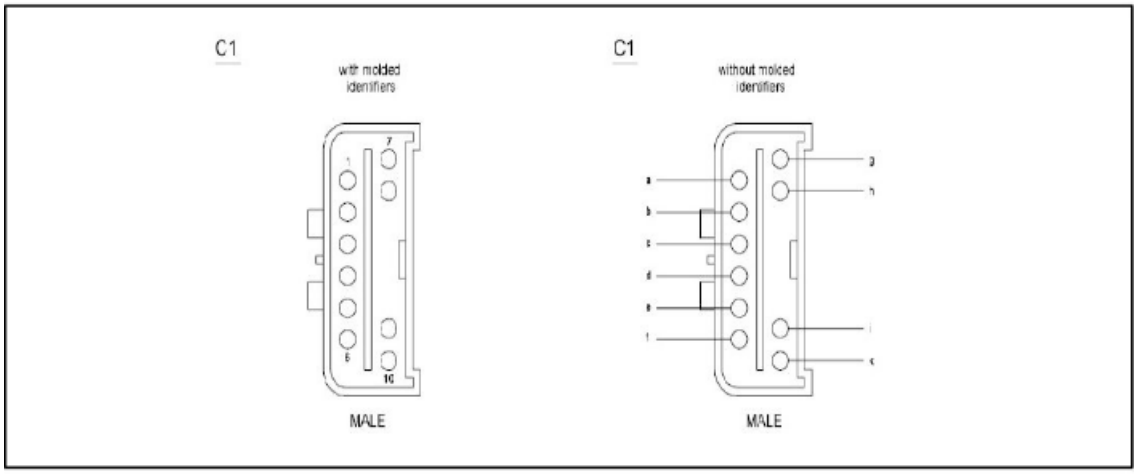
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals

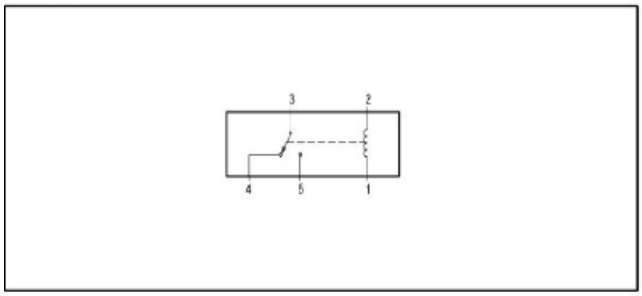


The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

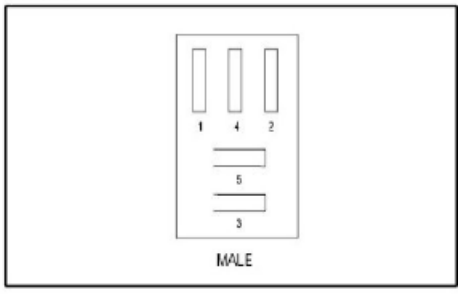
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Relay - Micro ISO

Schematic



Terminals



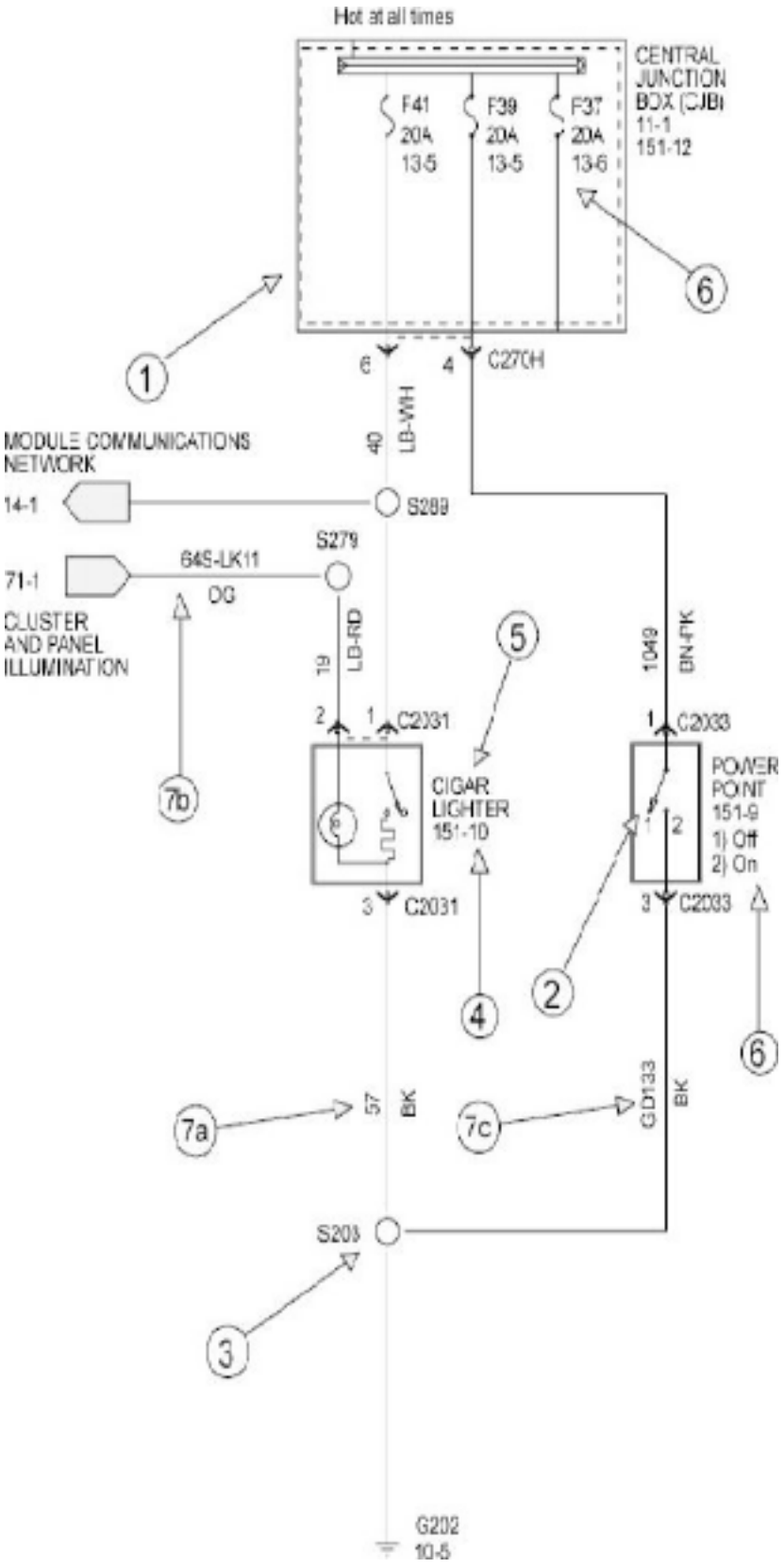
Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63-102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil - Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Relays and Modules > Relays and Modules - Body and Frame > Power Door Lock Relay > Component Information > Diagrams > Diagram Information and Instructions



Power Door Lock Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

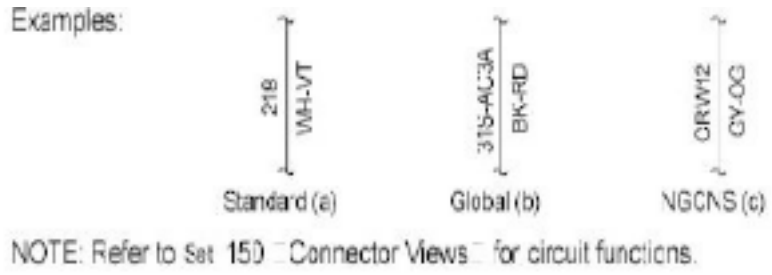
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

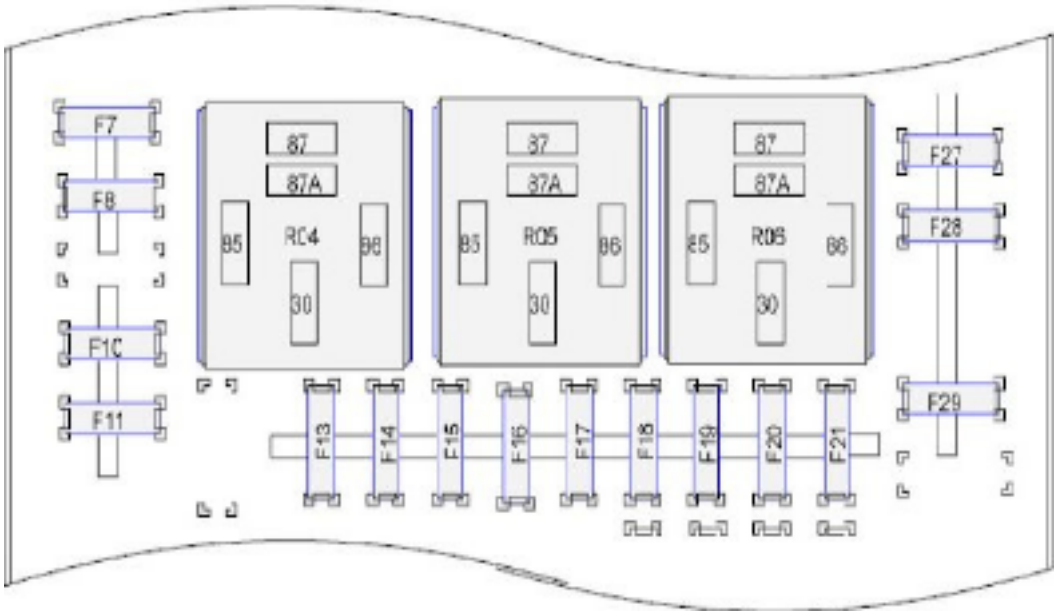
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

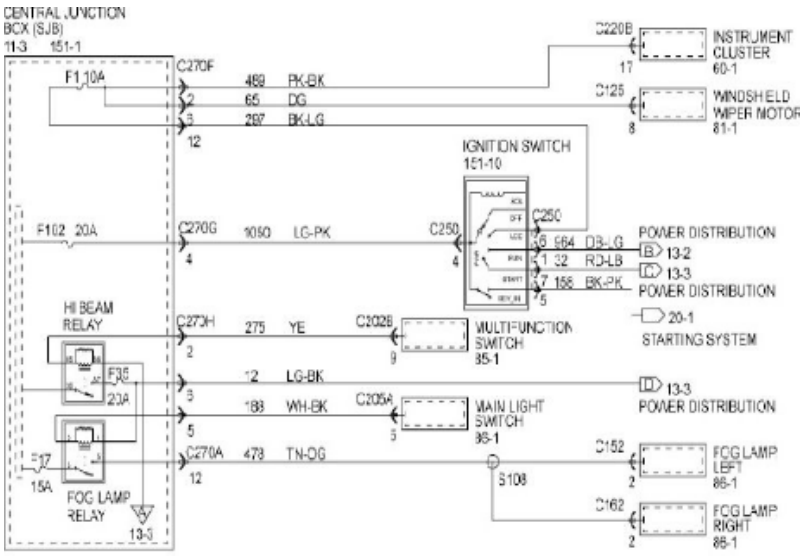
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

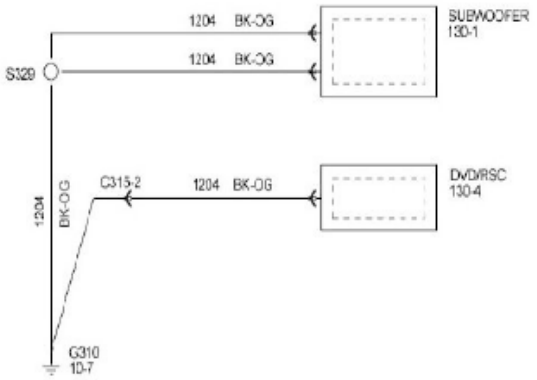
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

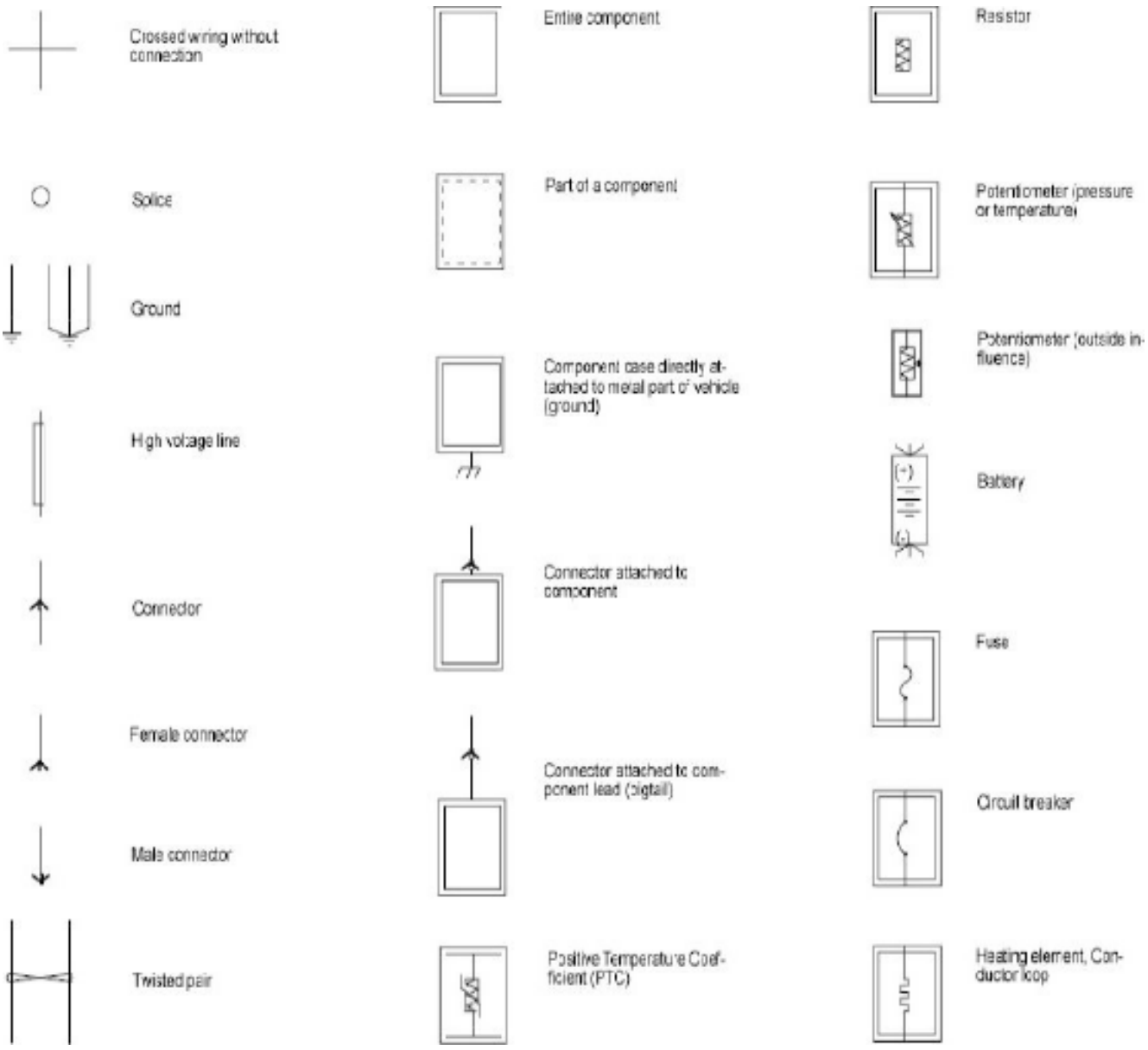
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

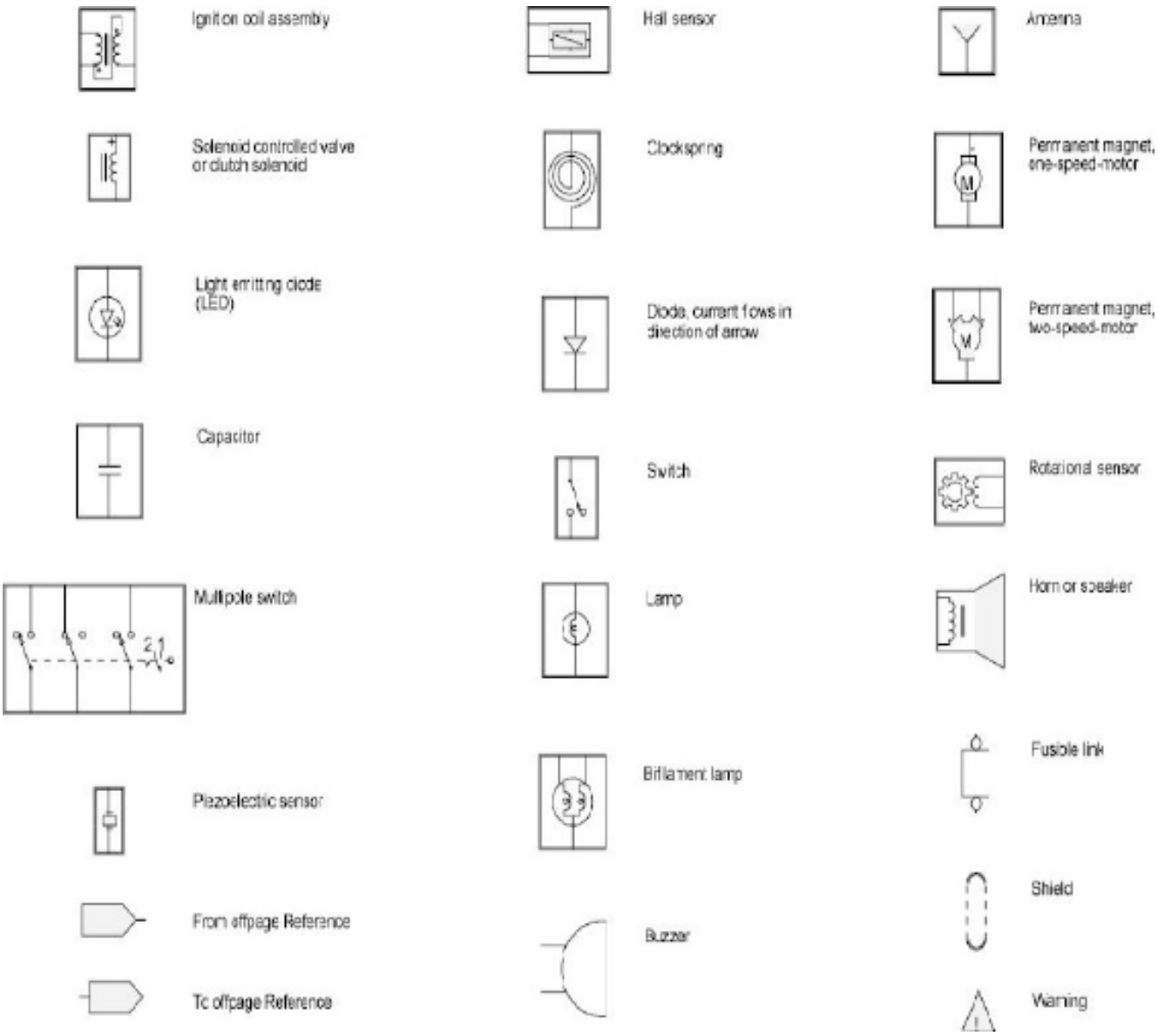
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

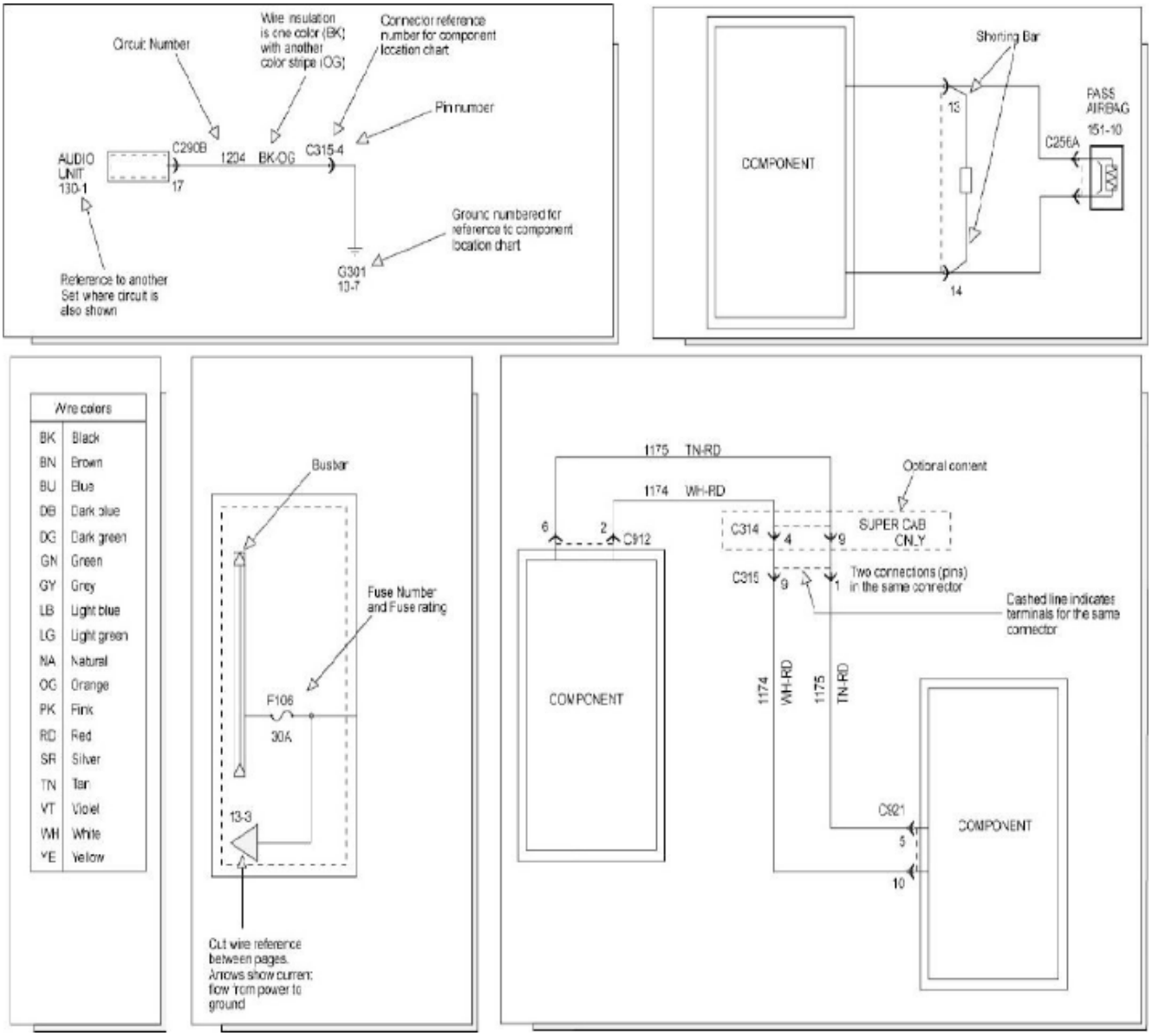
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

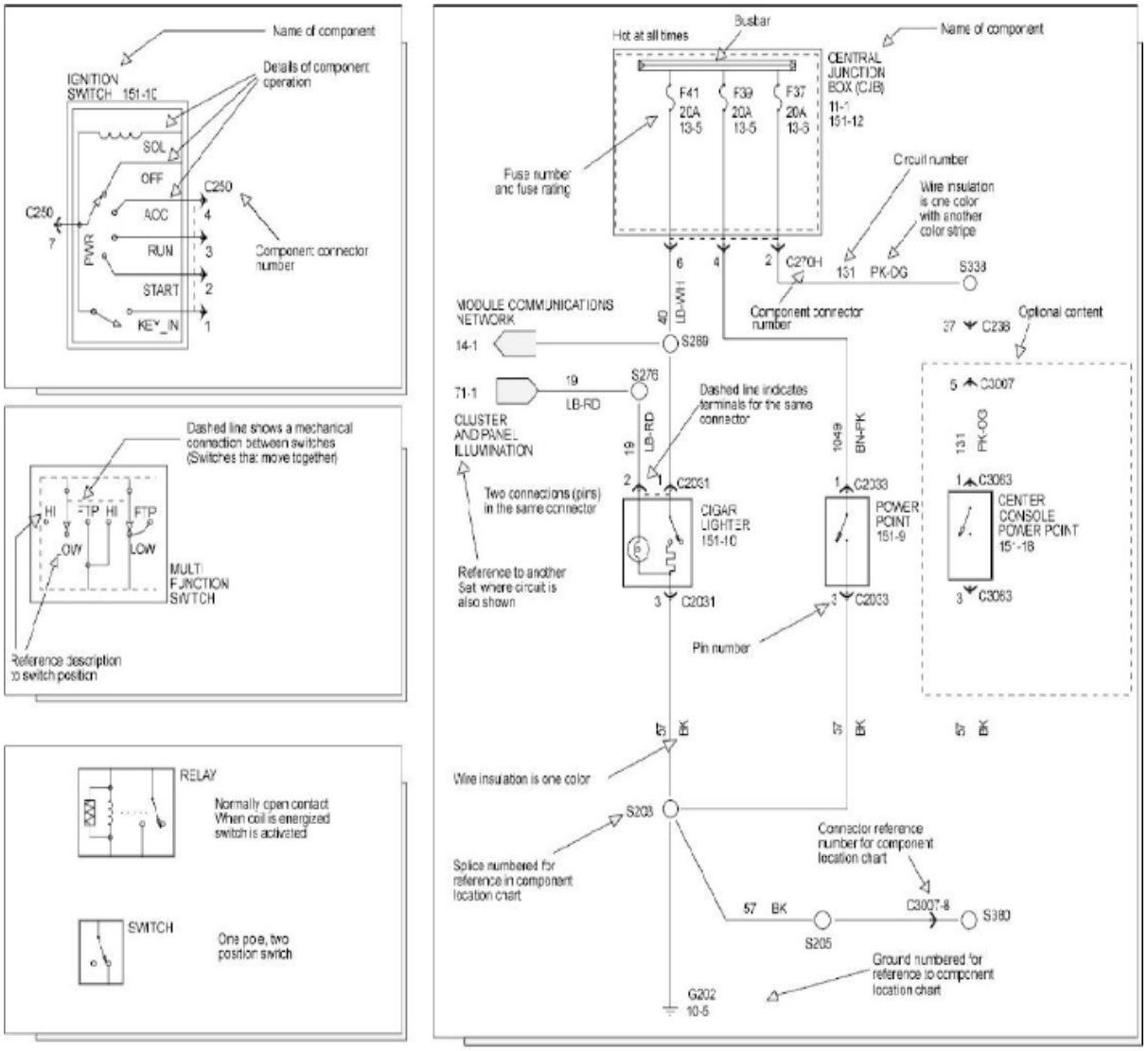
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

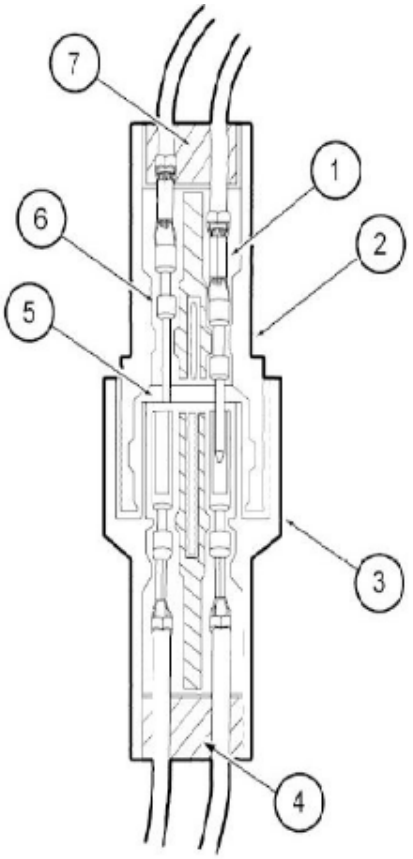


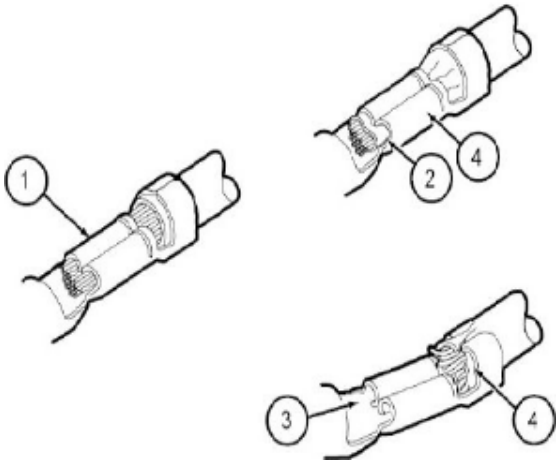
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Power Door Lock Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

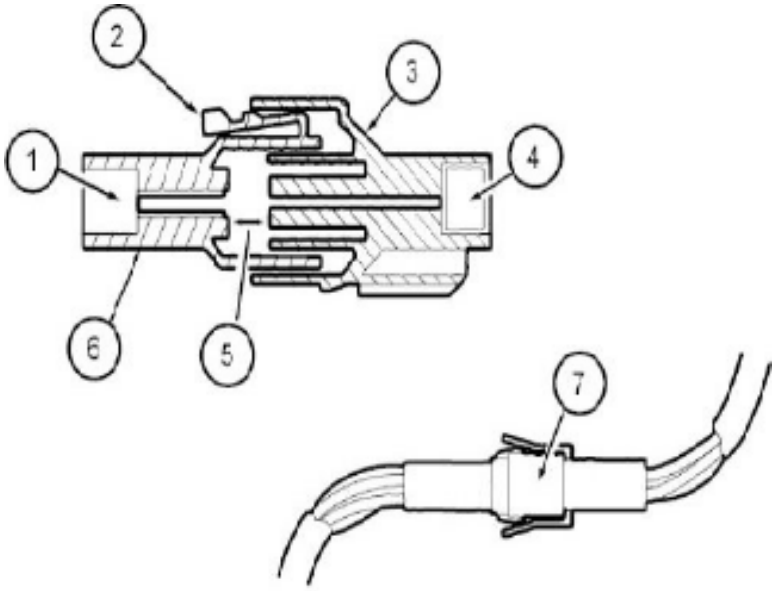
5 = Intermittent contact

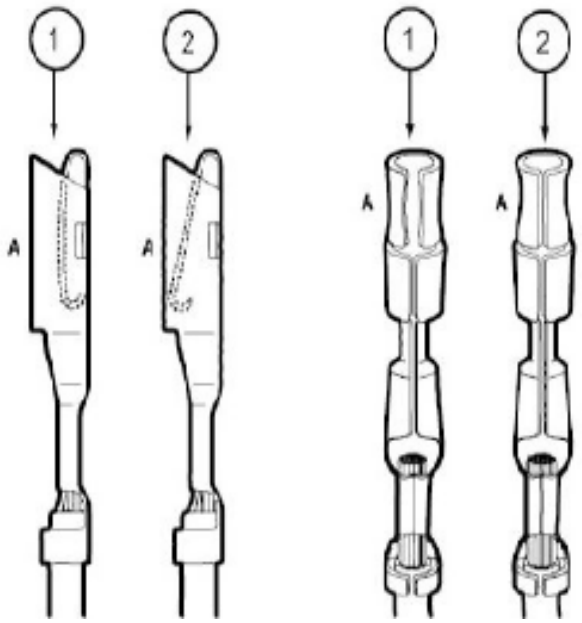
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

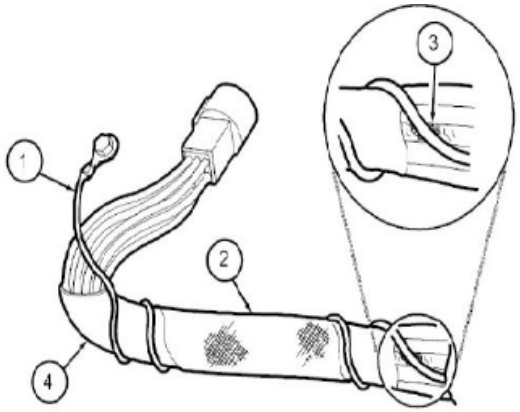
Deformed (enlarged) female terminals

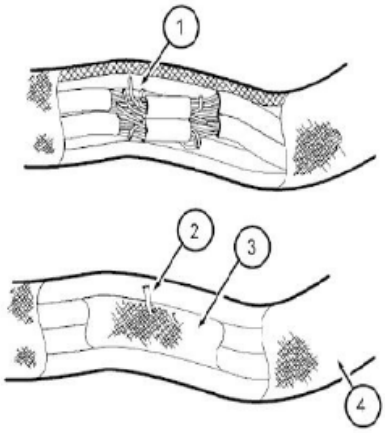
1 = Enlarged

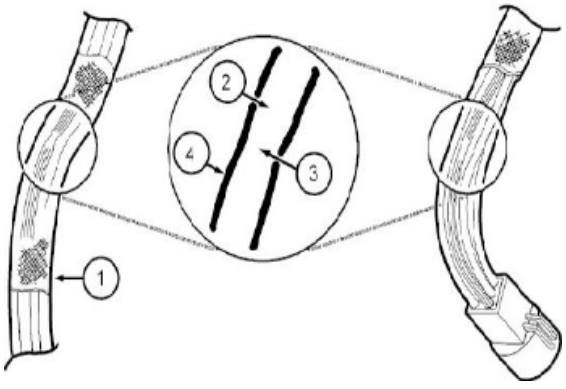
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

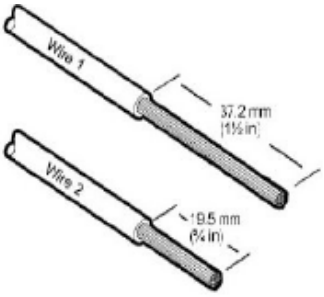
Splice covered 2

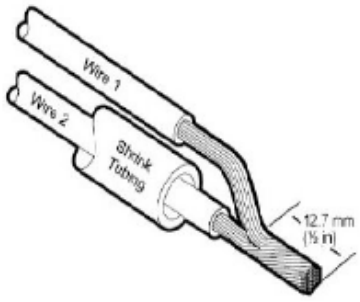
= Wire strand

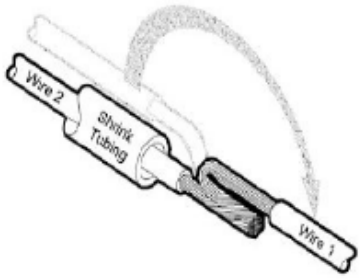
3 = Splice tape

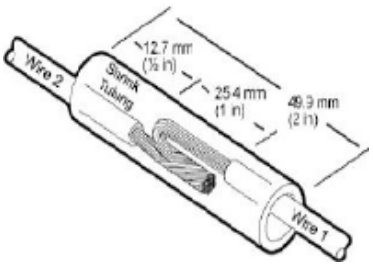
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

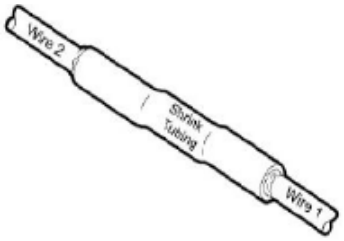
NOTE: -

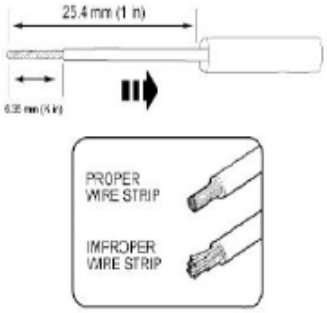
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

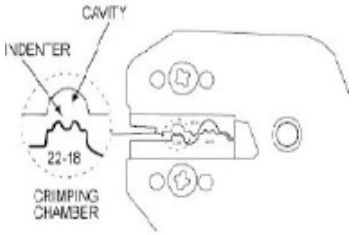
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

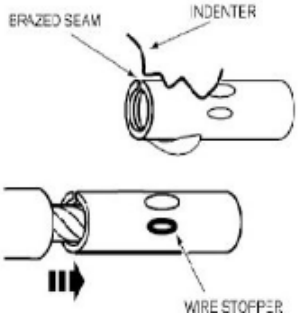
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
6.35 mm (¼ in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

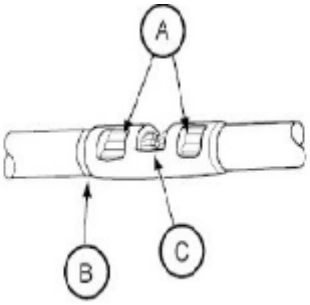
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

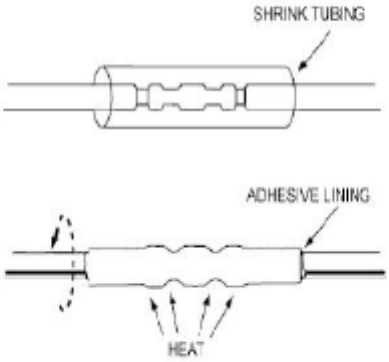
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4 strip, cut 9 strands	* 1/4 strip, cut 2 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip, fold 3x dia.
	16-14	* 1/4 strip, cut 7 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip fold 2x dia	1 strip, fold 3x dia.	1 1/4 strip, fold 4x dia.	Not Recommended
	12-10	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip fold 3x dia.	1 1/4 strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Pigtail only

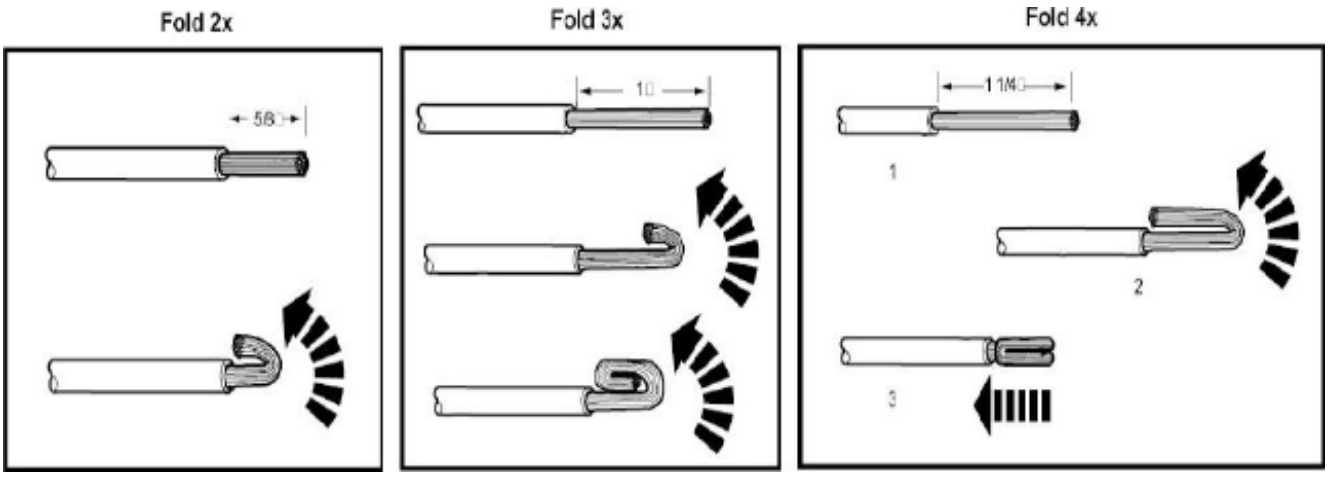
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



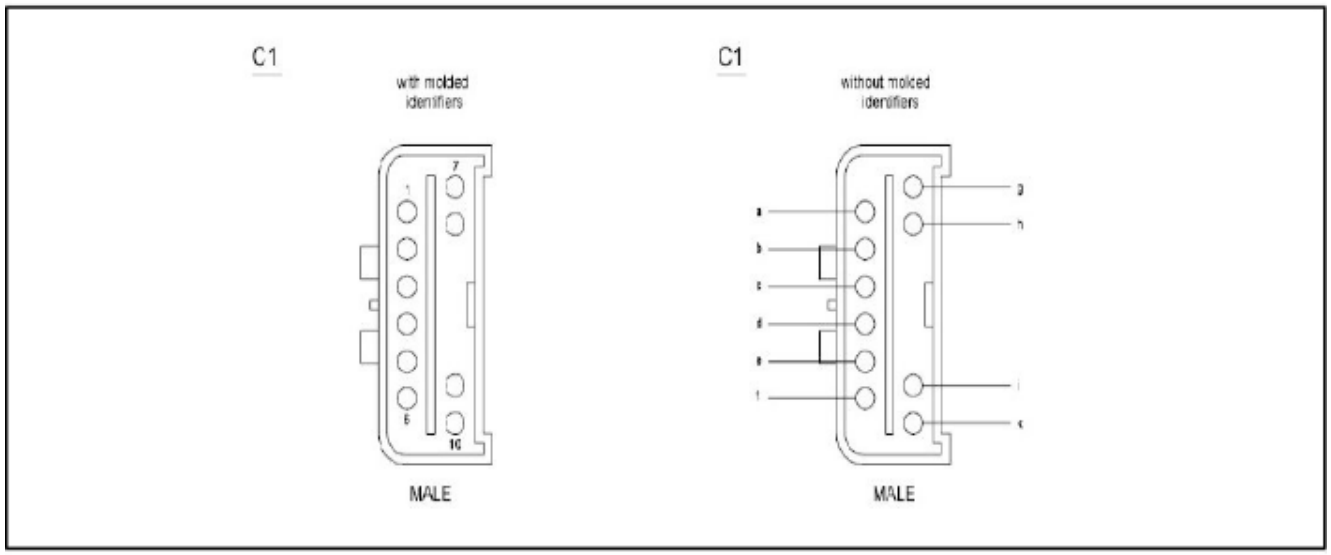
The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



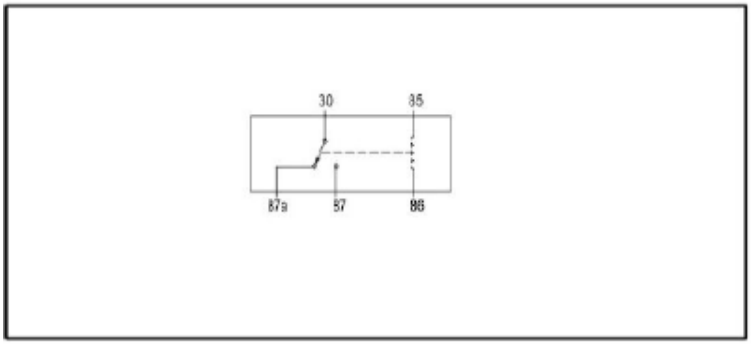
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

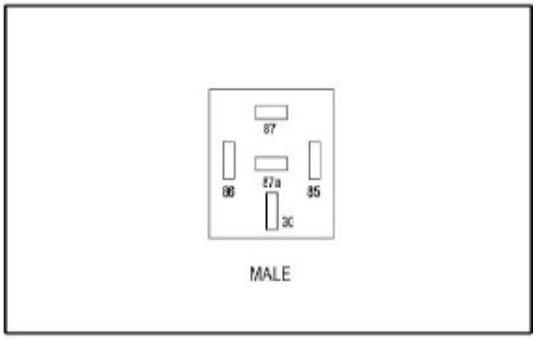
Power Door Lock Relay: Testing and Inspection Mini ISO Relay

Relay □ Mini ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

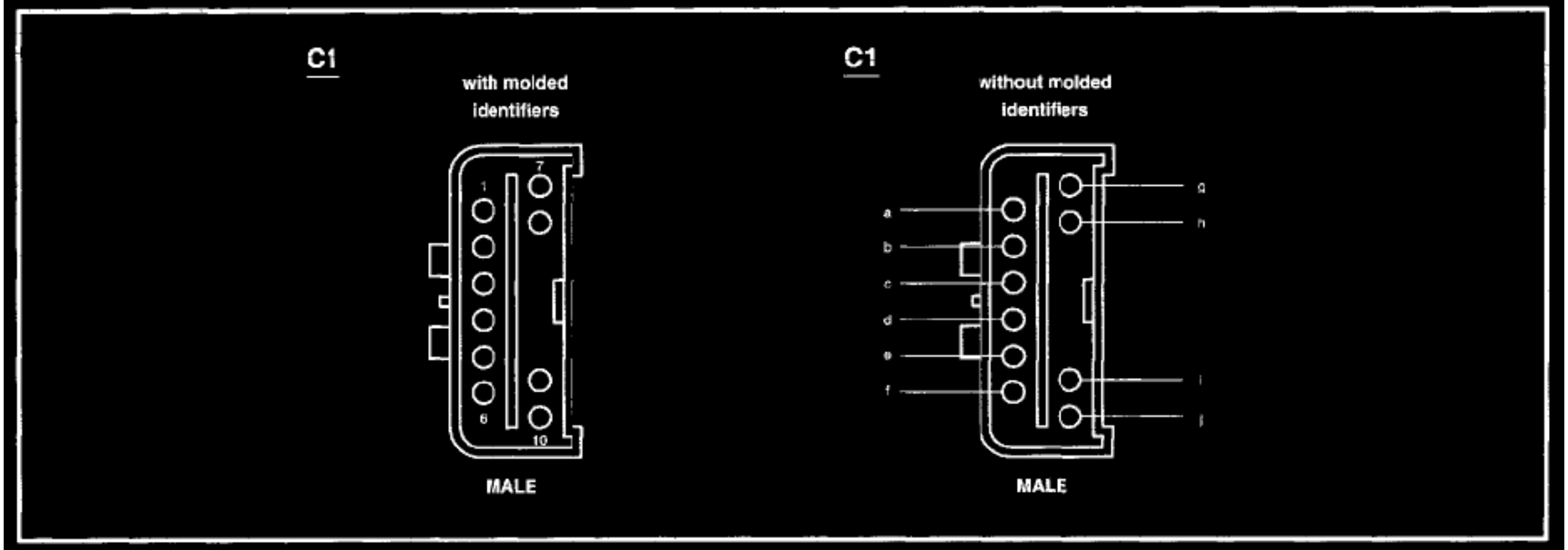
Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step–by–step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



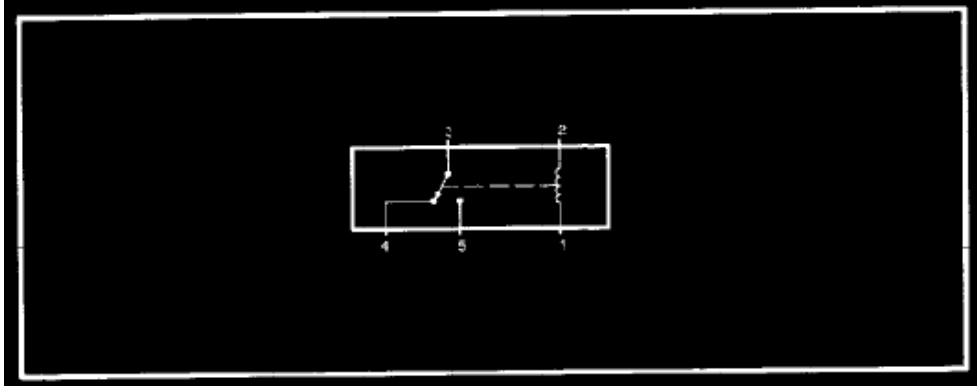
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

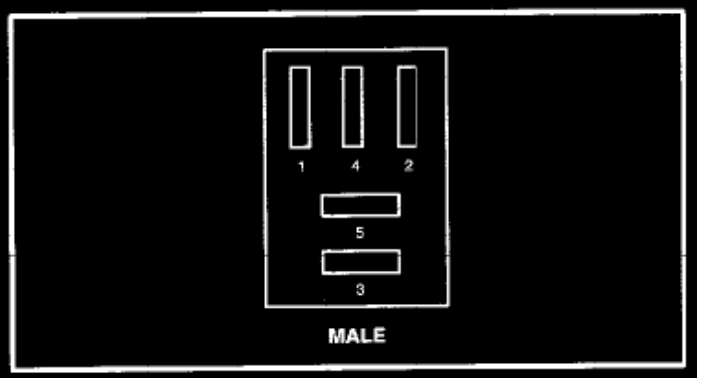
Power Door Lock Relay: Testing and Inspection Micro ISO Relay

Relay – Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63–102Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil – Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

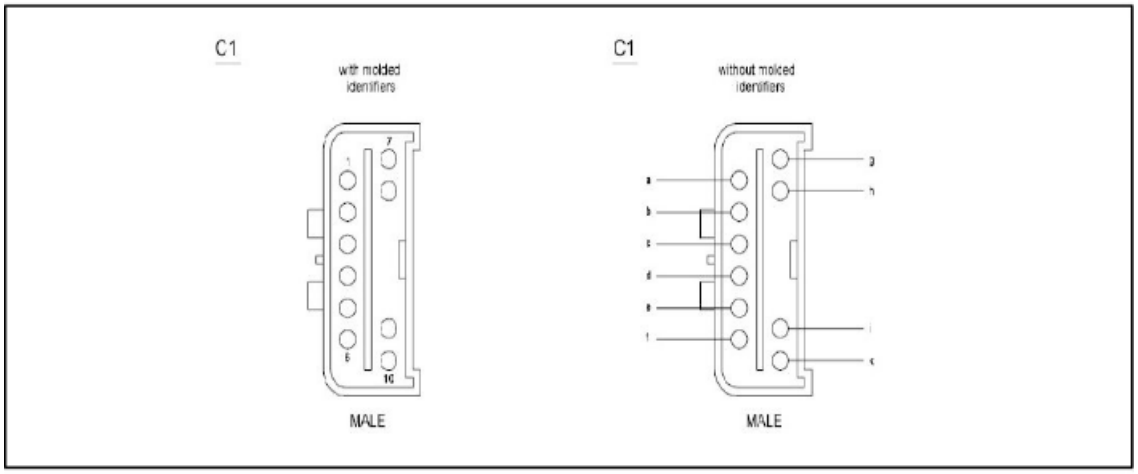
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step□by□step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals

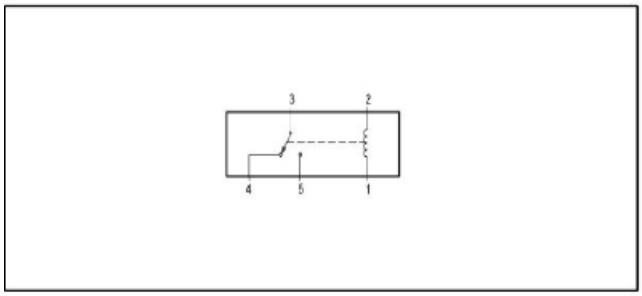


The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column □Circuit to test□. If you wish to test the complete component, perform all tests.

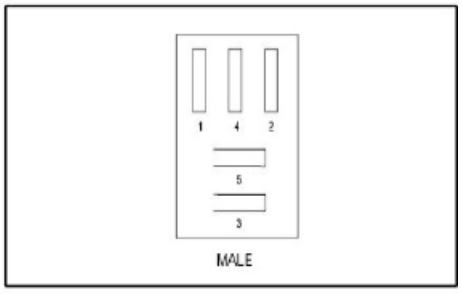
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Relay □ Micro ISO

Schematic



Terminals



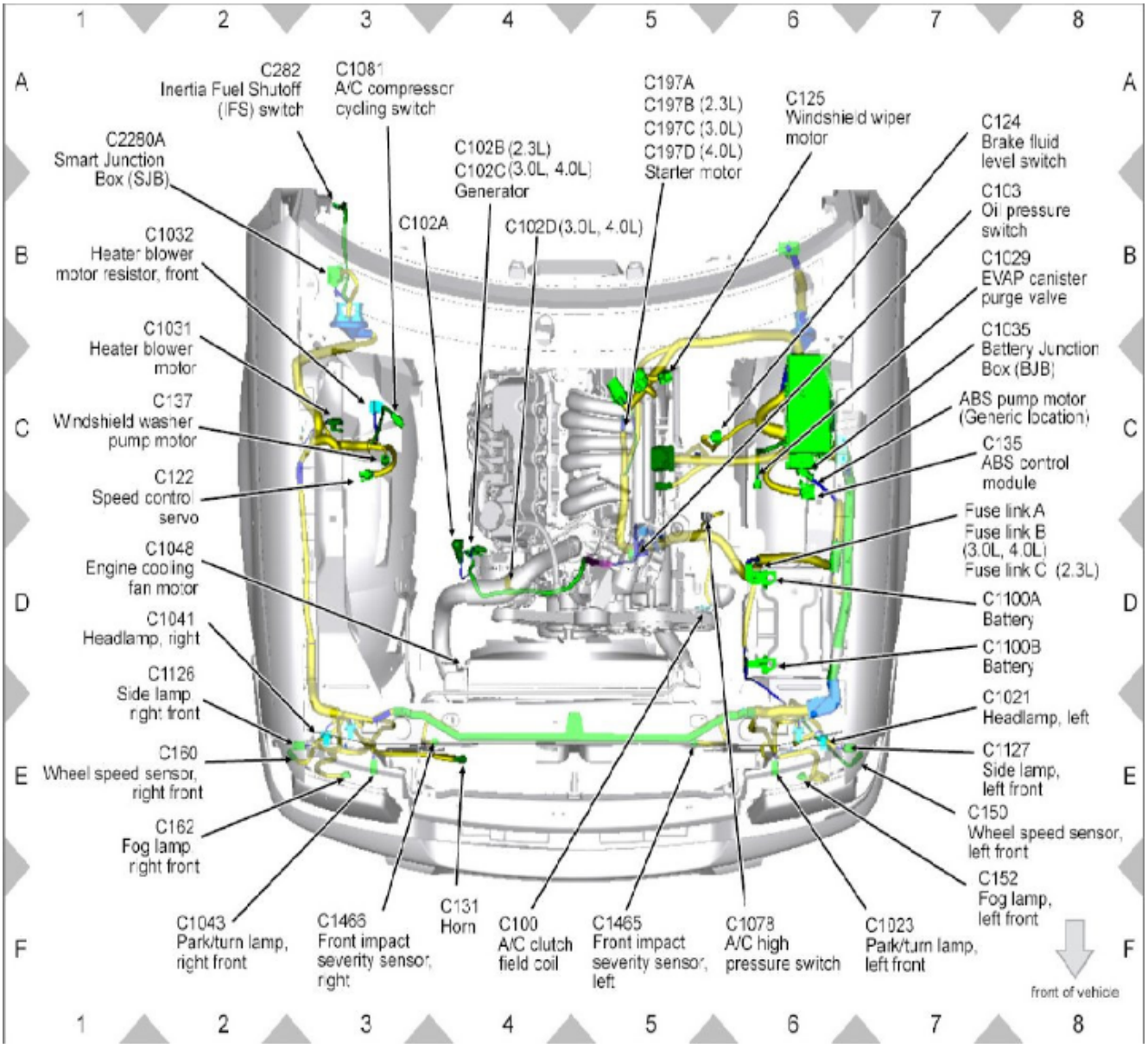
Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63□102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil □ Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Relays and Modules > Relays and Modules - Brakes and Traction Control > Electronic Brake Control Module > Component Information > Locations



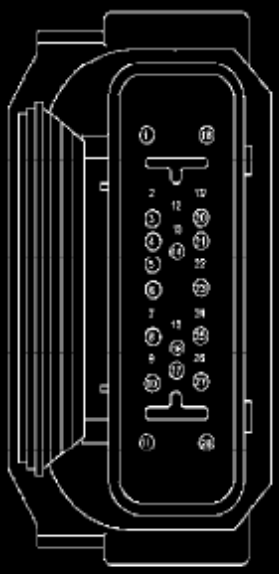
View 151-1

Connector: C135

Description: ABS CONTROL MODULE

Harness: 14290

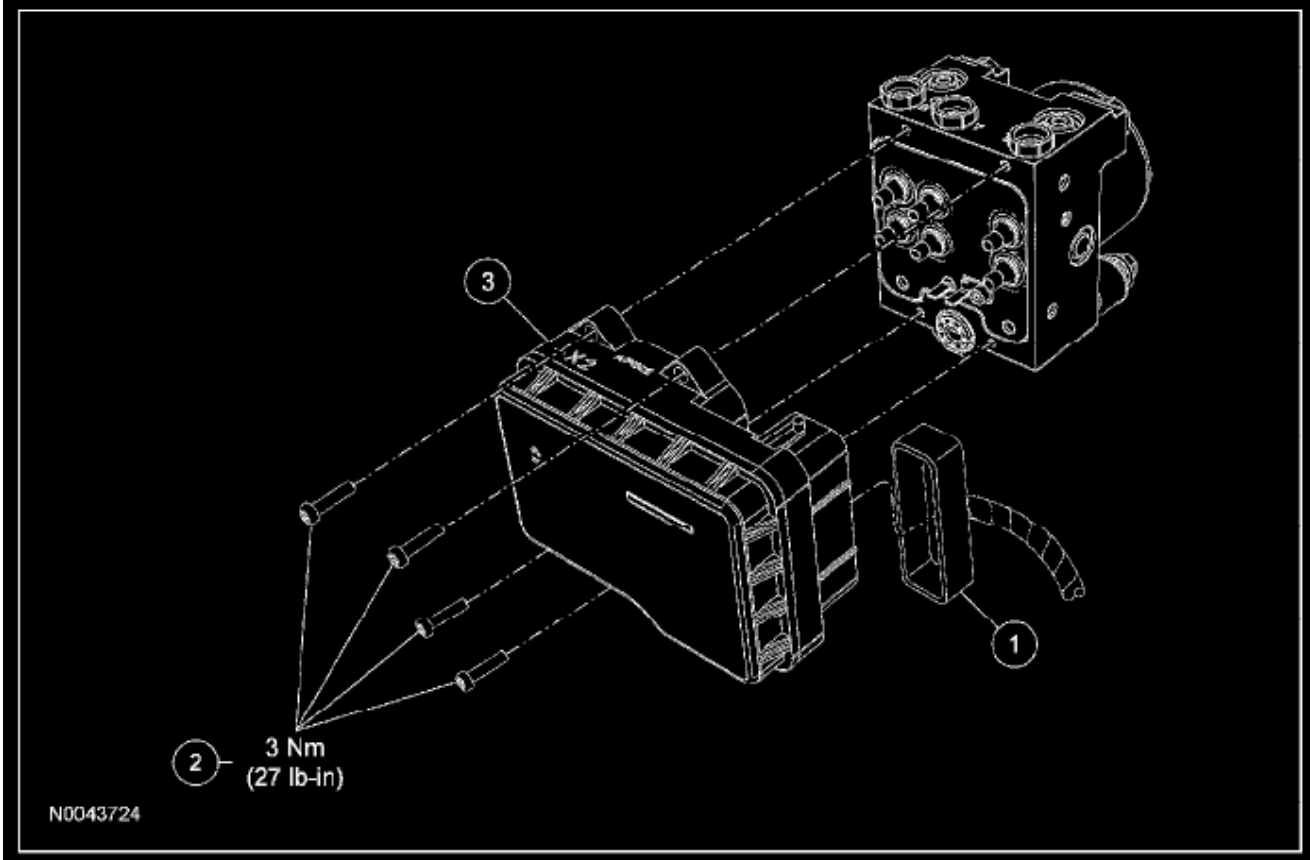
Base Part #: 2C219



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD122 (BK)	14	GROUND - FENDER FRONT LEFT # 3RD STUD	
2	*	*	not used	
3	VCA05 (GY-VT)	20	SENSOR - WHEEL SPEED RIGHT FRONT	
4	RCA19 (VT)	20	CTRL MOD. - SENSOR WHEEL SPEED RIGHT FRONT	
5	VCA03 (VT-WT)	20	SENSOR - WHEEL SPEED LEFT FRONT	
6	RCA17 (YE)	20	CTRL MOD. - SENSOR WHEEL SPEED LEFT FRONT	
7	*	*	not used	
8	CCB15 (BN-GN)	22	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL CLOSED	
9	*	*	not used	
10	CCF23 (GN-VT)	18	CTRL MOD. - POWERTRAIN # FOUR WHEEL DRIVE STATUS	
11	SBB15 (WH-RD)	14	FUSE - 15 OR CIRCUIT BREAKER	
12	*	*	not used	
13	*	*	not used	
14	RCA21 (BN-GN)	20	CTRL MOD. - SENSOR WHEEL SPEED REAR DIFFERENTIAL	
15	*	*	not used	
16	VDB10 (GY)	20	CONNECTOR - DIAGNOSTIC # K LINE ISO 9141	
17	CCA01 (BU-OG)	22	CTRL MOD. - INDICATOR WARNING ABS	
18	GD122 (BK)	14	GROUND - FENDER FRONT LEFT # 3RD STUD	
19	*	*	not used	
20	CBP20 (YE-VT)	20	FUSE - 20 OR CIRCUIT BREAKER	
21	VCA14 (WT-BN)	20	SENSOR - REAR AXLE	
22	*	*	not used	
23	RMC19 (YE-GY)	20	SWITCH - LOW LEVEL BRAKE FLUID (CONTINUITY CHECK)	
24	*	*	not used	
25	CMC19 (GY-VT)	20	SWITCH - LOW LEVEL BRAKE FLUID	
26	*	*	not used	
27	CCA02 (GN-VT)	22	CTRL MOD. - INDICATOR WARNING ELECTRONIC BRAKE DISTRIBUTION	
28	SBB17 (RD)	12	FUSE - 17 OR CIRCUIT BREAKER	

C135

Anti-Lock Brake System (ABS) Module



Item	Part Number	Description
1	—	ABS module electrical connector (part of 14290)
2	—	ABS module bolts (4 required) (part of 2C065)
3	2C065	ABS module

Electronic Brake Control Module: Service and Repair

Anti-Lock Brake System (ABS) Module

Anti-Lock Brake System (ABS) Module

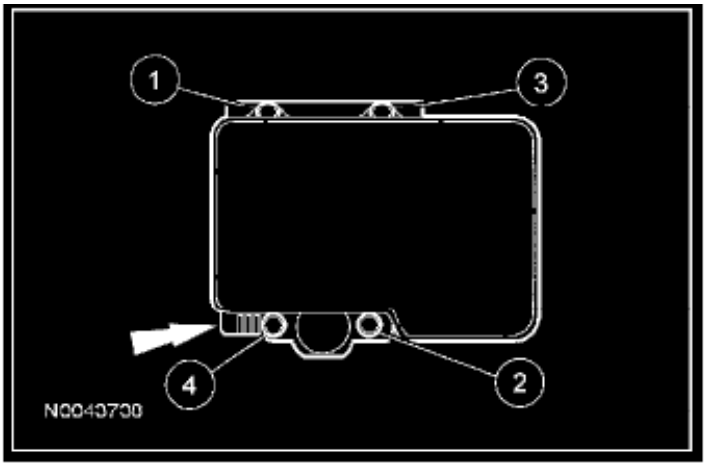
Removal and Installation

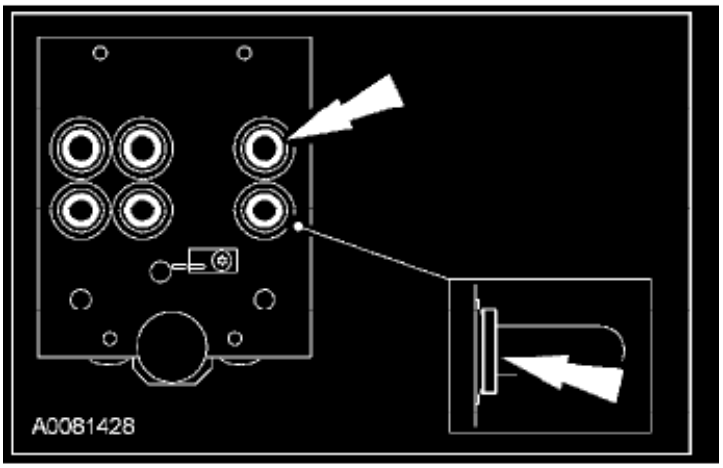
1. Remove the hydraulic control unit (HCU).

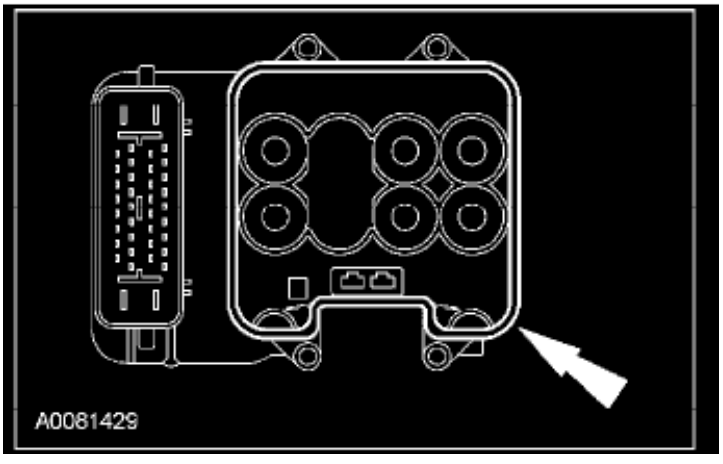
2. NOTE: The ABS module bolts must be removed and installed in the sequence shown.

Remove the 4 ABS module bolts in the sequence shown. ^

To install, tighten to 3 Nm (27 lb-inch).


1
3
4
2


A0081428


A0081429

3. CAUTION: When the anti-lock brake system (ABS) module is separated from the hydraulic control unit (HCU), the motor terminals and

the valve stems will be exposed. Protect the terminals and the valve stems from damage.

Remove the ABS module from the HCU.

4. Remove and discard the O-ring seals.

5. Remove and discard the ABS module seal.

6. CAUTION: All components must be free of dust, oil, fluid and foreign material prior to installation. A new seal kit must be used when

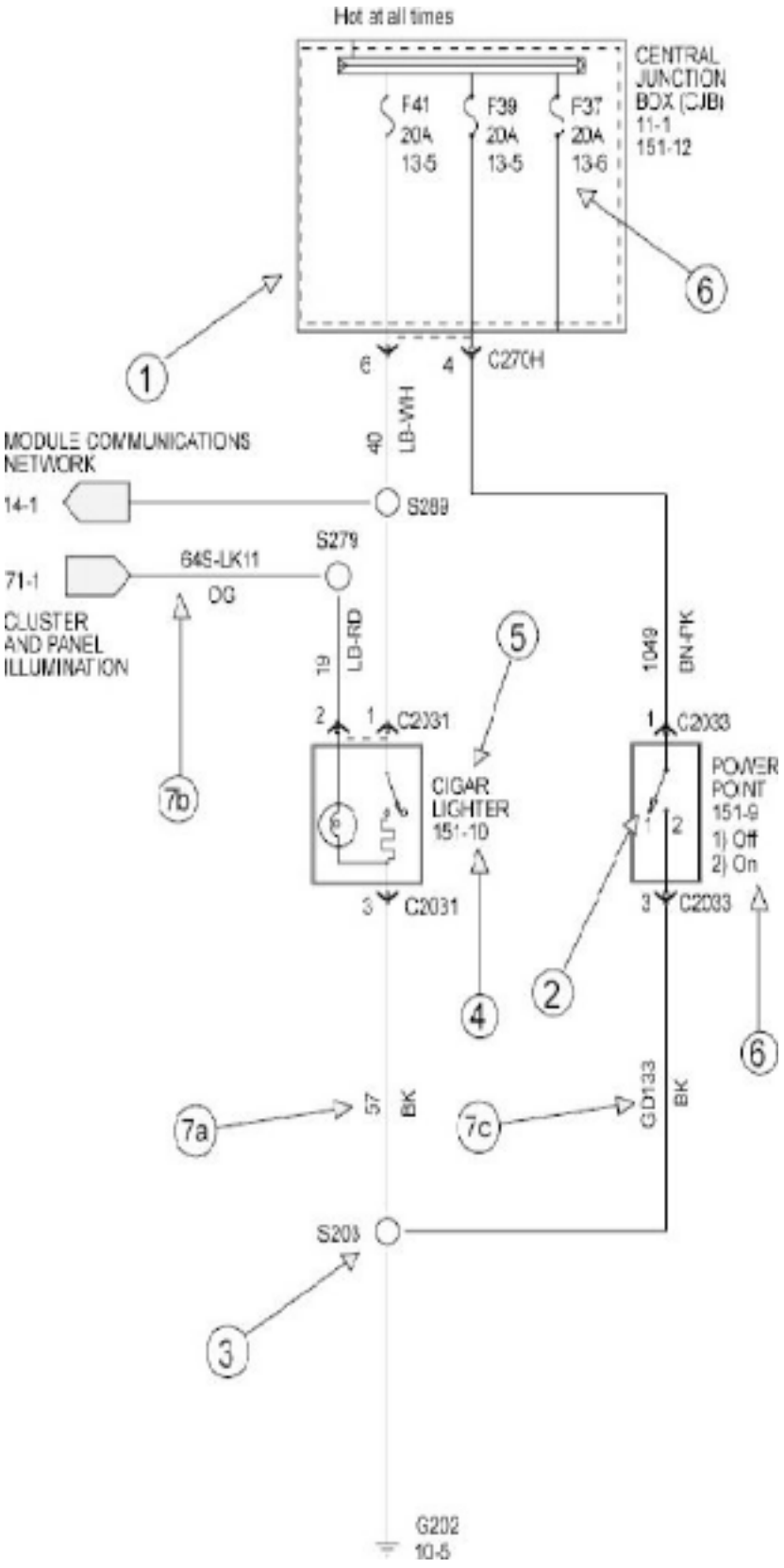
installing the anti-lock brake system (ABS) module. The old seals must be discarded as they may cause a leak between the ABS module and the hydraulic control unit (HCU).

NOTE: The O-ring seals must be installed to the valve flange. Make sure the O-ring seals are not deformed when installed.

NOTE: Clean the groove of the ABS module before installing a new seal.

To install, reverse the removal procedure.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Relays and Modules > Relays and Modules - Cooling System > Radiator Cooling Fan Motor Relay > Component Information > Diagrams > Diagram Information and Instructions



Radiator Cooling Fan Motor Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

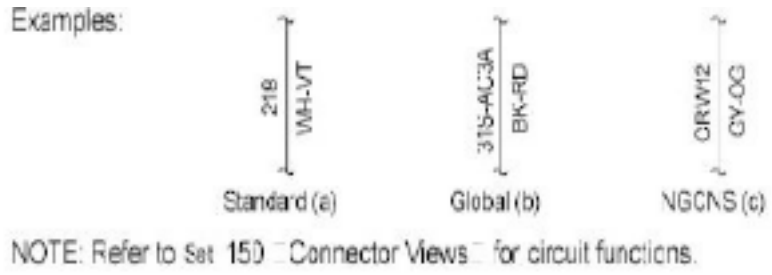
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

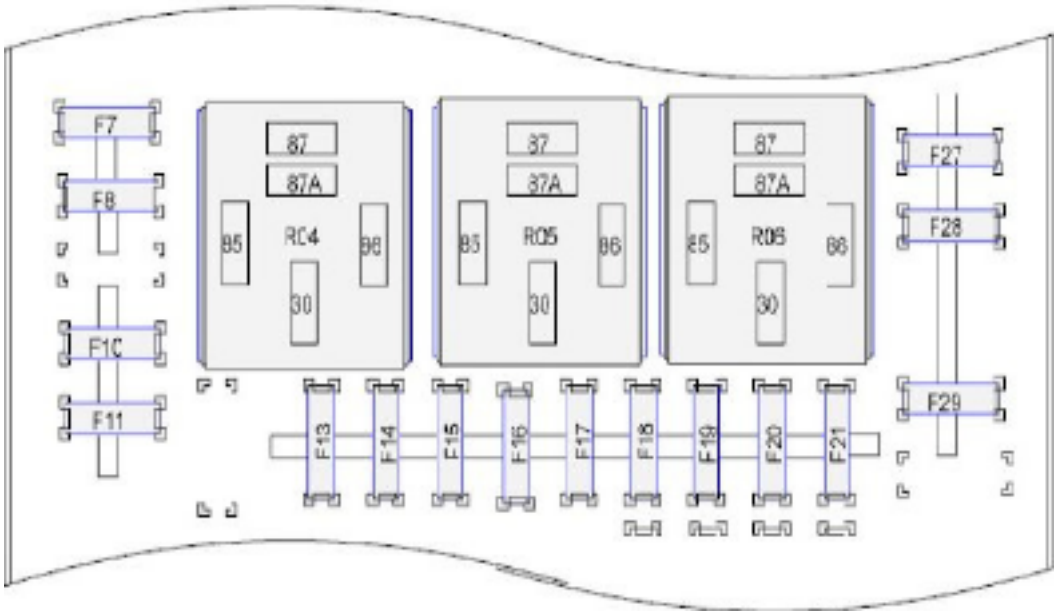
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

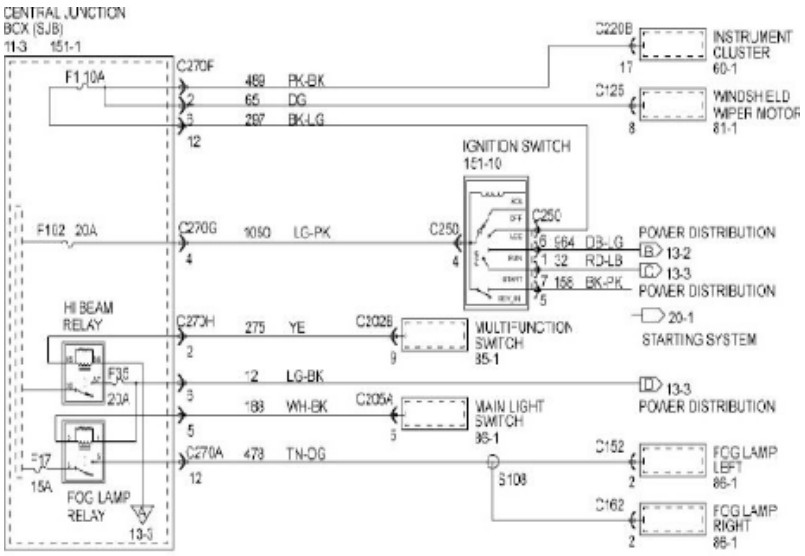
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

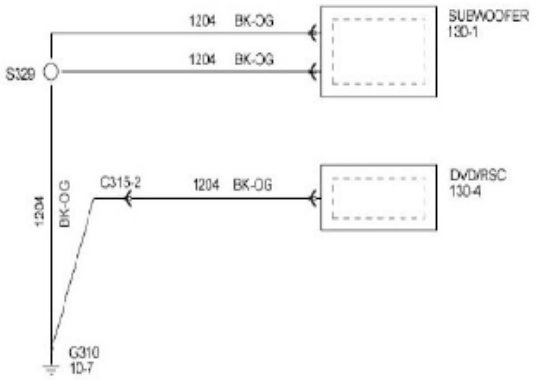
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

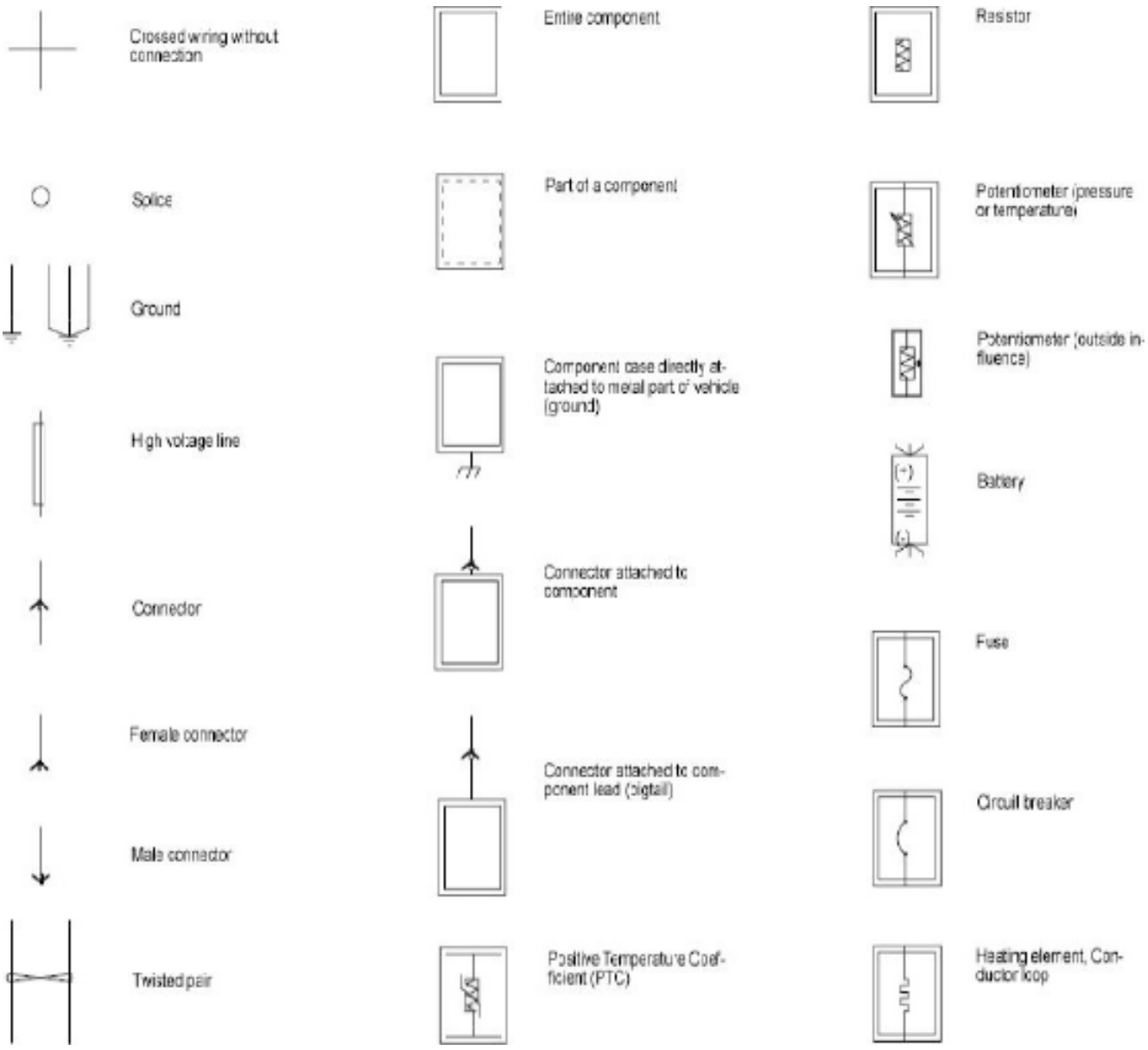
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

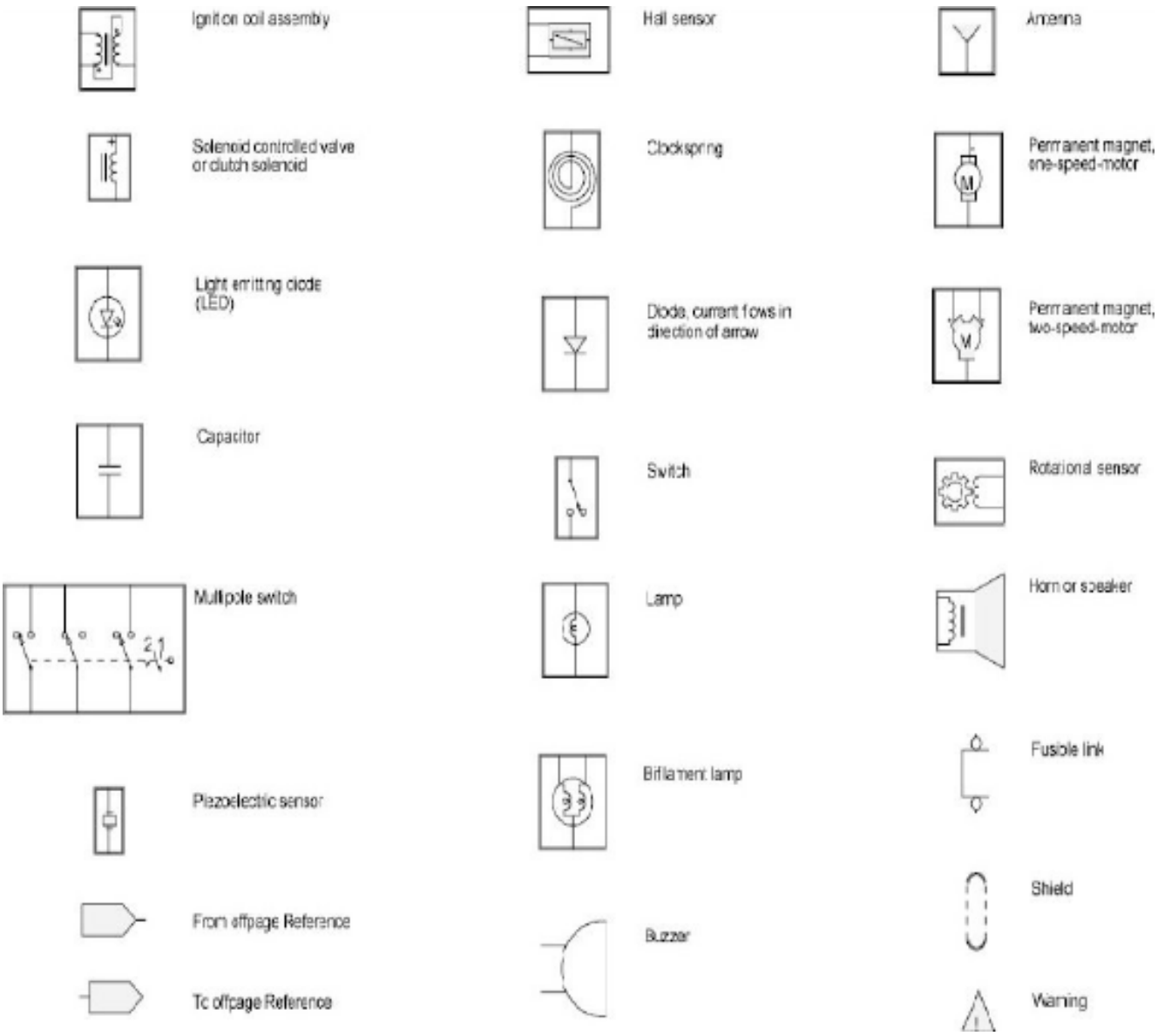
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

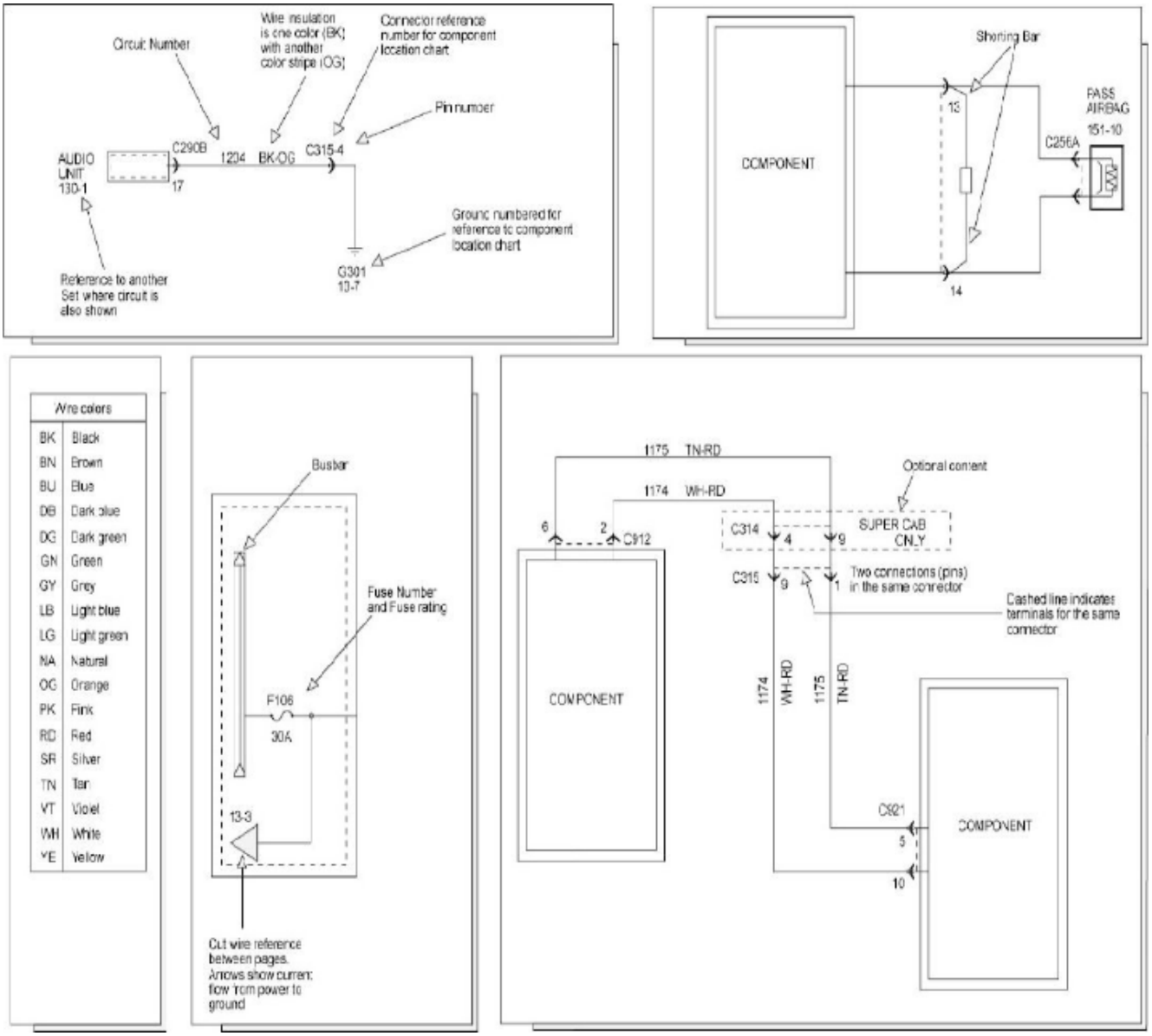
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

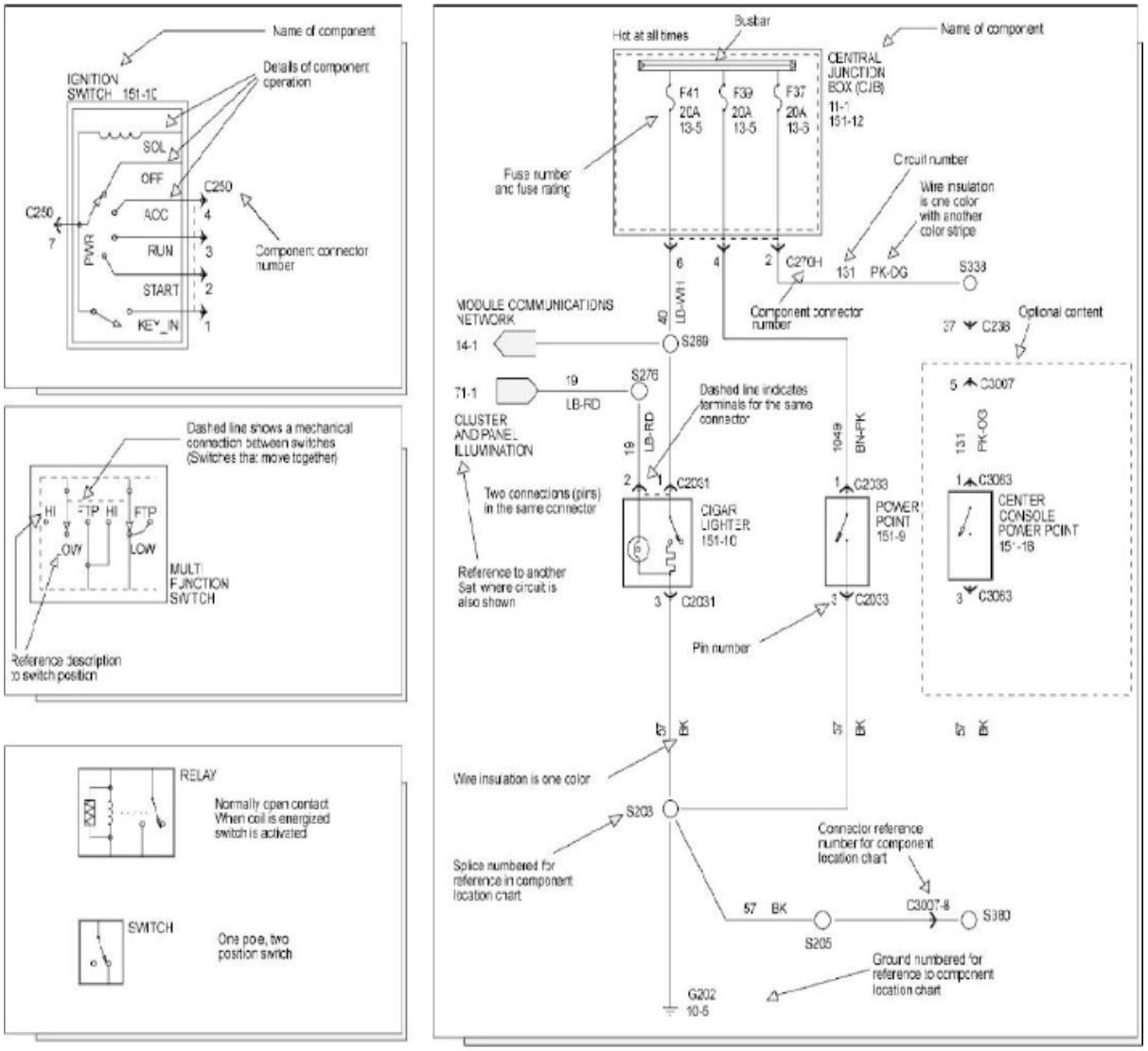
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

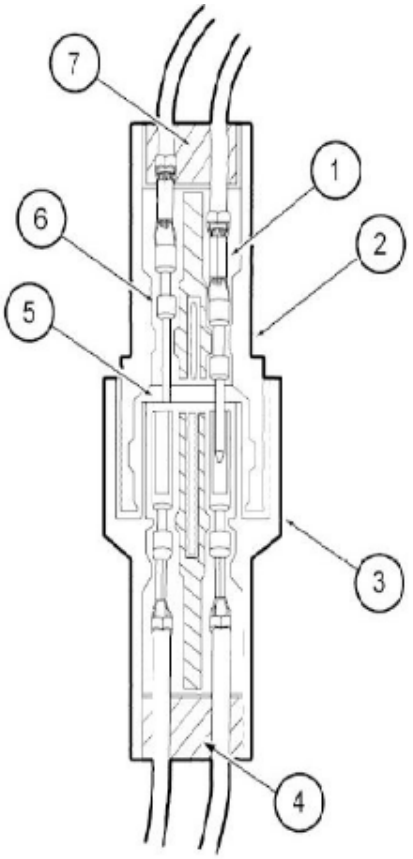


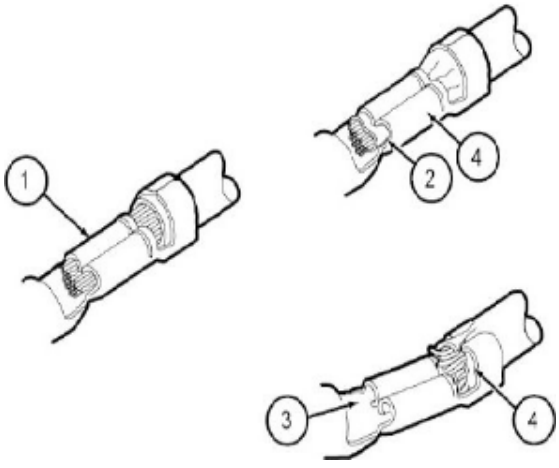
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Radiator Cooling Fan Motor Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

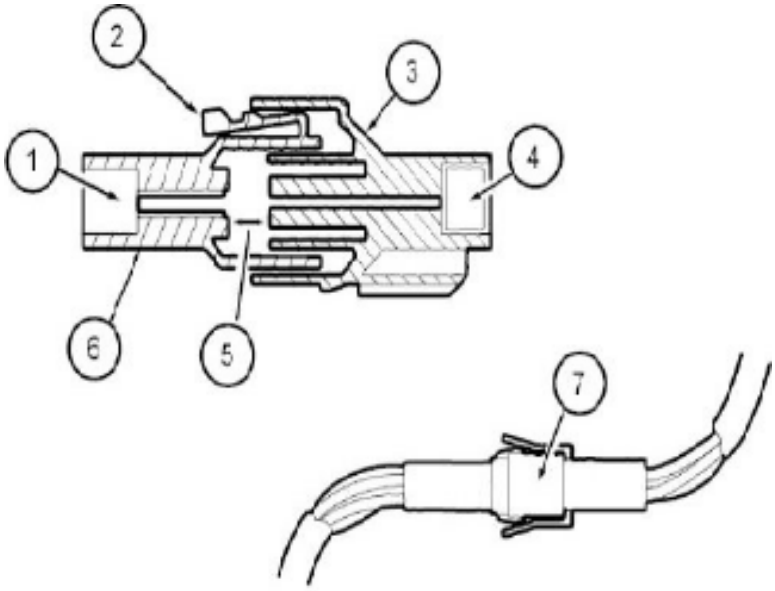
5 = Intermittent contact

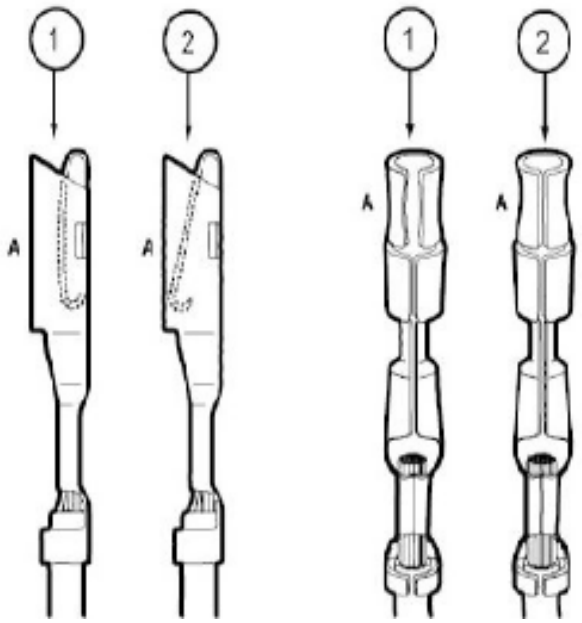
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

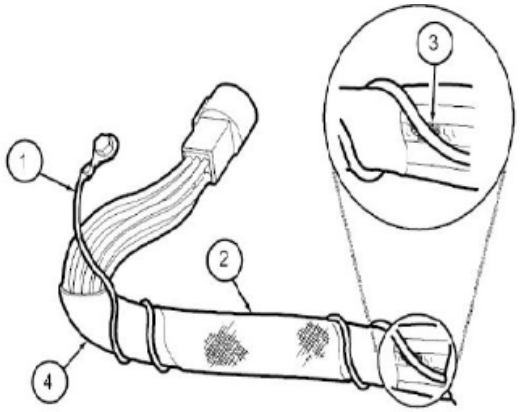
Deformed (enlarged) female terminals

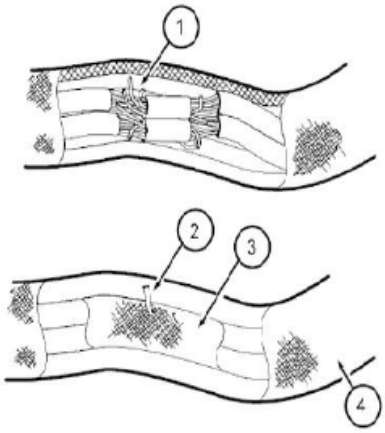
1 = Enlarged

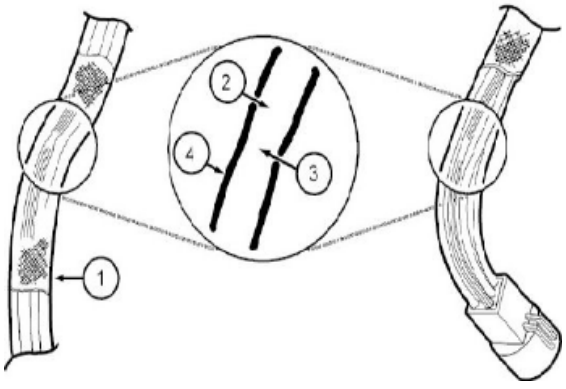
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

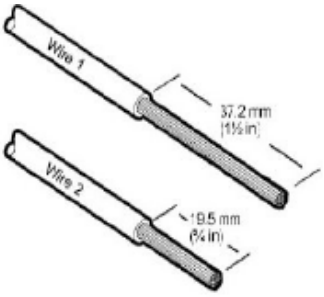
Splice covered 2

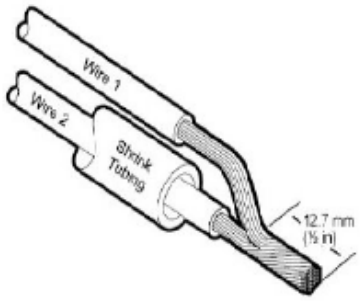
= Wire strand

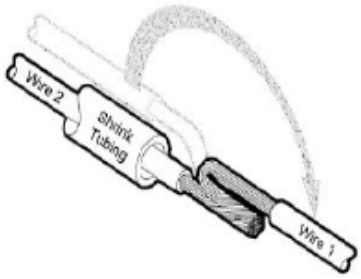
3 = Splice tape

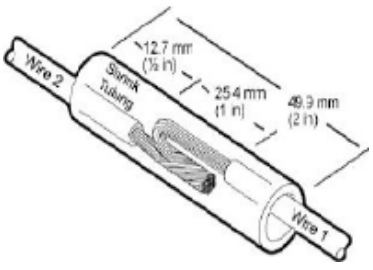
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

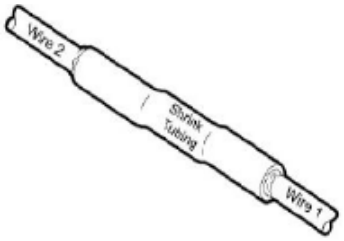
NOTE: -

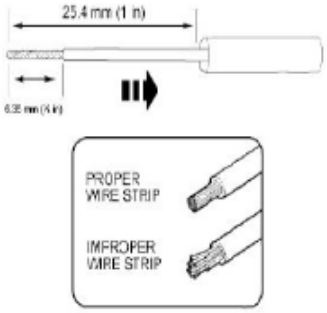
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

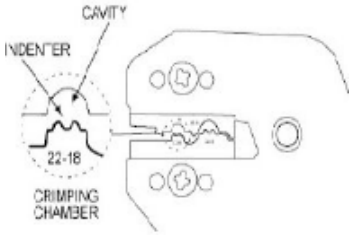
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

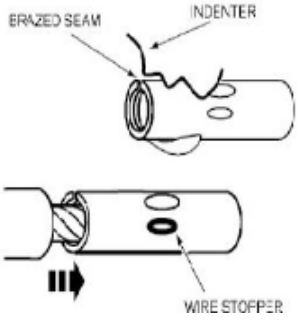
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
6.35 mm (¼ in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

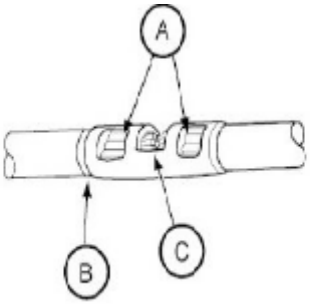
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

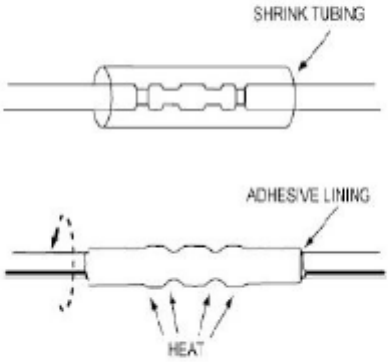
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4□ strip, cut 9 strands	* 1/4□ strip, cut 2 strands	1/4□ strip, no fold	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip, fold 2x dia.	1□ strip, fold 3x dia.
	16-14	* 1/4□ strip, cut 7 strands	1/4□ strip, no fold	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip fold 2x dia	1□ strip, fold 3x dia.	1 1/4□ strip, fold 4x dia.	Not Recommended
	12-10	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip, fold 2x dia.	1□ strip fold 3x cia.	1 1/4□ strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Pigtail only

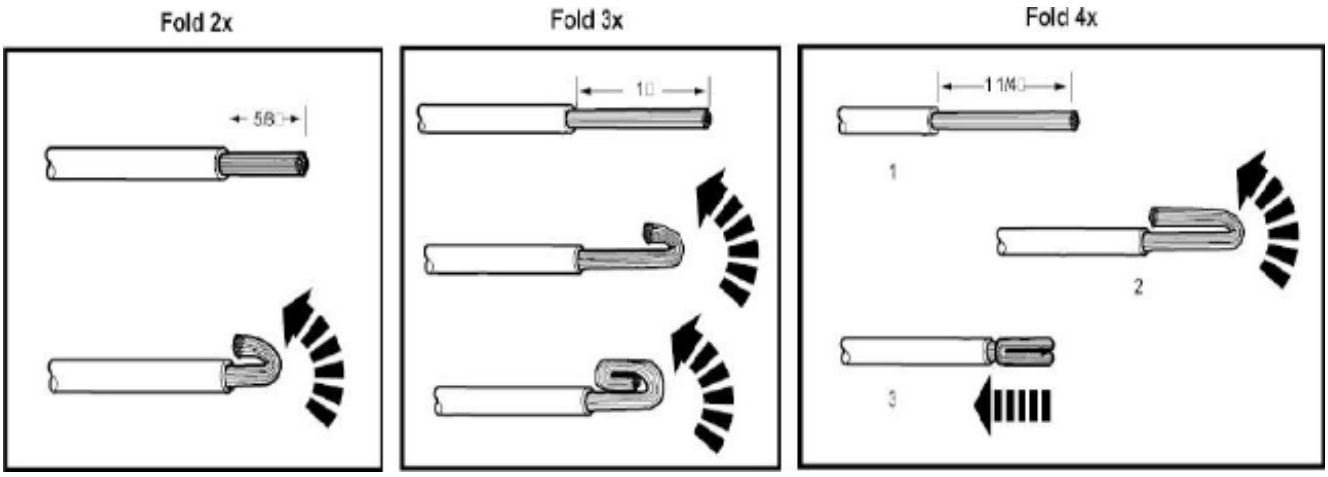
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



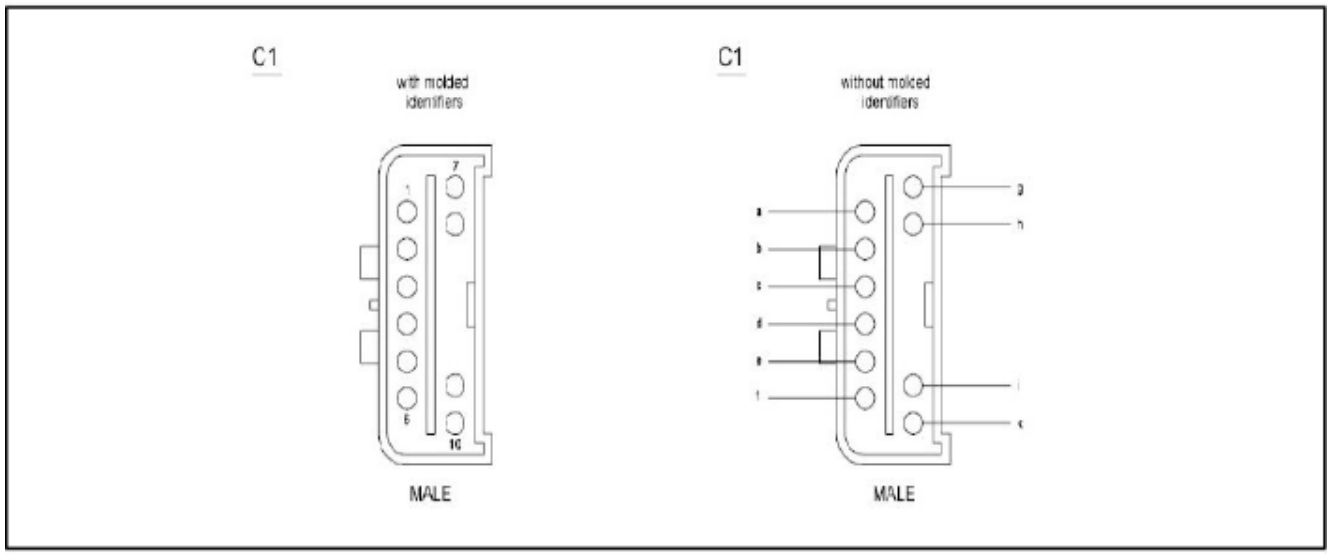
The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



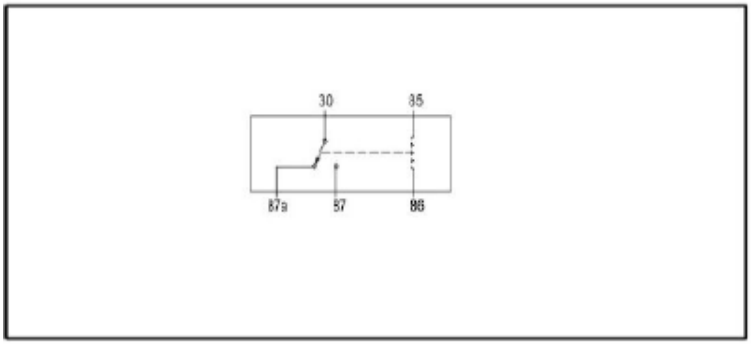
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

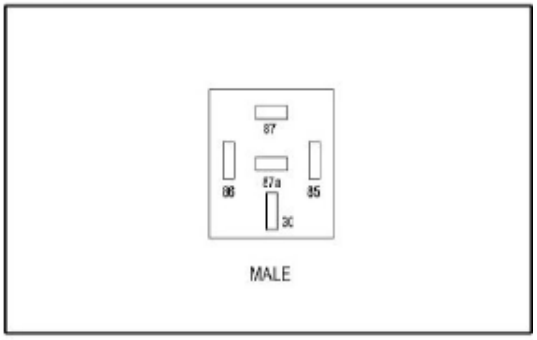
Radiator Cooling Fan Motor Relay: Testing and Inspection Mini ISO Relay

Relay □ Mini ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 □ 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

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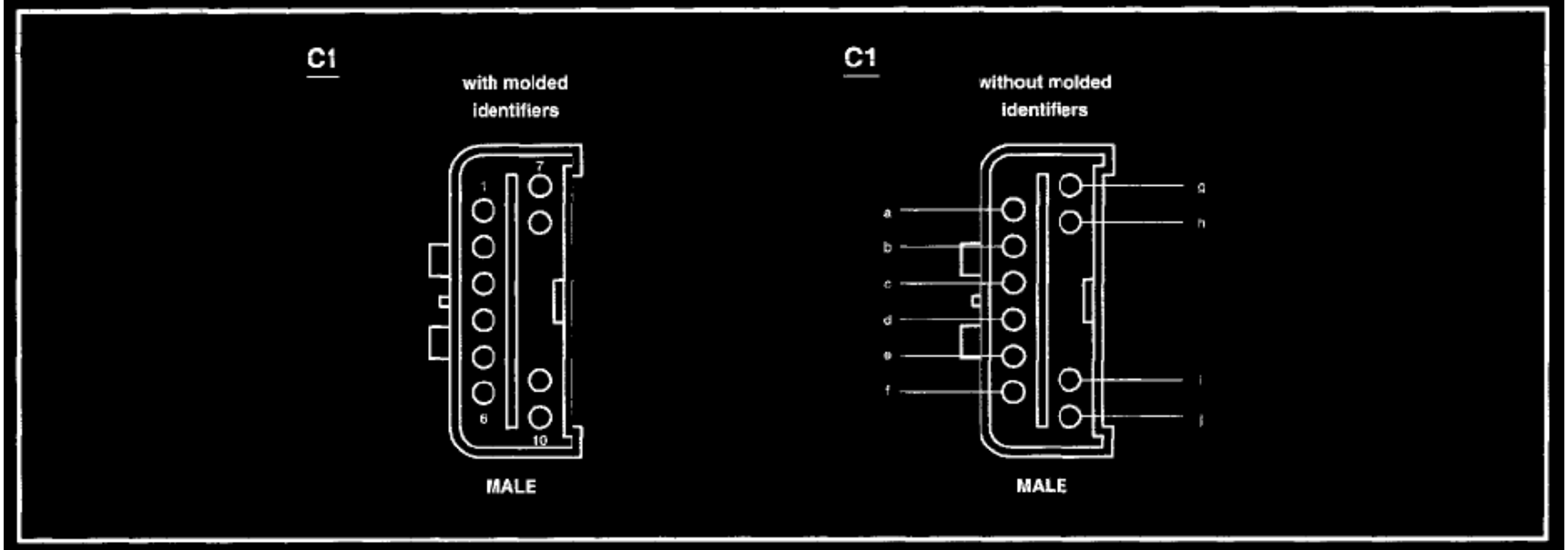
Terminals



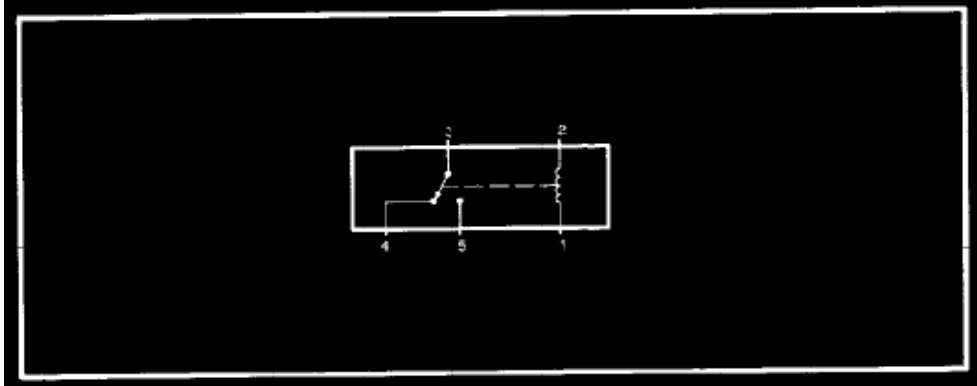
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

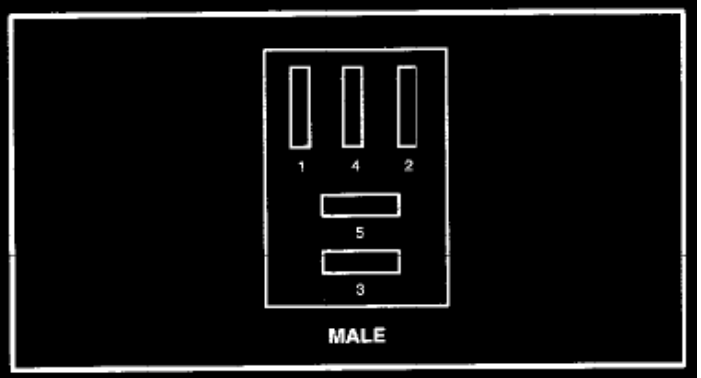
Radiator Cooling Fan Motor Relay: Testing and Inspection Micro ISO Relay

Relay – Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63–102Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil – Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

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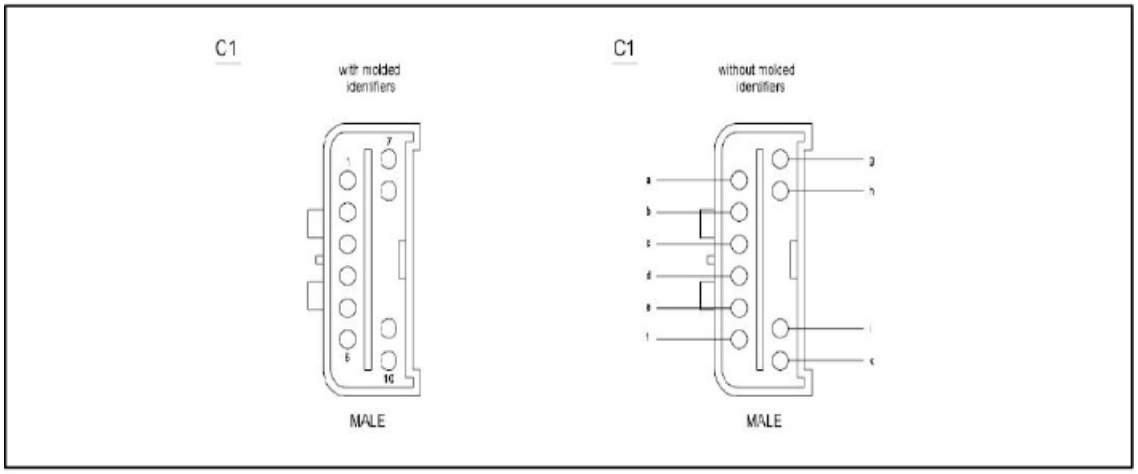
Terminals



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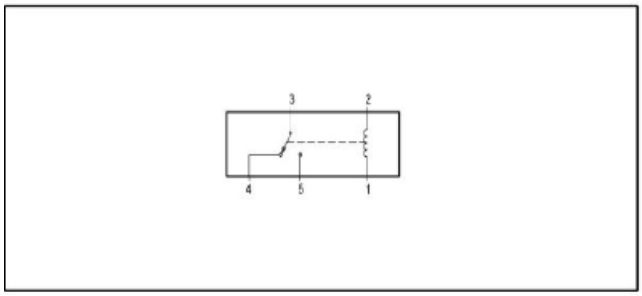
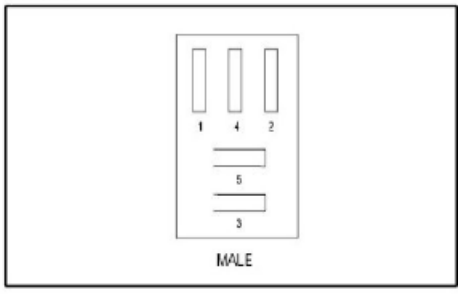
Relay - Micro ISO

Schematic



Terminals



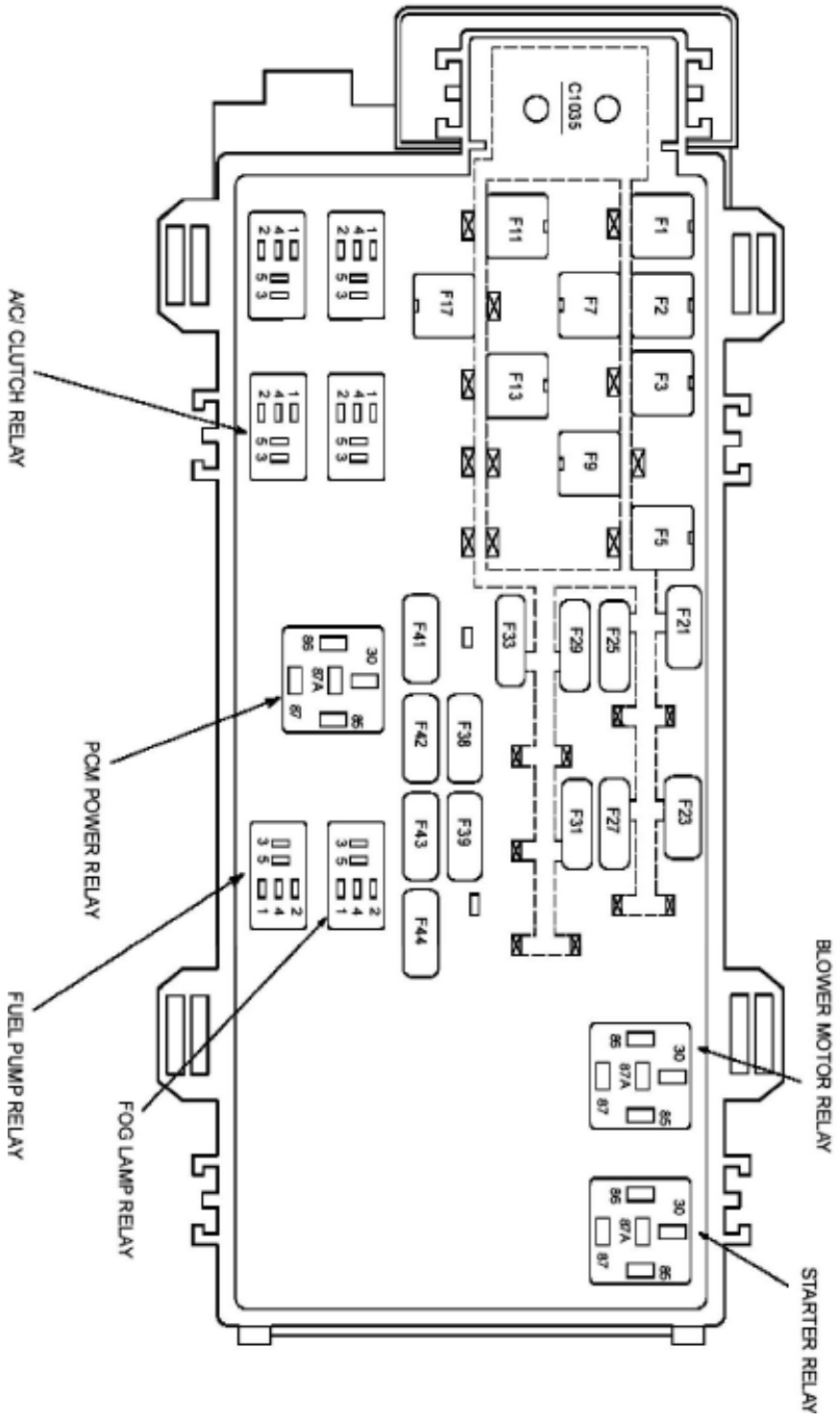
Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63-102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil - Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

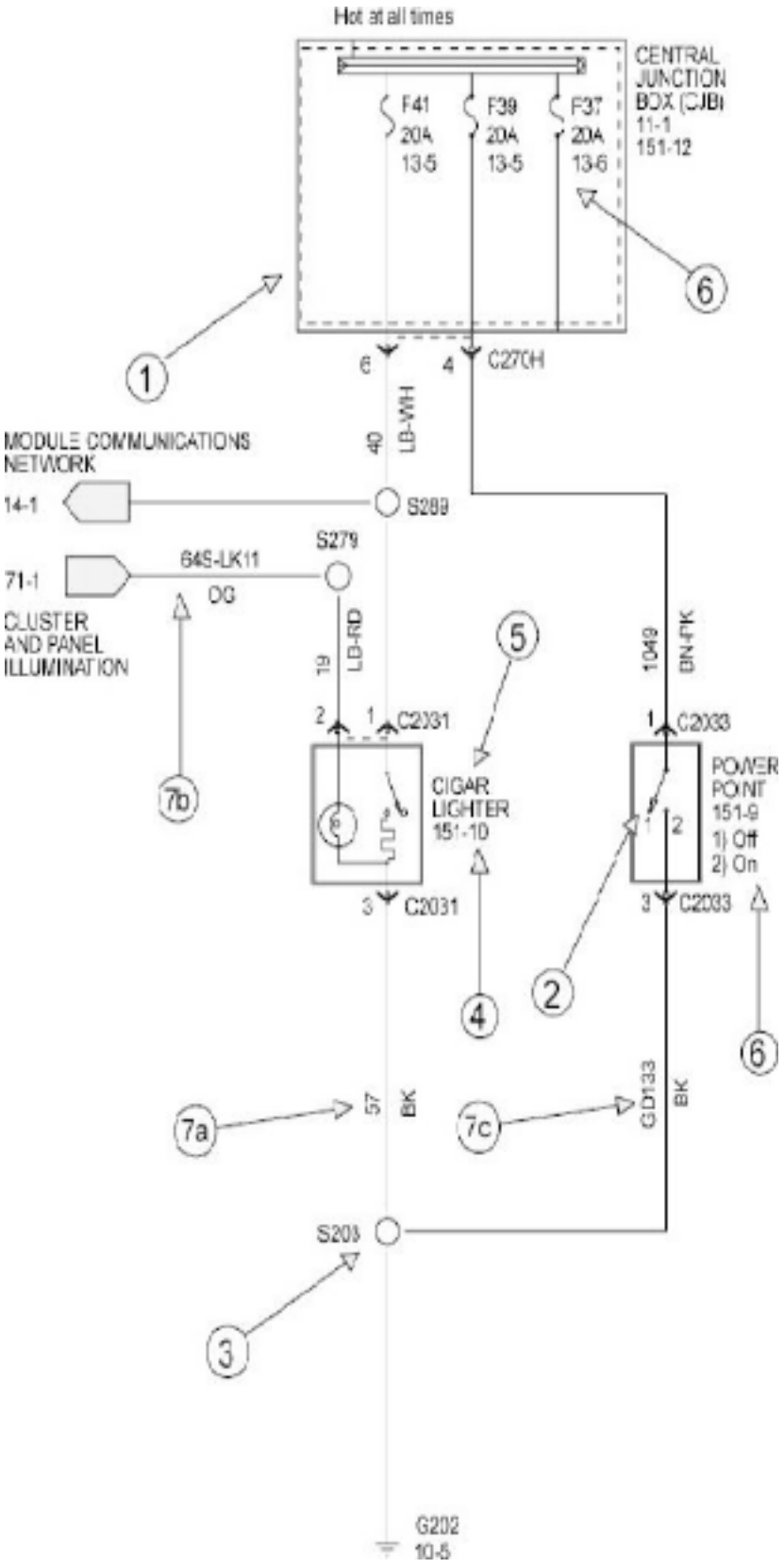
Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L



Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Relays and Modules > Relays and Modules - HVAC > Blower Motor Relay > Component Information > Diagrams > Diagram Information and Instructions



Blower Motor Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

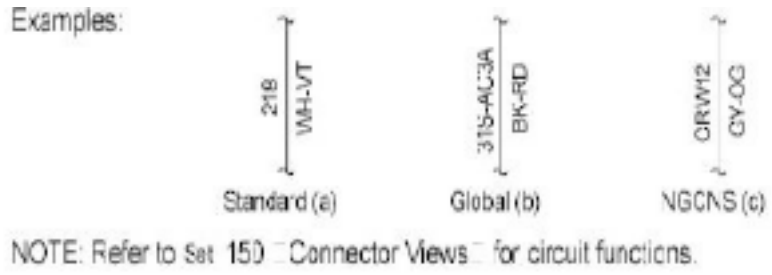
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

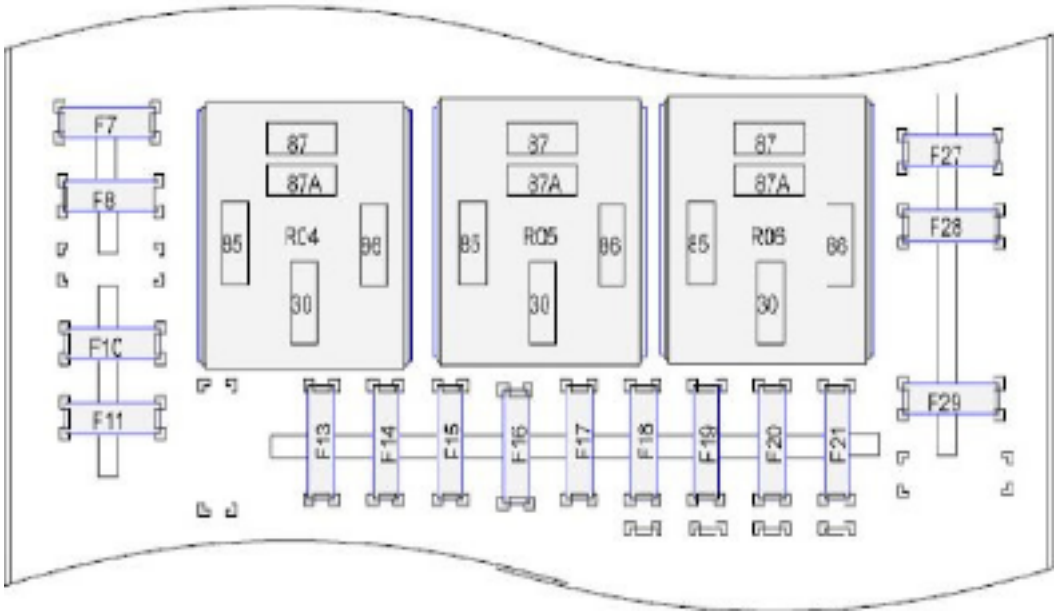
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

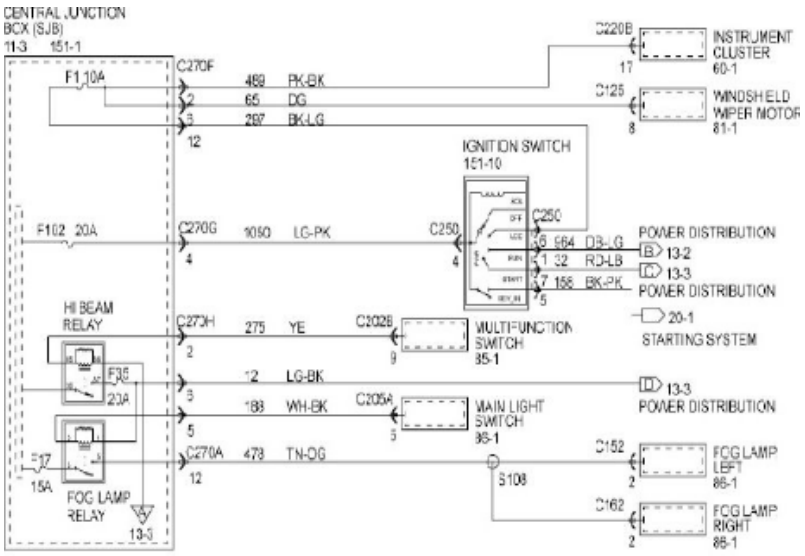
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

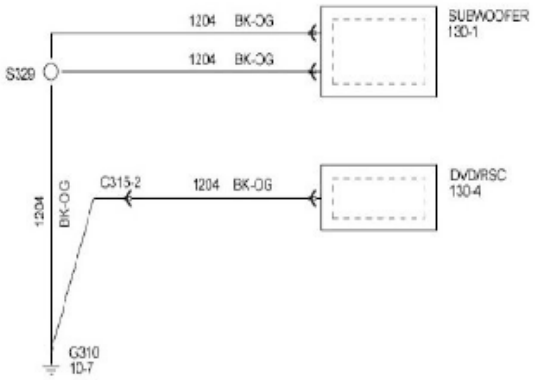
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

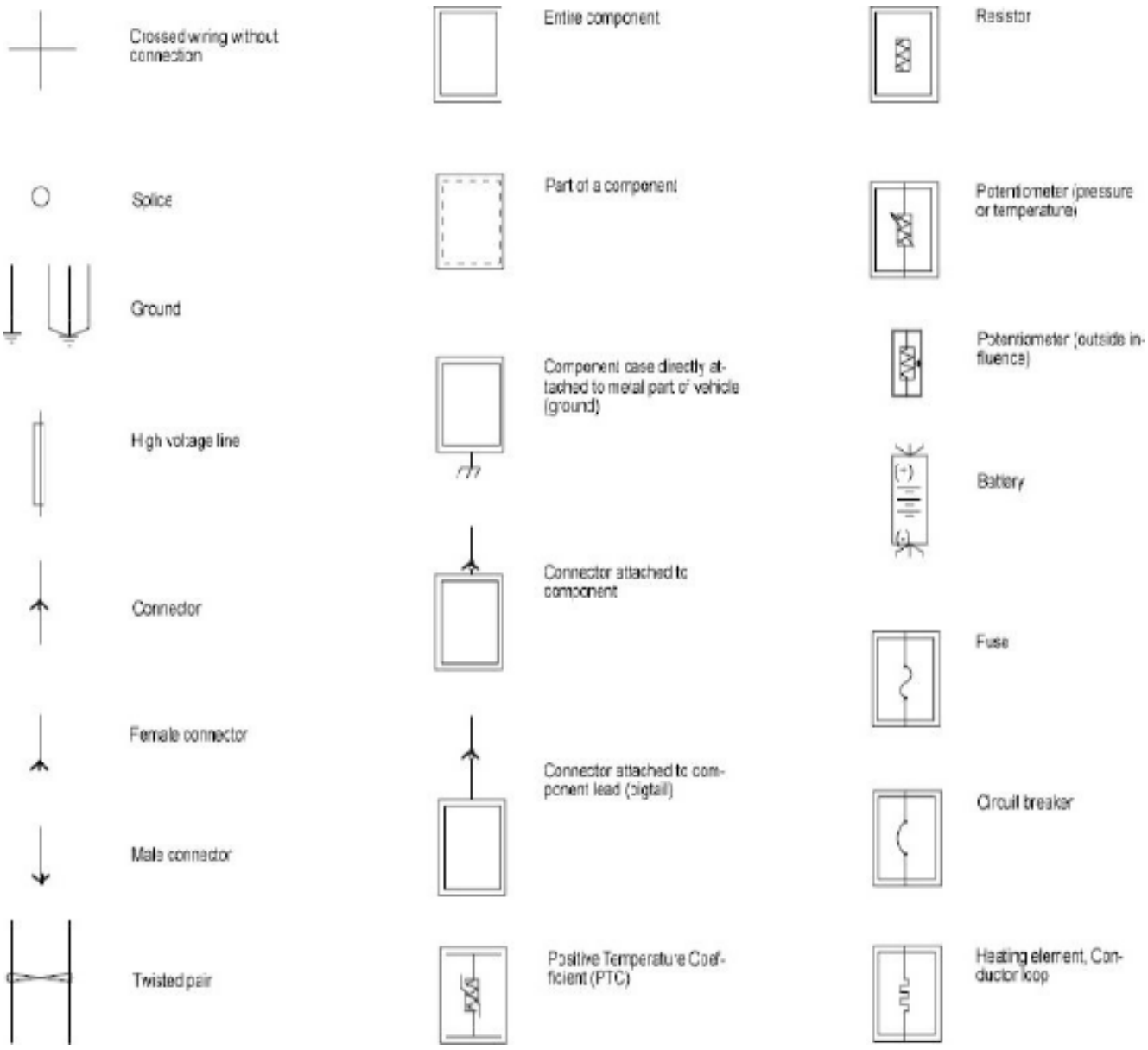
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

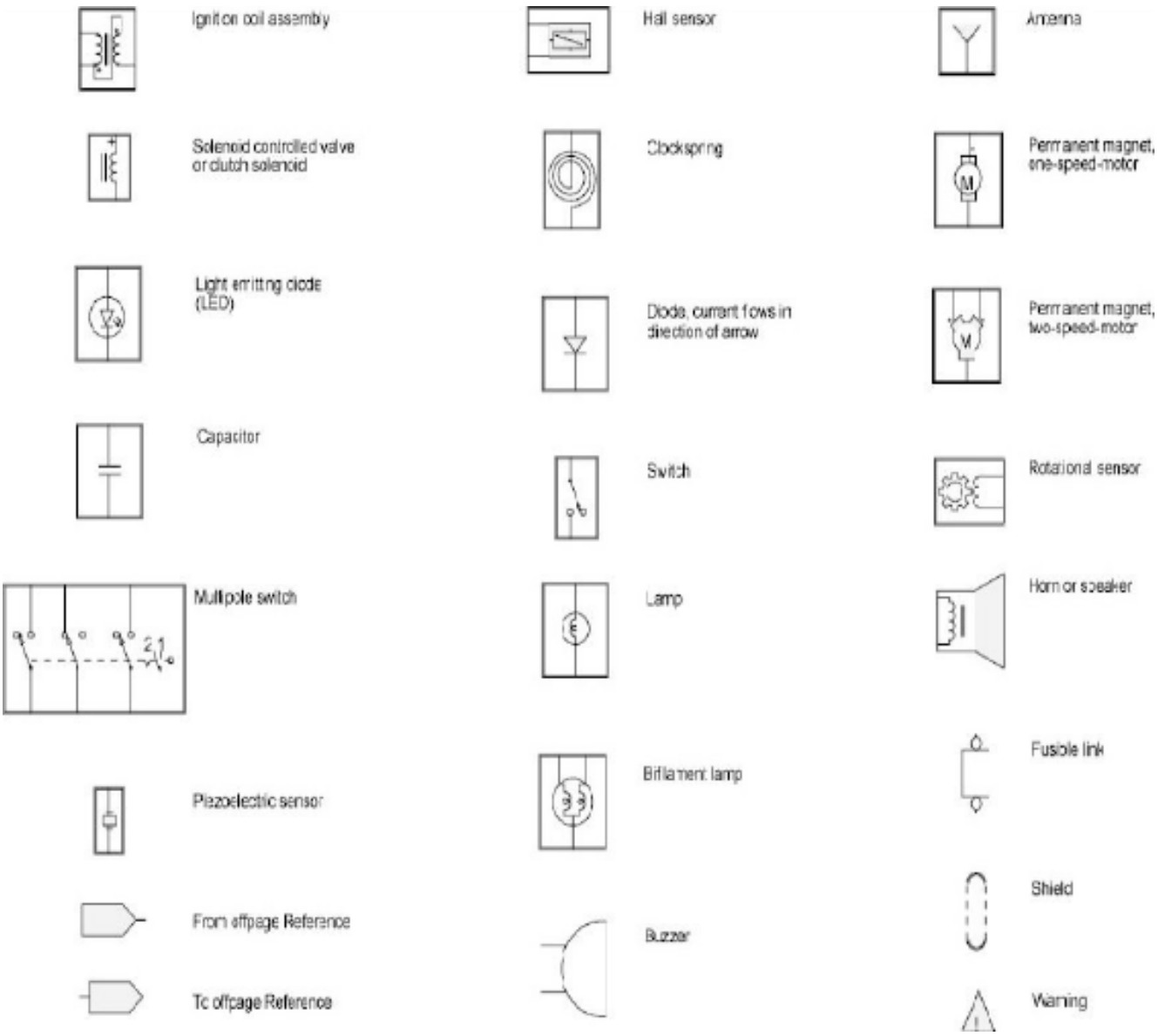
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

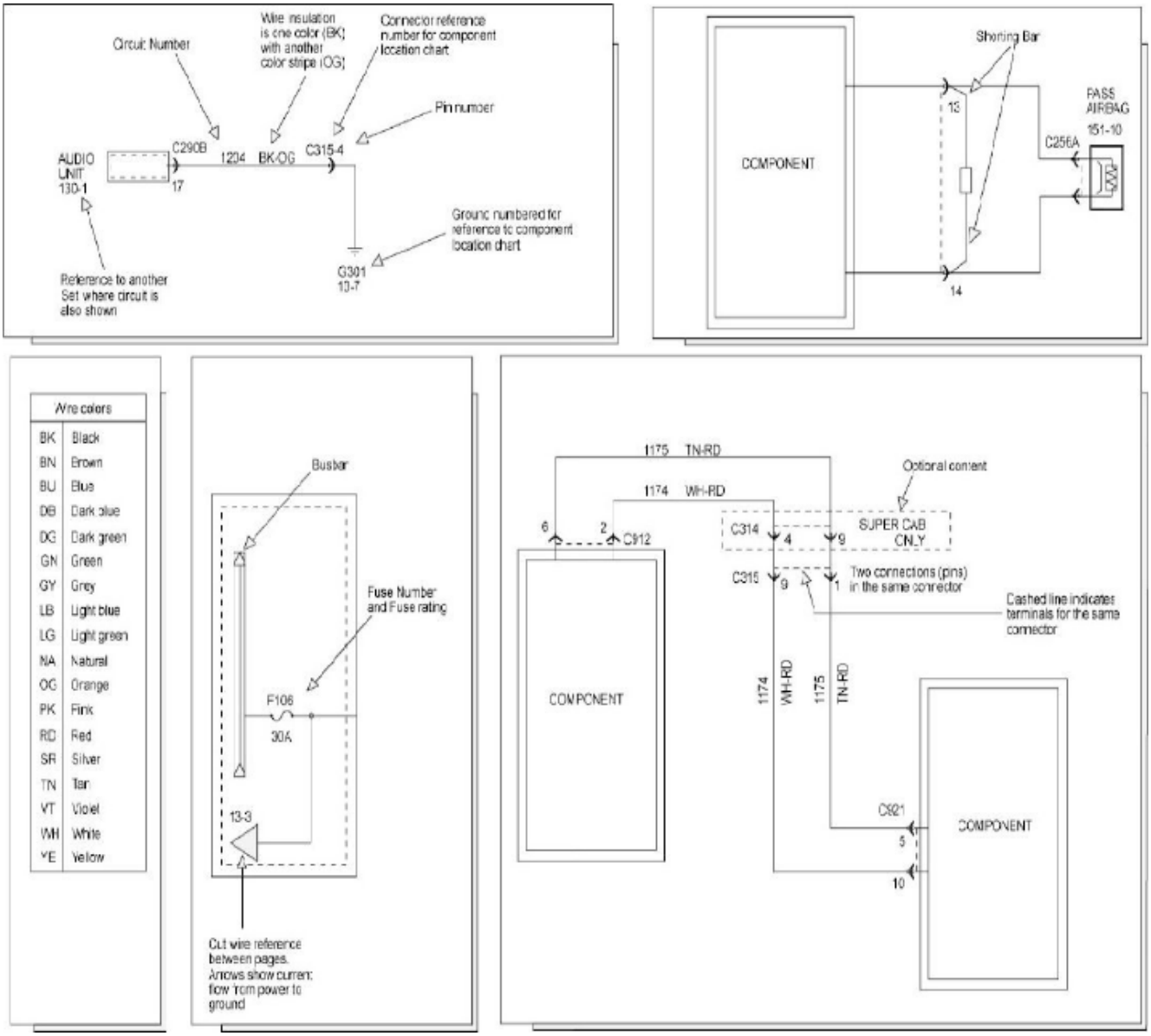
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

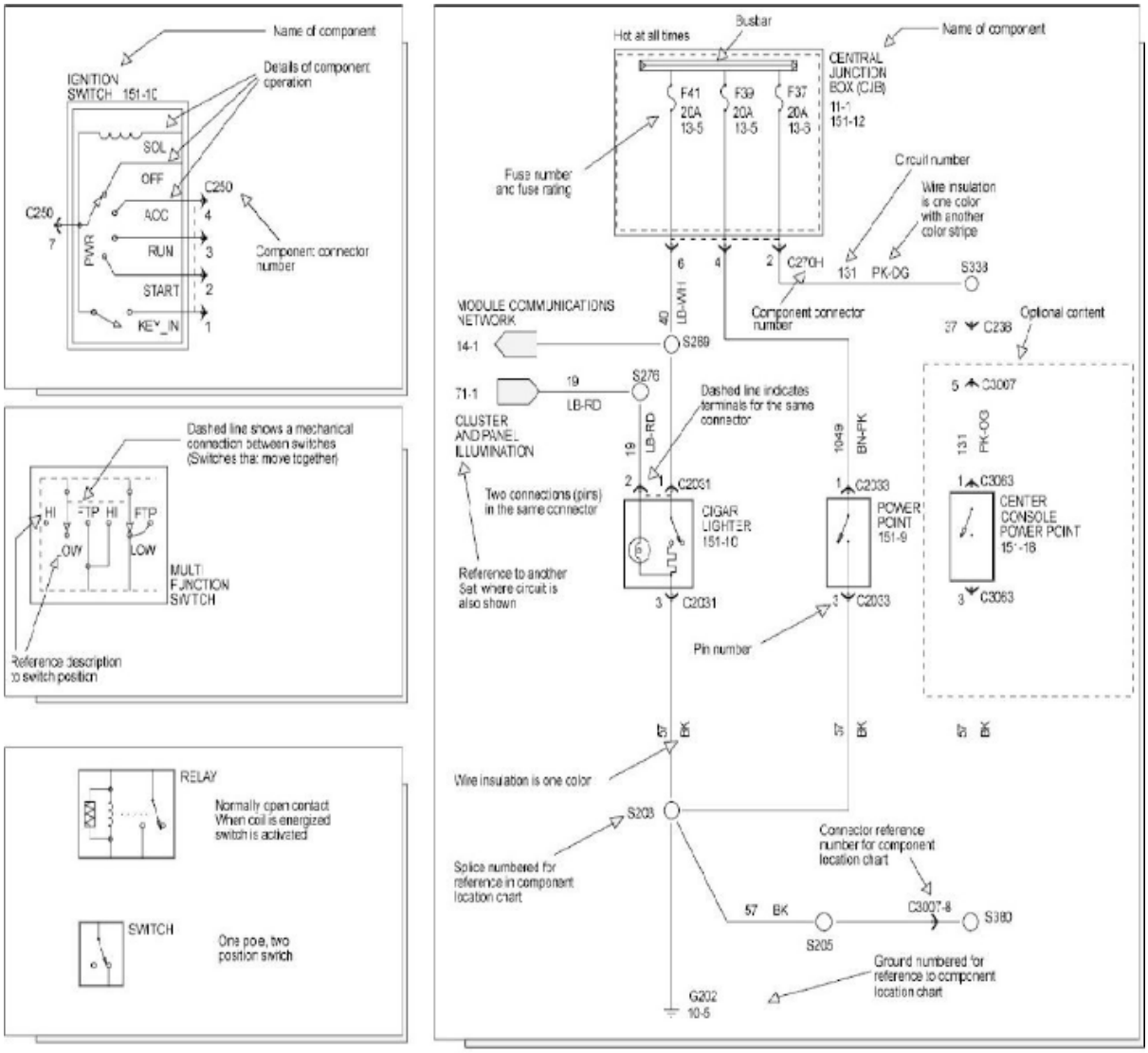
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

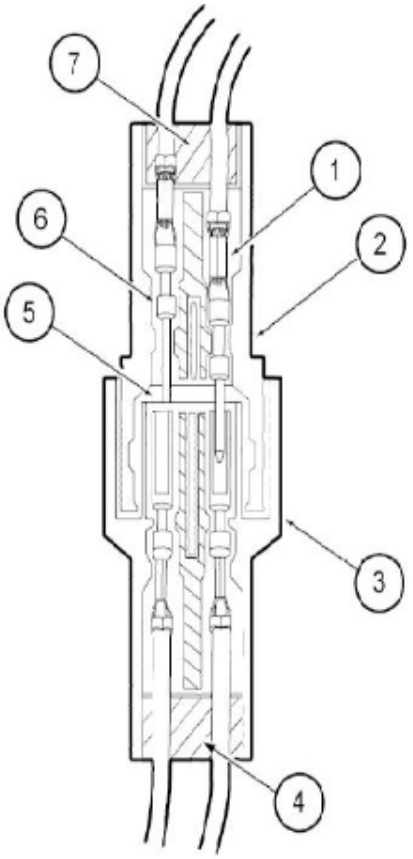


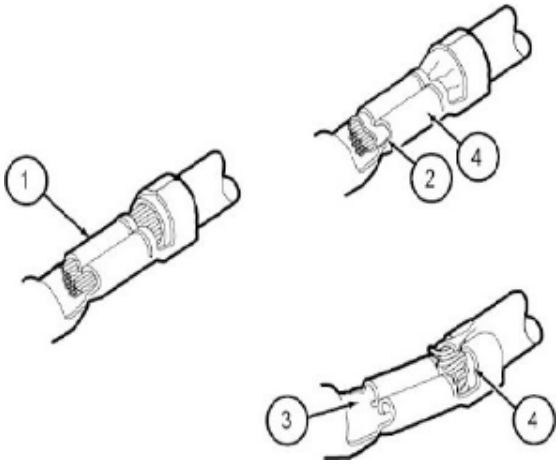
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Blower Motor Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

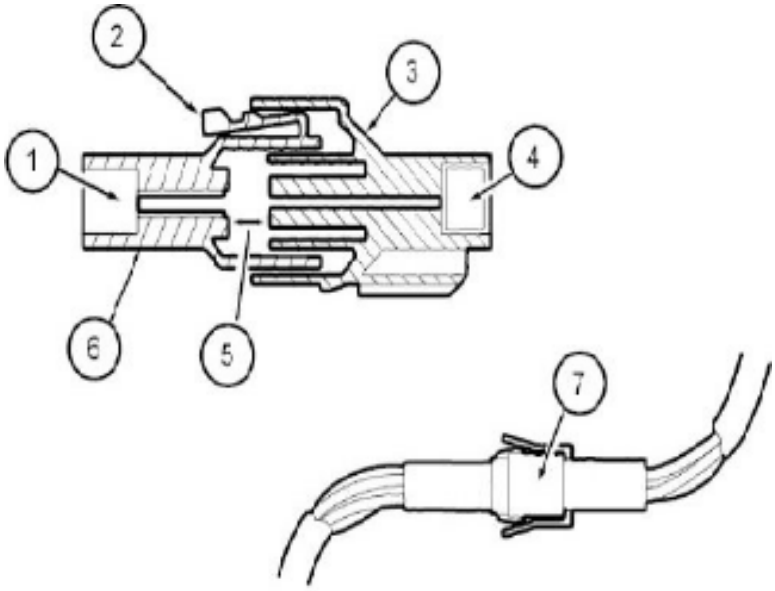
5 = Intermittent contact

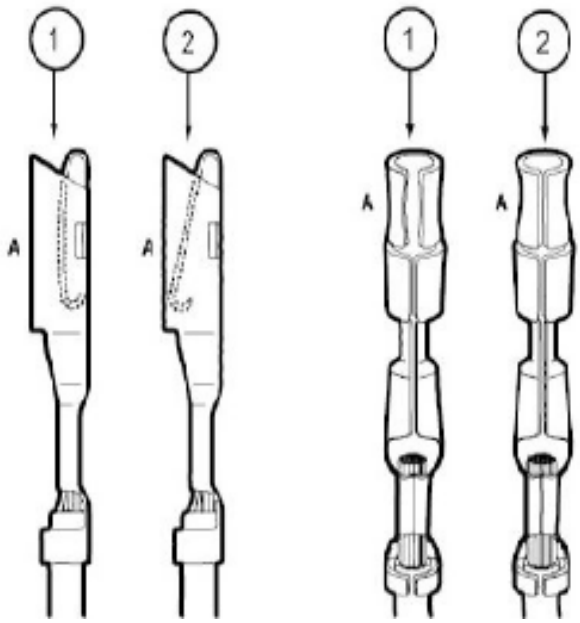
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

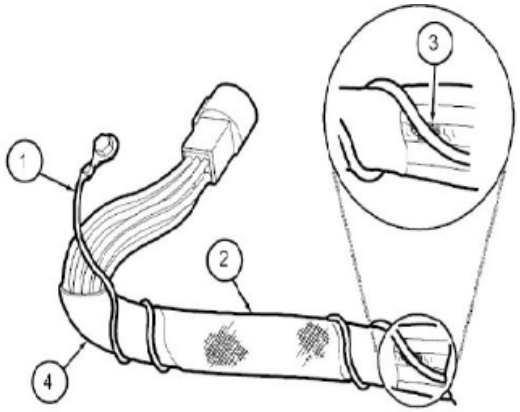
Deformed (enlarged) female terminals

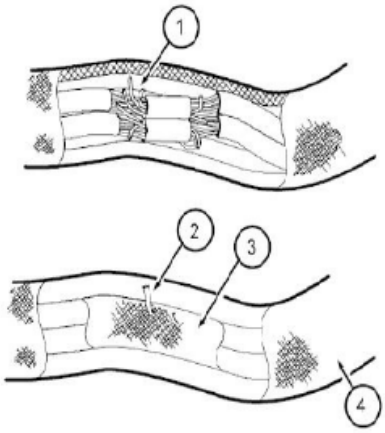
1 = Enlarged

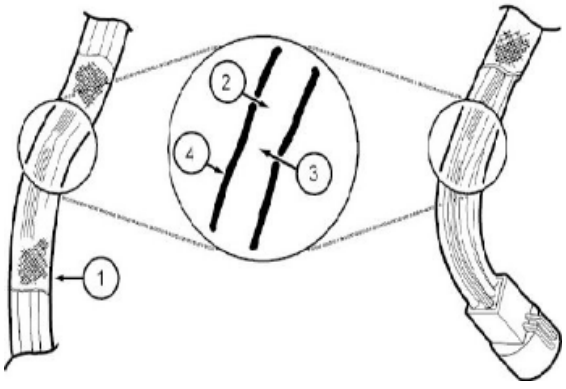
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

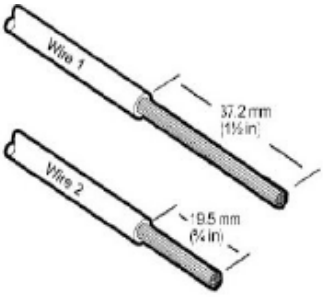
Splice covered 2

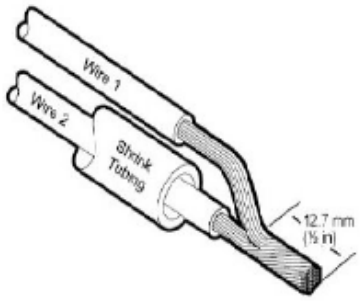
= Wire strand

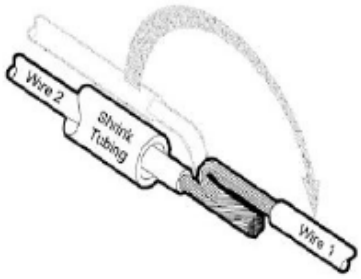
3 = Splice tape

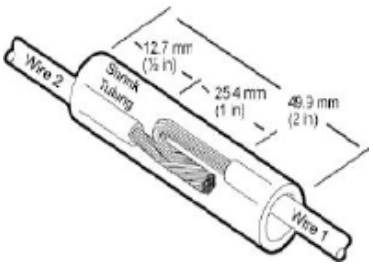
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

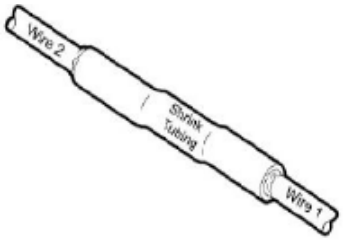
NOTE: -

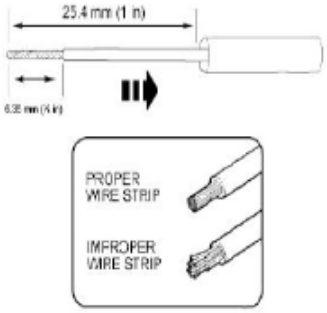
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

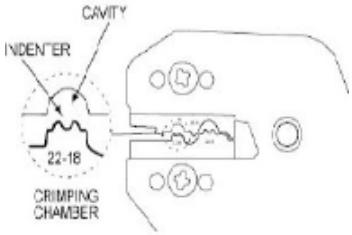
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

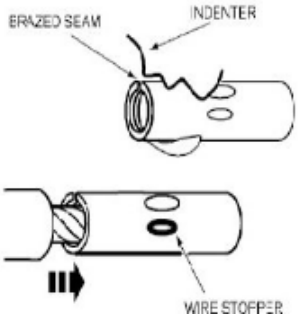
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

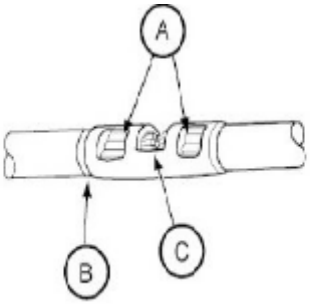
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

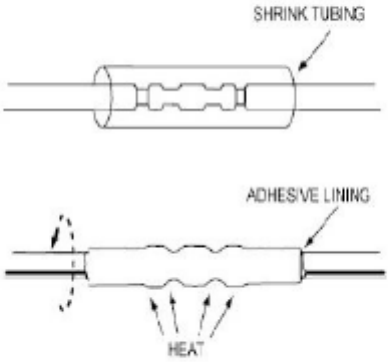
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4□ strip, cut 9 strands	* 1/4□ strip, cut 2 strands	1/4□ strip, no fold	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip, fold 2x dia.	1□ strip, fold 3x dia.
	16-14	* 1/4□ strip, cut 7 strands	1/4□ strip, no fold	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip fold 2x dia	1□ strip, fold 3x dia.	1 1/4□ strip, fold 4x dia.	Not Recommended
	12-10	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip, fold 2x dia.	1□ strip fold 3x dia.	1 1/4□ strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Pigtail only

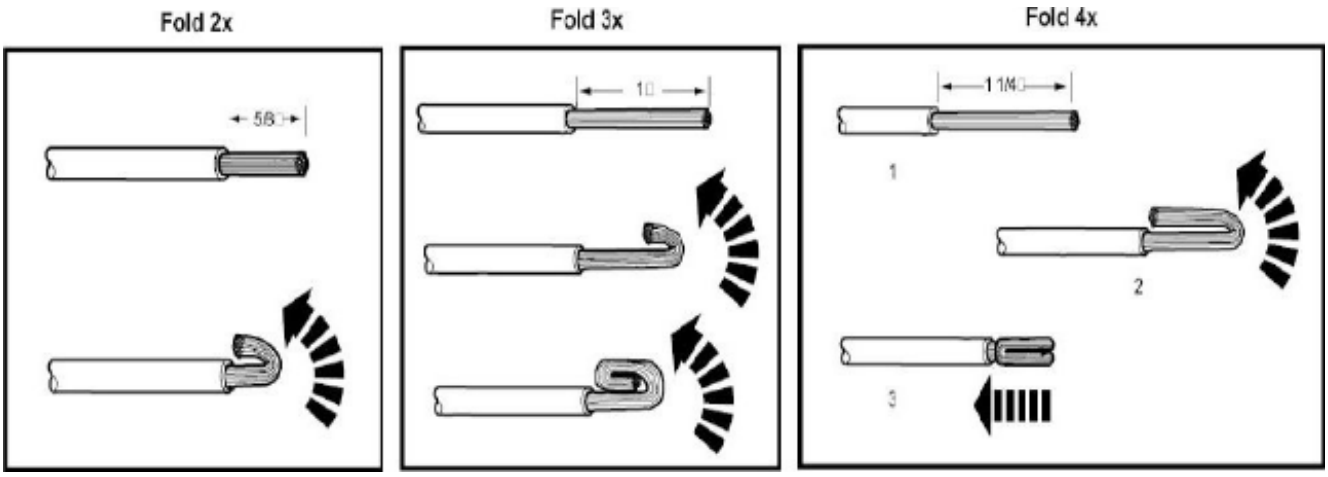
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



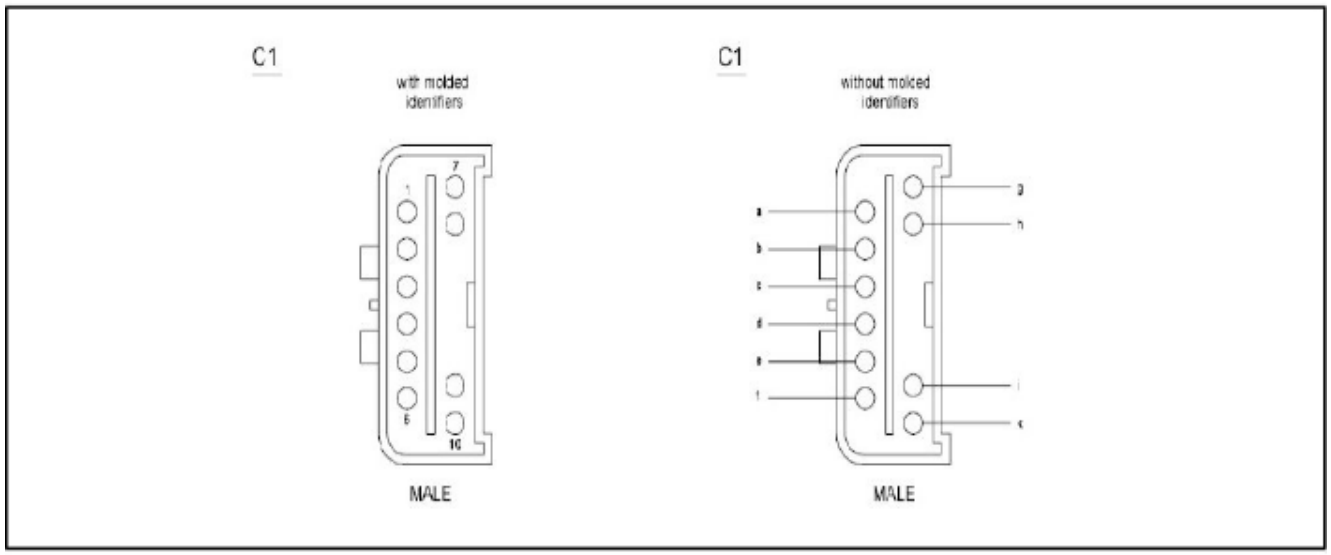
The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



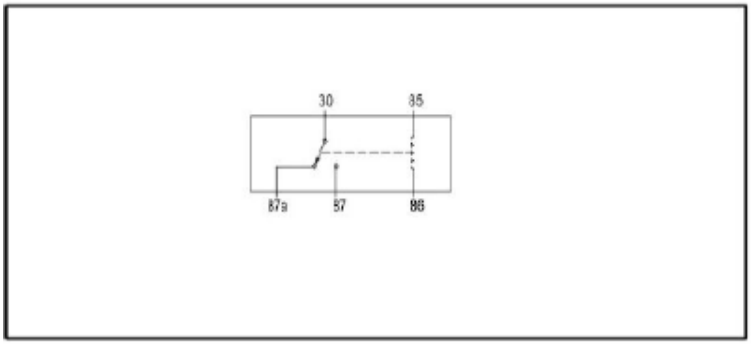
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

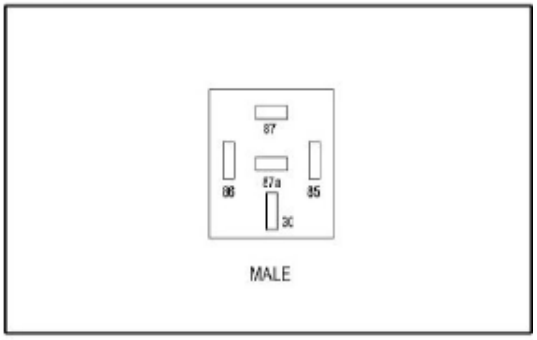
Blower Motor Relay: Testing and Inspection Mini ISO Relay

Relay □ Mini ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

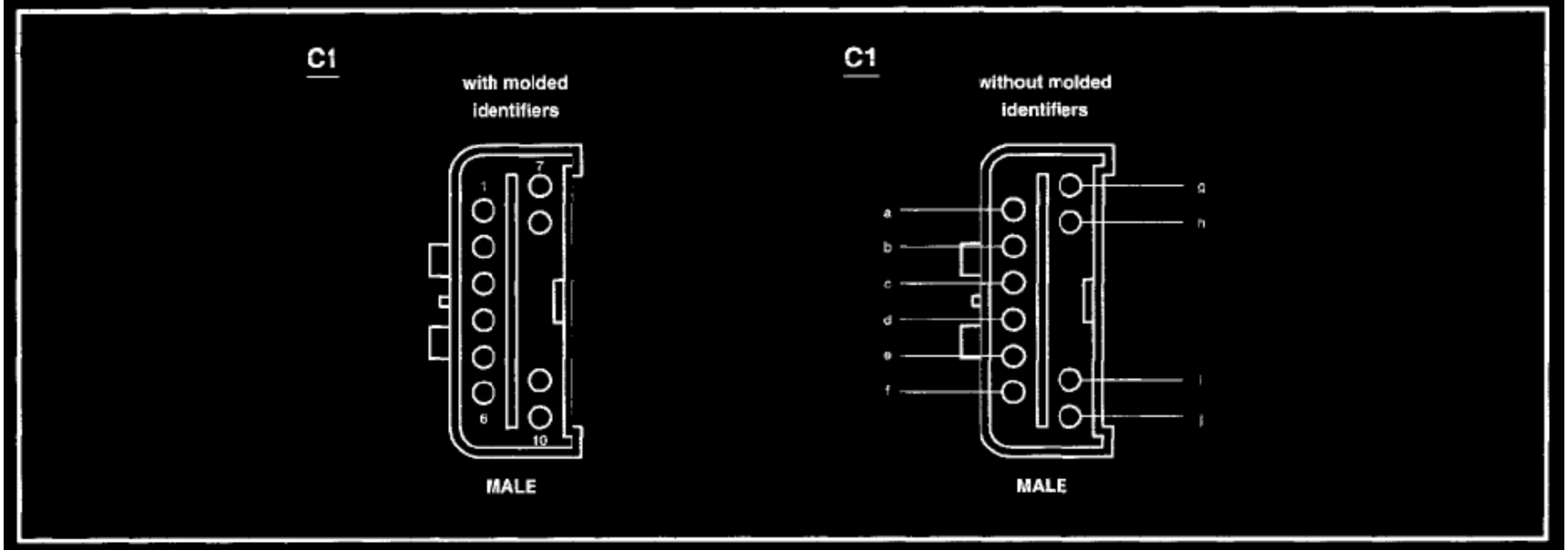
Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step–by–step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



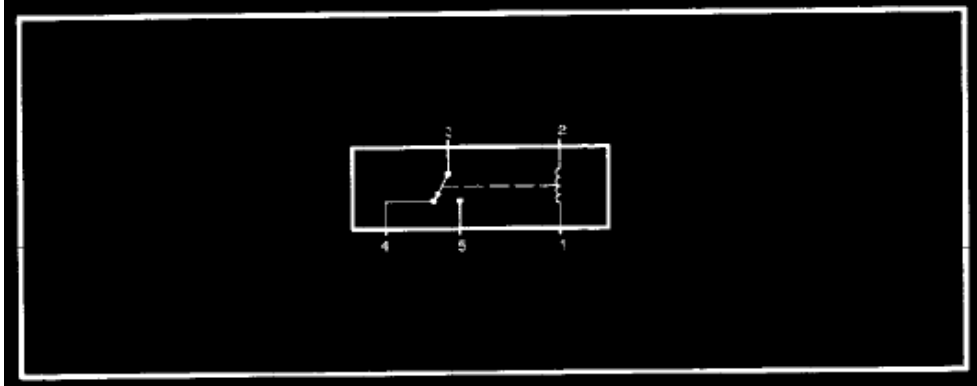
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

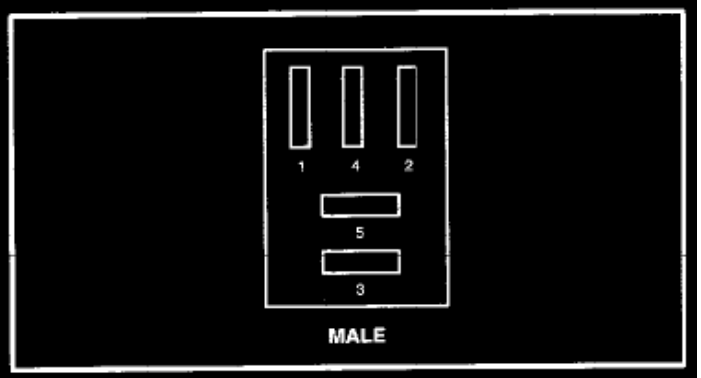
Blower Motor Relay: Testing and Inspection Micro ISO Relay

Relay – Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63–102Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil – Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

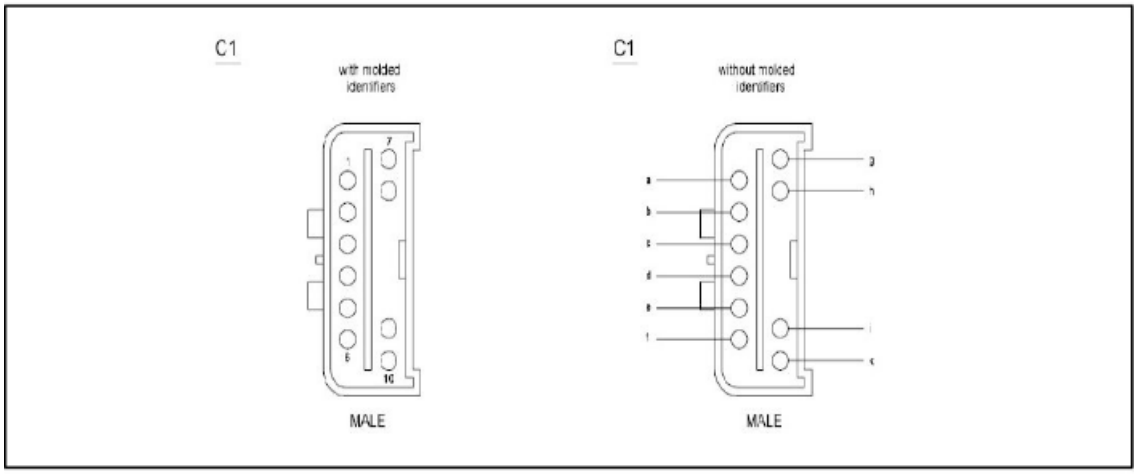
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step□by□step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals

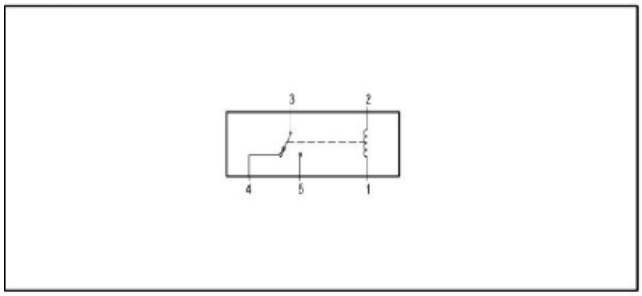


The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column □Circuit to test□. If you wish to test the complete component, perform all tests.

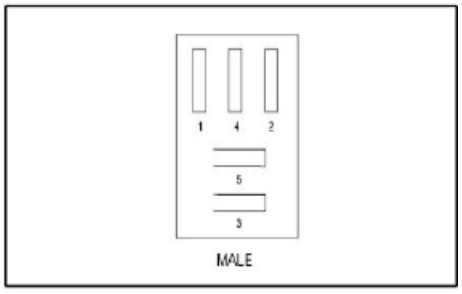
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Relay □ Micro ISO

Schematic



Terminals



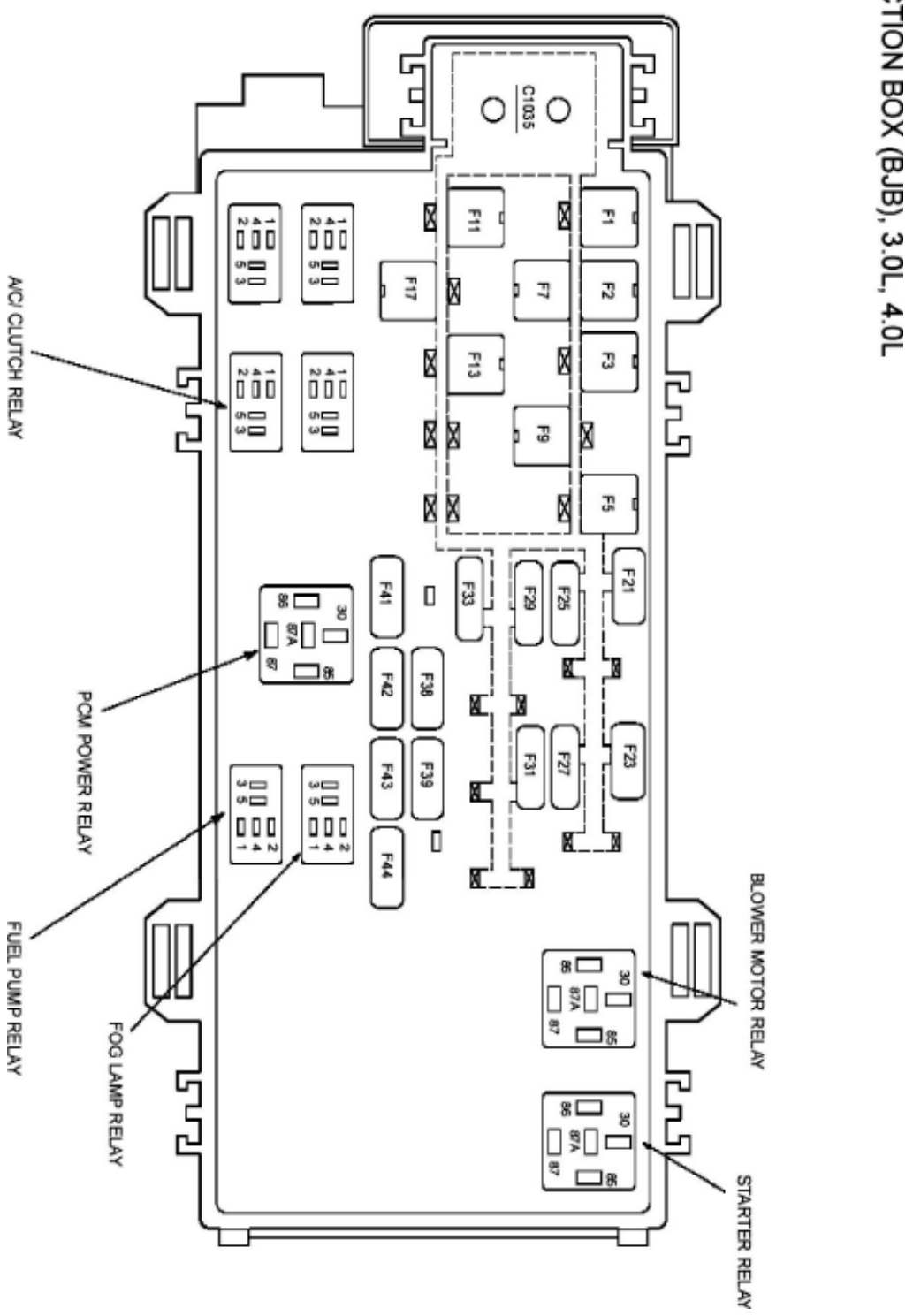
Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63□102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil □ Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

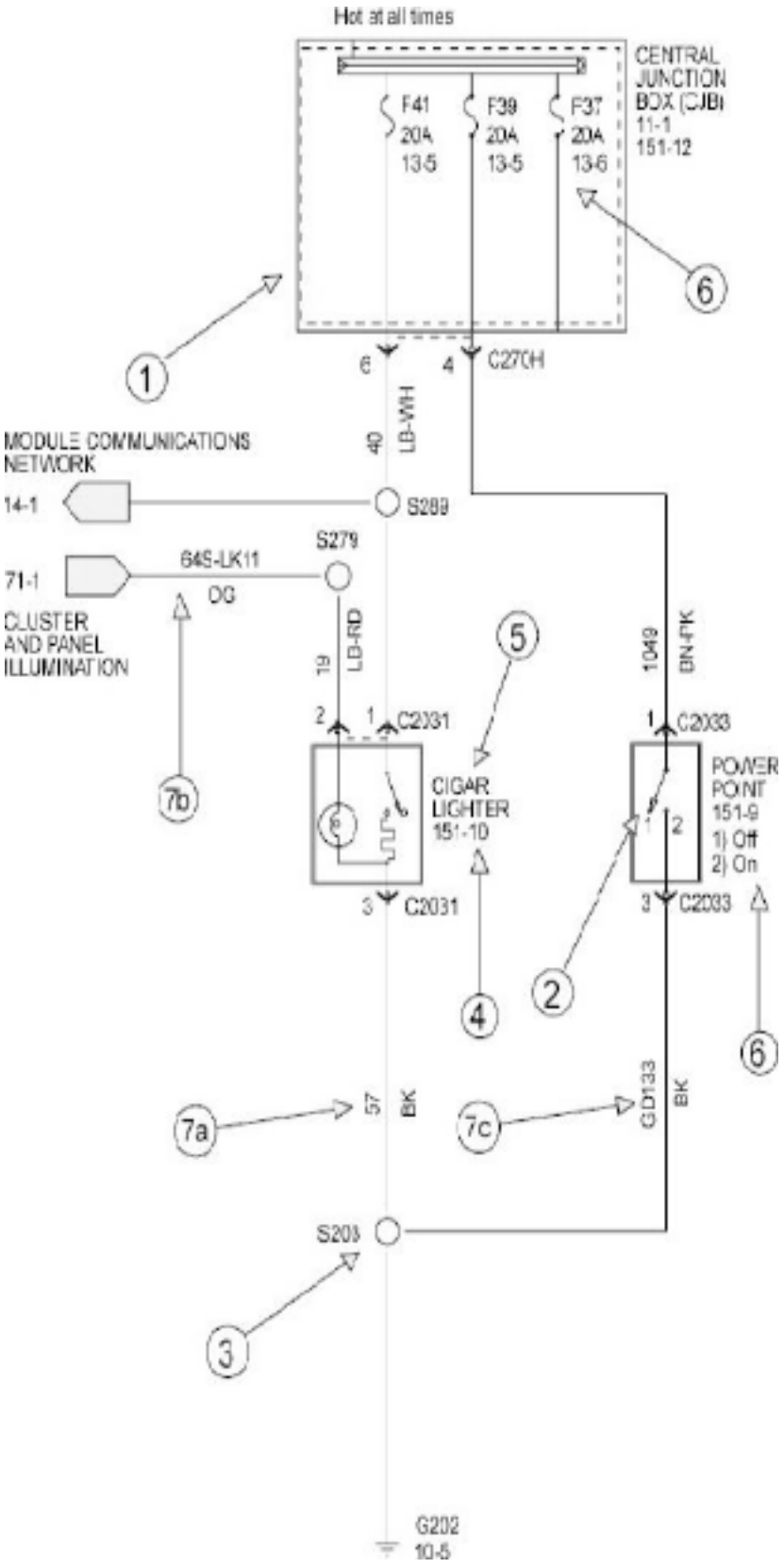
Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L



Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Relays and Modules > Relays and Modules - HVAC > Compressor Clutch Relay > Component Information > Diagrams > Diagram Information and Instructions



Compressor Clutch Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

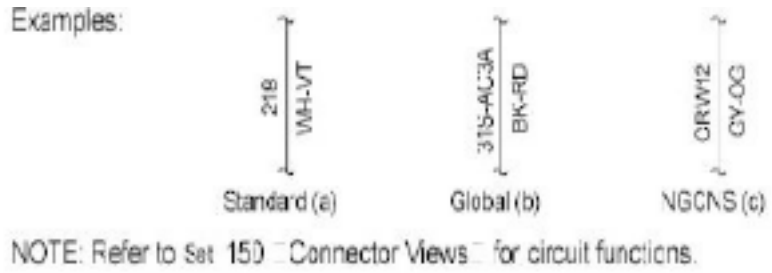
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

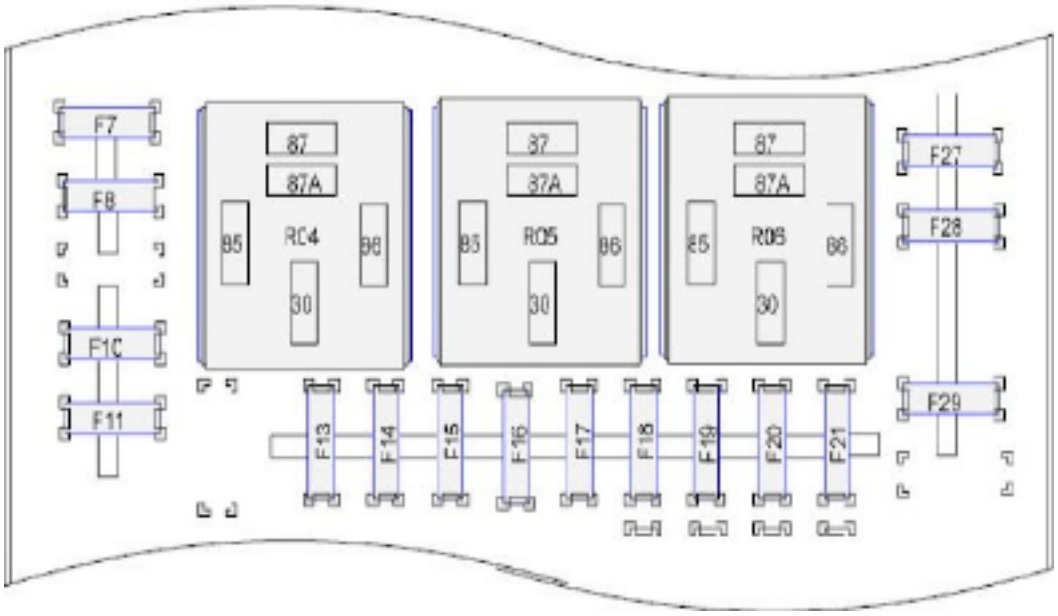
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

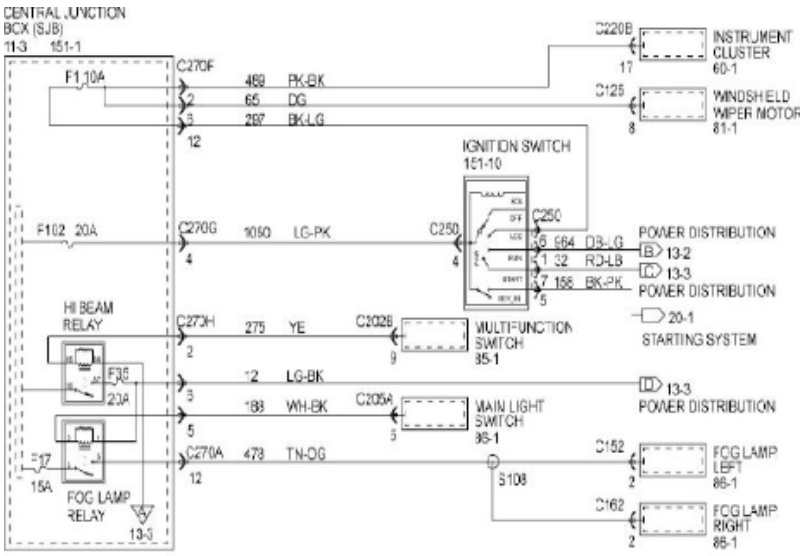
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

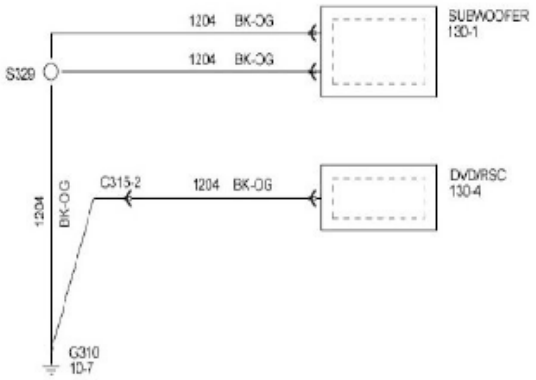
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

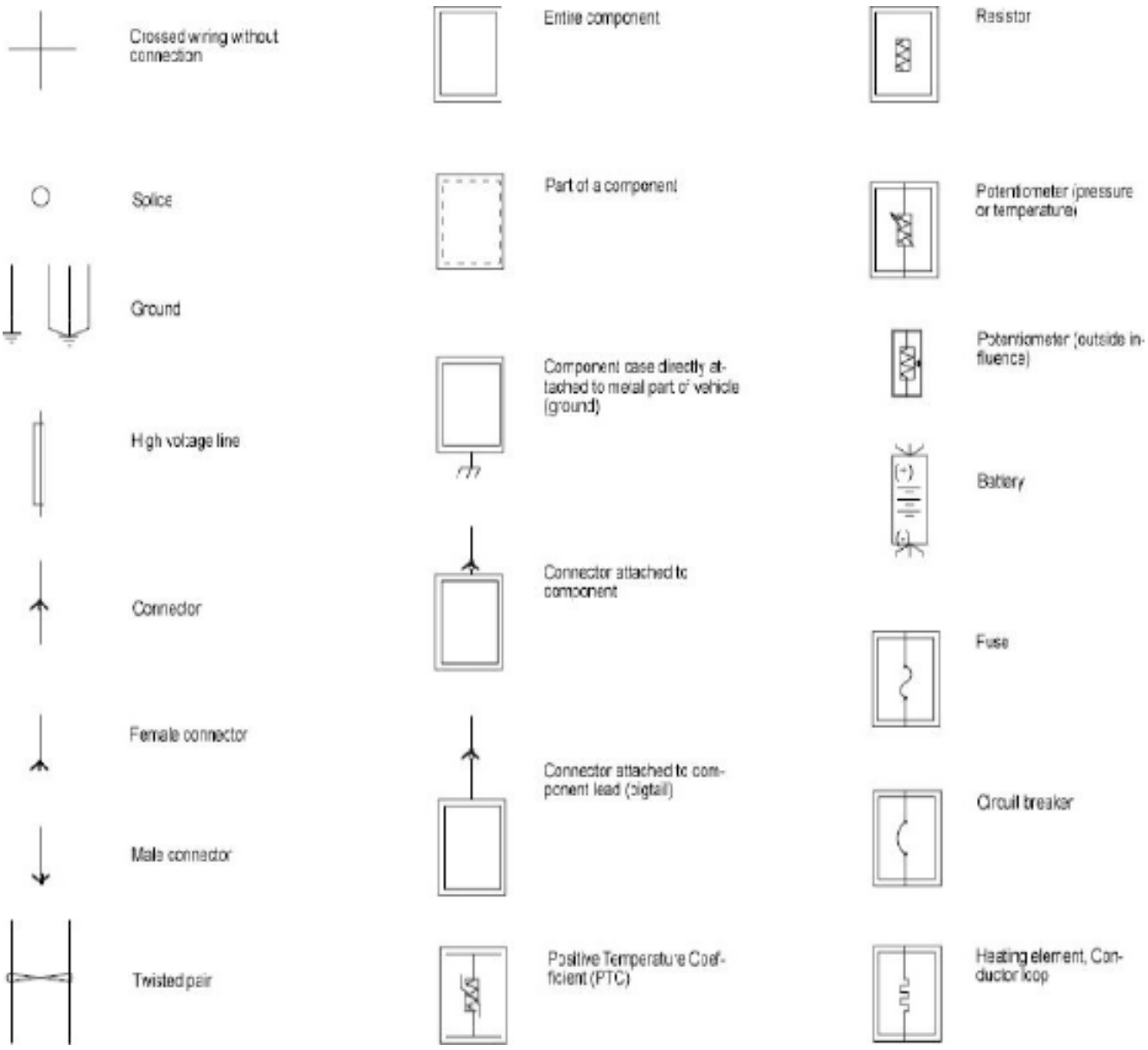
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

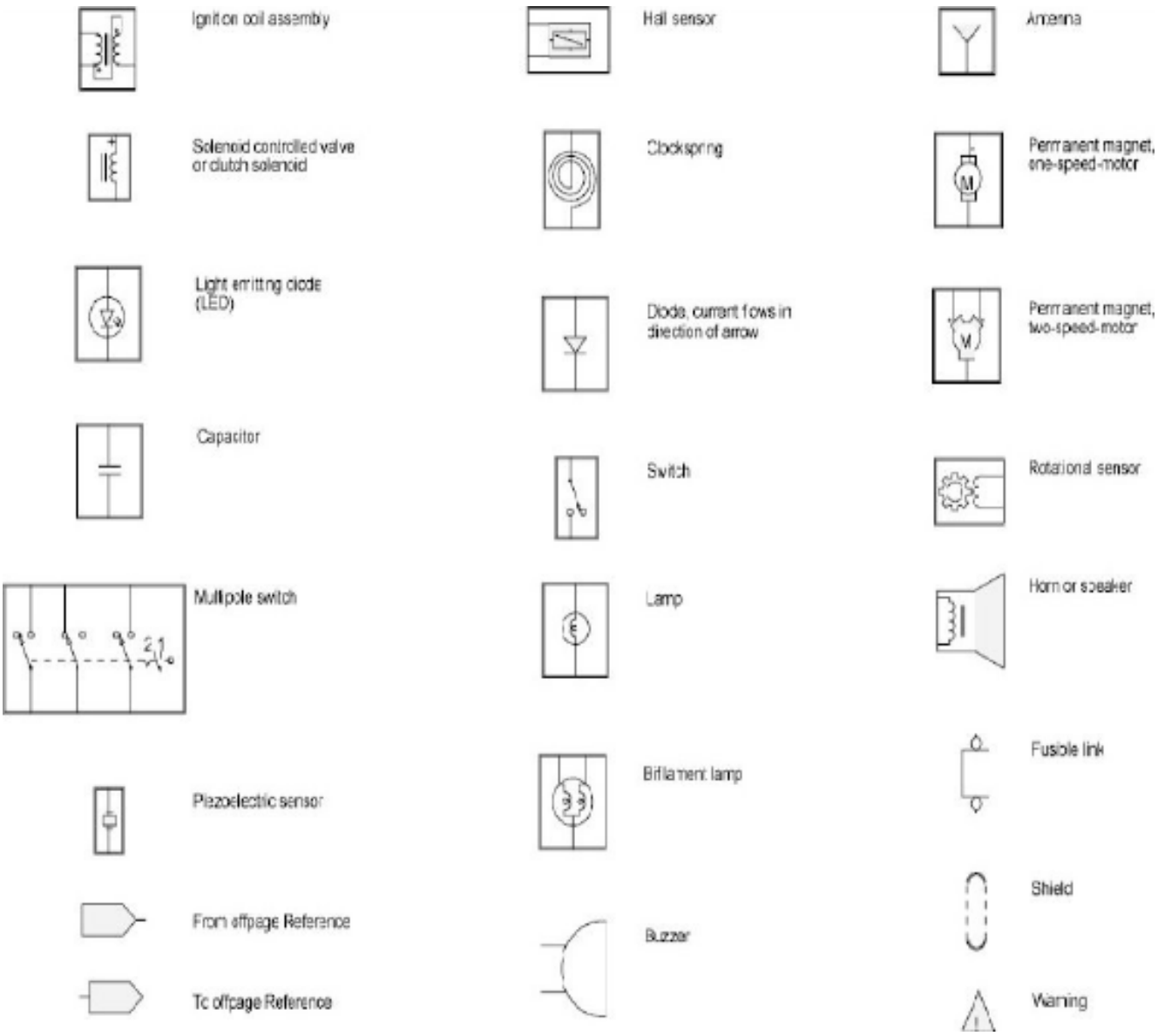
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

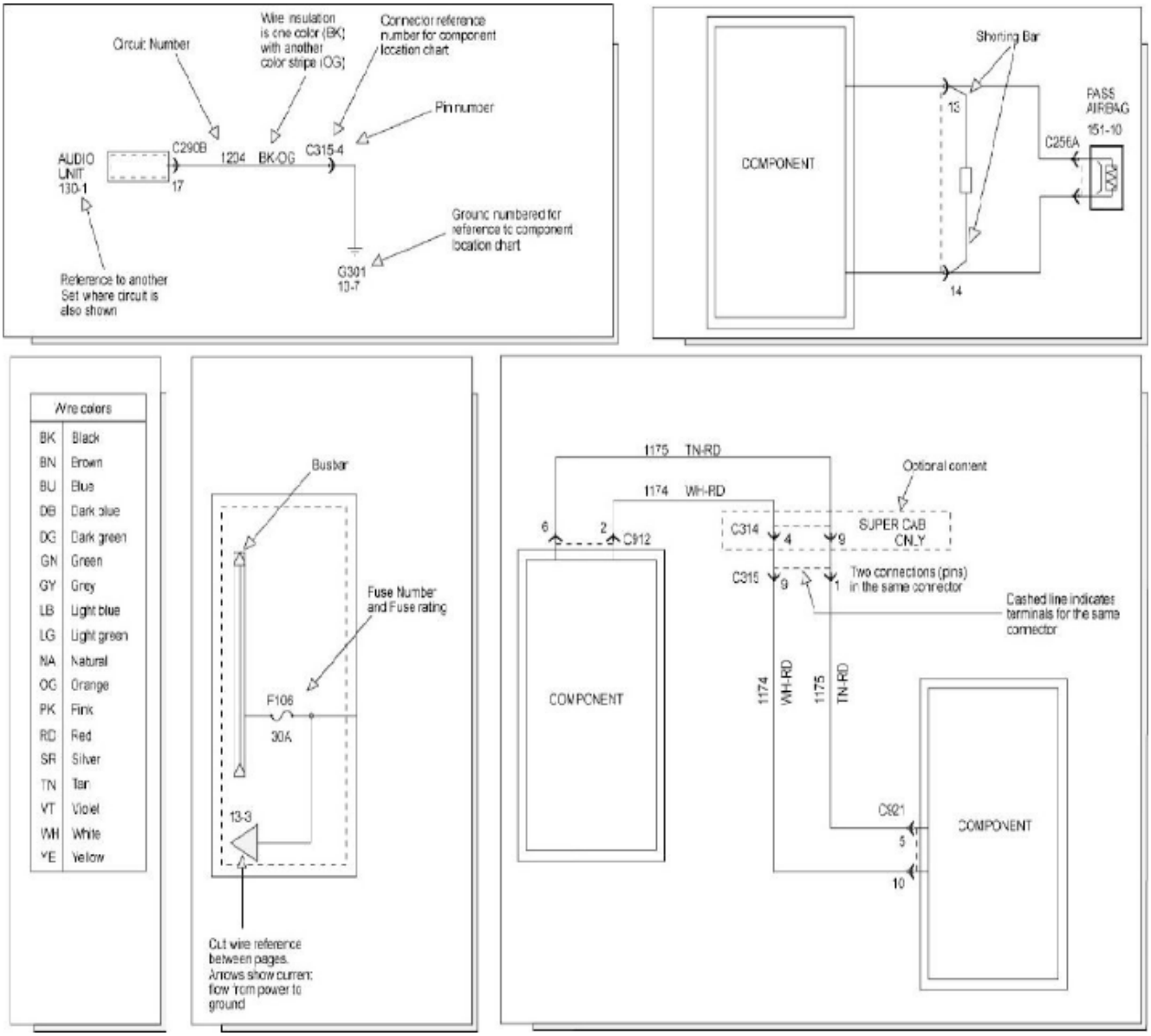
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

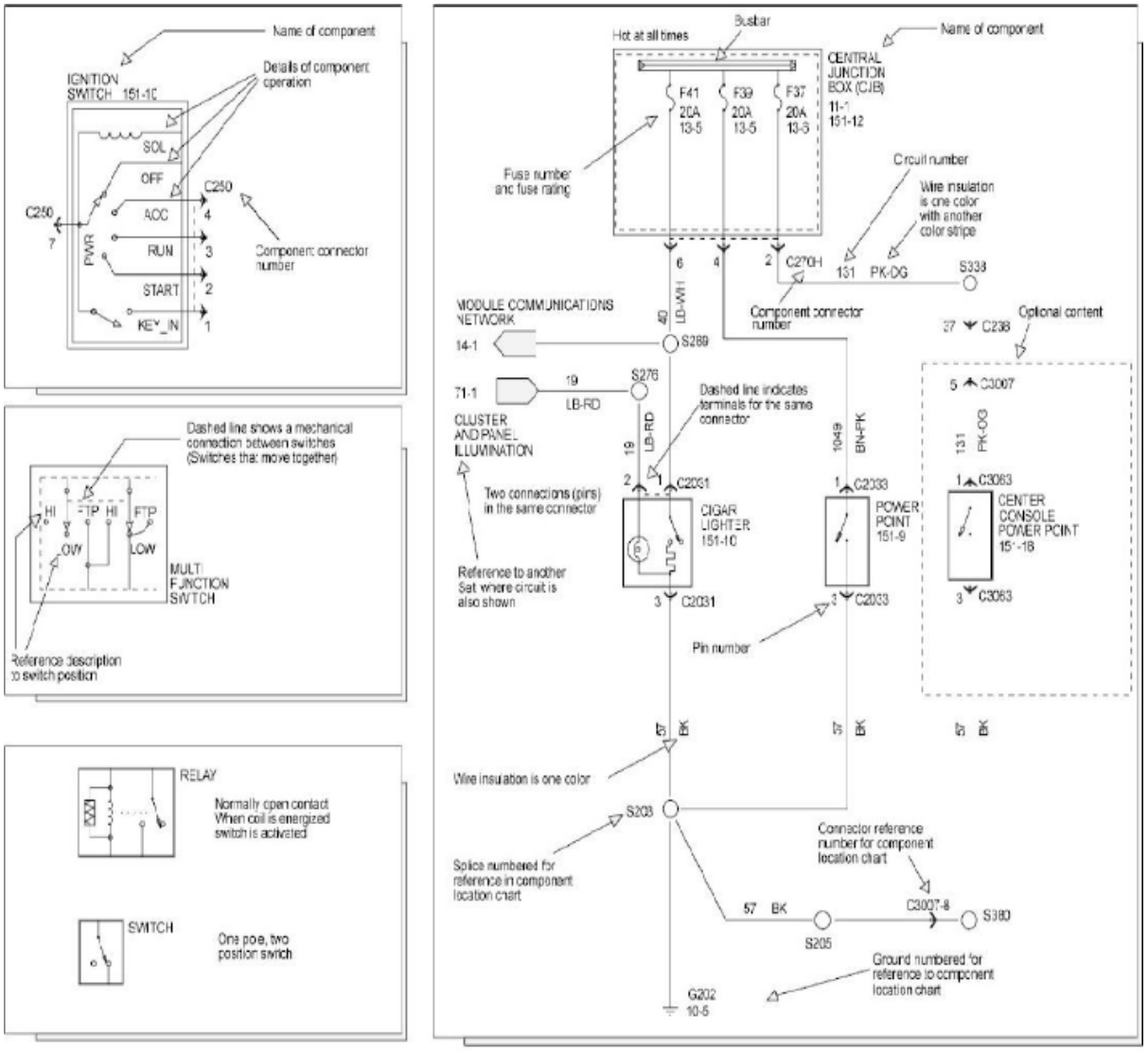
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

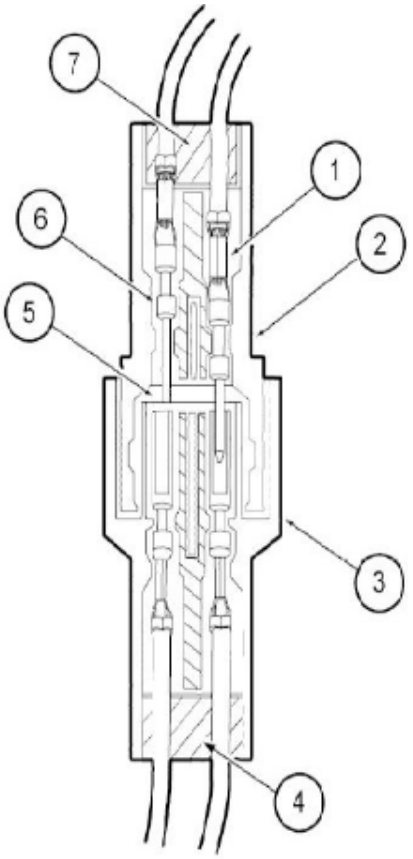


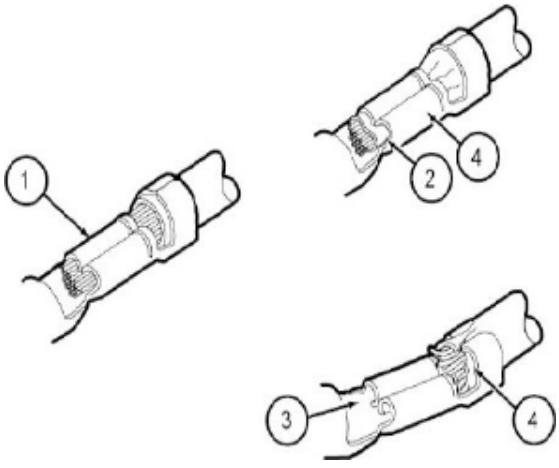
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Compressor Clutch Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

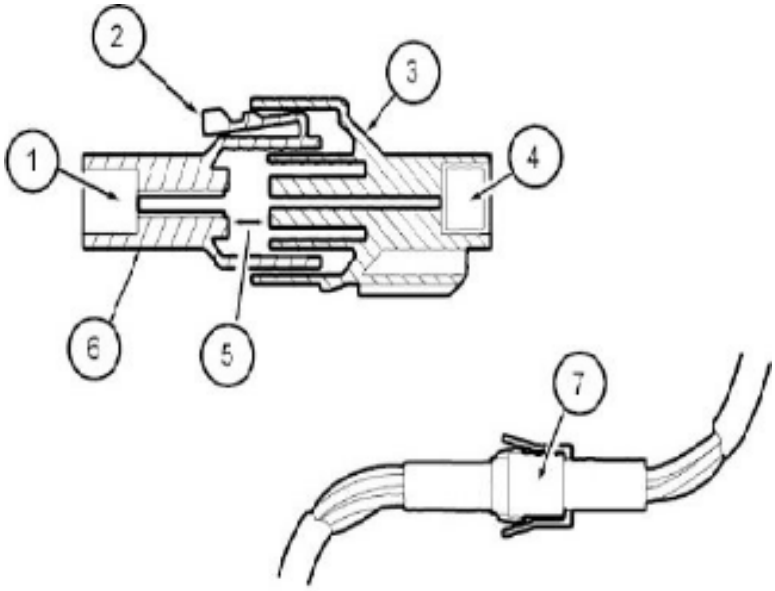
5 = Intermittent contact

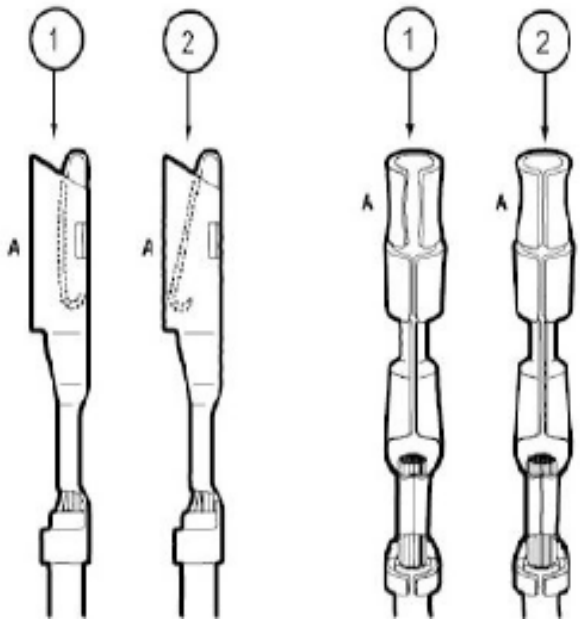
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

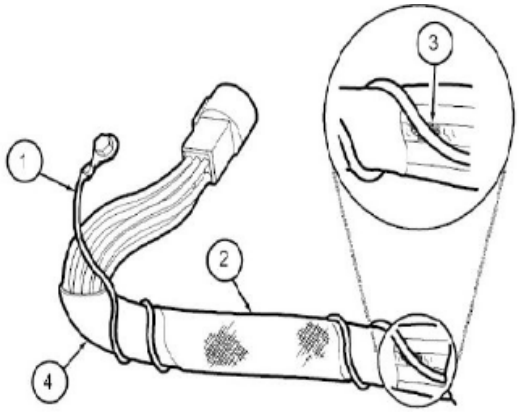
Deformed (enlarged) female terminals

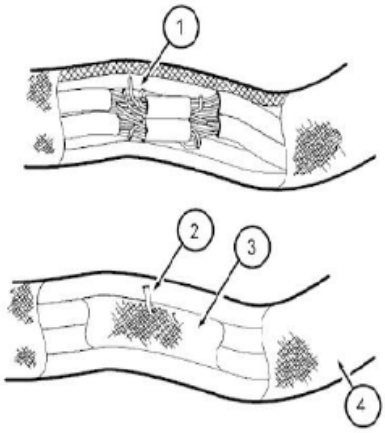
1 = Enlarged

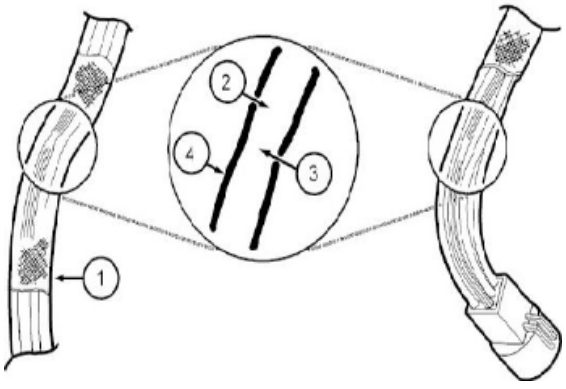
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

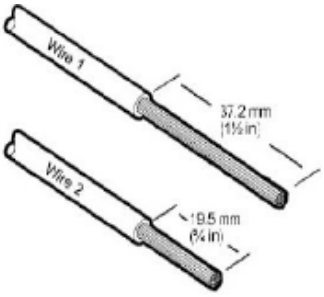
Splice covered 2

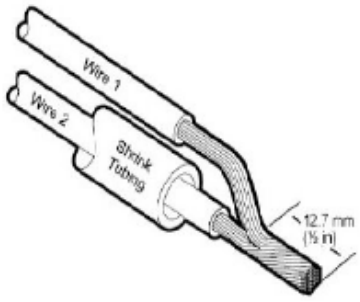
= Wire strand

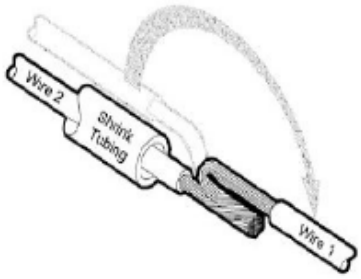
3 = Splice tape

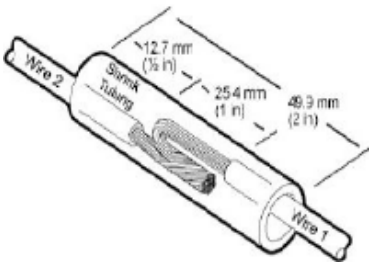
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

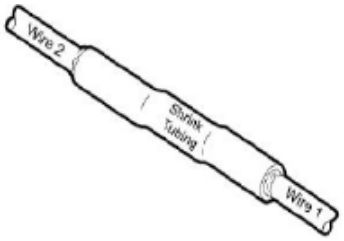
NOTE: -

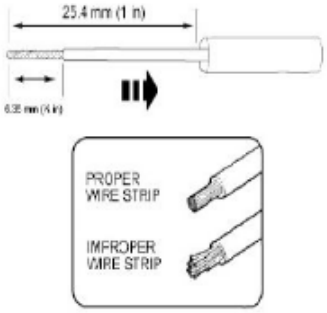
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

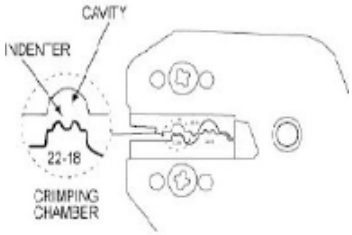
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

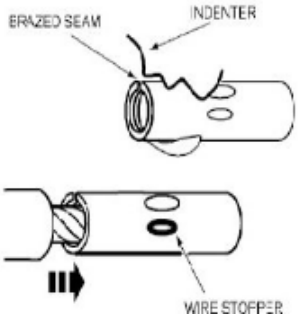
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
6.35 mm (¼ in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

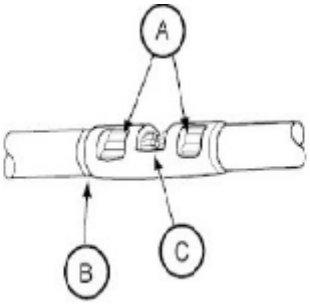
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

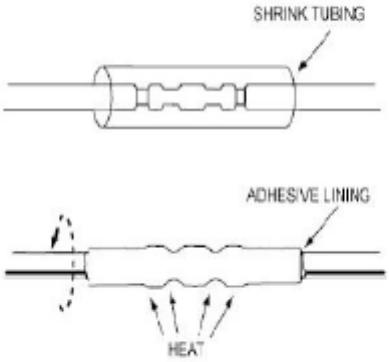
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4 strip, cut 9 strands	* 1/4 strip, cut 2 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip, fold 3x dia.
	16-14	* 1/4 strip, cut 7 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip fold 2x dia	1 strip, fold 3x dia.	1 1/4 strip, fold 4x dia.	Not Recommended
	12-10	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip fold 3x dia.	1 1/4 strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Pigtail only

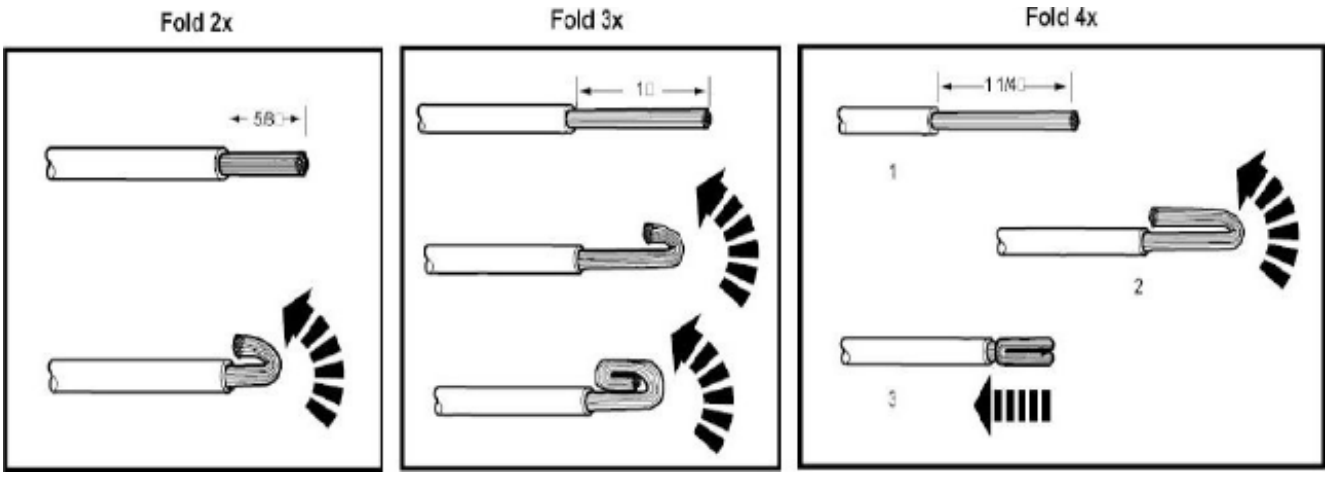
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Compressor Clutch Relay: Description and Operation

AIR CONDITIONING (A/C) CLUTCH RELAY (A/CCR)

NOTE: The PCM PIDs WAC and wide open throttle air conditioning cutoff fault (WACF) are used to monitor the A/CCR output.

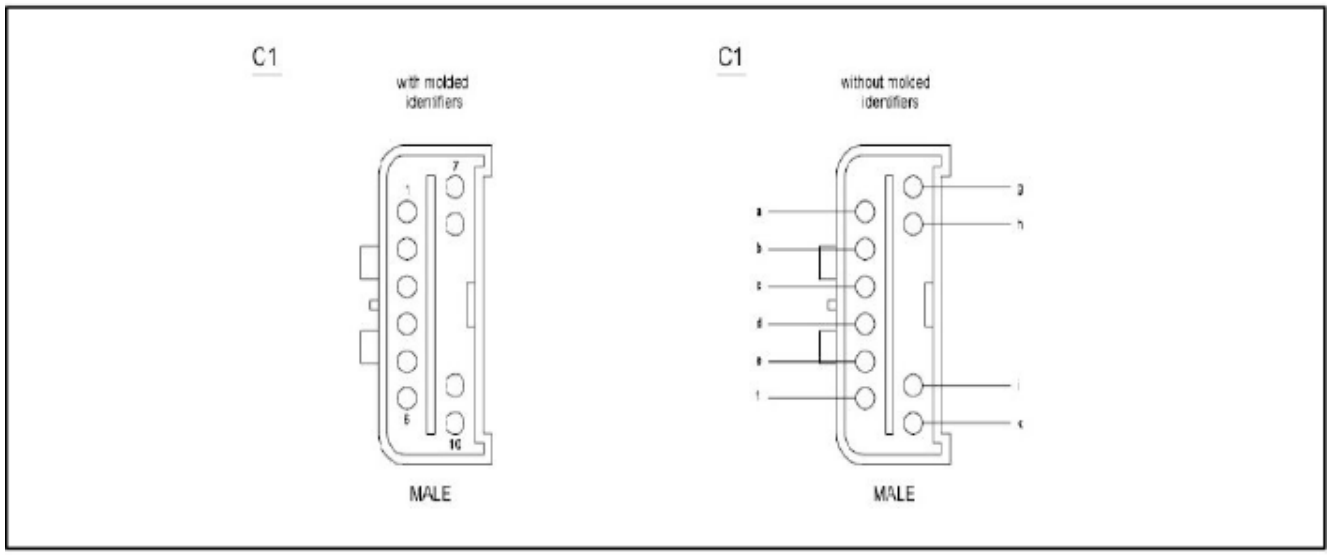
The A/CCR is wired normally open. There is no direct electrical connection between the A/C switch or electronic automatic temperature control (EATC) module and the A/C clutch. The PCM receives a signal indicating that A/C is requested. For some applications, this message is sent through the communications network. When A/C is requested, the PCM checks other A/C related inputs that are available, such as A/C pressure switch and A/C cycling switch. If these inputs indicate A/C operation is OK, and the engine conditions are OK (coolant temperature, engine RPM, throttle position), the PCM grounds the A/CCR output, closing the relay contacts and sending voltage to the A/CCR.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



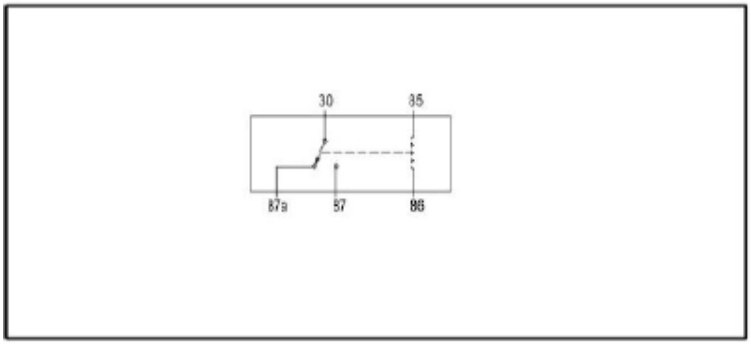
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

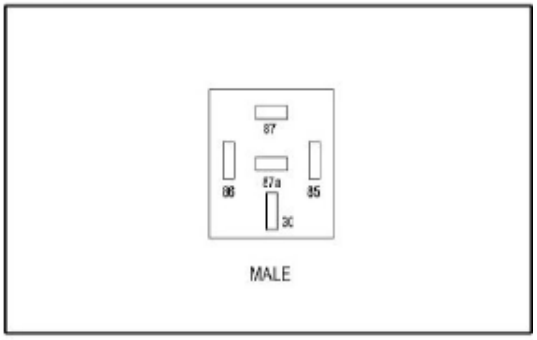
Compressor Clutch Relay: Testing and Inspection Mini ISO Relay

Relay □ Mini ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	45 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

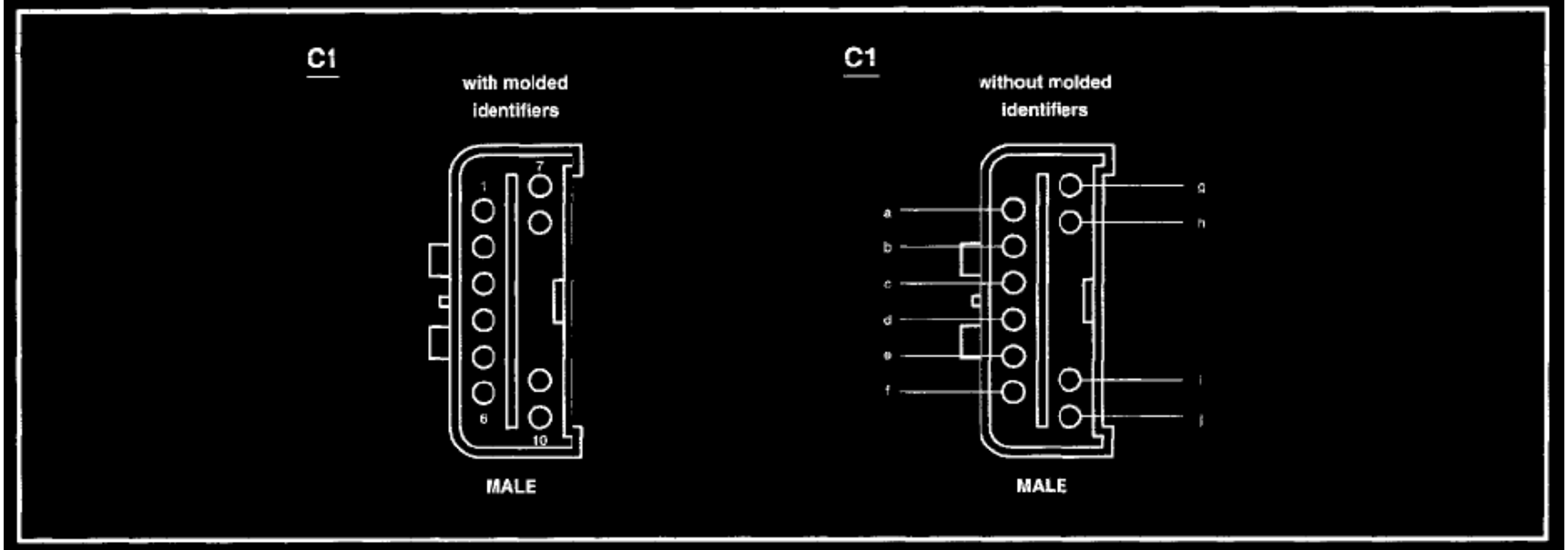
Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step–by–step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



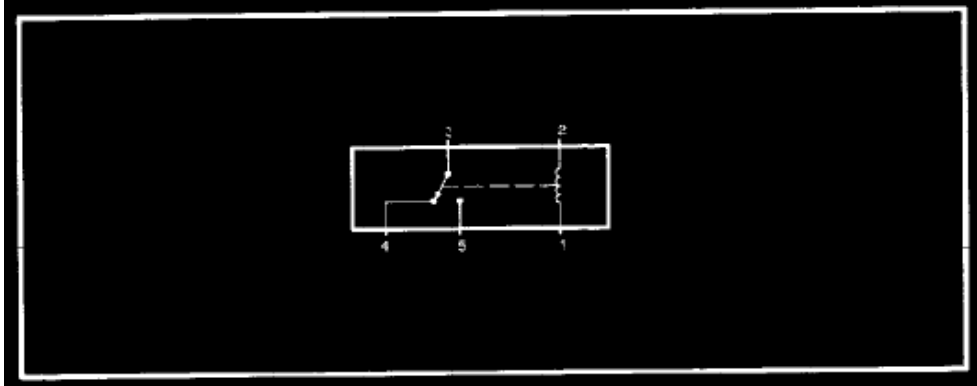
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

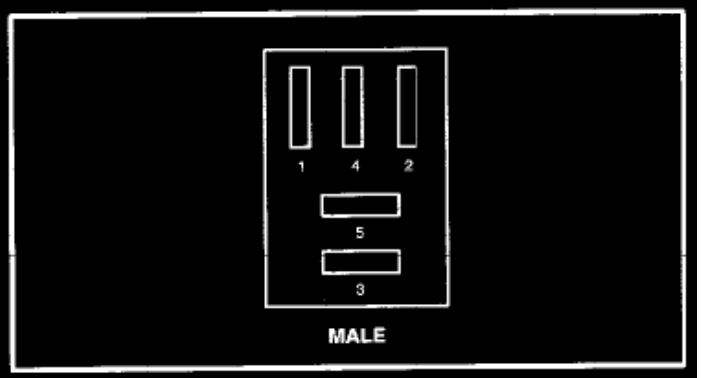
Compressor Clutch Relay: Testing and Inspection Micro ISO Relay

Relay – Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63–102Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil – Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

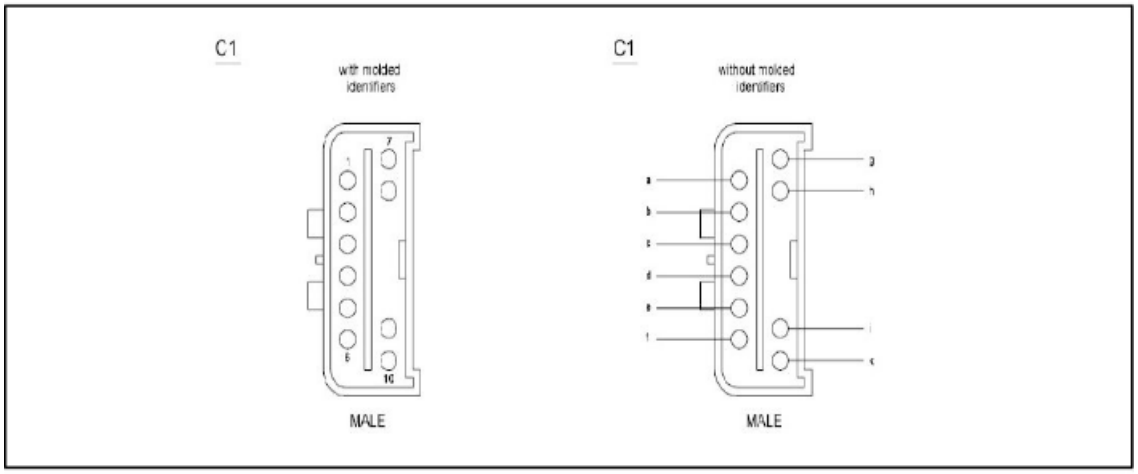
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step□by□step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals

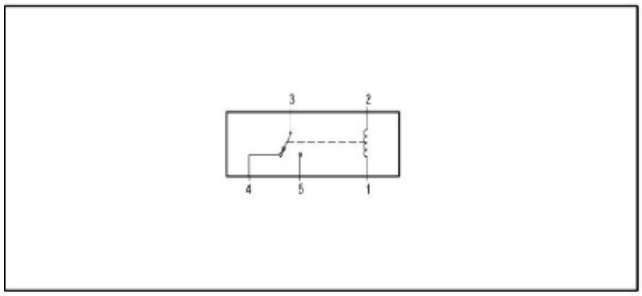


The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column □Circuit to test□. If you wish to test the complete component, perform all tests.

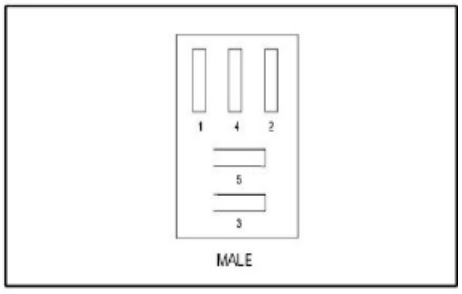
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Relay □ Micro ISO

Schematic



Terminals



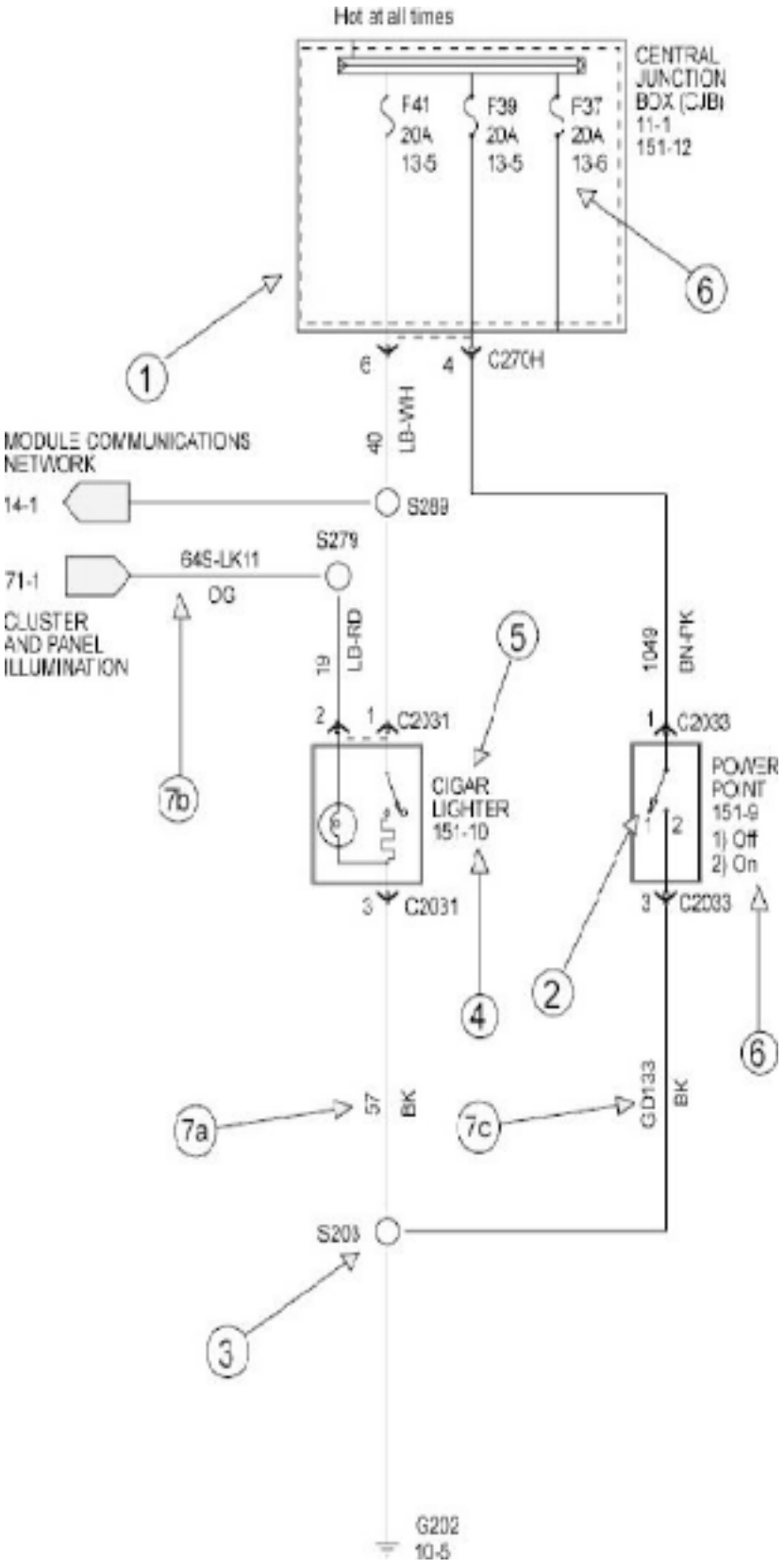
Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63□102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil □ Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Relays and Modules > Relays and Modules - Lighting and Horns > Battery Discharge Protection Relay, Lighting > Component Information > Diagrams > Diagram Information and Instructions



Battery Discharge Protection Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

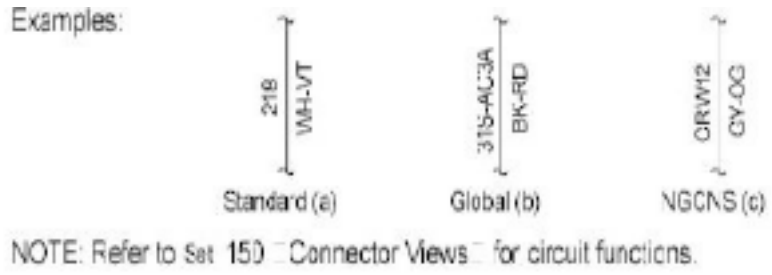
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

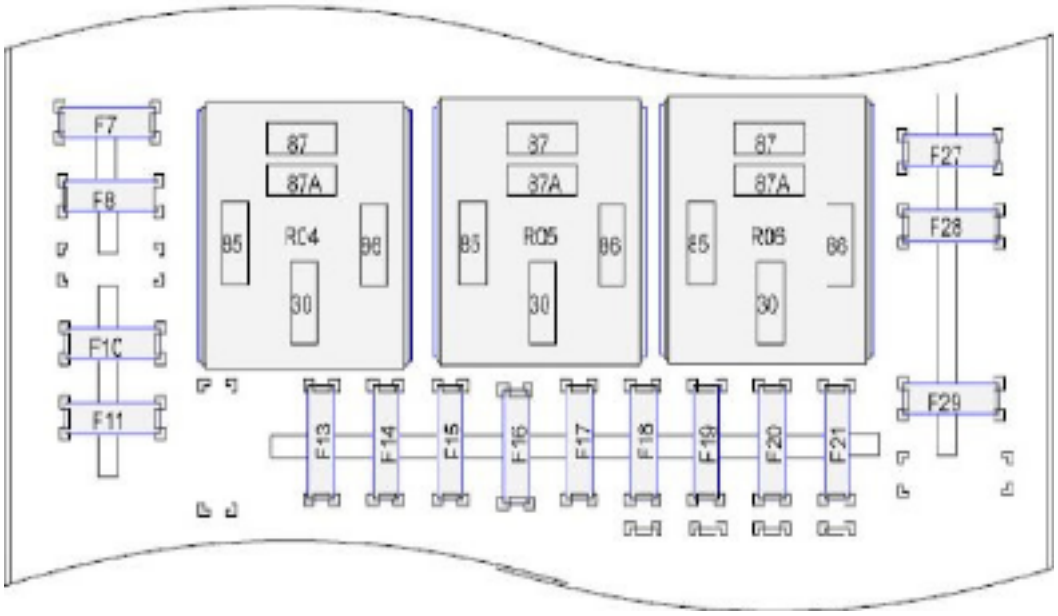
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

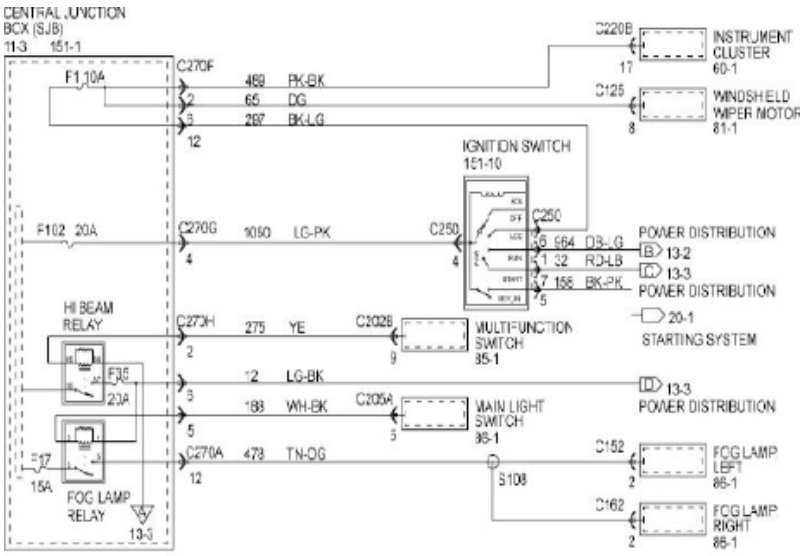
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

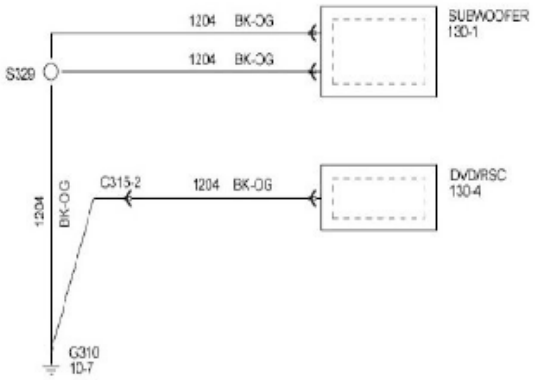
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

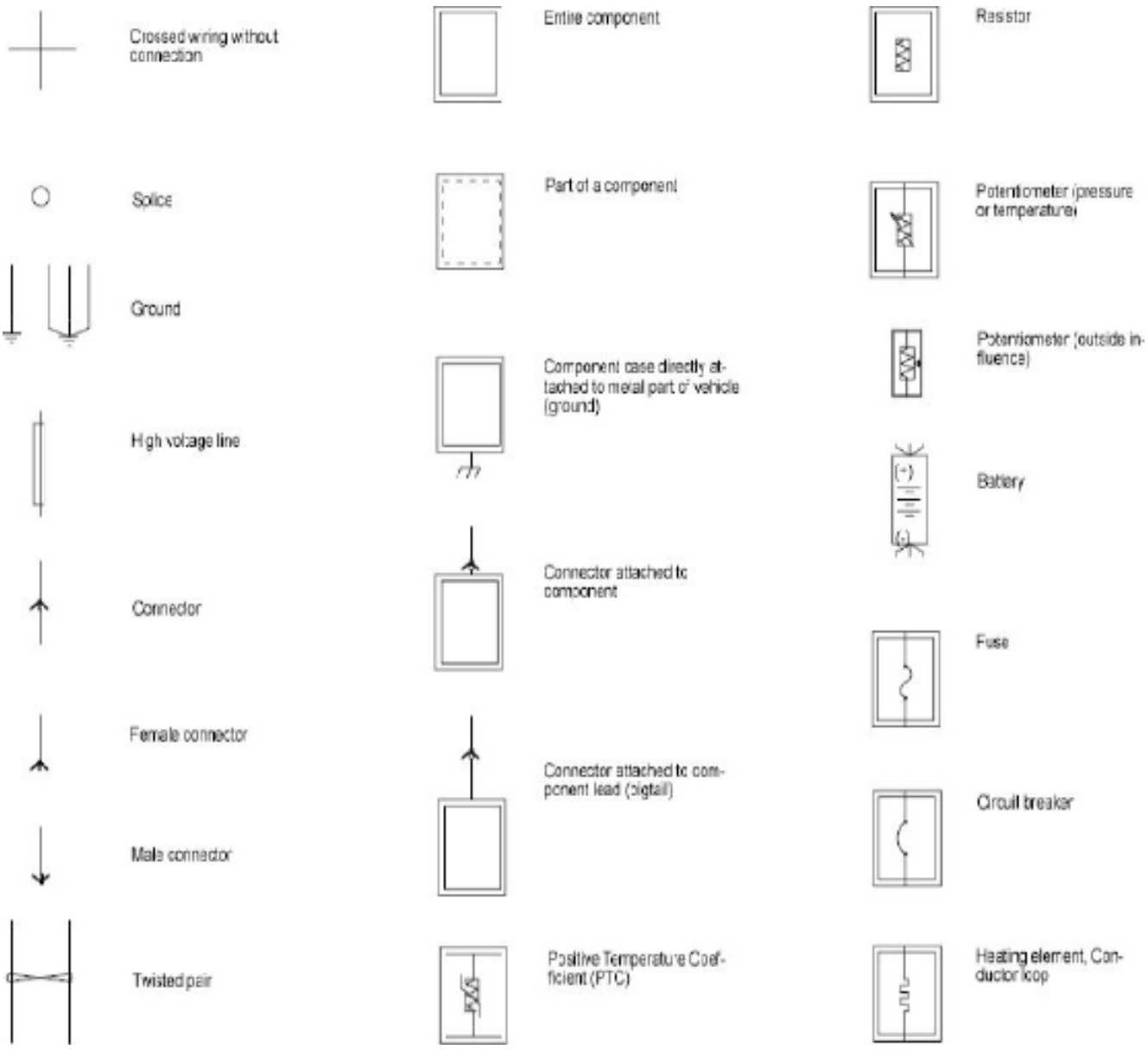
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

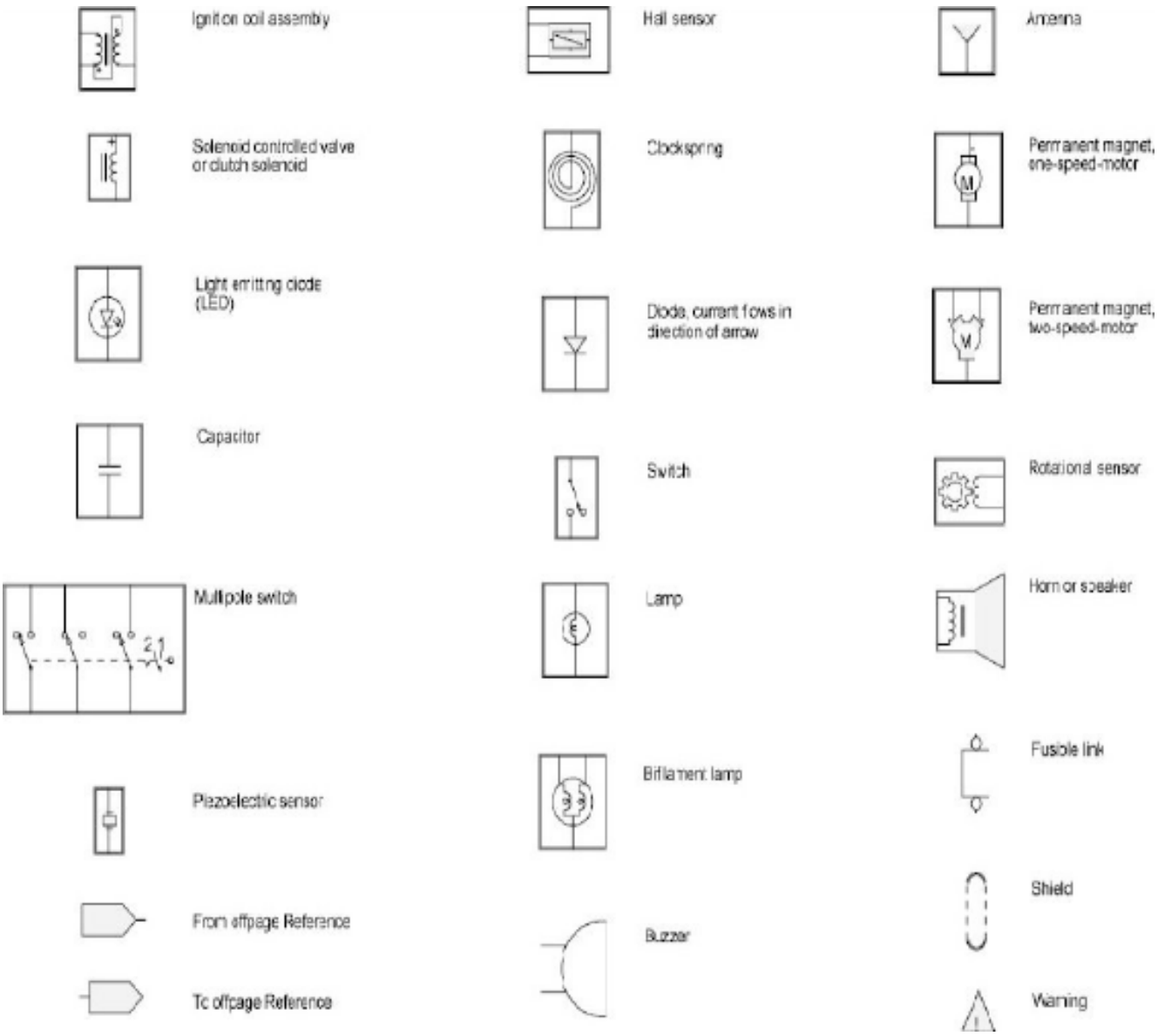
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

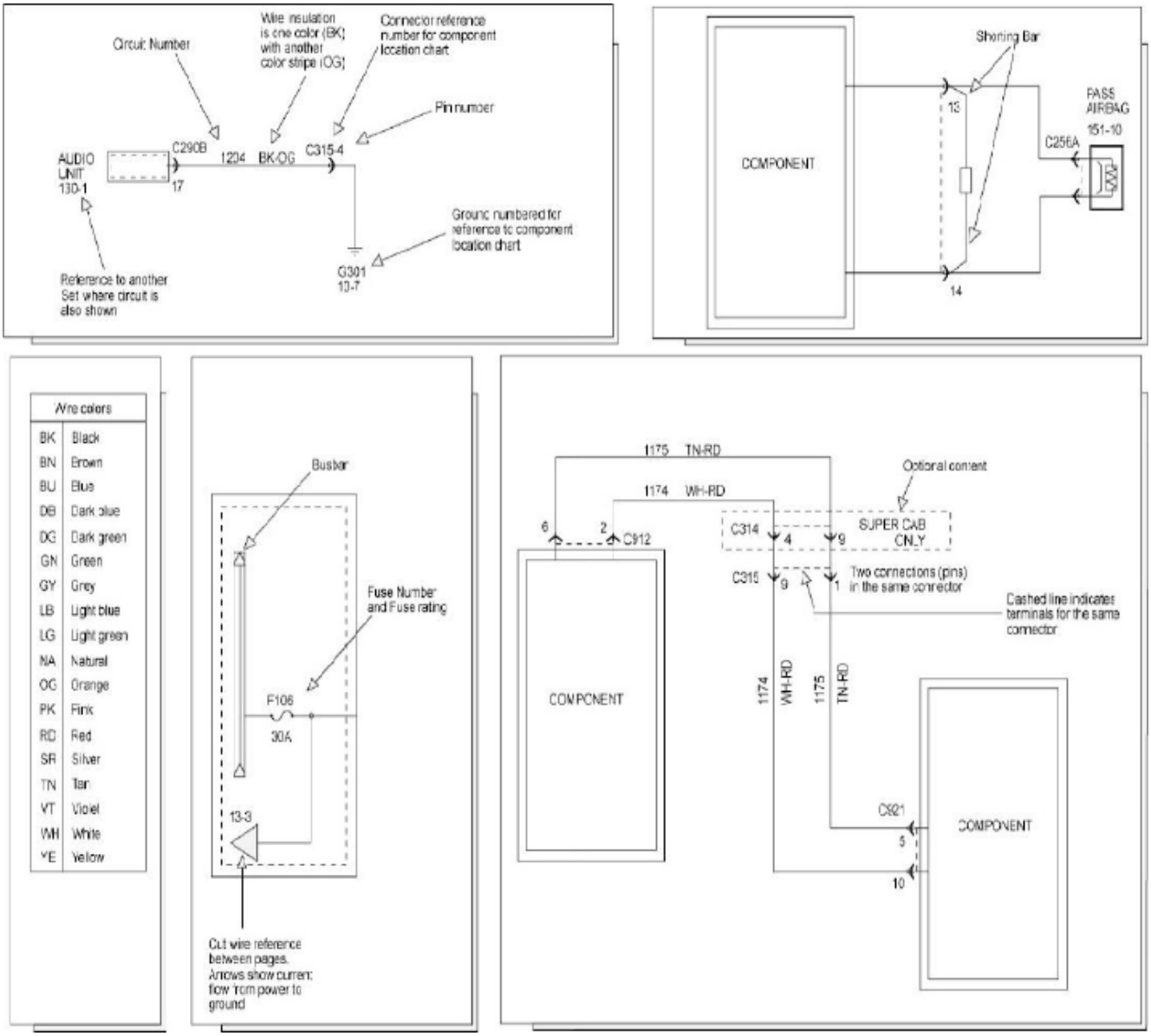
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

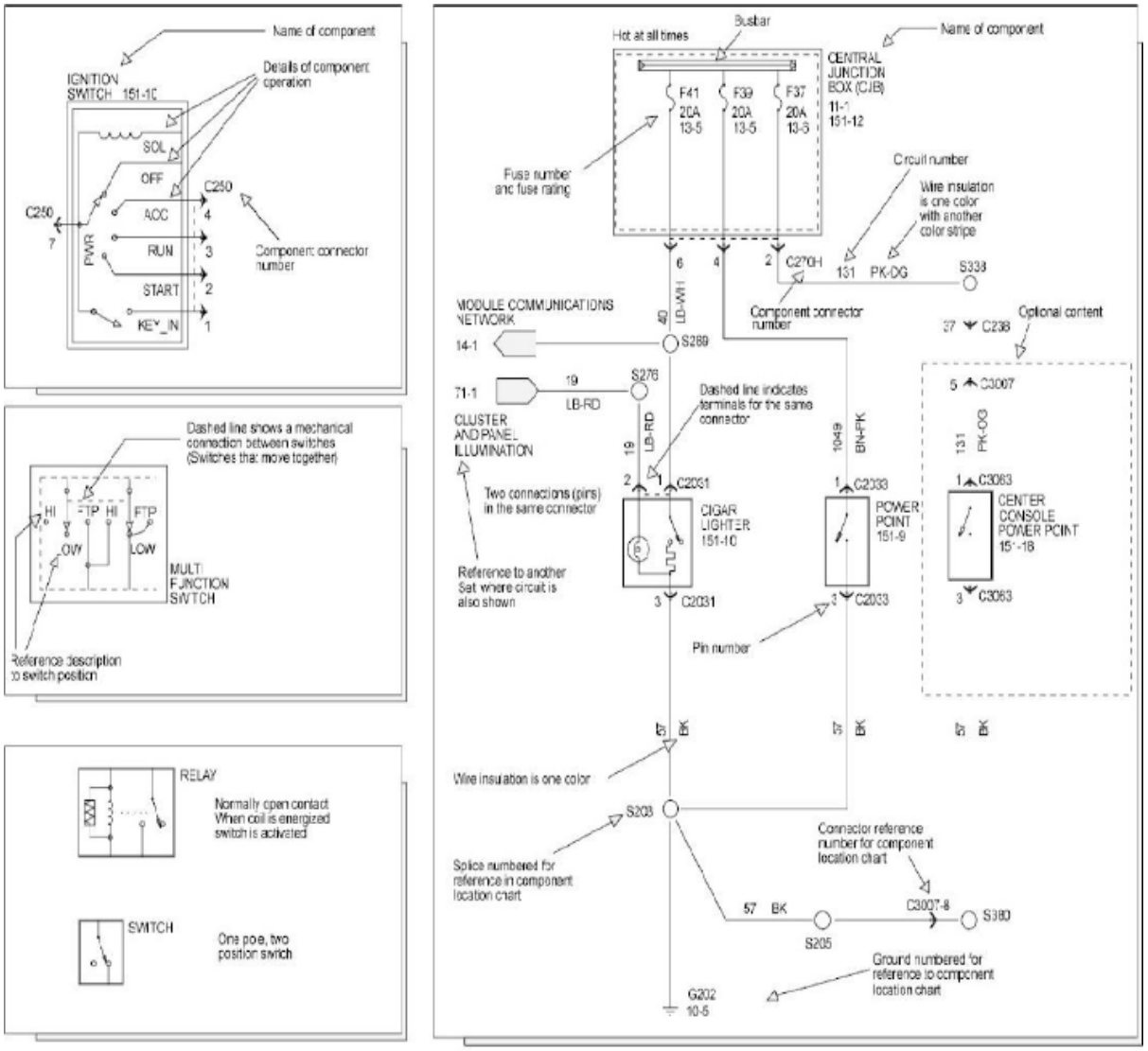
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

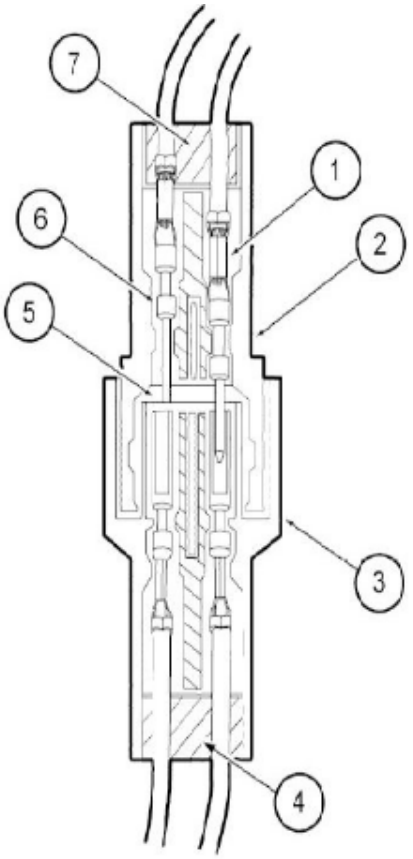


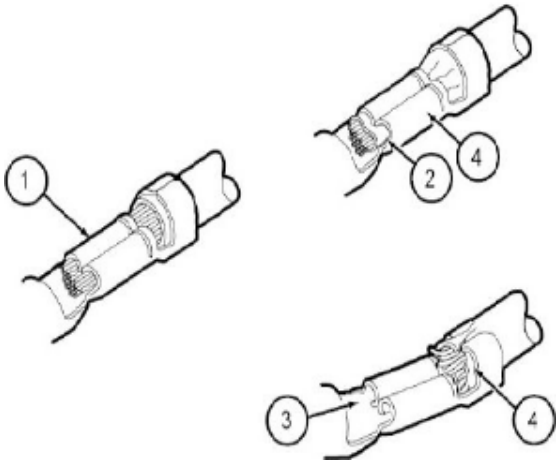
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Battery Discharge Protection Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

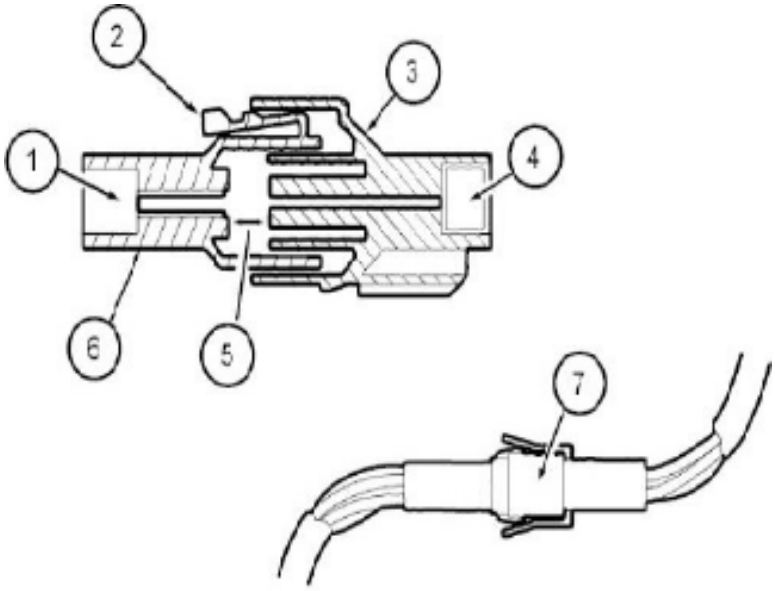
5 = Intermittent contact

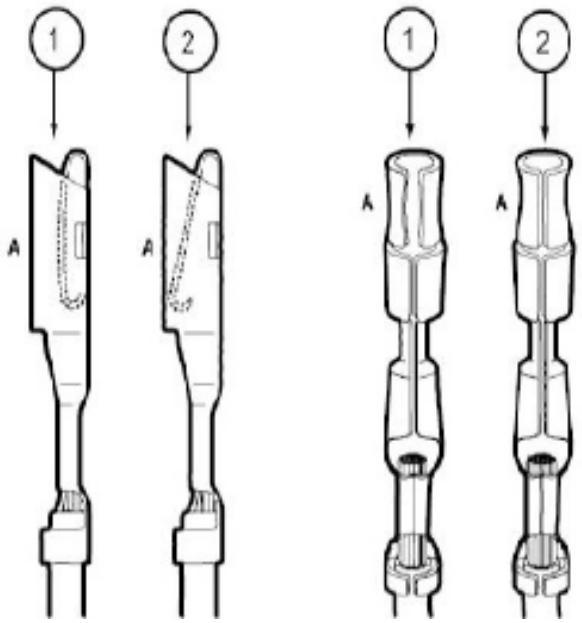
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

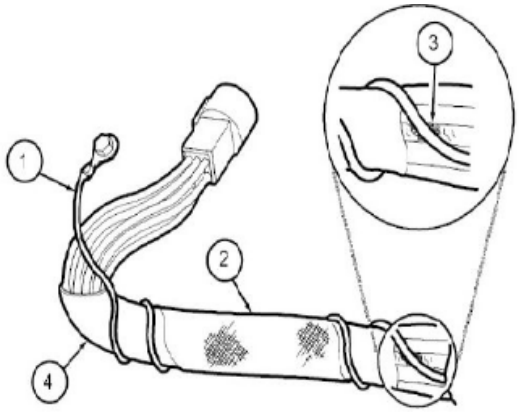
Deformed (enlarged) female terminals

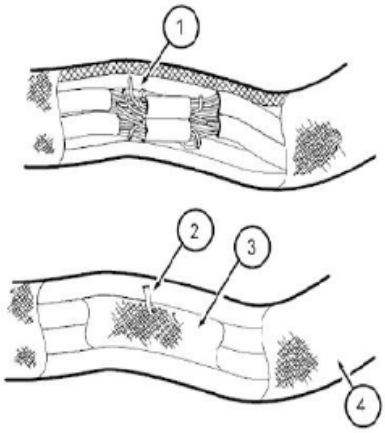
1 = Enlarged

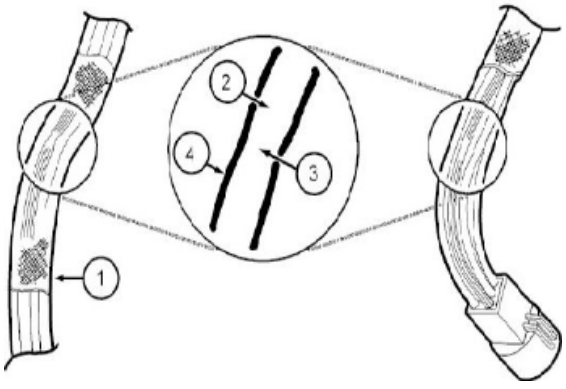
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

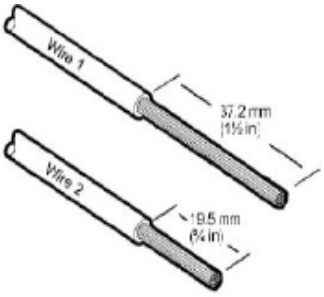
Splice covered 2

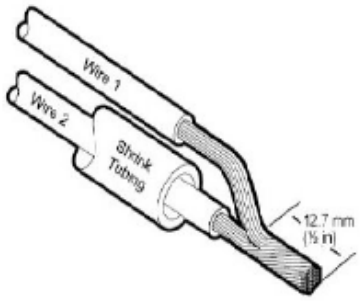
= Wire strand

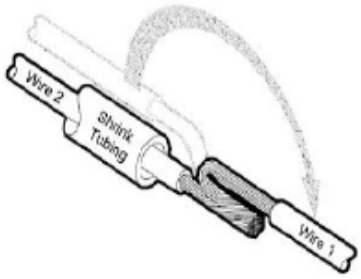
3 = Splice tape

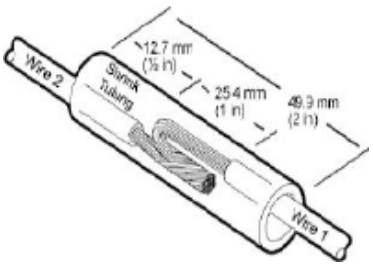
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

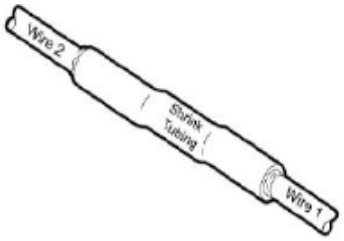
NOTE: -

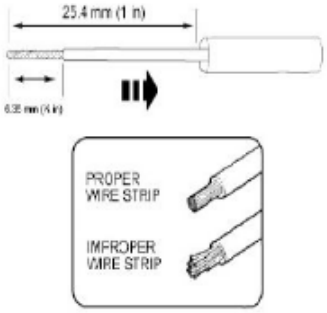
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

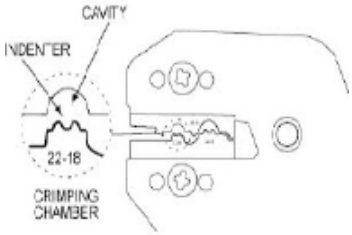
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

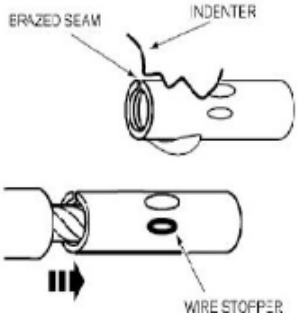
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
6.35 mm (¼ in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

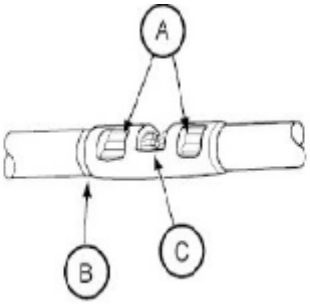
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

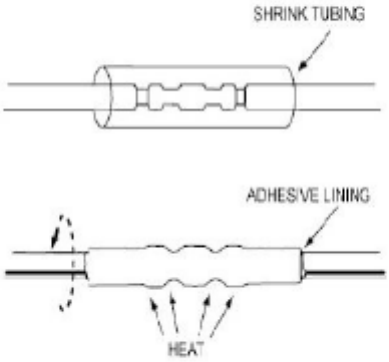
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4 strip, cut 9 strands	* 1/4 strip, cut 2 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip, fold 3x dia.
	16-14	* 1/4 strip, cut 7 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip fold 2x dia	1 strip, fold 3x dia.	1 1/4 strip, fold 4x dia.	Not Recommended
	12-10	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip fold 3x dia.	1 1/4 strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Pigtail only

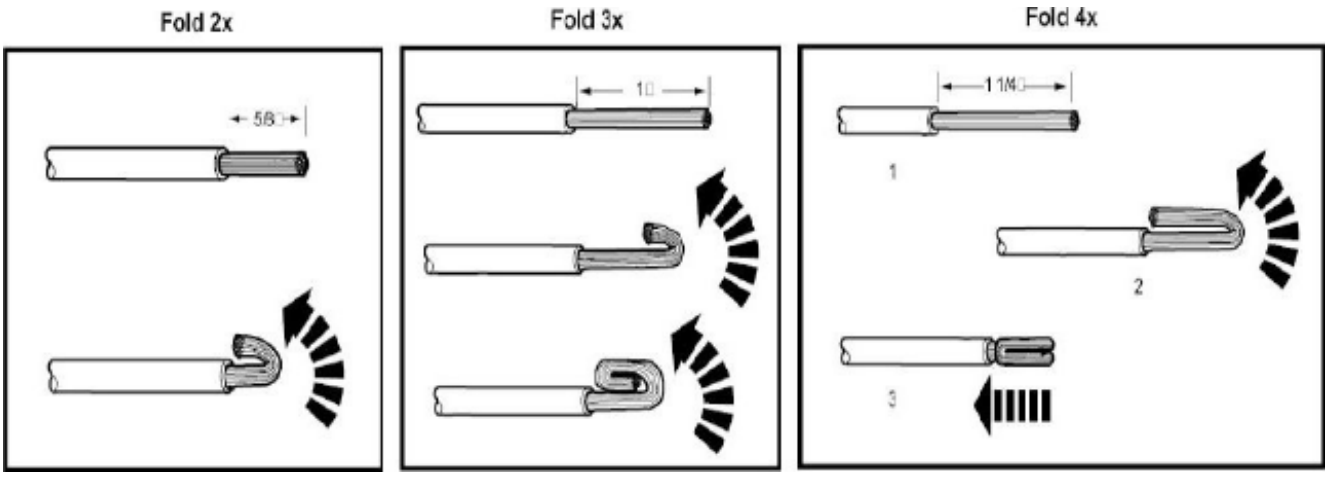
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



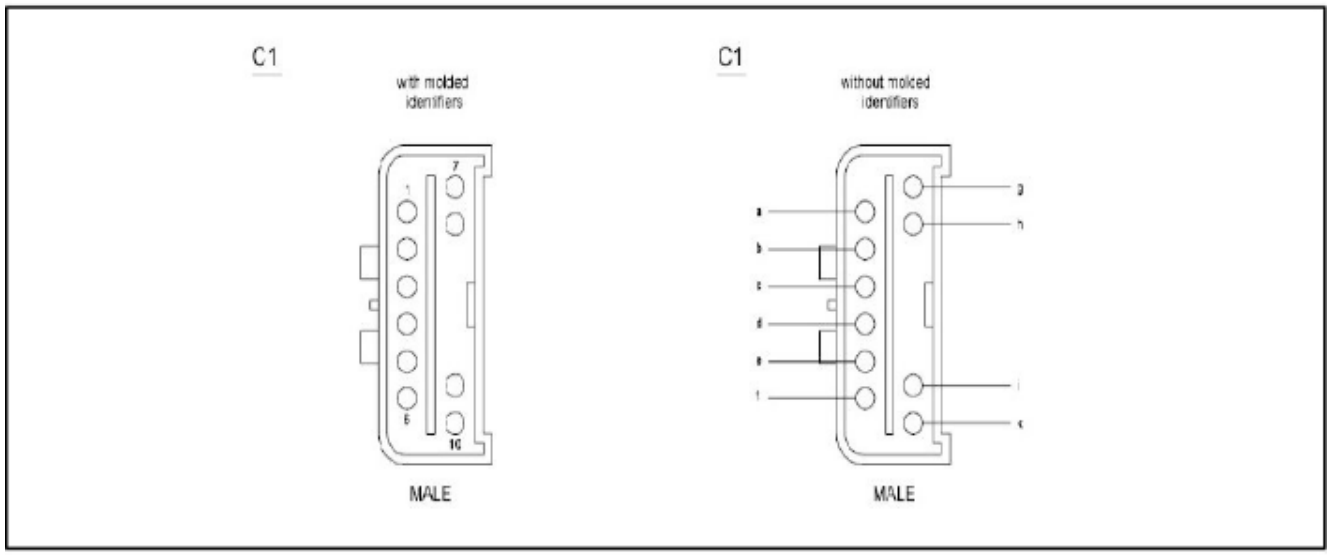
The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



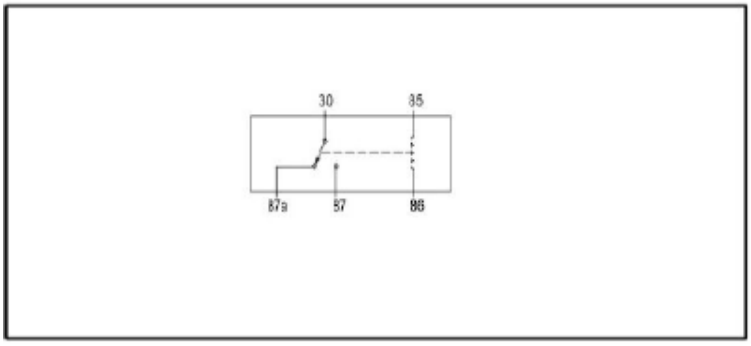
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

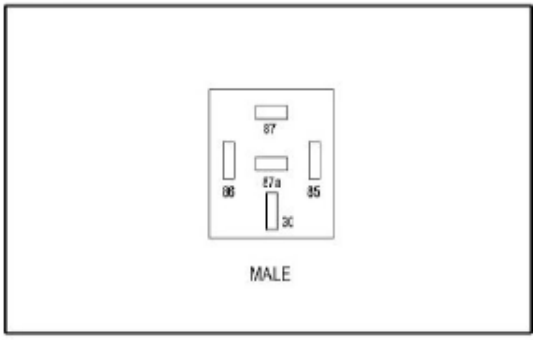
Battery Discharge Protection Relay: Testing and Inspection Mini ISO Relay

Relay □ Mini ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

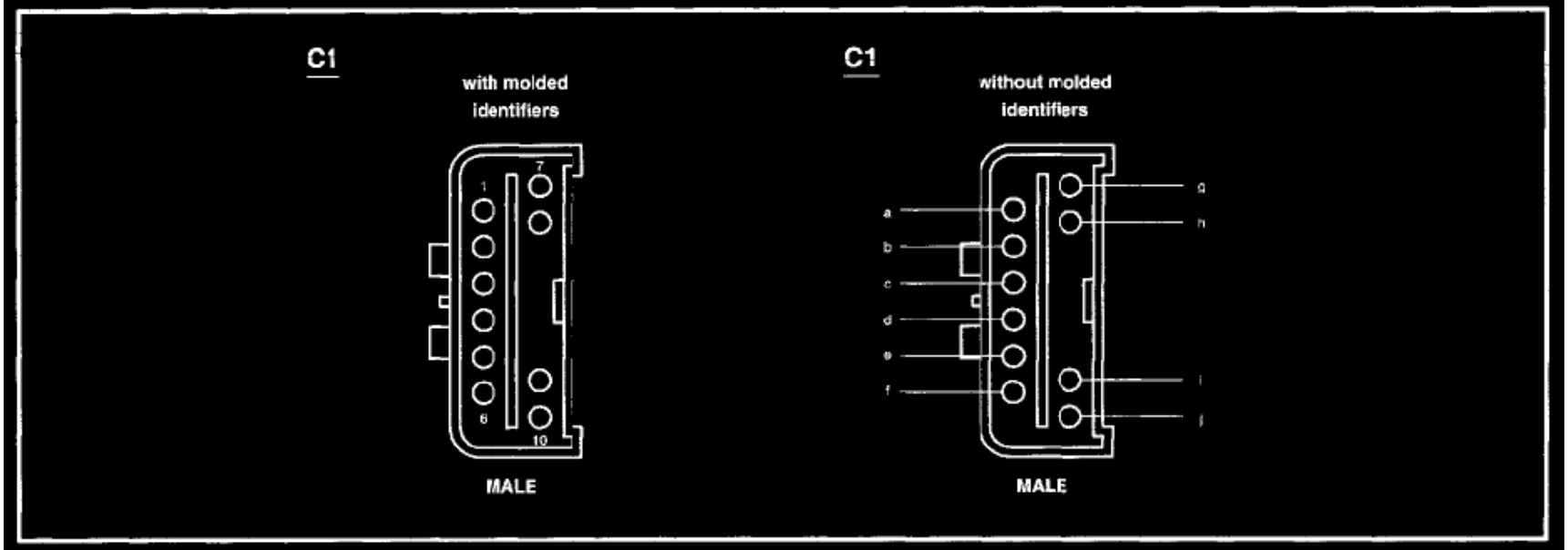
Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step–by–step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



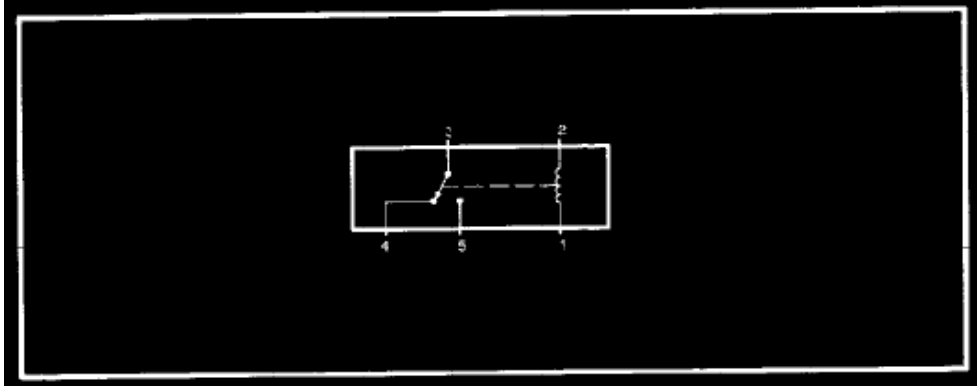
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

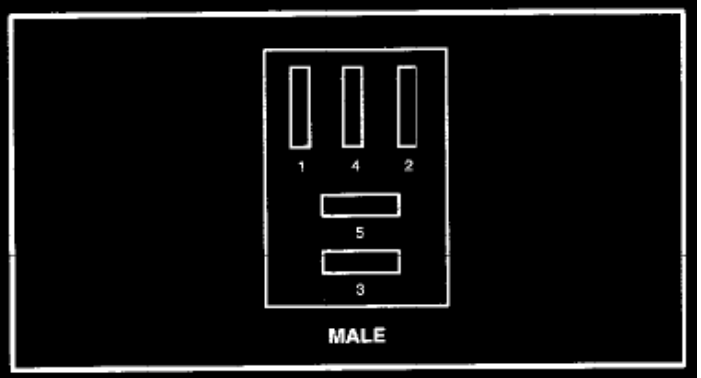
Battery Discharge Protection Relay: Testing and Inspection Micro ISO Relay

Relay – Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63–102Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil – Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

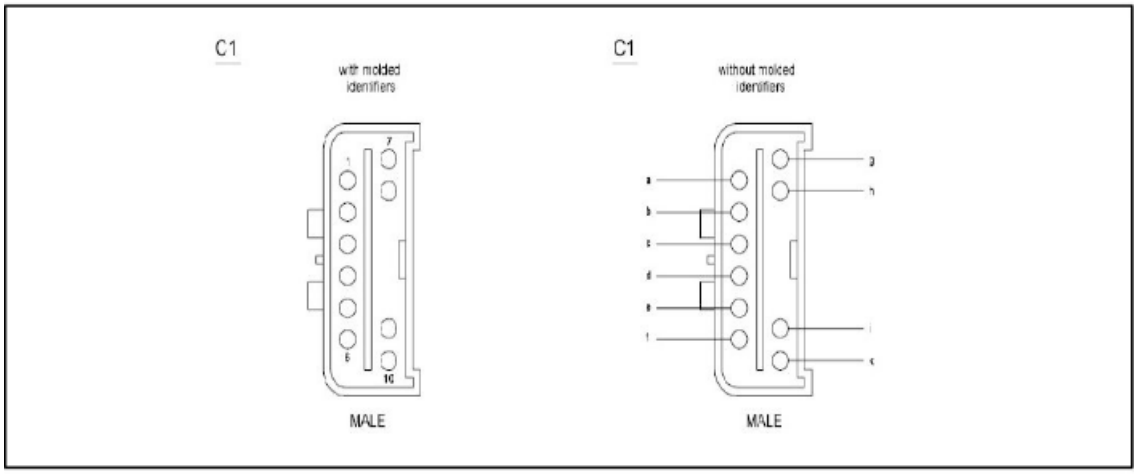
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step□by□step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals

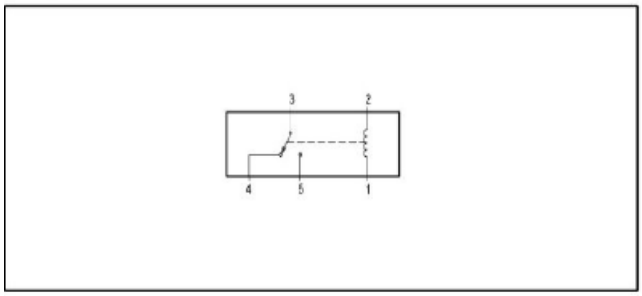


The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column □Circuit to test□. If you wish to test the complete component, perform all tests.

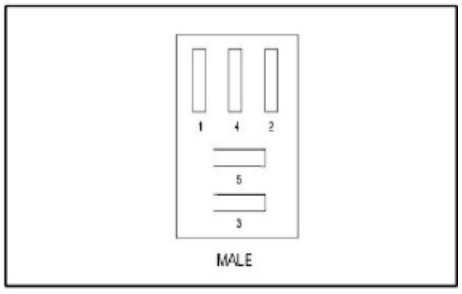
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Relay □ Micro ISO

Schematic



Terminals



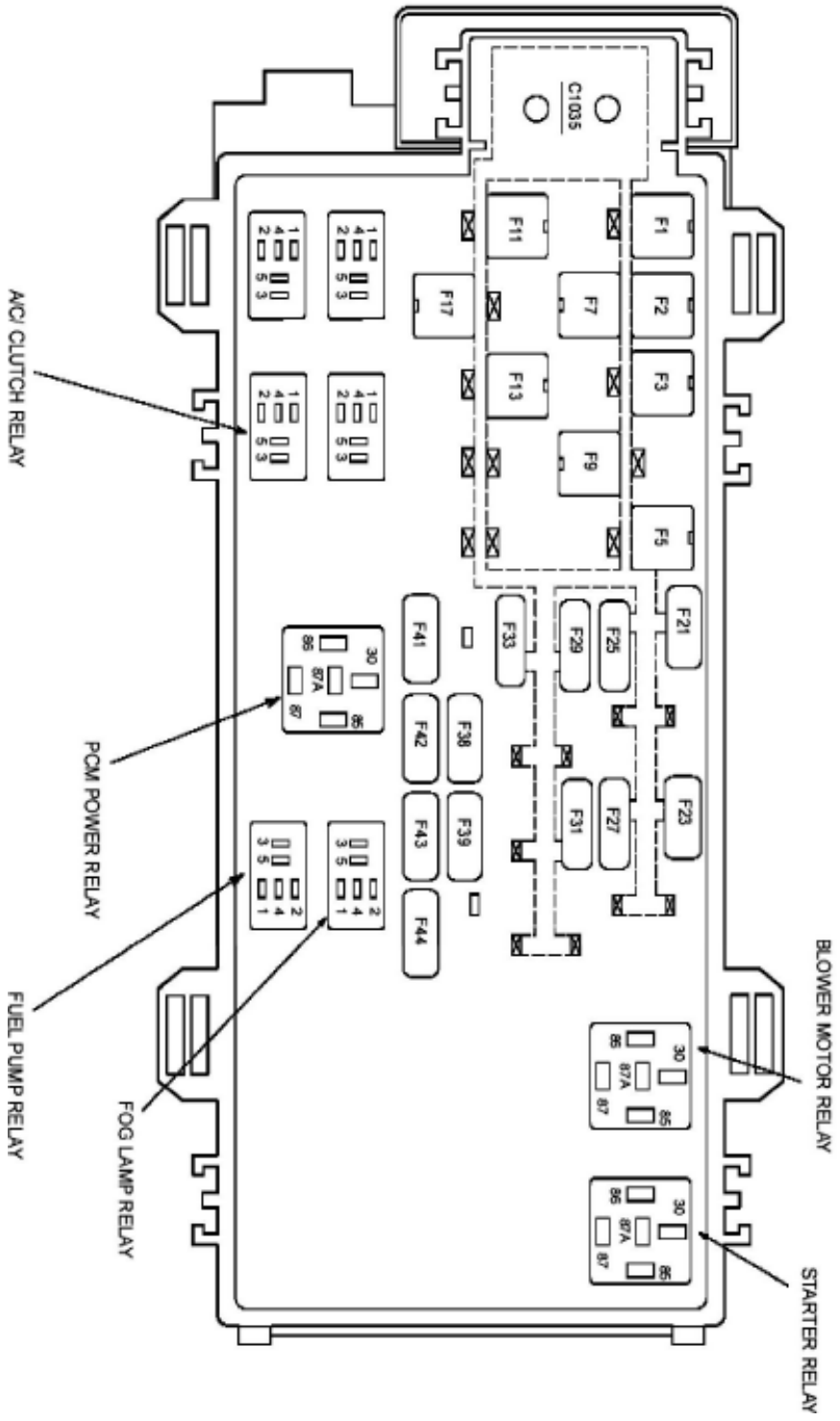
Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63□102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil □ Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

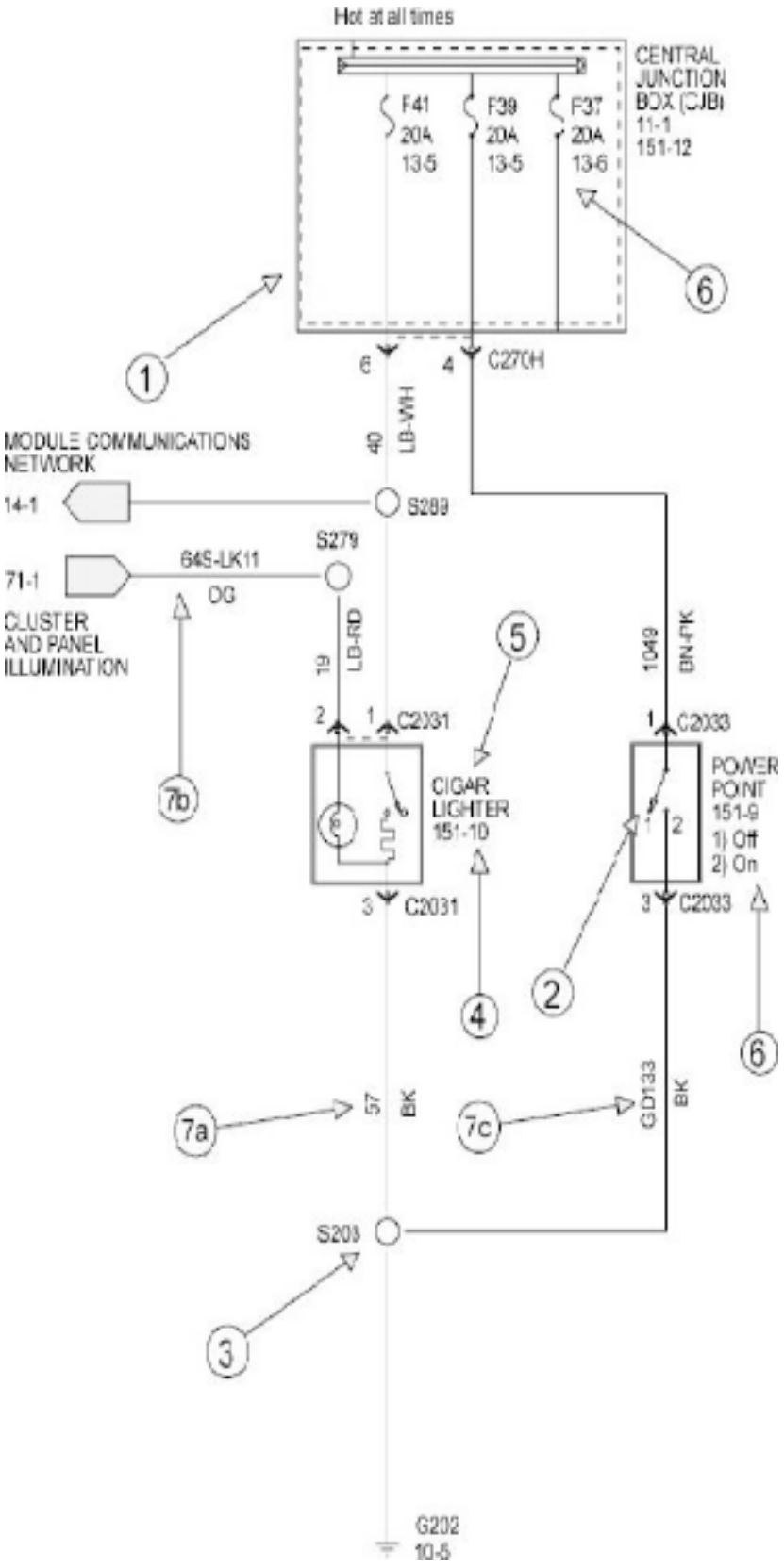
Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L



Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Relays and Modules > Relays and Modules - Lighting and Horns > Fog/Driving Lamp Relay > Component Information > Diagrams > Diagram Information and Instructions



Fog/Driving Lamp Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

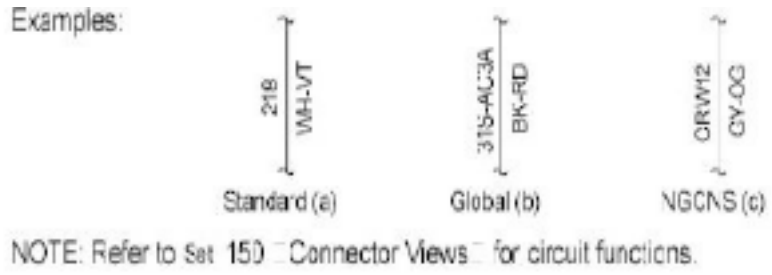
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

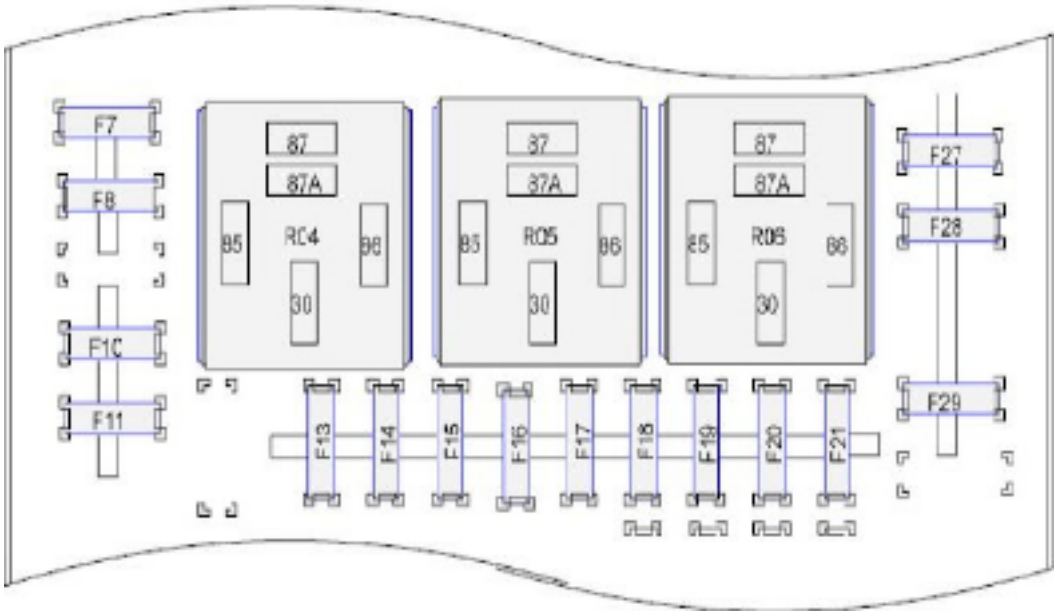
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

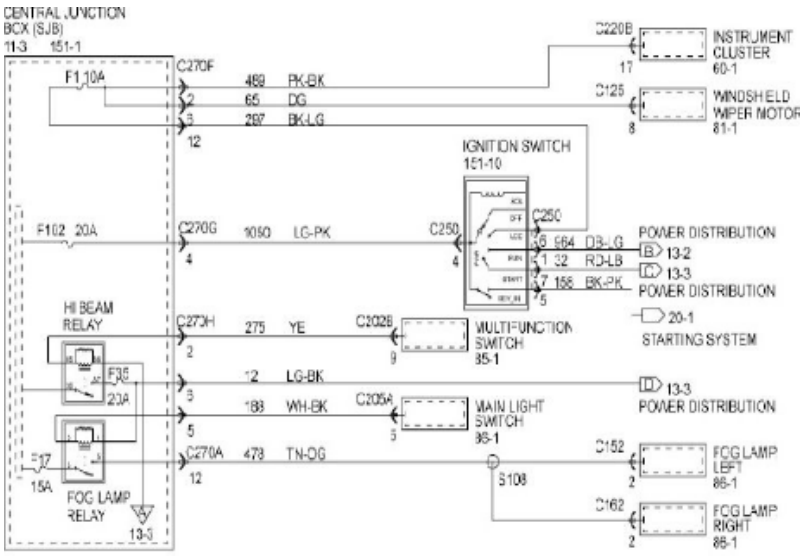
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

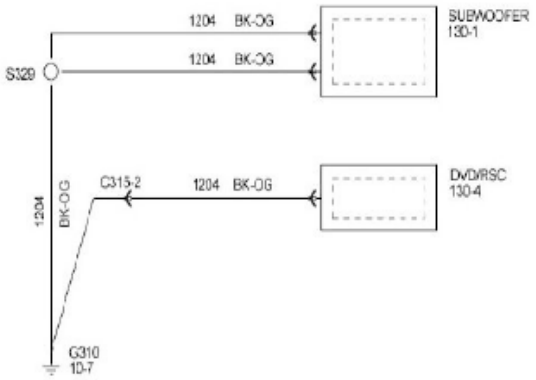
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

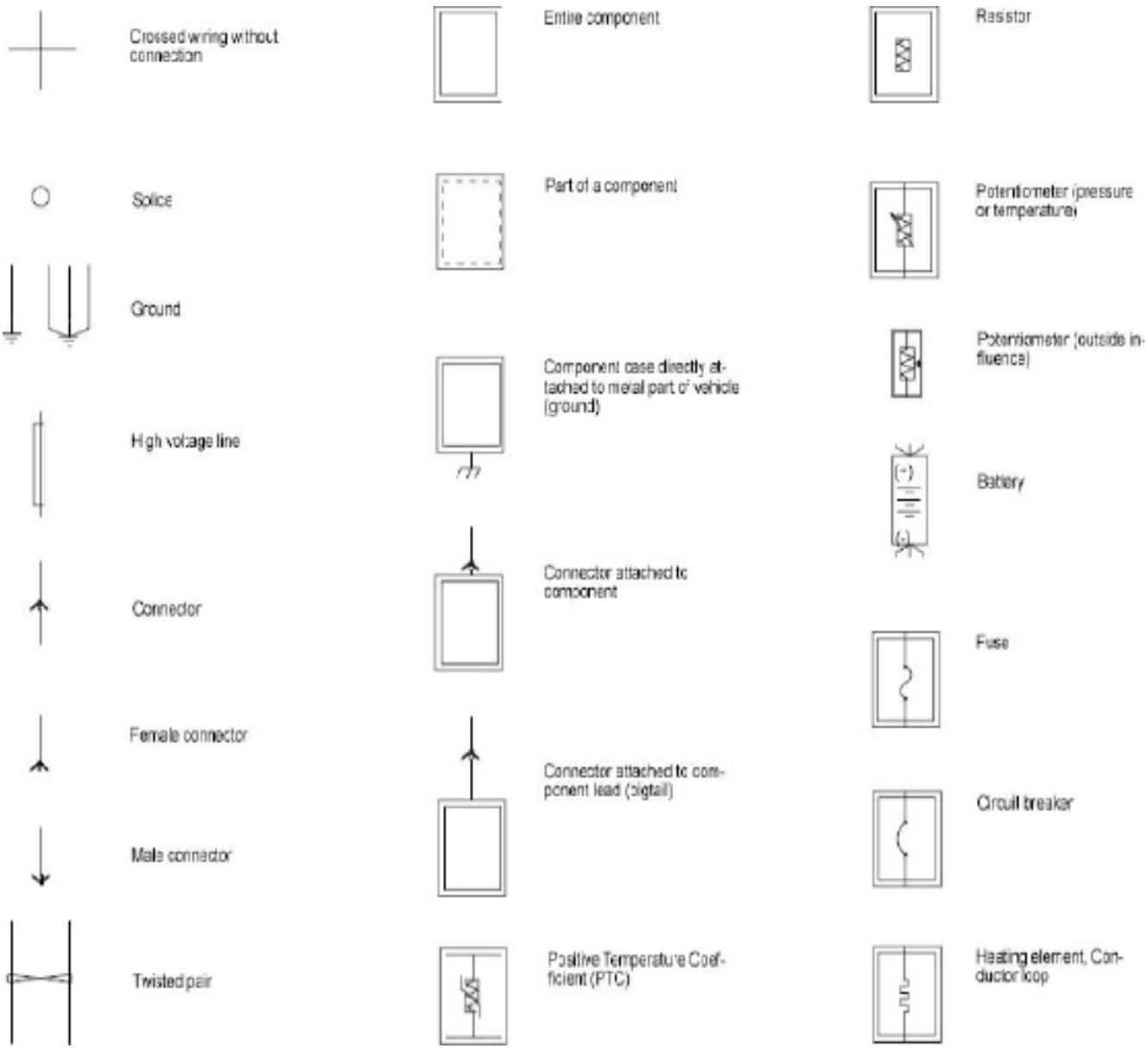
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

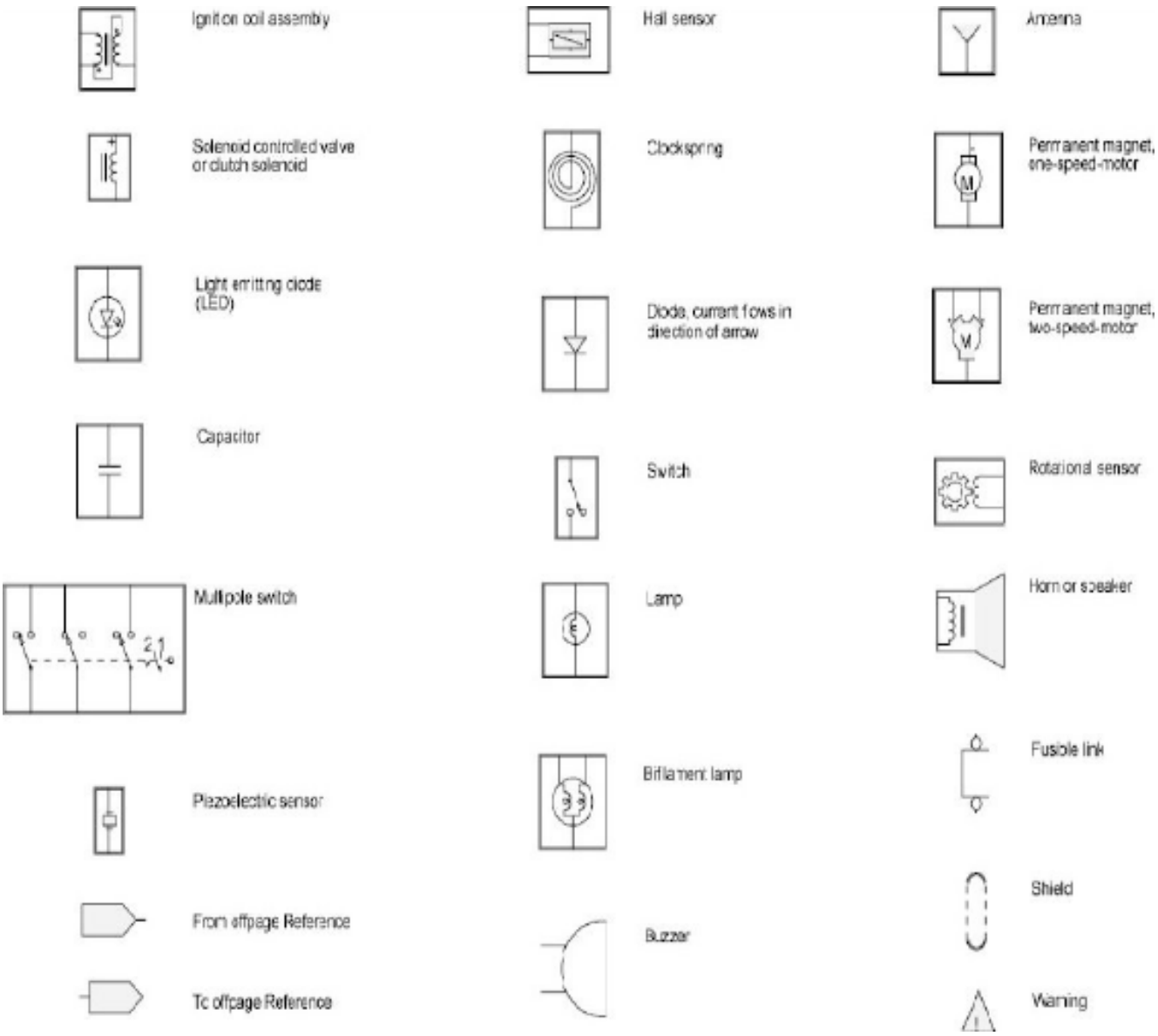
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

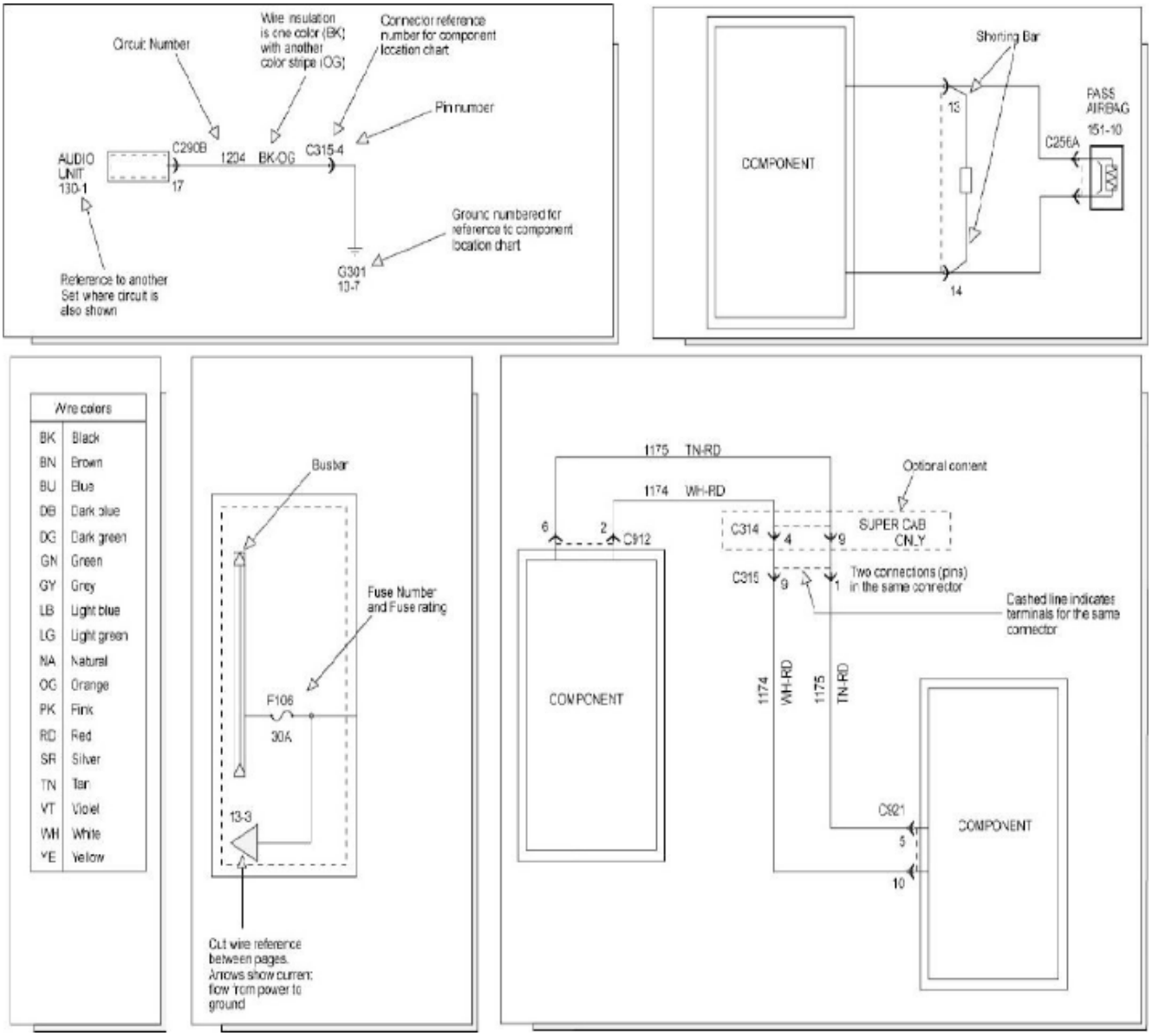
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

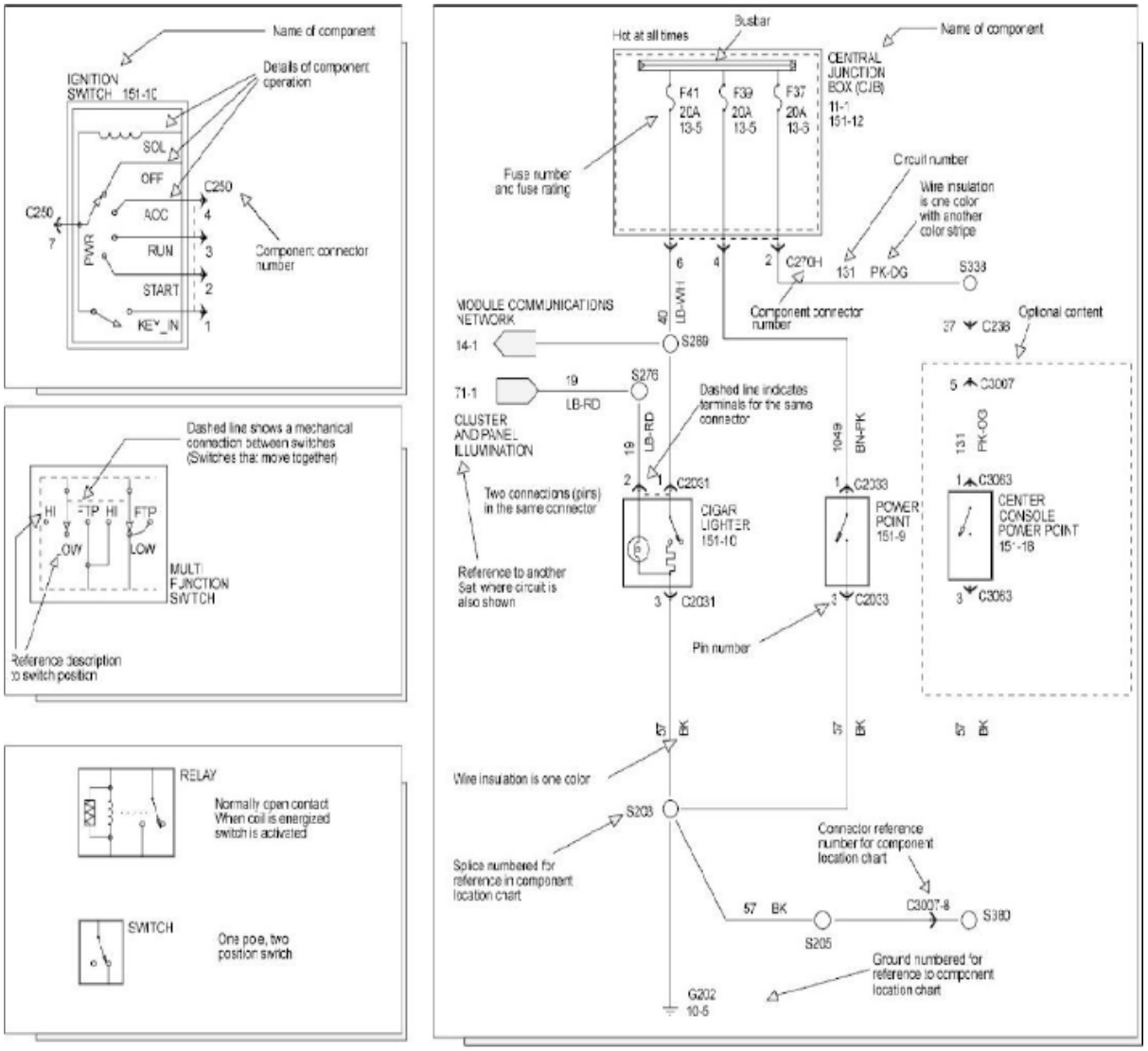
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

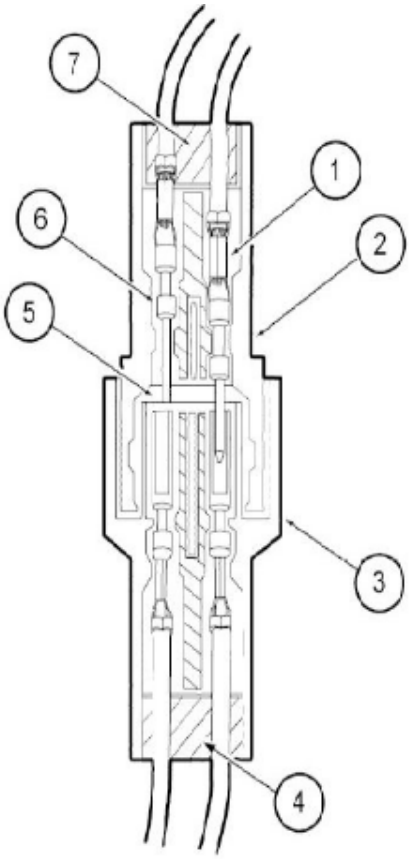


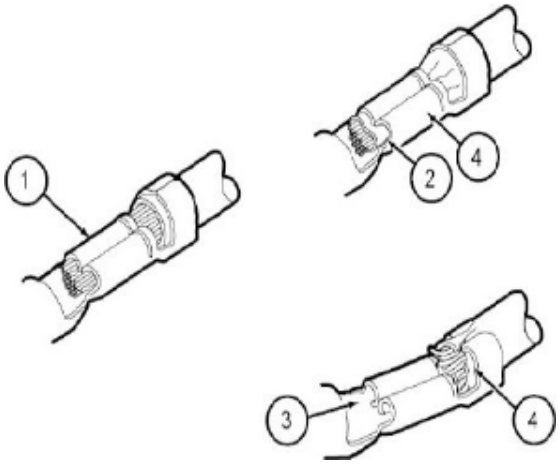
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Fog/Driving Lamp Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

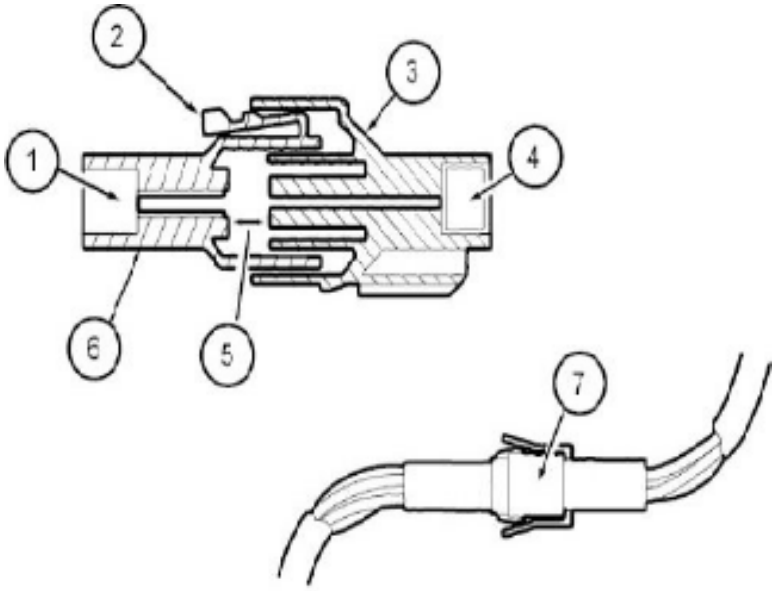
5 = Intermittent contact

6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping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6
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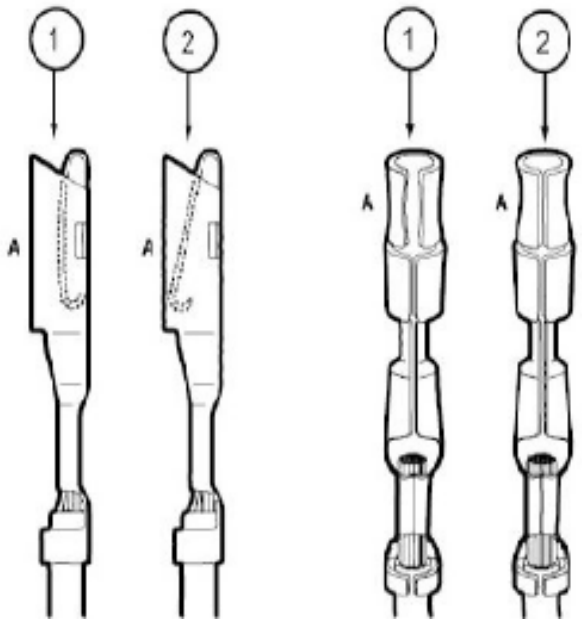
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

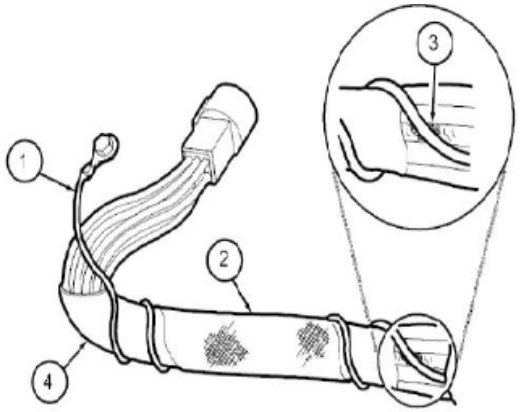
Deformed (enlarged) female terminals

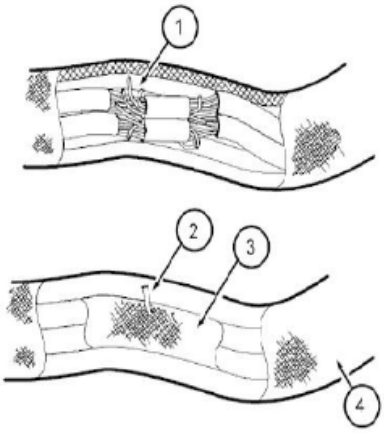
1 = Enlarged

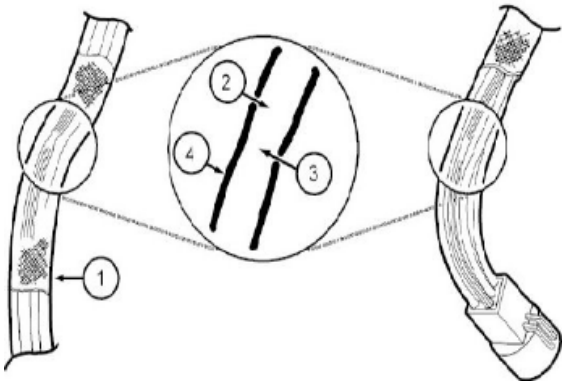
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

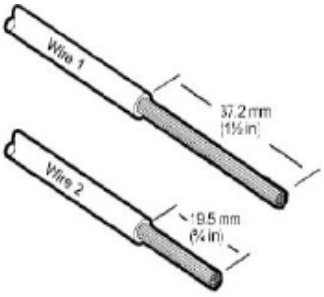
Splice covered 2

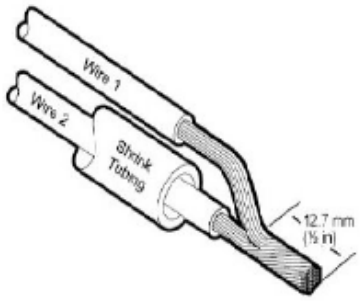
= Wire strand

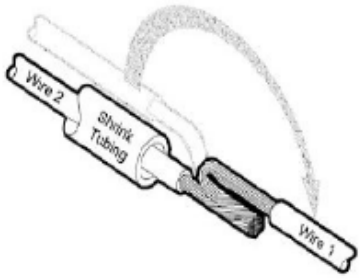
3 = Splice tape

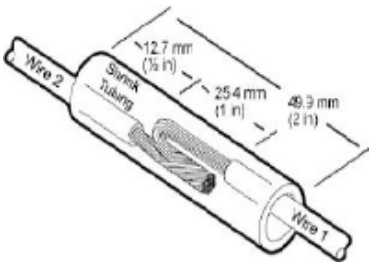
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

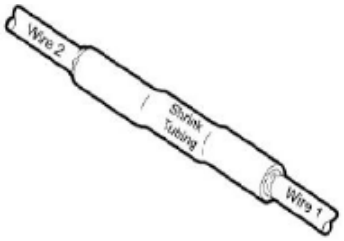
NOTE: -

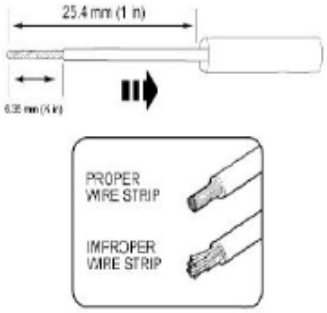
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

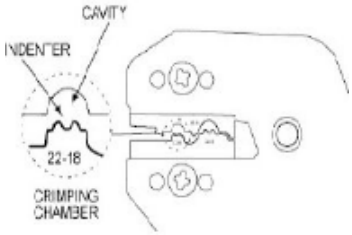
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

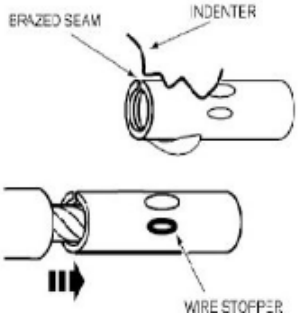
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
6.35 mm (¼ in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

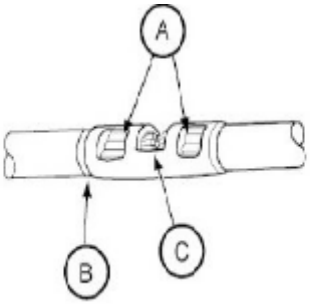
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

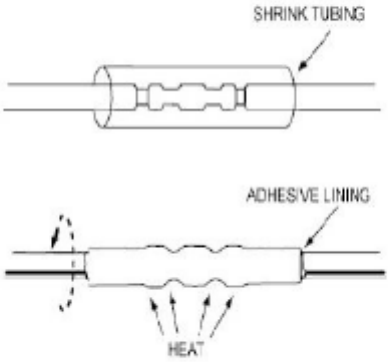
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4□ strip, cut 9 strands	* 1/4□ strip, cut 2 strands	1/4□ strip, no fold	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip, fold 2x dia.	1□ strip, fold 3x dia.
	16-14	* 1/4□ strip, cut 7 strands	1/4□ strip, no fold	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip fold 2x dia	1□ strip, fold 3x dia.	1 1/4□ strip, fold 4x dia.	Not Recommended
	12-10	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip, fold 2x dia.	1□ strip fold 3x cia.	1 1/4□ strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Pigtail only

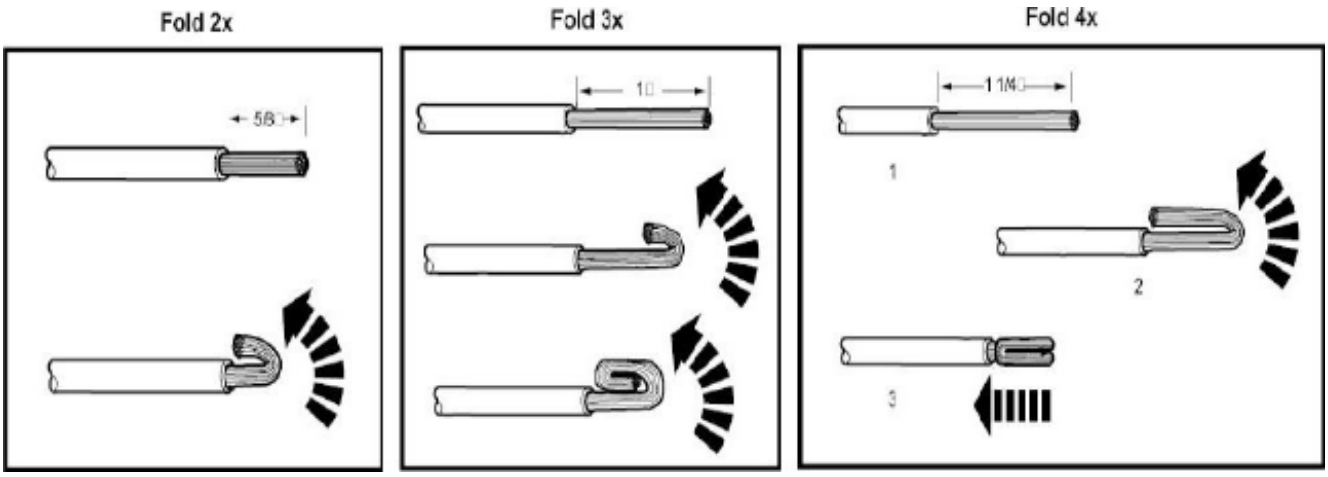
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



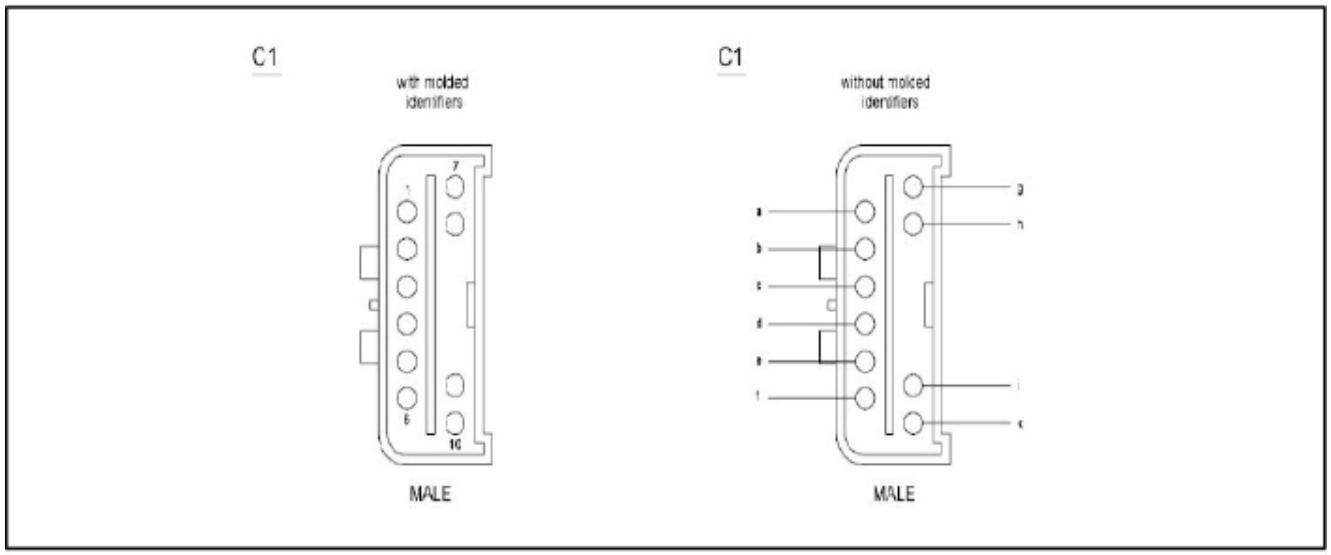
The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



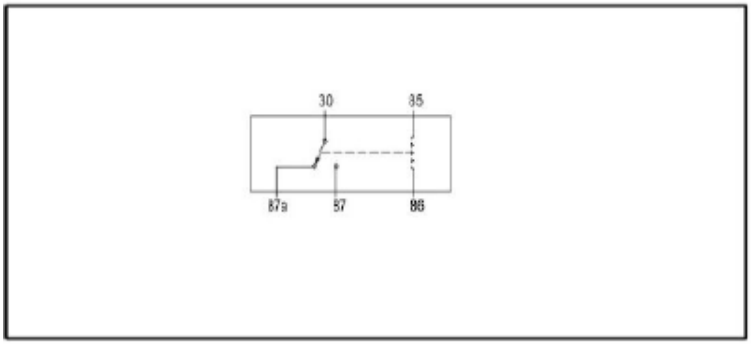
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

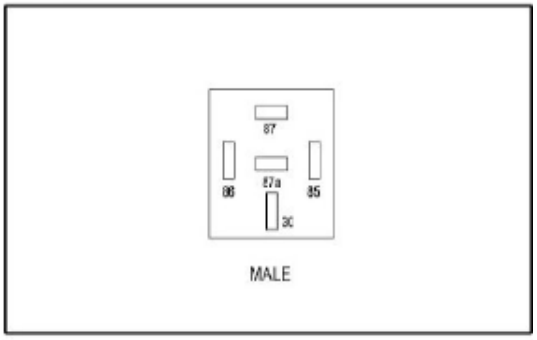
Fog/Driving Lamp Relay: Testing and Inspection Mini ISO Relay

Relay □ Mini ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

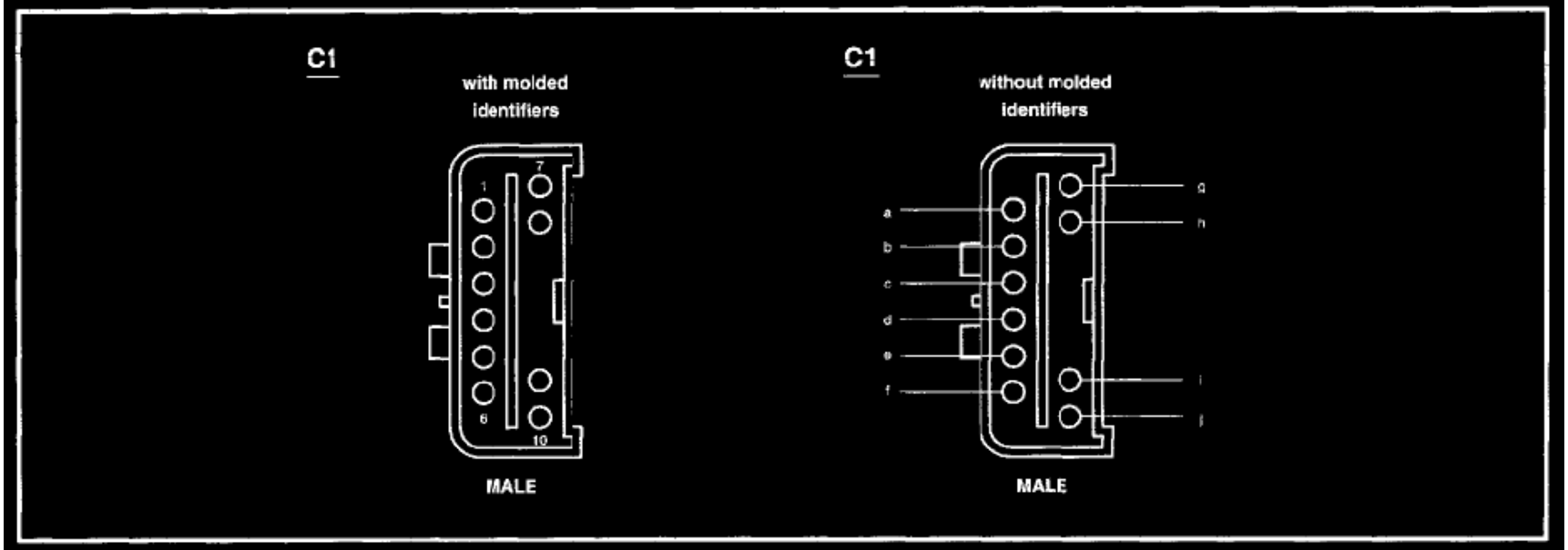
Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step–by–step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



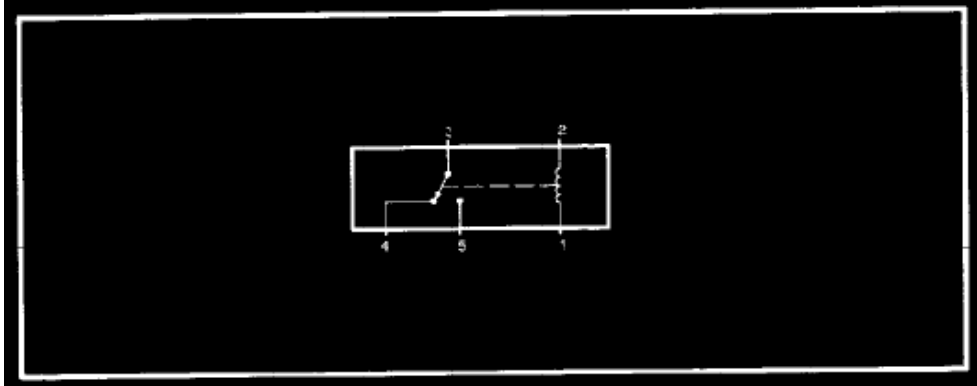
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

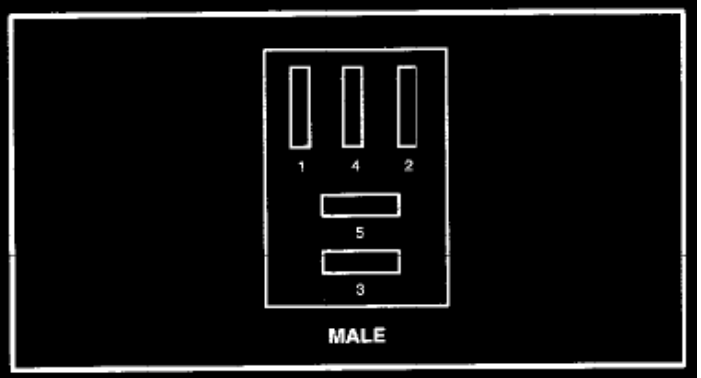
Fog/Driving Lamp Relay: Testing and Inspection Micro ISO Relay

Relay – Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63–102Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil – Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

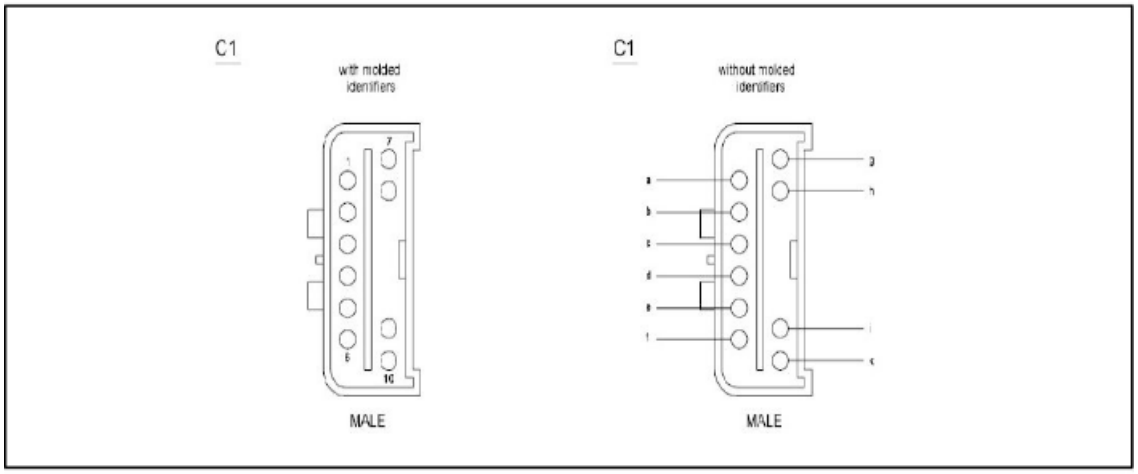
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals

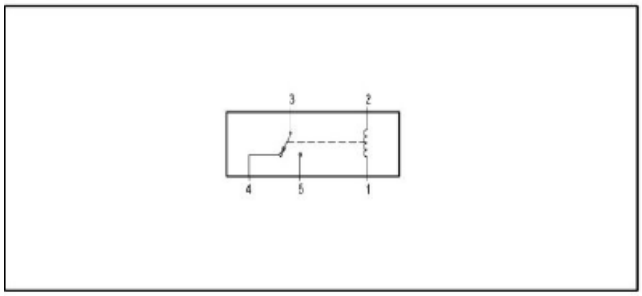


The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

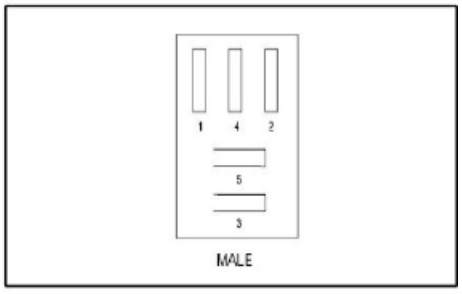
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Relay - Micro ISO

Schematic



Terminals

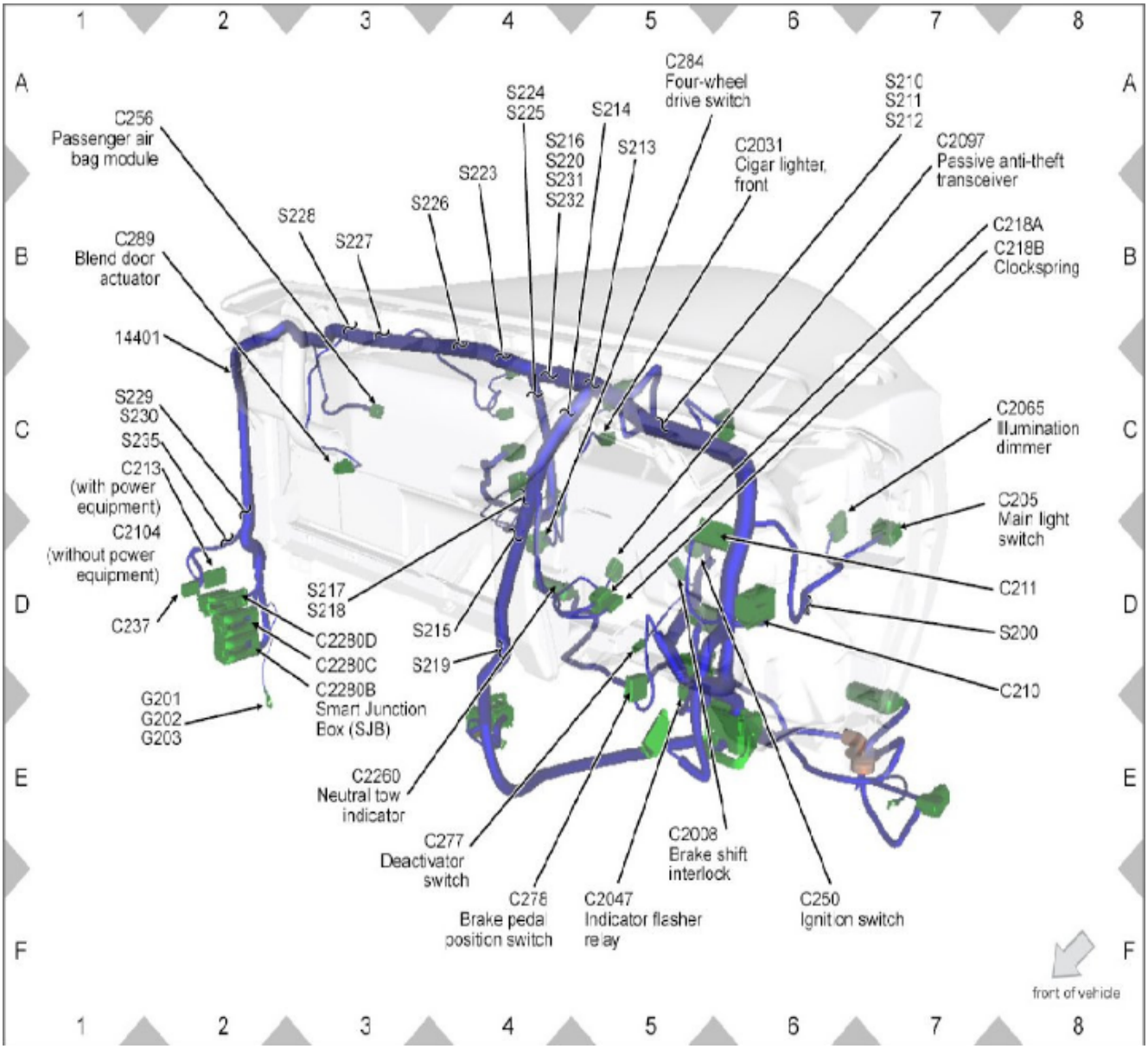


Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63-102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil - Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

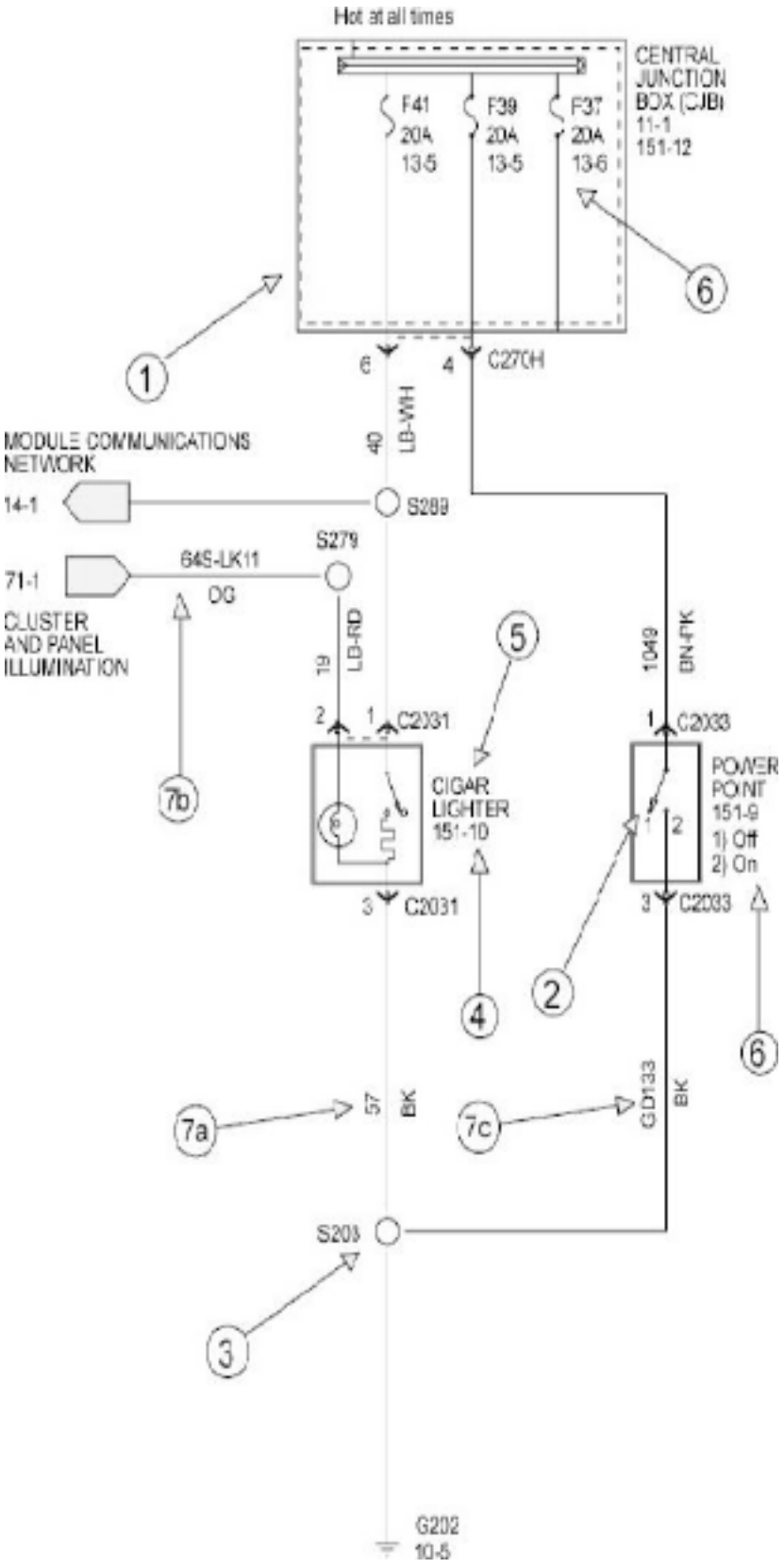
Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.


1
2
3
4
5
6
7
8
A
B
C
D
E
F
C256
Passenger air bag module
C289
Blend door actuator
14401
S229
S230
S235
C213
(with power equipment)
C2104
(without power equipment)
C237
S228
S227
S226
S223
S224
S225
S214
S216
S220
S231
S232
S213
C284
Four-wheel drive switch
C2031
Cigar lighter, front
S210
S211
S212
C2097
Passive anti-theft transceiver
C218A
C218B
Clockspring
C2065
Illumination dimmer
C205
Main light switch
C211
S200
C210
S217
S218
S215
S219
C2280D
C2280C
C2280B
Smart Junction Box (SJB)
G201
G202
G203
C2260
Neutral tow indicator
C277
Deactivator switch
C278
Brake pedal position switch
C2047
Indicator flasher relay
C2008
Brake shift interlock
C250
Ignition switch
front of vehicle

View 151-11

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Relays and Modules > Relays and Modules - Lighting and Horns > Hazard Flasher Relay > Component Information > Diagrams > Diagram Information and Instructions



Hazard Flasher Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

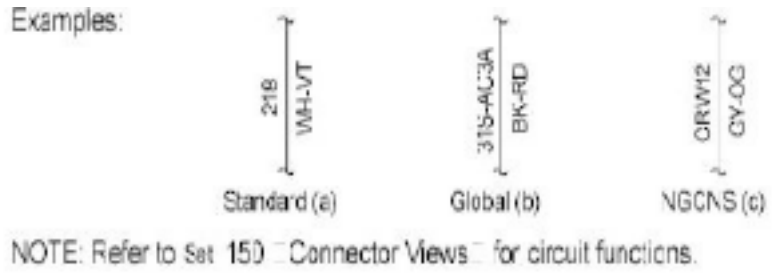
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

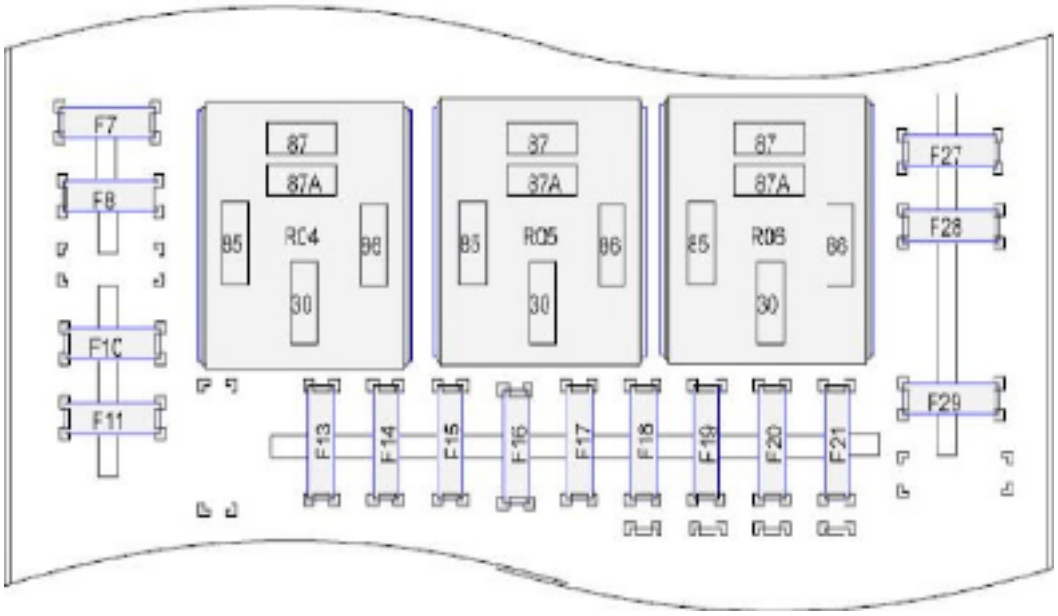
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

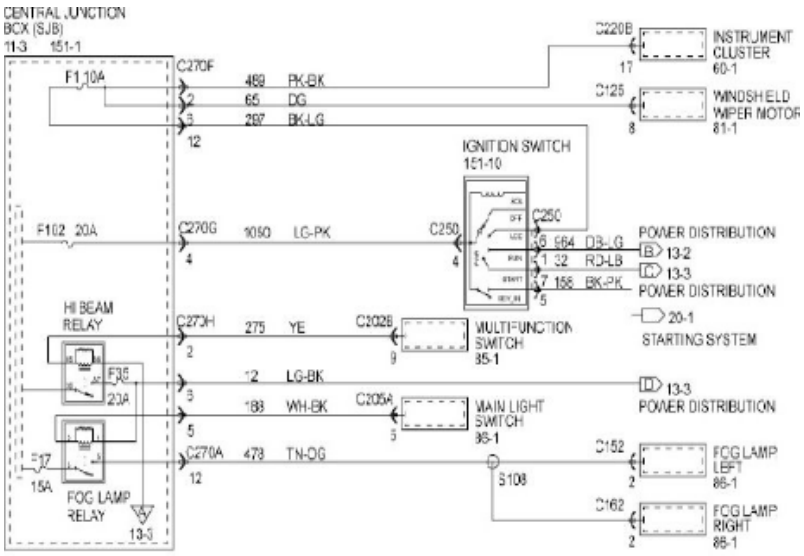
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

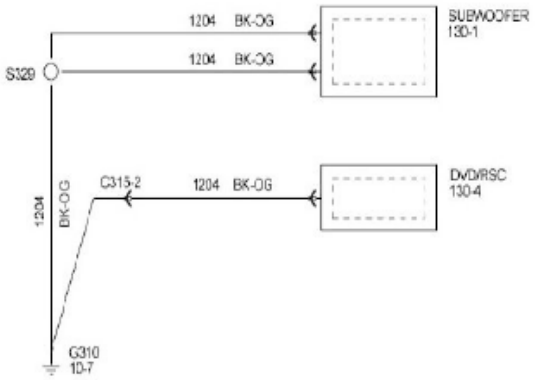
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

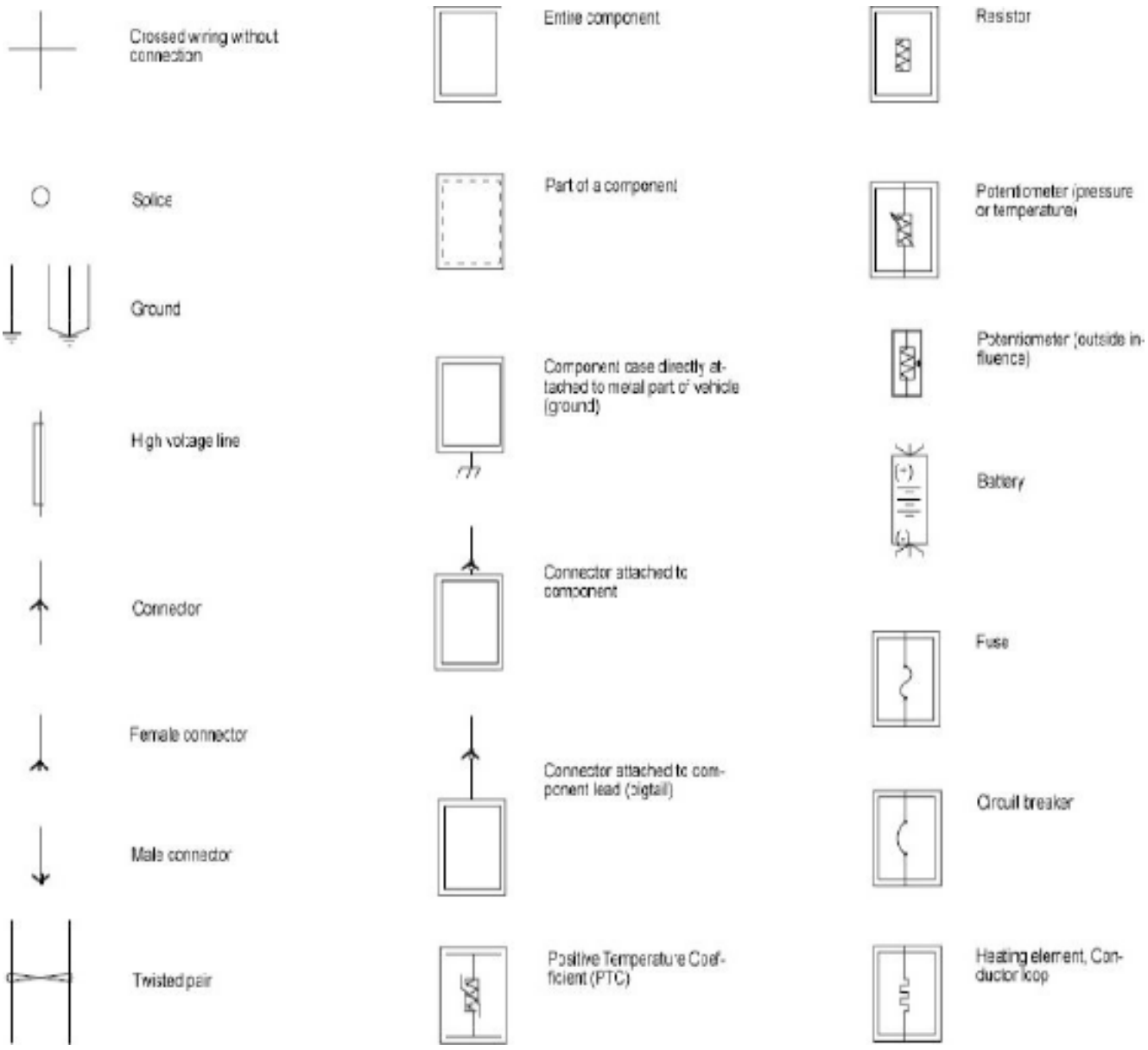
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

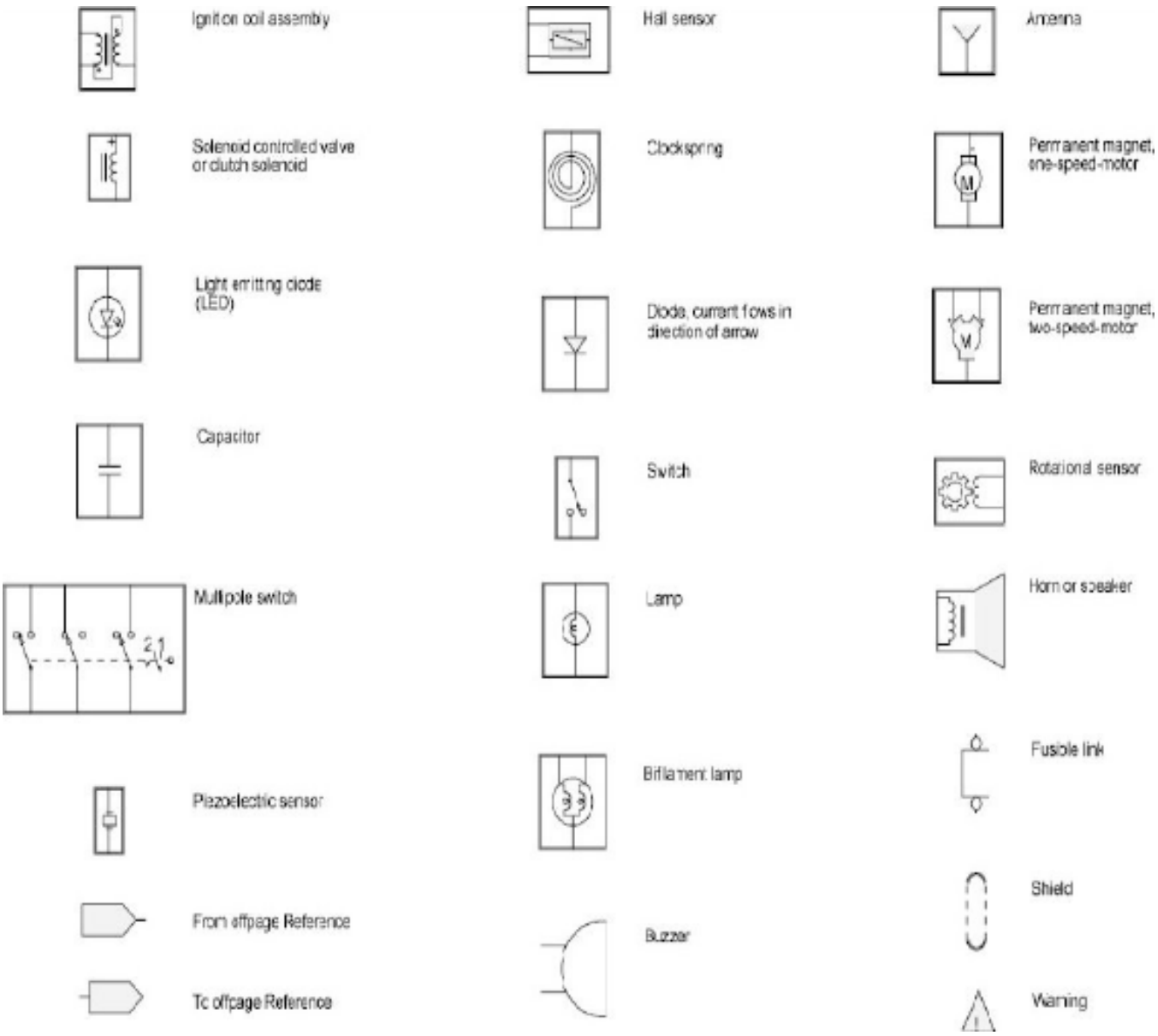
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

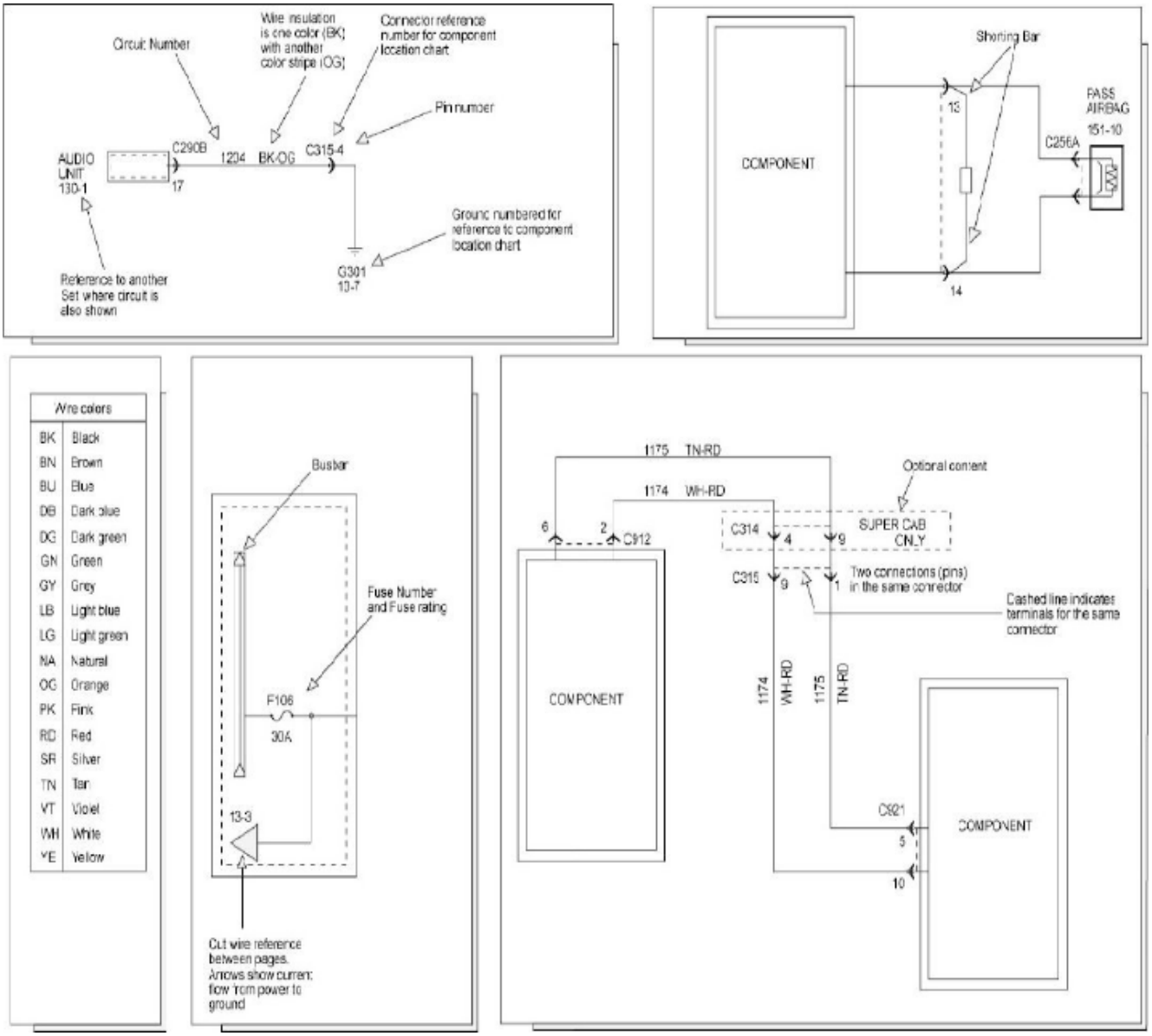
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

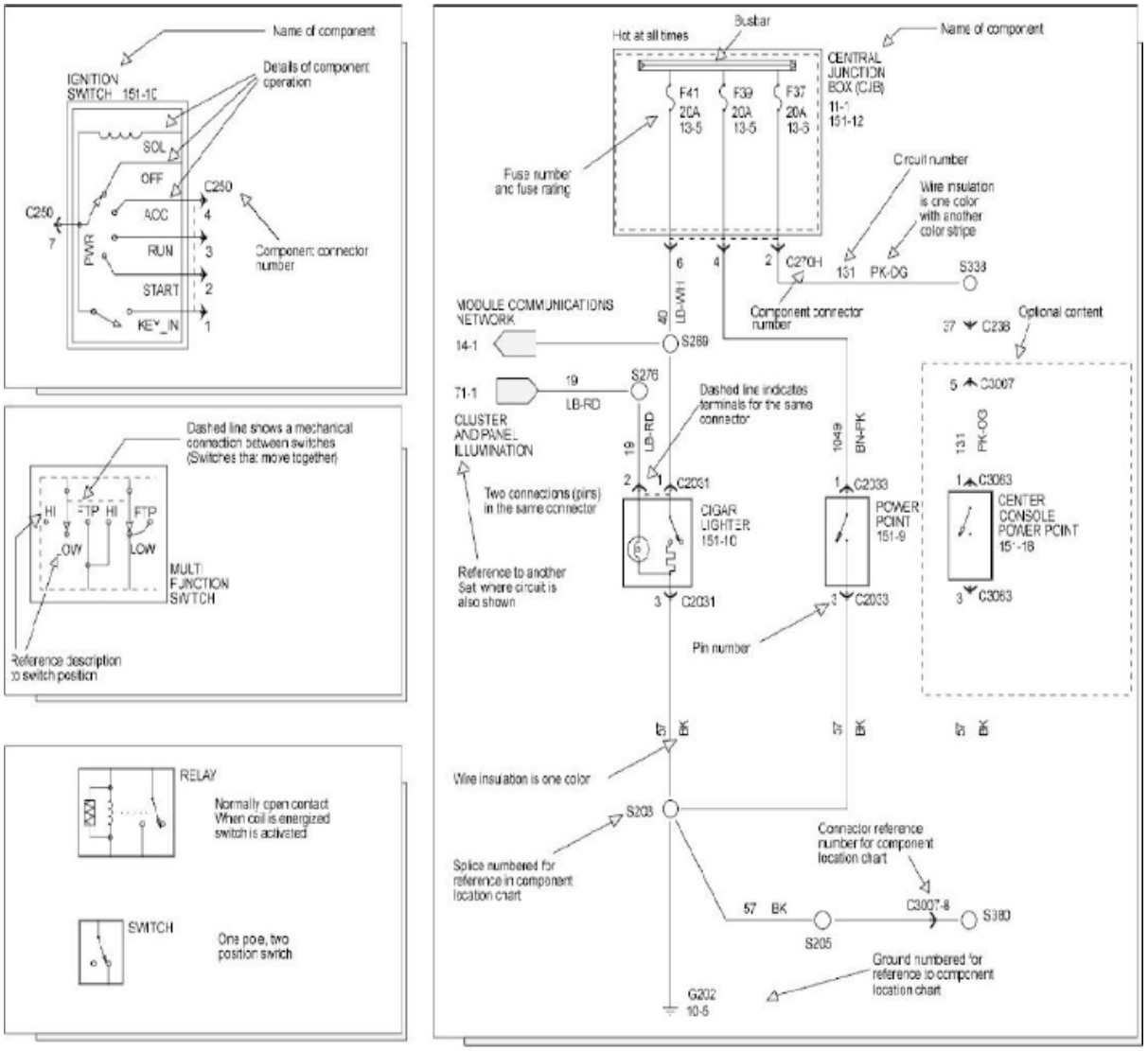
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

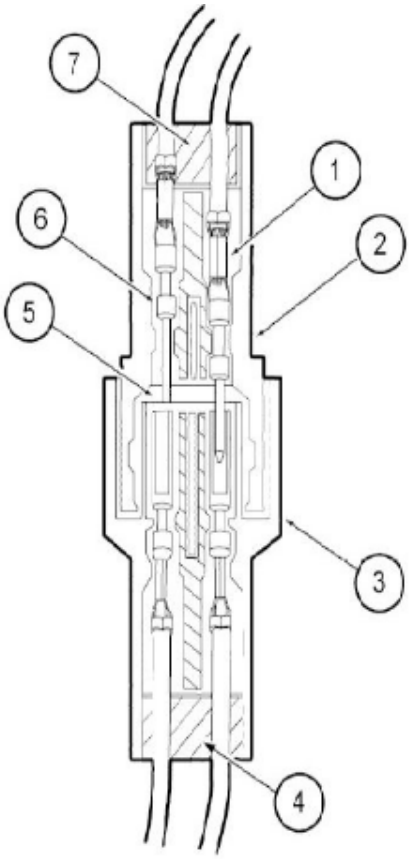


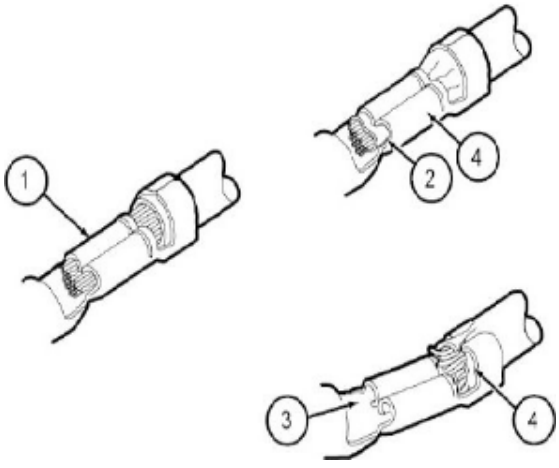
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Hazard Flasher Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

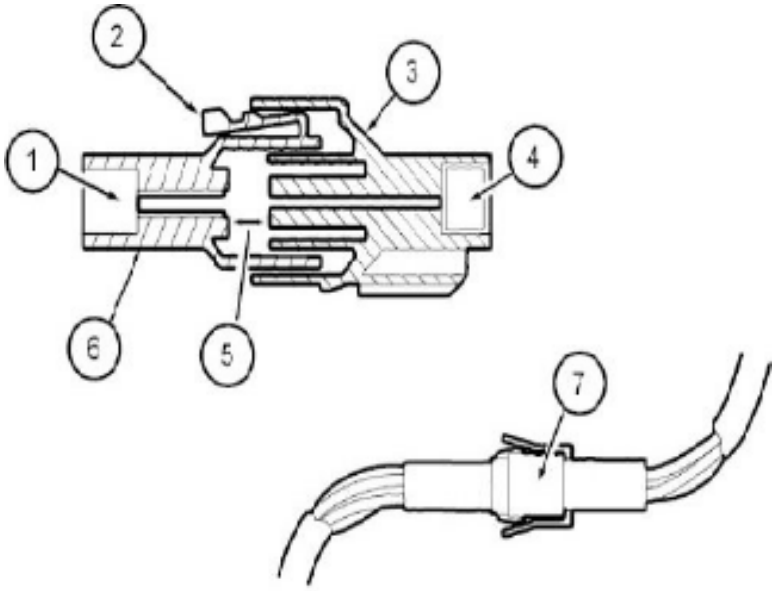
5 = Intermittent contact

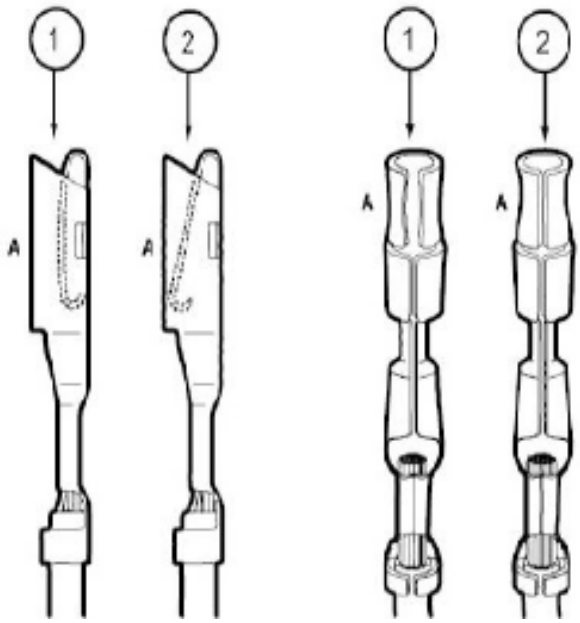
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

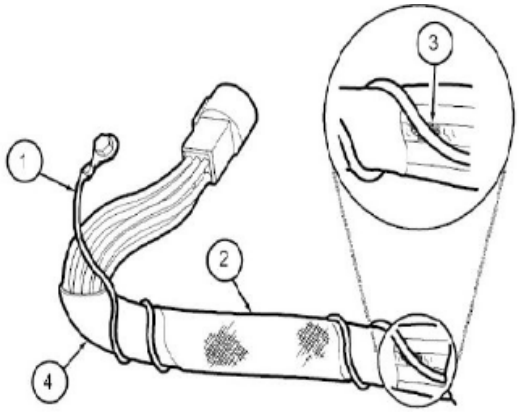
Deformed (enlarged) female terminals

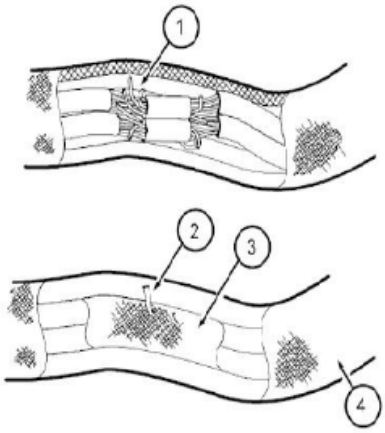
1 = Enlarged

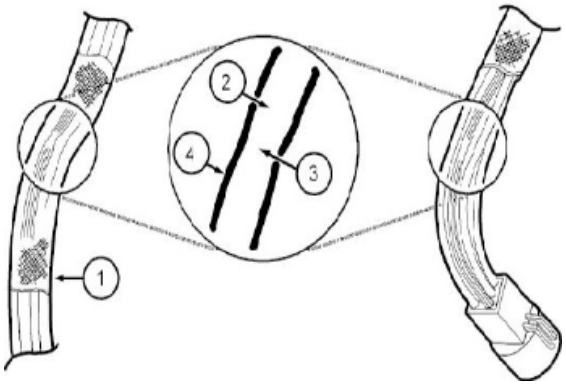
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

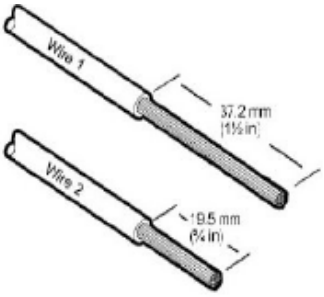
Splice covered 2

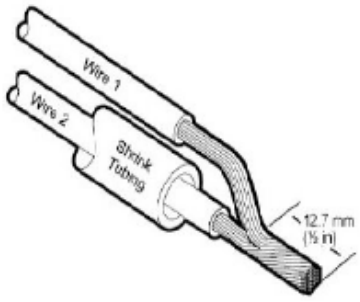
= Wire strand

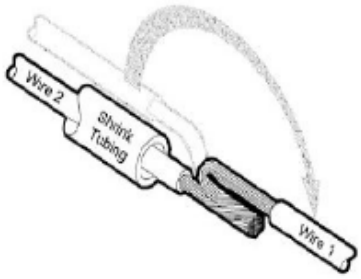
3 = Splice tape

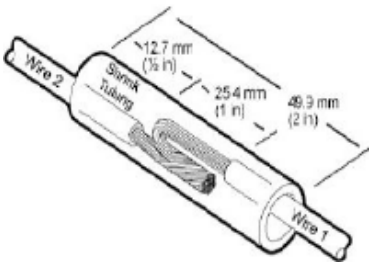
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

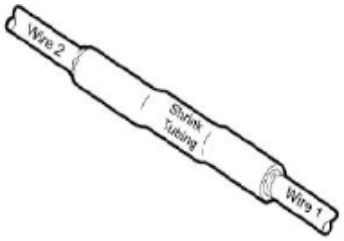
NOTE: -

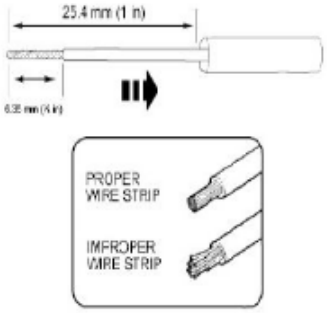
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

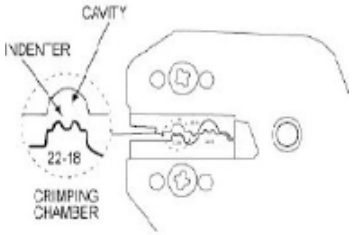
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

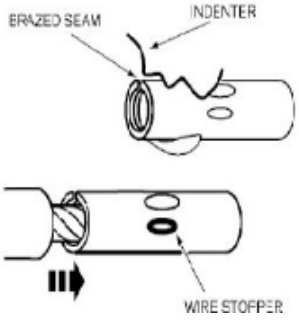
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
6.35 mm (¼ in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

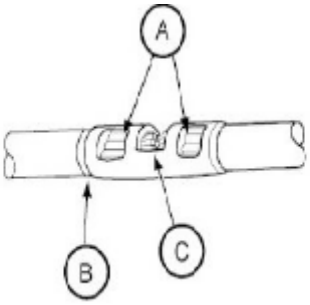
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

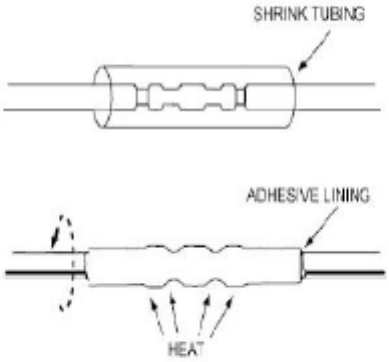
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4□ strip, cut 9 strands	* 1/4□ strip, cut 2 strands	1/4□ strip, no fold	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip, fold 2x dia.	1□ strip, fold 3x dia.
	16-14	* 1/4□ strip, cut 7 strands	1/4□ strip, no fold	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip fold 2x dia	1□ strip, fold 3x dia.	1 1/4□ strip, fold 4x dia.	Not Recommended
	12-10	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip, fold 2x dia.	1□ strip fold 3x cia.	1 1/4□ strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Figtail only

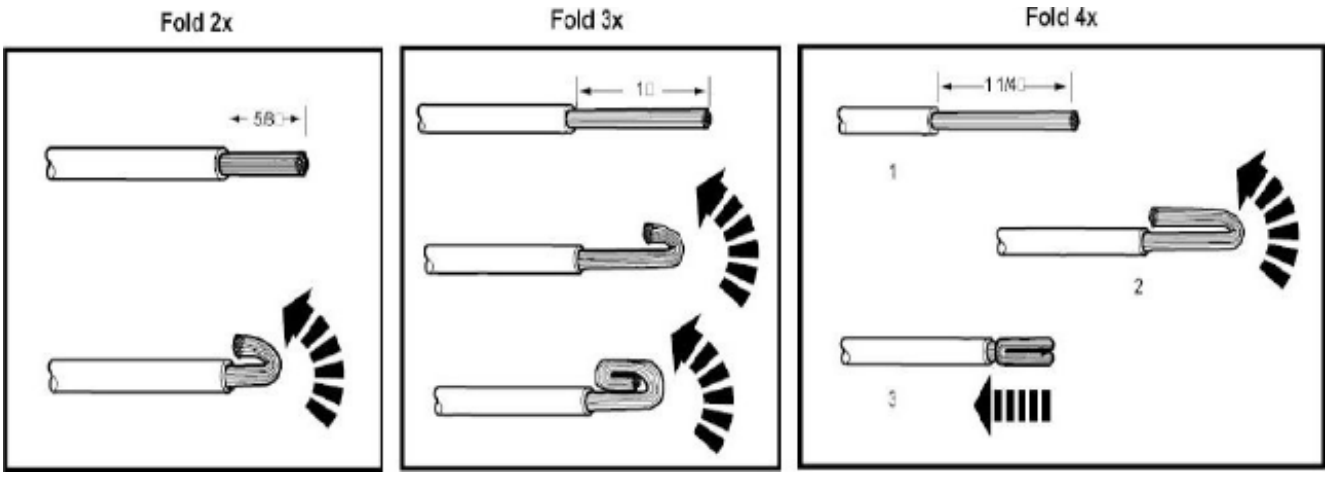
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

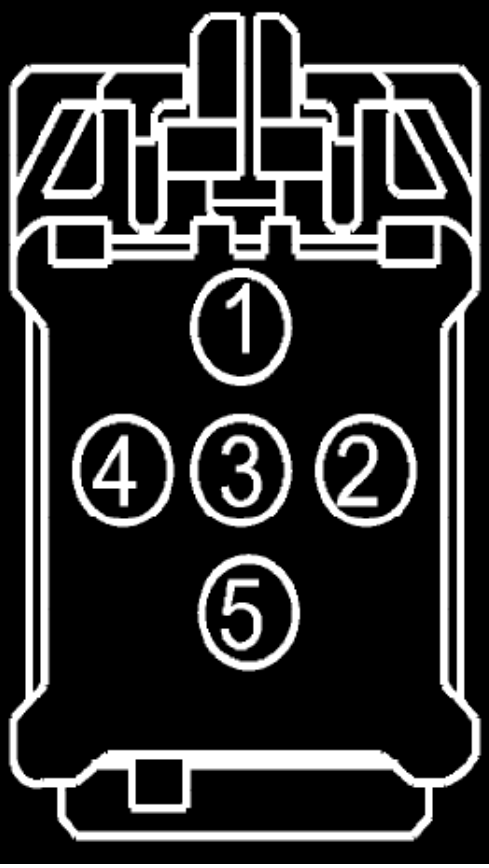
12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Connector: C2047

Description:	Harness:	Base Part #:
INDICATOR FLASHER RELAY	14401	13350



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CLS42 (VT-BN)	18	FLASHER - TURN SIGNAL/HAZARD	
2	GD161 (BK-YE)	18	GROUND - SEAT BRACKET REAR LEFT	
3	CLS32 (BN-YE)	18	SWITCH - HAZARD	
4	SBP17 (RD)	18	FUSE - 17 OR CIRCUIT BREAKER	
5	CBP20 (YE-VT)	18	FUSE - 20 OR CIRCUIT BREAKER	

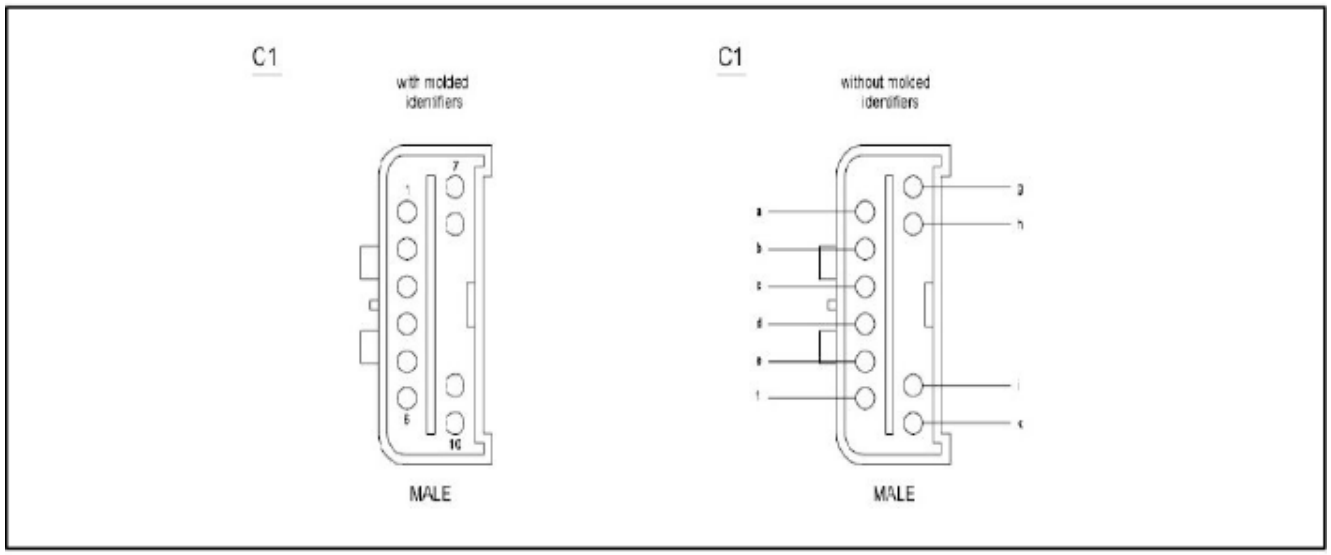
C2047

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



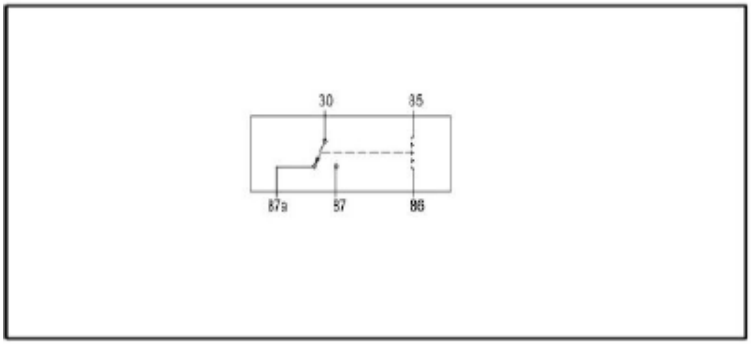
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

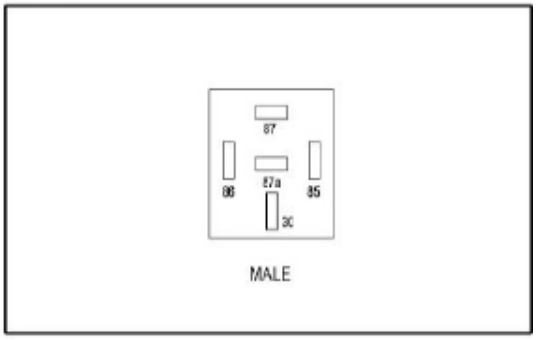
Hazard Flasher Relay: Testing and Inspection Mini ISO Relay

Relay □ Mini ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

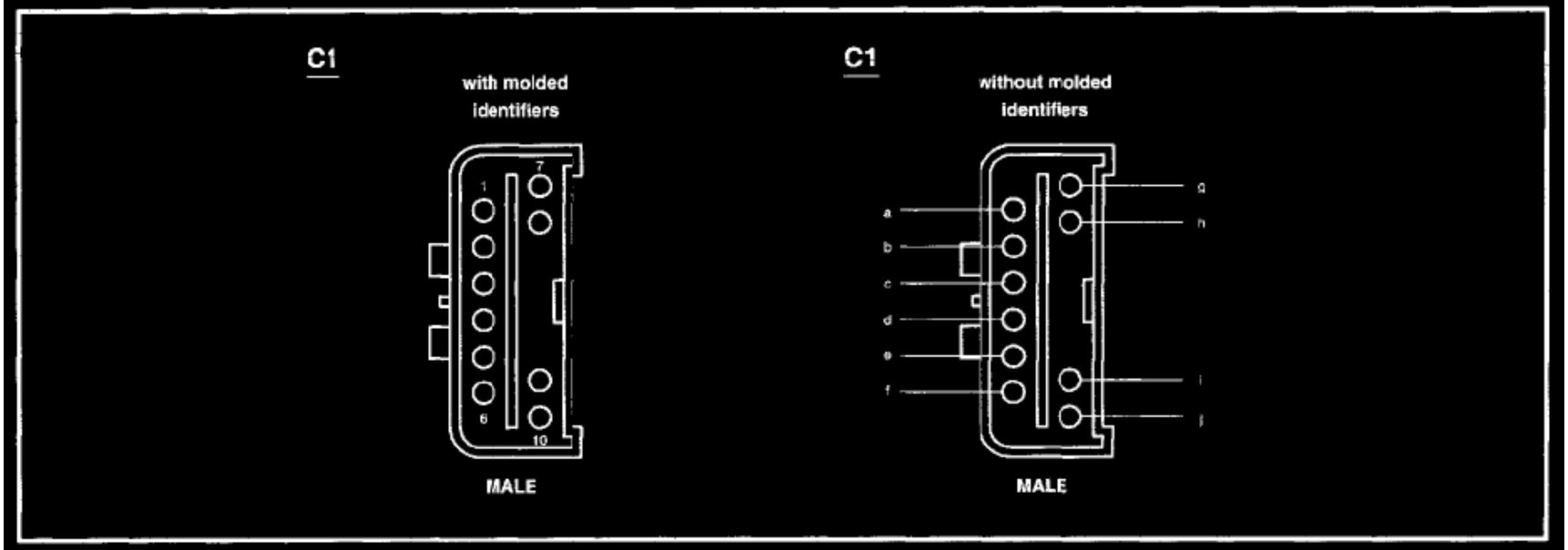
Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step–by–step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

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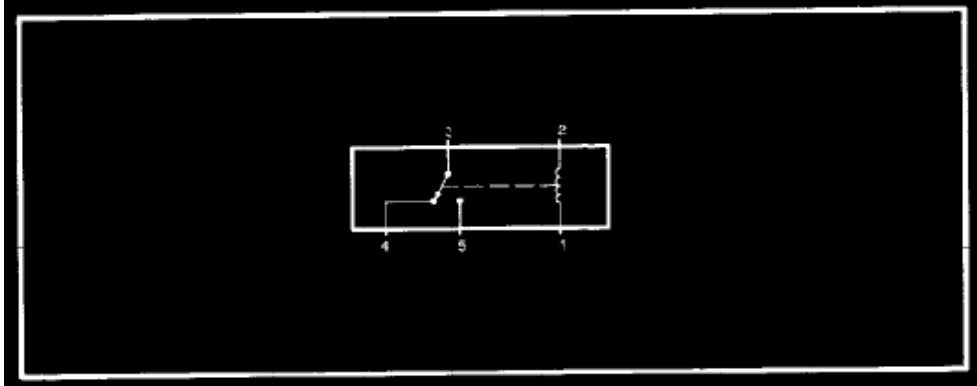
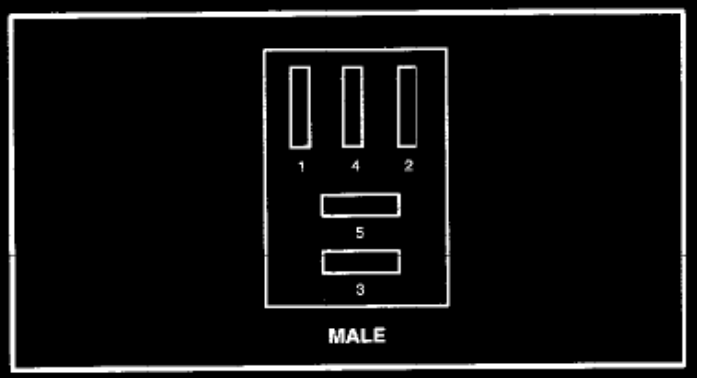
Hazard Flasher Relay: Testing and Inspection Micro ISO Relay

Relay – Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63–102Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil – Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

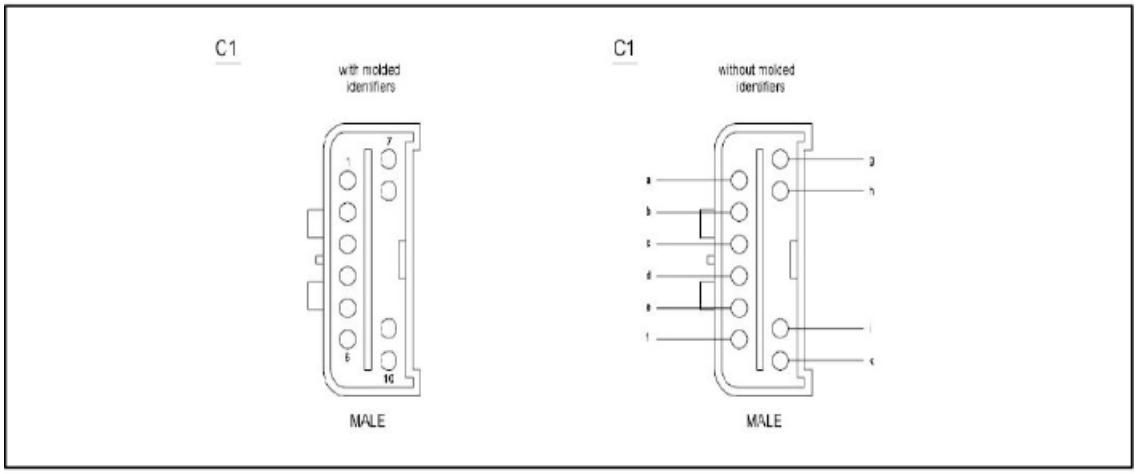
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals

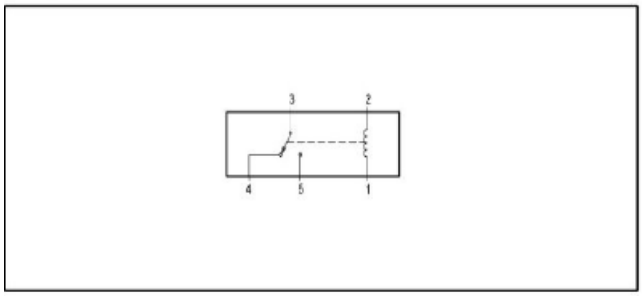


The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

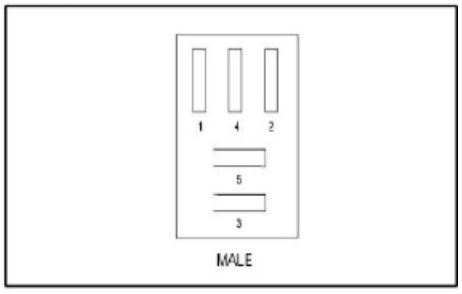
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Relay - Micro ISO

Schematic



Terminals



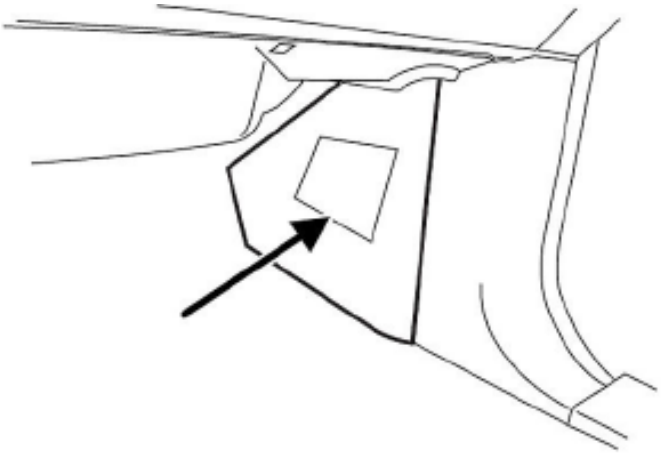
Component testing procedure (no voltage applied)

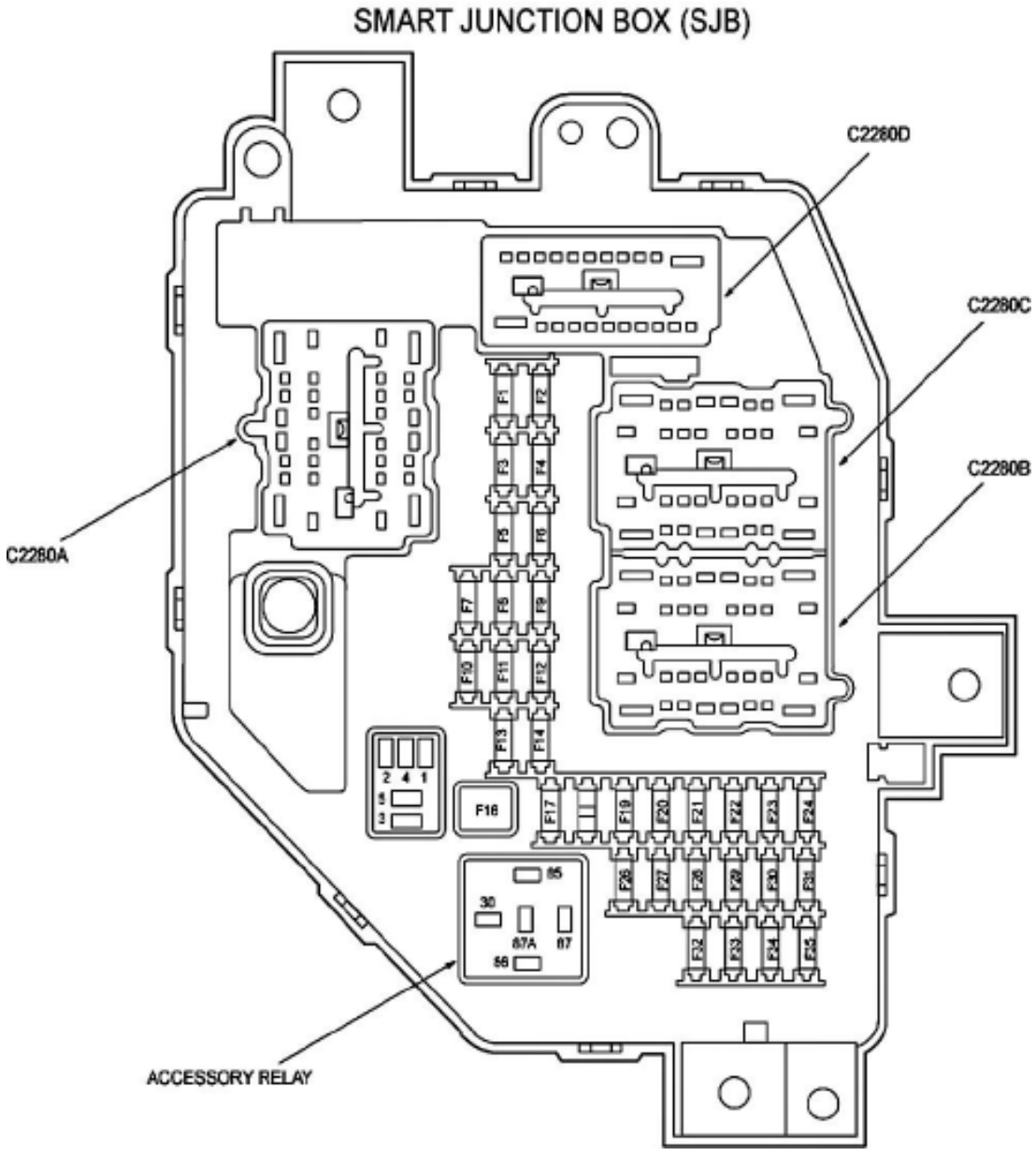
Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63-102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil - Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Relays and Modules > Relays and Modules - Lighting and Horns > Horn Relay > Component Information > Locations



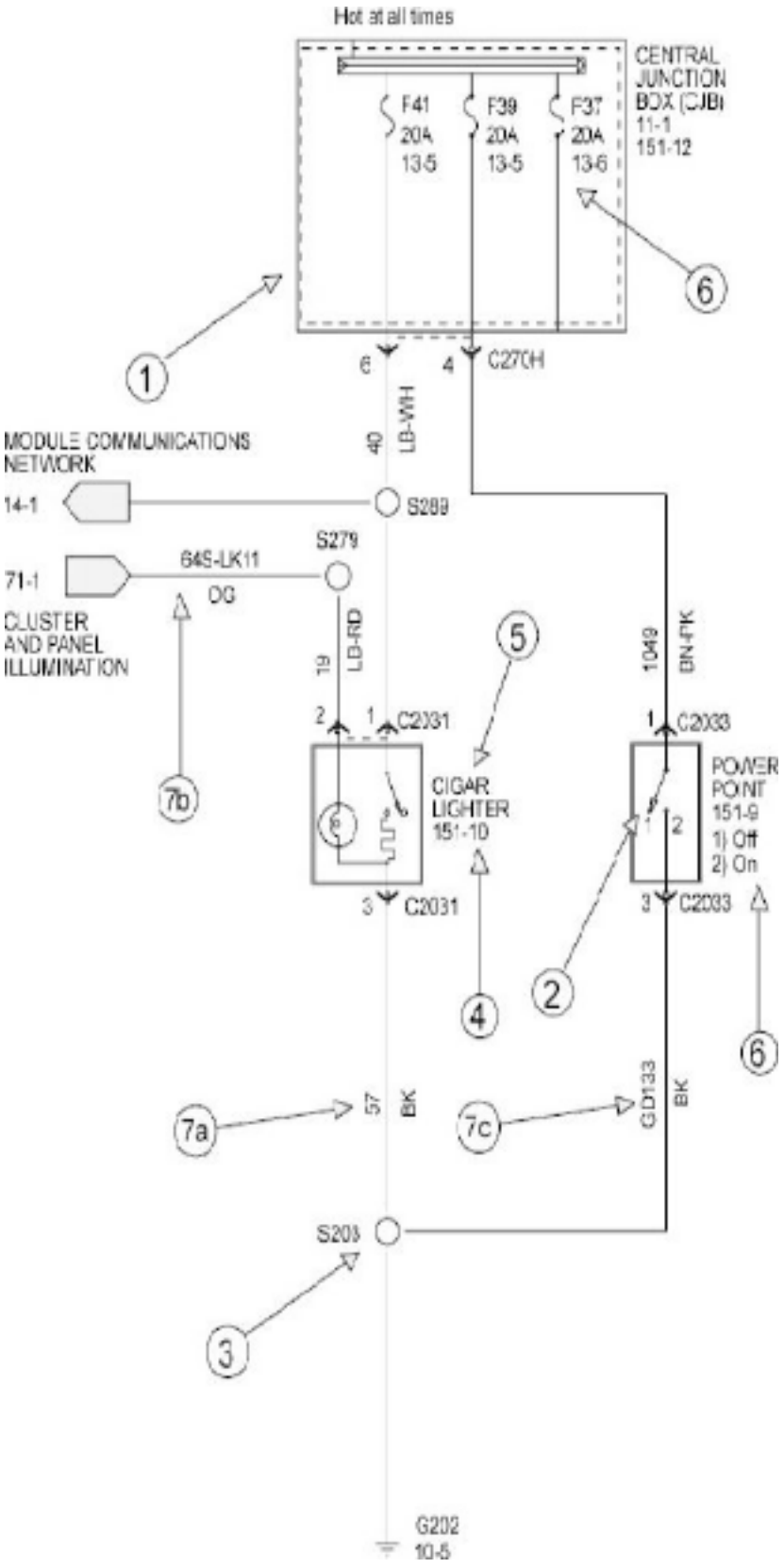


Horn Relay: Locations

FUSE	AMPS	Circuits Protected
F1	5A	Illumination dimmer
F2	10A	Trailer tow connector - Park
F3	10A	Headlamp, right (Low beam lamp feed)
F4	10A	Headlamp, left (Low beam lamp feed)
F5	5A	Windshield wiper module
F6	10A	Audio unit, Door lock switch illumination
F7	5A	Not Used
F8	10A	Restraints Control Module (RCM), Occupant Classification System Module (OCSM), Passenger Air bag Deactivation (PAD) Indicator
F9	5A	Instrument Cluster (IC), Air bag indicator
F10	10A	4X4 control module, Instrument Cluster (IC)
F11	10A	Smart Junction Box (SJB), logic power
F12	15A	Subwoofer amplifier with audiophile, Satellite radio receiver
F13	15A	Interior lamp relay, Horn relay
F14	15A	High beam lamp feed to High beam indicator, Headlamp, right, Headlamp, left
F16	30A	Accessory relay (Power windows)
F17	15A	Indicator flasher relay
F18	-	Not Used

FUSE	AMPS	Circuits Protected
F19	20A	Brake pedal position switch (Stoplamps)
F20	10A	Transmission control switch, Digital Transmission Range (TR) sensor, Speed control servo, Anti-lock Brake System (ABS) module, Indicator flasher relay, Reversing lamps switch, Speed control On/Off switch, Speed control Set/Resume switch
F21	5A	Digital Transmission Range (TR) sensor, Starter relay, Powertrain Control Module (PCM)
F22	5A	Audio unit
F23	30A	Main light switch, Multifunction switch
F24	20A	Audio unit
F26	2A	Deactivator switch
F27	10A	Blend door actuator, Climate control assembly
F28	15A	4X4 control module
F29	20A	Cigar lighter, front, Data Link Connector (DLC)
F30	5A	Exterior rear view mirror switch
F31	20A	Park lamp relay
F32	5A	Brake pedal position switch (logic power), Brake shift interlock
F33	5A	Instrument Cluster (IC), Neutral tow indicator
F34	20A	Power point
F35	15A	Door lock/unlock relay, Driver door unlock relay

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Relays and Modules > Relays and Modules - Lighting and Horns > Horn Relay > Component Information > Diagrams > Diagram Information and Instructions



Horn Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

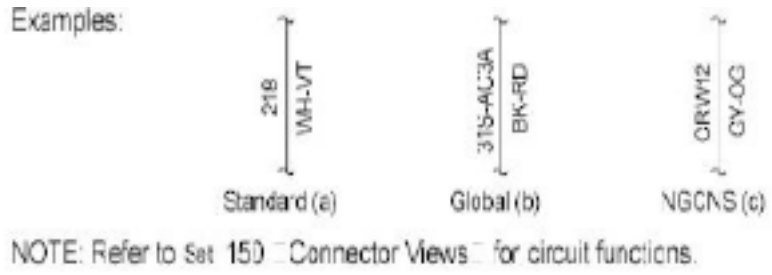
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

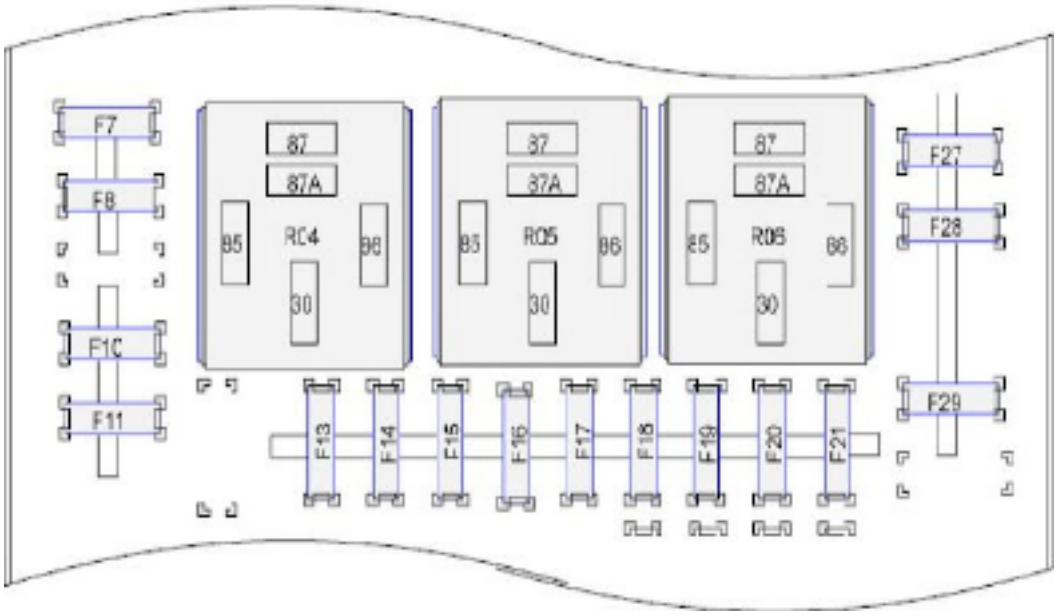
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

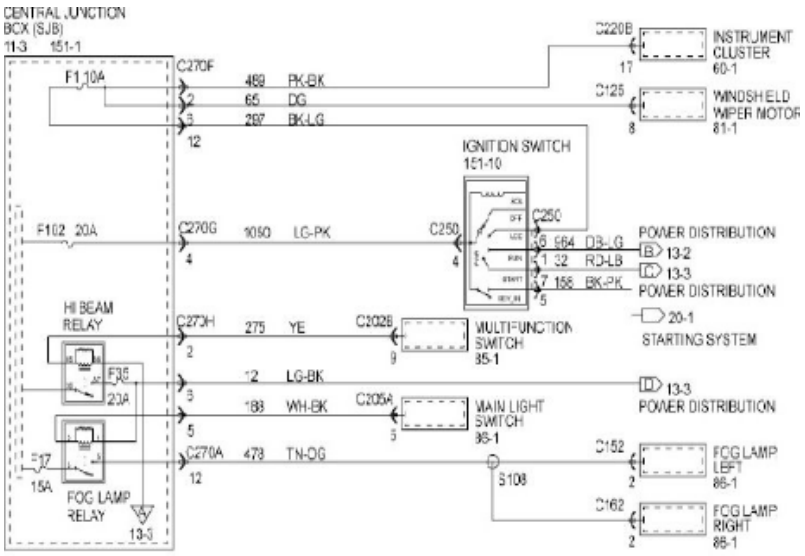
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

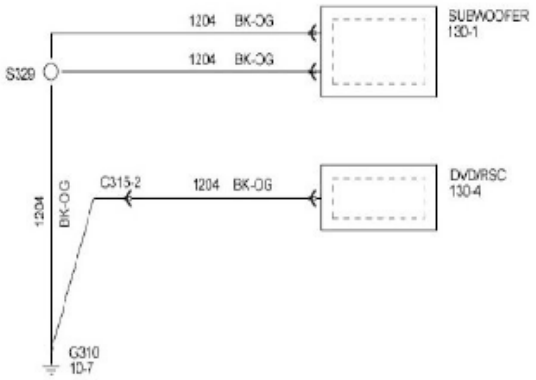
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

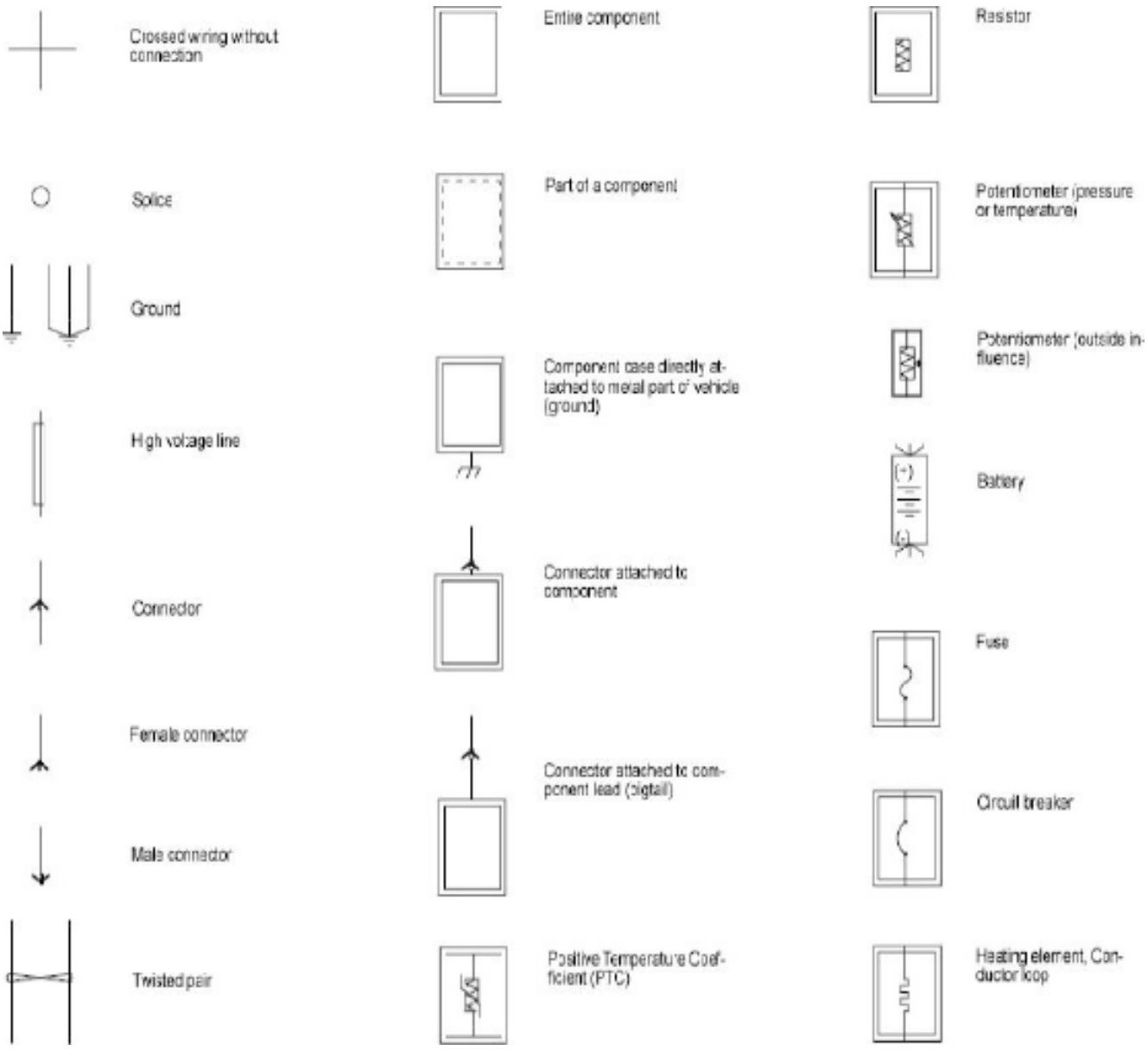
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

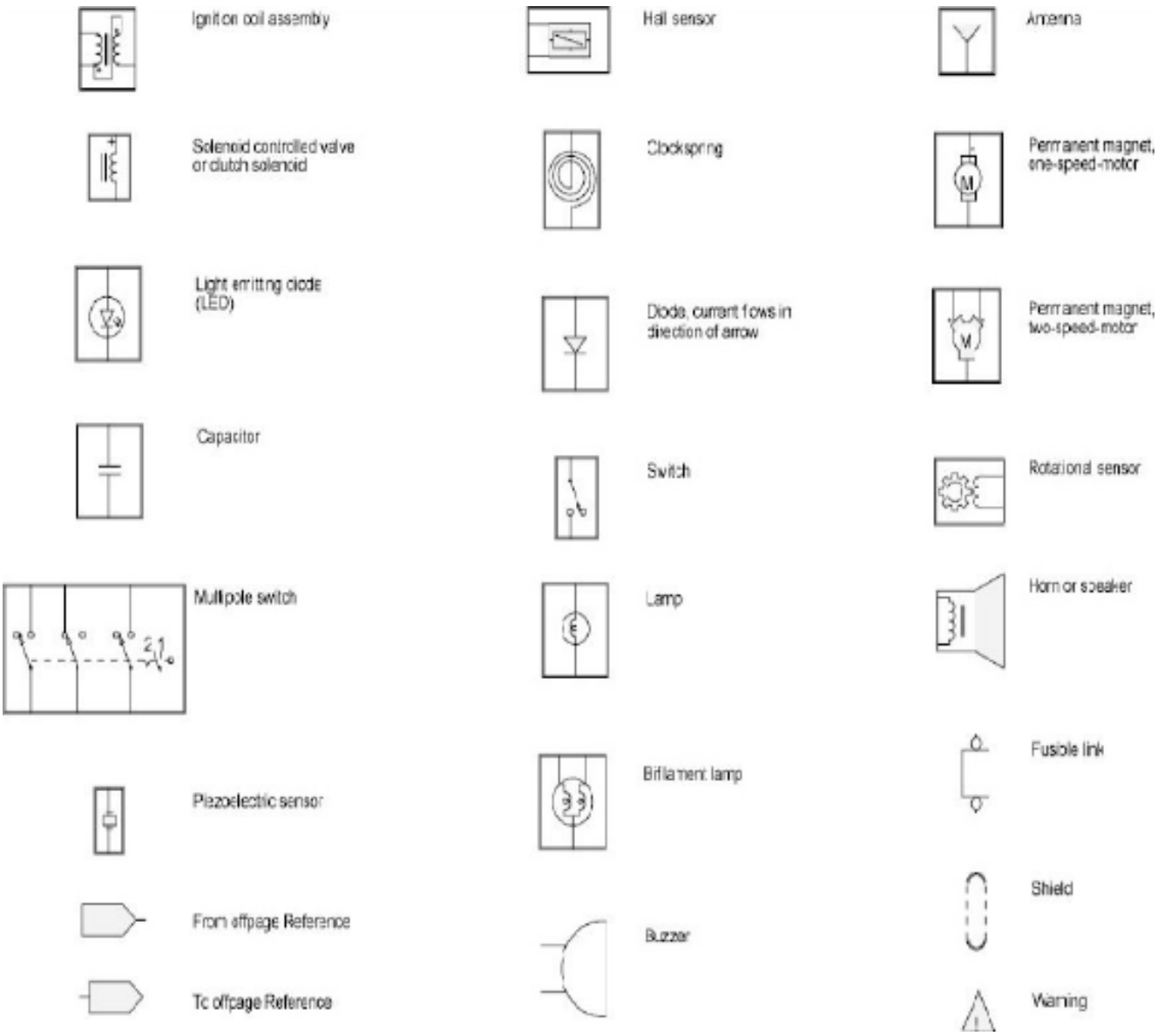
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

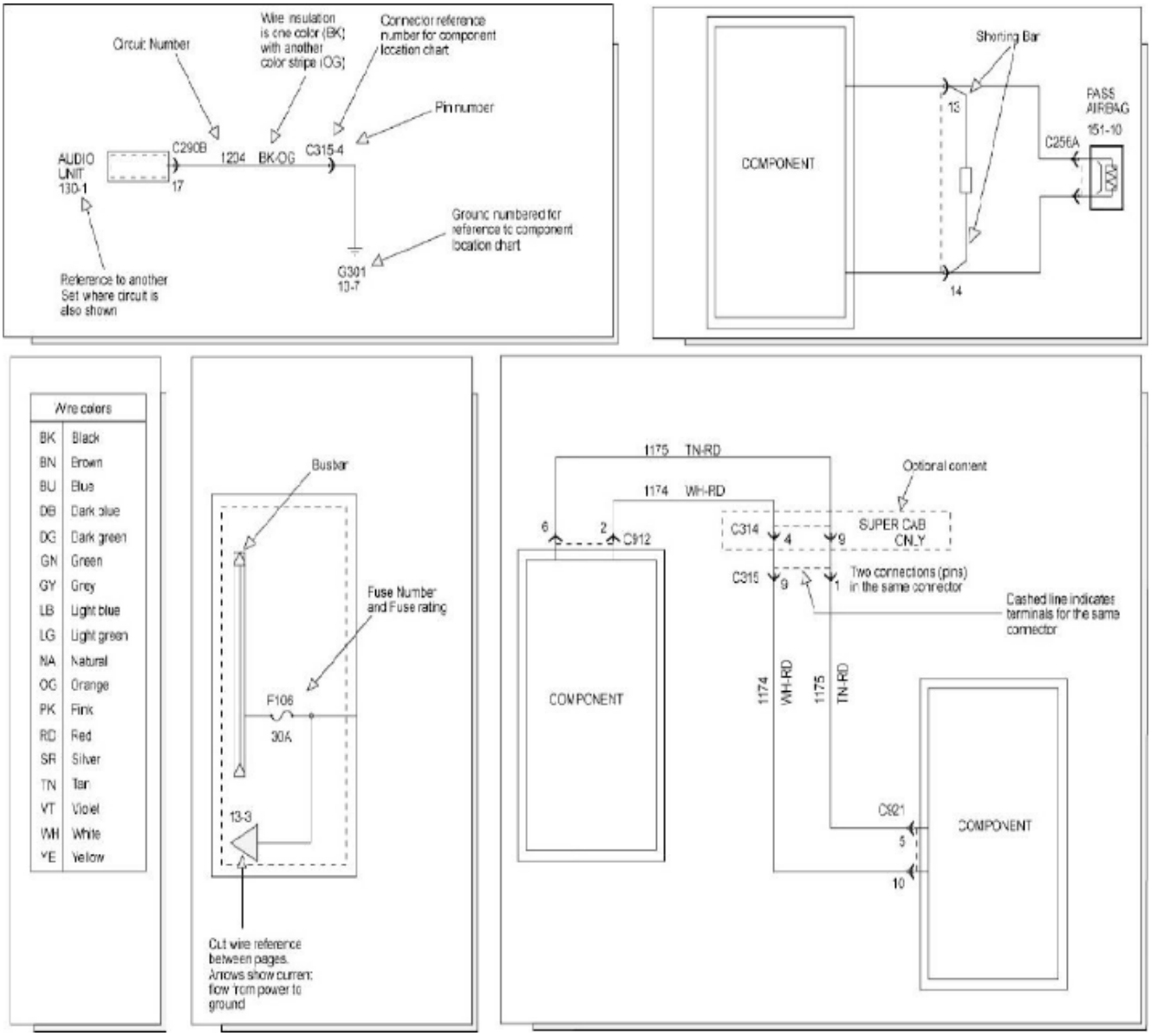
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

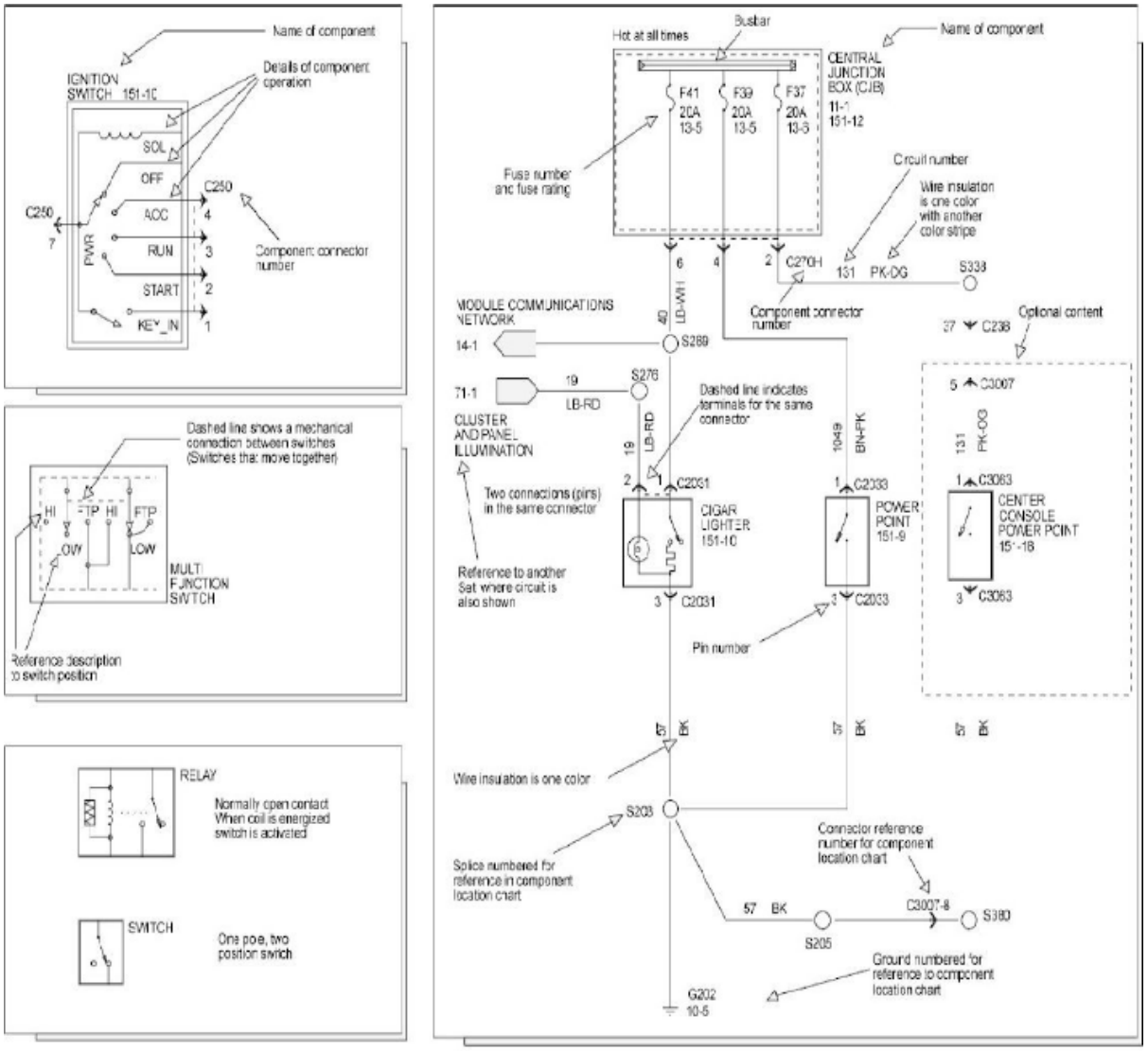
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

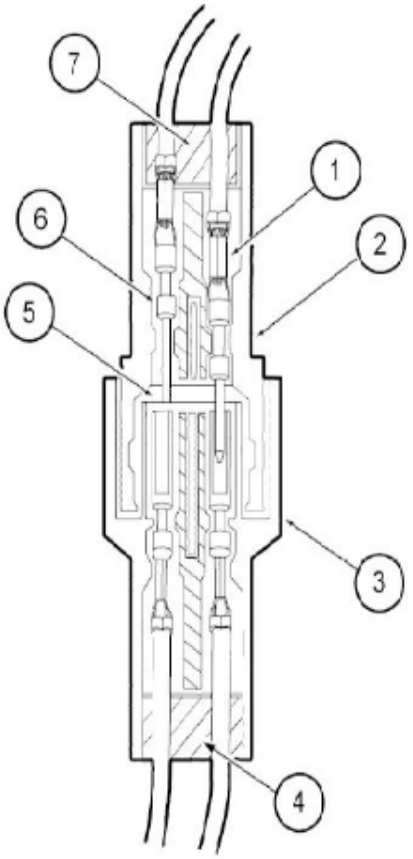


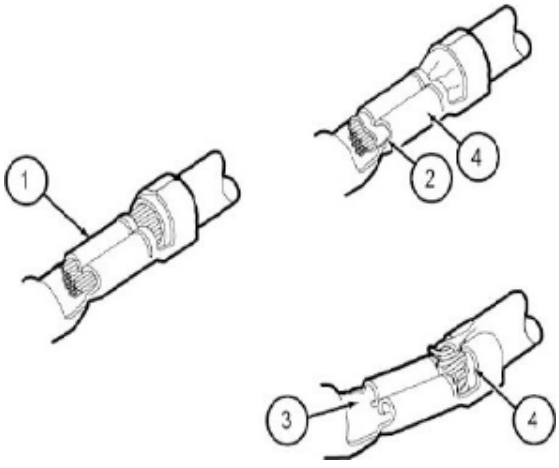
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Horn Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

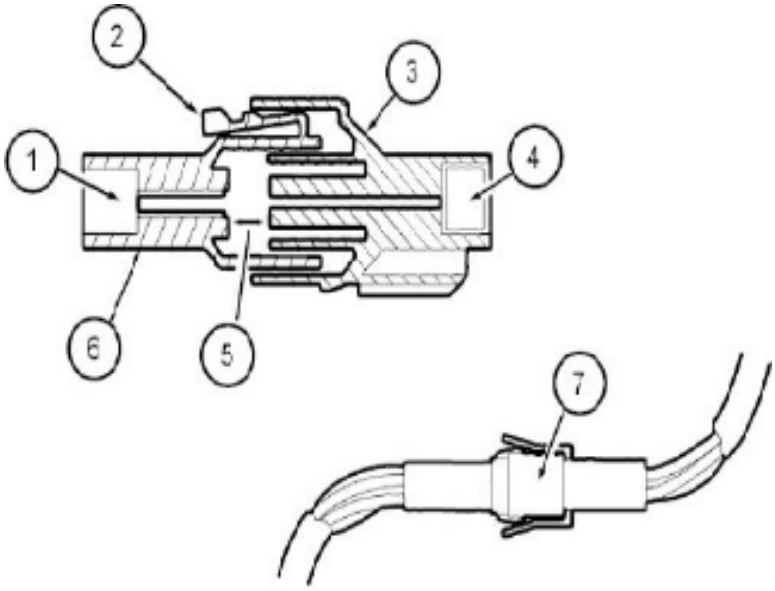
5 = Intermittent contact

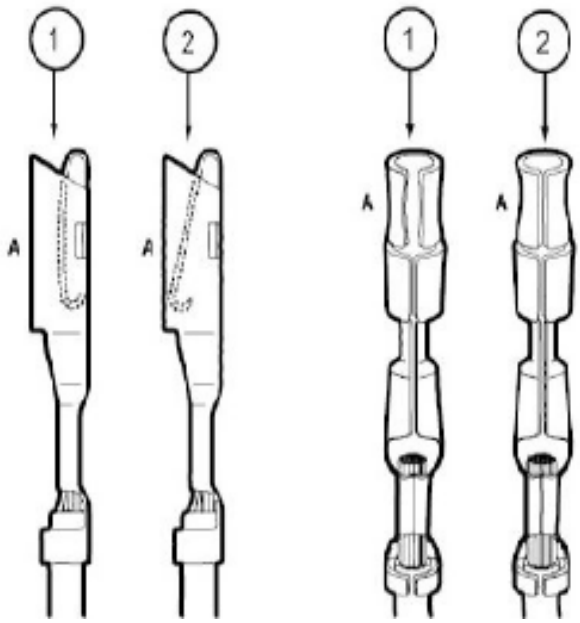
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

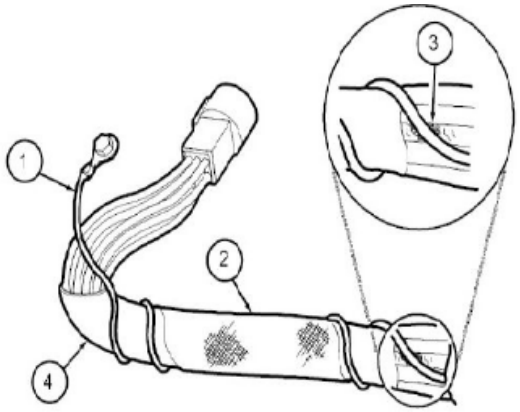
Deformed (enlarged) female terminals

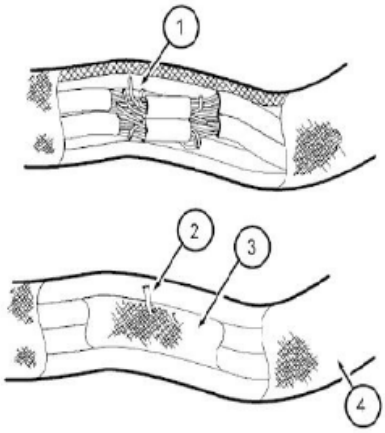
1 = Enlarged

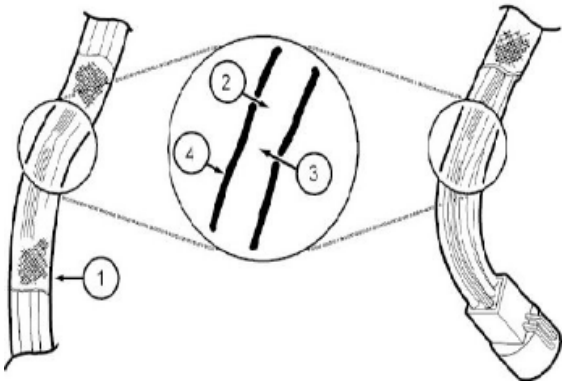
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

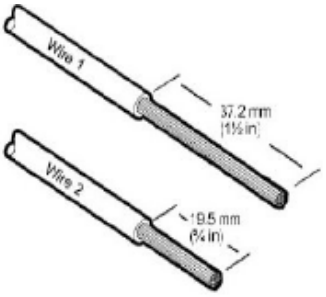
Splice covered 2

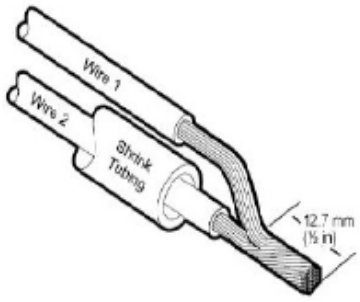
= Wire strand

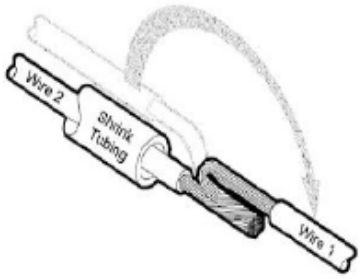
3 = Splice tape

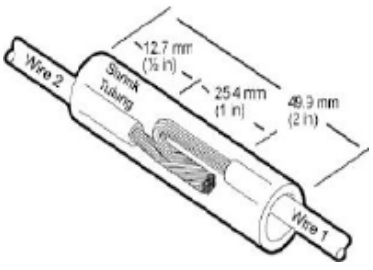
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

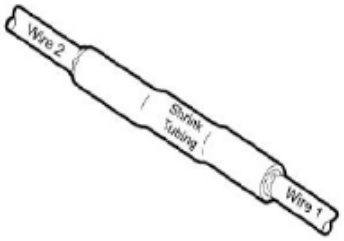
NOTE: -

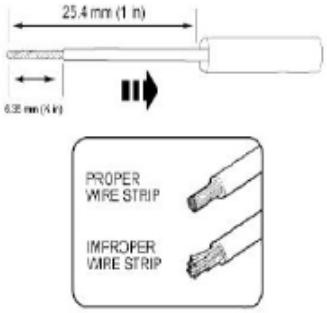
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

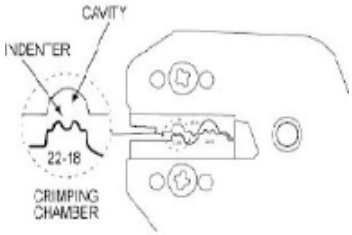
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

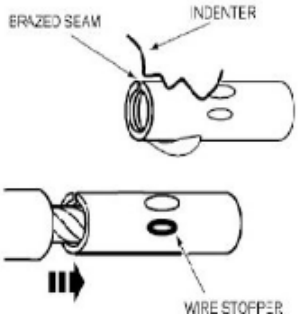
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
6.35 mm (¼ in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

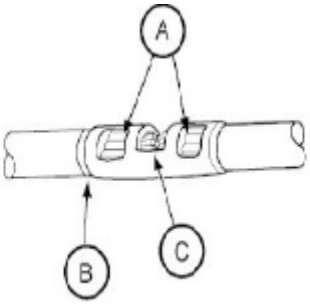
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

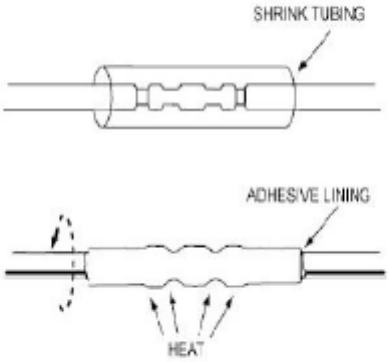
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4 strip, cut 9 strands	* 1/4 strip, cut 2 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip, fold 3x dia.
	16-14	* 1/4 strip, cut 7 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip fold 2x dia	1 strip, fold 3x dia.	1 1/4 strip, fold 4x dia.	Not Recommended
	12-10	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip fold 3x dia.	1 1/4 strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Pigtail only

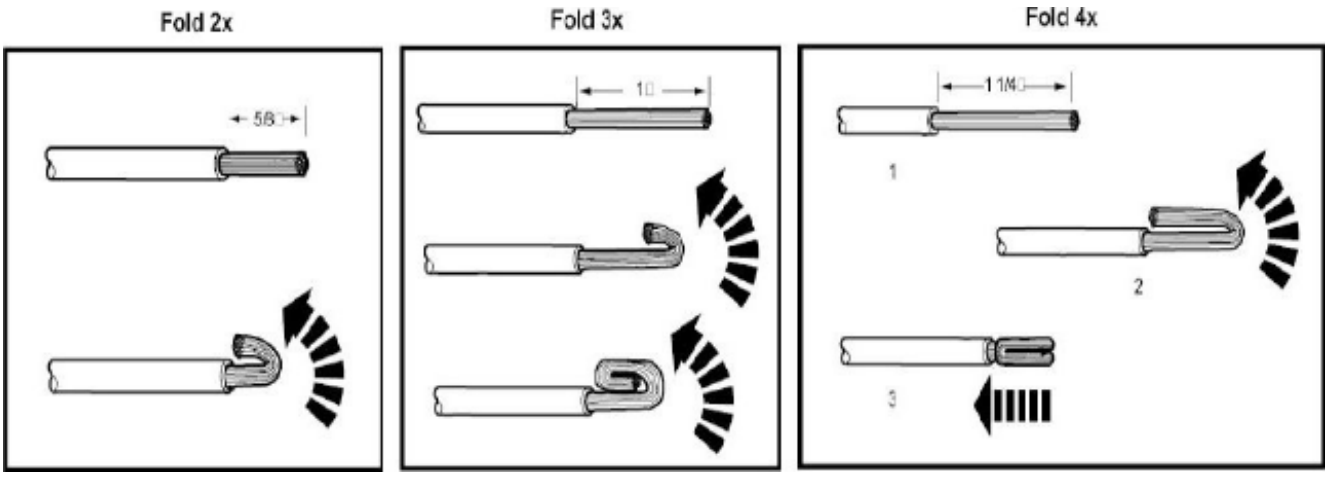
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



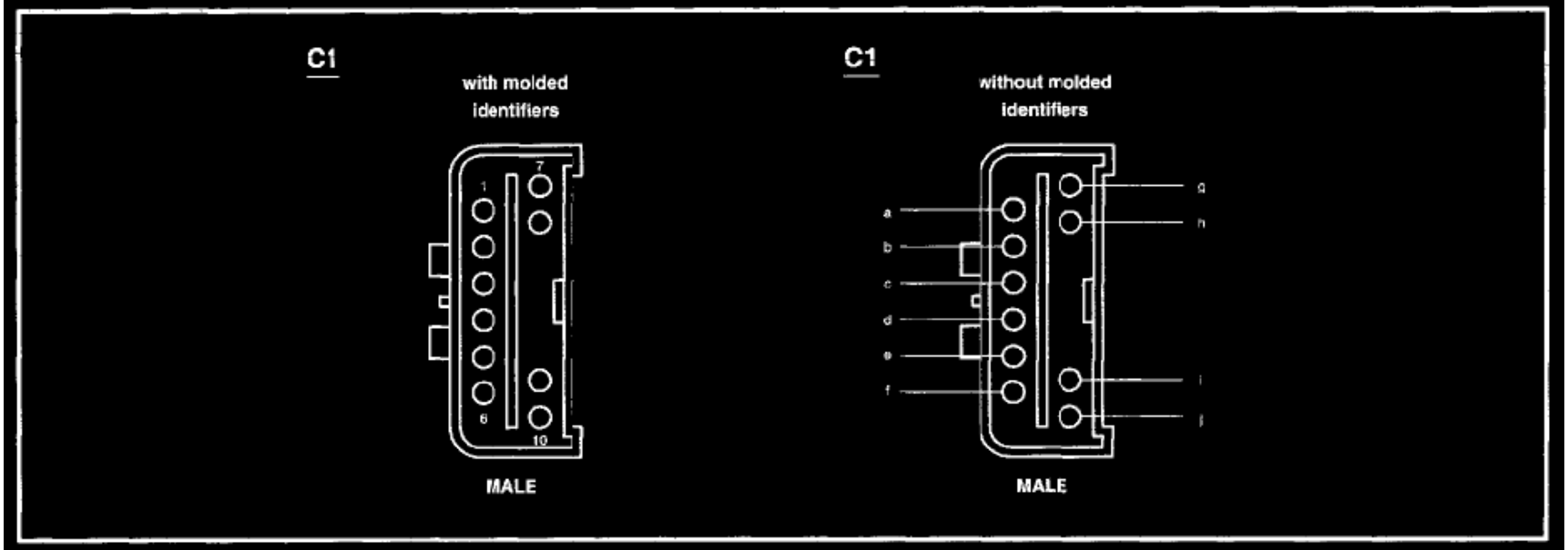
The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step–by–step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



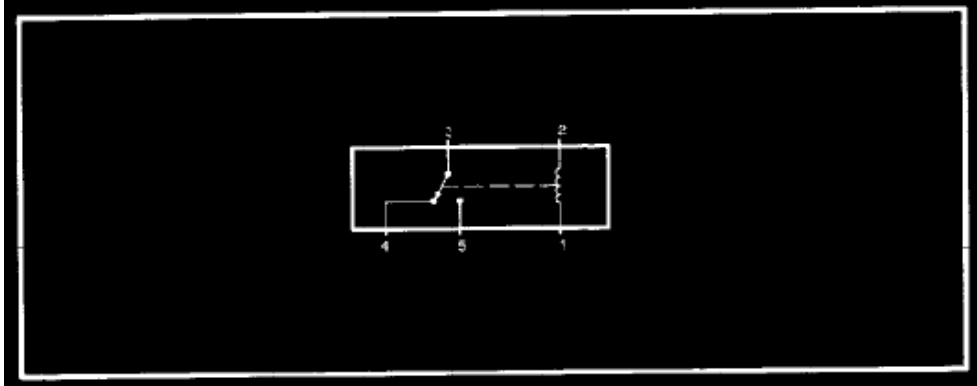
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

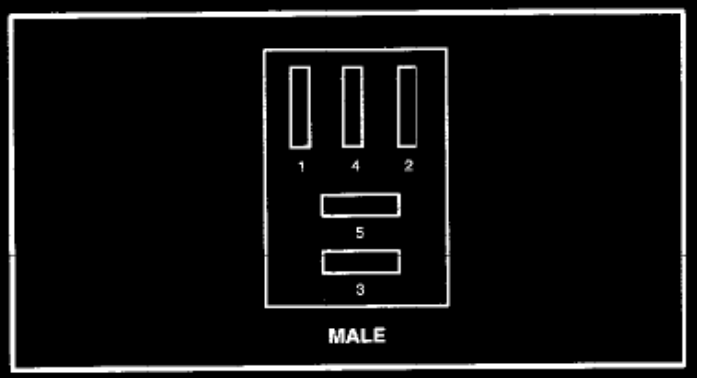
Horn Relay: Testing and Inspection Micro ISO Relay

Relay – Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63–102Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil – Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

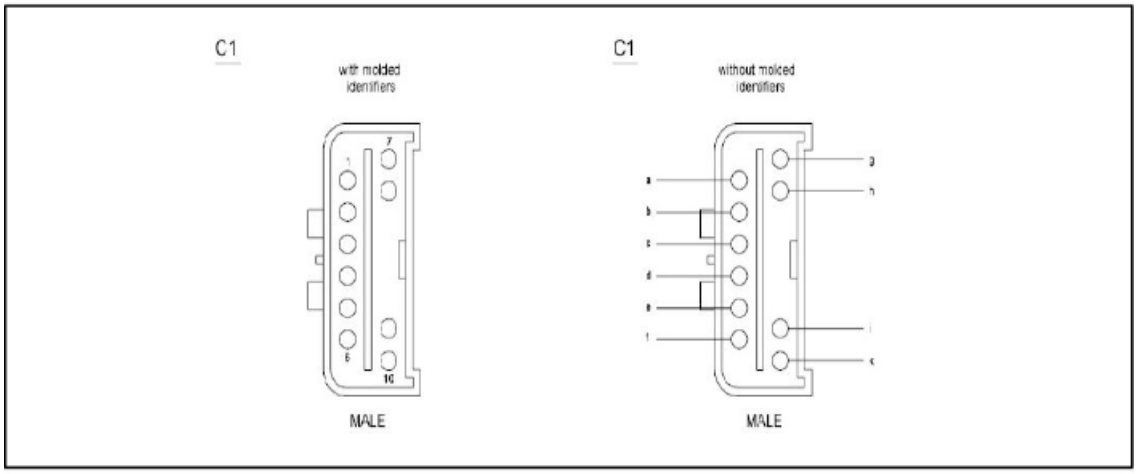
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step□by□step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals

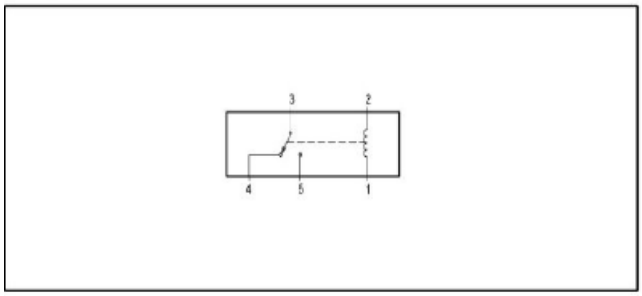


The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column □Circuit to test□. If you wish to test the complete component, perform all tests.

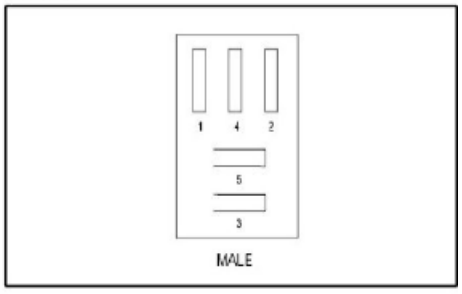
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Relay □ Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63□102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil □ Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

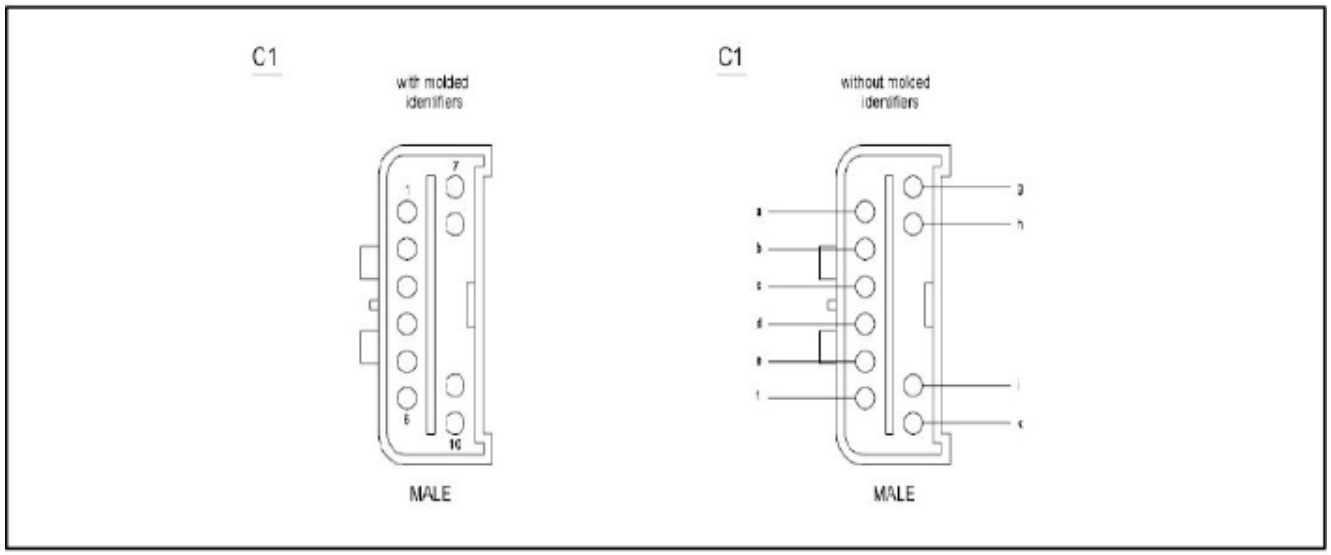
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step by step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



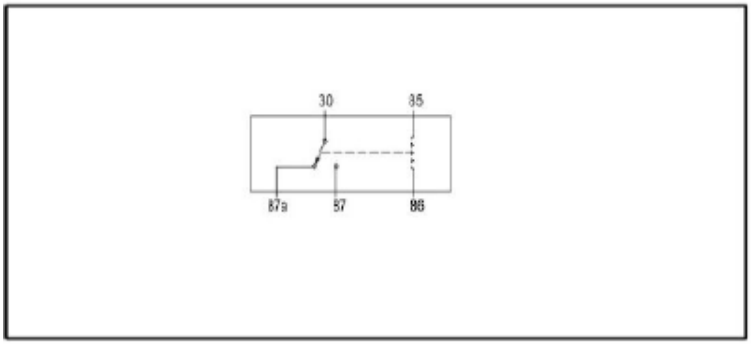
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

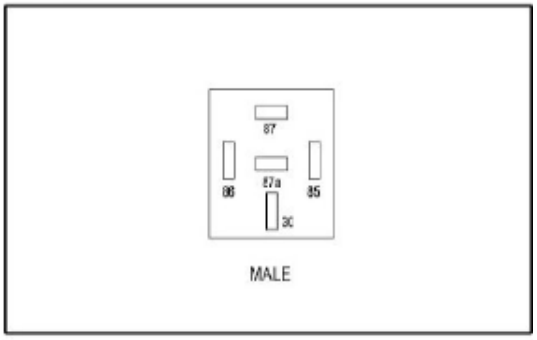
Horn Relay: Testing and Inspection Mini ISO Relay

Relay □ Mini ISO

Schematic



Terminals



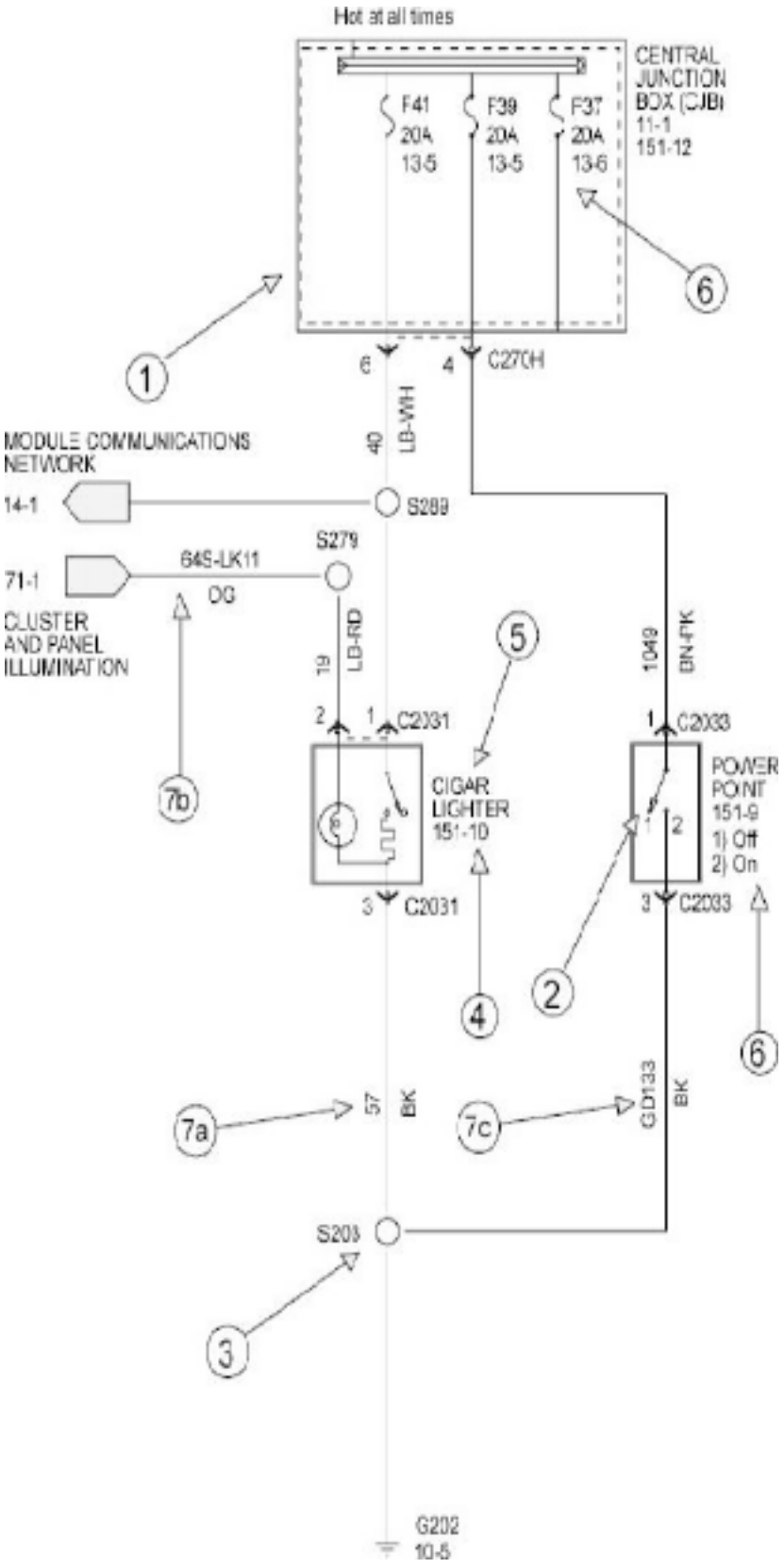
Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Relays and Modules > Relays and Modules - Lighting and Horns > Interior Lighting Relay > Component Information > Diagrams > Diagram Information and Instructions



Interior Lighting Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

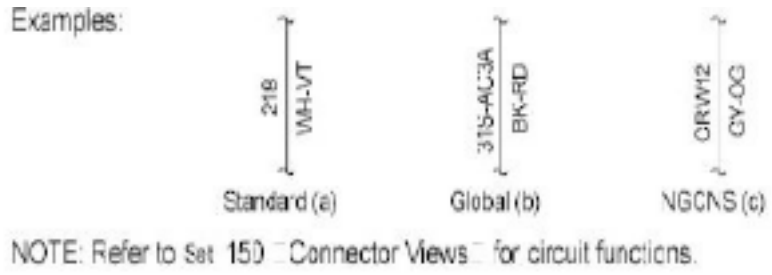
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

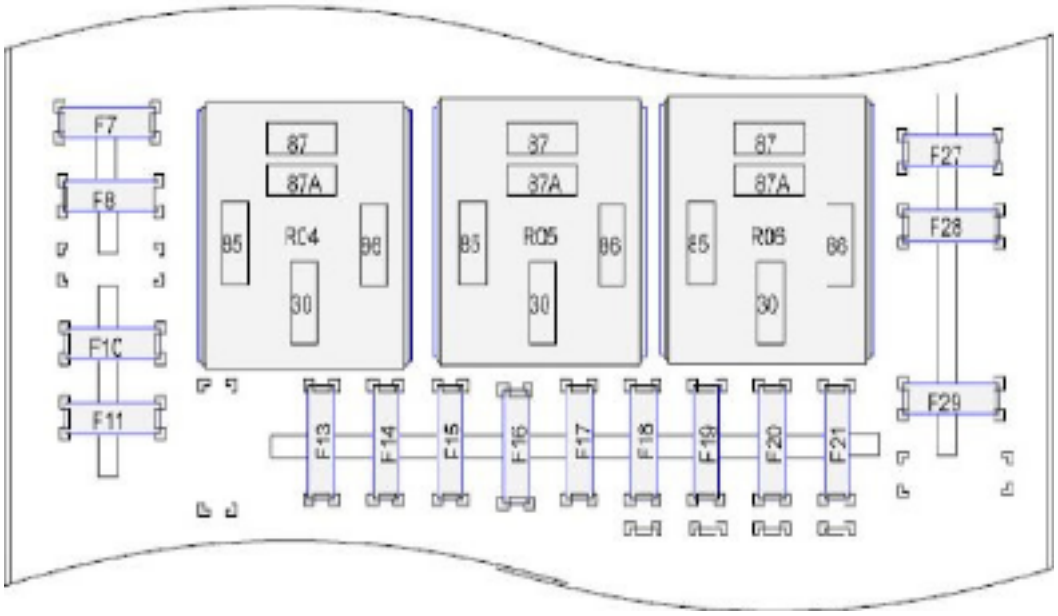
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

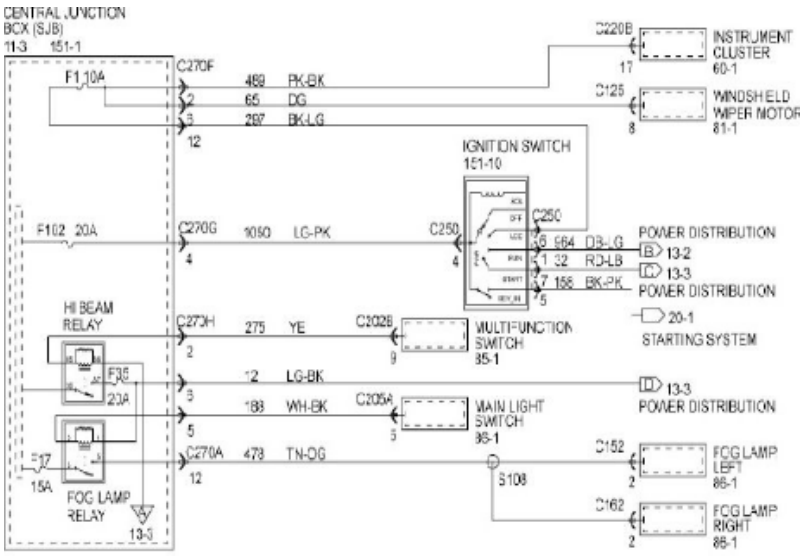
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

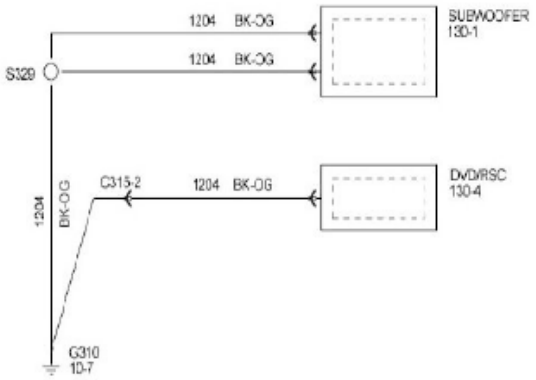
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

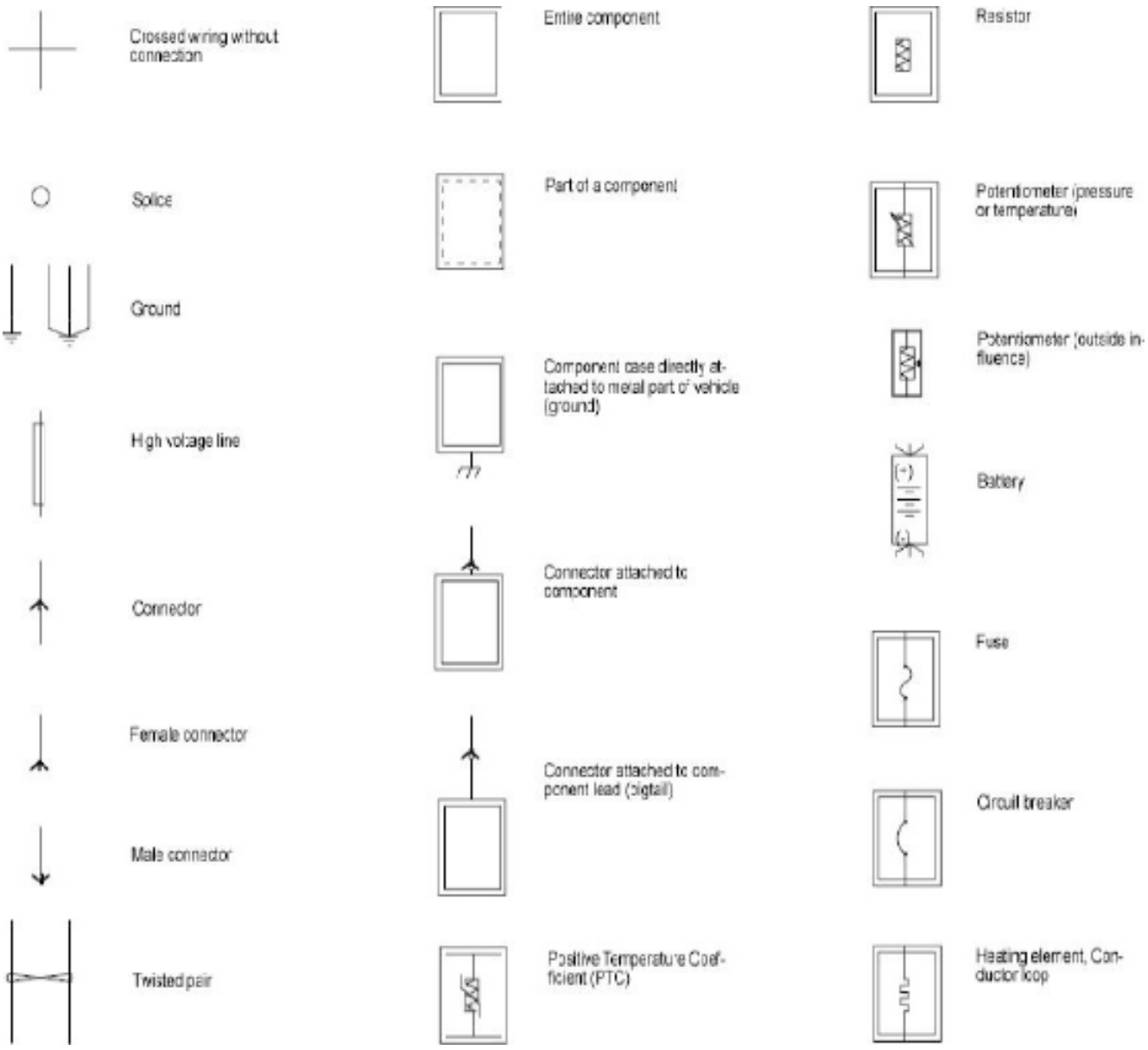
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

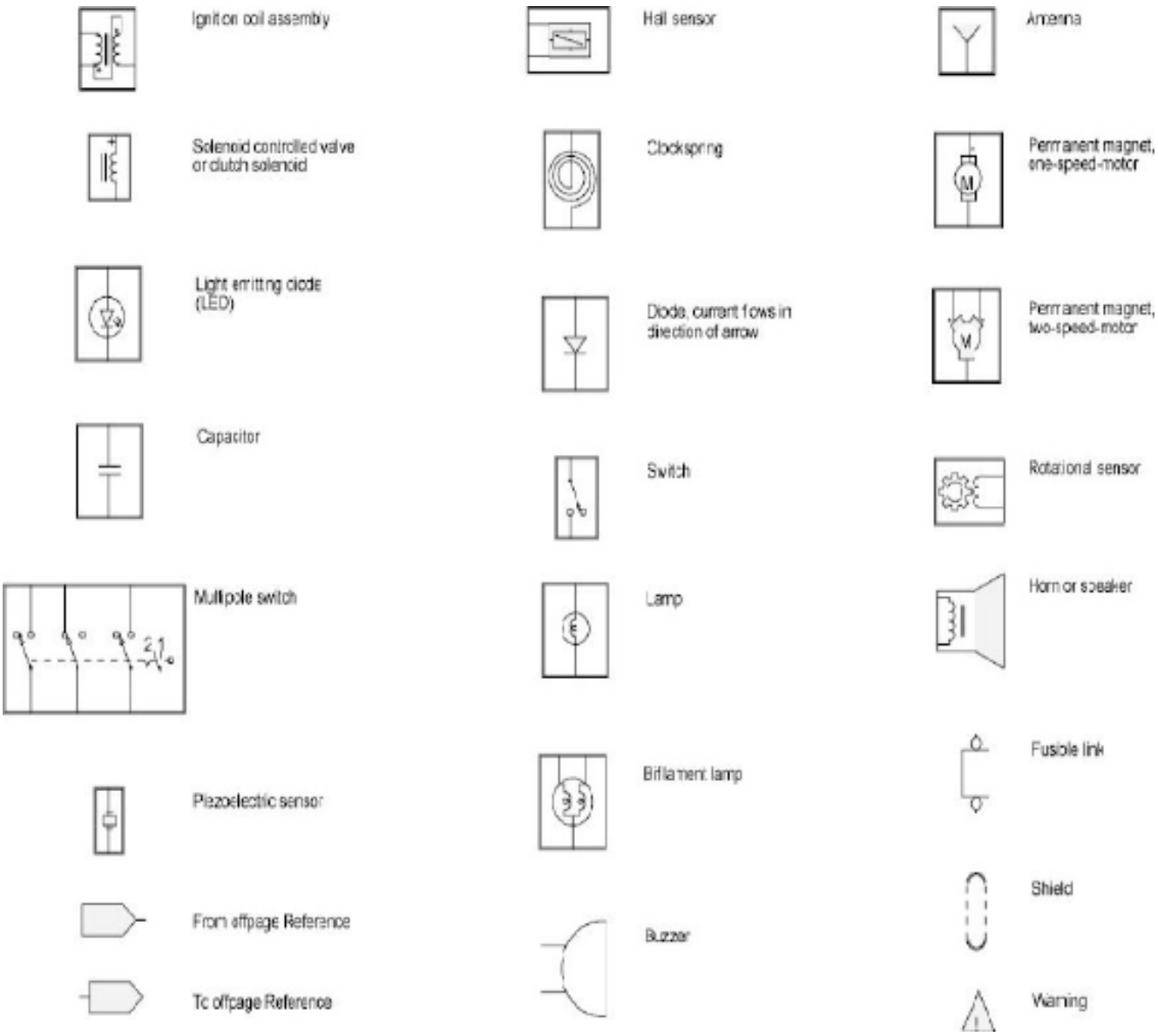
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

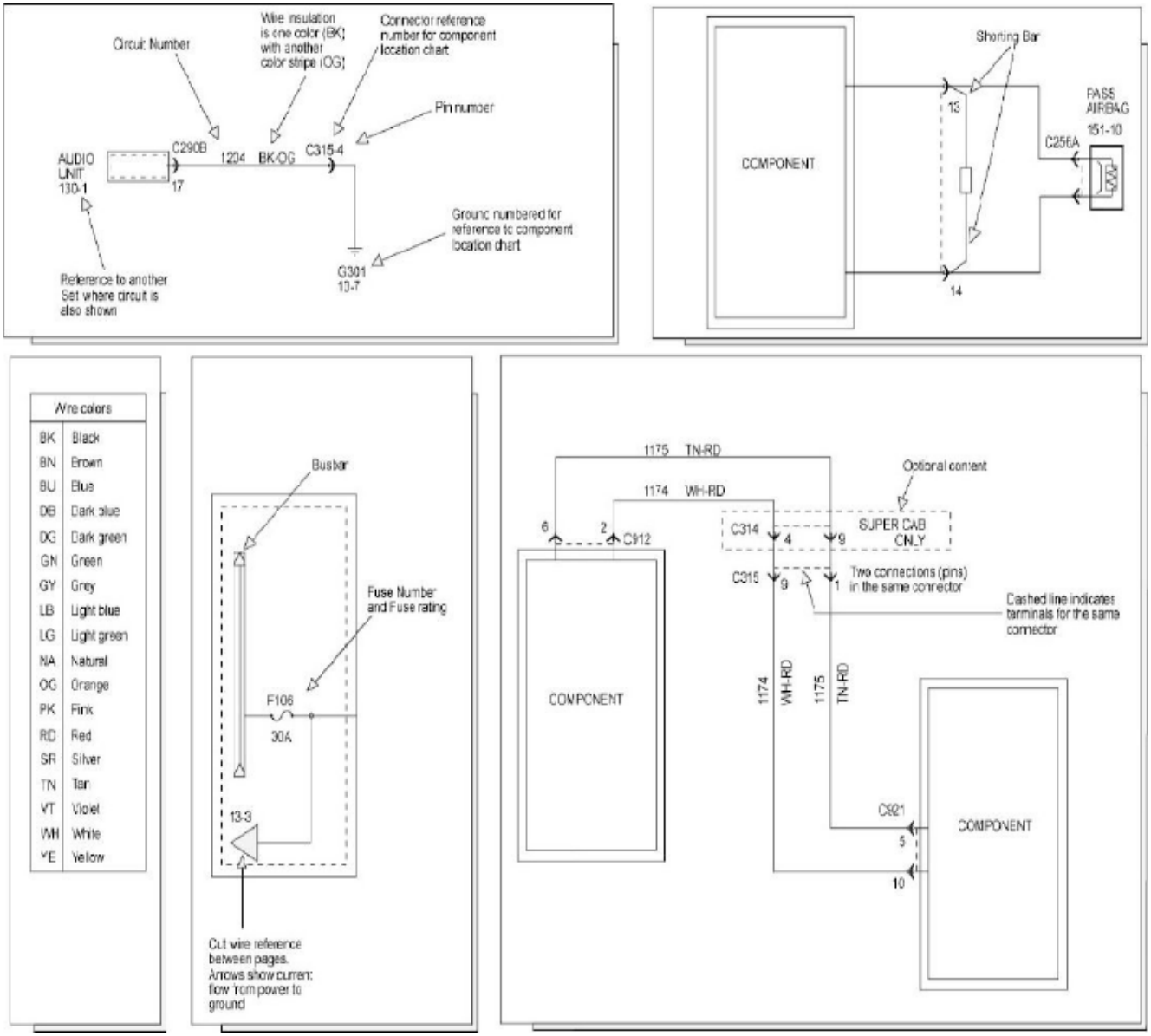
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

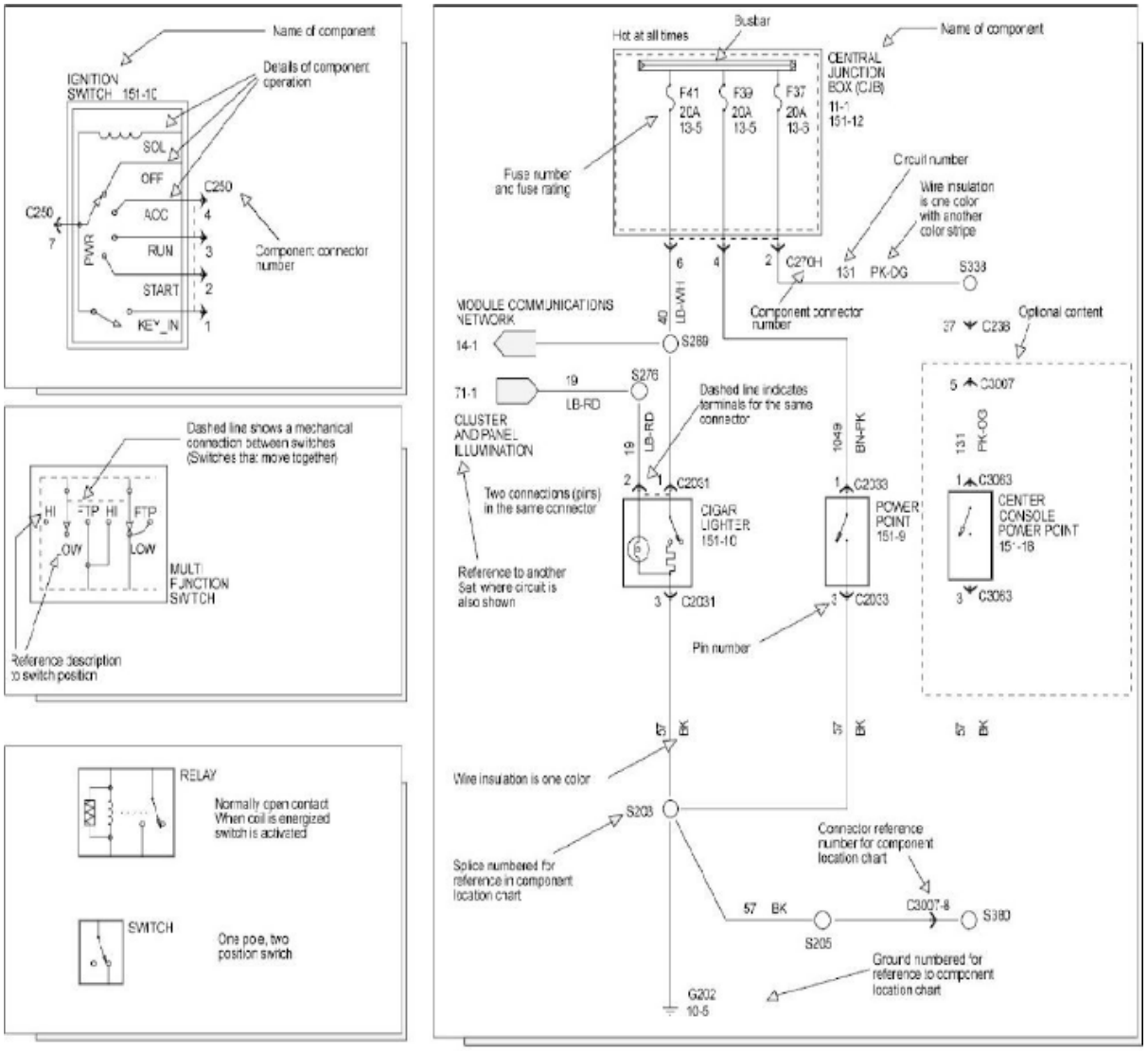
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

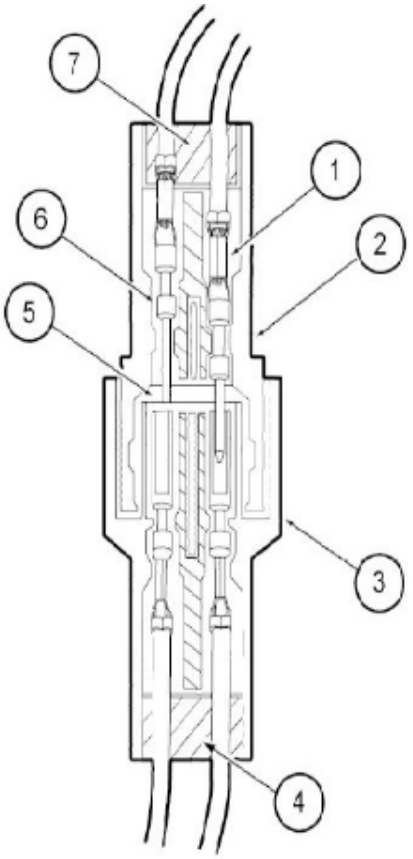


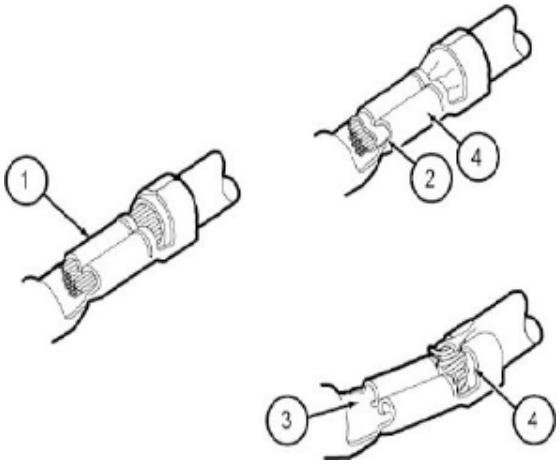
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Interior Lighting Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

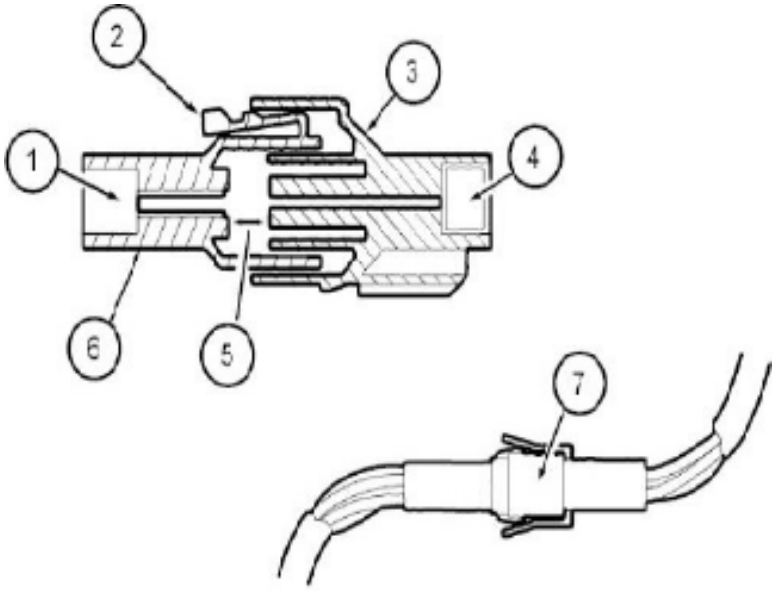
5 = Intermittent contact

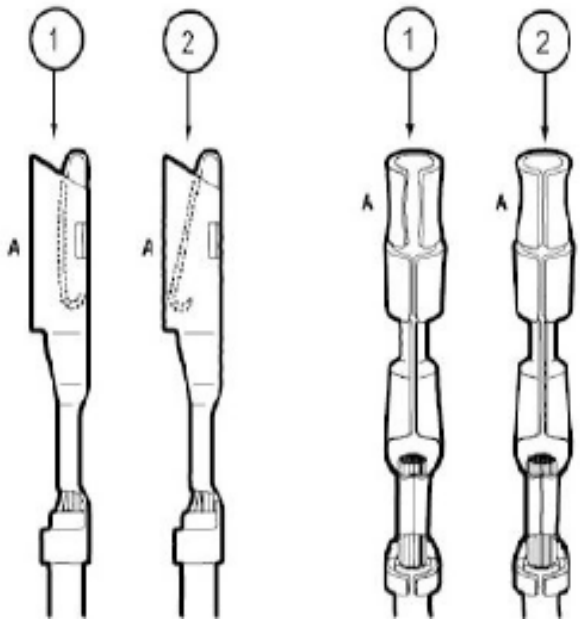
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

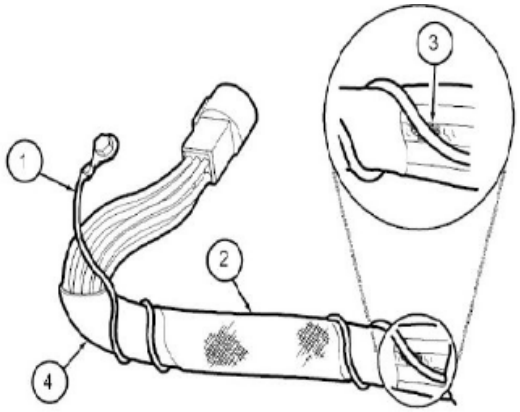
Deformed (enlarged) female terminals

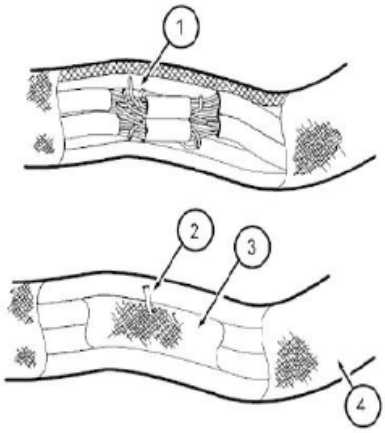
1 = Enlarged

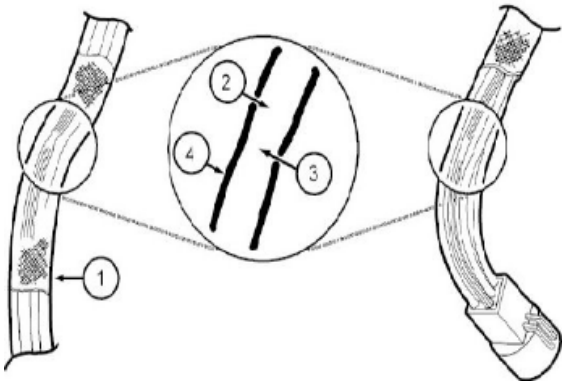
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

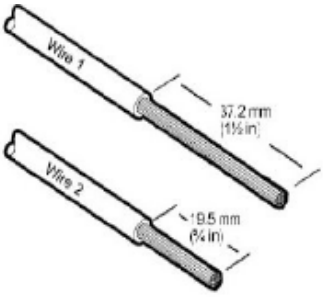
Splice covered 2

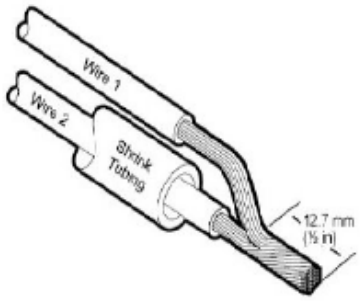
= Wire strand

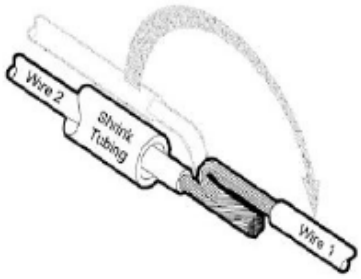
3 = Splice tape

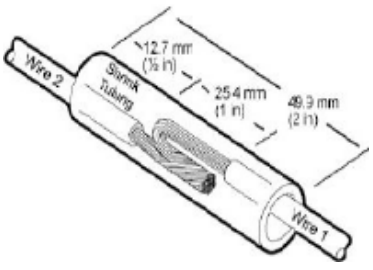
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

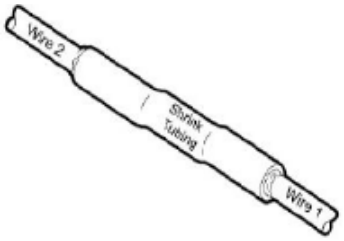
NOTE: -

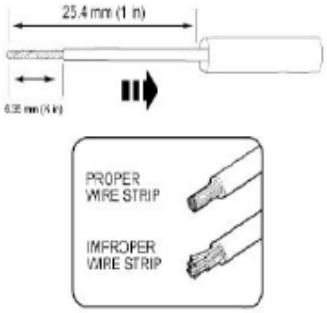
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

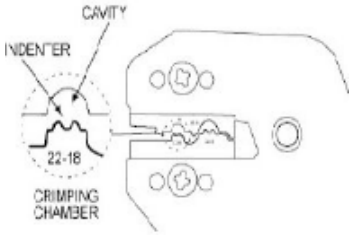
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

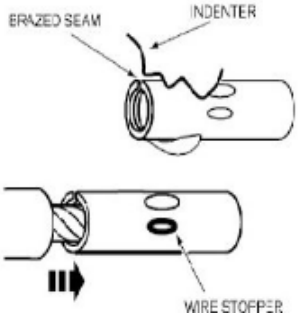
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
6.35 mm (¼ in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

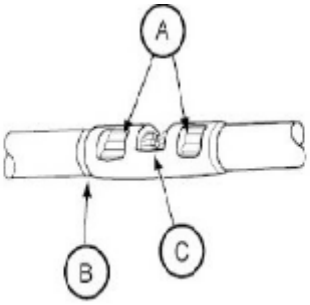
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

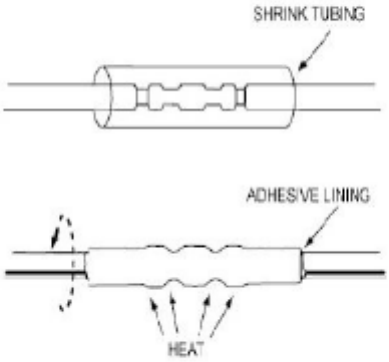
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4□ strip, cut 9 strands	* 1/4□ strip, cut 2 strands	1/4□ strip, no fold	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip, fold 2x dia.	1□ strip, fold 3x dia.
	16-14	* 1/4□ strip, cut 7 strands	1/4□ strip, no fold	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip fold 2x dia	1□ strip, fold 3x dia.	1 1/4□ strip, fold 4x dia.	Not Recommended
	12-10	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip, fold 2x dia.	1□ strip fold 3x cia.	1 1/4□ strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Figtail only

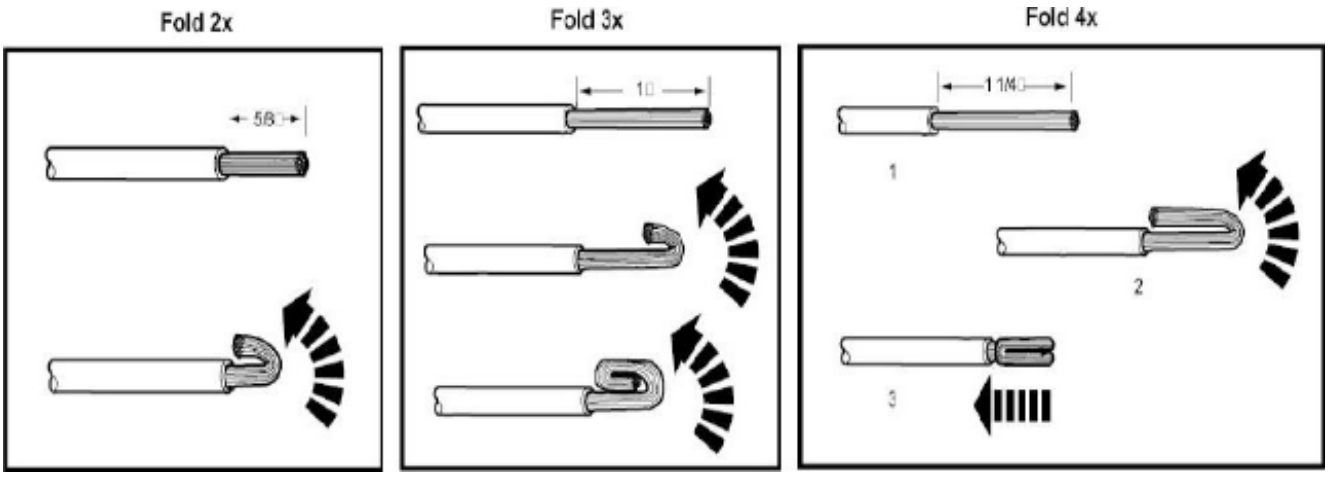
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



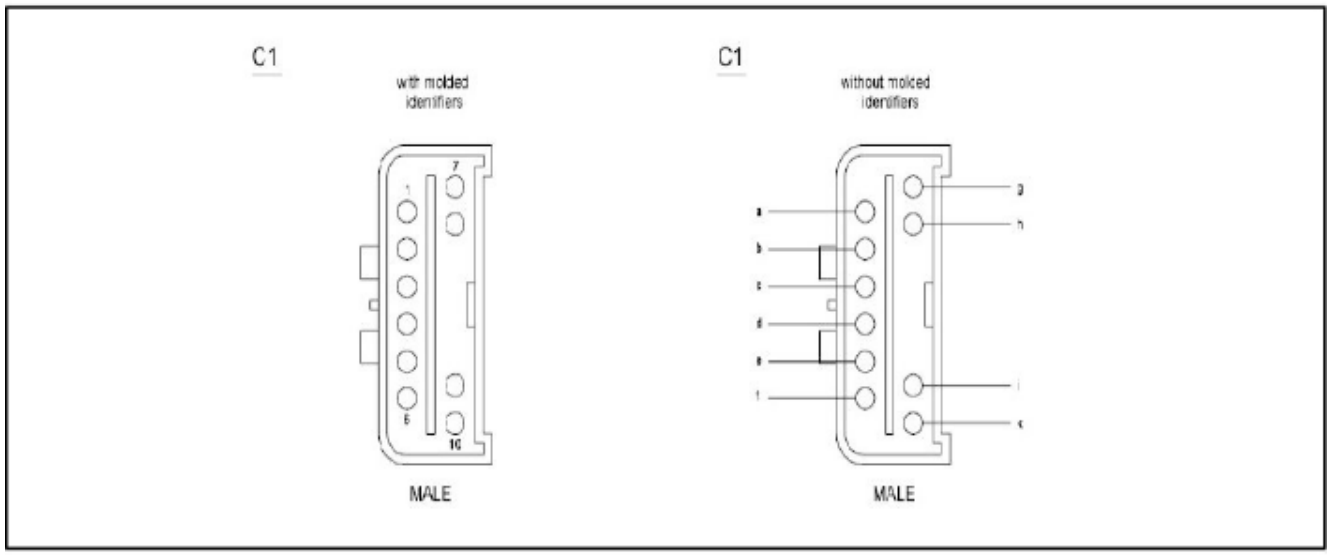
The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



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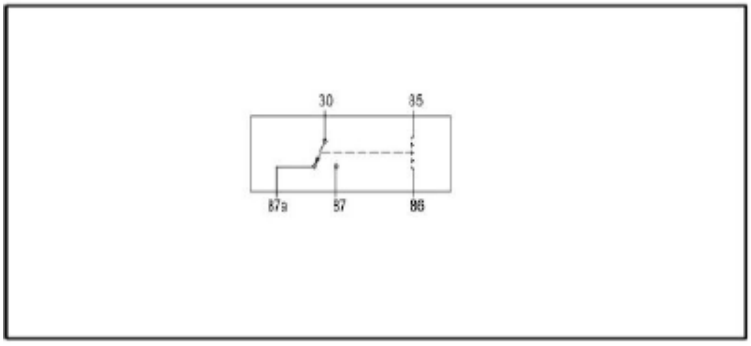
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

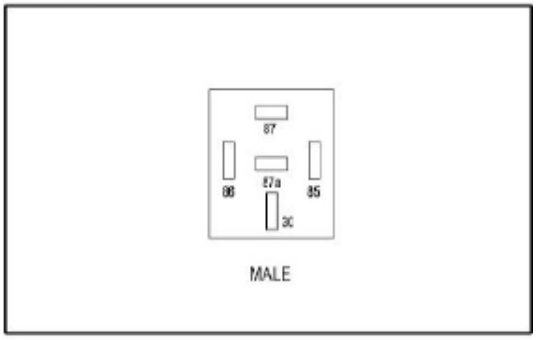
Interior Lighting Relay: Testing and Inspection Mini ISO Relay

Relay □ Mini ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

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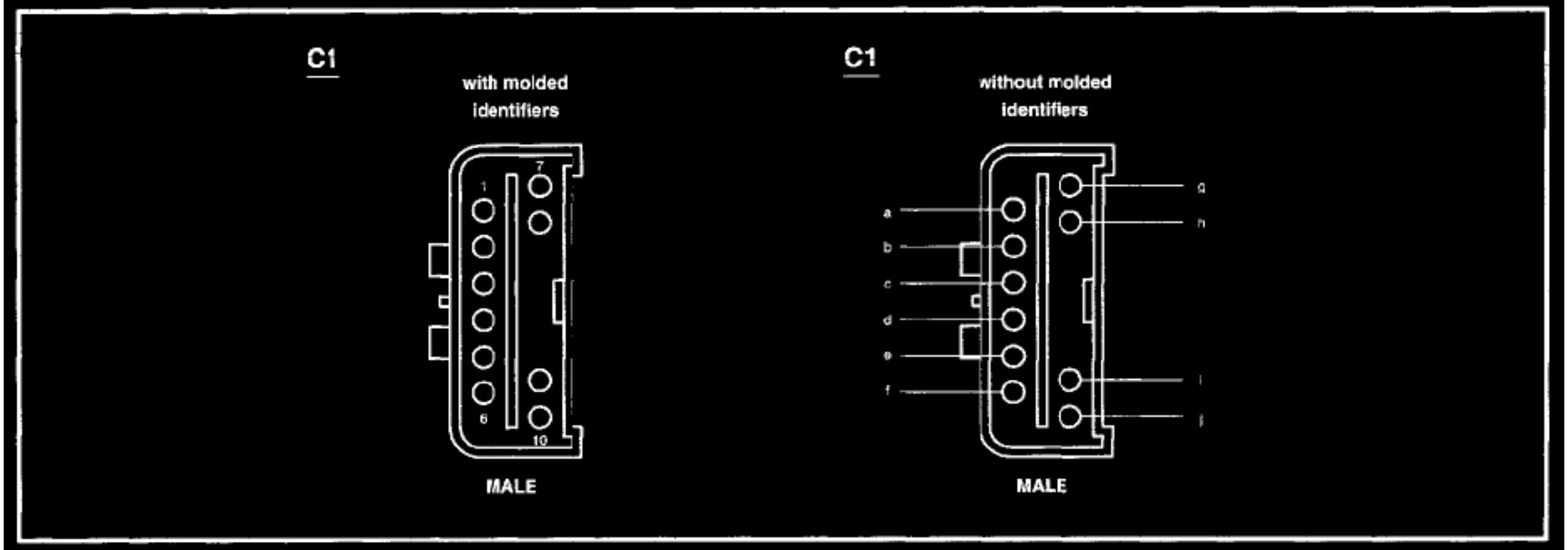

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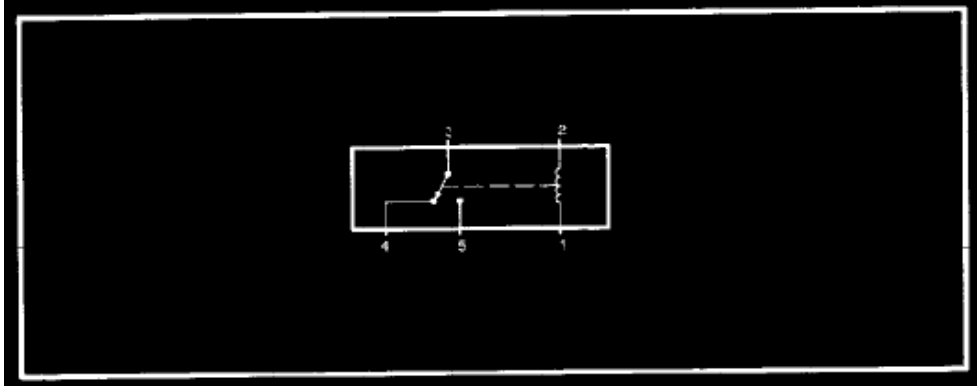
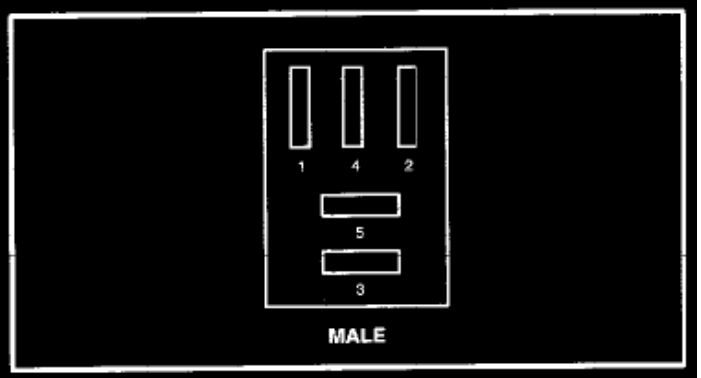
Interior Lighting Relay: Testing and Inspection Micro ISO Relay

Relay – Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63–102Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil – Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

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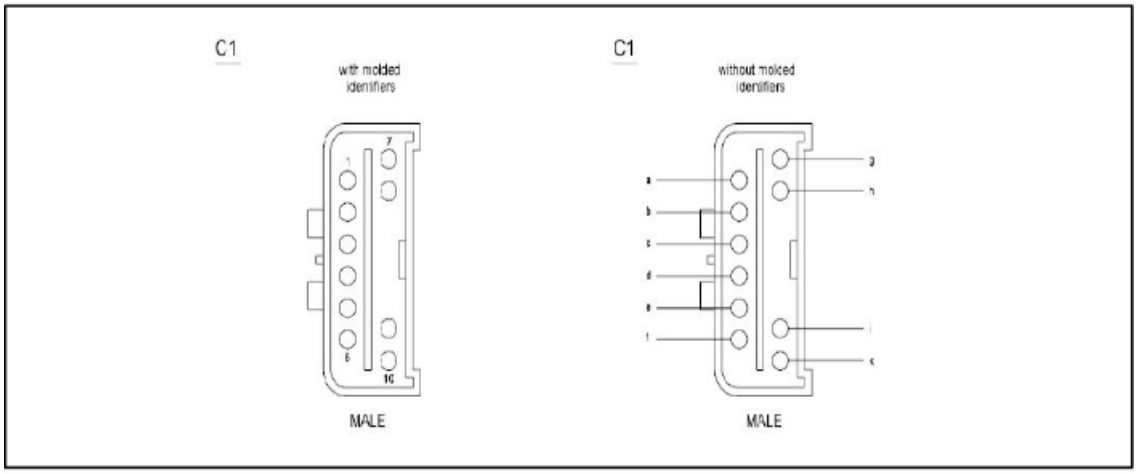

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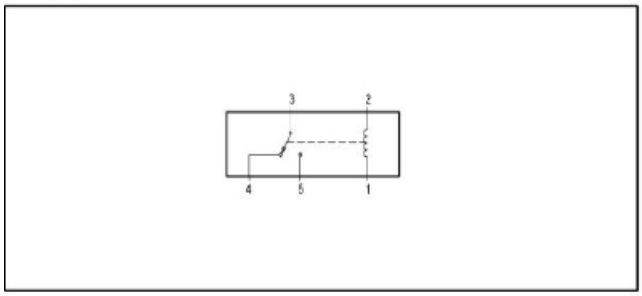
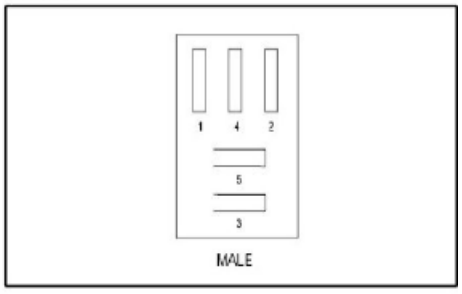
Relay □ Micro ISO

Schematic



Terminals



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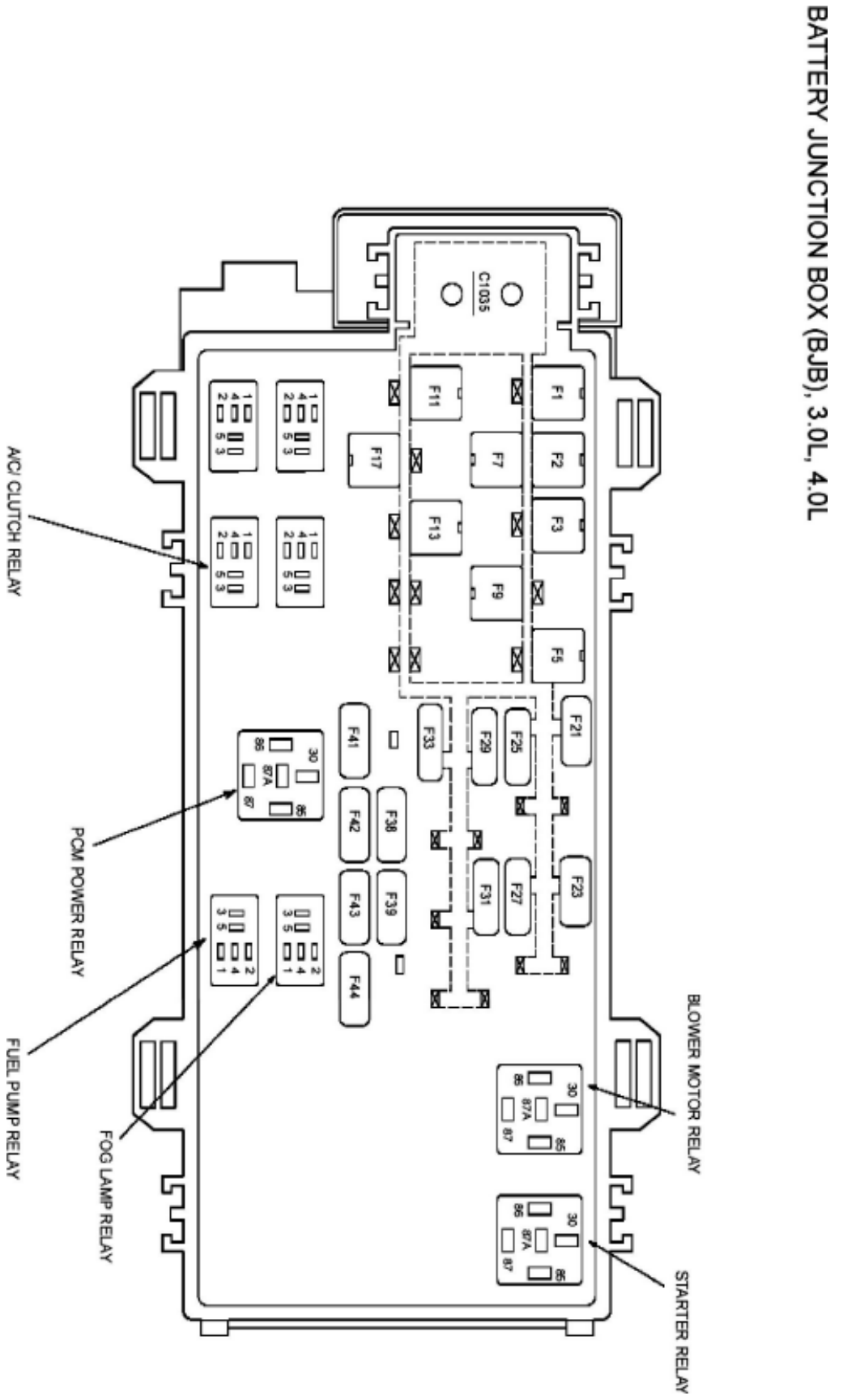
BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L
C1035
F1
F2
F3
F5
F7
F9
F11
F13
F17
F21
F23
F25
F27
F29
F31
F33
F38
F39
F41
F42
F43
F44
A/C CLUTCH RELAY
PCM POWER RELAY
FUEL PUMP RELAY
FOG LAMP RELAY
BLOWER MOTOR RELAY
STARTER RELAY

Introduction

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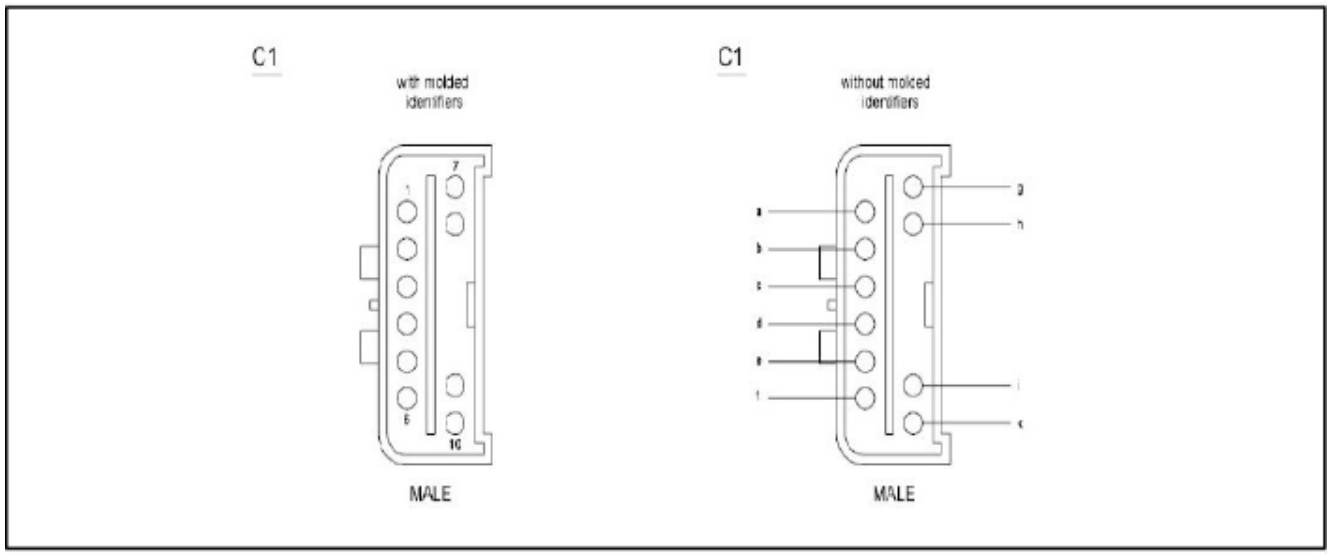

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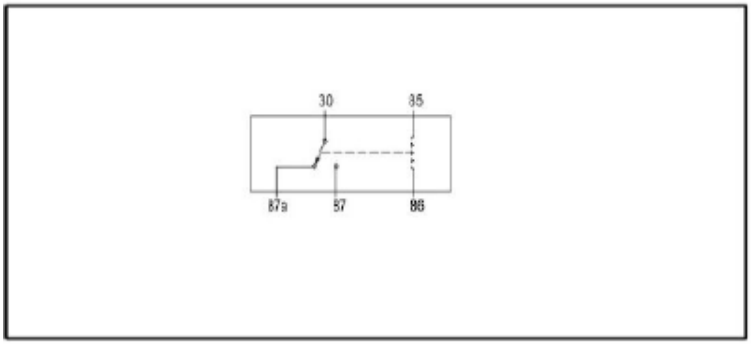
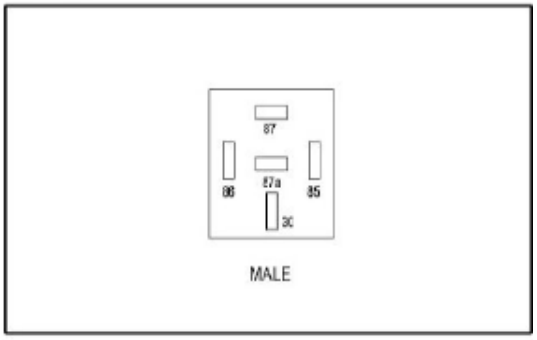
Parking Lamp Relay: Testing and Inspection Mini ISO Relay

Relay □ Mini ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	45 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
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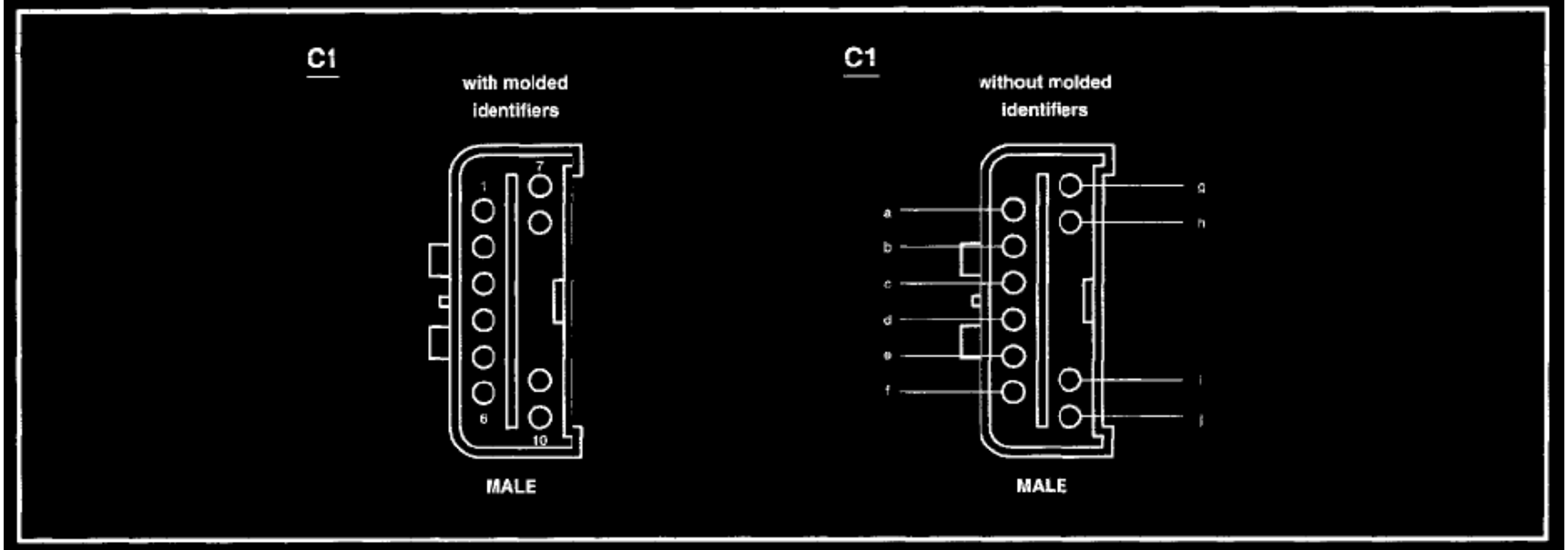

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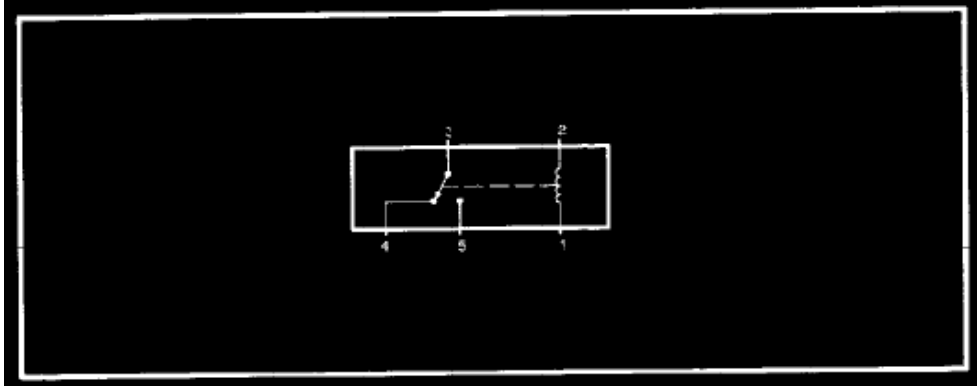

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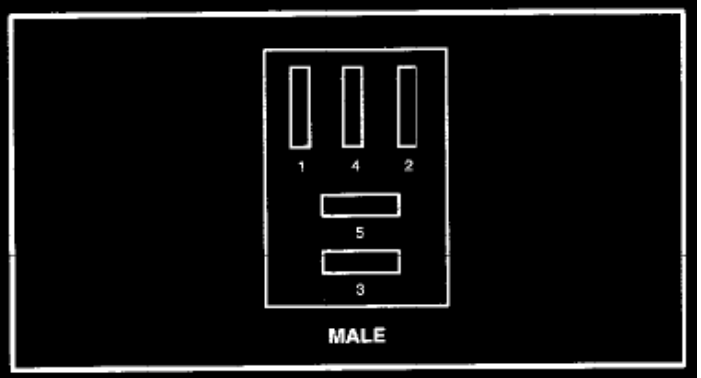

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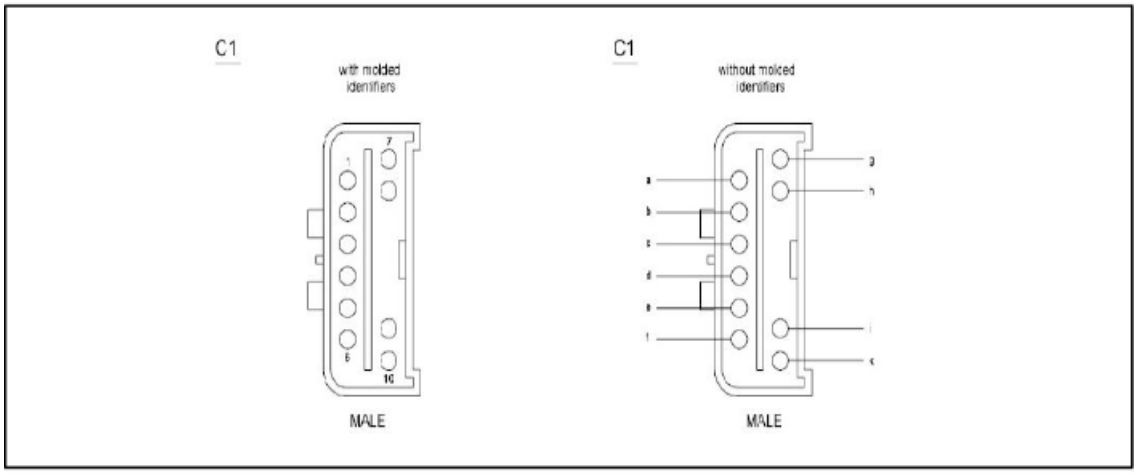

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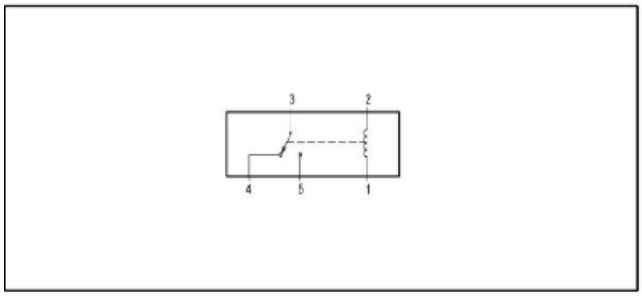
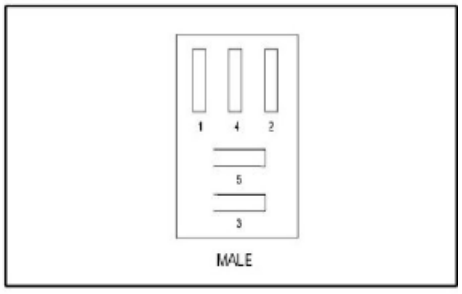


Terminals



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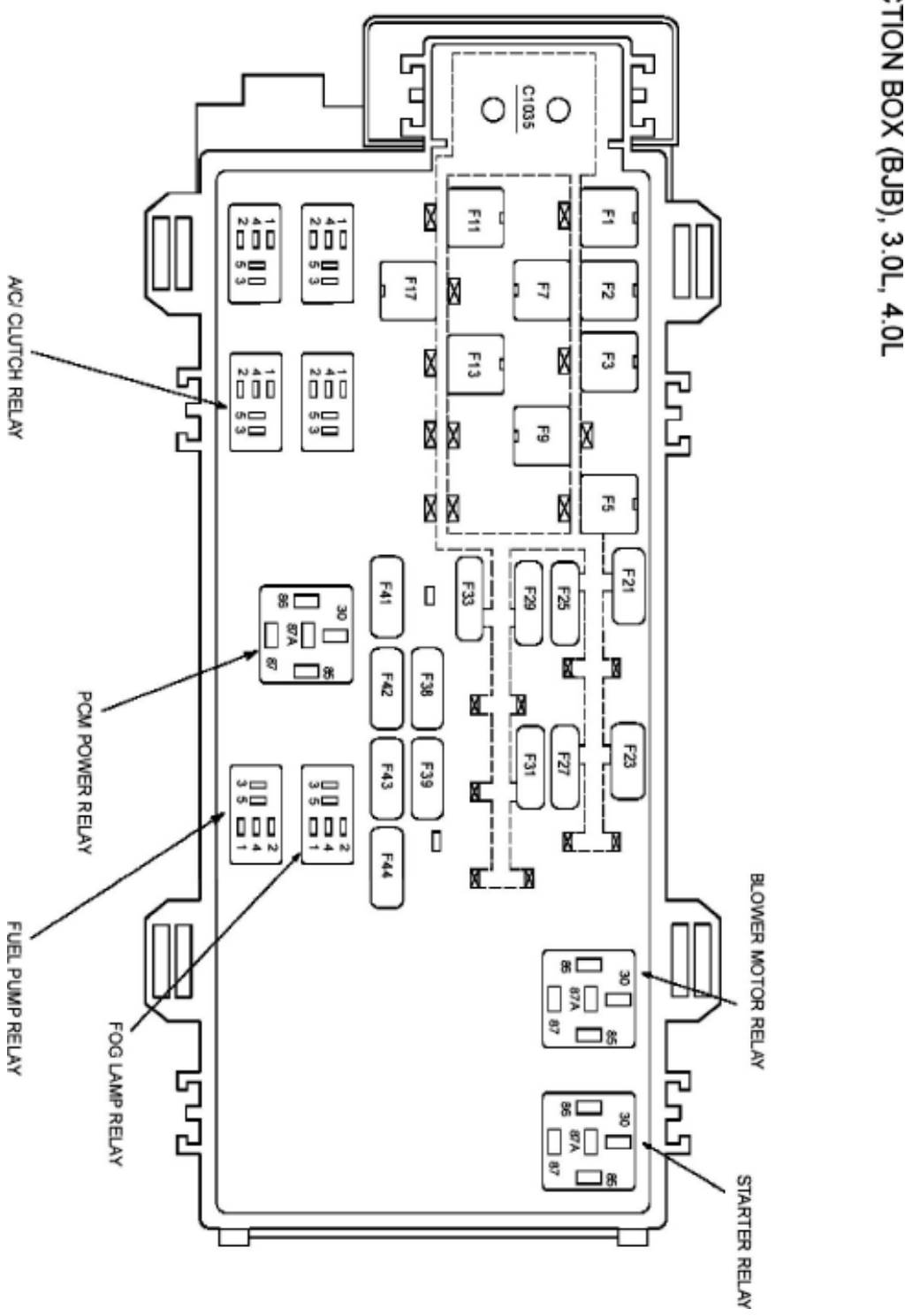
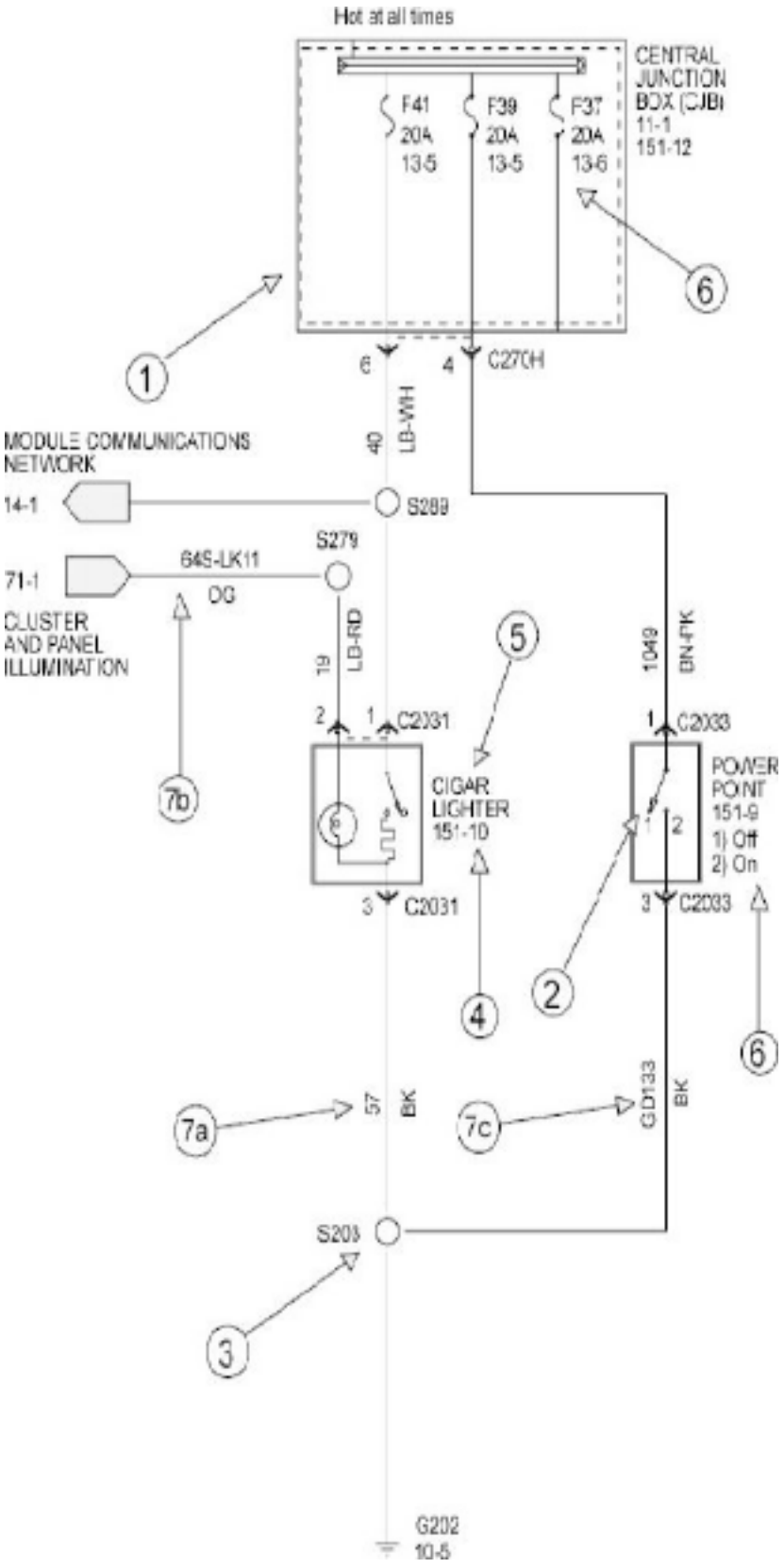
BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L



Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Relays and Modules > Relays and Modules - Lighting and Horns > Trailer Lighting Relay > Component Information > Diagrams > Diagram Information and Instructions



Trailer Lighting Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

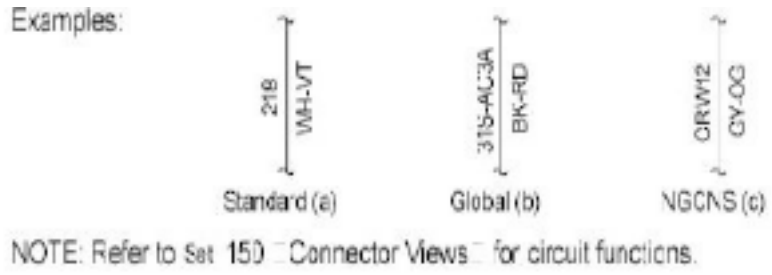
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

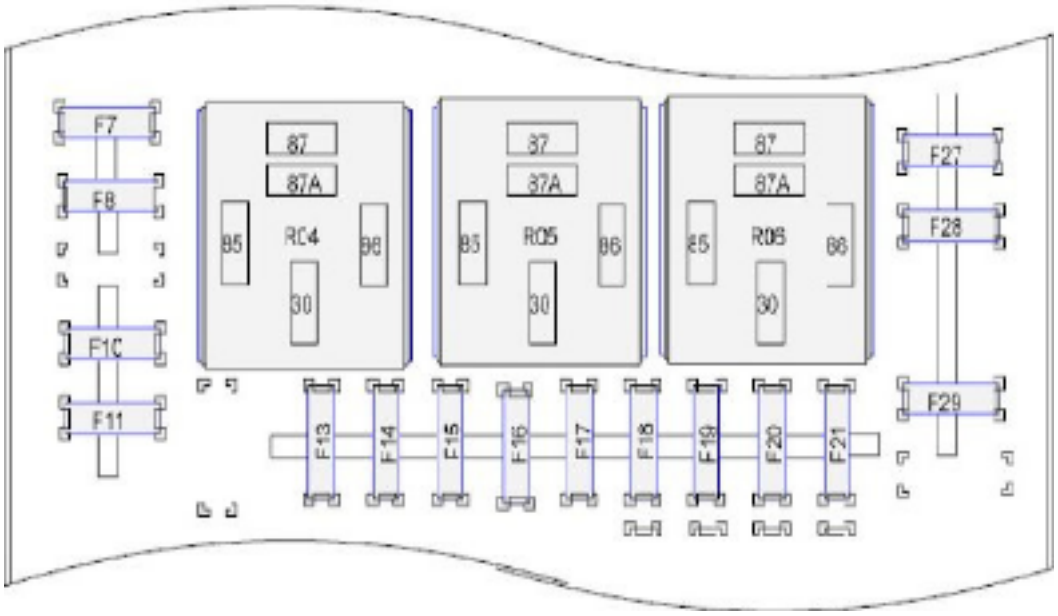
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

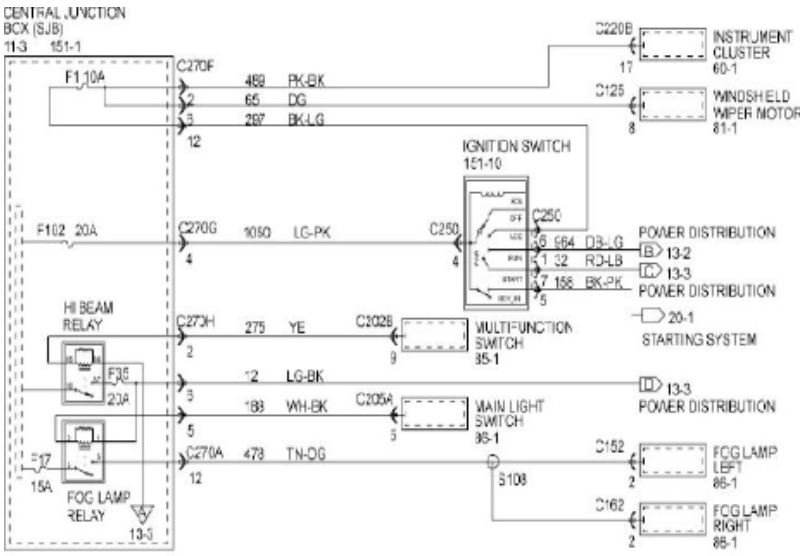
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

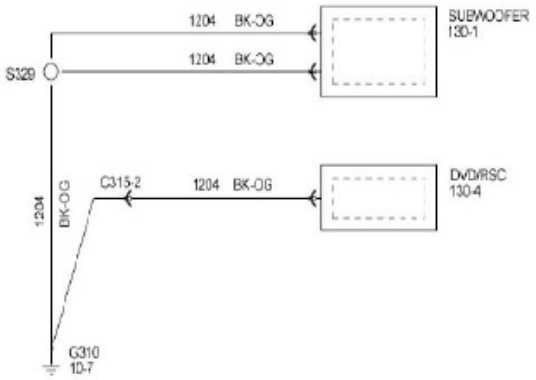
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

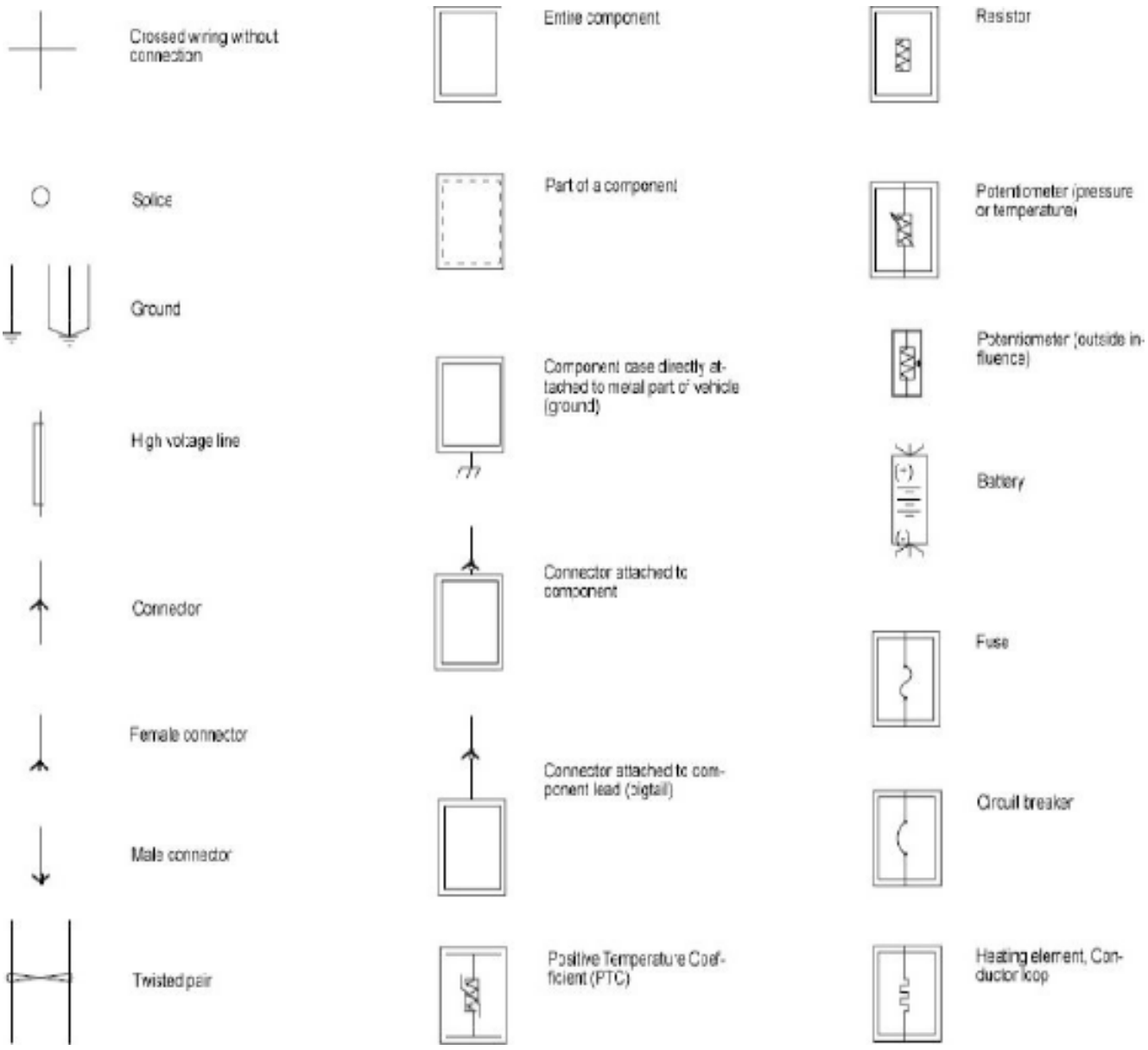
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

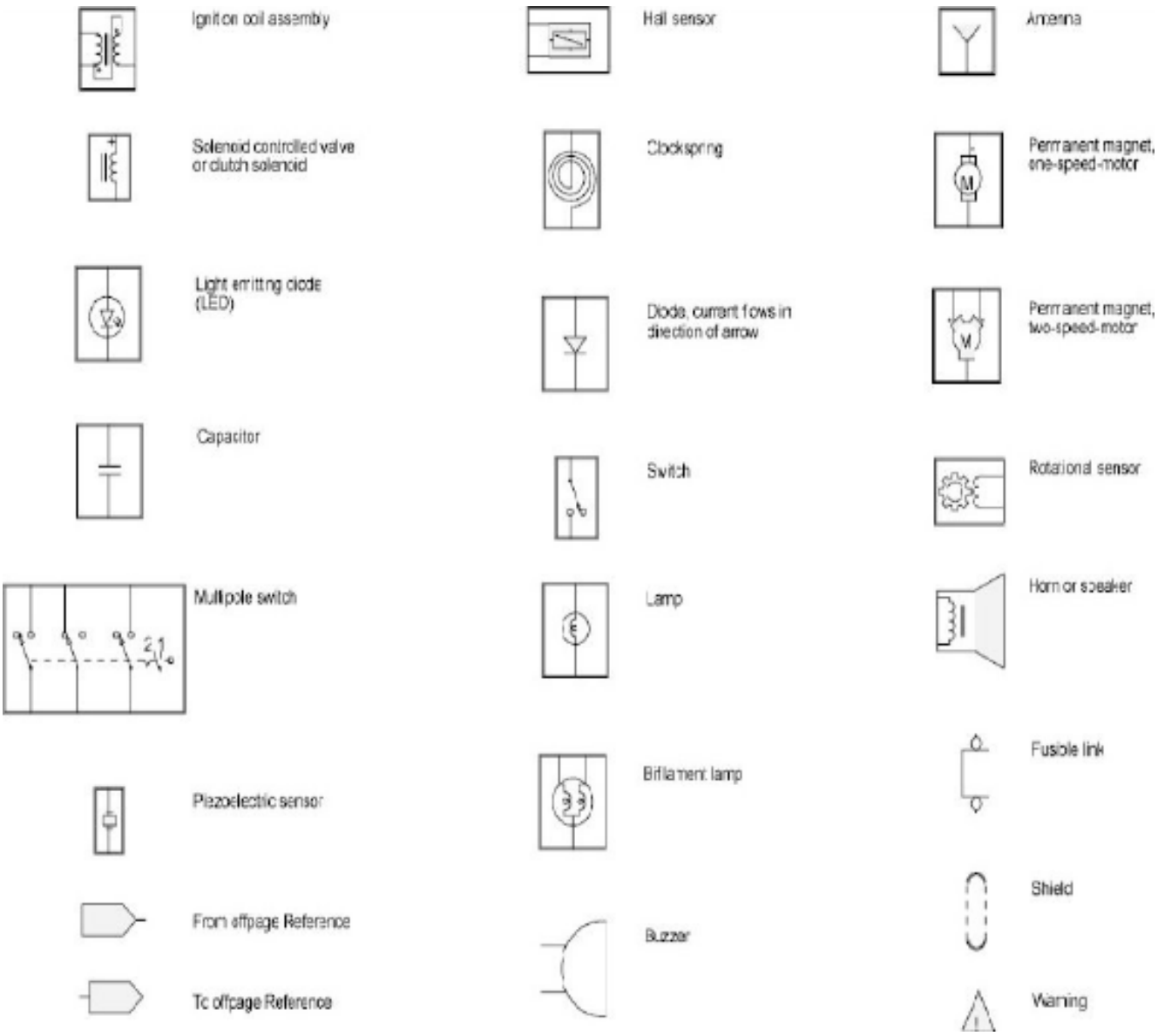
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

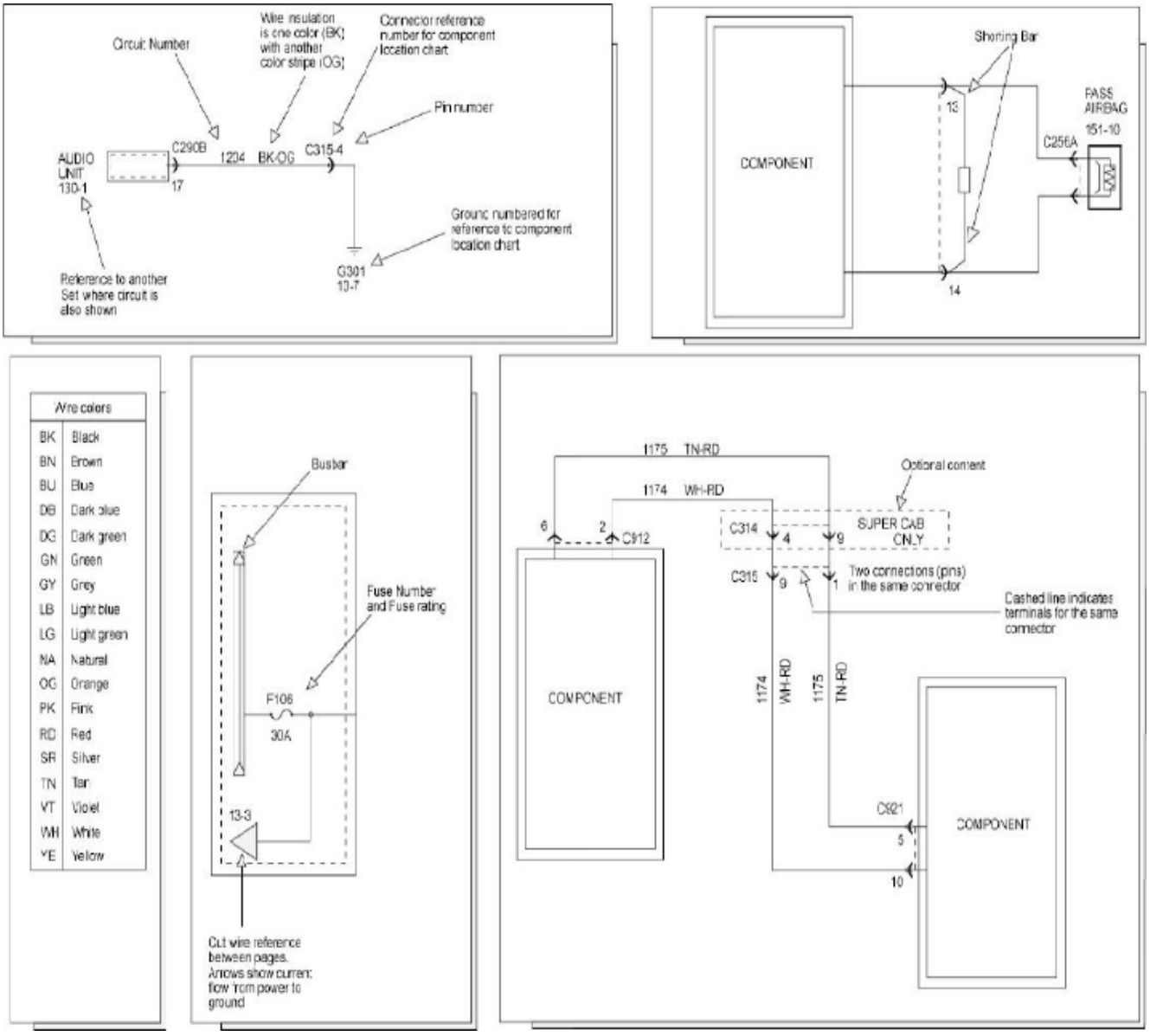
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

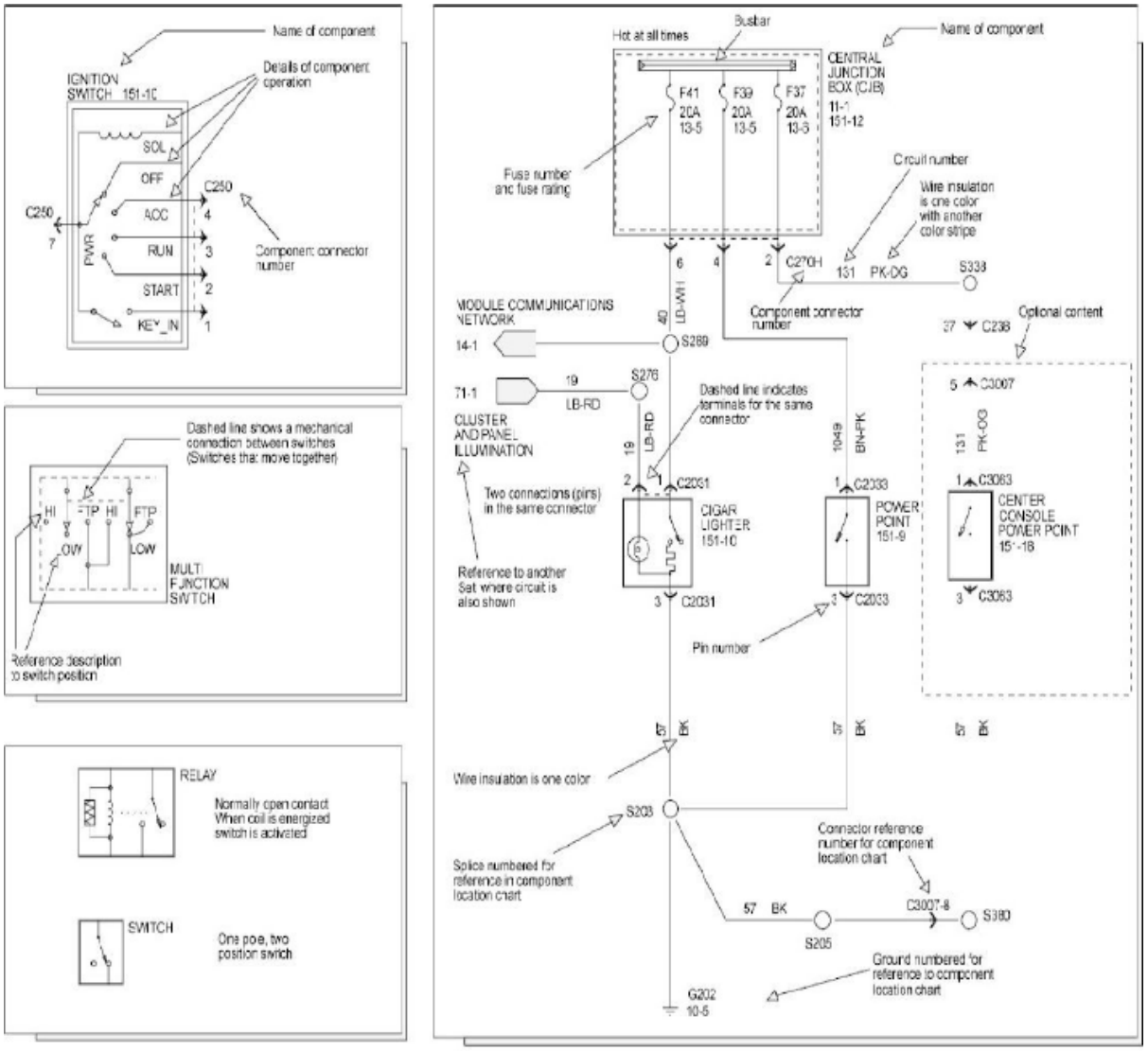
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

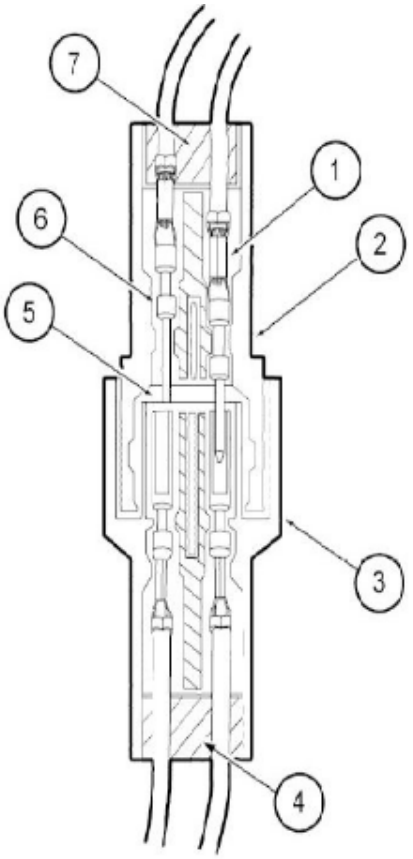


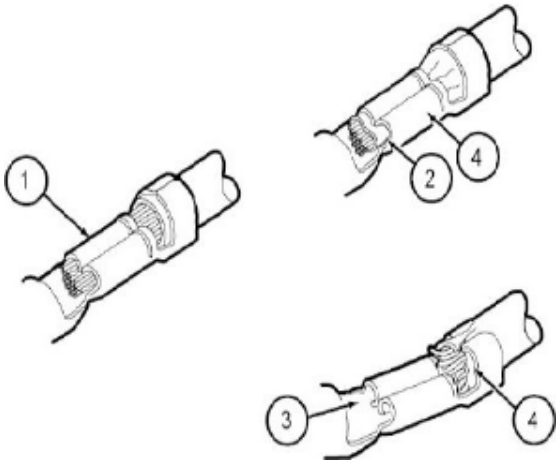
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Trailer Lighting Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

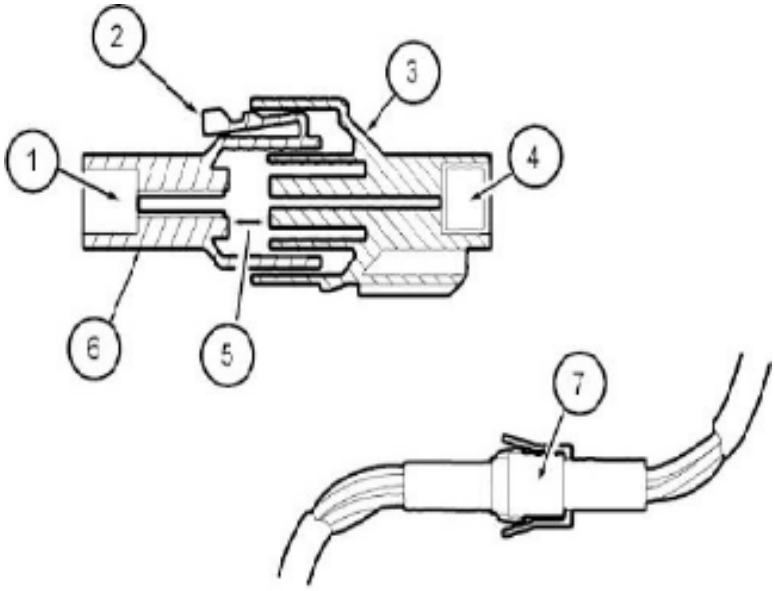
5 = Intermittent contact

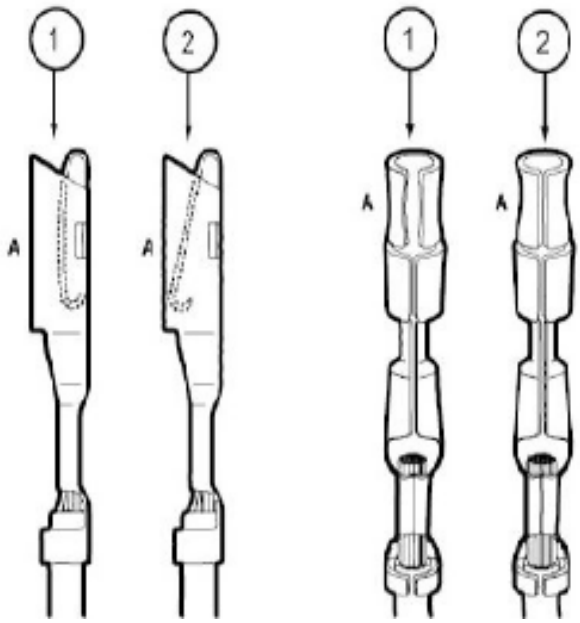
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

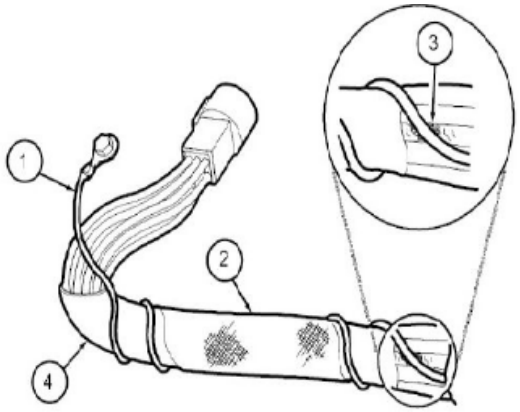
Deformed (enlarged) female terminals

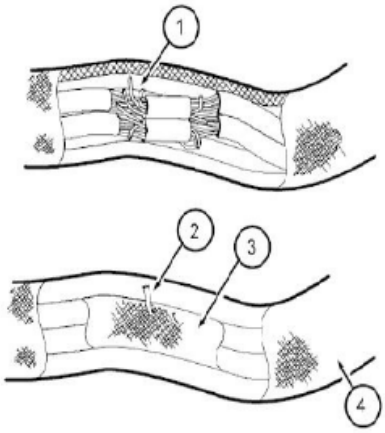
1 = Enlarged

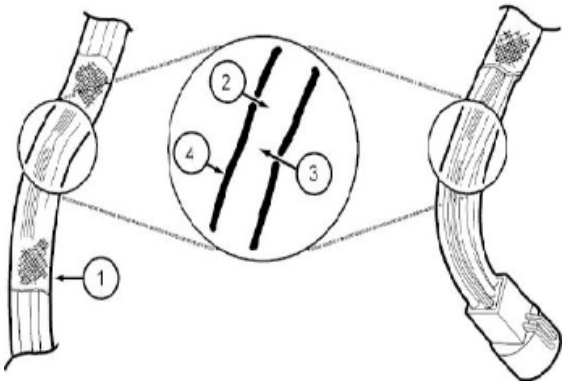
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

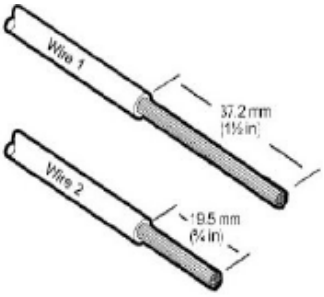
Splice covered 2

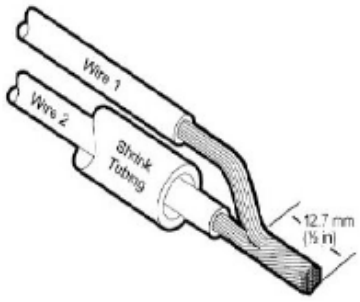
= Wire strand

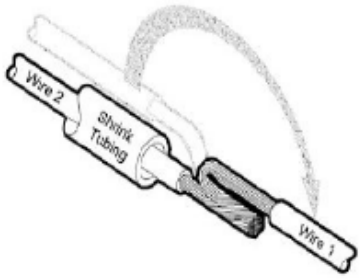
3 = Splice tape

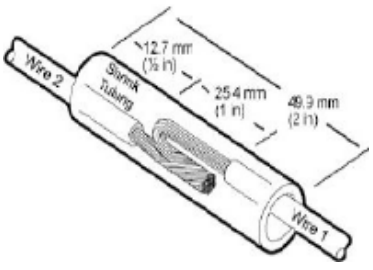
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

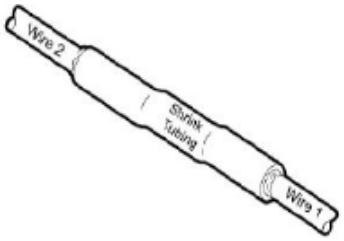
NOTE: -

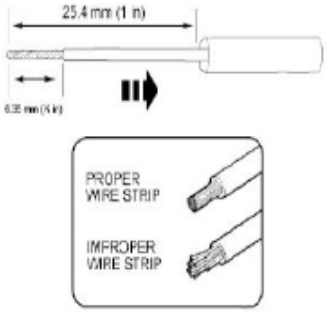
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

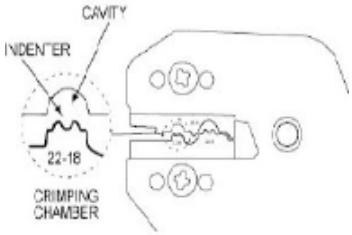
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

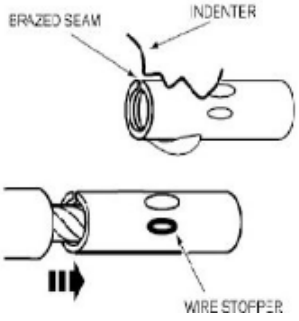
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
6.35 mm (¼ in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

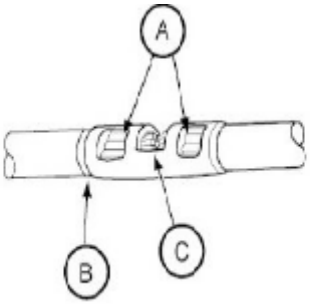
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

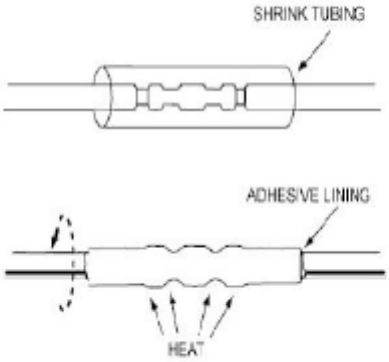
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4 strip, cut 9 strands	* 1/4 strip, cut 2 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip, fold 3x dia.
	16-14	* 1/4 strip, cut 7 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip fold 2x dia	1 strip, fold 3x dia.	1 1/4 strip, fold 4x dia.	Not Recommended
	12-10	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip fold 3x dia.	1 1/4 strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Pigtail only

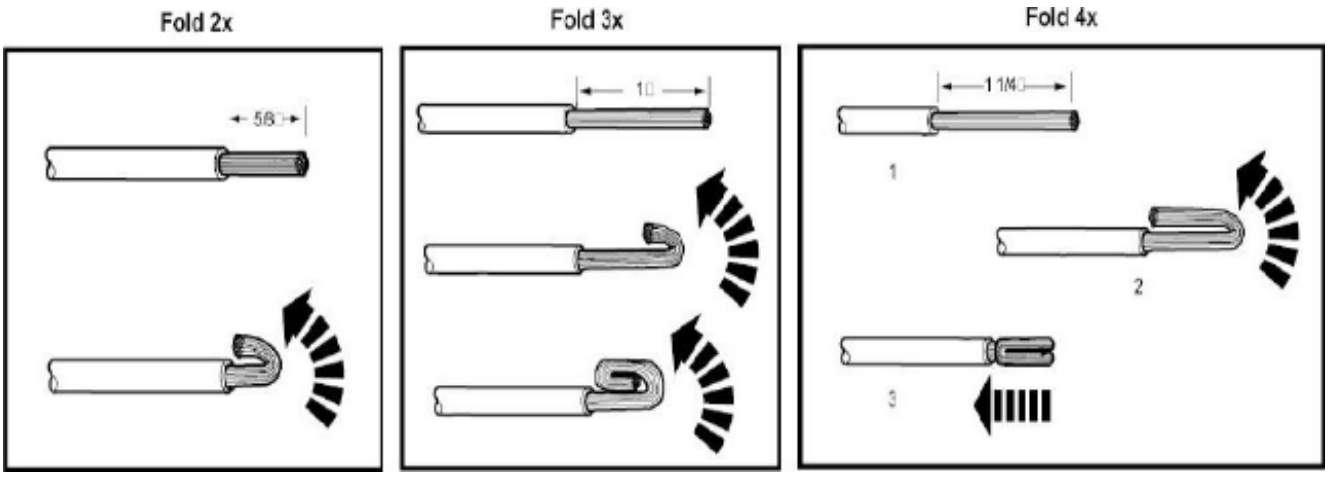
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



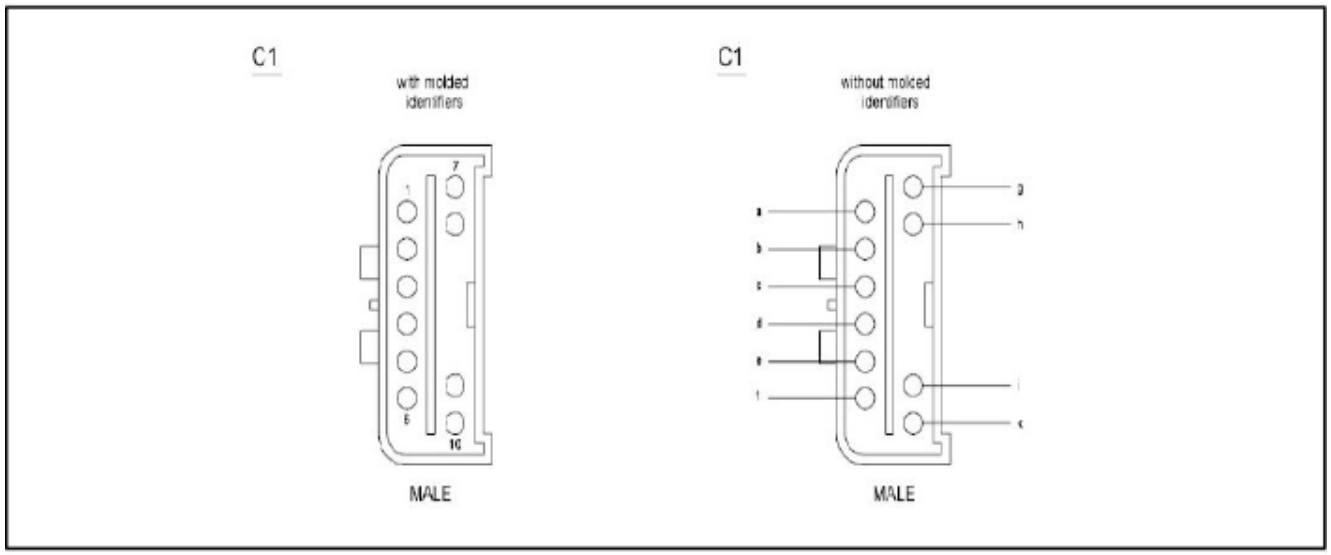
The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



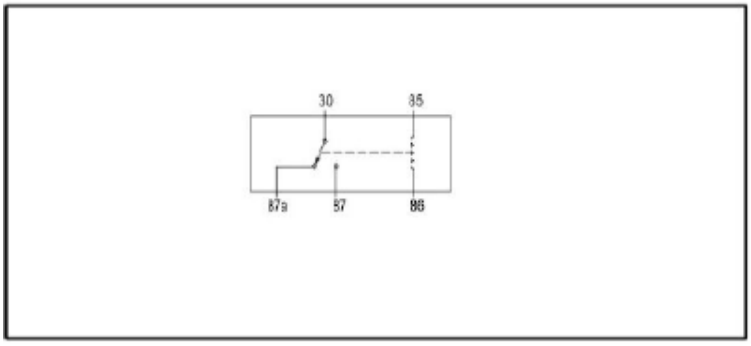
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

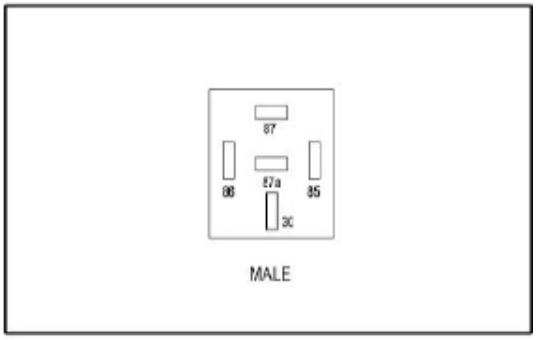
Trailer Lighting Relay: Testing and Inspection Mini ISO Relay

Relay □ Mini ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

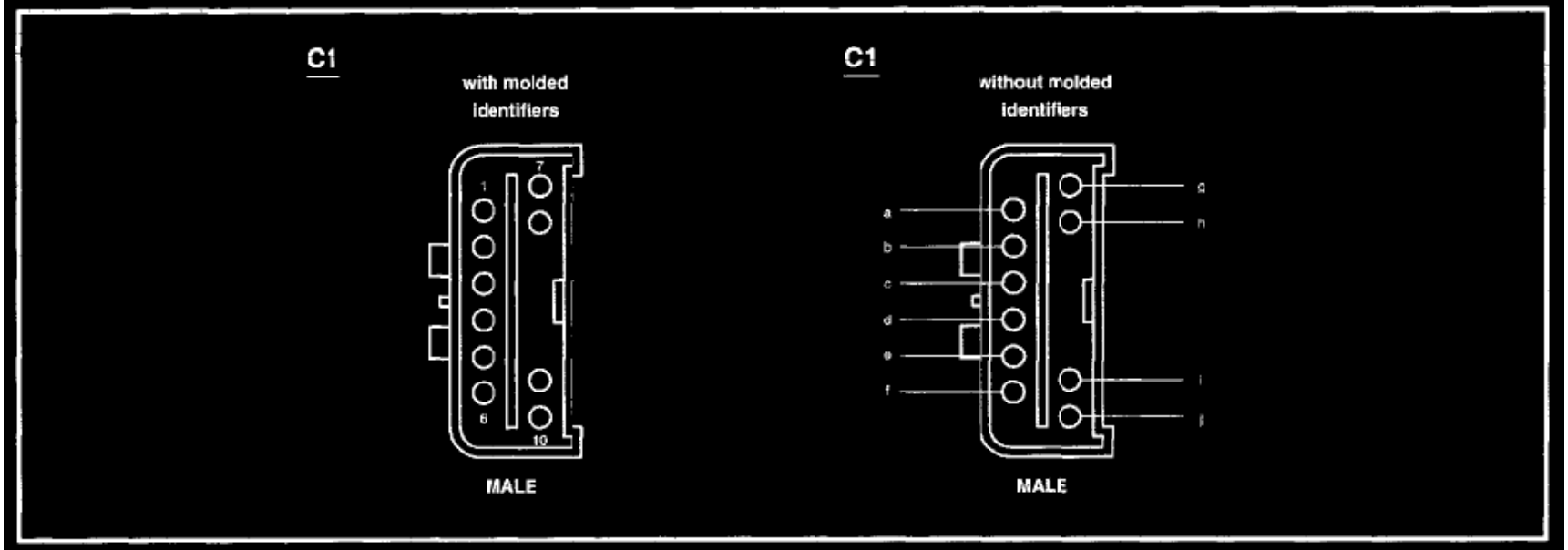
Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step–by–step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



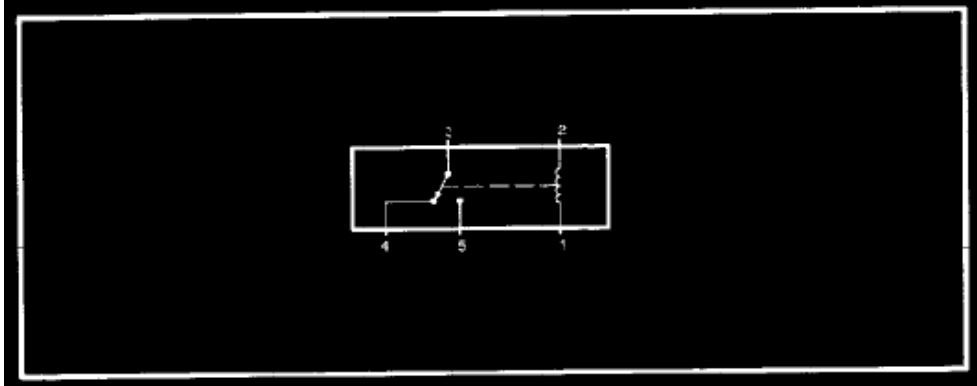
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

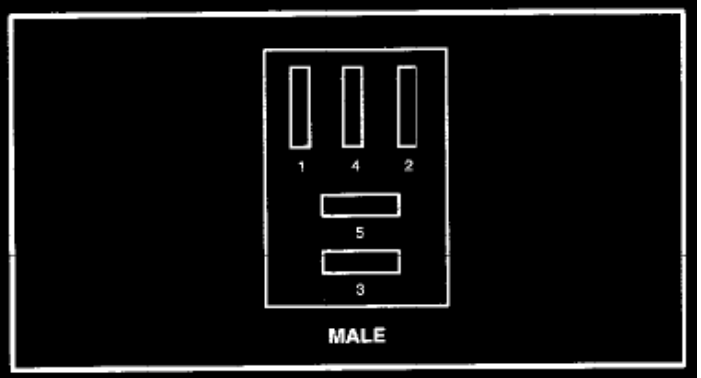
Trailer Lighting Relay: Testing and Inspection Micro ISO Relay

Relay – Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63–102Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil – Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

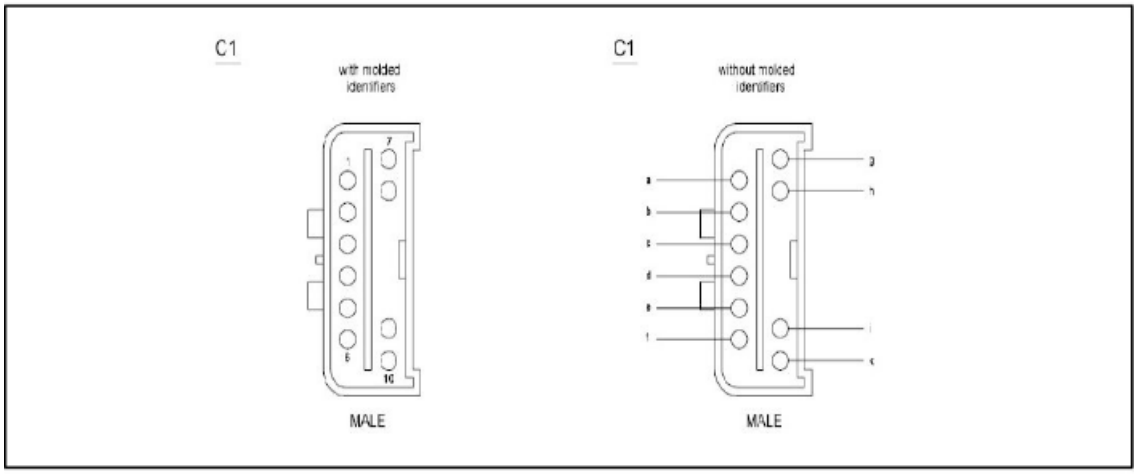
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step□by□step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals

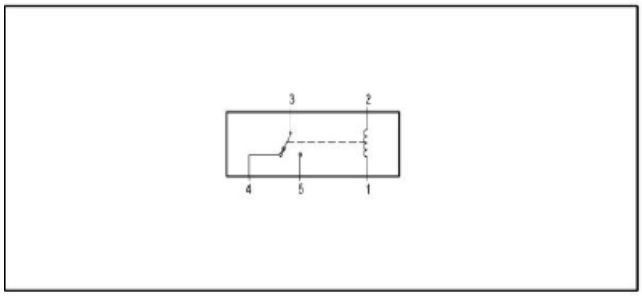


The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column □Circuit to test□. If you wish to test the complete component, perform all tests.

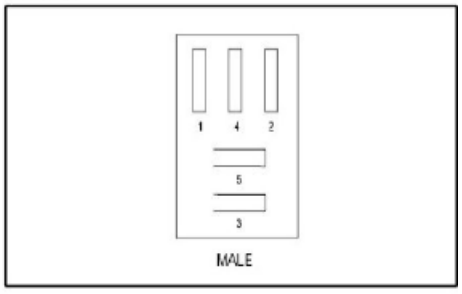
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Relay □ Micro ISO

Schematic



Terminals



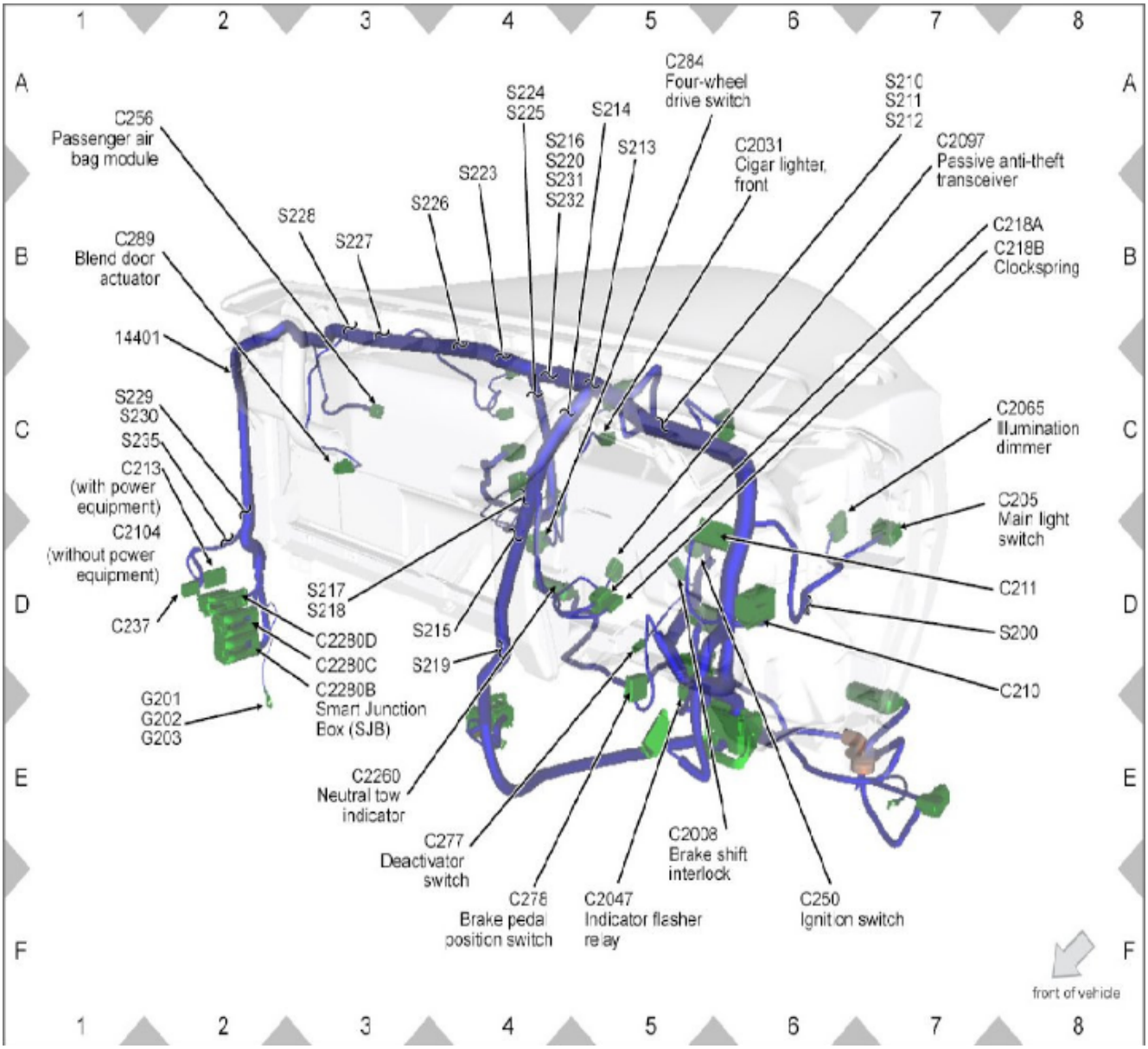
Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63□102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil □ Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

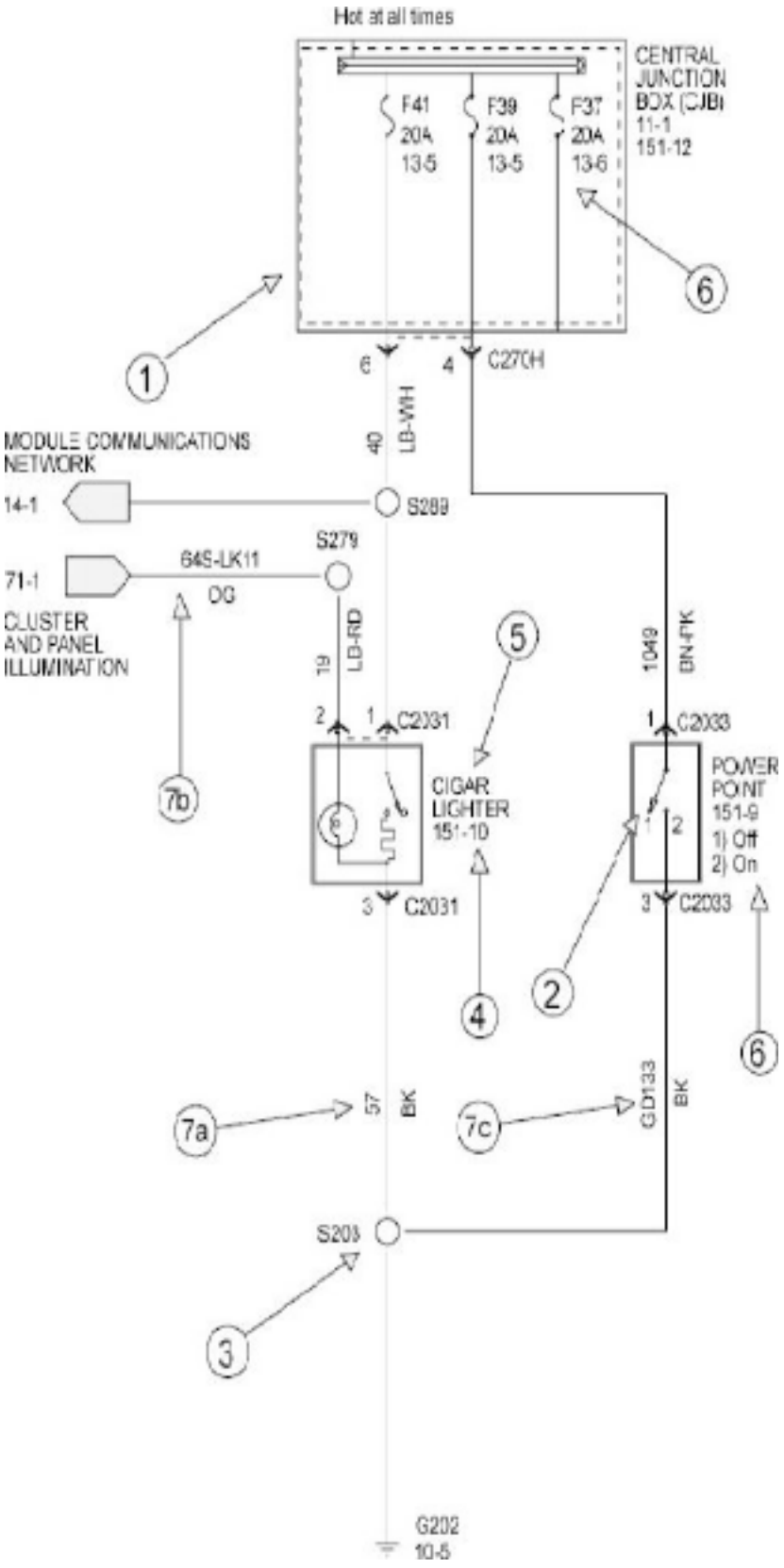
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Relays and Modules > Relays and Modules - Lighting and Horns > Turn Signal Relay > Component Information > Locations



View 151-11

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Relays and Modules > Relays and Modules - Lighting and Horns > Turn Signal Relay > Component Information > Diagrams > Diagram Information and Instructions



Turn Signal Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

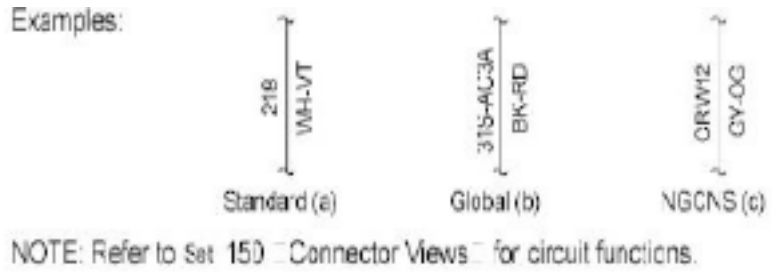
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

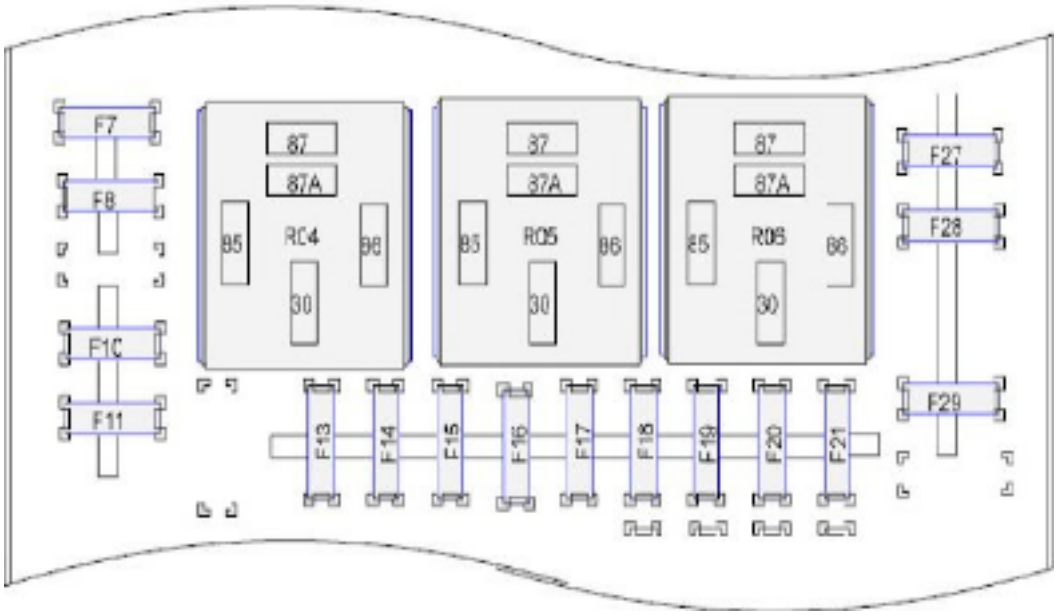
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

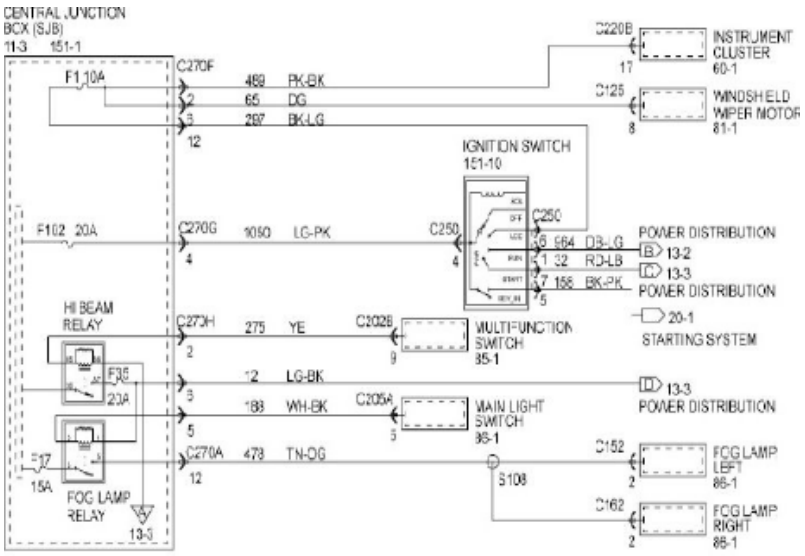
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

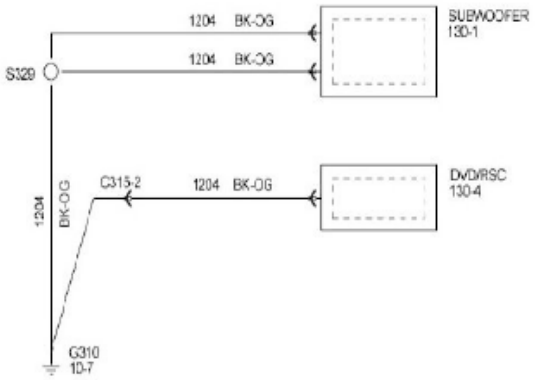
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

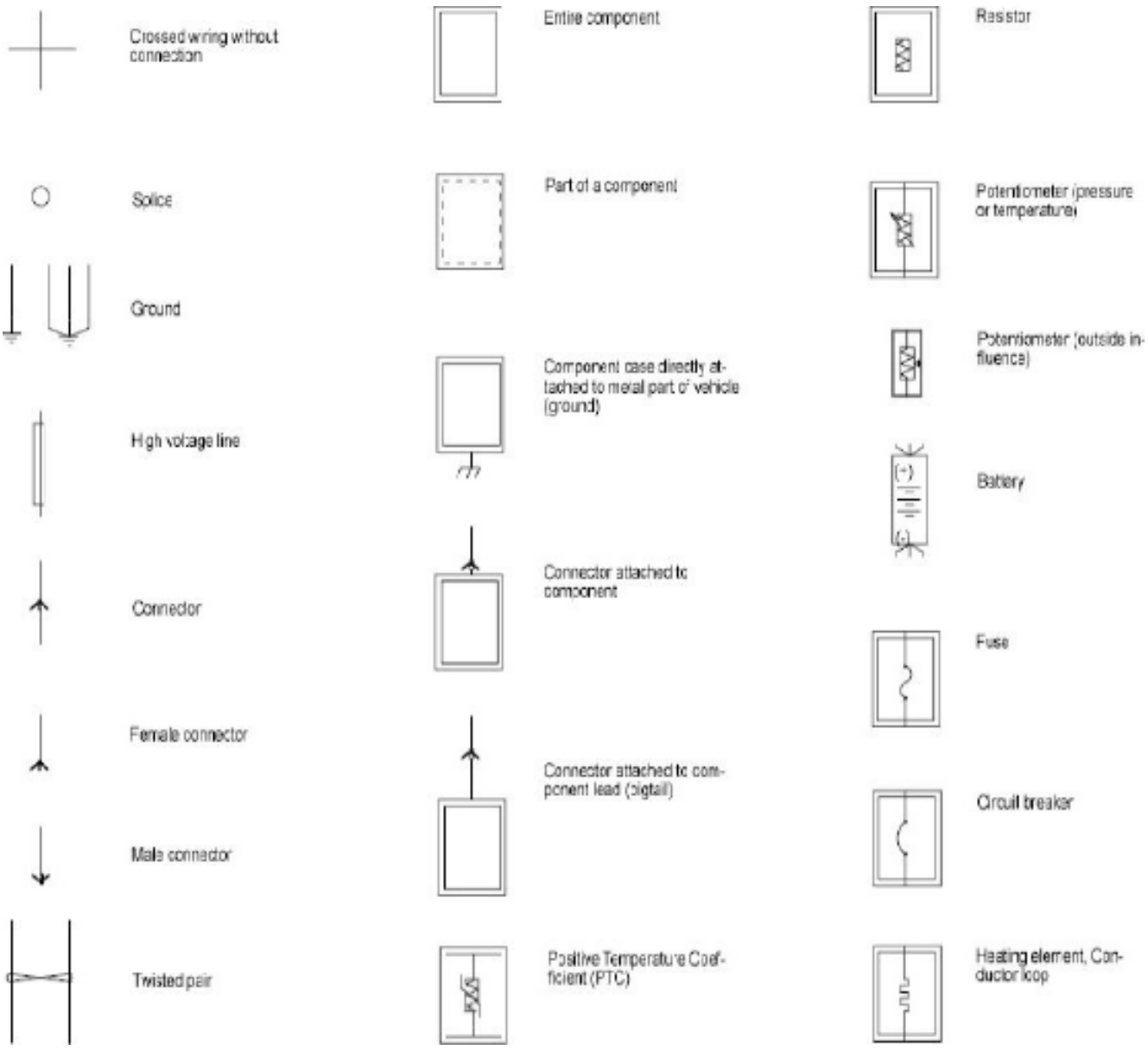
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

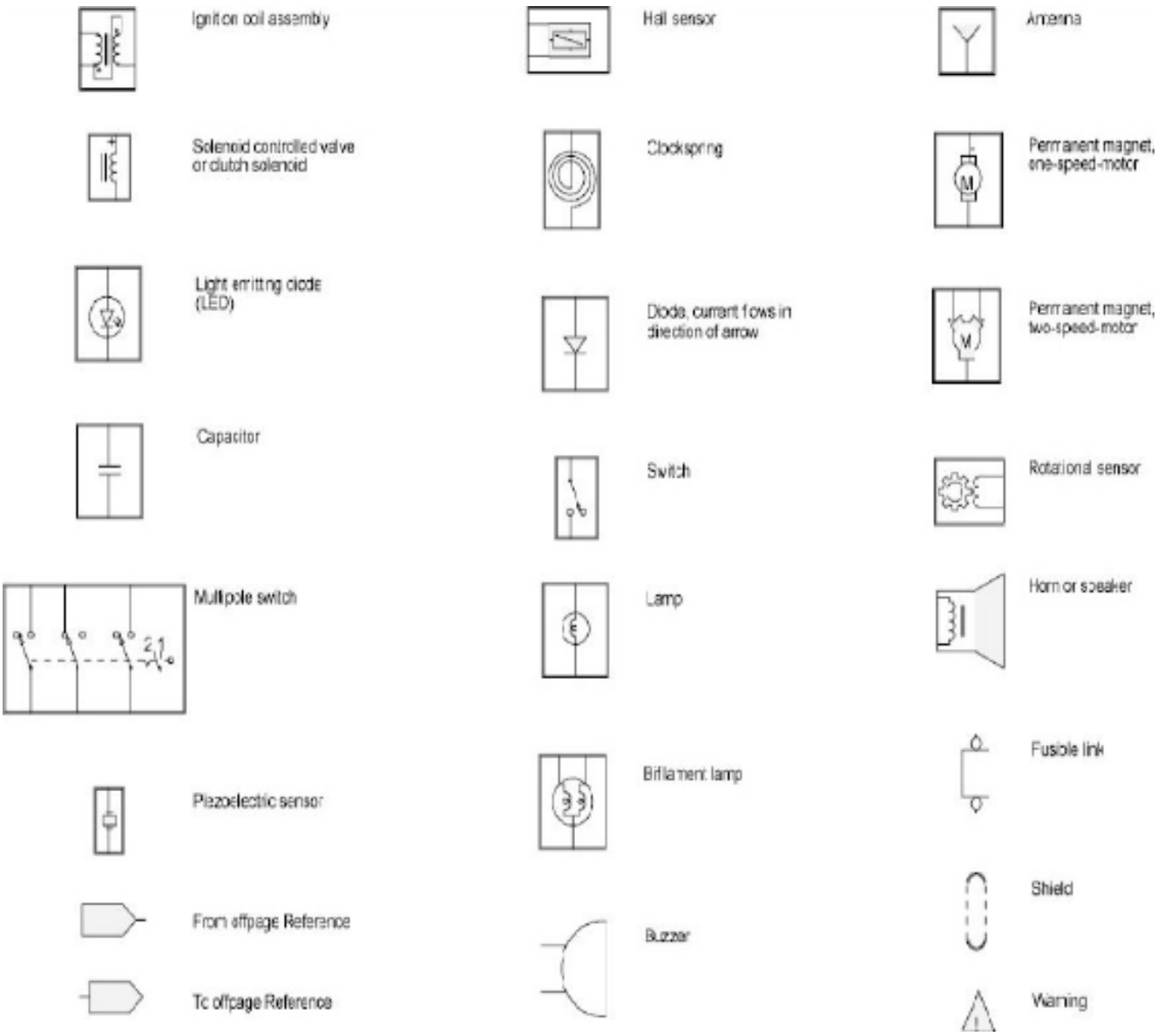
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

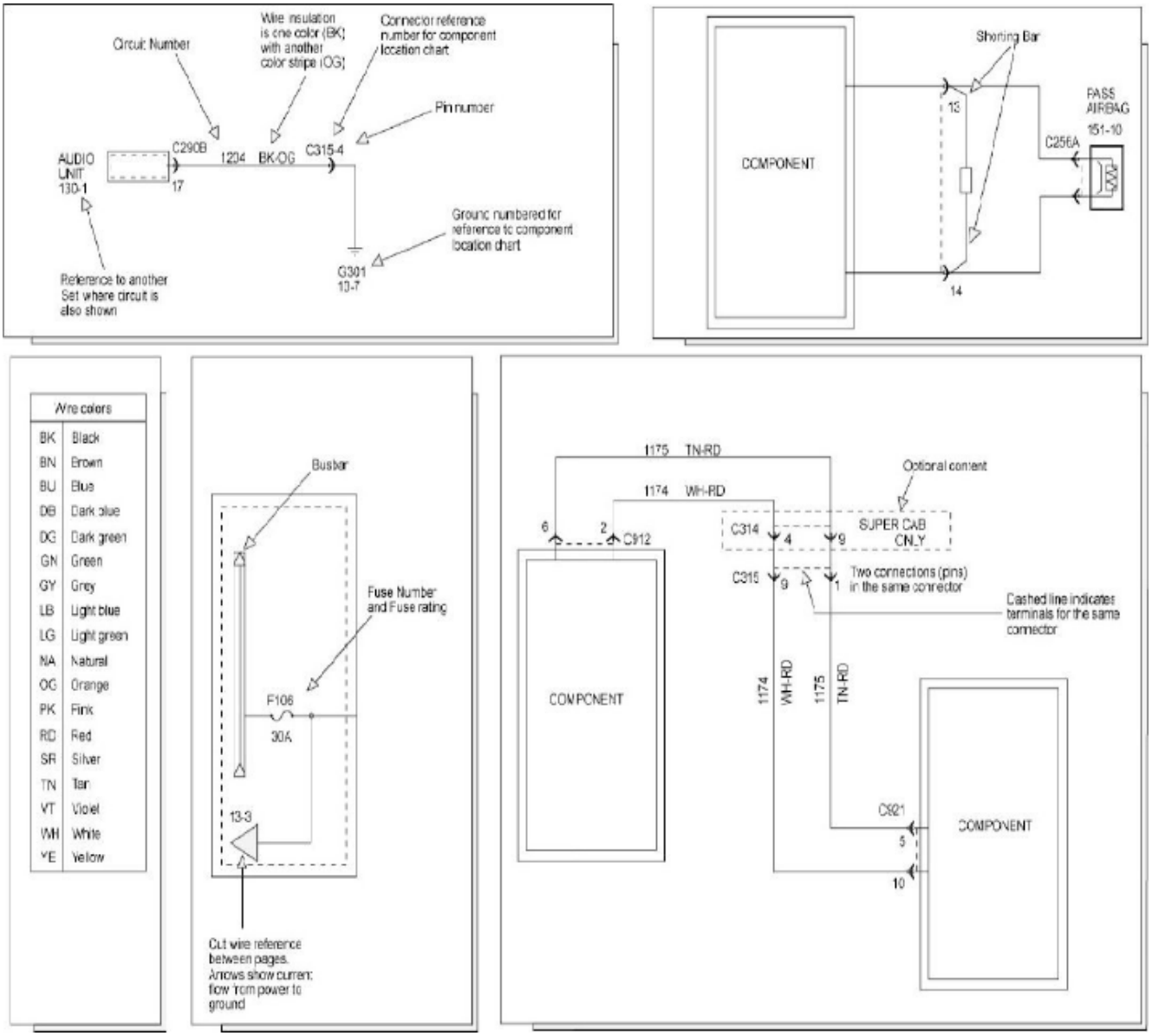
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

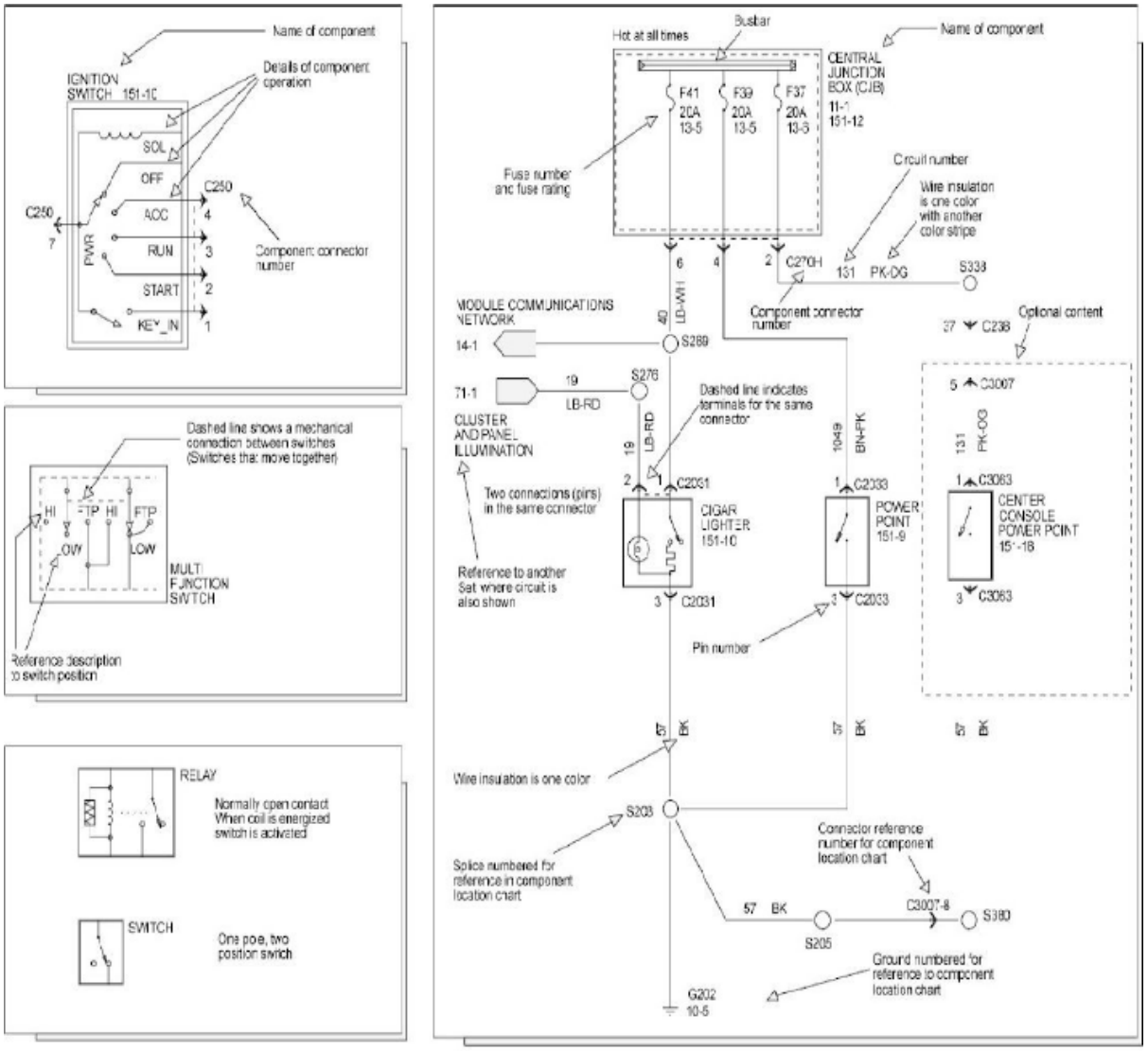
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

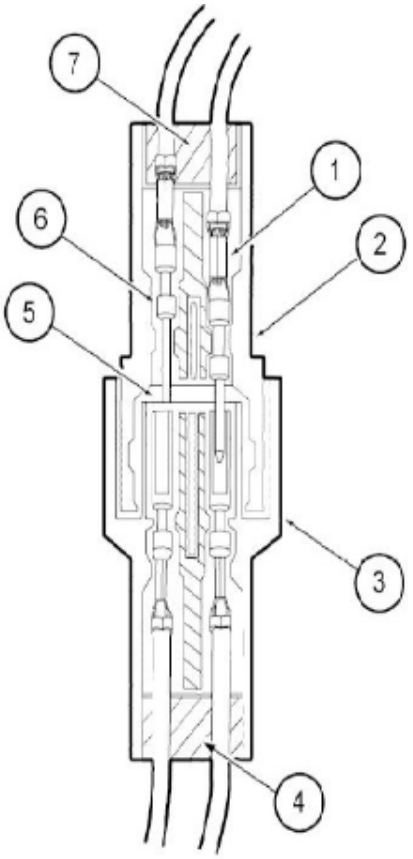


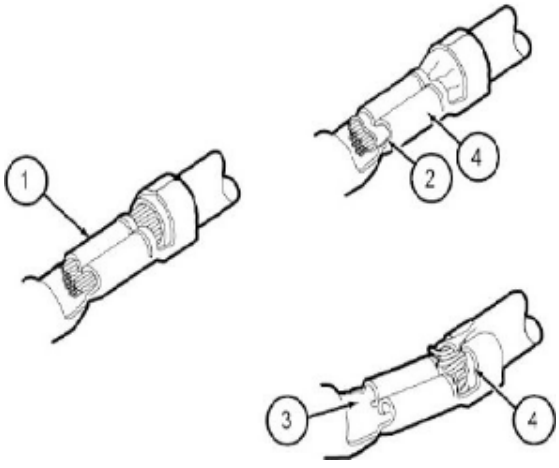
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Turn Signal Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

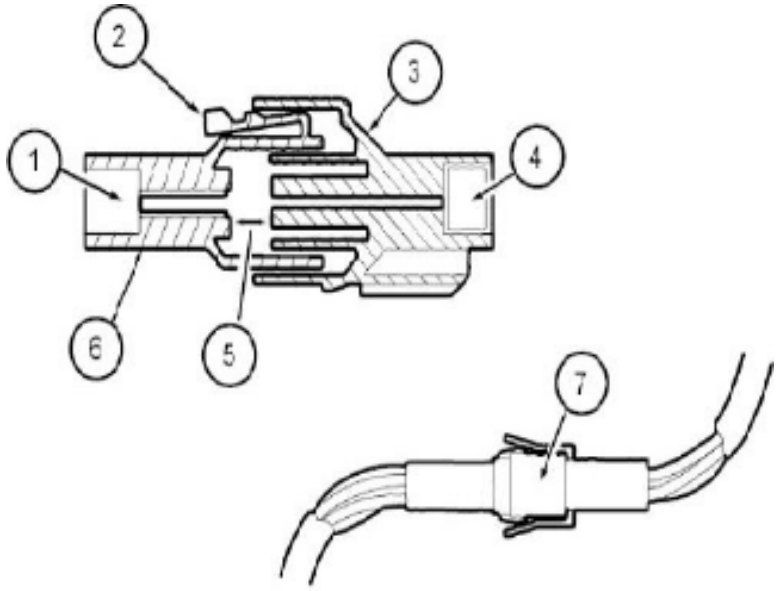
5 = Intermittent contact

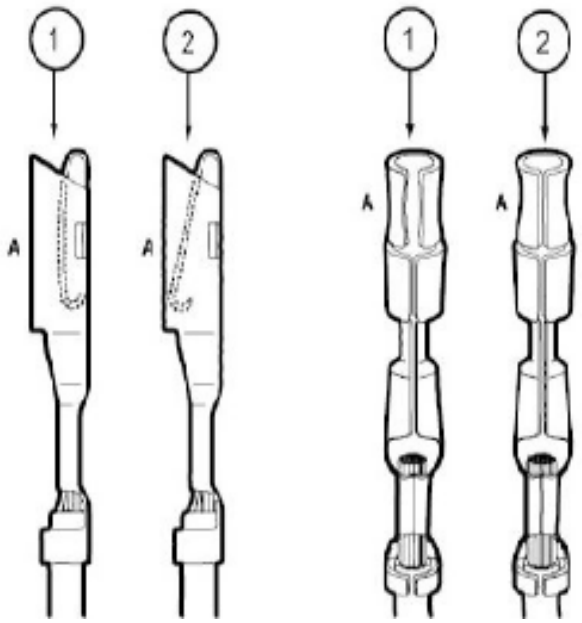
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

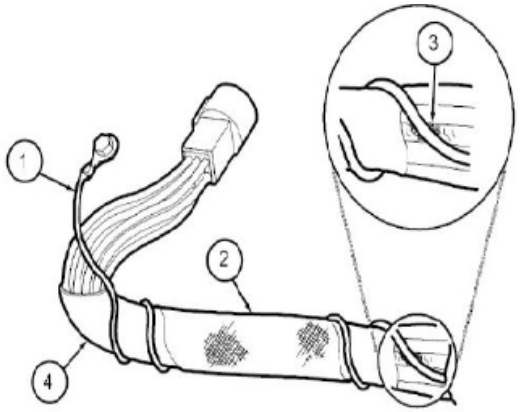
Deformed (enlarged) female terminals

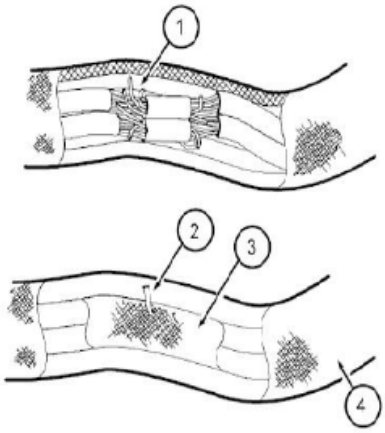
1 = Enlarged

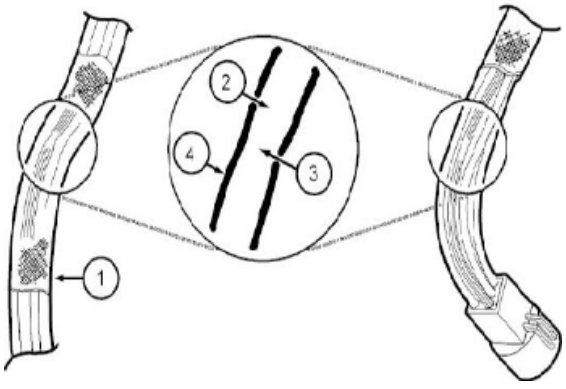
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

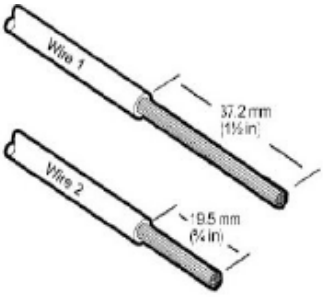
Splice covered 2

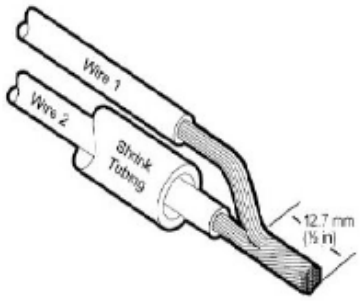
= Wire strand

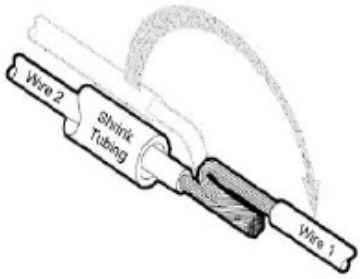
3 = Splice tape

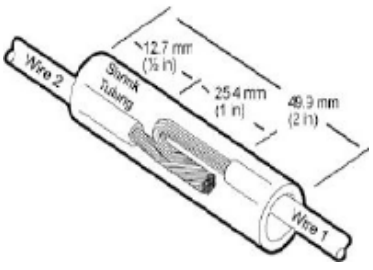
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

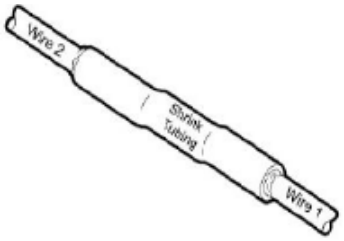
NOTE: -

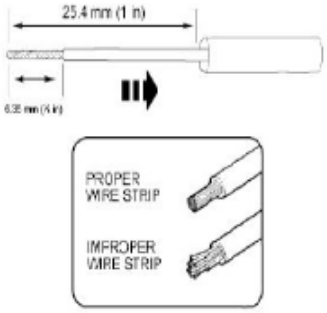
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

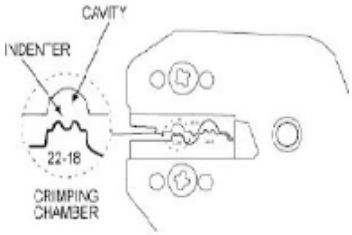
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

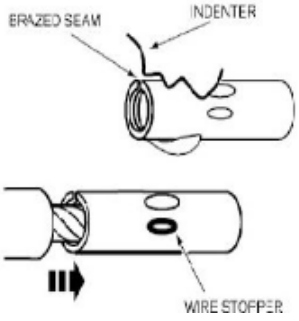
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
6.35 mm (¼ in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

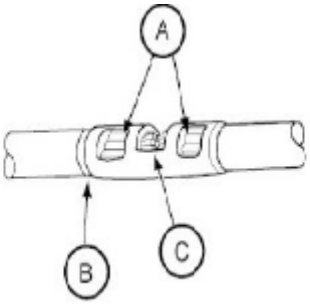
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

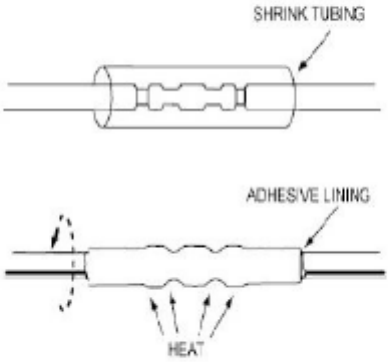
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4 strip, cut 9 strands	* 1/4 strip, cut 2 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip, fold 3x dia.
	16-14	* 1/4 strip, cut 7 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip fold 2x dia	1 strip, fold 3x dia.	1 1/4 strip, fold 4x dia.	Not Recommended
	12-10	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip fold 3x dia.	1 1/4 strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Pigtail only

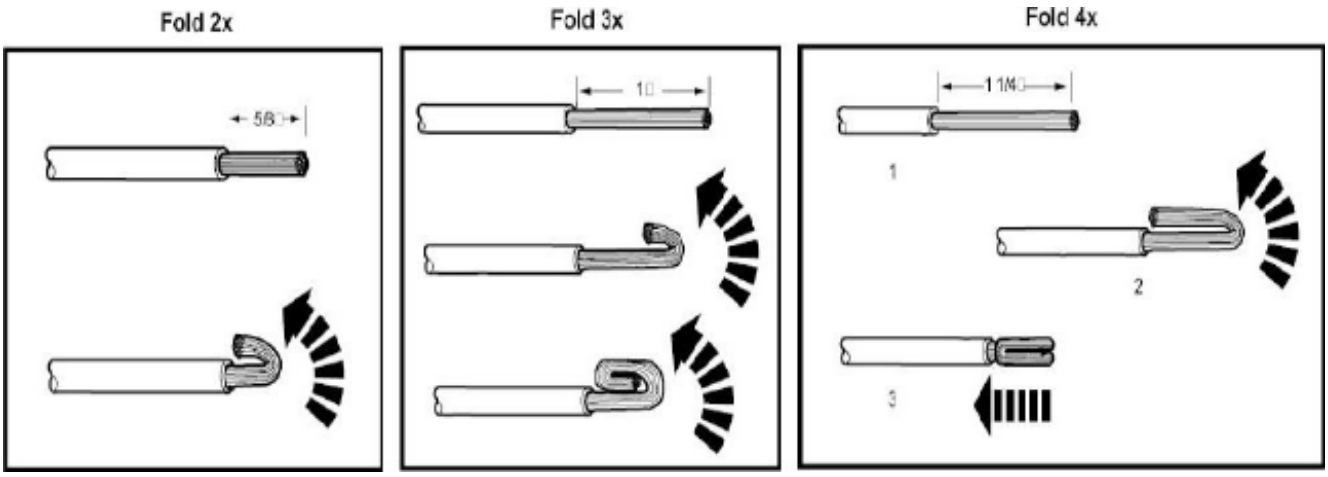
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

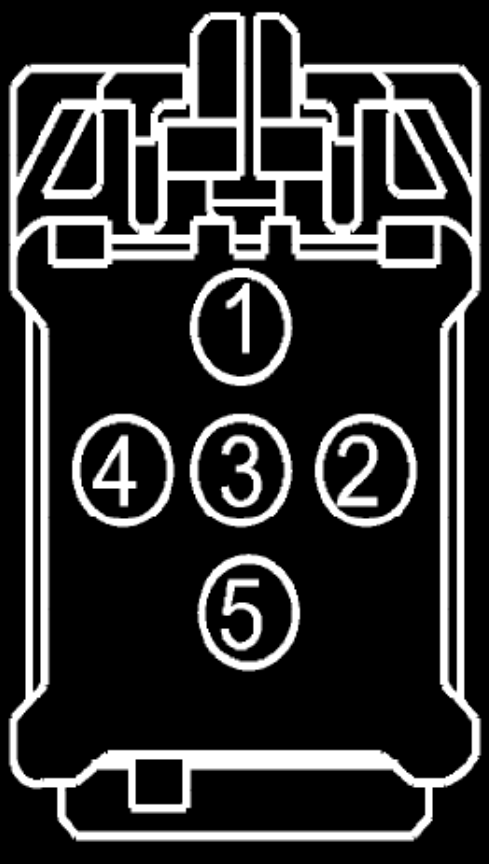
12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Connector: C2047

Description:	Harness:	Base Part #:
INDICATOR FLASHER RELAY	14401	13350



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CLS42 (VT-BN)	18	FLASHER - TURN SIGNAL/HAZARD	
2	GD161 (BK-YE)	18	GROUND - SEAT BRACKET REAR LEFT	
3	CLS32 (BN-YE)	18	SWITCH - HAZARD	
4	SBP17 (RD)	18	FUSE - 17 OR CIRCUIT BREAKER	
5	CBP20 (YE-VT)	18	FUSE - 20 OR CIRCUIT BREAKER	

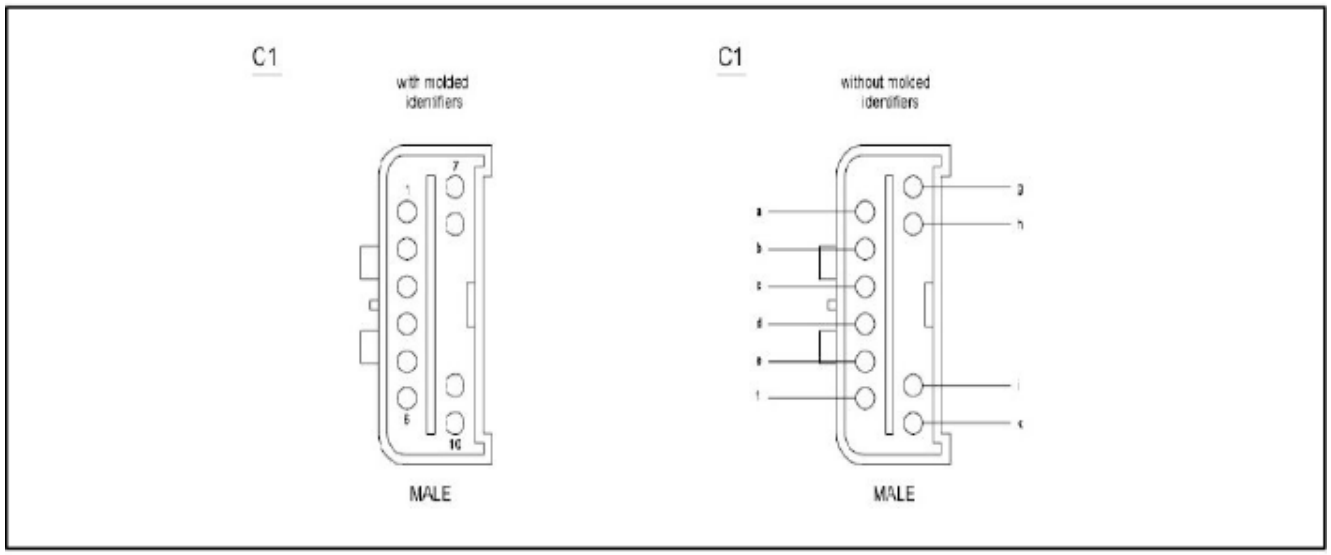
C2047

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



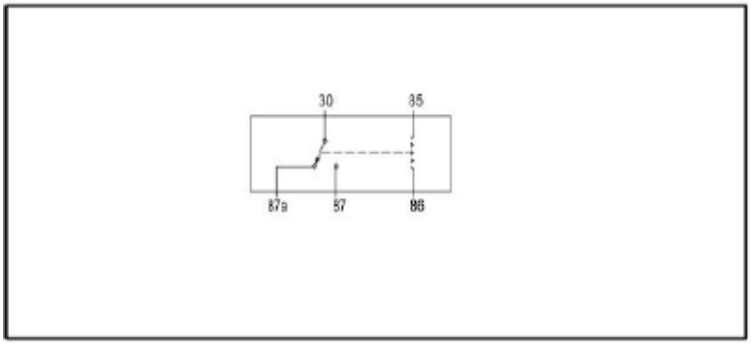
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

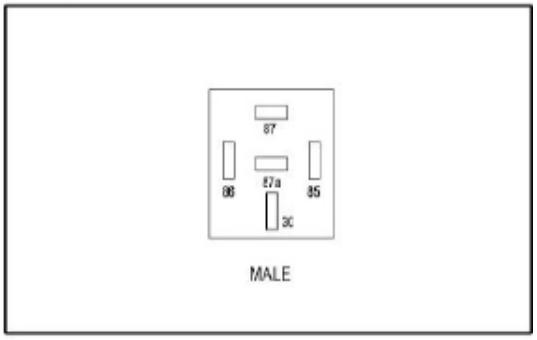
Turn Signal Relay: Testing and Inspection Mini ISO Relay

Relay □ Mini ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

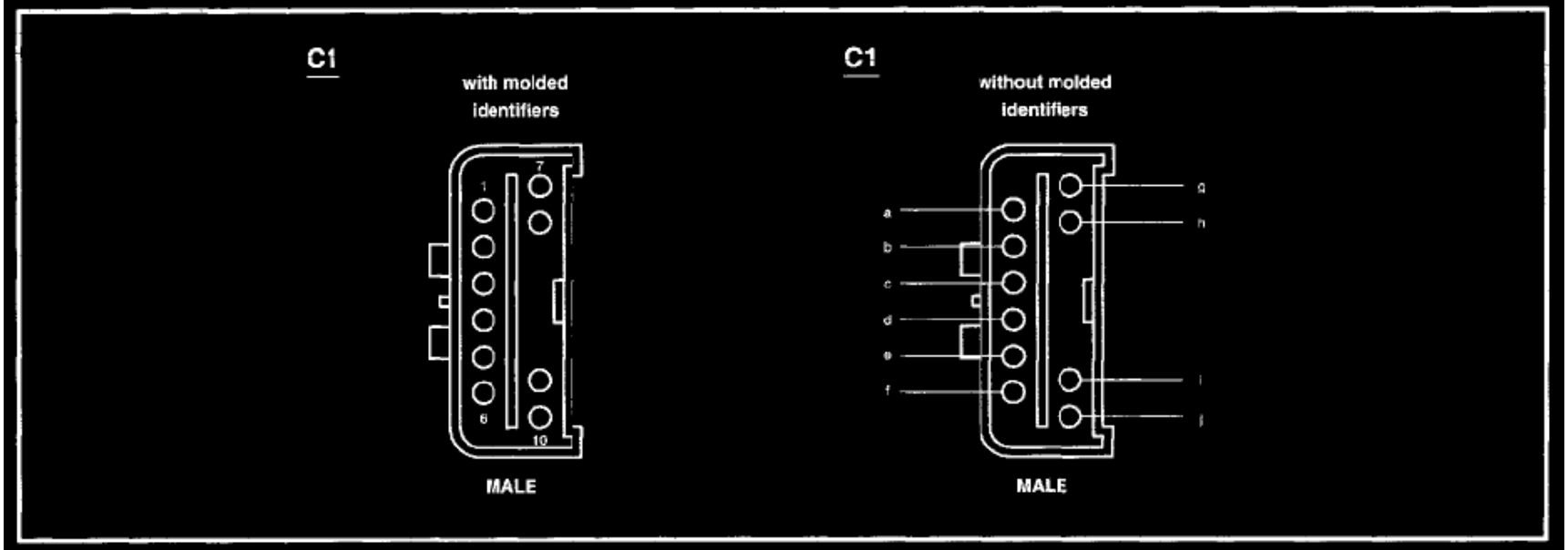
Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step–by–step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



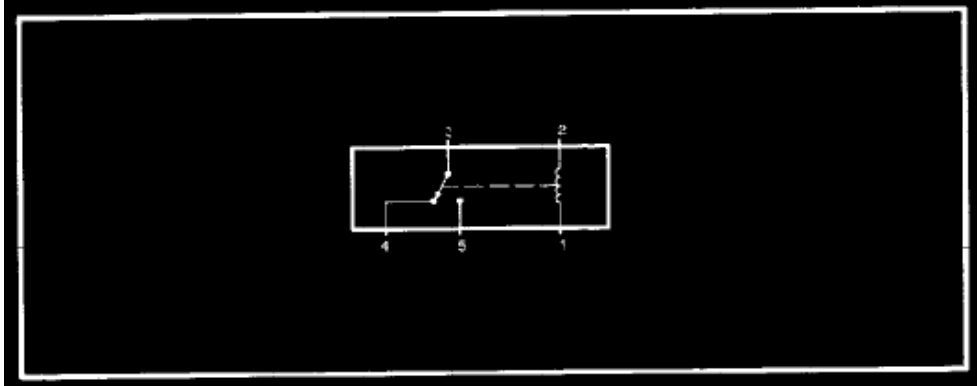
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

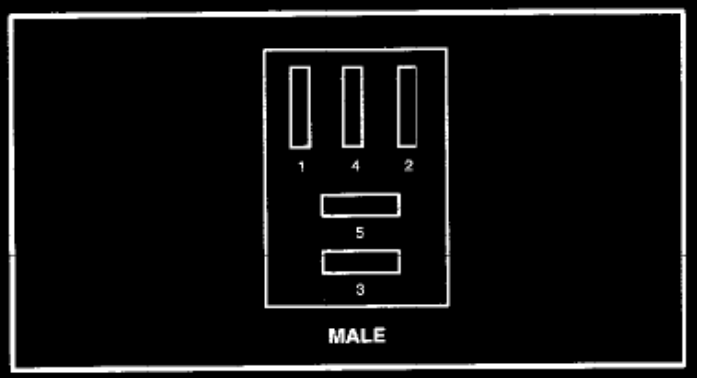
Turn Signal Relay: Testing and Inspection Micro ISO Relay

Relay – Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63–102Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil – Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

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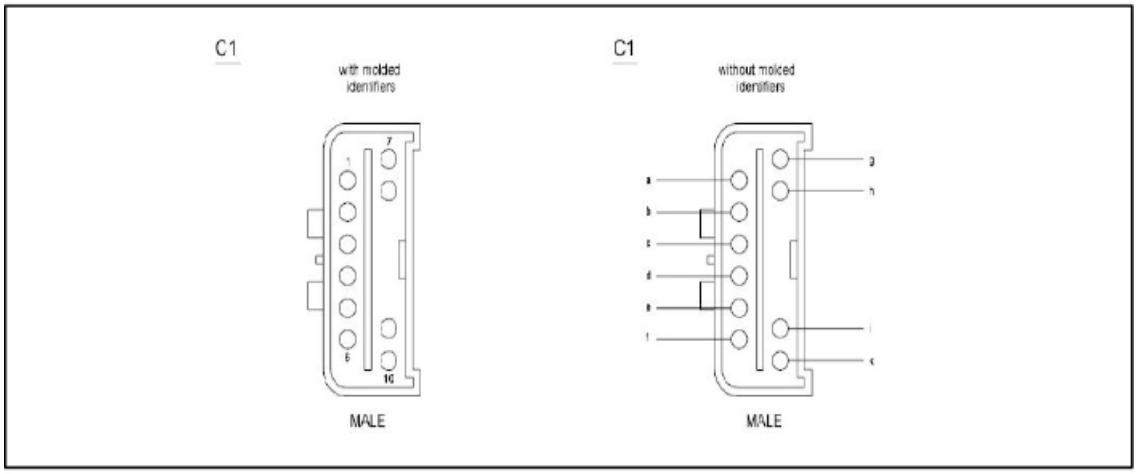
Terminals

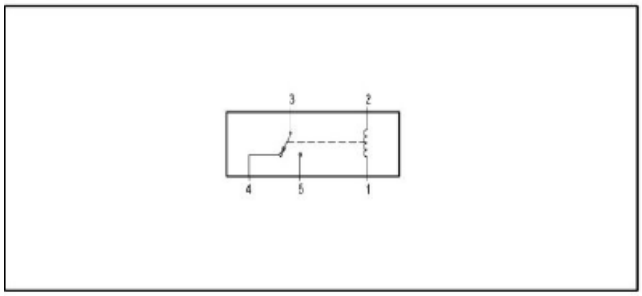


The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column □Circuit to test□. If you wish to test the complete component, perform all tests.

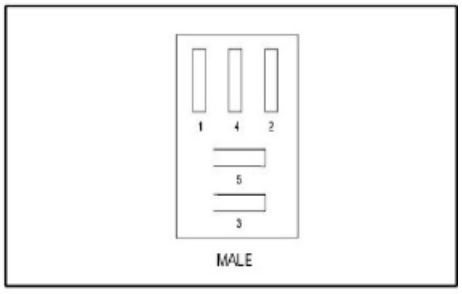
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Relay □ Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63□102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil □ Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

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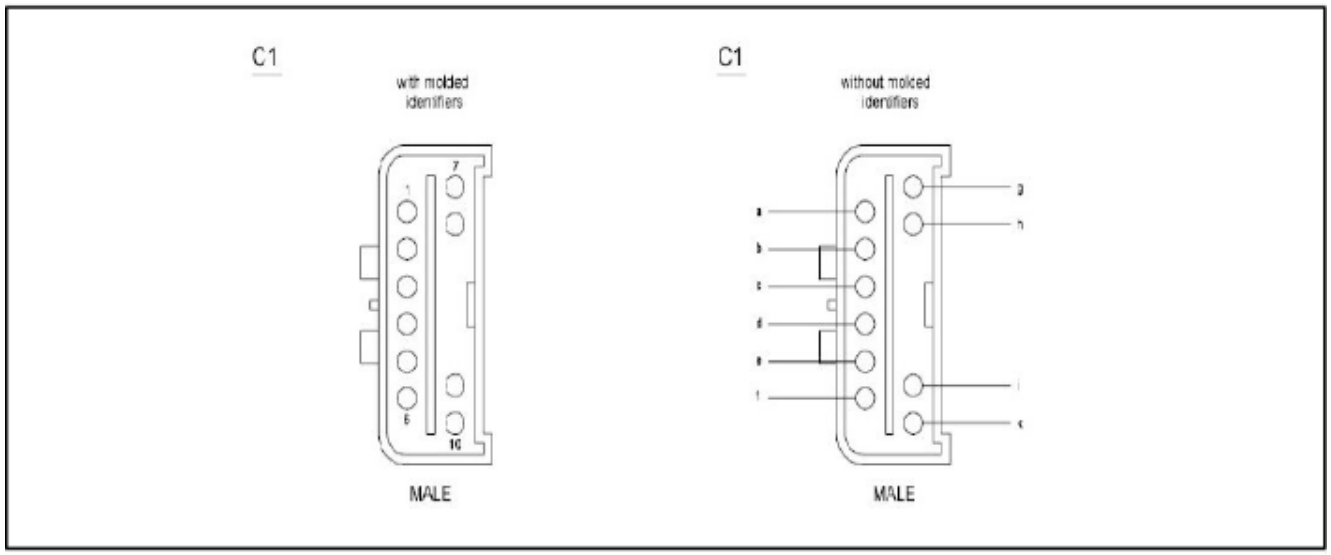
Terminals



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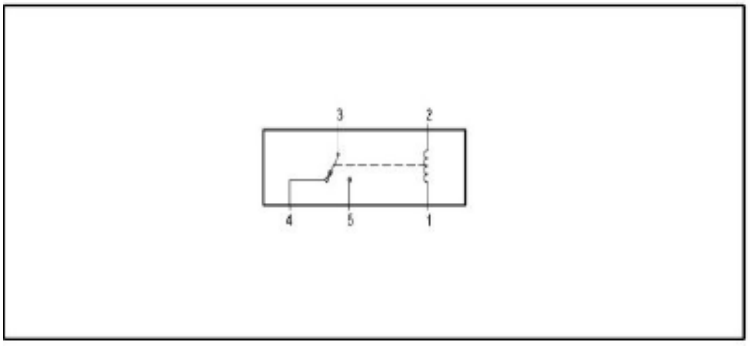
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

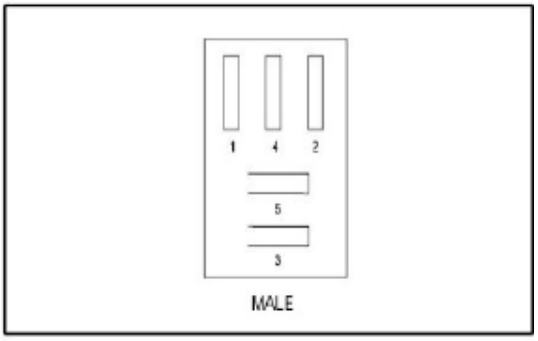
Micro ISO Relay: Testing and Inspection

Relay □ Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63□102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil □ Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

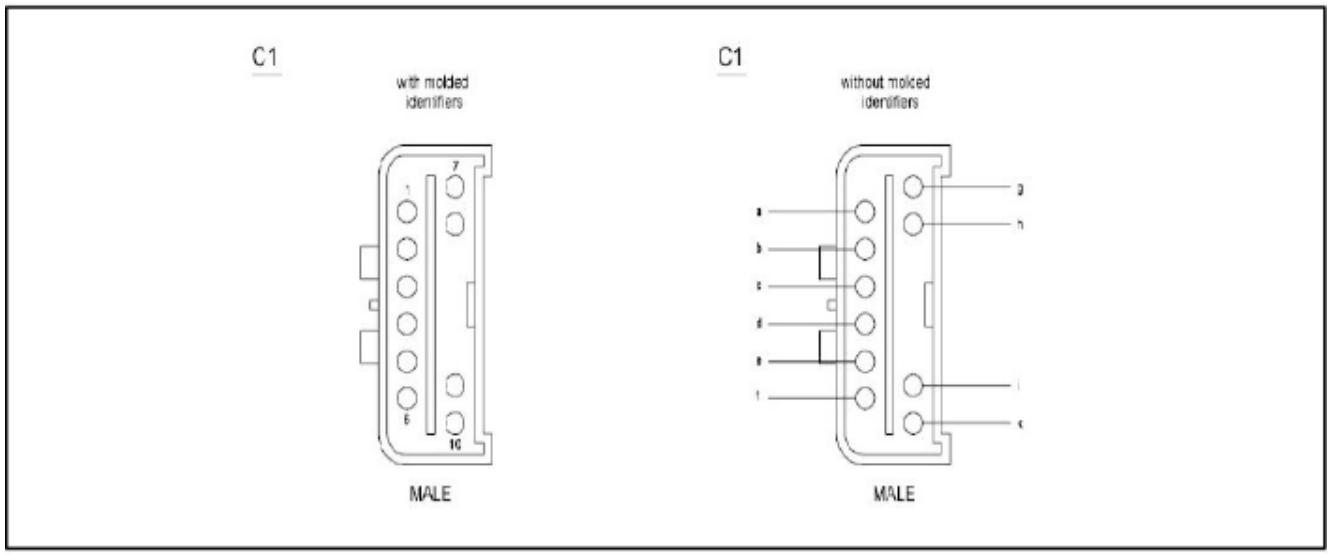
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



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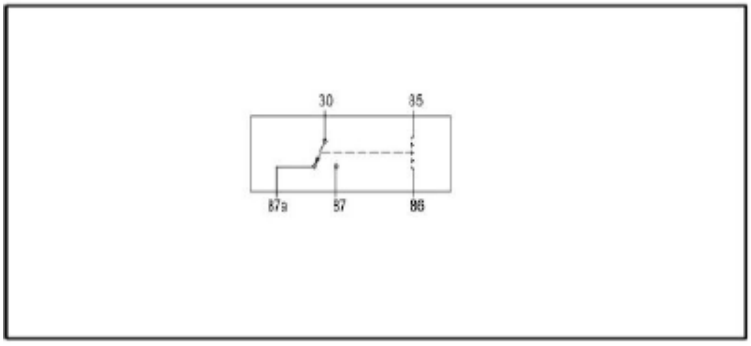
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

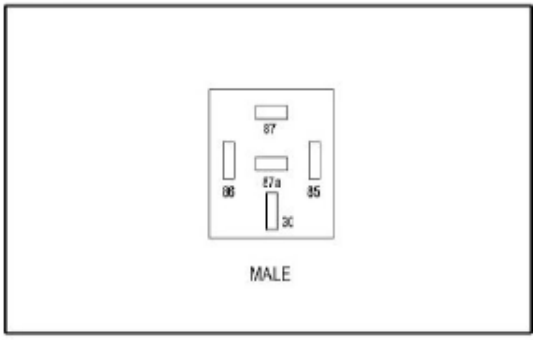
Mini ISO Relay: Testing and Inspection

Relay □ Mini ISO

Schematic



Terminals

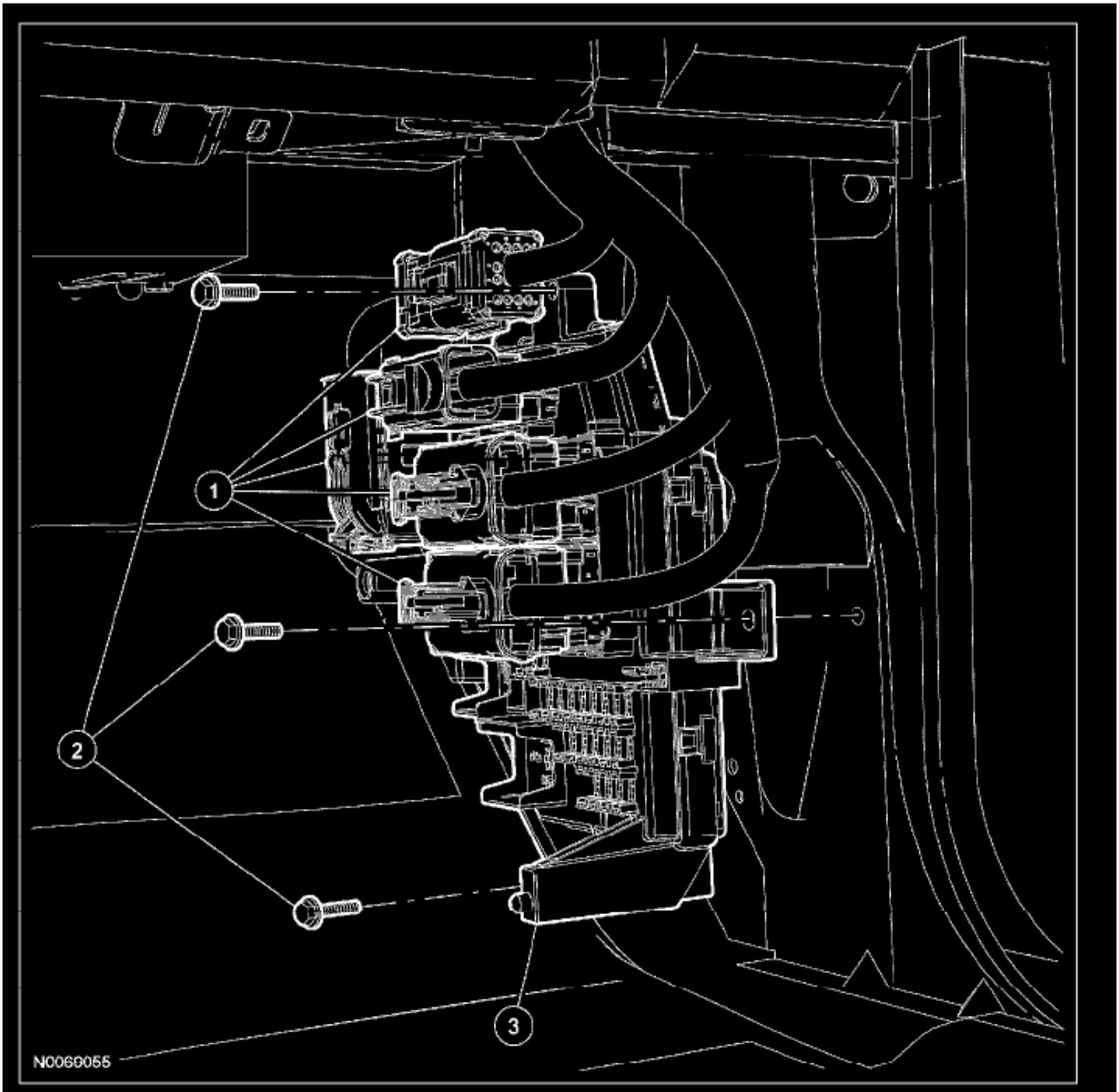


Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.



Item	Part Number	Description
1	—	Smart junction box (SJB) electrical connectors (part of 14401)
2	—	SJB screws (3 required)
3	15604	SJB

Power Distribution Module: Service and Repair

SMART JUNCTION BOX (SJB)

Removal

CAUTION: Electronic modules are sensitive to static electrical charges. If exposed to these charges, damage may result.

NOTE: -

Prior to the replacement of the module, it is necessary to upload the module configuration information into the appropriate scan tool. This information must be downloaded into the new module after installation.

- The tire pressure monitoring system (TPMS) functionality is integral to the smart junction box (SJB).

- The steps included in the SJB removal and installation procedure are critical to restoring the vehicle security and tire pressure monitoring systems to normal operation. A new SJB is delivered in a manufacturing mode with 7 pre-set DTCs related to the TPMS. To clear the DTCs, successful configuration of the SJB must occur, followed by successful TPMS sensor training, and a successful self-test, including clearing of the DTCs. The DTCs are as follows:

- B106D (Tire Pressure Monitor System [TPMS] Initiators Not Configured)

- B2477 (Module Configuration Failure)

- B2868 (Left Front Tire Pressure Sensor Fault)

- B2869 (Right Front Tire Pressure Sensor Fault)

- 2870 (Right Rear Tire Pressure Sensor Fault)

- B2871 (Left Rear Tire Pressure Sensor Fault)

- C2780 (ECU in Manufacturer Sub-State)

1. NOTE: This step is necessary only if the SJB is being replaced.

Upload the module configuration information from the SJB.

2. Remove the RH lower cowl trim panel. 3. Disconnect the electrical connectors. 4. Remove the 3 screws and the SJB.

Installation

NOTE: When a new SJB is installed, all customer RKE transmitters may be required to be present in order to program the RKE transmitters to the new SJB.

1. Install the SJB.

- Install the 3 screws.

- Connect the electrical connectors.

2. NOTE: If the SJB was not replaced, this is the last step that is necessary.

Install the RH lower cowl trim panel.

3. NOTE:

- When successful, this step provides the calibration necessary for the SJB operation and clears DTCs B106D and B2477. The clearing of these DTCs indicates the calibration data has been successfully downloaded to the new SJB.

- When successful, this step also programs the remote transmitters into the new SJB. In the event the remote transmitters do not program to the new SJB, all of the remote transmitters will need to be present. Refer to Locks, Remote Keyless Entry Transmitter Programming. This action will program the remote transmitters into the new SJB. See: Accessories and Optional Equipment/Antitheft and Alarm Systems/Keyless Entry/Keyless Entry Transmitter/Testing and Inspection

Download the SJB configuration information from the scan tool into the new SJB.

4. NOTE: When successful, this step clears DTCs B2868, B2869, B2870 and B2871. The clearing of these DTCs indicates the SJB has recognized

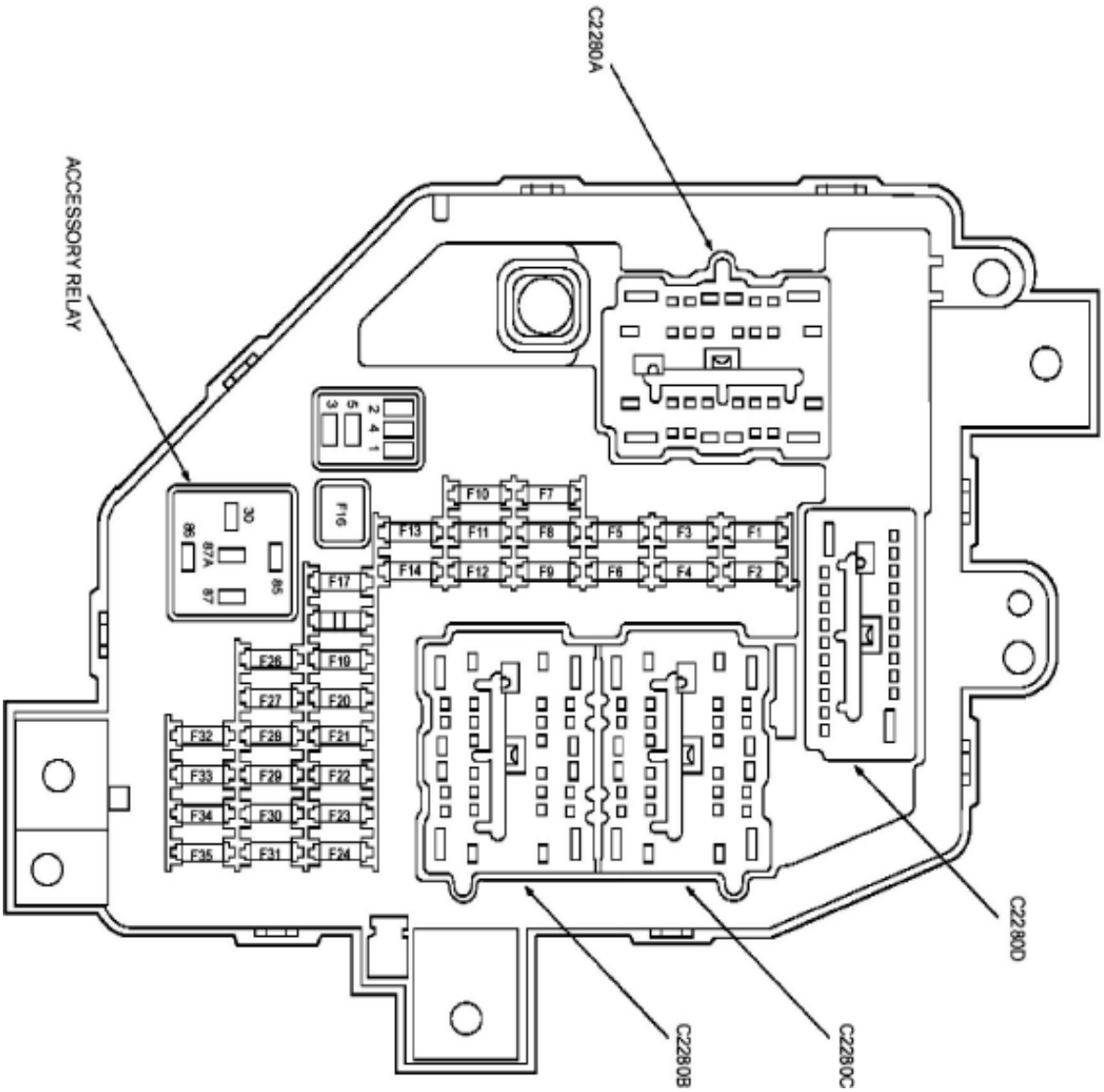
the tire pressure sensors during the training procedure.

Train the tire pressure sensors.

5. NOTE: DTC C2780 will not clear if any other DTCs are present in the SJB. When successful, this step will clear the DTC C2780.

Carry out the SJB on-demand self-test by clearing DTCs, and then retrieving DTCs to confirm all DTCs have been cleared.

SMART JUNCTION BOX (SJB)



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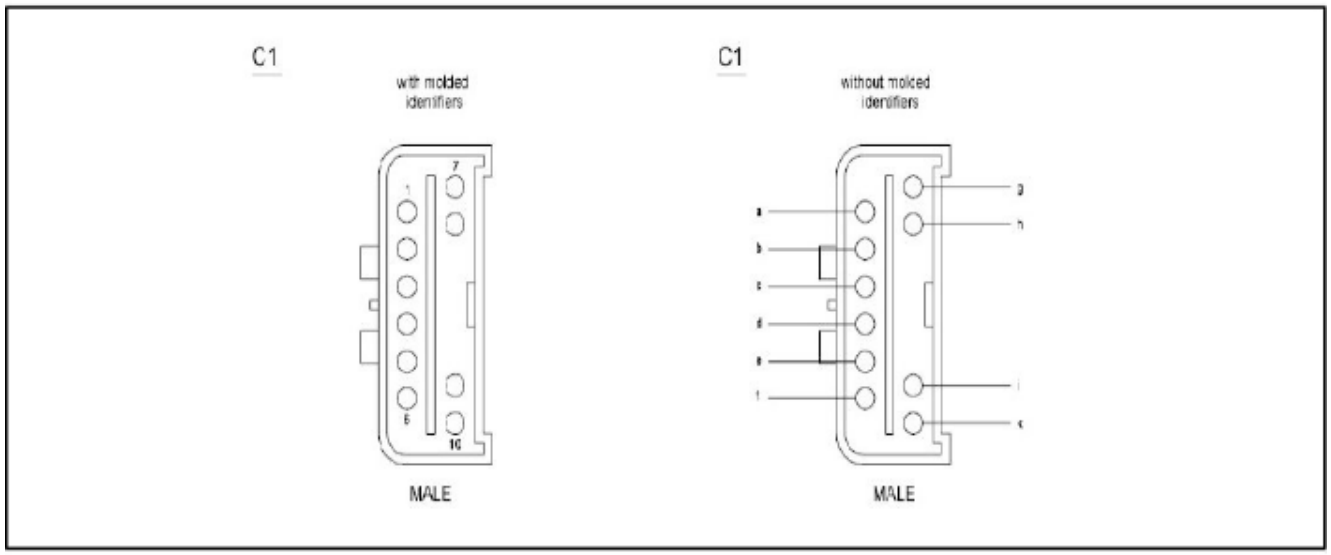

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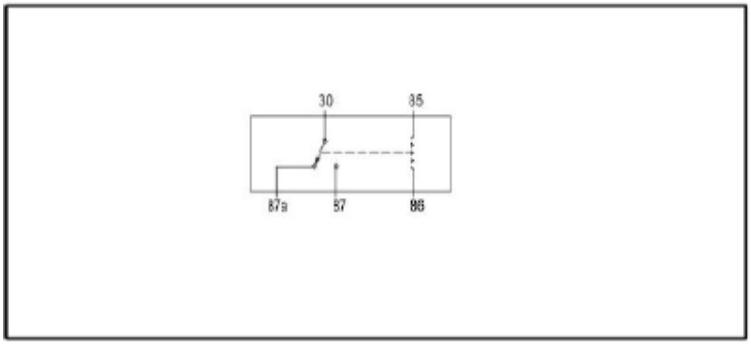
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

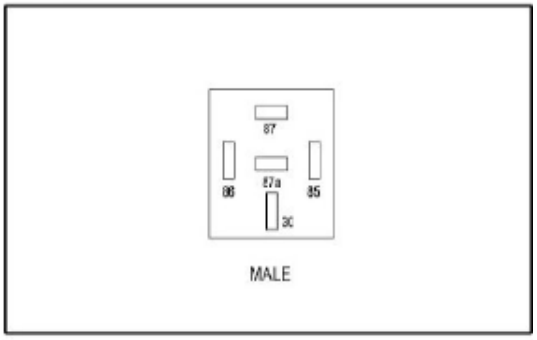
Power Distribution Relay: Testing and Inspection

Relay □ Mini ISO

Schematic



Terminals

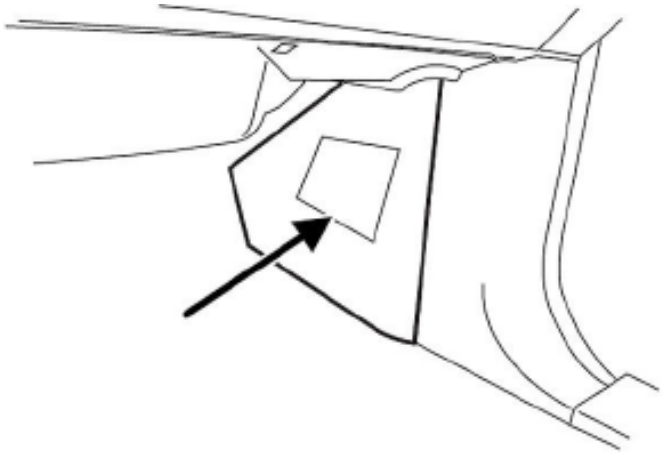


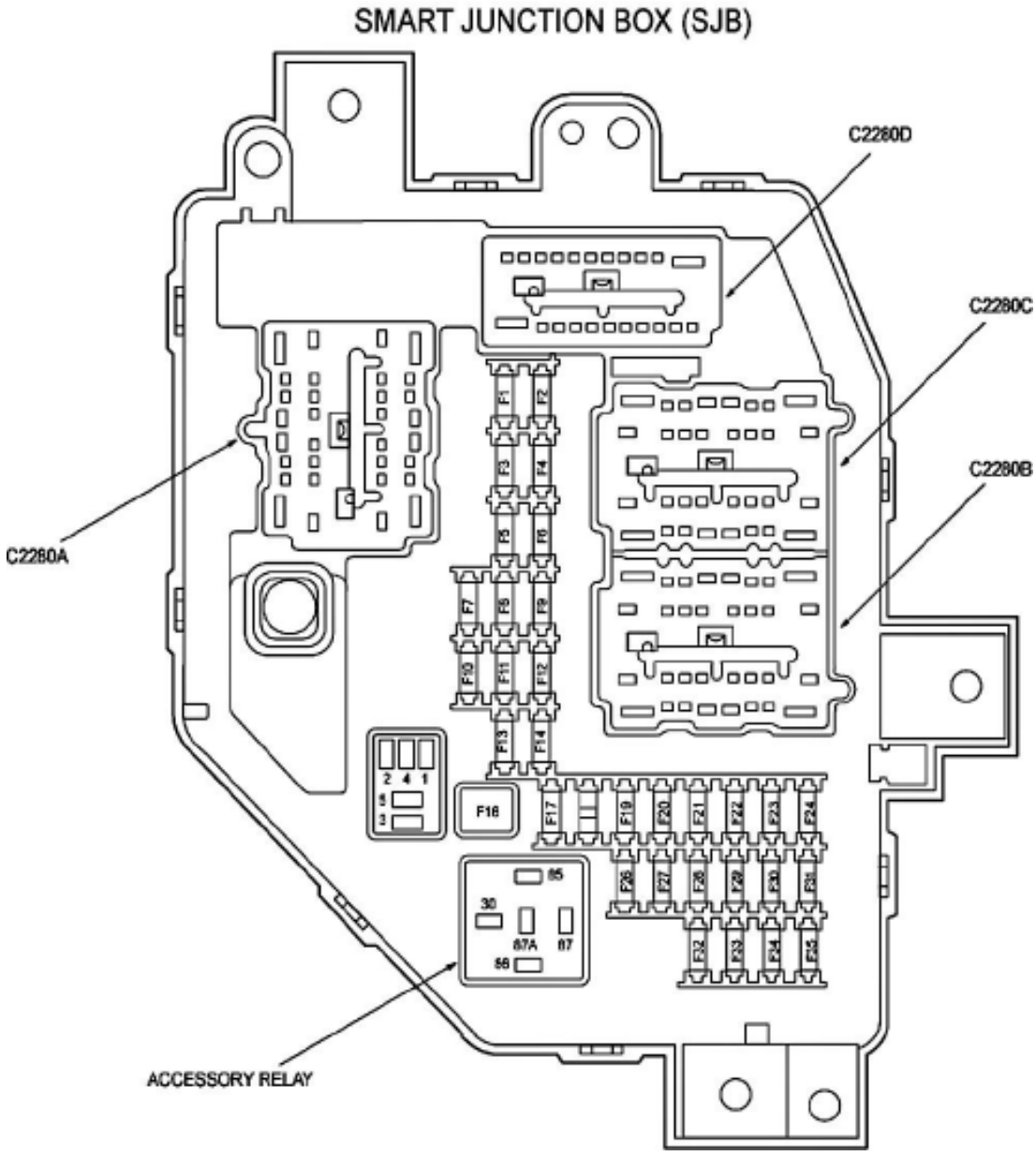
Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

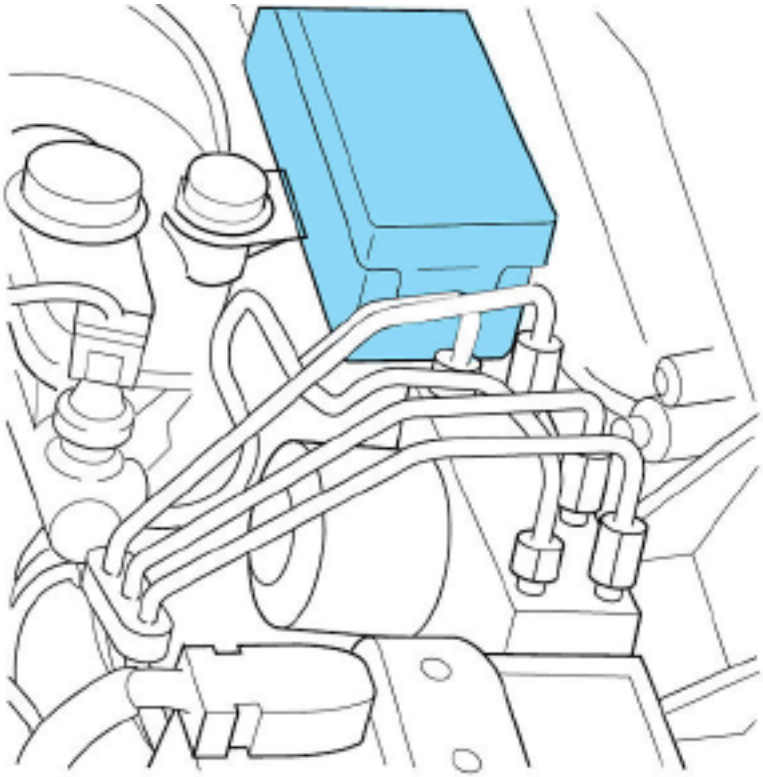



SMART JUNCTION BOX (SJB)
C2280D
C2280C
C2280B
C2280A
ACCESSORY RELAY
F1
F2
F3
F4
F5
F6
F7
F8
F9
F10
F11
F12
F13
F14
F16
F17
F19
F20
F21
F22
F23
F24
F26
F27
F28
F29
F30
F31
F32
F33
F34
F35
2 4 1
3
30
87A
87
86
85

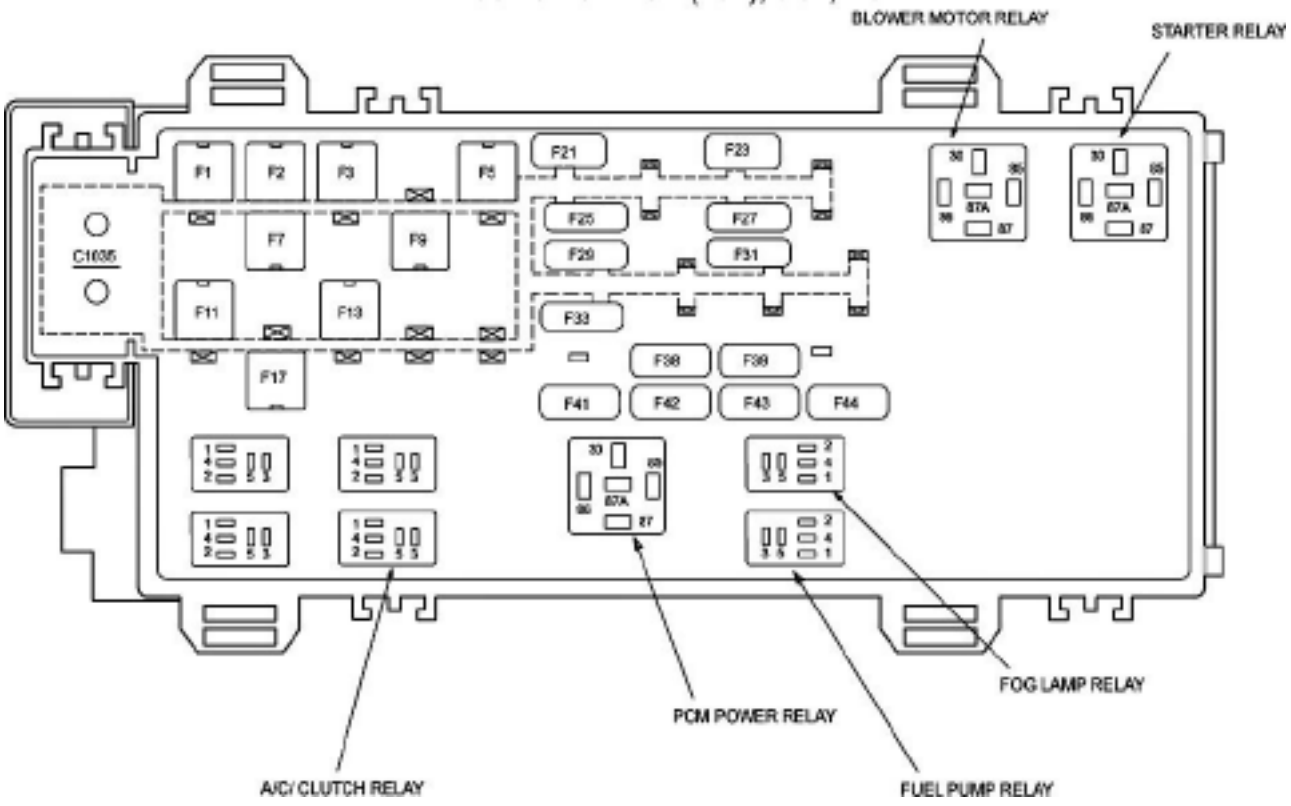
Relay Box: Locations Smart Junction Box

FUSE	AMPS	Circuits Protected
F1	5A	Illumination dimmer
F2	10A	Trailer tow connector - Park
F3	10A	Headlamp, right (Low beam lamp feed)
F4	10A	Headlamp, left (Low beam lamp feed)
F5	5A	Windshield wiper module
F6	10A	Audio unit, Door lock switch illumination
F7	5A	Not Used
F8	10A	Restraints Control Module (RCM), Occupant Classification System Module (OCSM), Passenger Air bag Deactivation (PAD) Indicator
F9	5A	Instrument Cluster (IC), Air bag indicator
F10	10A	4X4 control module, Instrument Cluster (IC)
F11	10A	Smart Junction Box (SJB), logic power
F12	15A	Subwoofer amplifier with audiophile, Satellite radio receiver
F13	15A	Interior lamp relay, Horn relay
F14	15A	High beam lamp feed to High beam indicator, Headlamp, right, Headlamp, left
F16	30A	Accessory relay (Power windows)
F17	15A	Indicator flasher relay
F18	-	Not Used

FUSE	AMPS	Circuits Protected
F19	20A	Brake pedal position switch (Stoplamps)
F20	10A	Transmission control switch, Digital Transmission Range (TR) sensor, Speed control servo, Anti-lock Brake System (ABS) module, Indicator flasher relay, Reversing lamps switch, Speed control On/Off switch, Speed control Set/Resume switch
F21	5A	Digital Transmission Range (TR) sensor, Starter relay, Powertrain Control Module (PCM)
F22	5A	Audio unit
F23	30A	Main light switch, Multifunction switch
F24	20A	Audio unit
F26	2A	Deactivator switch
F27	10A	Blend door actuator, Climate control assembly
F28	15A	4X4 control module
F29	20A	Cigar lighter, front, Data Link Connector (DLC)
F30	5A	Exterior rear view mirror switch
F31	20A	Park lamp relay
F32	5A	Brake pedal position switch (logic power), Brake shift interlock
F33	5A	Instrument Cluster (IC), Neutral tow indicator
F34	20A	Power point
F35	15A	Door lock/unlock relay, Driver door unlock relay



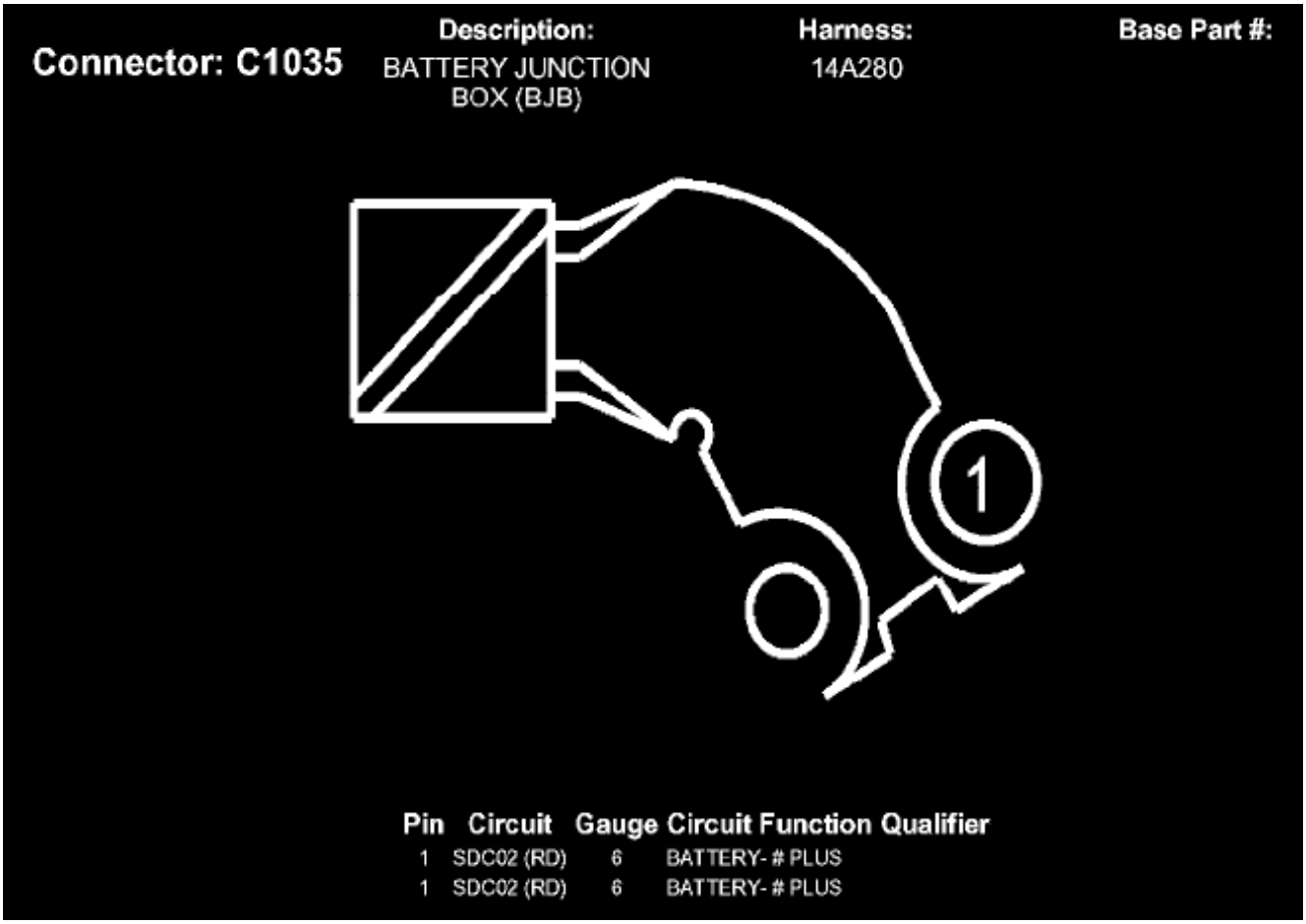
BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L



Relay Box: Locations Battery Junction Box

FUSE	AMPS	Circuits Protected
F1	40A	Smart Junction Box (SJB)
F2	-	Not Used
F3	40A	Smart Junction Box (SJB)
F4	-	Not Used
F5	50A	Smart Junction Box (SJB)
F6	-	Not Used
F7	30A	Starter Relay
F8	-	Not Used
F9	40A	Ignition Switch
F10	-	Not Used
F11	30A	PCM power relay
F12	-	Not Used
F13	30A	Blower motor relay
F14	-	Not Used
F15	-	Not Used
F16	-	Not Used
F17	40A	Anti-lock Brake System (ABS) module
F18	-	Not Used
F19	-	Not Used
F20	-	Not Used
F21	10A	Powertrain Control Module (PCM), Evaporative emission (EVAP) canister vent valve
F22	-	Not Used
F23	30A	Fuel Pump Relay, Fuel injectors
F24	-	Not Used

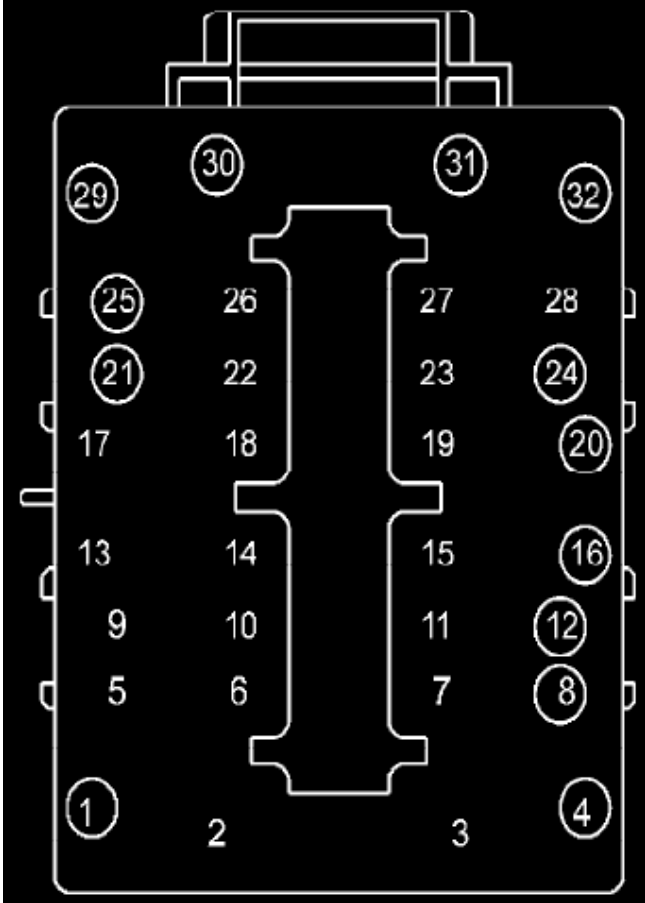
FUSE	AMPS	Circuits Protected
F25	10A	A/C clutch relay
F26	-	Not Used
F27	20A	4X4 control module
F28	-	Not Used
F29	30A	Windshield wipers/washer
F30	-	Not Used
F31	15A	Fog lamp relay
F32	-	Not Used
F33	30A	Anti-lock Brake System (ABS) module
F34	-	Not Used
F35	-	Not Used
F36	-	Not Used
F37	-	Not Used
F38	7.5A	Trailer tow connector - Right turn
F39	15A	Powertrain Control Module (PCM)
F40	-	Not Used
F41	10A	*5R44E Transmission **5R55E Transmission
F42	7.5A	Trailer tow connector - Left turn
F43	20A	EVAP canister purge valve, Heated Positive Crankcase Ventilation (PCV) valve, Idle Air Control (IAC) valve, Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor, Heated Oxygen Sensor (HO2S) #11, Heated Oxygen Sensor (HO2S) #12, Heated Oxygen Sensor (HO2S) #21, Heated Oxygen Sensor (HO2S) #22, EGR vacuum regulator solenoid valve, A/C relay coil
F44	15A	Ignition coil, *Ignition transformer capacitor 1


Connector: C1035
Description:
BATTERY JUNCTION BOX (BJB)
Harness:
14A280
Base Part #:
1
Pin Circuit Gauge Circuit Function Qualifier
1 SDC02 (RD) 6 BATTERY- # PLUS
1 SDC02 (RD) 6 BATTERY- # PLUS

C1035

Connector: C2280A

Description:	Harness:	Base Part #:
SMART JUNCTION BOX (SJB)	14290	14B476

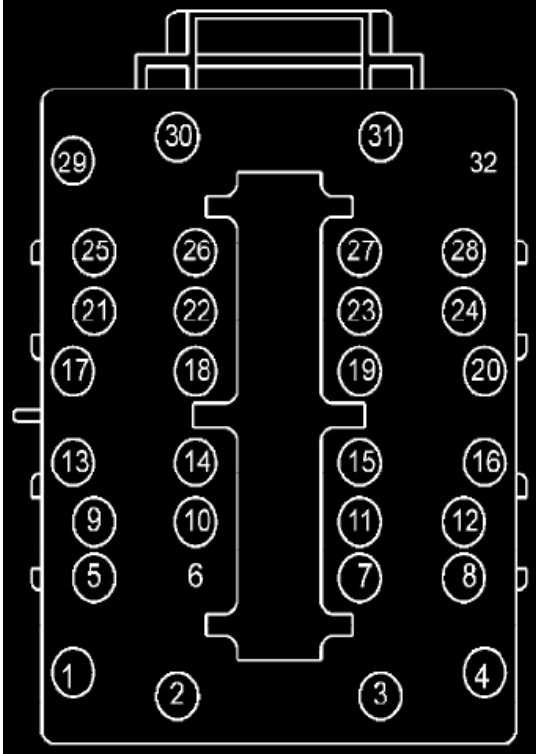


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	SBB01 (RD)	12	FUSE - 1 OR CIRCUIT BREAKER	
2	*	*	not used	
3	*	*	not used	
4	CBP05 (YE)	20	FUSE - 5 OR CIRCUIT BREAKER	
5	*	*	not used	
6	*	*	not used	
7	*	*	not used	
8	CES03 (VT-WH)	20	CTRL MOD - POWERTRAIN # SPEED CONTROL INDICATOR (SCIL)	
9	*	*	not used	
10	*	*	not used	
11	*	*	not used	
12	CLS34 (GY)	18	SWITCH - PARK LAMPS	
13	*	*	not used	
14	*	*	not used	
15	*	*	not used	
16	CBP04 (VT)	18	FUSE - 4 OR CIRCUIT BREAKER	
17	*	*	not used	
18	*	*	not used	
19	*	*	not used	
20	CBP03 (GY)	18	FUSE - 3 OR CIRCUIT BREAKER	
21	SBR14 (BN-RD)	18	FUSE - 14 OR CIRCUIT BREAKER	
22	*	*	not used	
23	*	*	not used	
24	CE517 (BU-GN)	20	DIODE - RELAY POWERTRAIN CONTROL MODULE	
25	CBP14 (VT-OG)	16	FUSE - 14 OR CIRCUIT BREAKER	
26	*	*	not used	
27	*	*	not used	
28	*	*	not used	
29	SBB03 (BU-RD)	12	FUSE - 3 OR CIRCUIT BREAKER	
30	CRH02 (BU-WH)	18	SWITCH - HORN	
31	CBP21 (BU-GY)	22	FUSE - 21 OR CIRCUIT BREAKER	
32	SBB05 (GY-RD)	10	FUSE - 5 OR CIRCUIT BREAKER	

Relay Box: Diagrams Smart Junction Box (SJB)

C2280A

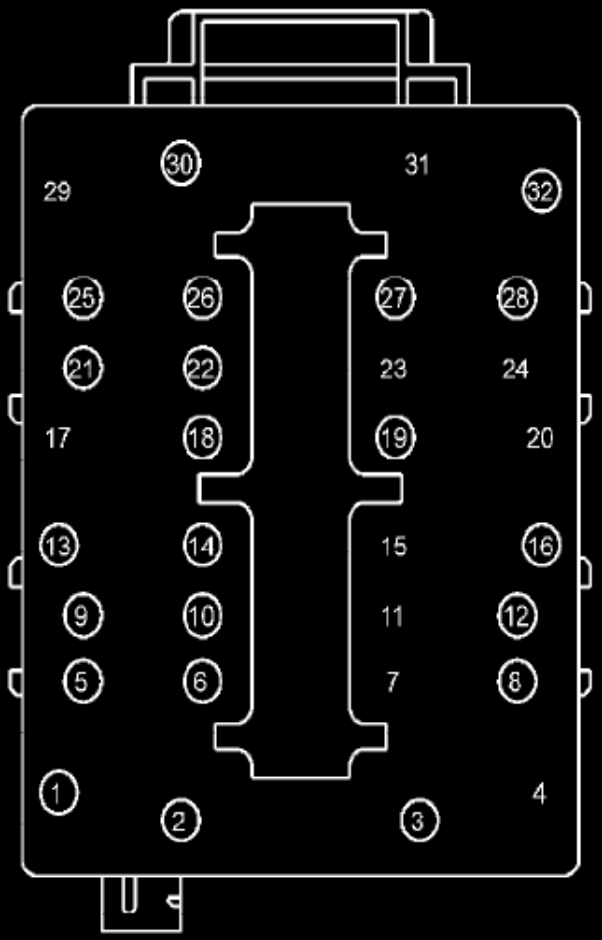
Connector: C2280B | **Description:** SMART JUNCTION BOX (SJB) | **Harness:** 14401 | **Base Part #:** 14B476



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	SBP23 (WH-RD)	14	FUSE - 23 OR CIRCUIT BREAKER	
2	SBP24 (VT-RD)	16	FUSE - 24 OR CIRCUIT BREAKER	
3	SBP34 (YE-RD)	16	FUSE - 34 OR CIRCUIT BREAKER	
4	SBP23 (WH-RD)	14	FUSE - 23 OR CIRCUIT BREAKER	
5	CBP10 (YE-OG)	20	FUSE - 10 OR CIRCUIT BREAKER	
6	*	*	not used	
7	SBP28 (GN-RD)	18	FUSE - 28 OR CIRCUIT BREAKER	
8	SBP30 (BN-RD)	22	FUSE - 30 OR CIRCUIT BREAKER	
9	CPL19 (WH-VT)	20	RELAY - DOOR LOCK # ALL LOCK	
10	CPL18 (GY-VT)	20	RELAY - DOOR LOCK # ALL UNLOCK	
11	CDC35 (BU-WH)	14	SWITCH - IGNITION # START	
12	SBP33 (RD)	20	FUSE - 33 OR CIRCUIT BREAKER	
13	CPL11 (GY-BN)	20	CTRL MOD. - DOOR LOCK # ALL LOCK	
14	GD161 (BK-YE)	18	GROUND - SEAT BRACKET REAR LEFT	
15	CBP20 (YE-VT)	18	FUSE - 20 OR CIRCUIT BREAKER	
16	SBP29 (GY-RD)	18	FUSE - 29 OR CIRCUIT BREAKER	
17	CDC32 (BN-YE)	12	SWITCH - IGNITION # RUN	
18	CBP27 (GN-BN)	22	FUSE - 27 OR CIRCUIT BREAKER	
19	CBP20 (YE-VT)	18	FUSE - 20 OR CIRCUIT BREAKER	
20	SBP29 (GY-RD)	16	FUSE - 29 OR CIRCUIT BREAKER	
21	CBP27 (GN-BN)	22	FUSE - 27 OR CIRCUIT BREAKER	
22	CBP26 (BU-WH)	20	FUSE - 26 OR CIRCUIT BREAKER	
23	CBP20 (YE-VT)	18	FUSE - 20 OR CIRCUIT BREAKER	
24	CBP22 (GN-OG)	20	FUSE - 22 OR CIRCUIT BREAKER	
25	CLF27 (GN-BN)	14	SWITCH - FLASH TO PASS	
26	SBP17 (RD)	18	FUSE - 17 OR CIRCUIT BREAKER	
27	CBP20 (YE-VT)	20	FUSE - 20 OR CIRCUIT BREAKER	
28	SBP32 (VT-RD)	22	FUSE - 32 OR CIRCUIT BREAKER	
29	CDC34 (WH-OG)	12	SWITCH - IGNITION # RUN; START	
30	SBP12 (GN-RD)	16	FUSE - 12 OR CIRCUIT BREAKER	Audiophile sound system
30	SBP12 (GN-RD)	20	FUSE - 12 OR CIRCUIT BREAKER	without Audiophile and satellite radio
31	SBP19 (BU-RD)	16	FUSE - 19 OR CIRCUIT BREAKER	
32	*	*	not used	

C2280B (Part 1)

Connector: C2280C | **Description:** SMART JUNCTION BOX (SJB) | **Harness:** 14401 | **Base Part #:** 14B476

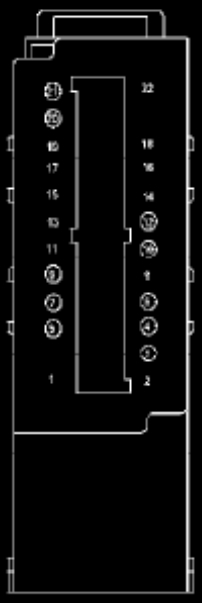


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD174 (BK-WH)	18	GROUND - TUNNEL	
2	CPL12 (VT-OG)	20	CTRL MOD. - DOOR LOCK # DOUBLE LOCK ALL LOCK	
3	CLS34 (GY)	16	SWITCH - PARK LAMPS	
4	*	*	not used	
5	CPL42 (GY-YE)	22	SWITCH - TRIM DOOR LOCK (DRIVER) # LOCK	
6	CPL26 (GN-VT)	20	SWITCH - LATCH DRIVER # AJAR	
7	*	*	not used	
8	CLN28 (GN-BU)	18	SWITCH - DOME LAMP	
9	CPL43 (VT-GY)	22	SWITCH - TRIM DOOR LOCK (DRIVER) # UNLOCK	
10	CPL42 (GY-YE)	22	SWITCH - TRIM DOOR LOCK (DRIVER) # LOCK	
11	*	*	not used	
12	CPL51 (BU-GN)	20	CTRL MOD. - DOOR LOCK # DRIVER UNLOCK	
13	CPW14 (VT-WH)	14	SWITCH - POWER WINDOW DRIVER # PASSENGER LOCK OUT (ENABLE)	
14	CPL43 (VT-GY)	22	SWITCH - TRIM DOOR LOCK (DRIVER) # UNLOCK	
15	*	*	not used	
16	CPW30 (GY-YE)	14	RELAY - POWER WINDOW	
17	*	*	not used	
18	CBP08 (GY-YE)	20	FUSE - 8 OR CIRCUIT BREAKER	
19	CE517 (BU-GN)	20	DIODE - RELAY POWERTRAIN CONTROL MODULE	
20	*	*	not used	
21	CLF29 (BN)	22	CTRL MOD. - FOG LAMPS FRONT (LEFT)	
22	CBP08 (GY-YE)	20	FUSE - 8 OR CIRCUIT BREAKER	
23	*	*	not used	
24	*	*	not used	
25	CAT17 (BN)	16	RELAY - TRAILER TOW PARK LAMPS (COLOR TO SAE 1239)	
26	CBP01 (BU)	22	FUSE - 1 OR CIRCUIT BREAKER	
27	CBP06 (WH-BU)	20	FUSE - 6 OR CIRCUIT BREAKER	
28	CBP09 (VT-GY)	20	FUSE - 9 OR CIRCUIT BREAKER	
29	*	*	not used	
30	CLF16 (BU-WH)	16	SWITCH - BEAM LOW	
31	*	*	not used	
32	CDC33 (VT-GN)	12	SWITCH - IGNITION # RUN: ACCESSORY	

C2280B (Part 2)

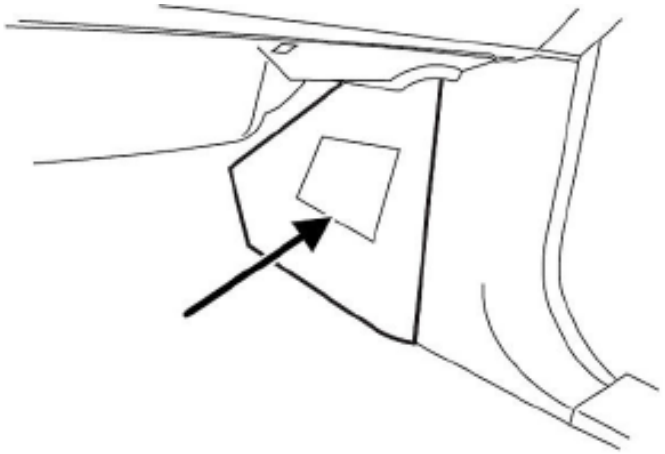
C2280C

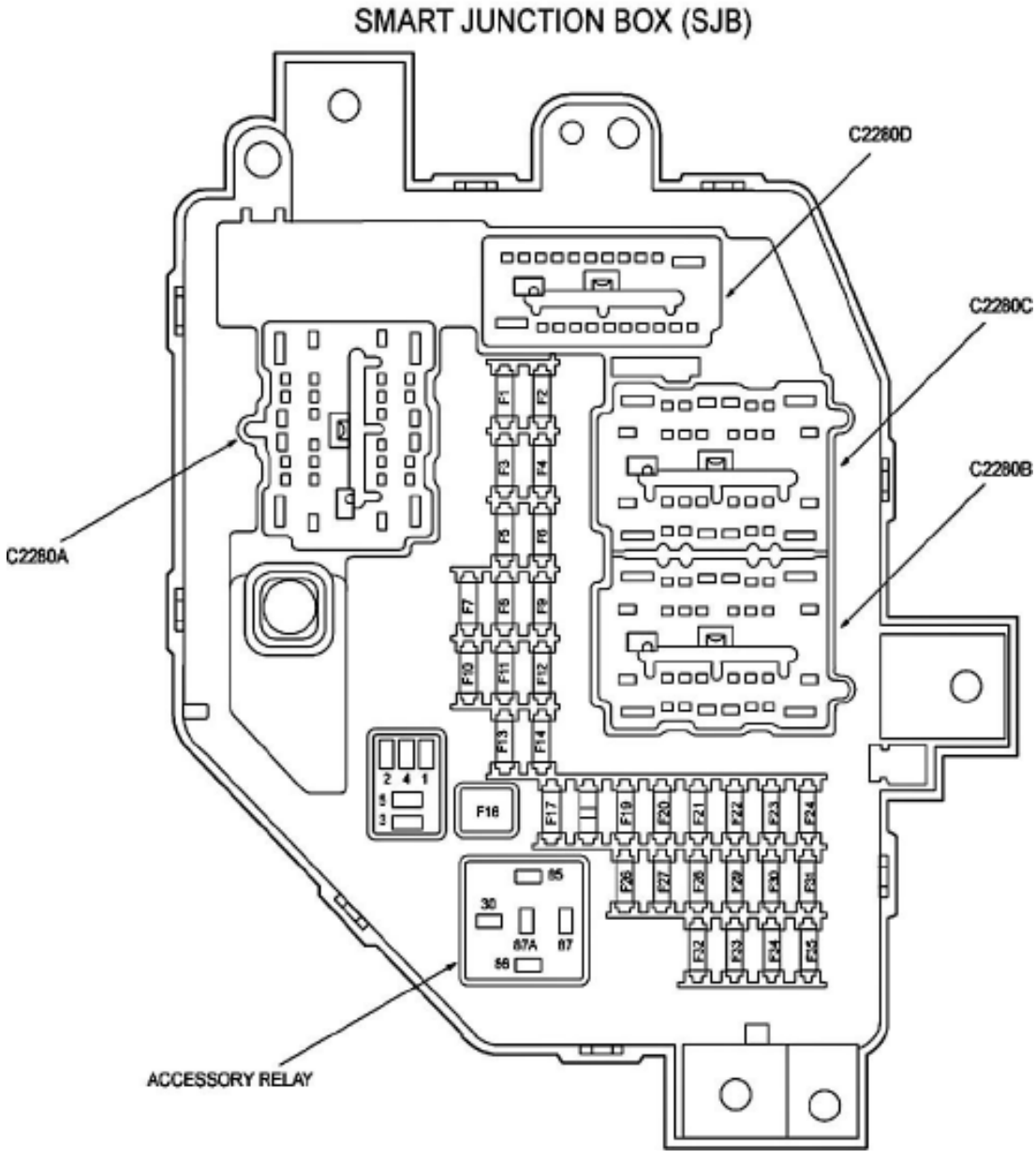
Connector: C2280D	Description:	Harness:	Base Part #:
	SMART JUNCTION BOX (SJB)	14401	14B476



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	*	*	not used	
3	CPL31 (WH)	20	SWITCH - LATCH PASSENGER # AJAR	
4	CPL36 (GN)	20	SWITCH - LATCH REAR DRIVER SIDE # AJAR (INCL.SLIDING DOOR)	
5	CLS30 (VT-WH)	18	RELAY - PARK LAMP	
6	CPL39 (YE)	20	SWITCH - LATCH REAR PASSENGER SIDE # AJAR (INCL.SLIDING DOOR)	
7	CCB15 (BN-GN)	22	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL CLOSED	
8	*	*	not used	
9	CLF21 (GY-VT)	18	SWITCH - FOG LAMPS FRONT	
10	CLN27 (WH-BN)	18	CTRL MOD. - DIMMER INSTRUMENT	
11	*	*	not used	
12	SRH01 (YE-RD)	20	RELAY - HORN	
13	*	*	not used	
14	*	*	not used	
15	*	*	not used	
16	*	*	not used	
17	*	*	not used	
18	*	*	not used	
19	*	*	not used	
20	VDB04 (WH-BU)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED HIGH	
21	VDB05 (WH)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED LOW	
22	*	*	not used	

C2280D




SMART JUNCTION BOX (SJB)
C2280D
C2280C
C2280B
C2280A
F1
F2
F3
F4
F5
F6
F7
F8
F9
F10
F11
F12
F13
F14
F16
F17
F19
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F26
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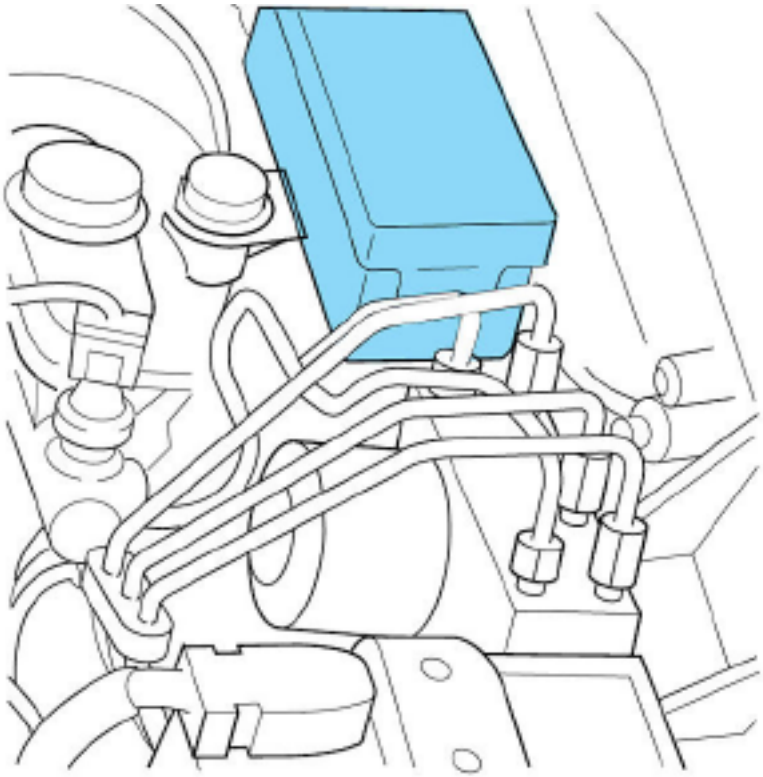
F28
F29
F30
F31
F32
F33
F34
F35
2 4 1
5
3
30
85
87A
87
86
ACCESSORY RELAY

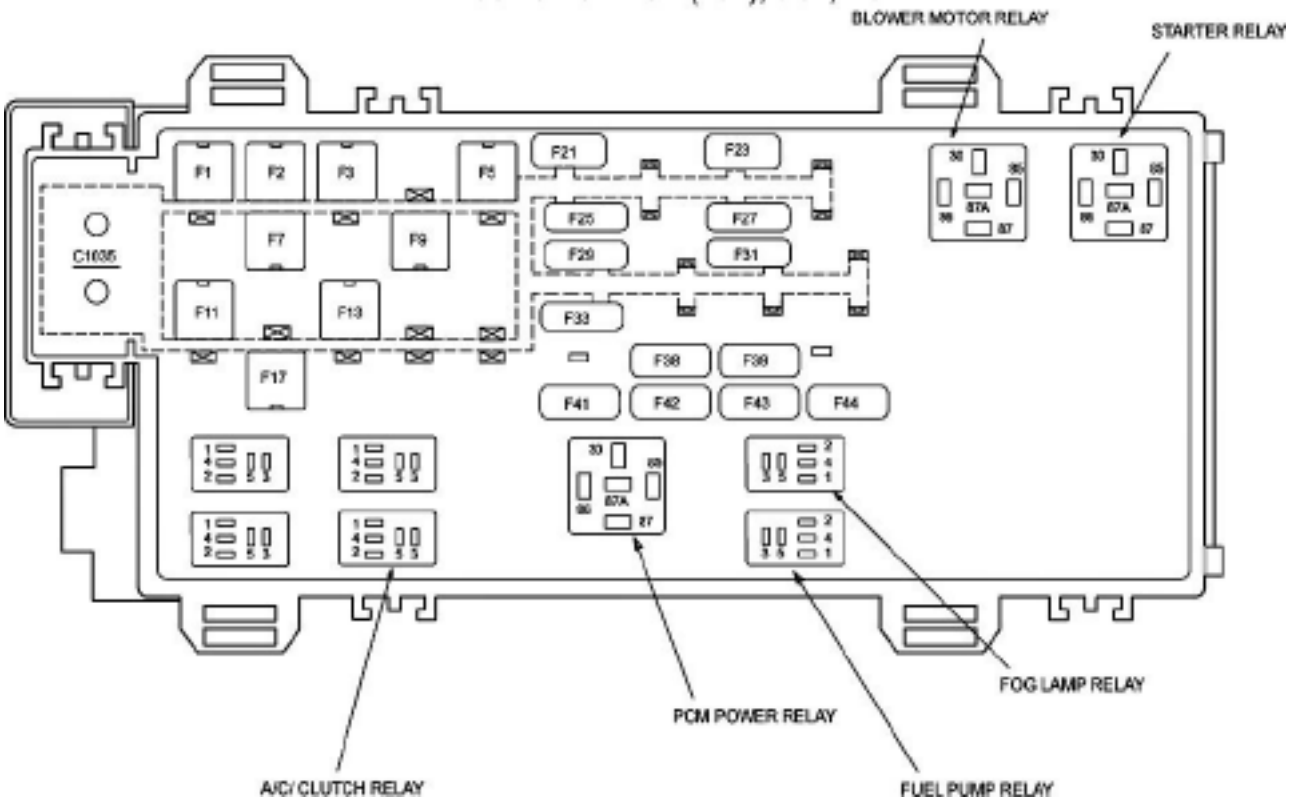
Relay Box: Application and ID Smart Junction Box

FUSE	AMPS	Circuits Protected
F1	5A	Illumination dimmer
F2	10A	Trailer tow connector - Park
F3	10A	Headlamp, right (Low beam lamp feed)
F4	10A	Headlamp, left (Low beam lamp feed)
F5	5A	Windshield wiper module
F6	10A	Audio unit, Door lock switch illumination
F7	5A	Not Used
F8	10A	Restraints Control Module (RCM), Occupant Classification System Module (OCSM), Passenger Air bag Deactivation (PAD) Indicator
F9	5A	Instrument Cluster (IC), Air bag indicator
F10	10A	4X4 control module, Instrument Cluster (IC)
F11	10A	Smart Junction Box (SJB), logic power
F12	15A	Subwoofer amplifier with audiophile, Satellite radio receiver
F13	15A	Interior lamp relay, Horn relay
F14	15A	High beam lamp feed to High beam indicator, Headlamp, right, Headlamp, left
F16	30A	Accessory relay (Power windows)
F17	15A	Indicator flasher relay
F18	-	Not Used

FUSE	AMPS	Circuits Protected
F19	20A	Brake pedal position switch (Stoplamps)
F20	10A	Transmission control switch, Digital Transmission Range (TR) sensor, Speed control servo, Anti-lock Brake System (ABS) module, Indicator flasher relay, Reversing lamps switch, Speed control On/Off switch, Speed control Set/Resume switch
F21	5A	Digital Transmission Range (TR) sensor, Starter relay, Powertrain Control Module (PCM)
F22	5A	Audio unit
F23	30A	Main light switch, Multifunction switch
F24	20A	Audio unit
F26	2A	Deactivator switch
F27	10A	Blend door actuator, Climate control assembly
F28	15A	4X4 control module
F29	20A	Cigar lighter, front, Data Link Connector (DLC)
F30	5A	Exterior rear view mirror switch
F31	20A	Park lamp relay
F32	5A	Brake pedal position switch (logic power), Brake shift interlock
F33	5A	Instrument Cluster (IC), Neutral tow indicator
F34	20A	Power point
F35	15A	Door lock/unlock relay, Driver door unlock relay



BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L



Relay Box: Application and ID Battery Junction Box

FUSE	AMPS	Circuits Protected
F1	40A	Smart Junction Box (SJB)
F2	-	Not Used
F3	40A	Smart Junction Box (SJB)
F4	-	Not Used
F5	50A	Smart Junction Box (SJB)
F6	-	Not Used
F7	30A	Starter Relay
F8	-	Not Used
F9	40A	Ignition Switch
F10	-	Not Used
F11	30A	PCM power relay
F12	-	Not Used
F13	30A	Blower motor relay
F14	-	Not Used
F15	-	Not Used
F16	-	Not Used
F17	40A	Anti-lock Brake System (ABS) module
F18	-	Not Used
F19	-	Not Used
F20	-	Not Used
F21	10A	Powertrain Control Module (PCM), Evaporative emission (EVAP) canister vent valve
F22	-	Not Used
F23	30A	Fuel Pump Relay, Fuel injectors
F24	-	Not Used

FUSE	AMPS	Circuits Protected
F25	10A	A/C clutch relay
F26	-	Not Used
F27	20A	4X4 control module
F28	-	Not Used
F29	30A	Windshield wipers/washer
F30	-	Not Used
F31	15A	Fog lamp relay
F32	-	Not Used
F33	30A	Anti-lock Brake System (ABS) module
F34	-	Not Used
F35	-	Not Used
F36	-	Not Used
F37	-	Not Used
F38	7.5A	Trailer tow connector - Right turn
F39	15A	Powertrain Control Module (PCM)
F40	-	Not Used
F41	10A	*5R44E Transmission **5R55E Transmission
F42	7.5A	Trailer tow connector - Left turn
F43	20A	EVAP canister purge valve, Heated Positive Crankcase Ventilation (PCV) valve, Idle Air Control (IAC) valve, Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor, Heated Oxygen Sensor (HO2S) #11, Heated Oxygen Sensor (HO2S) #12, Heated Oxygen Sensor (HO2S) #21, Heated Oxygen Sensor (HO2S) #22, EGR vacuum regulator solenoid valve, A/C relay coil
F44	15A	Ignition coil, *Ignition transformer capacitor 1

ETC System with a 3-Track APP Sensor Failure Mode and Effects Management:

Effect	Failure Mode ▪
No Effect on Driveability	A loss of redundancy or loss of a non-critical input could result in a concern that does not affect driveability. The powertrain malfunction indicator (wrench) illuminates, but the throttle control and torque control systems function normally. A DTC is set to indicate the component or circuit with the concern.
Disable Speed Control	If certain concerns are detected, speed control is disabled. Throttle control and torque control continue to function normally.

(Continued)

Electronic Throttle Control Module: Description and Operation

TORQUE BASED ELECTRONIC THROTTLE CONTROL (ETC)

Overview

The torque based ETC is a hardware and software strategy that delivers an engine output torque (via throttle angle) based on driver demand (pedal position). It uses an electronic throttle body, the powertrain control module (PCM), and an accelerator pedal assembly to control the throttle opening and engine torque.

Torque based ETC enables aggressive automatic transmission shift schedules (earlier upshifts and later downshifts). This is possible by adjusting the throttle angle to achieve the same wheel torque during shifts, and by calculating this desired torque, the system prevents engine lugging (low RPM and low manifold vacuum) while still delivering the performance and torque requested by the driver. It also enables many fuel economy/emission improvement technologies such as variable camshaft timing (VCT) (deliver same torque during transitions).

Torque based ETC also results in less intrusive vehicle and engine speed limiting, along with smoother traction control.

Other benefits of ETC are: -

eliminate cruise control actuators

- eliminate idle air control (IAC) valve

- better airflow range

- packaging (no cable)

- more responsive powertrain at altitude and improved shift quality

The ETC system illuminates a powertrain malfunction indicator (wrench) on the instrument cluster when a concern is present. Concerns are accompanied by diagnostic trouble codes (DTCs) and may also illuminate the malfunction indicator lamp (MIL).

Electronic Throttle Body (ETB)

The ETB has the following characteristics: -

The throttle actuator control (TAC) motor is a DC motor controlled by the PCM (requires 2-wires).

- There are 2 designs: parallel and in-line. The parallel design has the motor under the bore parallel to the plate shaft. The motor housing is integrated into the main housing. The in-line design has a separate motor housing.

- An internal spring is used in both designs to return the throttle plate to a default position. The default position is typically a throttle angle of 7 to 8 degrees from the hard stop angle.

- The closed throttle plate hard stop is used to prevent the throttle from binding in the bore (approximately 0.75 degree). This hard stop setting is not adjustable and is set to result in less airflow than the minimum engine airflow required at idle.

- The required idle airflow is provided by the plate angle in the throttle body assembly. This plate angle controls idle, idle quality, and eliminates the need for an IAC valve.

- There is 1 reference voltage and 1 signal return circuit between the PCM and the ETB. The reference voltage circuit and the signal return circuit is shared with the reference voltage circuits and signal return circuits used by the APP sensor. There are also 2 TP signal circuits for redundancy. The redundant TP signals are required for increased monitoring reasons. The first TP signal (TP1) has a negative slope (increasing angle, decreasing voltage) and the second signal (TP2) has a positive slope (increasing angle, increasing voltage). The TP2 signal reaches a limit of approximately 4.5 volts at approximately 45 degrees of throttle angle.

Accelerator Pedal Position (APP) Sensor

Depending on the application either a 2-track or 3-track APP sensor is used.

Electronic Throttle Control (ETC) System Strategy

ETC System With A 3-Track APP Sensor Failure Mode And Effects Management (Part 1)

ETC System with a 3-Track APP Sensor Failure Mode and Effects Management:

Effect	Failure Mode [a]
RPM Guard with Pedal Follower	In this mode, torque control is disabled due to the loss of a critical sensor or PCM concern. The throttle is controlled in pedal-follower mode as a function of the pedal position sensor input only. A maximum allowed RPM is determined based on the position of the accelerator pedal (RPM Guard). If the actual RPM exceeds this limit, spark and fuel are used to bring the RPM below the limit. The powertrain malfunction indicator (wrench) and the MIL illuminate in this mode and a DTC for an ETC-related component is set. EGR, VCT, and IMRC outputs are set to default values.
RPM Guard with Default Throttle	In this mode, the throttle plate control is disabled due to the loss of throttle position, the throttle plate position controller, or other major electronic throttle body concern. Depending on the concern detected, the throttle plate is either commanded to the default (limp home) position or the motor is disabled and the spring returns the throttle plate to the default (limp home) position. A maximum allowed RPM is determined based on the position of the accelerator pedal (RPM Guard). If the actual RPM exceeds this limit, spark and fuel are used to bring the RPM below the limit. The powertrain malfunction indicator (wrench) and the MIL illuminate in this mode and a DTC P2110 is set. EGR, VCT, and IMRC outputs are set to default values.
RPM Guard with High Forced Idle	This mode is caused by the loss of 2 or 3 pedal position sensor inputs due to sensor, wiring, or PCM concerns. The system is unable to determine driver demand, and the throttle is controlled to a fixed high idle airflow. There is no response to the driver input. The maximum allowed RPM is a fixed value (RPM Guard). If the actual RPM exceeds this limit, spark and fuel are used to bring the RPM below the limit. The powertrain malfunction indicator (wrench) and the MIL illuminate in this mode and a DTC P2104 is set. EGR, VCT, and IMRC outputs are set to default values.
Shutdown	If a significant processor concern is detected, the monitor forces vehicle shutdown by disabling all fuel injectors. The powertrain malfunction indicator (wrench) illuminates in this mode and a DTC P2105 is set.

a ETC illuminates or displays a message on the message center immediately; MIL illuminates after 2 driving cycles

ETC System With A 3-Track APP Sensor Failure Mode And Effects Management (Part 2)

ETC System with a 2-Track APP Sensor Failure Mode and Effects Management:

Effect	Failure Mode
No Effect on Driveability	A loss of redundancy or loss of a non-critical input could result in a concern that does not affect driveability. The powertrain malfunction indicator (wrench) and the MIL do not illuminate. However, speed control and power take off (PTO) may be disabled. A DTC is set to indicate the component or circuit with the concern.
Delayed APP Sensor Response with Brake Override	This mode is caused by the loss of 1 APP sensor input due to sensor, wiring, or PCM concerns. The system is unable to verify the APP sensor input and driver demand. The throttle plate response to the APP sensor input is delayed as the accelerator pedal is applied. The engine returns to idle RPM whenever the brake pedal is applied. The powertrain malfunction indicator (wrench) illuminates, but the MIL does not illuminate in this mode. An APP sensor related DTC is set.
Time-Based Driver Demand with Brake Override	This mode is caused by the loss of one brake pedal position (BPP) and one APP sensor input or both APP sensor inputs due to sensor, wiring, or PCM concerns. The system is unable to determine driver demand. There is no response when the accelerator pedal is applied. The engine returns to idle RPM whenever the brake pedal is applied. When the brake pedal is released, the PCM slowly increases the APP signal to a fixed value. The powertrain malfunction indicator (wrench) illuminates, but the MIL does not illuminate in this mode. An APP or BPP sensor related DTC is set.
RPM Guard with Pedal Follower	In this mode, torque control is disabled due to the loss of a critical sensor or PCM concern. The throttle is controlled in pedal-follower mode as a function of the APP sensor input only. A maximum allowed RPM is determined based on the position of the accelerator pedal (RPM Guard). If the actual RPM exceeds this limit, spark and fuel are used to bring the RPM below the limit. The powertrain malfunction indicator (wrench) and the MIL illuminate in this mode and a DTC for an ETC-related component is set. EGR, VCT, and IMRC outputs are set to default values and speed control is disabled.
RPM Guard with Default Throttle	In this mode, the throttle plate control is disabled due to the loss of both TP sensor inputs, loss of throttle plate control, stuck throttle plate, significant processor concerns, or other major electronic throttle body concern. The spring returns the throttle plate to the default (limp home) position. A maximum allowed RPM is determined based on the position of the accelerator pedal (RPM Guard). If the actual RPM exceeds this limit, spark and fuel are used to bring the RPM below the limit. The powertrain malfunction indicator (wrench) and the MIL illuminate in this mode and a DTC for an ETC-related component is set. EGR, VCT, and IMRC outputs are set to default values and speed control is disabled.

Electronic Throttle Monitor Operation:

DTCs [a]	
P060X, P061X	PCM processor concern (MIL, powertrain malfunction indicator [wrench])
P2104 (ETC system with a 3-track APP sensor)	ETC FMEM forced idle, 2 or 3 pedal sensor concerns (MIL, powertrain malfunction indicator [wrench])
P2105 (ETC system with a 3-track APP sensor)	ETC FMEM forced engine shutdown; PCM concern (MIL, powertrain malfunction indicator [wrench])
P2110 (ETC system with a 3-track APP sensor)	ETC FMEM forced limited RPM; Concern with both TP sensors; throttle plate position control concern (MIL, powertrain malfunction indicator [wrench])
U0300	ETC software version mismatch between processors internal to the PCM (non-MIL, powertrain malfunction indicator [wrench])

a Monitor execution is continuous. Monitor false detection duration is less than 1 second to register a concern.

ETC System With A 2-Track APP Sensor Failure Mode And Effects Management

Electronic Throttle Monitor Operation

Accelerator Pedal Position (APP) Sensor Check:

DTCs[a]	
P1575 (ETC system with a 2-track APP sensor)	APP sensor out of self-test range
P2122, P2123, P2127, P2128, P2132, P2133	APP sensor circuit continuity test (powertrain malfunction indicator [wrench], non-MIL)
P2121, P2126, P2131 (ETC system with a 3-track APP sensor)	APP range/performance (powertrain malfunction indicator [wrench], non-MIL)
P2138 (ETC system with a 2-track APP sensor)	APP to APP signal correlation (powertrain malfunction indicator [wrench], non-MIL)

a Correlation and range/performance - sensor disagreement between processors internal to the PCM. Monitor execution is continuous. Monitor false detection duration is less than 1 second to register a concern. Refer to Powertrain DTC Charts and Descriptions, Diagnostic Trouble Code (DTC) Charts and Descriptions for additional DTC information.

Throttle Position (TP) Sensor Check:

DTCs [a]	
P0122, P0123, P0222, P0223	TP circuit continuity test (MIL, powertrain malfunction indicator [wrench])
P0121, P0221 (ETC system with a 3-track APP sensor)	TP range/performance (non-MIL)
P1124 (ETC system with a 2-track APP sensor)	TP sensor out of self-test range
P2135	TP to TP sensor correlation test (powertrain malfunction indicator [wrench], non-MIL)

a Correlation and range/performance - sensor disagreement between processors internal to the PCM, TP inconsistent with requested throttle plate position. Monitor execution is continuous. Monitor false detection duration is less than 1 second to register a concern. Refer to Powertrain DTC Charts and Descriptions, Diagnostic Trouble Code (DTC) Charts and Descriptions for additional DTC information.

Electronic TAC Operation Check:

DTCs [a]	
P115E	Throttle actuator airflow trim at maximum limit (non-MIL)
P2072 (ETC system with a 3-track APP sensor)	Throttle body ice blockage (non-MIL)
P2100 (ETC system with a 3-track APP sensor)	Throttle actuator circuit open, short to power, short to ground (MIL)
P2101	Throttle actuator range/performance test (MIL)
P2107	Processor and TAC motor circuit test (MIL)
P2111	Throttle actuator system stuck open (MIL)
P2112	Throttle actuator system stuck closed (MIL)

a Note: For all DTCs, in addition to the MIL, the powertrain malfunction indicator (wrench) is on for the concern that caused the FMEM action. Monitor execution is continuous. Monitor false detection duration is less than 5 seconds to register a concern.

The torque based ETC strategy was developed to improve fuel economy and to accommodate variable camshaft timing (VCT). This is possible by not coupling the throttle angle to the driver

pedal position. Uncoupling the throttle angle (produce engine torque) from the pedal position (driver demand) allows the powertrain control strategy to optimize fuel control and transmission shift schedules while delivering the requested wheel torque.

The ETC monitor system is distributed across 2 processors within the PCM: the main powertrain control processor unit (CPU) and a separate monitoring processor. The primary monitoring function is carried out by the independent plausibility check (IPC) software, which resides on the main processor. It is responsible for determining the driver-demanded torque and comparing it to an estimate of the actual torque delivered. If the generated torque exceeds driver demand by a specified amount, appropriate corrective action is taken.

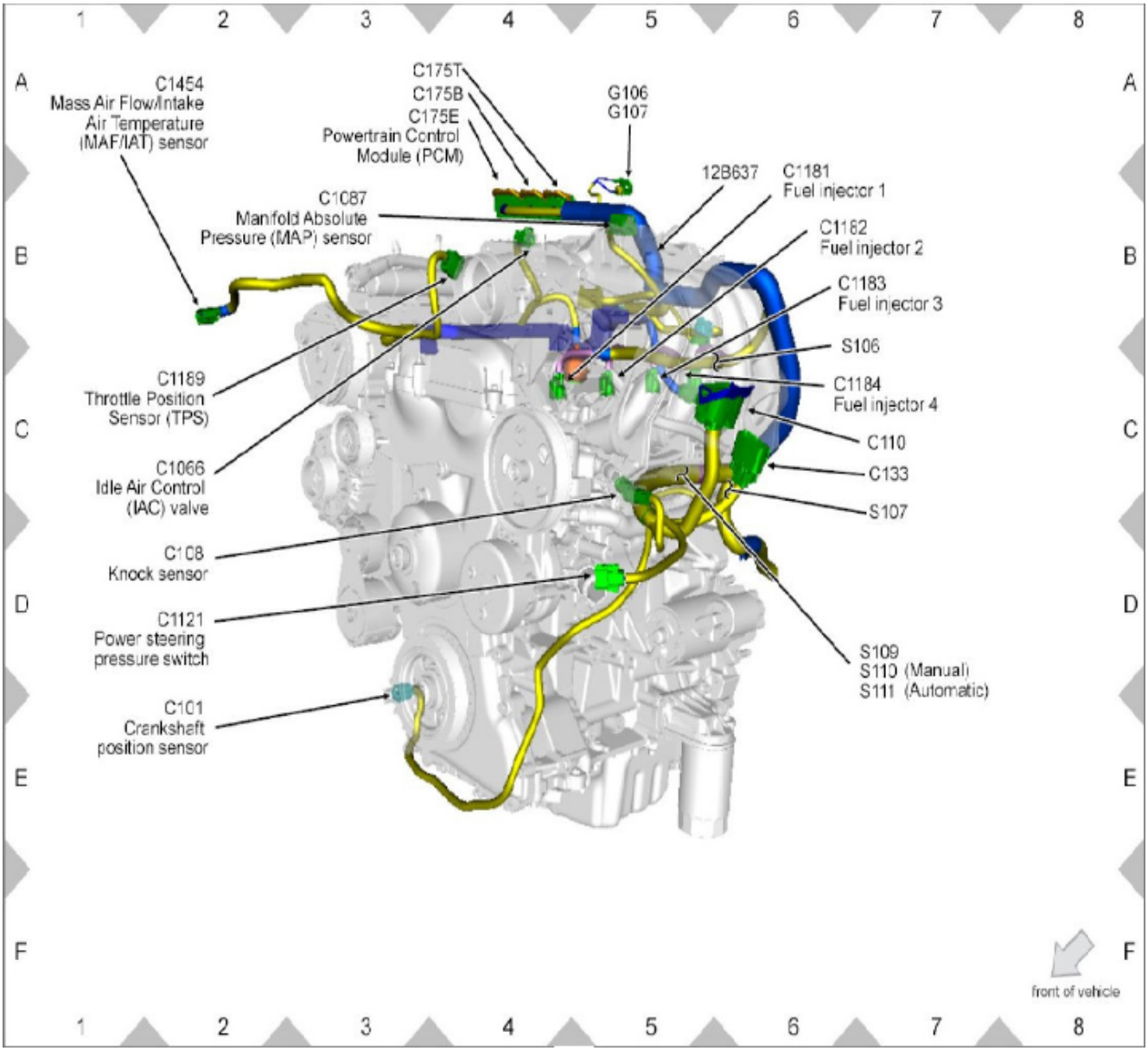
APP and TP Sensor Inputs

Accelerator Pedal Position (APP) Sensor Check

Throttle Position (TP) Sensor Check

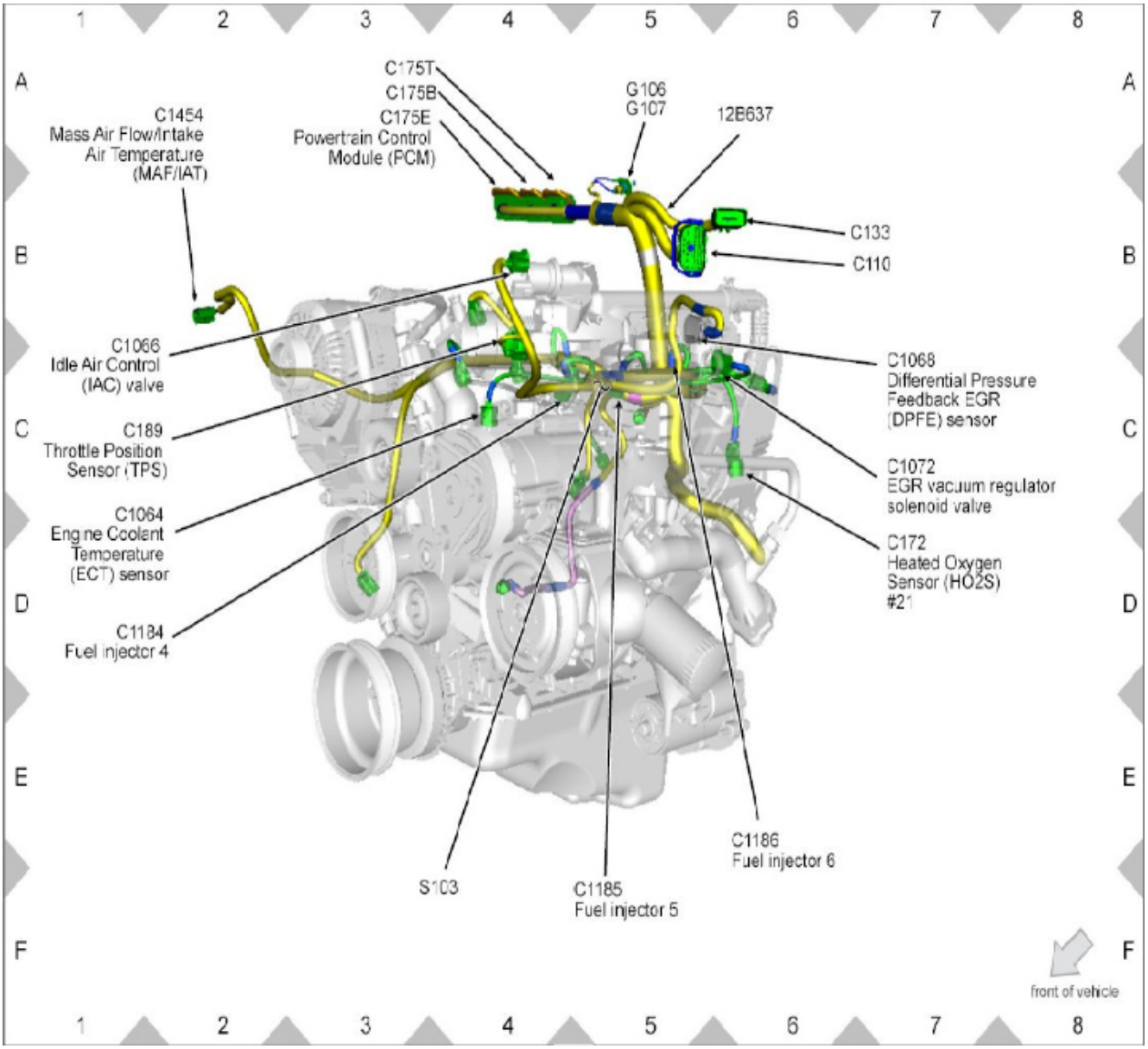
Electronic Throttle Actuator Control (TAC) Output

Electronic TAC Operation Check

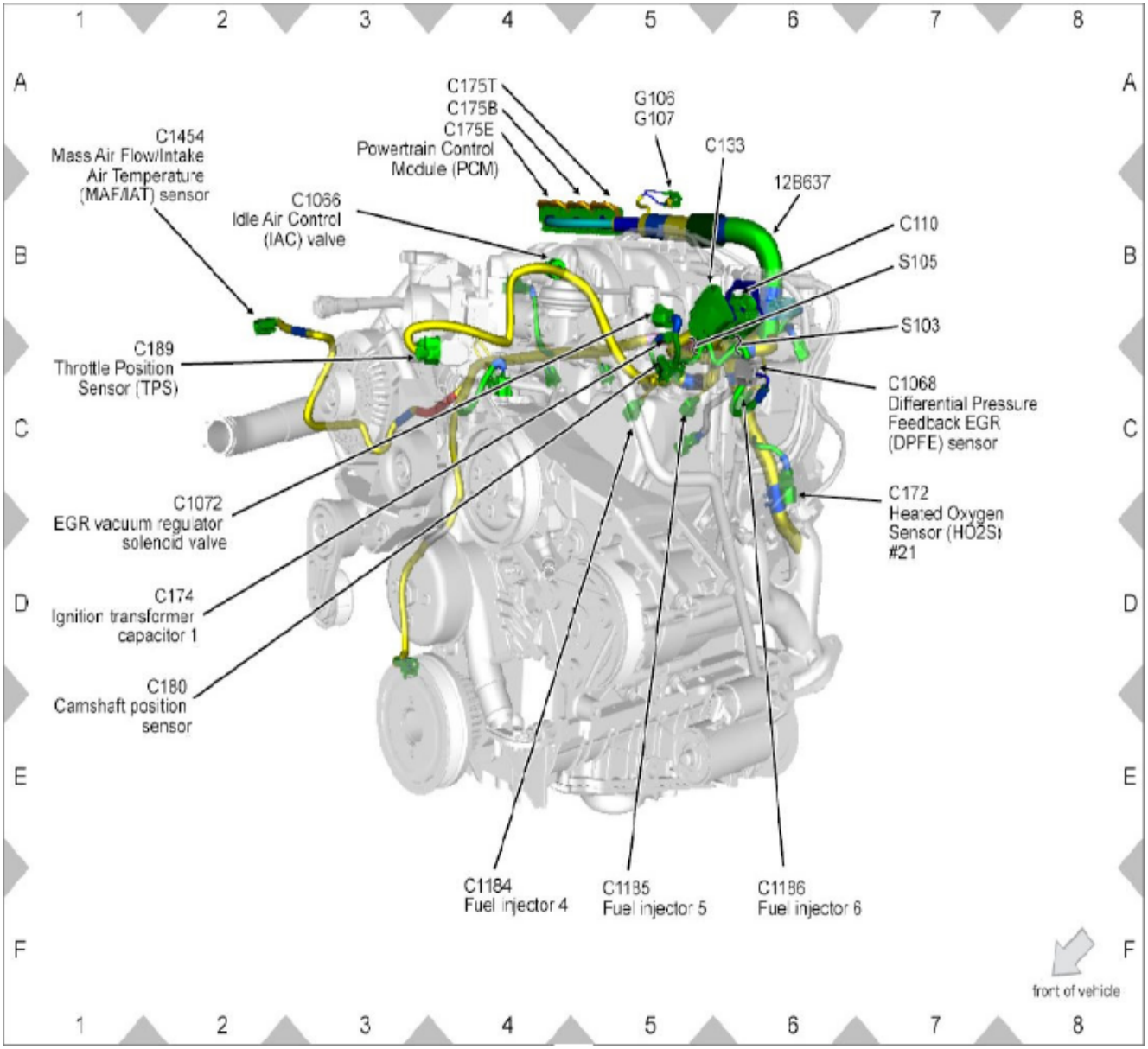


Engine Control Module: Locations

View 151-3


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
12B637
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT)
C133
C110
C1066
Idle Air Control (IAC) valve
C189
Throttle Position Sensor (TPS)
C1064
Engine Coolant Temperature (ECT) sensor
C1184
Fuel injector 4
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
S103
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

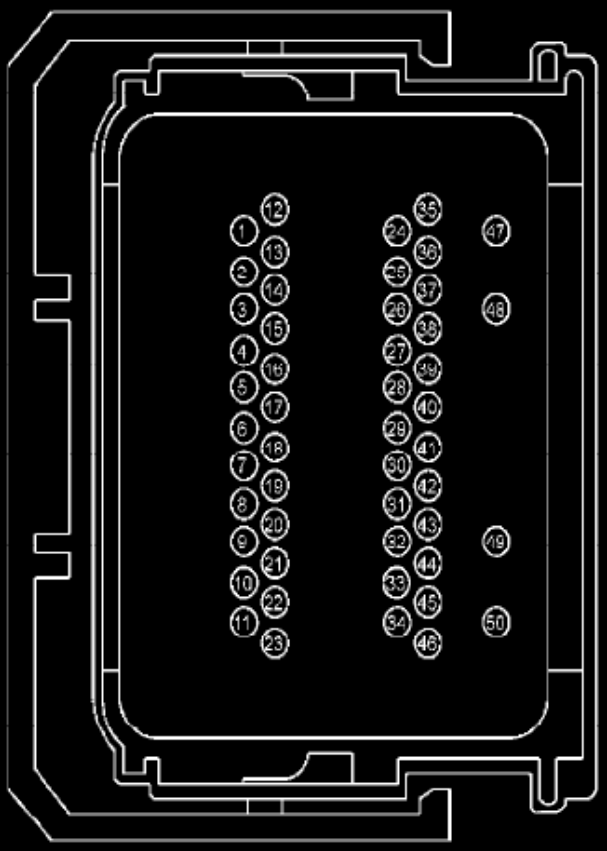
View 151-5


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
C133
12B637
C110
S105
S103
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor
C1066
Idle Air Control (IAC) valve
C189
Throttle Position Sensor (TPS)
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
C174
Ignition transformer capacitor 1
C180
Camshaft position sensor
C1184
Fuel injector 4
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-7

Connector: C175B

Description:	Harness:	Base Part #:
POWERTRAIN CONTROL MODULE (PCM)	12B637	12A650



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VCM05 (VT-OG)	20	CTRL MOD. - VEHICLE SPEED OUTPUT (VSOUT)	
2	CDC12 (YE)	20	CTRL MOD. - POWERTRAIN # STARTER MOTOR CONTROL (SMC)	
3	VE922 (VT-GN)	20	TRANSDUCER - FUEL TANK PRESSURE (FTPT)	
4	*	*	not used	
5	*	*	not used	
6	*	*	not used	
7	CBP21 (BU-GY)	20	FUSE - 21 OR CIRCUIT BREAKER	M/T
7	CET40 (GN-OG)	20	SWITCH - TRANSMISSION RANGE # PARK/NEUTRAL (TRSW-PN)	A/T
8	CCB15 (BN-GN)	20	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL CLOSED	
9	*	*	not used	
10	GD108 (BK-VT)	18	GROUND - CHASSIS/BATTERY	
11	VDB04 (WH-BU)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED HIGH	
12	VE225 (YE-OG)	20	CTRL MOD. - POWERTRAIN # FUEL PUMP MODULE COMMAND (FPC)	
13	CE114 (GN-BU)	20	CTRL MOD. - POWERTRAIN # CANISTER VENT SOLENOID (CANVNT)	
14	CH302 (WH-BN)	20	CTRL MOD. - POWERTRAIN # A/C CLUTCH CONTROL RELAY/WOT AC CUTOFF (ACCR)	
15	CH425 (GN-BU)	20	SWITCH - AC HEAD PRESSURE (ACPSW)	
16	*	*	not used	
17	*	*	not used	
18	*	*	not used	
19	*	*	not used	
20	*	*	not used	
21	VE518 (BN-WH)	18	MONITOR - FUEL PUMP (FPM)	
22	*	*	not used	
23	VDB05 (WH)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED LOW	
24	*	*	not used	
25	*	*	not used	
26	*	*	not used	
27	*	*	not used	
28	*	*	not used	
29	CET34 (BN-GN)	20	SWITCH - TRANSMISSION CONTROL/OVERDRIVE CANCEL (TCS)	
30	*	*	not used	
31	*	*	not used	
32	*	*	not used	
33	CDC36	20	SWITCH - START INTERLOCK	M/T

Engine Control Module: Diagrams

C175B (Part 1)

	(GN-BN)		CLUTCH PEDAL	
34	CCS09 (GN)	20	SWITCH - POWER STEERING PRESSURE (PSPS)	
35	CBB39 (VT-WH)	18	FUSE - 39 OR CIRCUIT BREAKER	
36	CBB39 (VT-WH)	18	FUSE - 39 OR CIRCUIT BREAKER	
37	*	*	not used	
38	*	*	not used	
39	CE904 (GN-VT)	20	SWITCH - CLUTCH PEDAL POSITION # TOP OF TRAVEL (CPP-TT)	M/T
40	LE424 (YE-GN)	20	CTRL MOD. - POWERTRAIN # VOLTAGE REFERENCE COWL (C-VREV)	
41	RE407 (YE-VT)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN COWL (C-SIGRTN) (SIGRTN C)	
42	*	*	not used	
43	*	*	not used	
44	CUB08 (BN)	20	CONNECTOR - DIAGNOSTIC # FLASH EEPROM POWER SUPPLY (FEPS)	
45	SBB21 (GY-RD)	20	FUSE - 21 OR CIRCUIT BREAKER	
46	*	*	not used	
47	GD108 (BK-VT)	18	GROUND - CHASSIS/BATTERY	
48	GD108 (BK-VT)	18	GROUND - CHASSIS/BATTERY	
49	GD108 (BK-VT)	18	GROUND - CHASSIS/BATTERY	
50	GD108 (BK-VT)	18	GROUND - CHASSIS/BATTERY	

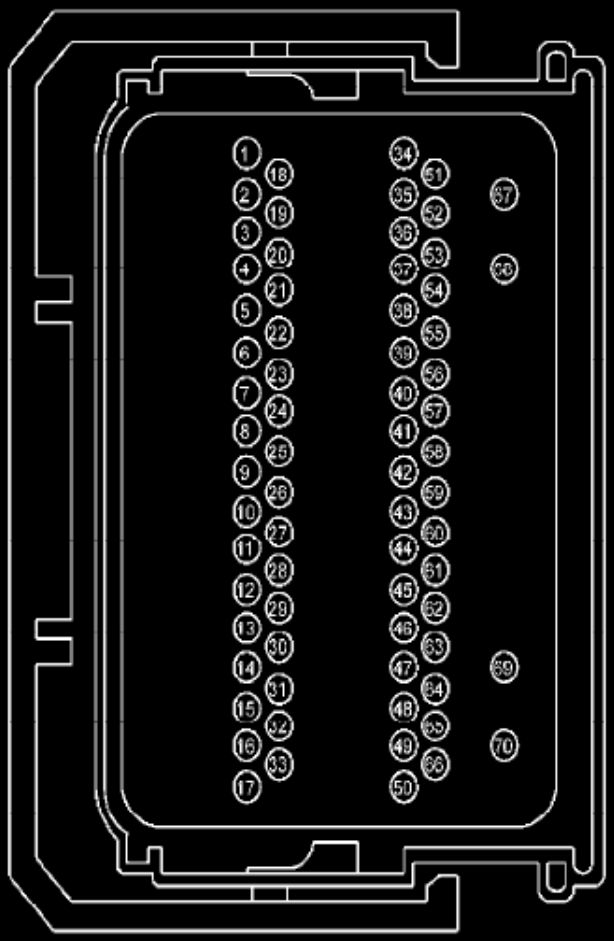
C175B (Part 2)

Connector: C175E

Description: POWERTRAIN CONTROL MODULE (PCM)

Harness: 12B637

Base Part #: 12A650



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	*	*	not used	
3	CE328 (YE-VT)	18	CTRL MOD. - POWERTRAIN # POS. CRANKCASE VENTIL. FITTING HEATER CONTROL (PCVFHC)	3.0L/4.0L
4	*	*	not used	
5	*	*	not used	
6	CE132 (BN-YE)	18	CTRL MOD. - POWERTRAIN # ELECTRIC VAPOR MANAGEMENT VALVE (EVMV)	
7	VH101 (WH-VT)	20	CTRL MOD. - CLIMATE # BLOWER MOTOR CONTROL	2.3L
8	CE101 (WH-VT)	18	CTRL MOD. - POWERTRAIN # EXHAUST GAS RECIRCUL. MOTOR (STEPPER CONTR. 1) (EGRMC) (+)	2.3L
9	*	*	not used	
10	*	*	not used	
11	*	*	not used	
12	CE125 (WH)	18	CTRL MOD. - POWERTRAIN # DISTRIBUTORLESS IGNITION SYSTEM COIL DRIVER C (DIS)	2.3L
12	CE123 (YE-GY)	18	CTRL MOD. POWERTRAIN # DISTRIBUTORLESS IGNITION SYSTEM COIL DRIVER A (DIS)	3.0L/4.0L
13	CE102 (YE-BU)	18	CTRL MOD. - POWERTRAIN # EXHAUST GAS RECIRCUL. MOTOR (STEPPER CONTR. 2) (EGRMC) (-)	2.3L
14	*	*	not used	
15	*	*	not used	
16	CE125 (WH)	18	CTRL MOD. - POWERTRAIN # DISTRIBUTORLESS IGNITION SYSTEM COIL DRIVER C (DIS)	3.0L/4.0L
17	CE124 (BU-BN)	18	CTRL MOD. - POWERTRAIN # DISTRIBUTORLESS IGNITION SYSTEM COIL DRIVER B (DIS)	
18	VE716 (YE)	20	SENSOR - ENGINE COOLANT TEMPERATURE (ECT)	3.0L/4.0L
19	*	*	not used	
20	*	*	not used	
21	VE713 (GN-OG)	20	SENSOR - DELTA PRESSURE FEEDBACK EGR (DPFE)	3.0L/4.0L
22	VE740 (VT-GY)	20	SENSOR - INTAKE AIR TEMPERATURE (IAT)	
23	*	*	not used	
24	*	*	not used	
25	VE807 (YE-VT)	20	SENSOR - MASS AIR FLOW LH BANK OR 1ST BANK OR UNIQUE (MAF)	
26	RF320 (BU)	20	CTRL MOD. - POWERTRAIN # MASS AIR FLOW SEN. LH BANK OR 1ST BANK (MAFRTN)	
27	*	*	not used	
28	VE735 (VT-GN)	18	SENSOR - HEATED OXYGEN PRE CAT. 1ST OR UNIQUE (HO2S11)	

C175E (Part 1)

29	VE737 (WH-BU)	18	SENSOR - HEATED OXYGEN PRE CAT. 2ND (HO2S21)	3.0L/4.0L
30	*	*	not used	
31	*	*	not used	
32	*	*	not used	
33	CE301 (GY-OG)	20	CTRL MOD. - POWERTRAIN # IDLE AIR CONTROL VALVE (IAC)	
34	*	*	not used	
35	CE206 (GY-TE)	20	CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 2 (INJ)	
36	CE208 (YE-OG)	20	CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 4 (INJ)	
37	CE210 (GN-WH)	20	CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 6 (INJ)	3.0L/4.0L
38	*	*	not used	
39	CE103 (BU-BN)	18	CTRL MOD. - POWERTRAIN # EXHAUST GAS RECIRCUL MOTOR (STEPPER CONTR. 3) (EGRMC)	2.3L
40	*	*	not used	
41	CE116 (VT-BN)	20	CTRL MOD. POWERTRAIN # CYLINDER HEAD TEMPERATURE INDICATOR LIGHT (CHTIL)	2.3L
42	*	*	not used	
43	*	*	not used	
44	*	*	not used	
45	VE706 (BN-BU)	18	SENSOR - CAMSHAFT POSITION BANK 1 IN+EX/ IN (CMP1) [CID-H] (CID1)	
46	RE135 (GN-BN)	18	CTRL MOD. - POWERTRAIN # CRANKSHAFT POSITION SENSOR (CKPN)	
47	VE711 (YE-VT)	18	SENSOR - CRANKSHAFT POSITION (CKPP)	
48	RE323 (WH-BN)	20	CTRL MOD. - POWERTRAIN # KNOCK SENSOR 1ST OR UNIQUE (KS1N) [KSL1-]	
49	VE801 (VT-OG)	20	SENSOR - KNOCK 1ST OR UNIQUE (KS1P) [KSL1+]	
50	*	*	not used	
51	*	*	not used	
52	CE205 (GN-BU)	20	CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 1 (INJ)	
53	CE207 (VT-GY)	20	CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 3 (INJ)	
54	CE209 (BN)	20	CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 5 (INJ)	3.0L/4.0L
55	*	*	not used	
56	CE104 (GN)	18	CTRL MOD. - POWERTRAIN # EXHAUST GAS RECIRCUL MOTOR (STEPPER CONTR. 4) (EGRMC)	2.3L
57	LE423 (GN-VT)	20	CTRL MOD. - POWERTRAIN # VOLTAGE REFERENCE ENGINE (VREF) (E-VREV)	
58	RE405 (GN-WH)	18	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	
59	*	*	not used	
60	*	*	not used	

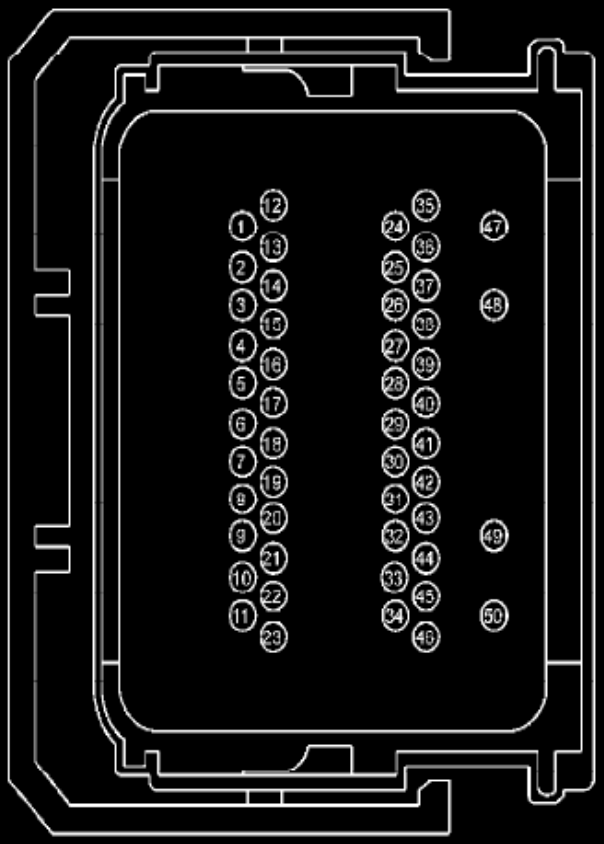
C175E (Part 2)

61	VE819 (GN-VT)	20	SENSOR - THROTTLE POSITION # POSITIVE SLOPE (TP2-PS)	
62	VE803 (BU-GN)	20	SENSOR - MANIFOLD ABSOLUTE PRESSURE (MAP)	2.3L
63	CE133 (VT WH)	20	CTRL MOD. - POWERTRAIN # ELECTRONIC VACUUM REGULATOR (EVR)	3.0L/4.0L
64	*	*	not used	
65	*	*	not used	
66	*	*	not used	
67	*	*	not used	
68	*	*	not used	
69	CE235 (GN-BN)	18	CTRL MOD. - POWERTRAIN # HEATER OXYGEN SEN. PRE CAT. 1ST OR UNIQUE (HTR11)	
70	CE236 (GY-VT)	18	CTRL MOD. - POWERTRAIN # HEATER OXYGEN SEN. PRE CAT. 2ND (HTR21)	3.0L/4.0L

C175E (Part 3)

Connector: C175T

Description:	Harness:	Base Part #:
POWERTRAIN CONTROL MODULE (PCM)	12B637	12A650



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	*	*	not used	
3	RET04 (YE-OG)	20	CTRL MOD. - POWERTRAIN # SENSOR OUTPUT SHAFT SPEED (OSS)	
4	VE739 (GY-YE)	20	SENSOR - INTERMEDIATE SHAFT SPEED SENSOR	A/T
5	*	*	not used	
6	*	*	not used	
7	*	*	not used	
8	*	*	not used	
9	*	*	not used	
10	*	*	not used	
11	VET27 (BN-YE)	20	CTRL MOD. - POWERTRAIN # SOLENOID PRESSURE CONTROL 2 (PC2) [EPC] [VFS]	A/T
12	*	*	not used	
13	*	*	not used	
14	*	*	not used	
15	VET33 (WH-OG)	20	SENSOR - TURBINE/TRANSMISSION SHAFT SPEED (TSS)	A/T
16	VET129 (VT-WH)	20	SENSOR - TRANSMISSION RANGE # 1 (TR1)	A/T
17	VET30 (YE)	20	SENSOR - TRANSMISSION RANGE # 2 (TR2)	A/T
18	*	*	not used	
19	*	*	not used	
20	*	*	not used	
21	*	*	not used	
22	*	*	not used	
23	*	*	not used	
24	VE731 (YE-GN)	18	SENSOR - HEATED OXYGEN POST CAT. 1ST OR UNIQUE (HO2S12)	
25	VE733 (WH)	18	SENSOR - HEATED OXYGEN POST CAT. 2ND (HO2S22)	3.0L, 4.0L
26	*	*	not used	
27	VET28 (GY-VT)	20	SENSOR - TRANSMISSION RANGE # (TR-3A)	A/T
28	VET31 (BU-OG)	20	SENSOR - TRANSMISSION RANGE # 4 (TR4)	A/T
29	VET06 (GN-BN)	20	SENSOR - TRANSMISSION FLUID TEMPERATURE (TFT)	A/T
30	*	*	not used	
31	*	*	not used	
32	*	*	not used	
33	*	*	not used	
34	*	*	not used	
35	*	*	not used	
36	*	*	not used	
37	*	*	not used	
38	*	*	not used	
39	*	*	not used	
40	*	*	not used	

C175T (Part 1)

41	RE406 (GY-VT)	18	CTRL MOD. - POWERTRAIN # SIGNAL RETURN TRANSMISSION (T-SIGRTN) (SIGRTN-B)	
42	CET05 (BU-GN)	20	CTRL MOD. - POWERTRAIN # SOLENOID SHIFT CONTROL LOW-SIDE A (SSA)	A/T
43	CET18 (GY-YE)	20	CTRL MOD. - POWERTRAIN # SOLENOID SHIFT CONTROL LOW-SIDE B (SSB)	A/T
44	CET07 (GY-OG)	20	CTRL MOD. - POWERTRAIN # SOLENOID SHIFT CONTROL LOW-SIDE C (SSC)	A/T
45	CET44 (BU-BN)	20	CTRL MOD. - POWERTRAIN # SOLENOID SHIFT CONTROL LOW-SIDE D (SSD)	A/T
46	CET19 (VT GY)	20	CTRL MOD. - POWERTRAIN # TORQUE CONVERTER CLUTCH HIGH IMPEDENCE (TCCH)	A/T
47	CE233 (WH-OG)	18	CTRL MOD. - POWERTRAIN # HEATER OXYGEN SEN. POST CAT. 1ST OR UNIQUE (HTR12)	
48	CE234 (BU-WH)	18	CTRL MOD. - POWERTRAIN # HEATER OXYGEN SEN. POST CAT. 2ND (HTR22)	3.0L, 4.0L
49	*	*	not used	
50	*	*	not used	

C175T (Part 2)

Engine Control Module: Procedures

FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)

Description

The EEPROM is contained in an integrated circuit internal to the powertrain control module (PCM). The EEPROM contains the vehicle strategy including calibration information specific to the vehicle, and is capable of being programmed or flashed repeatedly.

As part of the calibration there is an area referred to as the vehicle identification (VID) block. The VID block is programmed when installing a new PCM as described under Programming the VID Block for a Replacement PCM. Failure to carry out this procedure may generate DTCs PI635 or P1639. The VID block in an existing PCM can also be tailored to accommodate various hardware or parameter changes made to the vehicle since production. Failure to carry out this procedure properly may generate DTC P1635, Tire/Axle Ratio out of Acceptable Range. An incorrect tire/axle ratio is one of the main causes for DTC P1639. This is described under Making Changes to the VID Block and also under Making Changes to the PCM Calibration. The VID block contains many items used by the strategy for a variety of functions. Some of these items include the vehicle identification number (VIN), octane adjust, fuel octane, fuel type, vehicle speed limit, tire size, axle ratio, the presence of speed control, and 4-wheel drive electronic shift-on-the-fly (ESOF) versus manual shift-on-the-fly (MSOF). Only items applicable to the vehicle hardware and supported by the VID block is displayed on the scan tool.

When changing items in the VID block, the strategy places range limits on certain items such as tire and axle ratio. The number of times the VID block may be reconfigured is limited. When this limit is reached, the scan tool displays a message indicating the need to flash the PCM again to reset the VID block.

Programming can be carried out by a local Ford dealer or any non-Ford facility. Refer to the scan tool manufacturer's instruction manual for details.

Programming the VID Block for a Replacement PCM

A new PCM contains the latest strategy and calibration level for a particular vehicle. However, the VID block is blank and needs programming. There are 2 procedures available. The first is an automatic data transfer from the old PCM to the new PCM, and the second is manual data entry into the new PCM.

Automatic data transfer is carried out if the old PCM is capable of communicating. This is done by using a scan tool to retrieve data from the old PCM before removing it from the vehicle. The stored data can then be downloaded to the new PCM after it has been installed.

Carry out manual data entry if the old module is damaged or incapable of communicating. Remove and install a new PCM. Using a compatible scan tool, select and carry out the module/parameter programming, referring to the scan tool manufacturer's instruction manual. Make certain that all parameters are included. Failure to properly program tire size in revolutions per mile, (rev/mile equals 63,360 divided by the tire circumference in inches), axle ratio, 4x4/4x2, and/or MSOF/ESOF may result in DTCs P1635 and P1639. You may be instructed to contact the As-Built Data Center for the information needed to manually update the VID block with the scan tool. Contact the center only if the old PCM cannot be used or the data is corrupt. For Ford and Lincoln Mercury technicians, contact your National Hotline or the Professional Technician Society (PTS) website for As-Built data listed under the Service Publications Index. Non-Ford technicians use the Motorcraft(R) website at www.motorcraft.com. From the Motorcraft(R) homepage, use the search function to find the Module Programming or As-Built Data.

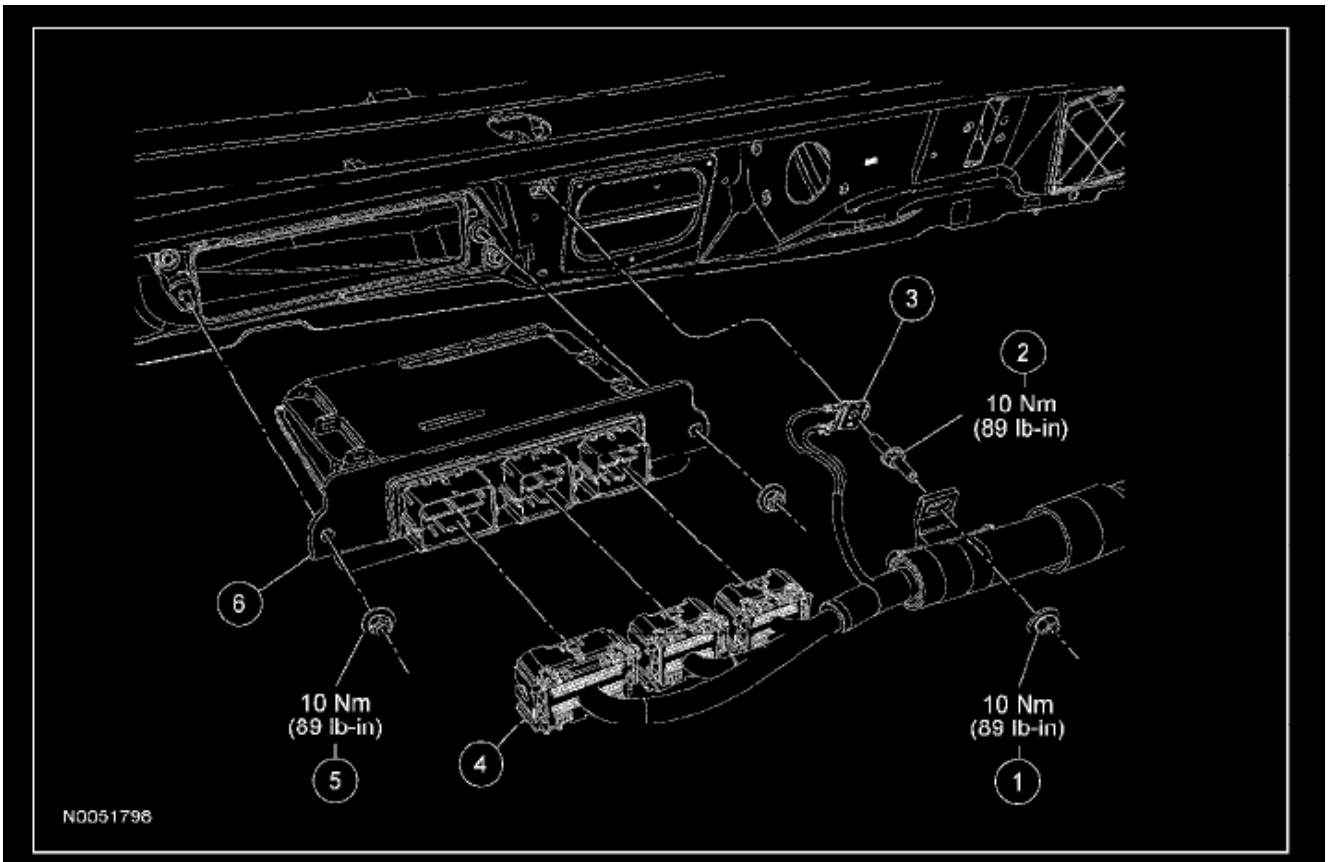
For Ford and Lincoln Mercury technicians, check the Programmable Module Installation link on the PTS website for quick Programmable Module data information by vehicle.

Making Changes to the VID Block

A PCM which is programmed may require changes to be made to certain VID information to accommodate the vehicle hardware. Refer to Module Reprogramming on the scan tool.

Making Changes to the PCM Calibration

At certain times, the entire EEPROM needs to be completely reprogrammed. This is due to changes made to the strategy or calibration after production, or the need to reset the VID block because it has reached its limit. Refer to Module Reprogramming on the scan tool.



Item	Part Number	Description
1	N621906	PCM wiring harness retainer nut
2	N806925	Ground wire stud bolt
3	—	Ground wire terminals (2 required) (part of 12B637)
4	14A464	PCM electrical connectors (3 required) (part of 12B637)
5	N621906	PCM nuts
6	12A651	PCM

Engine Control Module: Removal and Replacement

POWERTRAIN CONTROL MODULE (PCM)

Removal

1. Retrieve the module configuration. Carry out the module configuration retrieval steps of the Programmable Module Installation procedure. 2. Remove the PCM wiring harness retainer nut. 3. Remove the ground wire stud bolt. 4. Disconnect the 3 PCM electrical connectors. 5. Remove the 2 nuts and the PCM.

Installation

1. Install the PCM and the 2 nuts.

- Tighten to 10 Nm (89 lb-in).

2. Connect the 3 PCM electrical connectors. 3. Position the ground wire terminals and install the stud bolt.

- Tighten to 10 Nm (89 lb-in).

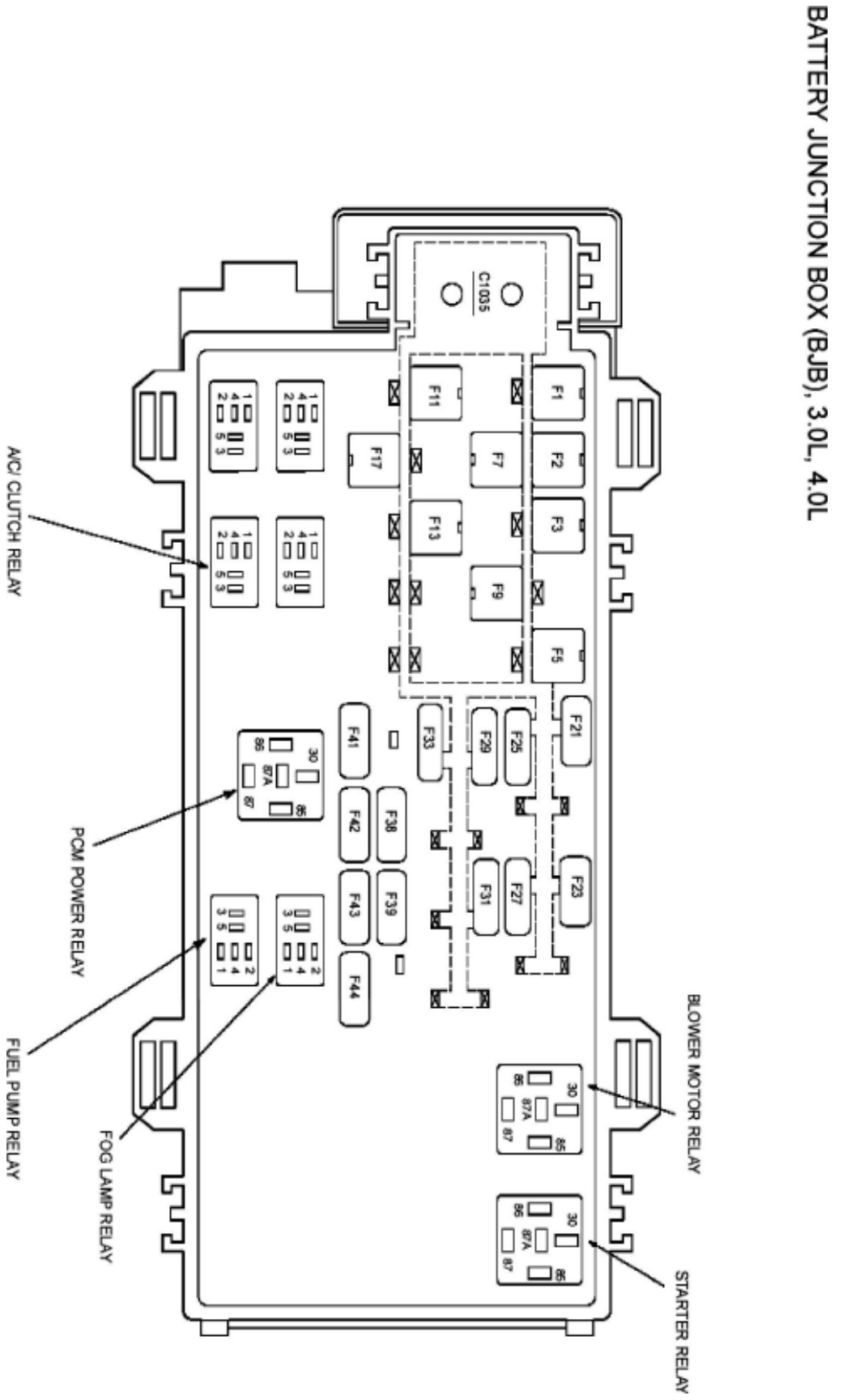
4. Install the PCM wiring harness retainer nut.

- Tighten to 10 Nm (89 lb-in).

5. NOTE: If a new PCM is installed, the parameters must be reset in both the PCM and the instrument cluster module or the vehicle will experience

a PATS no-start. This will occur even if the vehicle is not equipped with PATS. PATS vehicles and non-PATS vehicles have parameters in the instrument cluster module and the PCM and they both must be reset whenever a new PCM is installed.

Restore the module configurations for the instrument cluster module and the PCM. Carry out the module configuration restore steps of the Programmable Module Installation procedure.

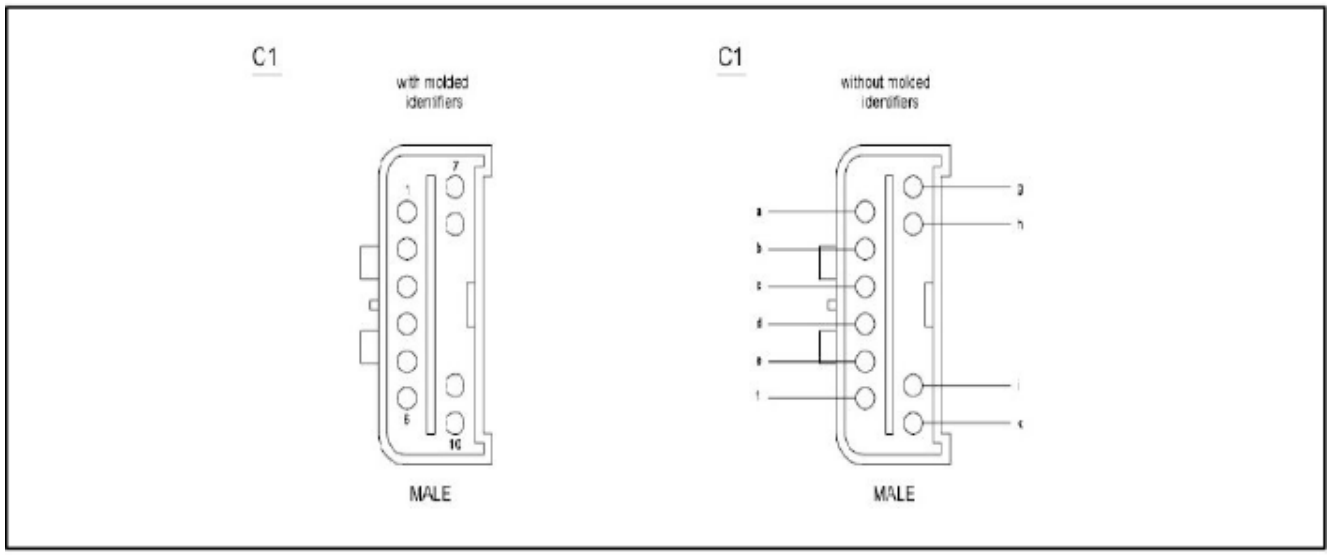

BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L
C1035
F1
F2
F3
F5
F7
F9
F11
F13
F17
F21
F23
F25
F27
F29
F31
F33
F38
F39
F41
F42
F43
F44
A/C CLUTCH RELAY
PCM POWER RELAY
FUEL PUMP RELAY
FOG LAMP RELAY
BLOWER MOTOR RELAY
STARTER RELAY

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



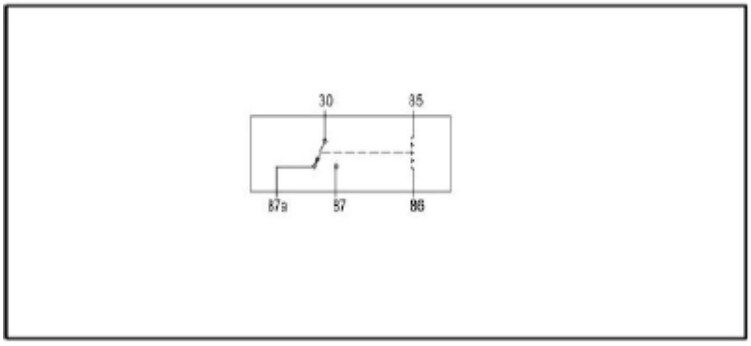
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

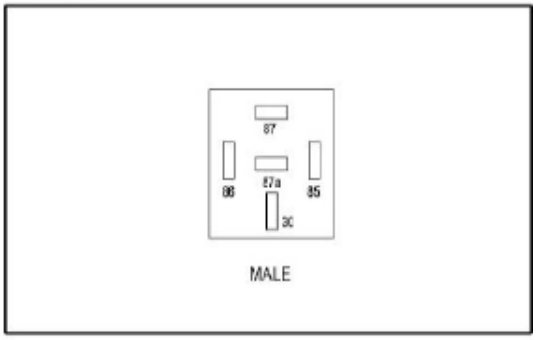
Main Relay (Computer/Fuel System): Testing and Inspection

Relay □ Mini ISO

Schematic



Terminals

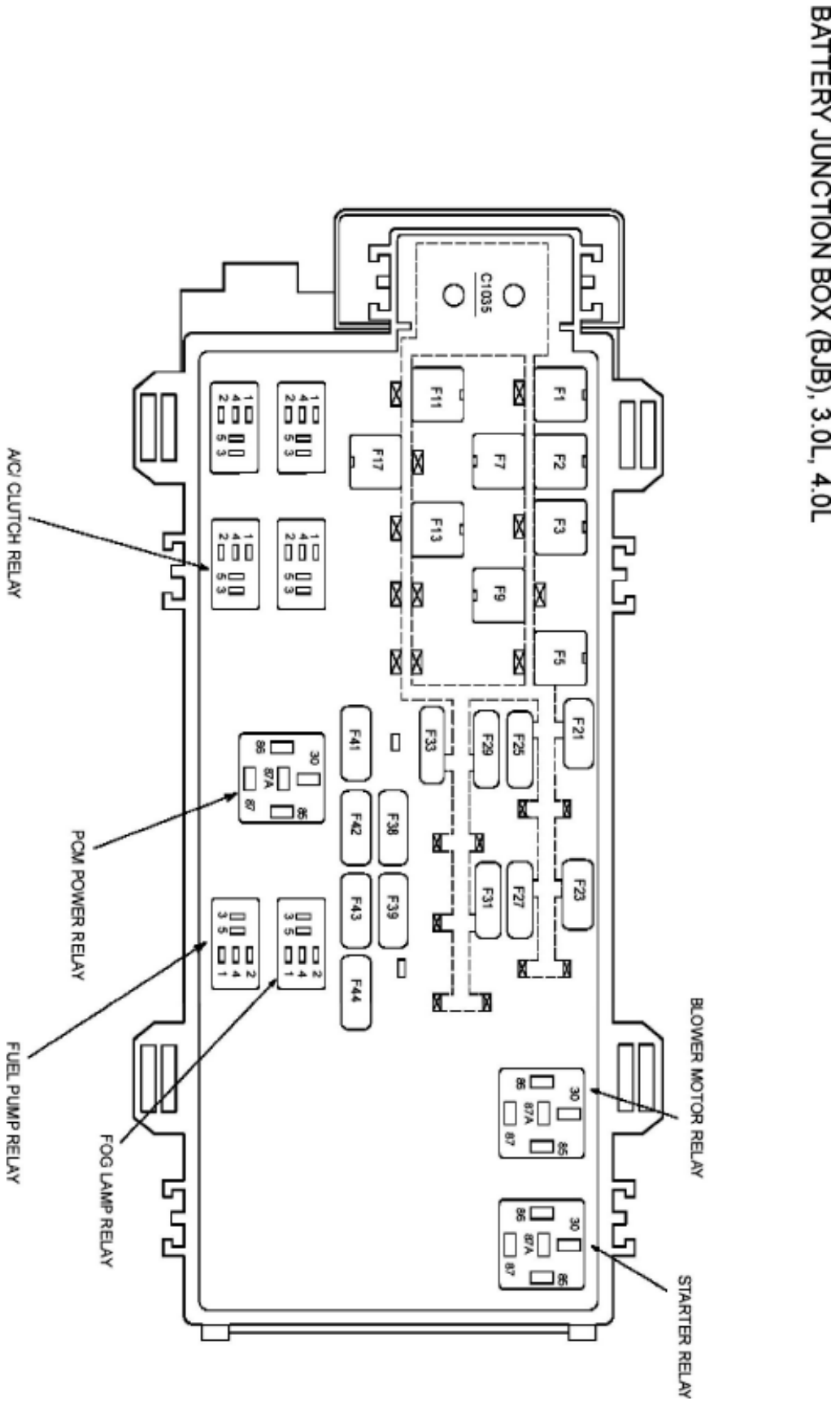


Component testing procedure (no voltage applied)

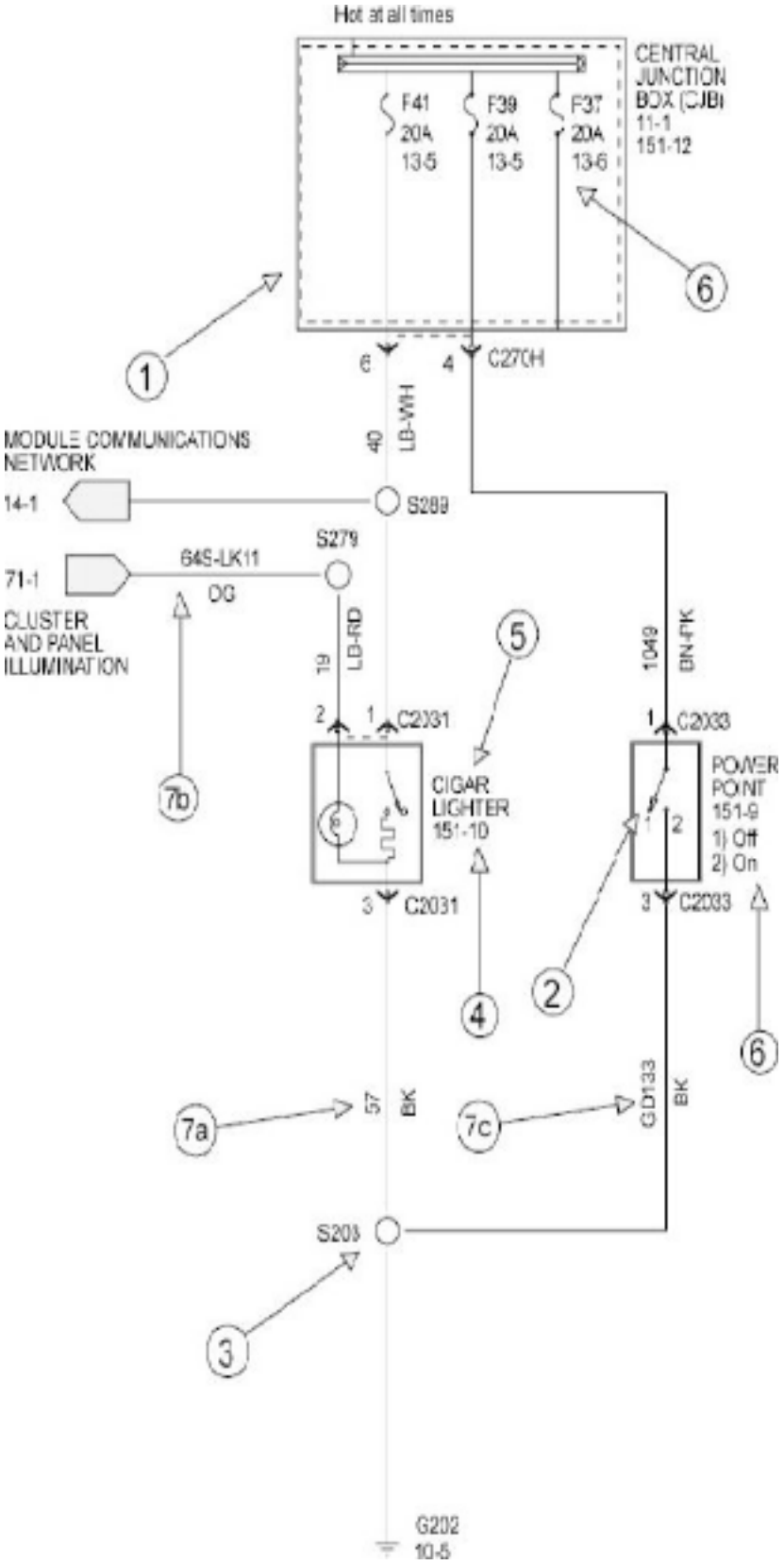
Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.


BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L
C1035
F1
F2
F3
F5
F7
F9
F11
F13
F17
F21
F23
F25
F27
F29
F31
F33
F38
F39
F41
F42
F43
F44
A/C CLUTCH RELAY
PCM POWER RELAY
FUEL PUMP RELAY
FOG LAMP RELAY
BLOWER MOTOR RELAY
STARTER RELAY

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Relays and Modules > Relays and Modules - Powertrain Management > Relays and Modules - Fuel Delivery and Air Induction > Fuel Pump Relay > Component Information > Diagrams > Diagram Information and Instructions



Fuel Pump Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

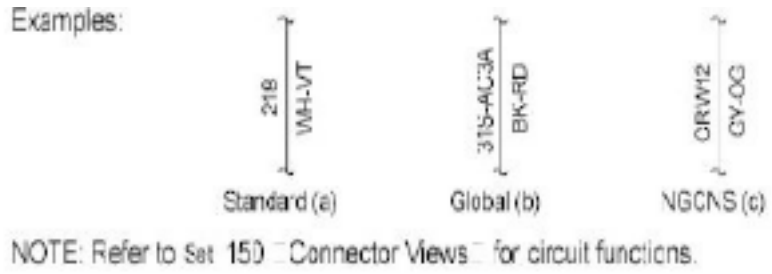
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

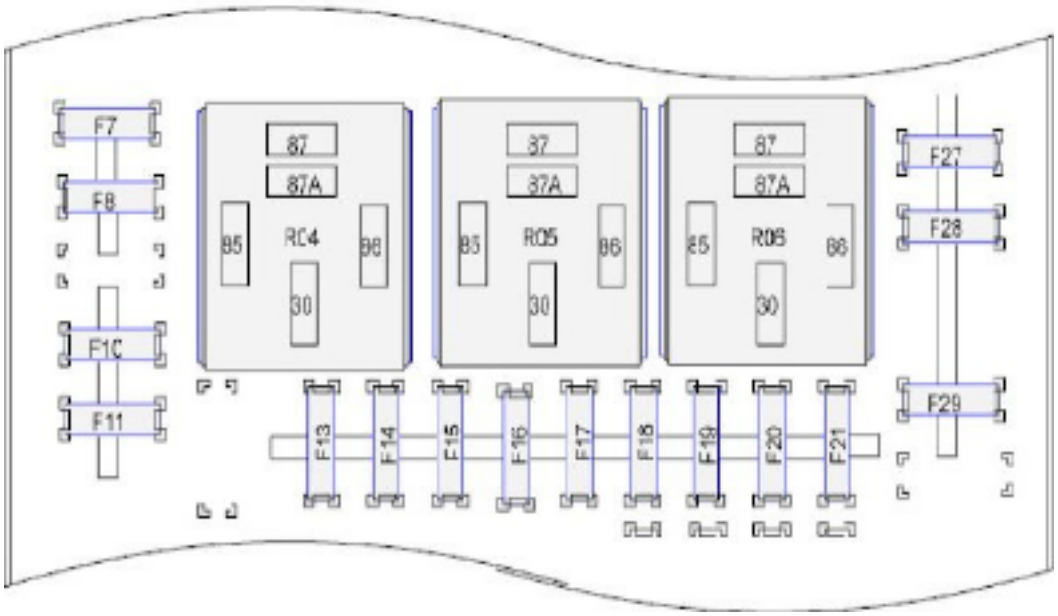
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

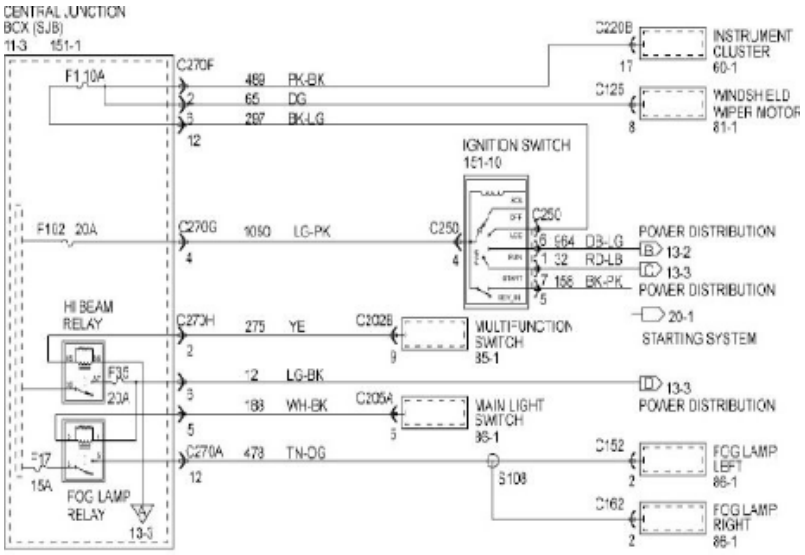
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

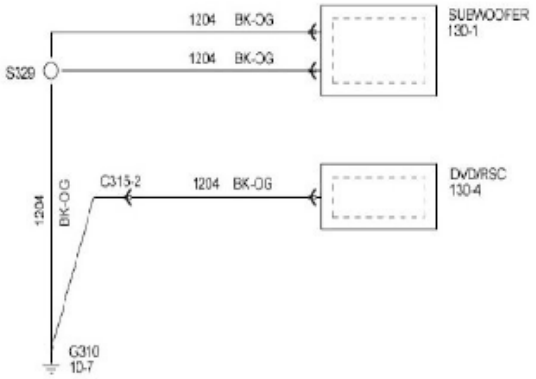
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by

each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

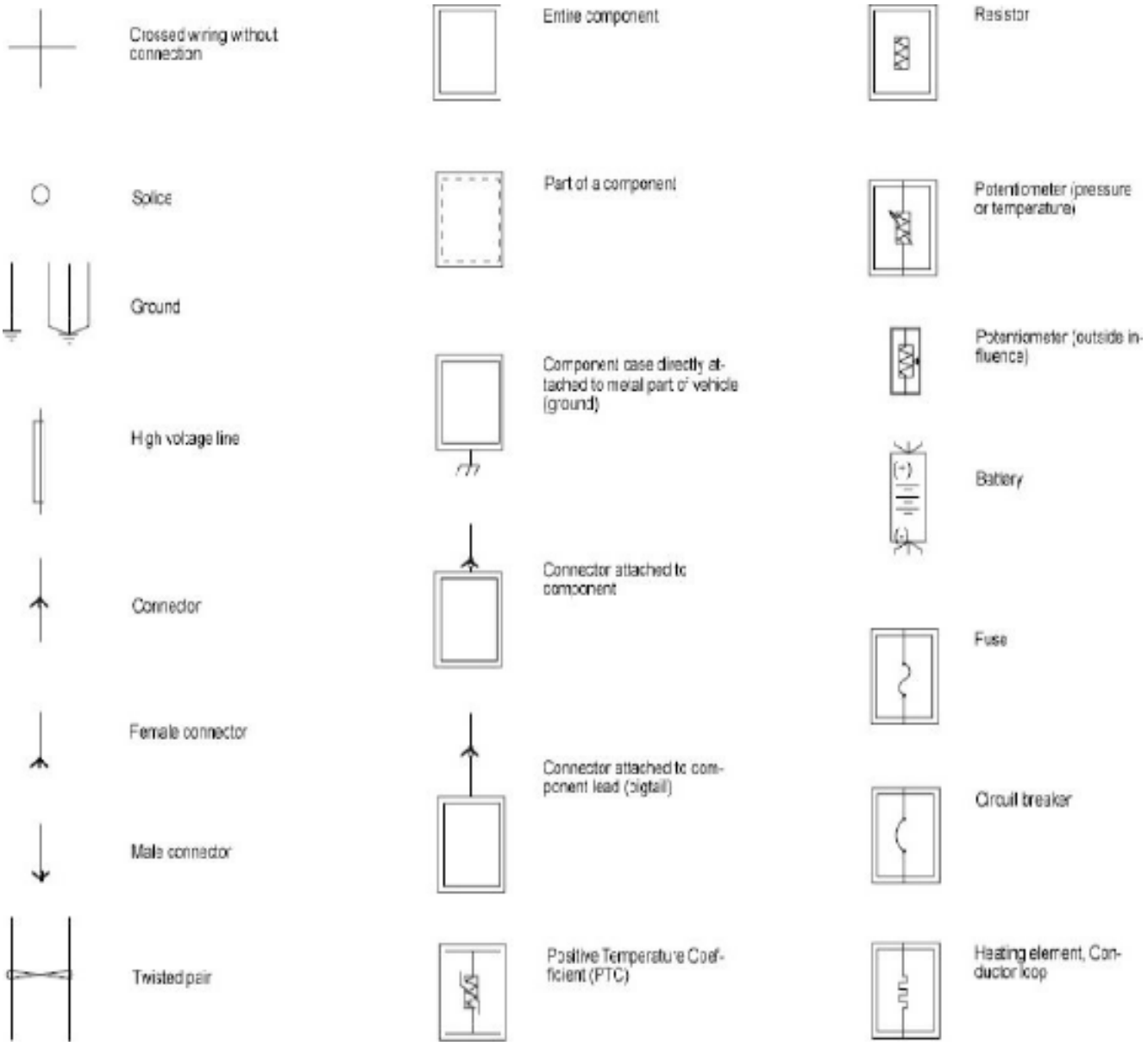
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

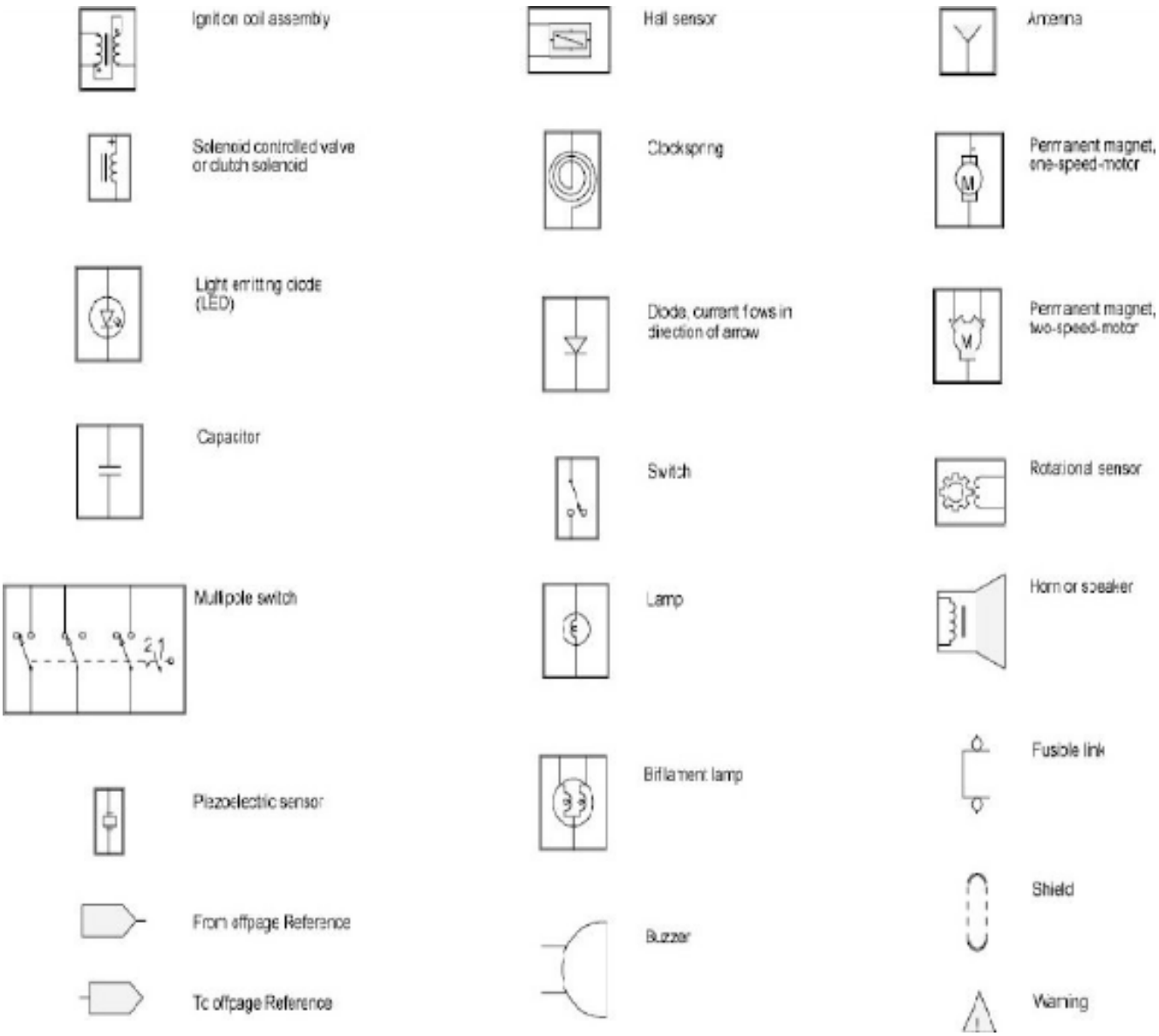
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

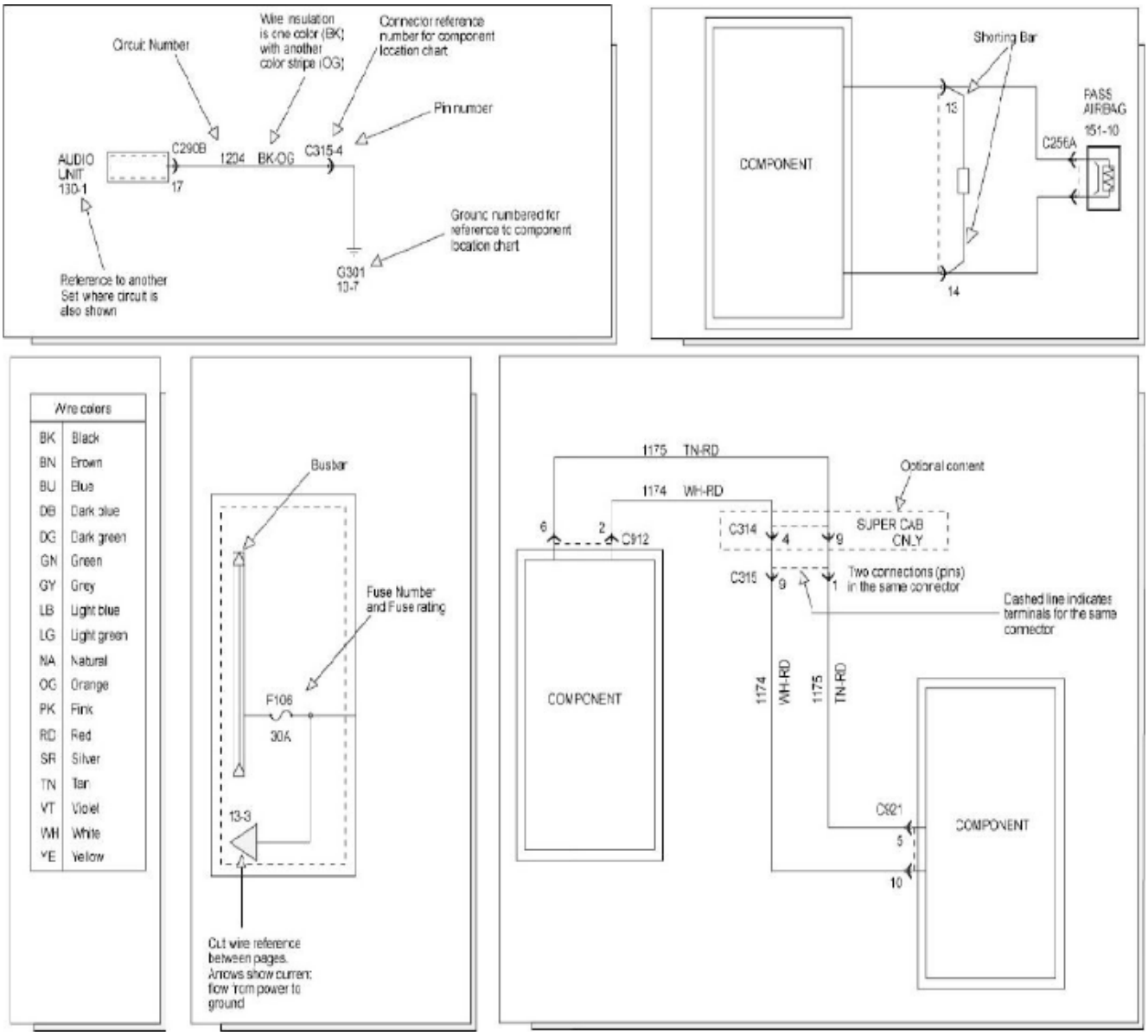
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

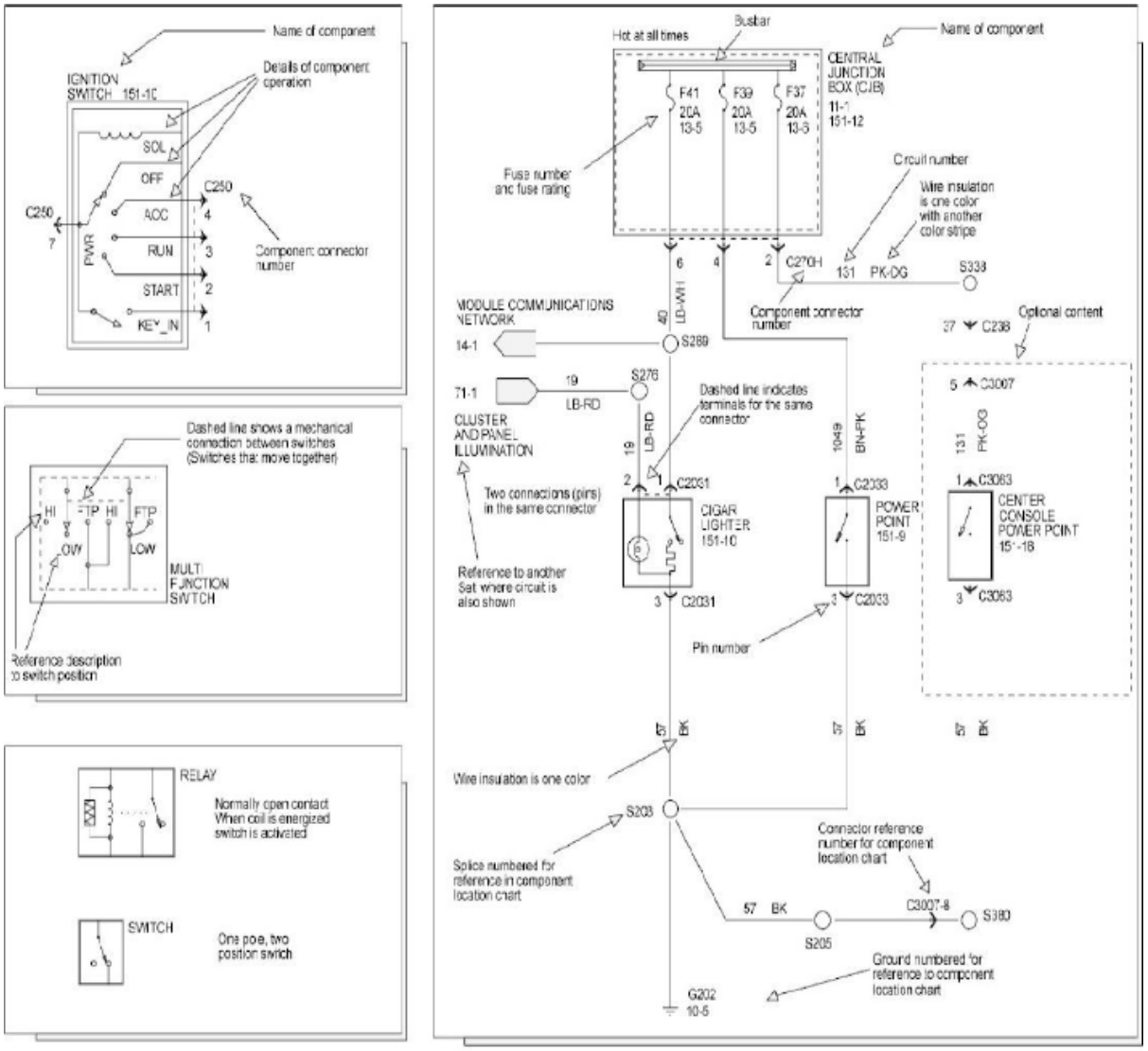
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

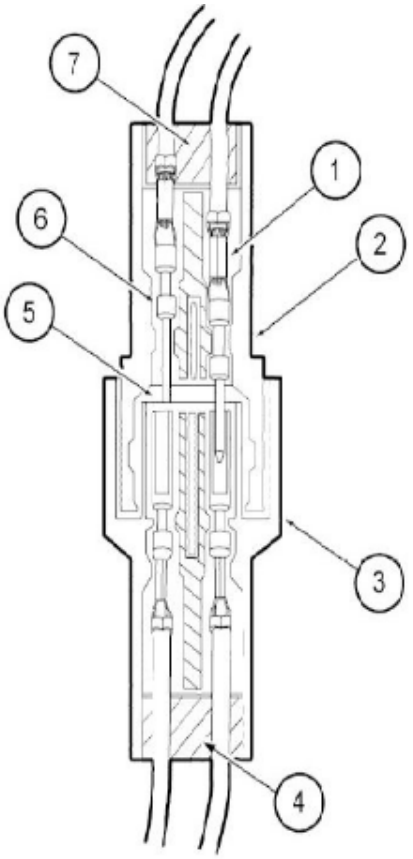


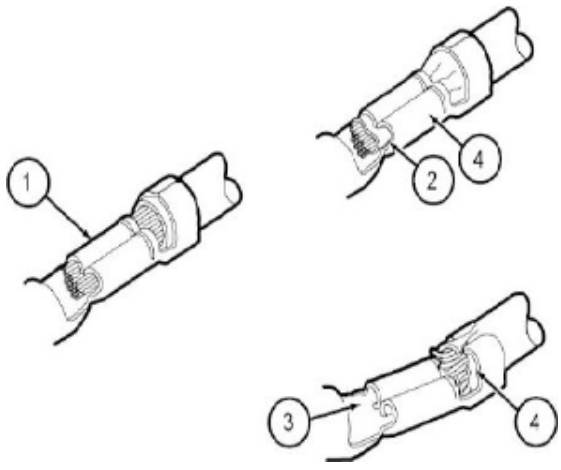
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)





Fuel Pump Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

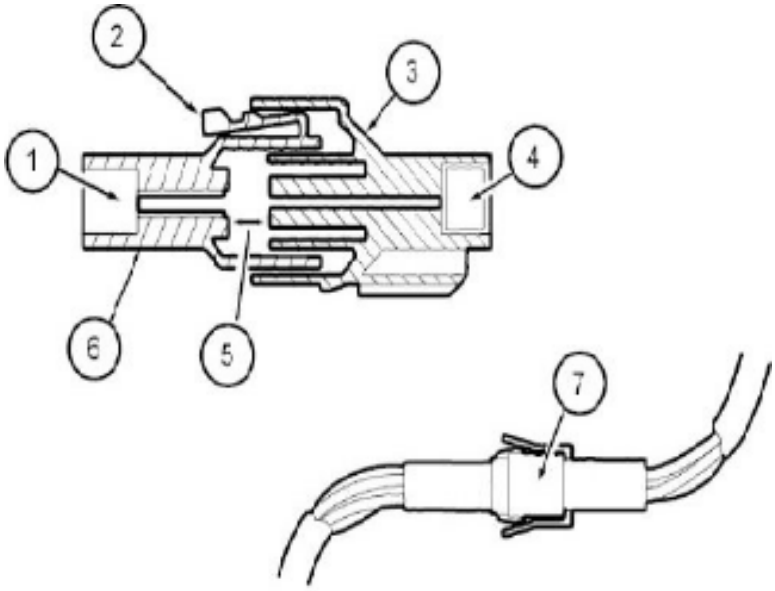
5 = Intermittent contact

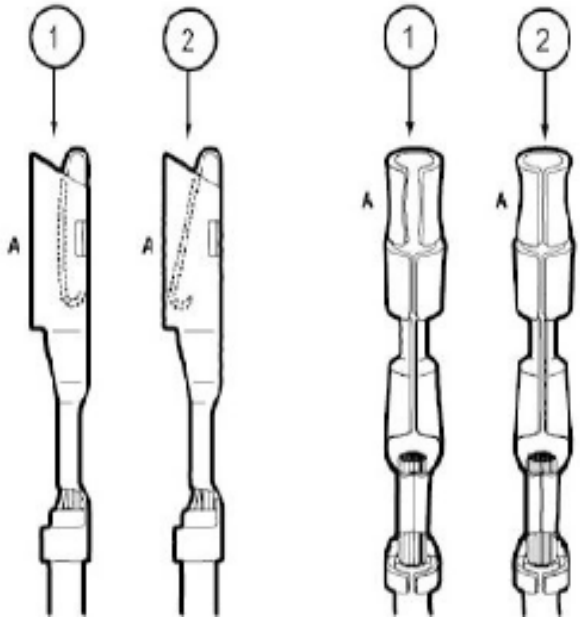
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping





1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

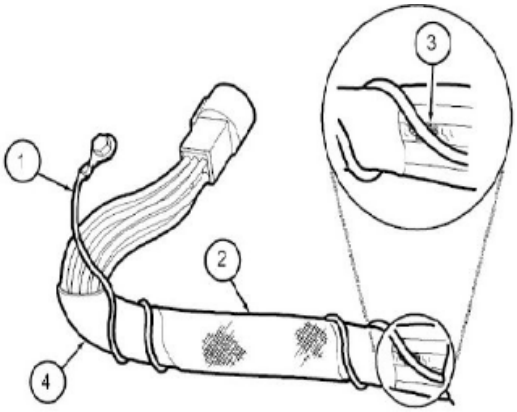
Deformed (enlarged) female terminals

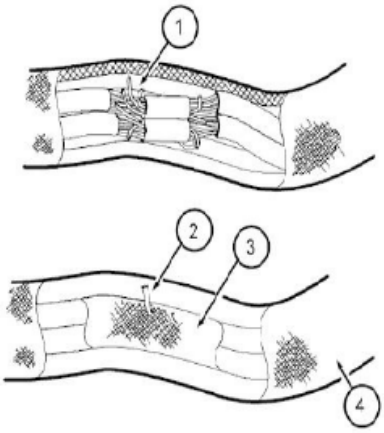
1 = Enlarged

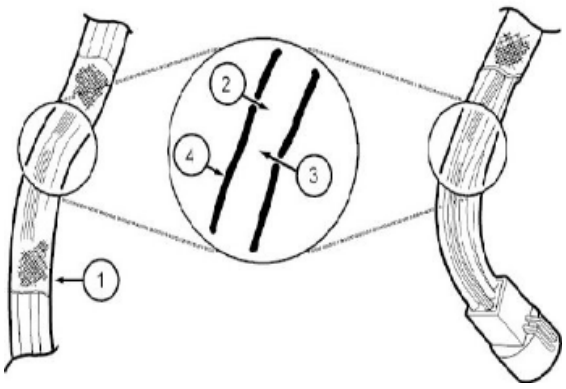
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.







Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

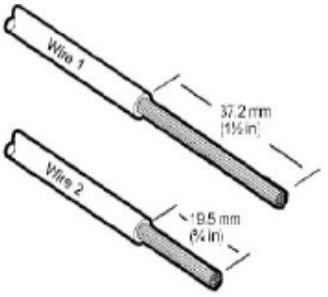
Splice covered 2

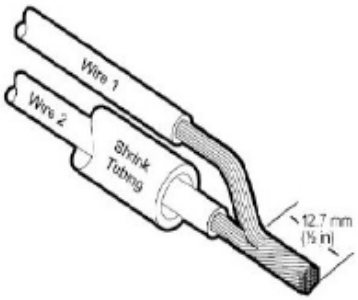
= Wire strand

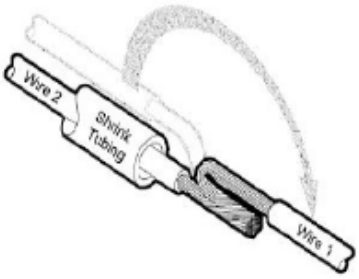
3 = Splice tape

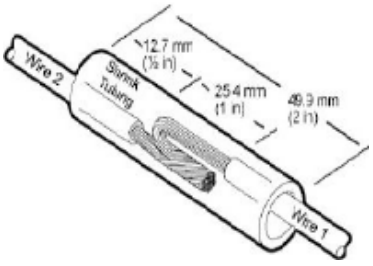
4 = Harness tape

Broken wire strands in harness









1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. lnstall heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

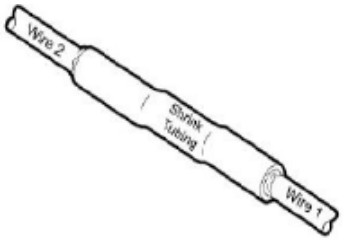
NOTE: -

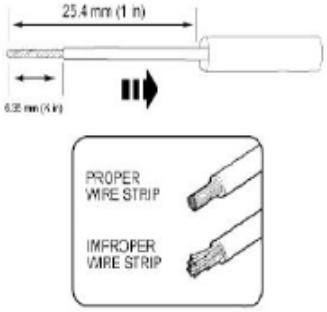
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

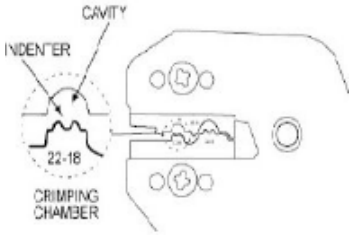
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

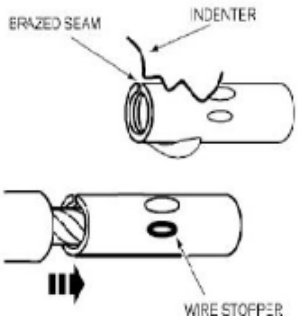
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.









7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

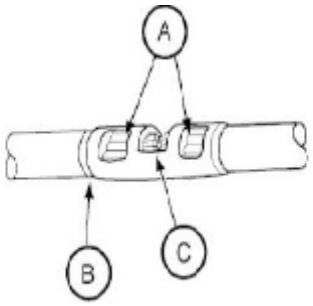
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

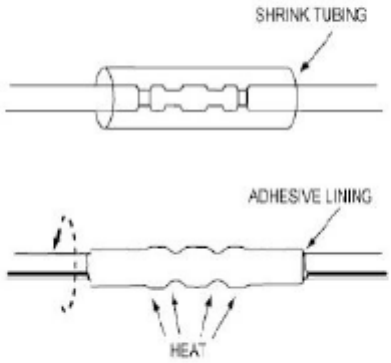
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4 strip, cut 9 strands	* 1/4 strip, cut 2 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip, fold 3x dia.
	16-14	* 1/4 strip, cut 7 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip fold 2x dia	1 strip, fold 3x dia.	1 1/4 strip, fold 4x dia.	Not Recommended
	12-10	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip, fold 3x cia.	1 1/4 strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Pigtail only

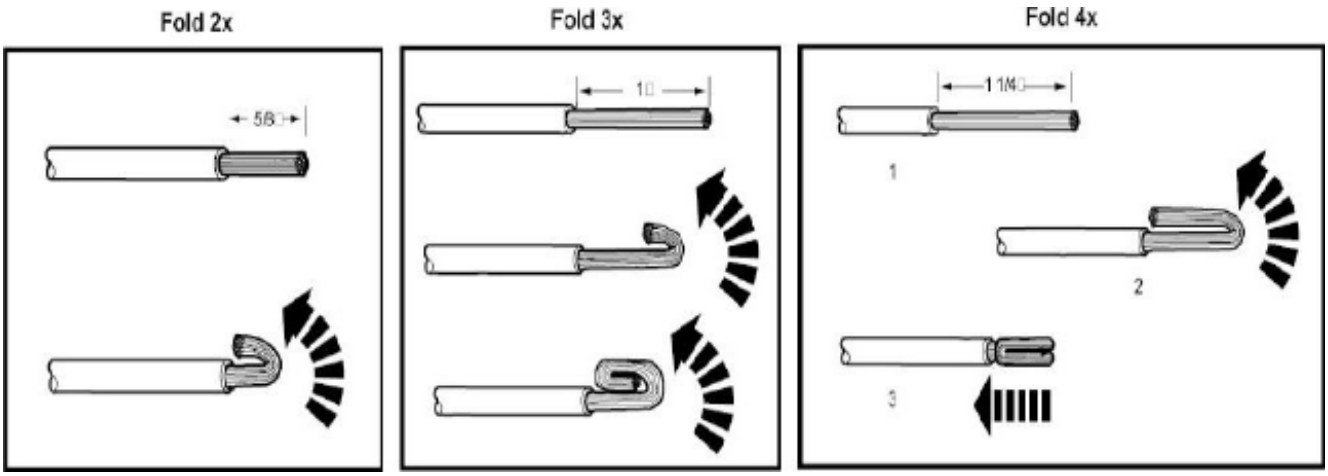
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



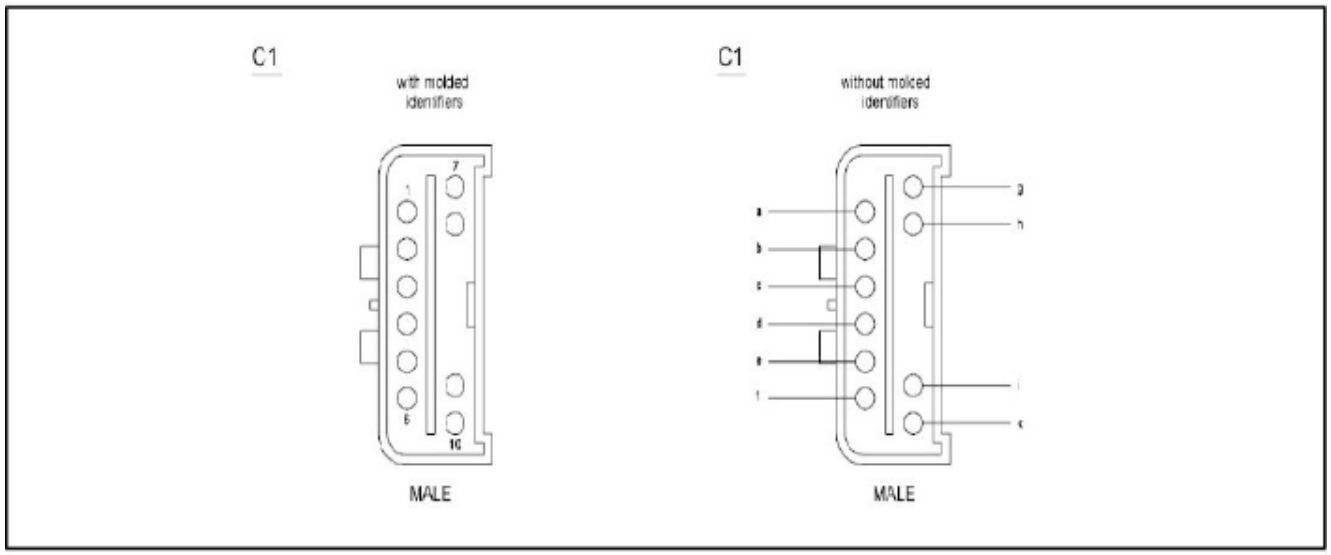
The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



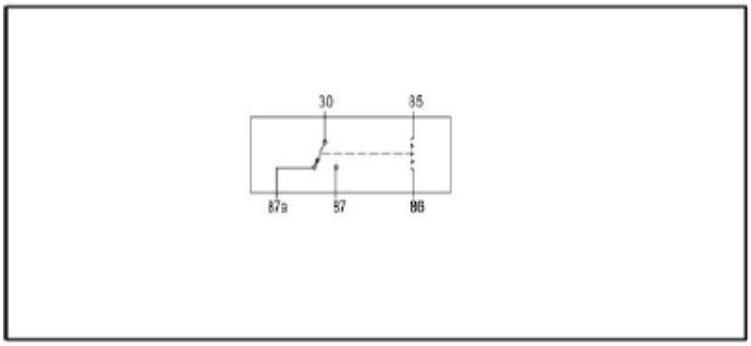
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

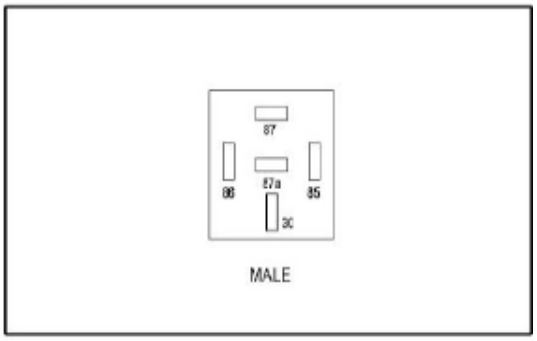
Fuel Pump Relay: Testing and Inspection Mini ISO Relay

Relay □ Mini ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	45 □ 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

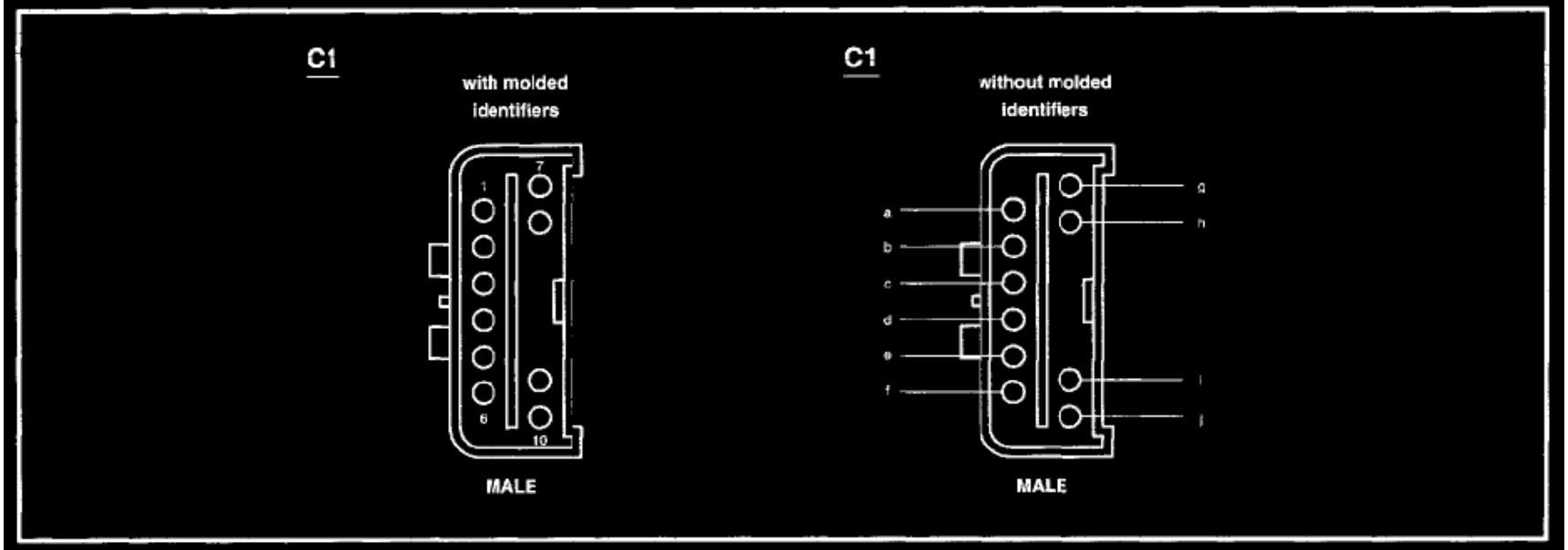
Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step–by–step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals

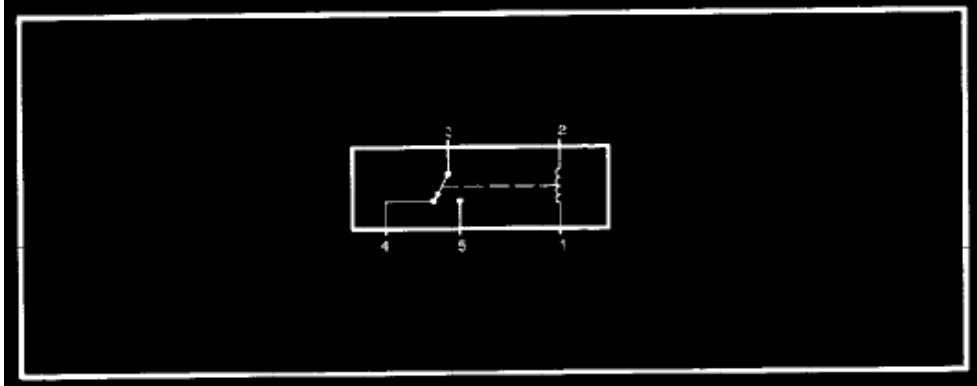


The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

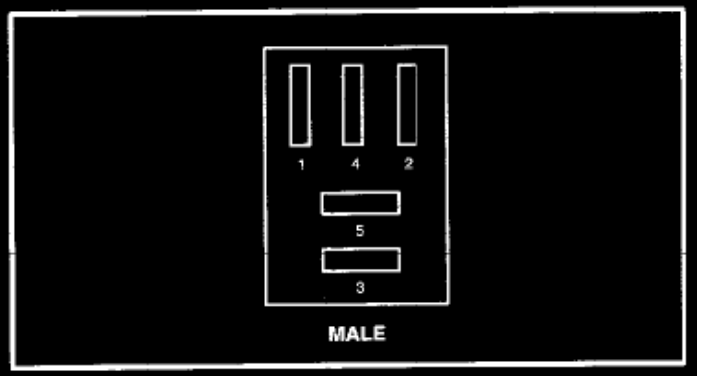
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Relay – Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63–102Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil – Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

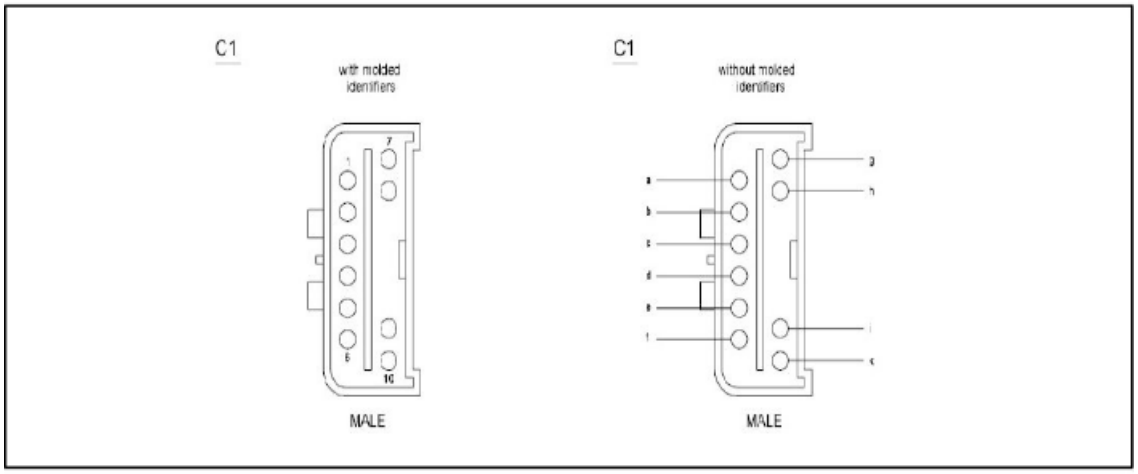
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



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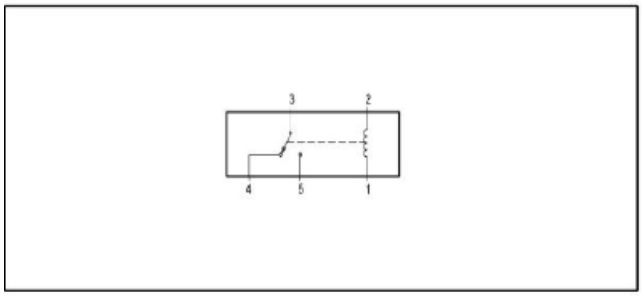
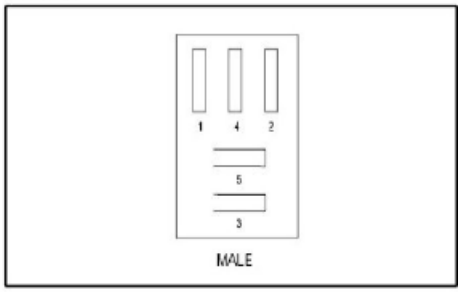
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Relay - Micro ISO

Schematic



Terminals

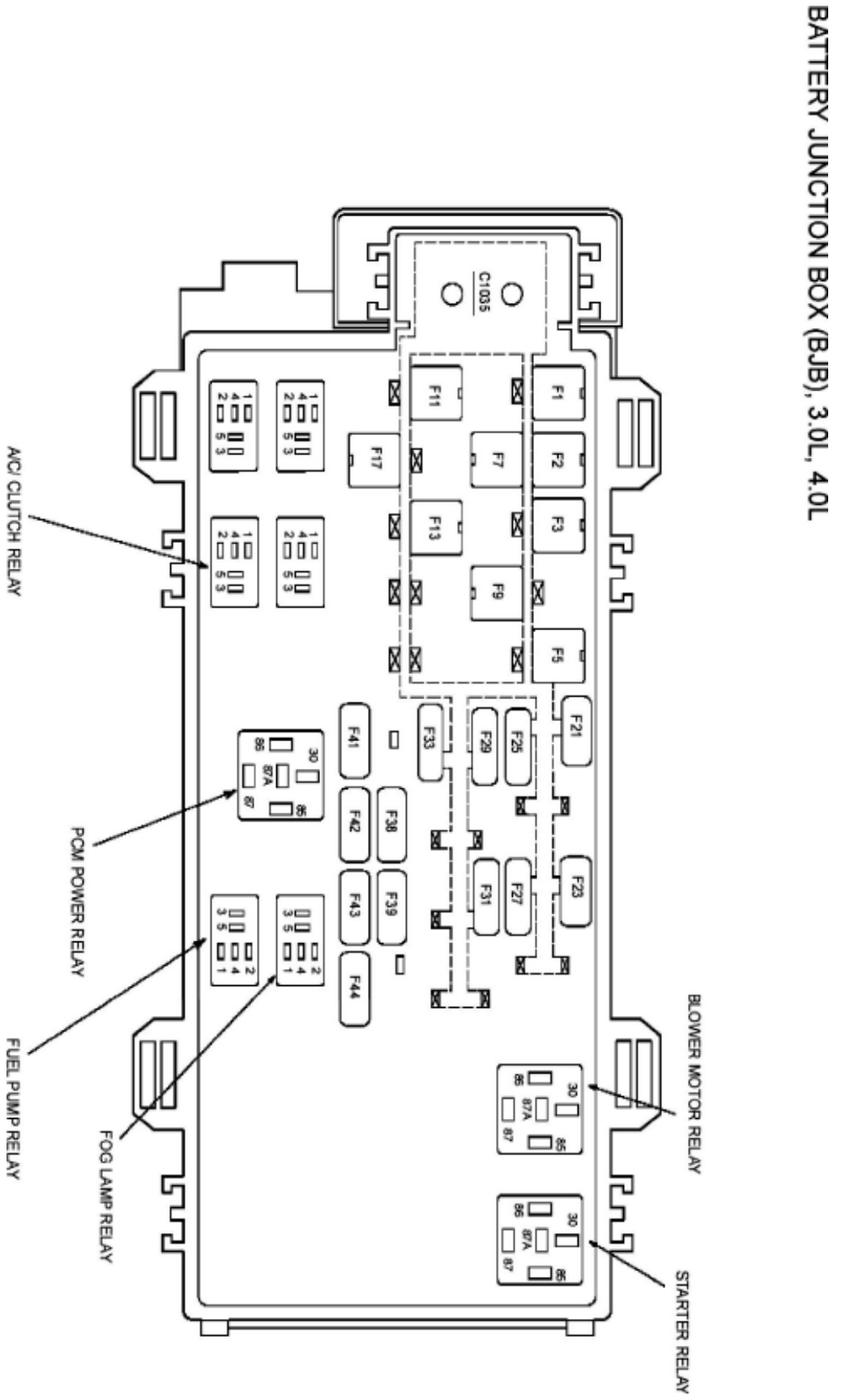


Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63-102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil - Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

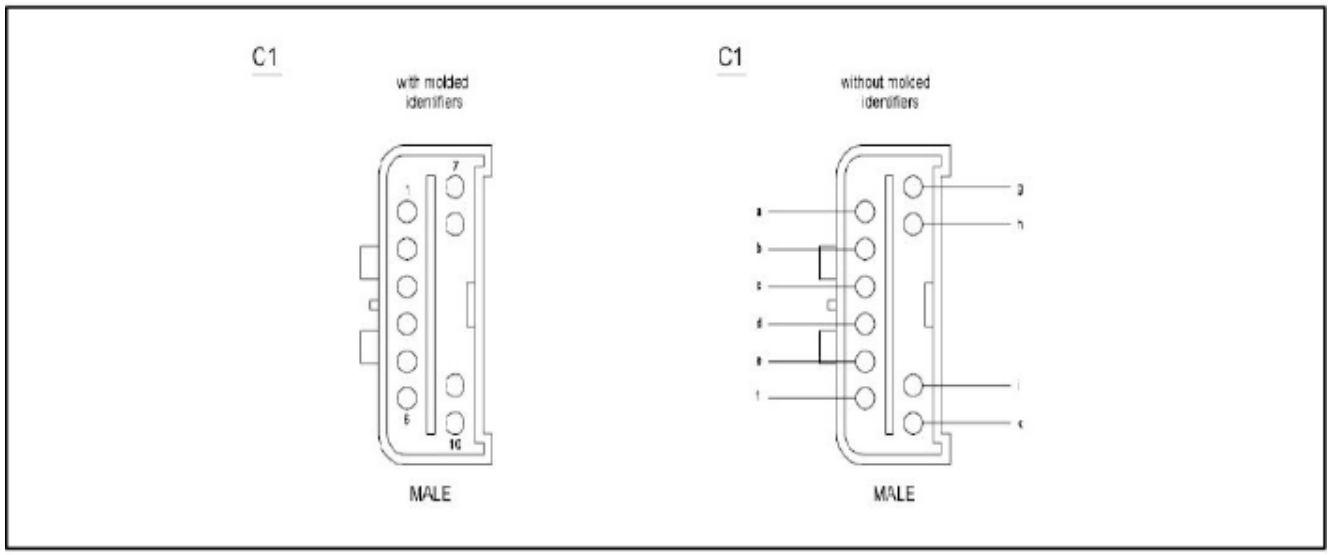

BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L
C1035
F1
F2
F3
F5
F7
F9
F11
F13
F17
F21
F23
F25
F27
F29
F31
F33
F38
F39
F41
F42
F43
F44
A/C CLUTCH RELAY
PCM POWER RELAY
FUEL PUMP RELAY
FOG LAMP RELAY
BLOWER MOTOR RELAY
STARTER RELAY

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



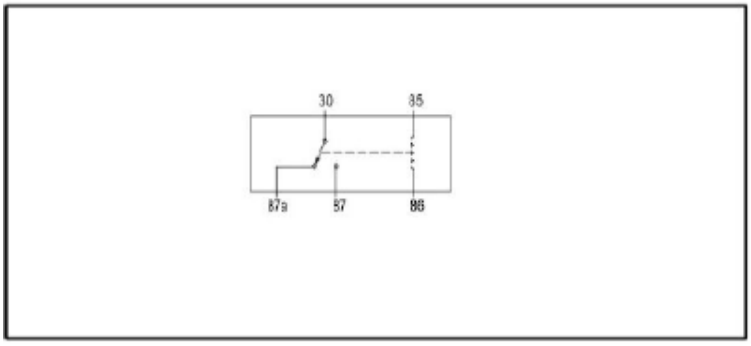
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

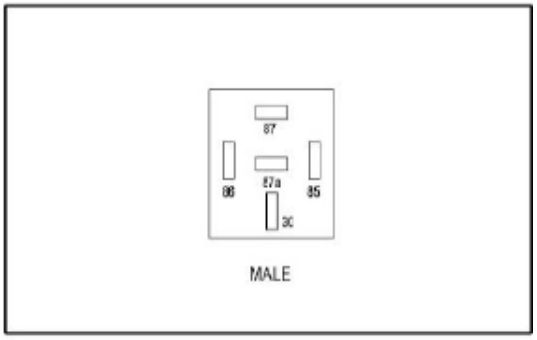
Main Relay (Computer/Fuel System): Testing and Inspection

Relay □ Mini ISO

Schematic



Terminals

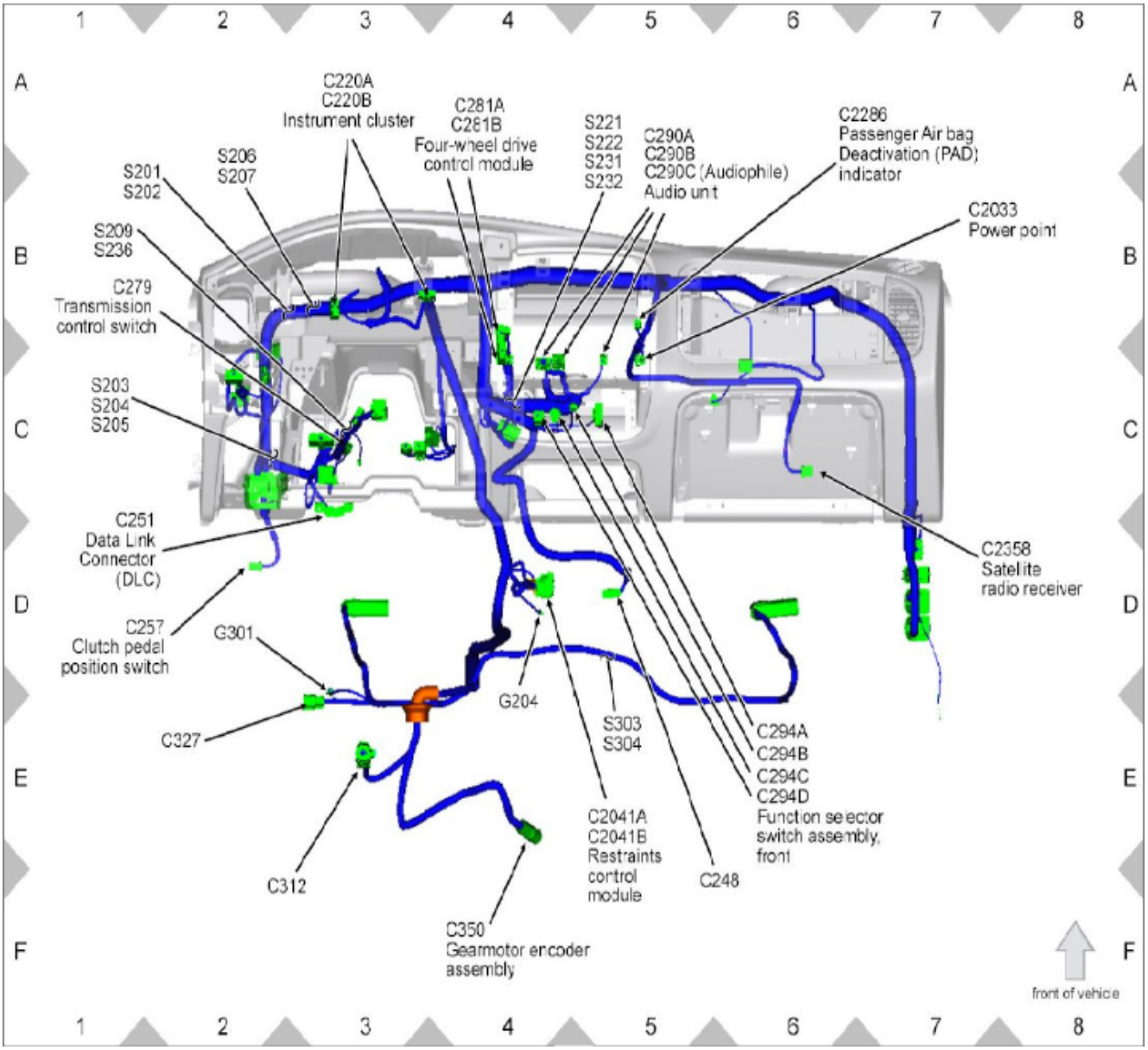


Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

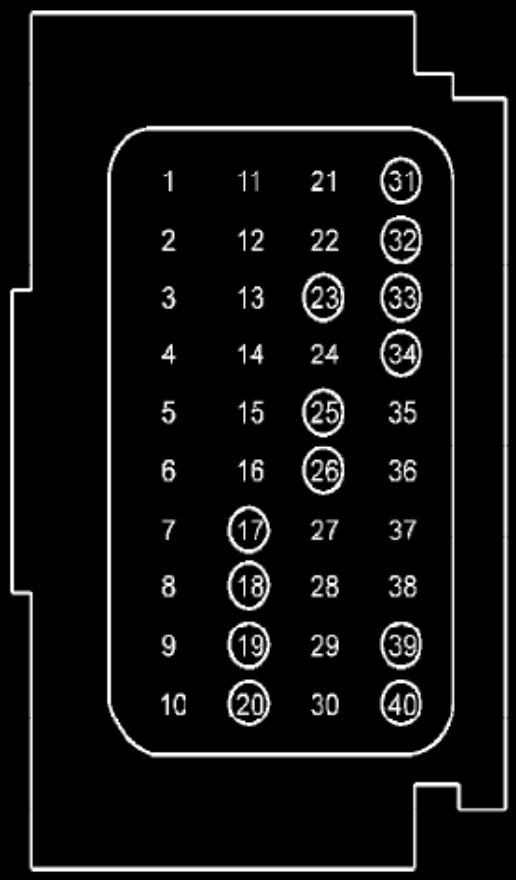
Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.


1
2
3
4
5
6
7
8
A
B
C
D
E
F
C220A
C220B
Instrument cluster
C281A
C281B
Four-wheel drive control module
S221
S222
S231
S232
C290A
C290B
C290C (Audiophile)
Audio unit
C2286
Passenger Air bag Deactivation (PAD) indicator
C2033
Power point
S201
S202
S206
S207
S209
S236
C279
Transmission control switch
S203
S204
S205
C251
Data Link Connector (DLC)
C257
Clutch pedal position switch
G301
C327
C312
G204
S303
S304
C2041A
C2041B
Restraints control module
C248
C294A
C294B
C294C
C294D
Function selector switch assembly, front
C2358
Satellite radio receiver
C350
Gearmotor encoder assembly
front of vehicle

View 151-12

Connector: C2041A — **Description:** RESTRAINTS CONTROL MODULE — **Harness:** 14401 — **Base Part #:** 14B321



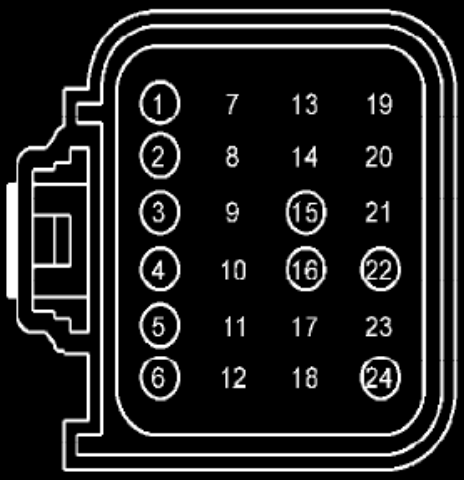
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	*	*	not used	
3	*	*	not used	
4	*	*	not used	
5	*	*	not used	
6	*	*	not used	
7	*	*	not used	
8	*	*	not used	
9	*	*	not used	
10	*	*	not used	
11	*	*	not used	
12	*	*	not used	
13	*	*	not used	
14	*	*	not used	
15	*	*	not used	
16	*	*	not used	
17	VDB05 (WH)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED LOW	
18	VDB04 (WH-BU)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED HIGH	
19	VR213 (VT-GN)	20	SENSOR - IMPACT FRONT 1ST OR LEFT	
20	RR129 (YE-GY)	20	CTRL MOD. - SENSOR IMPACT FRONT 1ST OR LEFT	
21	*	*	not used	
22	*	*	not used	
23	VR215 (YE-VT)	20	SENSOR - SEAT TRACK POSITION DRIVER	
24	*	*	not used	
25	CR201 (GN-BU)	20	SENSOR - SEAT BELT BUCKLE (SEAT BELT REMINDER) FRONT DRIVER SIDE	
26	CR203 (GY-VT)	20	SENSOR - SEAT BELT BUCKLE (SEAT BELT REMINDER) FRONT PASSENGER OUTBOARD	
27	*	*	not used	
28	*	*	not used	
29	*	*	not used	
30	*	*	not used	
31	CR120 (BU-OG)	20	CTRL MOD. - SEAT BELT PRETENSIONER FRONT DRIVER SIDE	
32	RR120 (BN-GN)	20	CTRL MOD. - SEAT BELT PRETENSIONER FRONT DRIVER SIDE	
33	RR122 (BN)	20	CTRL MOD. - SEAT BELT PRETENSIONER FRONT PASSENGER OUTBOARD	
34	CR122 (WH-OG)	20	CTRL MOD. - SEAT BELT PRETENSIONER FRONT PASSENGER OUTBOARD	
35	*	*	not used	
36	*	*	not used	
37	*	*	not used	

Air Bag Control Module: Diagrams

C2041A (Part 1)

38	*	*	not used
39	VR214 (WH-BU)	20	SENSOR - IMPACT FRONT 2ND OR RIGHT
40	RR130 (GN-BU)	20	CTRL MOD. - SENSOR IMPACT FRONT 2ND OR RIGHT

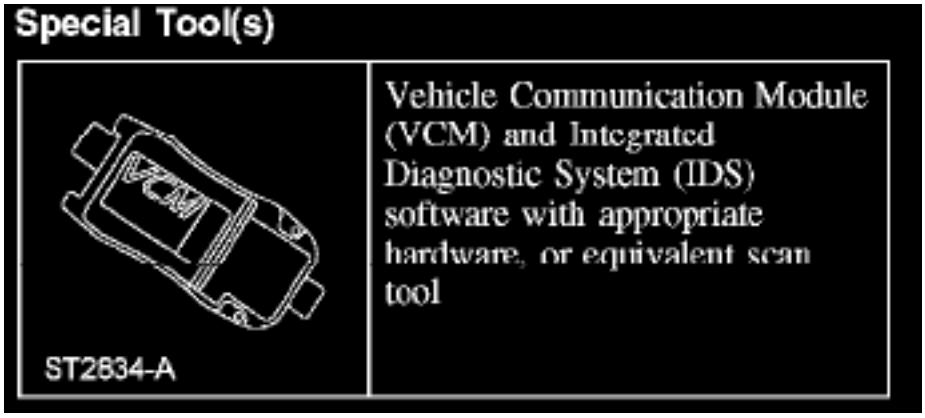
Connector: C2041B **Description:** RESTRAINTS CONTROL MODULE **Harness:** 14401 **Base Part #:** 14B321



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CR103 (GY-BU)	20	CTRL MOD. - AIR BAG FRONT PASSENGER 1	
2	RR103 (VT-GN)	20	CTRL MOD. - AIR BAG FRONT PASSENGER 1	
3	RR101 (YE-GN)	20	CTRL MOD. - AIR BAG DRIVER 1	
4	CR101 (VT-BN)	20	CTRL MOD. - AIR BAG DRIVER 1	
5	CR104 (YE-GY)	20	CTRL MOD. - AIR BAG FRONT PASSENGER 2	
6	RR104 (WH-BU)	20	CTRL MOD. - AIR BAG FRONT PASSENGER 2	
7	*	*	not used	
8	*	*	not used	
9	*	*	not used	
10	*	*	not used	
11	*	*	not used	
12	*	*	not used	
13	*	*	not used	
14	*	*	not used	
15	RR102 (WH)	20	CTRL MOD. - AIR BAG DRIVER 2	
16	CR102 (BU)	20	CTRL MOD. - AIR BAG DRIVER 2	
17	*	*	not used	
18	*	*	not used	
19	*	*	not used	
20	*	*	not used	
21	*	*	not used	
22	CR114 (YE-OG)	20	CTRL MOD. - INDICATOR AIR BAG	
23	*	*	not used	
24	CBP08 (GY-YE)	20	FUSE - 8 OR CIRCUIT BREAKER	

C2041A (Part 2)

C2041B



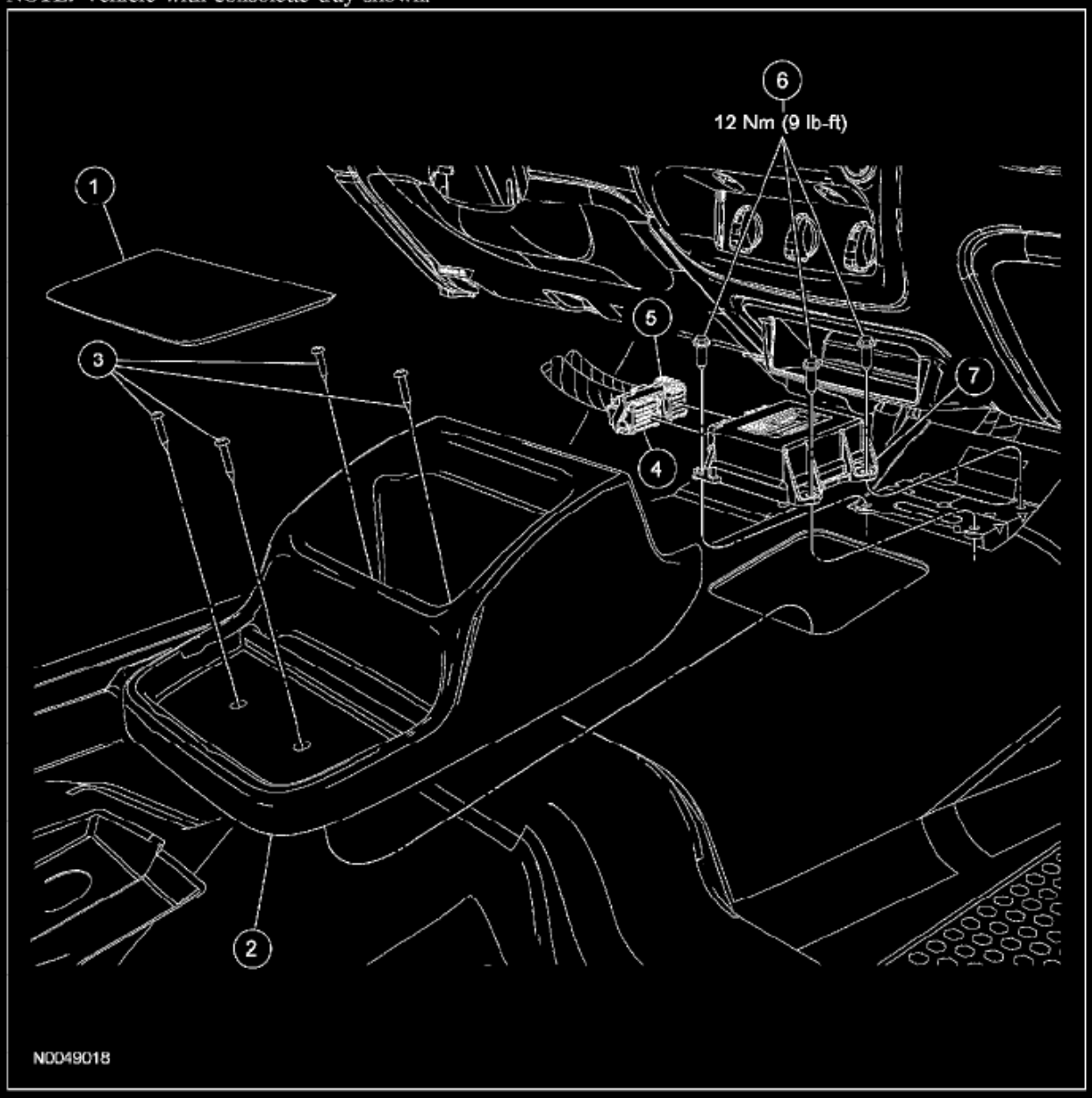
Air Bag Control Module: Service and Repair

RESTRAINTS CONTROL MODULE (RCM)

Special Tool(s)

Special Tool(s)

NOTE: Vehicle with consolette tray shown.



Item	Part Number	Description
1	—	Consolette tray mat (part of 045A36)
2	045A36	Consolette tray
3	—	Consolette tray screws (4 required) (part of 045A36)
4	—	Restraints control module (RCM) large electrical connector (part of 14401)

Item	Part Number	Description
5	—	RCM small electrical connector (part of 14401)
6	W701963	RCM bolts (3 required)
7	14B321	RCM

(Continued)

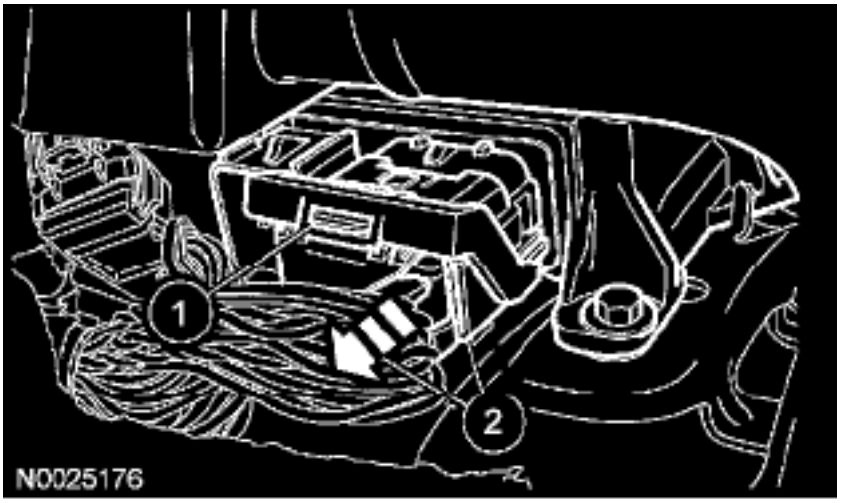
Removal

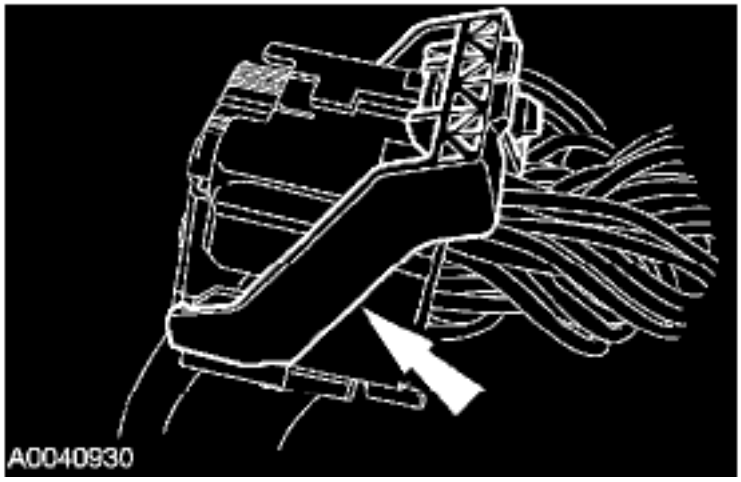
WARNING: If a vehicle has been in a crash, inspect the restraints control module (RCM) and the impact sensor (if equipped) mounting areas for deformation. If damaged, restore the mounting areas to the original production configuration. A new RCM and sensors must be installed whether or not the air bags have deployed. Failure to follow these instructions may result in serious personal injury or death in a crash.

CAUTION: -

When installing a new restraints control module (RCM), it is necessary to carry out programmable module installation (PMI). System failure may occur if PMI is not carried out.

- Electronic modules are sensitive to static electrical charges. If exposed to these charges, damage may result.


1
2
N0025176


A0040930

NOTE: -

The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

- The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

- Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and carry out the diagnostic procedure again.

All vehicles 1. Carry out the steps necessary to prepare for programmable module installation (PMI). 2. Depower the SRS.

Vehicles with high-series floor console 3. Remove the floor console.

Vehicles with a consolette 4. Remove the consolette tray mat. 5. Remove the 4 screws and remove the consolette tray.

All vehicles 6. Disconnect the small RCM electrical connector. 7. Disconnect the large RCM electrical connector.

1 Pinch the thumb tab and pivot the connector position assurance lever all the way back until it stops.

2 Pull out and disconnect the RCM electrical connector.

8. Remove the 3 bolts and the RCM.

Installation

All vehicles

1. WARNING: Always tighten the fasteners of the restraints control module (RCM) and impact sensor (if equipped) to the specified torque.

Failure to do so may result in incorrect restraint system operation, which increases the risk of personal injury or death in a crash.

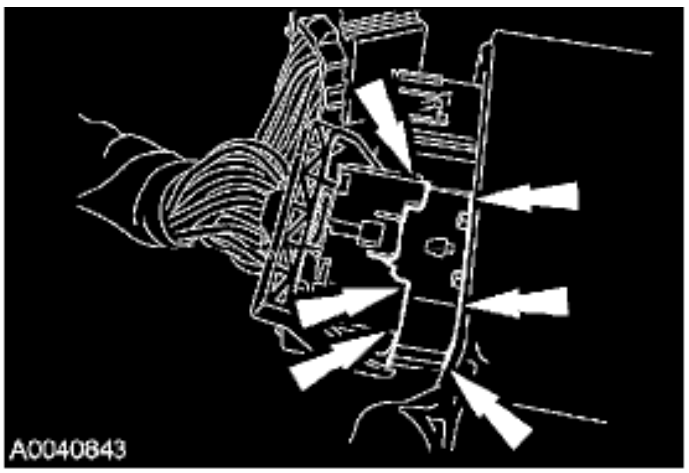
Install the RCM and the 3 bolts. -

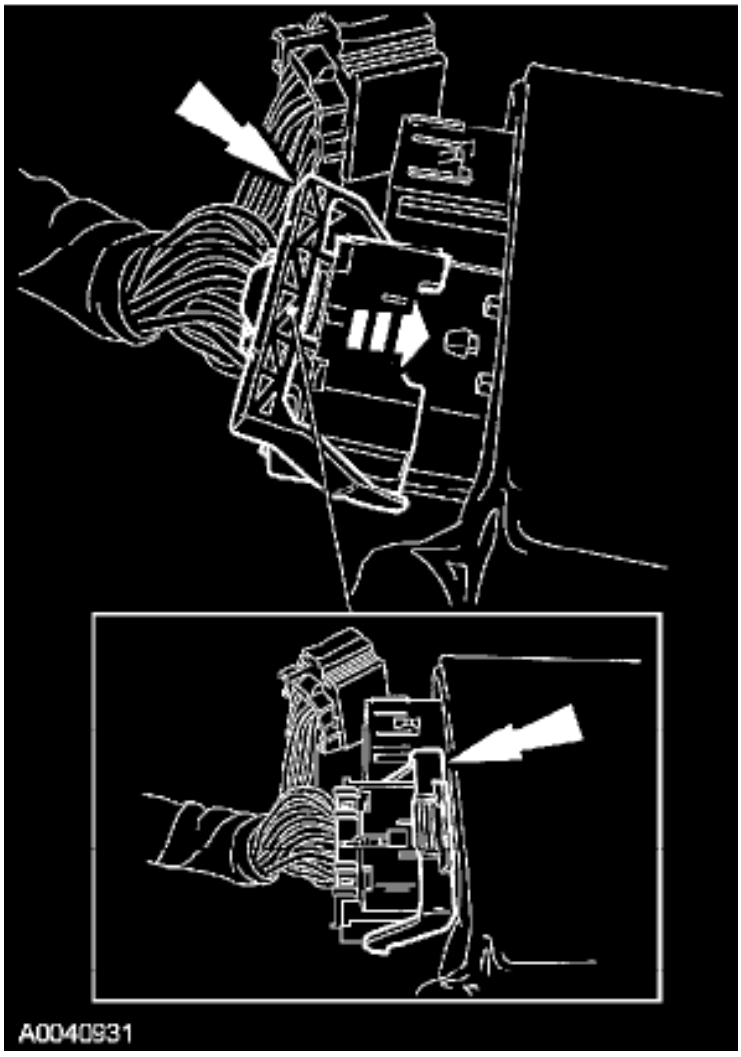
To install, tighten to 12 Nm (9 lb-ft).

2. Make sure the large RCM connector position assurance lever is in the full release position before attempting to connect the connector.

3. CAUTION: Putting the large restraints control module (RCM) electrical wiring connector into the RCM on an angle can cause bad

electrical connections and damage components.


A0040843


A0040931

NOTE: The RCM has been removed for clarity.

Position the large RCM electrical connector into the RCM.

-

CAUTION: Do not push the connector to the point where the lever pivots and seats itself. Light pressure is needed to get the connector into position on the restraints control module (RCM), before using the lever to fully seat the connector. Damage to the connector or component may occur.

With the large RCM electrical connector uniformly aligned to the RCM, lightly push in until a subtle audible click is heard and slight resistance is felt.

4. Connect the large RCM electrical connector.

- Using the connector position assurance lever, pivot it toward the RCM, drawing the connector into the RCM. -

Make sure the thumb tab is engaged to the retainer on the RCM and locked in place.

5. Connect the small RCM electrical connector.

Vehicles with a consolette 6. Install the consolette tray and the 4 screws. 7. Install the consolette tray mat.

Vehicles with high-series floor console 8. Install the floor console.

All vehicles 9. Repower the SRS. Do not prove out the SRS at this time.

10. When installing a new RCM, carry out the steps necessary to complete PMI.

11. Prove out the supplemental restraint system (SRS) as follows:

Turn the ignition switch from ON to OFF. Wait 10 seconds, then turn the ignition switch back to ON and visually monitor the air bag indicator with the air bag modules installed. The air bag indicator will light continuously for approximately 6 seconds and then turn OFF. If an air bag SRS fault is present, the air bag indicator will: -

fail to light.

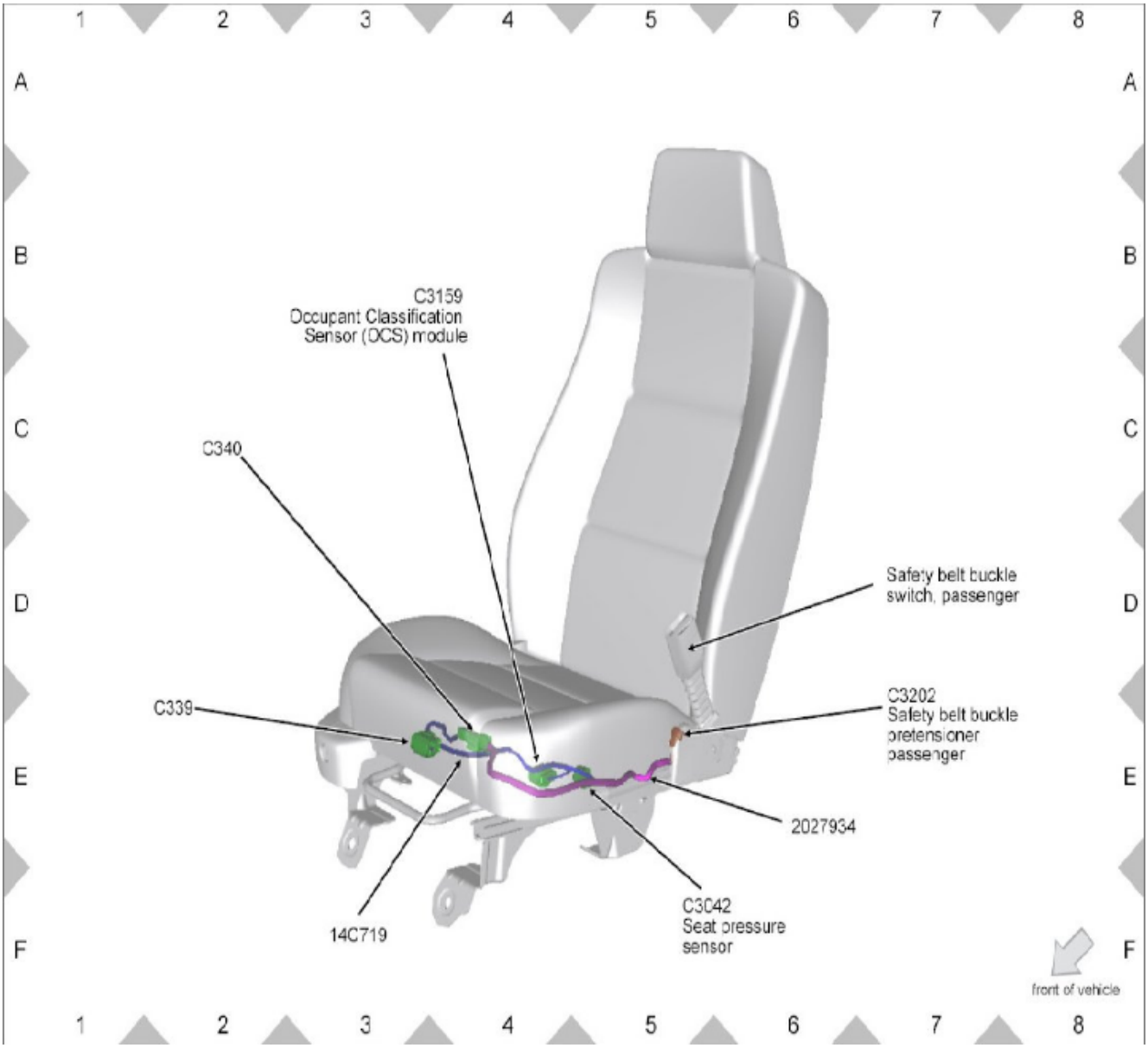
- remain lit continuously.

- flash at a 5 Hz rate (RCM not configured).

The air bag indicator might not light until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON position. This is the time required for the RCM to complete the testing of the SRS. If the air bag indicator is inoperative and a SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag indicator and any SRS fault discovered must be diagnosed and repaired.

Clear all continuous DTCs from the RCM and occupant classification system module (OCSM) using a scan tool.

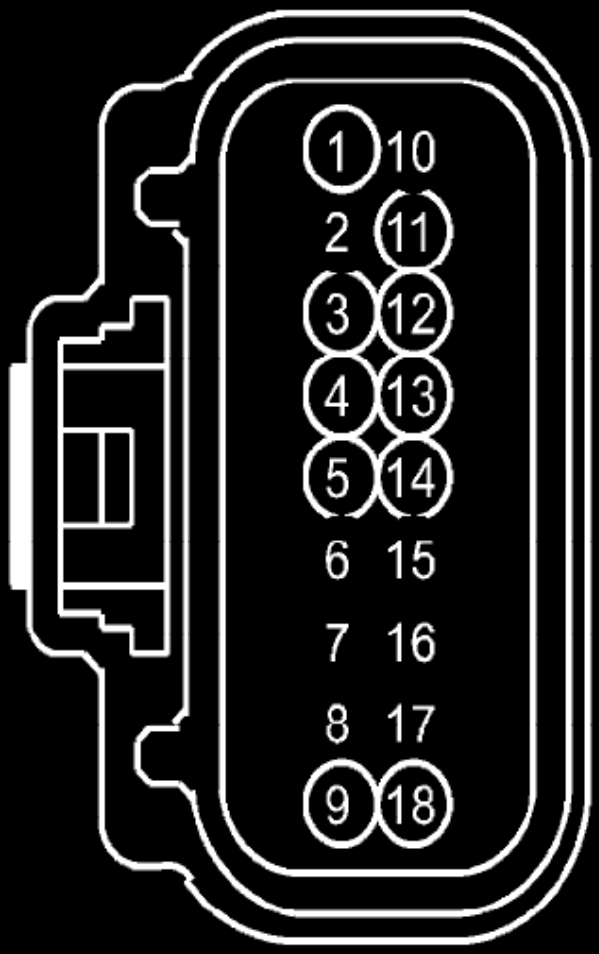
Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Relays and Modules > Relays and Modules - Restraint Systems > Seat Occupant Classification Module - Air Bag > Component Information > Locations



View 151-19

Connector: C3159

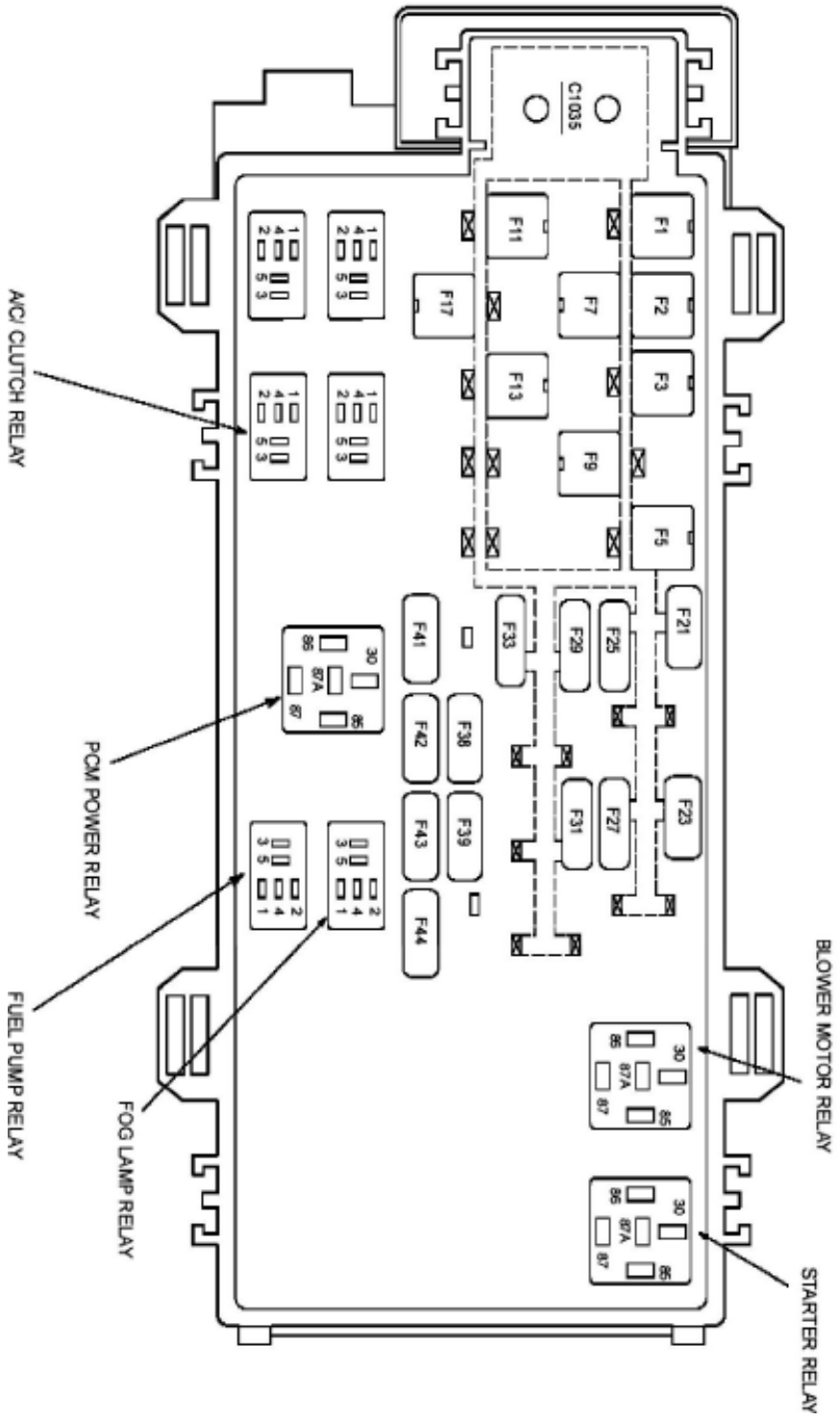
Description:	Harness:	Base Part #:
OCCUPANT CLASSIFICATIONSENSOR (OCS) MODULE	14C719	



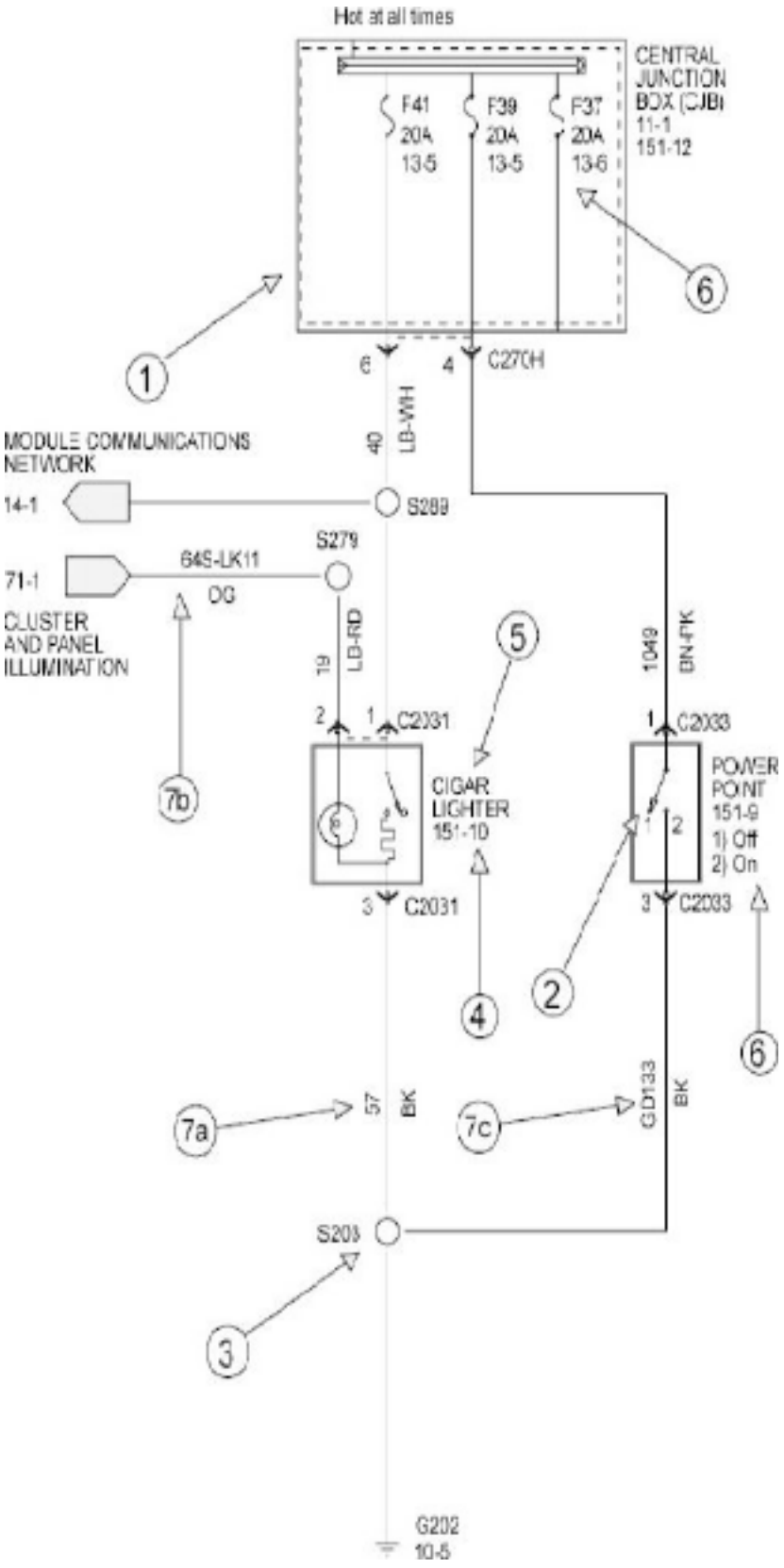
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBP08 (GY-YE)	20	FUSE - 8 OR CIRCUIT BREAKER	
2	*	*	not used	
3	CR152 (GY-YE)	22	CTRL MOD. - SENSOR OCCUPANT CLASSIFICATION PRESSURE	
4	VR223 (BU-WH)	22	SENSOR - OCCUPANT CLASSIFICATION PRESSURE	
5	RR152 (YE-VT)	22	CTRL MOD. - SENSOR OCCUPANT CLASSIFICATION PRESSURE	
6	*	*	not used	
7	*	*	not used	
8	*	*	not used	
9	VDB05 (WH)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED LOW	
10	*	*	not used	
11	LR142 (YE-BU)	20	CTRL MOD. - SENSOR SEAT BELT TENSION FRONT PASSENGER OUTBOARD	
12	VR210 (BU-BN)	20	SENSOR - SEAT BELT TENSION FRONT PASSENGER OUTBOARD	
13	RR142 (GN)	20	CTRL MOD. - SENSOR SEAT BELT TENSION FRONT PASSENGER OUTBOARD	
14	CD174 (BK-WH)	18	GROUND - TUNNEL	
15	*	*	not used	
16	*	*	not used	
17	*	*	not used	
18	VDB04 (WH-BU)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED HIGH	

C3159

BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L



Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Relays and Modules > Relays and Modules - Starting and Charging > Starter Relay > Component Information > Diagrams > Diagram Information and Instructions



Starter Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

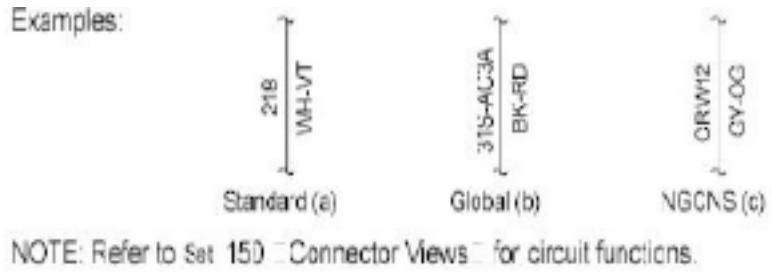
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

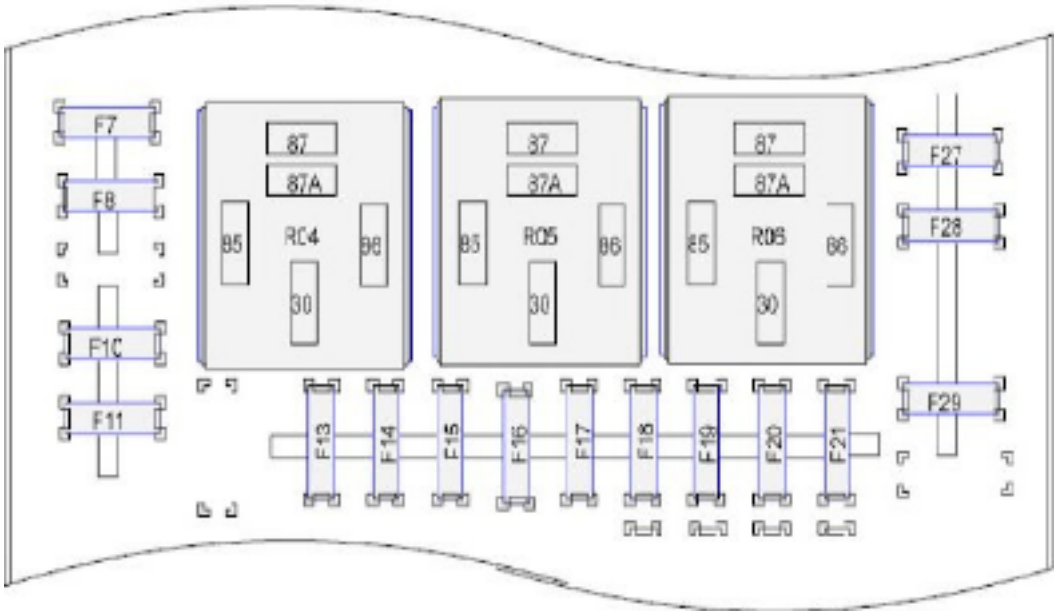
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

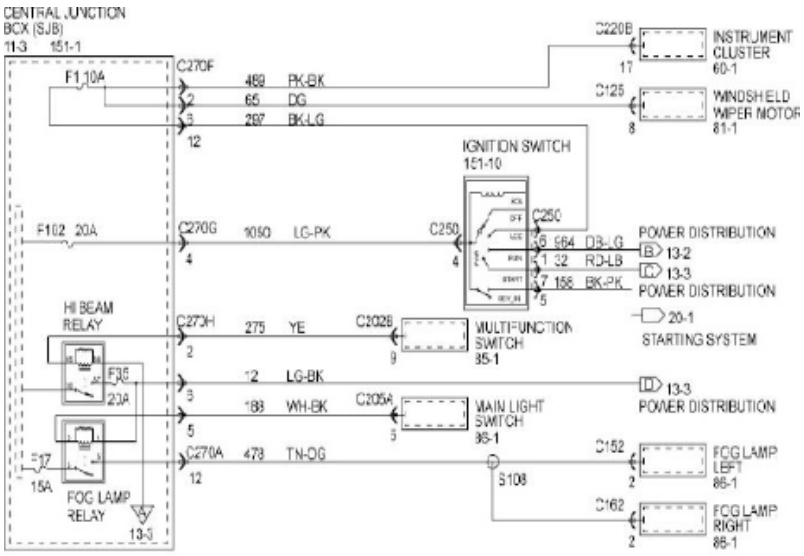
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

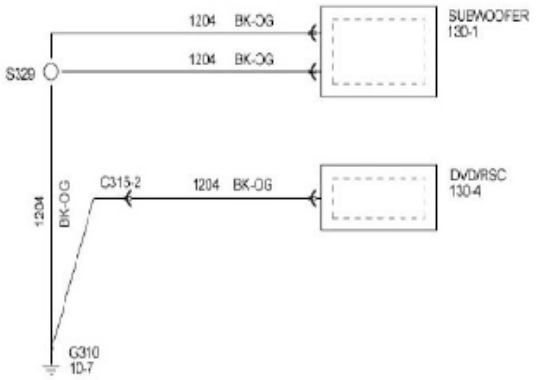
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

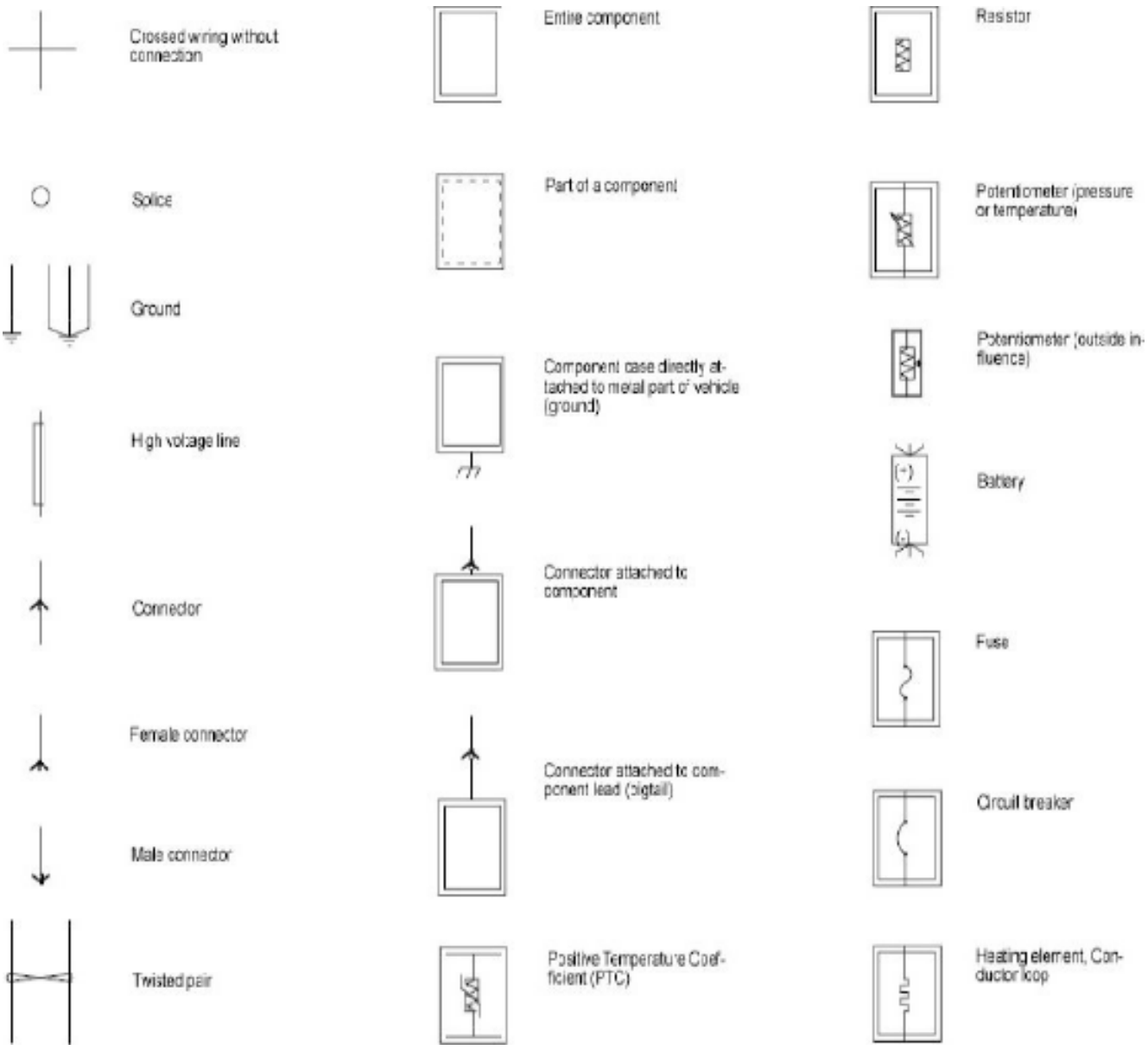
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

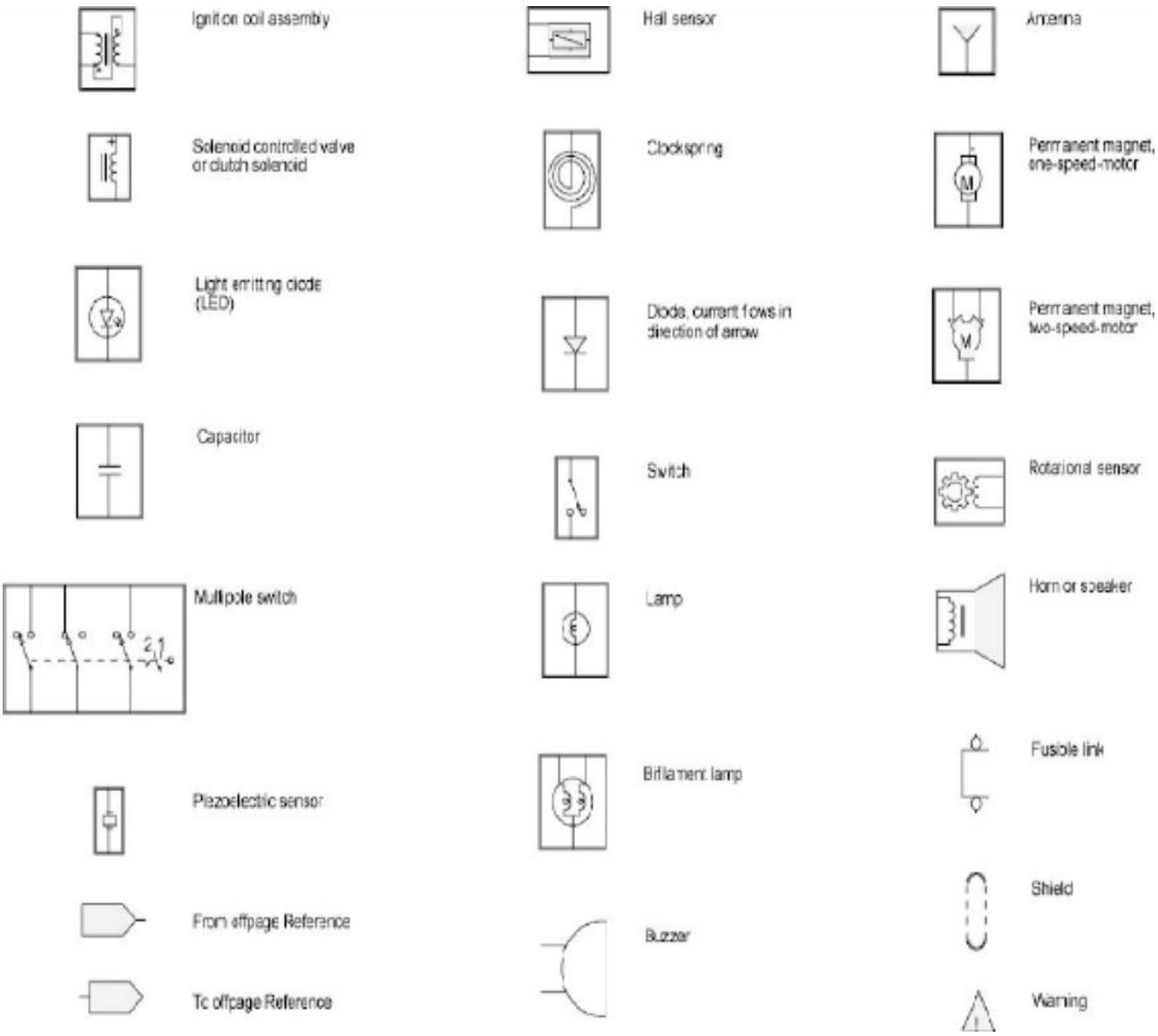
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

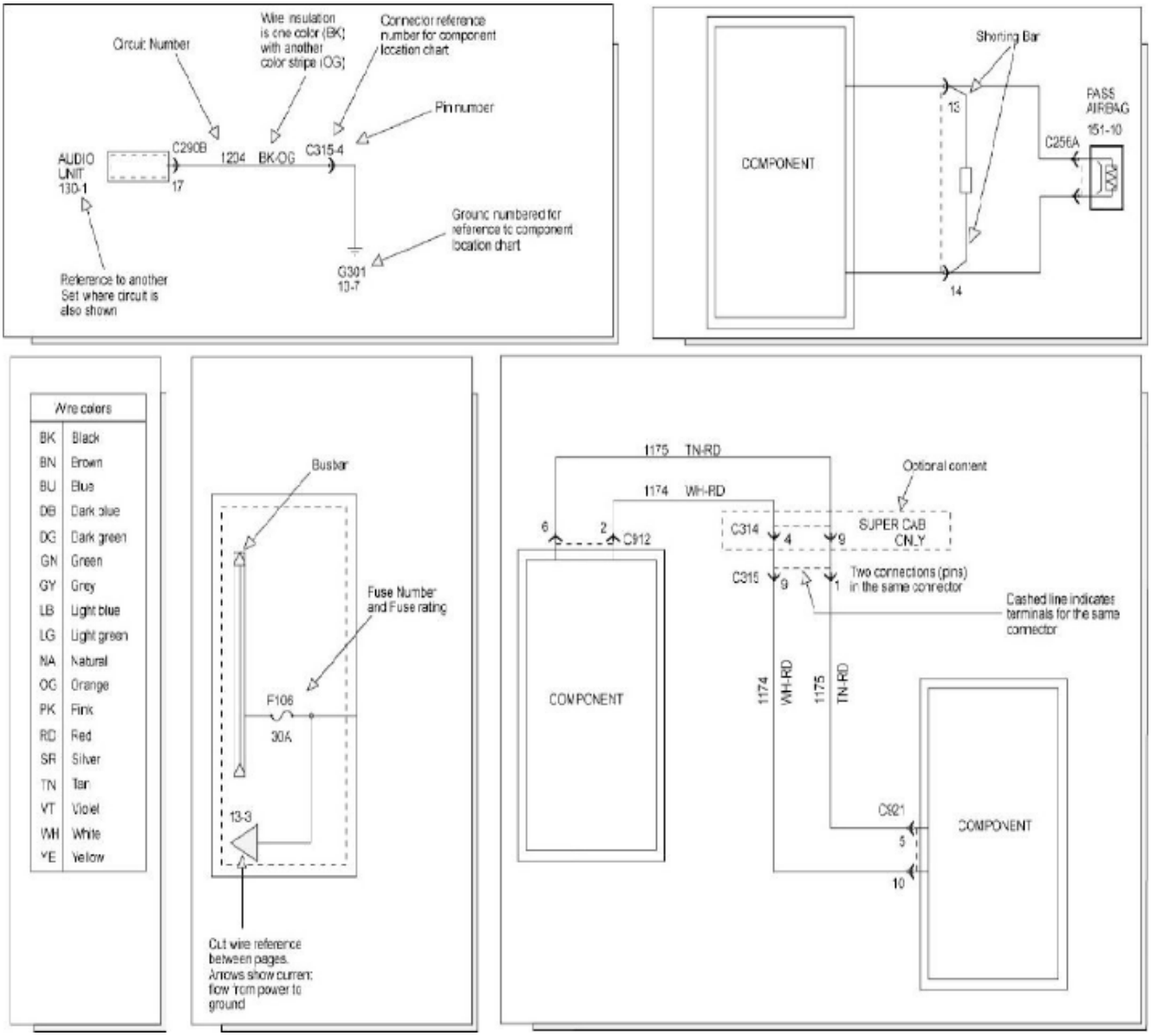
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

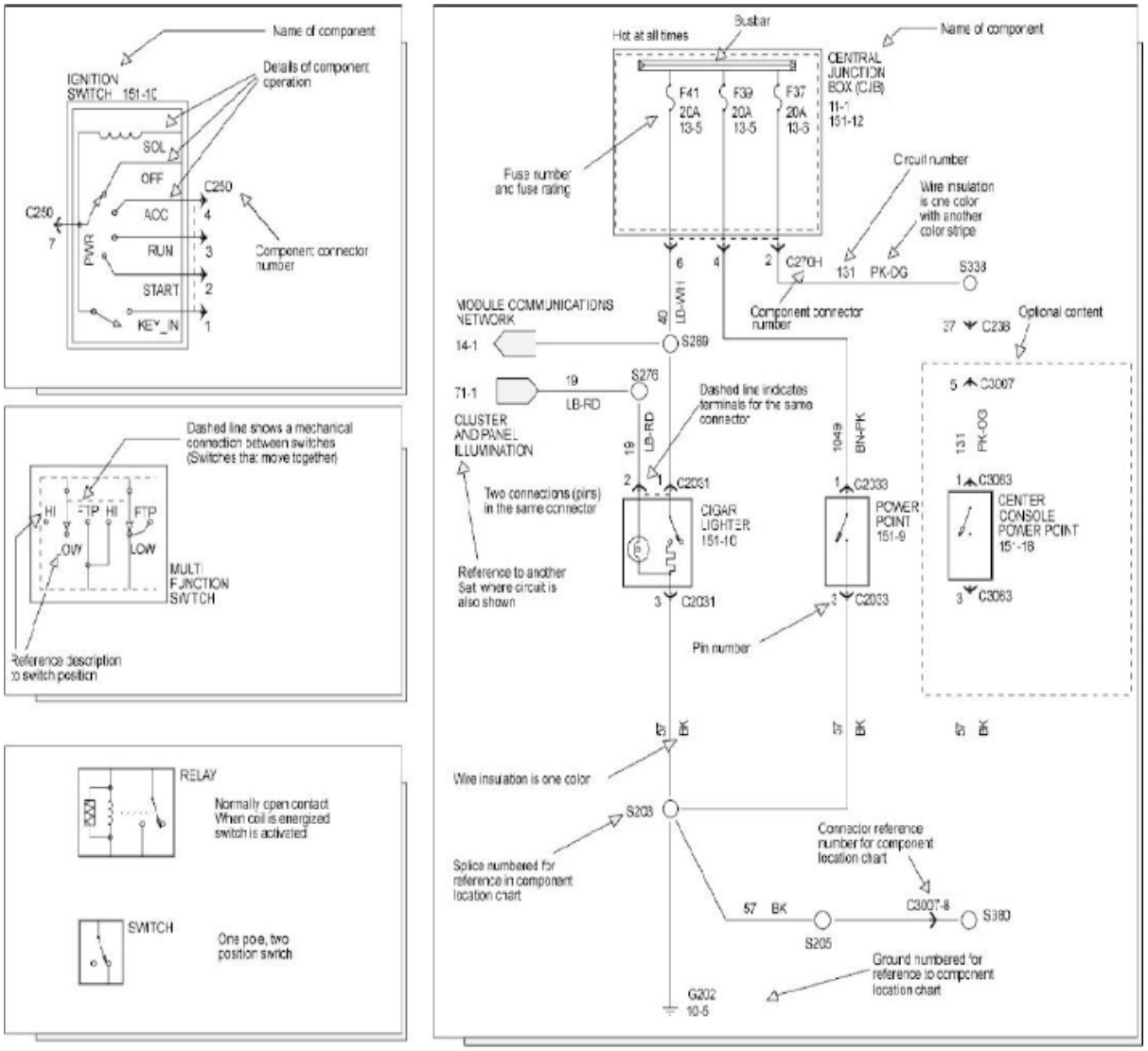
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

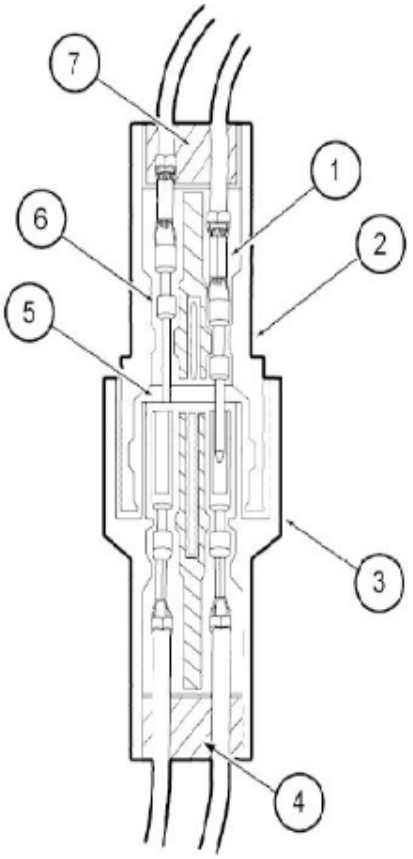


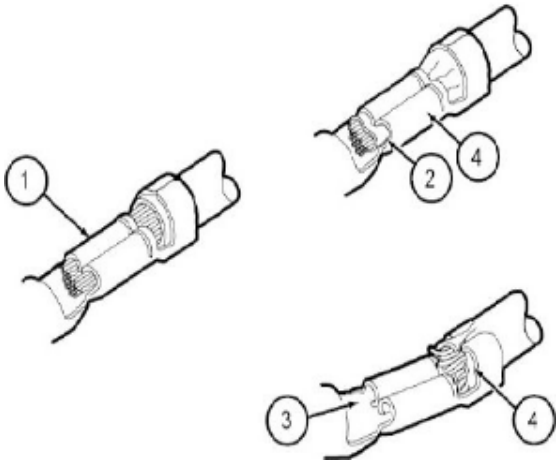
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Starter Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

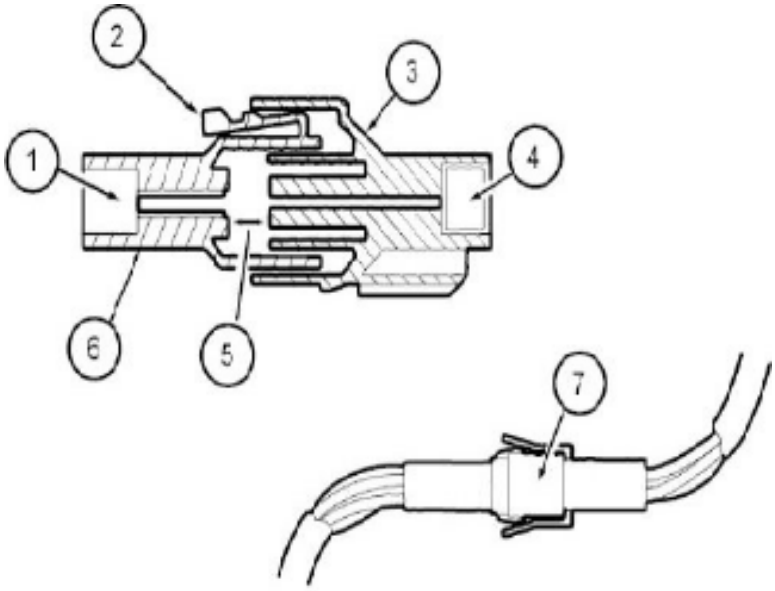
5 = Intermittent contact

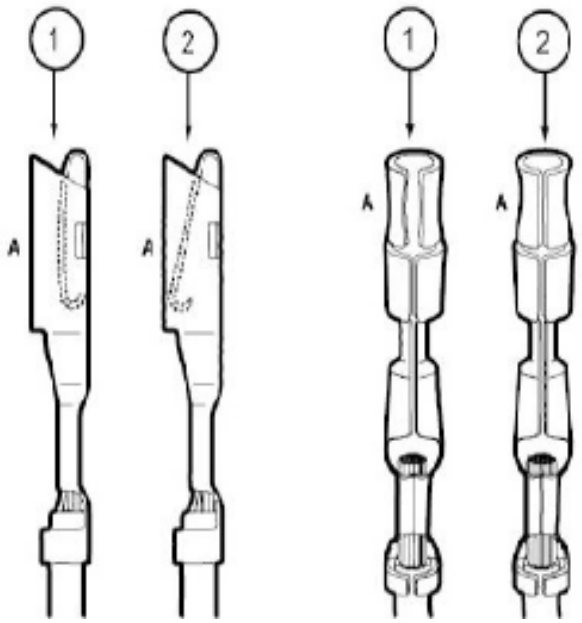
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

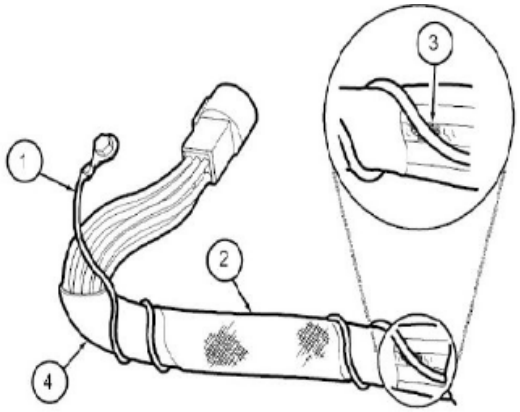
Deformed (enlarged) female terminals

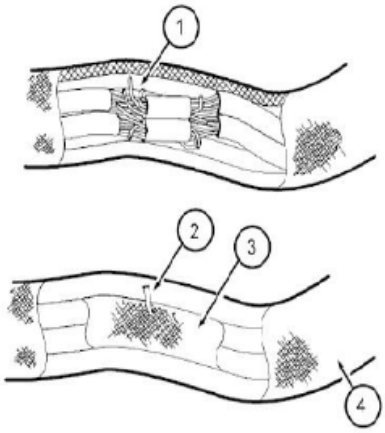
1 = Enlarged

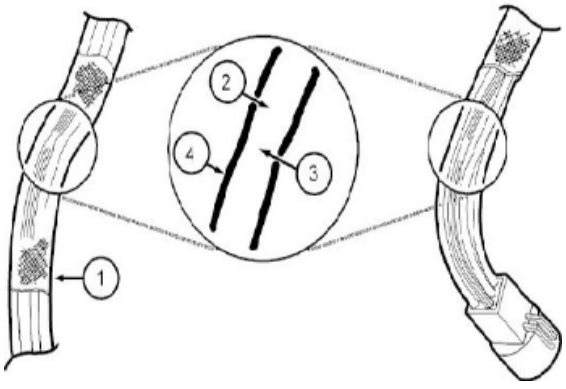
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

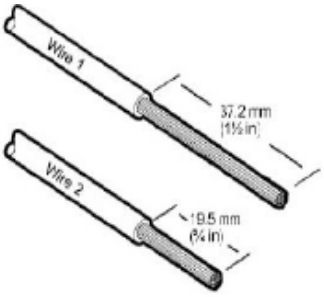
Splice covered 2

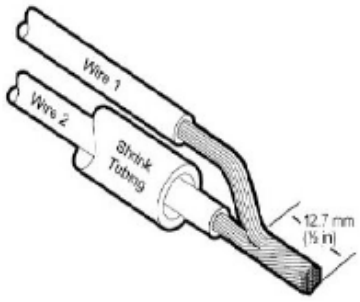
= Wire strand

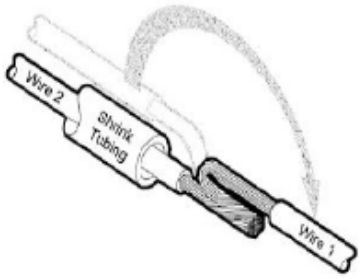
3 = Splice tape

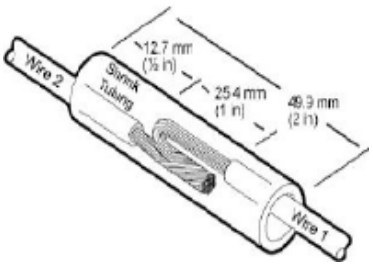
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

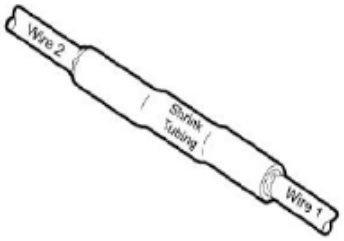
NOTE: -

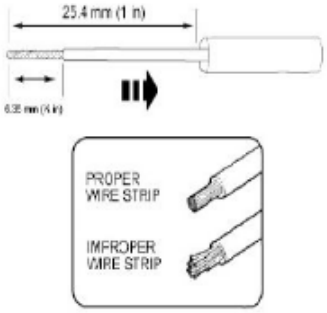
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

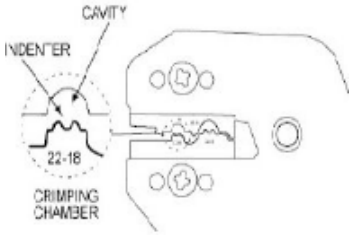
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

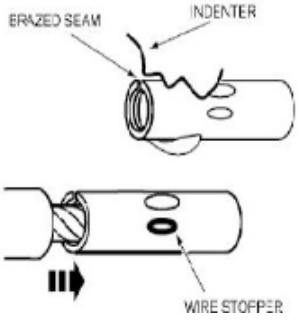
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
6.35 mm (¼ in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

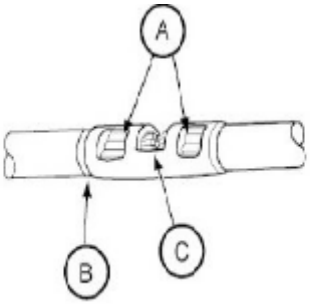
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

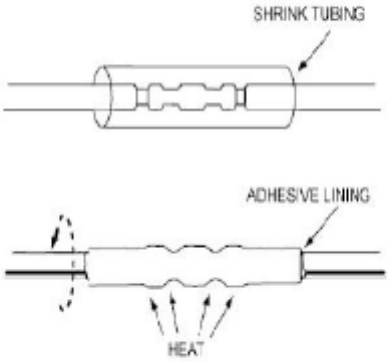
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4 strip, cut 9 strands	* 1/4 strip, cut 2 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip, fold 3x dia.
	16-14	* 1/4 strip, cut 7 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip fold 2x dia	1 strip, fold 3x dia.	1 1/4 strip, fold 4x dia.	Not Recommended
	12-10	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip fold 3x dia.	1 1/4 strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Figtail only

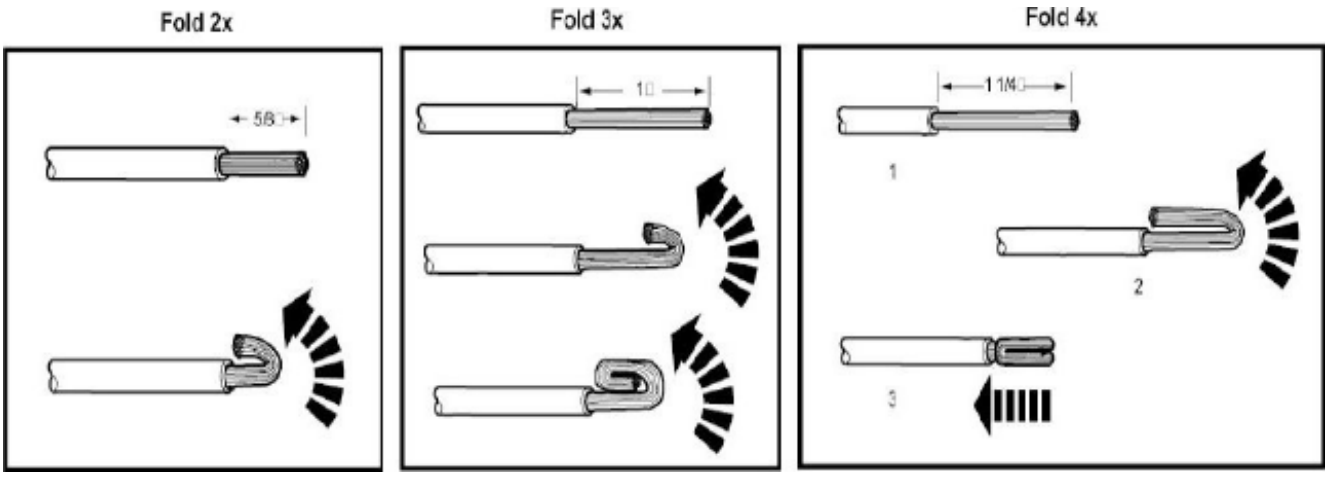
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Starter Relay: Description and Operation

The starter relay:

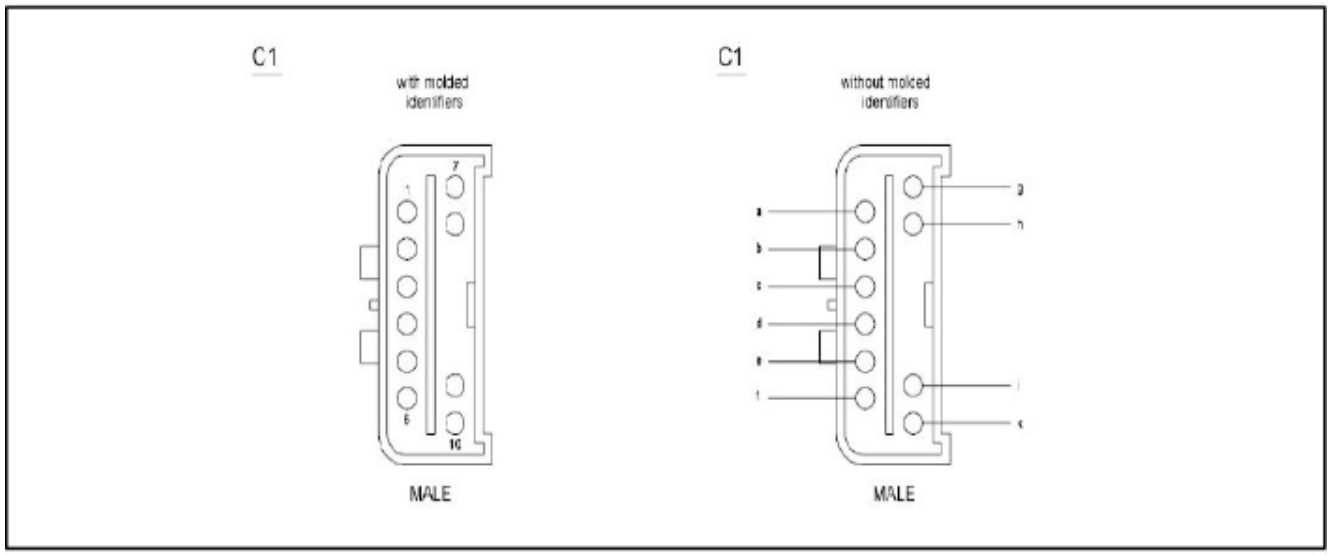
^ Is a mini ISO relay. A. switches power to the starter solenoid to engage the starter motor when it is provided a ground throigh the PCM.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



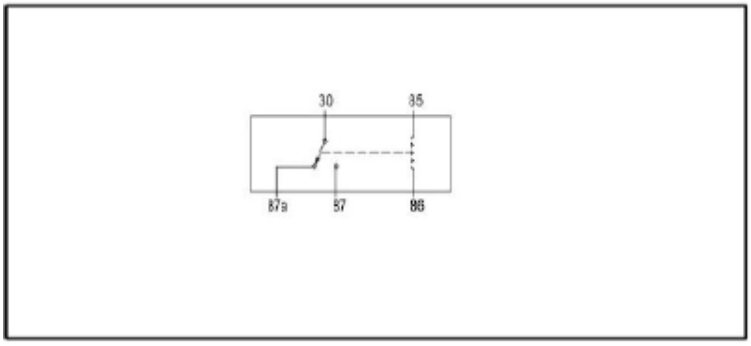
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

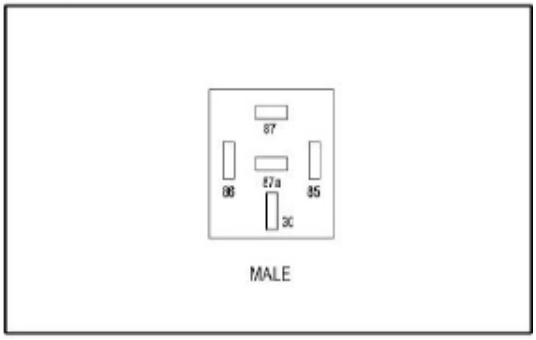
Starter Relay: Testing and Inspection

Relay □ Mini ISO

Schematic



Terminals



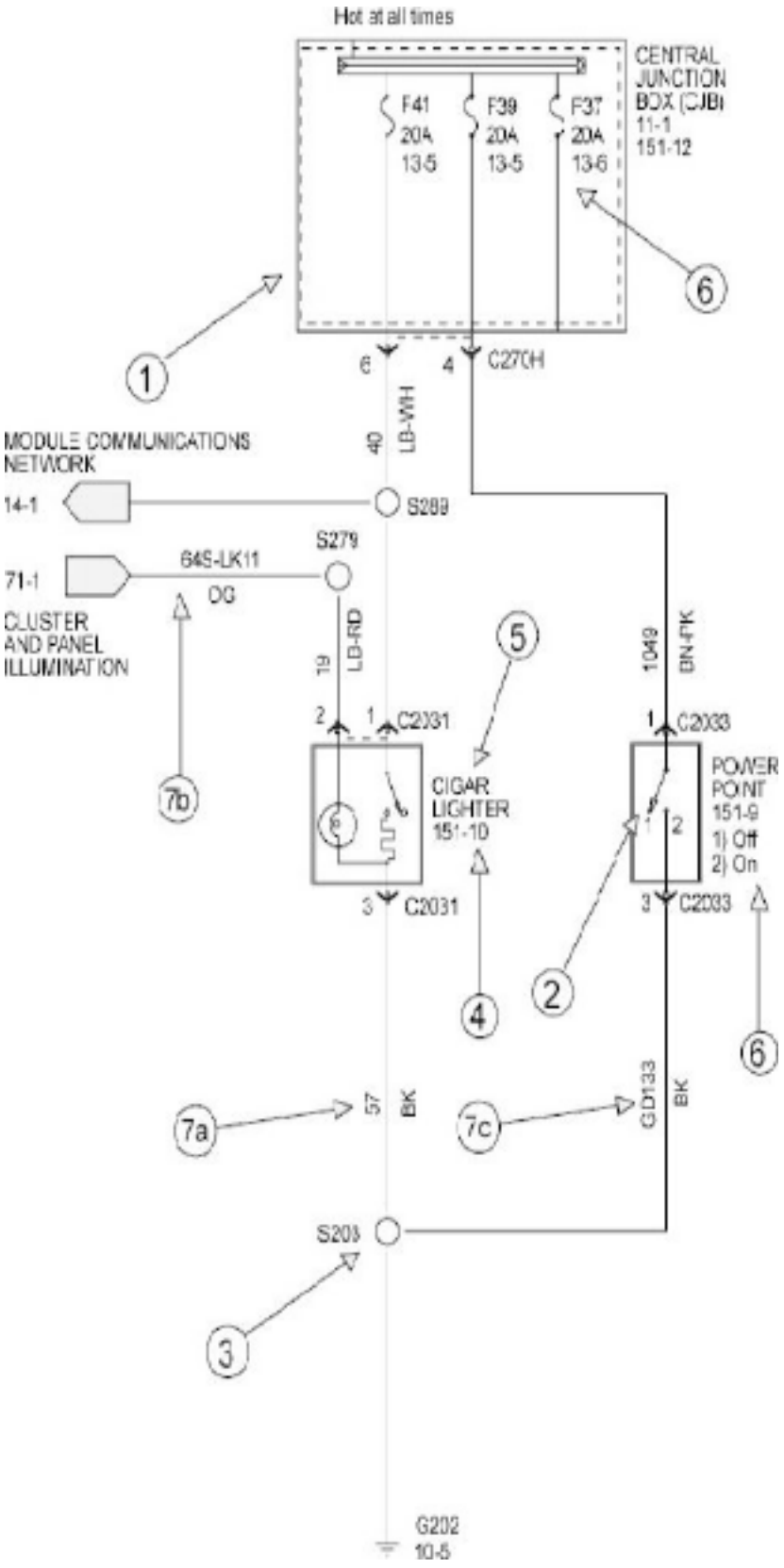
Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Relays and Modules > Relays and Modules - Windows and Glass > Power Window Relay > Component Information > Diagrams > Diagram Information and Instructions



Power Window Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

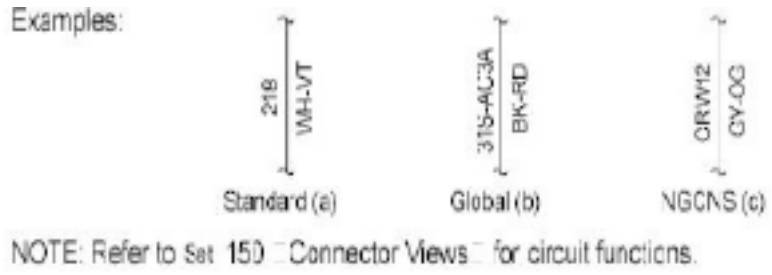
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

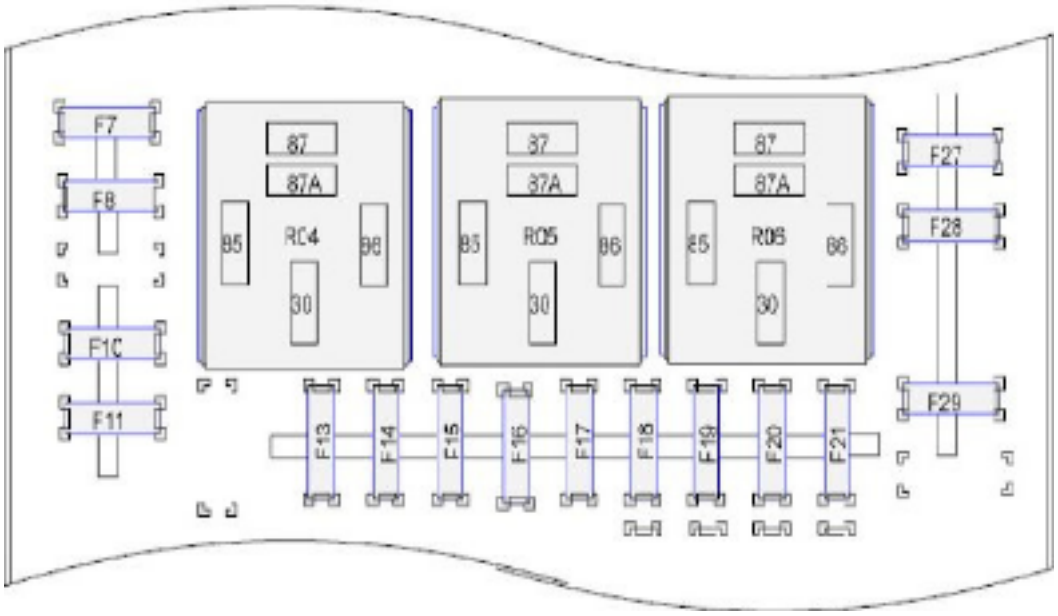
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

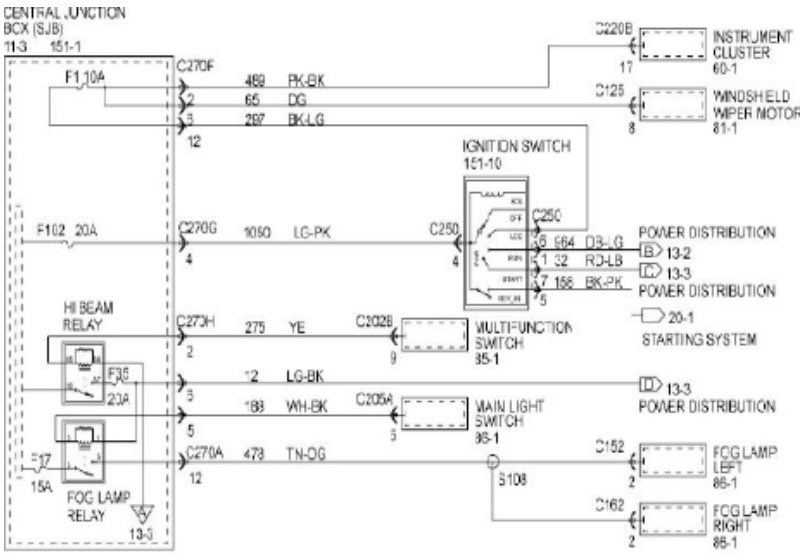
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

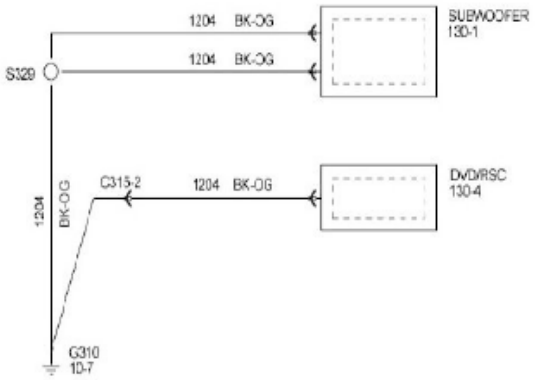
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

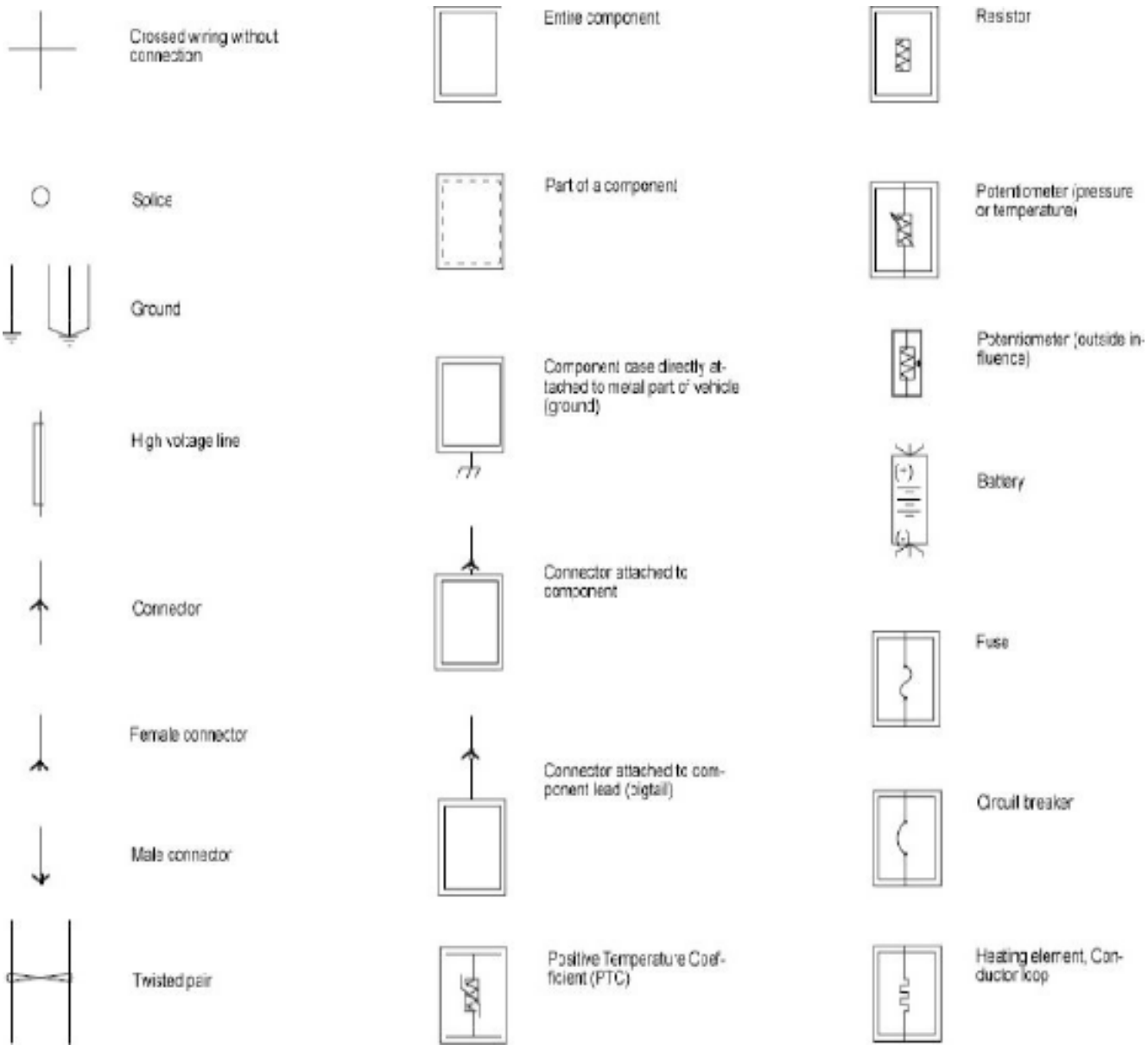
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

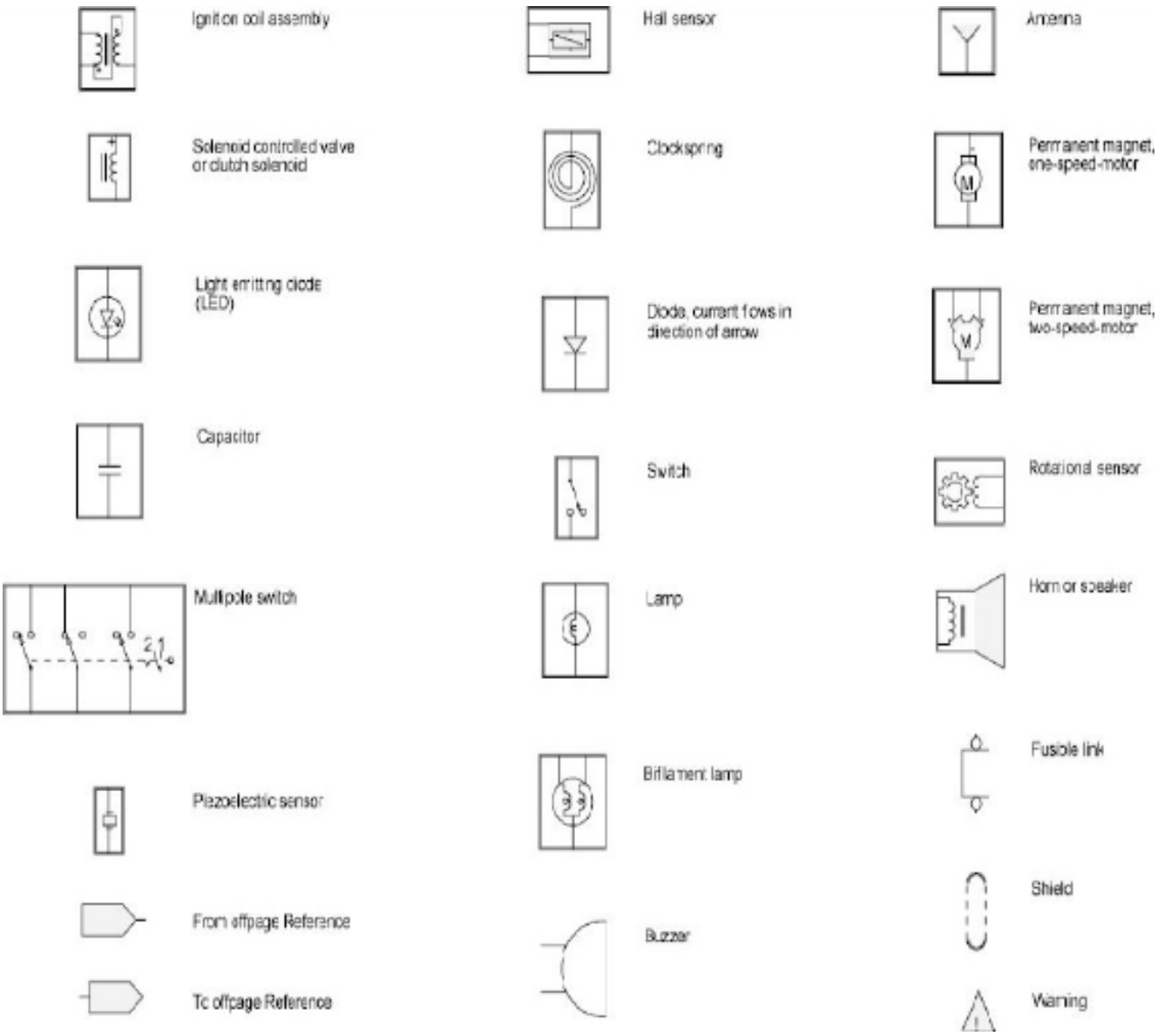
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

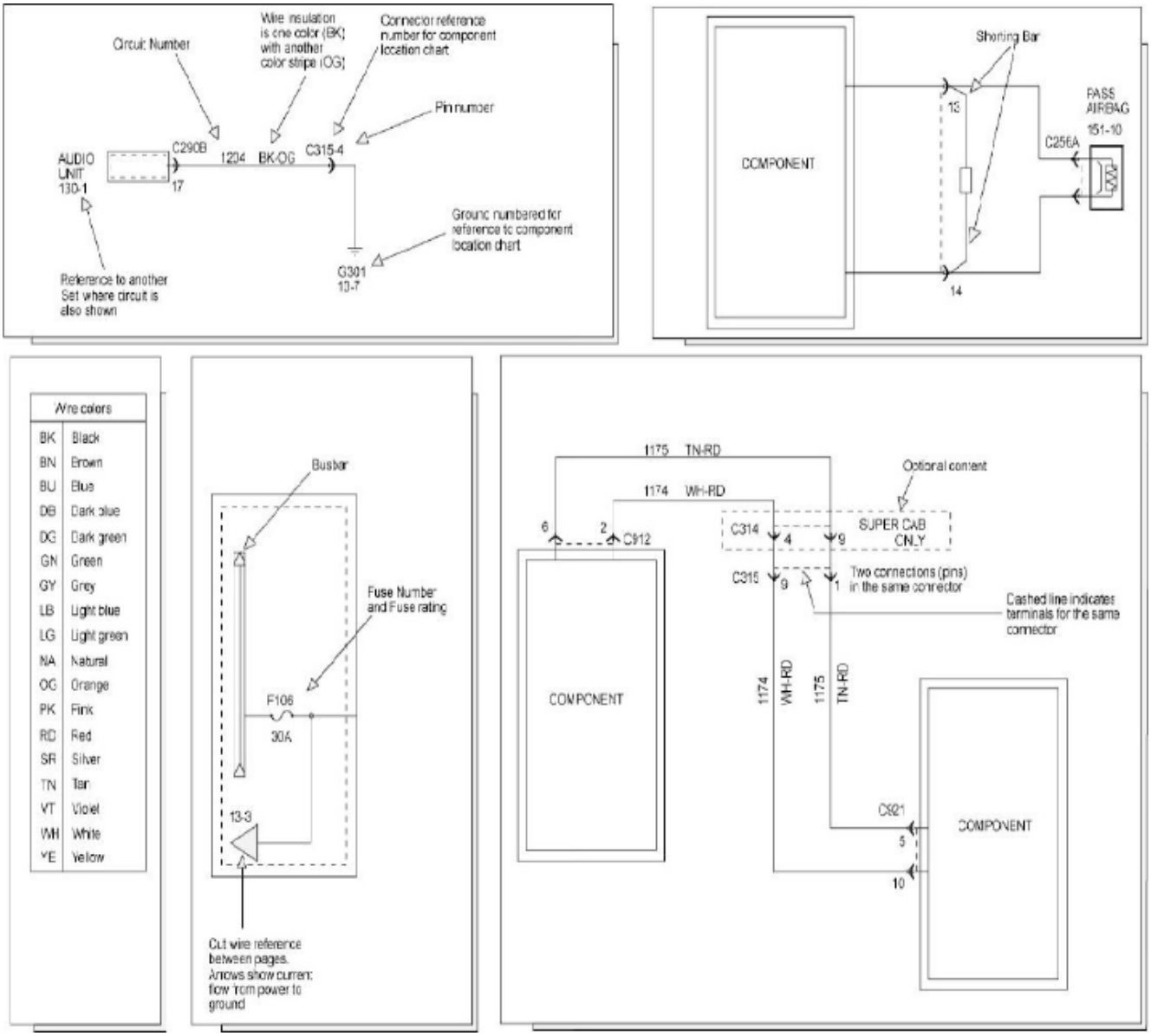
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

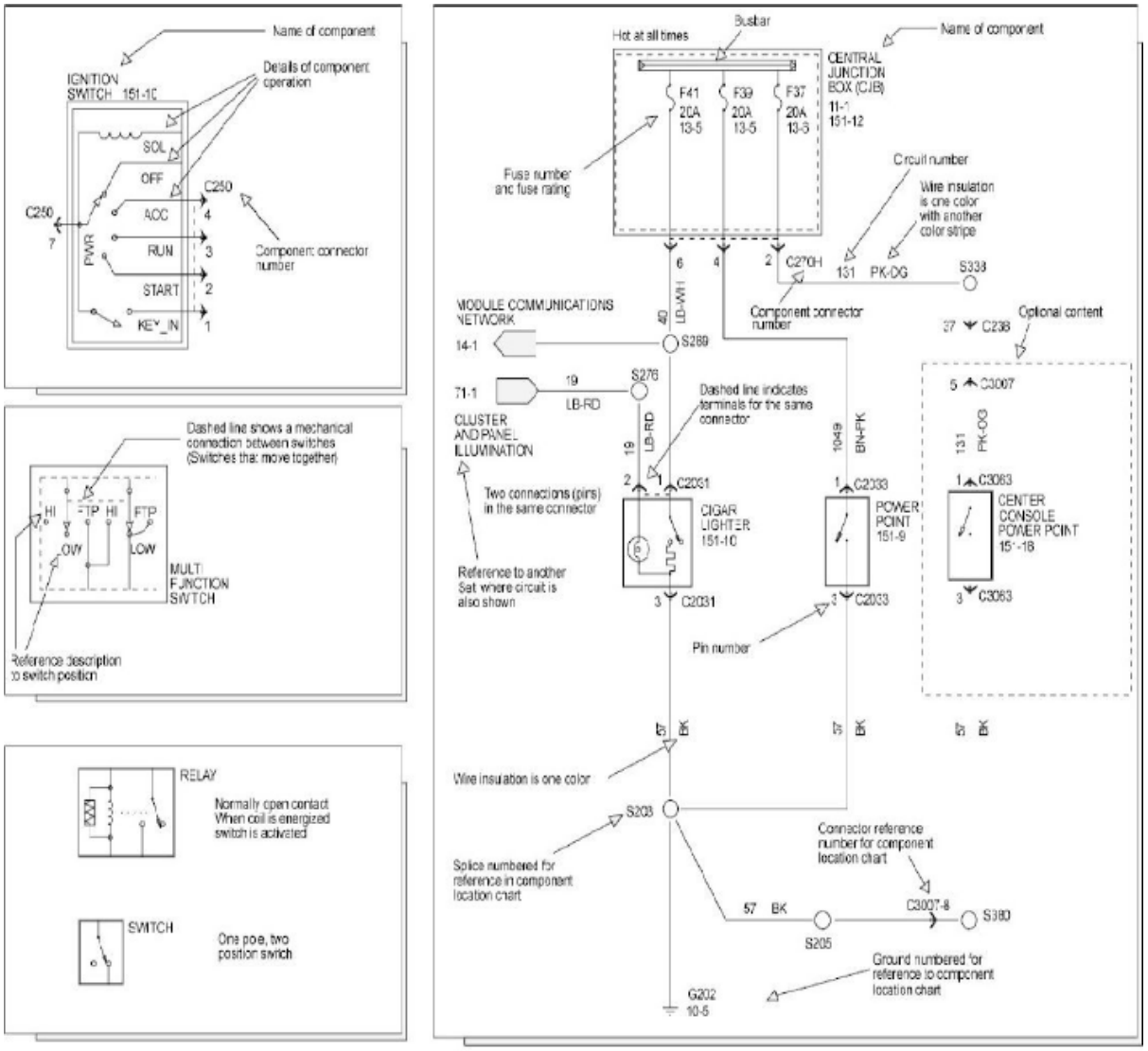
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

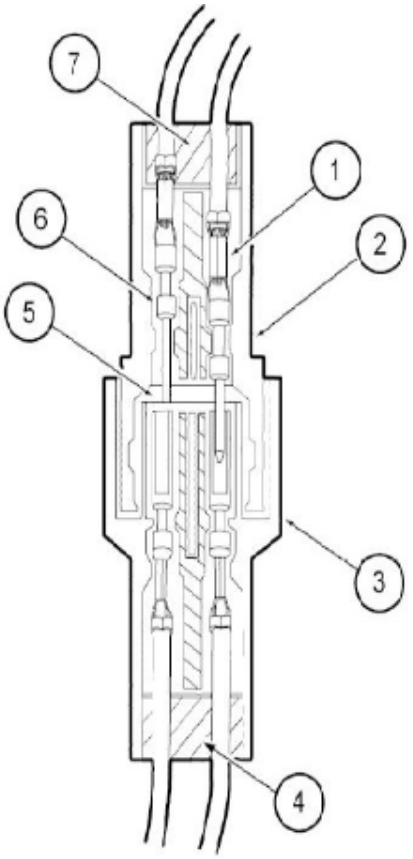


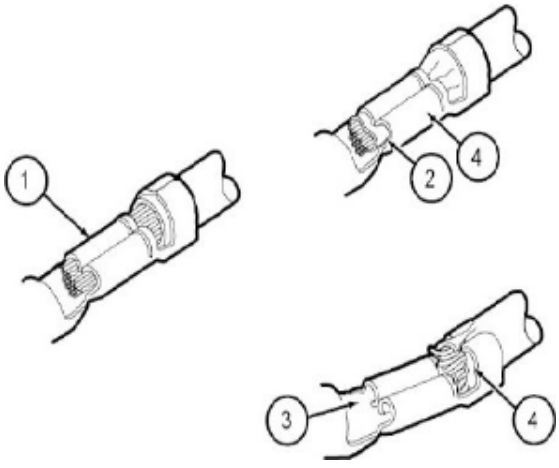
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Power Window Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

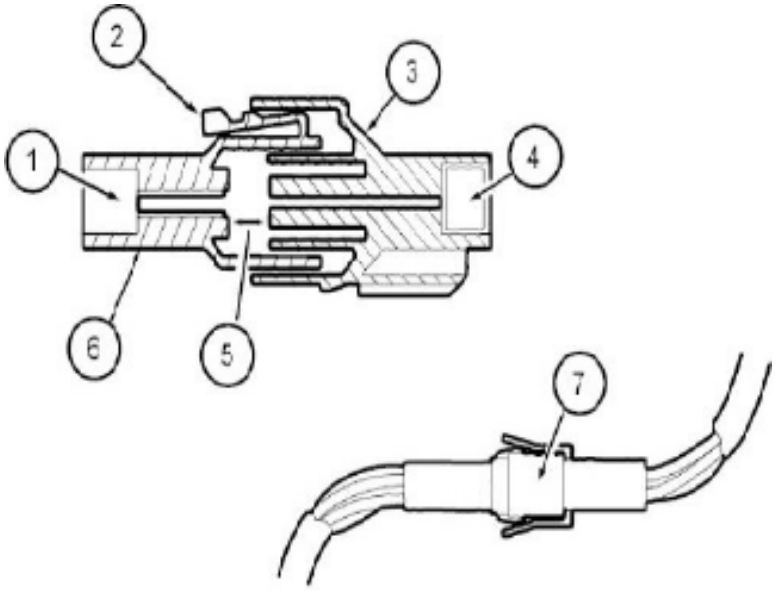
5 = Intermittent contact

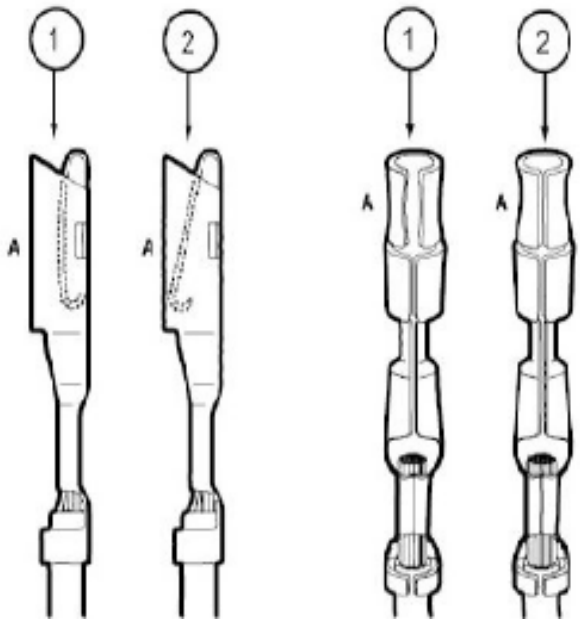
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

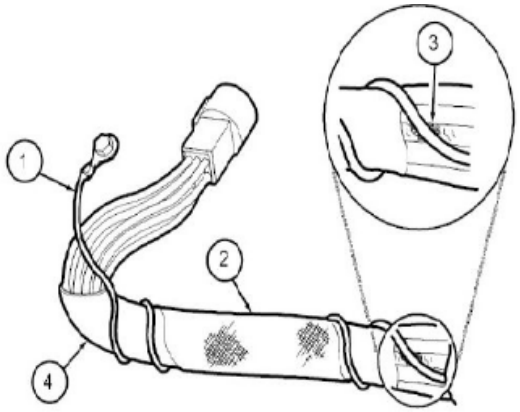
Deformed (enlarged) female terminals

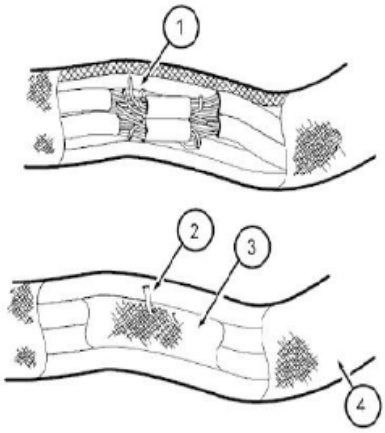
1 = Enlarged

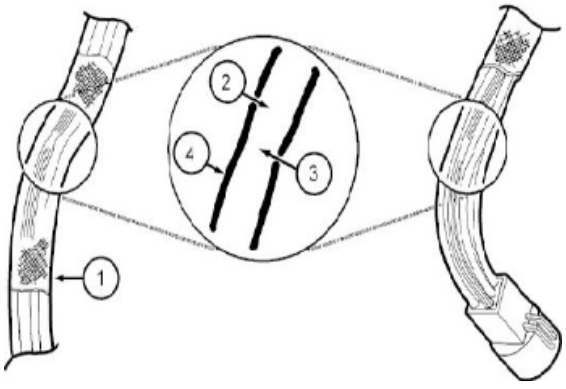
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

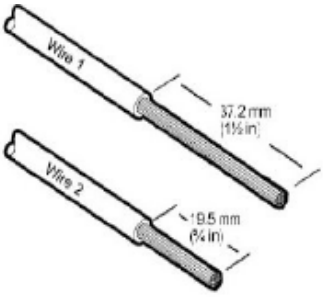
Splice covered 2

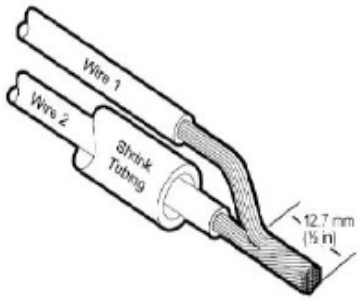
= Wire strand

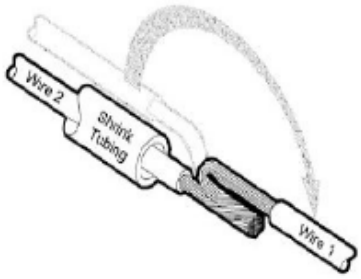
3 = Splice tape

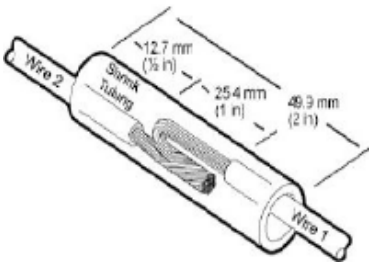
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

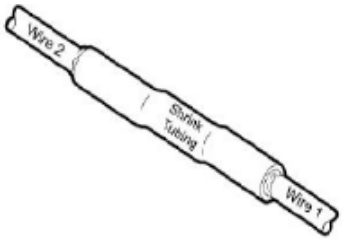
NOTE: -

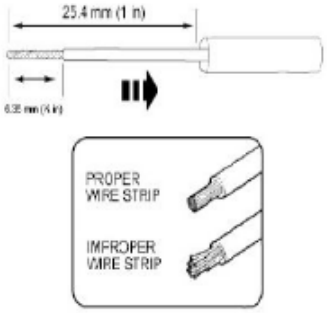
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

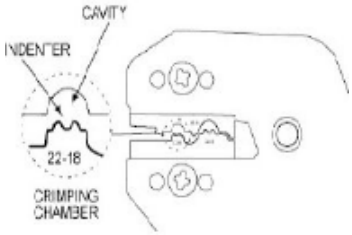
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

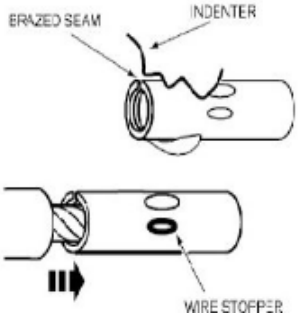
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
6.35 mm (¼ in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

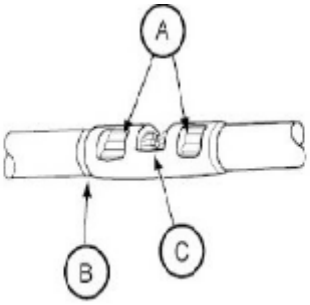
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

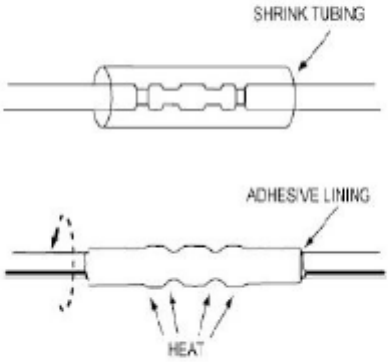
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4 strip, cut 9 strands	* 1/4 strip, cut 2 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip, fold 3x dia.
	16-14	* 1/4 strip, cut 7 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip fold 2x dia	1 strip, fold 3x dia.	1 1/4 strip, fold 4x dia.	Not Recommended
	12-10	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip fold 3x dia.	1 1/4 strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Pigtail only

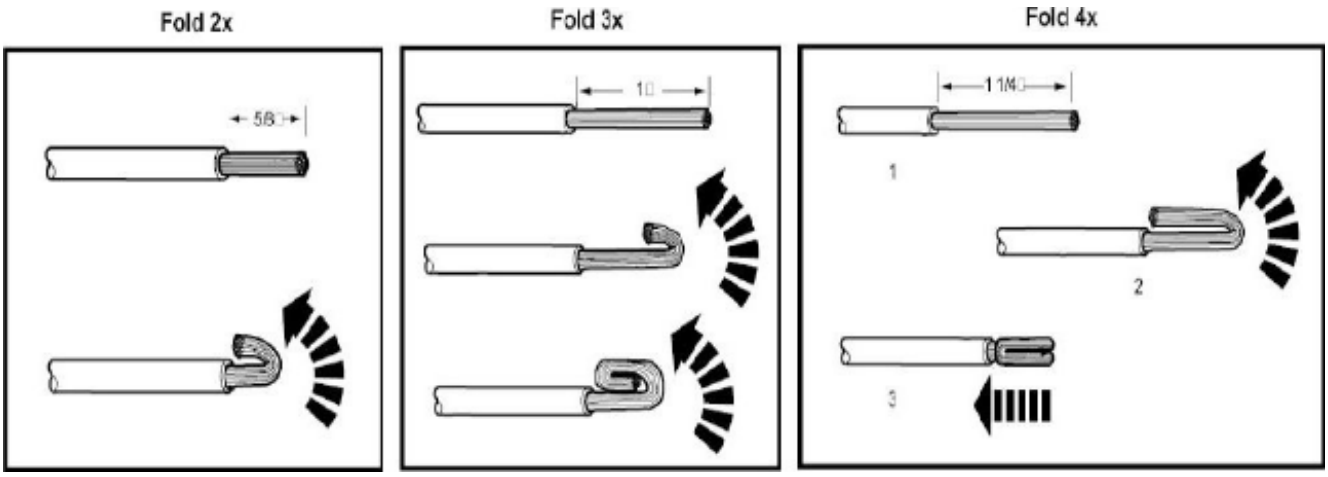
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



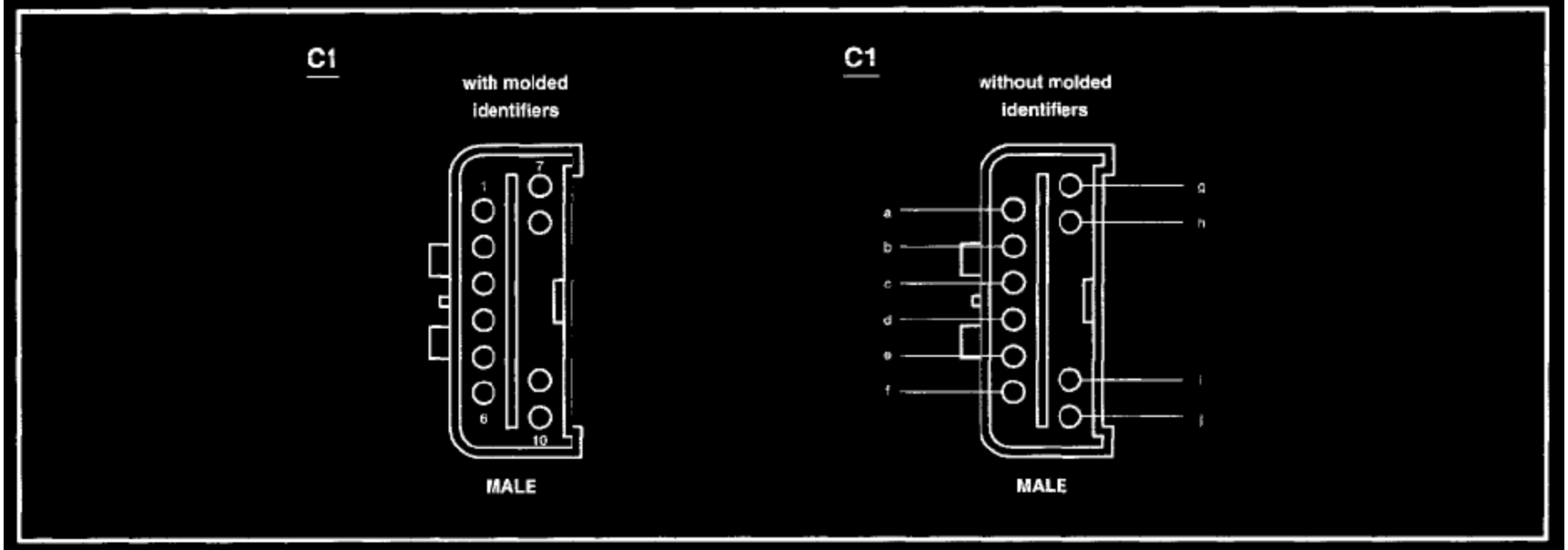
The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step–by–step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



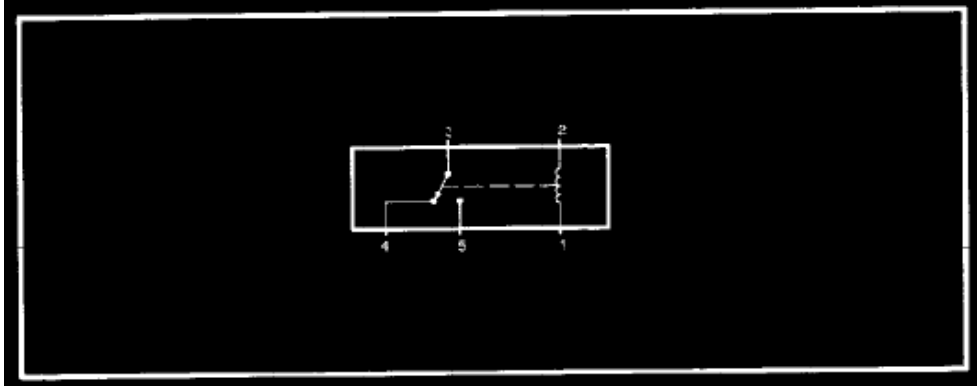
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

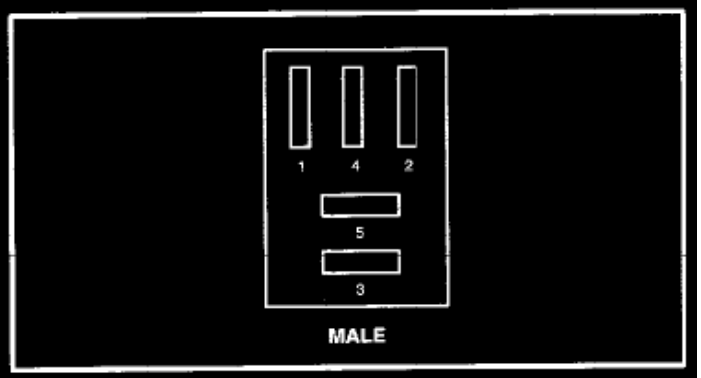
Power Window Relay: Testing and Inspection Micro ISO Relay

Relay – Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63–102Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil – Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

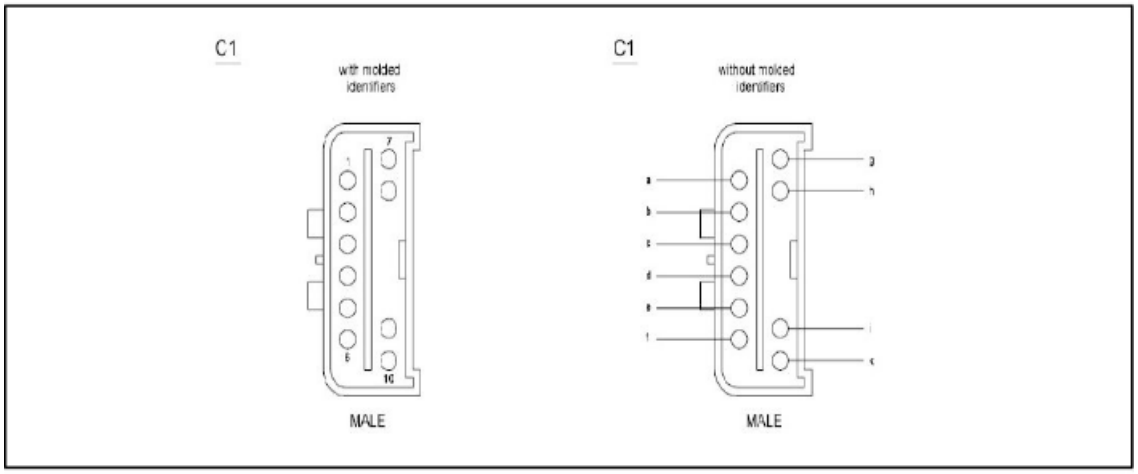
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step□by□step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals

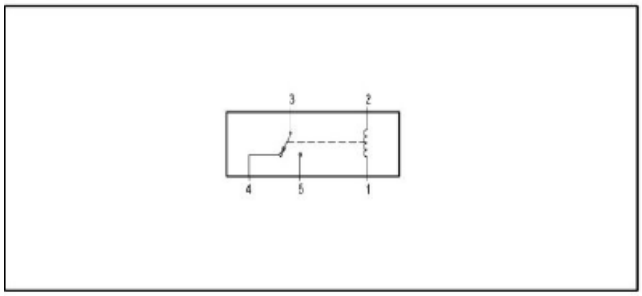


The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column □Circuit to test□. If you wish to test the complete component, perform all tests.

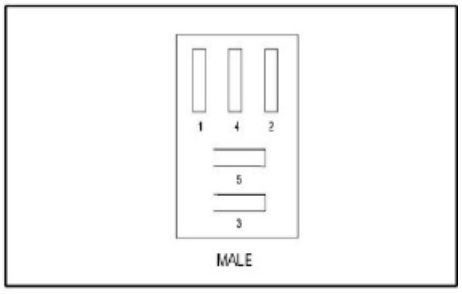
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Relay □ Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63□102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil □ Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

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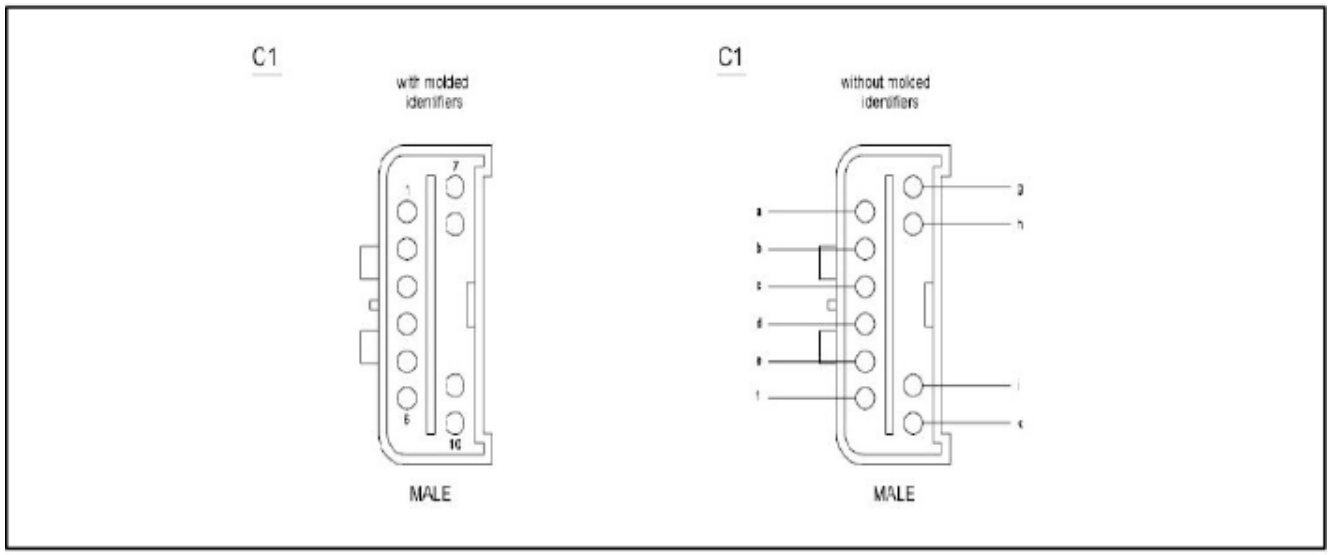
Terminals



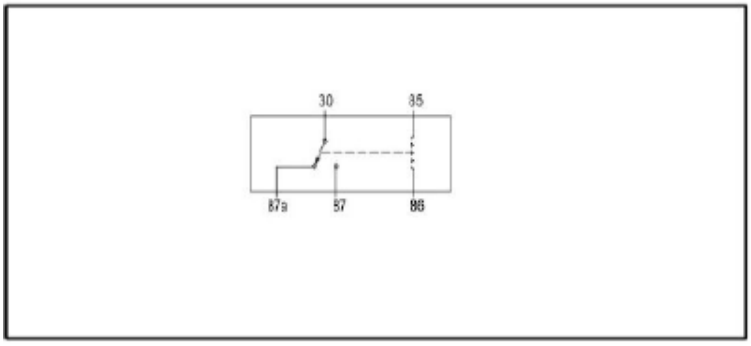
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

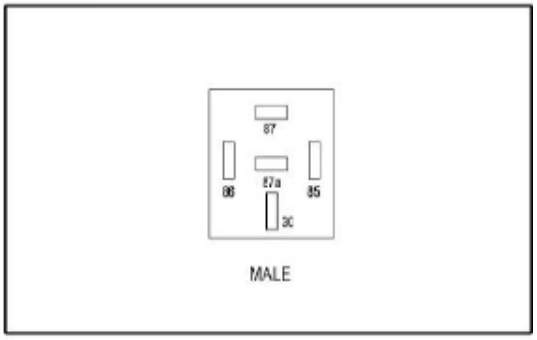
Power Window Relay: Testing and Inspection Mini ISO Relay

Relay □ Mini ISO

Schematic



Terminals



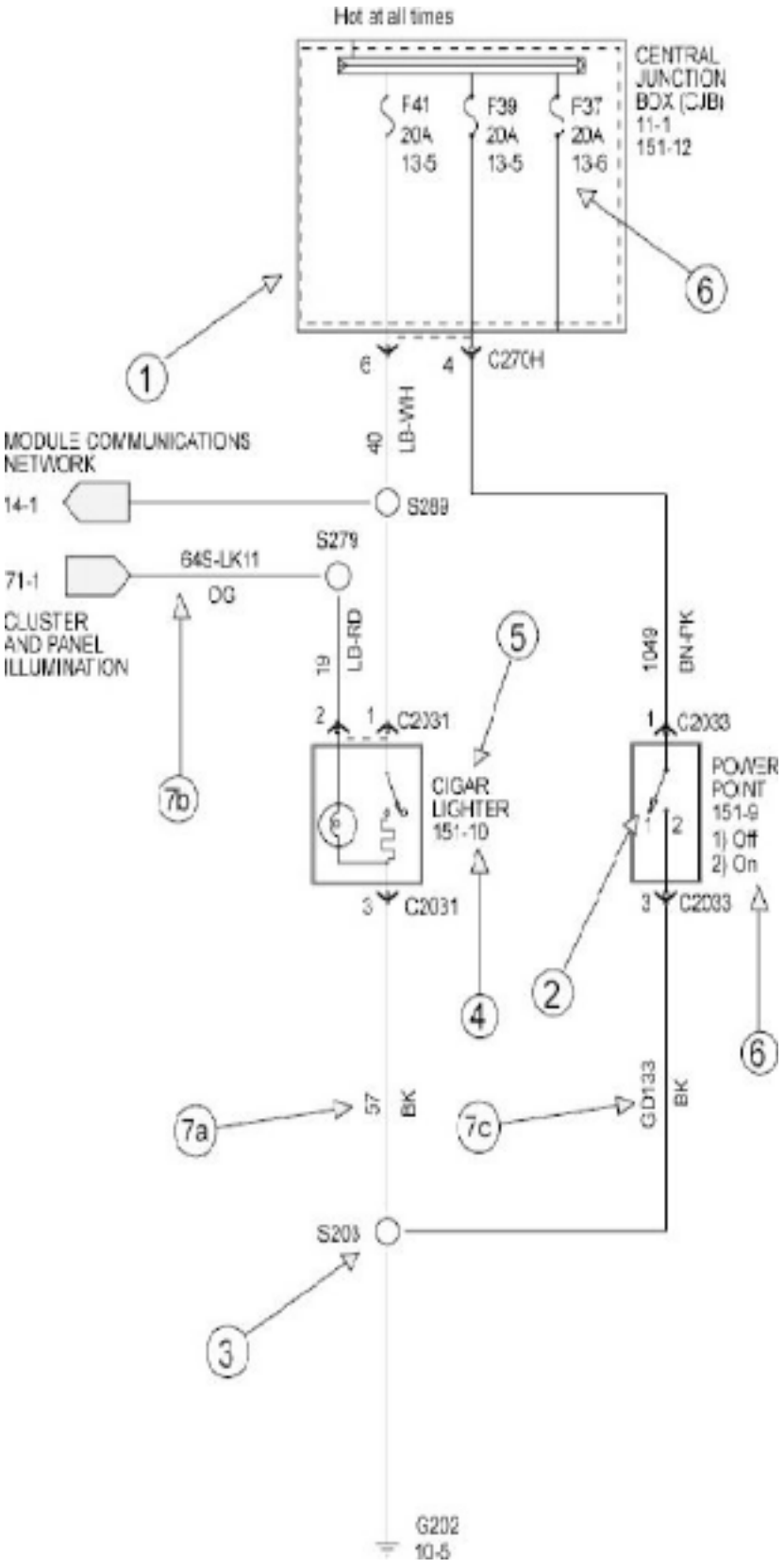
Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Relays and Modules > Relays and Modules - Wiper and Washer Systems > Windshield Washer Relay > Component Information > Diagrams > Diagram Information and Instructions



Windshield Washer Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

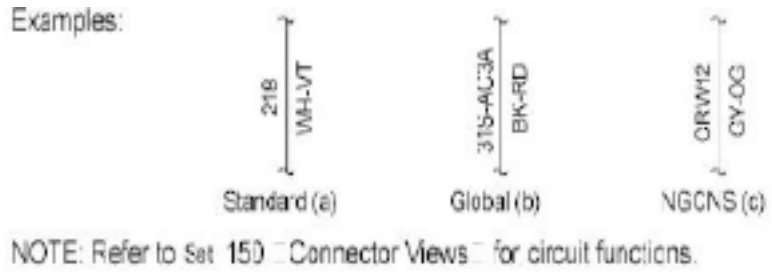
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

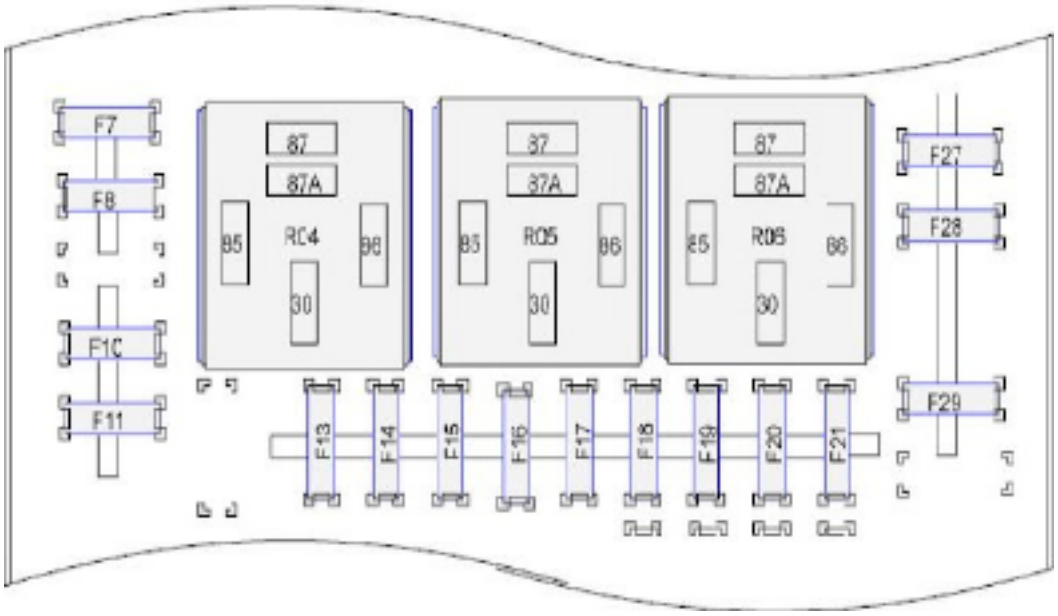
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

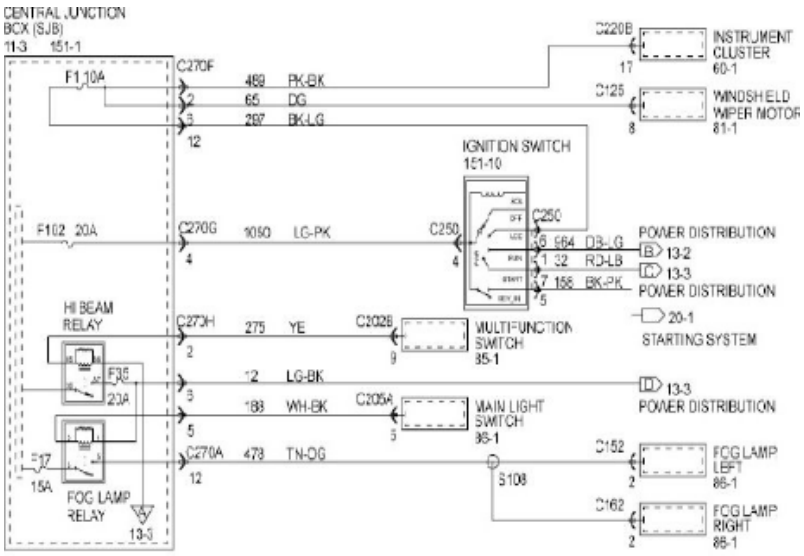
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

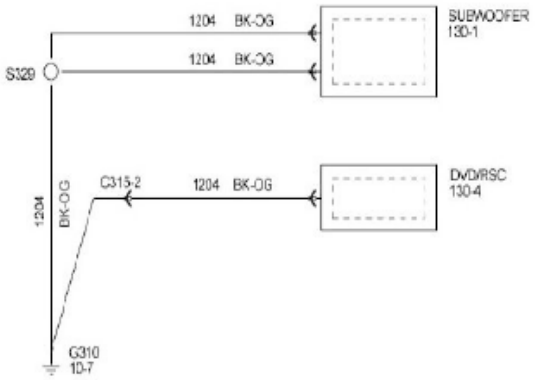
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

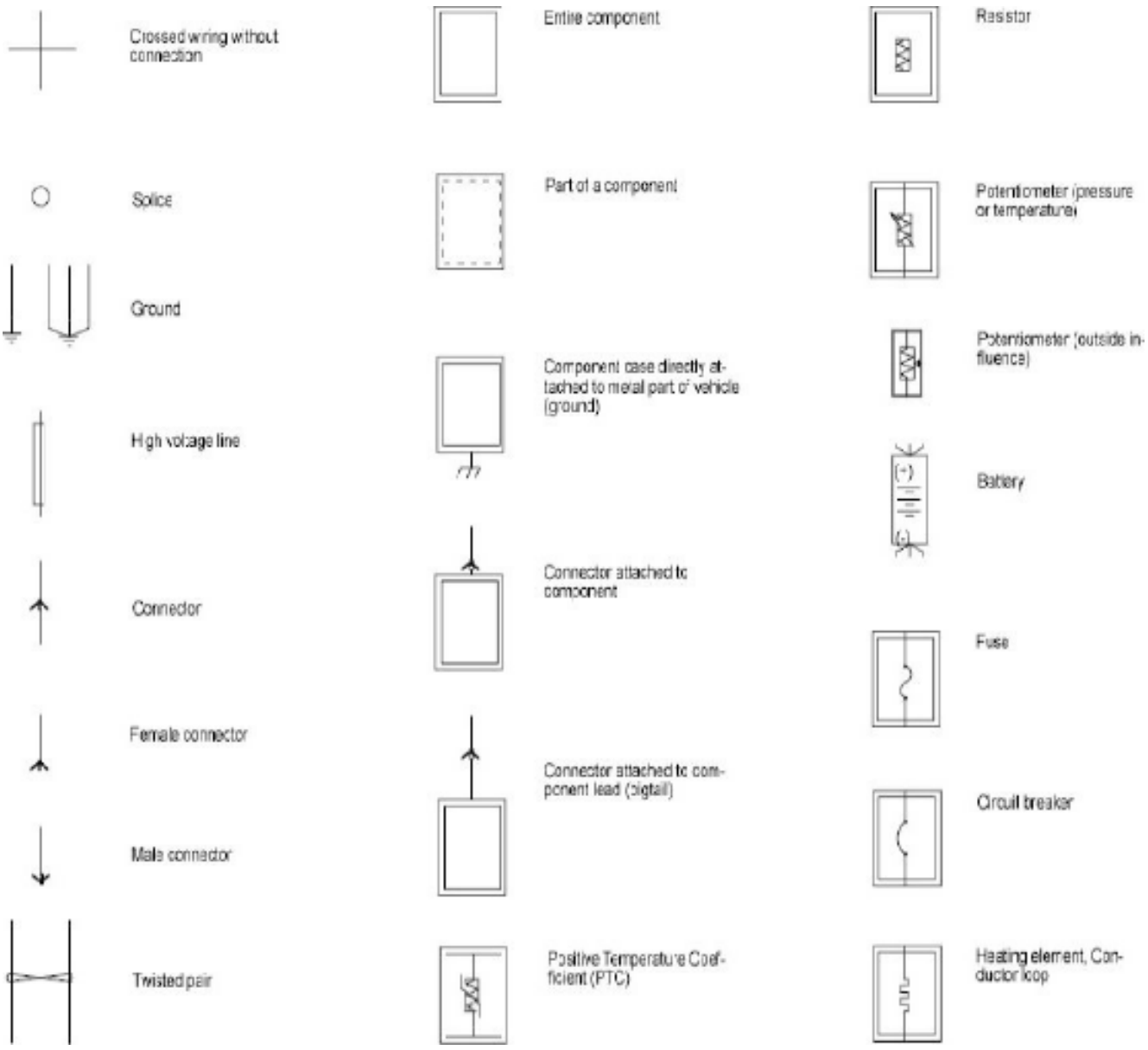
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

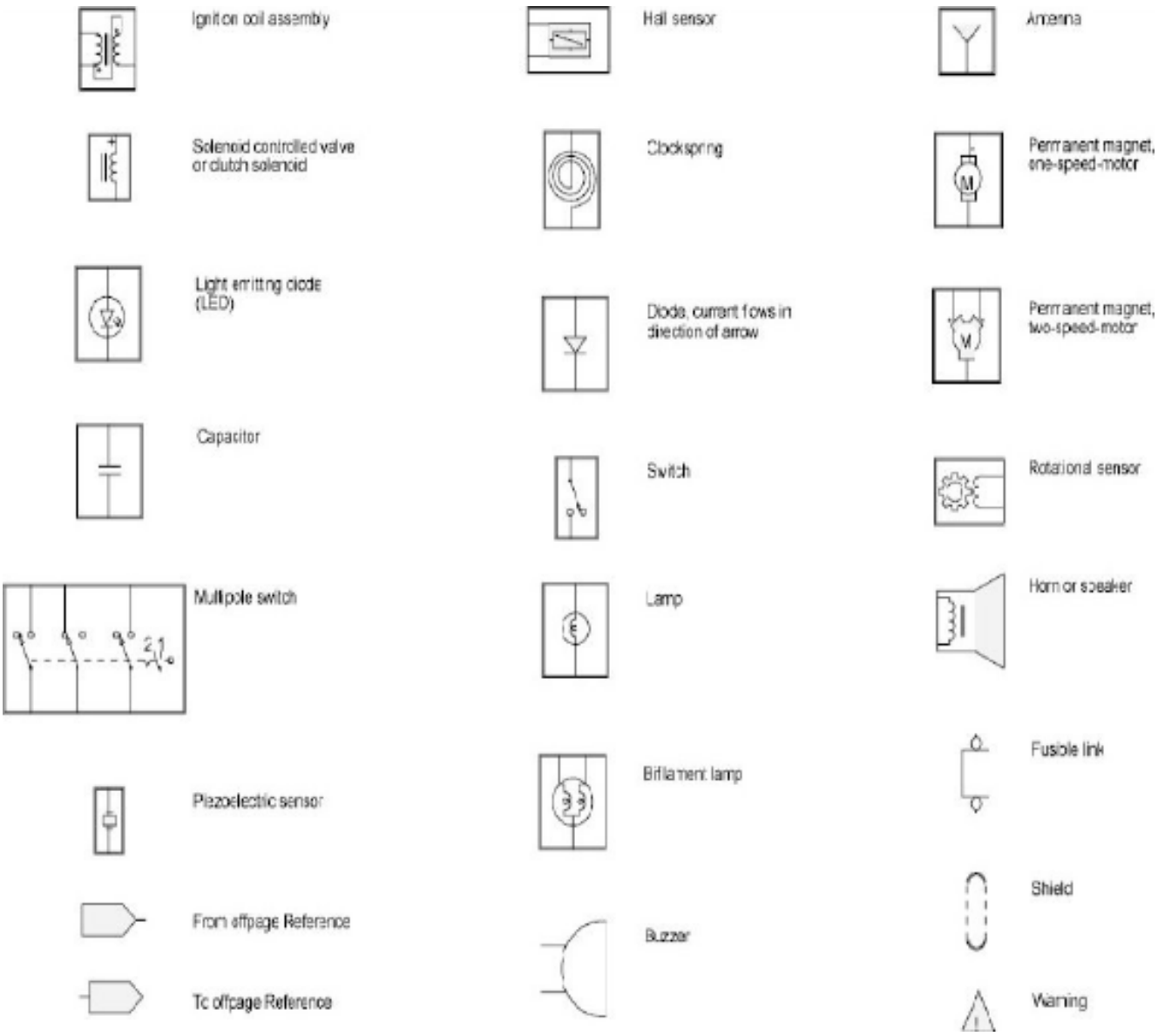
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

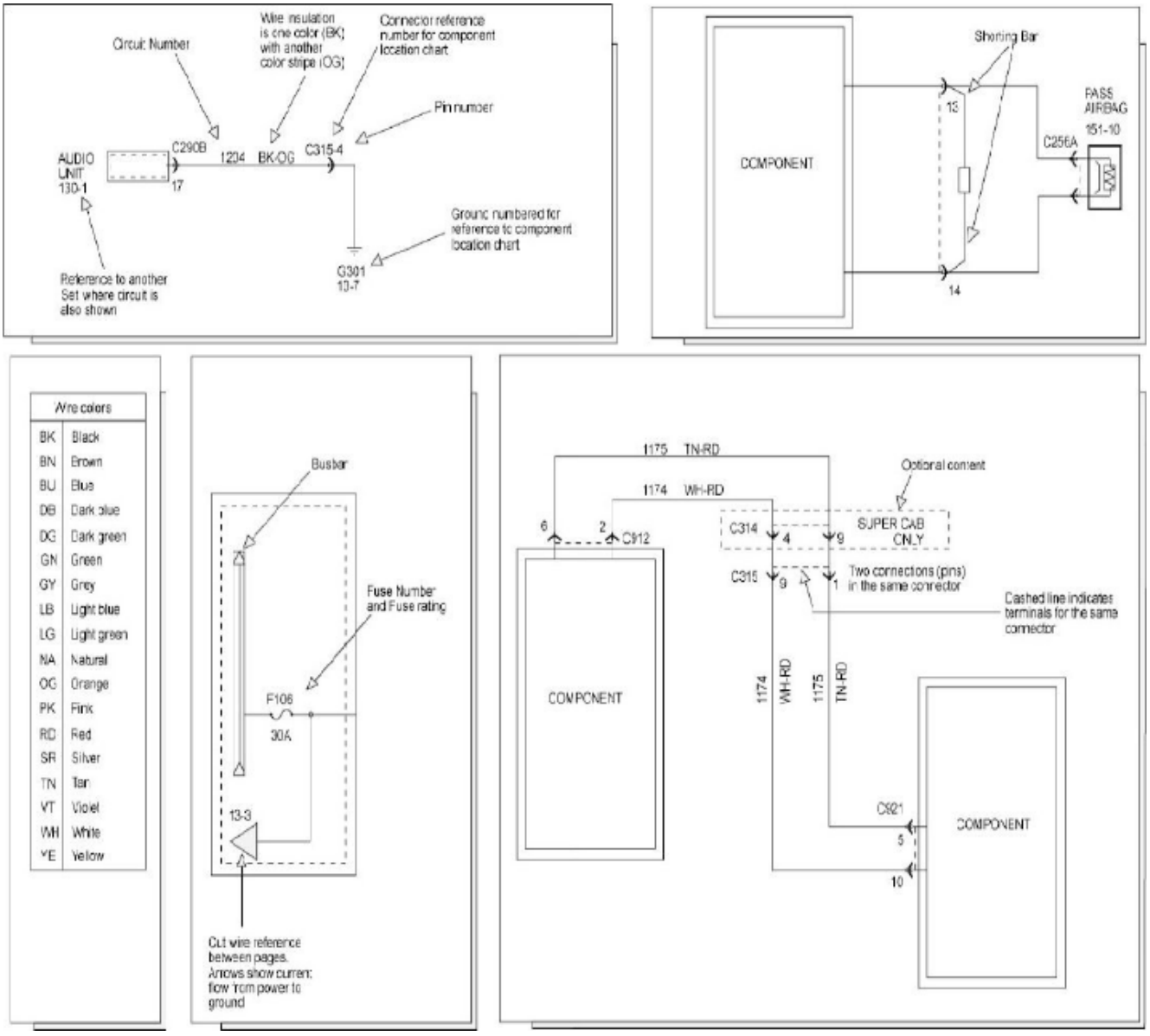
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

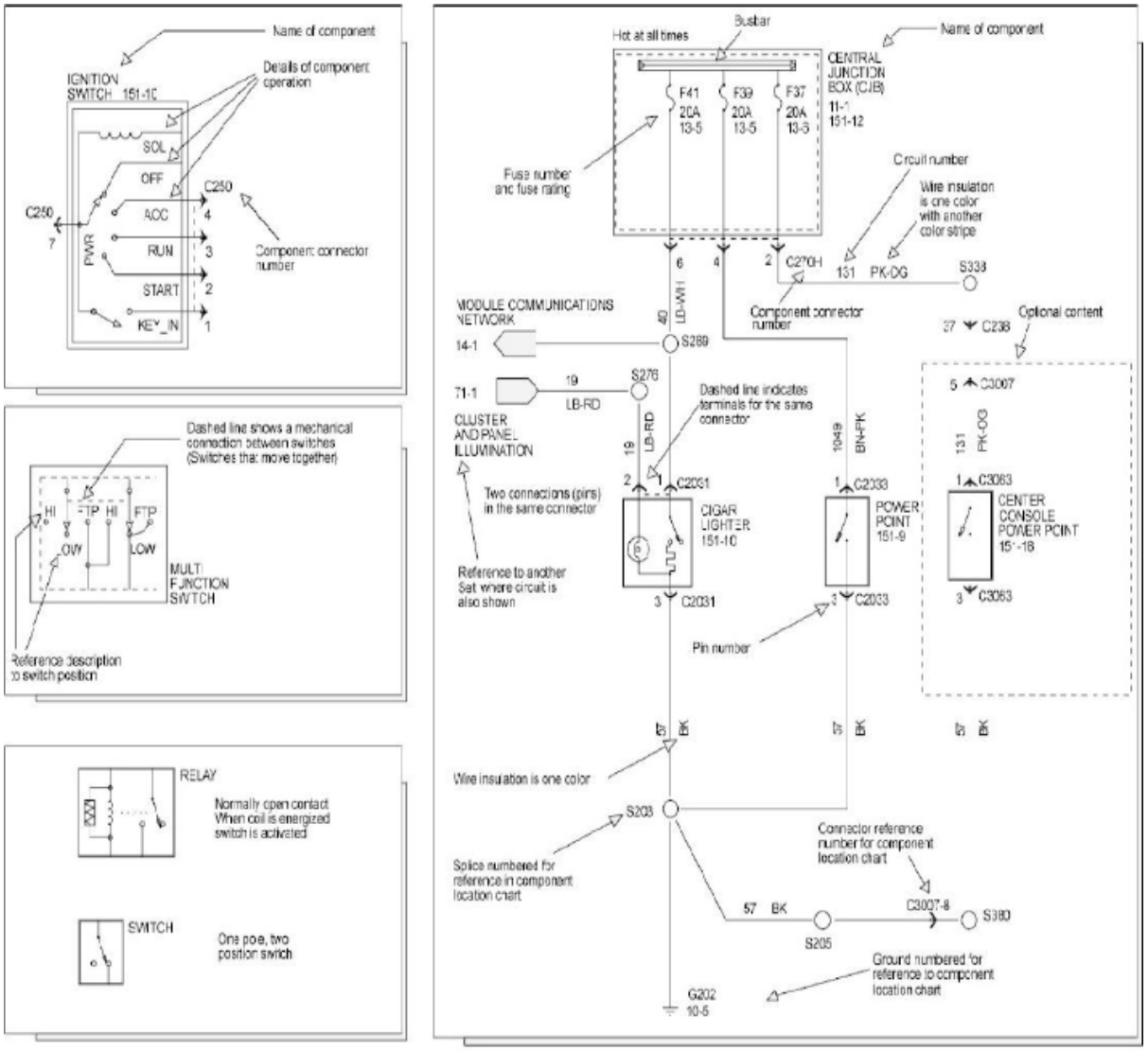
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

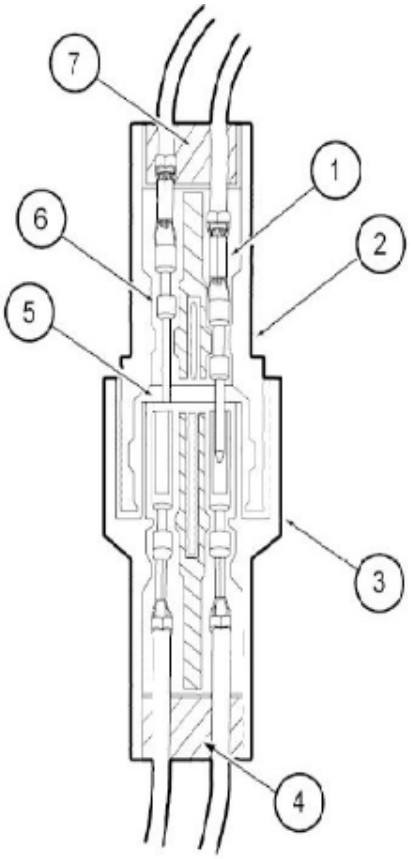


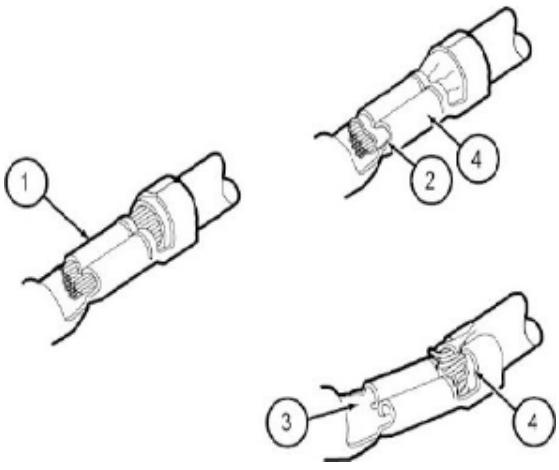
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Windshield Washer Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

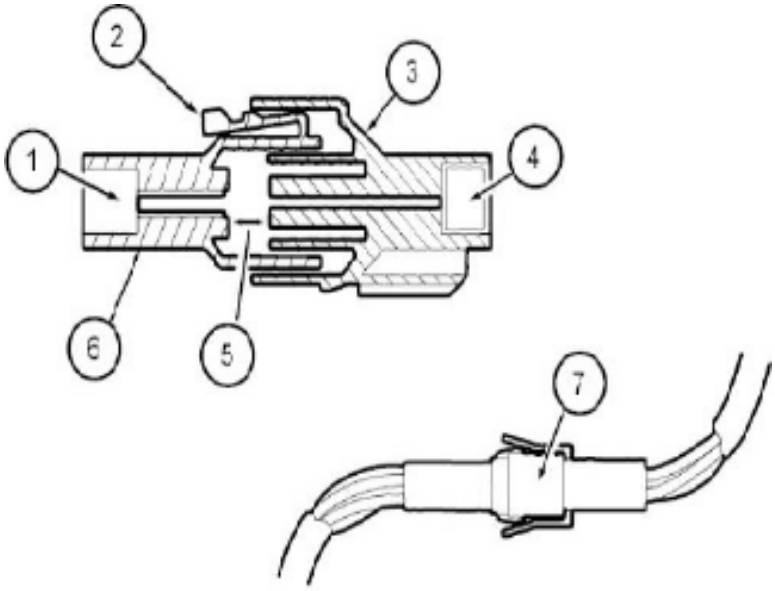
5 = Intermittent contact

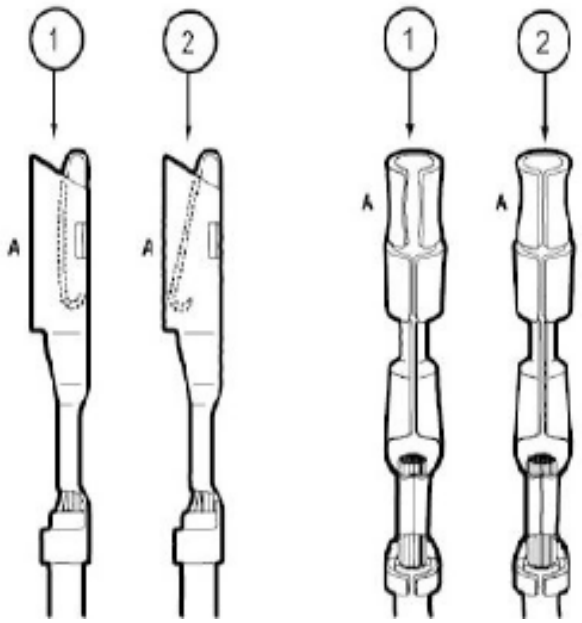
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

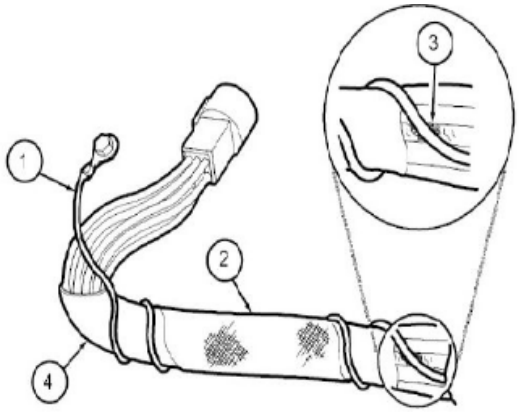
Deformed (enlarged) female terminals

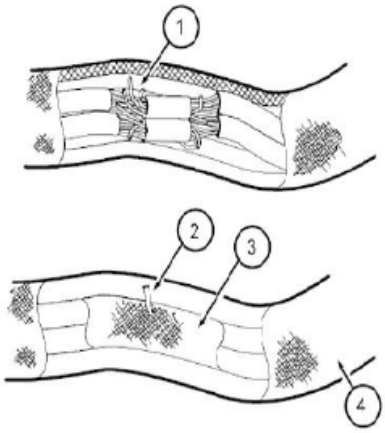
1 = Enlarged

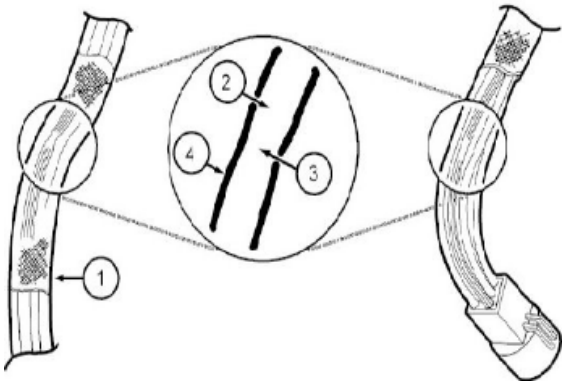
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

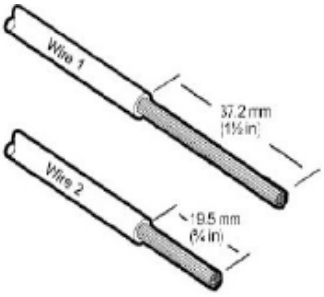
Splice covered 2

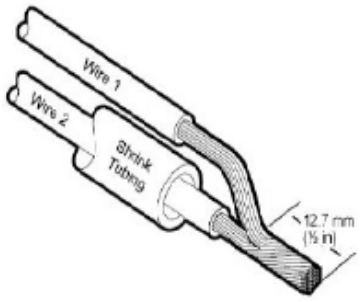
= Wire strand

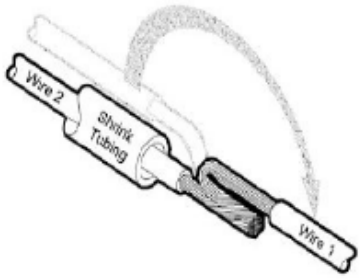
3 = Splice tape

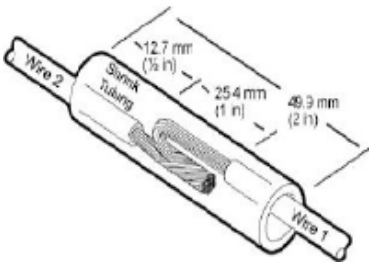
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

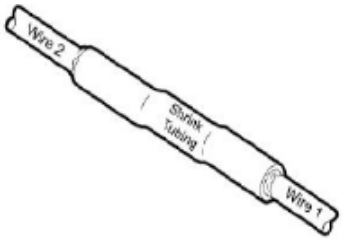
NOTE: -

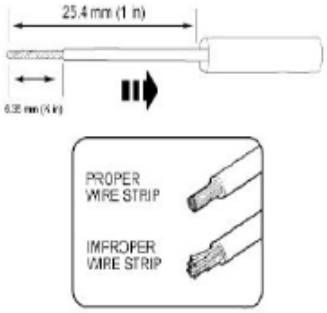
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

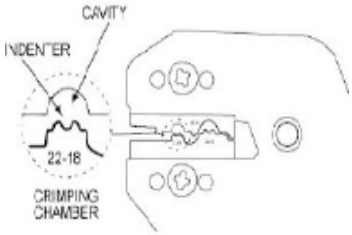
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

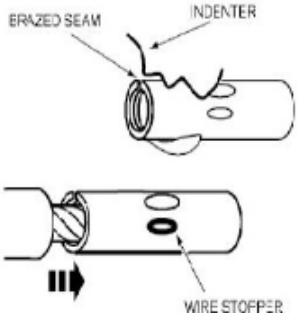
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

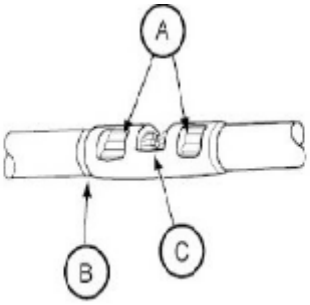
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

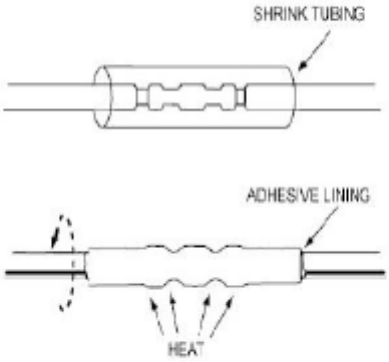
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4" strip, cut 9 strands	* 1/4" strip, cut 2 strands	1/4" strip, no fold	1/4" strip, no fold	1/4" strip, no fold	5/8" strip, fold 2x dia.	1" strip, fold 3x dia.
	16-14	* 1/4" strip, cut 7 strands	1/4" strip, no fold	1/4" strip, no fold	1/4" strip, no fold	5/8" strip fold 2x dia	1" strip, fold 3x dia.	1 1/4" strip, fold 4x dia.	Not Recommended
	12-10	1/4" strip, no fold	1/4" strip, no fold	5/8" strip, fold 2x dia.	1" strip fold 3x dia.	1 1/4" strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Pigtail only

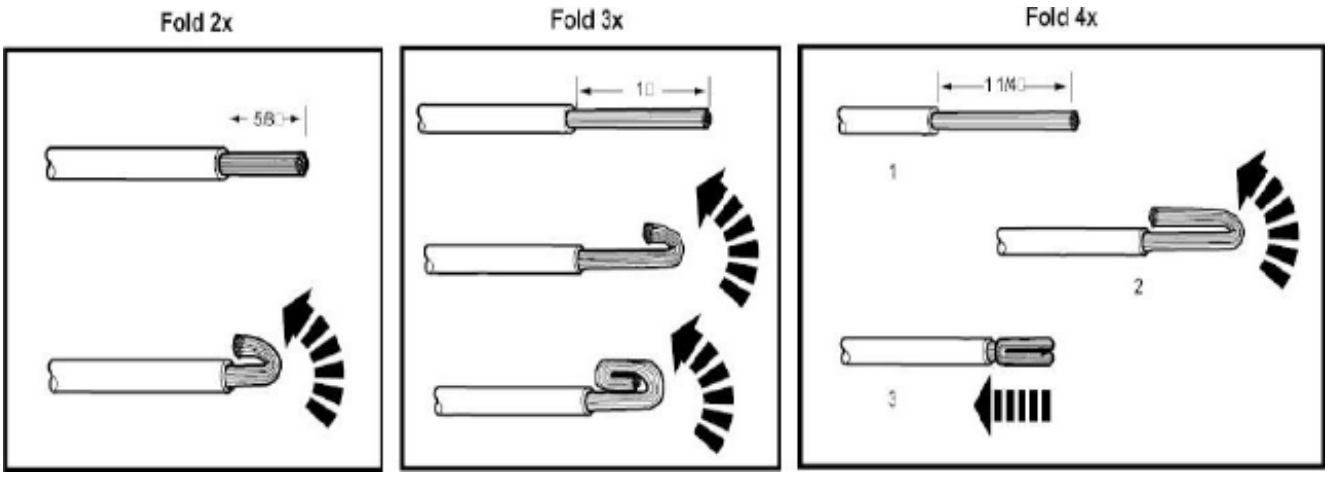
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



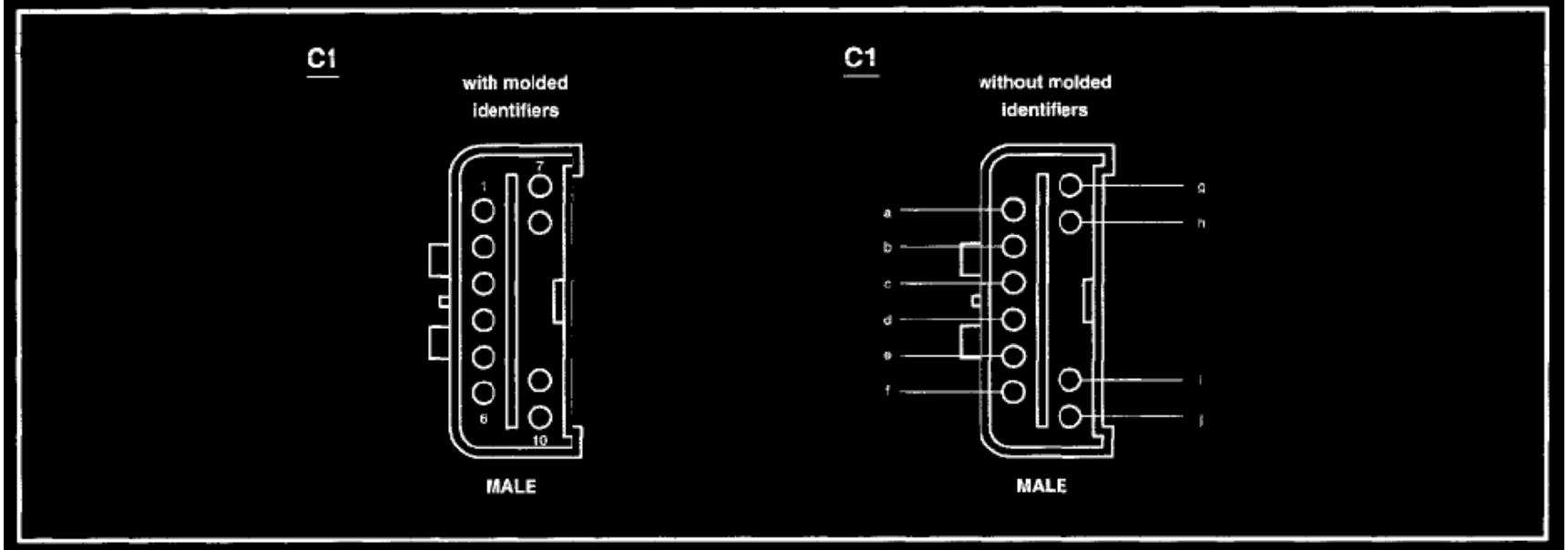
The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step–by–step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



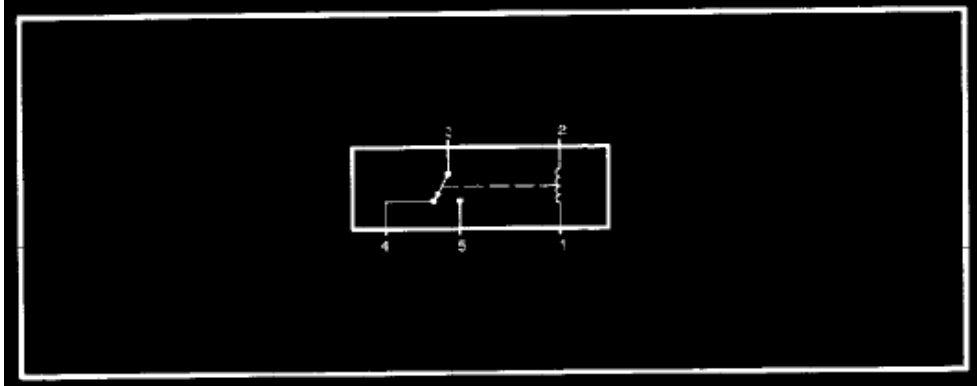
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

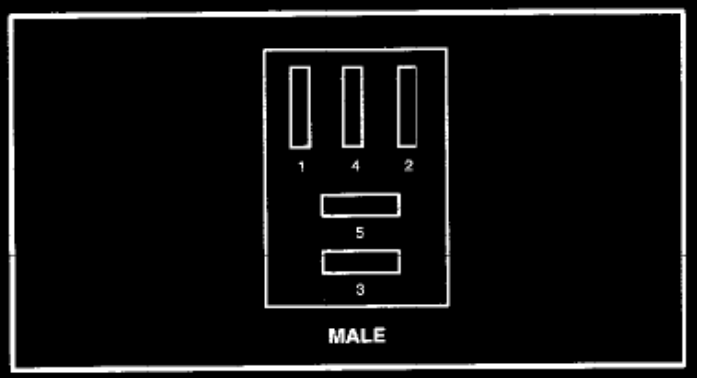
Windshield Washer Relay: Testing and Inspection Micro ISO Relay

Relay – Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63–102Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil – Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

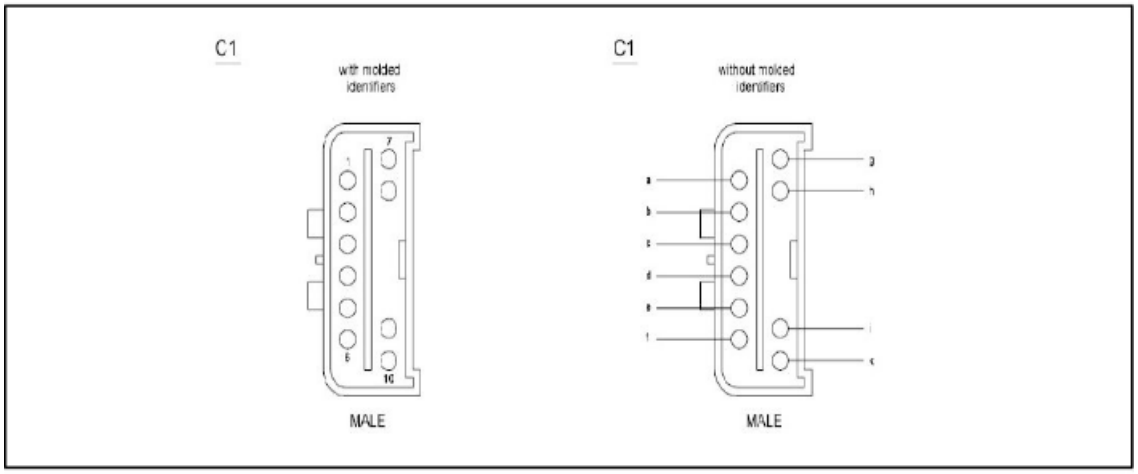
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step□by□step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



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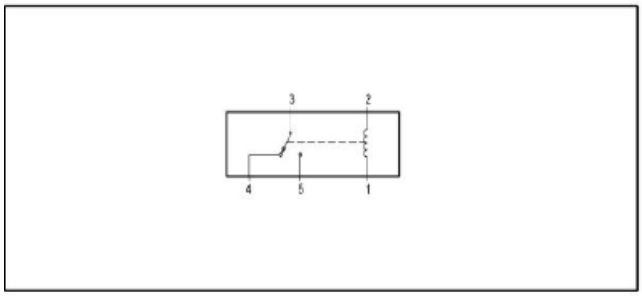
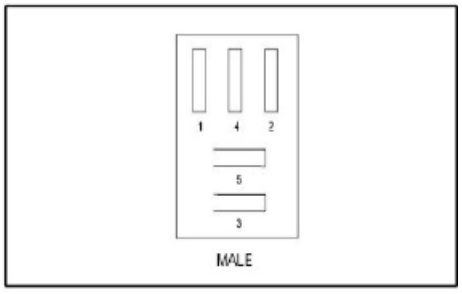
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Relay □ Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63□102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil □ Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

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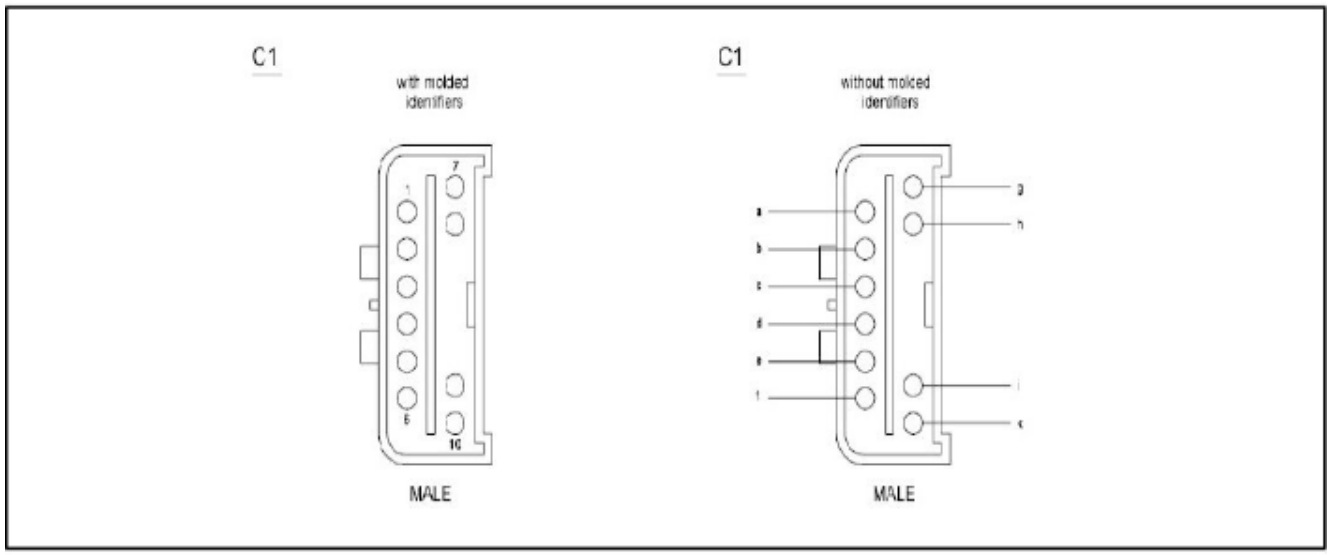
Terminals



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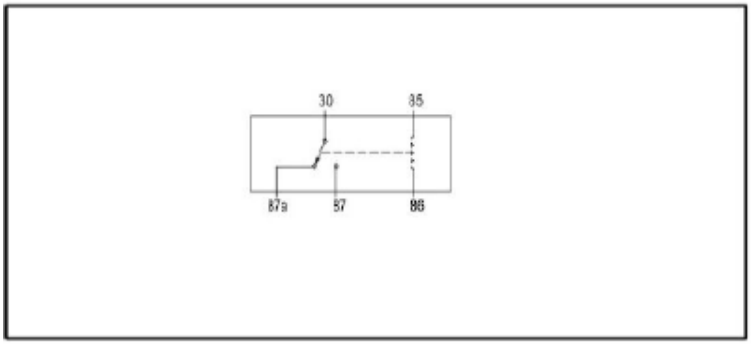
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

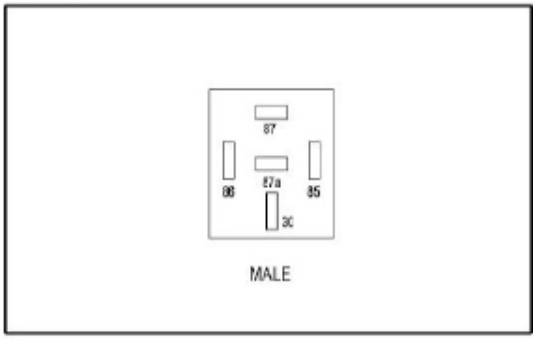
Windshield Washer Relay: Testing and Inspection Mini ISO Relay

Relay □ Mini ISO

Schematic



Terminals



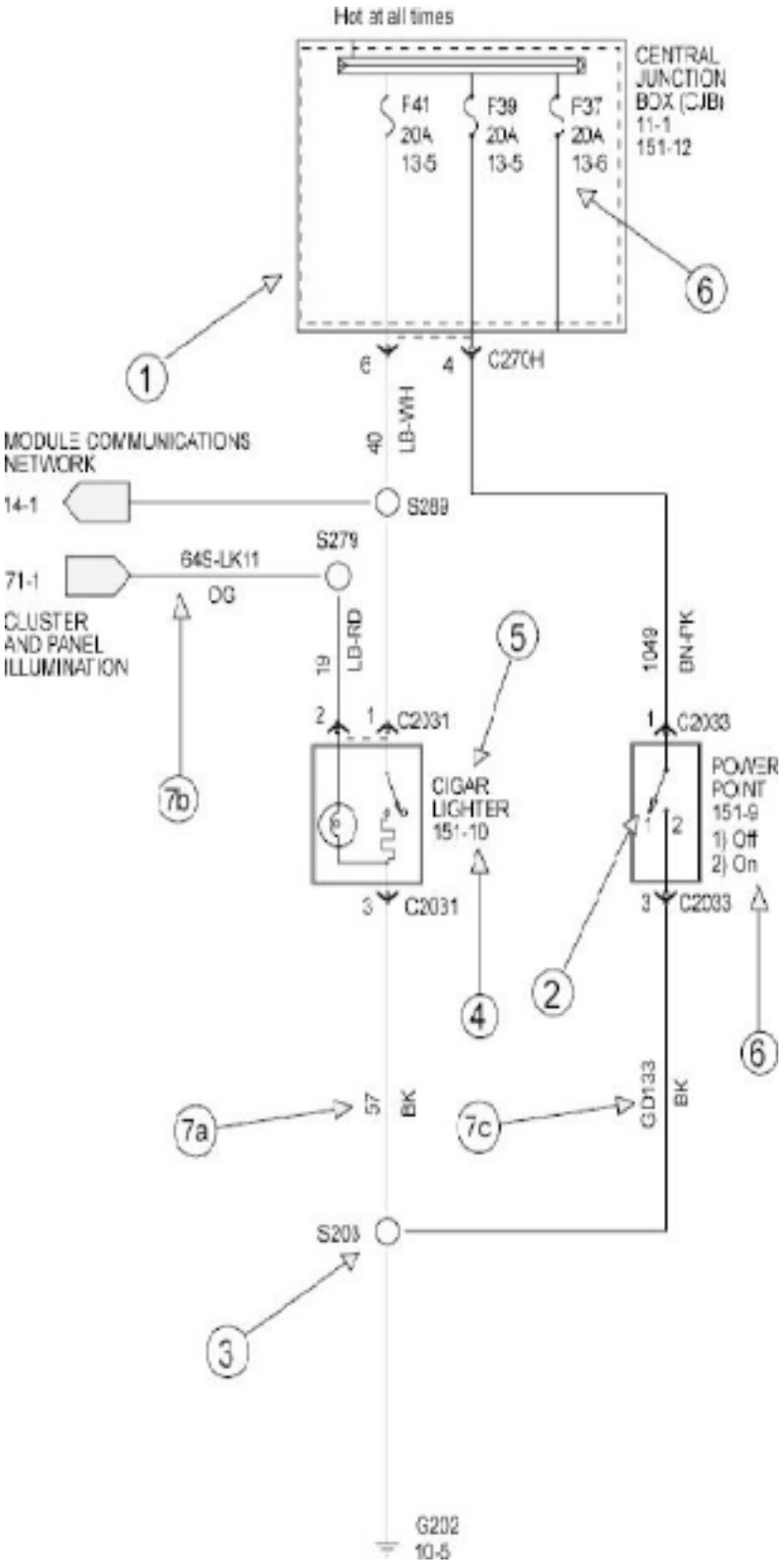
Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Relays and Modules > Relays and Modules - Wiper and Washer Systems > Wiper Relay > Component Information > Diagrams > Diagram Information and Instructions



Wiper Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

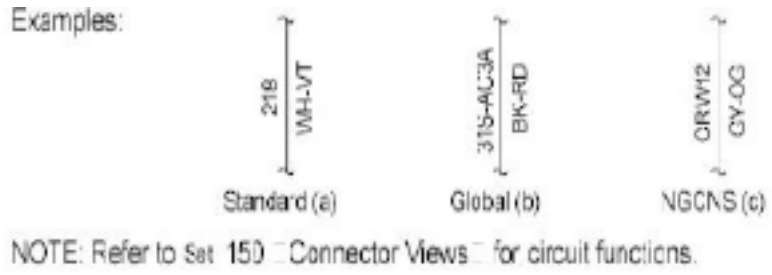
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

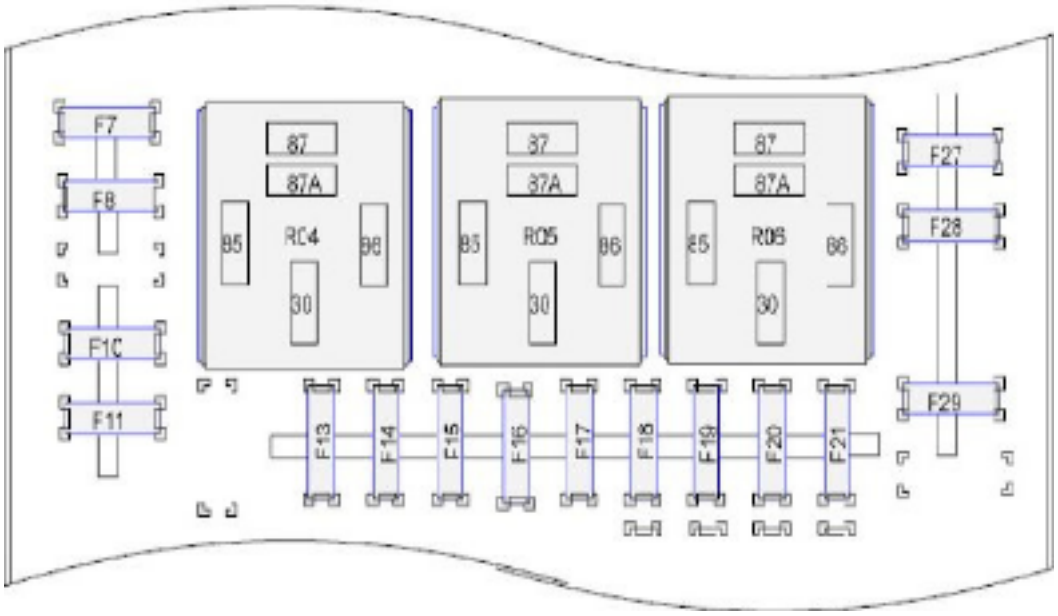
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

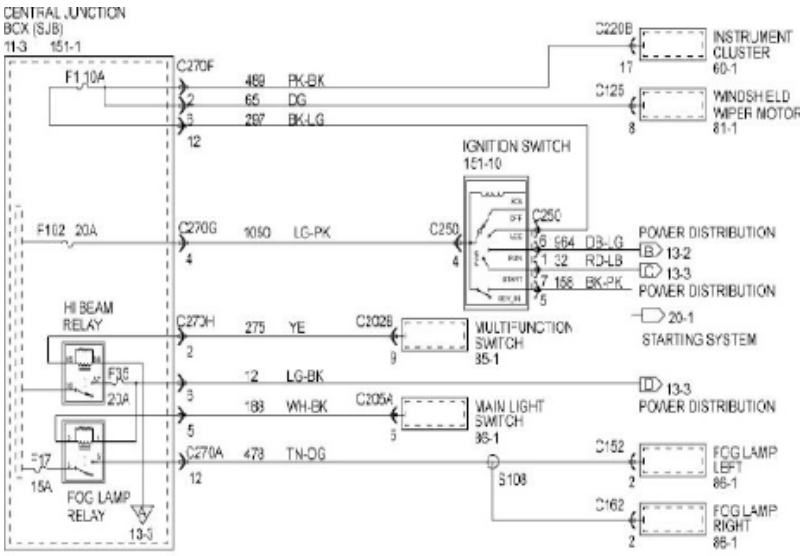
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

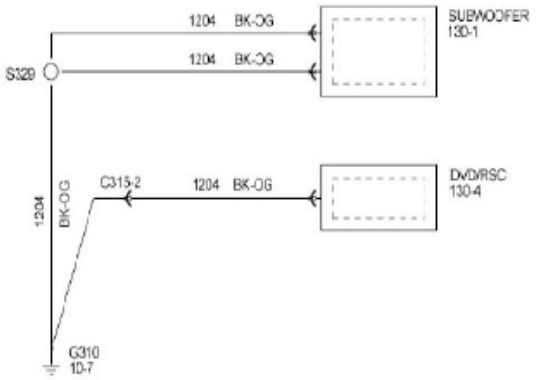
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

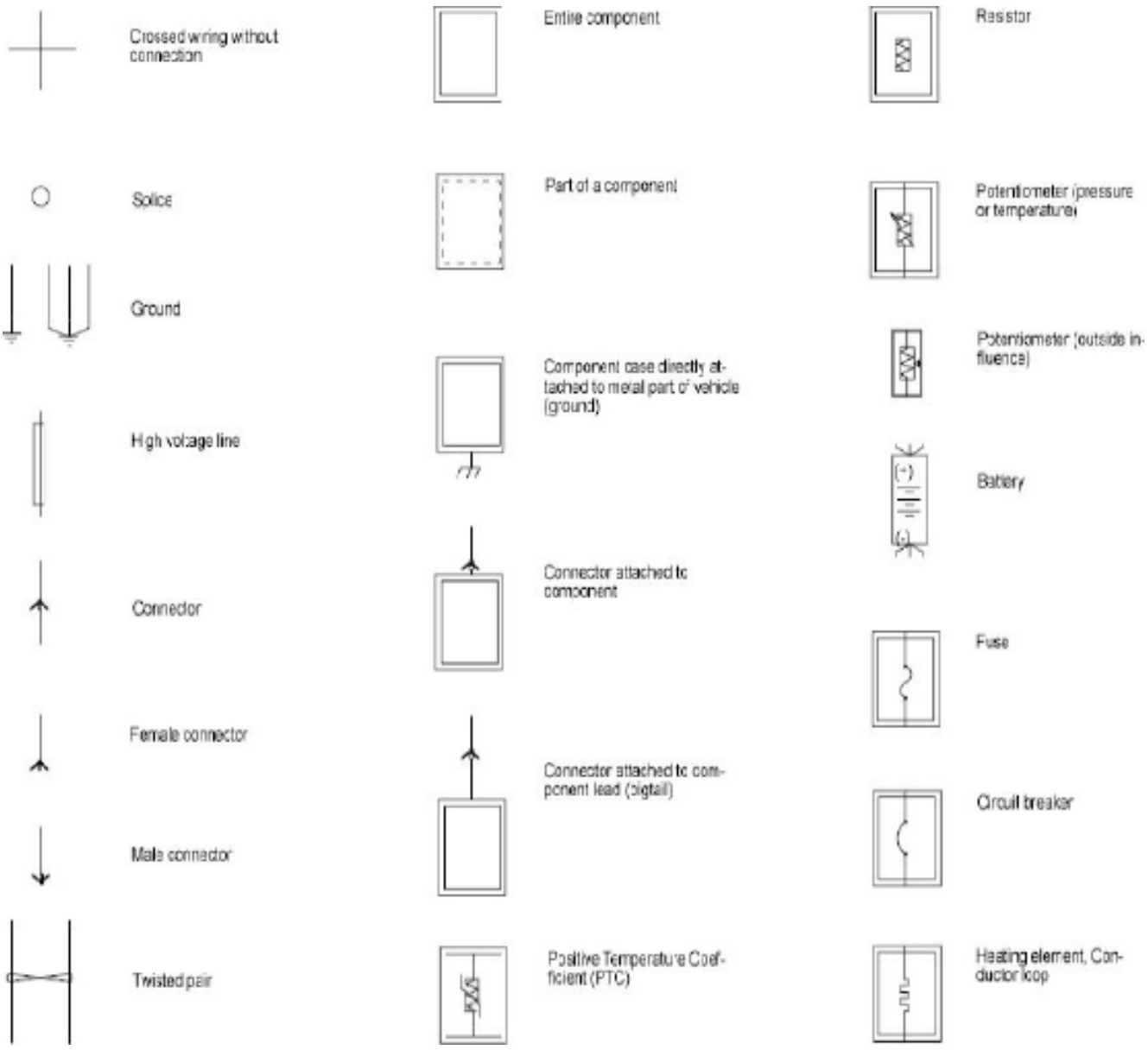
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

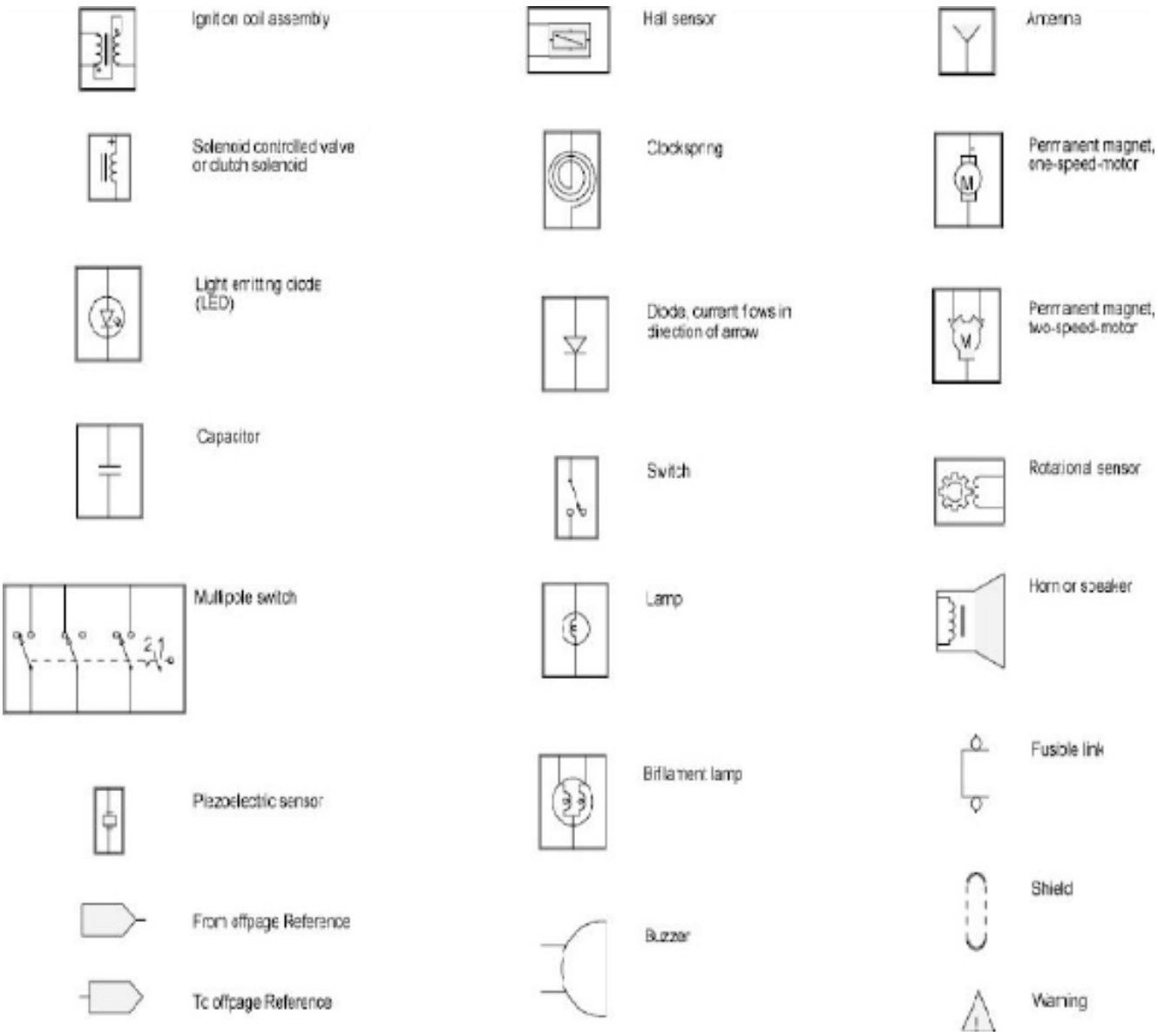
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

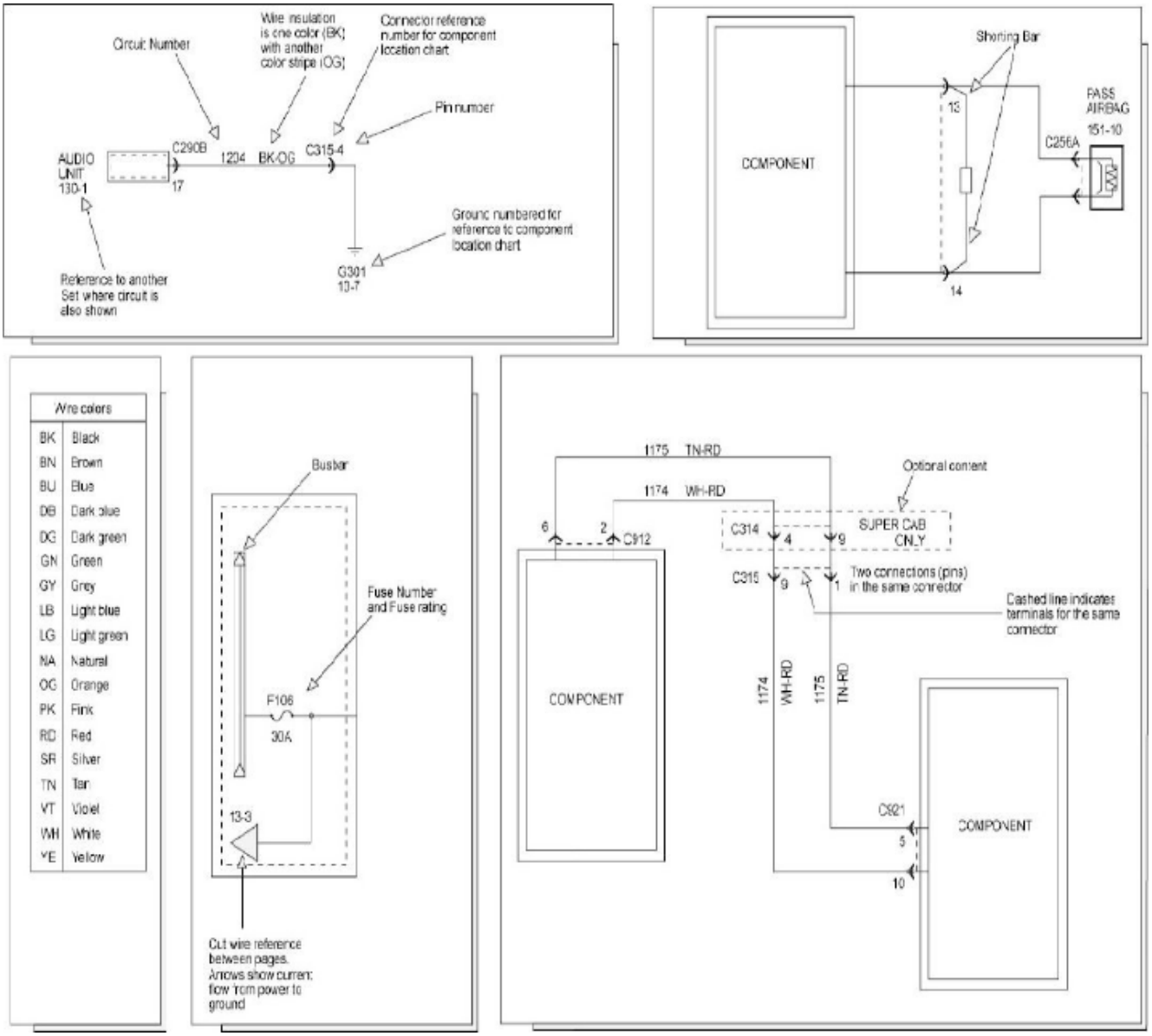
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

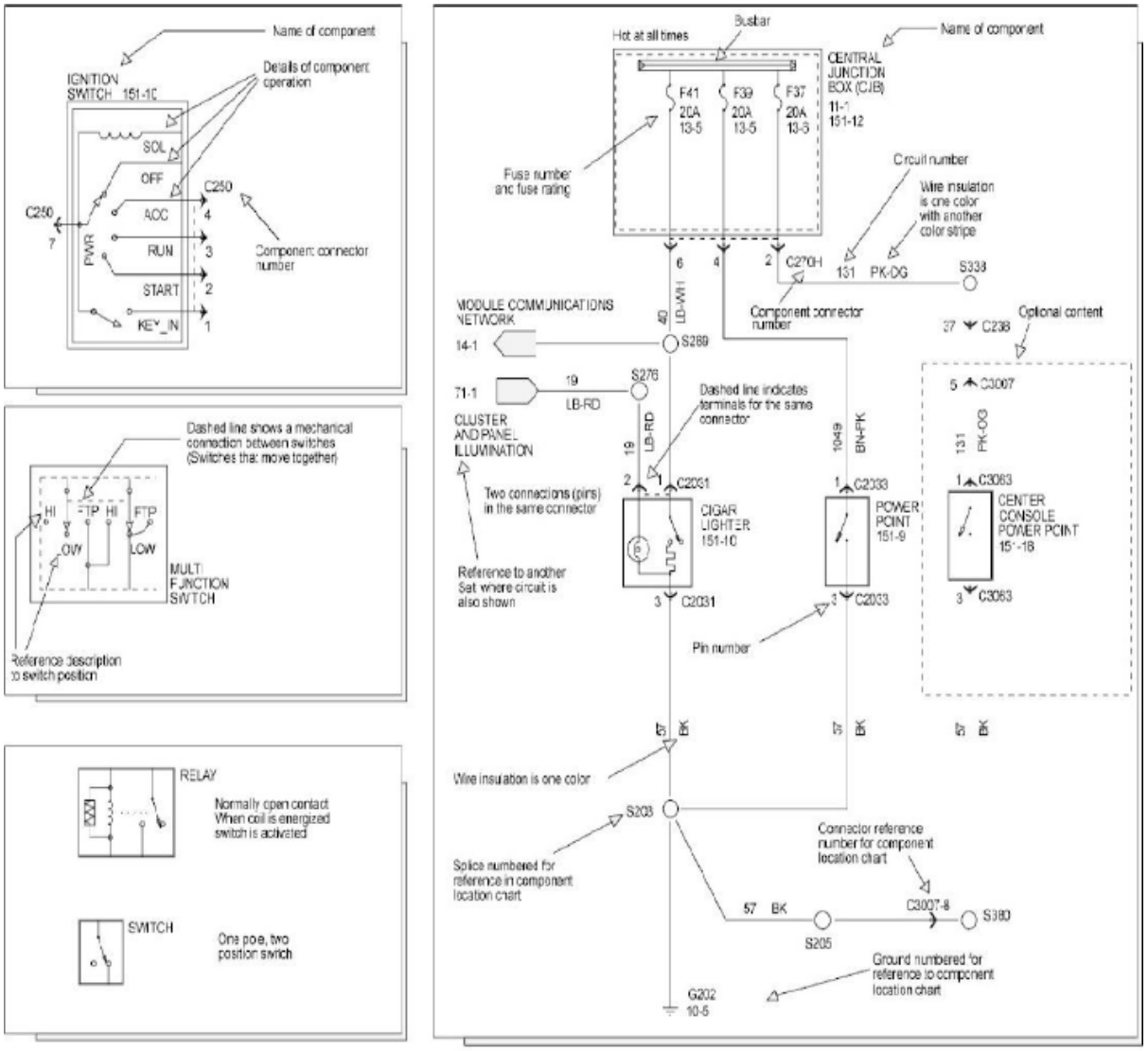
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

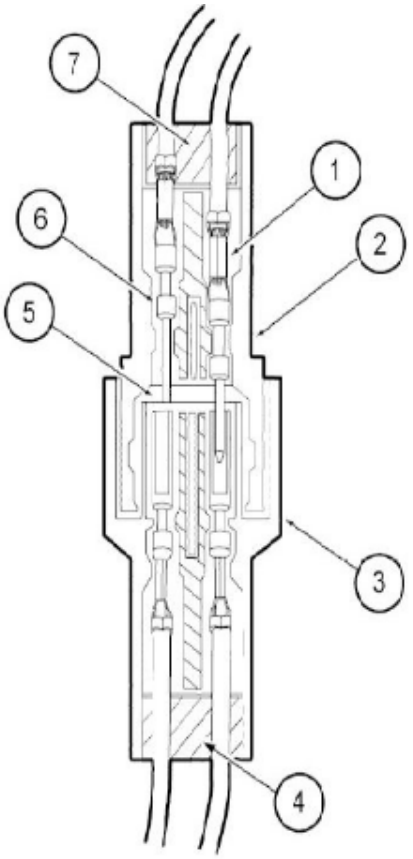


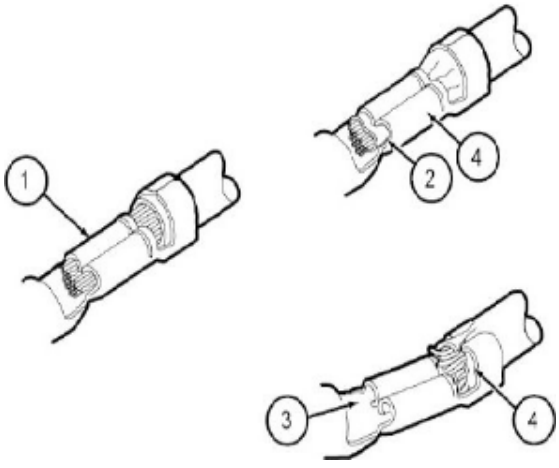
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Wiper Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

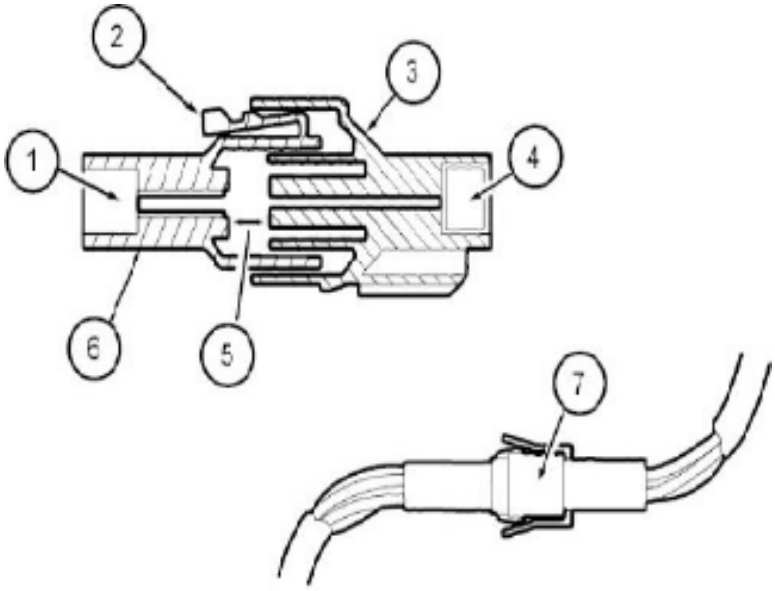
5 = Intermittent contact

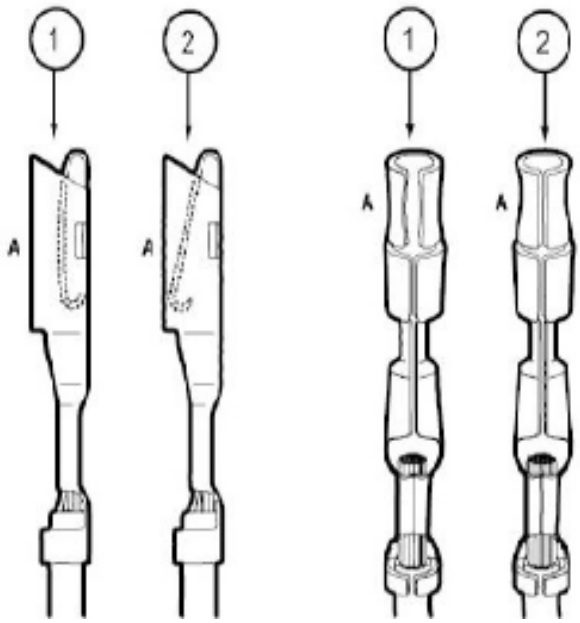
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

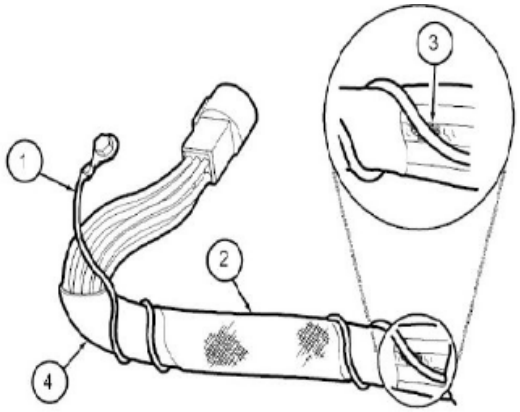
Deformed (enlarged) female terminals

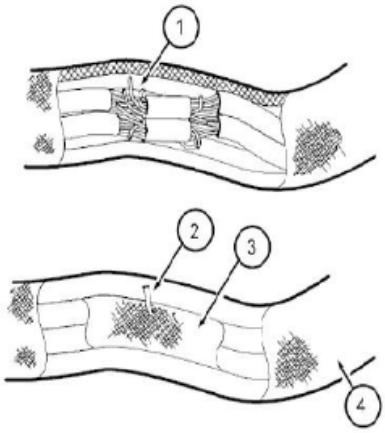
1 = Enlarged

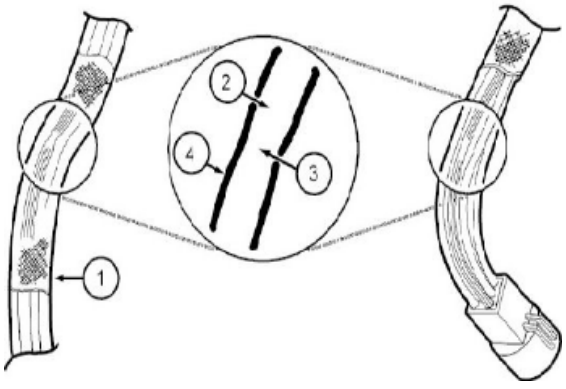
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

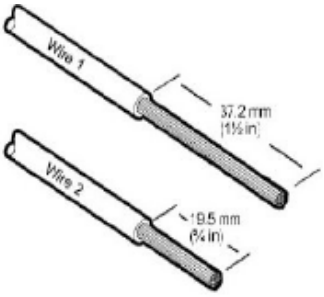
Splice covered 2

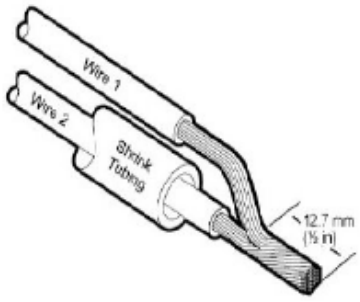
= Wire strand

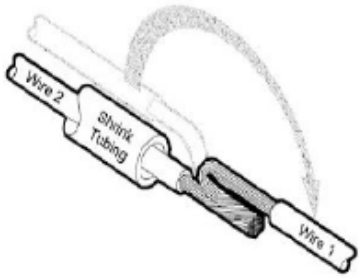
3 = Splice tape

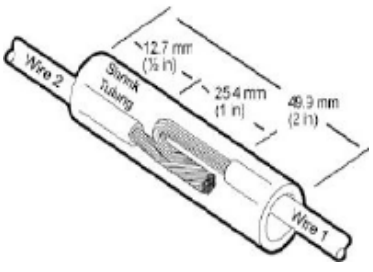
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

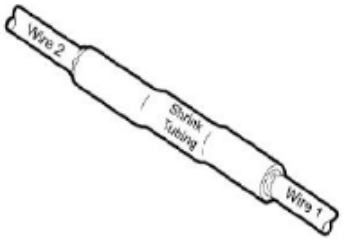
NOTE: -

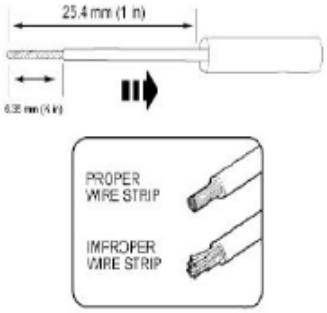
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

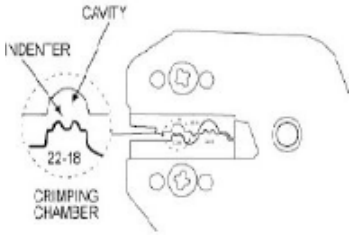
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

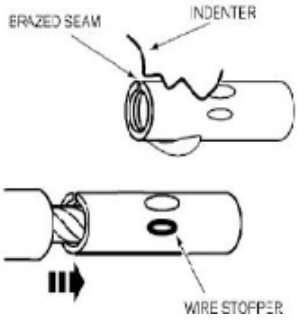
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

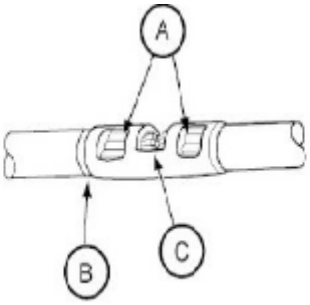
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

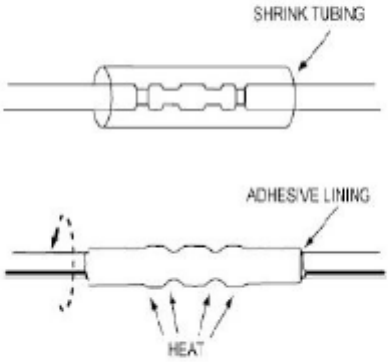
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4 strip, cut 9 strands	* 1/4 strip, cut 2 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip, fold 3x dia.
	16-14	* 1/4 strip, cut 7 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip fold 2x dia	1 strip, fold 3x dia.	1 1/4 strip, fold 4x dia.	Not Recommended
	12-10	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip fold 3x dia.	1 1/4 strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Pigtail only

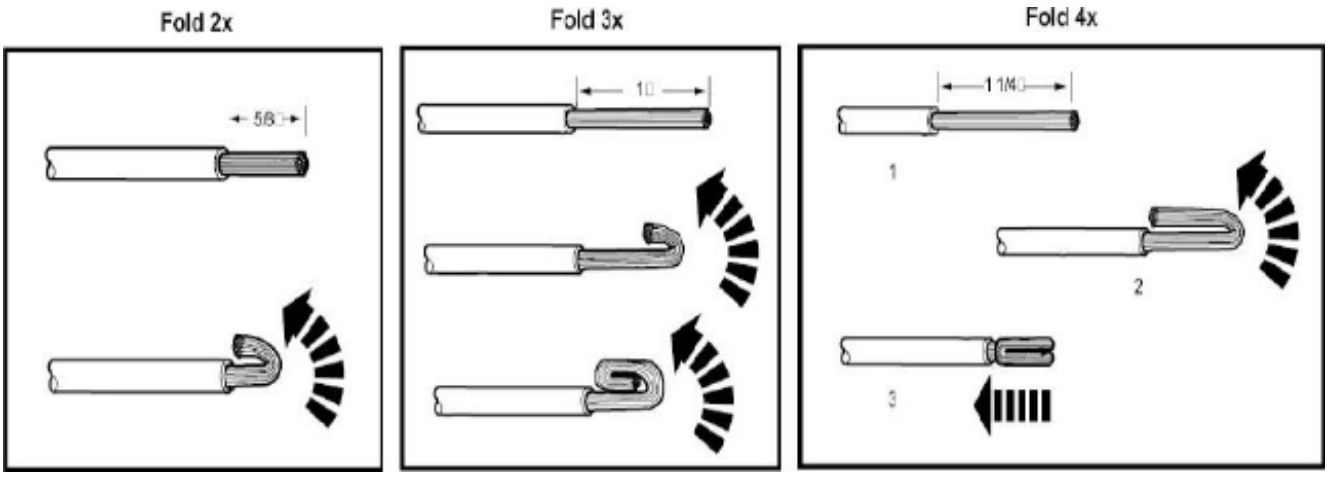
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



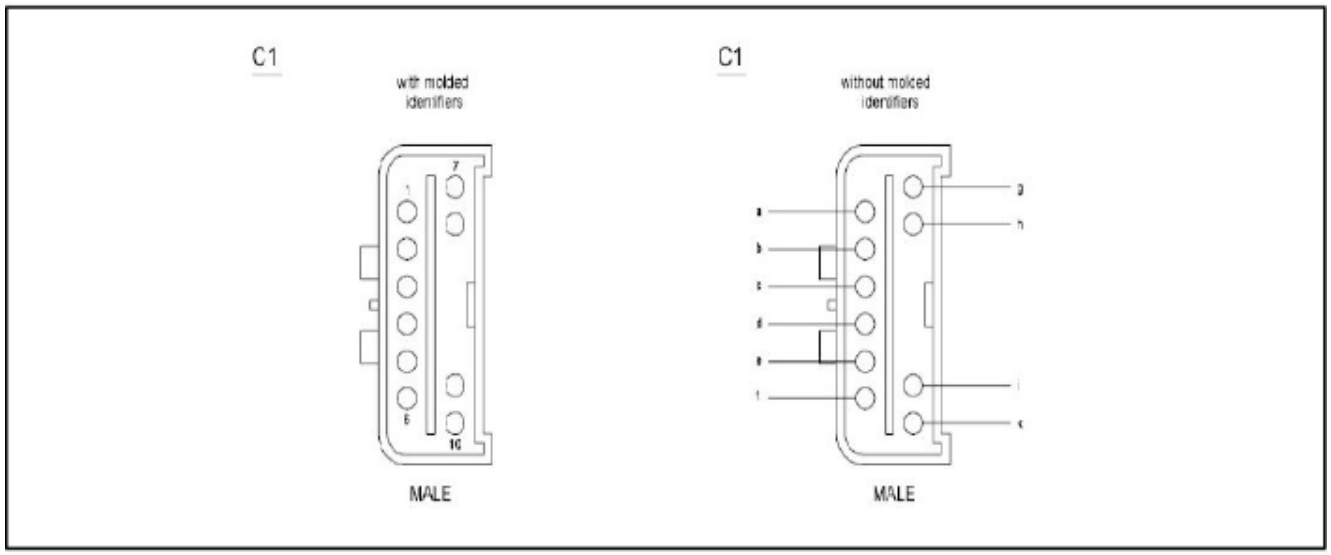
The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



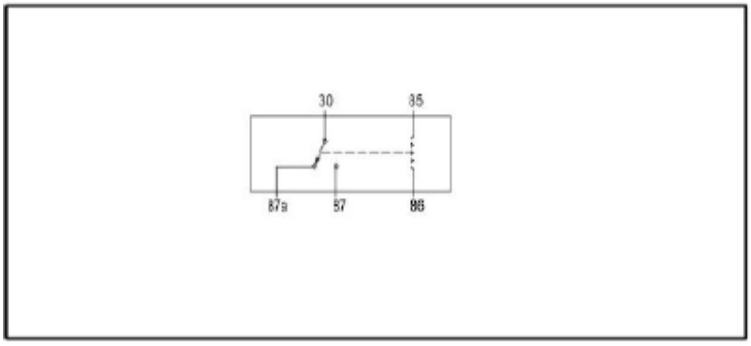
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

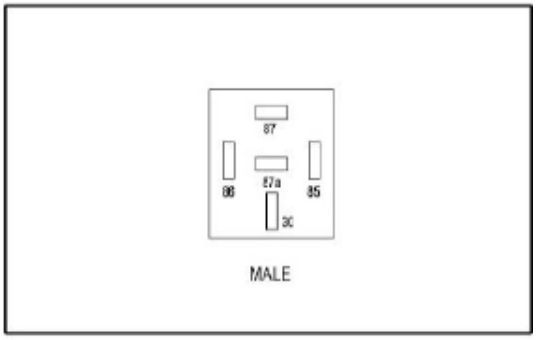
Wiper Relay: Testing and Inspection Mini ISO Relay

Relay □ Mini ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

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Component testing procedures are provided to determine whether a component is good or bad.

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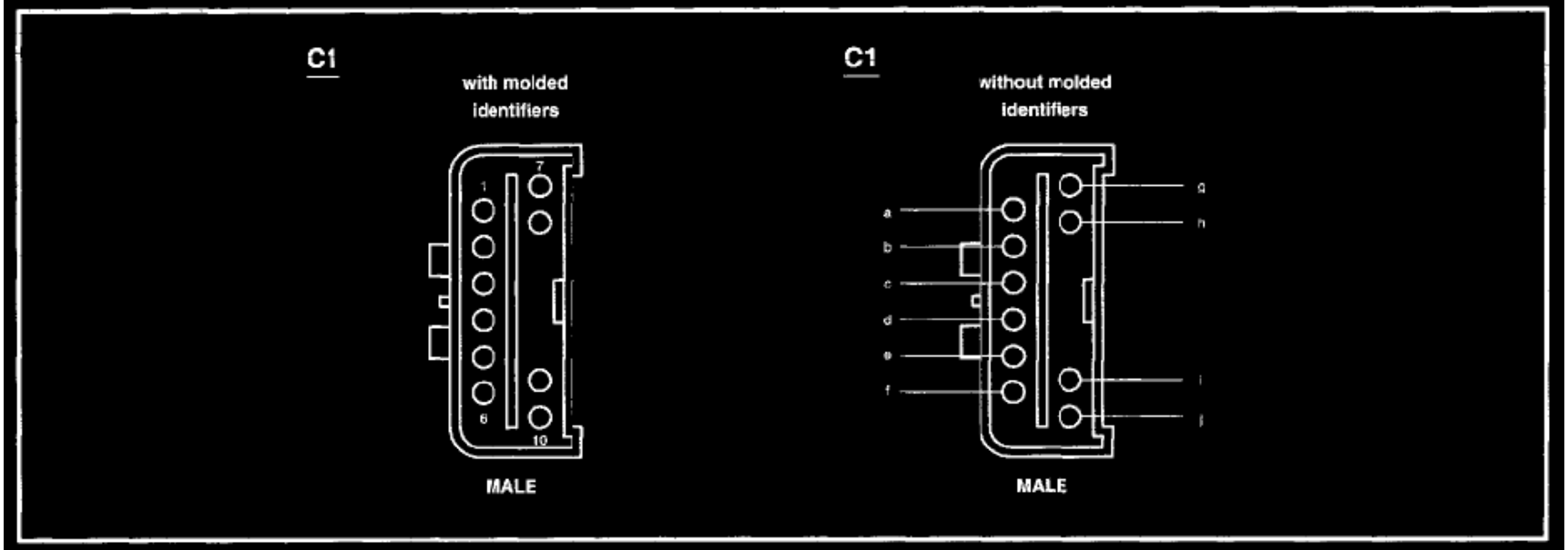
Terminals



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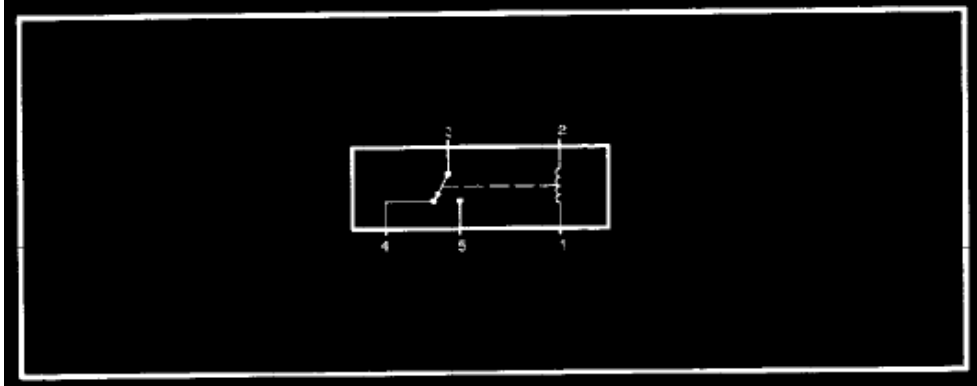
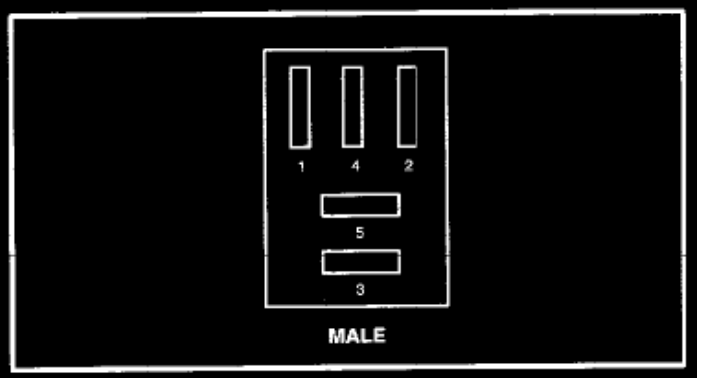
Wiper Relay: Testing and Inspection Micro ISO Relay

Relay – Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63–102Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil – Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

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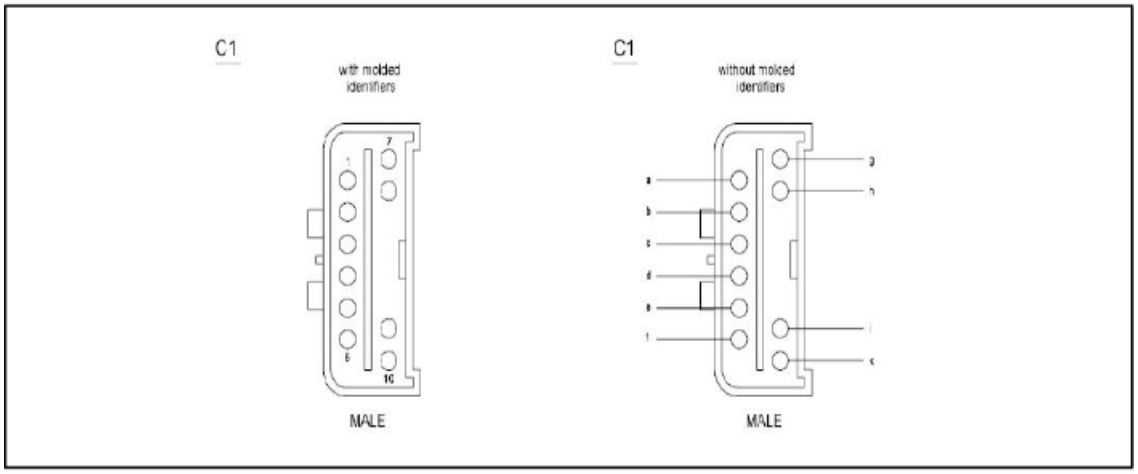

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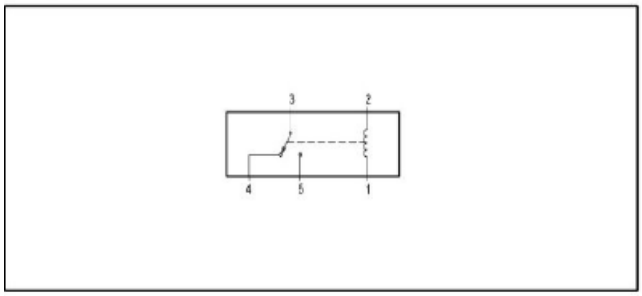
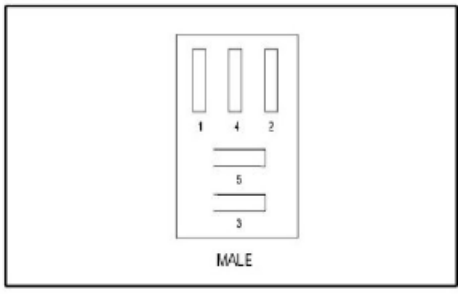
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Relay □ Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63□102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
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	1 and 4	Open circuit
	1 and 5	Open circuit

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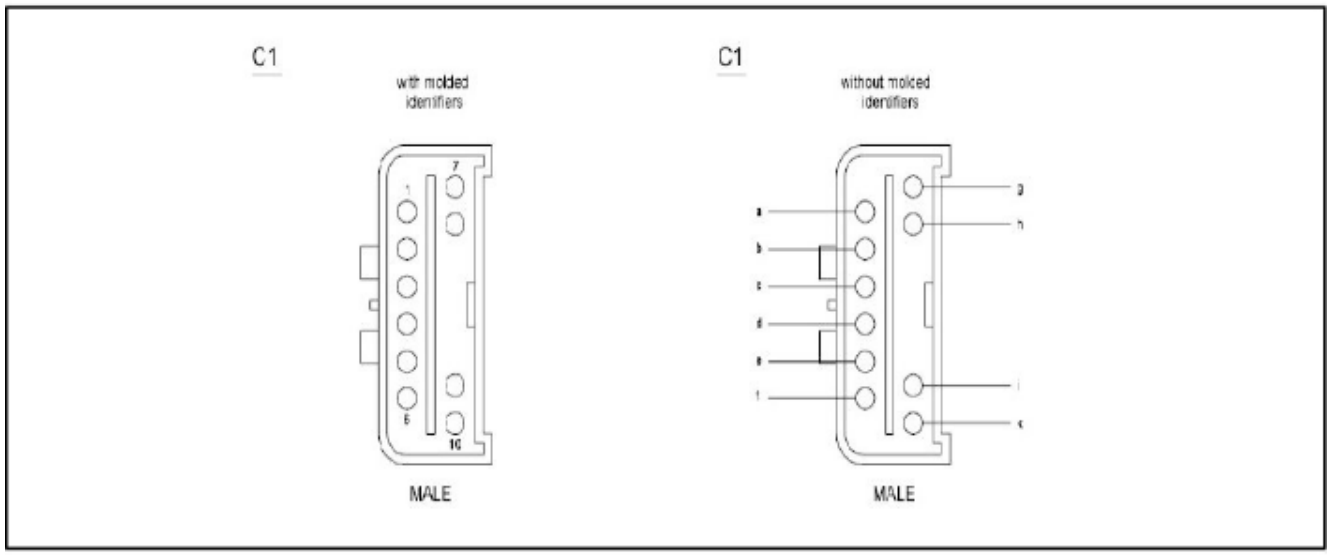
Terminals



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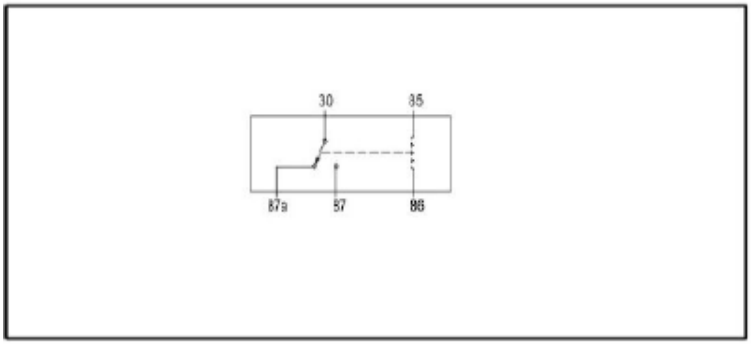
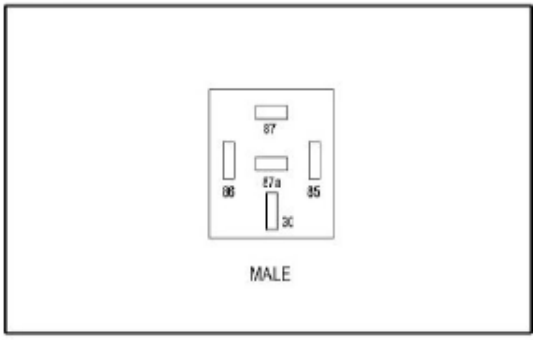
Wiper Relay: Testing and Inspection Wiper Run/Park Relay

Relay □ Mini ISO

Schematic



Terminals



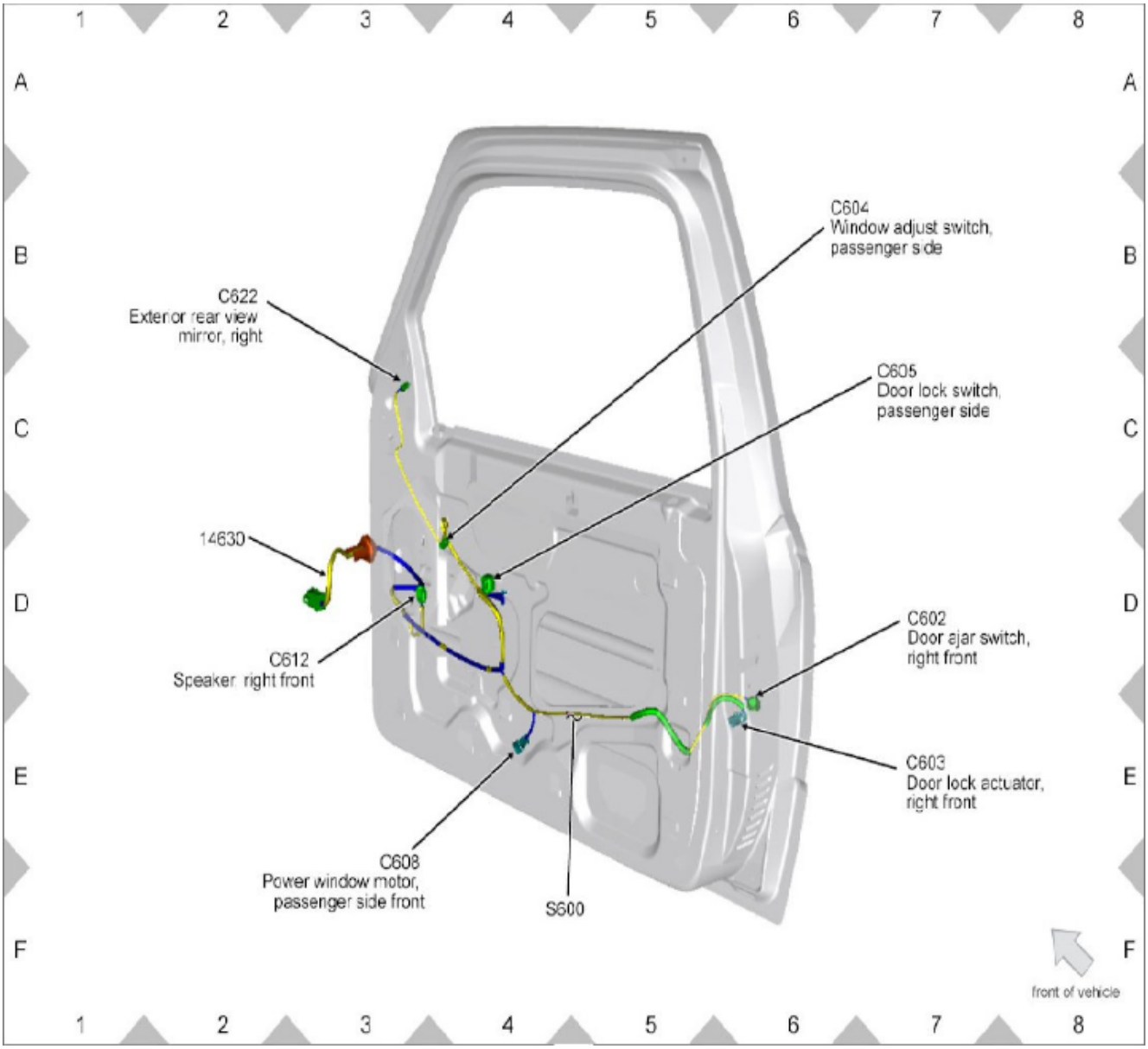
Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

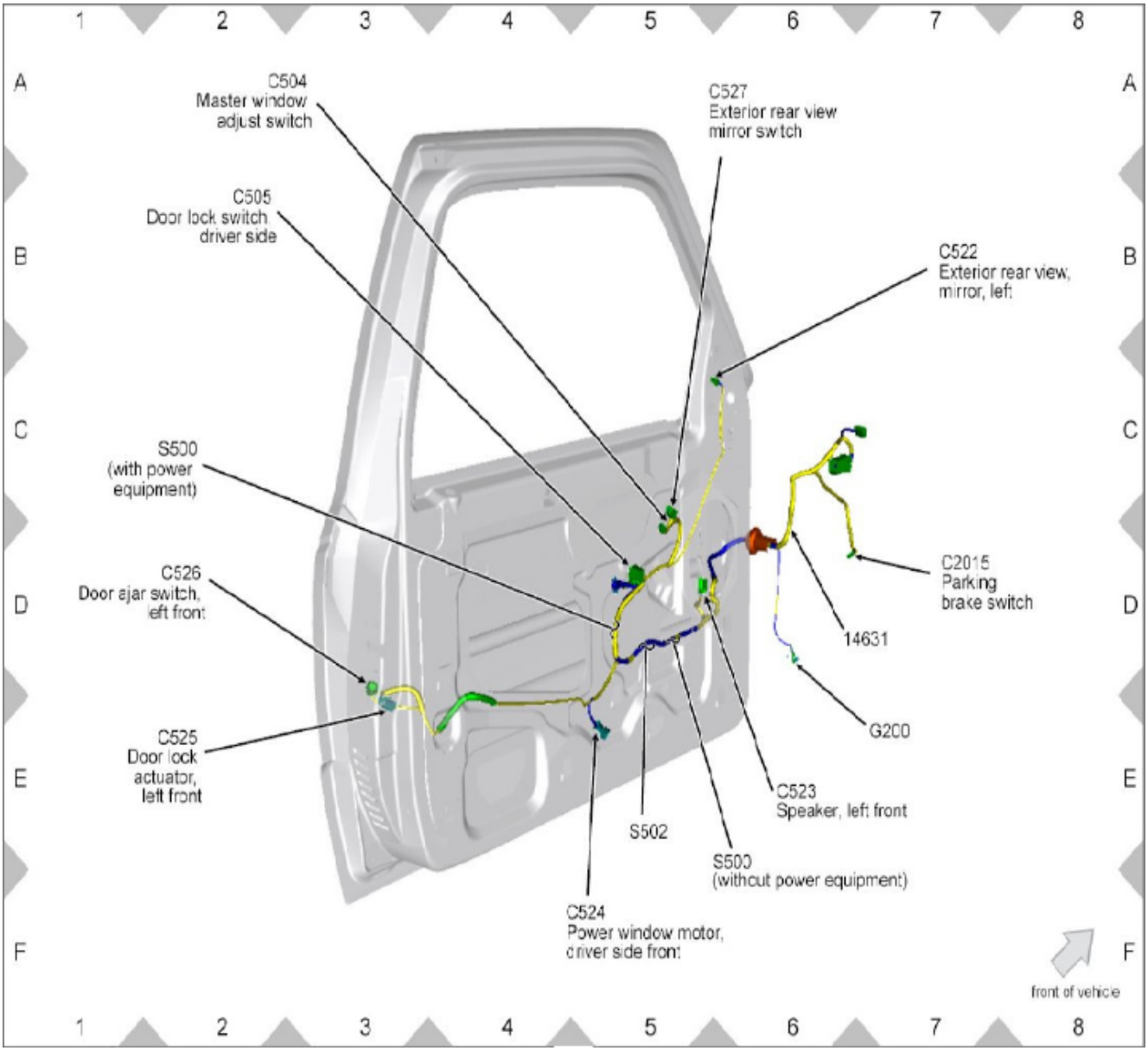
Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

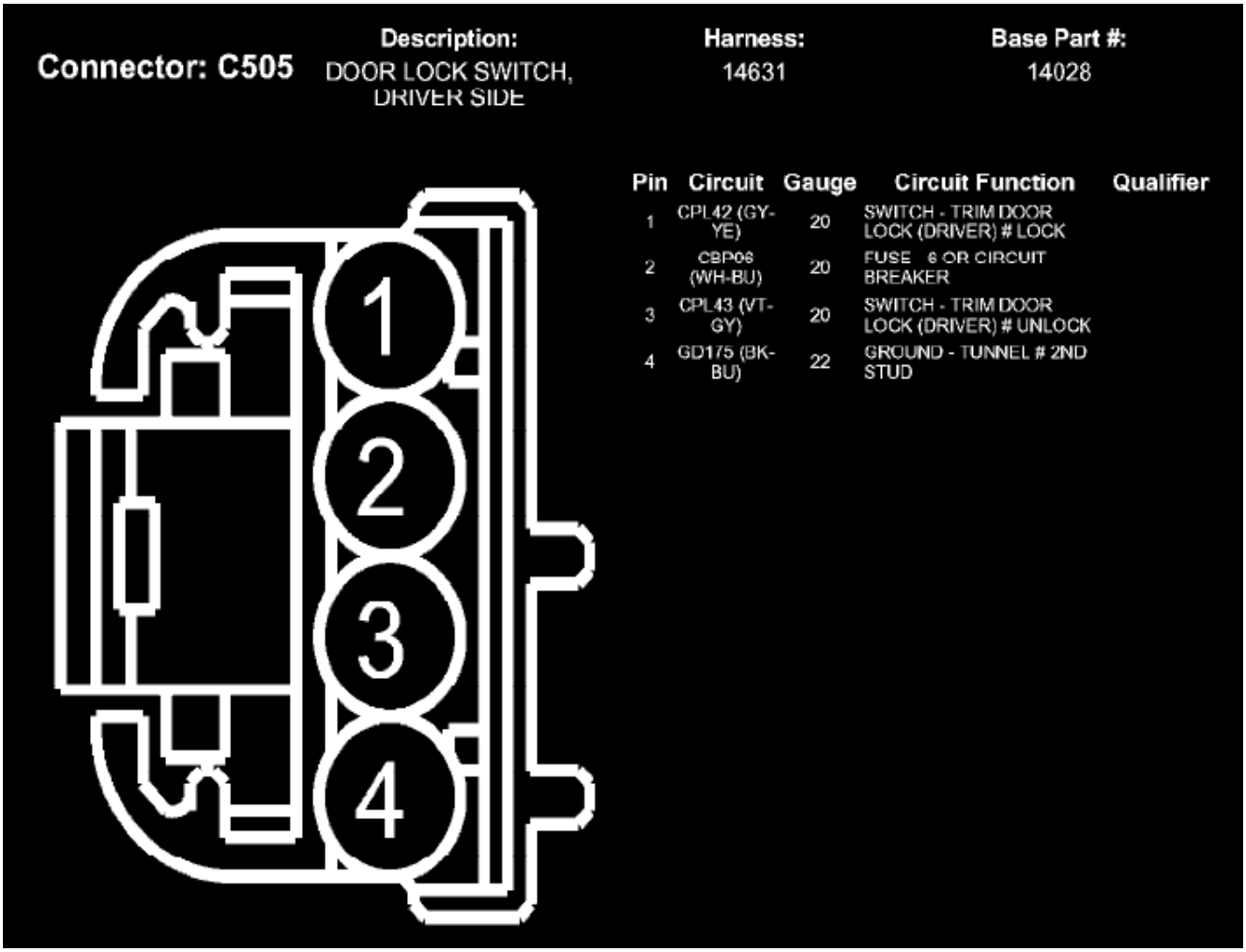
Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Sensors and Switches > Sensors and Switches - Body and Frame > Power Door Lock Switch > Component Information > Locations > Door Lock Switch, Passenger Side



View 151-21

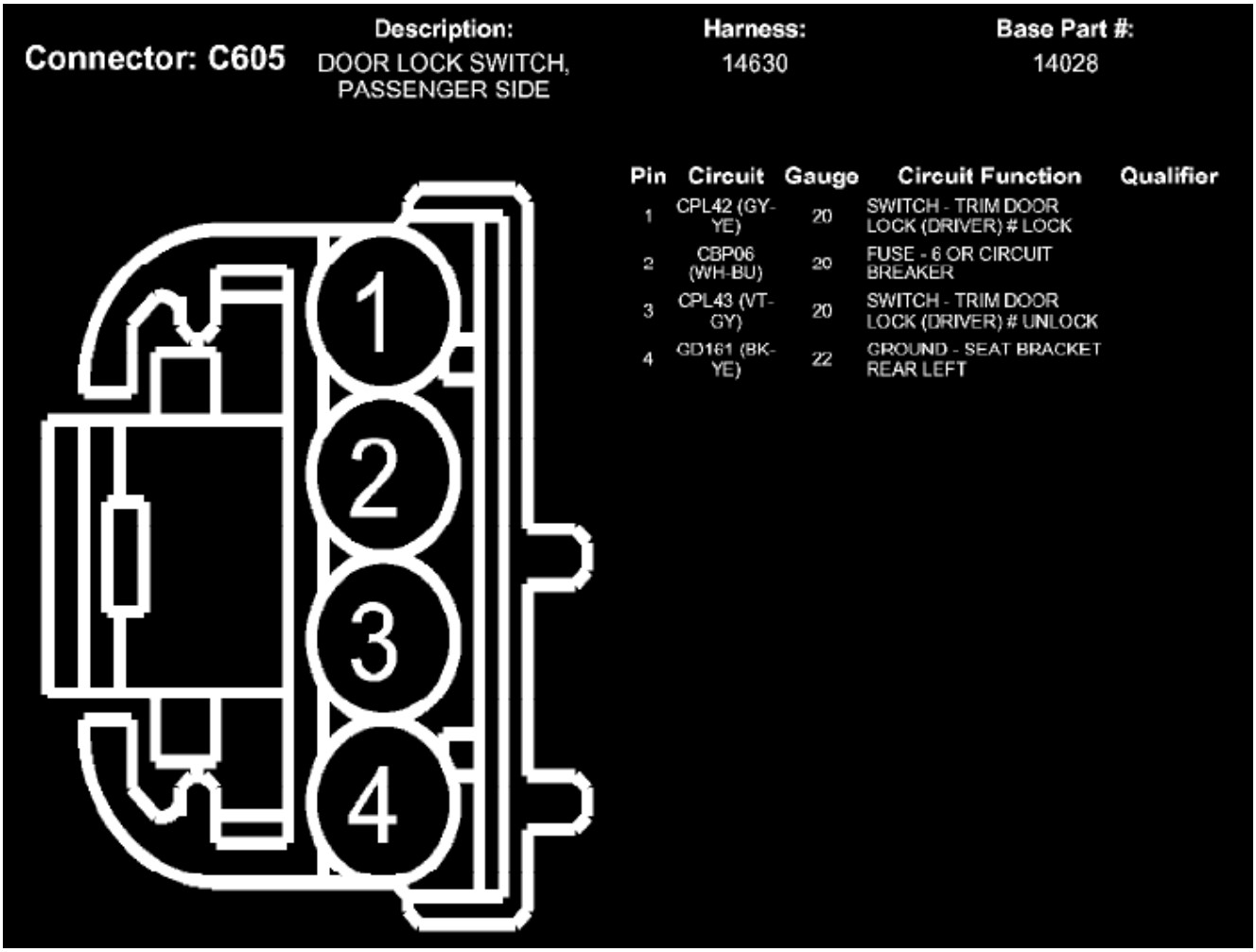

C504
Master window adjust switch
C505
Door lock switch driver side
S500
(with power equipment)
C526
Door ajar switch, left front
C525
Door lock actuator, left front
C524
Power window motor, driver side front
S502
S500
(without power equipment)
C523
Speaker, left front
G200
14631
C2015
Parking brake switch
C522
Exterior rear view mirror, left
C527
Exterior rear view mirror switch
front of vehicle

View 151-20



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPL42 (GY-YE)	20	SWITCH - TRIM DOOR LOCK (DRIVER) # LOCK	
2	CBP06 (WH-BU)	20	FUSE 6 OR CIRCUIT BREAKER	
3	CPL43 (VT-GY)	20	SWITCH - TRIM DOOR LOCK (DRIVER) # UNLOCK	
4	GD175 (BK-BU)	22	GROUND - TUNNEL # 2ND STUD	

C505


Connector: C605
Description:
DOOR LOCK SWITCH, PASSENGER SIDE
Harness:
14630
Base Part #:
14028
1
2
3
4
Pin Circuit Gauge Circuit Function Qualifier
1 CPL42 (GY-YE) 20 SWITCH - TRIM DOOR LOCK (DRIVER) # LOCK
2 CBP06 (WH-BU) 20 FUSE - 6 OR CIRCUIT BREAKER
3 CPL43 (VT-GY) 20 SWITCH - TRIM DOOR LOCK (DRIVER) # UNLOCK
4 GD161 (BK-YE) 22 GROUND - SEAT BRACKET REAR LEFT

C605

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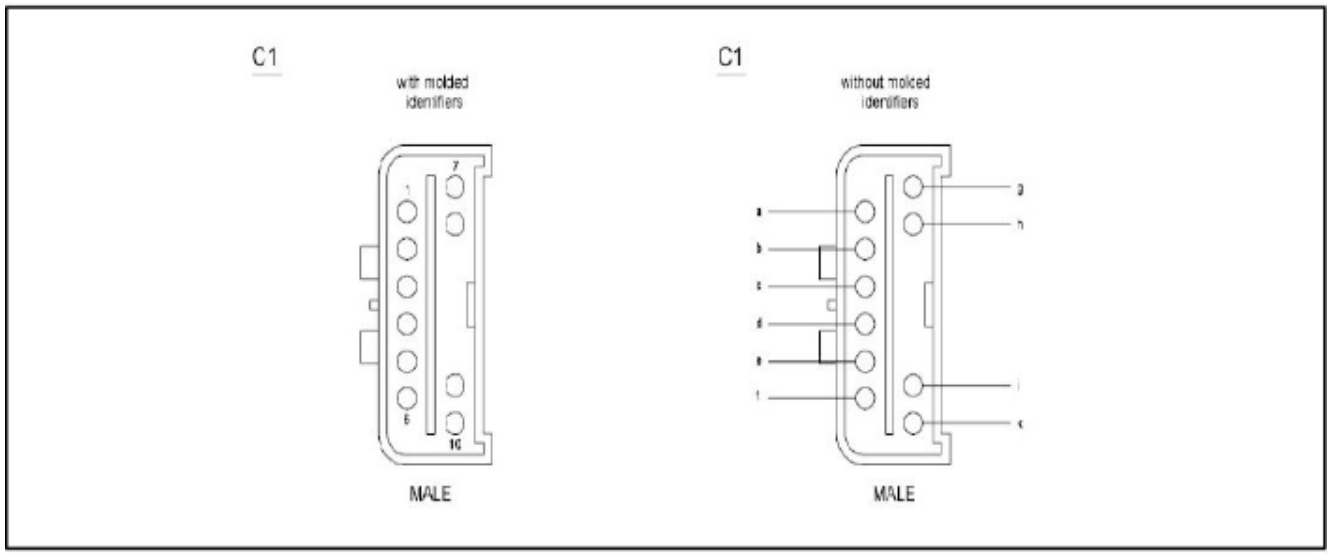
Terminals



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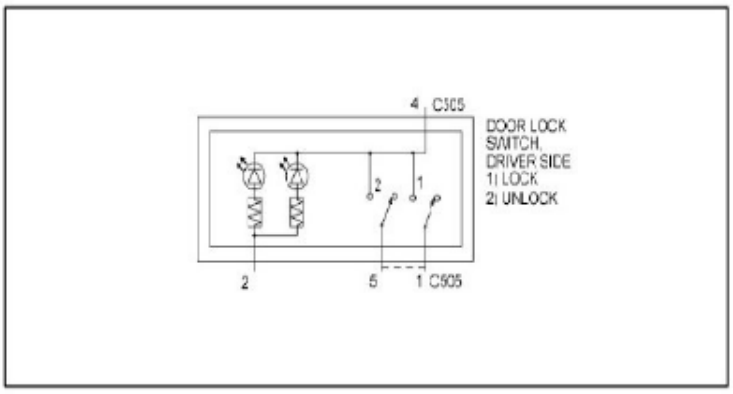
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

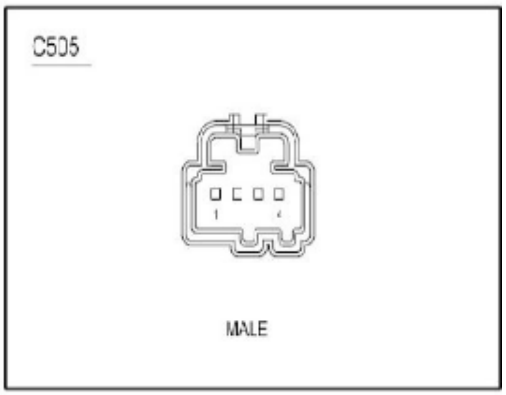
Power Door Lock Switch: Testing and Inspection Door Lock Switch, Driver Side

Door lock switch, Driver side

Schematic



Terminals



Component testing procedure

Circuit to test	Connect self-powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
Door lock switch	1 and 4	Lock	Closed circuit
		Unlock	Open circuit
		Neutral	Open circuit
	5 and 4	Lock	Open circuit
		Unlock	Closed circuit
		Neutral	Open circuit

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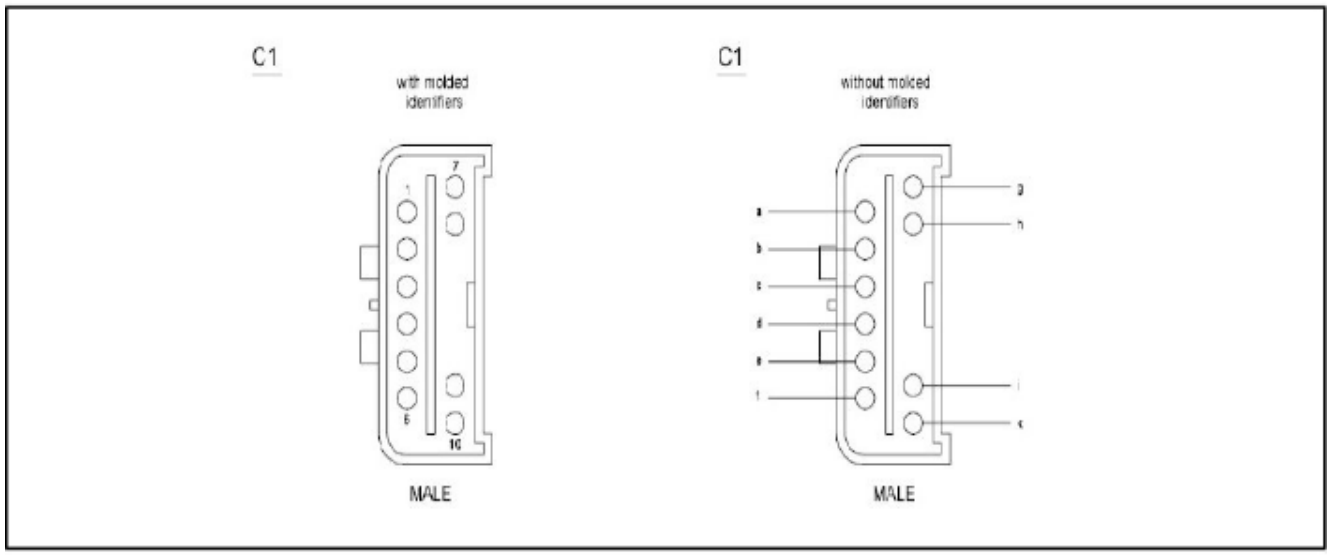
Terminals



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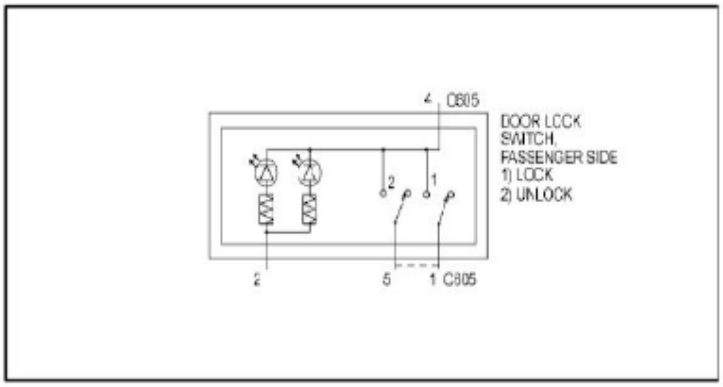
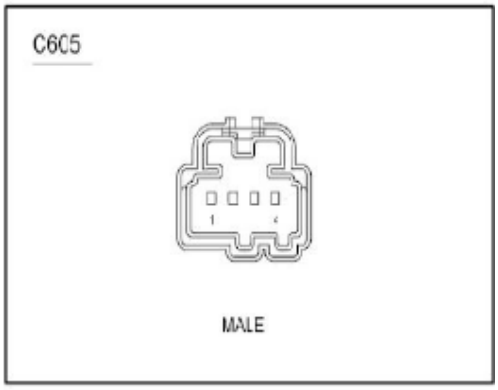
Power Door Lock Switch: Testing and Inspection Door Lock Switch, Passenger Side

Door lock switch, Passenger side

Schematic



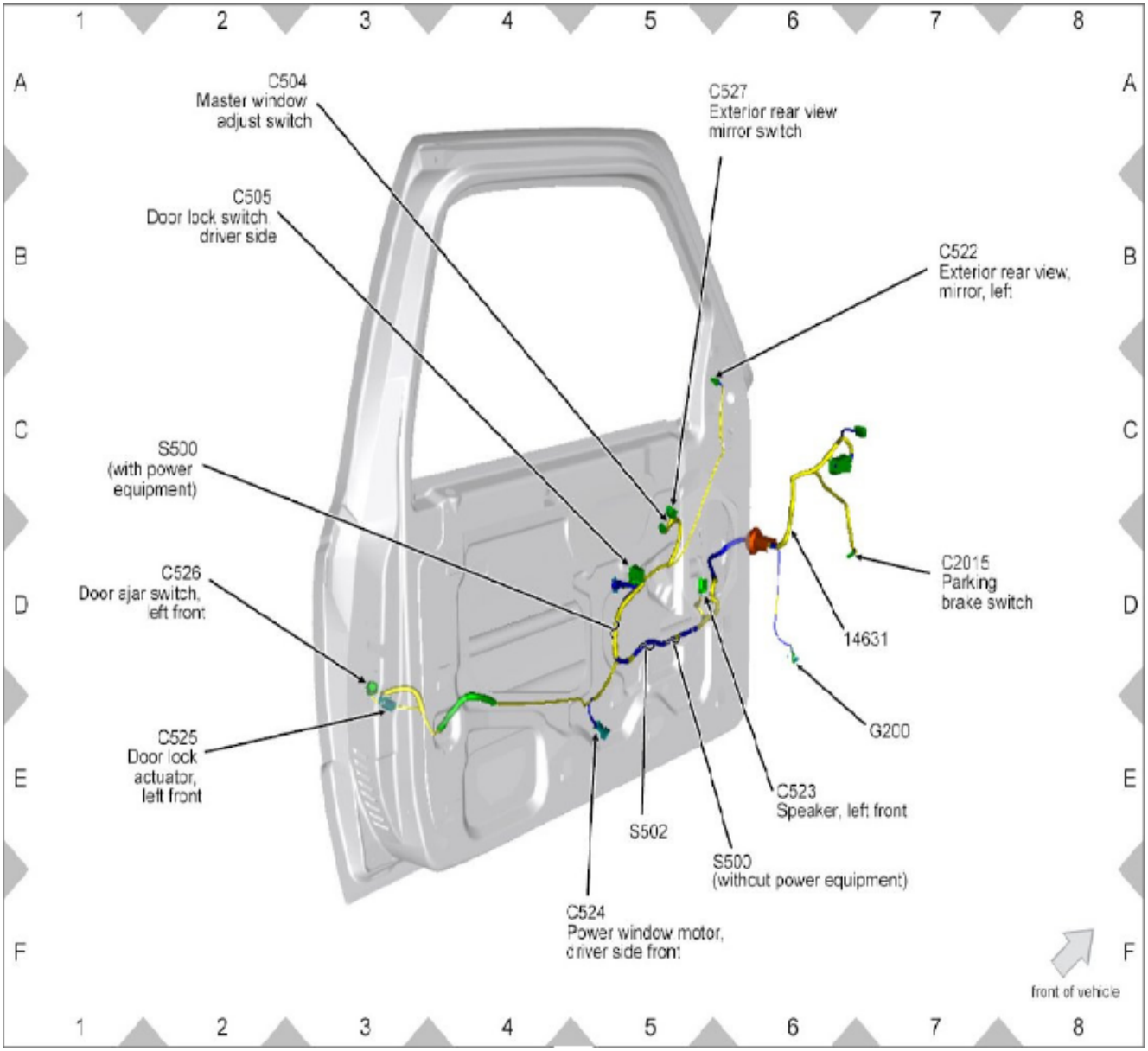
Terminals



Component testing procedure

Circuit to test	Connect self-powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
Door lock switch	1 and 4	Lock	Closed circuit
		Unlock	Open circuit
		Neutral	Open circuit
	5 and 4	Lock	Open circuit
		Unlock	Closed circuit
		Neutral	Open circuit

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Sensors and Switches > Sensors and Switches - Body and Frame > Power Mirror Switch > Component Information > Locations



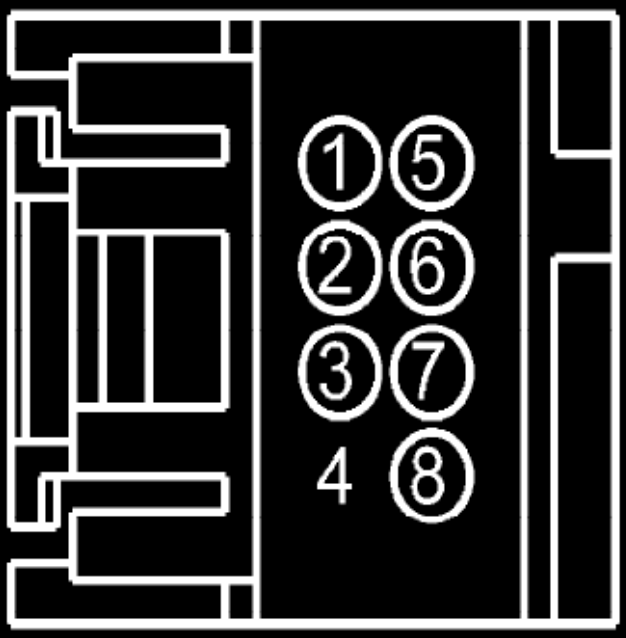
View 151-20

Connector: C527

Description: EXTERIOR REAR VIEW MIRROR SWITCH

Harness: 14631

Base Part #: 17B676



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD175 (BK-BU)	22	GROUND - TUNNEL # 2ND STUD	
2	CPM15 (VT-OG)	22	SWITCH - POWER MIRROR # LEFT MIRROR LEFTWARD (IF PLUS)	
3	SBP30 (BN-RD)	22	FUSE - 30 OR CIRCUIT BREAKER	
4	*	*	not used	
5	CPM19 (GY-OG)	22	SWITCH - POWER MIRROR # RIGHT MIRROR LEFTWARD (IF PLUS)	
6	CPM23 (GY)	22	SWITCH - POWER MIRROR # COMMON ALL MOTORS (LEFT AND RIGHT)	
7	CPM17 (BU-GN)	22	SWITCH - POWER MIRROR # LEFT MIRROR UPWARD (IF PLUS)	
8	CPM21 (YE-VT)	22	SWITCH - POWER MIRROR # RIGHT MIRROR UPWARD (IF PLUS)	

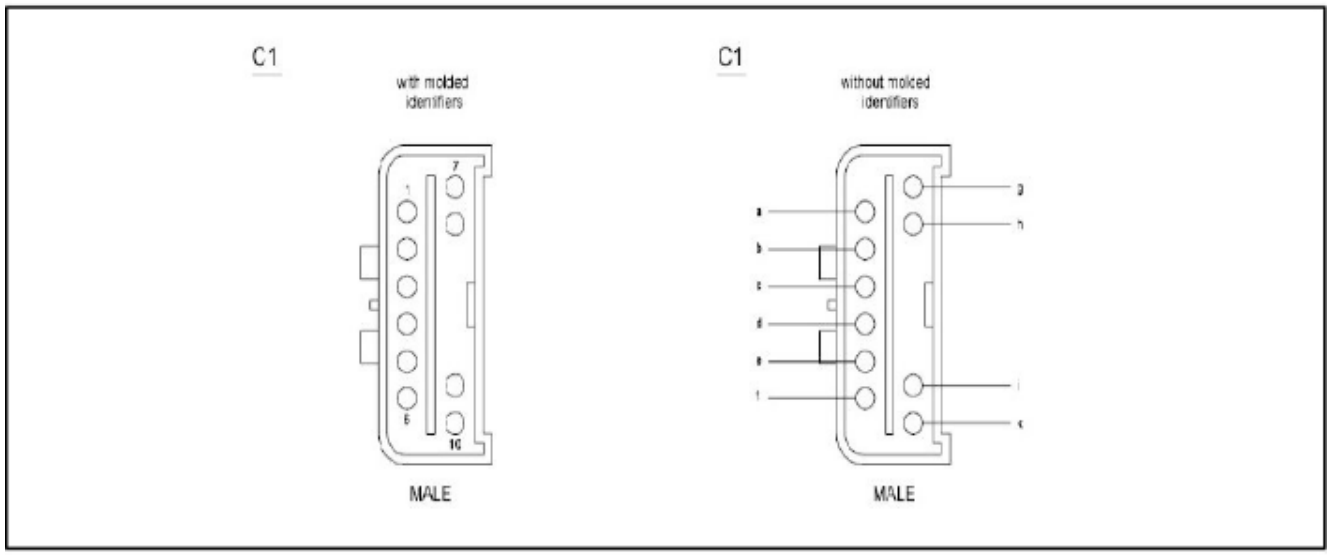
C527

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



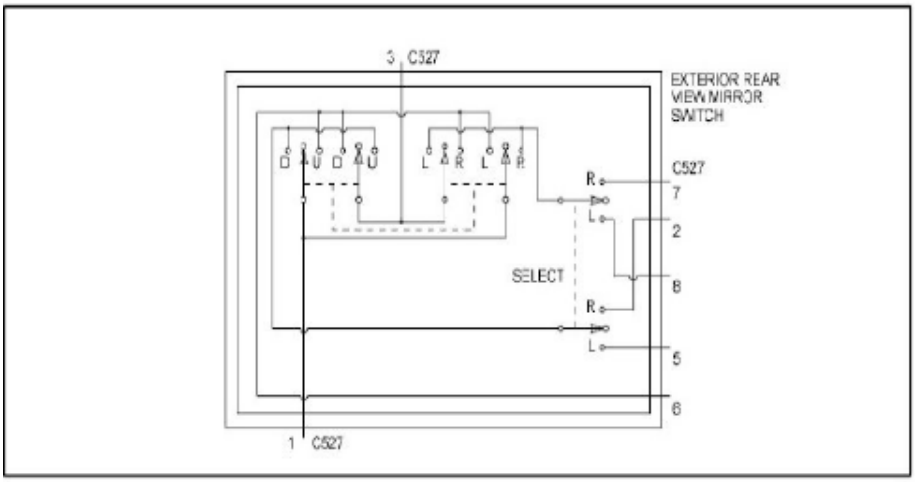
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

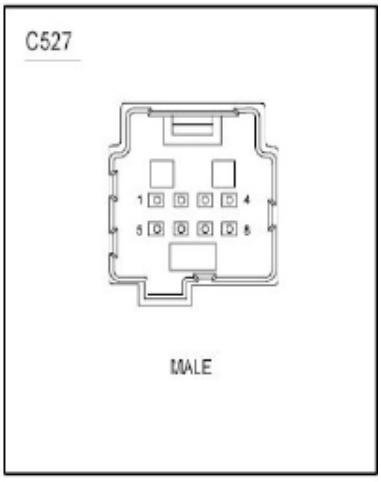
Power Mirror Switch: Testing and Inspection

Exterior rear view mirror switch

Schematic

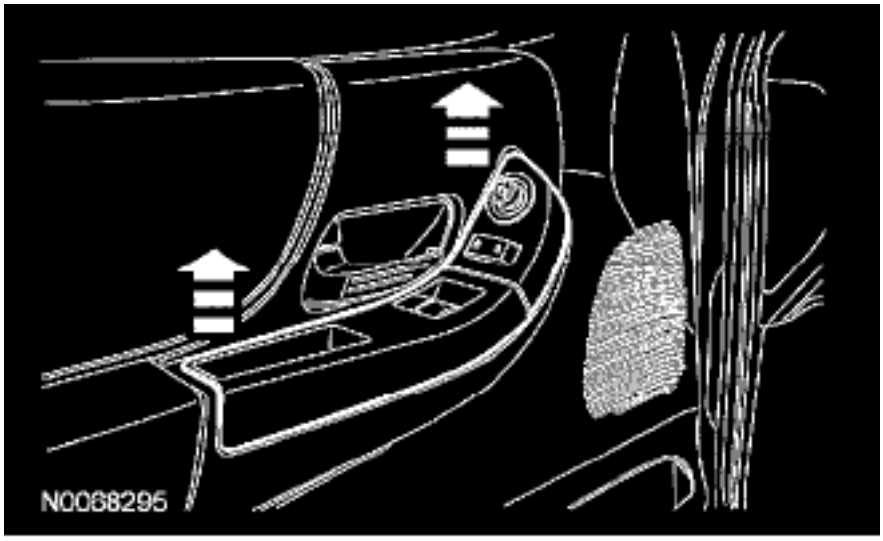


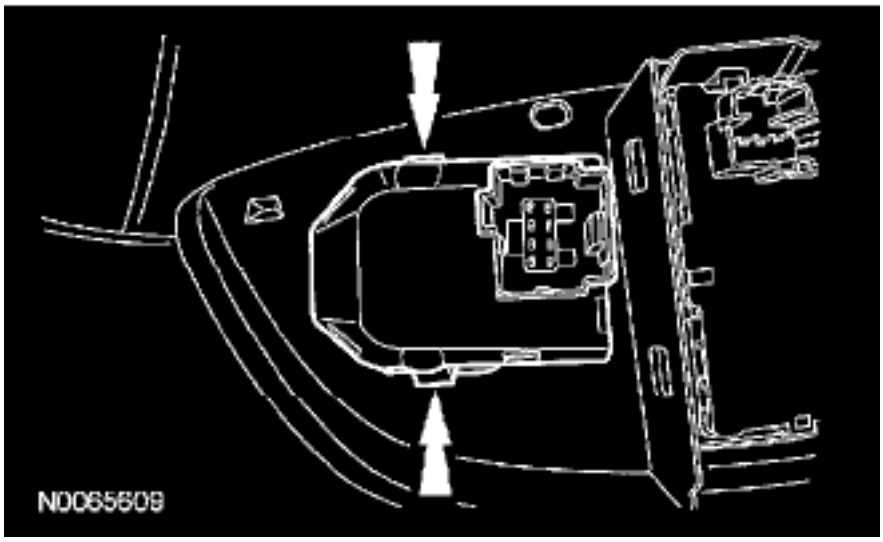
Terminals



Component testing procedure

Circuit to test		Connect self-powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
Left mirror	Up	3 and 5 6 and 1	Selector switch left Adjuster switch up	Closed circuit
	Down	3 and 6 5 and 1	Selector switch left Adjuster switch down	Closed circuit
	Left	3 and 8 6 and 1	Selector switch left Adjuster switch left	Closed circuit
	Right	3 and 6 8 and 1	Selector switch left Adjuster switch right	Closed circuit
Right mirror	Up	3 and 2 6 and 1	Selector switch right Adjuster switch up	Closed circuit
	Down	3 and 6 2 and 1	Selector switch right Adjuster switch down	Closed circuit
	Left	3 and 7 6 and 1	Selector switch right Adjuster switch left	Closed circuit
	Right	3 and 6 7 and 1	Selector switch right Adjuster switch right	Closed circuit





Power Mirror Switch: Service and Repair

EXTERIOR MIRROR CONTROL SWITCH

Removal and Installation

1. Remove the 2 interior door handle trim panel screws. 2. Remove the interior door handle trim panel.

- Lift the interior door handle trim panel upward to release the interior door handle trim panel retaining clips.

3. Remove the exterior mirror control switch.

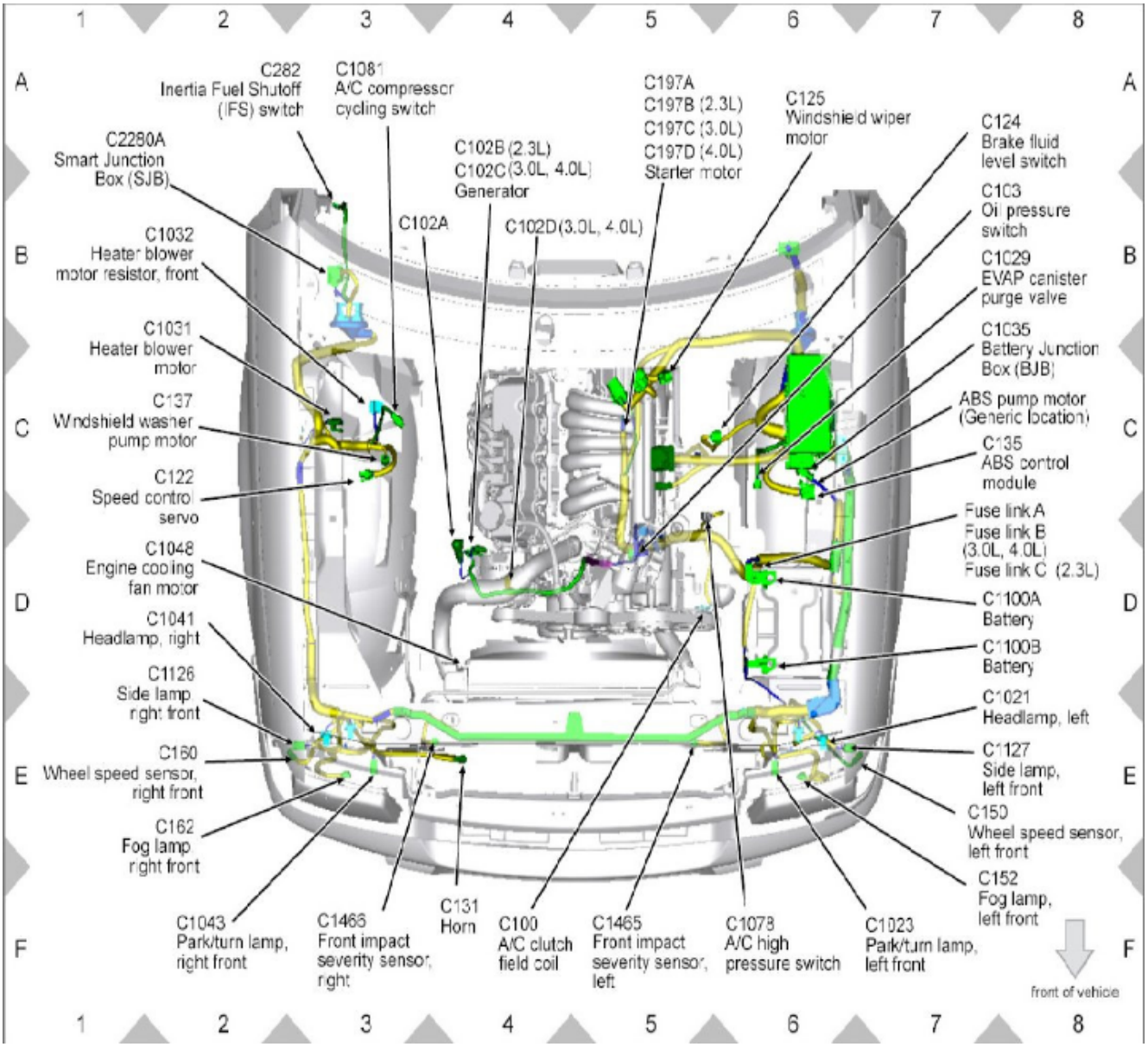
- Disconnect the electrical connector.

- Press the 2 exterior mirror control switch retaining tabs.

- Remove the exterior mirror control switch from the interior door handle trim panel.

4. To install, reverse the removal procedure.

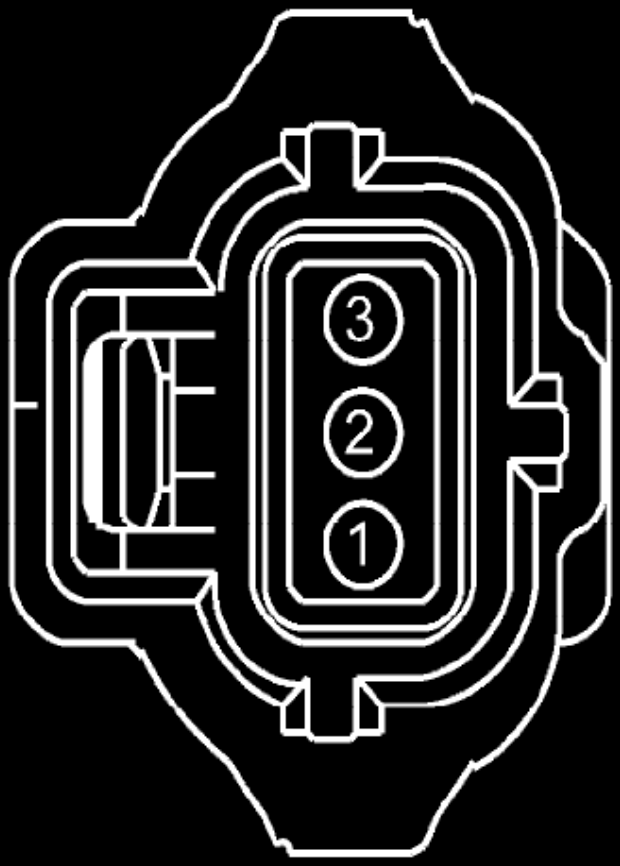
Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Sensors and Switches > Sensors and Switches - Brakes and Traction Control > Brake Fluid Level Sensor/Switch > Component Information > Locations



View 151-1

Connector: C124

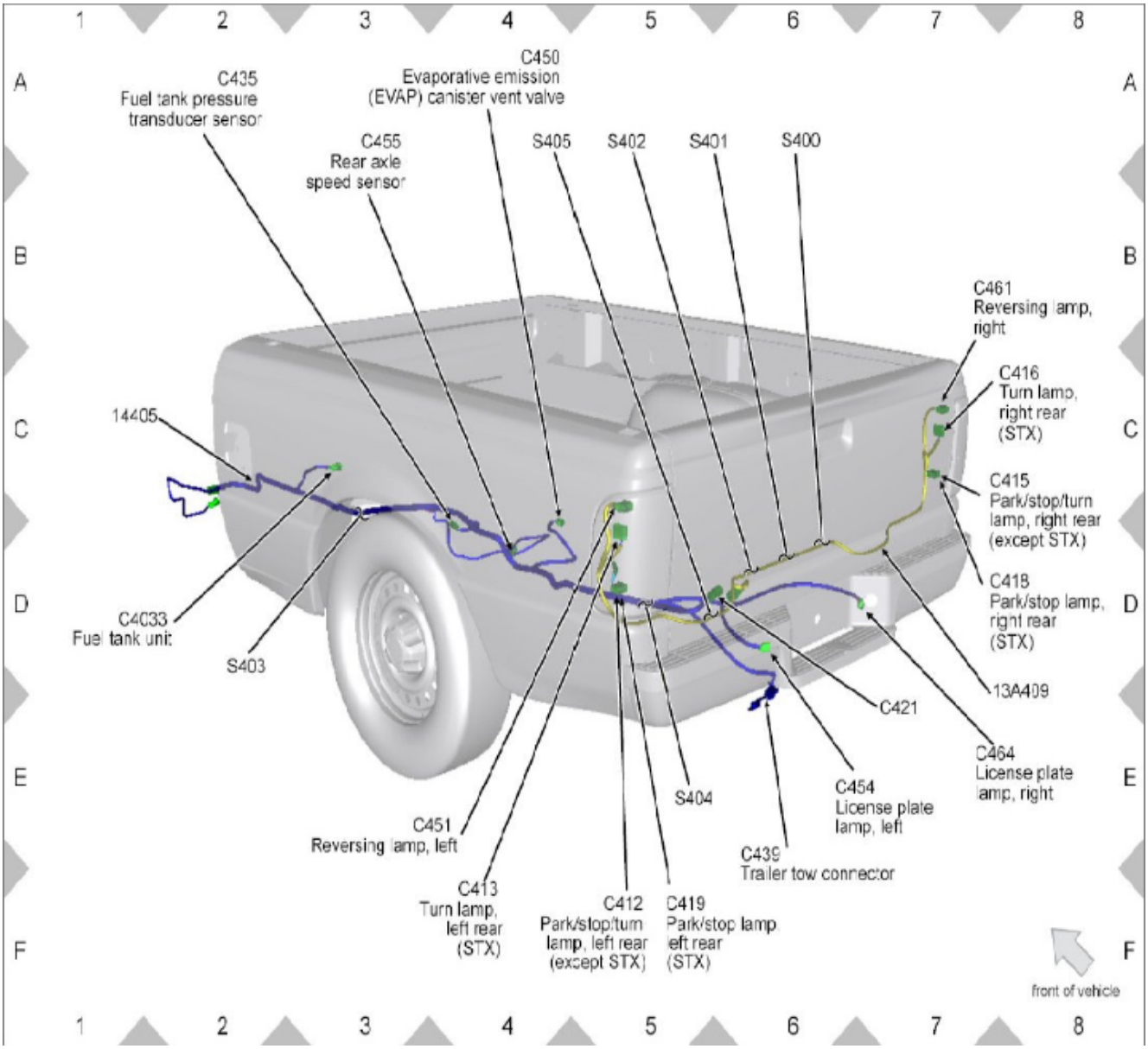
Description:	Harness:	Base Part #:
BRAKE FLUID LEVEL SWITCH	14290	2L414



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD121 (BK-YE)	20	GROUND - FENDER FRONT LEFT # 2ND STUD	
2	GMC19 (GY-VT)	20	SWITCH - LOW LEVEL BRAKE FLUID	
3	RMC19 (YE-GY)	20	SWITCH - LOW LEVEL BRAKE FLUID (CONTINUITY CHECK)	

C124

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Sensors and Switches > Sensors and Switches - Brakes and Traction Control > Differential Speed Sensor > Component Information > Locations



View 151-27

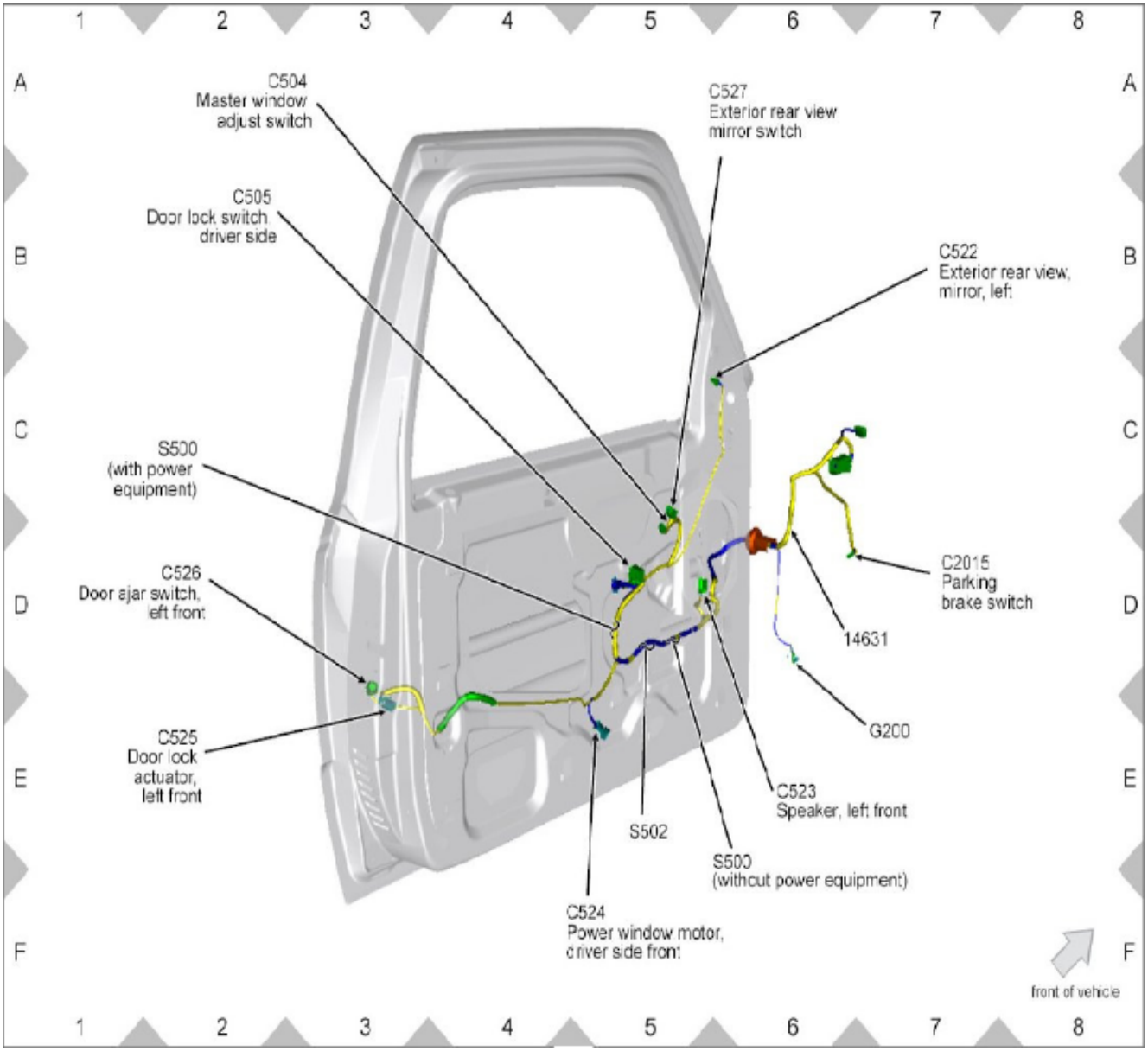
Connector: C455

Description:	Harness:	Base Part #:
REAR AXLE SPEED SENSOR	14405	4B409

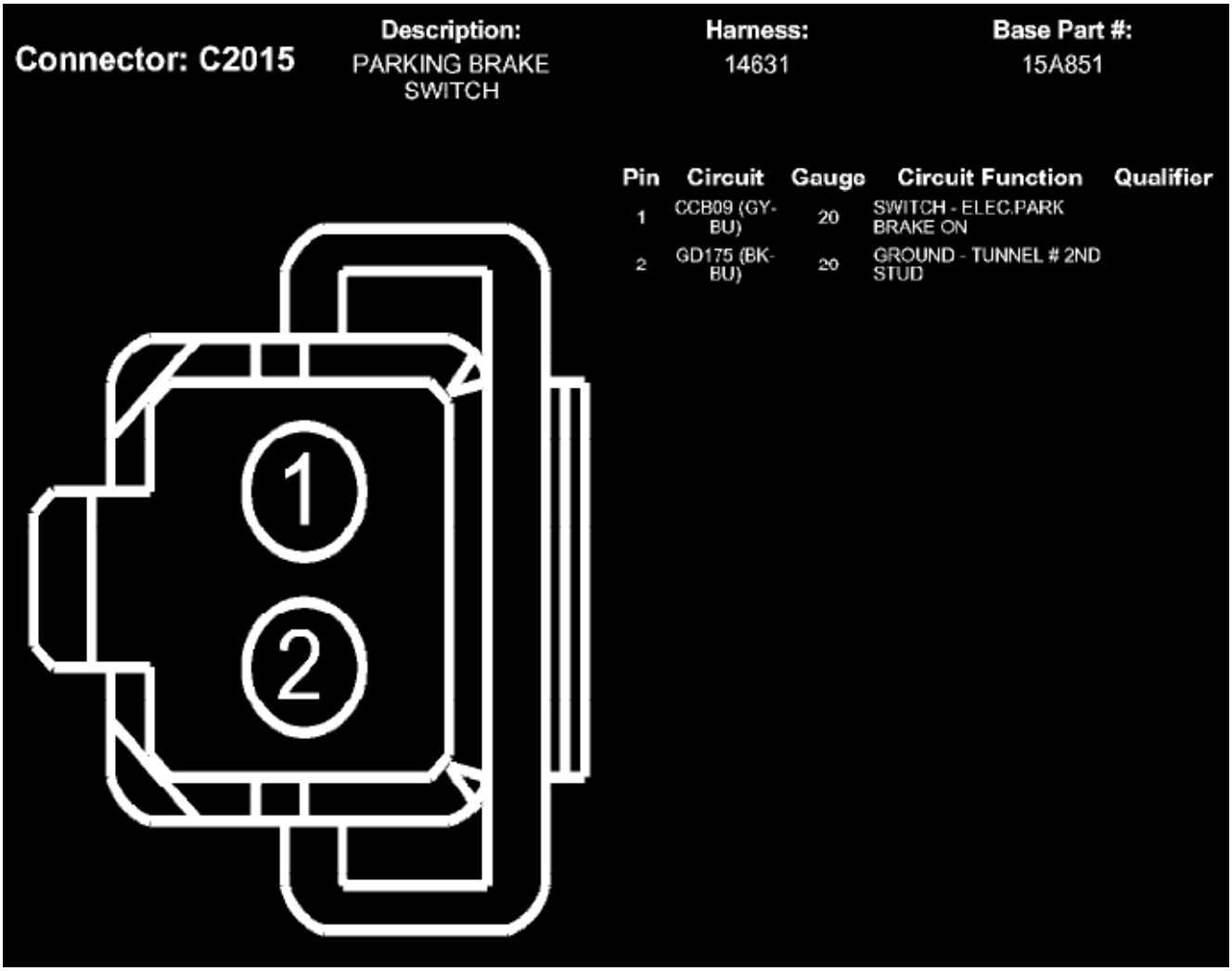
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RCA21 (BN-GN)	18	CTRL MOD. - SENSOR WHEEL SPEED REAR DIFFERENTIAL	
2	VCA14 (WH-BN)	18	SENSOR - REAR AXLE	

C455

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Sensors and Switches > Sensors and Switches - Brakes and Traction Control > Parking Brake Warning Switch > Component Information > Locations

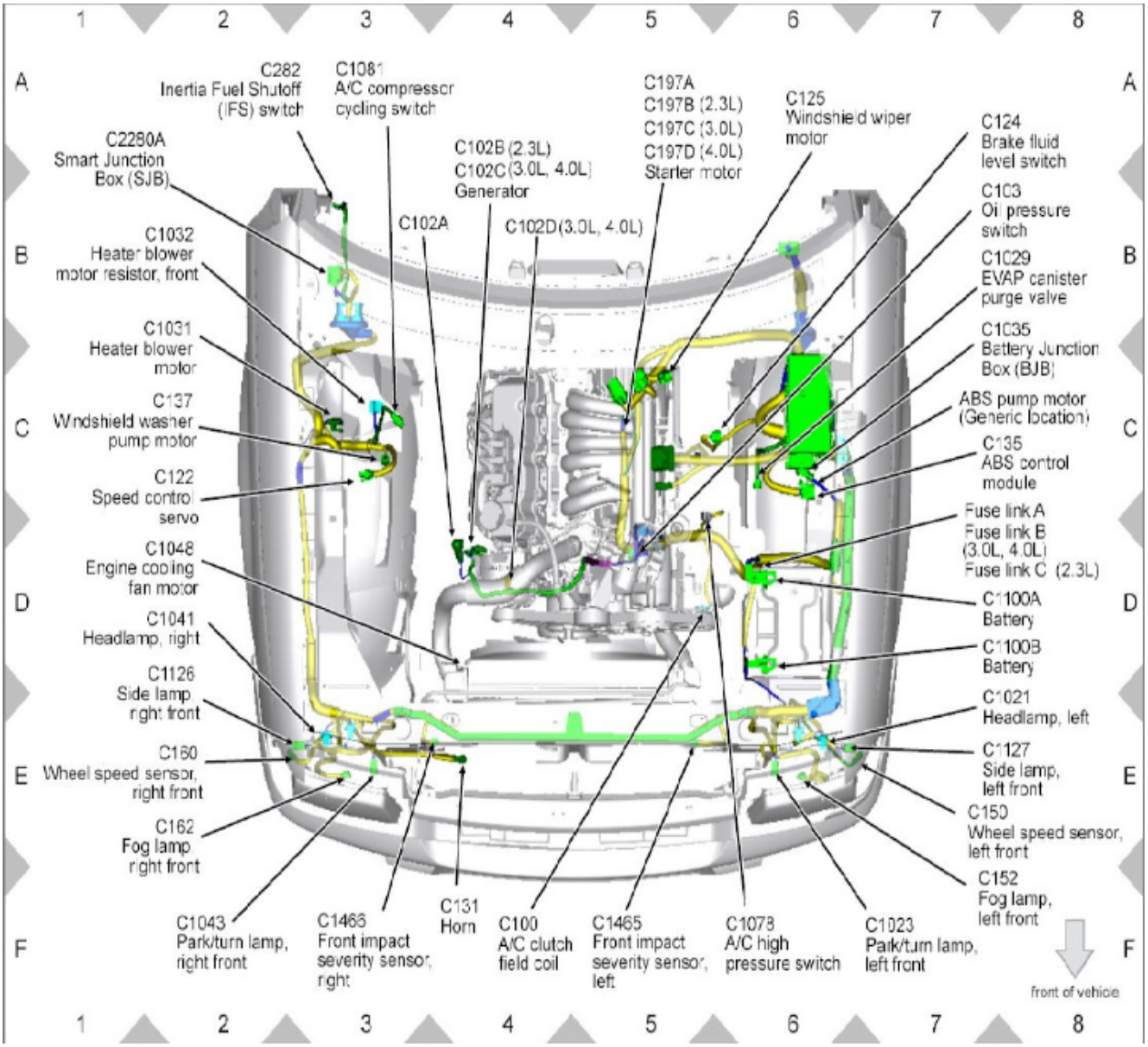


View 151-20

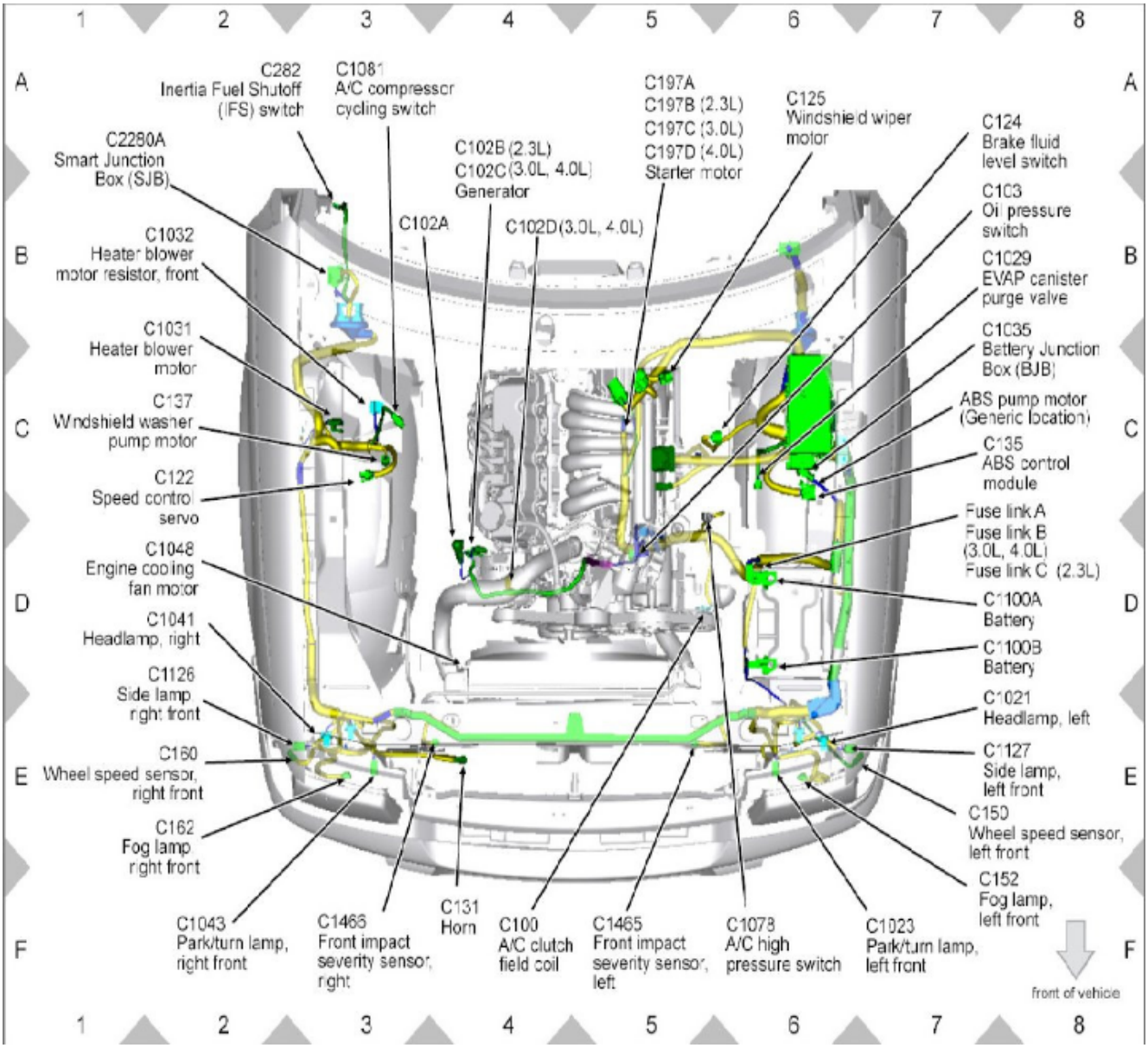

Connector: C2015
Description:
PARKING BRAKE SWITCH
Harness:
14631
Base Part #:
15A851
Pin
Circuit
Gauge
Circuit Function
Qualifier
1
CCB09 (GY-BU)
20
SWITCH - ELEC.PARK BRAKE ON
2
GD175 (BK-BU)
20
GROUND - TUNNEL # 2ND STUD
1
2

C2015

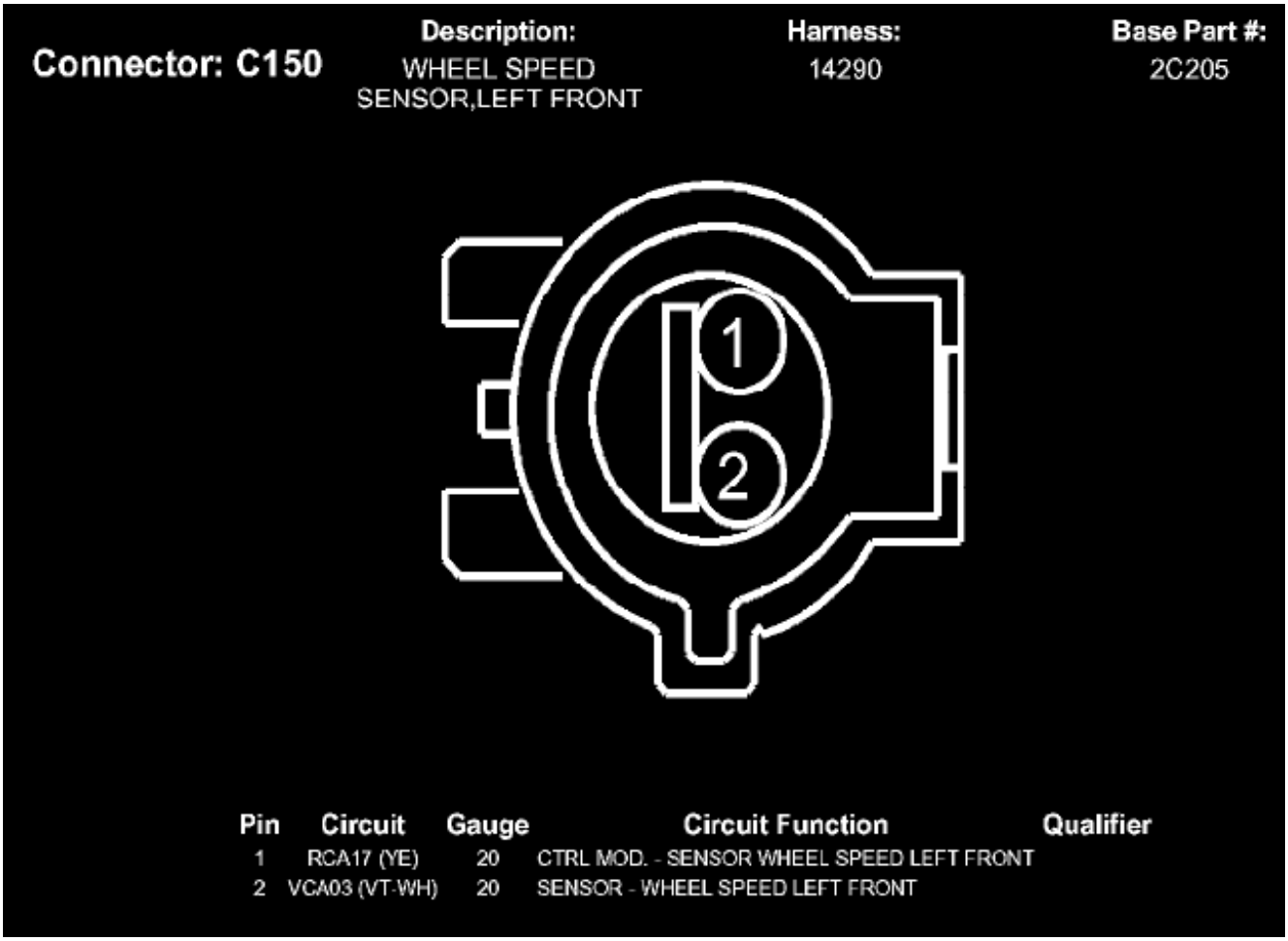
Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Sensors and Switches > Sensors and Switches - Brakes and Traction Control > Wheel Speed Sensor > Component Information > Locations > Wheel Speed Sensor, Right Front



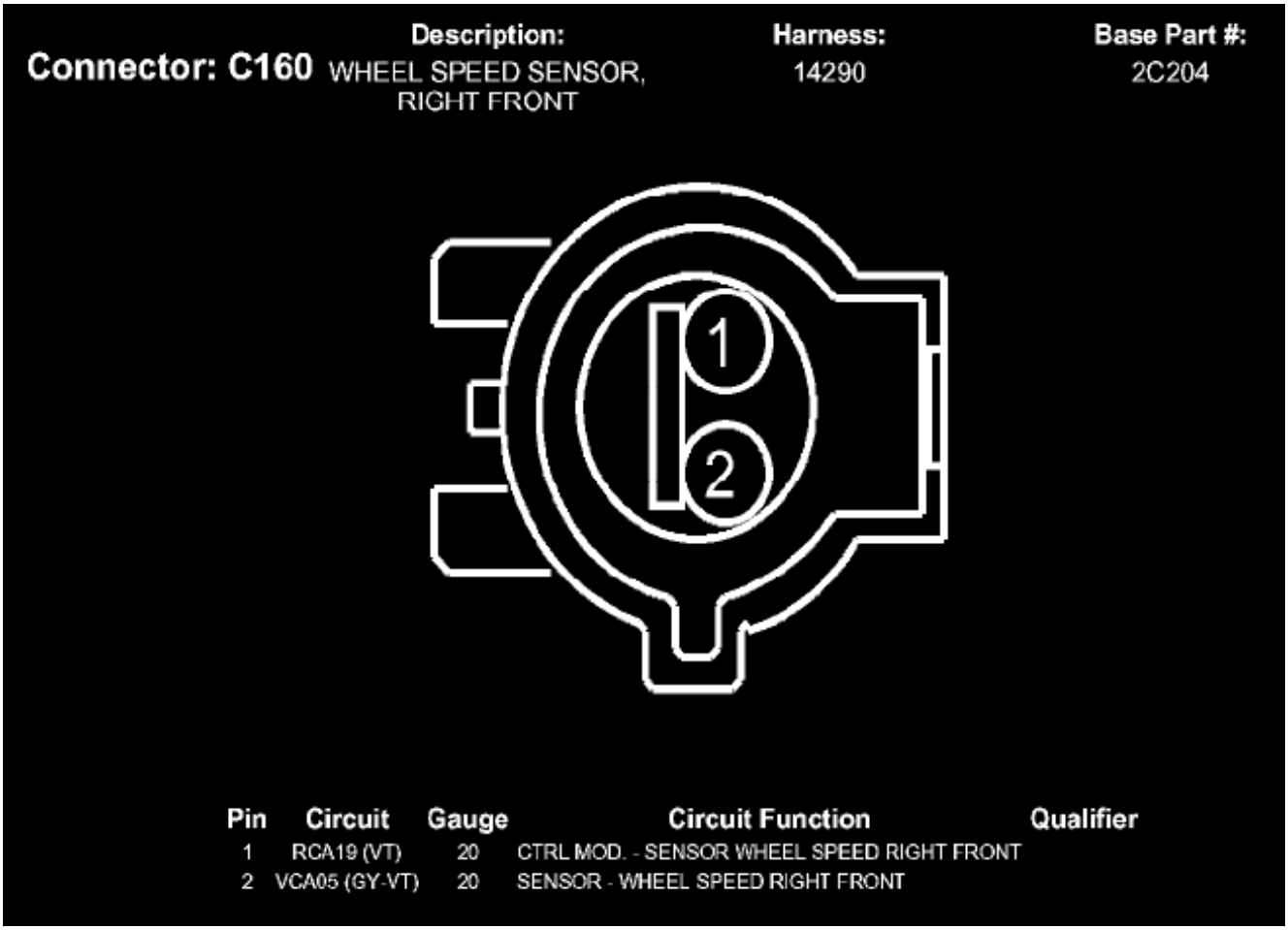
View 151-1


C282
Inertia Fuel Shutoff (IFS) switch
C1081
A/C compressor cycling switch
C2280A
Smart Junction Box (SJB)
C102B (2.3L)
C102C (3.0L, 4.0L)
Generator
C102A
C102D (3.0L, 4.0L)
C197A
C197B (2.3L)
C197C (3.0L)
C197D (4.0L)
Starter motor
C125
Windshield wiper motor
C124
Brake fluid level switch
C103
Oil pressure switch
C1032
Heater blower motor resistor, front
C1029
EVAP canister purge valve
C1031
Heater blower motor
C1035
Battery Junction Box (BJB)
C137
Windshield washer pump motor
ABS pump motor (Generic location)
C135
ABS control module
C122
Speed control servo
Fuse link A
Fuse link B (3.0L, 4.0L)
Fuse link C (2.3L)
C1048
Engine cooling fan motor
C1100A
Battery
C1041
Headlamp, right
C1100B
Battery
C1126
Side lamp, right front
C1021
Headlamp, left
C160
Wheel speed sensor, right front
C1127
Side lamp, left front
C162
Fog lamp, right front
C150
Wheel speed sensor, left front
C152
Fog lamp, left front
C1043
Park/turn lamp, right front
C1466
Front impact severity sensor, right
C131
Horn
C100
A/C clutch field coil
C1465
Front impact severity sensor, left
C1078
A/C high pressure switch
C1023
Park/turn lamp, left front
front of vehicle

View 151-1


Connector: C150
Description:
WHEEL SPEED SENSOR,LEFT FRONT
Harness:
14290
Base Part #:
2C205
1
2
Pin Circuit Gauge Circuit Function Qualifier
1 RCA17 (YE) 20 CTRL MOD. - SENSOR WHEEL SPEED LEFT FRONT
2 VCA03 (VT-WH) 20 SENSOR - WHEEL SPEED LEFT FRONT

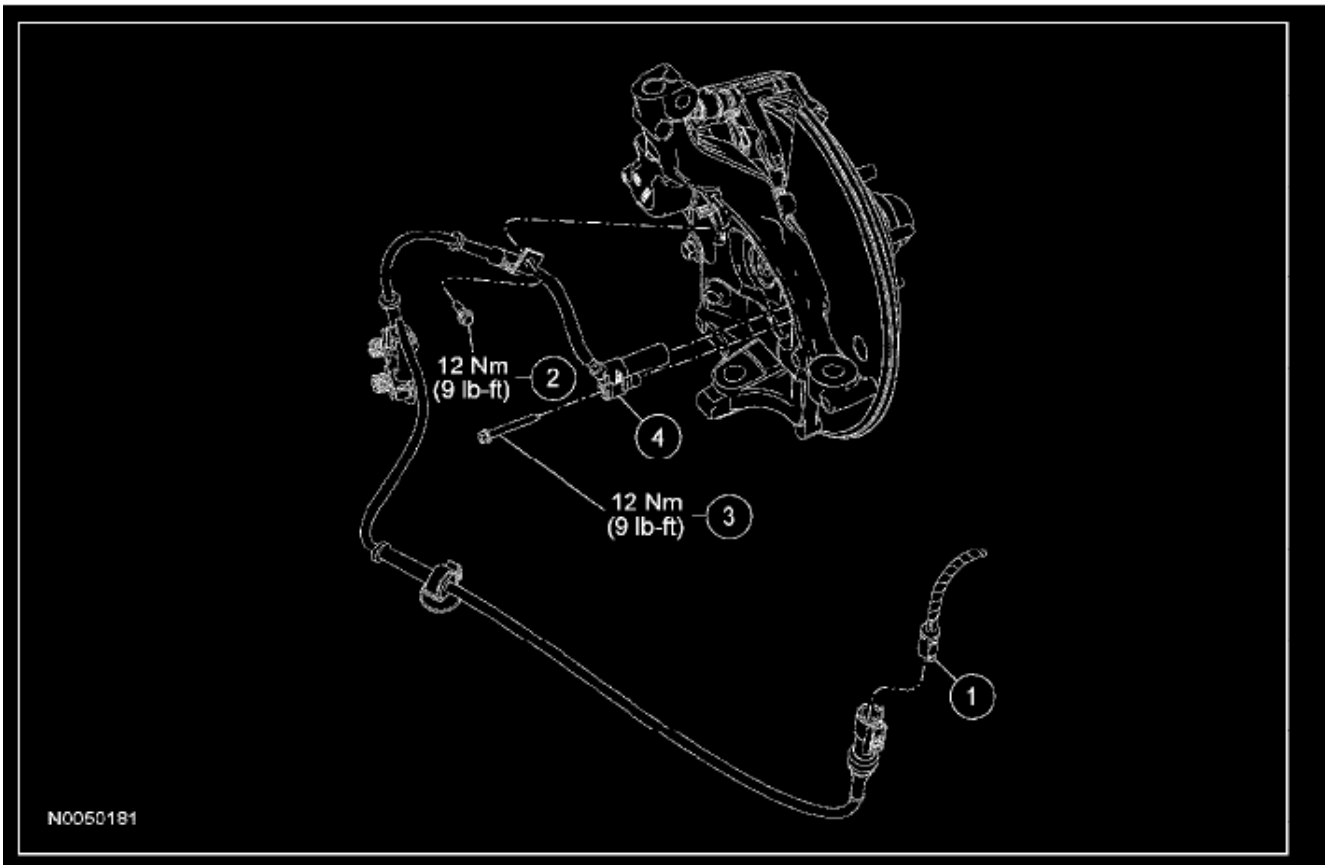
C150


Description:
Harness:
Base Part #:
Connector: C160
WHEEL SPEED SENSOR, RIGHT FRONT
14290
2C204
1
2
Pin
Circuit
Gauge
Circuit Function
Qualifier
1
RCA19 (VT)
20
CTRL MOD. - SENSOR WHEEL SPEED RIGHT FRONT
2
VCA05 (GY-VT)
20
SENSOR - WHEEL SPEED RIGHT FRONT

C160

Material

Item	Specification
High Temperature 4x4 Front Axle and Wheel Bearing Grease E8TZ-19590-A	WSS-M1C267-A1



Item	Part Number	Description
1	—	Wheel speed sensor electrical connector (part of 14290)
2	N611171	Wheel speed sensor harness bolt
3	N811177	Wheel speed sensor bolt
4	2C204	Wheel speed sensor

Wheel Speed Sensor: Service and Repair Wheel Speed Sensor - Front

Wheel Speed Sensor - Front, Rear Wheel Drive (RWD)

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the wheel speed sensor electrical connector. 3. Remove the wheel speed sensor harness bolt and unclip the retainers.

^ To install, tighten to 12 Nm (9 lb-ft).

4. Remove the wheel speed sensor bolt and the wheel speed sensor.

^ To install, tighten to 12 Nm (9 lb-ft).

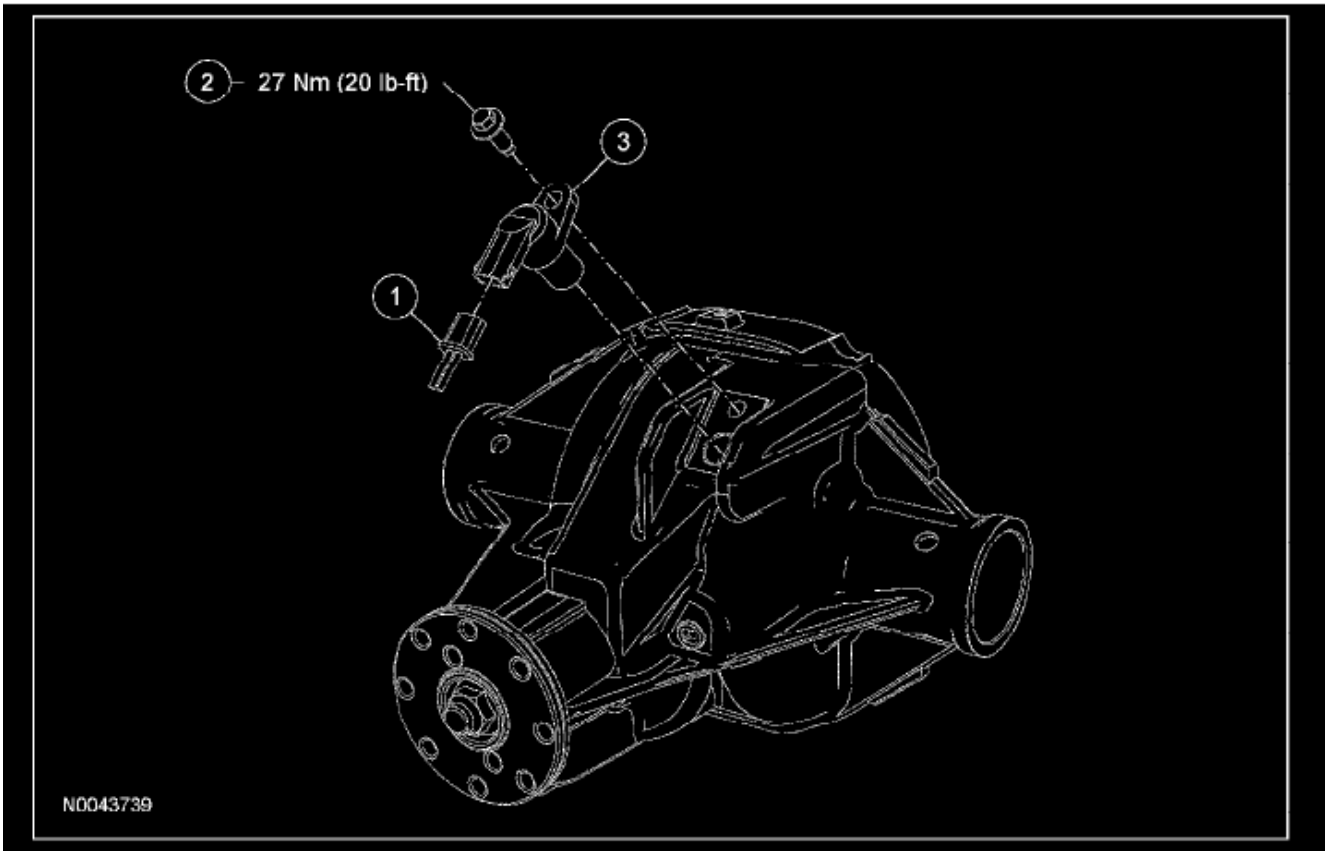
5. NOTE: Plug the sensor cavity and thoroughly clean the sensor mounting surface. Apply a light coating of the specified grease to the mounting

surface.

To install, reverse the removal procedure.

Material

Item	Specification
Motorcraft SAE 75W-140 Synthetic Rear Axle Lubricant XY-75W140-QL (US); CXY-75W140-1L (Canada)	WSL-M2C192-A



Item	Part Number	Description
1	—	Wheel speed sensor electrical connector (part of 14405)
2	391998	Wheel speed sensor bolt
3	9E731	Wheel speed sensor

Wheel Speed Sensor: Service and Repair Wheel Speed Sensor - Rear

Wheel Speed Sensor - Rear

Removal and Installation

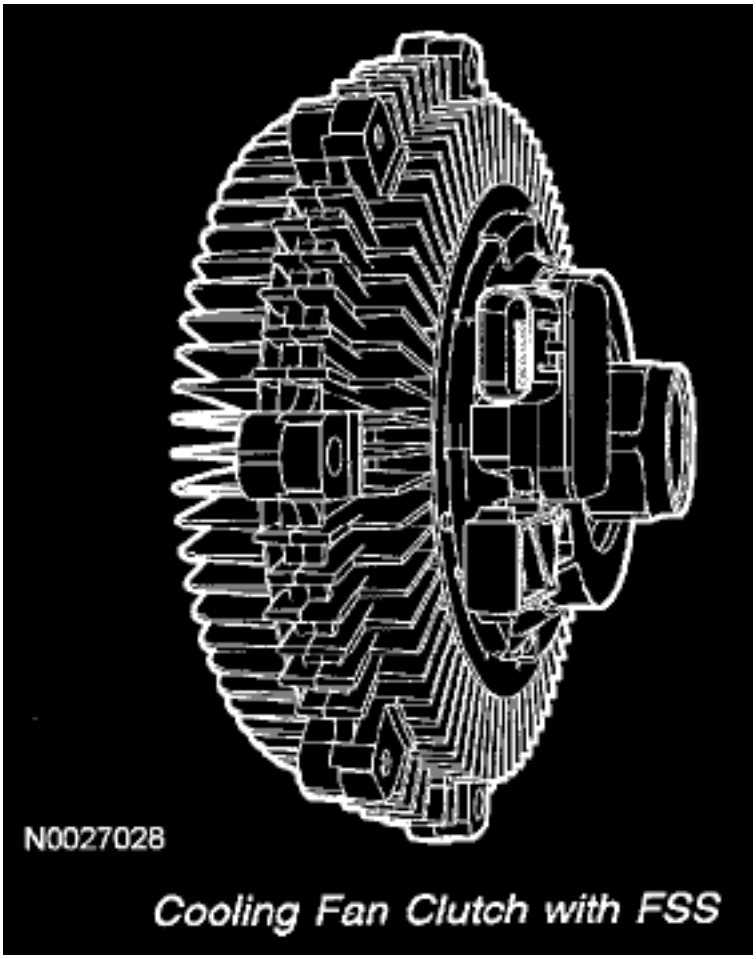
1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the wheel speed sensor electrical connector. 3. Remove the wheel speed sensor bolt and the wheel speed sensor.

^ To install, tighten to 27 Nm (20 lb-ft).

4. NOTE: Plug the sensor cavity and thoroughly clean the sensor mounting surface.

NOTE: Inspect the anti-lock brake sensor O-ring seal for damage; lightly lubricate the O-ring seal with the specified lubricant.

To install, reverse the removal procedure.

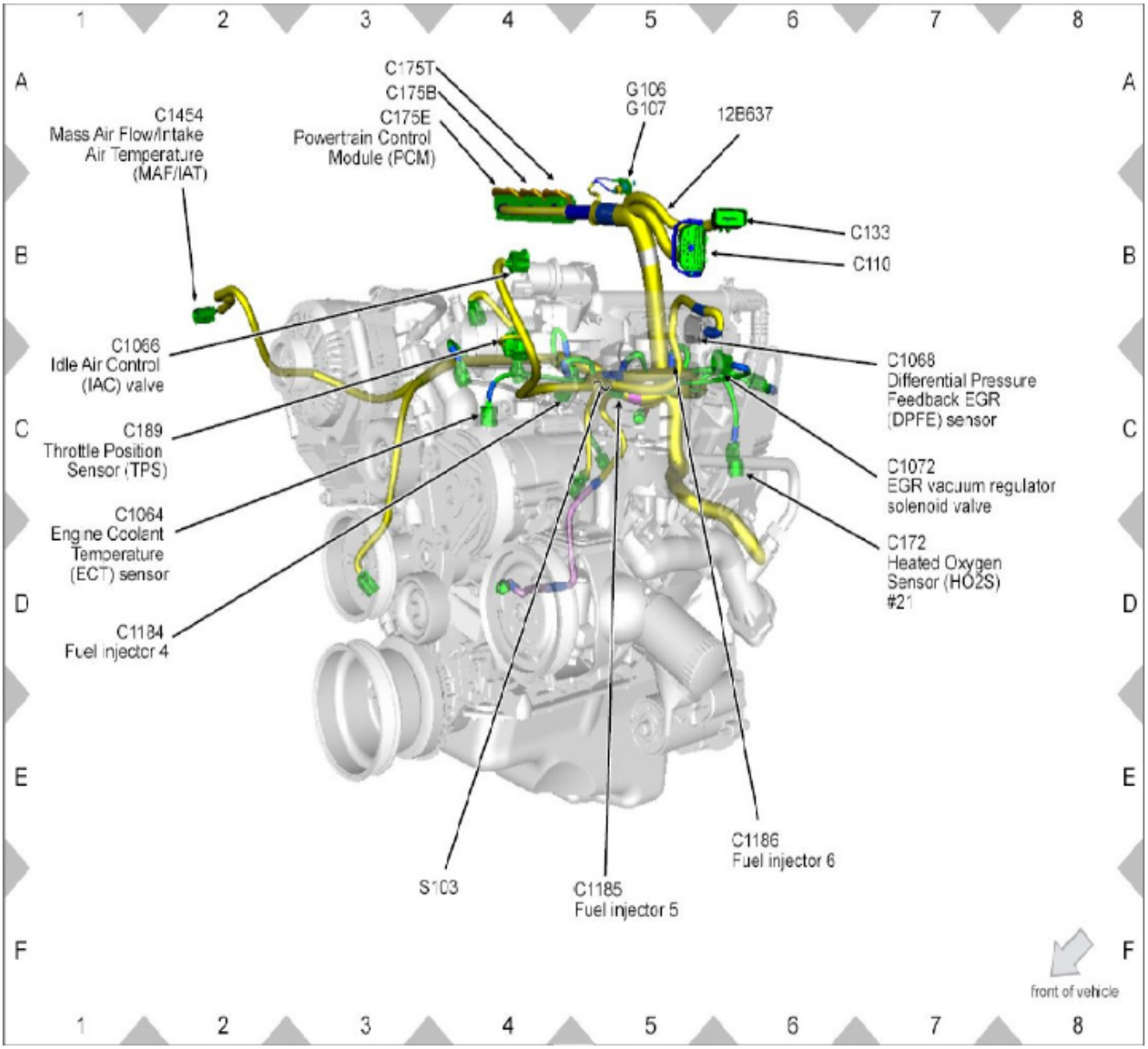


Radiator Cooling Fan Speed Sensor: Description and Operation

FAN SPEED SENSOR (FSS)

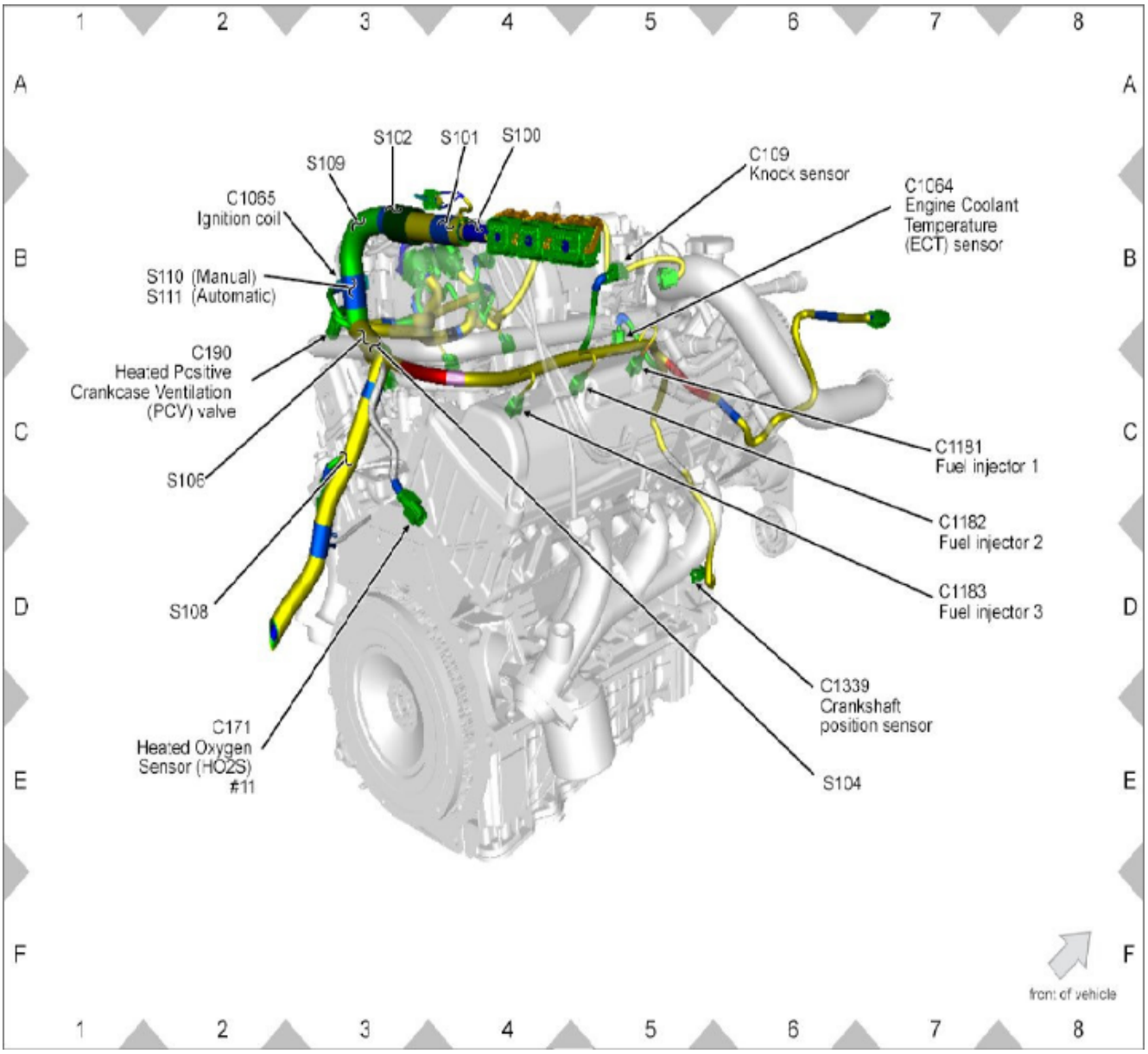
Cooling Fan Clutch With FSS

The FSS is a Hall-effect sensor that measures the cooling fan clutch speed by generating a waveform with a frequency proportional to the fan speed. If the cooling fan clutch is moving at a relatively low speed, the sensor produces a signal with a low frequency. As the cooling fan clutch speed increases, the sensor generates a signal with a higher frequency. The PCM uses the frequency signal generated by the FSS as a feedback for closed loop control of the cooling fan clutch.



Coolant Temperature Sensor/Switch (For Computer): Locations

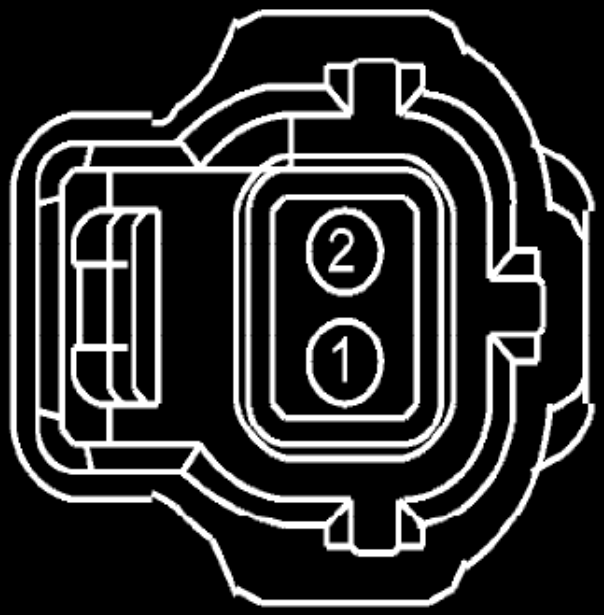
View 151-5


S102
S101
S100
S109
C109
Knock sensor
C1065
Ignition coil
C1064
Engine Coolant
Temperature
(ECT) sensor
S110 (Manual)
S111 (Automatic)
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
C1181
Fuel injector 1
C1182
Fuel injector 2
S108
C1183
Fuel injector 3
C1339
Crankshaft
position sensor
C171
Heated Oxygen
Sensor (HO2S)
#11
S104
front of vehicle

View 151-8

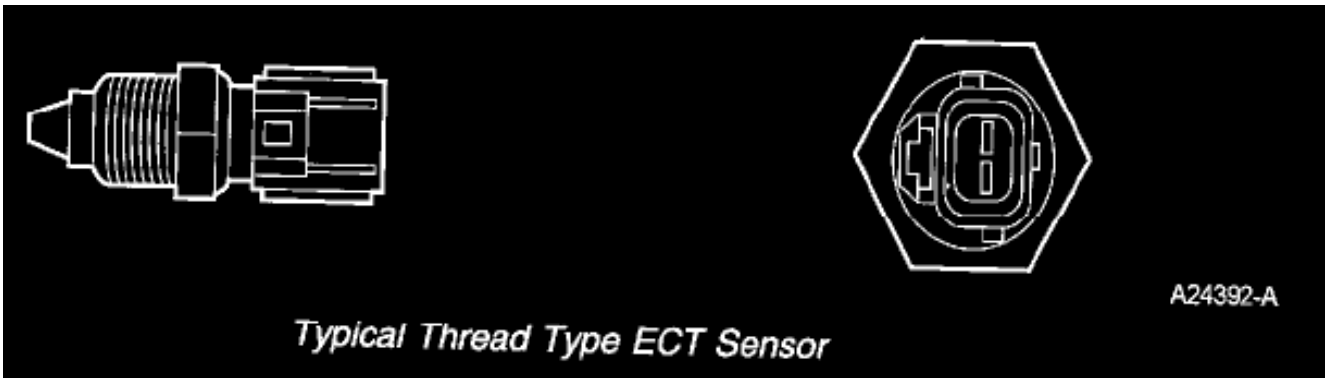
Connector: C1064

Description:	Harness:	Base Part #:
ENGINE COOLANT TEMPERATURE (ECT) SENSOR	12B637	12A648



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE716 (YE)	20	SENSOR - ENGINE COOLANT TEMPERATURE (ECT)	3.0L, 4.0L
2	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	3.0L, 4.0L

C1064



Coolant Temperature Sensor/Switch (For Computer): Description and Operation

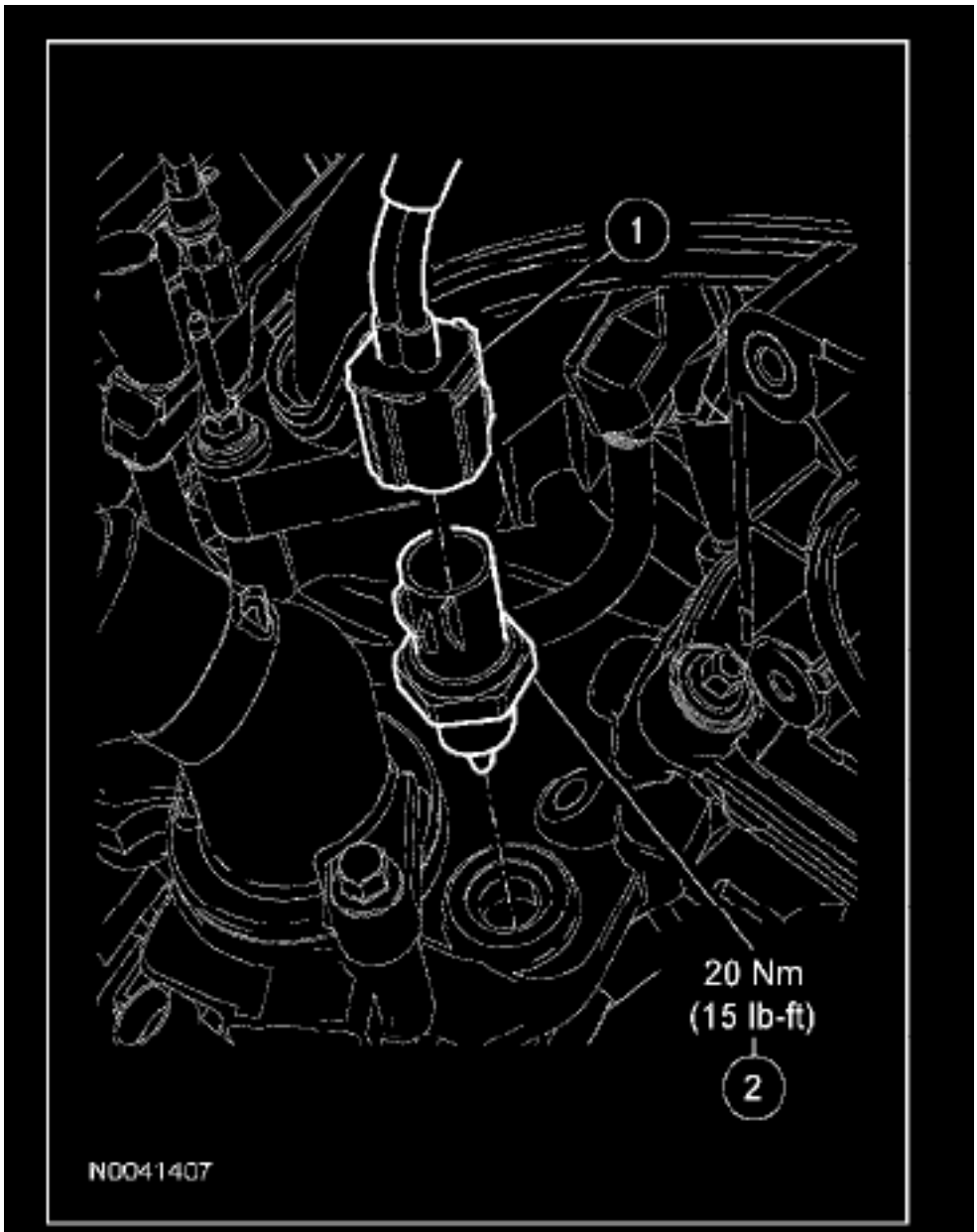
ENGINE COOLANT TEMPERATURE (ECT) SENSOR

Typical Thread Type ECT Sensor

The ECT sensor is a thermistor device in which resistance changes with temperature. The electrical resistance of a thermistor decreases as the temperature increases, and the resistance increases as the temperature decreases. The varying resistance changes the voltage drop across the sensor terminals and provides electrical signals to the PCM corresponding to temperature.

Thermistor-type sensors are considered passive sensors. A passive sensor is connected to a voltage divider network so that varying the resistance of the passive sensor causes a variation in total current flow. Voltage that is dropped across a fixed resistor in a series with the sensor resistor determines the voltage signal at the PCM. This voltage signal is equal to the reference voltage minus the voltage drop across the fixed resistor.

The ECT measures the temperature of the engine coolant. The PCM uses the ECT input for fuel control and for cooling fan control. There are 3 types of ECT sensors, threaded, push-in, and twist-lock. The ECT sensor is located in an engine coolant passage.



Item	Part Number	Description
1	14A464	Engine coolant temperature (ECT) sensor electrical connector (part of 12B637)
2	12A648	ECT sensor

Coolant Temperature Sensor/Switch (For Computer): Service and Repair

ENGINE COOLANT TEMPERATURE (ECT) SENSOR

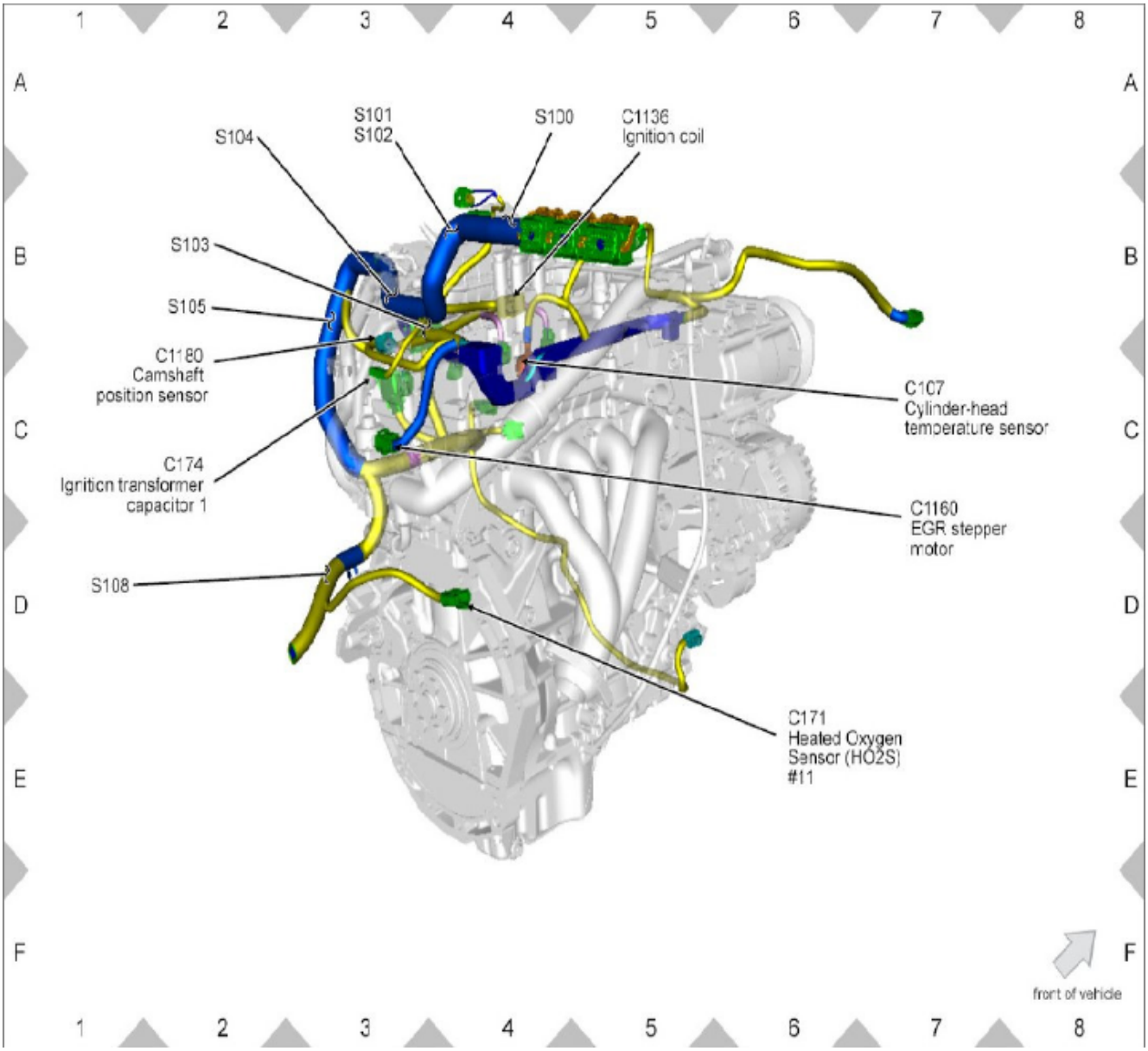
Removal and Installation

1. Drain the cooling system. 2. Disconnect the engine coolant temperature (ECT) sensor electrical connector. 3. Remove the ECT sensor.

- To install, tighten to 20 Nm (15 lb-ft).

4. To install, reverse the removal procedure.

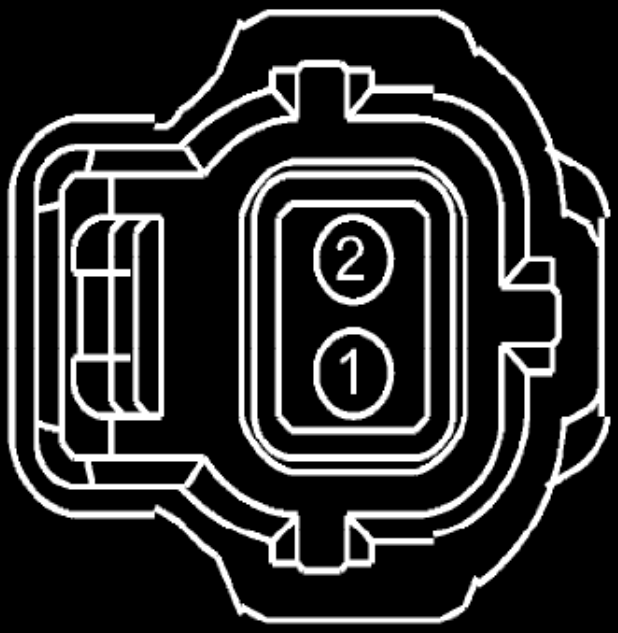
Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Sensors and Switches > Sensors and Switches - Cooling System > Engine - Coolant Temperature Sensor/Switch > Engine Temperature Sensor > Component Information > Locations



View 151-4

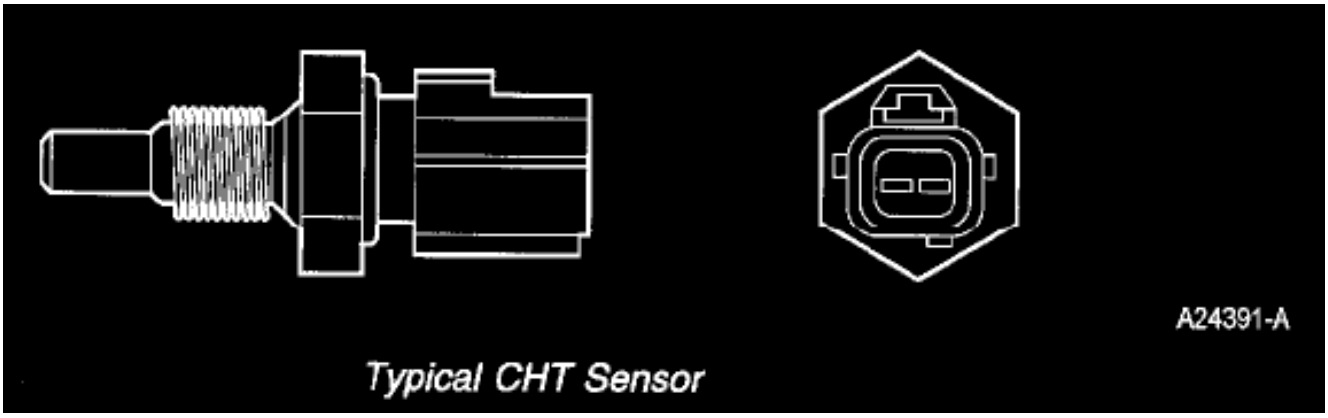
Connector: C107

Description:	Harness:	Base Part #:
CYLINDERHEAD TEMPERATURE SENSOR	12B637	6G004



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE116 (VT-BN)	20	CTRL MOD. - POWERTRAIN # CYLINDER HEAD TEMPERATURE INDICATOR LIGHT (CHTIL)	2.3L
2	RE405 (GN/WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	2.3L

C107



Typical CHT Sensor

Engine Temperature Sensor: Description and Operation

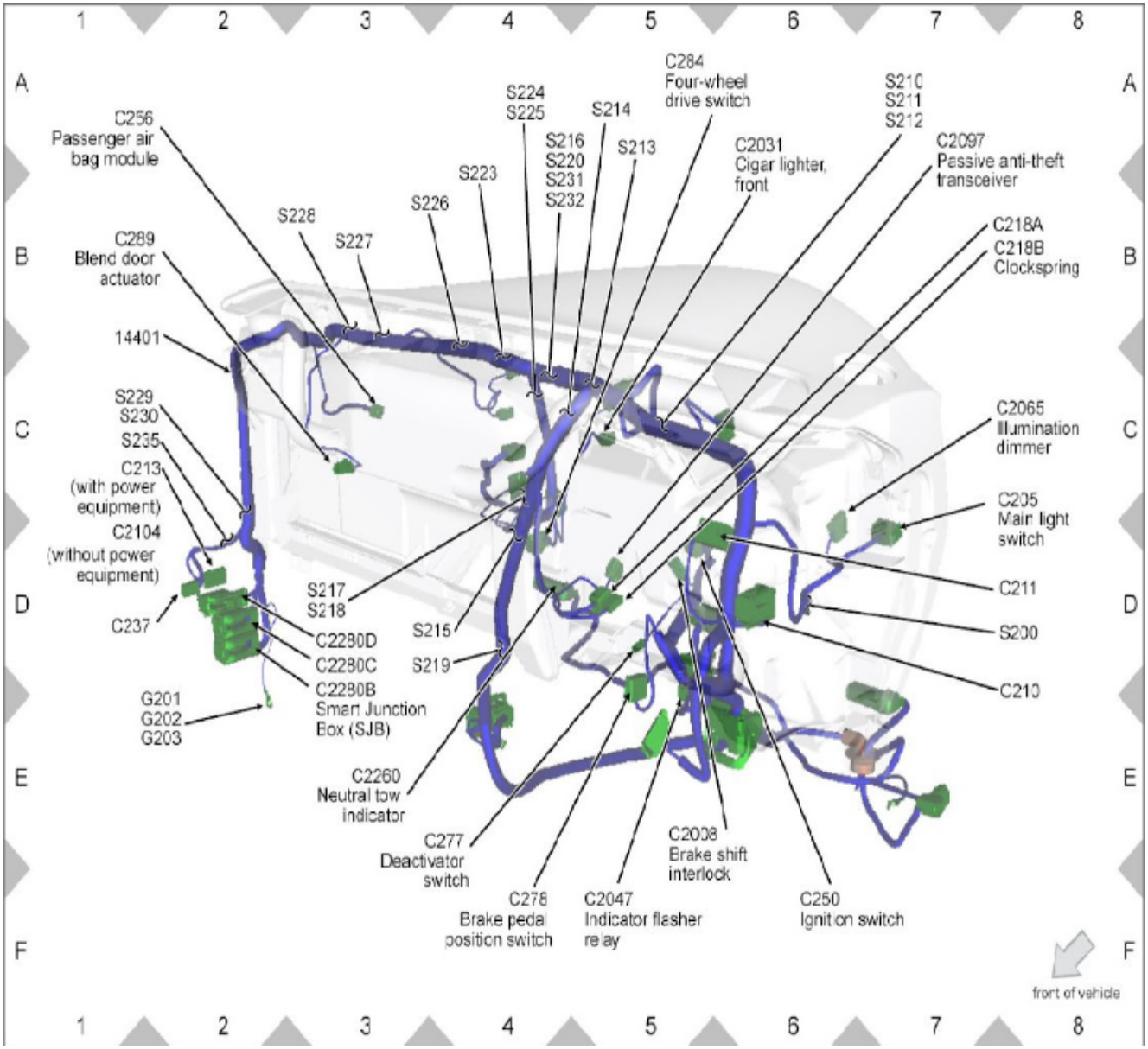
CYLINDER HEAD TEMPERATURE (CHT) SENSOR

Typical CHT Sensor

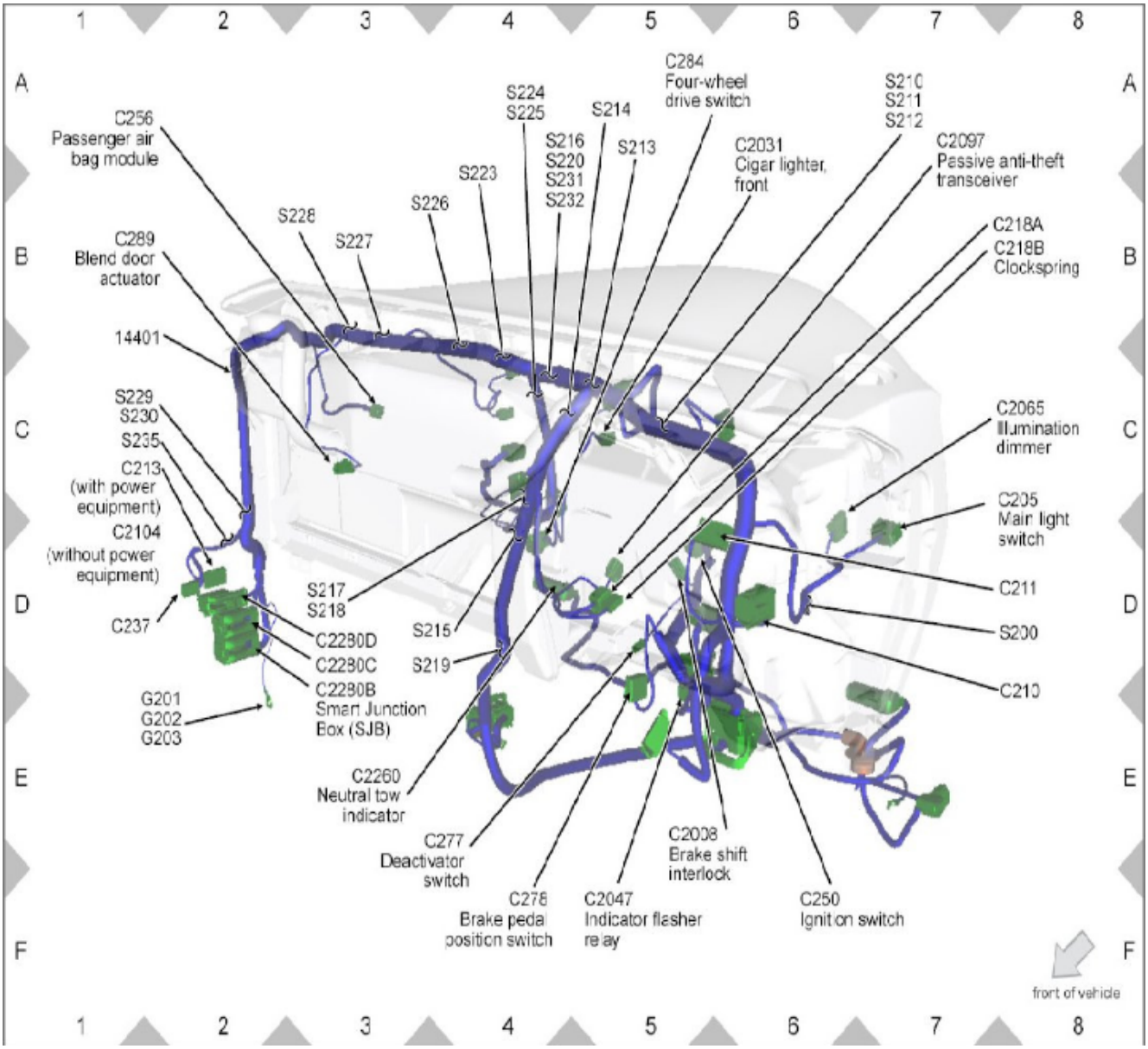
The CHT sensor is a thermistor device in which resistance changes with the temperature. The electrical resistance of a thermistor decreases as temperature increases, and the resistance increases as the temperature decreases. The varying resistance affects the voltage drop across the sensor terminals and provides electrical signals to the PCM corresponding to temperature.

The CHT sensor is installed in the cylinder head and measures the metal temperature. The CHT sensor can provide complete engine temperature information and can be used to infer coolant temperature. If the CHT sensor conveys an overheating condition to the PCM, the PCM initiates a fail-safe cooling strategy based on information from the CHT sensor. A cooling system concern such as low coolant or coolant loss could cause an overheating condition. As a result, damage to major engine components could occur. Using both the CHT sensor and fail-safe cooling strategy, the PCM prevents damage by allowing air cooling of the engine and limp home capability.

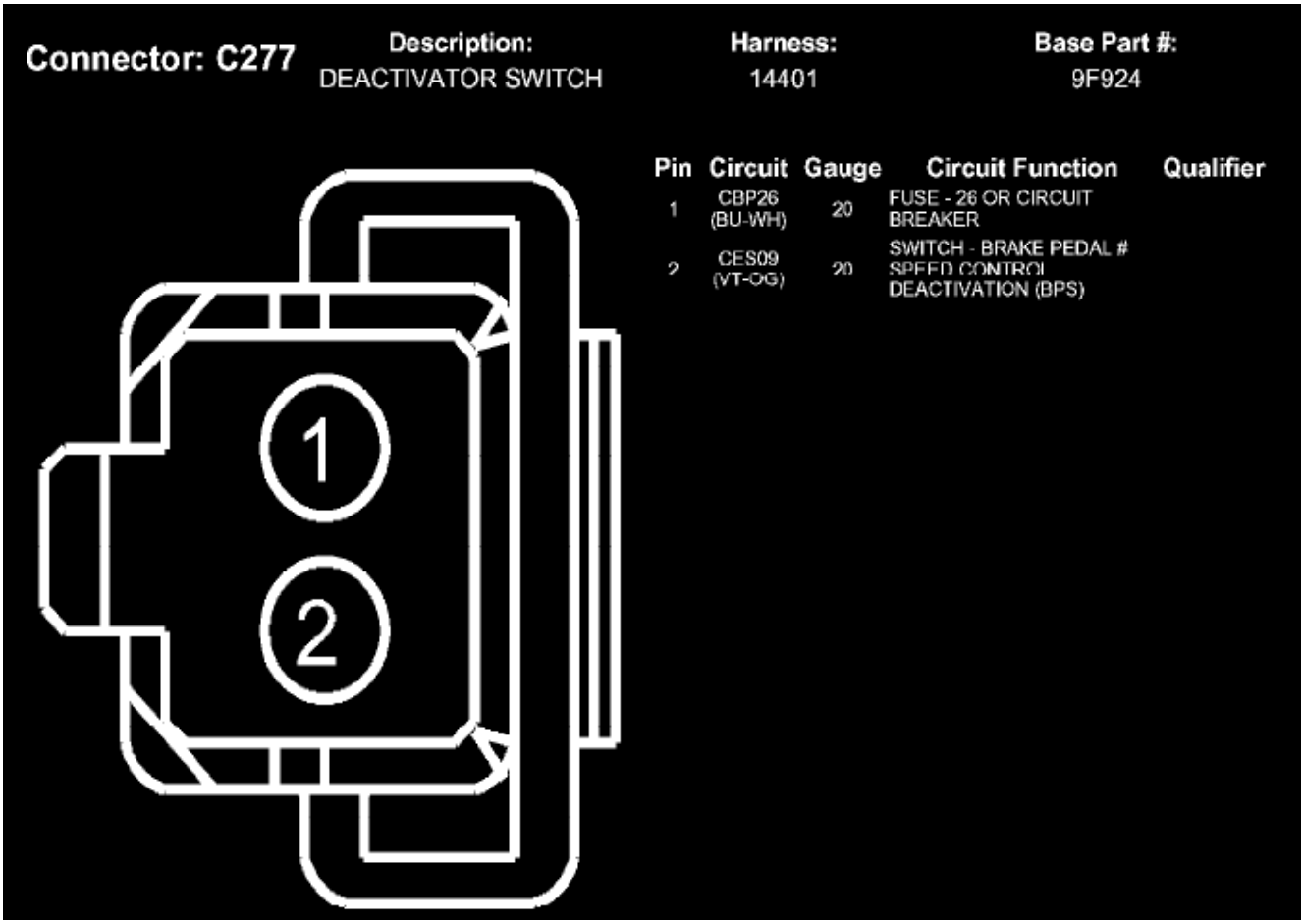
Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Sensors and Switches > Sensors and Switches - Cruise Control > Brake Switch (Cruise Control) > Component Information > Locations > Deactivator Switch



View 151-11


C256
Passenger air bag module
C289
Blend door actuator
14401
S229
S230
S235
C213
(with power equipment)
C2104
(without power equipment)
C237
G201
G202
G203
S228
S227
S226
S223
S224
S225
S216
S220
S231
S232
S214
S213
C284
Four-wheel drive switch
C2031
Cigar lighter, front
S210
S211
S212
C2097
Passive anti-theft transceiver
C218A
C218B
Clockspring
C2065
Illumination dimmer
C205
Main light switch
C211
S200
C210
S217
S218
S215
S219
C2280D
C2280C
C2280B
Smart Junction Box (SJB)
C2260
Neutral tow indicator
C277
Deactivator switch
C278
Brake pedal position switch
C2047
Indicator flasher relay
C2008
Brake shift interlock
C250
Ignition switch
front of vehicle

View 151-11


Connector: C277
Description:
DEACTIVATOR SWITCH
Harness:
14401
Base Part #:
9F924
Pin Circuit Gauge Circuit Function Qualifier
1 CBP26 (BU-WH) 20 FUSE - 26 OR CIRCUIT BREAKER
2 CES09 (VT-OG) 20 SWITCH - BRAKE PEDAL # SPEED CONTROL DEACTIVATION (BPS)
1
2

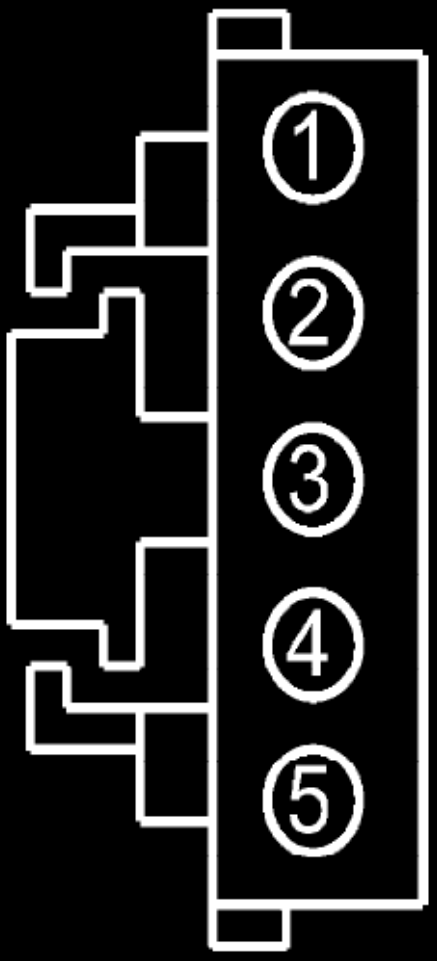
C277

Connector: C278

Description: BRAKE PEDAL POSITION SWITCH

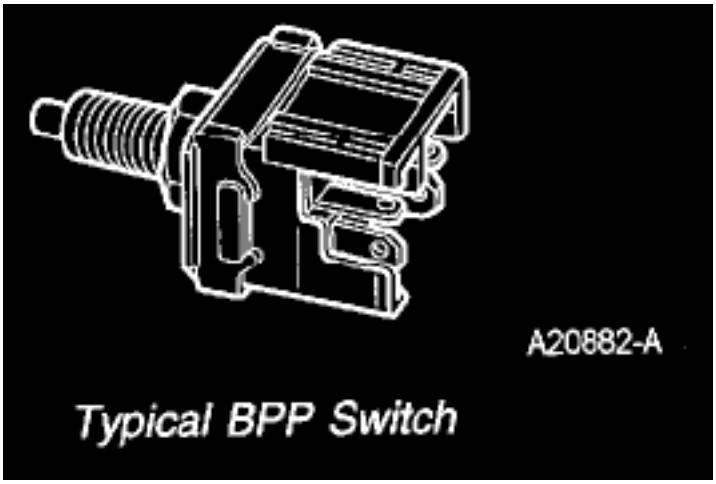
Harness: 14401

Base Part #:



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	SBP19 (BU-RD)	16	FUSE - 19 OR CIRCUIT BREAKER	
2	CCB08 (VT-WH)	16	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL OPEN	
3	SBP32 (VT-RD)	22	FUSE - 32 OR CIRCUIT BREAKER	
4	CCB15 (BN-GN)	22	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL CLOSED	
5	GD161 (BK-YE)	22	GROUND - SEAT BRACKET REAR LEFT	

C278



Brake Switch (Cruise Control): Description and Operation

Brake Pedal Position (BPP) Switch

Typical BPP Switch

The BPP switch is sometimes referred to as the stoplamp switch. The BPP switch provides a signal to the PCM indicating that the brakes are applied. The BPP switch is normally open and is mounted on the brake pedal support. Depending on the vehicle application the BPP switch can be hardwired as follows: -

to the PCM supplying battery positive voltage (B+) when the vehicle brake pedal is applied.

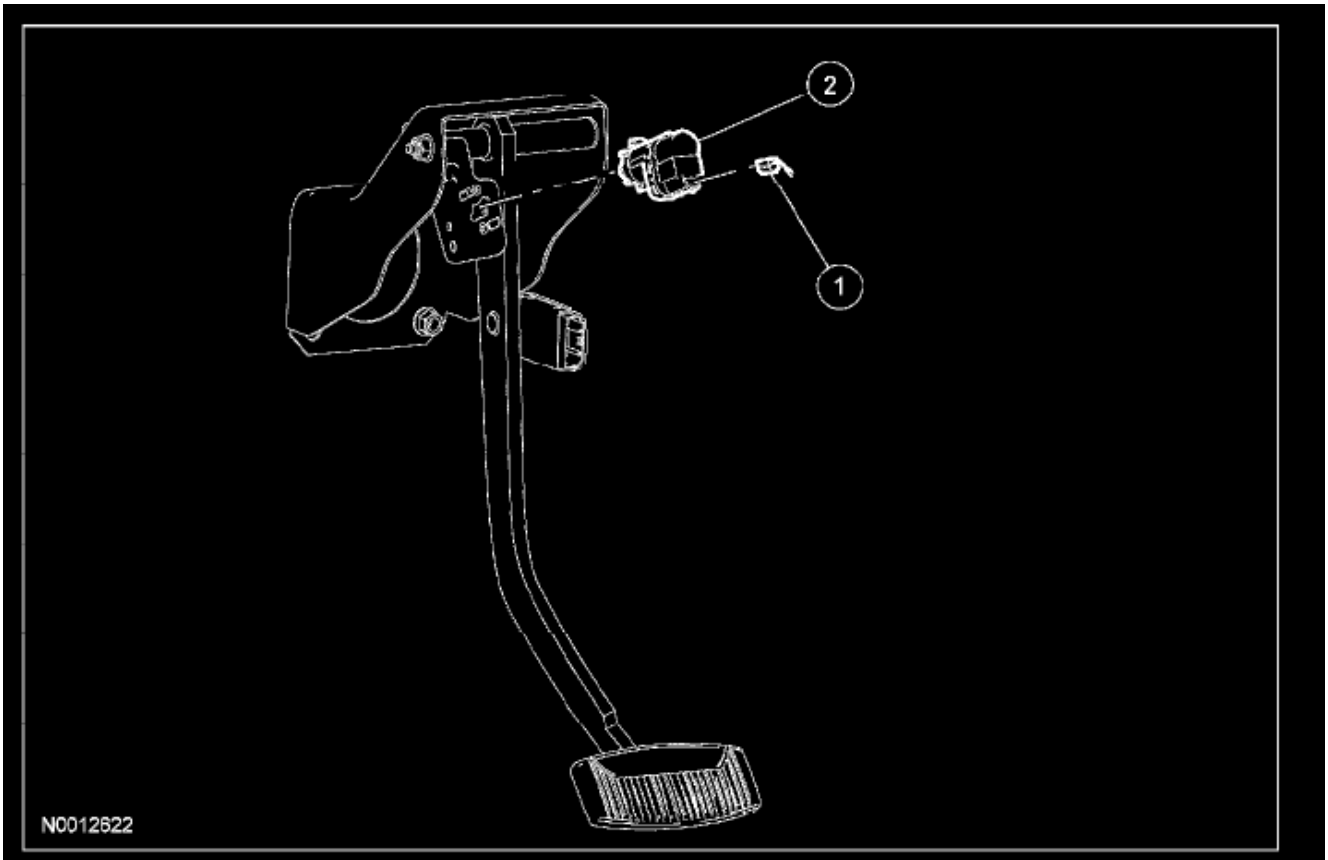
- to the antilock brake system (ABS) module, or lighting control module (LCM), the BPP signal is then broadcast over the network to be received by the PCM.

- to the ABS traction control/stability assist module. The ABS module interprets the BPP switch input along with other ABS inputs and generates an output called the driver brake application (DBA) signal. The DBA signal is then sent to the PCM and to other BPP signal users.

Brake Pedal Switch (BPS)/Brake Deactivator Switch

The BPS, also called the brake deactivator switch, is for vehicle speed control deactivation. A normally closed switch supplies battery positive voltage (B+) to the PCM when the brake pedal is not applied. When the brake pedal is applied, the normally closed switch opens and power is removed from the PCM.

On some applications the normally closed BPS, along with the normally open BPP switch, are used for a brake rationality test within the PCM. The PCM misfire monitor profile learn function may be disabled if a brake switch concern occurs. If one or both brake pedal inputs to the PCM is not changing states when they were expected to, a diagnostic trouble code (DTC) is set by the PCM strategy.



Item	Part Number	Description
1	—	Speed control deactivator switch electrical connector (part of 12A581)
2	9C872	Speed control deactivator switch

Brake Switch (Cruise Control): Service and Repair

SPEED CONTROL DEACTIVATOR SWITCH

Removal and Installation

1. CAUTION: Do not press the brake pedal when removing or installing the speed control deactivator switch or damage to the switch will

occur.

Disconnect the speed control deactivator switch electrical connector.

2. Rotate the speed control deactivator switch counterclockwise 45 degrees and remove it.

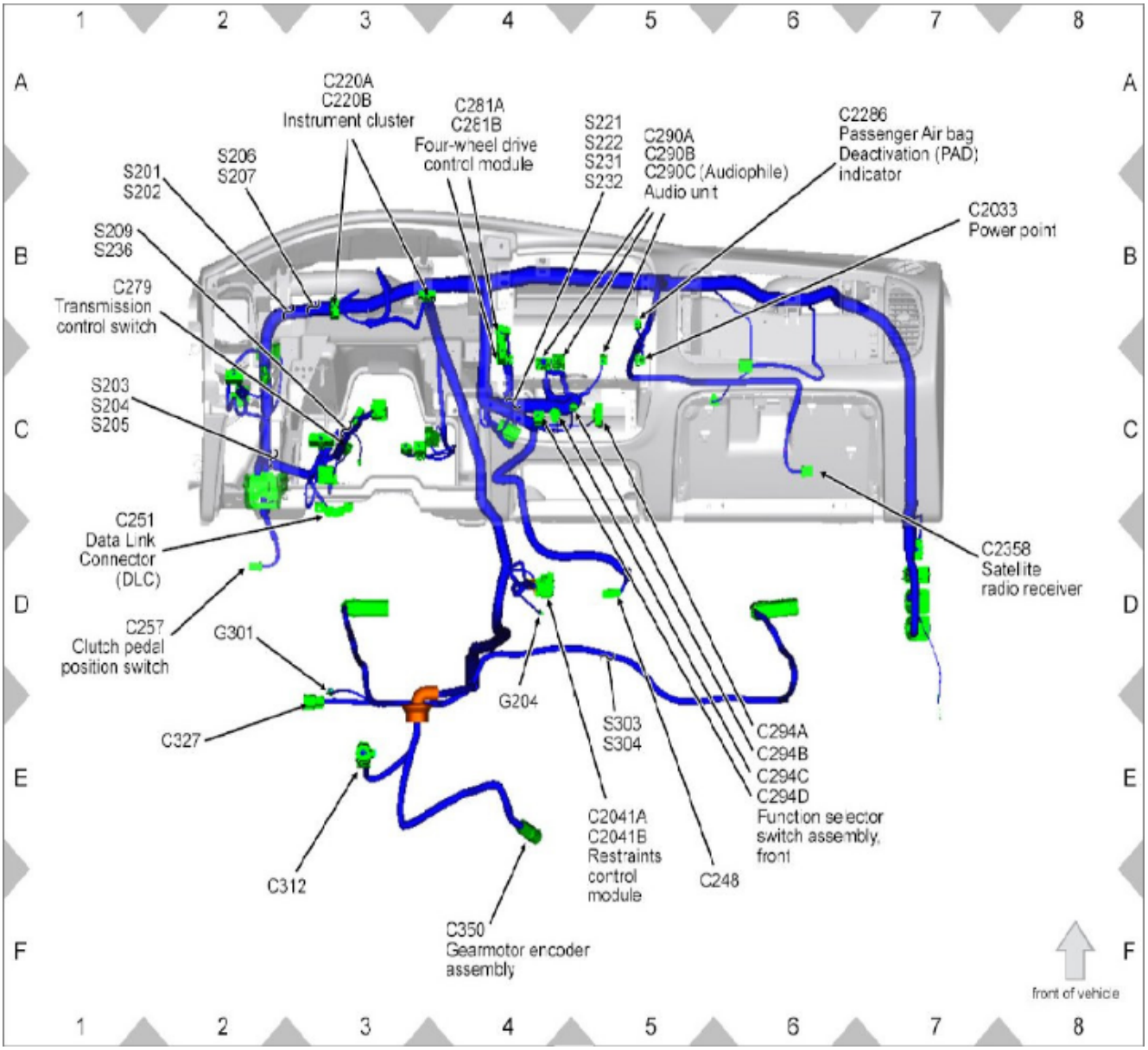
- Disconnect the electrical connector.

3. NOTE: The speed control deactivator switch is self-adjusting. Do not press the brake pedal during installation. Initial installation of the speed

control deactivator switch allows for one adjustment. If additional adjustments are necessary, install a new speed control deactivator switch.

To install, reverse the removal procedure.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Sensors and Switches > Sensors and Switches - Cruise Control > Clutch Switch, Cruise Control > Component Information > Locations



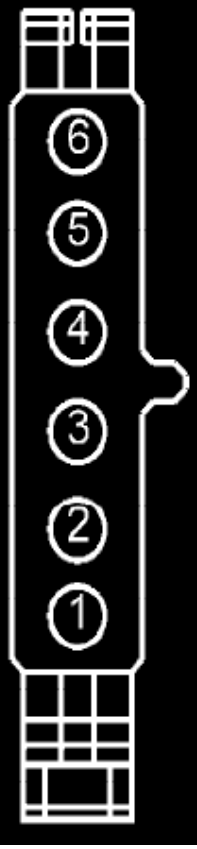
View 151-12

Connector: C257

Description: CLUTCH PEDAL POSITION SWITCH

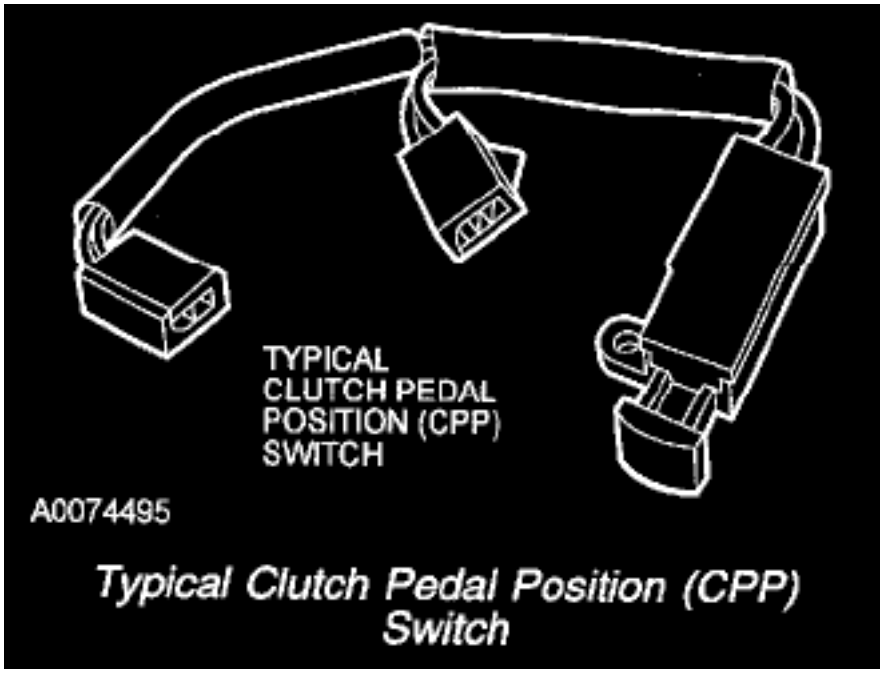
Harness: 14401

Base Part #: 11A152



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE904 (GN-VT)	22	SWITCH - CLUTCH PEDAL POSITION # TOP OF TRAVEL (CPP-TT)	
2	GD174 (BK-WH)	22	GROUND - TUNNEL	
3	CCB15 (BN-GN)	22	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL CLOSED	
4	CCB15 (BN-GN)	22	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL CLOSED	
5	GD174 (BK-WH)	22	GROUND - TUNNEL	
6	CDC36 (GN-BN)	22	SWITCH - START INTERLOCK CLUTCH PEDAL	

C257



Typical Clutch Pedal Position (CPP) Switch

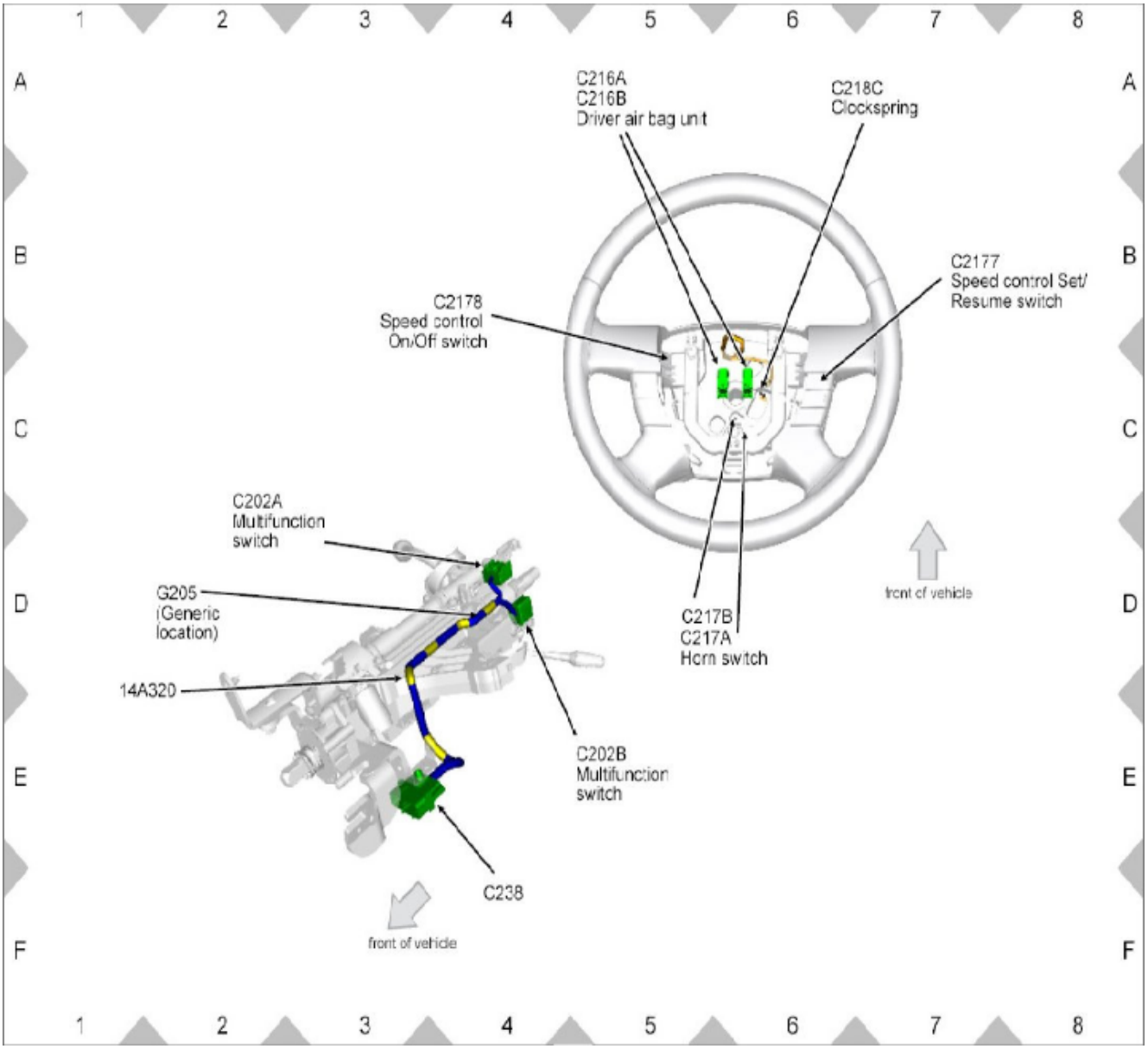
Clutch Switch: Description and Operation

CLUTCH PEDAL POSITION (CPP) SWITCH

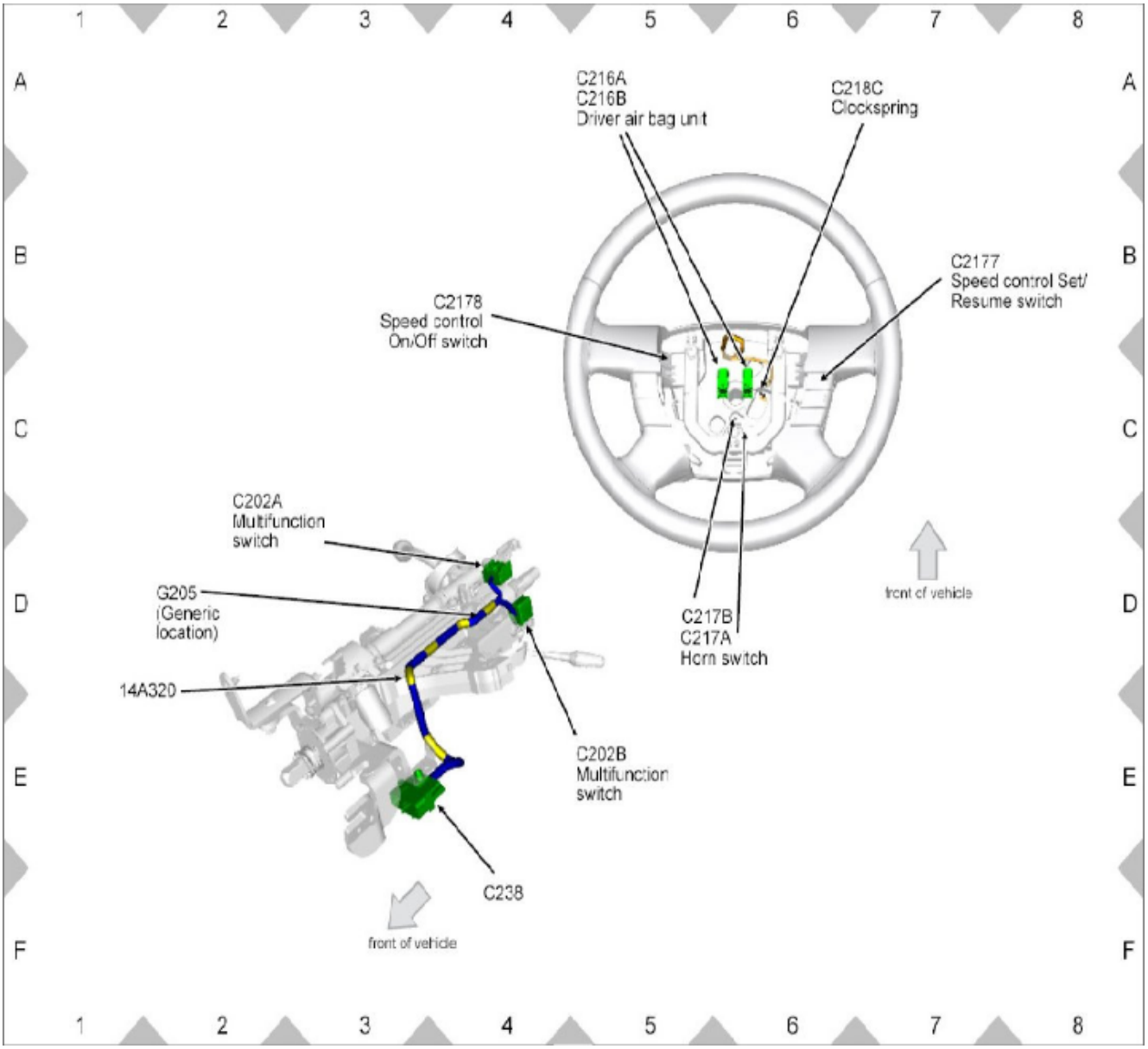
Typical Clutch Pedal Position (CPP) Switch

The CPP switch is an input to the PCM indicating the clutch pedal position. The PCM provides a low current voltage on the CPP circuit. When the CPP switch is closed, this voltage is pulled low through the SIG RTN circuit. The CPP input to the PCM is used to detect a reduction in engine load. The PCM uses the load information for mass air flow and fuel calculations.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Sensors and Switches > Sensors and Switches - Cruise Control > Cruise Control Switch > Component Information > Locations > Speed Control On/Off Switch



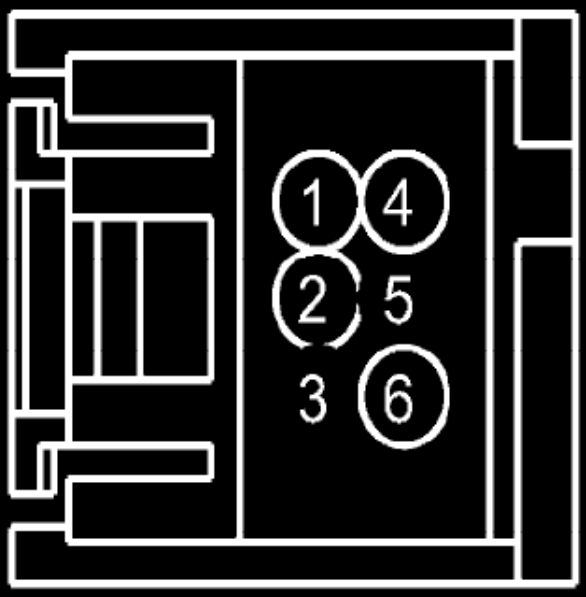
View 151-13


C216A
C216B
Driver air bag unit
C218C
Clockspring
C2177
Speed control Set/
Resume switch
C2178
Speed control
On/Off switch
C202A
Multifunction
switch
G205
(Generic
location)
14A320
C217B
C217A
Horn switch
front of vehicle
C202B
Multifunction
switch
C238
front of vehicle

View 151-13

Connector: C2177

Description:	Harness:	Base Part #:
SPEED CONTROL SET/RESUME SWITCH	17889	9C888

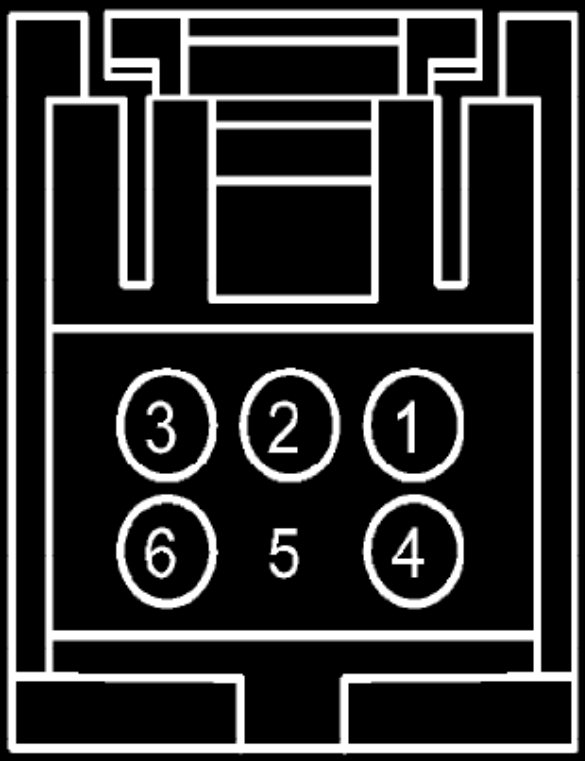


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	57 (GK)	22	GROUND - TUNNEL	
2	151 (LB-BK)	22	SWITCH - SPEED CONTROL COMMAND (SCCS)	
3	*	*	not used	
4	848 (DG-OG)	22	CTRL MOD. - POWERTRAIN # SPEED CONTROL COMMAND RETURN (SCCSRTN)	
5	*	*	not used	
6	235 (RD-BK)	22	DIMMER - IP/SWITCH ILLUMINATION	

C2177

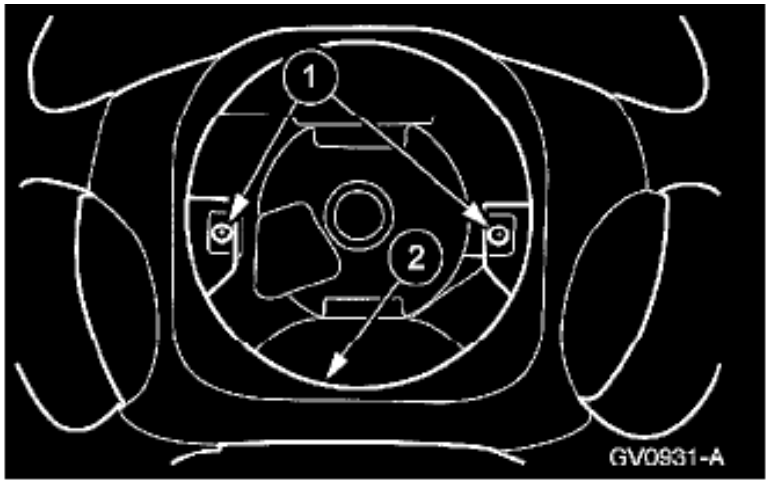
Connector: C2178

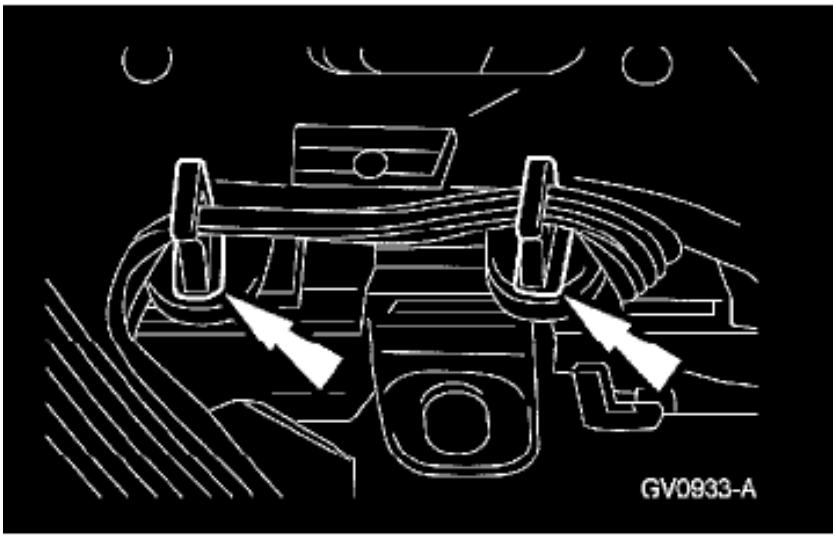
Description:	Harness:	Base Part #:
SPEED CONTROL ON/OFF SWITCH	17889	9C888

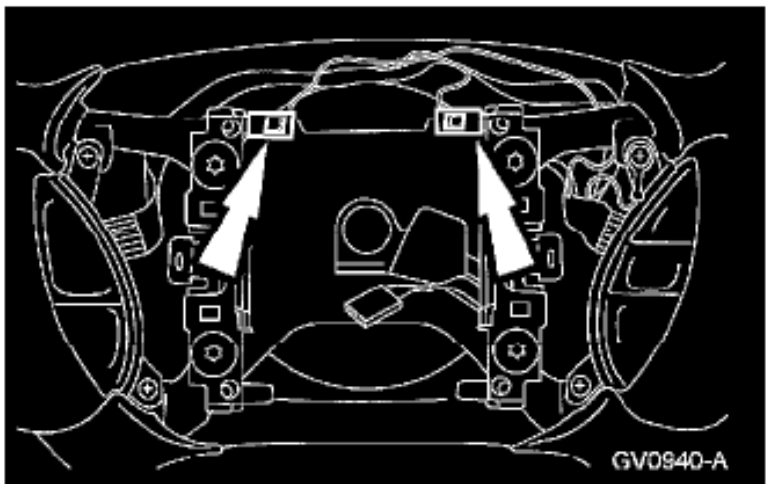


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	848 (DG-OG)	22	CTRL MOD. - POWERTRAIN # SPEED CONTROL COMMAND RETURN (SCCSRTN)	
2	151 (LB-BK)	22	SWITCH - SPEED CONTROL COMMAND (SCCS)	
3	CBP20 (YE-VT)	22	FUSE - 20 OR CIRCUIT BREAKER	
4	235 (RD-BK)	22	DIMMER - IP/SWITCH ILLUMINATION	
5	*	*	not used	
6	57 (BK)	22	GROUND - TUNNEL	

C2178


1
2
GV0931-A


GV0933-A


GV0940-A

Cruise Control Switch: Service and Repair

SPEED CONTROL SWITCH

Removal and Installation

1. Remove the steering wheel. 2. Remove the steering wheel rear cover.

1 Remove the 2 screws.

2 Remove the steering wheel rear cover.

3. Remove the ribbon harness from the clips.

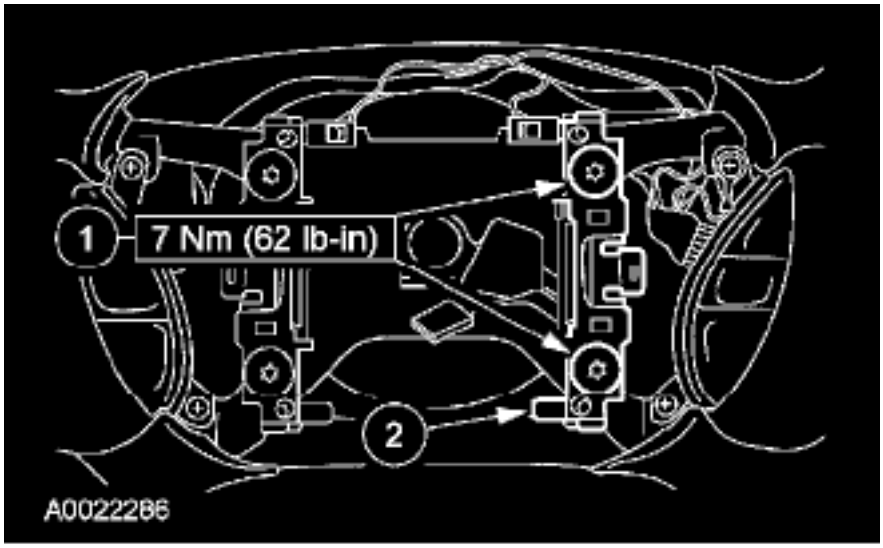
4. Disconnect the horn contact electrical connectors.

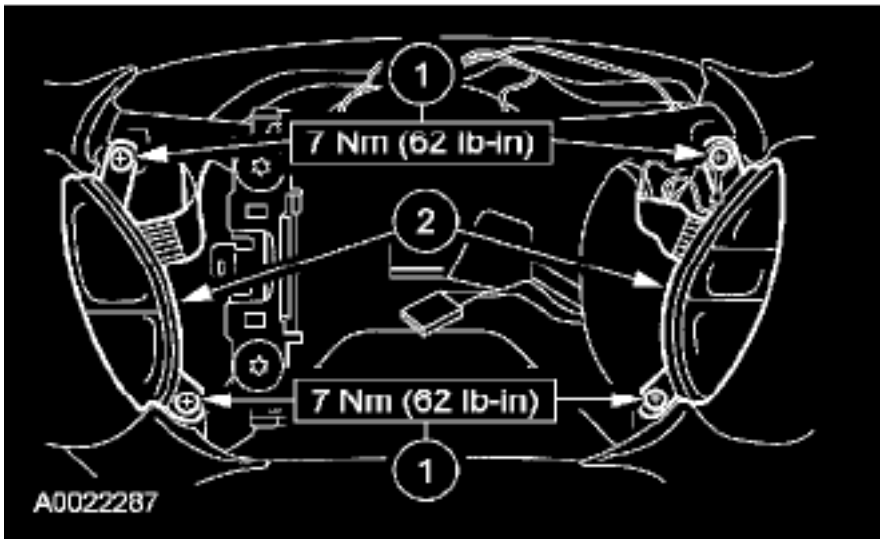
5. Remove the right side horn contact.

1 Remove the 2 screws. -

To install, tighten to 7 Nm (62 lb-in).

2 Remove the horn contact.





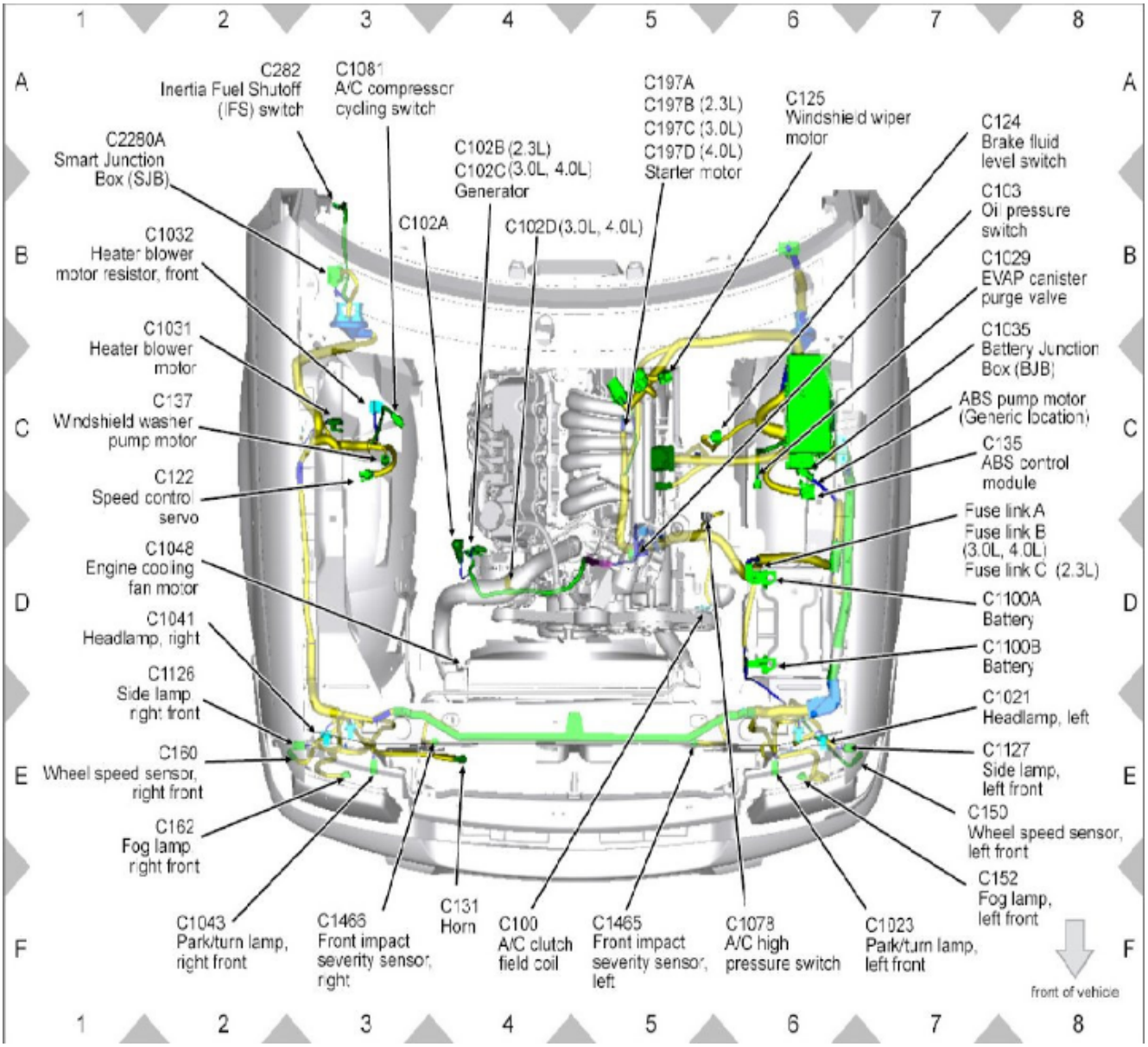
6. Remove the speed control switch assembly.

1 Remove the 4 screws. -

To install, tighten to 7 Nm (62 lb-in).

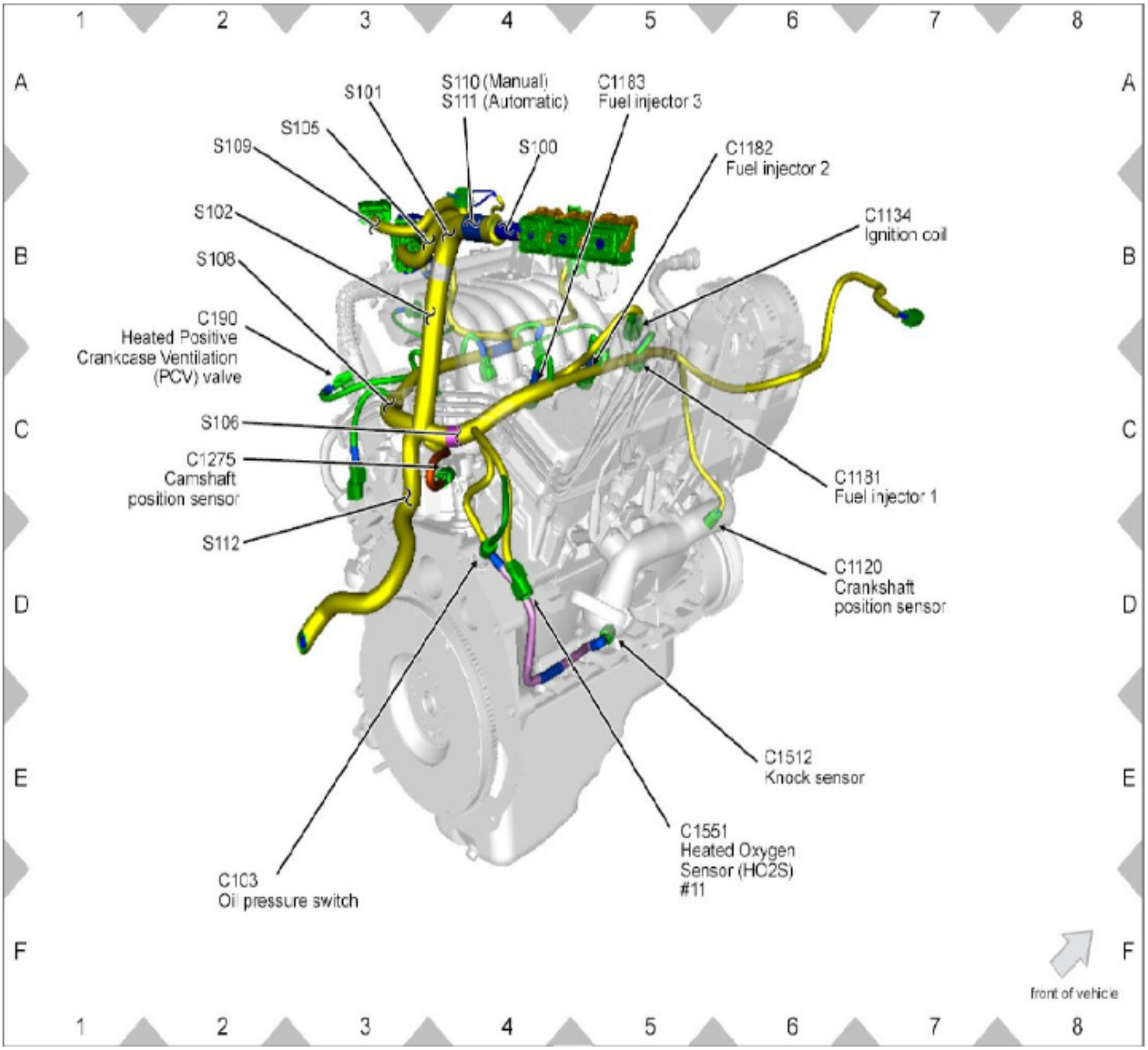
2 Remove the speed control switch assembly.

7. To install, reverse the removal procedure.

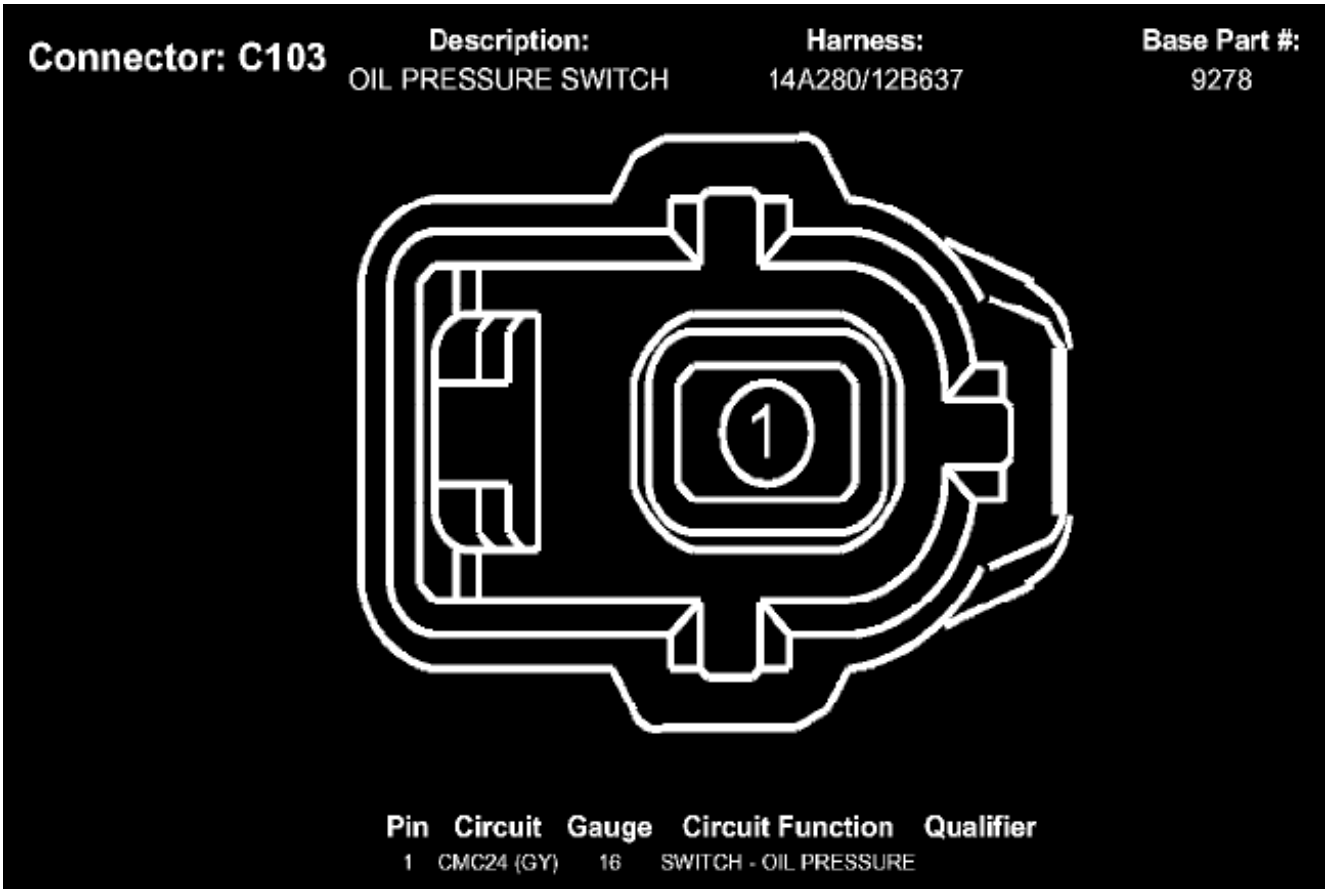


Oil Pressure Sender: Locations

View 151-1

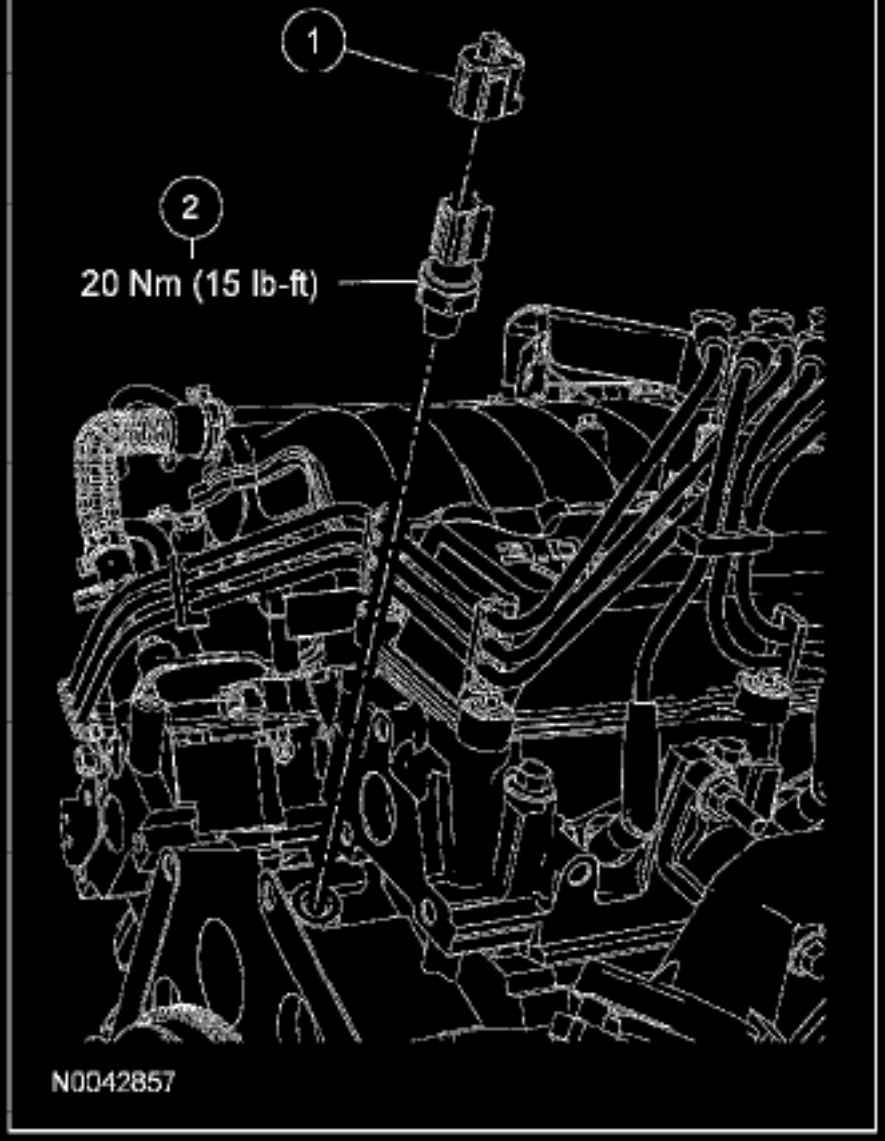

S101
S110 (Manual)
S111 (Automatic)
C1183
Fuel injector 3
S105
S109
S100
C1182
Fuel injector 2
S102
C1134
Ignition coil
S108
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
C1275
Camshaft
position sensor
S112
C1181
Fuel injector 1
C1120
Crankshaft
position sensor
C1512
Knock sensor
C1551
Heated Oxygen
Sensor (HO2S)
#11
C103
Oil pressure switch
front of vehicle

View 151-6


Connector: C103
Description:
OIL PRESSURE SWITCH
Harness:
14A280/12B637
Base Part #:
9278
1
Pin Circuit Gauge Circuit Function Qualifier
1 CMC24 (GY) 16 SWITCH - OIL PRESSURE

C103

Engine Oil Pressure (EOP) Switch



Item	Part Number	Description
1	14A464	Engine oil pressure (EOP) switch electrical connector (part of 12B637)
2	9278	EOP switch

Oil Pressure Sender: Service and Repair

Engine Oil Pressure (EOP) Switch

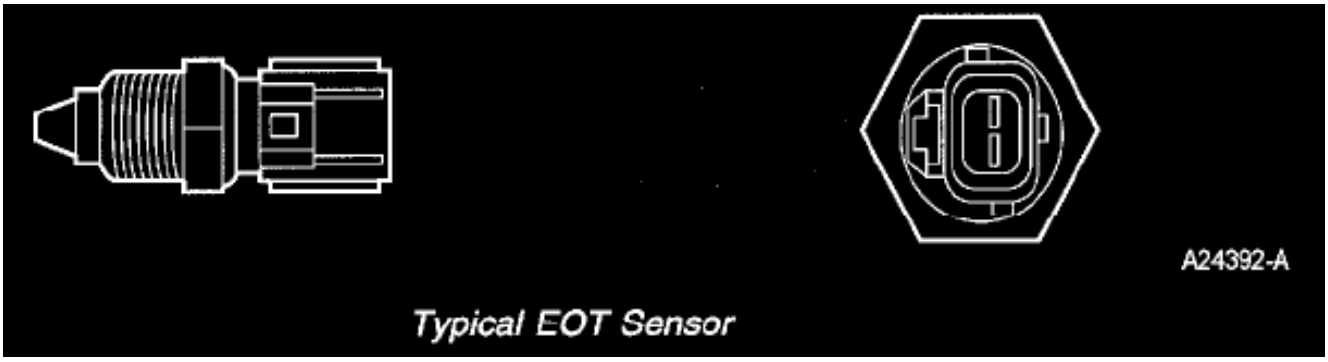
Engine Oil Pressure (EOP) Switch

Removal and Installation

1. Disconnect the engine oil pressure switch electrical connector from the engine oil pressure switch. 2. Remove the engine oil pressure switch.

^ To install, tighten to 20 Nm (15 lb-ft).

3. To install, reverse the removal procedure.



Typical EOT Sensor

Oil Temperature Sensor/Switch: Description and Operation

ENGINE OIL TEMPERATURE (EOT) SENSOR

Typical EOT Sensor

The EOT sensor is a thermistor device in which resistance changes with temperature. The electrical resistance of a thermistor decreases as the temperature increases and the resistance increases as the temperature decreases. The varying resistance changes the voltage drop across the sensor terminals and provides electrical signals to the PCM corresponding to temperature.

Thermistor-type sensors are considered passive sensors. A passive sensor is connected to a voltage divider network so that varying the resistance of the passive sensor causes a variation in total current flow. Voltage that is dropped across a fixed resistor in a series with the sensor resistor determines the voltage signal at the PCM. This voltage signal is equal to the reference voltage minus the voltage drop across the fixed resistor.

The EOT sensor measures the temperature of the engine oil. The sensor is typically threaded into the engine oil lubrication system. The PCM can use the EOT sensor input to determine the following:

- On variable camshaft timing (VCT) applications the EOT input is used to adjust the VCT control gains and logic for camshaft timing.

- The PCM can use EOT sensor input in conjunction with other PCM inputs to determine oil degradation.

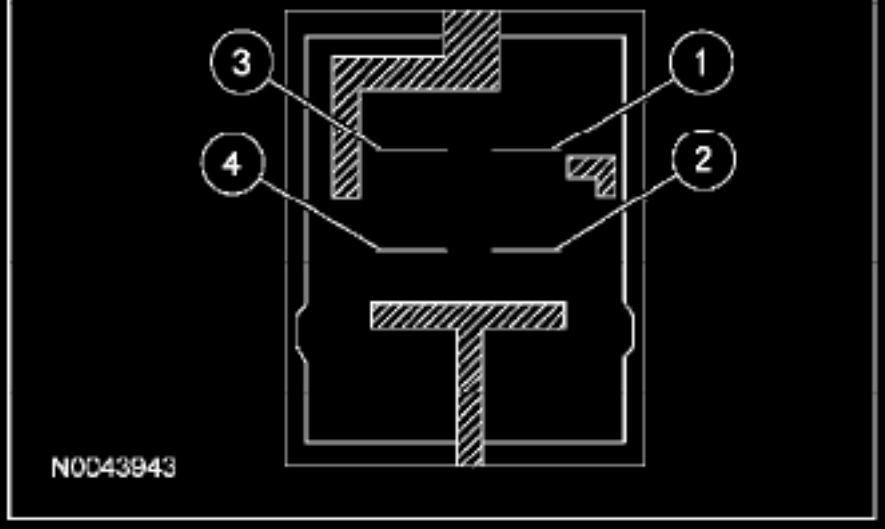
- The PCM can use EOT sensor input to initiate a soft engine shutdown. To prevent engine damage from occurring as a result of high oil temperatures, the PCM has the ability to initiate a soft engine shutdown. Whenever engine RPM exceeds a calibrated level for a certain period of time, the PCM begins reducing power by disabling engine cylinders.

Blower Motor Switch: Description and Operation

BLOWER MOTOR SWITCH

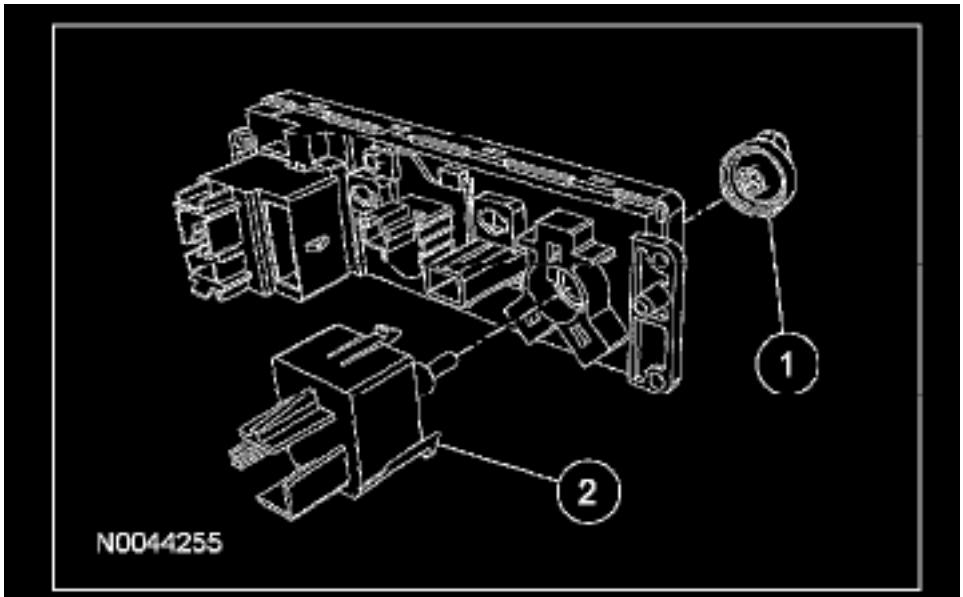
The blower motor switch controls blower motor speed by adding or by passing resistors in the heater blower motor switch resistor.

Switch — Blower Motor

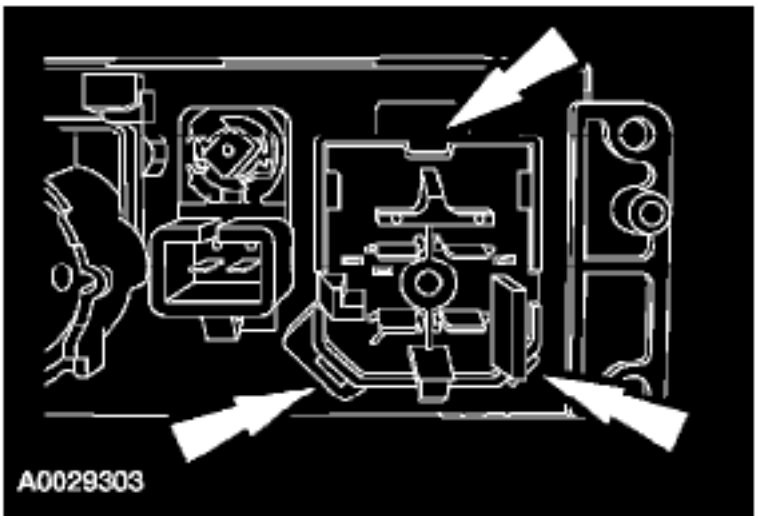


Switch Position	Continuity Between Pins
LOW	none
MED LOW	2 and 3
MED HIGH	2, 3 and 4
HIGH	1, 3 and 4

Switch - Blower Motor



Item	Part Number	Description
1	18519	Blower motor switch knob
2	19986	Blower motor switch



Blower Motor Switch: Service and Repair

BLOWER MOTOR SWITCH

Removal and Installation

1. Remove the climate control assembly. 2. Gently pull and remove the blower motor switch knob.
3. Release the 3 clips and remove the blower motor switch.

4. To install, reverse the removal procedure.

A/C EVAPORATOR TEMPERATURE (ACET) SENSOR VOLTAGE AND RESISTANCE

°C	°F	Volts	Resistance (K ohms)
100	212	0.47	2.08
90	194	0.61	2.80
80	176	0.80	3.84
70	158	1.05	5.34
60	140	1.37	7.55
50	122	1.77	10.93
40	104	2.23	16.11
30	86	2.74	24.25
20	68	3.26	37.34
10	50	3.73	58.99
0	32	4.14	95.85
-10	14	4.45	160.31
-20	-4	4.66	276.96

Evaporator Temperature Sensor / Switch: Description and Operation

AIR CONDITIONING EVAPORATOR TEMPERATURE (ACET) SENSOR

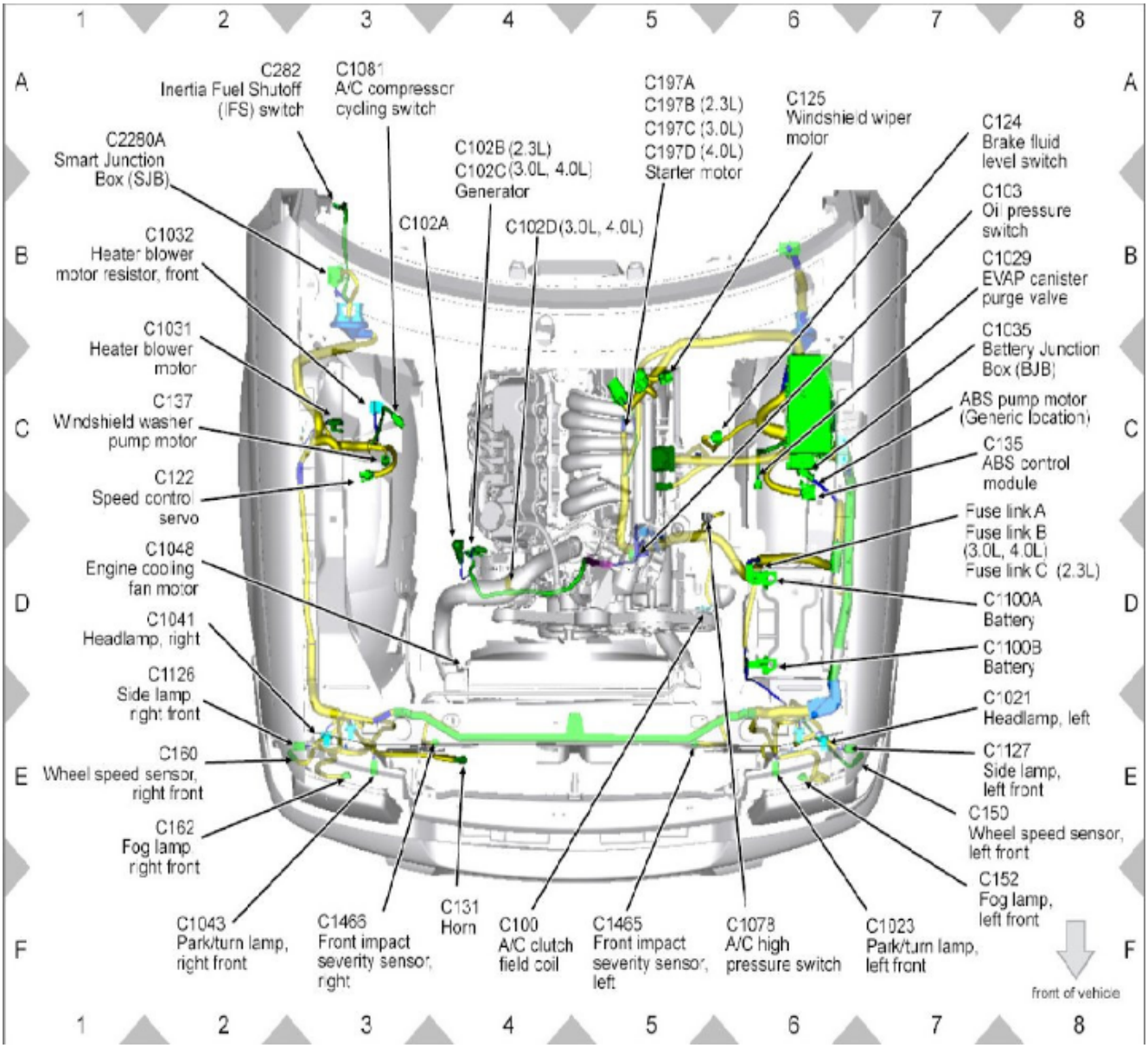
A/C Evaporator Temperature (ACET) Sensor Voltage And Resistance

The ACET sensor measures the evaporator air discharge temperature. The ACET sensor is a thermistor device in which resistance changes with temperature. The electrical resistance of a thermistor decreases as the temperature increases, and the resistance increases as the temperature decreases. The PCM sources a low current 5 volts on the ACET circuit. With SIG RTN also connected to the ACET sensor, the varying resistance changes the voltage drop across the sensor terminals. As A/C evaporator air temperature changes, the varying resistance of the ACET sensor changes the voltage the PCM detects.

The ACET sensor is used to more accurately control A/C clutch cycling, improve defrost/demist performance, and reduce A/C clutch cycling.

NOTE: These values can vary 15% due to sensor and VREF variations. Voltage values were calculated for VREF equals 5.0 volts.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Sensors and Switches > Sensors and Switches - HVAC > Refrigerant Pressure Sensor / Switch, HVAC > High Pressure Sensor / Switch, HVAC > Component Information > Locations



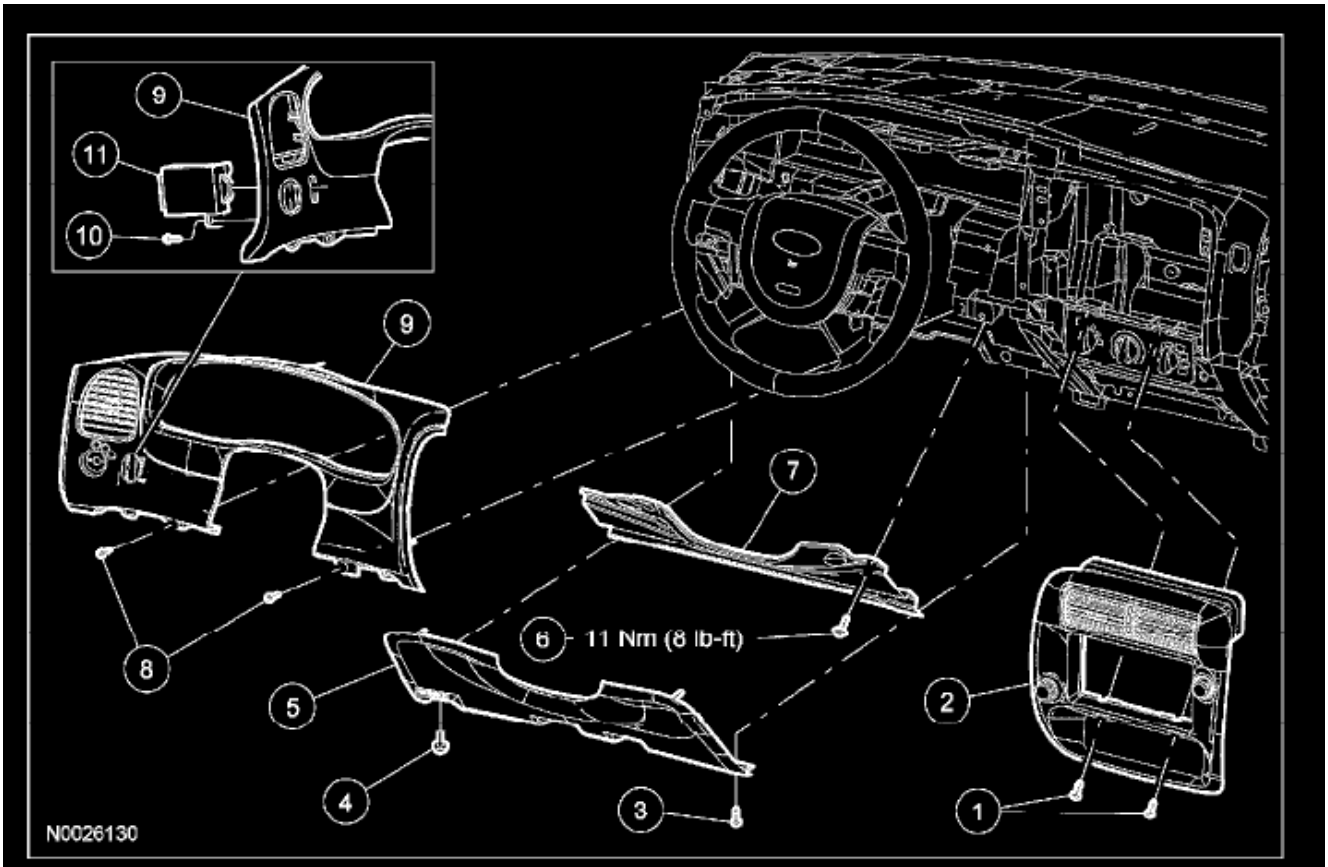
View 151-1

Connector: C1078

Description:	Harness:	Base Part #:
A/C HIGH PRESSURE SWITCH	14A280	19D594

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CH443 (GN-OG)	20	SWITCH - CLIMATE MODE # DEFROST MODES	
2	*	*	not used	
3	CH423 (YE)	20	SWITCH - A/C LOW PRESSURE CYCLING (ACLPCS)	
4	*	*	not used	

C1078



Item	Part Number	Description
1	W701679	Center instrument panel finish panel screws (2 required)
2	1004302	Center instrument panel finish panel
3	W705314	Instrument panel steering column cover screws (2 required)
4	N807316	Hood latch release handle bolts (2 required)
5	10044F08	Instrument panel steering column cover
6	N807316	Lower instrument panel reinforcement bolts (5 required)
7	10017A28	Lower instrument panel reinforcement
8	W705314	Instrument cluster finish panel screws (5 required)
9	011201	Instrument cluster finish panel
10	385754-S36	Instrument panel dimmer switch screws (2 required)

Item	Part Number	Description
11	11691	Instrument panel dimmer switch

(Continued)

Dimmer Switch: Service and Repair

INSTRUMENT PANEL DIMMER SWITCH

Removal and Installation

1. Remove the radio. 2. Remove the center instrument panel finish panel.

- Remove the 2 screws.

- Disconnect the electrical connectors.

3. Remove the 2 bolts and position aside the hood latch release handle. 4. Remove the 2 screws and remove the instrument panel steering column cover. 5. Remove the 5 bolts and the lower instrument panel reinforcement.

- To install, tighten to 11 Nm (8 lb-ft).

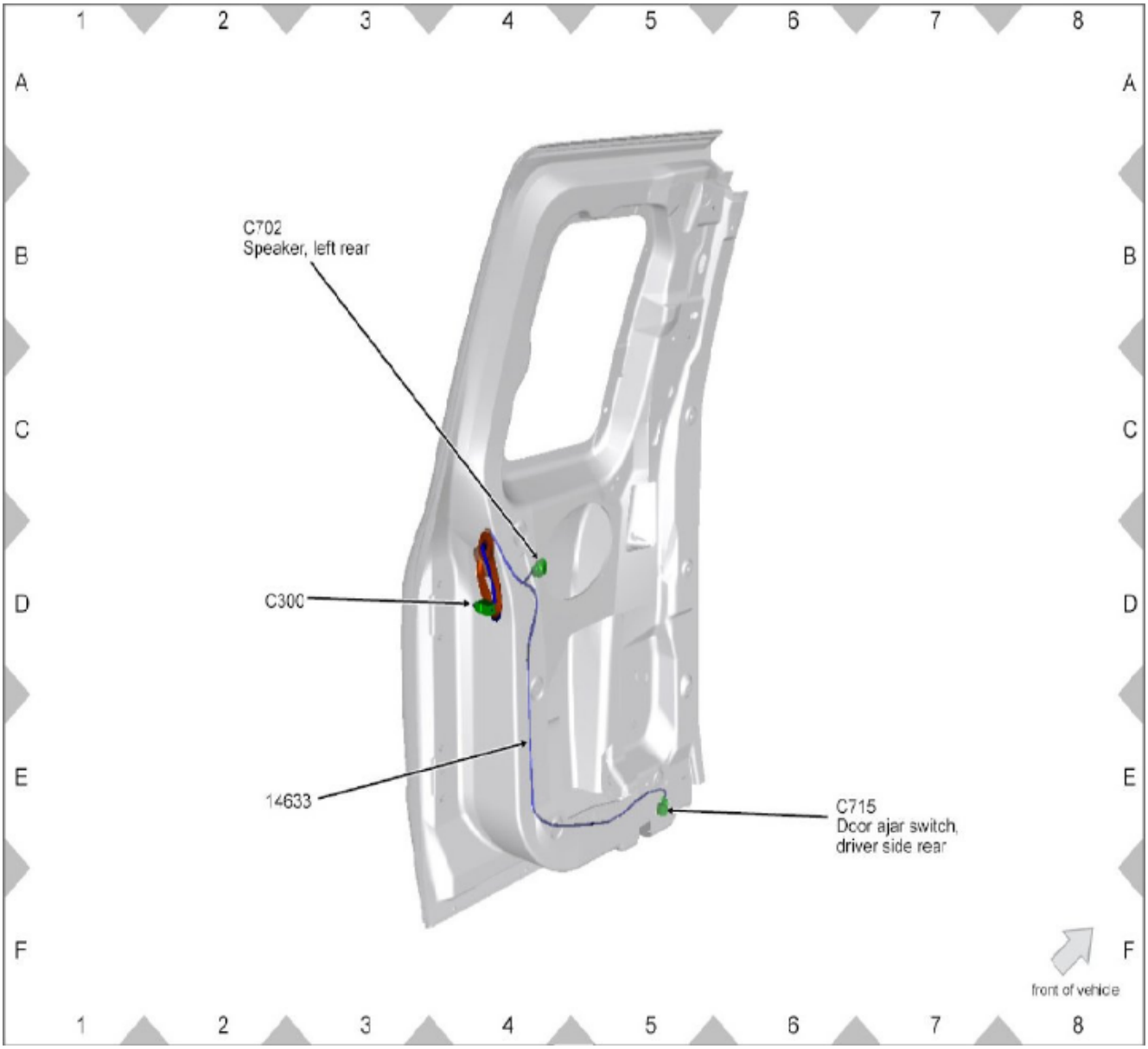
6. If equipped, position the column-mounted transmission range selector lever to the lowest position. 7. Remove the instrument cluster finish panel.

- Remove the 5 screws.

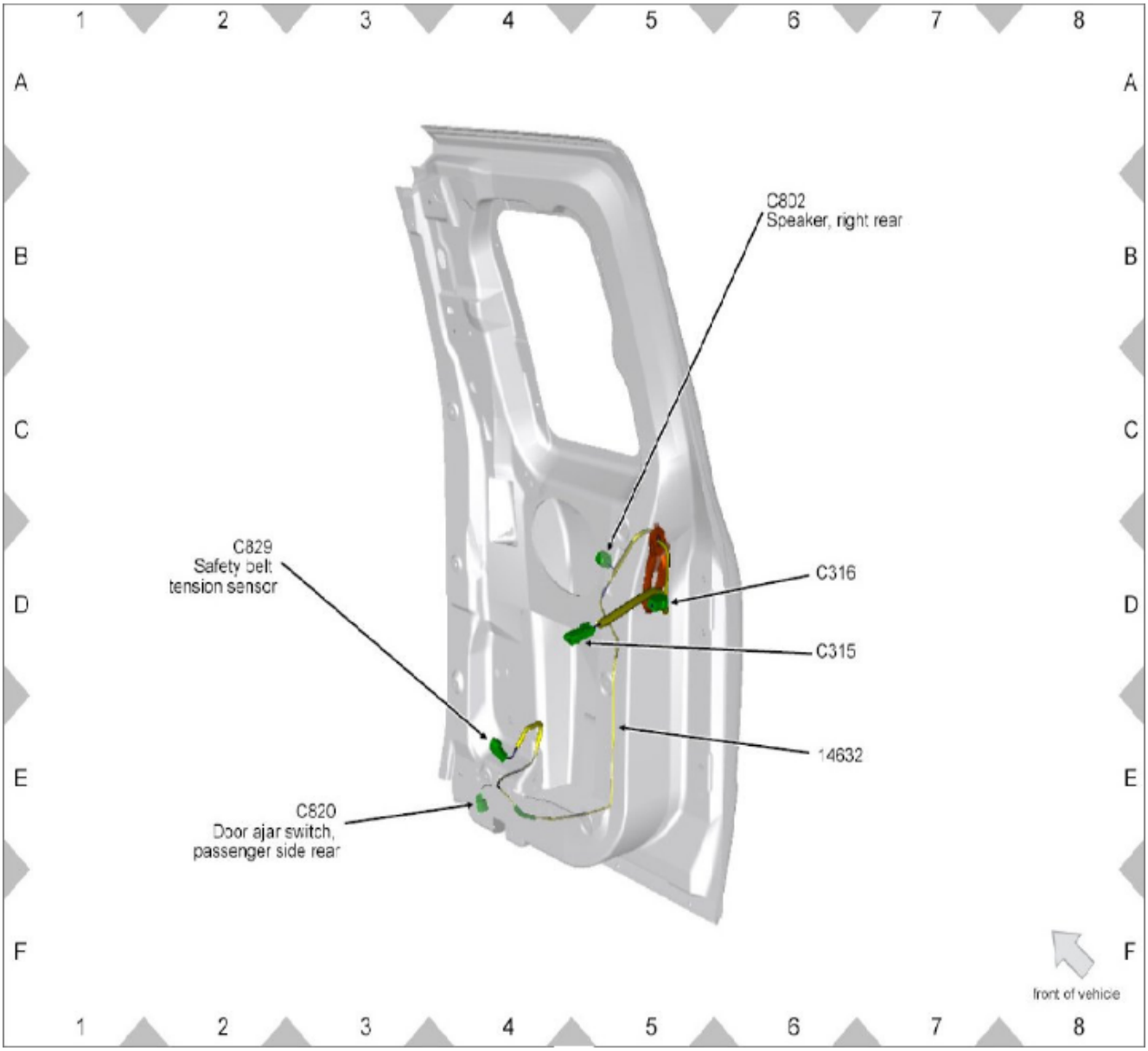
- Disconnect the electrical connectors.

8. Remove the 2 screws and the instrument panel dimmer switch. 9. To install, reverse the removal procedure.

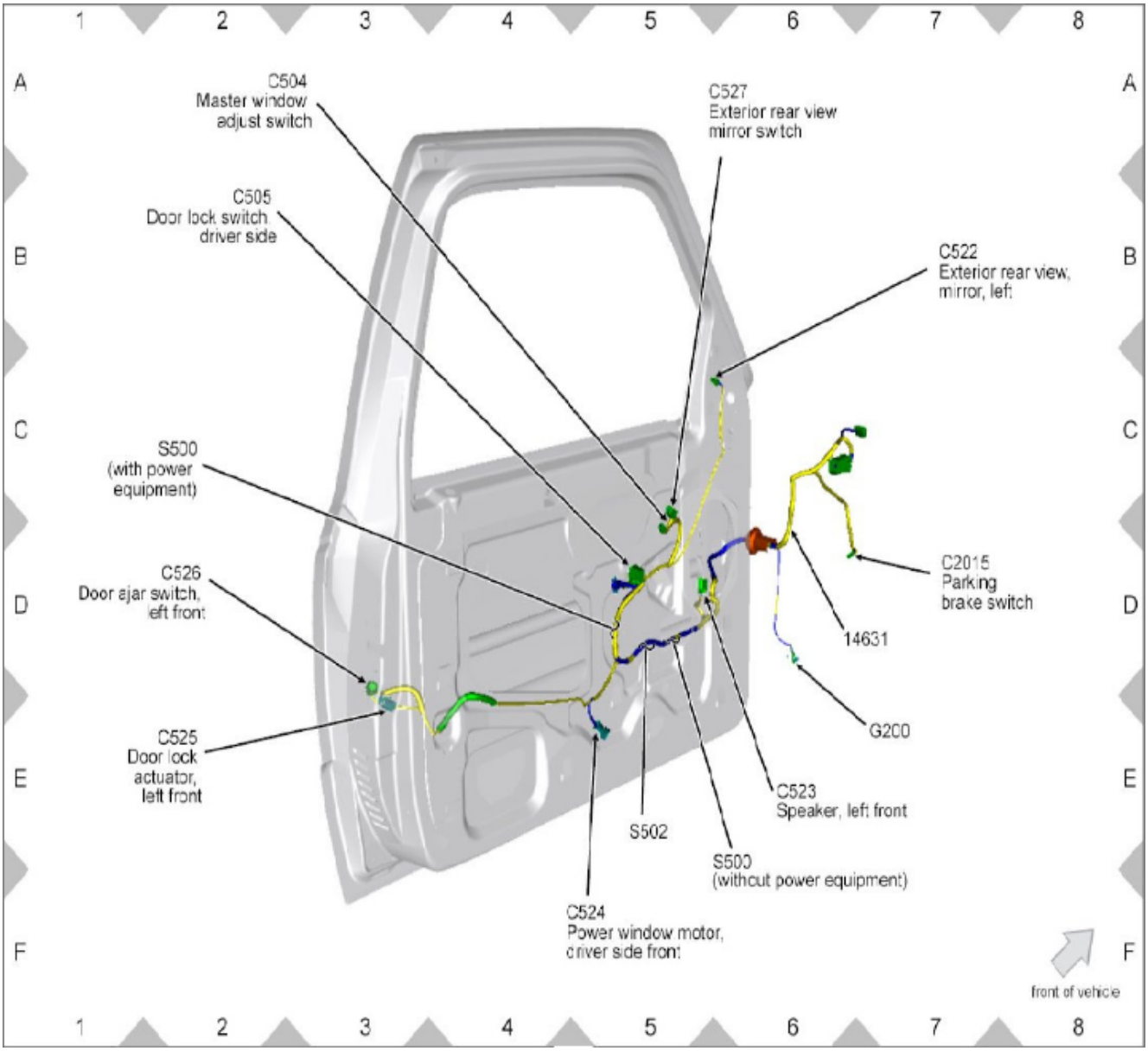
Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Sensors and Switches > Sensors and Switches - Instrument Panel > Door Switch > Component Information > Locations > Door Ajar Switch, Driver Side Rear



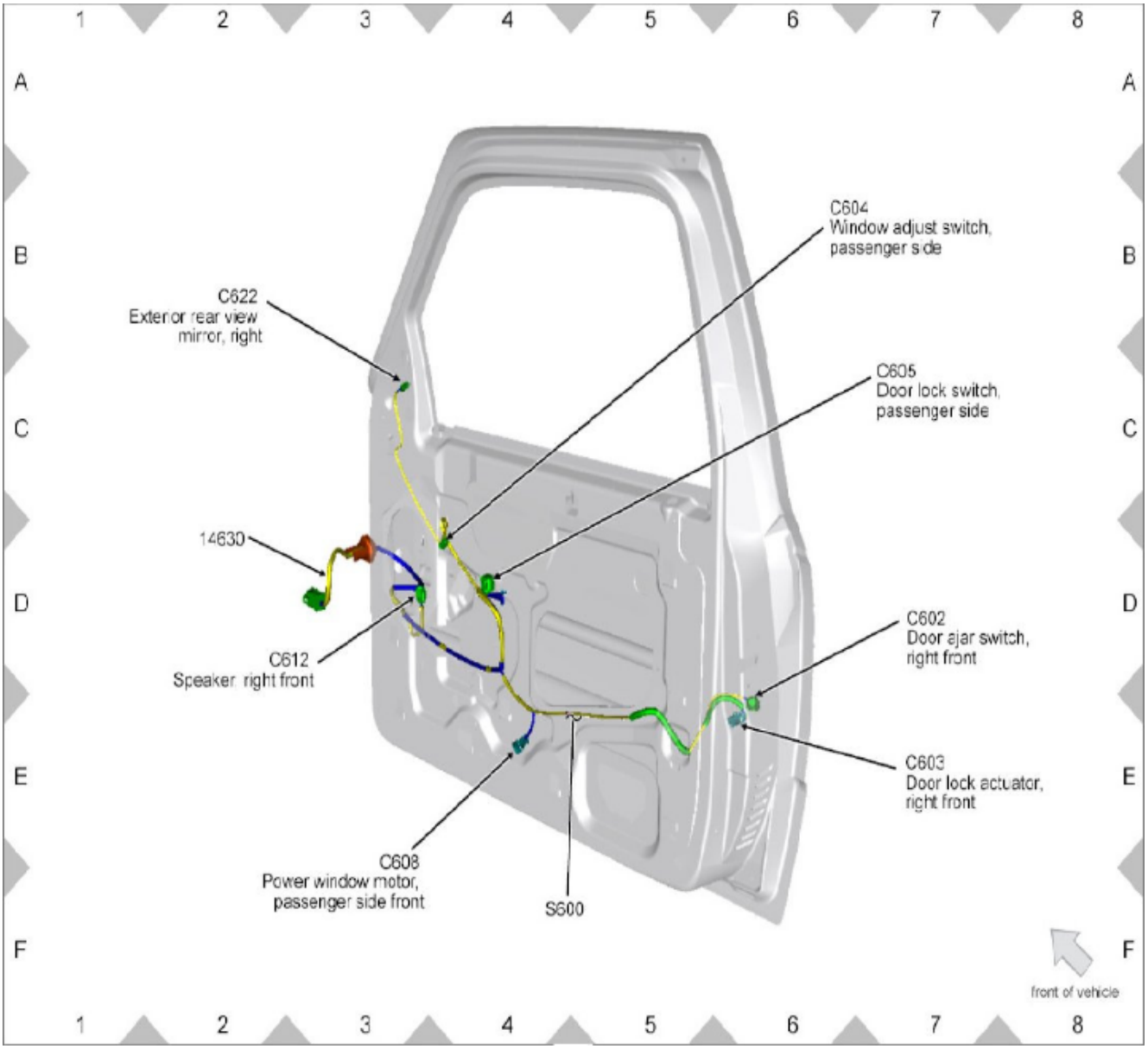
View 151-22


C802
Speaker, right rear
C829
Safety belt tension sensor
C316
C315
14632
C820
Door ajar switch, passenger side rear
front of vehicle

View 151-23


C504
Master window adjust switch
C505
Door lock switch driver side
S500
(with power equipment)
C526
Door ajar switch, left front
C525
Door lock actuator, left front
C527
Exterior rear view mirror switch
C522
Exterior rear view mirror, left
C2015
Parking brake switch
14631
G200
C523
Speaker, left front
S502
S500
(without power equipment)
C524
Power window motor, driver side front
front of vehicle

View 151-20


C604
Window adjust switch, passenger side
C622
Exterior rear view mirror, right
C605
Door lock switch, passenger side
14630
C612
Speaker, right front
C602
Door ajar switch, right front
C603
Door lock actuator, right front
C608
Power window motor, passenger side front
S600
front of vehicle

View 151-21

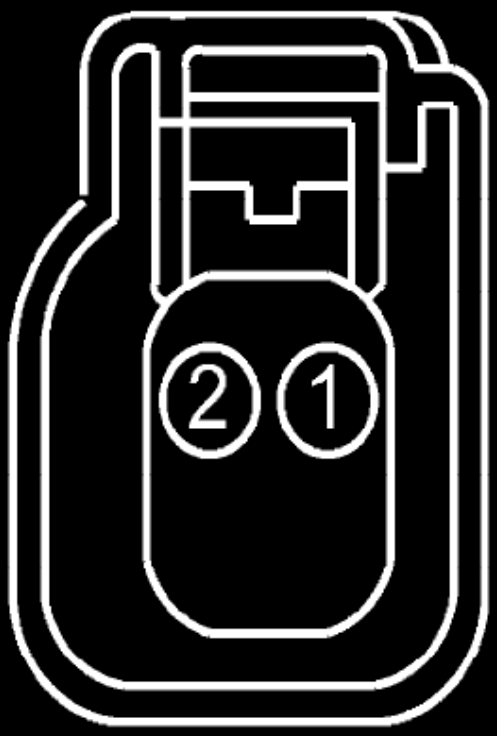
Connector: C526

Description: DOOR AJAR SWITCH, LEFT FRONT

Harness: 14631

Base Part #:

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPL26 (GN-VT)	20	SWITCH - LATCH DRIVER # AJAR	
2	GD175 (BK-BU)	20	GROUND - TUNNEL # 2ND STUD	



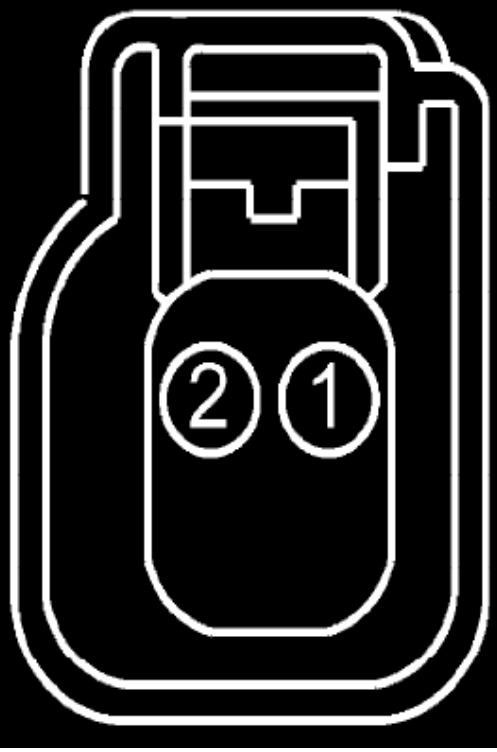
C526

Connector: C602
Description:
DOOR AJAR SWITCH, RIGHT FRONT
Harness:
14630
Base Part #:
Pin Circuit Gauge Circuit Function Qualifier
1 CPL31 (WH) 20 SWITCH - LATCH PASSENGER # AJAR
2 GD161 (BK-YE) 20 GROUND - SEAT BRACKET REAR LEFT
2
1

C602

Connector: C715

Description:	Harness:	Base Part #:
DOOR AJAR SWITCH, DRIVER SIDE REAR	14633	14018

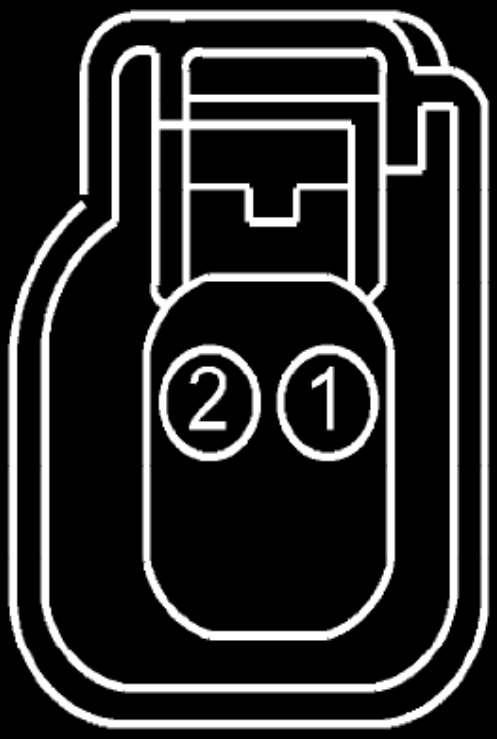


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPL36 (GN)	18	SWITCH - LATCH REAR DRIVER SIDE # AJAR (INCL.SLIDING DOOR)	
2	GD101 (BK-YE)	18	GROUND - SEAT BRACKET REAR LEFT	

C715

Connector: C820

Description:	Harness:	Base Part #:
DOOR AJAR SWITCH, PASSENGER SIDE REAR	14632	14018



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPL39 (YE)	18	SWITCH - LATCH REAR PASSENGER SIDE # AJAR (INCL.SLIDING DOOR)	
2	GD161 (BK-YE)	18	GROUND - SEAT BRACKET REAR LEFT	

C820

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Sensors and Switches > Sensors and Switches - Instrument Panel > Door Switch > Component Information > Service and Repair > Door Ajar Switch

Door Switch: Service and Repair Door Ajar Switch

DOOR AJAR SWITCH

Removal and Installation

1. Remove the front door latch. 2. Lift the locking tab, rotate the switch and remove the door ajar switch. 3. To install, reverse the removal procedure.

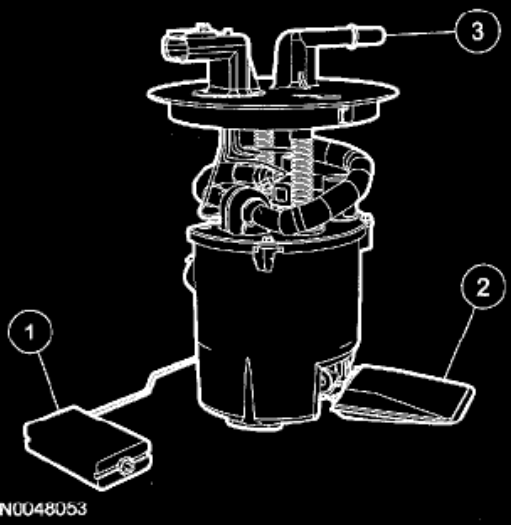
Door Switch: Service and Repair Door Ajar Switch - SuperCab Four-Door

DOOR AJAR SWITCH - SUPERCAB FOUR-DOOR

Removal and Installation

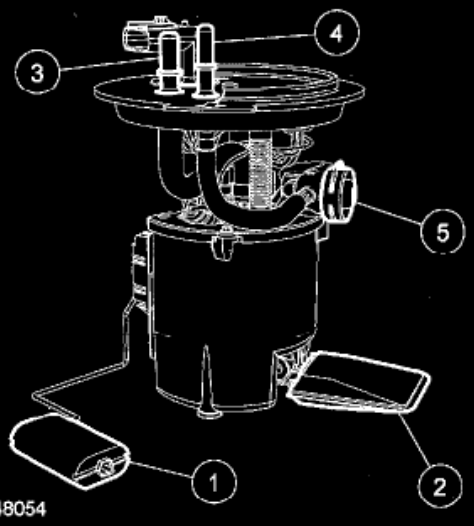
1. Remove the rear door lower latch. 2. Release the locking tabs, rotate the door ajar switch and remove the door ajar switch. 3. To install, reverse the removal procedure.

Typical Electronic Returnless Fuel Pump (FP) Module



Item	Part Number	Description
1	—	Fuel Level Float
2	—	Fuel Intake Filter
3	—	Fuel Supply

Typical Mechanical Returnless Fuel Pump (FP) Module



Item	Part Number	Description
1	—	Fuel Level Float
2	—	Fuel Intake Filter
3	—	Fuel Supply
4	—	Fuel Return from Fuel Filter
5	—	Fuel Pressure Regulator

Fuel Gauge Sender: Description and Operation

Fuel Pump (FP) Module

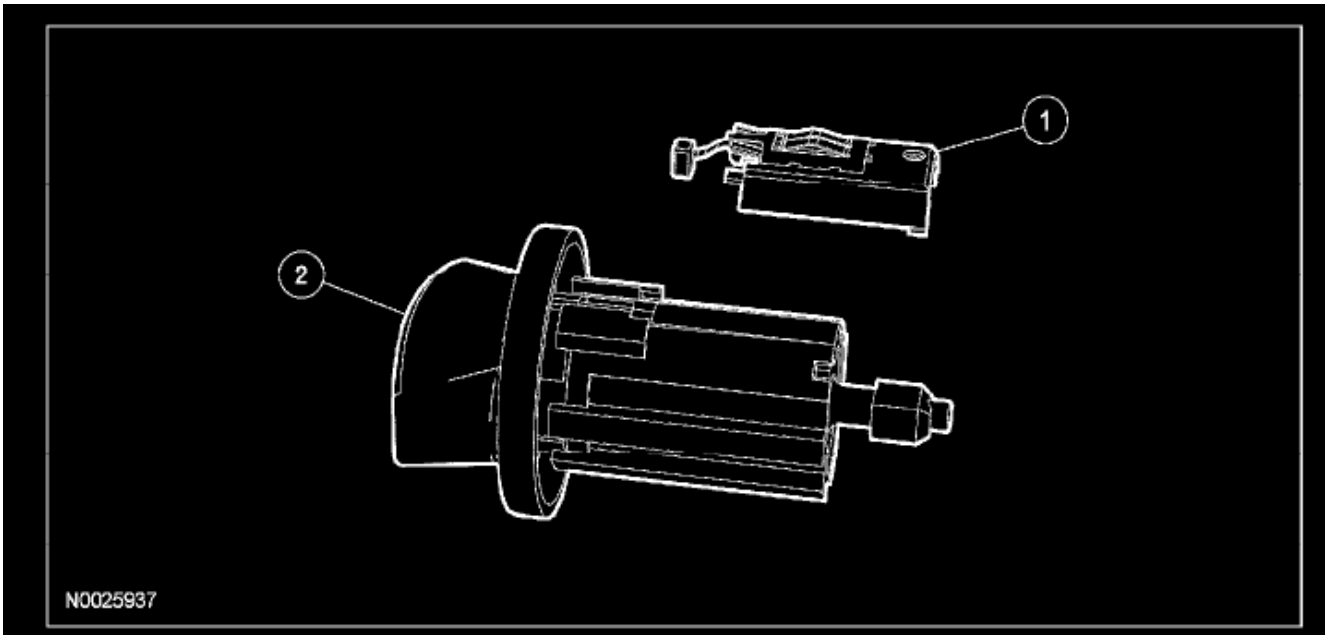
Typical Electronic Returnless Fuel Pump (FP) Module

Typical Mechanical Returnless Fuel Pump (FP) Module

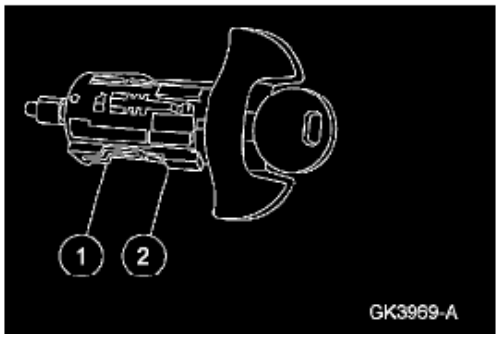
The FP module is a device that contains the fuel pump and sender assembly. The fuel pump is located inside the FP module reservoir and supplies fuel through the FP module manifold to the engine and FP module jet pump. The jet pump continuously refills the reservoir with fuel, and a check valve located in the manifold outlet maintains system pressure when the fuel pump is not energized. A flapper valve located in the bottom of the reservoir allows fuel to enter the reservoir and prime the fuel pump during the initial fill.

Fuel Pump (FP) Module and Reservoir

The FP module is mounted inside the fuel tank in a reservoir. The pump has a discharge check valve that maintains the system pressure after the key has been turned off to minimize starting concerns. The reservoir prevents fuel flow interruptions during extreme vehicle maneuvers with low tank fill levels.



Item	Part Number	Description
1	11A127	Key-in-ignition warning switch
2	11582	Ignition lock cylinder



Key Reminder Switch: Service and Repair

KEY-IN-IGNITION WARNING SWITCH

Removal and Installation

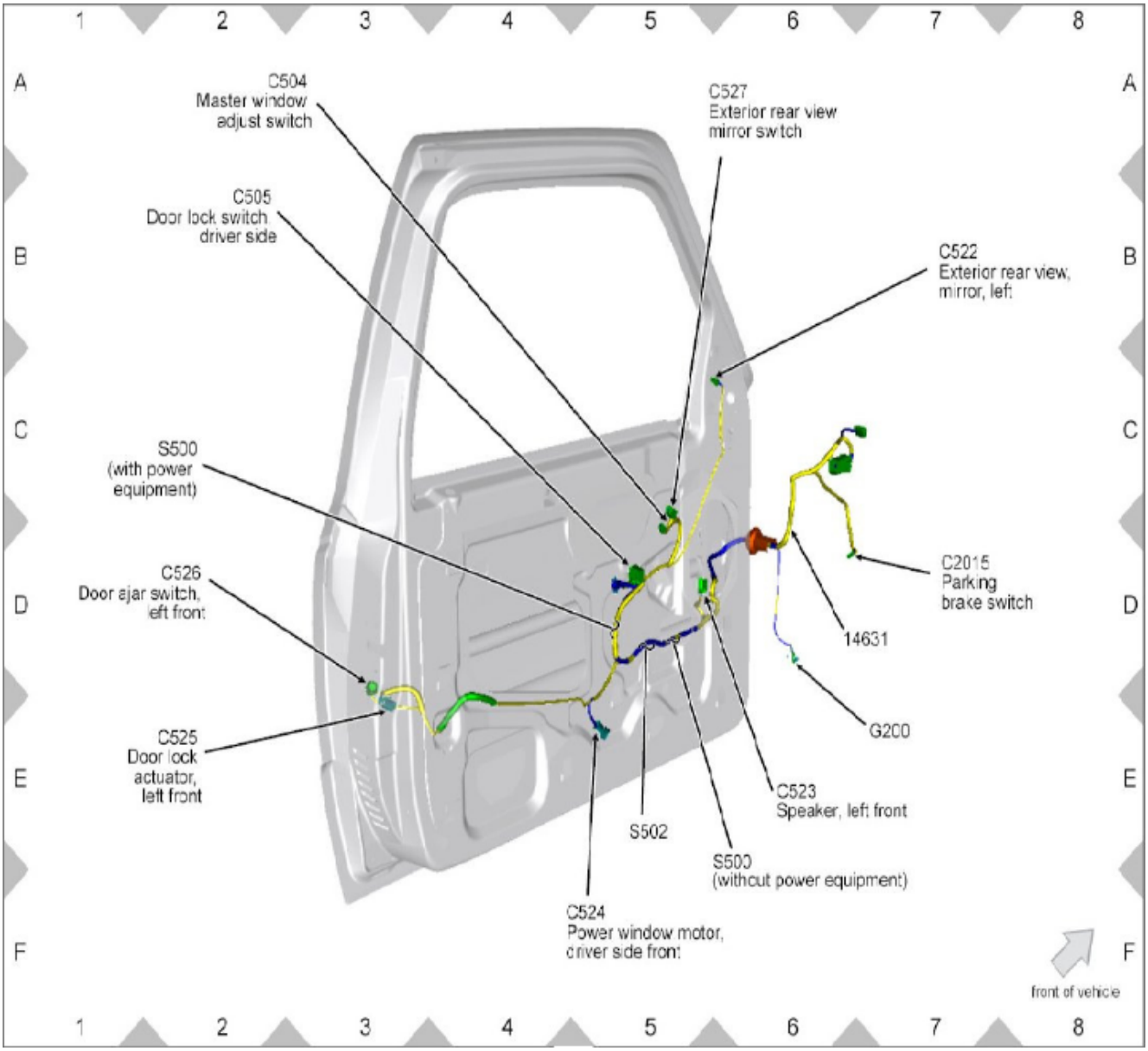
1. Remove the ignition lock cylinder. 2. Remove the key-in-ignition warning switch.

1 Pry the clip downward.

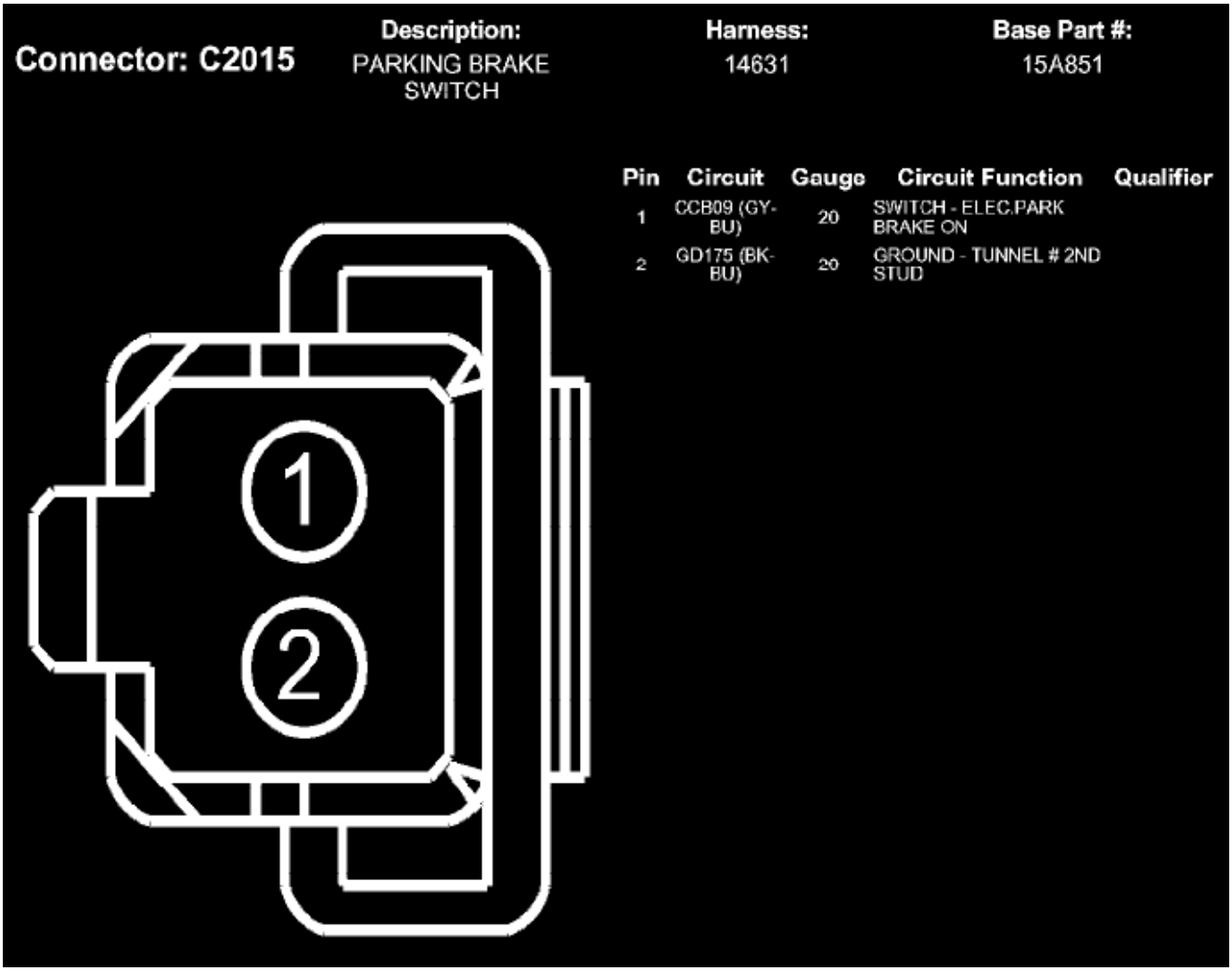
2 Release the key-in-ignition warning switch from the rear of the ignition lock cylinder.

3. To install, reverse the removal procedure.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Sensors and Switches > Sensors and Switches - Instrument Panel > Parking Brake Warning Switch > Component Information > Locations

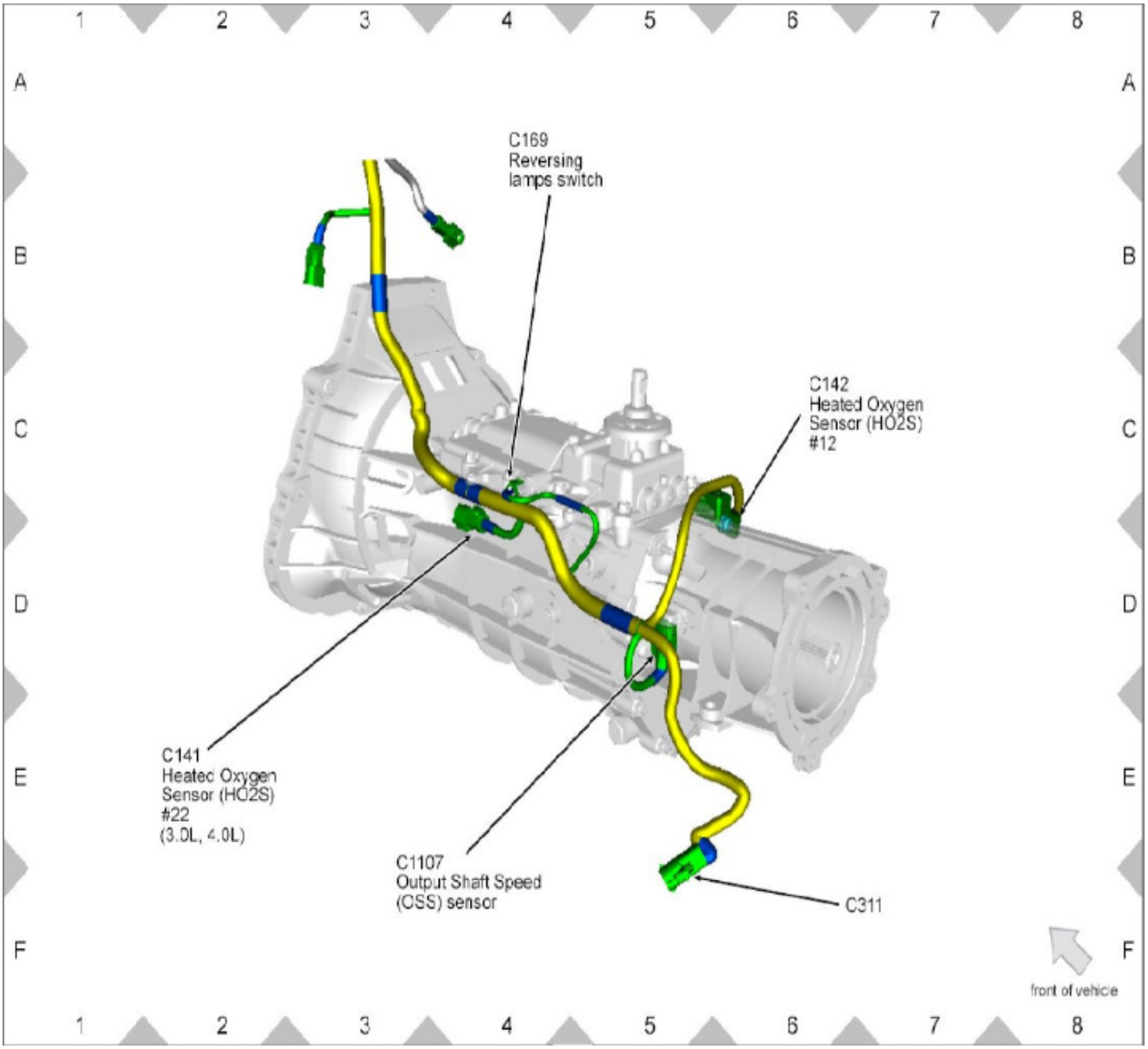


View 151-20

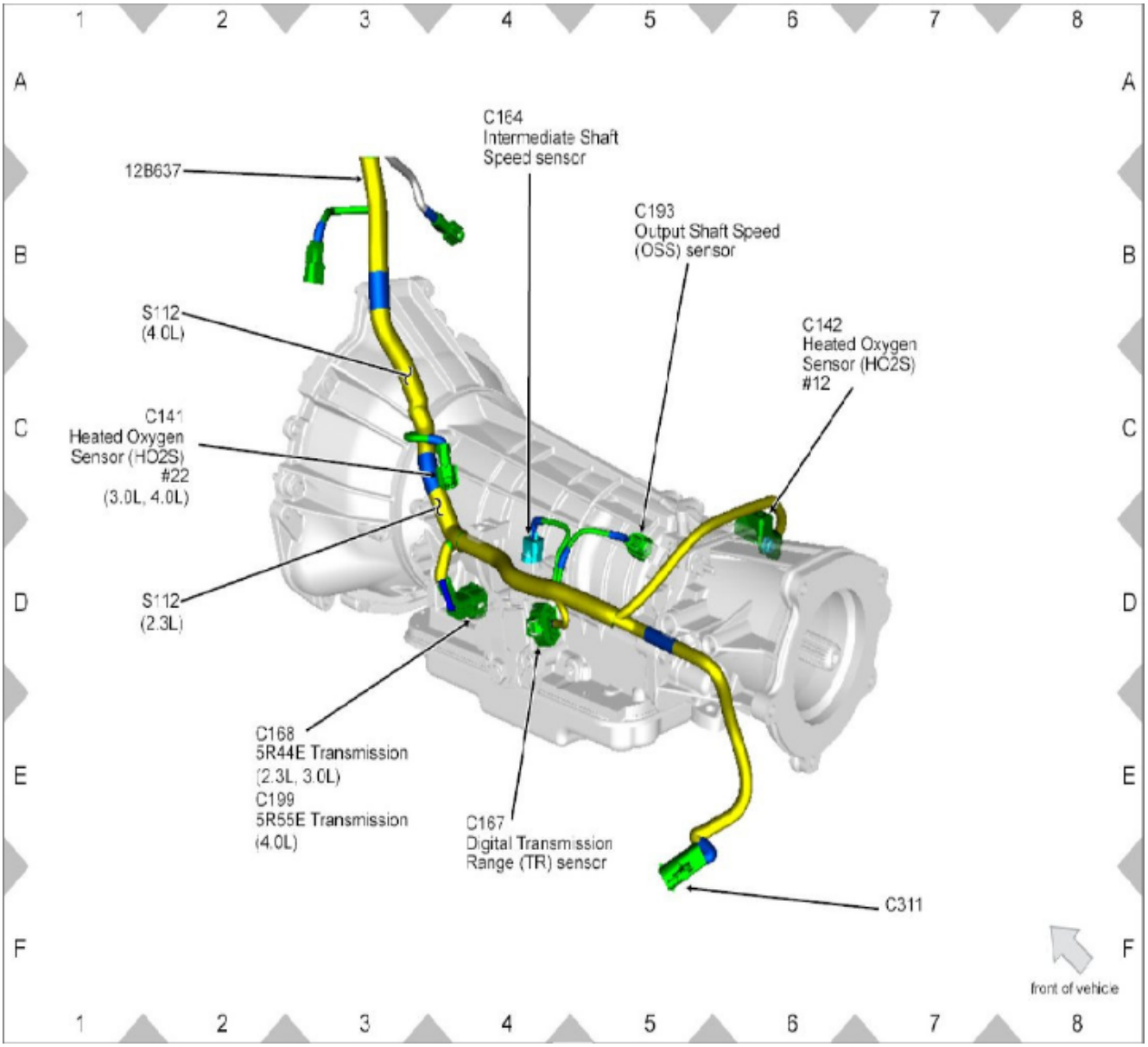

Connector: C2015
Description:
PARKING BRAKE SWITCH
Harness:
14631
Base Part #:
15A851
Pin
Circuit
Gauge
Circuit Function
Qualifier
1
CCB09 (GY-BU)
20
SWITCH - ELEC.PARK BRAKE ON
2
GD175 (BK-BU)
20
GROUND - TUNNEL # 2ND STUD
1
2

C2015

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Sensors and Switches > Sensors and Switches - Lighting and Horns > Backup Lamp Switch > Component Information > Locations > Reversing Lamps Switch



View 151-9


C164
Intermediate Shaft
Speed sensor
12B637
C193
Output Shaft Speed
(OSS) sensor
S112
(4.0L)
C142
Heated Oxygen
Sensor (HO2S)
#12
C141
Heated Oxygen
Sensor (HO2S)
#22
(3.0L, 4.0L)
S112
(2.3L)
C168
5R44E Transmission
(2.3L, 3.0L)
C199
5R55E Transmission
(4.0L)
C167
Digital Transmission
Range (TR) sensor
C311
front of vehicle

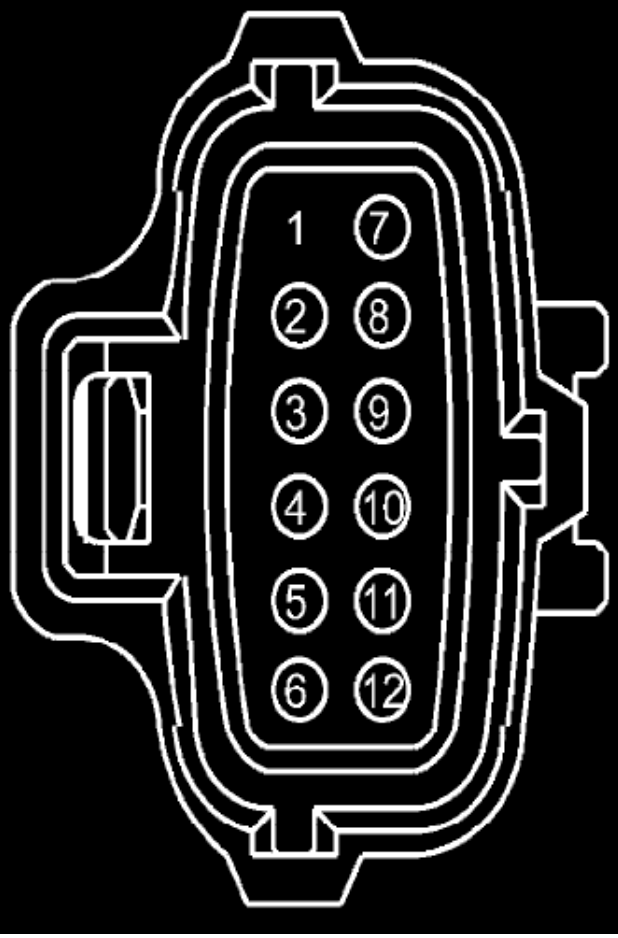
View 151-10

Connector: C167

Description: DIGITAL TRANSMISSION RANGE (TR) SENSOR

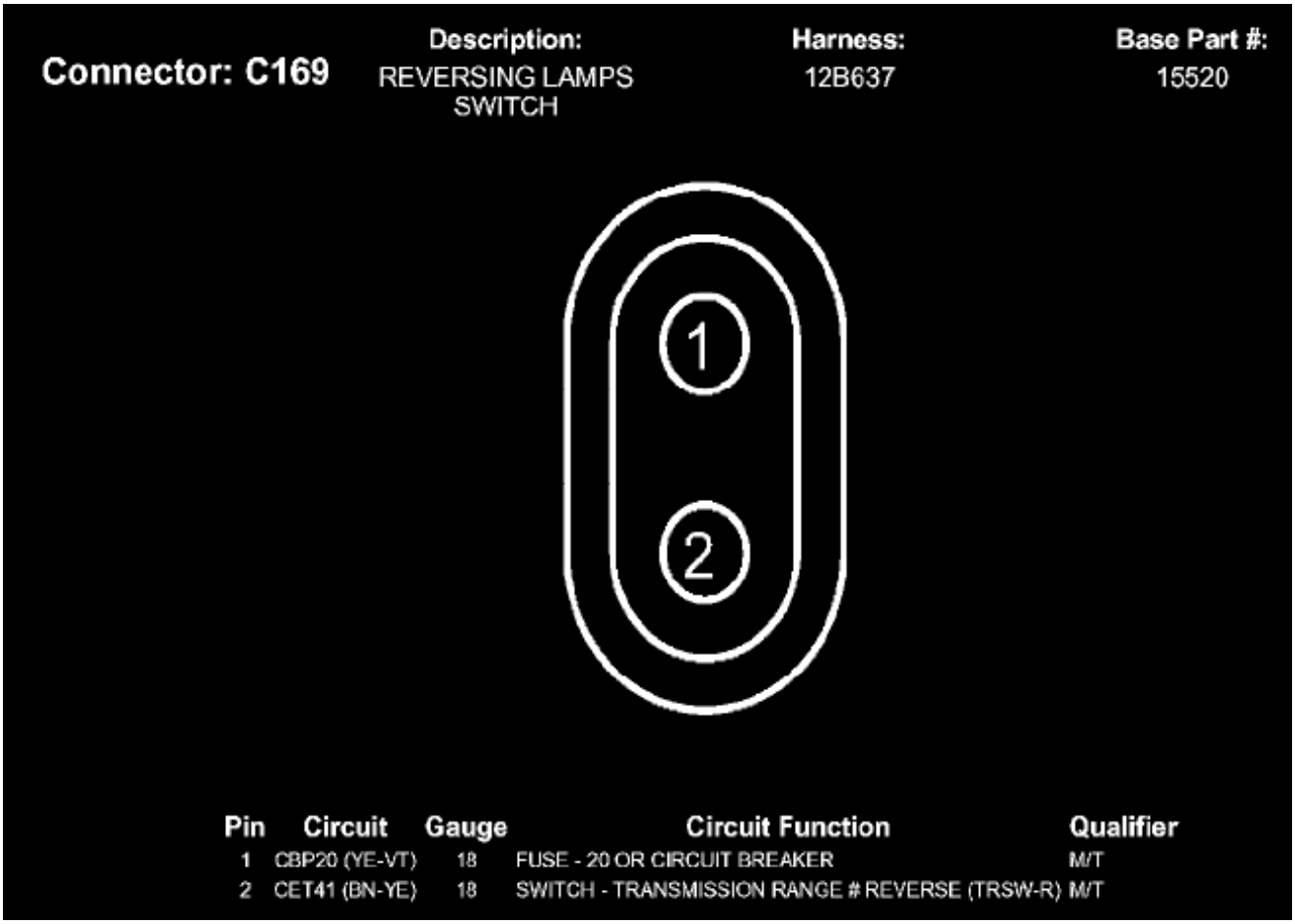
Harness: 12B637

Base Part #: 7F293

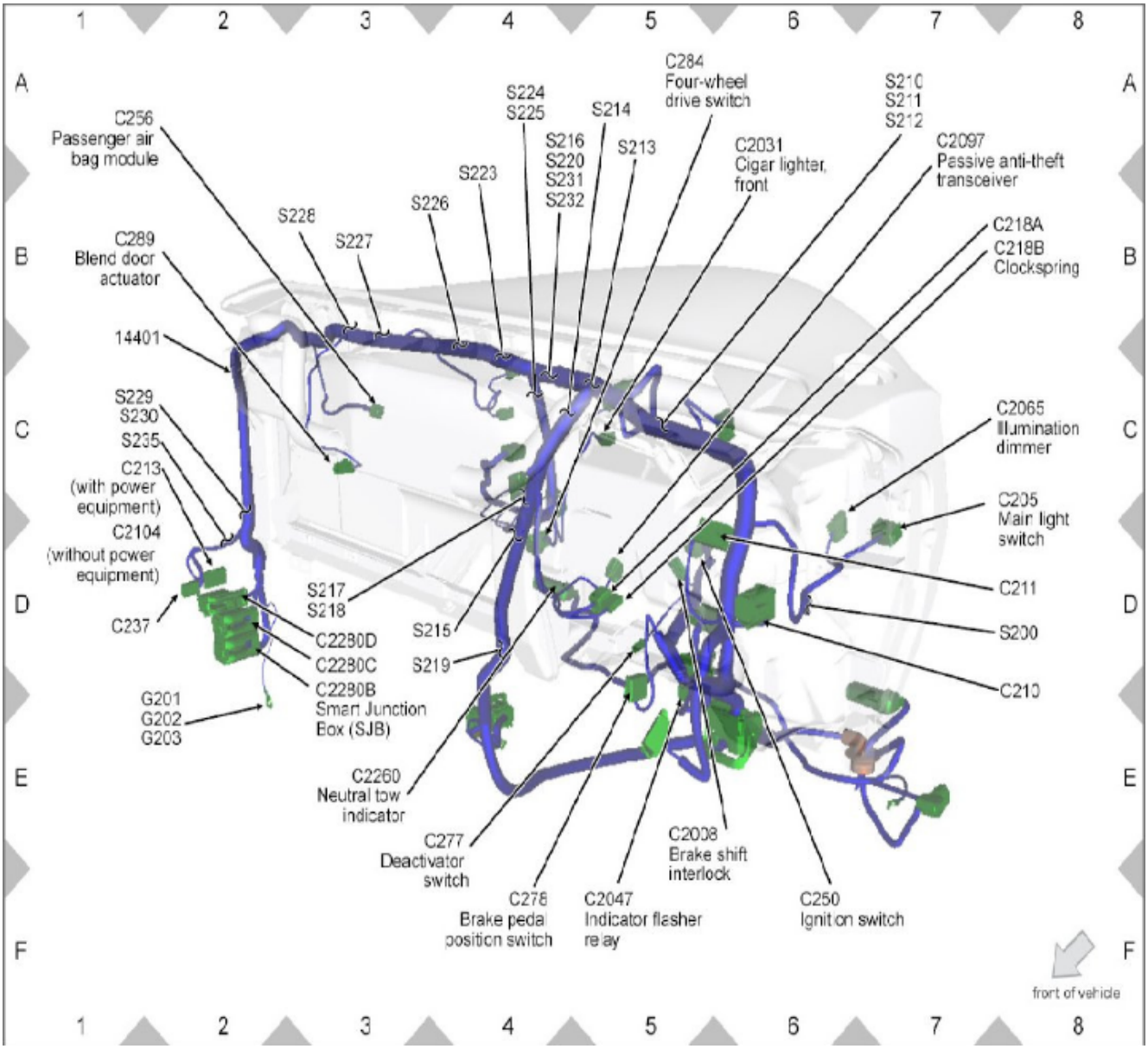


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	RE406 (GY-VT)	18	SIGNAL RETURN	
3	VET28 (GY-VT)	20	TR3A	
4	VET29 (VT-WH)	20	TR1	
5	VET30 (YE)	20	TR2	
6	VET31 (BU-OG)	20	TR4	
7	GD108 (BK-VT)	18	GROUND	4x4
8	CCF20 (GY-VT)	20	NETURAL SENSE	4x4
9	CBP20 (YE-VT)	18	FUSED POWER FEED	
10	CET40 (GN-OG)	20	STARTER CONTROL	
11	CET41 (BN-YE)	18	BACK UP	
12	CBP21 (BU-GY)	20	STARTER TO STARTER INTERRUPT RELAY	

C167


Connector: C169
Description:
REVERSING LAMPS SWITCH
Harness:
12B637
Base Part #:
15520
1
2
Pin Circuit Gauge Circuit Function Qualifier
1 CBP20 (YE-VT) 18 FUSE - 20 OR CIRCUIT BREAKER M/T
2 CET41 (BN-YE) 18 SWITCH - TRANSMISSION RANGE # REVERSE (TRSW-R) M/T

C169


1
2
3
4
5
6
7
8
A
B
C
D
E
F
C256
Passenger air bag module
C289
Blend door actuator
14401
S229
S230
S235
C213
(with power equipment)
C2104
(without power equipment)
C237
G201
G202
G203
S228
S227
S226
S223
S224
S225
S216
S220
S231
S232
S214
S213
C284
Four-wheel drive switch
C2031
Cigar lighter, front
S210
S211
S212
C2097
Passive anti-theft transceiver
C218A
C218B
Clockspring
C2065
Illumination dimmer
C205
Main light switch
C211
S200
C210
S217
S218
S215
S219
C2280D
C2280C
C2280B
Smart Junction Box (SJB)
C2260
Neutral tow indicator
C277
Deactivator switch
C278
Brake pedal position switch
C2047
Indicator flasher relay
C2008
Brake shift interlock
C250
Ignition switch
front of vehicle

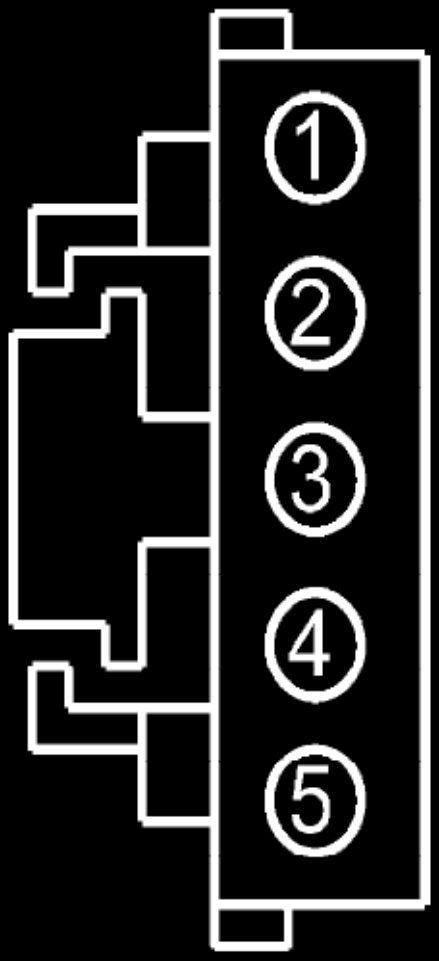
View 151-11

Connector: C278

Description: BRAKE PEDAL POSITION SWITCH

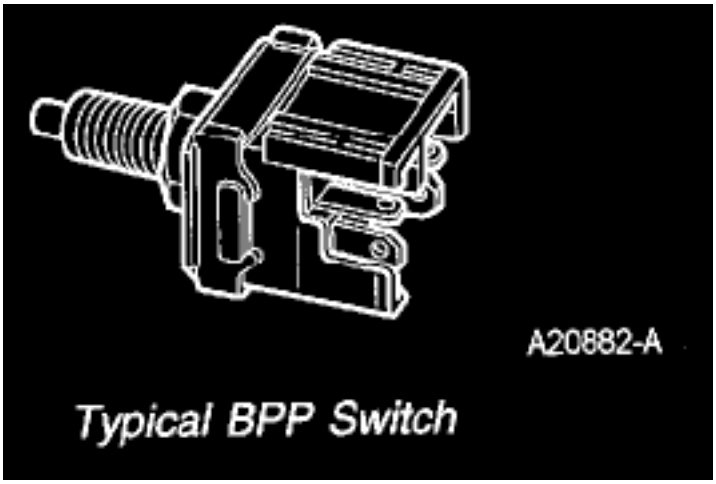
Harness: 14401

Base Part #:



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	SBP19 (BU-RD)	16	FUSE - 19 OR CIRCUIT BREAKER	
2	CCB08 (VT-WH)	16	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL OPEN	
3	SBP32 (VT-RD)	22	FUSE - 32 OR CIRCUIT BREAKER	
4	CCB15 (BN-GN)	22	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL CLOSED	
5	GD161 (BK-YE)	22	GROUND - SEAT BRACKET REAR LEFT	

C278



Brake Light Switch: Description and Operation

BRAKE PEDAL POSITION (BPP) SWITCH

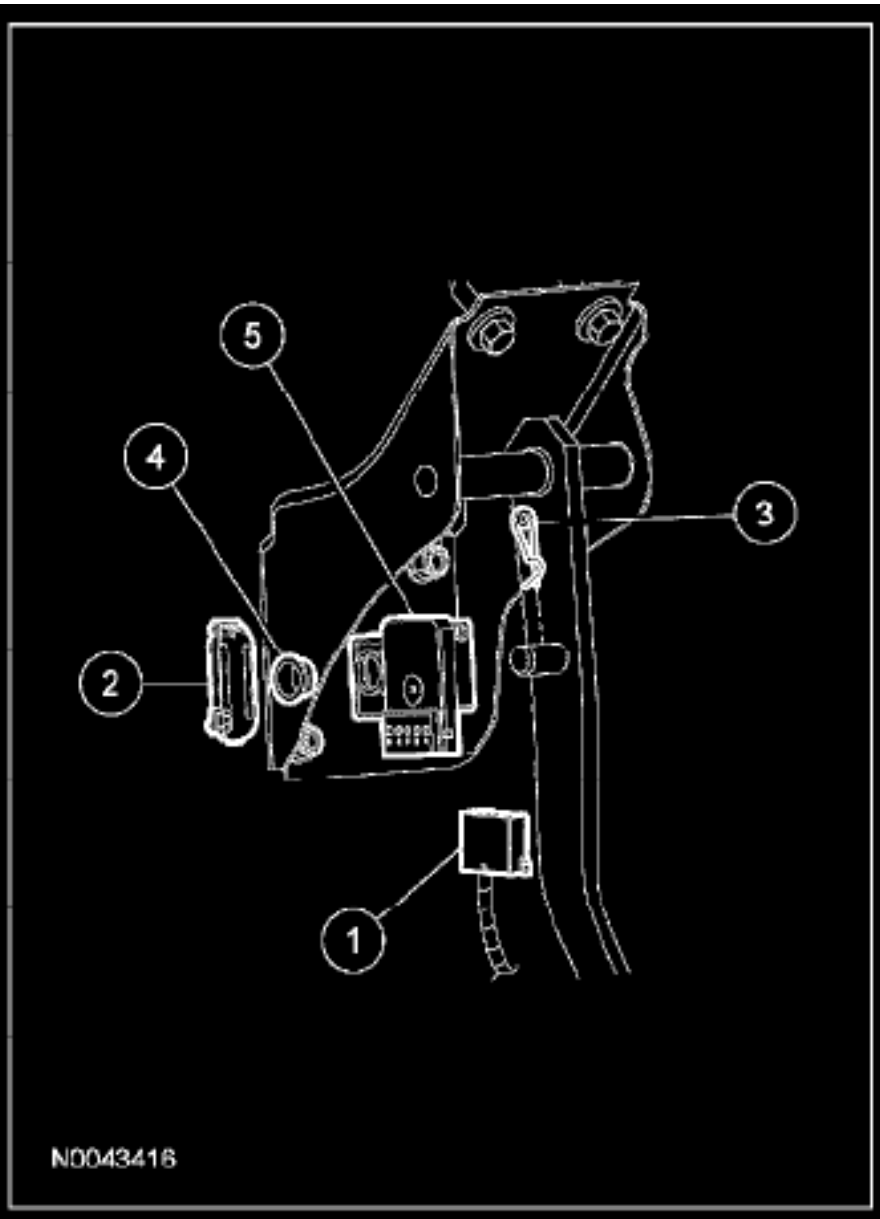
Typical BPP Switch

The BPP switch is sometimes referred to as the stoplamp switch. The BPP switch provides a signal to the PCM indicating that the brakes are applied. The BPP switch is normally open and is mounted on the brake pedal support. Depending on the vehicle application the BPP switch can be hardwired as follows:

- to the PCM supplying battery positive voltage (B+) when the vehicle brake pedal is applied.

- to the antilock brake system (ABS) module, or lighting control module (LCM), the BPP signal is then broadcast over the network to be received by the PCM.

- to the ABS traction control/stability assist module. The ABS module interprets the BPP switch input along with other ABS inputs and generates an output called the driver brake application (DBA) signal. The DBA signal is then sent to the PCM and to other BPP signal users.



Item	Part Number	Description
1	—	Stoplamp switch electrical connector (part of 14401)
2	2475	Stoplamp switch self-locking pin cover
3	380699	Stoplamp switch self-locking pin
4	2B219	Stoplamp switch spacer
5	13480	Stoplamp switch

Brake Light Switch: Service and Repair

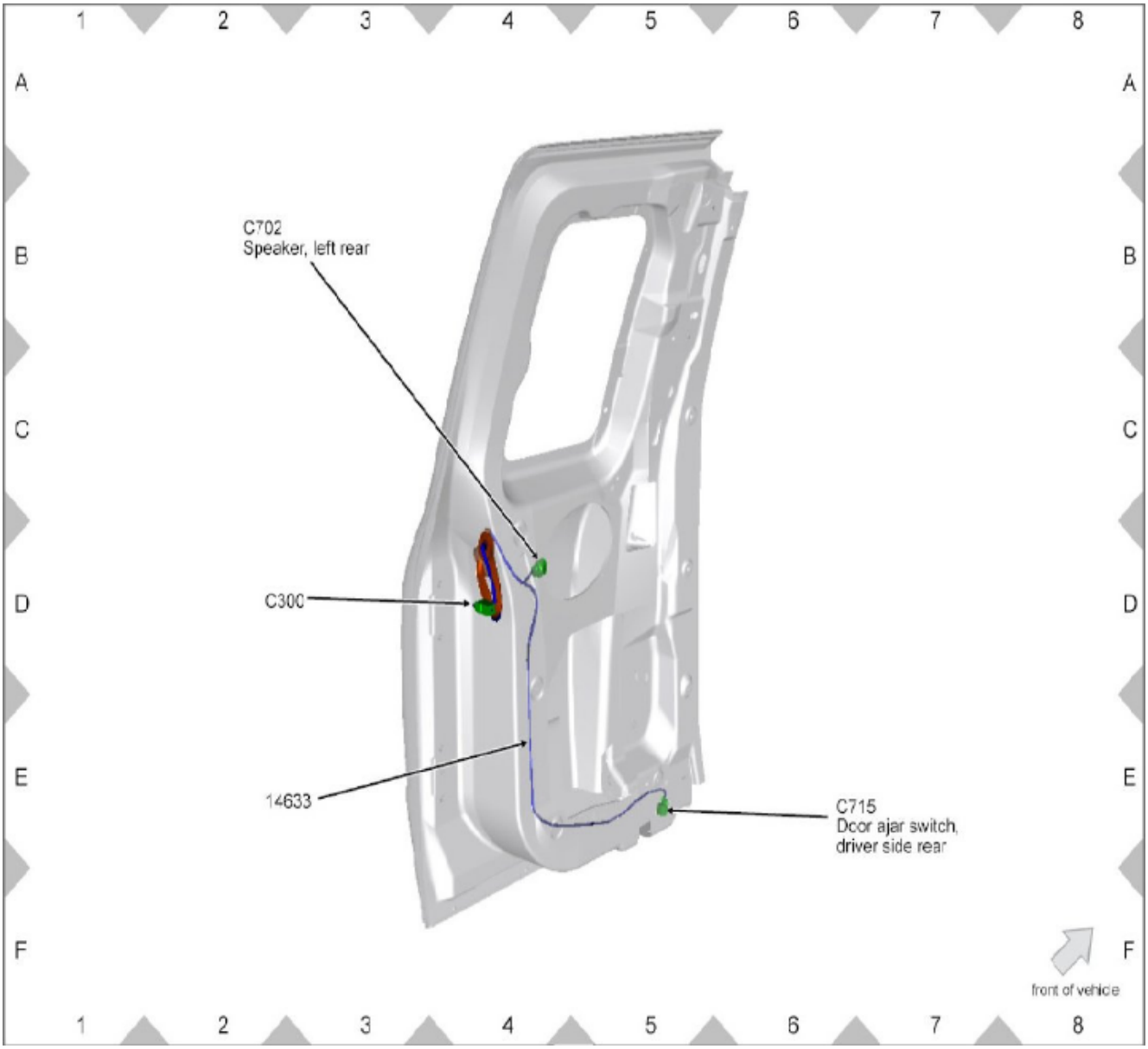
STOPLAMP SWITCH

Removal and Installation

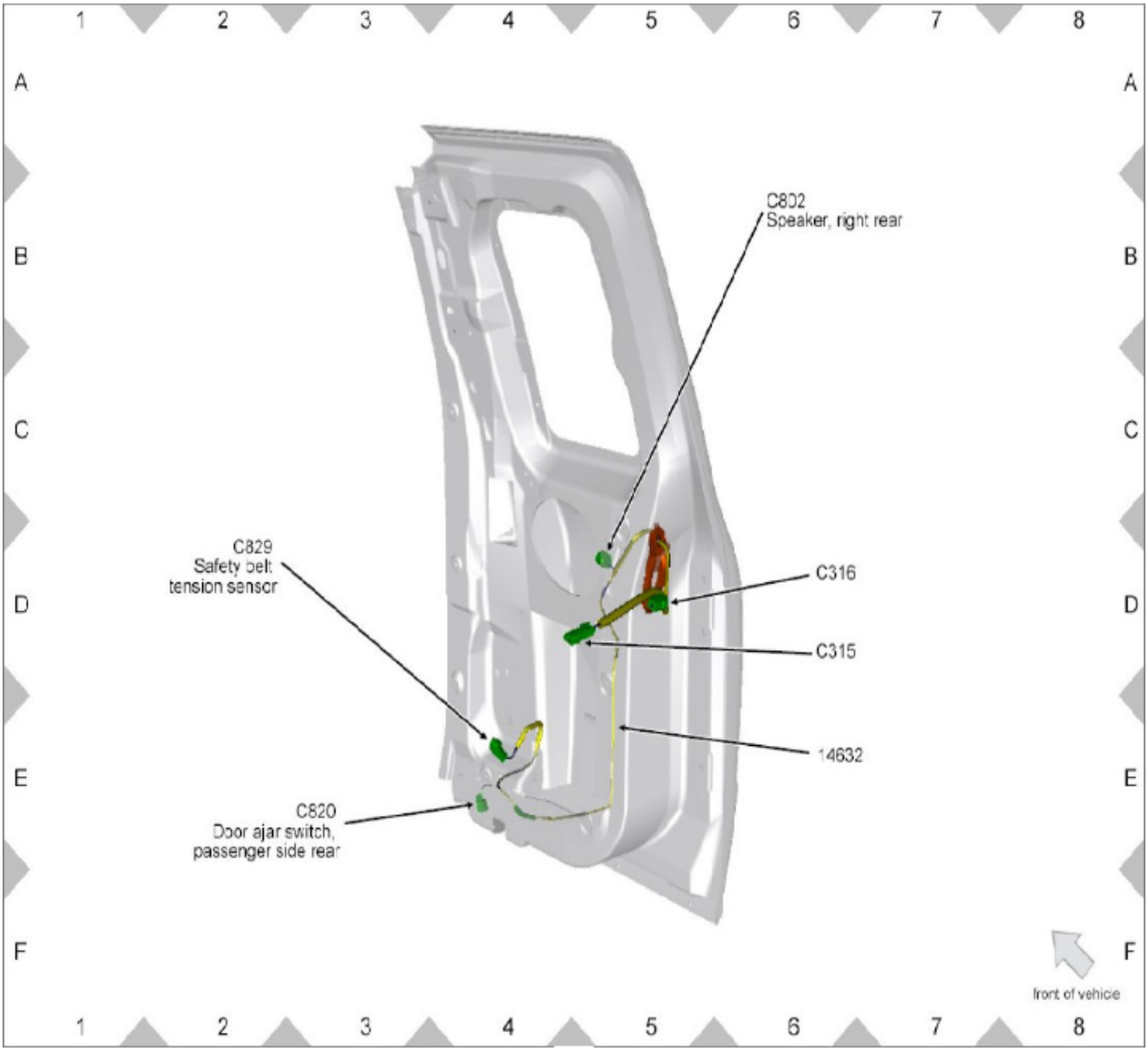
1. Disconnect the stoplamp switch electrical connector. 2. Remove the cover and the self-locking pin. 3. Remove the stoplamp switch from the brake booster push rod and the brake pedal assembly.

- Remove the spacer.

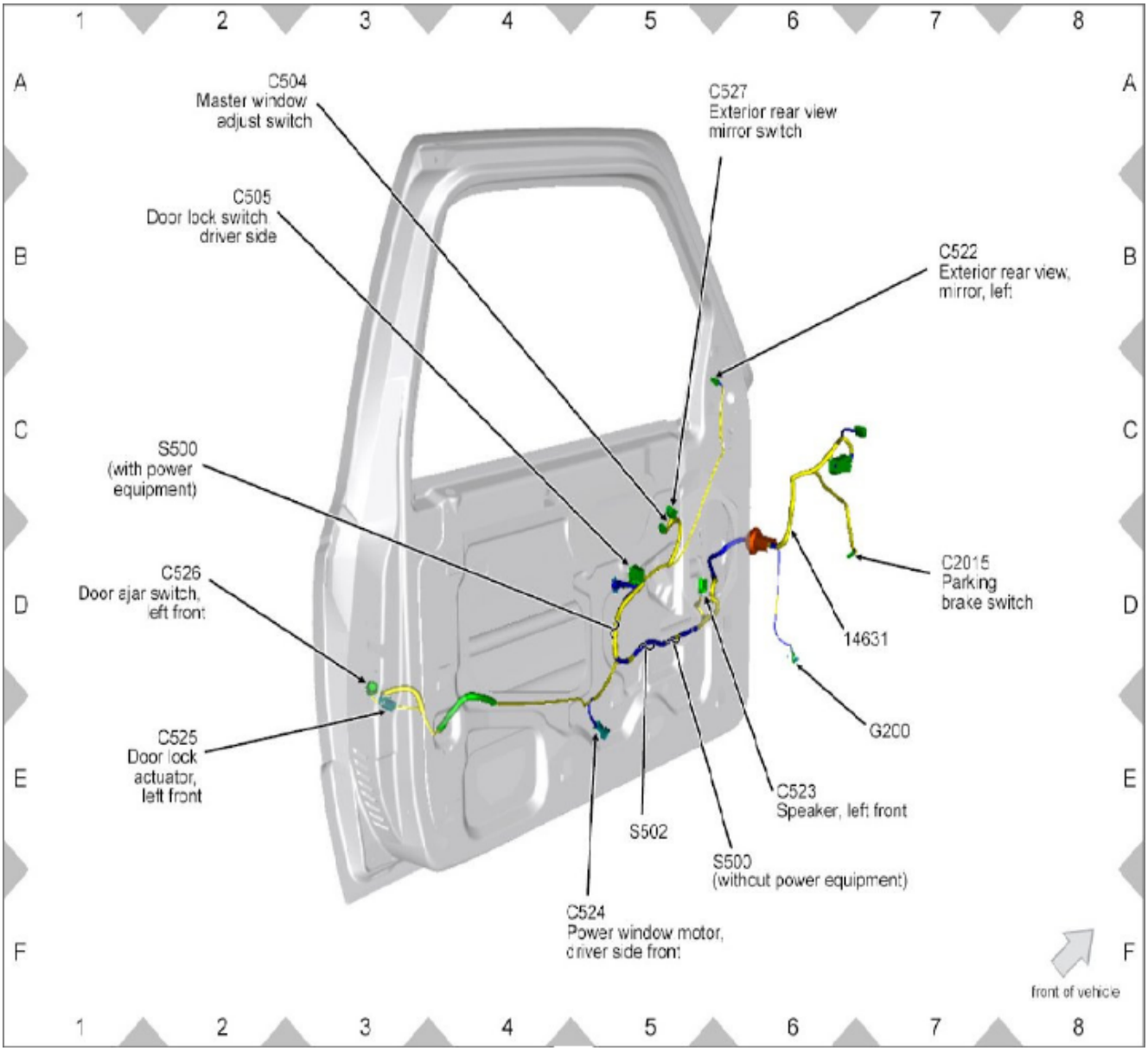
4. To install, reverse the removal procedure.


C702
Speaker, left rear
C300
14633
C715
Door ajar switch, driver side rear
front of vehicle

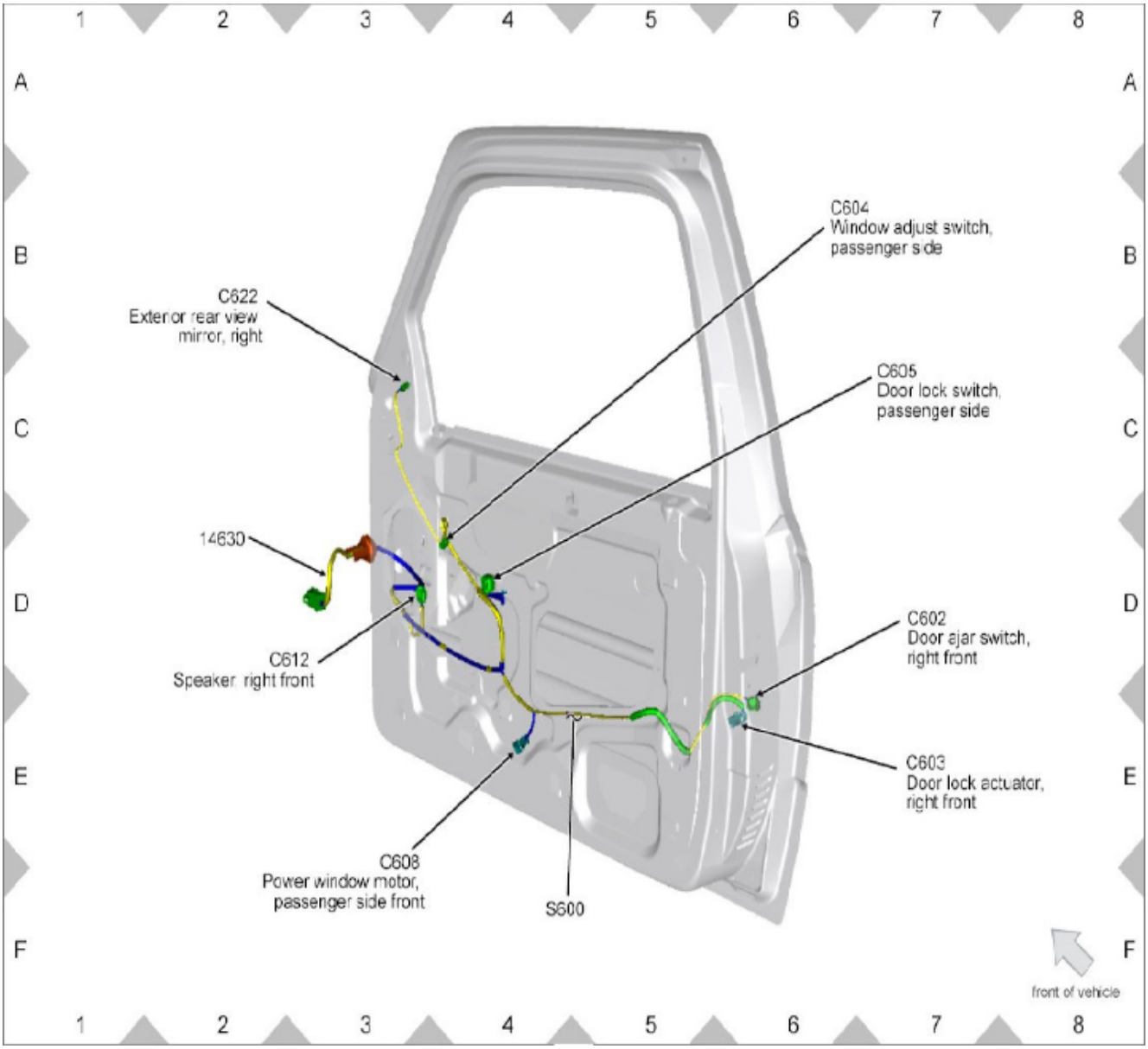
View 151-22


C802
Speaker, right rear
C829
Safety belt tension sensor
C316
C315
14632
C820
Door ajar switch, passenger side rear
front of vehicle

View 151-23


C504
Master window adjust switch
C505
Door lock switch driver side
S500
(with power equipment)
C526
Door ajar switch, left front
C525
Door lock actuator, left front
C527
Exterior rear view mirror switch
C522
Exterior rear view mirror, left
C2015
Parking brake switch
14631
G200
C523
Speaker, left front
S502
S500
(without power equipment)
C524
Power window motor, driver side front
front of vehicle

View 151-20


C604
Window adjust switch, passenger side
C622
Exterior rear view mirror, right
C605
Door lock switch, passenger side
14630
C612
Speaker, right front
C602
Door ajar switch, right front
C603
Door lock actuator, right front
C608
Power window motor, passenger side front
S600
front of vehicle

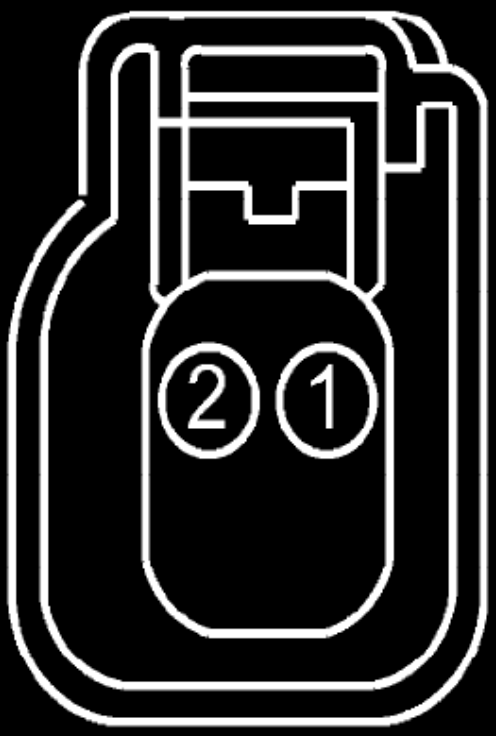
View 151-21

Connector: C526

Description: DOOR AJAR SWITCH, LEFT FRONT

Harness: 14631

Base Part #:



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPL26 (GN-VT)	20	SWITCH - LATCH DRIVER # AJAR	
2	GD175 (BK-BU)	20	GROUND - TUNNEL # 2ND STUD	

C526

Connector: C602
Description:
DOOR AJAR SWITCH, RIGHT FRONT
Harness:
14630
Base Part #:
Pin Circuit Gauge Circuit Function Qualifier
1 CPL31 (WH) 20 SWITCH - LATCH PASSENGER # AJAR
2 GD161 (BK-YE) 20 GROUND - SEAT BRACKET REAR LEFT
2
1

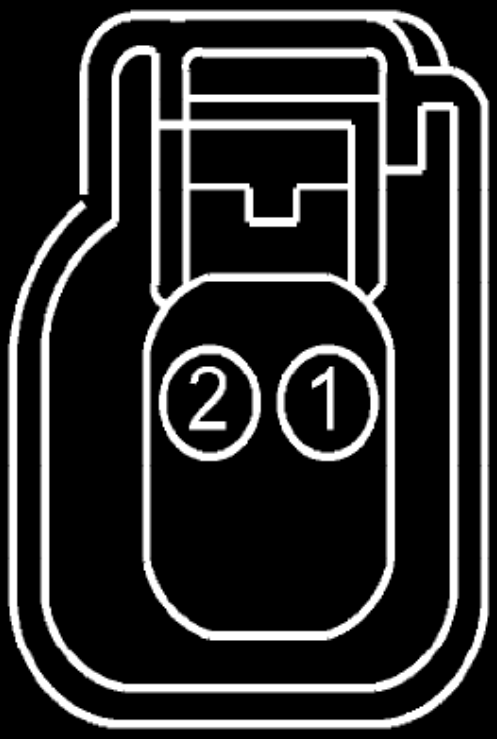
C602

Connector: C715
Description:
DOOR AJAR SWITCH, DRIVER SIDE REAR
Harness:
14633
Base Part #:
14018
Pin Circuit Gauge Circuit Function Qualifier
1 CPL36 (GN) 18 SWITCH - LATCH REAR DRIVER SIDE # AJAR (INCL.SLIDING DOOR)
2 GD101 (BK-YE) 18 GROUND - SEAT BRACKET REAR LEFT
2
1

C715

Connector: C820

Description:	Harness:	Base Part #:
DOOR AJAR SWITCH, PASSENGER SIDE REAR	14632	14018



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPL39 (YE)	18	SWITCH - LATCH REAR PASSENGER SIDE # AJAR (INCL.SLIDING DOOR)	
2	GD161 (BK-YE)	18	GROUND - SEAT BRACKET REAR LEFT	

C820

Door Switch: Service and Repair Door Ajar Switch

DOOR AJAR SWITCH

Removal and Installation

1. Remove the front door latch. 2. Lift the locking tab, rotate the switch and remove the door ajar switch. 3. To install, reverse the removal procedure.

Door Switch: Service and Repair Door Ajar Switch - SuperCab Four-Door

DOOR AJAR SWITCH - SUPERCAB FOUR-DOOR

Removal and Installation

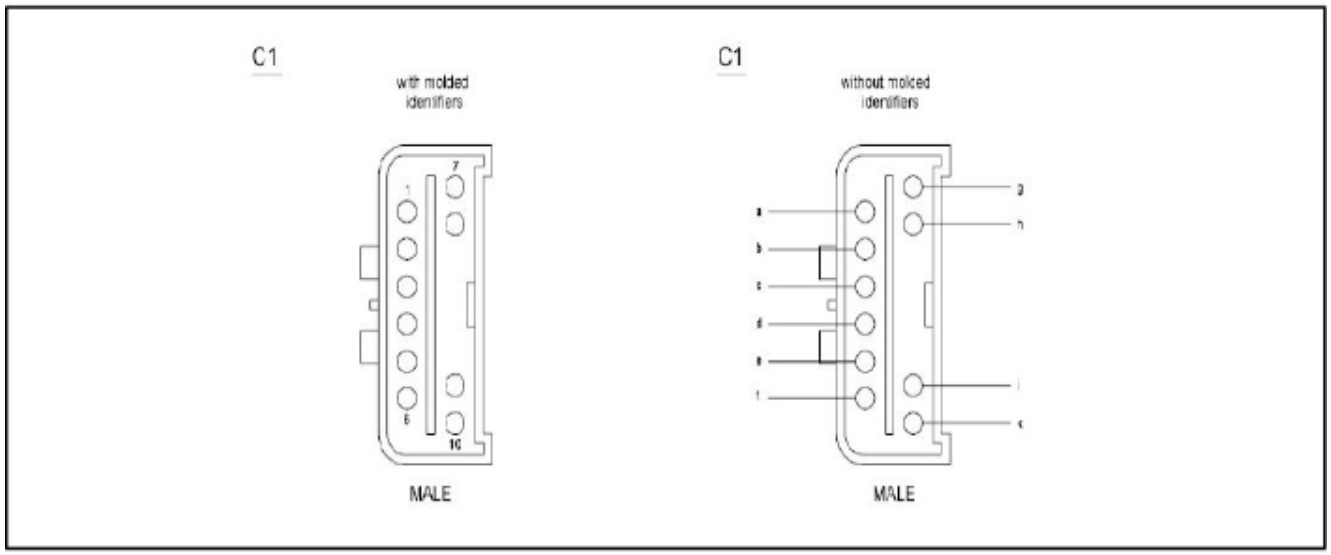
1. Remove the rear door lower latch. 2. Release the locking tabs, rotate the door ajar switch and remove the door ajar switch. 3. To install, reverse the removal procedure.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



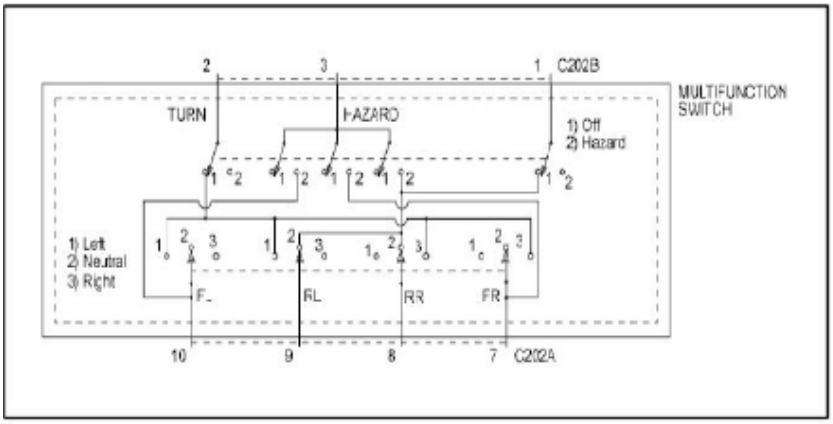
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

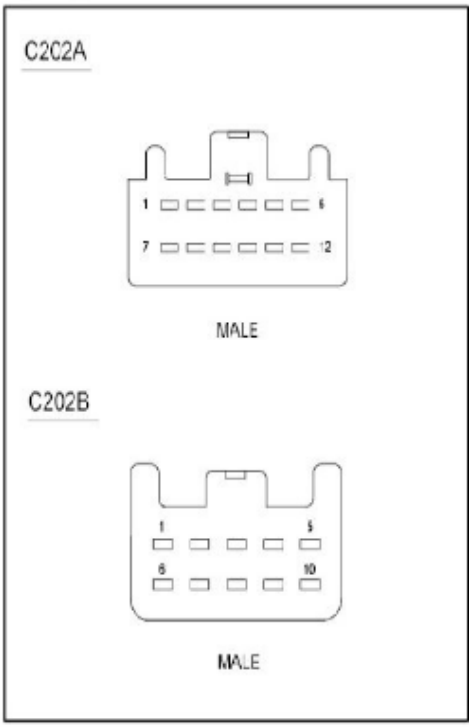
Hazard Warning Switch: Testing and Inspection

Multifunction Switch, Turn Portion

Schematic



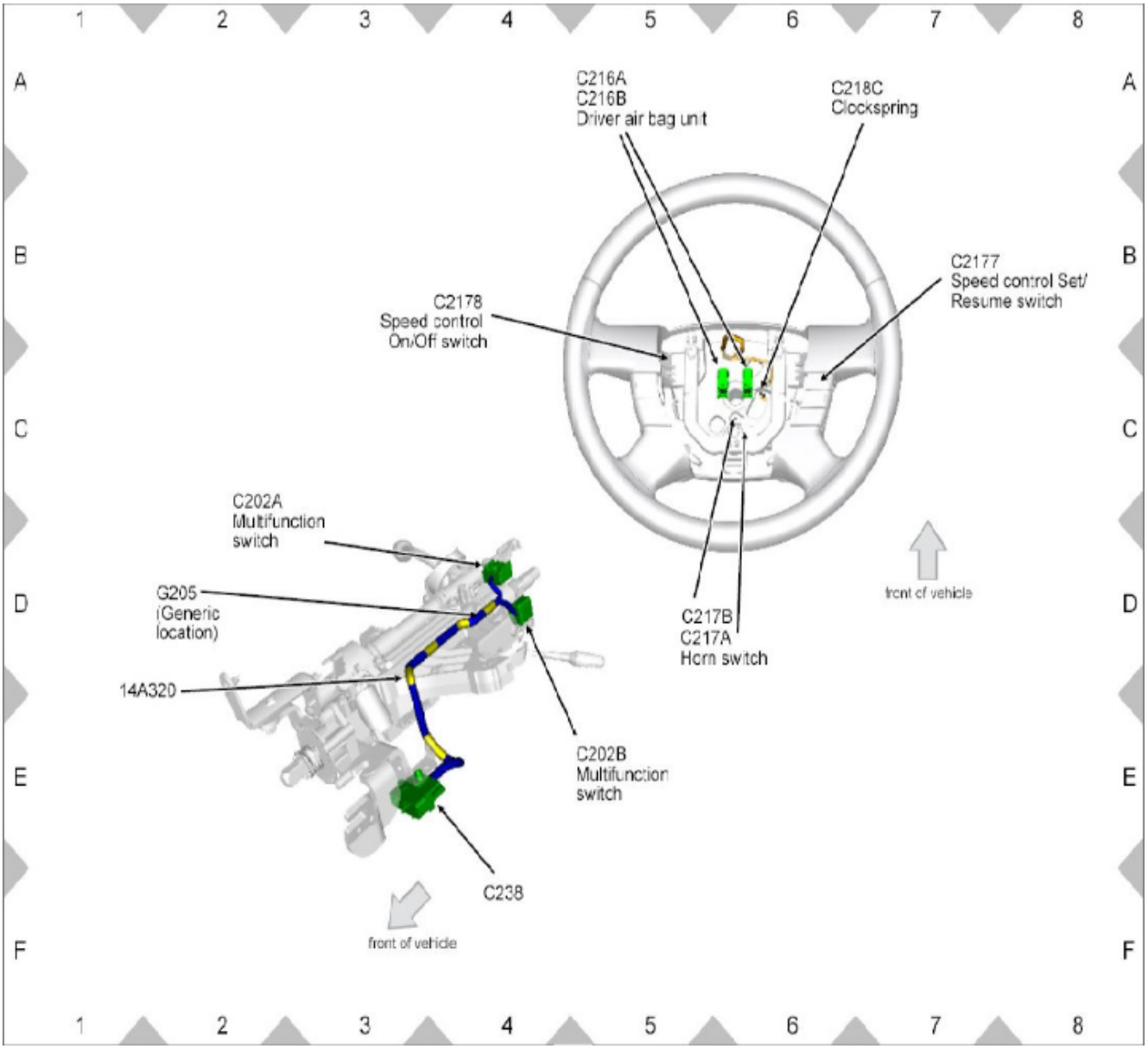
Terminals



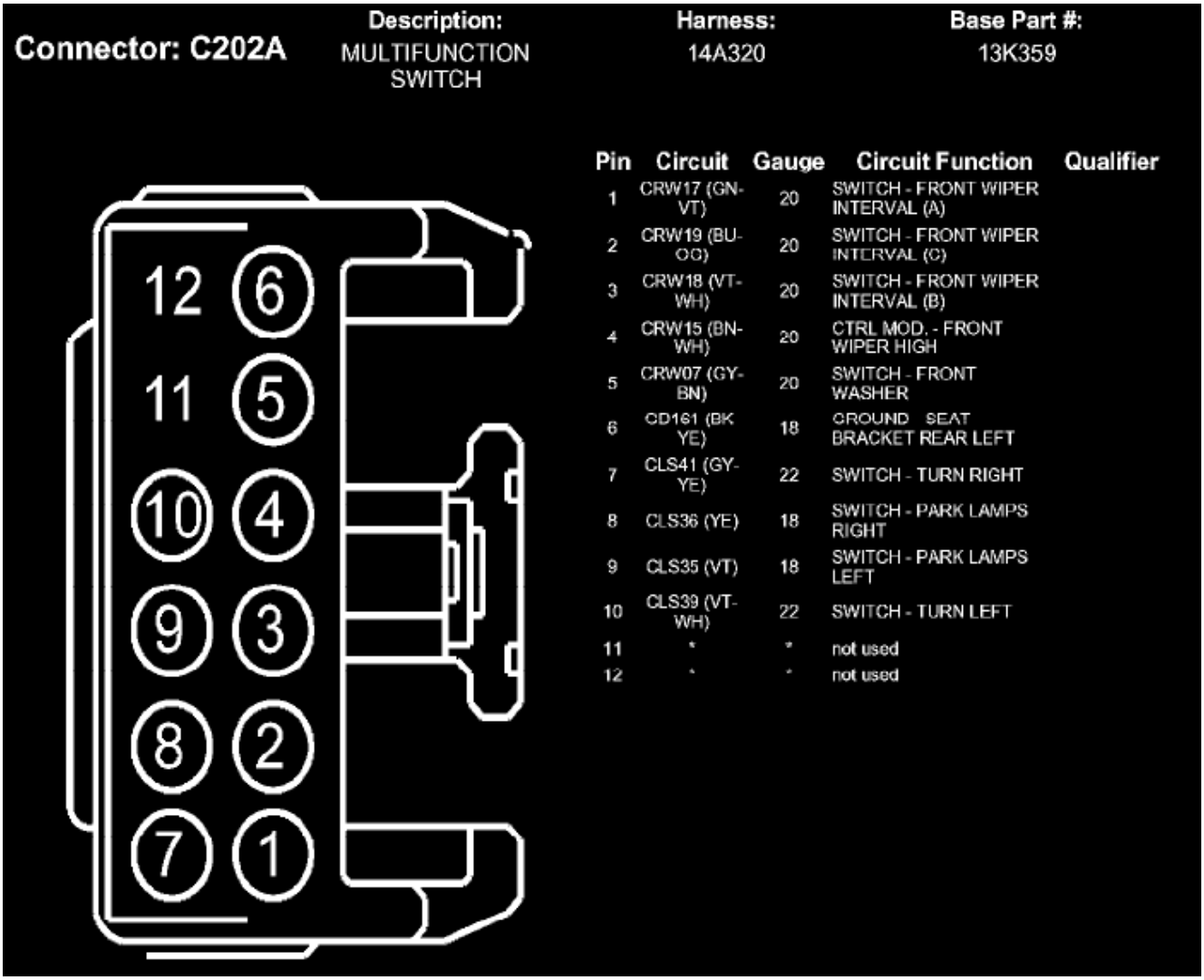
Component testing procedure

Circuit to test	Connect self-powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
Turn signal	C202b-2 and C202a-10	Left turn	Closed circuit
	C202b-2 and C202a-9	Left turn	Closed circuit
	C202b-2 and C202a-7	Right turn	Closed circuit
	C202b-2 and C202a-8	Right turn	Closed circuit
Hazard	C202b-3 and C202a-10	Turn signal switch in neutral, Hazard On	Closed circuit
	C202b-3 and C202a-7		
	C202b-3 and C202a-9		
	C202b-3 and C202a-8		
	C202b-1 and C202a-10	Turn signal switch in neutral, Hazard Off	Closed circuit
	C202b-1 and C202a-8		

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Sensors and Switches > Sensors and Switches - Lighting and Horns > Headlamp Dimmer Switch > Component Information > Locations



View 151-13



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CRW17 (GN-VT)	20	SWITCH - FRONT WIPER INTERVAL (A)	
2	CRW19 (BU-OG)	20	SWITCH - FRONT WIPER INTERVAL (C)	
3	CRW18 (VT-WH)	20	SWITCH - FRONT WIPER INTERVAL (B)	
4	CRW15 (BN-WH)	20	CTRL MOD. - FRONT WIPER HIGH	
5	CRW07 (GY-BN)	20	SWITCH - FRONT WASHER	
6	CD161 (BK YE)	18	GROUND SEAT BRACKET REAR LEFT	
7	CLS41 (GY-YE)	22	SWITCH - TURN RIGHT	
8	CLS36 (YE)	18	SWITCH - PARK LAMPS RIGHT	
9	CLS35 (VT)	18	SWITCH - PARK LAMPS LEFT	
10	CLS39 (VT-WH)	22	SWITCH - TURN LEFT	
11	*	*	not used	
12	*	*	not used	

Headlamp Dimmer Switch: Diagrams Multifunction Switch

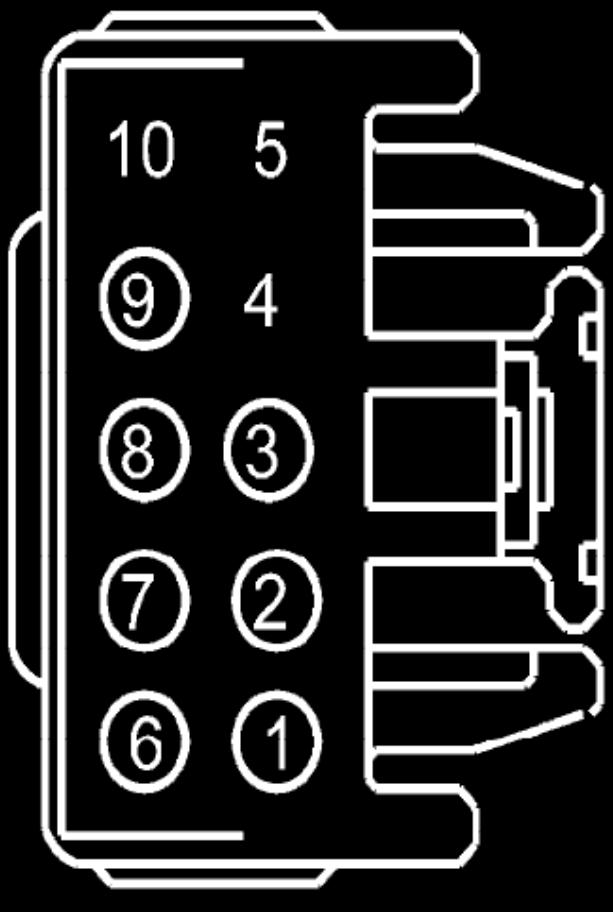
C202A

Connector: C202B

Description: MULTIFUNCTION SWITCH

Harness: 14A320

Base Part #: 13K359



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CCB08 (VT-WH)	16	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL OPEN	
2	CLS42 (VT-BN)	18	INDICATOR FLASHER RELAY - TURN SIGNAL SWITCHED POWER	
3	CLS32 (BN-YE)	18	INDICATOR FLASHER RELAY - HAZARD SWITCHED POWER	
4	*	*	not used	
5	*	*	not used	
6	SBP23 (WH-RD)	14	FUSE - 23 OR CIRCUIT BREAKER	
7	CLF27 (GN-BN)	14	SWITCH - FLASH TO PASS	
8	CLS24 (BN-WH)	16	CTRL MOD. - TURN LAMP RIGHT	
9	CLF18 (BU-WH)	16	SWITCH - BEAM LOW	
10	*	*	not used	

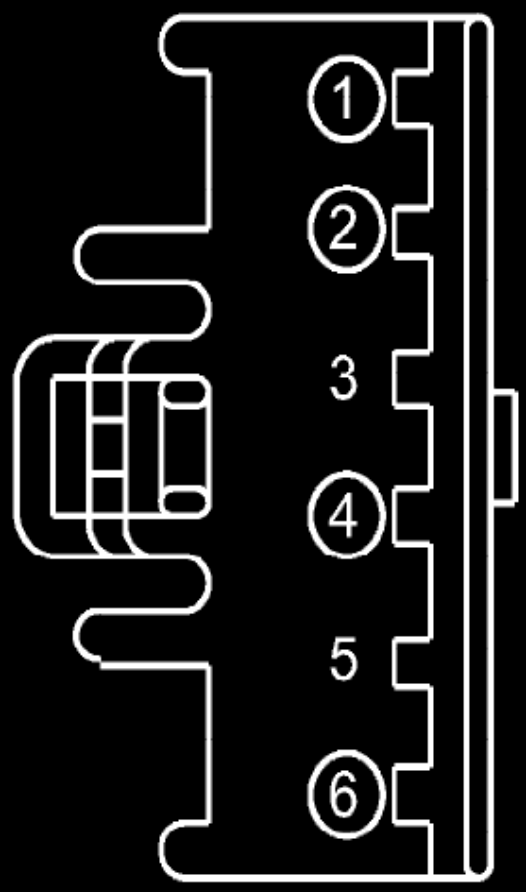
C202B

Connector: C2065

Description: ILLUMINATION DIMMER

Harness: 14401

Base Part #:



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VLN18 (BU-WH)	22	DIMMER - IP/SWITCH ILLUMINATION	
2	CLN27 (WH-BN)	18	CTRL MOD. - DIMMER INSTRUMENT	
3	*	*	not used	
4	GD161 (BK-YE)	22	GROUND - SEAT BRACKET REAR LEFT	
5	*	*	not used	
6	CBP01 (BU)	22	FUSE - 1 OR CIRCUIT BREAKER	

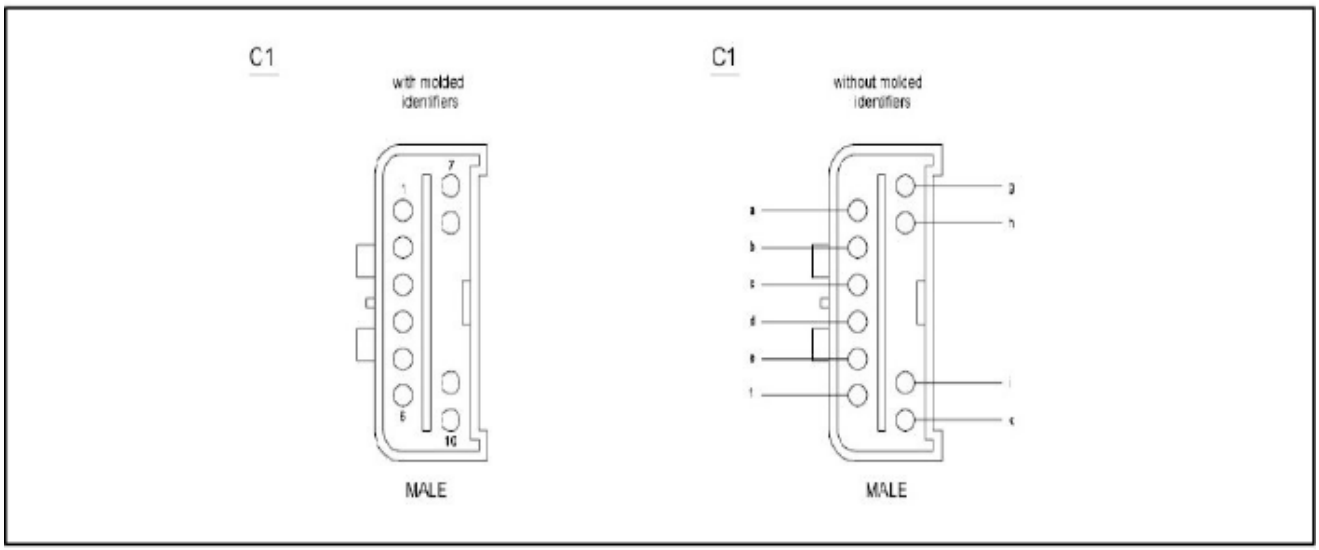
C2065

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals

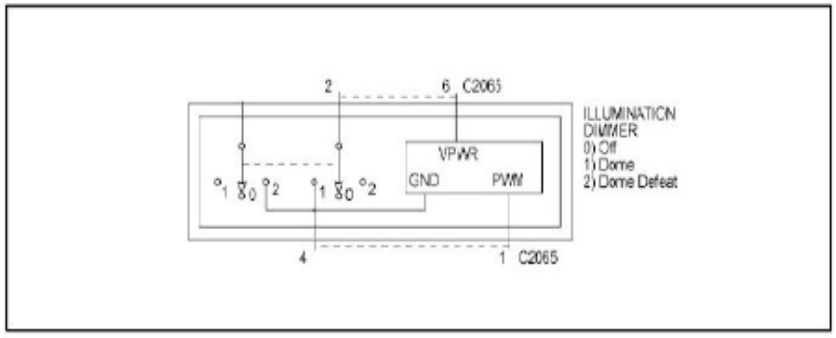


The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

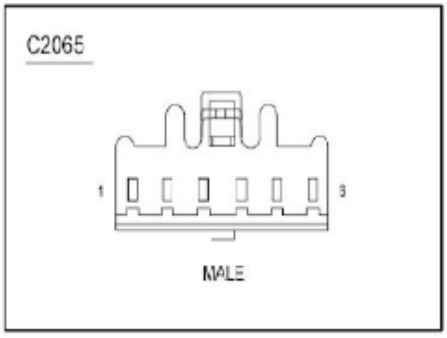
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Illumination dimmer

Schematic



Terminals



Component testing procedure

Circuit to test	Connect self-powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
Dome	2 and 4	On	Closed circuit
		Off	Open circuit

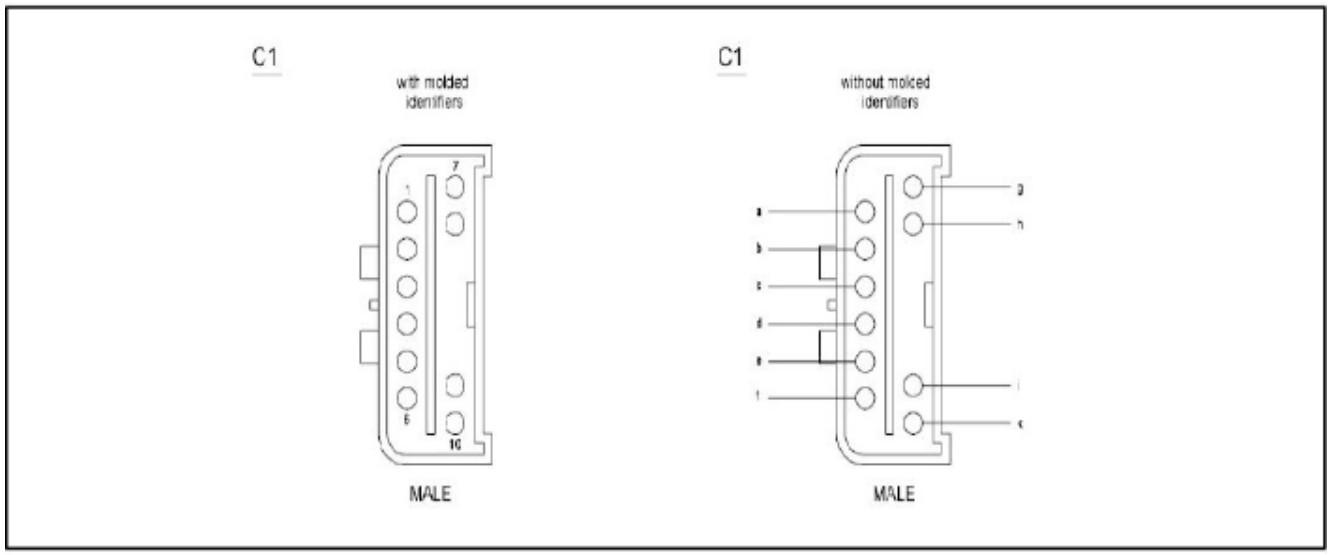
Headlamp Dimmer Switch: Testing and Inspection Illumination Dimmer

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



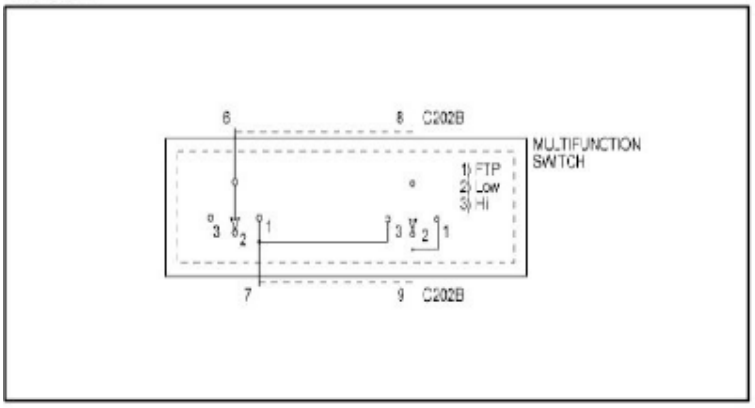
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

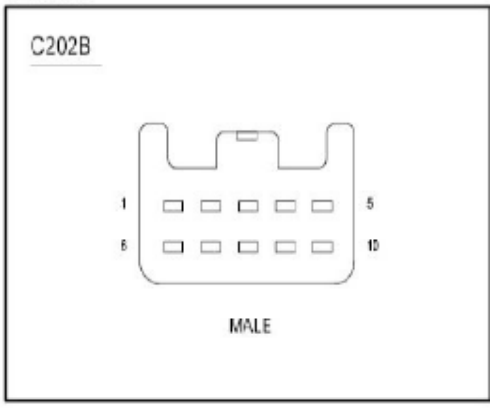
Headlamp Dimmer Switch: Testing and Inspection Multifunction Switch, Lamp Portion

Multifunction Switch, Lamp Portion

Schematic



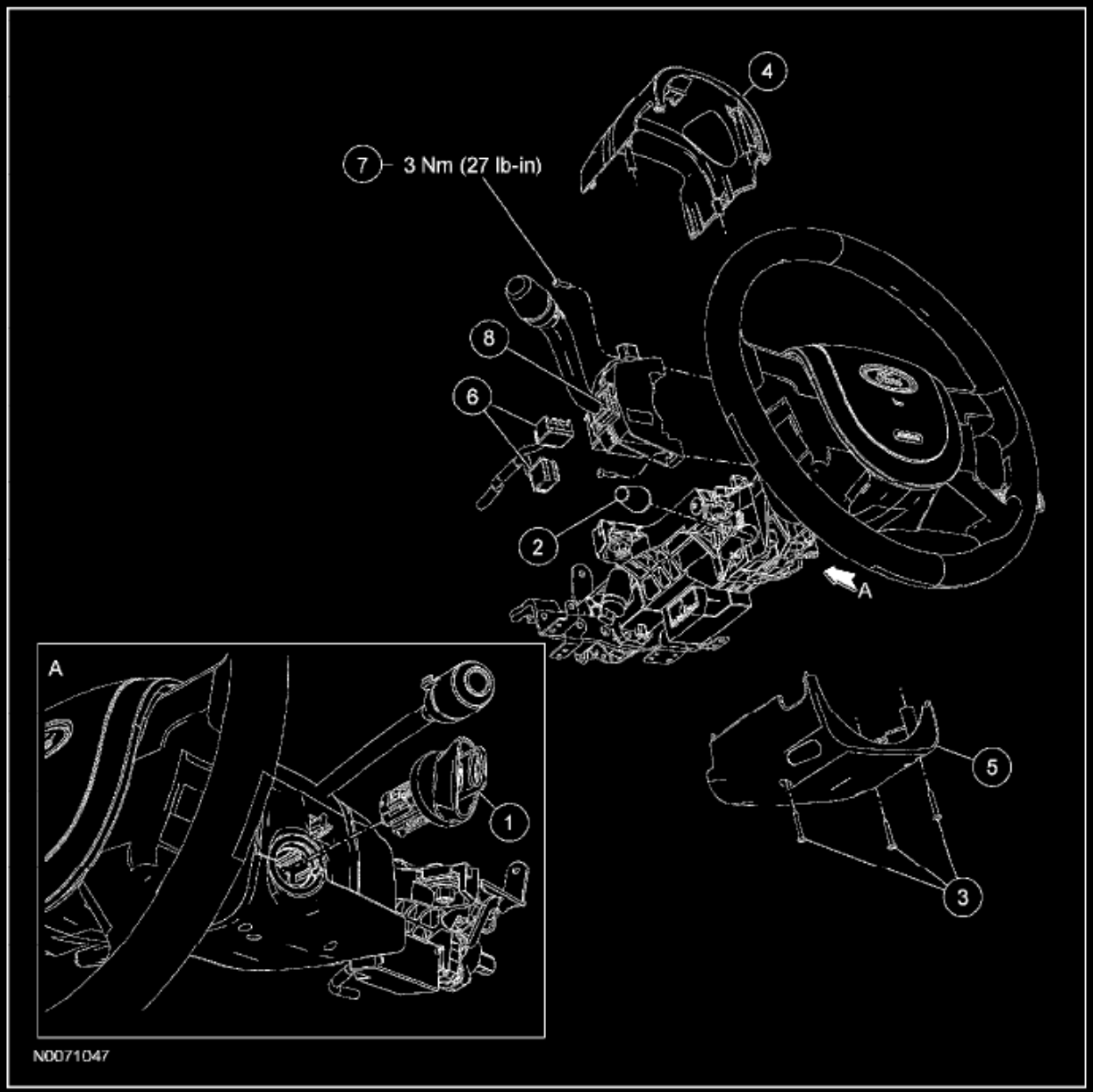
Terminals



Component testing procedure

Circuit to test	Connect self□powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
High beams	8 and 7	High beam	Closed circuit
		Flash□to□pass	Open circuit
		Low beam	Open circuit
Low beam/Flash□ to□pass	8 and 9	High beam	Open circuit
		Flash□to□pass	Closed circuit
		Low beam	Closed circuit
	6 and 7	High beam	Open circuit
		Flash□to□pass	Closed circuit
		Low beam	Open circuit

Steering Column Multifunction Switch



Item	Part Number	Description
1	11582	Ignition switch lock cylinder
2	3F609	Tilt release lever/ handle
3	391727	Steering column shroud screws (3 required)
4	3530	Upper steering column shroud
5	3533	Lower steering column shroud

(Continued)

Item	Part Number	Description
6	—	Steering column multi-function switch electrical connectors (part of 14A320)
7	390345	Steering column multi-function switch screws (2 required)
8	13K359	Steering column multi-function switch

Headlamp Dimmer Switch: Service and Repair

Steering Column Multifunction Switch

Steering Column Multifunction Switch

Removal and Installation

1. Remove the ignition switch lock cylinder.

1 Insert the ignition key into the ignition switch lock cylinder and turn to the RUN position.

2 Push the ignition switch lock cylinder release tab with a punch while pulling out the ignition switch lock cylinder.

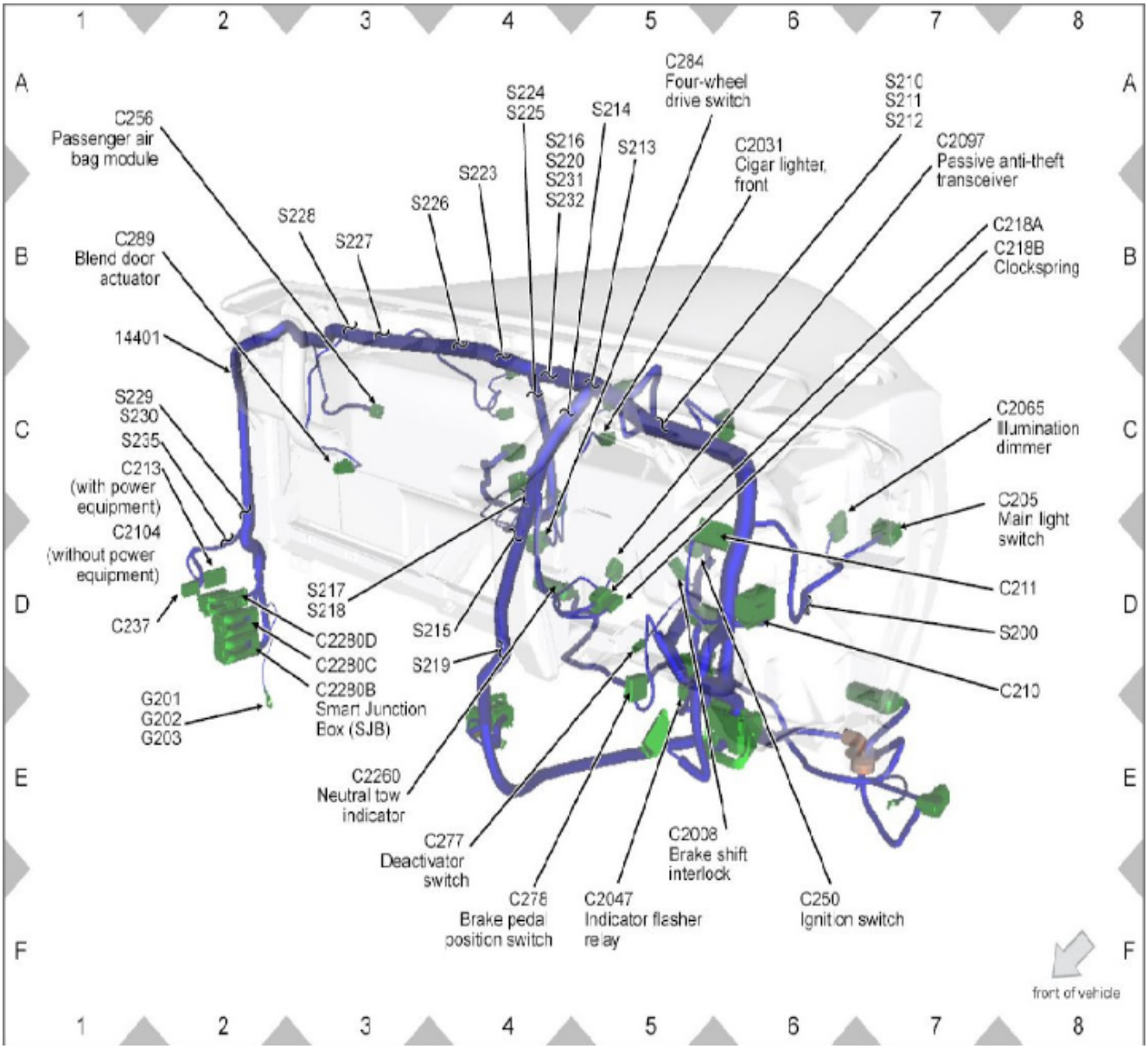
2. If equipped, remove the tilt release lever/ handle.

3. Remove the 3 steering column shroud screws and the upper and lower steering column shrouds. 4. Disconnect the multi-function switch electrical connectors. 5. Remove the 2 multi-function switch screws and the multi-function switch.

^ To install, tighten to 3 Nm (27 lb-inch).

6. To install, reverse the removal procedure.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Sensors and Switches > Sensors and Switches - Lighting and Horns > Headlamp Switch > Component Information > Locations



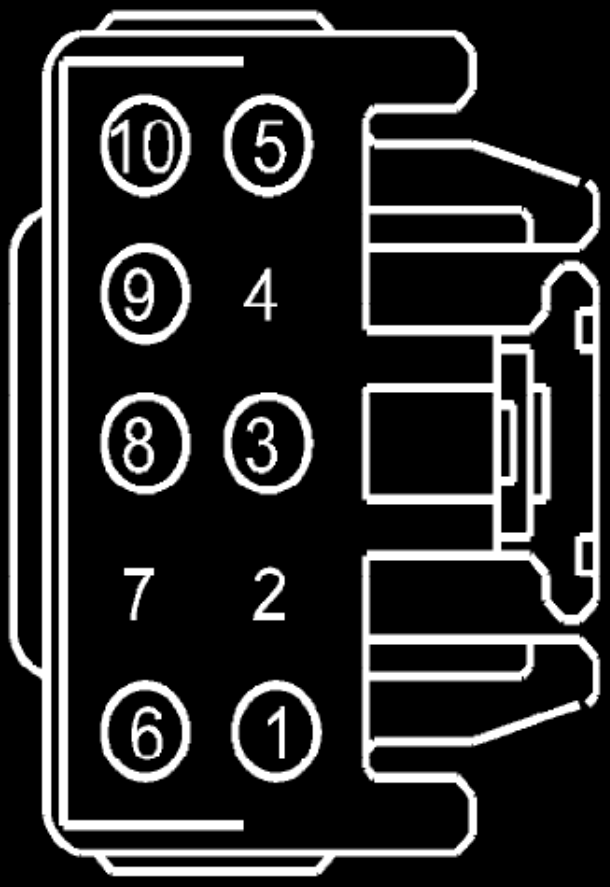
View 151-11

Connector: C205

Description: MAIN LIGHT SWITCH

Harness: 14401

Base Part #: 11654



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CLS24 (BN-WH)	16	CTRL MOD. - TURN LAMP RIGHT	
2	*	*	not used	
3	GD161 (BK YE)	20	GROUND SEAT BRACKET REAR LEFT	
4	*	*	not used	
5	CLS30 (VT-WH)	18	RELAY - PARK LAMP	
6	SBP23 (WH-RD)	14	FUSE - 23 OR CIRCUIT BREAKER	
7	*	*	not used	
8	VLN18 (BU-WH)	20	DIMMER - IP/SWITCH ILLUMINATION	
9	CLF21 (GY-VT)	18	SWITCH - FOG LAMPS FRONT	
10	SBP23 (WH-RD)	16	FUSE - 23 OR CIRCUIT BREAKER	

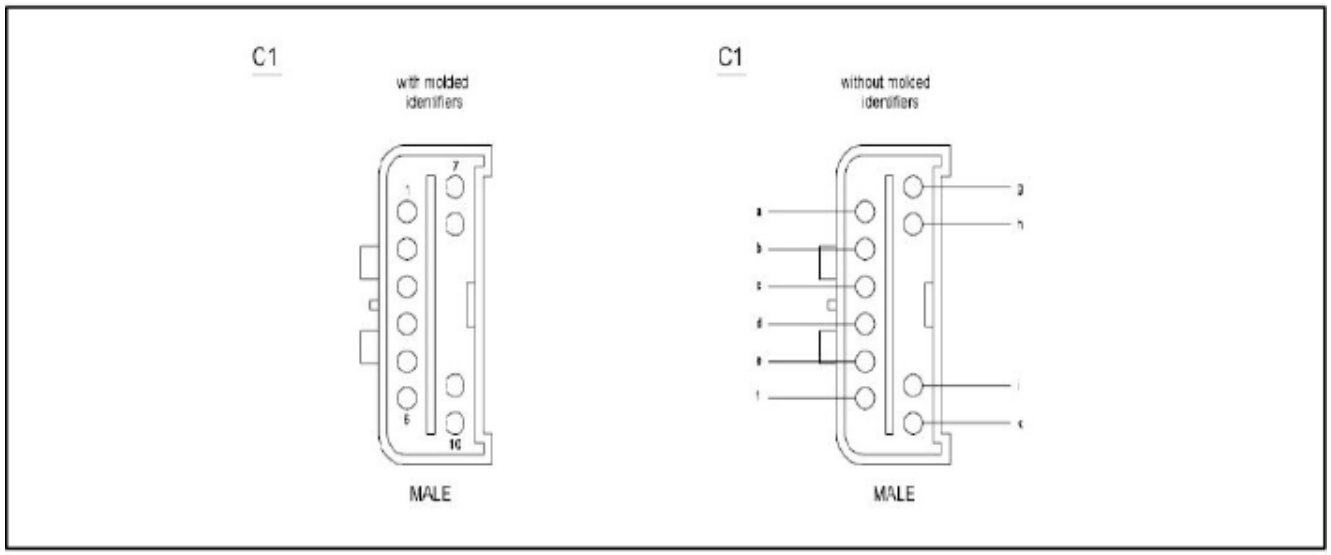
C205

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



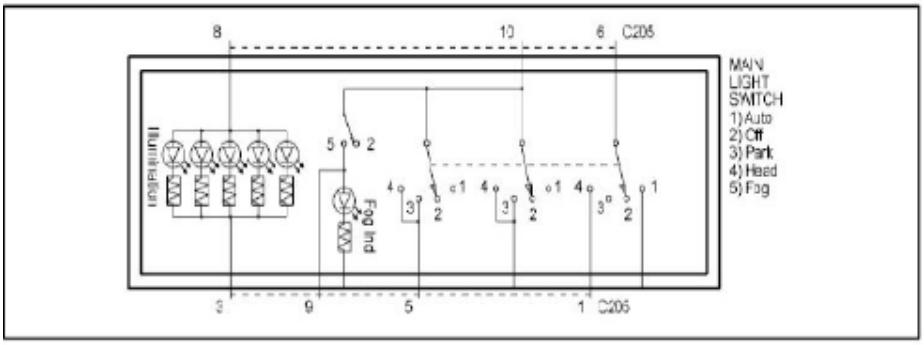
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

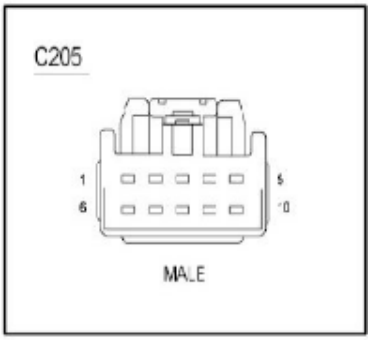
Headlamp Switch: Testing and Inspection

Main light switch, Exterior lamps

Schematic

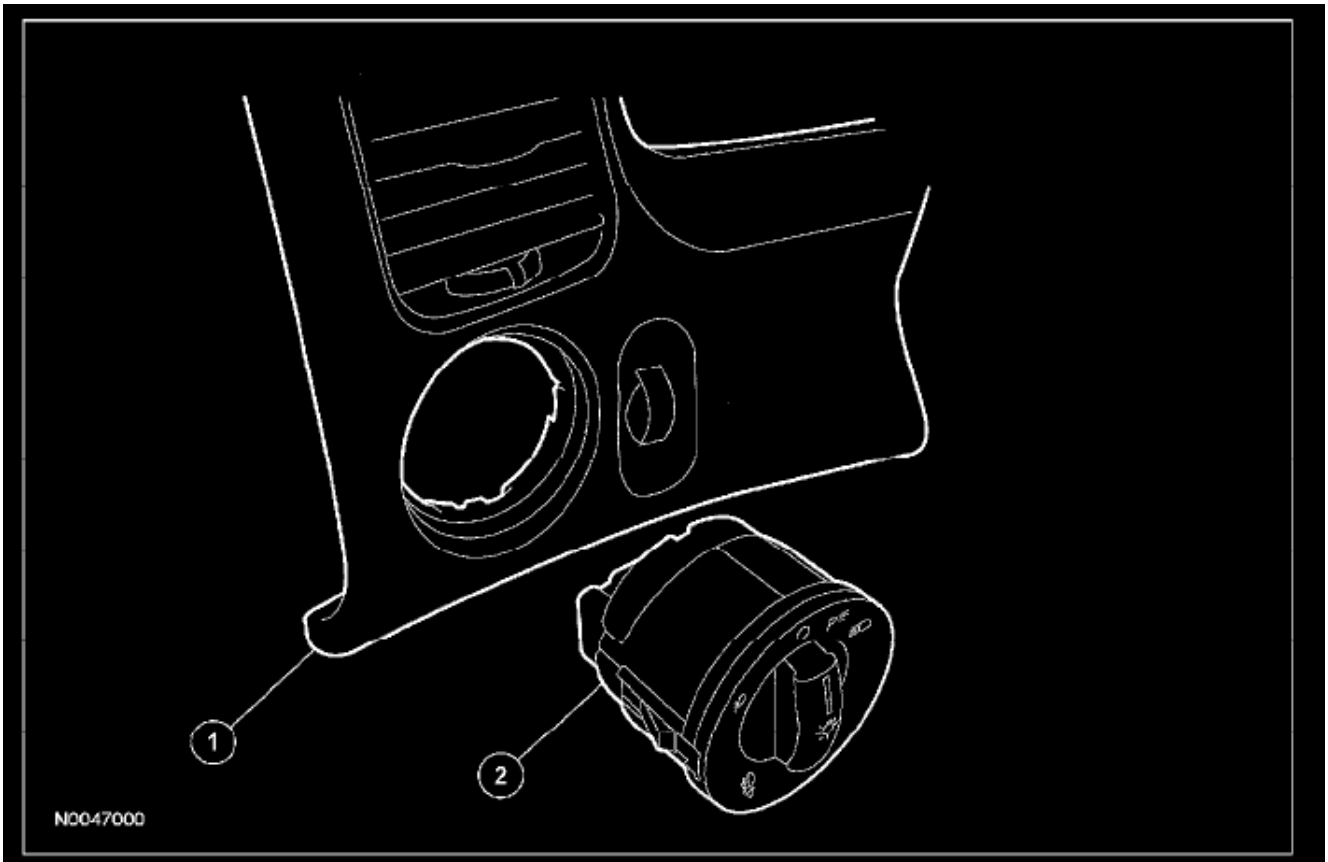


Terminals



Component testing procedure

Circuit to test	Connect self-powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
Headlamp	1 and 6	Off	Open circuit
		Head	Closed circuit
		Park	Open circuit
Park lamps	5 and 10	Off	Open circuit
		Head	Closed circuit
		Fog lamps	Closed circuit
Fog lamps	9 and 10	Off	Open circuit
		Park	Closed circuit
		Head	Closed circuit



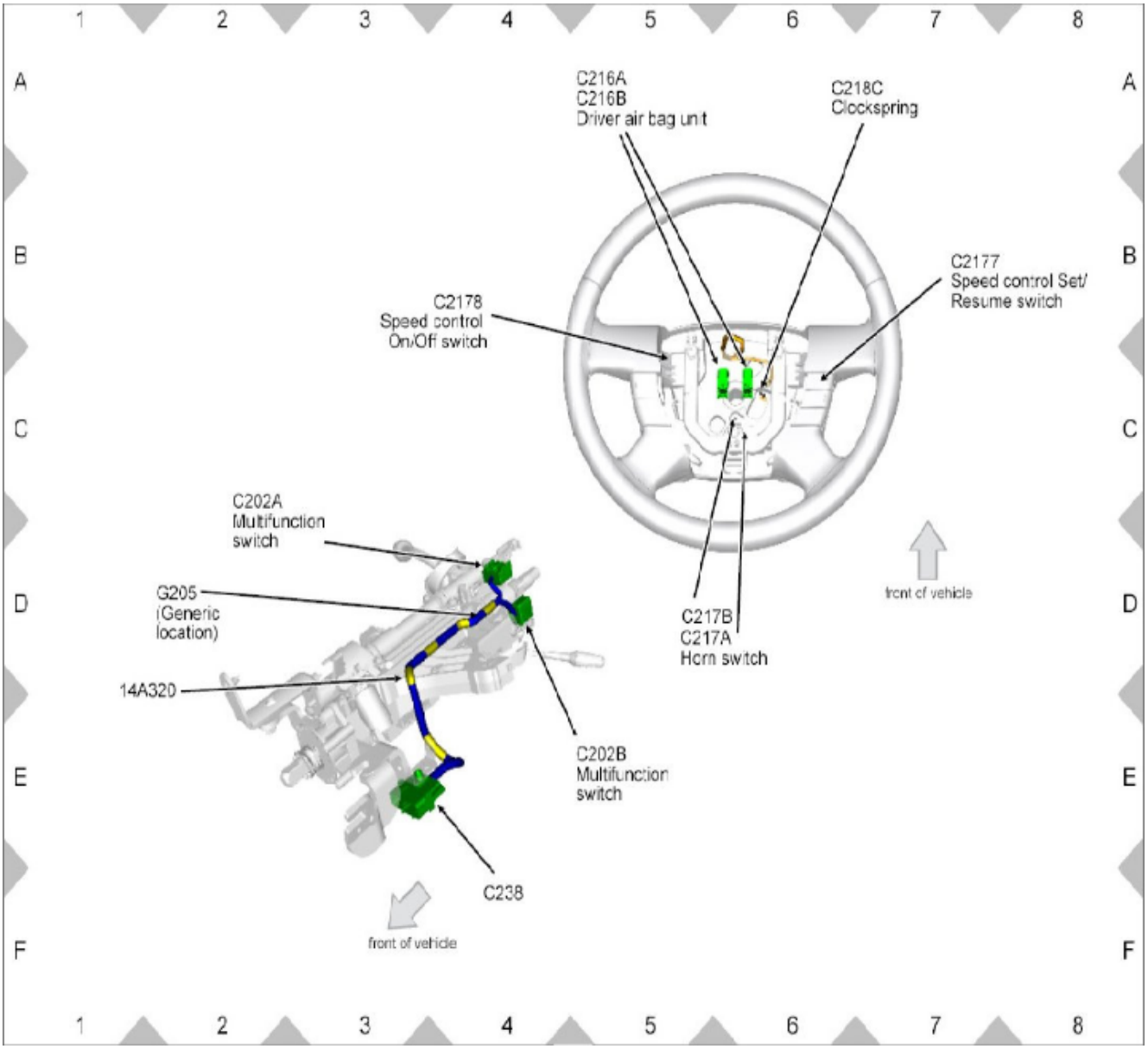
Item	Part Number	Description
1	044D70	Instrument panel finish panel
2	11654	Headlamp switch

Headlamp Switch: Service and Repair

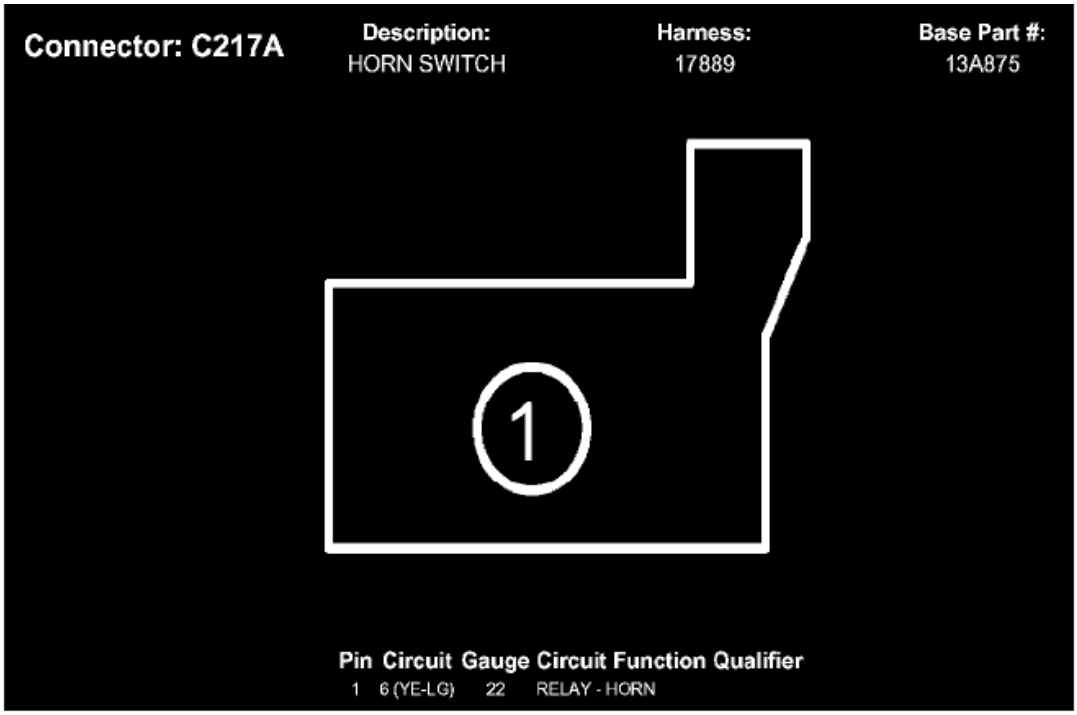
HEADLAMP SWITCH

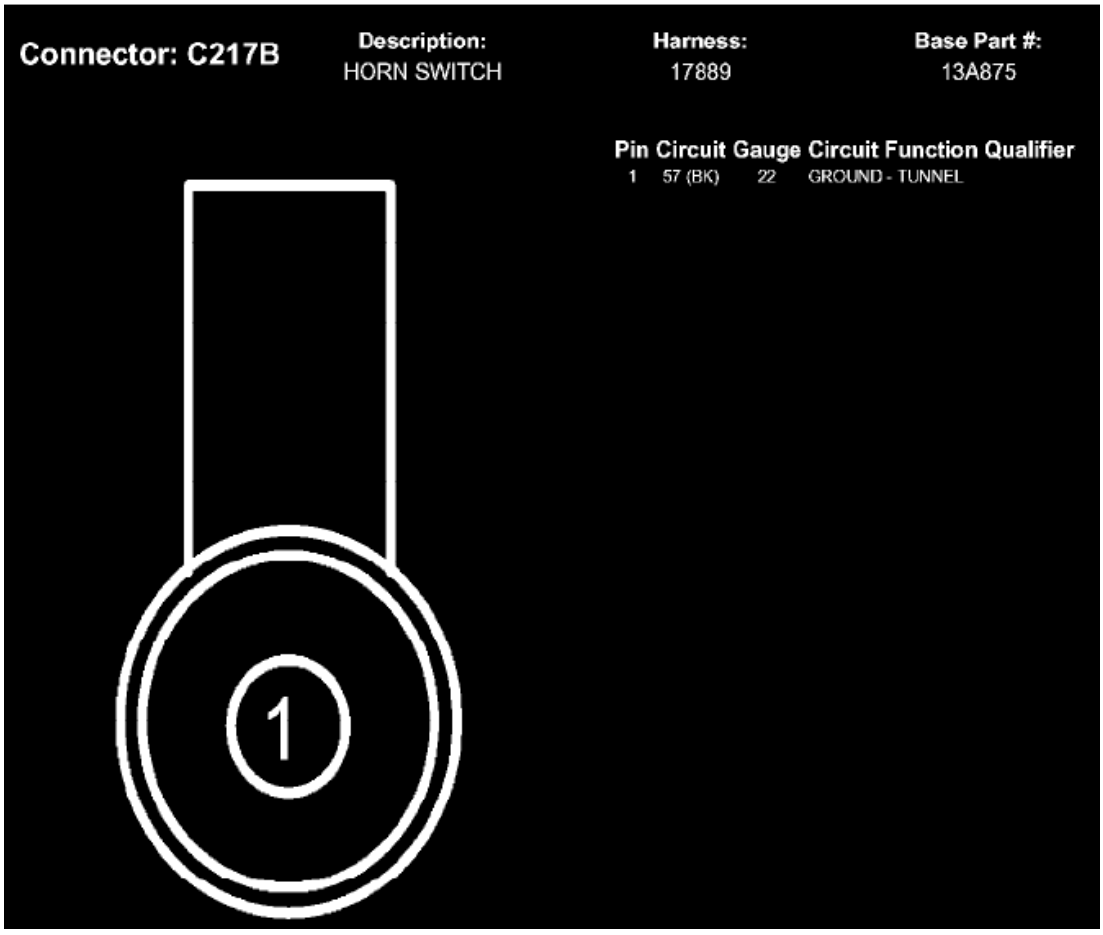
Removal and Installation

1. Remove the instrument panel finish panel. 2. Release the tabs and remove the headlamp switch.
3. To install, reverse the removal procedure.


C216A
C216B
Driver air bag unit
C218C
Clockspring
C2177
Speed control Set/
Resume switch
C2178
Speed control
On/Off switch
C202A
Multifunction
switch
G205
(Generic
location)
14A320
C217B
C217A
Horn switch
front of vehicle
C202B
Multifunction
switch
C238
front of vehicle

View 151-13


Connector: C217A
Description:
HORN SWITCH
Harness:
17889
Base Part #:
13A875
1
Pin Circuit Gauge Circuit Function Qualifier
1 6 (YE-LG) 22 RELAY - HORN

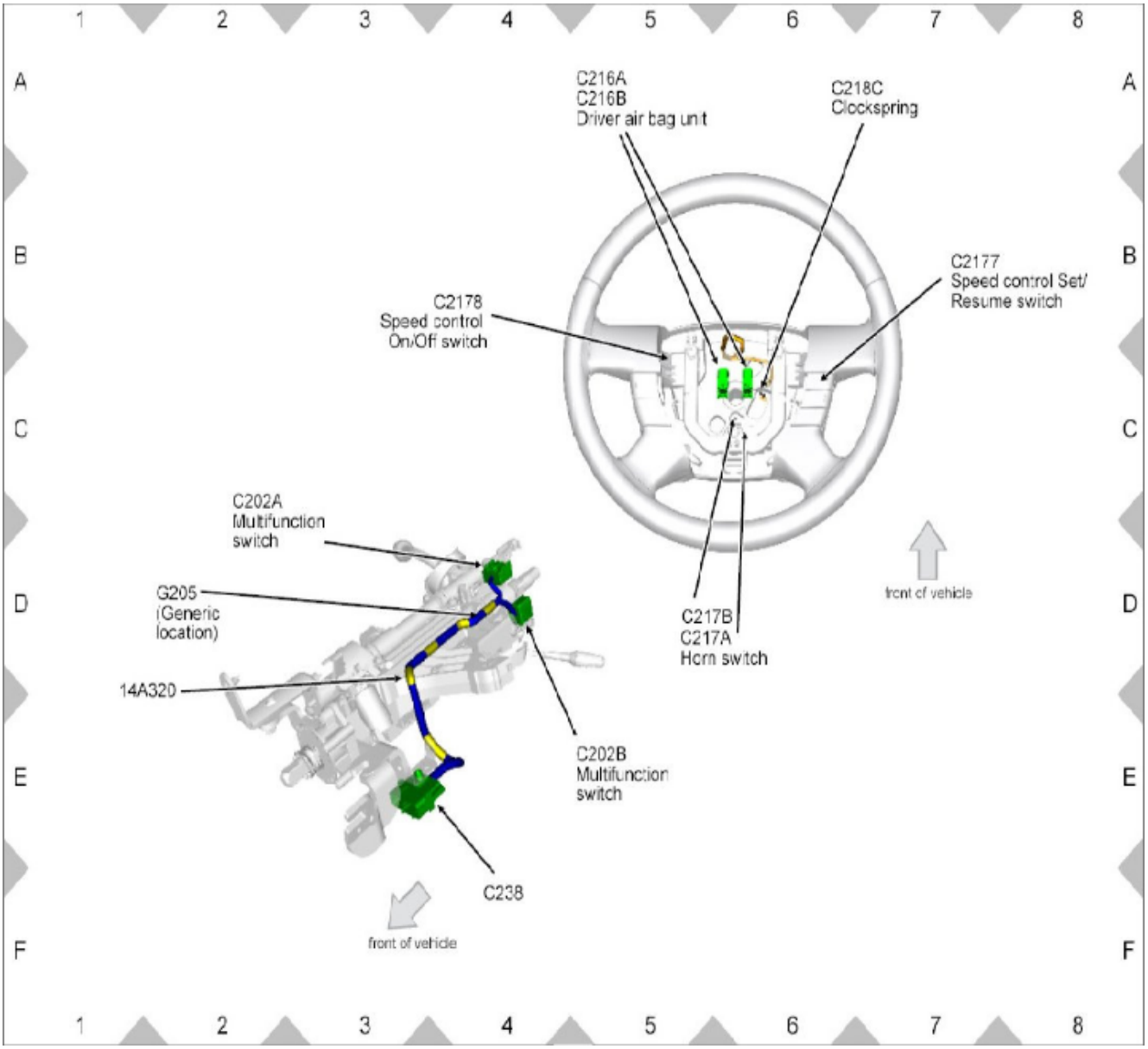

Connector: C217B
Description:
HORN SWITCH
Harness:
17889
Base Part #:
13A875
Pin Circuit Gauge Circuit Function Qualifier
1 57 (BK) 22 GROUND - TUNNEL
1

Horn Switch: Diagrams

C217A

C217B

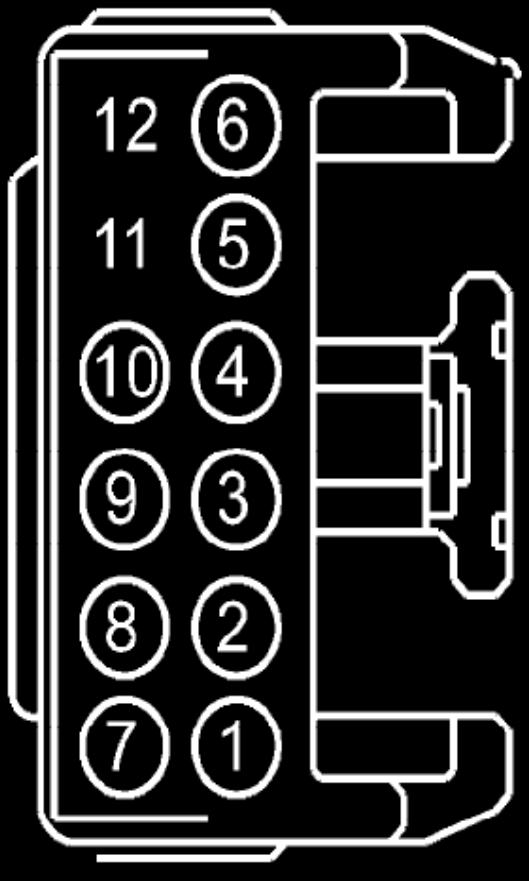
Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Sensors and Switches > Sensors and Switches - Lighting and Horns > Turn Signal Switch > Component Information > Locations



View 151-13

Connector: C202A

Description:	Harness:	Base Part #:
MULTIFUNCTION SWITCH	14A320	13K359



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CRW17 (GN-VT)	20	SWITCH - FRONT WIPER INTERVAL (A)	
2	CRW19 (BU-OG)	20	SWITCH - FRONT WIPER INTERVAL (C)	
3	CRW18 (VT-WH)	20	SWITCH - FRONT WIPER INTERVAL (B)	
4	CRW15 (BN-WH)	20	CTRL MOD. - FRONT WIPER HIGH	
5	CRW07 (GY-BN)	20	SWITCH - FRONT WASHER	
6	CD161 (BK YE)	18	GROUND SEAT BRACKET REAR LEFT	
7	CLS41 (GY-YE)	22	SWITCH - TURN RIGHT	
8	CLS36 (YE)	18	SWITCH - PARK LAMPS RIGHT	
9	CLS35 (VT)	18	SWITCH - PARK LAMPS LEFT	
10	CLS39 (VT-WH)	22	SWITCH - TURN LEFT	
11	*	*	not used	
12	*	*	not used	

Turn Signal Switch: Diagrams

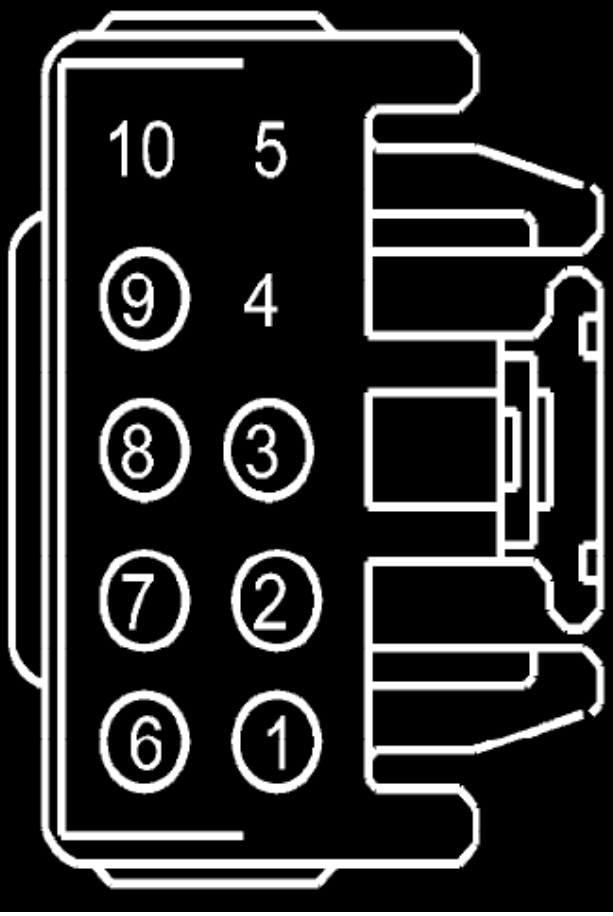
C202A

Connector: C202B

Description: MULTIFUNCTION SWITCH

Harness: 14A320

Base Part #: 13K359



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CCB08 (VT-WH)	16	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL OPEN	
2	CLS42 (VT-BN)	18	INDICATOR FLASHER RELAY - TURN SIGNAL SWITCHED POWER	
3	CLS32 (BN-YE)	18	INDICATOR FLASHER RELAY - HAZARD SWITCHED POWER	
4	*	*	not used	
5	*	*	not used	
6	SBP23 (WH-RD)	14	FUSE - 23 OR CIRCUIT BREAKER	
7	CLF27 (GN-BN)	14	SWITCH - FLASH TO PASS	
8	CLS24 (BN-WH)	16	CTRL MOD. - TURN LAMP RIGHT	
9	CLF18 (BU-WH)	16	SWITCH - BEAM LOW	
10	*	*	not used	

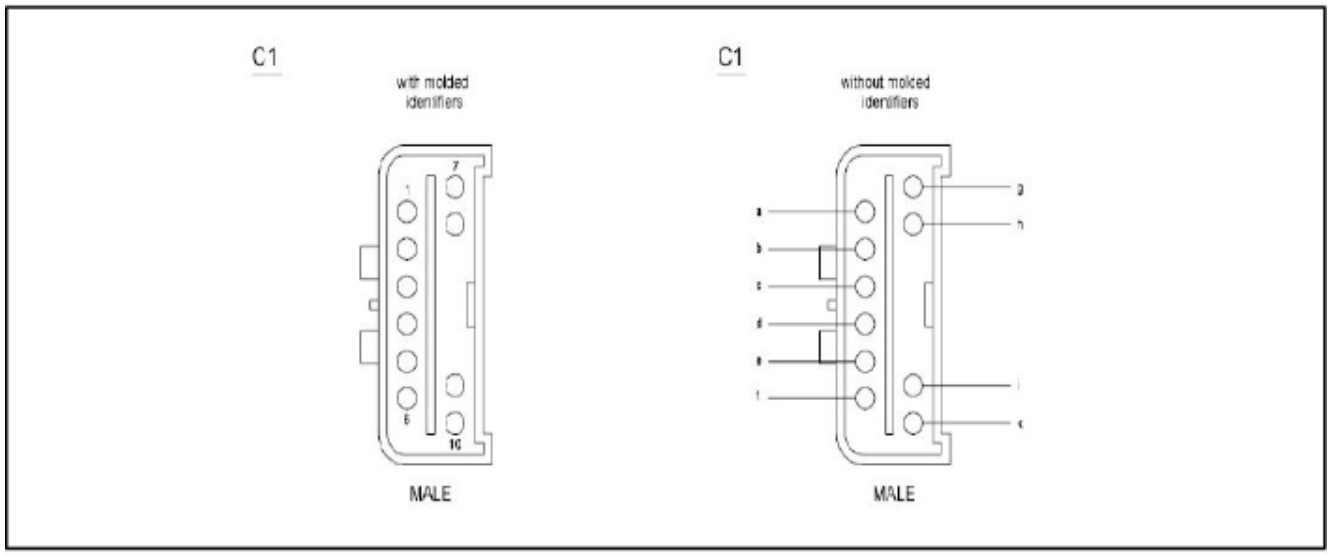
C202B

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



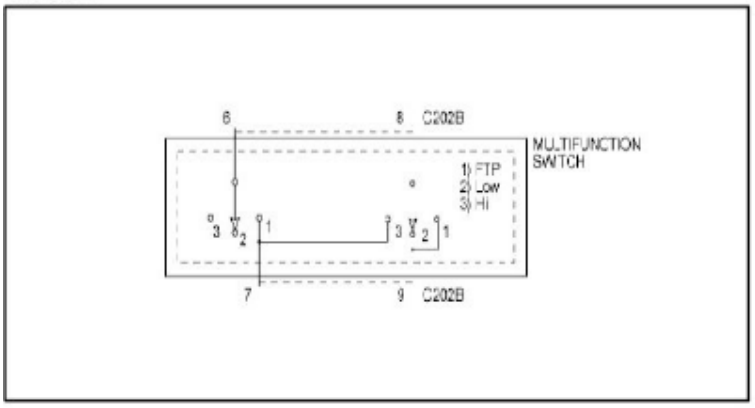
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

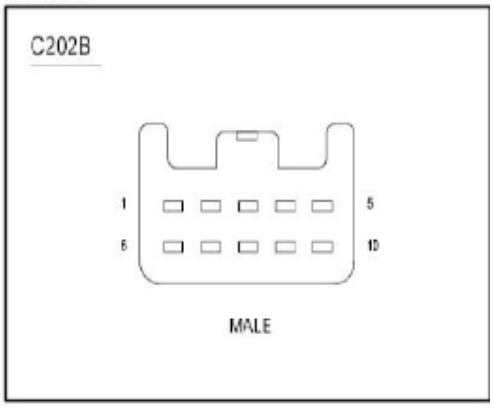
Turn Signal Switch: Testing and Inspection Multifunction Switch, Lamp Portion

Multifunction Switch, Lamp Portion

Schematic



Terminals



Component testing procedure

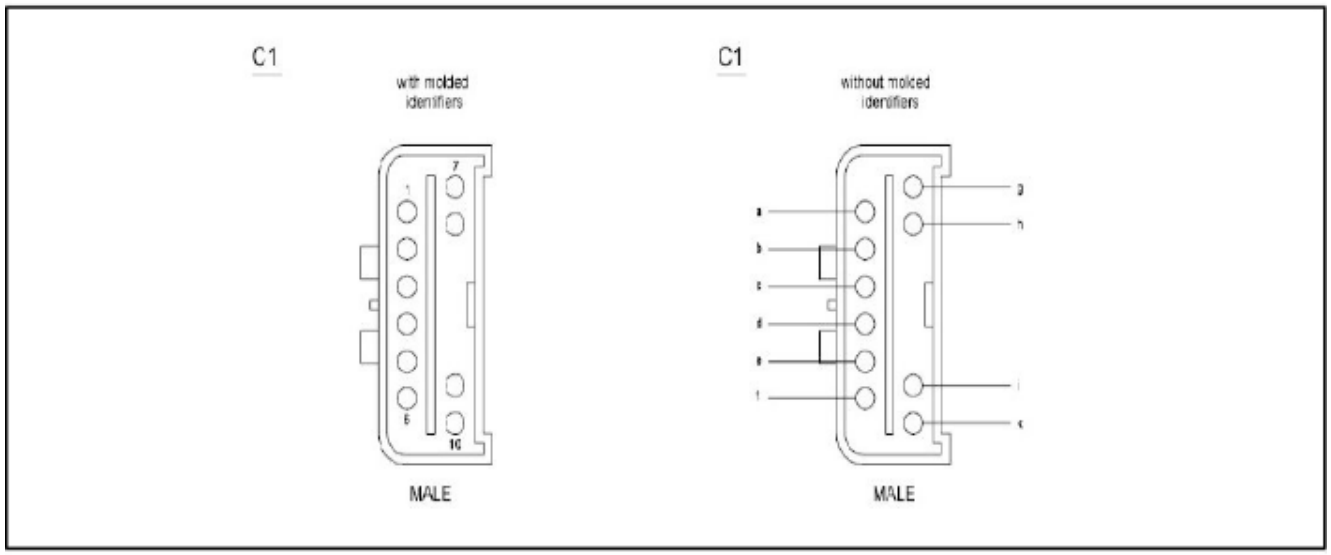
Circuit to test	Connect self□powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
High beams	8 and 7	High beam	Closed circuit
		Flash□to□pass	Open circuit
		Low beam	Open circuit
Low beam/Flash□ to□pass	8 and 9	High beam	Open circuit
		Flash□to□pass	Closed circuit
		Low beam	Closed circuit
	6 and 7	High beam	Open circuit
		Flash□to□pass	Closed circuit
		Low beam	Open circuit

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



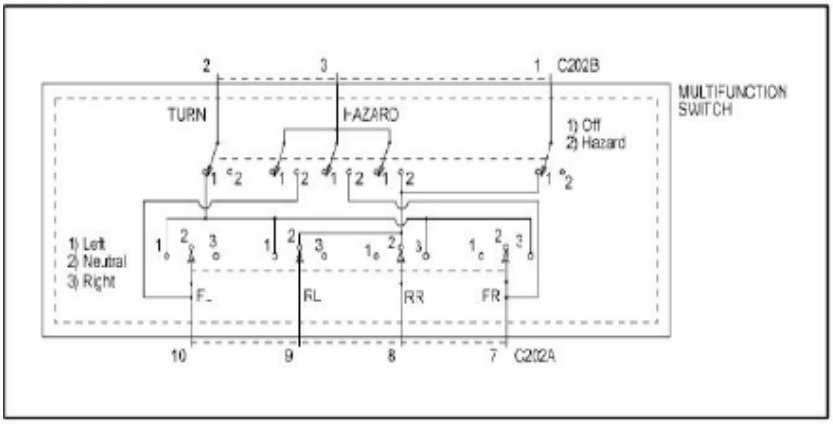
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

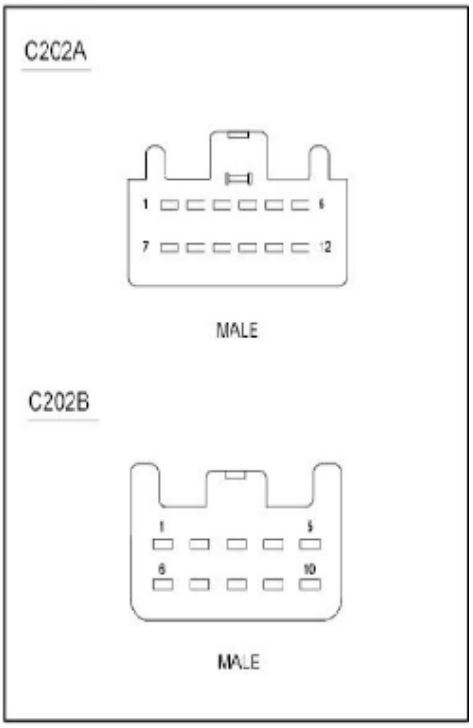
Turn Signal Switch: Testing and Inspection Multifunction Switch, Turn Portion

Multifunction Switch, Turn Portion

Schematic



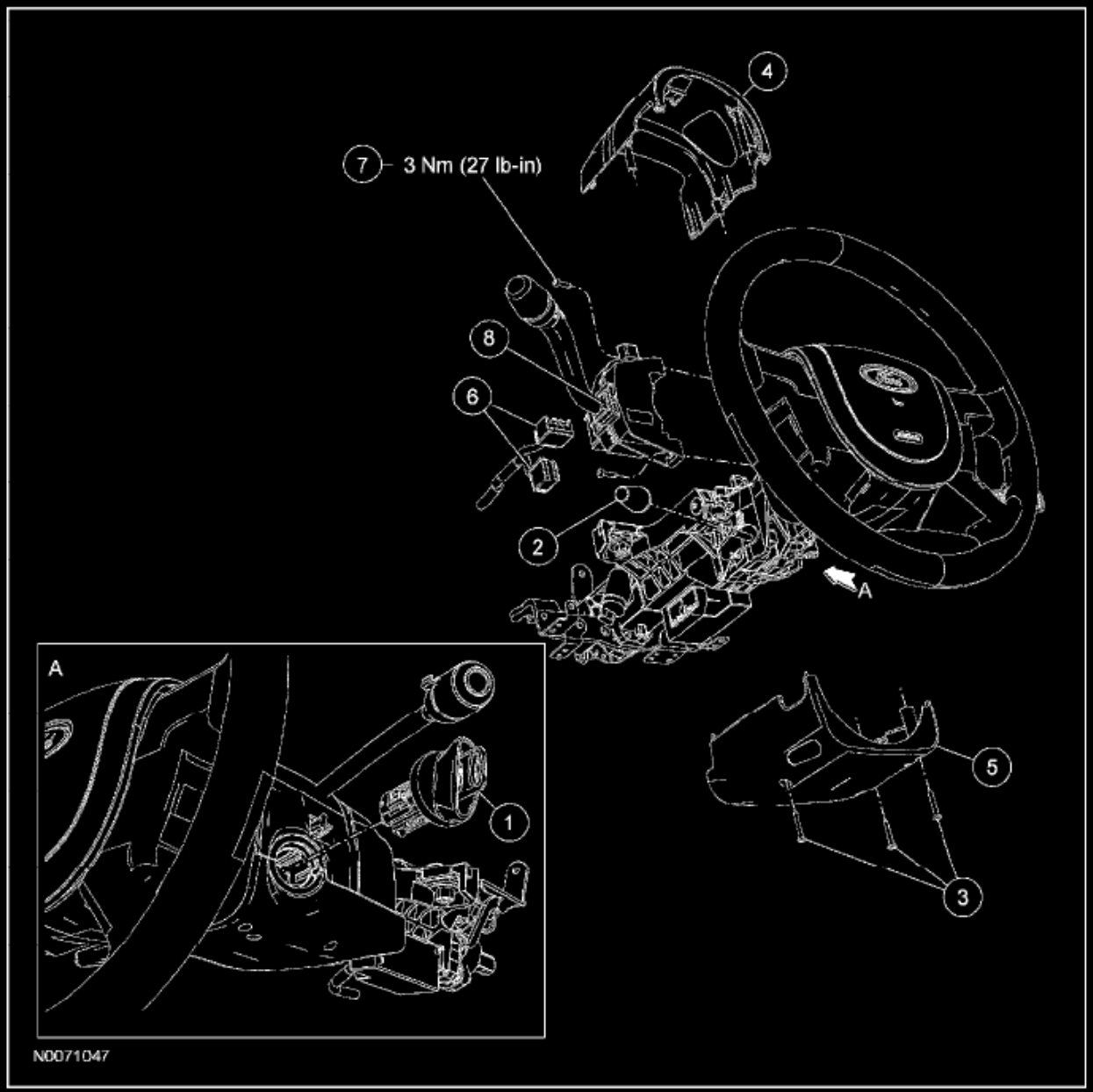
Terminals



Component testing procedure

Circuit to test	Connect self-powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
Turn signal	C202b-2 and C202a-10	Left turn	Closed circuit
	C202b-2 and C202a-9	Left turn	Closed circuit
	C202b-2 and C202a-7	Right turn	Closed circuit
	C202b-2 and C202a-8	Right turn	Closed circuit
Hazard	C202b-3 and C202a-10	Turn signal switch in neutral, Hazard On	Closed circuit
	C202b-3 and C202a-7		
	C202b-3 and C202a-9		
	C202b-3 and C202a-8		
	C202b-1 and C202a-10	Turn signal switch in neutral, Hazard Off	Closed circuit
	C202b-1 and C202a-8		

Steering Column Multifunction Switch



Item	Part Number	Description
1	11582	Ignition switch lock cylinder
2	3F609	Tilt release lever/ handle
3	391727	Steering column shroud screws (3 required)
4	3530	Upper steering column shroud
5	3533	Lower steering column shroud

(Continued)

Item	Part Number	Description
6	—	Steering column multi-function switch electrical connectors (part of 14A320)
7	390345	Steering column multi-function switch screws (2 required)
8	13K359	Steering column multi-function switch

Turn Signal Switch: Service and Repair

Steering Column Multifunction Switch

Steering Column Multifunction Switch

Removal and Installation

1. Remove the ignition switch lock cylinder.

1 Insert the ignition key into the ignition switch lock cylinder and turn to the RUN position.

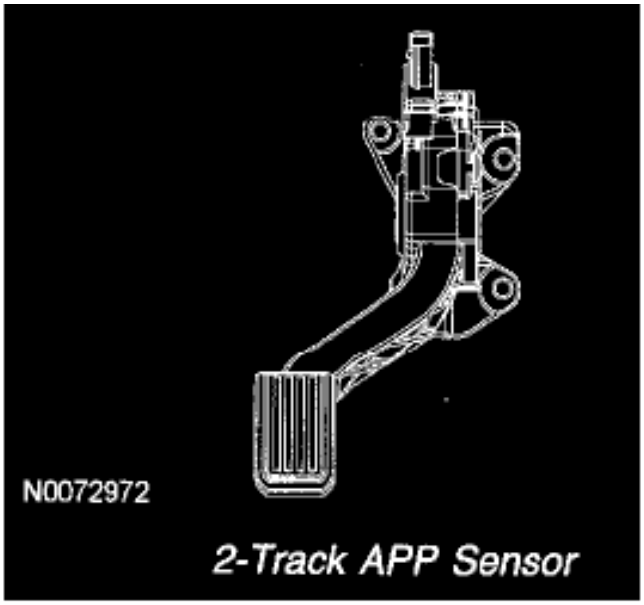
2 Push the ignition switch lock cylinder release tab with a punch while pulling out the ignition switch lock cylinder.

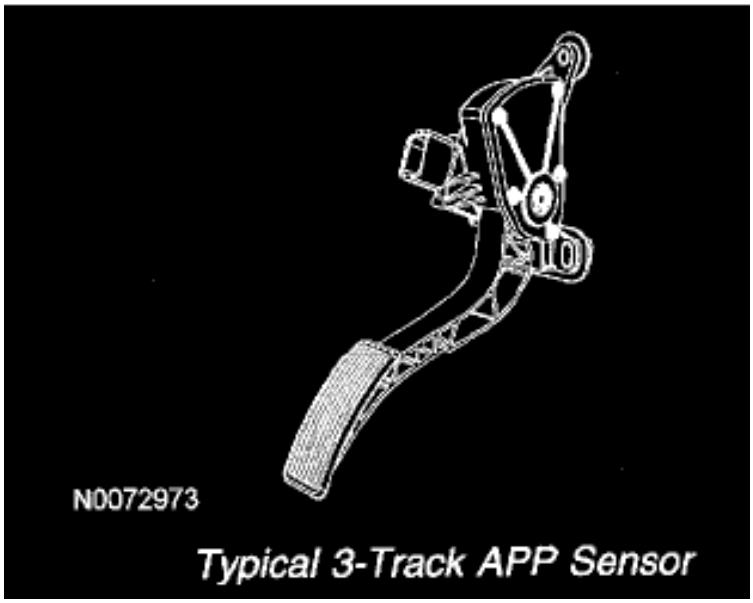
2. If equipped, remove the tilt release lever/ handle.

3. Remove the 3 steering column shroud screws and the upper and lower steering column shrouds. 4. Disconnect the multi-function switch electrical connectors. 5. Remove the 2 multi-function switch screws and the multi-function switch.

^ To install, tighten to 3 Nm (27 lb-inch).

6. To install, reverse the removal procedure.





Accelerator Pedal Position Sensor: Description and Operation

ACCELERATOR PEDAL POSITION (APP) SENSOR

The APP sensor is an input to the powertrain control module (PCM) and is used to determine the amount of torque requested by the operator. Depending on the application either a 2-track or 3-track APP sensor is used.

2-Track APP Sensor

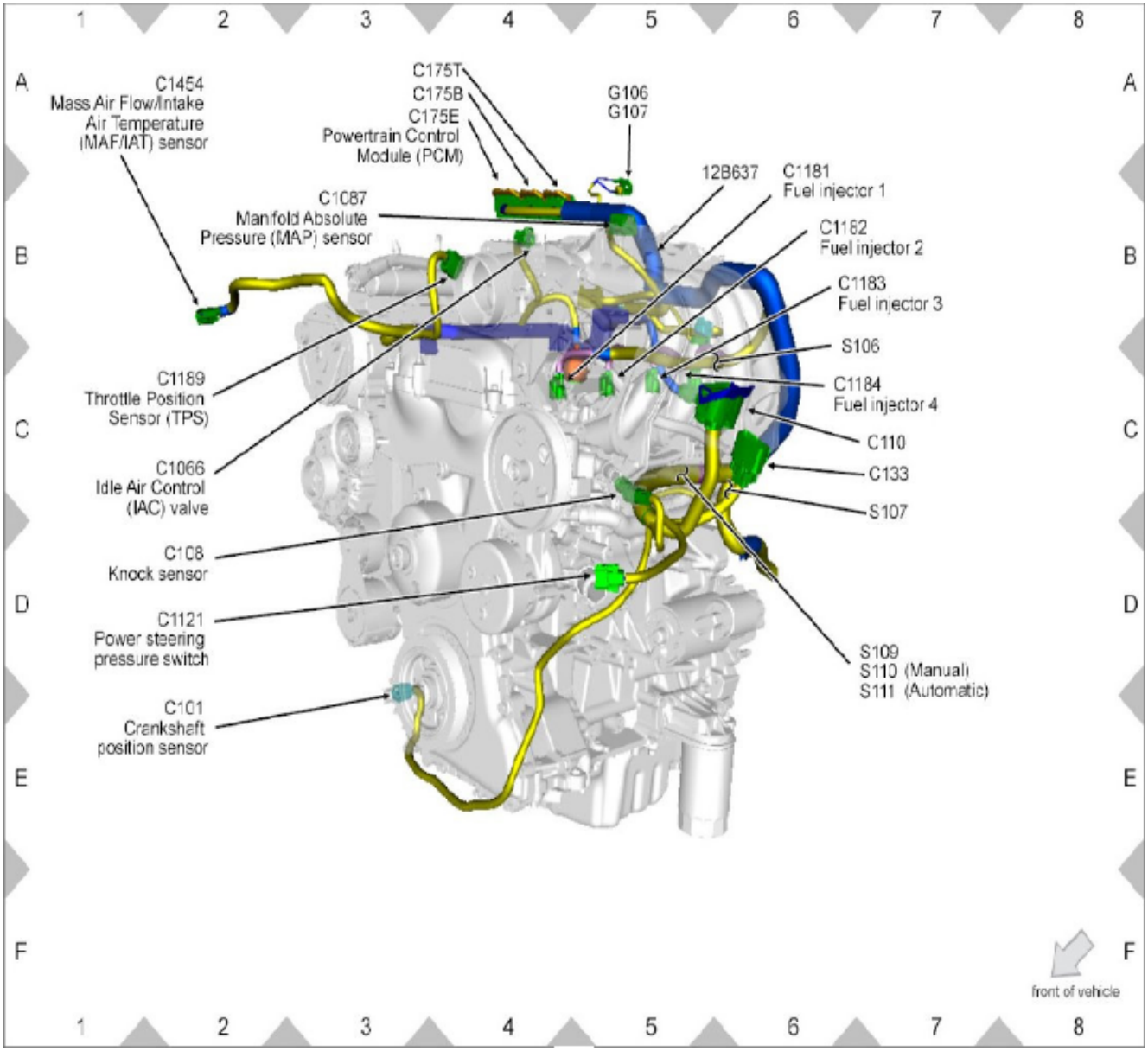
2-Track APP Sensor

There are 2 pedal position signals in the sensor. Both signals, APP1 and APP2, have a positive slope (increasing angle, increasing voltage), but are offset and increase at different rates. The 2 pedal position signals make sure the PCM receives a correct input even if 1 signal has a concern. The PCM determines if a signal is incorrect by calculating where it should be, inferred from the other signals. If a concern is present with one of the circuits the other input is used. There are 2 reference voltage circuits, 2 signal return circuits, and 2 signal circuits (a total of 6 circuits and pins) between the PCM and the APP sensor assembly. The reference voltage circuits and the signal return circuits are shared with the reference voltage circuit and signal return circuit used by the electronic throttle body (ETB) throttle position sensor. The pedal position signal is converted to pedal travel degrees (rotary angle) by the PCM. The software then converts these degrees to counts, which is the input to the torque based strategy.

3-Track APP Sensor

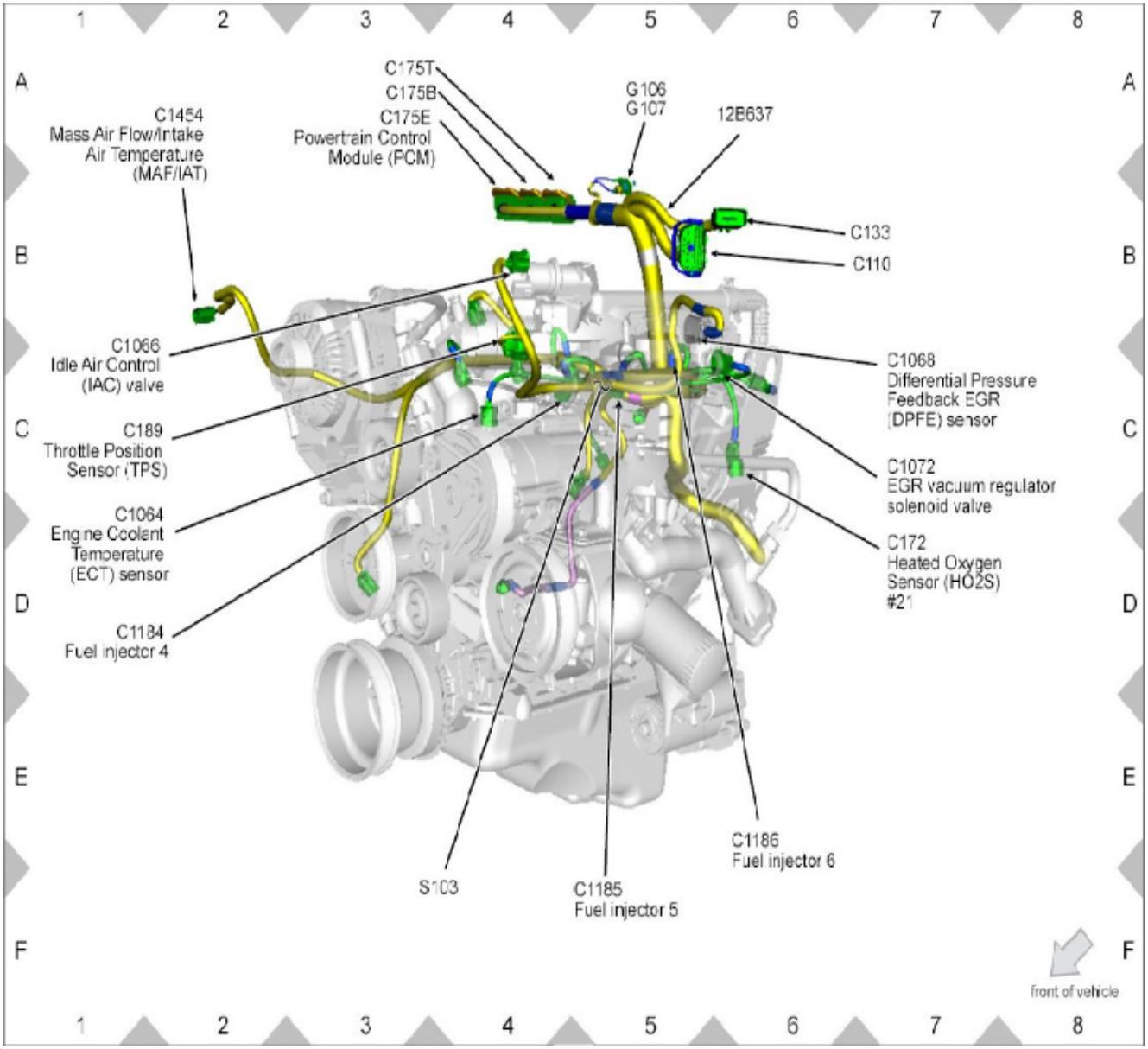
Typical 3-Track APP Sensor

There are 3 pedal position signals in the sensor. Signal 1, APP1, has a negative slope (increasing angle, decreasing voltage) and signals 2 and 3, APP2 and APP3, both have a positive slope (increasing angle, increasing voltage). During normal operation APP1 is used as the indication of pedal position by the strategy. The 3 pedal position signals make sure the PCM receives a correct input even if 1 signal has a concern. The PCM determines if a signal is incorrect by calculating where it should be, inferred from the other signals. If a concern is present with one of the circuits the other inputs are used. The pedal position signal is converted to pedal travel degrees (rotary angle) by the PCM. The software then converts these degrees to counts, which is the input to the torque based strategy. There are 2 reference voltage circuits, 2 signal return circuits, and 3 signal circuits (a total of 7 circuits and pins) between the PCM and the APP sensor assembly. The reference voltage circuits and the signal return circuits are shared with the reference voltage circuit and signal return circuit used by the electronic throttle body (ETB) throttle position sensor.

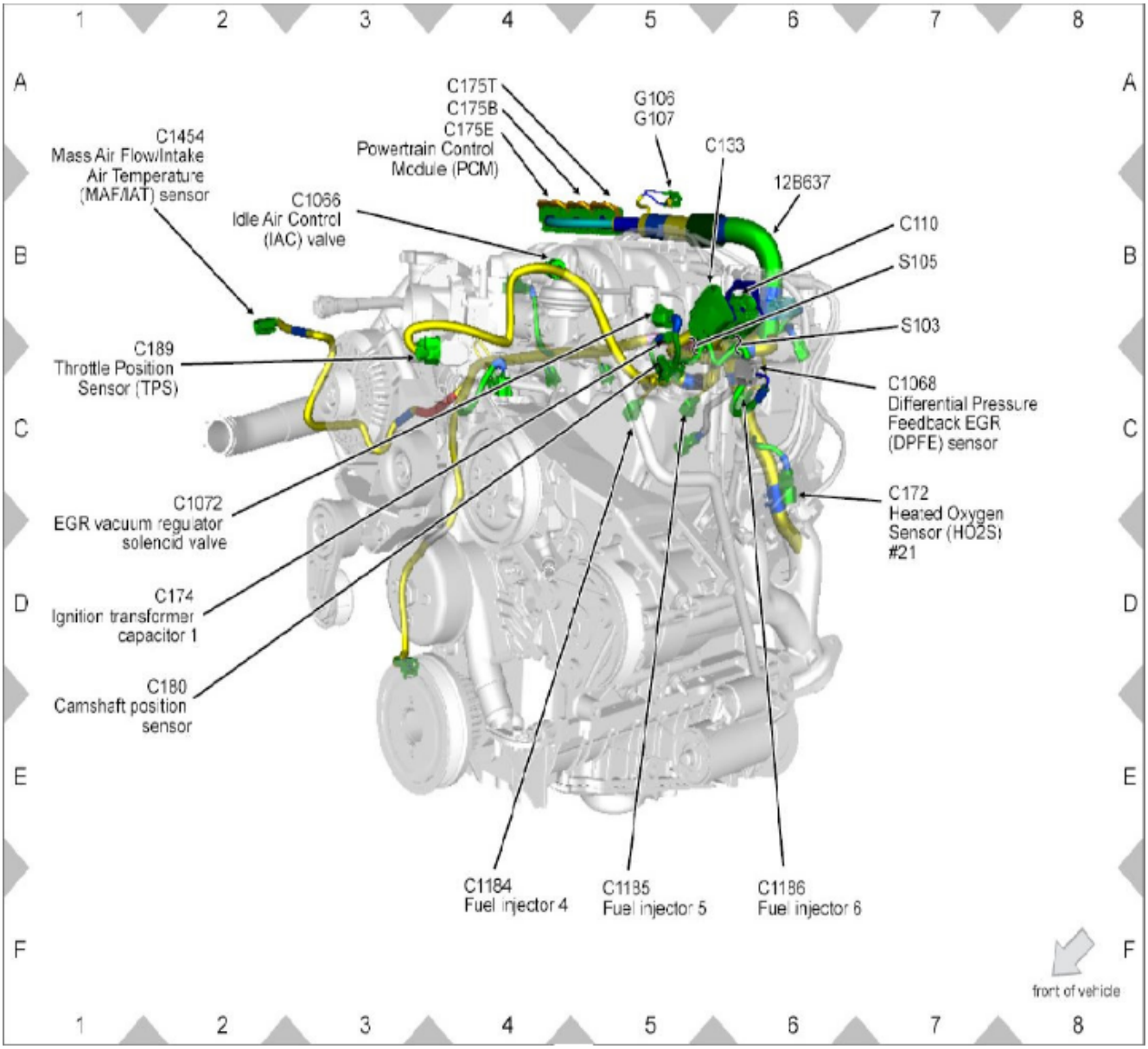


Air Flow Meter/Sensor: Locations

View 151-3


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
12B637
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT)
C133
C110
C1066
Idle Air Control (IAC) valve
C189
Throttle Position Sensor (TPS)
C1064
Engine Coolant Temperature (ECT) sensor
C1184
Fuel injector 4
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
S103
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

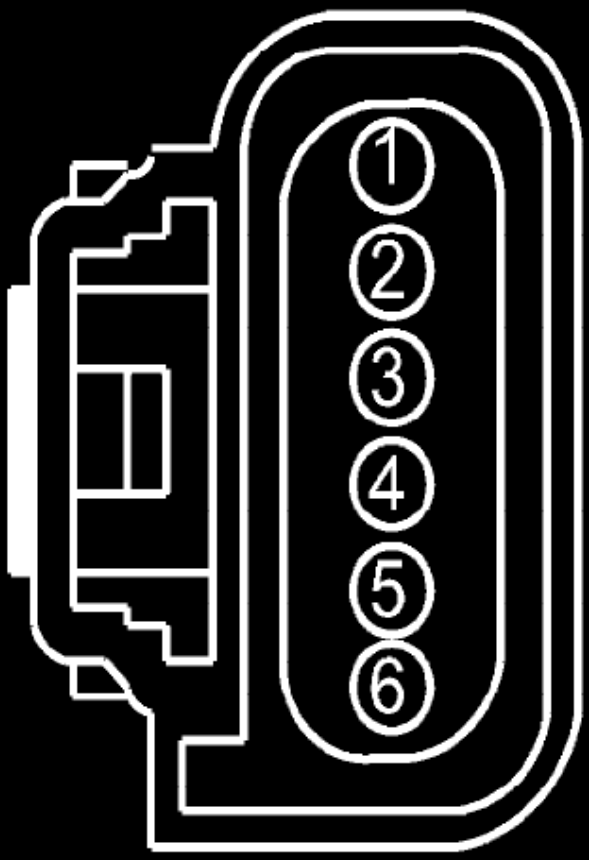
View 151-5


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
C133
12B637
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor
C1066
Idle Air Control (IAC) valve
C110
S105
S103
C189
Throttle Position Sensor (TPS)
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
C174
Ignition transformer capacitor 1
C180
Camshaft position sensor
C1184
Fuel injector 4
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-7

Connector: C1454

Description:	Harness:	Base Part #:
MASS AIR FLOW/INTAKE AIR TEMPERATURE (MAF/IAT) SENSOR	12B637	



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE740 (VT-GY)	20	SENSOR - INTAKE AIR TEMPERATURE (IAT)	
2	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	
3	VE807 (YE-VT)	20	SENSOR - MASS AIR FLOW LH BANK OR 1ST BANK OR UNIQUE (MAF)	
4	RE320 (BU)	20	CTRL MOD. - POWERTRAIN # MASS AIR FLOW SEN. LH BANK OR 1ST BANK (MAFRTN)	
5	GD108 (BK-VT)	20	GROUND - CHASSIS/BATTERY	
6	CBB43 (GY)	20	FUSE - 43 OR CIRCUIT BREAKER	

C1454

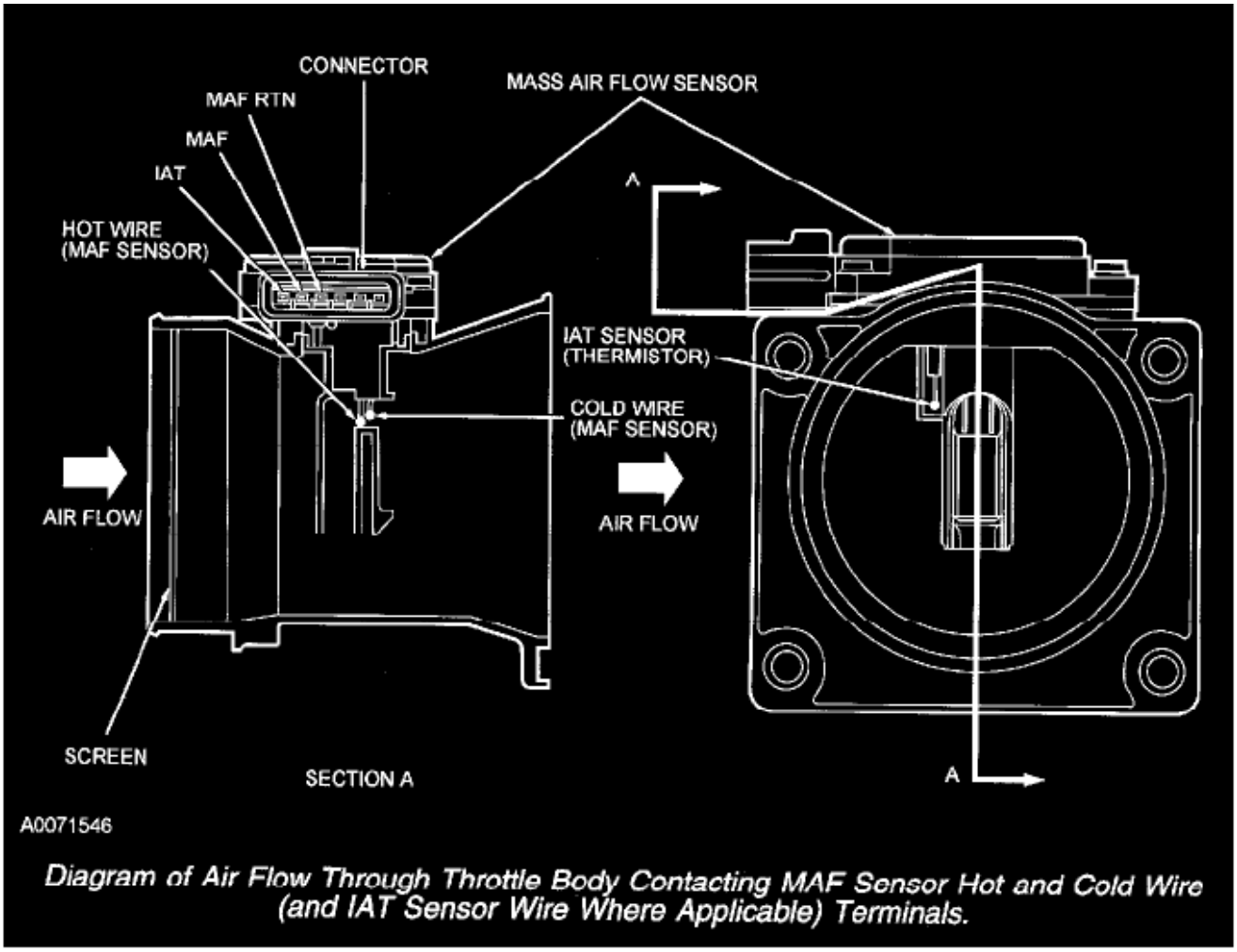
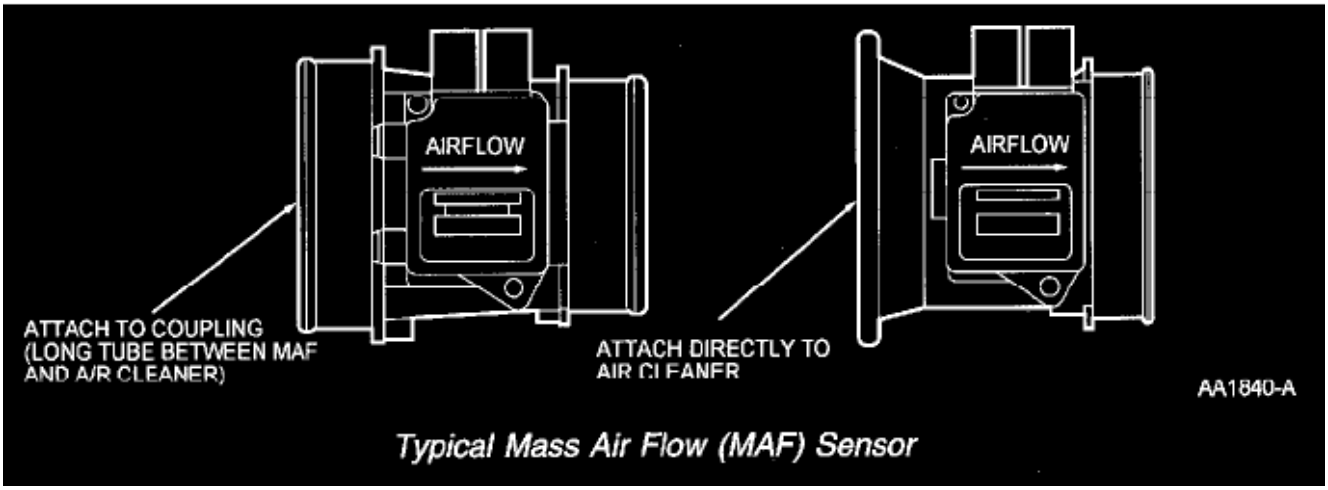


Diagram of Air Flow Through Throttle Body Contacting MAF Sensor Hot and Cold Wire (and IAT Sensor Wire Where Applicable) Terminals.



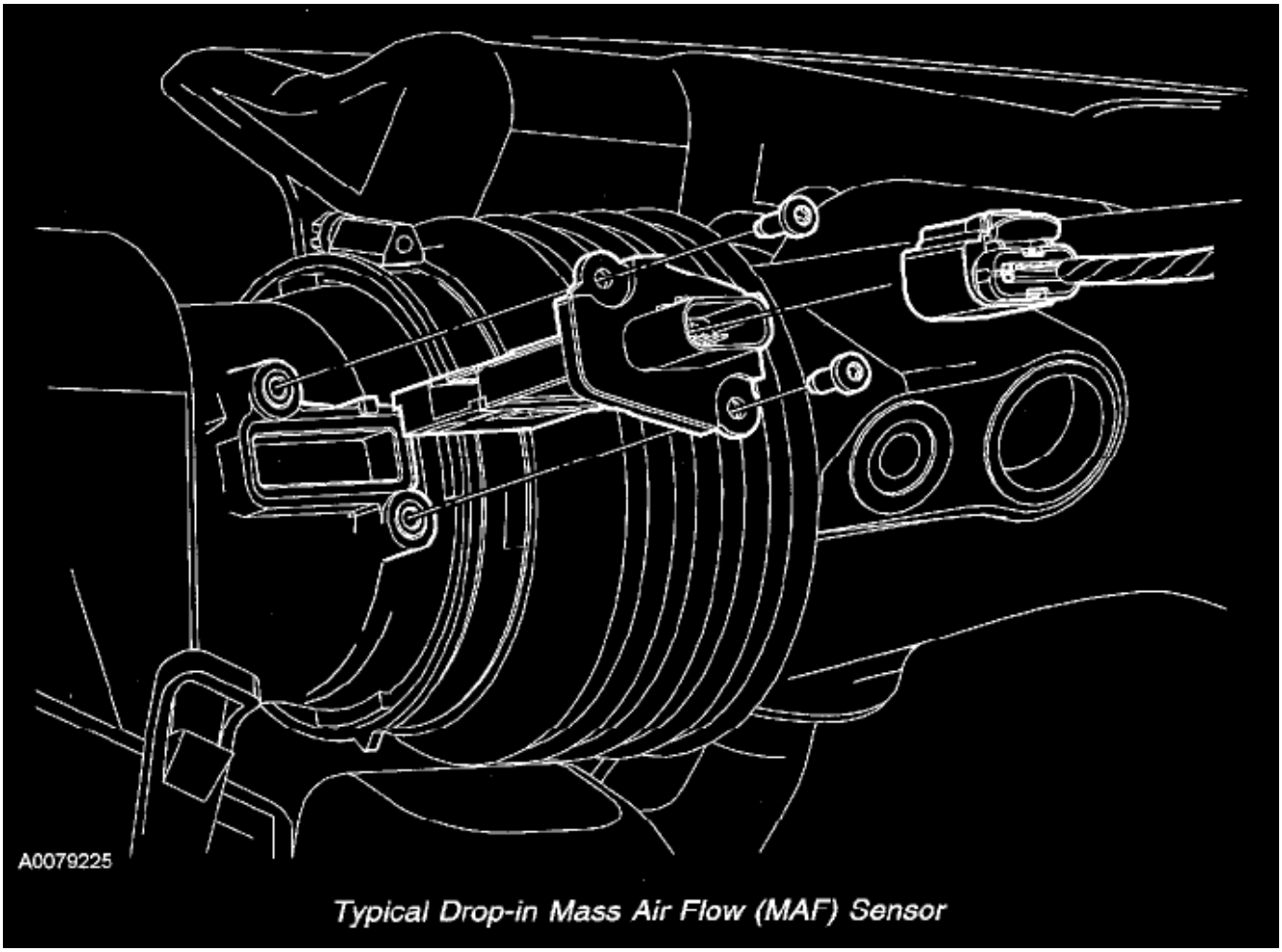
Typical Mass Air Flow (MAF) Sensor

Air Flow Meter/Sensor: Description and Operation

MASS AIR FLOW (MAF) SENSOR

Diagram Of Air Flow Through Throttle Body Contacting MAF Sensor Hot And Cold Wire (and IAT Sensor Wire Where Applicable) Terminals

Typical Mass Air Flow (MAF) Sensor

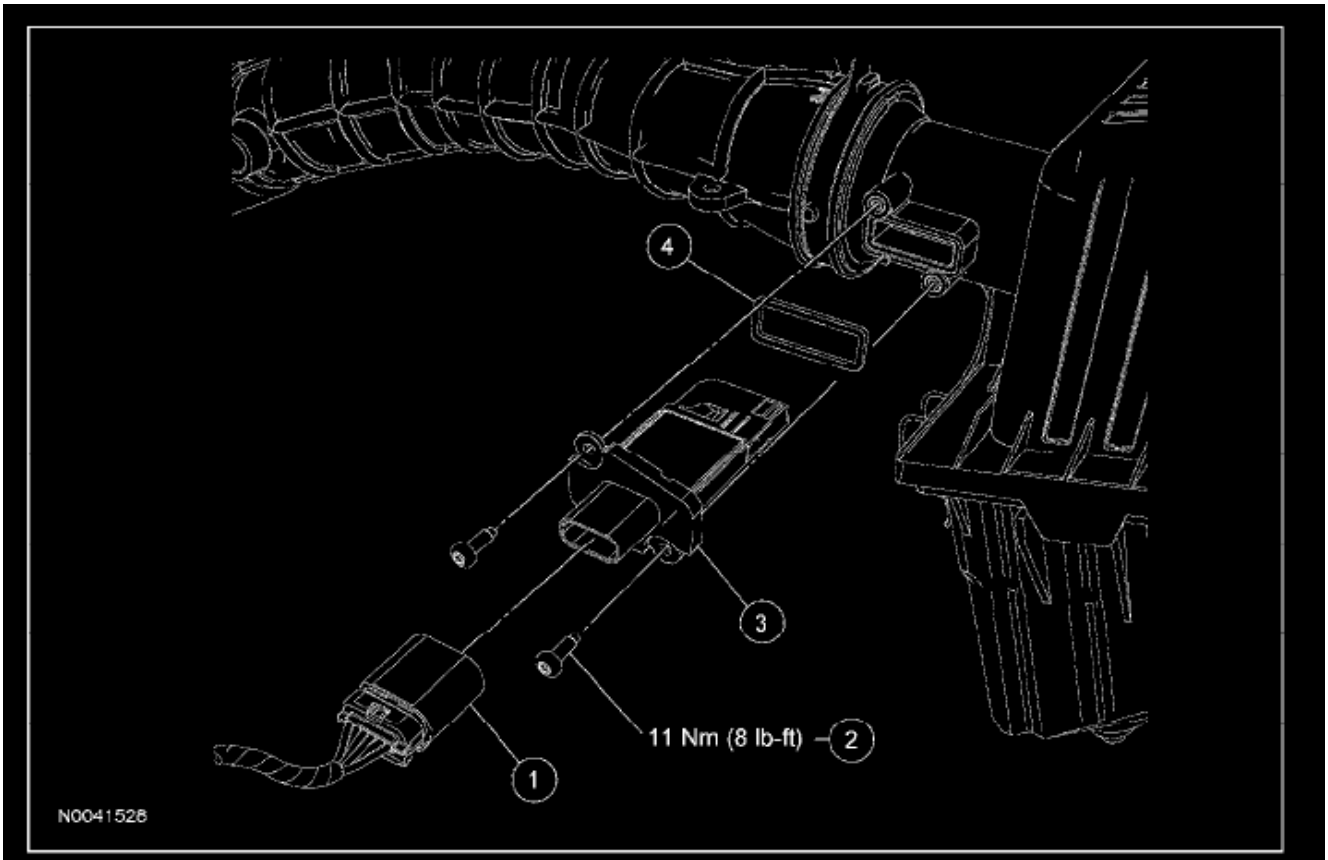


Typical Drop-in Mass Air Flow (MAF) Sensor

Typical Drop-in Mass Air Flow (MAF) Sensor

The MAF sensor uses a hot wire sensing element to measure the amount of air entering the engine. Air passing over the hot wire causes it to cool. This hot wire is maintained at 200°C (392°F) above the ambient temperature as measured by a constant cold wire. The current required to maintain the temperature of the hot wire is proportional to the mass air flow. The MAF sensor then outputs an analog voltage signal to the PCM proportional to the intake air mass. The PCM calculates the required fuel injector pulse width in order to provide the desired air/fuel ratio. This input is also used in determining transmission electronic pressure control (EPC), shift and torque converter clutch scheduling.

The MAF sensor is located between the air cleaner and the throttle body or inside the air cleaner assembly. Most MAF sensors have integrated bypass technology with an integrated intake air temperature (IAT) sensor. The hot wire electronic sensing element must be replaced as an assembly. Replacing only the element may change the air flow calibration.



Item	Part Number	Description
1	14A464	Mass air flow (MAF) sensor electrical connector (part of 12B637)
2	W709287	MAF sensor bolt (2 required)
3	12B605	MAF sensor
4	—	MAF sensor gasket

Air Flow Meter/Sensor: Service and Repair

MASS AIR FLOW (MAF) SENSOR

Removal and Installation

1. Disconnect the mass air flow (MAF) sensor electrical connector. 2. Remove the 2 bolts, the MAF sensor and discard the gasket.

- To install, tighten to 11 Nm (8 lb-ft).

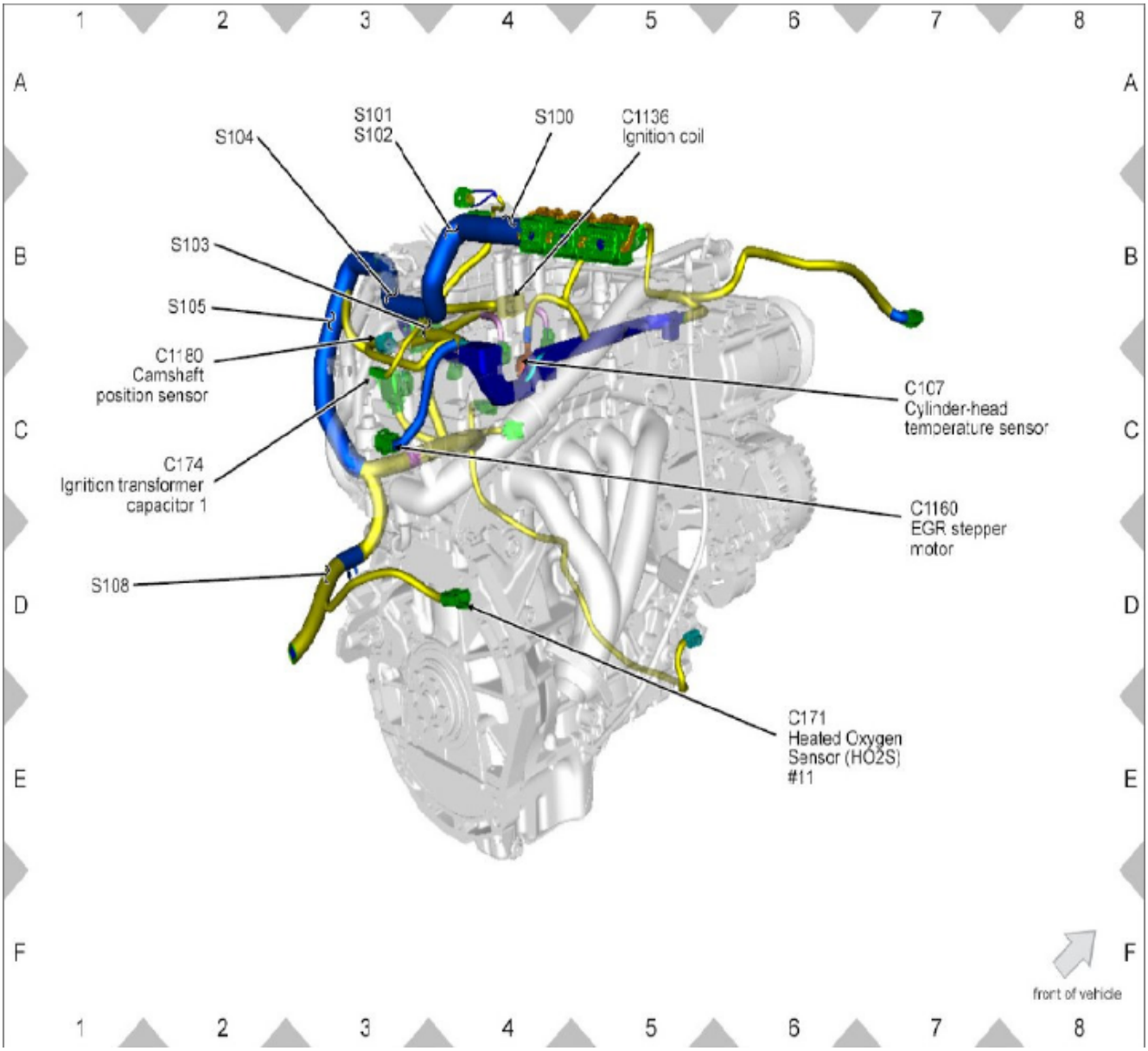
3. CAUTION: Do not tamper with the mass air flow (MAF) sensing elements located in the airflow bypass. Tampering may result in

failure.

NOTE: The MAF sensor module and body are calibrated and installed as a unit.

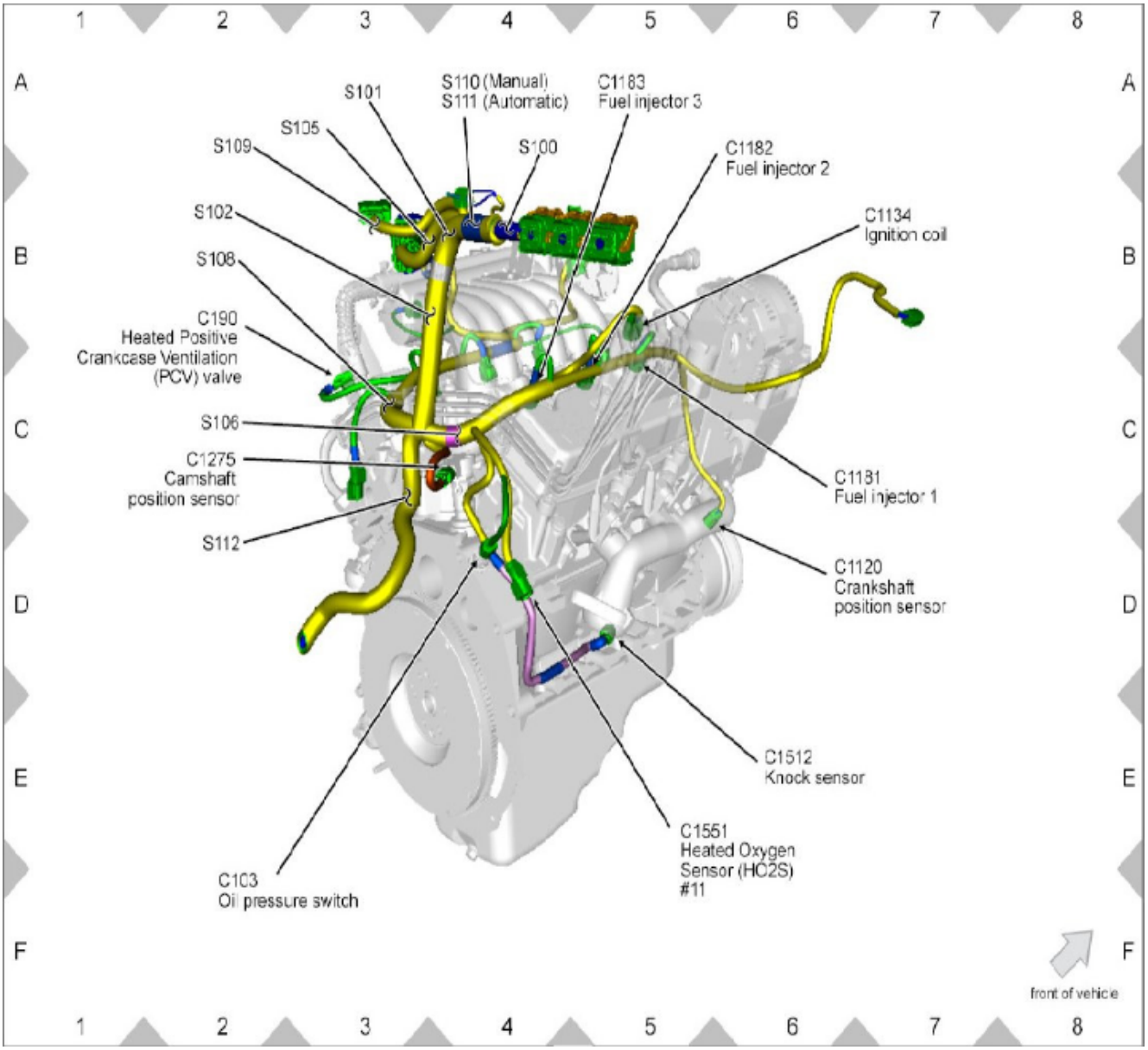
To install, reverse the removal procedure. -

Install a new gasket.

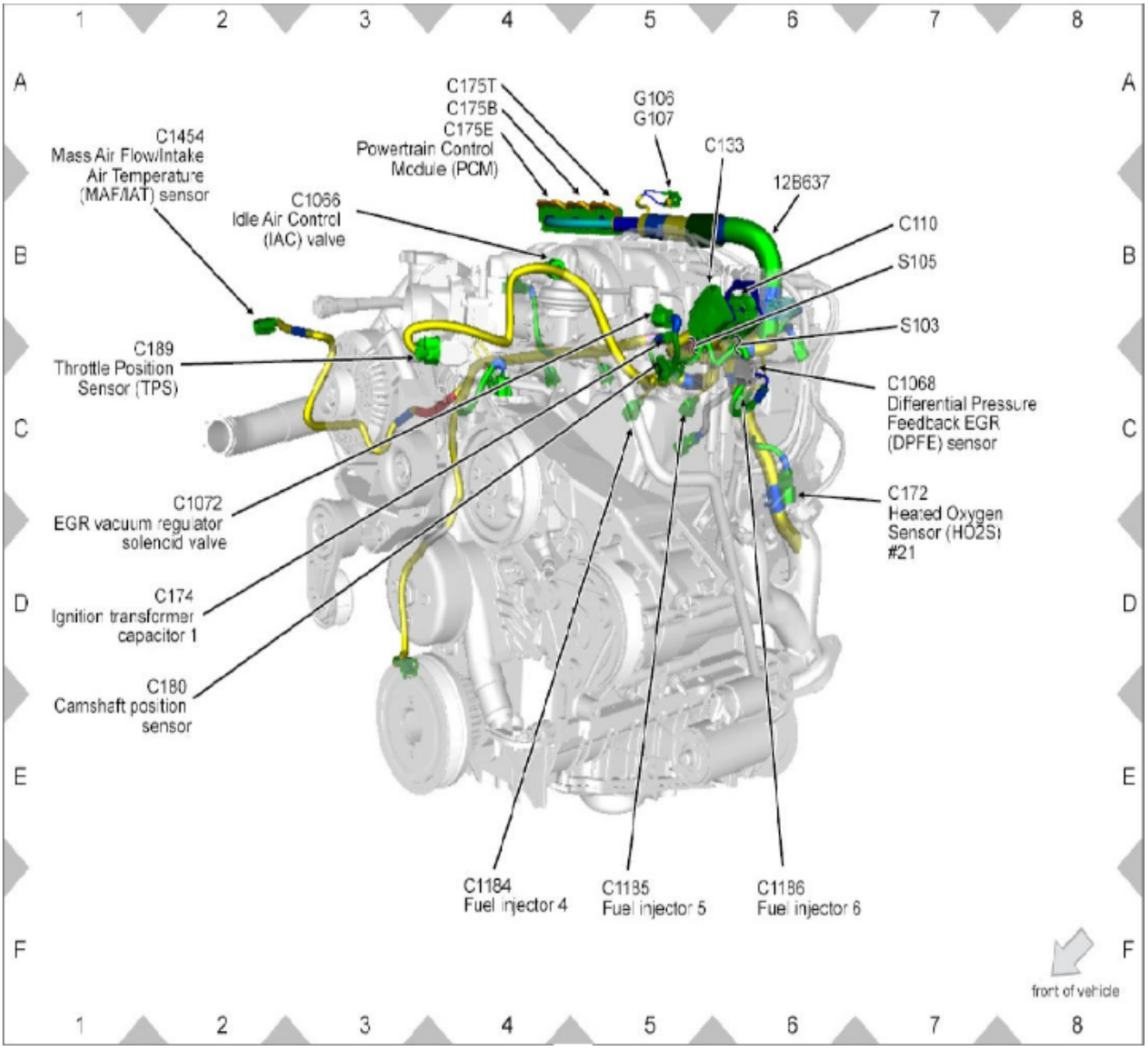


Camshaft Position Sensor: Locations

View 151-4


S101
S110 (Manual)
S111 (Automatic)
C1183
Fuel injector 3
S105
S109
S100
C1182
Fuel injector 2
S102
C1134
Ignition coil
S108
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
C1275
Camshaft
position sensor
S112
C1181
Fuel injector 1
C1120
Crankshaft
position sensor
C1512
Knock sensor
C1551
Heated Oxygen
Sensor (HO2S)
#11
C103
Oil pressure switch
front of vehicle

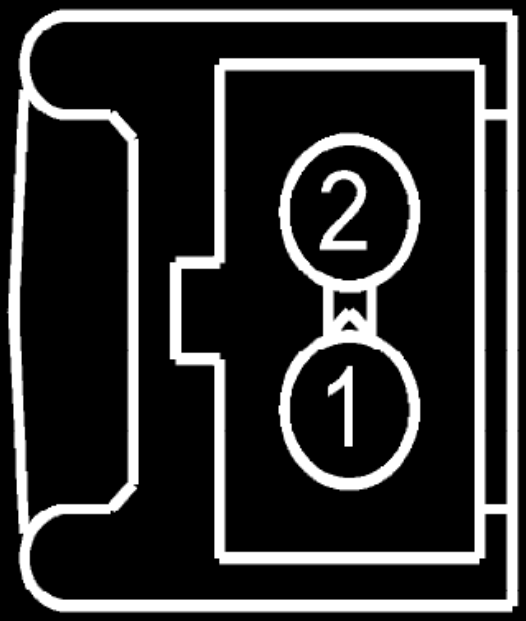
View 151-6


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
C133
12B637
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor
C1066
Idle Air Control (IAC) valve
C110
S105
S103
C189
Throttle Position Sensor (TPS)
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
C174
Ignition transformer capacitor 1
C180
Camshaft position sensor
C1184
Fuel injector 4
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-7

Connector: C180

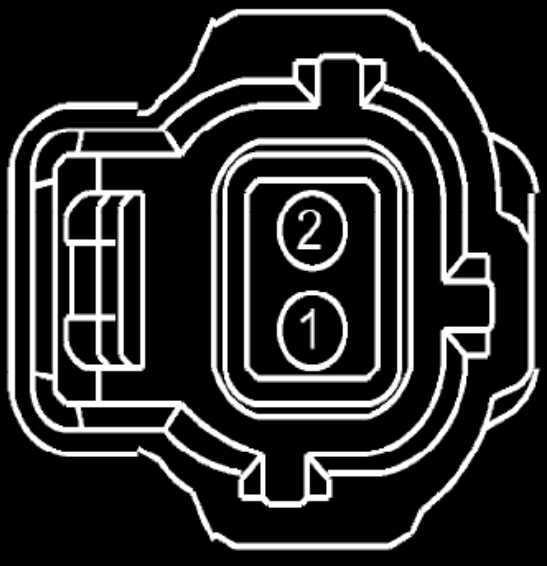
Description:	Harness:	Base Part #:
CAMSHAFT POSITION SENSOR	12B637	6B288



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE706 (BN-BU)	18	SENSOR - CAMSHAFT POSITION BANK 1 IN+EX/IN (CMP1) [CID-H] (CID1)	4.0L
2	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	4.0L

Connector: C1180

Description:	Harness:	Base Part #:
CAMSHAFT POSITION SENSOR	12B637	6B288



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	2.3L
2	VE706 (BN-BU)	18	SENSOR - CAMSHAFT POSITION BANK 1 IN+EX/ IN (CMP1) [CID-H] (CID1)	2.3L

Camshaft Position Sensor: Diagrams

C180

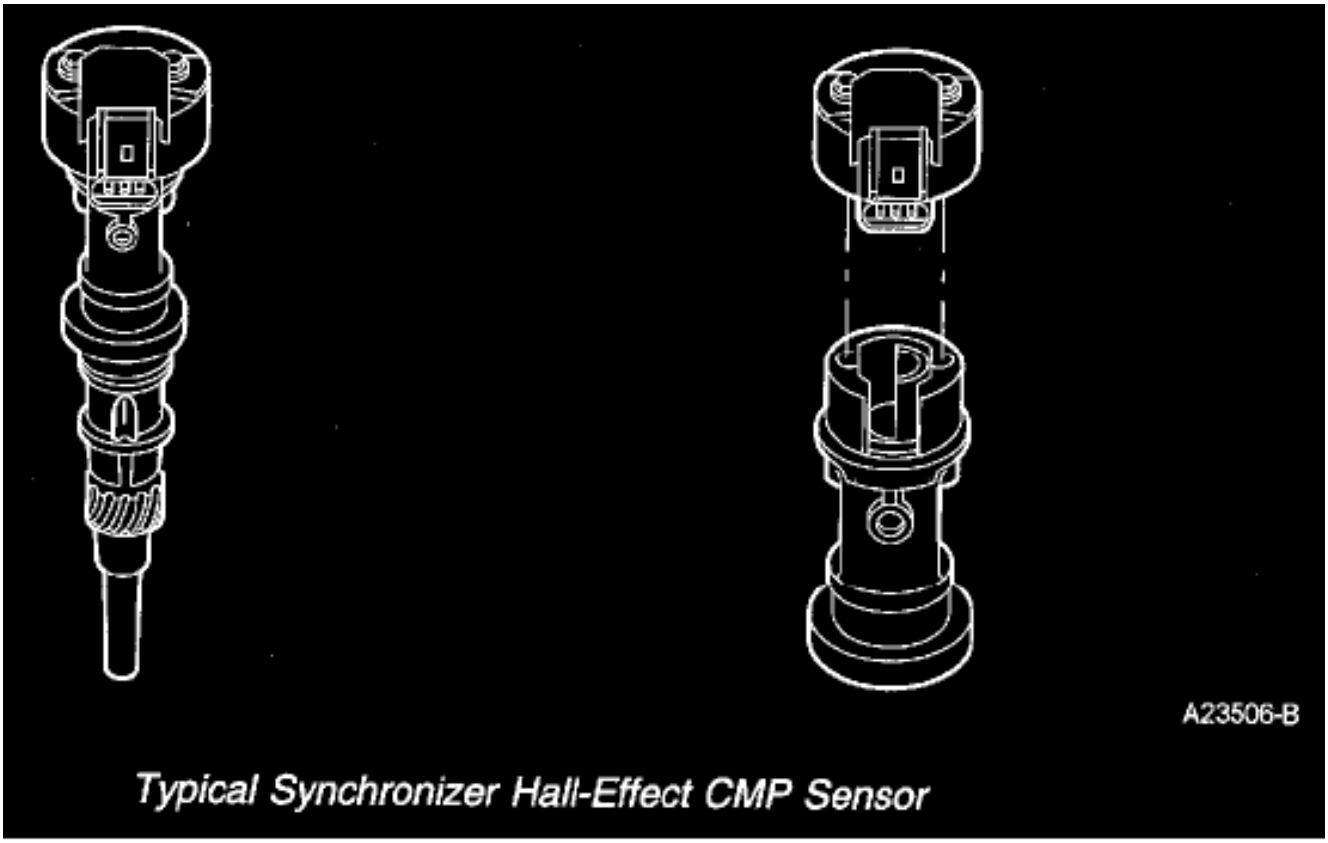
C1180

Connector: C1275

Description:	Harness:	Base Part #:
CAMSHAFT POSITION SENSOR	12B637	6B288

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	3.0L
2	VE706 (BN-BU)	18	SENSOR - CAMSHAFT POSITION BANK 1 IN+EX/ IN (CMP1) [CID-H] (CID1)	3.0L

C1275



Typical Synchronizer Hall-Effect CMP Sensor

Typical Variable Reluctance CMP Sensor

Camshaft Position Sensor: Description and Operation

CAMSHAFT POSITION (CMP) SENSOR

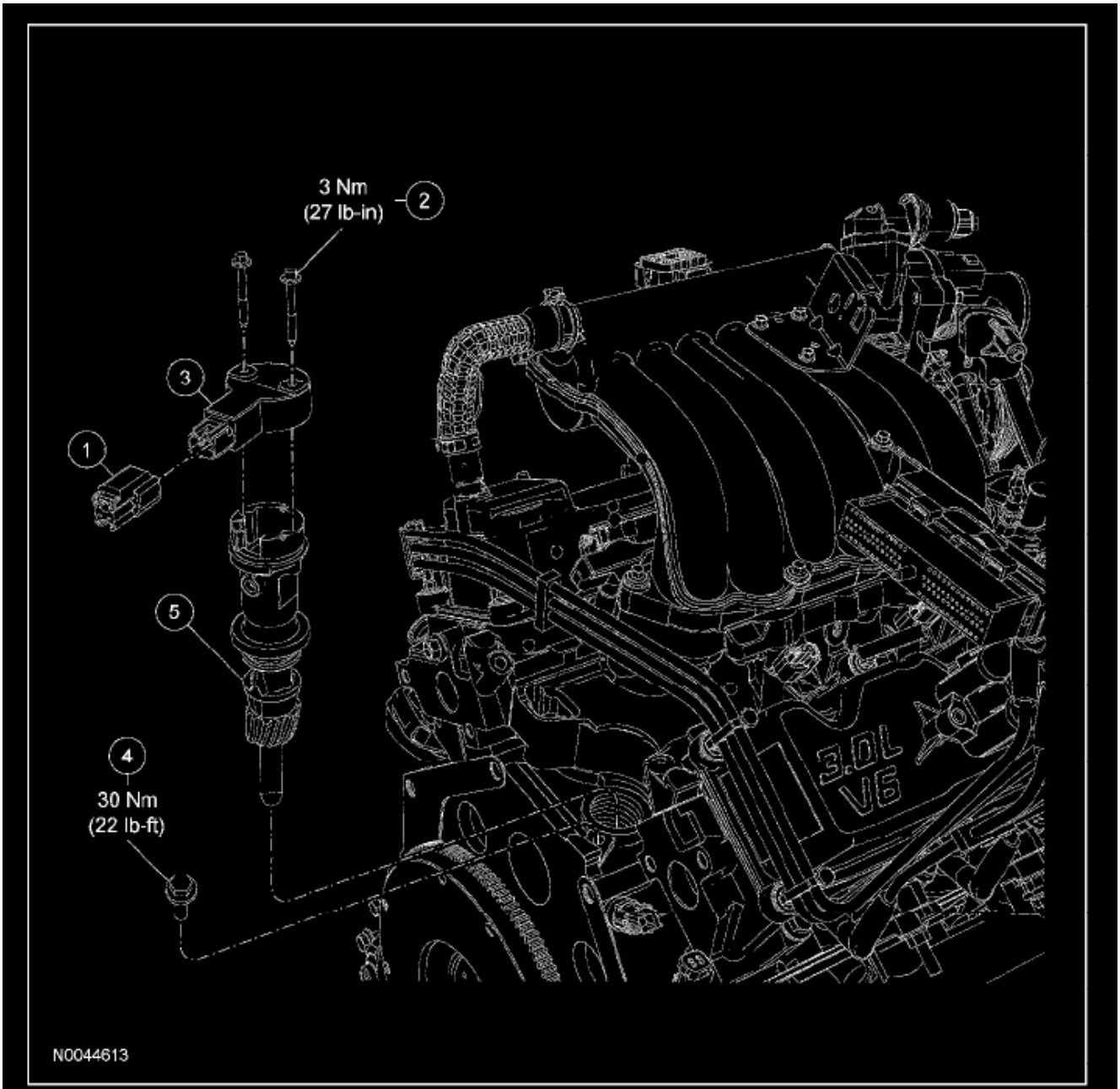
Typical Synchronizer Hall-Effect CMP Sensor

Typical Variable Reluctance CMP Sensor

The CMP sensor detects the position of the camshaft. The CMP sensor identifies when piston number 1 is on its compression stroke. A signal is then sent to the PCM and used for synchronizing the sequential firing of the fuel injectors. Coil on plug (COP) ignition applications use the CMP signal to select the correct ignition coil to fire.

Vehicles with 2 CMP sensors are equipped with variable camshaft timing (VCT). They use the second sensor to identify the position of the camshaft on bank 2 as an input to the PCM.

There are 2 types of CMP sensors: the 3-pin connector Hall-effect type sensor and the 2-pin connector variable reluctance type sensor.



Item	Part Number	Description
1	—	Camshaft position (CMP) sensor electrical connector (part of 12B637)
2	W701219	CMP sensor bolt (2 required)

(Continued)

Item	Part Number	Description
3	6B288	CMP sensor
4	—	Camshaft synchronizer bolt
5	12A362	Camshaft synchronizer

Camshaft Position Sensor: Service and Repair

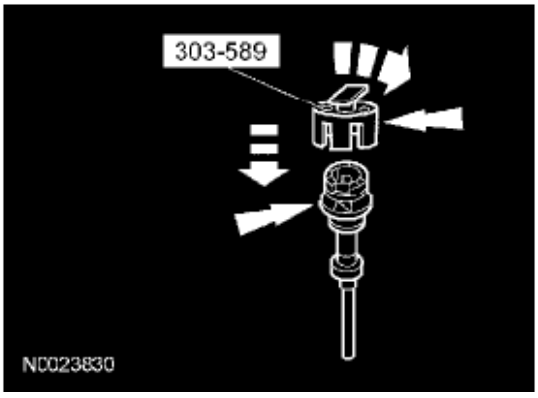
CAMSHAFT SYNCHRONIZER

Exploded View

Special Tool(s)

Special Tool(s)

ST2362-A	Synchronizer Alignment Gauge 303-589



Special Tool(s)

Removal

1. Disconnect the camshaft position (CMP) sensor electrical connector.

2. NOTE: Prior to the removal of the CMP sensor, note the position of the CMP sensor electrical connector. The installation procedure requires that

the electrical connector be located in the same position.

Remove the 2 bolts and the CMP sensor.

3. Remove the camshaft synchronizer bolt. 4. Remove the camshaft synchronizer. Inspect the O-ring seal and install a new O-ring seal if damaged.

Installation

1. CAUTION:

- After installation, do not loosen the synchronizer bolt and rotate the synchronizer assembly. The synchronizer assembly is not adjustable. Do not loosen the synchronizer bolt after the alignment tool has been removed in order to align the camshaft position (CMP) sensor electrical connector for any reason. If the electrical connector is not in the correct position, the synchronizer assembly must be removed. The alignment tool and the assembly must be reinstalled if the engine has not been rotated from top dead center (TDC) of the compression stroke on the No. 1 cylinder. Failure to follow this procedure will result in the fuel system being out of time with the engine, possibly causing engine damage.

- Do not turn the crankshaft or camshaft during the removal and installation procedure or the fuel system timing will be out of time with the engine, possibly causing engine damage.

- A special tool must be used during the installation of the new synchronizer assembly. Failure to follow this procedure will result in the fuel system being out of time with the engine, possibly causing engine damage.

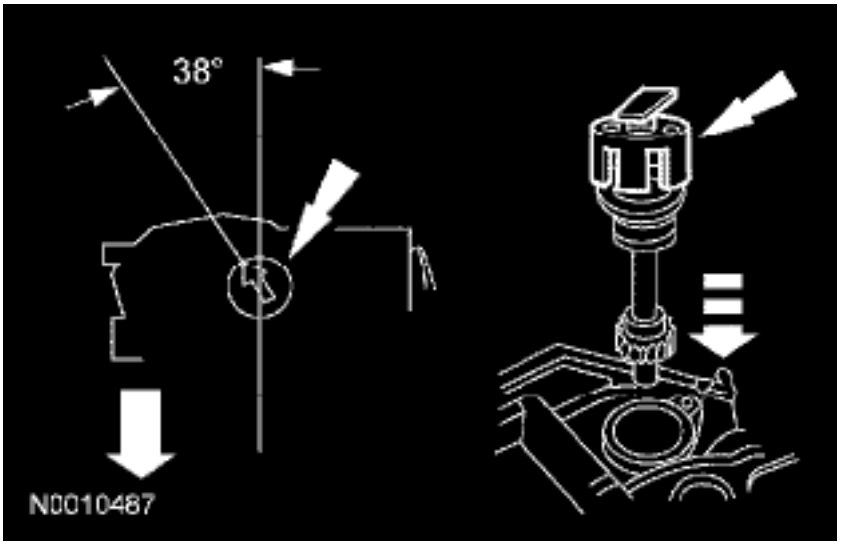
Install the special tool on the camshaft synchronizer by rotating the tool until it engages the notch in the camshaft synchronizer housing and the armature.

2. CAUTION: It is very important to coat the gear on the camshaft synchronizer with engine oil prior to installation. Failure to do so may

result in gear failure.

NOTE: During installation, the arrow on the special tool will rotate clockwise until the oil pump intermediate shaft and the camshaft gear engages.

Install the camshaft synchronizer housing assembly so the arrow on the special tool is 38 degrees from the centerline of the engine.



3. Install the camshaft synchronizer housing bolt.

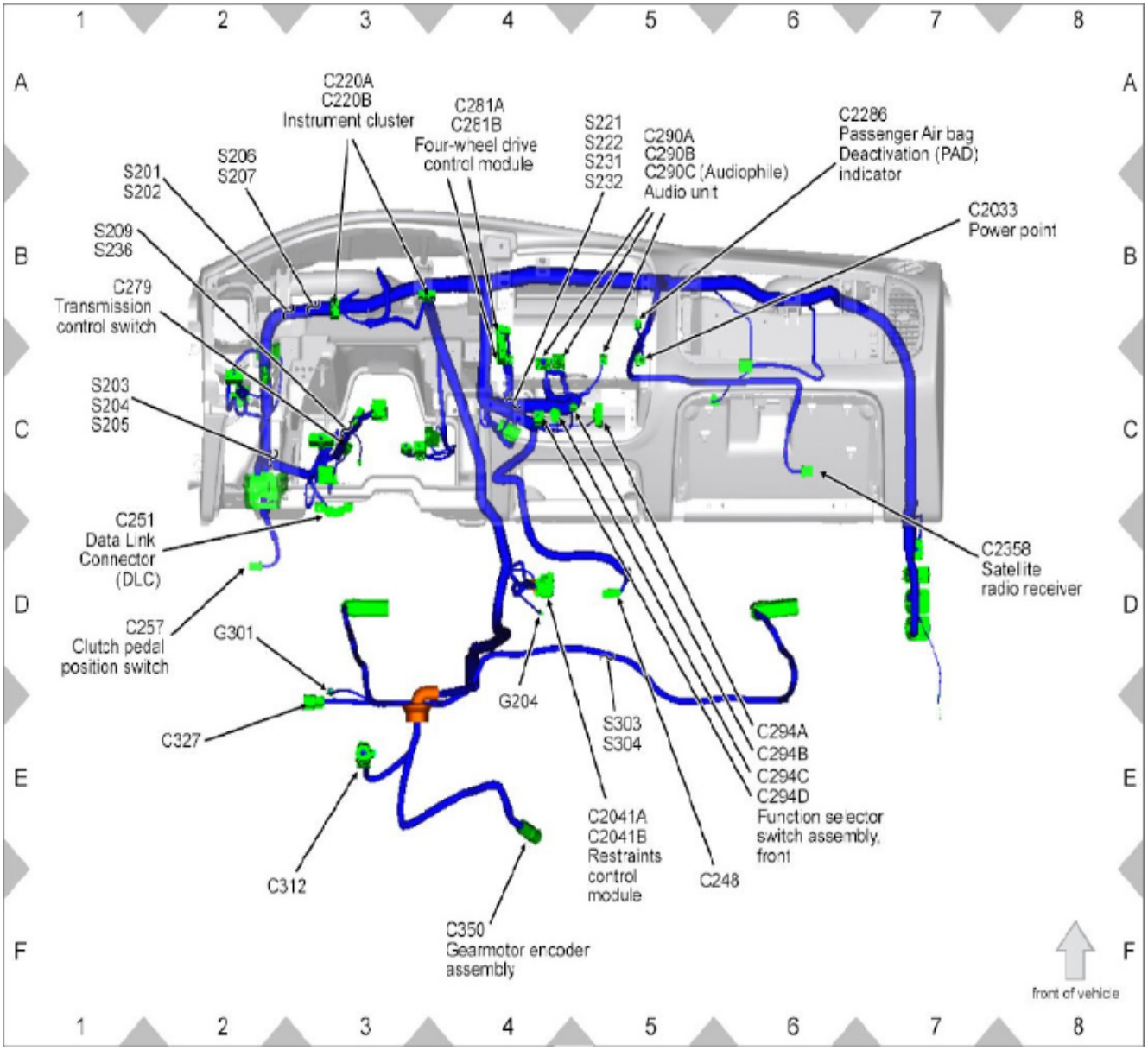
- Tighten to 30 Nm (22 lb-ft).

4. Position the CMP sensor and install the 2 bolts.

- Tighten to 3 Nm (27 lb-in).

5. Connect the CMP sensor electrical connector.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Sensors and Switches > Sensors and Switches - Powertrain Management > Sensors and Switches - Computers and Control Systems > Clutch Switch, ECM > Component Information > Locations



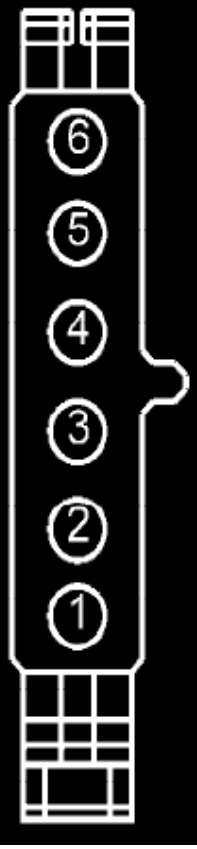
View 151-12

Connector: C257

Description: CLUTCH PEDAL POSITION SWITCH

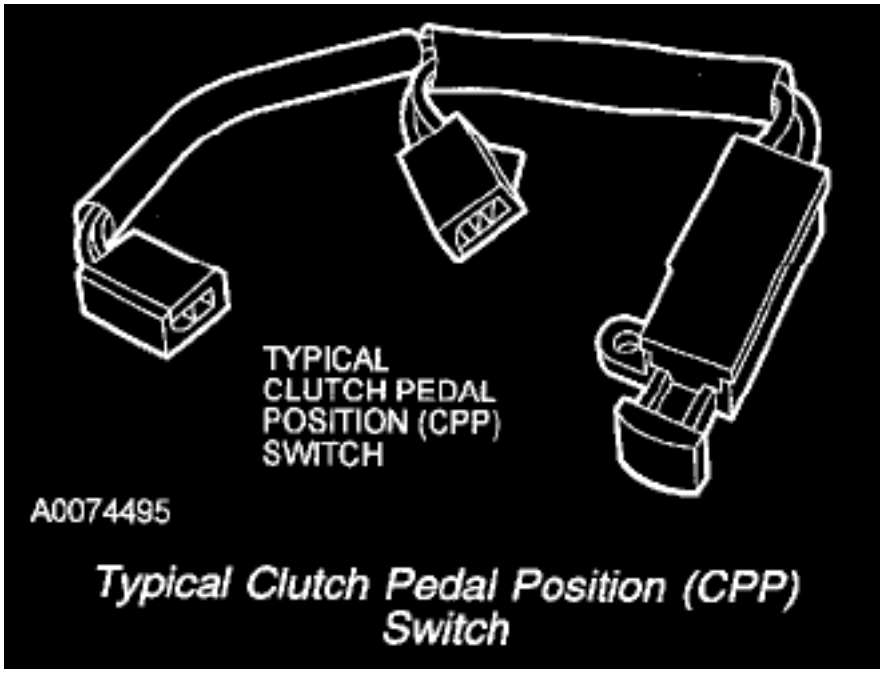
Harness: 14401

Base Part #: 11A152



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE904 (GN-VT)	22	SWITCH - CLUTCH PEDAL POSITION # TOP OF TRAVEL (CPP-TT)	
2	GD174 (BK-WH)	22	GROUND - TUNNEL	
3	CCB15 (BN-GN)	22	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL CLOSED	
4	CCB15 (BN-GN)	22	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL CLOSED	
5	GD174 (BK-WH)	22	GROUND - TUNNEL	
6	CDC36 (GN-BN)	22	SWITCH - START INTERLOCK CLUTCH PEDAL	

C257



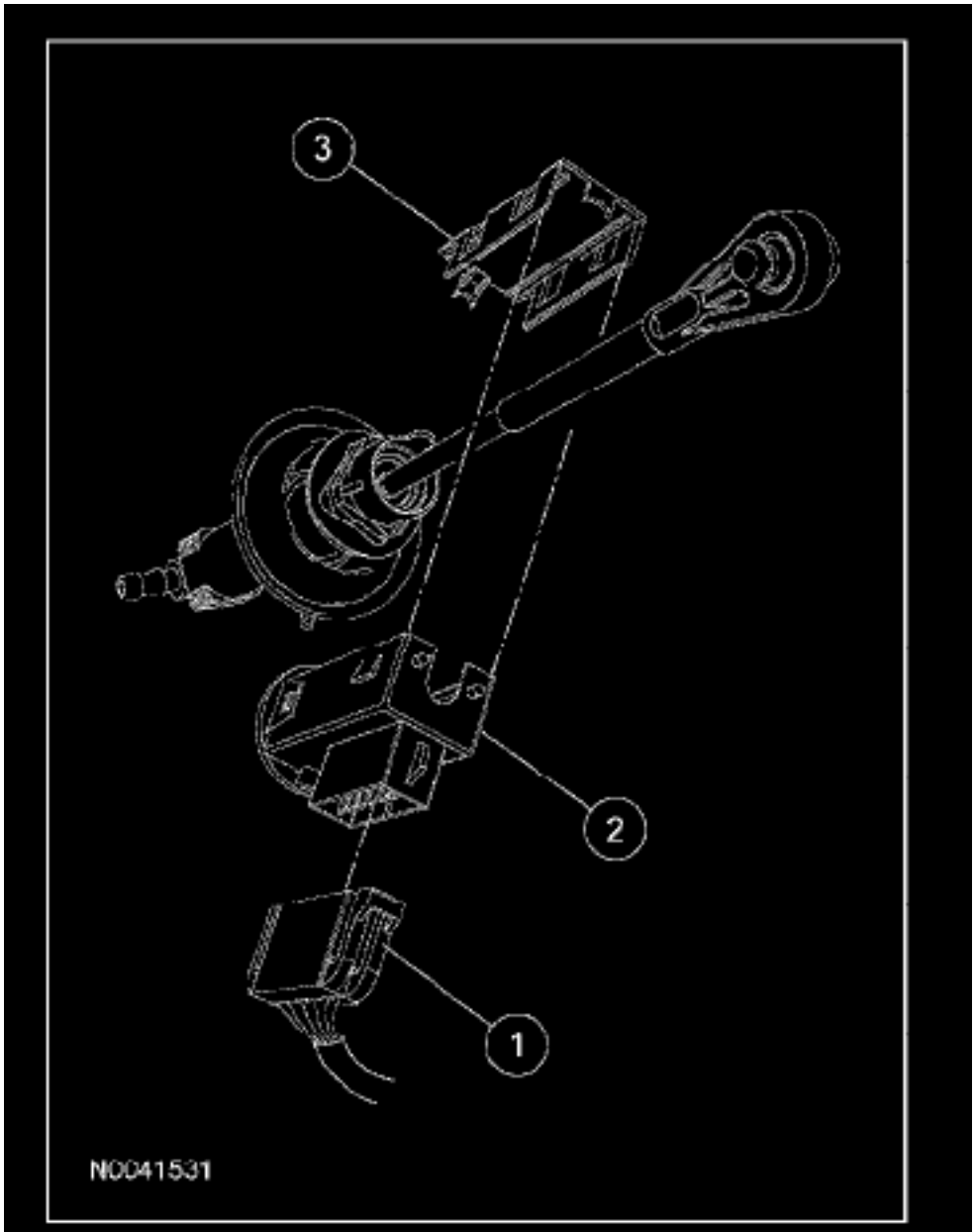
Typical Clutch Pedal Position (CPP) Switch

Clutch Switch: Description and Operation

CLUTCH PEDAL POSITION (CPP) SWITCH

Typical Clutch Pedal Position (CPP) Switch

The CPP switch is an input to the PCM indicating the clutch pedal position. The PCM provides a low current voltage on the CPP circuit. When the CPP switch is closed, this voltage is pulled low through the SIG RTN circuit. The CPP input to the PCM is used to detect a reduction in engine load. The PCM uses the load information for mass air flow and fuel calculations.



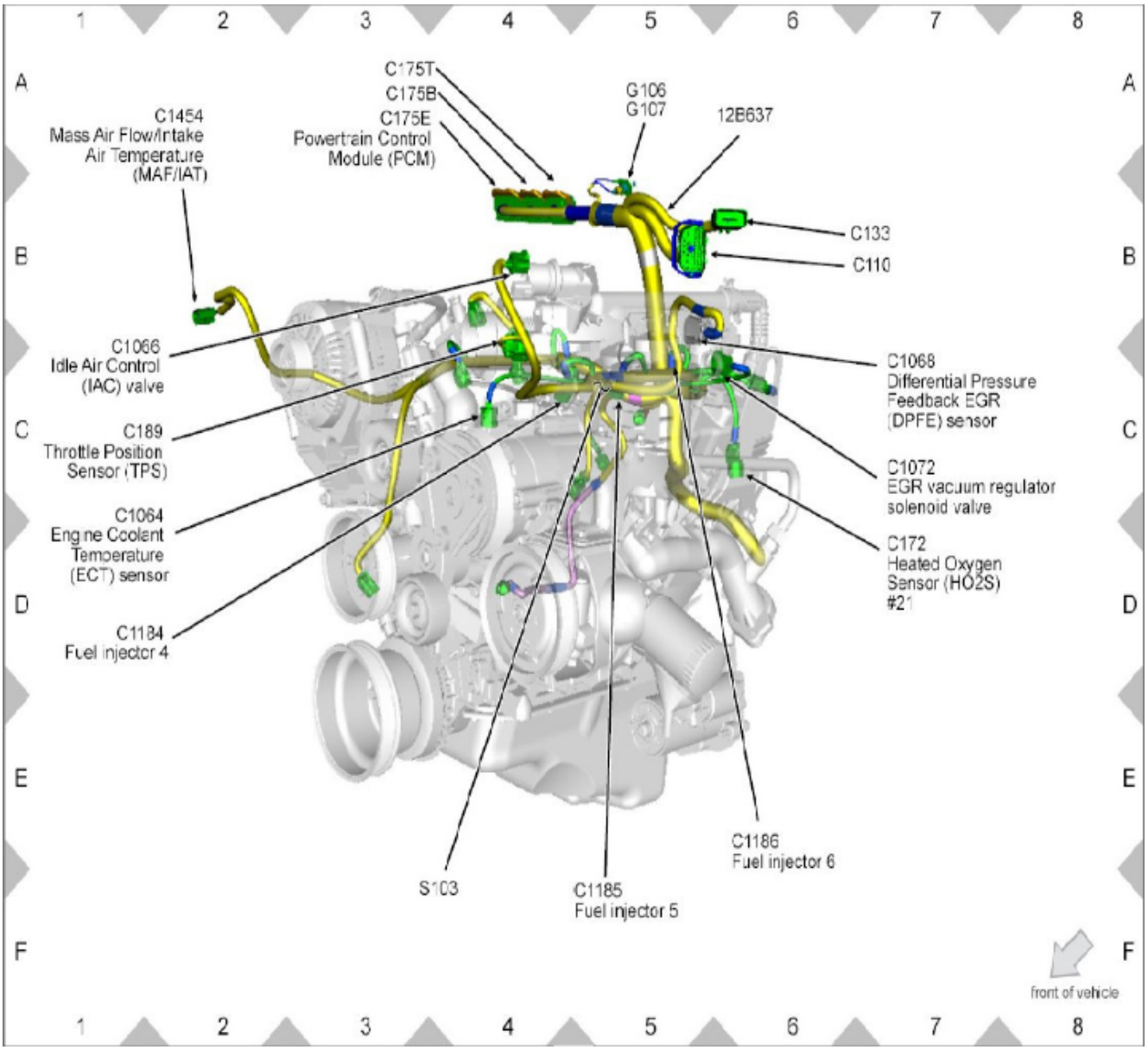
Item	Part Number	Description
1	—	Clutch pedal position (CPP) switch electrical connector
2	7C534	CPP switch
3	—	CPP switch cover (part of 7C534)

Clutch Switch: Service and Repair

CLUTCH PEDAL POSITION (CPP) SWITCH

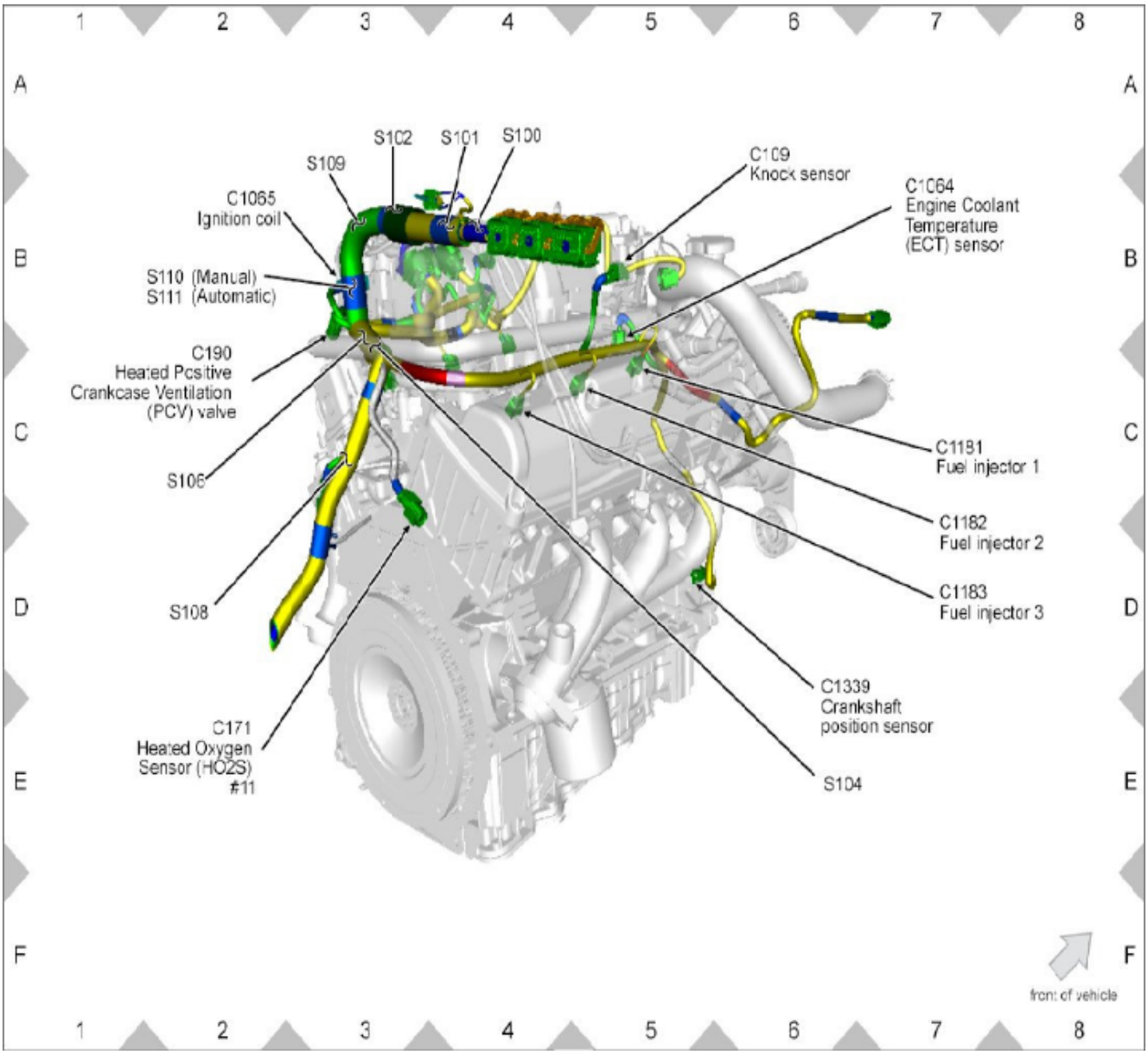
Removal and Installation

1. Disconnect the clutch pedal position (CPP) switch electrical connector. 2. Spread the CPP switch apart. Remove from the pedal rod. 3. To install, reverse the removal procedure.



Coolant Temperature Sensor/Switch (For Computer): Locations

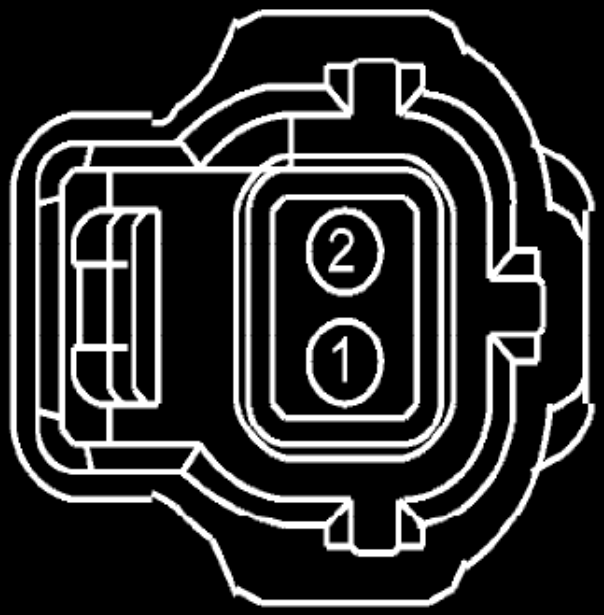
View 151-5


S102
S101
S100
S109
C109
Knock sensor
C1065
Ignition coil
C1064
Engine Coolant
Temperature
(ECT) sensor
S110 (Manual)
S111 (Automatic)
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
C1181
Fuel injector 1
C1182
Fuel injector 2
C1183
Fuel injector 3
S108
C1339
Crankshaft
position sensor
C171
Heated Oxygen
Sensor (HO2S)
#11
S104
front of vehicle

View 151-8

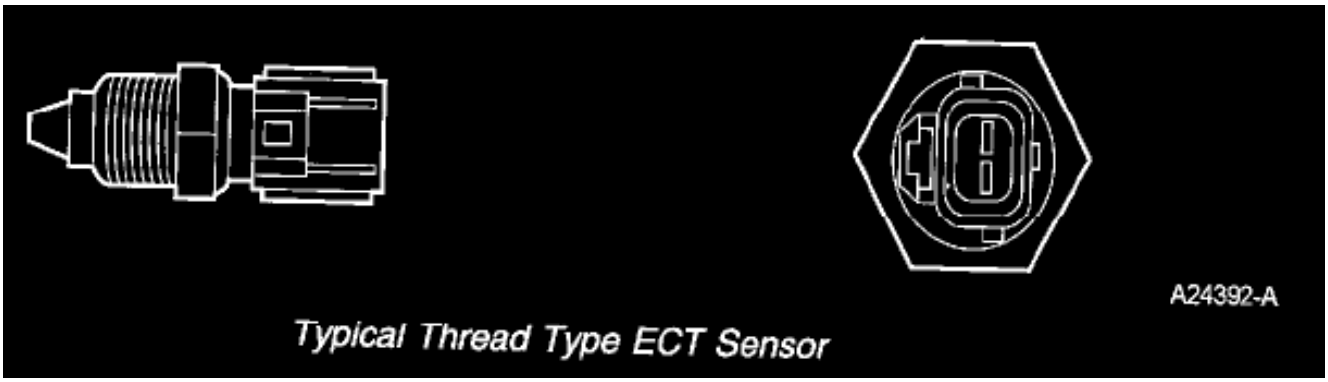
Connector: C1064

Description:	Harness:	Base Part #:
ENGINE COOLANT TEMPERATURE (ECT) SENSOR	12B637	12A648



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE716 (YE)	20	SENSOR - ENGINE COOLANT TEMPERATURE (ECT)	3.0L, 4.0L
2	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	3.0L, 4.0L

C1064



Coolant Temperature Sensor/Switch (For Computer): Description and Operation

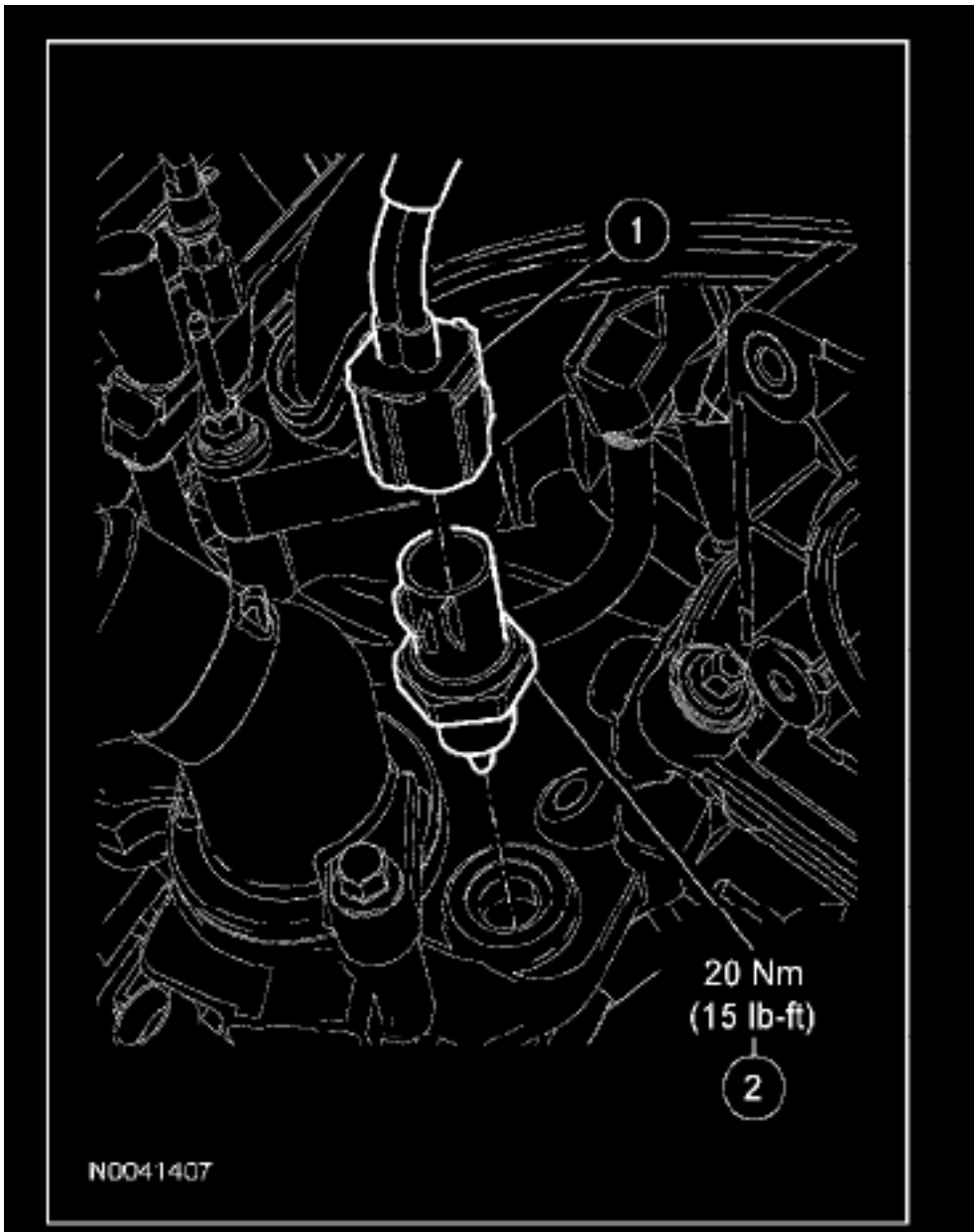
ENGINE COOLANT TEMPERATURE (ECT) SENSOR

Typical Thread Type ECT Sensor

The ECT sensor is a thermistor device in which resistance changes with temperature. The electrical resistance of a thermistor decreases as the temperature increases, and the resistance increases as the temperature decreases. The varying resistance changes the voltage drop across the sensor terminals and provides electrical signals to the PCM corresponding to temperature.

Thermistor-type sensors are considered passive sensors. A passive sensor is connected to a voltage divider network so that varying the resistance of the passive sensor causes a variation in total current flow. Voltage that is dropped across a fixed resistor in a series with the sensor resistor determines the voltage signal at the PCM. This voltage signal is equal to the reference voltage minus the voltage drop across the fixed resistor.

The ECT measures the temperature of the engine coolant. The PCM uses the ECT input for fuel control and for cooling fan control. There are 3 types of ECT sensors, threaded, push-in, and twist-lock. The ECT sensor is located in an engine coolant passage.



Item	Part Number	Description
1	14A464	Engine coolant temperature (ECT) sensor electrical connector (part of 12B637)
2	12A648	ECT sensor

Coolant Temperature Sensor/Switch (For Computer): Service and Repair

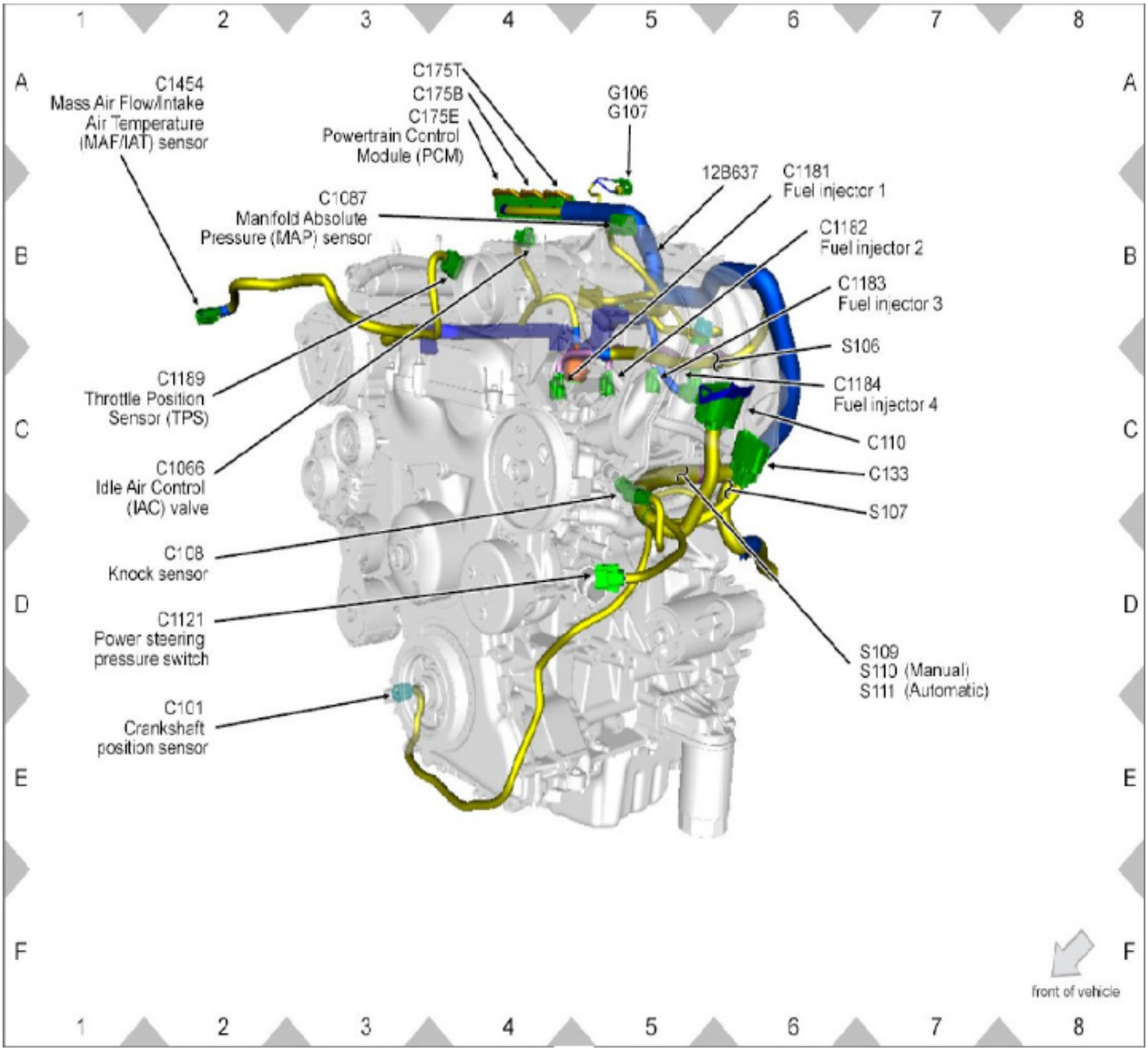
ENGINE COOLANT TEMPERATURE (ECT) SENSOR

Removal and Installation

1. Drain the cooling system. 2. Disconnect the engine coolant temperature (ECT) sensor electrical connector. 3. Remove the ECT sensor.

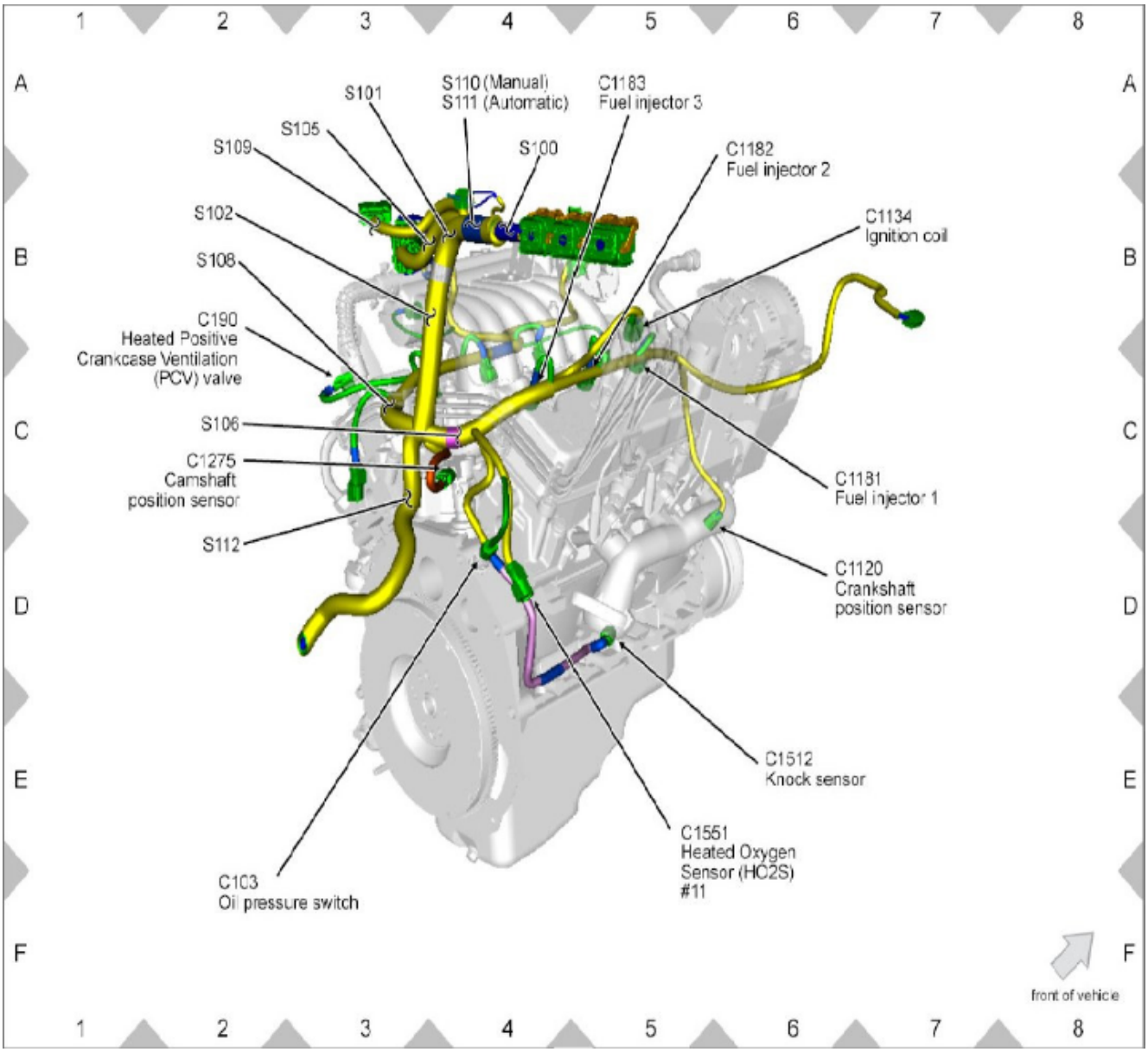
- To install, tighten to 20 Nm (15 lb-ft).

4. To install, reverse the removal procedure.

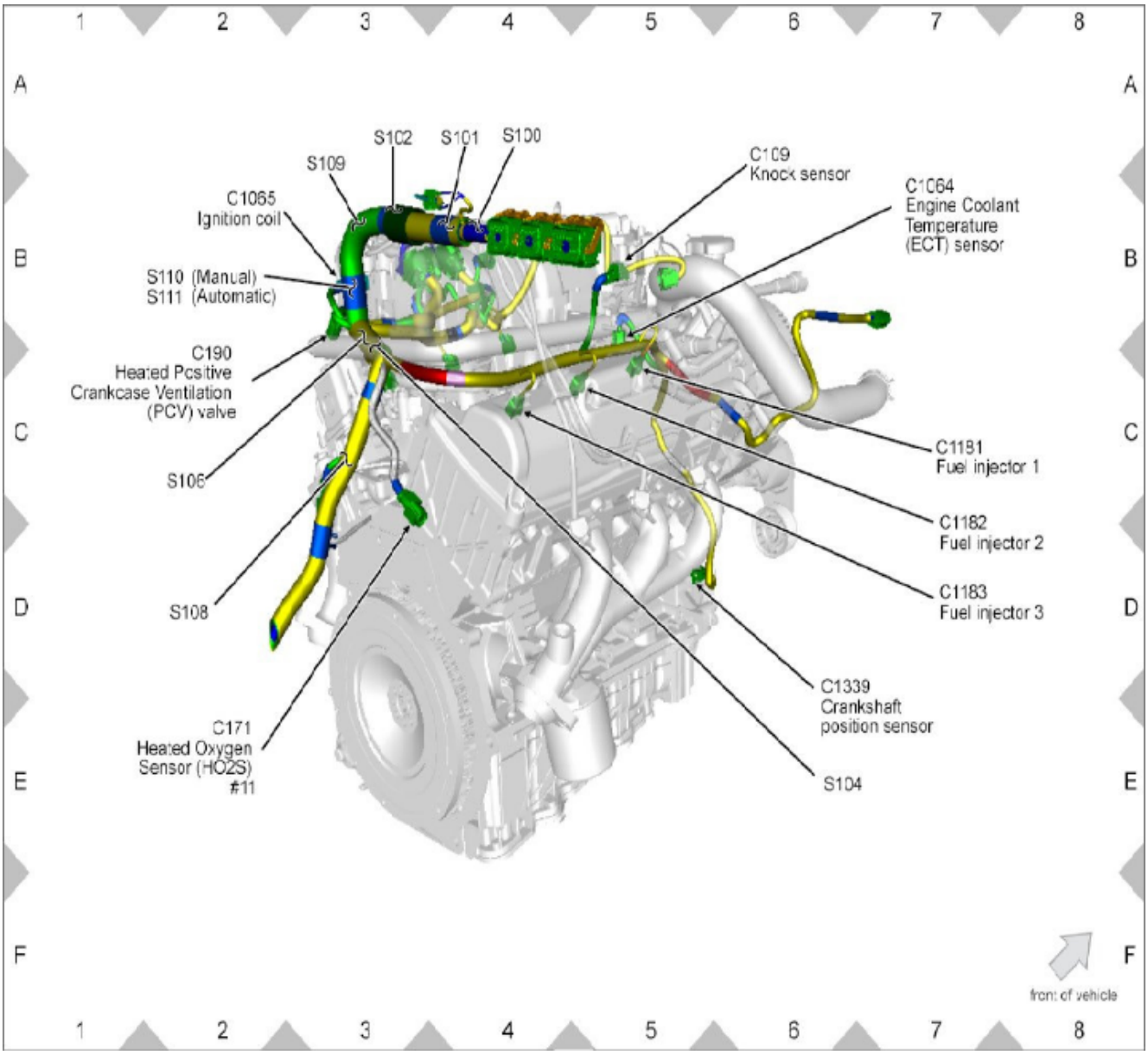


Crankshaft Position Sensor: Locations

View 151-3


S101
S110 (Manual)
S111 (Automatic)
C1183
Fuel injector 3
S105
S109
S100
C1182
Fuel injector 2
S102
C1134
Ignition coil
S108
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
C1275
Camshaft
position sensor
C1181
Fuel injector 1
S112
C1120
Crankshaft
position sensor
C1512
Knock sensor
C1551
Heated Oxygen
Sensor (HO2S)
#11
C103
Oil pressure switch
front of vehicle

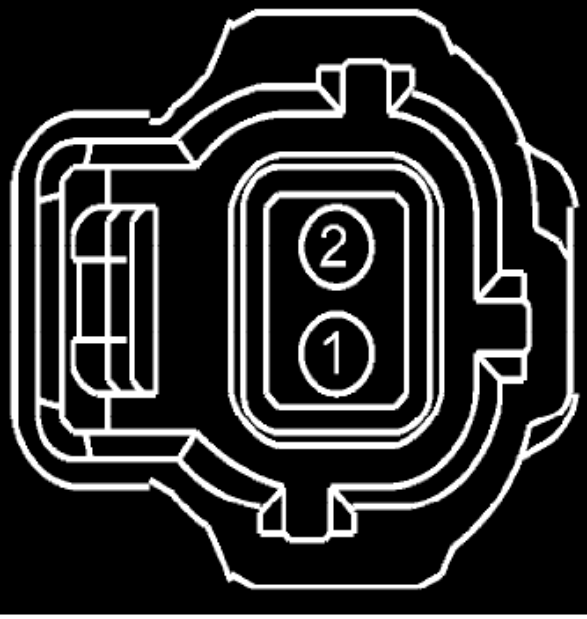
View 151-6


S102
S101
S100
S109
C109
Knock sensor
C1065
Ignition coil
C1064
Engine Coolant
Temperature
(ECT) sensor
S110 (Manual)
S111 (Automatic)
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
C1181
Fuel injector 1
C1182
Fuel injector 2
S108
C1183
Fuel injector 3
C1339
Crankshaft
position sensor
C171
Heated Oxygen
Sensor (HO2S)
#11
S104
front of vehicle

View 151-8

Connector: C101

Description:	Harness:	Base Part #:
CRANKSHAFT POSITION SENSOR	12B637	6C315



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE711 (YE-VT)	18	SENSOR - CRANKSHAFT POSITION (CKPP)	2.3L
2	RE135 (GN-BN)	18	CTRL MOD. - POWERTRAIN # CRANKSHAFT POSITION SENSOR (CKPN)	2.3L

Connector: C1120

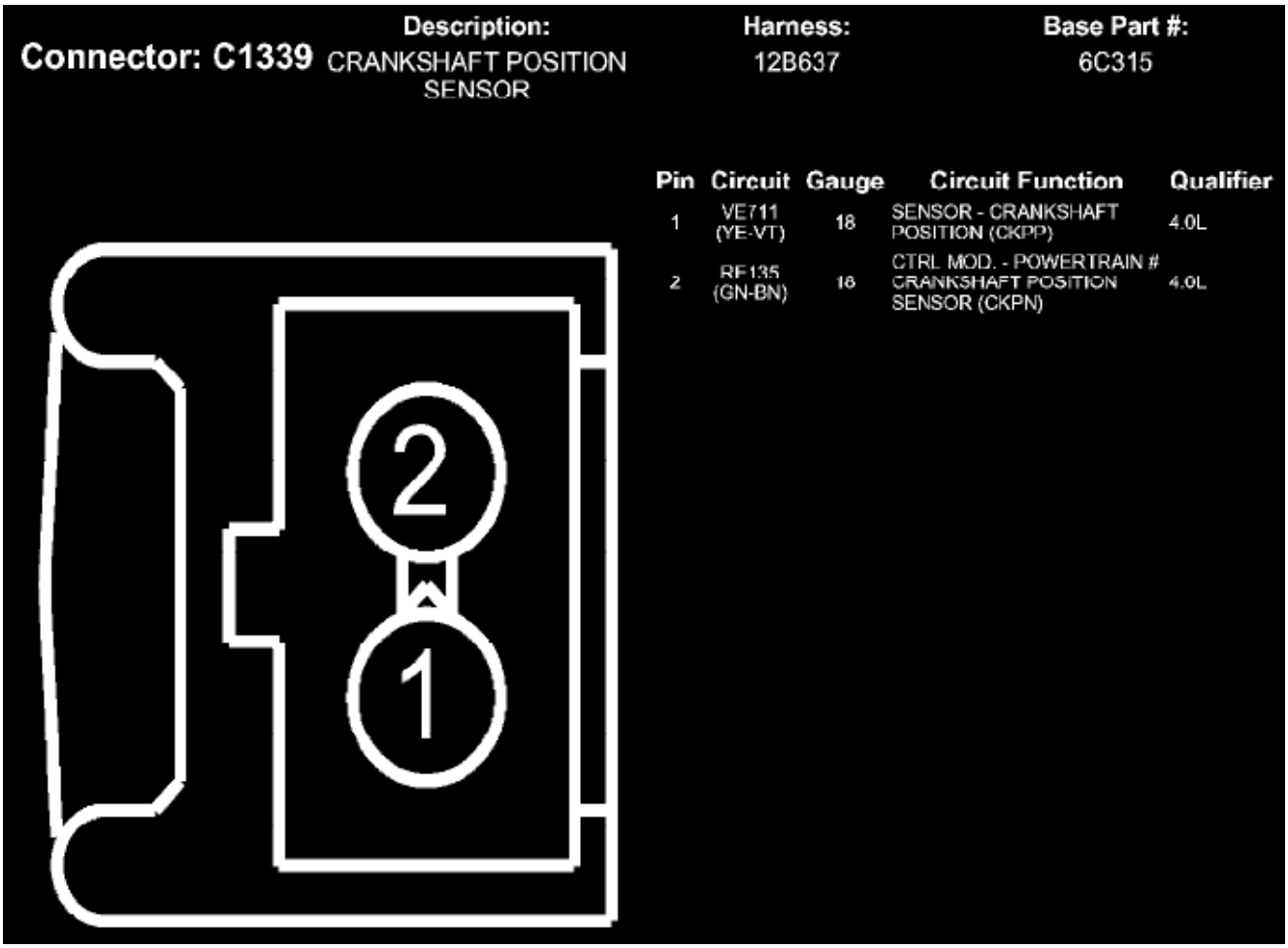
Description:	Harness:	Base Part #:
CRANKSHAFT POSITION SENSOR	12B637	6C315

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RE135 (GN-BN)	18	CTRL MOD. - POWERTRAIN # CRANKSHAFT POSITION SENSOR (CKPN)	3.0L
2	VE711 (YE-VT)	18	SENSOR - CRANKSHAFT POSITION (CKPP)	3.0L

Crankshaft Position Sensor: Diagrams

C101

C1120


Connector: C1339
Description:
CRANKSHAFT POSITION SENSOR
Harness:
12B637
Base Part #:
6C315
Pin
Circuit
Gauge
Circuit Function
Qualifier
1
VE711 (YE-VT)
18
SENSOR - CRANKSHAFT POSITION (CKPP)
4.0L
2
RF135 (GN-BN)
18
CTRL MOD. - POWERTRAIN # CRANKSHAFT POSITION SENSOR (CKPN)
4.0L
2
1

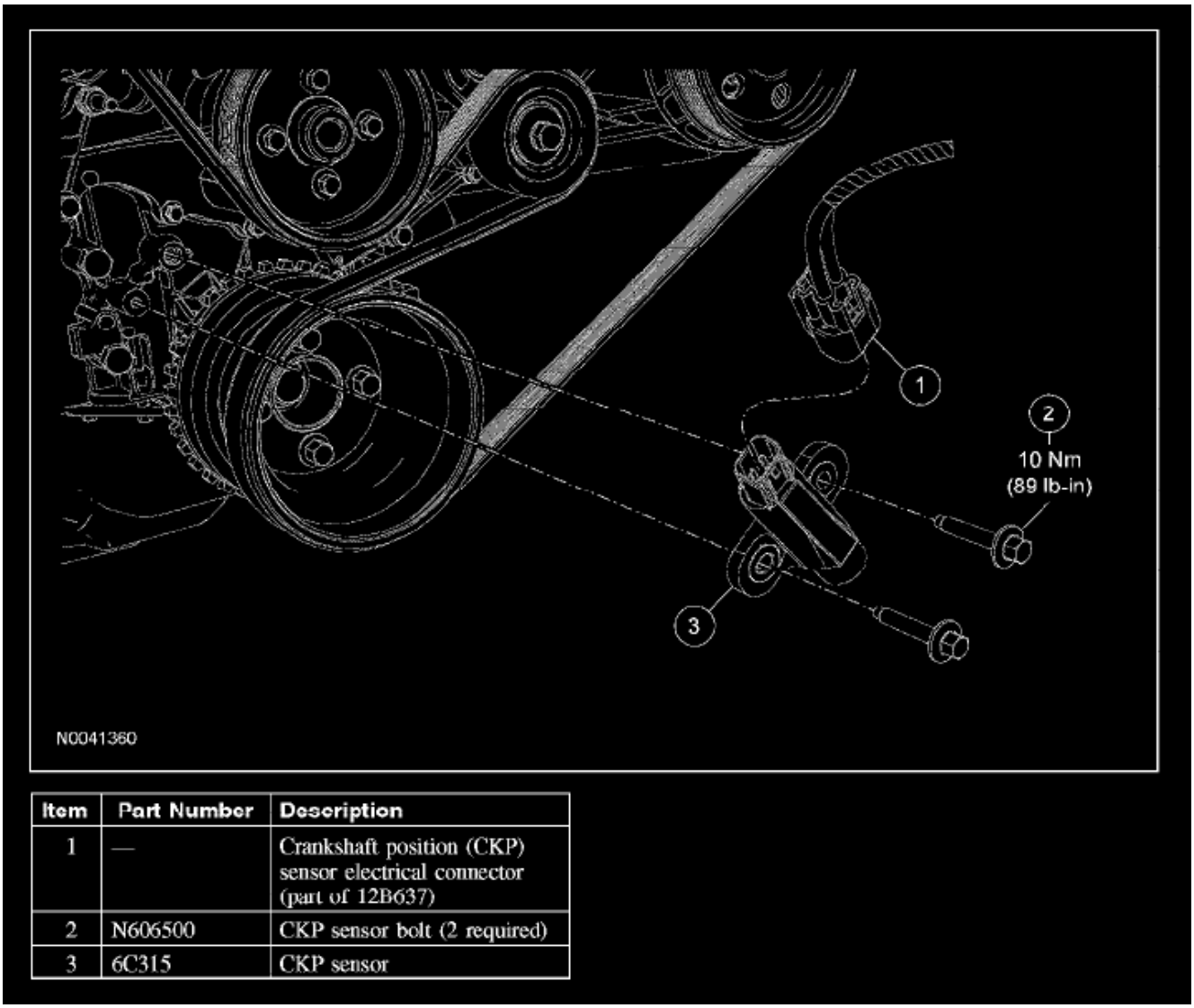
C1339

Crankshaft Position Sensor: Description and Operation

CRANKSHAFT POSITION (CKP) SENSOR

Typical Crankshaft Position (CKP) Sensor

The CKP sensor is a magnetic transducer mounted on the engine block adjacent to a pulse wheel located on the crankshaft. By monitoring the crankshaft mounted pulse wheel, the CKP is the primary sensor for ignition information to the PCM. The pulse wheel has a total of 35 teeth spaced 10 degrees apart with one empty space for a missing tooth. The 6.8L 10-cylinder pulse wheel has 39 teeth spaced 9 degrees apart and one 9 degree empty space for a missing tooth. By monitoring the pulse wheel, the CKP sensor signal indicates crankshaft position and speed information to the PCM. By monitoring the missing tooth, the CKP sensor is also able to identify piston travel in order to synchronize the ignition system and provide a way of tracking the angular position of the crankshaft relative to a fixed reference for the CKP sensor configuration. The PCM also uses the CKP signal to determine if a misfire has occurred by measuring rapid decelerations between teeth.



Item	Part Number	Description
1	—	Crankshaft position (CKP) sensor electrical connector (part of 12B637)
2	N606500	CKP sensor bolt (2 required)
3	6C315	CKP sensor

Crankshaft Position Sensor: Service and Repair

CRANKSHAFT POSITION (CKP) SENSOR

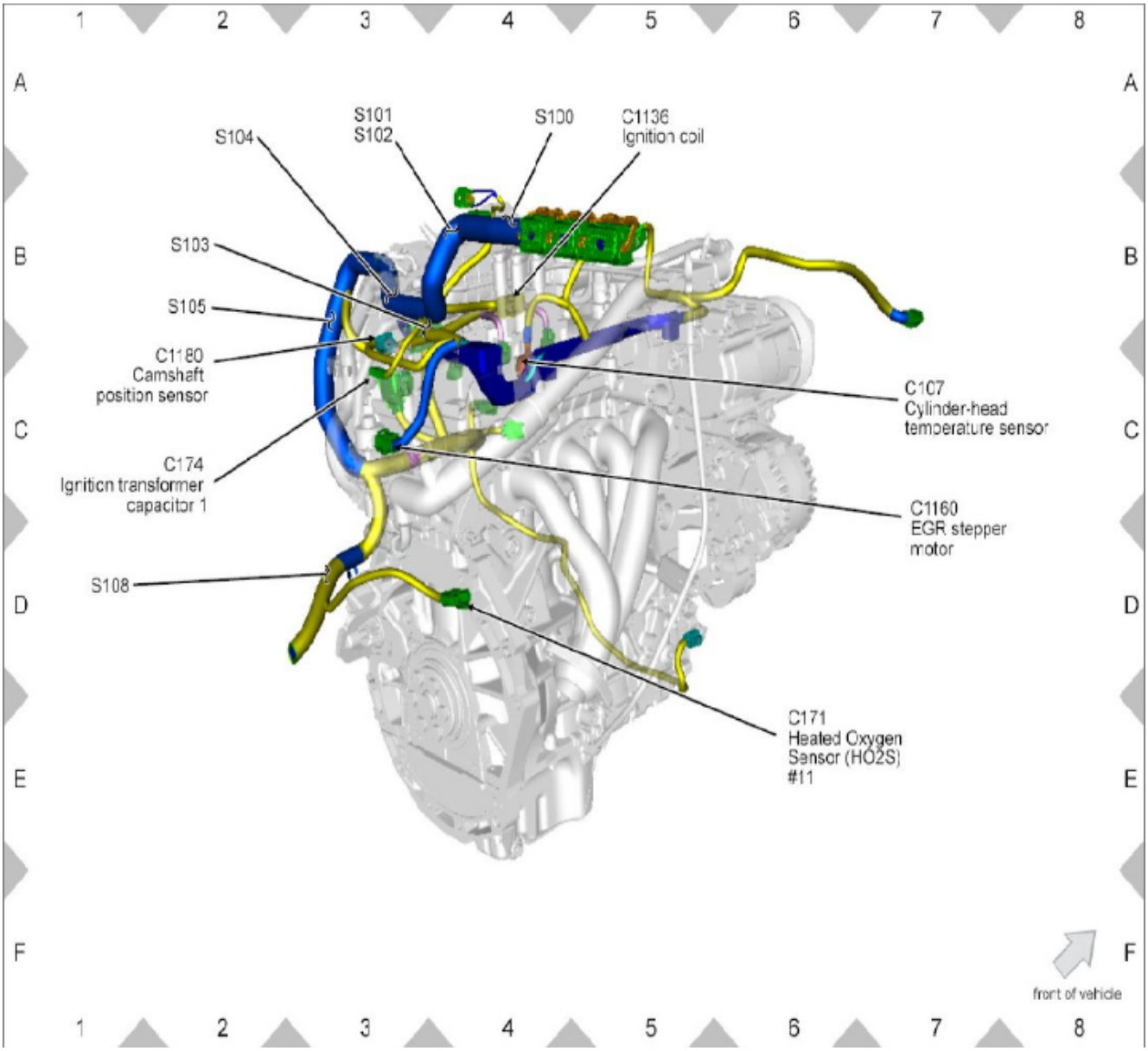
Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the crankshaft position (CKP) sensor electrical connector. 3. Remove the 2 bolts and the CKP sensor.

- To install, tighten to 10 Nm (89 lb-in).

4. To install, reverse the removal procedure.

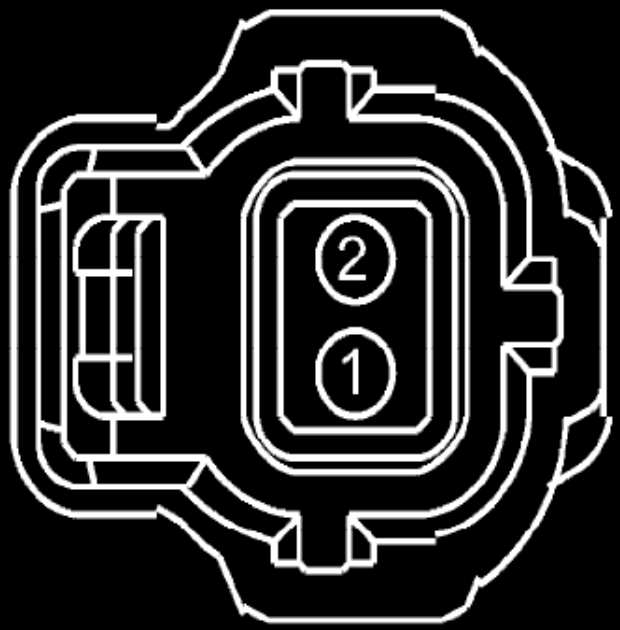
Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Sensors and Switches > Sensors and Switches - Powertrain Management > Sensors and Switches - Computers and Control Systems > Engine Temperature Sensor > Component Information > Locations



View 151-4

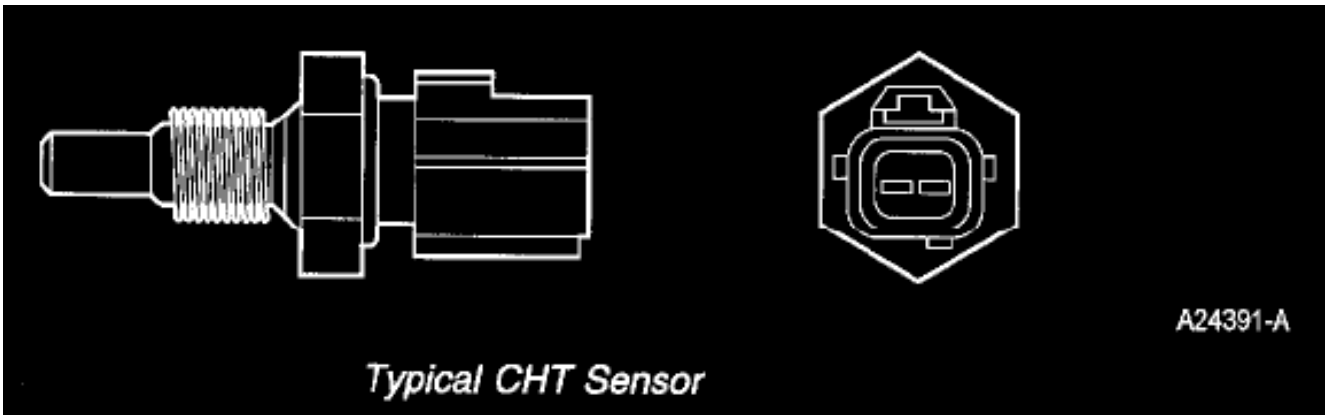
Connector: C107

Description:	Harness:	Base Part #:
CYLINDERHEAD TEMPERATURE SENSOR	12B637	6G004



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE116 (VT-BN)	20	CTRL MOD. - POWERTRAIN # CYLINDER HEAD TEMPERATURE INDICATOR LIGHT (CHTIL)	2.3L
2	RE405 (GN/WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	2.3L

C107



Typical CHT Sensor

Engine Temperature Sensor: Description and Operation

CYLINDER HEAD TEMPERATURE (CHT) SENSOR

Typical CHT Sensor

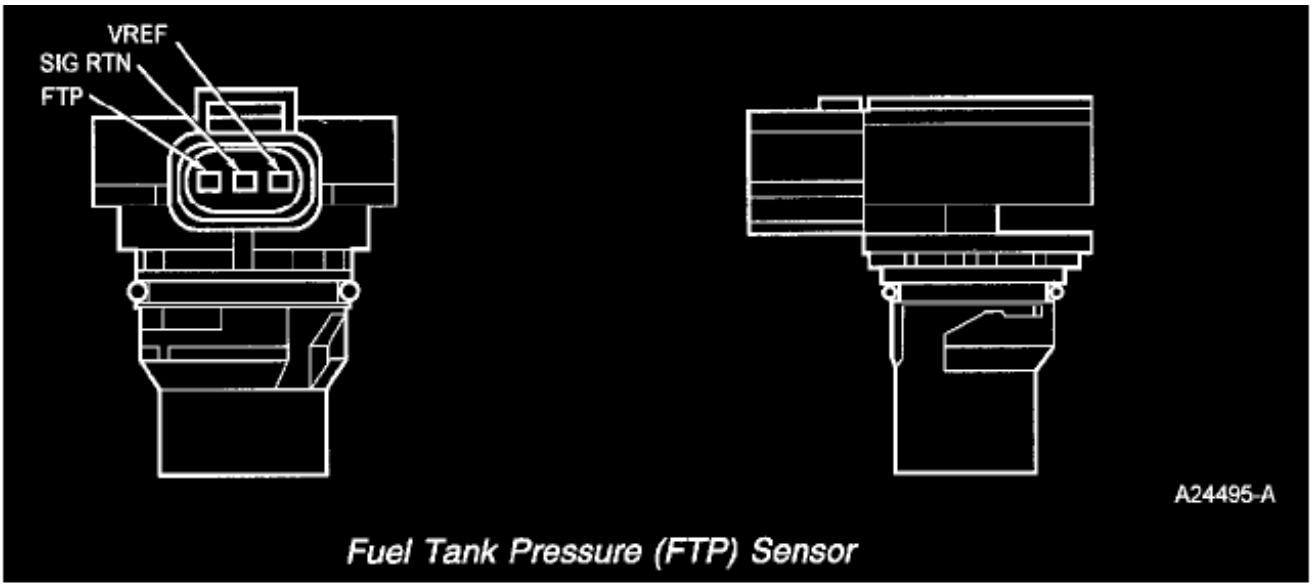
The CHT sensor is a thermistor device in which resistance changes with the temperature. The electrical resistance of a thermistor decreases as temperature increases, and the resistance increases as the temperature decreases. The varying resistance affects the voltage drop across the sensor terminals and provides electrical signals to the PCM corresponding to temperature.

The CHT sensor is installed in the cylinder head and measures the metal temperature. The CHT sensor can provide complete engine temperature information and can be used to infer coolant temperature. If the CHT sensor conveys an overheating condition to the PCM, the PCM initiates a fail-safe cooling strategy based on information from the CHT sensor. A cooling system concern such as low coolant or coolant loss could cause an overheating condition. As a result, damage to major engine components could occur. Using both the CHT sensor and fail-safe cooling strategy, the PCM prevents damage by allowing air cooling of the engine and limp home capability.

Fuel Level Sensor: Description and Operation

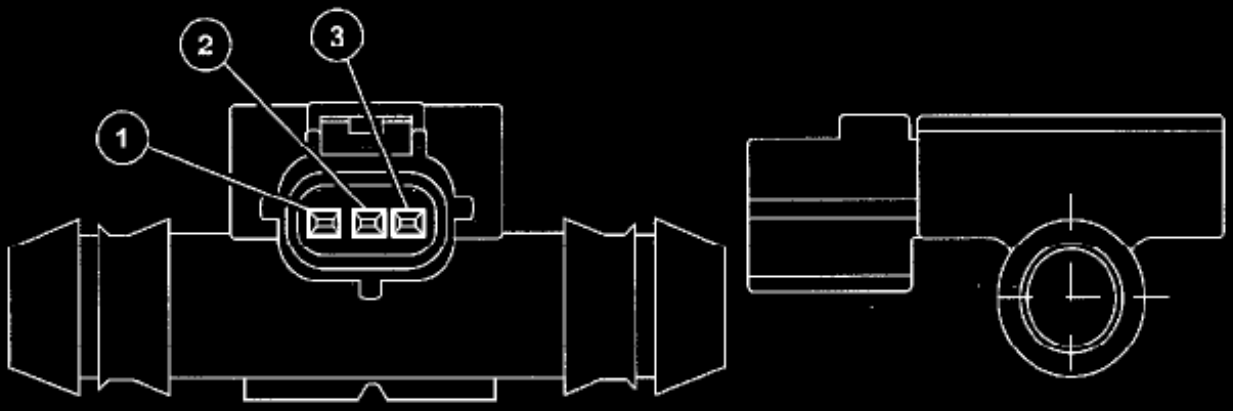
FUEL LEVEL INPUT (FLI)

The FLI is a communications network message. Most vehicle applications use a potentiometer type FLI sensor connected to a float in the FP module to determine fuel level.



Fuel Tank Pressure (FTP) Sensor

In-Line Fuel Tank Pressure (FTP) Sensor



N0048173

Item	Part Number	Description
1	—	VREF
2	—	SIG RTN
3	—	FTP

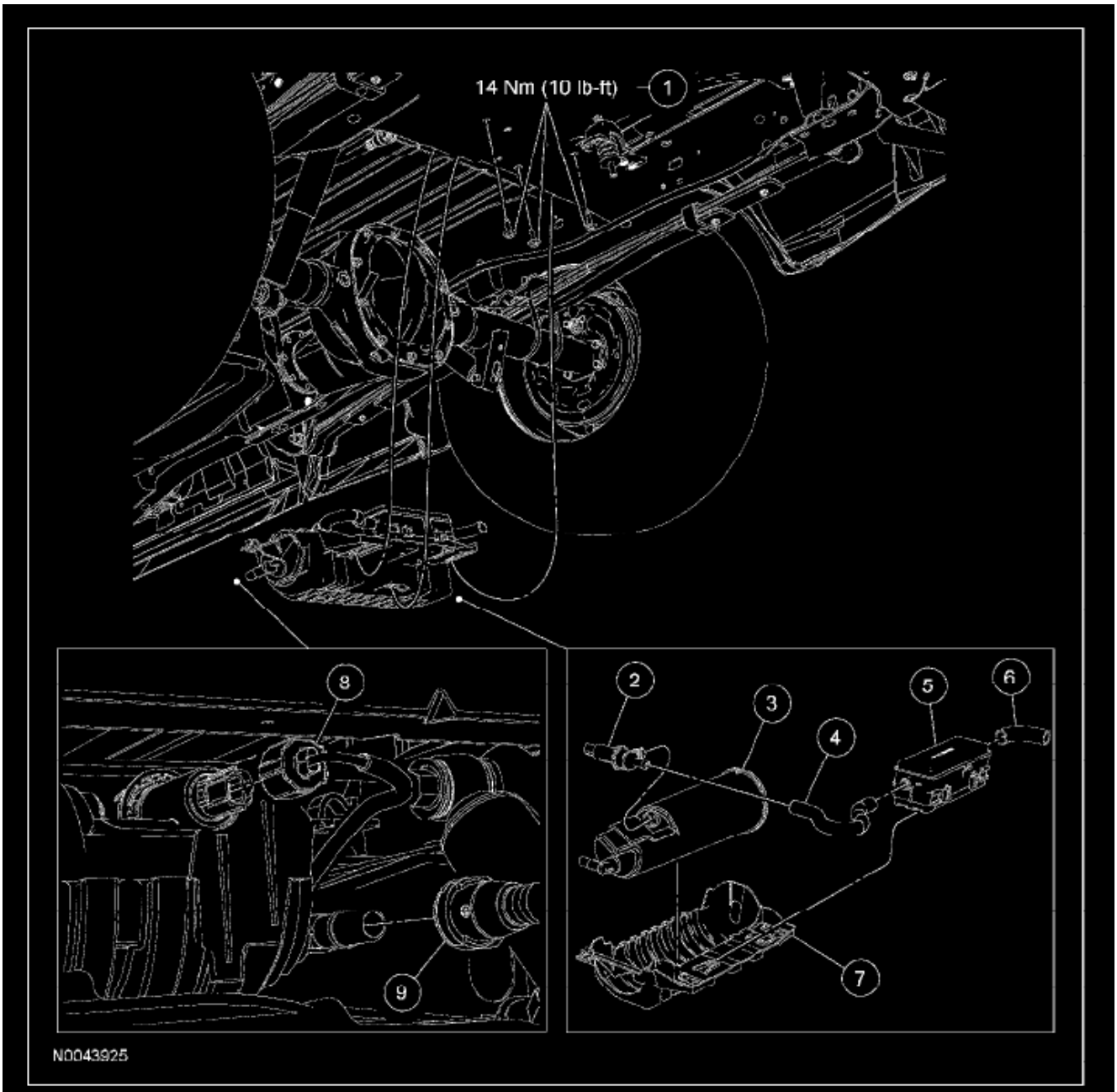
Fuel Tank Pressure Sensor: Description and Operation

FUEL TANK PRESSURE (FTP) SENSOR

Fuel Tank Pressure (FTP) Sensor

In-Line Fuel Tank Pressure (FTP) Sensor

The FTP sensor or in-line FTP sensor is used to measure the fuel tank pressure.



Item	Part Number	Description
1	W503932	Evaporative emissions (EVAP) canister and bracket assembly bolts
2	9F945	EVAP canister vent solenoid
3	9D653	EVAP canister

(Continued)

Item	Part Number	Description
4	9F459	EVAP canister vent solenoid-to-EVAP dust separator hose
5	9B328	EVAP dust separator
6	9F459	EVAP dust separator hose
7	9D665	EVAP canister bracket

(Continued)

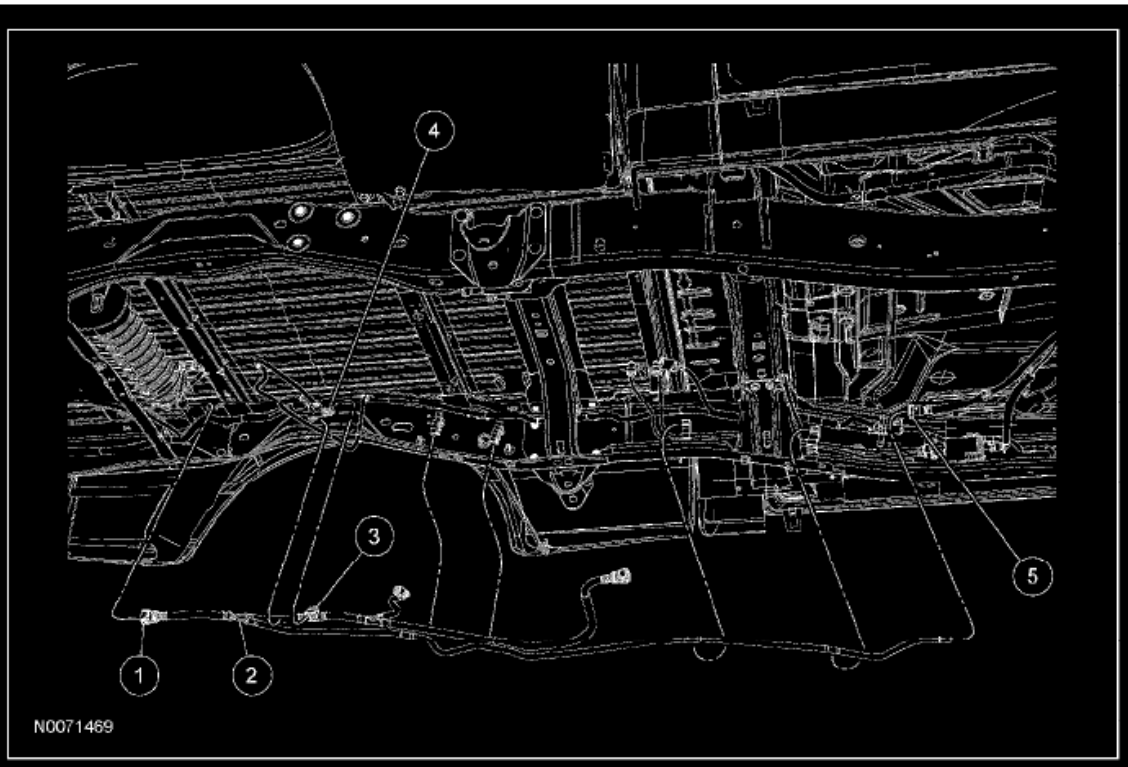
Fuel Tank Pressure Sensor: Service and Repair

FUEL TANK PRESSURE SENSOR

Exploded View

Part 1

Item	Part Number	Description
8	—	EVAP canister vent solenoid electrical connector (part of 14405)
9	—	Rear fuel tank vapor tube and fuel tank pressure sensor assembly-to-EVAP canister quick connect coupling (part of 9G291)



Item	Part Number	Description
1	—	Rear fuel tank vapor tube and fuel tank pressure sensor assembly-to-evaporative emission (EVAP) canister quick connect coupling (part of 9G291)
2	9G291	Rear fuel tank vapor tube and fuel tank pressure sensor assembly
3	—	Fuel tank pressure sensor (part of 9G291)
4	—	Fuel tank pressure sensor electrical connector (part of 14405)
5	—	Front fuel tank vapor tube-to-rear fuel tank vapor tube and fuel tank pressure sensor assembly quick connect coupling (part of 9L291)

Part 2

Removal and Installation

WARNING:

- When working on or near the evaporative emission (EVAP) system, disconnect the battery ground cable from the battery. The EVAP system contains fuel vapor and condensed fuel vapor, so an

electrical spark may cause a fire or explosion. Failure to follow this instruction may result in serious personal injury.

- Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

1. Remove the fuel tank. 2. Disconnect the fuel tank pressure sensor electrical connector.

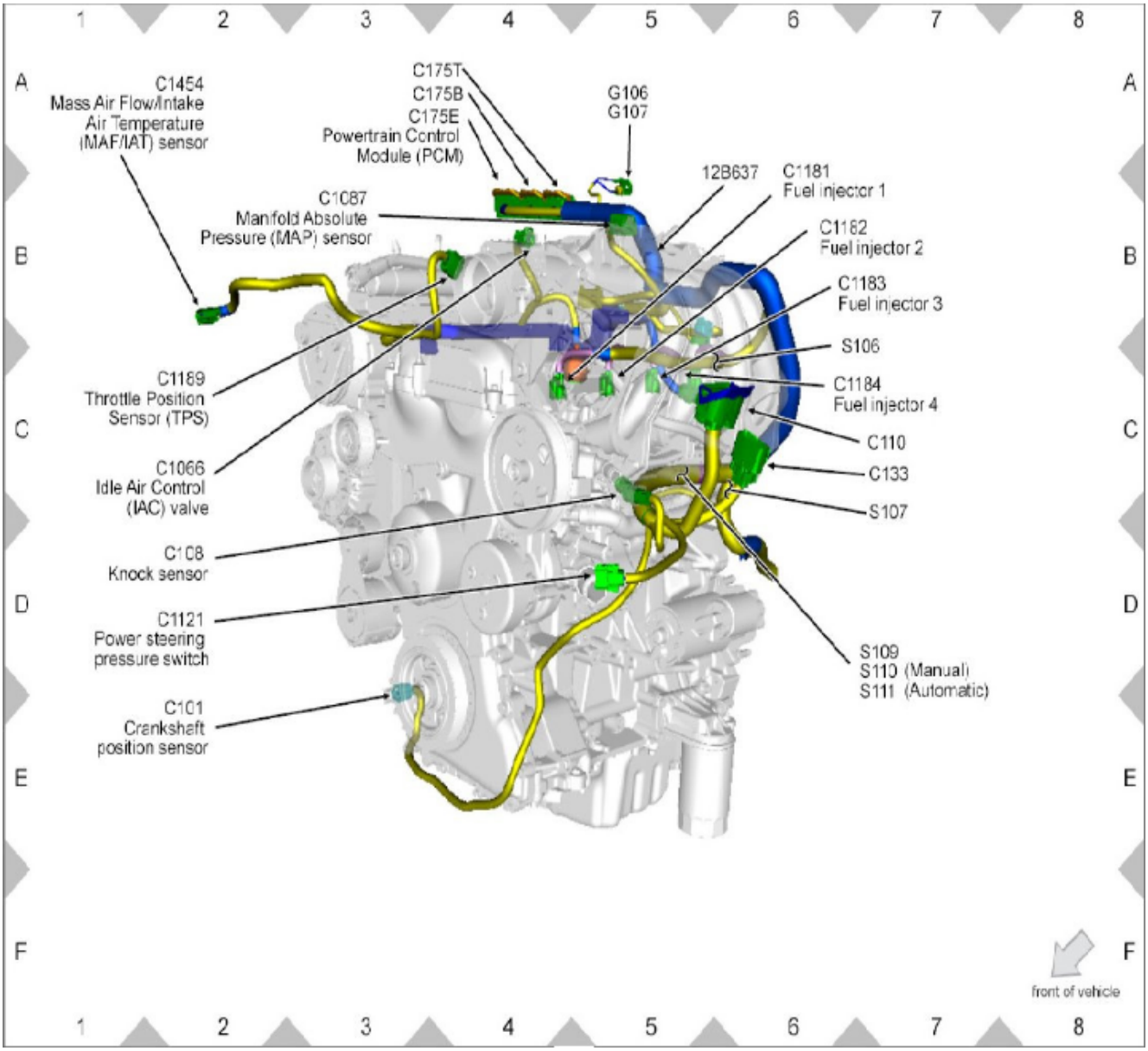
3. NOTE: The rear fuel tank vapor tube and fuel tank pressure sensor are an assembly and must be serviced as an assembly.

Disconnect the rear fuel tank vapor tube and fuel tank pressure sensor assembly-to-evaporative emissions (EVAP) canister quick connect coupling.

4. Disconnect the front fuel tank vapor tube-to-rear fuel tank vapor tube and fuel tank pressure sensor assembly quick connect coupling. 5. Remove the rear fuel tank vapor tube and fuel tank pressure sensor assembly. 6. To install, reverse the removal procedure.

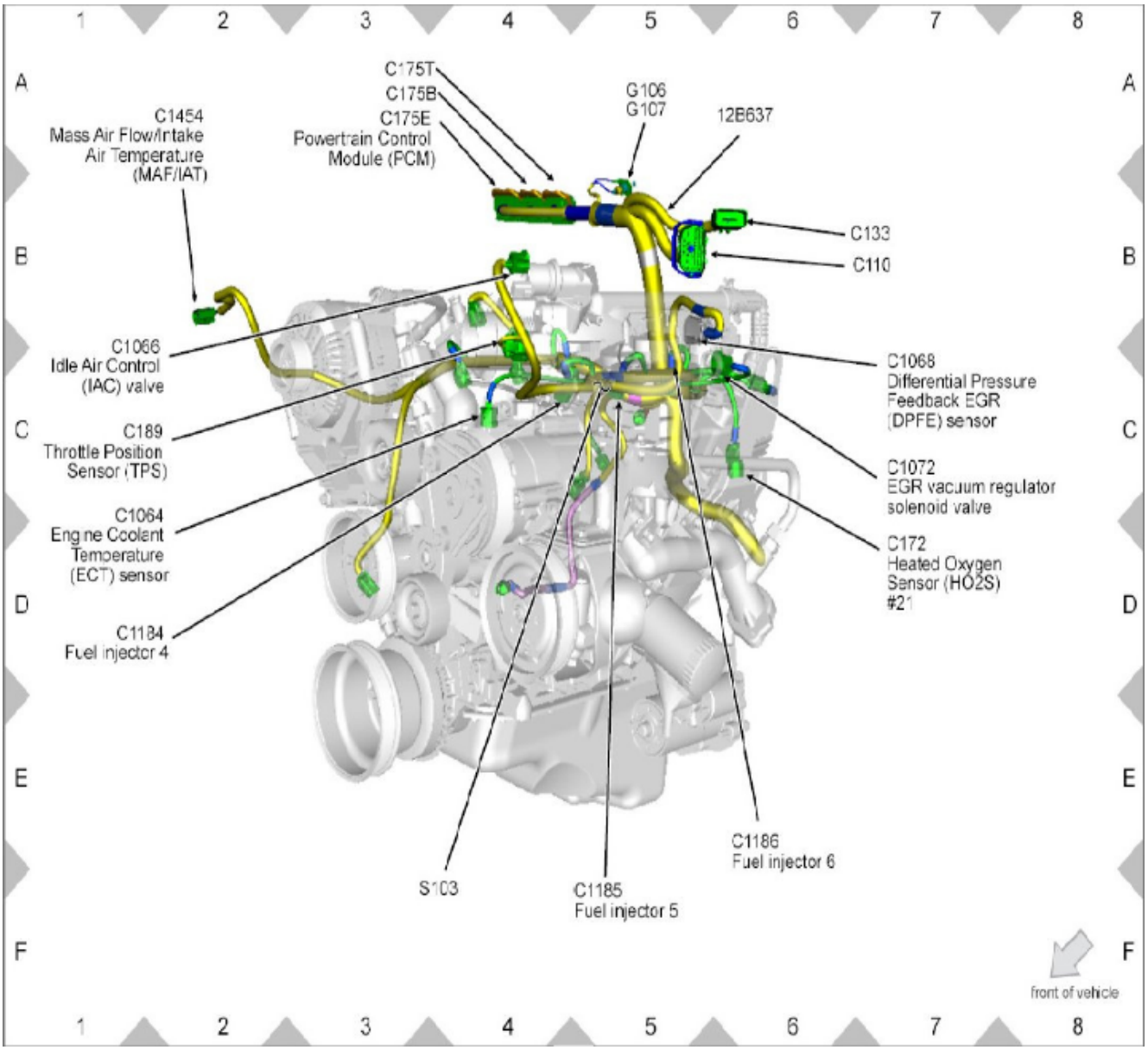
- Carry out the leak test. See: Powertrain Management/Emission Control Systems/Evaporative Emissions System/Testing and Inspection

- Carry out the evaporative emission repair verification drive cycle.

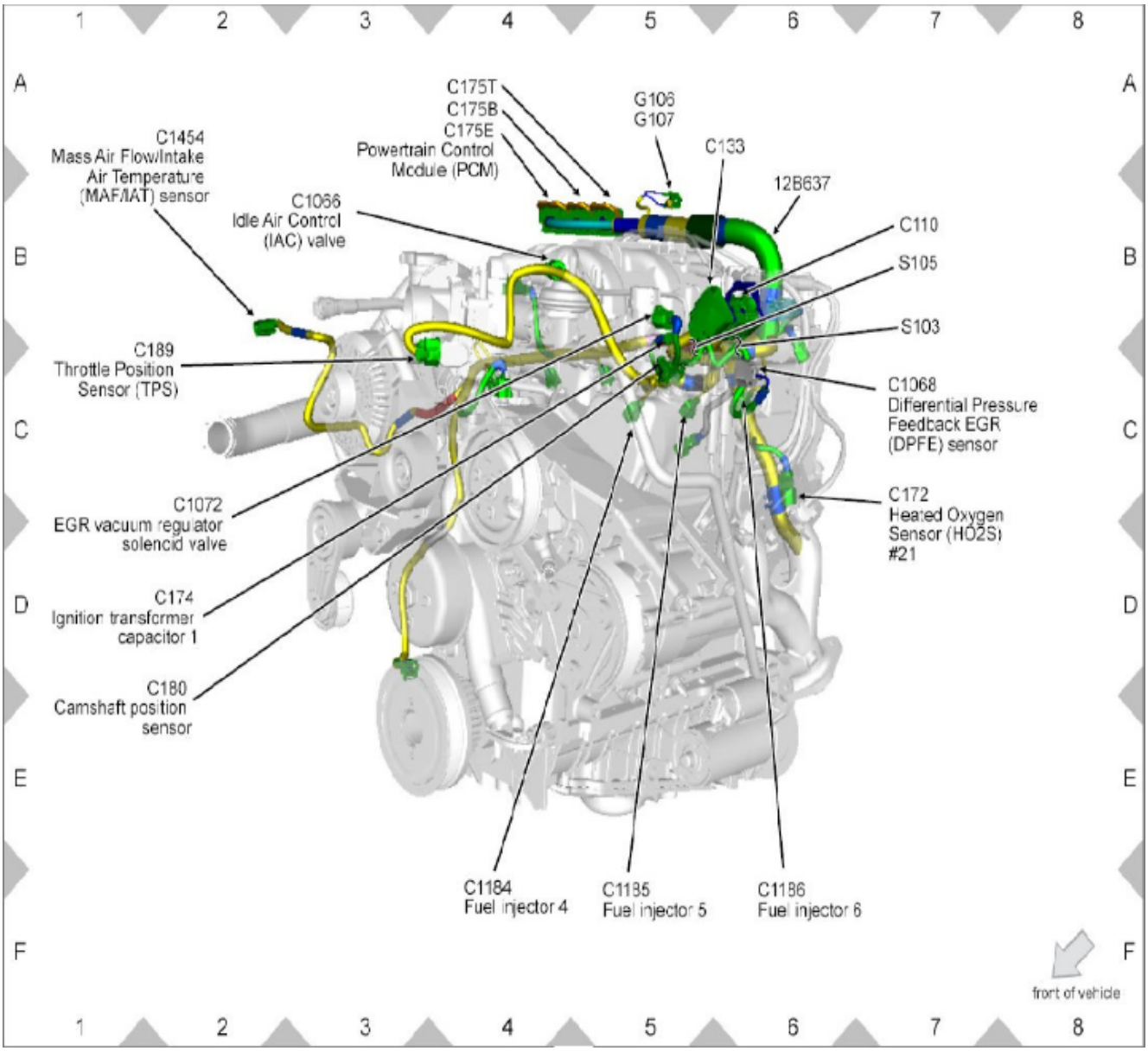


Intake Air Temperature Sensor: Locations

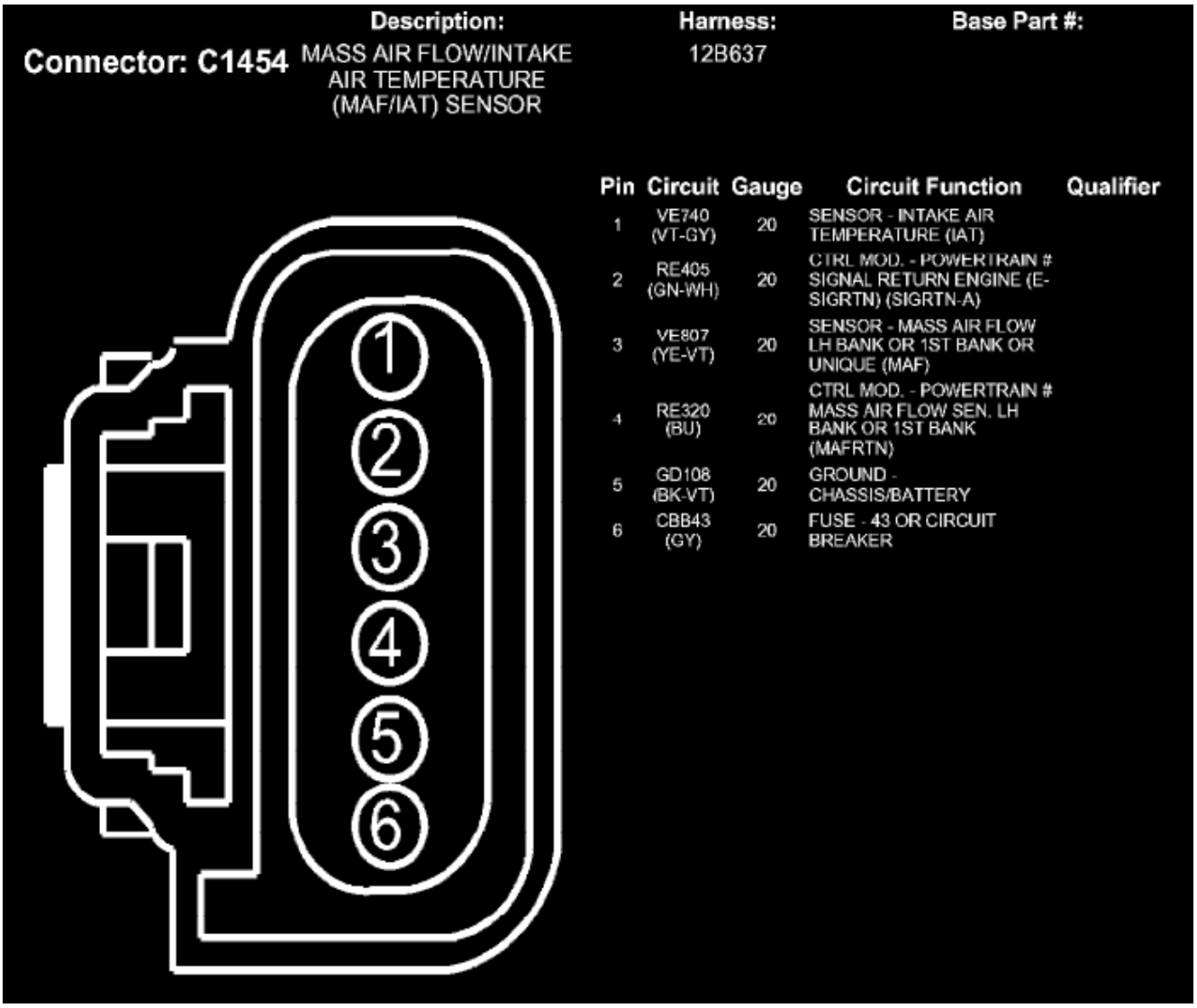
View 151-3


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
12B637
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT)
C133
C110
C1066
Idle Air Control (IAC) valve
C189
Throttle Position Sensor (TPS)
C1064
Engine Coolant Temperature (ECT) sensor
C1184
Fuel injector 4
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
S103
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-5

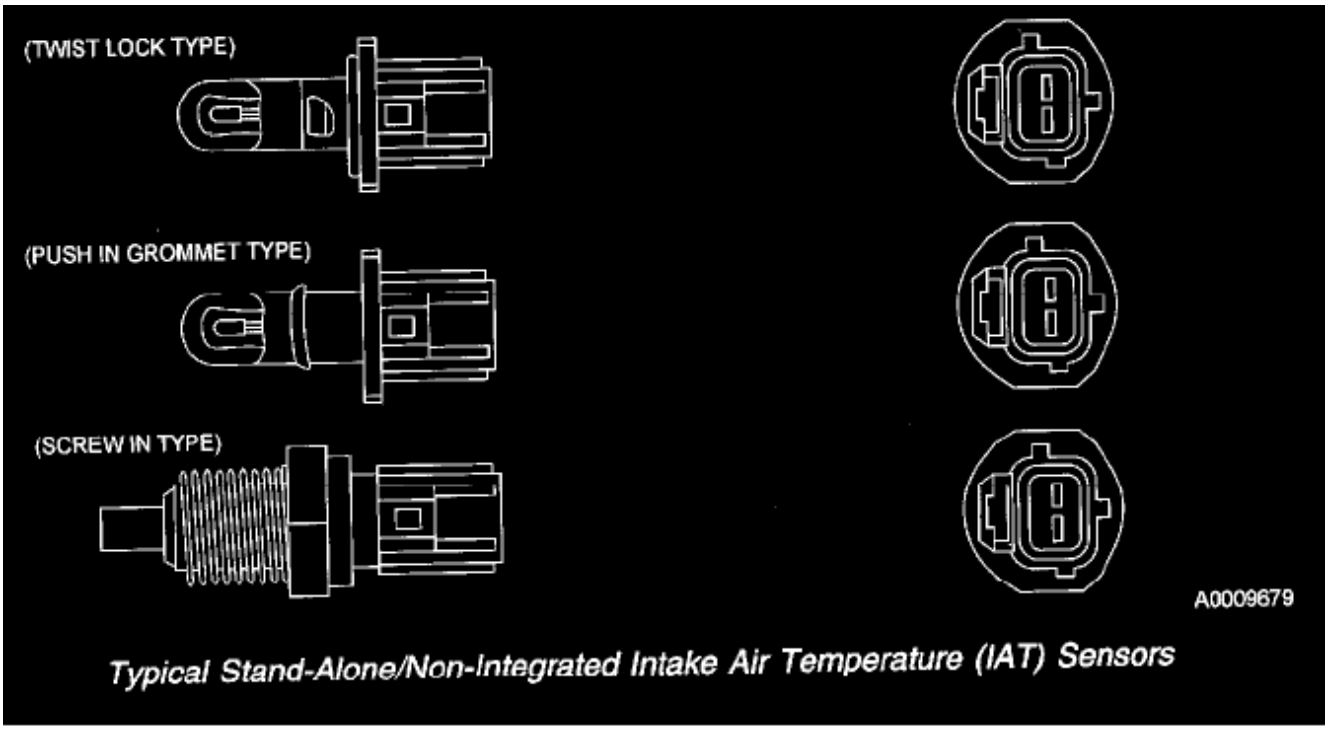

C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
C133
12B637
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor
C1066
Idle Air Control (IAC) valve
C110
S105
S103
C189
Throttle Position Sensor (TPS)
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
C174
Ignition transformer capacitor 1
C180
Camshaft position sensor
C1184
Fuel injector 4
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-7

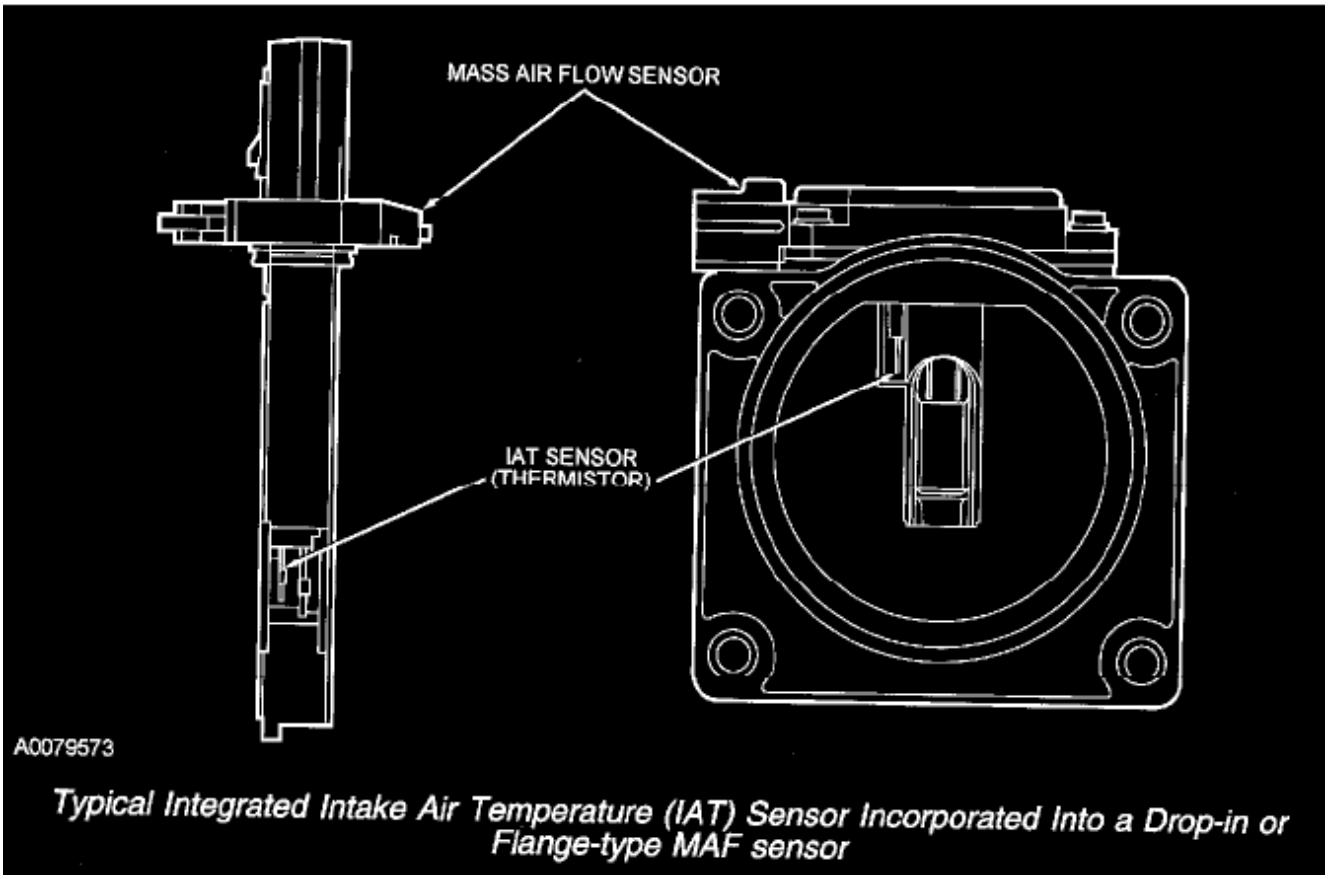


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE740 (VT-GY)	20	SENSOR - INTAKE AIR TEMPERATURE (IAT)	
2	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	
3	VE807 (YE-VT)	20	SENSOR - MASS AIR FLOW LH BANK OR 1ST BANK OR UNIQUE (MAF)	
4	RE320 (BU)	20	CTRL MOD. - POWERTRAIN # MASS AIR FLOW SEN. LH BANK OR 1ST BANK (MAFRTN)	
5	GD108 (BK-VT)	20	GROUND - CHASSIS/BATTERY	
6	CBB43 (GY)	20	FUSE - 43 OR CIRCUIT BREAKER	

C1454



Typical Stand-Alone/Non-Integrated Intake Air Temperature (IAT) Sensors



Typical Integrated Intake Air Temperature (IAT) Sensor Incorporated Into a Drop-in or Flange-type MAF sensor

Intake Air Temperature Sensor: Description and Operation

Intake Air Temperature (IAT) Sensor

Typical Stand-Alone/Non-Integrated Intake Air Temperature (IAT) Sensors

Typical Integrated Intake Air Temperature (IAT) Sensor Incorporated Into A Drop-in Or Flange-type MAF Sensor

The IAT sensor is a thermistor device in which resistance changes with temperature. The electrical resistance of a thermistor decreases as the temperature increases, and the resistance increases as the temperature decreases. The varying resistance affects the voltage drop across the sensor terminals and provides electrical signals to the PCM corresponding to temperature.

Thermistor-type sensors are considered passive sensors. A passive sensor is connected to a voltage divider network so that varying the resistance of the passive sensor causes a variation in total current flow. Voltage that is dropped across a fixed resistor in a series with the sensor resistor determines the voltage signal at the PCM. This voltage signal is equal to the reference voltage minus the voltage drop across the fixed resistor.

The IAT provides air temperature information to the PCM. The PCM uses the air temperature information as a correction factor in the calculation of

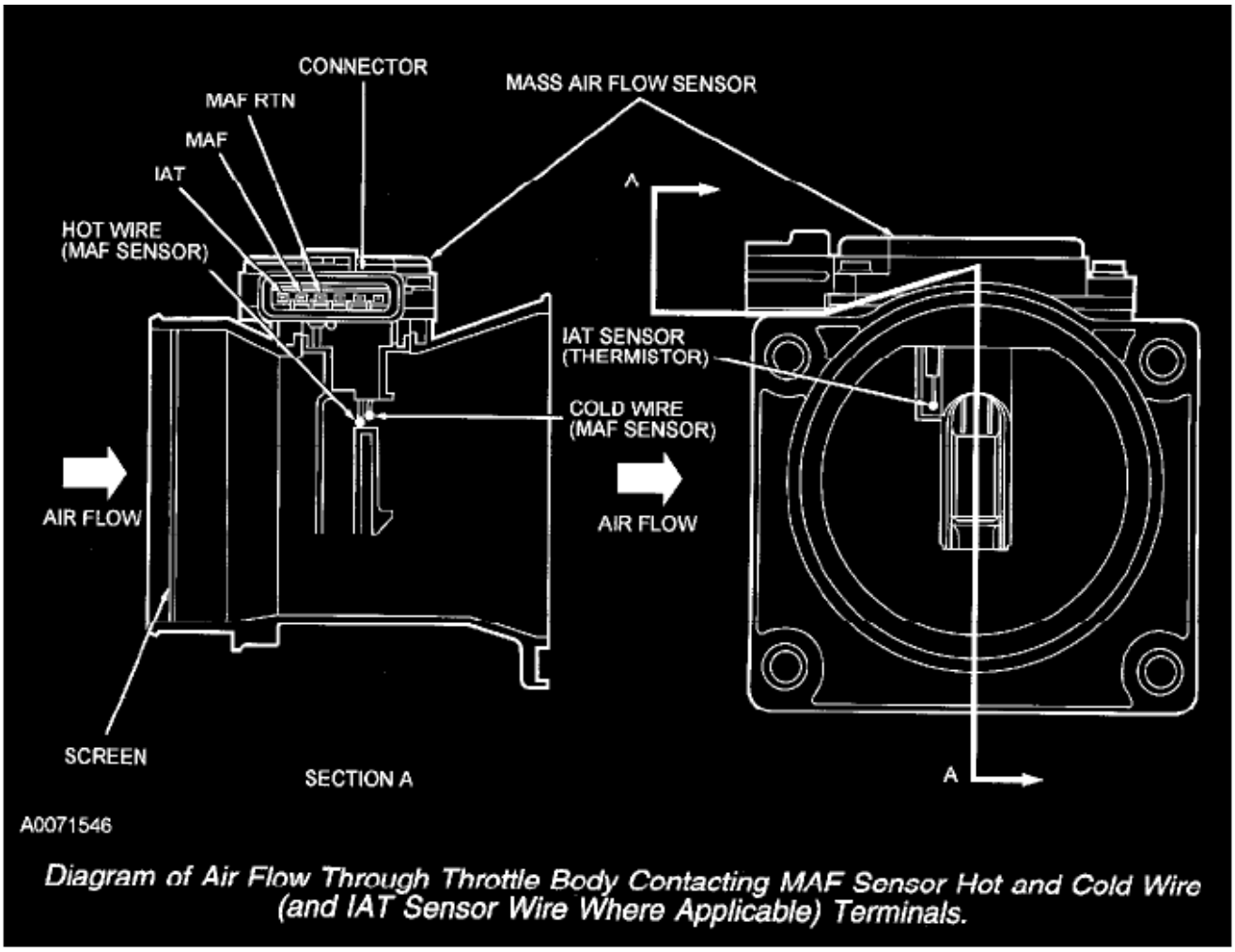
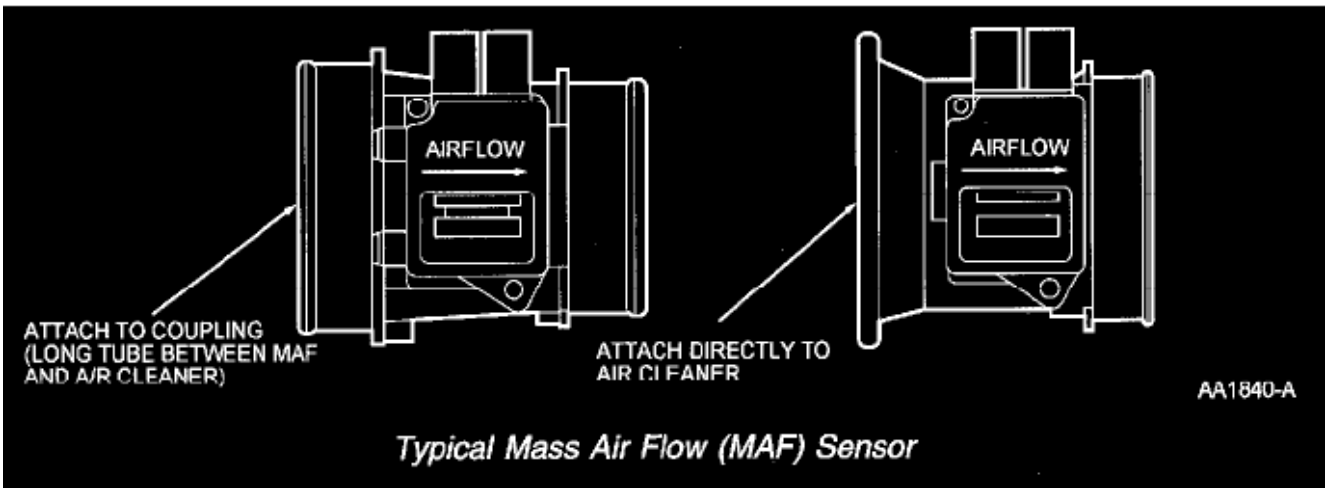


Diagram of Air Flow Through Throttle Body Contacting MAF Sensor Hot and Cold Wire (and IAT Sensor Wire Where Applicable) Terminals.



Typical Mass Air Flow (MAF) Sensor

fuel, spark, and air flow.

The IAT sensor provides a quicker temperature change response time than the ECT or CHT sensor.

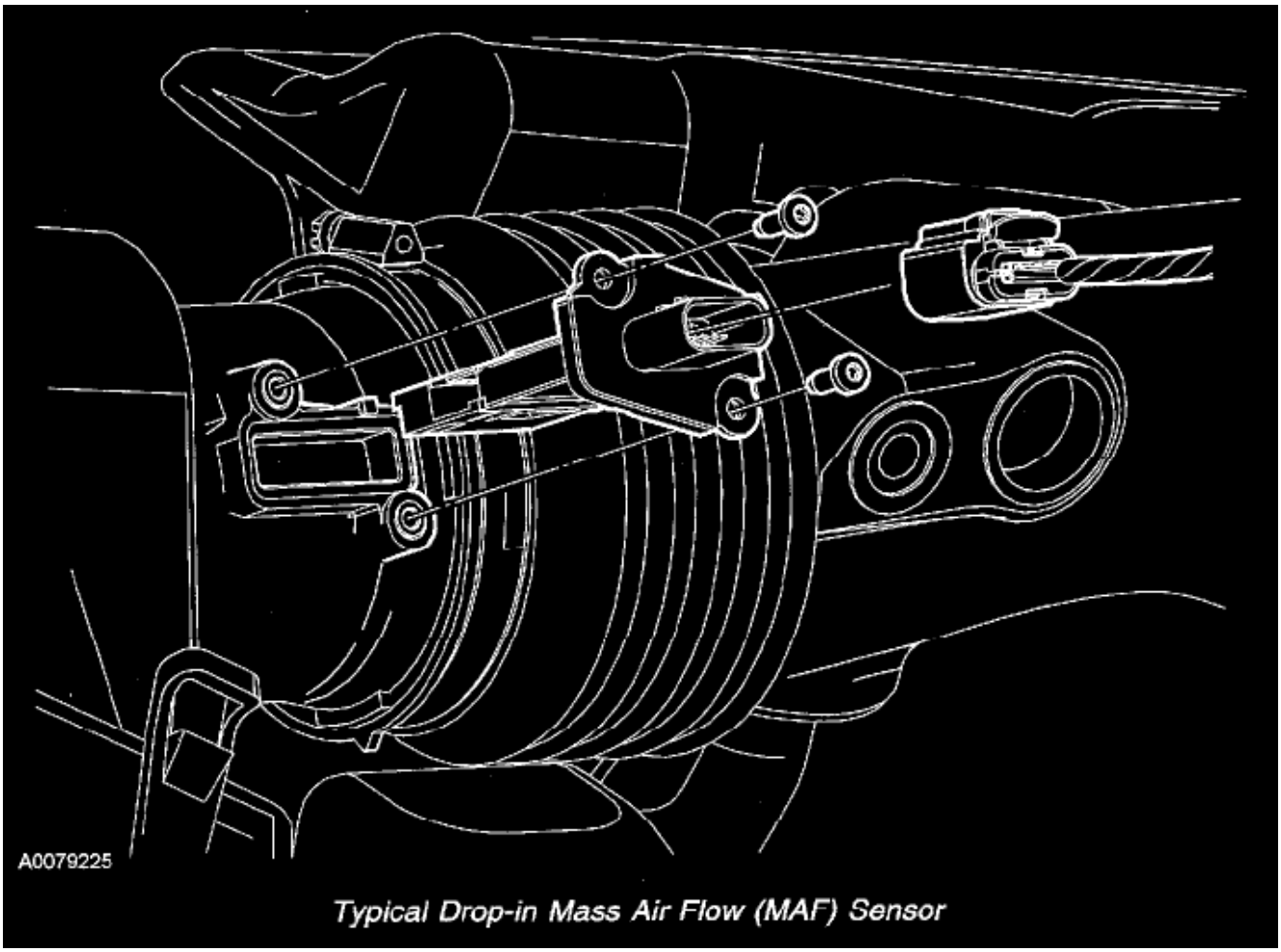
Currently there are 2 design types of IAT sensors used, a stand-alone/non-integrated type and a integrated type. Both types function the same, however the integrated type is incorporated into the mass air flow (MAF) sensor instead of being a stand alone sensor.

Supercharged vehicles use 2 IAT sensors. Both sensors are thermistor type devices and operate as described above. One is located before the supercharger at the air cleaner for standard OBD/cold weather input, while a second sensor (IAT2) is located after the supercharger in the intake manifold. The IAT2 sensor located after the supercharger provides air temperature information to the PCM to control spark and to help determine charge air cooler (CAC) efficiency.

Mass Air Flow (MAF) Sensor

Diagram Of Air Flow Through Throttle Body Contacting MAF Sensor Hot And Cold Wire (and IAT Sensor Wire Where Applicable) Terminals

Typical Mass Air Flow (MAF) Sensor

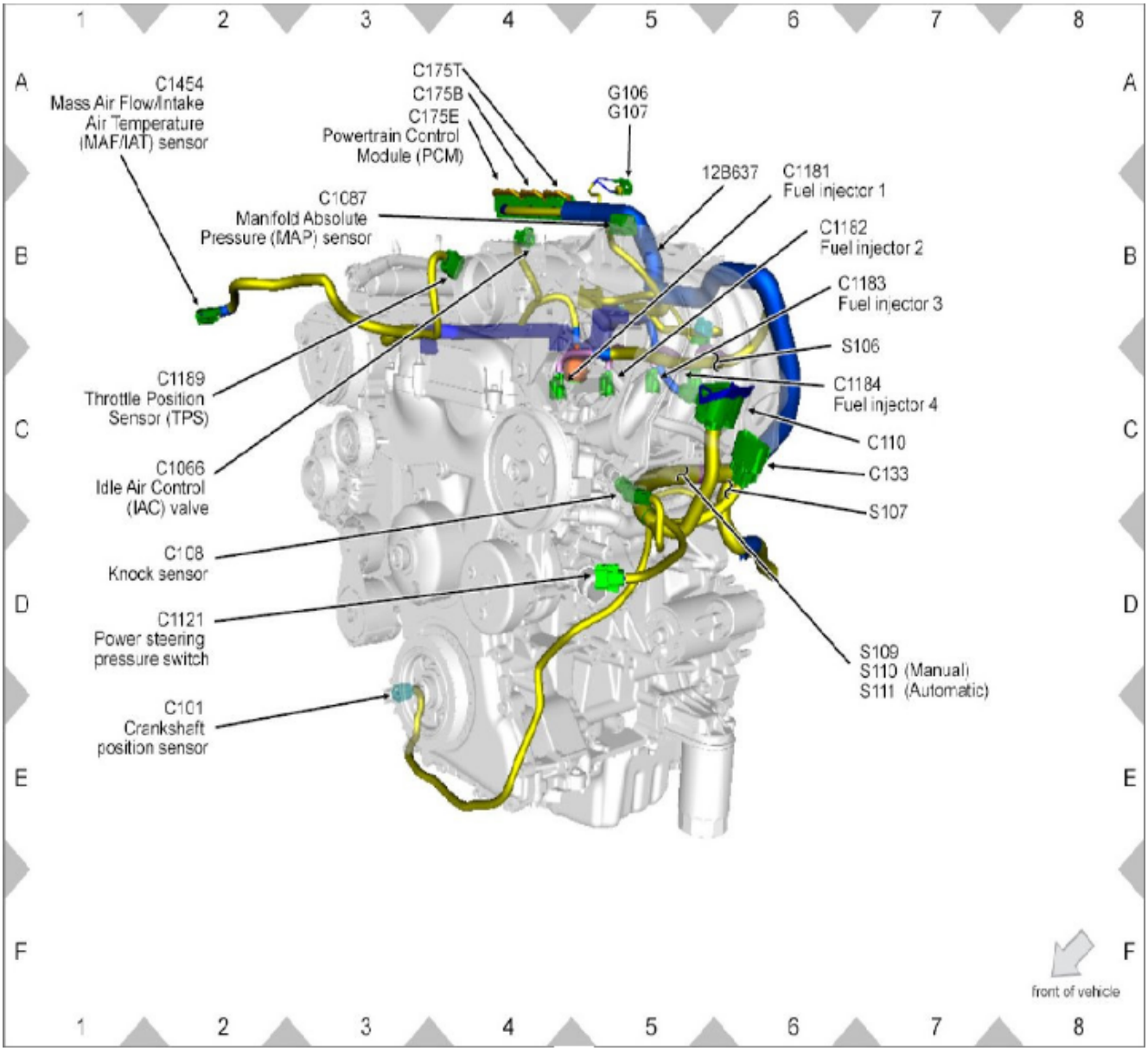


Typical Drop-in Mass Air Flow (MAF) Sensor

Typical Drop-in Mass Air Flow (MAF) Sensor

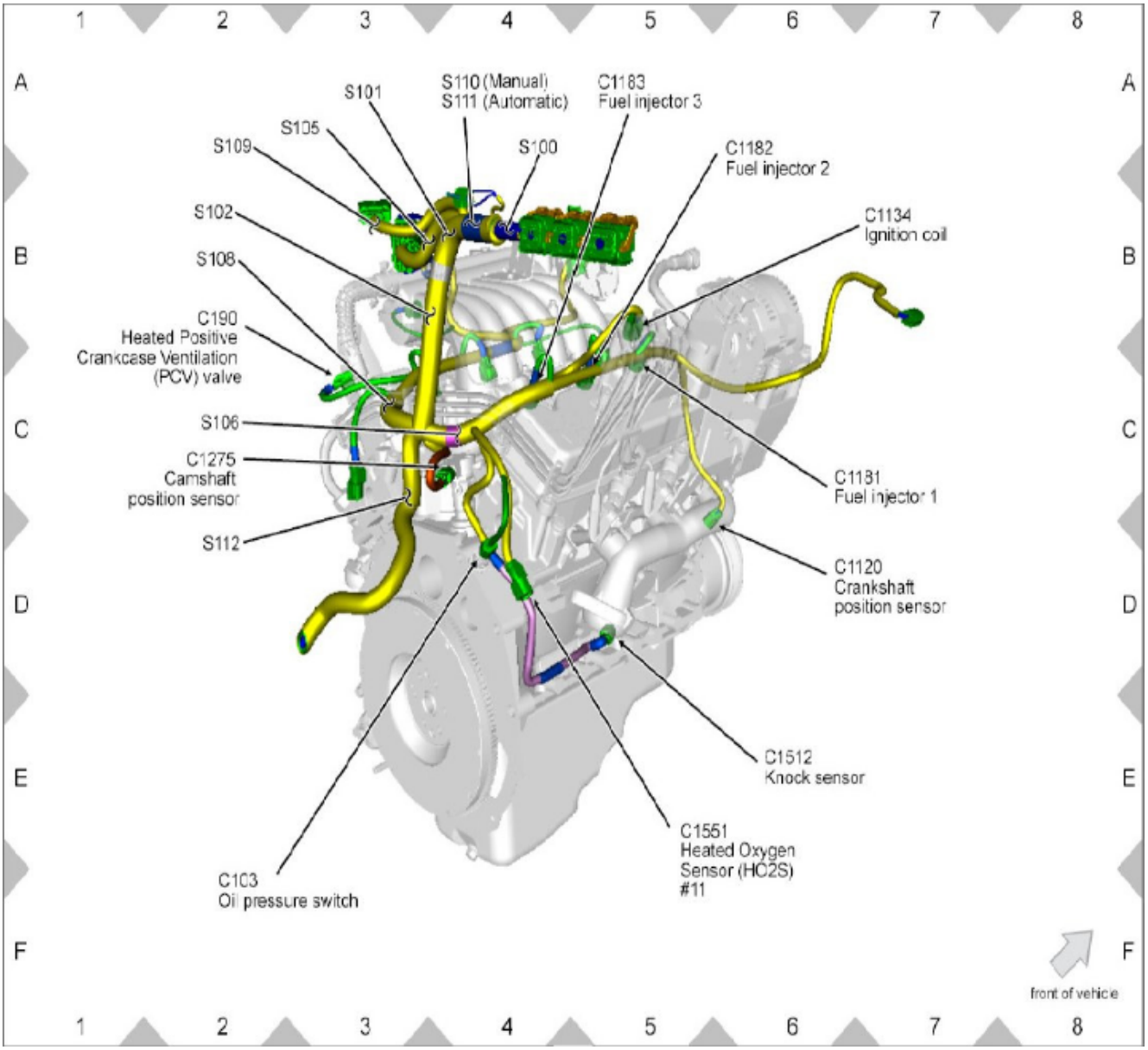
The MAF sensor uses a hot wire sensing element to measure the amount of air entering the engine. Air passing over the hot wire causes it to cool. This hot wire is maintained at 200°C (392°F) above the ambient temperature as measured by a constant cold wire. The current required to maintain the temperature of the hot wire is proportional to the mass air flow. The MAF sensor then outputs an analog voltage signal to the PCM proportional to the intake air mass. The PCM calculates the required fuel injector pulse width in order to provide the desired air/fuel ratio. This input is also used in determining transmission electronic pressure control (EPC), shift and torque converter clutch scheduling.

The MAF sensor is located between the air cleaner and the throttle body or inside the air cleaner assembly. Most MAF sensors have integrated bypass technology with an integrated intake air temperature (IAT) sensor. The hot wire electronic sensing element must be replaced as an assembly. Replacing only the element may change the air flow calibration.

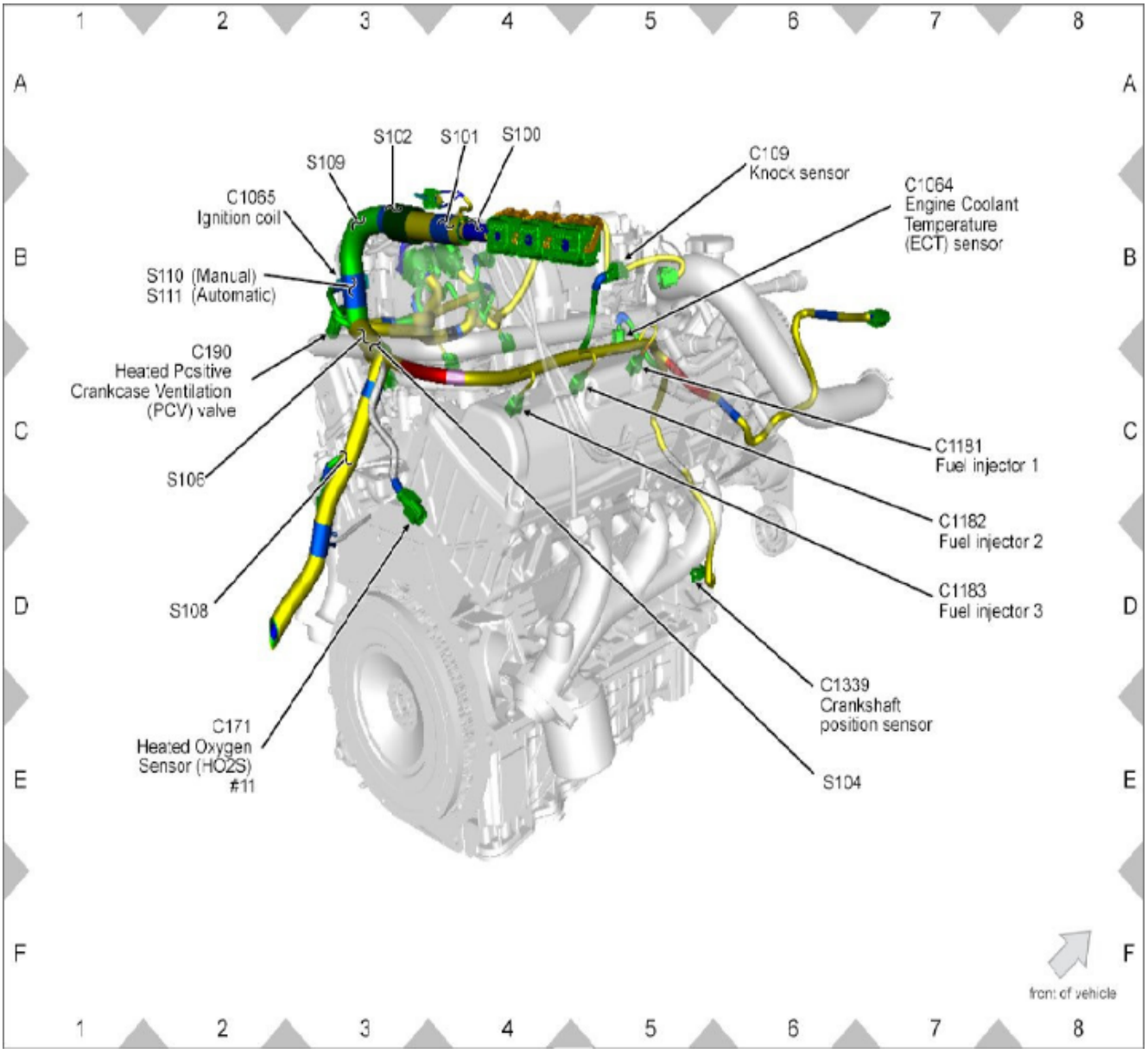


Knock Sensor: Locations

View 151-3


S101
S110 (Manual)
S111 (Automatic)
C1183
Fuel injector 3
S105
S109
S100
C1182
Fuel injector 2
S102
C1134
Ignition coil
S108
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
C1275
Camshaft
position sensor
S112
C1181
Fuel injector 1
C1120
Crankshaft
position sensor
C1512
Knock sensor
C1551
Heated Oxygen
Sensor (HO2S)
#11
C103
Oil pressure switch
front of vehicle

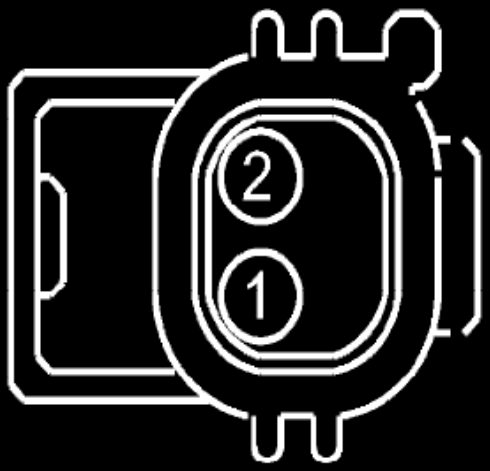
View 151-6


S102
S101
S100
S109
C1065
Ignition coil
S110 (Manual)
S111 (Automatic)
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
S108
C171
Heated Oxygen
Sensor (HO2S)
#11
C109
Knock sensor
C1064
Engine Coolant
Temperature
(ECT) sensor
C1181
Fuel injector 1
C1182
Fuel injector 2
C1183
Fuel injector 3
C1339
Crankshaft
position sensor
S104
front of vehicle

View 151-8

Connector: C108

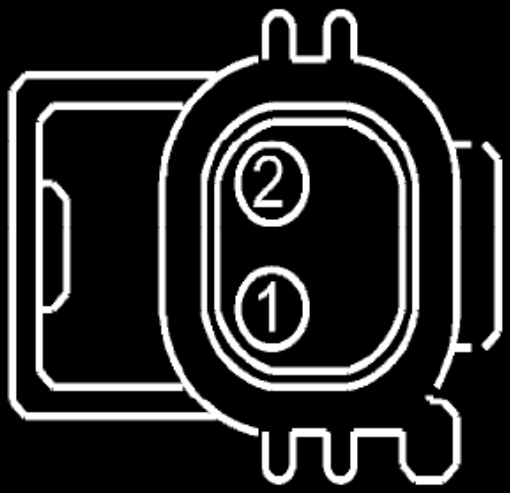
Description:	Harness:	Base Part #:
KNOCK SENSOR	12B637	12A699



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RE323 (WH-BN)	20	CTRL MOD. - POWERTRAIN # KNOCK SENSOR 1ST OR UNIQUE (KS1N) [KSL1-]	2.3L
2	VE801 (VT-OG)	20	SENSOR - KNOCK 1ST OR UNIQUE (KS1P) [KSL1+]	2.3L

Connector: C109

Description:	Harness:	Base Part #:
KNOCK SENSOR	12B637	12A699



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE801 (VT-OG)	20	SENSOR - KNOCK 1ST OR UNIQUE (KS1P) [KSL1+]	4.0L
2	RE323 (WH-BN)	20	CTRL MOD. - POWERTRAIN # KNOCK SENSOR 1ST OR UNIQUE (KS1N) [KSL1-]	4.0L

Knock Sensor: Diagrams

C108

C109

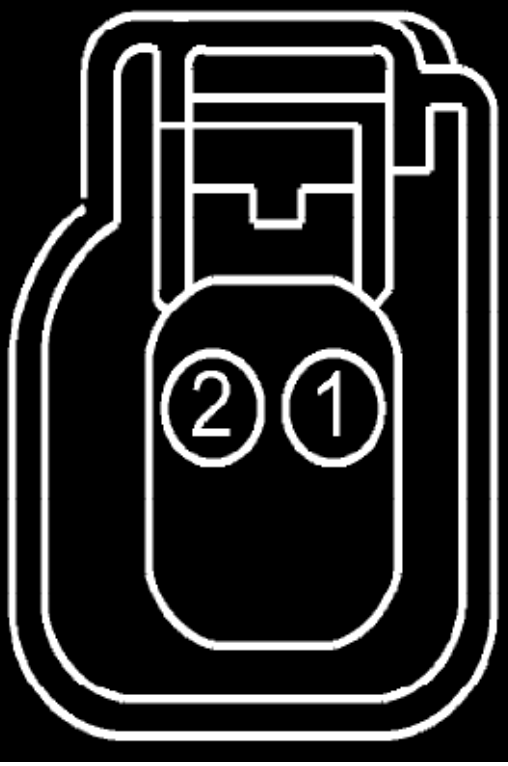
Connector: C1512

Description: KNOCK SENSOR

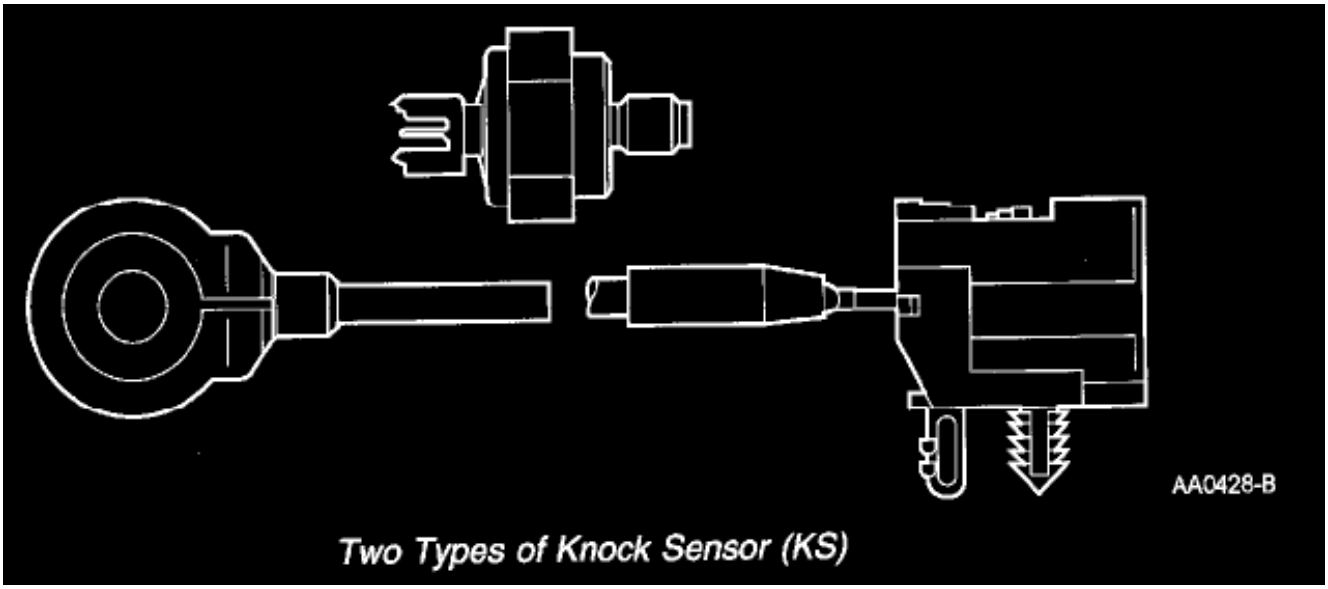
Harness: 12B637

Base Part #: 12A699

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE801 (VT-OG)	20	SENSOR - KNOCK 1ST OR UNIQUE (KS1P) [KSL1+]	3.0L
2	RE323 (WH-BN)	20	CTRL MOD. - POWERTRAIN # KNOCK SENSOR 1ST OR UNIQUE (KS1N) [KSL1-]	3.0L



C1512



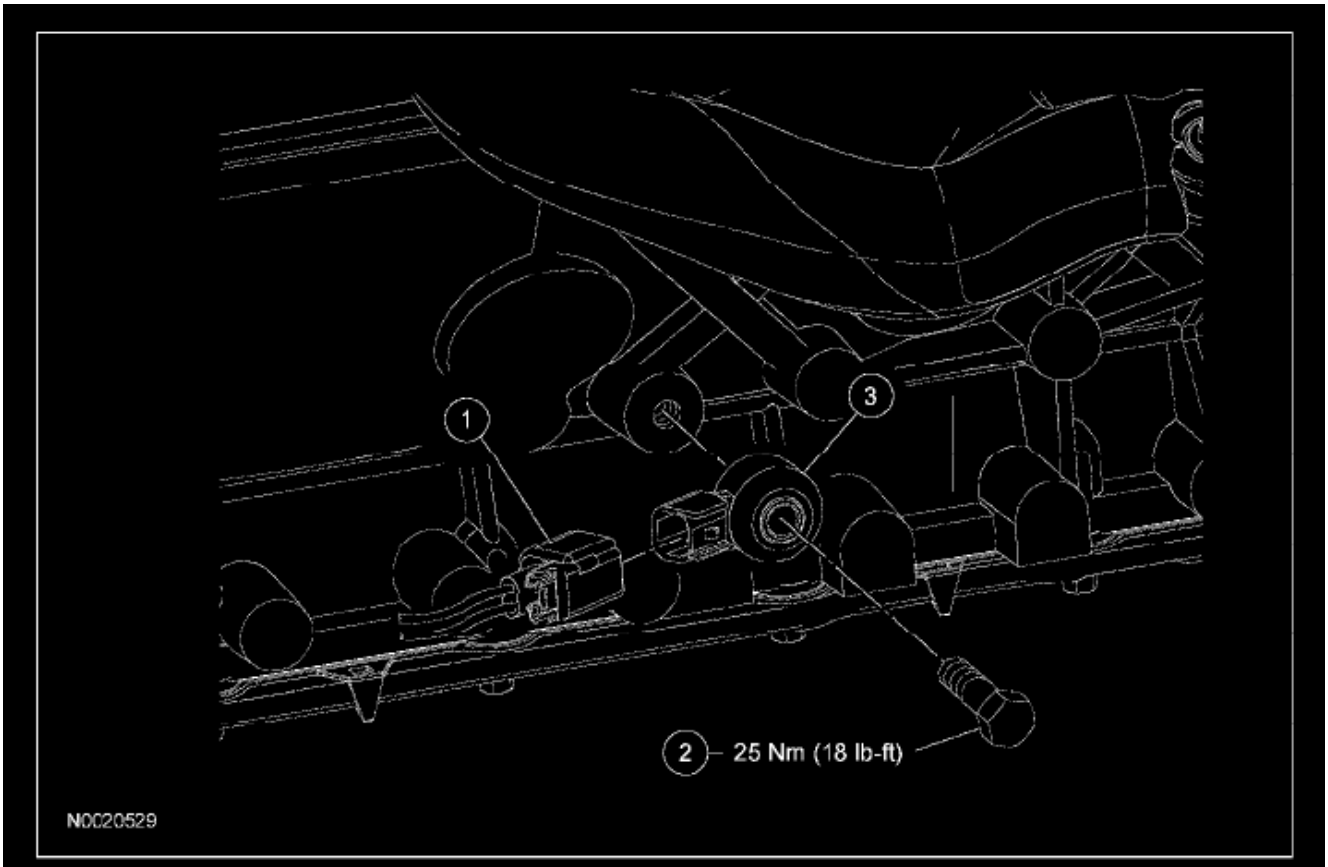
Two Types of Knock Sensor (KS)

Knock Sensor: Description and Operation

Knock Sensor (KS)

Two Types Of Knock Sensor (KS)

The KS is a tuned accelerometer on the engine which converts engine vibration to an electrical signal. The PCM uses this signal to determine the presence of engine knock and to retard spark timing.



Item	Part Number	Description
1	14A464	Knock sensor (KS) electrical connector (part of 12B637)
2	W5000225	KS bolt
3	12A699	KS

Knock Sensor: Service and Repair

KNOCK SENSOR (KS)

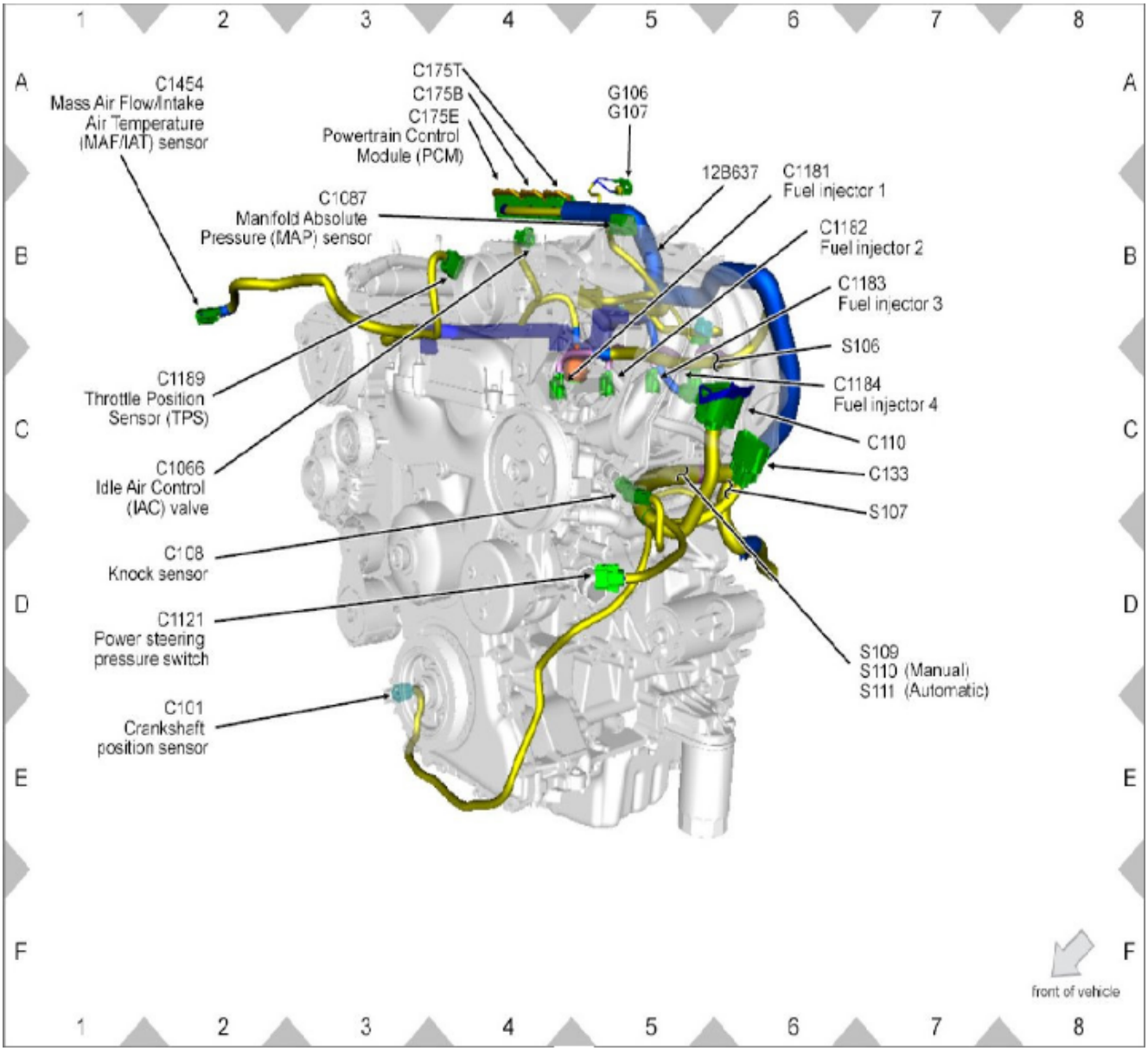
Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the knock sensor (KS) electrical connector. 3. Remove the bolt and the KS.

- To install, tighten to 25 Nm (18 lb-ft).

4. To install, reverse the removal procedure.

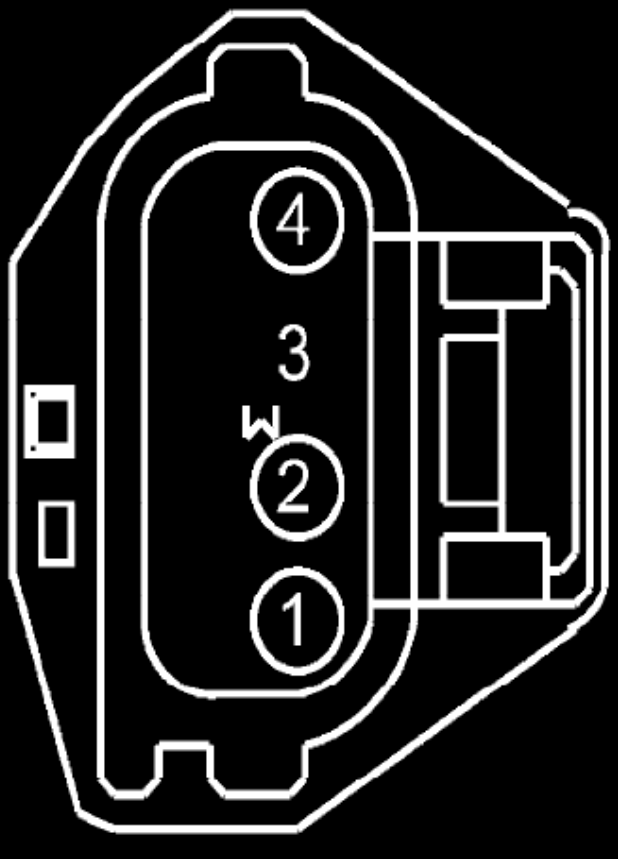
Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Sensors and Switches > Sensors and Switches - Powertrain Management > Sensors and Switches - Computers and Control Systems > Manifold Pressure/Vacuum Sensor > Component Information > Locations



View 151-3

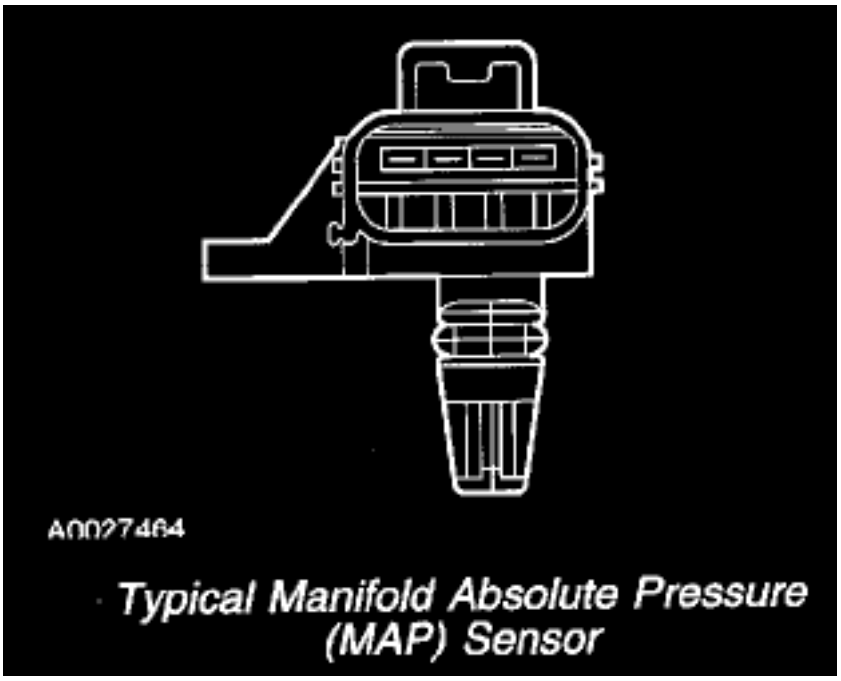
Connector: C1087

Description:	Harness:	Base Part #:
MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR	12B637	19F479



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE803 (BU-GN)	20	SENSOR - MANIFOLD ABSOLUTE PRESSURE (MAP)	2.3L
2	LE423 (GN-VT)	20	CTRL MOD. - POWERTRAIN # VOLTAGE REFERENCE ENGINE (VREF) (E-VREV)	2.3L
3	*	*	not used	
4	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN A)	2.3L

C1087



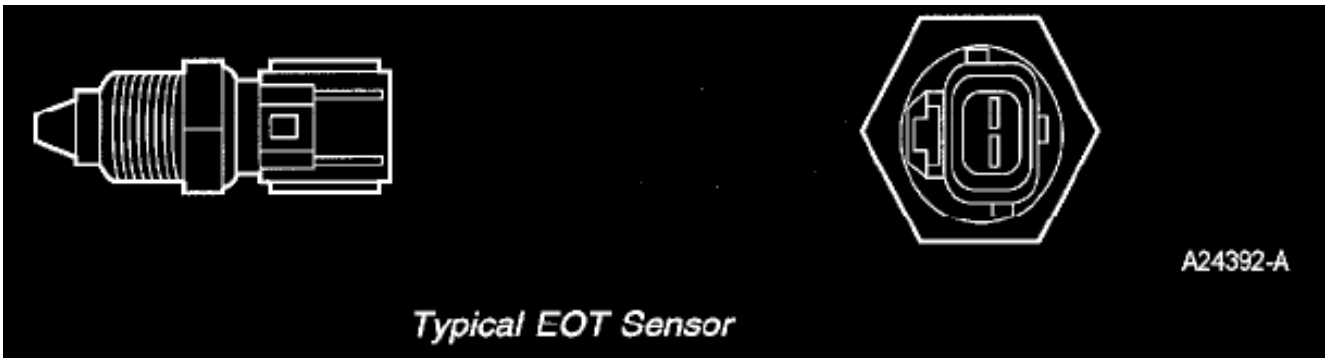
Typical Manifold Absolute Pressure (MAP) Sensor

Manifold Pressure/Vacuum Sensor: Description and Operation

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR

Typical Manifold Absolute Pressure (MAP) Sensor

The MAP sensor measures intake manifold absolute pressure. The PCM uses information from the MAP sensor to measure how much exhaust gas is introduced into the intake manifold.



Typical EOT Sensor

Oil Temperature Sensor For ECM: Description and Operation

ENGINE OIL TEMPERATURE (EOT) SENSOR

Typical EOT Sensor

The EOT sensor is a thermistor device in which resistance changes with temperature. The electrical resistance of a thermistor decreases as the temperature increases and the resistance increases as the temperature decreases. The varying resistance changes the voltage drop across the sensor terminals and provides electrical signals to the PCM corresponding to temperature.

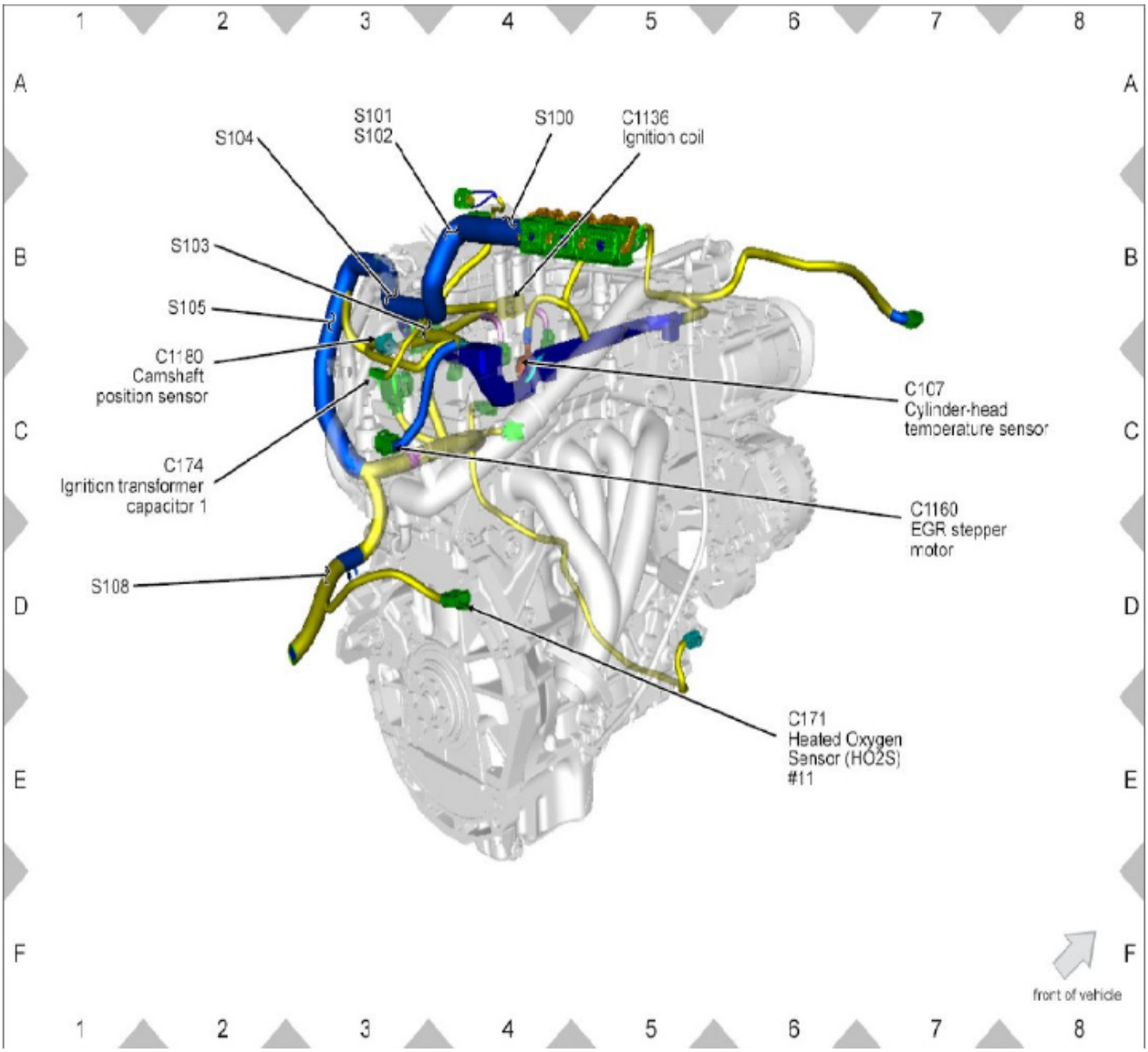
Thermistor-type sensors are considered passive sensors. A passive sensor is connected to a voltage divider network so that varying the resistance of the passive sensor causes a variation in total current flow. Voltage that is dropped across a fixed resistor in a series with the sensor resistor determines the voltage signal at the PCM. This voltage signal is equal to the reference voltage minus the voltage drop across the fixed resistor.

The EOT sensor measures the temperature of the engine oil. The sensor is typically threaded into the engine oil lubrication system. The PCM can use the EOT sensor input to determine the following:

- On variable camshaft timing (VCT) applications the EOT input is used to adjust the VCT control gains and logic for camshaft timing.

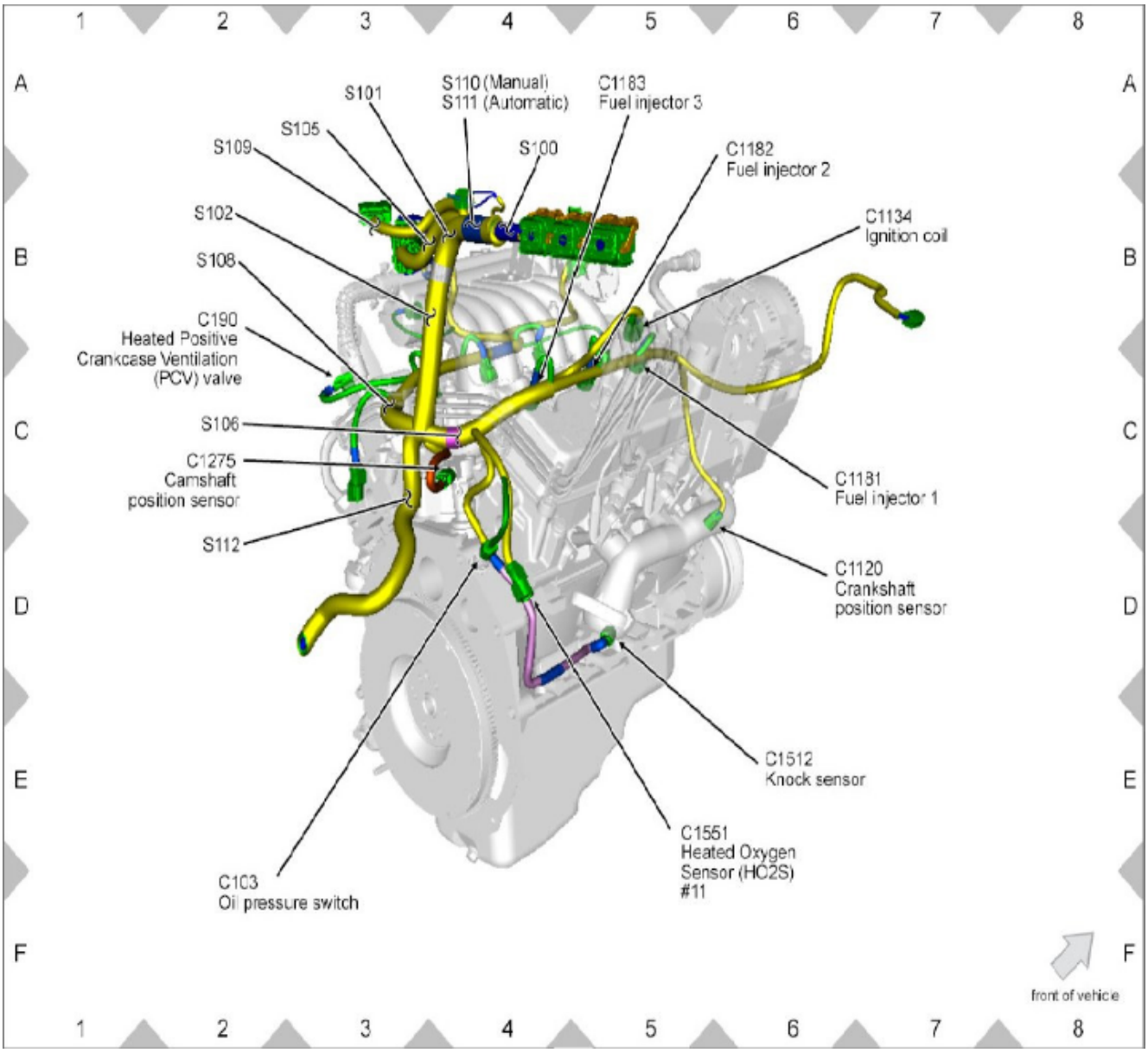
- The PCM can use EOT sensor input in conjunction with other PCM inputs to determine oil degradation.

- The PCM can use EOT sensor input to initiate a soft engine shutdown. To prevent engine damage from occurring as a result of high oil temperatures, the PCM has the ability to initiate a soft engine shutdown. Whenever engine RPM exceeds a calibrated level for a certain period of time, the PCM begins reducing power by disabling engine cylinders.

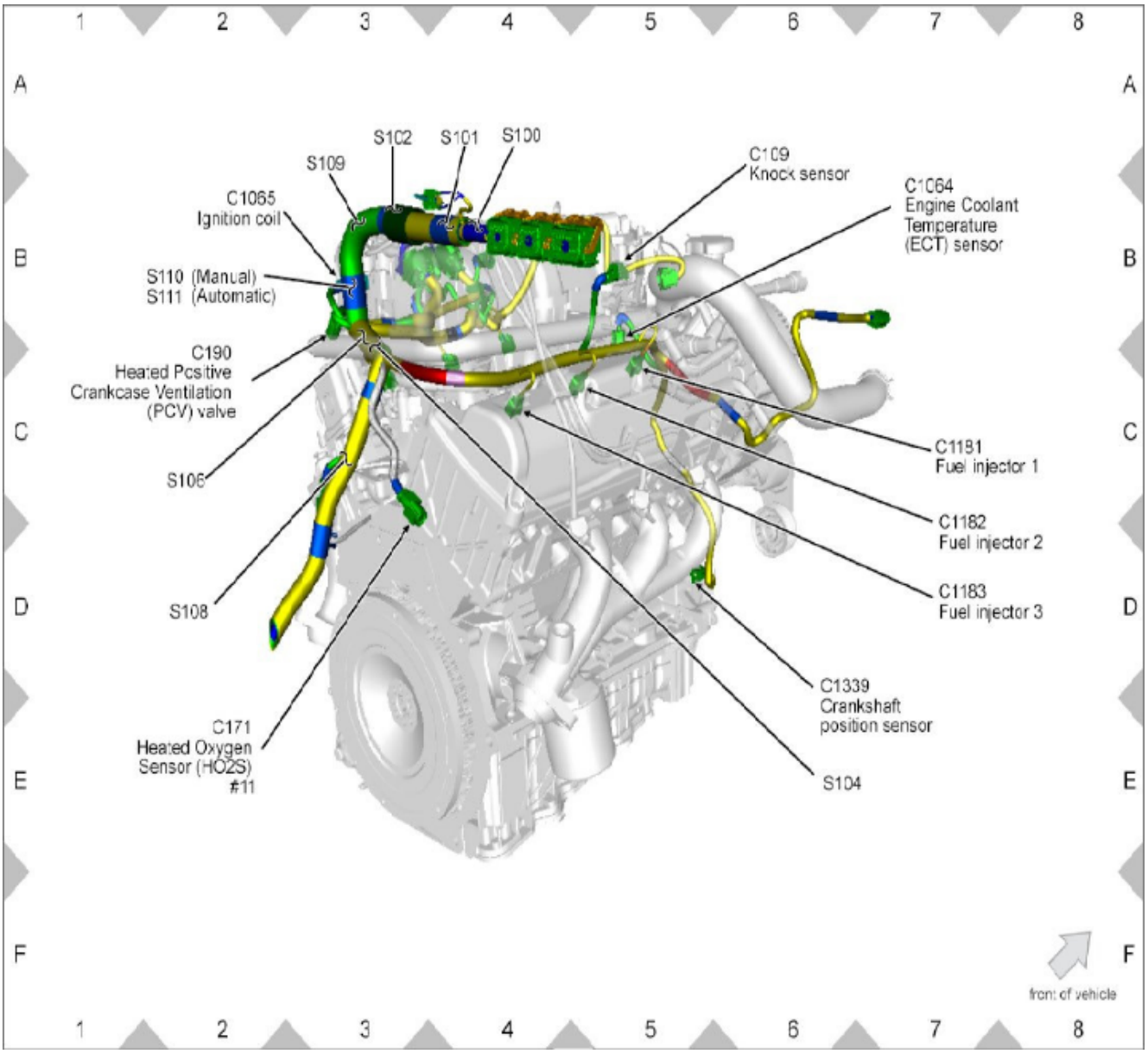


Oxygen Sensor: Locations Heated Oxygen Sensor (HO2S) #11

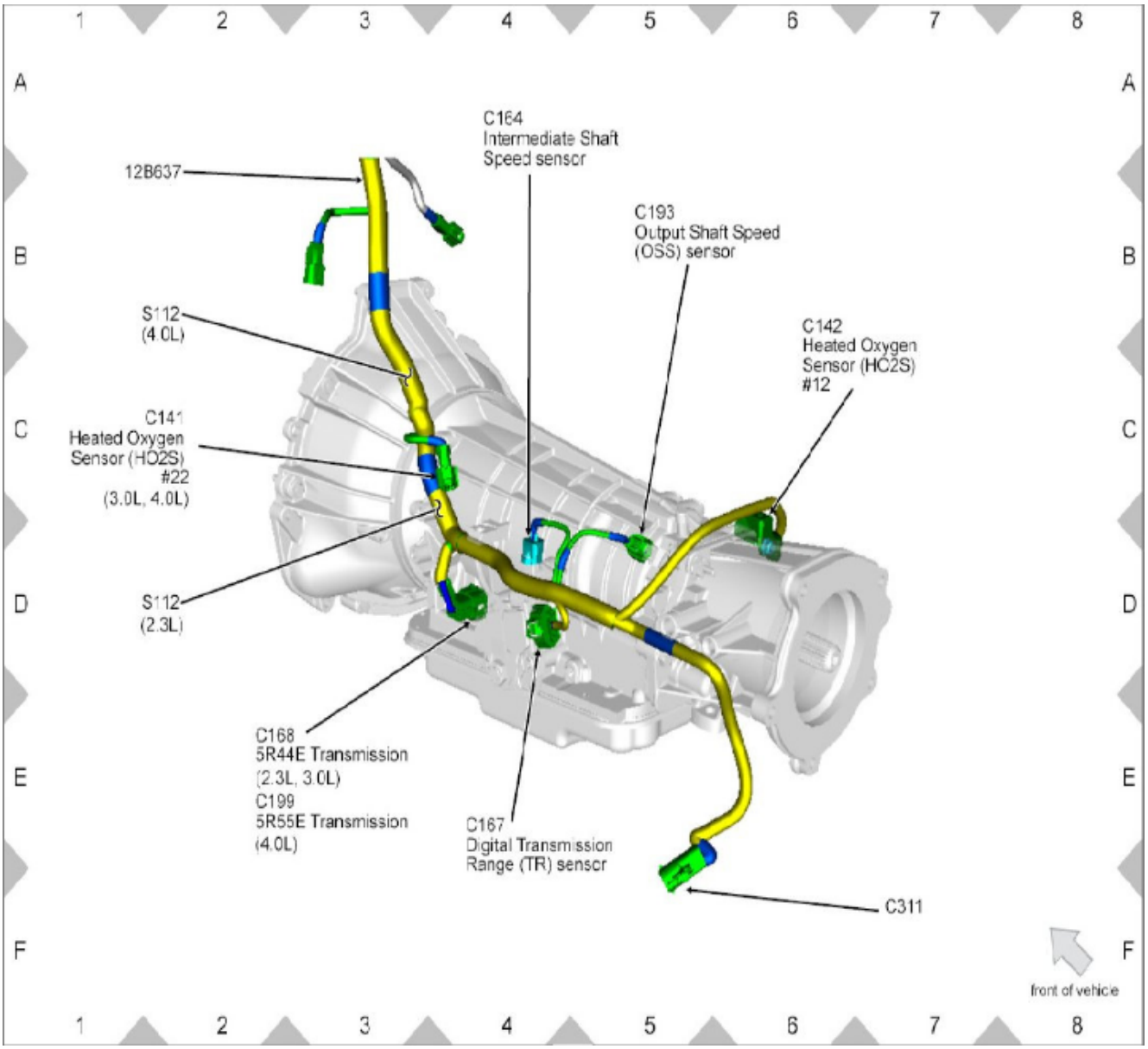
View 151-4


1
2
3
4
5
6
7
8
A
B
C
D
E
F
S101
S110 (Manual)
S111 (Automatic)
C1183
Fuel injector 3
S105
S109
S100
C1182
Fuel injector 2
S102
C1134
Ignition coil
S108
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
C1275
Camshaft
position sensor
S112
C1181
Fuel injector 1
C1120
Crankshaft
position sensor
C1512
Knock sensor
C1551
Heated Oxygen
Sensor (HO2S)
#11
C103
Oil pressure switch
front of vehicle

View 151-6

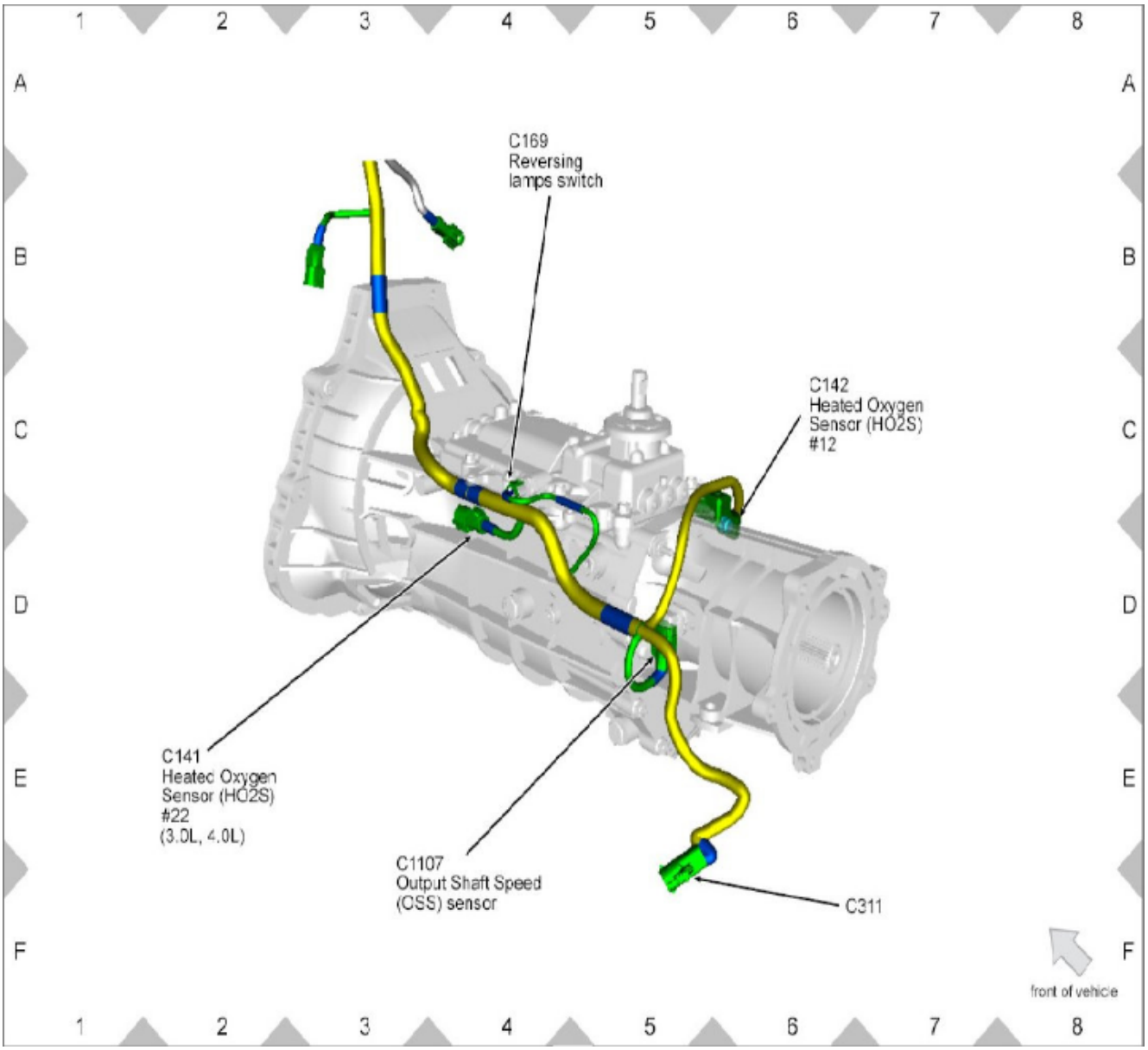

S102
S101
S100
S109
C109
Knock sensor
C1065
Ignition coil
C1064
Engine Coolant
Temperature
(ECT) sensor
S110 (Manual)
S111 (Automatic)
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
C1181
Fuel injector 1
C1182
Fuel injector 2
C1183
Fuel injector 3
S108
C1339
Crankshaft
position sensor
C171
Heated Oxygen
Sensor (HO2S)
#11
S104
front of vehicle

View 151-8

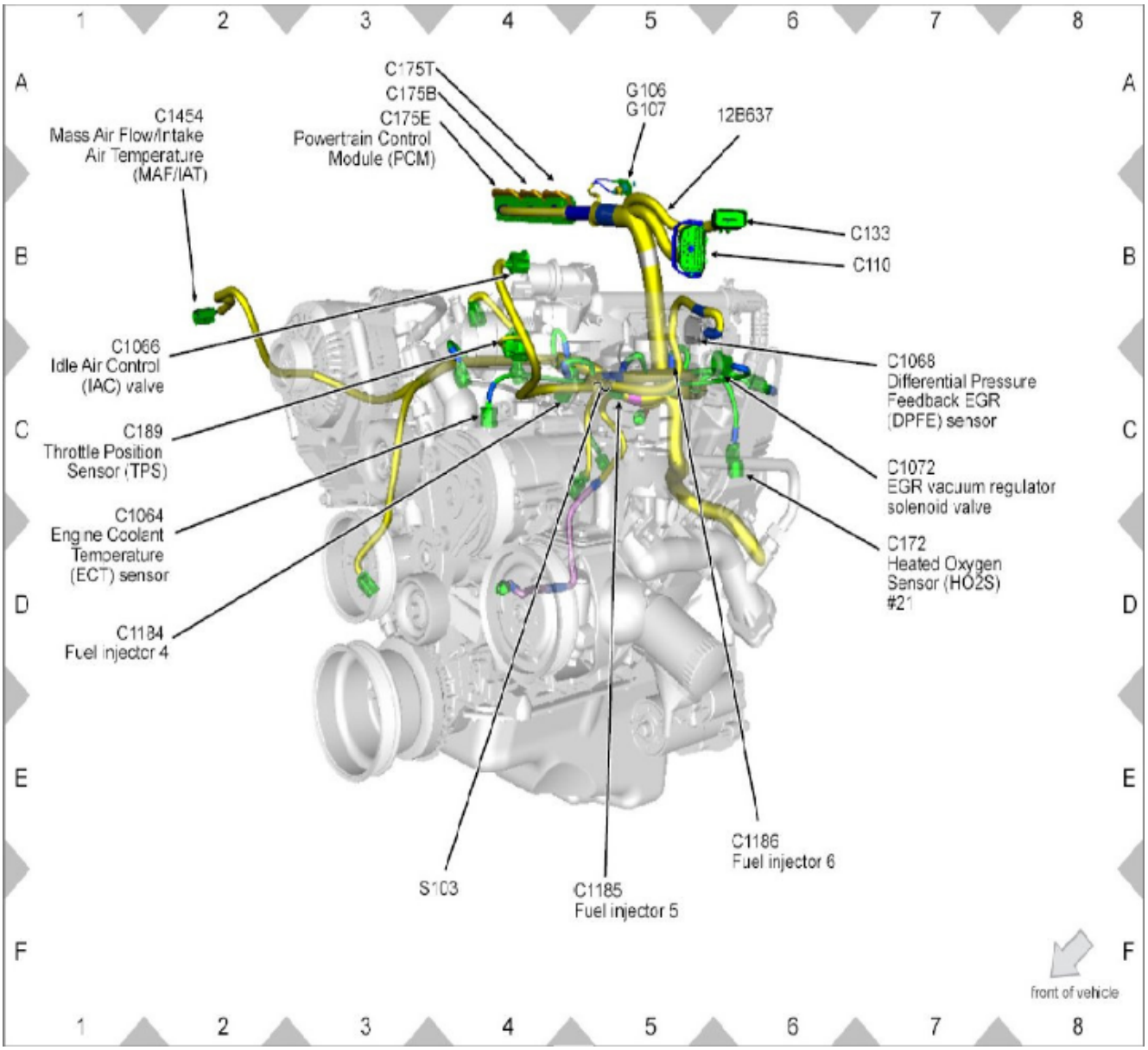


Oxygen Sensor: Locations Heated Oxygen Sensor (HO2S) #12

View 151-10

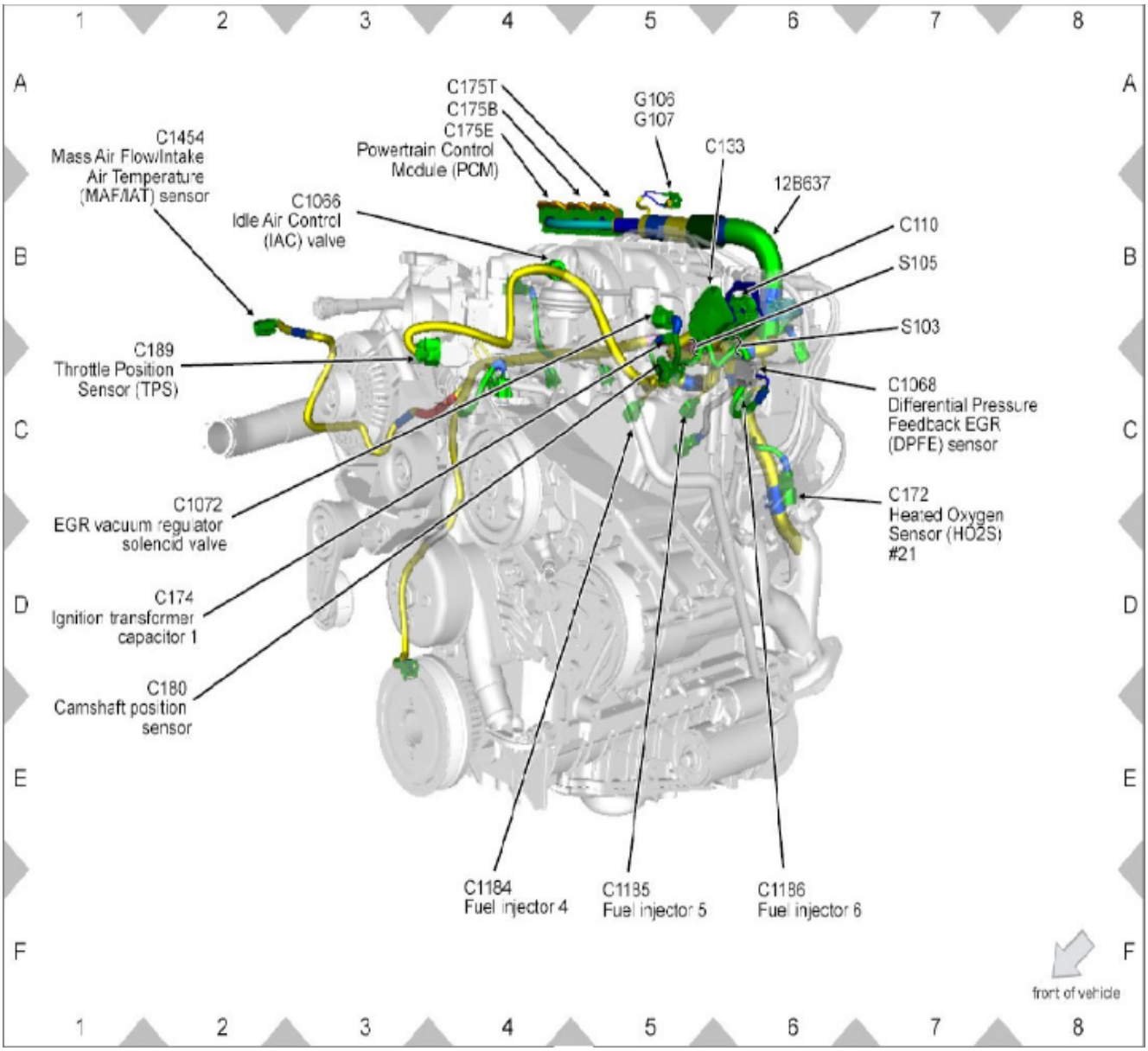

C169
Reversing lamps switch
C142
Heated Oxygen Sensor (HO2S) #12
C141
Heatec Oxygen Sensor (HO2S) #22
(3.0L, 4.0L)
C1107
Output Shaft Speed (OSS) sensor
C311
front of vehicle

View 151-9

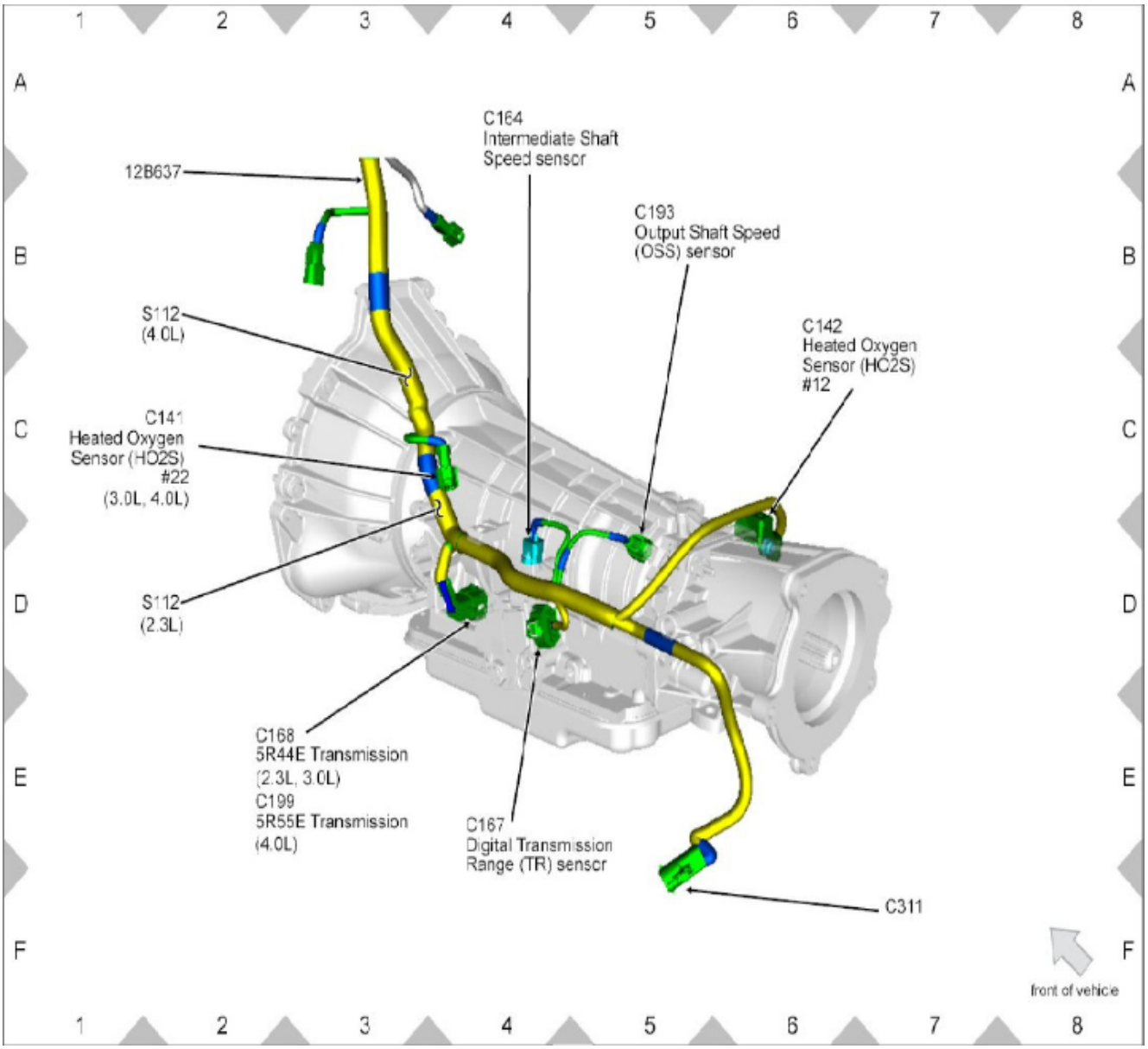


Oxygen Sensor: Locations Heated Oxygen Sensor (HO2S) #21

View 151-5

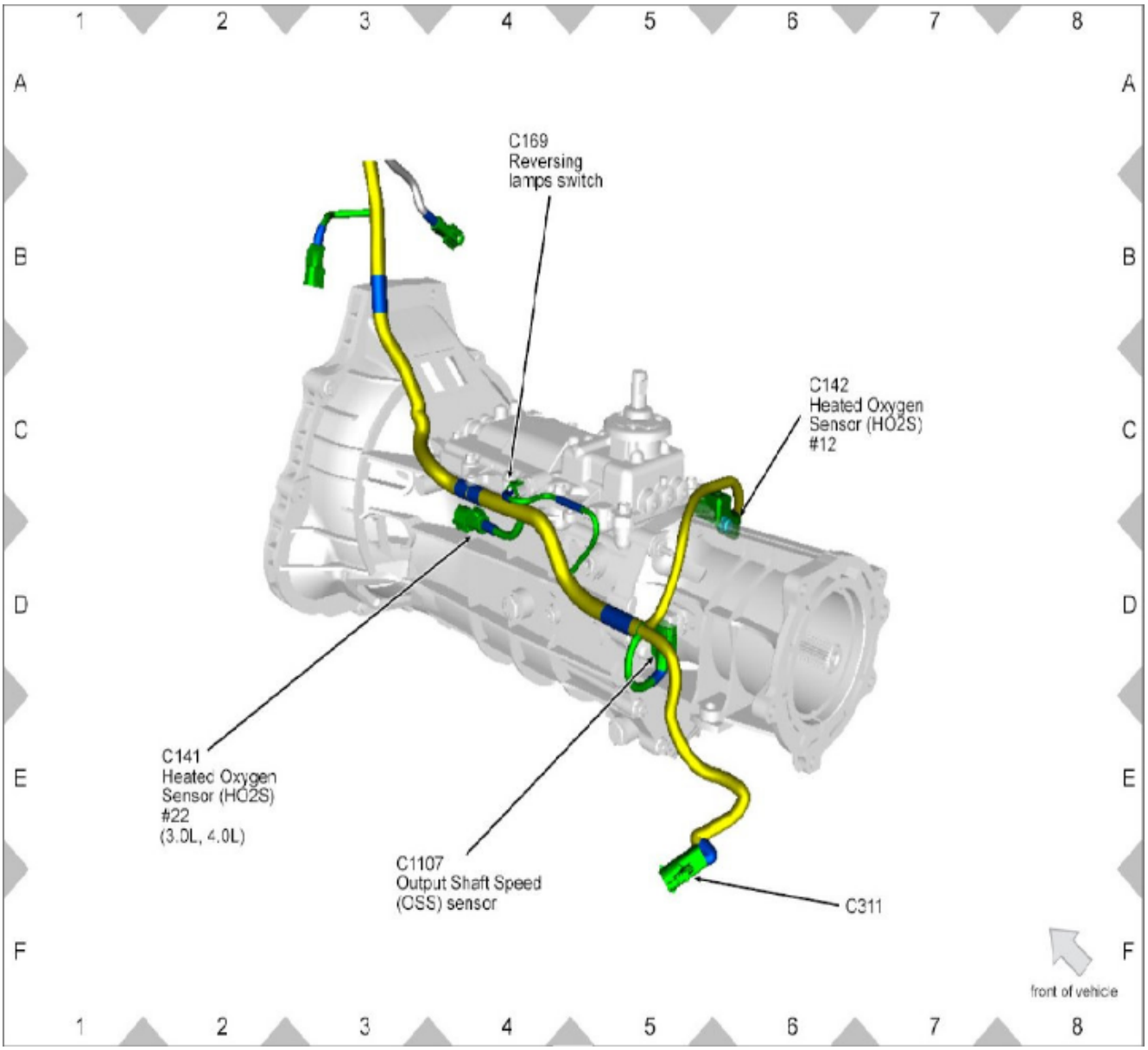

C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
C133
12B637
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor
C1066
Idle Air Control (IAC) valve
C110
S105
S103
C189
Throttle Position Sensor (TPS)
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
C174
Ignition transformer capacitor 1
C180
Camshaft position sensor
C1184
Fuel injector 4
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-7



Oxygen Sensor: Locations Heated Oxygen Sensor (HO2S) #22

View 151-10


C169
Reversing
lamps switch
C142
Heated Oxygen
Sensor (HO2S)
#12
C141
Heatec Oxygen
Sensor (HO2S)
#22
(3.0L, 4.0L)
C1107
Output Shaft Speed
(CSS) sensor
C311
front of vehicle

View 151-9

Connector: C141

Description:	Harness:	Base Part #:
HEATED OXYGEN SENSOR (HO2S) #22	12B637	9G444

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE234 (BU-WH)	18	CTRL MOD. - POWERTRAIN # HEATER OXYGEN SEN. POST CAT. 2ND (HTR22)	3.0L, 4.0L
2	CBB43 (GY)	18	FUSE - 43 OR CIRCUIT BREAKER	3.0L, 4.0L
3	VE733 (WH)	18	SENSOR - HEATED OXYGEN POST CAT. 2ND HO2S22)	3.0L, 4.0L
4	RE406 (GY-VT)	18	CTRL MOD. - POWERTRAIN # SIGNAL RETURN TRANSMISSION (T-SIGRTN) (SIGRTN-B)	3.0L, 4.0L

C141

Connector: C142

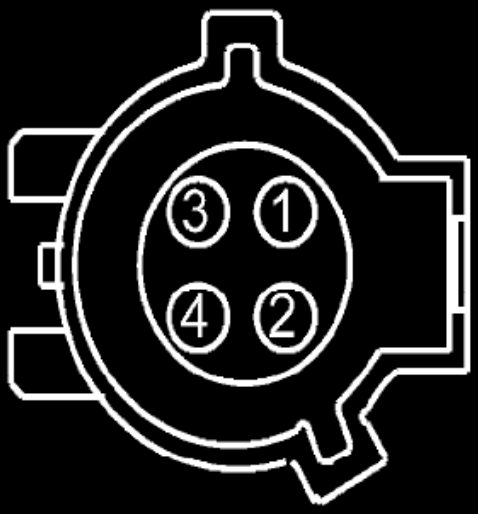
Description:	Harness:	Base Part #:
HEATED OXYGEN SENSOR (HO2S) #12	12B637	9G444

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE233 (WH-OG)	18	CTRL MOD. - POWERTRAIN # HEATER OXYGEN SEN. POST CAT. 1ST OR UNIQUE (HTR12)	
2	CBB43 (GY)	18	FUSE - 43 OR CIRCUIT BREAKER	
3	VE731 (YE-GN)	18	SENSOR - HEATED OXYGEN POST CAT. 1ST OR UNIQUE (HO2S12)	
4	RE406 (GY-VT)	18	CTRL MOD. - POWERTRAIN # SIGNAL RETURN TRANSMISSION (T-SIGRTN) (SIGRTN-B)	

C142

Connector: C171

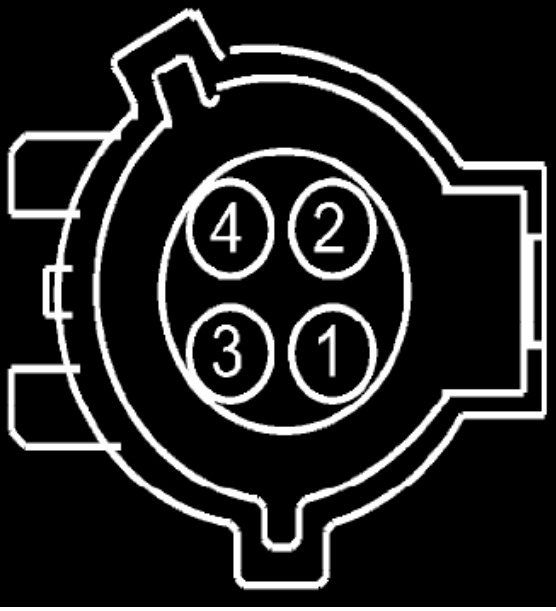
Description:	Harness:	Base Part #:
HEATED OXYGEN SENSOR (HO2S) #11	12B637	9F472



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE235 (GN-BN)	18	CTRL MOD. - POWERTRAIN # HEATER OXYGEN SEN. PRE CAT. 1ST OR UNIQUE (HTR11)	2.3L, 4.0L
2	CBB43 (GY)	18	FUSE - 43 OR CIRCUIT BREAKER	2.3L, 4.0L
3	VE735 (VT-GN)	18	SENSOR - HEATED OXYGEN PRE CAT. 1ST OR UNIQUE (HO2S11)	2.3L, 4.0L
4	RE405 (GN-WH)	18	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	2.3L, 4.0L

Connector: C1551

Description:	Harness:	Base Part #:
HEATED OXYGEN SENSOR (HO2S) #11	12B637	9F472



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBB43 (GY)	18	FUSE - 43 OR CIRCUIT BREAKER	3.0L
2	CE235 (GN-BN)	18	CTRL MOD. - POWERTRAIN # HEATER OXYGEN SEN. PRE CAT. 1ST OR UNIQUE (HTR11)	3.0L
3	RE405 (GN-WH)	18	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E SIGRTN) (SIGRTN-A)	3.0L
4	VE735 (VT-GN)	18	SENSOR - HEATED OXYGEN PRE CAT. 1ST OR UNIQUE (HO2S11)	3.0L

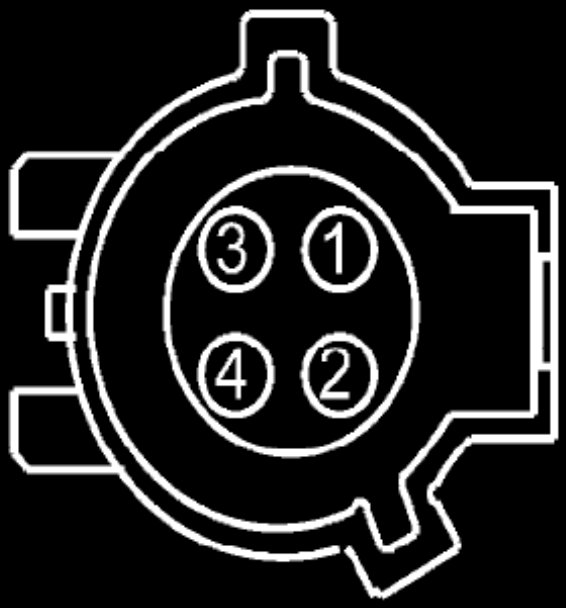
Oxygen Sensor: Diagrams Heated Oxygen Sensor (HO2S) #11

C171

C1551

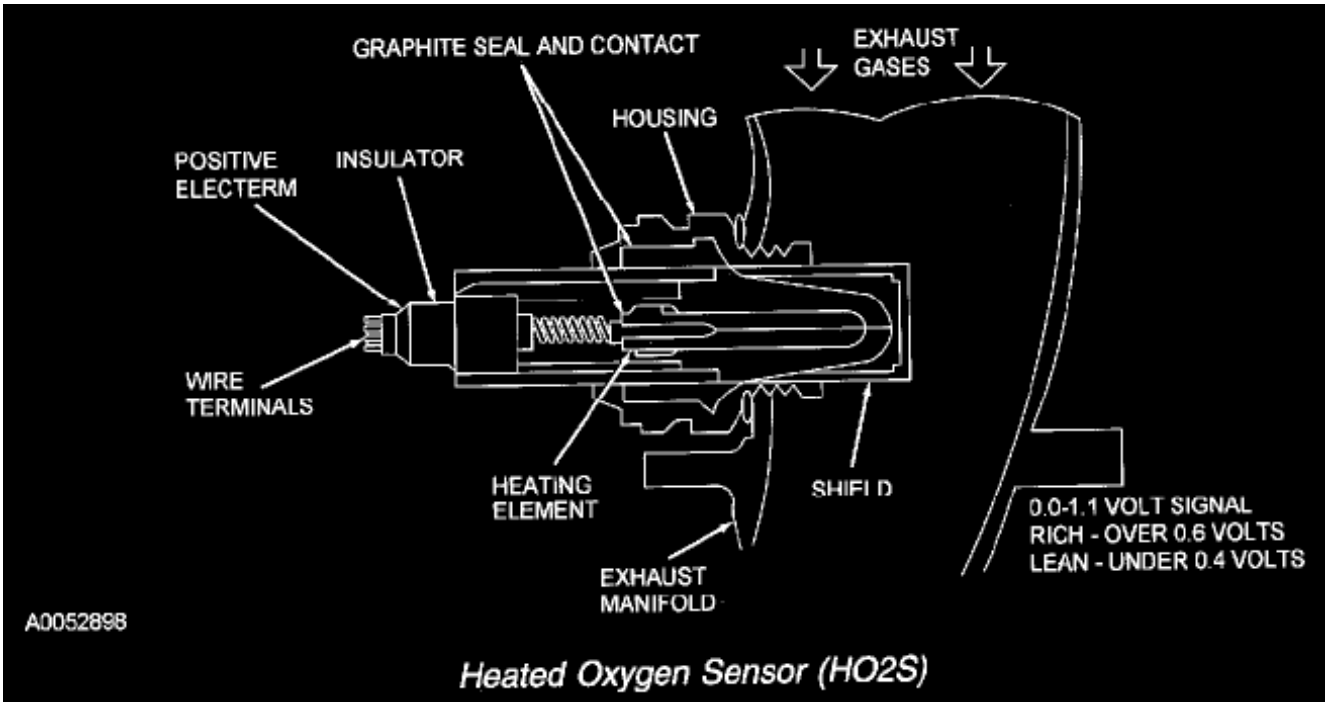
Connector: C172

Description:	Harness:	Base Part #:
HEATED OXYGEN SENSOR (HO2S) #21	12B637	9F472



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE236 (GY-VT)	18	CTRL MOD. - POWERTRAIN # HEATER OXYGEN SEN. PRE CAT. 2ND (HTR21)	3.0L, 4.0L
2	CBB43 (GY)	18	FUSE - 43 OR CIRCUIT BREAKER	3.0L, 4.0L
3	VE737 (WH-BU)	18	SENSOR - HEATED OXYGEN PRE CAT. 2ND (HO2S21)	3.0L, 4.0L
4	RE405 (GN-WH)	18	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	3.0L, 4.0L

C172



Heated Oxygen Sensor (HO2S)

Oxygen Sensor: Description and Operation

Heated Oxygen Sensor (HO2S)

Heated Oxygen Sensor (HO2S)

The HO2S detects the presence of oxygen in the exhaust and produces a variable voltage according to the amount of oxygen detected. A high concentration of oxygen (lean air/fuel ratio) in the exhaust produces a voltage signal less than 0.4 volt. A low concentration of oxygen (rich air/fuel ratio) produces a voltage signal greater than 0.6 volt. The HO2S provides feedback to the PCM indicating air/fuel ratio in order to achieve a near stoichiometric air/fuel ratio of 14.7:1 during closed loop engine operation. The HO2S generates a voltage between 0.0 and 1.1 volts.

Embedded with the sensing element is the HO2S heater. The heating element heats the sensor to a temperature of 800°C (1,472°F). At approximately 300°C (572°F) the engine can enter closed loop operation. The VPWR circuit supplies voltage to the heater. The PCM turns the heater on by providing the ground when the correct conditions occur. The heater allows the engine to enter closed loop operation sooner. The use of this heater requires the HO2S heater control to be duty cycled, to prevent damage to the heater.

Universal HO2S

The universal HO2S, sometimes referred to as a wideband oxygen sensor, uses the typical HO2S combined with a current controller in the PCM to infer an air/fuel ratio relative to the stoichiometric air/fuel ratio. This is accomplished by balancing the amount of oxygen ions pumped in or out of a measurement chamber within the sensor. The typical HO2S within the universal HO2S is used to detect the oxygen content of the exhaust gas in the measurement chamber. The oxygen content inside the measurement chamber is maintained at the stoichiometric air/fuel ratio by pumping oxygen ions in and out of the measurement chamber. As the exhaust gasses get richer or leaner, the amount of oxygen that must be pumped in or out to maintain a stoichiometric air/fuel ratio in the measurement chamber varies in proportion to the air/fuel ratio. The amount of current required to

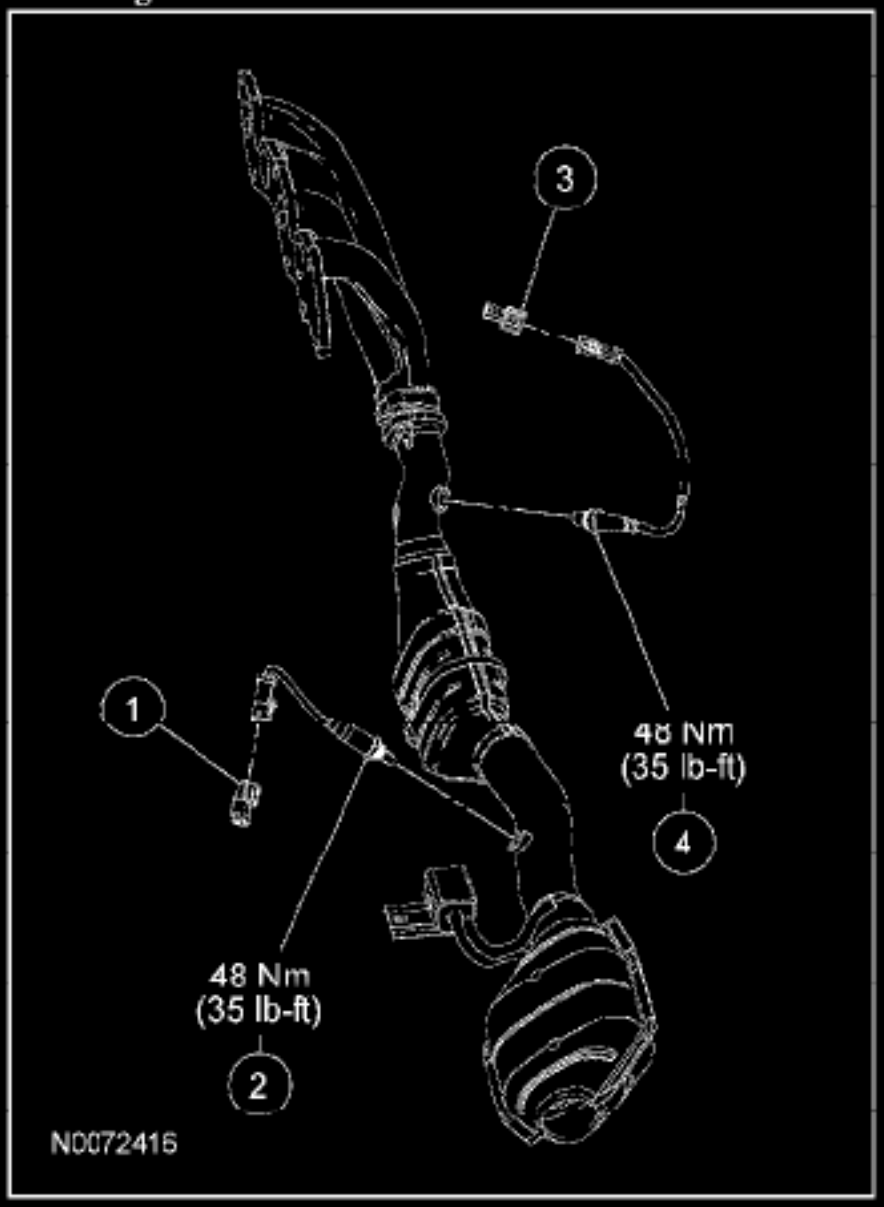
pump the oxygen ions in or out of the measurement chamber is used to measure the air/fuel ratio. The measured air/fuel ratio is actually the output from the current controller in the PCM and not a signal that comes directly from the sensor.

The universal HO2S also uses a self-contained reference chamber to make sure an oxygen differential is always present. The oxygen for the reference chamber is supplied by pumping small amounts of oxygen ions from the measurement chamber into the reference chamber. The universal HO2S does not need access to outside air.

Part to part variance is compensated for by placing a resistor in the connector. This resistor is used to trim the current measured by the current controller in the PCM.

Embedded with the sensing element is the universal H02S heater. The heater allows the engine to enter closed loop operation sooner. The heating element heats the sensor to a temperature of 780°C (1,436°F). The VPWR circuit supplies voltage to the heater. The PCM controls the heater on and off by providing the ground to maintain the sensor at the correct temperature for maximum accuracy.

2.3L Engines



Item	Part Number	Description
1	—	Catalyst monitor sensor electrical connector
2	9G444	Catalyst monitor sensor
3	—	Heated oxygen sensor (HO2S) electrical connector (part of 12B637)
4	9F472	HO2S

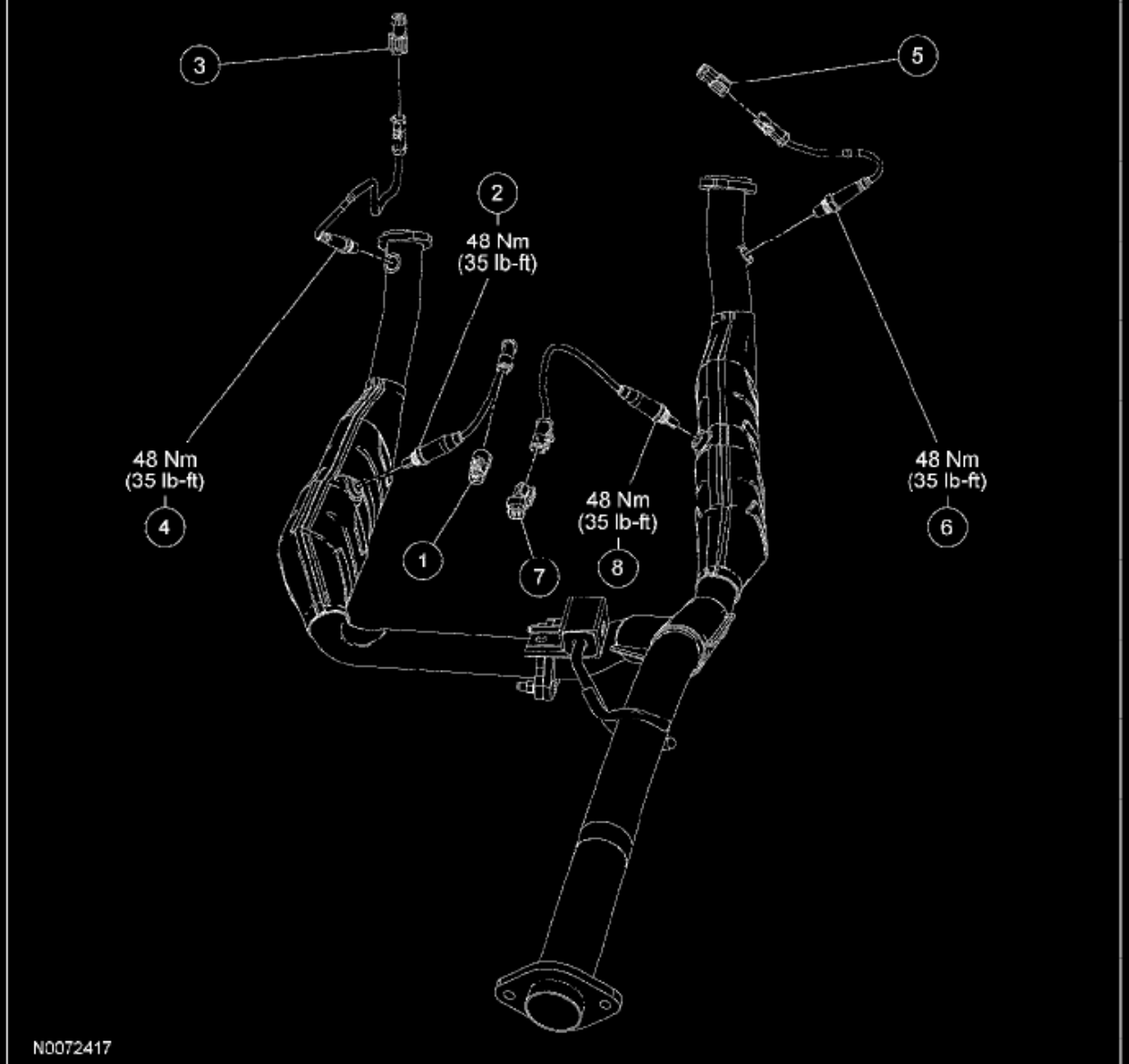
Oxygen Sensor: Service and Repair Heated Oxygen Sensor (HO2S)

HEATED OXYGEN SENSOR (HO2S)

Exploded View

2.3L Engines

3.0L Engines



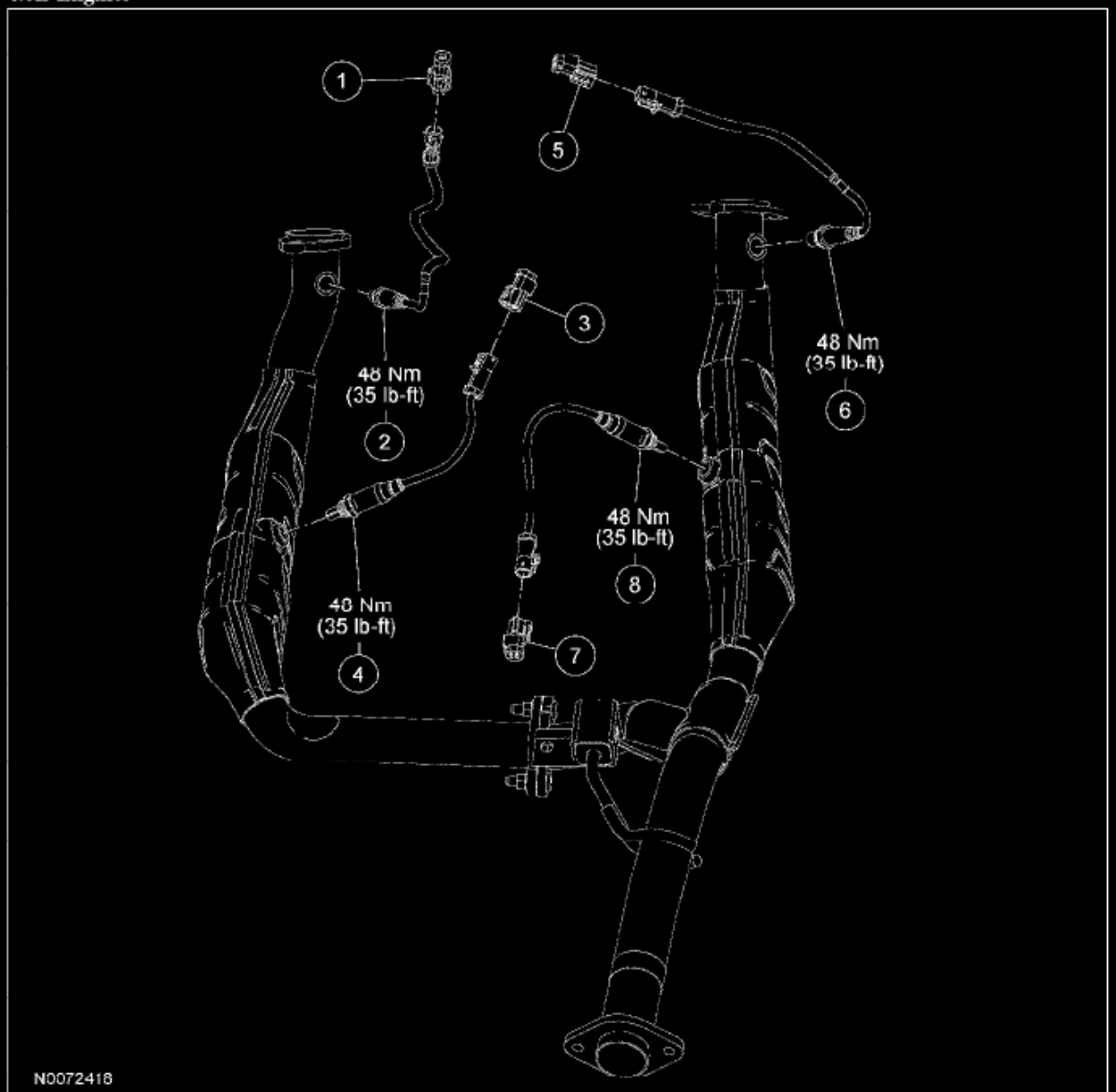
Item	Part Number	Description
1	—	Catalyst monitor sensor electrical connector (part of 14A464)
2	9G444	Catalyst monitor sensor
3	—	Heated oxygen sensor (HO2S) electrical connector (part of 12B637)
4	9F472	HO2S

(Continued)

Item	Part Number	Description
5	—	HO2S electrical connector (part of 12B637)
6	9F472	HO2S
7	—	Catalyst monitor sensor electrical connector (part of 14A464)
8	9G444	Catalyst monitor sensor

3.0L Engines

4.0L Engines



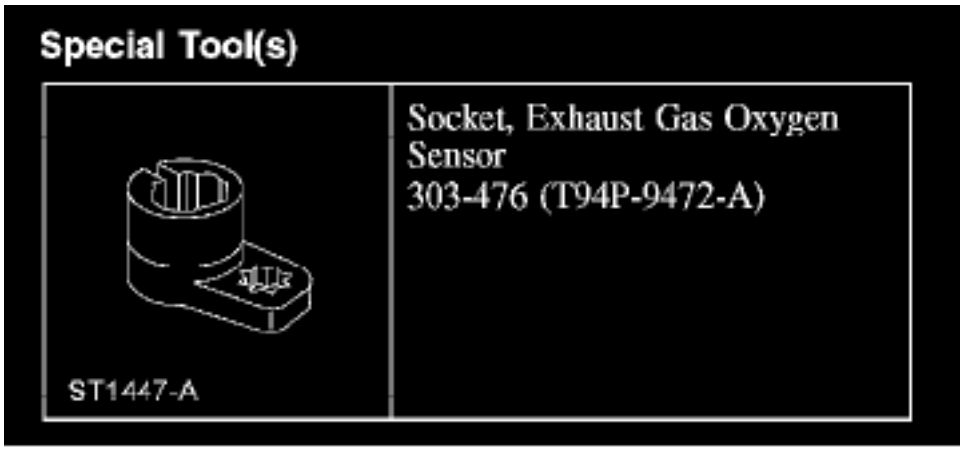
Item	Part Number	Description
1	—	Heated oxygen sensor (HO2S) electrical connector (part of 12B637)
2	9F472	HO2S
3	—	Catalyst monitor sensor electrical connector (part of 14A464)
4	9G444	Catalyst monitor sensor

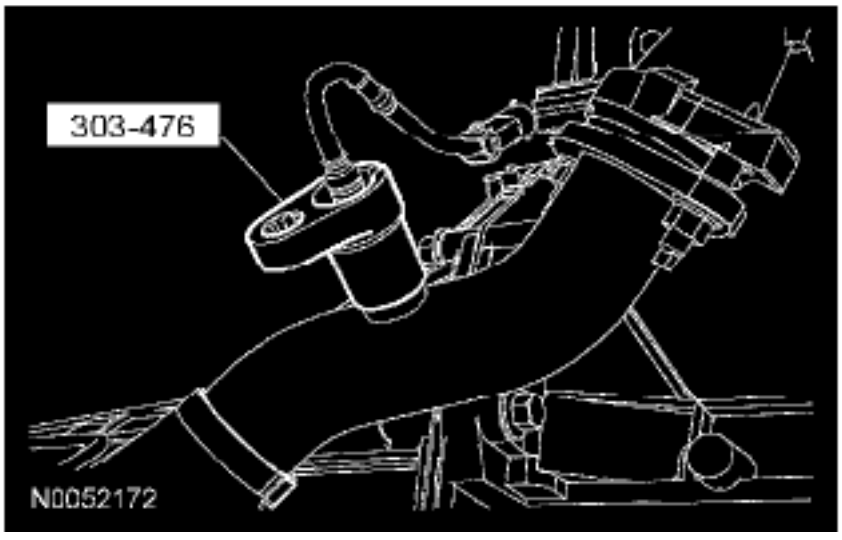
(Continued)

Item	Part Number	Description
5	—	HO2S electrical connector (part of 12B637)
6	9F472	HO2S
7	—	Catalyst monitor sensor electrical connector (part of 14A464)
8	9G444	Catalyst monitor sensor

4.0L Engines

Special Tool(s)





Special Tool(s)

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist.

2. NOTE: If necessary, lubricate the heated oxygen sensor (HO2S) with lock lubricant to assist in removal.

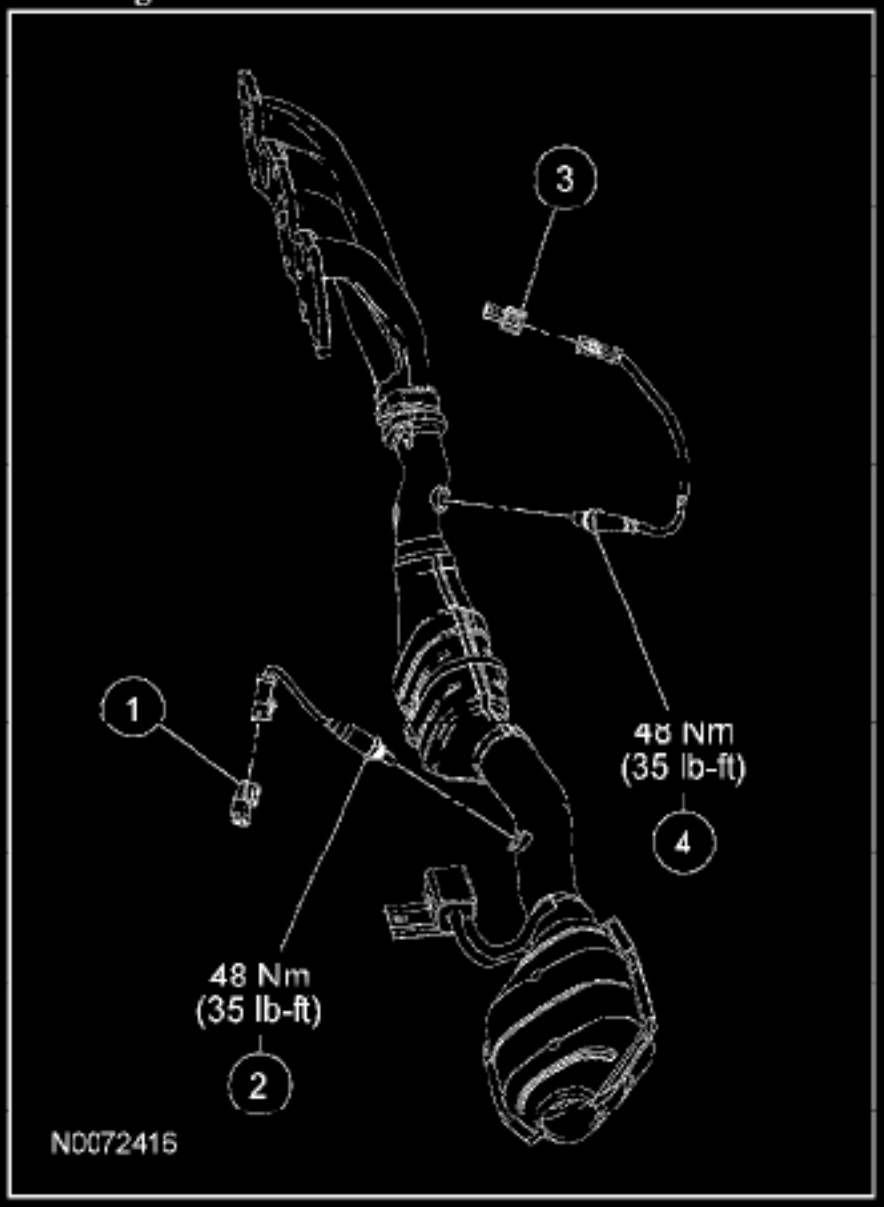
Using the special tool, remove the HO2S. -

To install, tighten to 48 Nm (35 lb-ft).

3. NOTE: Apply a light coat of anti-seize lubricant to the threads of the HO2S.

To install, reverse the removal procedure.

2.3L Engines



Item	Part Number	Description
1	—	Catalyst monitor sensor electrical connector
2	9G444	Catalyst monitor sensor
3	—	Heated oxygen sensor (HO2S) electrical connector (part of 12B637)
4	9F472	HO2S

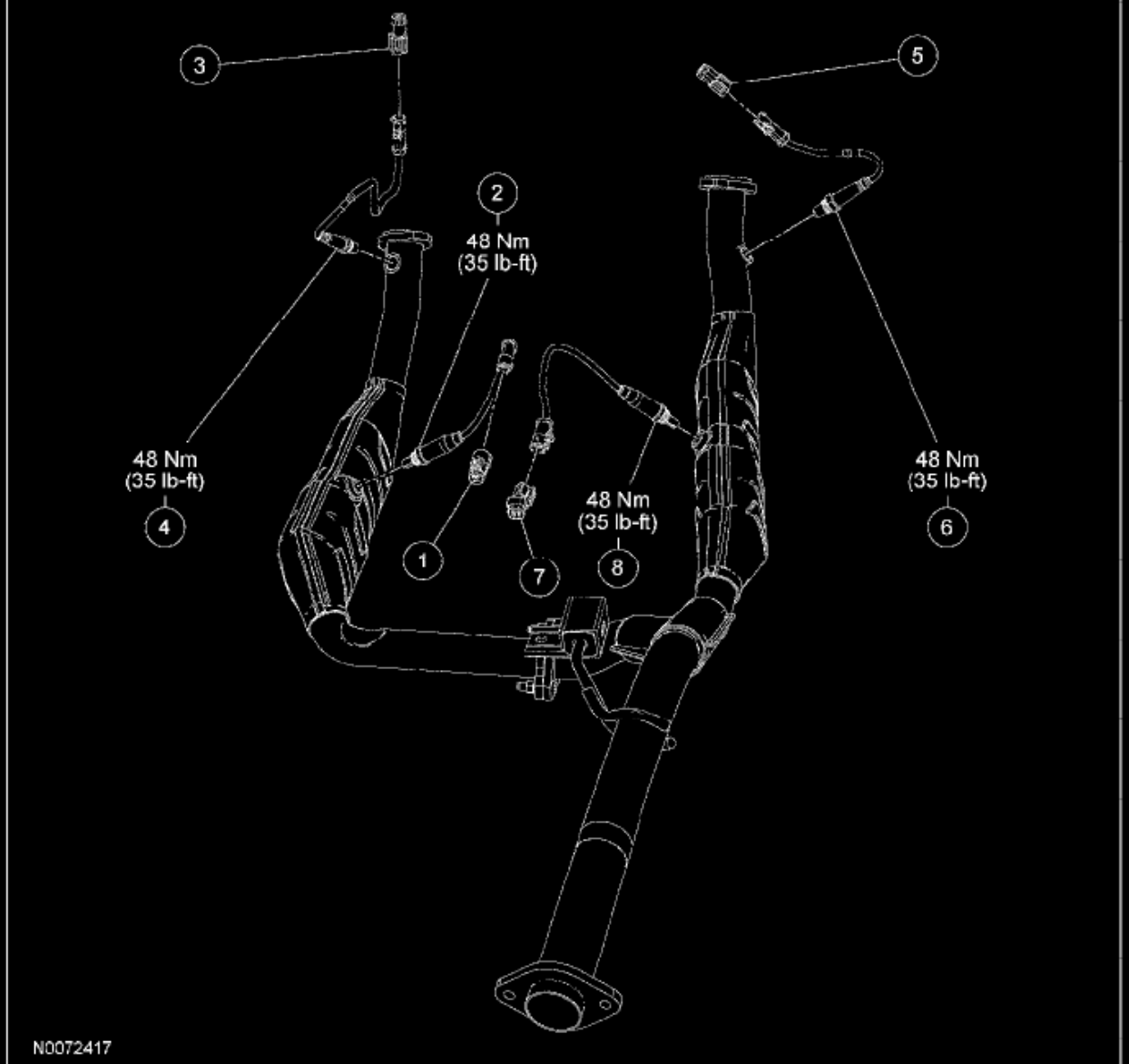
Oxygen Sensor: Service and Repair Catalyst Monitor Sensor

CATALYST MONITOR SENSOR

Exploded View

2.3L Engines

3.0L Engines



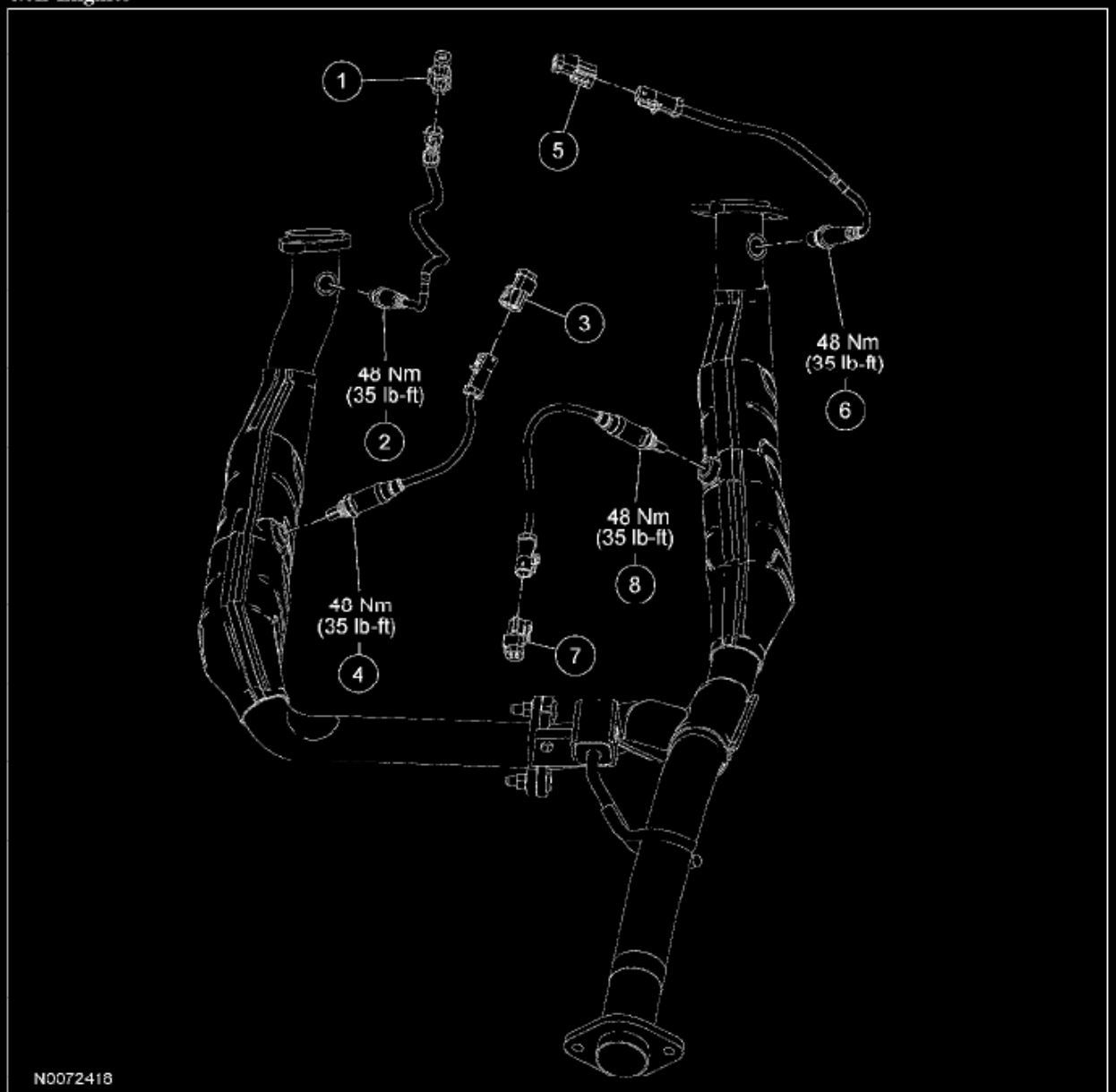
Item	Part Number	Description
1	—	Catalyst monitor sensor electrical connector (part of 14A464)
2	9G444	Catalyst monitor sensor
3	—	Heated oxygen sensor (HO2S) electrical connector (part of 12B637)
4	9F472	HO2S

(Continued)

Item	Part Number	Description
5	—	HO2S electrical connector (part of 12B637)
6	9F472	HO2S
7	—	Catalyst monitor sensor electrical connector (part of 14A464)
8	9G444	Catalyst monitor sensor

3.0L Engines

4.0L Engines



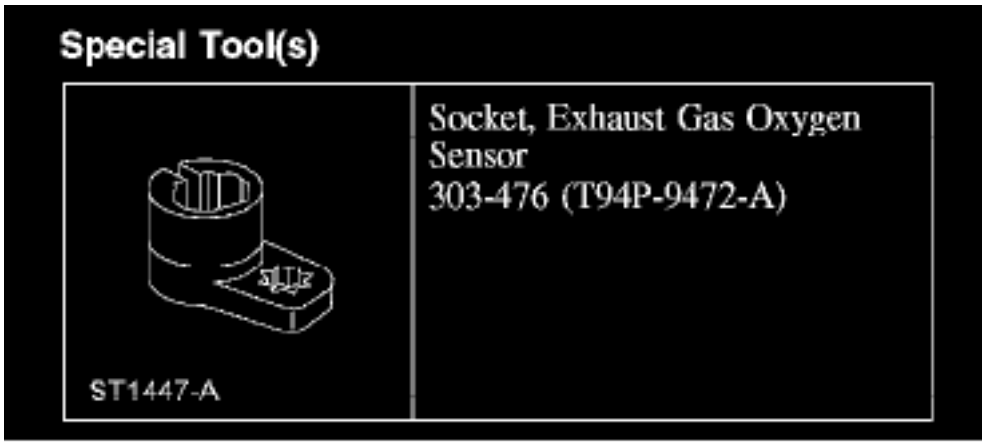
Item	Part Number	Description
1	—	Heated oxygen sensor (HO2S) electrical connector (part of 12B637)
2	9F472	HO2S
3	—	Catalyst monitor sensor electrical connector (part of 14A464)
4	9G444	Catalyst monitor sensor

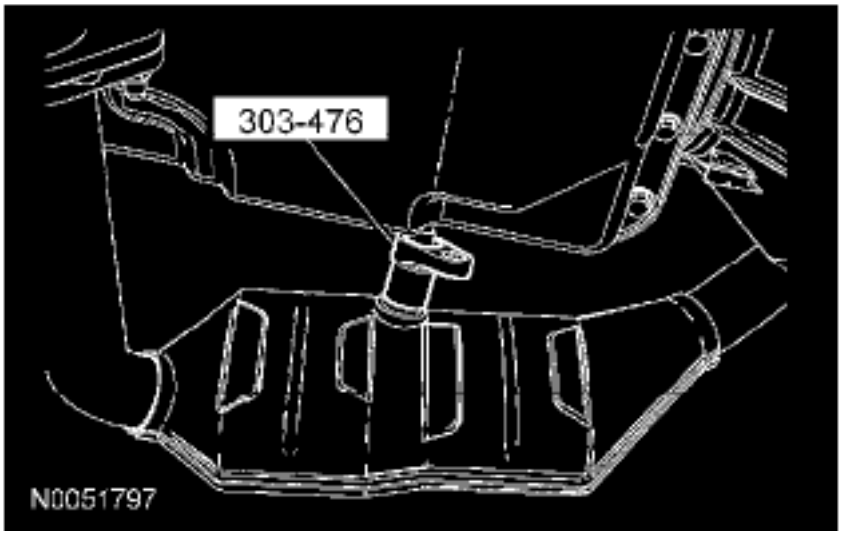
(Continued)

Item	Part Number	Description
5	—	HO2S electrical connector (part of 12B637)
6	9F472	HO2S
7	—	Catalyst monitor sensor electrical connector (part of 14A464)
8	9G444	Catalyst monitor sensor

4.0L Engines

Special Tool(s)





Special Tool(s)

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the catalyst monitor sensor electrical connector.

3. NOTE: If necessary, lubricate the catalyst monitor sensor with lock lubricant to assist in removal.

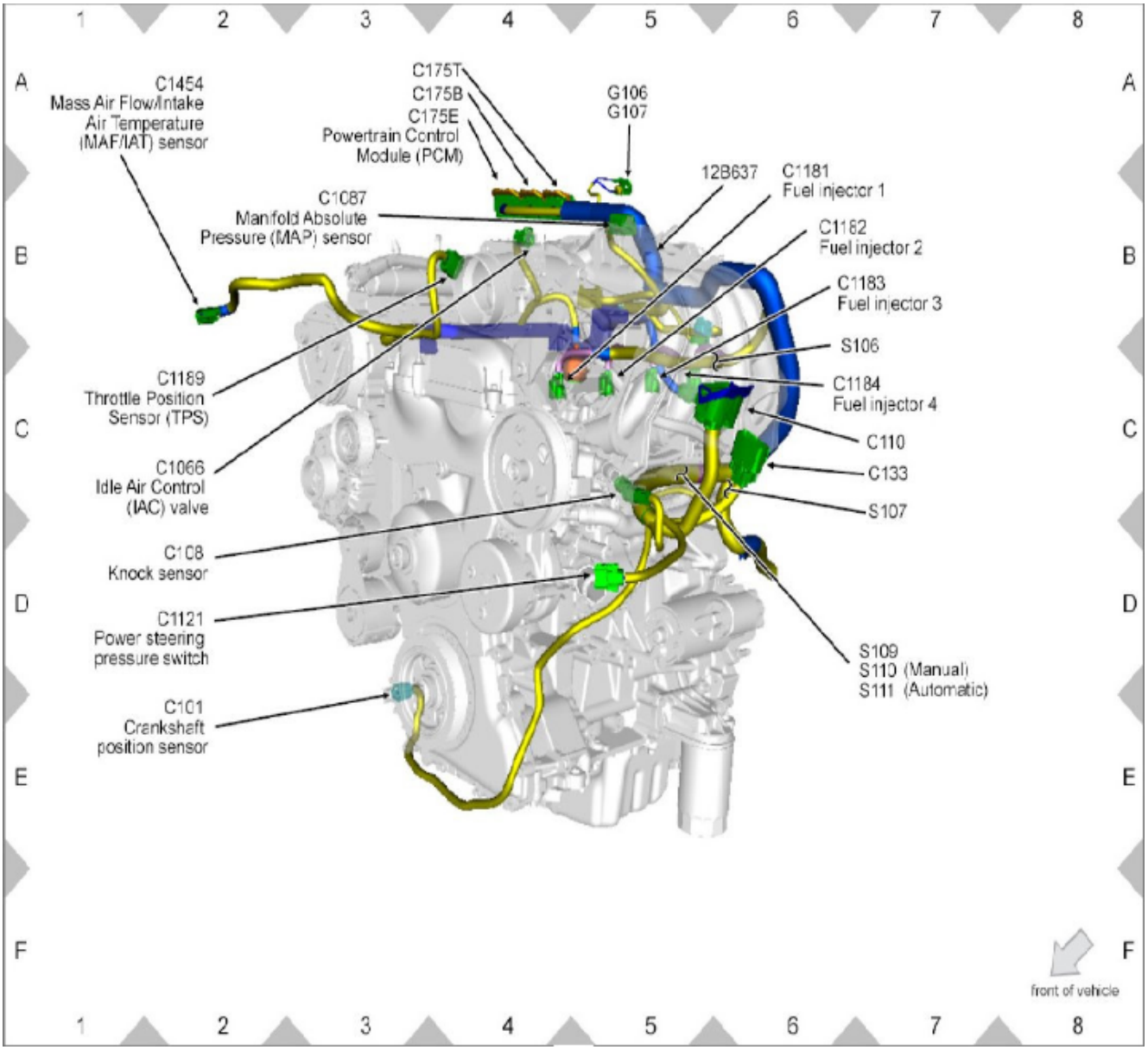
Using the special tool, remove the catalyst monitor sensor. -

To install, tighten to 48 Nm (35 lb-ft).

4. NOTE: Apply a light coat of anti-seize lubricant to the threads of the catalyst monitor sensor.

To install, reverse the removal procedure.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Sensors and Switches > Sensors and Switches - Powertrain Management > Sensors and Switches - Computers and Control Systems > Power Steering Pressure Switch > Component Information > Locations



View 151-3

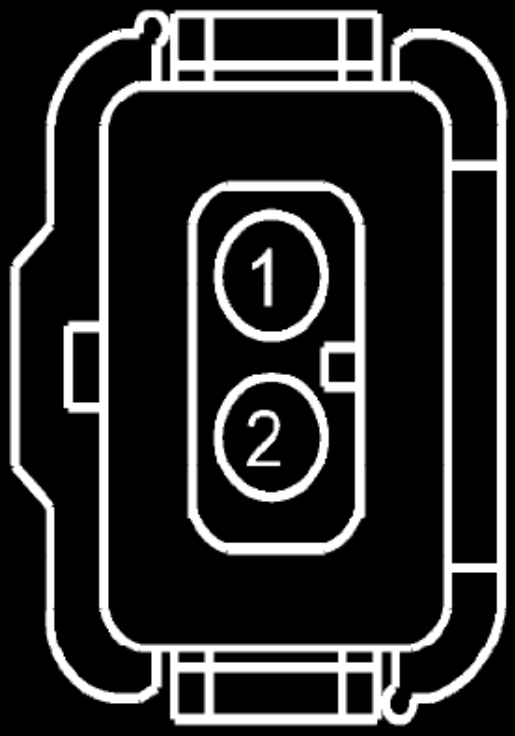
Connector: C1121

Description: POWER STEERING PRESSURE SWITCH

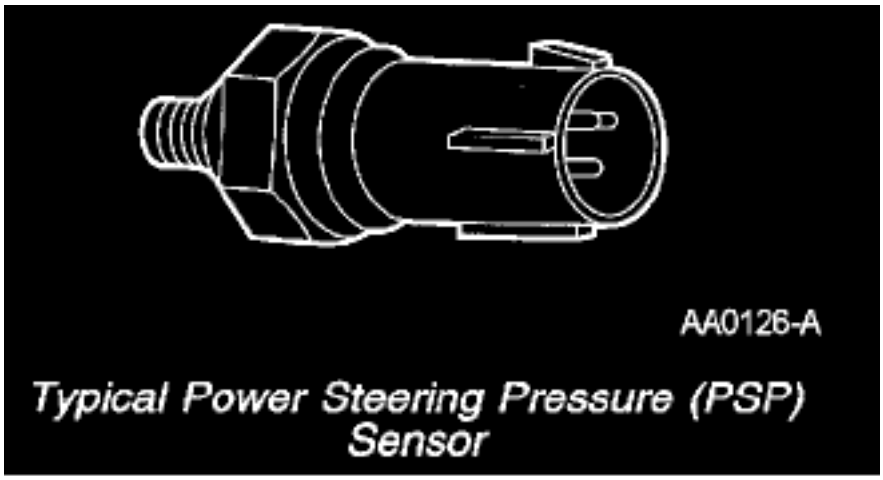
Harness: 12B637

Base Part #:

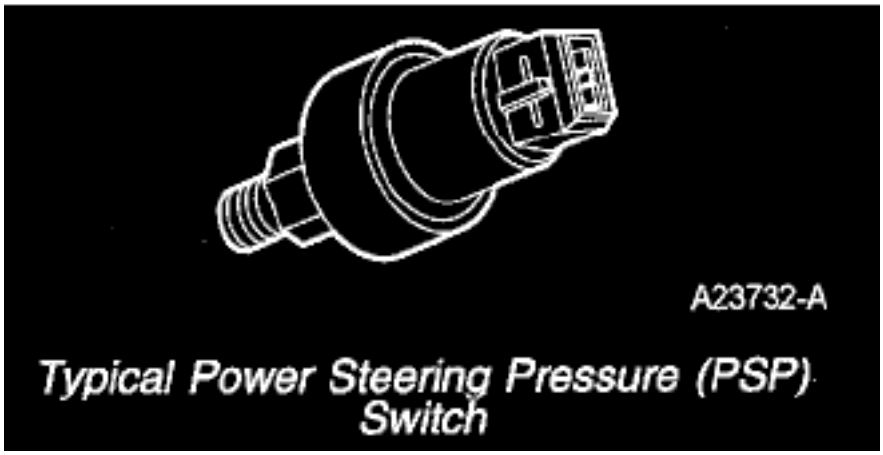
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CCS09 (GN)	20	SWITCH - POWER STEERING PRESSURE (PSPS)	2.3L
2	RE407 (YE-VT)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN COWL (C-SIGRTN) (SIGRTN-C)	2.3L



C1121



Typical Power Steering Pressure (PSP) Sensor



Typical Power Steering Pressure (PSP) Switch

Power Steering Pressure Switch: Description and Operation

Power Steering Pressure (PSP) Sensor

Typical Power Steering Pressure (PSP) Sensor

The PSP sensor monitors the hydraulic pressure within the power steering system. The PSP sensor voltage input to the PCM changes as the hydraulic pressure changes. The PCM uses the input signal from the PSP sensor to compensate for additional loads on the engine by adjusting the

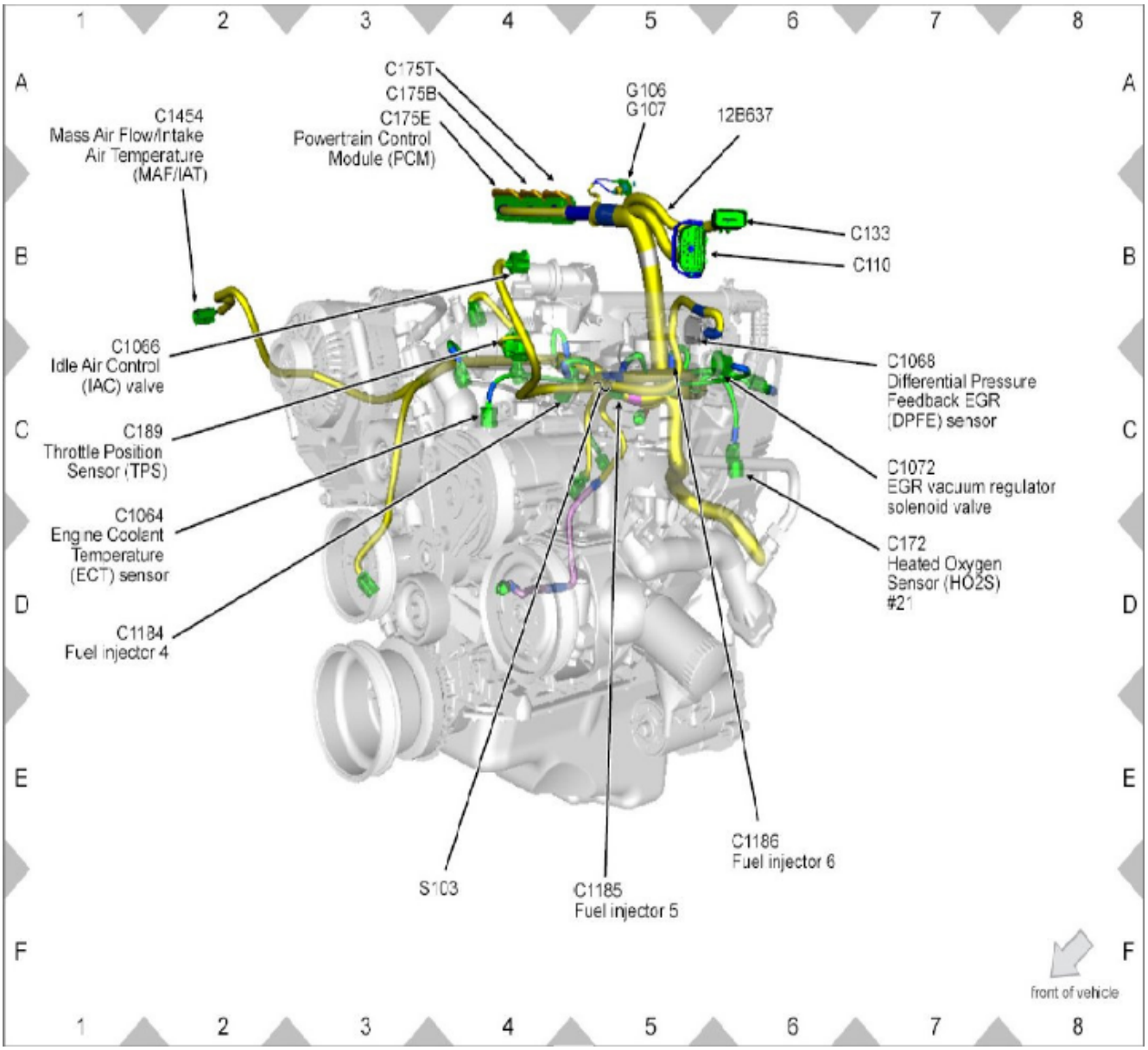
idle RPM and preventing engine stall during parking maneuvers. Also, the PSP sensor signals the PCM to adjust the transmission electronic pressure control (EPC) pressure during increased engine load, for example, during parking maneuvers.

Power Steering Pressure (PSP) Switch

Typical Power Steering Pressure (PSP) Switch

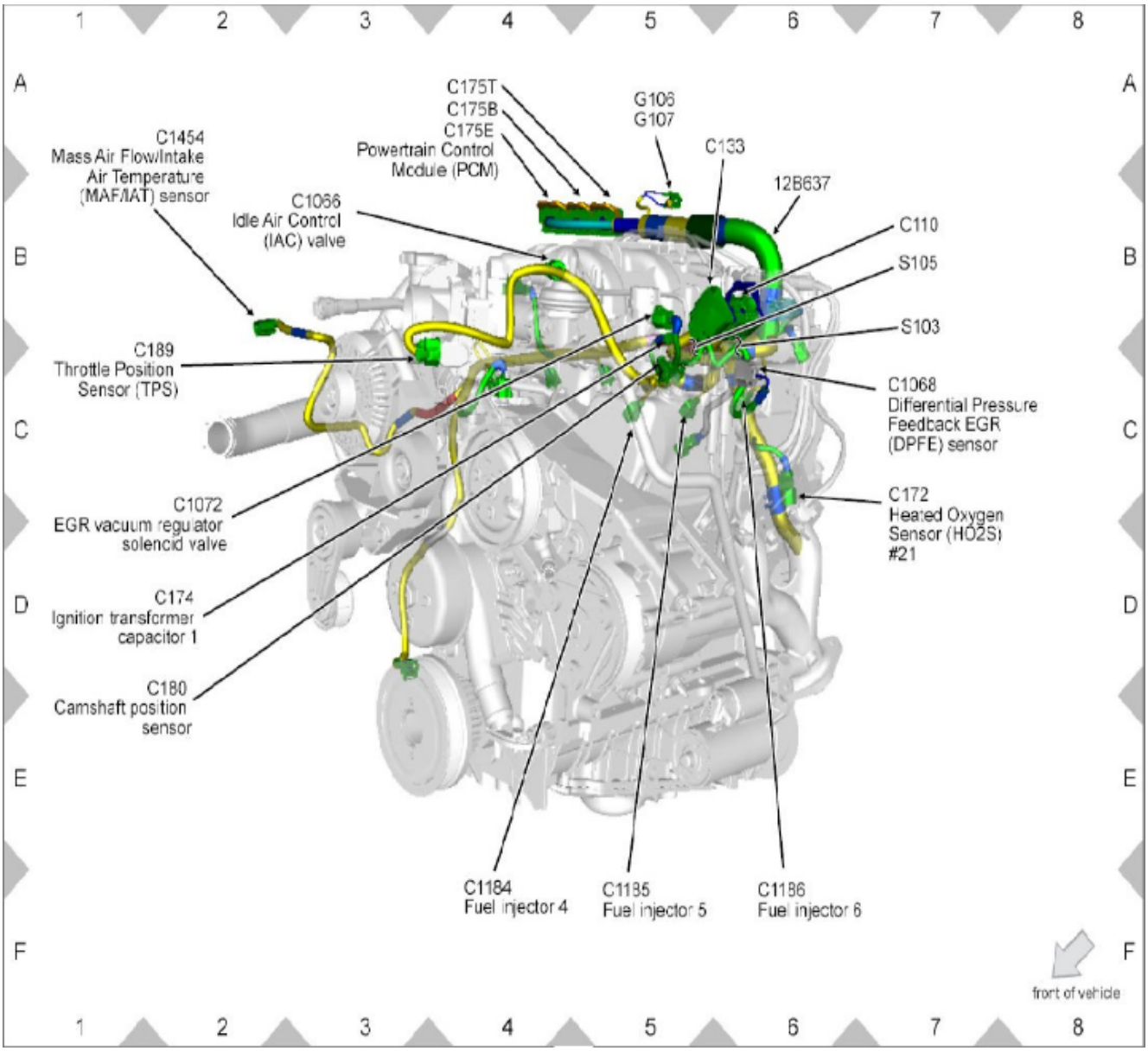
The PSP switch monitors the hydraulic pressure within the power steering system. The PSP switch is a normally closed switch that opens as the hydraulic pressure increases. The PCM provides a low current voltage on the PSP circuit. When the PSP switch is closed, this voltage is pulled low through the SIG RTN circuit. The PCM uses the input signal from the PSP switch to compensate for additional loads on the engine by adjusting the idle RPM and preventing engine stall during parking maneuvers. Also, the PSP switch signals the PCM to adjust the transmission electronic pressure control (EPC) pressure during increased engine load, for example during parking maneuvers.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Sensors and Switches > Sensors and Switches - Powertrain Management > Sensors and Switches - Computers and Control Systems > Pressure Feedback Exhaust Sensor, EGR > Component Information > Locations



Pressure Feedback Exhaust Sensor: Locations

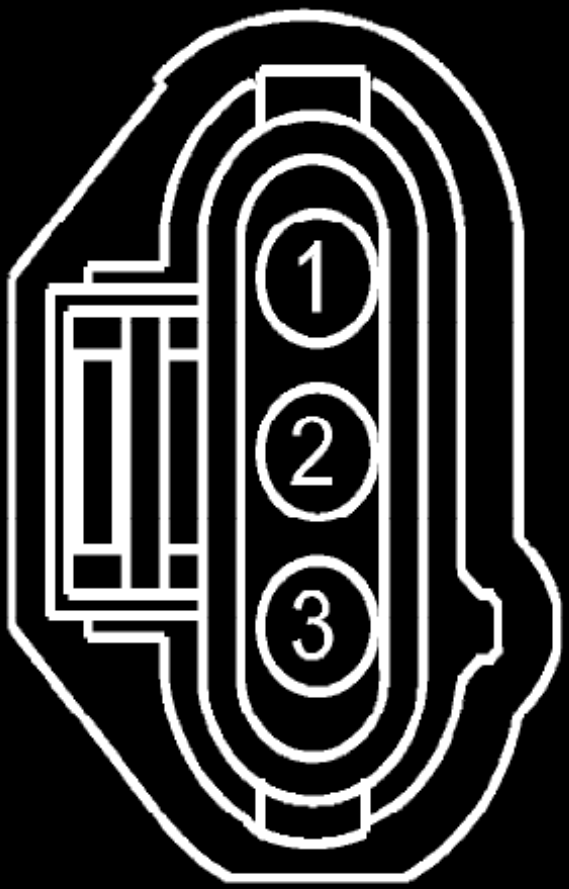
View 151-5


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
C133
12B637
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor
C1066
Idle Air Control (IAC) valve
C110
S105
S103
C189
Throttle Position Sensor (TPS)
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
C174
Ignition transformer capacitor 1
C180
Camshaft position sensor
C1184
Fuel injector 4
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-7

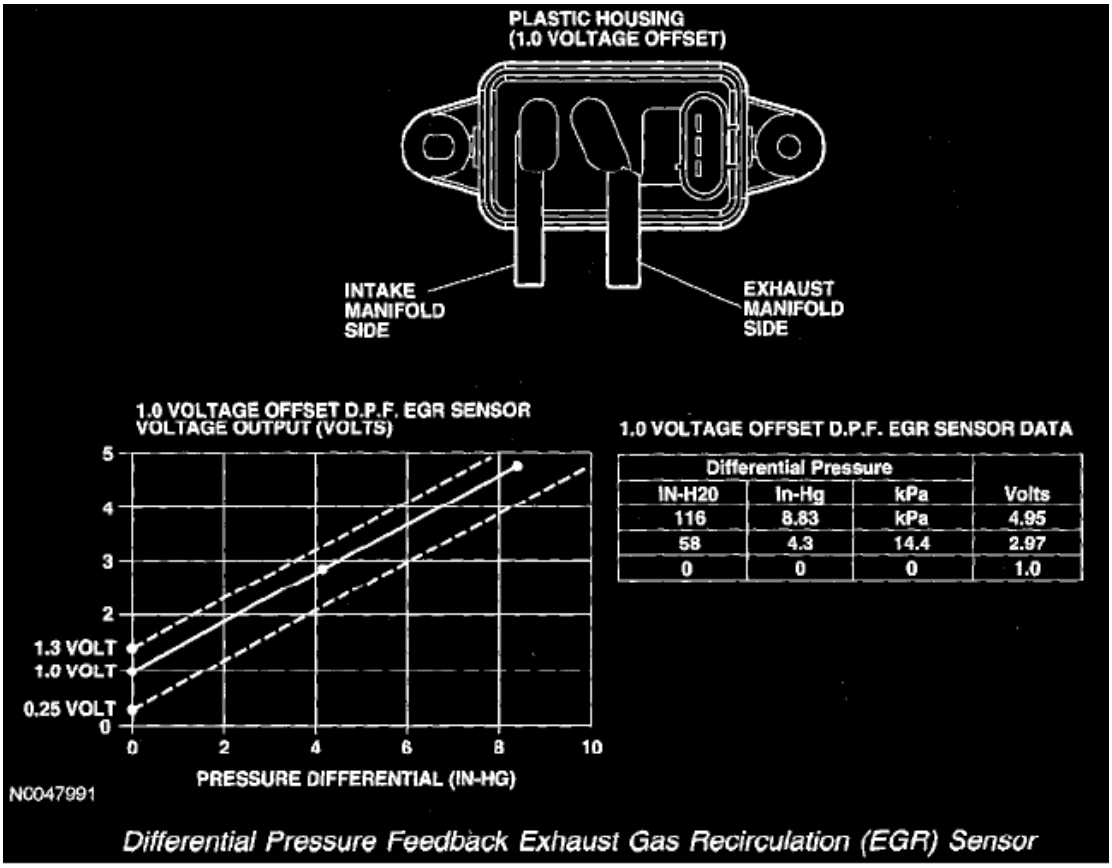
Connector: C1068

Description:	Harness:	Base Part #:
DIFFERENTIAL PRESSURE FEEDBACK EGR DPFE) SENSOR	12B637	9J460



Pin	Circuit	Gauge	Circuit Function	Quali
1	VE713 (GN-OG)	20	SENSOR - DELTA PRESSURE FEEDBACK EGR (DPFE)	3.0L, 4.
2	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	3.0L, 4.
3	LE423 (GN-VT)	20	CTRL MOD. - POWERTRAIN # VOLTAGE REFERENCE ENGINE (VREF) (E-VREV)	3.0L, 4.

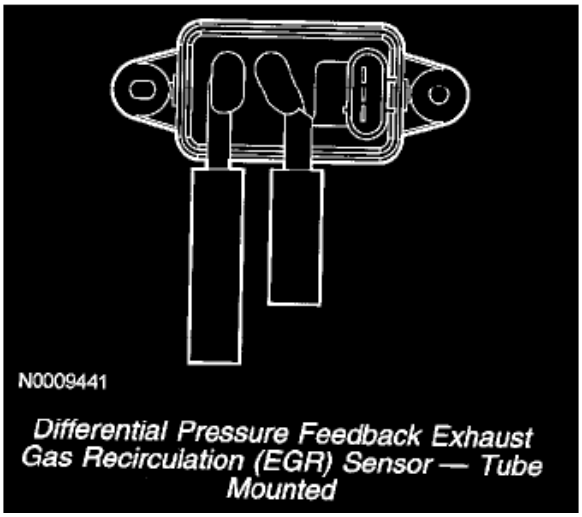
C1068



1.0 VOLTAGE OFFSET D.P.F. EGR SENSOR DATA

Differential Pressure			
IN-H20	In-Hg	kPa	Volts
116	8.83	kPa	4.95
58	4.3	14.4	2.97
0	0	0	1.0

Differential Pressure Feedback Exhaust Gas Recirculation (EGR) Sensor



Differential Pressure Feedback Exhaust Gas Recirculation (EGR) Sensor — Tube Mounted

Pressure Feedback Exhaust Sensor: Description and Operation

Differential Pressure Feedback Exhaust Gas Recirculation (EGR) Sensor

Differential Pressure Feedback Exhaust Gas Recirculation (EGR) Sensor

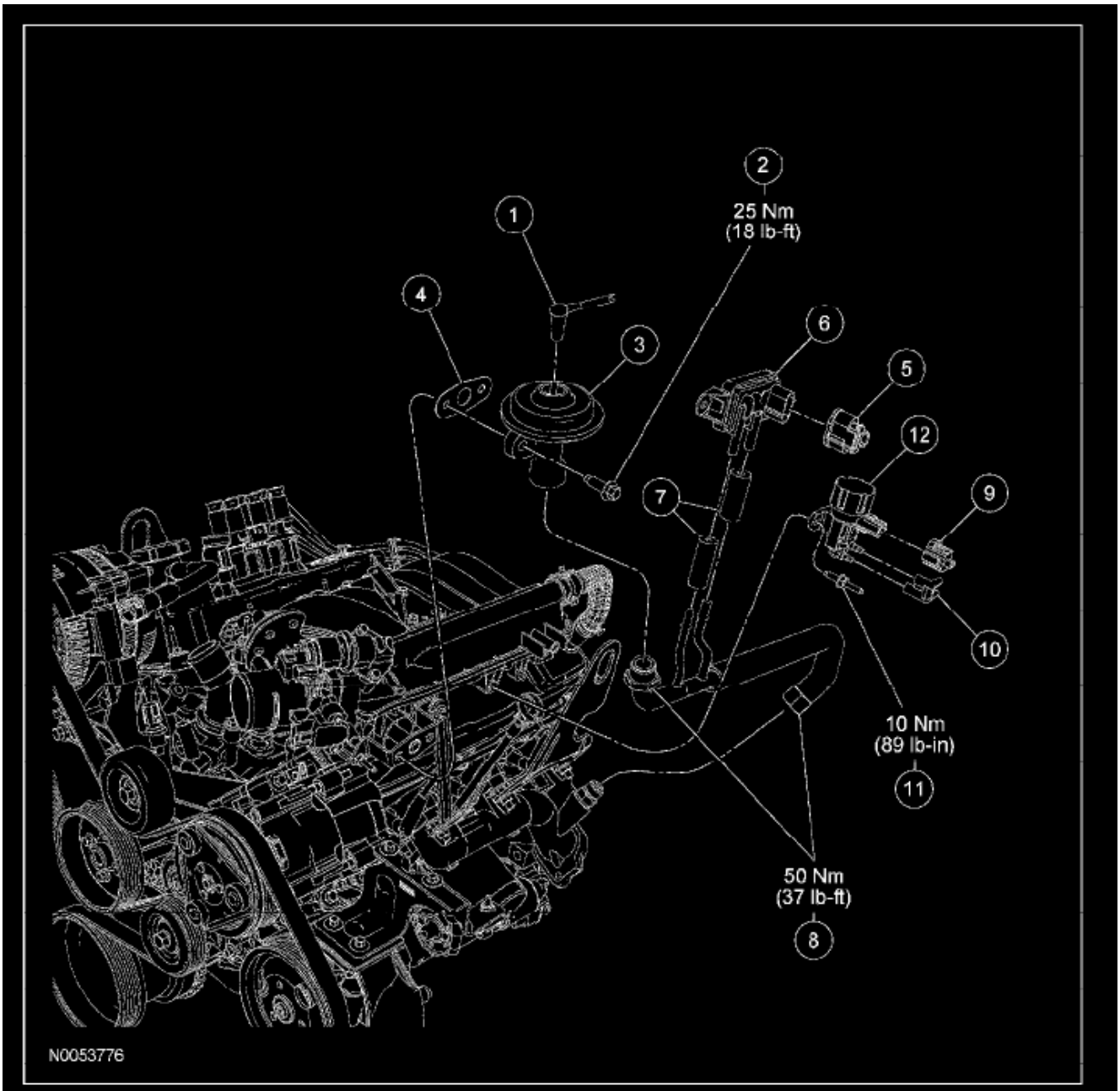
The differential pressure feedback EGR sensor is a ceramic, capacitive-type pressure transducer that monitors the differential pressure across a metering orifice located in the orifice tube assembly. The differential pressure feedback EGR sensor receives this signal through 2 hoses referred to as the downstream pressure hose (REF SIGNAL) and upstream pressure hose (HI SIGNAL). The HI and REF hose connections are marked on the differential pressure feedback EGR sensor housing for identification (note that the HI signal uses a larger diameter hose). The differential pressure feedback EGR sensor outputs a voltage proportional to the pressure drop across the metering orifice and supplies it to the PCM as EGR flow rate feedback.

Differential Pressure Feedback Exhaust Gas Recirculation (EGR) Sensor - Tube Mounted

Differential Pressure Feedback Exhaust Gas Recirculation (EGR) Sensor - Tube Mounted

The tube mounted differential pressure feedback EGR sensor is identical in operation as the larger plastic differential pressure feedback EGR sensors and uses a 1.0 volt offset. The HI and REF

hose connections are marked on the side of the sensor.



Item	Part Number	Description
1	9E499	EGR vacuum hose fitting
2	W500224	EGR valve bolt (2 required)
3	9D475	EGR valve
4	9D476	EGR valve gasket

(Continued)

Item	Part Number	Description
5	14A464	Differential pressure feedback EGR sensor electrical connector (part of 12B637)
6	9J460	Differential pressure feedback EGR sensor

(Continued)

Pressure Feedback Exhaust Sensor: Service and Repair

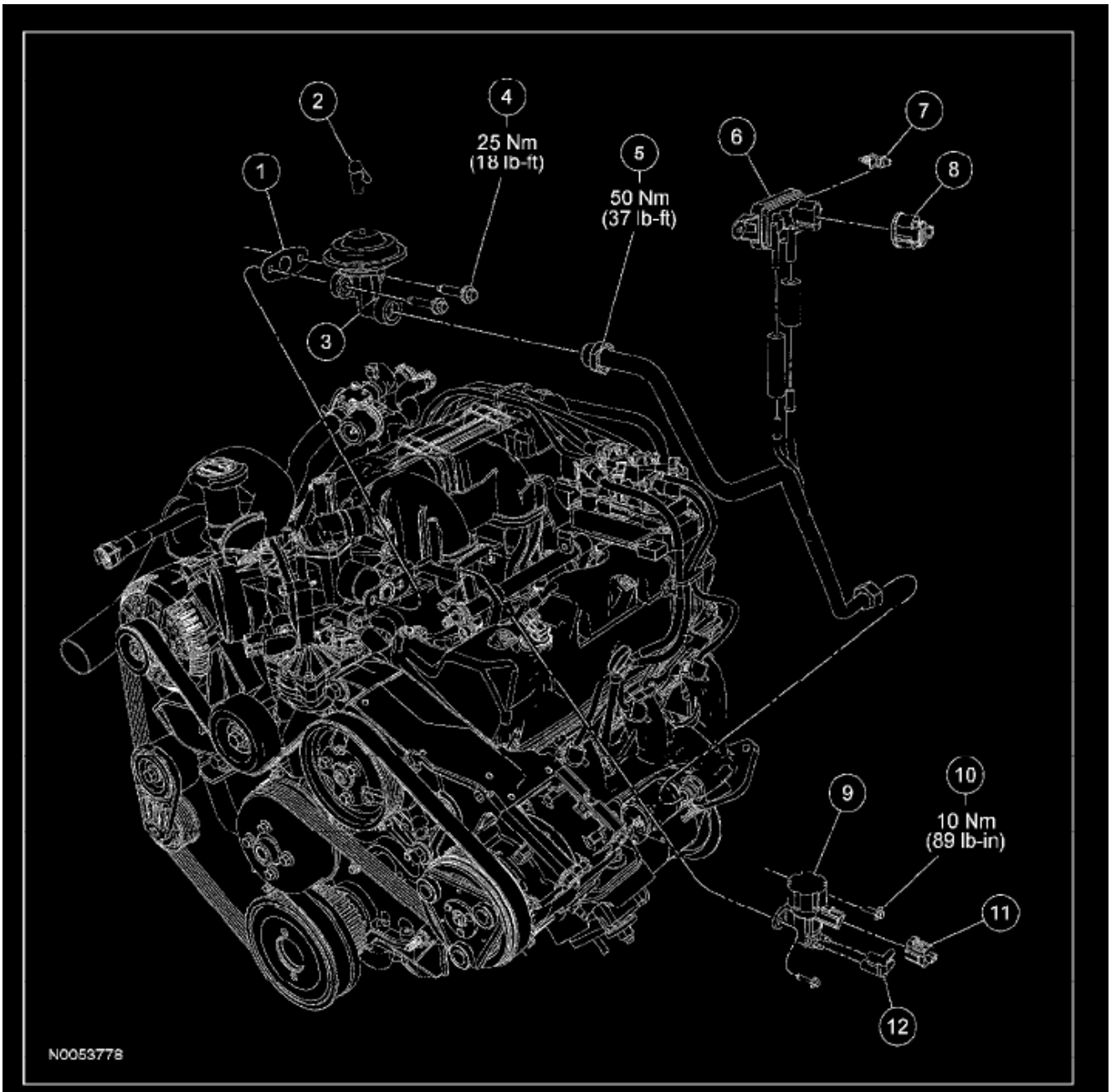
DIFFERENTIAL PRESSURE FEEDBACK EXHAUST GAS RECIRCULATION (EGR) SENSOR

Exploded View

Part 1

Item	Part Number	Description
7	9P761	Differential pressure feedback EGR sensor hoses
8	9D477	Exhaust manifold-to-EGR valve tube
9	14A464	EGR vacuum regulator solenoid electrical connector (part of 12B637)
10	9E499	EGR vacuum regulator solenoid vacuum hose fitting
11	W708628	EGR vacuum regulator solenoid stud bolt
12	9J459	EGR vacuum regulator solenoid

Part 2



Item	Part Number	Description
1	9D476	EGR valve gasket
2	9E499	EGR valve vacuum connector
3	9D475	EGR valve assembly
4	W701232	EGR valve bolt (2 required)

(Continued)

Item	Part Number	Description
5	9E469	EGR tube
6	9J460	Differential pressure feedback EGR sensor
7	13A506	Pushpin wire retainer

(Continued)

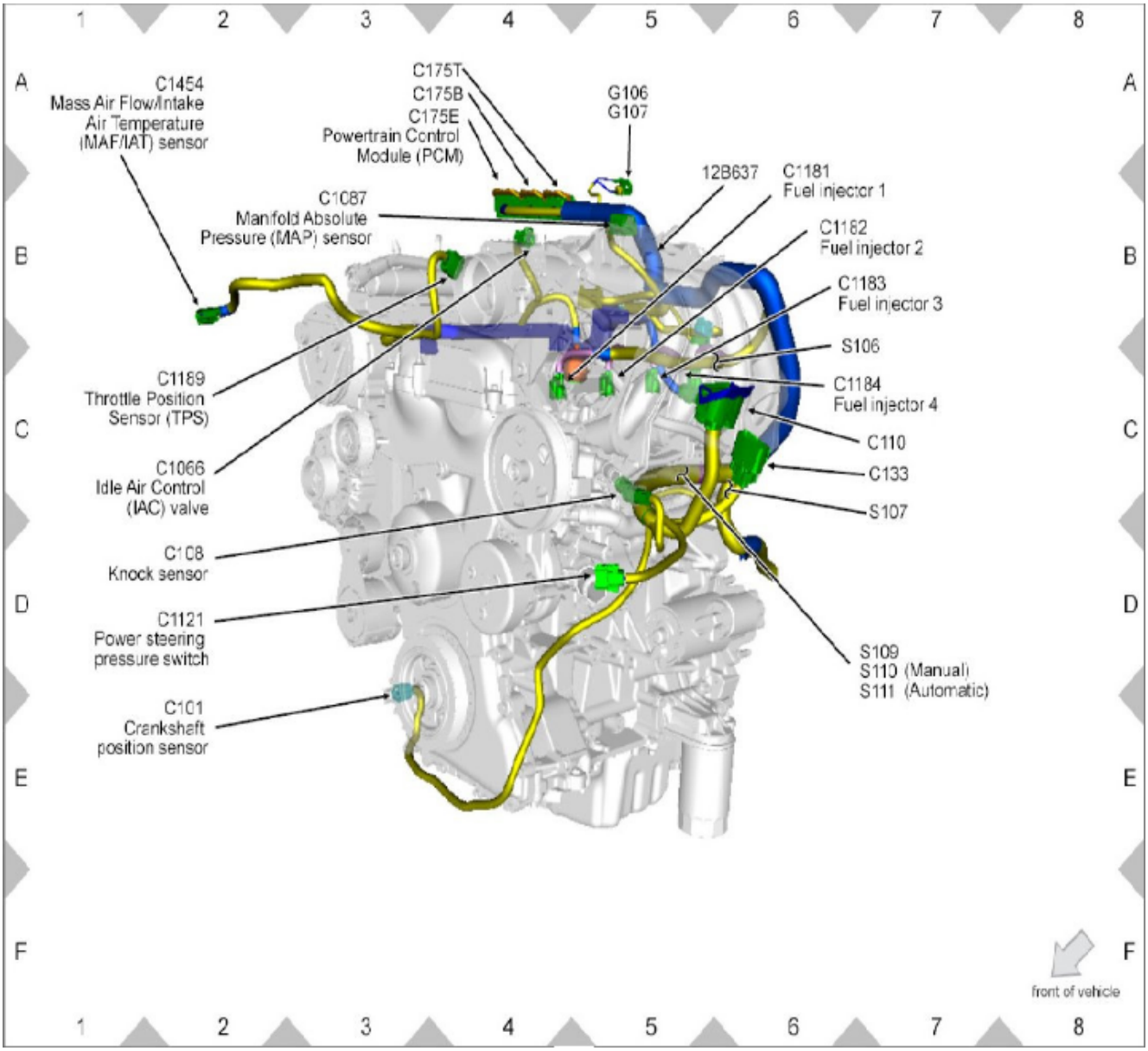
Part 1

Item	Part Number	Description
8	14A464	Differential pressure feedback EGR sensor electrical connector
9	9J459	EGR vacuum regulator solenoid
10	W704310	EGR vacuum regulator solenoid bolt (2 required)
11	14A464	EGR vacuum regulator solenoid electrical connector
12	9E499	EGR vacuum regulator solenoid vacuum connector

Part 2

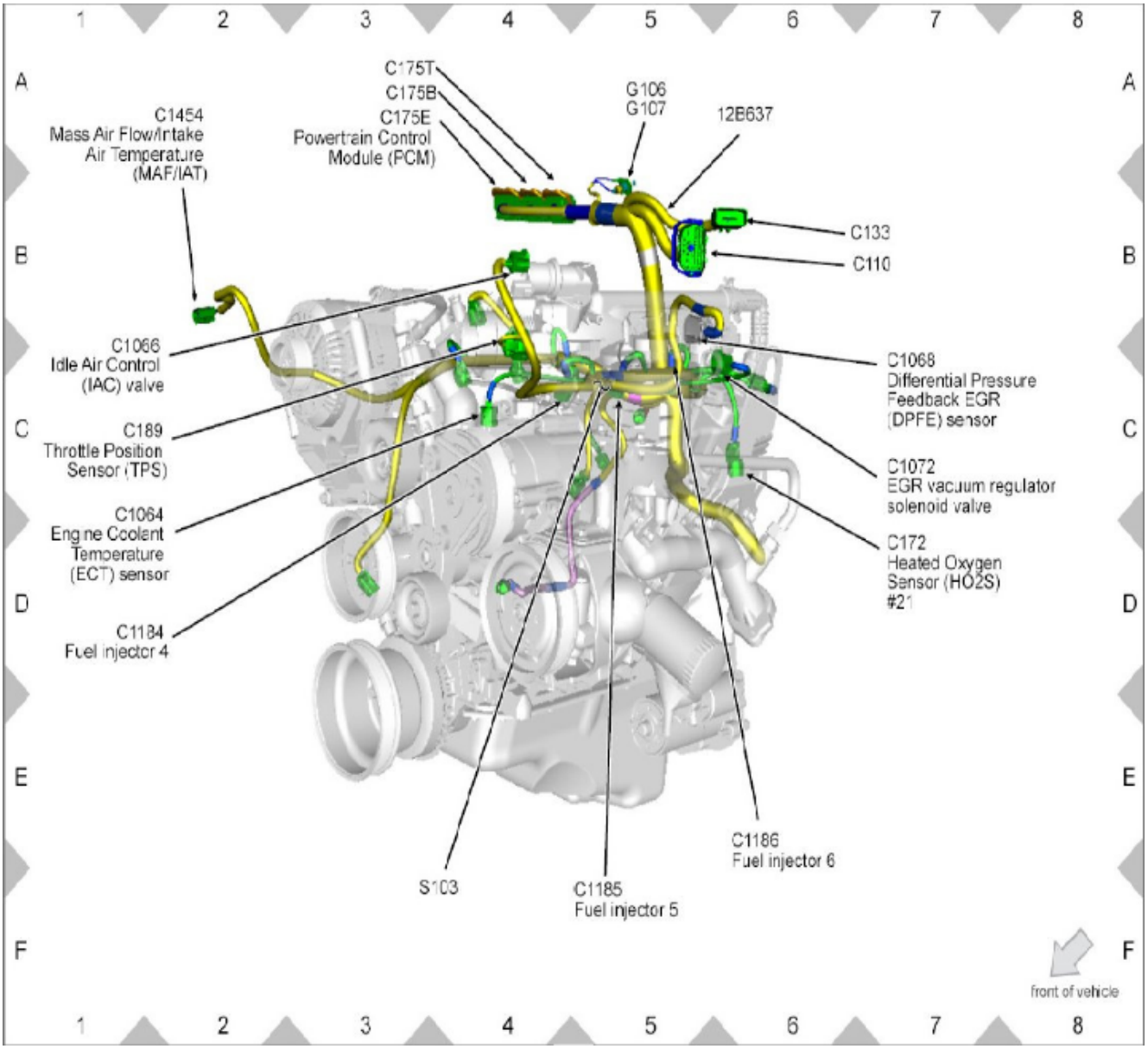
Removal and Installation

1. Disconnect the pushpin retainer from the differential pressure feedback EGR sensor. 2. Disconnect the differential pressure feedback EGR sensor electrical connector. 3. Remove the differential pressure feedback EGR sensor from the hoses. 4. To install, reverse the removal procedure.

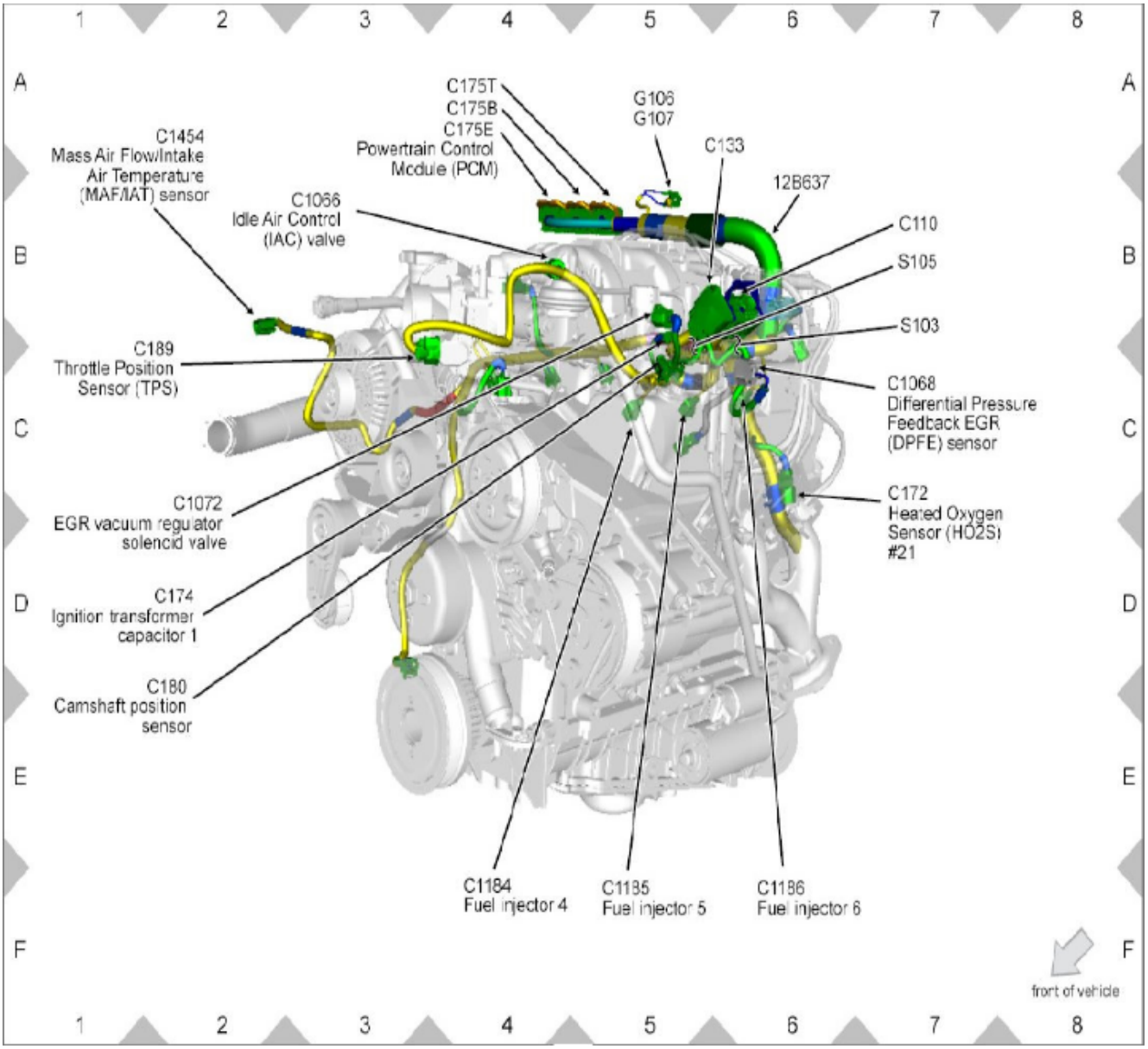


Throttle Position Sensor: Locations

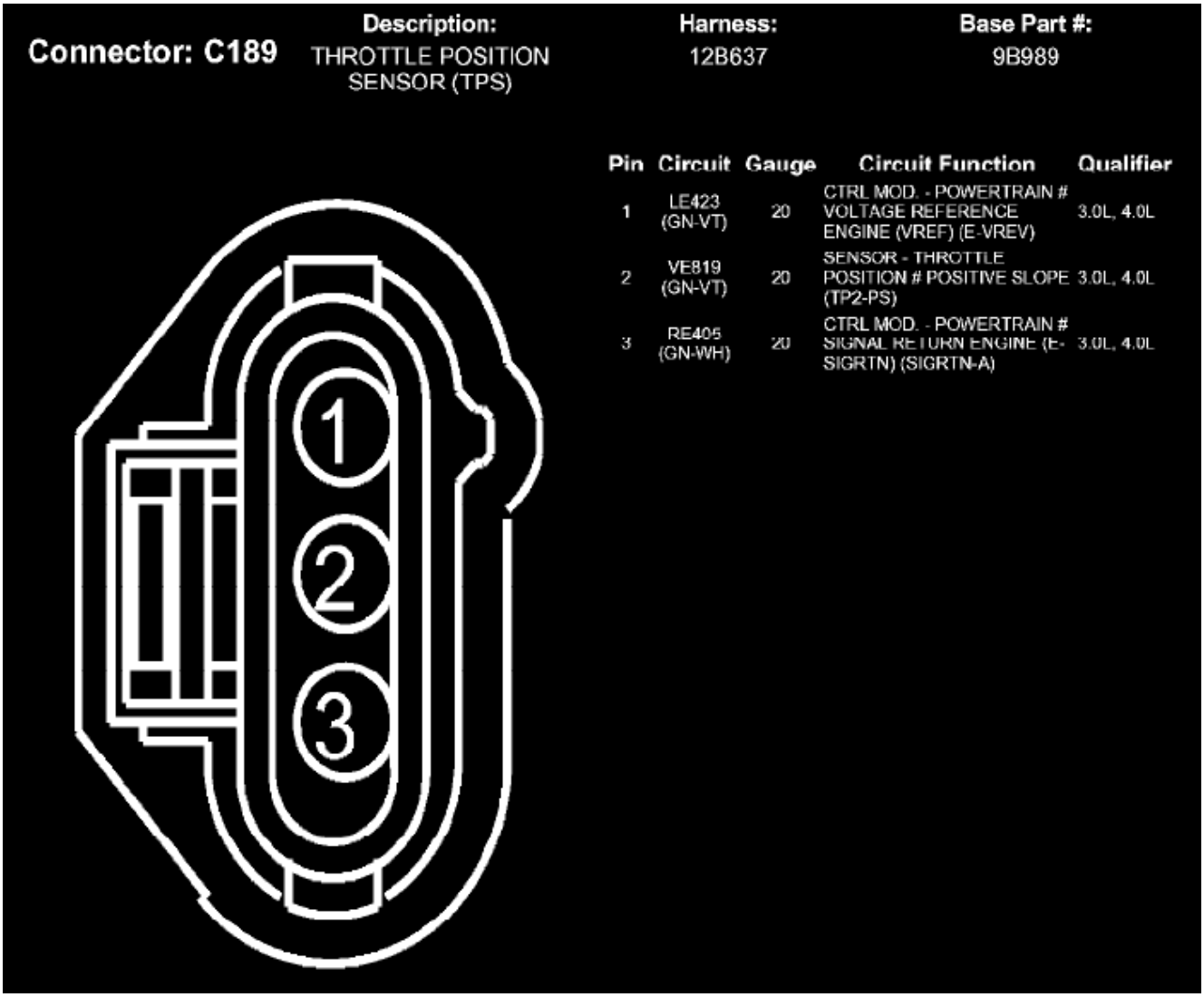
View 151-3


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
12B637
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT)
C133
C110
C1066
Idle Air Control (IAC) valve
C189
Throttle Position Sensor (TPS)
C1064
Engine Coolant Temperature (ECT) sensor
C1184
Fuel injector 4
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
S103
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-5


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
C133
12B637
C110
S105
S103
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor
C1066
Idle Air Control (IAC) valve
C189
Throttle Position Sensor (TPS)
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
C174
Ignition transformer capacitor 1
C180
Camshaft position sensor
C1184
Fuel injector 4
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-7



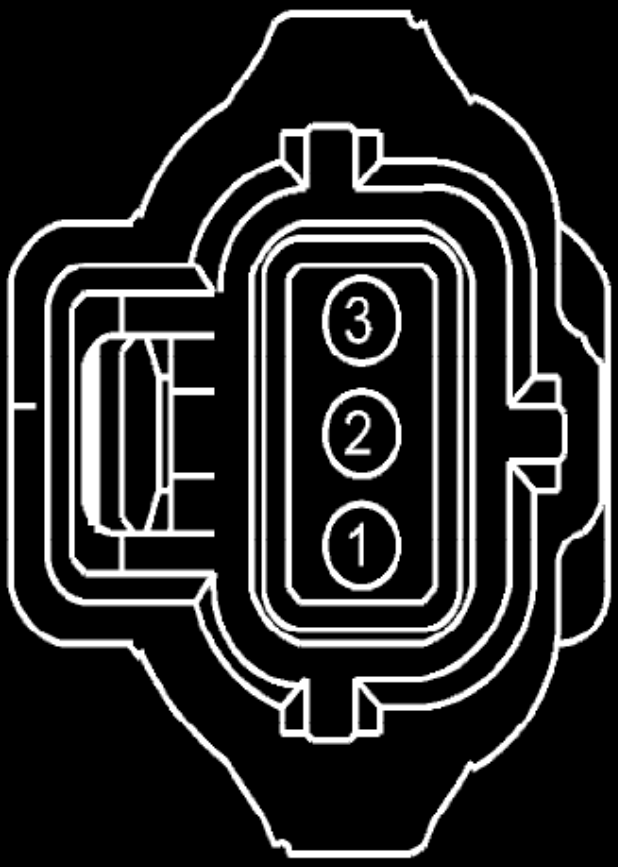
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	LE423 (GN-VT)	20	CTRL MOD. - POWERTRAIN # VOLTAGE REFERENCE ENGINE (VREF) (E-VREV)	3.0L, 4.0L
2	VE819 (GN-VT)	20	SENSOR - THROTTLE POSITION # POSITIVE SLOPE (TP2-PS)	3.0L, 4.0L
3	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	3.0L, 4.0L

Throttle Position Sensor: Diagrams

C189

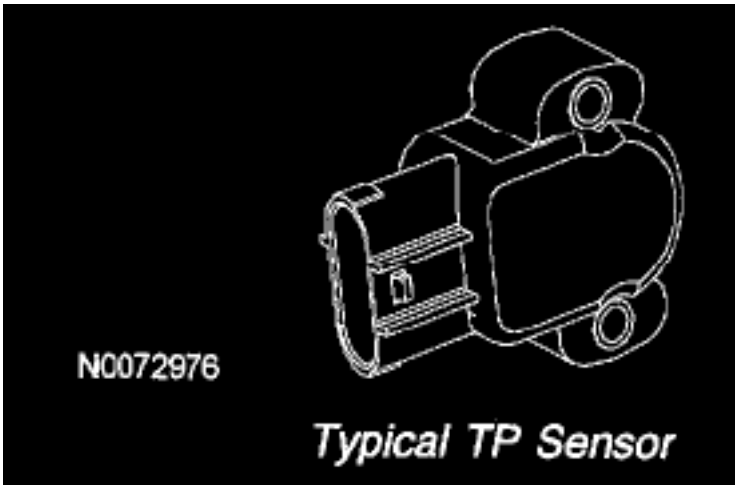
Connector: C1189

Description:	Harness:	Base Part #:
THROTTLE POSITION SENSOR (TPS)	12B637	9B989



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	2.3L
2	VE819 (GN-VT)	20	SENSOR - THROTTLE POSITION # POSITIVE SLOPE (TP2-PS)	2.3L
3	LE423 (GN-VT)	20	CTRL MOD. - POWERTRAIN # VOLTAGE REFERENCE ENGINE (VREF) (E-VREV)	2.3L

C1189



Throttle Position Sensor: Description and Operation

Electronic Throttle Body (ETB) Throttle Position Sensor

The ETB throttle position sensor has 2 signal circuits in the sensor for redundancy. The redundant ETB throttle position signals are required for increased monitoring. The first ETB throttle position sensor signal (TP1) has a negative slope (increasing angle, decreasing voltage) and the second signal (TP2) has a positive slope (increasing angle, increasing voltage). The 2 ETB throttle position sensor signals make sure the PCM receives a correct input even if 1 signal has a concern. There is 1 reference voltage circuit and 1 signal return circuit for the sensor. The reference voltage circuit and the signal return circuit is shared with the reference voltage circuits and signal return circuits used by the APP sensor.

Throttle Position (TP) Sensor

Typical TP Sensor

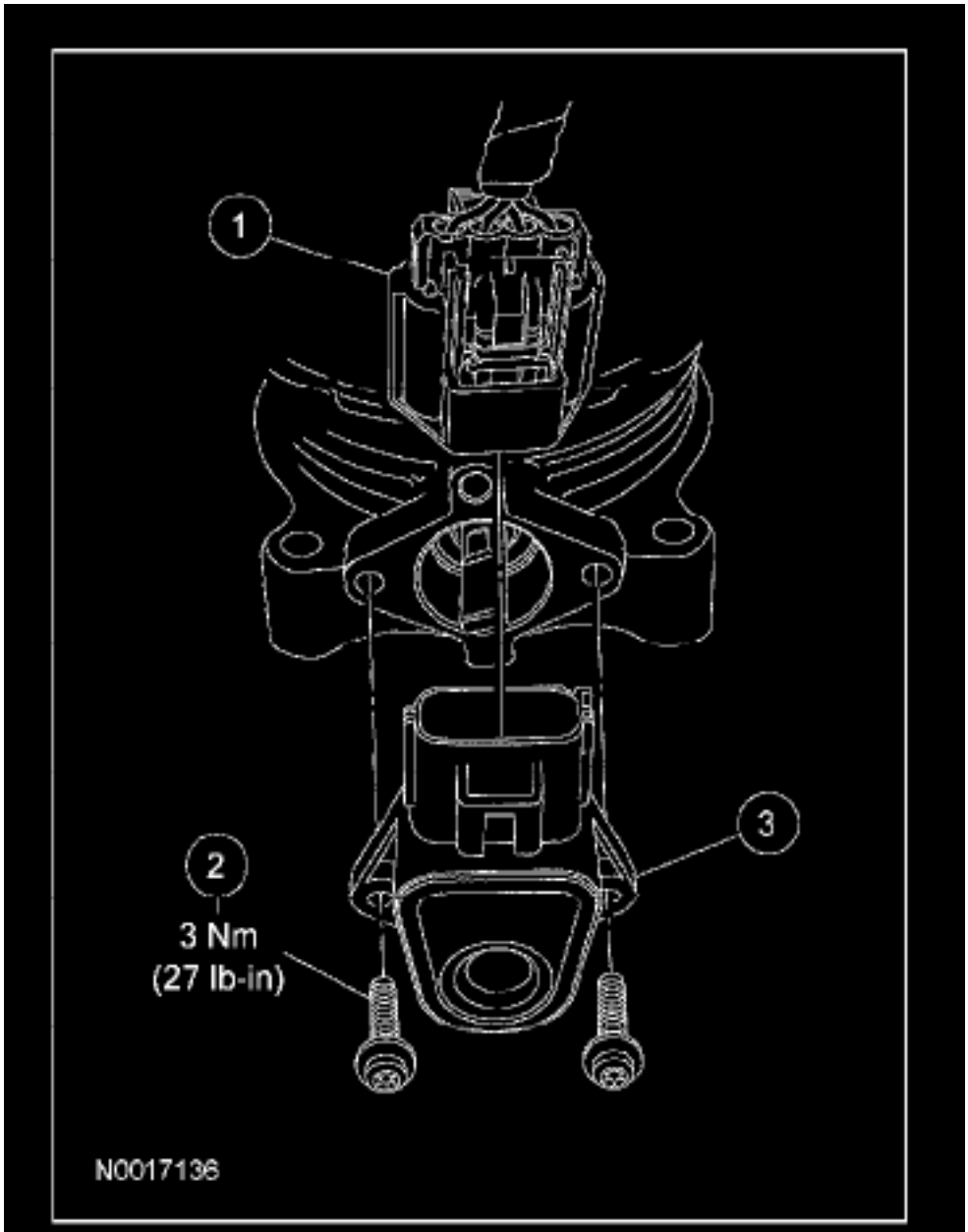
The TP sensor is a rotary potentiometer sensor that provides a signal to the PCM that is linearly proportional to the throttle plate/shaft position. The sensor housing has a 3-blade electrical connector that may be gold plated. The gold plating increases the corrosion resistance on the terminals and increases the connector durability. The TP sensor is mounted on the throttle body. As the TP sensor is rotated by the throttle shaft, 4 operating conditions are determined by the PCM from the TP. The operating conditions are: -

closed throttle (includes idle or deceleration)

- part throttle (includes cruise or moderate acceleration)

- wide open throttle (includes maximum acceleration or de-choke on crank)

- throttle angle rate



Item	Part Number	Description
1	14A464	Throttle position (TP) sensor electrical connector (part of 12B637)
2	W707535	TP sensor screw (2 required)
3	9E928	TP sensor

Throttle Position Sensor: Service and Repair

THROTTLE POSITION (TP) SENSOR

Removal and Installation

1. Disconnect the throttle position (TP) sensor electrical connector.

2. CAUTION: Failure to remove the throttle position (TP) sensor screws in the following manner will result in damage to the screws. First,

loosen the screws 1 to 2 full turns using a hand tool, and then use a suitable high-speed driver to complete the removal.

Remove and discard the 2 bolts and the TP sensor. -

To install, tighten to 3 Nm (27 lb-in).

3. CAUTION: Do not use a high-speed driver to install the new screws or damage to the throttle position (TP) sensor may occur.

NOTE: -

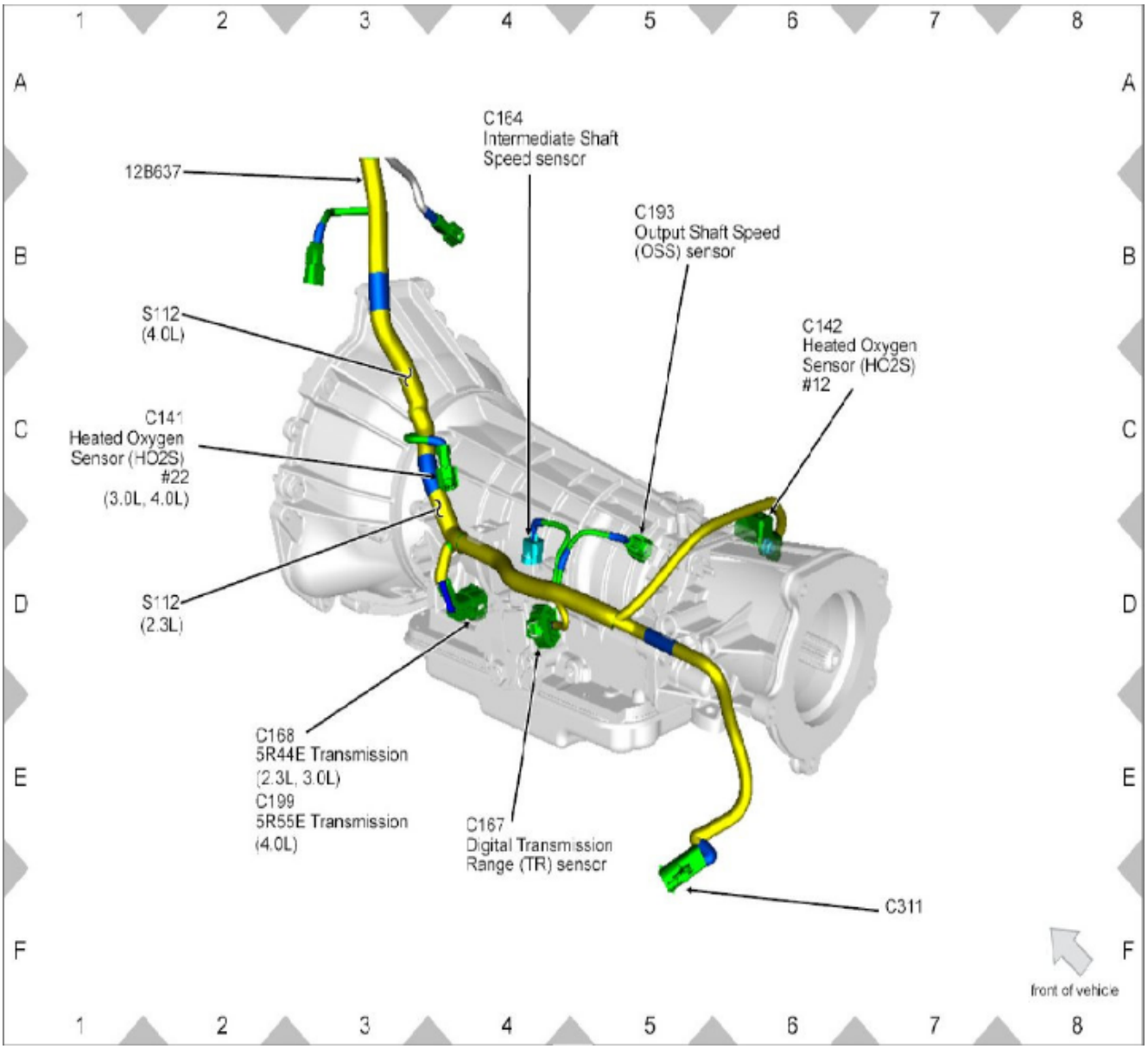
Do not reuse the TP sensor and screws. A new TP sensor and screws must be installed.

- Failure to install the TP sensor in this manner may result in excessive idle speeds. Slide the rotary tangs into position over the throttle shaft blade, then rotate the TP sensor.

To install, reverse the removal procedure. -

Install a new TP sensor and screws.

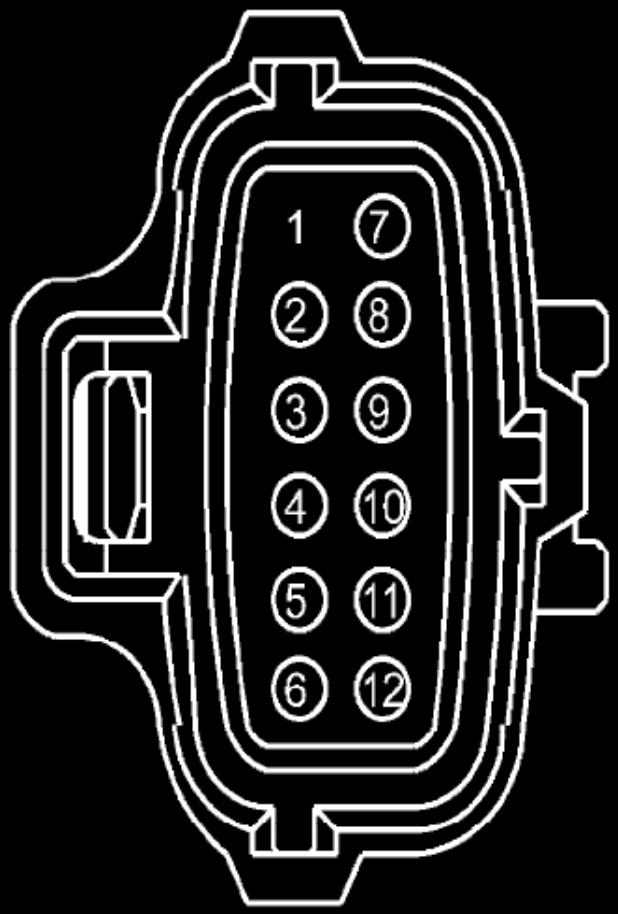
Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Sensors and Switches > Sensors and Switches - Powertrain Management > Sensors and Switches - Computers and Control Systems > Transmission Position Switch/Sensor, A/T > Component Information > Locations



View 151-10

Connector: C167

Description:	Harness:	Base Part #:
DIGITAL TRANSMISSION RANGE (TR) SENSOR	12B637	7F293



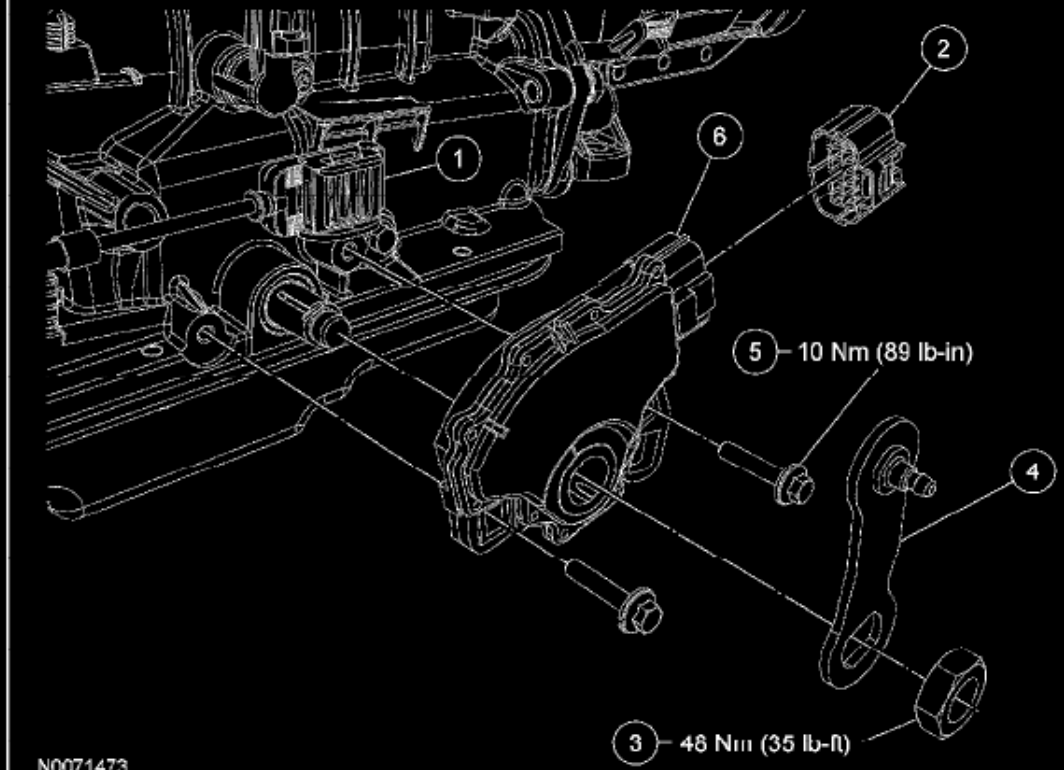
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	RE406 (GY-VT)	18	SIGNAL RETURN	
3	VET28 (GY-VT)	20	TR3A	
4	VET29 (VT-WH)	20	TR1	
5	VET30 (YE)	20	TR2	
6	VET31 (BU-OG)	20	TR4	
7	GD108 (BK-VT)	18	GROUND	4x4
8	CCF20 (GY-VT)	20	NETURAL SENSE	4x4
9	CBP20 (YE-VT)	18	FUSED POWER FEED	
10	CET40 (GN-OG)	20	STARTER CONTROL	
11	CET41 (BN-YE)	18	BACK UP	
12	CBP21 (BU-GY)	20	STARTER TO STARTER INTERRUPT RELAY	

C167

Special Tool(s)

ST1633-A	Alignment Gauge, TR Sensor 307-351 (T97L-70010-A)

Digital Transmission Range (TR) Sensor



Item	Part Number	Description
1	7E395-A	Selector lever cable
2	—	Digital transmission range (TR) sensor electrical connector
3	W701211-S	Manual control lever nut
4	7A256-A	Manual control lever
5	N806933-S	Digital TR sensor screw (2 required)
6	7F293-A	Digital TR sensor

Transmission Position Switch/Sensor: Service and Repair

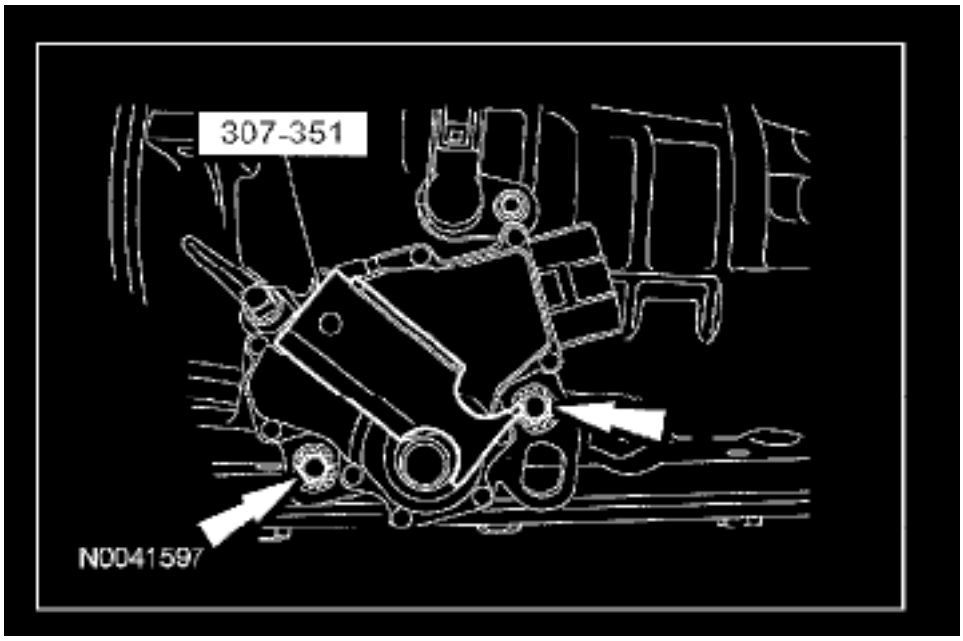
Digital Transmission Range (TR) Sensor

Digital Transmission Range (TR) Sensor

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the selector lever cable from the manual control lever. 3. Disconnect the digital transmission range (TR) sensor electrical connector. 4. Remove the manual control outer lever nut and manual control outer lever. 5. Remove the screws and the digital TR sensor.

Installation



1. CAUTION: The digital transmission range (TR) sensor must fit flush against the boss on the case to prevent damage to the sensor.

Install the digital TR sensor and loosely install the screws.

2. CAUTION: Tightening one screw before tightening the other may cause the sensor to bind or become damaged.

NOTE: The manual lever must be in the NEUTRAL position.

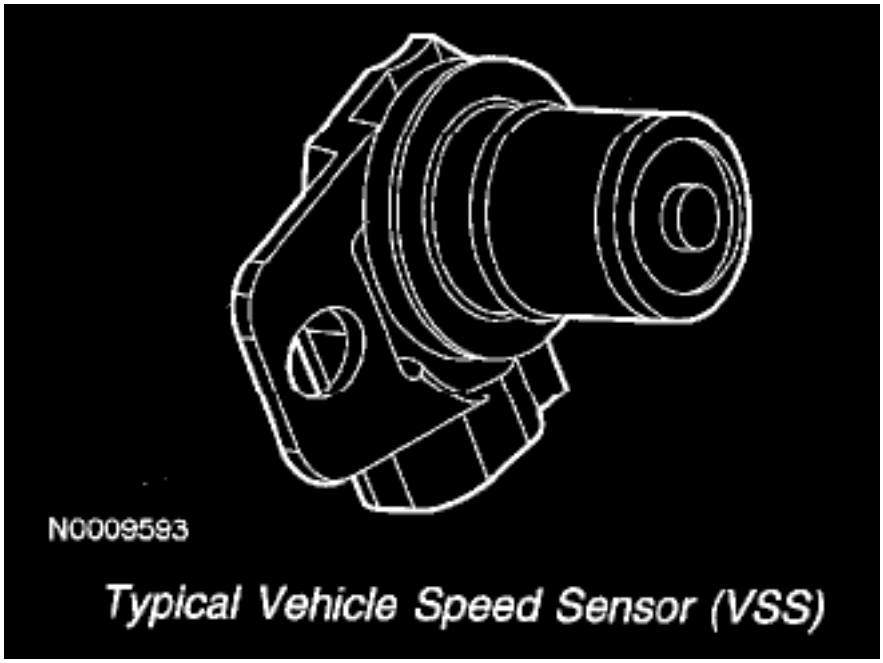
Using the special tool, align the digital TR sensor and tighten screws in an alternating sequence. ^

Tighten to 10 Nm (89 lb-inch).

3. Install the manual control outer lever and nut.

^ Tighten to 48 Nm (35 lb-ft).

4. Connect the digital TR sensor electrical connector. 5. Connect the selector lever cable to the manual control lever. 6. Verify that the selector lever cable is adjusted correctly.



Vehicle Speed Sensor: Description and Operation

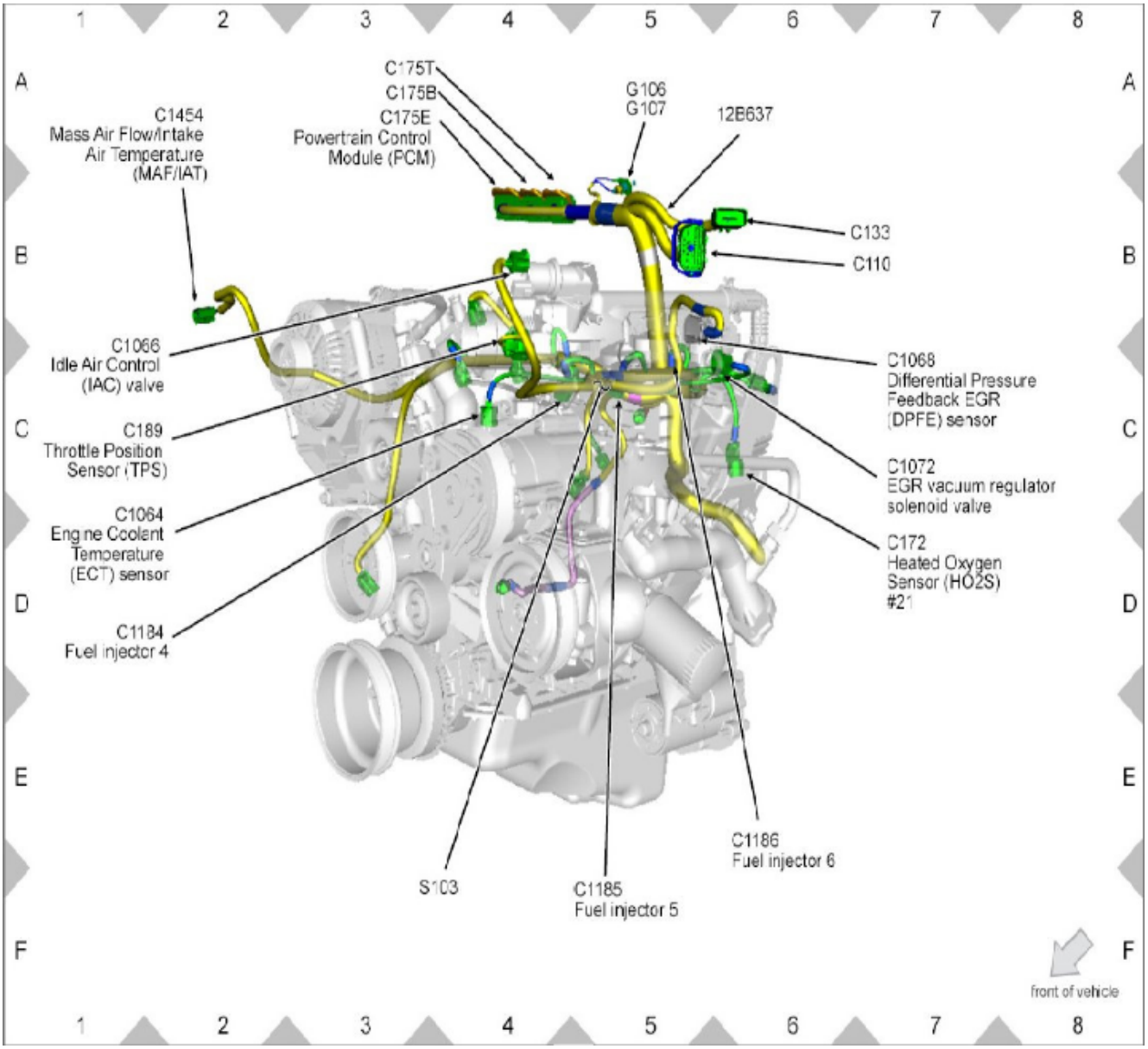
Output Shaft Speed (OSS) Sensor

The OSS sensor provides the PCM with information about the rotational speed of an output shaft. The PCM uses the information to control and diagnose powertrain behavior. In some applications, the sensor is also used as the source of vehicle speed. The sensor may be physically located in different places on the vehicle, depending upon the specific application. The design of each speed sensor is unique and depends on which powertrain control feature uses the information that is generated.

Vehicle Speed Sensor (VSS)

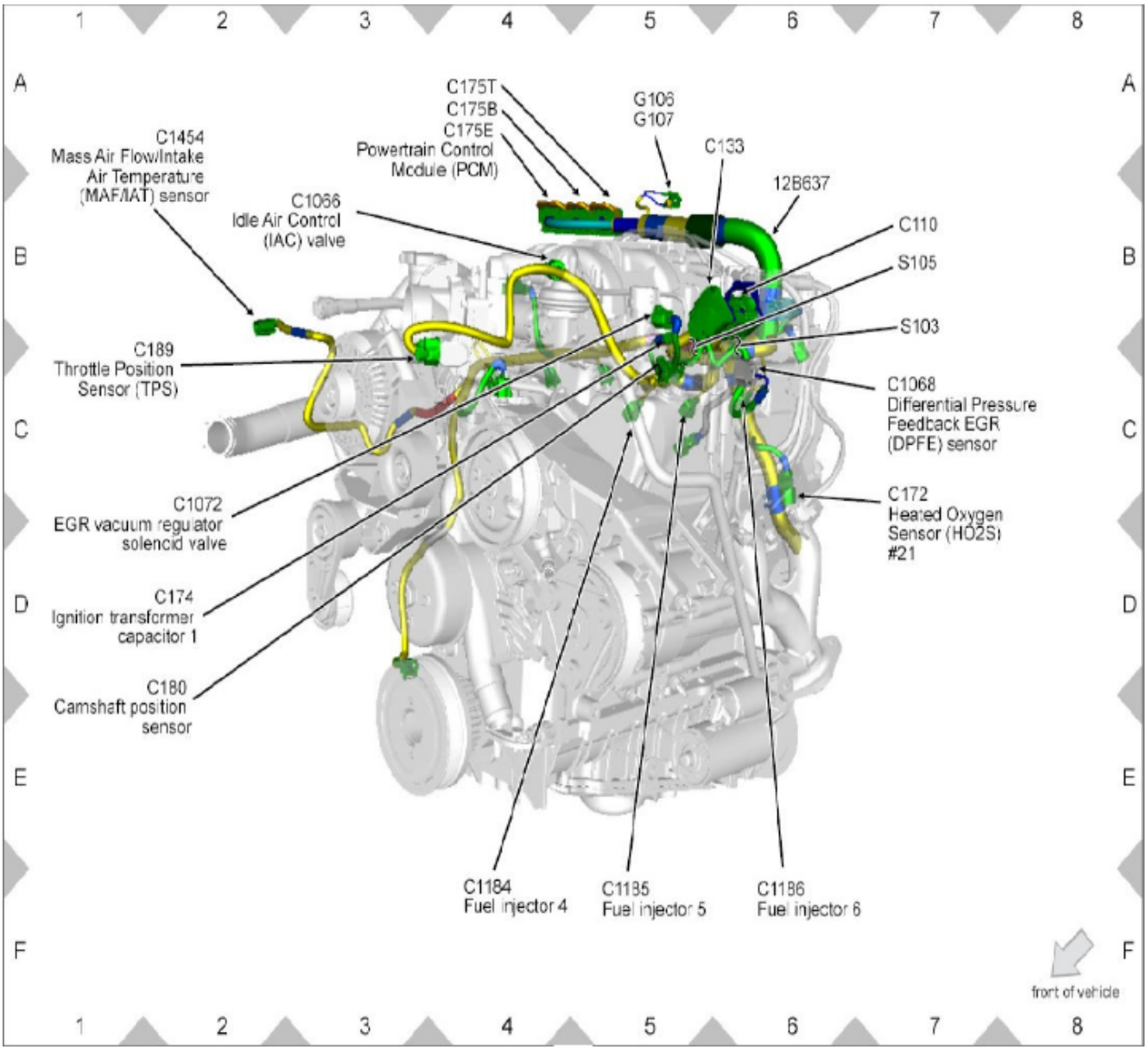
Typical Vehicle Speed Sensor (VSS)

The VSS is a variable reluctance or Hall-effect sensor that generates a waveform with a frequency that is proportional to the speed of the vehicle. If the vehicle is moving at a relatively low velocity, the sensor produces a signal with a low frequency. As the vehicle velocity increases, the sensor generates a signal with a higher frequency. The PCM uses the frequency signal generated by the VSS (and other inputs) to control such parameters as fuel injection, ignition control, transmission/transaxle shift scheduling, and torque converter clutch scheduling.



Pressure Feedback Exhaust Sensor: Locations

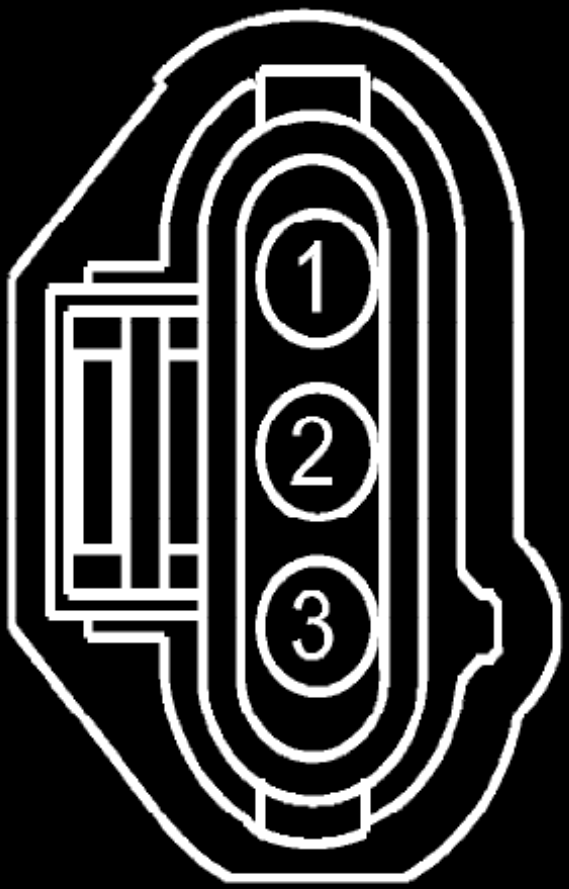
View 151-5


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
C133
12B637
C110
S105
S103
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor
C1066
Idle Air Control (IAC) valve
C189
Throttle Position Sensor (TPS)
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
C174
Ignition transformer capacitor 1
C180
Camshaft position sensor
C1184
Fuel injector 4
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-7

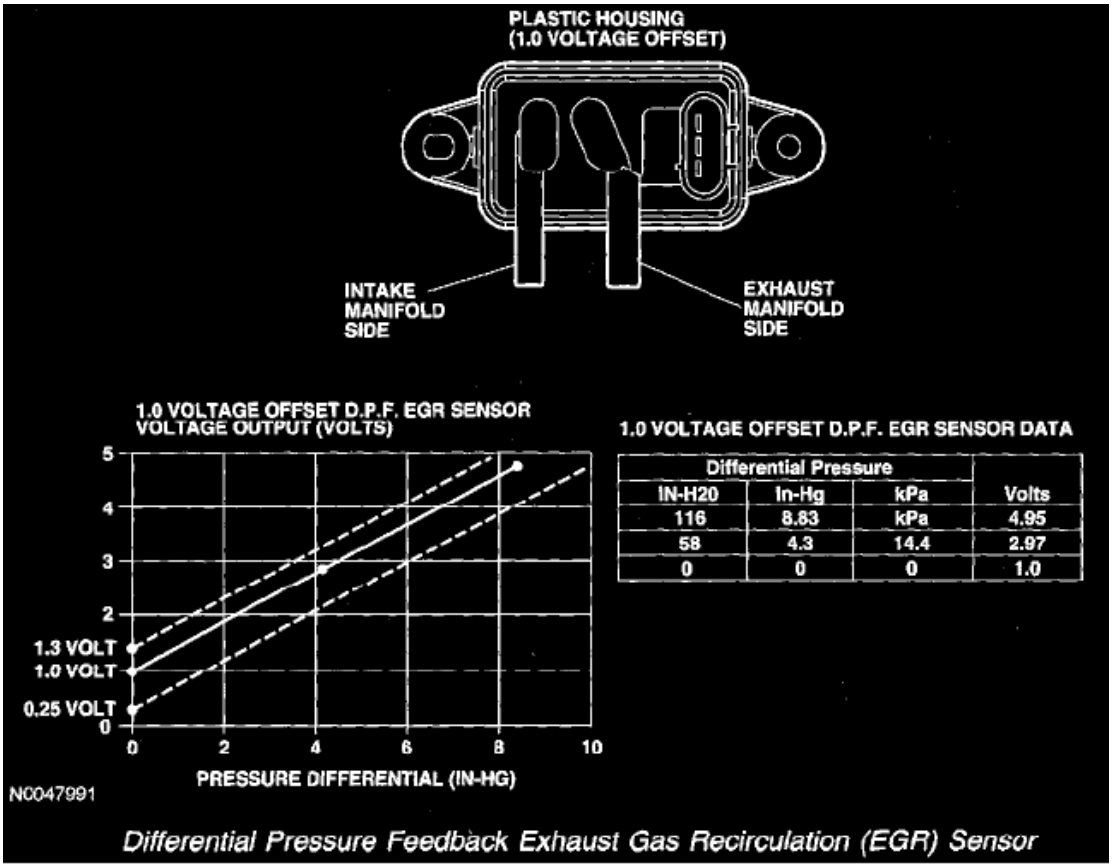
Connector: C1068

Description:	Harness:	Base Part #:
DIFFERENTIAL PRESSURE FEEDBACK EGR DPFE) SENSOR	12B637	9J460



Pin	Circuit	Gauge	Circuit Function	Quali
1	VE713 (GN-OG)	20	SENSOR - DELTA PRESSURE FEEDBACK EGR (DPFE)	3.0L, 4.
2	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	3.0L, 4.
3	LE423 (GN-VT)	20	CTRL MOD. - POWERTRAIN # VOLTAGE REFERENCE ENGINE (VREF) (E-VREV)	3.0L, 4.

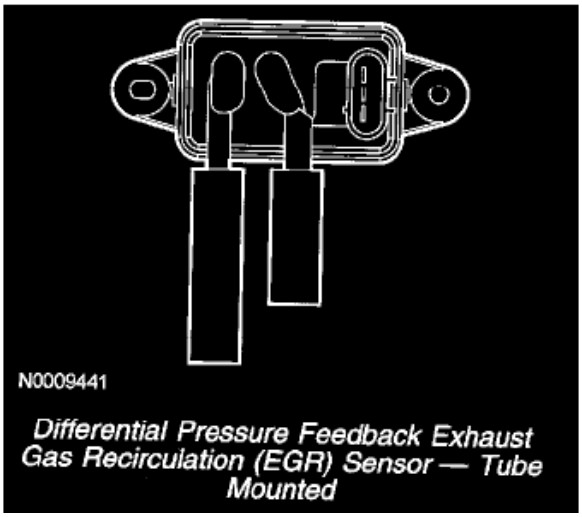
C1068



1.0 VOLTAGE OFFSET D.P.F. EGR SENSOR DATA

Differential Pressure			
IN-H20	In-Hg	kPa	Volts
116	8.83	kPa	4.95
58	4.3	14.4	2.97
0	0	0	1.0

Differential Pressure Feedback Exhaust Gas Recirculation (EGR) Sensor



Differential Pressure Feedback Exhaust Gas Recirculation (EGR) Sensor — Tube Mounted

Pressure Feedback Exhaust Sensor: Description and Operation

Differential Pressure Feedback Exhaust Gas Recirculation (EGR) Sensor

Differential Pressure Feedback Exhaust Gas Recirculation (EGR) Sensor

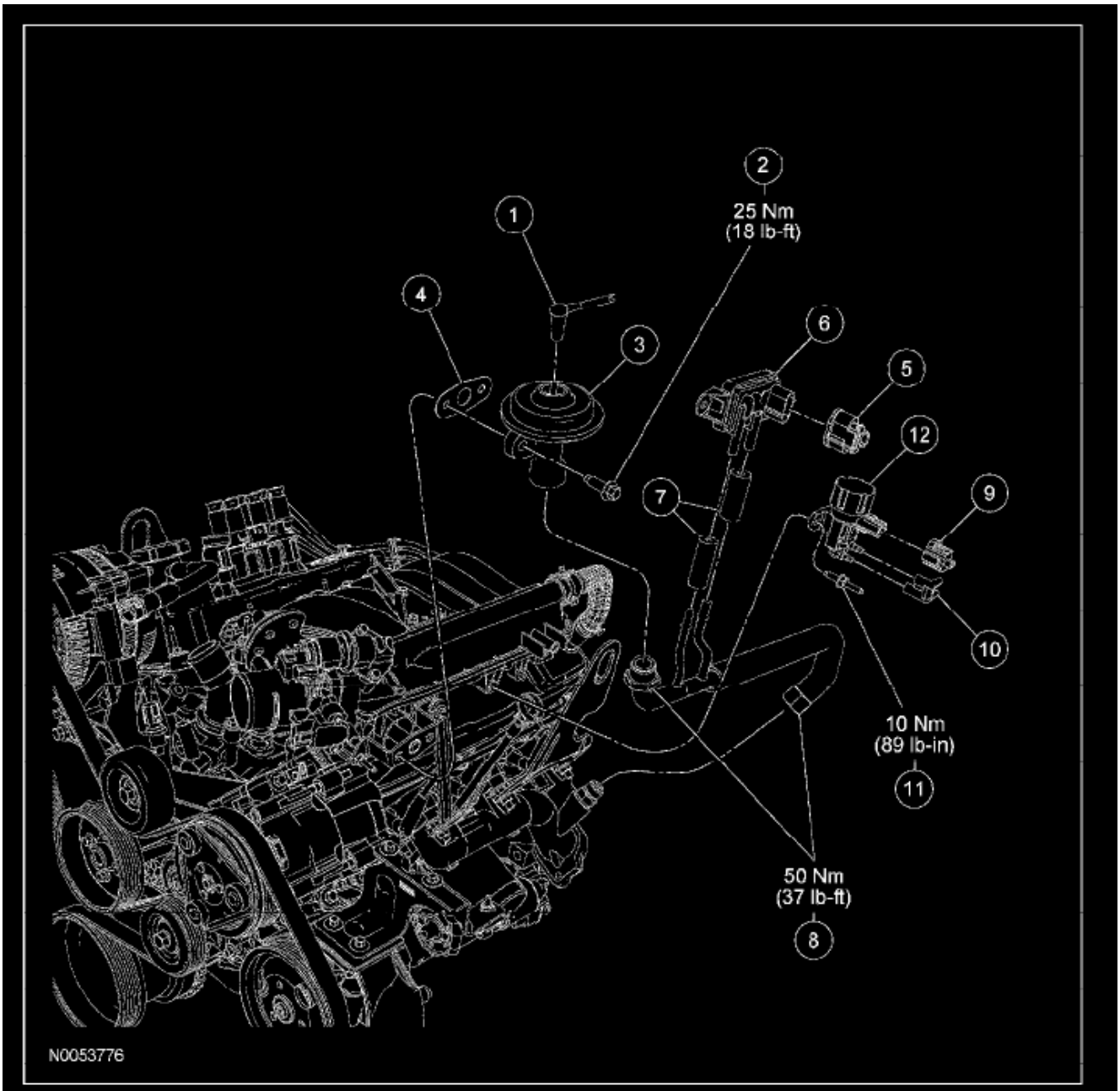
The differential pressure feedback EGR sensor is a ceramic, capacitive-type pressure transducer that monitors the differential pressure across a metering orifice located in the orifice tube assembly. The differential pressure feedback EGR sensor receives this signal through 2 hoses referred to as the downstream pressure hose (REF SIGNAL) and upstream pressure hose (HI SIGNAL). The HI and REF hose connections are marked on the differential pressure feedback EGR sensor housing for identification (note that the HI signal uses a larger diameter hose). The differential pressure feedback EGR sensor outputs a voltage proportional to the pressure drop across the metering orifice and supplies it to the PCM as EGR flow rate feedback.

Differential Pressure Feedback Exhaust Gas Recirculation (EGR) Sensor - Tube Mounted

Differential Pressure Feedback Exhaust Gas Recirculation (EGR) Sensor - Tube Mounted

The tube mounted differential pressure feedback EGR sensor is identical in operation as the larger plastic differential pressure feedback EGR sensors and uses a 1.0 volt offset. The HI and REF

hose connections are marked on the side of the sensor.



Item	Part Number	Description
1	9E499	EGR vacuum hose fitting
2	W500224	EGR valve bolt (2 required)
3	9D475	EGR valve
4	9D476	EGR valve gasket

(Continued)

Item	Part Number	Description
5	14A464	Differential pressure feedback EGR sensor electrical connector (part of 12B637)
6	9J460	Differential pressure feedback EGR sensor

(Continued)

Pressure Feedback Exhaust Sensor: Service and Repair

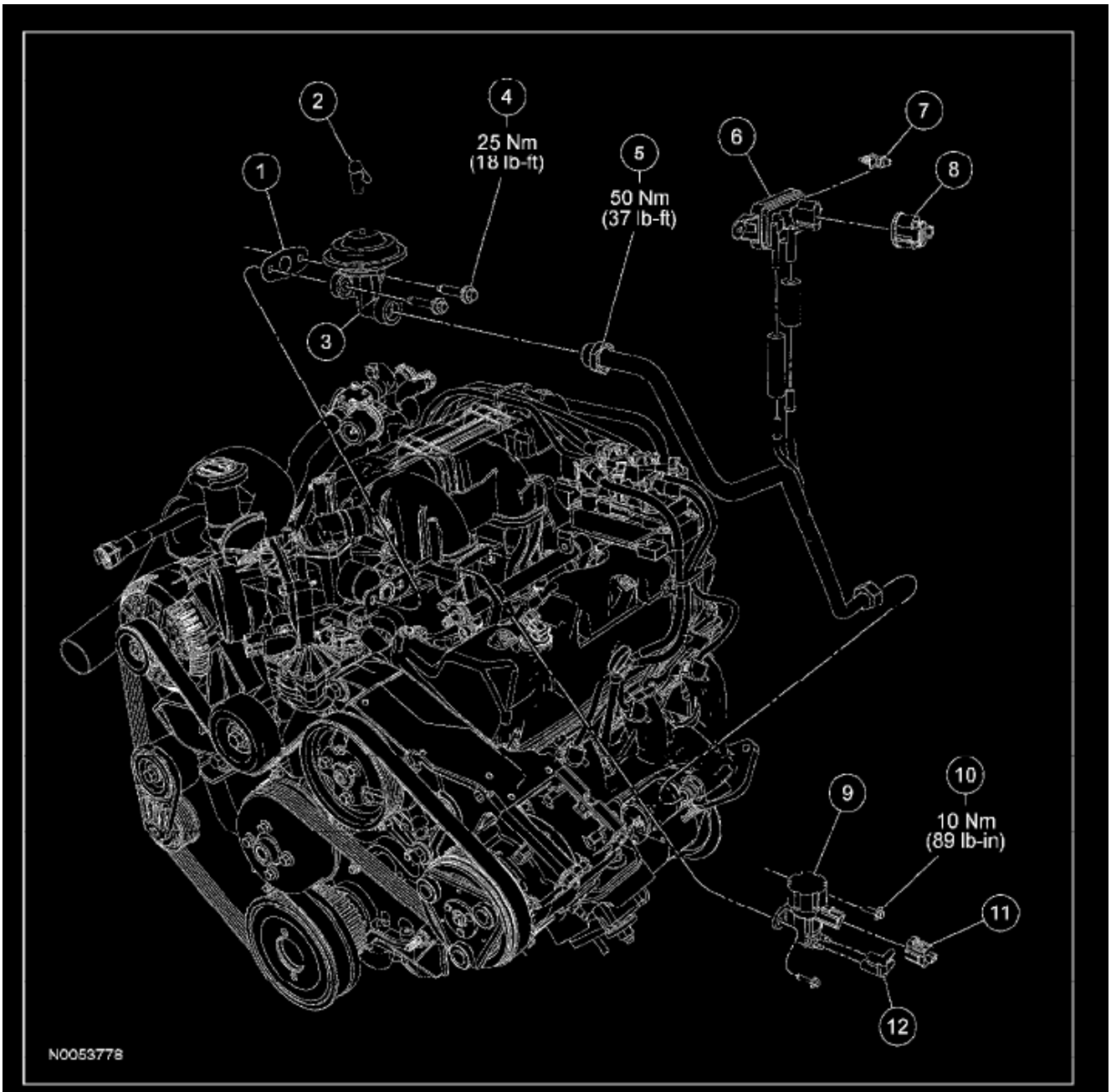
DIFFERENTIAL PRESSURE FEEDBACK EXHAUST GAS RECIRCULATION (EGR) SENSOR

Exploded View

Part 1

Item	Part Number	Description
7	9P761	Differential pressure feedback EGR sensor hoses
8	9D477	Exhaust manifold-to-EGR valve tube
9	14A464	EGR vacuum regulator solenoid electrical connector (part of 12B637)
10	9E499	EGR vacuum regulator solenoid vacuum hose fitting
11	W708628	EGR vacuum regulator solenoid stud bolt
12	9J459	EGR vacuum regulator solenoid

Part 2



Item	Part Number	Description
1	9D476	EGR valve gasket
2	9E499	EGR valve vacuum connector
3	9D475	EGR valve assembly
4	W701232	EGR valve bolt (2 required)

(Continued)

Item	Part Number	Description
5	9E469	EGR tube
6	9J460	Differential pressure feedback EGR sensor
7	13A506	Pushpin wire retainer

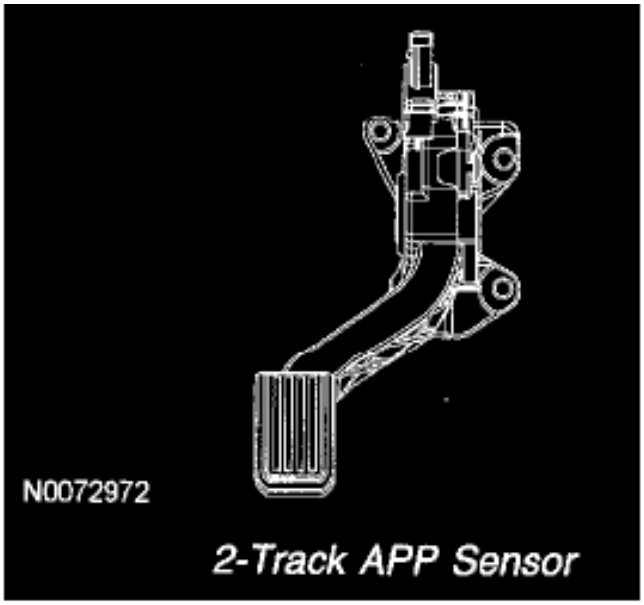
(Continued)

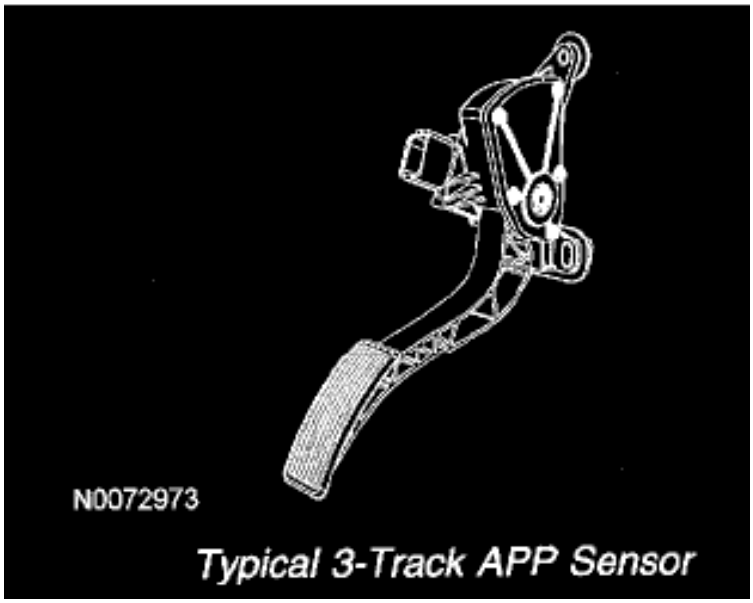
Item	Part Number	Description
8	14A464	Differential pressure feedback EGR sensor electrical connector
9	9J459	EGR vacuum regulator solenoid
10	W704310	EGR vacuum regulator solenoid bolt (2 required)
11	14A464	EGR vacuum regulator solenoid electrical connector
12	9E499	EGR vacuum regulator solenoid vacuum connector

Part 2

Removal and Installation

1. Disconnect the pushpin retainer from the differential pressure feedback EGR sensor. 2. Disconnect the differential pressure feedback EGR sensor electrical connector. 3. Remove the differential pressure feedback EGR sensor from the hoses. 4. To install, reverse the removal procedure.





Accelerator Pedal Position Sensor: Description and Operation

ACCELERATOR PEDAL POSITION (APP) SENSOR

The APP sensor is an input to the powertrain control module (PCM) and is used to determine the amount of torque requested by the operator. Depending on the application either a 2-track or 3-track APP sensor is used.

2-Track APP Sensor

2-Track APP Sensor

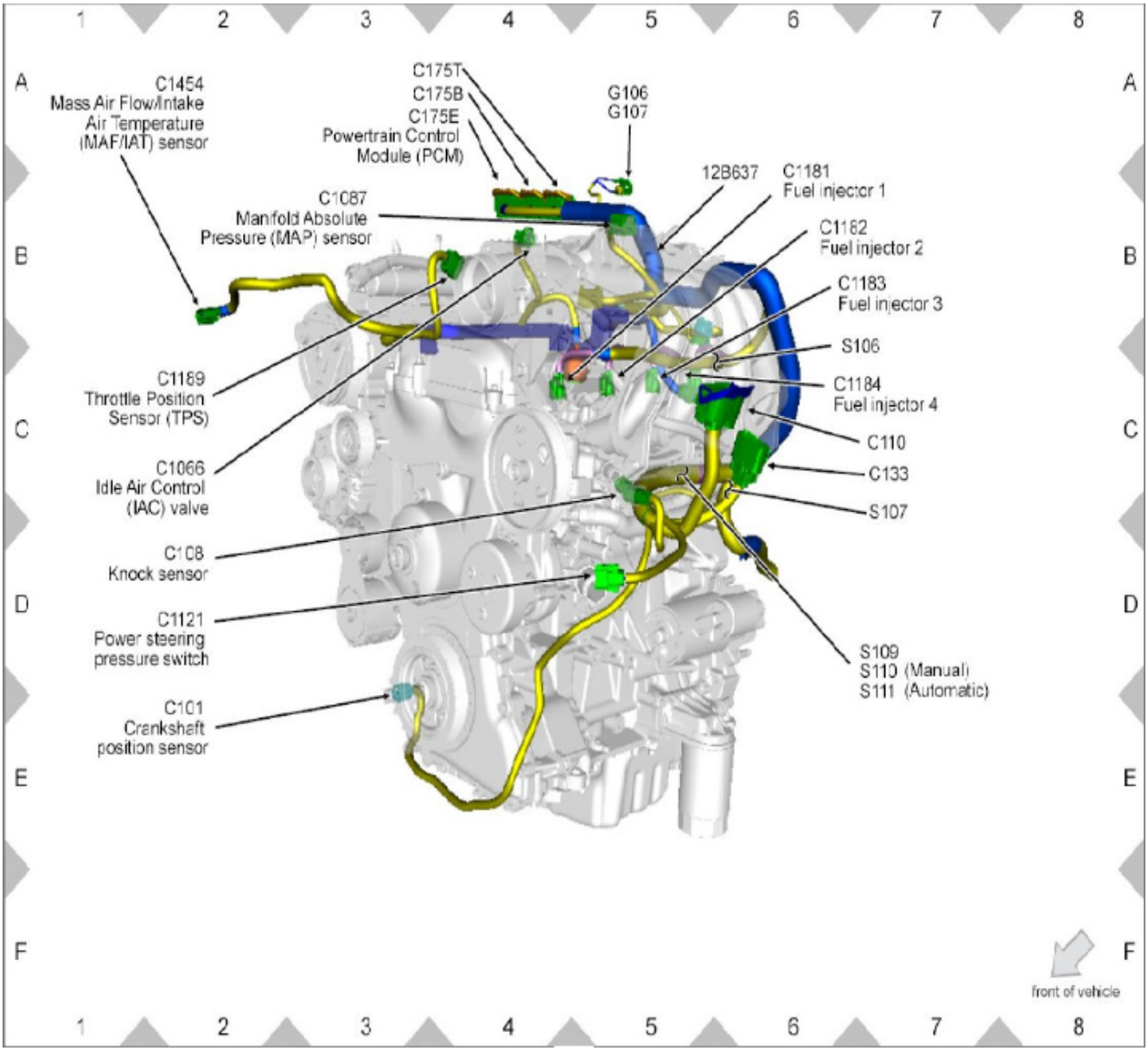
There are 2 pedal position signals in the sensor. Both signals, APP1 and APP2, have a positive slope (increasing angle, increasing voltage), but are offset and increase at different rates. The 2 pedal position signals make sure the PCM receives a correct input even if 1 signal has a concern. The PCM determines if a signal is incorrect by calculating where it should be, inferred from the other signals. If a concern is present with one of the circuits the other input is used. There are 2 reference voltage circuits, 2 signal return circuits, and 2 signal circuits (a total of 6 circuits and pins) between the PCM and the APP sensor assembly. The reference voltage circuits and the signal return circuits are shared with the reference voltage circuit and signal return circuit used by the electronic throttle body (ETB) throttle position sensor. The pedal position signal is converted to pedal travel degrees (rotary angle) by the PCM. The software then converts these degrees to counts, which is the input to the torque based strategy.

3-Track APP Sensor

Typical 3-Track APP Sensor

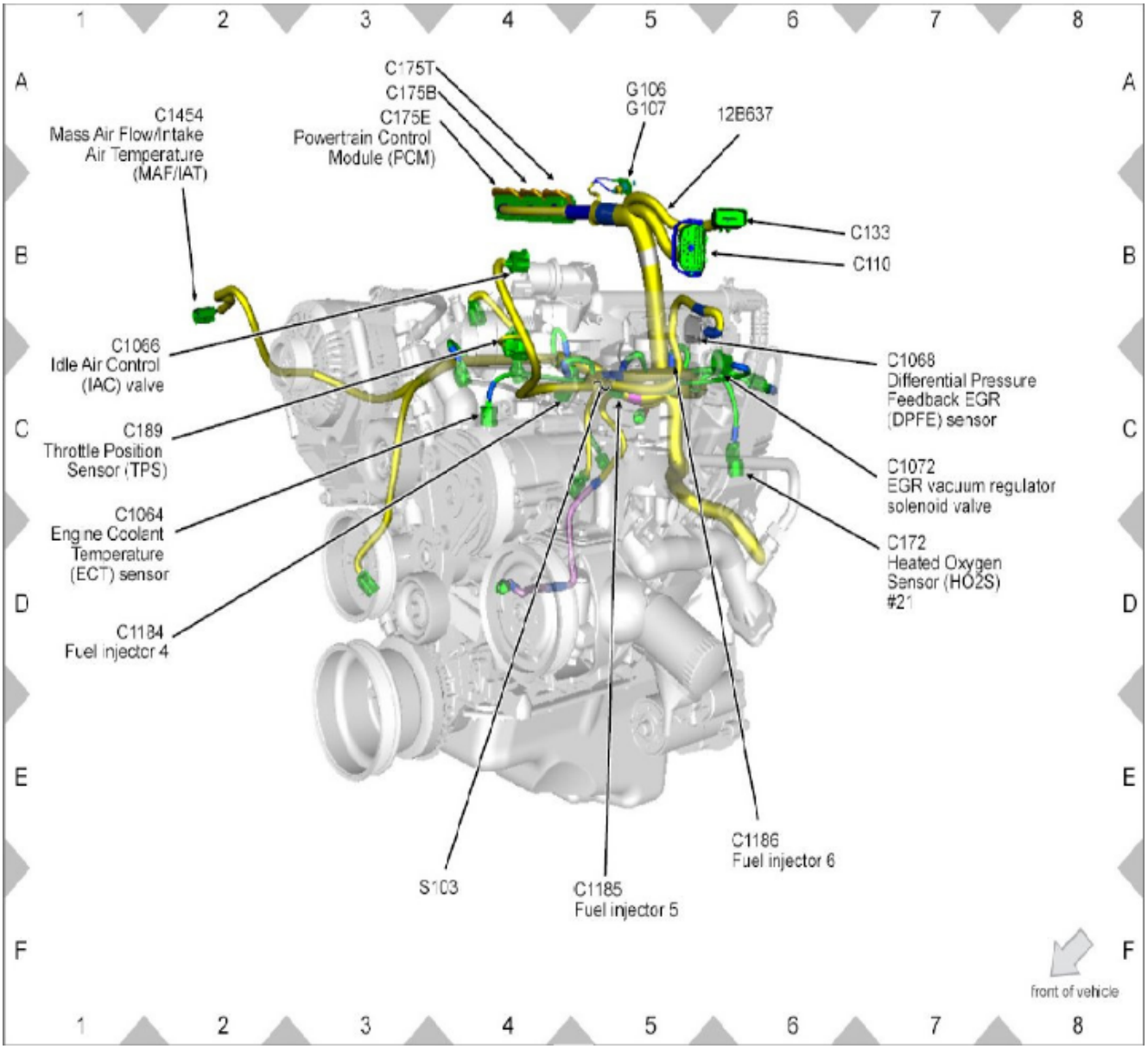
There are 3 pedal position signals in the sensor. Signal 1, APP1, has a negative slope (increasing angle, decreasing voltage) and signals 2 and 3, APP2 and APP3, both have a positive slope (increasing angle, increasing voltage). During normal operation APP1 is used as the indication of pedal position by the strategy. The 3 pedal position signals make sure the PCM receives a correct input even if 1 signal has a concern. The PCM determines if a signal is incorrect by calculating where it should be, inferred from the other signals. If a concern is present with one of the circuits the other inputs are used. The pedal position signal is converted to pedal travel degrees (rotary angle) by the PCM. The software then converts these degrees to counts, which is the input to the torque based strategy. There are 2 reference voltage circuits, 2 signal return circuits, and 3 signal circuits (a total of 7 circuits and pins) between the PCM and the APP sensor assembly. The reference voltage circuits and the signal return circuits are shared with the reference voltage circuit and signal return circuit used by the electronic throttle body (ETB) throttle position sensor.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Sensors and Switches > Sensors and Switches - Powertrain Management > Sensors and Switches - Fuel Delivery and Air Induction > Air Flow Meter/Sensor > Component Information > Locations

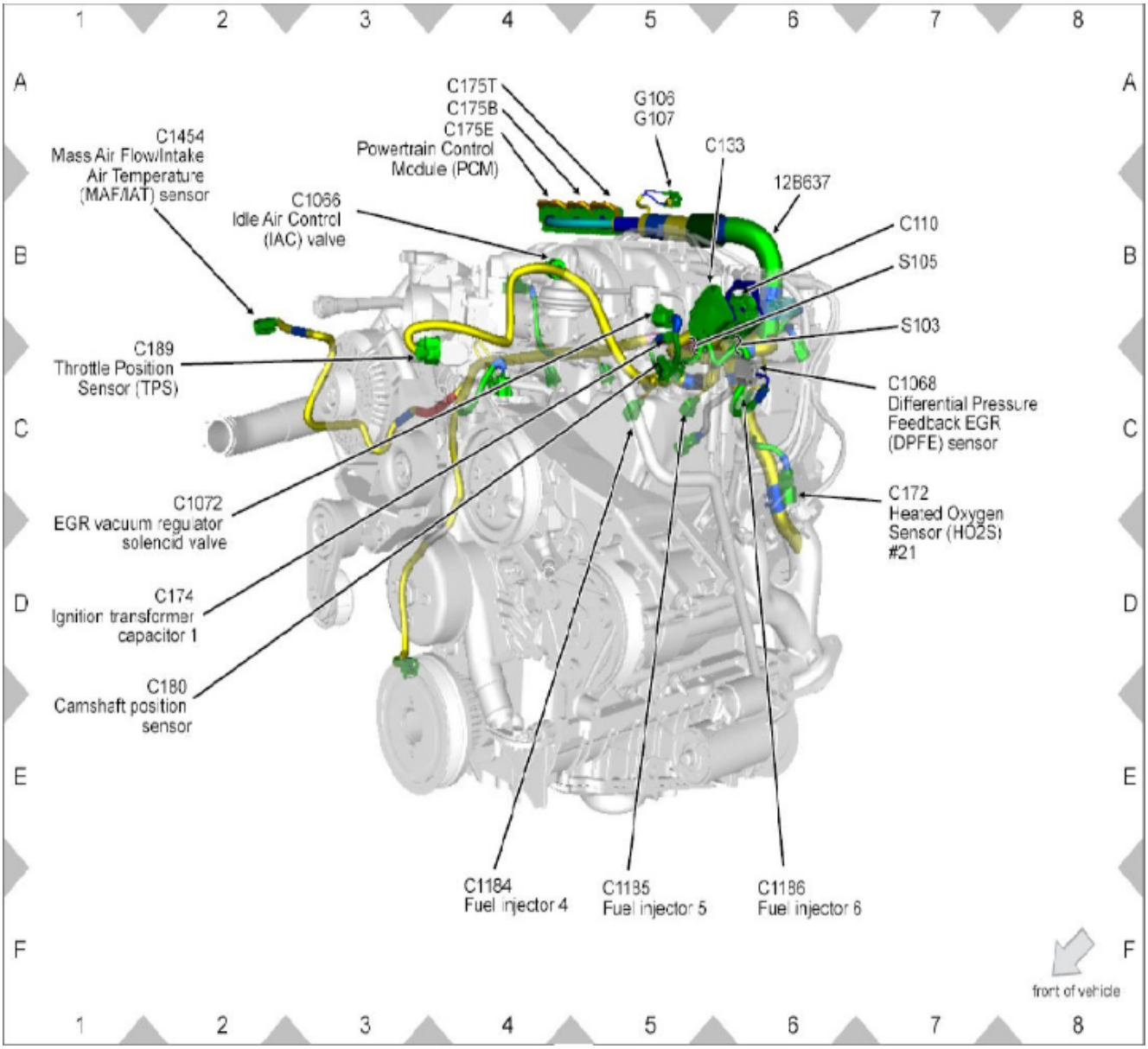


Air Flow Meter/Sensor: Locations

View 151-3


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
12B637
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT)
C133
C110
C1066
Idle Air Control (IAC) valve
C189
Throttle Position Sensor (TPS)
C1064
Engine Coolant Temperature (ECT) sensor
C1184
Fuel injector 4
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
S103
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-5


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
C133
12B637
C110
S105
S103
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor
C1066
Idle Air Control (IAC) valve
C189
Throttle Position Sensor (TPS)
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
C174
Ignition transformer capacitor 1
C180
Camshaft position sensor
C1184
Fuel injector 4
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

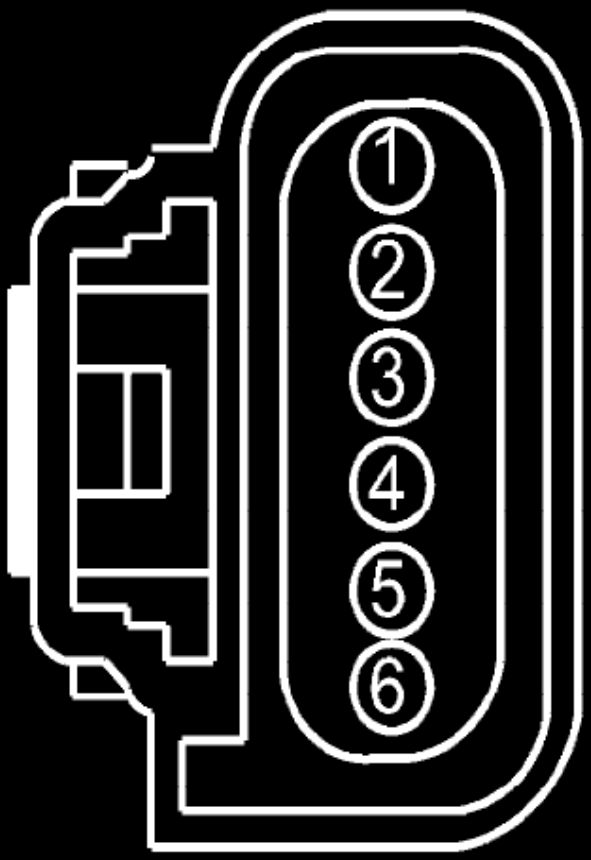
View 151-7

Connector: C1454

Description: MASS AIR FLOW/INTAKE AIR TEMPERATURE (MAF/IAT) SENSOR

Harness: 12B637

Base Part #:



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE740 (VT-GY)	20	SENSOR - INTAKE AIR TEMPERATURE (IAT)	
2	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	
3	VE807 (YE-VT)	20	SENSOR - MASS AIR FLOW LH BANK OR 1ST BANK OR UNIQUE (MAF)	
4	RE320 (BU)	20	CTRL MOD. - POWERTRAIN # MASS AIR FLOW SEN. LH BANK OR 1ST BANK (MAFRTN)	
5	GD108 (BK-VT)	20	GROUND - CHASSIS/BATTERY	
6	CBB43 (GY)	20	FUSE - 43 OR CIRCUIT BREAKER	

C1454

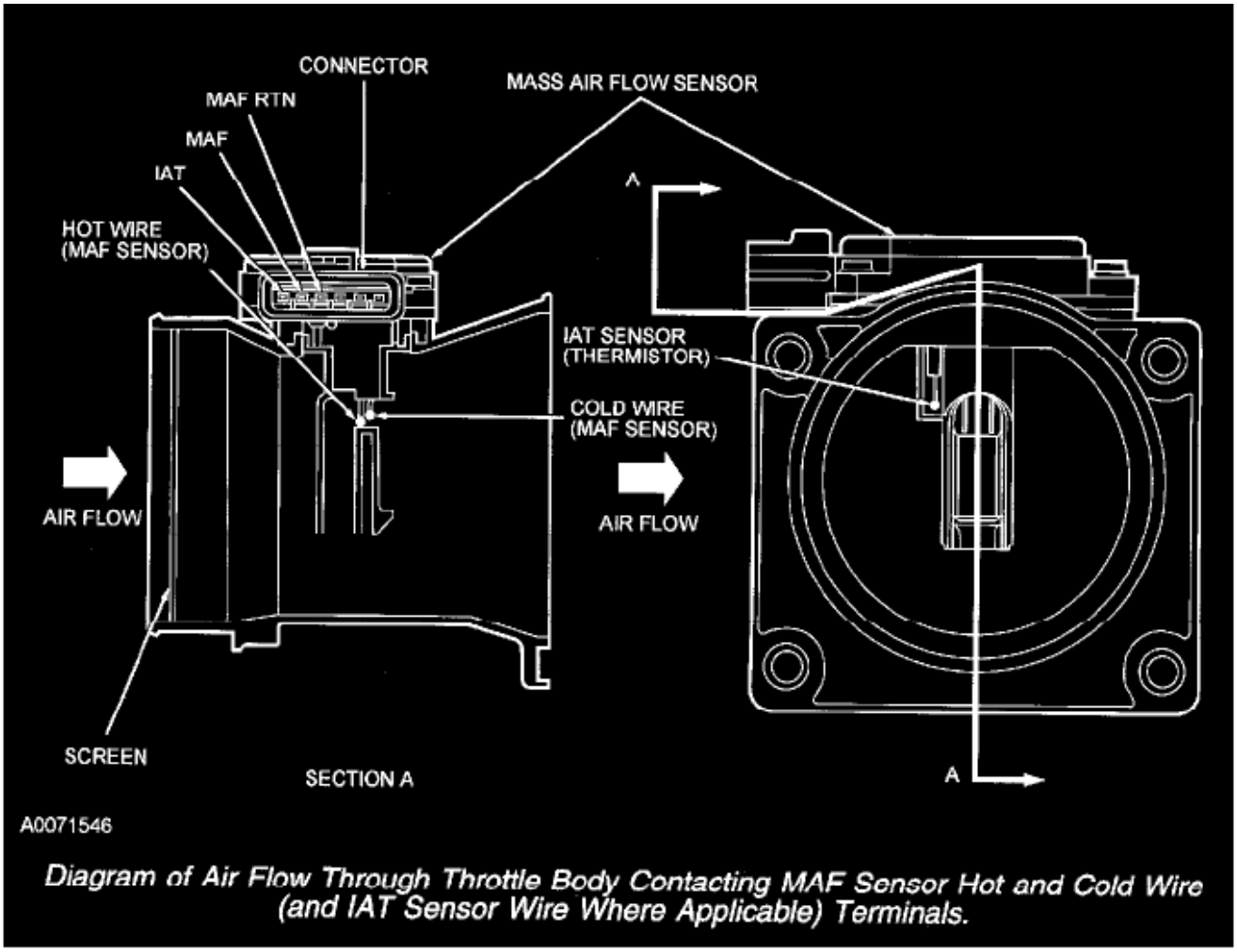
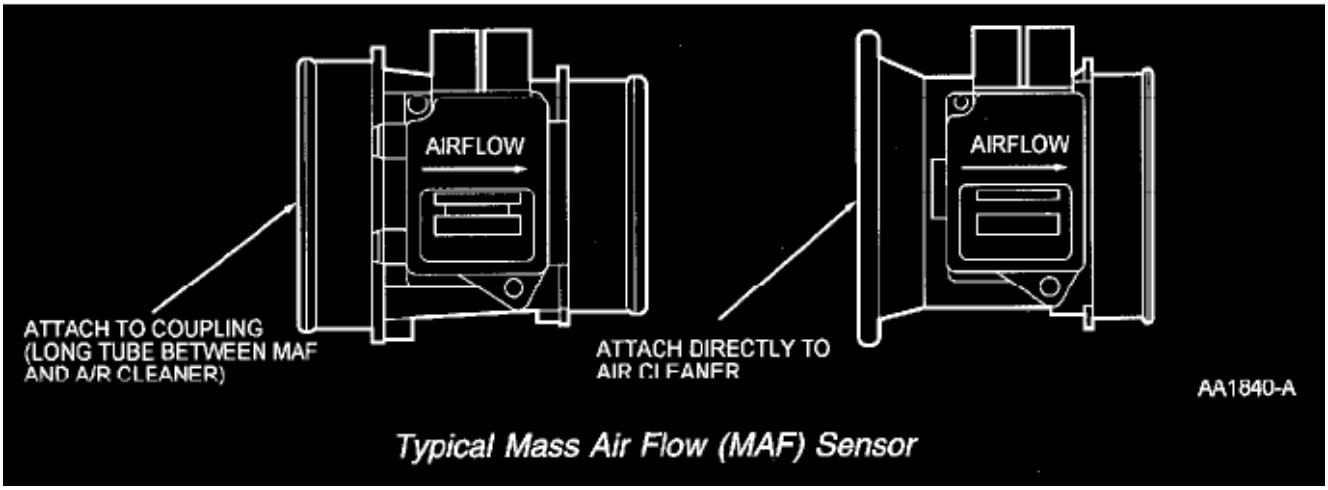


Diagram of Air Flow Through Throttle Body Contacting MAF Sensor Hot and Cold Wire (and IAT Sensor Wire Where Applicable) Terminals.



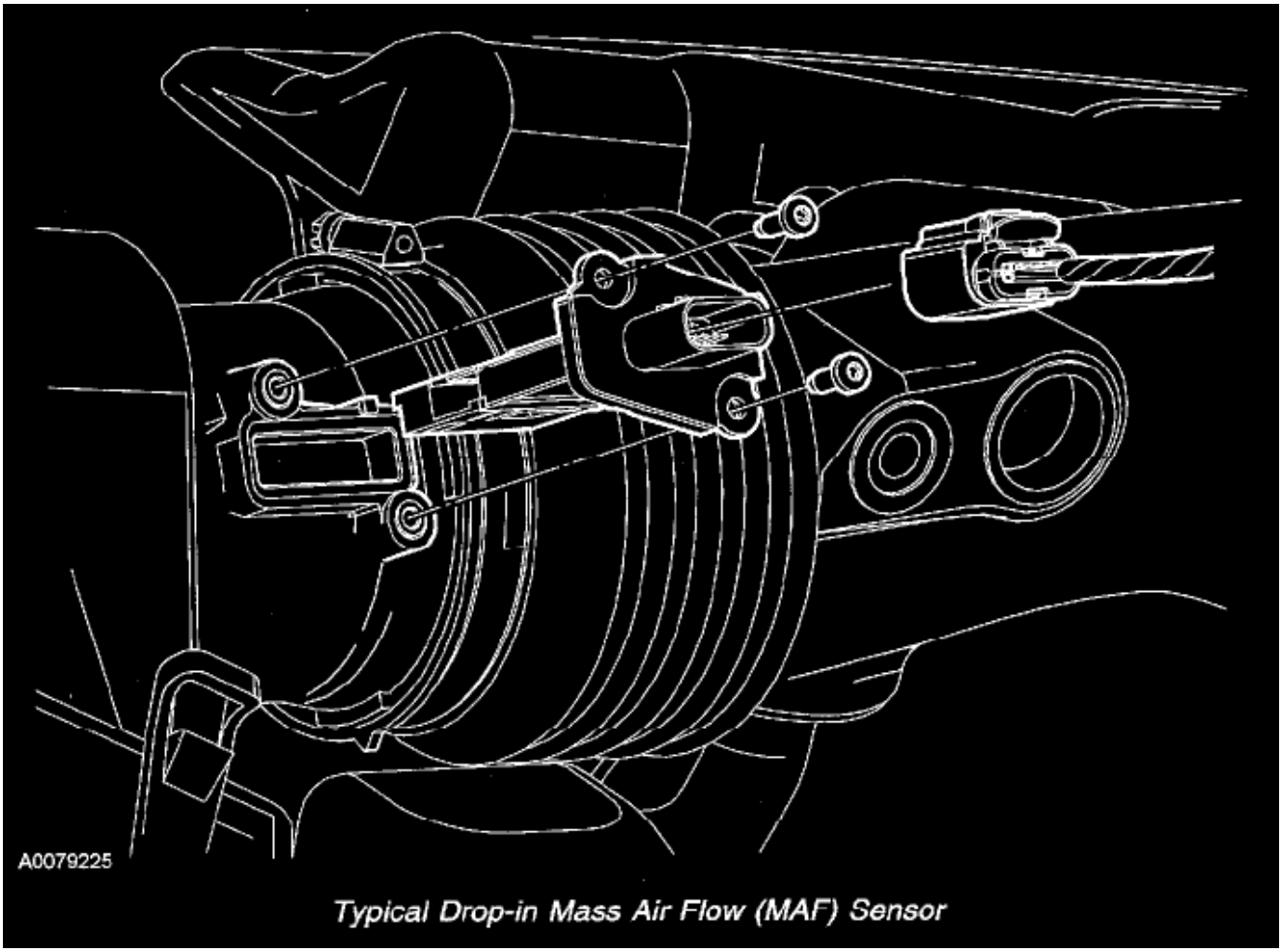
Typical Mass Air Flow (MAF) Sensor

Air Flow Meter/Sensor: Description and Operation

MASS AIR FLOW (MAF) SENSOR

Diagram Of Air Flow Through Throttle Body Contacting MAF Sensor Hot And Cold Wire (and IAT Sensor Wire Where Applicable) Terminals

Typical Mass Air Flow (MAF) Sensor

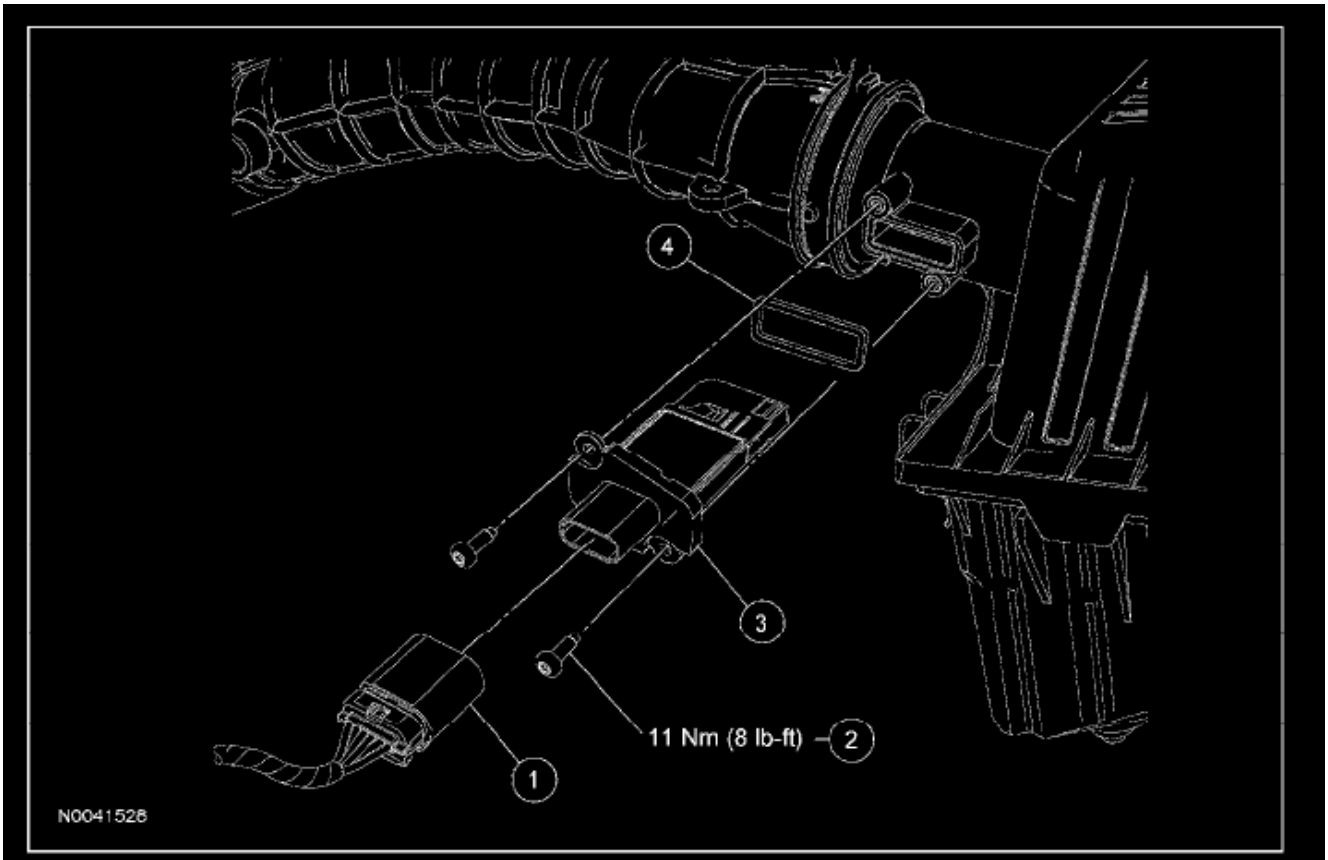


Typical Drop-in Mass Air Flow (MAF) Sensor

Typical Drop-in Mass Air Flow (MAF) Sensor

The MAF sensor uses a hot wire sensing element to measure the amount of air entering the engine. Air passing over the hot wire causes it to cool. This hot wire is maintained at 200°C (392°F) above the ambient temperature as measured by a constant cold wire. The current required to maintain the temperature of the hot wire is proportional to the mass air flow. The MAF sensor then outputs an analog voltage signal to the PCM proportional to the intake air mass. The PCM calculates the required fuel injector pulse width in order to provide the desired air/fuel ratio. This input is also used in determining transmission electronic pressure control (EPC), shift and torque converter clutch scheduling.

The MAF sensor is located between the air cleaner and the throttle body or inside the air cleaner assembly. Most MAF sensors have integrated bypass technology with an integrated intake air temperature (IAT) sensor. The hot wire electronic sensing element must be replaced as an assembly. Replacing only the element may change the air flow calibration.



Item	Part Number	Description
1	14A464	Mass air flow (MAF) sensor electrical connector (part of 12B637)
2	W709287	MAF sensor bolt (2 required)
3	12B605	MAF sensor
4	—	MAF sensor gasket

Air Flow Meter/Sensor: Service and Repair

MASS AIR FLOW (MAF) SENSOR

Removal and Installation

1. Disconnect the mass air flow (MAF) sensor electrical connector. 2. Remove the 2 bolts, the MAF sensor and discard the gasket.

- To install, tighten to 11 Nm (8 lb-ft).

3. CAUTION: Do not tamper with the mass air flow (MAF) sensing elements located in the airflow bypass. Tampering may result in

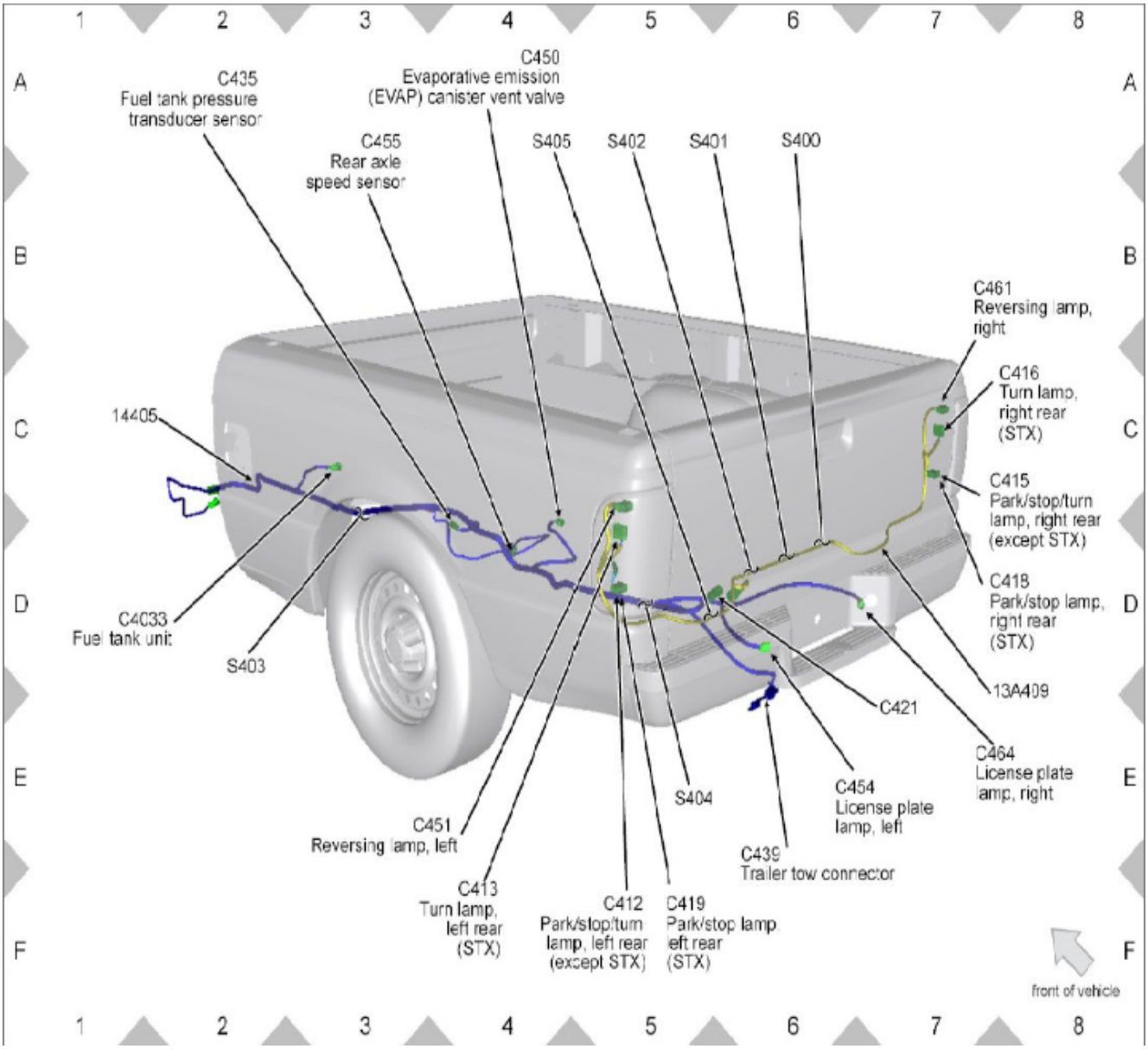
failure.

NOTE: The MAF sensor module and body are calibrated and installed as a unit.

To install, reverse the removal procedure. -

Install a new gasket.

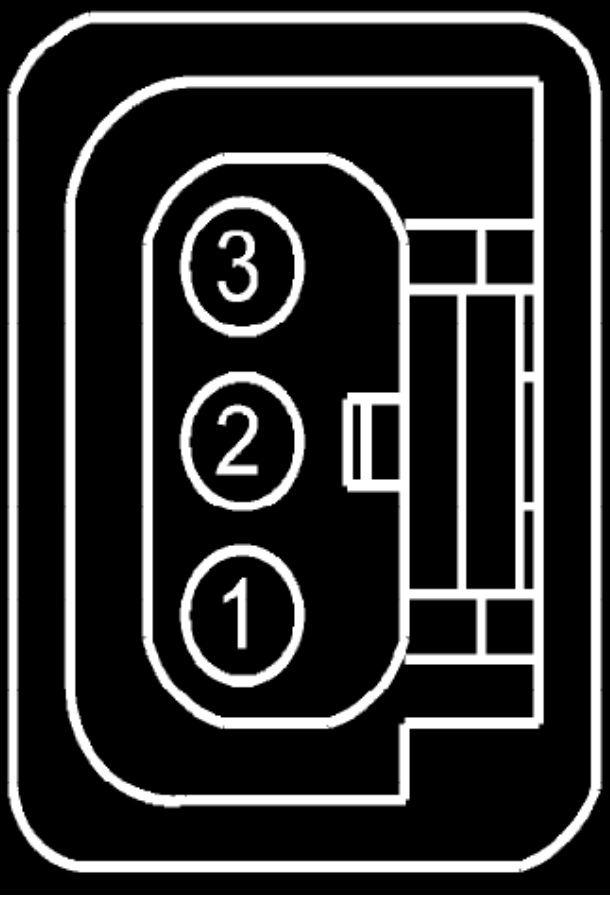
Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Sensors and Switches > Sensors and Switches - Powertrain Management > Sensors and Switches - Fuel Delivery and Air Induction > Fuel Pressure Sensor/Switch > Component Information > Locations



View 151-27

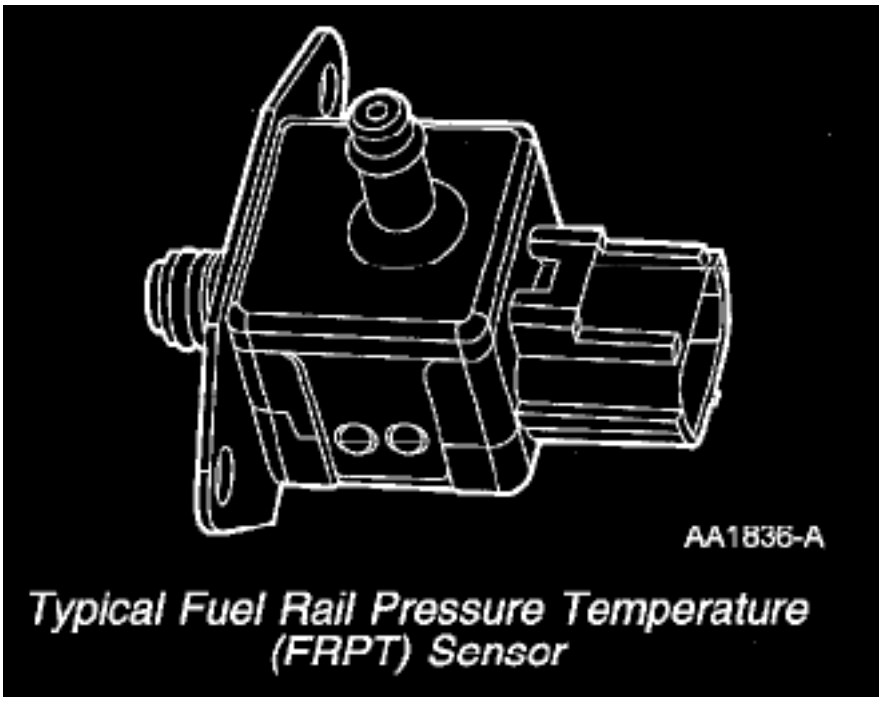
Connector: C435

Description:	Harness:	Base Part #:
FUEL TANK PRESSURE TRANSDUCER SENSOR	14405	9C968



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	LE424 (YE-GN)	20	CTRL MOD. - POWERTRAIN # VOLTAGE REFERENCE COWL (C-VREV)	
2	RE407 (YE-VT)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN COWL (C-SIGRTN) (SIGRTN-C)	
3	VE922 (VT-GN)	20	TRANSDUCER - FUEL TANK PRESSURE (FTPT)	

C435



Typical Fuel Rail Pressure Temperature (FRPT) Sensor

Fuel Pressure Sensor/Switch: Description and Operation

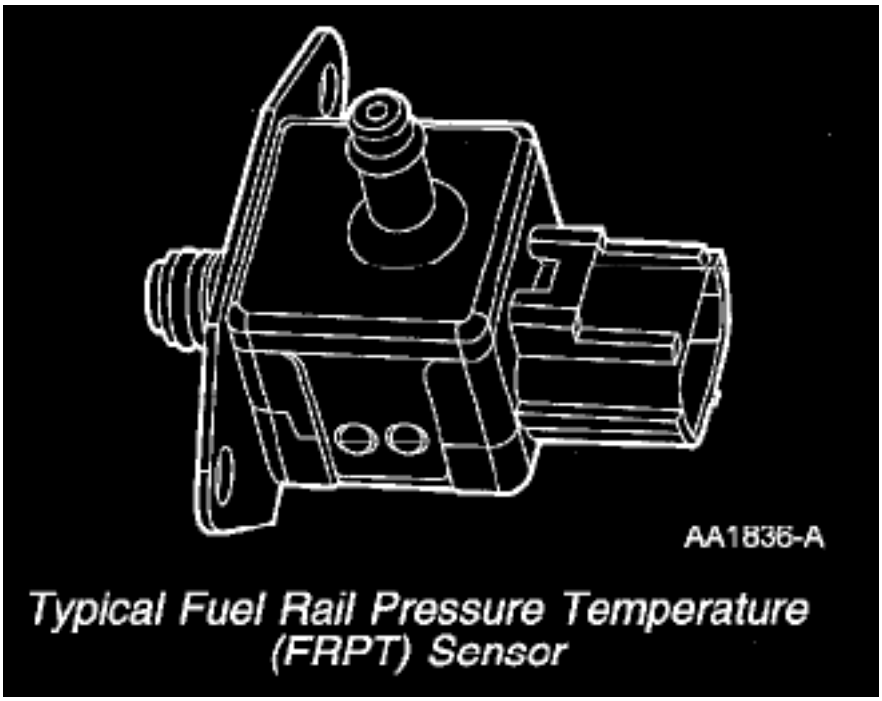
FUEL RAIL PRESSURE TEMPERATURE (FRPT) SENSOR

Typical Fuel Rail Pressure Temperature (FRPT) Sensor

The FRPT sensor measures the pressure and temperature of the fuel in the fuel rail and sends these signals to the PCM. The sensor uses the intake manifold vacuum as a reference to determine the pressure difference between the fuel rail and the intake manifold. The relationship between fuel pressure and fuel temperature is used to determine the possible presence of fuel vapor in the fuel rail.

The temperature sensing portion of the FRPT sensor is a thermistor device in which resistance changes with temperature. The electrical resistance of the thermistor decreases as the temperature increases, and the resistance increases as the temperature decreases. The varying resistance changes the voltage drop across the sensor terminals and provides electrical signals to the PCM corresponding to temperature.

Both the pressure and temperature signals are used to control the speed of the fuel pump. The speed of the fuel pump sustains fuel rail pressure which preserves fuel in its liquid state. The dynamic range of the fuel injectors increase because of the higher rail pressure, which allows the injector pulse width to decrease.



Typical Fuel Rail Pressure Temperature (FRPT) Sensor

Fuel Temperature Sensor: Description and Operation

FUEL RAIL PRESSURE TEMPERATURE (FRPT) SENSOR

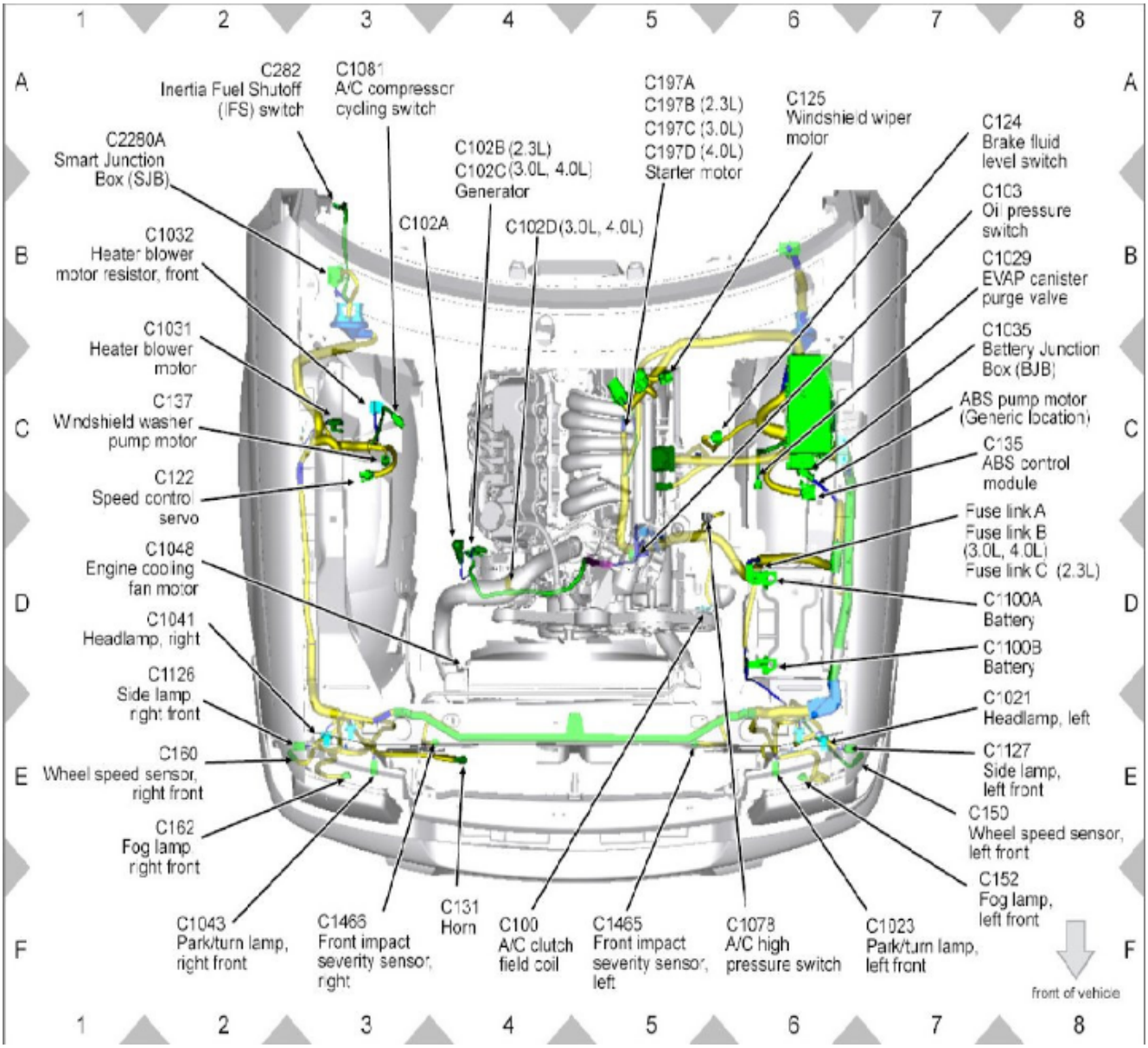
Typical Fuel Rail Pressure Temperature (FRPT) Sensor

The FRPT sensor measures the pressure and temperature of the fuel in the fuel rail and sends these signals to the PCM. The sensor uses the intake manifold vacuum as a reference to determine the pressure difference between the fuel rail and the intake manifold. The relationship between fuel pressure and fuel temperature is used to determine the possible presence of fuel vapor in the fuel rail.

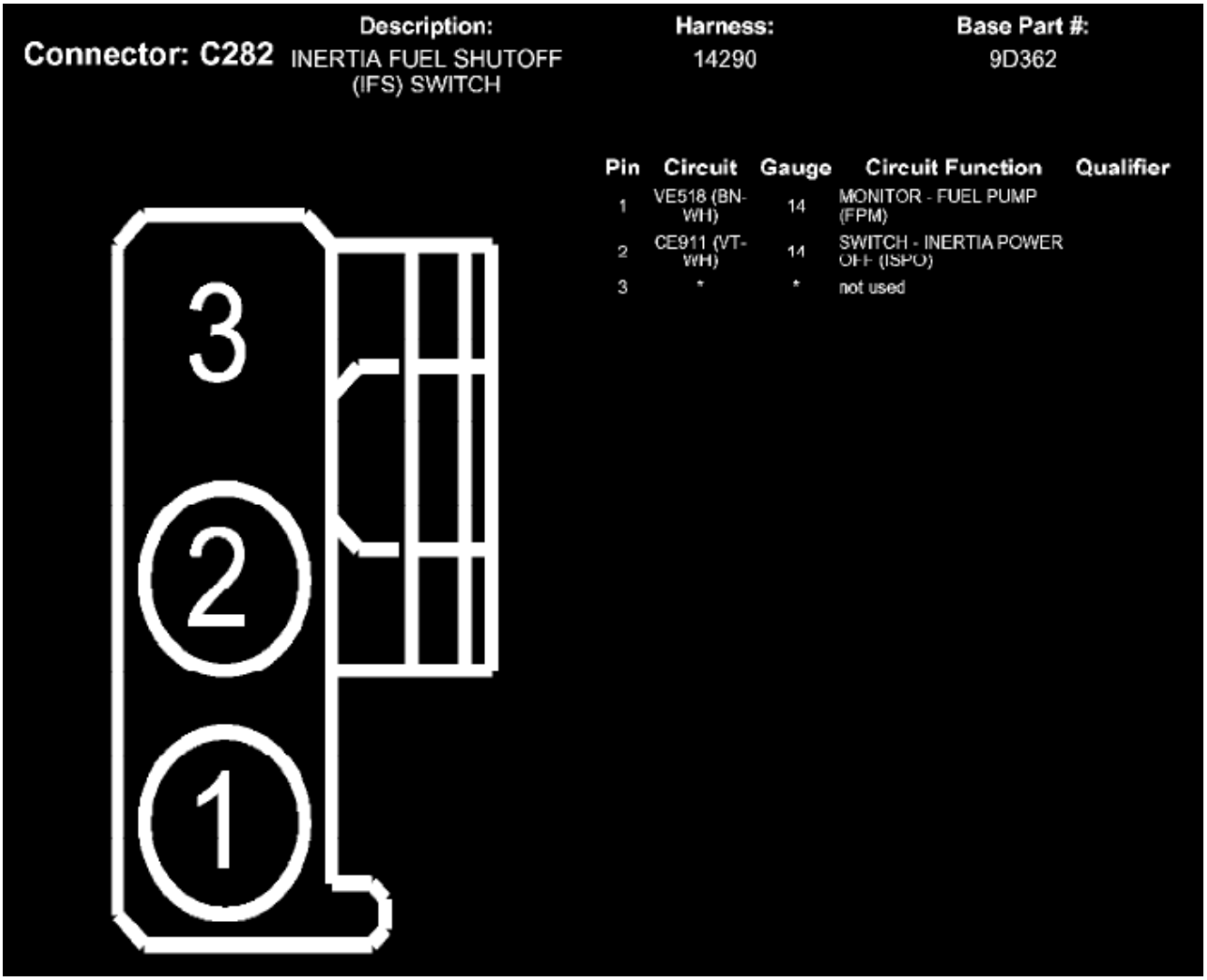
The temperature sensing portion of the FRPT sensor is a thermistor device in which resistance changes with temperature. The electrical resistance of the thermistor decreases as the temperature increases, and the resistance increases as the temperature decreases. The varying resistance changes the voltage drop across the sensor terminals and provides electrical signals to the PCM corresponding to temperature.

Both the pressure and temperature signals are used to control the speed of the fuel pump. The speed of the fuel pump sustains fuel rail pressure which preserves fuel in its liquid state. The dynamic range of the fuel injectors increase because of the higher rail pressure, which allows the injector pulse width to decrease.

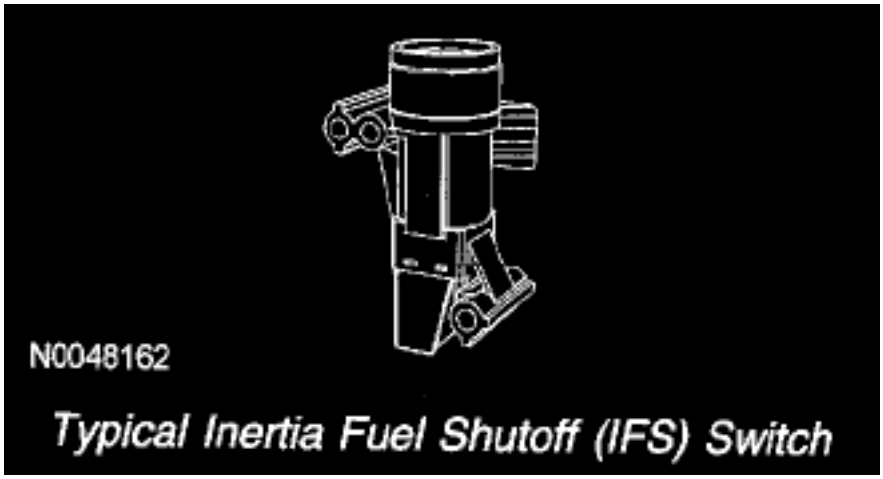
Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Sensors and Switches > Sensors and Switches - Powertrain Management > Sensors and Switches - Fuel Delivery and Air Induction > Inertia Fuel Shutoff Switch > Component Information > Locations



View 151-1


Connector: C282
Description:
INERTIA FUEL SHUTOFF (IFS) SWITCH
Harness:
14290
Base Part #:
9D362
Pin
Circuit
Gauge
Circuit Function
Qualifier
1
VE518 (BN-WH)
14
MONITOR - FUEL PUMP (FPM)
2
CE911 (VT-WH)
14
SWITCH - INERTIA POWER OFF (ISPO)
3
*
*
not used
3
2
1

C282

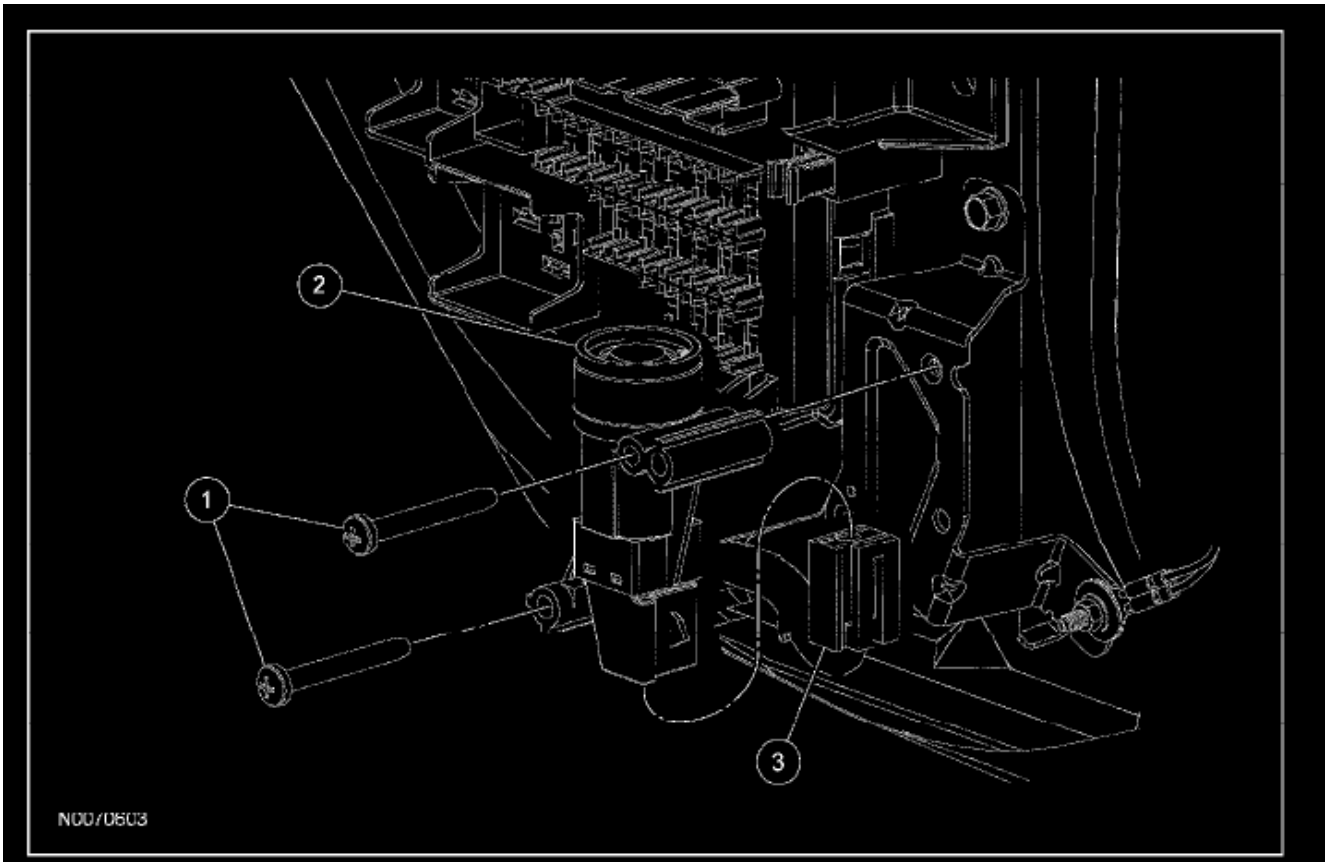


Inertia Fuel Shutoff Switch: Description and Operation

INERTIA FUEL SHUTOFF (IFS) SWITCH

Typical Inertia Fuel Shutoff (IFS) Switch

The IFS switch is used in conjunction with the electric fuel pump. The purpose of the IFS switch is to shutoff the fuel pump if a collision occurs. It consists of a steel ball held in place by a magnet. When a sharp impact occurs, the ball breaks loose from the magnet, rolls up a conical ramp and strikes a target plate which opens the electrical contacts of the switch and shuts off the electric fuel pump. Once the switch is open, it must be manually reset before restarting the vehicle. Refer to the Owner's Literature, Roadside Emergencies for the location of the IFS switch.



Item	Part Number	Description
1	W504467	Inertia fuel shutoff (IFS) switch screws
2	9341	IFS switch
3	—	IFS switch electrical connector (part of 180101)

Inertia Fuel Shutoff Switch: Service and Repair

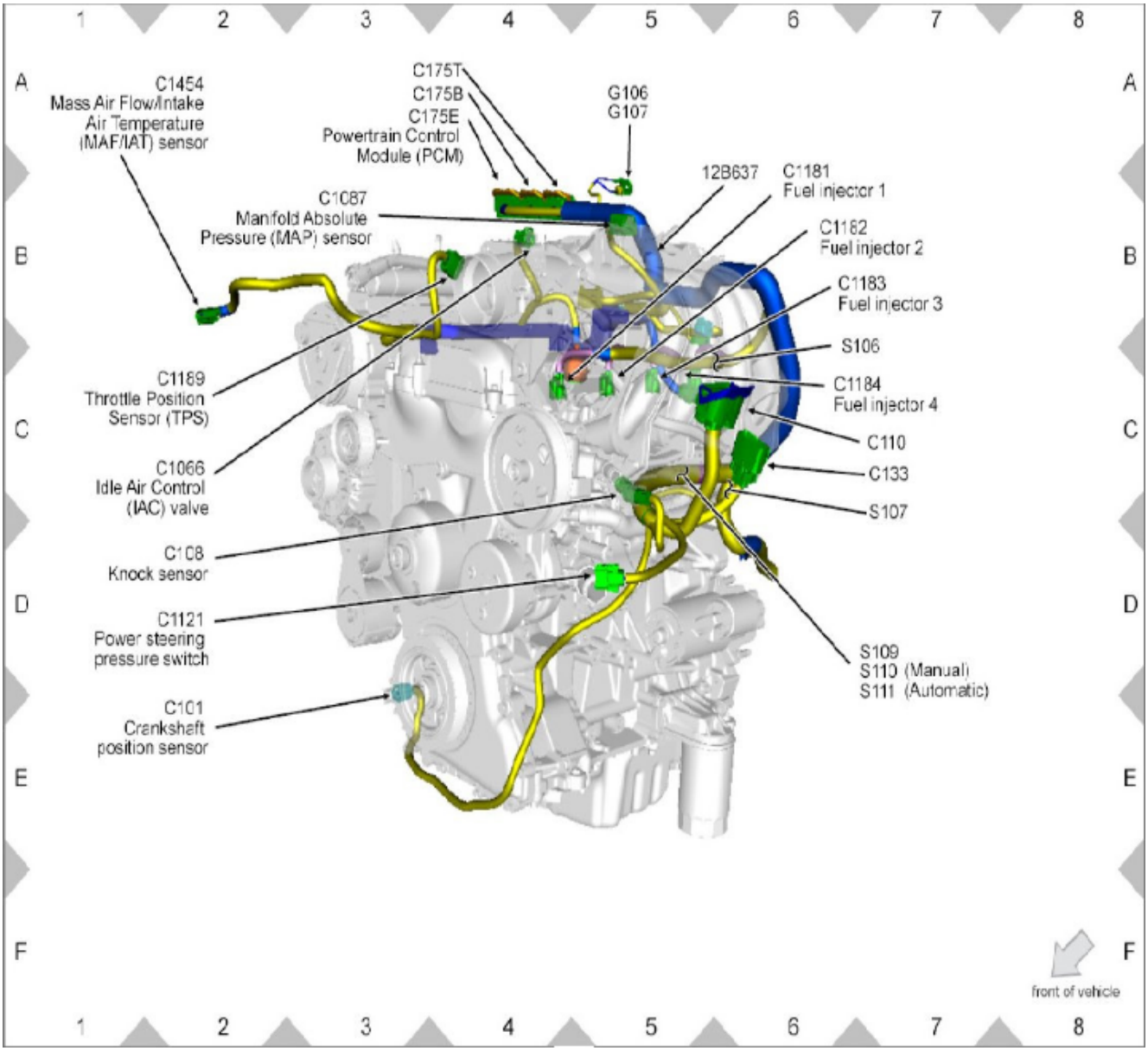
INERTIA FUEL SHUTOFF (IFS) SWITCH

Removal and Installation

1. NOTE: The inertia fuel shutoff (IFS) switch is located behind the RH cowl panel.

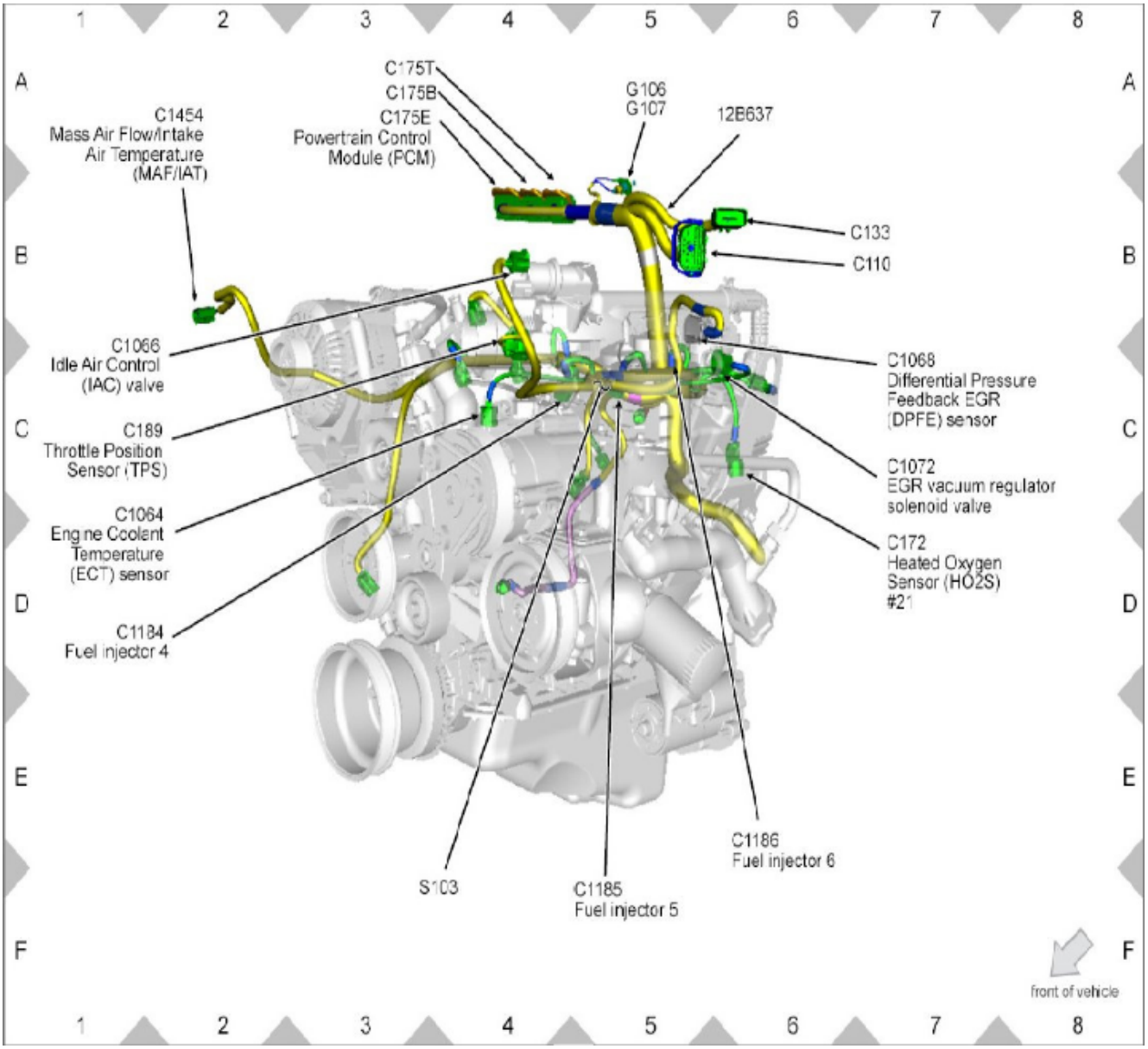
Remove the RH scuff plate and cowl panel.

2. Remove the screws and the IFS switch. 3. Disconnect the IFS switch electrical connector. 4. To install, reverse the removal procedure.

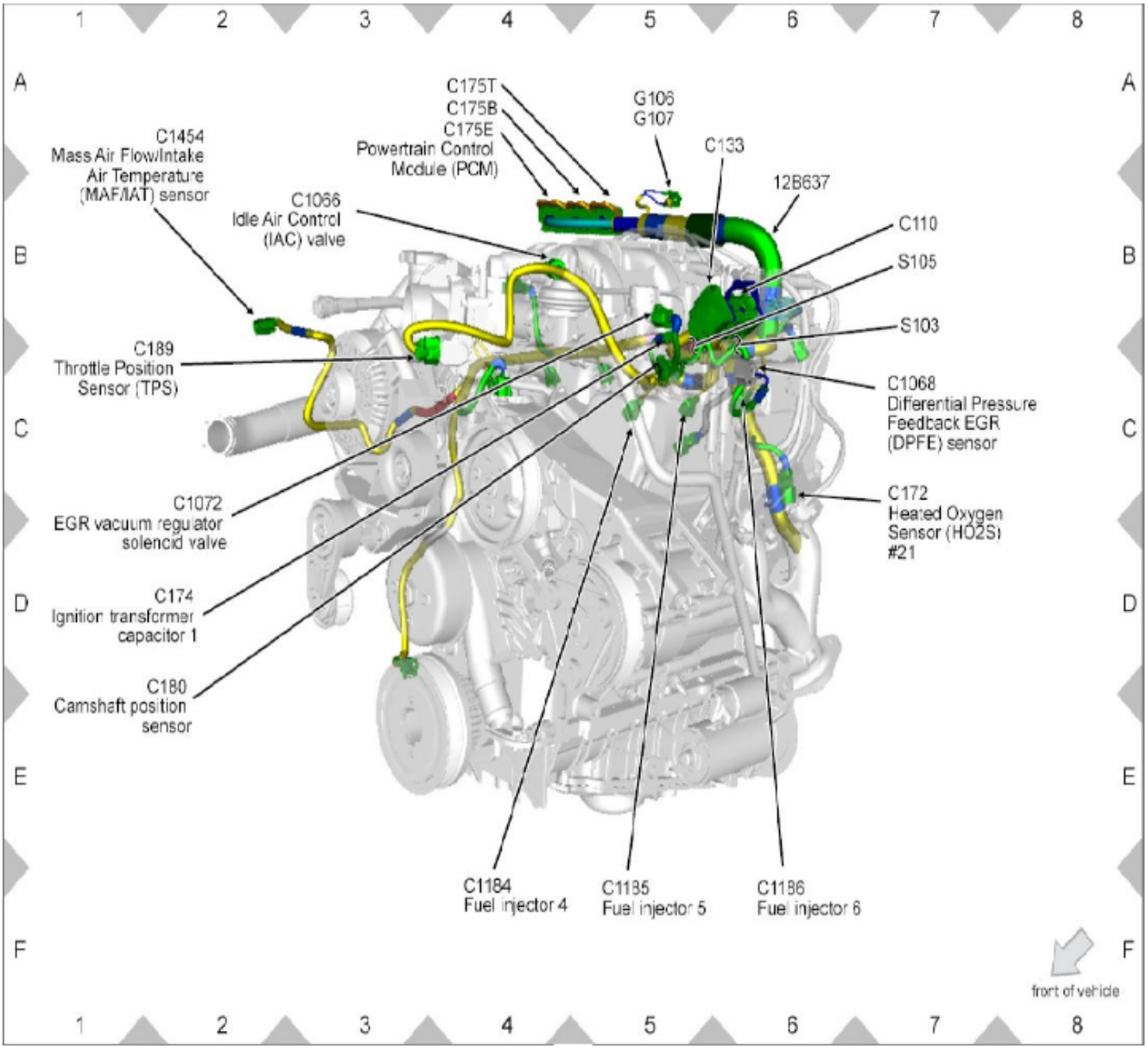


Throttle Position Sensor: Locations

View 151-3


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
12B637
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT)
C133
C110
C1066
Idle Air Control (IAC) valve
C189
Throttle Position Sensor (TPS)
C1064
Engine Coolant Temperature (ECT) sensor
C1184
Fuel injector 4
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
S103
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

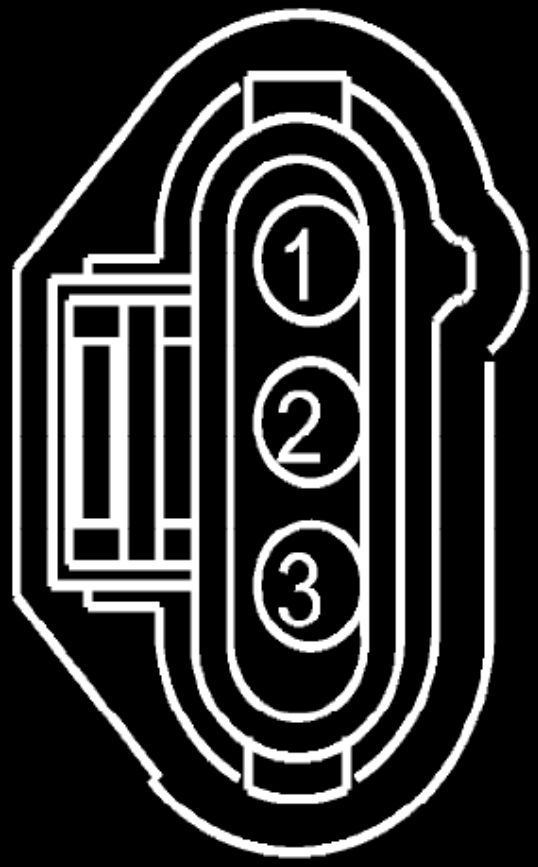
View 151-5


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
C133
12B637
C110
S105
S103
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor
C1066
Idle Air Control (IAC) valve
C189
Throttle Position Sensor (TPS)
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
C174
Ignition transformer capacitor 1
C180
Camshaft position sensor
C1184
Fuel injector 4
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-7

Connector: C189

Description:	Harness:	Base Part #:
THROTTLE POSITION SENSOR (TPS)	12B637	9B989



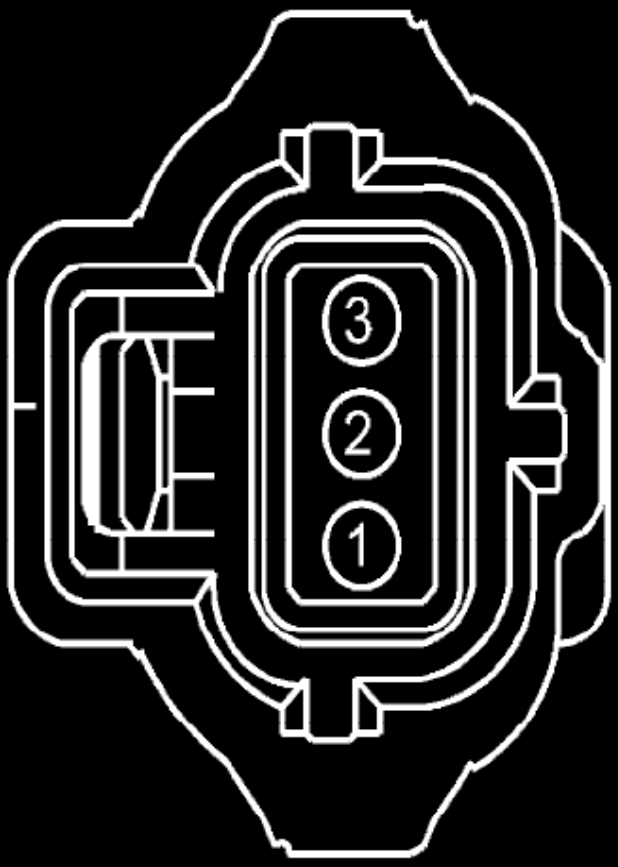
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	LE423 (GN-VT)	20	CTRL MOD. - POWERTRAIN # VOLTAGE REFERENCE ENGINE (VREF) (E-VREV)	3.0L, 4.0L
2	VE819 (GN-VT)	20	SENSOR - THROTTLE POSITION # POSITIVE SLOPE (TP2-PS)	3.0L, 4.0L
3	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	3.0L, 4.0L

Throttle Position Sensor: Diagrams

C189

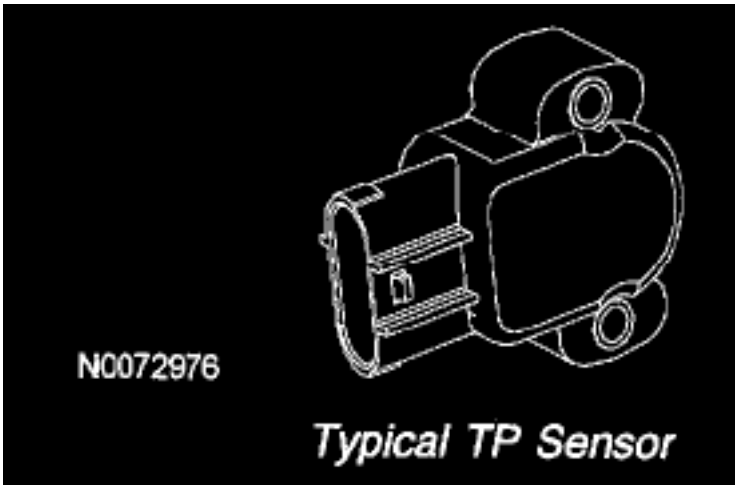
Connector: C1189

Description:	Harness:	Base Part #:
THROTTLE POSITION SENSOR (TPS)	12B637	9B989



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	2.3L
2	VE819 (GN-VT)	20	SENSOR - THROTTLE POSITION # POSITIVE SLOPE (TP2-PS)	2.3L
3	LE423 (GN-VT)	20	CTRL MOD. - POWERTRAIN # VOLTAGE REFERENCE ENGINE (VREF) (E-VREV)	2.3L

C1189



Throttle Position Sensor: Description and Operation

Electronic Throttle Body (ETB) Throttle Position Sensor

The ETB throttle position sensor has 2 signal circuits in the sensor for redundancy. The redundant ETB throttle position signals are required for increased monitoring. The first ETB throttle position sensor signal (TP1) has a negative slope (increasing angle, decreasing voltage) and the second signal (TP2) has a positive slope (increasing angle, increasing voltage). The 2 ETB throttle position sensor signals make sure the PCM receives a correct input even if 1 signal has a concern. There is 1 reference voltage circuit and 1 signal return circuit for the sensor. The reference voltage circuit and the signal return circuit is shared with the reference voltage circuits and signal return circuits used by the APP sensor.

Throttle Position (TP) Sensor

Typical TP Sensor

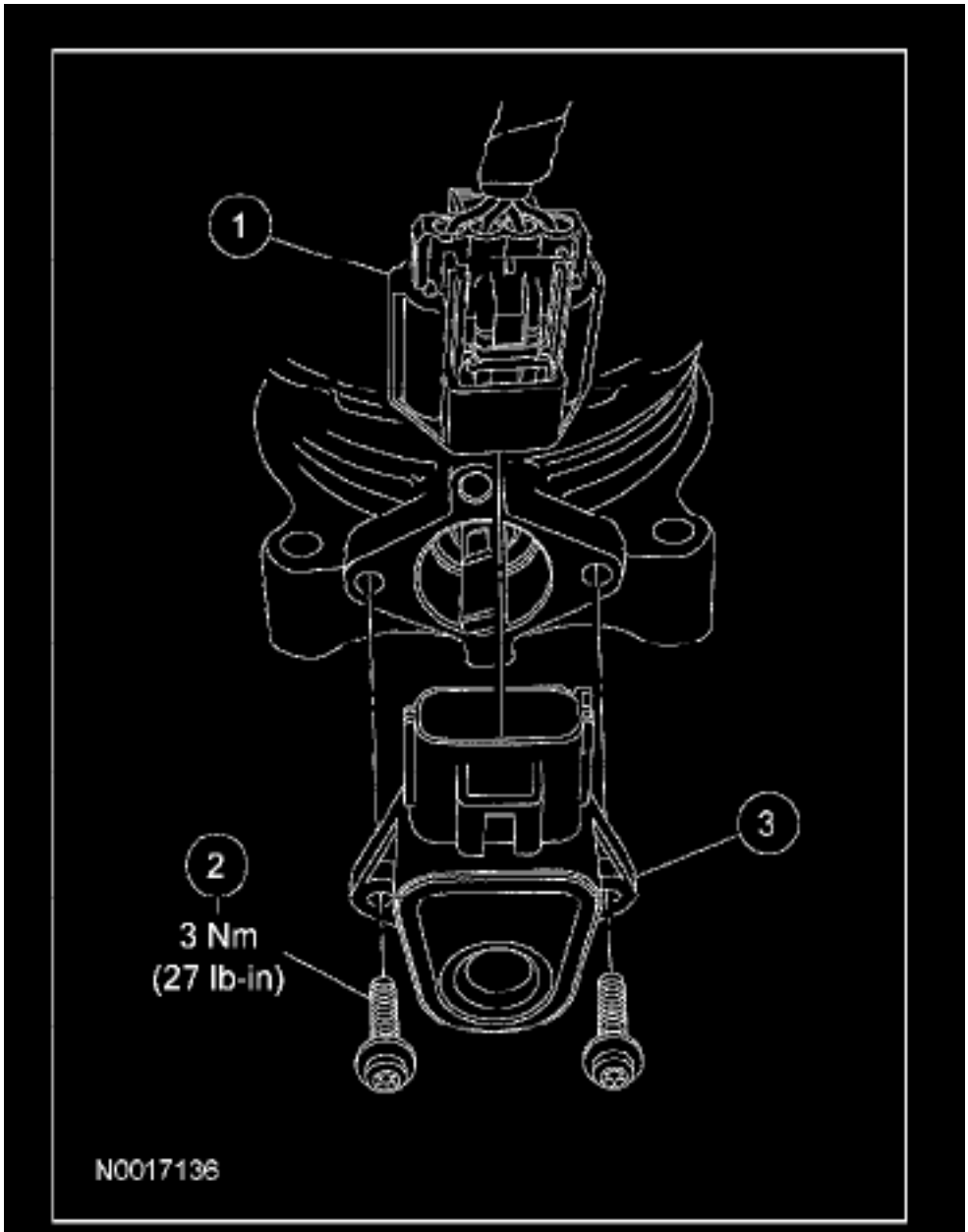
The TP sensor is a rotary potentiometer sensor that provides a signal to the PCM that is linearly proportional to the throttle plate/shaft position. The sensor housing has a 3-blade electrical connector that may be gold plated. The gold plating increases the corrosion resistance on the terminals and increases the connector durability. The TP sensor is mounted on the throttle body. As the TP sensor is rotated by the throttle shaft, 4 operating conditions are determined by the PCM from the TP. The operating conditions are: -

closed throttle (includes idle or deceleration)

- part throttle (includes cruise or moderate acceleration)

- wide open throttle (includes maximum acceleration or de-choke on crank)

- throttle angle rate



Item	Part Number	Description
1	14A464	Throttle position (TP) sensor electrical connector (part of 12B637)
2	W707535	TP sensor screw (2 required)
3	9E928	TP sensor

Throttle Position Sensor: Service and Repair

THROTTLE POSITION (TP) SENSOR

Removal and Installation

1. Disconnect the throttle position (TP) sensor electrical connector.

2. CAUTION: Failure to remove the throttle position (TP) sensor screws in the following manner will result in damage to the screws. First,

loosen the screws 1 to 2 full turns using a hand tool, and then use a suitable high-speed driver to complete the removal.

Remove and discard the 2 bolts and the TP sensor. -

To install, tighten to 3 Nm (27 lb-in).

3. CAUTION: Do not use a high-speed driver to install the new screws or damage to the throttle position (TP) sensor may occur.

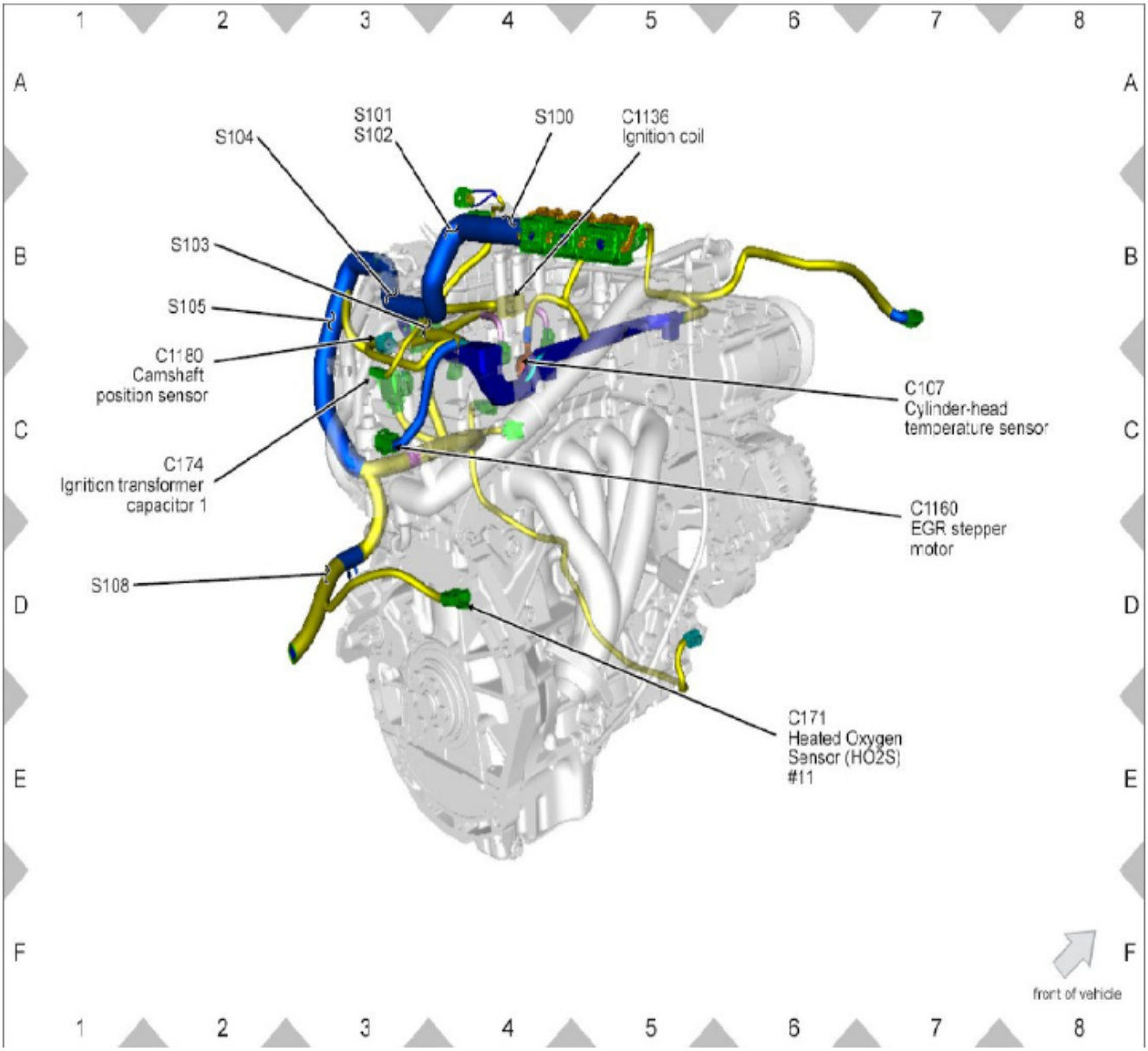
NOTE: -

Do not reuse the TP sensor and screws. A new TP sensor and screws must be installed.

- Failure to install the TP sensor in this manner may result in excessive idle speeds. Slide the rotary tangs into position over the throttle shaft blade, then rotate the TP sensor.

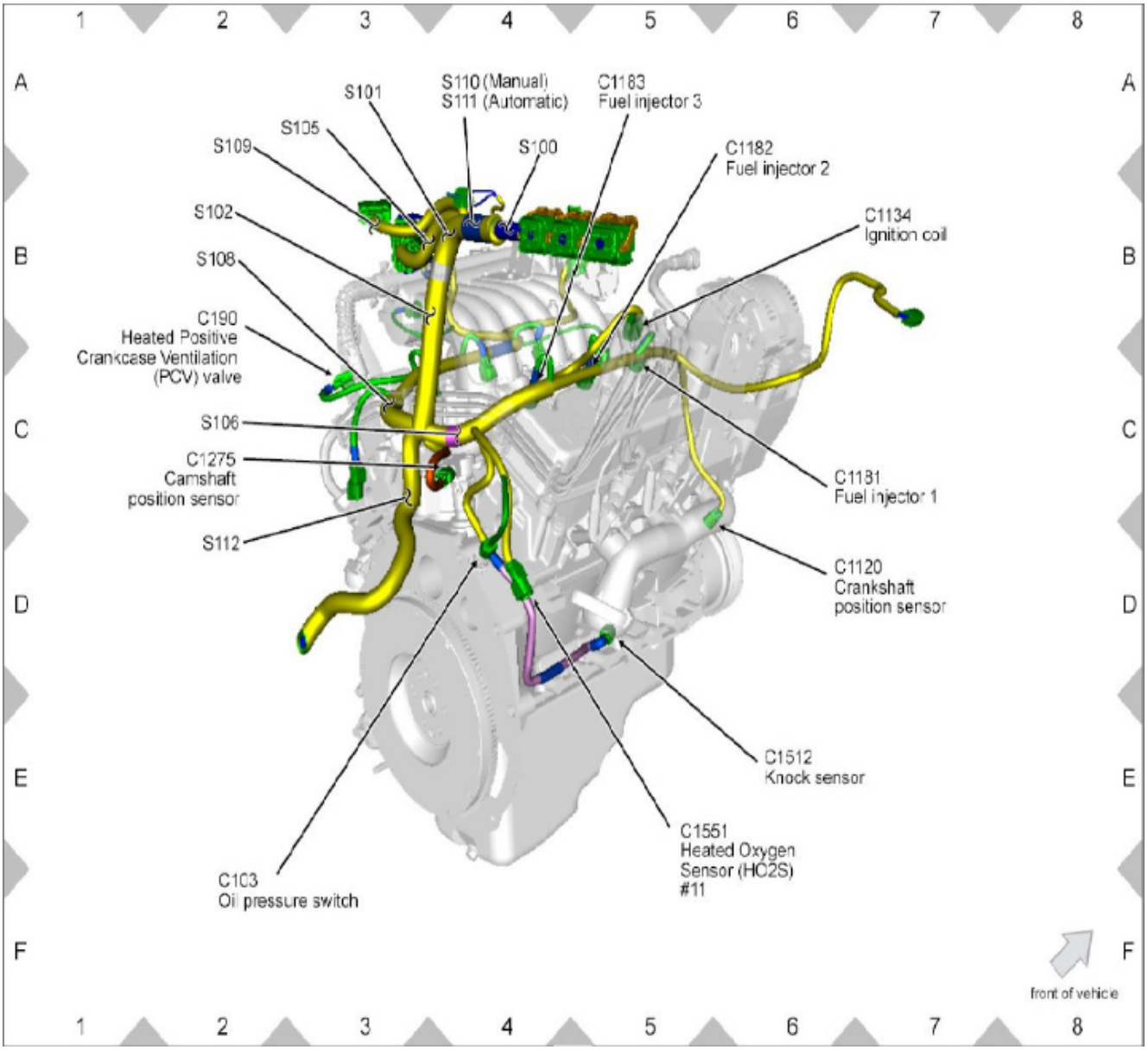
To install, reverse the removal procedure. -

Install a new TP sensor and screws.

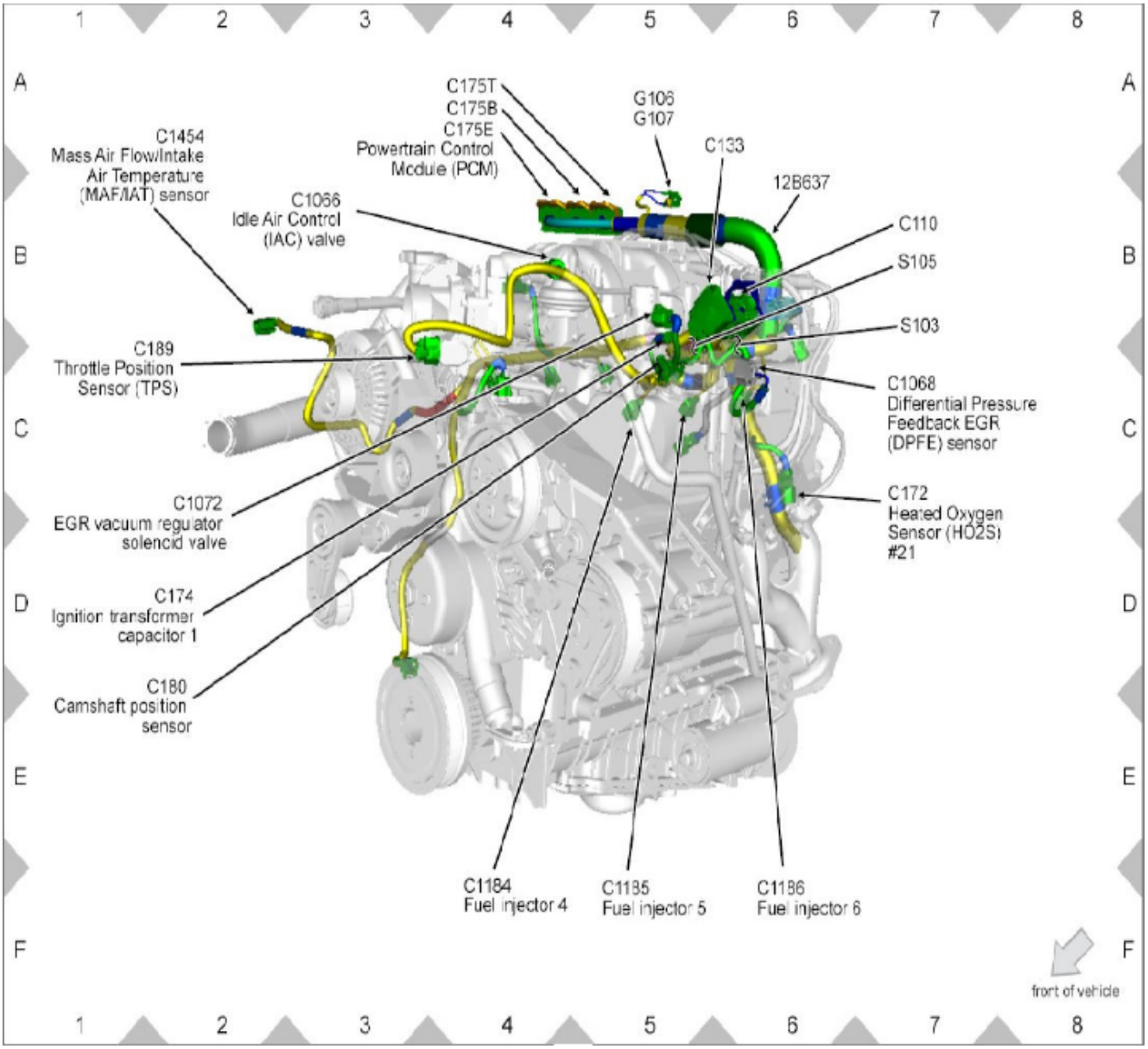


Camshaft Position Sensor: Locations

View 151-4


S101
S110 (Manual)
S111 (Automatic)
C1183
Fuel injector 3
S105
S109
S100
C1182
Fuel injector 2
S102
C1134
Ignition coil
S108
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
C1275
Camshaft
position sensor
S112
C1181
Fuel injector 1
C1120
Crankshaft
position sensor
C1512
Knock sensor
C1551
Heated Oxygen
Sensor (HO2S)
#11
C103
Oil pressure switch
front of vehicle

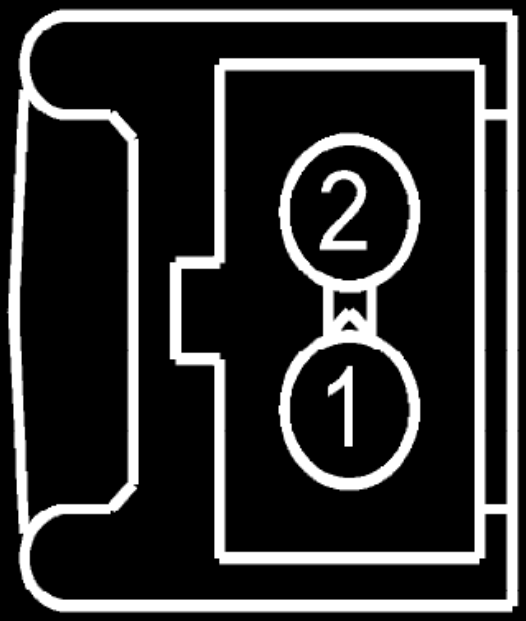
View 151-6


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
C133
12B637
C110
S105
S103
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor
C1066
Idle Air Control (IAC) valve
C189
Throttle Position Sensor (TPS)
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
C174
Ignition transformer capacitor 1
C180
Camshaft position sensor
C1184
Fuel injector 4
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-7

Connector: C180

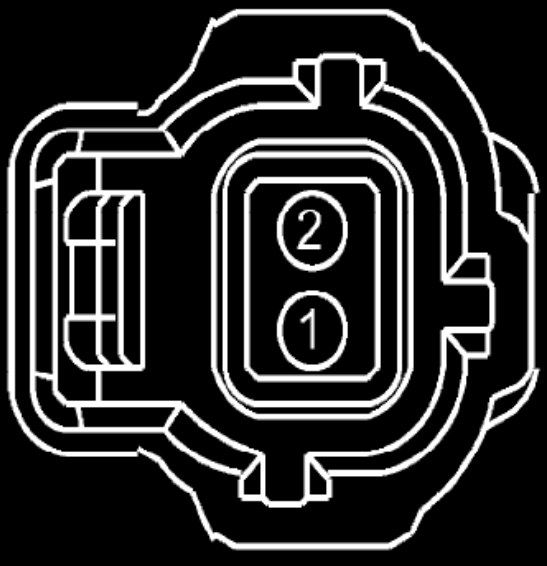
Description:	Harness:	Base Part #:
CAMSHAFT POSITION SENSOR	12B637	6B288



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE706 (BN-BU)	18	SENSOR - CAMSHAFT POSITION BANK 1 IN+EX/IN (CMP1) [CID-H] (CID1)	4.0L
2	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	4.0L

Connector: C1180

Description:	Harness:	Base Part #:
CAMSHAFT POSITION SENSOR	12B637	6B288



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	2.3L
2	VE706 (BN-BU)	18	SENSOR - CAMSHAFT POSITION BANK 1 IN+EX/ IN (CMP1) [CID-H] (CID1)	2.3L

Camshaft Position Sensor: Diagrams

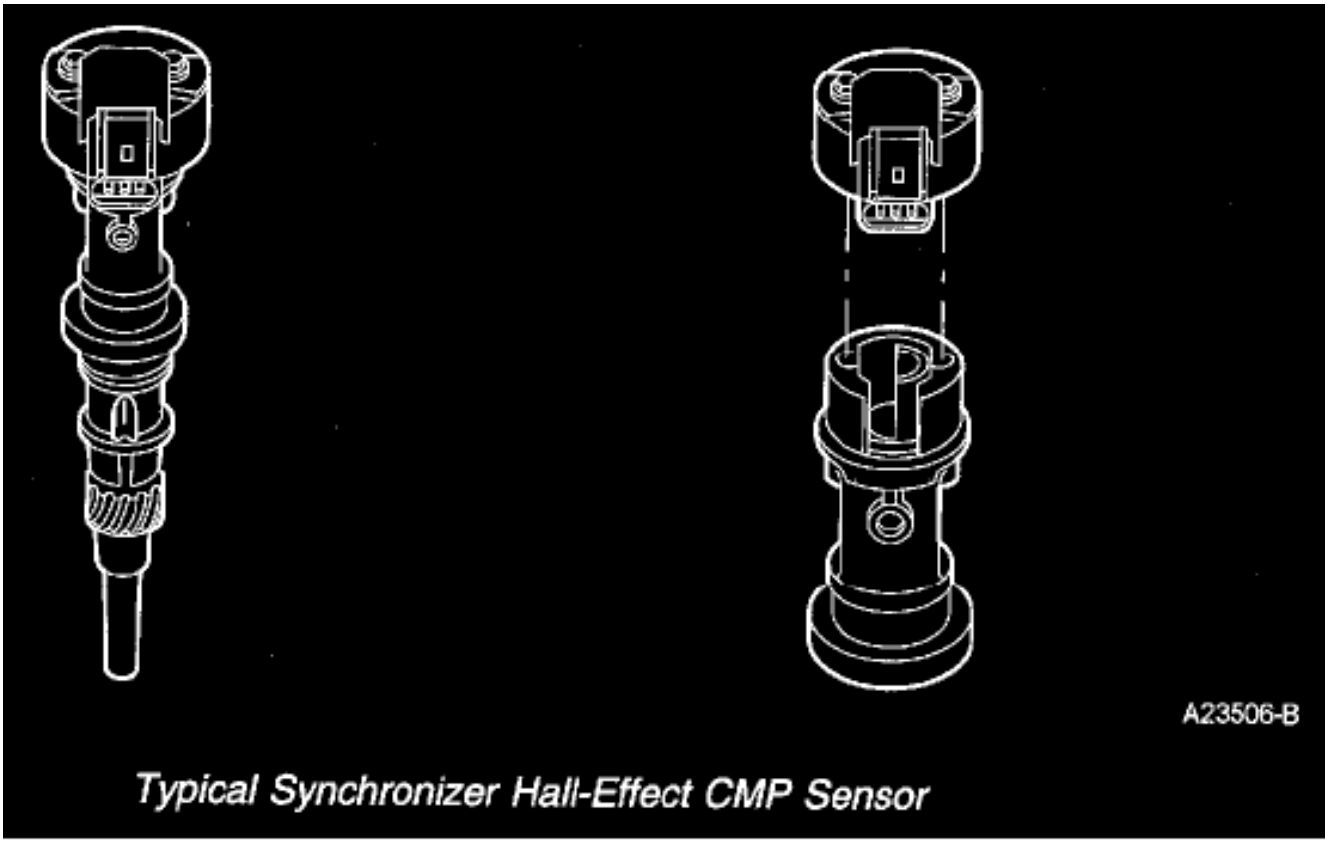
C180

C1180

Connector: C1275	Description:	Harness:	Base Part #:
	CAMSHAFT POSITION SENSOR	12B637	6B288

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	3.0L
2	VE706 (BN-BU)	18	SENSOR - CAMSHAFT POSITION BANK 1 IN+EX/ IN (CMP1) [CID-H] (CID1)	3.0L

C1275



Typical Synchronizer Hall-Effect CMP Sensor

Typical Variable Reluctance CMP Sensor

Camshaft Position Sensor: Description and Operation

CAMSHAFT POSITION (CMP) SENSOR

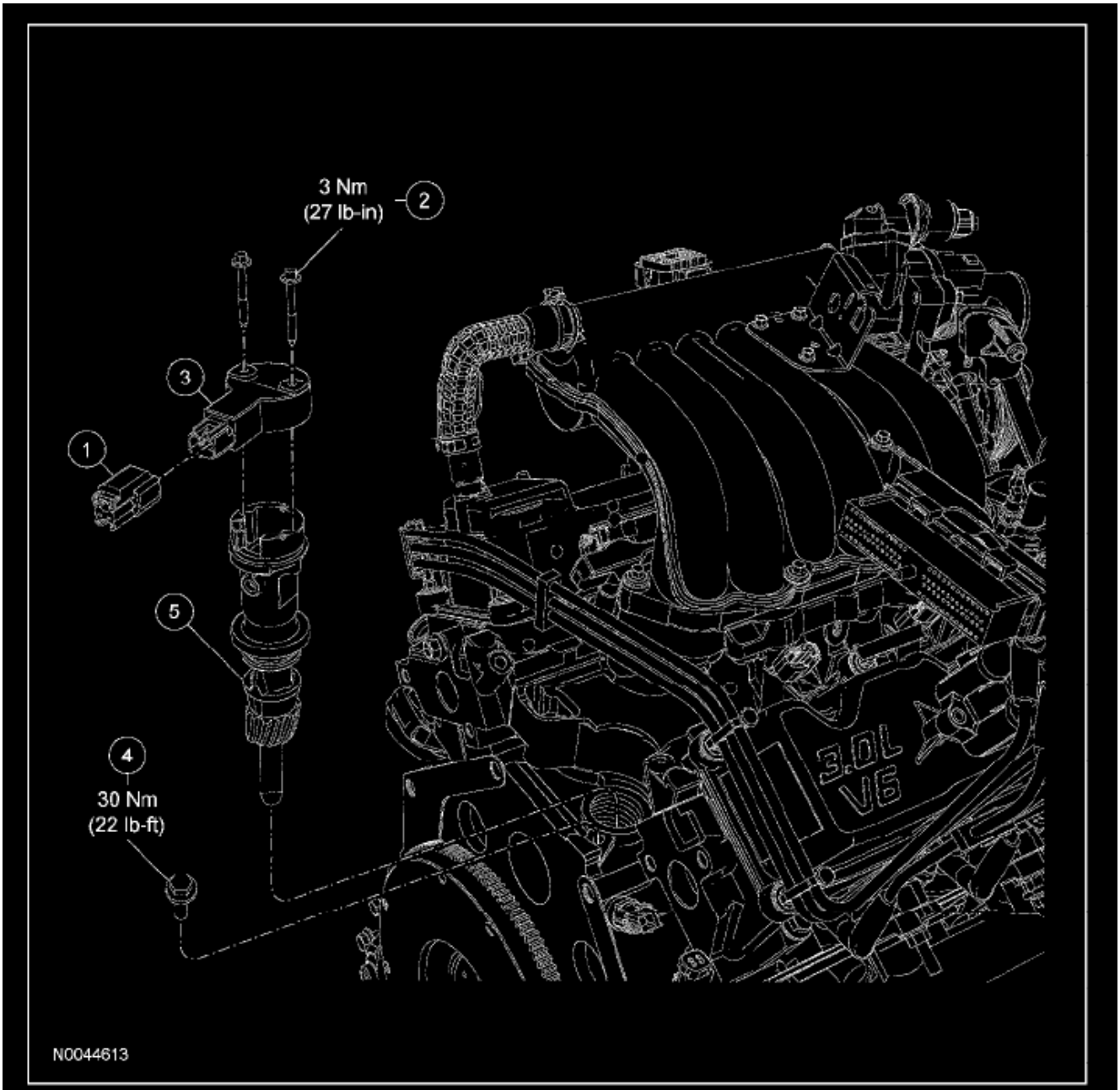
Typical Synchronizer Hall-Effect CMP Sensor

Typical Variable Reluctance CMP Sensor

The CMP sensor detects the position of the camshaft. The CMP sensor identifies when piston number 1 is on its compression stroke. A signal is then sent to the PCM and used for synchronizing the sequential firing of the fuel injectors. Coil on plug (COP) ignition applications use the CMP signal to select the correct ignition coil to fire.

Vehicles with 2 CMP sensors are equipped with variable camshaft timing (VCT). They use the second sensor to identify the position of the camshaft on bank 2 as an input to the PCM.

There are 2 types of CMP sensors: the 3-pin connector Hall-effect type sensor and the 2-pin connector variable reluctance type sensor.



Item	Part Number	Description
1	—	Camshaft position (CMP) sensor electrical connector (part of 12B637)
2	W701219	CMP sensor bolt (2 required)

(Continued)

Item	Part Number	Description
3	6B288	CMP sensor
4	—	Camshaft synchronizer bolt
5	12A362	Camshaft synchronizer

Camshaft Position Sensor: Service and Repair

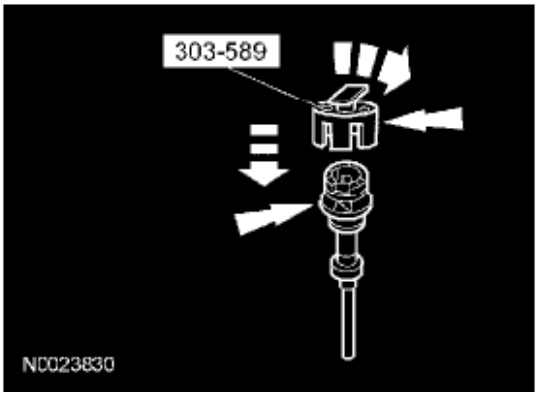
CAMSHAFT SYNCHRONIZER

Exploded View

Special Tool(s)

Special Tool(s)

ST2362-A	Synchronizer Alignment Gauge 303-589



Special Tool(s)

Removal

1. Disconnect the camshaft position (CMP) sensor electrical connector.

2. NOTE: Prior to the removal of the CMP sensor, note the position of the CMP sensor electrical connector. The installation procedure requires that

the electrical connector be located in the same position.

Remove the 2 bolts and the CMP sensor.

3. Remove the camshaft synchronizer bolt. 4. Remove the camshaft synchronizer. Inspect the O-ring seal and install a new O-ring seal if damaged.

Installation

1. CAUTION:

- After installation, do not loosen the synchronizer bolt and rotate the synchronizer assembly. The synchronizer assembly is not adjustable. Do not loosen the synchronizer bolt after the alignment tool has been removed in order to align the camshaft position (CMP) sensor electrical connector for any reason. If the electrical connector is not in the correct position, the synchronizer assembly must be removed. The alignment tool and the assembly must be reinstalled if the engine has not been rotated from top dead center (TDC) of the compression stroke on the No. 1 cylinder. Failure to follow this procedure will result in the fuel system being out of time with the engine, possibly causing engine damage.

- Do not turn the crankshaft or camshaft during the removal and installation procedure or the fuel system timing will be out of time with the engine, possibly causing engine damage.

- A special tool must be used during the installation of the new synchronizer assembly. Failure to follow this procedure will result in the fuel system being out of time with the engine, possibly causing engine damage.

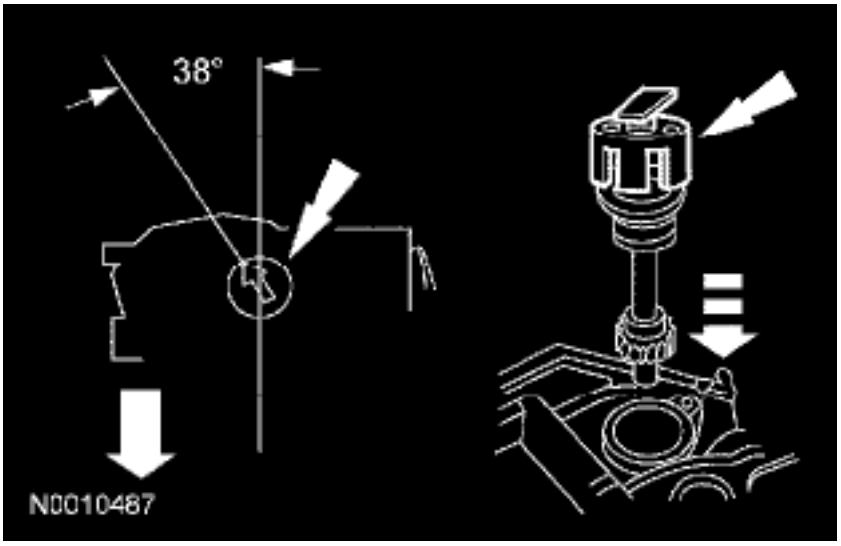
Install the special tool on the camshaft synchronizer by rotating the tool until it engages the notch in the camshaft synchronizer housing and the armature.

2. CAUTION: It is very important to coat the gear on the camshaft synchronizer with engine oil prior to installation. Failure to do so may

result in gear failure.

NOTE: During installation, the arrow on the special tool will rotate clockwise until the oil pump intermediate shaft and the camshaft gear engages.

Install the camshaft synchronizer housing assembly so the arrow on the special tool is 38 degrees from the centerline of the engine.



3. Install the camshaft synchronizer housing bolt.

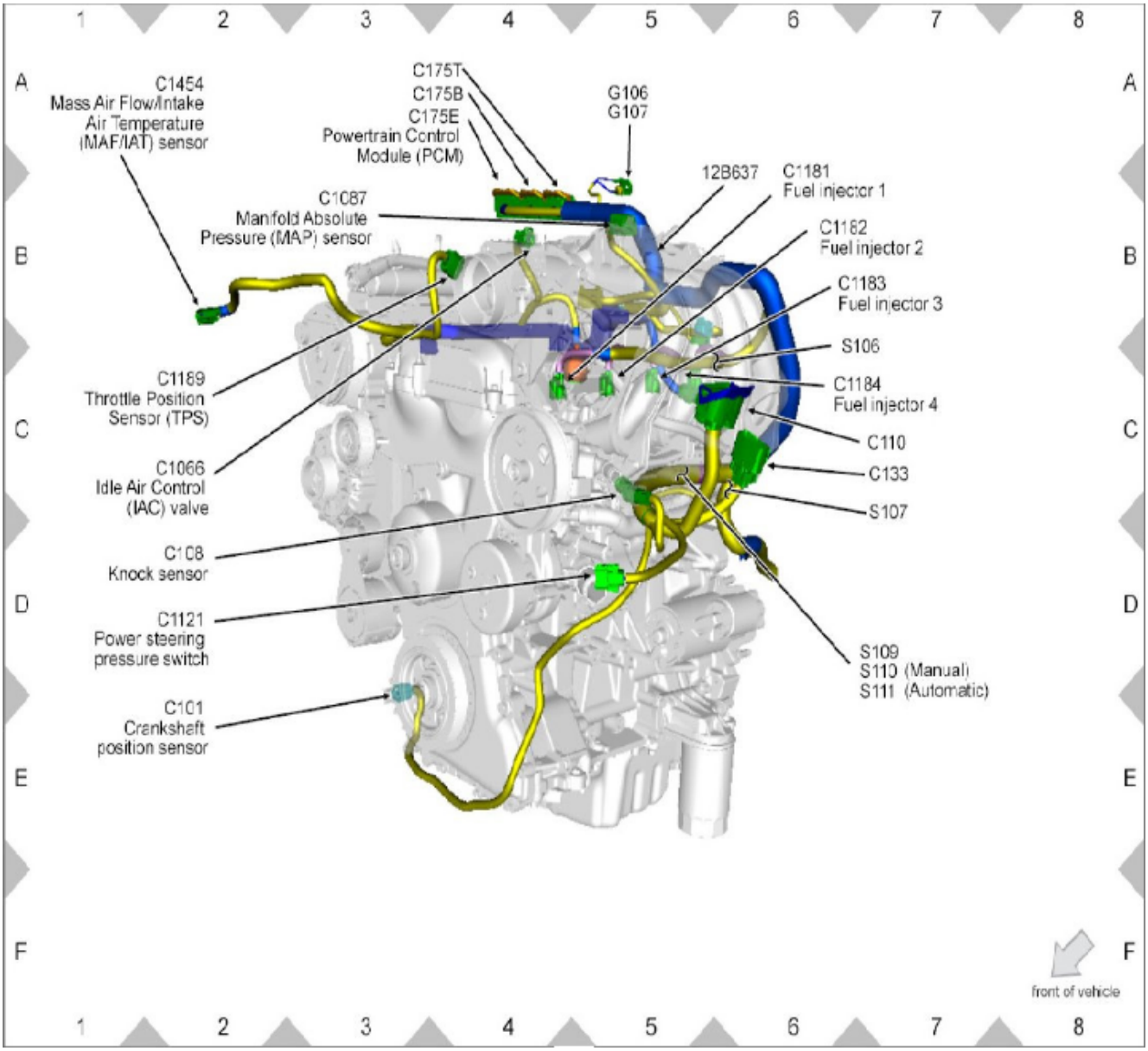
- Tighten to 30 Nm (22 lb-ft).

4. Position the CMP sensor and install the 2 bolts.

- Tighten to 3 Nm (27 lb-in).

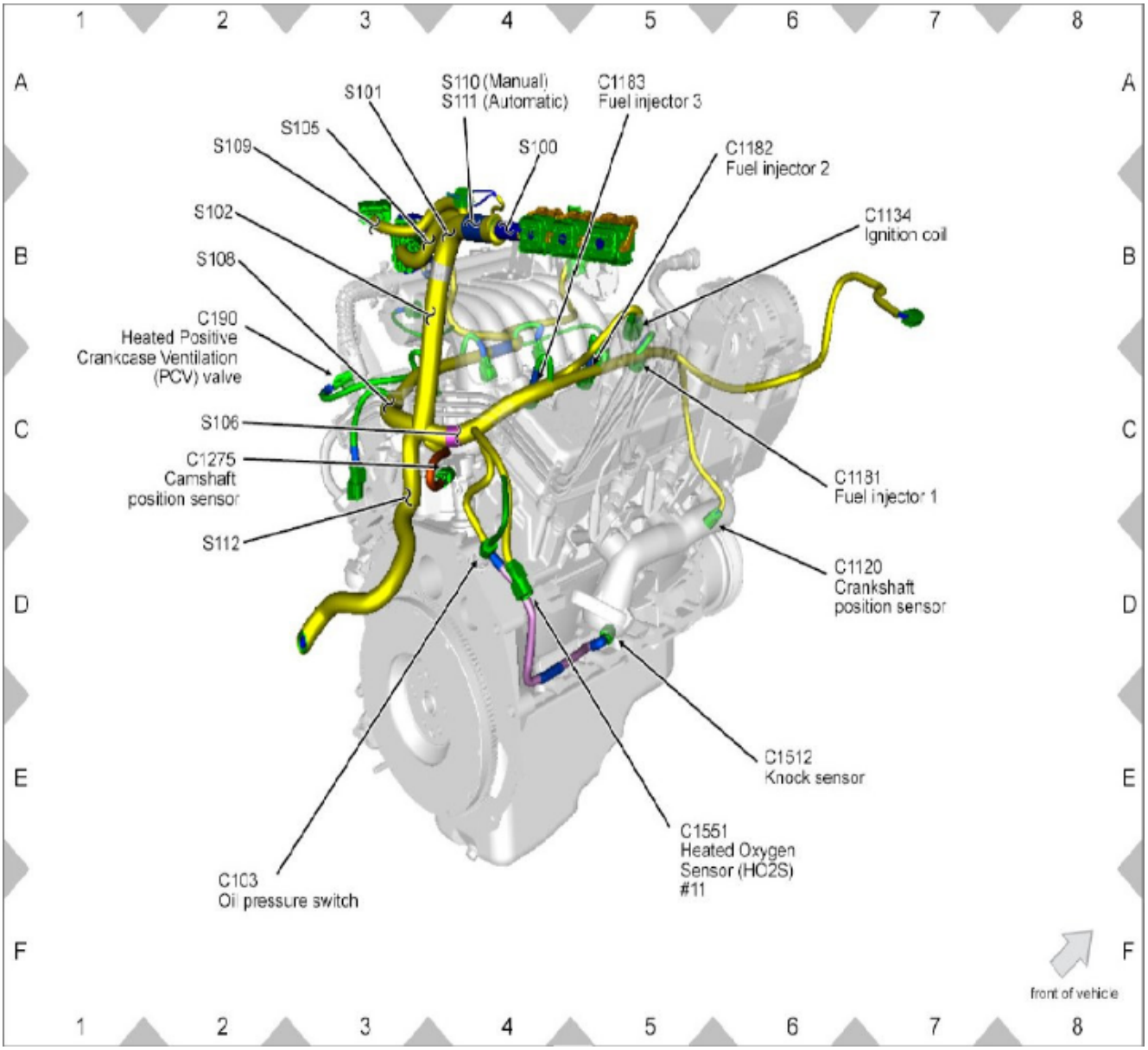
5. Connect the CMP sensor electrical connector.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Sensors and Switches > Sensors and Switches - Powertrain Management > Sensors and Switches - Ignition System > Crankshaft Position Sensor > Component Information > Locations

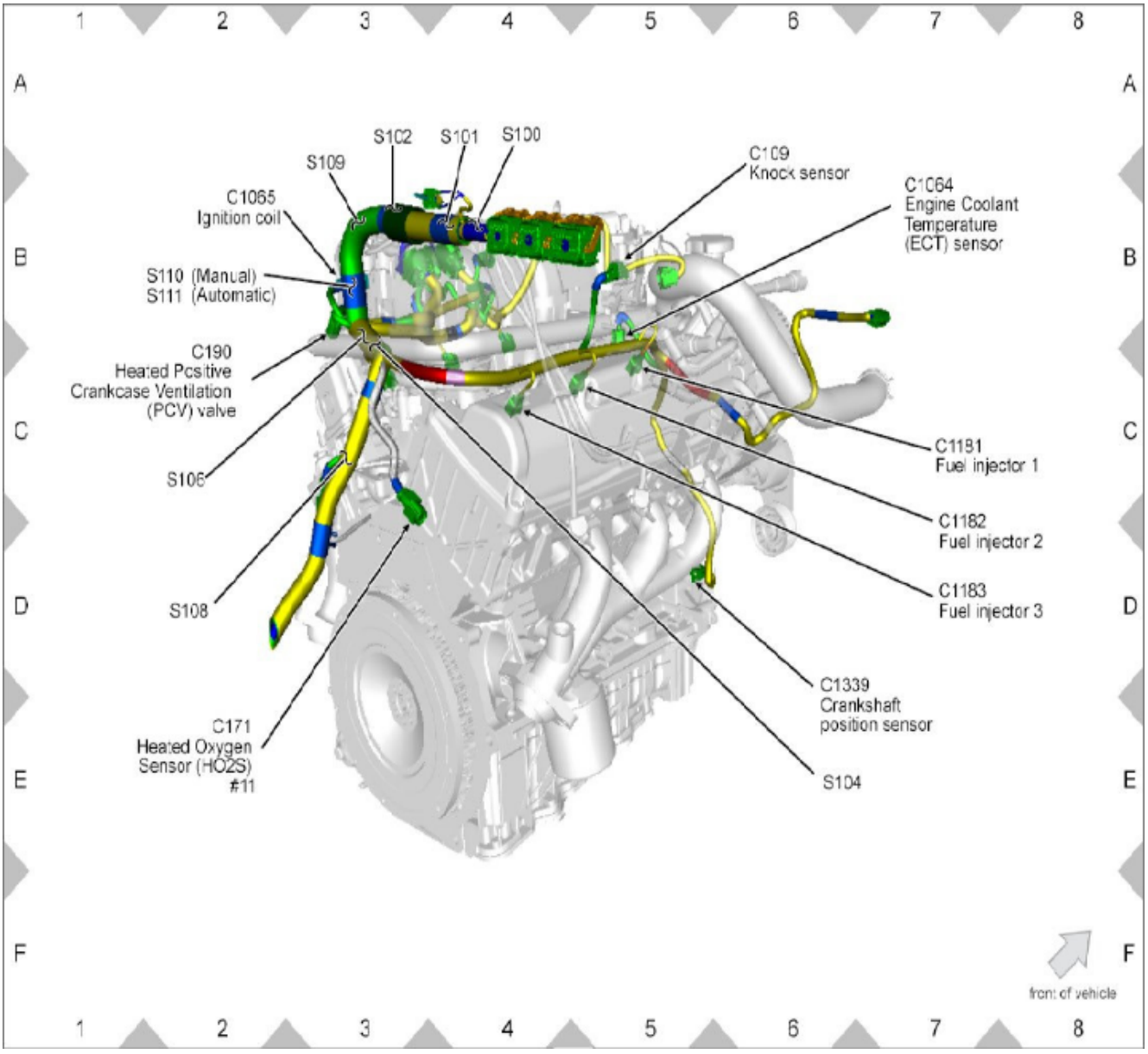


Crankshaft Position Sensor: Locations

View 151-3


S101
S110 (Manual)
S111 (Automatic)
C1183
Fuel injector 3
S105
S109
S100
C1182
Fuel injector 2
S102
C1134
Ignition coil
S108
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
C1275
Camshaft
position sensor
S112
C1181
Fuel injector 1
C1120
Crankshaft
position sensor
C1512
Knock sensor
C1551
Heated Oxygen
Sensor (HO2S)
#11
C103
Oil pressure switch
front of vehicle

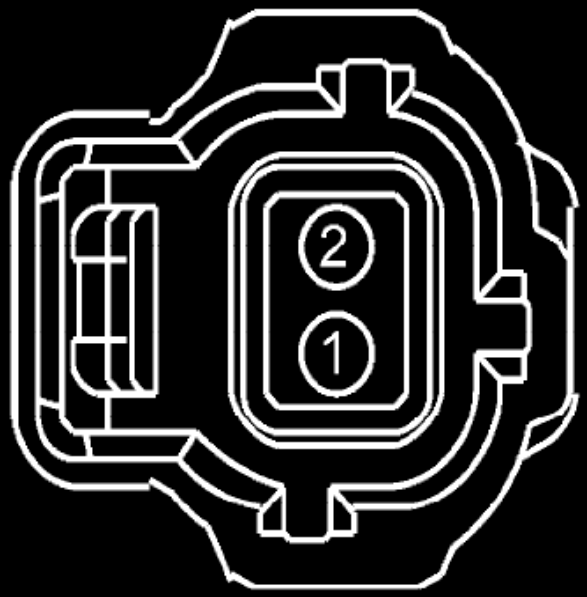
View 151-6


S102
S101
S100
S109
C1065
Ignition coil
S110 (Manual)
S111 (Automatic)
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
S108
C171
Heated Oxygen
Sensor (HO2S)
#11
C109
Knock sensor
C1064
Engine Coolant
Temperature
(ECT) sensor
C1181
Fuel injector 1
C1182
Fuel injector 2
C1183
Fuel injector 3
C1339
Crankshaft
position sensor
S104
front of vehicle

View 151-8

Connector: C101

Description:	Harness:	Base Part #:
CRANKSHAFT POSITION SENSOR	12B637	6C315



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE711 (YE-VT)	18	SENSOR - CRANKSHAFT POSITION (CKPP)	2.3L
2	RE135 (GN-BN)	18	CTRL MOD. - POWERTRAIN # CRANKSHAFT POSITION SENSOR (CKPN)	2.3L

Connector: C1120

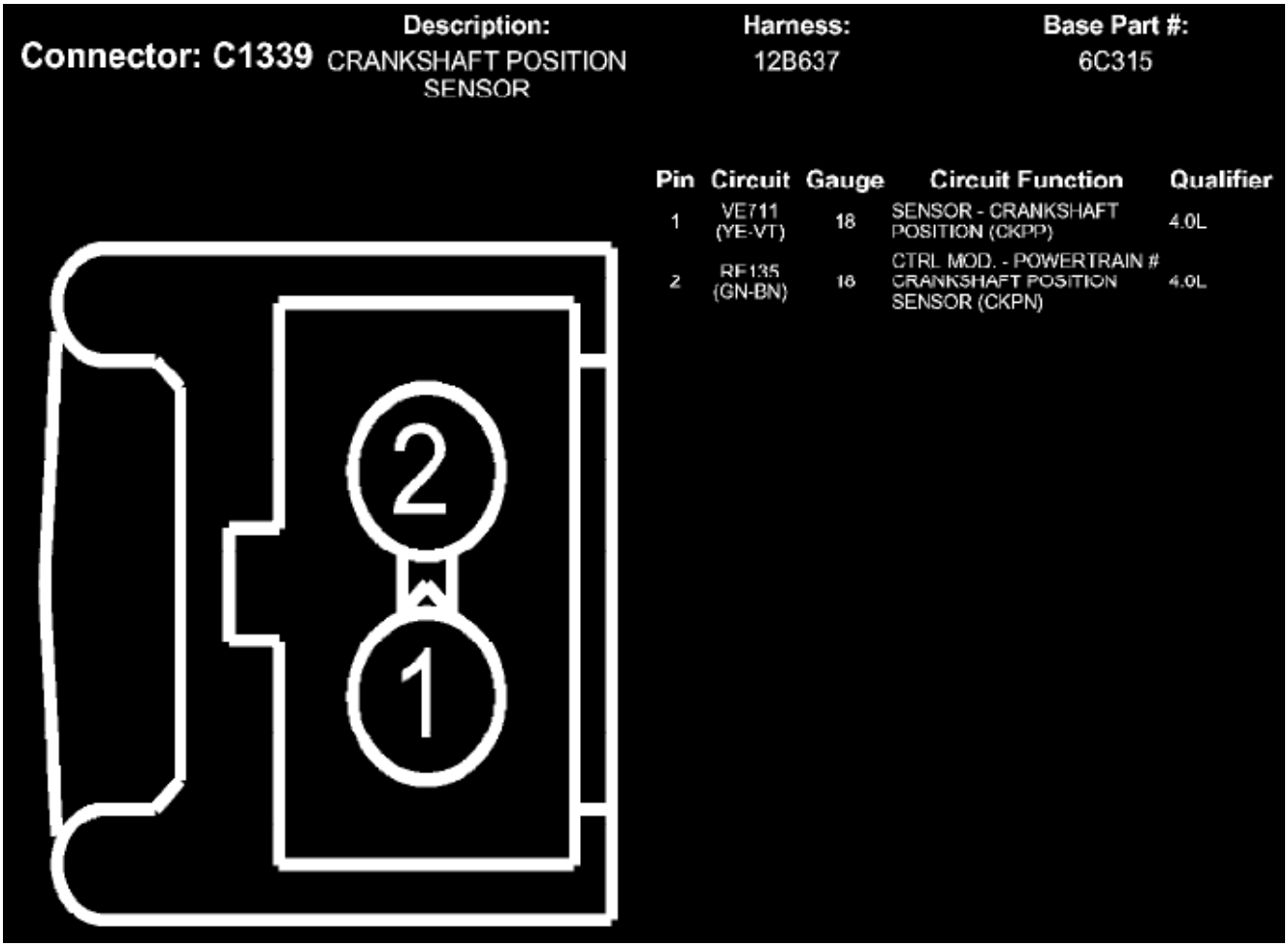
Description:	Harness:	Base Part #:
CRANKSHAFT POSITION SENSOR	12B637	6C315

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RE135 (GN-BN)	18	CTRL MOD. - POWERTRAIN # CRANKSHAFT POSITION SENSOR (CKPN)	3.0L
2	VE711 (YE-VT)	18	SENSOR - CRANKSHAFT POSITION (CKPP)	3.0L

Crankshaft Position Sensor: Diagrams

C101

C1120


Connector: C1339
Description:
CRANKSHAFT POSITION SENSOR
Harness:
12B637
Base Part #:
6C315
Pin Circuit Gauge Circuit Function Qualifier
1 VE711 (YE-VT) 18 SENSOR - CRANKSHAFT POSITION (CKPP) 4.0L
2 RF135 (GN-BN) 18 CTRL MOD. - POWERTRAIN # CRANKSHAFT POSITION SENSOR (CKPN) 4.0L
2
1

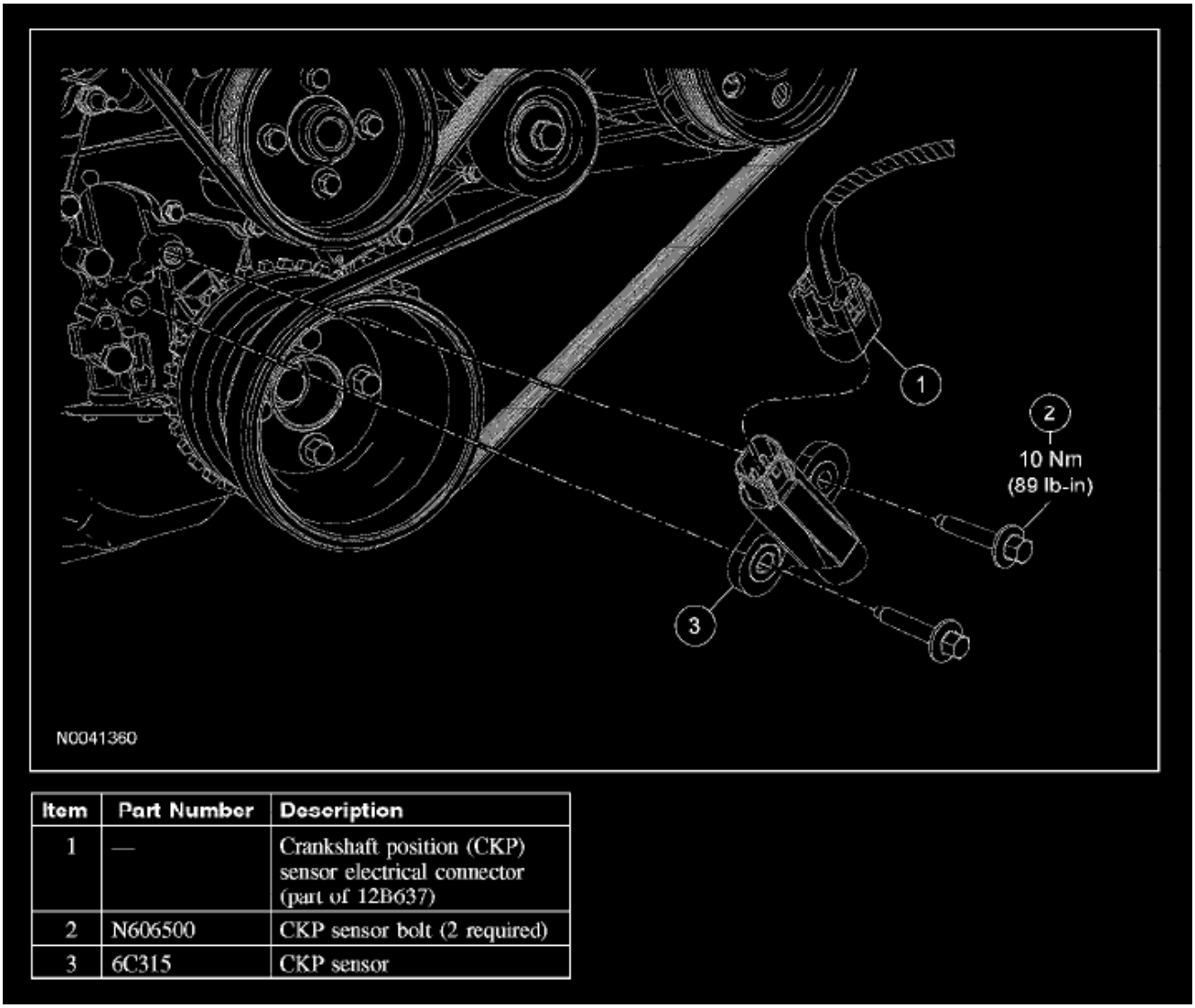
C1339

Crankshaft Position Sensor: Description and Operation

CRANKSHAFT POSITION (CKP) SENSOR

Typical Crankshaft Position (CKP) Sensor

The CKP sensor is a magnetic transducer mounted on the engine block adjacent to a pulse wheel located on the crankshaft. By monitoring the crankshaft mounted pulse wheel, the CKP is the primary sensor for ignition information to the PCM. The pulse wheel has a total of 35 teeth spaced 10 degrees apart with one empty space for a missing tooth. The 6.8L 10-cylinder pulse wheel has 39 teeth spaced 9 degrees apart and one 9 degree empty space for a missing tooth. By monitoring the pulse wheel, the CKP sensor signal indicates crankshaft position and speed information to the PCM. By monitoring the missing tooth, the CKP sensor is also able to identify piston travel in order to synchronize the ignition system and provide a way of tracking the angular position of the crankshaft relative to a fixed reference for the CKP sensor configuration. The PCM also uses the CKP signal to determine if a misfire has occurred by measuring rapid decelerations between teeth.



Item	Part Number	Description
1	—	Crankshaft position (CKP) sensor electrical connector (part of 12B637)
2	N606500	CKP sensor bolt (2 required)
3	6C315	CKP sensor

Crankshaft Position Sensor: Service and Repair

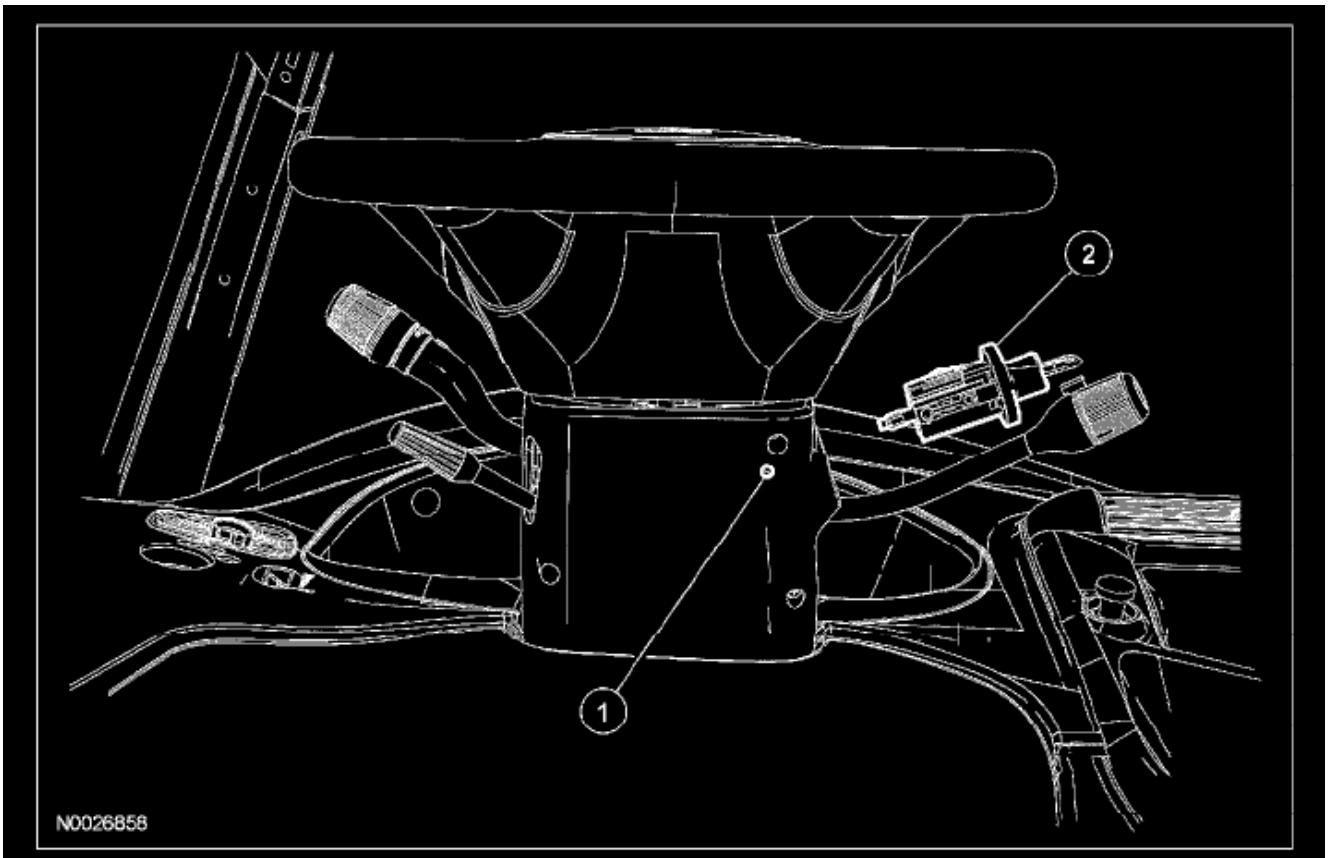
CRANKSHAFT POSITION (CKP) SENSOR

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the crankshaft position (CKP) sensor electrical connector. 3. Remove the 2 bolts and the CKP sensor.

- To install, tighten to 10 Nm (89 lb-in).

4. To install, reverse the removal procedure.



Item	Part Number	Description
1	—	Ignition lock cylinder release hole (part of 3530)
2	11582	Ignition lock cylinder

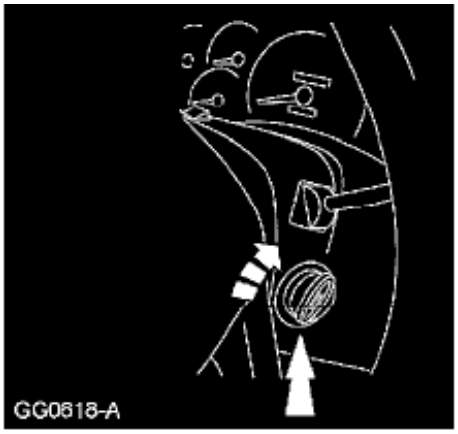
Ignition Switch Lock Cylinder: Service and Repair Ignition Lock Cylinder - Functional

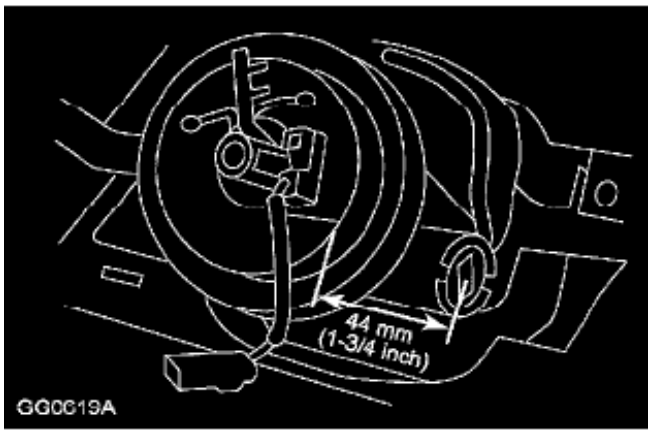
IGNITION LOCK CYLINDER - FUNCTIONAL

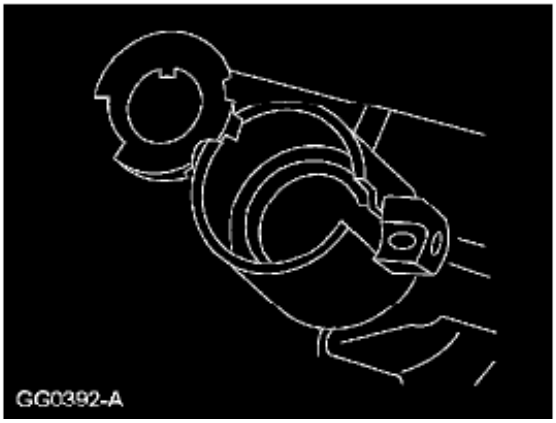
Removal and Installation

1. Disconnect the battery ground cable. 2. Insert the ignition key and turn to the RUN position. 3. Press the ignition lock cylinder release pin and remove the ignition lock cylinder. 4. To install, reverse the removal procedure.

- Verify ignition lock cylinder operation.







Ignition Switch Lock Cylinder: Service and Repair Ignition Lock Cylinder - Non Functional

IGNITION LOCK CYLINDER - NON FUNCTIONAL

Removal and Installation

1. NOTE: Make sure the front wheels are in the straight-ahead position.

Remove the steering wheel assembly.

2. Twist off the cap from the ignition lock cylinder.

3. NOTE: The lock cylinder is repaired by discarding the inoperative lock cylinder and building a new lock cylinder using the appropriate lock

repair package (F85Z-11582-AA). The lock repair package includes a detailed instruction sheet to build the new lock cylinder to the current key code of the vehicle.

Remove the ignition lock cylinder. -

Use a 1/8-inch diameter drill bit to drill out the lock cylinder retaining pin.

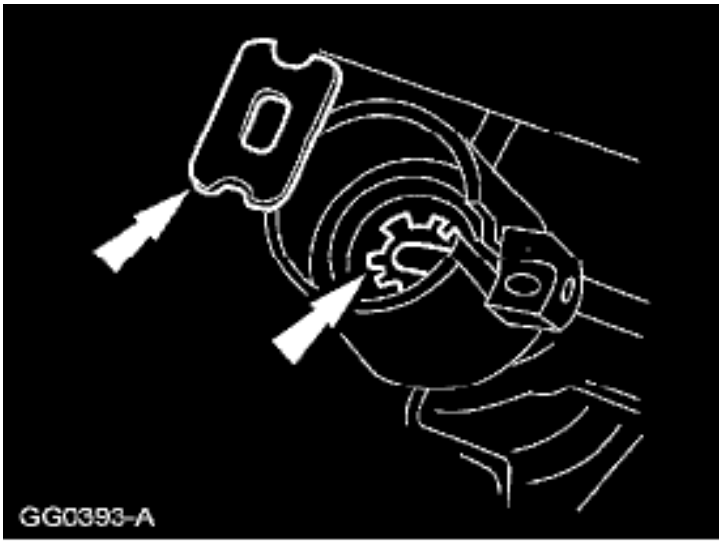
- Use a 3/8-inch drill bit to drill down the middle of the ignition lock key slot until the ignition lock cylinder breaks loose.

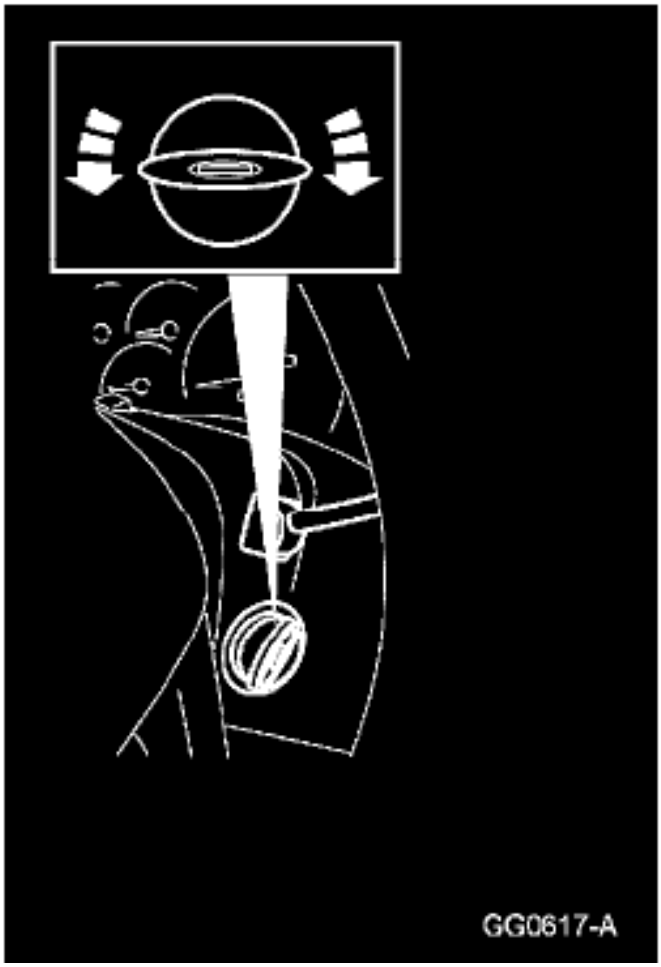
- Remove and discard the ignition lock cylinder and clean the drill shavings from the steering column.

4. Remove the bearing retainer.

5. Remove the bearing and gear.

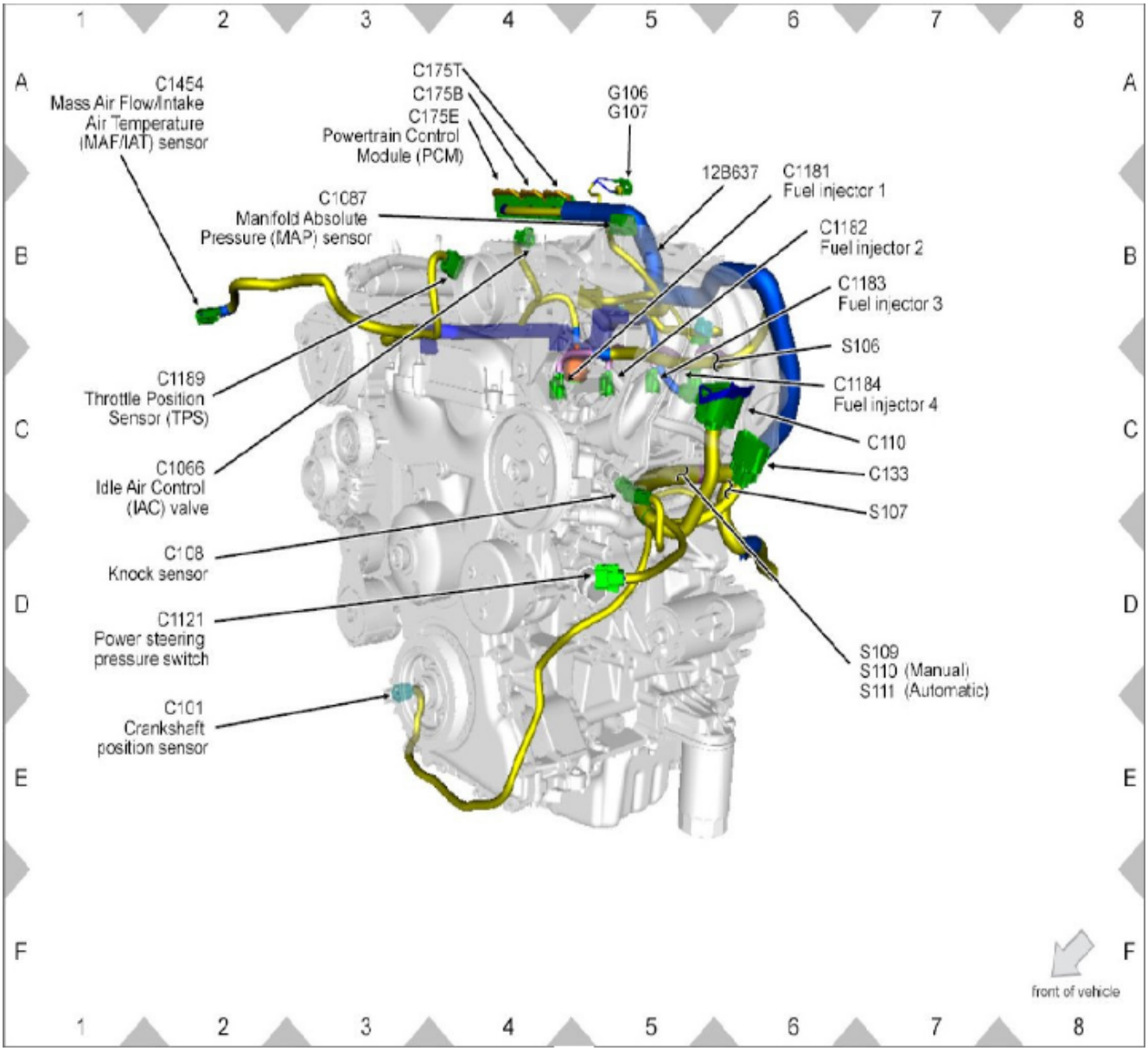
- Thoroughly clean all drill shavings from the steering column and inspect it for damage.





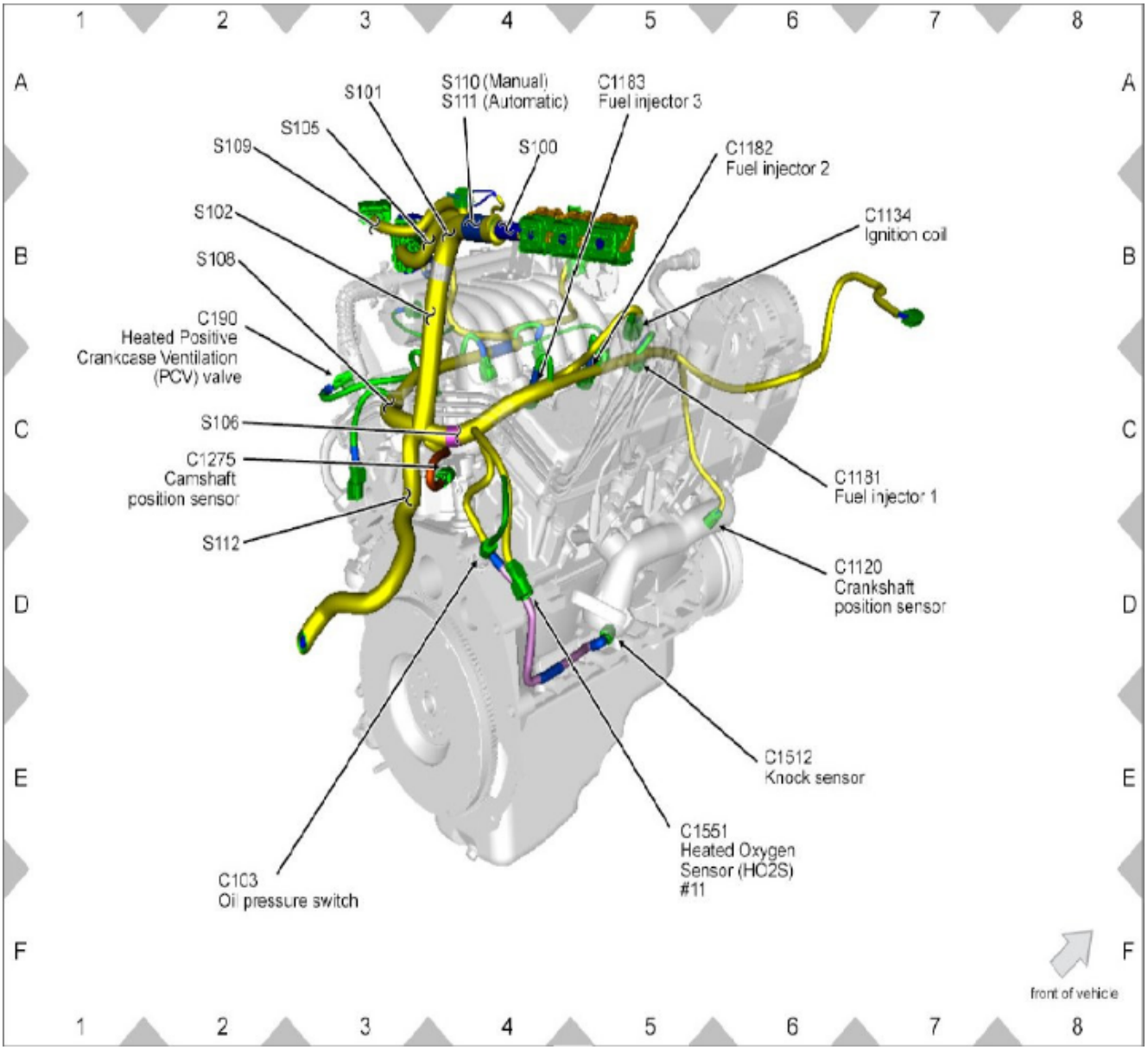
6. To install, reverse the removal procedure.

- Install a new ignition lock cylinder.
- Verify ignition lock cylinder operation.

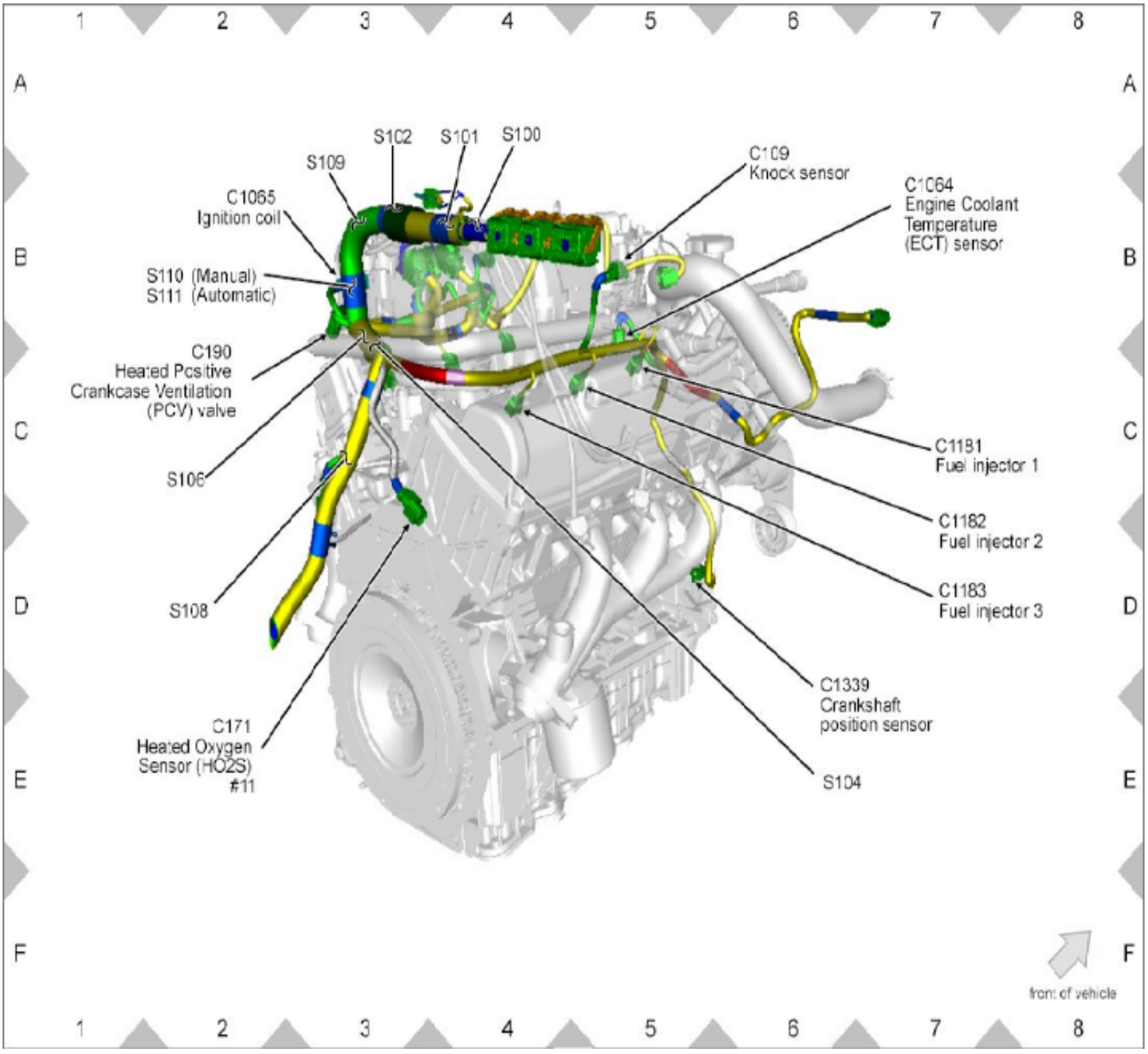


Knock Sensor: Locations

View 151-3


S101
S110 (Manual)
S111 (Automatic)
C1183
Fuel injector 3
S105
S109
S100
C1182
Fuel injector 2
S102
C1134
Ignition coil
S108
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
C1275
Camshaft
position sensor
S112
C1181
Fuel injector 1
C1120
Crankshaft
position sensor
C1512
Knock sensor
C1551
Heated Oxygen
Sensor (HO2S)
#11
C103
Oil pressure switch
front of vehicle

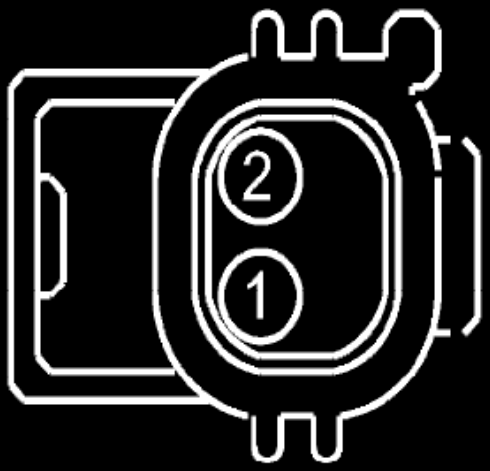
View 151-6


S102
S101
S100
S109
C1065
Ignition coil
S110 (Manual)
S111 (Automatic)
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
S108
C171
Heated Oxygen
Sensor (HO2S)
#11
C109
Knock sensor
C1064
Engine Coolant
Temperature
(ECT) sensor
C1181
Fuel injector 1
C1182
Fuel injector 2
C1183
Fuel injector 3
C1339
Crankshaft
position sensor
S104
front of vehicle

View 151-8

Connector: C108

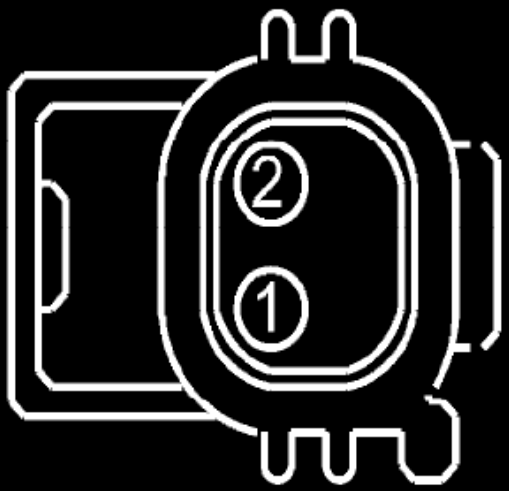
Description:	Harness:	Base Part #:
KNOCK SENSOR	12B637	12A699



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RE323 (WH-BN)	20	CTRL MOD. - POWERTRAIN # KNOCK SENSOR 1ST OR UNIQUE (KS1N) [KSL1-]	2.3L
2	VE801 (VT-OG)	20	SENSOR - KNOCK 1ST OR UNIQUE (KS1P) [KSL1+]	2.3L

Connector: C109

Description:	Harness:	Base Part #:
KNOCK SENSOR	12B637	12A699



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE801 (VT-OG)	20	SENSOR - KNOCK 1ST OR UNIQUE (KS1P) [KSL1+]	4.0L
2	RE323 (WH-BN)	20	CTRL MOD. - POWERTRAIN # KNOCK SENSOR 1ST OR UNIQUE (KS1N) [KSL1-]	4.0L

Knock Sensor: Diagrams

C108

C109

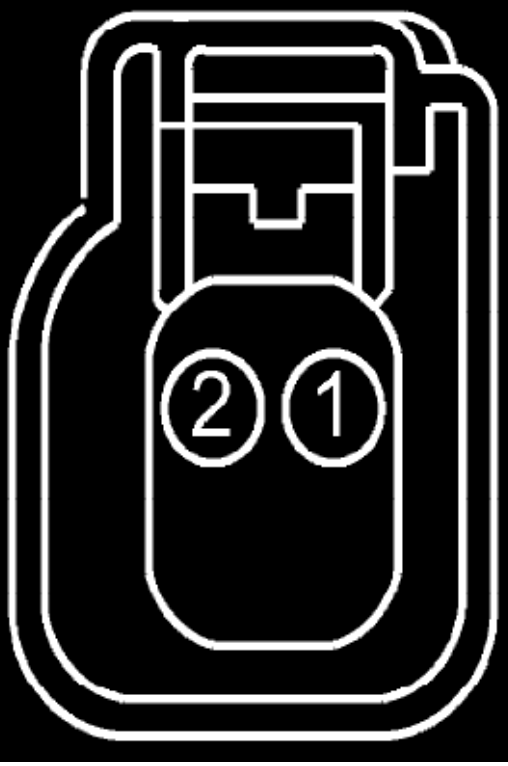
Connector: C1512

Description: KNOCK SENSOR

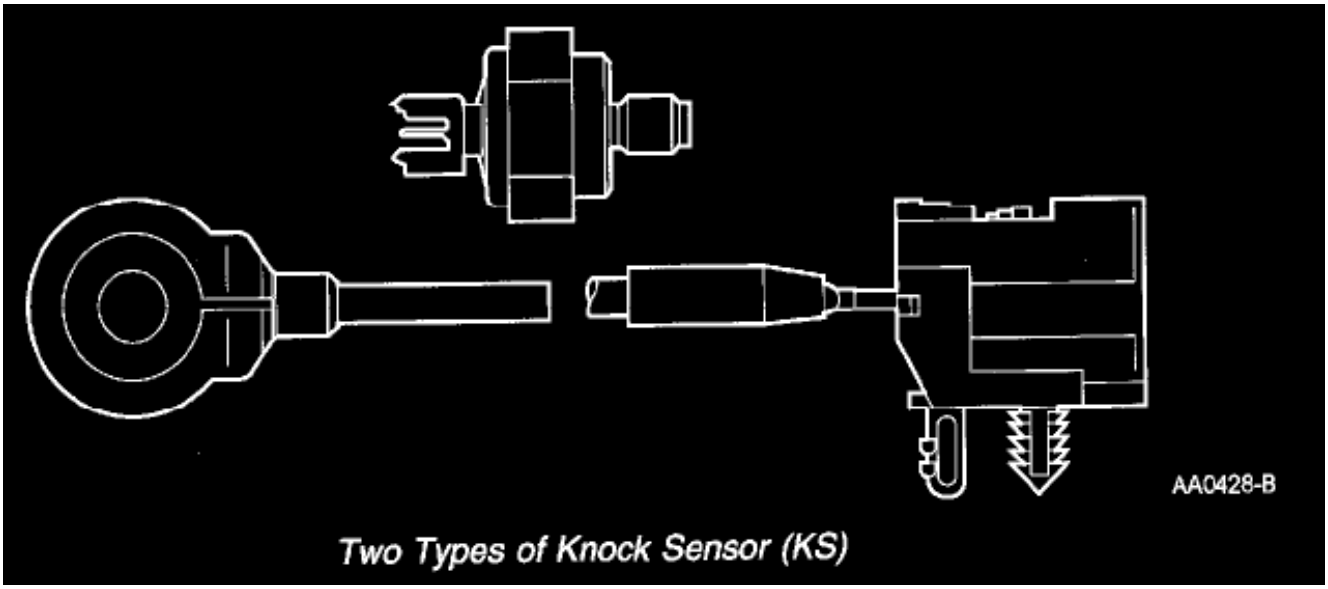
Harness: 12B637

Base Part #: 12A699

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE801 (VT-OG)	20	SENSOR - KNOCK 1ST OR UNIQUE (KS1P) [KSL1+]	3.0L
2	RE323 (WH-BN)	20	CTRL MOD. - POWERTRAIN # KNOCK SENSOR 1ST OR UNIQUE (KS1N) [KSL1-]	3.0L



C1512



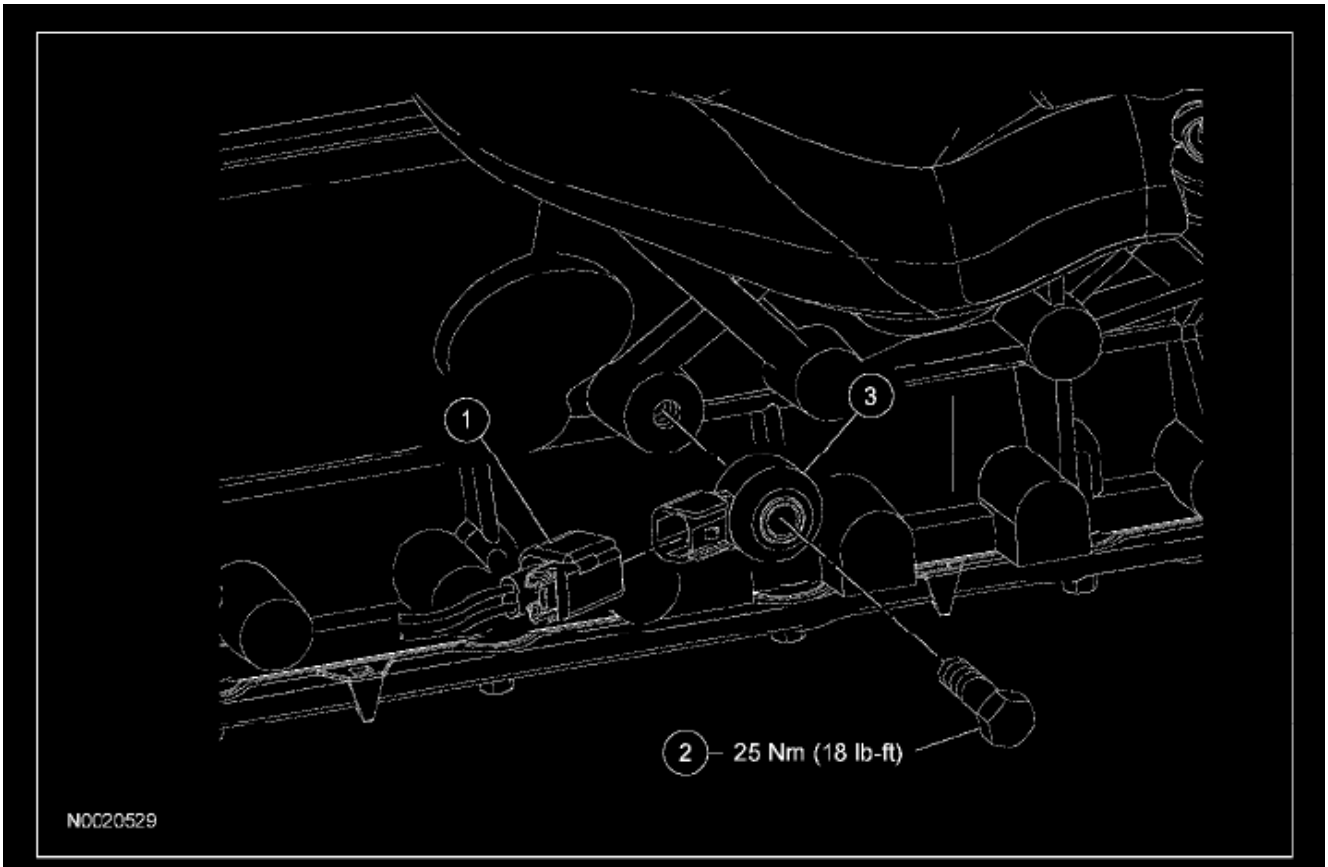
Two Types of Knock Sensor (KS)

Knock Sensor: Description and Operation

Knock Sensor (KS)

Two Types Of Knock Sensor (KS)

The KS is a tuned accelerometer on the engine which converts engine vibration to an electrical signal. The PCM uses this signal to determine the presence of engine knock and to retard spark timing.



Item	Part Number	Description
1	14A464	Knock sensor (KS) electrical connector (part of 12B637)
2	W5000225	KS bolt
3	12A699	KS

Knock Sensor: Service and Repair

KNOCK SENSOR (KS)

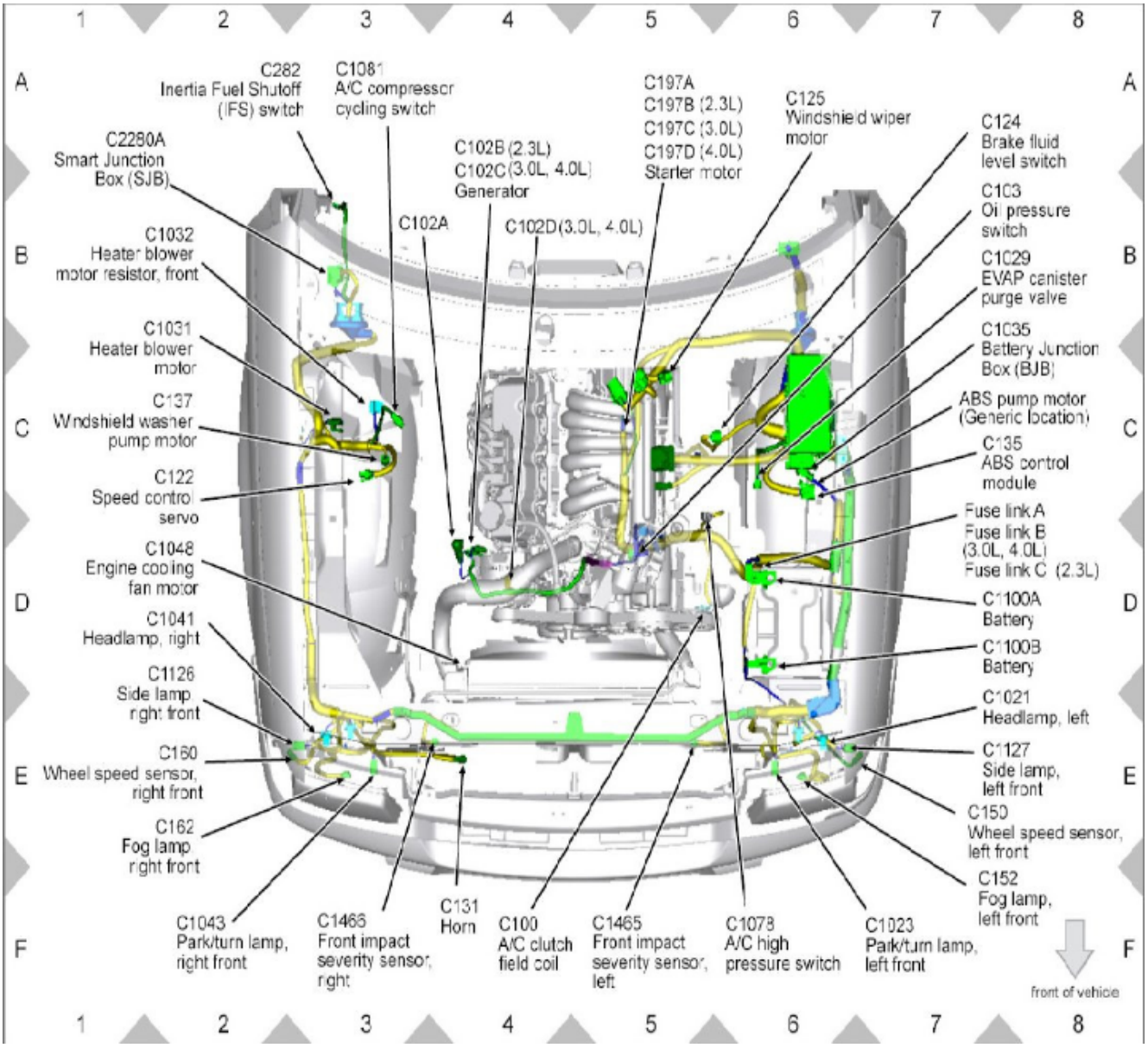
Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the knock sensor (KS) electrical connector. 3. Remove the bolt and the KS.

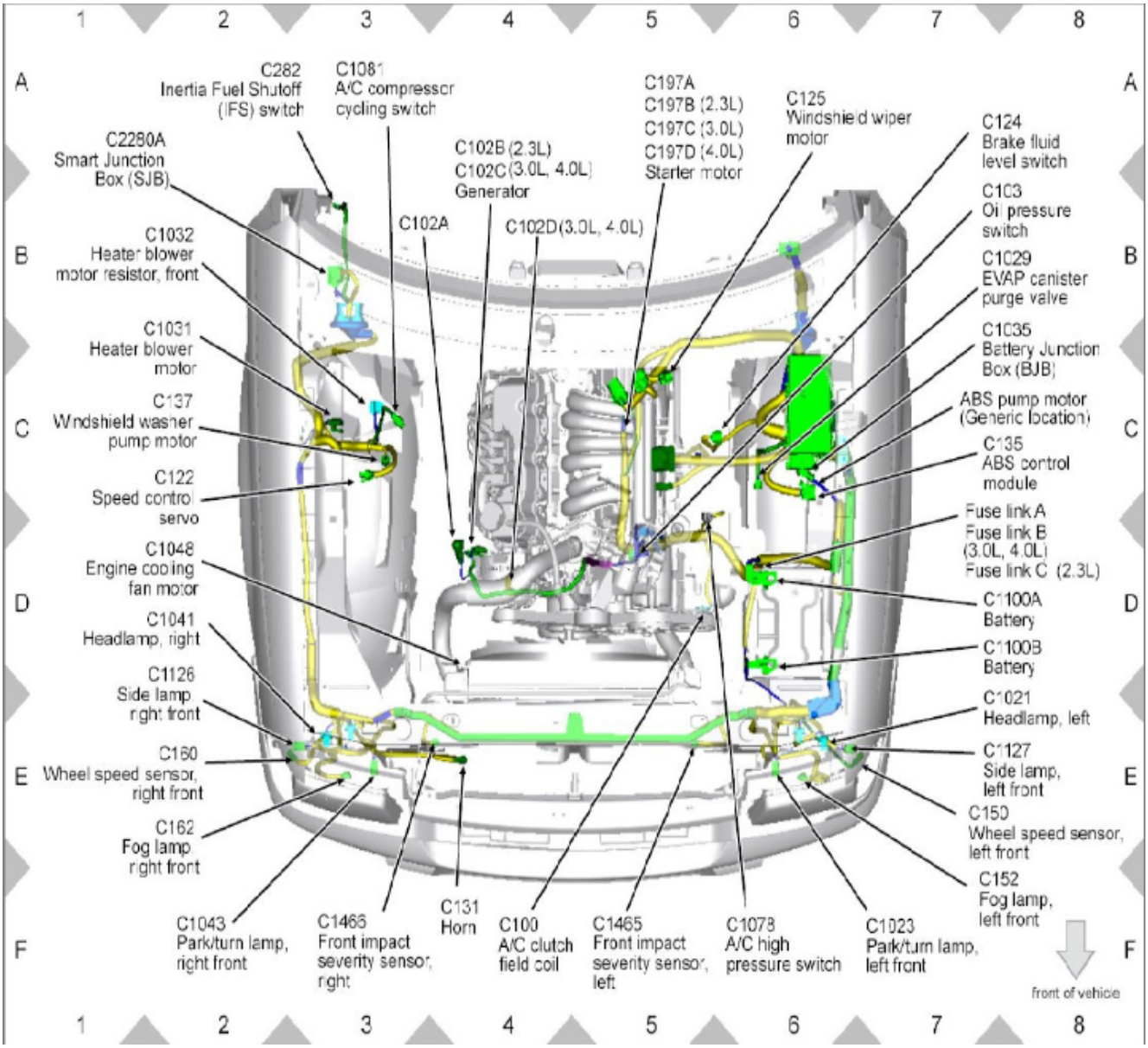
- To install, tighten to 25 Nm (18 lb-ft).

4. To install, reverse the removal procedure.

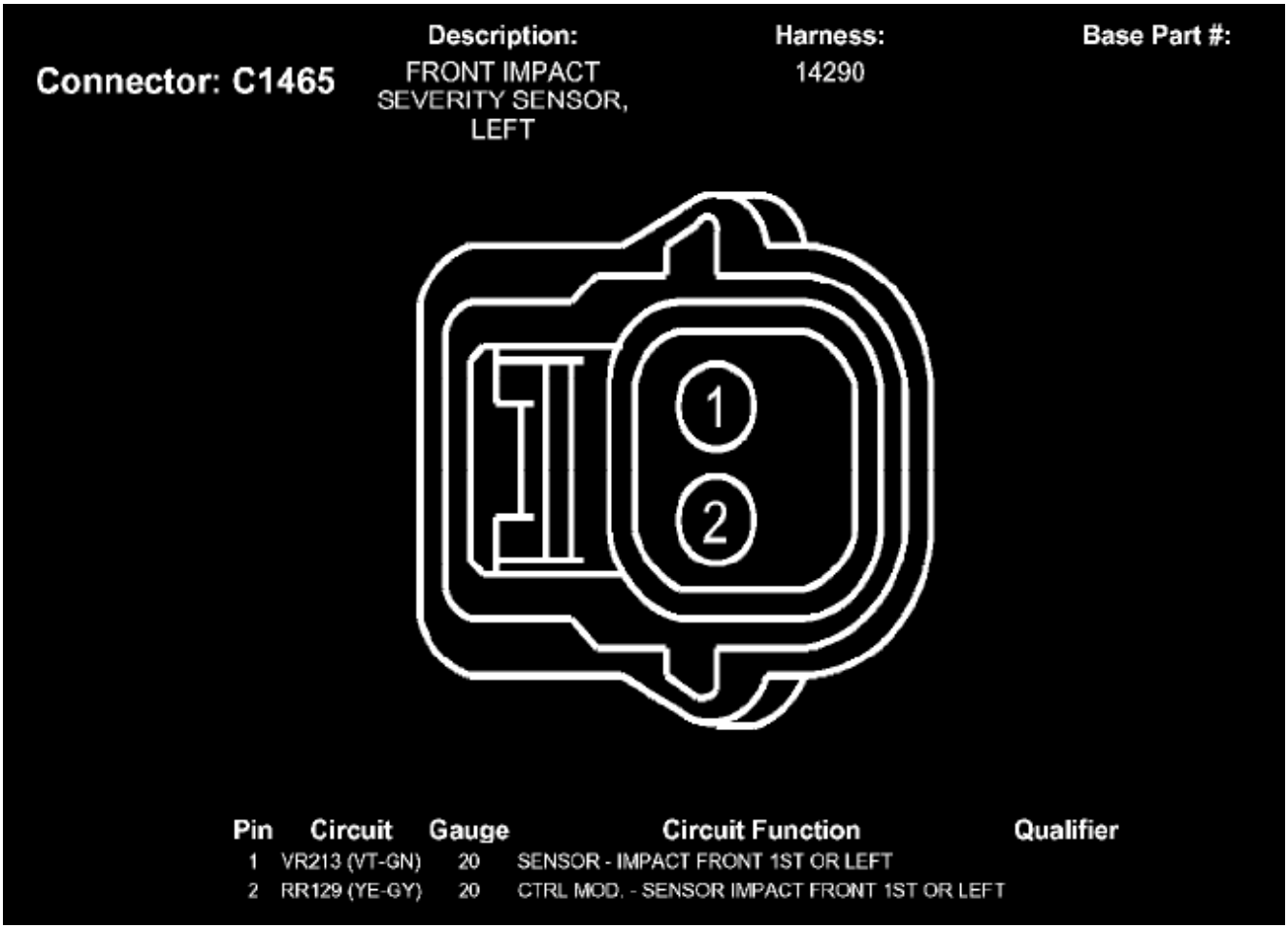
Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Sensors and Switches > Sensors and Switches - Restraint Systems > Impact Sensor > Component Information > Locations > Front Impact Severity Sensor, Left



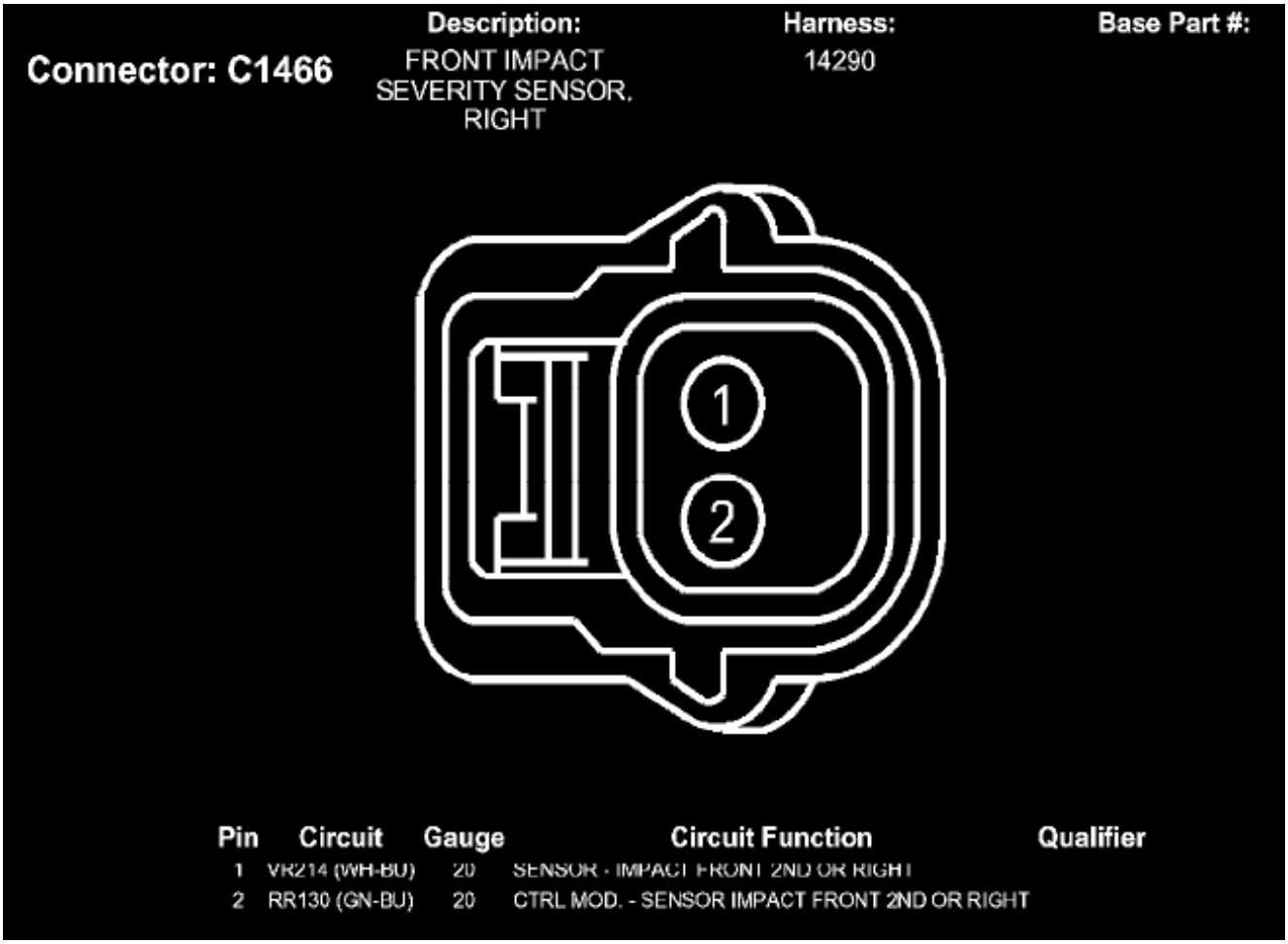
View 151-1


C282
Inertia Fuel Shutoff (IFS) switch
C1081
A/C compressor cycling switch
C2280A
Smart Junction Box (SJB)
C102B (2.3L)
C102C (3.0L, 4.0L)
Generator
C102A
C102D (3.0L, 4.0L)
C197A
C197B (2.3L)
C197C (3.0L)
C197D (4.0L)
Starter motor
C125
Windshield wiper motor
C124
Brake fluid level switch
C103
Oil pressure switch
C1032
Heater blower motor resistor, front
C1029
EVAP canister purge valve
C1031
Heater blower motor
C1035
Battery Junction Box (BJB)
C137
Windshield washer pump motor
ABS pump motor (Generic location)
C135
ABS control module
C122
Speed control servo
Fuse link A
Fuse link B (3.0L, 4.0L)
Fuse link C (2.3L)
C1048
Engine cooling fan motor
C1100A
Battery
C1041
Headlamp, right
C1100B
Battery
C1126
Side lamp, right front
C1021
Headlamp, left
C160
Wheel speed sensor, right front
C1127
Side lamp, left front
C162
Fog lamp, right front
C150
Wheel speed sensor, left front
C152
Fog lamp, left front
C1043
Park/turn lamp, right front
C1466
Front impact severity sensor, right
C131
Horn
C100
A/C clutch field coil
C1465
Front impact severity sensor, left
C1078
A/C high pressure switch
C1023
Park/turn lamp, left front
front of vehicle

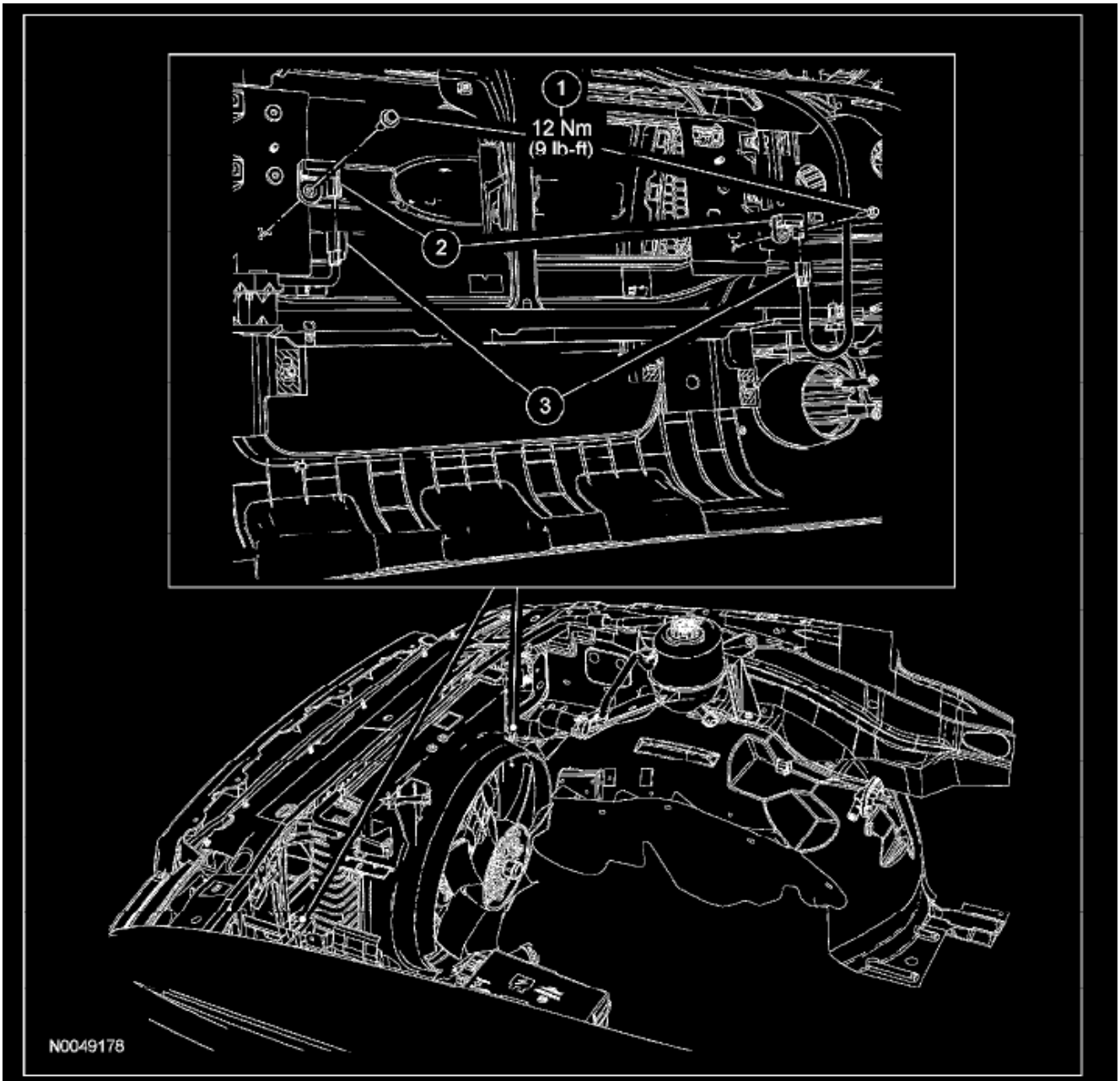
View 151-1


Connector: C1465
Description:
FRONT IMPACT SEVERITY SENSOR, LEFT
Harness:
14290
Base Part #:
1
2
Pin Circuit Gauge Circuit Function Qualifier
1 VR213 (VT-GN) 20 SENSOR - IMPACT FRONT 1ST OR LEFT
2 RR129 (YE-GY) 20 CTRL MOD. - SENSOR IMPACT FRONT 1ST OR LEFT

C1465


Connector: C1466
Description:
FRONT IMPACT SEVERITY SENSOR, RIGHT
Harness:
14290
Base Part #:
1
2
Pin Circuit Gauge Circuit Function Qualifier
1 VR214 (WH-BU) 20 SENSOR - IMPACT FRONT 2ND OR RIGHT
2 RR130 (GN-BU) 20 CTRL MOD. - SENSOR IMPACT FRONT 2ND OR RIGHT

C1466



Item	Part Number	Description
1	W505256	LH and RH front impact severity sensor bolts
2	14B006	LH and RH front impact severity sensors

Item	Part Number	Description
3	—	LH and RH front impact severity sensor electrical connectors (part of 14290)

(Continued)

Impact Sensor: Service and Repair

FRONT IMPACT SEVERITY SENSOR

Removal and Installation

WARNING:

- If a vehicle has been in a crash, inspect the restraints control module (RCM) and the impact sensor (if equipped) mounting areas for deformation. If damaged, restore the mounting areas to the original production configuration. A new RCM and sensors must be installed whether or not the air bags have deployed. Failure to follow these instructions may result in serious personal injury or death in a crash.

- Always tighten the fasteners of the restraints control module (RCM) and impact sensor (if equipped) to the specified torque. Failure to do so may result in incorrect restraint system operation, which increases the risk of personal injury or death in a crash.

NOTE:

- The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

- The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

- Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and carry out the diagnostic procedure again.

All vehicles

1. Depower the SRS.

Vehicles equipped with 2.3L and A/C

2. For the RH front impact severity sensor, remove the air cleaner and air cleaner outlet pipe.

All vehicles

3. NOTE:

- Make sure the radiator support and front impact severity sensor mating surfaces are clean and free of foreign material.

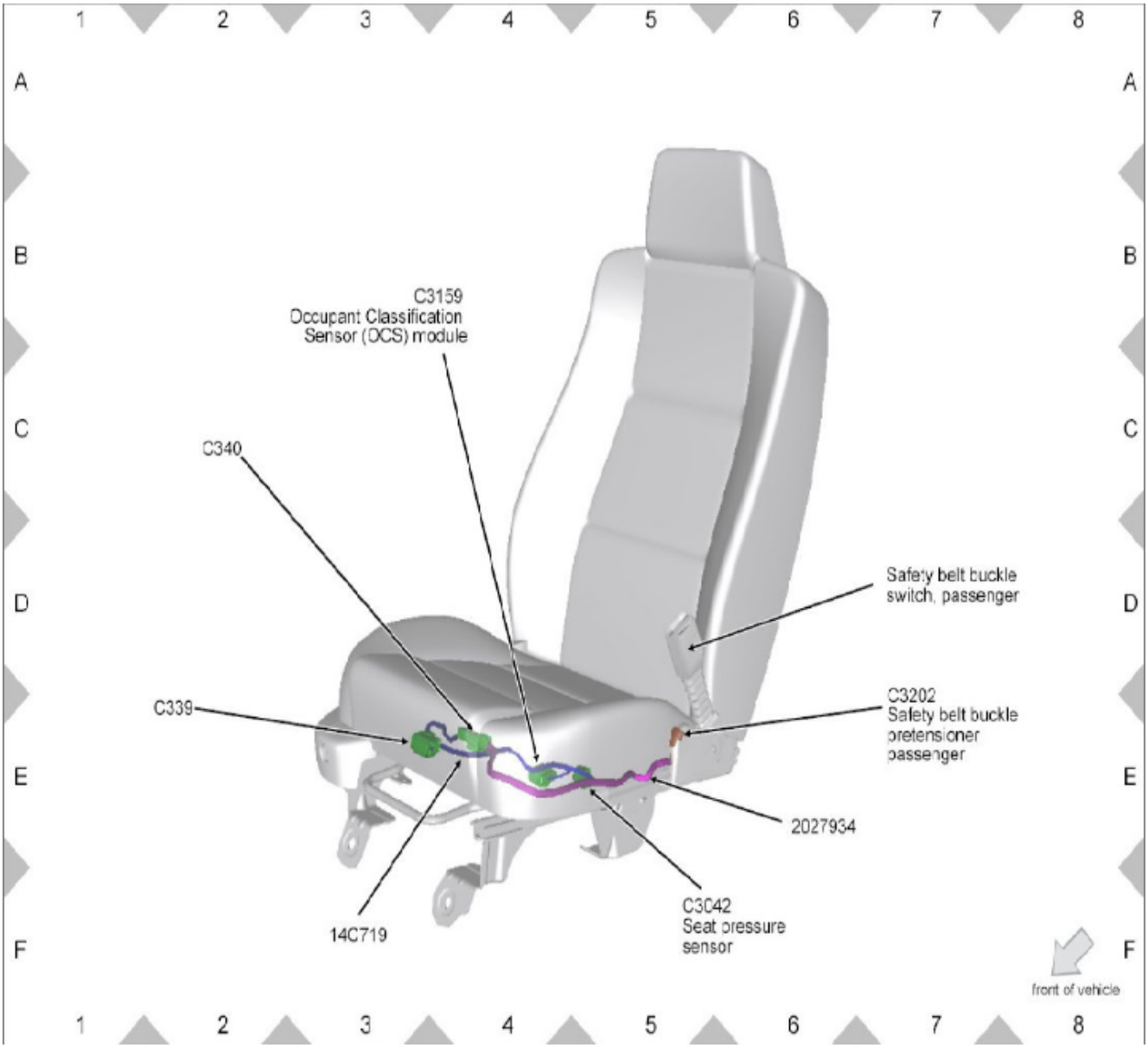
- Note position of locator tab on sensor bracket for installation.

Remove the front impact severity sensor bolt. -

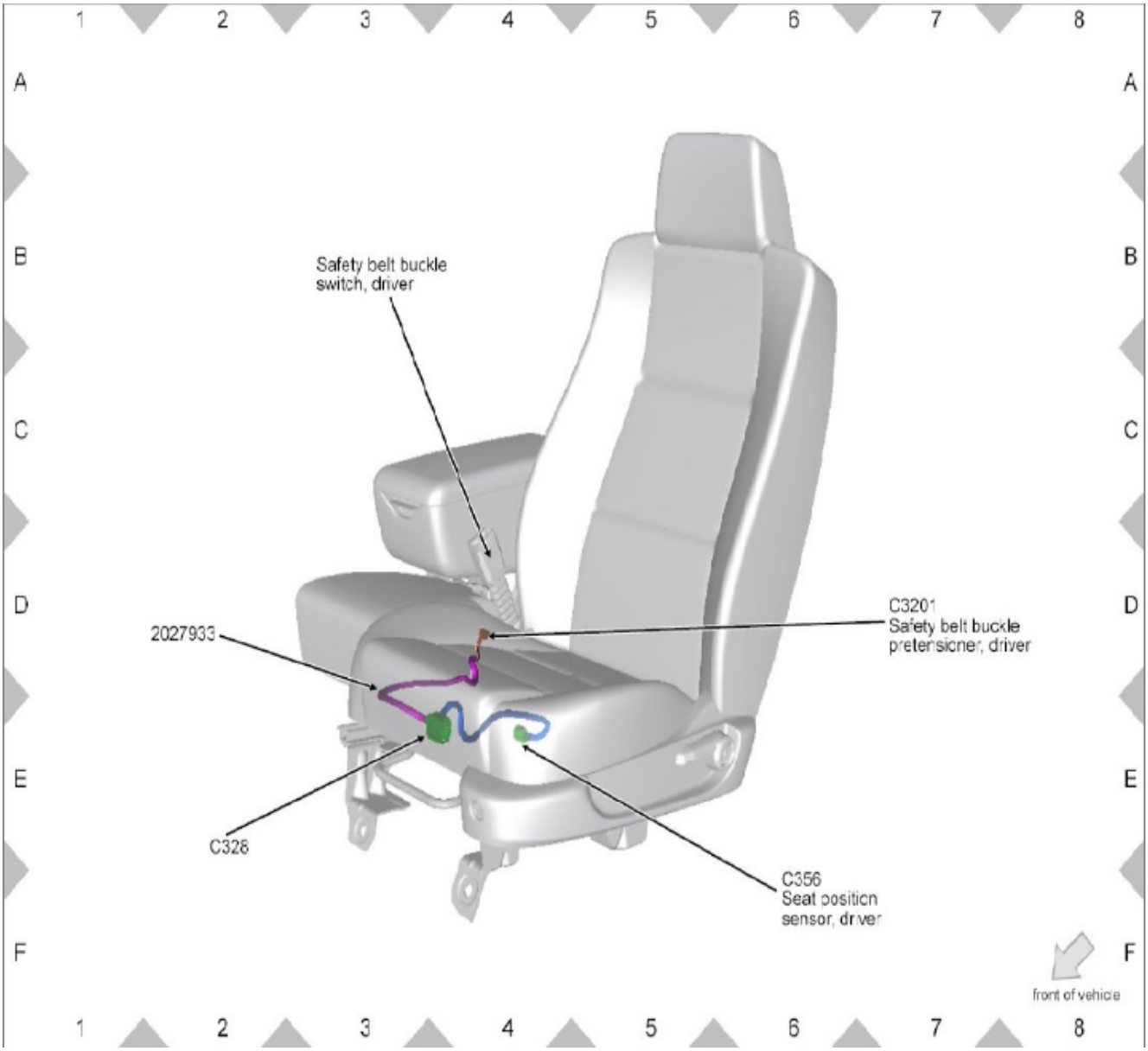
To install, tighten to 12 Nm (9 lb-ft).

4. Disconnect the front impact severity sensor electrical connector and remove the sensor. 5. To install, reverse the removal procedure. 6. Repower the SRS.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Sensors and Switches > Sensors and Switches - Restraint Systems > Seat Belt Buckle Switch > Component Information > Locations > Safety Belt Buckle Switch, Passenger



View 151-19

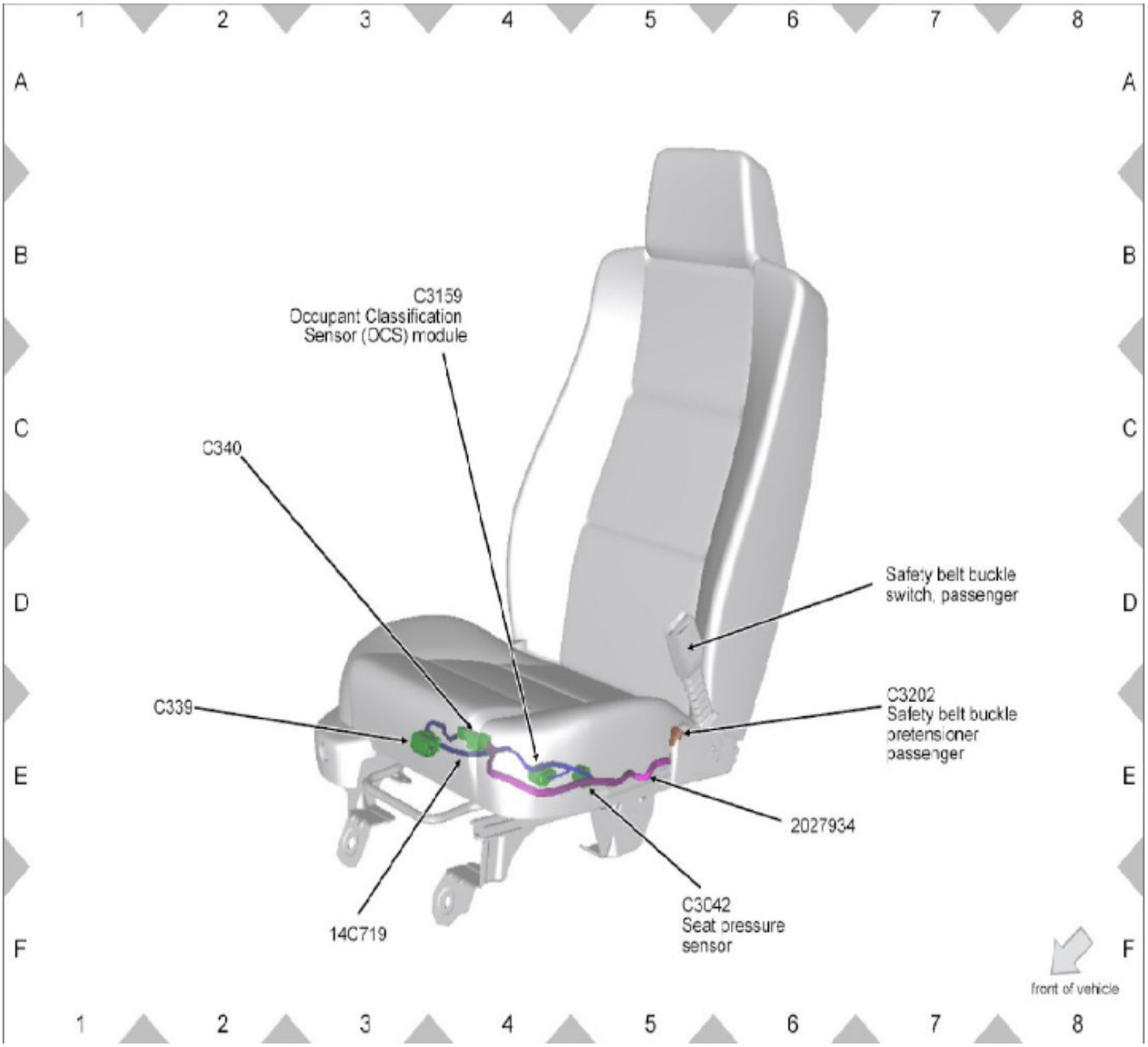

1
2
3
4
5
6
7
8
A
B
C
D
E
F
Safety belt buckle switch, driver
2027933
C3201
Safety belt buckle pretensioner, driver
C328
C356
Seat position sensor, driver
front of vehicle

View 151-18

Seat Belt Tension Sensor: Description and Operation

BELT TENSION SENSOR (BTS)

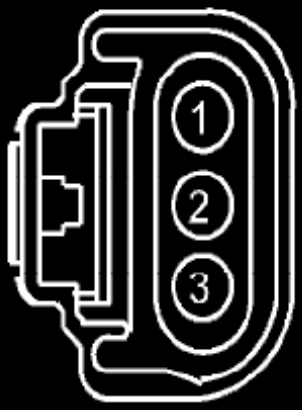
The safety belt tension sensor (BTS) is part of the passenger front safety belt and retractor assembly and is not serviced separately. The safety BTS is located at the safety belt anchor point and is used in conjunction with the occupant classification sensor (OCS) system. For information on diagnosing the BTS and OCS or servicing the OCS system, refer to the appropriate procedure in Air Bag Systems.


C3159
Occupant Classification Sensor (OCS) module
C340
Safety belt buckle switch, passenger
C339
C3202
Safety belt buckle pretensioner passenger
2027934
C3042
Seat pressure sensor
14C719
front of vehicle

View 151-19

Connector: C3042

Description:	Harness:	Base Part #:
SEAT PRESSURE SENSOR	14C719	



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CR152 (GY-YE)	22	CTRL MOD. - SENSOR OCCUPANT CLASSIFICATION PRESSURE	
2	VR223 (BU-WH)	22	SENSOR - OCCUPANT CLASSIFICATION PRESSURE	
3	RR152 (YE-VT)	22	CTRL MOD. - SENSOR OCCUPANT CLASSIFICATION PRESSURE	

C3042

Seat Occupant Sensor: Description and Operation

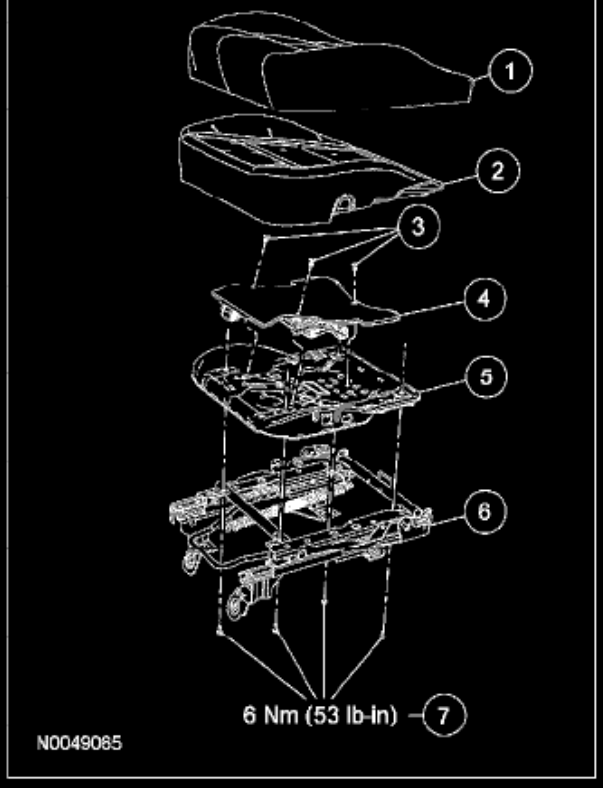
OCCUPANT CLASSIFICATION SENSOR (OCS) SYSTEM

The OCS system is standard equipment on all front outboard passenger seats.

Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Seat with a Production Occupant Classification Sensor



Item	Part Number	Description
1	62900	Seat cushion trim cover
2		Seat cushion foam pad
3	—	Pin-type retainers
4	—	Occupant classification sensor (OCS) system (bladder, hose with pressure sensor, occupant classification system module [OCSM] and seat wiring harness)
5	63101	Seat cushion frame
6	—	Seat track assembly
7		Seat track-to-cushion frame bolts

Seat Occupant Sensor: Service and Repair

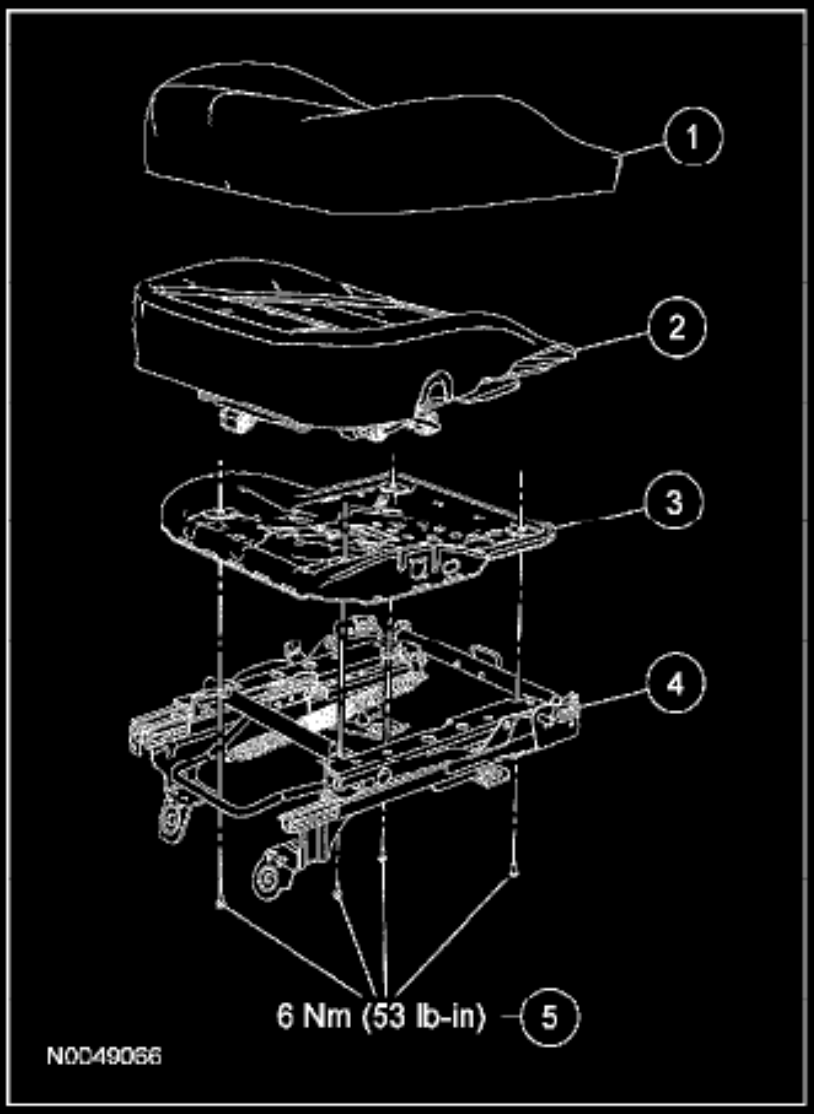
OCCUPANT CLASSIFICATION SENSOR

Special Tool(s)

Special Tool(s)

Seat With A Production Occupant Classification Sensor

Seat with a Service Kit Occupant Classification Sensor



Item	Part Number	Description
1	62900	Seat cushion trim cover
2	603B02	Occupant classification sensor (OCS) system service kit (foam pad, bladder, hose with pressure sensor, OCSM and wiring harness)
3	63101	Seat cushion frame
4	—	Seat track assembly
5	—	Seat track-to-cushion frame bolts

Seat With A Service Kit Occupant Classification Sensor

Removal

WARNING: -

Never probe the electrical connectors on safety belt buckle/retractor pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors, which increases the risk of serious personal injury or death.

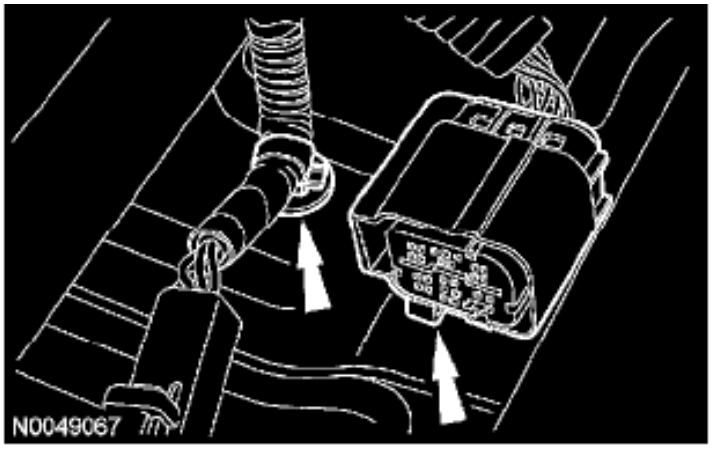
- Install a new occupant classification sensor (OCS) system service kit as a complete assembly. Never install only part of the kit components. Failure to follow this instruction may result in incorrect operation of the OCS system and increases the risk of serious personal injury or death in a crash.

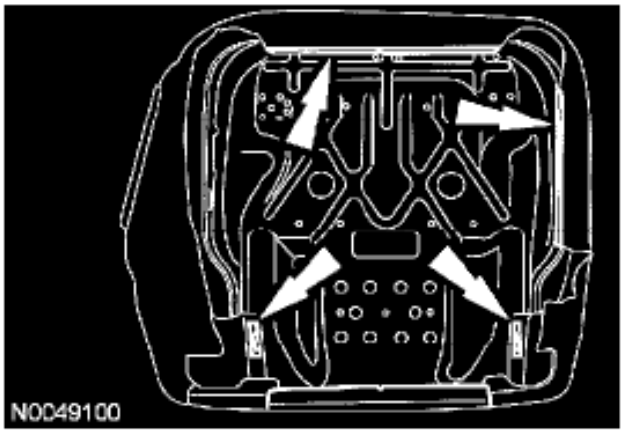
- Make sure the front passenger seat repair is complete, the seat and all attached components (head restraint, seat side shield, etc.) are correctly assembled, and the seat is correctly installed to the vehicle before carrying out the System Reset. Failure to follow these instructions may result in incorrect operation of the occupant classification sensor (OCS) system and increases the risk of serious personal injury or death in a crash.

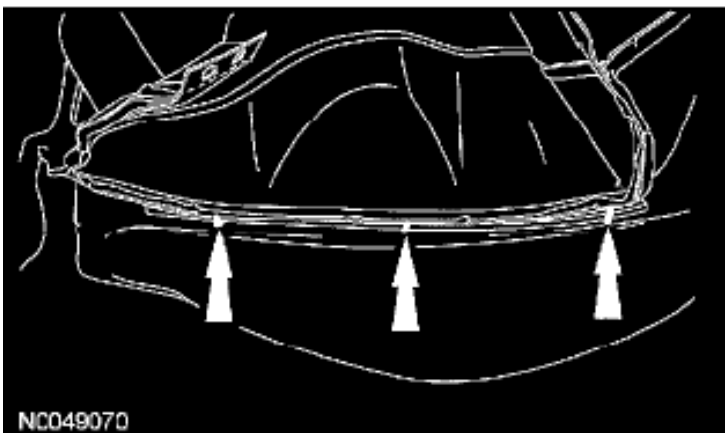
CAUTION: To prevent system failure, it is necessary to carry out the occupant classification sensor (OCS) system reset when a front passenger seat cushion is disassembled, a new trim cover installed or an OCS system service kit is installed. A scan tool is used to carry out the OCS system reset command.

NOTE: -

Occupant classification sensor (OCS) system components (seat cushion foam pad, bladder with pressure sensor and occupant classification system module [OCSM]) are calibrated to each other and are serviced as an assembly. The OCS system components are not to be installed separately. If a


N0049067


N0049100


N0049070

new OCS system, OCS system component or seat cushion foam pad are needed, a new OCS system service kit (seat cushion foam pad, bladder with pressure sensor, OCSM and seat wiring harness) must be installed as an assembly.

- The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

- The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

- Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and perform the diagnostic procedure again.

1. Remove the passenger seat. 2. Remove the seat backrest.

3. NOTE: Note position of wire routing for installation.

Release the seat wiring harness retainer clip and detach the seat wiring harness connector from the seat cushion frame.

4. Release the cushion trim cover rear J-clip. 5. Remove the 4 seat track-to-cushion frame bolts and the seat track assembly. 6. Release the remaining cushion trim cover J-clips.

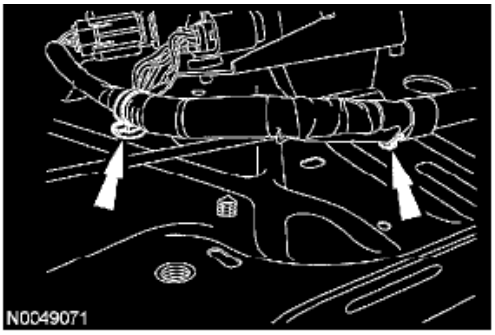
7. CAUTION: An occupant classification sensor (OCS) system service kit will have the OCS system bladder attached to the seat cushion

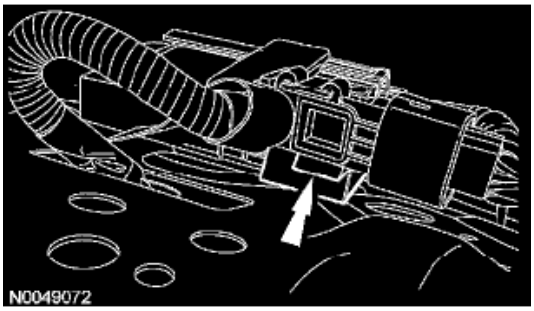
foam pad. Do not separate the OCS system bladder from the seat cushion foam pad. Failure to do so can result in component failure.

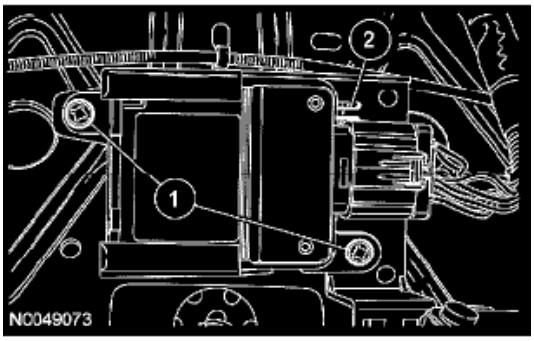
Remove the hog rings and the cushion trim cover from the seat cushion foam pad.

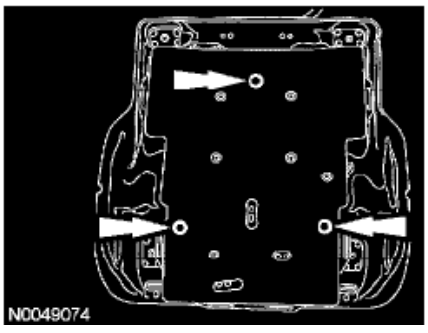
8. NOTE: Note position of wire routing for installation.

Release the 2 seat wiring harness routing clips from the cushion frame.


N0049071


N0049072


2
1
N0049073


N0049074

9. Release the pressure sensor bracket retainer and slide the pressure sensor off the bracket.

10. Remove the OCSM.

1 Remove the 2 screws from the OCSM.

2 Release the OCSM bracket retainer and slide the OCSM off the bracket.

11. CAUTION: A production occupant classification sensor (OCS) system bladder is shown. An OCS system service kit will have the OCS

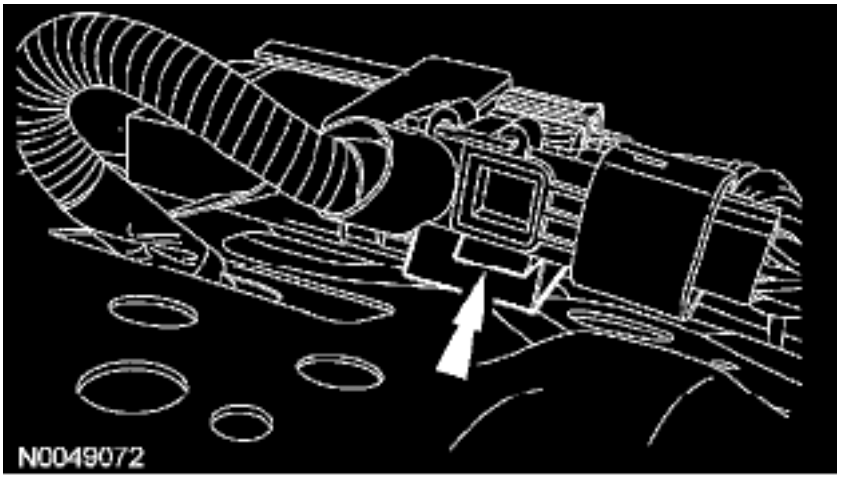
system bladder attached to the seat cushion foam pad. Do not separate the OCS system bladder from the seat cushion foam pad. Failure to do so can result in component failure.

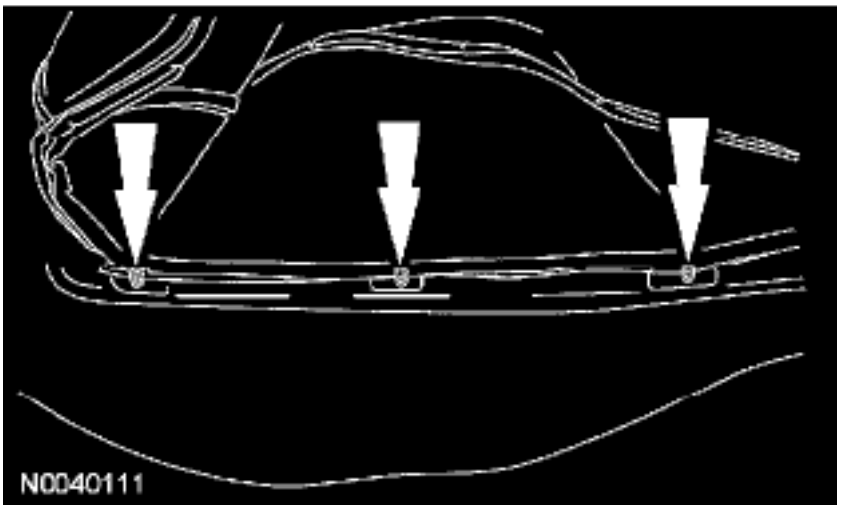
Release the 3 OCS system bladder pin-type retainers from the seat cushion frame.

12. NOTE: Note position of wire routing for installation.

Route the OCS system bladder hose and pressure sensor, OCSM and seat wiring harness out through the seat cushion pan opening.

Installation





1. WARNING: Install a new occupant classification sensor (OCS) system service kit as a complete assembly. Never install only part of the

kit components. Failure to follow this instruction may result in incorrect operation of the OCS system and increases the risk of serious personal injury or death in a crash.

CAUTION: -

Inspect the occupant classification sensor (OCS) system assembly, seat cushion frame and support assembly for any foreign objects before installing the OCS system assembly to the seat cushion frame. If any foreign objects are found, remove them. Failure to follow these instructions may result in incorrect OCS system operation or failure.

- Failure to route the seat occupant sensor components through the correct seat cushion support opening can cause component failure.

- While positioning the seat cushion pan and occupant classification sensor (OCS) assembly, be careful not to damage any of the components. Failure to do so may result in component failure.

NOTE: If the original equipment OCS system is not being installed, install a OCS system service kit using all parts in the kit.

Position the OCS system to the seat cushion frame. -

Route the OCS system bladder hose and pressure sensor, OCSM and seat wiring harness through the seat cushion pan opening.

2. CAUTION: An occupant classification sensor (OCS) system service kit will have the OCS bladder attached to the seat cushion foam pad.

Do not separate the OCS system bladder from the seat cushion foam pad. Failure to do so may result in component failure.

Install the 3 OCS system bladder pin-type retainers to the seat cushion frame.

3. Install the OCSM.

- Slide the OCSM back on the OCSM bracket until it is fully seated and locked in past the OCSM bracket retainer.

- Install the 2 screws in the OCSM.

4. Slide the pressure sensor on the bracket until it is fully seated and locked past the bracket retainer.

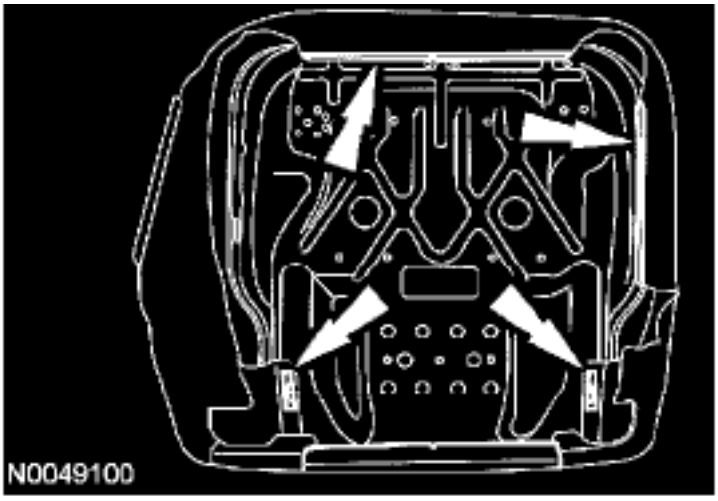
5. Install the 2 seat wiring harness routing clips to the seat cushion frame.

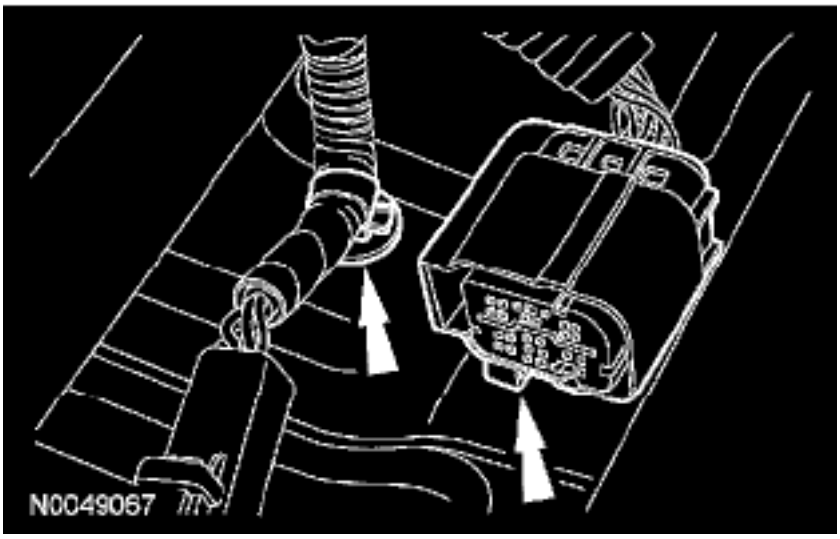
6. CAUTION: Inspect the seat cushion pad and seat cushion trim cover for any foreign objects, before installing the seat cushion trim cover

to the seat cushion pad. If any foreign objects are found, remove them. Failure to follow these instructions may result in incorrect operation of the occupant classification sensor (OCS) system and may cause system failure.

Position the cushion trim cover to the foam pad and install the hog rings.

7. Install the foam pad and cushion trim cover to the cushion frame and fasten the J-clips.





8. Install the seat track assembly and 4 bolts.

- Tighten to 6 Nm (53 lb-in).

9. Attach the seat cushion trim cover rear J-clip.

10. Install the seat wiring harness retainer clip and attach the seat wiring harness connector to the seat cushion frame.

11. Install the front seat backrest. 12. Install the passenger seat into the vehicle. 13. Repower the SRS. Do not prove out the SRS at this time.

14. WARNING:

- Install a new occupant classification sensor (OCS) system service kit as a complete assembly. Never install only part of the kit components. Failure to follow this instruction may result in incorrect operation of the OCS system and increases the risk of serious personal injury or death in a crash.

- Make sure the front passenger seat repair is complete, the seat and all attached components (head restraint, seat side shield, etc.) are correctly assembled, and the seat is correctly installed to the vehicle before carrying out the System Reset. Failure to follow these instructions may result in incorrect operation of the occupant classification sensor (OCS) system and increases the risk of serious personal injury or death in a crash.

CAUTION: -

To prevent system failure, it is necessary to carry out the occupant classification sensor (OCS) system reset of the OCS system when a front passenger seat cushion is disassembled, a new trim cover installed or an OCS system service kit is installed. A scan tool is used to carry out the OCS system reset command.

- To prevent system failure, the following precautions must be taken before carrying out the occupant classification sensor (OCS) system reset: -

Make sure the voltage to the occupant classification system module (OCSM) is above 8.0 volts and less than 18.0 volts.

- Make sure the OCS system is not at a temperature below 6°C (42°F) or above 36°C (97°F) when initiating the OCS system reset process. If the vehicle has been exposed to extreme cold or hot temperatures, the vehicle must be exposed and kept at a temperature within the limits, 6°C to 36°C (42°F to 97°F) for a minimum of 30 minutes.

- Make sure nothing is present on the passenger seat before carrying out the OCS system reset and nothing is placed on the seat during the process.

- Make sure a minimum 8-second time period has passed after cycling the ignition switch ON before the carrying out the OCS system reset process.

NOTE: If the first attempt to carry out the OCS system reset is unsuccessful, a second attempt must be made. If the second attempt is unsuccessful, a new OCS system service kit must be installed.

Carry out the OCS system reset active command.

15. Cycle the ignition switch from ON to OFF.

16. NOTE: The ignition switch must be cycled after the OCS system reset.

Cycle the ignition switch from OFF to ON.

17. Prove out the SRS as follows:

Turn the ignition key from ON to OFF. Wait 10 seconds, then turn the key back to ON and visually monitor the air bag indicator with the air bag modules installed. The air bag indicator will light continuously for approximately 6 seconds and then turn off. If an air bag SRS fault is present, the air bag indicator will: -

fail to light.

- remain lit continuously.

- flash at a 5 Hz rate (RCM not configured).

The air bag warning indicator may not illuminate until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON position. This is the time required for the RCM to complete the testing of the SRS. If the air bag warning indicator is inoperative and a SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag warning indicator and any SRS fault discovered must be diagnosed and repaired.

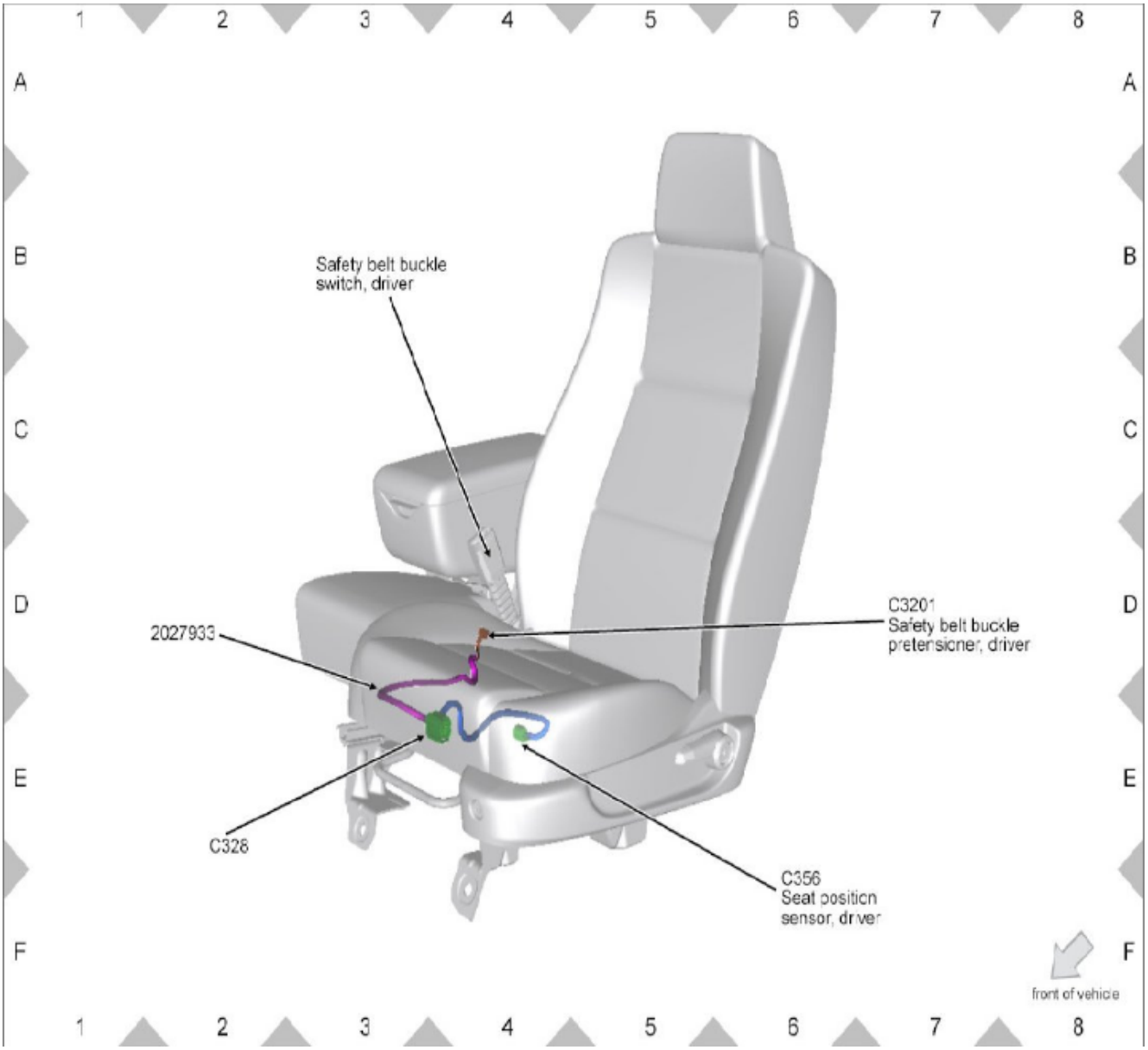
Clear all continuous RCM and OCSM DTCs using a scan tool.

18. NOTE: A prepaid return postcard is provided with a new OCS system service kit. The serial number for the new part and the vehicle

identification number (VIN) must be recorded and sent to Ford Motor Company.

If a new OCS system was installed, fill out the necessary information on the OCS system traceability card and return it along with the complete inoperative OCS system to Ford Motor Company. -

When returning the inoperative OCS system include: seat cushion foam pad, bladder, OCSM, pressure sensor (transducer), hose, electrical connectors and wire harness (service part OCS system only).


1
2
3
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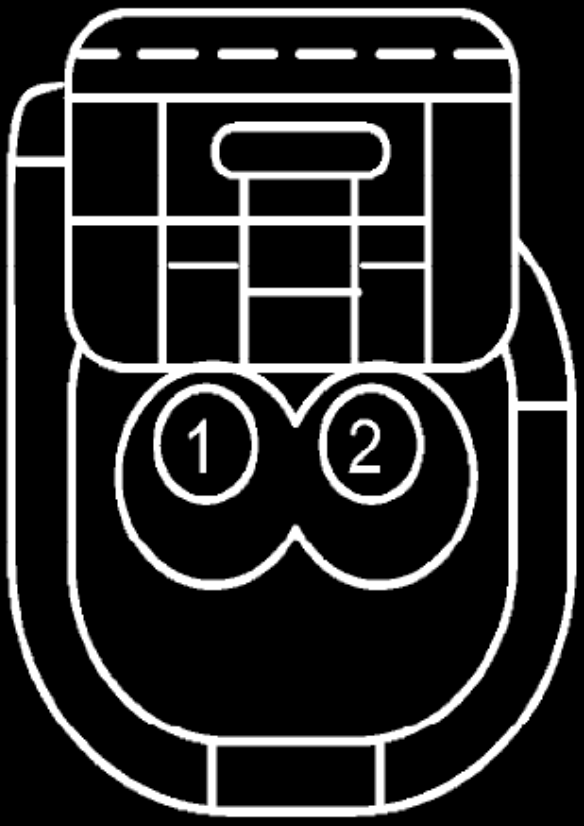
5
6
7
8
A
B
C
D
E
F
Safety belt buckle switch, driver
2027933
C3201
Safety belt buckle pretensioner, driver
C328
C356
Seat position sensor, driver
front of vehicle

View 151-18

Connector: C356

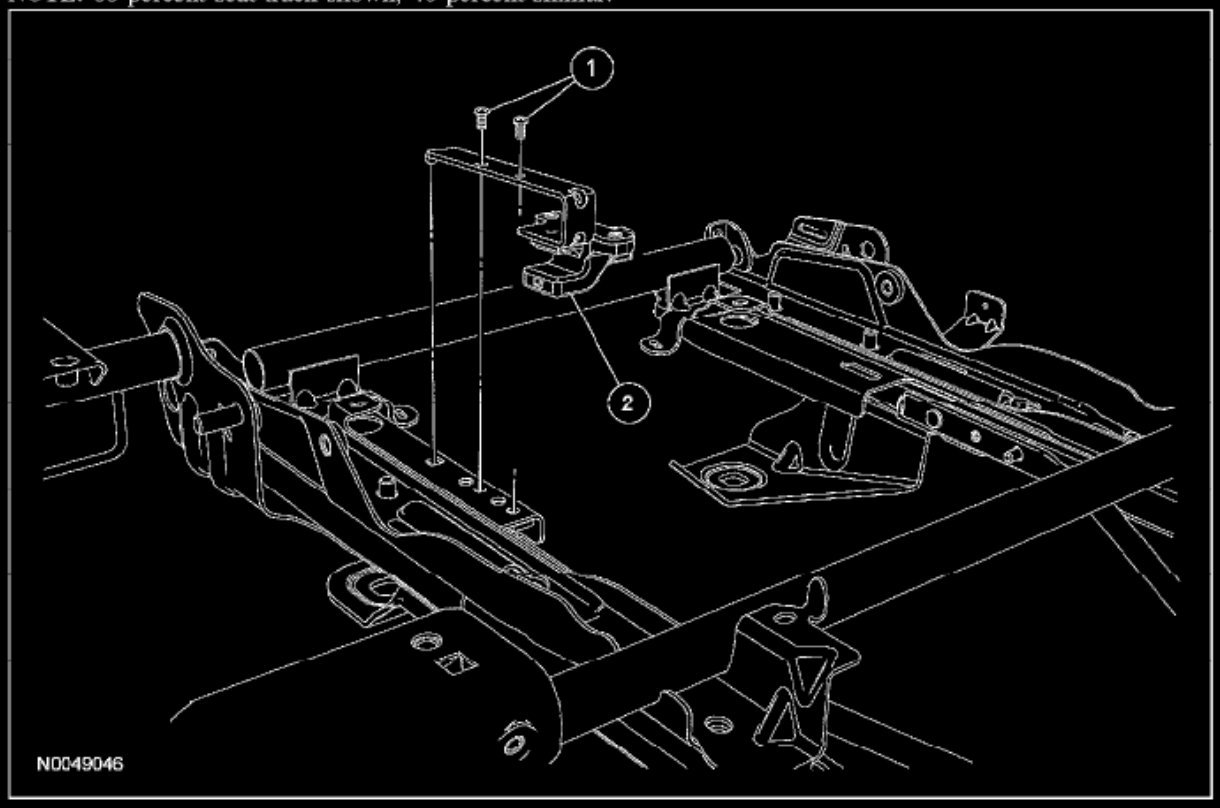
Description:	Harness:	Base Part #:
SEAT POSITION SENSOR, DRIVER	202793	



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD174 (OG)	20	GROUND - TUNNEL	
2	VR215 (OG)	20	SENSOR - SEAT TRACK POSITION DRIVER	

C356

NOTE: 60 percent seat track shown, 40 percent similar.



Item	Part Number	Description
1	—	Seat position sensor and bracket screws
2	14B416	Seat position sensor and bracket

Seat Position Sensor: Service and Repair

SEAT POSITION SENSOR

Removal and Installation

WARNING: Always tighten the seat position sensor retaining bolt to specified torque. Failure to do so may result in incorrect restraint system operation, which increases the risk of personal injury or death in a crash.

NOTE:

- The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a SRS fault.

- The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

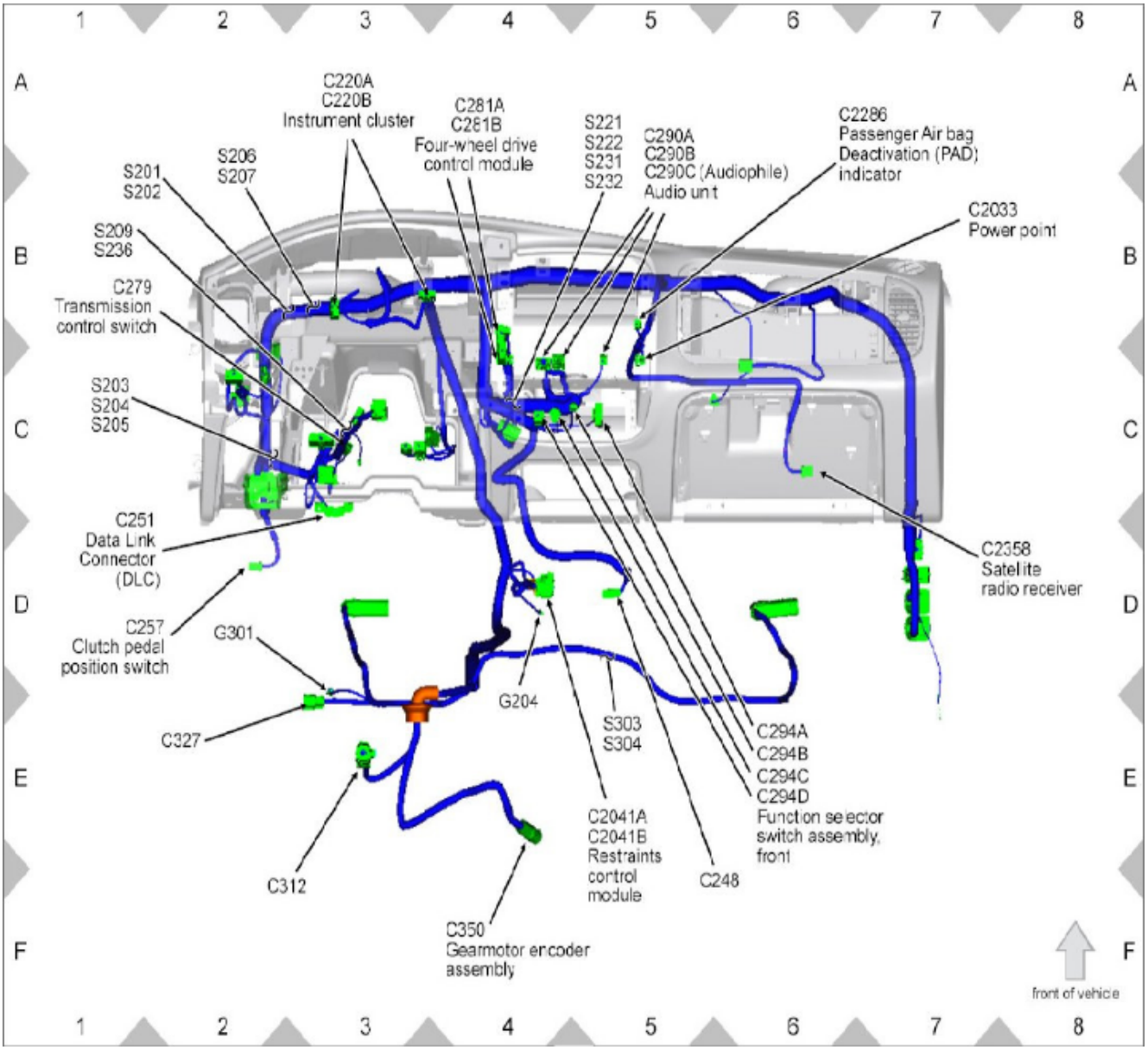
- Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and carry out the diagnostic procedure again.

1. Depower the SRS. 2. Remove the driver seat. 3. Remove the seat track.

4. NOTE: Note the position of the seat position sensor locator tab for installation.

Remove the 2 screws and the seat position sensor and bracket.

5. To install, reverse the removal procedure. 6. Repower the SRS.


1
2
3
4
5
6
7
8
A
B
C
D
E
F
C220A
C220B
Instrument cluster
C281A
C281B
Four-wheel drive control module
S221
S222
S231
S232
C290A
C290B
C290C (Audiophile)
Audio unit
C2286
Passenger Air bag Deactivation (PAD) indicator
C2033
Power point
S201
S202
S206
S207
S209
S236
C279
Transmission control switch
S203
S204
S205
C251
Data Link Connector (DLC)
C257
Clutch pedal position switch
G301
C327
C312
G204
S303
S304
C2041A
C2041B
Restraints control module
C248
C294A
C294B
C294C
C294D
Function selector switch assembly, front
C2358
Satellite radio receiver
C350
Gearmotor encoder assembly
front of vehicle

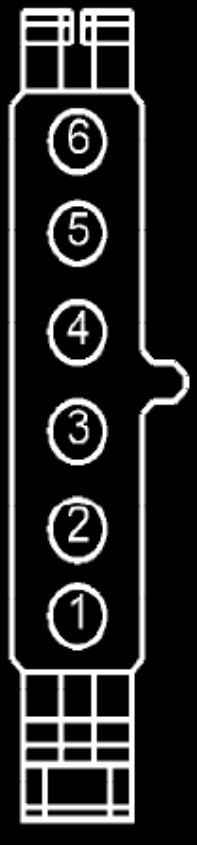
View 151-12

Connector: C257

Description: CLUTCH PEDAL POSITION SWITCH

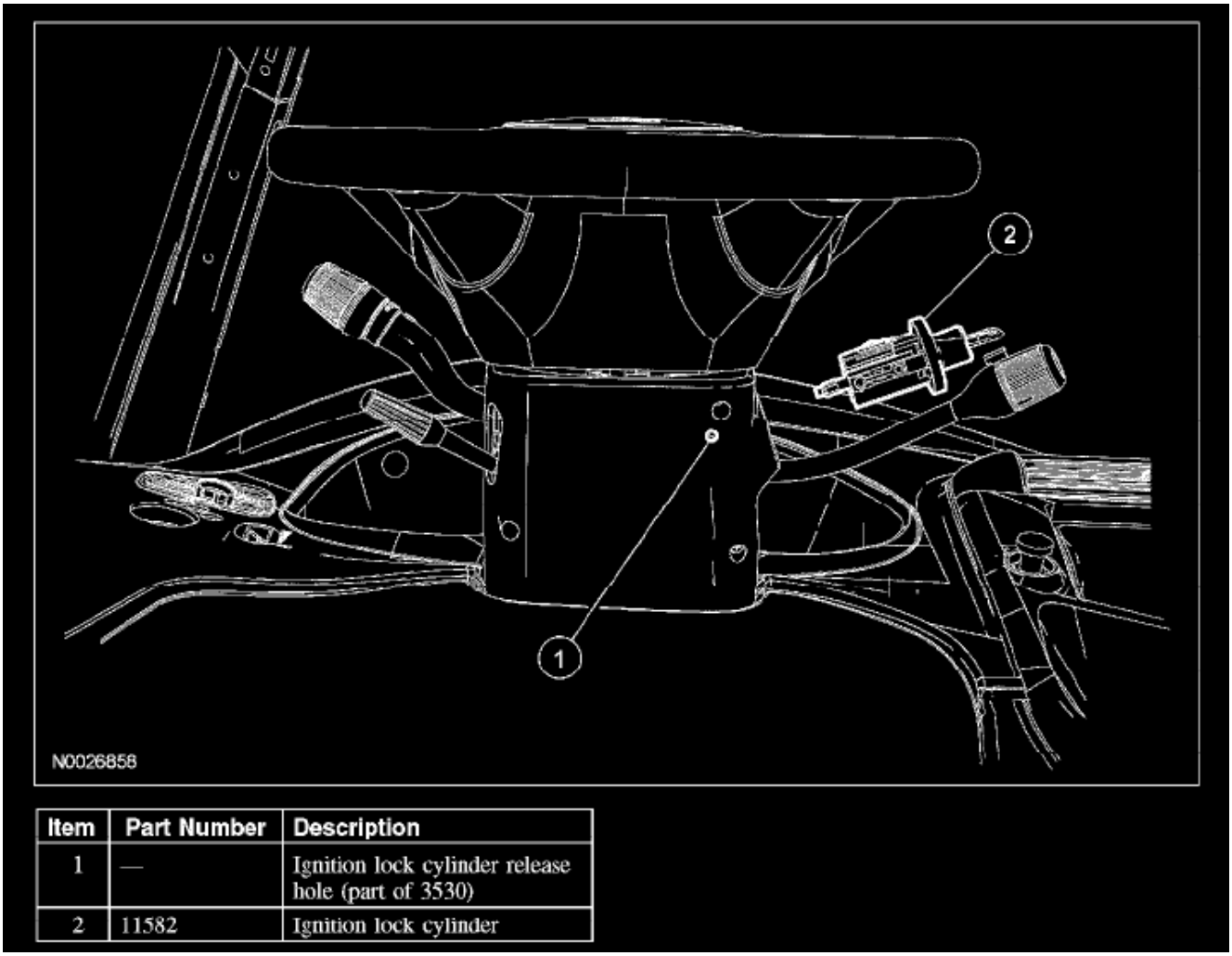
Harness: 14401

Base Part #: 11A152



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE904 (GN-VT)	22	SWITCH - CLUTCH PEDAL POSITION # TOP OF TRAVEL (CPP-TT)	
2	GD174 (BK-WH)	22	GROUND - TUNNEL	
3	CCB15 (BN-GN)	22	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL CLOSED	
4	CCB15 (BN-GN)	22	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL CLOSED	
5	GD174 (BK-WH)	22	GROUND - TUNNEL	
6	CDC36 (GN-BN)	22	SWITCH - START INTERLOCK CLUTCH PEDAL	

C257



Item	Part Number	Description
1	—	Ignition lock cylinder release hole (part of 3530)
2	11582	Ignition lock cylinder

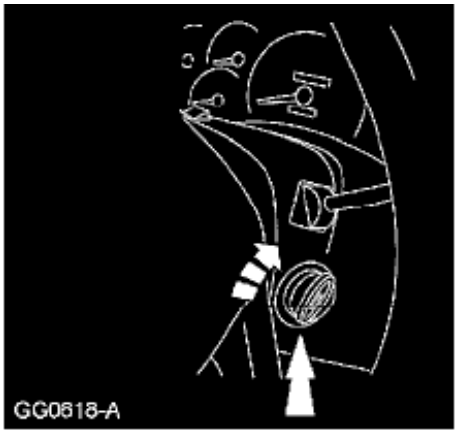
Ignition Switch Lock Cylinder: Service and Repair Ignition Lock Cylinder - Functional

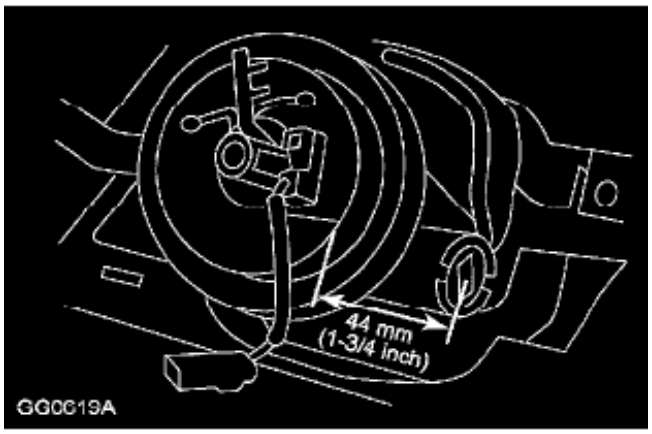
IGNITION LOCK CYLINDER - FUNCTIONAL

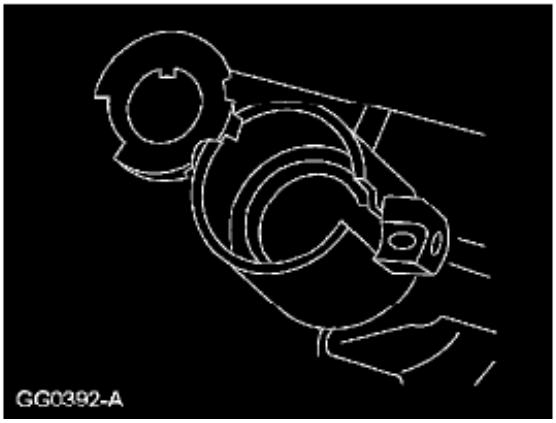
Removal and Installation

1. Disconnect the battery ground cable. 2. Insert the ignition key and turn to the RUN position. 3. Press the ignition lock cylinder release pin and remove the ignition lock cylinder. 4. To install, reverse the removal procedure.

- Verify ignition lock cylinder operation.







Ignition Switch Lock Cylinder: Service and Repair Ignition Lock Cylinder - Non Functional

IGNITION LOCK CYLINDER - NON FUNCTIONAL

Removal and Installation

1. NOTE: Make sure the front wheels are in the straight-ahead position.

Remove the steering wheel assembly.

2. Twist off the cap from the ignition lock cylinder.

3. NOTE: The lock cylinder is repaired by discarding the inoperative lock cylinder and building a new lock cylinder using the appropriate lock

repair package (F85Z-11582-AA). The lock repair package includes a detailed instruction sheet to build the new lock cylinder to the current key code of the vehicle.

Remove the ignition lock cylinder. -

Use a 1/8-inch diameter drill bit to drill out the lock cylinder retaining pin.

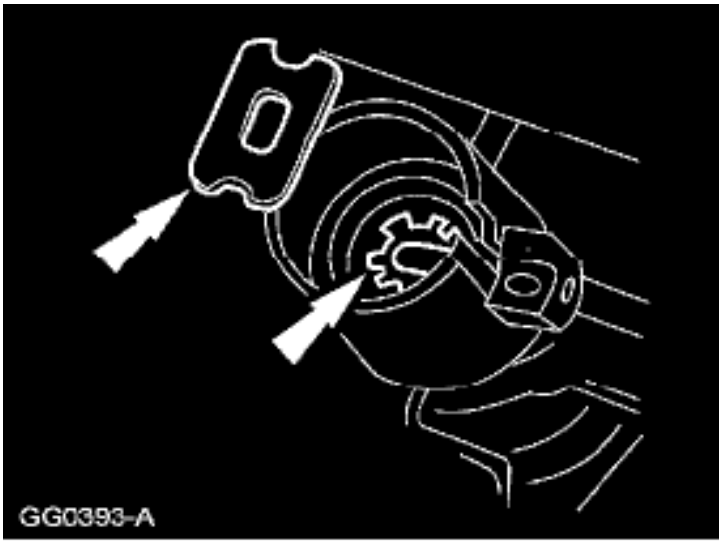
- Use a 3/8-inch drill bit to drill down the middle of the ignition lock key slot until the ignition lock cylinder breaks loose.

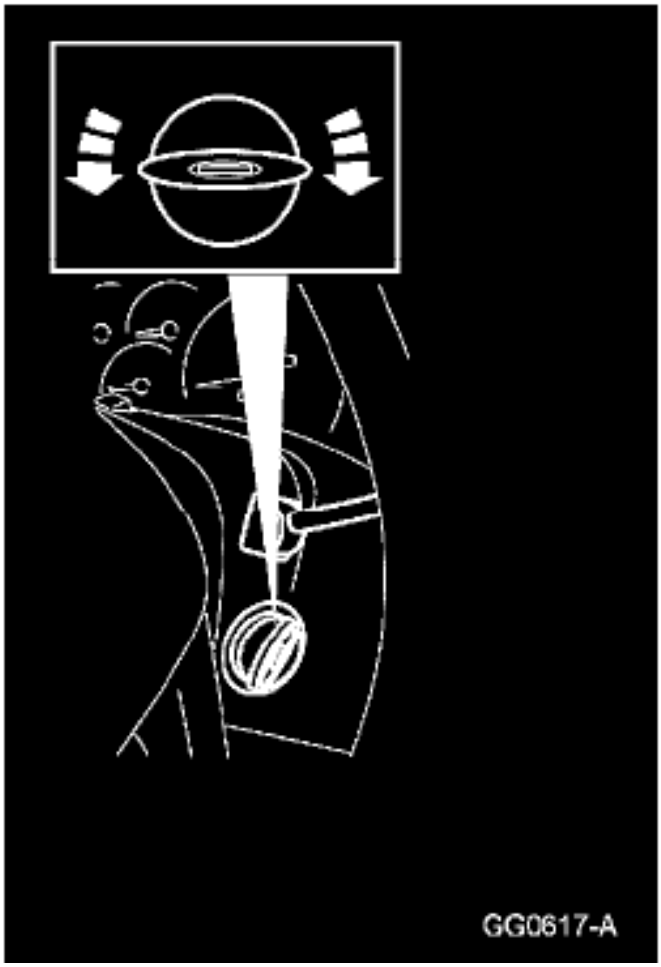
- Remove and discard the ignition lock cylinder and clean the drill shavings from the steering column.

4. Remove the bearing retainer.

5. Remove the bearing and gear.

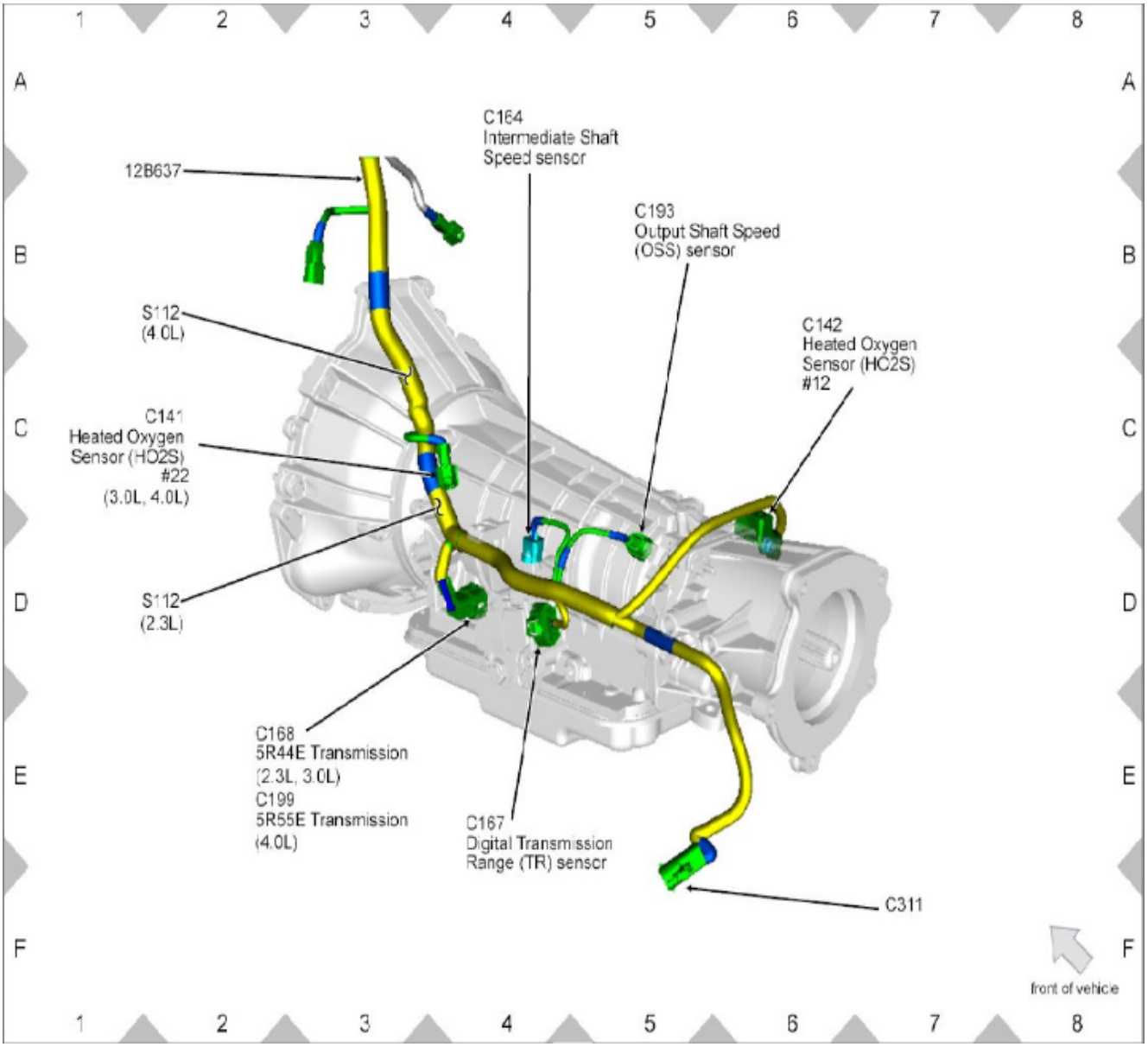
- Thoroughly clean all drill shavings from the steering column and inspect it for damage.





6. To install, reverse the removal procedure.

- Install a new ignition lock cylinder.
- Verify ignition lock cylinder operation.


C164
Intermediate Shaft Speed sensor
12B637
C193
Output Shaft Speed (OSS) sensor
S112
(4.0L)
C142
Heated Oxygen Sensor (HO2S) #12
C141
Heated Oxygen Sensor (HO2S) #22
(3.0L, 4.0L)
S112
(2.3L)
C168
5R44E Transmission
(2.3L, 3.0L)
C199
5R55E Transmission
(4.0L)
C167
Digital Transmission Range (TR) sensor
C311
front of vehicle

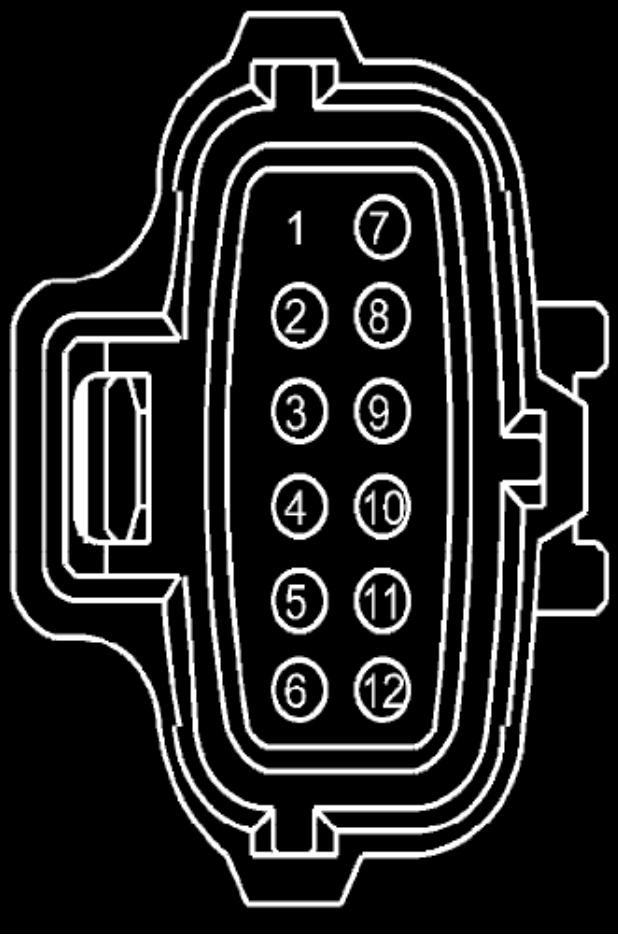
View 151-10

Connector: C167

Description: DIGITAL TRANSMISSION RANGE (TR) SENSOR

Harness: 12B637

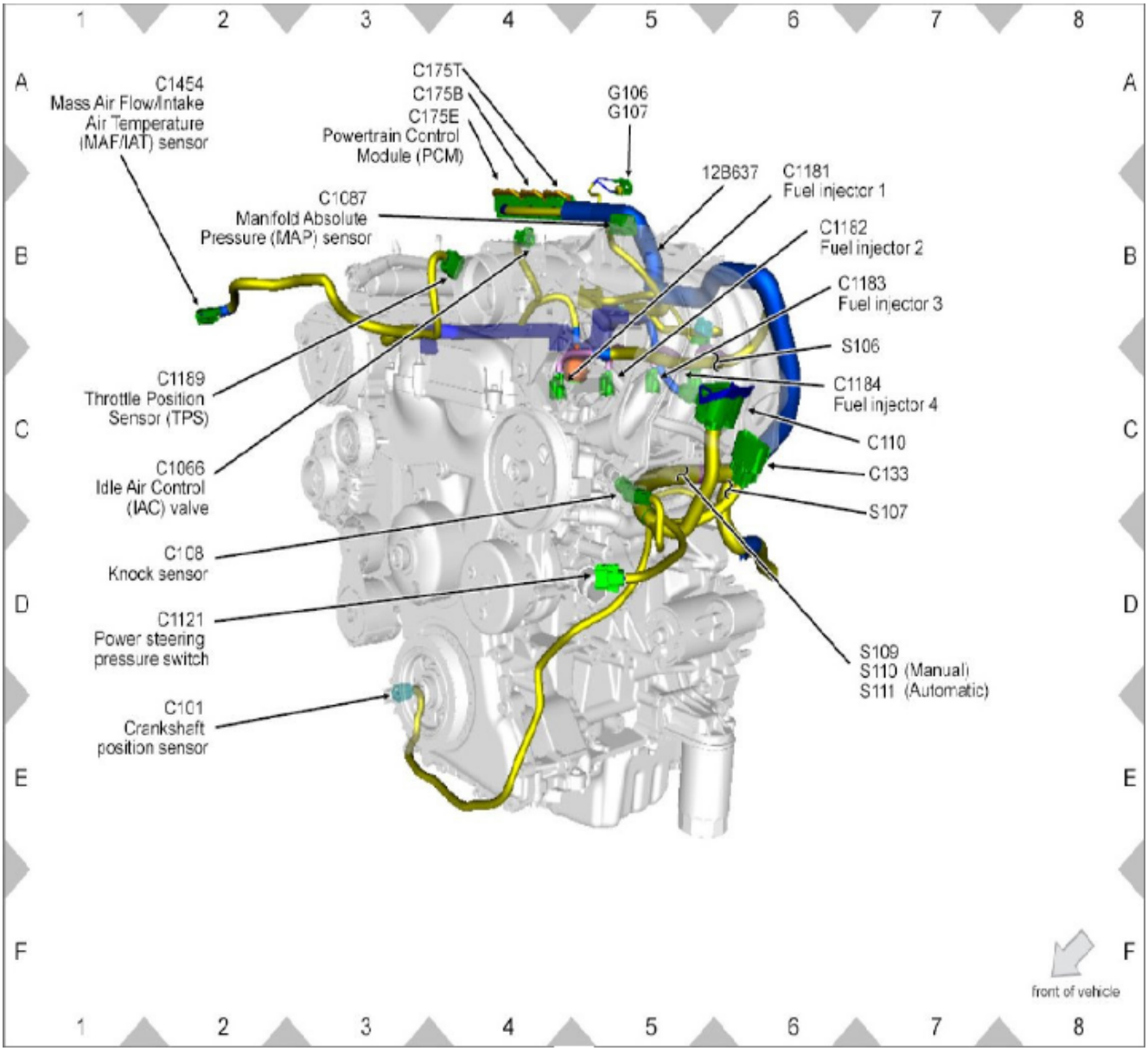
Base Part #: 7F293



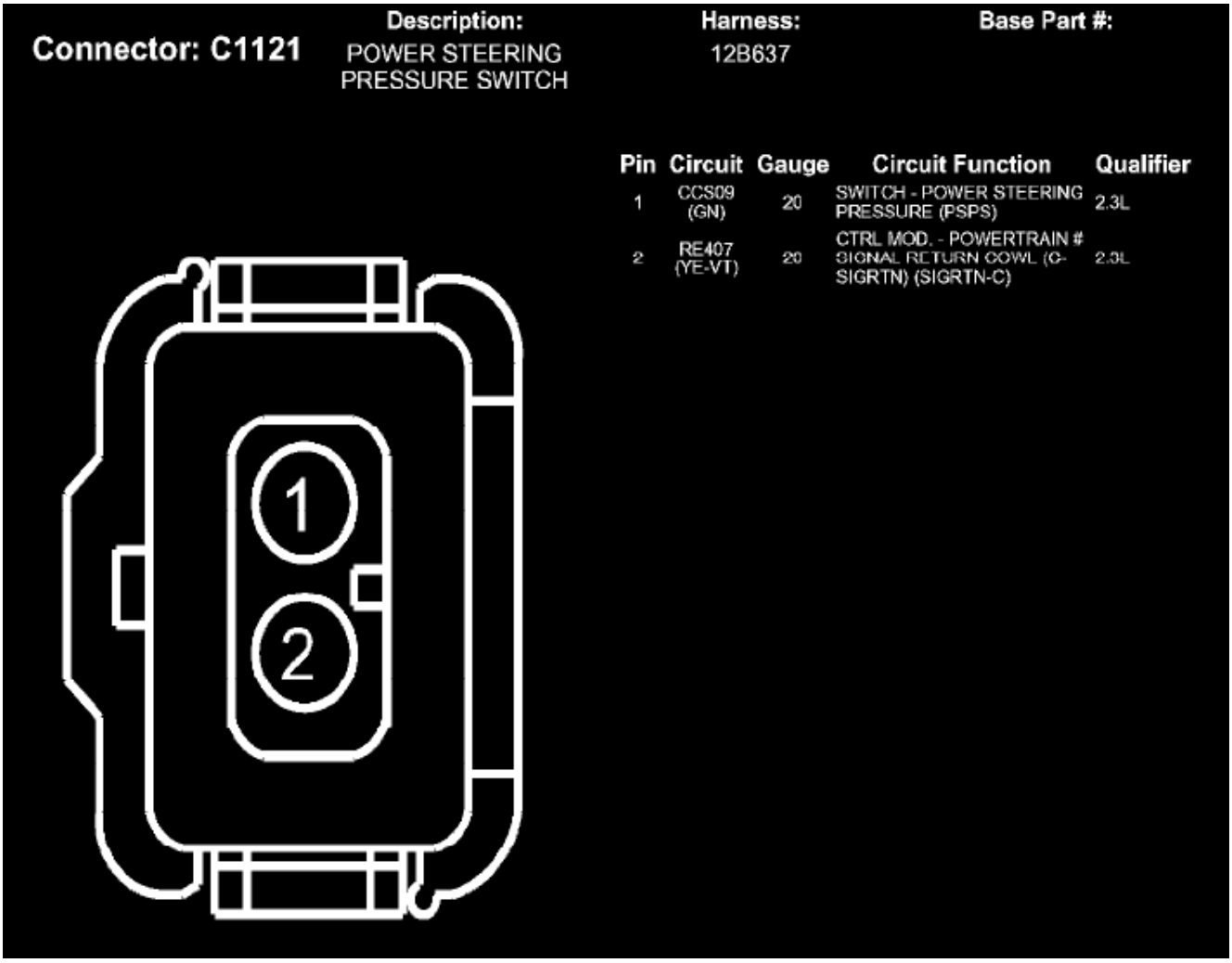
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	RE406 (GY-VT)	18	SIGNAL RETURN	
3	VET28 (GY-VT)	20	TR3A	
4	VET29 (VT-WH)	20	TR1	
5	VET30 (YE)	20	TR2	
6	VET31 (BU-OG)	20	TR4	
7	GD108 (BK-VT)	18	GROUND	4x4
8	CCF20 (GY-VT)	20	NETURAL SENSE	4x4
9	CBP20 (YE-VT)	18	FUSED POWER FEED	
10	CET40 (GN-OG)	20	STARTER CONTROL	
11	CET41 (BN-YE)	18	BACK UP	
12	CBP21 (BU-GY)	20	STARTER TO STARTER INTERRUPT RELAY	

C167

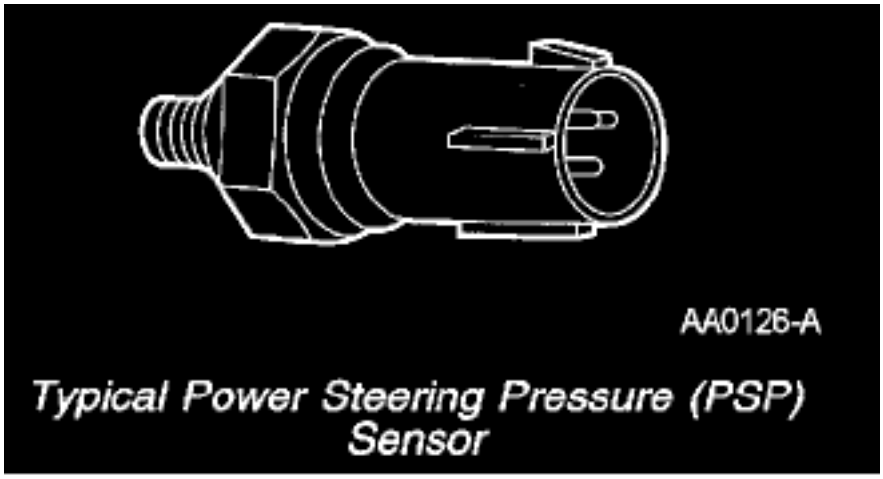
Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Sensors and Switches > Sensors and Switches - Steering and Suspension > Sensors and Switches - Steering > Power Steering Pressure Switch > Component Information > Locations



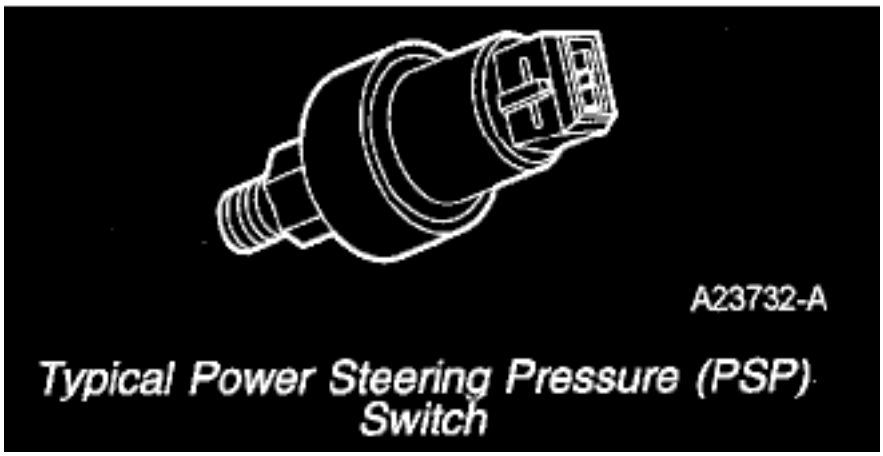
View 151-3


Connector: C1121
Description:
POWER STEERING PRESSURE SWITCH
Harness:
12B637
Base Part #:
Pin Circuit Gauge Circuit Function Qualifier
1 CCS09 (GN) 20 SWITCH - POWER STEERING PRESSURE (PSPS) 2.3L
2 RE407 (YE-VT) 20 CTRL MOD. - POWERTRAIN # SIGNAL RETURN COWL (C-SIGRTN) (SIGRTN-C) 2.3L
1
2

C1121



Typical Power Steering Pressure (PSP) Sensor



Typical Power Steering Pressure (PSP) Switch

Power Steering Pressure Switch: Description and Operation

Power Steering Pressure (PSP) Sensor

Typical Power Steering Pressure (PSP) Sensor

The PSP sensor monitors the hydraulic pressure within the power steering system. The PSP sensor voltage input to the PCM changes as the hydraulic pressure changes. The PCM uses the input signal from the PSP sensor to compensate for additional loads on the engine by adjusting the

idle RPM and preventing engine stall during parking maneuvers. Also, the PSP sensor signals the PCM to adjust the transmission electronic pressure control (EPC) pressure during increased engine load, for example, during parking maneuvers.

Power Steering Pressure (PSP) Switch

Typical Power Steering Pressure (PSP) Switch

The PSP switch monitors the hydraulic pressure within the power steering system. The PSP switch is a normally closed switch that opens as the hydraulic pressure increases. The PCM provides a low current voltage on the PSP circuit. When the PSP switch is closed, this voltage is pulled low through the SIG RTN circuit. The PCM uses the input signal from the PSP switch to compensate for additional loads on the engine by adjusting the idle RPM and preventing engine stall during parking maneuvers. Also, the PSP switch signals the PCM to adjust the transmission electronic pressure control (EPC) pressure during increased engine load, for example during parking maneuvers.

Special Tool(s)

ST2941-A	Activation Tool, Tire Pressure Monitor 204-363
ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Tire Pressure Sensor: Testing and Inspection Tire Pressure Monitoring System (TPMS) Sensor Training

Tire Pressure Monitoring System (TPMS) Sensor Training

NOTE: If the vehicle has been stationary for more than 30 minutes, the sensors will go into a "sleep mode" to conserve battery power. It will be necessary to wake them up so they will transmit the latest tire pressure information to the smart junction box (SJB). For additional information, refer to Tire Pressure Monitoring System (TPMS) Sensor Activation.

NOTE: The tire pressure sensor training procedure must be done on a single vehicle, in an area without radio frequency noise and at least 1 m (3 ft) away from other vehicles equipped with tire pressure monitoring system (TPMS). Radio frequency noise is generated by electrical motors and appliance operation, cellular telephones, remote transmitters, power inverters and portable entertainment equipment.

NOTE: If a sensor does not respond to the activation tool, attempt to activate the same sensor with the activation tool. If the sensor still does not respond, move the vehicle to rotate the wheels at least 1/4 of a turn and attempt to activate the same sensor again.

NOTE: The SJB has a 2-minute time limit between sensor responses. If the SJB does not recognize any 1 of the 4 tire pressure sensors during this time limit, the horn will sound twice and the message center (if equipped) will display TIRE NOT TRAINED REPEAT and the entire procedure must be repeated.

1. NOTE: For vehicles with different front and rear tire pressures (such as the E-Series and certain F-Series), the tire pressure sensors must be

trained following a tire rotation. Failure to train the sensors will cause the TPMS indicator to illuminate. For vehicles with the same tire pressure for front and rear tires, tire rotation will not affect the system.

Turn the ignition switch to the OFF position, then press and release the brake pedal.

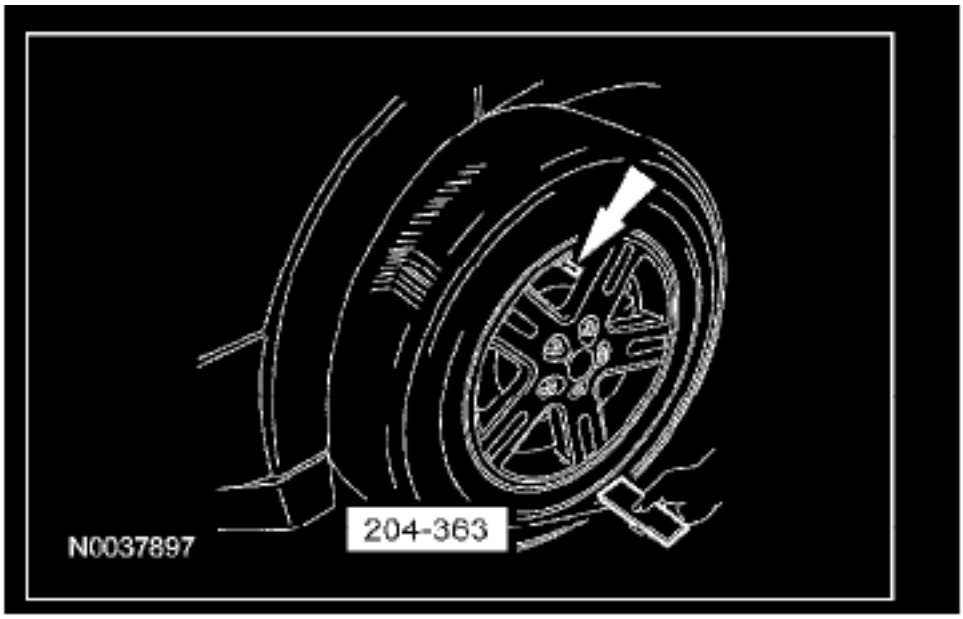
2. Cycle the ignition switch from the OFF position to the RUN position 3 times, ending in the RUN position. 3. Press and release the brake pedal. 4. Turn the ignition switch to the OFF position. 5. Turn the ignition switch from the OFF position to the RUN position 3 times, ending in the RUN position.

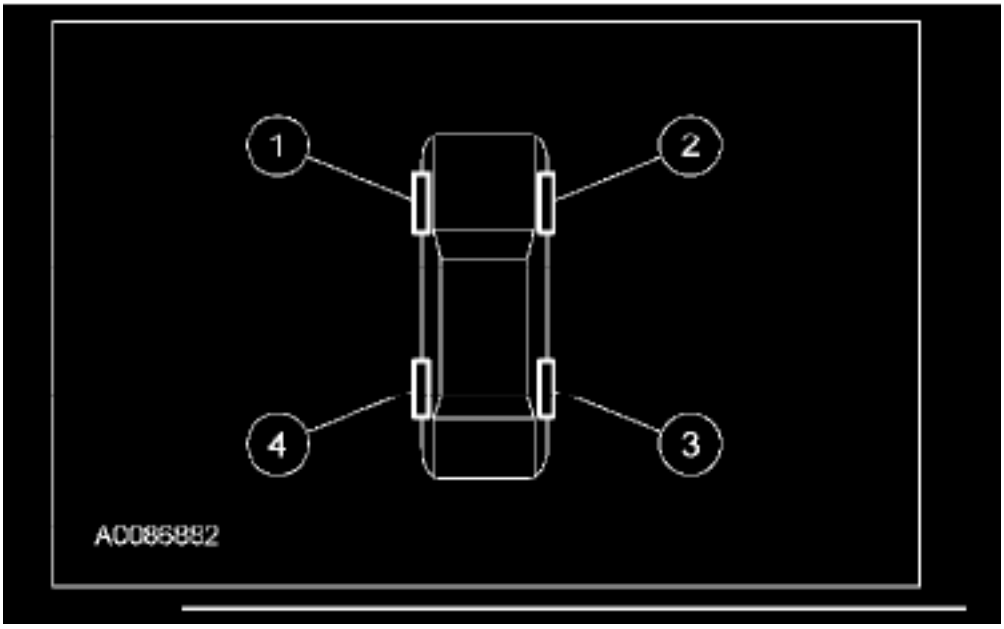
^ The horn will sound once and the TPMS indicator will flash if the training mode has been entered successfully. If equipped, the message center will display TRAIN LF TIRE.

6. NOTE: It may take up to 6 seconds to activate a tire pressure sensor. During this time, the activation tool must remain in place 180 degrees from

the valve stem.

Place the activation tool on the LF tire sidewall opposite (180 degrees) from the valve stem. Press and release the test button on the special tool. The horn will sound briefly to indicate that the tire pressure sensor has been recognized by the SJB.





7. Within 2 minutes of the horn sounding, place the activation tool on the RF tire sidewall opposite (180 degrees) from the valve stem and press and

release the test button to train the RF tire pressure sensor.

8. NOTE: Do not wait more than 2 minutes between training each sensor or the SJB will time out and the entire procedure must be repeated.

Repeat Step 7 for the RR and LR tires. ^

The procedure is completed after the last tire has been trained. When the training procedure is complete, the message center (if equipped) will display TIRE TRAINING COMPLETE.

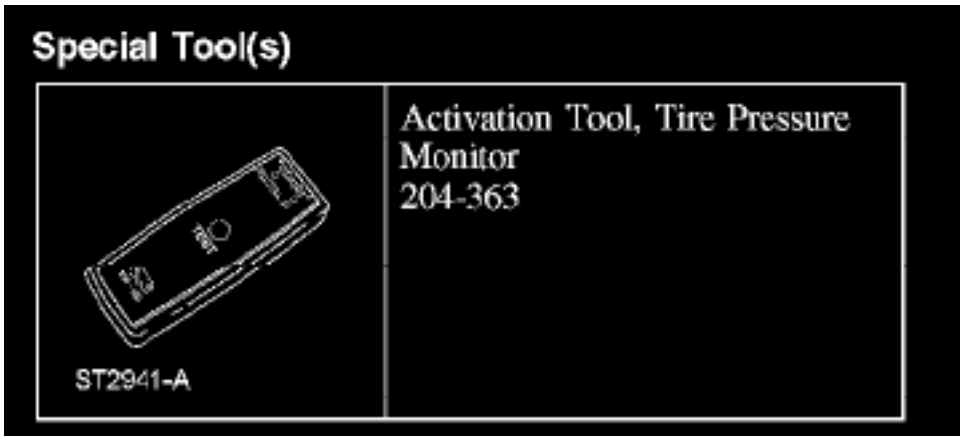
^ For vehicles not equipped with a message center, successful completion of the training procedure will be verified by turning the ignition switch to the OFF position without the horn sounding. If the horn sounds twice when the switch is turned to the OFF position, the training procedure was not successful.

9. Using the scan tool, locate the updated TPMS sensor IDs trained to the SJB and document them on the applicable warranty claim.

10. NOTE: This step is required to clear DTC C2780, cause the SJB to exit the manufacturing mode and to make sure there are no other concerns

with a newly programmed SJB.

If the sensors are being trained due to the installation of a new SJB, clear any DTCs and perform the SJB on-demand self test.



Tire Pressure Sensor: Testing and Inspection Tire Pressure Monitoring System (TPMS) Sensor Activation

Tire Pressure Monitoring System (TPMS) Sensor Activation

NOTE: The tire pressure sensors will go into a 14 sleep mode" after 30 minutes of inactivity to conserve battery power. The sensors do not transmit information while in sleep mode, it will be necessary to wake them up so they will transmit the latest tire pressure information.

1. Turn the ignition switch to the ON position. 2. Position the tire pressure monitor activation tool against the LF tire sidewall 180 degrees from the tire valve stem.

3. NOTE: The activation tool will provide feedback in the form of a flashing green light and a beep sound for each successful response from a tire

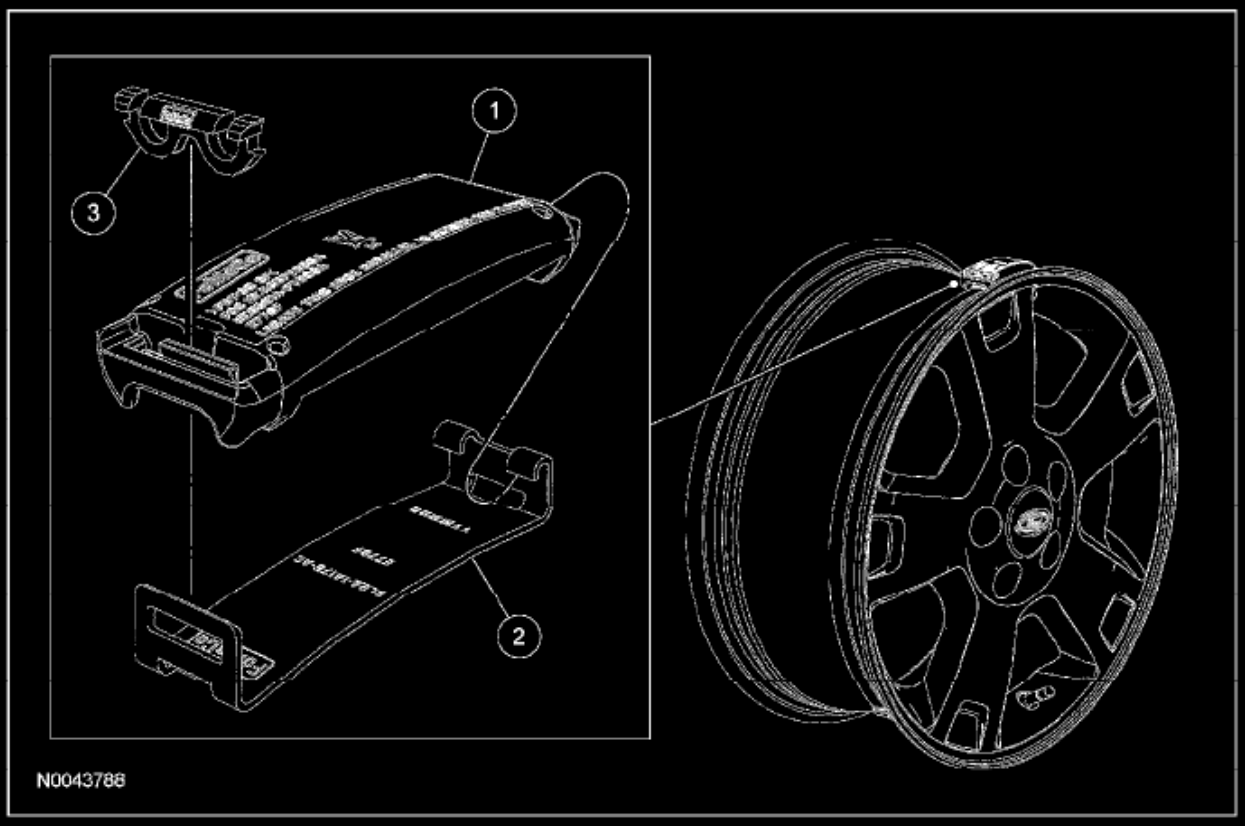
pressure sensor.

Press the test button on the activation tool to activate the sensor, activate the sensor at least 2 times.

4. Repeat Steps 2 and 3 for the remaining tires. 5. If the tire pressure monitoring system (TPMS) indicator remains illuminated after adjusting and activating each sensor, refer to the Symptom Chart

in Diagnosis and Testing.

Tire Pressure Monitoring System (TPMS) Sensor



Item	Part Number	Description
1	1A150/1A189	Tire pressure sensor/sensor kit
2	1A175	Sensor cradle

(Continued)

Item	Part Number	Description
3	14C202	Locking clip (also part of 1A189)

Tire Pressure Sensor: Service and Repair Tire Pressure Monitoring System (TPMS) Sensor

Tire Pressure Monitoring System (TPMS) Sensor

Tire Pressure Monitoring System (TPMS) Sensor

Disassembly

WARNING: The tire pressure monitoring system (TPMS) sensor battery may release hazardous chemicals if exposed to extreme mechanical damage. If these chemicals contact the skin or eyes, flush immediately with water for a minimum of 15 minutes and get prompt medical attention. If any part of the battery is swallowed, contact a physician immediately. When disposing of TPMS sensors, follow the correct procedures for hazardous material disposal. Failure to follow these instructions may result in serious personal injury.

NOTE: Tire pressure sensors are equipped with Lithium-ion batteries and must be disposed of accordingly.

NOTE: Tire pressure sensors are manufactured in multiple colors based on their application. When installing a new sensor, make sure the color of the sensor being installed matches the color of the sensor that was removed. The different colored sensors are not interchangeable.

NOTE: The sensor can be removed and installed without removing the strap or the cradle.

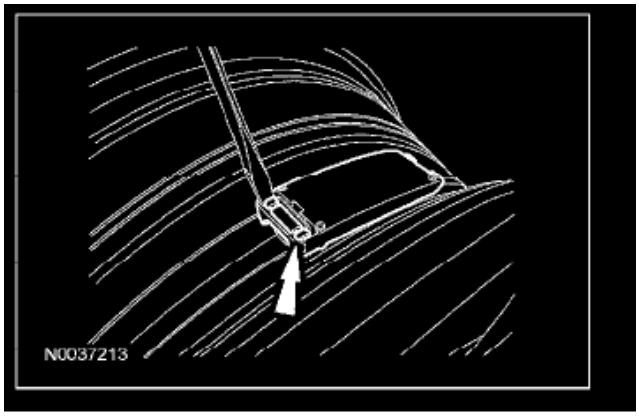
1. CAUTION: The sensor, cradle and strap may be damaged by incorrect tire mounting or dismounting. Dismount the tire only as

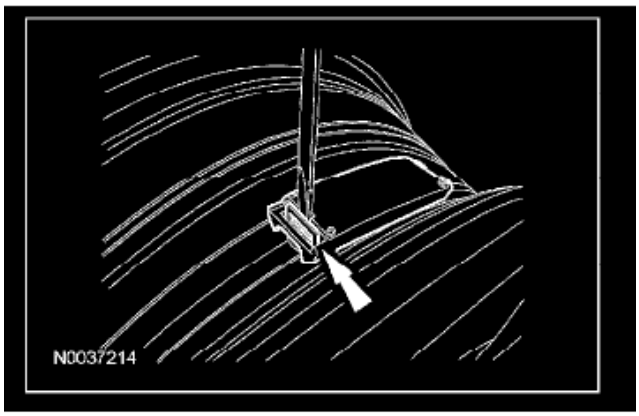
instructed.

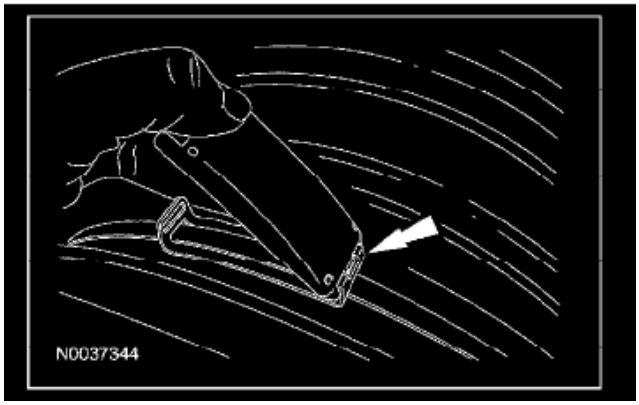
Remove the tire from the wheel.

2. CAUTION: Do not use a large screwdriver. Apply minimum force during removal or damage to the sensor locking clip may occur.

Using a pocket screwdriver or similar tool, remove the sensor locking clip.







3. CAUTION: Do not use a large screwdriver. Apply minimum force during removal or damage to the sensor may occur.

Using a pocket screwdriver or similar tool, detach the sensor from the cradle.

4. Remove the sensor.

Assembly

1. CAUTION: Damage to the sensor may occur if excessive force is applied during sensor installation.

NOTE: Make sure the sensor is fully seated into the cradle. The sensor will make a "click" noise when correctly seated.

Position the sensor into the cradle by inserting the hinge end of the sensor into the hook end of the cradle and pushing the opposite end of the sensor down onto the cradle.

2. NOTE: The locking clip can only be fully seated when installed in the correct orientation. If the sensor locking clip cannot be fully inserted, then

the sensor may not be fully seated on the cradle or the locking clip may be inserted backward.

Insert a new locking clip into the sensor.

3. CAUTION: The sensor, cradle and strap may be damaged by incorrect tire mounting or dismounting. Mount the tire only as instructed.

Install the tire onto the wheel.

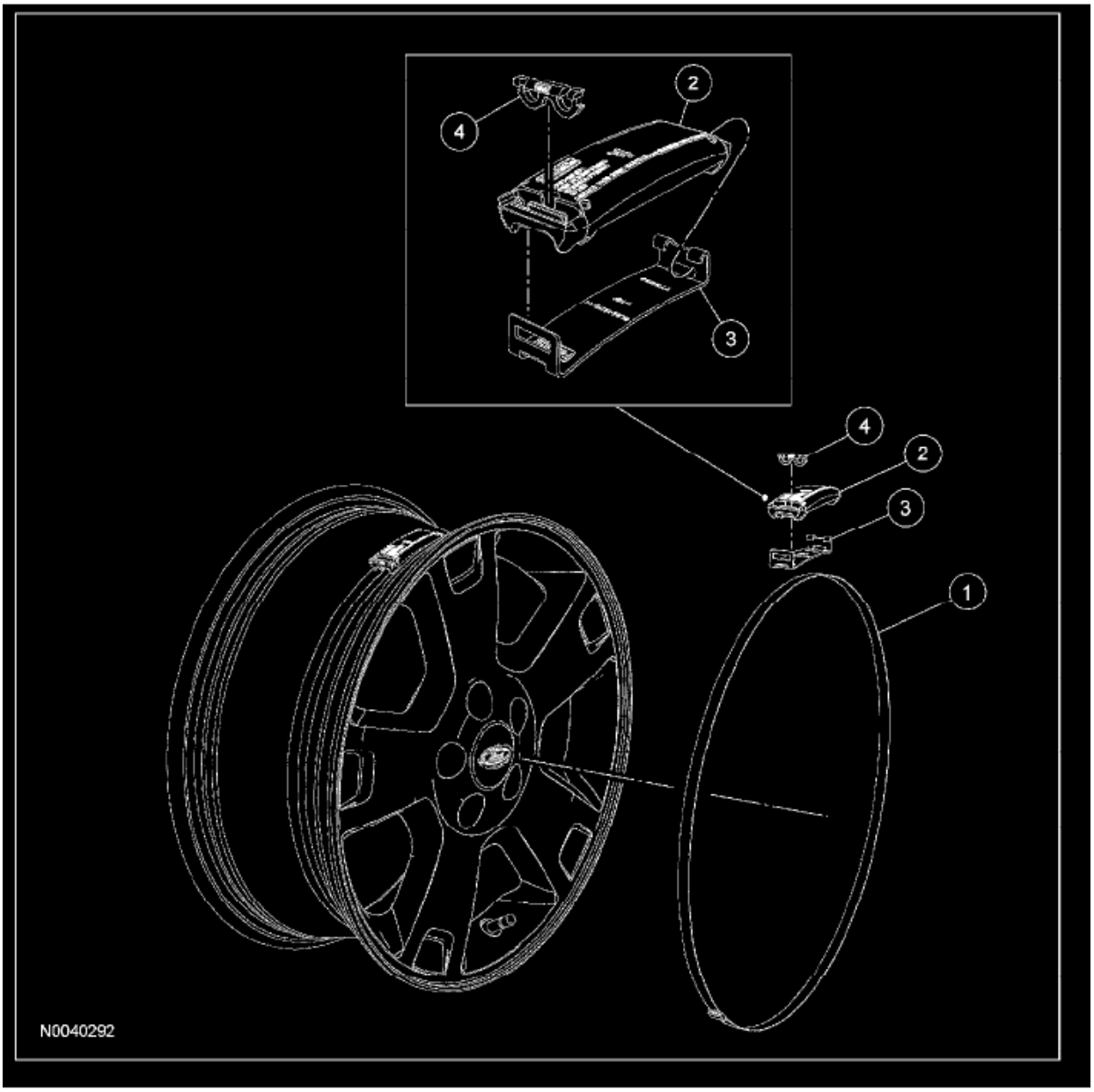
4. NOTE: A new tire pressure sensor is shipped in an off mode (or battery saver mode) and must be turned on before it can be trained. To turn the

sensor on, install it on a wheel, mount the tire and inflate the tire to the recommended inflation pressure. Wait at least 2 minutes, then continue with the sensor training procedure.

Train the tire pressure sensor(s).

Material

Item	Specification
Wheel and Tire Cleaner ZC-27-A or B	—

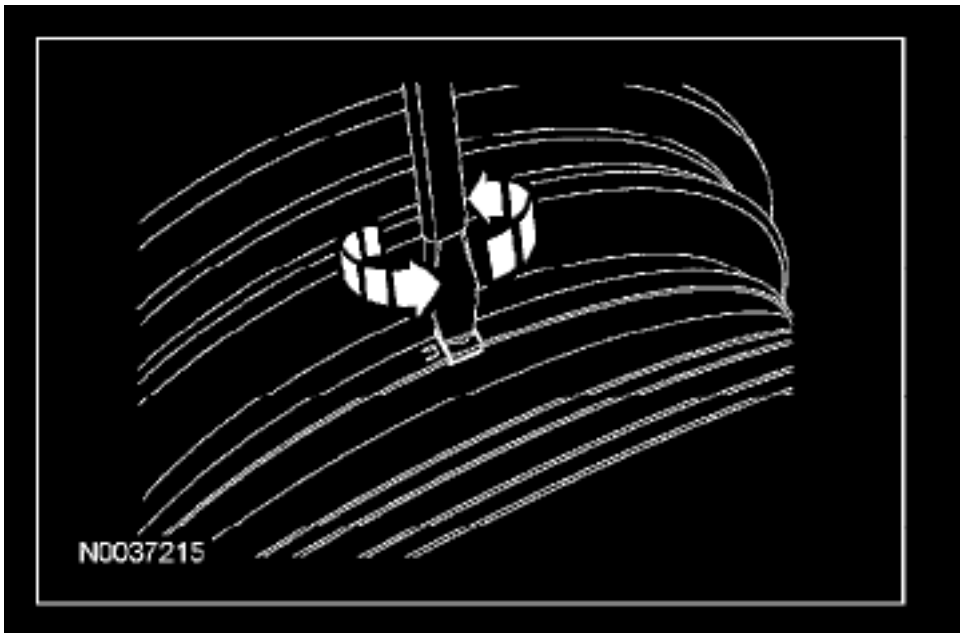


Item	Part Number	Description
1	1A177/1A193	Strap/strap kit
2	1A150/1A189	Tire pressure sensor/sensor kit
3	1A175	Sensor cradle (also part of 1A193)
4	14C202	Locking clip (also part of 1A189)

Tire Pressure Sensor: Service and Repair Tire Pressure Monitoring System (TPMS) Strap and Cradle

Tire Pressure Monitoring System (TPMS) Strap and Cradle

Disassembly



WARNING: The tire pressure monitoring system (TPMS) sensor battery may release hazardous chemicals if exposed to extreme mechanical damage. If these chemicals contact the skin or eyes, flush immediately with water for a minimum of 15 minutes and get prompt medical attention. If any part of the battery is swallowed, contact a physician immediately. When disposing of TPMS sensors, follow the correct procedures for hazardous material disposal. Failure to follow these instructions may result in serious personal injury.

NOTE: Tire pressure sensors are equipped with Lithium-ion batteries and must be disposed of accordingly.

NOTE: Tire pressure sensors are manufactured in multiple colors based on their application. When installing a new sensor, make sure the color of the sensor being installed matches the color of the sensor that was removed. The different colored sensors are not interchangeable.

NOTE: The sensor is available separately, the cradle and strap are available as a strap kit. There are several different strap kits available based on wheel diameter but all strap kits share the same base part number.

1. Remove the tire pressure monitoring system (TPMS) sensor.

2. WARNING: Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.

WARNING: Wear protective gloves when handling components or parts that have pointed or sharp edges. Failure to follow this instruction may result in serious personal injury.

Remove a factory installed strap in the following sequence: 1

Locate the strap buckle and secure the strap to the wheel using duct tape or a similar item, on both sides of the buckle approximately 25 mm (0.98 inch) from the buckle.

2 Using a large screwdriver and a twisting motion, unbuckle the strap.

3 Discard the strap.

3. To remove a dealer installed strap, turn the worm gear screw until the strap is fully released from the worm gear.

^ Discard the strap.

4. NOTE: To aid assembly, mark the location of the cradle prior to disassembly.

Using a screwdriver, or similar tool, remove the cradle by inserting the screwdriver under the cradle and prying up.

Assembly

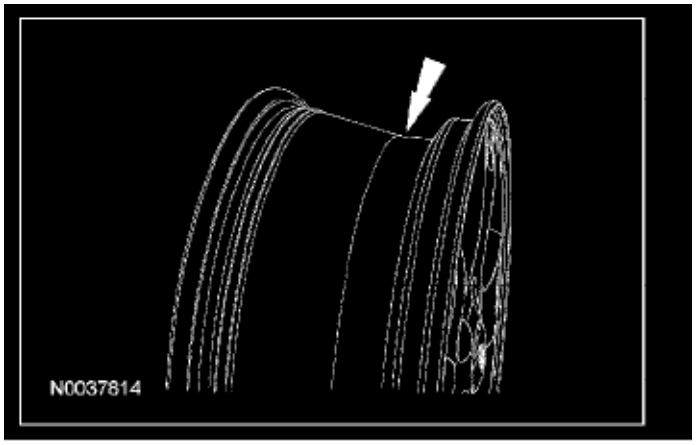
1. NOTE: Make sure the sensor is fully seated into the new cradle. The sensor will make a "click" noise when fully seated.

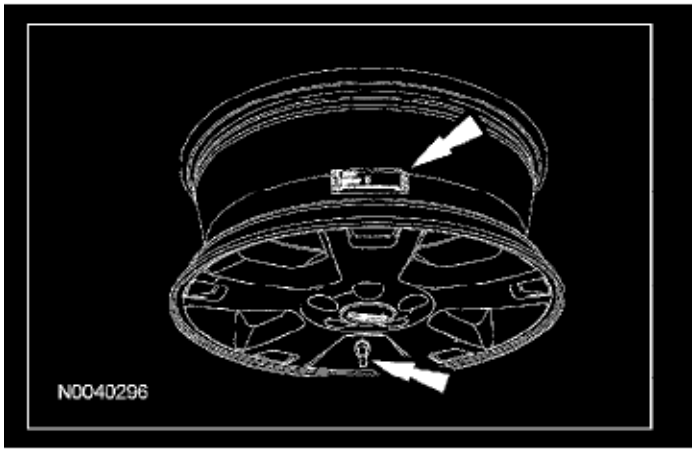
Position the sensor into the new cradle by inserting the hinge end of the sensor into the hook end of the cradle and pushing the opposite end of the sensor down onto the cradle.

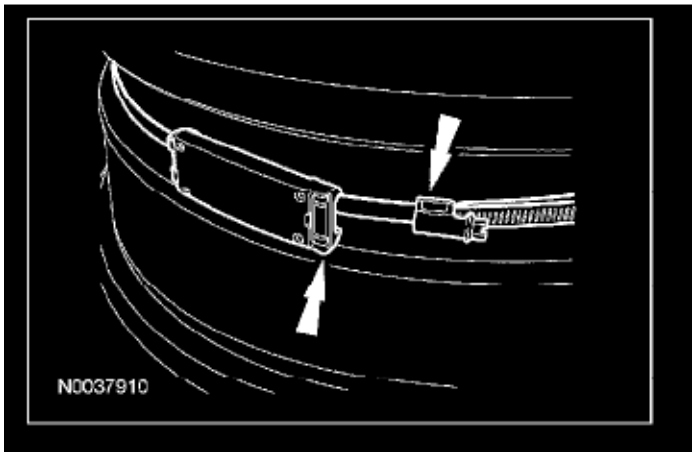
2. CAUTION: Metal scrapers may damage the wheel. Use only plastic or non-metallic scrapers to remove the cradle adhesive strip residue.

NOTE: The sensor and cradle must be installed in the drop well of the wheel, 180 degrees from the valve stem.

Clean the area where the sensor and cradle are to be installed.







3. NOTE: The sensor and cradle must be positioned with the hinge side of the sensor on the RH side when viewed from the curb side (beauty side)

of the wheel.

NOTE: The sensor has raised markings indicating how to position the sensor.

Remove the adhesive tape liner from the cradle and position the sensor and cradle into the wheel drop well 180 degrees from the valve stem.

4. Install the tapered end of the strap through the opening of the cradle on the hinge side of the sensor. This will position the worm gear on the

locking clip side of the sensor.

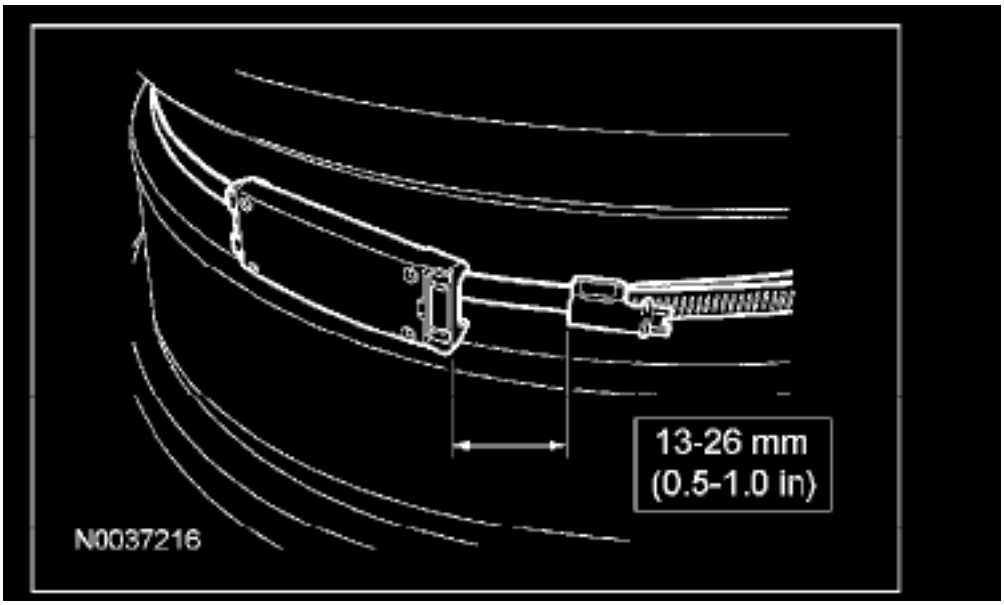
5. CAUTION: Steel wheels have a "high spot" along their circumference. Make sure the strap and sensor are mounted at the lowest spot

possible to avoid damaging the sensor during wheel and tire disassembly and assembly.

NOTE: Keep the strap parallel with the wheel flange while tightening the worm gear.

Position the worm gear 13-26 mm (0.5-1.0 inch) away from the sensor and tighten the worm gear.
^

Tighten to 3 Nm (27 lb-inch).



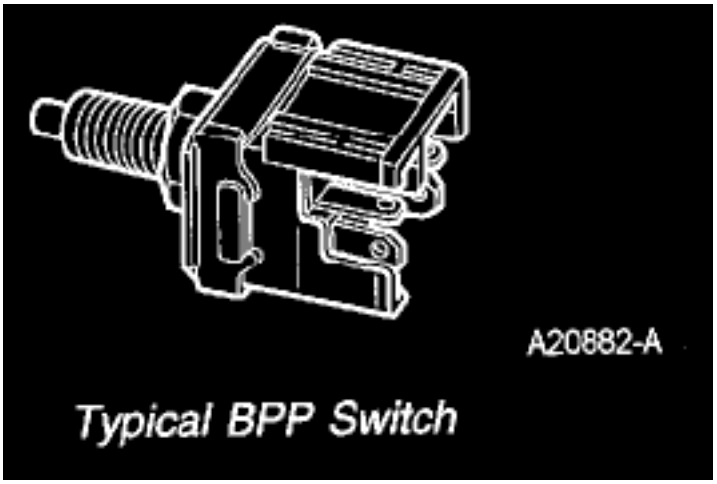
6. CAUTION: The sensor, cradle and strap may be damaged by incorrect tire mounting or dismounting. Mount the tire only as instructed.

Install the tire onto the wheel.

7. NOTE: A new tire pressure sensor is shipped in an off mode (or battery saver mode) and must be turned on before it can be trained. To turn the

sensor on, install it on a wheel, mount the tire and inflate the tire to the recommended inflation pressure. Wait at least 2 minutes, then continue with the sensor training procedure.

Train the tire pressure sensor(s).



Brake Switch - TCC: Description and Operation

BRAKE PEDAL POSITION (BPP) SWITCH

Typical BPP Switch

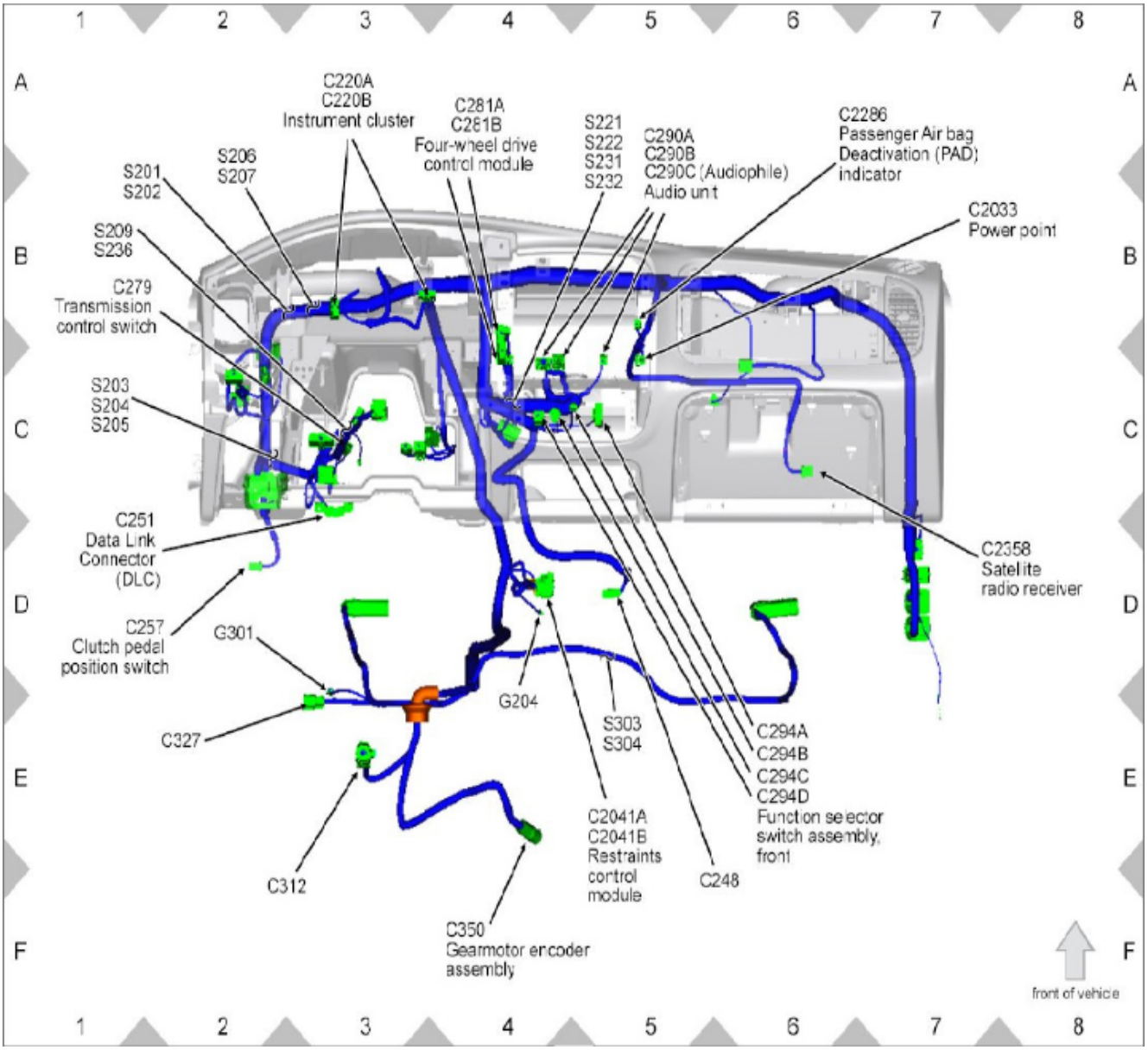
The BPP switch is sometimes referred to as the stoplamp switch. The BPP switch provides a signal to the PCM indicating that the brakes are applied. The BPP switch is normally open and is mounted on the brake pedal support. Depending on the vehicle application the BPP switch can be hardwired as follows:

- to the PCM supplying battery positive voltage (B+) when the vehicle brake pedal is applied.

- to the antilock brake system (ABS) module, or lighting control module (LCM), the BPP signal is then broadcast over the network to be received by the PCM.

- to the ABS traction control/stability assist module. The ABS module interprets the BPP switch input along with other ABS inputs and generates an output called the driver brake application (DBA) signal. The DBA signal is then sent to the PCM and to other BPP signal users.

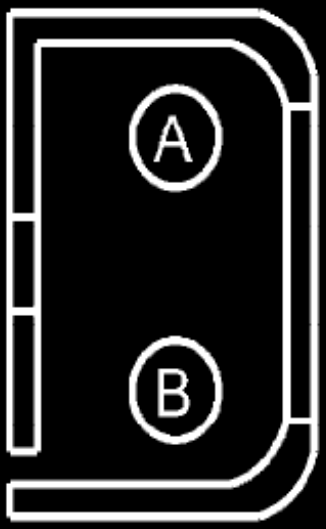
Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Sensors and Switches > Sensors and Switches - Transmission and Drivetrain > Sensors and Switches - A/T > Transmission Mode Switch, A/T > Component Information > Locations



View 151-12

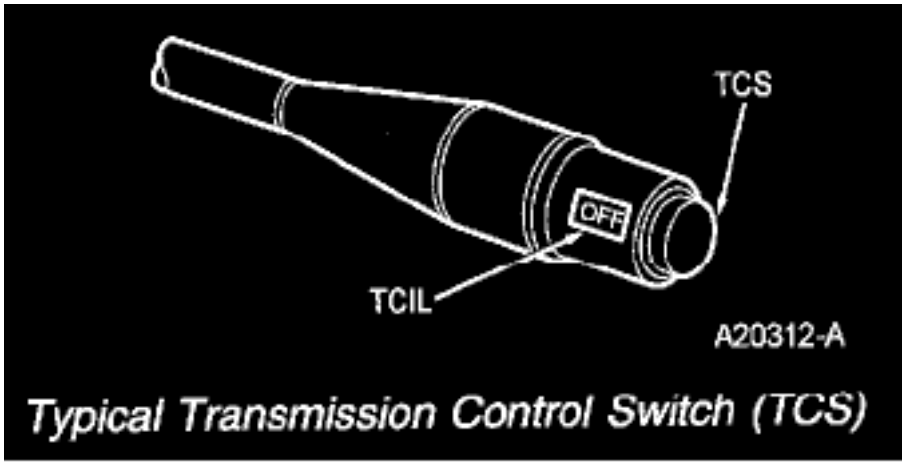
Connector: C279

Description:	Harness:	Base Part #:
TRANSMISSION CONTROL SWITCH	14401	7G550

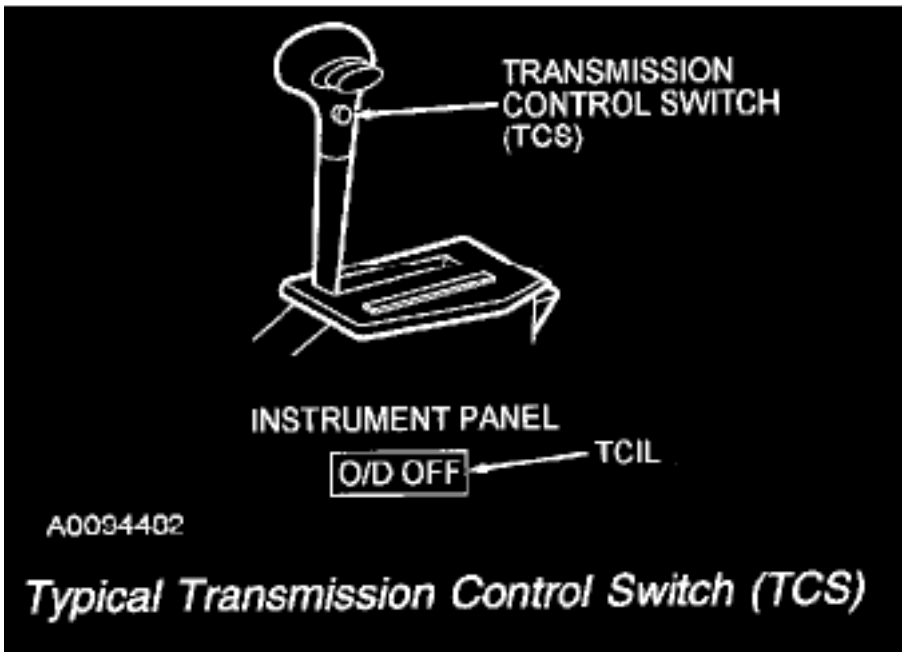


Pin	Circuit	Gauge	Circuit Function	Qualifier
A	CBP20 (YE-VT)	20	FUSE - 20 OR CIRCUIT BREAKER	
B	CE134 (BN-GN)	20	SWITCH - TRANSMISSION CONTROL/OVERDRIVE CANCEL (TCS)	

C279



Typical Transmission Control Switch (TCS)



Typical Transmission Control Switch (TCS)

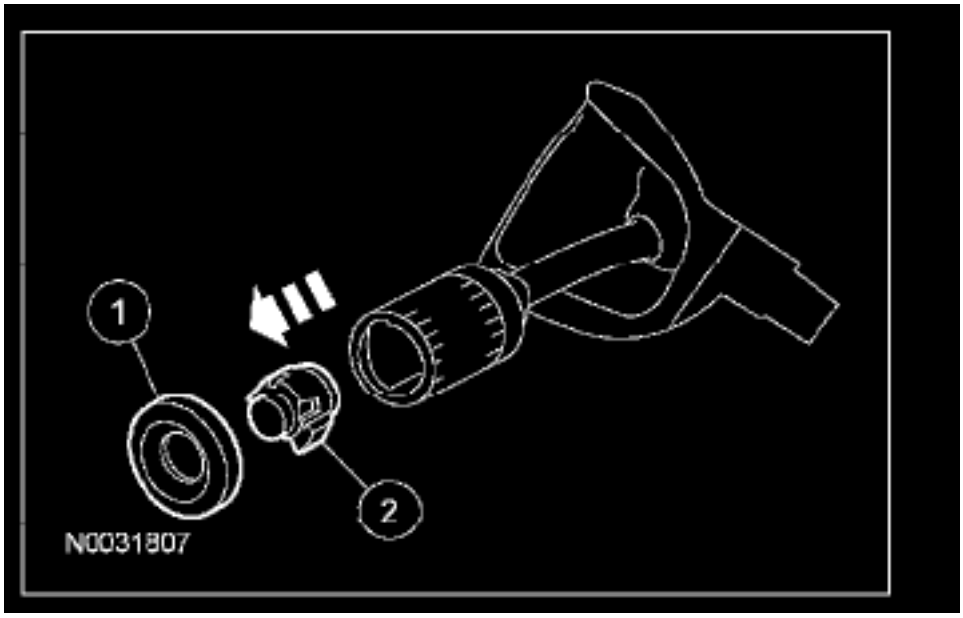
Transmission Mode Switch: Description and Operation

TRANSMISSION CONTROL SWITCH (TCS)

Typical Transmission Control Switch (TCS)

Typical Transmission Control Switch (TCS)

The TCS signals the PCM with VPWR whenever the TCS is pressed. On vehicles with this feature, the transmission control indicator lamp (TCIL) illuminates when the TCS is cycled to disengage overdrive.



Transmission Mode Switch: Service and Repair

Transmission Control (TC) Switch

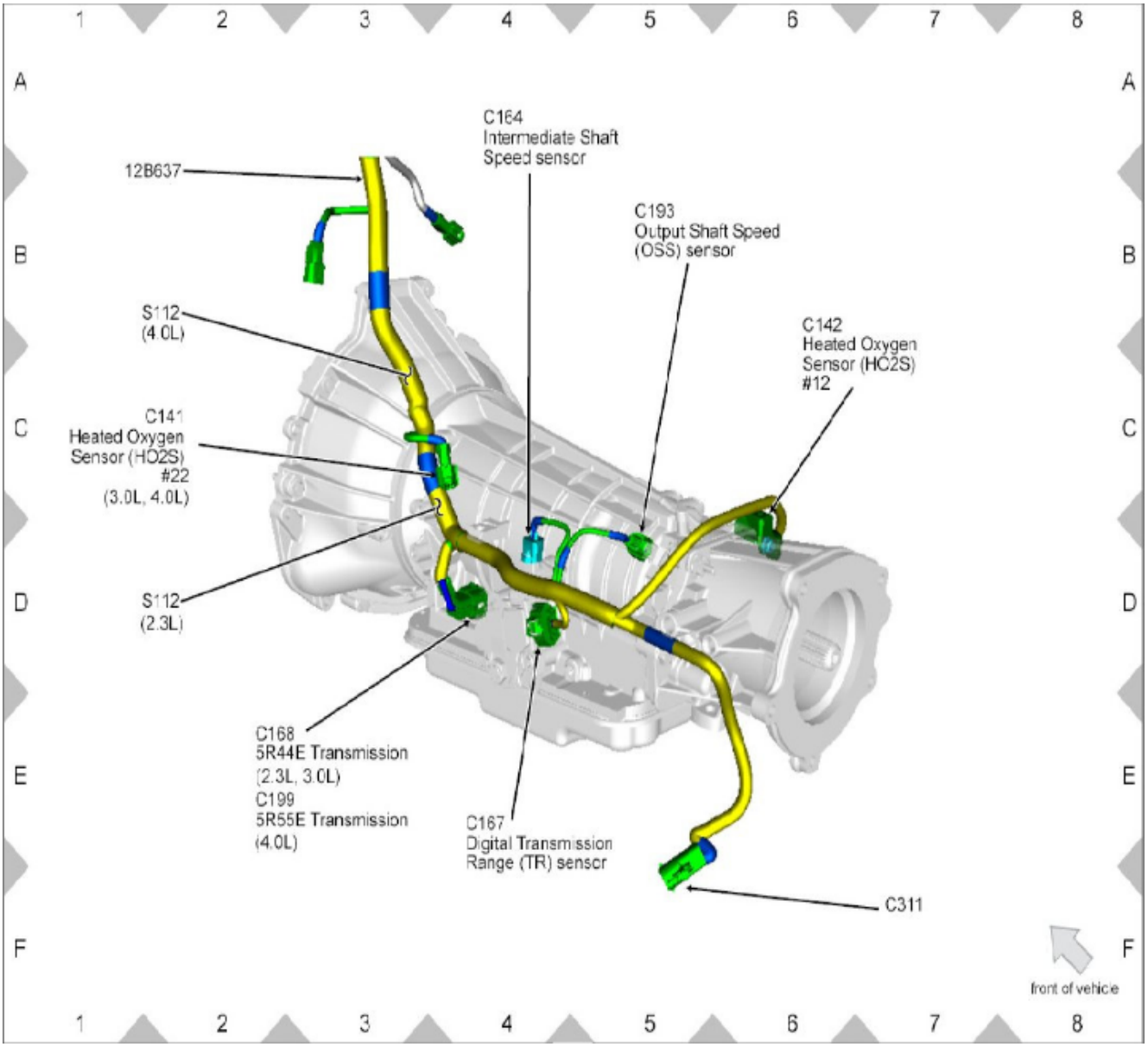
Removal and Installation

1. Remove the transmission control (TC) switch.

1 Remove the TC switch cover.

2 Remove the TC switch.

2. To install, reverse the removal procedure.


C164
Intermediate Shaft
Speed sensor
12B637
C193
Output Shaft Speed
(OSS) sensor
S112
(4.0L)
C142
Heated Oxygen
Sensor (HO2S)
#12
C141
Heated Oxygen
Sensor (HO2S)
#22
(3.0L, 4.0L)
S112
(2.3L)
C168
5R44E Transmission
(2.3L, 3.0L)
C199
5R55E Transmission
(4.0L)
C167
Digital Transmission
Range (TR) sensor
C311
front of vehicle

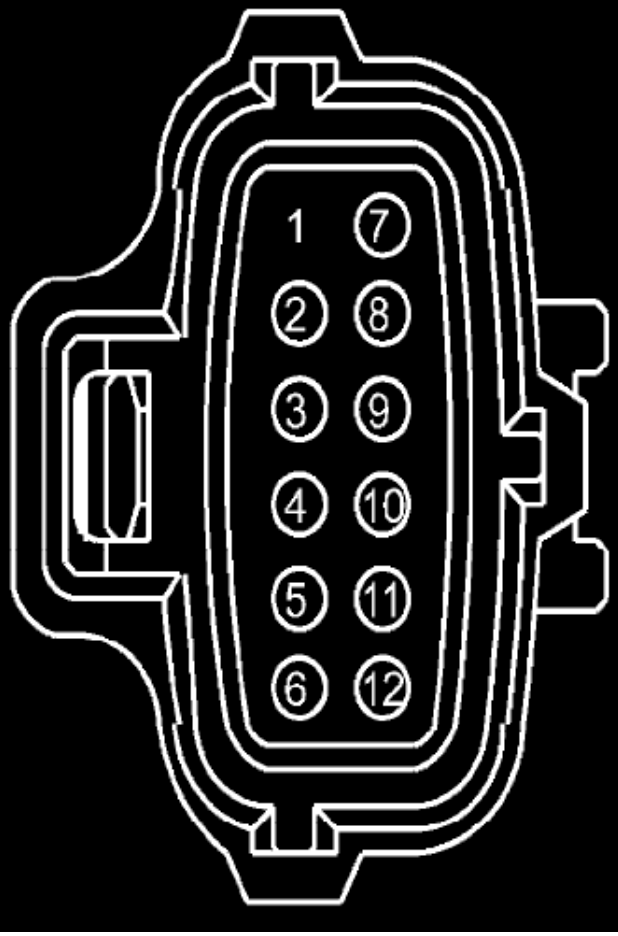
View 151-10

Connector: C167

Description: DIGITAL TRANSMISSION RANGE (TR) SENSOR

Harness: 12B637

Base Part #: 7F293



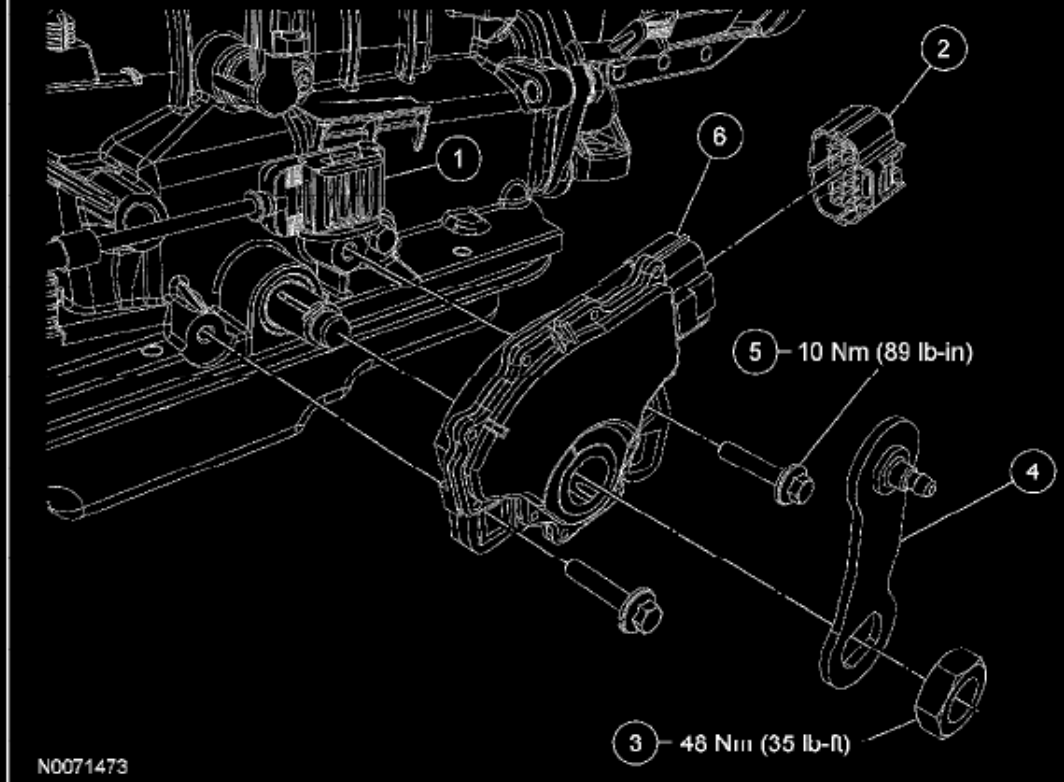
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	RE406 (GY-VT)	18	SIGNAL RETURN	
3	VET28 (GY-VT)	20	TR3A	
4	VET29 (VT-WH)	20	TR1	
5	VET30 (YE)	20	TR2	
6	VET31 (BU-OG)	20	TR4	
7	GD108 (BK-VT)	18	GROUND	4x4
8	CCF20 (GY-VT)	20	NETURAL SENSE	4x4
9	CBP20 (YE-VT)	18	FUSED POWER FEED	
10	CET40 (GN-OG)	20	STARTER CONTROL	
11	CET41 (BN-YE)	18	BACK UP	
12	CBP21 (BU-GY)	20	STARTER TO STARTER INTERRUPT RELAY	

C167

Special Tool(s)

ST1633-A	Alignment Gauge, TR Sensor 307-351 (T97L-70010-A)

Digital Transmission Range (TR) Sensor



Item	Part Number	Description
1	7E395-A	Selector lever cable
2	—	Digital transmission range (TR) sensor electrical connector
3	W701271-S	Manual control lever nut
4	7A256-A	Manual control lever
5	N806933-S	Digital TR sensor screw (2 required)
6	7F293-A	Digital TR sensor

Transmission Position Switch/Sensor: Service and Repair

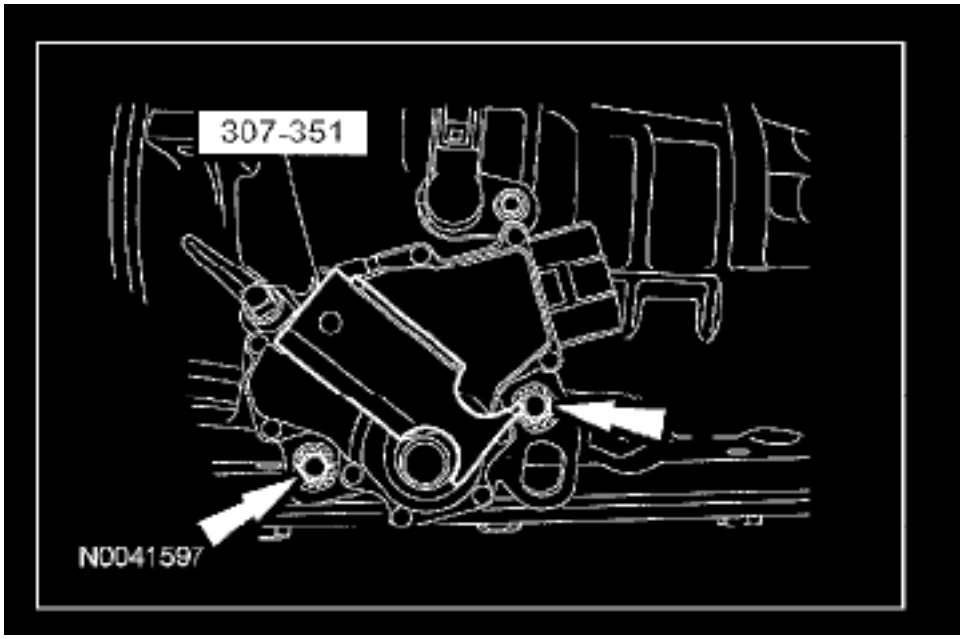
Digital Transmission Range (TR) Sensor

Digital Transmission Range (TR) Sensor

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the selector lever cable from the manual control lever. 3. Disconnect the digital transmission range (TR) sensor electrical connector. 4. Remove the manual control outer lever nut and manual control outer lever. 5. Remove the screws and the digital TR sensor.

Installation



1. CAUTION: The digital transmission range (TR) sensor must fit flush against the boss on the case to prevent damage to the sensor.

Install the digital TR sensor and loosely install the screws.

2. CAUTION: Tightening one screw before tightening the other may cause the sensor to bind or become damaged.

NOTE: The manual lever must be in the NEUTRAL position.

Using the special tool, align the digital TR sensor and tighten screws in an alternating sequence. ^

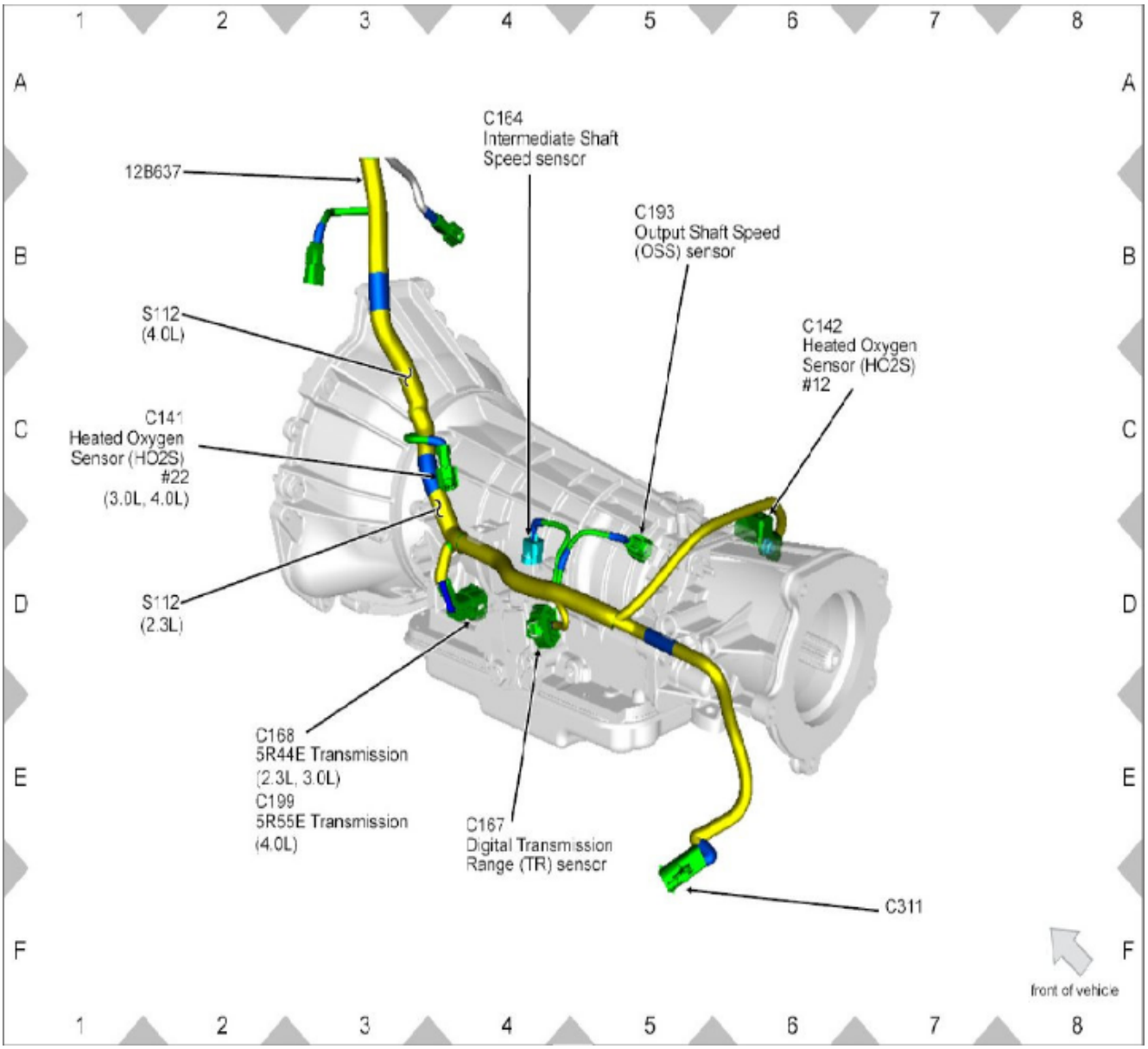
Tighten to 10 Nm (89 lb-inch).

3. Install the manual control outer lever and nut.

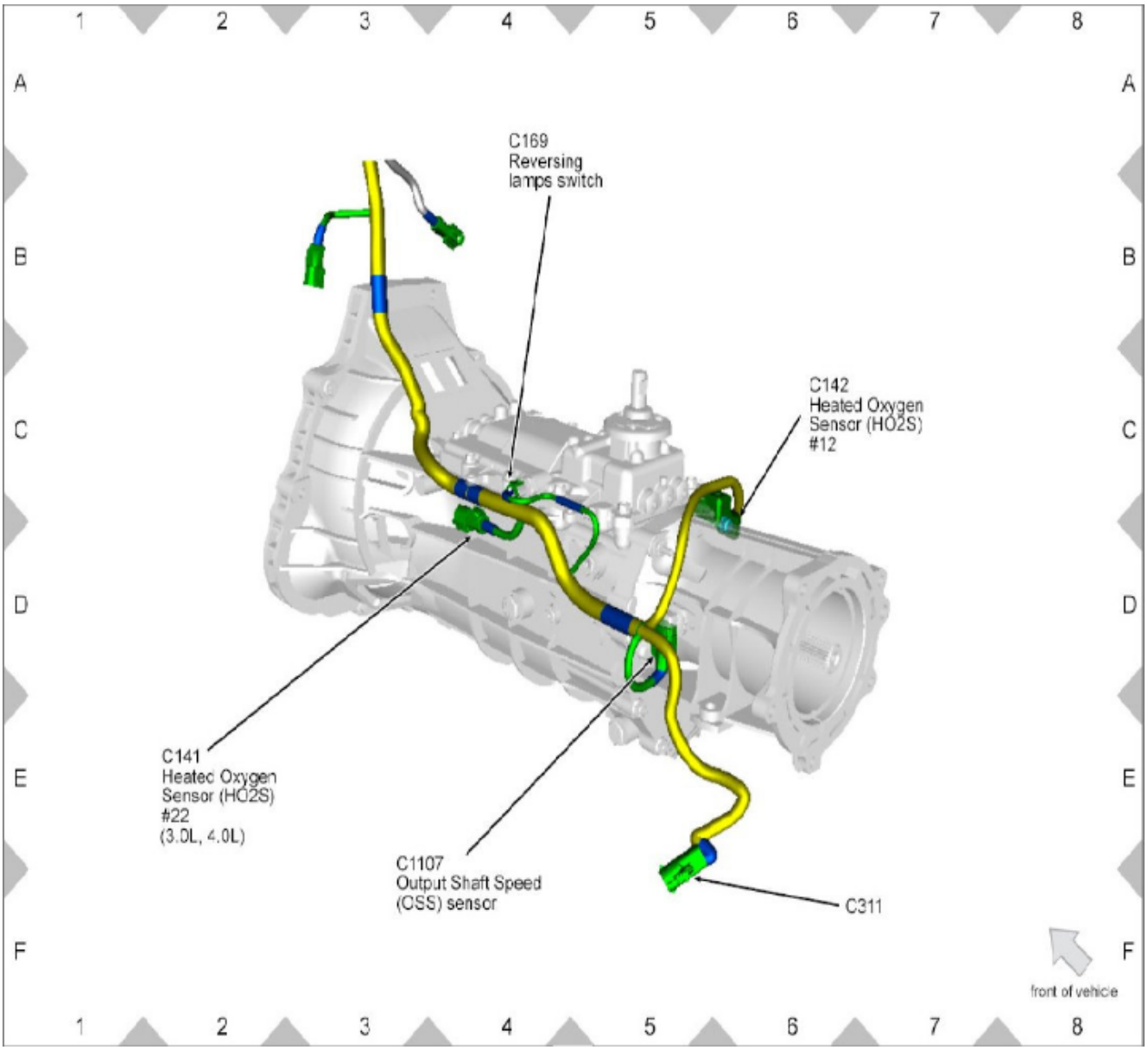
^ Tighten to 48 Nm (35 lb-ft).

4. Connect the digital TR sensor electrical connector. 5. Connect the selector lever cable to the manual control lever. 6. Verify that the selector lever cable is adjusted correctly.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Sensors and Switches > Sensors and Switches - Transmission and Drivetrain > Sensors and Switches - A/T > Transmission Speed Sensor, A/T > Component Information > Locations > Intermediate Shaft Speed Sensor

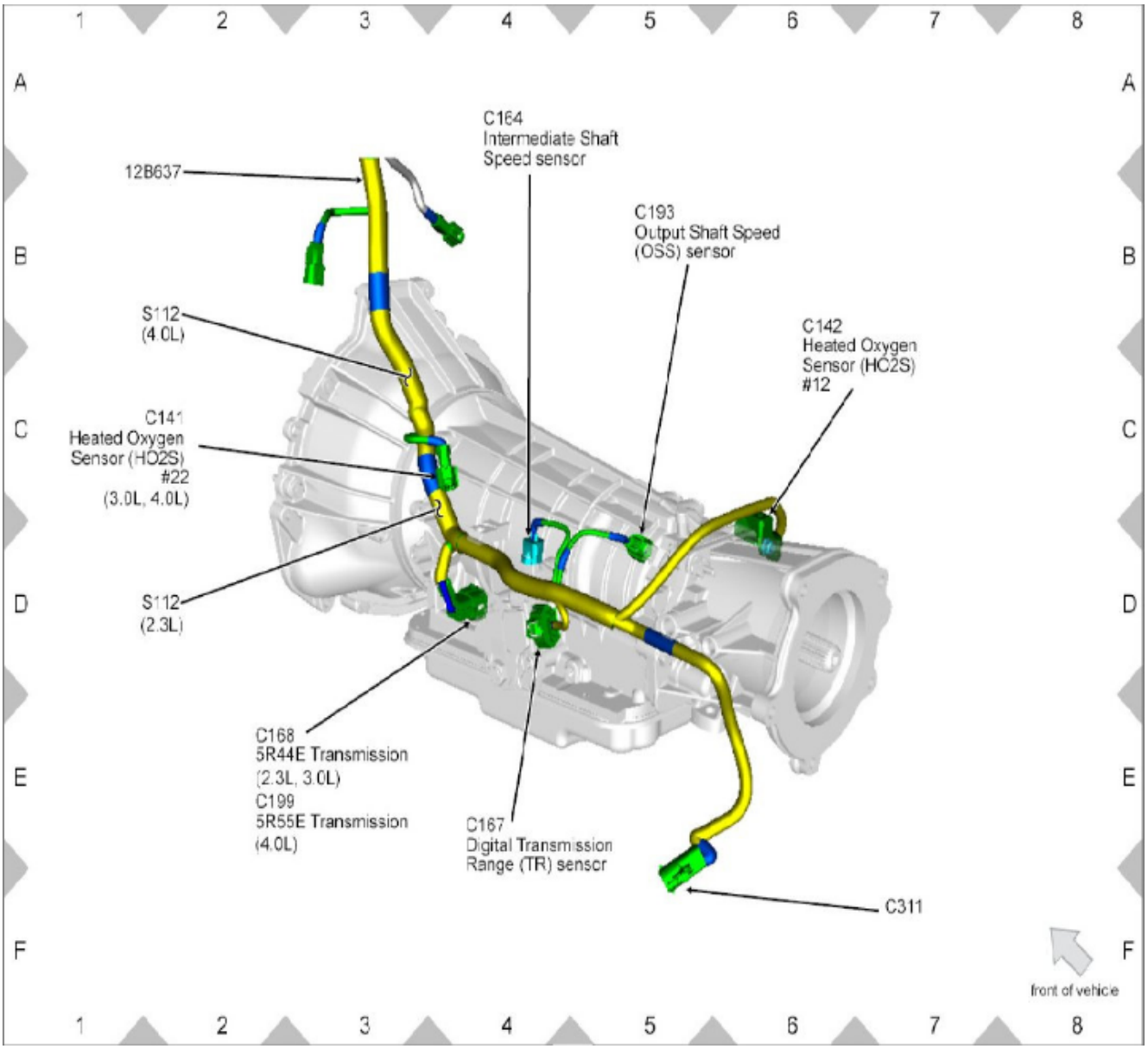


View 151-10

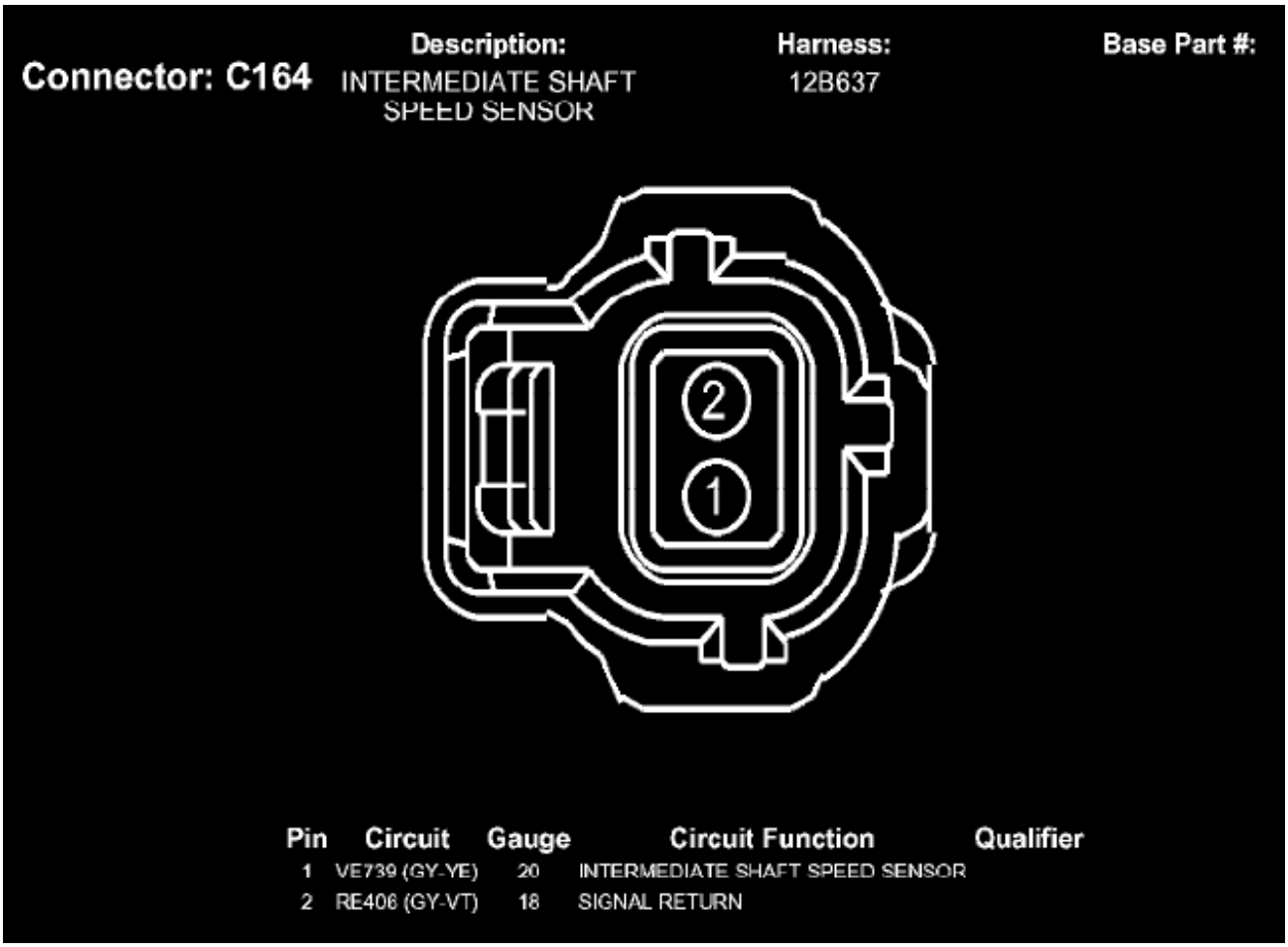


Transmission Speed Sensor: Locations Output Shaft Speed (OSS) Sensor

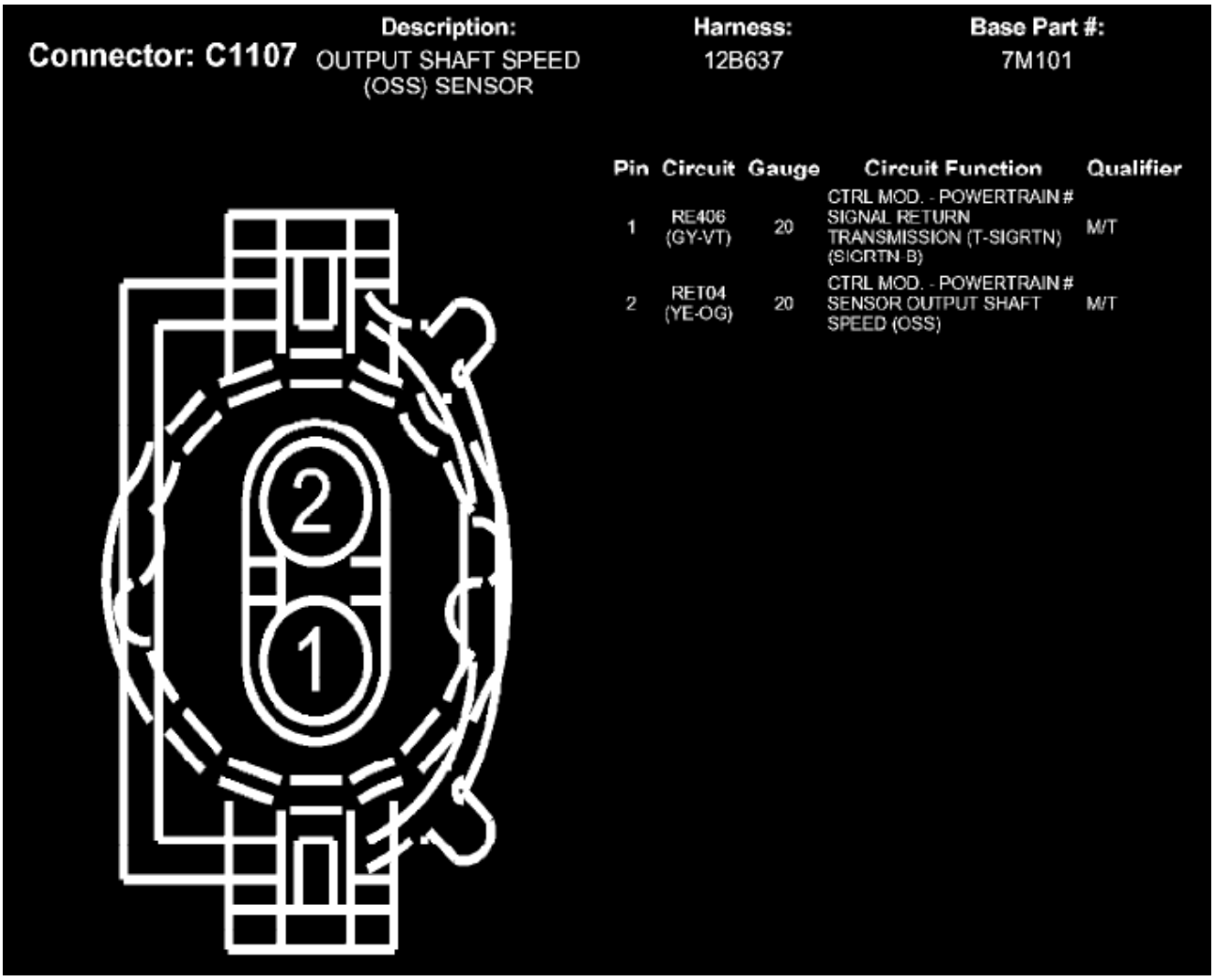
View 151-9


C164
Intermediate Shaft
Speed sensor
12B637
C193
Output Shaft Speed
(OSS) sensor
S112
(4.0L)
C142
Heated Oxygen
Sensor (HO2S)
#12
C141
Heated Oxygen
Sensor (HO2S)
#22
(3.0L, 4.0L)
S112
(2.3L)
C168
5R44E Transmission
(2.3L, 3.0L)
C199
5R55E Transmission
(4.0L)
C167
Digital Transmission
Range (TR) sensor
C311
front of vehicle

View 151-10


Connector: C164
Description:
INTERMEDIATE SHAFT SPEED SENSOR
Harness:
12B637
Base Part #:
2
1
Pin Circuit Gauge Circuit Function Qualifier
1 VE739 (GY-YE) 20 INTERMEDIATE SHAFT SPEED SENSOR
2 RE406 (GY-VT) 18 SIGNAL RETURN

C164

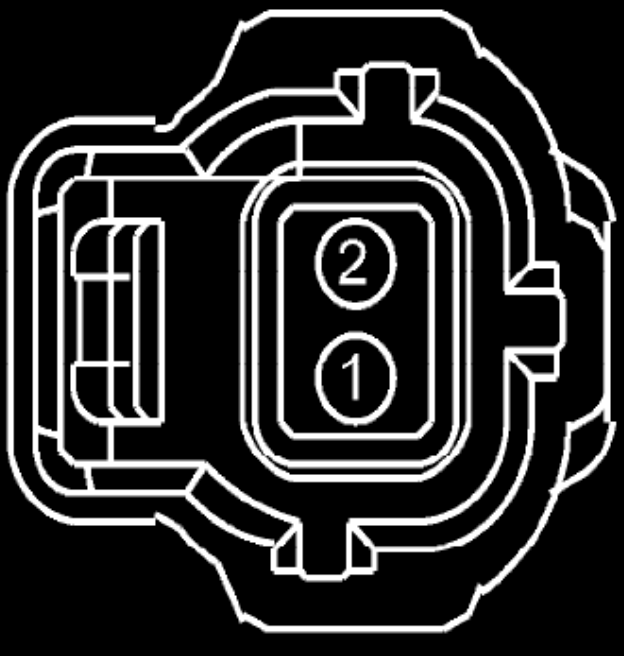


Transmission Speed Sensor: Diagrams Output Shaft Speed (OSS) Sensor

C1107

Connector: C193

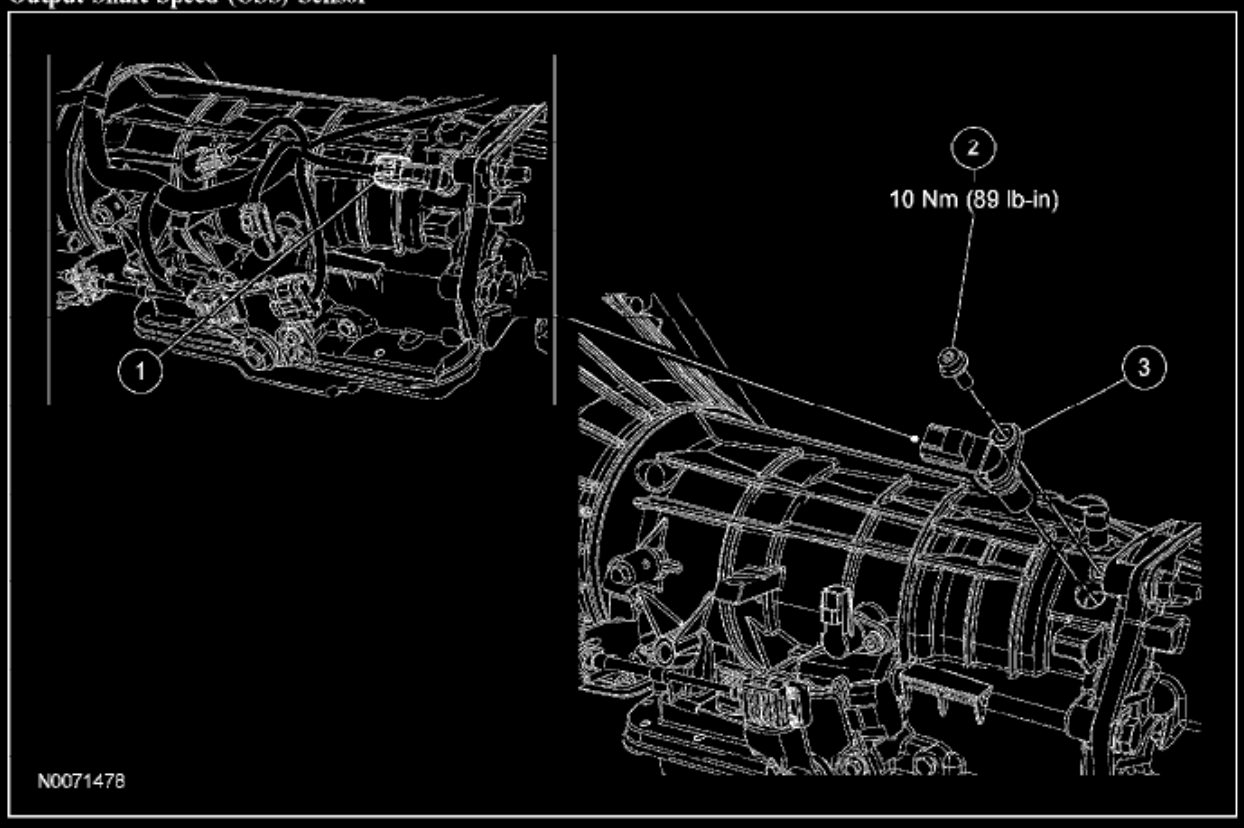
Description:	Harness:	Base Part #:
OUTPUT SHAFT SPEED (OSS) SENSOR	12B637	7H133



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RET04 (YE-OG)	20	OUTPUT SHAFT SPEED (OSS) SENSOR	A/T
2	RE406 (GY-VT)	18	SIGNAL RETURN	A/T

C193

Output Shaft Speed (OSS) Sensor



Item	Part Number	Description
1	—	Output shaft speed (OSS) sensor electrical connector
2	W702297-S	OSS sensor screw
3	7H103-B	OSS sensor

Transmission Speed Sensor: Service and Repair Output Shaft Speed (OSS) Sensor

Output Shaft Speed (OSS) Sensor

Output Shaft Speed (OSS) Sensor

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the output shaft speed (OSS) sensor electrical connector. 3. Remove the OSS sensor screw. 4. Remove the OSS sensor from the transmission.

Installation

1. NOTE: Inspect the OSS sensor O-ring for damage. If damaged, install a new O-ring Inspect and lubricate the O-ring with petroleum jelly.

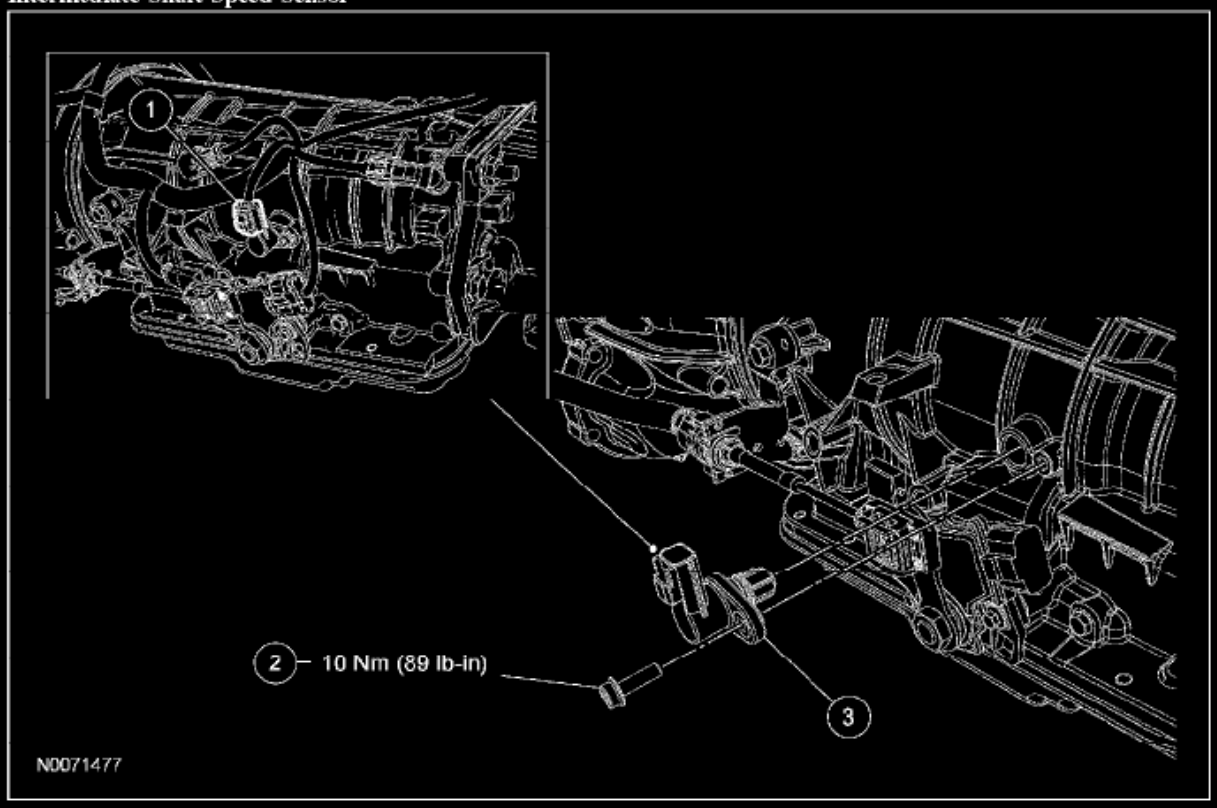
Install the OSS sensor into the transmission.

2. Install the OSS sensor screw.

^ Tighten to 10 Nm (89 lb-inch).

3. Connect the OSS sensor electrical connector.

Intermediate Shaft Speed Sensor



Item	Part Number	Description
1	—	Intermediate shaft speed sensor electrical connector
2	W702769-S	Intermediate shaft speed sensor screw
3	7M183-A	Intermediate shaft speed sensor

Transmission Speed Sensor: Service and Repair Intermediate Shaft Speed Sensor

Intermediate Shaft Speed Sensor

Intermediate Shaft Speed Sensor

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the intermediate shaft speed sensor electrical connector. 3. Remove the intermediate shaft speed sensor screw. 4. Remove the intermediate shaft speed sensor from the transmission.

Installation

1. NOTE: Inspect the intermediate shaft speed sensor O-ring for damage. If damaged, install a new O-ring

Inspect and lubricate the O-ring with petroleum jelly.

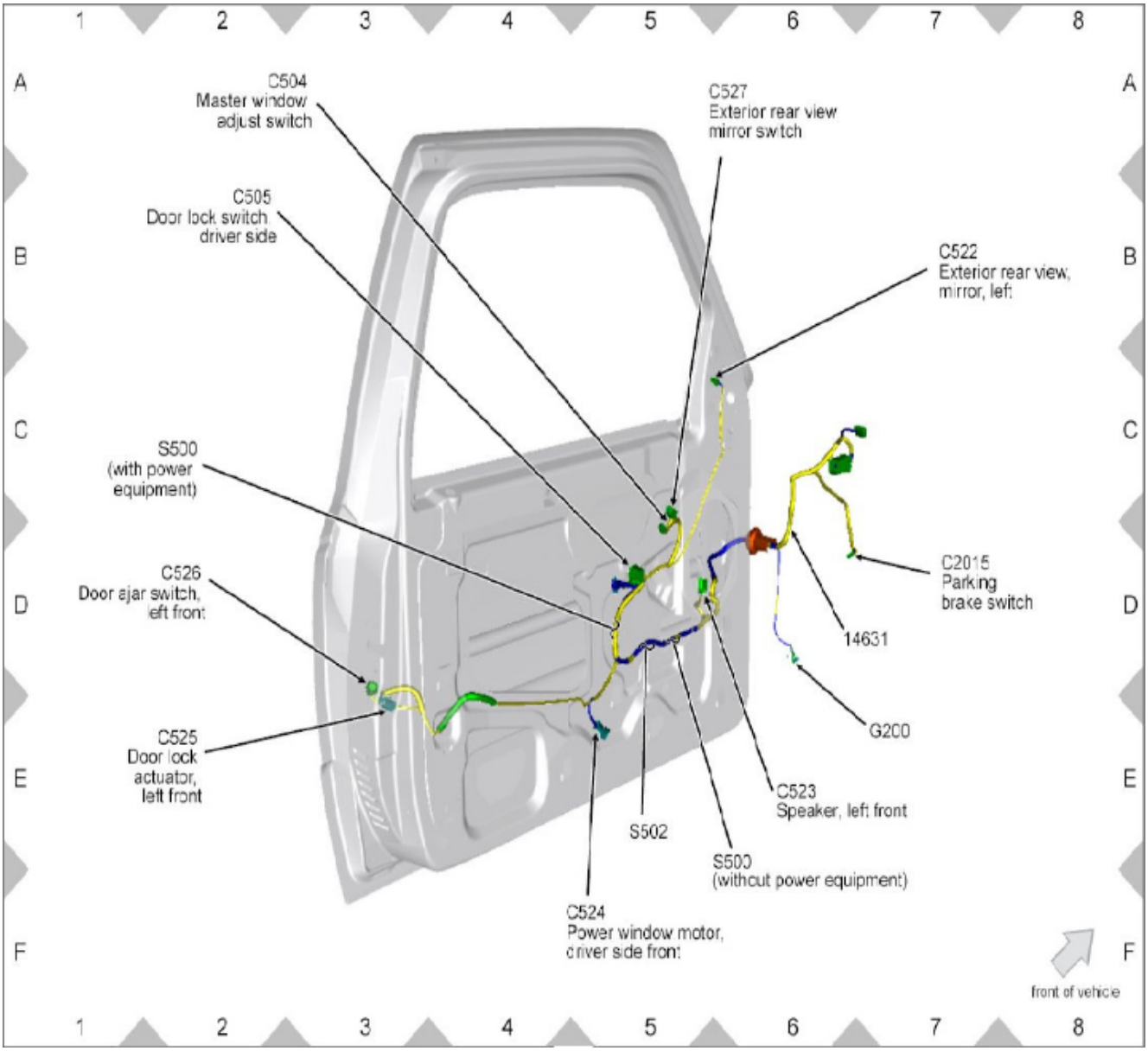
Install the intermediate shaft speed sensor into the transmission.

2. Install the intermediate shaft speed sensor screw.

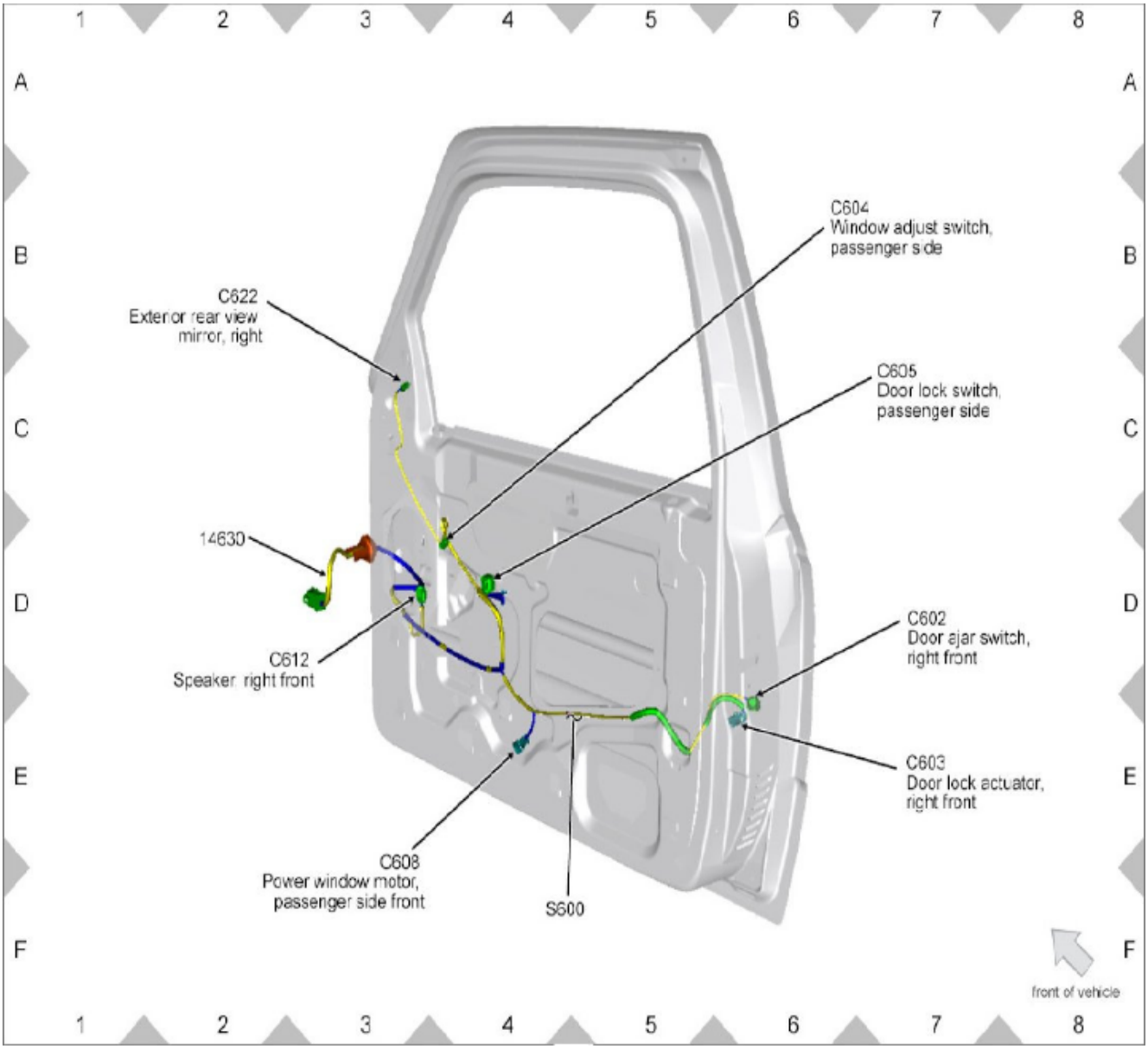
^ Tighten to 10 Nm (89 lb-inch).

3. Connect the intermediate shaft speed sensor electrical connector. 4. Lower the vehicle.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Sensors and Switches > Sensors and Switches - Windows and Glass > Power Window Switch > Component Information > Locations > Master Window Adjust Switch



View 151-20


C604
Window adjust switch, passenger side
C622
Exterior rear view mirror, right
C605
Door lock switch, passenger side
14630
C612
Speaker, right front
C602
Door ajar switch, right front
C603
Door lock actuator, right front
C608
Power window motor, passenger side front
S600
front of vehicle

View 151-21

Connector: C504

Description: MASTER WINDOW ADJUST SWITCH

Harness: 14631

Base Part #: 14529A

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPW10 (YE-VT)	14	SWITCH - POWER WINDOW DRIVER # DRIVER DOWN	
2	GD175 (BK-BU)	14	GROUND - TUNNEL # 2ND STUD	
3	CPW12 (GN-OG)	14	SWITCH - POWER WINDOW DRIVER # FRONT PASSENGER UP	
4	*	*	not used	
5	CPW11 (BU-GY)	14	SWITCH - POWER WINDOW DRIVER # DRIVER UP	
6	*	*	not used	
7	CPW30 (GY-YE)	14	RELAY - POWER WINDOW	
8	CPW13 (BN-YE)	14	SWITCH - POWER WINDOW DRIVER # FRONT PASSENGER DOWN	

C504

Connector: C604

Description:	Harness:	Base Part #:
WINDOW ADJUST SWITCH, PASSENGER SIDE	14630	14529

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPW12 (GN-OG)	14	SWITCH - POWER WINDOW DRIVER # FRONT PASSENGER UP	
2	CPW19 (VT)	14	SWITCH - POWER WINDOW FRONT PASSENGER # DOWN	
3	CPW14 (VT-WH)	14	SWITCH - POWER WINDOW DRIVER # PASSENGER LOCK OUT (ENABLE)	
4	*	*	not used	
5	CPW20 (WH-OG)	14	SWITCH - POWER WINDOW FRONT PASSENGER # UP	
6	CPW13 (BN-YE)	14	SWITCH - POWER WINDOW DRIVER # FRONT PASSENGER DOWN	

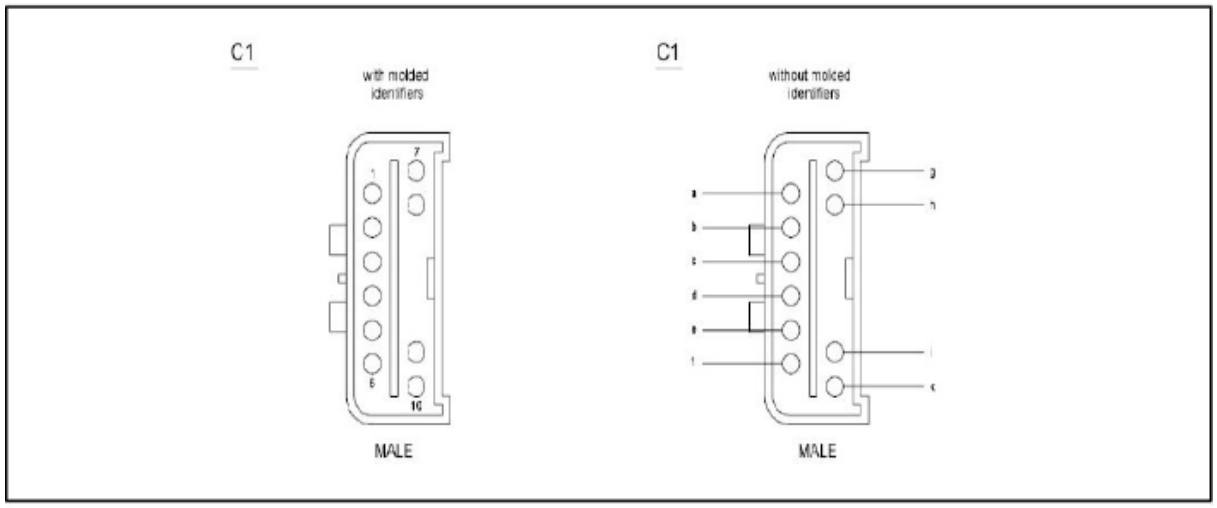
C604

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step by step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals

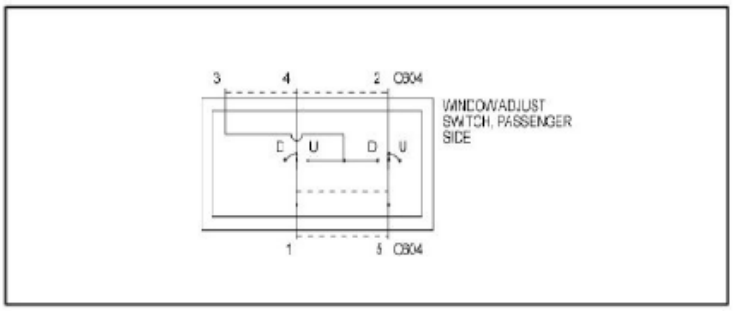


The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

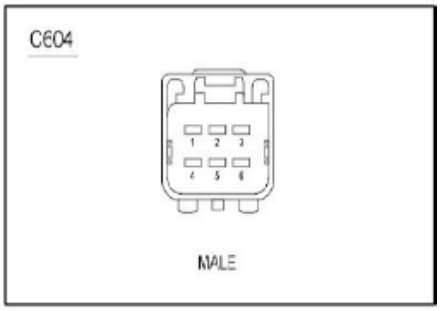
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Power Window Switch, Passenger Door

Schematic



Terminals



Component testing procedure

Circuit to test	Connect self-powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
Window adjust switches	3 and 1 4 and 5	Up	Closed circuit
	3 and 5 1 and 2	Down	Closed circuit
	4 and 5 2 and 1	Off	Closed circuit

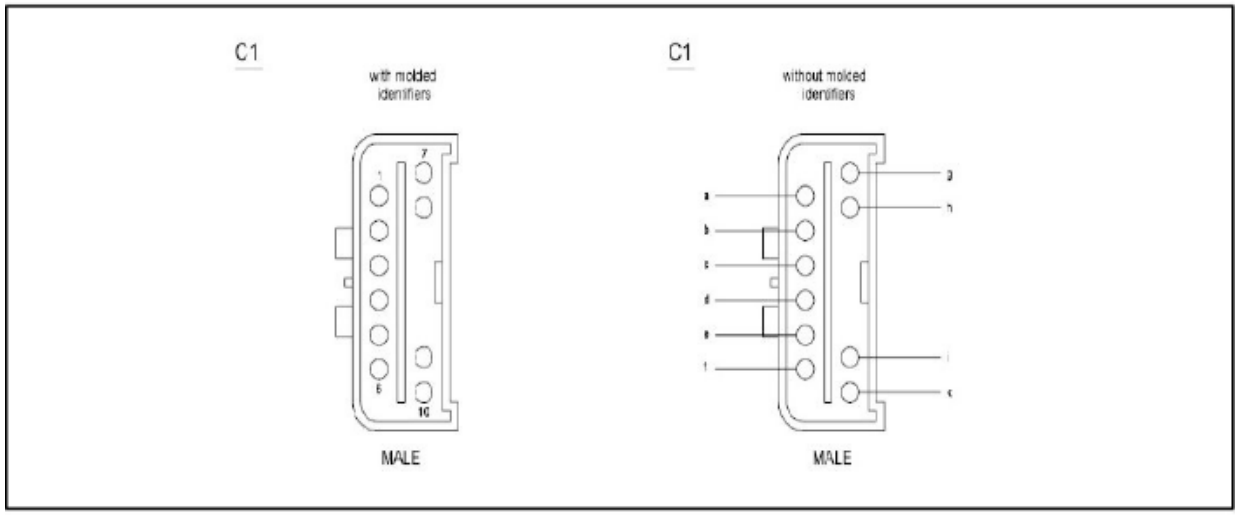
Power Window Switch: Testing and Inspection Power Window Switch, Passenger Door

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals

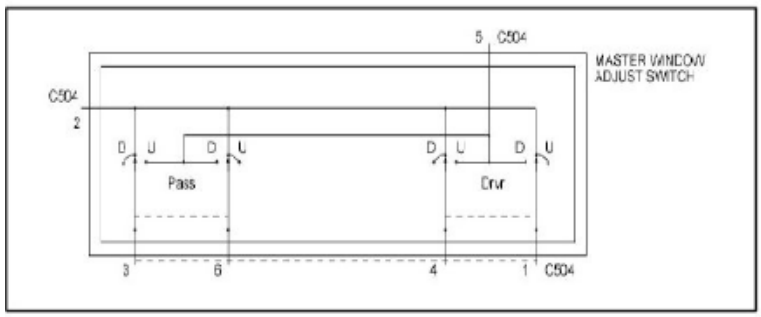


The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

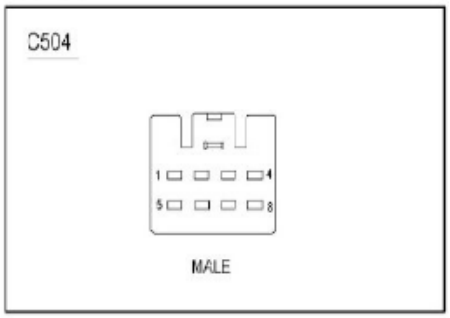
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Master window adjust switch

Schematic



Terminals

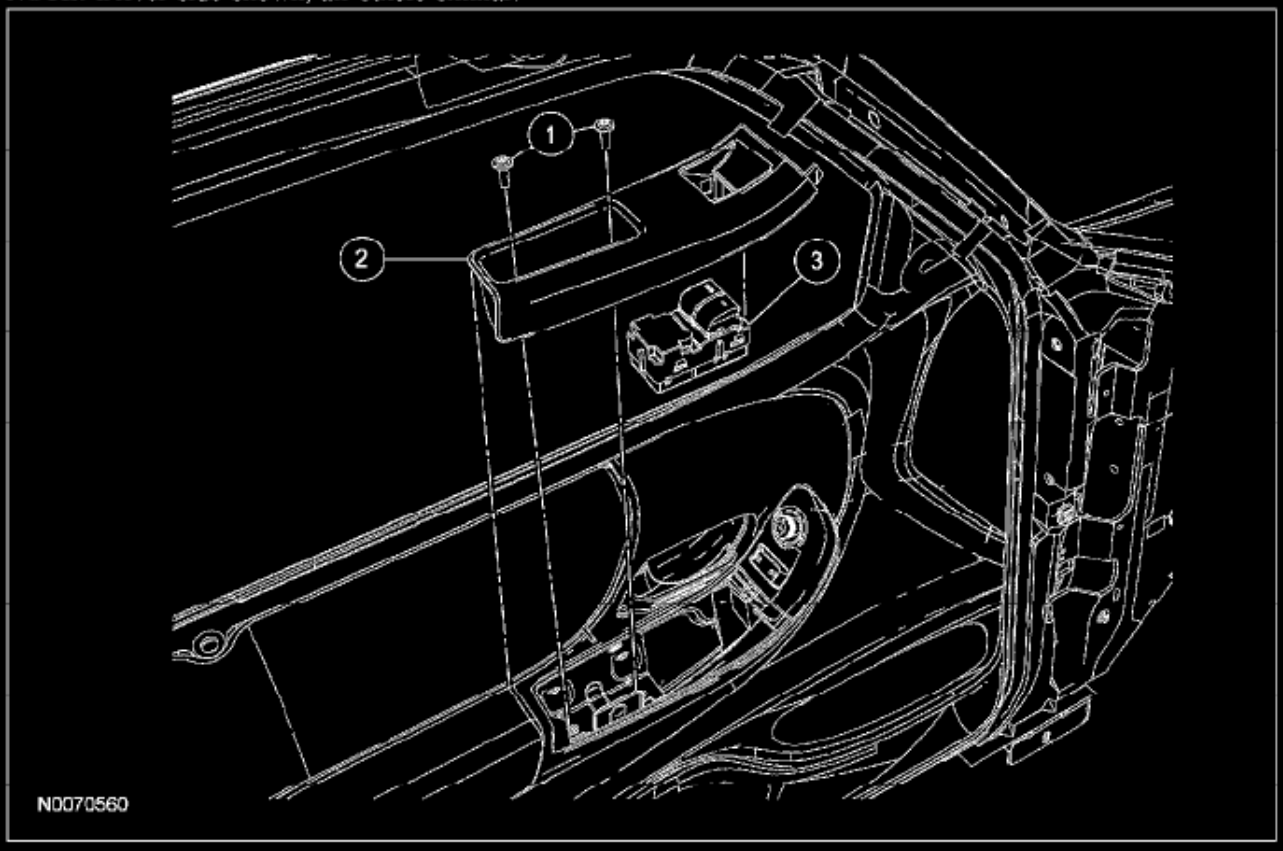


Component testing procedure

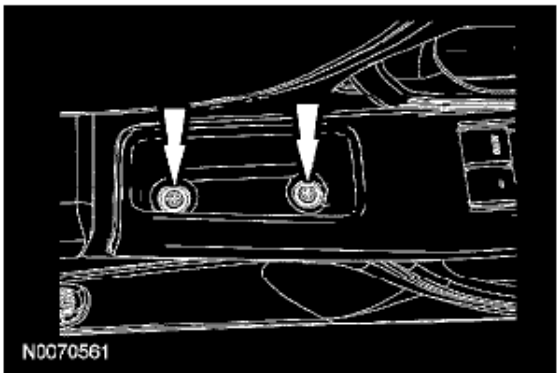
Circuit to test	Connect self-powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
Driver window circuit	5 and 4, 2 and 1	Up	Closed circuit
	5 and 1, 2 and 4	Down	Closed circuit
	2 and 4, 2 and 1	Rest	Closed circuit
Passenger window circuit	5 and 3, 2 and 6	Up	Closed circuit
	5 and 6, 2 and 3	Down	Closed circuit
	2 and 6, 2 and 3	Rest	Closed circuit

Power Window Switch: Testing and Inspection Master Window Adjust Switch

NOTE: Driver side shown, all others similar.



Item	Part Number	Description
1	56912-S	Finish panel screws (2 required)
2	14528	Finish panel
3	14529	Window control switch



Power Window Switch: Service and Repair

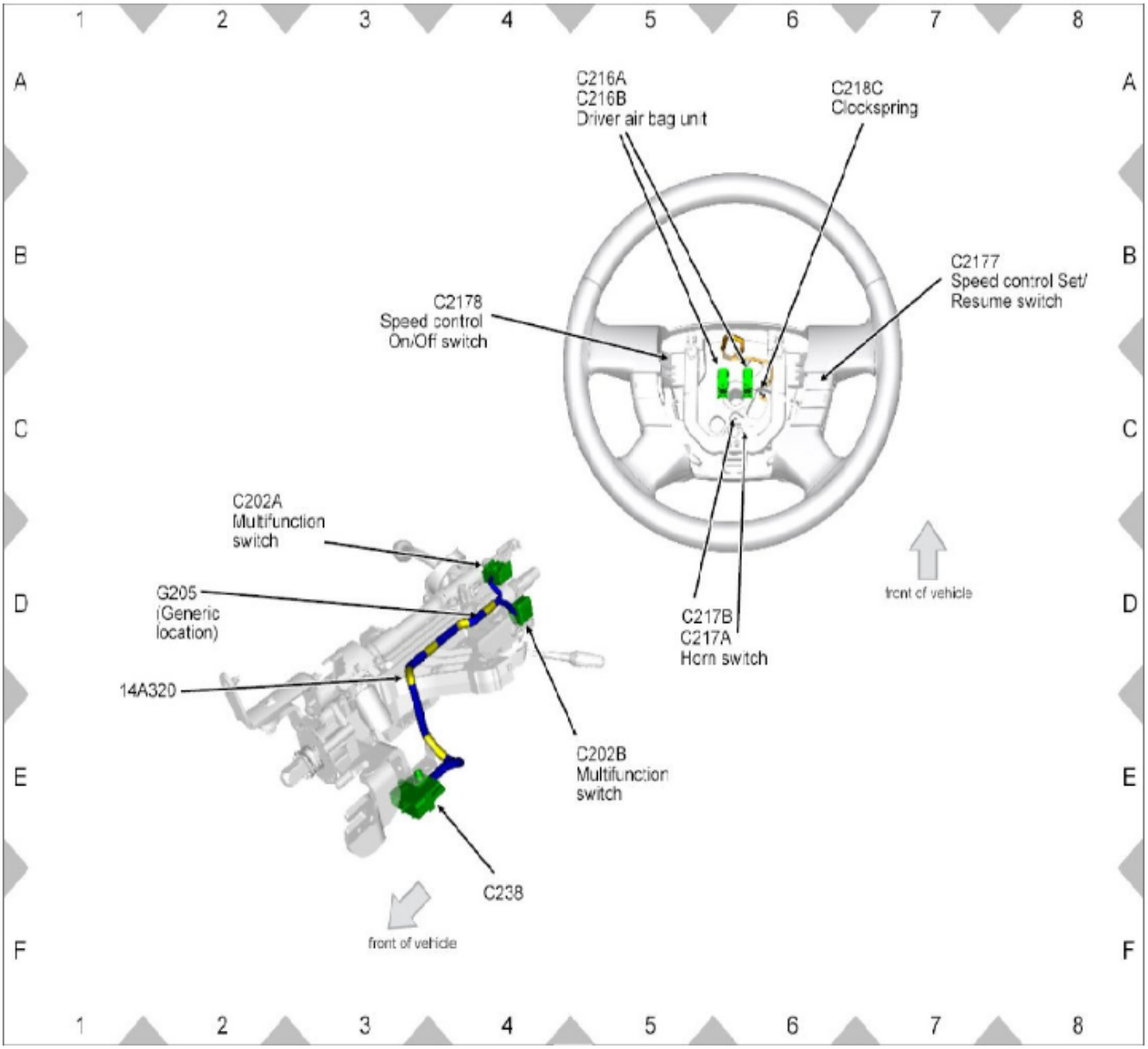
WINDOW CONTROL SWITCH

Removal and Installation

1. Remove the door trim panel finish panel screws.

2. Remove the door trim panel finish panel. 3. Disconnect the electrical connector. 4. Remove the window control switch from the finish panel. 5. To install, reverse the removal procedure.

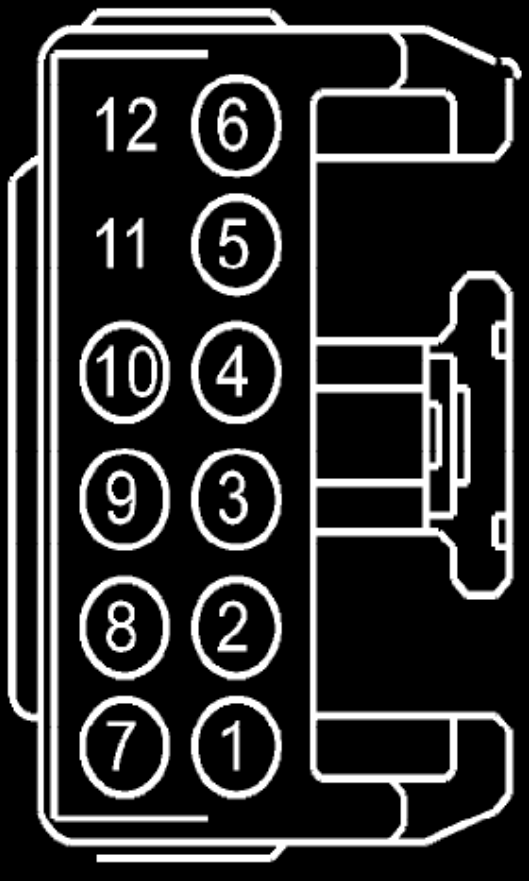
Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Sensors and Switches > Sensors and Switches - Wiper and Washer Systems > Windshield Washer Switch > Component Information > Locations



View 151-13

Connector: C202A

Description:	Harness:	Base Part #:
MULTIFUNCTION SWITCH	14A320	13K359



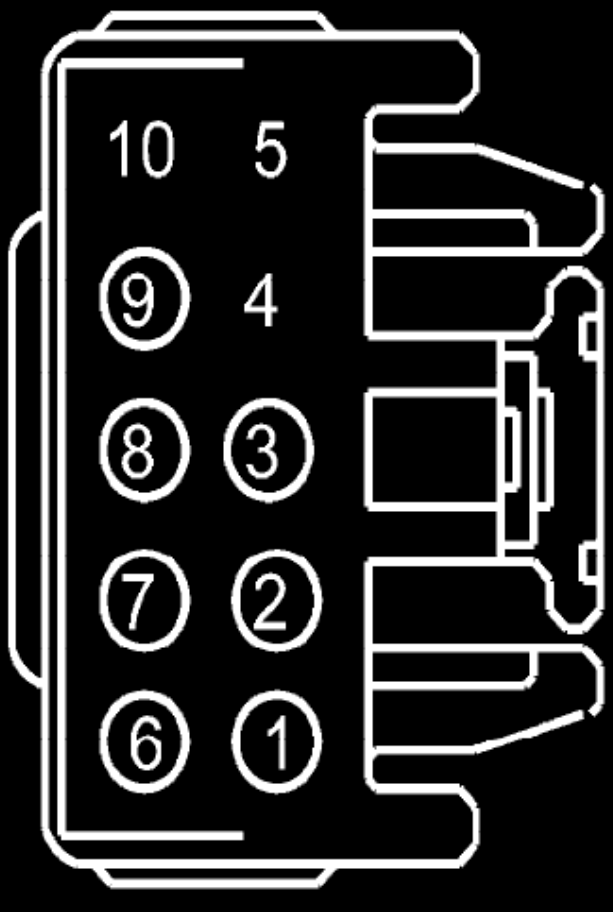
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CRW17 (GN-VT)	20	SWITCH - FRONT WIPER INTERVAL (A)	
2	CRW19 (BU-OG)	20	SWITCH - FRONT WIPER INTERVAL (C)	
3	CRW18 (VT-WH)	20	SWITCH - FRONT WIPER INTERVAL (B)	
4	CRW15 (BN-WH)	20	CTRL MOD. - FRONT WIPER HIGH	
5	CRW07 (GY-BN)	20	SWITCH - FRONT WASHER	
6	CD161 (BK YE)	18	GROUND SEAT BRACKET REAR LEFT	
7	CLS41 (GY-YE)	22	SWITCH - TURN RIGHT	
8	CLS36 (YE)	18	SWITCH - PARK LAMPS RIGHT	
9	CLS35 (VT)	18	SWITCH - PARK LAMPS LEFT	
10	CLS39 (VT-WH)	22	SWITCH - TURN LEFT	
11	*	*	not used	
12	*	*	not used	

Windshield Washer Switch: Diagrams

C202A

Connector: C202B

Description:	Harness:	Base Part #:
MULTIFUNCTION SWITCH	14A320	13K359



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CCB08 (VT-WH)	16	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL OPEN	
2	CLS42 (VT-BN)	18	INDICATOR FLASHER RELAY - TURN SIGNAL SWITCHED POWER	
3	CLS32 (BN-YE)	18	INDICATOR FLASHER RELAY - HAZARD SWITCHED POWER	
4	*	*	not used	
5	*	*	not used	
6	SBP23 (WH-RD)	14	FUSE - 23 OR CIRCUIT BREAKER	
7	CLF27 (GN-BN)	14	SWITCH - FLASH TO PASS	
8	CLS24 (BN-WH)	16	CTRL MOD. - TURN LAMP RIGHT	
9	CLF18 (BU-WH)	16	SWITCH - BEAM LOW	
10	*	*	not used	

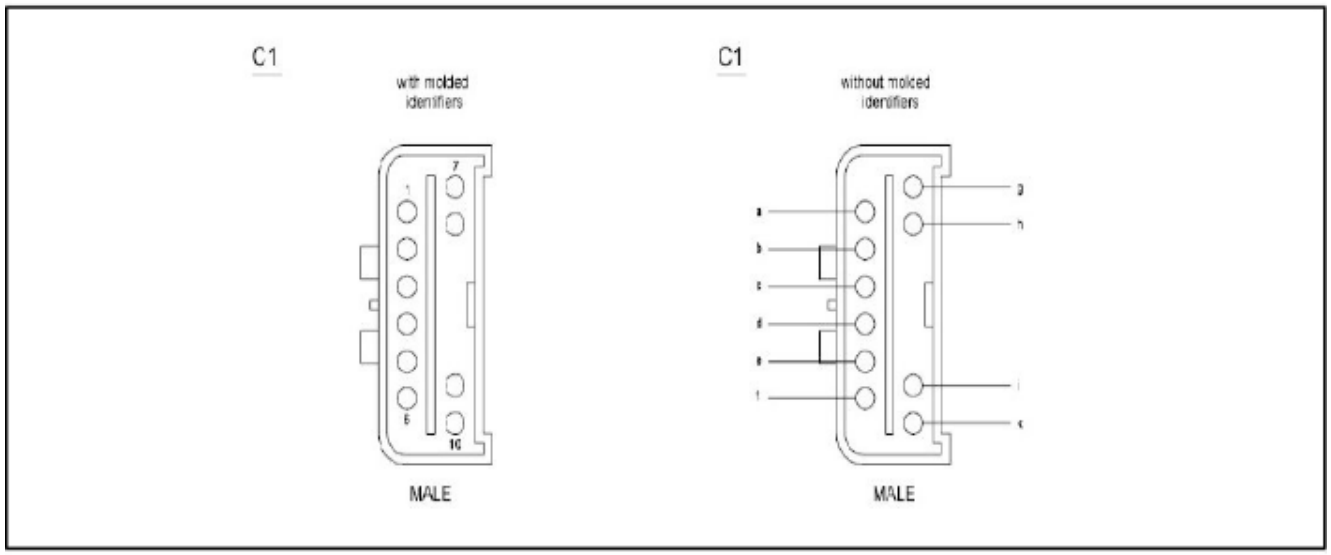
C202B

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step by step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



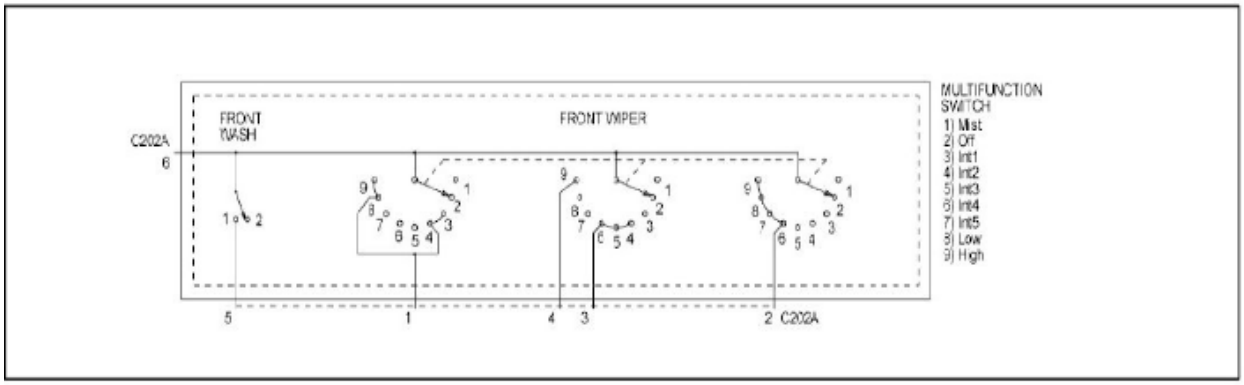
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Windshield Washer Switch: Testing and Inspection

Multifunction Switch, Wiper/Washer Portion

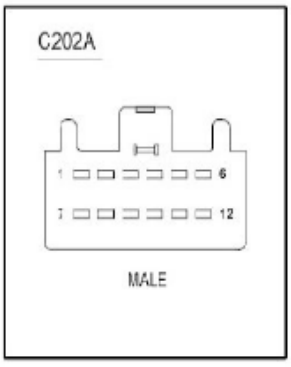
Schematic



Component testing procedure

Circuit to test	Connect self-powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
Front washer switch circuit	5 and 3	Front washer	Closed circuit
		Off	Open circuit
Front wiper switch circuit	1 and 3	Off	Open circuit
		Low	Closed circuit
		High	
	4 and 3	Off	Open circuit
		Low	
		High	Closed circuit
	2 and 3	Off	Open circuit
		Low	Closed circuit
		High	

Terminals

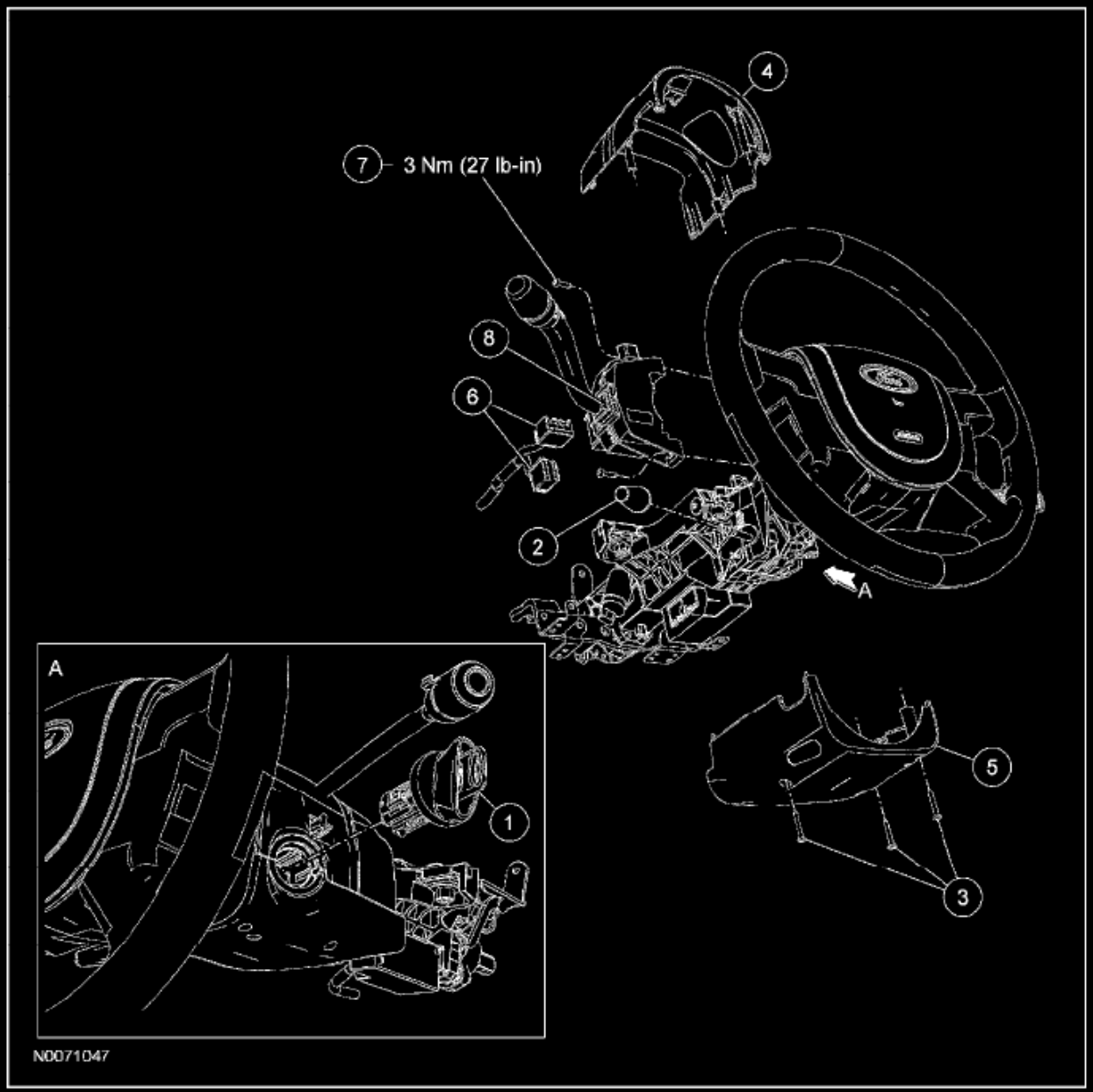


Multifunction Switch, Wiper/Washer Portion (continued)

Component testing procedure

Circuit to test	Connect self-powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
Intermittent wiper circuit, front	1 and 6	Interval 1	Closed circuit
		Interval 2	
		Interval 3	Open circuit
		Interval 4	
		Interval 5	
	3 and 6	Interval 1	Open circuit
		Interval 2	Closed circuit
		Interval 3	
		Interval 4	
		Interval 5	Open circuit
	2 and 6	Interval 1	Open circuit
		Interval 2	
		Interval 3	
		Interval 4	Closed circuit
		Interval 5	

Steering Column Multifunction Switch



Item	Part Number	Description
1	11582	Ignition switch lock cylinder
2	3F609	Tilt release lever/ handle
3	391727	Steering column shroud screws (3 required)
4	3530	Upper steering column shroud
5	3533	Lower steering column shroud

(Continued)

Item	Part Number	Description
6	—	Steering column multi-function switch electrical connectors (part of 14A320)
7	390345	Steering column multi-function switch screws (2 required)
8	13K359	Steering column multi-function switch

Windshield Washer Switch: Service and Repair

Steering Column Multifunction Switch

Steering Column Multifunction Switch

Removal and Installation

1. Remove the ignition switch lock cylinder.

1 Insert the ignition key into the ignition switch lock cylinder and turn to the RUN position.

2 Push the ignition switch lock cylinder release tab with a punch while pulling out the ignition switch lock cylinder.

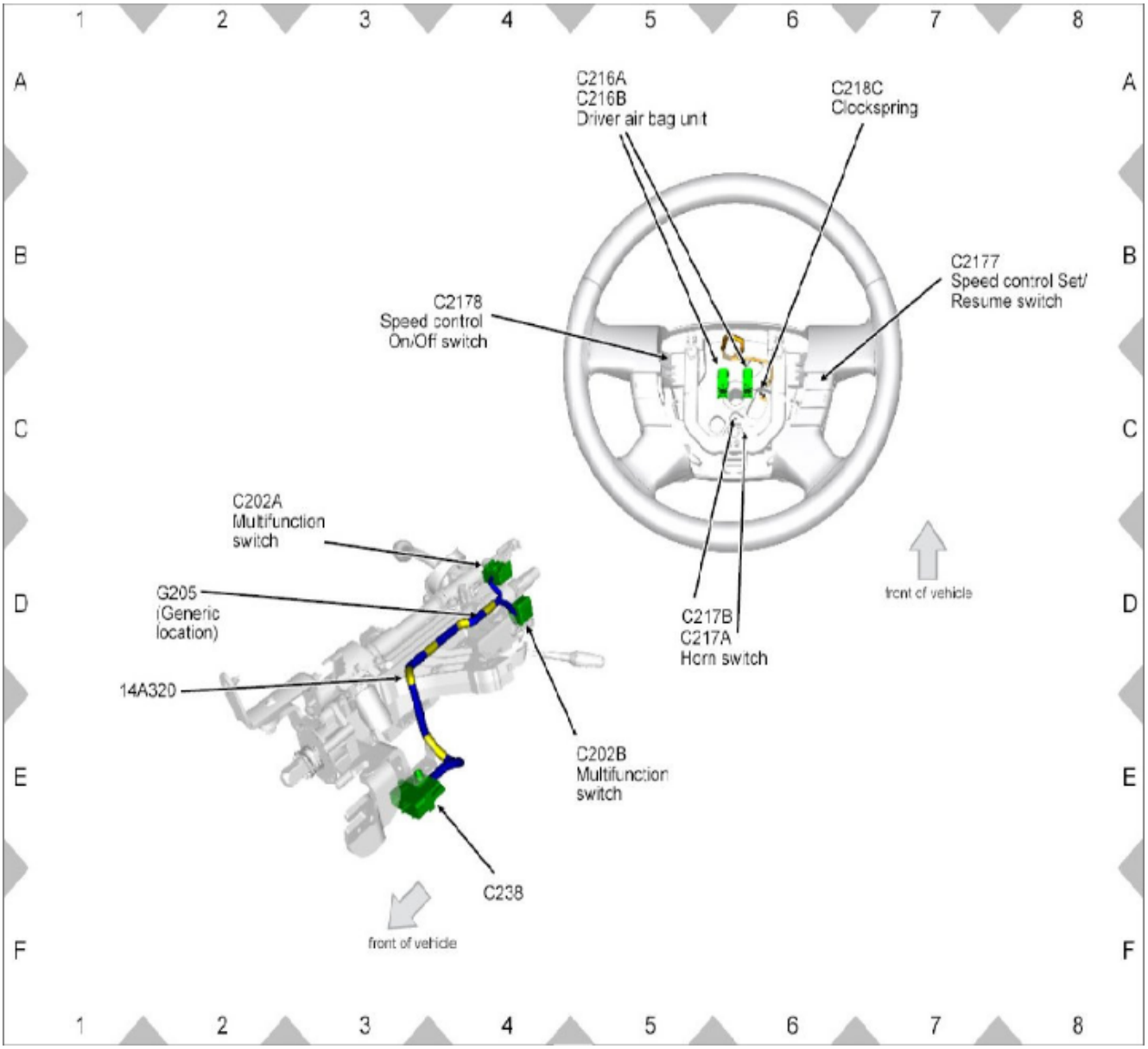
2. If equipped, remove the tilt release lever/ handle.

3. Remove the 3 steering column shroud screws and the upper and lower steering column shrouds. 4. Disconnect the multi-function switch electrical connectors. 5. Remove the 2 multi-function switch screws and the multi-function switch.

^ To install, tighten to 3 Nm (27 lb-inch).

6. To install, reverse the removal procedure.

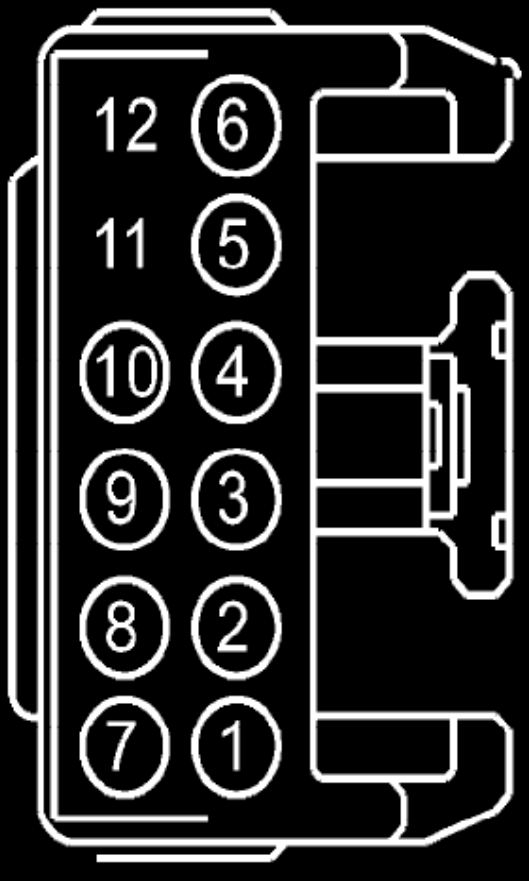
Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Sensors and Switches > Sensors and Switches - Wiper and Washer Systems > Wiper Switch > Component Information > Locations



View 151-13

Connector: C202A

Description:	Harness:	Base Part #:
MULTIFUNCTION SWITCH	14A320	13K359



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CRW17 (GN-VT)	20	SWITCH - FRONT WIPER INTERVAL (A)	
2	CRW19 (BU-OG)	20	SWITCH - FRONT WIPER INTERVAL (C)	
3	CRW18 (VT-WH)	20	SWITCH - FRONT WIPER INTERVAL (B)	
4	CRW15 (BN-WH)	20	CTRL MOD. - FRONT WIPER HIGH	
5	CRW07 (GY-BN)	20	SWITCH - FRONT WASHER	
6	CD161 (BK YE)	18	GROUND SEAT BRACKET REAR LEFT	
7	CLS41 (GY-YE)	22	SWITCH - TURN RIGHT	
8	CLS36 (YE)	18	SWITCH - PARK LAMPS RIGHT	
9	CLS35 (VT)	18	SWITCH - PARK LAMPS LEFT	
10	CLS39 (VT-WH)	22	SWITCH - TURN LEFT	
11	*	*	not used	
12	*	*	not used	

Wiper Switch: Diagrams

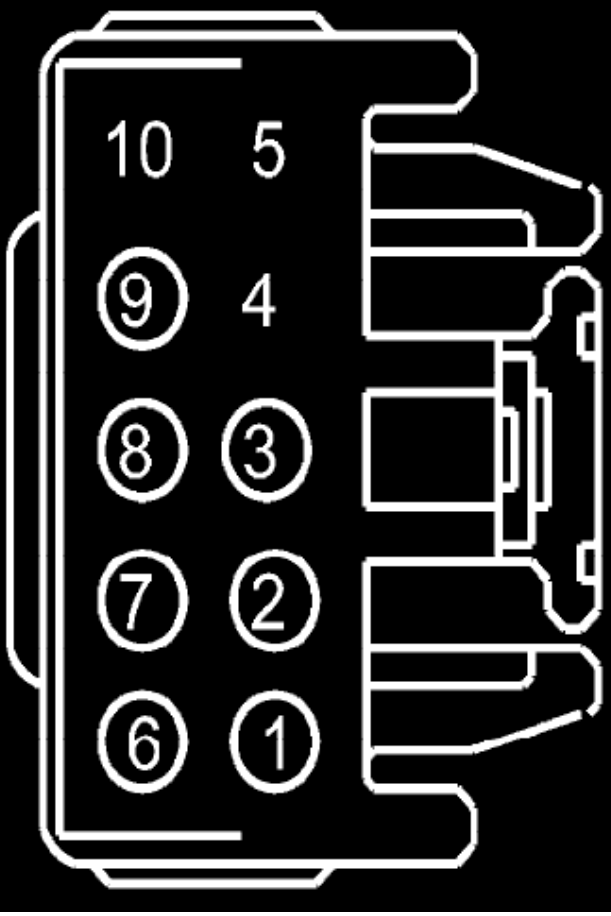
C202A

Connector: C202B

Description: MULTIFUNCTION SWITCH

Harness: 14A320

Base Part #: 13K359



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CCB08 (VT-WH)	16	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL OPEN	
2	CLS42 (VT-BN)	18	INDICATOR FLASHER RELAY - TURN SIGNAL SWITCHED POWER	
3	CLS32 (BN-YE)	18	INDICATOR FLASHER RELAY - HAZARD SWITCHED POWER	
4	*	*	not used	
5	*	*	not used	
6	SBP23 (WH-RD)	14	FUSE - 23 OR CIRCUIT BREAKER	
7	CLF27 (GN-BN)	14	SWITCH - FLASH TO PASS	
8	CLS24 (BN-WH)	16	CTRL MOD. - TURN LAMP RIGHT	
9	CLF18 (BU-WH)	16	SWITCH - BEAM LOW	
10	*	*	not used	

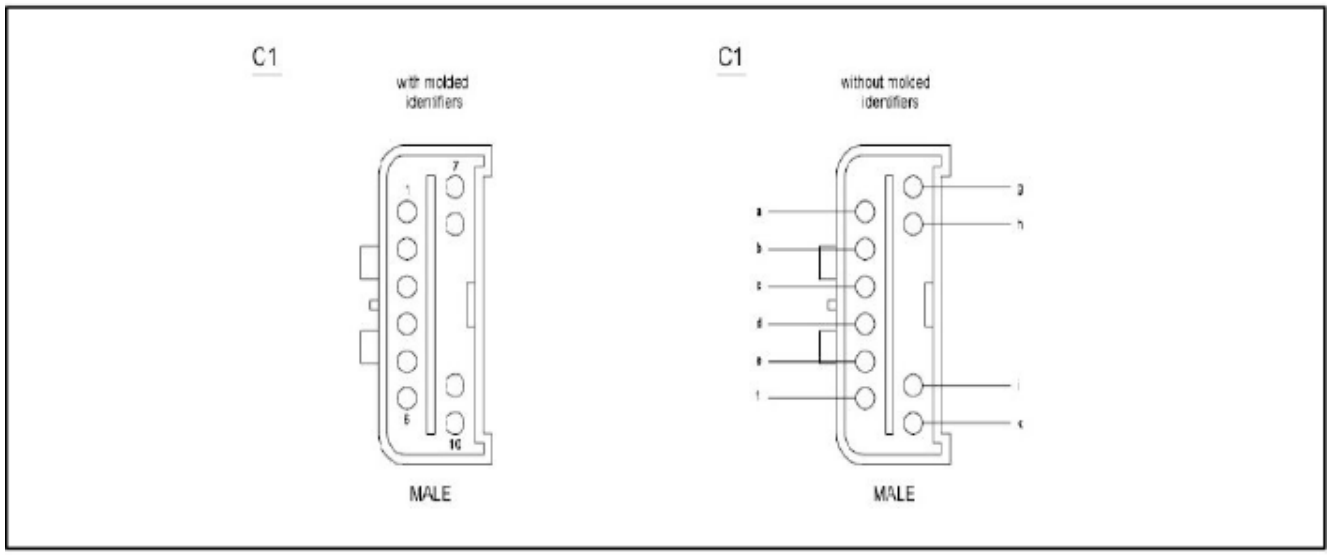
C202B

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



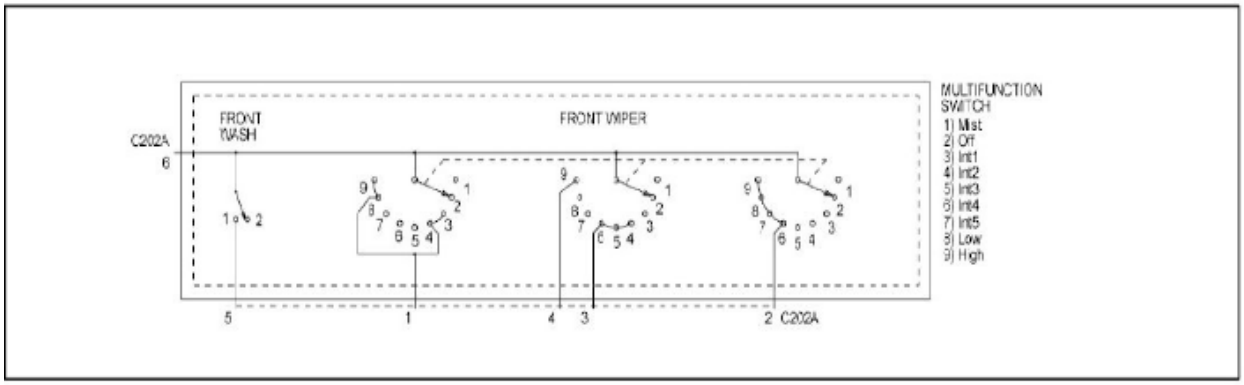
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Wiper Switch: Testing and Inspection

Multifunction Switch, Wiper/Washer Portion

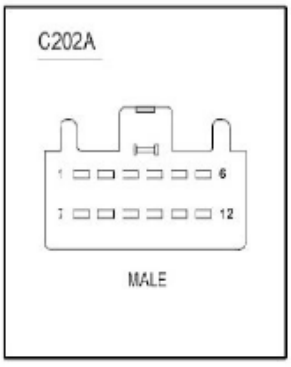
Schematic



Component testing procedure

Circuit to test	Connect self-powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
Front washer switch circuit	5 and 3	Front washer	Closed circuit
		Off	Open circuit
Front wiper switch circuit	1 and 3	Off	Open circuit
		Low	Closed circuit
		High	
	4 and 3	Off	Open circuit
		Low	
		High	Closed circuit
	2 and 3	Off	Open circuit
		Low	Closed circuit
		High	

Terminals

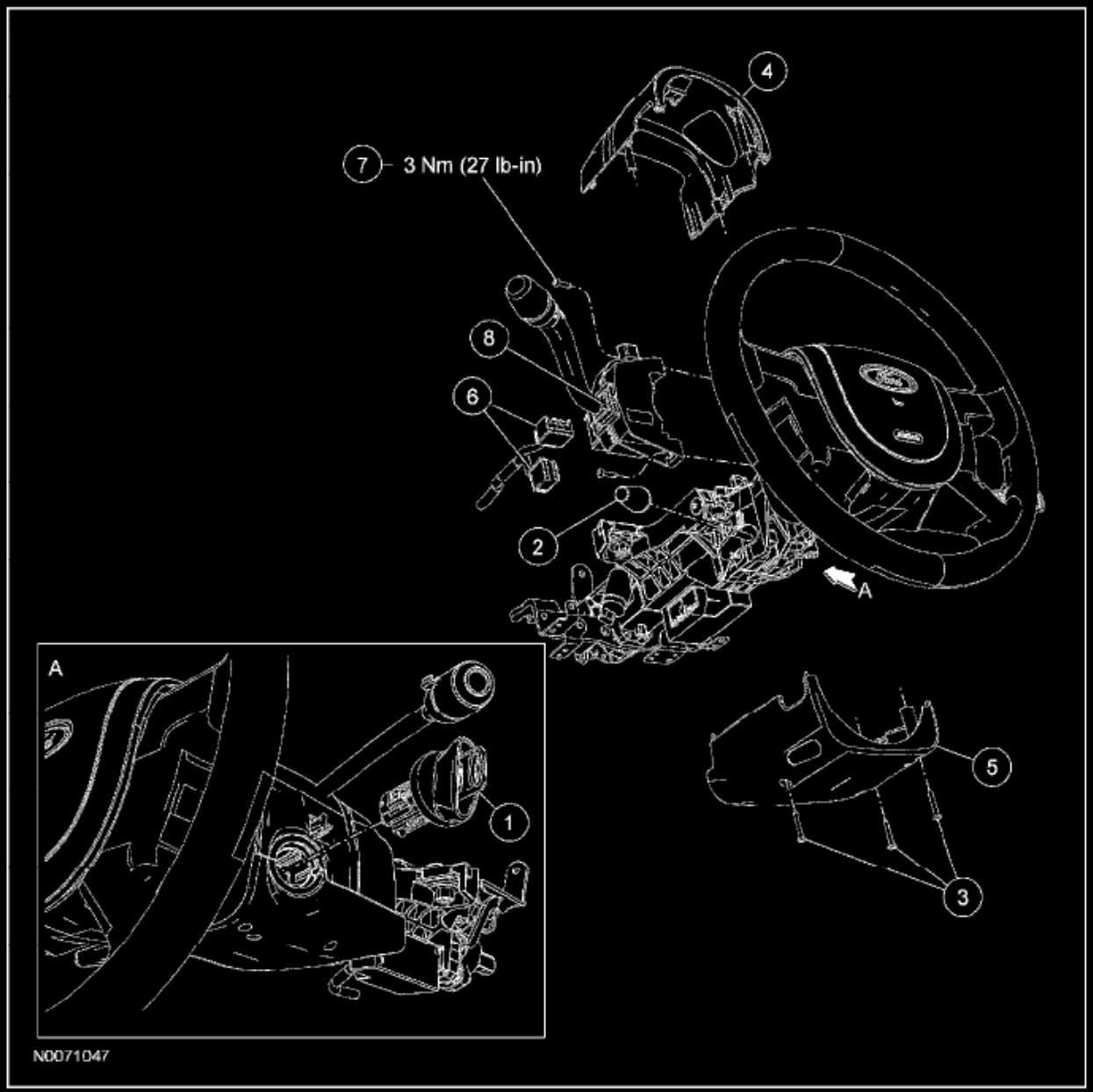


Multifunction Switch, Wiper/Washer Portion (continued)

Component testing procedure

Circuit to test	Connect self-powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
Intermittent wiper circuit, front	1 and 6	Interval 1	Closed circuit
		Interval 2	
		Interval 3	Open circuit
		Interval 4	
		Interval 5	
	3 and 6	Interval 1	Open circuit
		Interval 2	Closed circuit
		Interval 3	
		Interval 4	
		Interval 5	Open circuit
	2 and 6	Interval 1	Open circuit
		Interval 2	
		Interval 3	
		Interval 4	Closed circuit
		Interval 5	

Steering Column Multifunction Switch



Item	Part Number	Description
1	11582	Ignition switch lock cylinder
2	3F609	Tilt release lever/ handle
3	391727	Steering column shroud screws (3 required)
4	3530	Upper steering column shroud
5	3533	Lower steering column shroud

(Continued)

Item	Part Number	Description
6	—	Steering column multi-function switch electrical connectors (part of 14A320)
7	390345	Steering column multi-function switch screws (2 required)
8	13K359	Steering column multi-function switch

Wiper Switch: Service and Repair

Steering Column Multifunction Switch

Steering Column Multifunction Switch

Removal and Installation

1. Remove the ignition switch lock cylinder.

1 Insert the ignition key into the ignition switch lock cylinder and turn to the RUN position.

2 Push the ignition switch lock cylinder release tab with a punch while pulling out the ignition switch lock cylinder.

2. If equipped, remove the tilt release lever/ handle.

3. Remove the 3 steering column shroud screws and the upper and lower steering column shrouds. 4. Disconnect the multi-function switch electrical connectors. 5. Remove the 2 multi-function switch screws and the multi-function switch.

^ To install, tighten to 3 Nm (27 lb-inch).

6. To install, reverse the removal procedure.

Alignment Specifications

Item	LH	RH	Total/Split
Front — Rear Wheel Drive (RWD) with Coil Spring Suspension			
Camber	-0.5° ± 0.75°	-0.5° ± 0.75°	0.0° ± 0.75°
Caster	3.0° ± 1.0°	3.4° ± 1.0°	-0.4° ± 0.75°
Toe @ curb ride height (Positive value is toe-in, negative value is toe-out)	—	—	0.06° ± 0.25°
Front — Rear Wheel Drive (RWD) with Torsion Bar Suspension			
Camber	0.0° ± 0.7°	0.0° ± 0.7°	0.0° ± 0.75°
Caster	2.8° ± 1.0°	3.5° ± 1.0°	-0.7° ± 0.75°
Toe @ curb ride height (Positive value is toe-in, negative value is toe-out)	—	—	0.12° ± 0.25°
Front — Four Wheel Drive (4WD)			
Camber	0.0° ± 0.7°	0.0° ± 0.7°	0.0° ± 0.75°
Caster	2.8° ± 1.0°	3.5° ± 1.0°	-0.7° ± 0.75°
Toe @ curb ride height (Positive value is toe-in, negative value is toe-out)	—	—	0.12° ± 0.25°

Alignment: Specifications Alignment Specifications

Alignment Specifications

General Specifications

Item	Specification
Ball Joint Deflection	
Lower ball joint	0-0.8 mm (0-0.032 in)
Upper ball joint	0-0.2 mm (0-0.008 in)
Dogtracking	
Maximum (Centerline of front tires compared to centerline of rear tires)	30 mm (1.2 in)
Front Ride Height	
Four wheel drive (4WD) and rear wheel drive (RWD) torsion bar — if new parts are installed	105 mm (4.13 in) ± 12 mm (0.47 in)
4WD and RWD torsion bar — new vehicles with less than 805 km (500 mi)	105 mm (4.13 in) ± 12 mm (0.47 in)
4WD and RWD torsion bar — vehicles with more than 805 km (500 mi)	93 mm (3.66 in) ± 12 mm (0.47 in)
FX4 — if new parts are installed	113 mm (4.52 in) + 12 mm (0.47 in)
FX4 — new vehicles with less than 805 km (500 mi)	113 mm (4.52 in) ± 12 mm (0.47 in)
FX4 — vehicles with more than 805 km (500 mi)	101 mm (4.08 in) ± 12 mm (0.47 in)

Alignment: Specifications General Specifications

General Specifications

General Specifications (Continued)

Item	Specification
Max ride height, side-to-side variance	12 mm (0.47 in)
RWD coil spring — if new parts are installed	102 mm (4.08 in) + 12 mm (0.47 in)
RWD coil spring — vehicles with more than 805 km (500 mi)	102 mm (4.08 in) ± 12 mm (0.47 in)
Rear Ride Height	
4WD, FX4 and RWD torsion bar regular cab base suspension — if new parts are installed	185 mm (7.28 in) - 207 mm (8.15 in)
4WD, FX4 and RWD torsion bar regular cab base suspension — new vehicles with less than 805 km (500 mi)	185 mm (7.28 in) - 207 mm (8.15 in)
4WD, FX4 and RWD torsion bar regular cab base suspension — vehicles with more than 805 km (500 mi)	175 mm (6.89 in) - 197 mm (7.76 in)
4WD, FX4 and RWD torsion bar SuperCab base suspension — if new parts are installed	166 mm (6.54 in) - 185 mm (7.28 in)

General Specifications (Continued)

Item	Specification
4WD, FX4 and RWD torsion bar SuperCab base suspension — new vehicles with less than 805 km (500 mi)	166 mm (6.54 in) - 185 mm (7.28 in)
4WD, FX4 and RWD torsion bar SuperCab base suspension — vehicles with more than 805 km (500 mi)	156 mm (6.14 in) - 175 mm (6.89 in)
4WD, FX4 and RWD torsion bar SuperCab payload package — if new parts are installed	185 mm (7.28 in) - 207 mm (8.15 in)
4WD, FX4 and RWD torsion bar SuperCab payload package — new vehicles with less than 805 km (500 mi)	185 mm (7.28 in) - 207 mm (8.15 in)
4WD, FX4 and RWD torsion bar SuperCab payload package — vehicles with more than 805 km (500 mi)	175 mm (6.89 in) - 197 mm (7.76 in)
RWD, regular cab and SuperCab, coil spring base suspension — if new parts are installed	188 mm (7.40 in) - 210 mm (8.27 in)
RWD, regular cab and SuperCab, coil spring base suspension — new vehicles with less than 805 km (500 mi)	188 mm (7.40 in) - 210 mm (8.27 in)

General Specifications (Continued)

Item	Specification
RWD, regular cab and SuperCab, coil spring base suspension — vehicles with more than 805 km (500 mi)	178 mm (7.20 in) - 200 mm (7.87 in)
RWD, regular cab and SuperCab, coil spring payload package — if new parts are installed	208 mm (8.19 in) - 232 mm (9.13 in)
RWD, regular cab and SuperCab, coil spring payload package — new vehicles with less than 805 km (500 mi)	208 mm (8.19 in) - 232 mm (9.13 in)
RWD, regular cab and SuperCab, coil spring payload package — vehicles with more than 805 km (500 mi)	198 mm (7.80 in) - 222 mm (8.74 in)
Vehicle Lean (Side-to-Side Differences)	
Front and rear	13 mm (0.5 in)
Wheel Track	
Wheel track	30.6 mm (1.22 in)

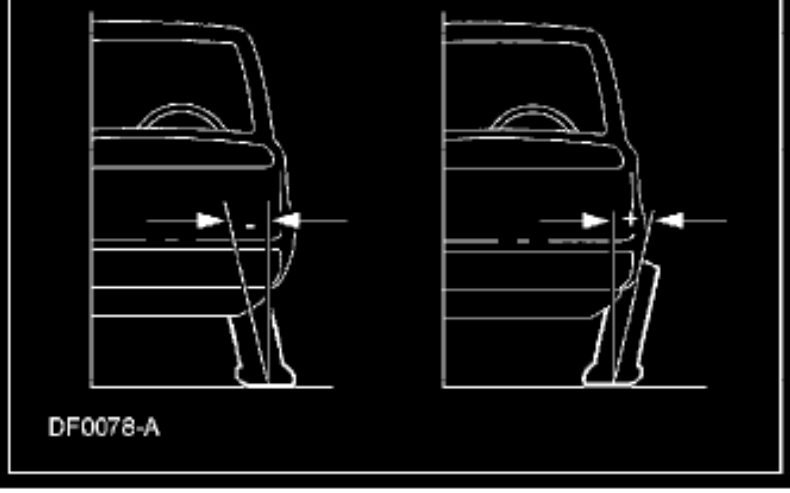
Torque Specifications

Description	Nm	lb-ft
Tie-rod jam nuts	80	59
U-bolt nuts	115	85
Upper arm-to-frame nuts	133	98

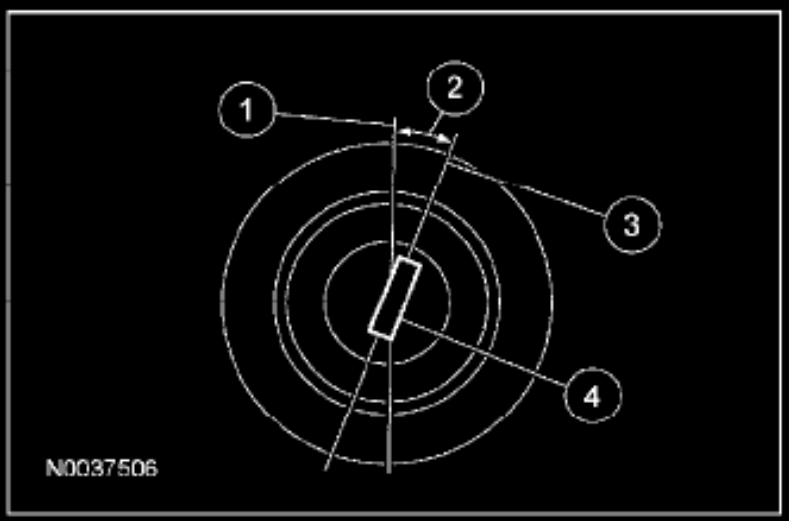
Alignment: Specifications Torque Specifications

Torque Specifications

Negative and Positive Camber



Caster



Item	Part Number	Description
1	—	True vertical
2	—	Positive caster angle
3	—	Ball joint center line
4	—	Pivot center line

Alignment: Description and Operation

Wheel Alignment Angles

Front caster and camber are adjusted by replacing the upper arm alignment set shims with washers, this allows for adjustment of the arm in the frame slot. Front toe is adjusted by the use of the inner tie rods.

Camber

Negative and Positive Camber

Camber is the vertical tilt of the wheel when viewed from the front. Camber can be positive or negative and has a direct effect on tire wear.

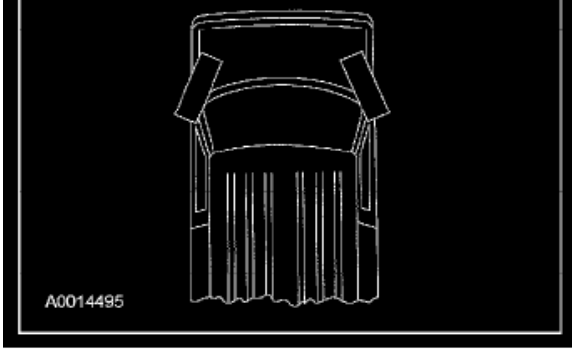
Caster

Caster

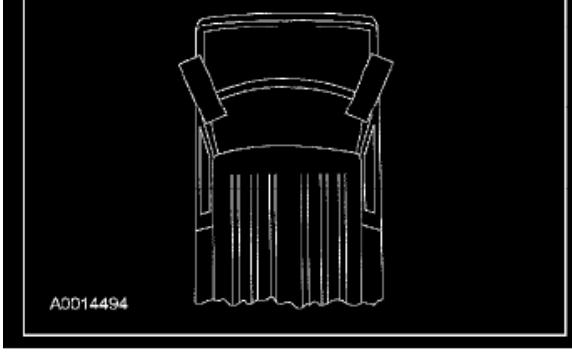
Caster is the deviation from vertical of an imaginary line drawn through the ball joints when viewed from the side. The caster specifications will give the vehicle the best directional stability characteristics when loaded and driven. The caster setting is not related to tire wear.

Toe

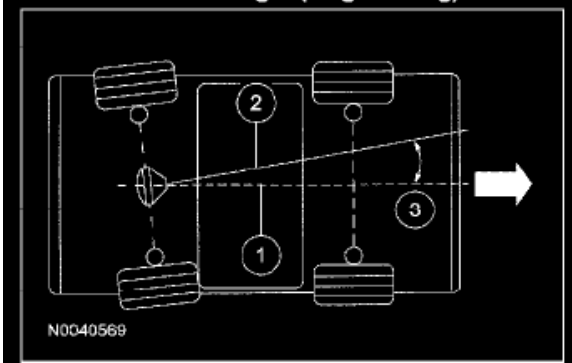
Positive Toe (Toe In)



Negative Toe (Toe Out)



Incorrect Thrust Angle (Dogtracking)



Item	Part Number	Description
1	—	Vertical centerline
2	—	Axle centerline
3	—	Thrust angle

Positive Toe (Toe In)

Negative Toe (Toe Out)

The vehicle toe setting: ^

affects tire wear and directional stability.

^ must be checked after adding aftermarket equipment, such as a snowplow.

Incorrect Thrust Angle (Dogtracking)

Incorrect Thrust Angle (Dogtracking)

Incorrect thrust angle (dogtracking) is the condition in which the rear axle is not square to the chassis. Heavily crowned roads can give the illusion of dogtracking.

Wander

Wander is the tendency of the vehicle to require frequent, random left and right steering wheel corrections to maintain a straight path down a level road.

Shimmy

Shimmy, as observed by the driver, is large, consistent, rotational oscillations of the steering wheel resulting from large, side-to-side (lateral) tire/wheel movements.

Shimmy is usually experienced near 64 km/h (40 mph), and can begin or be amplified when the tire contacts pot holes or irregularities in the road surface.

Nibble

Sometimes confused with shimmy, nibble is a condition resulting from tire interaction with various road surfaces and observed by the driver as small rotational oscillations of the steering wheel.

Poor Returnability/Sticky Steering

Poor returnability and sticky steering is used to described the poor return of the steering wheel to center after a turn or the steering correction is completed.

Drift/Pull

Pull is a tugging sensation, felt by the hands on the steering wheel, that must be overcome to keep the vehicle going straight.

Drift describes what a vehicle with this condition does with hands off the steering wheel. ^

A vehicle-related drift/pull, on a flat road, will cause a consistent deviation from the straight-ahead path and require constant steering input in the opposite direction to counteract the effect.

^ Drift/pull may be induced by conditions external to the vehicle (i.e., wind, road camber).

Poor Groove Feel

Poor groove feel is characterized by little or no buildup of turning effort felt in the steering wheel as the wheel is rocked slowly left and right within very small turns around center or straight-ahead (under 20 degrees of steering wheel turn). Efforts may be said to be "flat on center". ^

Under 20 degrees of turn, most of the turning effort that builds up comes from the mesh of gear teeth in the steering gear. In this range, the steering wheel is not yet turned enough to feel the effort from the self-aligning forces at the road wheel or tire patch.

^ In the diagnosis of a concern, it is important to understand the difference between wander and poor groove feel.

Adjustment	Front of Upper Arm	Rear of Upper Arm
Increase caster	Out	In
Decrease caster	In	Out
Increase camber	Out	Out
Decrease camber	In	In
Increase caster and camber simultaneously	Out	—
Decrease caster and camber simultaneously	In	—

Alignment: Service and Repair Camber and Caster Adjustment

Camber and Caster Adjustment

1. NOTE: The upper arm-to-frame mounting bolts have set shims that must be replaced with washers (W-705040S900) to allow for adjustment of

the arm in the frame slot.

Index-mark the upper arm-to-frame bolts, then remove and discard the upper arm-to-frame nuts and set shims.

2. Align the index marks and install the new washers and new nuts.

^ Tighten the nuts until snug.

3. Using alignment equipment and the manufacturer's instructions, measure the caster and camber.

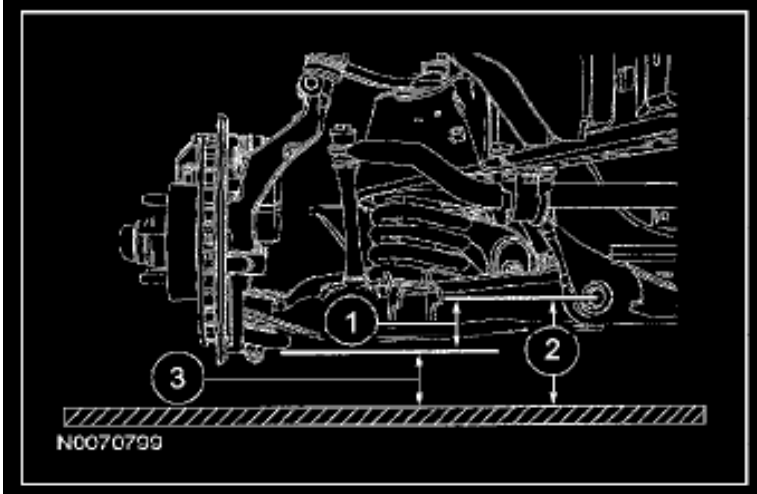
4. NOTE: The vehicle should be supported by the lower arms to ease movement of the upper arm in the slot.

To adjust the caster and camber refer to the following chart. ^

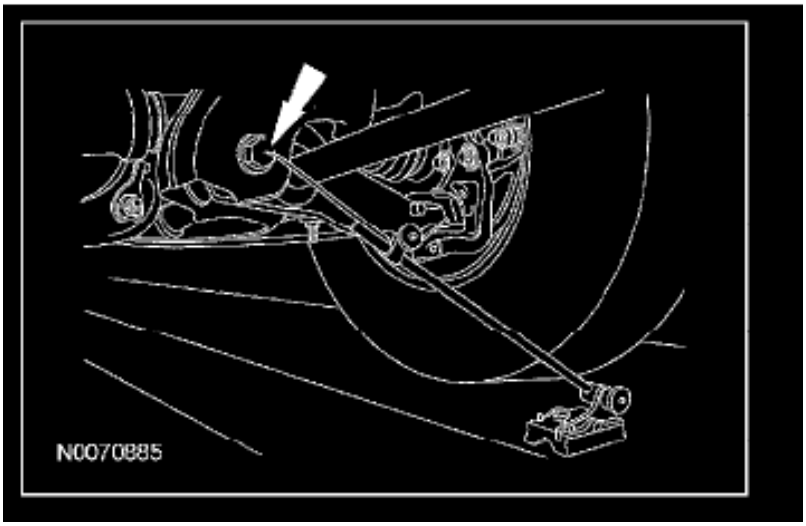
When making adjustments that require moving both the front and the rear of the upper arm, move both ends of the arm equally.

5. Tighten the upper arm-to-frame nuts to 133 Nm (98 lb-ft). 6. Recheck the caster and camber settings and adjust as necessary. 7. Check and, if necessary, adjust the front toe.

Front Ride Height Measurement



Item	Part Number	Description
1	—	Ride height = A - B
2	—	Measurement A
3	—	Measurement B



Alignment: Service and Repair Ride Height Measurement

Ride Height Measurement

Front Ride Height Measurement

Front Ride Height Measurement

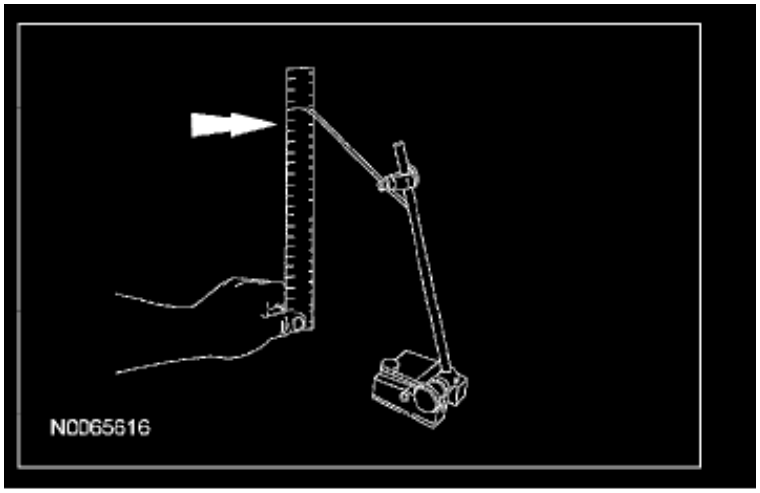
NOTE: Make sure that the vehicle is positioned on a flat, level surface and the tires are inflated to the correct pressure. Vehicle should have a full tank of fuel.

1. Position a suitable surface gauge (such as Starrett 57D Surface Gauge), on a flat, level surface and adjust the gauge's arm until the scriber point is

located in the center of the lower arm rearward bolt. ^

Lock the surface gauge in this position.

2. With the surface gauge positioned on a flat, level surface, record the measurement of the surface gauge position (measurement A).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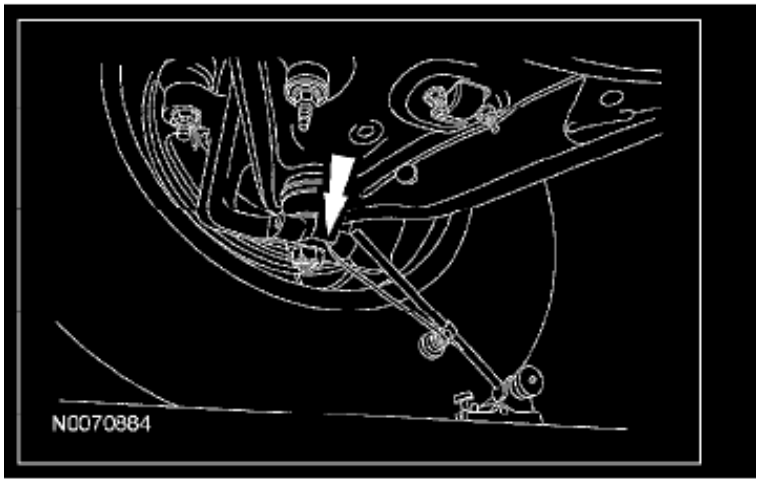
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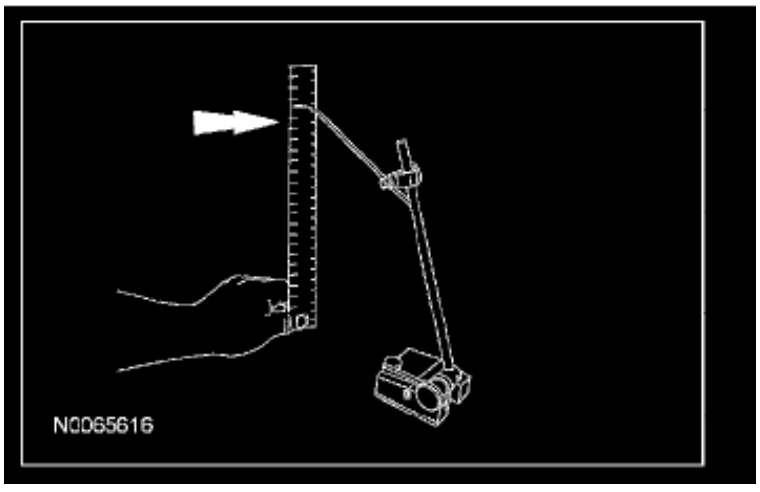

N0065616

3. Position the surface gauge on the same flat, level surface as used in Step 1, adjust the gauge's arm until the scriber point is located on the wheel

knuckle lowest point, behind the lower ball joint nut. ^

Lock the surface gauge in this position.

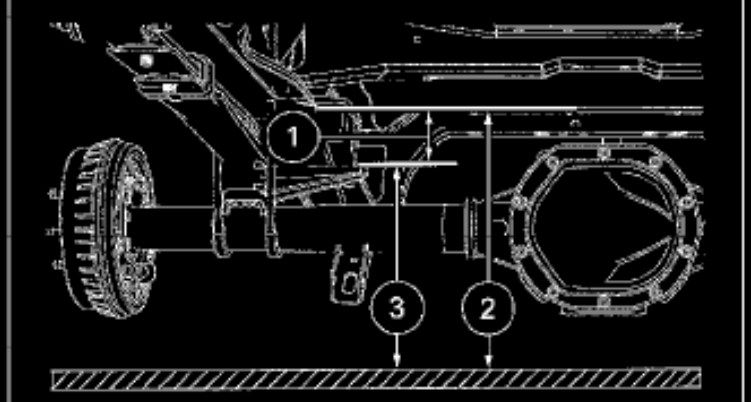
4. With the surface gauge positioned on a flat, level surface, record the measurement of the surface gauge position (measurement B).

5. Subtract measurement B from measurement A to obtain the front ride height.

^ Refer to Specifications.

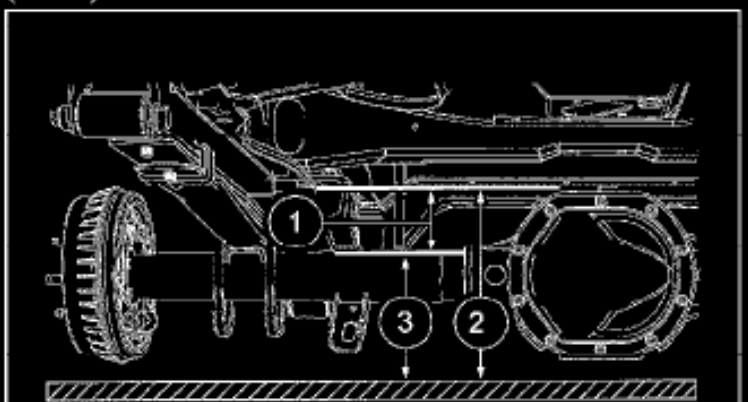
Rear Ride Height Measurement

Ride Height Measurement — Four Wheel Drive (4WD)



Item	Part Number	Description
1		Ride height = A - B
2	—	Measurement point A
3	—	Measurement point B

Ride Height Measurement — Rear Wheel Drive (RWD)



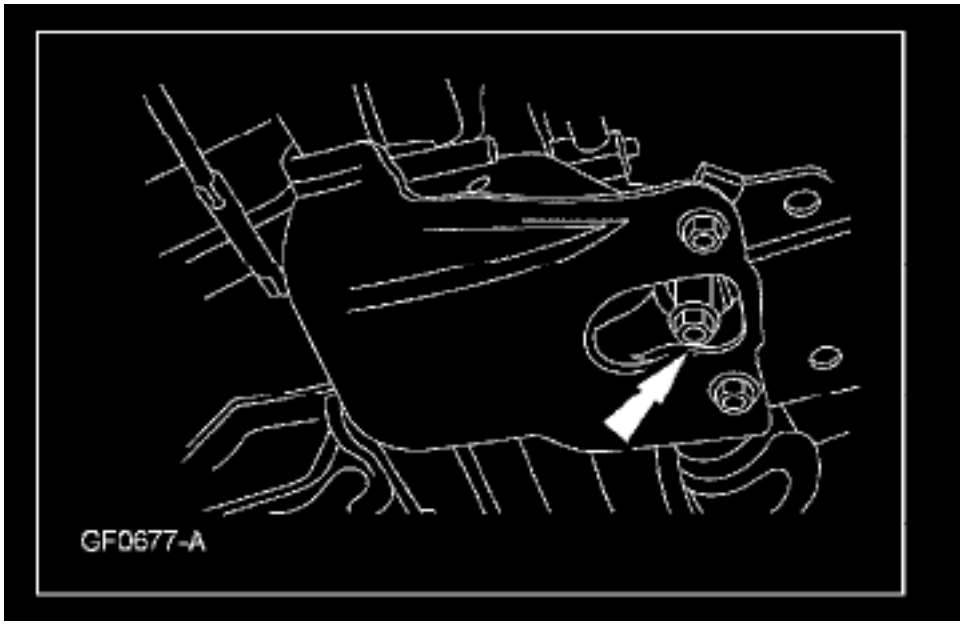
Item	Part Number	Description
1	—	Ride height = A - B
2	—	Measurement point A
3		Measurement point B

Ride Height Measurement - Four Wheel Drive (4WD)

Ride Height Measurement - Rear Wheel Drive (RWD)

NOTE: Make sure that the vehicle is positioned on a flat, level surface and the tires are inflated to the correct pressure. Vehicle should have a full tank of fuel.

1. To obtain rear ride height, measure the distance between points A and B. For additional information, refer to Specifications.



Alignment: Service and Repair Suspension Design Height Setting

Suspension Design Height Setting

NOTE: Make sure the vehicle is on a flat, level surface, such as a drive-on hoist.

1. Jounce the vehicle's front and rear suspension to normalize the vehicle static ride height. 2. Measure the ride height.

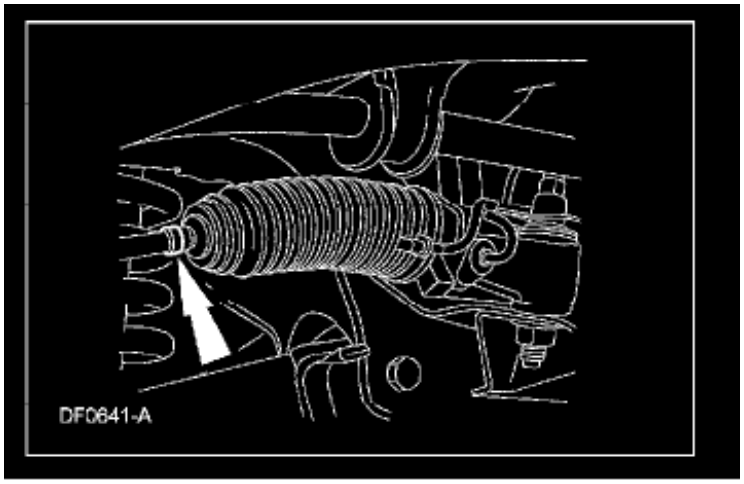
3. NOTE: The torsion bar adjusting bolt is coated with a thread locking compound that wears off after disassembly. If the torsion bar system is ever

disassembled or if the torsion bar adjusting bolt is ever removed, use a new torsion bar adjusting bolt when assembling.

Adjust the ride height as follows: ^

To increase the ride height, tighten the torsion bar adjusting bolt.

^ To decrease the ride height, loosen the torsion bar adjusting bolt.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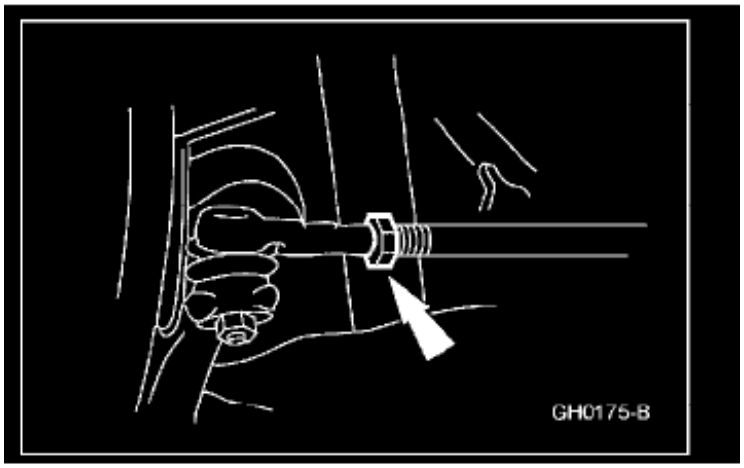
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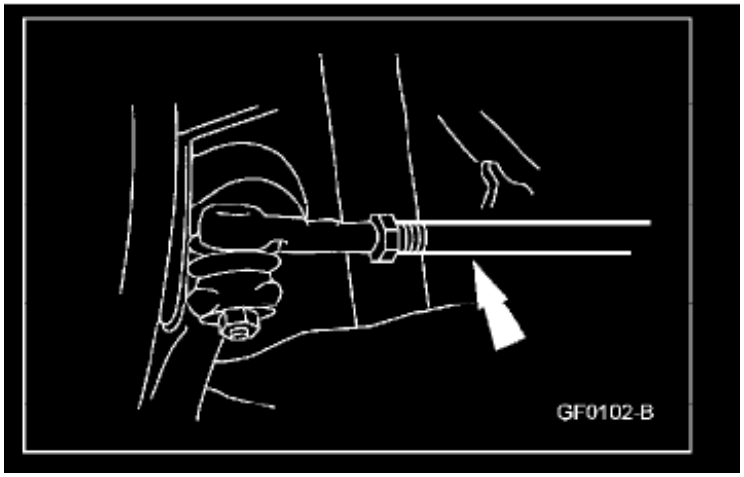
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Alignment: Service and Repair Toe Adjustment

Toe Adjustment

1. Start the engine and center the steering wheel. 2. Turn the engine OFF and, using a suitable holding device, lock the steering wheel in the straight ahead position. 3. Using alignment equipment and the manufacturer's instructions, measure the toe. 4. Remove the steering gear bellows clamps.

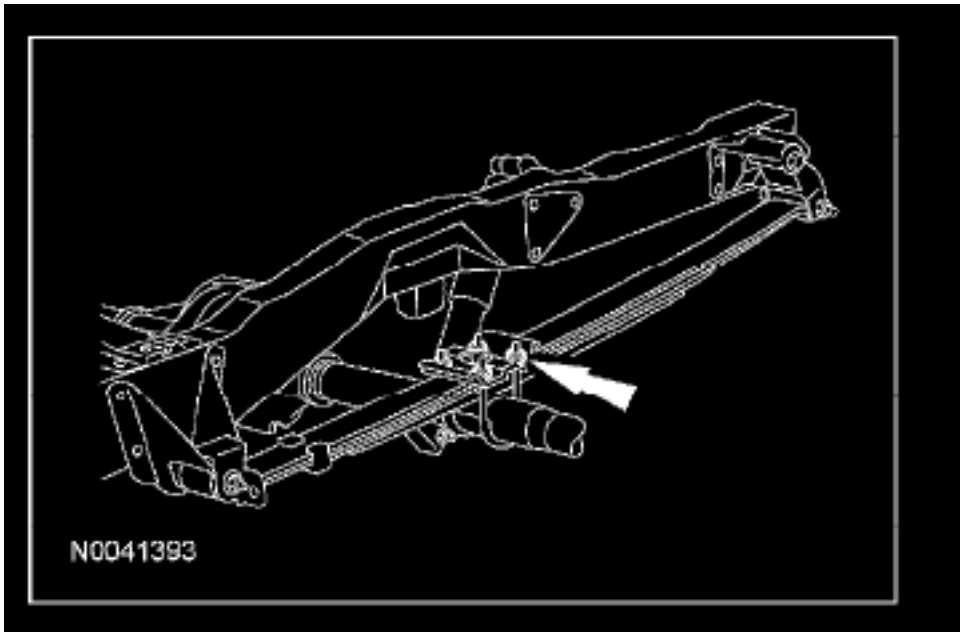
5. Loosen the tie-rod jam nuts.

6. CAUTION: Do not allow the steering gear bellows to twist when the front wheel spindle tie rod is rotated or damage to the bellows may

occur.

Rotate the inner tie rods until the toe setting is within specifications.

7. Tighten the tie-rod jam nuts to 80 Nm (59 lb-ft). 8. Install the steering gear bellows clamps. 9. Recheck the toe settings and adjust as necessary.



Alignment: Service and Repair Lean Correction - Rear

Lean Correction - Rear

NOTE: A side-to-side lean may be adjusted by 6 mm (0.25 inch). This is accomplished by placing a shim (D7TZ-5742-A) between the rear spring and the axle on the low side of the vehicle.

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Using a suitable jack, support the rear axle. 3. Remove and discard the 4 U-bolt nuts and U-bolts.

^ Remove the spring plate.

^ To install, tighten to 115 Nm (85 lb-ft).

4. Using the jack, lower the rear axle approximately 13 mm (0.51 inch).

5. NOTE: Make sure that the spring locator bolt is centered in the spacer hole.

NOTE: On vehicles equipped with a spring spacer block, place the shim between the rear spring and the axle spacer.

Install the spacer (D7TZ-5742-A) between the spring and the axle.

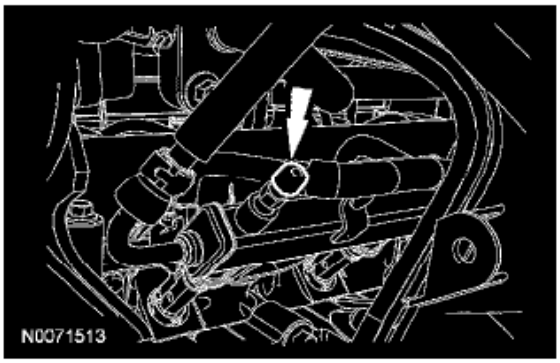
Fuel Pressure: Specifications

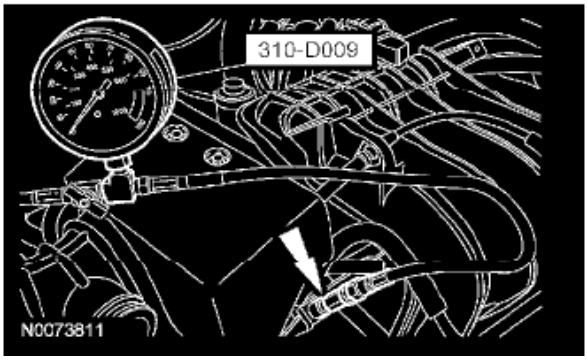
Item.....Specification

Engine running.....414-448 kPa (60-65 psi) Key ON, engine OFF.....414-448 kPa (60-65 psi)

Special Tool(s)

ST3038-A	Fuel Pressure Test Kit 310-D009 (D95L-7211A)





Fuel Pressure: Testing and Inspection

FUEL SYSTEM PRESSURE TEST

Special Tool(s)

Special Tool(s)

WARNING:

- Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

- Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.

- Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

- When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.

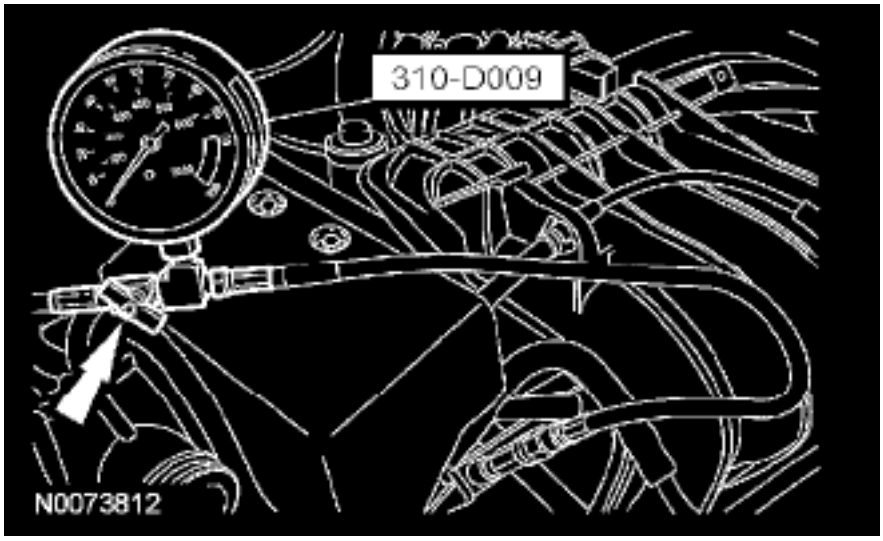
1. NOTE: 2.3L shown, 3.0L and 4.0L similar.

Remove the cap from the fuel pressure relief valve located on the fuel rail.

2. NOTE: 2.3L shown, 3.0L and 4.0L similar.

Install the special tool onto the fuel pressure relief valve.

3. Test the fuel system pressure to make sure it is within the specified range.



4. NOTE:

- 2.3L shown, 3.0L and 4.0L similar.

- Open the drain valve slowly to relieve the fuel system pressure. This may drain fuel from the system. Place fuel in a suitable container.

Upon completion of the fuel system pressure test, open the drain valve on the special tool and relieve the fuel system pressure.

5. NOTE: It may take more than one key cycle to pressurize the fuel system.

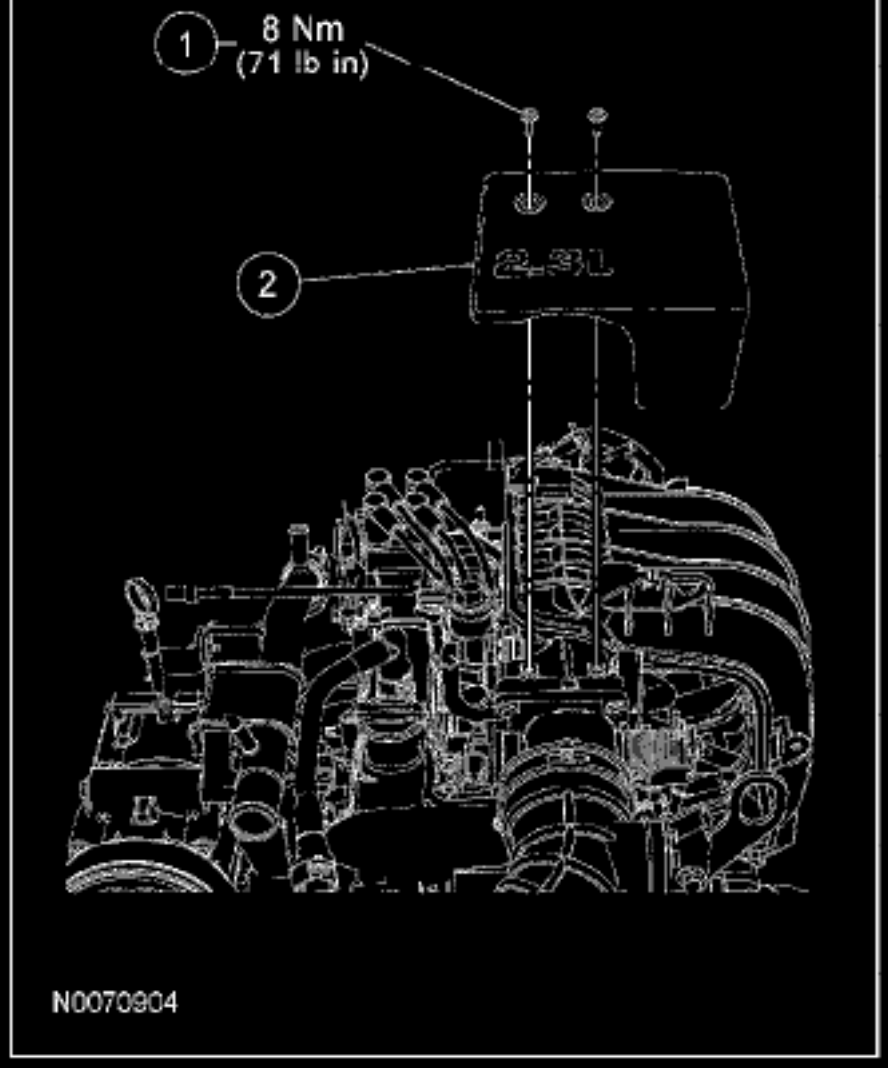
Cycle the ignition key and wait 3 seconds to pressurize the fuel system. Check for leaks before starting the engine.

Idle Speed: Specifications

Typical Diagnostic Reference Value

Measured/PID Values 750 RPM .... Hot Idle

2.3L Throttle Body (TB) Cover



Item	Part Number	Description
1	—	Throttle body (TB) cover bolt (2 required)
2	9E766	TB cover

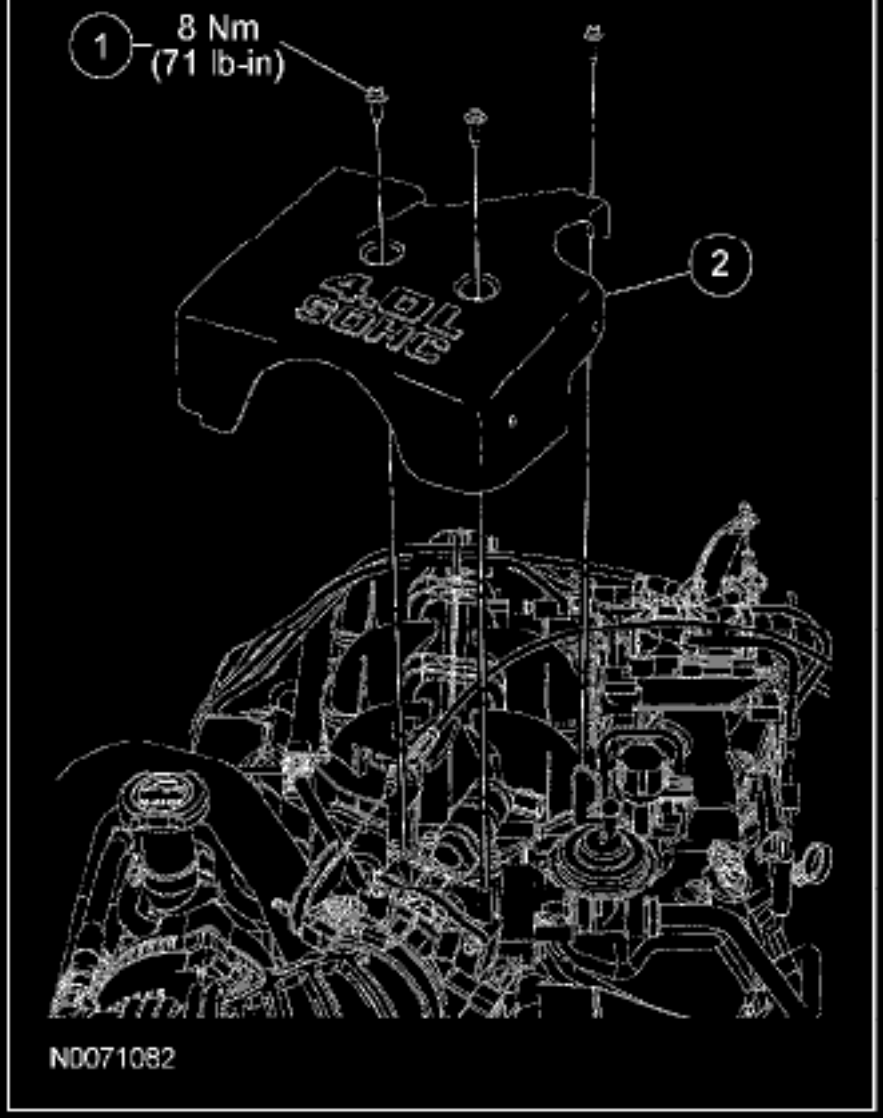
Air Cleaner Fresh Air Duct/Hose: Service and Repair

INTAKE AIR SYSTEM COMPONENTS

Exploded View

2.3L Throttle Body (TB) Cover

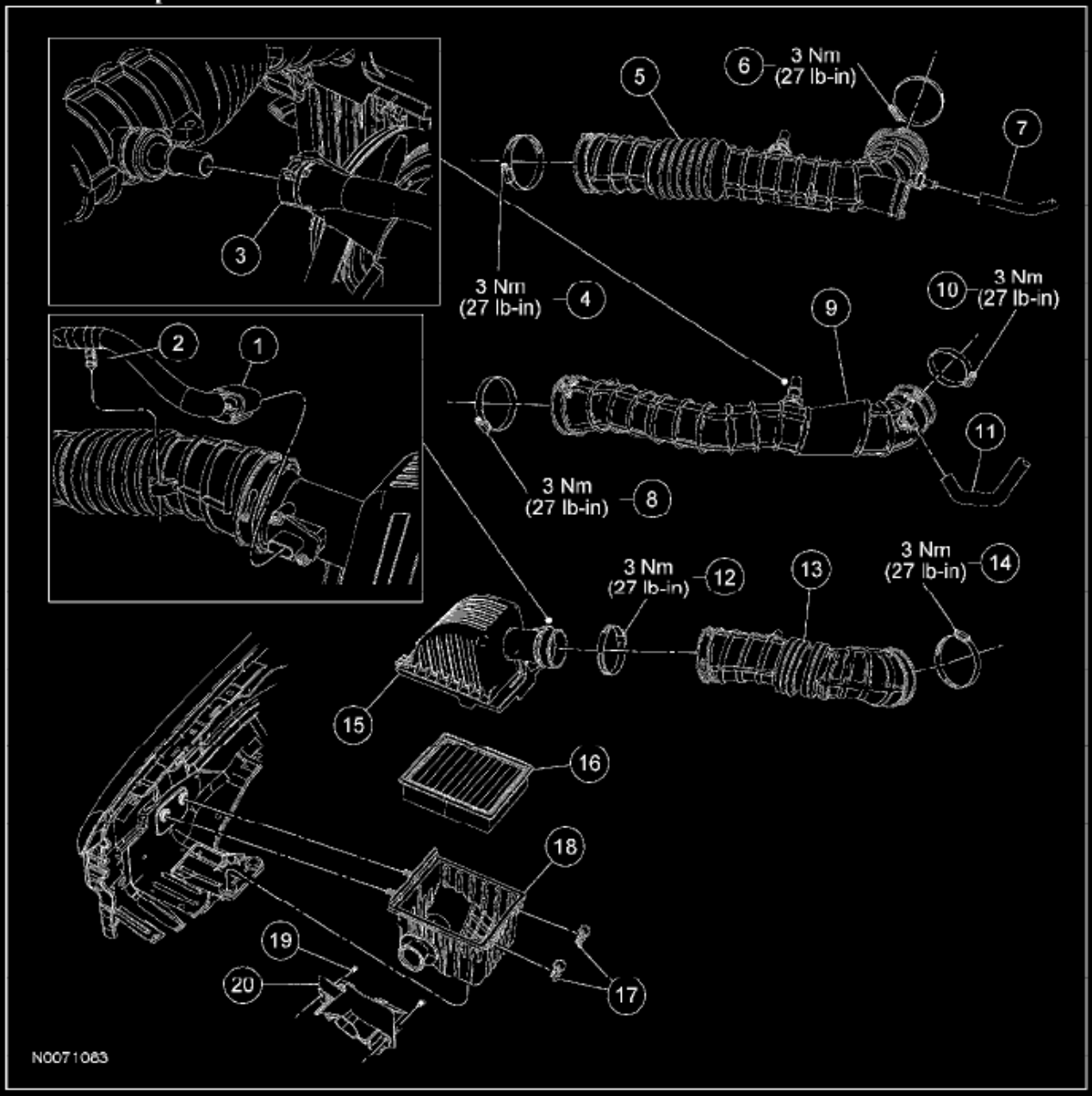
4.0L SOHC Throttle Body (TB) Cover



Item	Part Number	Description
1	W704704	Throttle body (TB) cover bolt (2 required)
2	9E766	TB cover

4.0L SOHC Throttle Body (TB) Cover

Intake Air Components



Item	Part Number	Description
1	—	Mass air flow (MAF) sensor electrical connector (part of 12B637)
2	13A506	Wiring harness retainer (2 required [2.3L engines]) (1 required [3.0L and 4.0L engines]) (part of 12B637)
3	—	Crankcase ventilation tube quick connect coupling

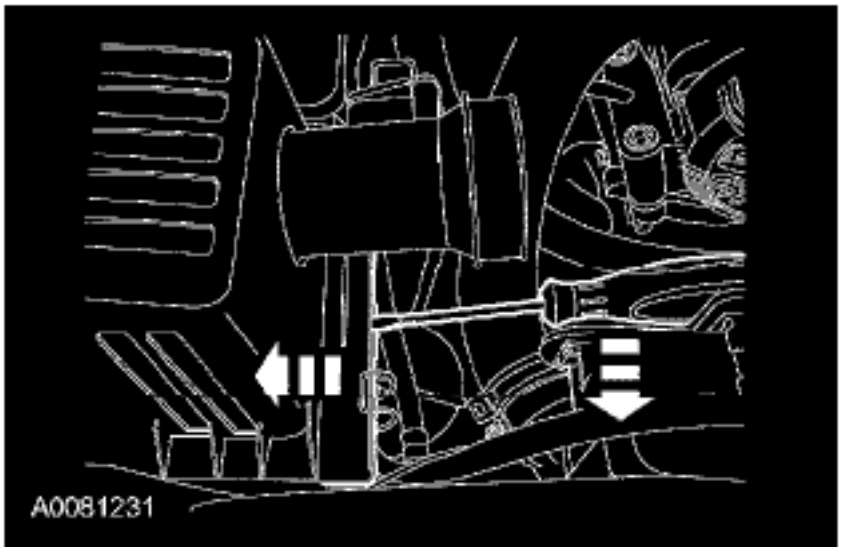
(Continued)

Item	Part Number	Description
4	6C632	Engine air cleaner (ACL) outlet tube-to-air cleaner clamp (2.3L)
5	9B659	ACL outlet tube (2.3L)
6	6C632	ACL outlet tube-to-throttle body (TB) clamp (2.3L)
7	9C490	Brake booster vacuum hose
8	6C632	ACL outlet tube-to-air cleaner clamp (3.0L)

(Continued)

Intake Air Components (Part 1)

Item	Part Number	Description
9	9B659	ACL outlet tube (3.0L)
10	6C632	ACL outlet tube-to-TB clamp (3.0L)
11	9C490	Brake booster vacuum hose
12	6C632	ACL outlet tube-to-air cleaner clamp (4.0L)
13	9B659	ACL outlet tube (4.0L)
14	6C632	ACL outlet tube-to-TB clamp (4.0L)
15	9643	ACL cover
16	9601	ACL element
17	9628	ACL-to-ACL cover clips
18	9A612	ACL
19	N810040	Air nozzle pushpins
20	9E961	Air nozzle

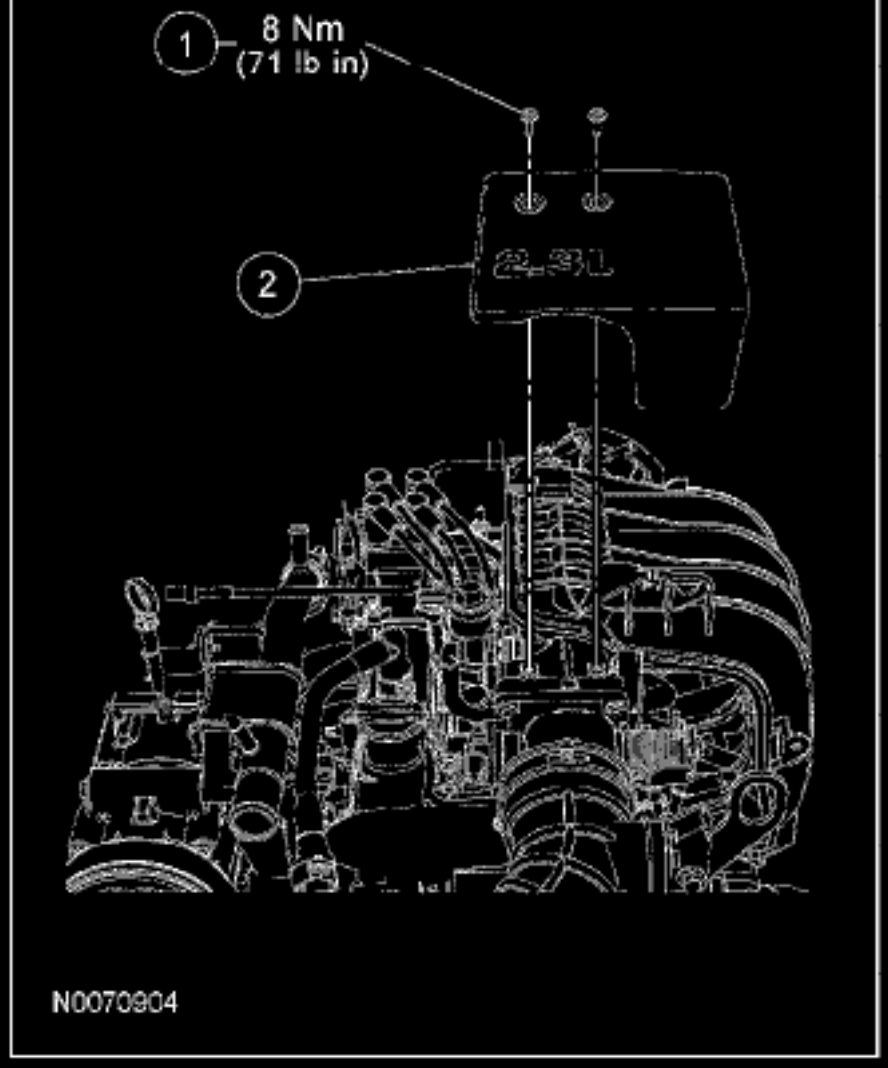


Intake Air Components (Part 2)

Removal and Installation

1. If necessary, pry the engine air cleaner (ACL) from the base support bracket when removing the ACL.

2.3L Throttle Body (TB) Cover



Item	Part Number	Description
1	—	Throttle body (TB) cover bolt (2 required)
2	9E766	TB cover

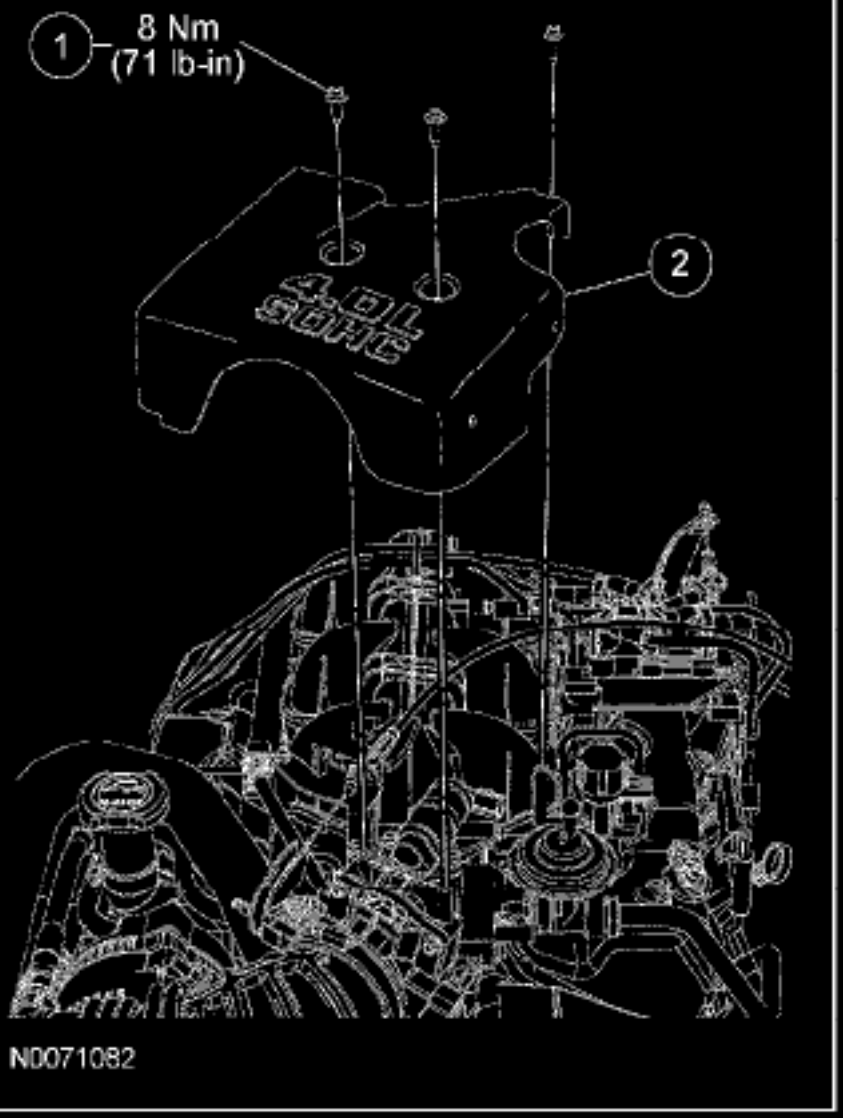
Air Filter Element: Service and Repair

INTAKE AIR SYSTEM COMPONENTS

Exploded View

2.3L Throttle Body (TB) Cover

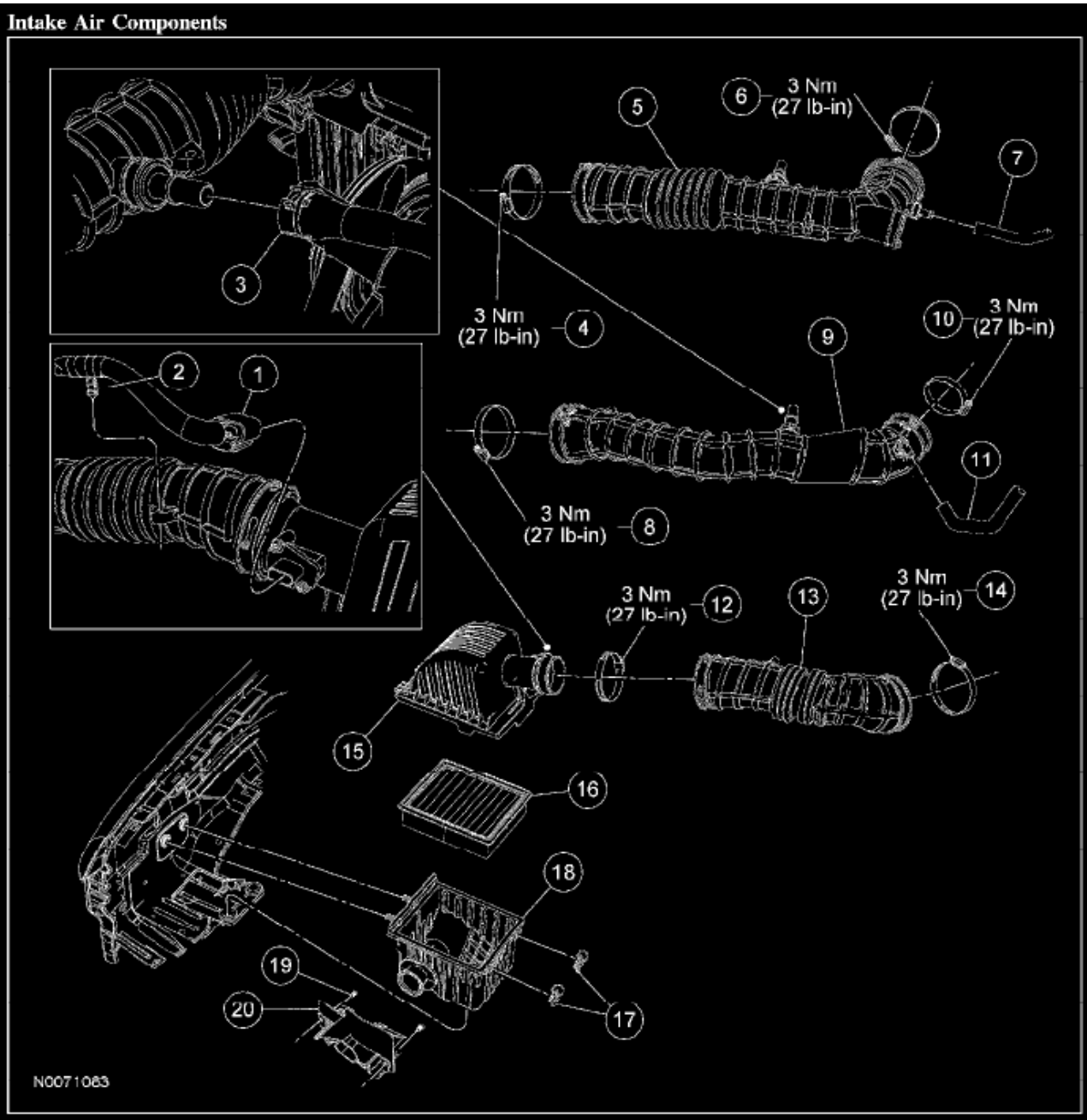
4.0L SOHC Throttle Body (TB) Cover



Item	Part Number	Description
1	W704704	Throttle body (TB) cover bolt (2 required)
2	9E766	TB cover

4.0L SOHC Throttle Body (TB) Cover

Intake Air Components



Item	Part Number	Description
1	—	Mass air flow (MAF) sensor electrical connector (part of 12B637)
2	13A506	Wiring harness retainer (2 required [2.3L engines]) (1 required [3.0L and 4.0L engines]) (part of 12B637)
3	—	Crankcase ventilation tube quick connect coupling

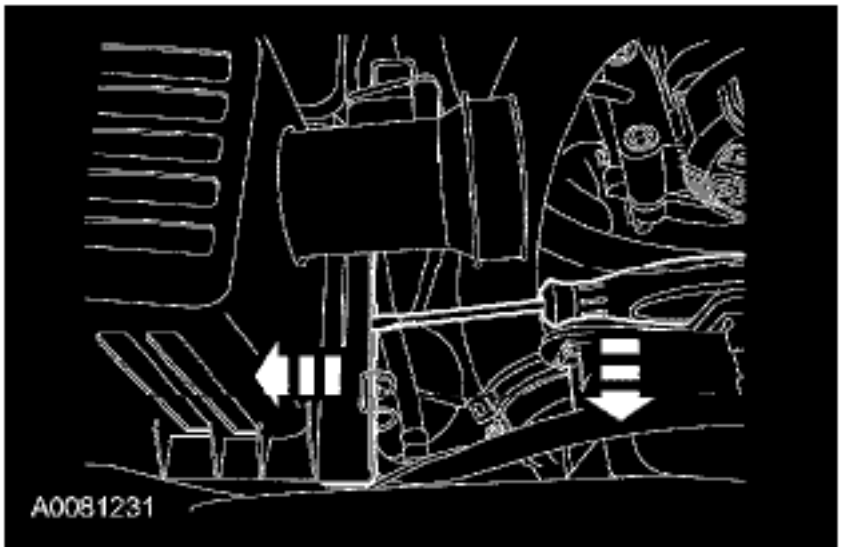
(Continued)

Item	Part Number	Description
4	6C632	Engine air cleaner (ACL) outlet tube-to-air cleaner clamp (2.3L)
5	9B659	ACL outlet tube (2.3L)
6	6C632	ACL outlet tube-to-throttle body (TB) clamp (2.3L)
7	9C490	Brake booster vacuum hose
8	6C632	ACL outlet tube-to-air cleaner clamp (3.0L)

(Continued)

Intake Air Components (Part 1)

Item	Part Number	Description
9	9B659	ACL outlet tube (3.0L)
10	6C632	ACL outlet tube-to-TB clamp (3.0L)
11	9C490	Brake booster vacuum hose
12	6C632	ACL outlet tube-to-air cleaner clamp (4.0L)
13	9B659	ACL outlet tube (4.0L)
14	6C632	ACL outlet tube-to-TB clamp (4.0L)
15	9643	ACL cover
16	9601	ACL element
17	9628	ACL-to-ACL cover clips
18	9A612	ACL
19	N810040	Air nozzle pushpins
20	9E961	Air nozzle



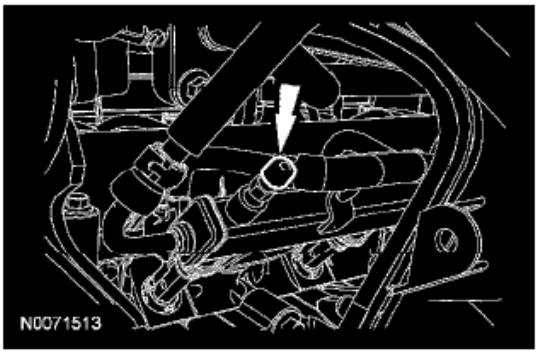
Intake Air Components (Part 2)

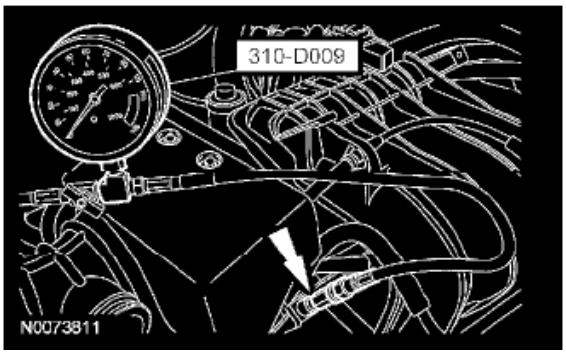
Removal and Installation

1. If necessary, pry the engine air cleaner (ACL) from the base support bracket when removing the ACL.

Special Tool(s)

ST3038-A	Fuel Pressure Test Kit 310-D009 (D95L-7211A)





Fuel Pressure Release: Service and Repair

FUEL SYSTEM PRESSURE RELEASE

Special Tool(s)

Special Tool(s)

WARNING:

- Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

- Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.

- Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

- When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.

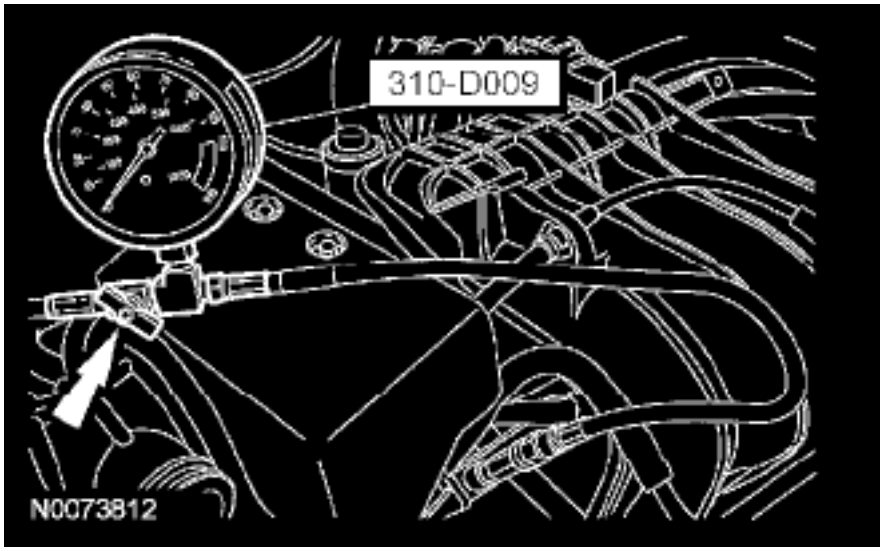
1. Disconnect the battery ground cable.

2. NOTE: 2.3L shown, 3.0L and 4.0L similar.

Remove the cap from the fuel pressure relief valve located on the fuel rail.

3. NOTE: 2.3L shown, 3.0L and 4.0L similar.

Install the special tool onto the fuel pressure relief valve.



4. NOTE:

- 2.3L shown, 3.0L and 4.0L similar.

- Open the drain valve slowly to relieve the system pressure. This may drain fuel from the system. Place fuel in a suitable container.

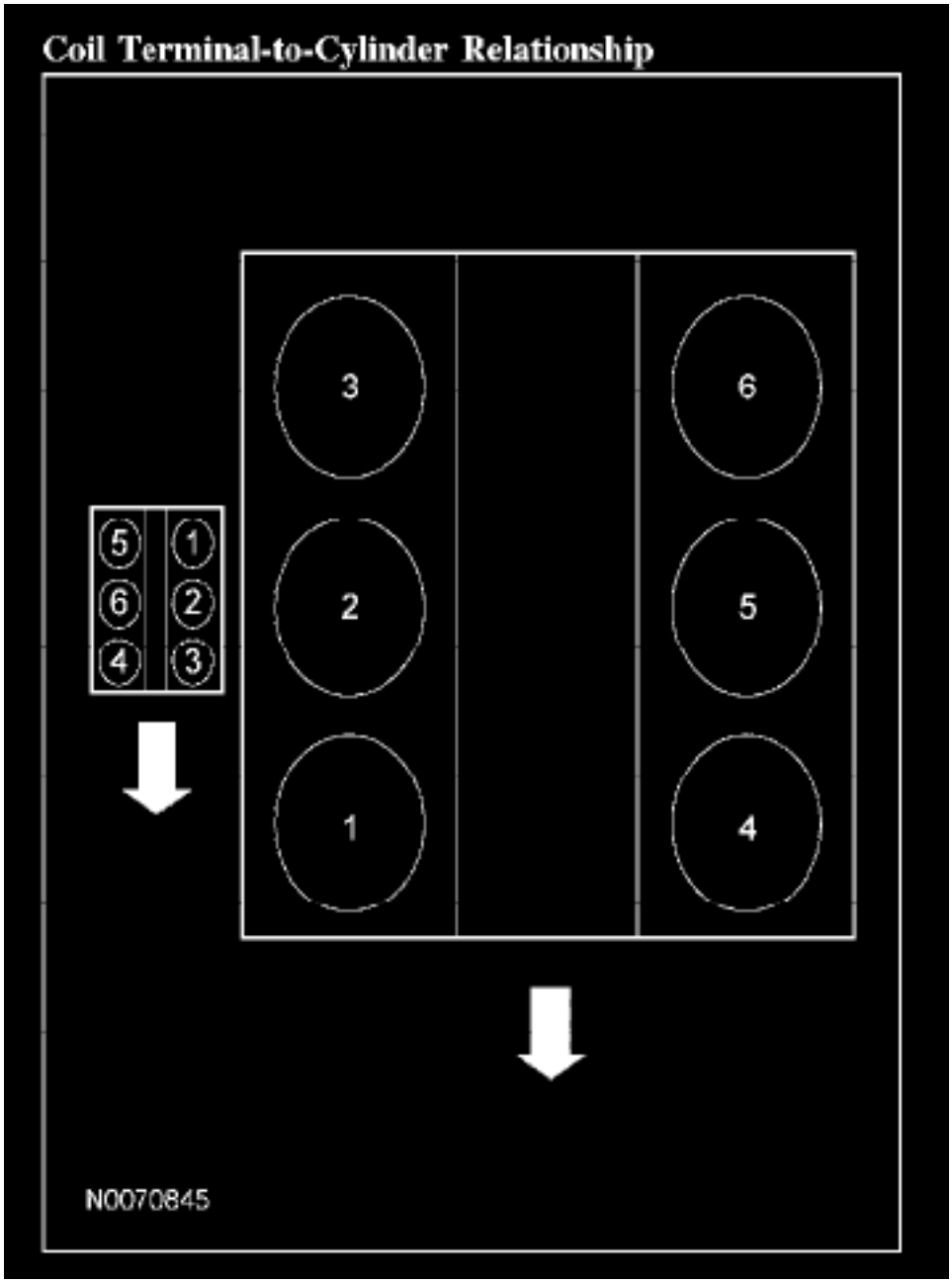
Open the drain valve on the special tool and relieve the fuel system pressure.

5. NOTE: It may take more than one key cycle to pressurize the fuel system.

Upon completion of the fuel system repairs, cycle the ignition key and wait 3 seconds to pressurize the fuel system. Check for leaks before starting the engine.

Firing Order: Specifications

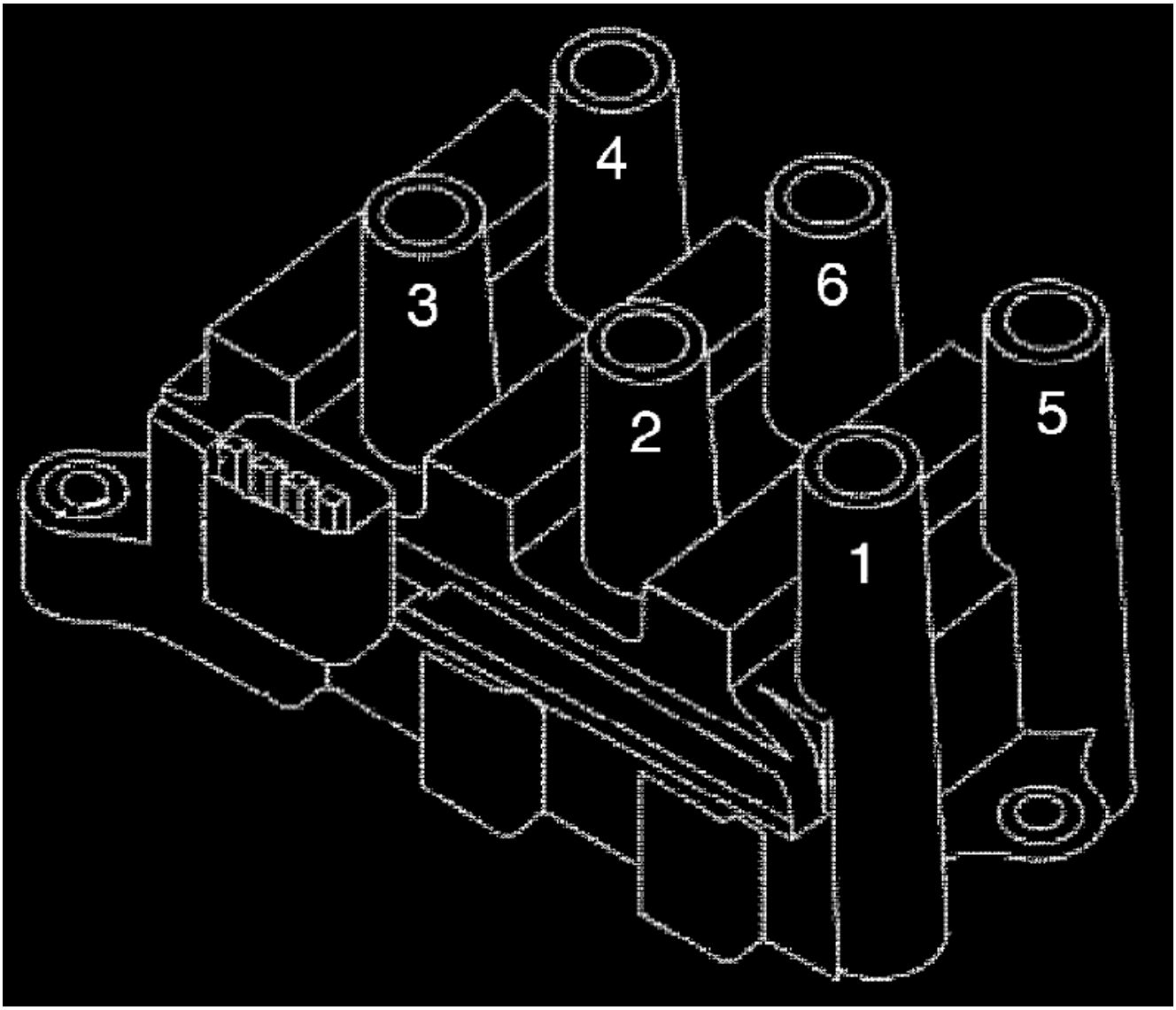
Item	Specification
Firing order	1-4-2-5-3-6



Firing Order: Locations

Coil Terminal-to-Cylinder Relationship

Number One Cylinder

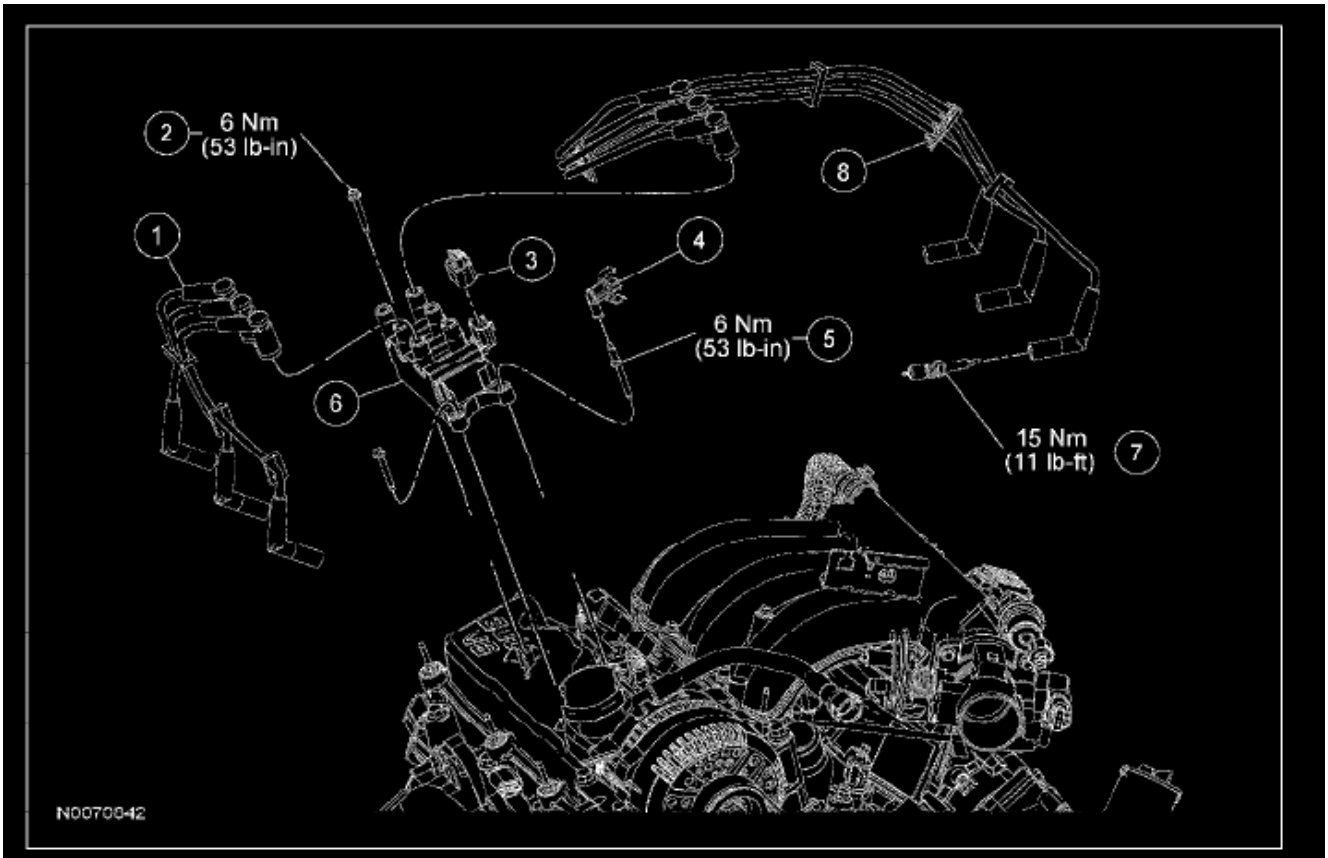


Spark Plug Cable Routing

Item	Specification
Firing order	1-4-2-5-3-6

Ignition Timing: Specifications

Item	Specification
Base ignition timing (not adjustable)	10 degrees before top dead center (BTDC)



Item	Part Number	Description
1	12259	Spark plug wire set
2	W706995	Ignition coil bolt (2 required)
3	—	Ignition coil electrical connector (part of 12B637)
4	18D331	Heater hose retainer
5	W706825	Ignition coil stud bolt

Item	Part Number	Description
6	12029	Ignition coil
7	12405	Spark plug (6 required)
8	12297	Spark plug wire retainer (7 required)

(Continued)

Special Tool(s)

Remover, Spark Plug Wire
303-106 (T74P-6666-A)

Ignition Cable: Service and Repair

SPARK PLUG WIRES

Exploded View

Special Tool(s)

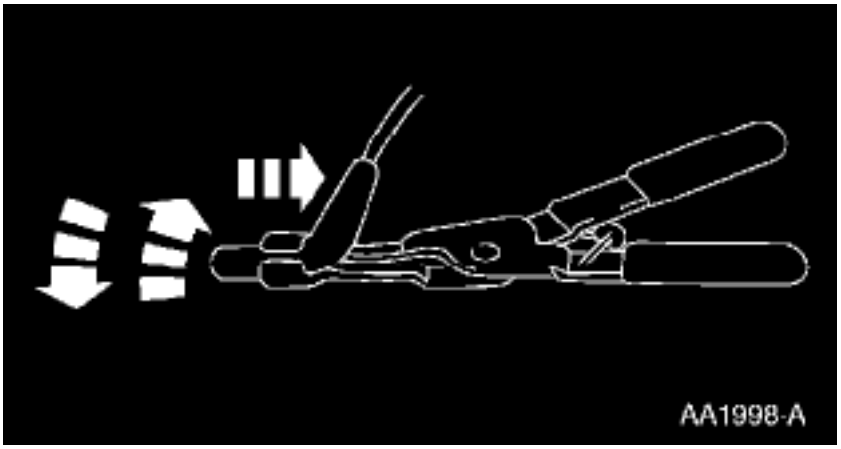
Special Tool(s)

Removal and Installation

CAUTION: Spark plug wires must be connected correctly. Failure to follow this instruction may result in poor engine performance.

1. CAUTION: Do not pull on the spark plug wire as it may separate from the spark plug wire connector inside the spark plug wire boot.

Use the Spark Plug Wire Remover to grasp and twist the spark plug wire boot back and forth on the spark plug insulator to release the connectors.



2. Disconnect the spark plug wires from the ignition coil by twisting while pulling upward. 3. Open the spark plug wire separators and remove the spark plug wires.

4. CAUTION: Correct installation of the spark plug wires is critical to vehicle operation. If one spark plug wire is not correctly installed on

the spark plug or ignition coil, both spark plugs connected to that segment of the ignition coil may not fire under load.

To install, reverse the removal procedure. -

Use a small, clean tool to coat the entire interior surface of the boots with silicone brake caliper grease.

Spark Plug: Specifications General Specifications

Item.....Specification

Spark plug gap.....1.31-1.45 mm 0.052-0.057 in)

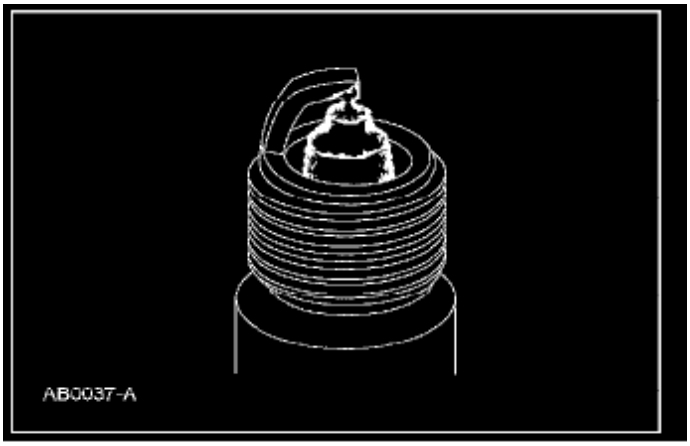
Torque Specifications

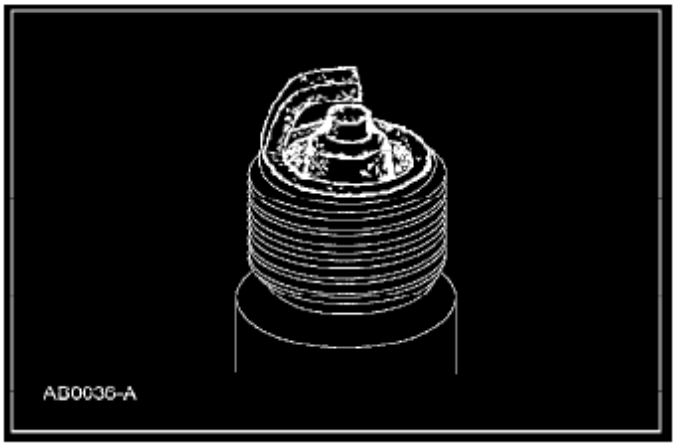
Description	Nm	lb-ft	lb-in
Ignition coil bolts	6	—	53
Spark plugs	15	11	—

Torque Specifications

Spark Plug: Application and ID

Item	Specification
Spark plug	AGSF-32FM


AB0037-A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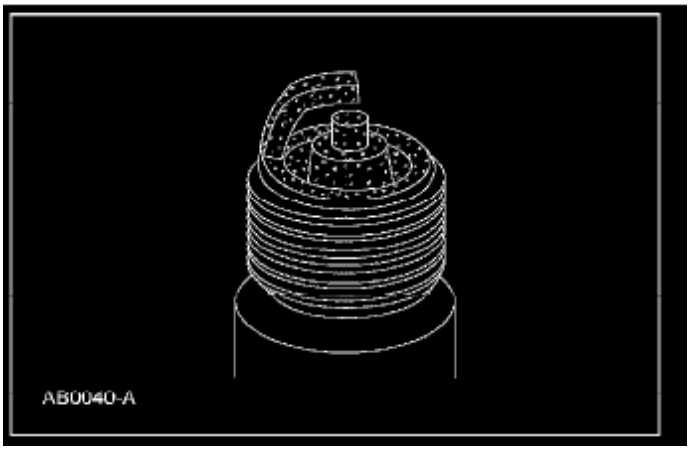
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Spark Plug: Testing and Inspection

Spark Plug Inspection

1. Inspect the spark plug for a bridged gap.

^ Check for deposit build-up closing the gap between the electrodes. Deposits are caused by oil or carbon fouling.

^ Clean the spark plug.

2. Check for oil fouling.

^ Check for wet, black deposits on the insulator shell bore electrodes, caused by excessive oil entering the combustion chamber through worn rings and pistons, excessive valve-to-guide clearance or worn or loose bearings.

^ Correct the oil leak concern.

^ Install a new spark plug.

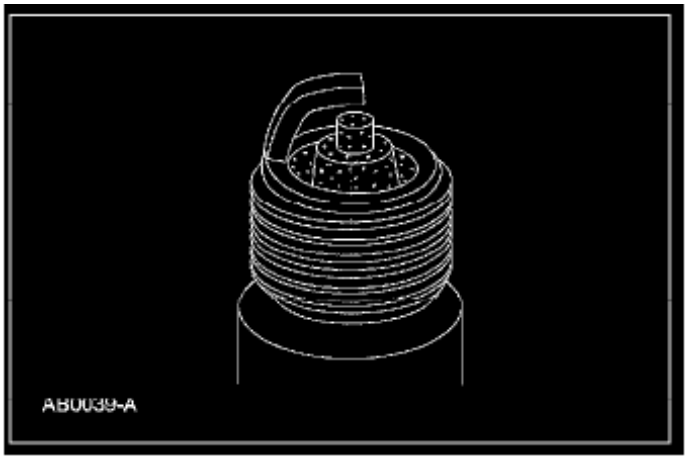
3. Inspect for carbon fouling. Look for black, dry, fluffy carbon deposits on the insulator tips, exposed shell surfaces and electrodes, caused by a

spark plug with an incorrect heat range, dirty air cleaner, too rich a fuel mixture or excessive idling.
^

Install new spark plugs.

4. Inspect for normal burning.

^ Check for light tan or gray deposits on the firing tip.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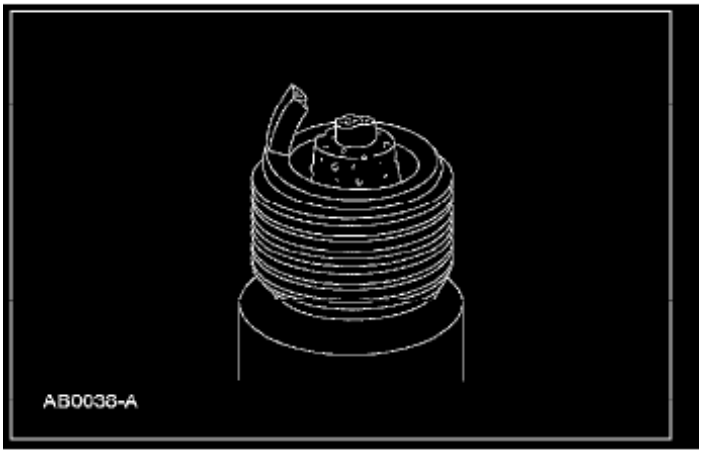
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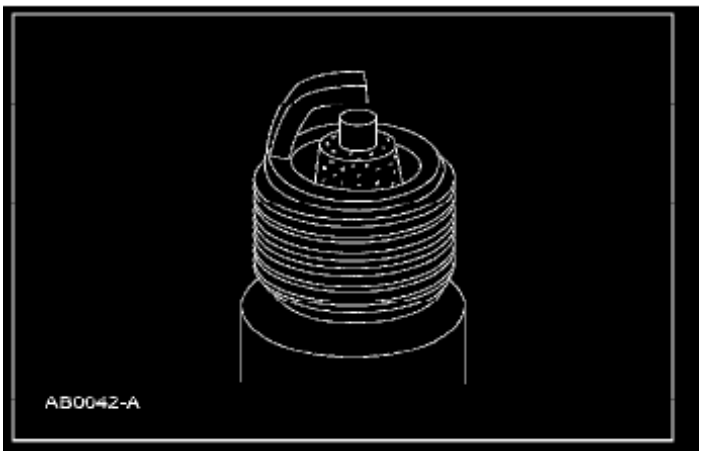

AB0042-A

5. Inspect for pre-ignition, identified by melted electrodes and a possibly damaged insulator. Metallic deposits on the insulator indicate engine

damage. This may be caused by incorrect ignition timing, wrong type of fuel or the unauthorized installation of a Heli-Coil(R) insert in place of the spark plug threads. ^

Install a new spark plug.

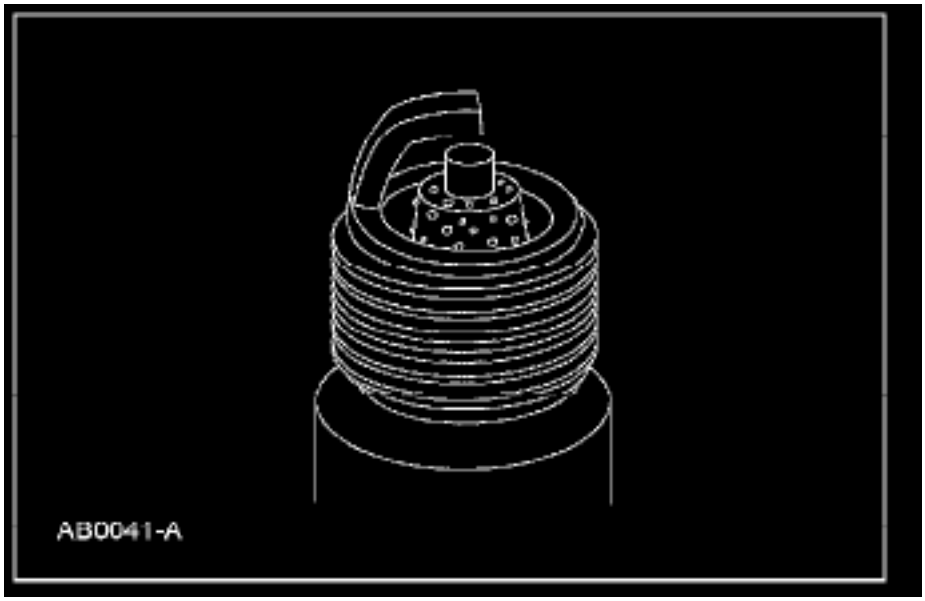
6. Inspect for overheating, identified by white or light gray spots and with a bluish-burnt appearance of electrodes. This is caused by engine

overheating, wrong type of fuel, loose spark plugs, spark plugs with an incorrect heat range, low fuel pump pressure or incorrect ignition timing. ^

Install a new spark plug.

7. Inspect for fused deposits, identified by melted or spotty deposits resembling bubbles or blisters. These are caused by sudden acceleration.

^ Install new spark plugs.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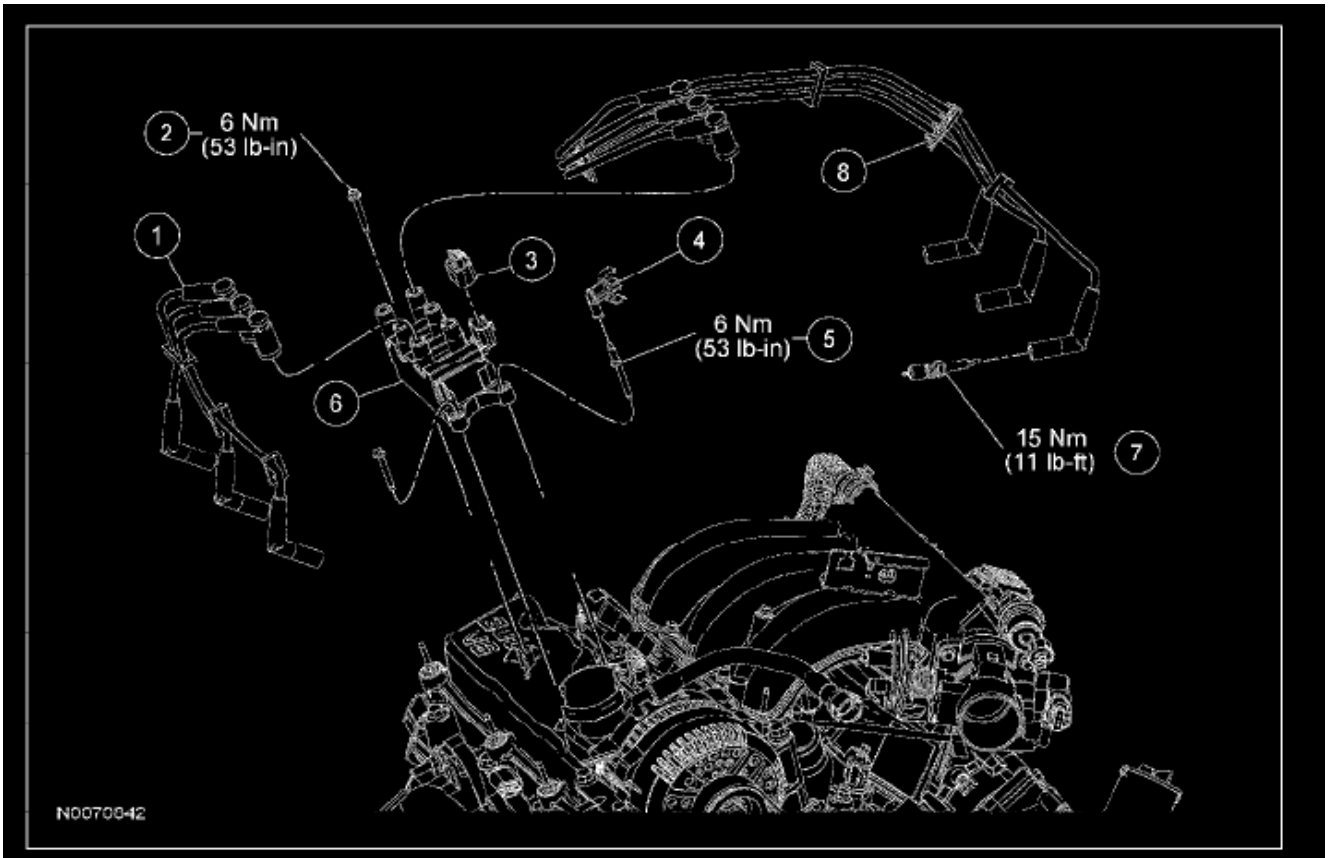

Item	Part Number	Description
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2	W706995	Ignition coil bolt (2 required)
3	—	Ignition coil electrical connector (part of 12B637)
4	18D331	Heater hose retainer
5	W706825	Ignition coil stud bolt

Item	Part Number	Description
6	12029	Ignition coil
7	12405	Spark plug (6 required)
8	12297	Spark plug wire retainer (7 required)

(Continued)

Special Tool(s)

ST1394-A	Remover, Spark Plug Wire 303-106 (T74P-6666-A)

Spark Plug: Service and Repair

SPARK PLUGS

Exploded View

Special Tool(s)

Special Tool(s)

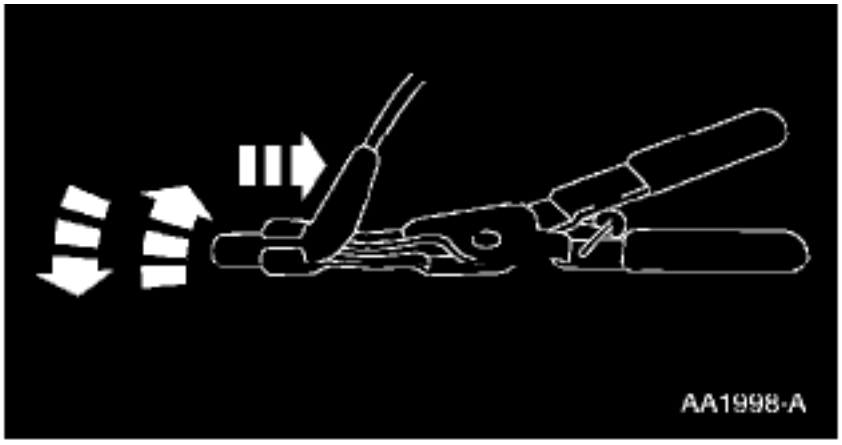
Removal and Installation

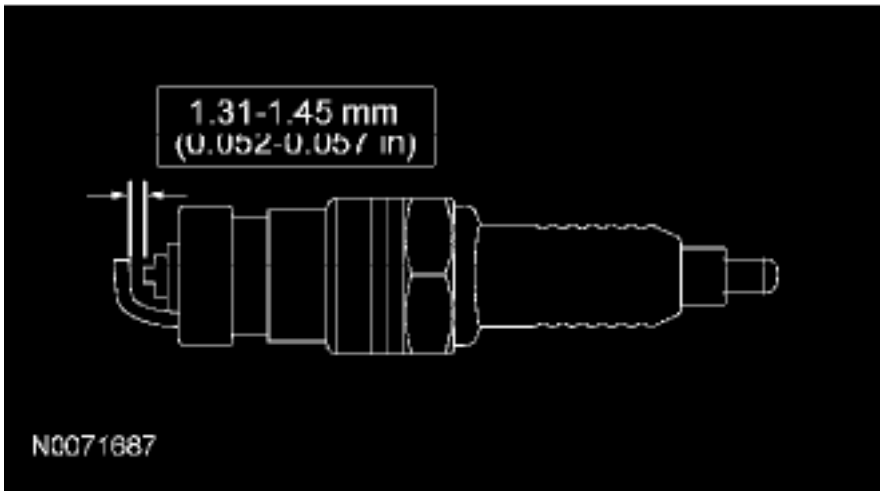
1. CAUTION:

- Spark plug wires must be connected correctly. Failure to follow this instruction may result in poor engine performance.

- Do not pull on the spark plug wire as it may separate from the spark plug wire connector inside the spark plug wire boot.

Use the Spark Plug Wire Remover to grasp and twist the spark plug wire boot back and forth on the spark plug insulator to release the connectors.





2. Loosen the spark plugs. 3. Remove any foreign material from the spark plug areas of the cylinder head with compressed air. 4. Remove the spark plugs.

- To install, tighten to 15 Nm (11 lb-ft).

5. Inspect the spark plugs. 6. Adjust the spark plug gap as necessary.

7. To install, reverse the removal procedure.

- Use a small, clean tool to coat the entire interior surface of the boot with silicone brake caliper grease.

Compression Pressure Limit Chart

Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure
924 kPa (134 psi)	696 kPa (101 psi)	1,131 kPa (164 psi)	848 kPa (123 psi)	1,338 kPa (194 psi)	1,000 kPa (146 psi)	1,544 kPa (224 psi)	1,158 kPa (168 psi)
938 kPa (136 psi)	703 kPa (102 psi)	1,145 kPa (166 psi)	855 kPa (124 psi)	1,351 kPa (196 psi)	1,014 kPa (147 psi)	1,558 kPa (226 psi)	1,165 kPa (169 psi)

Compression Pressure Limit Chart (Continued)

Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure
952 kPa (138 psi)	717 kPa (104 psi)	1,158 kPa (168 psi)	869 kPa (126 psi)	1,365 kPa (198 psi)	1,020 kPa (148 psi)	1,572 kPa (228 psi)	1,179 kPa (171 psi)
965 kPa (140 psi)	724 kPa (106 psi)	1,172 kPa (170 psi)	876 kPa (127 psi)	1,379 kPa (200 psi)	1,034 kPa (150 psi)	1,586 kPa (230 psi)	1,186 kPa (172 psi)
979 kPa (142 psi)	738 kPa (107 psi)	1,186 kPa (172 psi)	889 kPa (129 psi)	1,303 kPa (202 psi)	1,041 kPa (151 psi)	1,600 kPa (232 psi)	1,200 kPa (174 psi)
933 kPa (144 psi)	745 kPa (109 psi)	1,200 kPa (174 psi)	903 kPa (131 psi)	1,407 kPa (204 psi)	1,055 kPa (153 psi)	1,055 kPa (153 psi)	1,207 kPa (175 psi)
1,007 kPa (146 psi)	758 kPa (110 psi)	1,214 kPa (176 psi)	910 kPa (132 psi)	1,420 kPa (206 psi)	1,062 kPa (154 psi)	1,627 kPa (154 psi)	1,220 kPa (177 psi)
1,020 kPa (148 psi)	765 kPa (111 psi)	1,227 kPa (178 psi)	917 kPa (133 psi)	1,434 kPa (208 psi)	1,075 kPa (156 psi)	1,641 kPa (238 psi)	1,227 kPa (178 psi)
1,034 kPa (150 psi)	779 kPa (113 psi)	1,241 kPa (180 psi)	931 kPa (135 psi)	1,448 kPa (210 psi)	1,083 kPa (157 psi)	1,655 kPa (240 psi)	1,241 kPa (180 psi)
1,048 kPa (152 psi)	786 kPa (114 psi)	1,255 kPa (182 psi)	936 kPa (136 psi)	1,462 kPa (212 psi)	1,089 kPa (158 psi)	1,669 kPa (242 psi)	1,248 kPa (181 psi)
1,062 kPa (154 psi)	793 kPa (115 psi)	1,269 kPa (184 psi)	952 kPa (138 psi)	1,476 kPa (214 psi)	1,103 kPa (160 psi)	1,682 kPa (244 psi)	1,262 kPa (183 psi)
1,076 kPa (156 psi)	807 kPa (117 psi)	1,282 kPa (186 psi)	965 kPa (140 psi)	1,489 kPa (216 psi)	1,117 kPa (162 psi)	1,696 kPa (246 psi)	1,269 kPa (184 psi)
1,089 kPa (158 psi)	814 kPa (118 psi)	1,296 kPa (188 psi)	972 kPa (141 psi)	1,503 kPa (218 psi)	1,124 kPa (163 psi)	1,710 kPa (248 psi)	1,202 kPa (186 psi)
1,103 kPa (160 psi)	827 kPa (120 psi)	1,310 kPa (190 psi)	979 kPa (142 psi)	1,517 kPa (220 psi)	1,138 kPa (165 psi)	1,724 kPa (250 psi)	1,289 kPa (187 psi)
1,110 kPa (161 psi)	834 kPa (121 psi)	1,324 kPa (192 psi)	993 kPa (144 psi)	1,631 kPa (222 psi)	1,145 kPa (166 psi)	—	—

Compression Check: Specifications

Compression Pressure Limit Chart

The indicated compression pressures are considered within specification if the lowest reading cylinder is at least 75% of the highest reading.

Compression Pressure Limit Chart (Part 1)

Compression Pressure Limit Chart (Part 2)

Compression Pressure Limit Chart

Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure
924 kPa (134 psi)	696 kPa (101 psi)	1,131 kPa (164 psi)	848 kPa (123 psi)	1,338 kPa (194 psi)	1,000 kPa (146 psi)	1,544 kPa (224 psi)	1,158 kPa (168 psi)
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Compression Pressure Limit Chart (Continued)

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Compression Check: Testing and Inspection

Compression Test - Compression Gauge Check

1. Make sure the oil in the crankcase is of the correct viscosity and at the correct level and that the battery is correctly charged. Operate the vehicle

until the engine is at normal operating temperature. Turn the ignition switch to the OFF position, then remove all the spark plugs.

2. Set the throttle plates in the wide-open position. 3. Install a compression gauge such as the Compression Tester in the No. 1 cylinder. 4. Install an auxiliary starter switch in the starting circuit. With the ignition switch in the OFF position, and using the auxiliary starter switch, crank

the engine a minimum of 5 compression strokes and record the highest reading. Note the approximate number of compression strokes required to obtain the highest reading.

5. Repeat the test on each cylinder, cranking the engine approximately the same number of compression strokes.

Compression Test - Test Results

The indicated compression pressures are considered within specification if the lowest reading cylinder is at least 75% of the highest reading. Refer to the Compression Pressure Limit Chart.

Compression Pressure Limit Chart

Compression Pressure Limit Chart (Part 1)

Compression Pressure Limit Chart (Part 2)

If one or more cylinders read low, squirt approximately one tablespoon of engine oil on top of the pistons in the low-reading cylinders. Repeat the

compression pressure check on these cylinders.

Compression Test - Interpreting Compression Readings

1. If compression improves considerably, piston rings are faulty. 2. If compression does not improve, valves are sticking or seating incorrectly. 3. If 2 adjacent cylinders indicate low compression pressures and squirting oil on each piston does not increase compression, the head gasket may be

leaking between cylinders. Engine oil or coolant in cylinders could result from this condition.

Use the Compression Pressure Limit Chart when checking cylinder compression so that the lowest reading is within 75% of the highest reading.

Valve Clearance: Specifications

Valve Clearance

This engine is equipped with hydraulic valve lifters. No adjustment is required.

Visual Inspection Chart

Mechanical
• Drive belt cracking/chunking/wear • Belt/pulley contamination • Incorrect accessory drive belt • Incorrectly routed accessory drive belt • Pulley misalignment or excessive pulley runout • Loose or mislocated hardware • Incorrectly routed power steering tubes (rubbing) • Loose accessory drive belt • Damaged pulleys • Tensioner arm misalignment

Drive Belt: Initial Inspection and Diagnostic Overview

Inspection and Verification

CAUTION: Under no circumstances should the accessory drive belt, tensioner or pulleys have any fluids or belt dressing applied to them as damage to the belt material and tensioner damping mechanism may occur.

1. Verify the customer concern by operating the system. 2. Visually inspect for obvious signs of mechanical damage.

Visual Inspection Chart

Visual Inspection Chart

Belt Tensioner With Belt Length Indicator

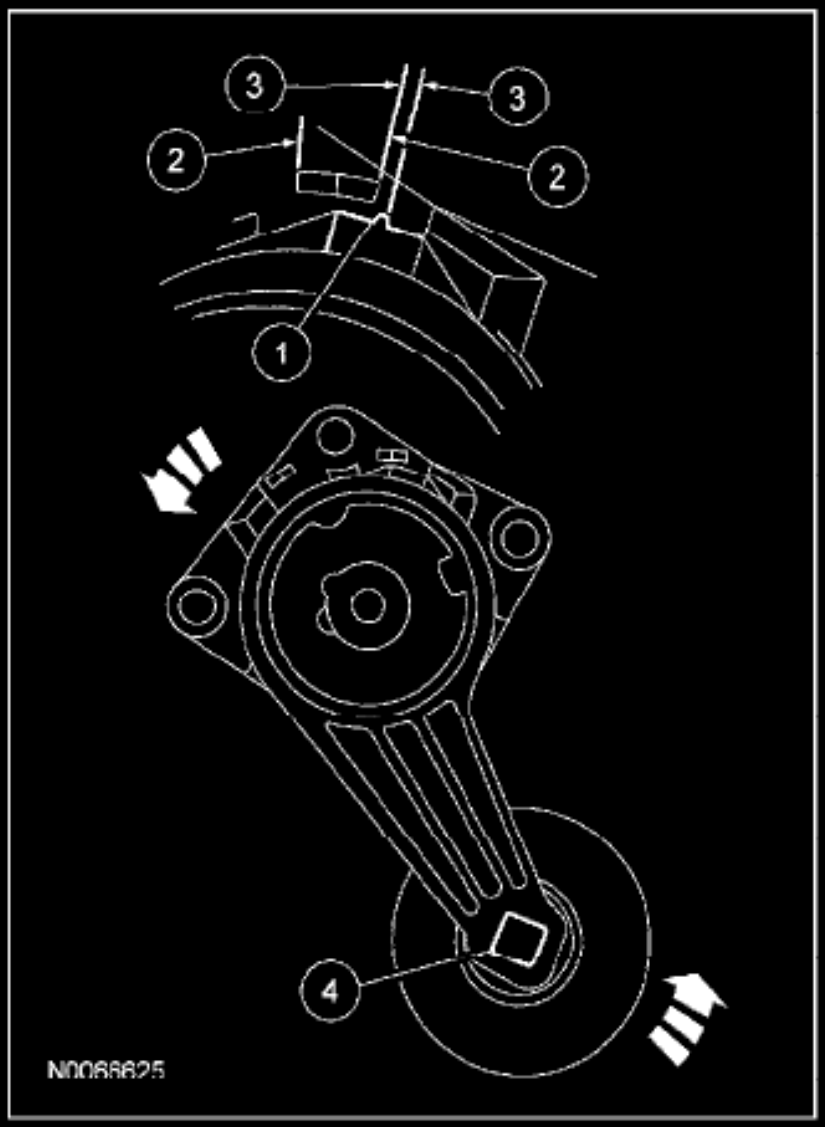
NOTE: Modular engine (without A/C) belt tensioner shown, others similar.

NOTE: Belt tensioner is shown in the free-state position against the arm travel stops.

Belt Tensioner With Belt Length Indicator

NOTE: Modular engine (without A/C) belt tensioner shown, others similar.

NOTE: Belt tensioner is shown in the free-state position against the arm travel stops



Item	Part Number	Description
1	—	Belt length indicator
2	—	Acceptable belt installation and wear range
3	—	Belt replacement range
4	—	Belt tension relief point

Belt Tensioner With Belt Length Indicator

3. Check that the belt length indicator, if equipped, on the belt tensioner is in the acceptable belt installation and wear range. If the indicator is in the

belt replacement range, either an incorrect belt is installed or the belt is worn beyond the service limit. Install a new belt as necessary.

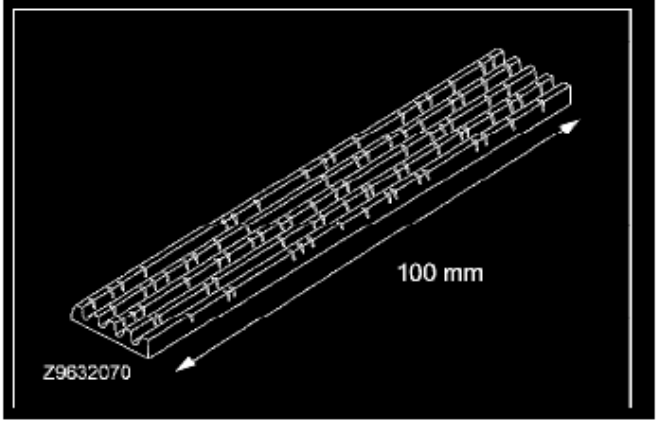
4. Eliminate all other non-belt related noises that could cause belt misdiagnosis, such as A/C compressor engagement chirp, A/C slugging noise,

power steering cavitations at low temperatures, variable camshaft timing (VCT) tick or generator whine.

5. If a concern is found, correct the condition before proceeding to the next step.

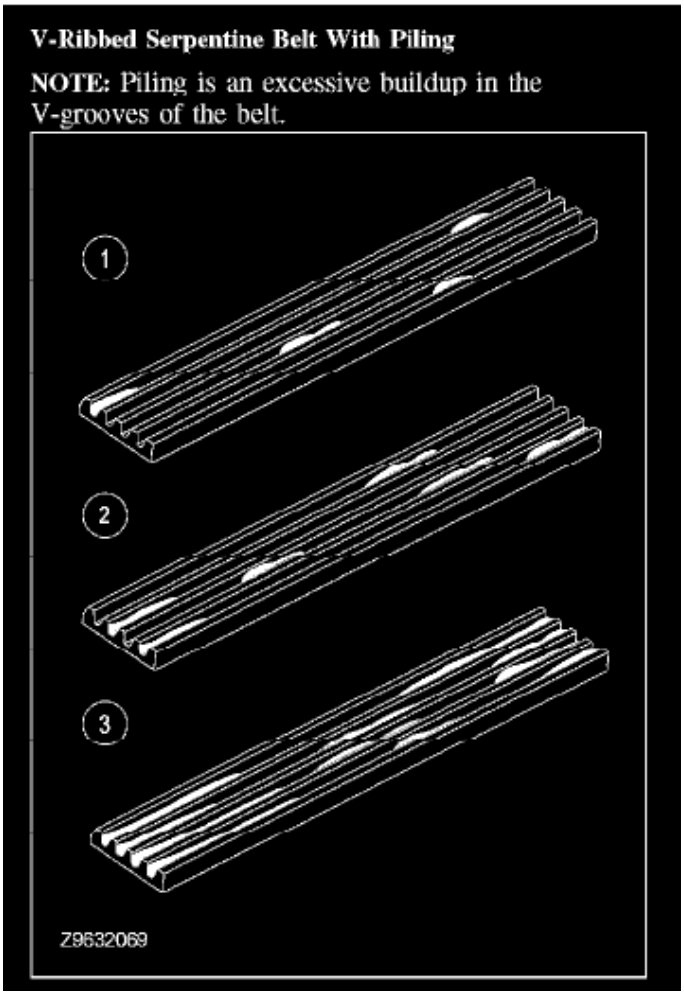
V-Ribbed Serpentine Drive Belt With Cracks Across Ribs

V-Ribbed Serpentine Drive Belt With Cracks Across Ribs



V-Ribbed Serpentine Belt With Piling

NOTE: Piling is an excessive buildup in the V-grooves of the belt.



V-Ribbed Serpentine Drive Belt With Cracks Across Ribs

6. Check the belt for cracks. Up to 15 cracks in a rib over a distance of 100 mm (4.0 inch) can be considered acceptable. If cracks exceed this

standard, install a new belt.

V-Ribbed Serpentine Belt With Piling

V-Ribbed Serpentine Belt With Piling

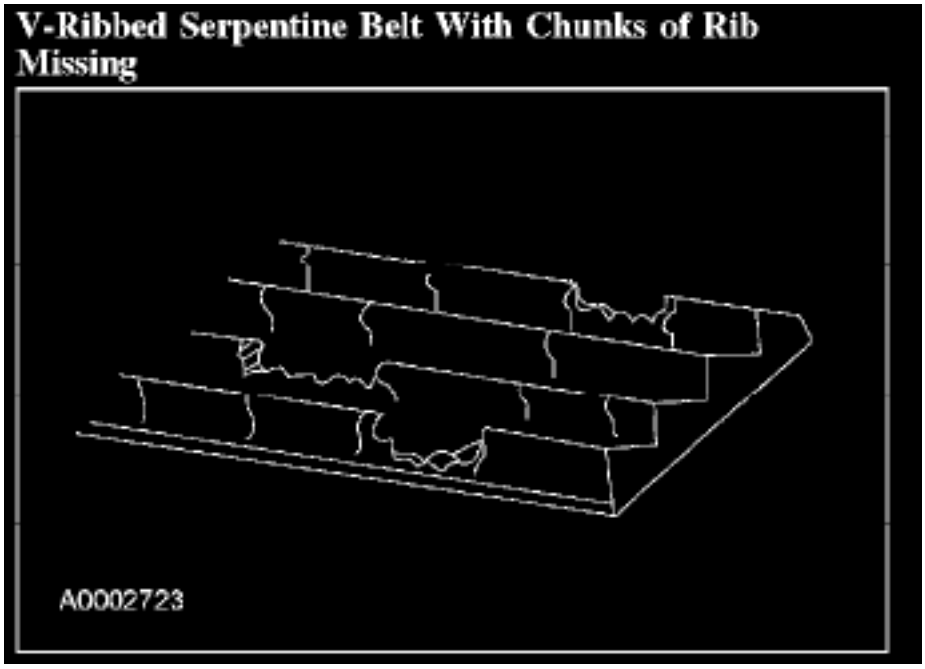
NOTE: Piling is an excessive buildup in the V-grooves of the belt.

7. The condition of the V-ribbed drive belt should be compared against the illustration and appropriate action taken.

1 Small scattered deposits of rubber material. This is not a concern, therefore, installation of a new belt is not required.

2 Longer deposit areas building up to 50% of the rib height. This is not considered a concern but it can result in excessive noise. If noise is apparent, install a new belt.

3 Heavy deposits building up along the grooves resulting in a possible noise and belt stability concern. If heavy deposits are apparent, install a new belt.



V-Ribbed Serpentine Belt With Chunks of Rib Missing

V-Ribbed Serpentine Belt With Chunks of Rib Missing

8. There should be no chunks missing from the belt ribs. If the belt shows any evidence of this, install a new accessory drive belt. 9. If the concern is not visually evident, verify the symptom and GO to Symptom Chart. See: Symptom Related Diagnostic Procedures

Symptom Chart

Condition	Possible Sources	Action
• Accessory drive belt cracking (over 15 cracks in a rib over a distance of 100 mm [4.0 in])	• Accessory drive belt	• INSPECT the accessory drive belt. REFER to Inspection and Verification, INSTALL a new accessory drive belt as necessary.
• Accessory drive belt chunking	• Accessory drive belt	• INSPECT the accessory drive belt. REFER to Inspection and Verification, INSTALL a new accessory drive belt as necessary.
	• Damaged pulley grooves	• INSPECT the accessory drive belt pulley grooves for damage. INSTALL a new pulley or component as necessary.

Drive Belt: Symptom Related Diagnostic Procedures

Symptom Chart

Symptom Chart (Part 1)

Symptom Chart (Continued)

Condition	Possible Sources	Action
• Accessory drive belt noise, squeal, chirping or flutter	• Defective/worn or incorrect accessory drive belt • Misaligned pulley(s) • Pulley runout • Damaged or worn accessory drive component or idler • Fluid contamination of accessory drive belt or pulleys	• REFER to Component Tests, Drive Belt, Noise/Flutter. REPAIR or INSTALL new parts as necessary.
	• Damaged or worn accessory drive belt tensioner	• REFER to Component Tests, Belt Tensioner — Mechanical and Belt Tensioner — Dynamics. INSTALL a new accessory drive belt tensioner as necessary.
	• Damaged pulley grooves	• INSPECT the accessory drive belt pulley grooves for damage. INSTALL a new pulley or component as necessary.
	• Accessory drive component failure	• CHECK the accessory drive components. INSTALL new components as necessary.
	• Accessory drive belt idler pulley bearing failure	• INSPECT the accessory drive belt idler pulley for freedom of rotation and damage. INSTALL a new accessory drive belt idler pulley as necessary.
• Premature accessory drive belt wear	• Defective or incorrect accessory drive belt • Misaligned pulley(s) • Pulley runout • Damaged accessories • Incorrectly installed drive belt • Fluid contamination	• REFER to Component Tests, Drive Belt Noise/Flutter and Incorrect Drive Belt Installation. REPAIR or INSTALL new parts as necessary.
	• Damaged pulley grooves	• INSPECT the accessory drive belt pulley grooves for damage. INSTALL a new pulley or component as necessary.

Symptom Chart (Part 2)

Drive Belt: Component Tests and General Diagnostics

Drive Belt - Noise/Flutter

Drive Belt - Noise/Flutter

CAUTION: Under no circumstances should the accessory drive belt, tensioner or pulleys have any fluids or belt dressing applied to them as damage to the belt material and tensioner damping mechanism may occur.

Drive belt chirp occurs due to pulley misalignment or excessive pulley runout. It can be the result of a damaged or incorrectly aligned grooved pulley.

To correct, determine the area where the noise comes from. Check each of the pulleys in that area with a straightedge to the crankshaft pulley. Look for accessory pulleys out of position in the fore/aft direction or at an angle to the straightedge.

Drive belt squeal may be an intermittent or constant noise that occurs when the drive belt slips on an accessory pulley under certain conditions.

A short intermittent squeal may occur during engine start-up and shut down or during very rapid engine acceleration and decelerations, such as: ^

wide open throttle (WOT) 1-2 and 2-3 shifts or 2-3 and 3-4 back out shifts on automatic transmissions.

^ WOT 1-2 and 2-3 shifts and any combination of rapid downshifting on manual transmissions.

These special short-term transient events are expected, and are due to the higher system inertia required to meet the electrical and cooling demands on today's vehicle systems. Constant or reoccurring drive belt squeal can occur: ^

if the A/C discharge pressure goes above specifications: -

the A/C system is overcharged.

- the A/C condenser core airflow is blocked.

^ if the A/C off equalized pressure (the common discharged and suction pressure that occurs after several minutes) exceeds specifications.

^ if any of the accessories or idler pulley(s) are damaged or have a worn or damaged bearing. All accessories should be rotatable by hand in the unloaded condition. If not, inspect the accessory.

^ if there is evidence of fluid contamination on the accessory drive belt. When the drive belt has been exposed to fluid contamination during vehicle operation, such as leaks from the power steering system, A/C system or cooling system, clean all pulleys with soap and water, rinse with clean water and install a new accessory drive belt. If the drive belt has been exposed to fluids in a localized area during routine vehicle service, such as replacement of hoses or fluids, the drive belt and pulleys should be washed with soap and water immediately (prior to starting the engine), and rinsed with clean water.

^ if the accessory drive belt is too long. A drive belt that is too long will allow the accessory drive belt tensioner arm to go all the way to the arm travel stop under certain load conditions, which will release tension to the drive belt. If the accessory drive belt tensioner indicator is outside the normal installation wear range window, install a new accessory drive belt.

^ NOTE: The accessory drive belt tensioner arm should rotate freely without binding.

Install a new accessory drive belt tensioner if the drive belt tensioner is worn or damaged.

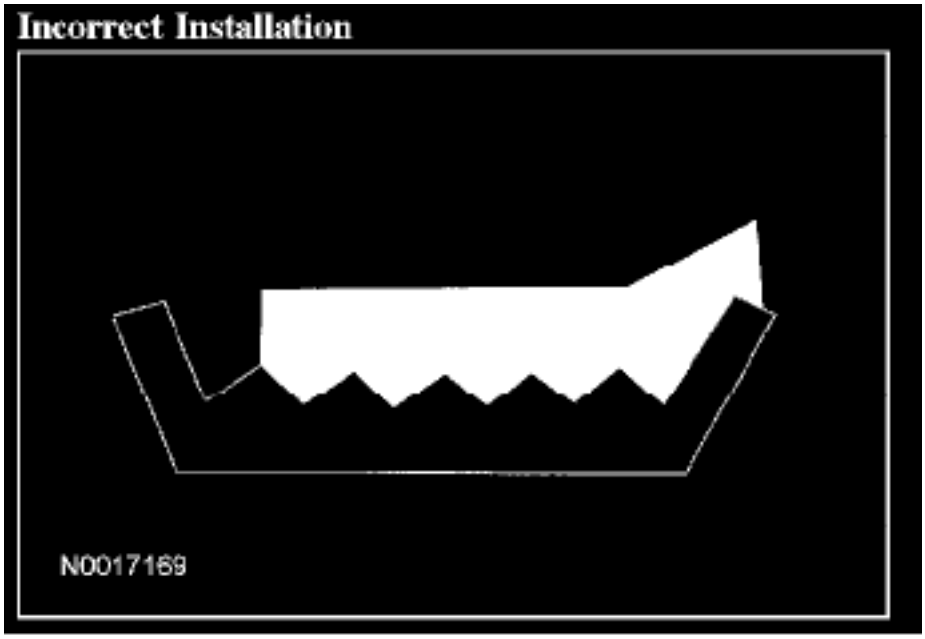
Drive Belt - Incorrect Installation

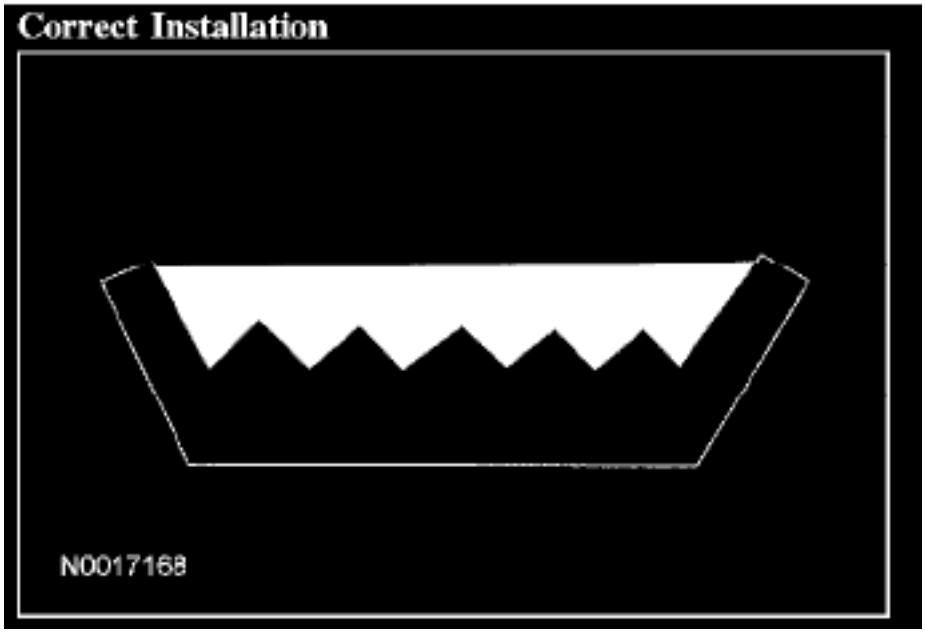
Drive Belt - Incorrect Installation

CAUTION: Incorrect accessory drive belt installation will cause excessive drive belt wear and may cause the drive belt to come off the pulleys.

Non-standard accessory drive belts can track differently or incorrectly. If an accessory drive belt tracks incorrectly, install a new accessory drive belt to avoid performance failure or loss of the drive belt.

Incorrect Installation





Incorrect Installation

Correct Installation

Correct Installation

With the engine running, check accessory drive belt tracking on all pulleys. If the edge of the accessory drive belt rides beyond the edge of the pulleys, noise and premature wear will occur. Make sure the accessory drive belt rides correctly on the pulley. If an accessory drive belt tracking condition exists, proceed with the following: ^

Visually check the accessory drive belt tensioner for damage and wear, especially the mounting pad surface and arm alignment. If the accessory drive belt tensioner is not installed correctly, the mounting surface pad will be out of position. If the tensioner arm is worn, the arm will be out of alignment. Either of these conditions will result in chirp and squeal noises.

^ With the engine running, visually observe the grooves in the pulleys (not the pulley flanges or the pulley forward faces) for excessive wobble. Install new components as necessary.

^ Check all accessories, mounting brackets and the accessory drive belt tensioner for any interference that would prevent the component from mounting correctly. Correct any interference condition and recheck the accessory drive belt tracking.

^ Tighten all accessories, mounting brackets and accessory drive belt tensioner retaining hardware to specification. Recheck the accessory drive belt tracking.

Belt Tensioner - Mechanical

Belt Tensioner - Mechanical

The only mechanical check that needs to be made is a check for tensioner stick, grab or bind. 1. With the engine off, check routing of the accessory drive belt. Refer to the illustrations under Description and Operation.

2. NOTE: The accessory drive belt tensioner spring is very strong and requires substantial force to release.

Using a suitable, commercially available serpentine belt tensioner release tool, release the tension on the belt and detach the accessory drive belt from the tensioner. Carry out the following tests: ^

Using the release tool, move the tensioner from its relaxed position, through its full stroke and back to the relaxed position to make sure there is no stick, grab or bind, and to make sure that there is tension on the tensioner spring.

^ Rotate the tensioner pulley by hand and check for a binding, contaminated or seized condition.

^ Inspect the area surrounding the accessory drive belt tensioner for oil leaks or contamination and repair any leaks.

3. If the accessory drive belt tensioner does not meet the criteria in the previous step, install a new tensioner. If the accessory drive belt tensioner

meets the criteria in the previous step, proceed to testing the tensioner dynamically.

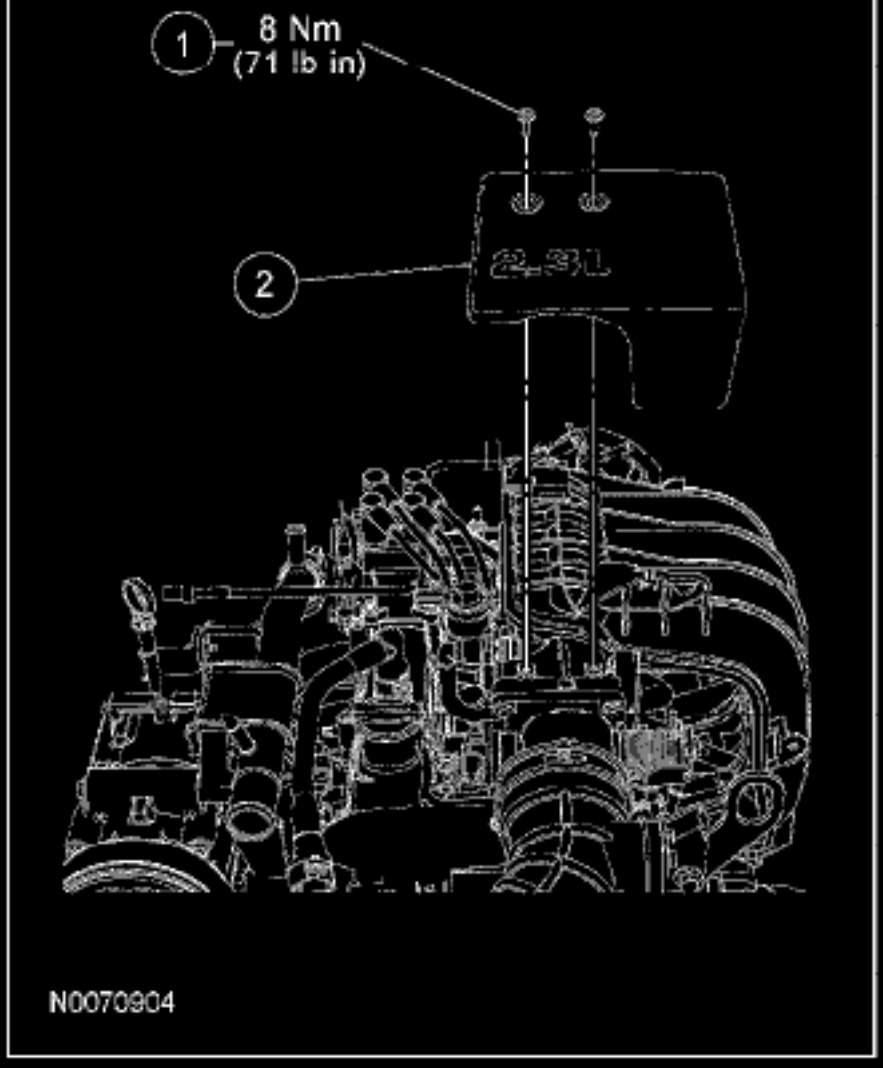
Belt Tensioner - Dynamics

Belt Tensioner - Dynamics

The accessory drive belt tensioner can be checked dynamically as follows: 1. With the engine running, observe the accessory drive belt tensioner movement. The accessory drive tensioner should move (respond) when the

A/C clutch cycles (if equipped), or when the engine is accelerated rapidly. If the accessory drive belt tensioner movement is excessive without A/C clutch cycling or engine acceleration, check belt rideout. Excessive belt rideout (uneven depth of grooves in the belt) can cause excessive accessory drive belt tensioner movement. Check rideout condition by installing a new belt. If excessive accessory drive belt tensioner movement still exists, install a new accessory drive belt tensioner.

2.3L Throttle Body (TB) Cover



Item	Part Number	Description
1	—	Throttle body (TB) cover bolt (2 required)
2	9E766	TB cover

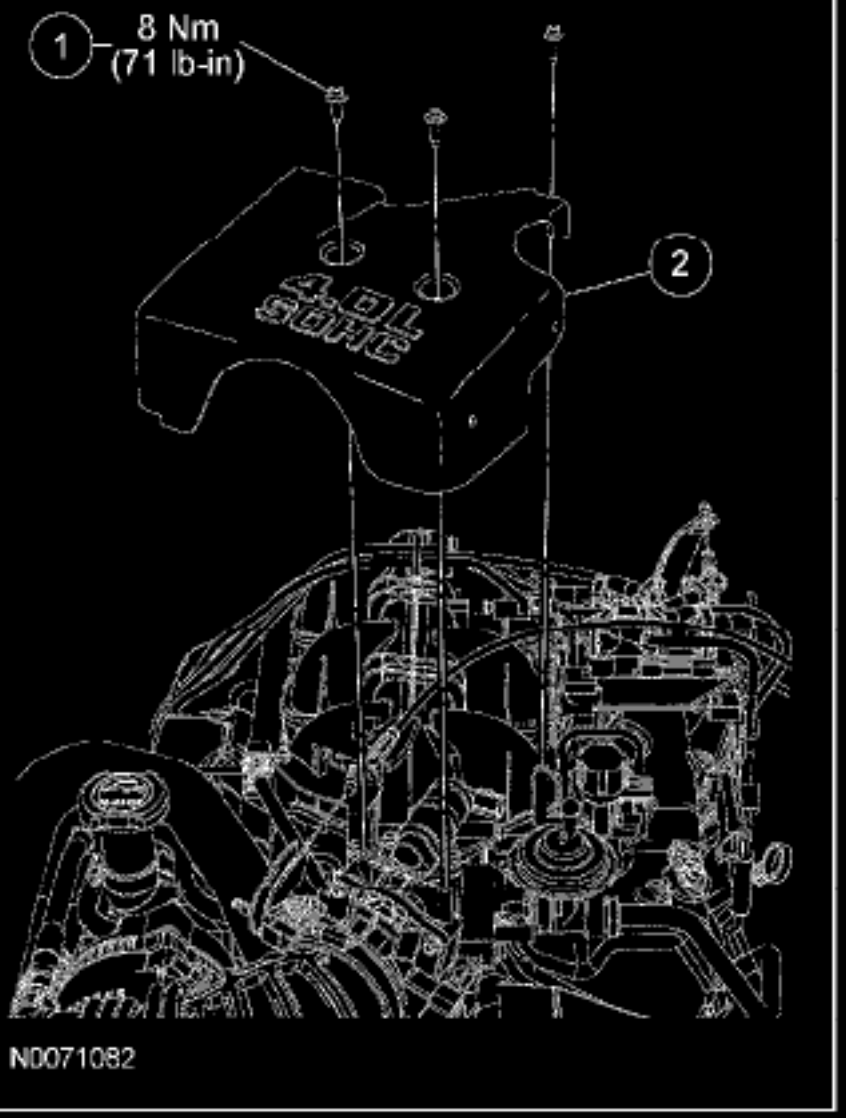
Air Cleaner Fresh Air Duct/Hose: Service and Repair

INTAKE AIR SYSTEM COMPONENTS

Exploded View

2.3L Throttle Body (TB) Cover

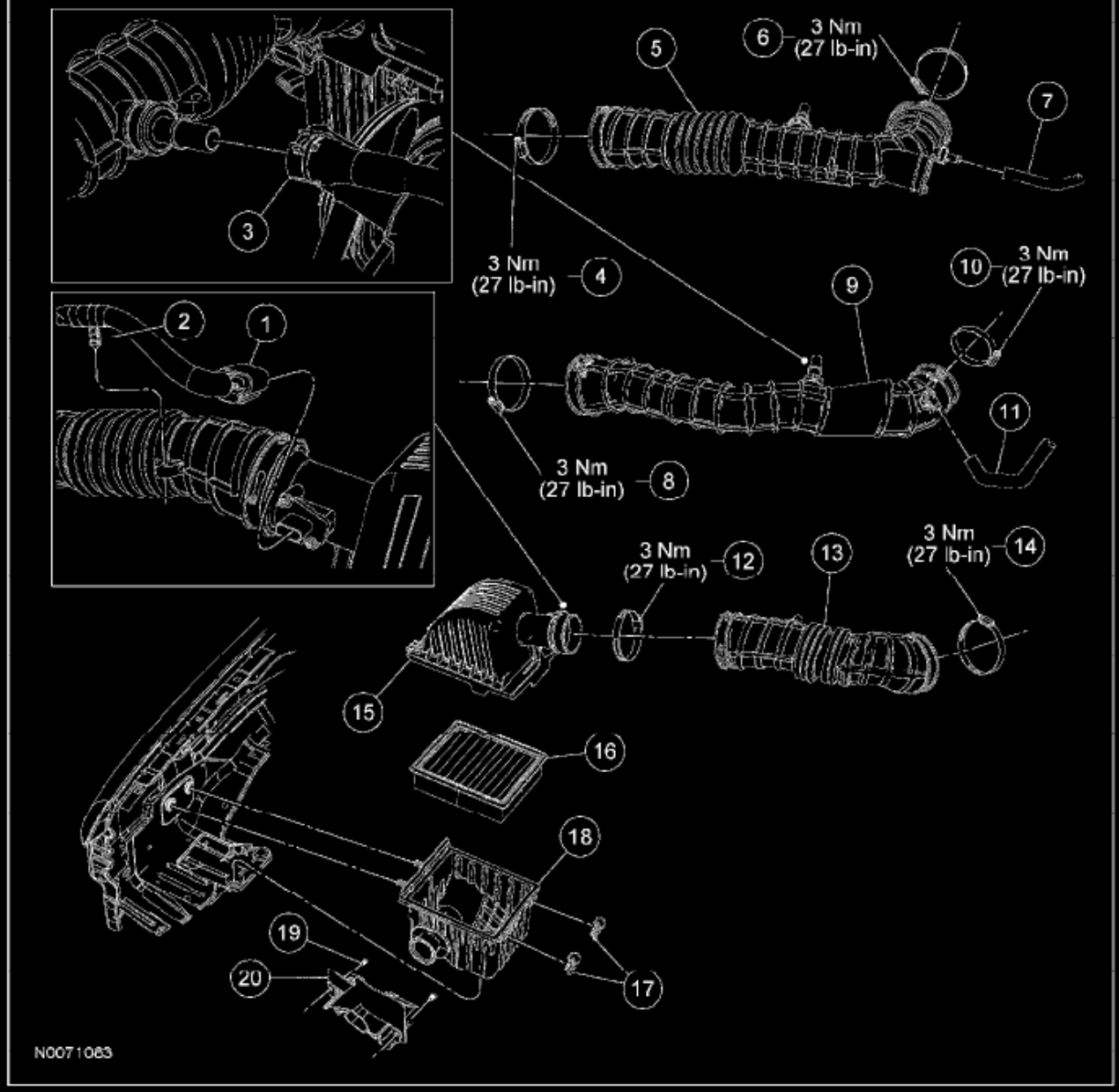
4.0L SOHC Throttle Body (TB) Cover



Item	Part Number	Description
1	W704704	Throttle body (TB) cover bolt (2 required)
2	9E766	TB cover

4.0L SOHC Throttle Body (TB) Cover

Intake Air Components



Item	Part Number	Description
1	—	Mass air flow (MAF) sensor electrical connector (part of 12B637)
2	13A506	Wiring harness retainer (2 required [2.3L engines]) (1 required [3.0L and 4.0L engines]) (part of 12B637)
3	—	Crankcase ventilation tube quick connect coupling

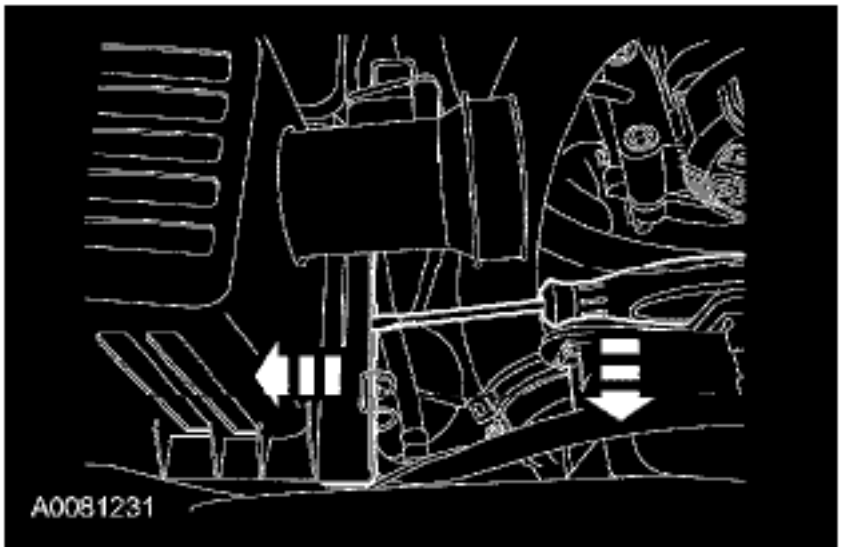
(Continued)

Item	Part Number	Description
4	6C632	Engine air cleaner (ACL) outlet tube-to-air cleaner clamp (2.3L)
5	9B659	ACL outlet tube (2.3L)
6	6C632	ACL outlet tube-to-throttle body (TB) clamp (2.3L)
7	9C490	Brake booster vacuum hose
8	6C632	ACL outlet tube-to-air cleaner clamp (3.0L)

(Continued)

Intake Air Components (Part 1)

Item	Part Number	Description
9	9B659	ACL outlet tube (3.0L)
10	6C632	ACL outlet tube-to-TB clamp (3.0L)
11	9C490	Brake booster vacuum hose
12	6C632	ACL outlet tube-to-air cleaner clamp (4.0L)
13	9B659	ACL outlet tube (4.0L)
14	6C632	ACL outlet tube-to-TB clamp (4.0L)
15	9643	ACL cover
16	9601	ACL element
17	9628	ACL-to-ACL cover clips
18	9A612	ACL
19	N810040	Air nozzle pushpins
20	9E961	Air nozzle

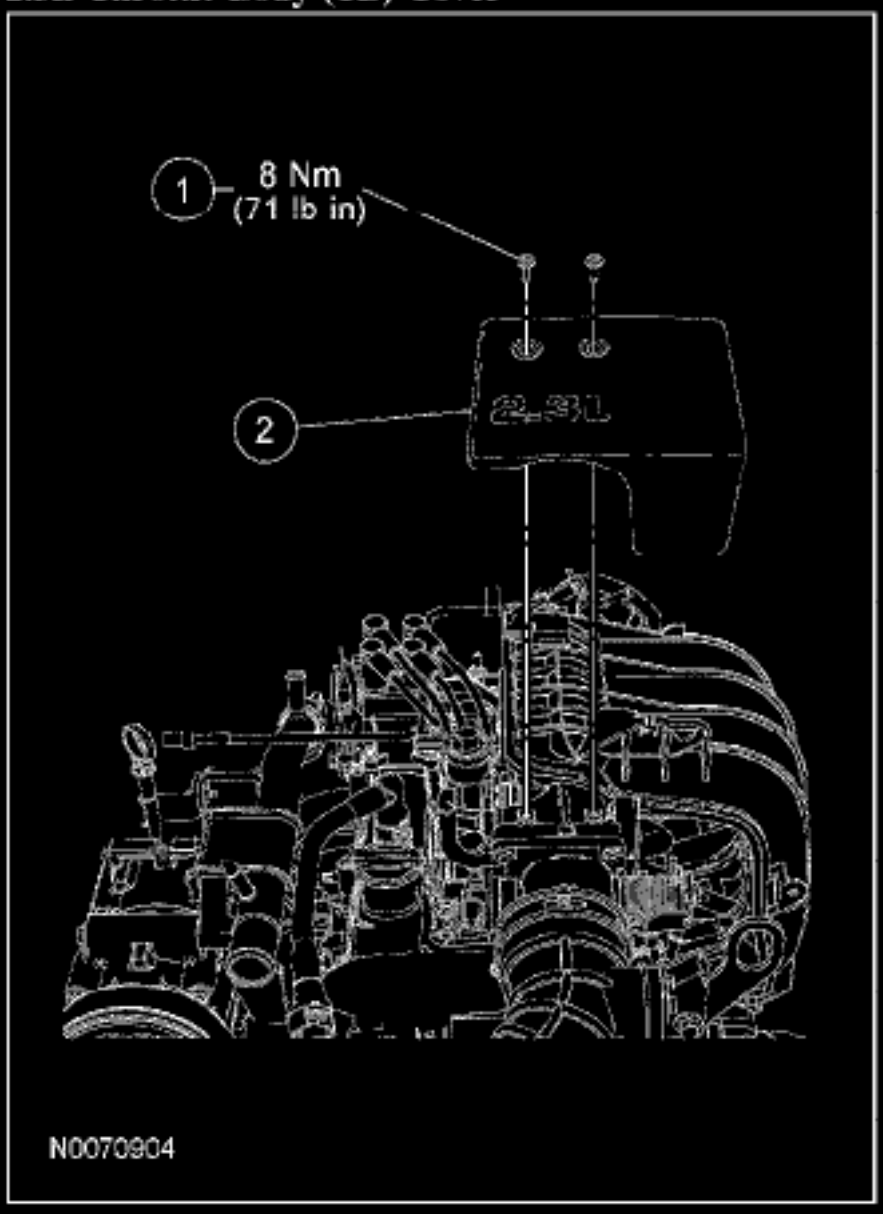


Intake Air Components (Part 2)

Removal and Installation

1. If necessary, pry the engine air cleaner (ACL) from the base support bracket when removing the ACL.

2.3L Throttle Body (TB) Cover



Item	Part Number	Description
1	—	Throttle body (TB) cover bolt (2 required)
2	9E766	TB cover

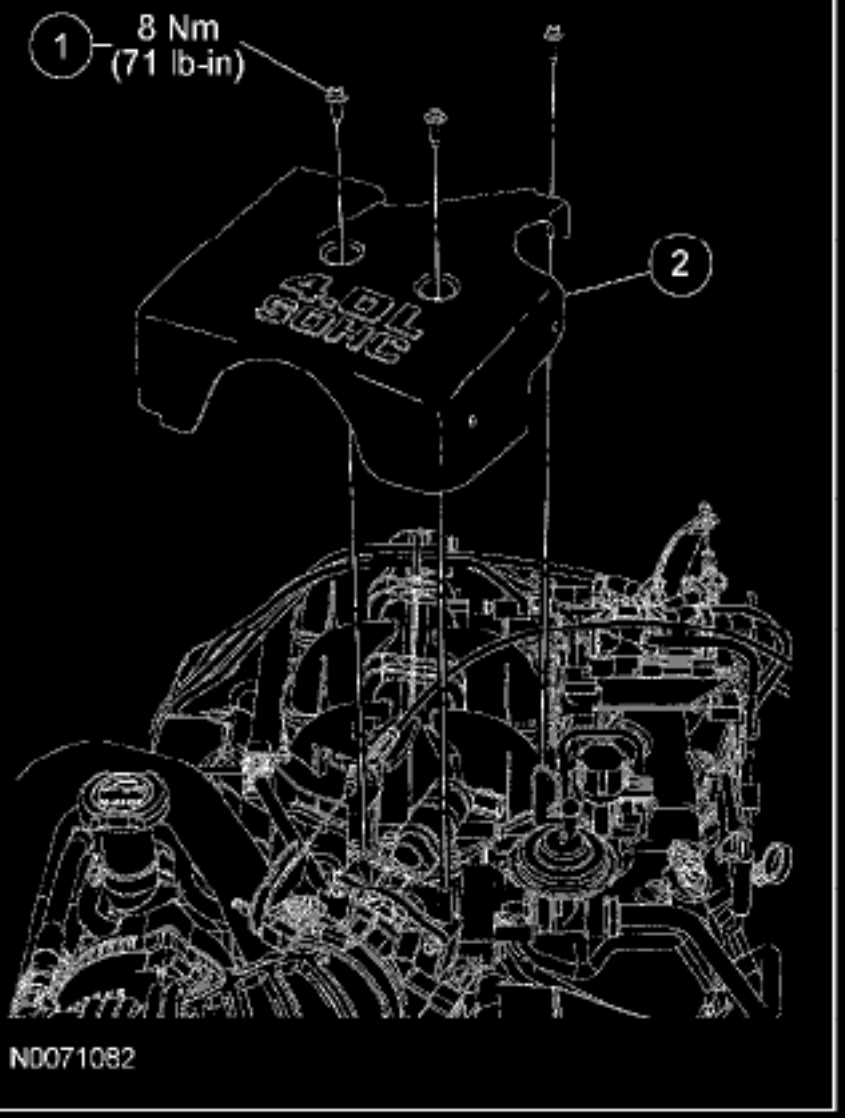
Air Filter Element: Service and Repair

INTAKE AIR SYSTEM COMPONENTS

Exploded View

2.3L Throttle Body (TB) Cover

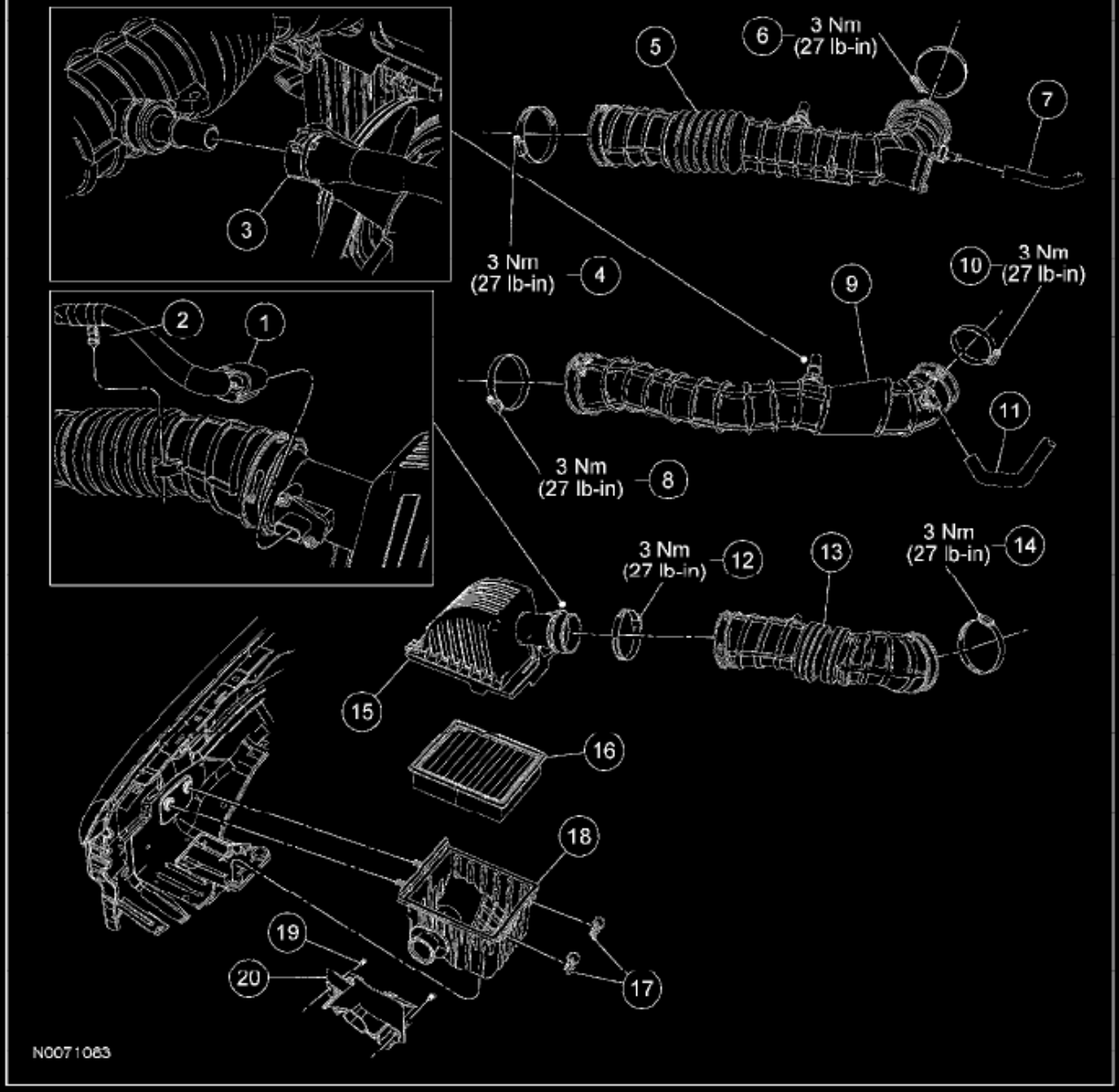
4.0L SOHC Throttle Body (TB) Cover



Item	Part Number	Description
1	W704704	Throttle body (TB) cover bolt (2 required)
2	9E766	TB cover

4.0L SOHC Throttle Body (TB) Cover

Intake Air Components



Item	Part Number	Description
1	—	Mass air flow (MAF) sensor electrical connector (part of 12B637)
2	13A506	Wiring harness retainer (2 required [2.3L engines]) (1 required [3.0L and 4.0L engines]) (part of 12B637)
3	—	Crankcase ventilation tube quick connect coupling

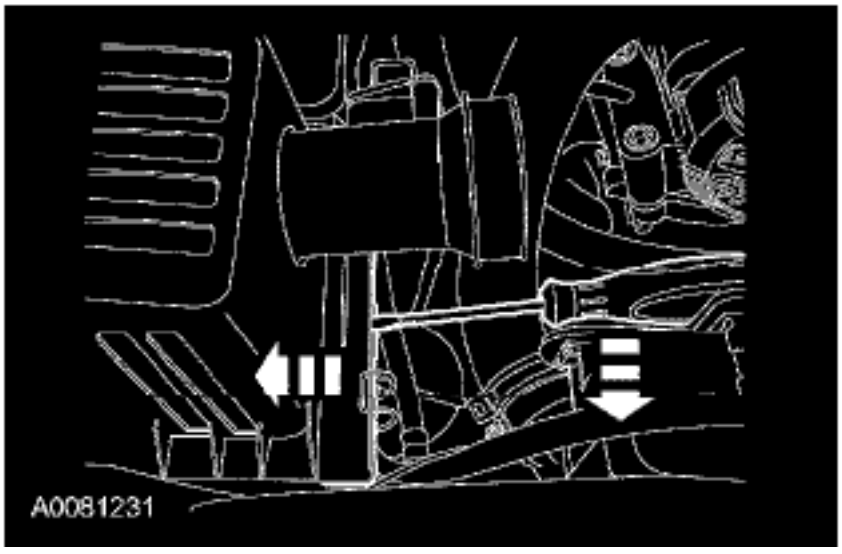
(Continued)

Item	Part Number	Description
4	6C632	Engine air cleaner (ACL) outlet tube-to-air cleaner clamp (2.3L)
5	9B659	ACL outlet tube (2.3L)
6	6C632	ACL outlet tube-to-throttle body (TB) clamp (2.3L)
7	9C490	Brake booster vacuum hose
8	6C632	ACL outlet tube-to-air cleaner clamp (3.0L)

(Continued)

Intake Air Components (Part 1)

Item	Part Number	Description
9	9B659	ACL outlet tube (3.0L)
10	6C632	ACL outlet tube-to-TB clamp (3.0L)
11	9C490	Brake booster vacuum hose
12	6C632	ACL outlet tube-to-air cleaner clamp (4.0L)
13	9B659	ACL outlet tube (4.0L)
14	6C632	ACL outlet tube-to-TB clamp (4.0L)
15	9643	ACL cover
16	9601	ACL element
17	9628	ACL-to-ACL cover clips
18	9A612	ACL
19	N810040	Air nozzle pushpins
20	9E961	Air nozzle



Intake Air Components (Part 2)

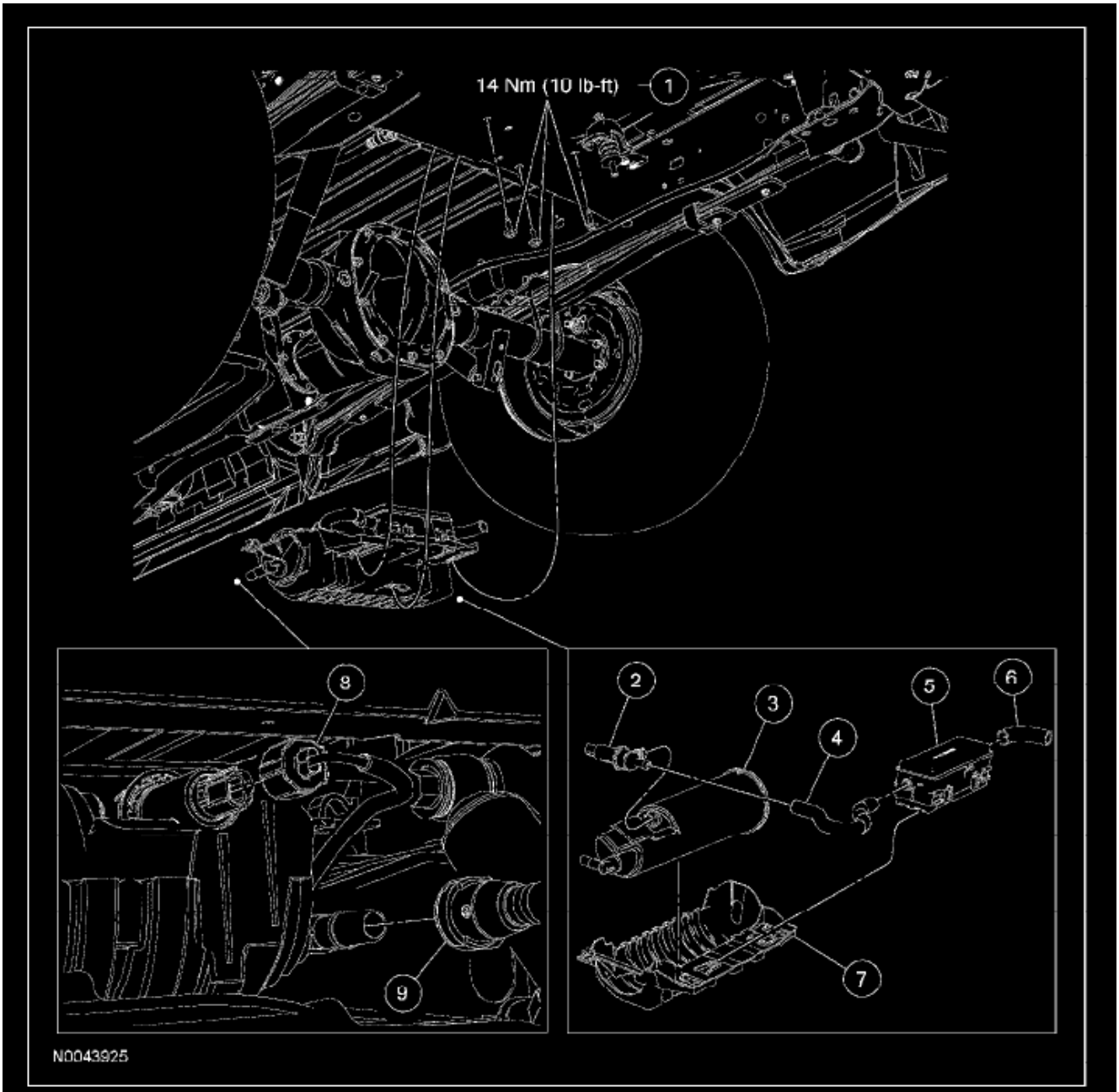
Removal and Installation

1. If necessary, pry the engine air cleaner (ACL) from the base support bracket when removing the ACL.

Cabin Air Filter: Service and Repair

Air Distribution

Note: The air distribution system of this vehicle CANNOT be equipped with a cabin air filter.



Item	Part Number	Description
1	W503932	Evaporative emissions (EVAP) canister and bracket assembly bolts
2	9F945	EVAP canister vent solenoid
3	9D653	EVAP canister

(Continued)

Item	Part Number	Description
4	9F459	EVAP canister vent solenoid-to-EVAP dust separator hose
5	9B328	EVAP dust separator
6	9F459	EVAP dust separator hose
7	9D665	EVAP canister bracket

(Continued)

Evaporative Canister Filter: Service and Repair

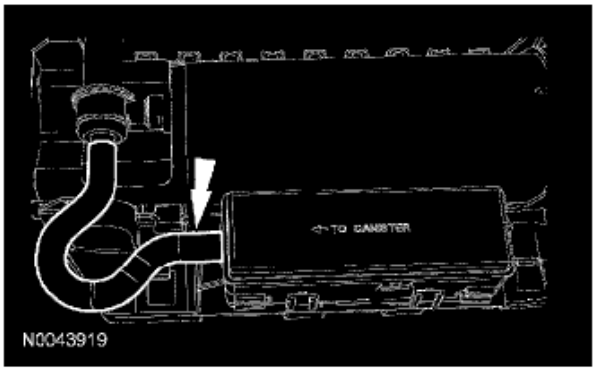
DUST SEPARATOR

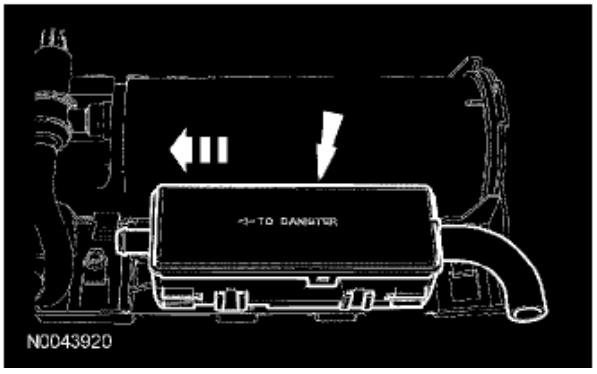
Removal and Installation

Exploded View

Part 1

Item	Part Number	Description
8	—	EVAP canister vent solenoid electrical connector (part of 14405)
9	—	Rear fuel tank vapor tube and fuel tank pressure sensor assembly-to-EVAP canister quick connect coupling (part of 9G291)





Part 2

WARNING:

- When working on or near the evaporative emission (EVAP) system, disconnect the battery ground cable from the battery. The EVAP system contains fuel vapor and condensed fuel vapor, so an electrical spark may cause a fire or explosion. Failure to follow this instruction may result in serious personal injury.

- Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the battery ground cable. 3. Disconnect the rear fuel tank vapor tube and fuel tank pressure sensor assembly-to-evaporative emissions (EVAP) canister quick connect coupling. 4. Disconnect the EVAP canister vent solenoid electrical connector. 5. Remove the EVAP canister and bracket assembly bolts.

- To install, tighten to 14 Nm (10 lb-ft).

6. Remove the EVAP canister and bracket assembly. 7. Disconnect the EVAP canister vent solenoid-to-dust separator hose from the dust separator.

8. Remove the dust separator from the bracket.

9. To install, reverse the removal procedure.

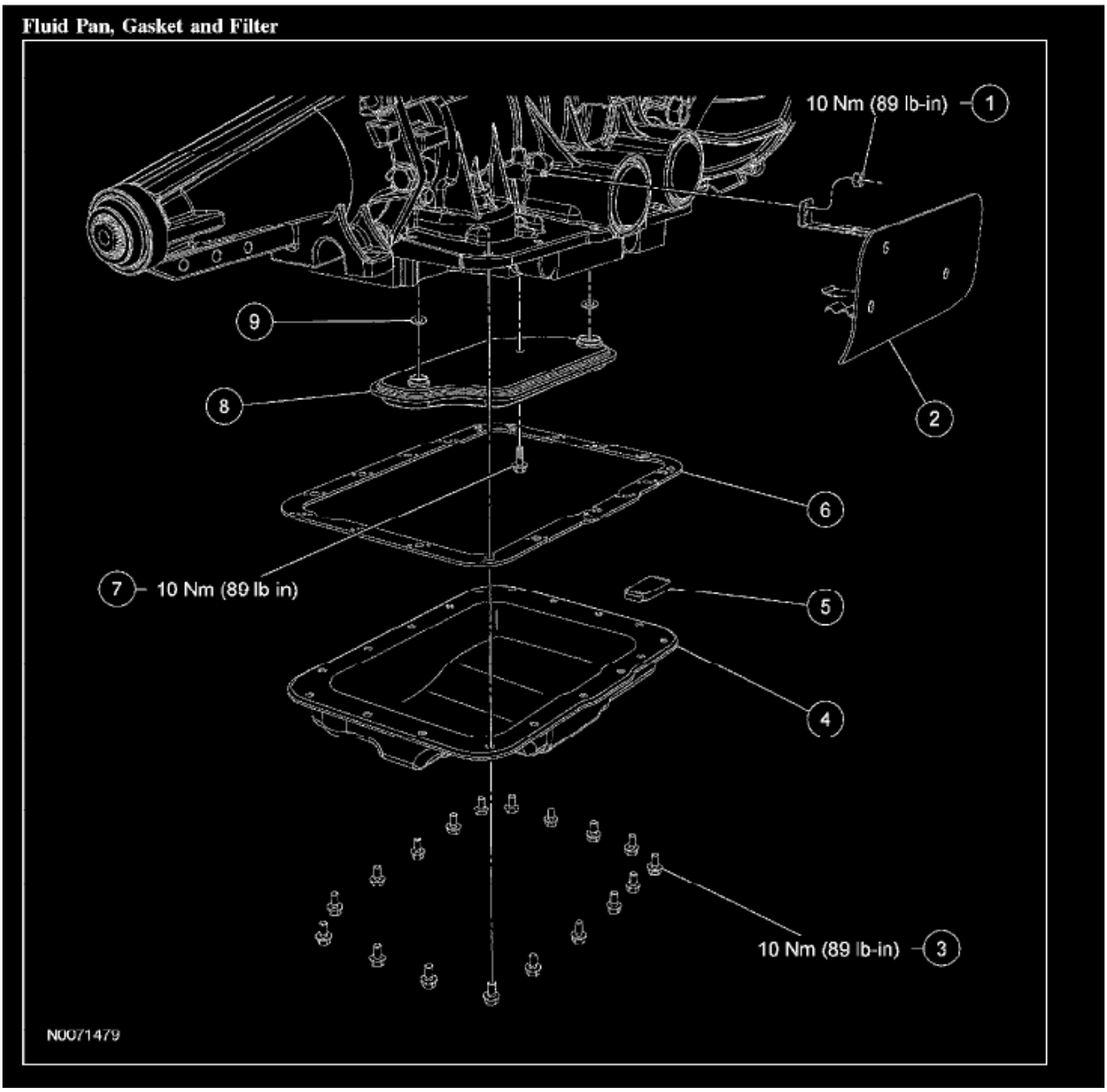
- Carry out the leak test. See: Powertrain Management/Emission Control Systems/Evaporative Emissions System/Testing and Inspection

- Carry out the evaporative emission repair verification drive cycle.

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

Fluid Pan, Gasket and Filter



Fluid Filter - A/T: Service and Repair Fluid Pan, Gasket and Filter

Fluid Pan, Gasket and Filter

Fluid Pan, Gasket and Filter (Part 1)

Item	Part Number	Description
1	N620040-S	Heat shield nut
2	7F013-B	Heat shield
3	W701203-S	Transmission fluid pan screw (18 required)
4	7A264-A	Transmission fluid pan
5	7L027	Magnet
6	7A191-A	Transmission fluid pan gasket
7	E800154	Transmission fluid filter screw
8	7A098-A	Transmission fluid filter
9	7A469	Transmission fluid filter O-ring (2 required)

Fluid Pan, Gasket and Filter (Part 2)

Removal

1. With the vehicle in NEUTRAL, position it on a hoist.

2. NOTE: If equipped, the transmission servo heat shield must be unclipped from the fluid pan rail and positioned aside for fluid pan removal.

If equipped, loosen the nut and position the heat shield aside.

3. Drain transmission fluid.

^ Remove all the transmission fluid pan screws except for 2 in the front. Loosen the 2 front transmission fluid pan screws. Pry the rear of the transmission fluid pan down and allow fluid to drain. After fluid is drained, remove the front 2 transmission fluid pan screws.

4. NOTE: The transmission fluid gasket is reusable. Clean and inspect for damage, if not damaged, the gasket should be reused.

Remove the transmission fluid pan.

5. Remove the transmission fluid pan gasket. 6. Remove the transmission fluid filter screw. 7. Remove the transmission fluid filter. 8. Clean and inspect the transmission fluid pan and magnet. Clean all mating surfaces.

Installation

1. CAUTION: Lubricate fluid filter O-ring seals with clean automatic transmission fluid or they may be damaged.

Lubricate and install new O-ring seals onto the transmission fluid filter.

2. Position the transmission fluid filter on the main control valve body. 3. Install the transmission fluid filter screw.

^ Tighten to 10 Nm (89 lb-inch).

4. Position the fluid pan magnet in the transmission fluid pan.

5. NOTE: The transmission fluid pan gasket is reusable. Clean and inspect for damage, it not damaged, the gasket should be reused.

Position the transmission fluid pan gasket on the transmission fluid pan.

6. Install and align the transmission fluid pan. 7. Loosely install the transmission fluid pan screws. 8. Tighten the transmission fluid pan screws in a crisscross pattern.

^ Tighten to 10 Nm (89 lb-inch).

9. If equipped, position the servo heat shield over the servos and clip it to the pan rail.

^ Tighten to 10 Nm (89 lb-inch).

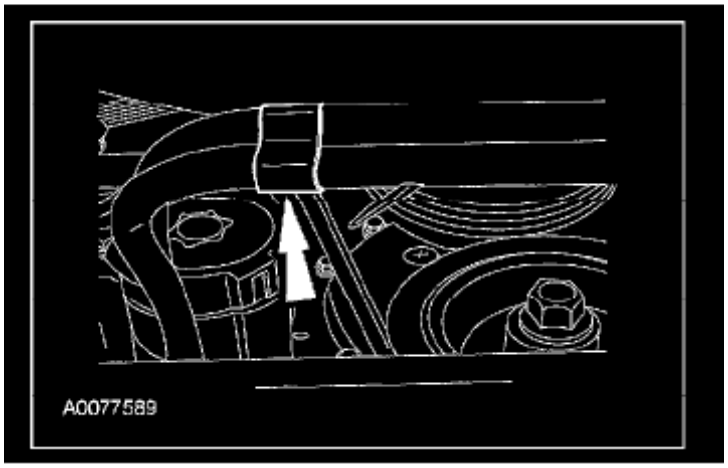
10. NOTE: Start with a minimum of 3.7L (4 qt) clean automatic transmission fluid.

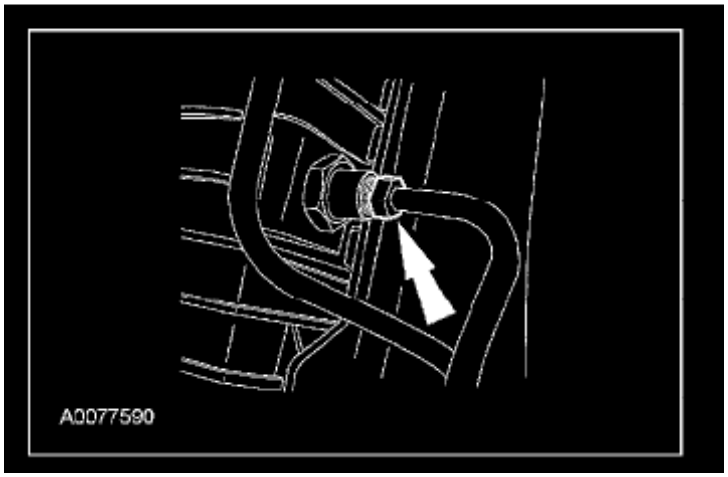
Fill transmission with clean automatic transmission fluid to the correct fluid level.

11. Apply the park brake and start the engine. 12. Move the range selector lever through all the gears. 13. Check the transmission fluid level.

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V





Fluid Filter - A/T: Service and Repair Transmission Filter - In Line

Transmission Filter - In Line

Transmission fluid in-line filter without oil-to-air (OTA) cooler

NOTE: Use the following guidelines for the in-line transmission fluid filter: ^

If the transmission was overhauled and the vehicle was equipped with an in-line fluid filter, install a new in-line fluid filter.

^ If the transmission was overhauled and the vehicle was not equipped with an in-line fluid filter, install a new in-line fluid filter kit.

^ If the transmission is being installed for a non-internal repair, do not install an in-line filter or filter kit.

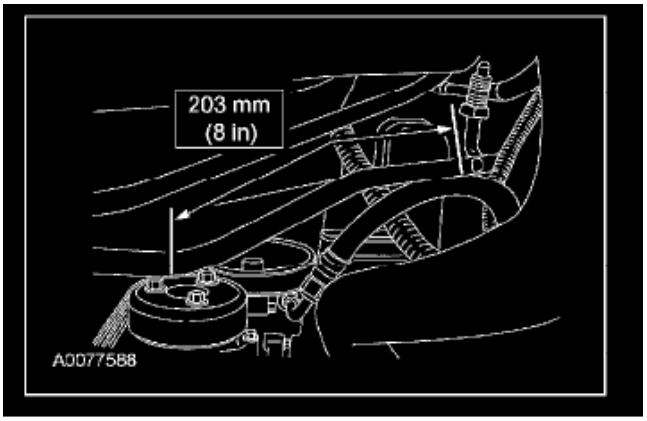
^ If installing a new or a Ford-authorized remanufactured transmission, install the in-line transmission fluid filter that is supplied.

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Remove the retainer clips from the cooler lines.

3. Disconnect the lower transmission cooler tube fitting.

4. Remove the section of the return line, as illustrated.

^ Clean and deburr the cut ends of the steel tubing.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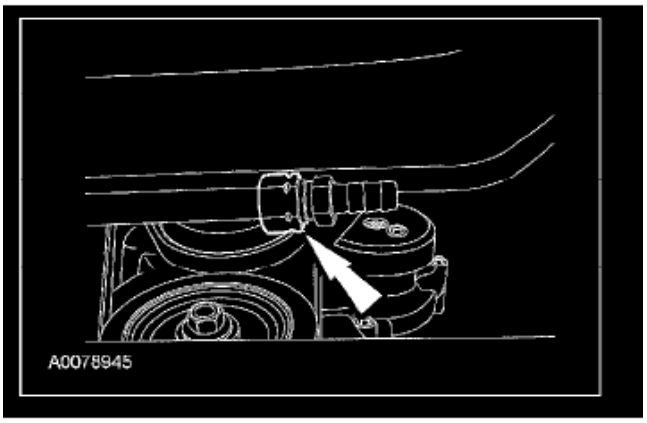
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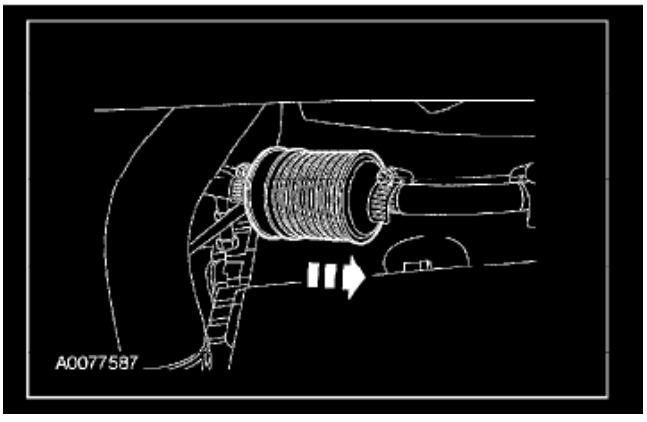
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5. NOTE: Be sure the cooler tube is fully seated in the body of the fitting before final tightening of the ferrule nut.

Install the 2 ferrule connectors finger tight onto each end of the tubing. Then tighten the nuts an additional 1-1/2 turns to seat the ferrules in the connectors.

6. CAUTION: The filter has a bypass valve in it. The red arrow on the filter indicates the direction of the fluid flow through the filter. The

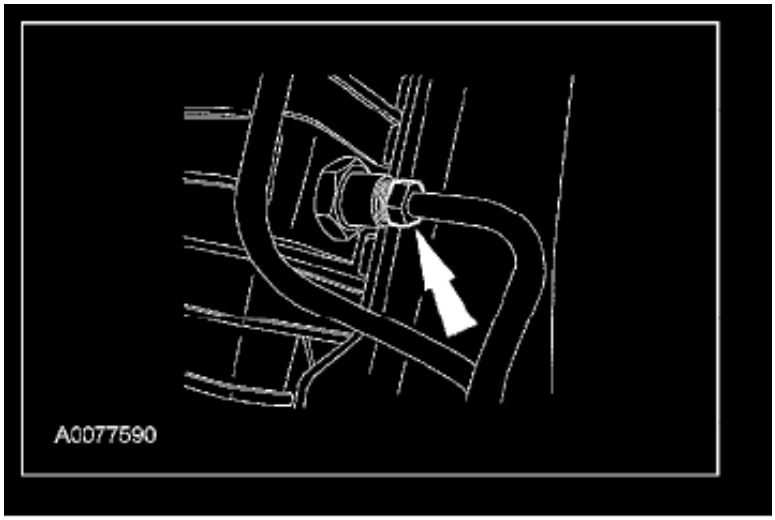
filter must be installed in the fluid cooler return line with the red arrow pointing away from the transmission fluid cooler and toward the transmission (the return line has fluid coming out of the cooler going to the transmission). If the fluid filter is not installed correctly, it will cause internal transmission damage.

NOTE: Do not install any rubber hoses or steel tubing with a bend entering the filter greater than 60 degrees.

Using suitable length of hose(s), install the filter. Tighten the clamps.

7. Connect the lower transmission cooler tube fitting.

^ Tighten to 28 Nm (21 lb-ft).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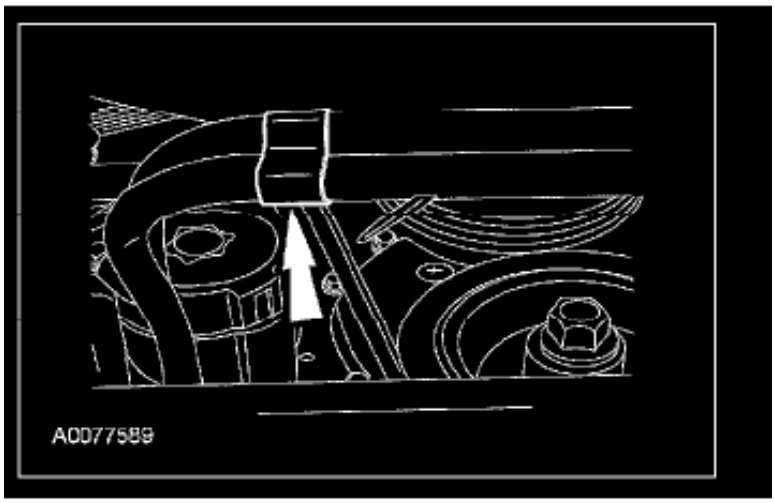
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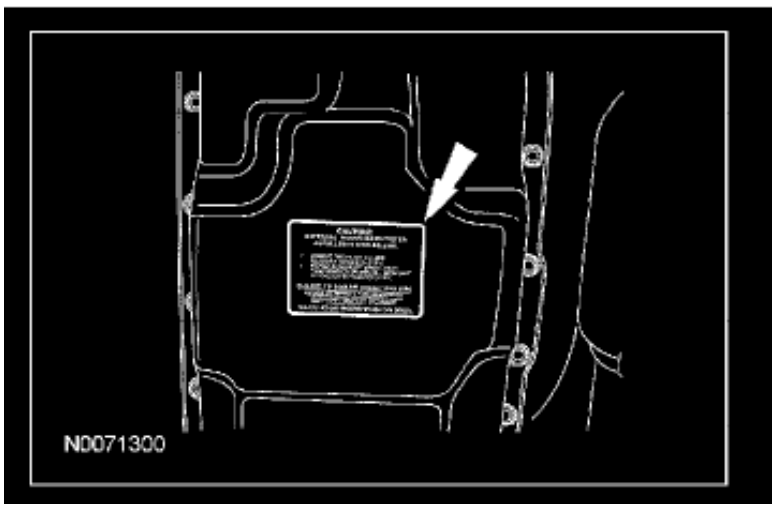

N0071300

8. Install the retainer clips on the cooler lines.

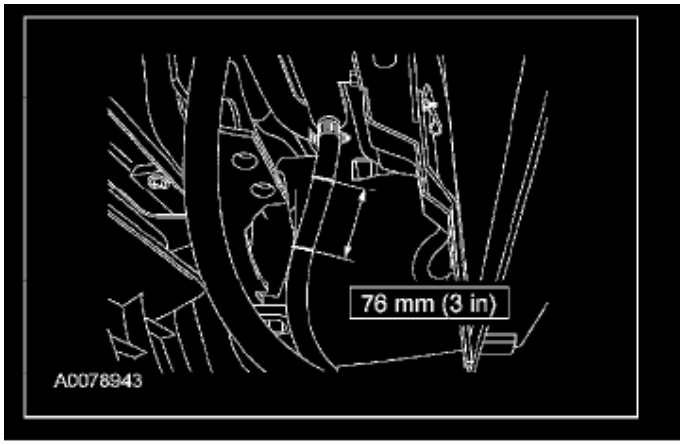
9. Clean a section of the transmission fluid pan and install the sticker.

10. Fill the transmission with clean automatic transmission fluid.

^ Verify for correct operation.

^ Check the filter for leaks.

Transmission fluid in-line filter with OTA cooler 11. With the vehicle in NEUTRAL, position it on a hoist. 12. Remove the section of the return line, as illustrated.


76 mm (3 in)
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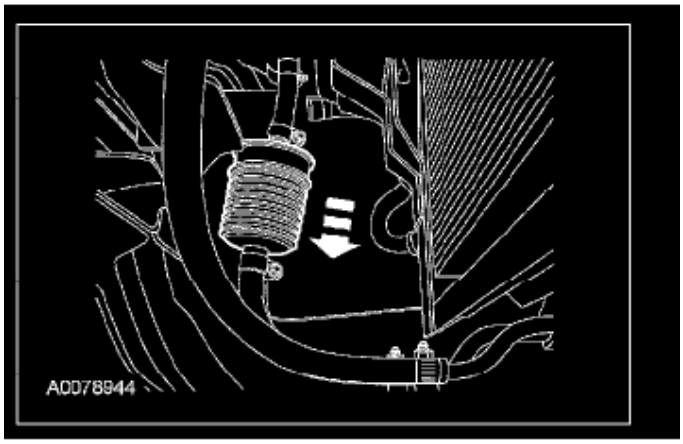
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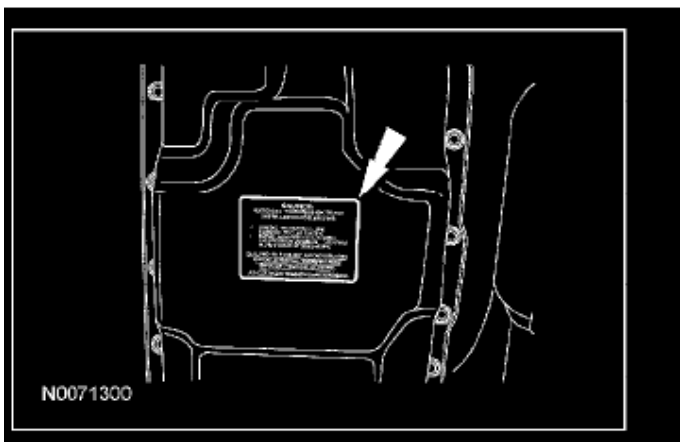

N0071300

13. CAUTION: The filter has a bypass valve in it. The red arrow on the filter indicates the direction of the fluid flow through the filter. The

filter must be installed in the fluid cooler return line with the red arrow pointing away from the transmission fluid cooler and toward the transmission (the return line has fluid coming out of the cooler going to the transmission). If the fluid filter is not installed correctly, it will cause internal transmission damage.

NOTE: Do not install any rubber hoses or steel tubing with a bend entering the filter greater than 60 degrees.

Using 2 hose clamps, install the filter.

14. Clean a section of the transmission fluid pan and install the sticker.

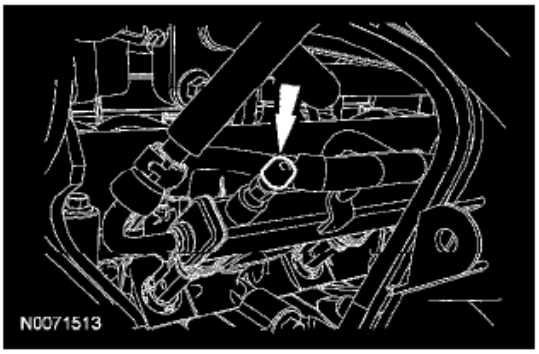
15. Fill the transmission with clean automatic transmission fluid.

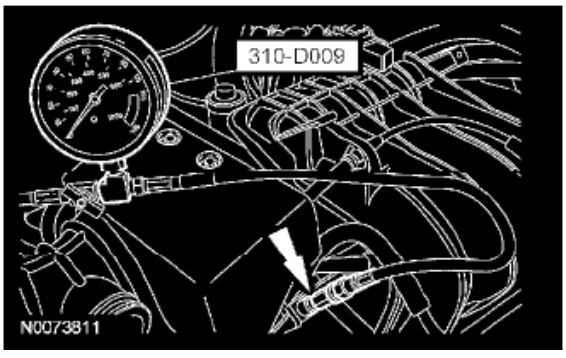
^ Verify for correct operation.

^ Check the filter for leaks.

Special Tool(s)

ST3038-A	Fuel Pressure Test Kit 310-D009 (D95L-7211A)





Fuel Pressure Release: Service and Repair

FUEL SYSTEM PRESSURE RELEASE

Special Tool(s)

Special Tool(s)

WARNING:

- Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

- Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.

- Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

- When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.

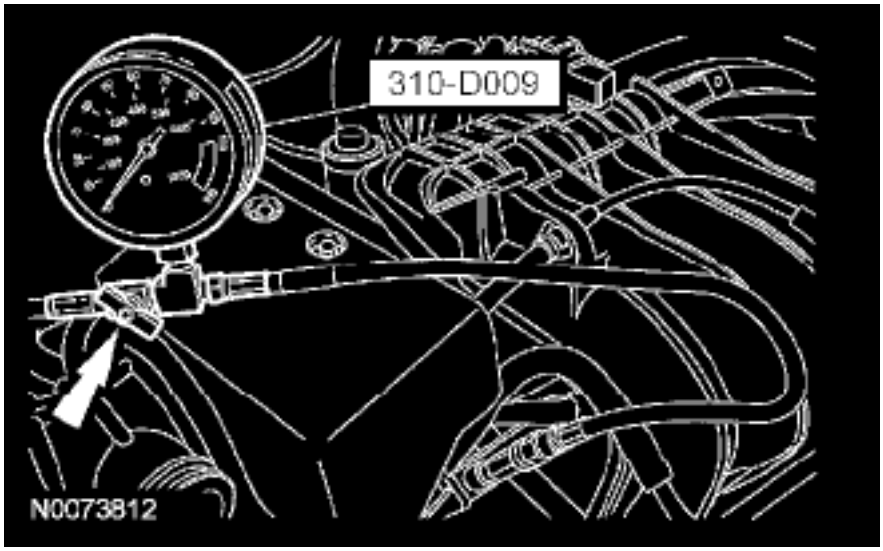
1. Disconnect the battery ground cable.

2. NOTE: 2.3L shown, 3.0L and 4.0L similar.

Remove the cap from the fuel pressure relief valve located on the fuel rail.

3. NOTE: 2.3L shown, 3.0L and 4.0L similar.

Install the special tool onto the fuel pressure relief valve.



4. NOTE:

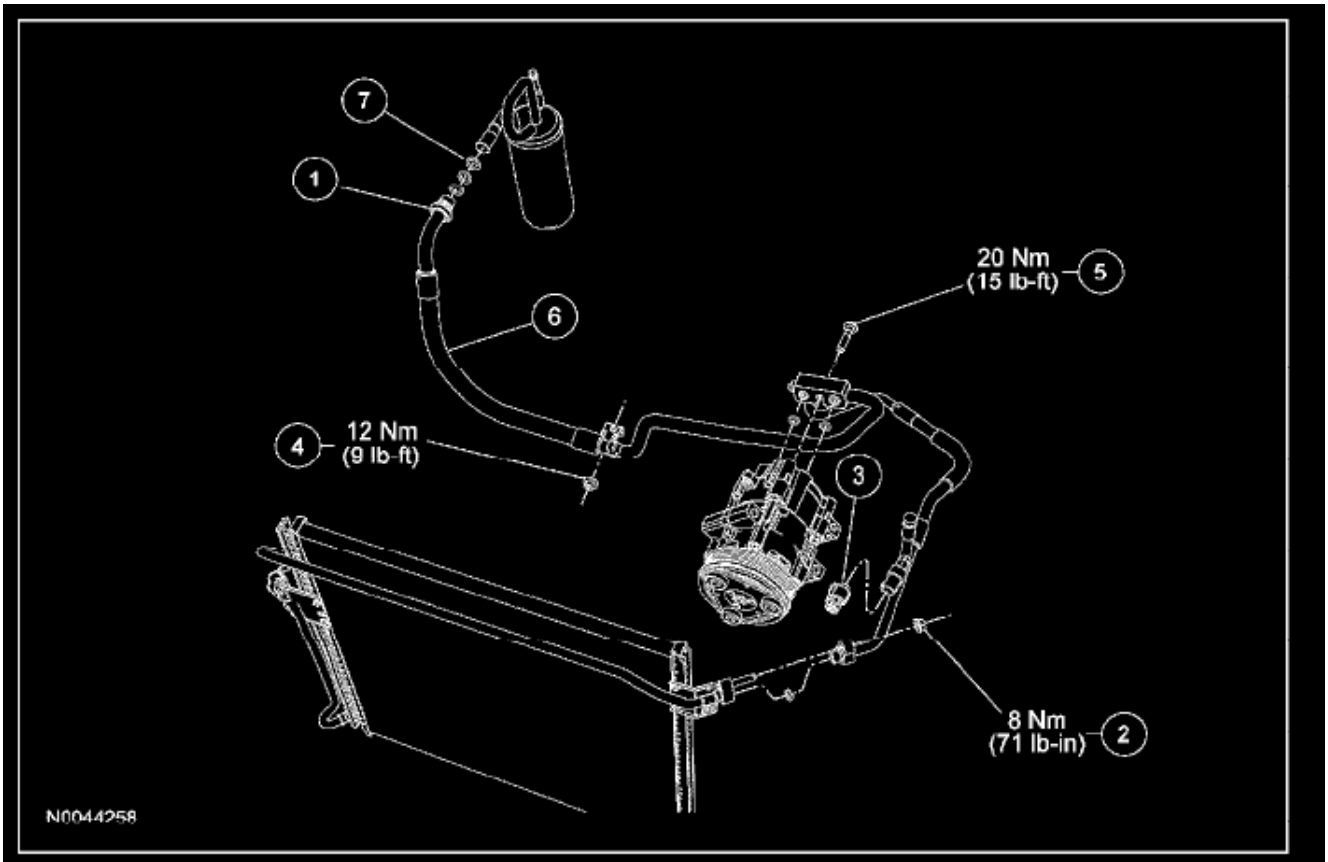
- 2.3L shown, 3.0L and 4.0L similar.

- Open the drain valve slowly to relieve the system pressure. This may drain fuel from the system. Place fuel in a suitable container.

Open the drain valve on the special tool and relieve the fuel system pressure.

5. NOTE: It may take more than one key cycle to pressurize the fuel system.

Upon completion of the fuel system repairs, cycle the ignition key and wait 3 seconds to pressurize the fuel system. Check for leaks before starting the engine.



Item	Part Number	Description
1	—	Suction accumulator outlet fitting (part of 19D850)
2	W520413	Condenser inlet fitting nut
3	—	Pressure cutoff switch electrical connector (part of 14A280)
4	N621940	Compressor manifold and tube assembly bracket nut
5	W704692	A/C compressor manifold bolt
6	19D850	Compressor manifold and tube assembly
7	19E889	O-ring seal (6 required)

Hose/Line HVAC: Service and Repair Compressor Manifold and Tube Assembly

COMPRESSOR MANIFOLD AND TUBE ASSEMBLY

Removal and Installation

NOTE: Installation of a new suction accumulator is not required when repairing the air conditioning system, except when there is physical evidence of system contamination from a failed A/C compressor or damage to the suction accumulator.

1. Recover the refrigerant. 2. Disconnect the suction accumulator outlet fitting.

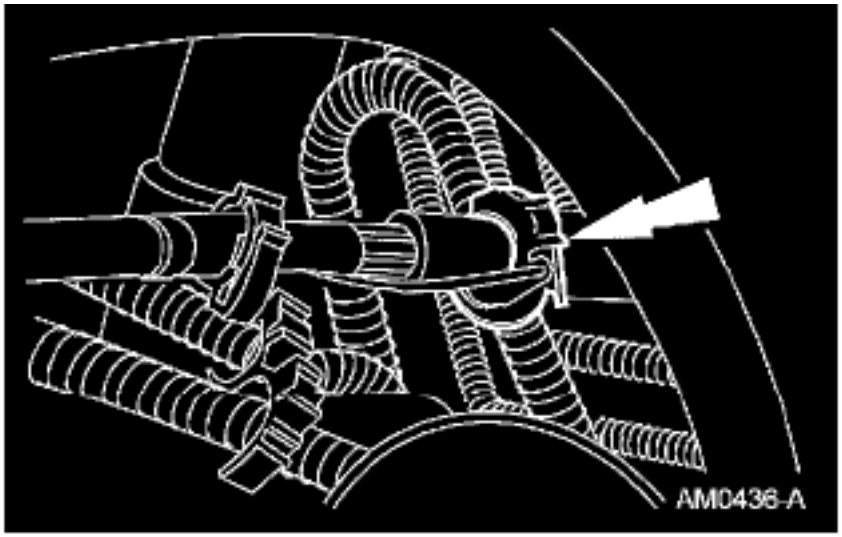
- Discard the O-ring seals.

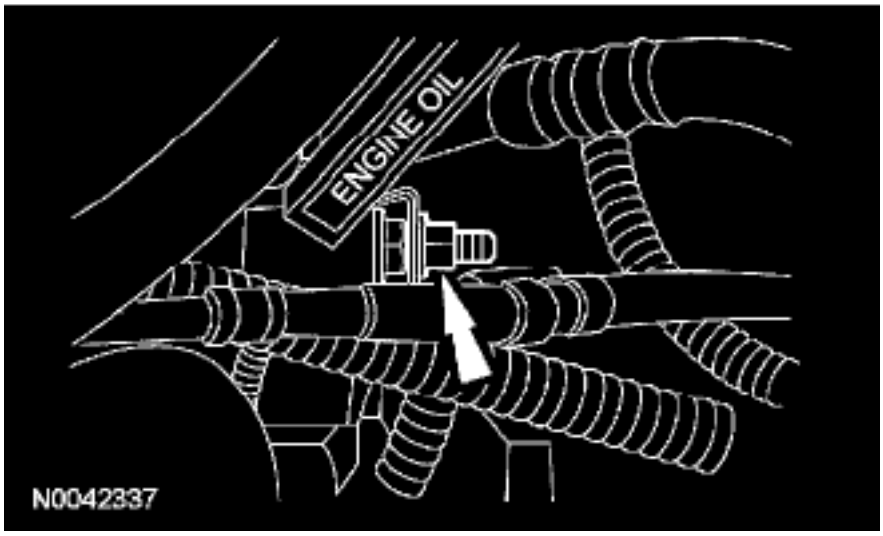
3. Remove the condenser inlet fitting nut and disconnect the fitting.

- Discard the O-ring seal.

- To install, tighten to 8 Nm (71 lb-in).

4. Disconnect the pressure cutoff switch electrical connector. 5. Disconnect the fuel line spring lock coupling.





6. Remove the nut and position the bracket aside.

- To install, tighten to 12 Nm (9 lb-ft).

7. Remove the compressor manifold and tube assembly bracket nut.

- To install, tighten to 12 Nm (9 lb-ft).

8. Loosen the A/C compressor manifold bolt and remove the compressor manifold and tube assembly.

- Discard the O-ring seals.

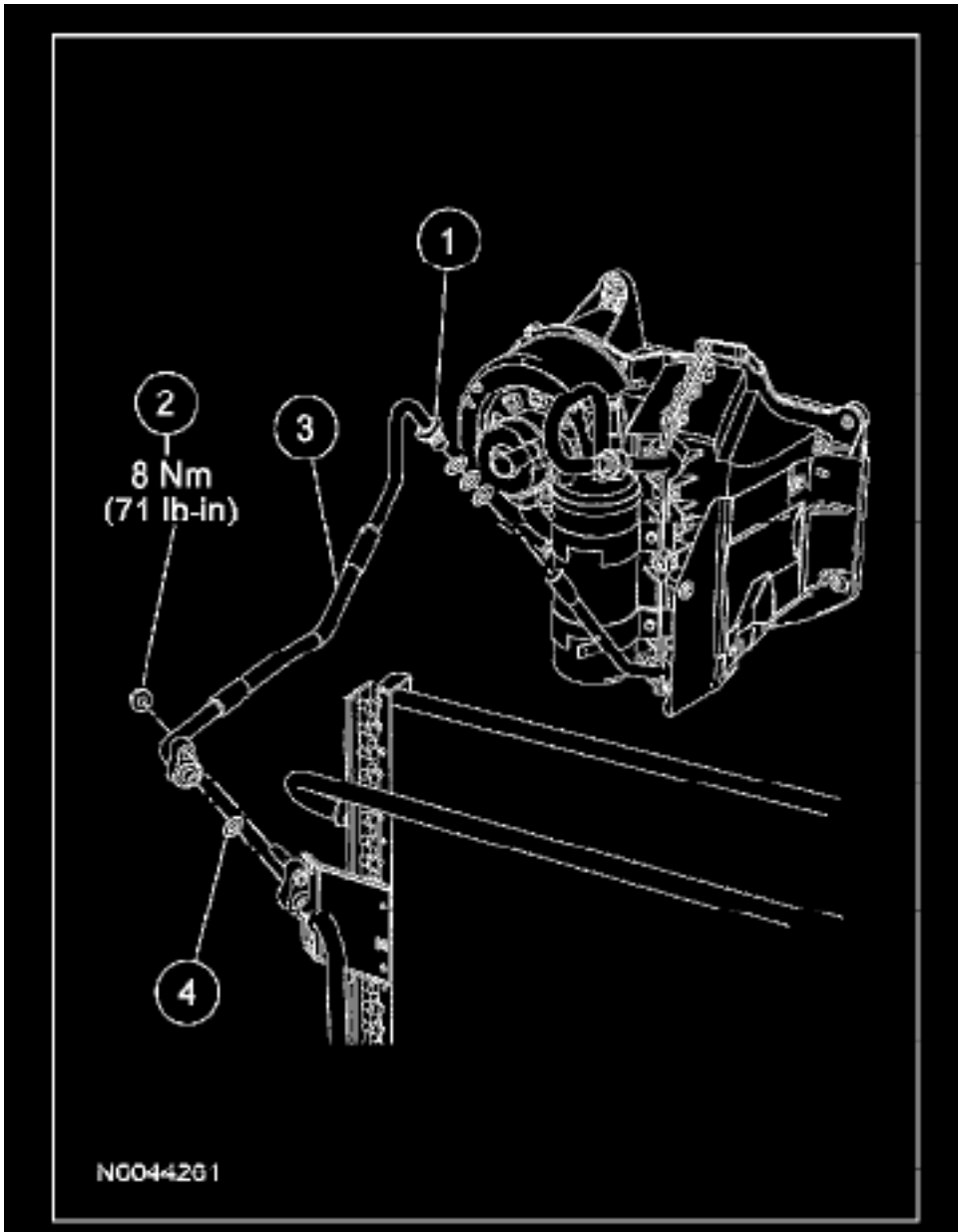
- To install, tighten to 20 Nm (15 lb-ft).

9. To install, reverse the removal procedure.

- Install new O-ring seals.

- Lubricate the refrigerant system with the correct amount of clean PAG oil.

10. Evacuate, leak test and charge the refrigerant system.



Item	Part Number	Description
1	—	Evaporator inlet fitting (part of 19835)
2	W520413	Condenser outlet fitting nut
3	19835	Condenser-to-evaporator line
4	19F889	O-ring seal (4 required)

Hose/Line HVAC: Service and Repair Condenser to Evaporator Line

CONDENSER TO EVAPORATOR LINE

Removal and Installation

NOTE: Installation of a new suction accumulator is not required when repairing the air conditioning system, except when there is physical evidence of system contamination from a failed A/C compressor or damage to the suction accumulator.

1. Recover the refrigerant. 2. Disconnect the evaporator inlet fitting.

- Discard the O-ring seals.

3. Remove the condenser outlet fitting nut and disconnect the fitting.

- Discard the O-ring seal.

- To install, tighten to 8 Nm (71 lb-in).

4. To install, reverse the removal procedure.

- Install new O-ring seals.

- Lubricate the refrigerant system with the correct amount of clean PAG oil.

5. Evacuate, leak test and charge the refrigerant system.

Brake Fluid: Specifications

Brake Fluid Type

Ford Part Name

- Motorcraft High Performance DOT 3 Motor Vehicle Brake Fluid

Ford Part Number

- PM-1 or PM-1-C

Ford Specifications

- ESA-M6C25-A or WSS-M6C62-A

Clutch Fluid: Specifications

Clutch Hydraulic Fluid - Motorcraft High Performance DOT 3 Motor Vehicle Brake Fluid

Coolant: Capacity Specifications

Coolant Capacity:

Manual Transmission ..... 15.1 qts (14.3L)

Automatic Transmission ..... 14.8 qts (14.0L)

Coolant: Fluid Type Specifications

Engine Coolant

.....

Motorcraft Premium Gold Engine Coolant

Note: Add the coolant type originally equipped in your vehicle.

Fluid - A/T: Capacity Specifications

Transmission Fluid ..... 10.0 qts (9.5L)

Note: Indicates only approximate dry-fill capacity. Some applications may vary based on cooler size and if equipped with an in-tank cooler. The amount of transmission fluid and fluid level should be set by the indication on the dipstick's normal operating range.

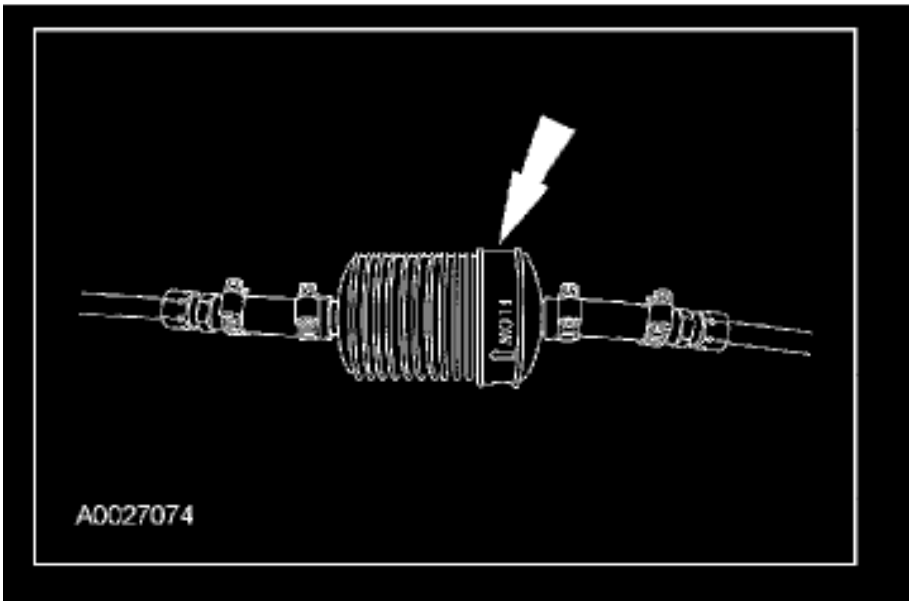
Fluid - A/T: Fluid Type Specifications

Transmission Fluid Type

Type ..... MERCON V

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V



Fluid - A/T: Service and Repair Transmission Fluid Cooler Backflushing and Cleaning

Transmission Fluid Cooler Backflushing and Cleaning

CAUTION: Whenever a transmission has been disassembled to install new parts or a new or remanufactured transmission has been installed, a new transmission fluid cooler, either in-tank, auxiliary or oil to air (OTA), if equipped will need to be installed. Using a suitable torque converter/fluid cooler cleaner, clean and backflush the transmission fluid cooler tubes.

When internal wear or damage has occurred in the transmission, metal particles, clutch plate material or band material may have been carried into the transmission fluid cooler. These contaminants are a major cause of recurring transmission concerns and must be removed from the system before the transmission is put back in use.

CAUTION: Use only clean automatic transmission fluid specified for this transmission. Do not use supplemental fluid additives, treatments or cleaning agent. The use of these materials may affect transmission operation and result in internal damage to the transmission.

NOTE: Do not use any solvents while carrying out this procedure. Only use clean automatic transmission fluid.

1. Conduct backflushing with a suitable torque converter/transmission fluid cooler cleaner. Test the equipment to make sure that a vigorous fluid

flow is present before proceeding. Install a new system filter if flow is weak or contaminated.

2. Remove and discard the in-line transmission fluid filter, if equipped.

3. To aid in attaching the cleaner to the transmission steel cooler lines, connect 2 additional rubber hoses to the transmission end of the steel

transmission cooler lines as described. ^

Connect the cleaner tank pressure line to the steel transmission cooler return line (longest line).

^ Connect a tank return hose to the steel transmission cooler pressure line (shorter line). Place the outlet end of this hose in the solvent tank reservoir.

4. Turn on the pump and allow the transmission fluid to circulate a minimum of 5 minutes (cycling switch on and off will help dislodge contaminants

in the cooler system).

5. Switch off the pump and disconnect the pressure hose from the transmission cooler return line.
6. Use compressed air to blow out the cooler(s) and lines (blow air into the transmission cooler return line) until all the fluid is removed. 7. Remove the rubber return hose from the remaining steel cooler line.

Special Tool(s)

ST2554-A	Automatic Transmission Flush and Fill Machine 211-00018 Automatic Transmission Flush and Fill Machine 199-00010 or equivalent

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

Fluid - A/T: Service and Repair Transmission Fluid Drain and Refill - Automated Equipment

Transmission Fluid Drain and Refill - Automated Equipment

Drain

CAUTION: Use only clean automatic transmission fluid. Do not use any supplemental transmission fluid additives, treatments or cleaning agents. The use of these materials can affect the operation of the transmission, resulting in internal component failure.

NOTE: Always refer to the instructions supplied with the flush and fill machine.

NOTE: This is a new procedure for draining and adding transmission fluid using a suitable transmission flush and fill machine.

1. With the vehicle in PARK, position on a hoist. 2. Use a suitable flush and fill machine to change the fluid. 3. When connecting the flush and fill machine, connect the machine to the fluid cooler tube after the fluid cooler on the cooler return tube. This will

help remove any foreign material trapped in the fluid coolers.

4. Carry out the fluid exchange process.

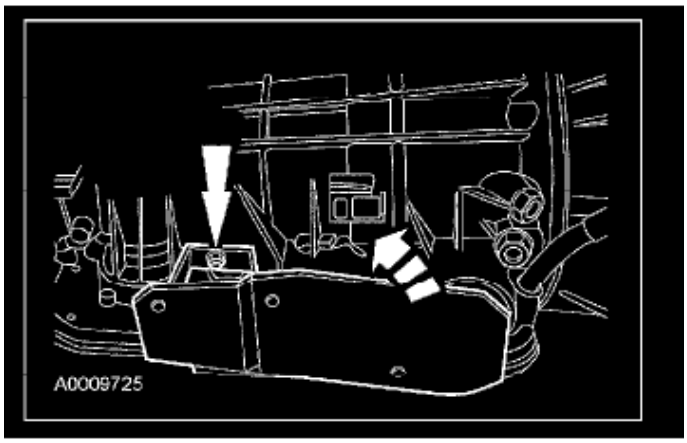
Refill

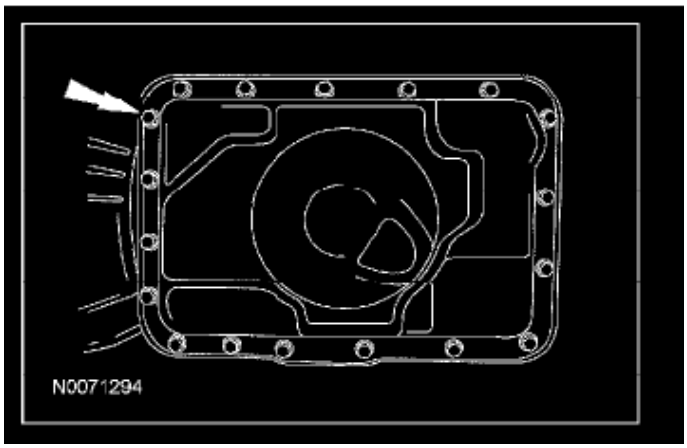
1. Use only clean automatic transmission fluid. 2. Once the fluid exchange has been completed, disconnect the flush and fill machine. Reconnect any disconnected fluid cooler tubes. 3. Lower the vehicle. 4. With the engine running and the transmission at normal operating temperature 66-77° C (150-170° F), check and adjust the transmission fluid

level and check for any leaks. If fluid is needed, add fluid in increments of 0.24L (0.5 pt) until the correct level is achieved (fluid should be in the cross-hatched area of the fluid level indicator).

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V





Fluid - A/T: Service and Repair Transmission Fluid Drain and Refill - Vehicles Not Equipped With Torque Converter Drain Plug

Transmission Fluid Drain and Refill - Vehicles Not Equipped With Torque Converter Drain Plug

Drain

CAUTION: Use only clean automatic transmission fluid. Do not use any supplemental transmission fluid additives, treatments or cleaning agents. The use of these materials may affect the operation of the transmission, resulting in internal component failure.

1. With the vehicle in PARK, position it on a hoist.

2. NOTE: If equipped, the transmission servo heat shield must be unclipped from the fluid pan rail and positioned aside for fluid pan removal.

If equipped, loosen the nut and position the heat shield aside.

3. Place a drain pan under the transmission fluid pan. 4. Drain transmission fluid.

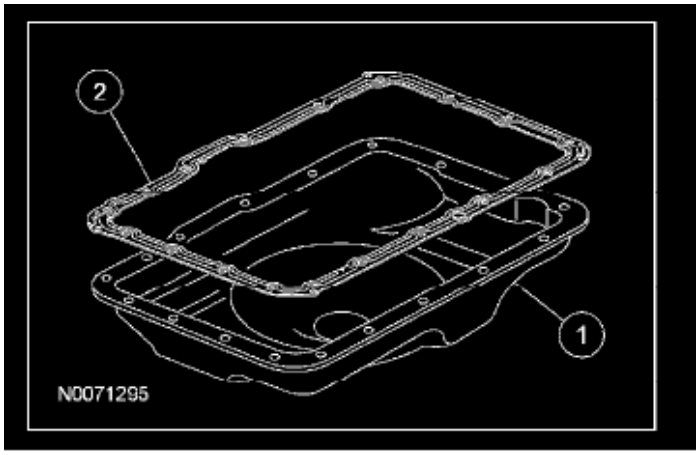
^ Remove all the transmission fluid pan screws except for 2 in the front. Loosen the 2 front transmission fluid pan screws. Pry the rear of the transmission fluid pan down and allow fluid to drain. After fluid is drained, remove the front 2 transmission fluid pan screws.

5. NOTE: The transmission fluid pan gasket is reusable. Clean and inspect for damage, if not damaged, the gasket should be reused.

Remove the transmission fluid pan. 1

Remove the transmission fluid pan.

2 Remove the transmission fluid pan gasket.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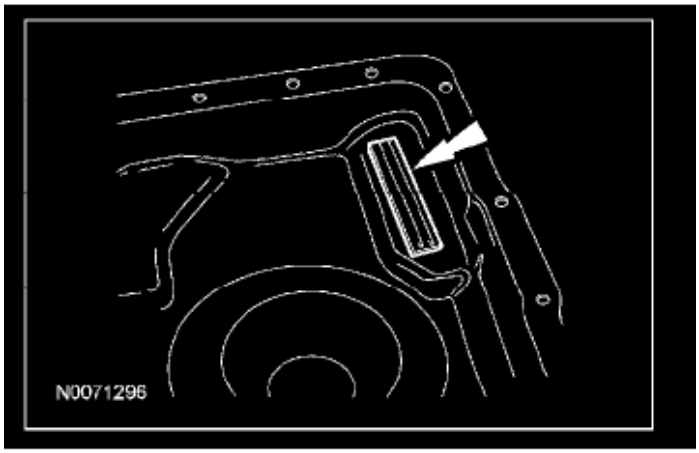
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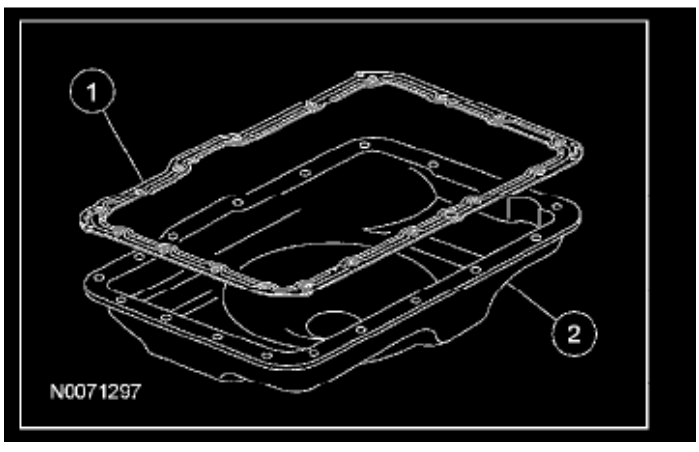

1
2
N0071297

6. Clean and inspect the transmission fluid pan and magnet. Clean all mating surfaces.

Refill

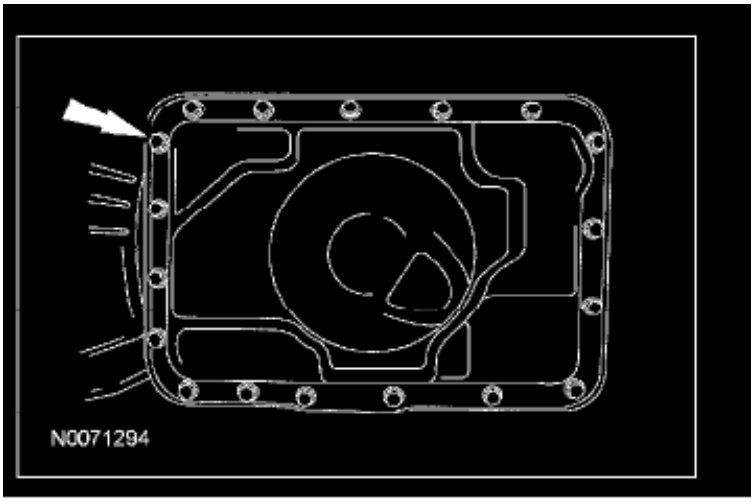
1. NOTE: The transmission fluid pan gasket is reusable. Clean and inspect for damage, if not damaged, the gasket should be reused.

Install the transmission fluid pan. 1

Position the transmission fluid pan gasket on the transmission fluid pan.

2 Install and align the transmission fluid pan.

2. Loosely install the transmission fluid pan screws.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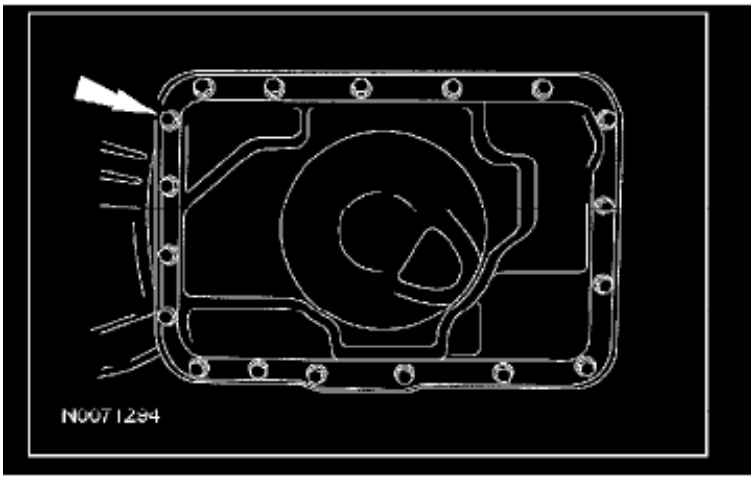
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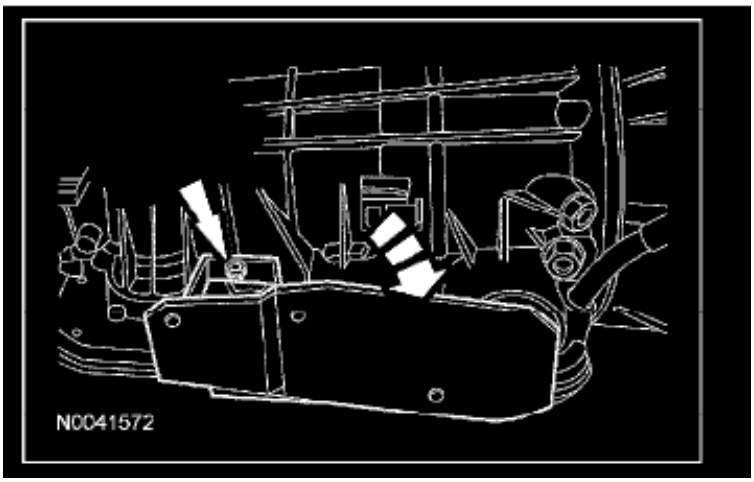

N0041572

3. Tighten the transmission fluid pan screws in a crisscross sequence.

^ Tighten to 10 Nm (89 lb-inch).

4. If equipped, position the servo heat shield over the servos and clip it to the pan rail.

^ Tighten to 10 Nm (89 lb-inch).

5. Lower the vehicle.

6. NOTE: When filling a dry transmission and converter, start with a minimum of 3.7L (4 qt).

With the engine running and the transmission at normal operating temperature 66-77° C (150-170° F), check and adjust the transmission fluid level and check for any leaks. If fluid is needed, add fluid in increments of 0.24L (0.5 pt) until the correct level is achieved (fluid should be in the crosshatched area of the fluid level indicator).

7. Apply the park brake and start the engine. 8. Move the range selector lever through all the gears. 9. Check the transmission fluid level.

Fluid - M/T: Capacity Specifications

Manual Transmission

Capacity ..... 2.8 Quarts

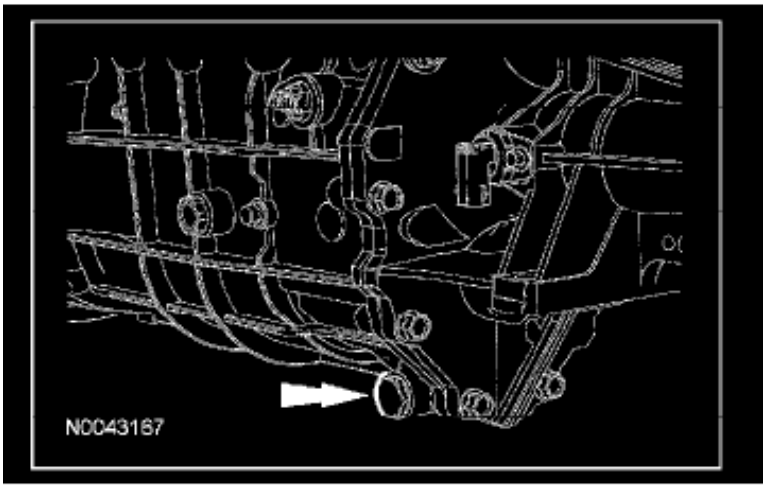
Note: Approximate refill. Service refill capacity is determined by filling the transmission to the bottom of the filler hole with the vehicle on a level surface.

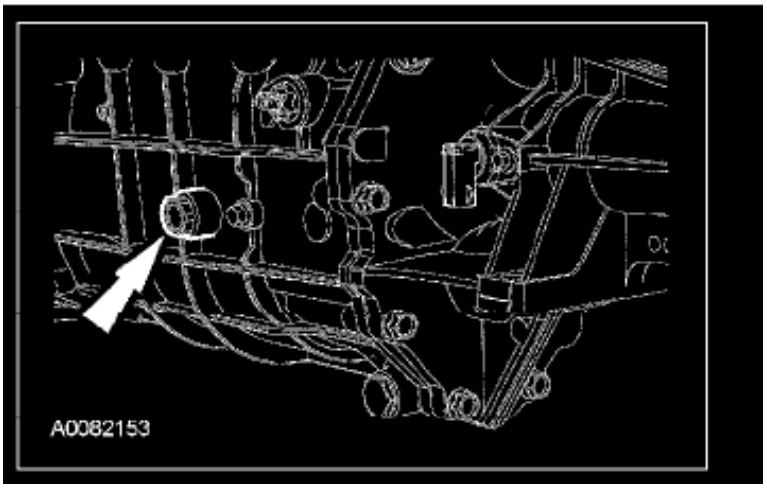
Fluid - M/T: Fluid Type Specifications

Manual Transmission Fluid ..... Mercon V ATF

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V





Fluid - M/T: Service and Repair

Transmission Draining and Filling

1. NOTE: Position a suitable drain pan under the transmission.

Remove the drain plug and drain the transmission.

2. Clean and install the drain plug.

^ Tighten to 48 Nm (35 lb-ft).

3. NOTE: Before removing, clean the area around the filler plug.

Remove the filler plug.

4. NOTE: Fill the transmission with the vehicle on a level surface.

Using a suitable oil suction gun, fill the transmission to the correct level with the specified fluid. The fluid must be just below the fill plug hole. ^

Transmission capacity is 2.6L (2.8 qt).

5. Install the fill plug.

^ Tighten to 48 Nm (35 lb-ft).

Fluid - Differential: Capacity Specifications

Differential Oil Capacity

Rear Axle ..... 5.0 - 5.3 Pints (2.4 - 2.5 L)

Note: Traction-Lok axles use 4.75 - 5.0 pints (2.2 - 2.4 L) of rear axle lubricant.

Note: Service refill capacities are determined by filling the rear axle 1/4 inch to 9/16 inch (6 mm to 14 mm) below the bottom of the filler hole.

Note: Add 8 oz. (118 ml) of Additive Friction Modifier XL-3 or equivalent meeting Ford specification EST-M2C118-A for complete refill of Traction-Lok axles.

Fluid - Differential: Fluid Type Specifications

Differential Fluid Type

Rear Axle Ford Part Name ..... Motorcraft SAE 80W-90 Premium Rear Axle Lubricant Ford Part Number ..... XY-80W90-QL Ford Specification WSP-m2C197-A

Engine Oil: Capacity Specifications

Engine Oil

With Filter ..... 4.25L (4.5 Qt)

Engine Oil: Fluid Type Specifications

Engine Oil

U.S. .....
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil Canada
.....
Motorcraft SAE 5W-20 Super Premium Motor Oil

Note: Use of synthetic or synthetic blend motor oil is not mandatory. Engine oil need only have the API Certification mark and meet the requirements of Ford Specification WSS-M2C930-A.

Power Steering Fluid: Specifications

Transfer Case Fluid Type

Ford Part Number ..... Motorcraft MERCON V ATF Ford Part Number XT-5-QM
Ford Specification ..... MERCON V

Power Steering Fluid: Testing and Inspection

Power Steering Fluid Leak Test

NOTE: This test should only be carried out if a leak in the system has not been detected during a thorough visual inspection. Refer to Inspection and Verification.

1. Check the power steering fluid level. If necessary, add the specified power steering fluid. 2. Remove the power steering pump reservoir cap and tightly install the evacuation cap to the power steering pump reservoir. 3. Install the hose from the fill adapter manifold tee to the evacuation cap on the power steering pump reservoir. 4. Install the vacuum pump to the evacuation cap. 5. Using the vacuum pump, apply 68-85 kPa (20-25 in-Hg) of vacuum to the power steering system. 6. Observe the vacuum gauge for 30 seconds. If the vacuum gauge reading drops more than 3 kPa (0.88 in-Hg) a leak is present. 7. Remove the vacuum pump.

8. CAUTION: Do not hold the steering wheel at the stops for an extended amount of time. Damage to the power steering pump may occur.

Start the engine. With the engine at idle, raise the power steering fluid temperature to 74-80° C (165-176° F) by rotating the steering wheel fully to the left and right several times.

9. Visually inspect the system for leaks. If a leak is evident, repair as necessary. If a leak is not evident, add the specified UV fluorescent tracer dye

to the power steering fluid. Use 14.78 ml (1/2 oz) of dye solution for every 1.89L (2 qt) of power steering fluid.

10. CAUTION: Do not hold the steering wheel at the stops for an extended amount of time. Damage to the power steering pump may occur.

Start the engine. With the engine at idle, raise the power steering fluid temperature to 74-80° C (165-176° F) by rotating the steering wheel fully to the left and right several times.

11. Using the special tool (UV lamp), inspect the system for traces of UV dye. Repair as necessary.

Refrigerant: Capacity Specifications

R-134a Refrigerant YN-19 (US); CYN-16-P or CYN-16-R (Canada).....
WSH-M17B19-A (Specification) - 0.94 kg (33 oz) (Fill Capacity)

Refrigerant: Fluid Type Specifications

R-134a Refrigerant YN-19 (US); CYN-16-P or CYN-16-R (Canada).....
WSH-M17B19-A (Specification) - 0.94 kg (33 oz) (Fill Capacity)

Refrigerant Oil: Capacity Specifications

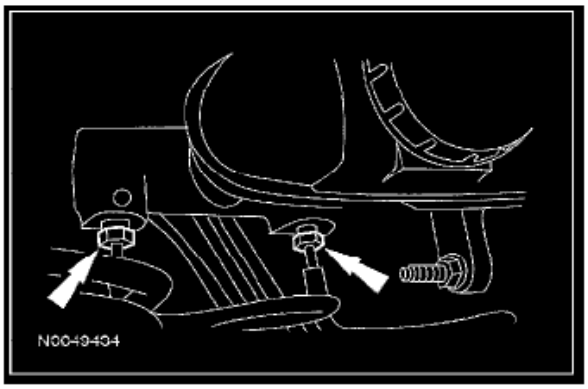
PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D.....
WSH-M1C231-B (Specification) - 266 ml (9 fl oz) (Fill Capacity)

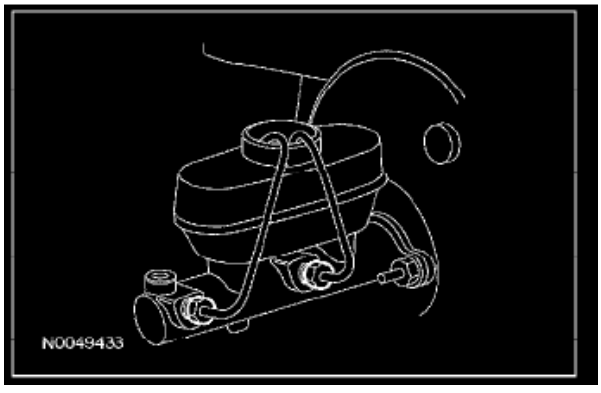
Refrigerant Oil: Fluid Type Specifications

PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D.....
WSH-M1C231-B (Specification) - 266 ml (9 fl oz) (Fill Capacity)

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A





Brake Bleeding: Service and Repair Component Bleeding

Component Bleeding

Master Cylinder Priming

WARNING: Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.

WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

WARNING: Do not allow the brake master cylinder to run dry during the bleeding operation. Master cylinder may be damaged if operated without fluid, resulting in degraded braking performance. Failure to follow this instruction may result in serious personal injury.

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

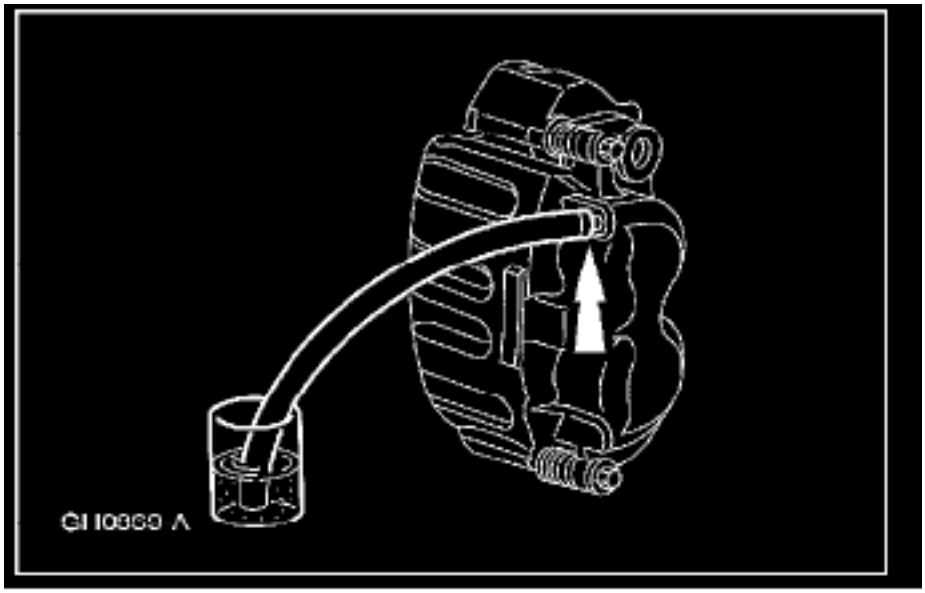
NOTE: When the brake master cylinder has been installed new or the system has been emptied or partially emptied, it must be primed to prevent air from entering the system.

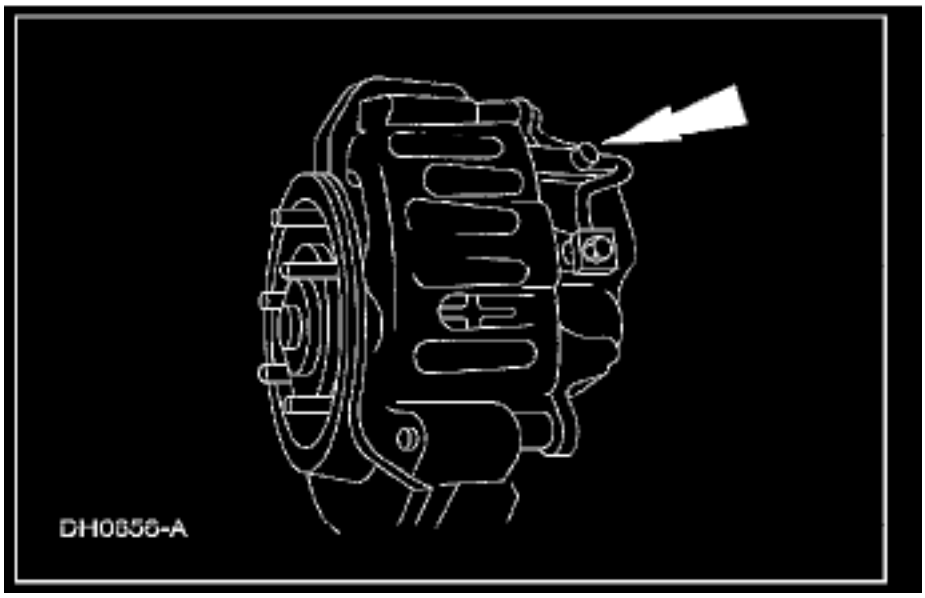
1. Disconnect the brake outlet tubes from the master cylinder.

2. Install short brake tubes with the ends submerged in the brake master cylinder reservoir and fill the brake master cylinder reservoir with clean,

specified brake fluid.

3. Have an assistant pump the brake pedal until clear fluid flows from both brake tubes, without air bubbles.





4. Remove the short brake tubes and install the brake outlet tubes. 5. Bleed each brake tube at the brake master cylinder as follows:

1 Have an assistant pump the brake pedal at least 2 times and then hold firm pressure on the brake pedal.

2 Loosen the rearmost brake tube fitting until a stream of brake fluid comes out. While the assistant maintains pressure on the brake pedal, tighten the brake tube fitting.

3 Repeat this operation until clear, bubble-free fluid comes out.

4 Refill the brake master cylinder reservoir as necessary. Repeat the bleeding operation at the front brake tube.

5 Tighten the master cylinder brake tube fittings to 18 Nm (13 lb-ft).

6. Bleed the brake system.

Brake caliper

WARNING: Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.

WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

WARNING: Do not allow the brake master cylinder to run dry during the bleeding operation. Master cylinder may be damaged if operated without fluid, resulting in degraded braking performance. Failure to follow this instruction may result in serious personal injury.

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

NOTE: It is not necessary to do a complete brake system bleed if only the brake caliper was disconnected or installed new.

1. Remove the bleeder screw cap and place a box-end wrench on the disc brake caliper bleeder screw. Attach a rubber drain hose to the disc brake

caliper bleeder screw and submerge the free end of the hose in a container partially filled with clean, specified brake fluid.

2. Have an assistant pump the brake pedal at least 2 times and then hold firm pressure on the brake pedal. 3. Loosen the disc brake caliper bleeder screw until a stream of brake fluid comes out. While the assistant maintains pressure on the brake pedal,

tighten the disc brake caliper bleeder screw. ^

Repeat until clear, bubble-free fluid comes out.

^ Refill the brake master cylinder reservoir as necessary.

4. Tighten the brake caliper bleeder screw to 15 Nm (11 lb-ft), remove the rubber hose and install the bleeder screw cap.

5. Apply brakes several times to verify correct brake operation.

Wheel Cylinder

WARNING: Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.

WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

WARNING: Do not allow the brake master cylinder to run dry during the bleeding operation. Master cylinder may be damaged if operated without fluid, resulting in degraded braking performance. Failure to follow this instruction may result in serious personal injury.

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

NOTE: It is not necessary to do a complete brake system bleed if only the wheel cylinder was disconnected or installed new.

1. Remove the bleeder screw cap and place a box-end wrench on the wheel cylinder bleeder screw. Attach a rubber drain hose to the disc brake

caliper bleeder screw and submerge the free end of the hose in a container partially filled with clean, specified brake fluid.

2. Have an assistant pump the brake pedal at least 2 times and then hold firm pressure on the brake pedal. 3. Loosen the wheel cylinder bleeder screw until a stream of brake fluid comes out. While the assistant maintains pressure on the brake pedal, tighten

the bleeder screw. ^

Repeat until clear, bubble-free fluid comes out.

^ Refill the brake master cylinder reservoir as necessary.

4. Tighten the wheel cylinder bleeder screw to 8 Nm (71 lb-inch), remove the rubber hose and install the bleeder screw cap. 5. Apply brakes several times to verify correct brake operation.

Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A

Brake Bleeding: Service and Repair Brake System Bleeding

Brake System Bleeding

ABS Hydraulic Control Unit (HCU) Bleeding

WARNING: Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.

WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

WARNING: Do not allow the brake master cylinder to run dry during the bleeding operation. Master cylinder may be damaged if operated without fluid, resulting in degraded braking performance. Failure to follow this instruction may result in serious personal injury.

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

NOTE: When any part of the hydraulic system has been disconnected for repair or installation of new components, air can get into the system and cause spongy brake pedal action. This requires bleeding of the hydraulic system, including the hydraulic control unit (HCU) after it has been correctly connected.

NOTE: If the HCU or any component upstream of the HCU is installed new, carry out the brake system bleed procedure first without the scan tool, followed by the brake system bleed procedure using the scan tool.

NOTE: This procedure is only required when a new HCU is installed.

1. Connect the scan tool and follow the ABS bleed instructions. 2. Follow the manual bleeding or pressure bleeding procedure steps to bleed the system.

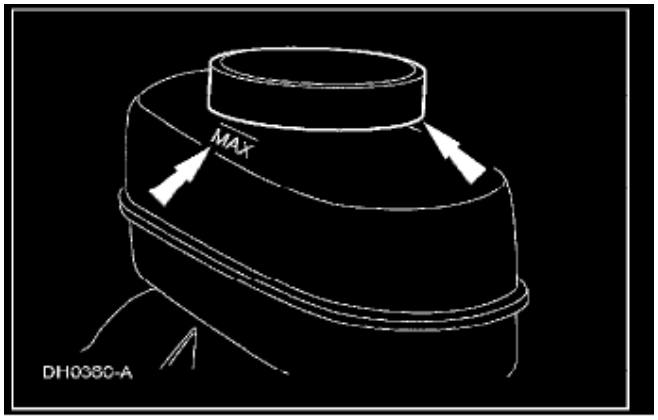
Manual Bleeding Method

WARNING: Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.

WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

WARNING: Do not allow the brake master cylinder to run dry during the bleeding operation. Master cylinder may be damaged if operated without fluid, resulting in degraded braking performance. Failure to follow this instruction may result in serious personal injury.

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.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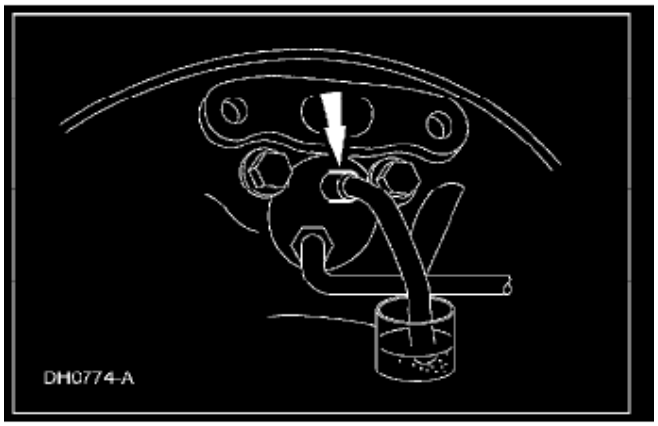
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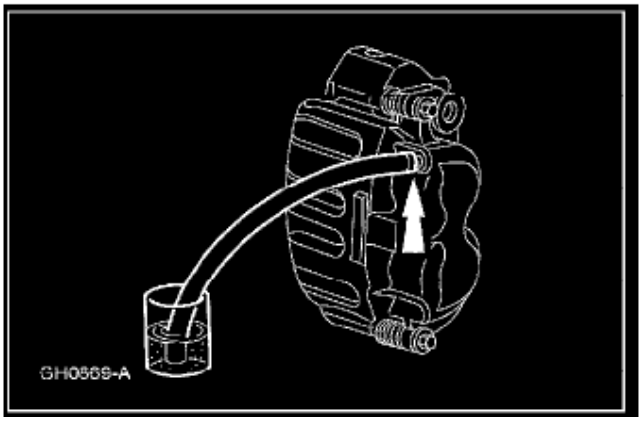
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NOTE: When any part of the hydraulic system has been disconnected for repair or installation of new components, air can get into the system and cause spongy brake pedal action. This requires bleeding of the hydraulic system, including the HCU after it has been correctly connected.

1. Clean all the dirt from around the brake fluid reservoir cap and remove the cap. Fill the brake master cylinder reservoir with clean, specified brake

fluid.

2. Remove the RR wheel cylinder bleeder screw cap and place a box-end wrench on the bleeder screw. Attach a rubber drain hose to the RR wheel

cylinder bleeder screw and submerge the free end of the hose in a container partially filled with clean, specified brake fluid.

3. Have an assistant pump and then hold firm pressure on the brake pedal. 4. Loosen the RR wheel cylinder bleeder screw until a stream of brake fluid comes out. While an assistant maintains pressure on the brake pedal,

tighten the RR wheel cylinder bleeder screw. ^

Repeat until clear, bubble-free fluid comes out.

^ Refill the brake master cylinder reservoir as necessary.

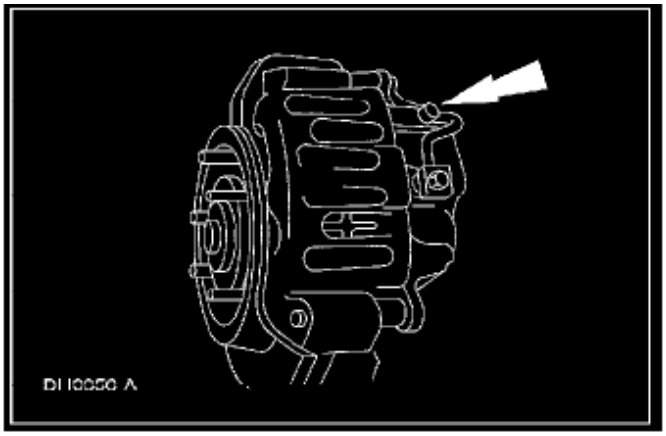
5. Tighten the RR wheel cylinder bleeder screw to 8 Nm (71 lb-inch), remove the rubber hose and install the bleeder screw cap. 6. Repeat Steps 2-5 for the LR wheel cylinder bleeder screw. 7. Remove the RF brake caliper bleeder cap and place a box-end wrench on the bleeder screw. Attach a rubber drain hose to the RF brake caliper

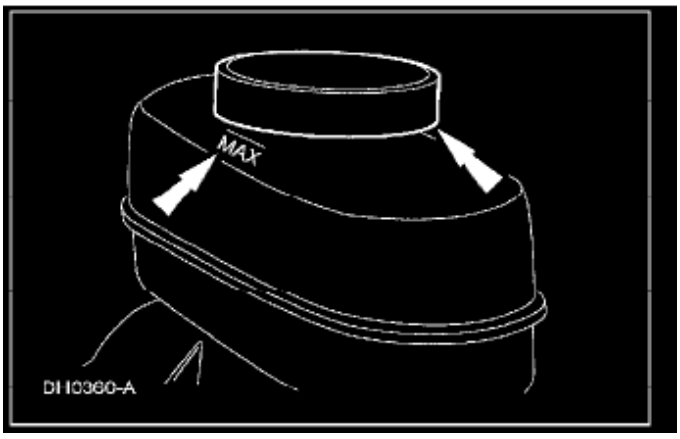
bleeder screw and submerge the free end of the hose in a container partially filled with clean, specified brake fluid.

8. Have an assistant pump and then hold firm pressure on the brake pedal. 9. Loosen the RF brake caliper bleeder screw until a stream of brake fluid comes out. While the assistant maintains pressure on the brake pedal,

tighten the RF brake caliper bleeder screw. ^

Repeat until clear, bubble-free fluid comes out.

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^ Refill the brake master cylinder reservoir as necessary.

10. Tighten the RF brake caliper bleeder screw to 15 Nm (11 lb-ft), remove the rubber hose and install the bleeder screw cap.

11. Repeat Steps 7 through 10 for the LF brake caliper bleeder screw. 12. Apply brakes several times to verify correct brake operation.

Pressure Bleeding Method

WARNING: Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.

WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

WARNING: Do not allow the brake master cylinder to run dry during the bleeding operation. Master cylinder may be damaged if operated without fluid, resulting in degraded braking performance. Failure to follow this instruction may result in serious personal injury.

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

NOTE: When any part of the hydraulic system has been disconnected for repair or installation of new components, air can get into the system and cause spongy brake pedal action. This requires bleeding of the hydraulic system, including the hydraulic control unit (HCU) after it has been correctly connected.

1. Clean all dirt from and remove the brake master cylinder filler cap and fill the brake master cylinder reservoir with clean, specified brake fluid.

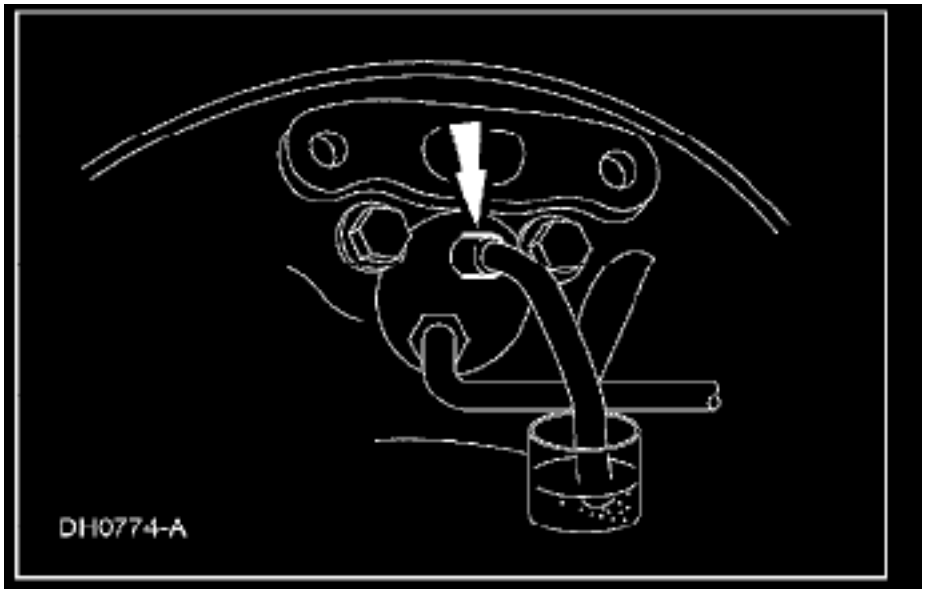
2. NOTE: Master cylinder pressure bleeder adapter tools are available from various manufacturers of pressure bleeding equipment. Follow the

instructions of the manufacturer when installing the adapter.

Install the bleeder adapter to the brake master cylinder reservoir, and attach the bleeder tank hose to the fitting on the adapter.

3. NOTE: Bleed the longest line first. Make sure the bleeder tank contains enough specified brake fluid to complete the bleeding operation.

Remove the RR wheel cylinder bleeder screw cap and place a box-end wrench on the bleeder screw. Attach a rubber drain hose to the RR wheel cylinder bleeder screw and submerge the free end of the hose in a container partially filled with clean, specified brake fluid.



4. Open the valve on the bleeder tank. 5. Loosen the RR wheel cylinder bleeder screw. Leave open until clear, bubble-free brake fluid flows, then tighten the RR wheel cylinder bleeder

screw to 8 Nm (71 lb-inch) and remove the rubber hose.

6. Continue bleeding the rest of the system, going in order from the LR wheel cylinder bleeder screw to the RF disc brake caliper bleeder screw,

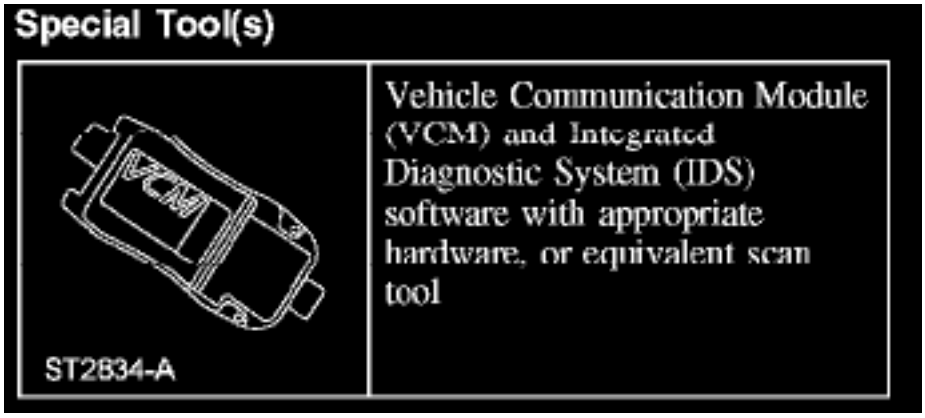
ending with the LF disc brake caliper bleeder screw. ^

Tighten the brake caliper bleeder screws to 15 Nm (11 lb-ft).

7. Close the bleeder tank valve. Remove the tank hose from the adapter and remove the adapter. Fill the reservoir with clean, specified brake fluid

and install the reservoir cap.

8. Apply brakes several times to verify correct brake operation.



Air Bag(s) Arming and Disarming: Service and Repair Supplemental Restraint System (SRS) Depowering and Repowering

SUPPLEMENTAL RESTRAINT SYSTEM (SRS) DEPOWERING AND REPOWERING

Special Tool(s)

Special Tool(s)

Depowering Procedure

WARNING:

- Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.

- To reduce the risk of accidental deployment, do not use any memory saver devices. Failure to follow this instruction may result in serious personal injury or death.

NOTE:

- The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate an SRS fault.

- The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1. Turn all vehicle accessories OFF. 2. Turn the ignition switch to OFF. 3. At the smart junction box (SJB), located below the RH side of the instrument panel, remove the RH lower cowl trim panel and remove the

restraints control module (RCM) fuse 8 (10A) from the SJB.

4. Turn the ignition ON and visually monitor the air bag warning indicator for at least 30 seconds. The air bag warning indicator will remain lit

continuously (no flashing) if the correct RCM fuse has been removed. If the air bag warning indicator does not remain lit continuously, remove the correct RCM fuse before proceeding.

5. Turn the ignition OFF.

6. WARNING: Always deplete the backup power supply before repairing or installing any new front or side air bag supplemental restraint

system (SRS) component and before servicing, removing, installing, adjusting or striking components near the front or side impact sensors or the restraints control module (RCM). Nearby components include doors, instrument panel, console, door latches, strikers, seats and hood latches.

Refer to the Description and Operation portion of Air Bag Systems for location of the RCM and impact sensor(s).

To deplete the backup power supply energy, disconnect the battery ground cable and wait at least 1 minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Failure to follow these instructions may result in serious personal injury or death in the event of an accidental deployment.

Disconnect the battery ground cable and wait at least one minute.

Repowering Procedure

1. Turn the ignition switch from OFF to ON. 2. Install the RCM fuse 8 (10A) to the SJB and install the RH lower cowl trim panel.

3. WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is

connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

Connect the battery ground cable.

4. Prove out the SRS as follows:

Turn the ignition key from ON to OFF. Wait 10 seconds, then turn the key back to ON and visually monitor the air bag warning indicator with the air bag modules installed. The air bag warning indicator will light continuously for approximately 6 seconds and then turn off. If an air bag SRS fault is present, the air bag warning indicator will: -

fail to light.

- remain lit continuously.

- flash at a 5Hz rate (RCM not configured).

The air bag warning indicator may not illuminate until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON position. This is the time required for the RCM to complete the testing of the SRS. If the air bag warning indicator is inoperative and a SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag warning indicator and any SRS fault discovered must be diagnosed and repaired.

Clear all continuous RCM and occupant classification system module (OCSM) DTCs using a scan tool.

Special Tool(s)

ST2621-A	Diagnostic Tool, Restraint System (2 required) 418-F395
ST2512-A	Diagnostic Tool, Restraint System 418-F403
ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Air Bag(s) Arming and Disarming: Service and Repair Supplemental Restraint System (SRS) Deactivation and Reactivation

SUPPLEMENTAL RESTRAINT SYSTEM (SRS) DEACTIVATION AND REACTIVATION

Special Tool(s)

Deactivation Procedure

WARNING:

- Always carry or place a live air bag module with the air bag and deployment door/trim cover/tear seam pointed away from the body. Do not set a live air bag module down with the deployment door/trim cover/tear seam face down. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

- Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.

- To reduce the risk of accidental deployment, do not use any memory saver devices. Failure to follow this instruction may result in serious personal injury or death.

NOTE:

- The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

- No restraint system diagnostic tools are available for the safety belt buckle pretensioners. If the ignition switch is set to RUN or START with either the driver or passenger safety belt buckle pretensioner electrical connector disconnected, the DTCs for an open circuit fault will be active.

- The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1. Turn all vehicle accessories OFF. 2. Turn the ignition switch to OFF. 3. At the smart junction box (SJB), located below the RH side of the instrument panel, remove the restraints control module (RCM) fuse 8 (10A)

from the SJB.

4. Turn the ignition ON and visually monitor the air bag warning indicator for at least 30 seconds. The air bag warning indicator will remain lit

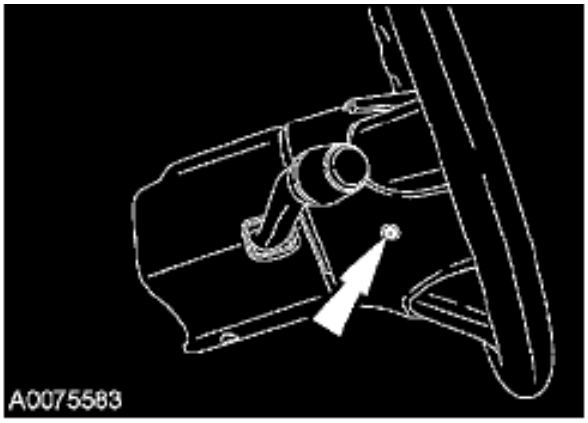
continuously (no flashing) if the correct RCM fuse has been removed. If the air bag warning indicator does not remain lit continuously, remove the correct RCM fuse before proceeding.

5. Turn the ignition OFF.

6. WARNING: Always deplete the backup power supply before repairing or installing any new front or side air bag supplemental restraint

system (SRS) component and before servicing, removing, installing, adjusting or striking components near the front or side impact sensors or the restraints control module (RCM). Nearby components include doors, instrument panel, console, door latches, strikers, seats and hood latches.

Refer to the Description and Operation portion of Air Bag Systems for location of the RCM and impact sensor(s).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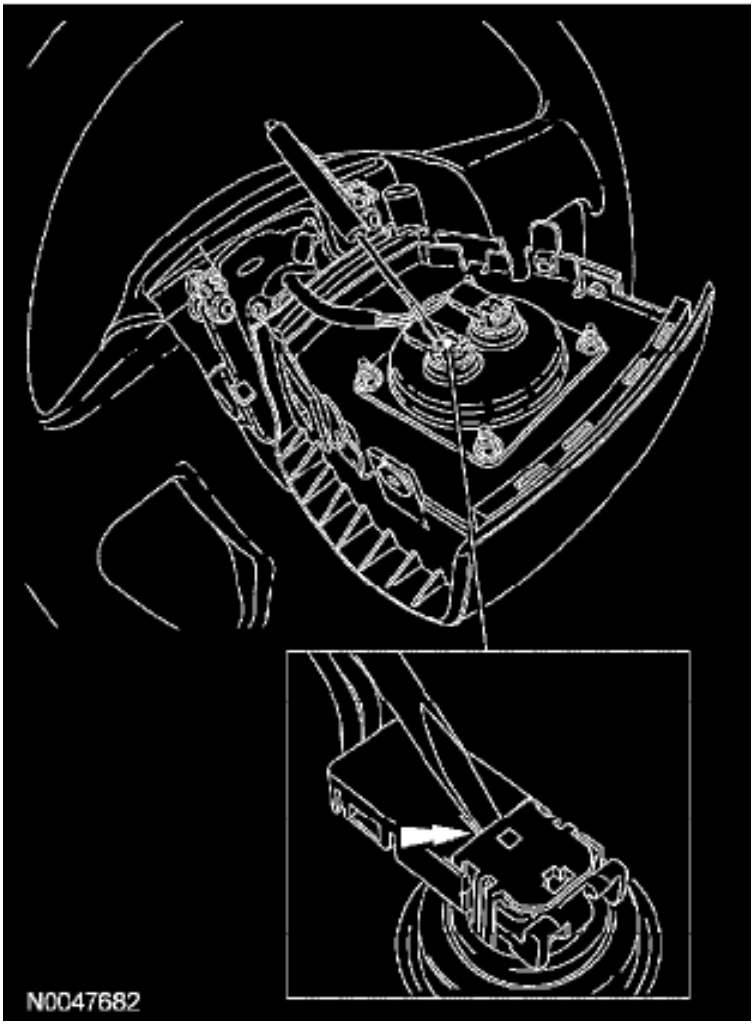
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To deplete the backup power supply energy, disconnect the battery ground cable and wait at least 1 minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Failure to follow these instructions may result in serious personal injury or death in the event of an accidental deployment.

Disconnect the battery ground cable and wait at least 1 minute.

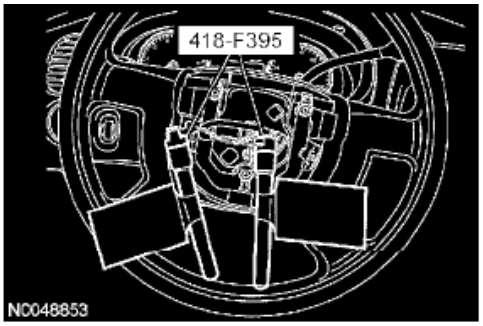
7. Remove the 2 driver air bag module bolts (1 shown).

8. CAUTION: Do not pull the driver air bag module electrical connectors out by the locking buttons. Damage to the locking buttons may

occur.

Using a small screwdriver as shown, lift up and release the locking buttons on the driver air bag module electrical connectors. With the locking buttons released, remove the electrical connectors and the driver air bag module.

9. Attach the restraint system diagnostic tools to the clockspring electrical connectors at the top of the steering column.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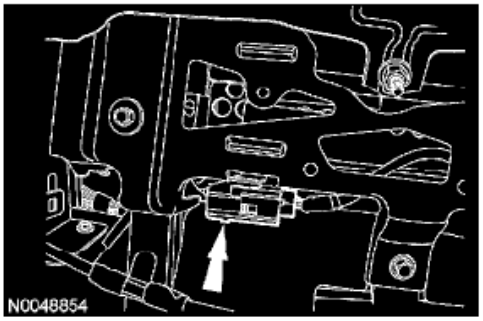
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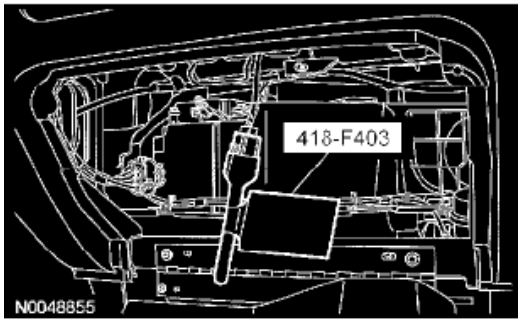
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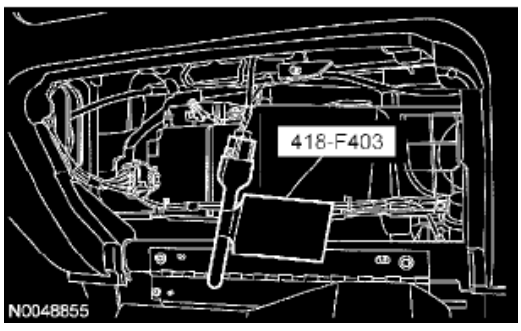
N0048855


418-F403
N0048855

10. Open the glove compartment door fully to access the passenger air bag electrical connector.
11. Release the tab and disconnect the passenger air bag module electrical connector.

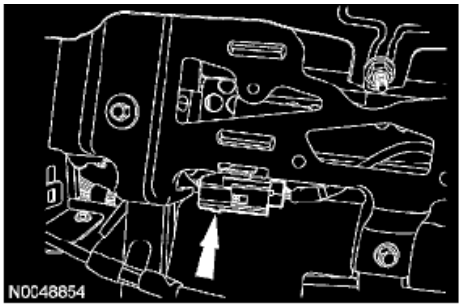
12. Attach the restraint system diagnostic tool to the vehicle harness side of the passenger air bag module electrical connector.

13. Install the RCM fuse 8 (10A) to the SJB. 14. Connect the battery ground cable.

Reactivation Procedure

1. Remove the RCM fuse 8 (10A) from the SJB. 2. Disconnect the battery ground cable and wait at least one minute. 3. Remove the restraint system diagnostic tool from the vehicle harness side of the passenger air bag module electrical connector.

4. Connect the passenger air bag module electrical connector.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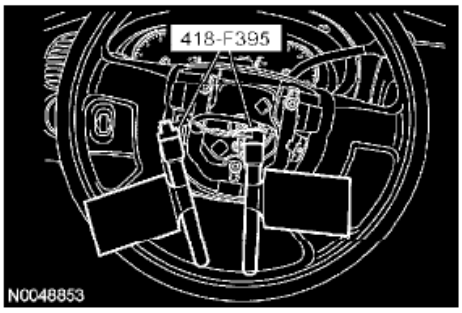
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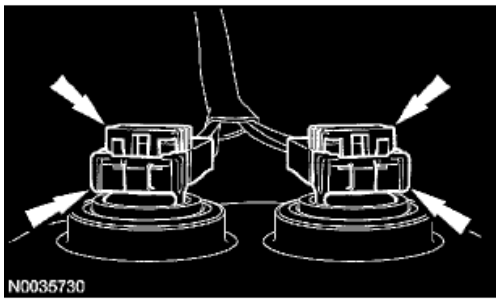
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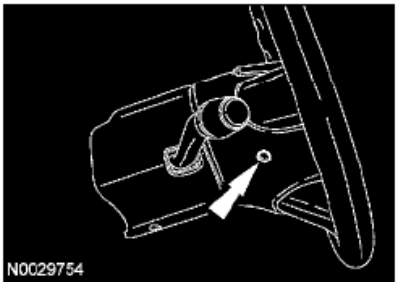

N0029754

5. Close the glove compartment door. 6. Remove the restraint system diagnostic tools from the clockspring electrical connectors at the top of the steering column.

7. CAUTION:

- Do not install the driver air bag module electrical connectors by the locking buttons. Damage to the locking buttons may occur.

- The driver air bag module electrical connector locking buttons must be in the released position when the connector is being installed or connector damage may occur.

- The driver air bag module electrical connectors are unique and cannot be reversed when connected to the driver air bag module. Match the electrical connector key to the keyway in the driver air bag module. Do not force the electrical connectors into the driver air bag module. Damage to the connector or component may occur.

With the locking buttons released, install the driver air bag module electrical connectors fully into the driver air bag module and seat the locking buttons.

8. Install the 2 driver air bag module bolts (1 shown).

- Tighten to 6 Nm (53 lb-in).

9. WARNING: Remove restraint system diagnostic tools from the vehicle prior to road testing. If tools are not removed, the supplemental

restraint system (SRS) device may not deploy in a crash. Failure to follow this instruction may result in serious personal injury or death

in a crash and possibly violate vehicle safety standards.

Make sure all restraint system diagnostic tool(s) that may have been installed during the repair have been removed from the vehicle and all SRS components are connected.

10. Turn the ignition from OFF to ON. 11. Install the restraint system control module fuse 8 (10A) to the SJB.

12. WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is

connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

Connect the battery ground cable.

13. Prove out the SRS as follows:

Turn the ignition key from ON to OFF. Wait 10 seconds, then turn the key back to ON and visually monitor the air bag warning indicator with the air bag modules installed. The air bag warning indicator will light continuously for approximately 6 seconds and then turn off. If an air bag SRS fault is present, the air bag warning indicator will: -

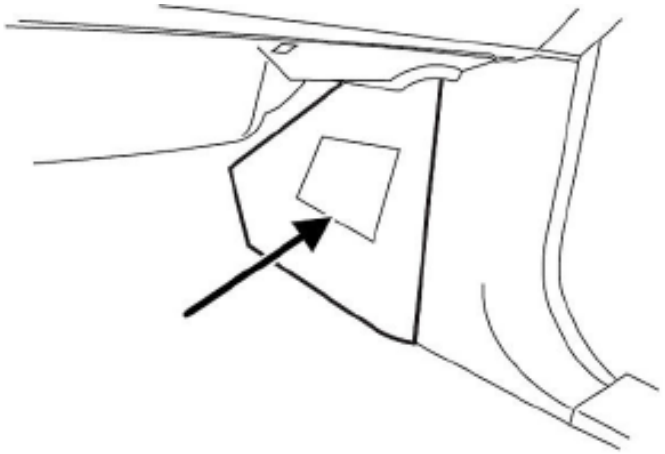
fail to light.

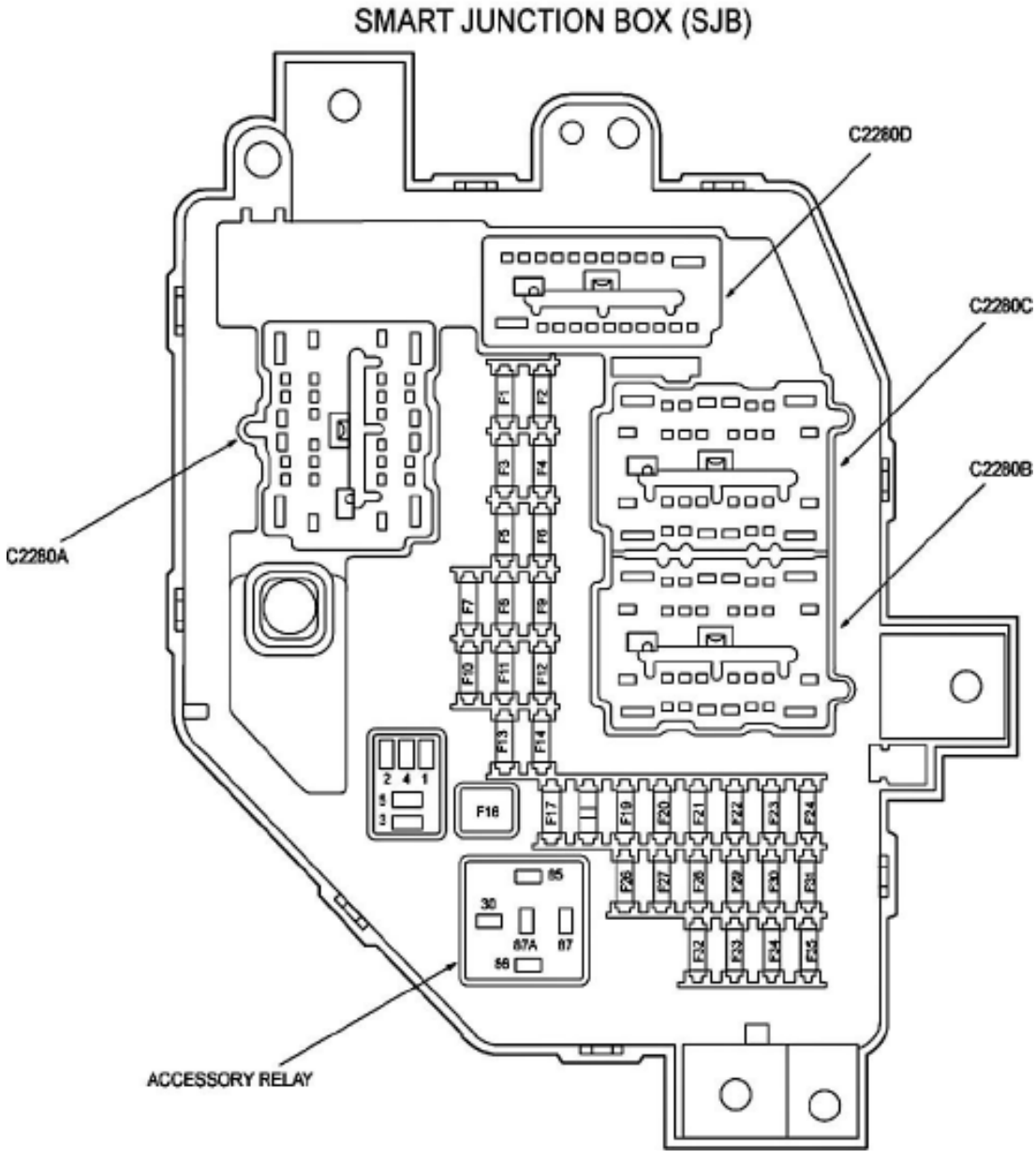
- remain lit continuously.

- flash at a 5Hz rate (RCM not configured).

The air bag warning indicator may not illuminate until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON position. This is the time required for the RCM to complete the testing of the SRS. If the air bag warning indicator is inoperative and a SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag warning indicator and any SRS fault discovered must be diagnosed and repaired.

Clear all continuous RCM and occupant classification system module (OCSM) DTCs using a scan tool.




SMART JUNCTION BOX (SJB)
C2280D
C2280C
C2280B
C2280A
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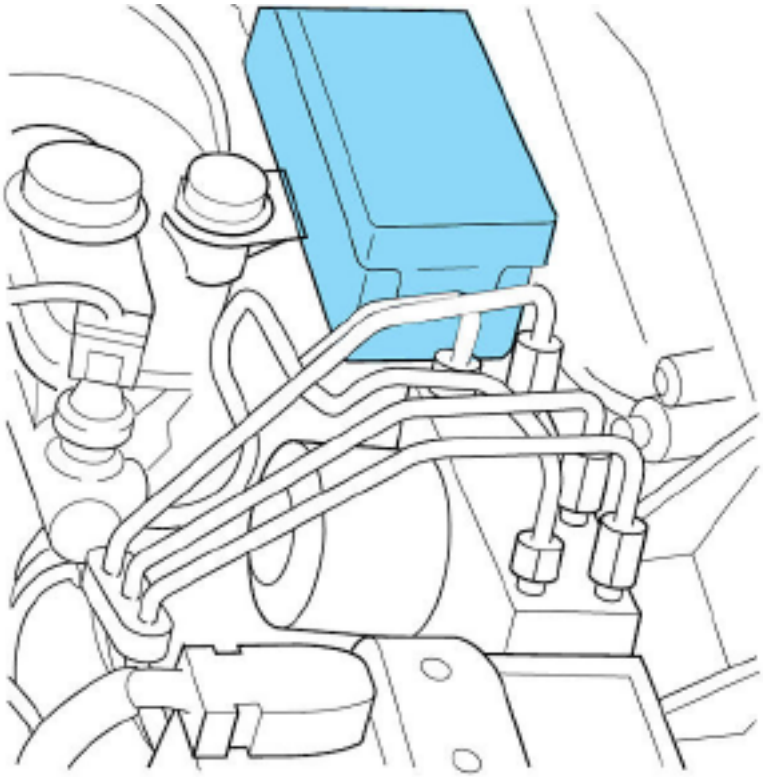
2 4 1
3
30
85
87A
87
86
ACCESSORY RELAY

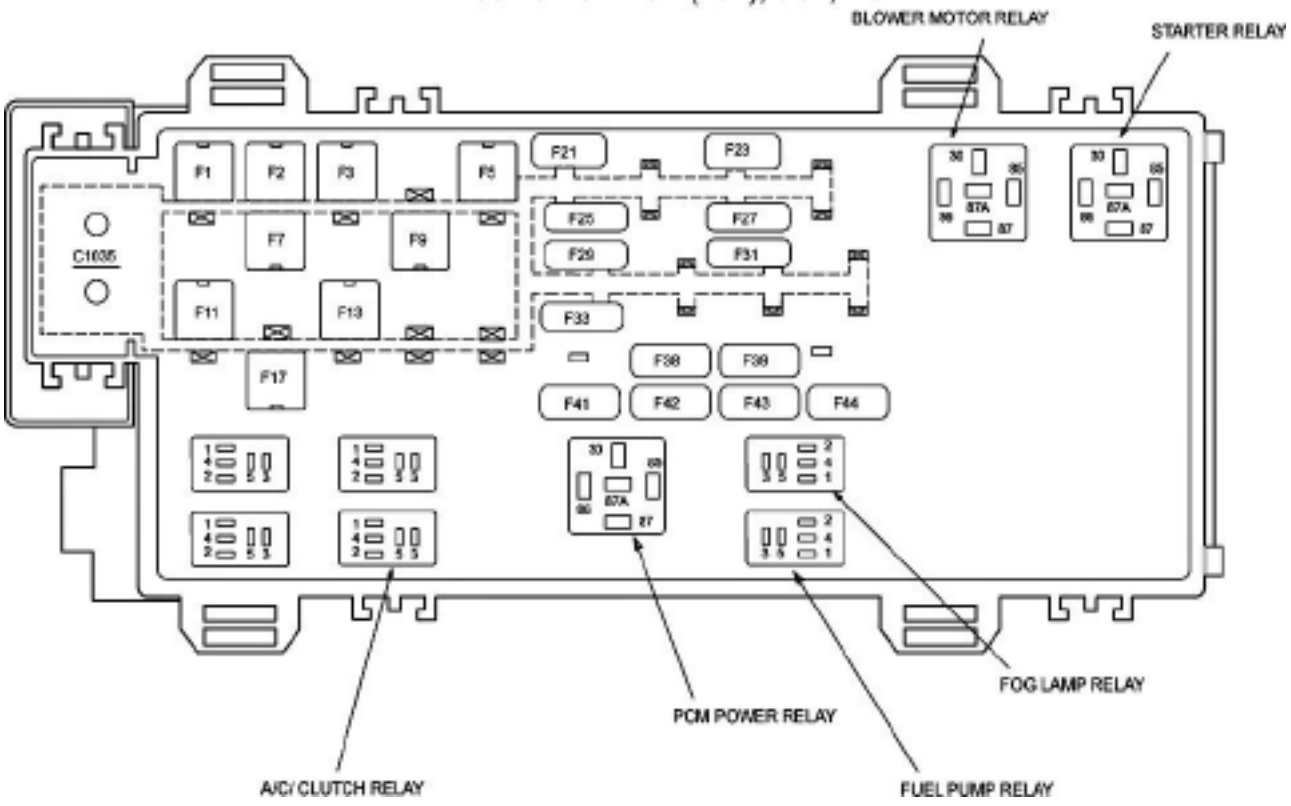
Fuse: Locations Smart Junction Box

FUSE	AMPS	Circuits Protected
F1	5A	Illumination dimmer
F2	10A	Trailer tow connector - Park
F3	10A	Headlamp, right (Low beam lamp feed)
F4	10A	Headlamp, left (Low beam lamp feed)
F5	5A	Windshield wiper module
F6	10A	Audio unit, Door lock switch illumination
F7	5A	Not Used
F8	10A	Restraints Control Module (RCM), Occupant Classification System Module (OCSM), Passenger Air bag Deactivation (PAD) Indicator
F9	5A	Instrument Cluster (IC), Air bag indicator
F10	10A	4X4 control module, Instrument Cluster (IC)
F11	10A	Smart Junction Box (SJB), logic power
F12	15A	Subwoofer amplifier with audiophile, Satellite radio receiver
F13	15A	Interior lamp relay, Horn relay
F14	15A	High beam lamp feed to High beam indicator, Headlamp, right, Headlamp, left
F16	30A	Accessory relay (Power windows)
F17	15A	Indicator flasher relay
F18	-	Not Used

FUSE	AMPS	Circuits Protected
F19	20A	Brake pedal position switch (Stoplamps)
F20	10A	Transmission control switch, Digital Transmission Range (TR) sensor, Speed control servo, Anti-lock Brake System (ABS) module, Indicator flasher relay, Reversing lamps switch, Speed control On/Off switch, Speed control Set/Resume switch
F21	5A	Digital Transmission Range (TR) sensor, Starter relay, Powertrain Control Module (PCM)
F22	5A	Audio unit
F23	30A	Main light switch, Multifunction switch
F24	20A	Audio unit
F26	2A	Deactivator switch
F27	10A	Blend door actuator, Climate control assembly
F28	15A	4X4 control module
F29	20A	Cigar lighter, front, Data Link Connector (DLC)
F30	5A	Exterior rear view mirror switch
F31	20A	Park lamp relay
F32	5A	Brake pedal position switch (logic power), Brake shift interlock
F33	5A	Instrument Cluster (IC), Neutral tow indicator
F34	20A	Power point
F35	15A	Door lock/unlock relay, Driver door unlock relay



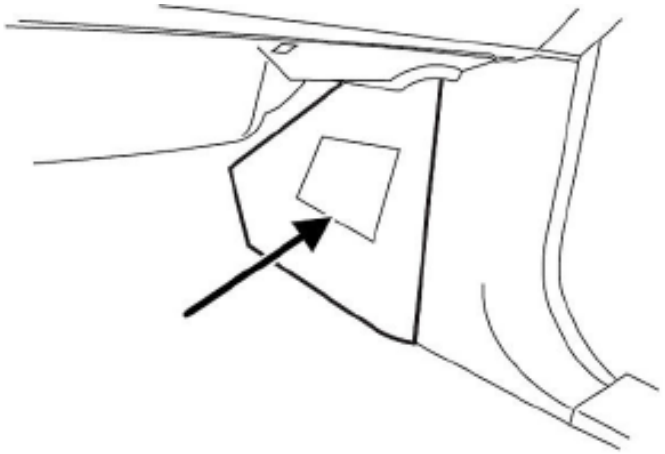
BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L

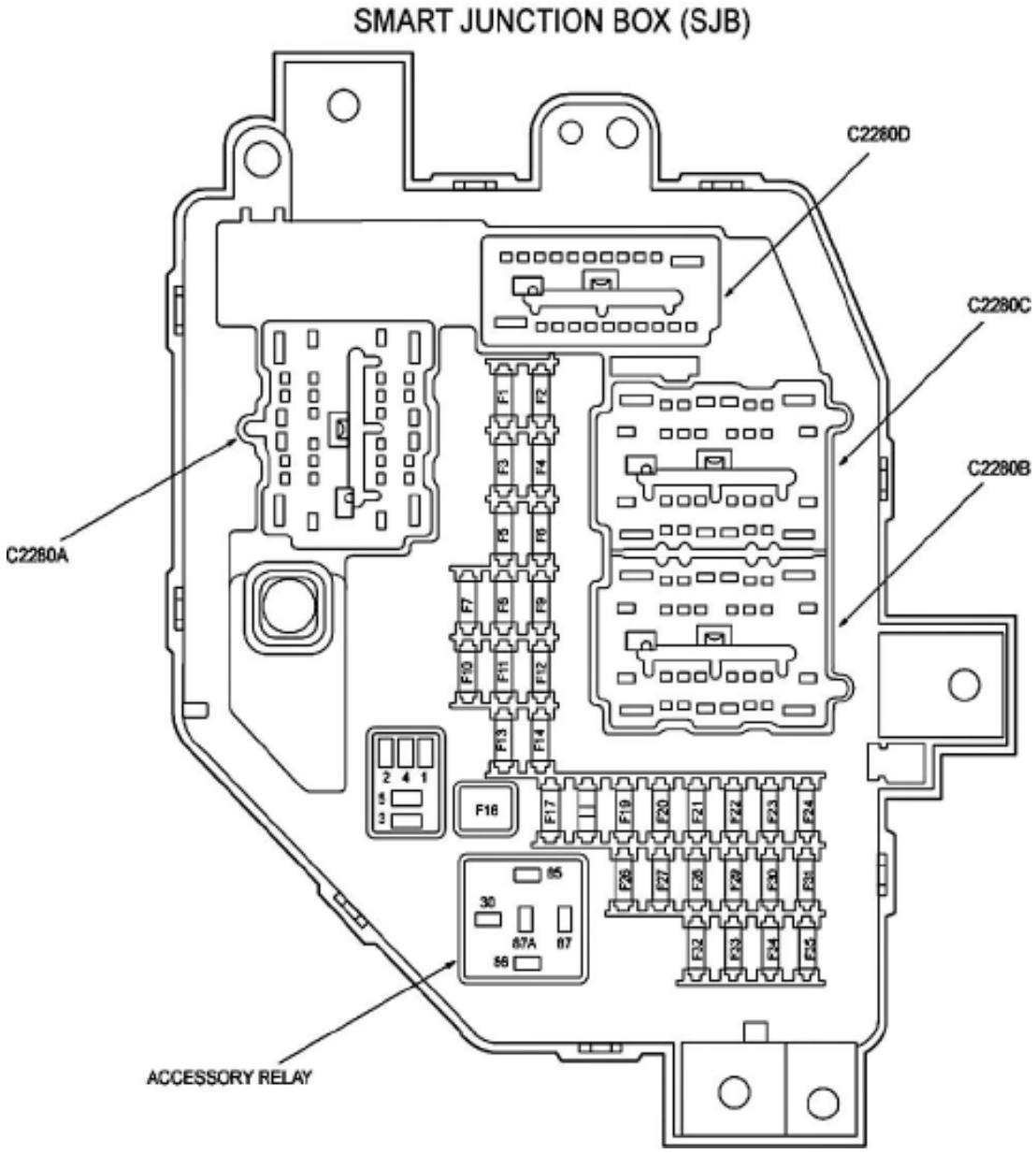


Fuse: Locations Battery Junction Box

FUSE	AMPS	Circuits Protected
F1	40A	Smart Junction Box (SJB)
F2	-	Not Used
F3	40A	Smart Junction Box (SJB)
F4	-	Not Used
F5	50A	Smart Junction Box (SJB)
F6	-	Not Used
F7	30A	Starter Relay
F8	-	Not Used
F9	40A	Ignition Switch
F10	-	Not Used
F11	30A	PCM power relay
F12	-	Not Used
F13	30A	Blower motor relay
F14	-	Not Used
F15	-	Not Used
F16	-	Not Used
F17	40A	Anti-lock Brake System (ABS) module
F18	-	Not Used
F19	-	Not Used
F20	-	Not Used
F21	10A	Powertrain Control Module (PCM), Evaporative emission (EVAP) canister vent valve
F22	-	Not Used
F23	30A	Fuel Pump Relay, Fuel injectors
F24	-	Not Used

FUSE	AMPS	Circuits Protected
F25	10A	A/C clutch relay
F26	-	Not Used
F27	20A	4X4 control module
F28	-	Not Used
F29	30A	Windshield wipers/washer
F30	-	Not Used
F31	15A	Fog lamp relay
F32	-	Not Used
F33	30A	Anti-lock Brake System (ABS) module
F34	-	Not Used
F35	-	Not Used
F36	-	Not Used
F37	-	Not Used
F38	7.5A	Trailer tow connector - Right turn
F39	15A	Powertrain Control Module (PCM)
F40	-	Not Used
F41	10A	*5R44E Transmission **5R55E Transmission
F42	7.5A	Trailer tow connector - Left turn
F43	20A	EVAP canister purge valve, Heated Positive Crankcase Ventilation (PCV) valve, Idle Air Control (IAC) valve, Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor, Heated Oxygen Sensor (HO2S) #11, Heated Oxygen Sensor (HO2S) #12, Heated Oxygen Sensor (HO2S) #21, Heated Oxygen Sensor (HO2S) #22, EGR vacuum regulator solenoid valve, A/C relay coil
F44	15A	Ignition coil, *Ignition transformer capacitor 1




SMART JUNCTION BOX (SJB)
C2280D
C2280C
C2280B
C2280A
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2 4 1
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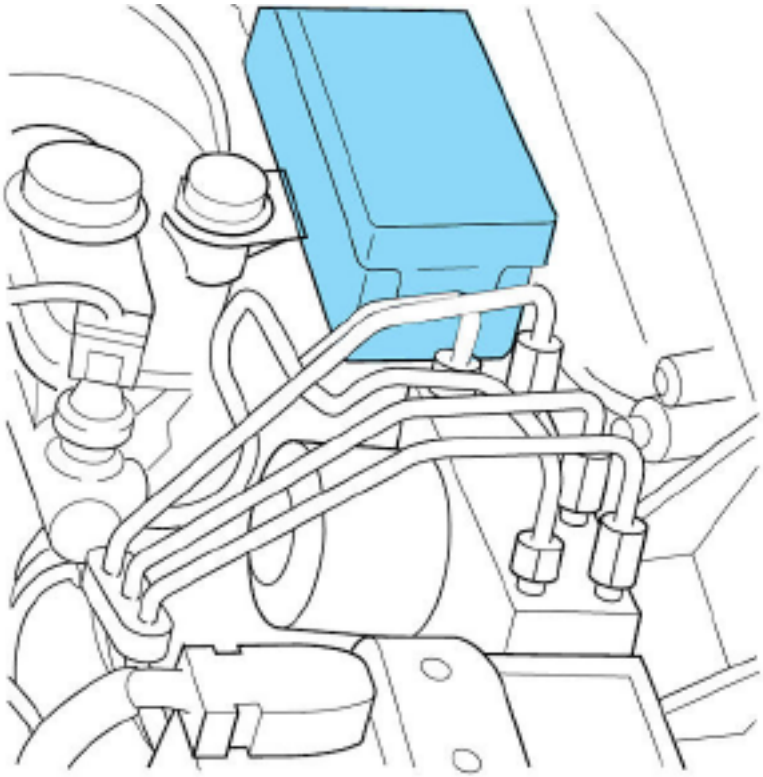
85
87A
87
86
ACCESSORY RELAY

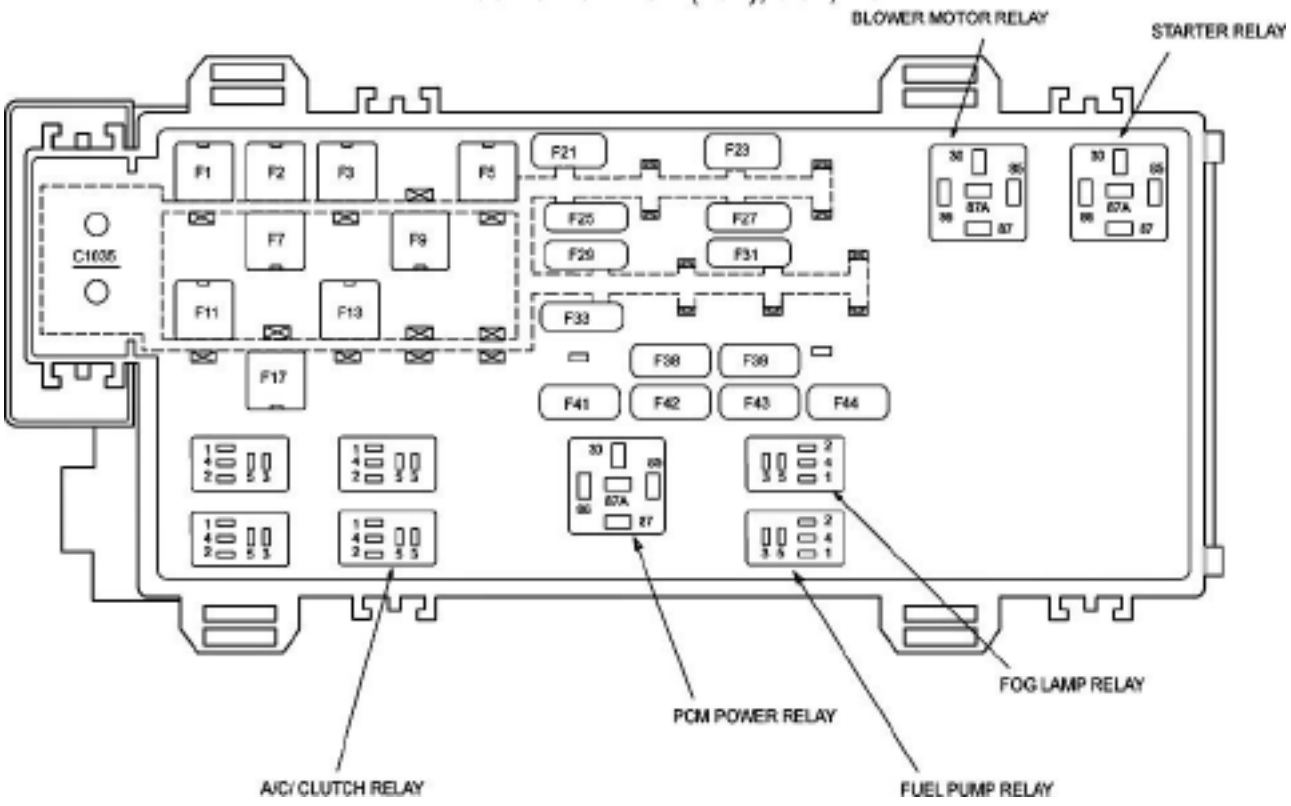
Fuse: Application and ID Smart Junction Box

FUSE	AMPS	Circuits Protected
F1	5A	Illumination dimmer
F2	10A	Trailer tow connector - Park
F3	10A	Headlamp, right (Low beam lamp feed)
F4	10A	Headlamp, left (Low beam lamp feed)
F5	5A	Windshield wiper module
F6	10A	Audio unit, Door lock switch illumination
F7	5A	Not Used
F8	10A	Restraints Control Module (RCM), Occupant Classification System Module (OCSM), Passenger Air bag Deactivation (PAD) Indicator
F9	5A	Instrument Cluster (IC), Air bag indicator
F10	10A	4X4 control module, Instrument Cluster (IC)
F11	10A	Smart Junction Box (SJB), logic power
F12	15A	Subwoofer amplifier with audiophile, Satellite radio receiver
F13	15A	Interior lamp relay, Horn relay
F14	15A	High beam lamp feed to High beam indicator, Headlamp, right, Headlamp, left
F16	30A	Accessory relay (Power windows)
F17	15A	Indicator flasher relay
F18	-	Not Used

FUSE	AMPS	Circuits Protected
F19	20A	Brake pedal position switch (Stoplamps)
F20	10A	Transmission control switch, Digital Transmission Range (TR) sensor, Speed control servo, Anti-lock Brake System (ABS) module, Indicator flasher relay, Reversing lamps switch, Speed control On/Off switch, Speed control Set/Resume switch
F21	5A	Digital Transmission Range (TR) sensor, Starter relay, Powertrain Control Module (PCM)
F22	5A	Audio unit
F23	30A	Main light switch, Multifunction switch
F24	20A	Audio unit
F26	2A	Deactivator switch
F27	10A	Blend door actuator, Climate control assembly
F28	15A	4X4 control module
F29	20A	Cigar lighter, front, Data Link Connector (DLC)
F30	5A	Exterior rear view mirror switch
F31	20A	Park lamp relay
F32	5A	Brake pedal position switch (logic power), Brake shift interlock
F33	5A	Instrument Cluster (IC), Neutral tow indicator
F34	20A	Power point
F35	15A	Door lock/unlock relay, Driver door unlock relay



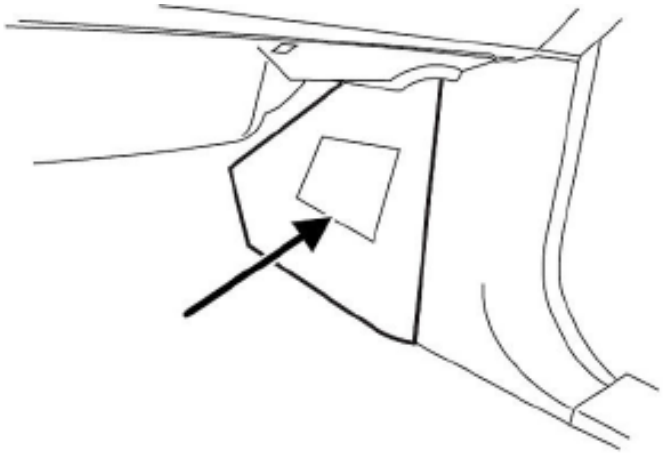
BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L

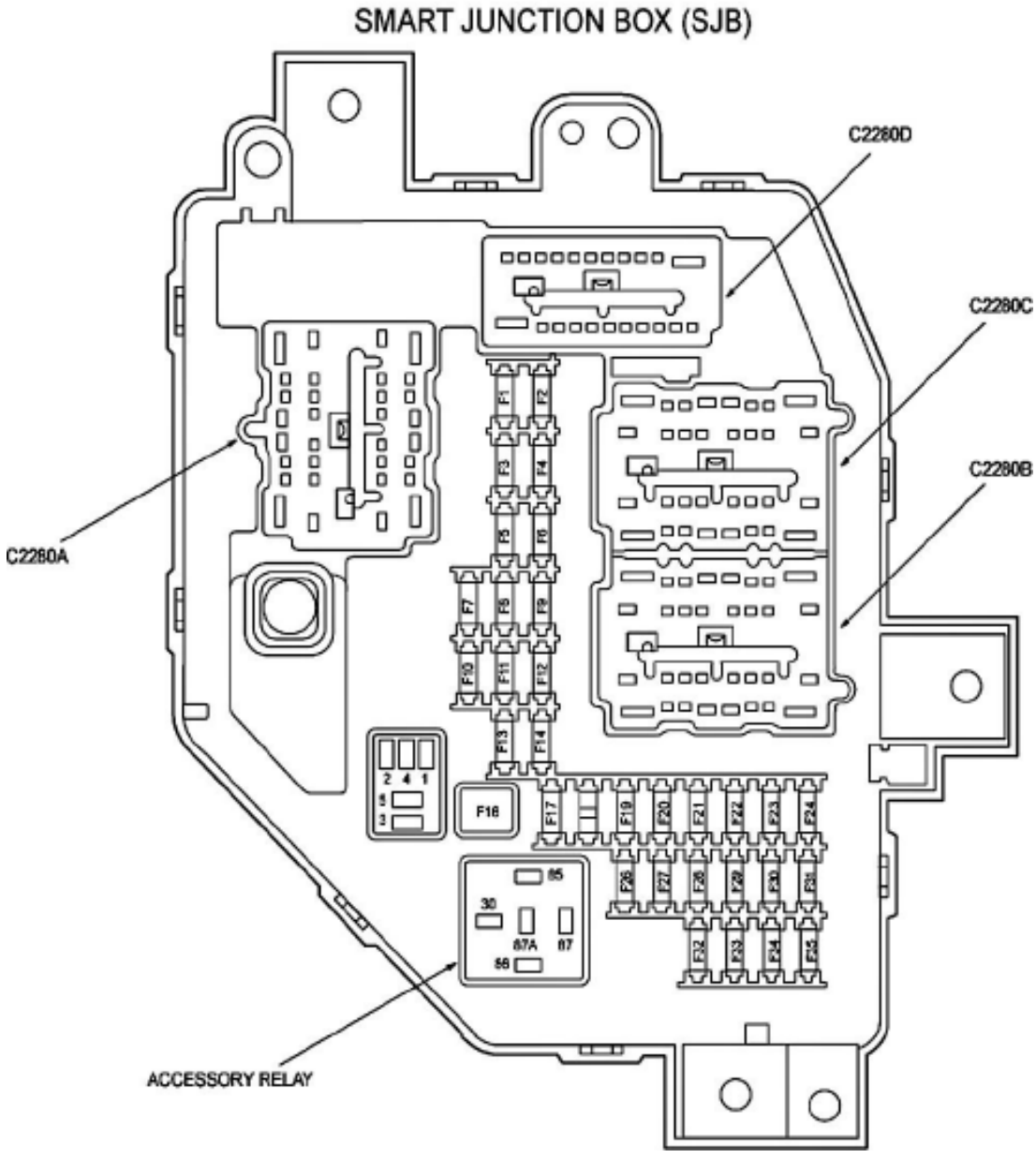


Fuse: Application and ID Battery Junction Box

FUSE	AMPS	Circuits Protected
F1	40A	Smart Junction Box (SJB)
F2	-	Not Used
F3	40A	Smart Junction Box (SJB)
F4	-	Not Used
F5	50A	Smart Junction Box (SJB)
F6	-	Not Used
F7	30A	Starter Relay
F8	-	Not Used
F9	40A	Ignition Switch
F10	-	Not Used
F11	30A	PCM power relay
F12	-	Not Used
F13	30A	Blower motor relay
F14	-	Not Used
F15	-	Not Used
F16	-	Not Used
F17	40A	Anti-lock Brake System (ABS) module
F18	-	Not Used
F19	-	Not Used
F20	-	Not Used
F21	10A	Powertrain Control Module (PCM), Evaporative emission (EVAP) canister vent valve
F22	-	Not Used
F23	30A	Fuel Pump Relay, Fuel injectors
F24	-	Not Used

FUSE	AMPS	Circuits Protected
F25	10A	A/C clutch relay
F26	-	Not Used
F27	20A	4X4 control module
F28	-	Not Used
F29	30A	Windshield wipers/washer
F30	-	Not Used
F31	15A	Fog lamp relay
F32	-	Not Used
F33	30A	Anti-lock Brake System (ABS) module
F34	-	Not Used
F35	-	Not Used
F36	-	Not Used
F37	-	Not Used
F38	7.5A	Trailer tow connector - Right turn
F39	15A	Powertrain Control Module (PCM)
F40	-	Not Used
F41	10A	*5R44E Transmission **5R55E Transmission
F42	7.5A	Trailer tow connector - Left turn
F43	20A	EVAP canister purge valve, Heated Positive Crankcase Ventilation (PCV) valve, Idle Air Control (IAC) valve, Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor, Heated Oxygen Sensor (HO2S) #11, Heated Oxygen Sensor (HO2S) #12, Heated Oxygen Sensor (HO2S) #21, Heated Oxygen Sensor (HO2S) #22, EGR vacuum regulator solenoid valve, A/C relay coil
F44	15A	Ignition coil, *Ignition transformer capacitor 1




SMART JUNCTION BOX (SJB)
C2280D
C2280C
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C2280A
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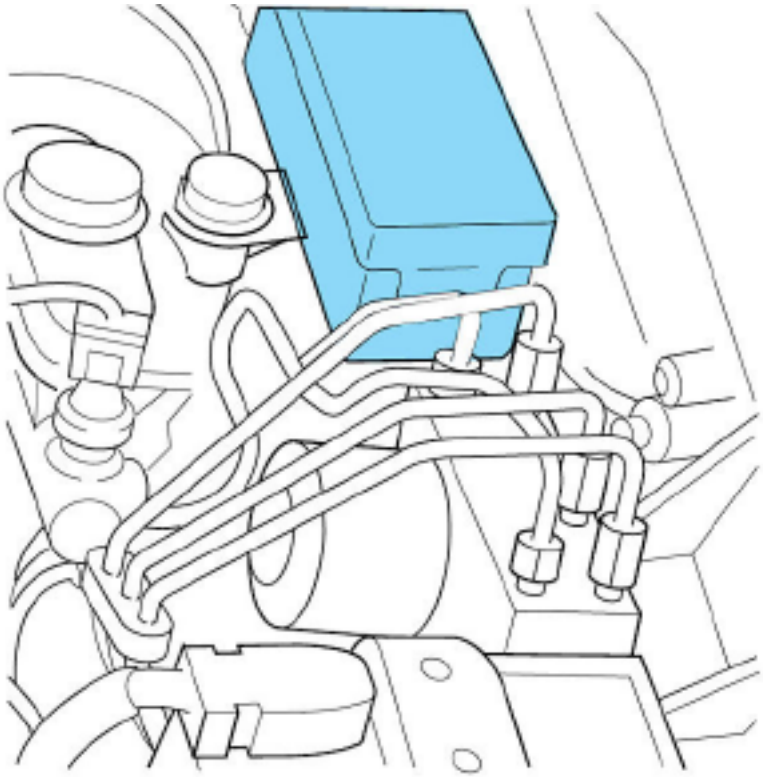
ACCESSORY RELAY

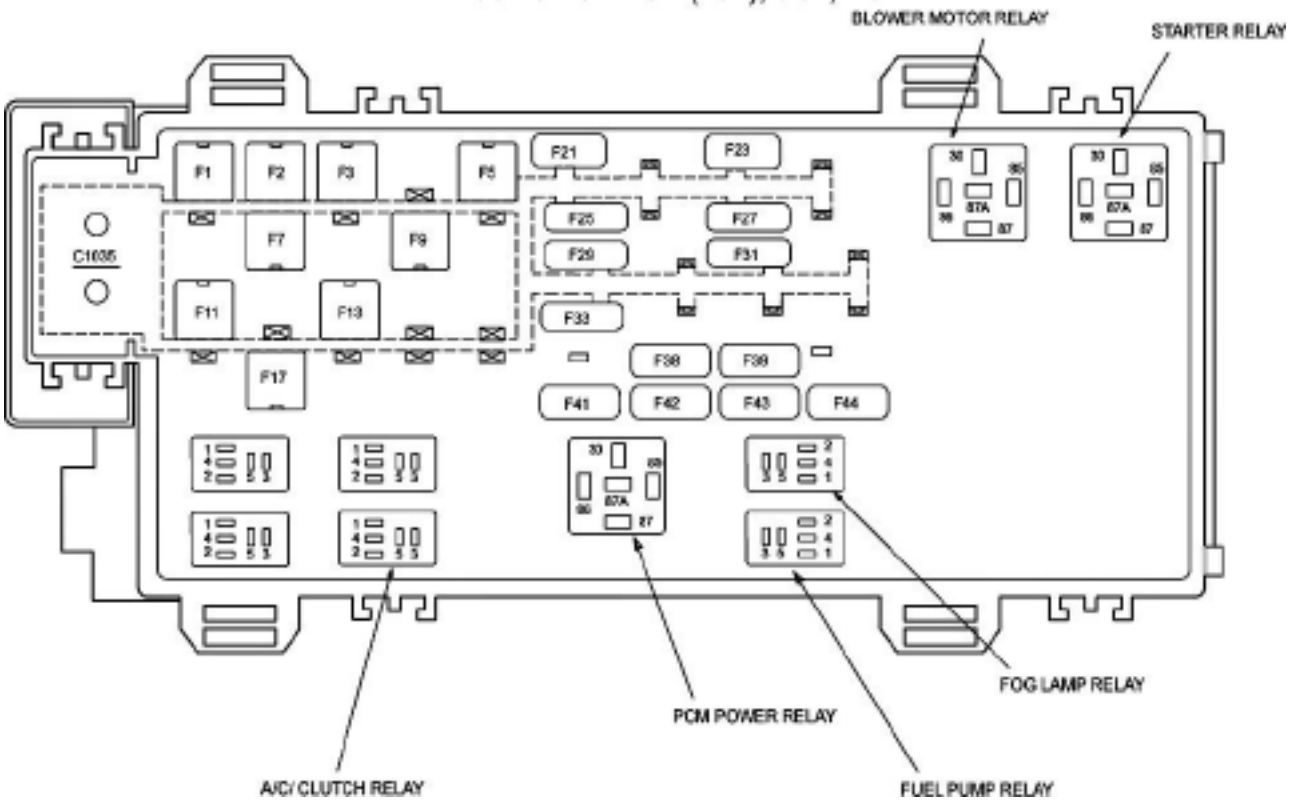
Fuse Block: Locations Smart Junction Box

FUSE	AMPS	Circuits Protected
F1	5A	Illumination dimmer
F2	10A	Trailer tow connector - Park
F3	10A	Headlamp, right (Low beam lamp feed)
F4	10A	Headlamp, left (Low beam lamp feed)
F5	5A	Windshield wiper module
F6	10A	Audio unit, Door lock switch illumination
F7	5A	Not Used
F8	10A	Restraints Control Module (RCM), Occupant Classification System Module (OCSM), Passenger Air bag Deactivation (PAD) Indicator
F9	5A	Instrument Cluster (IC), Air bag indicator
F10	10A	4X4 control module, Instrument Cluster (IC)
F11	10A	Smart Junction Box (SJB), logic power
F12	15A	Subwoofer amplifier with audiophile, Satellite radio receiver
F13	15A	Interior lamp relay, Horn relay
F14	15A	High beam lamp feed to High beam indicator, Headlamp, right, Headlamp, left
F16	30A	Accessory relay (Power windows)
F17	15A	Indicator flasher relay
F18	-	Not Used

FUSE	AMPS	Circuits Protected
F19	20A	Brake pedal position switch (Stoplamps)
F20	10A	Transmission control switch, Digital Transmission Range (TR) sensor, Speed control servo, Anti-lock Brake System (ABS) module, Indicator flasher relay, Reversing lamps switch, Speed control On/Off switch, Speed control Set/Resume switch
F21	5A	Digital Transmission Range (TR) sensor, Starter relay, Powertrain Control Module (PCM)
F22	5A	Audio unit
F23	30A	Main light switch, Multifunction switch
F24	20A	Audio unit
F26	2A	Deactivator switch
F27	10A	Blend door actuator, Climate control assembly
F28	15A	4X4 control module
F29	20A	Cigar lighter, front, Data Link Connector (DLC)
F30	5A	Exterior rear view mirror switch
F31	20A	Park lamp relay
F32	5A	Brake pedal position switch (logic power), Brake shift interlock
F33	5A	Instrument Cluster (IC), Neutral tow indicator
F34	20A	Power point
F35	15A	Door lock/unlock relay, Driver door unlock relay



BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L

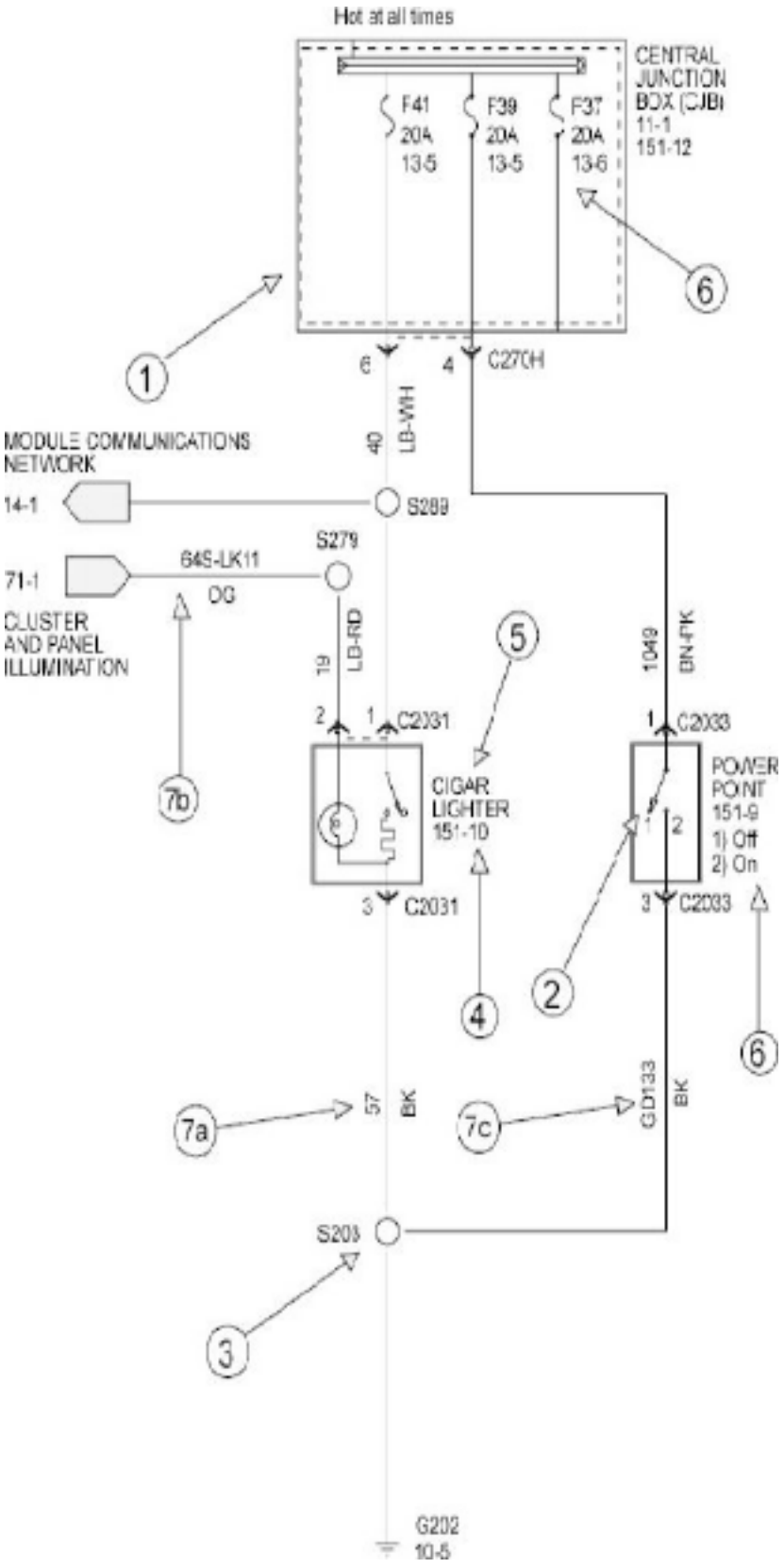


Fuse Block: Locations Battery Junction Box

FUSE	AMPS	Circuits Protected
F1	40A	Smart Junction Box (SJB)
F2	-	Not Used
F3	40A	Smart Junction Box (SJB)
F4	-	Not Used
F5	50A	Smart Junction Box (SJB)
F6	-	Not Used
F7	30A	Starter Relay
F8	-	Not Used
F9	40A	Ignition Switch
F10	-	Not Used
F11	30A	PCM power relay
F12	-	Not Used
F13	30A	Blower motor relay
F14	-	Not Used
F15	-	Not Used
F16	-	Not Used
F17	40A	Anti-lock Brake System (ABS) module
F18	-	Not Used
F19	-	Not Used
F20	-	Not Used
F21	10A	Powertrain Control Module (PCM), Evaporative emission (EVAP) canister vent valve
F22	-	Not Used
F23	30A	Fuel Pump Relay, Fuel injectors
F24	-	Not Used

FUSE	AMPS	Circuits Protected
F25	10A	A/C clutch relay
F26	-	Not Used
F27	20A	4X4 control module
F28	-	Not Used
F29	30A	Windshield wipers/washer
F30	-	Not Used
F31	15A	Fog lamp relay
F32	-	Not Used
F33	30A	Anti-lock Brake System (ABS) module
F34	-	Not Used
F35	-	Not Used
F36	-	Not Used
F37	-	Not Used
F38	7.5A	Trailer tow connector - Right turn
F39	15A	Powertrain Control Module (PCM)
F40	-	Not Used
F41	10A	*5R44E Transmission **5R55E Transmission
F42	7.5A	Trailer tow connector - Left turn
F43	20A	EVAP canister purge valve, Heated Positive Crankcase Ventilation (PCV) valve, Idle Air Control (IAC) valve, Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor, Heated Oxygen Sensor (HO2S) #11, Heated Oxygen Sensor (HO2S) #12, Heated Oxygen Sensor (HO2S) #21, Heated Oxygen Sensor (HO2S) #22, EGR vacuum regulator solenoid valve, A/C relay coil
F44	15A	Ignition coil, *Ignition transformer capacitor 1

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Maintenance > Fuses and Circuit Breakers > Fuse Block > Component Information > Diagrams > Diagram Information and Instructions



Fuse Block: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

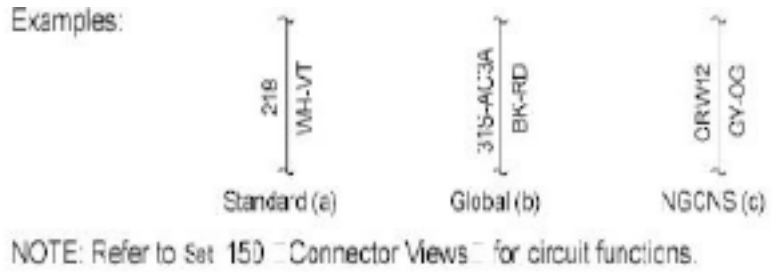
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

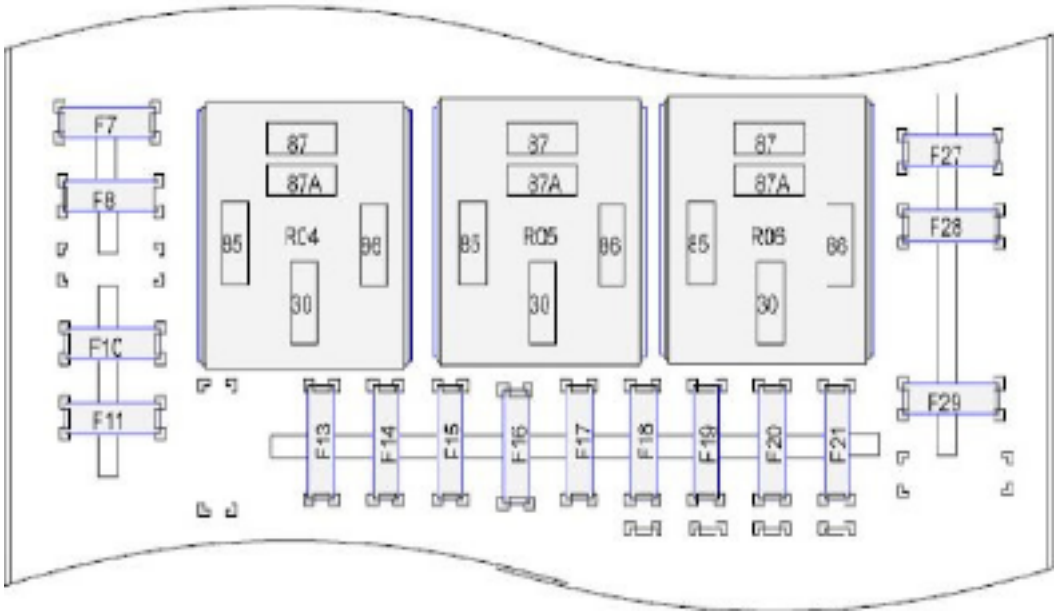
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

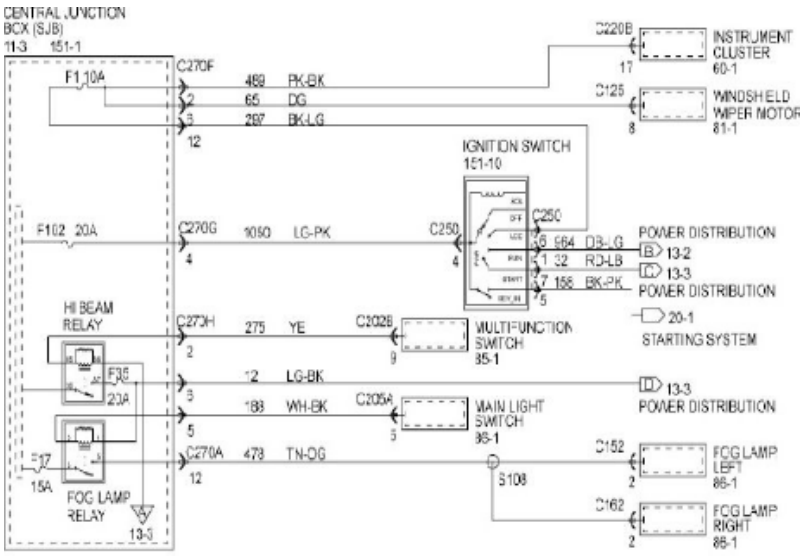
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

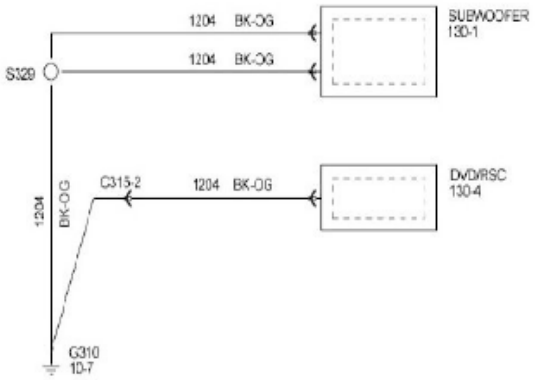
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

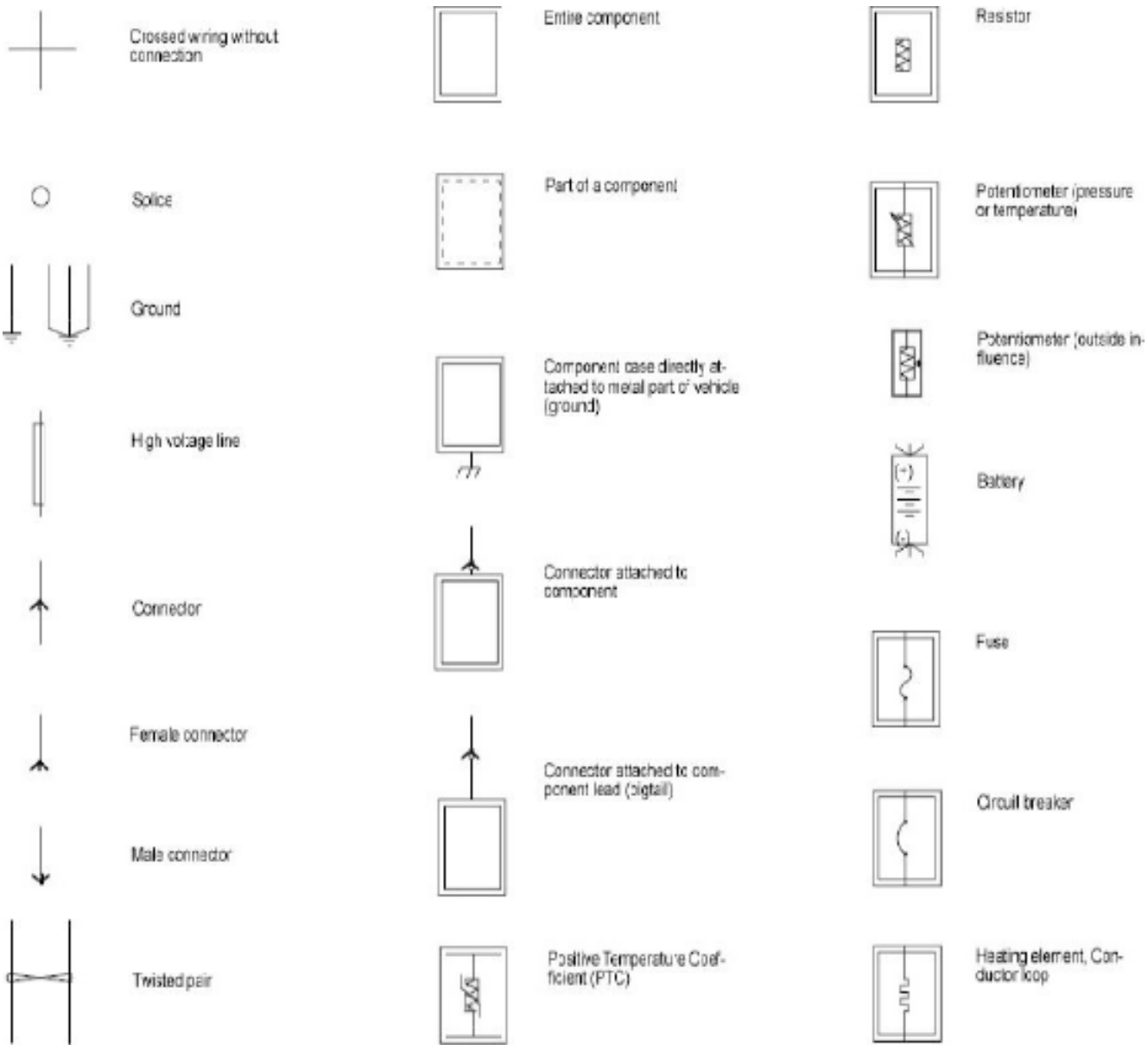
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

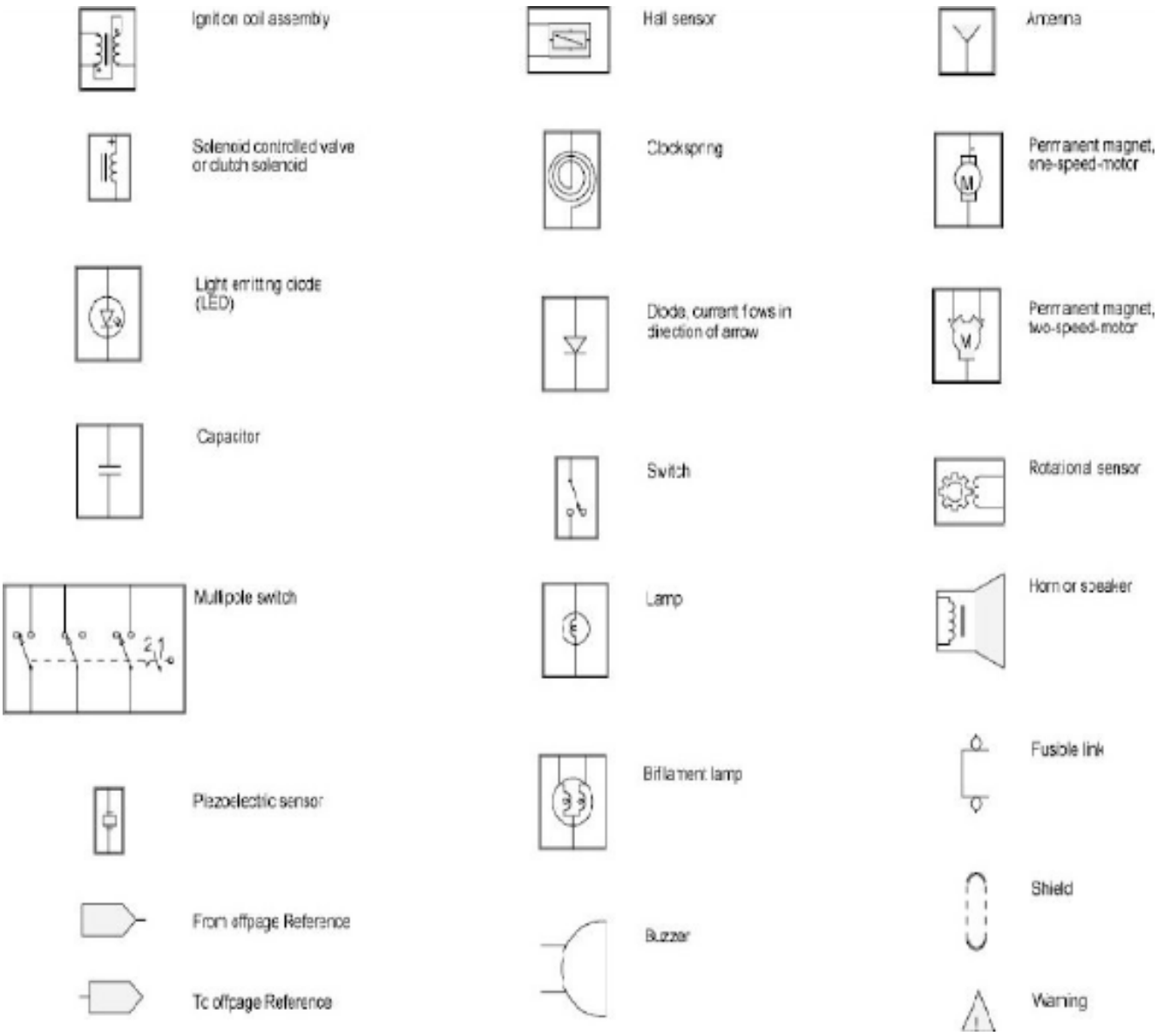
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

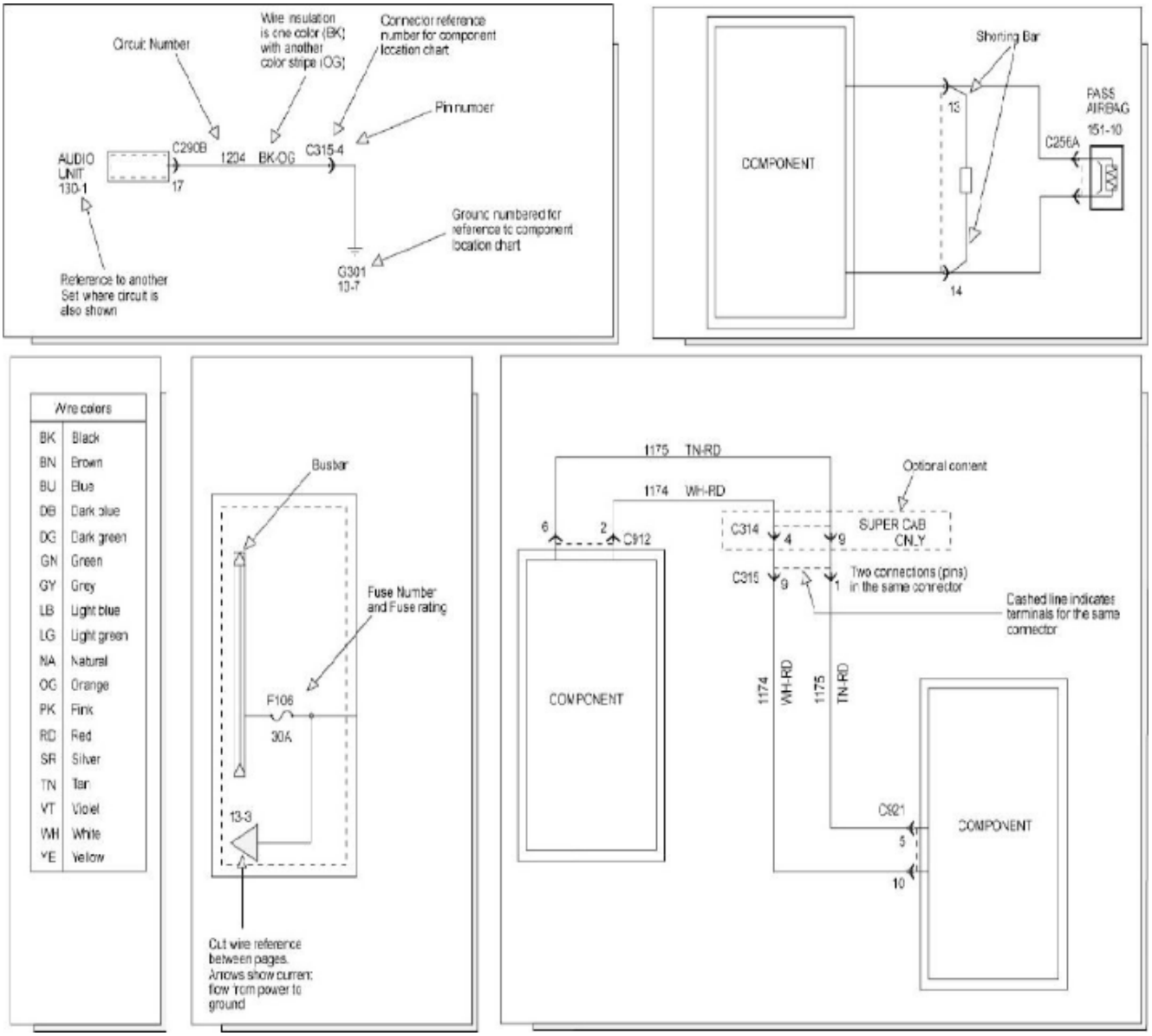
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

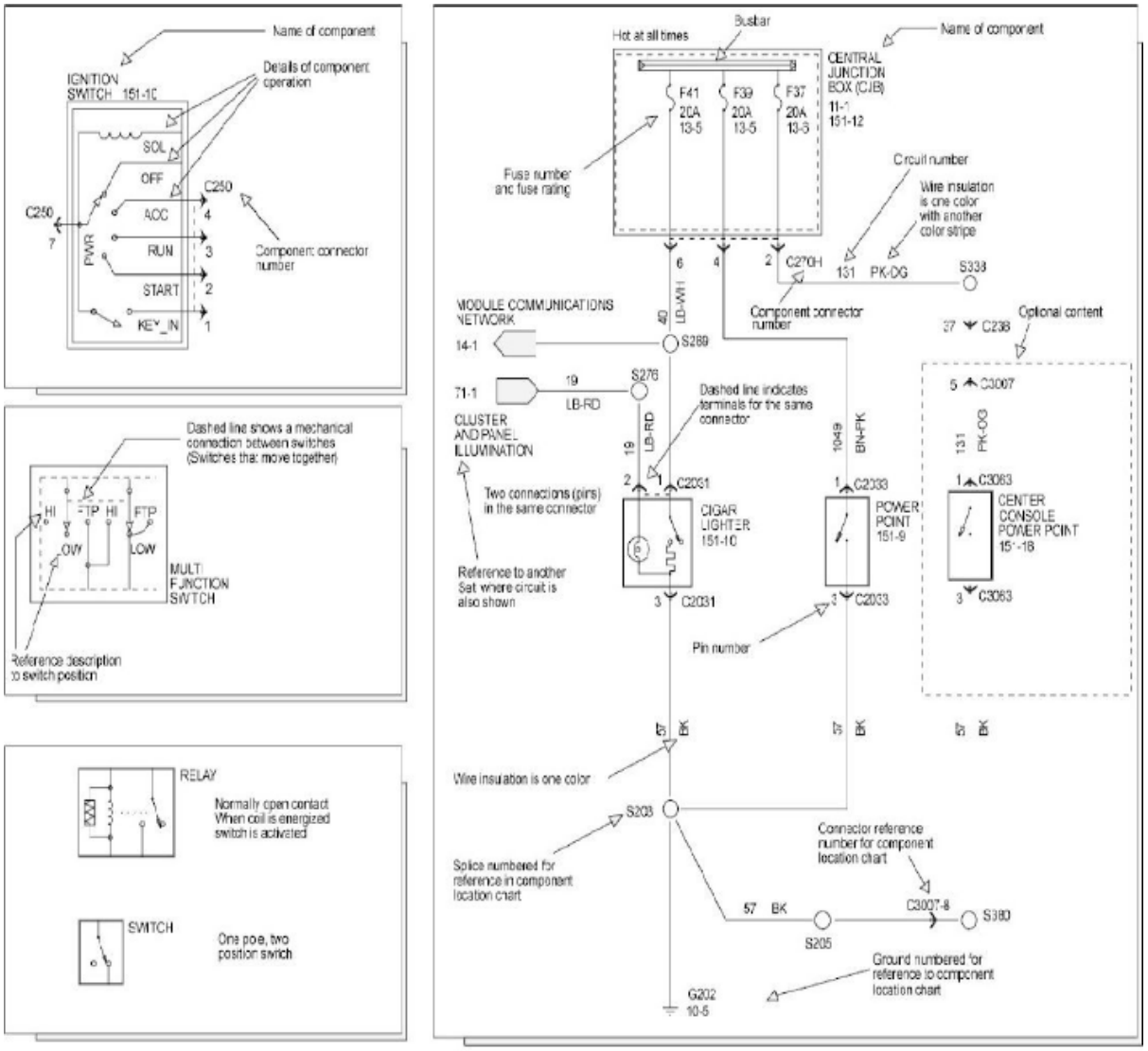
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

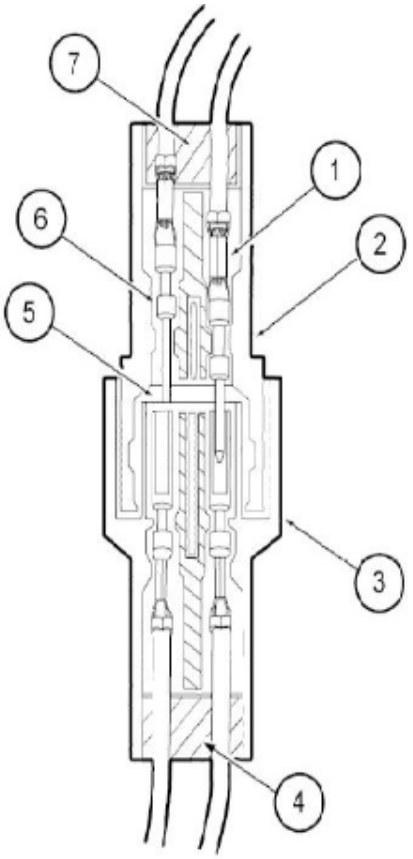


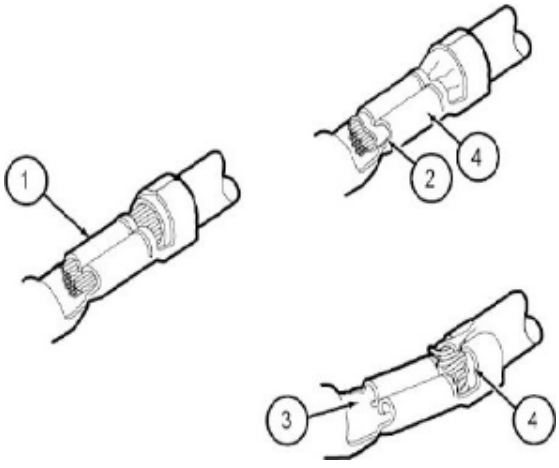
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Fuse Block: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

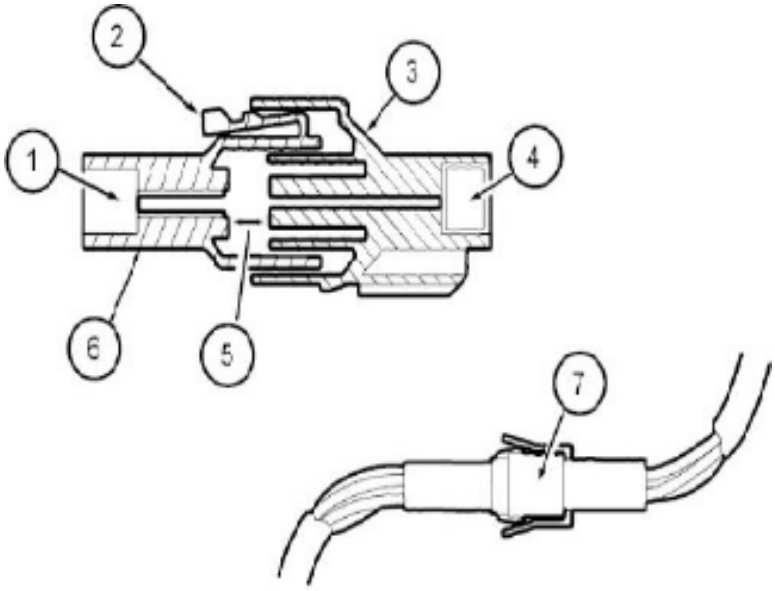
5 = Intermittent contact

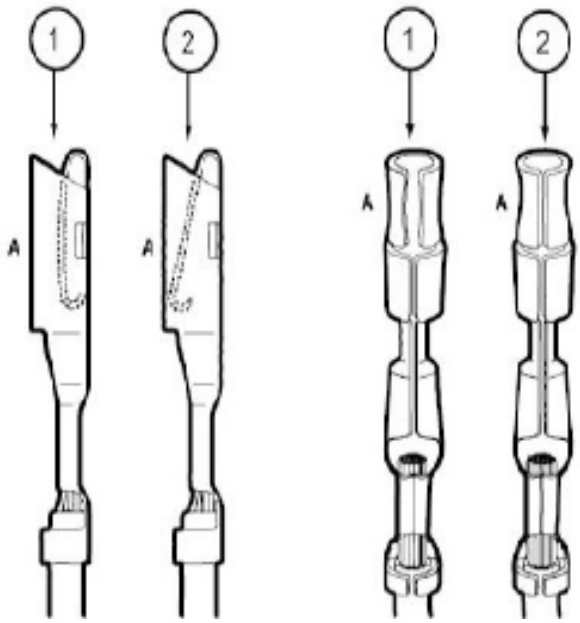
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

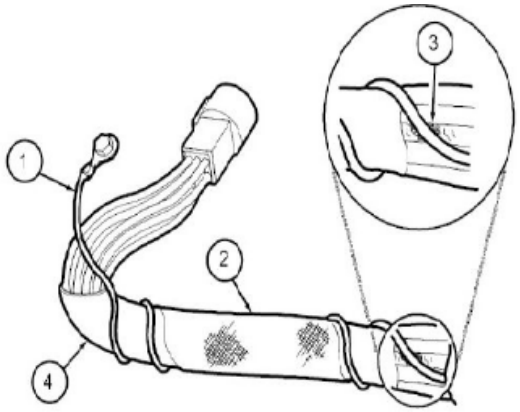
Deformed (enlarged) female terminals

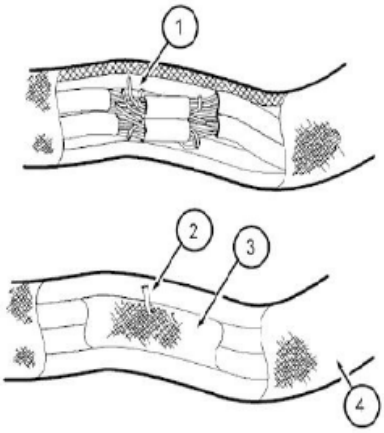
1 = Enlarged

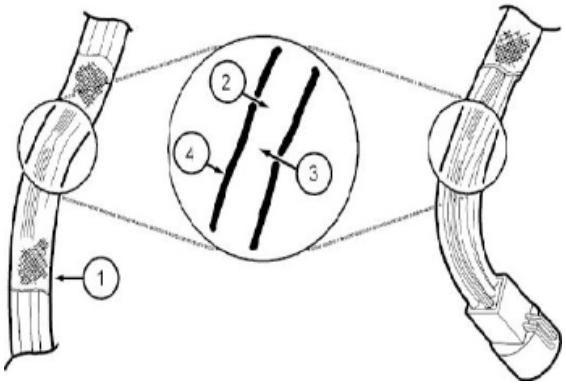
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

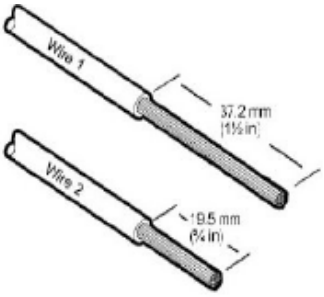
Splice covered 2

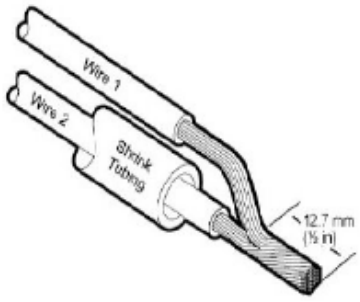
= Wire strand

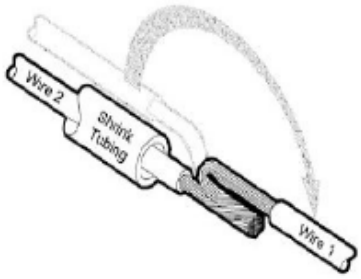
3 = Splice tape

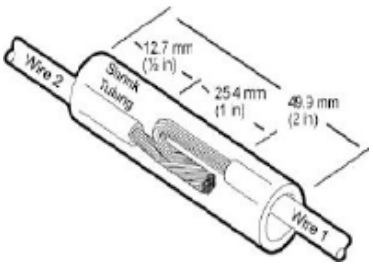
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

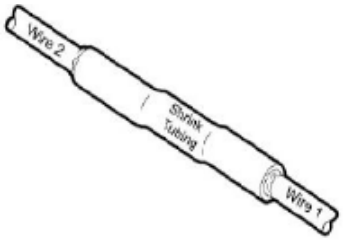
NOTE: -

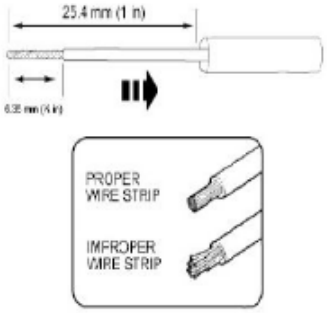
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

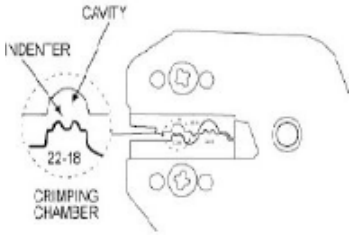
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

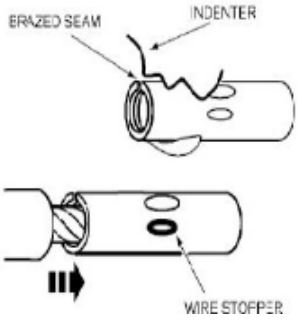
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
6.35 mm (¼ in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

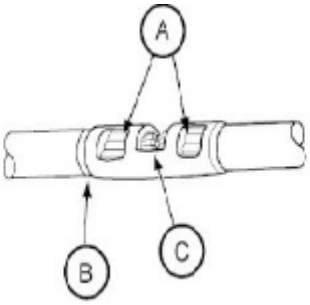
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

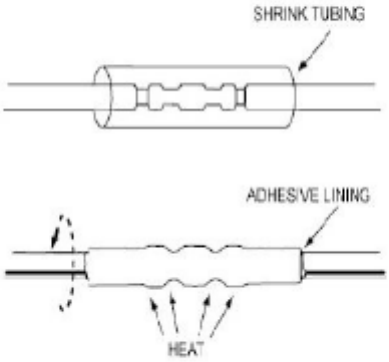
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4□ strip, cut 9 strands	* 1/4□ strip, cut 2 strands	1/4□ strip, no fold	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip, fold 2x dia.	1□ strip, fold 3x dia.
	16-14	* 1/4□ strip, cut 7 strands	1/4□ strip, no fold	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip fold 2x dia	1□ strip, fold 3x dia.	1 1/4□ strip, fold 4x dia.	Not Recommended
	12-10	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip, fold 2x dia.	1□ strip fold 3x dia.	1 1/4□ strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Pigtail only

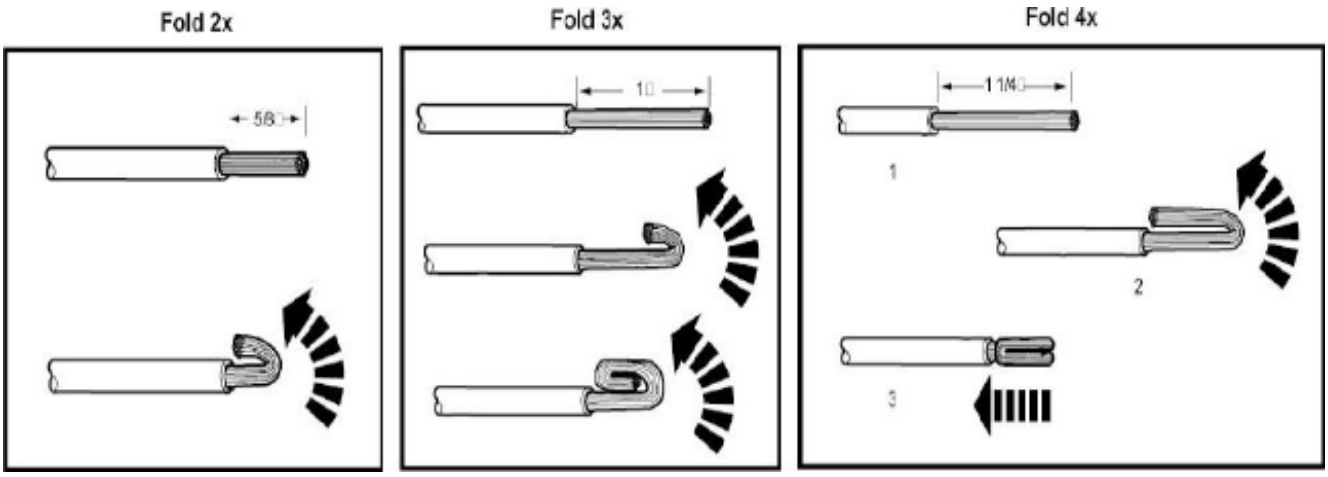
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

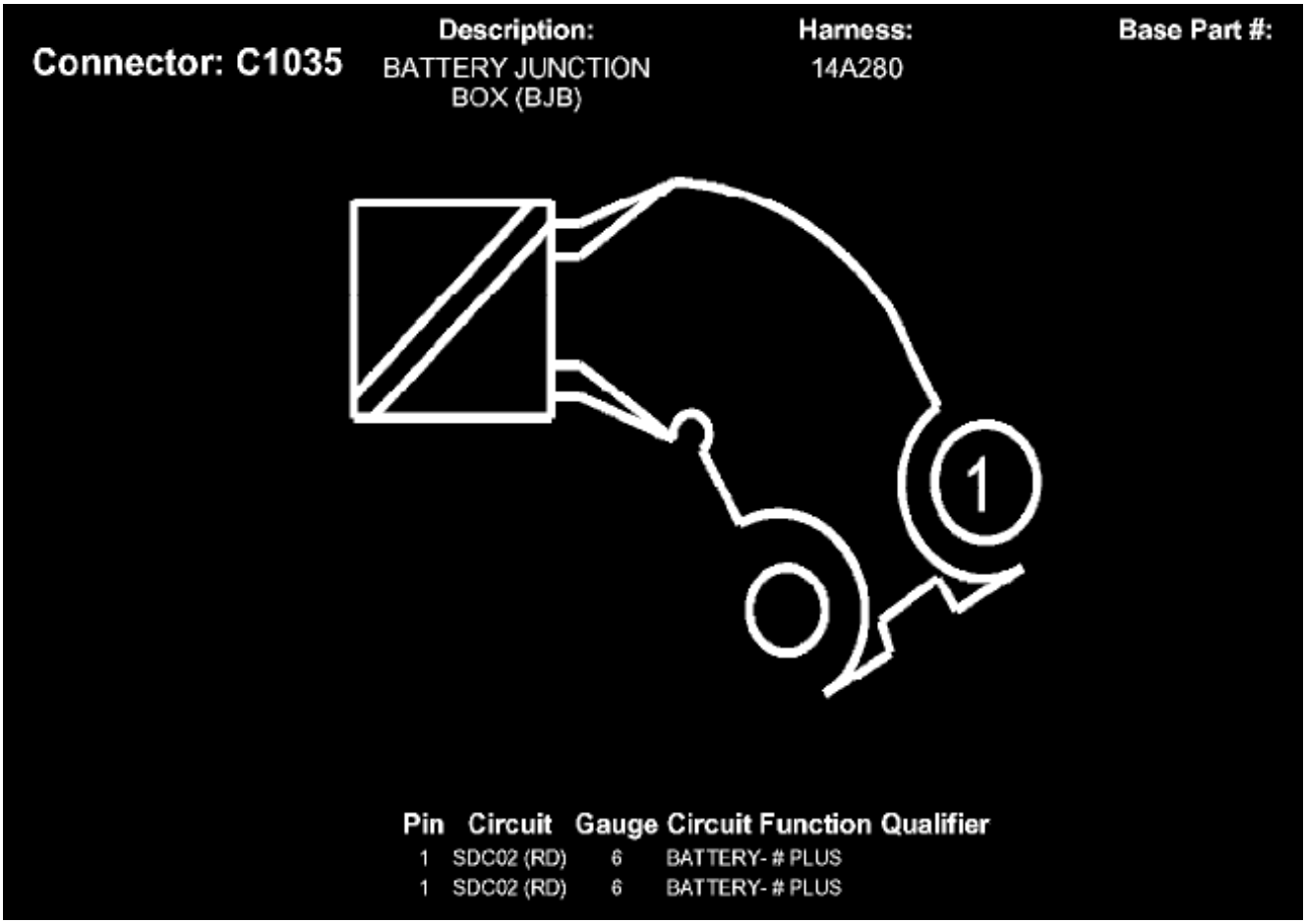
11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



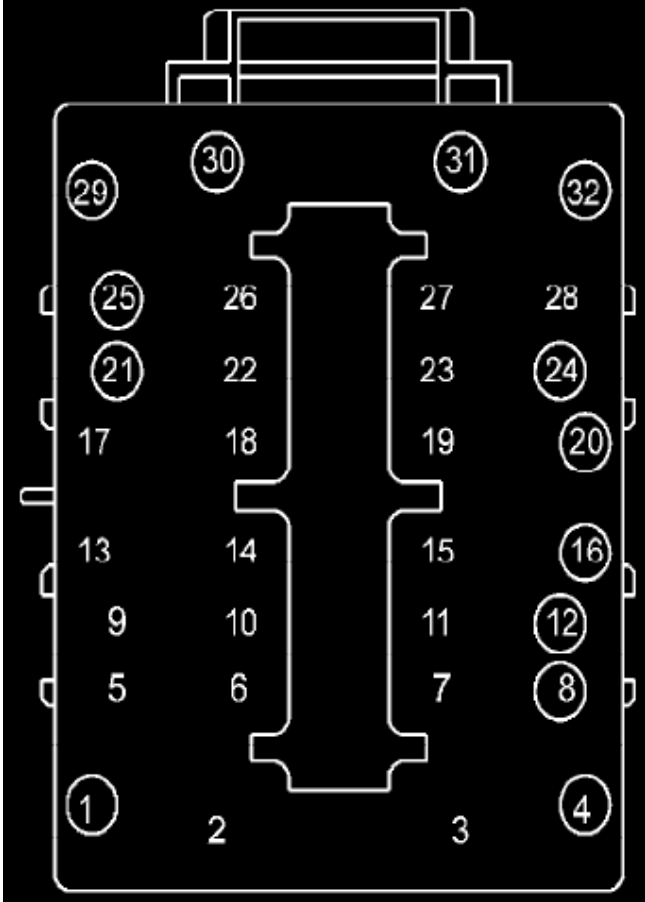
The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.



Fuse Block: Connector Views

C1035

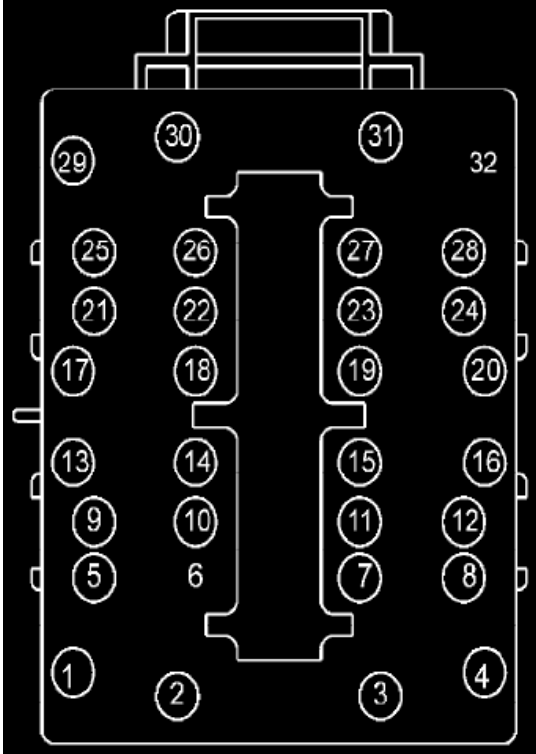
Connector: C2280A — Description: SMART JUNCTION BOX (SJB) — Harness: 14290 — Base Part #: 14B476



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	SBB01 (RD)	12	FUSE - 1 OR CIRCUIT BREAKER	
2	*	*	not used	
3	*	*	not used	
4	CBP05 (YE)	20	FUSE - 5 OR CIRCUIT BREAKER	
5	*	*	not used	
6	*	*	not used	
7	*	*	not used	
8	CES03 (VT-WH)	20	CTRL MOD - POWERTRAIN # SPEED CONTROL INDICATOR (SCIL)	
9	*	*	not used	
10	*	*	not used	
11	*	*	not used	
12	CLS34 (GY)	18	SWITCH - PARK LAMPS	
13	*	*	not used	
14	*	*	not used	
15	*	*	not used	
16	CBP04 (VT)	18	FUSE - 4 OR CIRCUIT BREAKER	
17	*	*	not used	
18	*	*	not used	
19	*	*	not used	
20	CBP03 (GY)	18	FUSE - 3 OR CIRCUIT BREAKER	
21	SBR14 (BN-RD)	18	FUSE - 14 OR CIRCUIT BREAKER	
22	*	*	not used	
23	*	*	not used	
24	CE517 (BU-GN)	20	DIODE - RELAY POWERTRAIN CONTROL MODULE	
25	CBP14 (VT-OG)	16	FUSE - 14 OR CIRCUIT BREAKER	
26	*	*	not used	
27	*	*	not used	
28	*	*	not used	
29	SBB03 (BU-RD)	12	FUSE - 3 OR CIRCUIT BREAKER	
30	CRH02 (BU-WH)	18	SWITCH - HORN	
31	CBP21 (BU-GY)	22	FUSE - 21 OR CIRCUIT BREAKER	
32	SBB05 (GY-RD)	10	FUSE - 5 OR CIRCUIT BREAKER	

C2280A

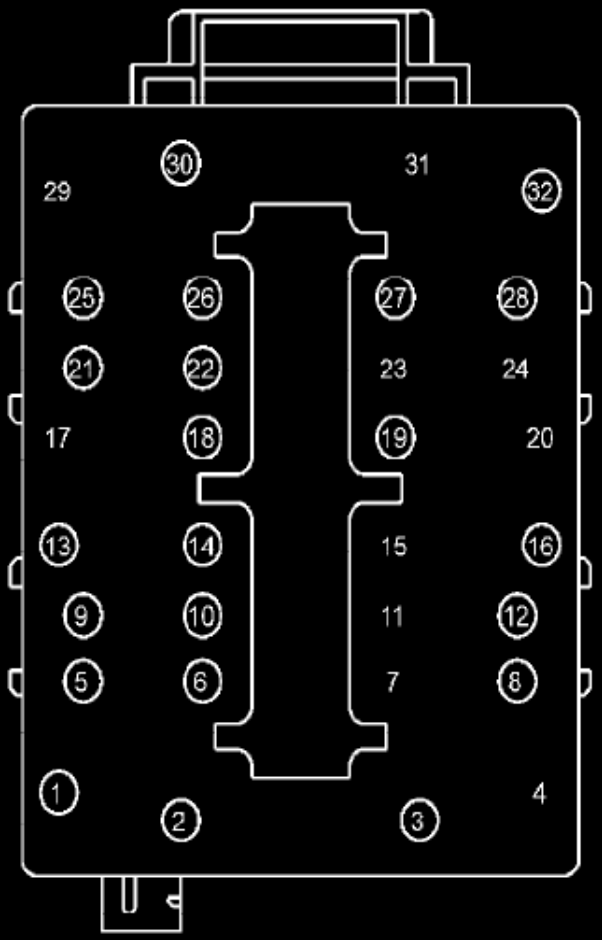
Connector: C2280B | **Description:** SMART JUNCTION BOX (SJB) | **Harness:** 14401 | **Base Part #:** 14B476



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	SBP23 (WH-RD)	14	FUSE - 23 OR CIRCUIT BREAKER	
2	SBP24 (VT-RD)	16	FUSE - 24 OR CIRCUIT BREAKER	
3	SBP34 (YE-RD)	16	FUSE - 34 OR CIRCUIT BREAKER	
4	SBP23 (WH-RD)	14	FUSE - 23 OR CIRCUIT BREAKER	
5	CBP10 (YE-OG)	20	FUSE - 10 OR CIRCUIT BREAKER	
6	*	*	not used	
7	SBP28 (GN-RD)	18	FUSE - 28 OR CIRCUIT BREAKER	
8	SBP30 (BN-RD)	22	FUSE - 30 OR CIRCUIT BREAKER	
9	CPL19 (WH-VT)	20	RELAY - DOOR LOCK # ALL LOCK	
10	CPL18 (GY-VT)	20	RELAY - DOOR LOCK # ALL UNLOCK	
11	CDC35 (BU-WH)	14	SWITCH - IGNITION # START	
12	SBP33 (RD)	20	FUSE - 33 OR CIRCUIT BREAKER	
13	CPL11 (GY-BN)	20	CTRL MOD. - DOOR LOCK # ALL LOCK	
14	GD161 (BK-YE)	18	GROUND - SEAT BRACKET REAR LEFT	
15	CBP20 (YE-VT)	18	FUSE - 20 OR CIRCUIT BREAKER	
16	SBP29 (GY-RD)	18	FUSE - 29 OR CIRCUIT BREAKER	
17	CDC32 (BN-YE)	12	SWITCH - IGNITION # RUN	
18	CBP27 (GN-BN)	22	FUSE - 27 OR CIRCUIT BREAKER	
19	CBP20 (YE-VT)	18	FUSE - 20 OR CIRCUIT BREAKER	
20	SBP29 (GY-RD)	16	FUSE - 29 OR CIRCUIT BREAKER	
21	CBP27 (GN-BN)	22	FUSE - 27 OR CIRCUIT BREAKER	
22	CBP26 (BU-WH)	20	FUSE - 26 OR CIRCUIT BREAKER	
23	CBP20 (YE-VT)	18	FUSE - 20 OR CIRCUIT BREAKER	
24	CBP22 (GN-OG)	20	FUSE - 22 OR CIRCUIT BREAKER	
25	CLF27 (GN-BN)	14	SWITCH - FLASH TO PASS	
26	SBP17 (RD)	18	FUSE - 17 OR CIRCUIT BREAKER	
27	CBP20 (YE-VT)	20	FUSE - 20 OR CIRCUIT BREAKER	
28	SBP32 (VT-RD)	22	FUSE - 32 OR CIRCUIT BREAKER	
29	CDC34 (WH-OG)	12	SWITCH - IGNITION # RUN; START	
30	SBP12 (GN-RD)	16	FUSE - 12 OR CIRCUIT BREAKER	Audiophile sound system
30	SBP12 (GN-RD)	20	FUSE - 12 OR CIRCUIT BREAKER	without Audiophile and satellite radio
31	SBP19 (BU-RD)	16	FUSE - 19 OR CIRCUIT BREAKER	
32	*	*	not used	

C2280B (Part 1)

Connector: C2280C | **Description:** SMART JUNCTION BOX (SJB) | **Harness:** 14401 | **Base Part #:** 14B476

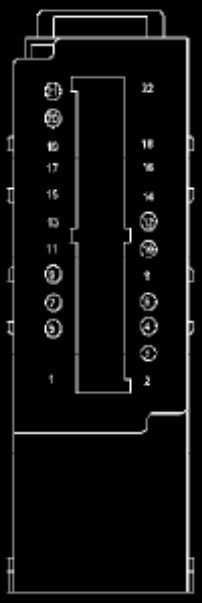


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD174 (BK-WH)	18	GROUND - TUNNEL	
2	CPL12 (VT-OG)	20	CTRL MOD. - DOOR LOCK # DOUBLE LOCK ALL LOCK	
3	CLS34 (GY)	16	SWITCH - PARK LAMPS	
4	*	*	not used	
5	CPL42 (GY-YE)	22	SWITCH - TRIM DOOR LOCK (DRIVER) # LOCK	
6	CPL26 (GN-VT)	20	SWITCH - LATCH DRIVER # AJAR	
7	*	*	not used	
8	CLN28 (GN-BU)	18	SWITCH - DOME LAMP	
9	CPL43 (VT-GY)	22	SWITCH - TRIM DOOR LOCK (DRIVER) # UNLOCK	
10	CPL42 (GY-YE)	22	SWITCH - TRIM DOOR LOCK (DRIVER) # LOCK	
11	*	*	not used	
12	CPL51 (BU-GN)	20	CTRL MOD. - DOOR LOCK # DRIVER UNLOCK	
13	CPW14 (VT-WH)	14	SWITCH - POWER WINDOW DRIVER # PASSENGER LOCK OUT (ENABLE)	
14	CPL43 (VT-GY)	22	SWITCH - TRIM DOOR LOCK (DRIVER) # UNLOCK	
15	*	*	not used	
16	CPW30 (GY-YE)	14	RELAY - POWER WINDOW	
17	*	*	not used	
18	CBP08 (GY-YE)	20	FUSE - 8 OR CIRCUIT BREAKER	
19	CE517 (BU-GN)	20	DIODE - RELAY POWERTRAIN CONTROL MODULE	
20	*	*	not used	
21	CLF29 (BN)	22	CTRL MOD. - FOG LAMPS FRONT (LEFT)	
22	CBP08 (GY-YE)	20	FUSE - 8 OR CIRCUIT BREAKER	
23	*	*	not used	
24	*	*	not used	
25	CAT17 (BN)	16	RELAY - TRAILER TOW PARK LAMPS (COLOR TO SAE 1239)	
26	CBP01 (BU)	22	FUSE - 1 OR CIRCUIT BREAKER	
27	CBP06 (WH-BU)	20	FUSE - 6 OR CIRCUIT BREAKER	
28	CBP09 (VT-GY)	20	FUSE - 9 OR CIRCUIT BREAKER	
29	*	*	not used	
30	CLF16 (BU-WH)	16	SWITCH - BEAM LOW	
31	*	*	not used	
32	CDC33 (VT-GN)	12	SWITCH - IGNITION # RUN: ACCESSORY	

C2280B (Part 2)

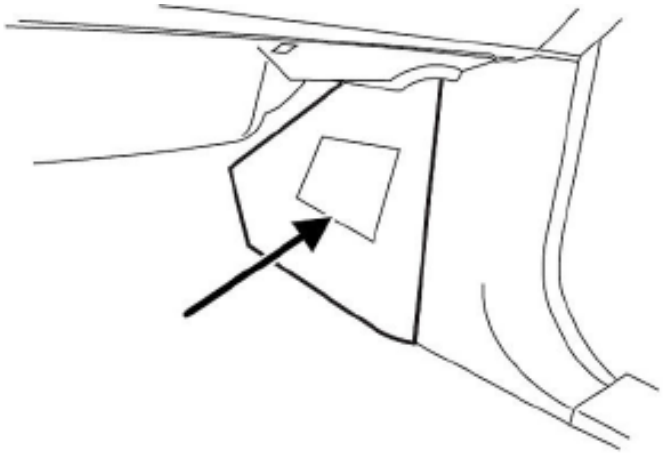
C2280C

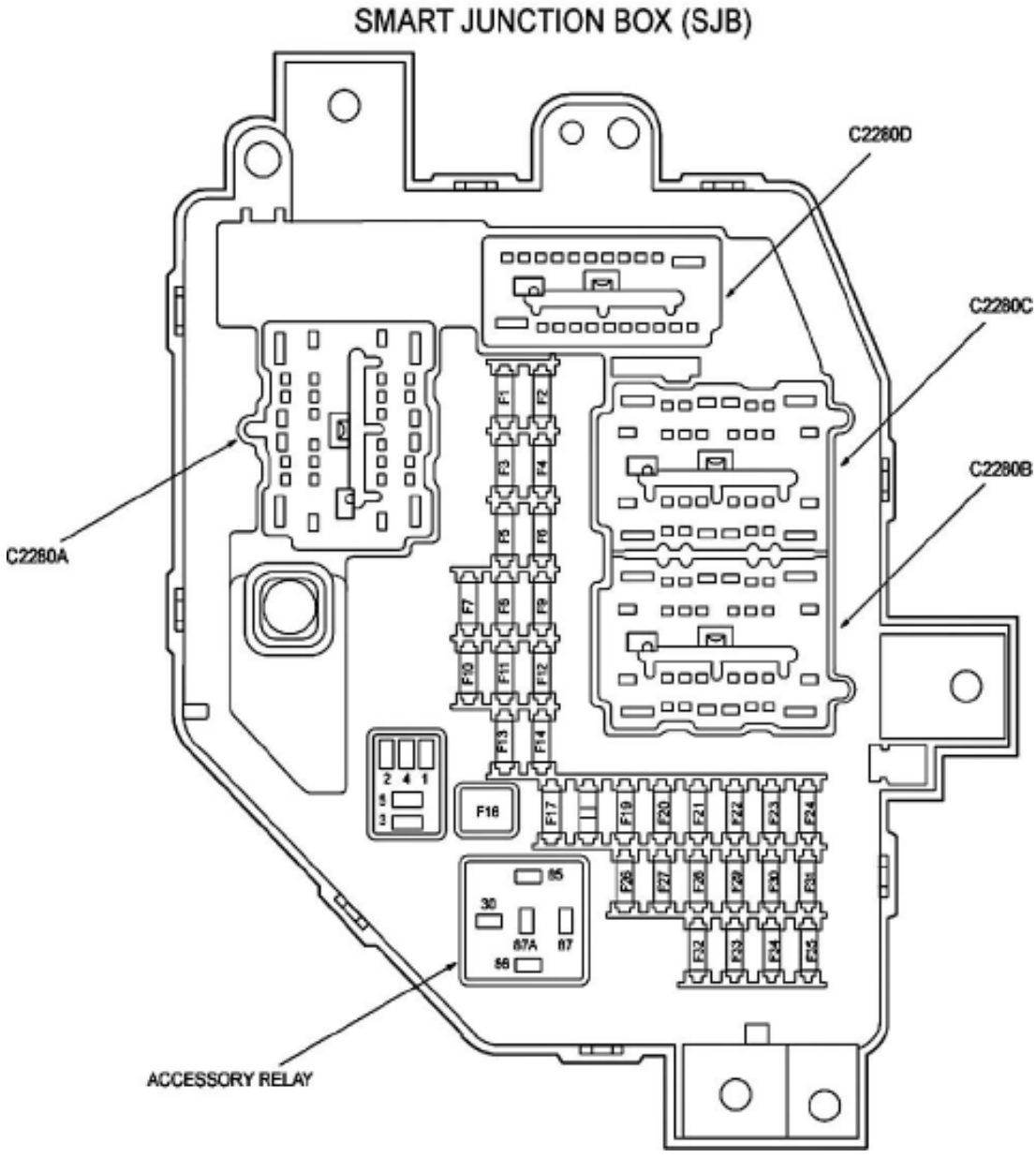
Connector: C2280D	Description:	Harness:	Base Part #:
	SMART JUNCTION BOX (SJB)	14401	14B476



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	*	*	not used	
3	CPL31 (WH)	20	SWITCH - LATCH PASSENGER # AJAR	
4	CPL36 (GN)	20	SWITCH - LATCH REAR DRIVER SIDE # AJAR (INCL.SLIDING DOOR)	
5	CLS30 (VT-WH)	18	RELAY - PARK LAMP	
6	CPL39 (YE)	20	SWITCH - LATCH REAR PASSENGER SIDE # AJAR (INCL.SLIDING DOOR)	
7	CCB15 (BN-GN)	22	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL CLOSED	
8	*	*	not used	
9	CLF21 (GY-VT)	18	SWITCH - FOG LAMPS FRONT	
10	CLN27 (WH-BN)	18	CTRL MOD. - DIMMER INSTRUMENT	
11	*	*	not used	
12	SRH01 (YE-RD)	20	RELAY - HORN	
13	*	*	not used	
14	*	*	not used	
15	*	*	not used	
16	*	*	not used	
17	*	*	not used	
18	*	*	not used	
19	*	*	not used	
20	VDB04 (WH-BU)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED HIGH	
21	VDB05 (WH)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED LOW	
22	*	*	not used	

C2280D

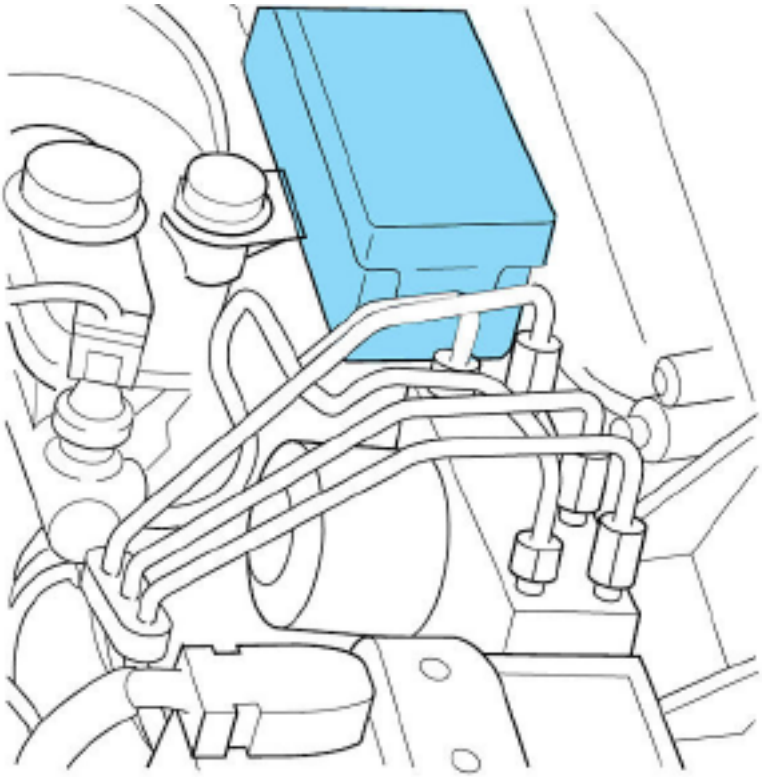



SMART JUNCTION BOX (SJB)
C2280D
C2280C
C2280B
C2280A
F1
F2
F3
F4
F5
F6
F7
F8
F9
F10
F11
F12
F13
F14
F16
F17
F19
F20
F21
F22
F23
F24
F26
F27
F28
F29
F30
F31
F32
F33
F34
F35
2 4 1
3
30
85
87A
87
86
ACCESSORY RELAY

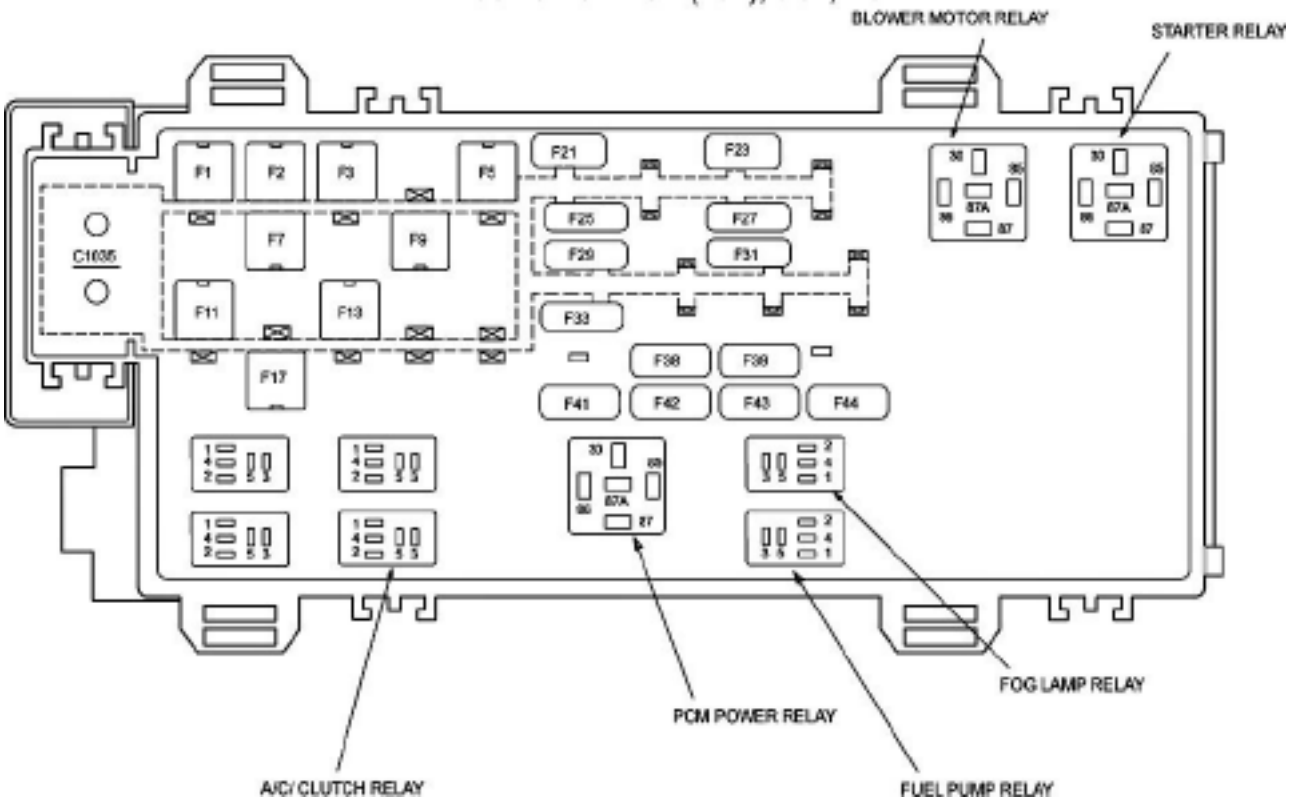
Fuse Block: Application and ID Smart Junction Box

FUSE	AMPS	Circuits Protected
F1	5A	Illumination dimmer
F2	10A	Trailer tow connector - Park
F3	10A	Headlamp, right (Low beam lamp feed)
F4	10A	Headlamp, left (Low beam lamp feed)
F5	5A	Windshield wiper module
F6	10A	Audio unit, Door lock switch illumination
F7	5A	Not Used
F8	10A	Restraints Control Module (RCM), Occupant Classification System Module (OCSM), Passenger Air bag Deactivation (PAD) Indicator
F9	5A	Instrument Cluster (IC), Air bag indicator
F10	10A	4X4 control module, Instrument Cluster (IC)
F11	10A	Smart Junction Box (SJB), logic power
F12	15A	Subwoofer amplifier with audiophile, Satellite radio receiver
F13	15A	Interior lamp relay, Horn relay
F14	15A	High beam lamp feed to High beam indicator, Headlamp, right, Headlamp, left
F16	30A	Accessory relay (Power windows)
F17	15A	Indicator flasher relay
F18	-	Not Used

FUSE	AMPS	Circuits Protected
F19	20A	Brake pedal position switch (Stoplamps)
F20	10A	Transmission control switch, Digital Transmission Range (TR) sensor, Speed control servo, Anti-lock Brake System (ABS) module, Indicator flasher relay, Reversing lamps switch, Speed control On/Off switch, Speed control Set/Resume switch
F21	5A	Digital Transmission Range (TR) sensor, Starter relay, Powertrain Control Module (PCM)
F22	5A	Audio unit
F23	30A	Main light switch, Multifunction switch
F24	20A	Audio unit
F26	2A	Deactivator switch
F27	10A	Blend door actuator, Climate control assembly
F28	15A	4X4 control module
F29	20A	Cigar lighter, front, Data Link Connector (DLC)
F30	5A	Exterior rear view mirror switch
F31	20A	Park lamp relay
F32	5A	Brake pedal position switch (logic power), Brake shift interlock
F33	5A	Instrument Cluster (IC), Neutral tow indicator
F34	20A	Power point
F35	15A	Door lock/unlock relay, Driver door unlock relay



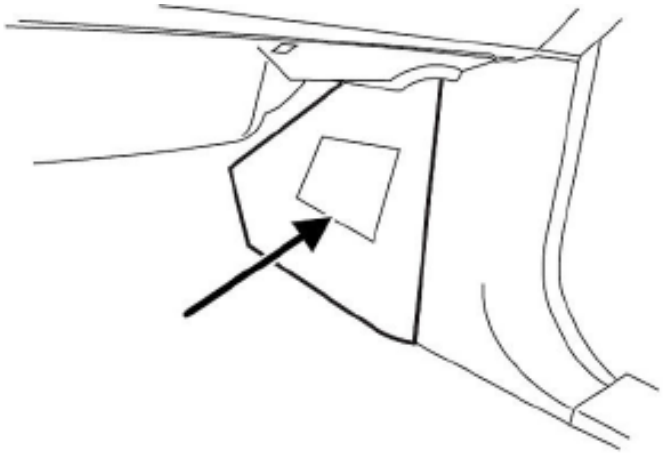
BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L

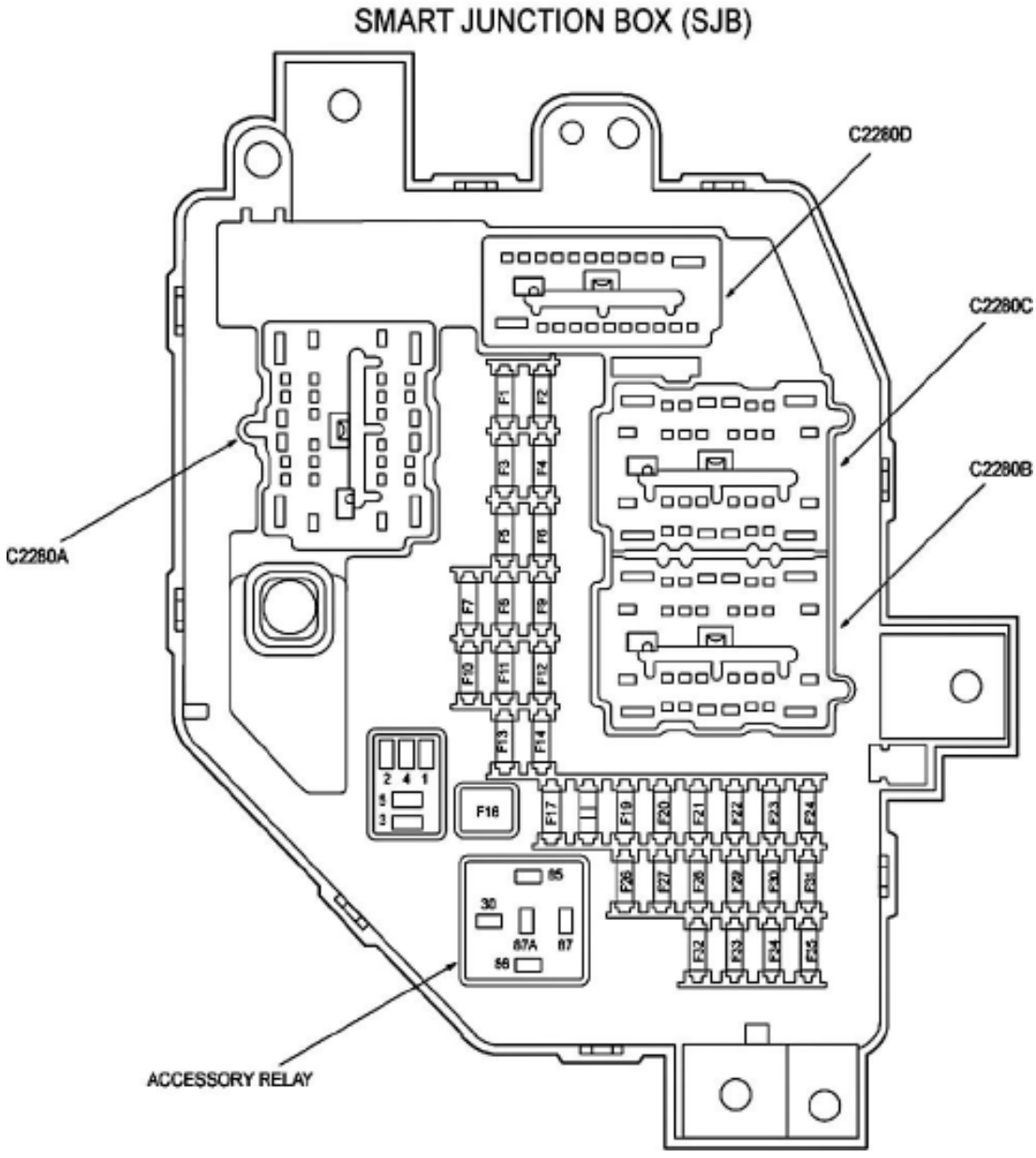


Fuse Block: Application and ID Battery Junction Box

FUSE	AMPS	Circuits Protected
F1	40A	Smart Junction Box (SJB)
F2	-	Not Used
F3	40A	Smart Junction Box (SJB)
F4	-	Not Used
F5	50A	Smart Junction Box (SJB)
F6	-	Not Used
F7	30A	Starter Relay
F8	-	Not Used
F9	40A	Ignition Switch
F10	-	Not Used
F11	30A	PCM power relay
F12	-	Not Used
F13	30A	Blower motor relay
F14	-	Not Used
F15	-	Not Used
F16	-	Not Used
F17	40A	Anti-lock Brake System (ABS) module
F18	-	Not Used
F19	-	Not Used
F20	-	Not Used
F21	10A	Powertrain Control Module (PCM), Evaporative emission (EVAP) canister vent valve
F22	-	Not Used
F23	30A	Fuel Pump Relay, Fuel injectors
F24	-	Not Used

FUSE	AMPS	Circuits Protected
F25	10A	A/C clutch relay
F26	-	Not Used
F27	20A	4X4 control module
F28	-	Not Used
F29	30A	Windshield wipers/washer
F30	-	Not Used
F31	15A	Fog lamp relay
F32	-	Not Used
F33	30A	Anti-lock Brake System (ABS) module
F34	-	Not Used
F35	-	Not Used
F36	-	Not Used
F37	-	Not Used
F38	7.5A	Trailer tow connector - Right turn
F39	15A	Powertrain Control Module (PCM)
F40	-	Not Used
F41	10A	*5R44E Transmission **5R55E Transmission
F42	7.5A	Trailer tow connector - Left turn
F43	20A	EVAP canister purge valve, Heated Positive Crankcase Ventilation (PCV) valve, Idle Air Control (IAC) valve, Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor, Heated Oxygen Sensor (HO2S) #11, Heated Oxygen Sensor (HO2S) #12, Heated Oxygen Sensor (HO2S) #21, Heated Oxygen Sensor (HO2S) #22, EGR vacuum regulator solenoid valve, A/C relay coil
F44	15A	Ignition coil, *Ignition transformer capacitor 1




SMART JUNCTION BOX (SJB)
C2280D
C2280C
C2280B
C2280A
F1
F2
F3
F4
F5
F6
F7
F8
F9
F10
F11
F12
F13
F14
F16
F17
F19
F20
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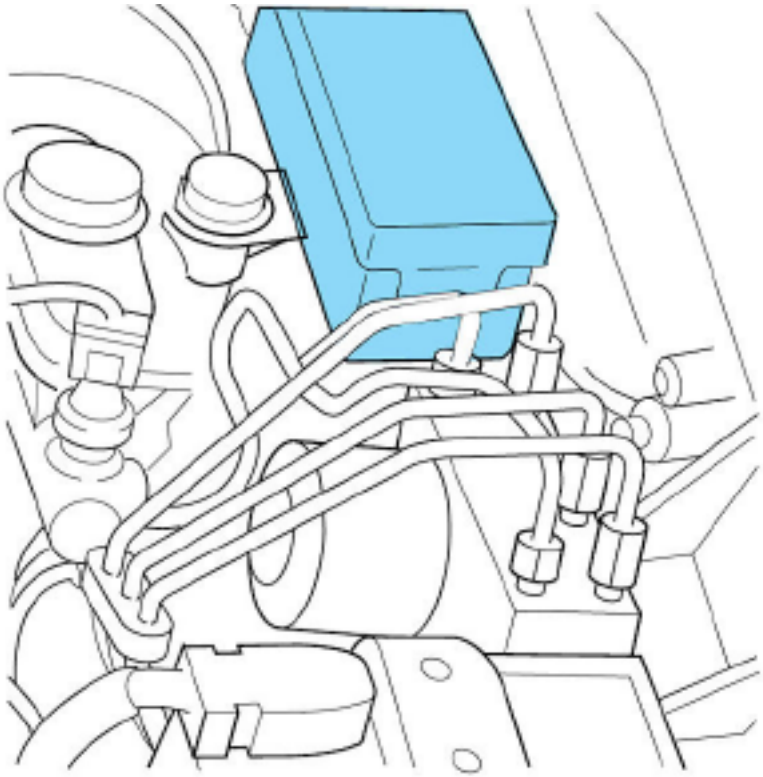
F27
F28
F29
F30
F31
F32
F33
F34
F35
2 4 1
3
30
85
87A
87
86
ACCESSORY RELAY

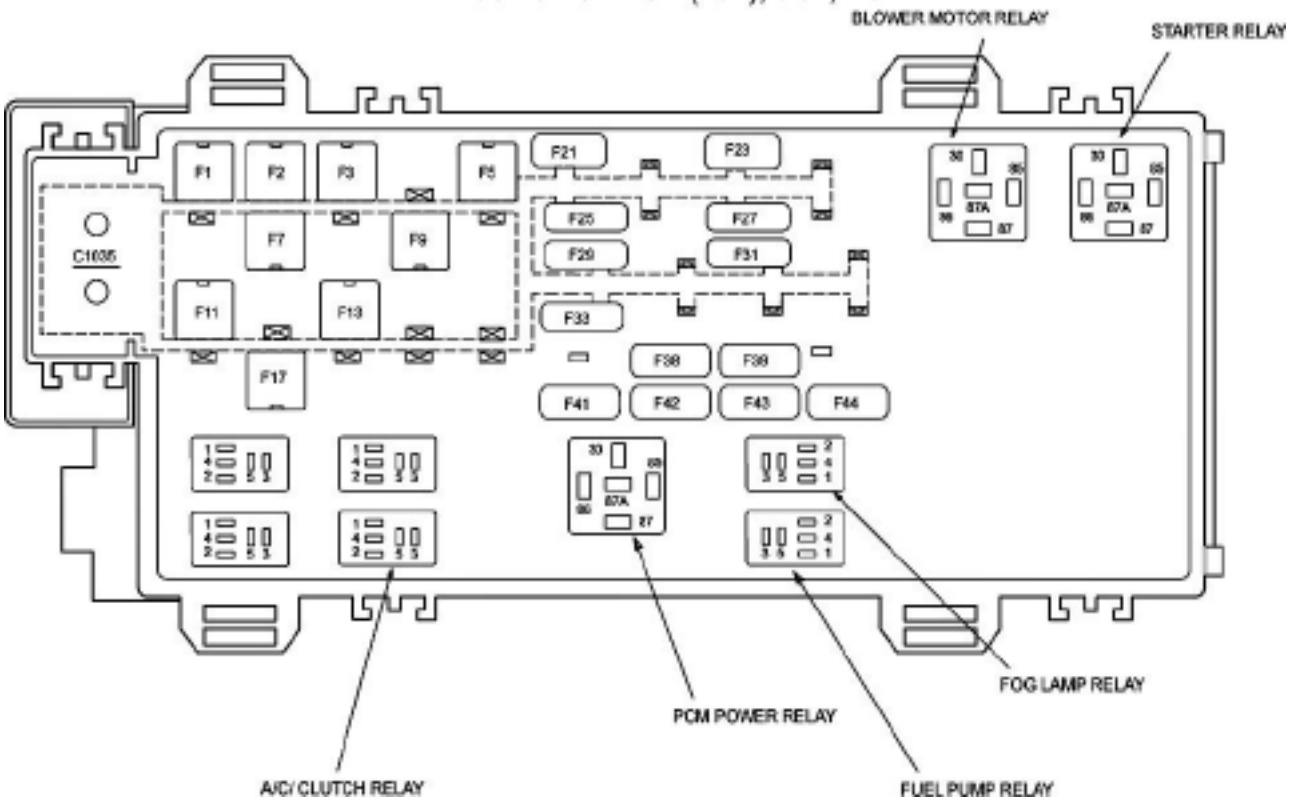
Relay Box: Locations Smart Junction Box

FUSE	AMPS	Circuits Protected
F1	5A	Illumination dimmer
F2	10A	Trailer tow connector - Park
F3	10A	Headlamp, right (Low beam lamp feed)
F4	10A	Headlamp, left (Low beam lamp feed)
F5	5A	Windshield wiper module
F6	10A	Audio unit, Door lock switch illumination
F7	5A	Not Used
F8	10A	Restraints Control Module (RCM), Occupant Classification System Module (OCSM), Passenger Air bag Deactivation (PAD) Indicator
F9	5A	Instrument Cluster (IC), Air bag indicator
F10	10A	4X4 control module, Instrument Cluster (IC)
F11	10A	Smart Junction Box (SJB), logic power
F12	15A	Subwoofer amplifier with audiophile, Satellite radio receiver
F13	15A	Interior lamp relay, Horn relay
F14	15A	High beam lamp feed to High beam indicator, Headlamp, right, Headlamp, left
F16	30A	Accessory relay (Power windows)
F17	15A	Indicator flasher relay
F18	-	Not Used

FUSE	AMPS	Circuits Protected
F19	20A	Brake pedal position switch (Stoplamps)
F20	10A	Transmission control switch, Digital Transmission Range (TR) sensor, Speed control servo, Anti-lock Brake System (ABS) module, Indicator flasher relay, Reversing lamps switch, Speed control On/Off switch, Speed control Set/Resume switch
F21	5A	Digital Transmission Range (TR) sensor, Starter relay, Powertrain Control Module (PCM)
F22	5A	Audio unit
F23	30A	Main light switch, Multifunction switch
F24	20A	Audio unit
F26	2A	Deactivator switch
F27	10A	Blend door actuator, Climate control assembly
F28	15A	4X4 control module
F29	20A	Cigar lighter, front, Data Link Connector (DLC)
F30	5A	Exterior rear view mirror switch
F31	20A	Park lamp relay
F32	5A	Brake pedal position switch (logic power), Brake shift interlock
F33	5A	Instrument Cluster (IC), Neutral tow indicator
F34	20A	Power point
F35	15A	Door lock/unlock relay, Driver door unlock relay



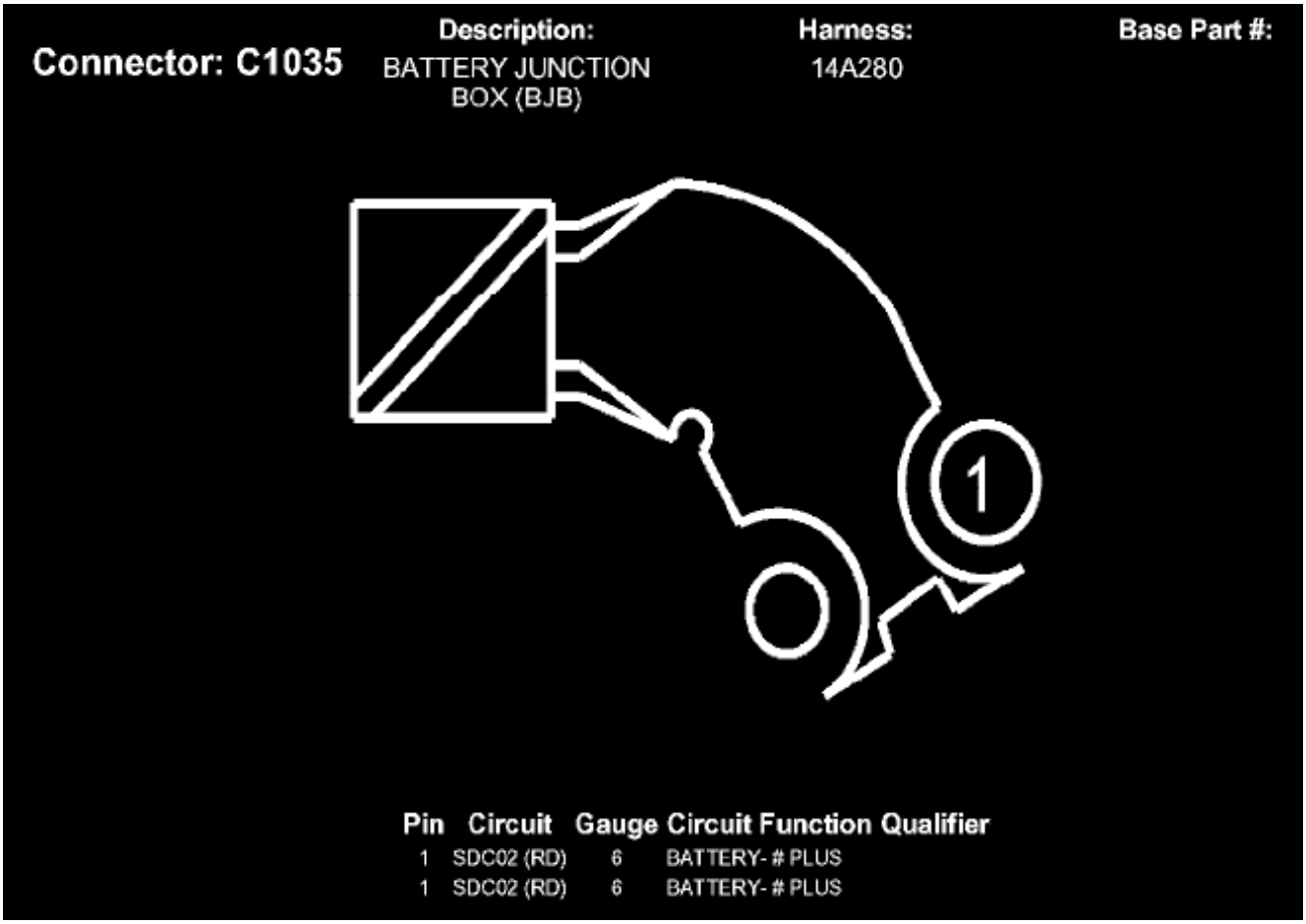
BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L



Relay Box: Locations Battery Junction Box

FUSE	AMPS	Circuits Protected
F1	40A	Smart Junction Box (SJB)
F2	-	Not Used
F3	40A	Smart Junction Box (SJB)
F4	-	Not Used
F5	50A	Smart Junction Box (SJB)
F6	-	Not Used
F7	30A	Starter Relay
F8	-	Not Used
F9	40A	Ignition Switch
F10	-	Not Used
F11	30A	PCM power relay
F12	-	Not Used
F13	30A	Blower motor relay
F14	-	Not Used
F15	-	Not Used
F16	-	Not Used
F17	40A	Anti-lock Brake System (ABS) module
F18	-	Not Used
F19	-	Not Used
F20	-	Not Used
F21	10A	Powertrain Control Module (PCM), Evaporative emission (EVAP) canister vent valve
F22	-	Not Used
F23	30A	Fuel Pump Relay, Fuel injectors
F24	-	Not Used

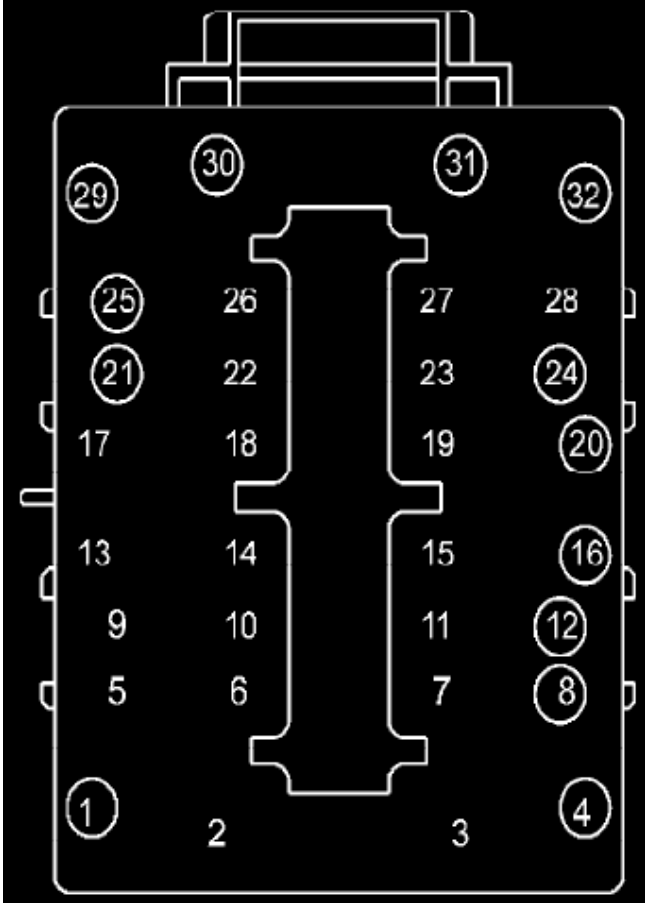
FUSE	AMPS	Circuits Protected
F25	10A	A/C clutch relay
F26	-	Not Used
F27	20A	4X4 control module
F28	-	Not Used
F29	30A	Windshield wipers/washer
F30	-	Not Used
F31	15A	Fog lamp relay
F32	-	Not Used
F33	30A	Anti-lock Brake System (ABS) module
F34	-	Not Used
F35	-	Not Used
F36	-	Not Used
F37	-	Not Used
F38	7.5A	Trailer tow connector - Right turn
F39	15A	Powertrain Control Module (PCM)
F40	-	Not Used
F41	10A	*5R44E Transmission **5R55E Transmission
F42	7.5A	Trailer tow connector - Left turn
F43	20A	EVAP canister purge valve, Heated Positive Crankcase Ventilation (PCV) valve, Idle Air Control (IAC) valve, Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor, Heated Oxygen Sensor (HO2S) #11, Heated Oxygen Sensor (HO2S) #12, Heated Oxygen Sensor (HO2S) #21, Heated Oxygen Sensor (HO2S) #22, EGR vacuum regulator solenoid valve, A/C relay coil
F44	15A	Ignition coil, *Ignition transformer capacitor 1


Connector: C1035
Description:
BATTERY JUNCTION BOX (BJB)
Harness:
14A280
Base Part #:
1
Pin Circuit Gauge Circuit Function Qualifier
1 SDC02 (RD) 6 BATTERY- # PLUS
1 SDC02 (RD) 6 BATTERY- # PLUS

C1035

Connector: C2280A

Description:	Harness:	Base Part #:
SMART JUNCTION BOX (SJB)	14290	14B476

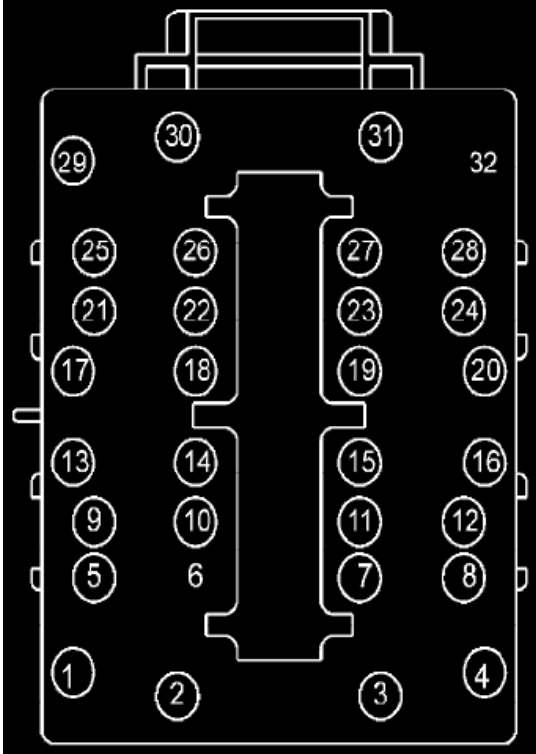


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	SBB01 (RD)	12	FUSE - 1 OR CIRCUIT BREAKER	
2	*	*	not used	
3	*	*	not used	
4	CBP05 (YE)	20	FUSE - 5 OR CIRCUIT BREAKER	
5	*	*	not used	
6	*	*	not used	
7	*	*	not used	
8	CES03 (VT-WH)	20	CTRL MOD - POWERTRAIN # SPEED CONTROL INDICATOR (SCIL)	
9	*	*	not used	
10	*	*	not used	
11	*	*	not used	
12	CLS34 (GY)	18	SWITCH - PARK LAMPS	
13	*	*	not used	
14	*	*	not used	
15	*	*	not used	
16	CBP04 (VT)	18	FUSE - 4 OR CIRCUIT BREAKER	
17	*	*	not used	
18	*	*	not used	
19	*	*	not used	
20	CBP03 (GY)	18	FUSE - 3 OR CIRCUIT BREAKER	
21	SBR14 (BN-RD)	18	FUSE - 14 OR CIRCUIT BREAKER	
22	*	*	not used	
23	*	*	not used	
24	CE517 (BU-GN)	20	DIODE - RELAY POWERTRAIN CONTROL MODULE	
25	CBP14 (VT-OG)	16	FUSE - 14 OR CIRCUIT BREAKER	
26	*	*	not used	
27	*	*	not used	
28	*	*	not used	
29	SBB03 (BU-RD)	12	FUSE - 3 OR CIRCUIT BREAKER	
30	CRH02 (BU-WH)	18	SWITCH - HORN	
31	CBP21 (BU-GY)	22	FUSE - 21 OR CIRCUIT BREAKER	
32	SBB05 (GY-RD)	10	FUSE - 5 OR CIRCUIT BREAKER	

Relay Box: Diagrams Smart Junction Box (SJB)

C2280A

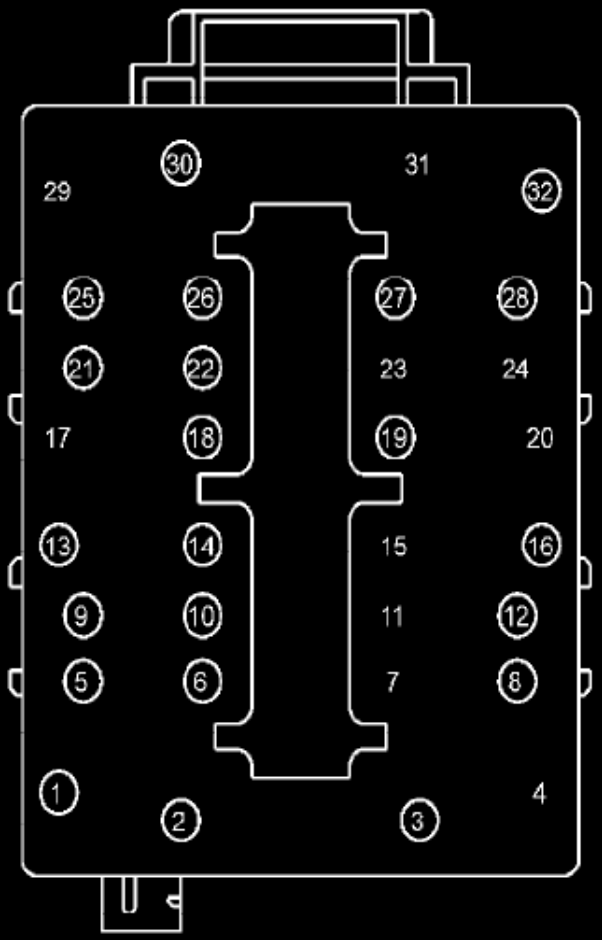
Connector: C2280B | **Description:** SMART JUNCTION BOX (SJB) | **Harness:** 14401 | **Base Part #:** 14B476



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	SBP23 (WH-RD)	14	FUSE - 23 OR CIRCUIT BREAKER	
2	SBP24 (VT-RD)	16	FUSE - 24 OR CIRCUIT BREAKER	
3	SBP34 (YE-RD)	16	FUSE - 34 OR CIRCUIT BREAKER	
4	SBP23 (WH-RD)	14	FUSE - 23 OR CIRCUIT BREAKER	
5	CBP10 (YE-OG)	20	FUSE - 10 OR CIRCUIT BREAKER	
6	*	*	not used	
7	SBP28 (GN-RD)	18	FUSE - 28 OR CIRCUIT BREAKER	
8	SBP30 (BN-RD)	22	FUSE - 30 OR CIRCUIT BREAKER	
9	CPL19 (WH-VT)	20	RELAY - DOOR LOCK # ALL LOCK	
10	CPL18 (GY-VT)	20	RELAY - DOOR LOCK # ALL UNLOCK	
11	CDC35 (BU-WH)	14	SWITCH - IGNITION # START	
12	SBP33 (RD)	20	FUSE - 33 OR CIRCUIT BREAKER	
13	CPL11 (GY-BN)	20	CTRL MOD. - DOOR LOCK # ALL LOCK	
14	GD161 (BK-YE)	18	GROUND - SEAT BRACKET REAR LEFT	
15	CBP20 (YE-VT)	18	FUSE - 20 OR CIRCUIT BREAKER	
16	SBP29 (GY-RD)	18	FUSE - 29 OR CIRCUIT BREAKER	
17	CDC32 (BN-YE)	12	SWITCH - IGNITION # RUN	
18	CBP27 (GN-BN)	22	FUSE - 27 OR CIRCUIT BREAKER	
19	CBP20 (YE-VT)	18	FUSE - 20 OR CIRCUIT BREAKER	
20	SBP29 (GY-RD)	16	FUSE - 29 OR CIRCUIT BREAKER	
21	CBP27 (GN-BN)	22	FUSE - 27 OR CIRCUIT BREAKER	
22	CBP26 (BU-WH)	20	FUSE - 26 OR CIRCUIT BREAKER	
23	CBP20 (YE-VT)	18	FUSE - 20 OR CIRCUIT BREAKER	
24	CBP22 (GN-OG)	20	FUSE - 22 OR CIRCUIT BREAKER	
25	CLF27 (GN-BN)	14	SWITCH - FLASH TO PASS	
26	SBP17 (RD)	18	FUSE - 17 OR CIRCUIT BREAKER	
27	CBP20 (YE-VT)	20	FUSE - 20 OR CIRCUIT BREAKER	
28	SBP32 (VT-RD)	22	FUSE - 32 OR CIRCUIT BREAKER	
29	CDC34 (WH-OG)	12	SWITCH - IGNITION # RUN; START	
30	SBP12 (GN-RD)	16	FUSE - 12 OR CIRCUIT BREAKER	Audiophile sound system
30	SBP12 (GN-RD)	20	FUSE - 12 OR CIRCUIT BREAKER	without Audiophile and satellite radio
31	SBP19 (BU-RD)	16	FUSE - 19 OR CIRCUIT BREAKER	
32	*	*	not used	

C2280B (Part 1)

Connector: C2280C | **Description:** SMART JUNCTION BOX (SJB) | **Harness:** 14401 | **Base Part #:** 14B476

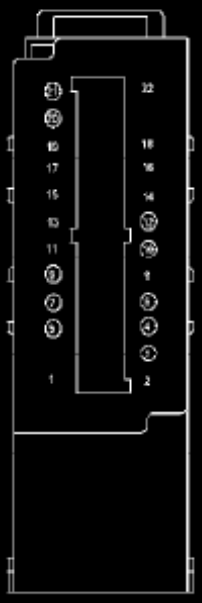


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD174 (BK-WH)	18	GROUND - TUNNEL	
2	CPL12 (VT-OG)	20	CTRL MOD. - DOOR LOCK # DOUBLE LOCK ALL LOCK	
3	CLS34 (GY)	16	SWITCH - PARK LAMPS	
4	*	*	not used	
5	CPL42 (GY-YE)	22	SWITCH - TRIM DOOR LOCK (DRIVER) # LOCK	
6	CPL26 (GN-VT)	20	SWITCH - LATCH DRIVER # AJAR	
7	*	*	not used	
8	CLN28 (GN-BU)	18	SWITCH - DOME LAMP	
9	CPL43 (VT-GY)	22	SWITCH - TRIM DOOR LOCK (DRIVER) # UNLOCK	
10	CPL42 (GY-YE)	22	SWITCH - TRIM DOOR LOCK (DRIVER) # LOCK	
11	*	*	not used	
12	CPL51 (BU-GN)	20	CTRL MOD. - DOOR LOCK # DRIVER UNLOCK	
13	CPW14 (VT-WH)	14	SWITCH - POWER WINDOW DRIVER # PASSENGER LOCK OUT (ENABLE)	
14	CPL43 (VT-GY)	22	SWITCH - TRIM DOOR LOCK (DRIVER) # UNLOCK	
15	*	*	not used	
16	CPW30 (GY-YE)	14	RELAY - POWER WINDOW	
17	*	*	not used	
18	CBP08 (GY-YE)	20	FUSE - 8 OR CIRCUIT BREAKER	
19	CE517 (BU-GN)	20	DIODE - RELAY POWERTRAIN CONTROL MODULE	
20	*	*	not used	
21	CLF29 (BN)	22	CTRL MOD. - FOG LAMPS FRONT (LEFT)	
22	CBP08 (GY-YE)	20	FUSE - 8 OR CIRCUIT BREAKER	
23	*	*	not used	
24	*	*	not used	
25	CAT17 (BN)	16	RELAY - TRAILER TOW PARK LAMPS (COLOR TO SAE 1239)	
26	CBP01 (BU)	22	FUSE - 1 OR CIRCUIT BREAKER	
27	CBP06 (WH-BU)	20	FUSE - 6 OR CIRCUIT BREAKER	
28	CBP09 (VT-GY)	20	FUSE - 9 OR CIRCUIT BREAKER	
29	*	*	not used	
30	CLF16 (BU-WH)	16	SWITCH - BEAM LOW	
31	*	*	not used	
32	CDC33 (VT-GN)	12	SWITCH - IGNITION # RUN: ACCESSORY	

C2280B (Part 2)

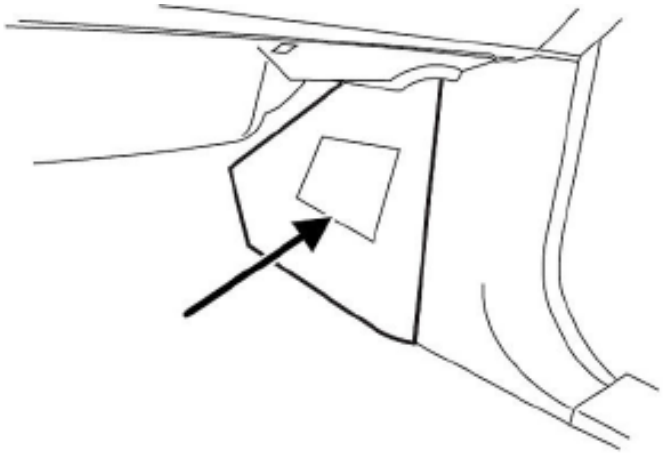
C2280C

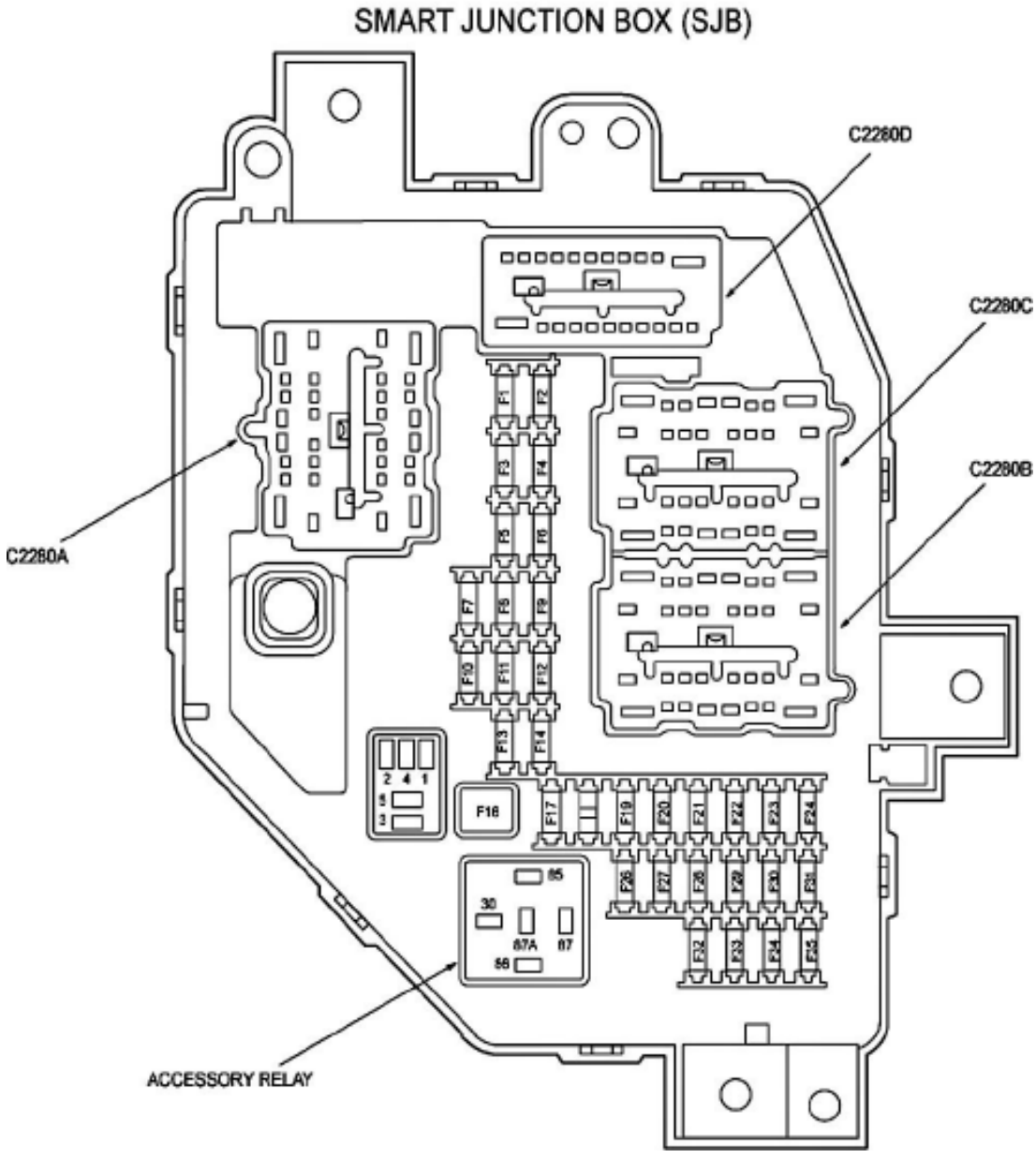
Connector: C2280D	Description:	Harness:	Base Part #:
	SMART JUNCTION BOX (SJB)	14401	14B476



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	*	*	not used	
3	CPL31 (WH)	20	SWITCH - LATCH PASSENGER # AJAR	
4	CPL36 (GN)	20	SWITCH - LATCH REAR DRIVER SIDE # AJAR (INCL.SLIDING DOOR)	
5	CLS30 (VT-WH)	18	RELAY - PARK LAMP	
6	CPL39 (YE)	20	SWITCH - LATCH REAR PASSENGER SIDE # AJAR (INCL.SLIDING DOOR)	
7	CCB15 (BN-GN)	22	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL CLOSED	
8	*	*	not used	
9	CLF21 (GY-VT)	18	SWITCH - FOG LAMPS FRONT	
10	CLN27 (WH-BN)	18	CTRL MOD. - DIMMER INSTRUMENT	
11	*	*	not used	
12	SRH01 (YE-RD)	20	RELAY - HORN	
13	*	*	not used	
14	*	*	not used	
15	*	*	not used	
16	*	*	not used	
17	*	*	not used	
18	*	*	not used	
19	*	*	not used	
20	VDB04 (WH-BU)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED HIGH	
21	VDB05 (WH)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED LOW	
22	*	*	not used	

C2280D

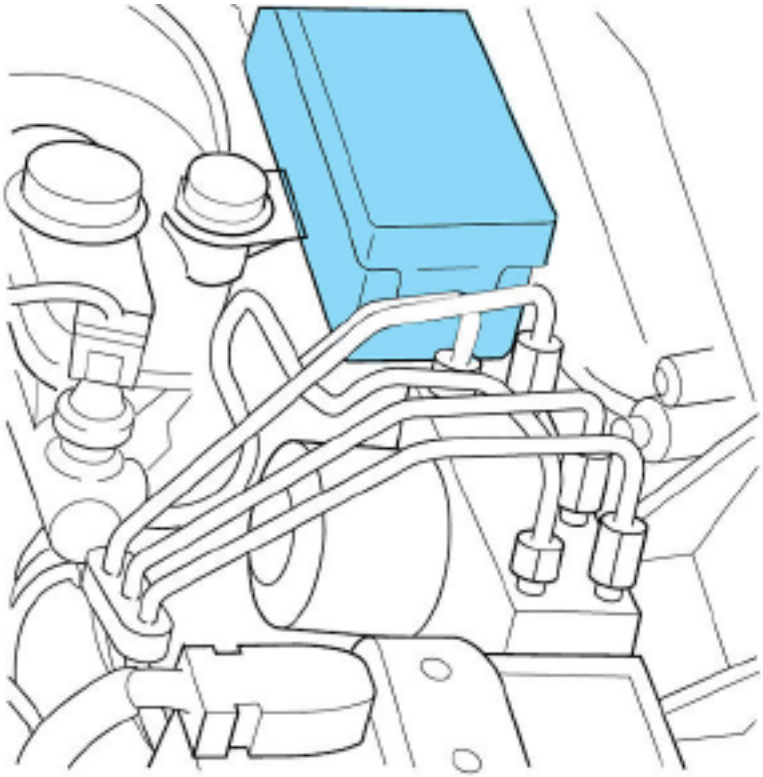



SMART JUNCTION BOX (SJB)
C2280D
C2280C
C2280B
C2280A
F1
F2
F3
F4
F5
F6
F7
F8
F9
F10
F11
F12
F13
F14
F16
F17
F19
F20
F21
F22
F23
F24
F26
F27
F28
F29
F30
F31
F32
F33
F34
F35
2 4 1
3
30
85
87A
87
86
ACCESSORY RELAY

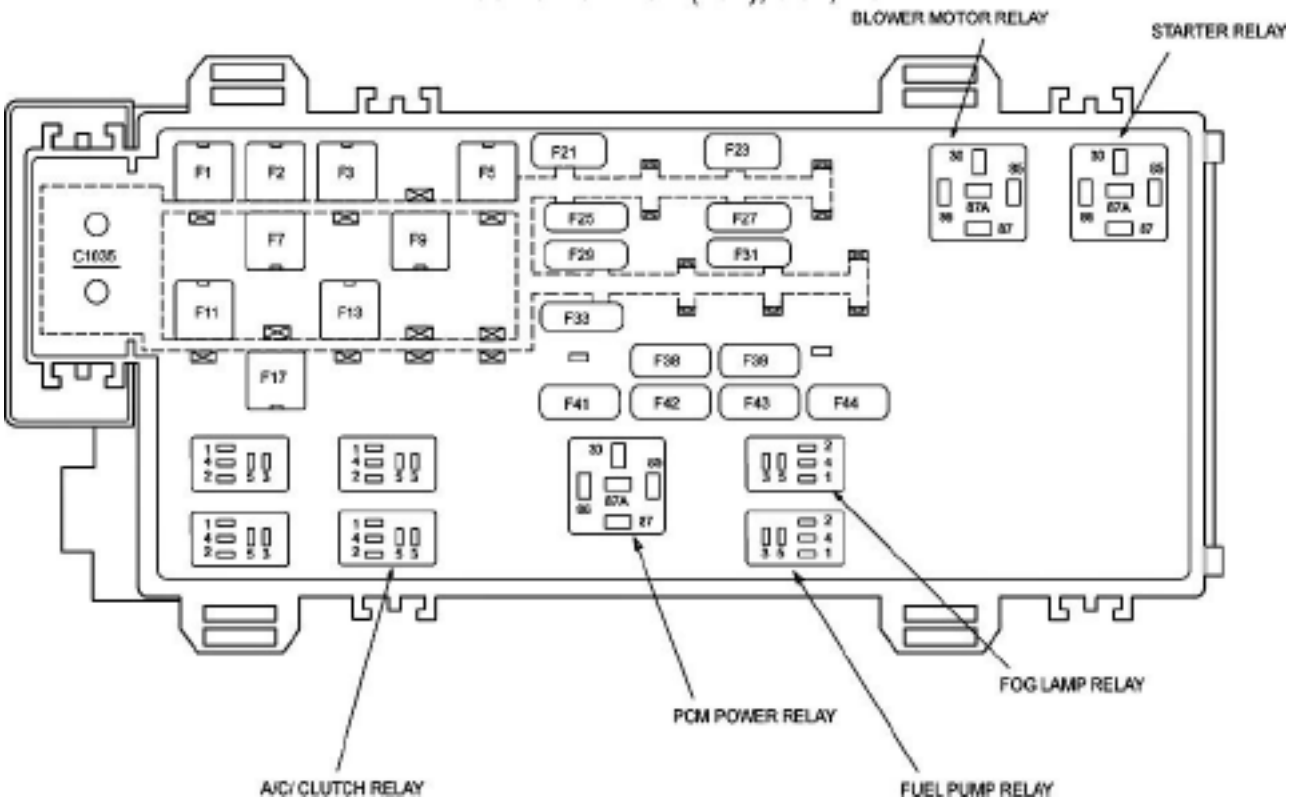
Relay Box: Application and ID Smart Junction Box

FUSE	AMPS	Circuits Protected
F1	5A	Illumination dimmer
F2	10A	Trailer tow connector - Park
F3	10A	Headlamp, right (Low beam lamp feed)
F4	10A	Headlamp, left (Low beam lamp feed)
F5	5A	Windshield wiper module
F6	10A	Audio unit, Door lock switch illumination
F7	5A	Not Used
F8	10A	Restraints Control Module (RCM), Occupant Classification System Module (OCSM), Passenger Air bag Deactivation (PAD) Indicator
F9	5A	Instrument Cluster (IC), Air bag indicator
F10	10A	4X4 control module, Instrument Cluster (IC)
F11	10A	Smart Junction Box (SJB), logic power
F12	15A	Subwoofer amplifier with audiophile, Satellite radio receiver
F13	15A	Interior lamp relay, Horn relay
F14	15A	High beam lamp feed to High beam indicator, Headlamp, right, Headlamp, left
F16	30A	Accessory relay (Power windows)
F17	15A	Indicator flasher relay
F18	-	Not Used

FUSE	AMPS	Circuits Protected
F19	20A	Brake pedal position switch (Stoplamps)
F20	10A	Transmission control switch, Digital Transmission Range (TR) sensor, Speed control servo, Anti-lock Brake System (ABS) module, Indicator flasher relay, Reversing lamps switch, Speed control On/Off switch, Speed control Set/Resume switch
F21	5A	Digital Transmission Range (TR) sensor, Starter relay, Powertrain Control Module (PCM)
F22	5A	Audio unit
F23	30A	Main light switch, Multifunction switch
F24	20A	Audio unit
F26	2A	Deactivator switch
F27	10A	Blend door actuator, Climate control assembly
F28	15A	4X4 control module
F29	20A	Cigar lighter, front, Data Link Connector (DLC)
F30	5A	Exterior rear view mirror switch
F31	20A	Park lamp relay
F32	5A	Brake pedal position switch (logic power), Brake shift interlock
F33	5A	Instrument Cluster (IC), Neutral tow indicator
F34	20A	Power point
F35	15A	Door lock/unlock relay, Driver door unlock relay



BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L



Relay Box: Application and ID Battery Junction Box

FUSE	AMPS	Circuits Protected
F1	40A	Smart Junction Box (SJB)
F2	-	Not Used
F3	40A	Smart Junction Box (SJB)
F4	-	Not Used
F5	50A	Smart Junction Box (SJB)
F6	-	Not Used
F7	30A	Starter Relay
F8	-	Not Used
F9	40A	Ignition Switch
F10	-	Not Used
F11	30A	PCM power relay
F12	-	Not Used
F13	30A	Blower motor relay
F14	-	Not Used
F15	-	Not Used
F16	-	Not Used
F17	40A	Anti-lock Brake System (ABS) module
F18	-	Not Used
F19	-	Not Used
F20	-	Not Used
F21	10A	Powertrain Control Module (PCM), Evaporative emission (EVAP) canister vent valve
F22	-	Not Used
F23	30A	Fuel Pump Relay, Fuel injectors
F24	-	Not Used

FUSE	AMPS	Circuits Protected
F25	10A	A/C clutch relay
F26	-	Not Used
F27	20A	4X4 control module
F28	-	Not Used
F29	30A	Windshield wipers/washer
F30	-	Not Used
F31	15A	Fog lamp relay
F32	-	Not Used
F33	30A	Anti-lock Brake System (ABS) module
F34	-	Not Used
F35	-	Not Used
F36	-	Not Used
F37	-	Not Used
F38	7.5A	Trailer tow connector - Right turn
F39	15A	Powertrain Control Module (PCM)
F40	-	Not Used
F41	10A	*5R44E Transmission **5R55E Transmission
F42	7.5A	Trailer tow connector - Left turn
F43	20A	EVAP canister purge valve, Heated Positive Crankcase Ventilation (PCV) valve, Idle Air Control (IAC) valve, Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor, Heated Oxygen Sensor (HO2S) #11, Heated Oxygen Sensor (HO2S) #12, Heated Oxygen Sensor (HO2S) #21, Heated Oxygen Sensor (HO2S) #22, EGR vacuum regulator solenoid valve, A/C relay coil
F44	15A	Ignition coil, *Ignition transformer capacitor 1

Low Tire Pressure Indicator: Testing and Inspection

Tire Pressure Monitoring System (TPMS) Indicator and Message Center Messages

The TPMS indicator and vehicle message center (if equipped) sometimes displays faults that cannot be resolved by the customer. Treat these messages as TPMS faults that must be serviced.

Tire Pressure Monitoring System (TPMS) Indicator Illuminates Continuously

NOTE: If the spare tire is in use, the damaged road tire must be repaired and installed on the vehicle to restore complete TPMS functionality before carrying out any diagnosis.

NOTE: For vehicles with different front and rear tire pressures (such as E-Series and certain F-Series), the tire pressure sensors must be trained following a tire rotation. Failure to train the sensors will cause the TPMS indicator to illuminate.

For vehicles with the same tire pressures for front and rear tires, tire rotation will not affect the system.

1. The TPMS indicator remains on continuously for the following condition:

^ Low Tire Pressure - The TPMS indicator is illuminated solid and the message center displays LOW TIRE PRESSURE (if equipped). This is displayed when any of the tire pressures are low. When this condition exists, the tire pressure must be adjusted to the recommended cold pressure as indicated on the vehicle certification label.

2. NOTE: The TPMS sensors do not transmit when the vehicle is stationary. If the vehicle has been stationary for more than 30 minutes, it will be

necessary to wake up the sensors so they will transmit the latest tire pressure information to the SJB.

If the vehicle has been stationary for more than 30 minutes, refer to Tire Pressure Monitoring System (TPMS) Sensor Activation procedure.

Tire Pressure Monitoring System (TPMS) Indicator Flashes

The TPMS indicator flashes for 70 seconds and then remains ON solid when the ignition key is turned to the ON position for the following conditions: 1. Tire Pressure Sensor Fault - If equipped, the message center will display TIRE SENSOR FAULT when a tire pressure sensor is malfunctioning.

GO to Symptom Chart. See: Wheels and Tires/Tire Monitoring System/Testing and Inspection/Symptom Related Diagnostic Procedures

2. No communication with the SJB (TPMS is integral to the SJB) - The TPMS indicator is illuminated when the instrument cluster has received no

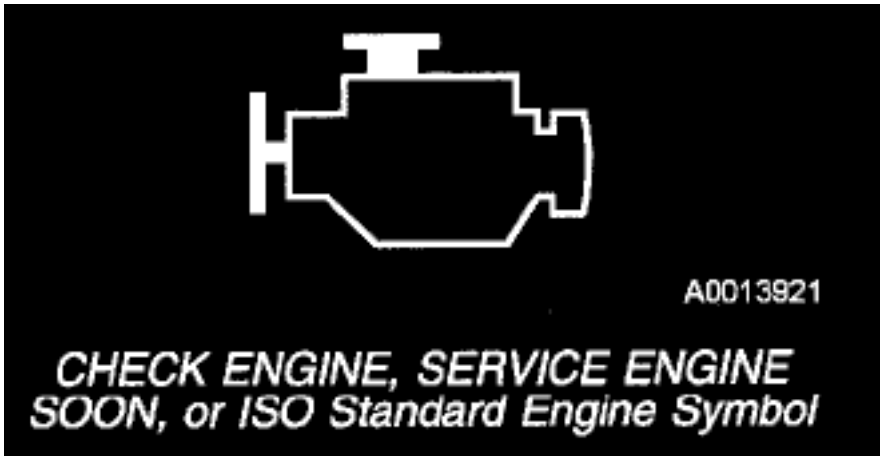
signals from the SJB for more than 5 seconds. If equipped, the message center displays TIRE MONITOR FAULT. GO to Symptom Chart. See: Wheels and Tires/Tire Monitoring System/Testing and Inspection/Symptom Related Diagnostic Procedures

3. Tire Pressure Monitor Fault - If equipped, the message center will display TIRE MONITOR FAULT when the tire pressure monitoring system is

malfunctioning or communication with the instrument cluster has been lost. GO to Symptom Chart. See: Wheels and Tires/Tire Monitoring System/Testing and Inspection/Symptom Related Diagnostic Procedures

Maintenance Required Lamp/Indicator: Service and Repair

This vehicle is not equipped with a Maintenance Required Lamp/Indicator.



Malfunction Indicator Lamp: Description and Operation

MALFUNCTION INDICATOR LAMP (MIL)

Check Engine, Service Engine Soon, Or ISO Standard Engine Symbol

The MIL notifies the driver that the powertrain control module (PCM) has detected an on board diagnostic (OBD) emission-related component or system concern. When this occurs, an OBD diagnostic trouble code (DTC) sets.

- The MIL is located in the instrument cluster and is labeled CHECK ENGINE, SERVICE ENGINE SOON or the international standards organization (ISO) standard engine symbol.

- The MIL is illuminated during the instrument cluster prove out for approximately 4 seconds.

- The MIL remains illuminated after instrument cluster prove out if: -

an emission-related concern and DTC exists.

- the PCM does not send a control message to the instrument cluster (applications with the MIL controlled through the communication link).

- the PCM is operating in the hardware limited operation strategy (HLOS).

- The MIL remains off during the instrument cluster prove out if an indicator or instrument cluster concern is present.

- To turn off the MIL after a repair, a reset command from the scan tool must be sent, or 3 consecutive drive cycles must be completed without a concern.

- For all MIL concerns, go to Symptom Charts. See: Powertrain Management/Computers and Control Systems/Testing and Inspection/Symptom Related Diagnostic Procedures

- If the MIL flashes at a steady rate, a severe misfire condition may exist.

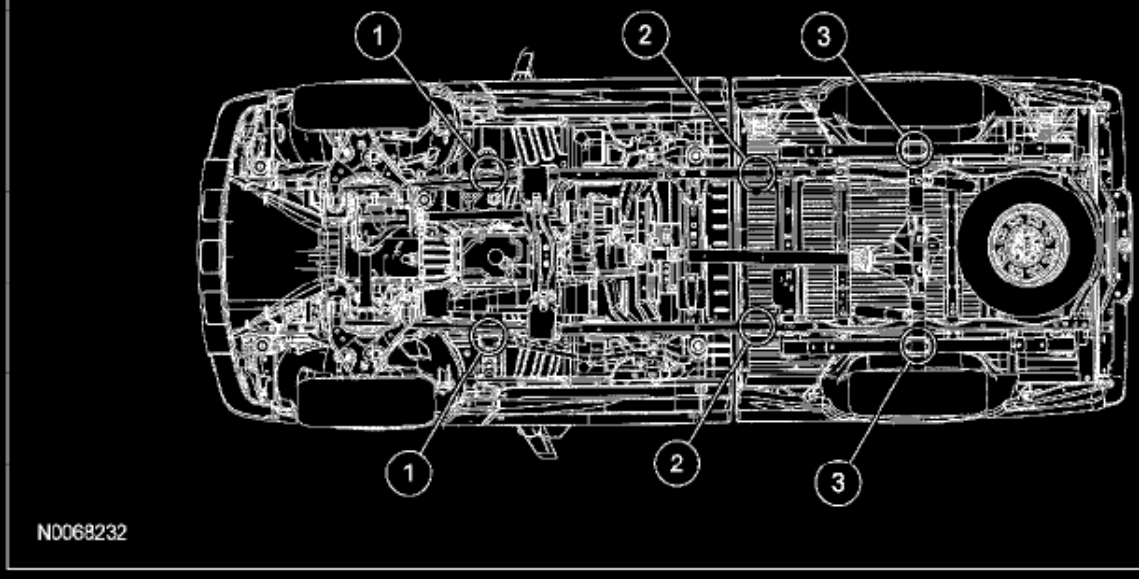
- If the MIL flashes erratically, the PCM can reset while cranking if the battery voltage is low.

- The MIL flashes after a period of time with the key in the RUN position (engine not running) if DTC P1000 is set.

Oil Change Reminder Lamp: Service and Repair

This vehicle is not equipped with an Oil Change Reminder Lamp.

Jacking and Lifting Locations — Four Wheel Drive (4WD)



Item	Description
1	Front jacking and lifting locations
2	Rear lifting locations
3	Rear jacking locations

Vehicle Lifting: Description and Operation

JACKING AND LIFTING

WARNING:

- Block all wheels, set the parking brake and firmly apply the service brake to reduce the risk of vehicle movement during this procedure. Failure to follow these instructions may result in serious personal injury.

- Only raise the vehicle when positioned on a hard, level surface. Attempting to raise the vehicle on an uneven or soft surface may result in vehicle slipping or falling from the jack or jackstand. Failure to follow this instruction may result in serious personal injury.

- Never get underneath a vehicle that is supported only by a jack. The jack could unintentionally lower. Always support vehicle with floor stands. Failure to follow these instructions may result in serious personal injury.

CAUTION:

- The jack provided with the vehicle is intended to be used in an emergency for changing a deflated tire. To avoid damage to the vehicle, never use the jack to hoist the vehicle for any other purpose.

- Do not attempt to use jack pressure on either the front bumper or the rear bumper of any vehicle. Damage to bumper covers will occur.

- To prevent possible damage to the underbody, do not drive the vehicle onto the drive-on lift without first checking for possible interference.

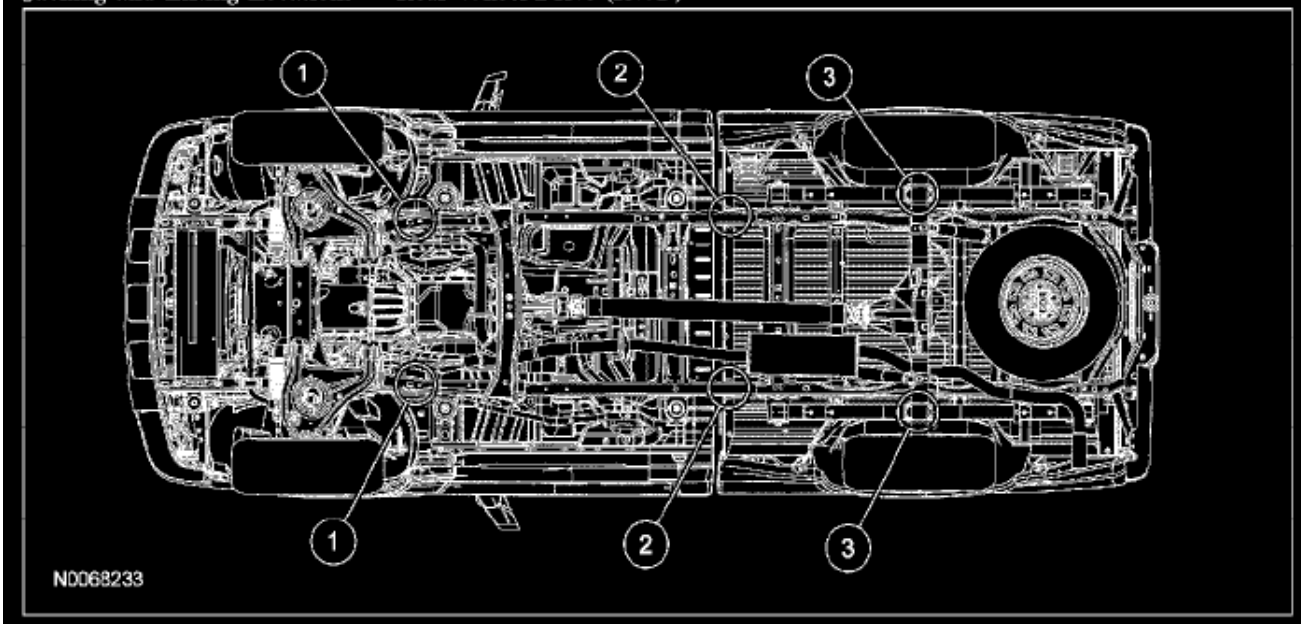
- Make sure the jack has an adequate lifting capacity for the vehicle being lifted, or damage to the vehicle may occur.

- When raising a vehicle on a twin-post hoist, use care when positioning the vehicle so that the hoisting forks do not interfere with the suspension components, mounting brackets or stabilizer mounting brackets, if so equipped. In addition, use care in hoist positioning to avoid possible damage to the axle carrier or rear cover.

- Damage to the suspension, exhaust or steering linkage components may occur if care is not exercised when positioning the hoist adapters prior to lifting the vehicle.

Jacking and Lifting Locations - Four Wheel Drive (4WD)

Jacking and Lifting Locations — Rear Wheel Drive (RWD)



Item	Description
1	Front jacking and lifting locations
2	Rear lifting locations
3	Rear jacking locations

Jacking and Lifting Locations - Rear Wheel Drive (RWD)

Special Tool(s)

ST2941-A	Activation Tool, Tire Pressure Monitor 204-363
ST2634-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Tire Pressure Sensor: Testing and Inspection Tire Pressure Monitoring System (TPMS) Sensor Training

Tire Pressure Monitoring System (TPMS) Sensor Training

NOTE: If the vehicle has been stationary for more than 30 minutes, the sensors will go into a "sleep mode" to conserve battery power. It will be necessary to wake them up so they will transmit the latest tire pressure information to the smart junction box (SJB). For additional information, refer to Tire Pressure Monitoring System (TPMS) Sensor Activation.

NOTE: The tire pressure sensor training procedure must be done on a single vehicle, in an area without radio frequency noise and at least 1 m (3 ft) away from other vehicles equipped with tire pressure monitoring system (TPMS). Radio frequency noise is generated by electrical motors and appliance operation, cellular telephones, remote transmitters, power inverters and portable entertainment equipment.

NOTE: If a sensor does not respond to the activation tool, attempt to activate the same sensor with the activation tool. If the sensor still does not respond, move the vehicle to rotate the wheels at least 1/4 of a turn and attempt to activate the same sensor again.

NOTE: The SJB has a 2-minute time limit between sensor responses. If the SJB does not recognize any 1 of the 4 tire pressure sensors during this time limit, the horn will sound twice and the message center (if equipped) will display TIRE NOT TRAINED REPEAT and the entire procedure must be repeated.

1. NOTE: For vehicles with different front and rear tire pressures (such as the E-Series and certain F-Series), the tire pressure sensors must be

trained following a tire rotation. Failure to train the sensors will cause the TPMS indicator to illuminate. For vehicles with the same tire pressure for front and rear tires, tire rotation will not affect the system.

Turn the ignition switch to the OFF position, then press and release the brake pedal.

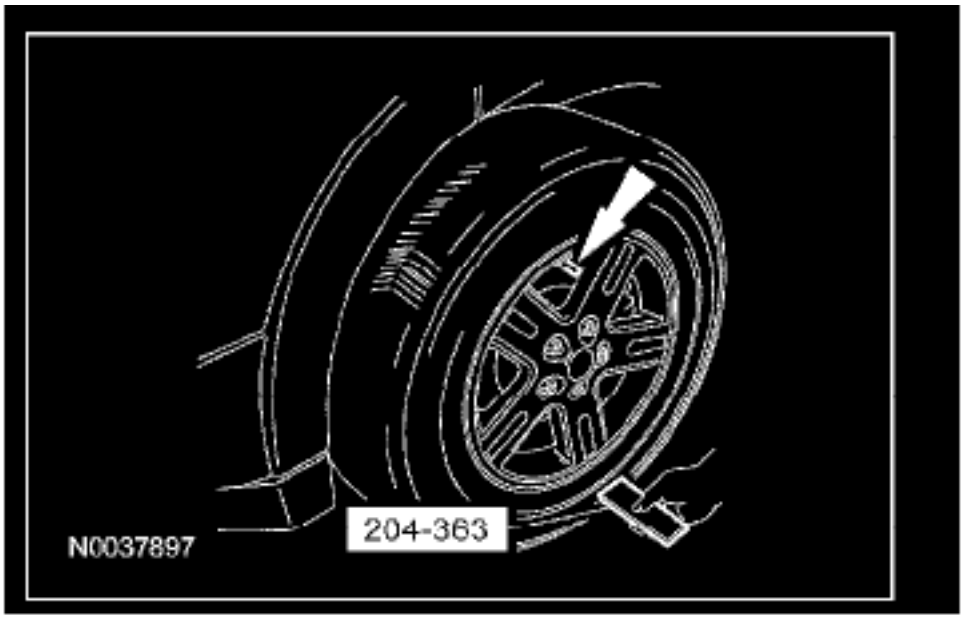
2. Cycle the ignition switch from the OFF position to the RUN position 3 times, ending in the RUN position. 3. Press and release the brake pedal. 4. Turn the ignition switch to the OFF position. 5. Turn the ignition switch from the OFF position to the RUN position 3 times, ending in the RUN position.

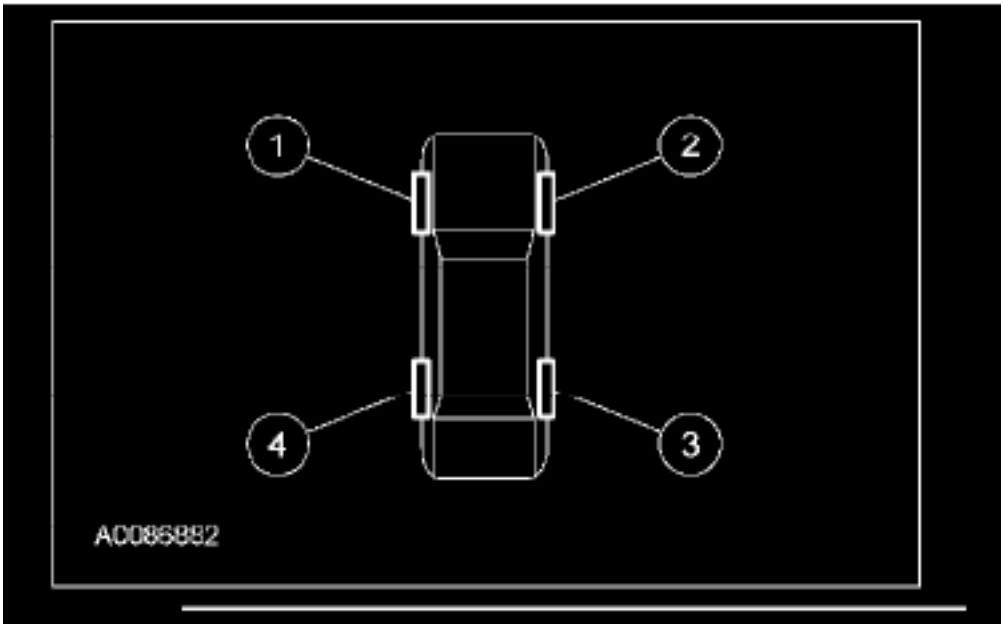
^ The horn will sound once and the TPMS indicator will flash if the training mode has been entered successfully. If equipped, the message center will display TRAIN LF TIRE.

6. NOTE: It may take up to 6 seconds to activate a tire pressure sensor. During this time, the activation tool must remain in place 180 degrees from

the valve stem.

Place the activation tool on the LF tire sidewall opposite (180 degrees) from the valve stem. Press and release the test button on the special tool. The horn will sound briefly to indicate that the tire pressure sensor has been recognized by the SJB.





7. Within 2 minutes of the horn sounding, place the activation tool on the RF tire sidewall opposite (180 degrees) from the valve stem and press and

release the test button to train the RF tire pressure sensor.

8. NOTE: Do not wait more than 2 minutes between training each sensor or the SJB will time out and the entire procedure must be repeated.

Repeat Step 7 for the RR and LR tires. ^

The procedure is completed after the last tire has been trained. When the training procedure is complete, the message center (if equipped) will display TIRE TRAINING COMPLETE.

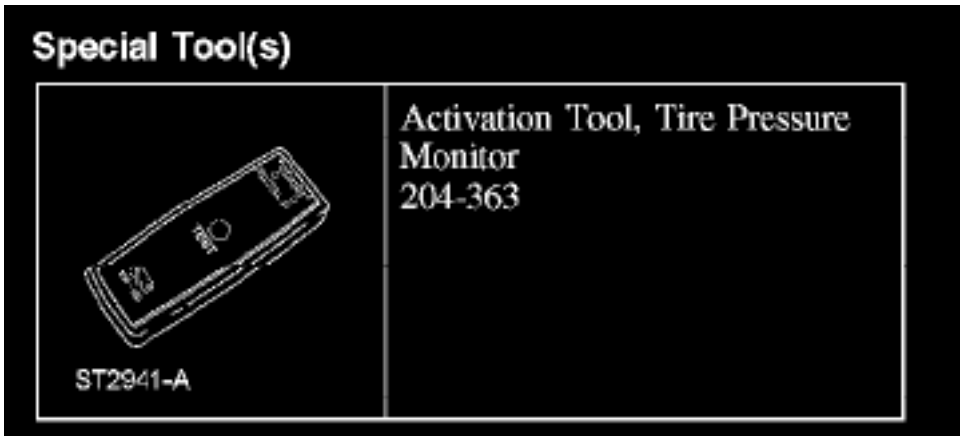
^ For vehicles not equipped with a message center, successful completion of the training procedure will be verified by turning the ignition switch to the OFF position without the horn sounding. If the horn sounds twice when the switch is turned to the OFF position, the training procedure was not successful.

9. Using the scan tool, locate the updated TPMS sensor IDs trained to the SJB and document them on the applicable warranty claim.

10. NOTE: This step is required to clear DTC C2780, cause the SJB to exit the manufacturing mode and to make sure there are no other concerns

with a newly programmed SJB.

If the sensors are being trained due to the installation of a new SJB, clear any DTCs and perform the SJB on-demand self test.



Tire Pressure Sensor: Testing and Inspection Tire Pressure Monitoring System (TPMS) Sensor Activation

Tire Pressure Monitoring System (TPMS) Sensor Activation

NOTE: The tire pressure sensors will go into a 14 sleep mode" after 30 minutes of inactivity to conserve battery power. The sensors do not transmit information while in sleep mode, it will be necessary to wake them up so they will transmit the latest tire pressure information.

1. Turn the ignition switch to the ON position. 2. Position the tire pressure monitor activation tool against the LF tire sidewall 180 degrees from the tire valve stem.

3. NOTE: The activation tool will provide feedback in the form of a flashing green light and a beep sound for each successful response from a tire

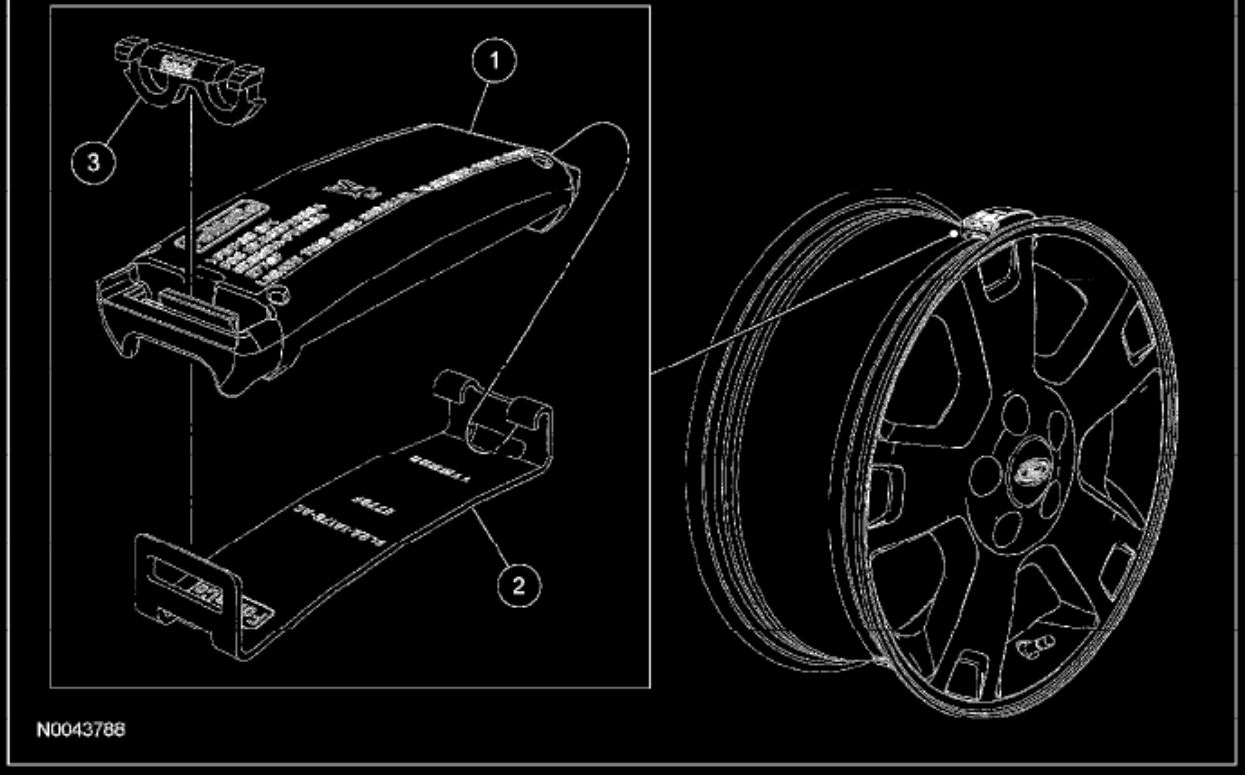
pressure sensor.

Press the test button on the activation tool to activate the sensor, activate the sensor at least 2 times.

4. Repeat Steps 2 and 3 for the remaining tires. 5. If the tire pressure monitoring system (TPMS) indicator remains illuminated after adjusting and activating each sensor, refer to the Symptom Chart

in Diagnosis and Testing.

Tire Pressure Monitoring System (TPMS) Sensor



Item	Part Number	Description
1	1A150/1A189	Tire pressure sensor/sensor kit
2	1A175	Sensor cradle

(Continued)

Item	Part Number	Description
3	14C202	Locking clip (also part of 1A189)

Tire Pressure Sensor: Service and Repair Tire Pressure Monitoring System (TPMS) Sensor

Tire Pressure Monitoring System (TPMS) Sensor

Tire Pressure Monitoring System (TPMS) Sensor

Disassembly

WARNING: The tire pressure monitoring system (TPMS) sensor battery may release hazardous chemicals if exposed to extreme mechanical damage. If these chemicals contact the skin or eyes, flush immediately with water for a minimum of 15 minutes and get prompt medical attention. If any part of the battery is swallowed, contact a physician immediately. When disposing of TPMS sensors, follow the correct procedures for hazardous material disposal. Failure to follow these instructions may result in serious personal injury.

NOTE: Tire pressure sensors are equipped with Lithium-ion batteries and must be disposed of accordingly.

NOTE: Tire pressure sensors are manufactured in multiple colors based on their application. When installing a new sensor, make sure the color of the sensor being installed matches the color of the sensor that was removed. The different colored sensors are not interchangeable.

NOTE: The sensor can be removed and installed without removing the strap or the cradle.

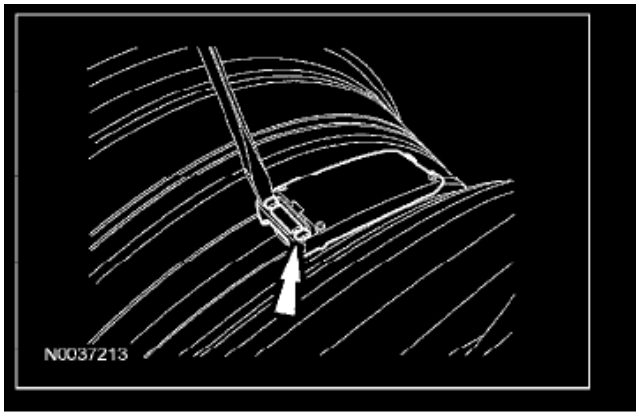
1. CAUTION: The sensor, cradle and strap may be damaged by incorrect tire mounting or dismounting. Dismount the tire only as

instructed.

Remove the tire from the wheel.

2. CAUTION: Do not use a large screwdriver. Apply minimum force during removal or damage to the sensor locking clip may occur.

Using a pocket screwdriver or similar tool, remove the sensor locking clip.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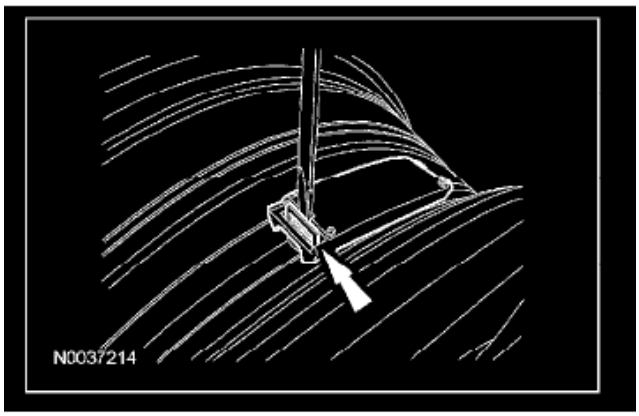
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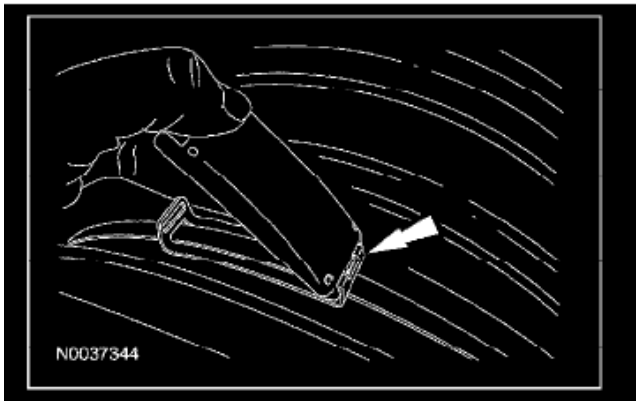
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3. CAUTION: Do not use a large screwdriver. Apply minimum force during removal or damage to the sensor may occur.

Using a pocket screwdriver or similar tool, detach the sensor from the cradle.

4. Remove the sensor.

Assembly

1. CAUTION: Damage to the sensor may occur if excessive force is applied during sensor installation.

NOTE: Make sure the sensor is fully seated into the cradle. The sensor will make a "click" noise when correctly seated.

Position the sensor into the cradle by inserting the hinge end of the sensor into the hook end of the cradle and pushing the opposite end of the sensor down onto the cradle.

2. NOTE: The locking clip can only be fully seated when installed in the correct orientation. If the sensor locking clip cannot be fully inserted, then

the sensor may not be fully seated on the cradle or the locking clip may be inserted backward.

Insert a new locking clip into the sensor.

3. CAUTION: The sensor, cradle and strap may be damaged by incorrect tire mounting or dismounting. Mount the tire only as instructed.

Install the tire onto the wheel.

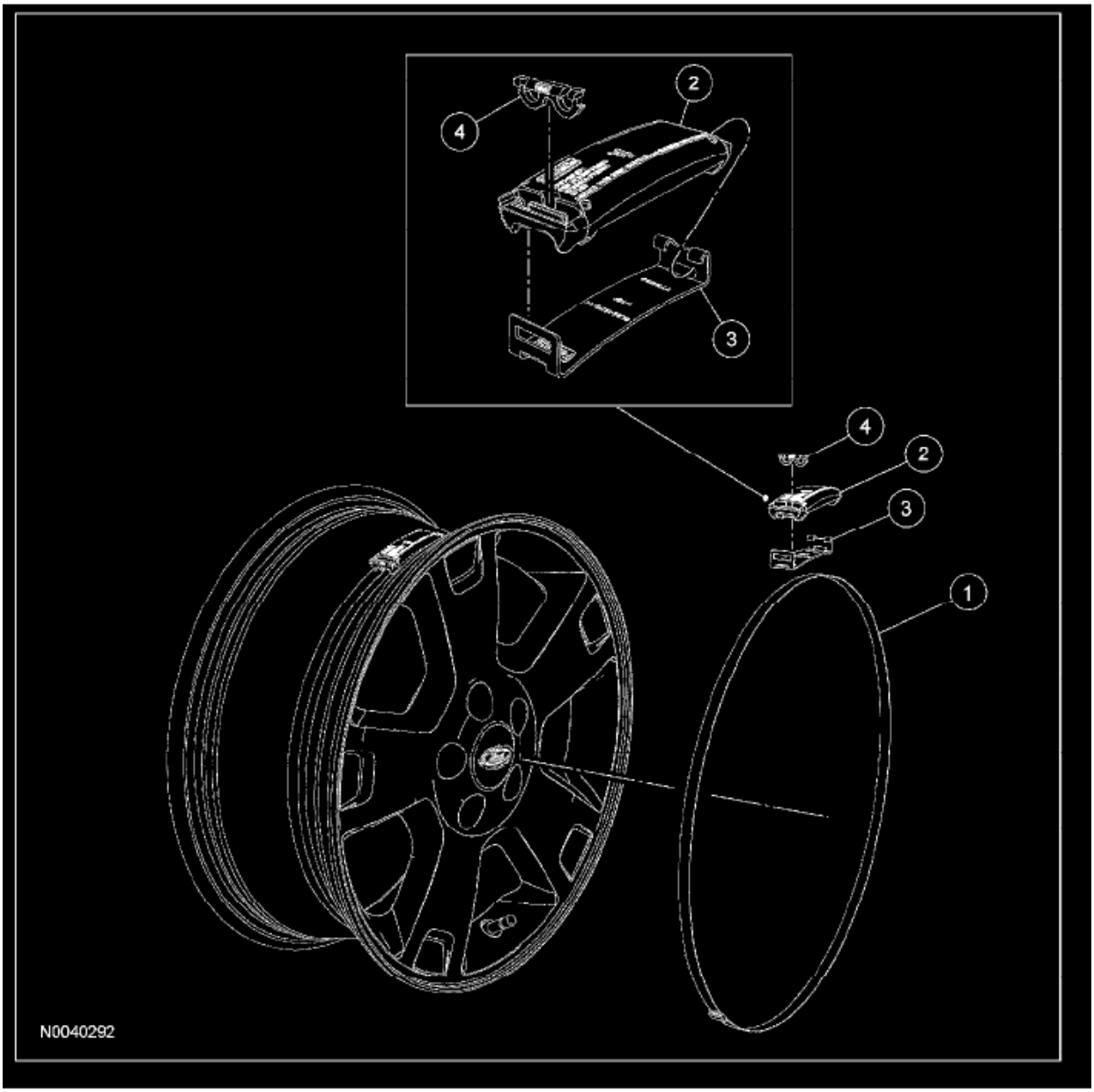
4. NOTE: A new tire pressure sensor is shipped in an off mode (or battery saver mode) and must be turned on before it can be trained. To turn the

sensor on, install it on a wheel, mount the tire and inflate the tire to the recommended inflation pressure. Wait at least 2 minutes, then continue with the sensor training procedure.

Train the tire pressure sensor(s).

Material

Item	Specification
Wheel and Tire Cleaner ZC-27-A or B	—

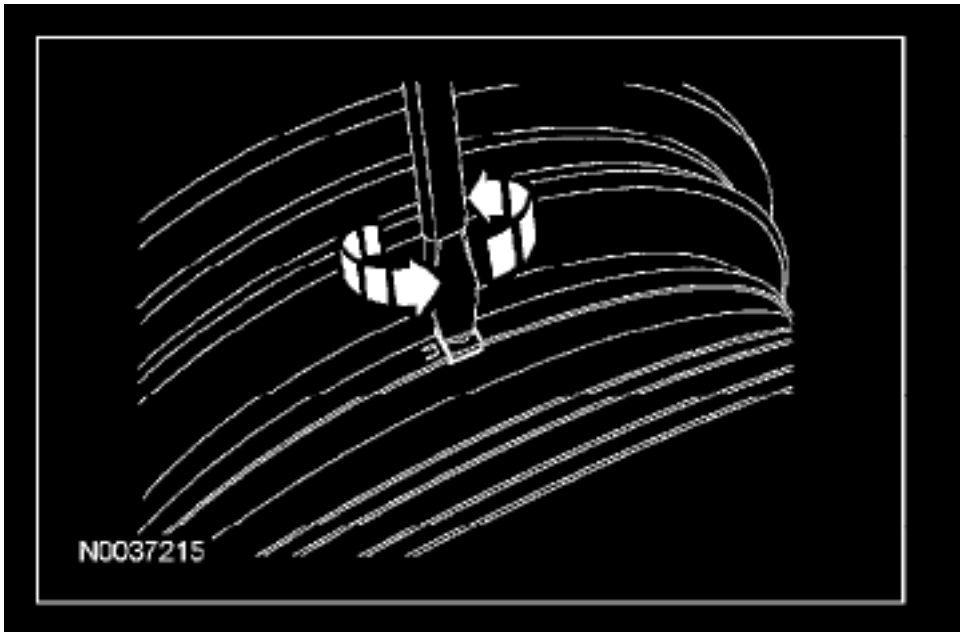


Item	Part Number	Description
1	1A177/1A193	Strap/strap kit
2	1A150/1A189	Tire pressure sensor/sensor kit
3	1A175	Sensor cradle (also part of 1A193)
4	14C202	Locking clip (also part of 1A189)

Tire Pressure Sensor: Service and Repair Tire Pressure Monitoring System (TPMS) Strap and Cradle

Tire Pressure Monitoring System (TPMS) Strap and Cradle

Disassembly



WARNING: The tire pressure monitoring system (TPMS) sensor battery may release hazardous chemicals if exposed to extreme mechanical damage. If these chemicals contact the skin or eyes, flush immediately with water for a minimum of 15 minutes and get prompt medical attention. If any part of the battery is swallowed, contact a physician immediately. When disposing of TPMS sensors, follow the correct procedures for hazardous material disposal. Failure to follow these instructions may result in serious personal injury.

NOTE: Tire pressure sensors are equipped with Lithium-ion batteries and must be disposed of accordingly.

NOTE: Tire pressure sensors are manufactured in multiple colors based on their application. When installing a new sensor, make sure the color of the sensor being installed matches the color of the sensor that was removed. The different colored sensors are not interchangeable.

NOTE: The sensor is available separately, the cradle and strap are available as a strap kit. There are several different strap kits available based on wheel diameter but all strap kits share the same base part number.

1. Remove the tire pressure monitoring system (TPMS) sensor.

2. WARNING: Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.

WARNING: Wear protective gloves when handling components or parts that have pointed or sharp edges. Failure to follow this instruction may result in serious personal injury.

Remove a factory installed strap in the following sequence: 1

Locate the strap buckle and secure the strap to the wheel using duct tape or a similar item, on both sides of the buckle approximately 25 mm (0.98 inch) from the buckle.

2 Using a large screwdriver and a twisting motion, unbuckle the strap.

3 Discard the strap.

3. To remove a dealer installed strap, turn the worm gear screw until the strap is fully released from the worm gear.

^ Discard the strap.

4. NOTE: To aid assembly, mark the location of the cradle prior to disassembly.

Using a screwdriver, or similar tool, remove the cradle by inserting the screwdriver under the cradle and prying up.

Assembly

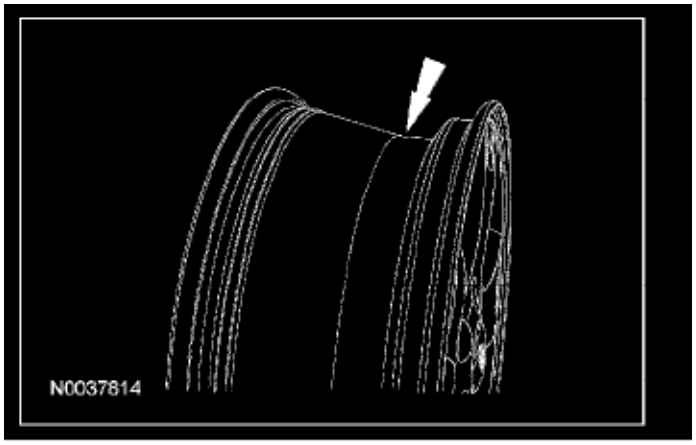
1. NOTE: Make sure the sensor is fully seated into the new cradle. The sensor will make a "click" noise when fully seated.

Position the sensor into the new cradle by inserting the hinge end of the sensor into the hook end of the cradle and pushing the opposite end of the sensor down onto the cradle.

2. CAUTION: Metal scrapers may damage the wheel. Use only plastic or non-metallic scrapers to remove the cradle adhesive strip residue.

NOTE: The sensor and cradle must be installed in the drop well of the wheel, 180 degrees from the valve stem.

Clean the area where the sensor and cradle are to be installed.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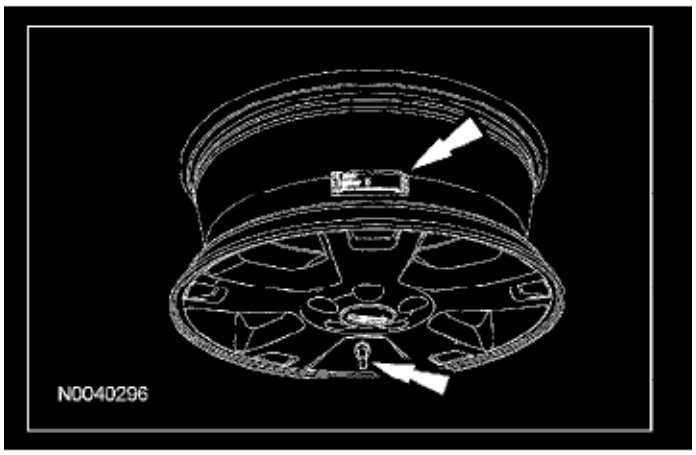
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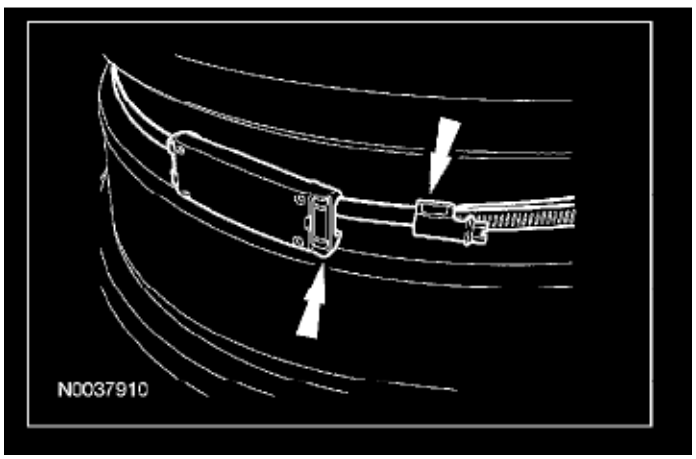
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3. NOTE: The sensor and cradle must be positioned with the hinge side of the sensor on the RH side when viewed from the curb side (beauty side)

of the wheel.

NOTE: The sensor has raised markings indicating how to position the sensor.

Remove the adhesive tape liner from the cradle and position the sensor and cradle into the wheel drop well 180 degrees from the valve stem.

4. Install the tapered end of the strap through the opening of the cradle on the hinge side of the sensor. This will position the worm gear on the

locking clip side of the sensor.

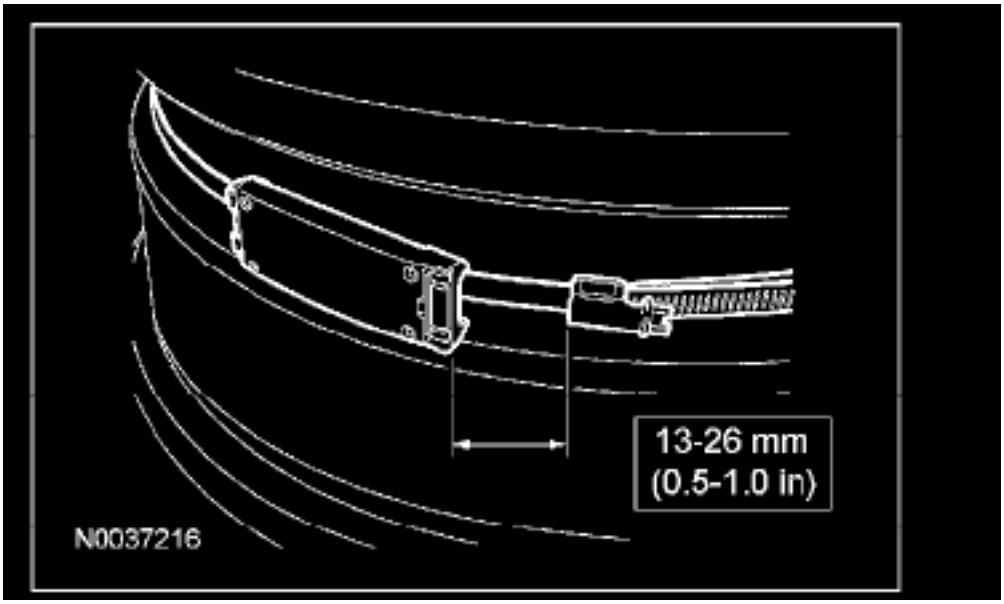
5. CAUTION: Steel wheels have a "high spot" along their circumference. Make sure the strap and sensor are mounted at the lowest spot

possible to avoid damaging the sensor during wheel and tire disassembly and assembly.

NOTE: Keep the strap parallel with the wheel flange while tightening the worm gear.

Position the worm gear 13-26 mm (0.5-1.0 inch) away from the sensor and tighten the worm gear.
^

Tighten to 3 Nm (27 lb-inch).



6. CAUTION: The sensor, cradle and strap may be damaged by incorrect tire mounting or dismounting. Mount the tire only as instructed.

Install the tire onto the wheel.

7. NOTE: A new tire pressure sensor is shipped in an off mode (or battery saver mode) and must be turned on before it can be trained. To turn the

sensor on, install it on a wheel, mount the tire and inflate the tire to the recommended inflation pressure. Wait at least 2 minutes, then continue with the sensor training procedure.

Train the tire pressure sensor(s).

Low Tire Pressure Indicator: Testing and Inspection

Tire Pressure Monitoring System (TPMS) Indicator and Message Center Messages

The TPMS indicator and vehicle message center (if equipped) sometimes displays faults that cannot be resolved by the customer. Treat these messages as TPMS faults that must be serviced.

Tire Pressure Monitoring System (TPMS) Indicator Illuminates Continuously

NOTE: If the spare tire is in use, the damaged road tire must be repaired and installed on the vehicle to restore complete TPMS functionality before carrying out any diagnosis.

NOTE: For vehicles with different front and rear tire pressures (such as E-Series and certain F-Series), the tire pressure sensors must be trained following a tire rotation. Failure to train the sensors will cause the TPMS indicator to illuminate.

For vehicles with the same tire pressures for front and rear tires, tire rotation will not affect the system.

1. The TPMS indicator remains on continuously for the following condition:

^ Low Tire Pressure - The TPMS indicator is illuminated solid and the message center displays LOW TIRE PRESSURE (if equipped). This is displayed when any of the tire pressures are low. When this condition exists, the tire pressure must be adjusted to the recommended cold pressure as indicated on the vehicle certification label.

2. NOTE: The TPMS sensors do not transmit when the vehicle is stationary. If the vehicle has been stationary for more than 30 minutes, it will be

necessary to wake up the sensors so they will transmit the latest tire pressure information to the SJB.

If the vehicle has been stationary for more than 30 minutes, refer to Tire Pressure Monitoring System (TPMS) Sensor Activation procedure.

Tire Pressure Monitoring System (TPMS) Indicator Flashes

The TPMS indicator flashes for 70 seconds and then remains ON solid when the ignition key is turned to the ON position for the following conditions: 1. Tire Pressure Sensor Fault - If equipped, the message center will display TIRE SENSOR FAULT when a tire pressure sensor is malfunctioning.

GO to Symptom Chart. See: Testing and Inspection/Symptom Related Diagnostic Procedures

2. No communication with the SJB (TPMS is integral to the SJB) - The TPMS indicator is illuminated when the instrument cluster has received no

signals from the SJB for more than 5 seconds. If equipped, the message center displays TIRE MONITOR FAULT. GO to Symptom Chart. See: Testing and Inspection/Symptom Related Diagnostic Procedures

3. Tire Pressure Monitor Fault - If equipped, the message center will display TIRE MONITOR FAULT when the tire pressure monitoring system is

malfunctioning or communication with the instrument cluster has been lost. GO to Symptom Chart. See: Testing and Inspection/Symptom Related Diagnostic Procedures

Special Tool(s)

ST2941-A	Activation Tool, Tire Pressure Monitor 204-363
ST2634-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Tire Pressure Sensor: Testing and Inspection Tire Pressure Monitoring System (TPMS) Sensor Training

Tire Pressure Monitoring System (TPMS) Sensor Training

NOTE: If the vehicle has been stationary for more than 30 minutes, the sensors will go into a "sleep mode" to conserve battery power. It will be necessary to wake them up so they will transmit the latest tire pressure information to the smart junction box (SJB). For additional information, refer to Tire Pressure Monitoring System (TPMS) Sensor Activation.

NOTE: The tire pressure sensor training procedure must be done on a single vehicle, in an area without radio frequency noise and at least 1 m (3 ft) away from other vehicles equipped with tire pressure monitoring system (TPMS). Radio frequency noise is generated by electrical motors and appliance operation, cellular telephones, remote transmitters, power inverters and portable entertainment equipment.

NOTE: If a sensor does not respond to the activation tool, attempt to activate the same sensor with the activation tool. If the sensor still does not respond, move the vehicle to rotate the wheels at least 1/4 of a turn and attempt to activate the same sensor again.

NOTE: The SJB has a 2-minute time limit between sensor responses. If the SJB does not recognize any 1 of the 4 tire pressure sensors during this time limit, the horn will sound twice and the message center (if equipped) will display TIRE NOT TRAINED REPEAT and the entire procedure must be repeated.

1. NOTE: For vehicles with different front and rear tire pressures (such as the E-Series and certain F-Series), the tire pressure sensors must be

trained following a tire rotation. Failure to train the sensors will cause the TPMS indicator to illuminate. For vehicles with the same tire pressure for front and rear tires, tire rotation will not affect the system.

Turn the ignition switch to the OFF position, then press and release the brake pedal.

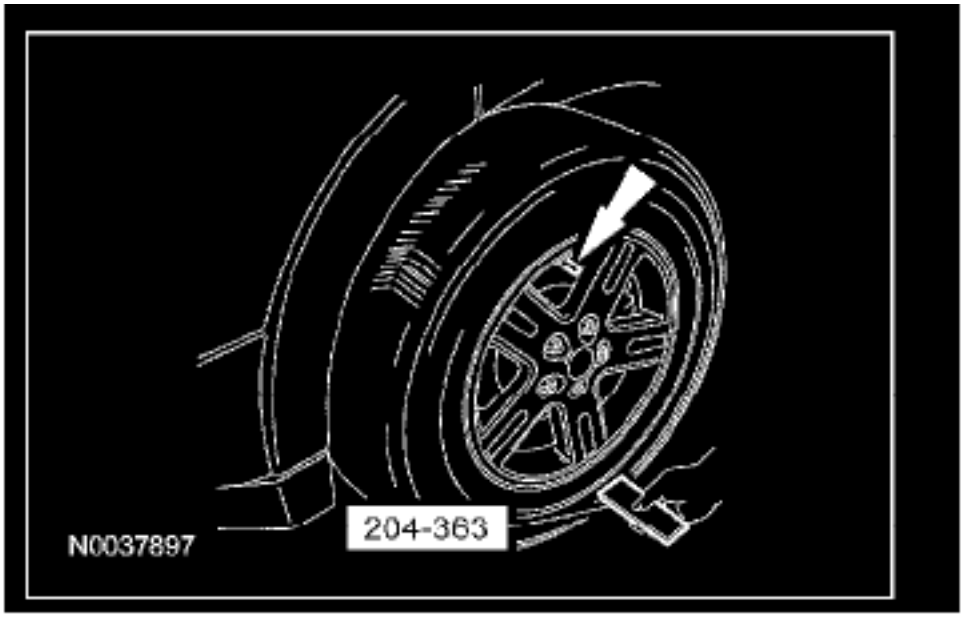
2. Cycle the ignition switch from the OFF position to the RUN position 3 times, ending in the RUN position. 3. Press and release the brake pedal. 4. Turn the ignition switch to the OFF position. 5. Turn the ignition switch from the OFF position to the RUN position 3 times, ending in the RUN position.

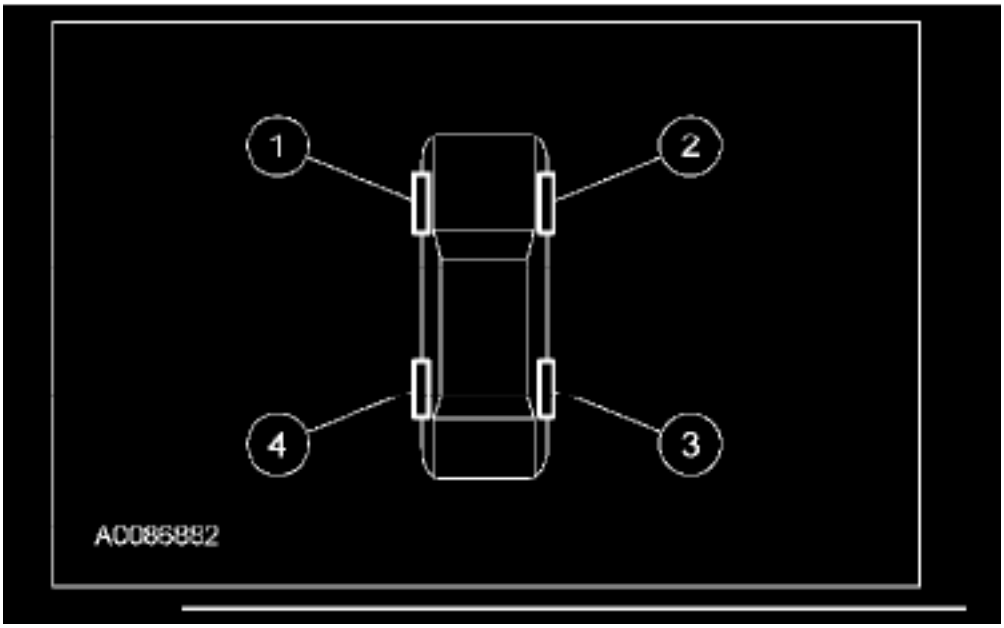
^ The horn will sound once and the TPMS indicator will flash if the training mode has been entered successfully. If equipped, the message center will display TRAIN LF TIRE.

6. NOTE: It may take up to 6 seconds to activate a tire pressure sensor. During this time, the activation tool must remain in place 180 degrees from

the valve stem.

Place the activation tool on the LF tire sidewall opposite (180 degrees) from the valve stem. Press and release the test button on the special tool. The horn will sound briefly to indicate that the tire pressure sensor has been recognized by the SJB.





7. Within 2 minutes of the horn sounding, place the activation tool on the RF tire sidewall opposite (180 degrees) from the valve stem and press and

release the test button to train the RF tire pressure sensor.

8. NOTE: Do not wait more than 2 minutes between training each sensor or the SJB will time out and the entire procedure must be repeated.

Repeat Step 7 for the RR and LR tires. ^

The procedure is completed after the last tire has been trained. When the training procedure is complete, the message center (if equipped) will display TIRE TRAINING COMPLETE.

^ For vehicles not equipped with a message center, successful completion of the training procedure will be verified by turning the ignition switch to the OFF position without the horn sounding. If the horn sounds twice when the switch is turned to the OFF position, the training procedure was not successful.

9. Using the scan tool, locate the updated TPMS sensor IDs trained to the SJB and document them on the applicable warranty claim.

10. NOTE: This step is required to clear DTC C2780, cause the SJB to exit the manufacturing mode and to make sure there are no other concerns

with a newly programmed SJB.

If the sensors are being trained due to the installation of a new SJB, clear any DTCs and perform the SJB on-demand self test.

Special Tool(s)

Activation Tool, Tire Pressure Monitor
204-363

Tire Pressure Sensor: Testing and Inspection Tire Pressure Monitoring System (TPMS) Sensor Activation

Tire Pressure Monitoring System (TPMS) Sensor Activation

NOTE: The tire pressure sensors will go into a 14 sleep mode" after 30 minutes of inactivity to conserve battery power. The sensors do not transmit information while in sleep mode, it will be necessary to wake them up so they will transmit the latest tire pressure information.

1. Turn the ignition switch to the ON position. 2. Position the tire pressure monitor activation tool against the LF tire sidewall 180 degrees from the tire valve stem.

3. NOTE: The activation tool will provide feedback in the form of a flashing green light and a beep sound for each successful response from a tire

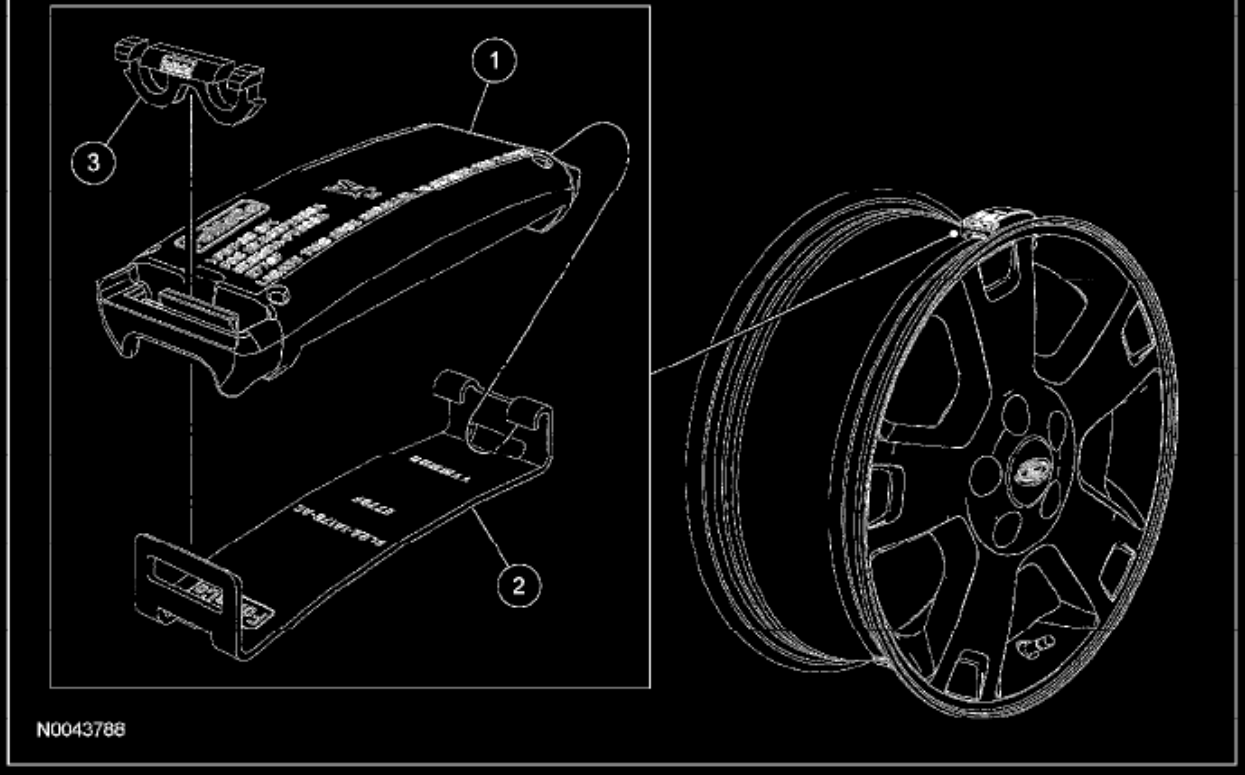
pressure sensor.

Press the test button on the activation tool to activate the sensor, activate the sensor at least 2 times.

4. Repeat Steps 2 and 3 for the remaining tires. 5. If the tire pressure monitoring system (TPMS) indicator remains illuminated after adjusting and activating each sensor, refer to the Symptom Chart

in Diagnosis and Testing.

Tire Pressure Monitoring System (TPMS) Sensor



Item	Part Number	Description
1	1A150/1A189	Tire pressure sensor/sensor kit
2	1A175	Sensor cradle

Item	Part Number	Description
3	14C202	Locking clip (also part of 1A189)

(Continued)

Tire Pressure Sensor: Service and Repair Tire Pressure Monitoring System (TPMS) Sensor

Tire Pressure Monitoring System (TPMS) Sensor

Tire Pressure Monitoring System (TPMS) Sensor

Disassembly

WARNING: The tire pressure monitoring system (TPMS) sensor battery may release hazardous chemicals if exposed to extreme mechanical damage. If these chemicals contact the skin or eyes, flush immediately with water for a minimum of 15 minutes and get prompt medical attention. If any part of the battery is swallowed, contact a physician immediately. When disposing of TPMS sensors, follow the correct procedures for hazardous material disposal. Failure to follow these instructions may result in serious personal injury.

NOTE: Tire pressure sensors are equipped with Lithium-ion batteries and must be disposed of accordingly.

NOTE: Tire pressure sensors are manufactured in multiple colors based on their application. When installing a new sensor, make sure the color of the sensor being installed matches the color of the sensor that was removed. The different colored sensors are not interchangeable.

NOTE: The sensor can be removed and installed without removing the strap or the cradle.

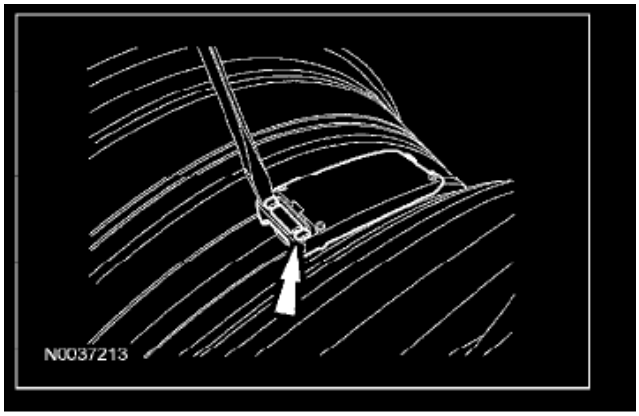
1. CAUTION: The sensor, cradle and strap may be damaged by incorrect tire mounting or dismounting. Dismount the tire only as

instructed.

Remove the tire from the wheel.

2. CAUTION: Do not use a large screwdriver. Apply minimum force during removal or damage to the sensor locking clip may occur.

Using a pocket screwdriver or similar tool, remove the sensor locking clip.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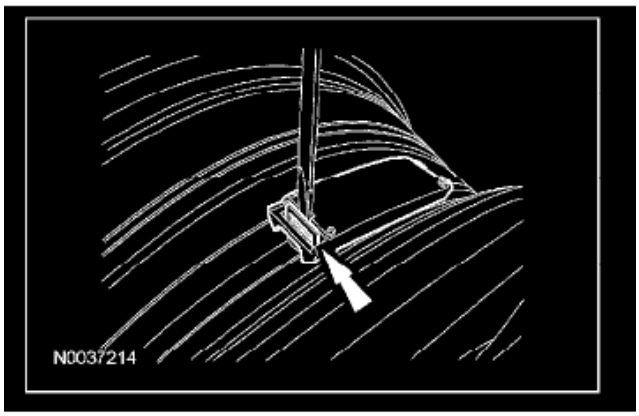
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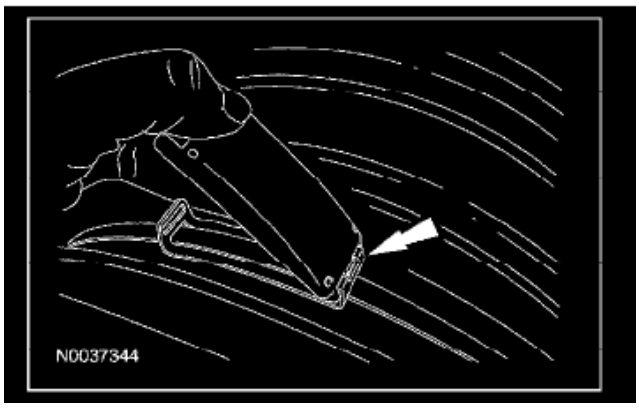
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Using a pocket screwdriver or similar tool, detach the sensor from the cradle.

4. Remove the sensor.

Assembly

1. CAUTION: Damage to the sensor may occur if excessive force is applied during sensor installation.

NOTE: Make sure the sensor is fully seated into the cradle. The sensor will make a "click" noise when correctly seated.

Position the sensor into the cradle by inserting the hinge end of the sensor into the hook end of the cradle and pushing the opposite end of the sensor down onto the cradle.

2. NOTE: The locking clip can only be fully seated when installed in the correct orientation. If the sensor locking clip cannot be fully inserted, then

the sensor may not be fully seated on the cradle or the locking clip may be inserted backward.

Insert a new locking clip into the sensor.

3. CAUTION: The sensor, cradle and strap may be damaged by incorrect tire mounting or dismounting. Mount the tire only as instructed.

Install the tire onto the wheel.

4. NOTE: A new tire pressure sensor is shipped in an off mode (or battery saver mode) and must be turned on before it can be trained. To turn the

sensor on, install it on a wheel, mount the tire and inflate the tire to the recommended inflation pressure. Wait at least 2 minutes, then continue with the sensor training procedure.

Train the tire pressure sensor(s).

Material

Item	Specification
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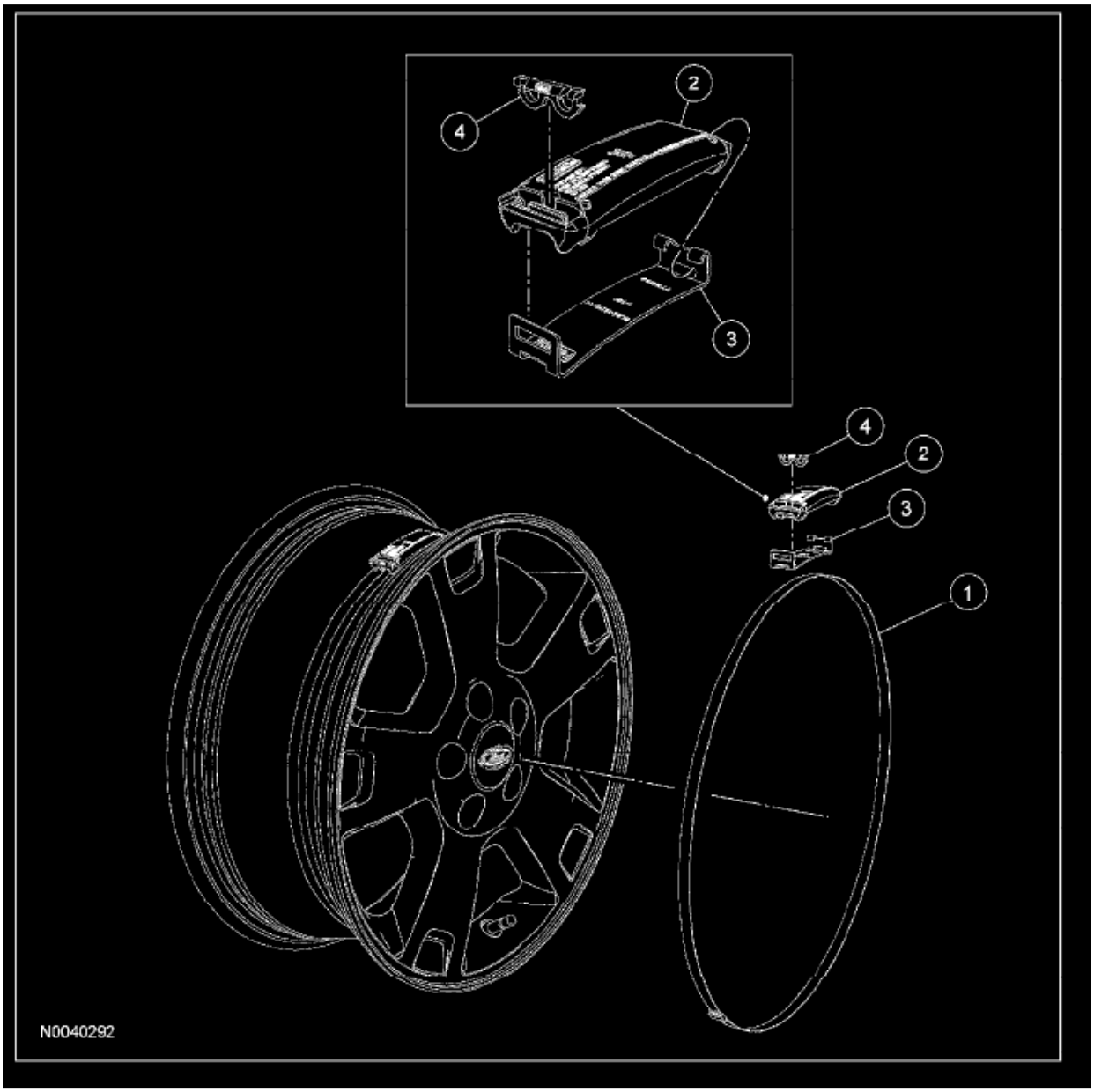

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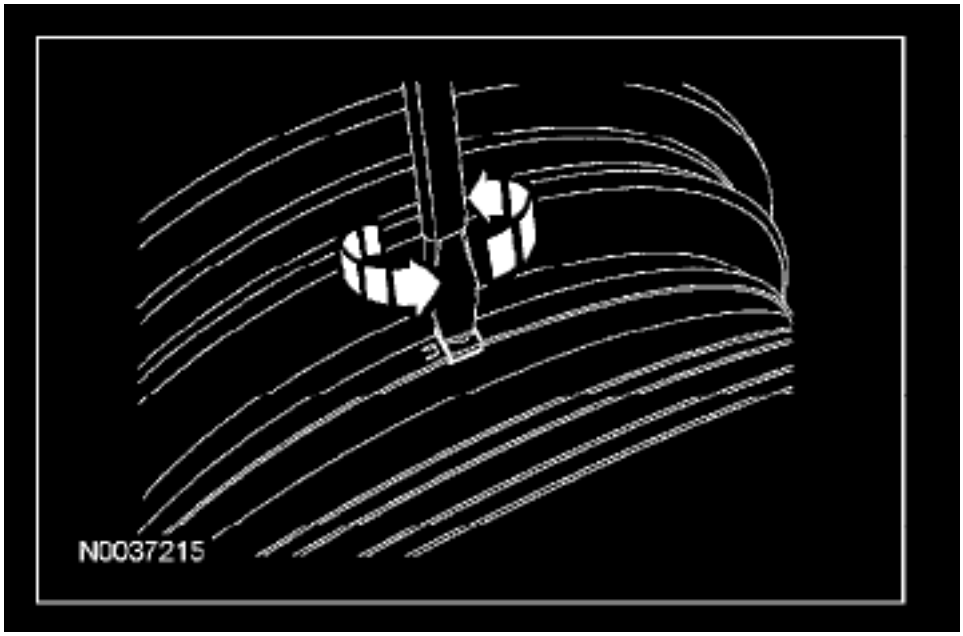
Tire Pressure Sensor: Service and Repair Tire Pressure Monitoring System (TPMS) Strap and Cradle

Tire Pressure Monitoring System (TPMS) Strap and Cradle

Disassembly



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NOTE: The sensor is available separately, the cradle and strap are available as a strap kit. There are several different strap kits available based on wheel diameter but all strap kits share the same base part number.

1. Remove the tire pressure monitoring system (TPMS) sensor.

2. WARNING: Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.

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Remove a factory installed strap in the following sequence: 1

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2 Using a large screwdriver and a twisting motion, unbuckle the strap.

3 Discard the strap.

3. To remove a dealer installed strap, turn the worm gear screw until the strap is fully released from the worm gear.

^ Discard the strap.

4. NOTE: To aid assembly, mark the location of the cradle prior to disassembly.

Using a screwdriver, or similar tool, remove the cradle by inserting the screwdriver under the cradle and prying up.

Assembly

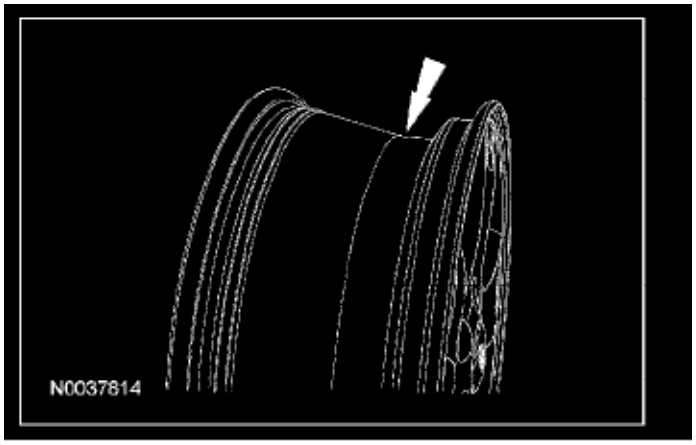
1. NOTE: Make sure the sensor is fully seated into the new cradle. The sensor will make a "click" noise when fully seated.

Position the sensor into the new cradle by inserting the hinge end of the sensor into the hook end of the cradle and pushing the opposite end of the sensor down onto the cradle.

2. CAUTION: Metal scrapers may damage the wheel. Use only plastic or non-metallic scrapers to remove the cradle adhesive strip residue.

NOTE: The sensor and cradle must be installed in the drop well of the wheel, 180 degrees from the valve stem.

Clean the area where the sensor and cradle are to be installed.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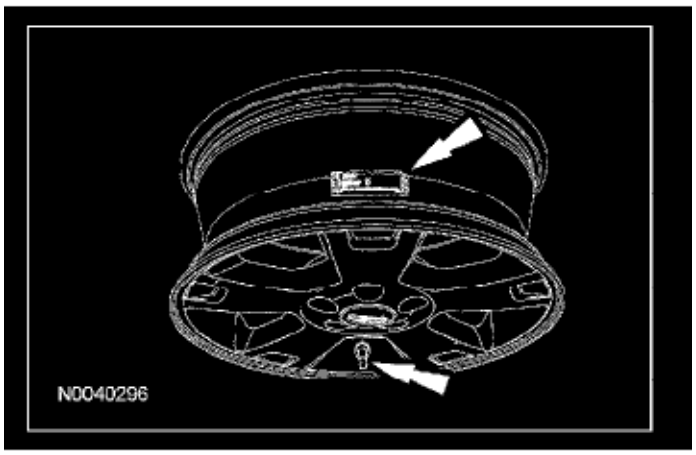
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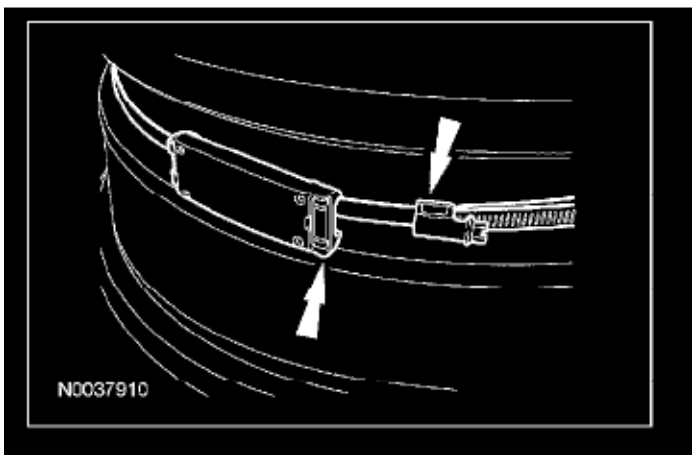

N0037910

3. NOTE: The sensor and cradle must be positioned with the hinge side of the sensor on the RH side when viewed from the curb side (beauty side)

of the wheel.

NOTE: The sensor has raised markings indicating how to position the sensor.

Remove the adhesive tape liner from the cradle and position the sensor and cradle into the wheel drop well 180 degrees from the valve stem.

4. Install the tapered end of the strap through the opening of the cradle on the hinge side of the sensor. This will position the worm gear on the

locking clip side of the sensor.

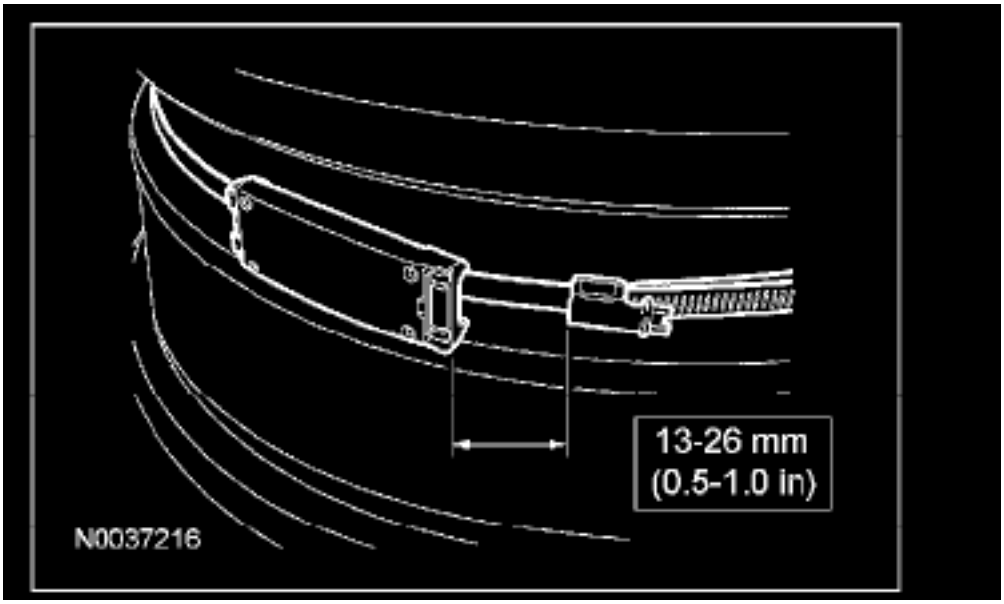
5. CAUTION: Steel wheels have a "high spot" along their circumference. Make sure the strap and sensor are mounted at the lowest spot

possible to avoid damaging the sensor during wheel and tire disassembly and assembly.

NOTE: Keep the strap parallel with the wheel flange while tightening the worm gear.

Position the worm gear 13-26 mm (0.5-1.0 inch) away from the sensor and tighten the worm gear.
^

Tighten to 3 Nm (27 lb-inch).



6. CAUTION: The sensor, cradle and strap may be damaged by incorrect tire mounting or dismounting. Mount the tire only as instructed.

Install the tire onto the wheel.

7. NOTE: A new tire pressure sensor is shipped in an off mode (or battery saver mode) and must be turned on before it can be trained. To turn the

sensor on, install it on a wheel, mount the tire and inflate the tire to the recommended inflation pressure. Wait at least 2 minutes, then continue with the sensor training procedure.

Train the tire pressure sensor(s).

Special Tool(s)

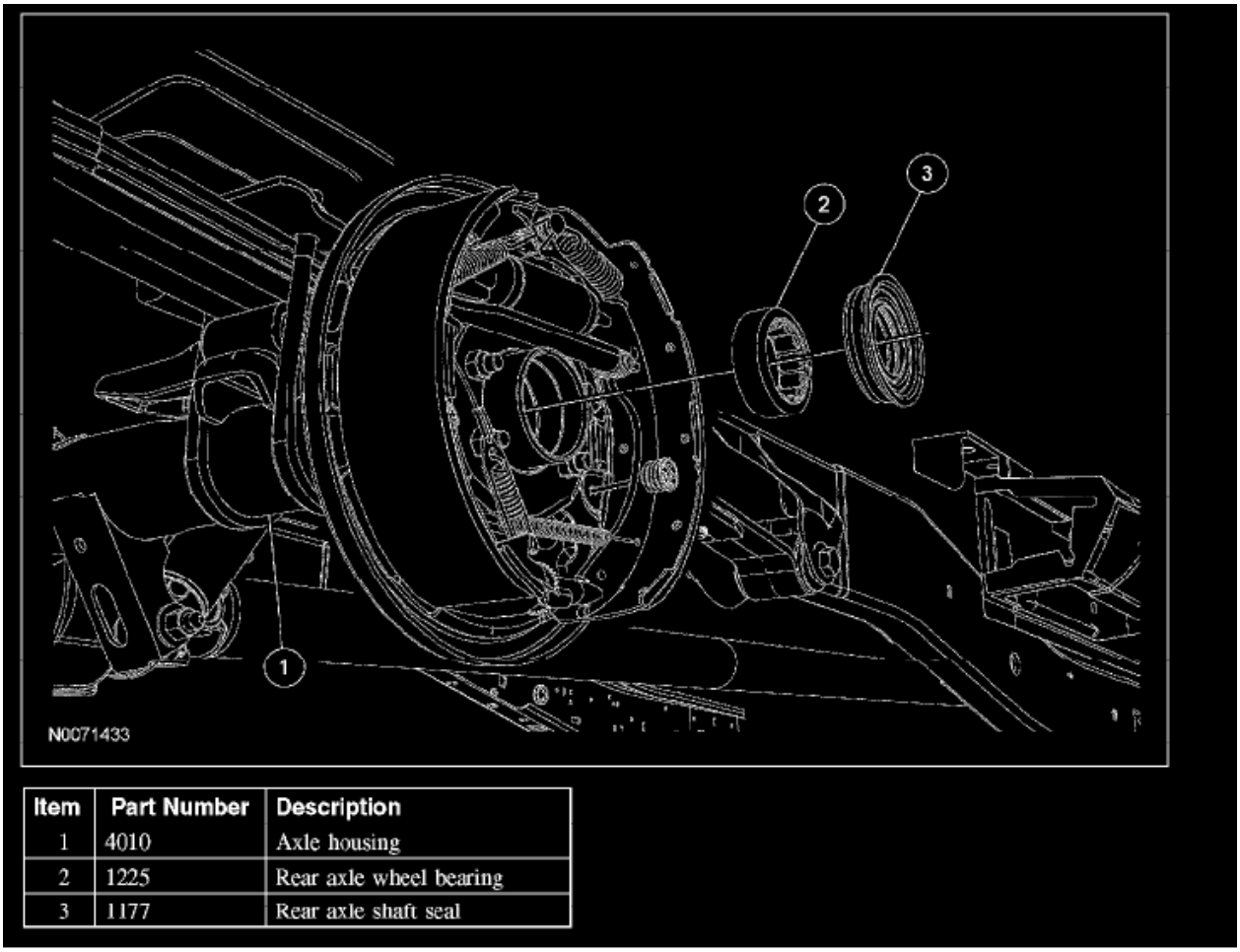
ST1326-A	Adapter for 303-224 (Handle) 205-153 (T80T-4000-W)
ST1541A	Installer, Axle Shaft Bearing 205-124 (T78P-1225-A)
ST2027 A	Installer, Rear Axle Oil Seal 205-390 (T97T-1177-B)
ST1185-A	Slide Hammer 100-001 (T50T-100-A)
ST2035-A	Remover, Axle Bearing 205-219 (T85L-1225-AH)

Material

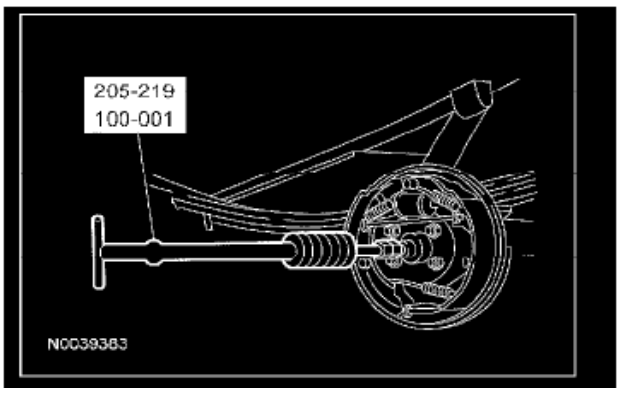
Item	Specification
Motorcraft SAE 80W-90 Premium Rear Axle Lubricant XY-80W90-QL (US); CXY-80W90-1L (Canada)	WSP-M2C197-A
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B

Wheel Bearing: Service and Repair Ford 7.5-Inch Ring Gear - Rear Drive Axle/Differential

Rear Wheel Bearing and Axle Shaft Seal



Item	Part Number	Description
1	4010	Axle housing
2	1225	Rear axle wheel bearing
3	1177	Rear axle shaft seal



Removal

1. NOTE: If the wheel bearing oil seal is leaking, the axle housing vent may be plugged.

Remove the axle shaft.

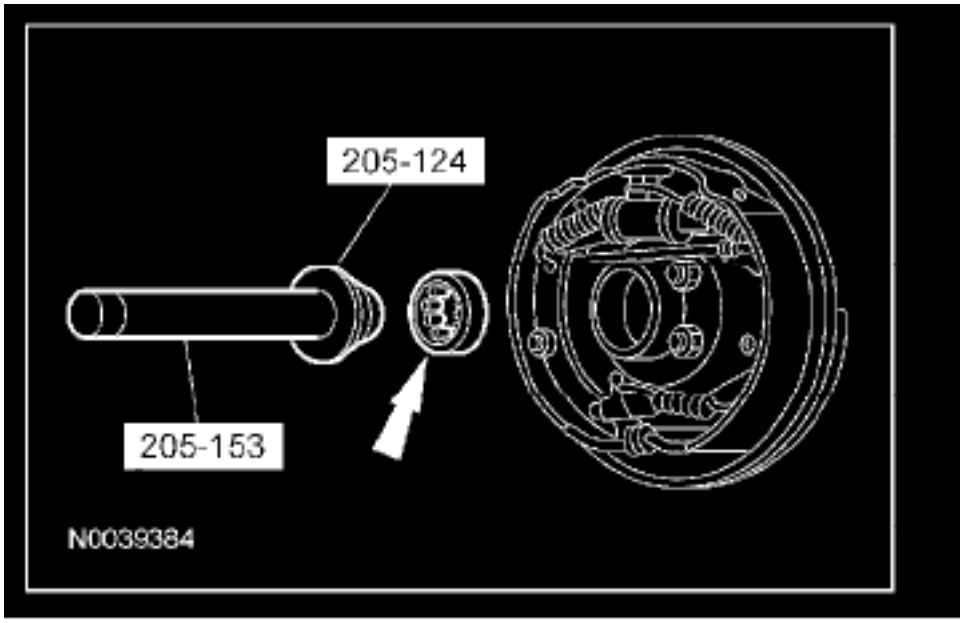
2. NOTE: If only a new seal needs to be installed, use care to avoid damaging the seal bore.

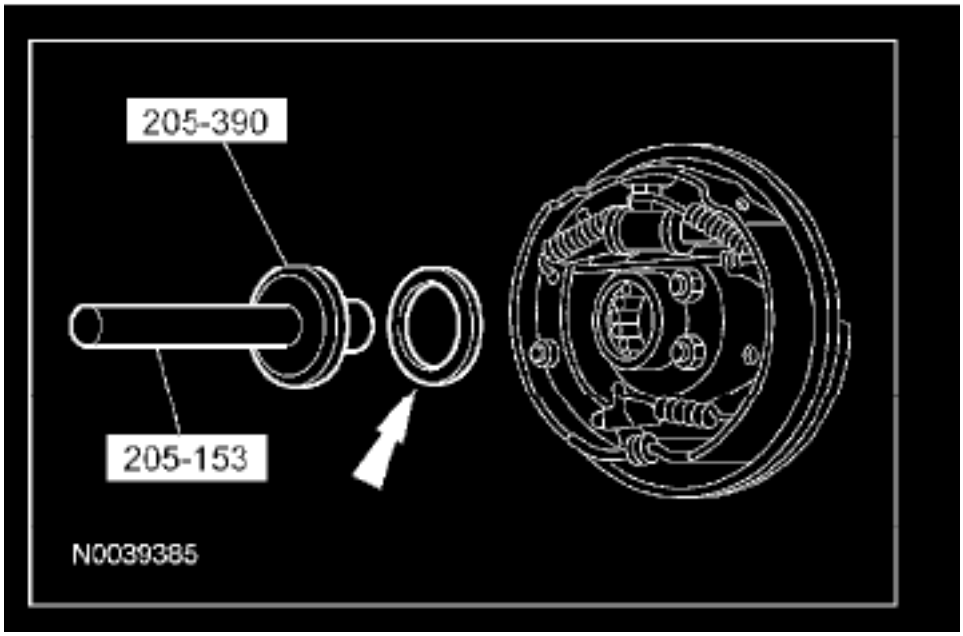
Using a suitable seal remover, remove and discard the axle shaft oil seal.

3. Inspect the rear wheel bearing and axle shaft for wear or damage. 4. If necessary, using the special tools, remove the rear wheel bearing.

Installation

1. Lubricate the new rear wheel bearing with lubricant. 2. Using the special tools, install the rear wheel bearing. 3. Lubricate the lip of the new wheel bearing oil seal with grease.





4. Using the special tools, install the wheel bearing oil seal.

5. Install the axle shaft.

Special Tool(s)

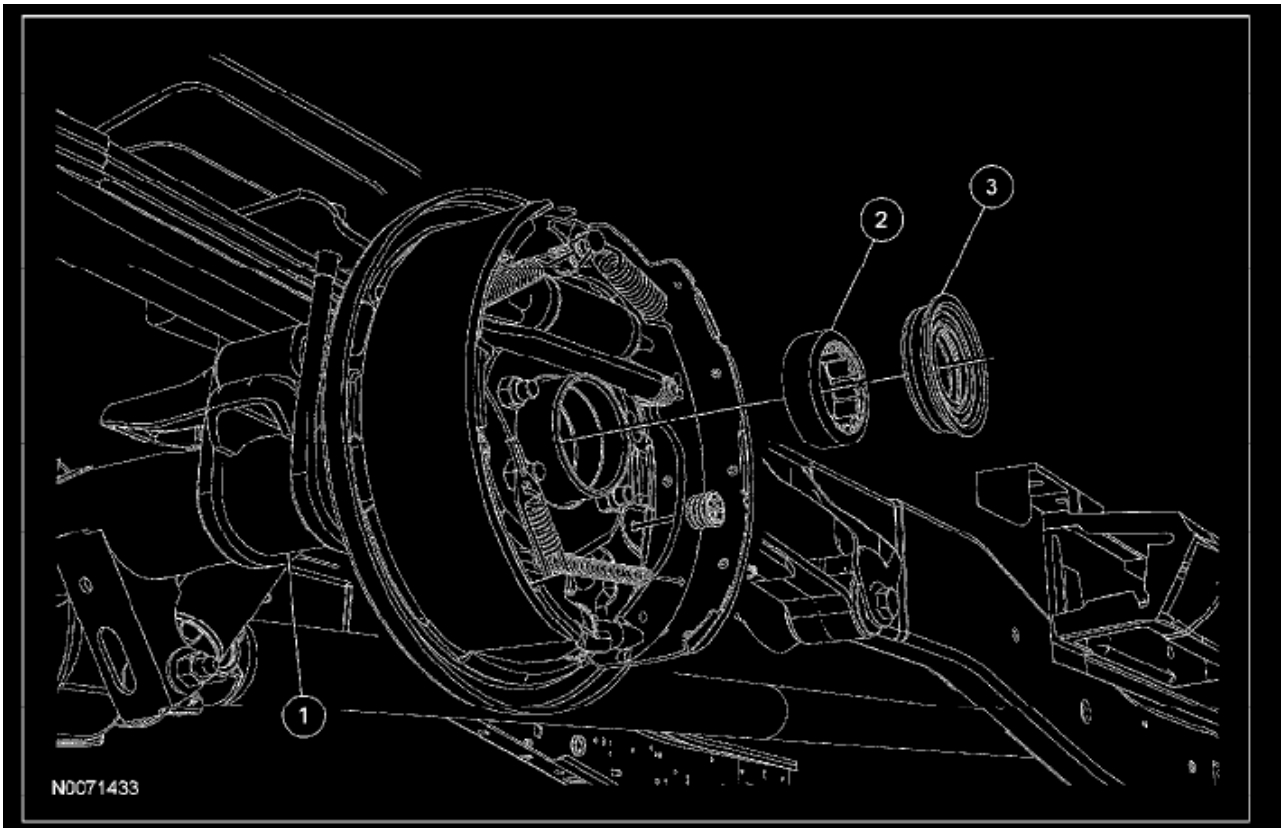
ST1325-A	Adapter For 303-224 (Handle) 205-153 (T80T-4000-W)
ST1185-A	Impact Slide Hammer 100-001 (T50T-100-A)
ST1541A	Installer, Axle Shaft Bearing 205-124 (T78P-1225-A)
ST2027-A	Installer, Rear Axle Oil Seal 205-390 (T97-1177-B)
ST2035-A	Remover, Axle Bearing 205-219 (T85L-1225-AH)

Material

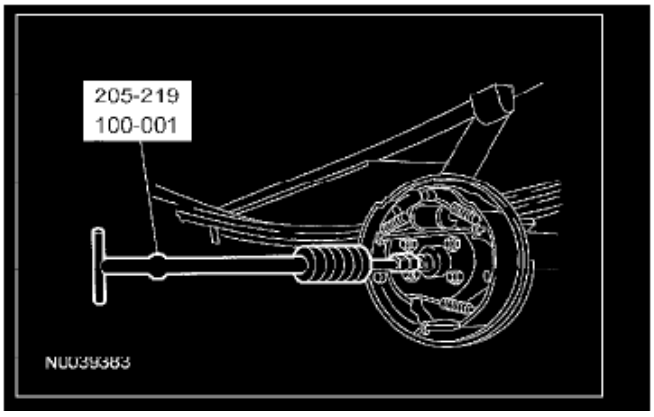
Item	Specification
Motorcraft SAE 80W-90 Premium Rear Axle Lubricant XY-80W90-QL (US); CXY-80W90-1L (Canada)	WSP-M2C197-A
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B

Wheel Bearing: Service and Repair Ford 8.8-Inch Ring Gear - Rear Drive Axle/Differential

Rear Wheel Bearing and Axle Shaft Seal



Item	Part Number	Description
1	4010	Axle housing
2	1225	Rear axle wheel bearing
3	1177	Rear axle shaft seal



Removal

1. Remove the axle shaft.

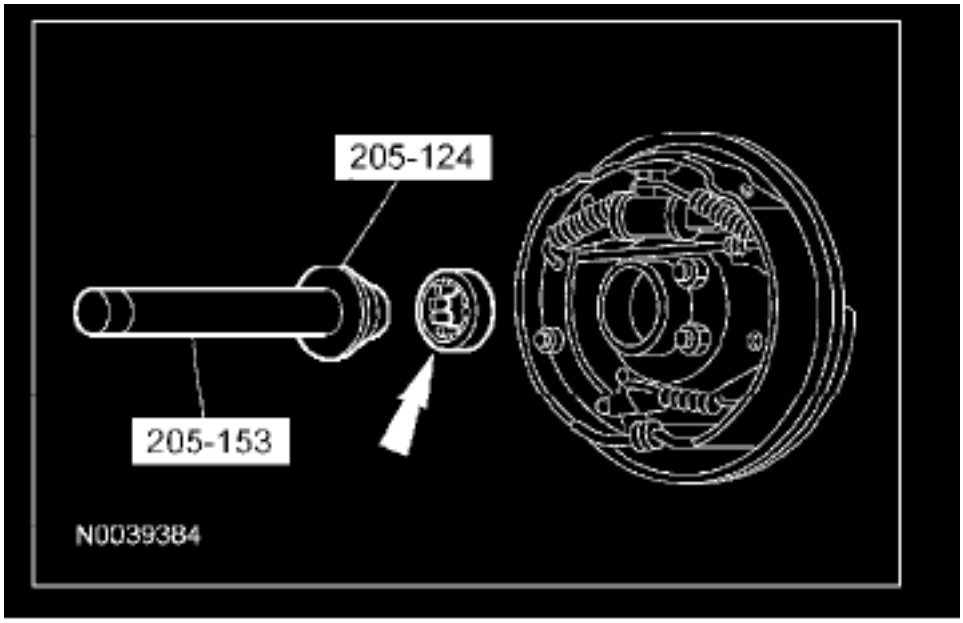
2. NOTE: If only a new seal needs to be installed, use care to avoid damaging the seal bore.

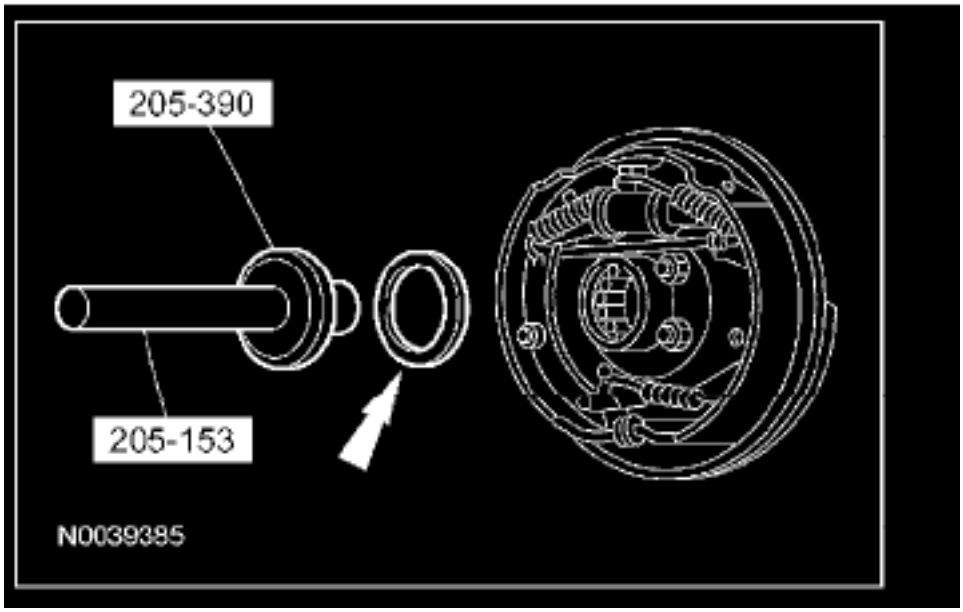
Using a suitable seal remover, remove and discard the axle shaft oil seal.

3. Inspect the rear wheel bearing and axle shaft for wear or damage. 4. If necessary, using the special tools, remove the rear wheel bearing.

Installation

1. Lubricate the new rear wheel bearing with rear axle lubricant.





2. Using the special tools, install the rear wheel bearing. 3. Lubricate the lip of the new wheel bearing oil seal with grease. 4. Using the special tools, install the wheel bearing oil seal.

5. Install the axle shaft.

Special Tool(s)

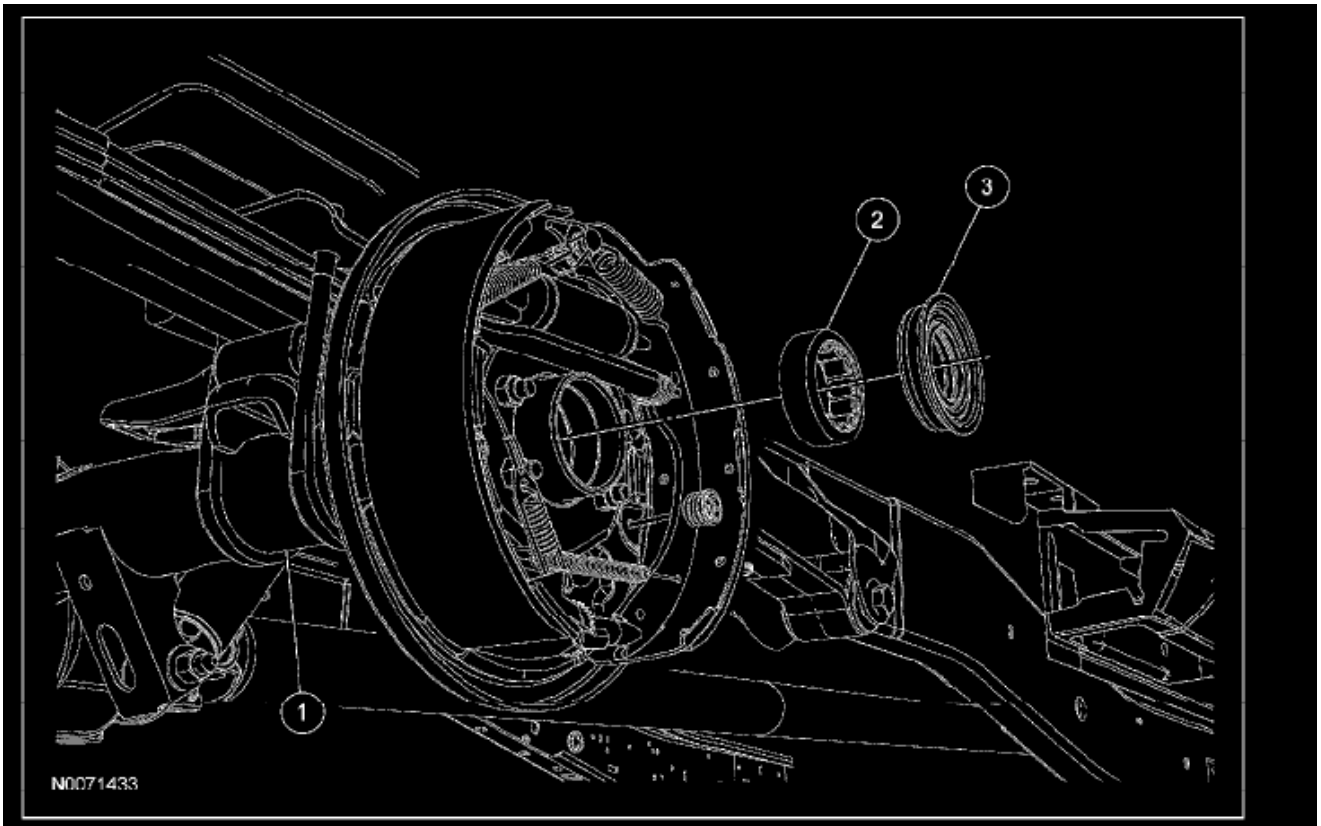
ST1326-A	Adapter For 303-224 (Handle) 205-153 (T80T-4000-W)
ST1322-A	Installer, Axle Bearing 205-194 (T83T-1225-B)
ST1736-A	Installer, Axle Oil Seal 205-190 (T83T-1175-A)
ST1263-A	Remover, Axle Bearing 205-193 (T83T-1225-A)
ST1185-A	Slide Hammer 100-001 (T50T-100-A)

Material

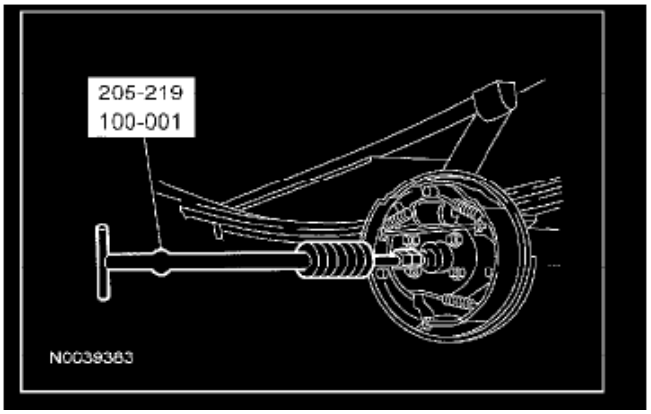
Item	Specification
Additive Friction Modifier XL-3 (US); CXL-3 (Canada)	EST-M2C118-A
Motorcraft SAE 75W-140 Synthetic Rear Axle Lubricant XY-75W140-QL (US); CXY-75W140-1L (Canada)	WSL-M2C192-A
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B

Wheel Bearing: Service and Repair Ford 8.8-Inch Ring Gear High Torque - Rear Drive Axle/Differential

Rear Wheel Bearing and Axle Shaft Seal



Item	Part Number	Description
1	4010	Axle housing
2	1225	Rear axle wheel bearing
3	1177	Rear axle shaft seal



Removal

1. Remove the axle shaft.

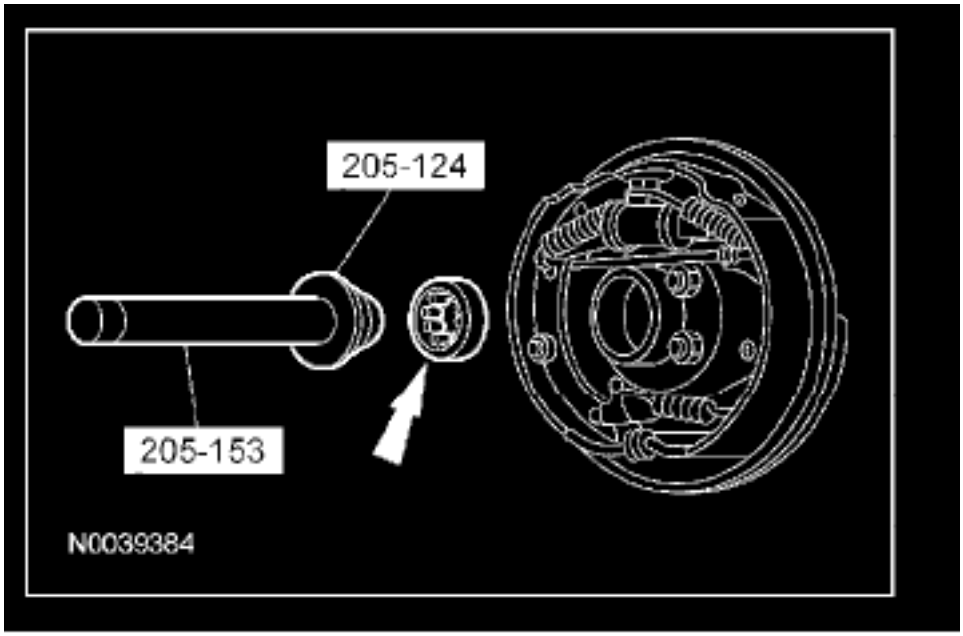
2. NOTE: If only a new seal needs to be installed, use care to avoid damaging the seal bore.

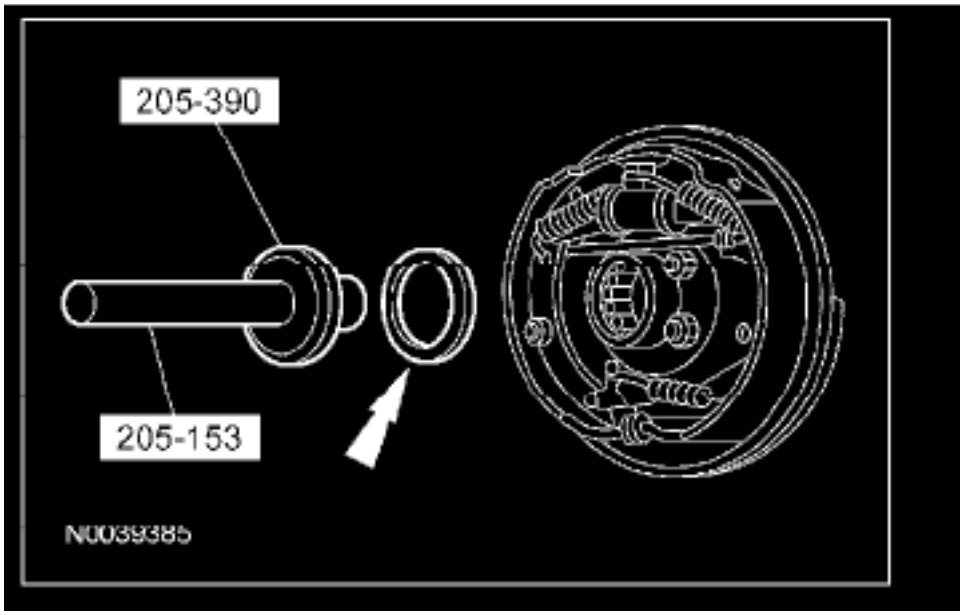
Using a suitable seal remover, remove the axle shaft oil seal. Discard the oil seal.

3. Inspect the rear wheel bearing and axle shaft for wear or damage. 4. If necessary, using the special tools, remove the rear wheel bearing.

Installation

1. Lubricate the new rear wheel bearing with rear axle lubricant. 2. Using the special tools, install the rear wheel bearing.



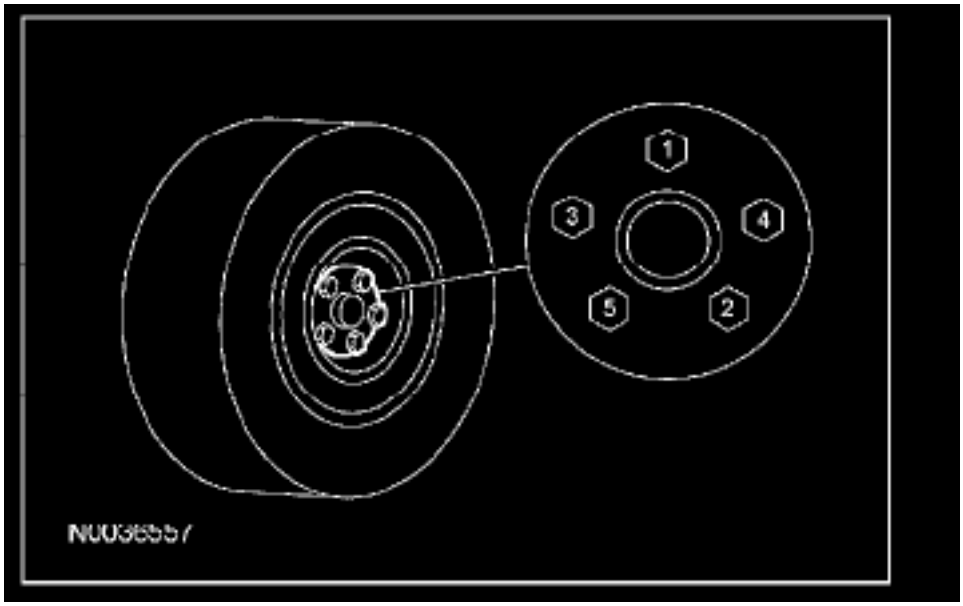


3. Lubricate the lip of the new wheel bearing oil seal with grease. 4. Using the special tools, install the wheel bearing oil seal.

5. Install the axle shaft.

Axle Nut: Specifications

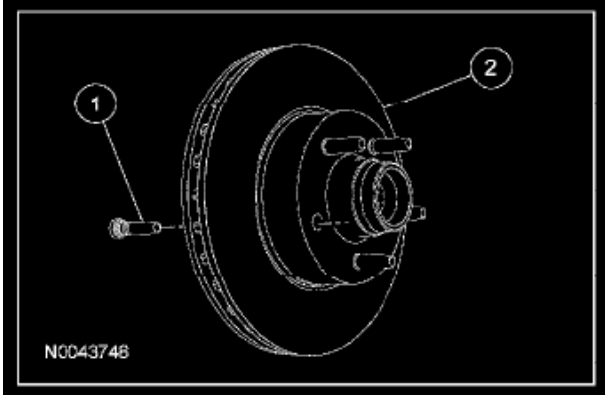
Hub Nut and Washer ..... 250 Nm (184 lb-ft)



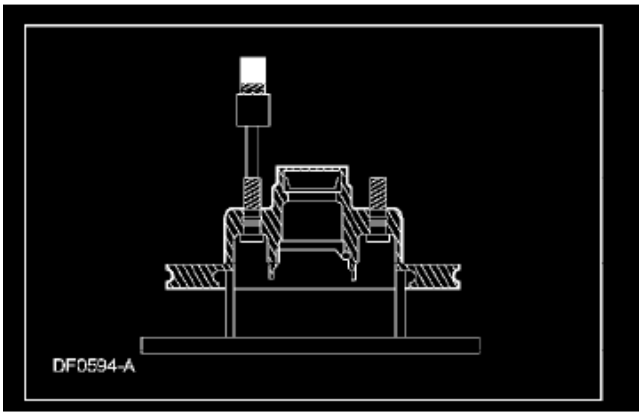
Wheel Fastener: Specifications

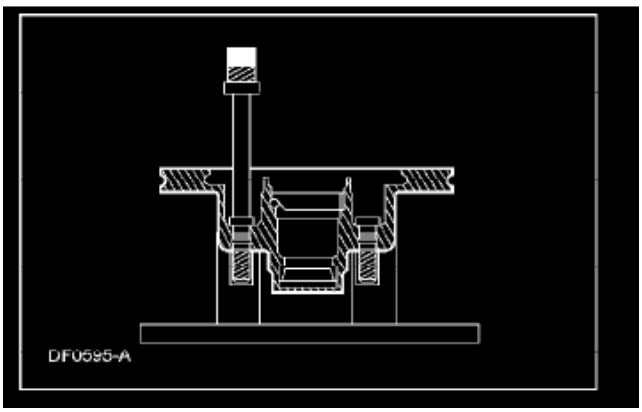
Wheel Nuts ..... 135 Nm (100 lb-ft)

Wheel Studs



Item	Part Number	Description
1	1107	Wheel stud (5 required)
2	1102	Brake disc and hub





Wheel Fastener: Service and Repair Front

Wheel Studs

Wheel Studs

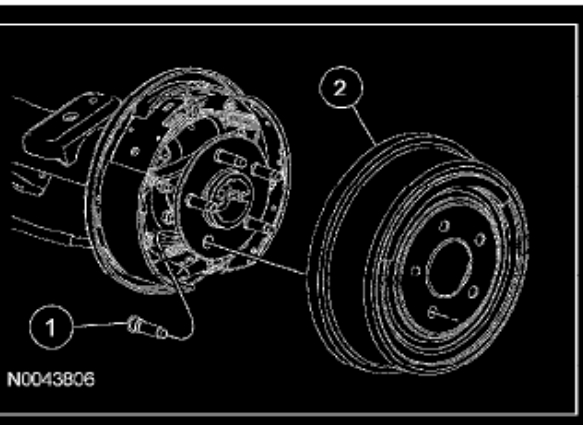
Removal and Installation

1. Remove the brake disc. 2. Using a suitable press, remove the wheel stud from the brake disc.

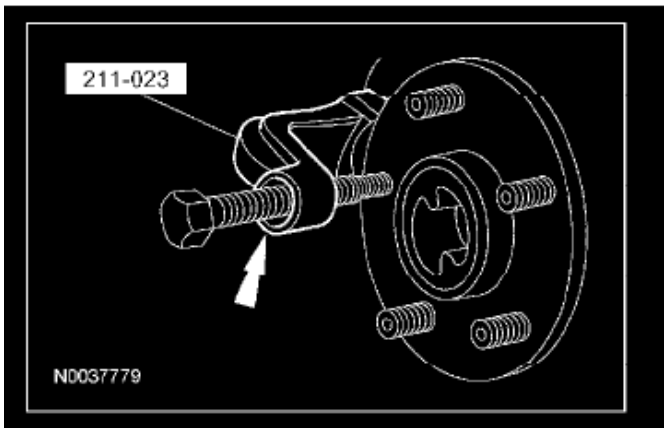
3. To install, reverse the removal procedure.

Special Tool(s)

ST1494-A	C-Frame and Clamp Assembly 211-023 (T74P-3044-A1)



Item	Part Number	Description
1	W707287	Wheel stud
2	1126	Rear brake drum



Wheel Fastener: Service and Repair Rear

Wheel Studs

Removal

CAUTION: Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part numbers or equivalent parts if replacement is necessary. Do not use replacement parts of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

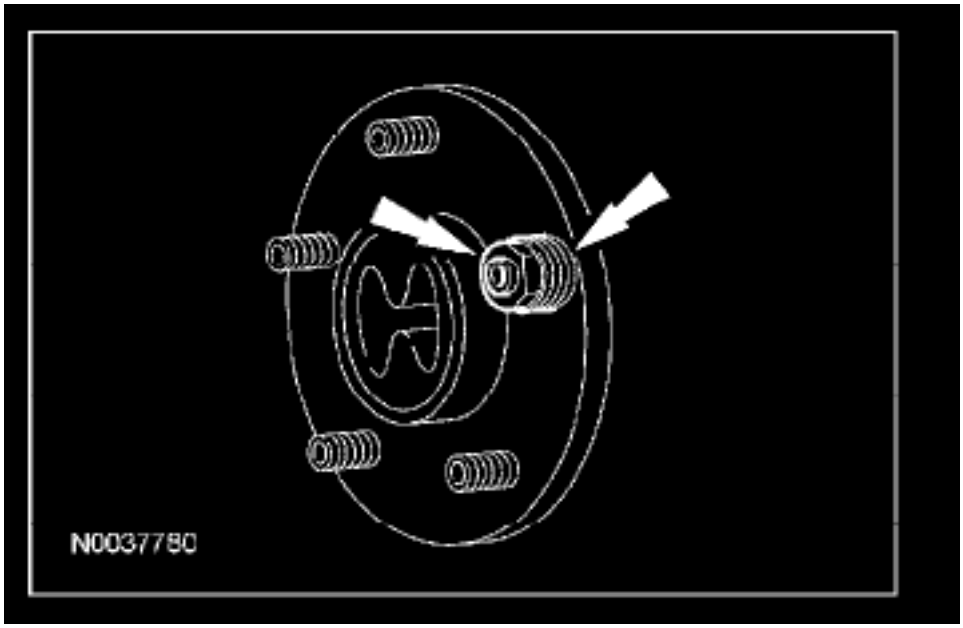
CAUTION: Never use a hammer to remove the wheel stud or damage to the axle flange, wheel bearing or hub may occur.

1. Remove the rear brake drum. 2. Using the special tool, press the wheel stud from its seat and discard.

Installation

CAUTION: Never use air tools to install wheel studs. The serrations may be stripped from the stud.

1. Insert a new wheel stud in the axle flange, making sure the serrations are aligned with those made by the original wheel stud.



2. Seat the new wheel stud in the axle flange.

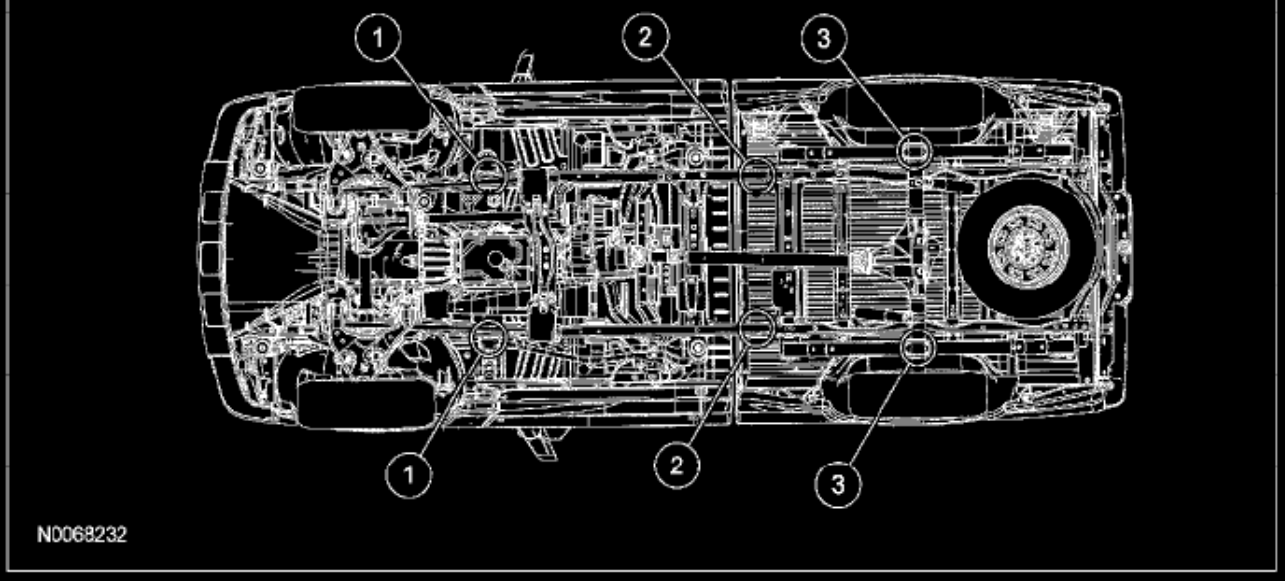
^ Place 4 flat washers over the outside end of the wheel stud.

^ Thread a standard wheel nut with the flat side against the washers.

^ Tighten the wheel nut until the wheel stud head seats against the back side of the flange.

3. Remove the wheel nut and flat washers. 4. Install the rear brake drum.

Jacking and Lifting Locations — Four Wheel Drive (4WD)



Item	Description
1	Front jacking and lifting locations
2	Rear lifting locations
3	Rear jacking locations

Vehicle Lifting: Description and Operation

JACKING AND LIFTING

WARNING:

- Block all wheels, set the parking brake and firmly apply the service brake to reduce the risk of vehicle movement during this procedure. Failure to follow these instructions may result in serious personal injury.

- Only raise the vehicle when positioned on a hard, level surface. Attempting to raise the vehicle on an uneven or soft surface may result in vehicle slipping or falling from the jack or jackstand. Failure to follow this instruction may result in serious personal injury.

- Never get underneath a vehicle that is supported only by a jack. The jack could unintentionally lower. Always support vehicle with floor stands. Failure to follow these instructions may result in serious personal injury.

CAUTION:

- The jack provided with the vehicle is intended to be used in an emergency for changing a deflated tire. To avoid damage to the vehicle, never use the jack to hoist the vehicle for any other purpose.

- Do not attempt to use jack pressure on either the front bumper or the rear bumper of any vehicle. Damage to bumper covers will occur.

- To prevent possible damage to the underbody, do not drive the vehicle onto the drive-on lift without first checking for possible interference.

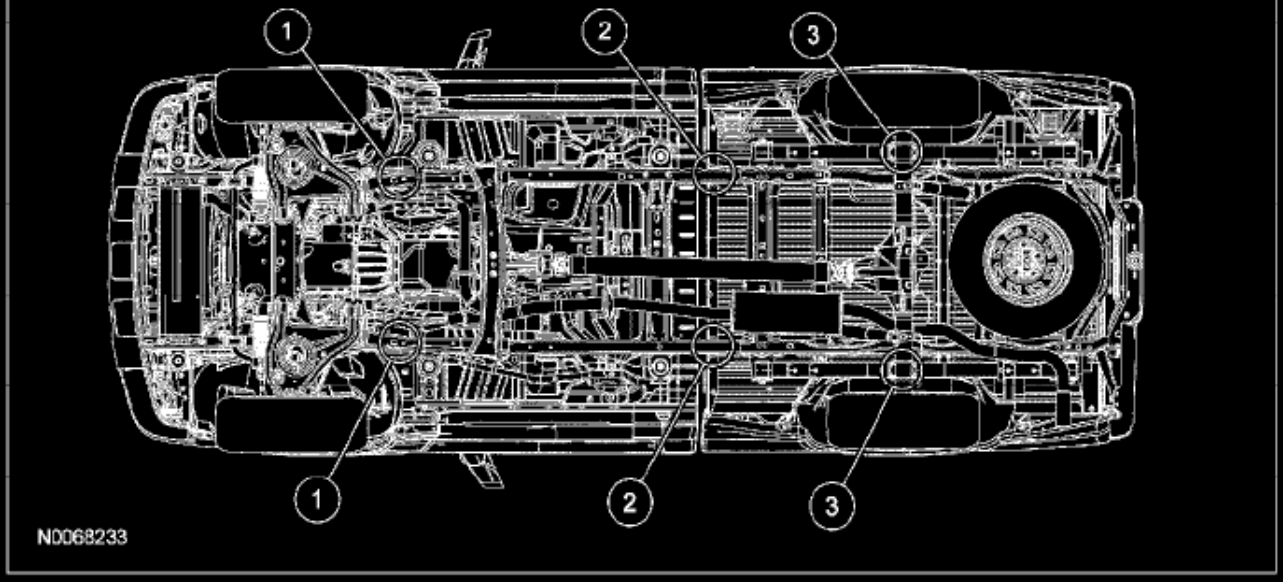
- Make sure the jack has an adequate lifting capacity for the vehicle being lifted, or damage to the vehicle may occur.

- When raising a vehicle on a twin-post hoist, use care when positioning the vehicle so that the hoisting forks do not interfere with the suspension components, mounting brackets or stabilizer mounting brackets, if so equipped. In addition, use care in hoist positioning to avoid possible damage to the axle carrier or rear cover.

- Damage to the suspension, exhaust or steering linkage components may occur if care is not exercised when positioning the hoist adapters prior to lifting the vehicle.

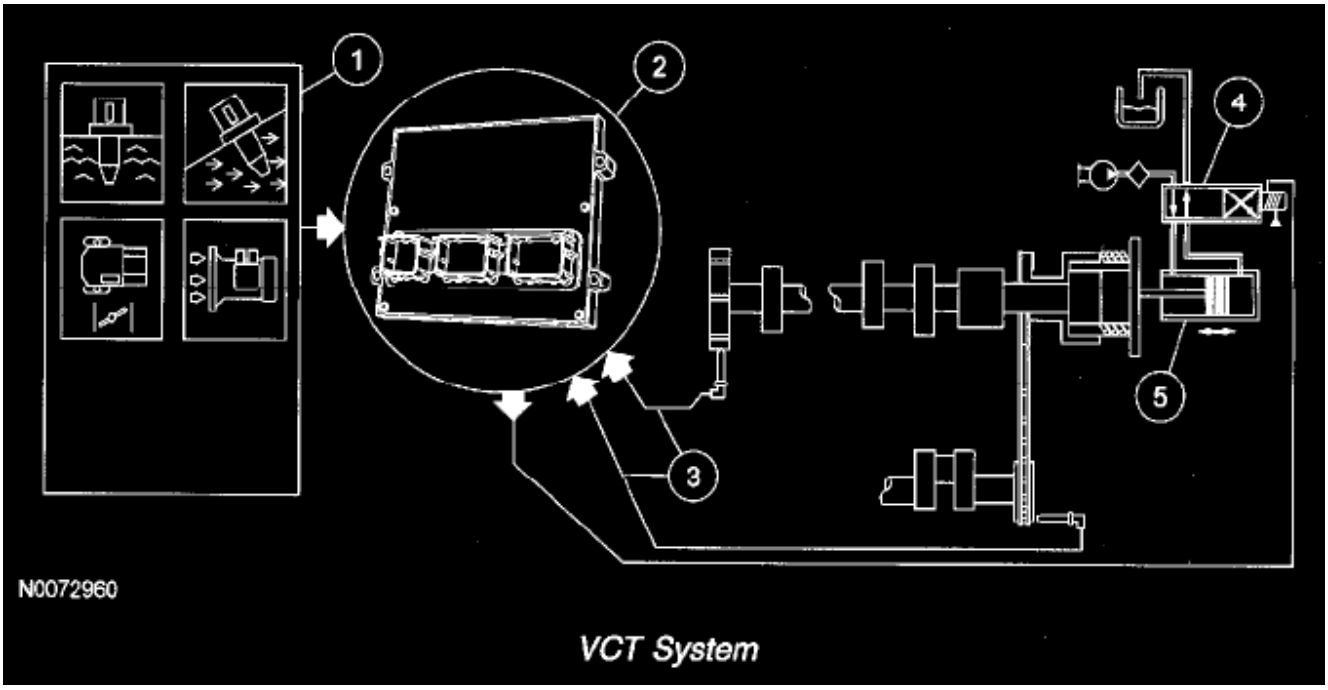
Jacking and Lifting Locations - Four Wheel Drive (4WD)

Jacking and Lifting Locations — Rear Wheel Drive (RWD)



Item	Description
1	Front jacking and lifting locations
2	Rear lifting locations
3	Rear jacking locations

Jacking and Lifting Locations - Rear Wheel Drive (RWD)



VCT System

Variable Valve Timing Actuator: Description and Operation

VARIABLE CAMSHAFT TIMING (VCT) SYSTEM

Overview

The VCT enables rotation of the camshaft(s) relative to the crankshaft rotation as a function of engine operating conditions. There are 4 types of VCT systems.

- Exhaust phase shifting (EPS) system - the exhaust cam is the active cam being retarded.

- Intake phase shifting (IPS) system - the intake cam is the active cam being advanced.

- Dual equal phase shifting (DEPS) system - both intake and exhaust cams are phase shifted and equally advanced or retarded.

- Dual independent phase shifting (DIPS) system - where both the intake and exhaust cams are shifted independently.

All systems have 4 operational modes: idle, part throttle, wide open throttle (WOT), and default mode. At idle and low engine speeds with closed throttle, the powertrain control module (PCM) determines the phase angle based on air flow, engine oil temperature and engine coolant temperature. At part and wide open throttle the PCM determines the phase angle based on engine RPM, load, and throttle position. VCT systems provide reduced emissions and enhanced engine power, fuel economy and idle quality. IPS systems also have the added benefit of improved torque. In addition, some VCT system applications can eliminate the need for an external exhaust gas recirculation (EGR) system. The elimination of the EGR system is accomplished by controlling the overlap time between the intake valve opening and exhaust valve closing. Currently, both the IPS and DEPS systems are used.

Variable Camshaft Timing (VCT) System

VCT System

The VCT system consists of an electric hydraulic positioning control solenoid, a camshaft position (CMP) sensor, and a trigger wheel. The CMP trigger wheel has a number of equally spaced teeth equal to the number (n) of cylinders on a bank plus one extra tooth (n+1). Four cylinder and V8 engines use a CMP 4+1 tooth trigger wheel. V6 engines use a CMP 3+1 tooth trigger wheel. The extra tooth placed between the equally spaced teeth represents the CMP signal for that bank. A crankshaft position (CKP) sensor provides the PCM with crankshaft positioning information in 10 degree increments.

1. The PCM receives input signals from the intake air temperature (IAT) sensor, engine coolant temperature (ECT) sensor, engine oil temperature

(EOT) sensor, CMP, throttle position (TP) sensor, mass air flow (MAF) sensor, and CKP to determine the operating conditions of the engine. At idle and low engine speeds with closed throttle, the PCM controls the camshaft position based on ECT, EOT, IAT, and MAF. During part and wide open throttle, the camshaft position is determined by engine RPM, load and throttle position. The VCT system does not operate until the engine is at normal operating temperature.

2. The VCT system is enabled by the PCM when the correct conditions are met. 3. The CKP signal is used as a reference for CMP positioning. 4. The VCT solenoid valve is an integral part of the VCT system. The solenoid valve controls the flow of engine oil in the VCT actuator assembly.

As the PCM controls the duty cycle of the solenoid valve, oil pressure/flow advances or retards the cam timing. Duty cycles near 0% or 100% represent rapid movement of the camshaft. Retaining a fixed camshaft position is accomplished by dithering (oscillating) the solenoid valve duty cycle.

The PCM calculates and determines the desired camshaft position. It continually updates the VCT solenoid duty cycle until the desired position is achieved. A difference between the desired and actual camshaft position represents a position error in the PCM VCT control loop. The PCM

disables the VCT and places the camshaft in a default position if a concern is detected. A related DTC is also set when the concern is detected.

5. When the VCT solenoid is energized, engine oil is allowed to flow to the VCT actuator assembly which advances or retards the camshaft timing.

One half of the VCT actuator is coupled to the camshaft and the other half is connected to the timing chain. Oil chambers between the 2 halves couple the camshaft to the timing chain. When the flow of oil is shifted from one side of the chamber to the other, the differential change in oil pressure forces the camshaft to rotate in either an advance or retard position depending on the oil flow.

Compression Pressure Limit Chart

Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure
924 kPa (134 psi)	696 kPa (101 psi)	1,131 kPa (164 psi)	848 kPa (123 psi)	1,338 kPa (194 psi)	1,000 kPa (146 psi)	1,544 kPa (224 psi)	1,158 kPa (168 psi)
938 kPa (136 psi)	703 kPa (102 psi)	1,145 kPa (166 psi)	855 kPa (124 psi)	1,351 kPa (196 psi)	1,014 kPa (147 psi)	1,558 kPa (226 psi)	1,165 kPa (169 psi)

Compression Pressure Limit Chart (Continued)

Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure
952 kPa (138 psi)	717 kPa (104 psi)	1,158 kPa (168 psi)	869 kPa (126 psi)	1,365 kPa (198 psi)	1,020 kPa (148 psi)	1,572 kPa (228 psi)	1,179 kPa (171 psi)
965 kPa (140 psi)	724 kPa (106 psi)	1,172 kPa (170 psi)	876 kPa (127 psi)	1,379 kPa (200 psi)	1,034 kPa (150 psi)	1,586 kPa (230 psi)	1,186 kPa (172 psi)
979 kPa (142 psi)	738 kPa (107 psi)	1,186 kPa (172 psi)	889 kPa (129 psi)	1,303 kPa (202 psi)	1,041 kPa (151 psi)	1,600 kPa (232 psi)	1,200 kPa (174 psi)
933 kPa (144 psi)	745 kPa (109 psi)	1,200 kPa (174 psi)	903 kPa (131 psi)	1,407 kPa (204 psi)	1,055 kPa (153 psi)	1,055 kPa (153 psi)	1,207 kPa (175 psi)
1,007 kPa (146 psi)	758 kPa (110 psi)	1,214 kPa (176 psi)	910 kPa (132 psi)	1,420 kPa (206 psi)	1,062 kPa (154 psi)	1,627 kPa (154 psi)	1,220 kPa (177 psi)
1,020 kPa (148 psi)	765 kPa (111 psi)	1,227 kPa (178 psi)	917 kPa (133 psi)	1,434 kPa (208 psi)	1,075 kPa (156 psi)	1,641 kPa (238 psi)	1,227 kPa (178 psi)
1,034 kPa (150 psi)	779 kPa (113 psi)	1,241 kPa (180 psi)	931 kPa (135 psi)	1,448 kPa (210 psi)	1,083 kPa (157 psi)	1,655 kPa (240 psi)	1,241 kPa (180 psi)
1,048 kPa (152 psi)	786 kPa (114 psi)	1,255 kPa (182 psi)	936 kPa (136 psi)	1,462 kPa (212 psi)	1,089 kPa (158 psi)	1,669 kPa (242 psi)	1,248 kPa (181 psi)
1,062 kPa (154 psi)	793 kPa (115 psi)	1,269 kPa (184 psi)	952 kPa (138 psi)	1,476 kPa (214 psi)	1,103 kPa (160 psi)	1,682 kPa (244 psi)	1,262 kPa (183 psi)
1,076 kPa (156 psi)	807 kPa (117 psi)	1,282 kPa (186 psi)	965 kPa (140 psi)	1,489 kPa (216 psi)	1,117 kPa (162 psi)	1,696 kPa (246 psi)	1,269 kPa (184 psi)
1,089 kPa (158 psi)	814 kPa (118 psi)	1,296 kPa (188 psi)	972 kPa (141 psi)	1,503 kPa (218 psi)	1,124 kPa (163 psi)	1,710 kPa (248 psi)	1,202 kPa (186 psi)
1,103 kPa (160 psi)	827 kPa (120 psi)	1,310 kPa (190 psi)	979 kPa (142 psi)	1,517 kPa (220 psi)	1,138 kPa (165 psi)	1,724 kPa (250 psi)	1,289 kPa (187 psi)
1,110 kPa (161 psi)	834 kPa (121 psi)	1,324 kPa (192 psi)	993 kPa (144 psi)	1,631 kPa (222 psi)	1,145 kPa (166 psi)	—	—

Compression Check: Specifications

Compression Pressure Limit Chart

The indicated compression pressures are considered within specification if the lowest reading cylinder is at least 75% of the highest reading.

Compression Pressure Limit Chart (Part 1)

Compression Pressure Limit Chart (Part 2)

Compression Pressure Limit Chart

Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure
924 kPa (134 psi)	696 kPa (101 psi)	1,131 kPa (164 psi)	848 kPa (123 psi)	1,338 kPa (194 psi)	1,000 kPa (146 psi)	1,544 kPa (224 psi)	1,158 kPa (168 psi)
938 kPa (136 psi)	703 kPa (102 psi)	1,145 kPa (166 psi)	855 kPa (124 psi)	1,351 kPa (196 psi)	1,014 kPa (147 psi)	1,558 kPa (226 psi)	1,165 kPa (169 psi)

Compression Pressure Limit Chart (Continued)

Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure
952 kPa (138 psi)	717 kPa (104 psi)	1,158 kPa (168 psi)	869 kPa (126 psi)	1,365 kPa (198 psi)	1,020 kPa (148 psi)	1,572 kPa (228 psi)	1,179 kPa (171 psi)
965 kPa (140 psi)	724 kPa (106 psi)	1,172 kPa (170 psi)	876 kPa (127 psi)	1,379 kPa (200 psi)	1,034 kPa (150 psi)	1,586 kPa (230 psi)	1,186 kPa (172 psi)
979 kPa (142 psi)	738 kPa (107 psi)	1,186 kPa (172 psi)	889 kPa (129 psi)	1,303 kPa (202 psi)	1,041 kPa (151 psi)	1,600 kPa (232 psi)	1,200 kPa (174 psi)
933 kPa (144 psi)	745 kPa (109 psi)	1,200 kPa (174 psi)	903 kPa (131 psi)	1,407 kPa (204 psi)	1,055 kPa (153 psi)	1,055 kPa (153 psi)	1,207 kPa (175 psi)
1,007 kPa (146 psi)	758 kPa (110 psi)	1,214 kPa (176 psi)	910 kPa (132 psi)	1,420 kPa (206 psi)	1,062 kPa (154 psi)	1,627 kPa (154 psi)	1,220 kPa (177 psi)
1,020 kPa (148 psi)	765 kPa (111 psi)	1,227 kPa (178 psi)	917 kPa (133 psi)	1,434 kPa (208 psi)	1,075 kPa (156 psi)	1,641 kPa (238 psi)	1,227 kPa (178 psi)
1,034 kPa (150 psi)	779 kPa (113 psi)	1,241 kPa (180 psi)	931 kPa (135 psi)	1,448 kPa (210 psi)	1,083 kPa (157 psi)	1,655 kPa (240 psi)	1,241 kPa (180 psi)
1,048 kPa (152 psi)	786 kPa (114 psi)	1,255 kPa (182 psi)	936 kPa (136 psi)	1,462 kPa (212 psi)	1,089 kPa (158 psi)	1,669 kPa (242 psi)	1,248 kPa (181 psi)
1,062 kPa (154 psi)	793 kPa (115 psi)	1,269 kPa (184 psi)	952 kPa (138 psi)	1,476 kPa (214 psi)	1,103 kPa (160 psi)	1,682 kPa (244 psi)	1,262 kPa (183 psi)
1,076 kPa (156 psi)	807 kPa (117 psi)	1,282 kPa (186 psi)	965 kPa (140 psi)	1,489 kPa (216 psi)	1,117 kPa (162 psi)	1,696 kPa (246 psi)	1,269 kPa (184 psi)
1,089 kPa (158 psi)	814 kPa (118 psi)	1,296 kPa (188 psi)	972 kPa (141 psi)	1,503 kPa (218 psi)	1,124 kPa (163 psi)	1,710 kPa (248 psi)	1,202 kPa (186 psi)
1,103 kPa (160 psi)	827 kPa (120 psi)	1,310 kPa (190 psi)	979 kPa (142 psi)	1,517 kPa (220 psi)	1,138 kPa (165 psi)	1,724 kPa (250 psi)	1,289 kPa (187 psi)
1,110 kPa (161 psi)	834 kPa (121 psi)	1,324 kPa (192 psi)	993 kPa (144 psi)	1,631 kPa (222 psi)	1,145 kPa (166 psi)	—	—

Compression Check: Testing and Inspection

Compression Test - Compression Gauge Check

1. Make sure the oil in the crankcase is of the correct viscosity and at the correct level and that the battery is correctly charged. Operate the vehicle

until the engine is at normal operating temperature. Turn the ignition switch to the OFF position, then remove all the spark plugs.

2. Set the throttle plates in the wide-open position. 3. Install a compression gauge such as the Compression Tester in the No. 1 cylinder. 4. Install an auxiliary starter switch in the starting circuit. With the ignition switch in the OFF position, and using the auxiliary starter switch, crank

the engine a minimum of 5 compression strokes and record the highest reading. Note the approximate number of compression strokes required to obtain the highest reading.

5. Repeat the test on each cylinder, cranking the engine approximately the same number of compression strokes.

Compression Test - Test Results

The indicated compression pressures are considered within specification if the lowest reading cylinder is at least 75% of the highest reading. Refer to the Compression Pressure Limit Chart.

Compression Pressure Limit Chart

Compression Pressure Limit Chart (Part 1)

Compression Pressure Limit Chart (Part 2)

If one or more cylinders read low, squirt approximately one tablespoon of engine oil on top of the pistons in the low-reading cylinders. Repeat the

compression pressure check on these cylinders.

Compression Test - Interpreting Compression Readings

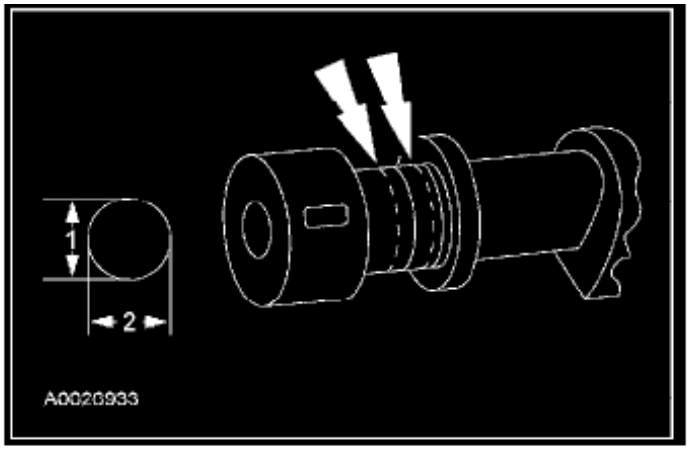
1. If compression improves considerably, piston rings are faulty. 2. If compression does not improve, valves are sticking or seating incorrectly. 3. If 2 adjacent cylinders indicate low compression pressures and squirting oil on each piston does not increase compression, the head gasket may be

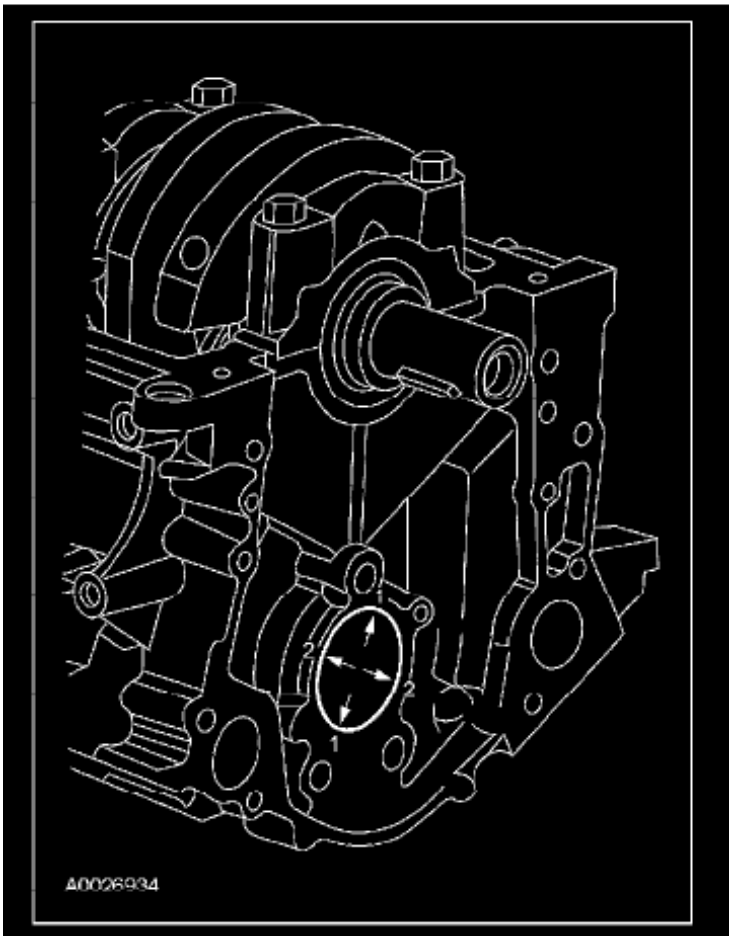
leaking between cylinders. Engine oil or coolant in cylinders could result from this condition.

Use the Compression Pressure Limit Chart when checking cylinder compression so that the lowest reading is within 75% of the highest reading.

Camshaft Gear/Sprocket: Specifications

Camshaft sprocket bolt ..... 63 Nm (46 lb-ft)


1
2
A0020933


1
2
2
A0026934

Camshaft: Procedures

Camshaft Bearing Journal Diameter

NOTE: Refer to Specifications.

1. Measure each camshaft journal diameter in 2 directions.

Camshaft Journal to Bearing Clearance - Push Rod Engines

NOTE: Refer to Specifications.

1. NOTE: The camshaft journals must meet specifications before checking camshaft journal clearance.

Measure each camshaft bearing in 2 directions. ^

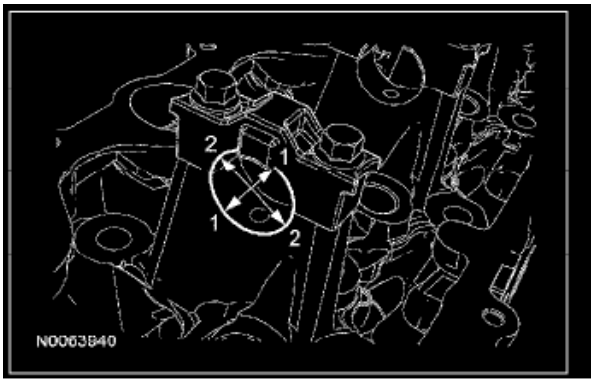
Subtract the camshaft journal diameter from the camshaft bearing diameter.

Camshaft Journal to Bearing Clearance - OHC Engines

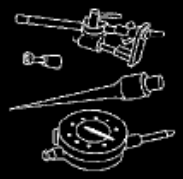
NOTE: Refer to Specifications.

1. NOTE: The camshaft journals must meet specifications before checking camshaft journal clearance.

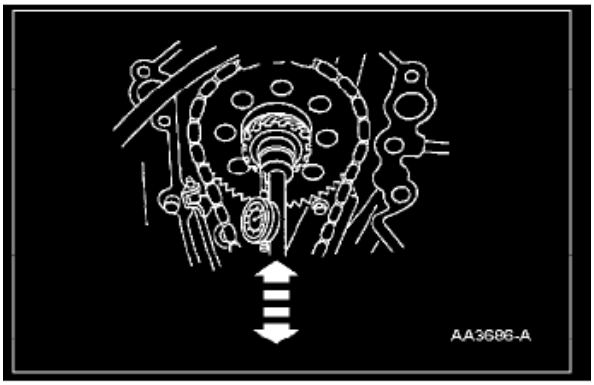
Measure each camshaft bearing in 2 directions.



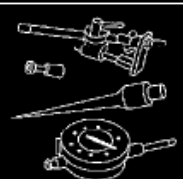
Special Tool(s)



Dial Indicator Gauge with Holding Fixture
100-002 (TOOL-4201-C) or equivalent



Special Tool(s)



Dial Indicator Gauge with Holding Fixture
100-002 (TOOL-4201-C) or equivalent

^ Subtract the camshaft journal diameter from the camshaft bearing diameter.

Camshaft End Play - Push Rod Engines

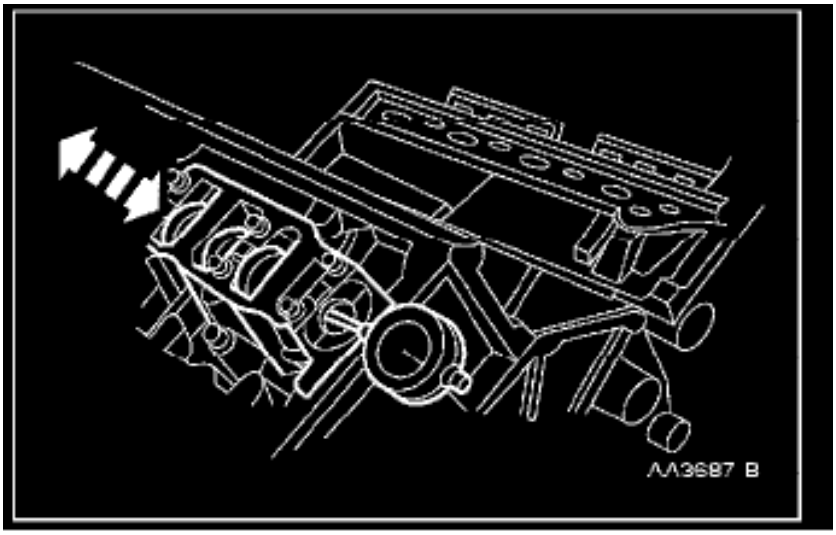
NOTE: Refer to Specifications.

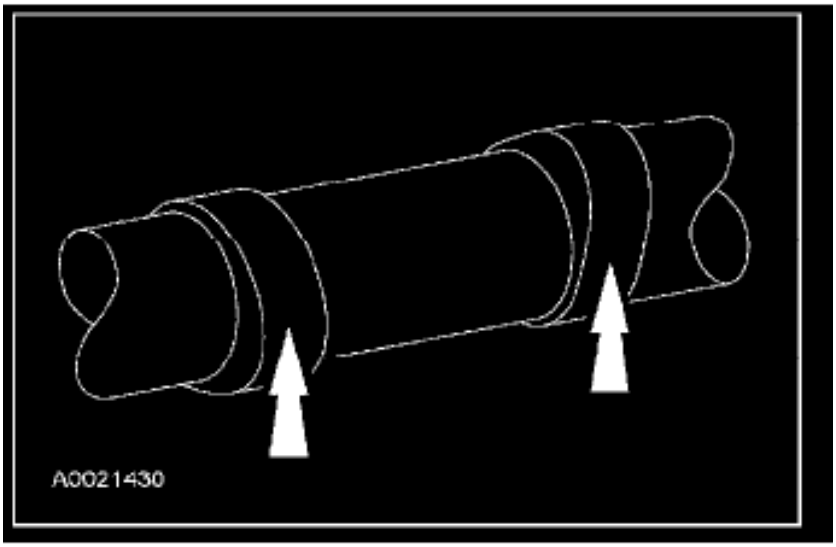
1. Remove the hydraulic lash adjusters. Refer to the appropriate procedure. 2. Use a Dial Indicator Gauge with Holding Fixture to measure camshaft end play. 3. Position the camshaft to the rear of the cylinder block. 4. Zero the indicator. 5. Move the camshaft to the front of the cylinder block. Note and record the camshaft end play.

Camshaft End Play - OHC Engines

NOTE: Refer to Specifications.

1. Using the special tool, measure the camshaft end play.





Special Tool(s)

ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent

2. Position the camshaft to the rear of the cylinder head. 3. Zero the indicator. 4. Move the camshaft to the front of the cylinder head. Note and record the camshaft end play.

^ If camshaft end play exceeds specifications, install a new camshaft and recheck end play.

^ If camshaft end play exceeds specification after camshaft installation, install a new cylinder head.

Camshaft Surface Inspection

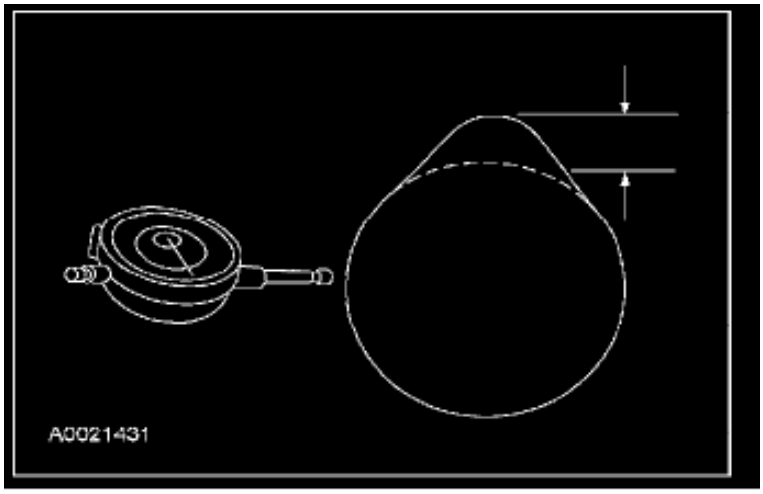
1. Inspect camshaft lobes for pitting or damage in the contact area. Minor pitting is acceptable outside the contact area.

Camshaft Lobe Lift

NOTE: Refer to Specifications.

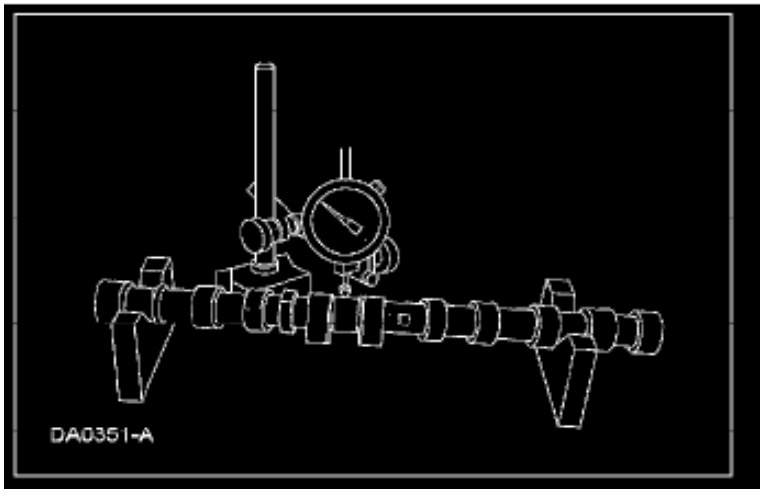
1. Use an indicator gauge to measure camshaft intake/exhaust lobe lift.

^ Rotate the camshaft and subtract the lowest indicator reading from the highest indicator reading to figure the camshaft lobe lift.



Special Tool(s)

ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent



Camshaft Runout

NOTE: Refer to Specifications.

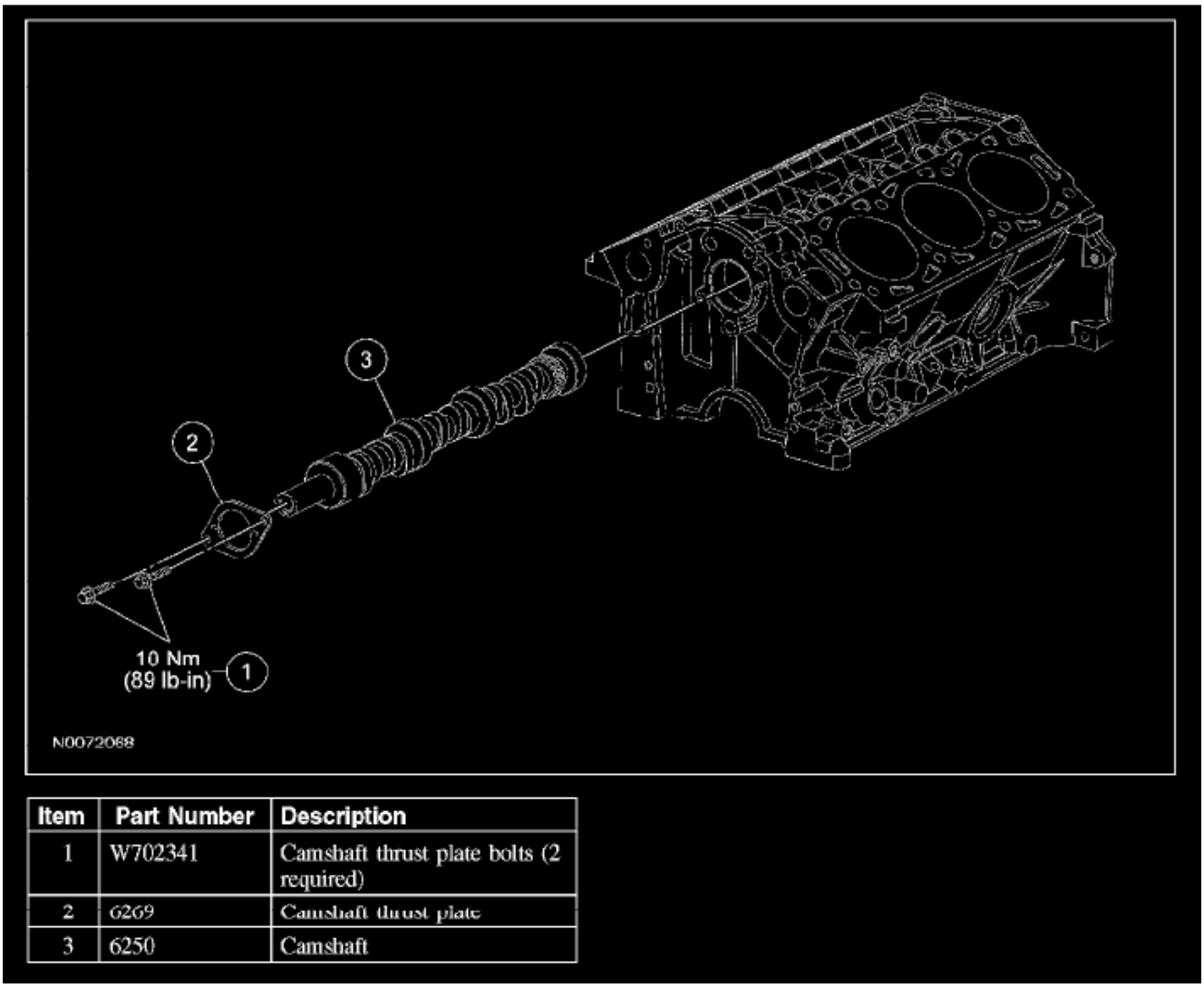
1. NOTE: Camshaft journals must be within specifications before checking runout.

Using the special tool, measure the camshaft runout. ^

Rotate the camshaft and subtract the lowest indicator reading from the highest indicator reading.

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A



Item	Part Number	Description
1	W702341	Camshaft thrust plate bolts (2 required)
2	6269	Camshaft thrust plate
3	6250	Camshaft

Camshaft: Removal and Replacement

Camshaft

Removal

1. Remove the radiator assembly. 2. Remove the hydraulic lash adjusters. 3. Remove the timing chain. 4. Remove the camshaft synchronizer assembly. 5. Remove the bolts and the camshaft thrust plate.

6. CAUTION: Damage to the camshaft or the camshaft bearings may occur if the camshaft is allowed to drop on the bearing surface or

cylinder block.

Remove the camshaft.

Installation

1. CAUTION: Damage to the camshaft or the camshaft bearings may occur if the camshaft is allowed to drop on the bearing surface or

cylinder block.

NOTE: Lubricate the camshaft, the camshaft bearings and the camshaft position sensor drive gear with clean engine oil prior to installation.

Install the camshaft.

2. NOTE: Lubricate the camshaft thrust plate with clean engine oil prior to installation.

Install the camshaft thrust plate and the bolts. ^

Tighten to 10 Nm (89 lb-inch).

3. Measure the camshaft end play. 4. Install the timing chain.

5. CAUTION: If a new camshaft is installed, always add the rest of the clean engine oil to the engine oil by pouring it through the

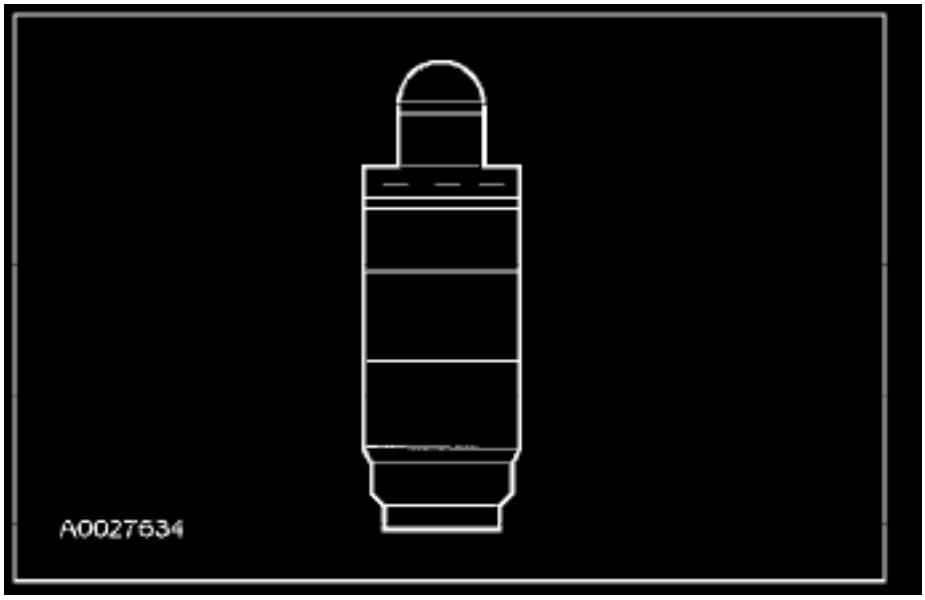
distributor hole onto the camshaft drive gear. Run engine at idle for 5 minutes before driving vehicle. Failure to follow these instructions may cause engine damage.

NOTE: Completely coat camshaft synchronizer gear teeth with clean engine oil.

Install the camshaft synchronizer assembly.

6. Install the hydraulic lash adjusters. 7. Install the radiator assembly. 8. Drain the engine oil. 9. Fill the engine with clean engine oil.

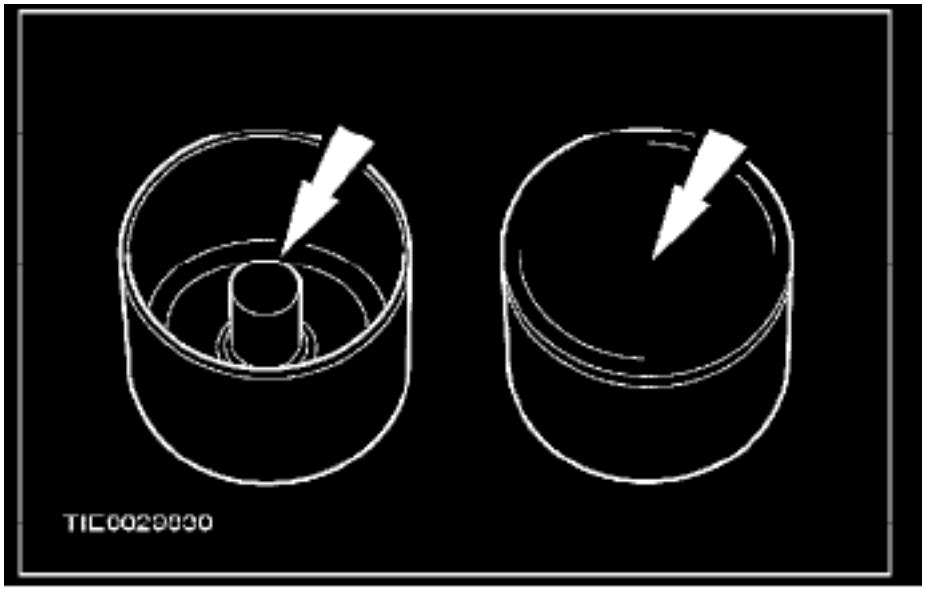
10. Fill and bleed the cooling system.

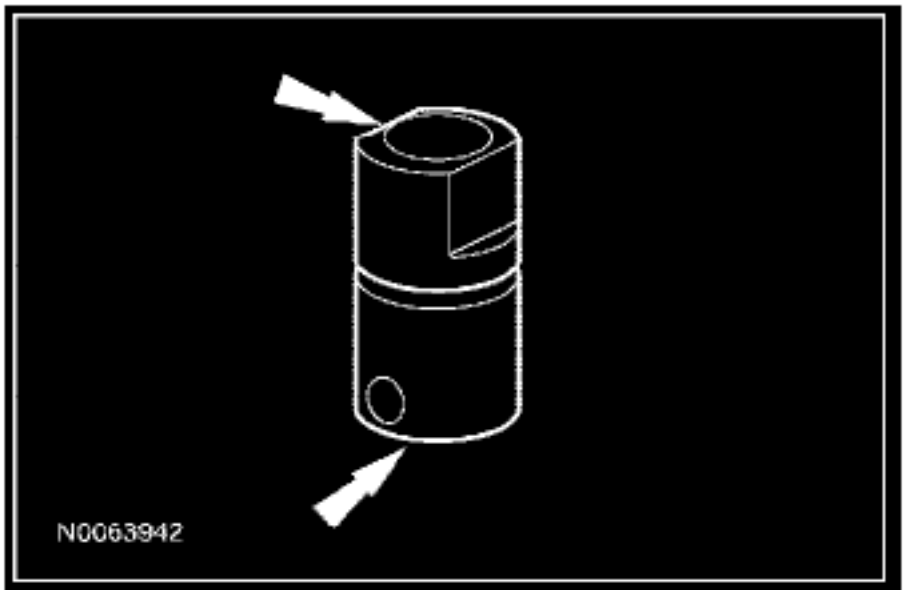


Lifter / Lash Adjuster: Testing and Inspection Hydraulic Lash Adjuster Inspection

Hydraulic Lash Adjuster Inspection

1. Inspect the hydraulic lash adjuster and roller follower for damage. If any damage is found, inspect the camshaft lobes and valves for damage.





Lifter / Lash Adjuster: Testing and Inspection Valve Tappet Inspection

Valve Tappet Inspection

OHC engines

1. Inspect the valve tappet for damage, especially in the indicated areas. If any damage is evident, inspect the camshaft lobes and valves for damage.

Replace components as necessary.

Push rod engines

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

Lifter / Lash Adjuster: Service and Repair

Hydraulic Lash Adjuster

Removal

CAUTION: During engine repair procedures, cleanliness is extremely important. Any foreign material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, can cause engine failure.

NOTE: For a valve train noise concern, inspect the valve-to-rocker arm clearance, rocker arms and push rods for wear.

1. Remove the lower intake manifold. 2. Remove the 2 bolts and the hydraulic lash adjuster guide plate retainer. 3. Remove the hydraulic lash adjuster guide plates. 4. Remove the hydraulic lash adjusters.

Installation

1. NOTE: Lubricate the hydraulic lash adjusters and the hydraulic lash adjuster bores with clean engine oil prior to installation.

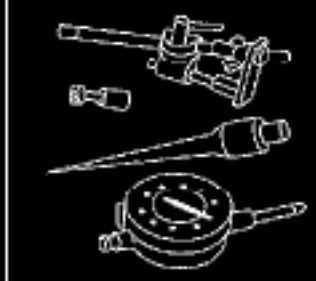
Install the hydraulic lash adjusters.

2. Install the hydraulic lash adjuster guide plates. 3. Install the hydraulic lash adjuster guide plate retainer and the 2 bolts.

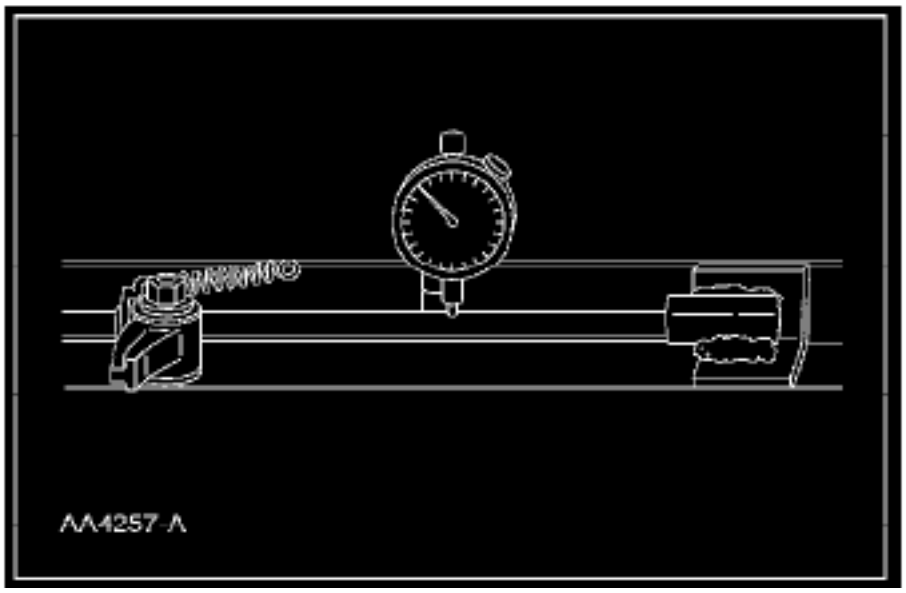
^ Tighten to 12 Nm (9 lb-ft).

4. Install the lower intake manifold.

Special Tool(s)



Dial Indicator Gauge with Holding Fixture
100-002 (TOOL-4201-C) or equivalent



Push Rod: Testing and Inspection

Push Rod Cleaning and Inspection

NOTE: Refer to Specifications.

1. Clean the push rods in a suitable solvent. Blow out the oil passage in the push rods with compressed air.

2. NOTE: Do not attempt to straighten the push rods.

Check the ends of the push rods for nicks, grooves, roughness or excessive wear. ^

The push rods can be checked for straightness while they are installed in the engine by rotating them with the valve closed.

^ They also can be checked using a Dial Indicator.

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

Push Rod: Service and Repair

Push Rod

Removal and Installation

CAUTION: During engine repair procedures, cleanliness is extremely important. Any foreign material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, can cause engine failure.

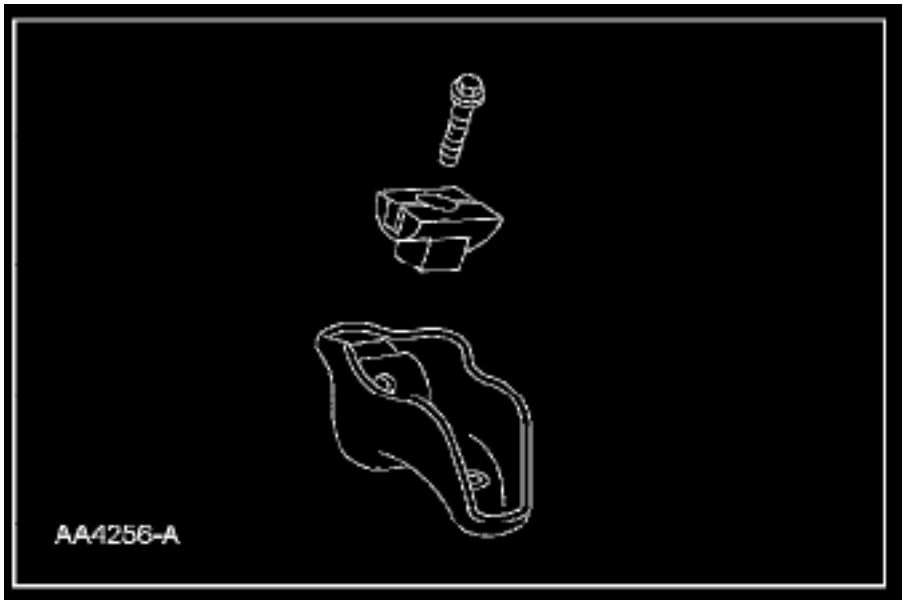
1. Remove the rocker arms.

2. NOTE: Identify and mark the location of each push rod. Each push rod must be installed in the original location.

Remove the push rods.

3. To install, reverse the removal procedure.

^ Lubricate the push rods with clean engine oil.



Rocker Arm Assembly: Testing and Inspection Rocker Arm Cleaning and Inspection

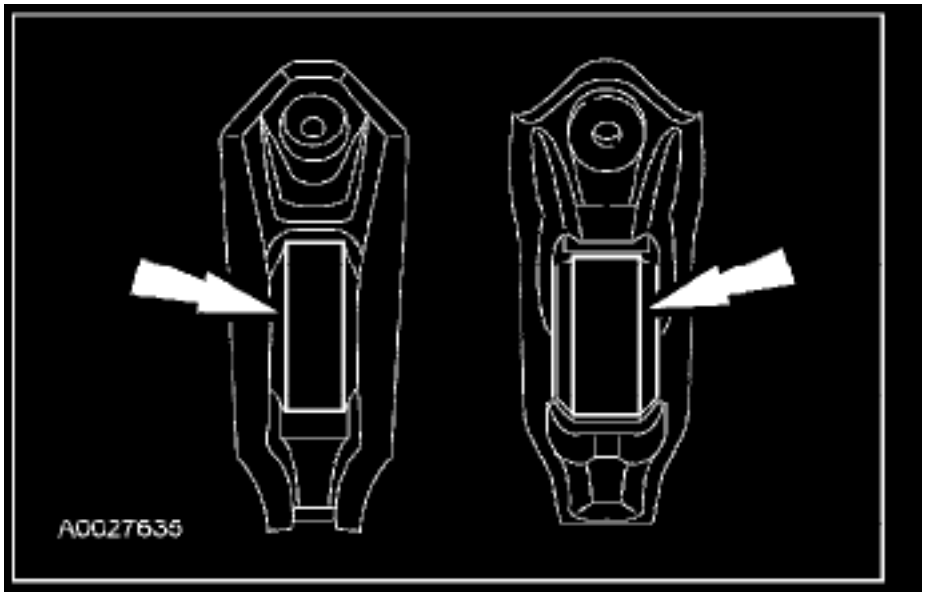
Rocker Arm Cleaning and Inspection

1. Clean all parts thoroughly. Make sure all oil passages are open. 2. Make sure the oil passage in the push rod/valve tappet end of the rocker arm is open.

CAUTION: Do not attempt to true surfaces by grinding. Check the rocker arm pad, side rails and seat for excessive wear, cracks, nicks or burrs. Check the rocker arm seat bolt for stripped or broken threads. Install new components as necessary or engine damage may occur.

3. Inspect the rocker arm push rod bore for nicks, scratches, scores or scuffs.

4. Inspect the pad at the valve end of the rocker arm for indications of grooving, scuffing or abnormal wear.



Rocker Arm Assembly: Testing and Inspection Roller Follower Inspection

Roller Follower Inspection

1. Inspect the roller follower for flat spots or scoring. If any damage is found, inspect the camshaft lobes and hydraulic lash adjuster for damage.

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

Rocker Arm Assembly: Service and Repair

Rocker Arm

Removal and Installation

CAUTION: During engine repair procedures, cleanliness is extremely important. Any foreign material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, can cause engine failure.

1. Remove the valve cover.

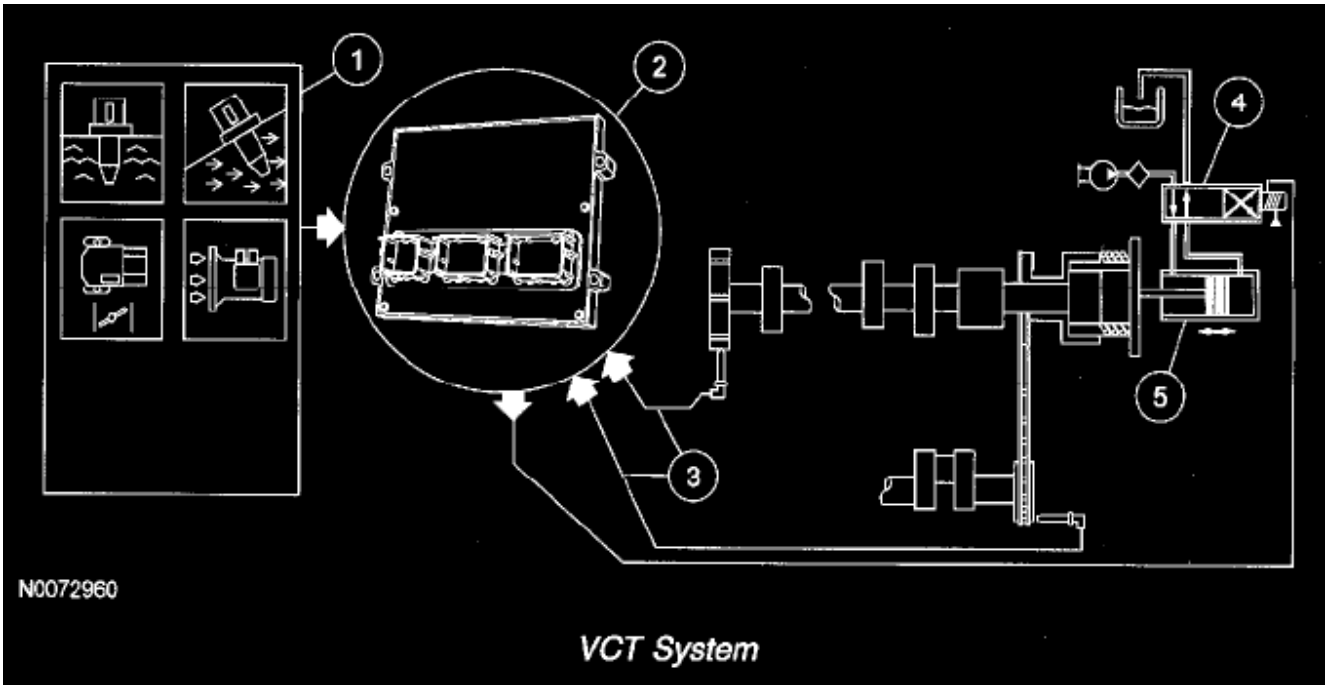
2. NOTE: Identify and mark the location of each rocker arm. Each rocker arm must be installed in the original location.

Remove the bolts and the rocker arms and fulcrums. ^

To install, tighten to 32 Nm (24 lb-ft).

3. To install, reverse the removal procedure.

^ Lubricate the rocker arms and fulcrums with clean engine oil.



VCT System

Variable Valve Timing Actuator: Description and Operation

VARIABLE CAMSHAFT TIMING (VCT) SYSTEM

Overview

The VCT enables rotation of the camshaft(s) relative to the crankshaft rotation as a function of engine operating conditions. There are 4 types of VCT systems.

- Exhaust phase shifting (EPS) system - the exhaust cam is the active cam being retarded.

- Intake phase shifting (IPS) system - the intake cam is the active cam being advanced.

- Dual equal phase shifting (DEPS) system - both intake and exhaust cams are phase shifted and equally advanced or retarded.

- Dual independent phase shifting (DIPS) system - where both the intake and exhaust cams are shifted independently.

All systems have 4 operational modes: idle, part throttle, wide open throttle (WOT), and default mode. At idle and low engine speeds with closed throttle, the powertrain control module (PCM) determines the phase angle based on air flow, engine oil temperature and engine coolant temperature. At part and wide open throttle the PCM determines the phase angle based on engine RPM, load, and throttle position. VCT systems provide reduced emissions and enhanced engine power, fuel economy and idle quality. IPS systems also have the added benefit of improved torque. In addition, some VCT system applications can eliminate the need for an external exhaust gas recirculation (EGR) system. The elimination of the EGR system is accomplished by controlling the overlap time between the intake valve opening and exhaust valve closing. Currently, both the IPS and DEPS systems are used.

Variable Camshaft Timing (VCT) System

VCT System

The VCT system consists of an electric hydraulic positioning control solenoid, a camshaft position (CMP) sensor, and a trigger wheel. The CMP trigger wheel has a number of equally spaced teeth equal to the number (n) of cylinders on a bank plus one extra tooth (n+1). Four cylinder and V8 engines use a CMP 4+1 tooth trigger wheel. V6 engines use a CMP 3+1 tooth trigger wheel. The extra tooth placed between the equally spaced teeth represents the CMP signal for that bank. A crankshaft position (CKP) sensor provides the PCM with crankshaft positioning information in 10 degree increments.

1. The PCM receives input signals from the intake air temperature (IAT) sensor, engine coolant temperature (ECT) sensor, engine oil temperature

(EOT) sensor, CMP, throttle position (TP) sensor, mass air flow (MAF) sensor, and CKP to determine the operating conditions of the engine. At idle and low engine speeds with closed throttle, the PCM controls the camshaft position based on ECT, EOT, IAT, and MAF. During part and wide open throttle, the camshaft position is determined by engine RPM, load and throttle position. The VCT system does not operate until the engine is at normal operating temperature.

2. The VCT system is enabled by the PCM when the correct conditions are met. 3. The CKP signal is used as a reference for CMP positioning. 4. The VCT solenoid valve is an integral part of the VCT system. The solenoid valve controls the flow of engine oil in the VCT actuator assembly.

As the PCM controls the duty cycle of the solenoid valve, oil pressure/flow advances or retards the cam timing. Duty cycles near 0% or 100% represent rapid movement of the camshaft. Retaining a fixed camshaft position is accomplished by dithering (oscillating) the solenoid valve duty cycle.

The PCM calculates and determines the desired camshaft position. It continually updates the VCT solenoid duty cycle until the desired position is achieved. A difference between the desired and actual camshaft position represents a position error in the PCM VCT control loop. The PCM

disables the VCT and places the camshaft in a default position if a concern is detected. A related DTC is also set when the concern is detected.

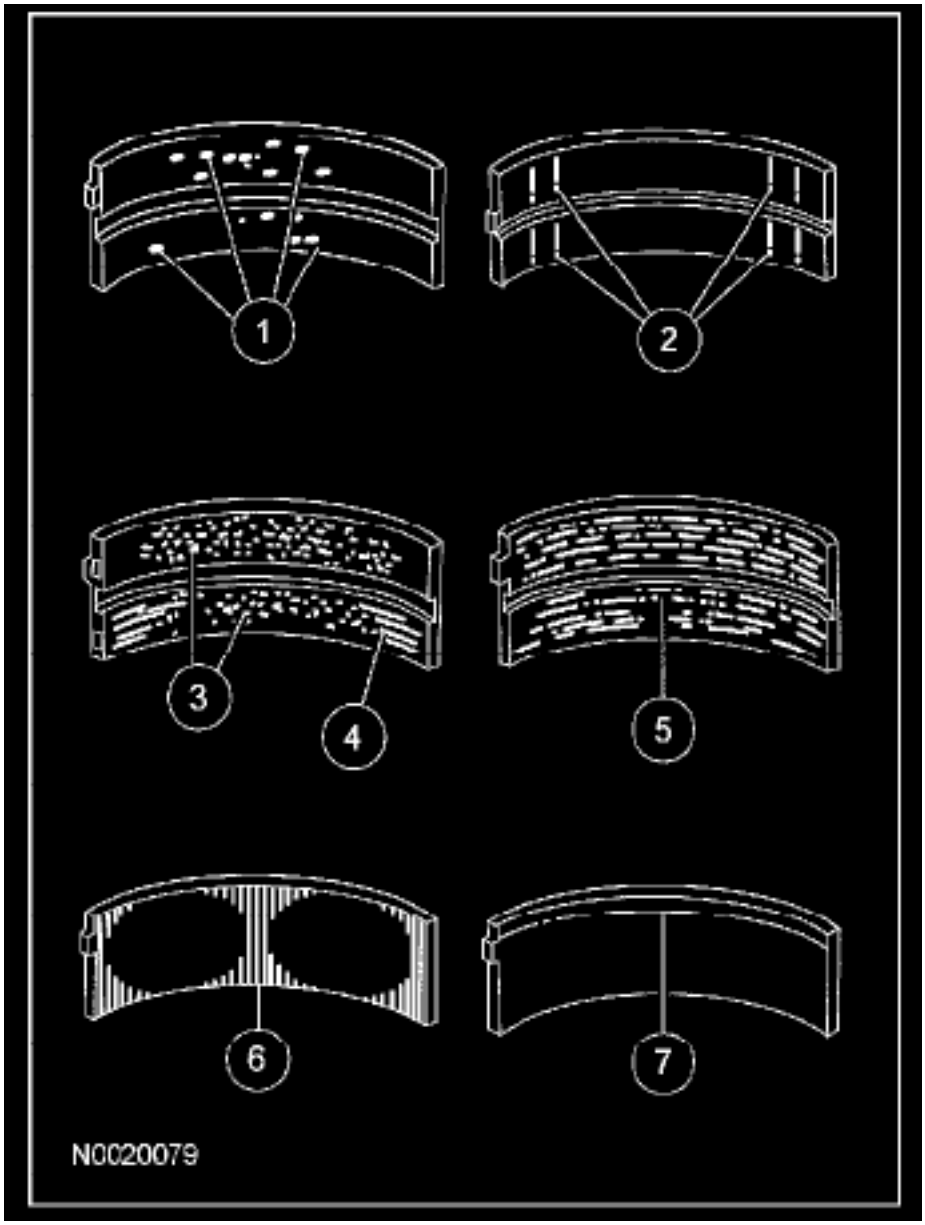
5. When the VCT solenoid is energized, engine oil is allowed to flow to the VCT actuator assembly which advances or retards the camshaft timing.

One half of the VCT actuator is coupled to the camshaft and the other half is connected to the timing chain. Oil chambers between the 2 halves couple the camshaft to the timing chain. When the flow of oil is shifted from one side of the chamber to the other, the differential change in oil pressure forces the camshaft to rotate in either an advance or retard position depending on the oil flow.

Connecting Rod Bearing: Specifications

Connecting Rod Bearings Clearance to crankshaft

Desired .... 0.025-0.035 mm (0.001-0.0014 in) Allowable .... 0.020-0.066 mm (0.00086-0.0027 in) Bearing wall thickness (Std) ..... 1.557-1.570 mm (0.0612-0.0618 in)



Connecting Rod Bearing: Testing and Inspection

Bearing Inspection

1. Inspect bearings for the following defects:

1 Cratering - fatigue failure

2 Spot polishing - incorrect seating

3 Imbedded dirty engine oil

4 Scratching - dirty engine oil

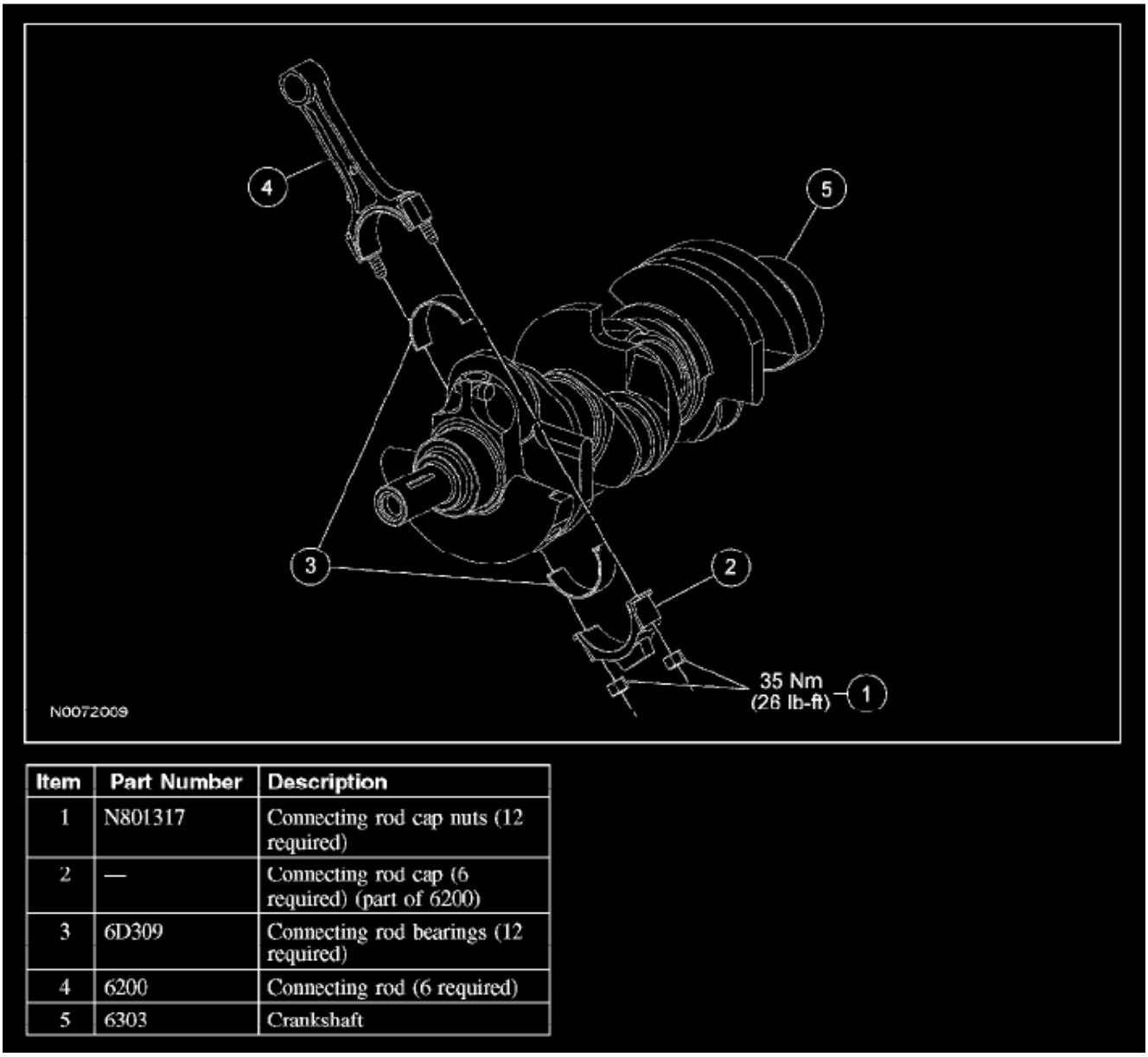
5 Base exposed - poor lubrication

6 Both edges worn - journal damaged

7 One edge worn - journal tapered or bearing not seated

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A



Item	Part Number	Description
1	N801317	Connecting rod cap nuts (12 required)
2	—	Connecting rod cap (6 required) (part of 6200)
3	6D309	Connecting rod bearings (12 required)
4	6200	Connecting rod (6 required)
5	6303	Crankshaft

Connecting Rod Bearing: Service and Repair

Connecting Rod Bearings

Removal

1. Remove the oil pan. 2. Remove the 7 nuts and the oil pan baffle.

3. CAUTION: The connecting rod bearing caps and the connecting rods are a matched set. Installing the incorrect connecting rod bearing

cap on a connecting rod may result in engine damage.

Remove the 2 nuts and the connecting rod bearing cap.

4. Lift the piston slightly and remove the connecting rod bearings.

Installation

1. The connecting rod bearings are precision fit. Refer to Engine for checking clearances or bearing selection.

2. CAUTION: The connecting rod bearings must be lubricated with clean engine oil prior to installation or the connecting rod bearing may

be damaged.

Install the connecting rod bearings.

3. CAUTION: Bearing caps are directional and must be installed exactly as they were removed or the connecting rods, the connecting rod

bearings or the crankshaft may be damaged.

Install the connecting rod bearing cap and 2 nuts. ^

Tighten to 35 Nm (26 lb-ft).

4. Repeat the procedure until all the connecting rod bearings are installed. 5. Install the oil pan baffle and the 7 nuts.

^ Tighten to 32 Nm (24 lb-ft).

6. Install the oil pan.

Connecting Rod: Specifications

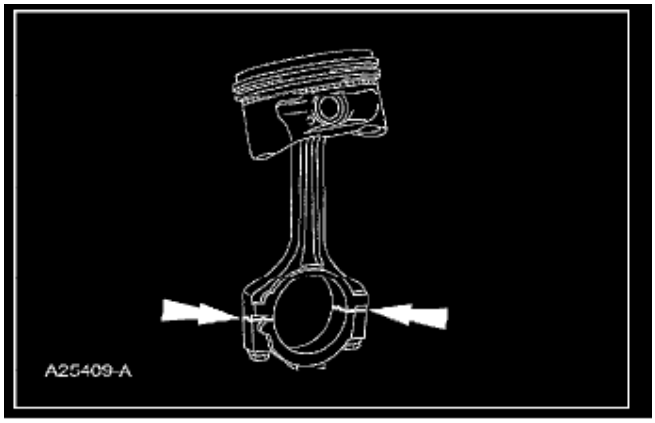
Connecting Rod

Piston pin bore diameter
.....
23.105-23.145 mm (0.9096-0.9112 in) Crankshaft bearing bore diameter
..... 5.15-5.17
mm (2.250-2.251 in) Length (center-to-center)
.....
140.46-140.54 mm (5.530-5.533 in)

Alignment (Bore-to-bore maximum difference) Twist .....
..... 0.075 per 25 mm (0.003 per in)
Bend .....
..... 0.04 per 25 mm (0.0016 per in)

Side clearance (assembled to crank) Standard .....
..... 0.15-0.35 mm (0.006-0.014 in) Service
limit .....
..... 0.36 mm (0.014 in) max

Connecting rod caps and nuts .....
..... 35 Nm (26 lb-ft)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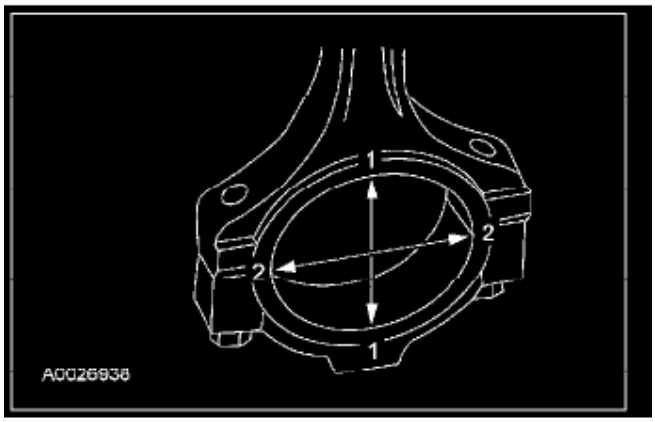
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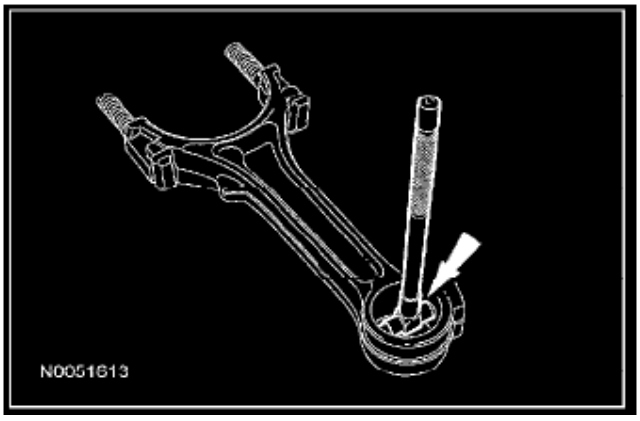
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Connecting Rod: Service and Repair

Connecting Rod Cleaning

CAUTION: Do not use a caustic cleaning solution or damage to connecting rods can occur.

1. NOTE: The connecting rod large end is a matched set. The connecting rod cap must be installed on the original connecting rod in the original

position. Do not reverse the cap. Parts are not interchangeable.

Mark and separate the parts and clean with solvent. Clean the oil passages.

Connecting Rod Large End Bore

NOTE: Refer to Specifications.

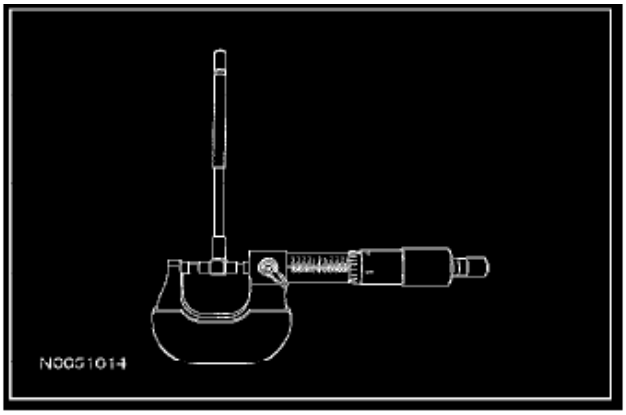
1. Tighten the bolts to specification, then measure the bore in 2 directions. The difference is the connecting rod bore out-of-round. Verify the

out-of-round is within specification.

Connecting Rod Bushing Diameter

NOTE: Refer to Specifications.

1. Use a telescoping gauge to determine the inner diameter of the connecting rod bushing, if equipped.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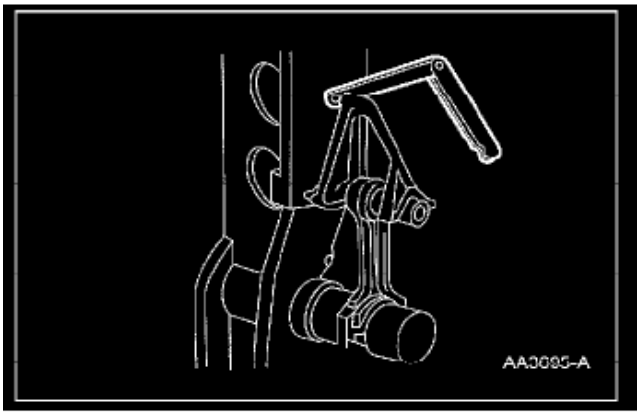
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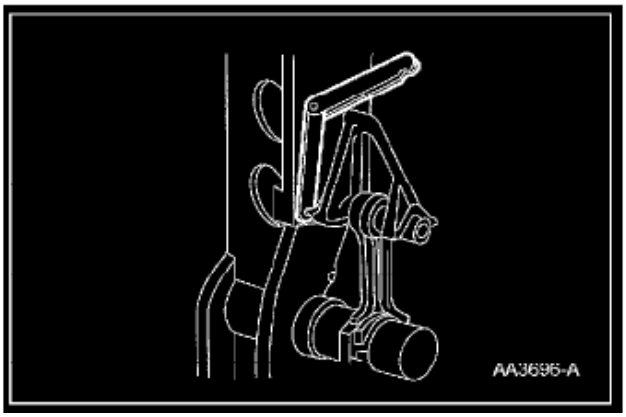
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2. Measure the telescoping gauge with a micrometer. Verify the diameter is within specification.

Connecting Rod Bend

NOTE: Refer to Specifications.

1. Measure the connecting rod bend on a suitable alignment fixture. Follow the instructions of the fixture manufacturer. Verify the bend measurement

is within specification.

Connecting Rod Twist

NOTE: Refer to Specifications.

1. Measure the connecting rod twist on a suitable alignment fixture. Follow the instructions of the fixture manufacturer. Verify the measurement is

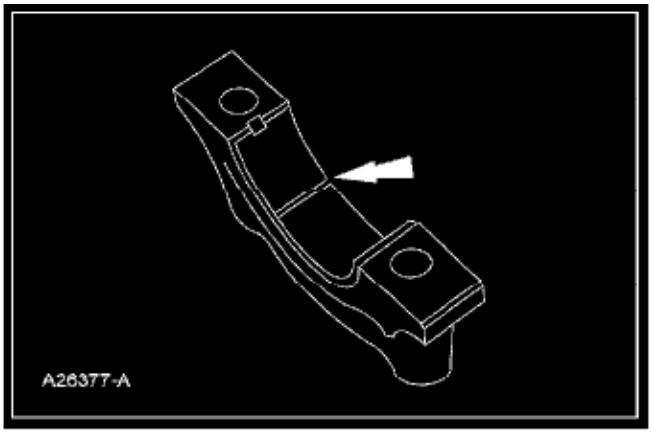
within specification.

Connecting Rod Bearing Journal-to-Bearing Clearance

NOTE: Refer to Specifications.

NOTE: The crankshaft connecting rod journals must be within specifications to check the connecting rod bearing journal clearance.

1. Remove the connecting rod bearing cap.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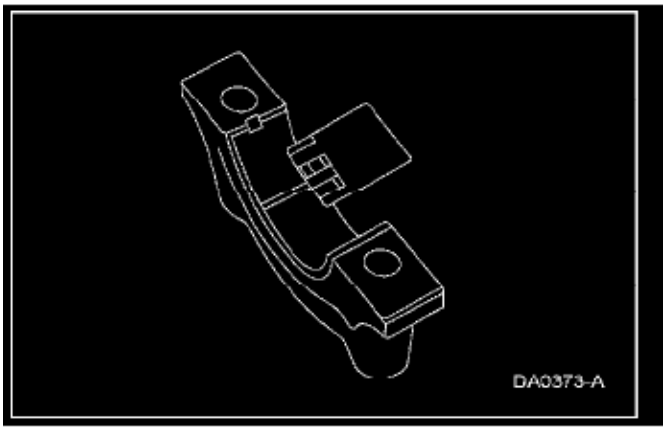
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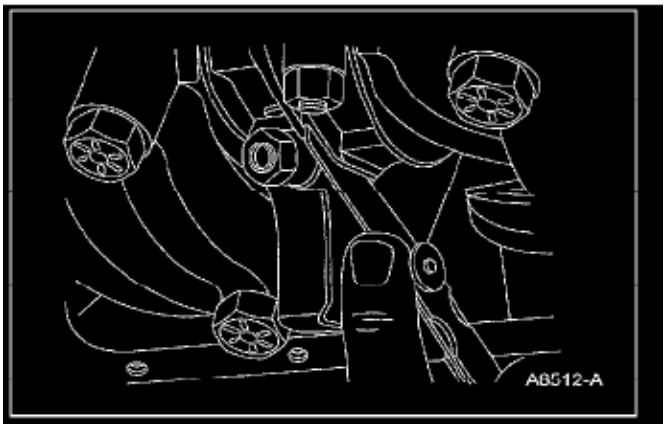
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2. Position a piece of Plastigage(R) across the bearing surface.

3. NOTE: Do not turn the crankshaft during this step.

Install and tighten to specifications, then remove the connecting rod bearing cap.

4. Measure the Plastigage(R) to get the connecting rod bearing journal clearance. The Plastigage(R) should be smooth and flat. A changing width

indicates a tapered or damaged connecting rod or connecting rod bearing.

Connecting Rod to Crankshaft Side Clearance

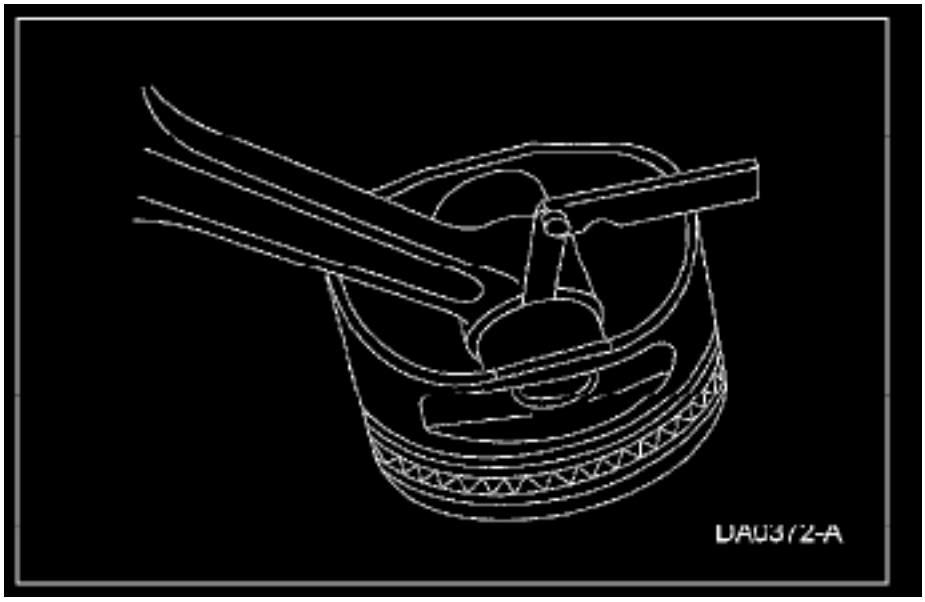
NOTE: Refer to Specifications.

1. Measure the clearance between the connecting rod and the crankshaft. Verify the measurement is within specification.

Connecting Rod-to-Piston Clearance

NOTE: Refer to Specifications.

1. Measure the clearance between the connecting rod and the piston. Verify the measurement is within specification.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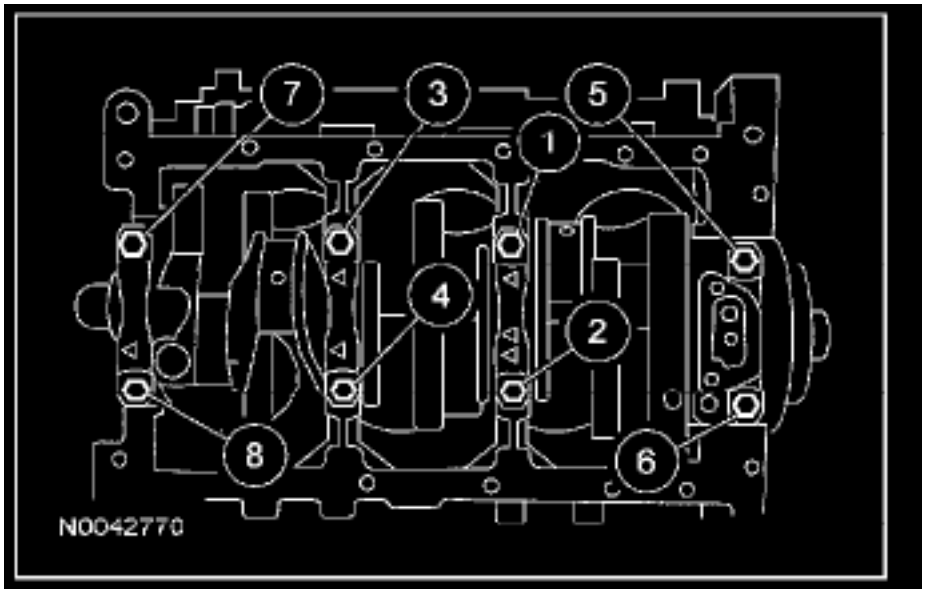
Crankshaft Gear/Sprocket: Specifications

Crankshaft Damper Bolt ..... 145 Nm (107 lb-ft)

Crankshaft Pulley Bolts ..... 63 Nm (46 lb-ft)



Crankshaft Main Bearing: Specifications

Main Bearings Clearance to crankshaft Desired .... 0.25-0.035 mm (0.001-0.0014 in)
Allowable .... 0.020-0.066 mm (0.0005-0.0023 in)

Bearing wall thickness (Std.)

1st and 2nd .... 2.444-2.481 mm (0.0962-0.0967 in) 3rd and rear .... 2.427-2.491 mm (0.0955-0.0980 in)

Main Bearing Thrust Face Surface finish (RMS)

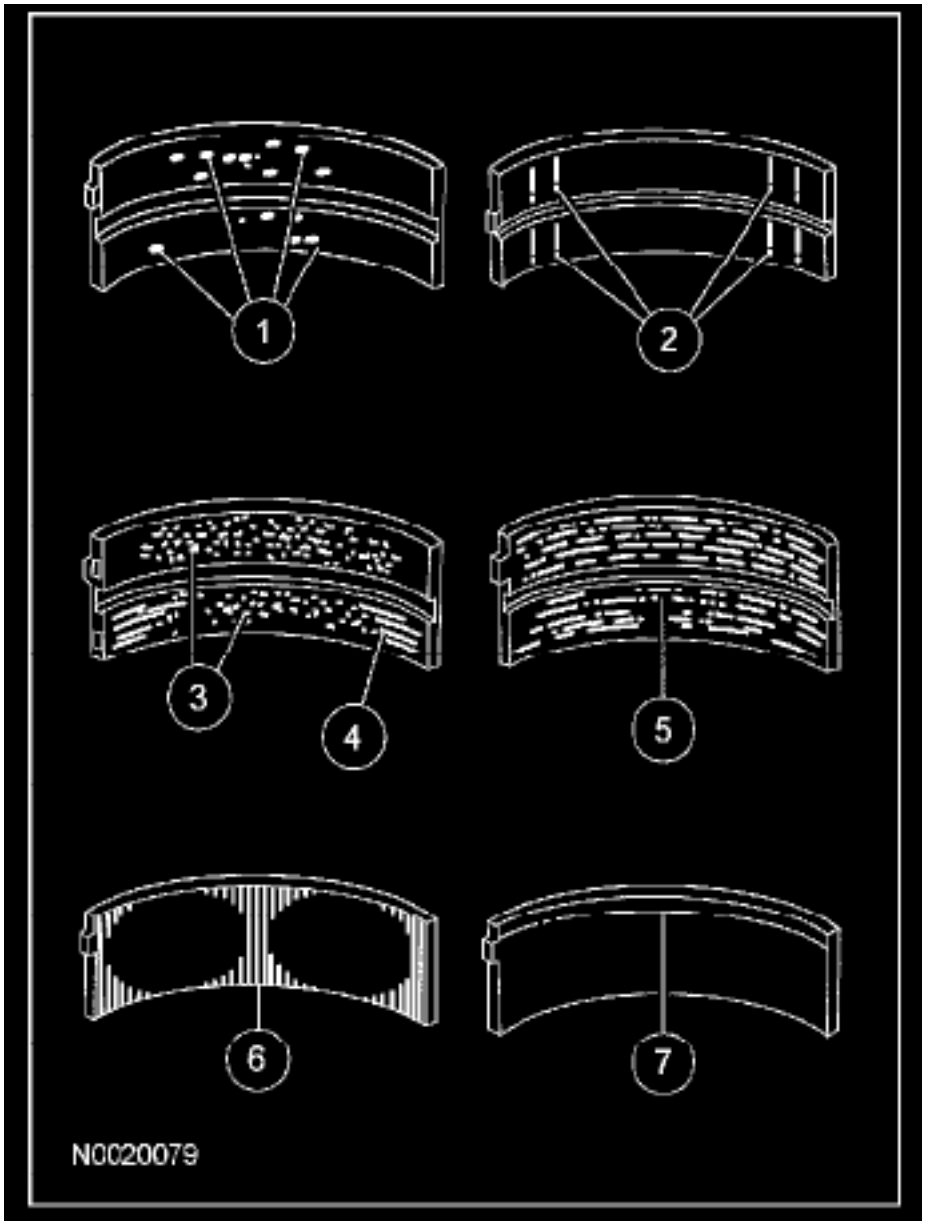
front .... 0.4 micrometer (0.157 micro in) rear .... 0.4 micrometer (0.157 micro in)

Runout limit .... 0.025 mm (0.001 in)

Main bearing bore .... 68.905 mm (2.713 in)

Diameter .... 68.885 mm (2.712 in)

Main Bearing Cap Bolts .... 80 Nm (59 lb-ft)



Crankshaft Main Bearing: Testing and Inspection

Bearing Inspection

1. Inspect bearings for the following defects:

1 Cratering - fatigue failure

2 Spot polishing - incorrect seating

3 Imbedded dirty engine oil

4 Scratching - dirty engine oil

5 Base exposed - poor lubrication

6 Both edges worn - journal damaged

7 One edge worn - journal tapered or bearing not seated

Crankshaft: Specifications

Main bearing journal diameter ..... 63.983-64.003 mm (2.5190-2.5198 in) Out-of-round limit ..... 0.008 mm (0.0003 in)

Taper limit

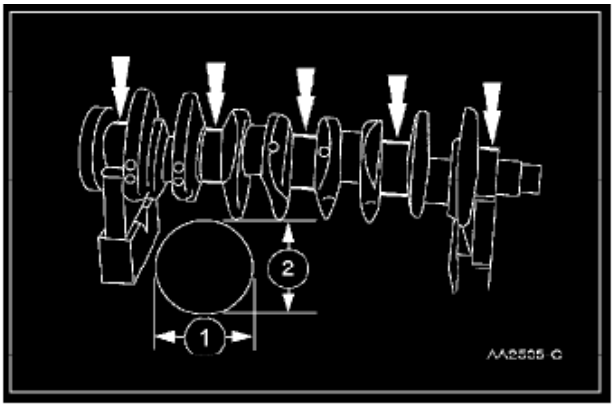
total ..... 0.06 mm (0.003 in) per 25 mm (1 in) ..... 0.013 mm (0.0003 in)

Journal runout limit

a ..... 0.05 mm (0.002 in) b ..... 0.05 mm (0.002 in)

a Runout of journals II and III to journals I and IV. b Runout of adjacent journals to each other.

Surface finish (RMS) ..... 0.25 micrometer (10.0 micro in)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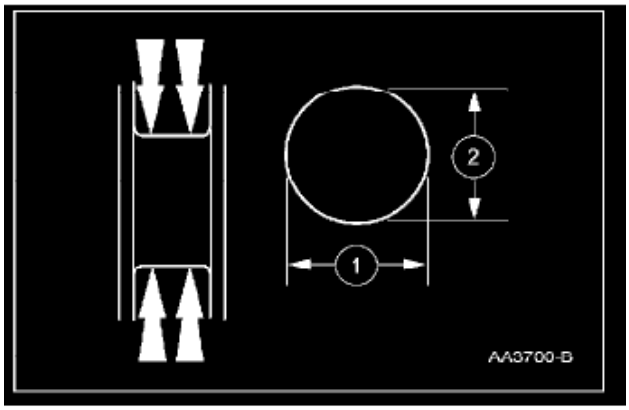
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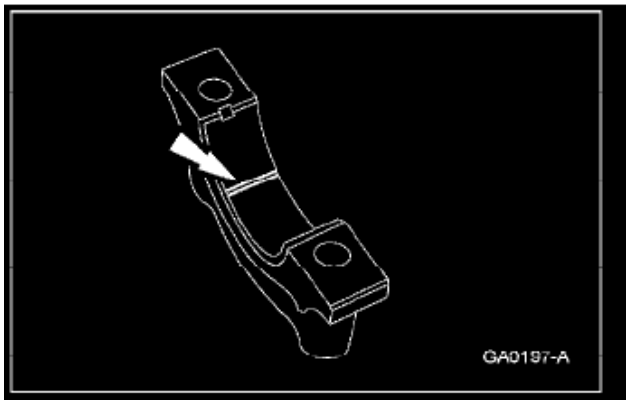
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Crankshaft: Service and Repair

Crankshaft Main Bearing Journal Diameter

NOTE: Refer to Specifications.

1. Measure each of the crankshaft main bearing journal diameters in at least 2 directions.

Crankshaft Main Bearing Journal Taper and Out-of-Round

NOTE: Refer to Specifications.

1. Measure each of the crankshaft main bearing journal diameters in at least 2 directions at each end of the main bearing journal.

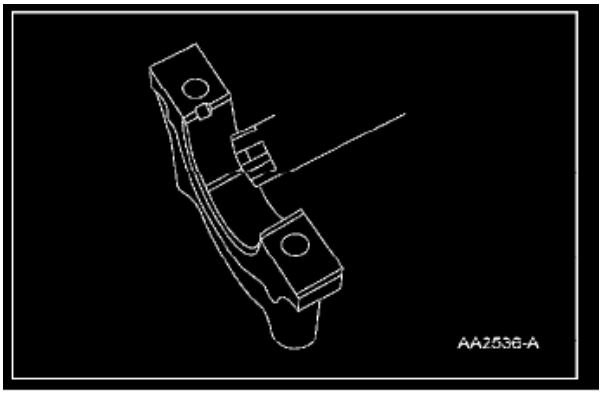
Crankshaft Main Bearing Journal-to-Bearing Clearance

NOTE: Refer to Specifications.

NOTE: Crankshaft main bearing journals must be within specifications before checking journal clearance.

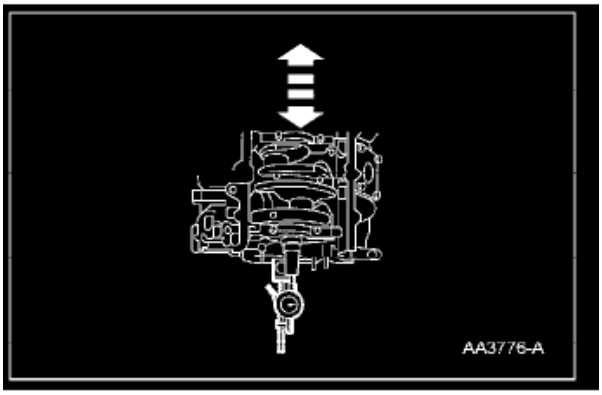
1. Remove the crankshaft main bearing caps and crankshaft main bearing. 2. Lay a piece of Plastigage(R) across the face of each crankshaft main bearing surface.

3. NOTE: Do not turn the crankshaft while carrying out this procedure.



Special Tool(s)

ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent



Special Tool(s)

ST1214-A	Dial Indicator with Bracketry 100-002 (TOOL-4201-C) or equivalent

Install and remove the crankshaft main bearing cap.

4. Verify the crankshaft journal clearance.

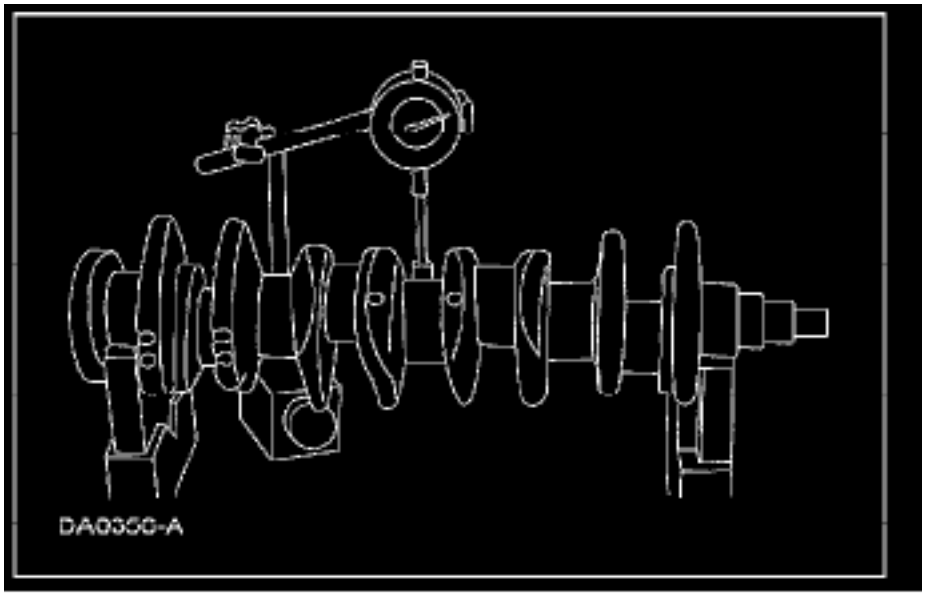
Crankshaft End Play

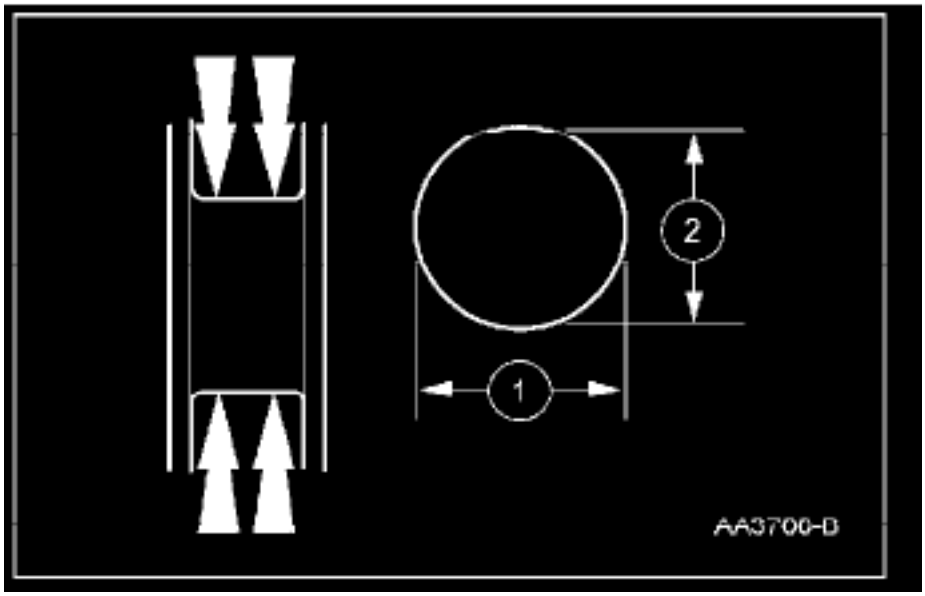
NOTE: Refer to Specifications.

1. Using the Dial Indicator Gauge, measure the crankshaft end play. 2. Position the crankshaft to the rear of the cylinder block. 3. Zero the indicator. 4. Move the crankshaft to the front of the cylinder block. Note and record the crankshaft end play.

Crankshaft Runout

NOTE: Refer to Specifications.





1. NOTE: Crankshaft main bearing journals must be within specifications before checking runout.

Use the Dial Indicator Gauge to measure the crankshaft runout. ^

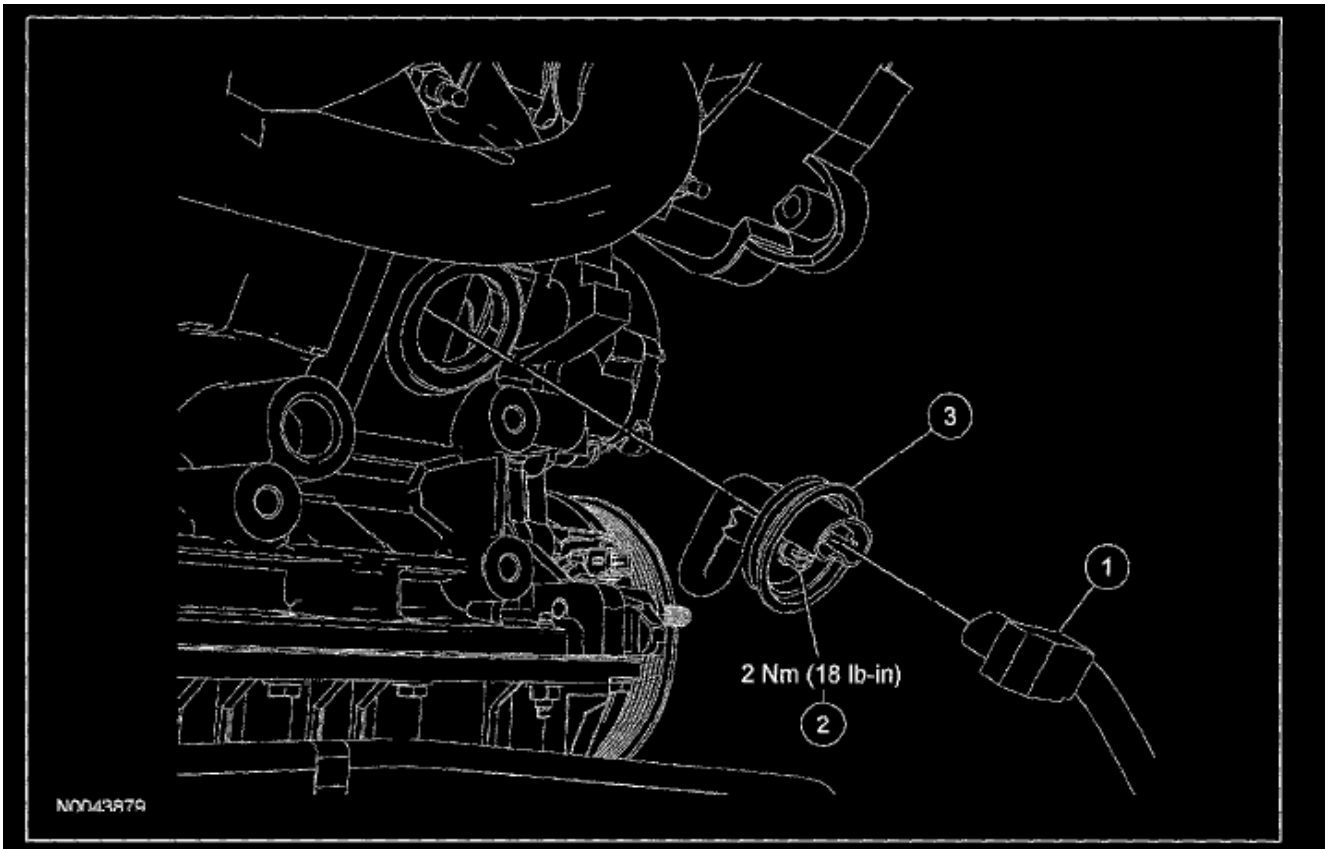
Rotate the crankshaft and subtract the lowest dial indicator reading from the highest dial indicator reading to figure the crankshaft runout.

Connecting Rod Bearing Journal Taper and Out-of-Round

NOTE: Refer to Specifications.

1. Measure the crankshaft connecting rod journal diameters in 2 directions perpendicular to one another at each end of the connecting rod journal.

The difference in the measurements from one end to the other is the taper. Verify measurement is within the wear limit.



Item	Part Number	Description
1	14A199	Block heater electrical connector (part of 6B018)
2	—	Block heater screw (part of 6A051)
3	6A051	Block heater

Engine Block Heater: Service and Repair

Block Heater

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Drain the cooling system. 3. Disconnect the block heater electrical connector.

4. NOTE: Do not loosen the screw more than necessary for removal.

Loosen the block heater screw and twist and slide the block heater to release the retainer clip. Discard the retainer clip and remove the block heater.

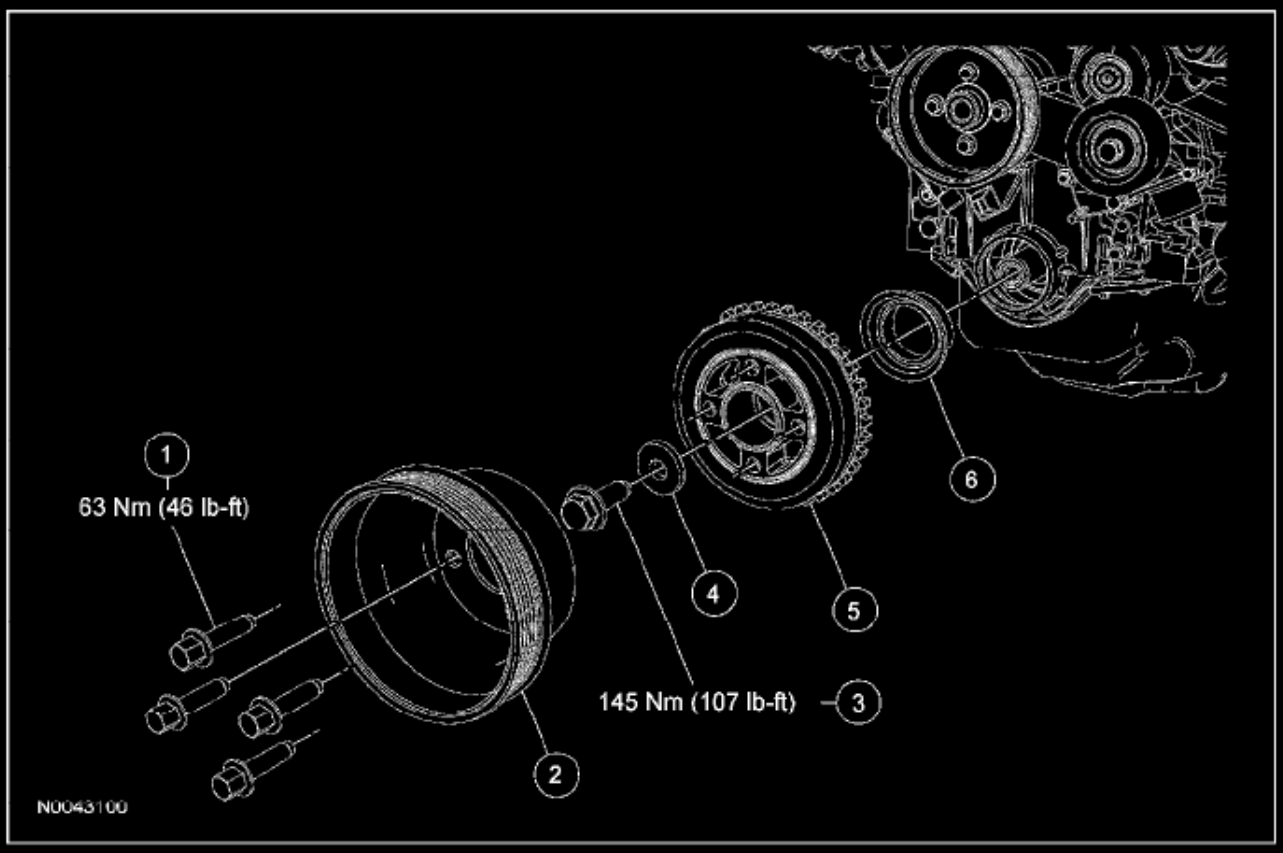
5. To install, reverse the removal procedure.

Harmonic Balancer - Crankshaft Pulley: Specifications

Crankshaft Damper Bolt ..... 145 Nm (107 lb-ft)

Crankshaft Pulley Bolts ..... 63 Nm (46 lb-ft)

Lower End Components — Exploded View



Item	Part Number	Description
1	N807551	Crankshaft pulley bolt (4 required)
2	6312	Crankshaft pulley
3	N808089-S	Crankshaft damper bolt
4	6373	Crankshaft damper bolt washer

Item	Part Number	Description
5	6316	Crankshaft damper
6	6700	Crankshaft front seal

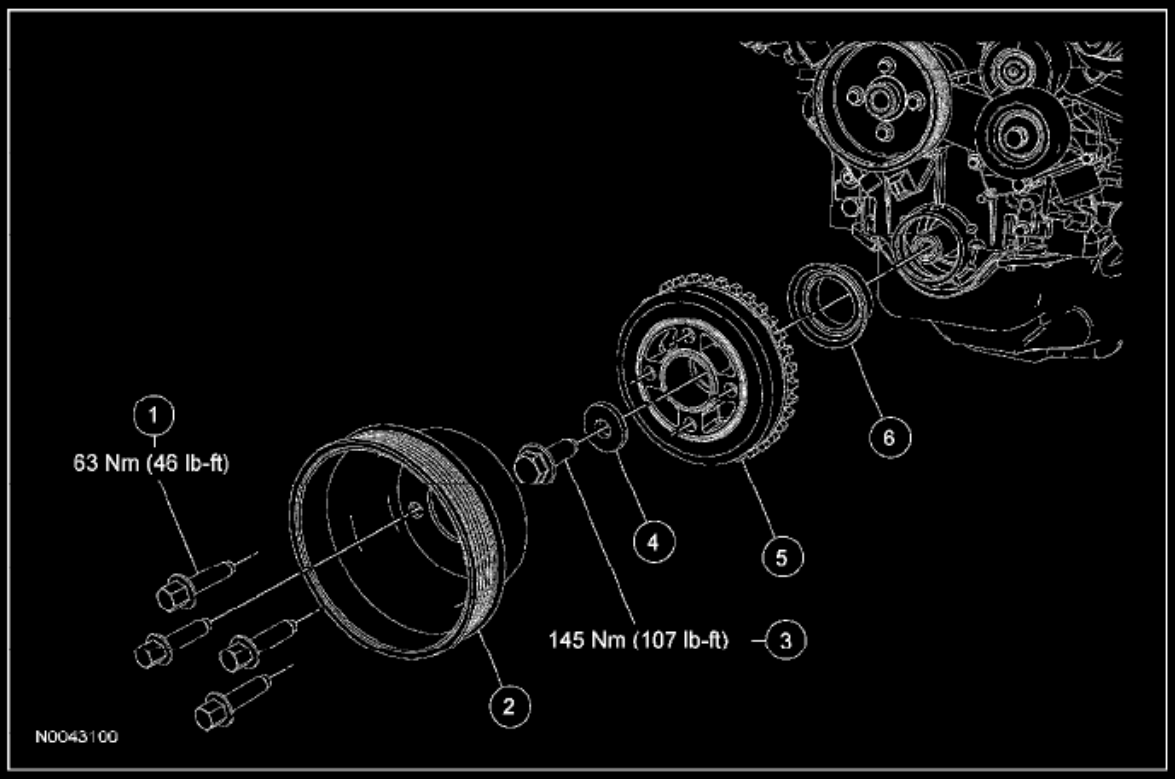
(Continued)

Harmonic Balancer - Crankshaft Pulley: Diagrams

Lower End Components - Exploded View

Lower End Components - Exploded View

Lower End Components — Exploded View



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3	N808089-S	Crankshaft damper bolt
4	6373	Crankshaft damper bolt washer

Item	Part Number	Description
5	6316	Crankshaft damper
6	6700	Crankshaft front seal

(Continued)

Special Tool(s)

ST1387-A	Installer, Crankshaft Vibration Damper 303-175 (T82L-6316-A)
ST1286-A	Remover, Crankshaft Vibration Damper 303-009 (T58P-6316-D)

Harmonic Balancer - Crankshaft Pulley: Service and Repair

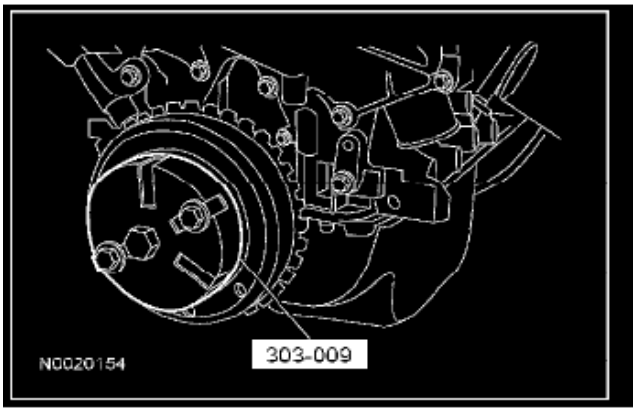
Crankshaft Pulley

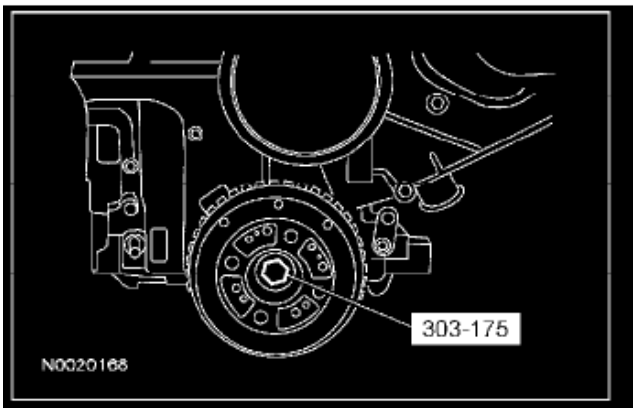
Lower End Components - Exploded View

Lower End Components - Exploded View

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4





Removal

1. Remove the air cleaner outlet tube. 2. Remove the fan blade and the fan shroud. 3. Remove the accessory drive belt. 4. Remove the 4 bolts and the crankshaft pulley. 5. Remove the crankshaft bolt and the washer. 6. Using the special tool, remove the crankshaft damper.

Installation

1. Using the special tool, install the crankshaft damper.

^ Coat the sealing surfaces of the crankshaft damper with clean engine oil.

^ Coat the crankshaft damper keyway with silicone gasket and sealant.

^ Install the crankshaft damper.

2. Install the crankshaft bolt and the washer.

^ Tighten to 145 Nm (107 lb-ft).

3. Install the crankshaft pulley and 4 bolts.

^ Tighten to 63 Nm (46 lb-ft).

4. Install the drive belt. 5. Install the fan blade and the fan shroud. 6. Install the air cleaner outlet tube.

Piston: Specifications

Piston Diameter Coded red .... 88.962-88.978 mm (3.5024-3.5031 in) Coded blue .... 88.988-89.004 mm (3.5035-3.5041 in) Coded yellow ..... 89.014-89.030 mm (3.5045-3.5051 in) Piston-to-bore clearance ..... 0.030-0.056 mm (0.0012-0.0022 in) Service limit .... 0.081 mm (0.003 in) max

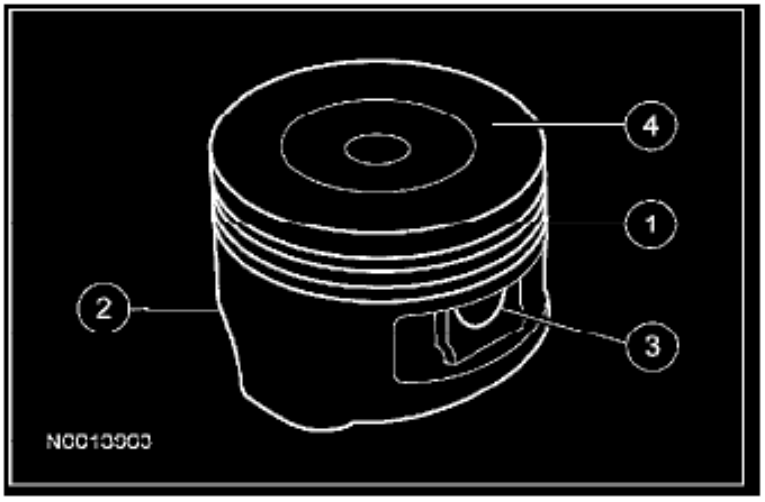
Service Piston Selection a

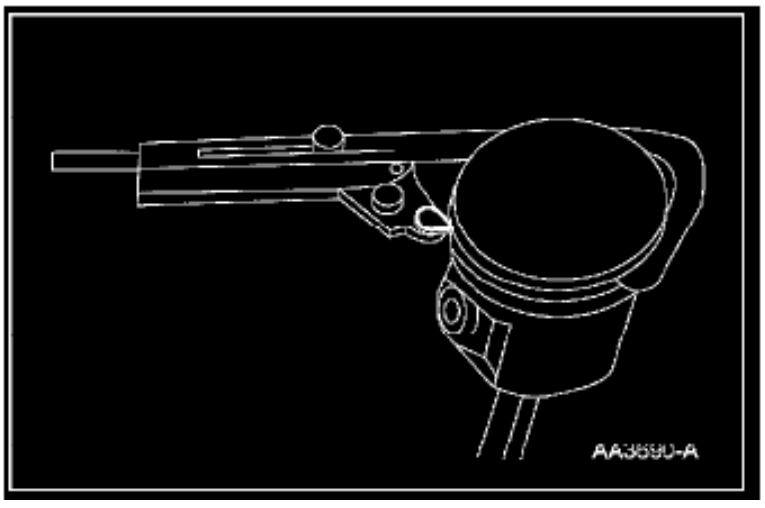
Piston bore diameter .... Service piston grade required 89.009-89.035 mm (3.5043-3.05053 in) .... Red 89.035-89.060 mm (3.5053-3.5063 in) .... Blue 89.060-89.086 mm (3.5063-3.5073 in) .... Yellow

a When replacing pistons, measure the cylinder bore, and install the indicated service piston.

Special Tool(s)

ST1279-A	Scraper, Piston Ring Groove 303-D033 (D81L-6002-D) or equivalent





Piston: Procedures

Piston Inspection

CAUTION: Do not use a caustic cleaning solution or a wire brush to clean the pistons or damage can occur.

1. Clean and inspect the (1) ring lands, (2) skirts, (3) pin bosses and the (4) tops of the pistons. If wear marks, scores or glazing is found on the piston

skirt, check for a bent or twisted connecting rod.

2. Use the Piston Ring Groove Scraper to clean the piston ring grooves.

^ Make sure the oil ring holes are clean.

Piston Pin Bore Diameter

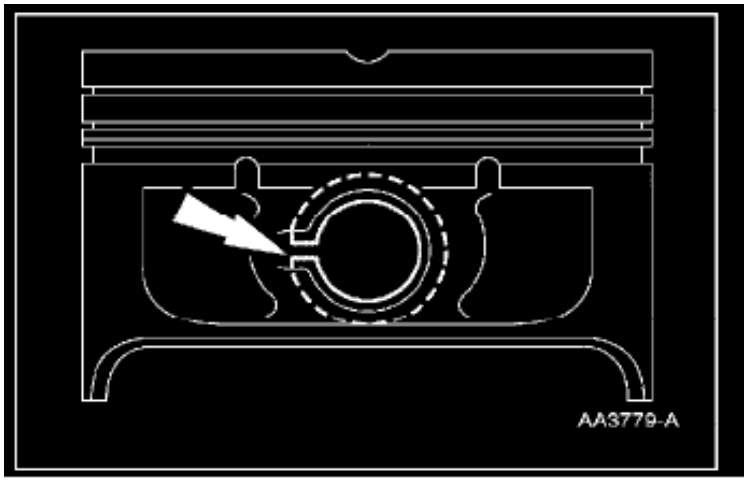
NOTE: Refer to Specifications.

1. WARNING: Since the retainer ring has a tendency to spring out, cover the end of the pin bore with a hand or shop rag when removing

the ring. Wear eye protection. Failure to follow these instructions may result in serious personal injury.

NOTE: Piston and piston pins are a matched set and should not be interchanged.

Measure the piston pin bore diameter in 2 directions on each side. Verify the diameter is within specification.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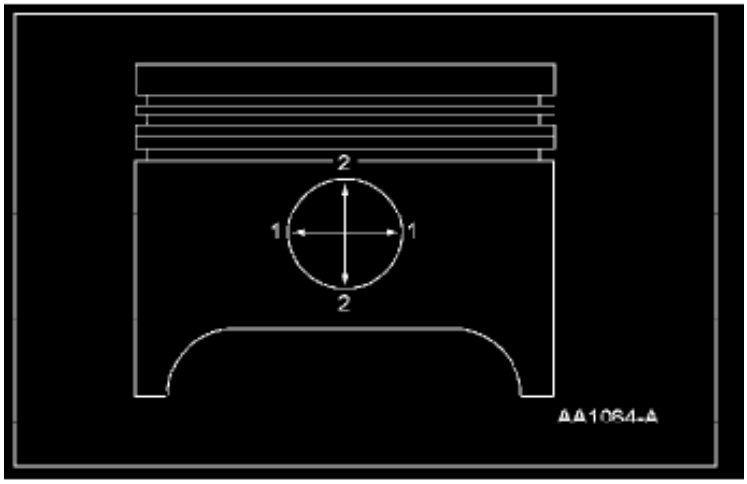
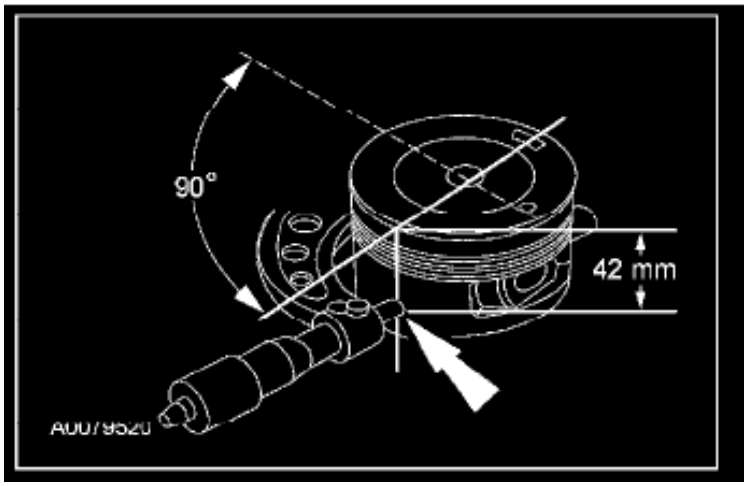

2
1
1
2
AA1084-A


90°
42 mm
A00/9520

Piston Diameter

NOTE: Refer to Specifications.

1. Measure the piston diameter 90 degrees from the piston pin and 42 mm (1.65 inch) down from the top of the piston at the point indicated.

Piston To Cylinder Bore Clearance

NOTE: Refer to Specifications.

1. Subtract the piston diameter from the cylinder bore diameter to find the piston-to-cylinder bore clearance.

Piston Ring End Gap

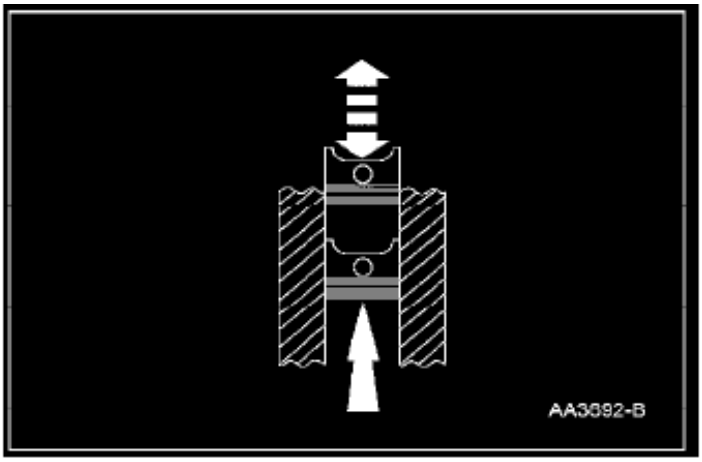
CAUTION: Use care when fitting piston rings to avoid possible damage to the piston ring or the cylinder bore.

NOTE: Piston rings should not be transferred from one piston to another.

NOTE: Refer to Specifications.

NOTE: The cylinder bore must be within specification for taper and out-of-round.

1. Use a piston without rings to push a piston ring in a cylinder to the bottom of ring travel.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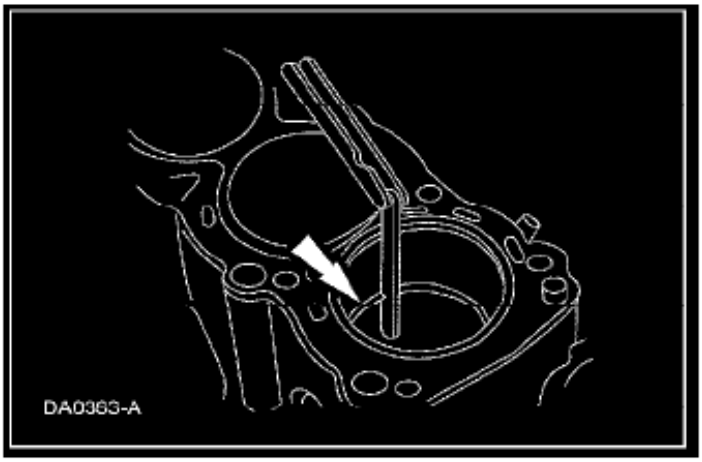
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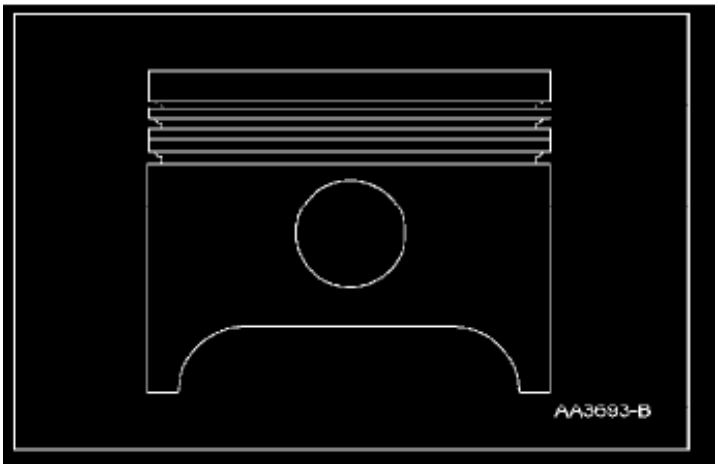

AA3693-B

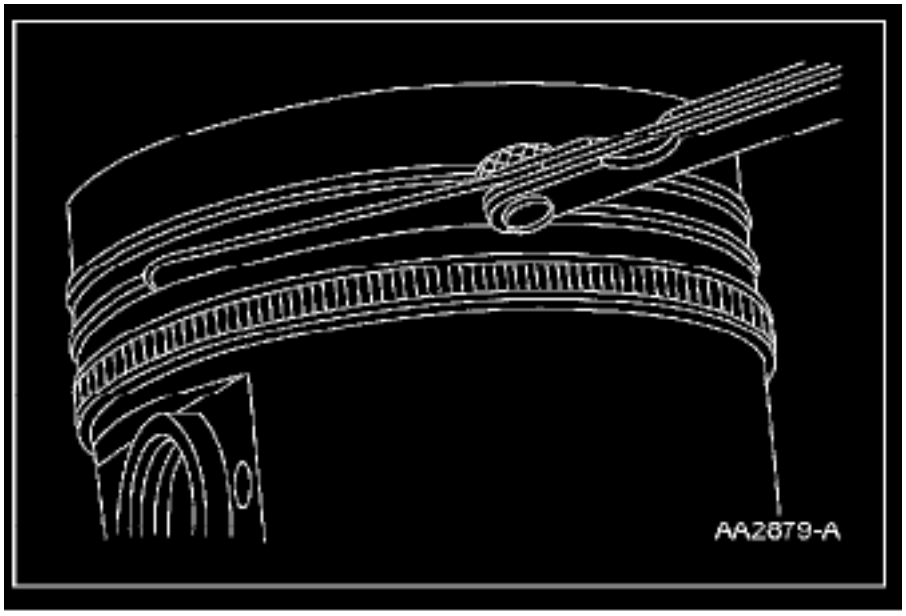
2. Use a feeler gauge to measure the top piston ring end gap and the second piston ring end gap.

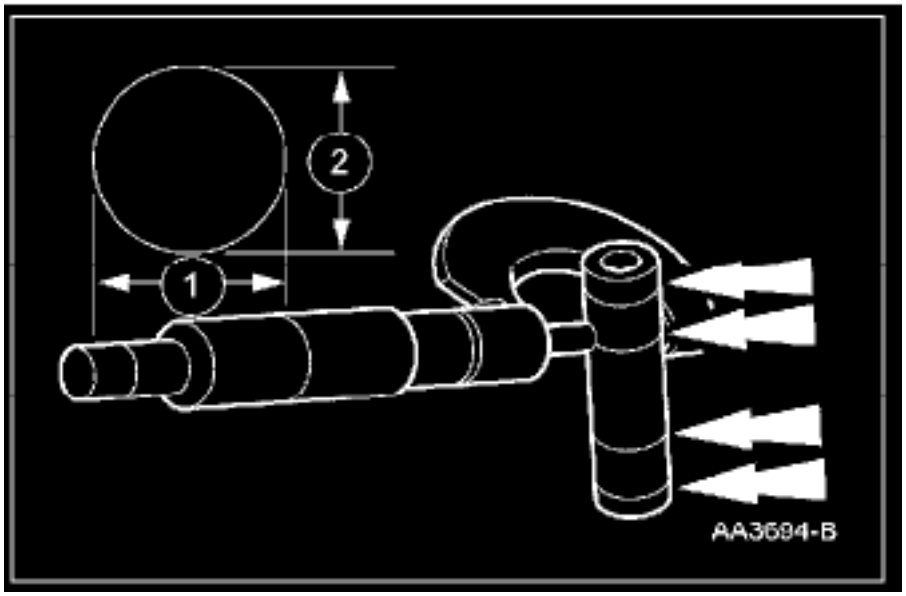
Piston Ring-to-Groove Clearance

NOTE: Refer to Specifications.

1. Inspect the piston for ring land damage or accelerated wear.

2. Measure the piston ring-to-groove clearance.





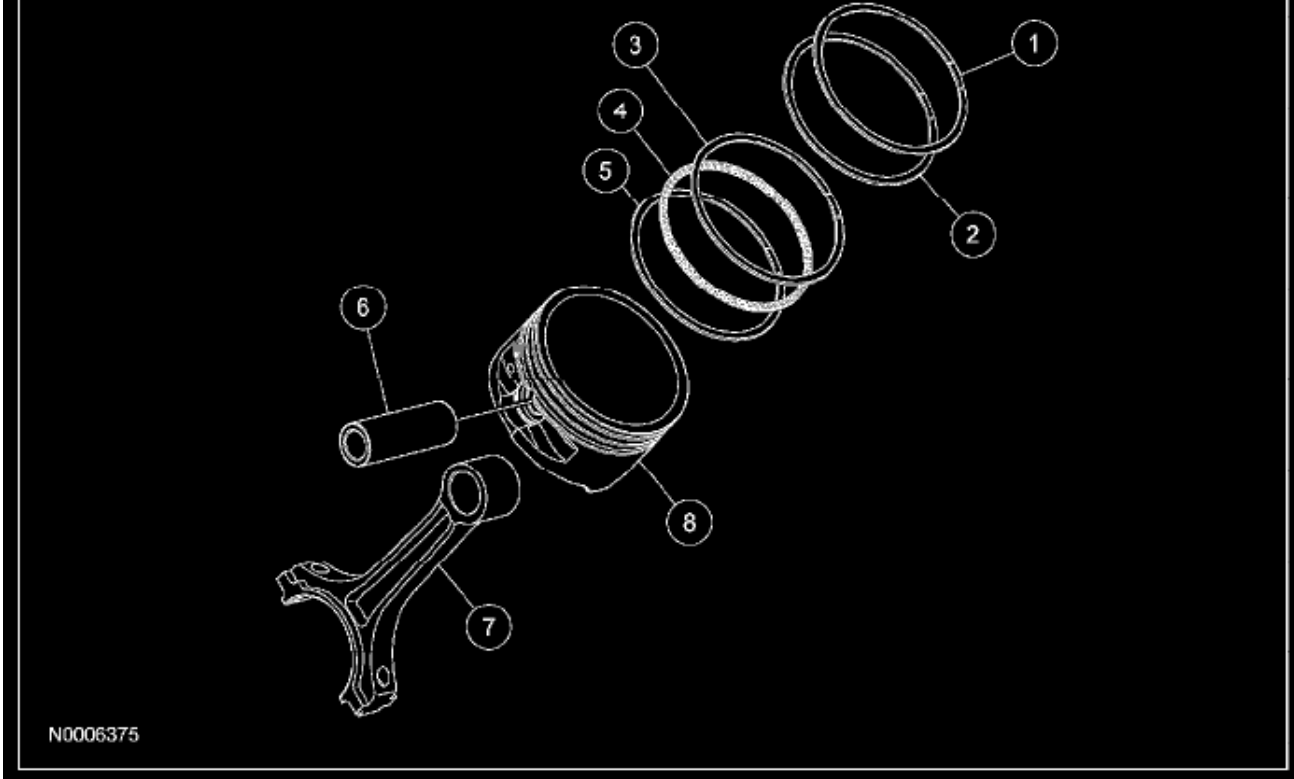
Piston Pin Diameter

NOTE: Refer to Specifications.

1. Measure the piston pin diameter in 2 directions at the points shown. Verify the diameter is within specification.

Special Tool(s)

ST1336-A	Service Set, Piston Pin 303-S024 (T68P-6135-A)



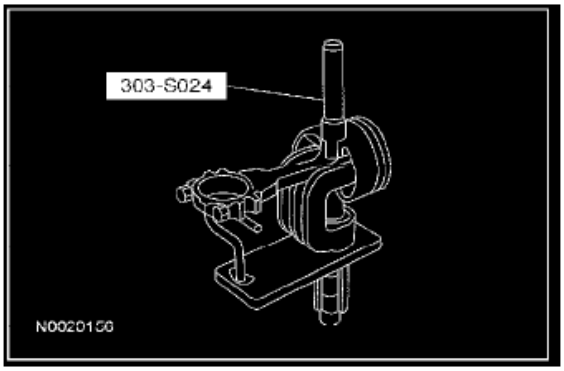
Item	Part Number	Description
1	6150	Piston compression upper ring
2	6152	Piston compression lower ring
3	6159	Piston oil control upper segment ring
4	6161	Piston oil control spacer
5	6159	Piston control lower segment ring
6	6135	Piston pin
7	6200	Connecting rod
8	6110	Piston

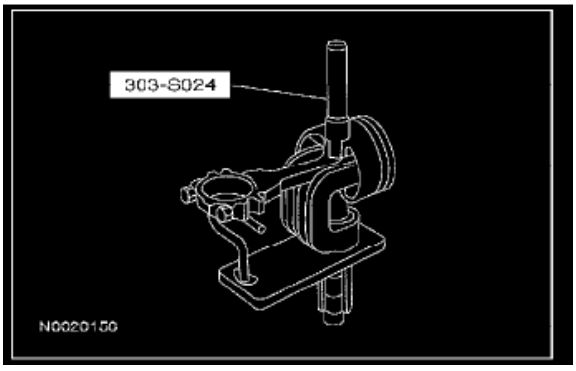
Piston: Overhaul

Piston

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A





Disassembly

1. CAUTION: Use a suitable ring expander to remove piston rings to prevent damage.

Remove the piston rings one at a time, starting with the top compression ring and finishing with the lower oil control ring. ^

Discard the piston rings.

2. NOTE: Take note of piston connecting rod assembly and index-mark the connecting rod and the piston to make sure of correct orientation during

reassembly.

Using the special tool, press the piston pin out of the piston connecting rod assembly.

3. Remove the connecting rod from the piston. 4. Clean and inspect the connecting rod and the piston.

Assembly

1. Lubricate the piston pin and piston pin bore.

^ Use clean engine oil.

2. NOTE: During assembly, the small end of the connecting rod must be heated to 232°-316° C (450°-600° F).

Using the special tool, press the piston pin into the piston and the connecting rod.

3. NOTE: Lubricate the piston and the piston rings with clean engine oil.

NOTE: Use a suitable ring expander to install the piston rings. Make sure ring end gaps are equally spaced around the circumference of the piston

for all piston rings.

Install the piston rings.

4. Check piston ring end gap and ring-to-groove side clearance.

Piston Ring: Specifications

Piston Ring gap Compression (top) (in gauge) ..... 0.25-0.50 mm (0.01-0.02 in) Compression (bottom) (in Gauge) ..... 0.25-0.50 mm (0.01-0.02 in) Oil ring (steel rail) (in Gauge) ..... 0.25-1.25 mm (0.010-0.049 in)

Side clearance 1st ring ..... 0.040-0.095 mm (0.0016-0.0037 in) 2nd ring ..... 0.040-0.095 mm (0.0016-0.0037 in)

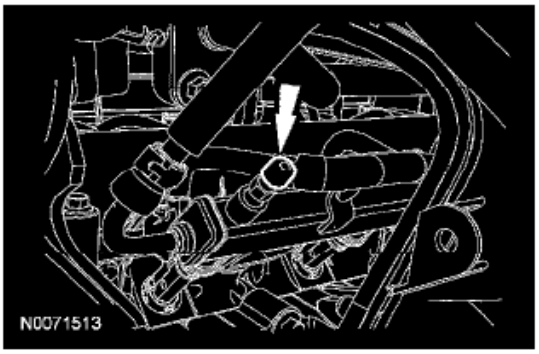
Valve Clearance: Specifications

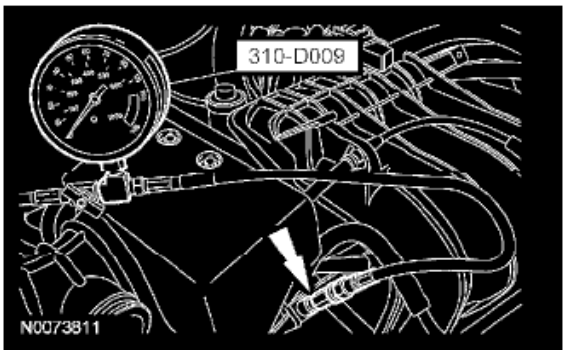
Valve Clearance

This engine is equipped with hydraulic valve lifters. No adjustment is required.

Special Tool(s)

ST3038-A	Fuel Pressure Test Kit 310-D009 (D95L-7211A)





Fuel Pressure Release: Service and Repair

FUEL SYSTEM PRESSURE RELEASE

Special Tool(s)

Special Tool(s)

WARNING:

- Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

- Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.

- Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

- When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.

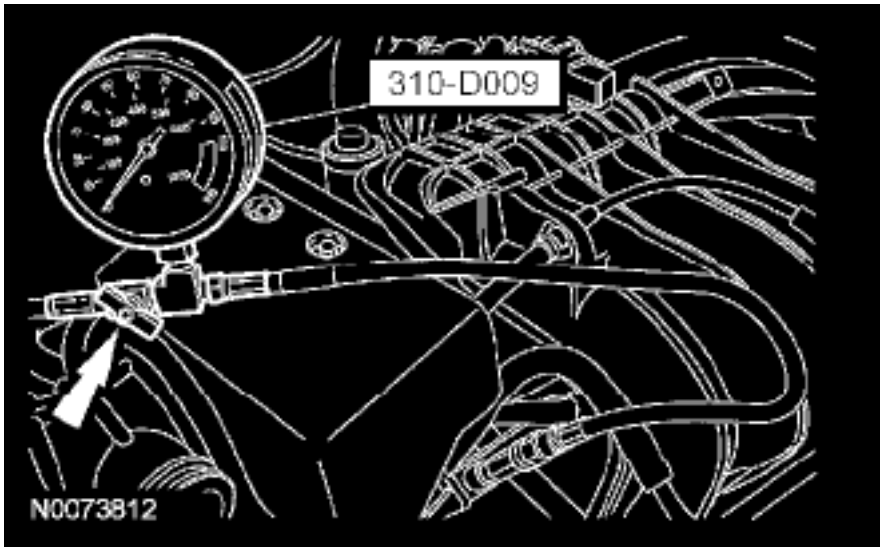
1. Disconnect the battery ground cable.

2. NOTE: 2.3L shown, 3.0L and 4.0L similar.

Remove the cap from the fuel pressure relief valve located on the fuel rail.

3. NOTE: 2.3L shown, 3.0L and 4.0L similar.

Install the special tool onto the fuel pressure relief valve.



4. NOTE:

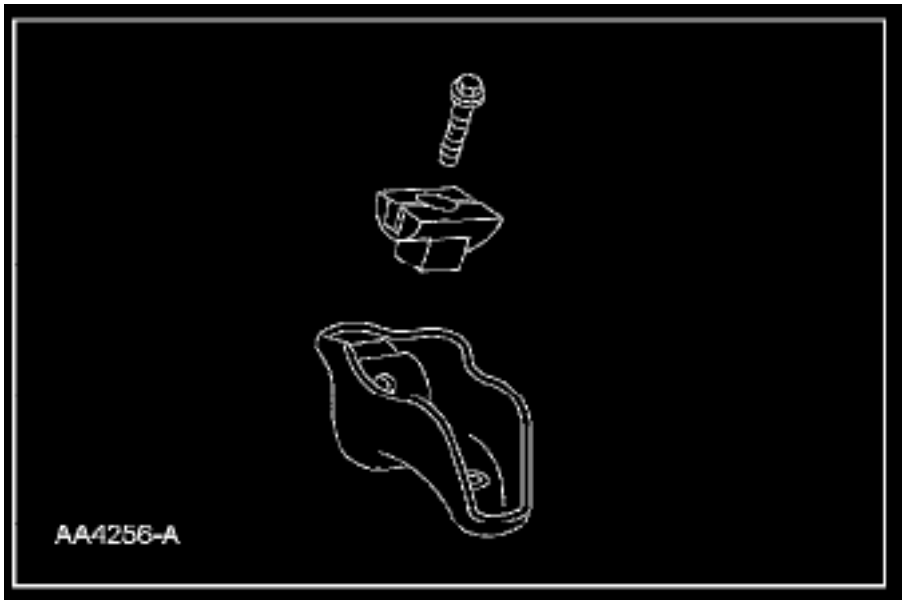
- 2.3L shown, 3.0L and 4.0L similar.

- Open the drain valve slowly to relieve the system pressure. This may drain fuel from the system. Place fuel in a suitable container.

Open the drain valve on the special tool and relieve the fuel system pressure.

5. NOTE: It may take more than one key cycle to pressurize the fuel system.

Upon completion of the fuel system repairs, cycle the ignition key and wait 3 seconds to pressurize the fuel system. Check for leaks before starting the engine.



Rocker Arm Assembly: Testing and Inspection Rocker Arm Cleaning and Inspection

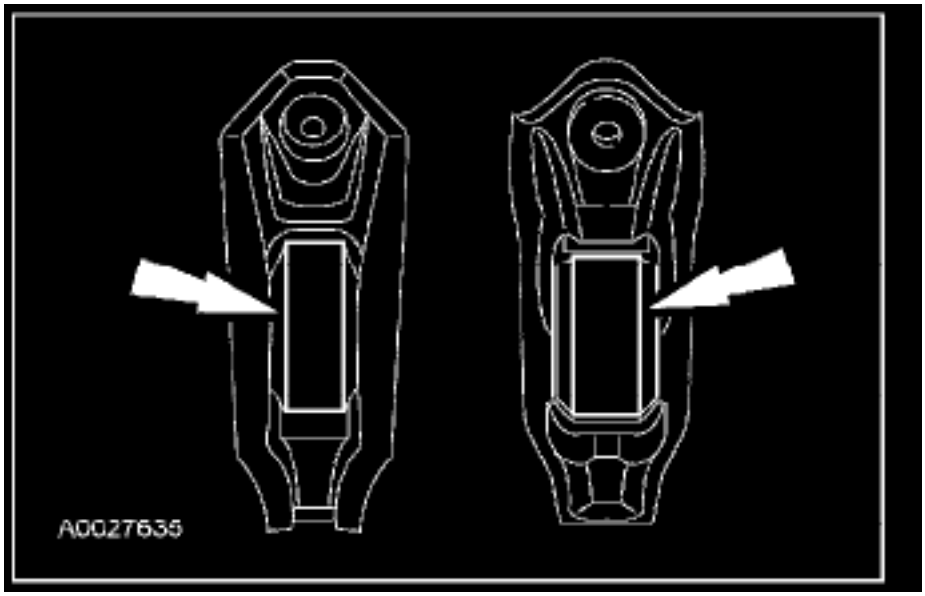
Rocker Arm Cleaning and Inspection

1. Clean all parts thoroughly. Make sure all oil passages are open. 2. Make sure the oil passage in the push rod/valve tappet end of the rocker arm is open.

CAUTION: Do not attempt to true surfaces by grinding. Check the rocker arm pad, side rails and seat for excessive wear, cracks, nicks or burrs. Check the rocker arm seat bolt for stripped or broken threads. Install new components as necessary or engine damage may occur.

3. Inspect the rocker arm push rod bore for nicks, scratches, scores or scuffs.

4. Inspect the pad at the valve end of the rocker arm for indications of grooving, scuffing or abnormal wear.



Rocker Arm Assembly: Testing and Inspection Roller Follower Inspection

Roller Follower Inspection

1. Inspect the roller follower for flat spots or scoring. If any damage is found, inspect the camshaft lobes and hydraulic lash adjuster for damage.

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A

Rocker Arm Assembly: Service and Repair

Rocker Arm

Removal and Installation

CAUTION: During engine repair procedures, cleanliness is extremely important. Any foreign material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, can cause engine failure.

1. Remove the valve cover.

2. NOTE: Identify and mark the location of each rocker arm. Each rocker arm must be installed in the original location.

Remove the bolts and the rocker arms and fulcrums. ^

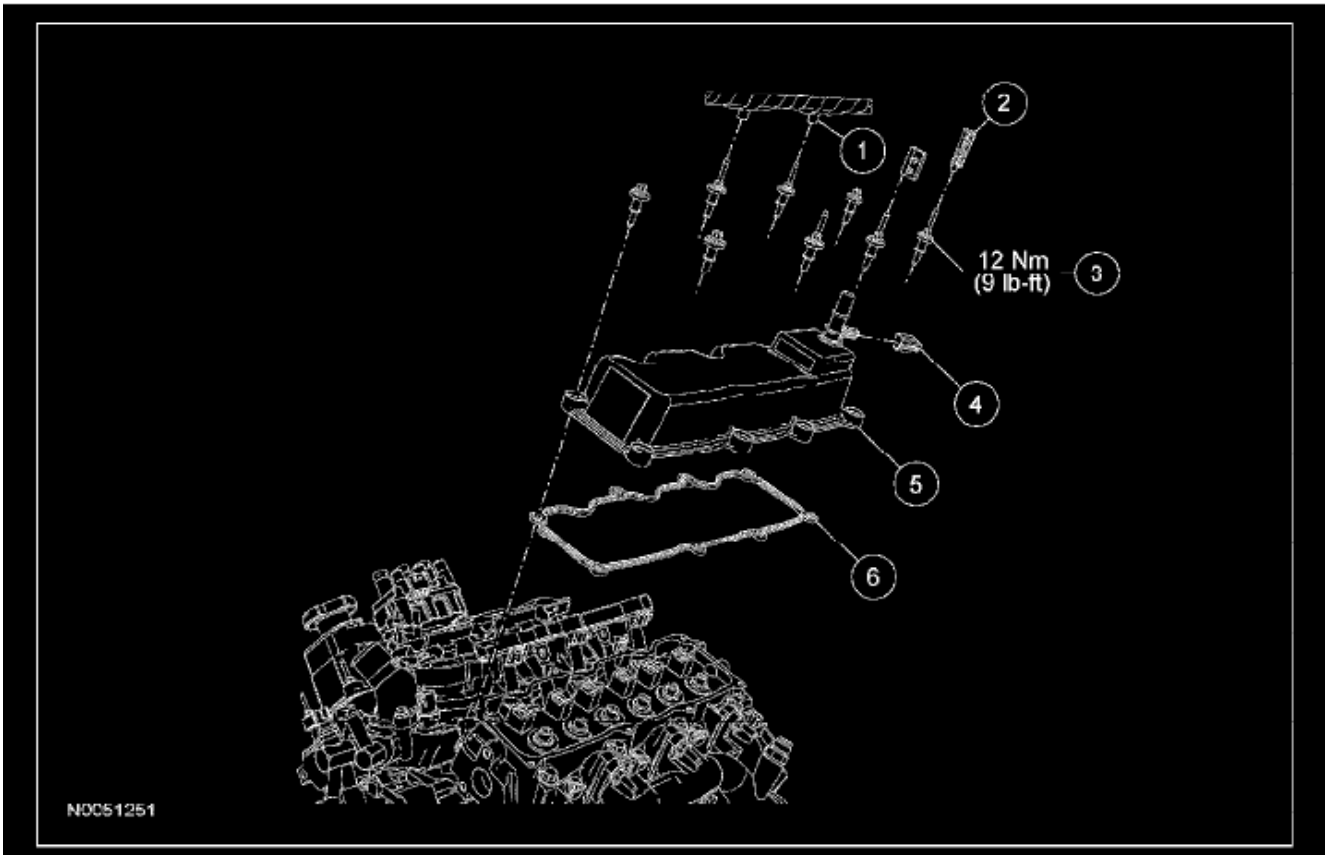
To install, tighten to 32 Nm (24 lb-ft).

3. To install, reverse the removal procedure.

^ Lubricate the rocker arms and fulcrums with clean engine oil.

Material

Item	Specification
Motorcraft Metal Surface Prep ZC-31	—
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4
Silicone Gasket Remover ZC-30	—



Item	Part Number	Description
1	13A506	Engine wiring harness retainer (part of 12B637)
2	12297	Spark plug wire holder
3	6C519	LH valve cover bolt (8 required)
4	14A464	PCV valve electrical connector (part of 12B637)
5	6A513	LH valve cover
6	6584	LH valve cover gasket

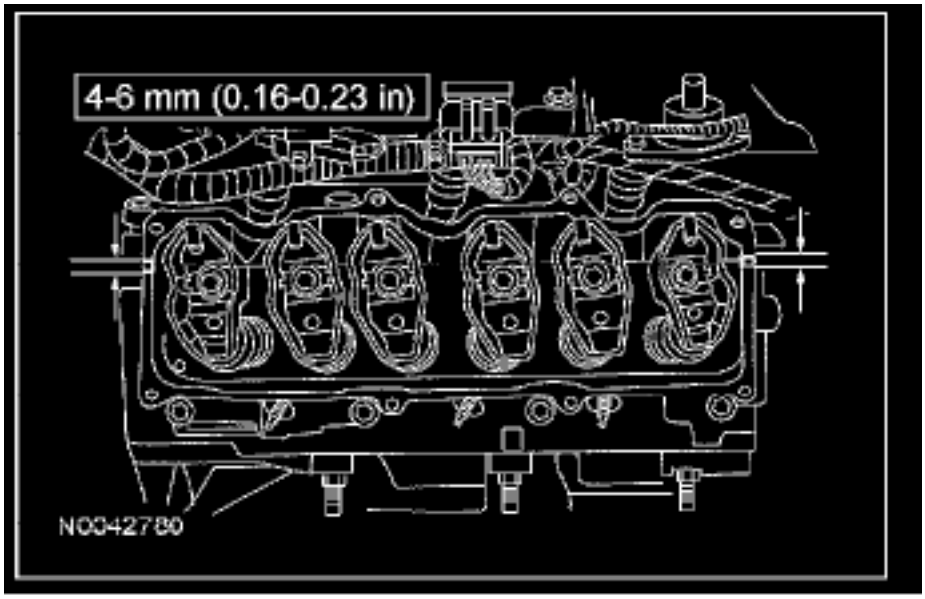
Valve Cover: Service and Repair Valve Cover - LH

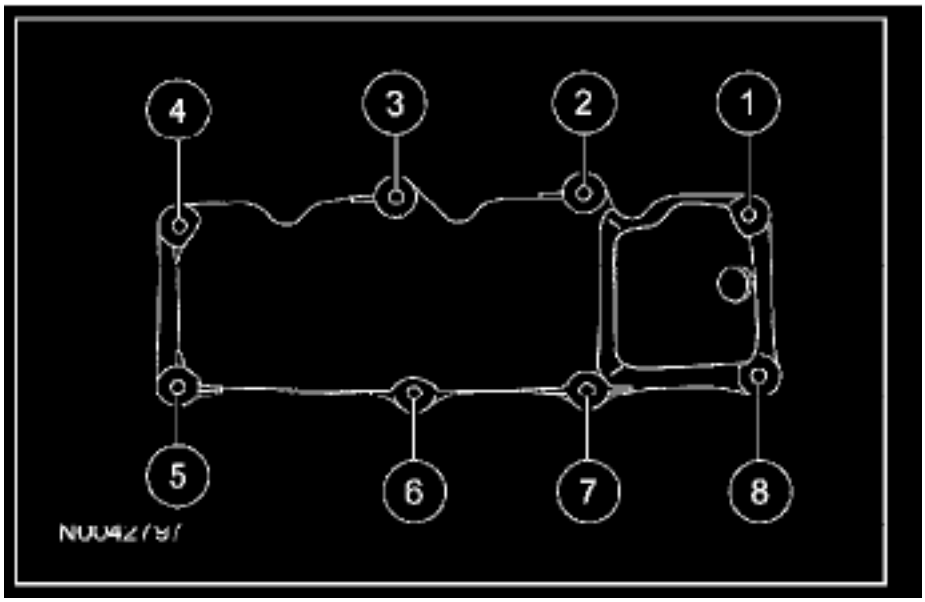
Valve Cover - LH

Removal

1. Remove the upper intake manifold. 2. Disconnect the LH spark plug wire holders. 3. Disconnect the engine wiring harness from the valve cover studs. 4. Disconnect the PCV valve electrical connector. 5. Remove the 3 bolts and the 5 stud bolts.

6. NOTE: To prevent stretching the valve cover gasket, loosen silicone gasket and sealant from the cylinder head by sliding a flat knife between the





valve cover gasket and cylinder head.

Remove the valve cover.

7. Remove and discard the valve cover gasket.

8. CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These

tools cause scratches and gouges, which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.

NOTE: To clean the sealing area, use silicone gasket remover and metal surface prep. Observe all warnings and cautions and follow all application directions contained on the packaging of the silicone gasket remover and metal surface prep.

Clean the LH valve cover gasket mating surfaces.

Installation

1. Install a new valve cover gasket.

2. CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These

tools cause scratches and gouges, which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.

NOTE: If not secured within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Observe all warnings and cautions and follow all application directions contained on the packaging of the silicone gasket remover and metal surface prep. Allow to dry until there is no sign of wetness, or 4 minutes, whichever is longer. Failure to follow this procedure can cause future oil leakage.

Apply a drop of silicone gasket and sealant at the 4 cylinder block-to-cylinder head seams.

3. Install the valve cover.

^ Tighten the 3 bolts and the 5 stud bolts in the sequence shown.

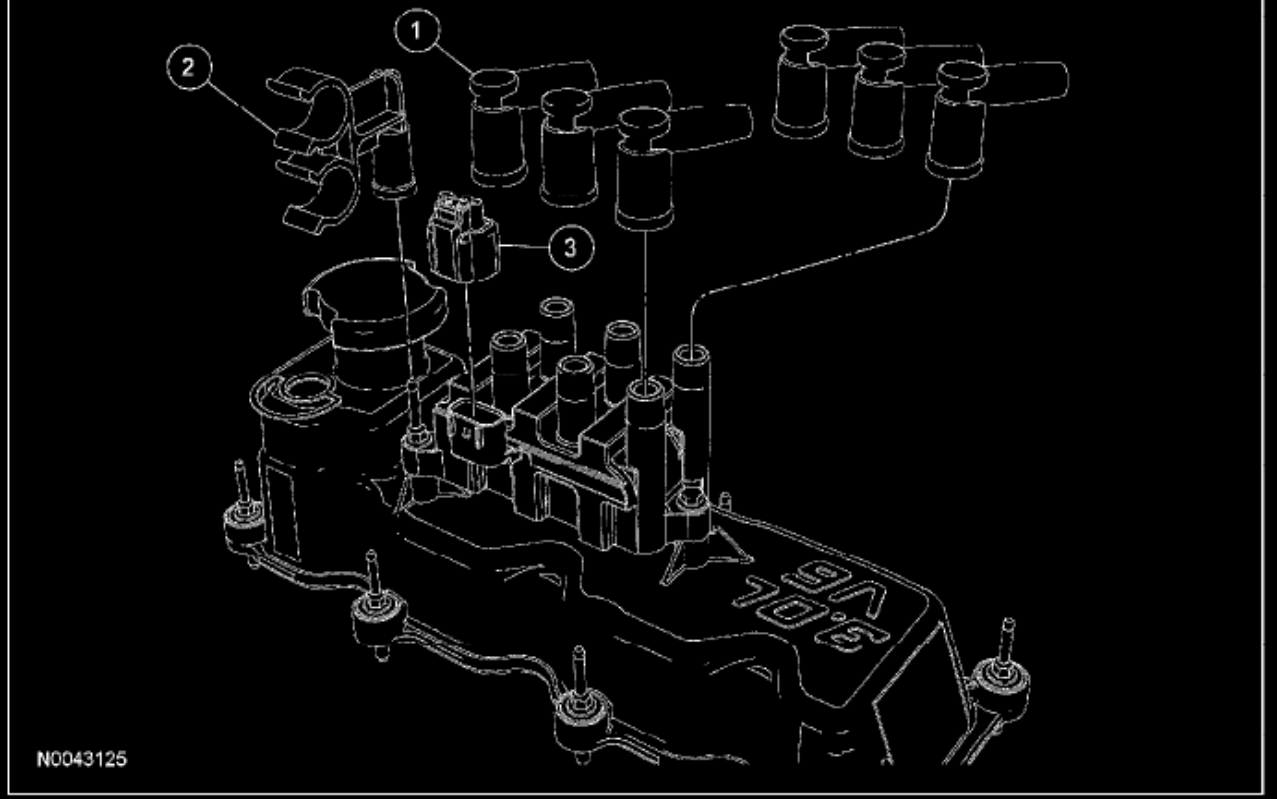
^ Tighten to 12 Nm (9 lb-ft).

4. Connect the PCV valve electrical connector. 5. Connect the engine wiring harness to the valve cover studs. 6. Connect the LH spark plug wire holders. 7. Install the upper intake manifold.

Material

Item	Specification
Motorcraft Metal Surface Prep ZC-31	—
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4
Silicone Gasket Remover ZC-30	—

Ignition System Components and Heater Hose Bracket



Item	Part Number	Description
1	12286	Spark plug wires
2	18D331	Heater hose support

Item	Part Number	Description
3	14A464	Ignition coil electrical connector

(Continued)

Valve Cover: Service and Repair Valve Cover - RH

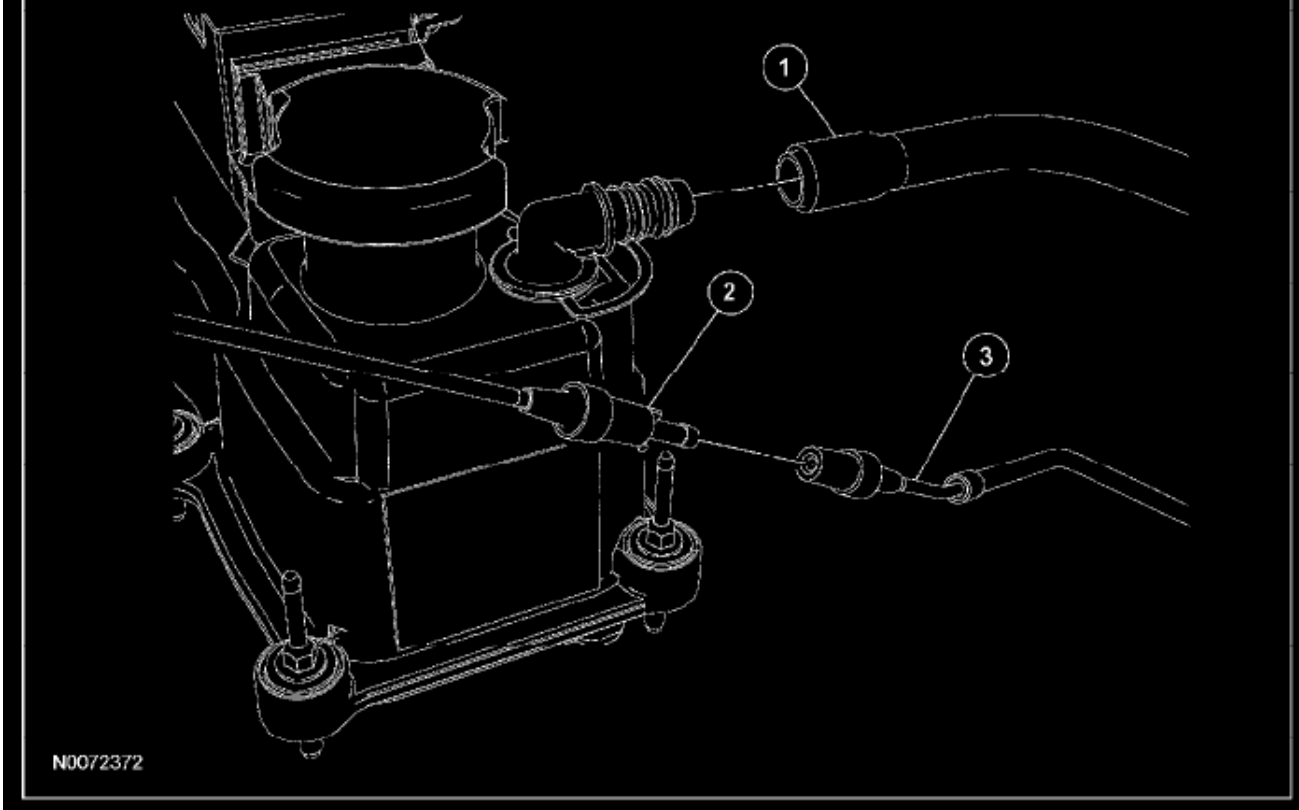
Valve Cover - RH

Ignition System Components and Heater Hose Bracket

Ignition System Components and Heater Hose Bracket

Hose Connections

Hose Connections

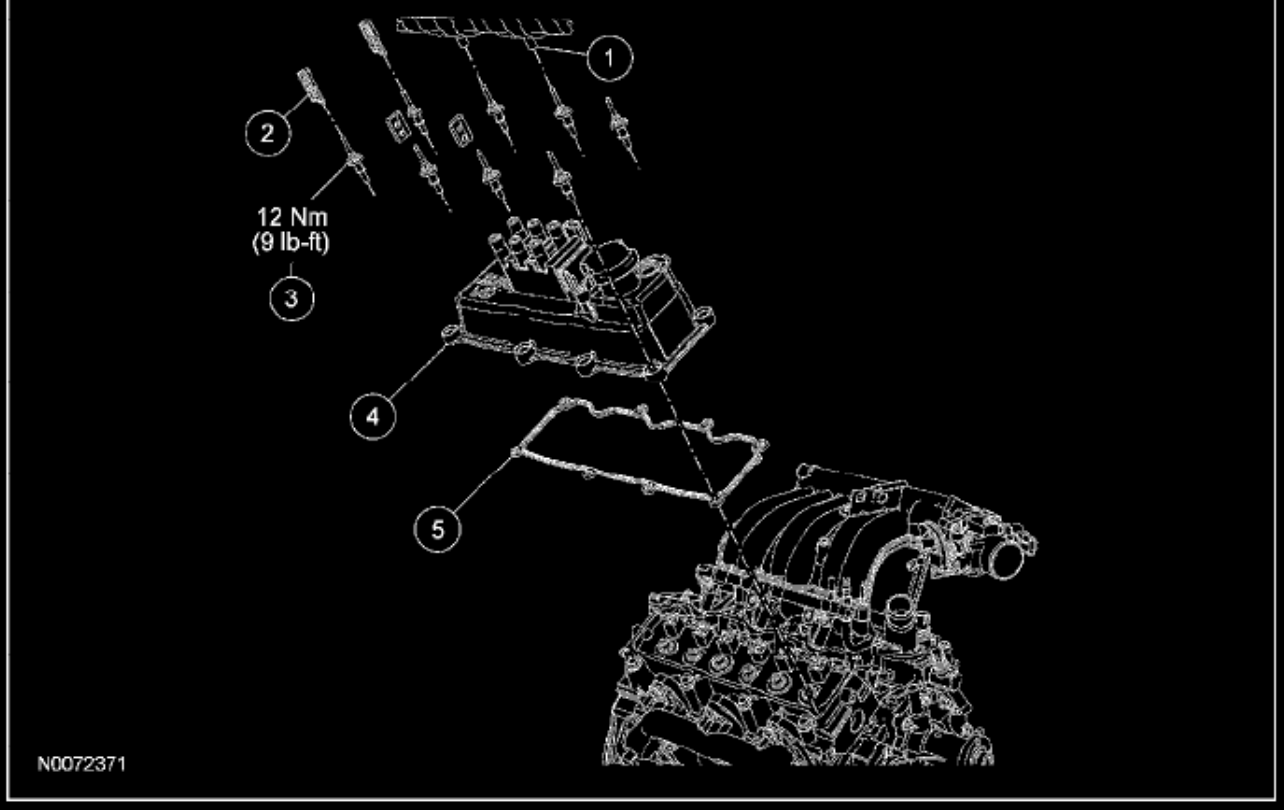


Item	Part Number	Description
1	6C342	Crankcase ventilation tube
2	19C828	A/C vacuum hose
3	9E498	Main vacuum hose

Hose Connections

Valve Cover

Valve Cover



Item	Part Number	Description
1	13A506	Engine wiring harness retainer (part of 12B637)
2	12297	Spark plug wire holder
3	6C520	RH valve cover bolt (8 required)
4	6583	RH valve cover
5	6584	RH valve cover gasket

Valve Cover

Removal

1. Disconnect the ignition coil electrical connector

2. CAUTION: Do not pull on the spark plug wire as it may separate from the spark plug wire connector inside the spark plug boot.

Disconnect the spark plug wires from the ignition coil by twisting while pulling upward.

3. Disconnect the heater hose support from the stud. 4. Disconnect the spark plug wire holders. 5. Disconnect the vacuum hose. 6. Disconnect the engine wiring harness from the valve cover studs. 7. Disconnect the crankcase ventilation tube.

8. NOTE: To prevent stretching the valve cover gasket, loosen silicone gasket and sealant from the cylinder head by sliding a flat knife between the

valve cover gasket and cylinder head.

Remove the 8 bolts and remove the valve cover.

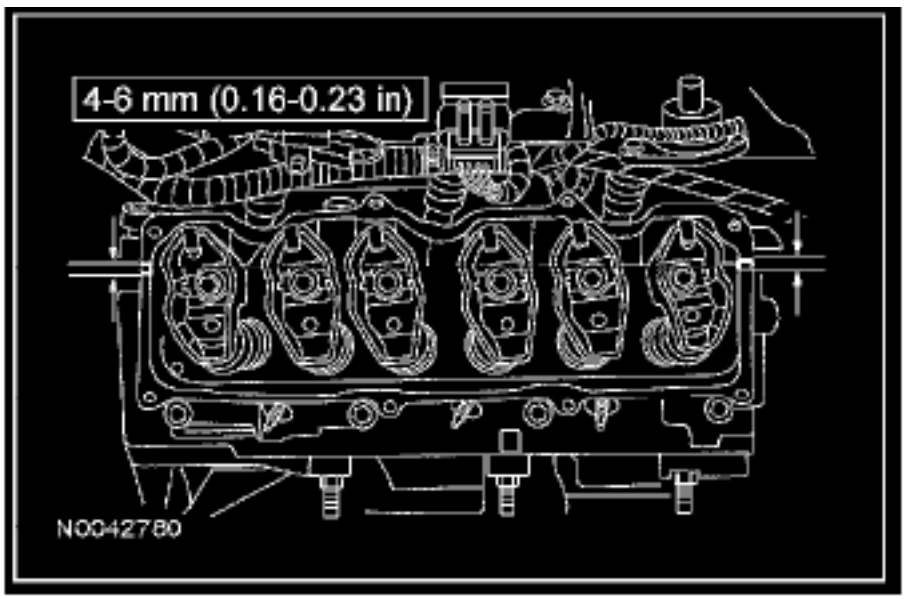
9. Remove and discard the valve cover gasket.

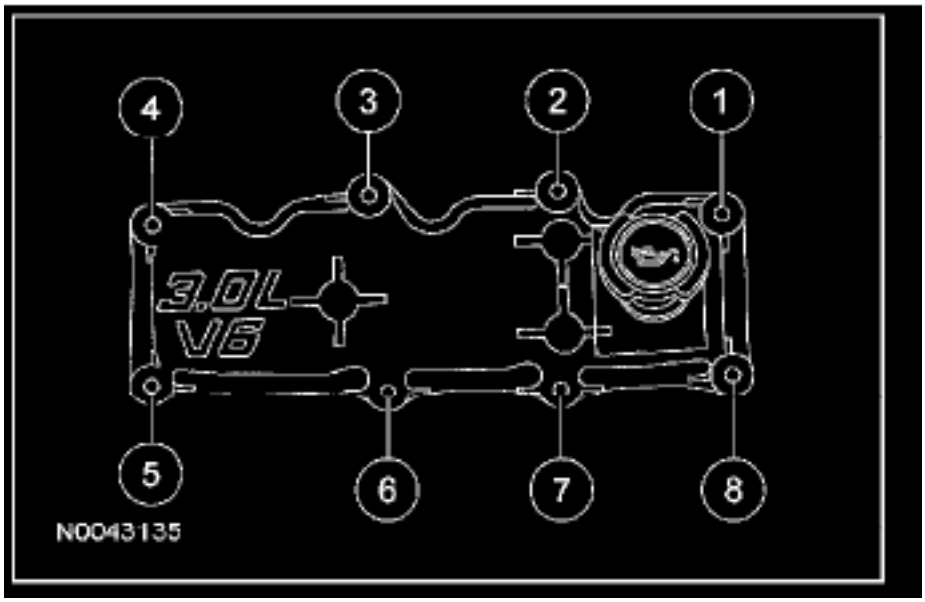
10. CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These

tools cause scratches and gouges, which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.

NOTE: To clean the sealing area, use silicone gasket remover and metal surface prep. Observe all warnings and cautions and follow all application directions contained on the packaging of the silicone gasket remover and metal surface prep.

Clean the RH valve cover gasket mating surfaces.





Installation

1. Install a new valve cover gasket.

2. CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These

tools cause scratches and gouges, which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.

NOTE: If not secured within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Observe all warnings and cautions and follow all application directions contained on the packaging of the silicone gasket remover and metal surface prep. Allow to dry until there is no sign of wetness, or 4 minutes, whichever is longer. Failure to follow this procedure can cause future oil leakage.

Apply a drop of silicone gasket and sealant at the 4 cylinder block-to-cylinder head seams.

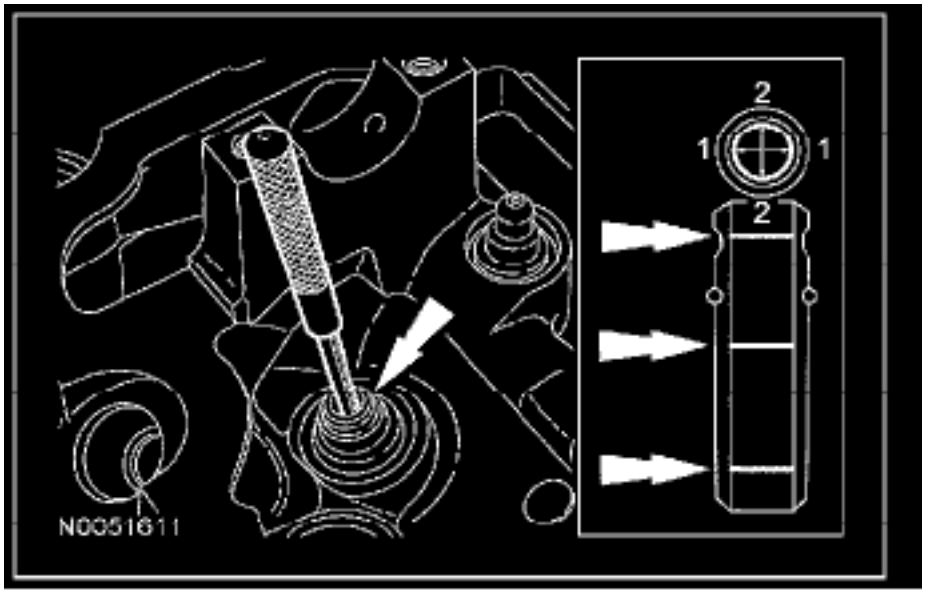
3. Install the valve cover.

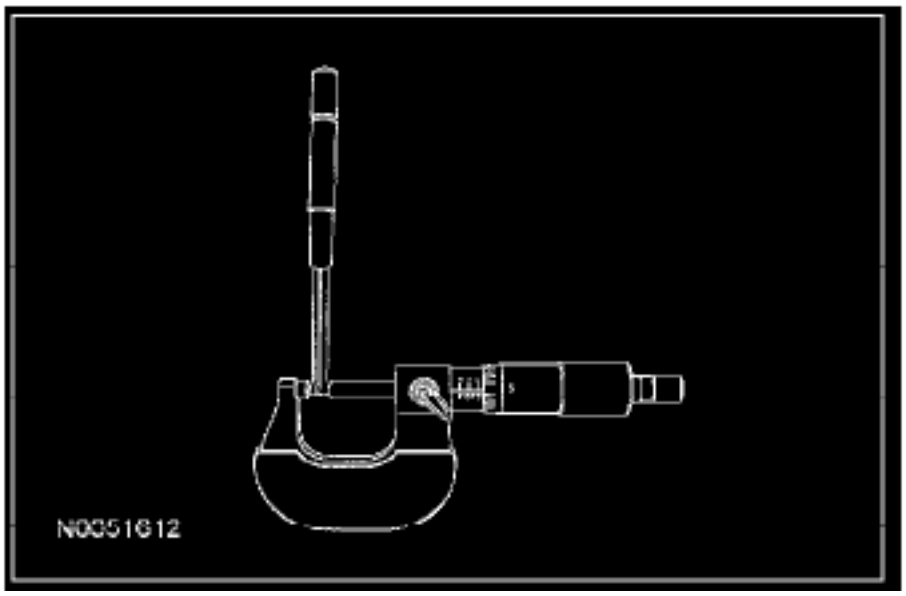
^ Tighten the 8 bolts in the sequence shown.

^ Tighten to 12 Nm (9 lb-ft).

4. Connect the crankcase ventilation tube. 5. Connect the engine wiring harness to the valve cover studs. 6. Connect the vacuum hose. 7. Connect the RH spark plug wire holders. 8. Connect the heater hose support. 9. Connect the spark plug wires to the ignition coil.

10. Connect the ignition coil electrical connector.





Valve Guide: Service and Repair

Valve Guide Inner Diameter

NOTE: Refer to Specifications.

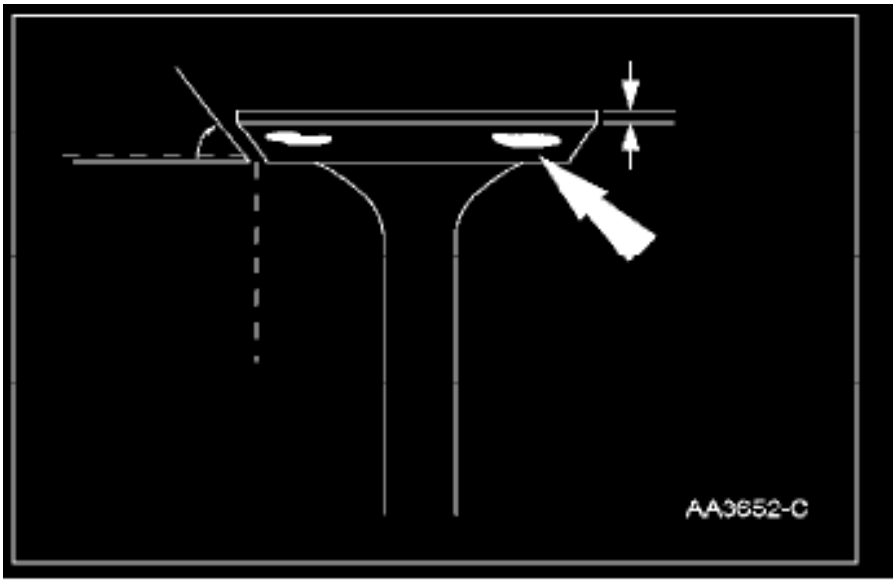
1. NOTE: Valve guides tend to wear in an hourglass pattern. The ball gauge can be inserted into the combustion chamber side of the valve guide if

necessary.

Use a ball gauge to determine the inner diameter of the valve guides in 2 directions at the top, middle and bottom of the valve guide.

2. Measure the ball gauge with a micrometer.

3. If the valve guide is not within specifications, install a new cylinder head assembly.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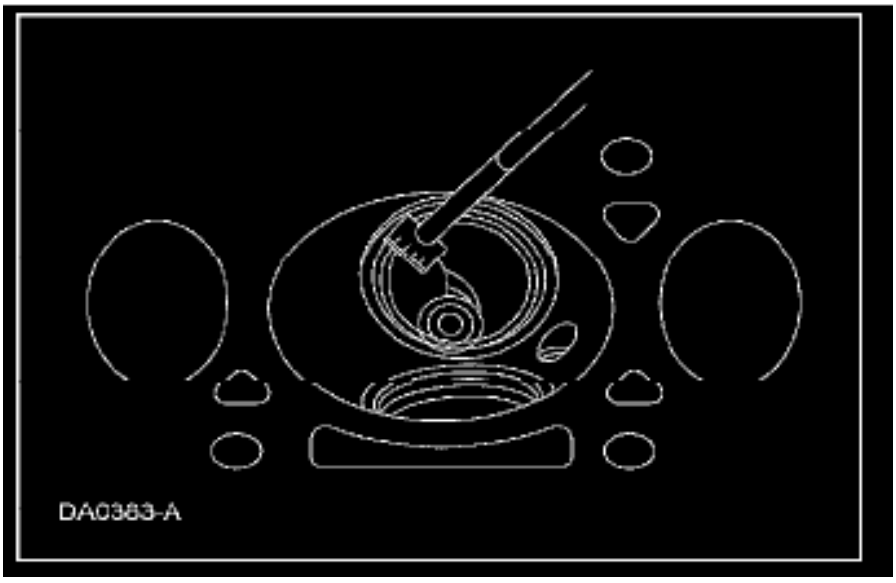
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Valve Seat: Service and Repair

Valve Seat Inspection

Valve and Seat Refacing Measurements

NOTE: Refer to Specifications.

NOTE: After grinding valves or valve seats, check valve clearance.

1. Check the valve head and seat.

^ Check valve angles.

^ Check margin width.

^ Be sure margin width is within specification.

2. Inspect for abnormalities on the valve face and seat. Install a new cylinder head assembly if abnormalities are found.

Valve Seat Width

NOTE: Refer to Specifications.

1. Measure the valve seat width. If necessary, grind the valve seat to specification.

^ Measure the intake valve seat width.

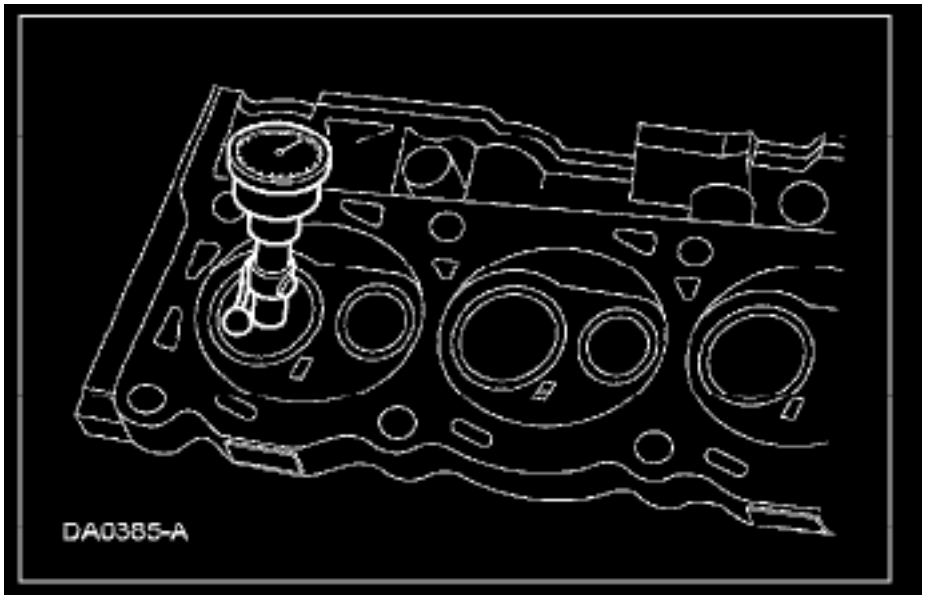
^ Measure the exhaust valve seat width.

^ Recheck the valve spring installed length after the seats have been ground, and shim the valve springs as necessary to achieve the correct installed spring length.

Valve Seat Runout

NOTE: Refer to Specifications.

1. Use a valve seat runout gauge to check valve seat runout.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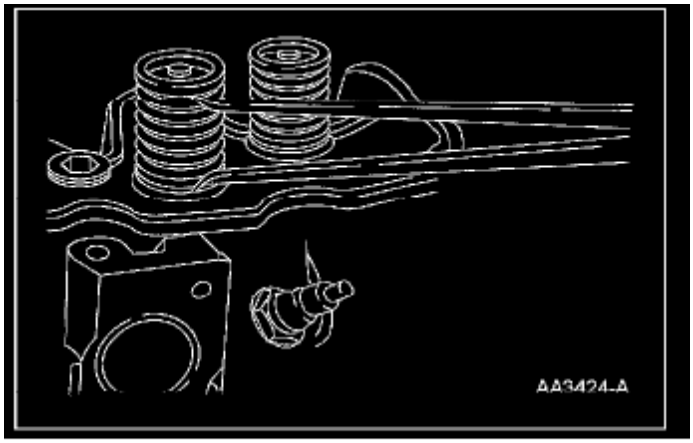
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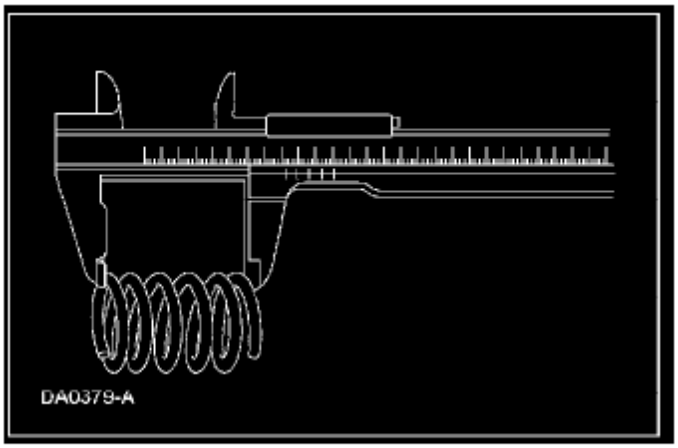
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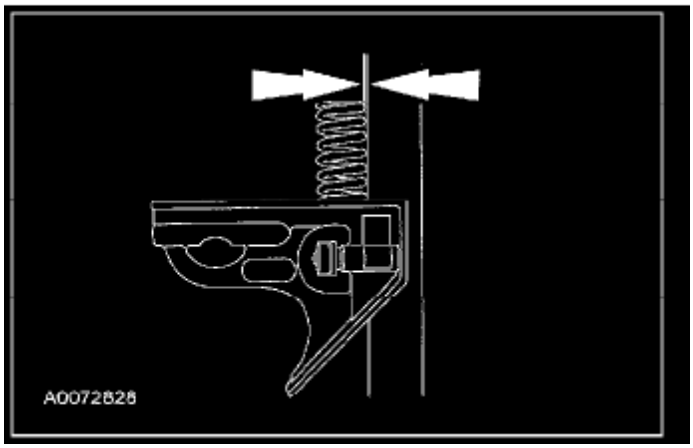
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Valve Spring: Service and Repair

Valve Spring Installed Length

NOTE: Refer to Specifications.

1. Measure the installed length of each valve spring.

Valve Spring Free Length

NOTE: Refer to Specifications.

1. Measure the free length of each valve spring.

Valve Spring Squareness

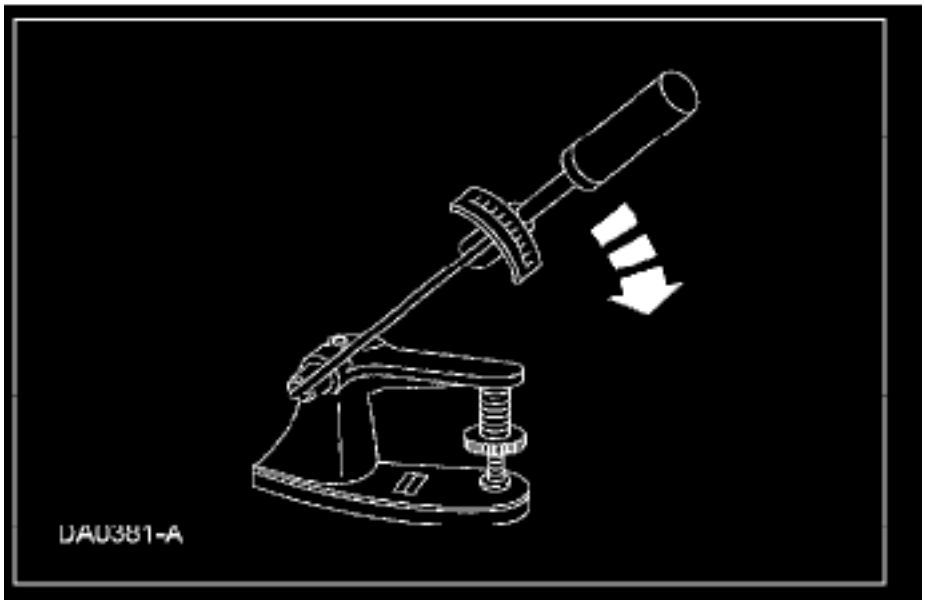
1. Measure the out-of-square on each valve spring.

^ Turn the valve spring and observe the space between the top of the valve spring and the square.

Valve Spring Strength

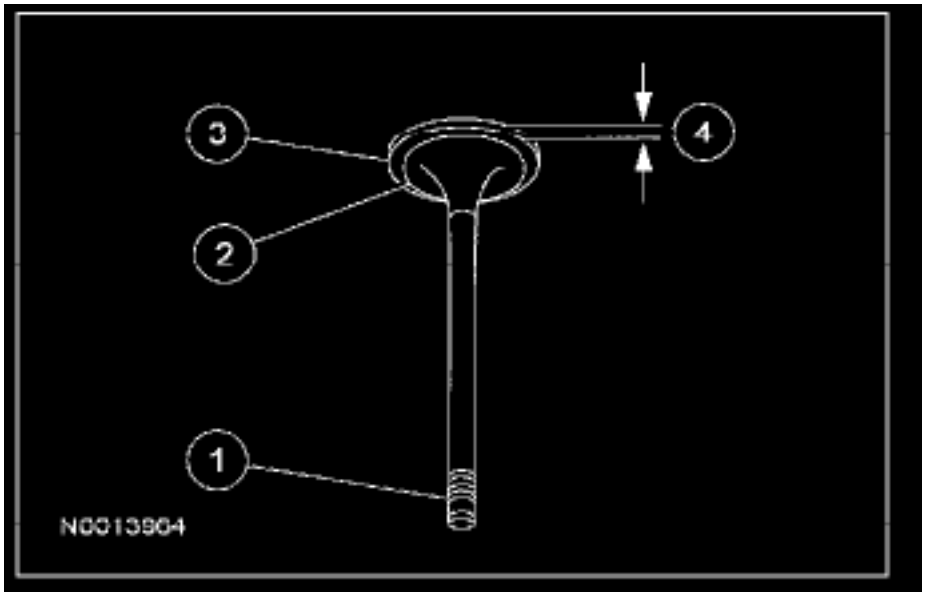
Special Tool(s)

ST1278-A	Pressure Gauge, Valve/Clutch Spring 303-006 (TOOL-6513-DD) or equivalent



NOTE: Refer to Specifications.

1. Use the special tool to check the valve spring for correct strength at the specified valve spring length.



Valve: Testing and Inspection

Valve Inspection

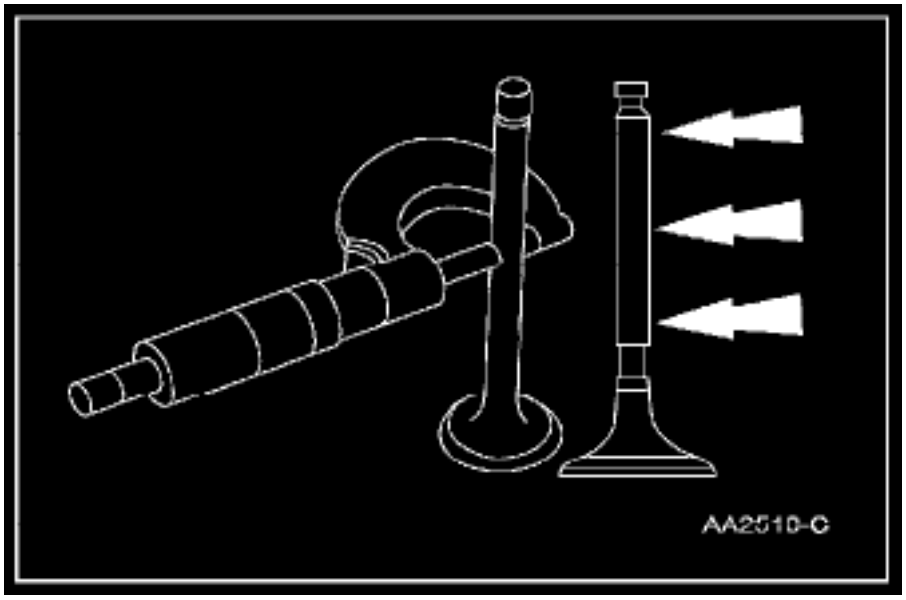
1. Inspect the following valve areas:

1 The end of the stem for grooves or scoring.

2 The valve face and the edge for pits, grooves or scores.

3 The valve head for signs of burning, erosion, warpage and cracking.

4 The valve margin for wear.



Valve: Service and Repair Valve Stem Diameter

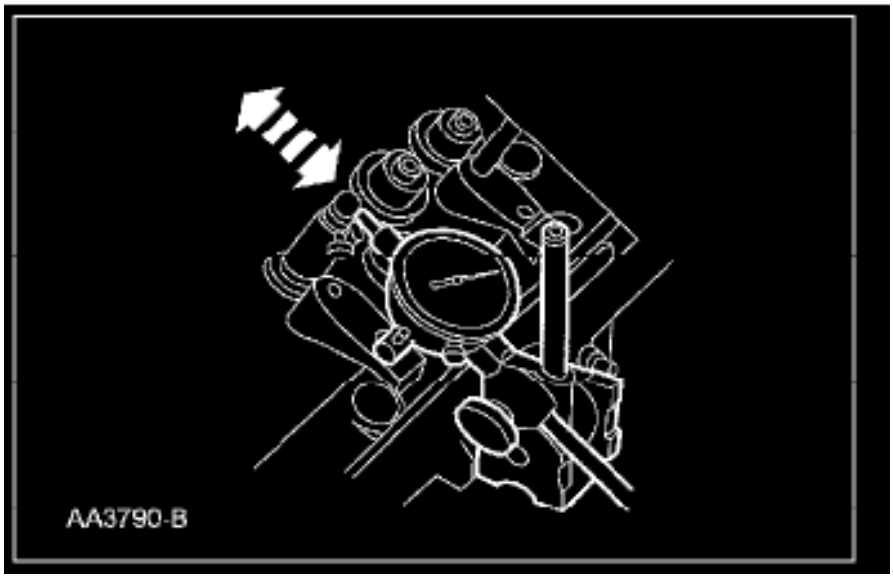
Valve Stem Diameter

NOTE: Refer to Specifications.

1. Measure the diameter of each intake and exhaust valve stem at the points shown. Verify the diameter is within specification.

Special Tool(s)

ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent
ST1251-A	Clearance Gauge, Valve Guide 303-004 (TOOL-6505-E) or equivalent



Valve: Service and Repair Valve Stem to Valve Guide Clearance

Valve Stem to Valve Guide Clearance

NOTE: Refer to Specifications.

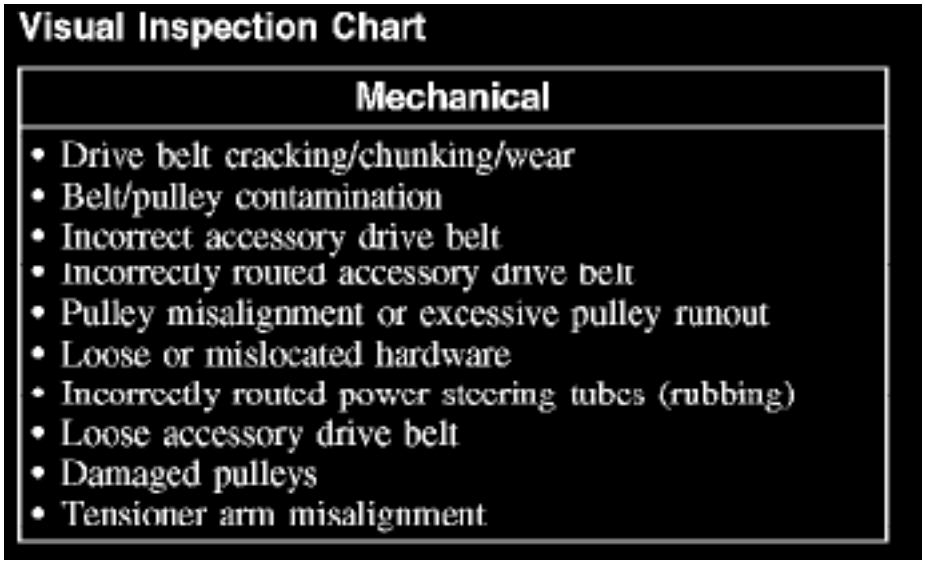
NOTE: The valve stem diameter must be within specifications before checking valve stem-to-valve guide clearance.

1. NOTE: If necessary, use a magnetic base.

Install a Valve Guide Clearance Gauge on the valve stem and install a Dial Indicator Gauge with Holding Fixture. Lower the valve until the clearance gauge contacts the upper surface of the valve guide.

2. Move the clearance gauge toward the indicator and zero the indicator. Move the clearance gauge away from the indicator and note the reading.

The reading will be DOUBLE the valve stem-to-valve guide clearance.



Drive Belt: Initial Inspection and Diagnostic Overview

Inspection and Verification

CAUTION: Under no circumstances should the accessory drive belt, tensioner or pulleys have any fluids or belt dressing applied to them as damage to the belt material and tensioner damping mechanism may occur.

1. Verify the customer concern by operating the system. 2. Visually inspect for obvious signs of mechanical damage.

Visual Inspection Chart

Visual Inspection Chart

Belt Tensioner With Belt Length Indicator

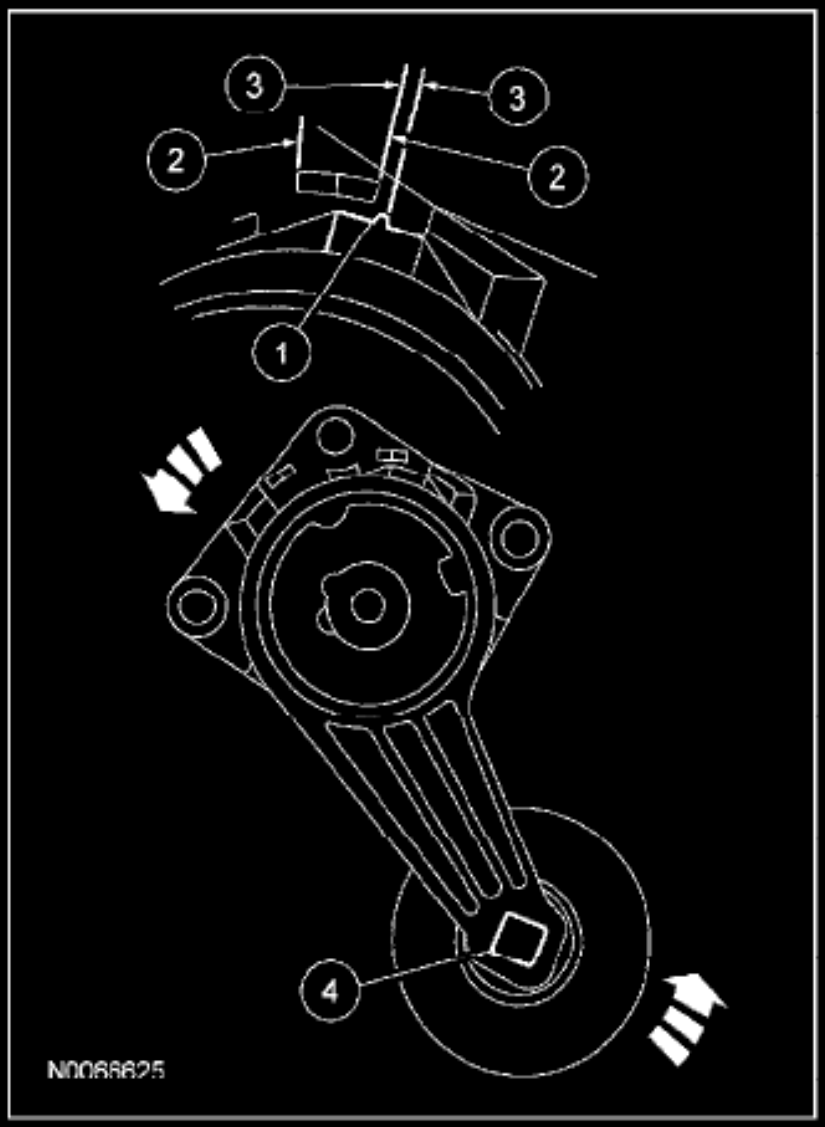
NOTE: Modular engine (without A/C) belt tensioner shown, others similar.

NOTE: Belt tensioner is shown in the free-state position against the arm travel stops.

Belt Tensioner With Belt Length Indicator

NOTE: Modular engine (without A/C) belt tensioner shown, others similar.

NOTE: Belt tensioner is shown in the free-state position against the arm travel stops



Item	Part Number	Description
1	—	Belt length indicator
2	—	Acceptable belt installation and wear range
3	—	Belt replacement range
4	—	Belt tension relief point

Belt Tensioner With Belt Length Indicator

3. Check that the belt length indicator, if equipped, on the belt tensioner is in the acceptable belt installation and wear range. If the indicator is in the

belt replacement range, either an incorrect belt is installed or the belt is worn beyond the service limit. Install a new belt as necessary.

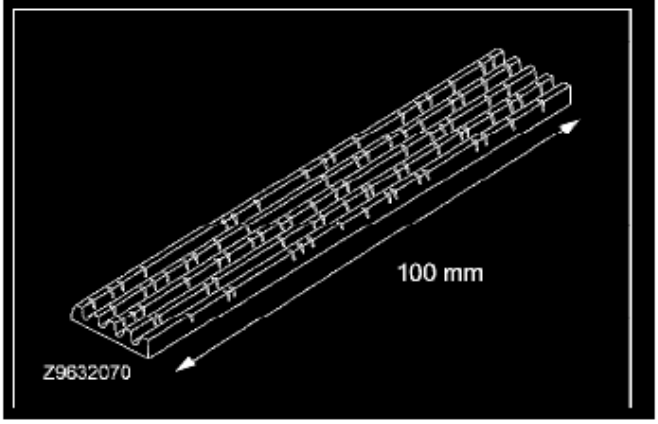
4. Eliminate all other non-belt related noises that could cause belt misdiagnosis, such as A/C compressor engagement chirp, A/C slugging noise,

power steering cavitations at low temperatures, variable camshaft timing (VCT) tick or generator whine.

5. If a concern is found, correct the condition before proceeding to the next step.

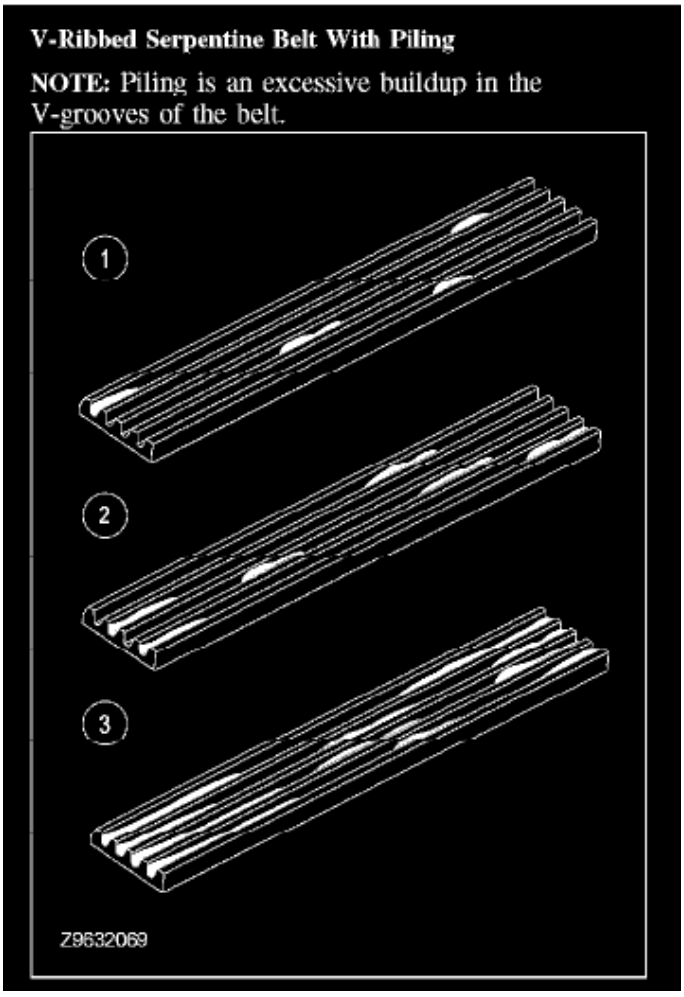
V-Ribbed Serpentine Drive Belt With Cracks Across Ribs

V-Ribbed Serpentine Drive Belt With Cracks Across Ribs



V-Ribbed Serpentine Belt With Piling

NOTE: Piling is an excessive buildup in the V-grooves of the belt.



V-Ribbed Serpentine Drive Belt With Cracks Across Ribs

6. Check the belt for cracks. Up to 15 cracks in a rib over a distance of 100 mm (4.0 inch) can be considered acceptable. If cracks exceed this

standard, install a new belt.

V-Ribbed Serpentine Belt With Piling

V-Ribbed Serpentine Belt With Piling

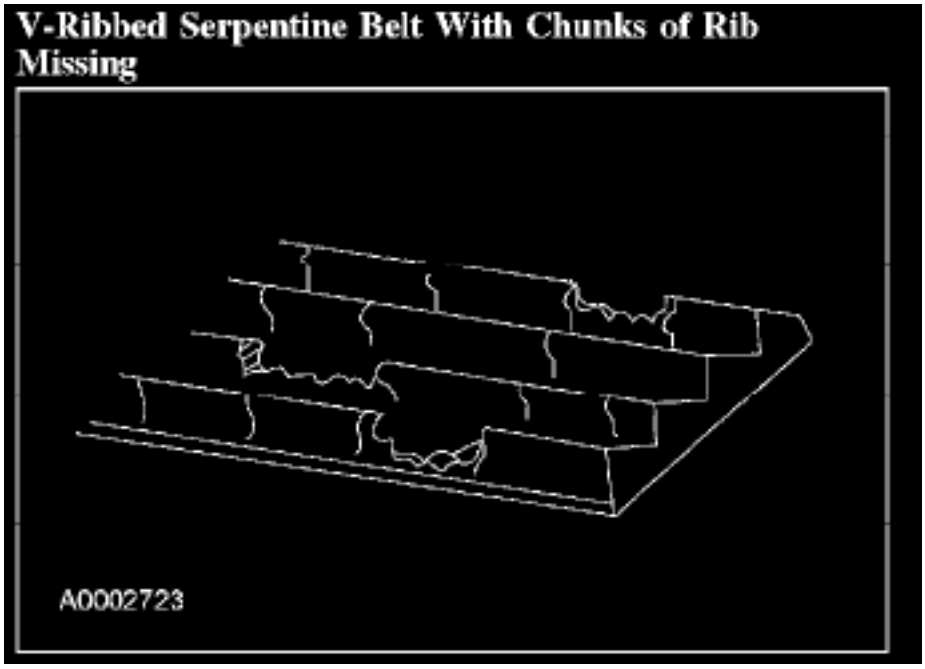
NOTE: Piling is an excessive buildup in the V-grooves of the belt.

7. The condition of the V-ribbed drive belt should be compared against the illustration and appropriate action taken.

1 Small scattered deposits of rubber material. This is not a concern, therefore, installation of a new belt is not required.

2 Longer deposit areas building up to 50% of the rib height. This is not considered a concern but it can result in excessive noise. If noise is apparent, install a new belt.

3 Heavy deposits building up along the grooves resulting in a possible noise and belt stability concern. If heavy deposits are apparent, install a new belt.



V-Ribbed Serpentine Belt With Chunks of Rib Missing

V-Ribbed Serpentine Belt With Chunks of Rib Missing

8. There should be no chunks missing from the belt ribs. If the belt shows any evidence of this, install a new accessory drive belt. 9. If the concern is not visually evident, verify the symptom and GO to Symptom Chart. See: Symptom Related Diagnostic Procedures

Symptom Chart

Condition	Possible Sources	Action
• Accessory drive belt cracking (over 15 cracks in a rib over a distance of 100 mm [4.0 in])	• Accessory drive belt	• INSPECT the accessory drive belt. REFER to Inspection and Verification, INSTALL a new accessory drive belt as necessary.
• Accessory drive belt chunking	• Accessory drive belt	• INSPECT the accessory drive belt. REFER to Inspection and Verification, INSTALL a new accessory drive belt as necessary.
	• Damaged pulley grooves	• INSPECT the accessory drive belt pulley grooves for damage. INSTALL a new pulley or component as necessary.

Drive Belt: Symptom Related Diagnostic Procedures

Symptom Chart

Symptom Chart (Part 1)

Symptom Chart (Continued)

Condition	Possible Sources	Action
• Accessory drive belt noise, squeal, chirping or flutter	• Defective/worn or incorrect accessory drive belt • Misaligned pulley(s) • Pulley runout • Damaged or worn accessory drive component or idler • Fluid contamination of accessory drive belt or pulleys	• REFER to Component Tests, Drive Belt, Noise/Flutter. REPAIR or INSTALL new parts as necessary.
	• Damaged or worn accessory drive belt tensioner	• REFER to Component Tests, Belt Tensioner — Mechanical and Belt Tensioner — Dynamics. INSTALL a new accessory drive belt tensioner as necessary.
	• Damaged pulley grooves	• INSPECT the accessory drive belt pulley grooves for damage. INSTALL a new pulley or component as necessary.
	• Accessory drive component failure	• CHECK the accessory drive components. INSTALL new components as necessary.
	• Accessory drive belt idler pulley bearing failure	• INSPECT the accessory drive belt idler pulley for freedom of rotation and damage. INSTALL a new accessory drive belt idler pulley as necessary.
• Premature accessory drive belt wear	• Defective or incorrect accessory drive belt • Misaligned pulley(s) • Pulley runout • Damaged accessories • Incorrectly installed drive belt • Fluid contamination	• REFER to Component Tests, Drive Belt Noise/Flutter and Incorrect Drive Belt Installation. REPAIR or INSTALL new parts as necessary.
	• Damaged pulley grooves	• INSPECT the accessory drive belt pulley grooves for damage. INSTALL a new pulley or component as necessary.

Symptom Chart (Part 2)

Drive Belt: Component Tests and General Diagnostics

Drive Belt - Noise/Flutter

Drive Belt - Noise/Flutter

CAUTION: Under no circumstances should the accessory drive belt, tensioner or pulleys have any fluids or belt dressing applied to them as damage to the belt material and tensioner damping mechanism may occur.

Drive belt chirp occurs due to pulley misalignment or excessive pulley runout. It can be the result of a damaged or incorrectly aligned grooved pulley.

To correct, determine the area where the noise comes from. Check each of the pulleys in that area with a straightedge to the crankshaft pulley. Look for accessory pulleys out of position in the fore/aft direction or at an angle to the straightedge.

Drive belt squeal may be an intermittent or constant noise that occurs when the drive belt slips on an accessory pulley under certain conditions.

A short intermittent squeal may occur during engine start-up and shut down or during very rapid engine acceleration and decelerations, such as: ^

wide open throttle (WOT) 1-2 and 2-3 shifts or 2-3 and 3-4 back out shifts on automatic transmissions.

^ WOT 1-2 and 2-3 shifts and any combination of rapid downshifting on manual transmissions.

These special short-term transient events are expected, and are due to the higher system inertia required to meet the electrical and cooling demands on today's vehicle systems. Constant or reoccurring drive belt squeal can occur: ^

if the A/C discharge pressure goes above specifications: -

the A/C system is overcharged.

- the A/C condenser core airflow is blocked.

^ if the A/C off equalized pressure (the common discharged and suction pressure that occurs after several minutes) exceeds specifications.

^ if any of the accessories or idler pulley(s) are damaged or have a worn or damaged bearing. All accessories should be rotatable by hand in the unloaded condition. If not, inspect the accessory.

^ if there is evidence of fluid contamination on the accessory drive belt. When the drive belt has been exposed to fluid contamination during vehicle operation, such as leaks from the power steering system, A/C system or cooling system, clean all pulleys with soap and water, rinse with clean water and install a new accessory drive belt. If the drive belt has been exposed to fluids in a localized area during routine vehicle service, such as replacement of hoses or fluids, the drive belt and pulleys should be washed with soap and water immediately (prior to starting the engine), and rinsed with clean water.

^ if the accessory drive belt is too long. A drive belt that is too long will allow the accessory drive belt tensioner arm to go all the way to the arm travel stop under certain load conditions, which will release tension to the drive belt. If the accessory drive belt tensioner indicator is outside the normal installation wear range window, install a new accessory drive belt.

^ NOTE: The accessory drive belt tensioner arm should rotate freely without binding.

Install a new accessory drive belt tensioner if the drive belt tensioner is worn or damaged.

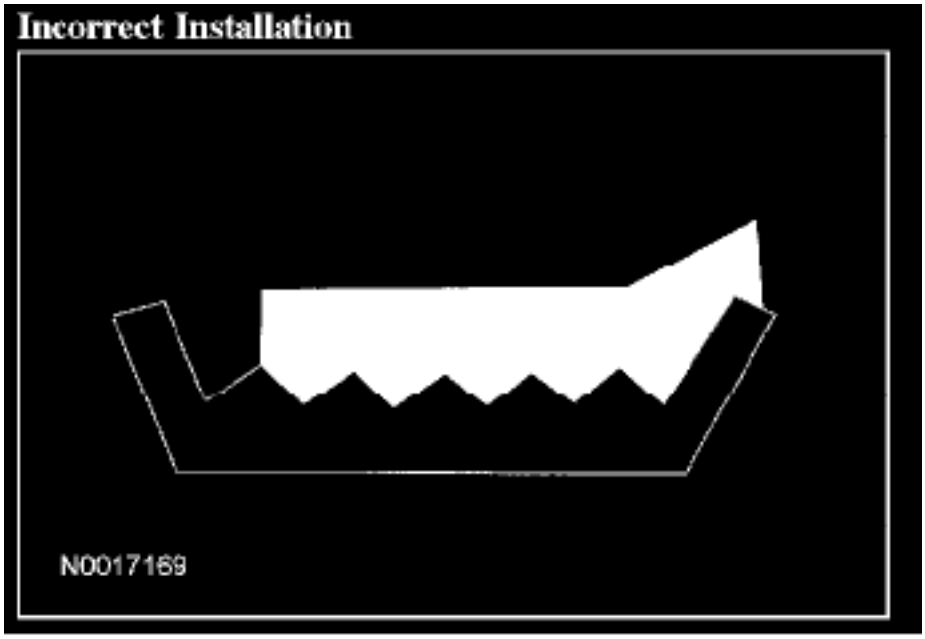
Drive Belt - Incorrect Installation

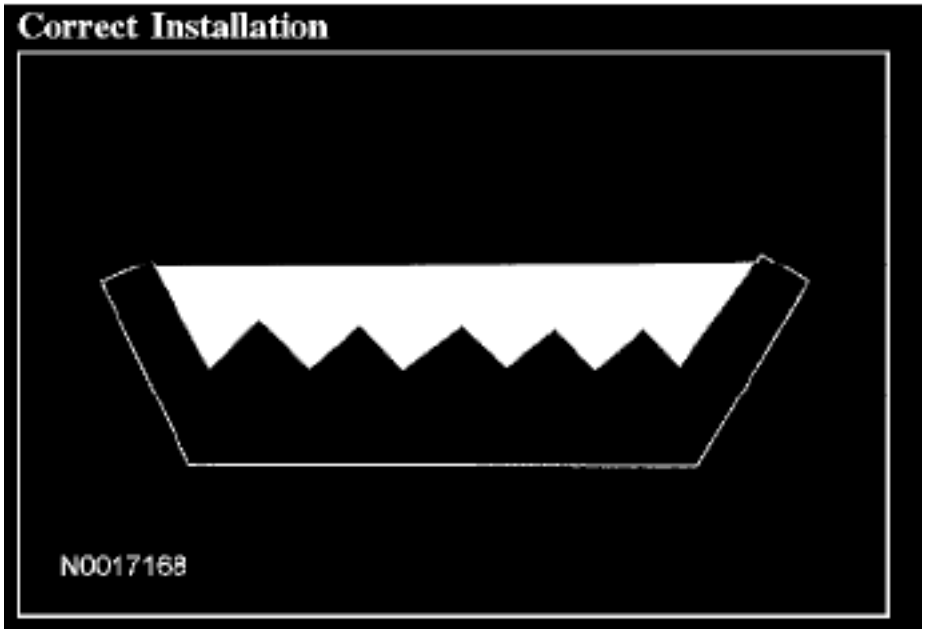
Drive Belt - Incorrect Installation

CAUTION: Incorrect accessory drive belt installation will cause excessive drive belt wear and may cause the drive belt to come off the pulleys.

Non-standard accessory drive belts can track differently or incorrectly. If an accessory drive belt tracks incorrectly, install a new accessory drive belt to avoid performance failure or loss of the drive belt.

Incorrect Installation





Incorrect Installation

Correct Installation

Correct Installation

With the engine running, check accessory drive belt tracking on all pulleys. If the edge of the accessory drive belt rides beyond the edge of the pulleys, noise and premature wear will occur. Make sure the accessory drive belt rides correctly on the pulley. If an accessory drive belt tracking condition exists, proceed with the following: ^

Visually check the accessory drive belt tensioner for damage and wear, especially the mounting pad surface and arm alignment. If the accessory drive belt tensioner is not installed correctly, the mounting surface pad will be out of position. If the tensioner arm is worn, the arm will be out of alignment. Either of these conditions will result in chirp and squeal noises.

^ With the engine running, visually observe the grooves in the pulleys (not the pulley flanges or the pulley forward faces) for excessive wobble. Install new components as necessary.

^ Check all accessories, mounting brackets and the accessory drive belt tensioner for any interference that would prevent the component from mounting correctly. Correct any interference condition and recheck the accessory drive belt tracking.

^ Tighten all accessories, mounting brackets and accessory drive belt tensioner retaining hardware to specification. Recheck the accessory drive belt tracking.

Belt Tensioner - Mechanical

Belt Tensioner - Mechanical

The only mechanical check that needs to be made is a check for tensioner stick, grab or bind. 1. With the engine off, check routing of the accessory drive belt. Refer to the illustrations under Description and Operation.

2. NOTE: The accessory drive belt tensioner spring is very strong and requires substantial force to release.

Using a suitable, commercially available serpentine belt tensioner release tool, release the tension on the belt and detach the accessory drive belt from the tensioner. Carry out the following tests: ^

Using the release tool, move the tensioner from its relaxed position, through its full stroke and back to the relaxed position to make sure there is no stick, grab or bind, and to make sure that there is tension on the tensioner spring.

^ Rotate the tensioner pulley by hand and check for a binding, contaminated or seized condition.

^ Inspect the area surrounding the accessory drive belt tensioner for oil leaks or contamination and repair any leaks.

3. If the accessory drive belt tensioner does not meet the criteria in the previous step, install a new tensioner. If the accessory drive belt tensioner

meets the criteria in the previous step, proceed to testing the tensioner dynamically.

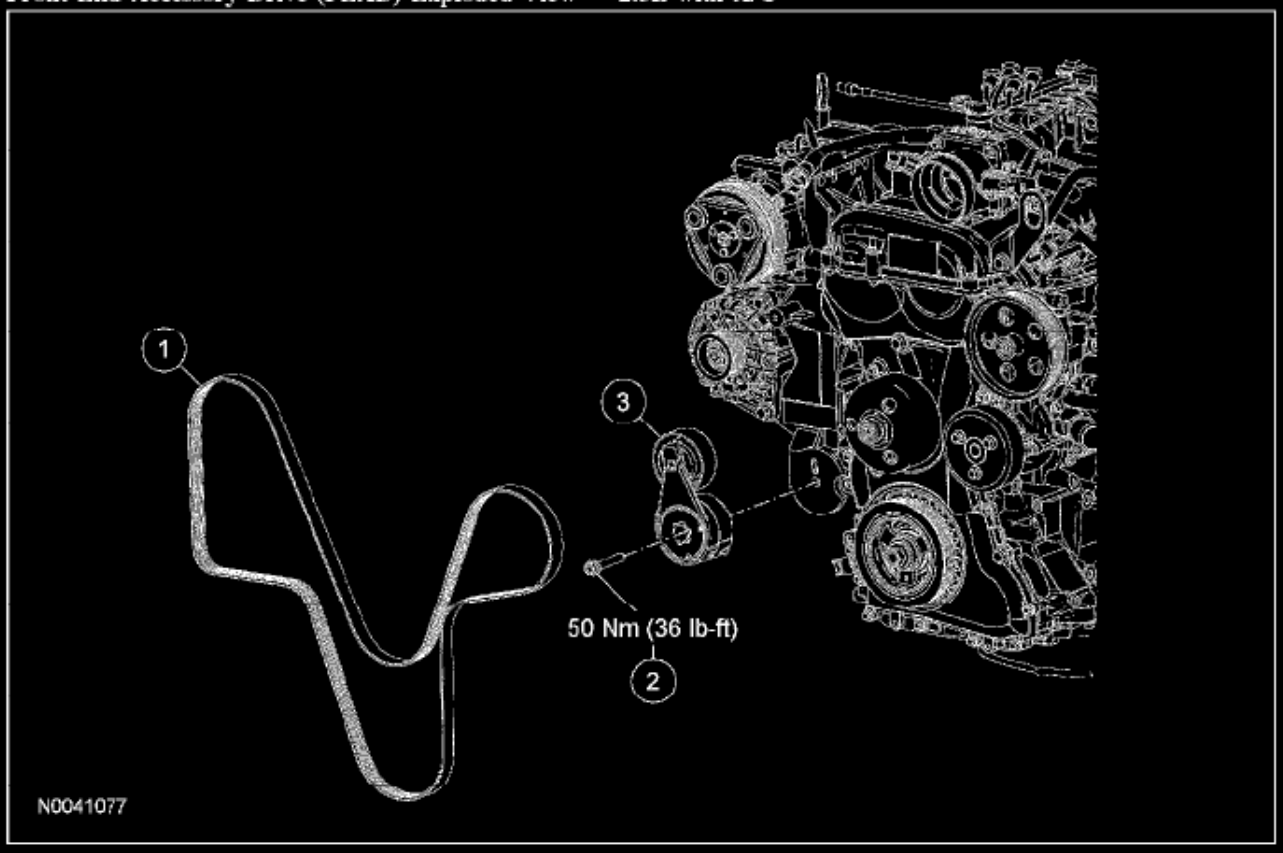
Belt Tensioner - Dynamics

Belt Tensioner - Dynamics

The accessory drive belt tensioner can be checked dynamically as follows: 1. With the engine running, observe the accessory drive belt tensioner movement. The accessory drive tensioner should move (respond) when the

A/C clutch cycles (if equipped), or when the engine is accelerated rapidly. If the accessory drive belt tensioner movement is excessive without A/C clutch cycling or engine acceleration, check belt rideout. Excessive belt rideout (uneven depth of grooves in the belt) can cause excessive accessory drive belt tensioner movement. Check rideout condition by installing a new belt. If excessive accessory drive belt tensioner movement still exists, install a new accessory drive belt tensioner.

Front End Accessory Drive (FEAD) Exploded View — 2.3L with A/C



Item	Part Number	Description
1	8620	Accessory drive belt
2	—	Accessory drive belt tensioner bolt (part of 6A228)
3	6A228	Accessory drive belt tensioner

Drive Belt Tensioner: Diagrams

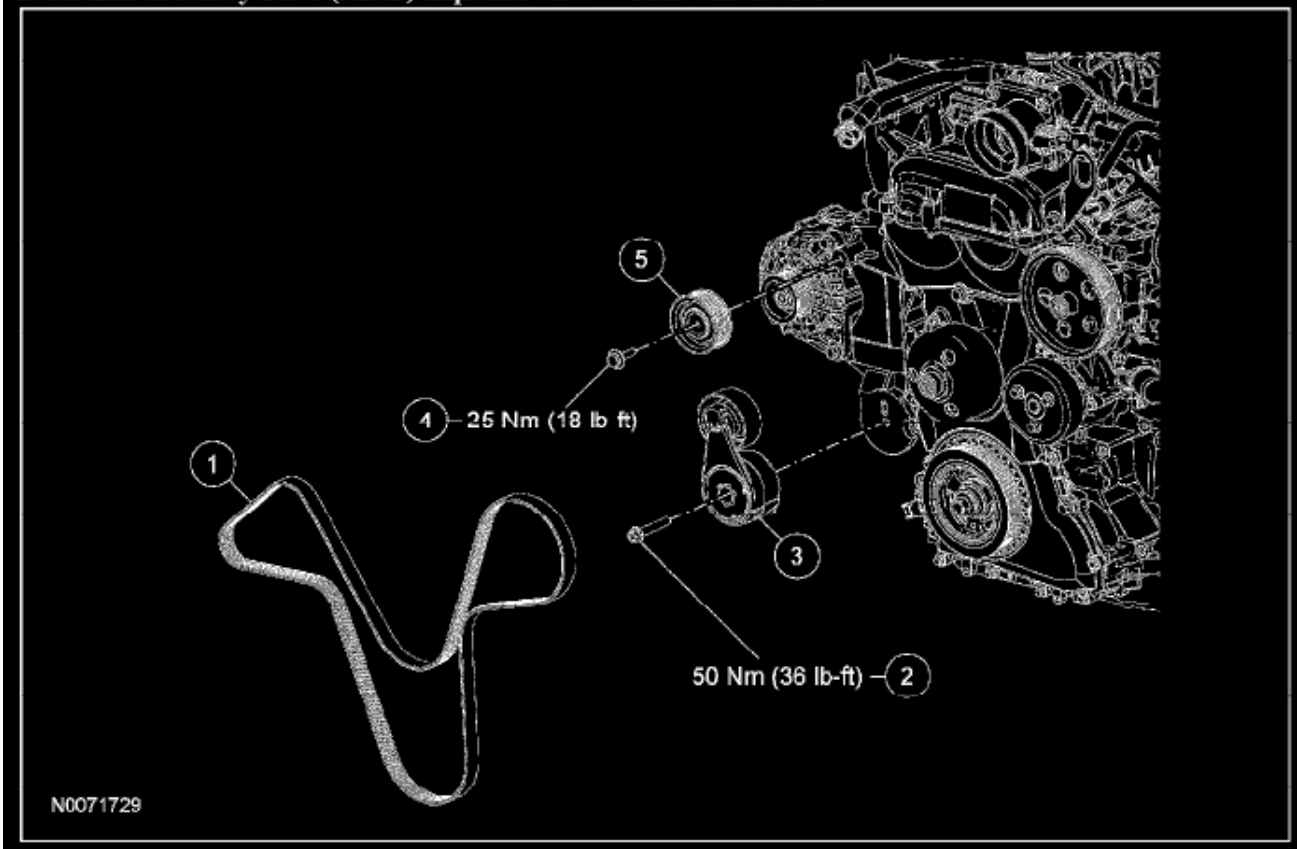
Front End Accessory Drive (FEAD) - Exploded View

Front End Accessory Drive (FEAD) Exploded View - 2.3L with A/C

Front End Accessory Drive (FEAD) Exploded View - 2.3L with A/C

Front End Accessory Drive (FEAD) Exploded View - 2.3L without A/C

Front End Accessory Drive (FEAD) Exploded View — 2.3L without A/C



Item	Part Number	Description
1	8620	Accessory drive belt
2		Accessory drive belt tensioner bolt (part of 6A228)
3	6A228	Accessory drive belt tensioner

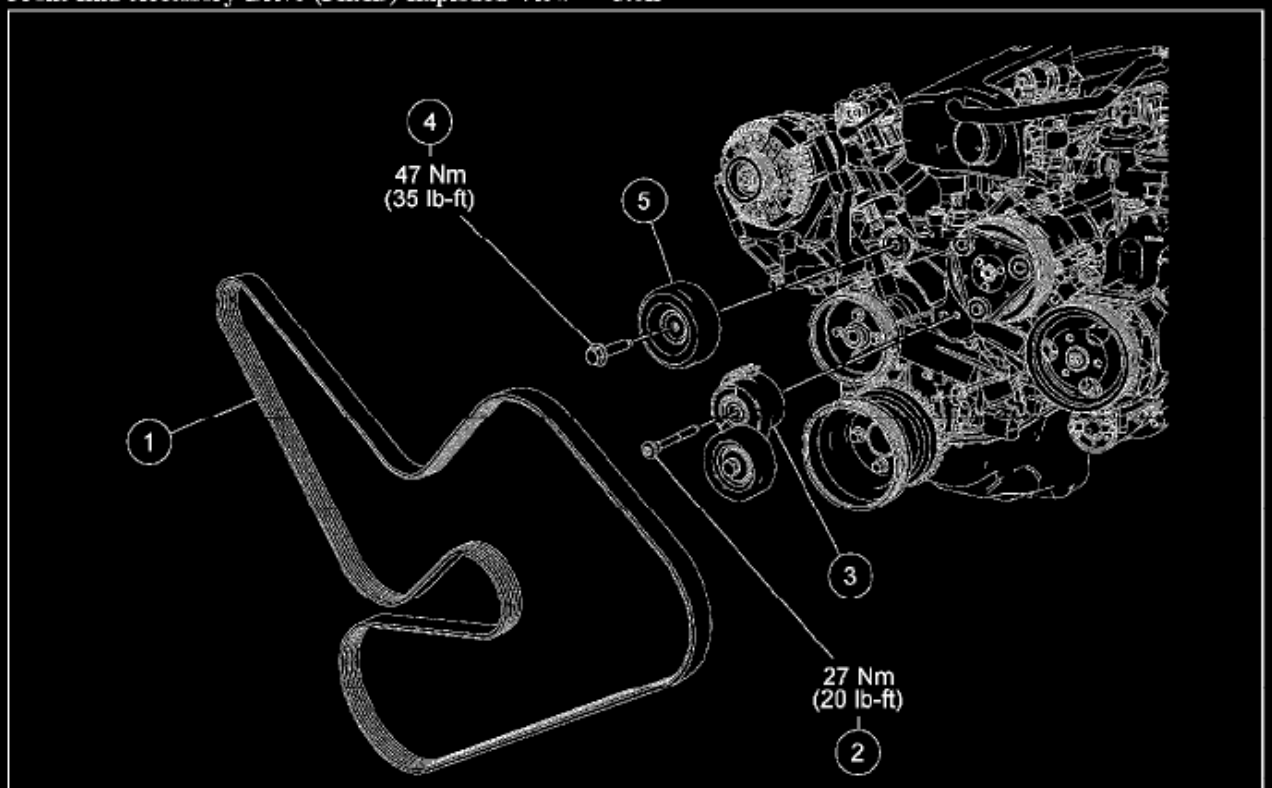
Item	Part Number	Description
4	—	Accessory drive belt idler pulley bolt (part of 6C348)
5	6C348	Accessory drive belt idler pulley

(Continued)

Front End Accessory Drive (FEAD) Exploded View - 2.3L without A/C

Front End Accessory Drive (FEAD) Exploded View - 3.0L

Front End Accessory Drive (FEAD) Exploded View — 3.0L



Item	Part Number	Description
1	8620	Accessory drive belt
2	—	Accessory drive belt tensioner bolt (part of 6B209)
3	6B209	Accessory drive belt tensioner

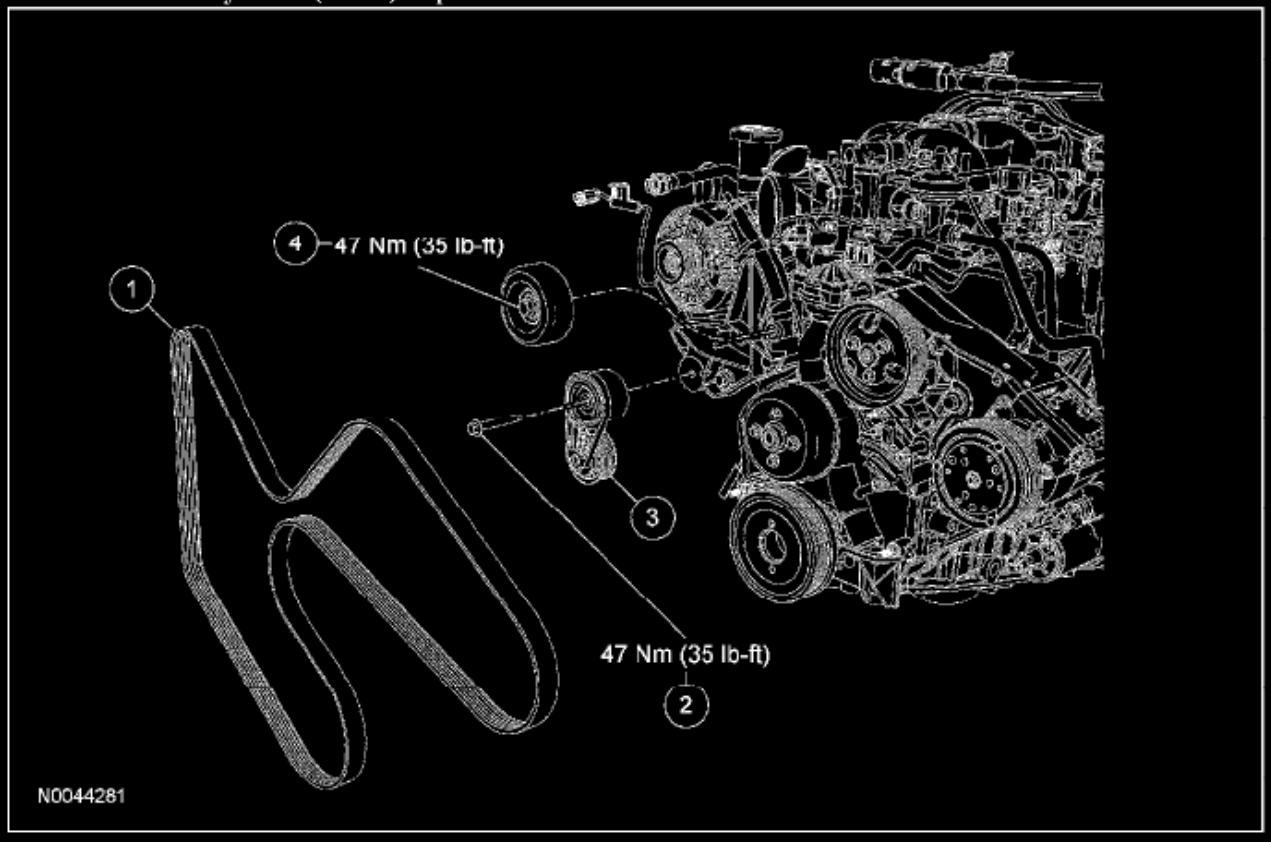
Item	Part Number	Description
4	—	Accessory drive belt idler pulley bolt (part of 6C348)
5	6C348	Accessory drive belt idler pulley

(Continued)

Front End Accessory Drive (FEAD) Exploded View - 3.0L

Front End Accessory Drive (FEAD) Exploded View - 4.0L

Front End Accessory Drive (FEAD) Exploded View — 4.0L



Item	Part Number	Description
1	8620	Accessory drive belt
2	W500326	Accessory drive belt tensioner bolt
3	6B209	Accessory drive belt tensioner

Item	Part Number	Description
4	6C348	Accessory drive belt idler pulley and bolt

(Continued)

Front End Accessory Drive (FEAD) Exploded View - 4.0L

Drive Belt Tensioner: Service and Repair

Accessory Drive Belt Tensioner - 3.0L

Removal and Installation

1. Rotate the accessory drive belt tensioner clockwise and remove the accessory drive belt. 2. Remove the bolt and the belt tensioner.

^ To install, tighten to 27 Nm (20 lb-ft).

3. To install, reverse the removal procedure.

Engine Mount: Procedures

Powertrain/Drivetrain Mount Neutralizing

NOTE: Refer to the appropriate procedure for special instructions on loosening and tightening mount fasteners.

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Loosen, but do not remove, the powertrain/drivetrain mount fasteners. 3. Lower the vehicle.

4. CAUTION: Do not twist or strain the powertrain/drivetrain mounts or damage to the mounts may occur.

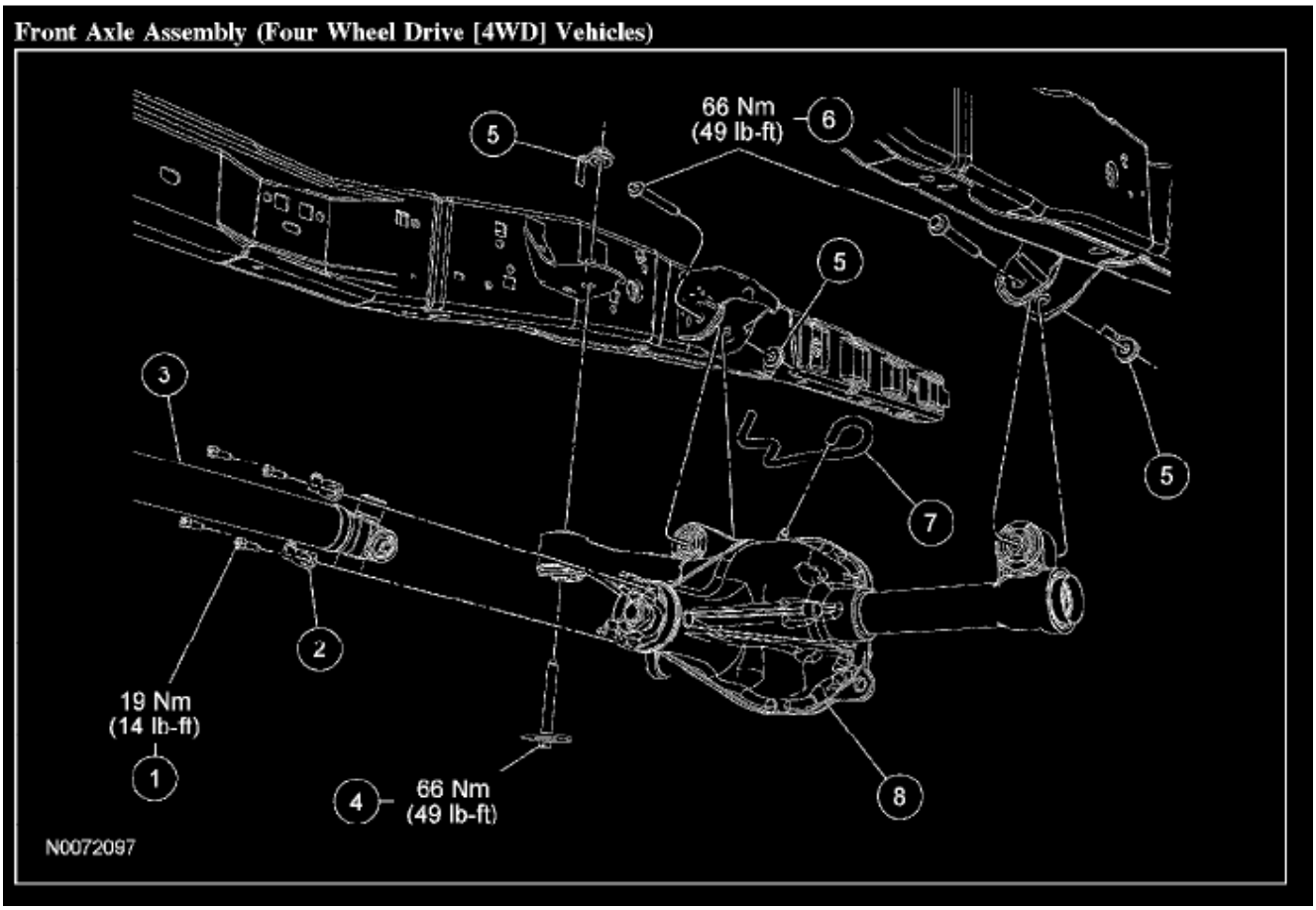
Move the vehicle in forward and reverse 0.6-1.2 m (2-4 ft).

5. Raise and support the vehicle. 6. Tighten the powertrain/drivetrain mount fasteners. 7. Lower the vehicle. 8. Test the system for normal operation.

Special Tool(s)

ST1831-A	Lifting Eyes 303-D030 (D81L-6001-D) or equivalent
ST2333-A	Three-Bar Engine Support Kit 303-F073 or equivalent

Front Axle Assembly (Four Wheel Drive [4WD] Vehicles)



Engine Mount: Removal and Replacement

Engine Support Insulators - LH

Engine Support Insulators - LH

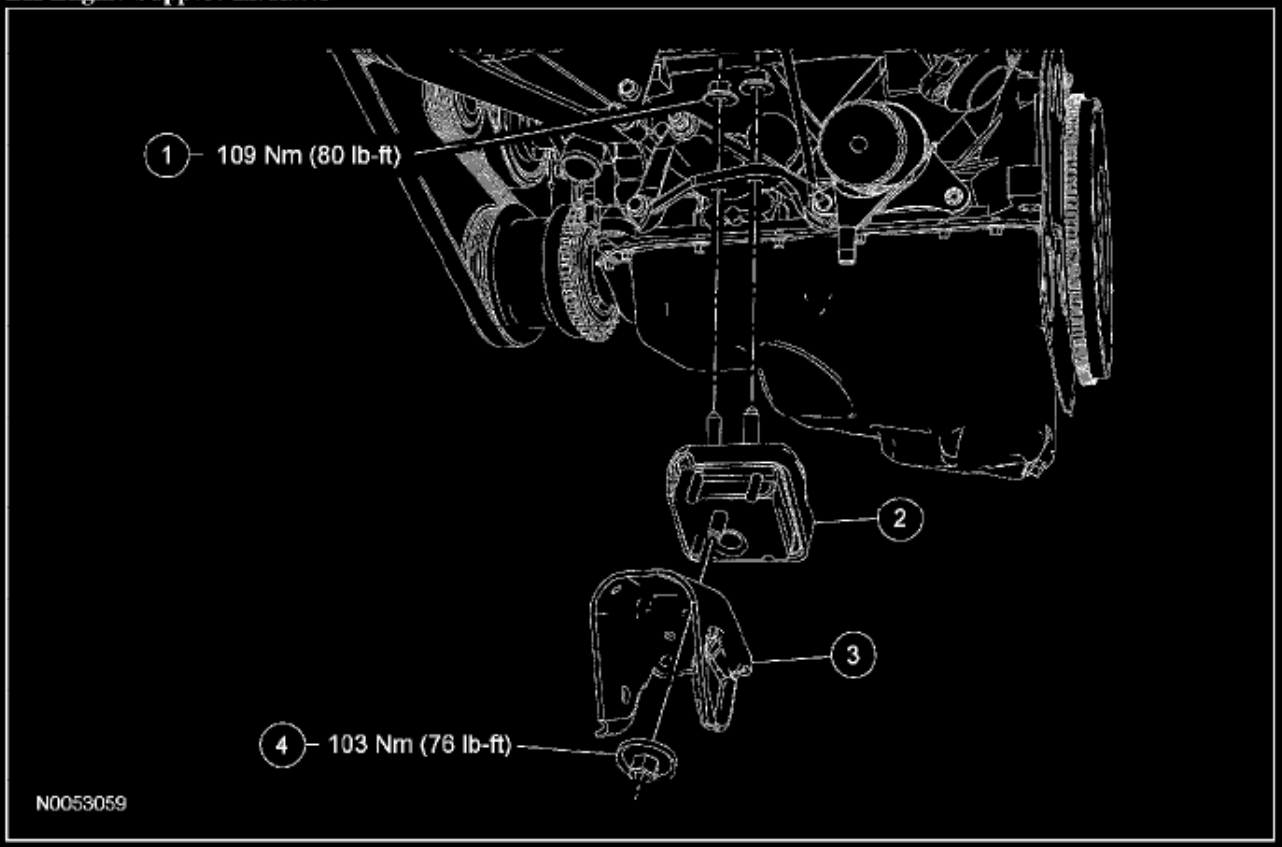
Front Axle Assembly (Four Wheel Drive [4WD] Vehicles) (Part 1)

Item	Part Number	Description
1	N389665	Front driveshaft strap bolt (4 required)
2	4369	Front driveshaft strap (2 required)
3	4A376	Front driveshaft
4	N811242	Front axle housing support bolt

(Continued)

Item	Part Number	Description
5	N811623	Flagnuts (3 required)
6	N808403	Front axle housing support bolts (2 required)
7	3B476	Front axle vent hose
8	3002	Front axle housing support

LH Engine Support Insulator



Item	Part Number	Description
1	W710719	Engine support insulator nut (2 required)
2	6B032	Engine support insulator
3	31570	Engine mounting bracket (part of 5005)
4	W710657	Engine support insulator nut

Front Axle Assembly (Four Wheel Drive [4WD] Vehicles) (Part 2)

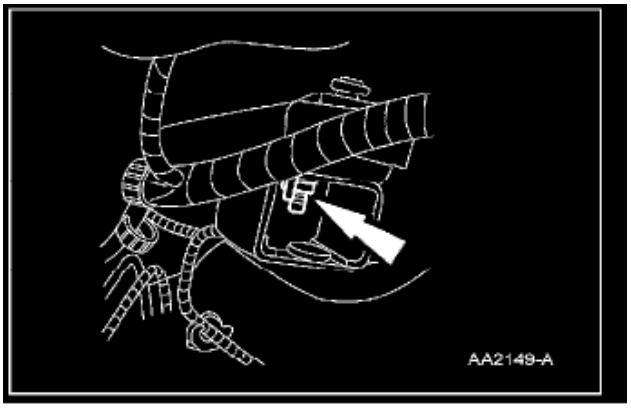
LH Engine Support Insulator

Removal

All vehicles

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Maintenance/Service and Repair. 2. Disconnect the battery ground cable. 3. Remove the hood. 4. Remove the fan. 5. Attach the Lifting Eyes. 6. Remove the engine support insulator nuts. 7. Raise the engine and support it with a Three-Bar Engine Support.

Rear wheel drive (RWD) vehicles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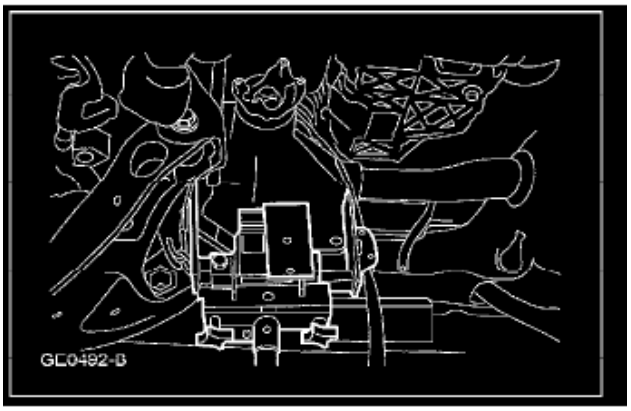
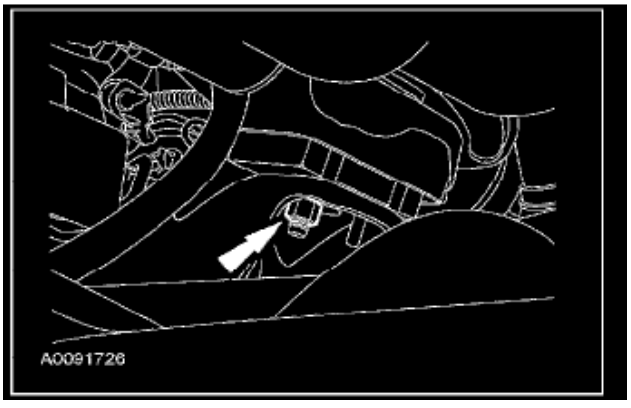

GE0492-B


A0091726

8. Remove the engine support insulator nut.

Four wheel drive (4WD) vehicles

9. NOTE: Tape the U-joint bearing caps to prevent them from falling off the U-joints.

NOTE: Index-mark the front axle pinion flange to the front driveshaft.

Remove and discard the bolts and straps. Secure the driveshaft aside.

10. Secure the front axle housing to a suitable jack.

11. CAUTION: Any time bolts, washers, spacers or flagnuts are loosened in the front axle housing support for any reason, install new

components to prevent damage.

Remove the 3 axle housing mounting bolts and flagnuts, and lower the front axle housing support approximately 50 mm (2 inch).

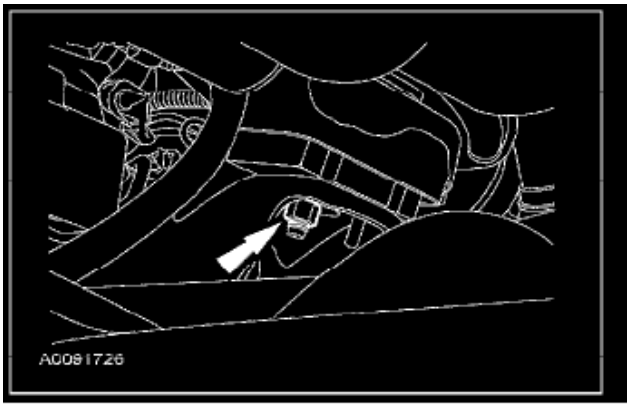
12. Remove the engine support insulator nut.

All vehicles

13. Remove the engine support insulator.

Installation

All vehicles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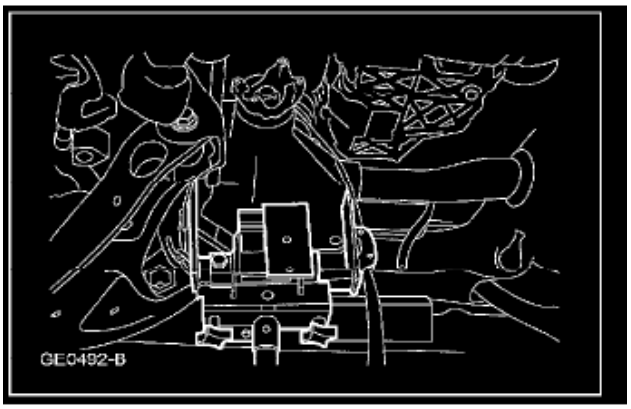
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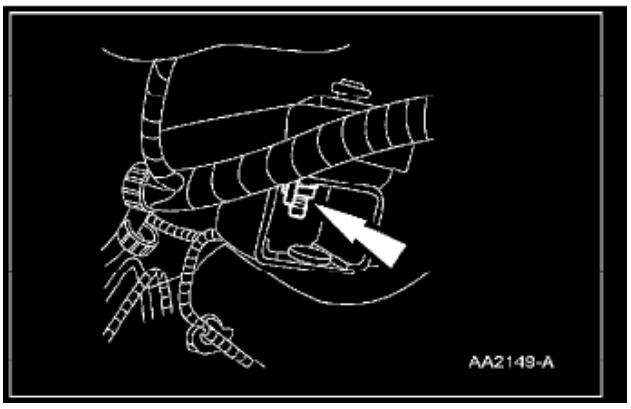
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1. Position the engine support insulator.

4WD vehicles

2. Install the engine support insulator nut.

^ Tighten to 103 Nm (76 lb-ft).

3. CAUTION: Any time bolts, washers, spacers or flagnuts are loosened in the front axle housing support for any reason, install new

components to prevent damage.

Raise the front axle housing into place and install the 3 bolts and flagnuts. ^

Tighten to 66 Nm (49 lb-ft).

4. Remove the jack.

5. Align the index marks and install new front driveshaft straps and the bolts.

^ Tighten to 19 Nm (14 lb-ft).

RWD vehicles

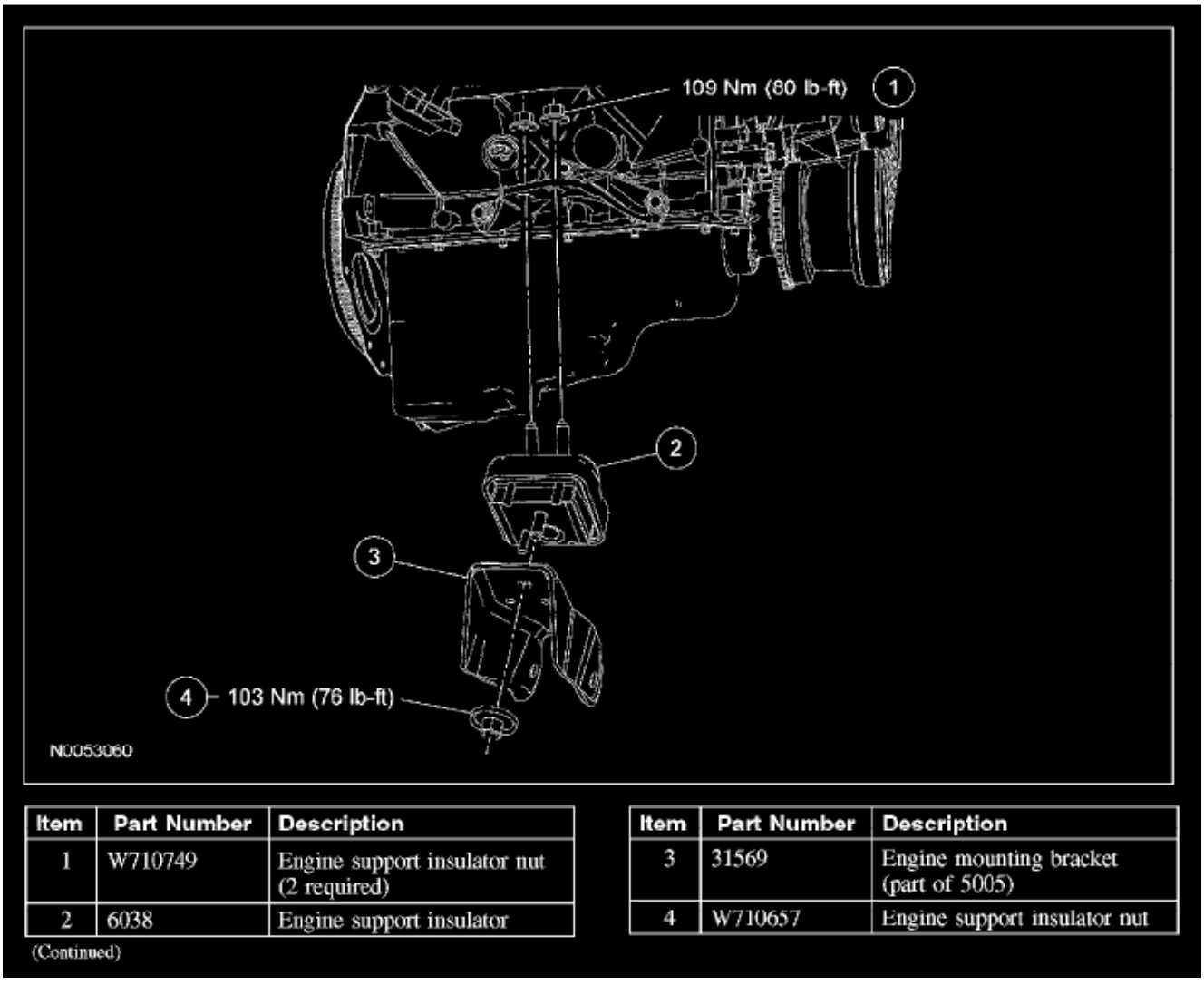
6. Install the engine support insulator nut.

^ Tighten to 103 Nm (76 lb-ft).

All vehicles

Special Tool(s)

ST1831-A	Lifting Eyes 303-D030 (D81L-6001-D) or equivalent
ST2333-A	Three-Bar Engine Support Kit 303-F073 or equivalent



Item	Part Number	Description
1	W710749	Engine support insulator nut (2 required)
2	6038	Engine support insulator
3	31569	Engine mounting bracket (part of 5005)
4	W710657	Engine support insulator nut

(Continued)

7. Lower the engine and remove the Three-Bar Engine Support. 8. Install the engine support insulator nuts.

^ Tighten to 109 Nm (80 lb-ft).

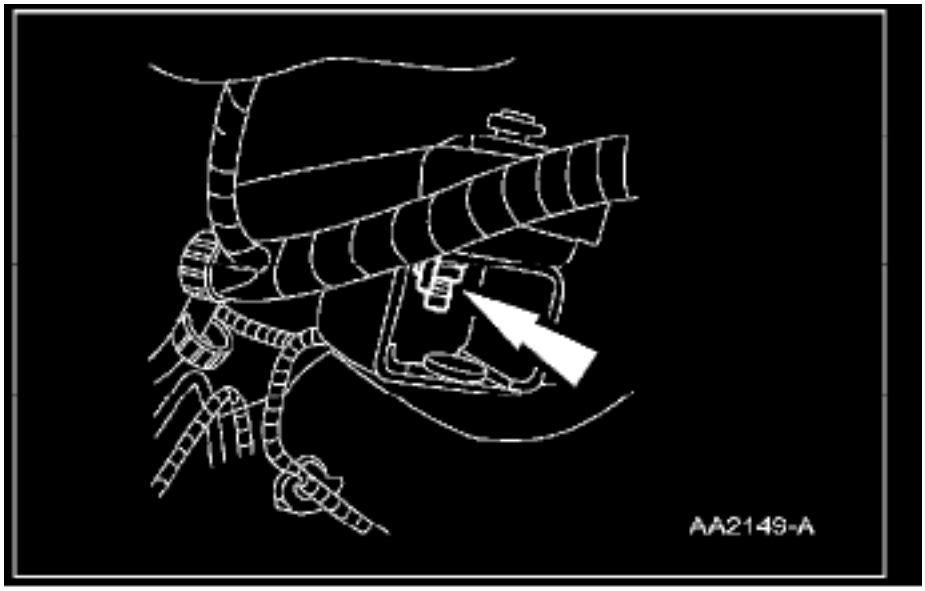
9. Remove the Lifting Eyes.

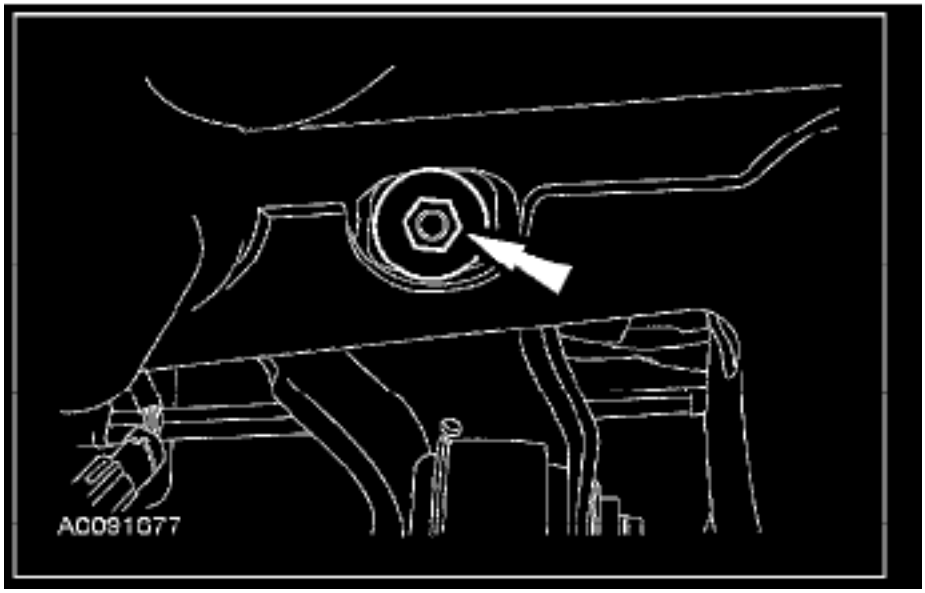
10. Install the fan blade. 11. Install the hood. 12. Connect the battery ground cable.

Engine Support Insulators - RH

Engine Support Insulators - RH

Removal





All vehicles

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Remove the hood. 3. Remove the fan blade. 4. Attach the Lifting Eyes. 5. Remove the engine support insulator nuts. 6. Raise the engine and support with a Three-Bar Engine Support Kit.

Rear wheel drive (RWD) vehicles

7. Remove the right front spring. 8. Remove the engine support insulator nut.

Four wheel drive (4WD) vehicles

9. Remove the RH front halfshaft.

10. Remove the engine support insulator nut.

All vehicles

11. Remove the engine support insulator.

Installation

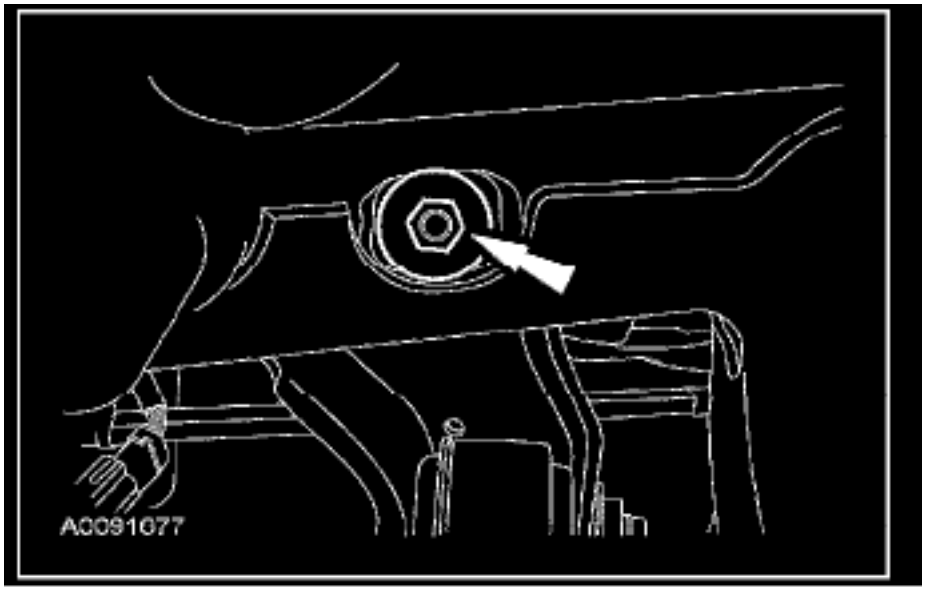
All vehicles

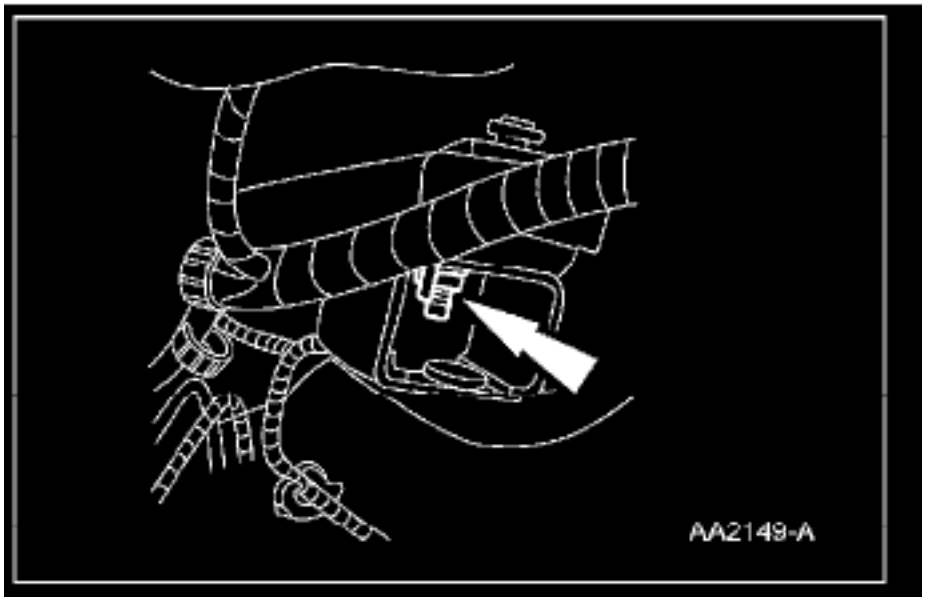
1. Position the engine support insulator.

4WD vehicles

2. Install the engine support insulator nut.

^ Tighten to 103 Nm (76 lb-ft).





3. Install the RH front halfshaft.

RWD vehicles

4. Install the engine support insulator nut.

^ Tighten to 103 Nm (76 lb-ft).

5. Install the right front spring.

All vehicles

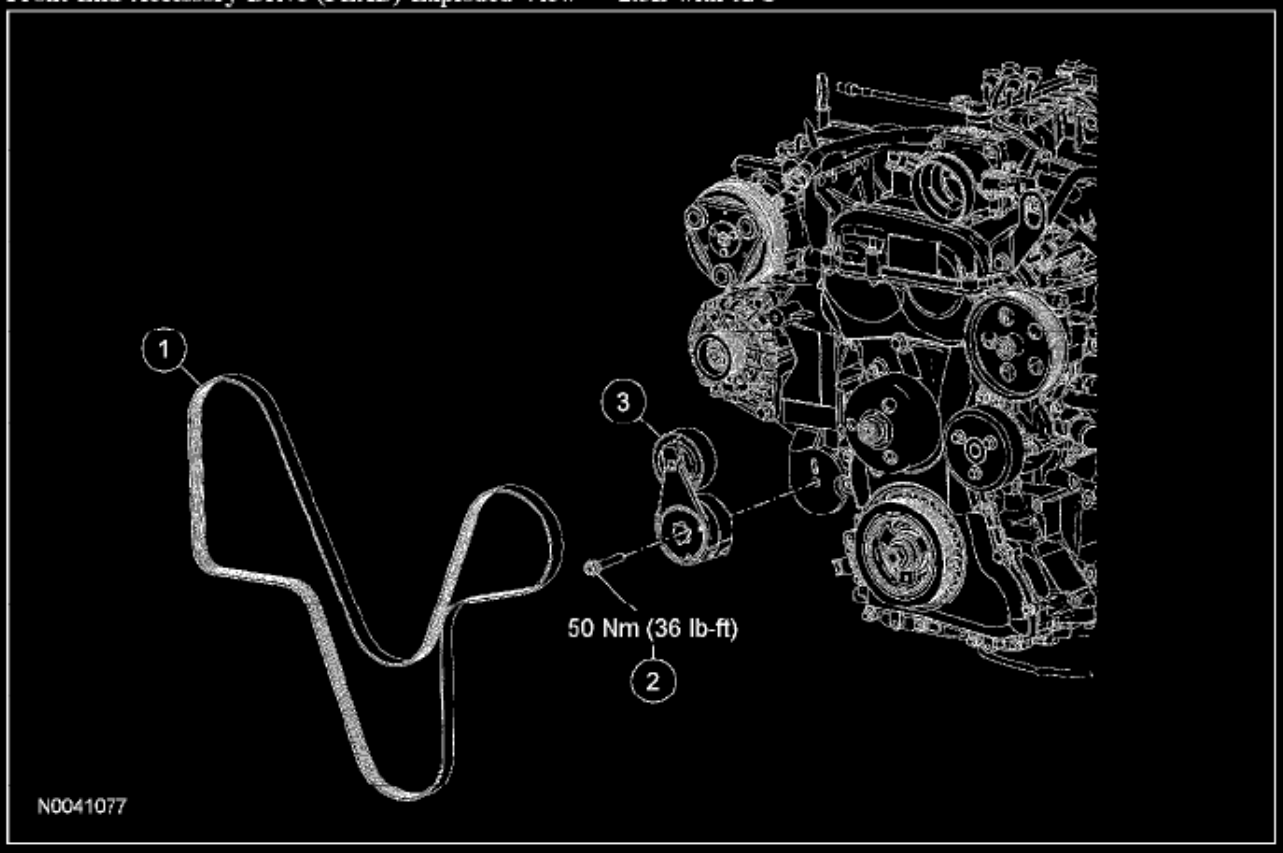
6. Lower the engine and remove the Three-Bar Engine Support Kit. 7. Install the engine support insulator nuts.

^ Tighten to 109 Nm (80 lb-ft).

8. Remove the Lifting Eyes. 9. Install the fan blade.

10. Install the hood.

Front End Accessory Drive (FEAD) Exploded View — 2.3L with A/C



Item	Part Number	Description
1	8620	Accessory drive belt
2	—	Accessory drive belt tensioner bolt (part of 6A228)
3	6A228	Accessory drive belt tensioner

Idler Pulley: Diagrams

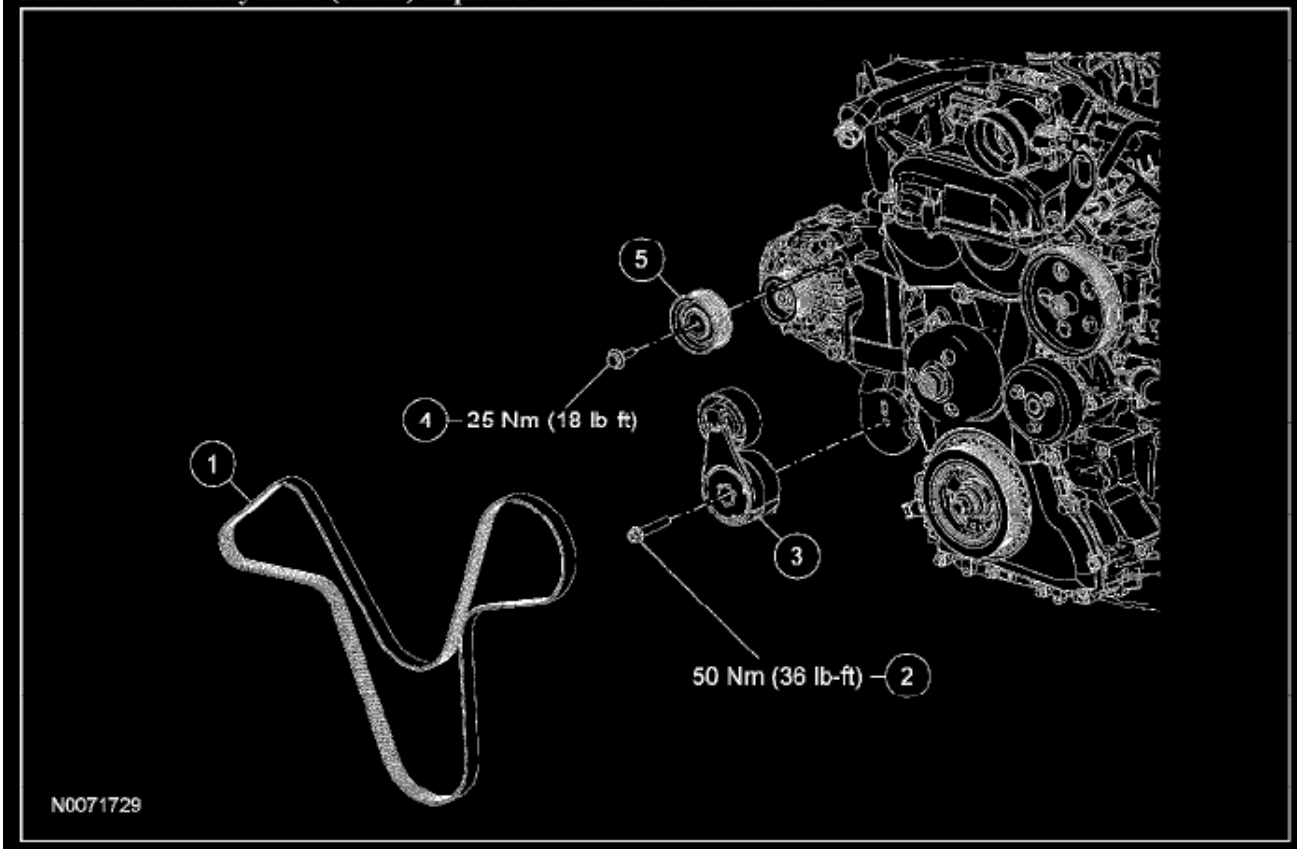
Front End Accessory Drive (FEAD) - Exploded View

Front End Accessory Drive (FEAD) Exploded View - 2.3L with A/C

Front End Accessory Drive (FEAD) Exploded View - 2.3L with A/C

Front End Accessory Drive (FEAD) Exploded View - 2.3L without A/C

Front End Accessory Drive (FEAD) Exploded View — 2.3L without A/C



Item	Part Number	Description
1	8620	Accessory drive belt
2		Accessory drive belt tensioner bolt (part of 6A228)
3	6A228	Accessory drive belt tensioner

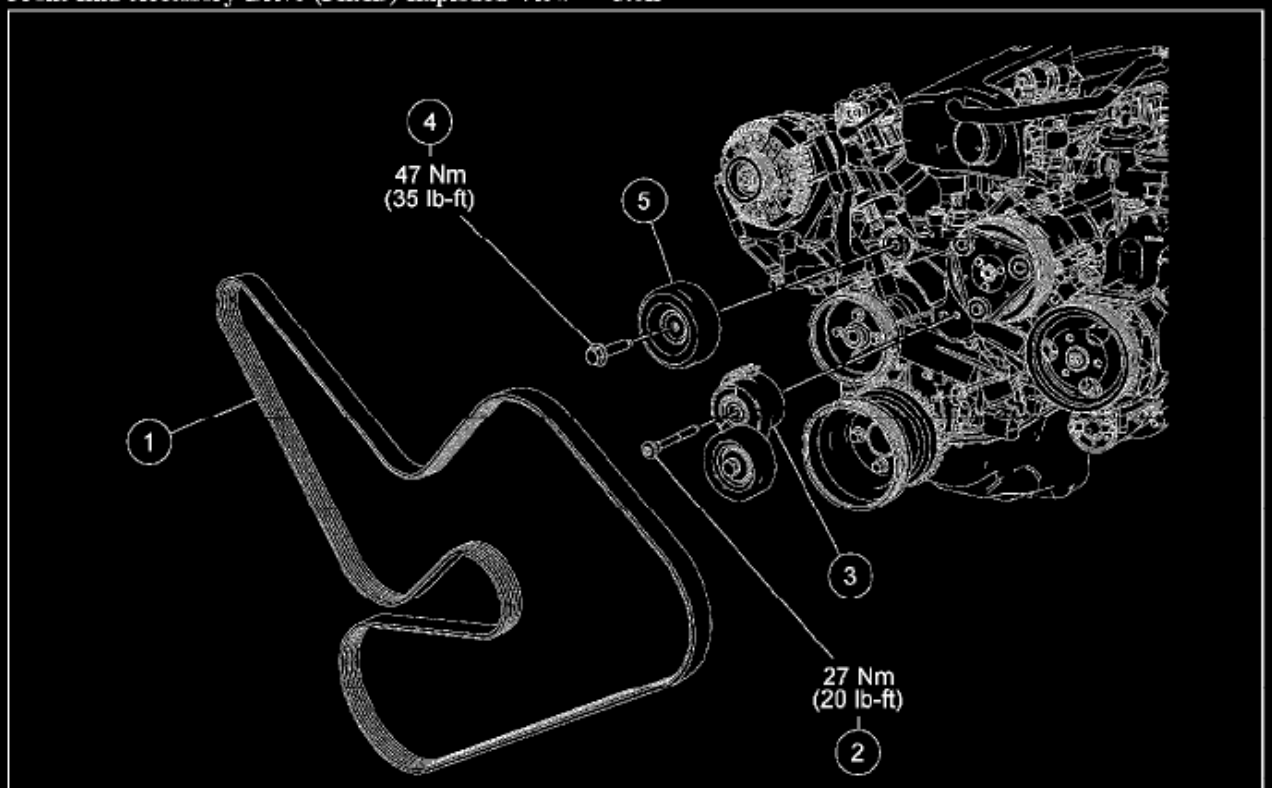
Item	Part Number	Description
4	—	Accessory drive belt idler pulley bolt (part of 6C348)
5	6C348	Accessory drive belt idler pulley

(Continued)

Front End Accessory Drive (FEAD) Exploded View - 2.3L without A/C

Front End Accessory Drive (FEAD) Exploded View - 3.0L

Front End Accessory Drive (FEAD) Exploded View — 3.0L



Item	Part Number	Description
1	8620	Accessory drive belt
2	—	Accessory drive belt tensioner bolt (part of 6B209)
3	6B209	Accessory drive belt tensioner

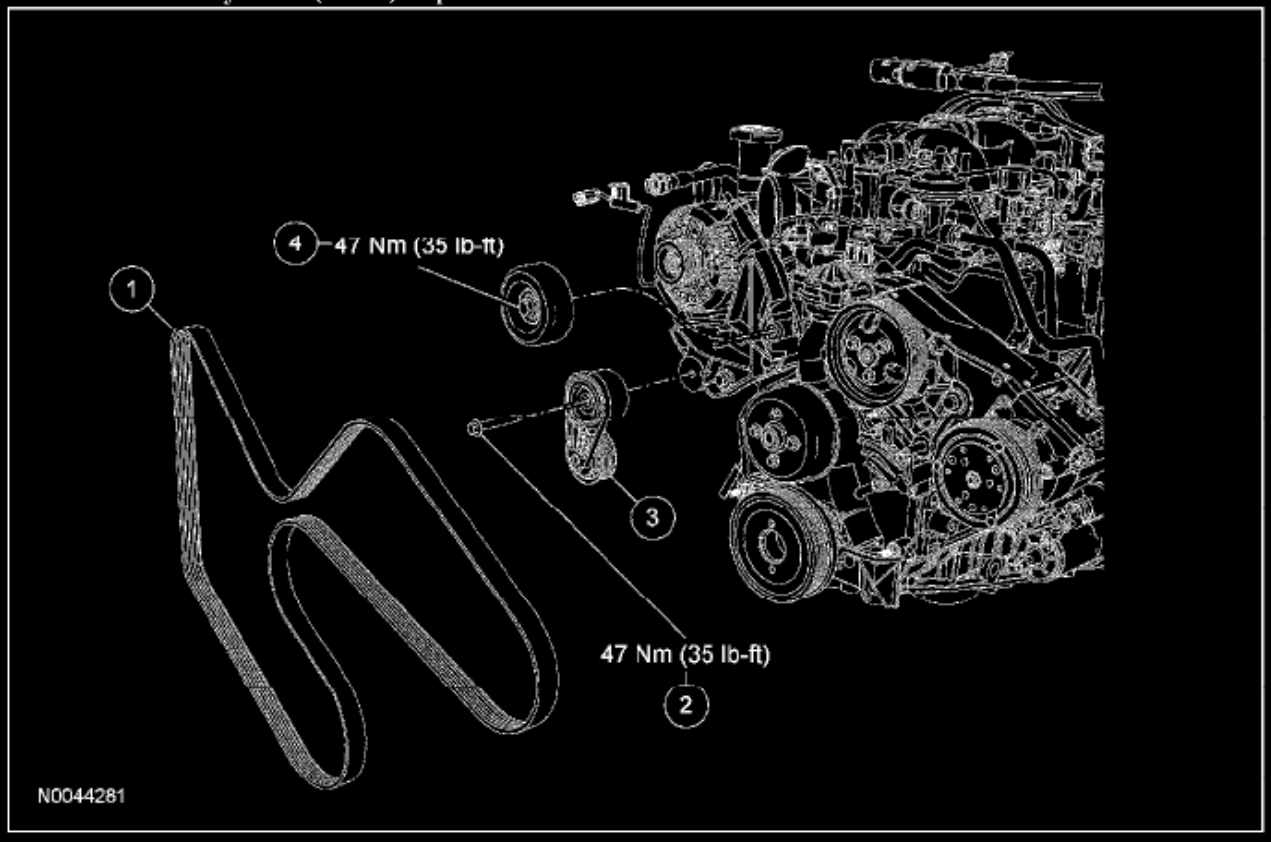
Item	Part Number	Description
4	—	Accessory drive belt idler pulley bolt (part of 6C348)
5	6C348	Accessory drive belt idler pulley

(Continued)

Front End Accessory Drive (FEAD) Exploded View - 3.0L

Front End Accessory Drive (FEAD) Exploded View - 4.0L

Front End Accessory Drive (FEAD) Exploded View — 4.0L



Item	Part Number	Description
1	8620	Accessory drive belt
2	W500326	Accessory drive belt tensioner bolt
3	6B209	Accessory drive belt tensioner

Item	Part Number	Description
4	6C348	Accessory drive belt idler pulley and bolt

(Continued)

Front End Accessory Drive (FEAD) Exploded View - 4.0L

Idler Pulley: Service and Repair

Accessory Drive Belt Idler Pulley

Removal and Installation

Vehicles equipped with a 4.0L SOHC engine

1. Remove the air cleaner outlet pipe.

All vehicles

2. NOTE: The accessory drive belt tensioner on 2.3L and 4.0L SOHC engines is turned counterclockwise to remove the accessory drive belt. On

3.0L engines, it is turned clockwise.

Rotate the accessory drive belt tensioner and remove the accessory drive belt.

3. Remove the belt idler pulley assembly.

^ To install, tighten the 2.3L belt idler pulley assembly to 25 Nm (18 lb-ft).

^ To install, tighten the 3.0L and 4.0L belt idler pulley assembly to 47 Nm (35 lb-ft).

4. To install, reverse the removal procedure.

Engine Oil Pressure: Specifications

Oil pressure (hot 2,500 rpm) ..... 276-414 kPa (40-60 psi)

Engine Oil Pressure: Testing and Inspection

Oil Pressure Test

1. Disconnect and remove the oil pressure sensor from the engine. 2. Connect the Engine Oil Pressure Gauge to the oil pressure sender oil galley port. 3. Run the engine until normal operating temperature is reached. 4. Run the engine at the specified rpm and record the gauge reading. 5. The oil pressure should be within specifications; refer to the appropriate specification chart. 6. If the pressure is not within specification, check the following possible sources:

^ Insufficient oil

^ Oil leakage

^ Worn or damaged oil pump

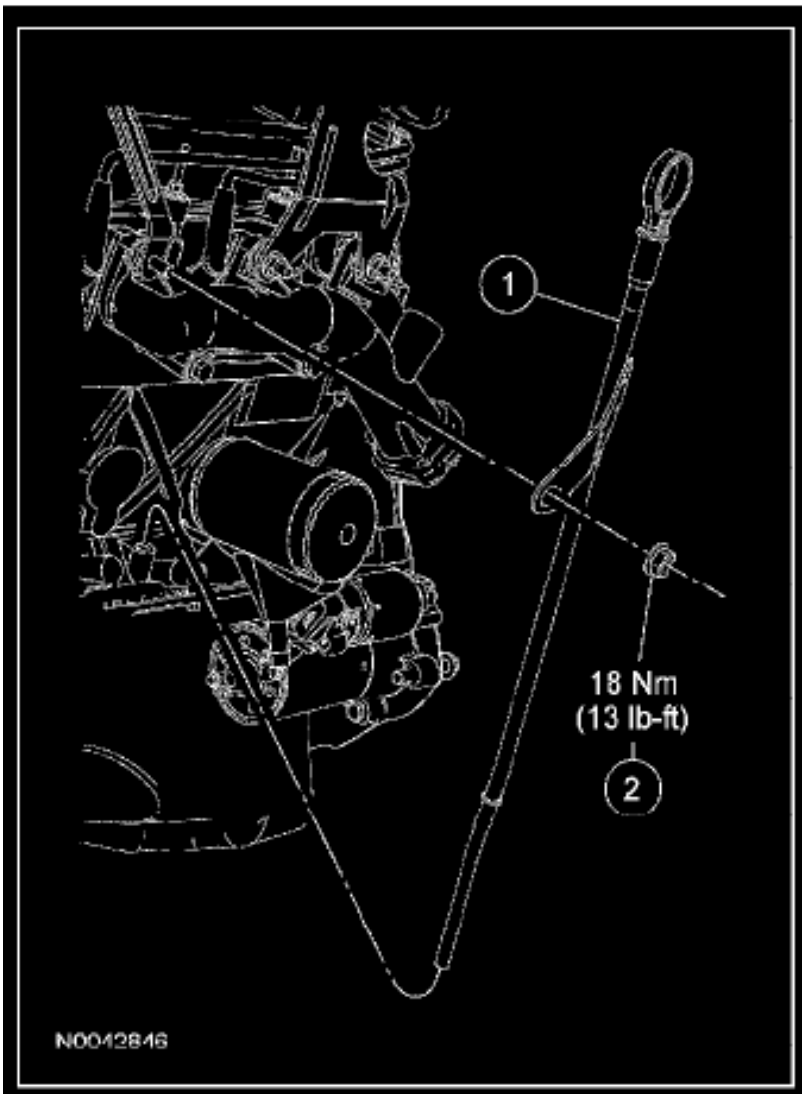
^ Oil pump screen cover and tube

^ Excessive main bearing clearance

^ Excessive connecting rod bearing clearance

Material

Item	Specification
Motorcraft Metal Surface Prep ZC-31	—
Silicone Gasket and Sealant TA-26	WSE-M4G323-A4



Item	Part Number	Description
1	6754	Oil level indicator tube assembly
2	N804178-S	Nut

Engine Oil Dip Stick - Dip Stick Tube: Service and Repair

Oil Level Indicator and Tube

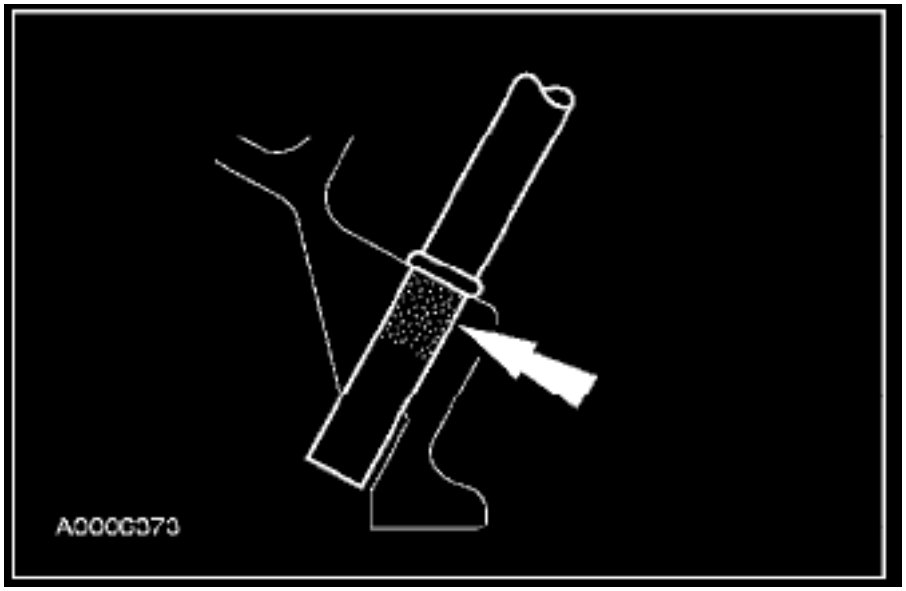
Removal

1. Remove the nut and the oil level indicator tube assembly.

Installation

1. NOTE: The end of the oil level indicator tube should be cleaned with metal surface prep before application of the sealant.

Coat the sealing surfaces of the oil level indicator tube with silicone gasket and sealant.



2. Install the oil level indicator tube assembly and nut.

^ Tighten to 18 Nm (13 lb-ft).

Engine Oil: Capacity Specifications

Engine Oil

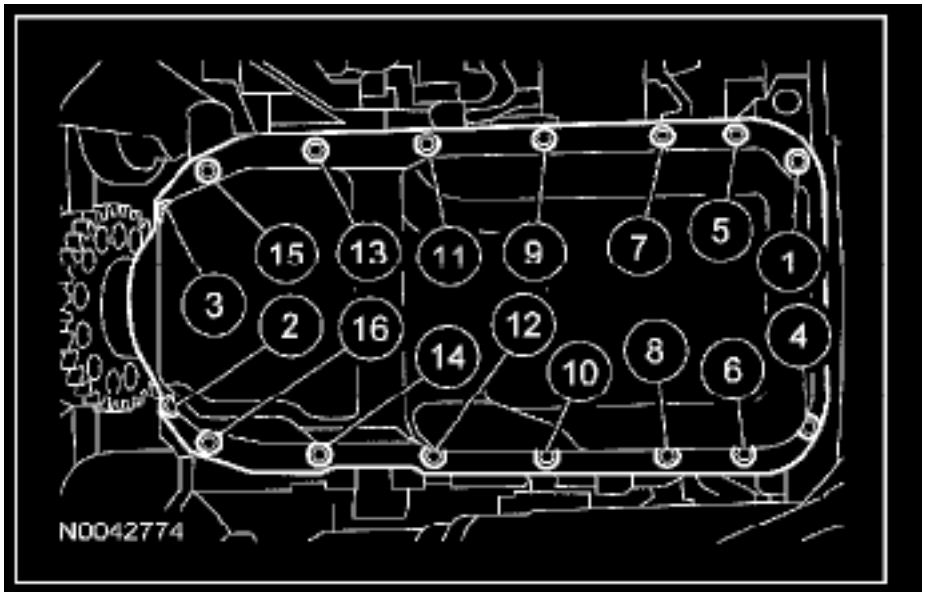
With Filter ..... 4.25L (4.5 Qt)

Engine Oil: Fluid Type Specifications

Engine Oil

U.S. .....
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil Canada
.....
Motorcraft SAE 5W-20 Super Premium Motor Oil

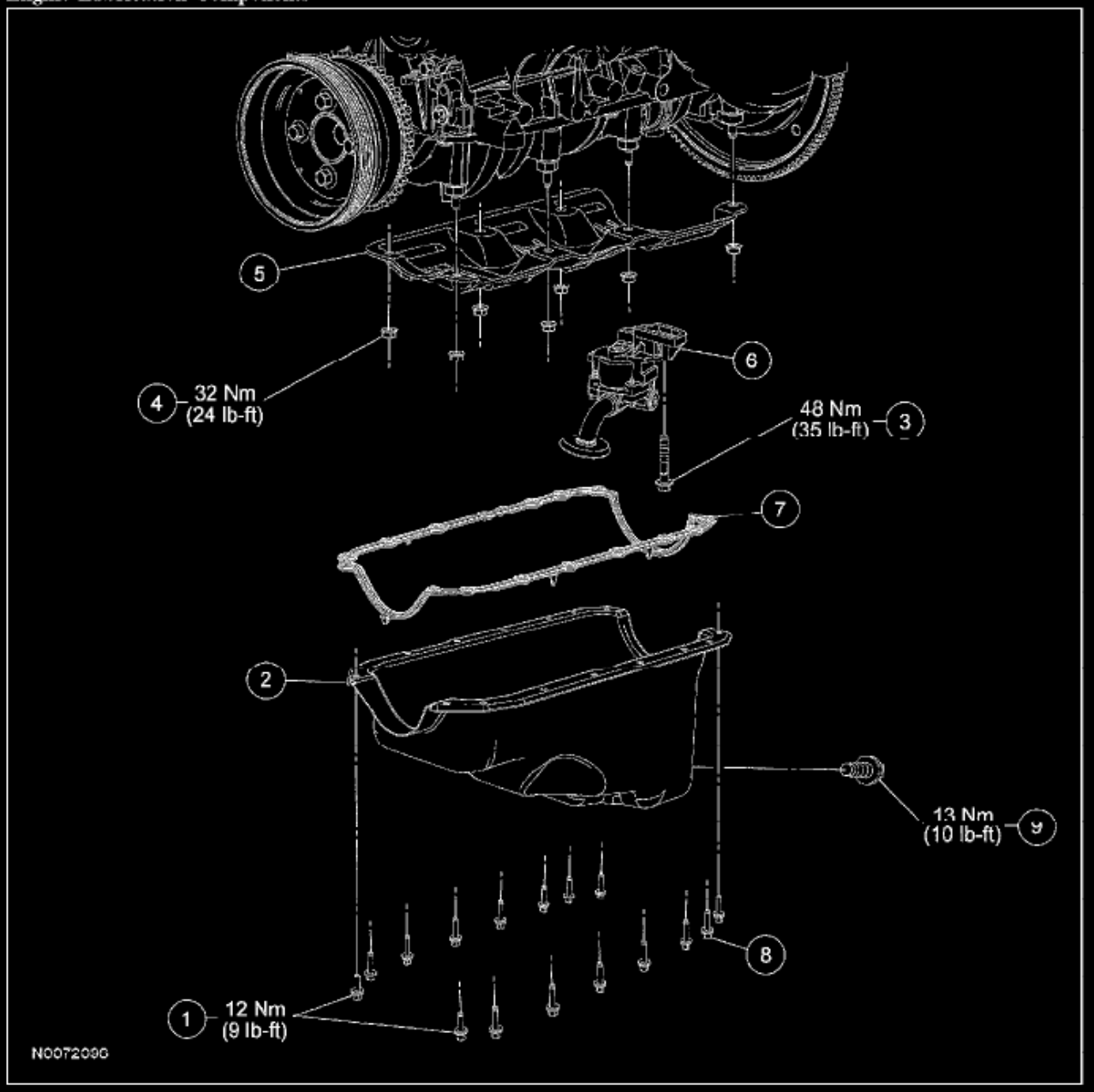
Note: Use of synthetic or synthetic blend motor oil is not mandatory. Engine oil need only have the API Certification mark and meet the requirements of Ford Specification WSS-M2C930-A.



Oil Pan: Specifications

Oil pan ..... 12 Nm (9 lb-ft)

Engine Lubrication Components



Item	Part Number	Description
1	W708366	Oil pan bolts (2 required)
2	6675	Oil pan
3	N606563	Oil pump bolt
4	W520513	Oil pan baffle nut (7 required)
5	6687	Oil pan baffle
6	6600	Oil pump

(Continued)

Item	Part Number	Description
7	6710	Oil pan gasket
8	W708365	Oil pan bolt (14 required)
9	—	Oil pan drain plug

Oil Pan: Service and Repair Oil Pan

Oil Pan - Rear Wheel Drive (RWD)

Engine Lubrication Components

Engine Lubrication Components

Special Tool(s)

ST1831-A	Lifting Eyes 303-D030 (D81L-6001-D) or equivalent
ST1703-A	Three-Bar Engine Support Kit 303-D063 (D88L-6000-A) or equivalent

Material

Item	Specification
Motorcraft Metal Surface Prep ZC-31	—
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4
Silicone Gasket Remover ZC-30	—

Removal

All vehicles

1. Remove the flywheel or flexplate. 2. Drain the engine oil. Vehicles equipped with coil springs 3. Remove the air cleaner outlet tube. 4. Remove the engine support insulator nuts. 5. Install the Lifting Eyes, the Three-Bar Engine Support and raise the engine 43 mm (1.72 inch). 6. Install blocks between the engine mounts and the support brackets.

All vehicles

7. Remove the bolts and the oil pan.

^ Discard the oil pan gasket.

Installation

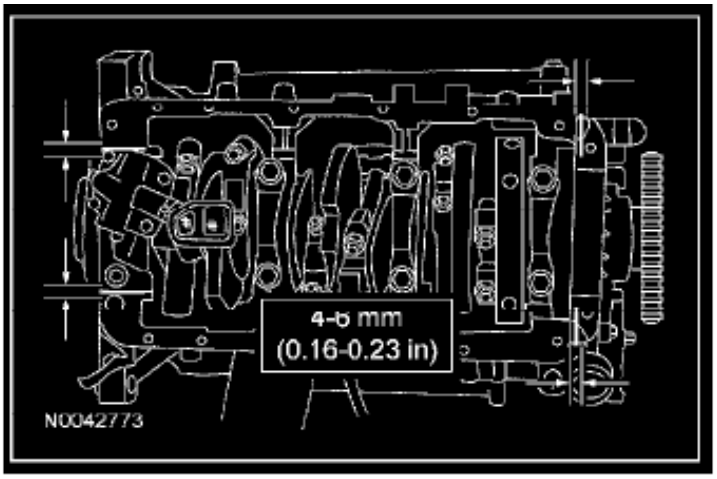
All vehicles

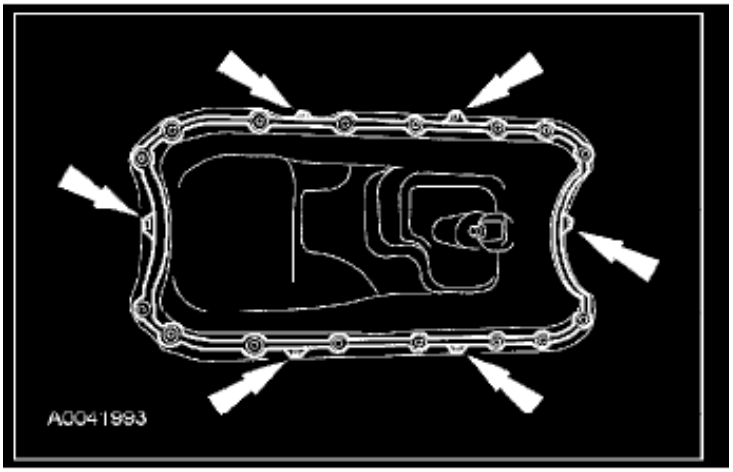
1. CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These

tools cause scratches and gouges, which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.

NOTE: If not secured within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Observe all warnings and cautions and follow all application directions contained on the packaging of the silicone gasket remover and metal surface prep. Allow to dry until there is no sign of wetness, or 4 minutes, whichever is longer. Failure to follow this procedure can cause future oil leakage.

Thoroughly clean the oil pan and the old sealer from all gasket surfaces. Thoroughly clean all exposed areas with metal surface prep. Thoroughly clean the transmission bell housing area. Clean and inspect the oil inlet tube.


4-6 mm
(0.16-0.23 in)
N0042773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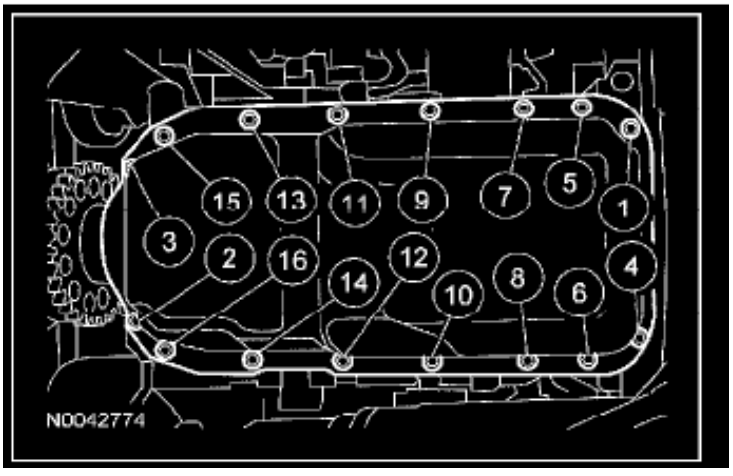

15
13
11
9
7
5
1
3
2
16
14
12
10
8
6
4
N0042774

2. CAUTION: The thickness of the sealant must be between 4-6 mm (0.16-0.23 inch) or oil leaks may occur.

NOTE: If not secured within 4 minutes, the sealant must be removed and the sealing area cleaned.

Apply a 4-6 mm (0.16-0.23 inch) bead of silicone gasket and sealant to the junction of the main bearing cap and the cylinder block and to the junction of the front cover assembly and the cylinder block.

3. Position the oil pan gasket to the oil pan by aligning the fastener holes and securing the gasket with the gasket clips.

4. NOTE: Make sure the fasteners are clean and dry prior to installation.

Install the oil pan and bolts. Tighten in the sequence shown. ^

Tighten to 12 Nm (9 lb-ft).

Vehicles equipped with coil springs

5. Remove the blocks from between the engine mounts and the support brackets. 6. Lower the engine and remove the Three-Bar Engine Support and the Lifting Eyes. 7. Install the engine support insulator nuts.

^ Tighten to 109 Nm (80 lb-ft).

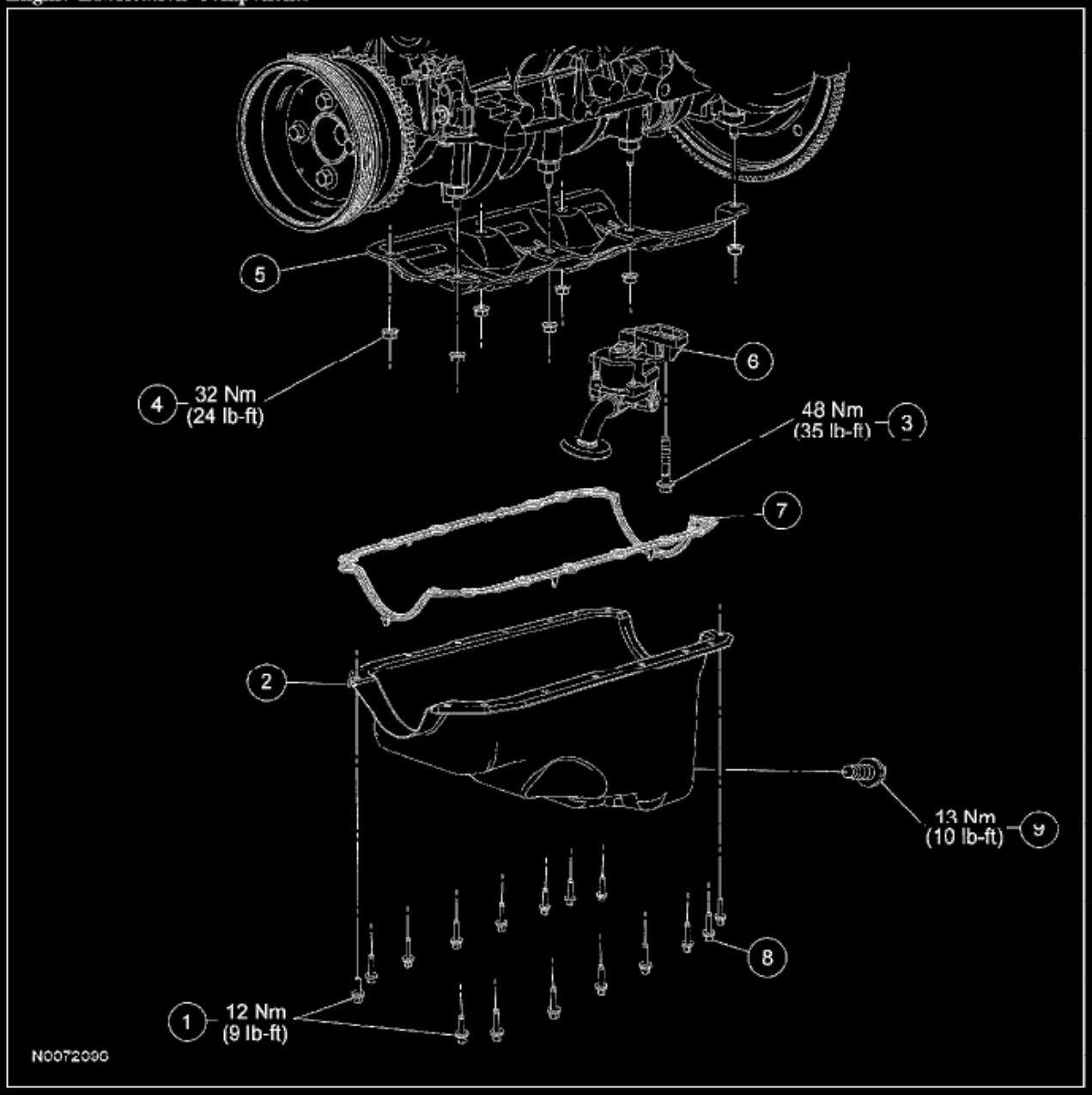
8. Install the air cleaner outlet tube.

All vehicles

9. Install the flywheel or flexplate.

10. Fill the engine with clean engine oil. 11. Start the engine and check for leaks.

Engine Lubrication Components



Item	Part Number	Description
1	W708366	Oil pan bolts (2 required)
2	6675	Oil pan
3	N606563	Oil pump bolt
4	W520513	Oil pan baffle nut (7 required)
5	6687	Oil pan baffle
6	6600	Oil pump

(Continued)

Item	Part Number	Description
7	6710	Oil pan gasket
8	W708365	Oil pan bolt (14 required)
9	—	Oil pan drain plug

Oil Pan: Service and Repair Oil Pan Baffle

Oil Pan Baffle

Engine Lubrication Components

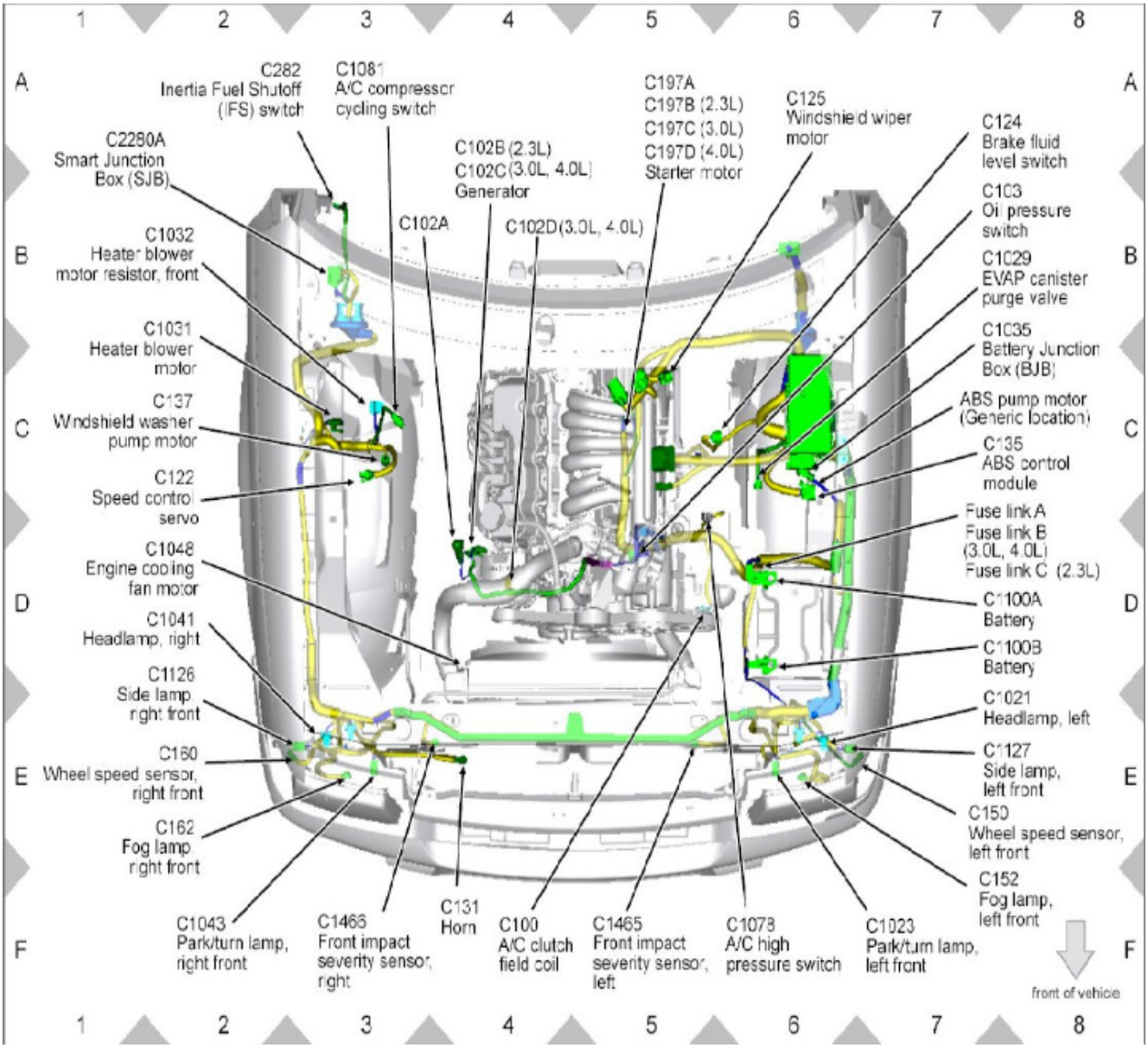
Engine Lubrication Components

Removal and Installation

1. Remove the oil pan. 2. Remove the 7 nuts and the oil pan baffle.

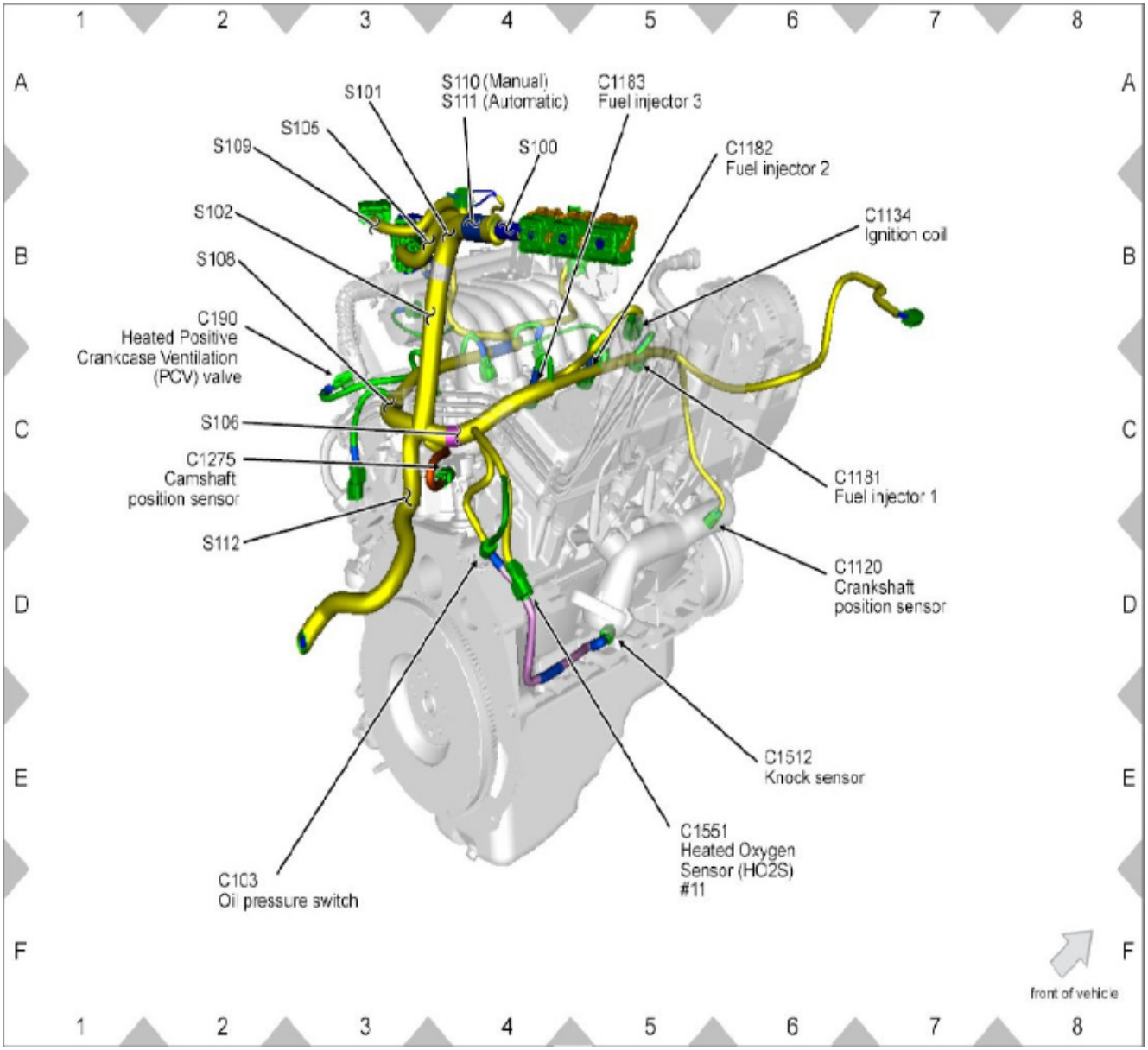
^ To install, tighten to 32 Nm (24 lb-ft).

3. To install reverse the removal procedure.

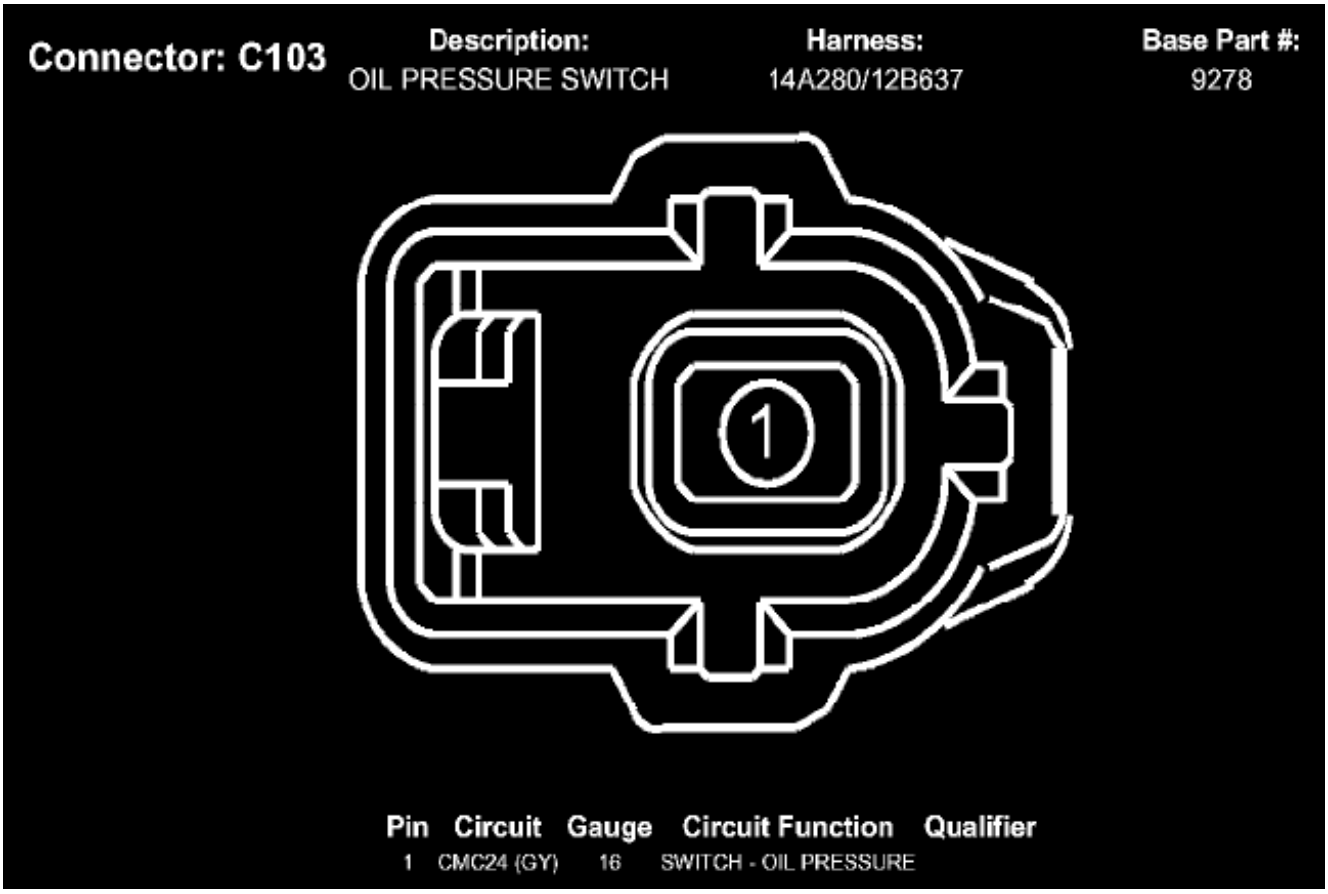


Oil Pressure Sender: Locations

View 151-1

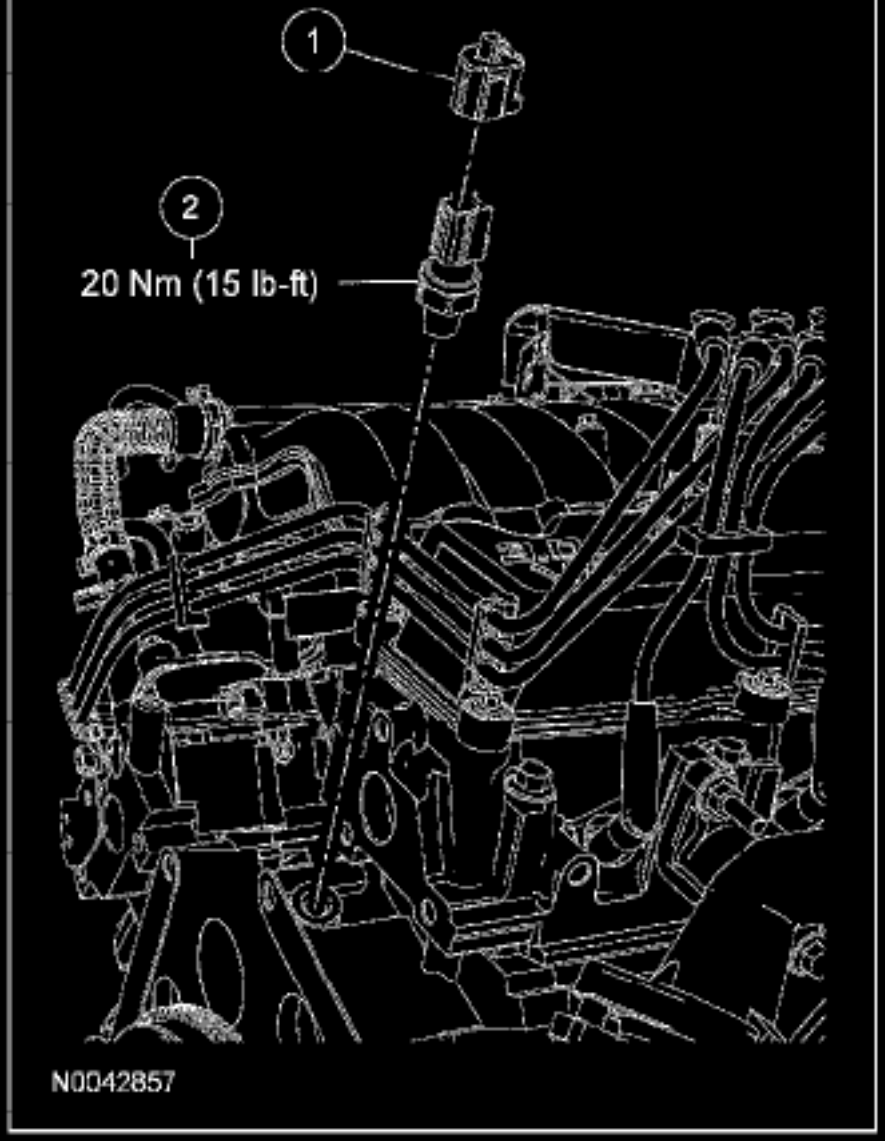

S101
S110 (Manual)
S111 (Automatic)
C1183
Fuel injector 3
S105
S109
S100
C1182
Fuel injector 2
S102
C1134
Ignition coil
S108
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
C1275
Camshaft
position sensor
S112
C1181
Fuel injector 1
C1120
Crankshaft
position sensor
C1512
Knock sensor
C1551
Heated Oxygen
Sensor (HO2S)
#11
C103
Oil pressure switch
front of vehicle

View 151-6


Connector: C103
Description:
OIL PRESSURE SWITCH
Harness:
14A280/12B637
Base Part #:
9278
1
Pin Circuit Gauge Circuit Function Qualifier
1 CMC24 (GY) 16 SWITCH - OIL PRESSURE

C103

Engine Oil Pressure (EOP) Switch



Item	Part Number	Description
1	14A464	Engine oil pressure (EOP) switch electrical connector (part of 12B637)
2	9278	EOP switch

Oil Pressure Sender: Service and Repair

Engine Oil Pressure (EOP) Switch

Engine Oil Pressure (EOP) Switch

Removal and Installation

1. Disconnect the engine oil pressure switch electrical connector from the engine oil pressure switch. 2. Remove the engine oil pressure switch.

^ To install, tighten to 20 Nm (15 lb-ft).

3. To install, reverse the removal procedure.

Engine Oil Pressure: Specifications

Oil pressure (hot 2,500 rpm) ..... 276-414 kPa (40-60 psi)

Engine Oil Pressure: Testing and Inspection

Oil Pressure Test

1. Disconnect and remove the oil pressure sensor from the engine. 2. Connect the Engine Oil Pressure Gauge to the oil pressure sender oil galley port. 3. Run the engine until normal operating temperature is reached. 4. Run the engine at the specified rpm and record the gauge reading. 5. The oil pressure should be within specifications; refer to the appropriate specification chart. 6. If the pressure is not within specification, check the following possible sources:

^ Insufficient oil

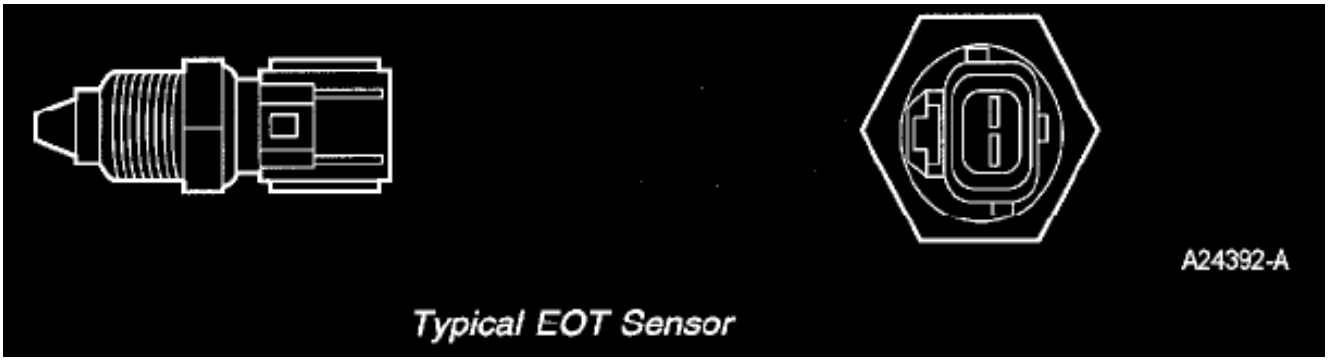
^ Oil leakage

^ Worn or damaged oil pump

^ Oil pump screen cover and tube

^ Excessive main bearing clearance

^ Excessive connecting rod bearing clearance



Typical EOT Sensor

Oil Temperature Sensor/Switch: Description and Operation

ENGINE OIL TEMPERATURE (EOT) SENSOR

Typical EOT Sensor

The EOT sensor is a thermistor device in which resistance changes with temperature. The electrical resistance of a thermistor decreases as the temperature increases and the resistance increases as the temperature decreases. The varying resistance changes the voltage drop across the sensor terminals and provides electrical signals to the PCM corresponding to temperature.

Thermistor-type sensors are considered passive sensors. A passive sensor is connected to a voltage divider network so that varying the resistance of the passive sensor causes a variation in total current flow. Voltage that is dropped across a fixed resistor in a series with the sensor resistor determines the voltage signal at the PCM. This voltage signal is equal to the reference voltage minus the voltage drop across the fixed resistor.

The EOT sensor measures the temperature of the engine oil. The sensor is typically threaded into the engine oil lubrication system. The PCM can use the EOT sensor input to determine the following:

- On variable camshaft timing (VCT) applications the EOT input is used to adjust the VCT control gains and logic for camshaft timing.

- The PCM can use EOT sensor input in conjunction with other PCM inputs to determine oil degradation.

- The PCM can use EOT sensor input to initiate a soft engine shutdown. To prevent engine damage from occurring as a result of high oil temperatures, the PCM has the ability to initiate a soft engine shutdown. Whenever engine RPM exceeds a calibrated level for a certain period of time, the PCM begins reducing power by disabling engine cylinders.

PART NUMBER	PART NAME
8L5Z-6C324-A	PVC Connector And Hose Asy

Intake Manifold: Customer Interest Engine - Blue Smoke On Start Up

TSB 07-22-10

11/12/07

3.0L 2V VULCAN ENGINE - BLUE SMOKE ON START Up

FORD: 2004-2008 Ranger

ISSUE Some 2004-2008 Ranger vehicles equipped with a 3.0L 2V Vulcan engine may exhibit blue smoke on start up after approximately a 4 hour cold soak. This may be due to small amounts of oil commonly found in the PCV system collecting in the upper intake manifold PCV channel. Under certain parking conditions, this oil can be drawn into the combustion chamber, creating momentary blue smoke that may be visible by the customer.

ACTION Follow the Service Procedure steps to reduce blue smoke on start up.

SERVICE PROCEDURE

1. Remove the clamp on the PCV tube assembly at the PCV valve.

2. Remove the upper intake manifold per the Workshop Manual (WSM), Section 303-01B. Leave the PCV tube assembly attached to the upper intake

manifold.

3. Remove the clamp on the PCV tube assembly at the upper intake manifold PCV port, and remove the PCV Tube Assembly from the upper intake

manifold PCV channel.

4. Drain the residual oil from the upper intake manifold PCV channel by holding the PCV channel vertical with the port facing down.

5. While holding the upper intake manifold in the vertical position, spray Brake Cleaner into the PCV channel. Use regulated compressed air to aid in

drying the PCV channel.

6. Lubricate the 0-Ring at the end of the new PCV Tube Assembly with water or diluted soapy water solution.

7. Install the new PCV Tube Assembly into the clean upper intake manifold PCV channel.

8. Install the upper intake manifold per WSM, Section 303-01B.

Parts Block

WARRANTY STATUS: Eligible Under Provisions Of New Vehicle Limited Warranty Coverage
IMPORTANT: Warranty coverage limits/policies are not altered by a TSB. Warranty coverage limits are determined by the identified causal part.

OPERATION DESCRIPTION TIME

072210A 2004-2008 Ranger 3.0L: 0.8 Hr.

Replace The PCV Tube, Includes Time To Remove Clean, Install Upper Intake Manifold (Do Not Use With 9424A, 6666A)

DEALER CODING

CONDITION

BASIC PART NO. CODE

6C324 D8

NOTE: The information in Technical Service Bulletins is intended for use by trained, professional technicians with the knowledge, tools, and equipment to do the job properly and safely. It informs these technicians of conditions that may occur on some vehicles, or provides information that could assist in proper vehicle service. The procedures should not be performed by "do-it-yourselfers". Do not assume that a condition described affects your car or truck. Contact a Ford, Lincoln, or Mercury dealership to determine whether the Bulletin applies to your vehicle.

Disclaimer

PART NUMBER	PART NAME
8L5Z-6C324-A	PVC Connector And Hose Asy

Intake Manifold: All Technical Service Bulletins Engine - Blue Smoke On Start Up

TSB 07-22-10

11/12/07

3.0L 2V VULCAN ENGINE - BLUE SMOKE ON START Up

FORD: 2004-2008 Ranger

ISSUE Some 2004-2008 Ranger vehicles equipped with a 3.0L 2V Vulcan engine may exhibit blue smoke on start up after approximately a 4 hour cold soak. This may be due to small amounts of oil commonly found in the PCV system collecting in the upper intake manifold PCV channel. Under certain parking conditions, this oil can be drawn into the combustion chamber, creating momentary blue smoke that may be visible by the customer.

ACTION Follow the Service Procedure steps to reduce blue smoke on start up.

SERVICE PROCEDURE

1. Remove the clamp on the PCV tube assembly at the PCV valve.

2. Remove the upper intake manifold per the Workshop Manual (WSM), Section 303-01B. Leave the PCV tube assembly attached to the upper intake

manifold.

3. Remove the clamp on the PCV tube assembly at the upper intake manifold PCV port, and remove the PCV Tube Assembly from the upper intake

manifold PCV channel.

4. Drain the residual oil from the upper intake manifold PCV channel by holding the PCV channel vertical with the port facing down.

5. While holding the upper intake manifold in the vertical position, spray Brake Cleaner into the PCV channel. Use regulated compressed air to aid in

drying the PCV channel.

6. Lubricate the 0-Ring at the end of the new PCV Tube Assembly with water or diluted soapy water solution.

7. Install the new PCV Tube Assembly into the clean upper intake manifold PCV channel.

8. Install the upper intake manifold per WSM, Section 303-01B.

Parts Block

WARRANTY STATUS: Eligible Under Provisions Of New Vehicle Limited Warranty Coverage
IMPORTANT: Warranty coverage limits/policies are not altered by a TSB. Warranty coverage limits are determined by the identified causal part.

OPERATION DESCRIPTION TIME

072210A 2004-2008 Ranger 3.0L: 0.8 Hr.

Replace The PCV Tube, Includes Time To Remove Clean, Install Upper Intake Manifold (Do Not Use With 9424A, 6666A)

DEALER CODING

CONDITION

BASIC PART NO. CODE

6C324 D8

NOTE: The information in Technical Service Bulletins is intended for use by trained, professional technicians with the knowledge, tools, and equipment to do the job properly and safely. It informs these technicians of conditions that may occur on some vehicles, or provides information that could assist in proper vehicle service. The procedures should not be performed by "do-it-yourselfers". Do not assume that a condition described affects your car or truck. Contact a Ford, Lincoln, or Mercury dealership to determine whether the Bulletin applies to your vehicle.

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NOTE: The information in Technical Service Bulletins is intended for use by trained, professional technicians with the knowledge, tools, and equipment to do the job properly and safely. It informs these technicians of conditions that may occur on some vehicles, or provides information that could assist in proper vehicle service. The procedures should not be performed by "do-it-yourselfers". Do not assume that a condition described affects your car or truck. Contact a Ford, Lincoln, or Mercury dealership to determine whether the Bulletin applies to your vehicle.

PROM - Programmable Read Only Memory: All Technical Service Bulletins Engine, A/T Controls - Delayed A/T Engagement

TSB 08-5-2

03/17/08

DELAYED AUTOMATIC TRANSMISSION ENGAGEMENT - BUILT ON OR BEFORE 02/14/2008

FORD: 2007-2008 Ranger

This article supersedes TSB 08-2-5 to add a production fix date.

ISSUE Some 2007-2008 Ranger vehicles equipped with an automatic transmission and built on or before 02/14/2008 may exhibit a delayed shift engagement into drive or reverse.

ACTION Reprogram the powertrain control module (PCM) to the latest calibration using IDS release 52.11 and higher or 53.1 and higher. This new calibration is not included in the VCM 2007.11 DVD. Calibration files may also be obtained at the website.

NOTE

TO MAXIMIZE THE BENEFIT OF THIS CALIBRATION, PCM KEEP ALIVE MEMORY (KAM) MUST BE RESET.

NOTE

AUTHORIZATION DECAL NOT REQUIRED.

WARRANTY STATUS: Eligible Under Provisions Of New Vehicle Limited Warranty Coverage IMPORTANT: Warranty coverage limits/policies are not altered by a TSB. Warranty coverage limits are determined by the identified causal part.

OPERATION DESCRIPTION TIME

080502A 2007-2008 Ranger With 0.7Hr.

Automatic Transmission: Check DTCs And Reprogram The PCM, Includes Time To Clear KAM and, Road Test Authorization Decal Not Required (Do Not Use With 12650D)

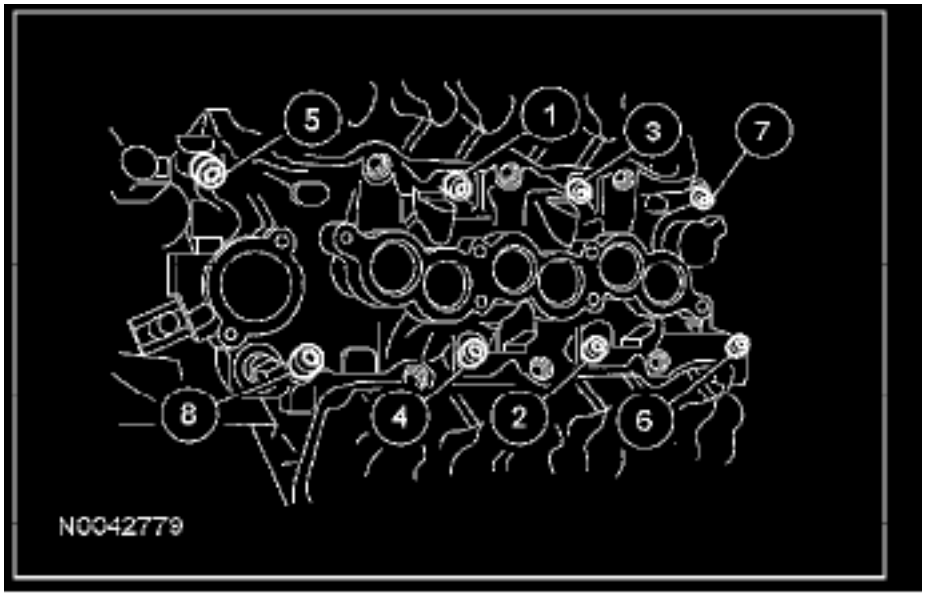
DEALER CODING

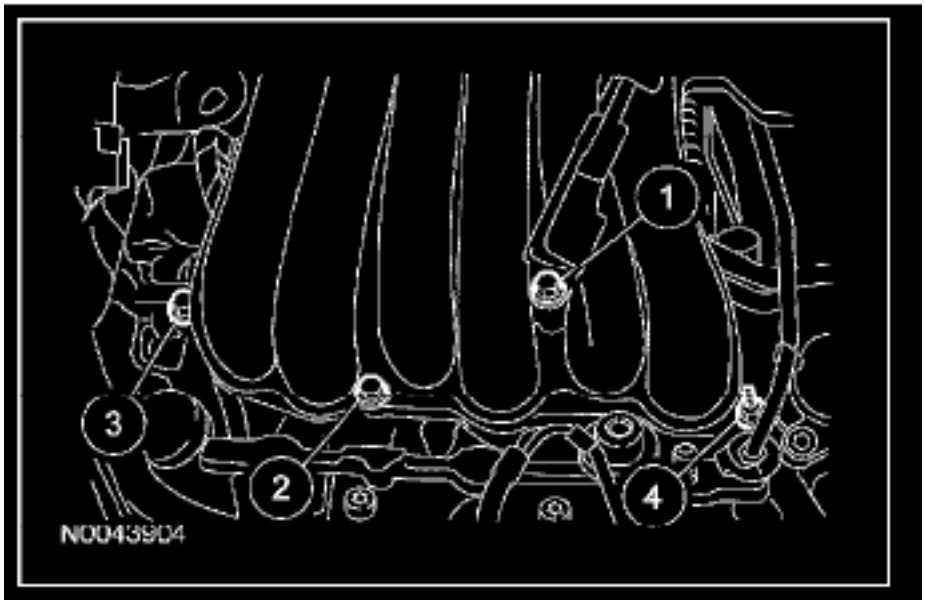
CONDITION

BASIC PART NO. CODE

RECAL 04

Disclaimer





Intake Manifold: Specifications

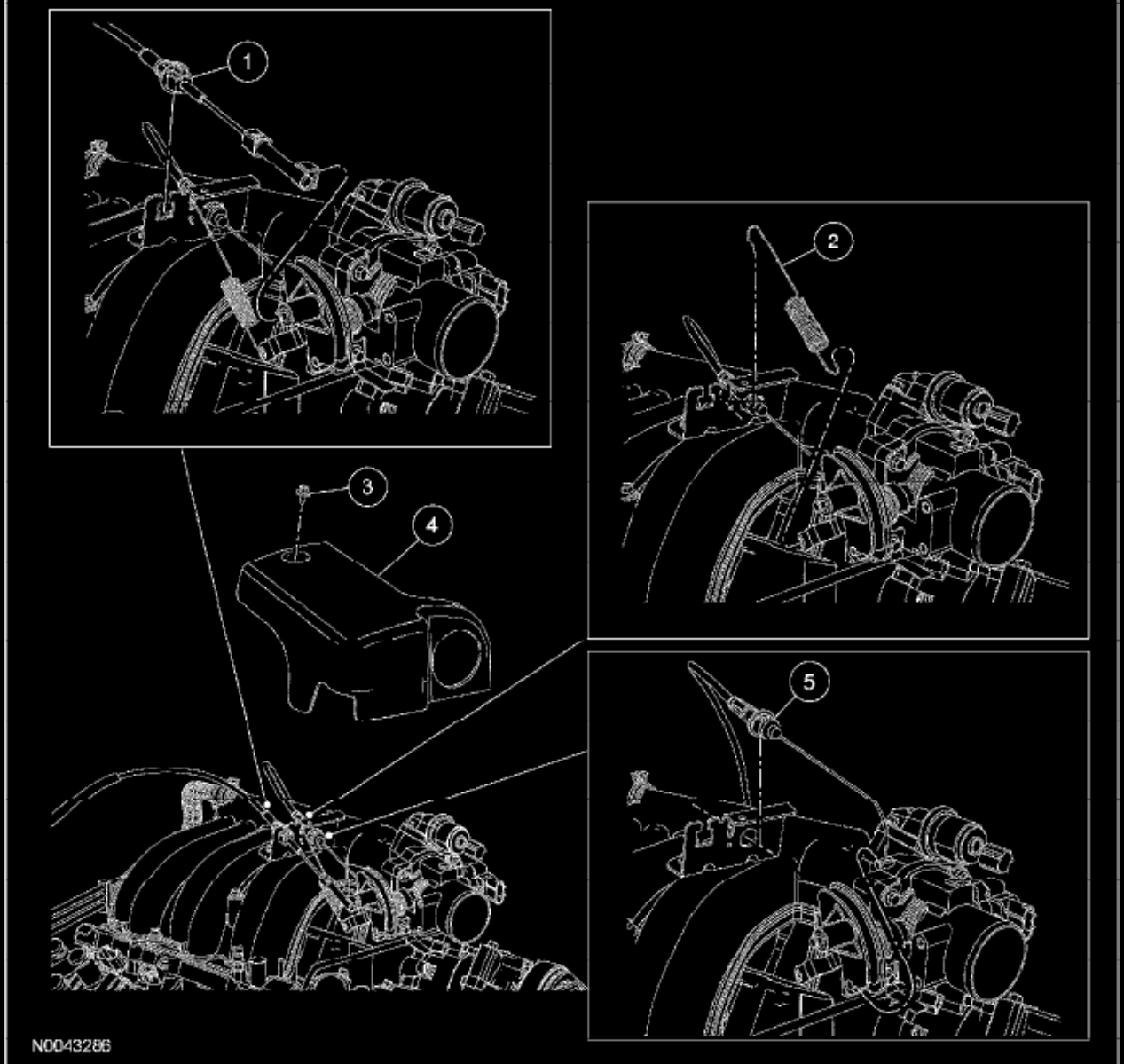
Lower intake manifold bolts:

Stage 1 ..... 15 Nm (11 lb-ft) Stage 2 ..... 32 Nm (24 lb-ft)

Upper intake manifold bolts ..... 10 Nm (89 lb-inch)

Throttle Body (TB) Bolts and Stud Bolt ..... 10 Nm (89 lb-in).

Throttle Body (TB) Cover, Cables and Spring



Item	Part Number	Description
1	9A825	Speed control cable
2	9E894	Return spring
3	N800312	Throttle body (TB) cover bolt

Item	Part Number	Description
4	9E766	TB cover
5	9A758	Accelerator cable

(Continued)

Intake Manifold: Service and Repair Upper Intake Manifold

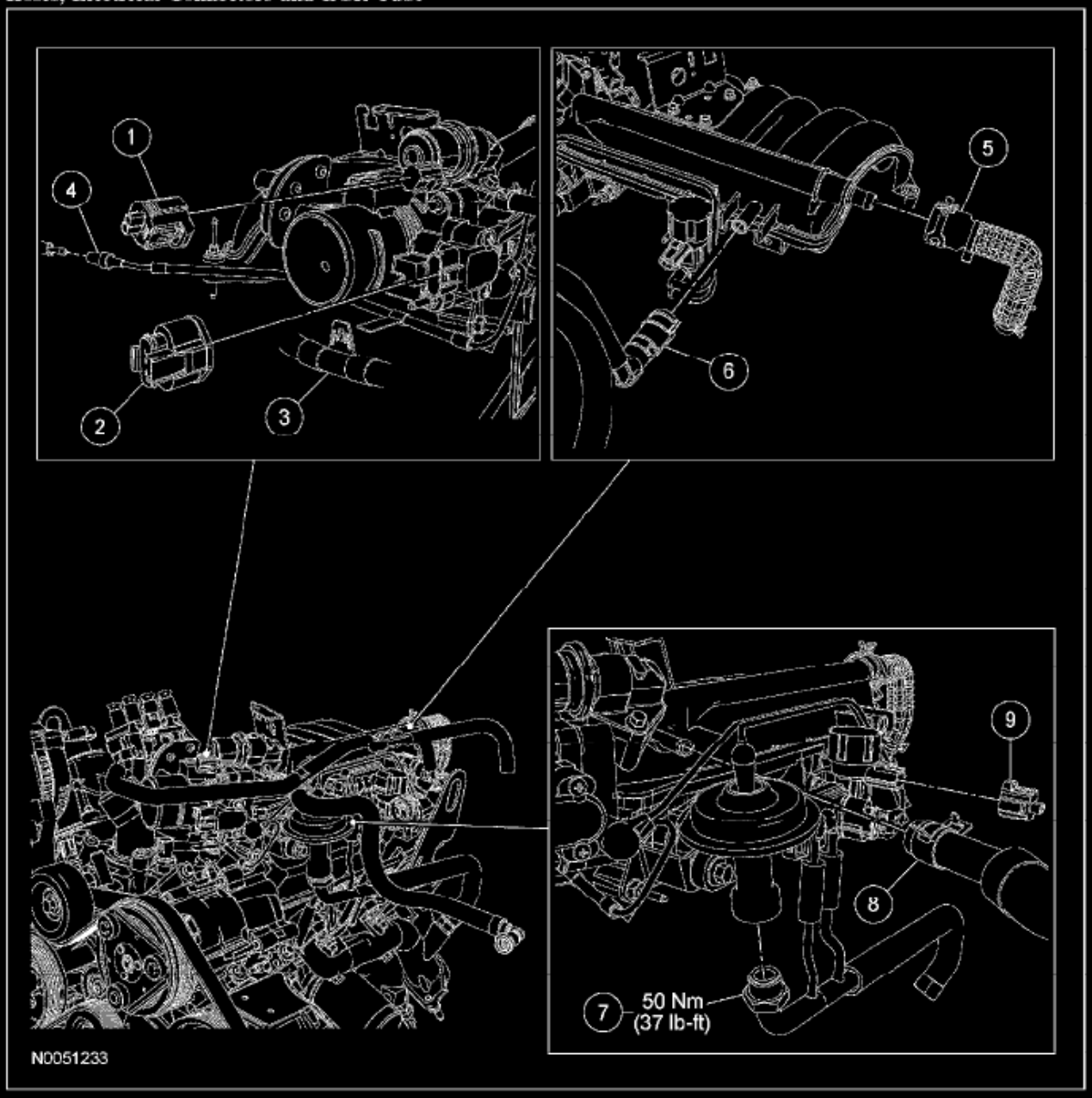
Upper Intake Manifold

Throttle Body (TB) Cover, Cables and Spring

Throttle Body (TB) Cover, Cables and Spring

Hoses, Electrical Connectors and EGR Tube

Hoses, Electrical Connectors and EGR Tube



Item	Part Number	Description
1	14A464	Idle air control (IAC) valve electrical connector (part of 12B637)
2	14A464	Throttle position (TP) sensor electrical connector (part of 12B637)
3	13A506	Wiring harness retainer
4	9F498	Vacuum hose
5	6C324	PCV valve tube

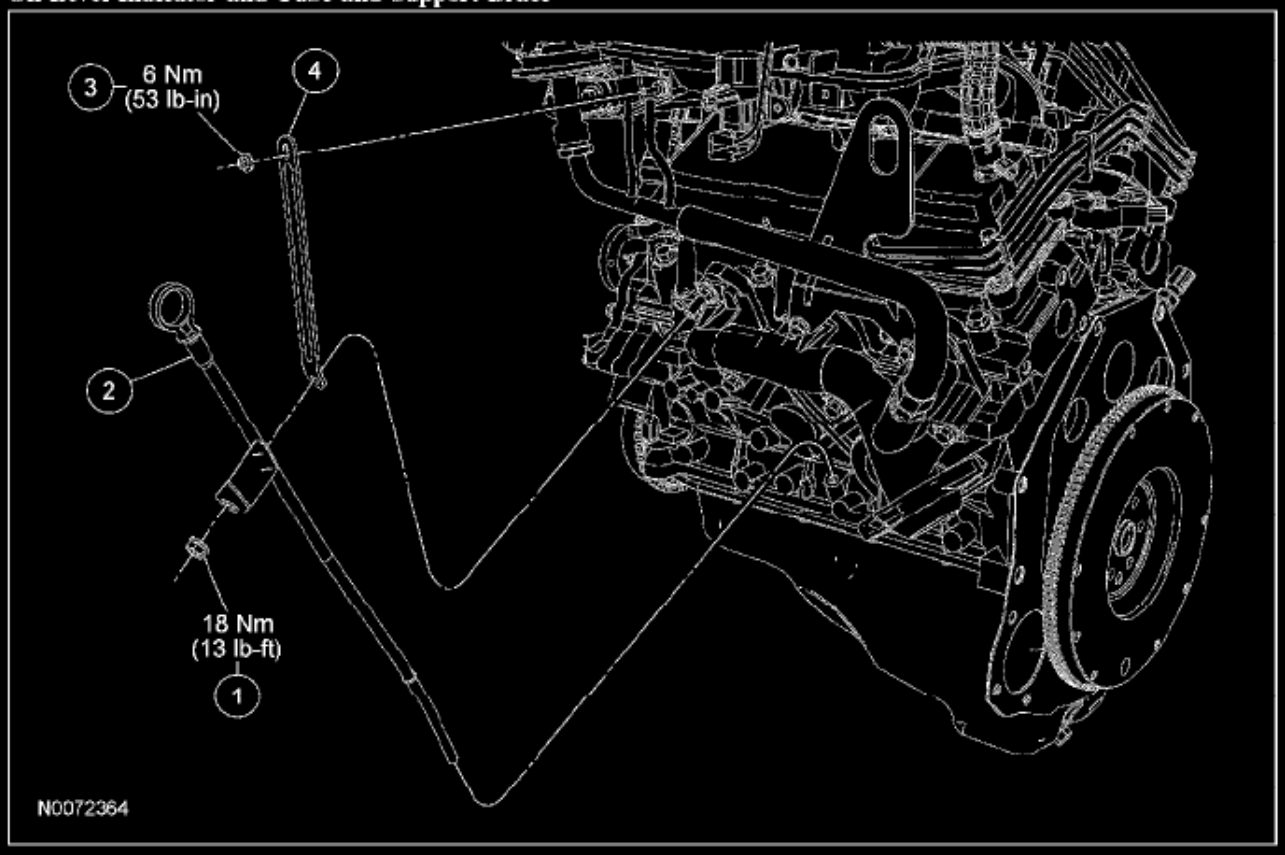
(Continued)

Item	Part Number	Description
6	9C482	Brake booster vacuum hose
7	9D477	Exhaust manifold-to-EGR valve tube
8	9Y476	Fuel vapor hose
9	14A464	EGR vacuum regulator solenoid electrical connector (part of 12B637)

Hoses, Electrical Connectors and EGR Tube

Oil Level Indicator and Tube and Support Brace

Oil Level Indicator and Tube and Support Brace



Item	Part Number	Description
1	N804178-S	Oil level indicator and tube assembly nut
2	6754	Oil level indicator and tube assembly

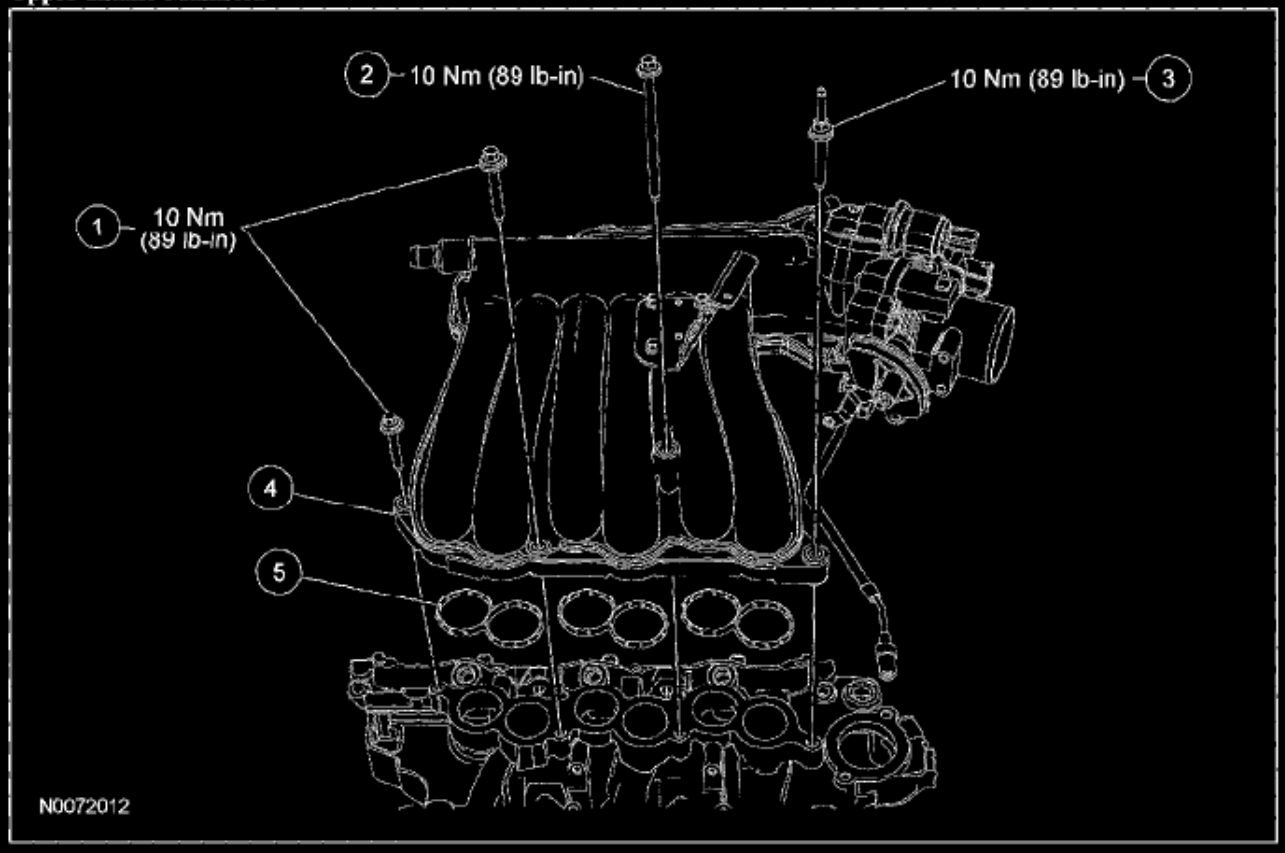
Item	Part Number	Description
3	N808338-S	Upper intake manifold support brace nut
4	95444	Upper intake manifold support brace

(Continued)

Oil Level Indicator and Tube and Support Brace

Upper Intake Manifold

Upper Intake Manifold



Item	Part Number	Description
1	W708242-S	Upper intake manifold bolts (2 required)
2	W706375-S	Upper intake manifold bolt
3	W707272-S	Upper intake manifold stud bolt
4	9424	Upper intake manifold
5	9H486	Upper intake manifold gasket (3 required)

Upper Intake Manifold

Removal

1. Disconnect the battery ground cable. 2. Remove the air cleaner outlet pipe. 3. Remove the bolt and the snow shield. 4. Disconnect the accelerator cable, speed control cable and the return spring. 5. Disconnect the accelerator cable and speed control cable from the accelerator bracket. 6. Disconnect the throttle position (TP) sensor and idle air control (IAC) valve electrical connectors. Disconnect the wire retainer. 7. Disconnect the engine vacuum harness-to-vacuum reservoir hose connection. 8. Disconnect the exhaust manifold-to-EGR valve tube from the EGR valve.

^ To install, tighten to 50 Nm (37 lb-ft).

9. Disconnect the fuel vapor hose from the intake manifold.

10. Disconnect the EGR vacuum regulator solenoid electrical connector. 11. Disconnect the brake booster vacuum hose and the PCV valve tube. 12. Remove the oil level indicator tube bracket nut and position the tube and bracket out of the way.

^ To install, tighten to 18 Nm (13 lb-ft).

13. Remove the nut and the upper intake manifold brace.

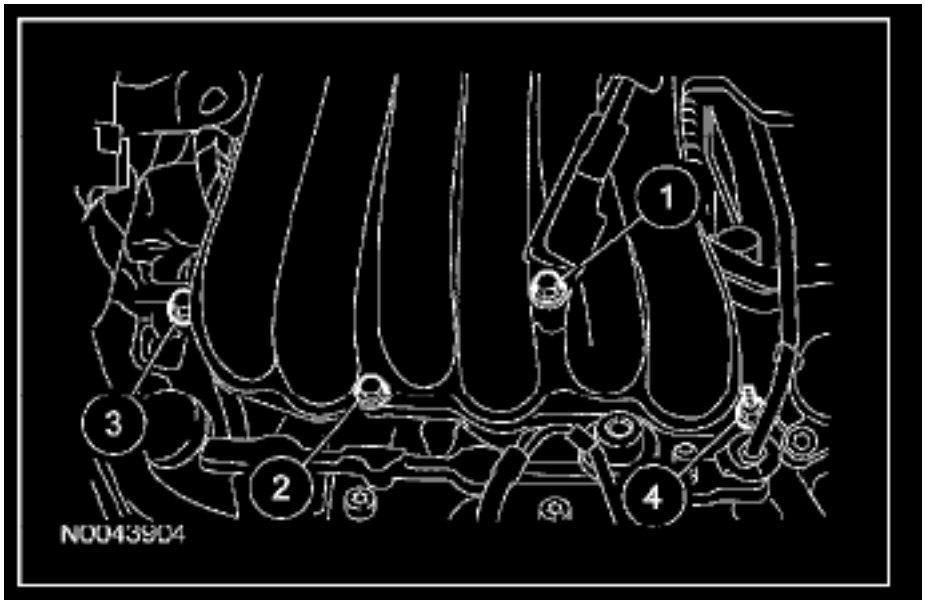
^ To install, tighten to 6 Nm (53 lb-inch).

14. Remove the bolts, the studbolt and the upper intake manifold.

^ Remove and discard the gaskets.

^ Clean and inspect all mating surfaces.

^ To install, tighten to 10 Nm (89 lb-inch) in the sequence shown.



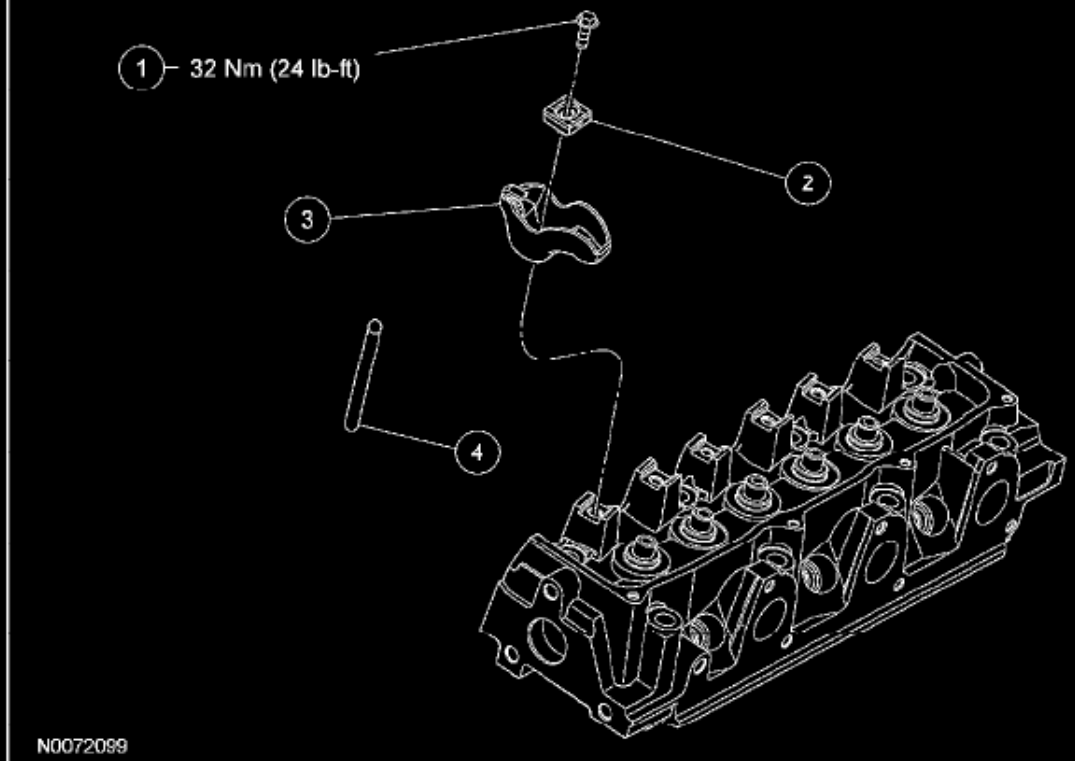
15. NOTE: Install new gaskets.

To install, reverse the removal procedure.

Material

Item	Specification
Motorcraft Metal Surface Prep ZC-31	—
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4
Silicone Gasket Remover ZC-30	—

Rocker Arms and Push Rods



Item	Part Number	Description
1	6513	Rocker arm bolt (12 required)
2	6A528	Rocker arm fulcrum (12 required)

Item	Part Number	Description
3	6564	Rocker arm (12 required)
4	6565	Push rod (12 required)

(Continued)

Intake Manifold: Service and Repair Lower Intake Manifold

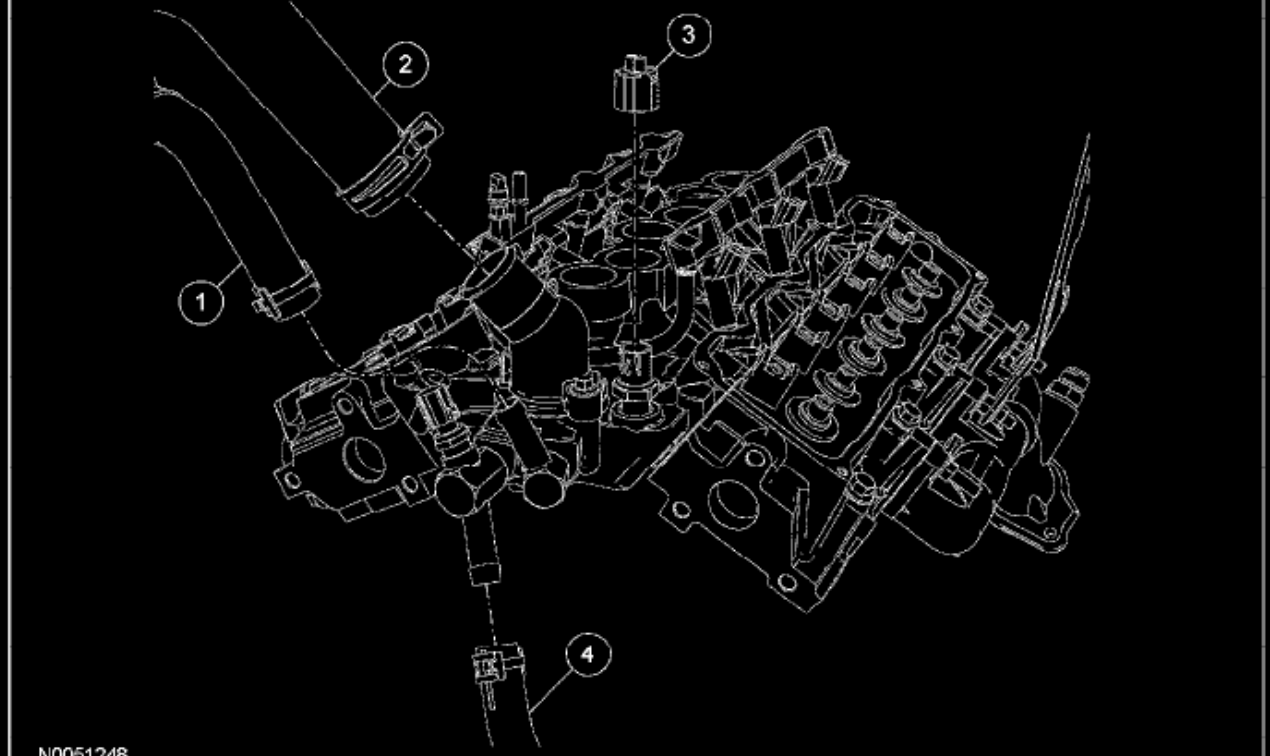
Lower Intake Manifold

Rocker Arms and Push Rods

Rocker Arms and Push Rods

Hoses and Electrical Connector

Hoses and Electrical Connector



Item	Part Number	Description
1	18C266	Heater hose
2	8B274	Upper radiator hose
3	14A464	Engine coolant temperature (ECT) sensor electrical connector

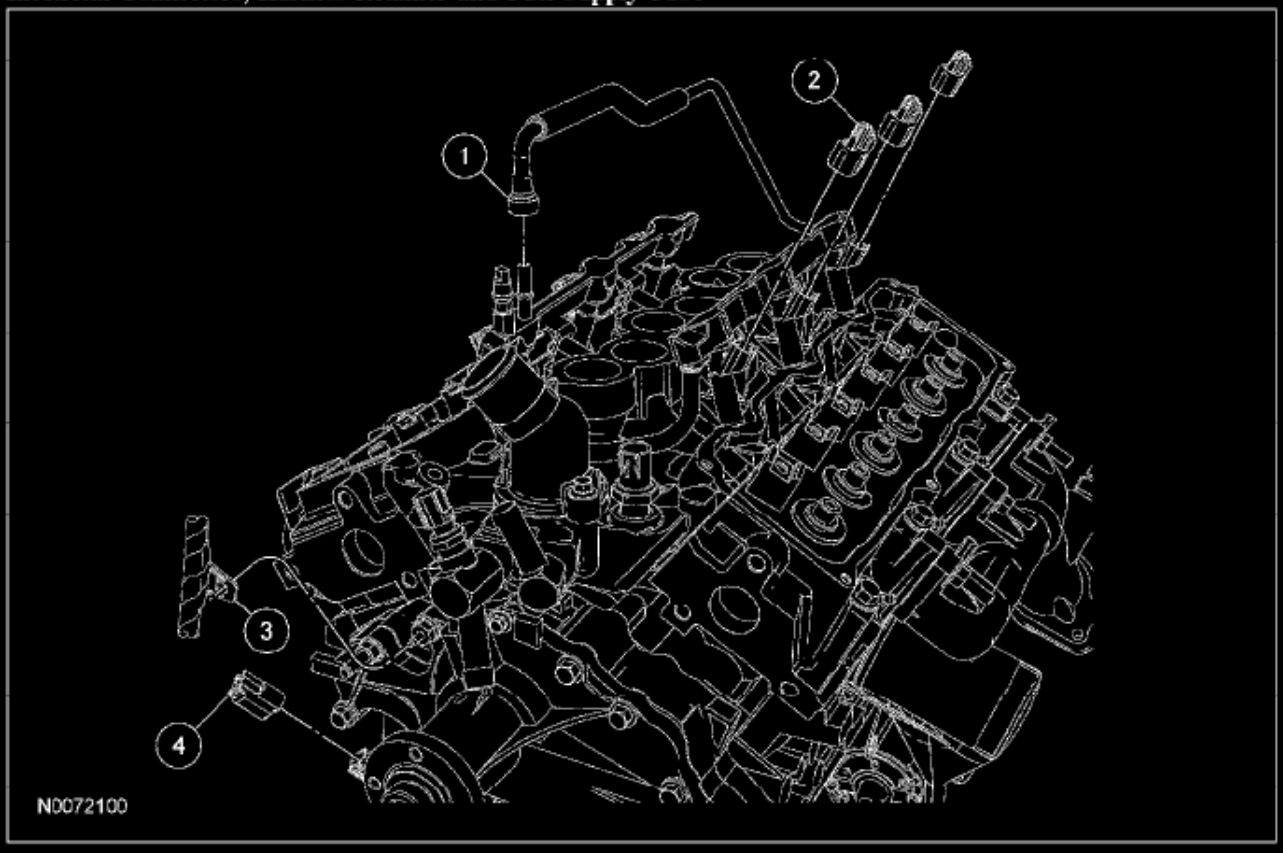
Item	Part Number	Description
4	—	Coolant bypass hose (part of 8B273)

(Continued)

Hoses and Electrical Connector

Electrical Connectors, Harness Retainer and Fuel Supply Tube

Electrical Connectors, Harness Retainer and Fuel Supply Tube



Item	Part Number	Description
1	9J338	Fuel tube spring lock coupling
2	14A464	Fuel injector electrical connector (6 required) (part of 12B637)

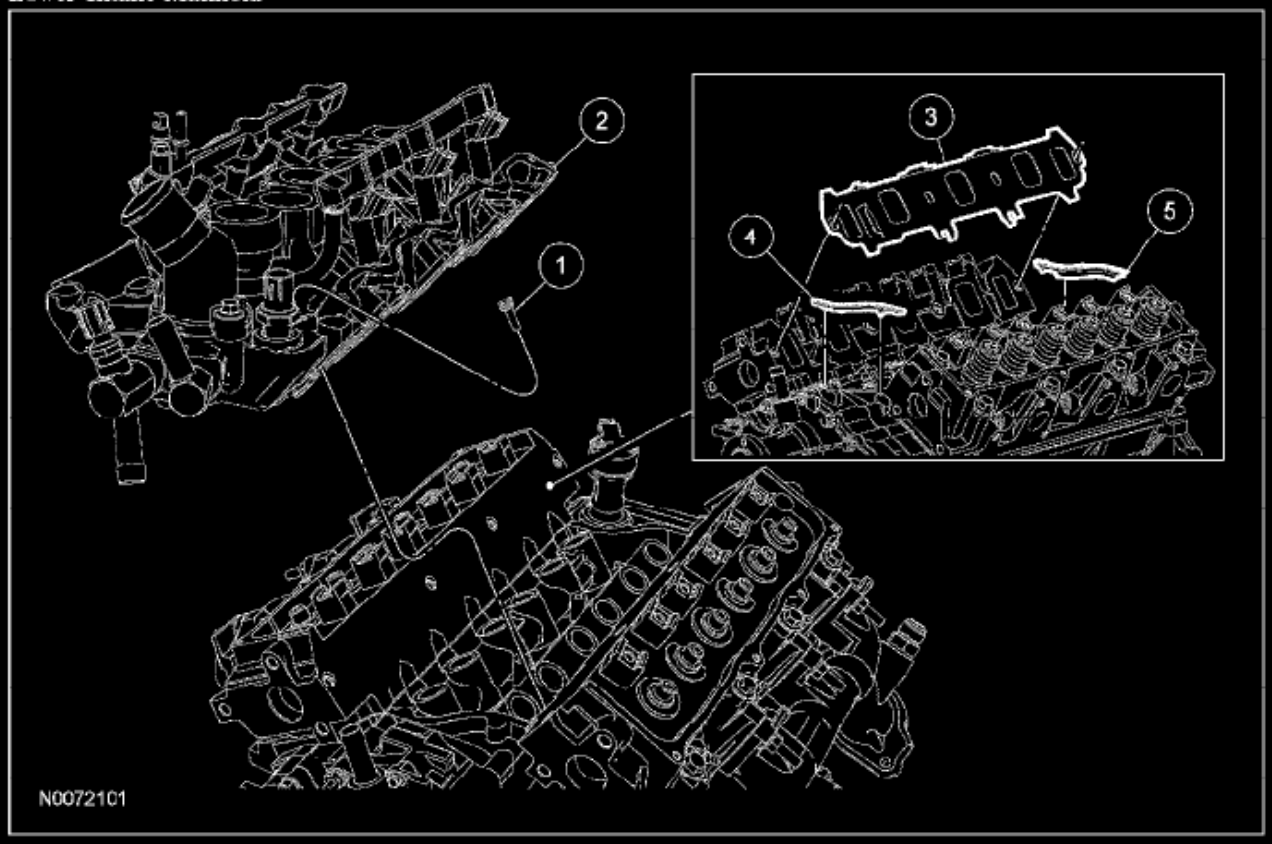
Item	Part Number	Description
3	13A506	Wiring harness retainer (part of 12B637)
4	14A464	Crankshaft position (CKP) sensor electrical connector (part of 12B637)

(Continued)

Electrical Connectors, Harness Retainer and Fuel Supply Tube

Lower Intake Manifold

Lower Intake Manifold



Item	Part Number	Description
1	N803539	Lower intake manifold bolt (8 required)
2	9K461	Lower intake manifold
3	9439	Lower intake manifold gasket (2 required)
4	9A425	Lower intake manifold front seal
5	9A424	Lower intake manifold rear seal

Lower Intake Manifold

Removal

1. Drain the engine cooling system. 2. Remove both the valve covers. 3. Disconnect the upper radiator hose, heater hose and coolant bypass hose. 4. Disconnect the engine coolant temperature (ECT) sensor electrical connector. 5. Disconnect the crankshaft position (CKP) sensor electrical connector and detach the wiring retainer from the stud bolt. 6. Disconnect the fuel injector electrical connectors and position the engine wiring harness aside. 7. Release the fuel pressure and disconnect the fuel tube spring lock coupling. 8. Loosen the rocker arm bolts.

9. NOTE: Identify the location of each push rod. Each push rod is to be installed in the original location to prevent premature wear.

Remove all the push rods.

10. Remove the bolts from the lower intake manifold.

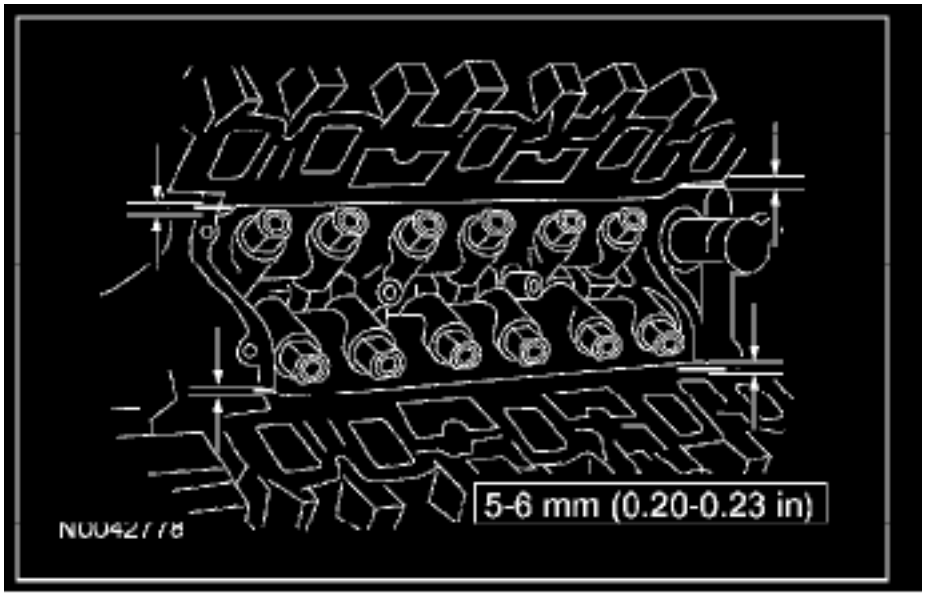
11. NOTE: Gently loosen the intake manifold to separate the silicone sealant from the cylinder block.

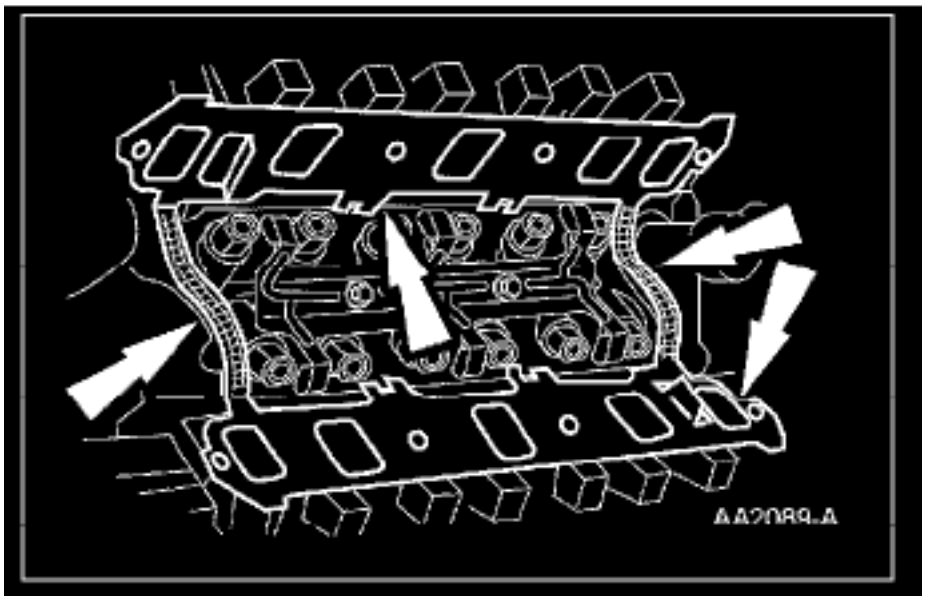
Remove the lower intake manifold.

12. Remove and discard the intake manifold gaskets and end seals.

13. CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These

tools cause scratches and gouges, which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.





NOTE: To clean the sealing area, use silicone gasket remover and metal surface prep. Observe all warnings and cautions and follow all application directions contained on the packaging of the silicone gasket remover and metal surface prep.

Clean the lower intake manifold gasket mating surfaces.

Installation

1. CAUTION: Do not use metal scrapers, wire brushes, power abrasive discs or other abrasive means to clean the sealing surfaces. These

tools cause scratches and gouges, which make leak paths. Use a plastic scraping tool to remove all traces of old sealant.

NOTE: If not secured within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Observe all warnings and cautions and follow all application directions contained on the packaging of the silicone gasket remover and metal surface prep. Allow to dry until there is no sign of wetness, or 4 minutes, whichever is longer. Failure to follow this procedure can cause future oil leakage.

Apply a drop of silicone gasket and sealant at the 4 cylinder block-to-cylinder head seams.

2. Install the intake manifold gaskets and end seals.

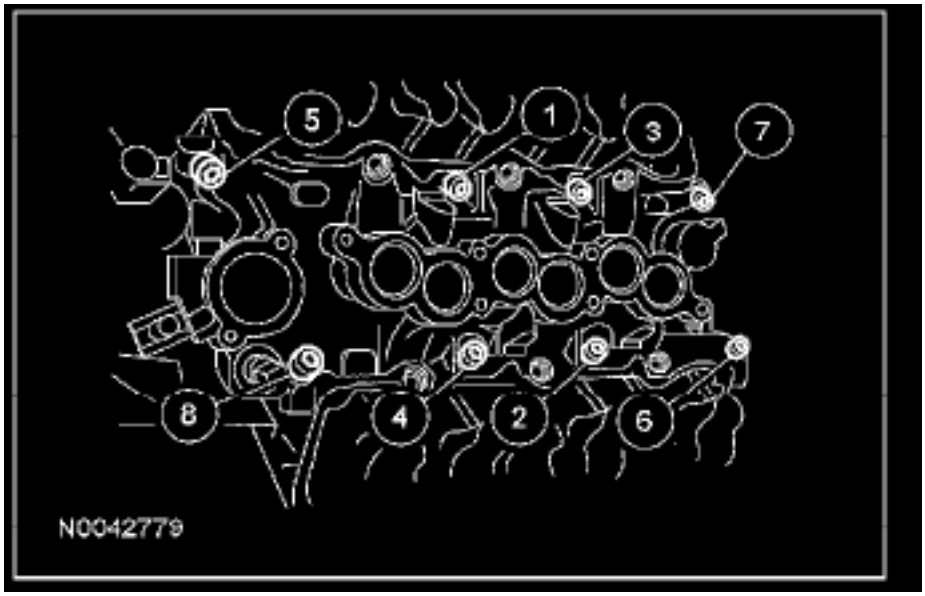
^ Position the intake manifold gaskets.

^ Position the end seals.

3. Position the lower intake manifold. 4. Install the bolts and tighten in 2 stages in the sequence shown.

^ Stage 1: Tighten to 15 Nm (11 lb-ft).

^ Stage 2: Tighten to 32 Nm (24 lb-ft).



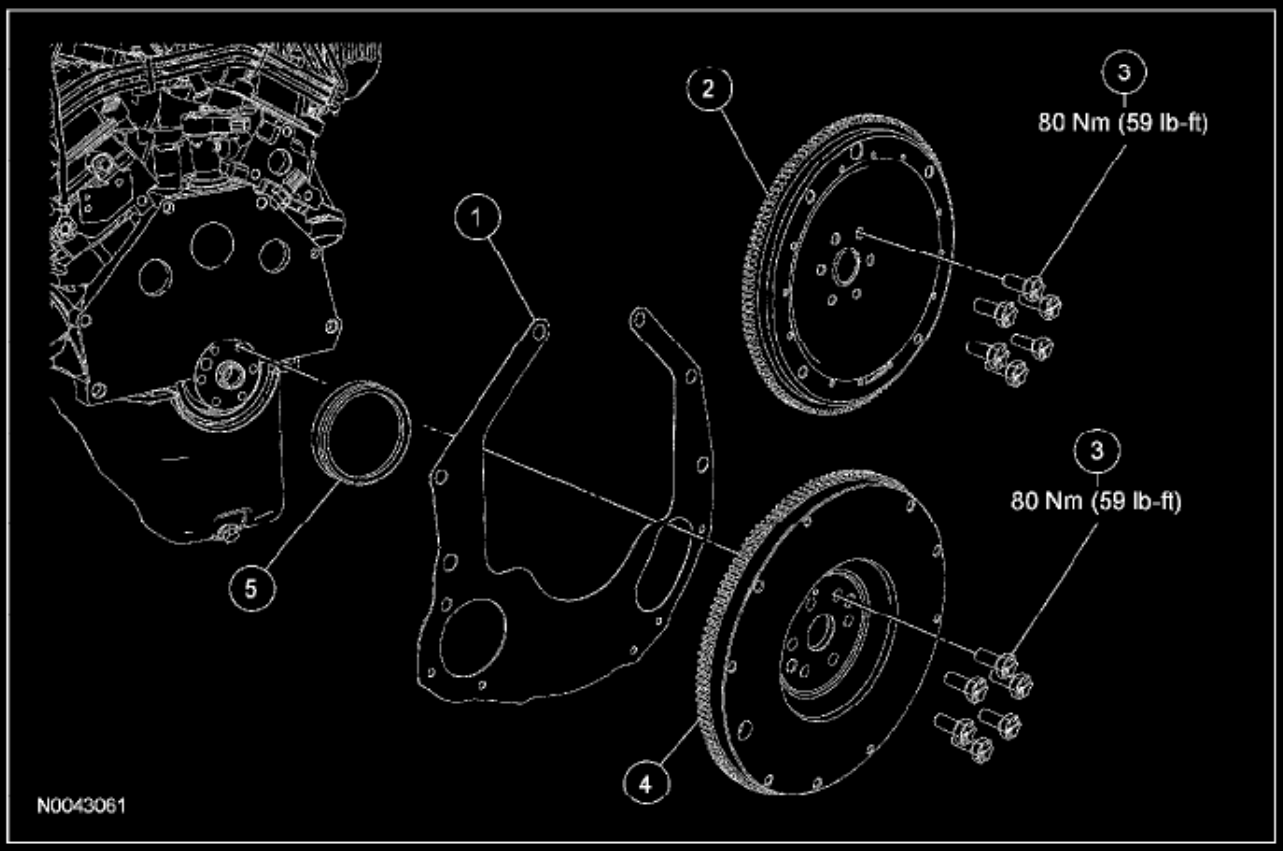
5. Install the push rods. 6. Tighten the rocker arm bolts.

^ Tighten to 32 Nm (24 lb-ft).

7. Connect the fuel tube. 8. Connect the fuel injector electrical connectors. 9. Connect the CKP sensor electrical connector and attach the wiring retainer to the stud bolt.

10. Connect the ECT sensor electrical connector. 11. Connect the upper radiator hose, heater hose and coolant bypass hose. 12. Install both valve covers. 13. Fill and bleed the engine cooling system.

Flexplate or Flywheel and Crankshaft Rear Seal — Exploded View



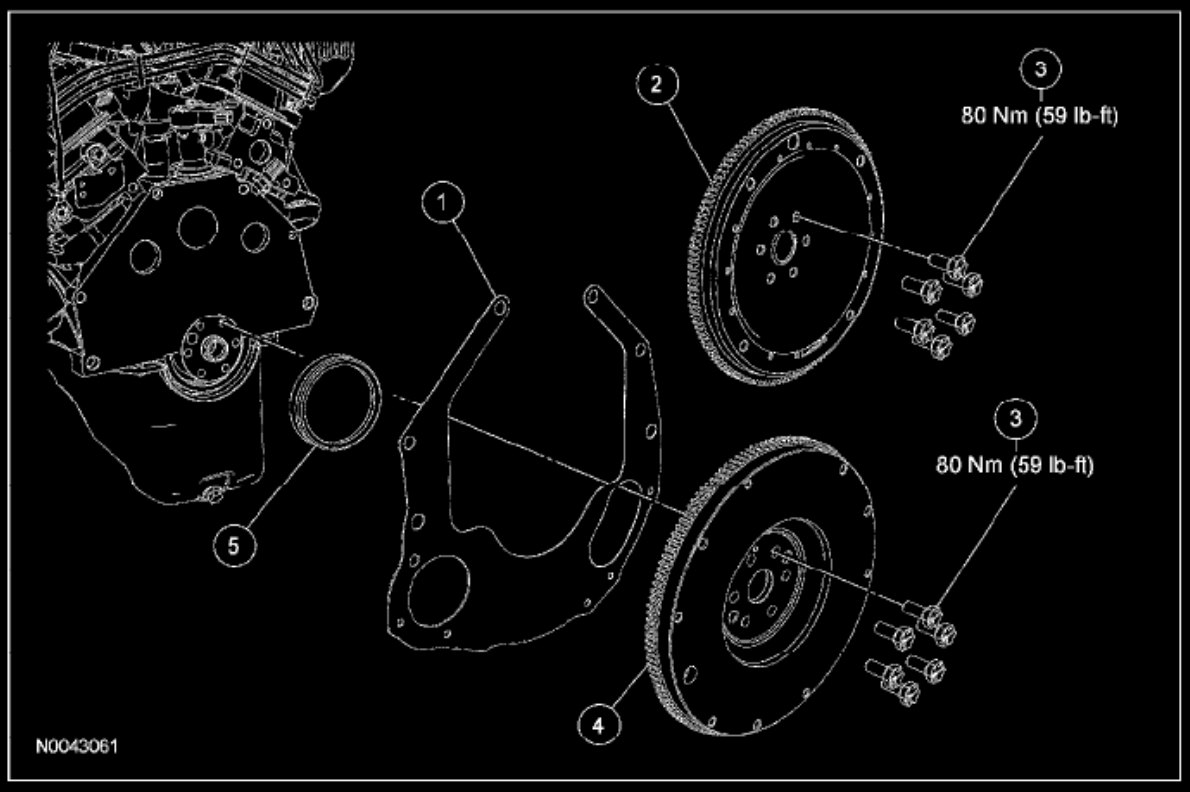
Item	Part Number	Description
1	6A372	Engine-to-transmission spacer plate
2	6375	Flexplate
3	N802012-S	Flexplate/flywheel bolt
4	6375	Flywheel
5	6701	Crankshaft rear seal

Crankshaft Main Bearing Seal: Diagrams

Flexplate or Flywheel and Crankshaft Rear Seal - Exploded View

Flexplate or Flywheel and Crankshaft Rear Seal - Exploded View

Flexplate or Flywheel and Crankshaft Rear Seal — Exploded View



Item	Part Number	Description
1	6A372	Engine-to-transmission spacer plate
2	6375	Flexplate
3	N802012-S	Flexplate/flywheel bolt
4	6375	Flywheel
5	6701	Crankshaft rear seal

Special Tool(s)

ST2627-A	Installer, Crankshaft Rear Main Oil Seal 303-323 (T88L-6701-A)
ST1807-A	Remover, Jet Plug 310-005 (T77L-9533-B)

Crankshaft Main Bearing Seal: Service and Repair

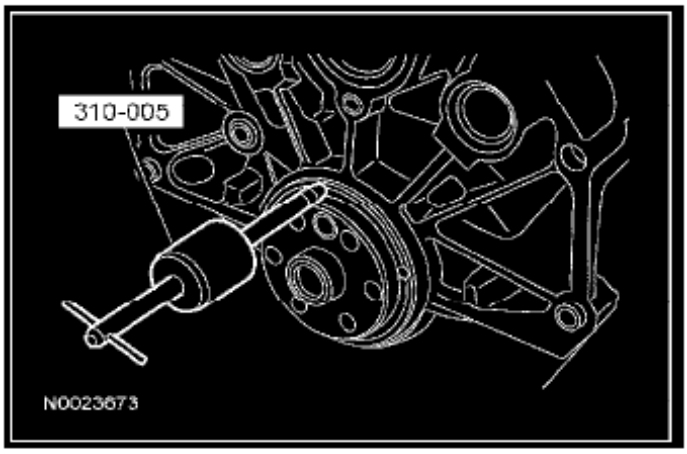
Crankshaft Rear Seal

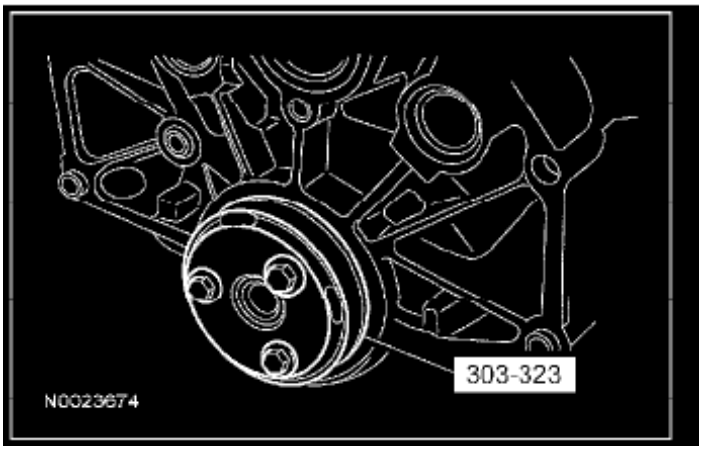
Flexplate or Flywheel and Crankshaft Rear Seal - Exploded View

Flexplate or Flywheel and Crankshaft Rear Seal - Exploded View

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A





Removal

1. Remove the flywheel or flexplate.

2. CAUTION: Use care to avoid scratching or damaging the oil seal surface or leakage may occur.

Using a sharp awl, punch one hole into the crankshaft rear oil seal metal surface between the seal lip and the cylinder block.

3. Screw the threaded end of the special tool into the oil seal. Use the special tool to remove the crankshaft rear oil seal.

Installation

1. Lubricate the outer lips and the inner seal on the crankshaft rear oil seal with clean engine oil. 2. Using the special tool, install the crankshaft rear oil seal. Alternate bolt tightening to correctly seat the crankshaft rear oil seal.

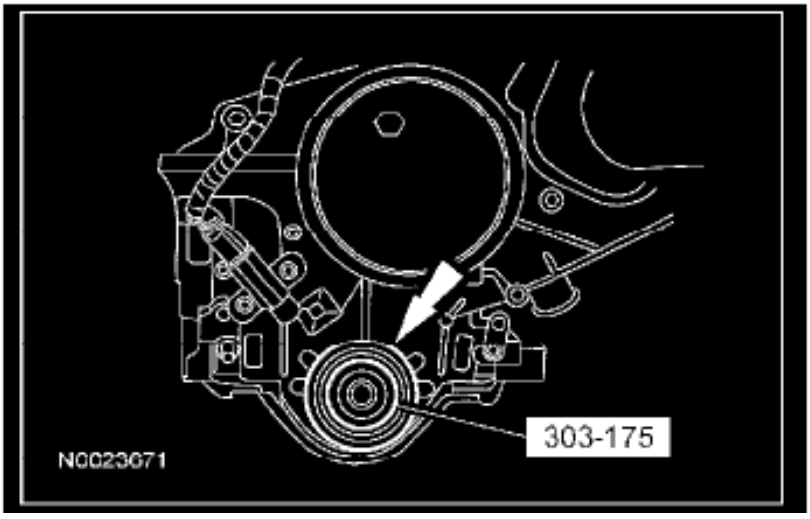
3. Install the flywheel or flexplate.

Special Tool(s)

ST1387-A	Installer, Crankshaft Vibration Damper 303-175 (T82L-6316-A)

Material

Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A



Front Crankshaft Seal: Service and Repair

Crankshaft Front Seal

Removal

1. Remove the crankshaft vibration damper. 2. Remove the crankshaft front seal.

Installation

1. Install the crankshaft front seal.

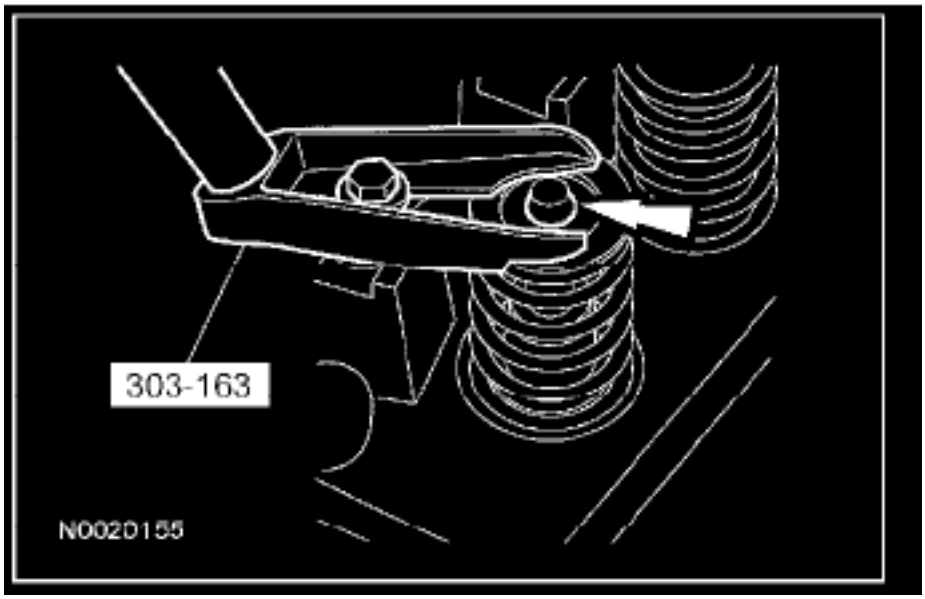
^ Lubricate the seal lip with clean engine oil.

^ Using the special tool, install the crankshaft front seal.

2. Install the crankshaft damper.

Special Tool(s)

Compressor, Valve Spring
303-163 (T81P-6513-A)



Valve Guide Seal: Service and Repair

Valve Seals

Removal and Installation

CAUTION: During engine repair procedures, cleanliness is extremely important. Any foreign material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, may cause engine failure.

1. Remove the rocker arms.

2. NOTE: Install an air line with an adapter in the spark plug hole and turn on the air supply. If the air pressure fails to hold the valve(s) closed while

carrying out the following steps, valve or valve seat damage is indicated and the cylinder head must be removed.

NOTE: Apply a minimum of 689 kPa (100 psi) of compressed air to the cylinder.

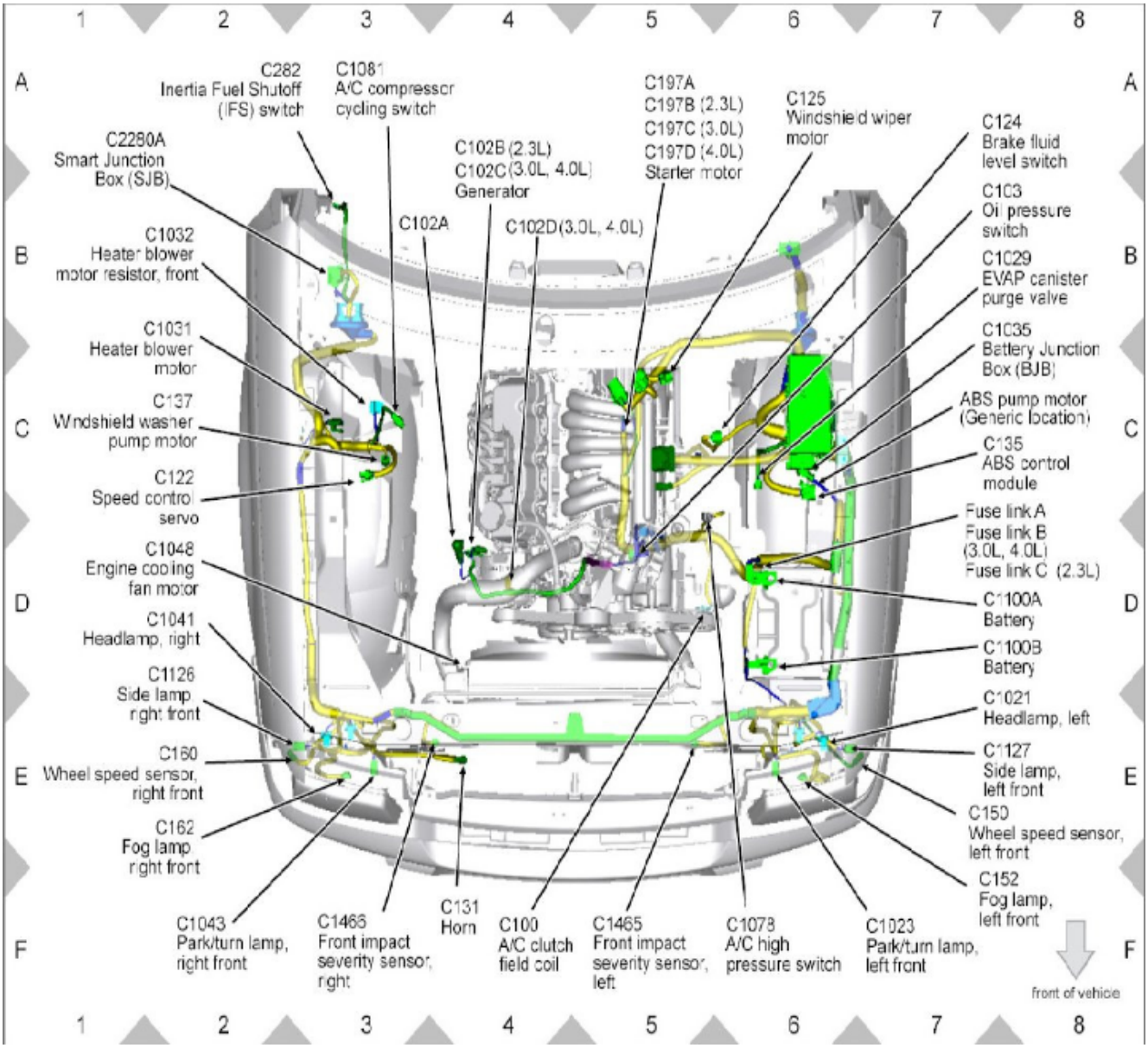
Using the special tool, remove the valve spring retainer keys.

3. Remove the valve spring retainer. 4. Remove the valve spring and inspect. Refer to Engine for component tests for the valve spring. 5. Remove the valve stem seal.

6. CAUTION: Do not release the compressed air from the cylinder until after the valve spring retainer keys are installed, or the valve will

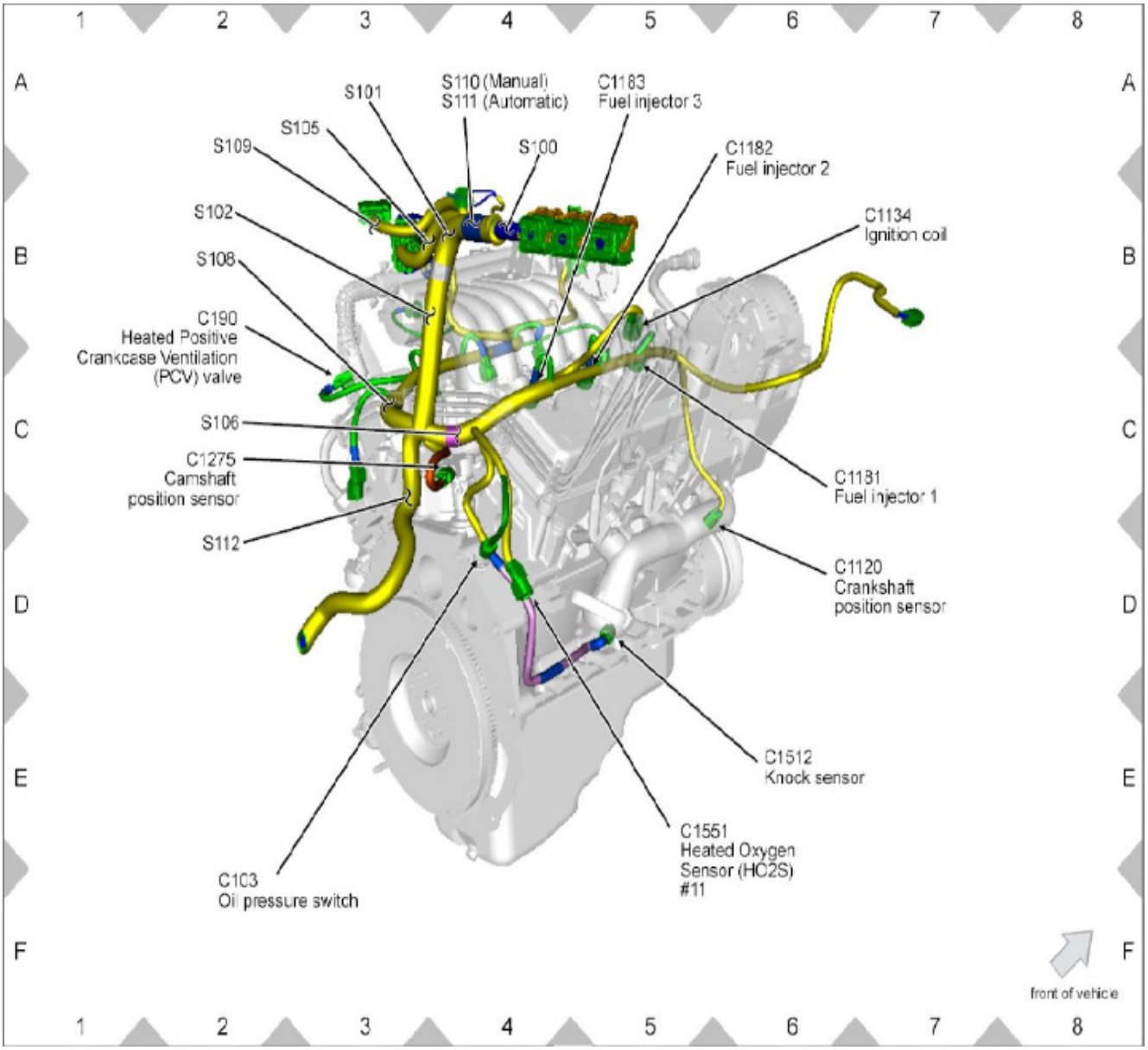
fall into the cylinder.

To install, reverse the removal procedure.

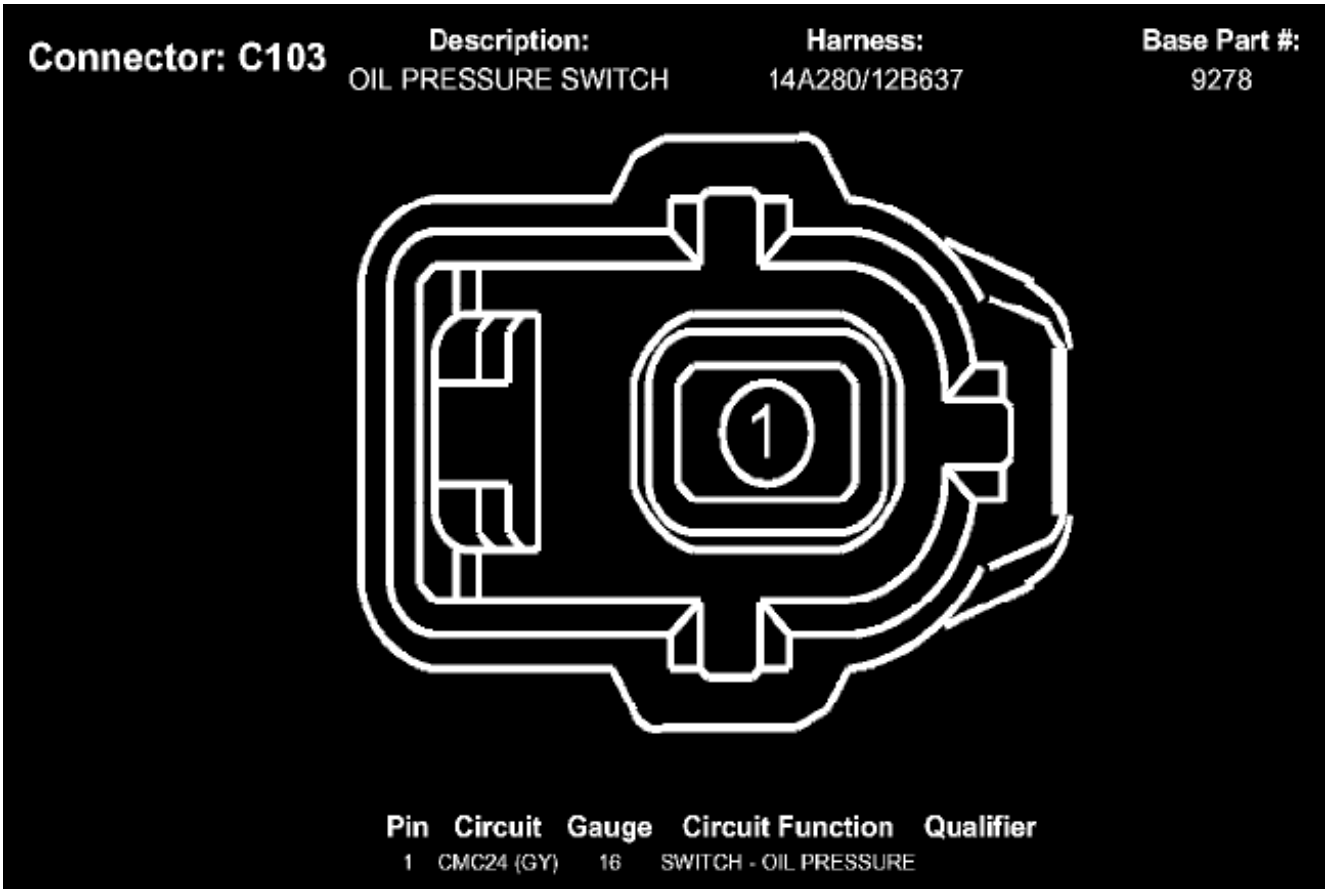


Oil Pressure Sender: Locations

View 151-1

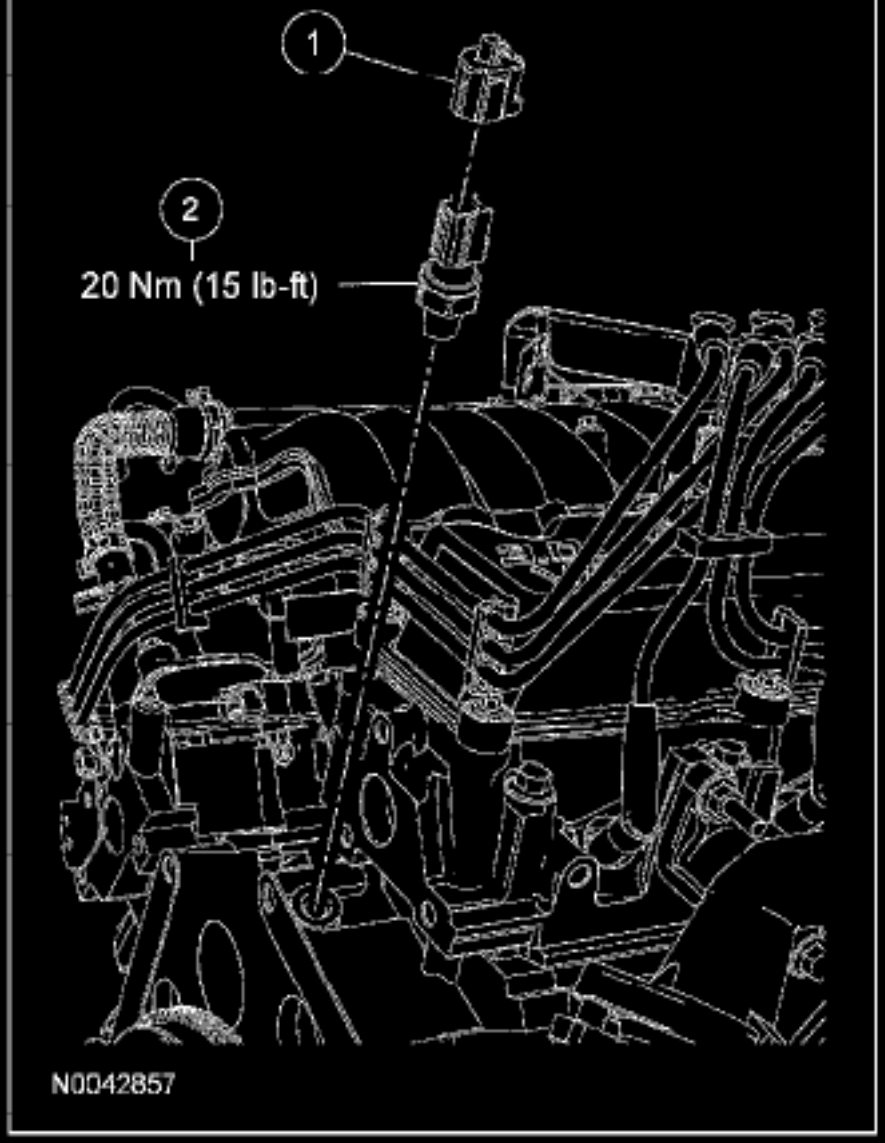

S101
S110 (Manual)
S111 (Automatic)
C1183
Fuel injector 3
S105
S109
S100
C1182
Fuel injector 2
S102
C1134
Ignition coil
S108
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
C1275
Camshaft
position sensor
S112
C1181
Fuel injector 1
C1120
Crankshaft
position sensor
C1512
Knock sensor
C1551
Heated Oxygen
Sensor (HO2S)
#11
C103
Oil pressure switch
front of vehicle

View 151-6


Connector: C103
Description:
OIL PRESSURE SWITCH
Harness:
14A280/12B637
Base Part #:
9278
1
Pin Circuit Gauge Circuit Function Qualifier
1 CMC24 (GY) 16 SWITCH - OIL PRESSURE

C103

Engine Oil Pressure (EOP) Switch



Item	Part Number	Description
1	14A464	Engine oil pressure (EOP) switch electrical connector (part of 12B637)
2	9278	EOP switch

Oil Pressure Sender: Service and Repair

Engine Oil Pressure (EOP) Switch

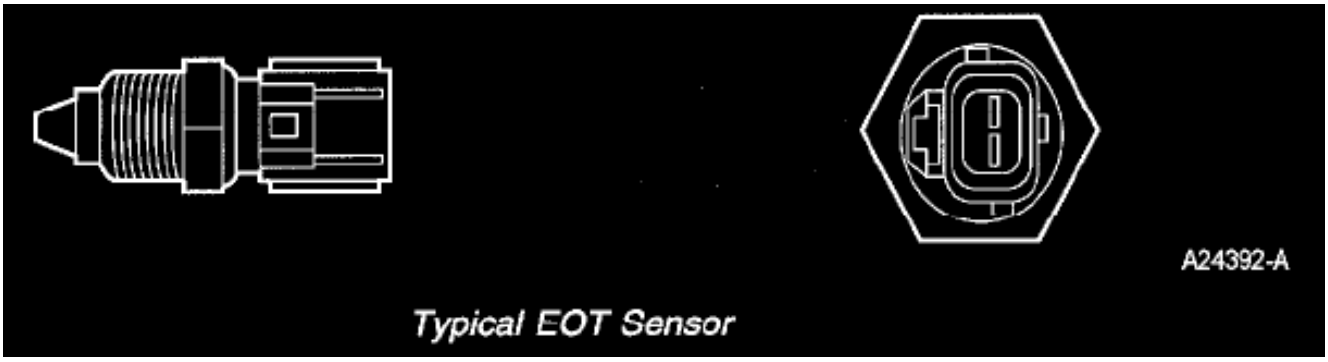
Engine Oil Pressure (EOP) Switch

Removal and Installation

1. Disconnect the engine oil pressure switch electrical connector from the engine oil pressure switch. 2. Remove the engine oil pressure switch.

^ To install, tighten to 20 Nm (15 lb-ft).

3. To install, reverse the removal procedure.



Typical EOT Sensor

Oil Temperature Sensor/Switch: Description and Operation

ENGINE OIL TEMPERATURE (EOT) SENSOR

Typical EOT Sensor

The EOT sensor is a thermistor device in which resistance changes with temperature. The electrical resistance of a thermistor decreases as the temperature increases and the resistance increases as the temperature decreases. The varying resistance changes the voltage drop across the sensor terminals and provides electrical signals to the PCM corresponding to temperature.

Thermistor-type sensors are considered passive sensors. A passive sensor is connected to a voltage divider network so that varying the resistance of the passive sensor causes a variation in total current flow. Voltage that is dropped across a fixed resistor in a series with the sensor resistor determines the voltage signal at the PCM. This voltage signal is equal to the reference voltage minus the voltage drop across the fixed resistor.

The EOT sensor measures the temperature of the engine oil. The sensor is typically threaded into the engine oil lubrication system. The PCM can use the EOT sensor input to determine the following:

- On variable camshaft timing (VCT) applications the EOT input is used to adjust the VCT control gains and logic for camshaft timing.

- The PCM can use EOT sensor input in conjunction with other PCM inputs to determine oil degradation.

- The PCM can use EOT sensor input to initiate a soft engine shutdown. To prevent engine damage from occurring as a result of high oil temperatures, the PCM has the ability to initiate a soft engine shutdown. Whenever engine RPM exceeds a calibrated level for a certain period of time, the PCM begins reducing power by disabling engine cylinders.

Camshaft Gear/Sprocket: Specifications

Camshaft sprocket bolt ..... 63 Nm (46 lb-ft)

Crankshaft Gear/Sprocket: Specifications

Crankshaft Damper Bolt ..... 145 Nm (107 lb-ft)

Crankshaft Pulley Bolts ..... 63 Nm (46 lb-ft)

Timing Cover: Specifications

Front cover bolts and studs ..... 25 Nm (18 lb-ft)

Material

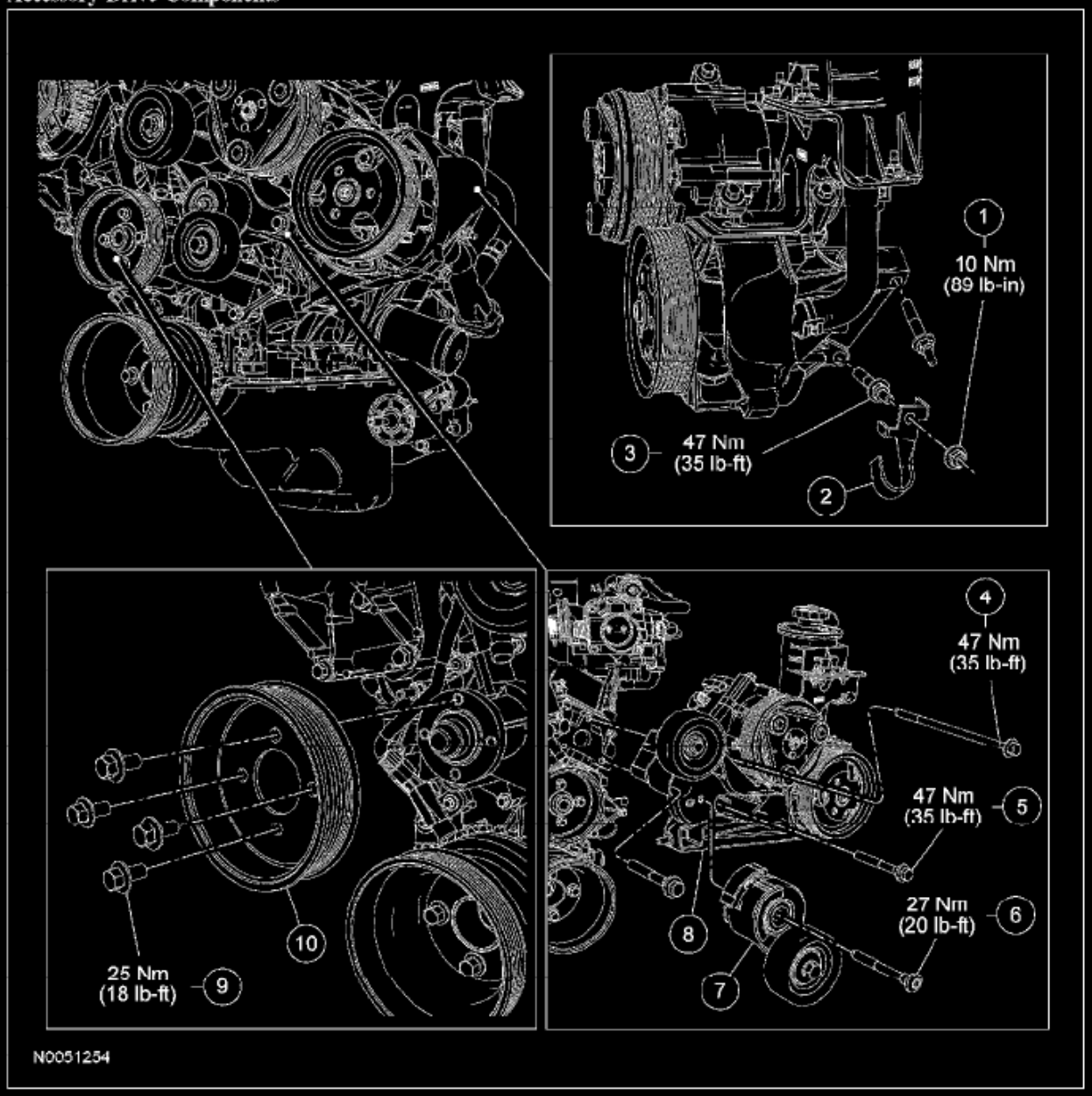
Item	Specification
Motorcraft SAE 5W-20 Premium Synthetic Blend Motor Oil XO-5W20-QSP (US); Motorcraft SAE 5W-20 Super Premium Motor Oil CXO-5W20-LSP12 (Canada); or equivalent	WSS-M2C930-A
Thread Sealant with PTFE TA-24	WSK-M2G350-A2

Timing Cover: Service and Repair

Engine Front Cover

Accessory Drive Components

Accessory Drive Components



Item	Part Number	Description
1	W620481-S	Wiring harness bracket nut
2	7B085	Wiring harness bracket (part of 14A280)
3	N807123-S	A/C compressor and power steering pump bracket stud bolt (2 required)
4	N807124-S	A/C compressor and power steering pump bracket bolt

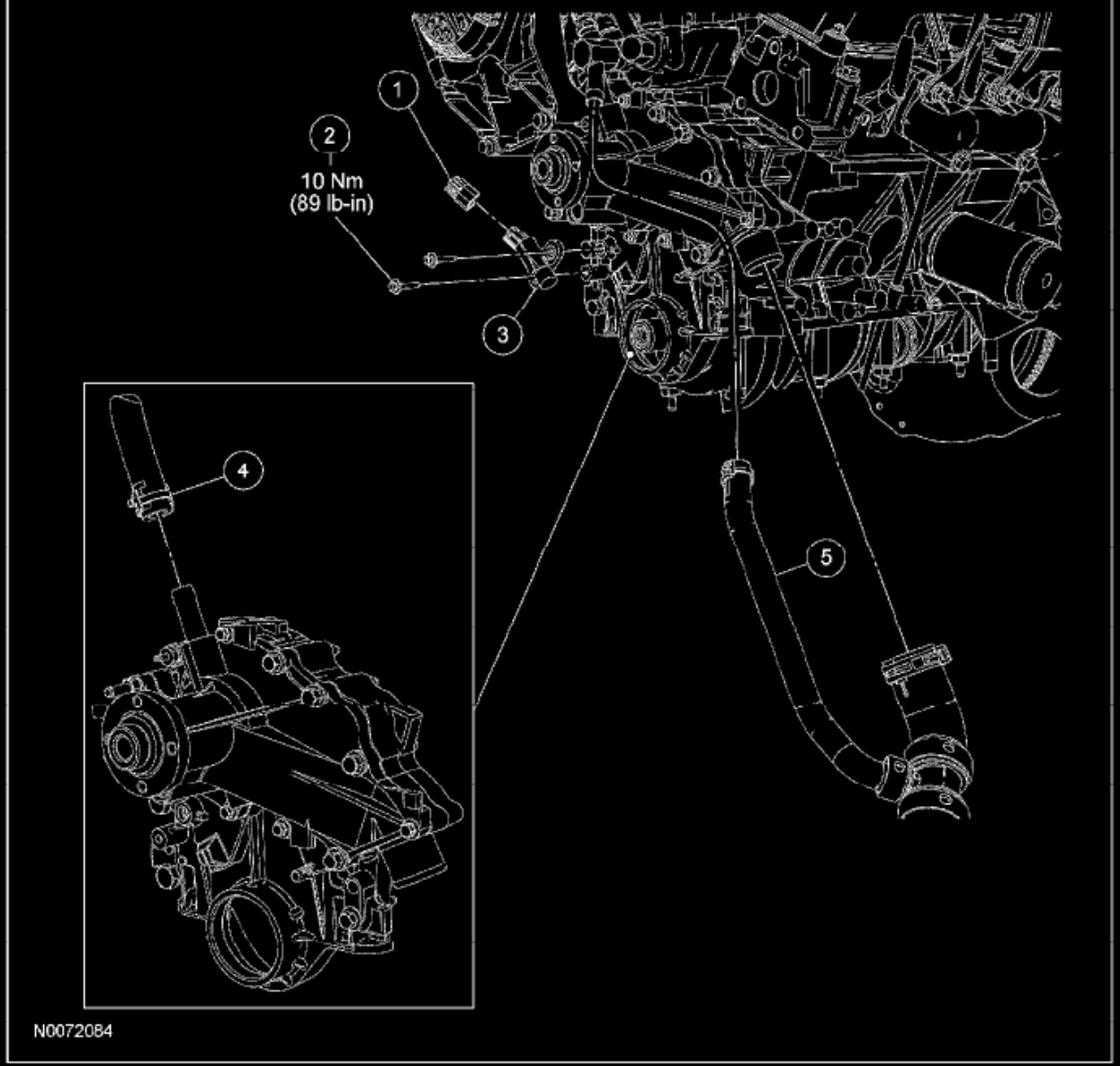
(Continued)

Item	Part Number	Description
5	N606068-S	A/C compressor and power steering pump bracket bolt (2 required)
6	2021BA209	Accessory drive belt tensioner bolt
7	6B209	Accessory drive belt tensioner
8	19E708	A/C compressor and power steering pump bracket
9	N605784-S	Coolant pump pulley bolt (4 required)
10	8A528	Coolant pump pulley

Accessory Drive Components

Hoses and Crankshaft Position (CKP) Sensor

Hoses and Crankshaft Position (CKP) Sensor



Item	Part Number	Description
1	14A464	Crankshaft position (CKP) sensor electrical connector (part of 12B637)
2	W706175-S	CKP sensor bolt (2 required)

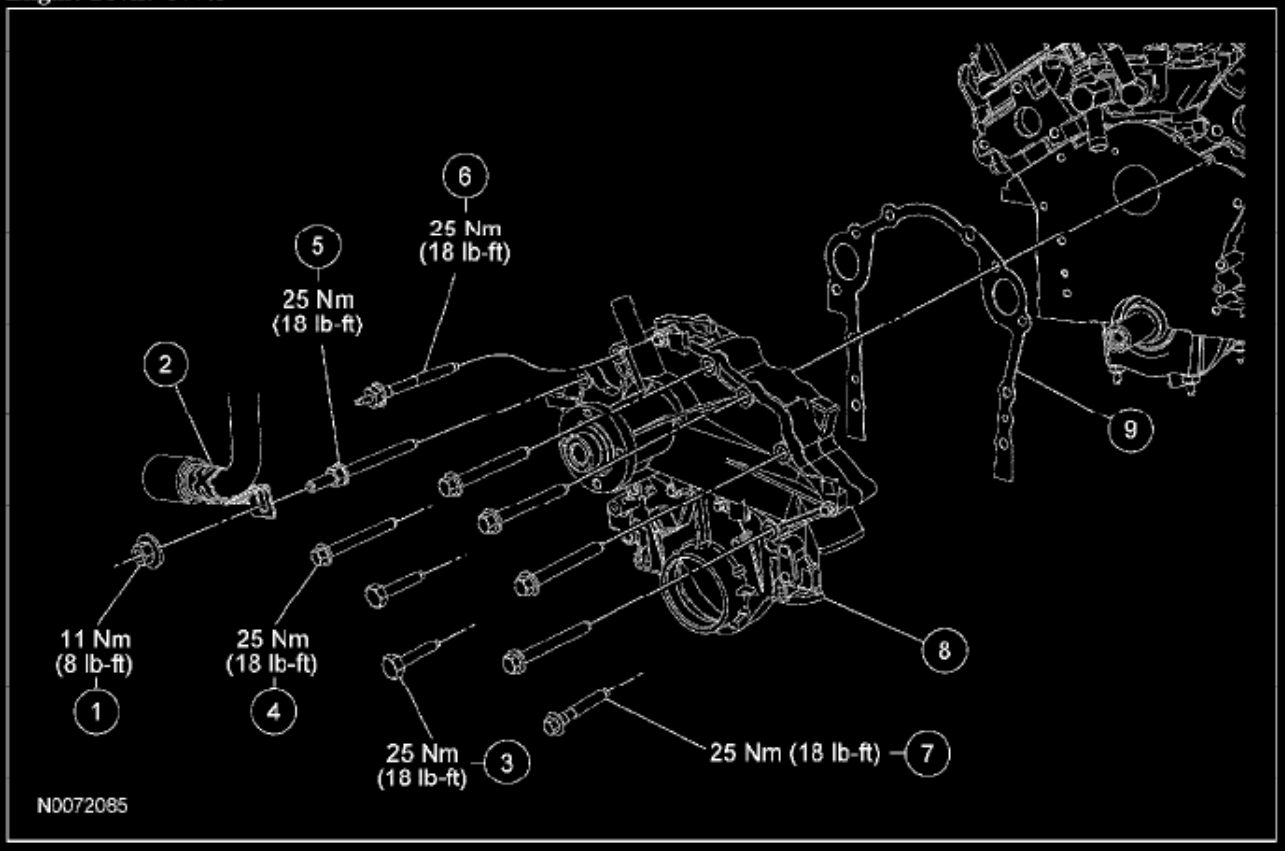
Item	Part Number	Description
3	6C315	CKP sensor
4	18C266	Heater hose
5	8B273	Lower radiator hose assembly

(Continued)

Hoses and Crankshaft Position (CKP) Sensor

Engine Front Cover

Engine Front Cover



Item	Part Number	Description
1	N621940	A/C hose and bracket assembly nut
2	19D734	A/C hose and bracket assembly
3	N-804113-S	Engine front cover bolt (2 required)
4	N811375-S	Engine front cover bolt (5 required)
5	N807515-S	Engine front cover stud bolt
6	N708249-S	Engine front cover stud bolt
7	N606543-S	Engine front cover bolt
8	6059	Engine front cover
9	6020	Engine front cover gasket

Engine Front Cover

Removal

1. Drain the engine coolant. 2. Remove the accessory drive belt. 3. Remove the fan and shroud assembly. 4. Remove the bolts and the coolant pump pulley. 5. Remove the nut and detach the wiring harness bracket. 6. Remove the nut and position the A/C hose and bracket assembly aside.

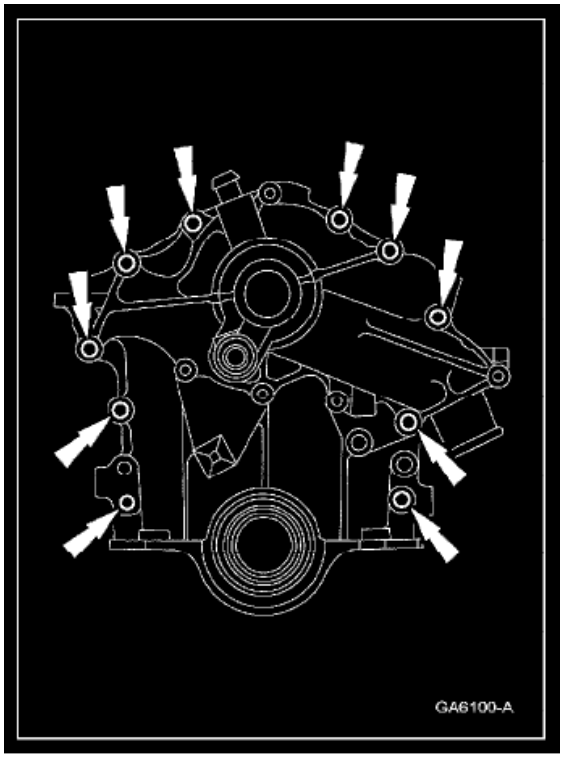
7. Remove the stud bolts from the A/C compressor mounting bracket. 8. Remove the bolt and the accessory drive belt tensioner. 9. Remove the bolts and position the power steering bracket and compressor aside.

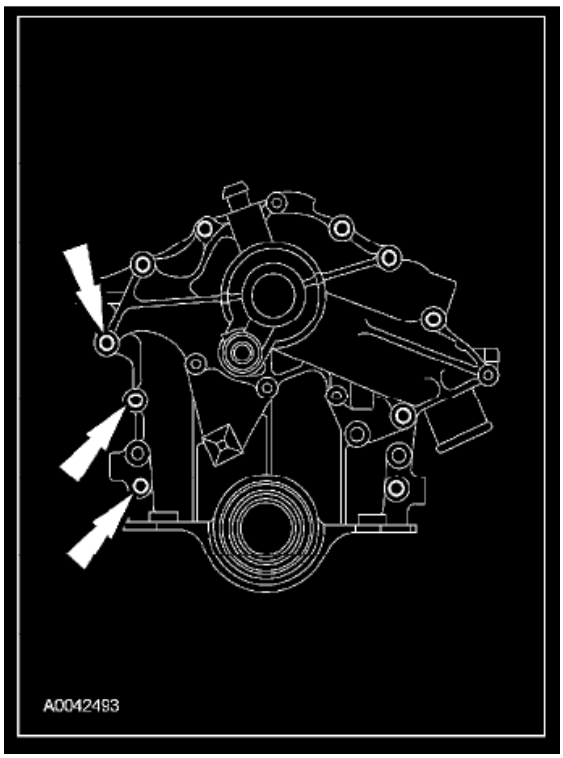
10. Disconnect the heater hose at the coolant pump. 11. Disconnect the lower radiator hose assembly at the coolant pump outlet and lower intake manifold. 12. Remove the crankshaft front seal. 13. Remove the oil pan. 14. Remove the crankshaft position (CKP) sensor.

^ Disconnect the CKP sensor electrical connector.

^ Remove the 2 bolts and the CKP sensor.

15. Remove the bolts and the stud bolts, and remove the engine front cover and the coolant pump as an assembly.


GA6100-A

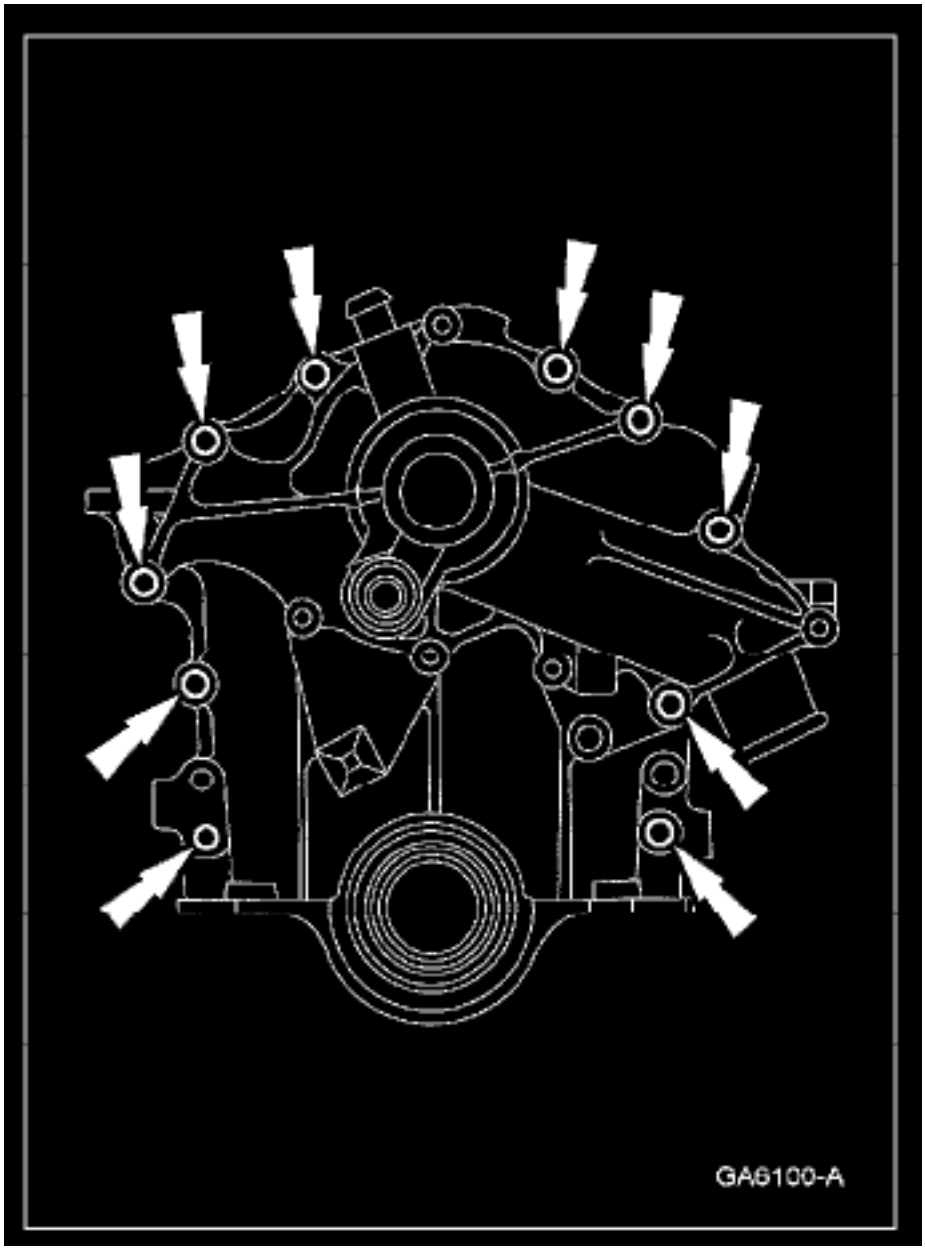

A0042483

16. Remove and discard the front cover gasket.

Installation

1. Clean all sealing surfaces and position a new front cover gasket. 2. Position the engine front cover. 3. Apply pipe sealant with PTFE to the bolts to be installed in the locations shown.

4. Install the engine front cover bolts.



^ Tighten to 25 Nm (18 lb-ft).

5. Position the CKP and install the 2 bolts.

^ Tighten to 10 Nm (89 lb-inch).

6. Connect the CKP sensor electrical connector. 7. Install the oil pan. 8. Install the crankshaft front seal. 9. Connect the lower radiator hose assembly at the coolant pump outlet and lower intake manifold.

10. Connect the heater hose at the coolant pump. 11. Position the A/C compressor and power steering bracket. Install the bolts.

^ Tighten to 47 Nm (35 lb-ft).

12. Install the accessory drive belt tensioner and install the bolt.

^ Tighten to 27 Nm (20 lb-ft).

13. Install the stud bolts to the A/C compressor mounting bracket.

^ Tighten to 47 Nm (35 lb-ft).

14. Position the A/C hose and bracket assembly and install the nut.

^ Tighten to 11 Nm (8 lb-ft).

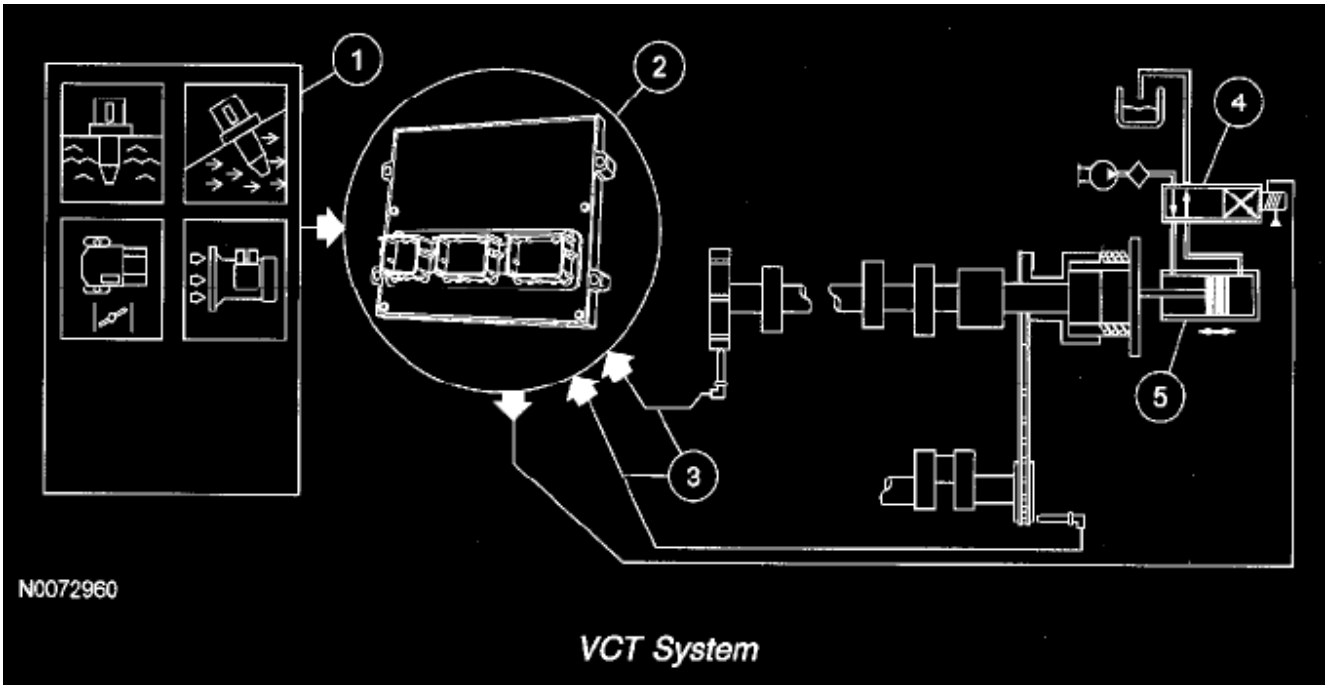
15. Position the wiring harness bracket and install the nut.

^ Tighten to 10 Nm (89 lb-inch).

16. Install the coolant pump pulley and the bolts.

^ Tighten to 25 Nm (18 lb-ft).

17. Install the fan and shroud assembly. 18. Install the accessory drive belt. 19. Fill and bleed the cooling system.



VCT System

Variable Valve Timing Actuator: Description and Operation

VARIABLE CAMSHAFT TIMING (VCT) SYSTEM

Overview

The VCT enables rotation of the camshaft(s) relative to the crankshaft rotation as a function of engine operating conditions. There are 4 types of VCT systems.

- Exhaust phase shifting (EPS) system - the exhaust cam is the active cam being retarded.

- Intake phase shifting (IPS) system - the intake cam is the active cam being advanced.

- Dual equal phase shifting (DEPS) system - both intake and exhaust cams are phase shifted and equally advanced or retarded.

- Dual independent phase shifting (DIPS) system - where both the intake and exhaust cams are shifted independently.

All systems have 4 operational modes: idle, part throttle, wide open throttle (WOT), and default mode. At idle and low engine speeds with closed throttle, the powertrain control module (PCM) determines the phase angle based on air flow, engine oil temperature and engine coolant temperature. At part and wide open throttle the PCM determines the phase angle based on engine RPM, load, and throttle position. VCT systems provide reduced emissions and enhanced engine power, fuel economy and idle quality. IPS systems also have the added benefit of improved torque. In addition, some VCT system applications can eliminate the need for an external exhaust gas recirculation (EGR) system. The elimination of the EGR system is accomplished by controlling the overlap time between the intake valve opening and exhaust valve closing. Currently, both the IPS and DEPS systems are used.

Variable Camshaft Timing (VCT) System

VCT System

The VCT system consists of an electric hydraulic positioning control solenoid, a camshaft position (CMP) sensor, and a trigger wheel. The CMP trigger wheel has a number of equally spaced teeth equal to the number (n) of cylinders on a bank plus one extra tooth (n+1). Four cylinder and V8 engines use a CMP 4+1 tooth trigger wheel. V6 engines use a CMP 3+1 tooth trigger wheel. The extra tooth placed between the equally spaced teeth represents the CMP signal for that bank. A crankshaft position (CKP) sensor provides the PCM with crankshaft positioning information in 10 degree increments.

1. The PCM receives input signals from the intake air temperature (IAT) sensor, engine coolant temperature (ECT) sensor, engine oil temperature

(EOT) sensor, CMP, throttle position (TP) sensor, mass air flow (MAF) sensor, and CKP to determine the operating conditions of the engine. At idle and low engine speeds with closed throttle, the PCM controls the camshaft position based on ECT, EOT, IAT, and MAF. During part and wide open throttle, the camshaft position is determined by engine RPM, load and throttle position. The VCT system does not operate until the engine is at normal operating temperature.

2. The VCT system is enabled by the PCM when the correct conditions are met. 3. The CKP signal is used as a reference for CMP positioning. 4. The VCT solenoid valve is an integral part of the VCT system. The solenoid valve controls the flow of engine oil in the VCT actuator assembly.

As the PCM controls the duty cycle of the solenoid valve, oil pressure/flow advances or retards the cam timing. Duty cycles near 0% or 100% represent rapid movement of the camshaft. Retaining a fixed camshaft position is accomplished by dithering (oscillating) the solenoid valve duty cycle.

The PCM calculates and determines the desired camshaft position. It continually updates the VCT solenoid duty cycle until the desired position is achieved. A difference between the desired and actual camshaft position represents a position error in the PCM VCT control loop. The PCM

disables the VCT and places the camshaft in a default position if a concern is detected. A related DTC is also set when the concern is detected.

5. When the VCT solenoid is energized, engine oil is allowed to flow to the VCT actuator assembly which advances or retards the camshaft timing.

One half of the VCT actuator is coupled to the camshaft and the other half is connected to the timing chain. Oil chambers between the 2 halves couple the camshaft to the timing chain. When the flow of oil is shifted from one side of the chamber to the other, the differential change in oil pressure forces the camshaft to rotate in either an advance or retard position depending on the oil flow.

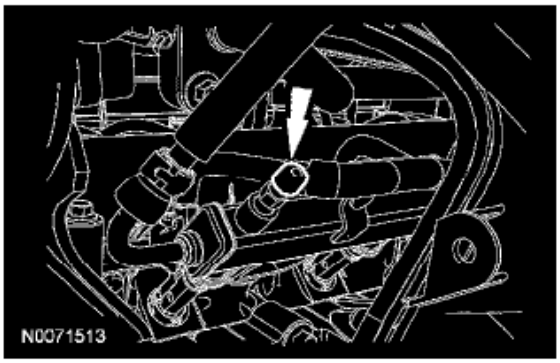
Fuel Pressure: Specifications

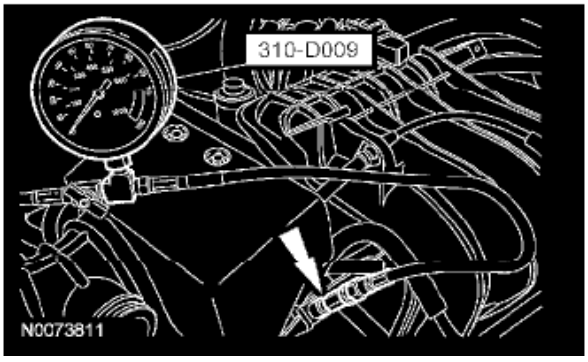
Item.....Specification

Engine running.....414-448 kPa (60-65 psi) Key ON, engine OFF.....414-448 kPa (60-65 psi)

Special Tool(s)

ST3038-A	Fuel Pressure Test Kit 310-D009 (D95L-7211A)





Fuel Pressure: Testing and Inspection

FUEL SYSTEM PRESSURE TEST

Special Tool(s)

Special Tool(s)

WARNING:

- Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

- Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.

- Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

- When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.

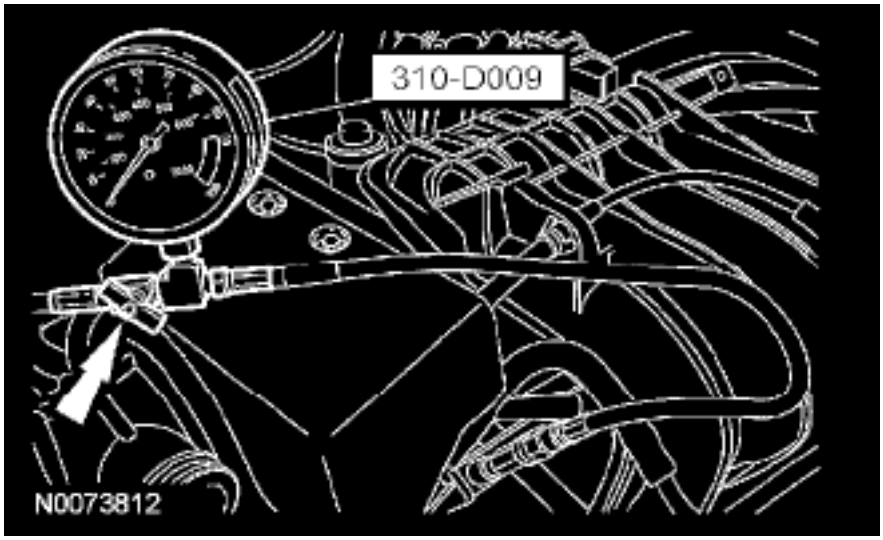
1. NOTE: 2.3L shown, 3.0L and 4.0L similar.

Remove the cap from the fuel pressure relief valve located on the fuel rail.

2. NOTE: 2.3L shown, 3.0L and 4.0L similar.

Install the special tool onto the fuel pressure relief valve.

3. Test the fuel system pressure to make sure it is within the specified range.



4. NOTE:

- 2.3L shown, 3.0L and 4.0L similar.

- Open the drain valve slowly to relieve the fuel system pressure. This may drain fuel from the system. Place fuel in a suitable container.

Upon completion of the fuel system pressure test, open the drain valve on the special tool and relieve the fuel system pressure.

5. NOTE: It may take more than one key cycle to pressurize the fuel system.

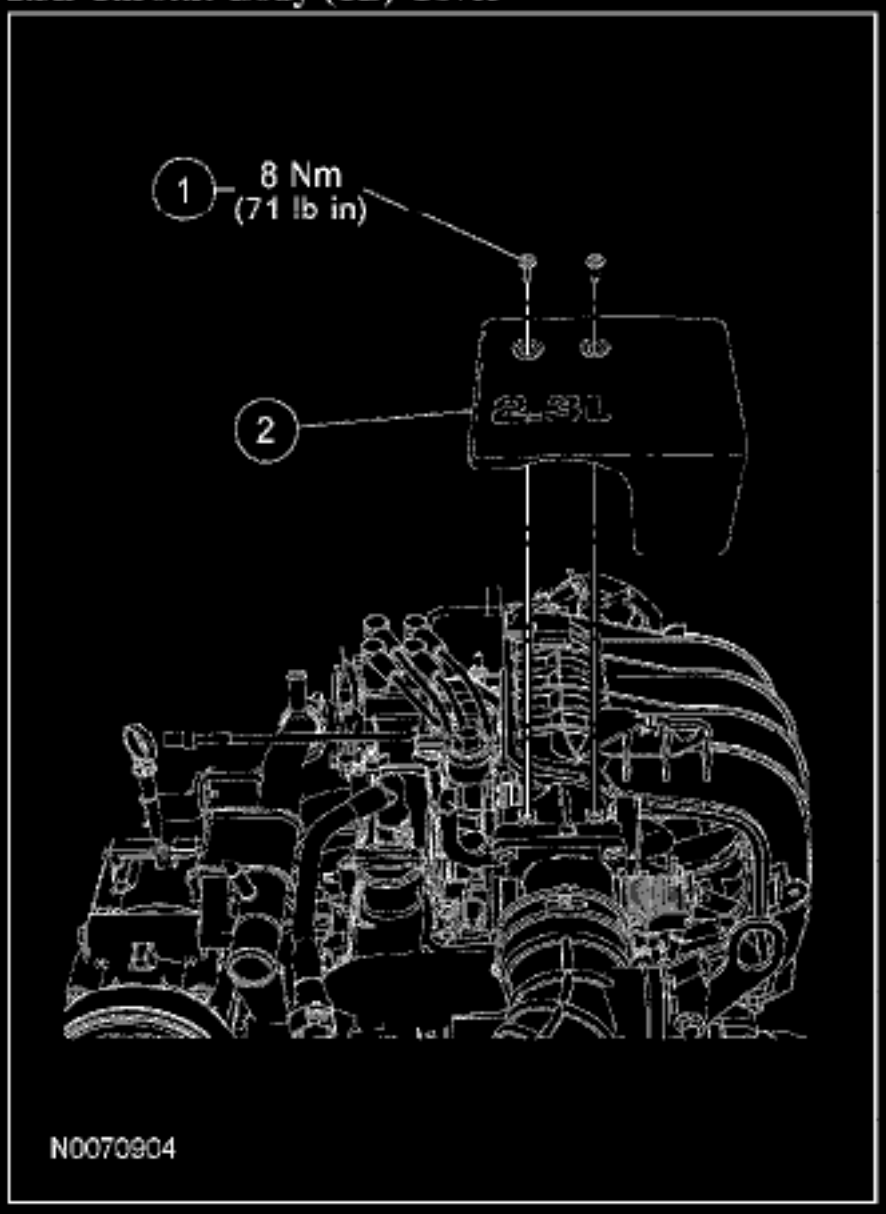
Cycle the ignition key and wait 3 seconds to pressurize the fuel system. Check for leaks before starting the engine.

Idle Speed: Specifications

Typical Diagnostic Reference Value

Measured/PID Values 750 RPM .... Hot Idle

2.3L Throttle Body (TB) Cover



Item	Part Number	Description
1	—	Throttle body (TB) cover bolt (2 required)
2	9E766	TB cover

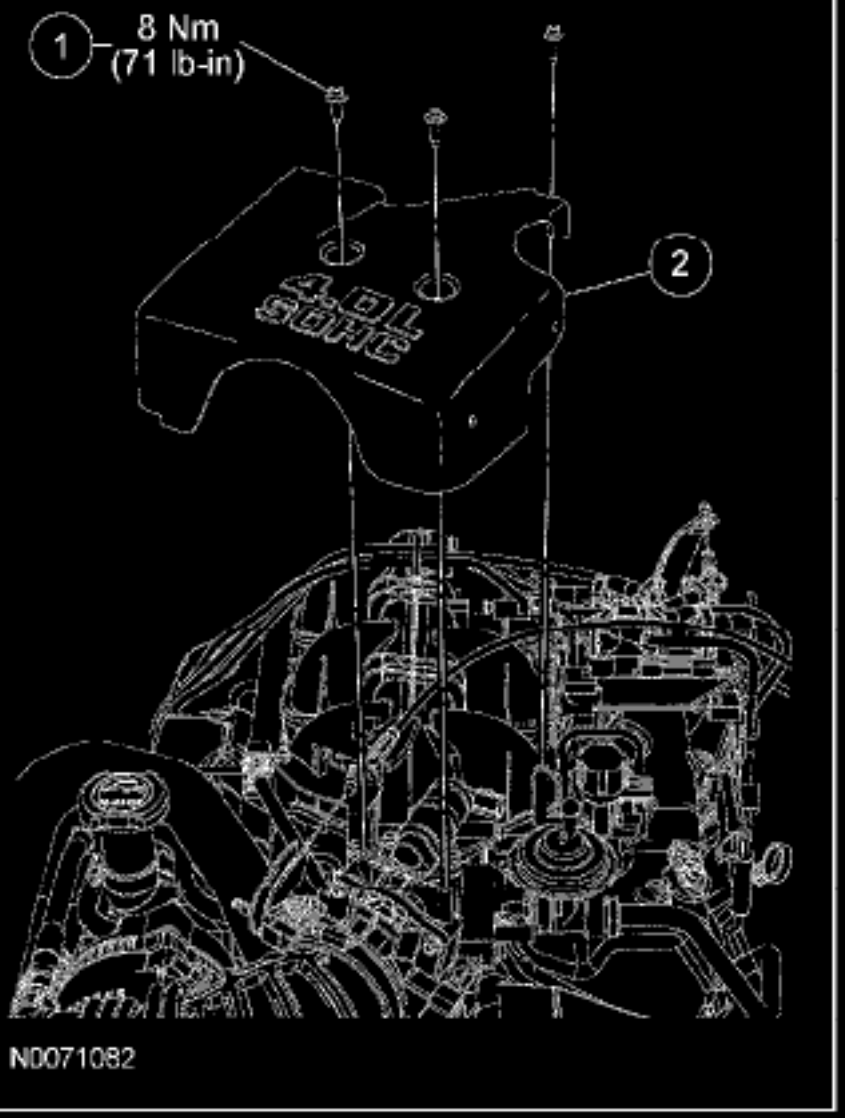
Air Cleaner Fresh Air Duct/Hose: Service and Repair

INTAKE AIR SYSTEM COMPONENTS

Exploded View

2.3L Throttle Body (TB) Cover

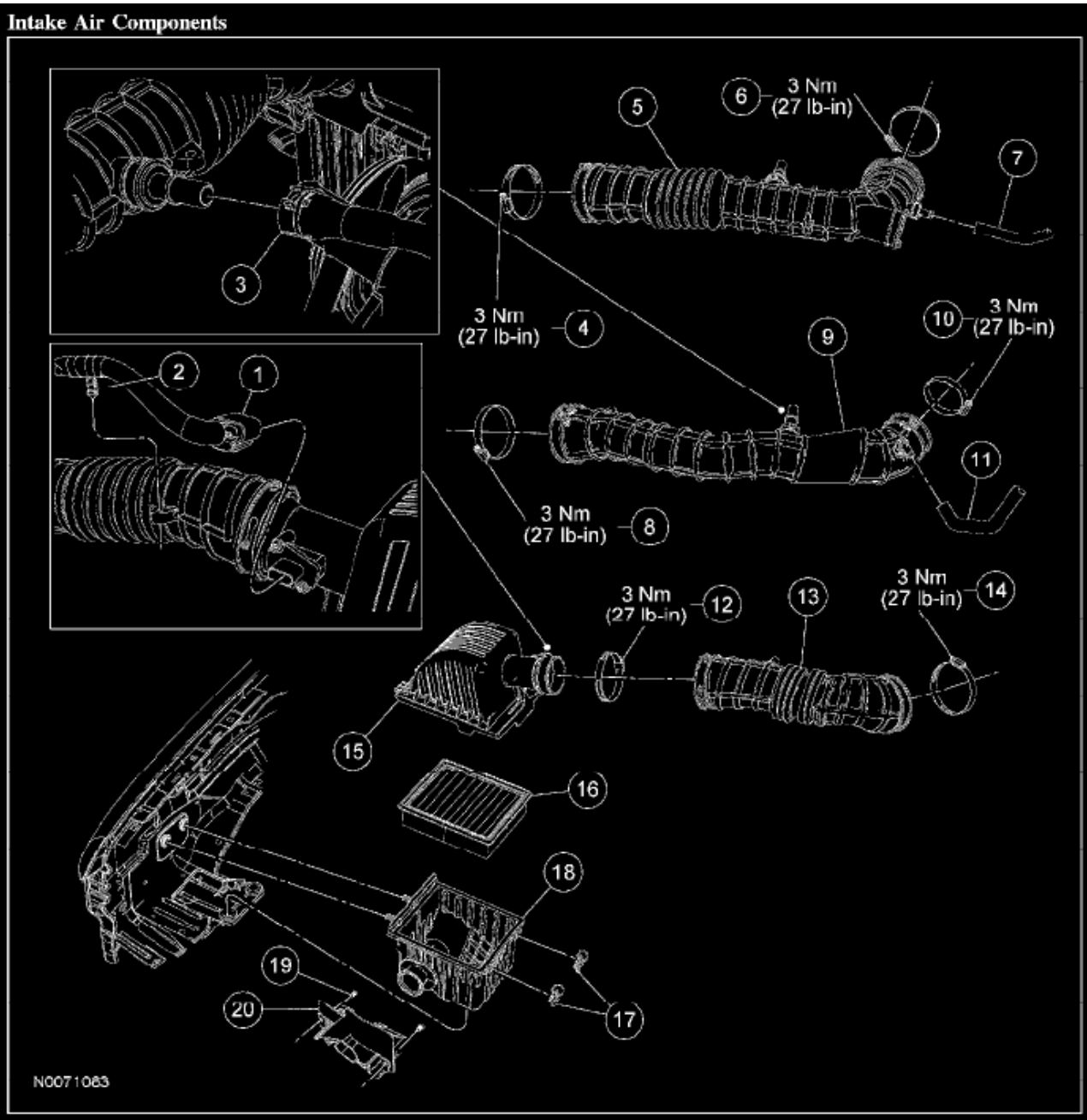
4.0L SOHC Throttle Body (TB) Cover



Item	Part Number	Description
1	W704704	Throttle body (TB) cover bolt (2 required)
2	9E766	TB cover

4.0L SOHC Throttle Body (TB) Cover

Intake Air Components



Item	Part Number	Description
1	—	Mass air flow (MAF) sensor electrical connector (part of 12B637)
2	13A506	Wiring harness retainer (2 required [2.3L engines]) (1 required [3.0L and 4.0L engines]) (part of 12B637)
3	—	Crankcase ventilation tube quick connect coupling

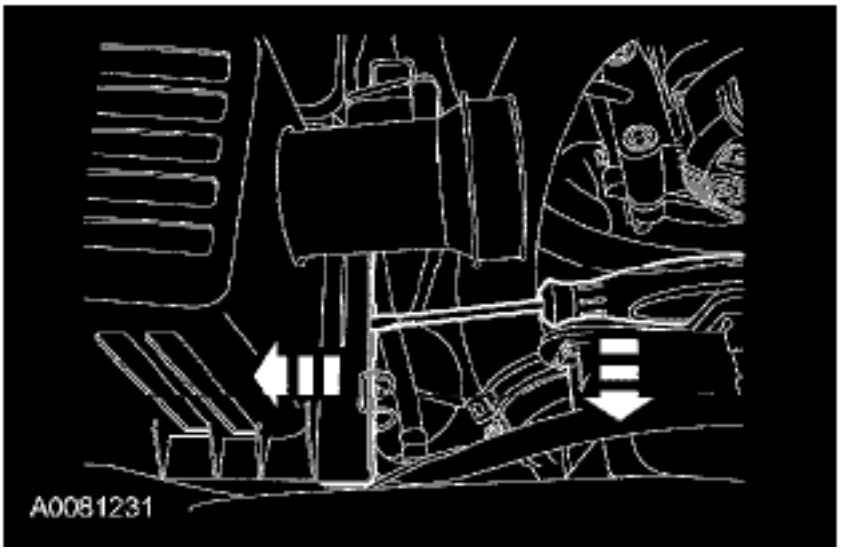
(Continued)

Item	Part Number	Description
4	6C632	Engine air cleaner (ACL) outlet tube-to-air cleaner clamp (2.3L)
5	9B659	ACL outlet tube (2.3L)
6	6C632	ACL outlet tube-to-throttle body (TB) clamp (2.3L)
7	9C490	Brake booster vacuum hose
8	6C632	ACL outlet tube-to-air cleaner clamp (3.0L)

(Continued)

Intake Air Components (Part 1)

Item	Part Number	Description
9	9B659	ACL outlet tube (3.0L)
10	6C632	ACL outlet tube-to-TB clamp (3.0L)
11	9C490	Brake booster vacuum hose
12	6C632	ACL outlet tube-to-air cleaner clamp (4.0L)
13	9B659	ACL outlet tube (4.0L)
14	6C632	ACL outlet tube-to-TB clamp (4.0L)
15	9643	ACL cover
16	9601	ACL element
17	9628	ACL-to-ACL cover clips
18	9A612	ACL
19	N810040	Air nozzle pushpins
20	9E961	Air nozzle

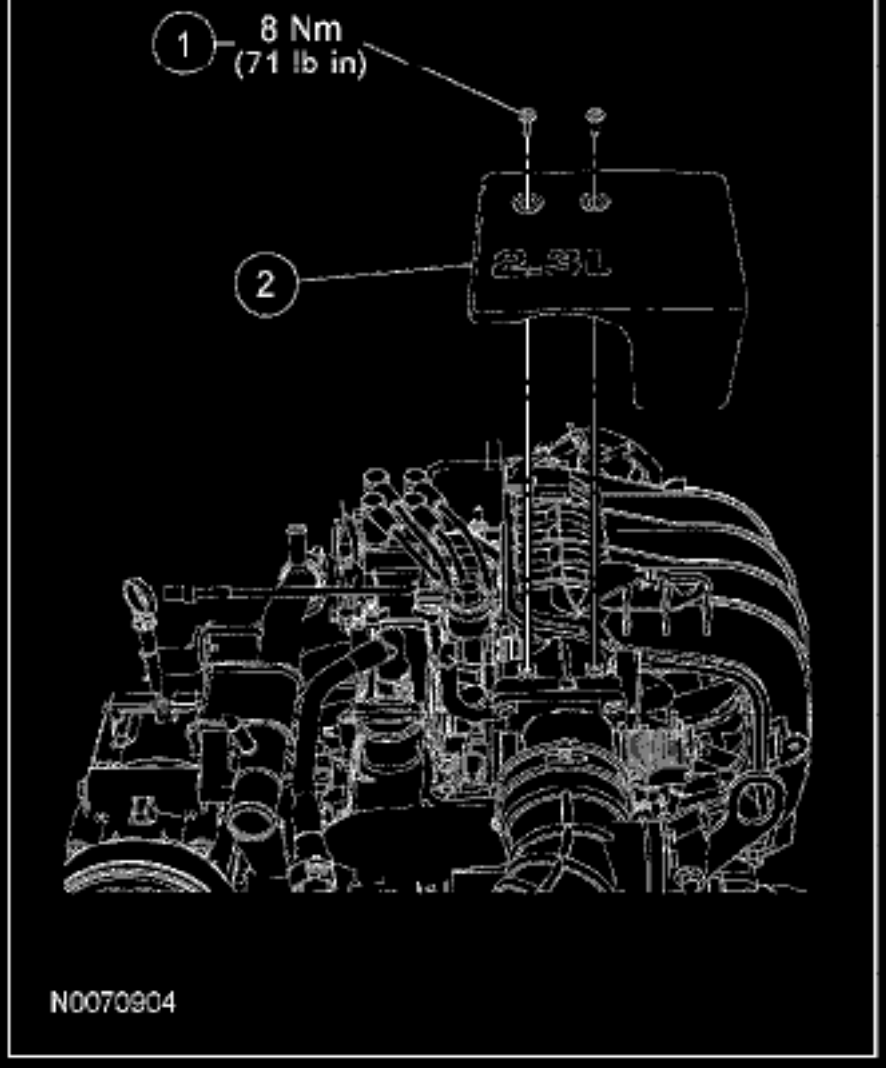


Intake Air Components (Part 2)

Removal and Installation

1. If necessary, pry the engine air cleaner (ACL) from the base support bracket when removing the ACL.

2.3L Throttle Body (TB) Cover



Item	Part Number	Description
1	—	Throttle body (TB) cover bolt (2 required)
2	9E766	TB cover

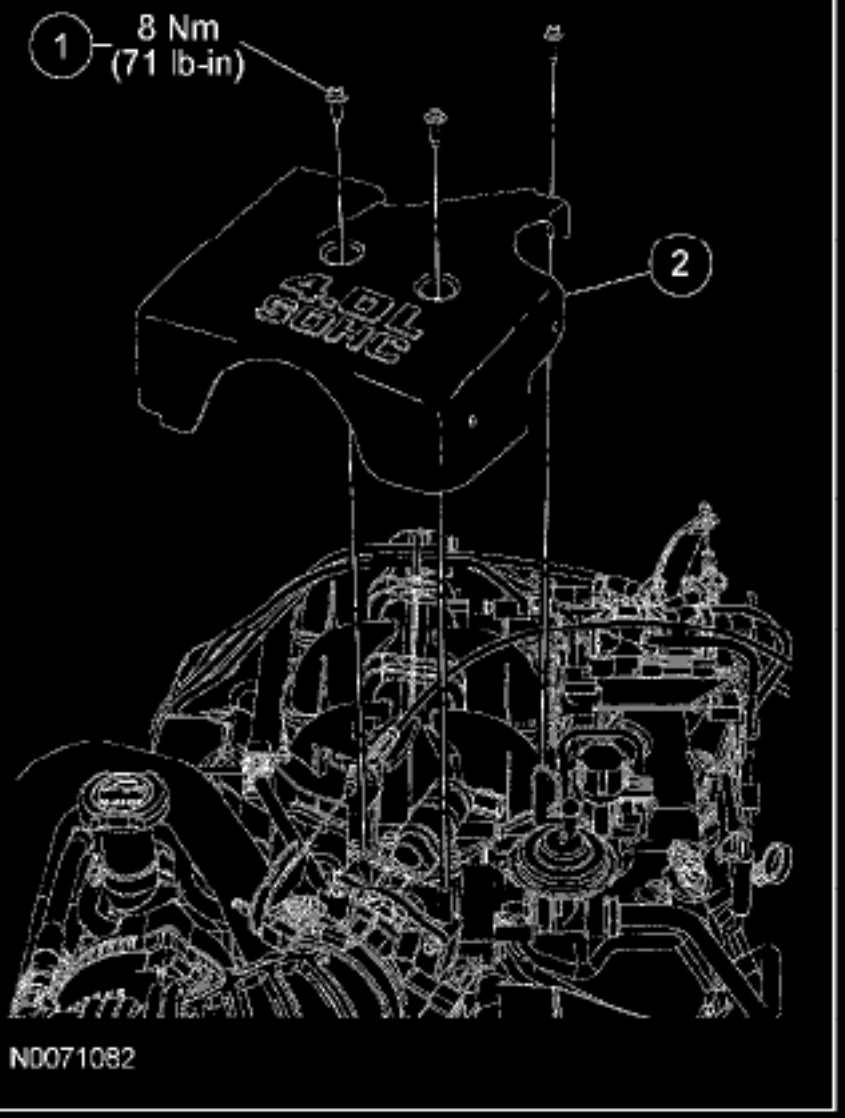
Air Filter Element: Service and Repair

INTAKE AIR SYSTEM COMPONENTS

Exploded View

2.3L Throttle Body (TB) Cover

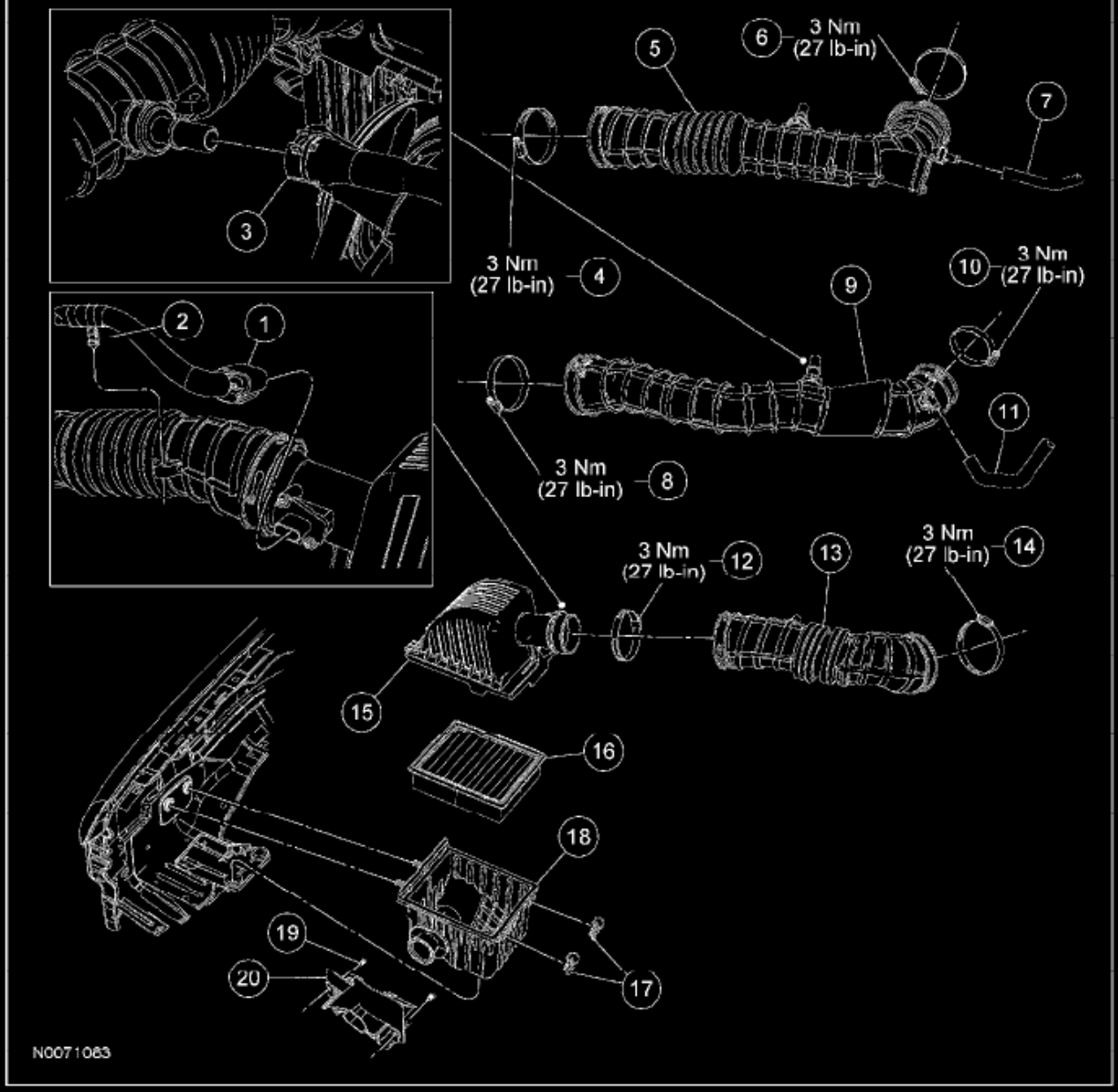
4.0L SOHC Throttle Body (TB) Cover



Item	Part Number	Description
1	W704704	Throttle body (TB) cover bolt (2 required)
2	9E766	TB cover

4.0L SOHC Throttle Body (TB) Cover

Intake Air Components



Item	Part Number	Description
1	—	Mass air flow (MAF) sensor electrical connector (part of 12B637)
2	13A506	Wiring harness retainer (2 required [2.3L engines]) (1 required [3.0L and 4.0L engines]) (part of 12B637)
3	—	Crankcase ventilation tube quick connect coupling

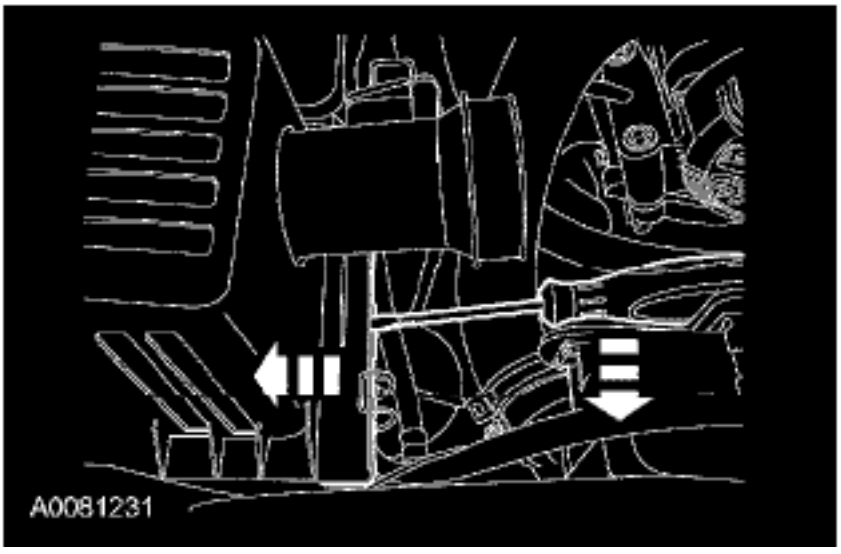
(Continued)

Item	Part Number	Description
4	6C632	Engine air cleaner (ACL) outlet tube-to-air cleaner clamp (2.3L)
5	9B659	ACL outlet tube (2.3L)
6	6C632	ACL outlet tube-to-throttle body (TB) clamp (2.3L)
7	9C490	Brake booster vacuum hose
8	6C632	ACL outlet tube-to-air cleaner clamp (3.0L)

(Continued)

Intake Air Components (Part 1)

Item	Part Number	Description
9	9B659	ACL outlet tube (3.0L)
10	6C632	ACL outlet tube-to-TB clamp (3.0L)
11	9C490	Brake booster vacuum hose
12	6C632	ACL outlet tube-to-air cleaner clamp (4.0L)
13	9B659	ACL outlet tube (4.0L)
14	6C632	ACL outlet tube-to-TB clamp (4.0L)
15	9643	ACL cover
16	9601	ACL element
17	9628	ACL-to-ACL cover clips
18	9A612	ACL
19	N810040	Air nozzle pushpins
20	9E961	Air nozzle



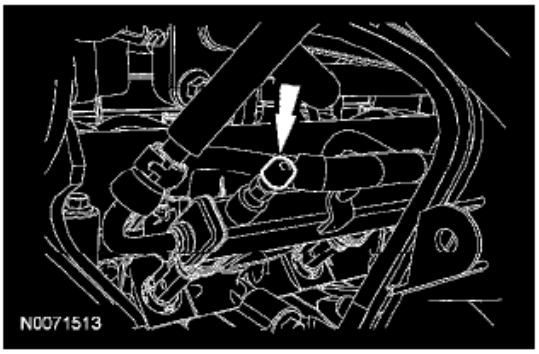
Intake Air Components (Part 2)

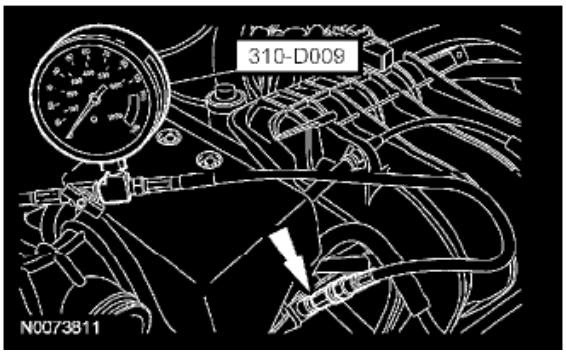
Removal and Installation

1. If necessary, pry the engine air cleaner (ACL) from the base support bracket when removing the ACL.

Special Tool(s)

ST3038-A	Fuel Pressure Test Kit 310-D009 (D95L-7211A)





Fuel Pressure Release: Service and Repair

FUEL SYSTEM PRESSURE RELEASE

Special Tool(s)

Special Tool(s)

WARNING:

- Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

- Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.

- Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

- When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.

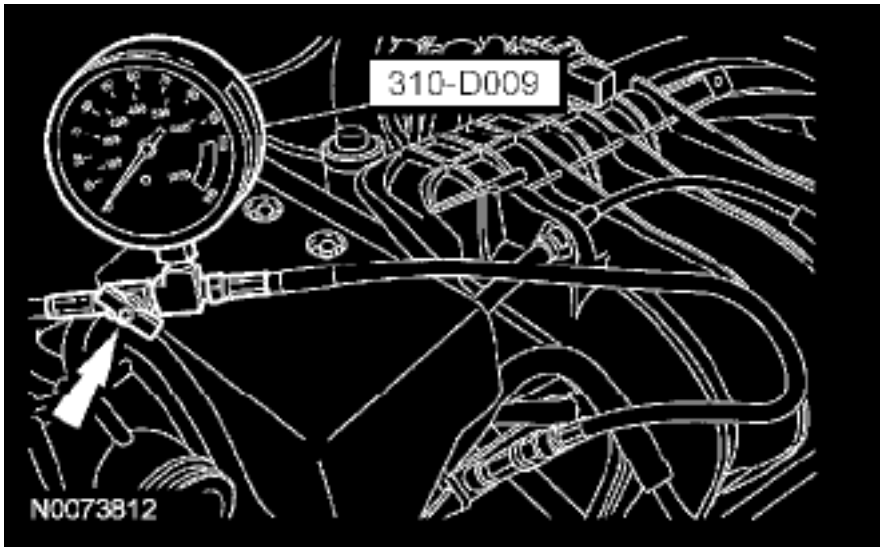
1. Disconnect the battery ground cable.

2. NOTE: 2.3L shown, 3.0L and 4.0L similar.

Remove the cap from the fuel pressure relief valve located on the fuel rail.

3. NOTE: 2.3L shown, 3.0L and 4.0L similar.

Install the special tool onto the fuel pressure relief valve.



4. NOTE:

- 2.3L shown, 3.0L and 4.0L similar.

- Open the drain valve slowly to relieve the system pressure. This may drain fuel from the system. Place fuel in a suitable container.

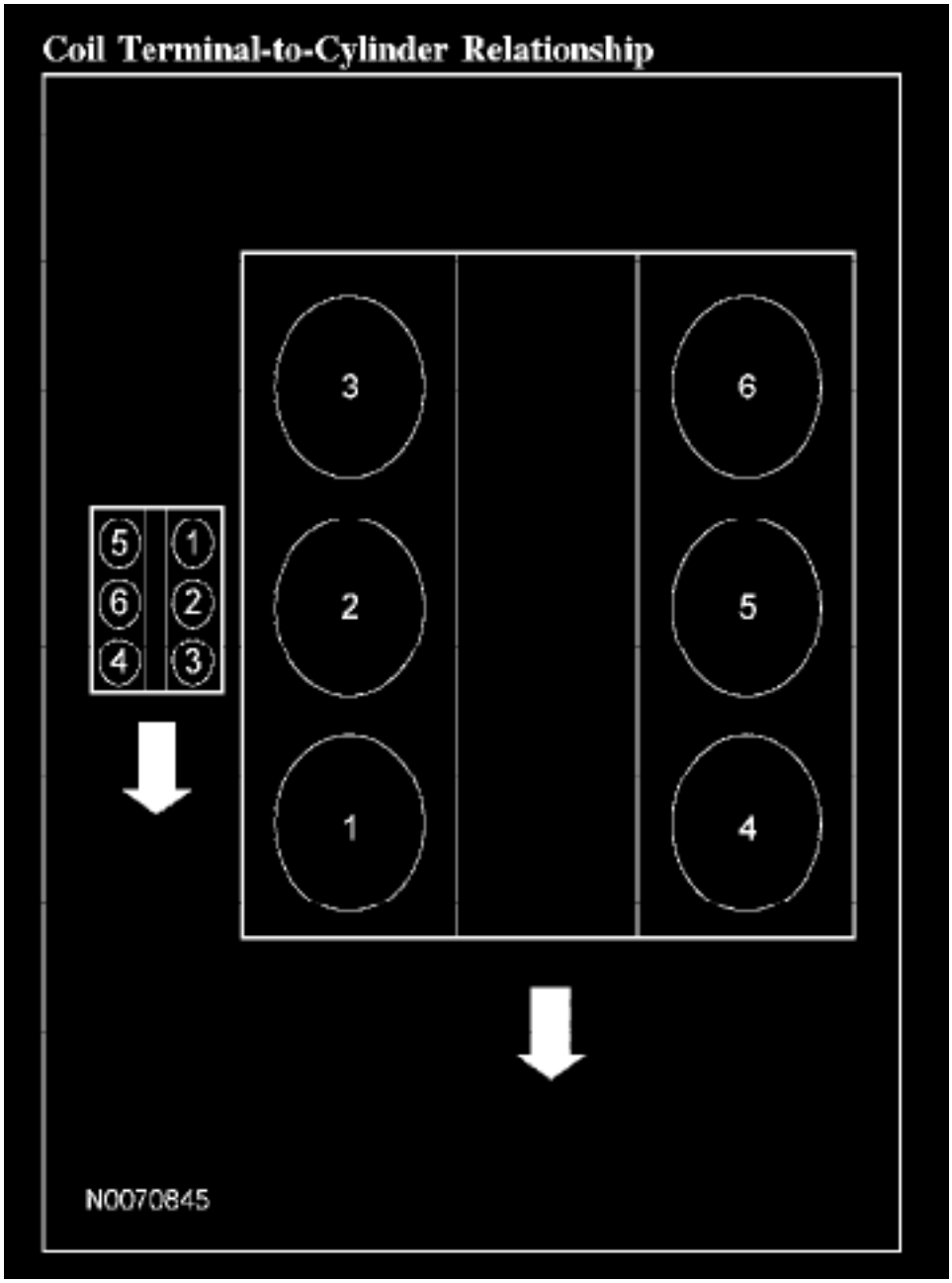
Open the drain valve on the special tool and relieve the fuel system pressure.

5. NOTE: It may take more than one key cycle to pressurize the fuel system.

Upon completion of the fuel system repairs, cycle the ignition key and wait 3 seconds to pressurize the fuel system. Check for leaks before starting the engine.

Firing Order: Specifications

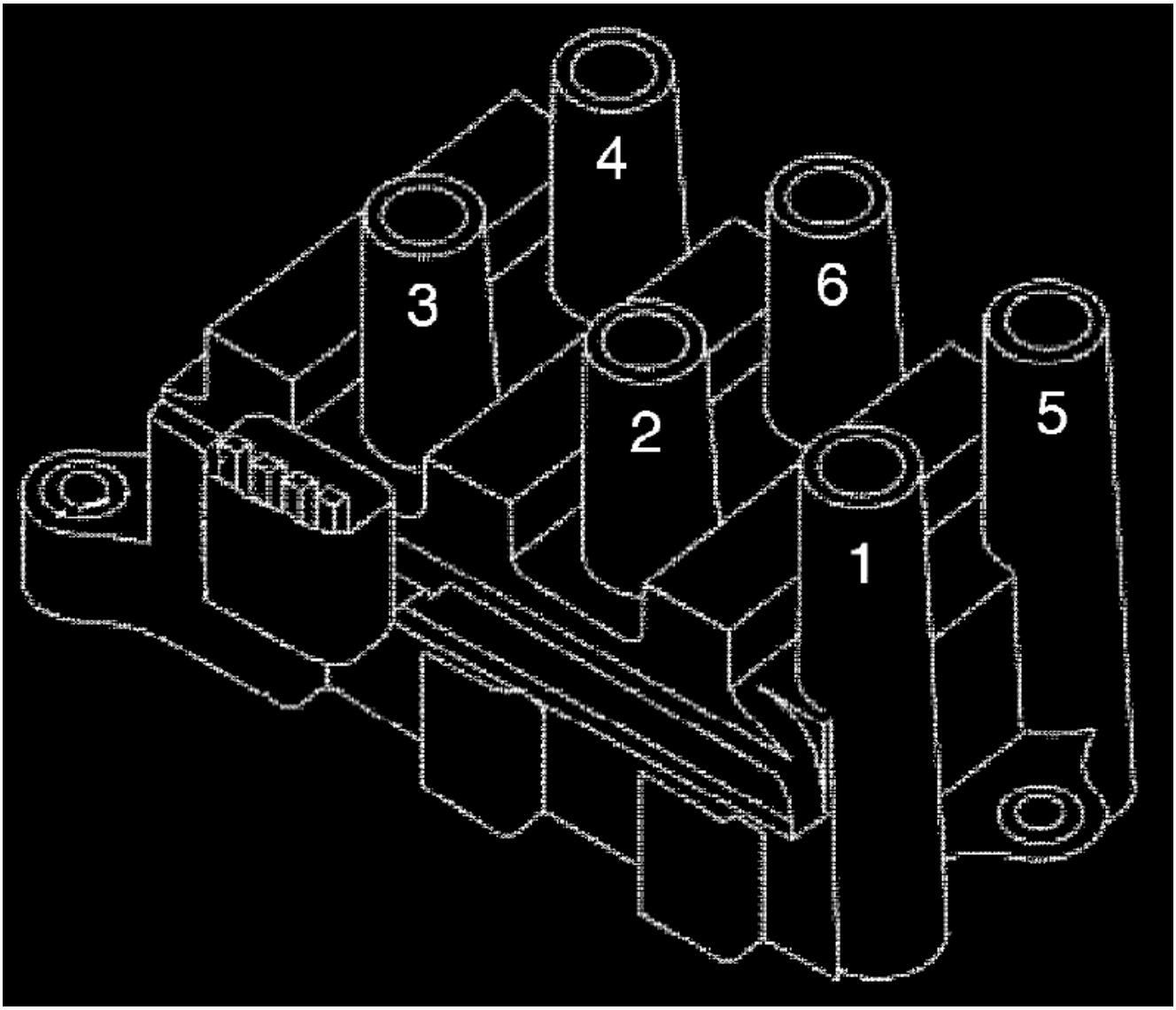
Item	Specification
Firing order	1-4-2-5-3-6



Firing Order: Locations

Coil Terminal-to-Cylinder Relationship

Number One Cylinder

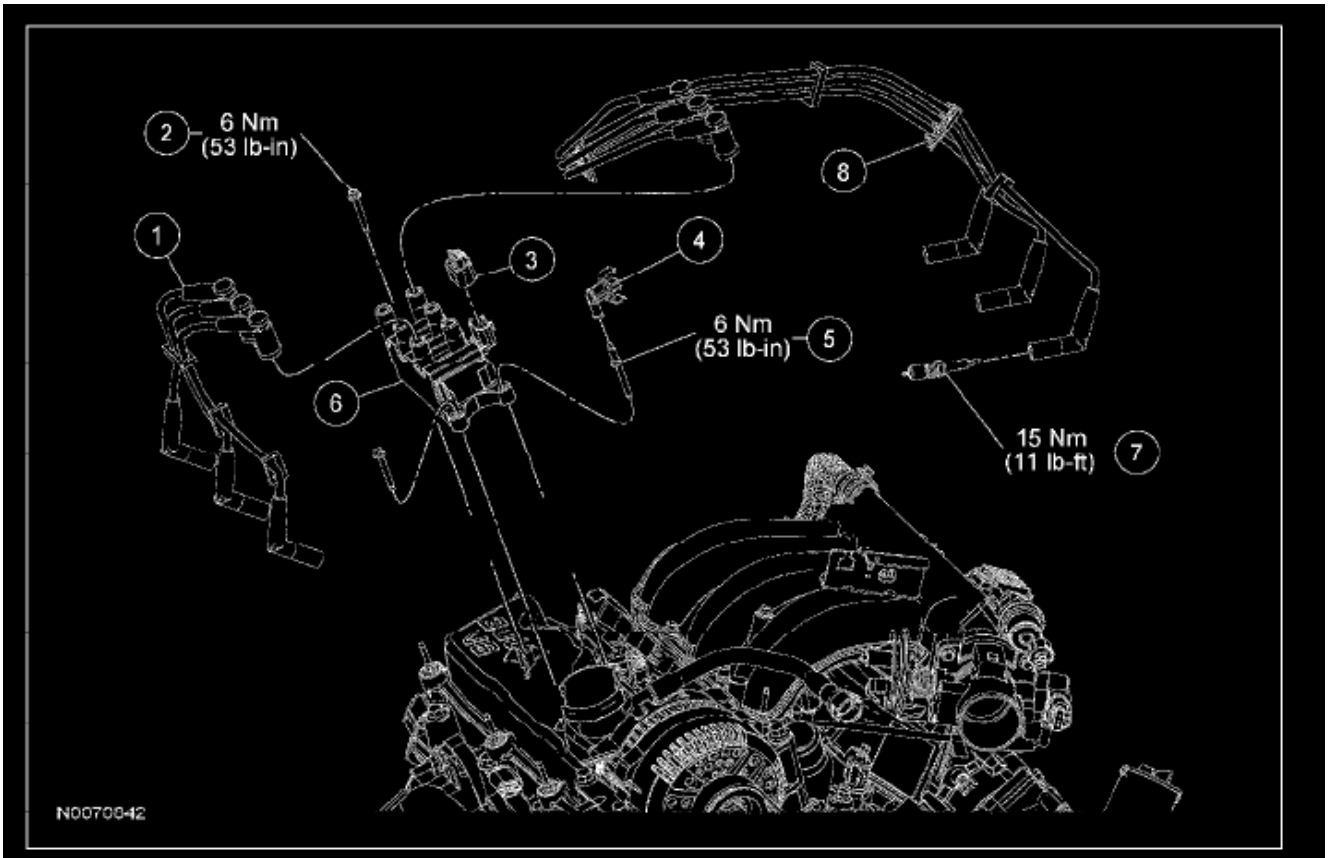


Spark Plug Cable Routing

Item	Specification
Firing order	1-4-2-5-3-6

Ignition Timing: Specifications

Item	Specification
Base ignition timing (not adjustable)	10 degrees before top dead center (BTDC)



Item	Part Number	Description
1	12259	Spark plug wire set
2	W706995	Ignition coil bolt (2 required)
3	—	Ignition coil electrical connector (part of 12B637)
4	18D331	Heater hose retainer
5	W706825	Ignition coil stud bolt

Item	Part Number	Description
6	12029	Ignition coil
7	12405	Spark plug (6 required)
8	12297	Spark plug wire retainer (7 required)

(Continued)

Special Tool(s)

ST1394-A	Remover, Spark Plug Wire 303-106 (T74P-6666-A)

Ignition Cable: Service and Repair

SPARK PLUG WIRES

Exploded View

Special Tool(s)

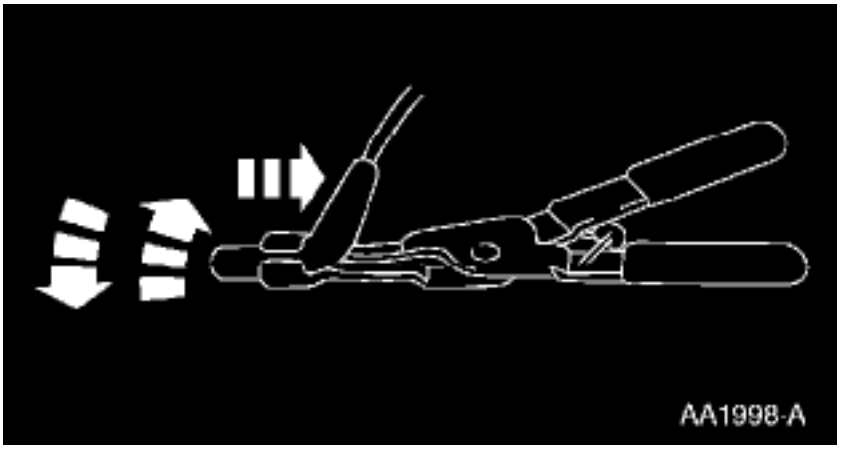
Special Tool(s)

Removal and Installation

CAUTION: Spark plug wires must be connected correctly. Failure to follow this instruction may result in poor engine performance.

1. CAUTION: Do not pull on the spark plug wire as it may separate from the spark plug wire connector inside the spark plug wire boot.

Use the Spark Plug Wire Remover to grasp and twist the spark plug wire boot back and forth on the spark plug insulator to release the connectors.



2. Disconnect the spark plug wires from the ignition coil by twisting while pulling upward. 3. Open the spark plug wire separators and remove the spark plug wires.

4. CAUTION: Correct installation of the spark plug wires is critical to vehicle operation. If one spark plug wire is not correctly installed on

the spark plug or ignition coil, both spark plugs connected to that segment of the ignition coil may not fire under load.

To install, reverse the removal procedure. -

Use a small, clean tool to coat the entire interior surface of the boots with silicone brake caliper grease.

Spark Plug: Specifications General Specifications

Item.....Specification

Spark plug gap.....1.31-1.45 mm 0.052-0.057 in)

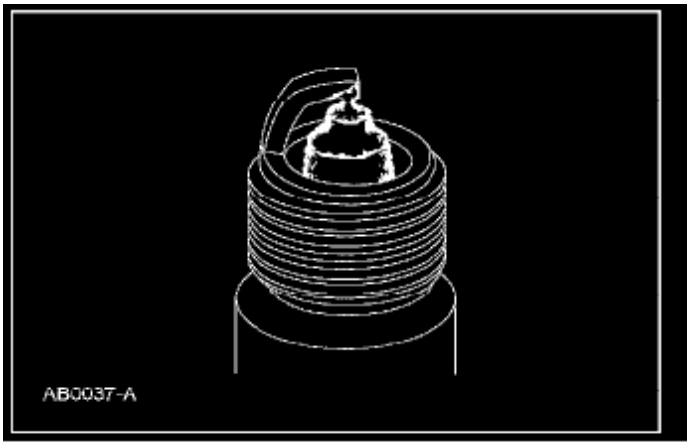
Torque Specifications

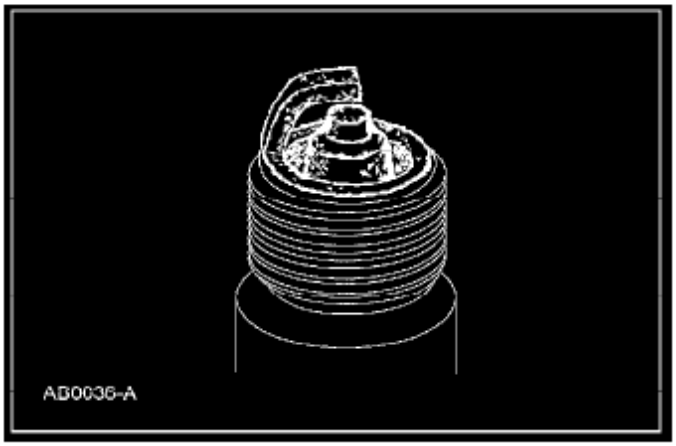
Description	Nm	lb-ft	lb-in
Ignition coil bolts	6	—	53
Spark plugs	15	11	—

Torque Specifications

Spark Plug: Application and ID

Item	Specification
Spark plug	AGSF-32FM


AB0037-A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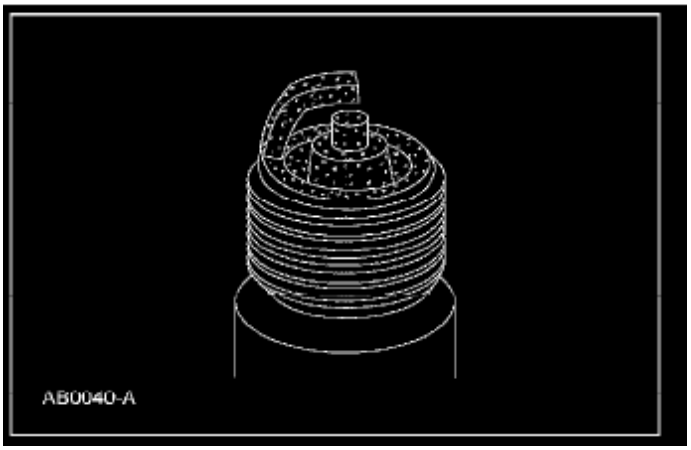

AB0040-A

Spark Plug: Testing and Inspection

Spark Plug Inspection

1. Inspect the spark plug for a bridged gap.

^ Check for deposit build-up closing the gap between the electrodes. Deposits are caused by oil or carbon fouling.

^ Clean the spark plug.

2. Check for oil fouling.

^ Check for wet, black deposits on the insulator shell bore electrodes, caused by excessive oil entering the combustion chamber through worn rings and pistons, excessive valve-to-guide clearance or worn or loose bearings.

^ Correct the oil leak concern.

^ Install a new spark plug.

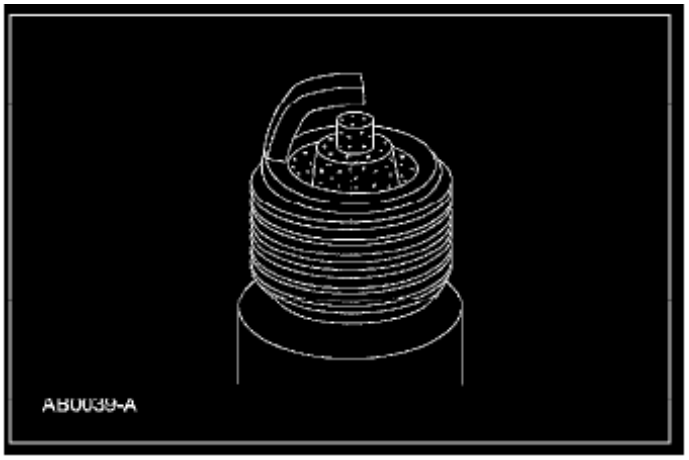
3. Inspect for carbon fouling. Look for black, dry, fluffy carbon deposits on the insulator tips, exposed shell surfaces and electrodes, caused by a

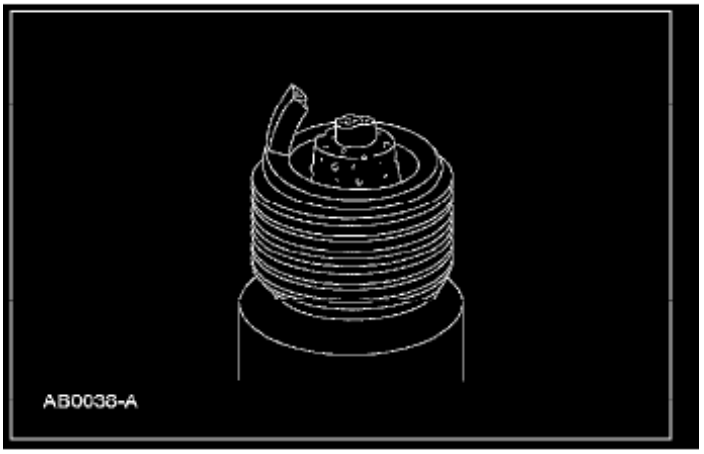
spark plug with an incorrect heat range, dirty air cleaner, too rich a fuel mixture or excessive idling.
^

Install new spark plugs.

4. Inspect for normal burning.

^ Check for light tan or gray deposits on the firing tip.


AB0039-A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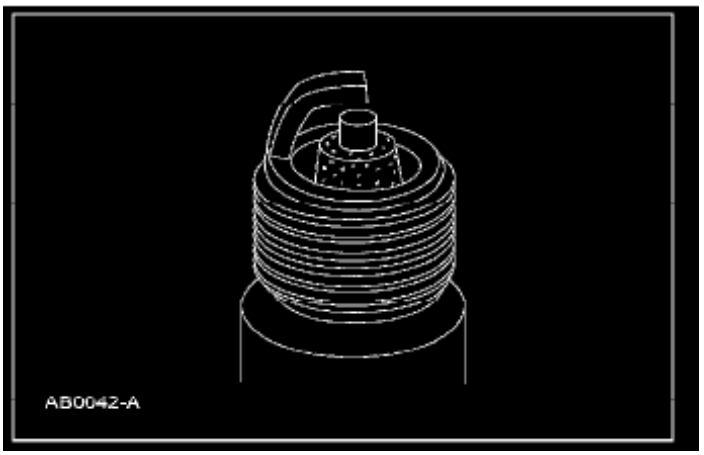

AB0042-A

5. Inspect for pre-ignition, identified by melted electrodes and a possibly damaged insulator. Metallic deposits on the insulator indicate engine

damage. This may be caused by incorrect ignition timing, wrong type of fuel or the unauthorized installation of a Heli-Coil(R) insert in place of the spark plug threads. ^

Install a new spark plug.

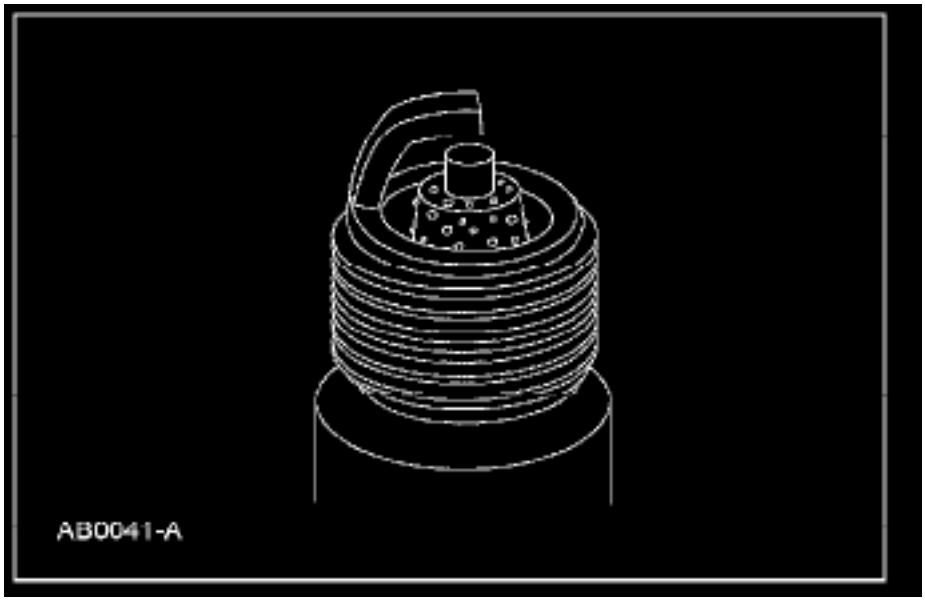
6. Inspect for overheating, identified by white or light gray spots and with a bluish-burnt appearance of electrodes. This is caused by engine

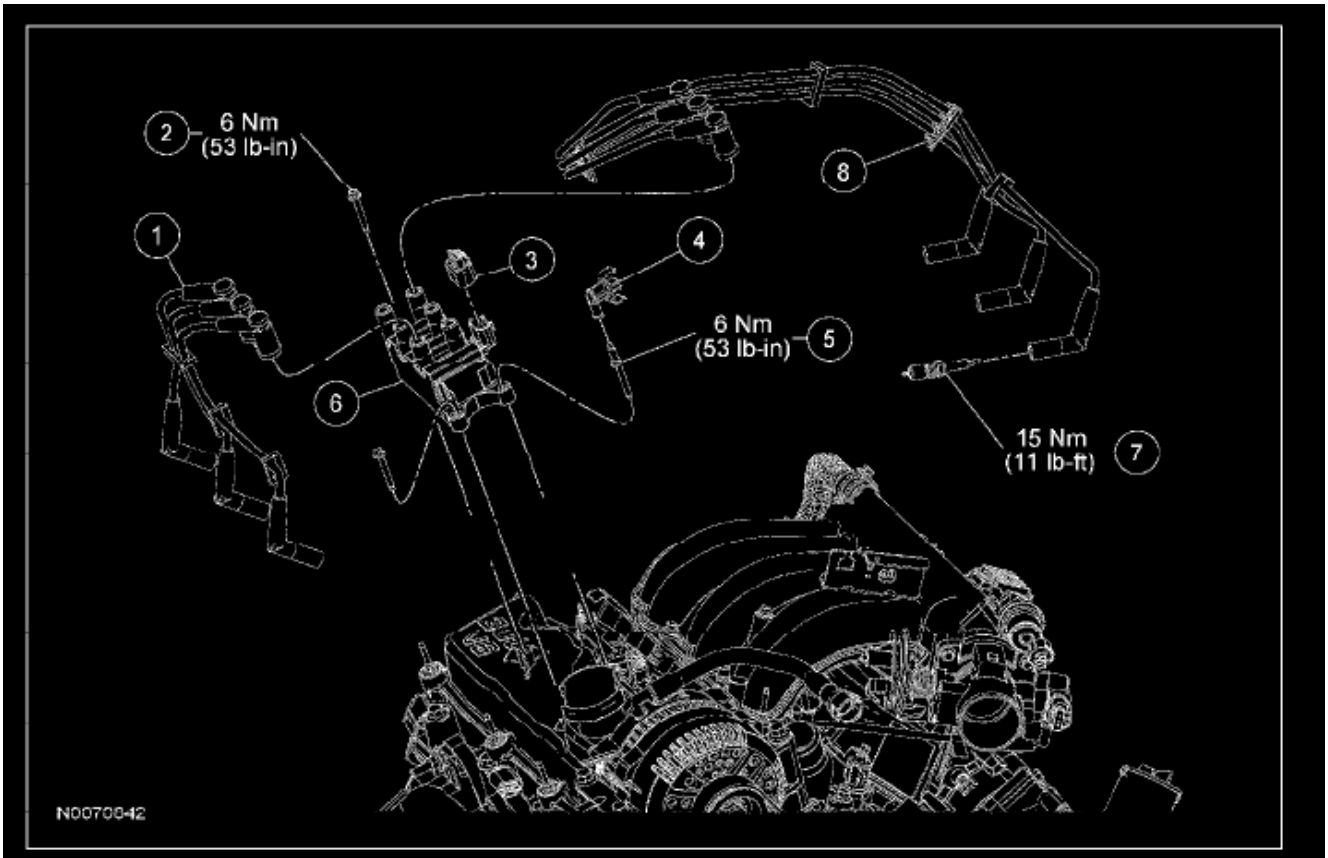
overheating, wrong type of fuel, loose spark plugs, spark plugs with an incorrect heat range, low fuel pump pressure or incorrect ignition timing. ^

Install a new spark plug.

7. Inspect for fused deposits, identified by melted or spotty deposits resembling bubbles or blisters. These are caused by sudden acceleration.

^ Install new spark plugs.


AB0041-A



Item	Part Number	Description
1	12259	Spark plug wire set
2	W706995	Ignition coil bolt (2 required)
3	—	Ignition coil electrical connector (part of 12B637)
4	18D331	Heater hose retainer
5	W706825	Ignition coil stud bolt

Item	Part Number	Description
6	12029	Ignition coil
7	12405	Spark plug (6 required)
8	12297	Spark plug wire retainer (7 required)

(Continued)

Special Tool(s)

Remover, Spark Plug Wire
303-106 (T74P-6666-A)

Spark Plug: Service and Repair

SPARK PLUGS

Exploded View

Special Tool(s)

Special Tool(s)

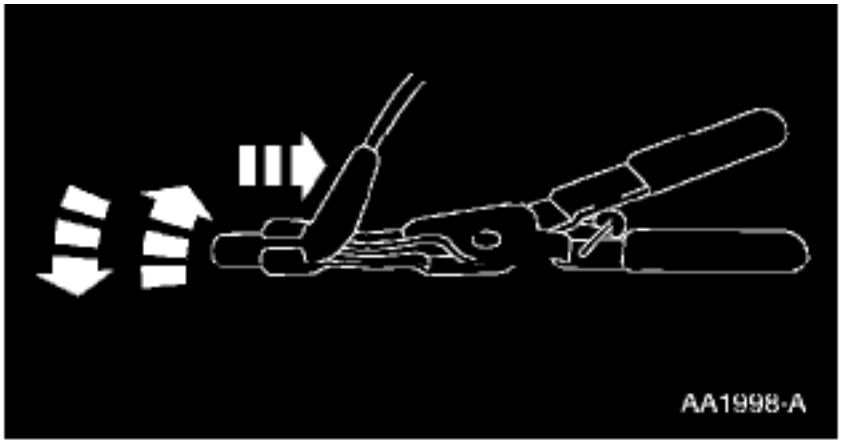
Removal and Installation

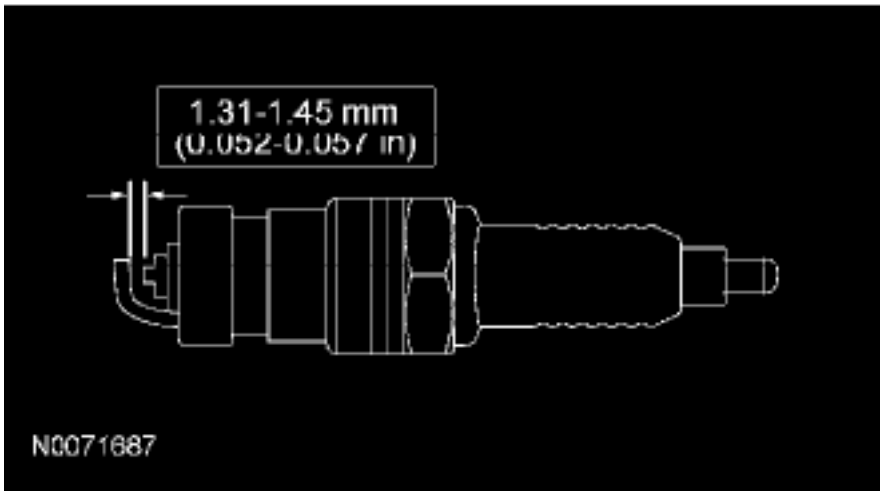
1. CAUTION:

- Spark plug wires must be connected correctly. Failure to follow this instruction may result in poor engine performance.

- Do not pull on the spark plug wire as it may separate from the spark plug wire connector inside the spark plug wire boot.

Use the Spark Plug Wire Remover to grasp and twist the spark plug wire boot back and forth on the spark plug insulator to release the connectors.





2. Loosen the spark plugs. 3. Remove any foreign material from the spark plug areas of the cylinder head with compressed air. 4. Remove the spark plugs.

- To install, tighten to 15 Nm (11 lb-ft).

5. Inspect the spark plugs. 6. Adjust the spark plug gap as necessary.

7. To install, reverse the removal procedure.

- Use a small, clean tool to coat the entire interior surface of the boot with silicone brake caliper grease.

Compression Pressure Limit Chart

Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure
924 kPa (134 psi)	696 kPa (101 psi)	1,131 kPa (164 psi)	848 kPa (123 psi)	1,338 kPa (194 psi)	1,000 kPa (146 psi)	1,544 kPa (224 psi)	1,158 kPa (168 psi)
938 kPa (136 psi)	703 kPa (102 psi)	1,145 kPa (166 psi)	855 kPa (124 psi)	1,351 kPa (196 psi)	1,014 kPa (147 psi)	1,558 kPa (226 psi)	1,165 kPa (169 psi)

Compression Pressure Limit Chart (Continued)

Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure
952 kPa (138 psi)	717 kPa (104 psi)	1,158 kPa (168 psi)	869 kPa (126 psi)	1,365 kPa (198 psi)	1,020 kPa (148 psi)	1,572 kPa (228 psi)	1,179 kPa (171 psi)
965 kPa (140 psi)	724 kPa (106 psi)	1,172 kPa (170 psi)	876 kPa (127 psi)	1,379 kPa (200 psi)	1,034 kPa (150 psi)	1,586 kPa (230 psi)	1,186 kPa (172 psi)
979 kPa (142 psi)	738 kPa (107 psi)	1,186 kPa (172 psi)	889 kPa (129 psi)	1,303 kPa (202 psi)	1,041 kPa (151 psi)	1,600 kPa (232 psi)	1,200 kPa (174 psi)
933 kPa (144 psi)	745 kPa (109 psi)	1,200 kPa (174 psi)	903 kPa (131 psi)	1,407 kPa (204 psi)	1,055 kPa (153 psi)	1,055 kPa (153 psi)	1,207 kPa (175 psi)
1,007 kPa (146 psi)	758 kPa (110 psi)	1,214 kPa (176 psi)	910 kPa (132 psi)	1,420 kPa (206 psi)	1,062 kPa (154 psi)	1,627 kPa (154 psi)	1,220 kPa (177 psi)
1,020 kPa (148 psi)	765 kPa (111 psi)	1,227 kPa (178 psi)	917 kPa (133 psi)	1,434 kPa (208 psi)	1,075 kPa (156 psi)	1,641 kPa (238 psi)	1,227 kPa (178 psi)
1,034 kPa (150 psi)	779 kPa (113 psi)	1,241 kPa (180 psi)	931 kPa (135 psi)	1,448 kPa (210 psi)	1,083 kPa (157 psi)	1,655 kPa (240 psi)	1,241 kPa (180 psi)
1,048 kPa (152 psi)	786 kPa (114 psi)	1,255 kPa (182 psi)	936 kPa (136 psi)	1,462 kPa (212 psi)	1,089 kPa (158 psi)	1,669 kPa (242 psi)	1,248 kPa (181 psi)
1,062 kPa (154 psi)	793 kPa (115 psi)	1,269 kPa (184 psi)	952 kPa (138 psi)	1,476 kPa (214 psi)	1,103 kPa (160 psi)	1,682 kPa (244 psi)	1,262 kPa (183 psi)
1,076 kPa (156 psi)	807 kPa (117 psi)	1,282 kPa (186 psi)	965 kPa (140 psi)	1,489 kPa (216 psi)	1,117 kPa (162 psi)	1,696 kPa (246 psi)	1,269 kPa (184 psi)
1,089 kPa (158 psi)	814 kPa (118 psi)	1,296 kPa (188 psi)	972 kPa (141 psi)	1,503 kPa (218 psi)	1,124 kPa (163 psi)	1,710 kPa (248 psi)	1,202 kPa (186 psi)
1,103 kPa (160 psi)	827 kPa (120 psi)	1,310 kPa (190 psi)	979 kPa (142 psi)	1,517 kPa (220 psi)	1,138 kPa (165 psi)	1,724 kPa (250 psi)	1,289 kPa (187 psi)
1,110 kPa (161 psi)	834 kPa (121 psi)	1,324 kPa (192 psi)	993 kPa (144 psi)	1,631 kPa (222 psi)	1,145 kPa (166 psi)	—	—

Compression Check: Specifications

Compression Pressure Limit Chart

The indicated compression pressures are considered within specification if the lowest reading cylinder is at least 75% of the highest reading.

Compression Pressure Limit Chart (Part 1)

Compression Pressure Limit Chart (Part 2)

Compression Pressure Limit Chart

Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure
924 kPa (134 psi)	696 kPa (101 psi)	1,131 kPa (164 psi)	848 kPa (123 psi)	1,338 kPa (194 psi)	1,000 kPa (146 psi)	1,544 kPa (224 psi)	1,158 kPa (168 psi)
938 kPa (136 psi)	703 kPa (102 psi)	1,145 kPa (166 psi)	855 kPa (124 psi)	1,351 kPa (196 psi)	1,014 kPa (147 psi)	1,558 kPa (226 psi)	1,165 kPa (169 psi)

Compression Pressure Limit Chart (Continued)

Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure
952 kPa (138 psi)	717 kPa (104 psi)	1,158 kPa (168 psi)	869 kPa (126 psi)	1,365 kPa (198 psi)	1,020 kPa (148 psi)	1,572 kPa (228 psi)	1,179 kPa (171 psi)
965 kPa (140 psi)	724 kPa (106 psi)	1,172 kPa (170 psi)	876 kPa (127 psi)	1,379 kPa (200 psi)	1,034 kPa (150 psi)	1,586 kPa (230 psi)	1,186 kPa (172 psi)
979 kPa (142 psi)	738 kPa (107 psi)	1,186 kPa (172 psi)	889 kPa (129 psi)	1,303 kPa (202 psi)	1,041 kPa (151 psi)	1,600 kPa (232 psi)	1,200 kPa (174 psi)
933 kPa (144 psi)	745 kPa (109 psi)	1,200 kPa (174 psi)	903 kPa (131 psi)	1,407 kPa (204 psi)	1,055 kPa (153 psi)	1,055 kPa (153 psi)	1,207 kPa (175 psi)
1,007 kPa (146 psi)	758 kPa (110 psi)	1,214 kPa (176 psi)	910 kPa (132 psi)	1,420 kPa (206 psi)	1,062 kPa (154 psi)	1,627 kPa (154 psi)	1,220 kPa (177 psi)
1,020 kPa (148 psi)	765 kPa (111 psi)	1,227 kPa (178 psi)	917 kPa (133 psi)	1,434 kPa (208 psi)	1,075 kPa (156 psi)	1,641 kPa (238 psi)	1,227 kPa (178 psi)
1,034 kPa (150 psi)	779 kPa (113 psi)	1,241 kPa (180 psi)	931 kPa (135 psi)	1,448 kPa (210 psi)	1,083 kPa (157 psi)	1,655 kPa (240 psi)	1,241 kPa (180 psi)
1,048 kPa (152 psi)	786 kPa (114 psi)	1,255 kPa (182 psi)	936 kPa (136 psi)	1,462 kPa (212 psi)	1,089 kPa (158 psi)	1,669 kPa (242 psi)	1,248 kPa (181 psi)
1,062 kPa (154 psi)	793 kPa (115 psi)	1,269 kPa (184 psi)	952 kPa (138 psi)	1,476 kPa (214 psi)	1,103 kPa (160 psi)	1,682 kPa (244 psi)	1,262 kPa (183 psi)
1,076 kPa (156 psi)	807 kPa (117 psi)	1,282 kPa (186 psi)	965 kPa (140 psi)	1,489 kPa (216 psi)	1,117 kPa (162 psi)	1,696 kPa (246 psi)	1,269 kPa (184 psi)
1,089 kPa (158 psi)	814 kPa (118 psi)	1,296 kPa (188 psi)	972 kPa (141 psi)	1,503 kPa (218 psi)	1,124 kPa (163 psi)	1,710 kPa (248 psi)	1,202 kPa (186 psi)
1,103 kPa (160 psi)	827 kPa (120 psi)	1,310 kPa (190 psi)	979 kPa (142 psi)	1,517 kPa (220 psi)	1,138 kPa (165 psi)	1,724 kPa (250 psi)	1,289 kPa (187 psi)
1,110 kPa (161 psi)	834 kPa (121 psi)	1,324 kPa (192 psi)	993 kPa (144 psi)	1,631 kPa (222 psi)	1,145 kPa (166 psi)	—	—

Compression Check: Testing and Inspection

Compression Test - Compression Gauge Check

1. Make sure the oil in the crankcase is of the correct viscosity and at the correct level and that the battery is correctly charged. Operate the vehicle

until the engine is at normal operating temperature. Turn the ignition switch to the OFF position, then remove all the spark plugs.

2. Set the throttle plates in the wide-open position. 3. Install a compression gauge such as the Compression Tester in the No. 1 cylinder. 4. Install an auxiliary starter switch in the starting circuit. With the ignition switch in the OFF position, and using the auxiliary starter switch, crank

the engine a minimum of 5 compression strokes and record the highest reading. Note the approximate number of compression strokes required to obtain the highest reading.

5. Repeat the test on each cylinder, cranking the engine approximately the same number of compression strokes.

Compression Test - Test Results

The indicated compression pressures are considered within specification if the lowest reading cylinder is at least 75% of the highest reading. Refer to the Compression Pressure Limit Chart.

Compression Pressure Limit Chart

Compression Pressure Limit Chart (Part 1)

Compression Pressure Limit Chart (Part 2)

If one or more cylinders read low, squirt approximately one tablespoon of engine oil on top of the pistons in the low-reading cylinders. Repeat the

compression pressure check on these cylinders.

Compression Test - Interpreting Compression Readings

1. If compression improves considerably, piston rings are faulty. 2. If compression does not improve, valves are sticking or seating incorrectly. 3. If 2 adjacent cylinders indicate low compression pressures and squirting oil on each piston does not increase compression, the head gasket may be

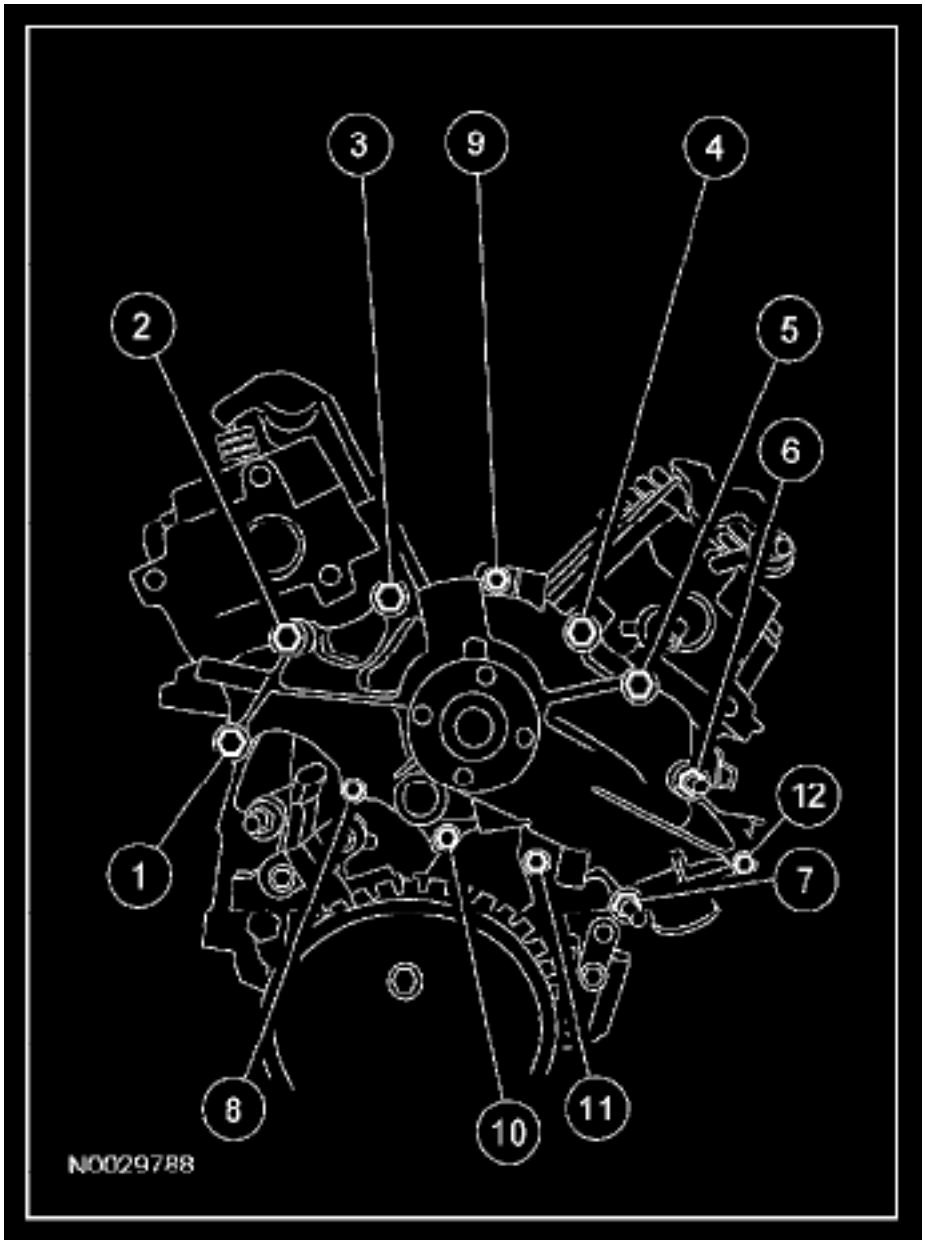
leaking between cylinders. Engine oil or coolant in cylinders could result from this condition.

Use the Compression Pressure Limit Chart when checking cylinder compression so that the lowest reading is within 75% of the highest reading.

Valve Clearance: Specifications

Valve Clearance

This engine is equipped with hydraulic valve lifters. No adjustment is required.

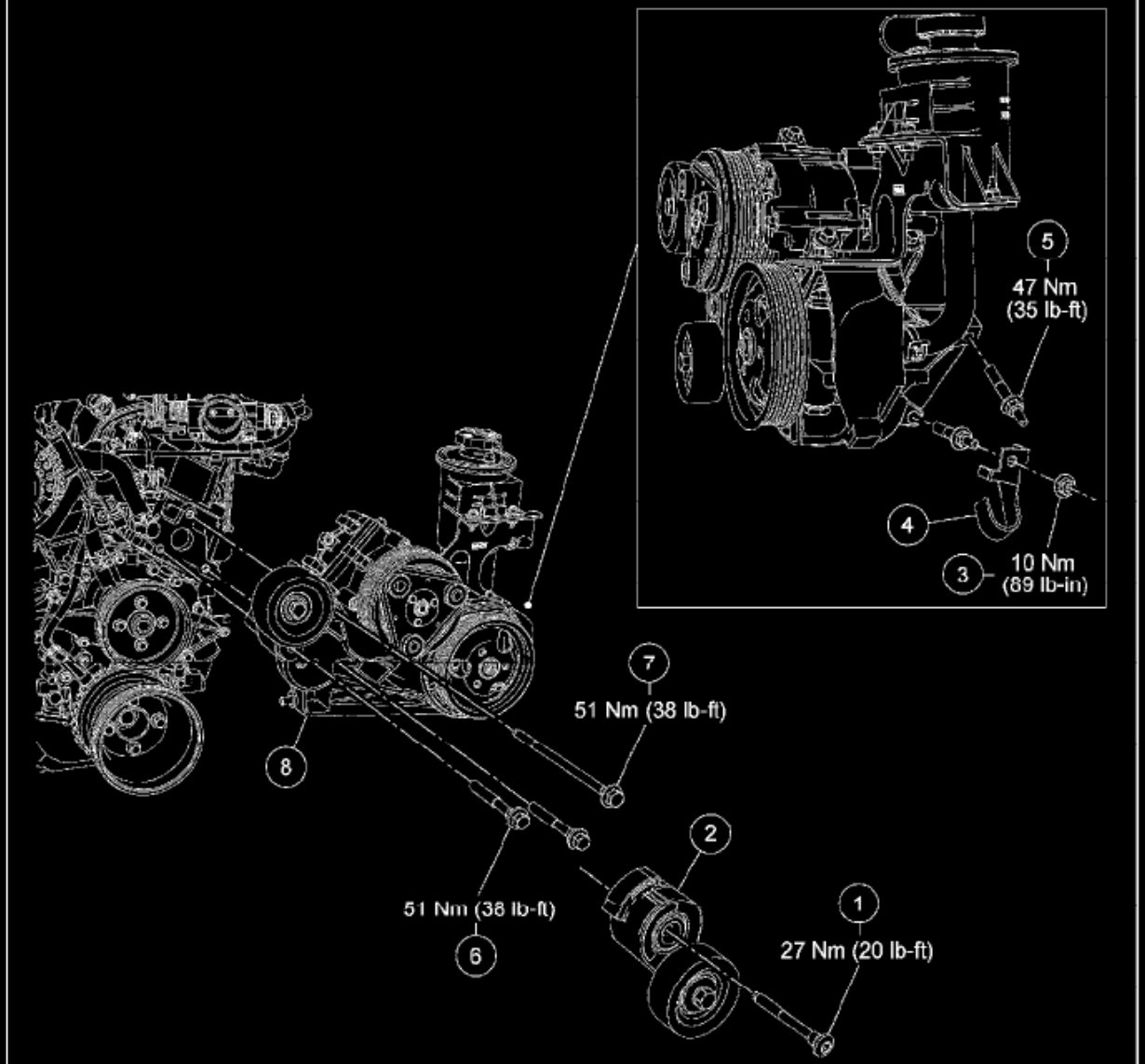


Water Pump: Specifications

Coolant pump 10 bolts and 2 stud bolts:

bolts 1-7 ..... 25 Nm (18 lb-ft) bolts 8-12 ..... 10 Nm (89 lb-inch)

LH Accessory Drive Bracket



Item	Part Number	Description
1	—	Accessory drive belt tensioner bolt (part of 6B209)
2	6B209	Accessory drive belt tensioner
3	W620481	Battery cable bracket nut
4	7B085	Battery cable bracket (part of 14A280)

(Continued)

Item	Part Number	Description
5	N807123	A/C compressor mounting stud bolt (2 required)
6	N606068	A/C compressor mounting bolt (2 required)
7	N807124	A/C compressor mounting bolt
8	19E708	A/C compressor mounting bracket

Water Pump: Service and Repair

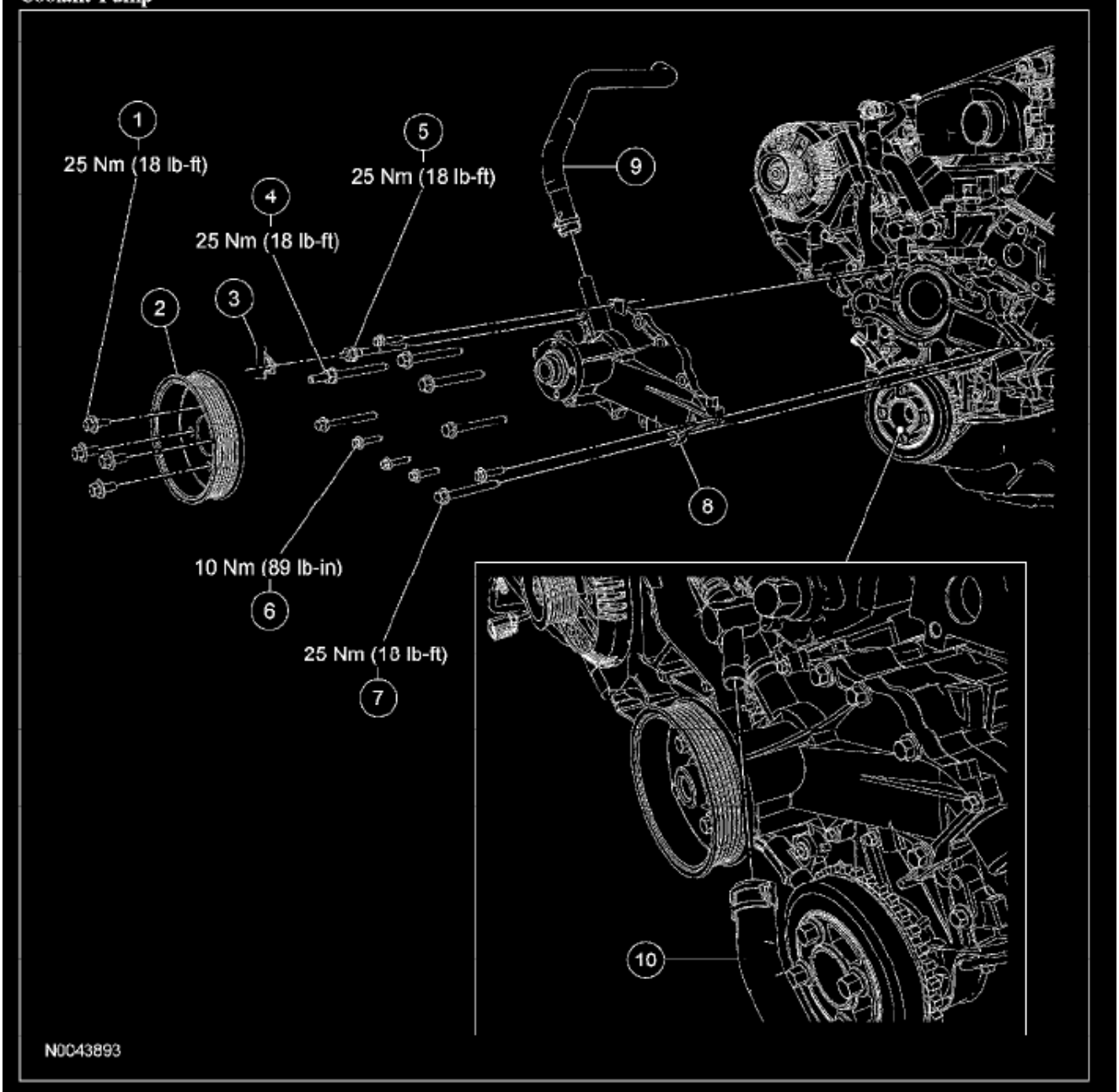
Coolant Pump - 3.0L

LH Accessory Drive Bracket

LH Accessory Drive Bracket

Coolant Pump

Coolant Pump



Item	Part Number	Description
1	N605784	Coolant pump pulley bolt
2	8A528	Coolant pump pulley
3	13A506	Wiring harness retainer (part of 12B637)
4	W807515	Coolant pump stud bolt
5	W708249	Coolant pump stud bolt

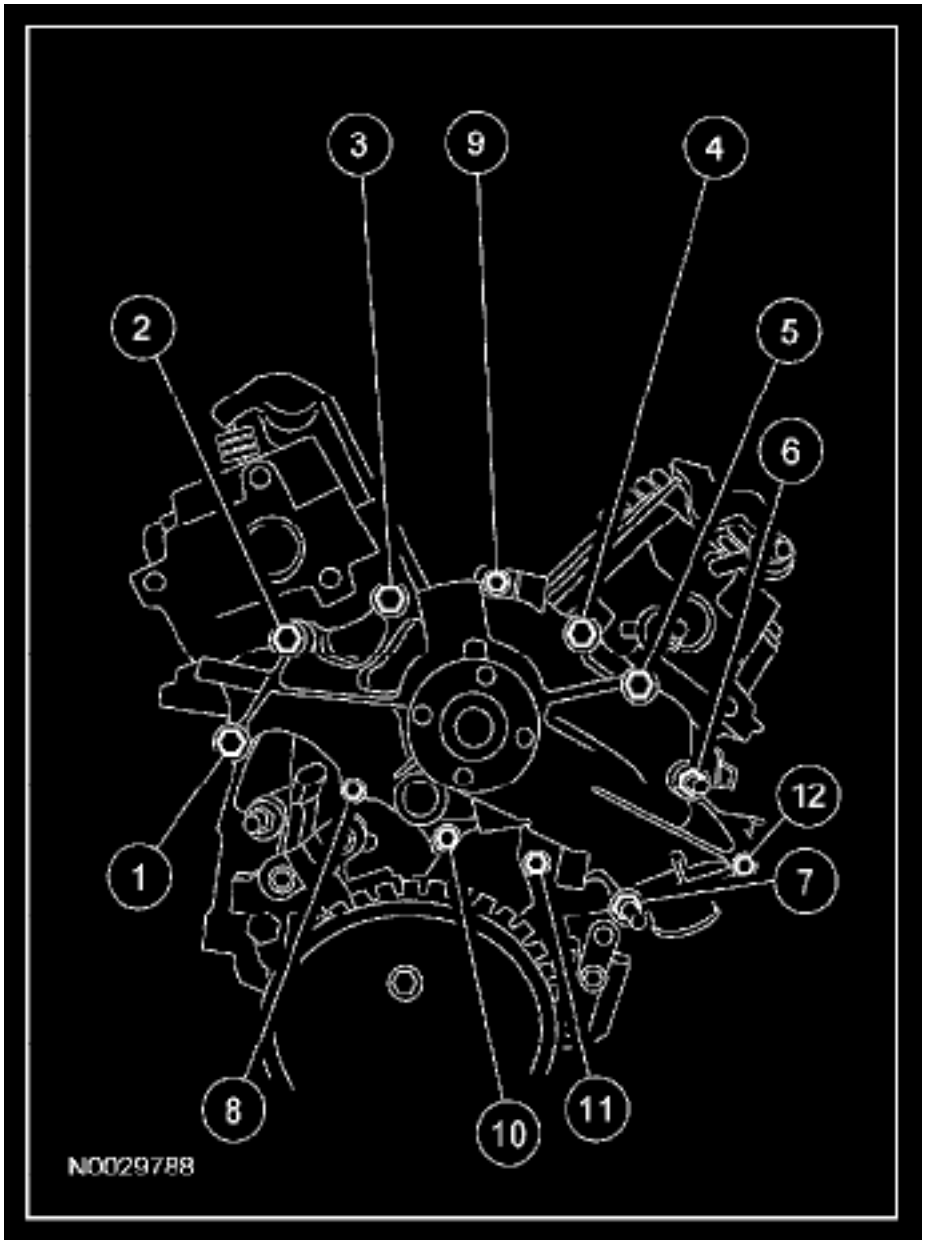
(Continued)

Item	Part Number	Description
6	N804576	Coolant pump bolt (5 required)
7	N811375	Coolant pump bolt (5 required)
8	8501	Coolant pump
9	18472	Heater hose
10	—	Bypass hose (part of 8B273)

Coolant Pump

Removal

1. Drain the cooling system. 2. Remove the air cleaner outlet tube. 3. Remove the accessory drive belt. 4. Remove the fan blade and the fan shroud. 5. Remove the bolts and the coolant pump pulley. 6. Disconnect the heater hose. 7. Disconnect the wiring harness retainer. 8. Remove the nut and detach the battery cable bracket. 9. Remove the side stud bolts from the A/C compressor mounting bracket.



10. Disconnect the bypass hose. 11. Remove the bolt and the accessory drive belt tensioner. 12. Remove the front bolts and position the A/C compressor mounting bracket aside. 13. Remove the bolts and the coolant pump. 14. Clean the sealing surfaces.

Installation

1. Position the coolant pump and loosely install the 10 bolts and 2 stud bolts.

^ Tighten bolts 1-7 in the sequence shown to 25 Nm (18 lb-ft).

^ Tighten bolts 8-12 in the sequence shown to 10 Nm (89 lb-inch).

2. Position the A/C compressor mounting bracket and install the front bolts.

^ Tighten to 51 Nm (38 lb-ft).

3. Position the accessory drive belt tensioner and install the bolt.

^ Tighten to 27 Nm (20 lb-ft).

4. Connect the bypass hose. 5. Install the A/C compressor mounting bracket side stud bolts.

^ Tighten to 47 Nm (35 lb-ft).

6. Position the battery cable bracket and install the nut.

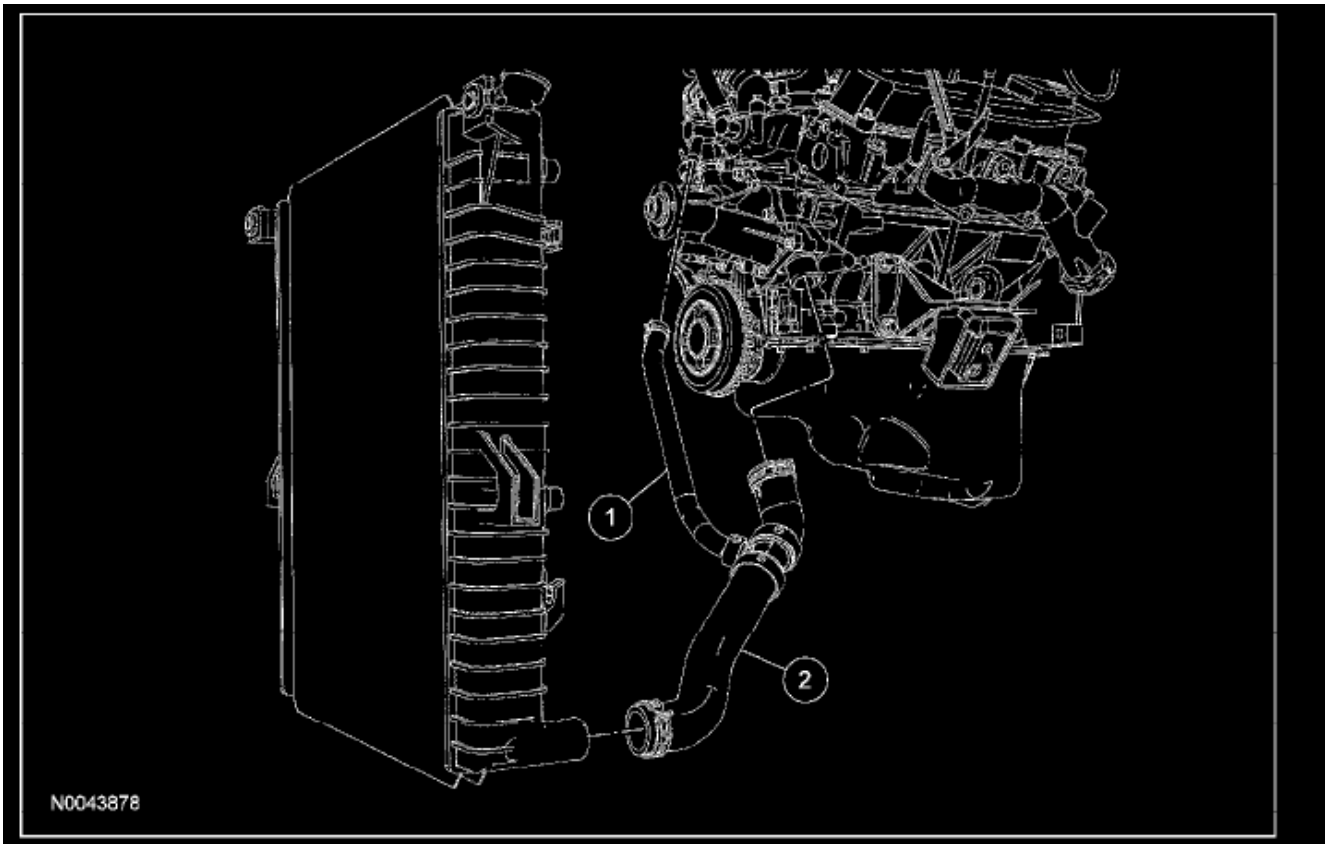
^ Tighten to 10 Nm (89 lb-inch).

7. Install the coolant pump pulley.

^ Tighten to 25 Nm (18 lb-ft).

8. Install the accessory drive belt. 9. Attach the wiring harness retainer.

10. Connect the heater hose. 11. Install the fan blade and fan shroud. 12. Install the air cleaner outlet tube. 13. Fill the cooling system.



Item	Part Number	Description
1	—	Bypass tube (part of 8286)
2	8286	Lower radiator hose

Thermostat Bypass Hose: Service and Repair

Bypass Tube - 3.0L

Removal and Installation

NOTE: The bypass tube and the lower radiator hose are a molded, one-piece assembly.

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Drain the cooling system. 3. Disconnect the bypass tube from the water pump. 4. Disconnect the lower radiator hose from the engine. 5. Disconnect the lower radiator hose from the radiator and remove the lower radiator hose. 6. To install, reverse the removal procedure.

Coolant: Capacity Specifications

Coolant Capacity:

Manual Transmission ..... 15.1 qts (14.3L)

Automatic Transmission ..... 14.8 qts (14.0L)

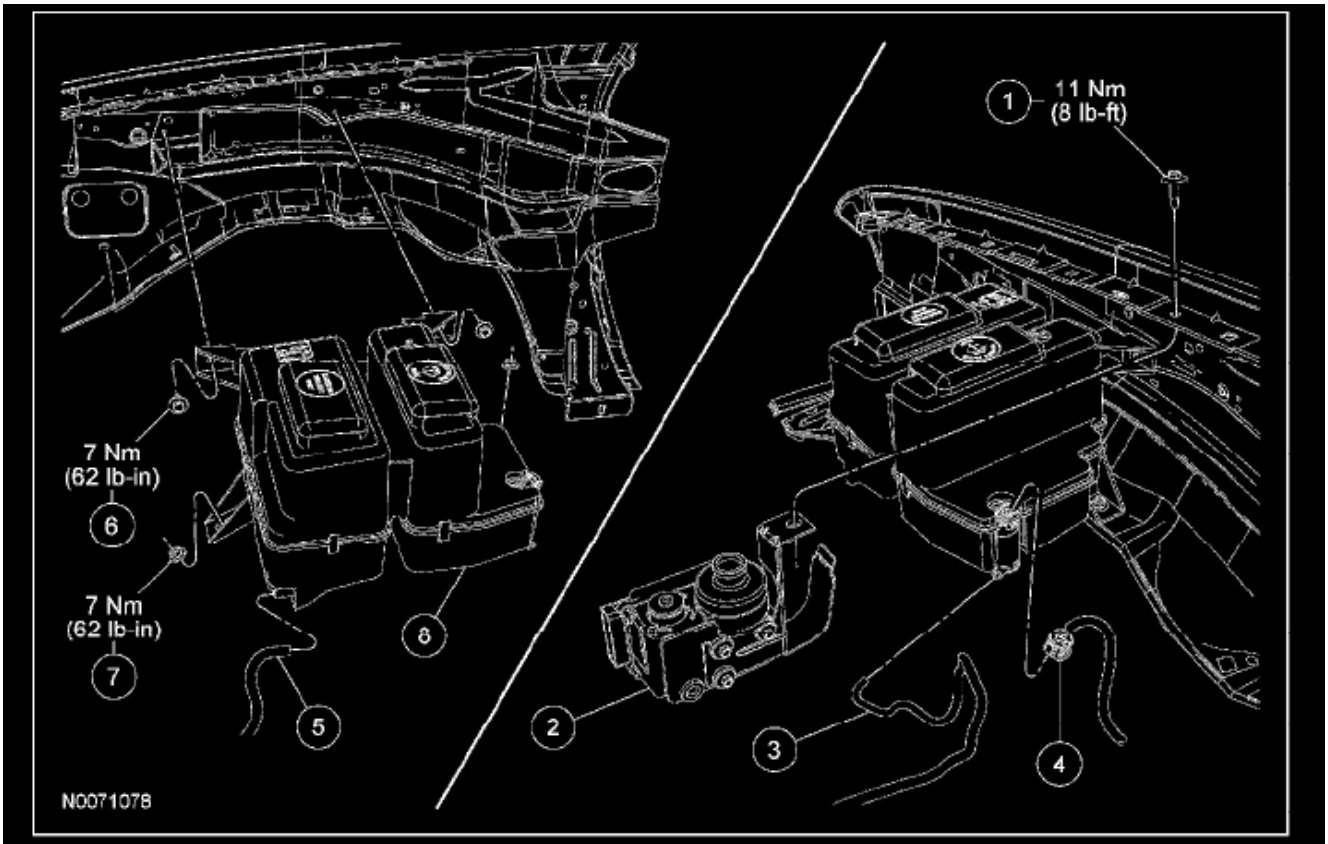
Coolant: Fluid Type Specifications

Engine Coolant

.....

Motorcraft Premium Gold Engine Coolant

Note: Add the coolant type originally equipped in your vehicle.



Item	Part Number	Description
1	N811664	Speed control servo bolt
2	9C734	Speed control servo
3	17K605	Windshield washer hose
4	14A464	Windshield washer motor electrical connector (part of 14290)
5	8W005	Radiator overflow hose
6	N611102	Coolant expansion tank bolt (2 required)
7	N621906	Coolant expnasion tank nut (2 required)
8	17B613	Coolant expansion tank

Coolant Reservoir: Service and Repair

Coolant Expansion Tank - 3.0L, 4.0L

Removal and Installation

1. Remove the air cleaner. 2. If equipped, remove the speed control servo bolt and position the servo aside.

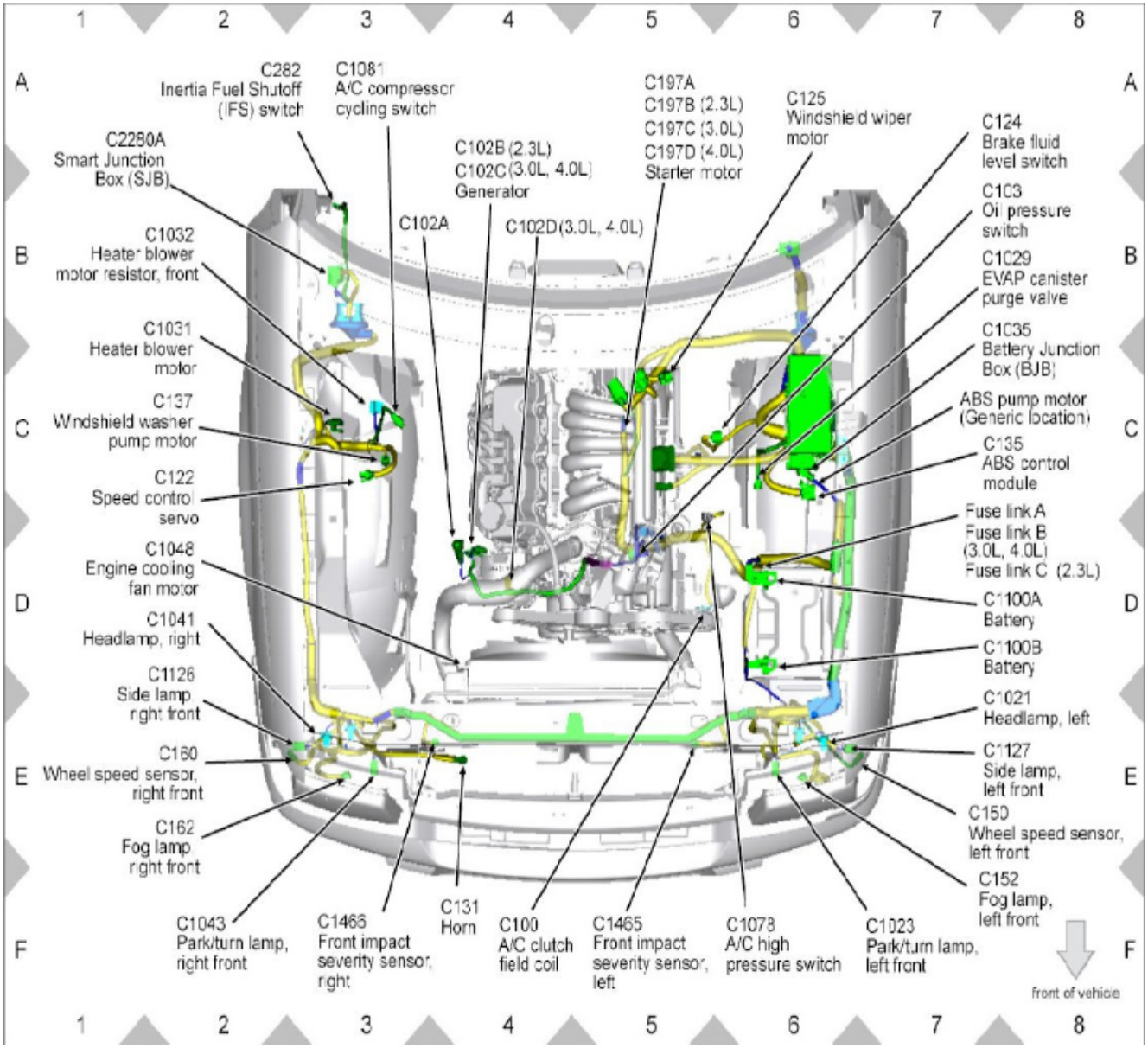
^ To install, tighten to 11 Nm (8 lb-ft).

3. Disconnect the windshield washer hose. 4. Disconnect the windshield washer motor electrical connector. 5. Disconnect the overflow hose at the coolant expansion tank and drain the coolant into a suitable container. 6. Remove the 2 bolts, the 2 nuts and the coolant expansion tank.

^ To install, tighten to 7 Nm (62 lb-inch).

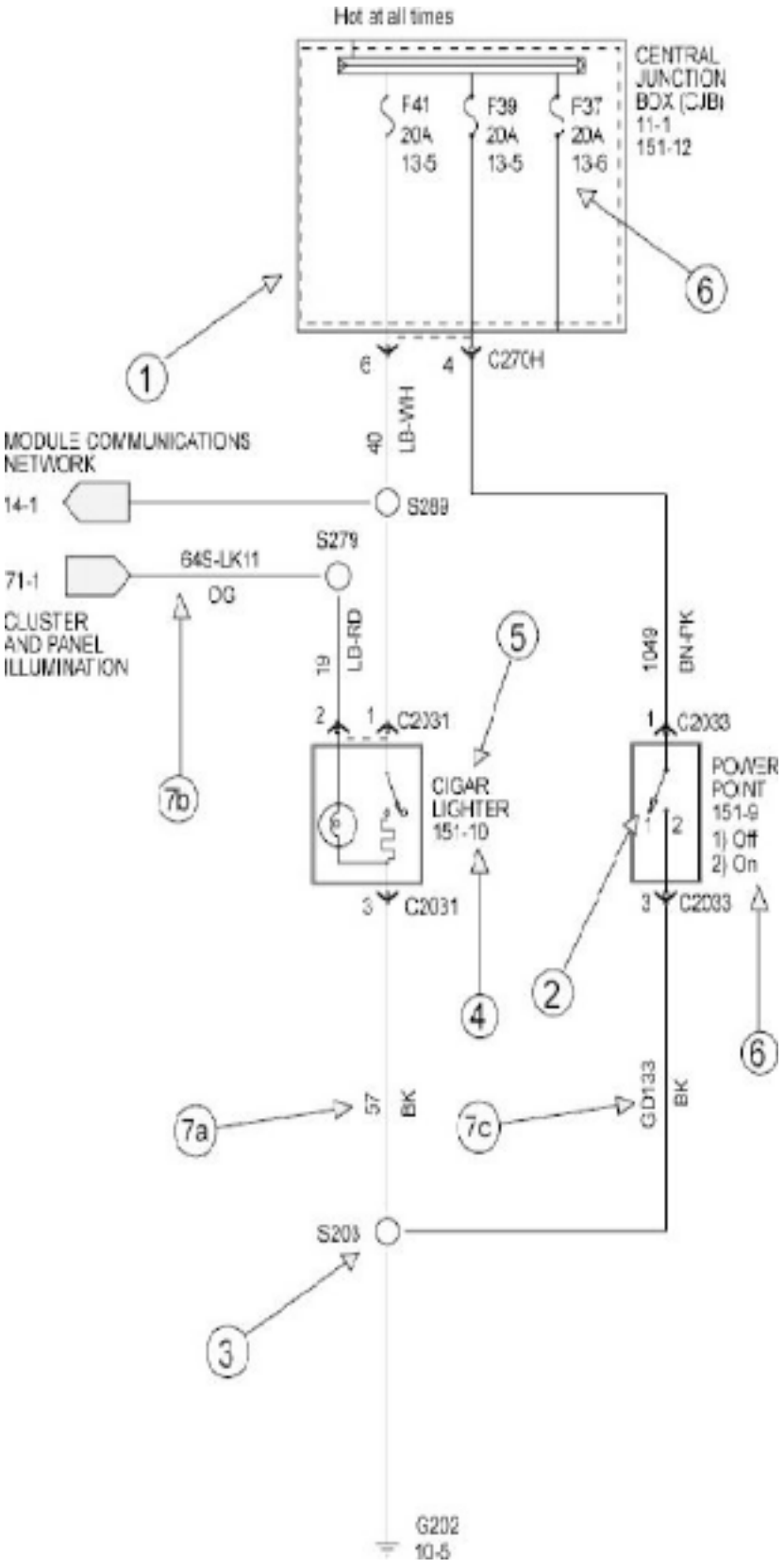
7. To install, reverse the removal procedure.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Engine, Cooling and Exhaust > Cooling System > Radiator Cooling Fan > Radiator Cooling Fan Motor > Component Information > Locations



View 151-1

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Engine, Cooling and Exhaust > Cooling System > Radiator Cooling Fan > Radiator Cooling Fan Motor > Component Information > Diagrams > Diagram Information and Instructions



Radiator Cooling Fan Motor: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

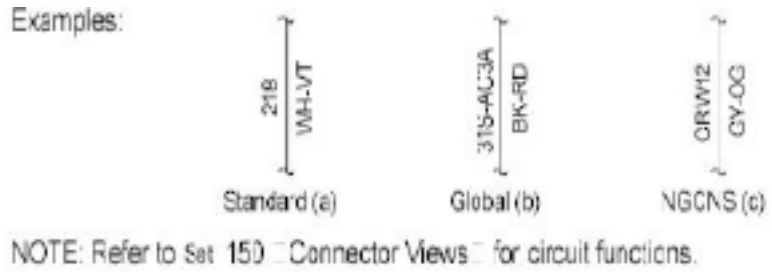
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

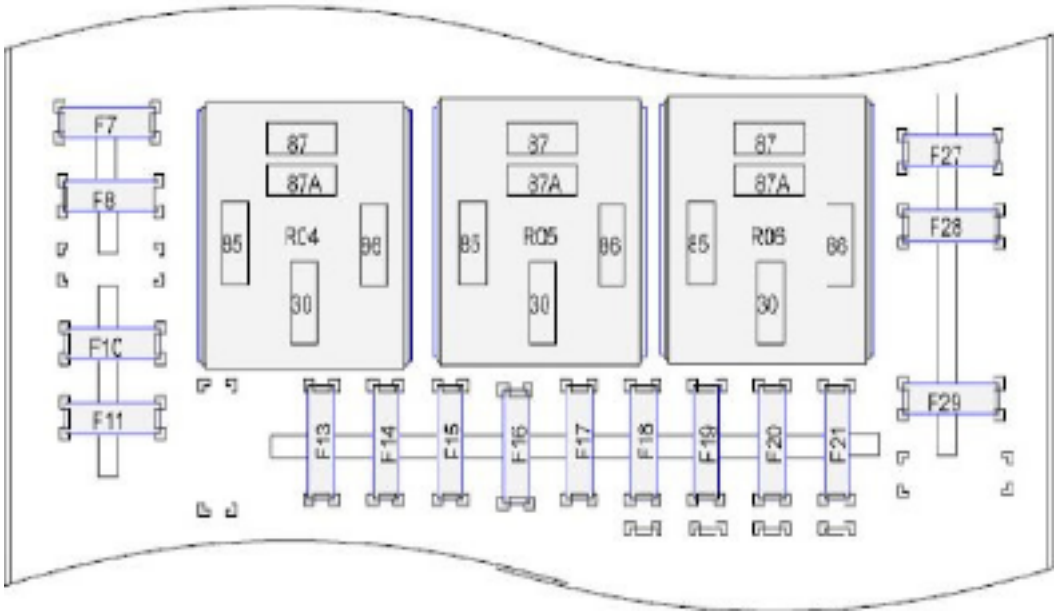
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

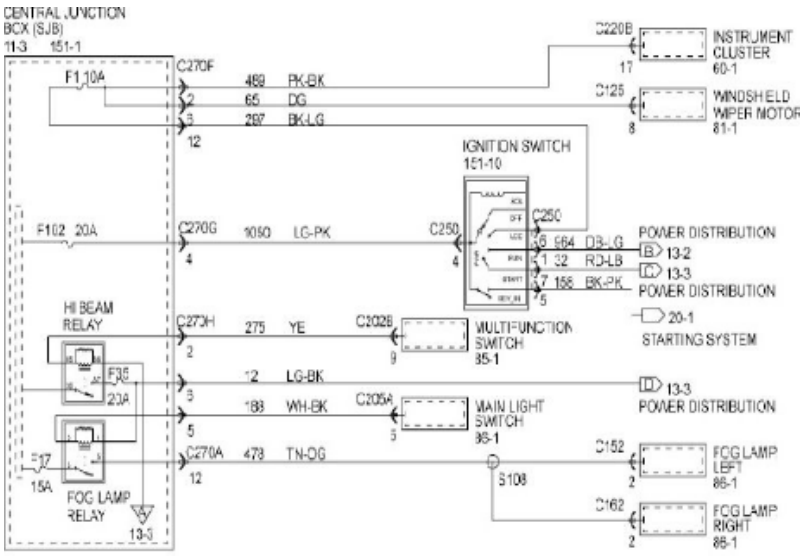
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

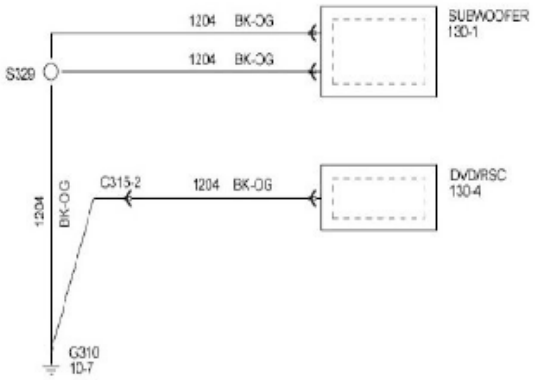
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

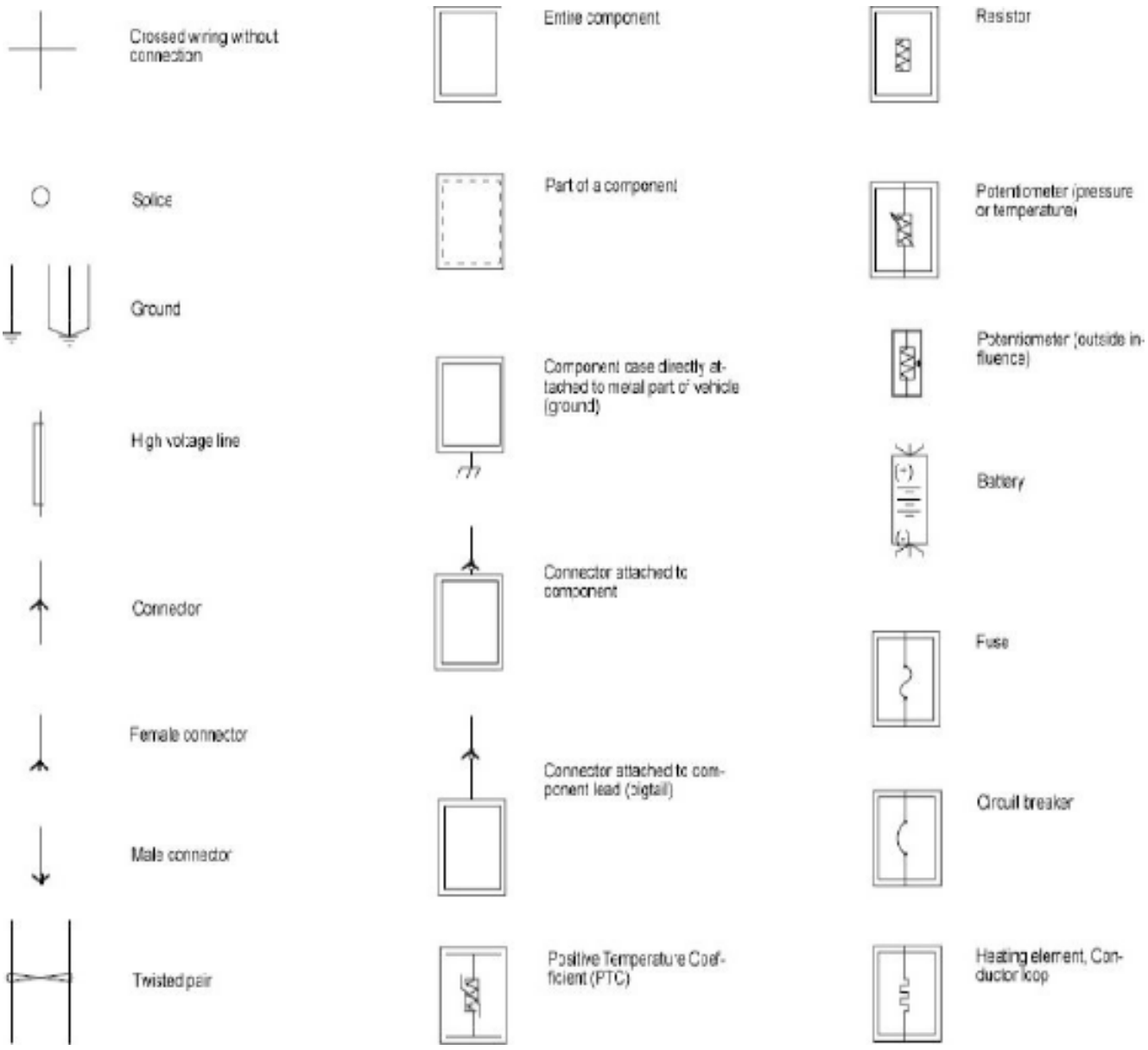
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

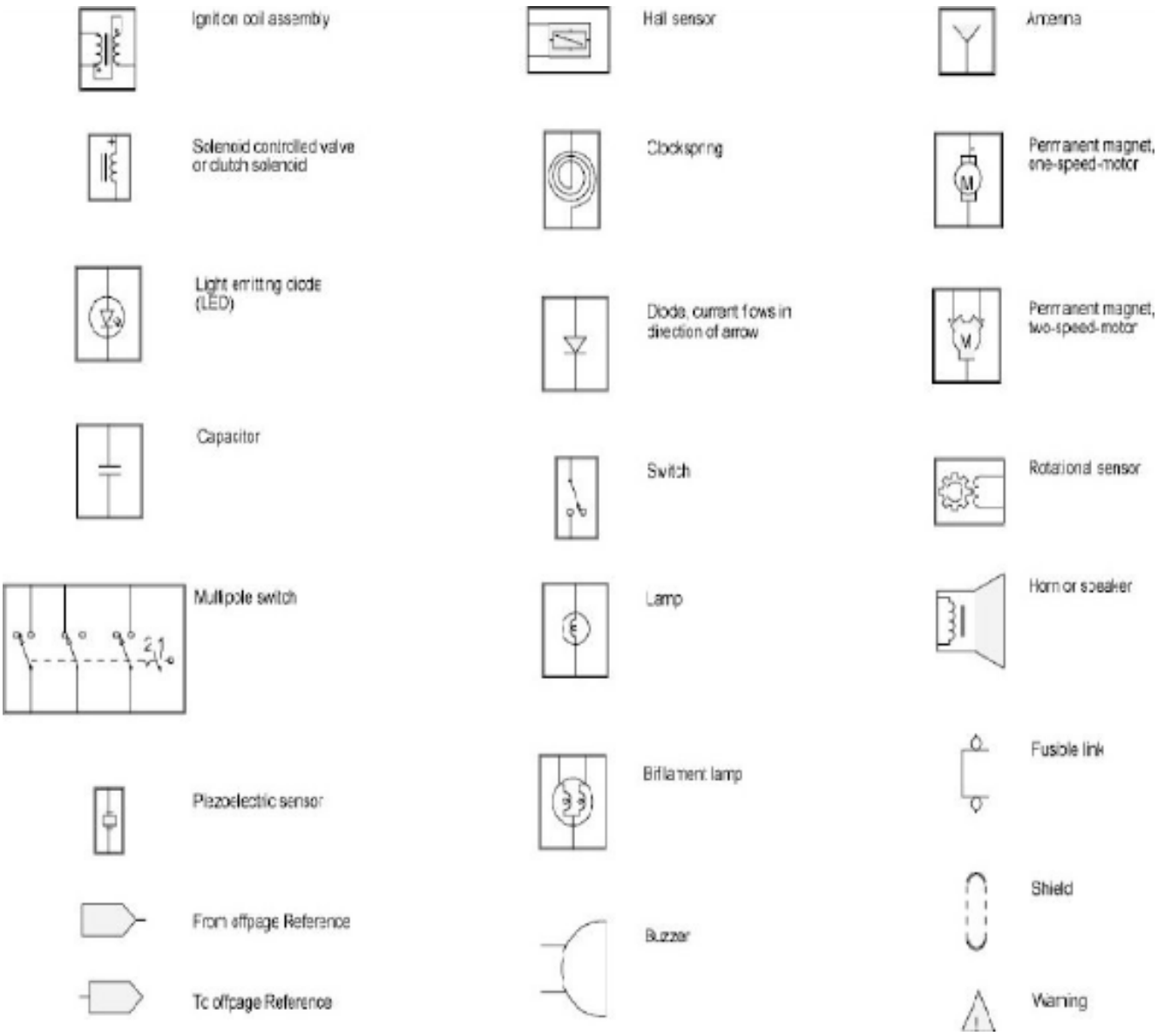
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

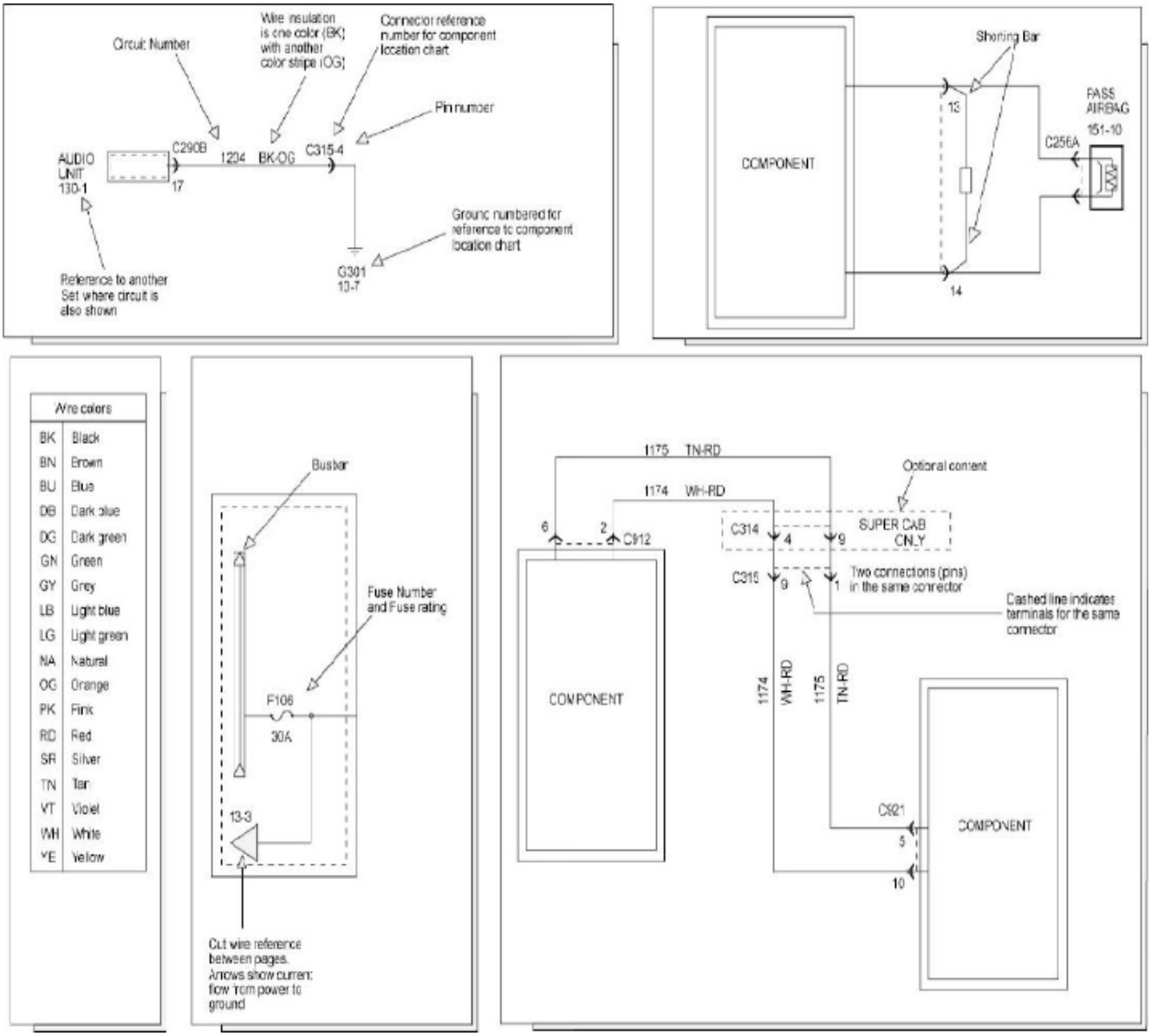
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

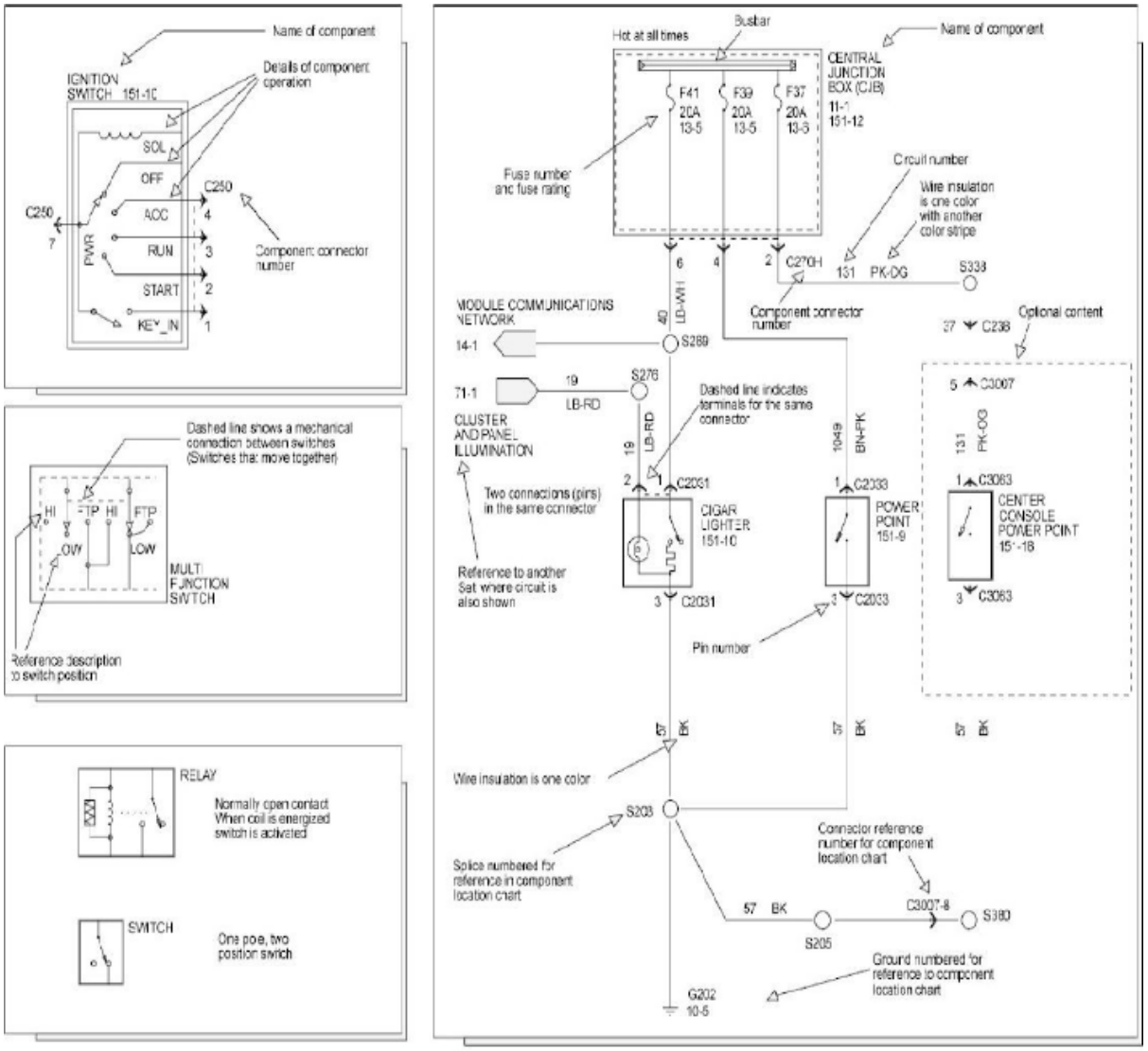
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

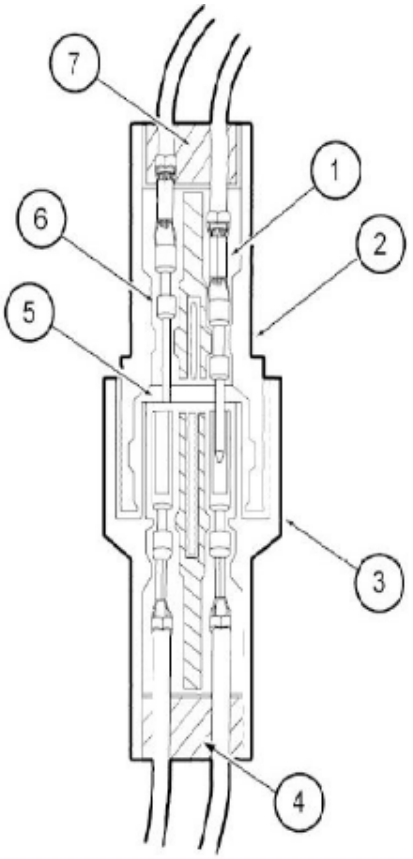


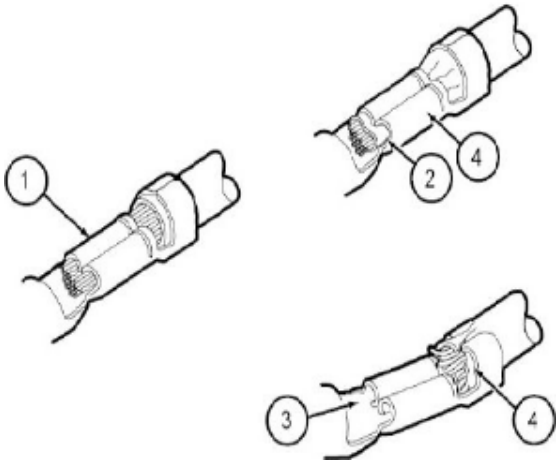
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Radiator Cooling Fan Motor: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

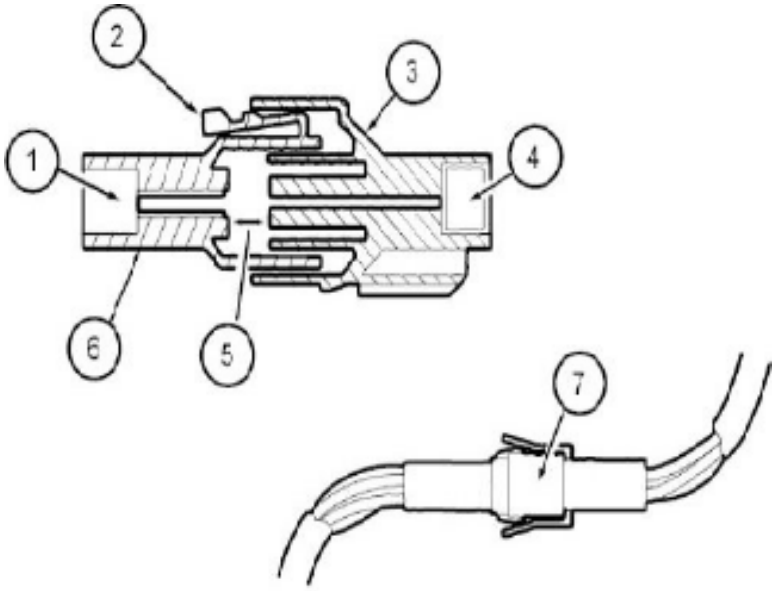
5 = Intermittent contact

6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
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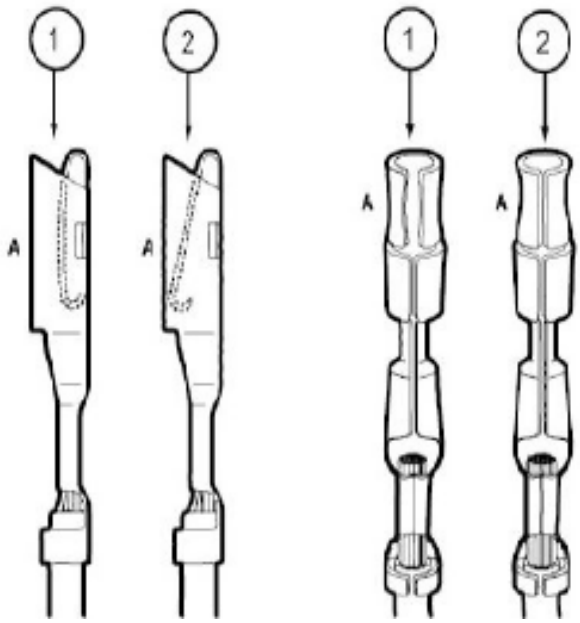
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

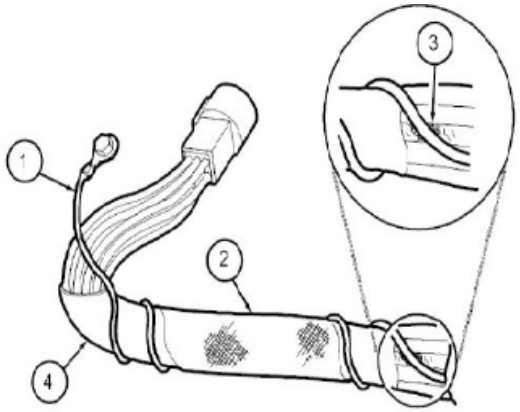
Deformed (enlarged) female terminals

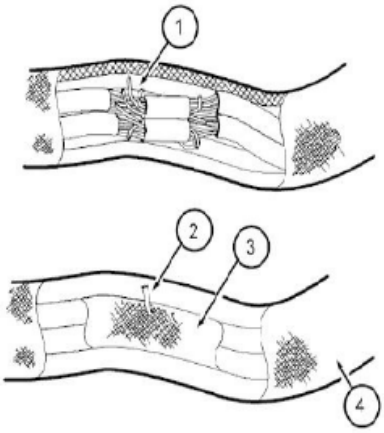
1 = Enlarged

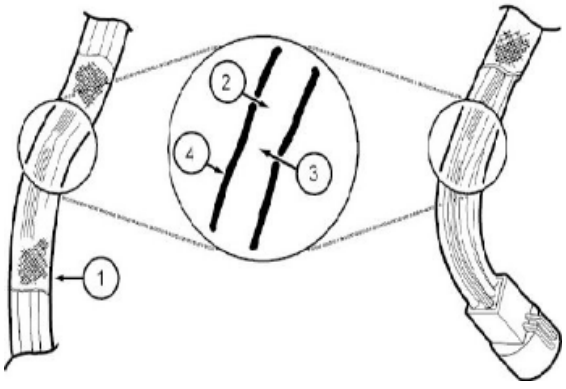
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

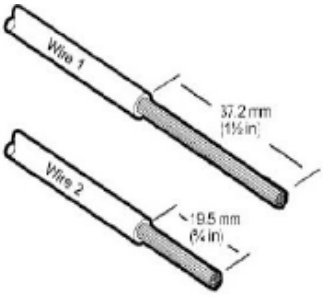
Splice covered 2

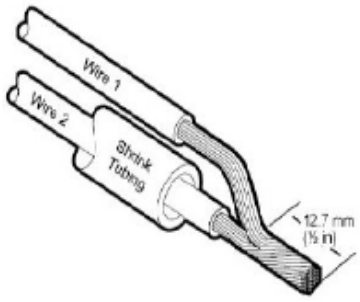
= Wire strand

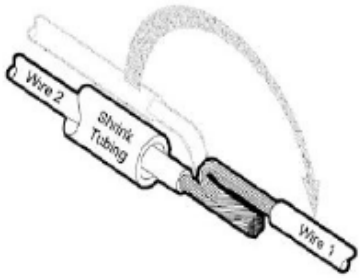
3 = Splice tape

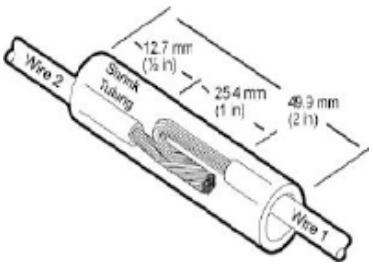
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

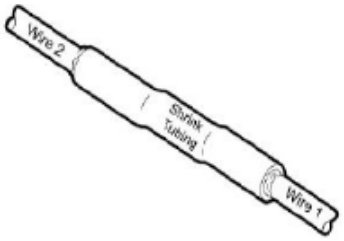
NOTE: -

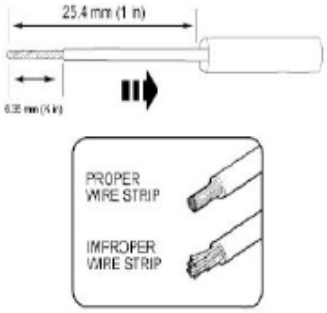
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

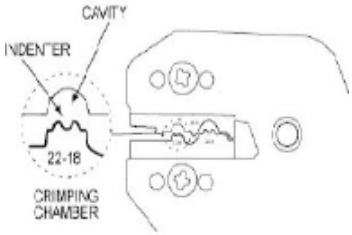
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

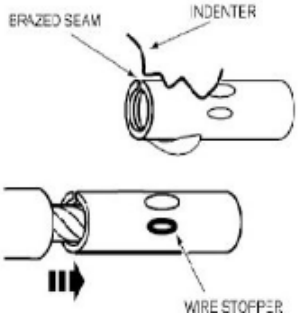
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
6.35 mm (¼ in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

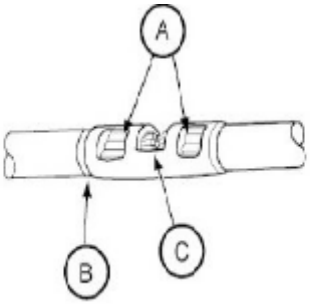
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

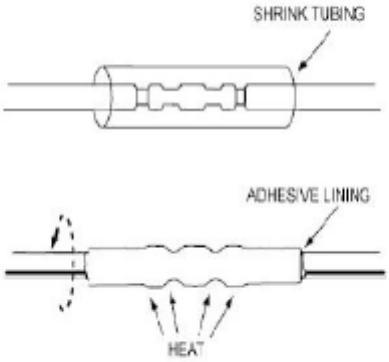
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4 strip, cut 9 strands	* 1/4 strip, cut 2 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip, fold 3x dia.
	16-14	* 1/4 strip, cut 7 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip fold 2x dia	1 strip, fold 3x dia.	1 1/4 strip, fold 4x dia.	Not Recommended
	12-10	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip fold 3x cia.	1 1/4 strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Figtail only

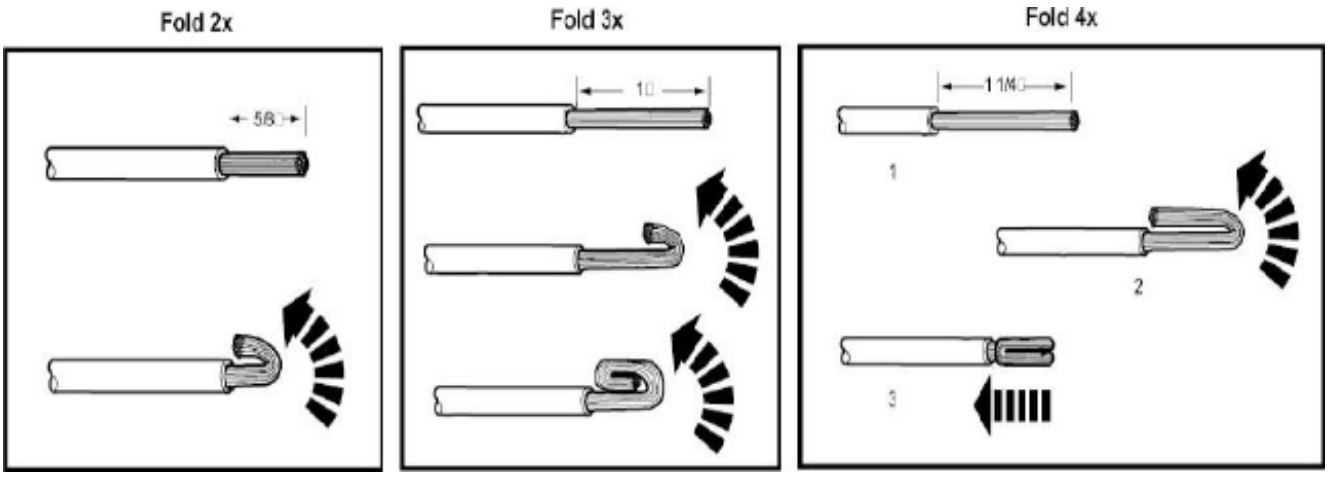
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

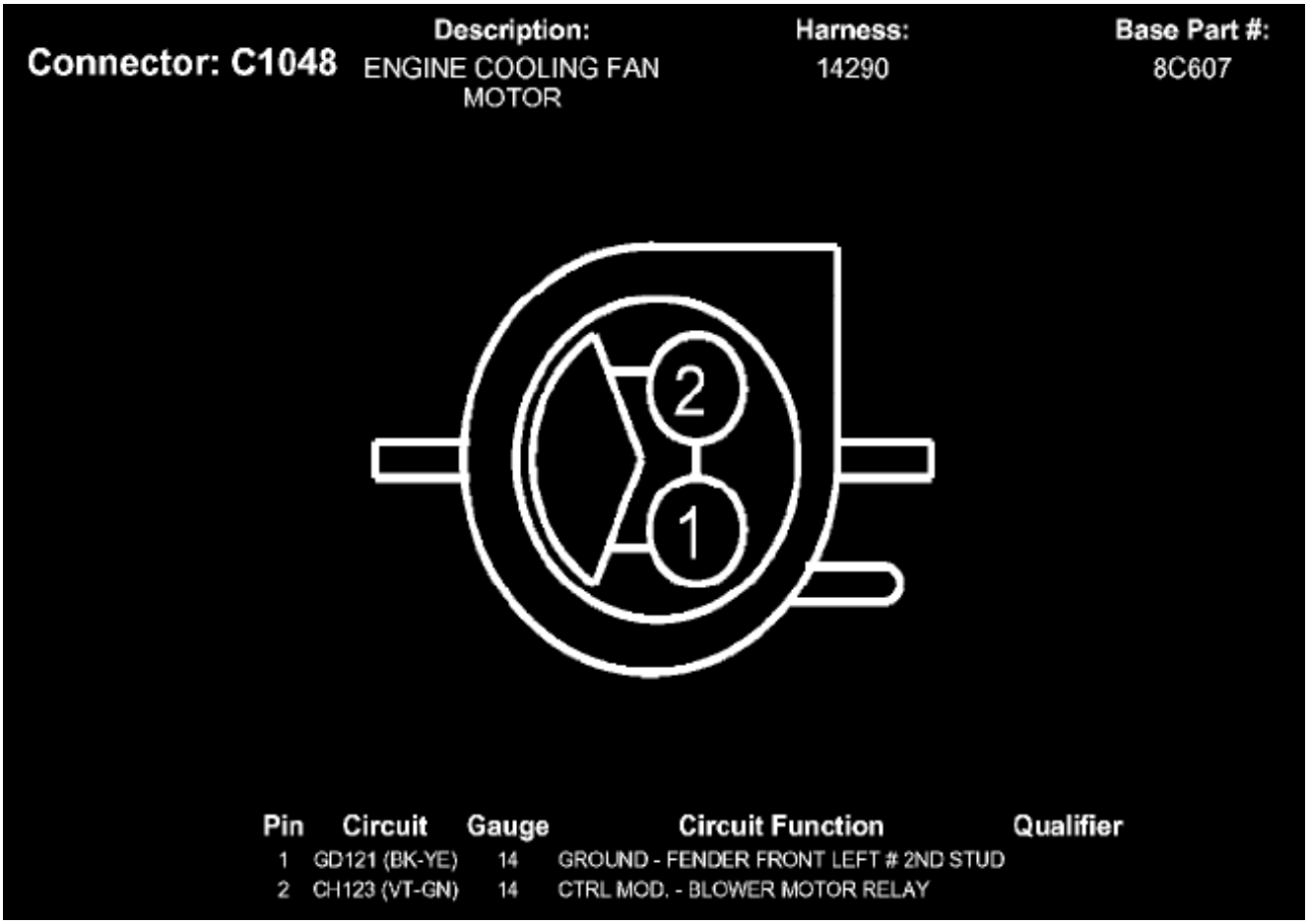
11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.


Connector: C1048
Description:
ENGINE COOLING FAN MOTOR
Harness:
14290
Base Part #:
8C607
2
1
Pin Circuit Gauge Circuit Function Qualifier
1 GD121 (BK-YE) 14 GROUND - FENDER FRONT LEFT # 2ND STUD
2 CH123 (VT-GN) 14 CTRL MOD. - BLOWER MOTOR RELAY

C1048

Radiator Cooling Fan Motor: Electrical Diagrams

For information regarding diagrams for this component, please refer to Cooling System Diagrams.

EDGE/MKX, TAURUS/TAURUS X/SABLE, FUSION/MILAN/MKZ, CROWN VICTORIA/GRAND MARQUIS, TOWN CAR: FCV DUTY CYCLE OUTPUT FROM PCM (negative duty cycle)

FCV Duty Cycle Command (NEGATIVE (-) duty cycle)	Cooling Fan Response/Speed
Greater than 0 but less than 5%	Fan off, controller inactive
Greater than 5% but less than 10%	Fan off, controller is in active/ready state
Edge/MKX, Crown Victoria/Grand Marquis, Town Car: 10% - 90%	Edge/MKX, Crown Victoria/Grand Marquis, Town Car: Linear speed increase from 30% to 100%
Taurus/Taurus X/Sable, Fusion/Milan/MKZ: 30% - 90%	Taurus/Taurus X/Sable, Fusion/Milan/MKZ: Linear speed increase from 50% to 100%
Greater than 90% but less than 95%	100%
Greater than 95% but less than 100%	Fan off

2.0L FOCUS (with A/C): PCM FC OUTPUT STATE FOR COOLING FAN SPEEDS

PCM OUTPUT	LOW SPEED	MEDIUM SPEED	HIGH SPEED	FAN OFF
LFC (FC1)	ON	ON	ON	OFF
MFC (FC2)	ON	OFF	ON	OFF
HFC (FC3)	ON	OFF	OFF	OFF

2.3L ESCAPE: PCM FC OUTPUT STATE FOR COOLING FAN SPEEDS

PCM OUTPUT	LOW SPEED	MEDIUM SPEED	HIGH SPEED	FAN OFF
LFC (FC1)	ON	ON	ON	OFF
MFC (FC2)	OFF	ON	OFF (or ON)	OFF
HFC (FC3)	OFF	OFF	ON	OFF

Radiator Cooling Fan Motor: Description and Operation

FAN CONTROL

The PCM monitors certain parameters (such as engine coolant temperature, vehicle speed, A/C on/off status, A/C pressure) to determine engine cooling fan needs.

For variable speed electric fan(s):

Edge/MKX, Taurus/Taurus X/Sable, Fusion/Milan/MKZ, Crown Victoria/Grand Marquis, Town Car: FCV Duty Cycle Output From PCM (Negative Duty Cycle)

The PCM controls the fan speed and operation using a duty cycle output on the fan control variable (FCV) circuit. The fan controller (located at or integral to the engine cooling fan assembly) receives the FCV command and operates the cooling fan at the speed requested (by varying the power applied to the fan motor).

For relay controlled fans:

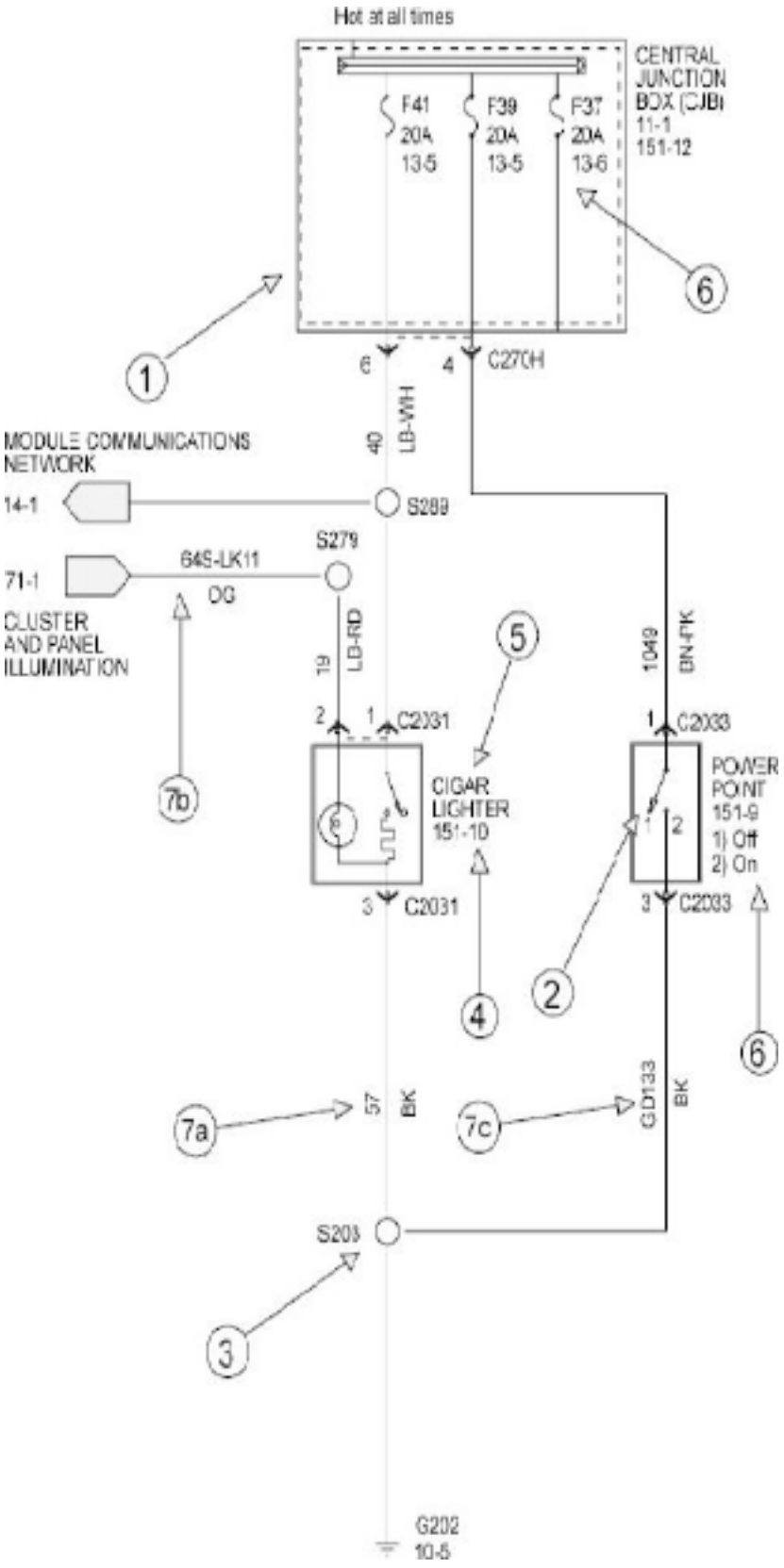
2.0L Focus (With A/C): PCM FC Output State For Cooling Fan Speeds

2.3L Escape: PCM FC Output State For Cooling Fan Speeds

The PCM controls the fan operation through the fan control (FC) (single speed fan applications), low fan control (LFC), medium fan control (MFC), and high fan control (HFC) outputs. Some applications will have the xFC circuit wired-to 2 separate-relays.

For 3-speed fans, although the PCM output circuits are called low, medium, and high fan control (FC), cooling fan speed is controlled by a combination of these outputs. Refer to the table.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Engine, Cooling and Exhaust > Cooling System > Radiator Cooling Fan > Radiator Cooling Fan Motor Relay > Component Information > Diagrams > Diagram Information and Instructions



Radiator Cooling Fan Motor Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

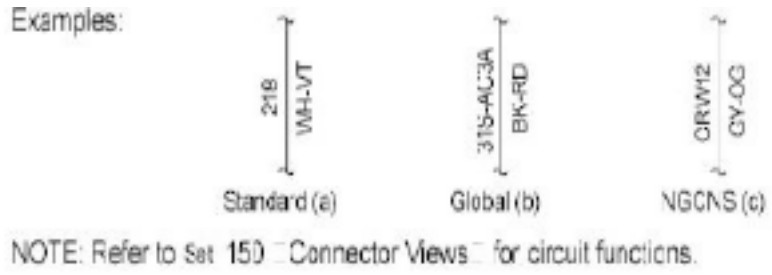
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

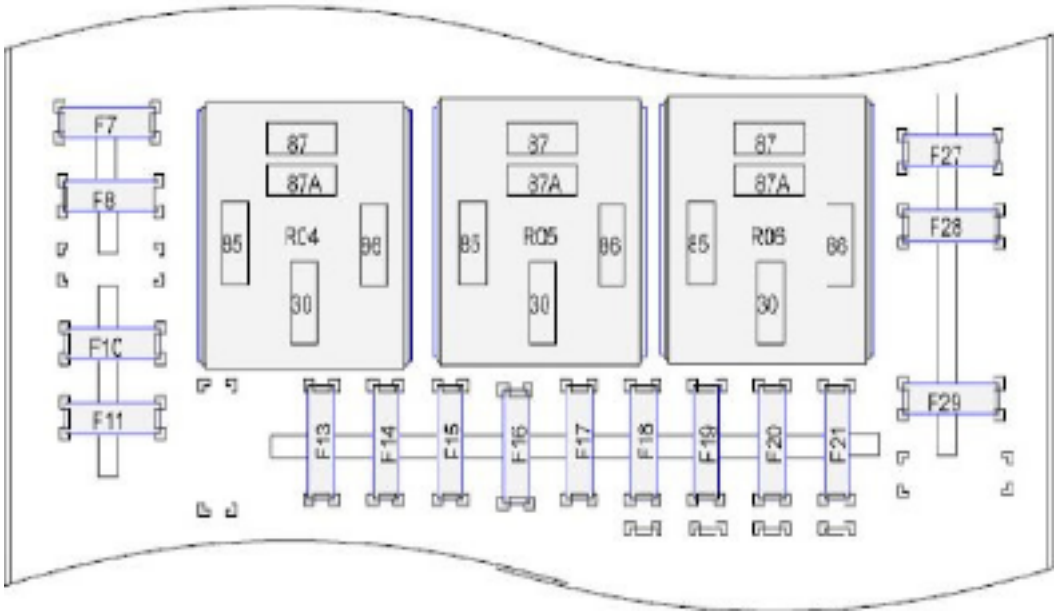
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

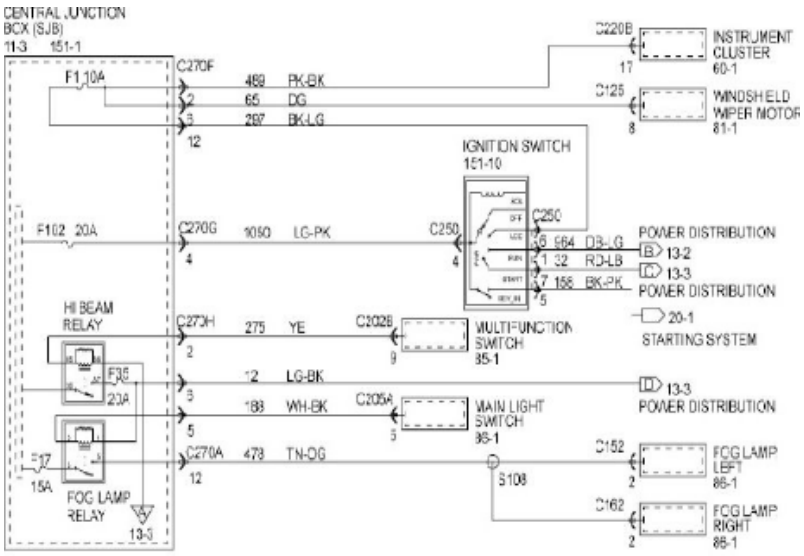
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

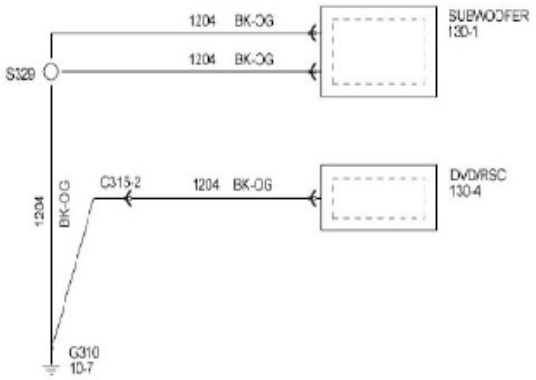
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

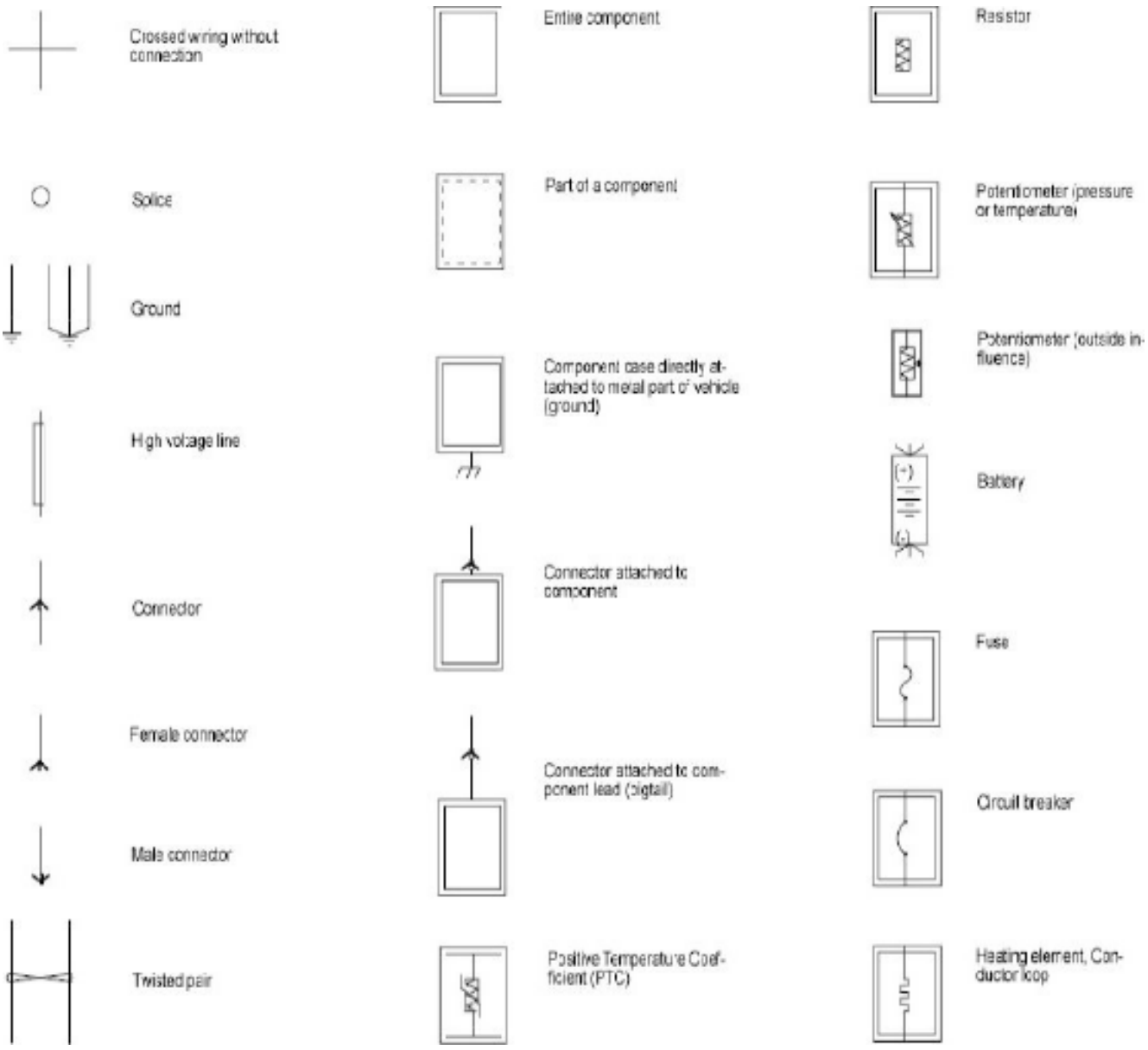
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

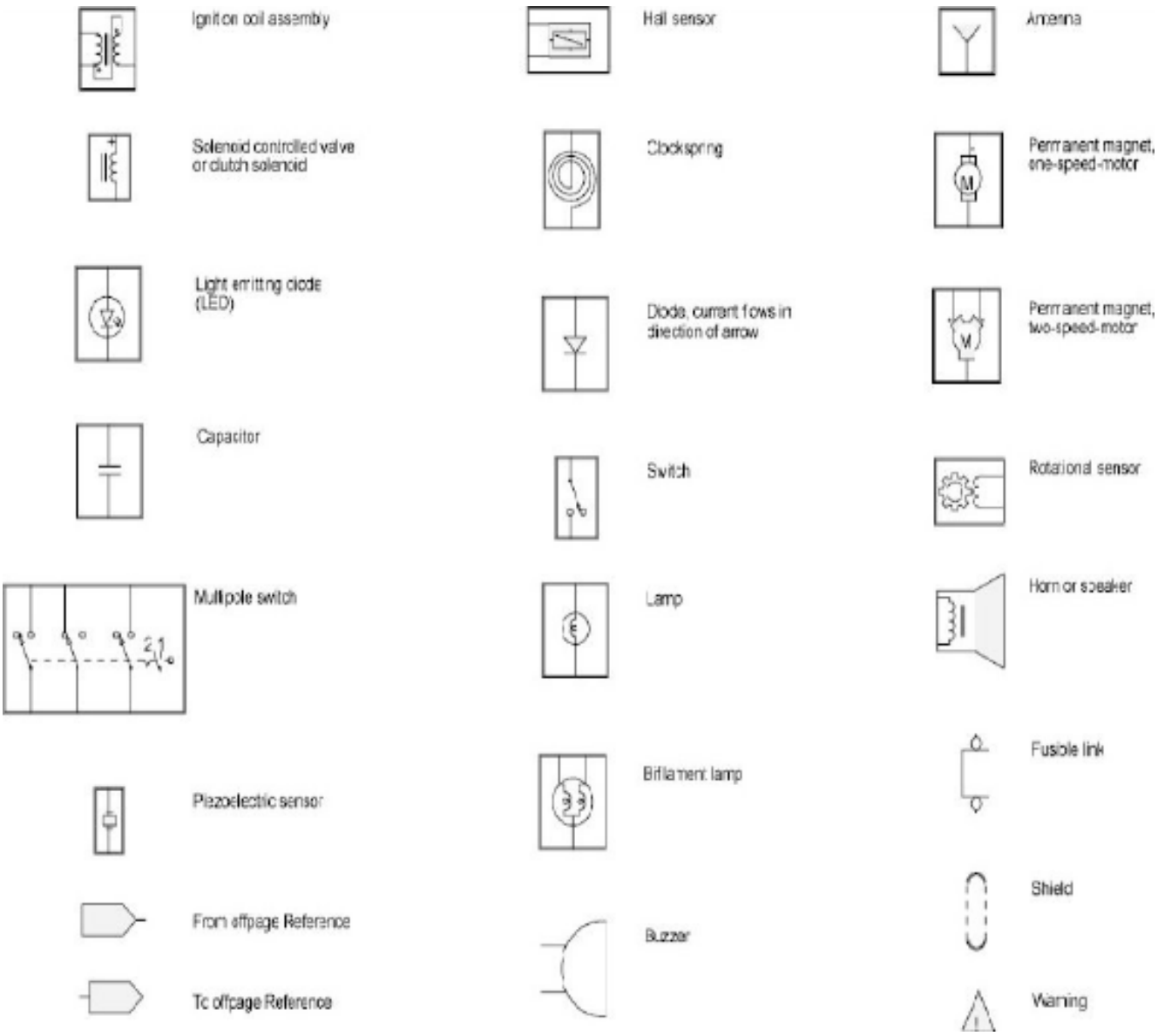
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

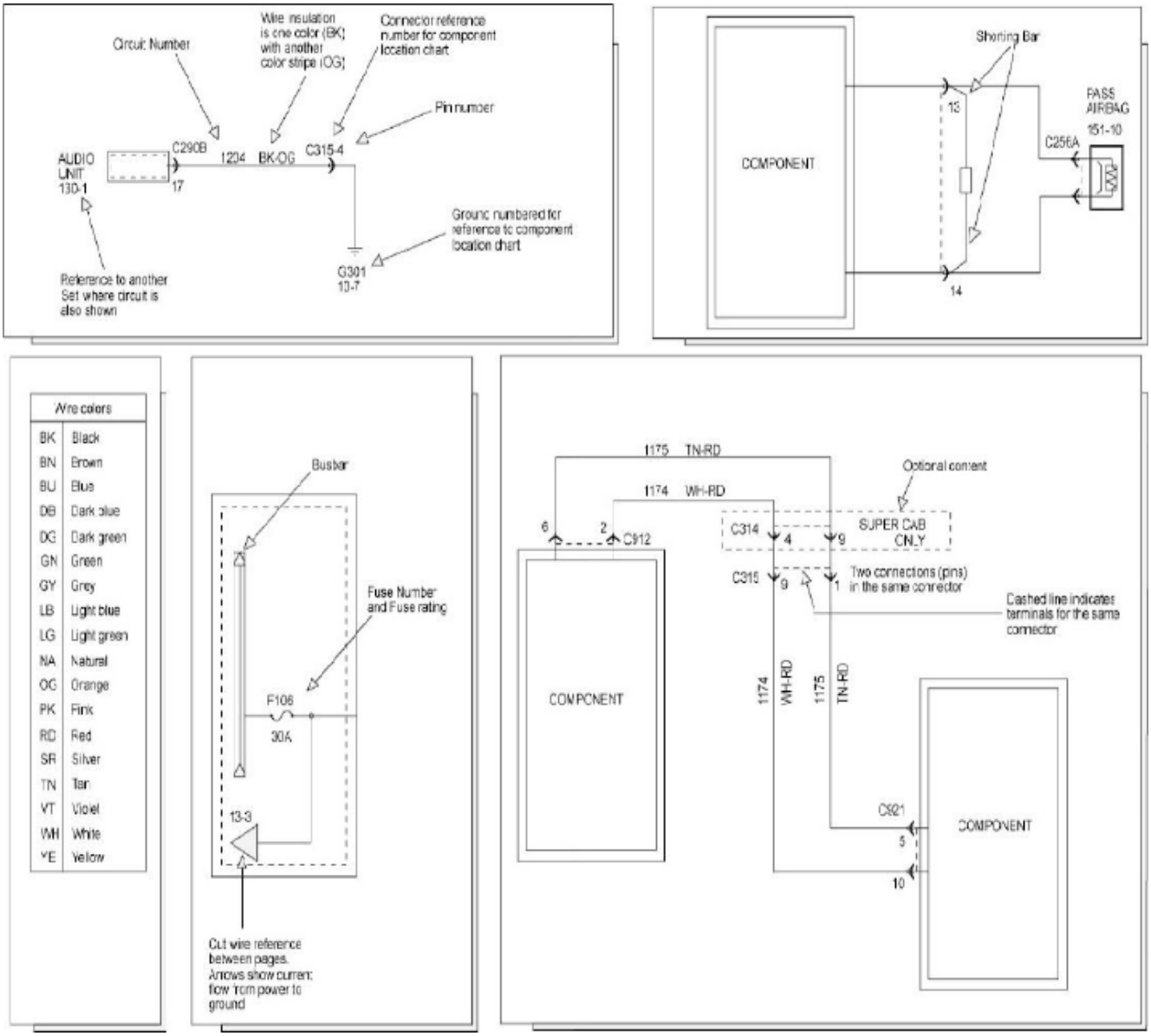
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

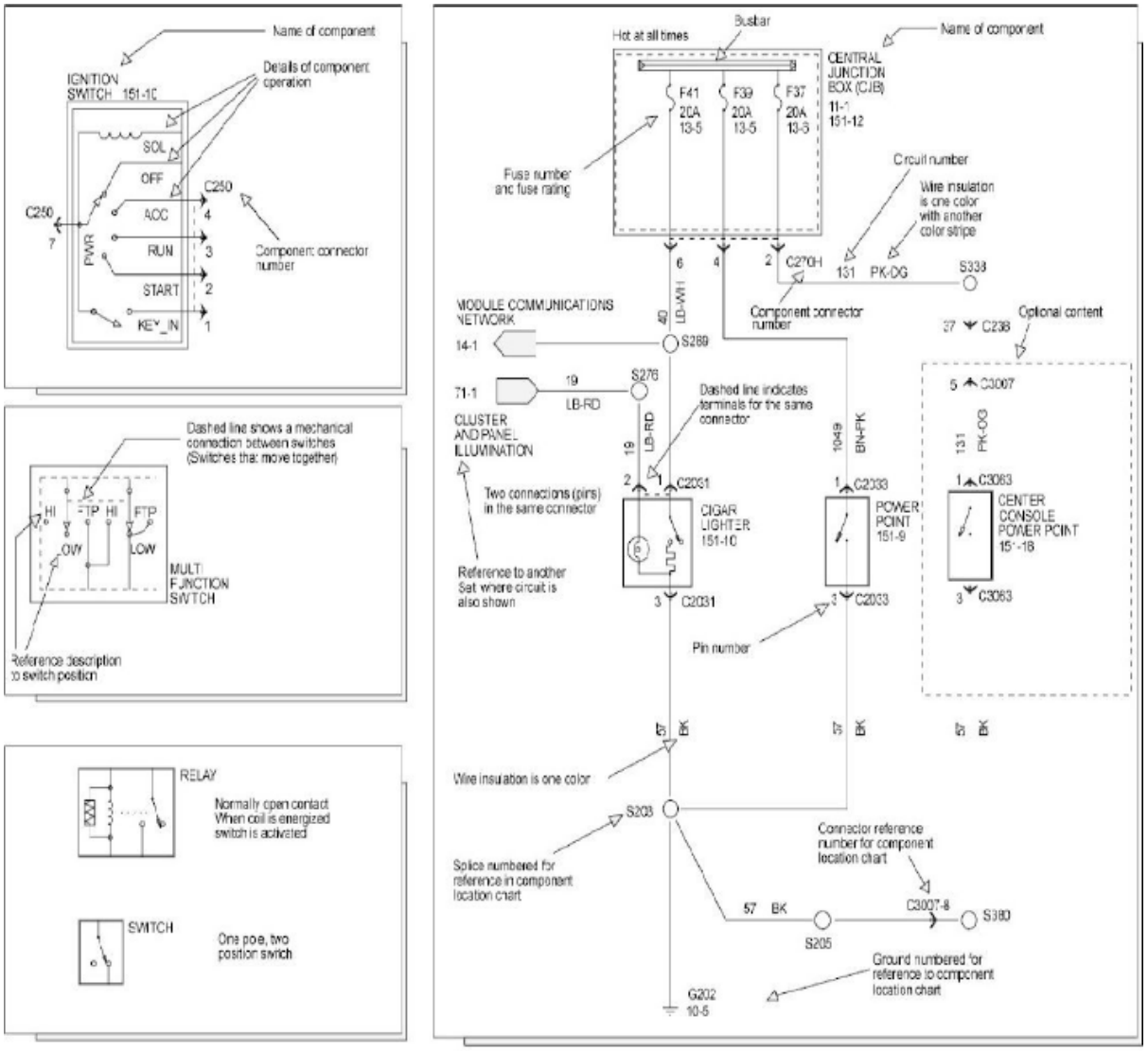
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

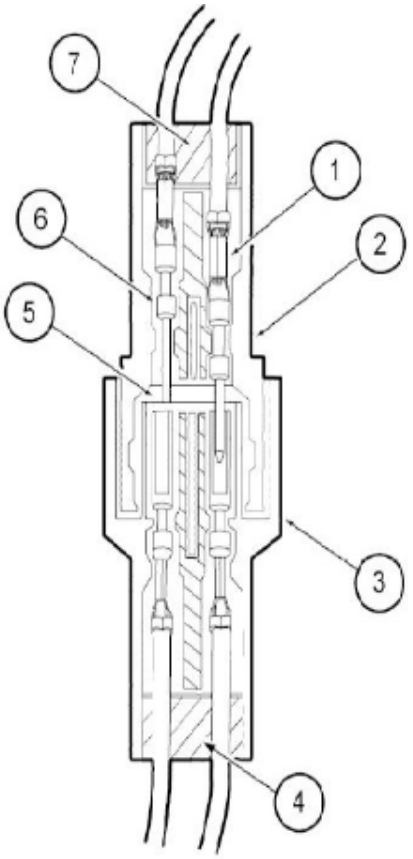


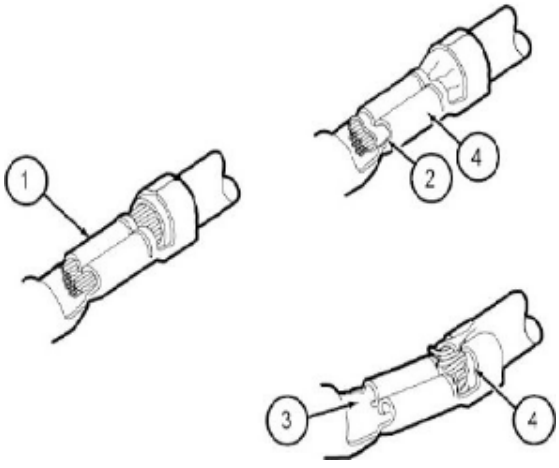
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Radiator Cooling Fan Motor Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

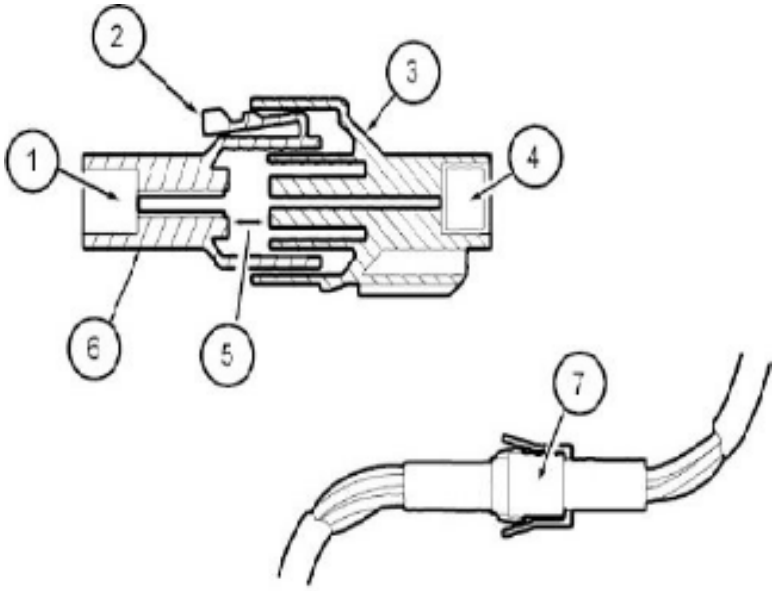
5 = Intermittent contact

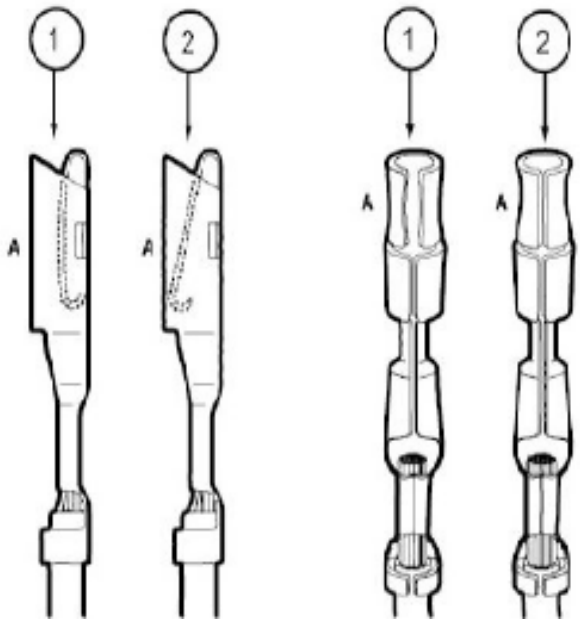
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

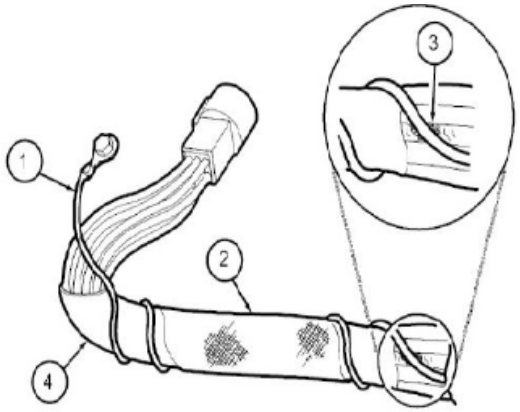
Deformed (enlarged) female terminals

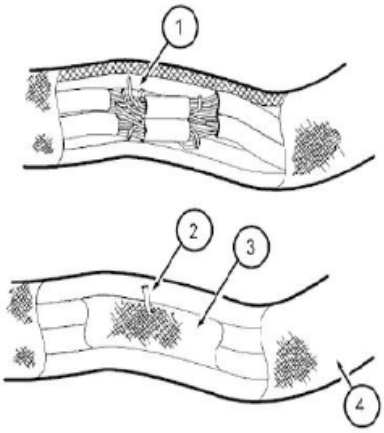
1 = Enlarged

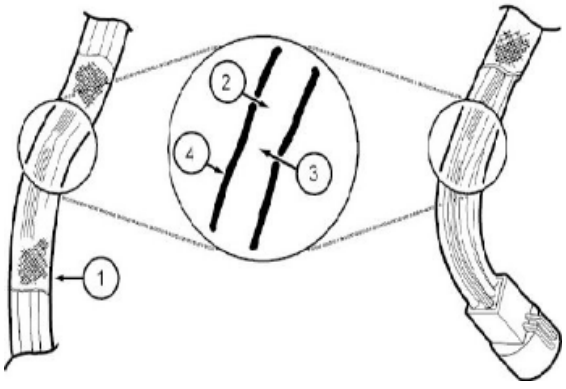
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

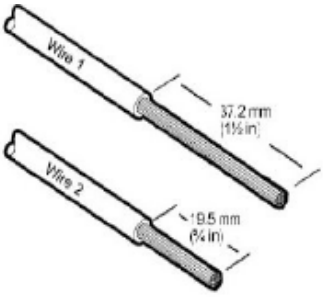
Splice covered 2

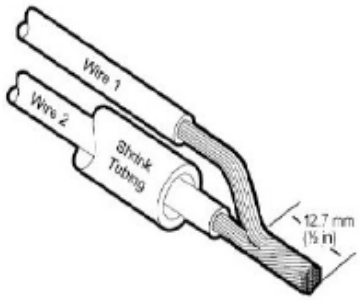
= Wire strand

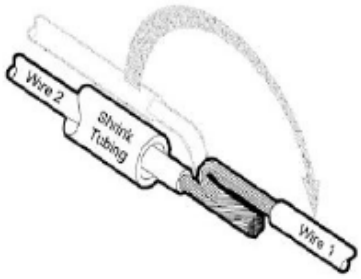
3 = Splice tape

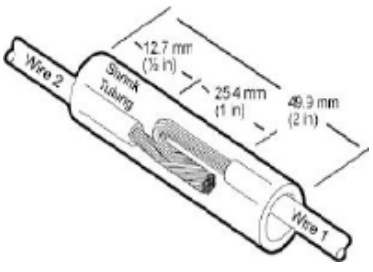
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

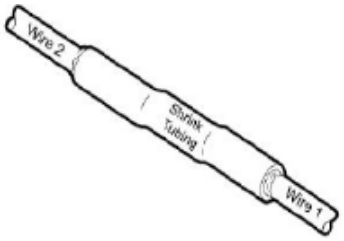
NOTE: -

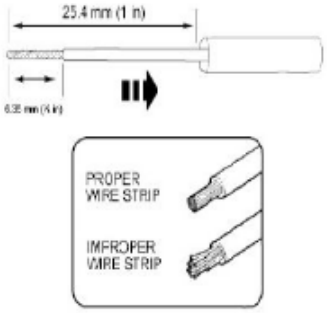
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

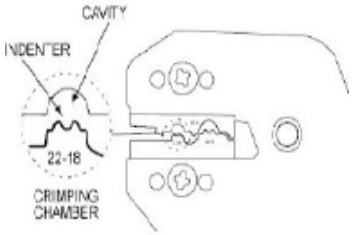
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

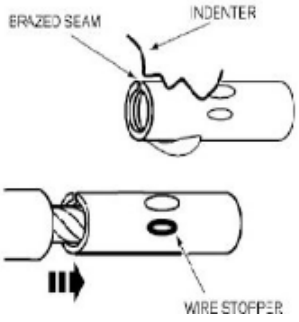
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
6.35 mm (¼ in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

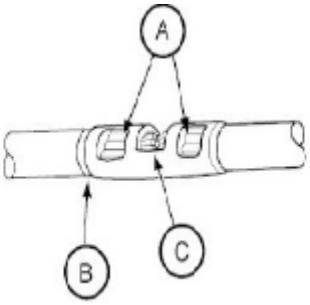
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

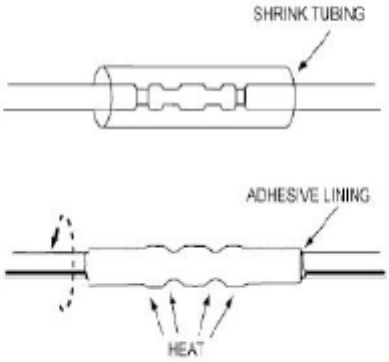
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4□ strip, cut 9 strands	* 1/4□ strip, cut 2 strands	1/4□ strip, no fold	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip, fold 2x dia.	1□ strip, fold 3x dia.
	16-14	* 1/4□ strip, cut 7 strands	1/4□ strip, no fold	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip fold 2x dia	1□ strip, fold 3x dia.	1 1/4□ strip, fold 4x dia.	Not Recommended
	12-10	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip, fold 2x dia.	1□ strip fold 3x dia.	1 1/4□ strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Pigtail only

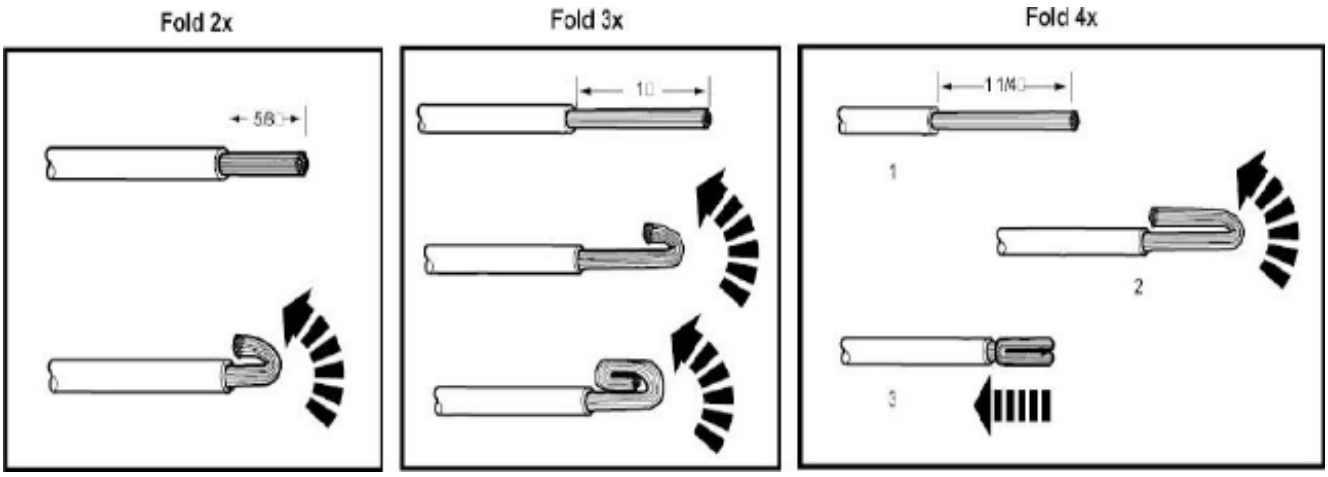
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



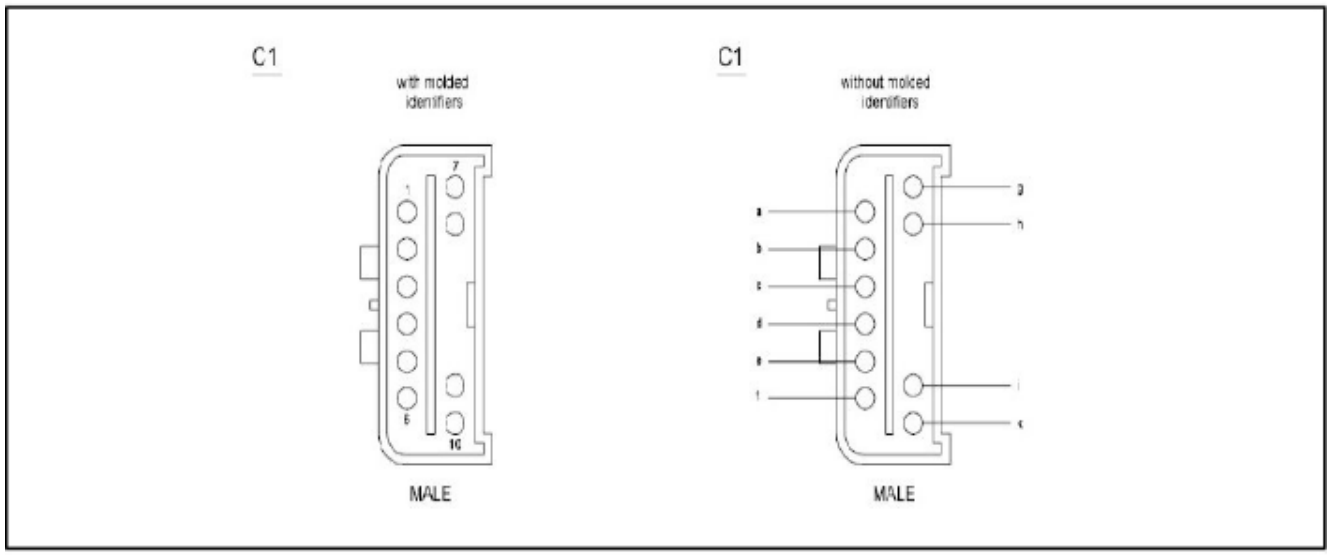
The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



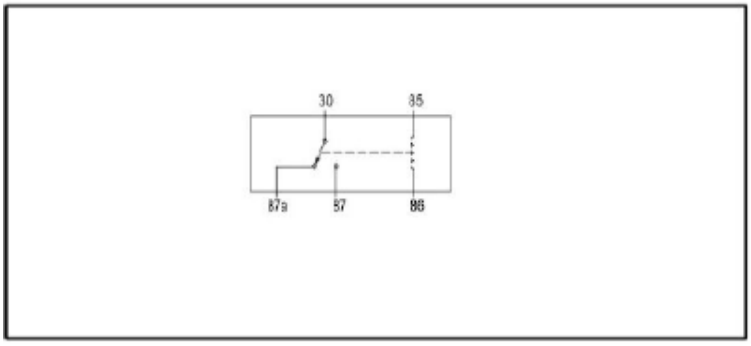
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

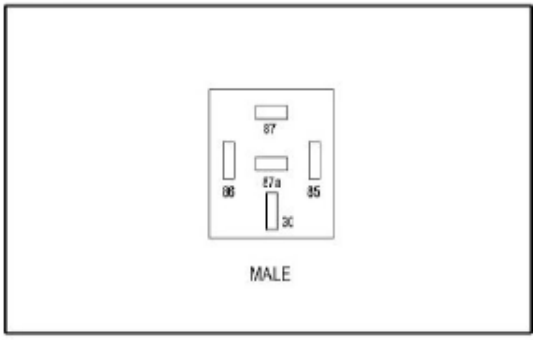
Radiator Cooling Fan Motor Relay: Testing and Inspection Mini ISO Relay

Relay □ Mini ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

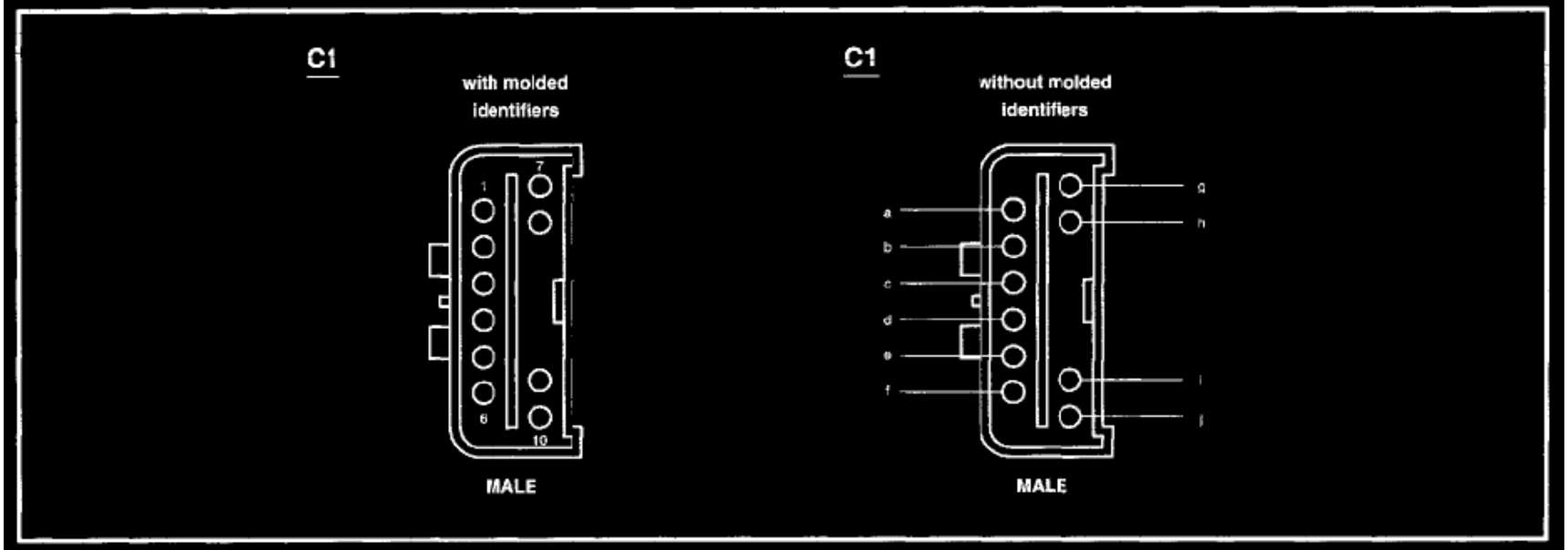
Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step–by–step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



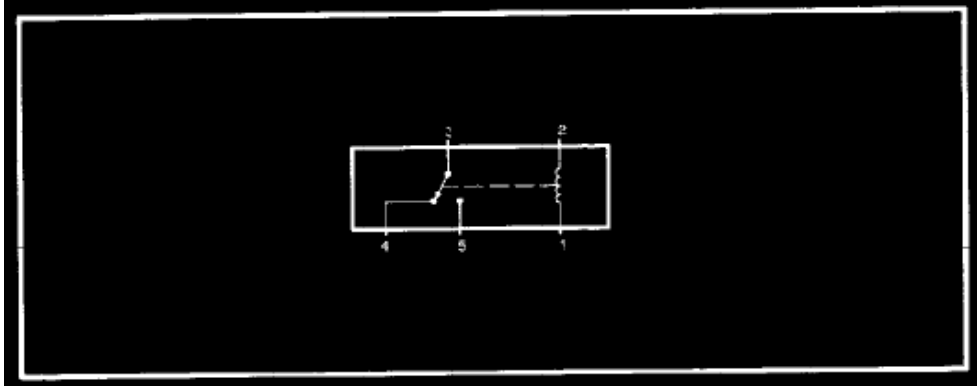
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

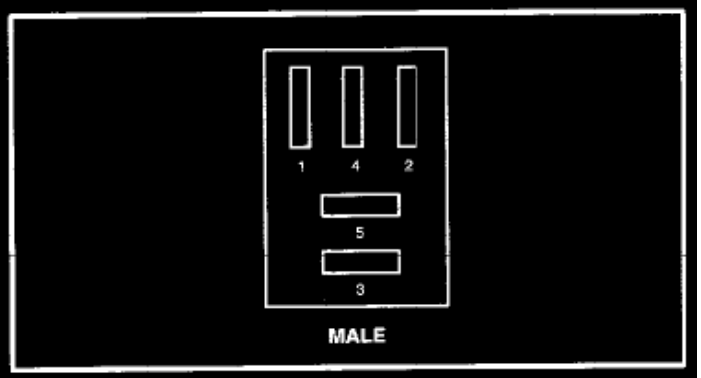
Radiator Cooling Fan Motor Relay: Testing and Inspection Micro ISO Relay

Relay – Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63–102Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil – Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

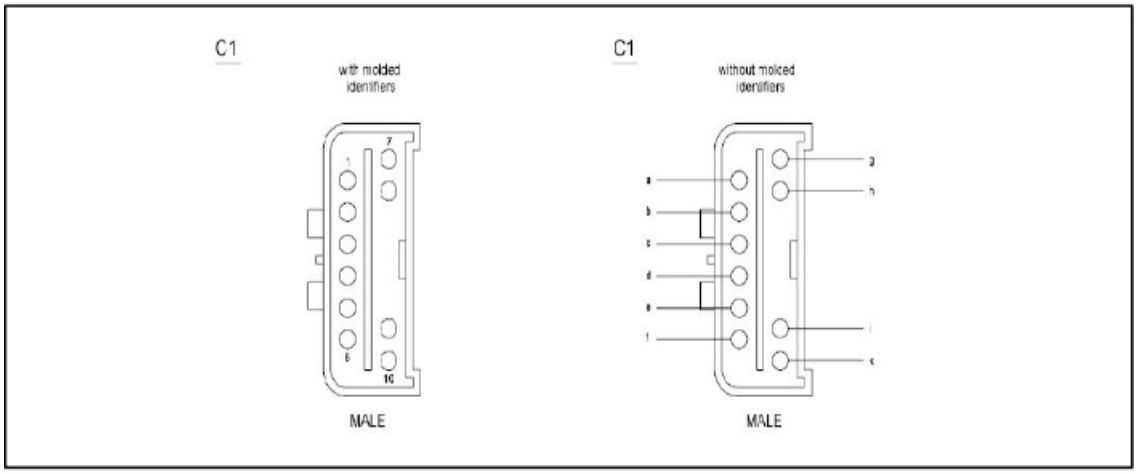
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step□by□step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals

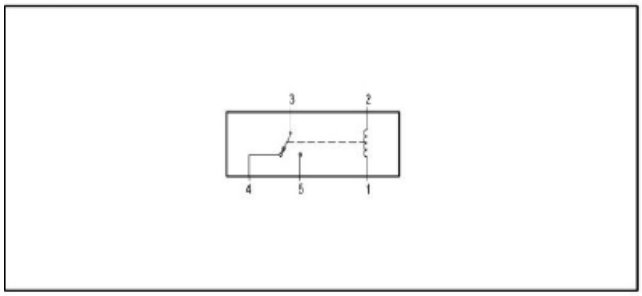


The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column □Circuit to test□. If you wish to test the complete component, perform all tests.

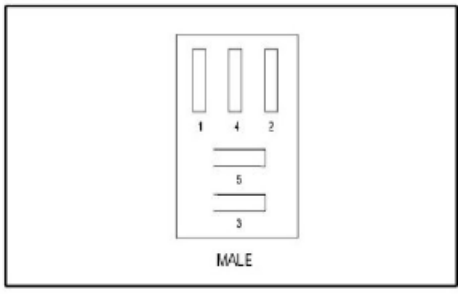
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Relay □ Micro ISO

Schematic



Terminals

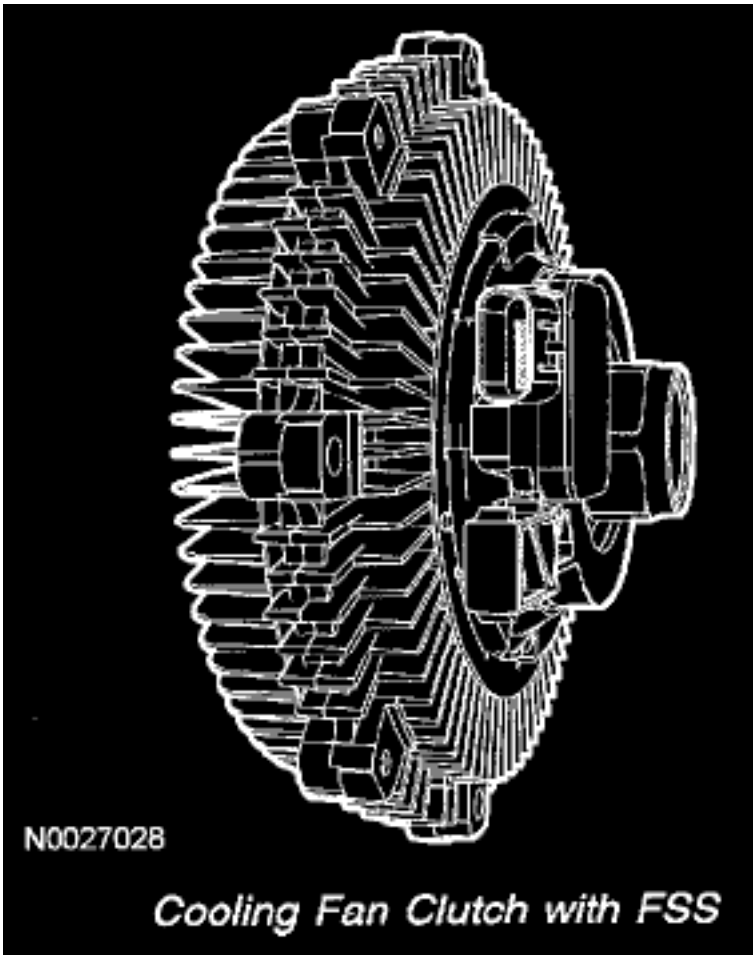


Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63□102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil □ Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.



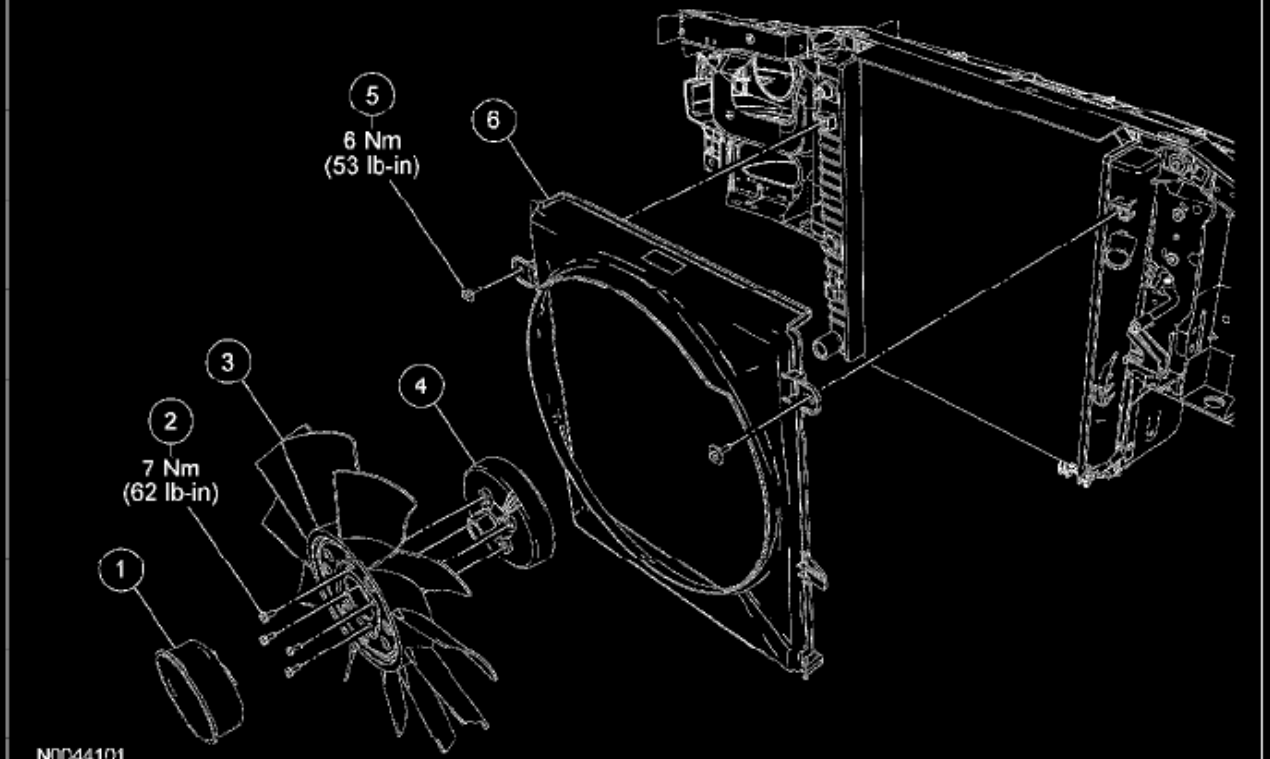
Radiator Cooling Fan Speed Sensor: Description and Operation

FAN SPEED SENSOR (FSS)

Cooling Fan Clutch With FSS

The FSS is a Hall-effect sensor that measures the cooling fan clutch speed by generating a waveform with a frequency proportional to the fan speed. If the cooling fan clutch is moving at a relatively low speed, the sensor produces a signal with a low frequency. As the cooling fan clutch speed increases, the sensor generates a signal with a higher frequency. The PCM uses the frequency signal generated by the FSS as a feedback for closed loop control of the cooling fan clutch.

Cooling Fan and Shroud



Item	Part Number	Description
1	8509	Coolant pump pulley
2	W602527	Cooling fan-to-cooling fan clutch bolt (4 required)
3	8600	Cooling fan

Item	Part Number	Description
4	8A616	Cooling fan clutch
5	N811864	Cooling fan shroud bolt (2 required)
6	8146	Cooling fan shroud

(Continued)

Fan Blade: Diagrams

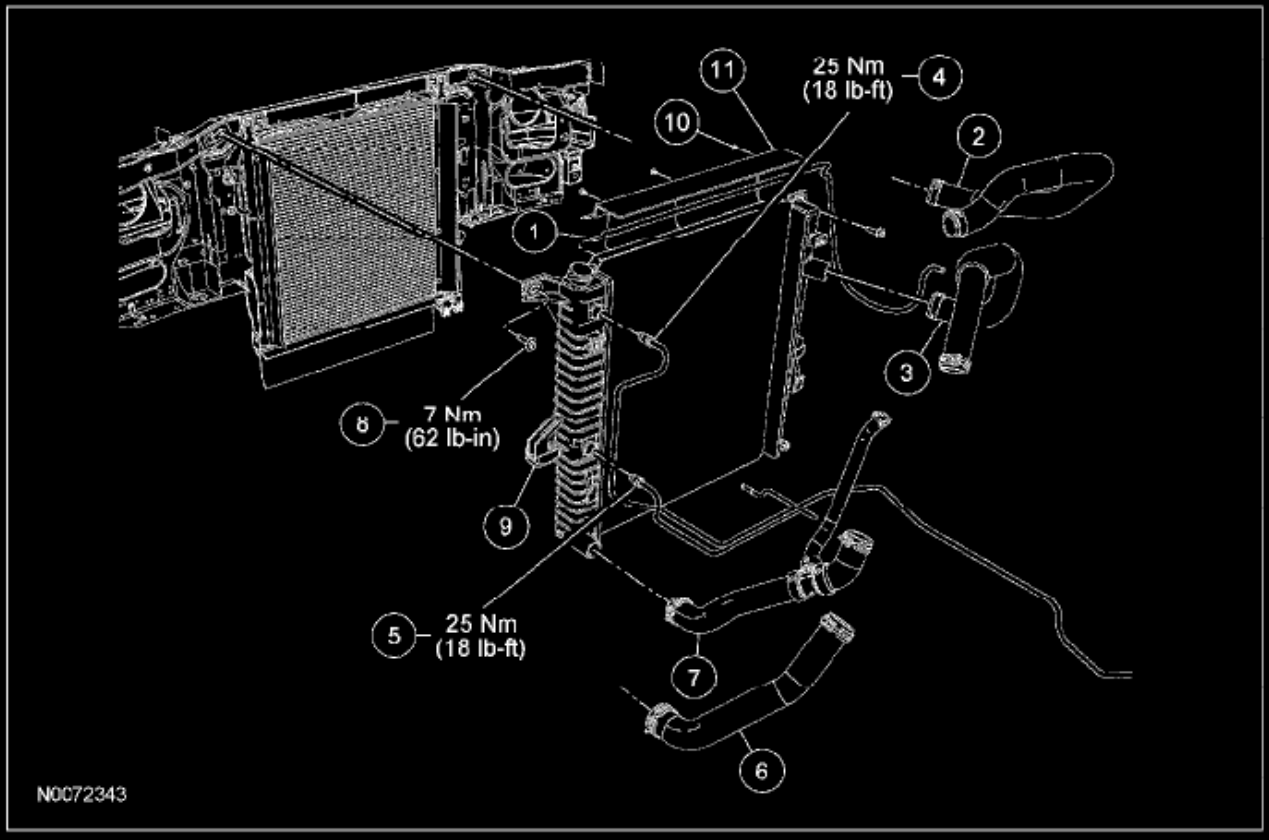
Radiator and Cooling Fan - Exploded View, 3.0L and 4.0L

Cooling Fan and Shroud

Cooling Fan and Shroud

Radiator and Hoses

Radiator and Hoses



Item	Part Number	Description
1	8075	Radiator overflow hose
2	8260	Upper radiator hose (4.0L SOHC engines)
3	8260	Upper radiator hose (3.0L engines)
4	7A031	Transmission cooler outlet hose
5	7C410	Transmission cooler inlet hose
6	8286	Lower radiator hose (4.0L SOHC engines)

(Continued)

Item	Part Number	Description
7	8286	Lower radiator hose (3.0L engines)
8	N811605	Radiator-to-radiator support bolt (2 required)
9	8005	Radiator
10	N806799	Pushpin
11	19T555	Seal

Radiator and Hoses

Fan Blade: Service and Repair

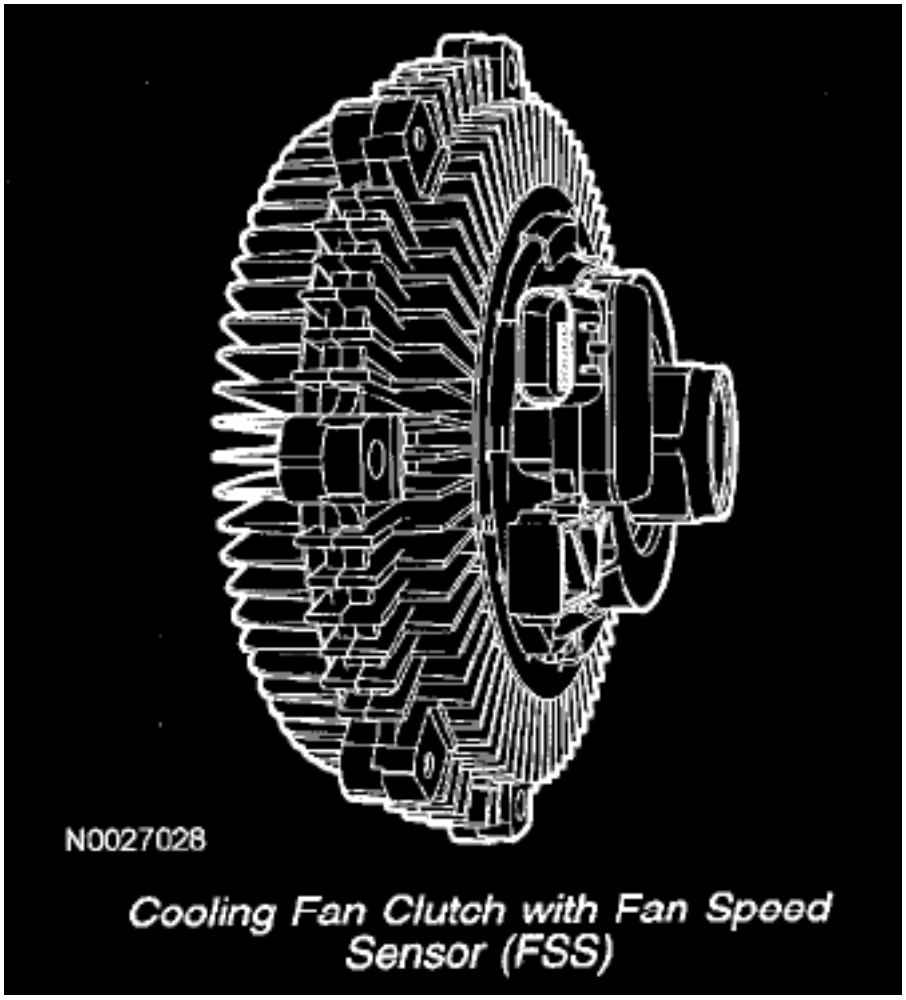
Cooling Fan - 3.0L, 4.0L

Removal and Installation

1. Remove fan shroud. 2. Remove the bolts and separate the fan from the fan clutch.

^ To install, tighten to 7 Nm (62 lb-inch).

3. To install, reverse the removal procedure.



Fan Clutch: Description and Operation

COOLING FAN CLUTCH

Cooling Fan Clutch With Fan Speed Sensor (FSS)

The cooling fan clutch is an electrically actuated viscous clutch that consists of 3 main elements:

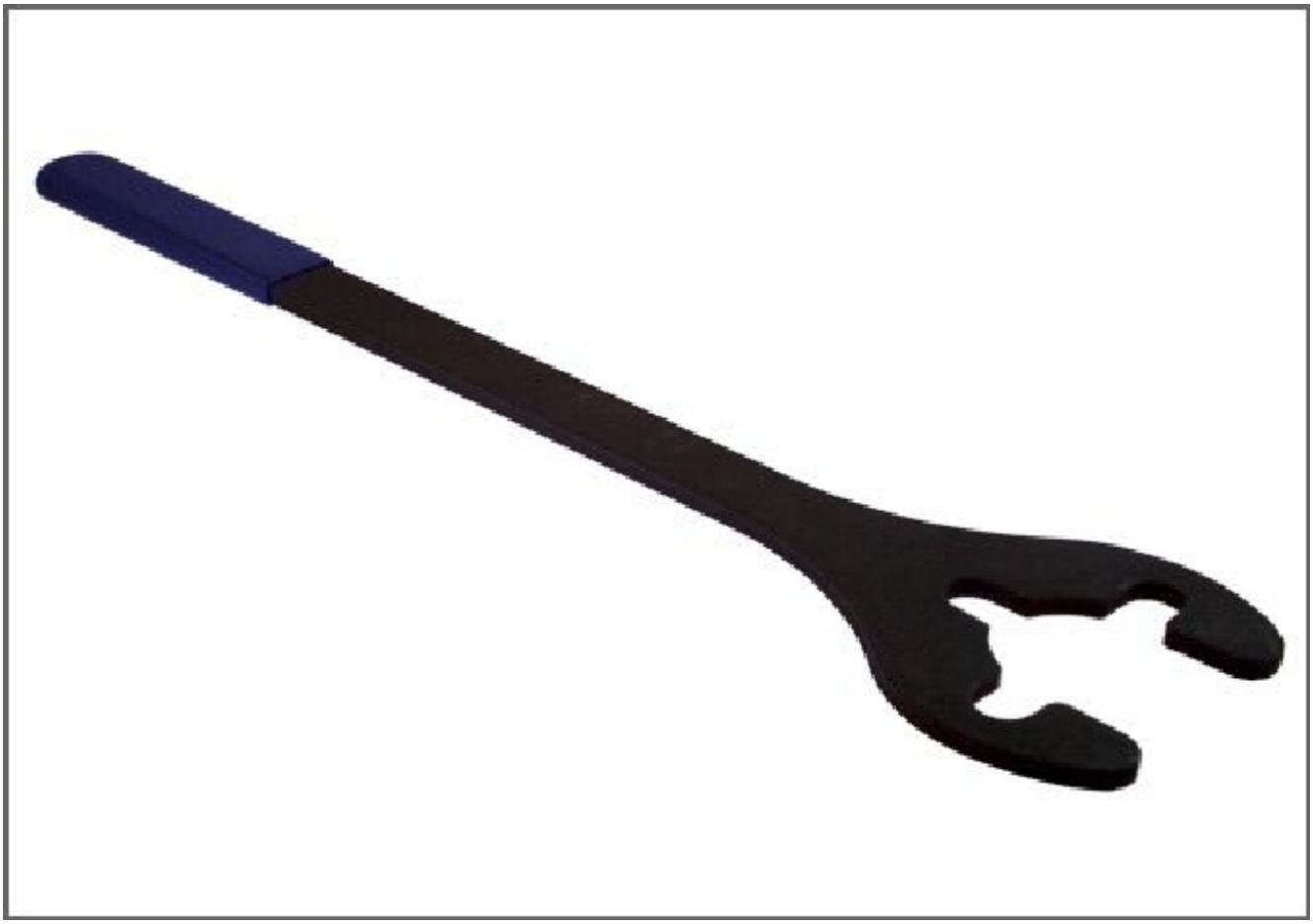
- a working chamber

- a reservoir chamber

- a cooling fan clutch actuator valve and a fan speed sensor (FSS)

The cooling fan clutch actuator valve controls the fluid flow from the reservoir into the working chamber. Once viscous fluid is in the working chamber, shearing of the fluid results in fan rotation. The cooling fan clutch actuator valve is activated with a pulse width modulated (PWM) output signal from the PCM. By opening and closing the fluid port valve, the PCM can control the cooling fan clutch speed. The cooling fan clutch speed is measured by a Hall-effect sensor and is monitored by the PCM during closed loop operation.

The PCM optimizes fan speed based on engine coolant temperature (ECT), engine oil temperature (EOT), transmission fluid temperature (TFT), intake air temperature (IAT), or air conditioning requirements. When an increased demand for fan speed is requested for vehicle cooling, the PCM monitors the fan speed through the Hall-effect sensor. If a fan speed increase is required, the PCM outputs the PWM signal to the fluid port, providing the required fan speed increase.



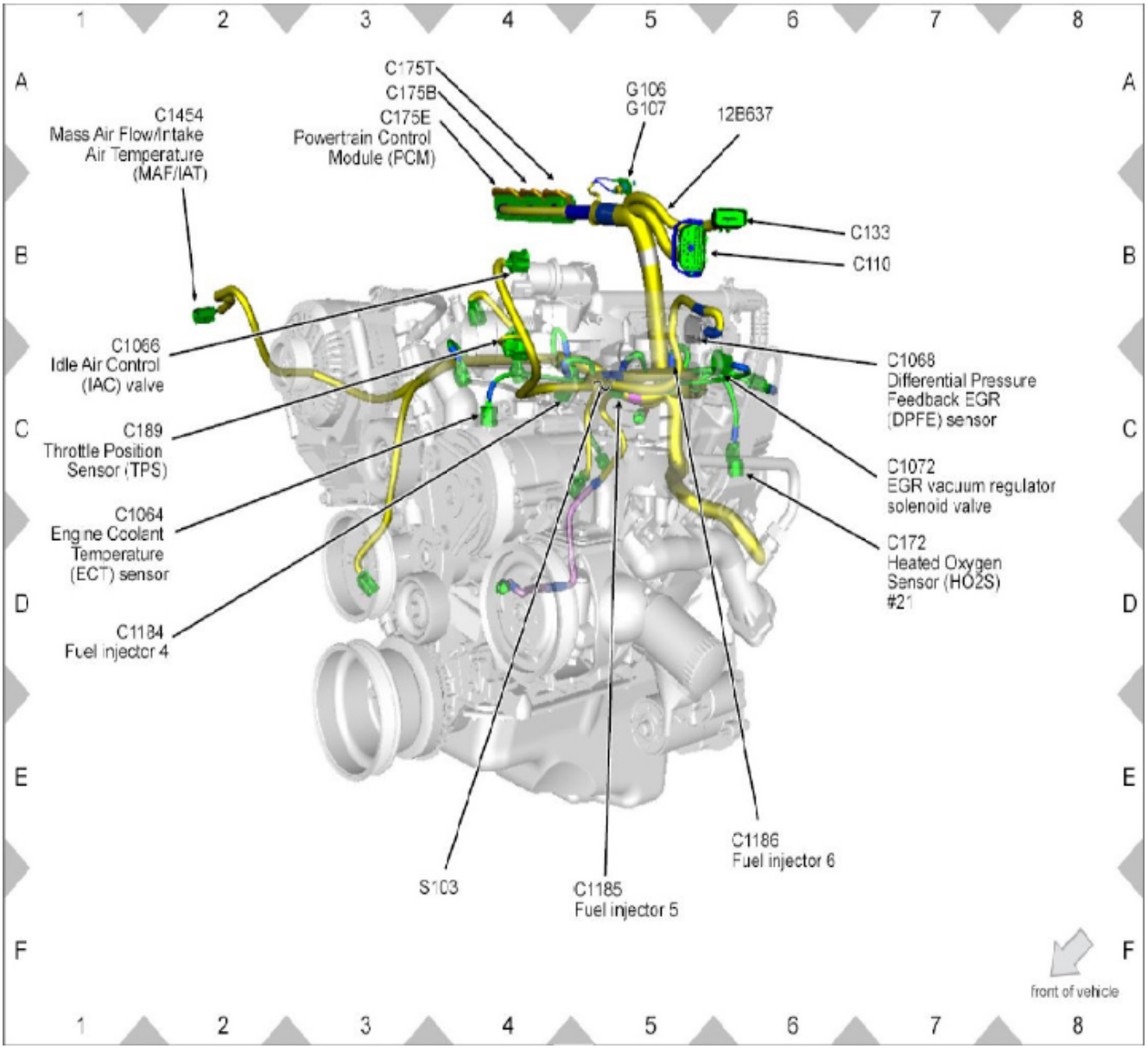
Fan Clutch: Tools and Equipment

Fan Clutch Holding Tool AST tool# 8005

Allows the technician to hold the water pump pulleuy in place while loosening the radiator fan.

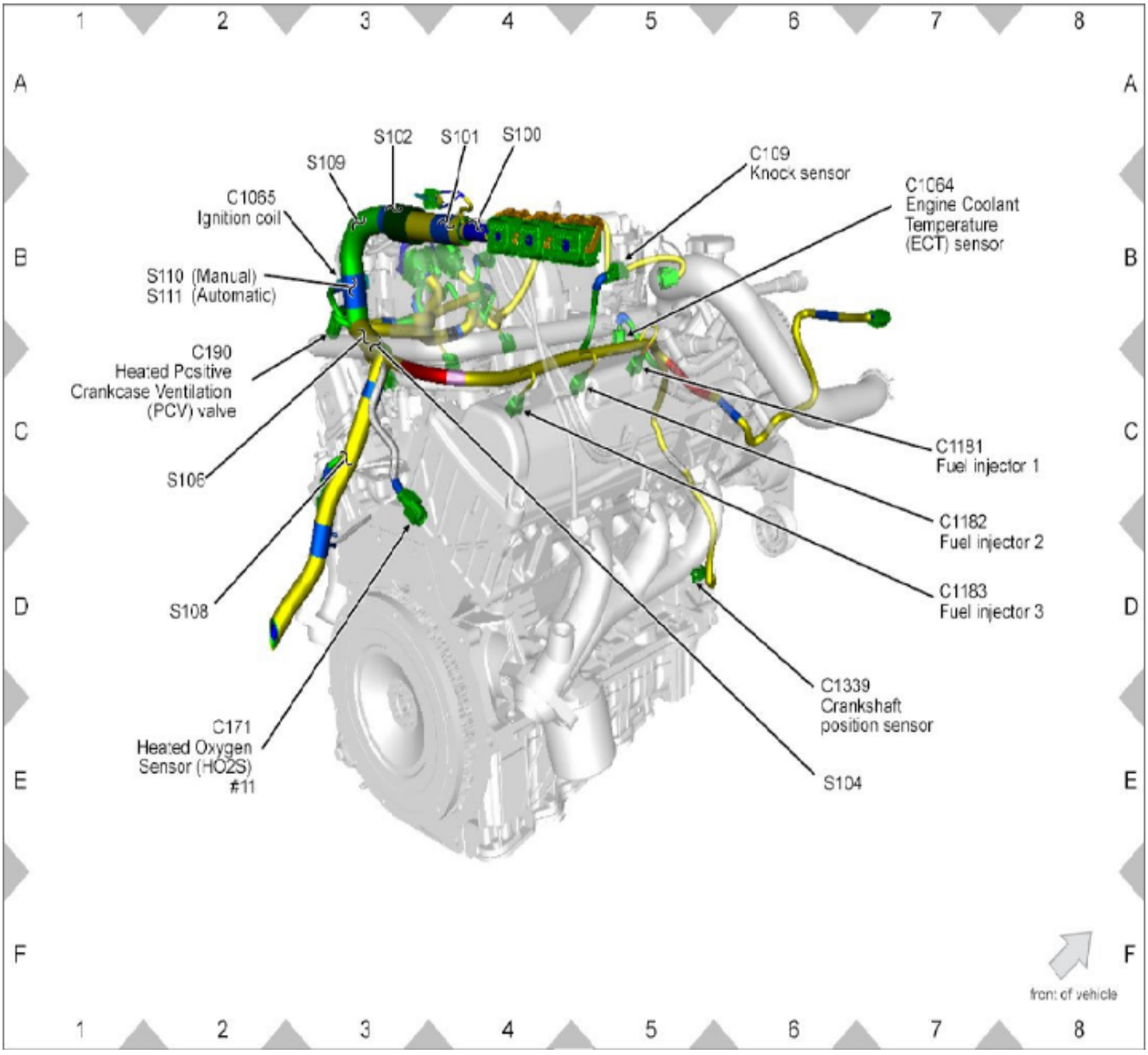
2009 Suggested user price: $41.20

Assenmacher Specialty Tools 1 800 525 2943



Coolant Temperature Sensor/Switch (For Computer): Locations

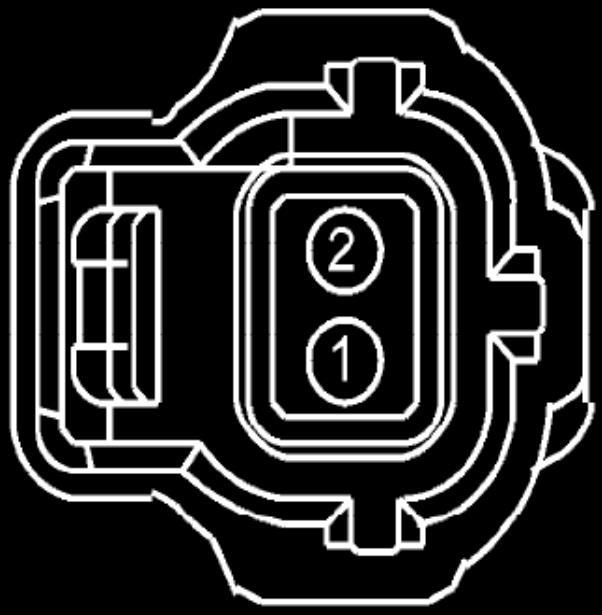
View 151-5


S102
S101
S100
S109
C109
Knock sensor
C1065
Ignition coil
C1064
Engine Coolant
Temperature
(ECT) sensor
S110 (Manual)
S111 (Automatic)
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
C1181
Fuel injector 1
C1182
Fuel injector 2
S108
C1183
Fuel injector 3
C1339
Crankshaft
position sensor
C171
Heated Oxygen
Sensor (HO2S)
#11
S104
front of vehicle

View 151-8

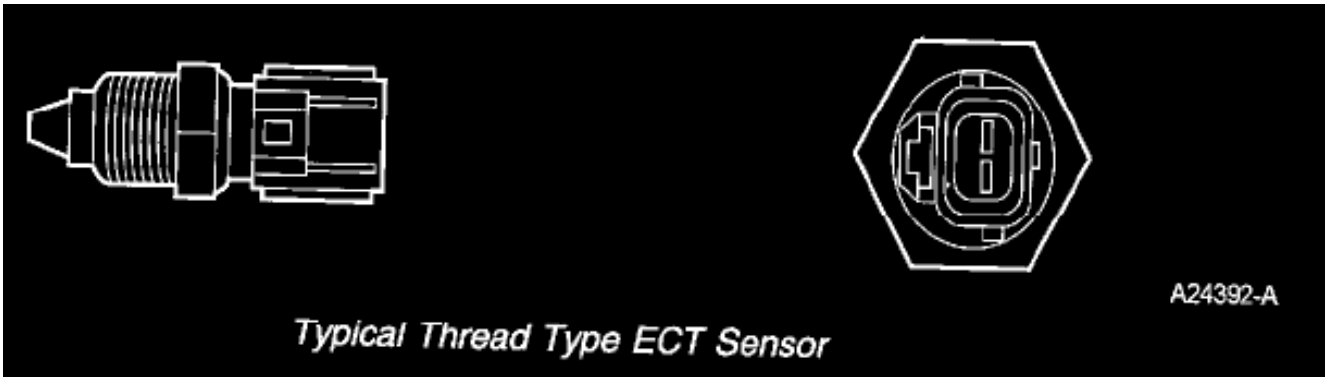
Connector: C1064

Description:	Harness:	Base Part #:
ENGINE COOLANT TEMPERATURE (ECT) SENSOR	12B637	12A648



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE716 (YE)	20	SENSOR - ENGINE COOLANT TEMPERATURE (ECT)	3.0L, 4.0L
2	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	3.0L, 4.0L

C1064



Coolant Temperature Sensor/Switch (For Computer): Description and Operation

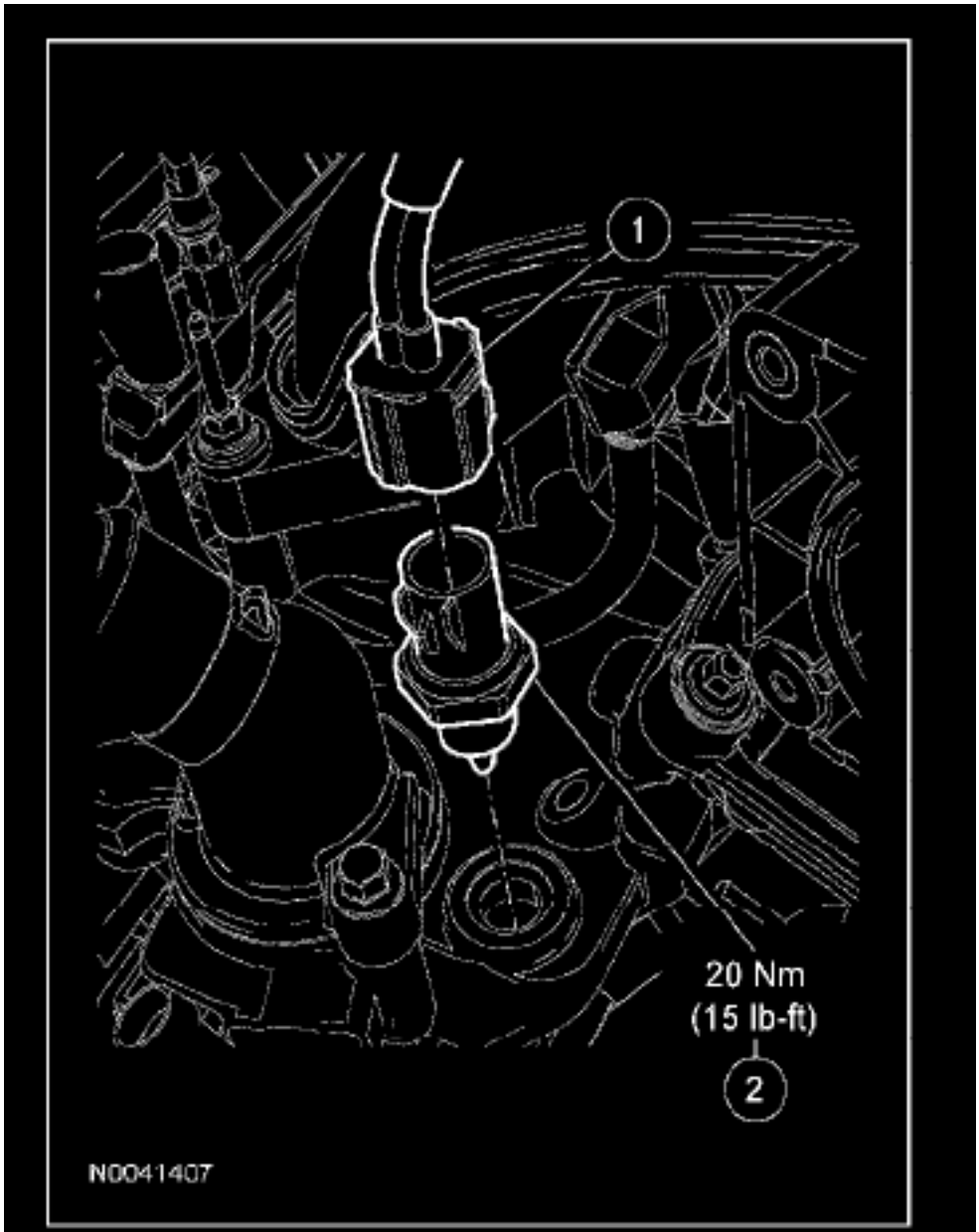
ENGINE COOLANT TEMPERATURE (ECT) SENSOR

Typical Thread Type ECT Sensor

The ECT sensor is a thermistor device in which resistance changes with temperature. The electrical resistance of a thermistor decreases as the temperature increases, and the resistance increases as the temperature decreases. The varying resistance changes the voltage drop across the sensor terminals and provides electrical signals to the PCM corresponding to temperature.

Thermistor-type sensors are considered passive sensors. A passive sensor is connected to a voltage divider network so that varying the resistance of the passive sensor causes a variation in total current flow. Voltage that is dropped across a fixed resistor in a series with the sensor resistor determines the voltage signal at the PCM. This voltage signal is equal to the reference voltage minus the voltage drop across the fixed resistor.

The ECT measures the temperature of the engine coolant. The PCM uses the ECT input for fuel control and for cooling fan control. There are 3 types of ECT sensors, threaded, push-in, and twist-lock. The ECT sensor is located in an engine coolant passage.



Item	Part Number	Description
1	14A464	Engine coolant temperature (ECT) sensor electrical connector (part of 12B637)
2	12A648	ECT sensor

Coolant Temperature Sensor/Switch (For Computer): Service and Repair

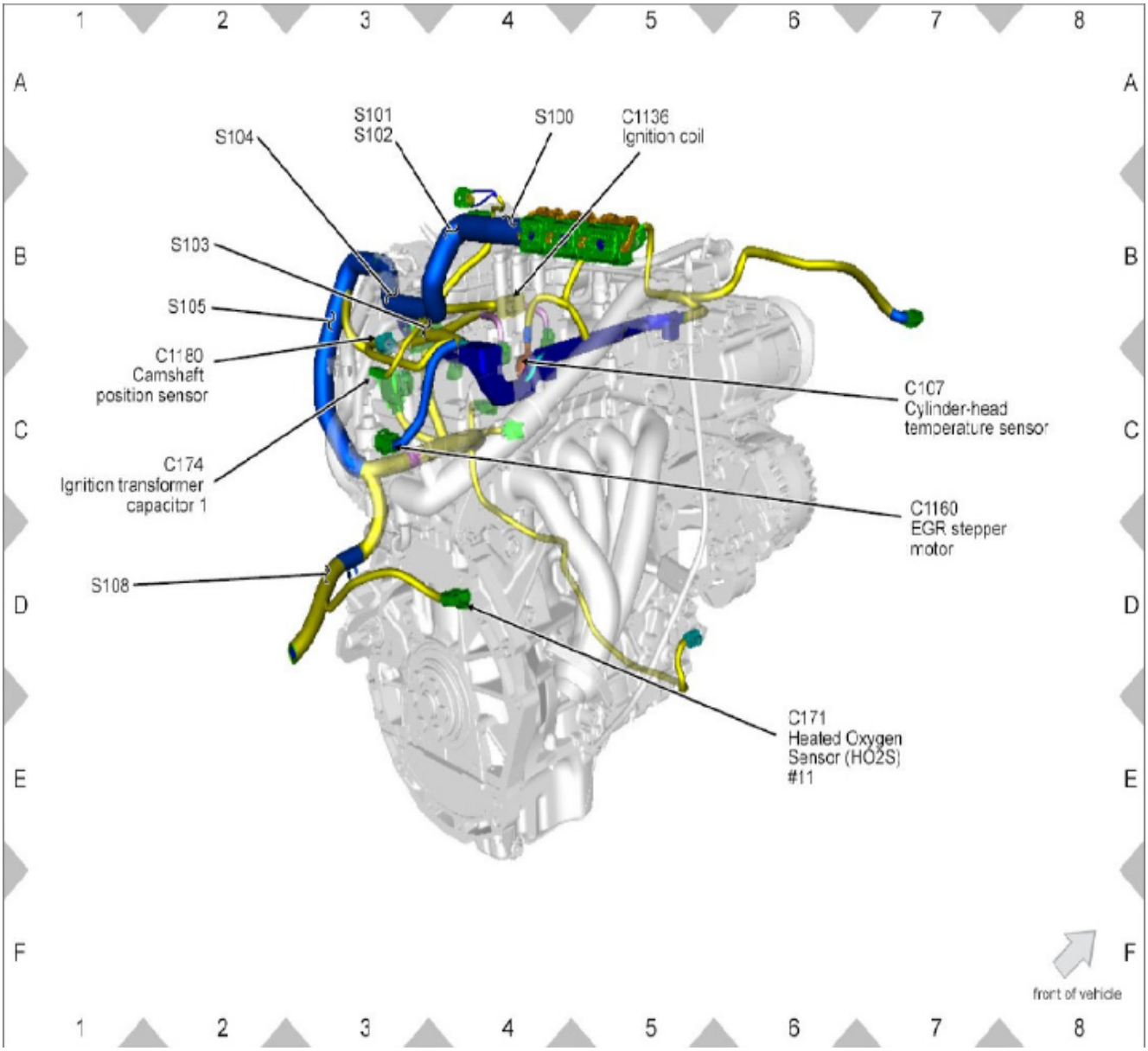
ENGINE COOLANT TEMPERATURE (ECT) SENSOR

Removal and Installation

1. Drain the cooling system. 2. Disconnect the engine coolant temperature (ECT) sensor electrical connector. 3. Remove the ECT sensor.

- To install, tighten to 20 Nm (15 lb-ft).

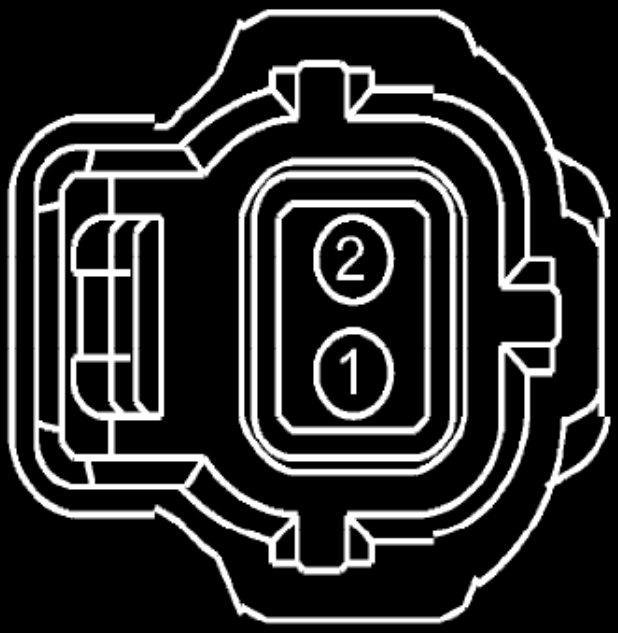
4. To install, reverse the removal procedure.


S104
S101
S102
S100
C1136
Ignition coil
S103
S105
C1180
Camshaft
position sensor
C107
Cylinder-head
temperature sensor
C174
Ignition transformer
capacitor 1
C1160
EGR stepper
motor
S108
C171
Heated Oxygen
Sensor (HO2S)
#11
front of vehicle

View 151-4

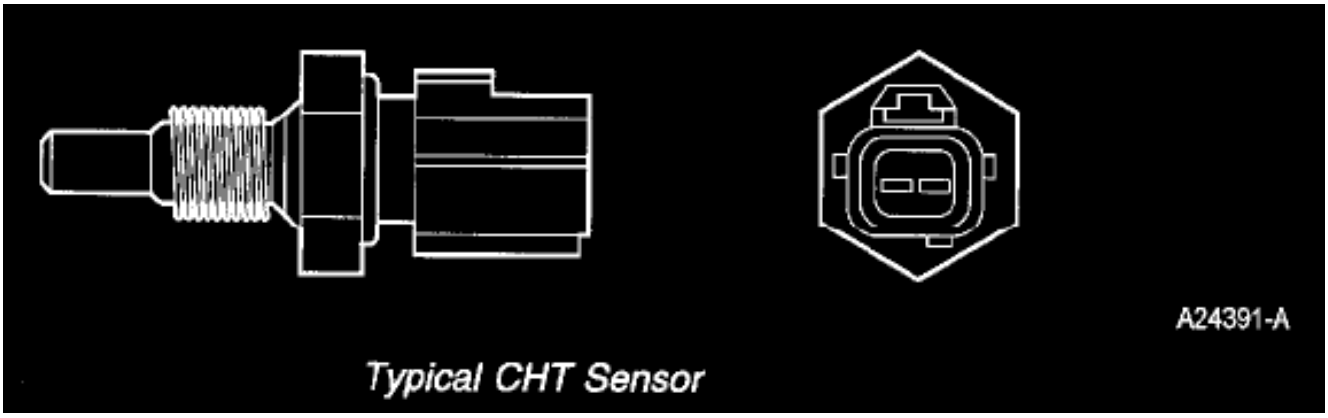
Connector: C107

Description:	Harness:	Base Part #:
CYLINDERHEAD TEMPERATURE SENSOR	12B637	6G004



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE116 (VT-BN)	20	CTRL MOD. - POWERTRAIN # CYLINDER HEAD TEMPERATURE INDICATOR LIGHT (CHTIL)	2.3L
2	RE405 (GN/WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	2.3L

C107



Typical CHT Sensor

Engine Temperature Sensor: Description and Operation

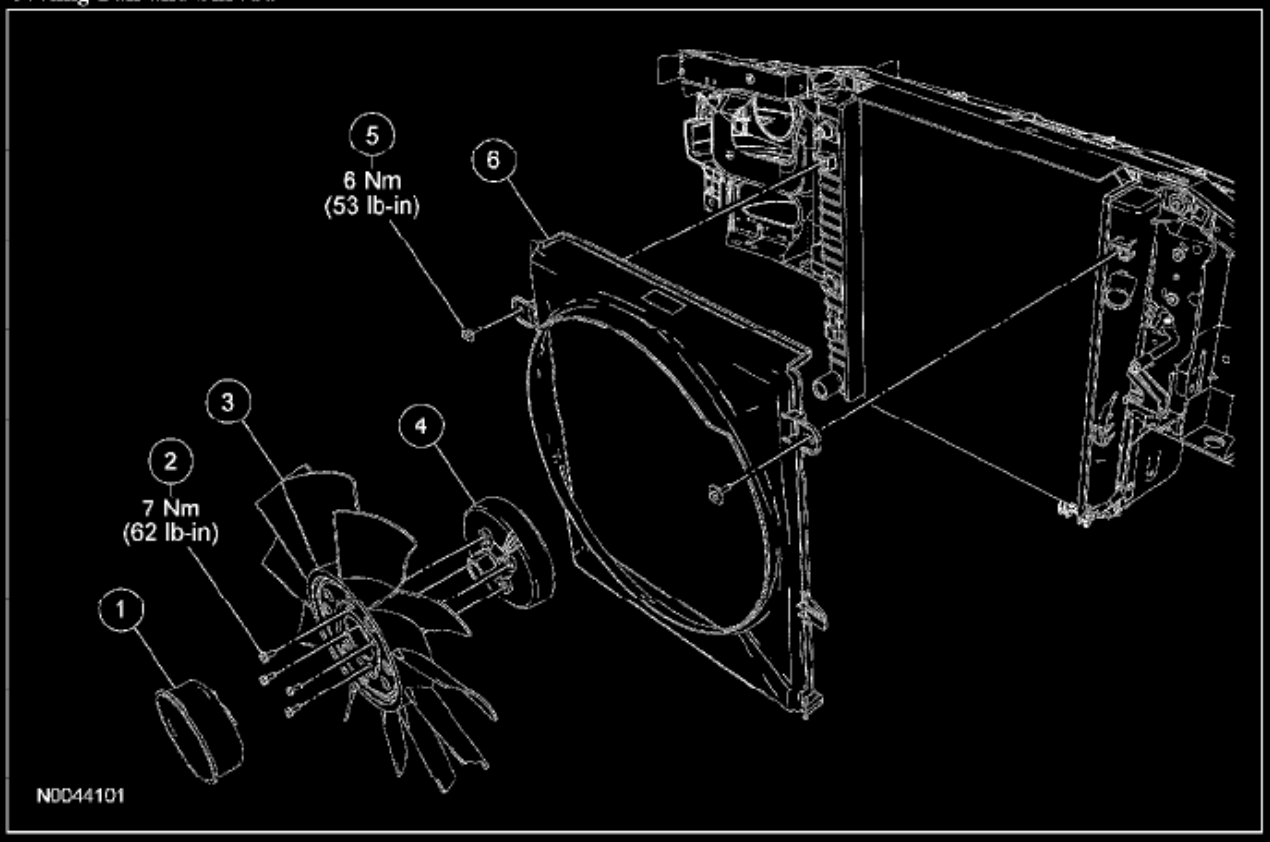
CYLINDER HEAD TEMPERATURE (CHT) SENSOR

Typical CHT Sensor

The CHT sensor is a thermistor device in which resistance changes with the temperature. The electrical resistance of a thermistor decreases as temperature increases, and the resistance increases as the temperature decreases. The varying resistance affects the voltage drop across the sensor terminals and provides electrical signals to the PCM corresponding to temperature.

The CHT sensor is installed in the cylinder head and measures the metal temperature. The CHT sensor can provide complete engine temperature information and can be used to infer coolant temperature. If the CHT sensor conveys an overheating condition to the PCM, the PCM initiates a fail-safe cooling strategy based on information from the CHT sensor. A cooling system concern such as low coolant or coolant loss could cause an overheating condition. As a result, damage to major engine components could occur. Using both the CHT sensor and fail-safe cooling strategy, the PCM prevents damage by allowing air cooling of the engine and limp home capability.

Cooling Fan and Shroud



Item	Part Number	Description
1	8509	Coolant pump pulley
2	W602527	Cooling fan-to-cooling fan clutch bolt (4 required)
3	8600	Cooling fan

Item	Part Number	Description
4	8A616	Cooling fan clutch
5	N811864	Cooling fan shroud bolt (2 required)
6	8146	Cooling fan shroud

(Continued)

Fan Shroud: Diagrams

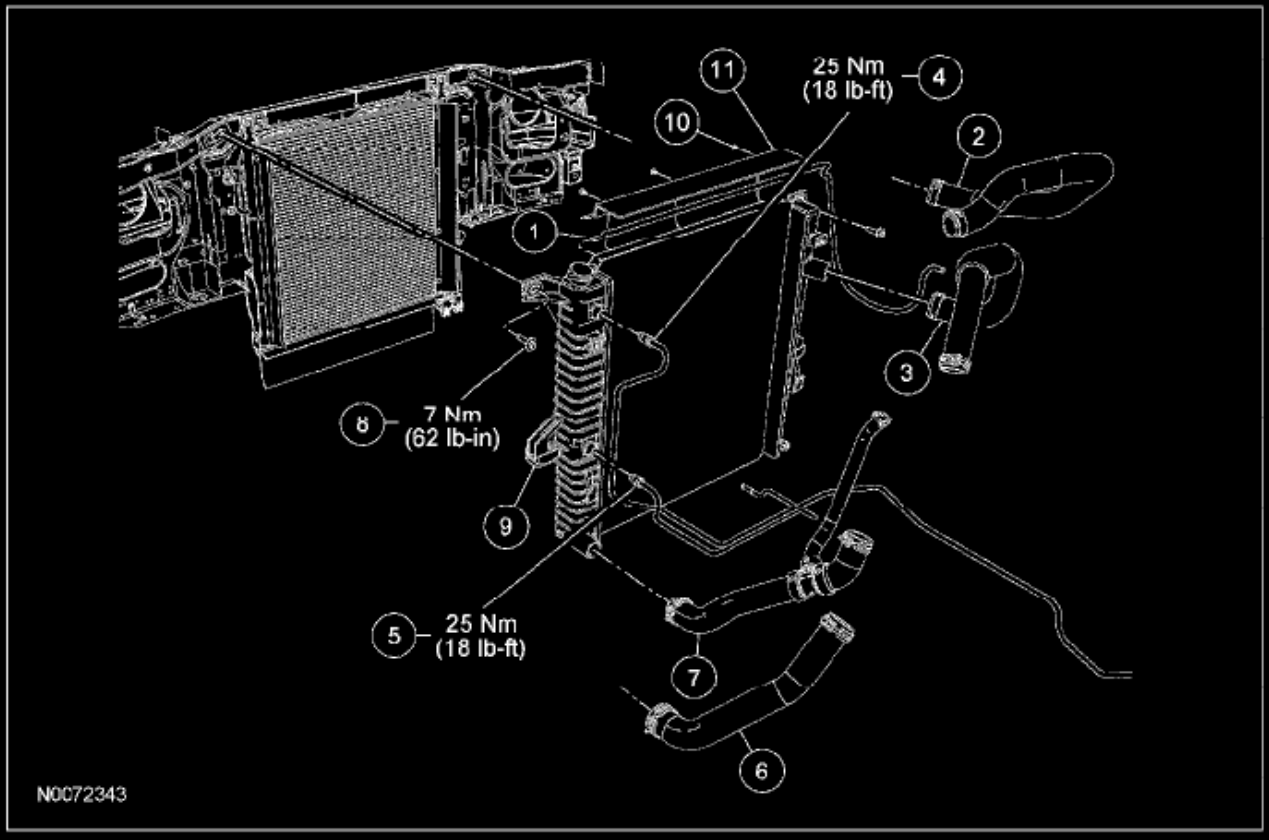
Radiator and Cooling Fan - Exploded View, 3.0L and 4.0L

Cooling Fan and Shroud

Cooling Fan and Shroud

Radiator and Hoses

Radiator and Hoses



Item	Part Number	Description
1	8075	Radiator overflow hose
2	8260	Upper radiator hose (4.0L SOHC engines)
3	8260	Upper radiator hose (3.0L engines)
4	7A031	Transmission cooler outlet hose
5	7C410	Transmission cooler inlet hose
6	8286	Lower radiator hose (4.0L SOHC engines)

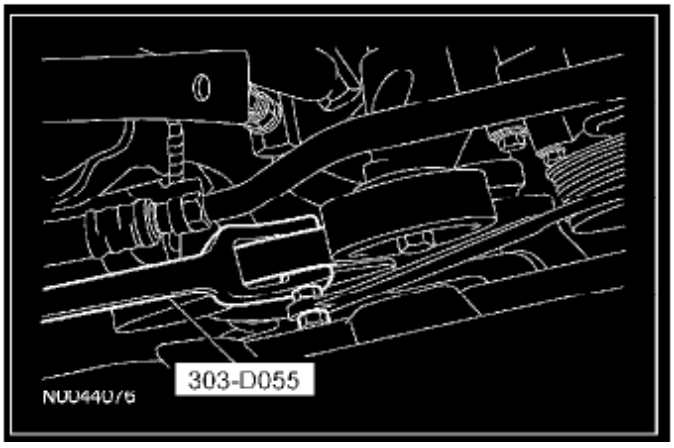
(Continued)

Item	Part Number	Description
7	8286	Lower radiator hose (3.0L engines)
8	N811605	Radiator-to-radiator support bolt (2 required)
9	8005	Radiator
10	N806799	Pushpin
11	19T555	Seal

Radiator and Hoses

Special Tool(s)

ST1828-A	Holding Wrench, Fan Pulley 303-239 (T84T-6312-C)
ST1500-A	Wrench, Fan Clutch Nut 303-240 (T84T-6312-D)
ST1436-A	Strap Wrench 303-D055 (D85L-6000-A) or equivalent



Fan Shroud: Service and Repair

Cooling Fan Shroud - 3.0L, 4.0L

Removal and Installation

All vehicles

1. Remove the air cleaner outlet tube. 2. Remove the accessory drive belt.

3.0L vehicles

3. NOTE: The fan clutch has a left-hand thread and must be rotated clockwise for removal.

Using the special tool and a standard 7/8-in wrench, remove the fan and fan clutch assembly and position it into the shroud. ^

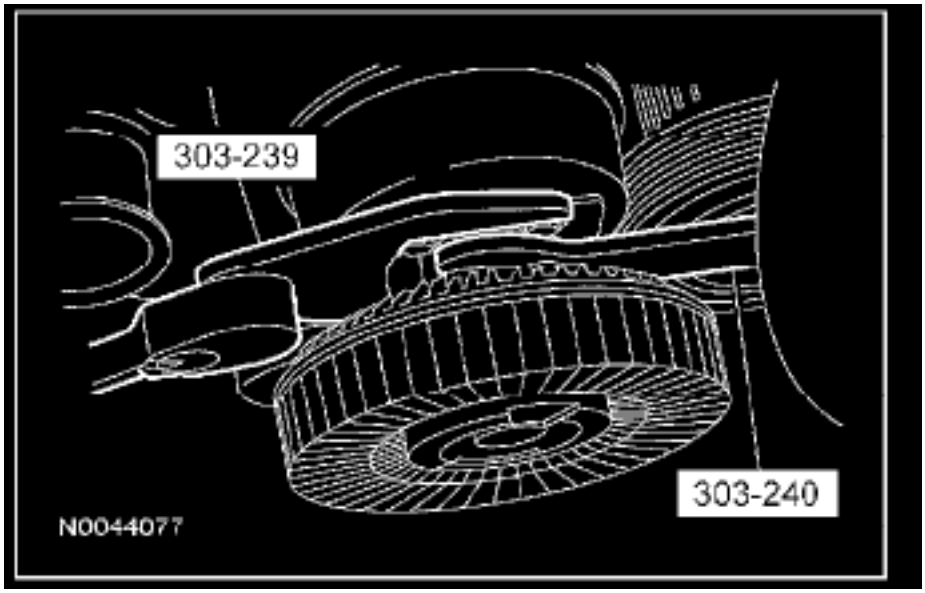
To install, tighten to 54 Nm (40 lb-ft).

4.0L SOHC vehicles

4. NOTE: The fan clutch has a left-hand thread and must be rotated clockwise for removal.

Using the special tools, remove the fan and fan clutch assembly and position it inside the shroud. ^

To install, tighten to 55 Nm (41 lb-ft).

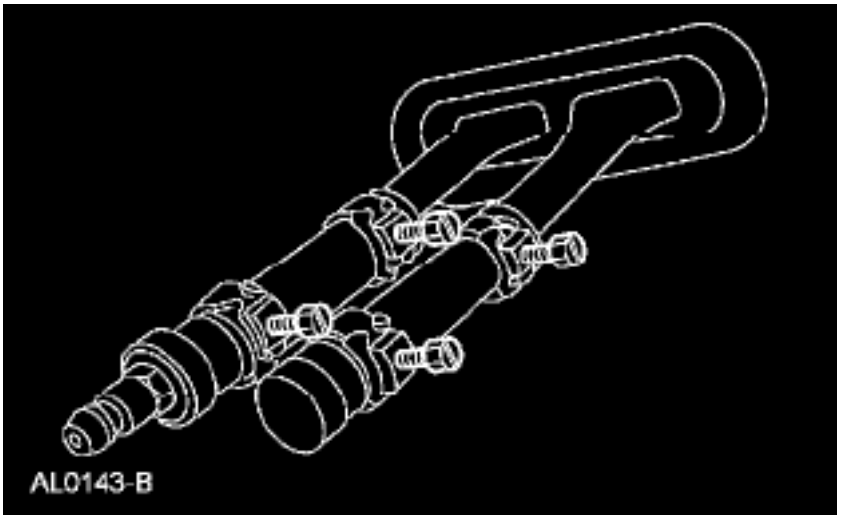


All vehicles

5. Remove the fan shroud bolts. Lift the fan and fan clutch assembly and the fan shroud together and remove from the vehicle.

^ To install, tighten to 6 Nm (53 lb-inch).

6. To install, reverse the removal procedure.



Heater Core: Testing and Inspection

HEATER CORE

1. NOTE: Testing of returned heater cores reveals that a large percentage of heater cores are good and did not require the installation of a new

heater core. If a heater core leak is suspected, the heater core must be tested by following the plugged heater core component test before the heater core pressure test. Carry out a system inspection by checking the heater system thoroughly as follows:

Inspect for evidence of coolant leakage at the heater hose-to-heater core attachments. A coolant leak in the heater hose could follow the heater core tube to the heater core and appear as a leak in the heater core.

2. NOTE: Spring-type clamps are installed as original equipment. Installation and overtightening of non-specified clamps can cause leakage at the

heater hose connection and damage the heater core.

Check the integrity of the heater hose clamps.

Heater Core - Plugged

WARNING: Before disconnecting any heater water hoses, shut OFF the engine and wait until engine is fully cool. Failure to comply with this warning may result in serious injury or burns from hot liquid escaping from the engine cooling system.

1. Check to see that the engine coolant is at the correct level. 2. Start the engine and turn on the heater. 3. When the engine coolant reaches operating temperature, feel the heater core inlet and outlet hoses to see if they are hot. 4. If the outlet only is not hot:

- the heater core may have an air pocket.

- the heater core may be plugged.

5. If the inlet only is not hot, the thermostat may not be working correctly.

Heater Core - Pressure Test

Use the Pressure Test Kit to carry out the pressure test.

1. NOTE: Due to space limitations, a bench test may be necessary for pressure testing.

Drain the coolant from the cooling system.

2. Disconnect the heater hoses from the heater core. 3. Install a short piece of heater hose, approximately 101 mm (4 in) long on each heater core tube. 4. Fill the heater core and heater hoses with water and install plug BT-7422-B and adapter BT-7422-A from the Pressure Test Kit. Secure the heater

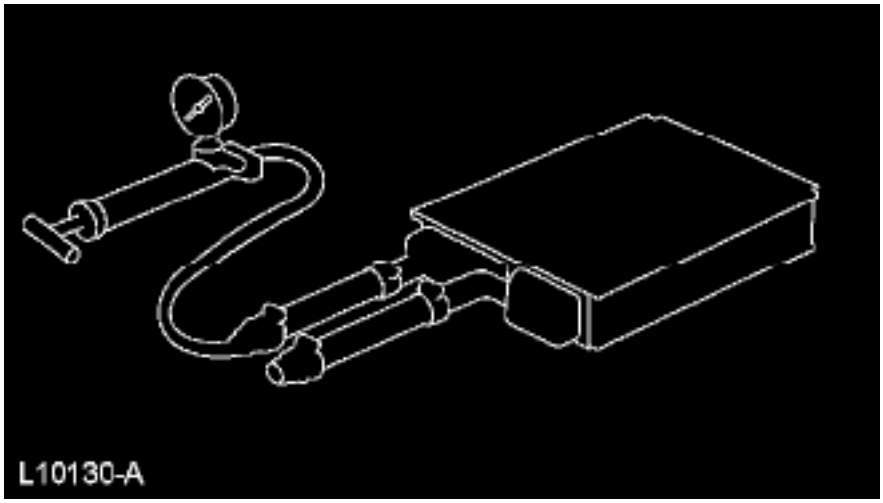
hoses, plug and adapter with hose clamps.

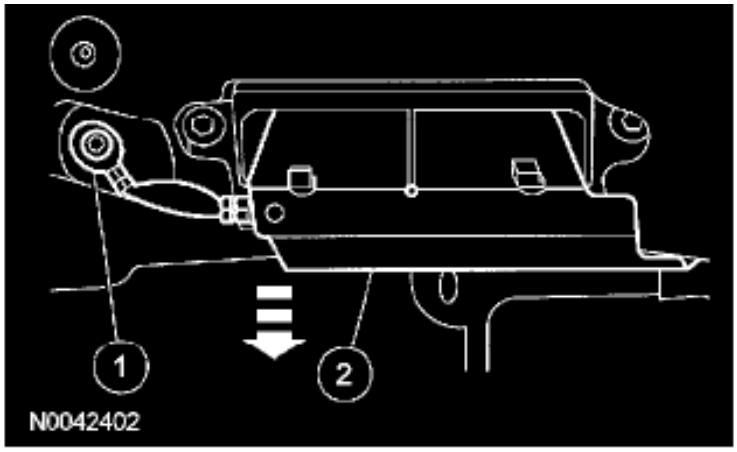
5. Attach the pump and gauge assembly from the Pressure Test Kit to the adapter. 6. Close the bleed valve at the base of the gauge. Pump 138 kPa (20 psi) of air pressure into the heater core. 7. Observe the pressure gauge for a minimum of 3 minutes. 8. If the pressure drops, check the heater hose connections to the core tubes for leaks. If the heater hoses do not leak, remove the heater core from the

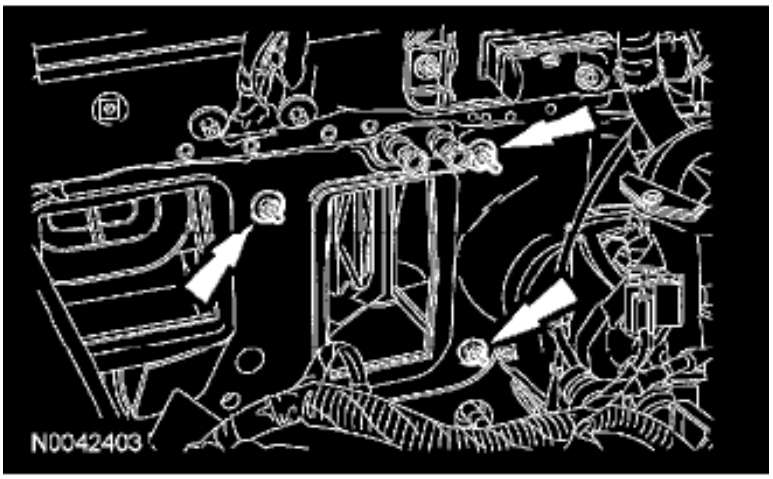
vehicle and carry out the bench test.

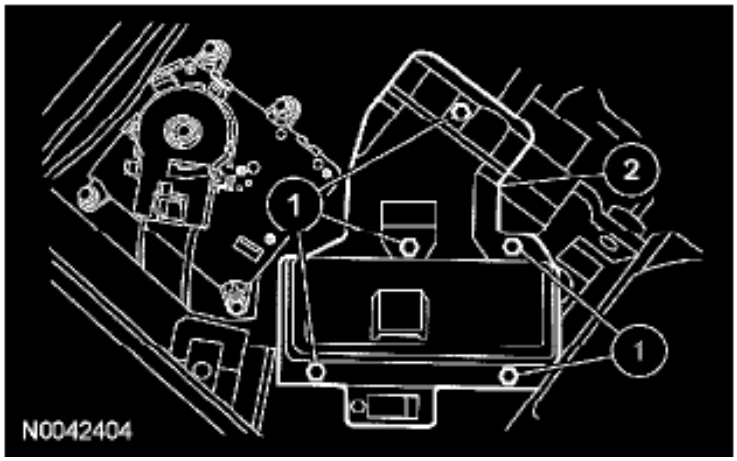
Heater Core - Bench Test

1. Remove the heater core from the vehicle. 2. Drain all of the coolant from the heater core. 3. Connect the 101 mm (4 in) test heater hoses with plug and adapter to the core tubes. Then connect the Pressure Test Kit to the adapter. 4. Apply 138 kPa (20 psi) of air pressure to the heater core. Submerge the heater core in water. 5. If a leak is observed, install a new heater core.


L10130-A


1
2
N0042402


N0042403


1
2
1
N0042404

Heater Core: Service and Repair

HEATER CORE

Removal and Installation

1. NOTE: If a heater core leak is suspected, the heater core must be leak tested before it is removed from the vehicle.

Remove the evaporator core housing.

2. Remove the instrument panel. 3. Remove the PCM. 4. Remove the PCM heat sink.

1 Remove the ground strap screw.

2 Remove the heat sink.

5. Remove the 4 nuts from the engine side of the dash panel. Position the plenum chamber on the vehicle floor.

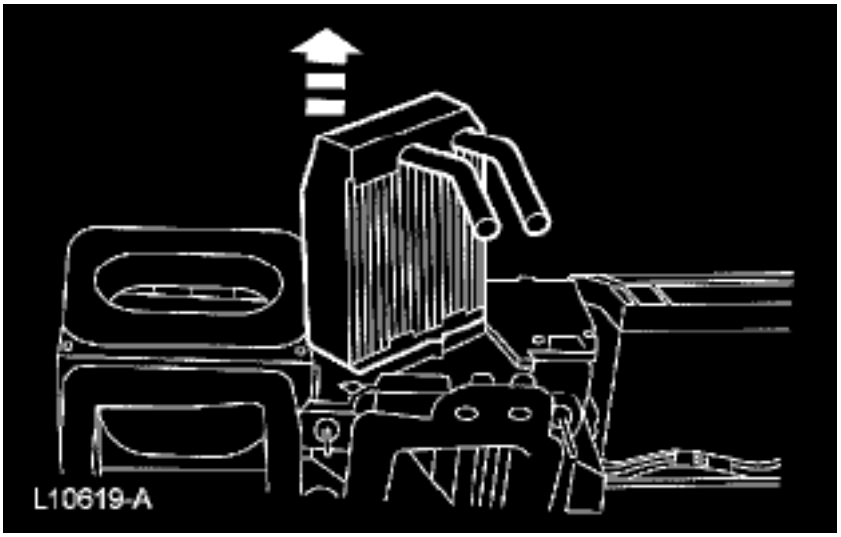
- To install, tighten to 4 Nm (35 lb-in).

6. Remove the heater core cover.

1 Remove the screws.

2 Remove the heater core cover.

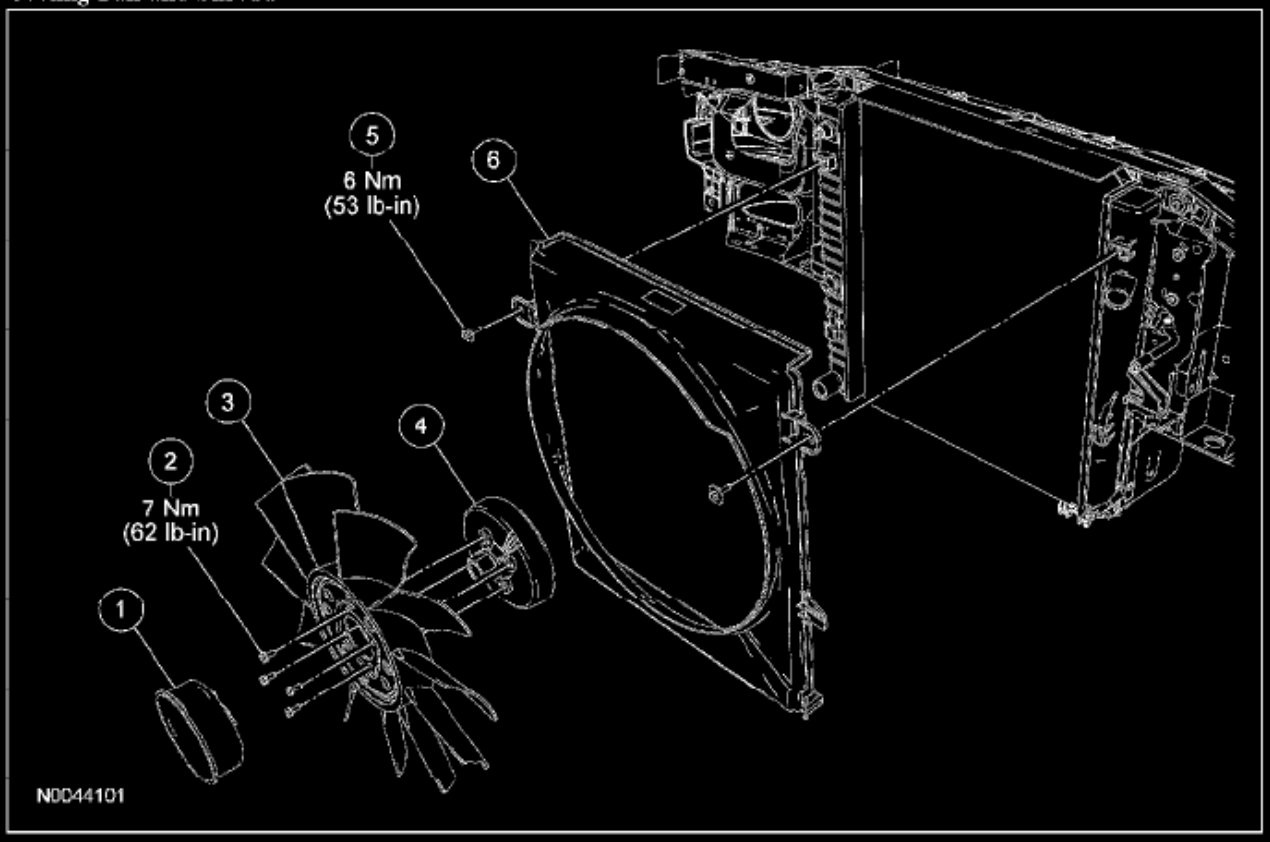
7. Remove the heater core.



8. To install, reverse the removal procedure.

- During installation, be sure to install a new oval foam seal around the heater core inlet and outlet tubes.

Cooling Fan and Shroud



Item	Part Number	Description
1	8509	Coolant pump pulley
2	W602527	Cooling fan-to-cooling fan clutch bolt (4 required)
3	8600	Cooling fan

Item	Part Number	Description
4	8A616	Cooling fan clutch
5	N811864	Cooling fan shroud bolt (2 required)
6	8146	Cooling fan shroud

(Continued)

Radiator: Diagrams

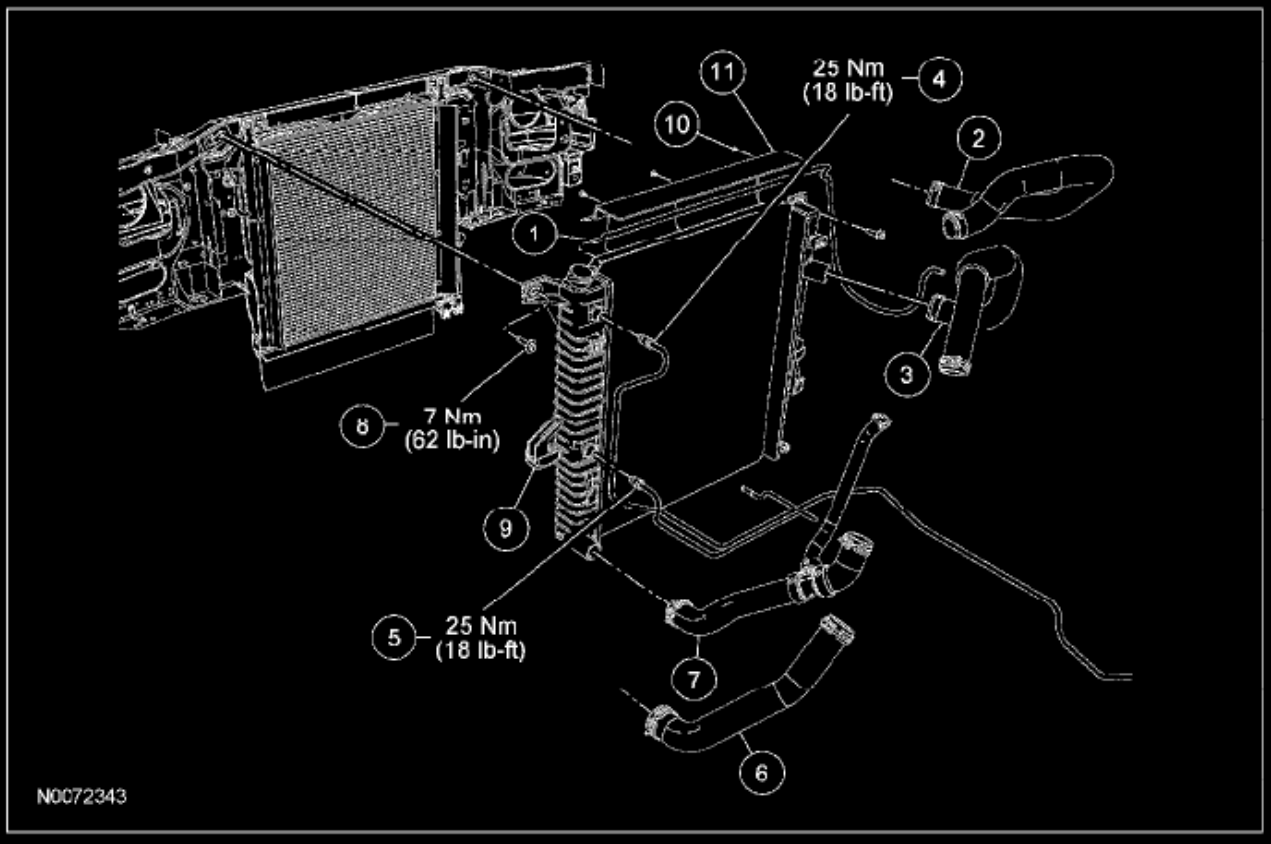
Radiator and Cooling Fan - Exploded View, 3.0L and 4.0L

Cooling Fan and Shroud

Cooling Fan and Shroud

Radiator and Hoses

Radiator and Hoses



Item	Part Number	Description
1	8075	Radiator overflow hose
2	8260	Upper radiator hose (4.0L SOHC engines)
3	8260	Upper radiator hose (3.0L engines)
4	7A031	Transmission cooler outlet hose
5	7C410	Transmission cooler inlet hose
6	8286	Lower radiator hose (4.0L SOHC engines)

(Continued)

Item	Part Number	Description
7	8286	Lower radiator hose (3.0L engines)
8	N811605	Radiator-to-radiator support bolt (2 required)
9	8005	Radiator
10	N806799	Pushpin
11	19T555	Seal

Radiator and Hoses

Radiator: Service and Repair

Radiator - 3.0L, 4.0L

Removal

All vehicles

1. Drain the cooling system. 2. Disconnect the radiator overflow hose from the radiator. 3. Remove the cooling fan shroud. 4. Disconnect the upper radiator hose from the radiator. 5. Disconnect the lower radiator hose from the radiator.

Vehicles equipped with an automatic transmission

6. NOTE: To avoid disturbing the transmission oil cooler fittings, use a back-up wrench.

Disconnect the 2 transmission cooler tubes from the radiator.

All vehicles

7. Remove the 2 bolts and the radiator.

Installation

All vehicles

1. Position the radiator and install the 2 bolts.

^ Tighten to 7 Nm (62 lb-inch).

Vehicles equipped with an automatic transmission

2. NOTE: To avoid disturbing the transmission oil cooler fittings, use a back-up wrench.

Connect the transmission cooler tubes to the radiator. ^

Tighten to 25 Nm (18 lb-ft).

All vehicles

3. Connect the lower radiator hose to the radiator. 4. Connect the upper radiator hose to the radiator. 5. Install the cooling fan shroud. 6. Connect the radiator overflow hose to the radiator. 7. Fill and bleed the cooling system.

8. WARNING: Do not stand in line with or near the engine cooling fan blade when revving the engine. A damaged fan can separate during

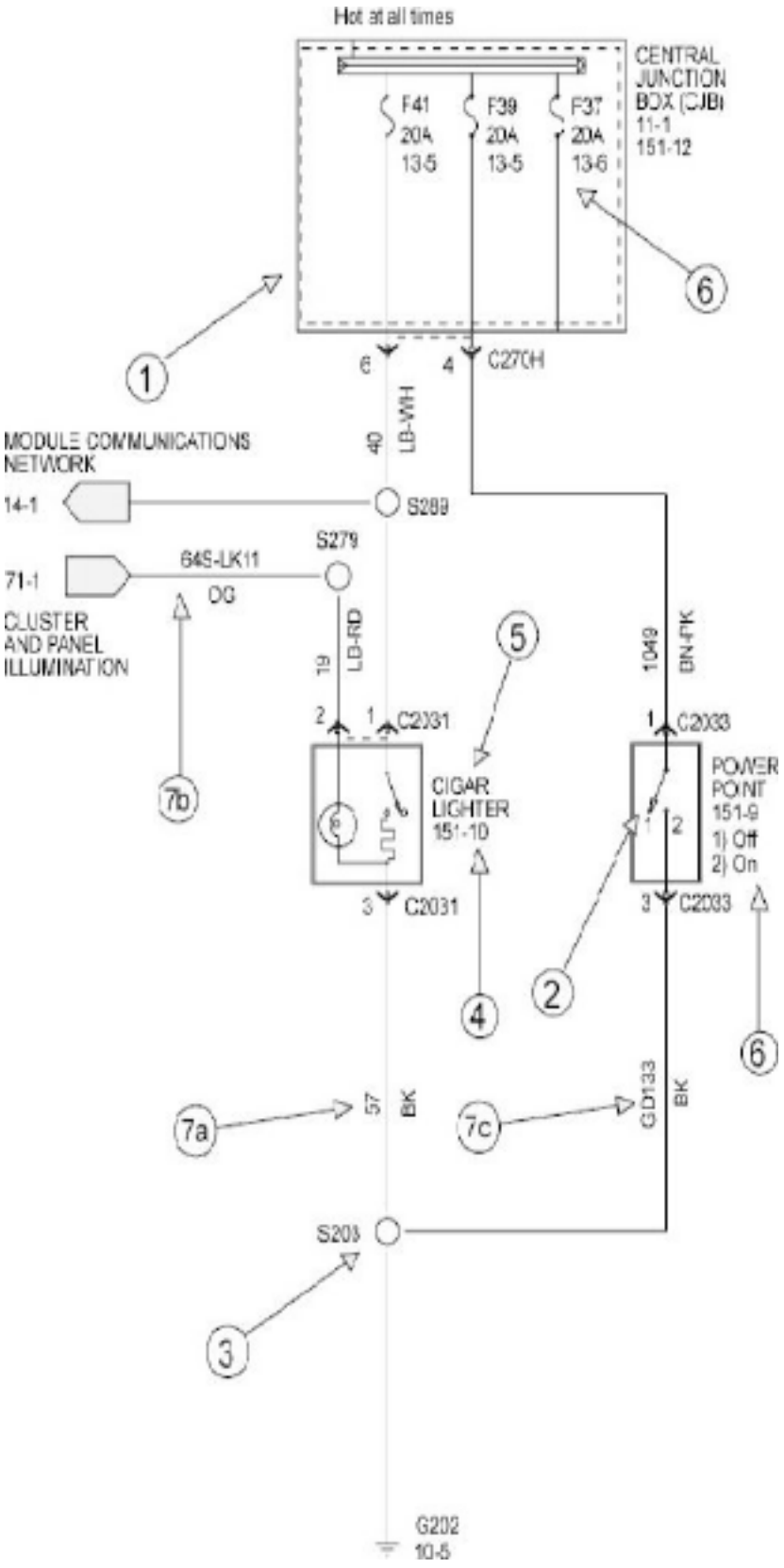
operation. Failure to follow this instruction may result in serious personal injury.

Operate the engine for several minutes and check the hoses and connections for leaks.

Vehicles equipped with an automatic transmission

9. Check the transmission fluid level. Fill as needed.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Engine, Cooling and Exhaust > Cooling System > Relays and Modules - Cooling System > Radiator Cooling Fan Motor Relay > Component Information > Diagrams > Diagram Information and Instructions



Radiator Cooling Fan Motor Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

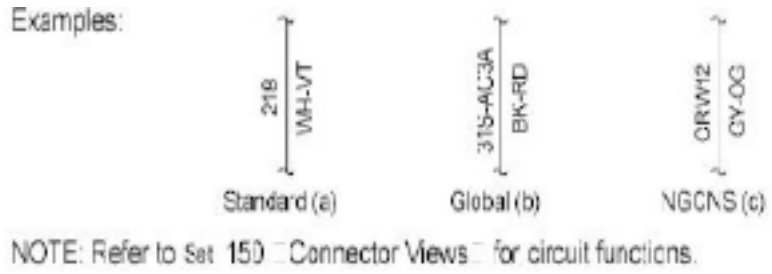
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

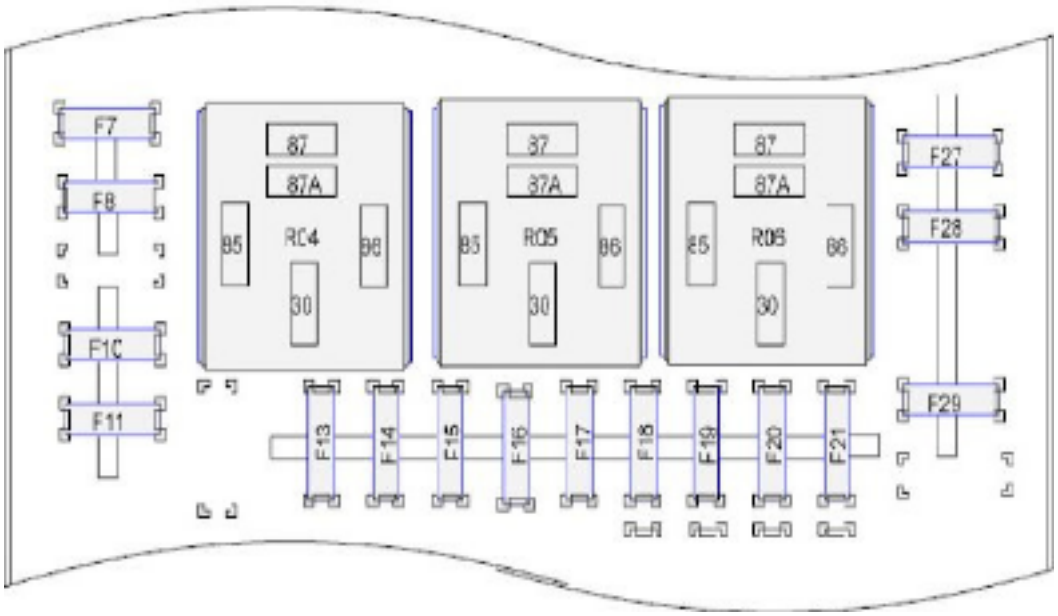
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

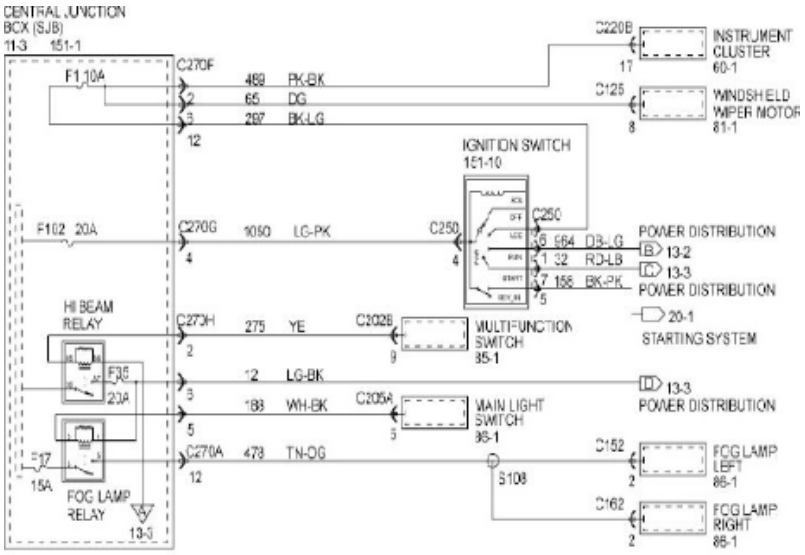
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

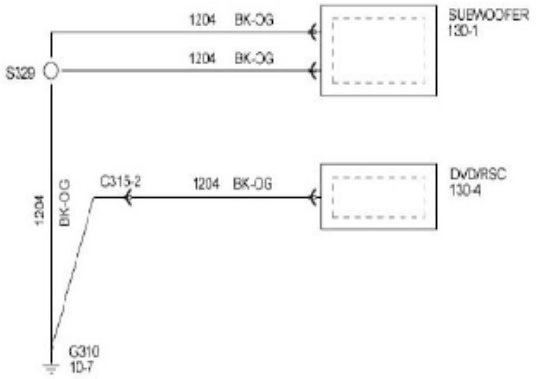
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by

each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

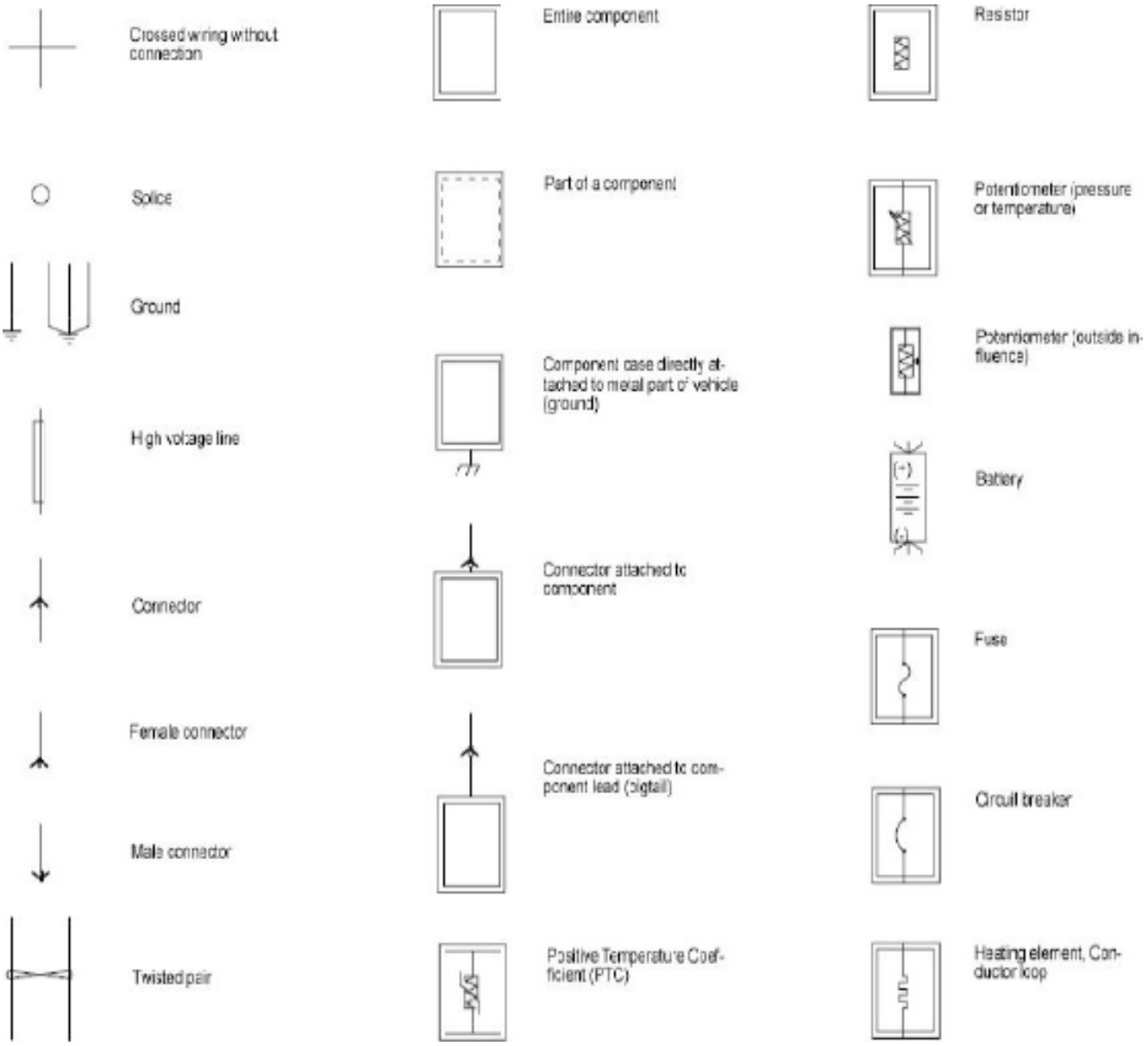
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

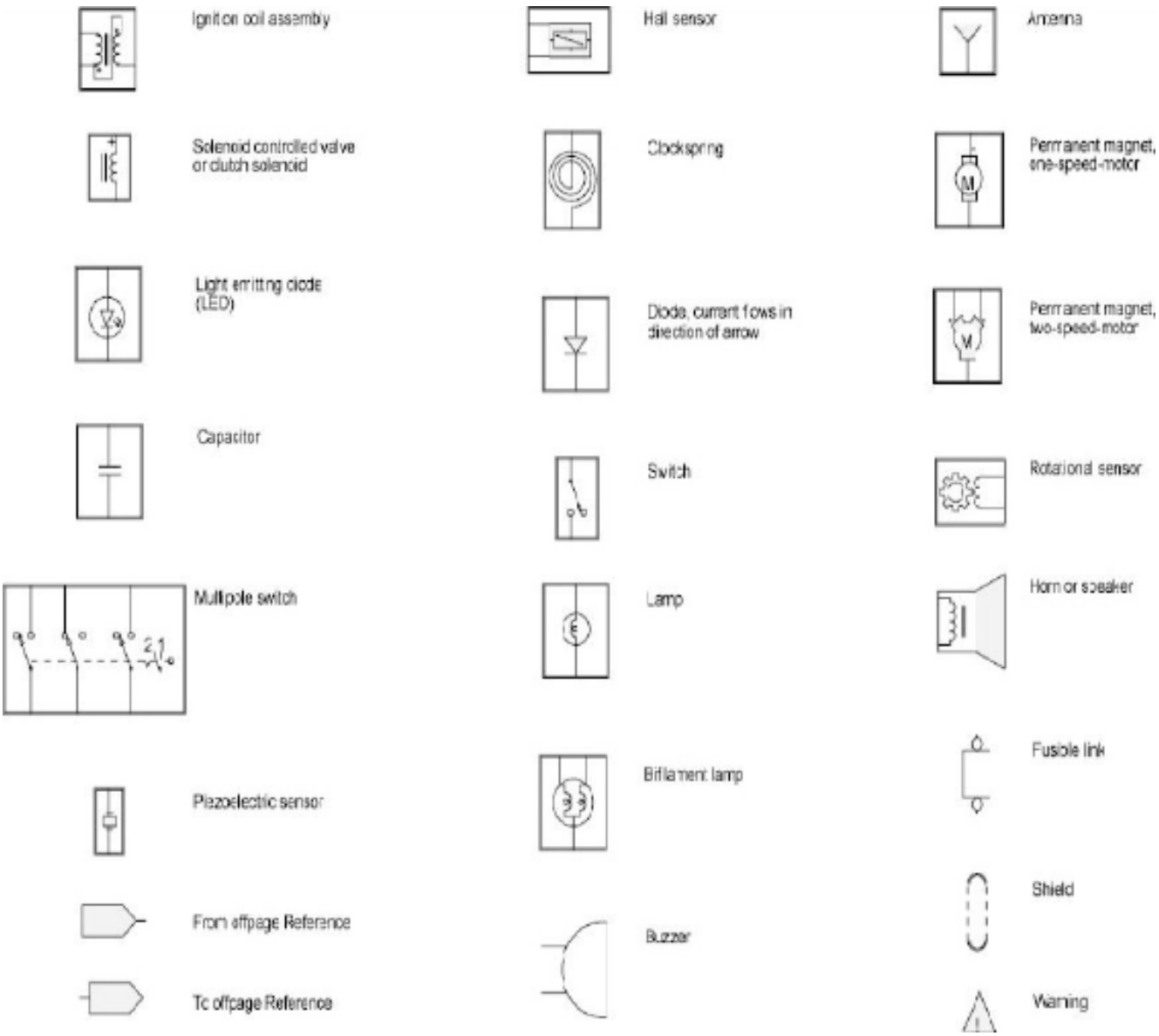
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

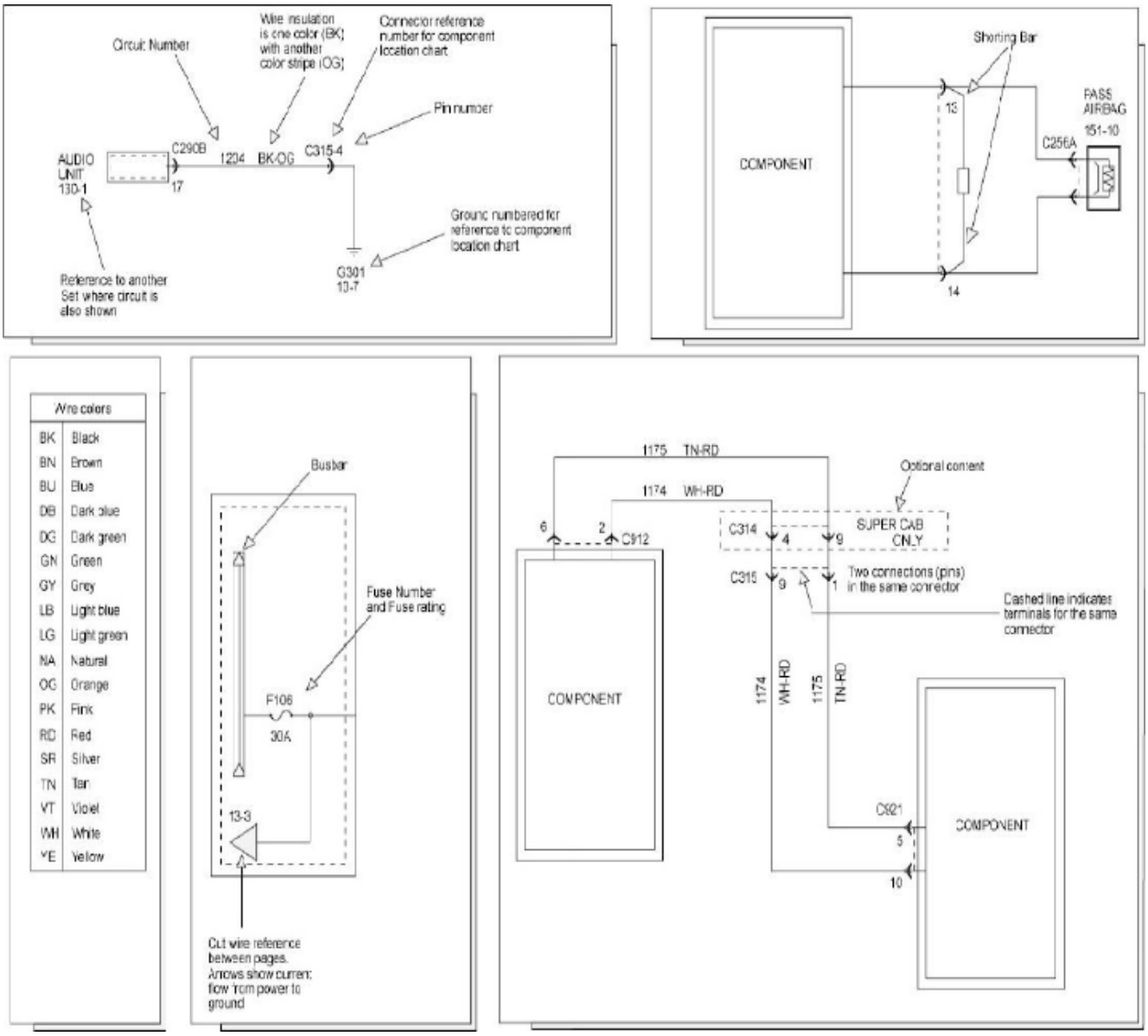
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

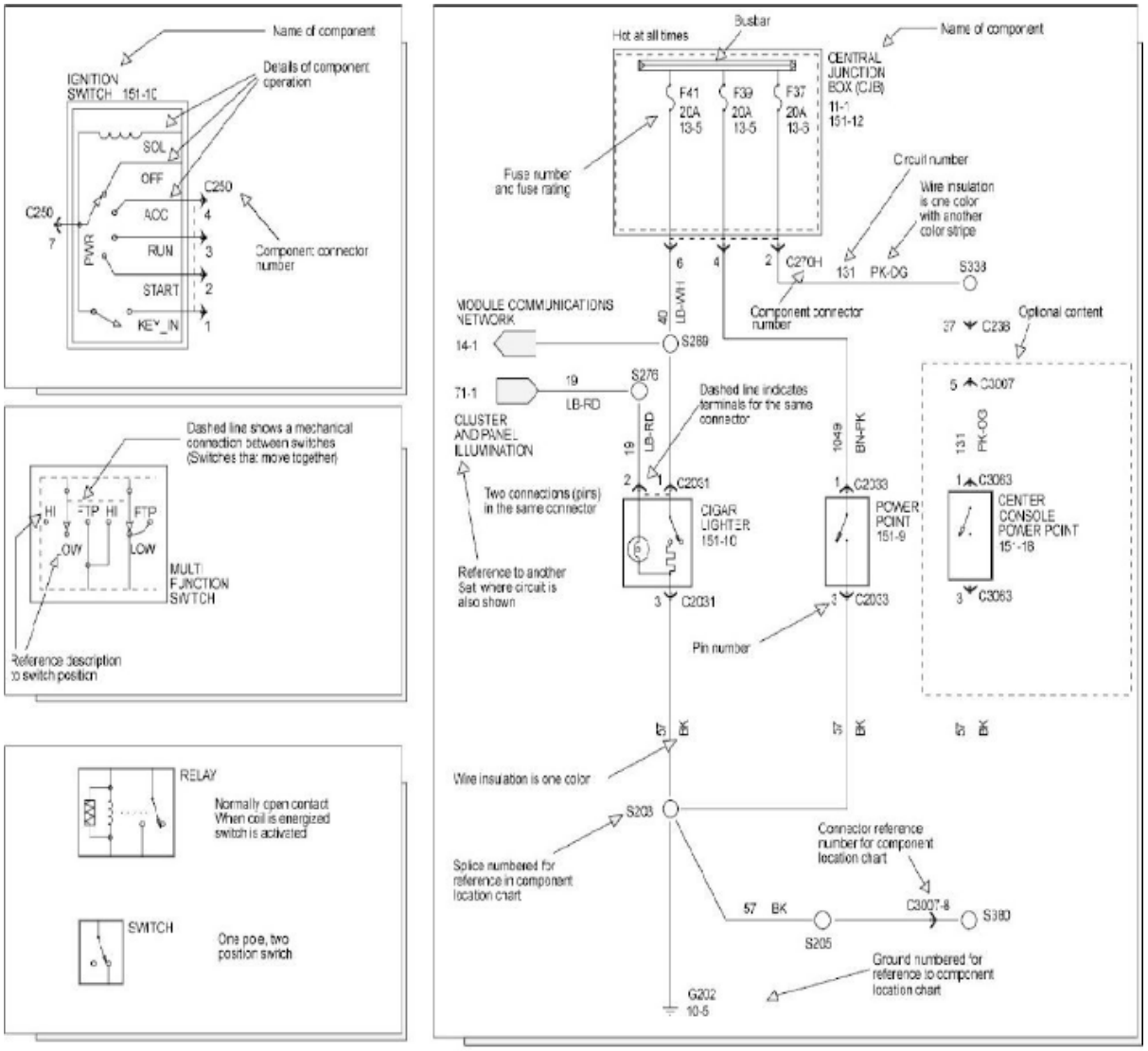
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

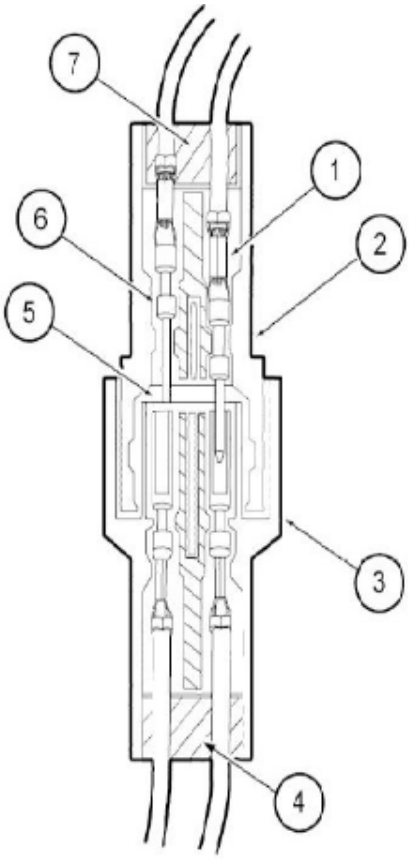


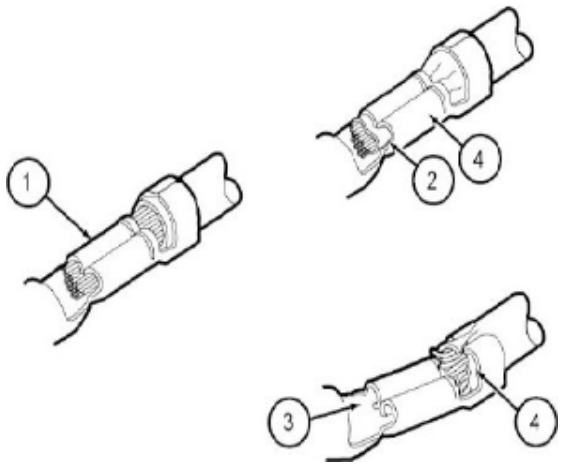
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)





Radiator Cooling Fan Motor Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

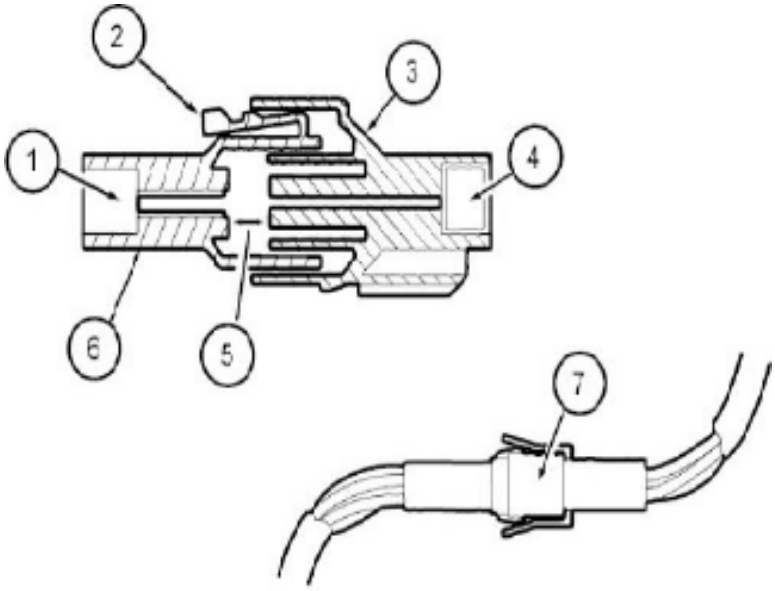
5 = Intermittent contact

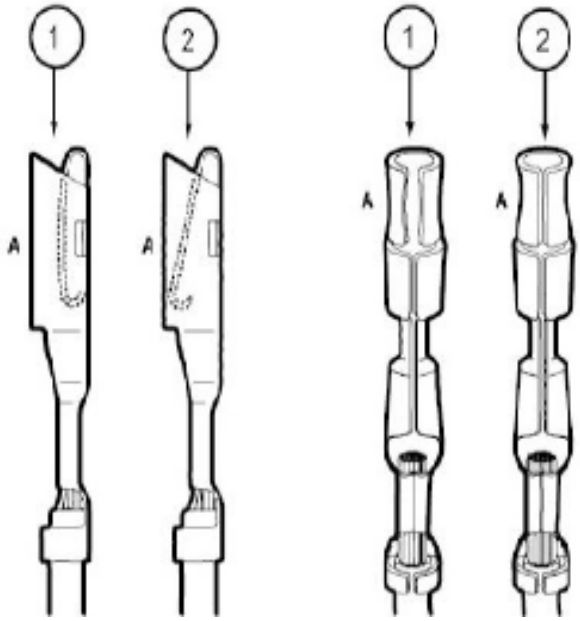
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping





1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

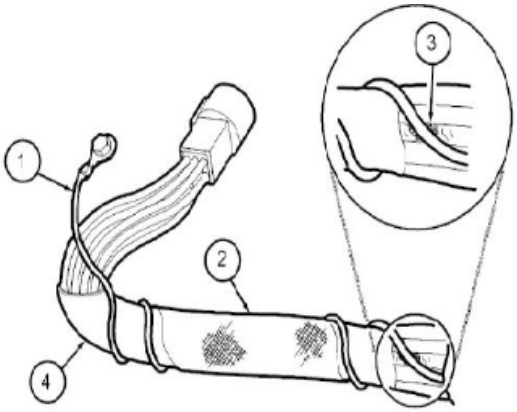
Deformed (enlarged) female terminals

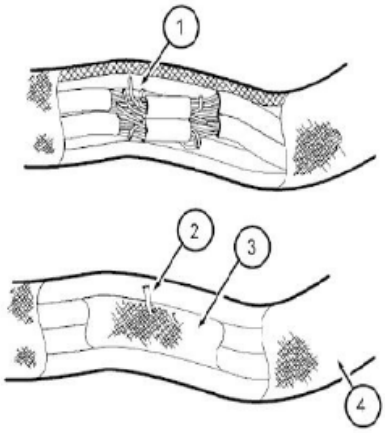
1 = Enlarged

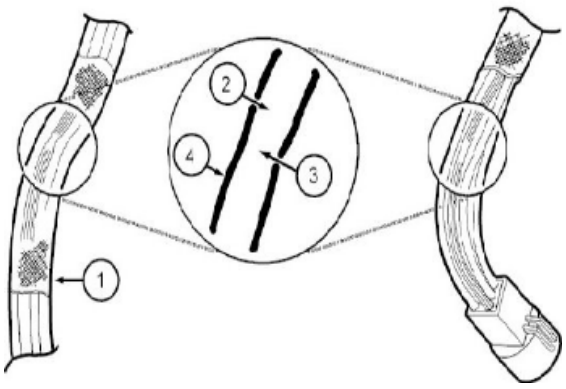
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.







Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

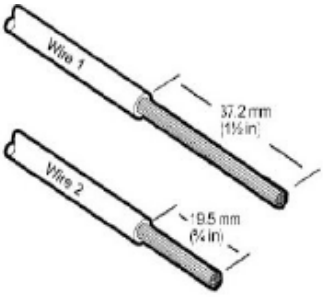
Splice covered 2

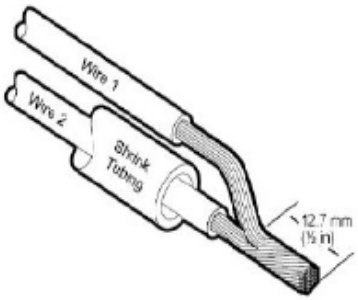
= Wire strand

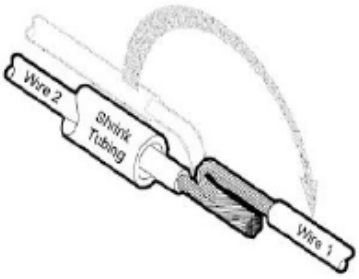
3 = Splice tape

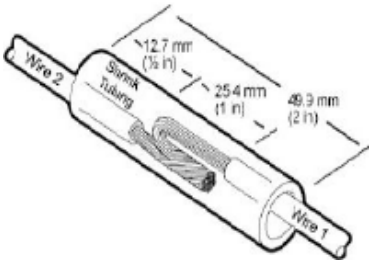
4 = Harness tape

Broken wire strands in harness









1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. lnstall heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

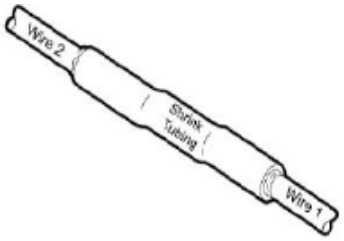
NOTE: -

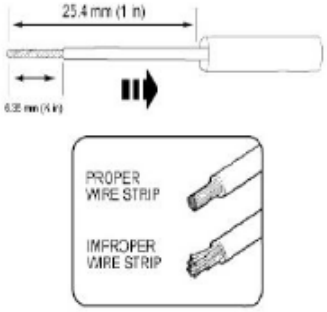
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

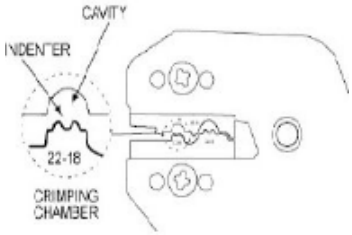
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

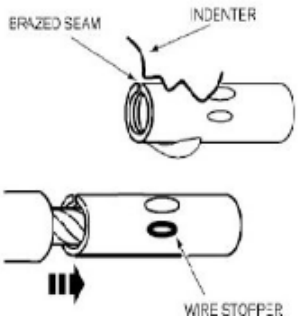
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.









7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

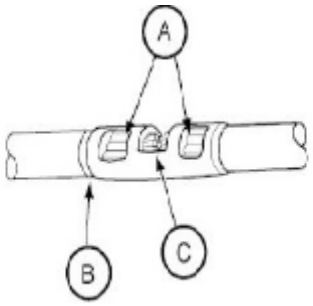
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

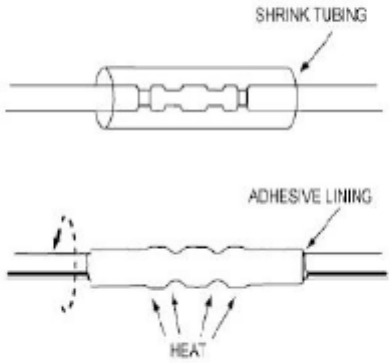
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4 strip, cut 9 strands	* 1/4 strip, cut 2 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip, fold 3x dia.
	16-14	* 1/4 strip, cut 7 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip fold 2x dia	1 strip, fold 3x dia.	1 1/4 strip, fold 4x dia.	Not Recommended
	12-10	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip, fold 3x cia.	1 1/4 strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Pigtail only

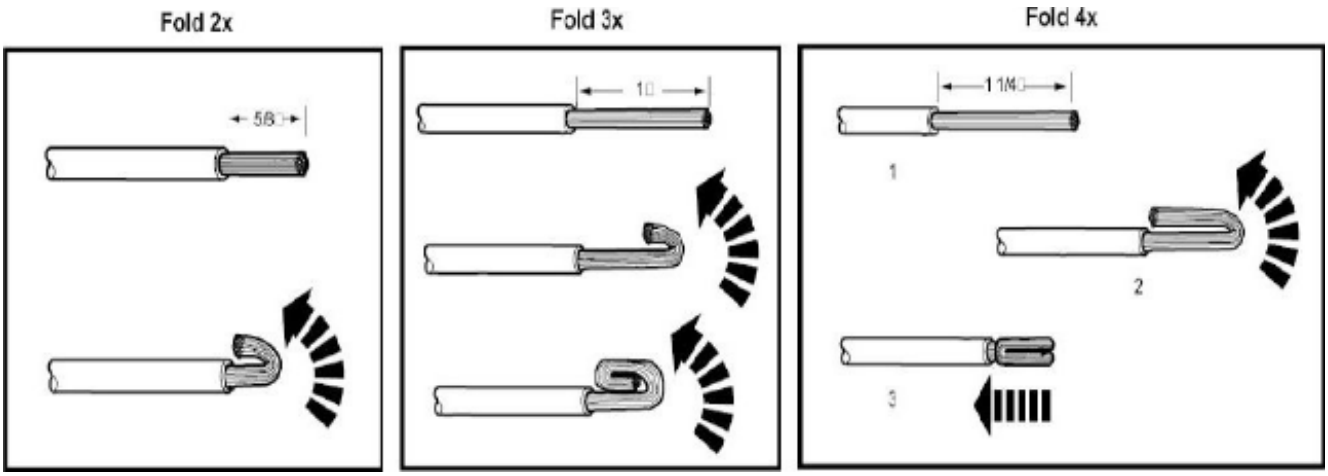
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



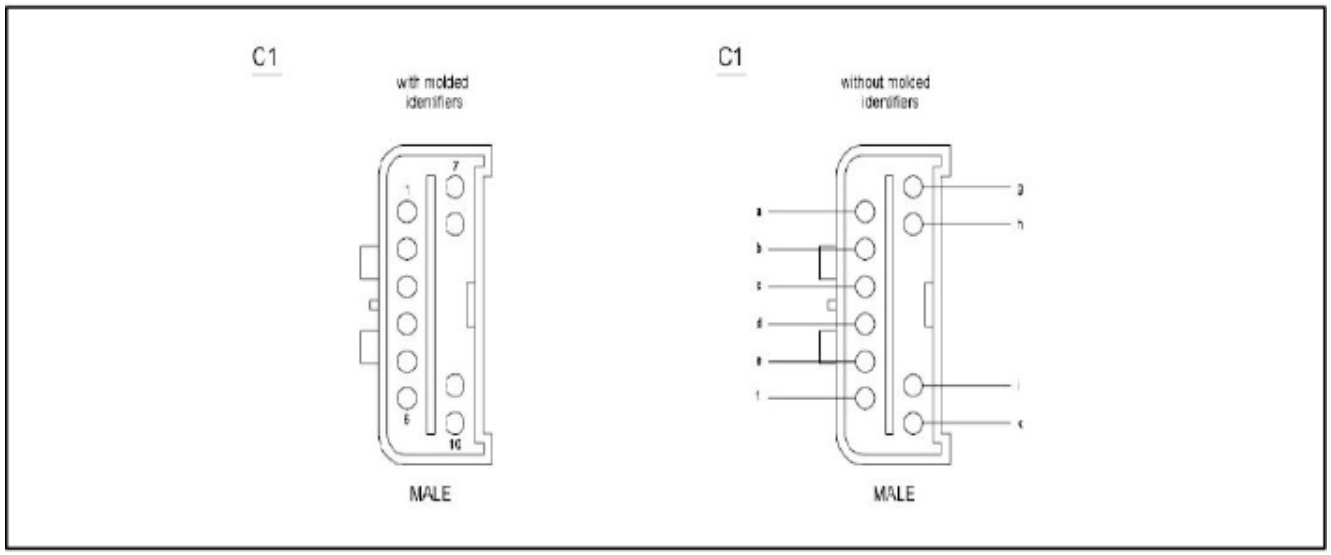
The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



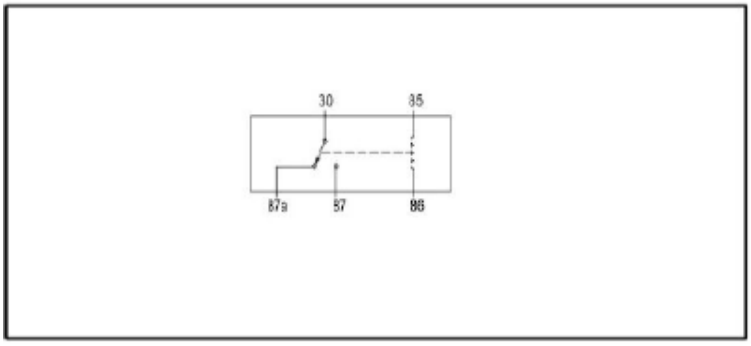
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

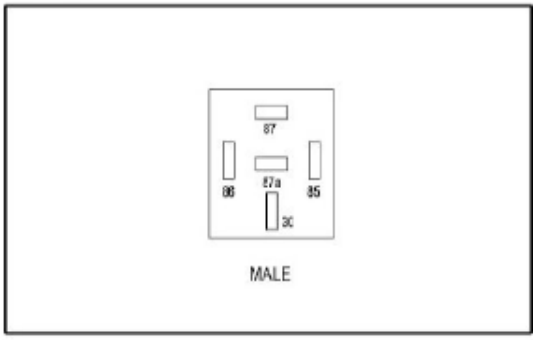
Radiator Cooling Fan Motor Relay: Testing and Inspection Mini ISO Relay

Relay □ Mini ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

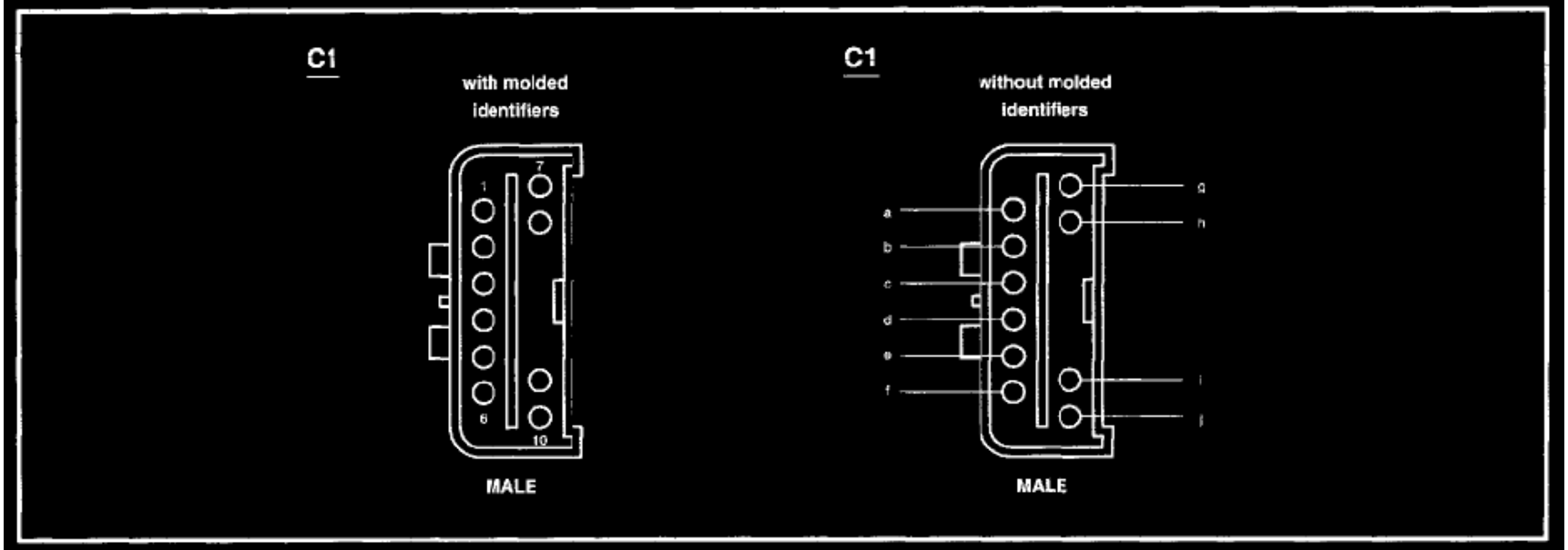
Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step–by–step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



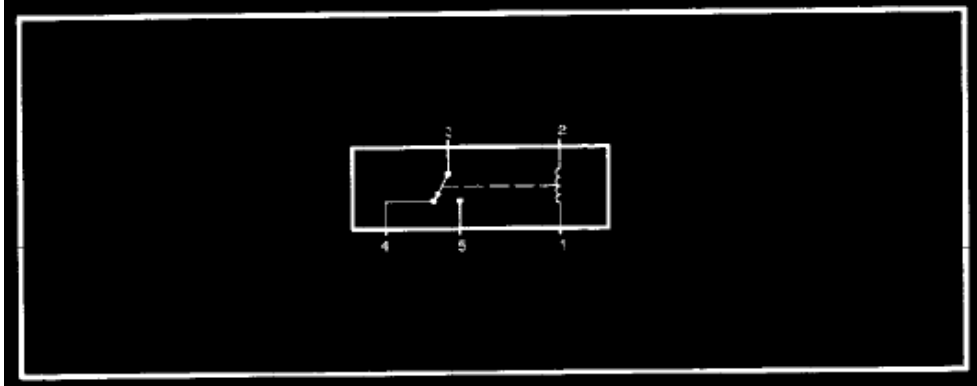
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

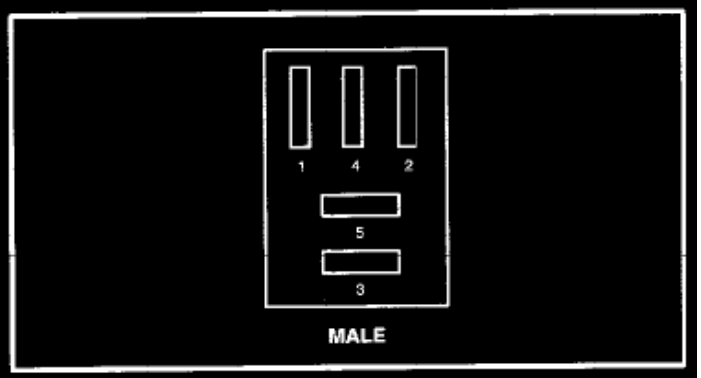
Radiator Cooling Fan Motor Relay: Testing and Inspection Micro ISO Relay

Relay – Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63–102Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil – Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

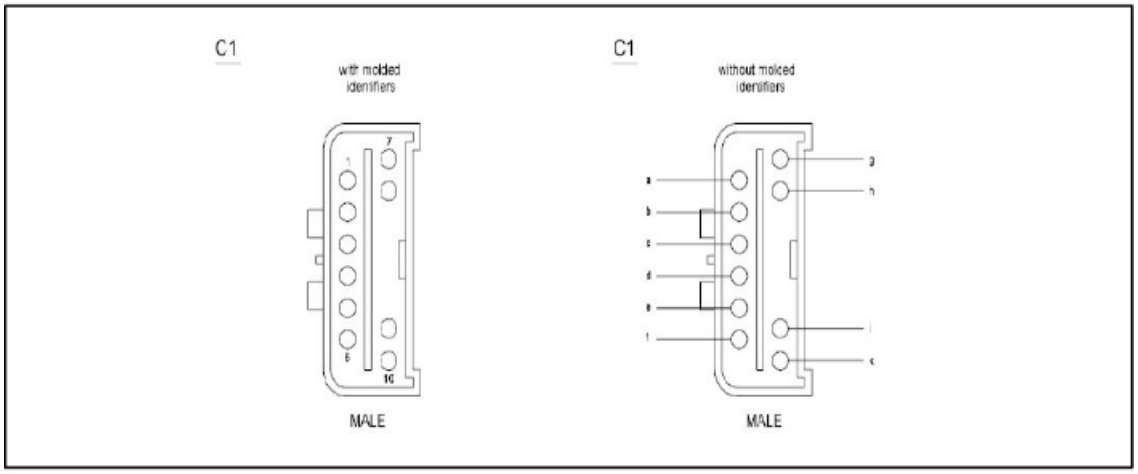
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



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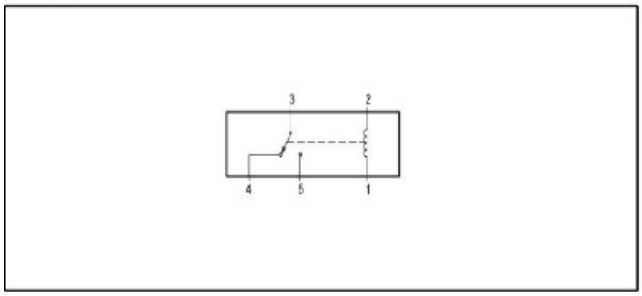
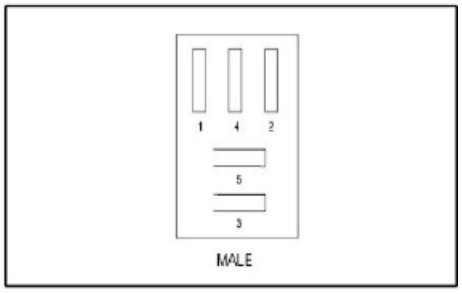
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Relay - Micro ISO

Schematic



Terminals

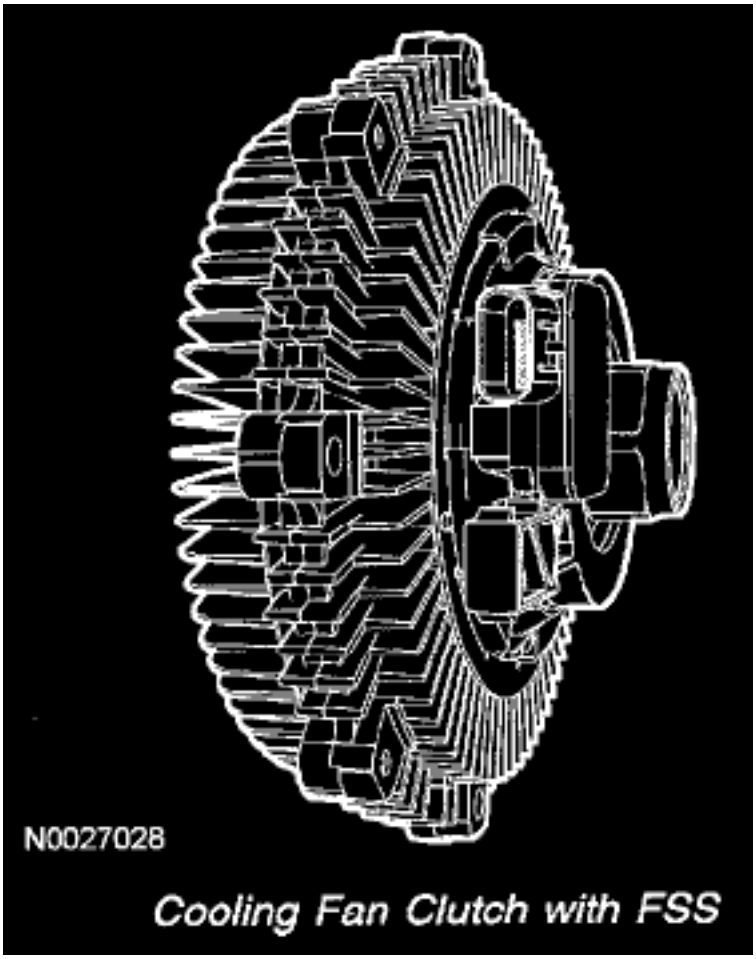


Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63-102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil - Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

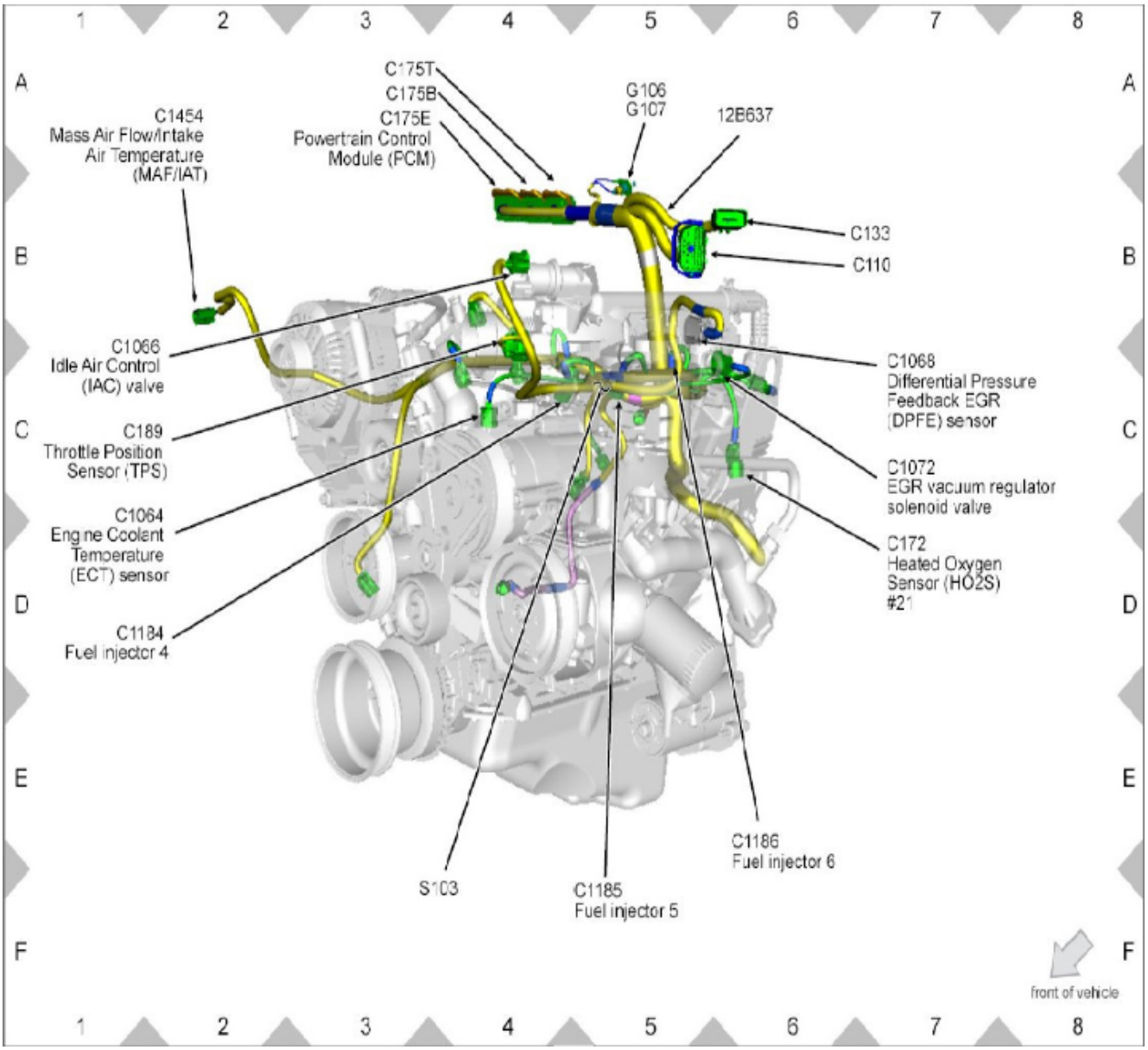


Radiator Cooling Fan Speed Sensor: Description and Operation

FAN SPEED SENSOR (FSS)

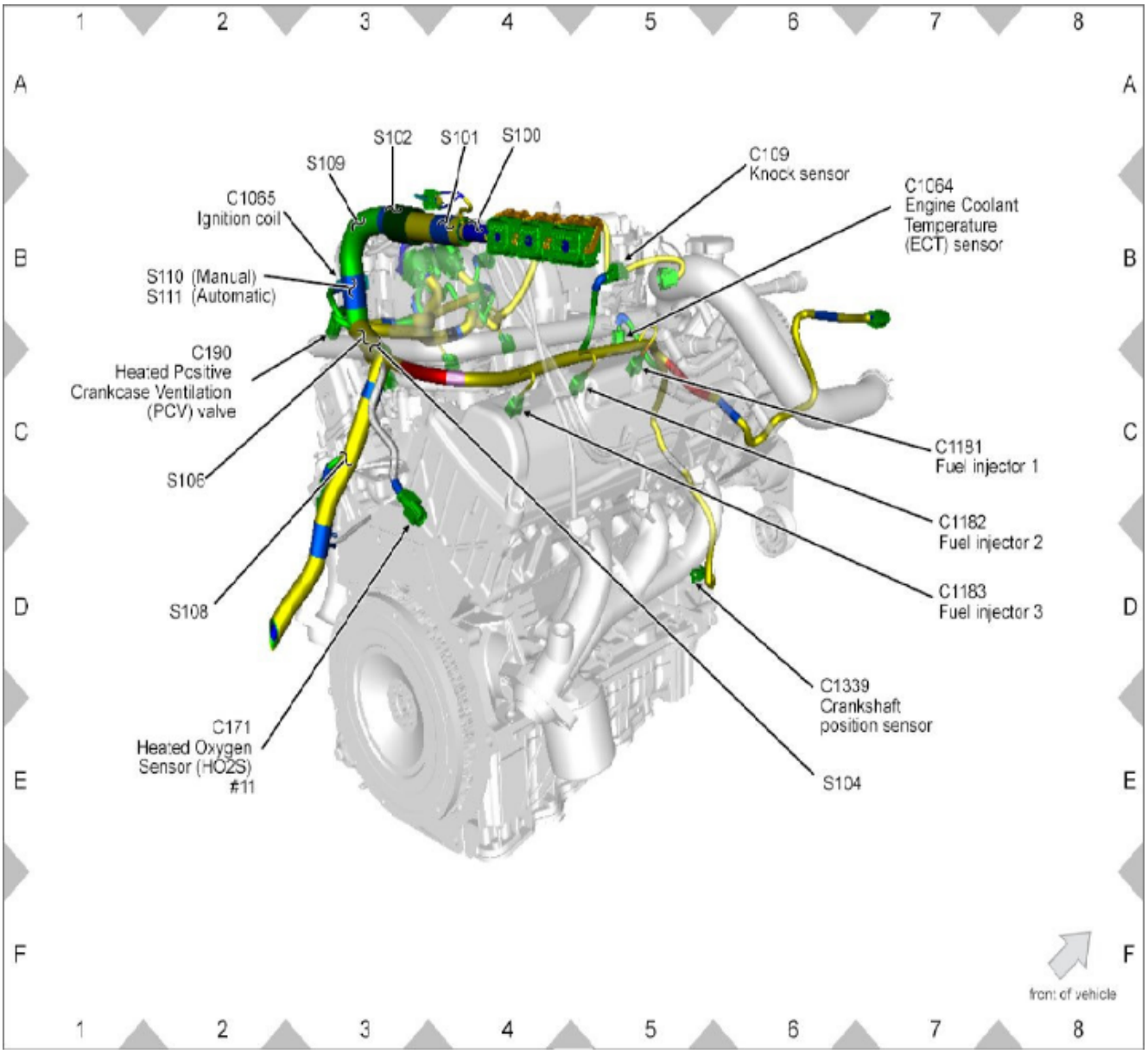
Cooling Fan Clutch With FSS

The FSS is a Hall-effect sensor that measures the cooling fan clutch speed by generating a waveform with a frequency proportional to the fan speed. If the cooling fan clutch is moving at a relatively low speed, the sensor produces a signal with a low frequency. As the cooling fan clutch speed increases, the sensor generates a signal with a higher frequency. The PCM uses the frequency signal generated by the FSS as a feedback for closed loop control of the cooling fan clutch.



Coolant Temperature Sensor/Switch (For Computer): Locations

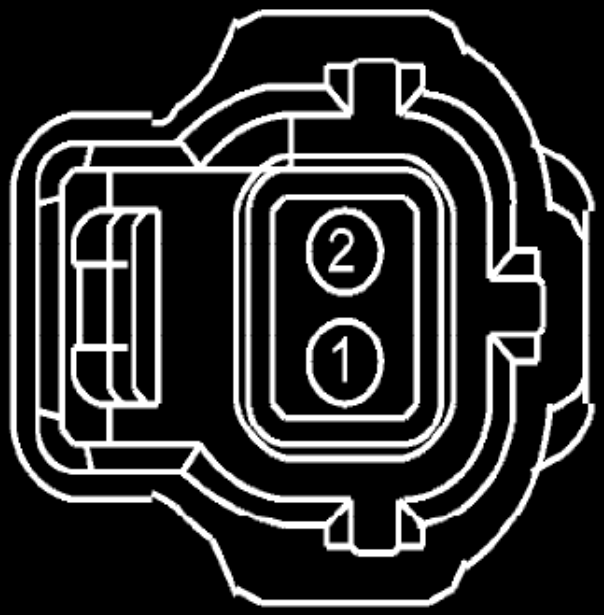
View 151-5


S102
S101
S100
S109
C1065
Ignition coil
S110 (Manual)
S111 (Automatic)
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
S108
C171
Heated Oxygen
Sensor (HO2S)
#11
C109
Knock sensor
C1064
Engine Coolant
Temperature
(ECT) sensor
C1181
Fuel injector 1
C1182
Fuel injector 2
C1183
Fuel injector 3
C1339
Crankshaft
position sensor
S104
front of vehicle

View 151-8

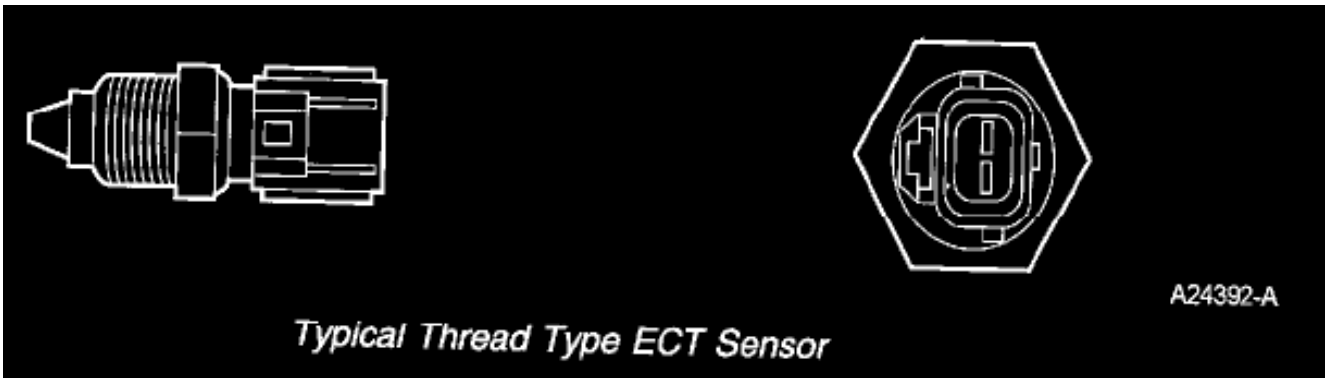
Connector: C1064

Description:	Harness:	Base Part #:
ENGINE COOLANT TEMPERATURE (ECT) SENSOR	12B637	12A648



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE716 (YE)	20	SENSOR - ENGINE COOLANT TEMPERATURE (ECT)	3.0L, 4.0L
2	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	3.0L, 4.0L

C1064



Coolant Temperature Sensor/Switch (For Computer): Description and Operation

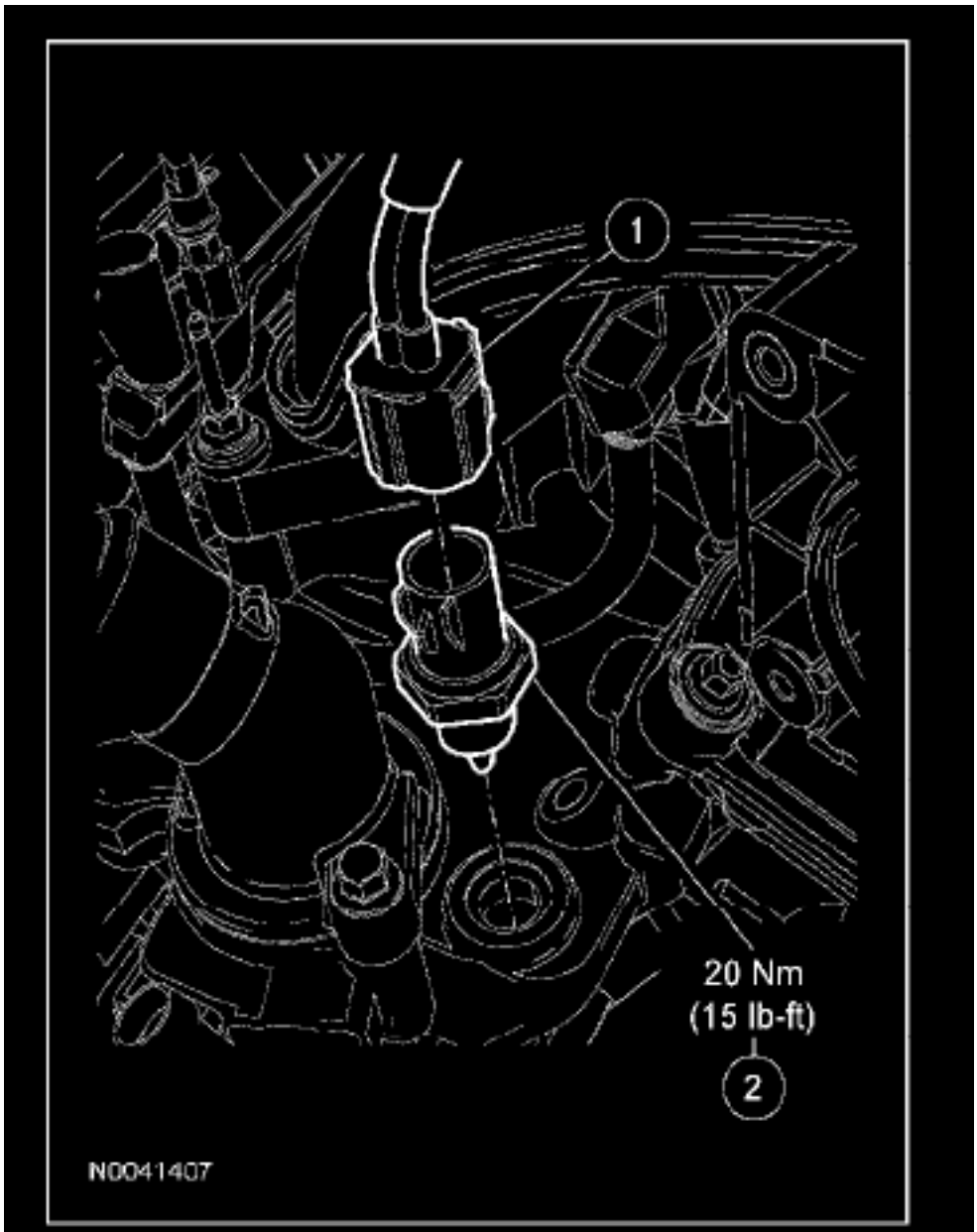
ENGINE COOLANT TEMPERATURE (ECT) SENSOR

Typical Thread Type ECT Sensor

The ECT sensor is a thermistor device in which resistance changes with temperature. The electrical resistance of a thermistor decreases as the temperature increases, and the resistance increases as the temperature decreases. The varying resistance changes the voltage drop across the sensor terminals and provides electrical signals to the PCM corresponding to temperature.

Thermistor-type sensors are considered passive sensors. A passive sensor is connected to a voltage divider network so that varying the resistance of the passive sensor causes a variation in total current flow. Voltage that is dropped across a fixed resistor in a series with the sensor resistor determines the voltage signal at the PCM. This voltage signal is equal to the reference voltage minus the voltage drop across the fixed resistor.

The ECT measures the temperature of the engine coolant. The PCM uses the ECT input for fuel control and for cooling fan control. There are 3 types of ECT sensors, threaded, push-in, and twist-lock. The ECT sensor is located in an engine coolant passage.



Item	Part Number	Description
1	14A464	Engine coolant temperature (ECT) sensor electrical connector (part of 12B637)
2	12A648	ECT sensor

Coolant Temperature Sensor/Switch (For Computer): Service and Repair

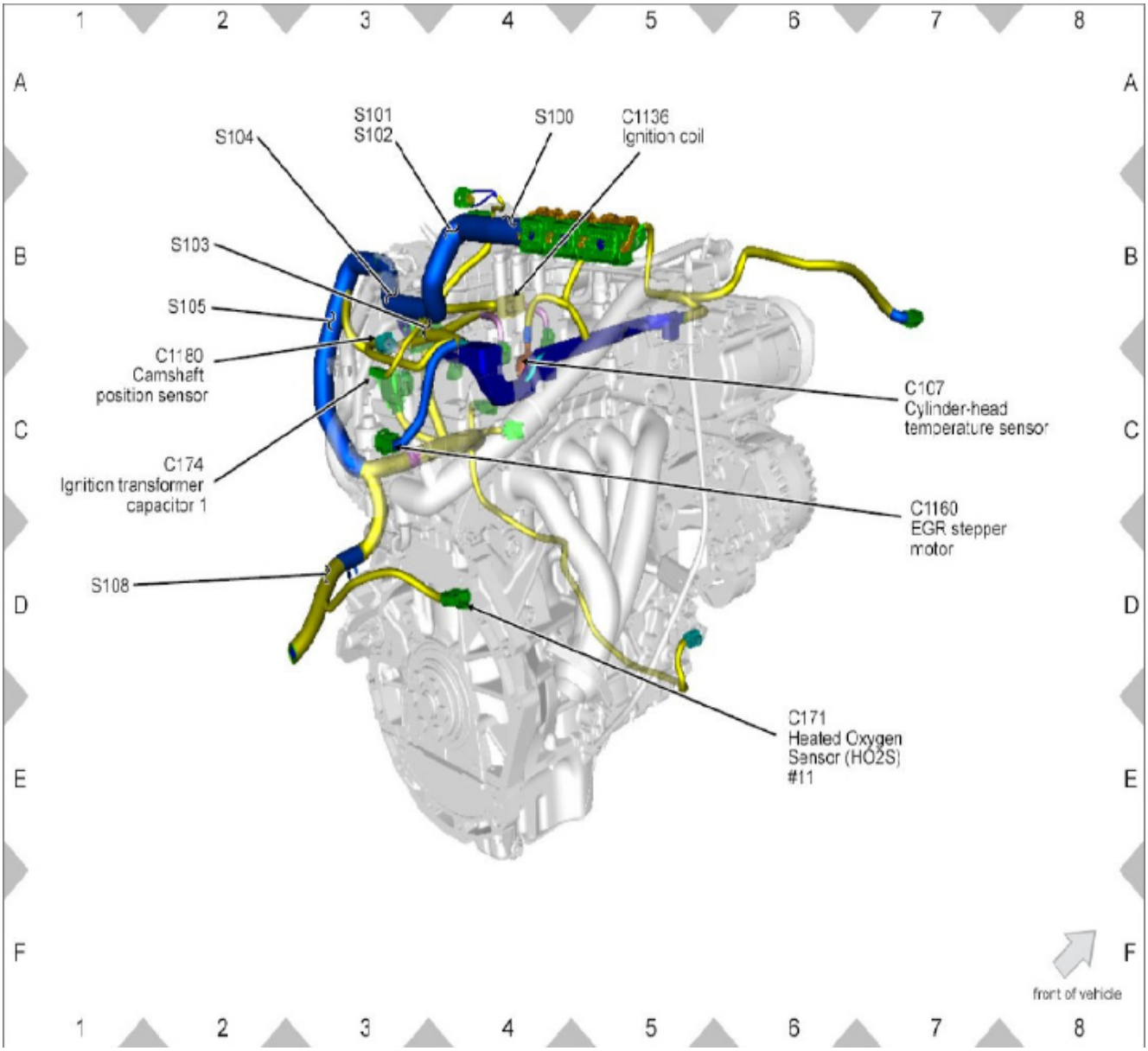
ENGINE COOLANT TEMPERATURE (ECT) SENSOR

Removal and Installation

1. Drain the cooling system. 2. Disconnect the engine coolant temperature (ECT) sensor electrical connector. 3. Remove the ECT sensor.

- To install, tighten to 20 Nm (15 lb-ft).

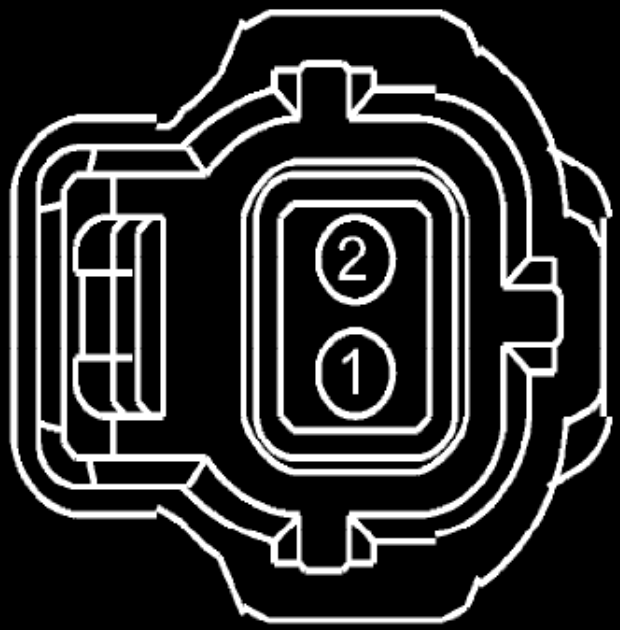
4. To install, reverse the removal procedure.


S104
S101
S102
S100
C1136
Ignition coil
S103
S105
C1180
Camshaft
position sensor
C107
Cylinder-head
temperature sensor
C174
Ignition transformer
capacitor 1
C1160
EGR stepper
motor
S108
C171
Heated Oxygen
Sensor (HO2S)
#11
front of vehicle

View 151-4

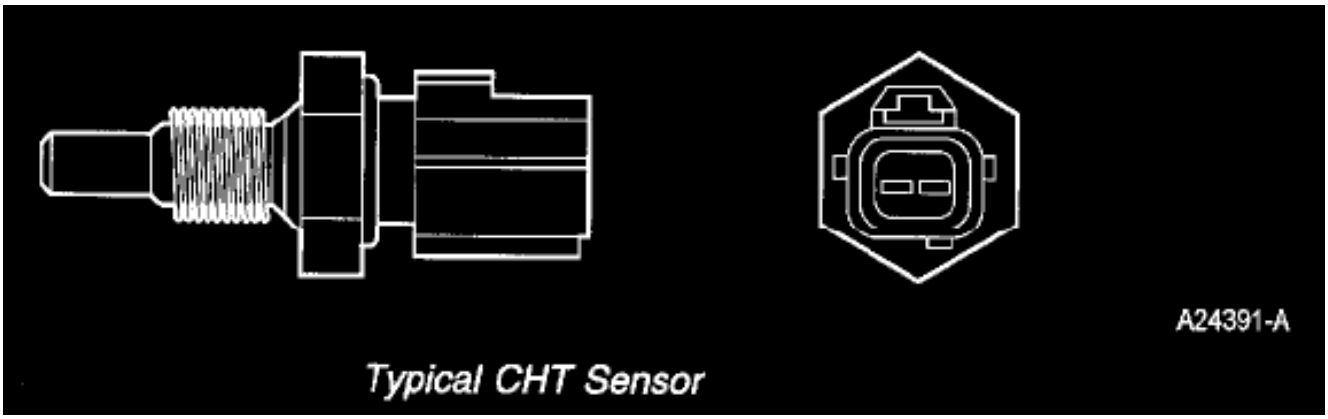
Connector: C107

Description:	Harness:	Base Part #:
CYLINDERHEAD TEMPERATURE SENSOR	12B637	6G004



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE116 (VT-BN)	20	CTRL MOD. - POWERTRAIN # CYLINDER HEAD TEMPERATURE INDICATOR LIGHT (CHTIL)	2.3L
2	RE405 (GN/WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	2.3L

C107



Engine Temperature Sensor: Description and Operation

CYLINDER HEAD TEMPERATURE (CHT) SENSOR

Typical CHT Sensor

The CHT sensor is a thermistor device in which resistance changes with the temperature. The electrical resistance of a thermistor decreases as temperature increases, and the resistance increases as the temperature decreases. The varying resistance affects the voltage drop across the sensor terminals and provides electrical signals to the PCM corresponding to temperature.

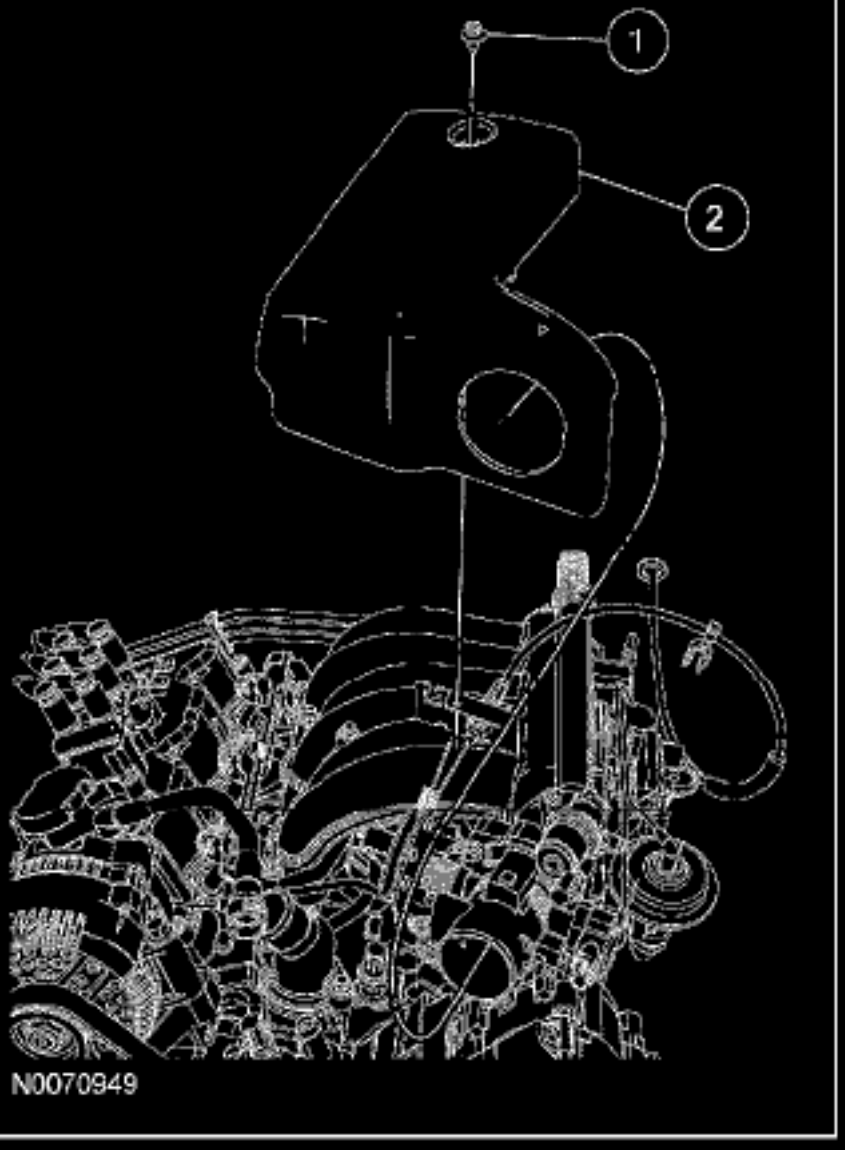
The CHT sensor is installed in the cylinder head and measures the metal temperature. The CHT sensor can provide complete engine temperature information and can be used to infer coolant temperature. If the CHT sensor conveys an overheating condition to the PCM, the PCM initiates a fail-safe cooling strategy based on information from the CHT sensor. A cooling system concern such as low coolant or coolant loss could cause an overheating condition. As a result, damage to major engine components could occur. Using both the CHT sensor and fail-safe cooling strategy, the PCM prevents damage by allowing air cooling of the engine and limp home capability.

Thermostat: Specifications

Thermostat Opening Temperature

Fully Open ..... 97-106°C (206.6-222.8°F) Starts to open ..... 90°C (194°F)

Throttle Body Cover



Item	Part Number	Description
1	N800312	Throttle body (TB) cover bolt
2	9E766	TB cover

Thermostat: Service and Repair

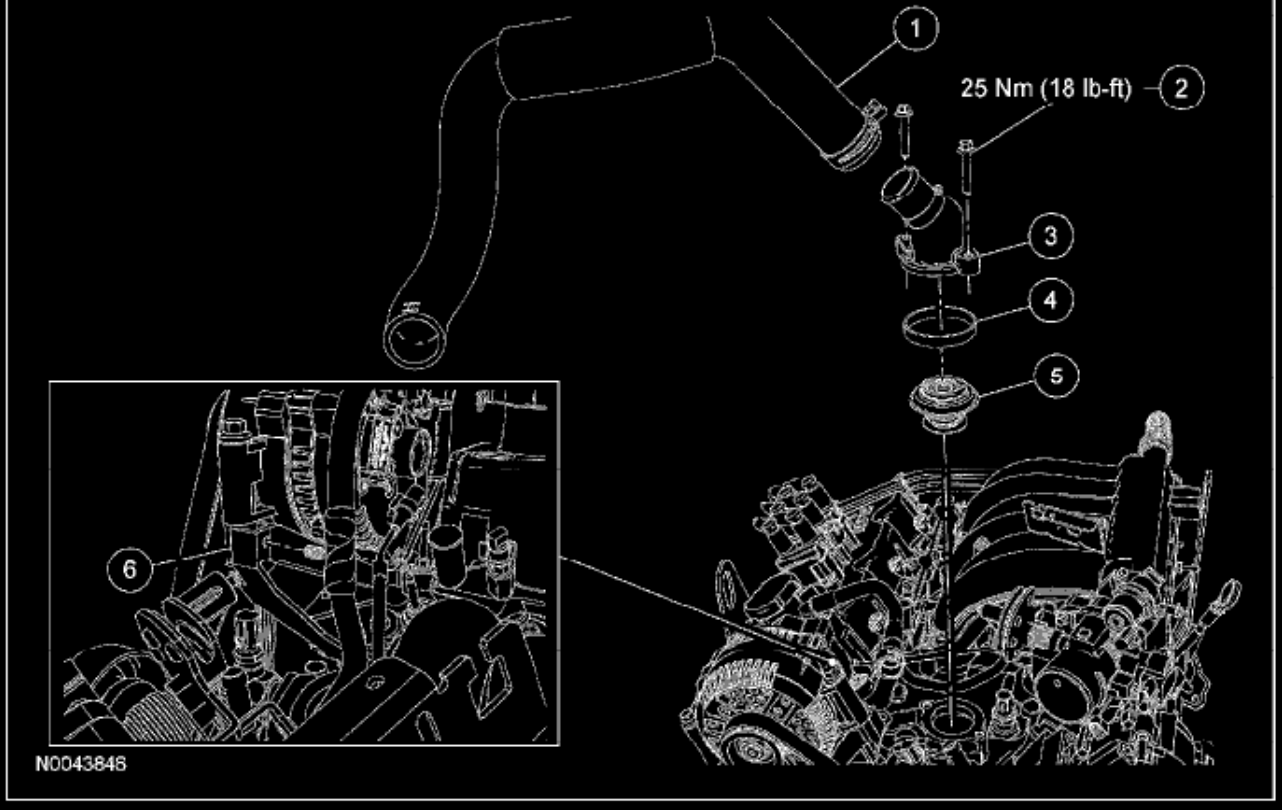
Thermostat - 3.0L (2V)

Throttle Body Cover

Throttle Body Cover

Thermostat

Thermostat



Item	Part Number	Description
1	8260	Upper radiator hose
2	N605909	Thermostat outlet housing bolt (2 required)
3	8592	Thermostat outlet housing
4	8255	Thermostat outlet housing gasket
5	8575	Thermostat
6	13A506	Alternator wiring pin-type retainer (part of 14A280)

Thermostat

Removal and Installation

1. Drain the cooling system. 2. Remove the air cleaner outlet tube. 3. Remove the bolt and the throttle body (TB) cover. 4. Remove the upper radiator hose from the thermostat outlet housing. 5. Detach the alternator wiring pin-type retainer. 6. Remove the bolts, the thermostat outlet housing and the thermostat.

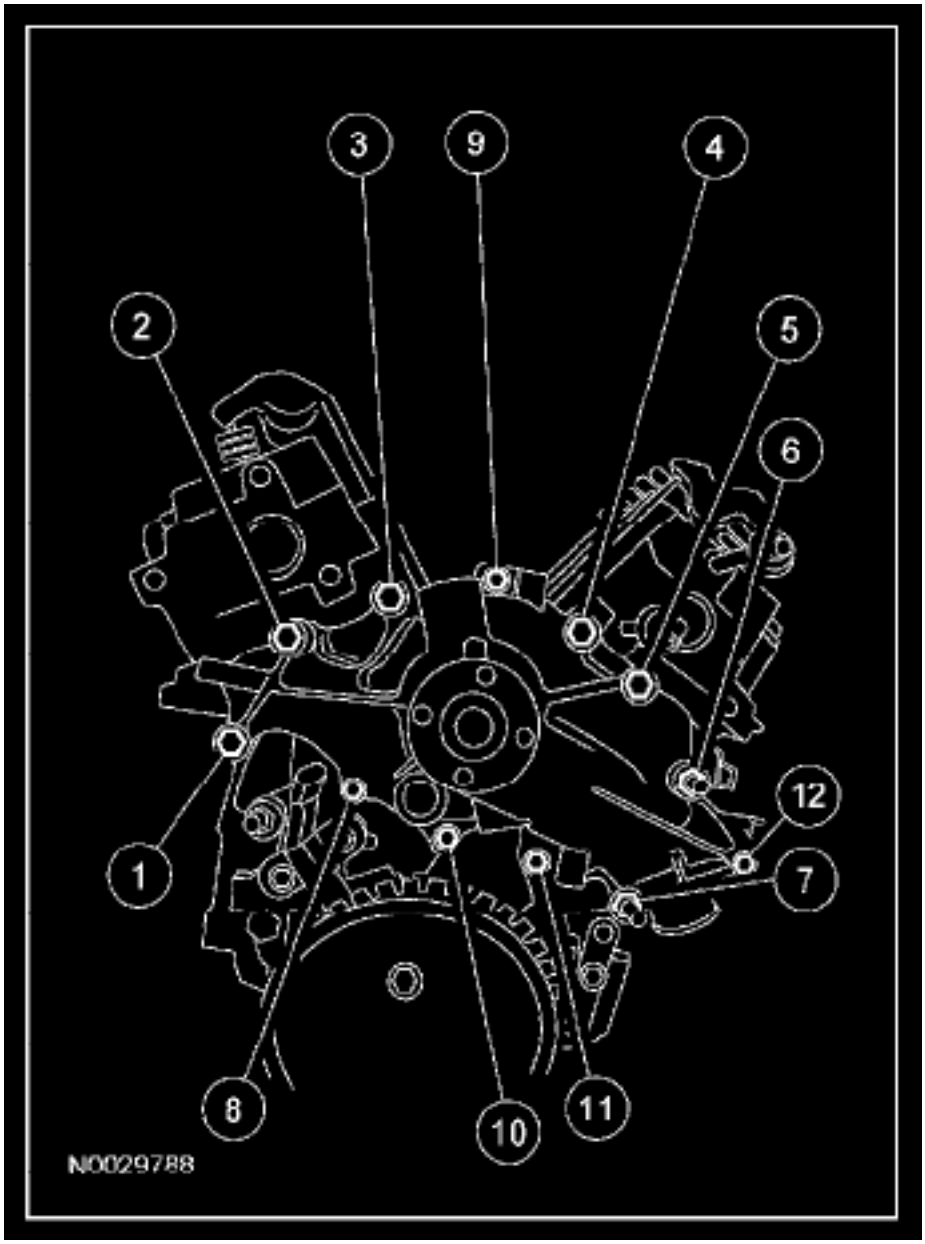
^ To install, tighten to 25 Nm (18 lb-ft).

7. CAUTION: Use care when scraping thermostat housing-to-gasket mating surfaces. Gouges in aluminum could form leak paths.

Discard the gasket and clean the sealing surfaces.

8. NOTE: Make sure the sealing surfaces are totally free of gasket material.

To install, reverse the removal procedure.

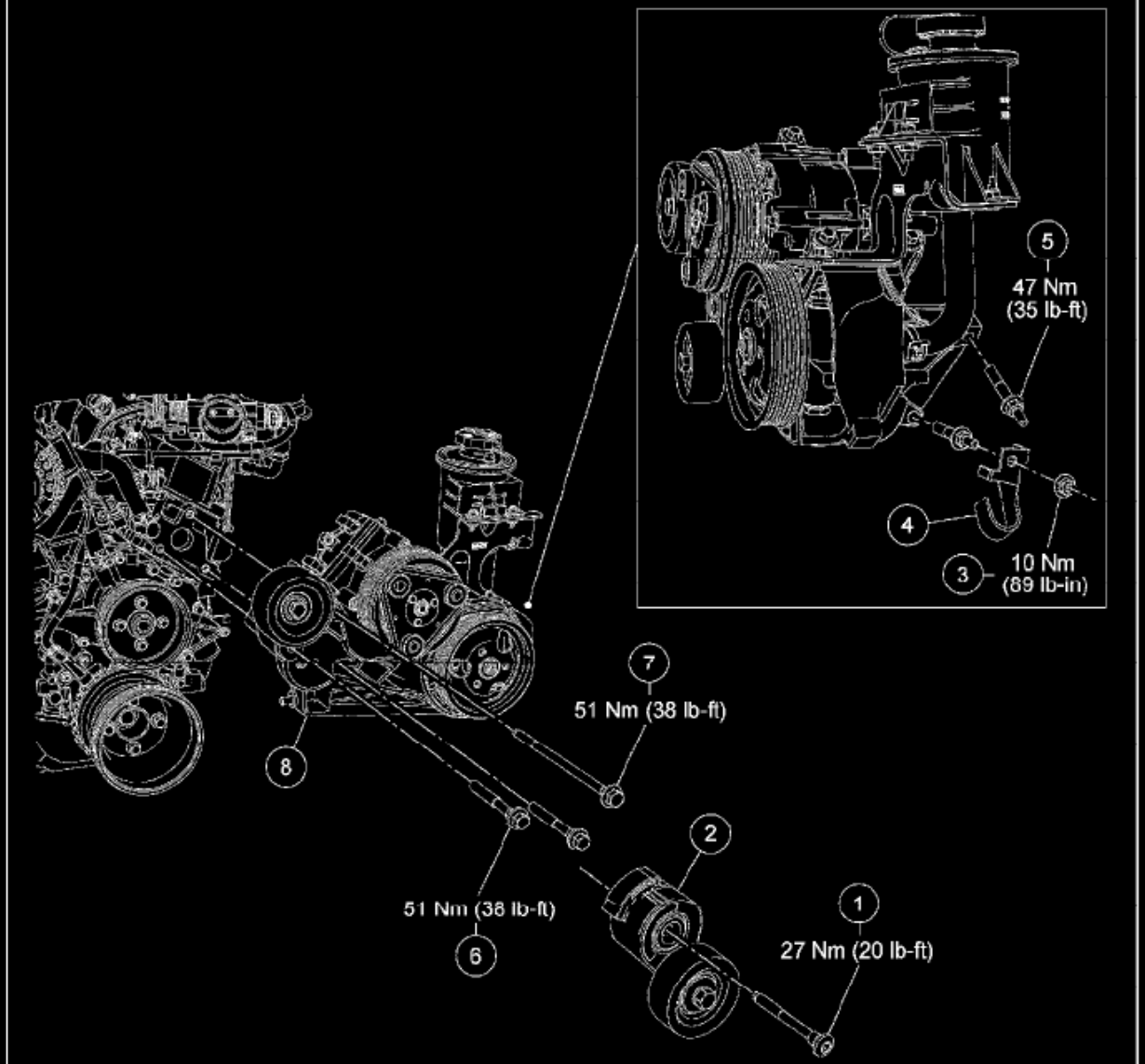


Water Pump: Specifications

Coolant pump 10 bolts and 2 stud bolts:

bolts 1-7 ..... 25 Nm (18 lb-ft) bolts 8-12 ..... 10 Nm (89 lb-inch)

LH Accessory Drive Bracket



Item	Part Number	Description
1	—	Accessory drive belt tensioner bolt (part of 6B209)
2	6B209	Accessory drive belt tensioner
3	W620481	Battery cable bracket nut
4	7B085	Battery cable bracket (part of 14A280)

(Continued)

Item	Part Number	Description
5	N807123	A/C compressor mounting stud bolt (2 required)
6	N606068	A/C compressor mounting bolt (2 required)
7	N807124	A/C compressor mounting bolt
8	19E708	A/C compressor mounting bracket

Water Pump: Service and Repair

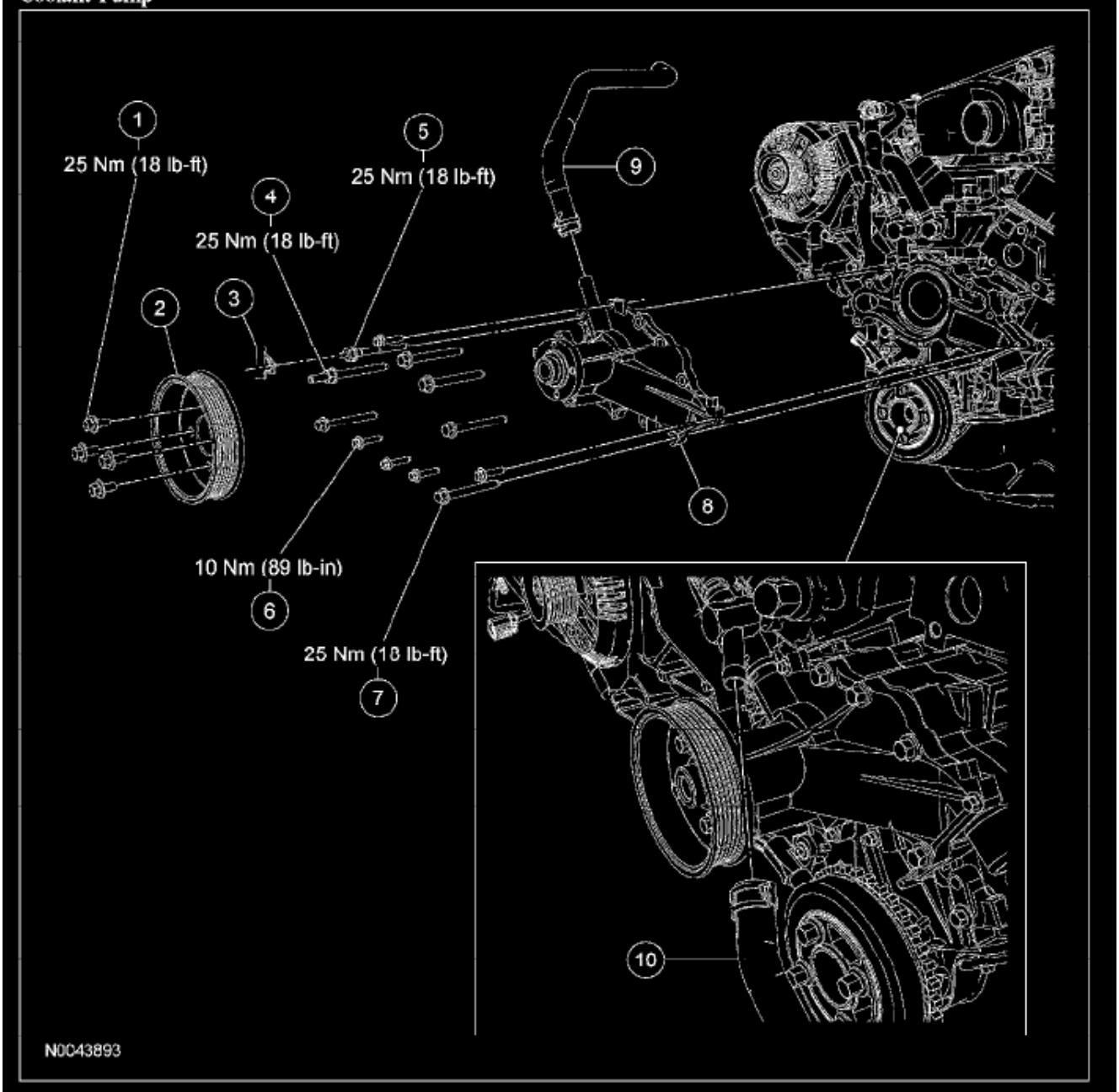
Coolant Pump - 3.0L

LH Accessory Drive Bracket

LH Accessory Drive Bracket

Coolant Pump

Coolant Pump



Item	Part Number	Description
1	N605784	Coolant pump pulley bolt
2	8A528	Coolant pump pulley
3	13A506	Wiring harness retainer (part of 12B637)
4	W807515	Coolant pump stud bolt
5	W708249	Coolant pump stud bolt

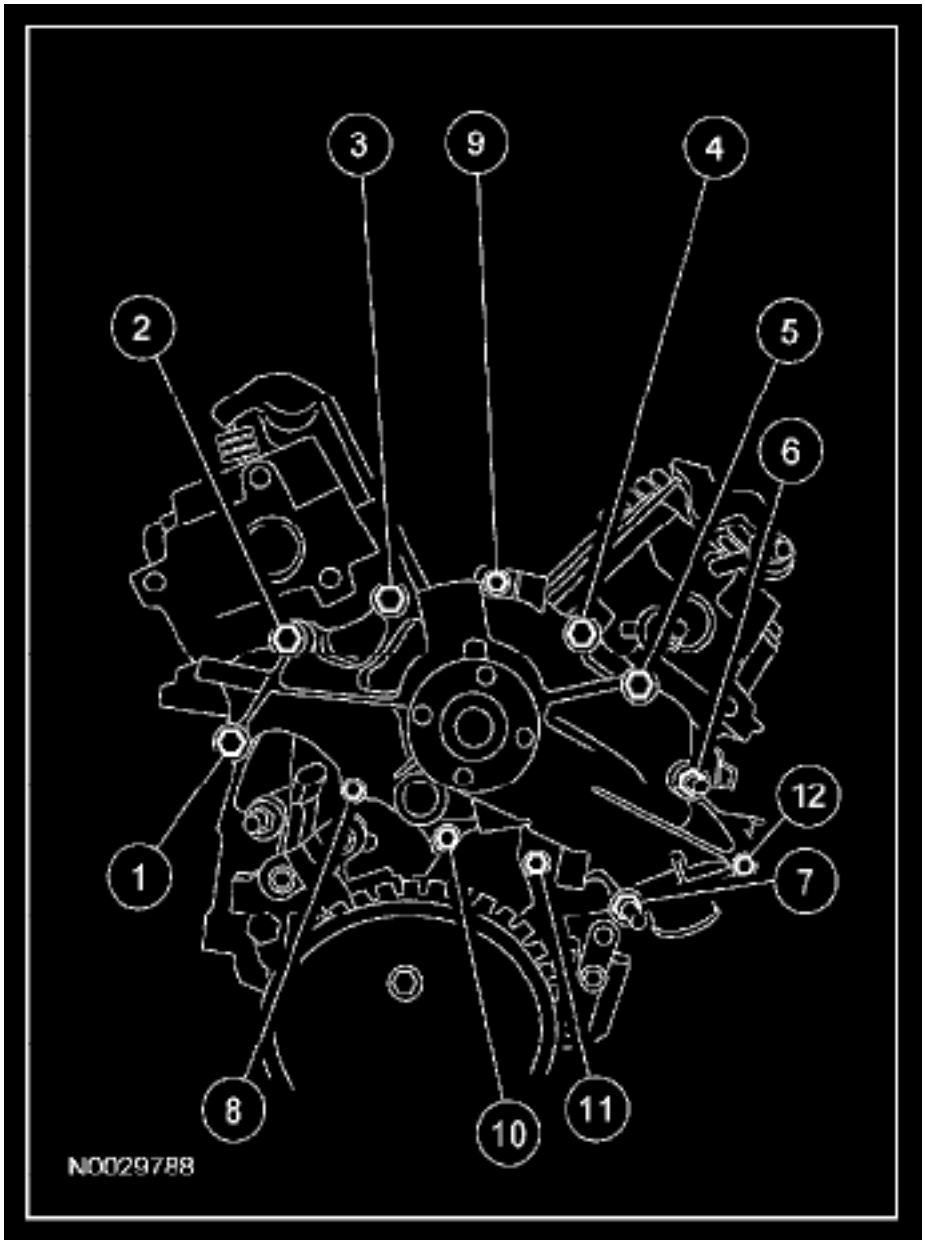
(Continued)

Item	Part Number	Description
6	N804576	Coolant pump bolt (5 required)
7	N811375	Coolant pump bolt (5 required)
8	8501	Coolant pump
9	18472	Heater hose
10	—	Bypass hose (part of 8B273)

Coolant Pump

Removal

1. Drain the cooling system. 2. Remove the air cleaner outlet tube. 3. Remove the accessory drive belt. 4. Remove the fan blade and the fan shroud. 5. Remove the bolts and the coolant pump pulley. 6. Disconnect the heater hose. 7. Disconnect the wiring harness retainer. 8. Remove the nut and detach the battery cable bracket. 9. Remove the side stud bolts from the A/C compressor mounting bracket.



10. Disconnect the bypass hose. 11. Remove the bolt and the accessory drive belt tensioner. 12. Remove the front bolts and position the A/C compressor mounting bracket aside. 13. Remove the bolts and the coolant pump. 14. Clean the sealing surfaces.

Installation

1. Position the coolant pump and loosely install the 10 bolts and 2 stud bolts.

^ Tighten bolts 1-7 in the sequence shown to 25 Nm (18 lb-ft).

^ Tighten bolts 8-12 in the sequence shown to 10 Nm (89 lb-inch).

2. Position the A/C compressor mounting bracket and install the front bolts.

^ Tighten to 51 Nm (38 lb-ft).

3. Position the accessory drive belt tensioner and install the bolt.

^ Tighten to 27 Nm (20 lb-ft).

4. Connect the bypass hose. 5. Install the A/C compressor mounting bracket side stud bolts.

^ Tighten to 47 Nm (35 lb-ft).

6. Position the battery cable bracket and install the nut.

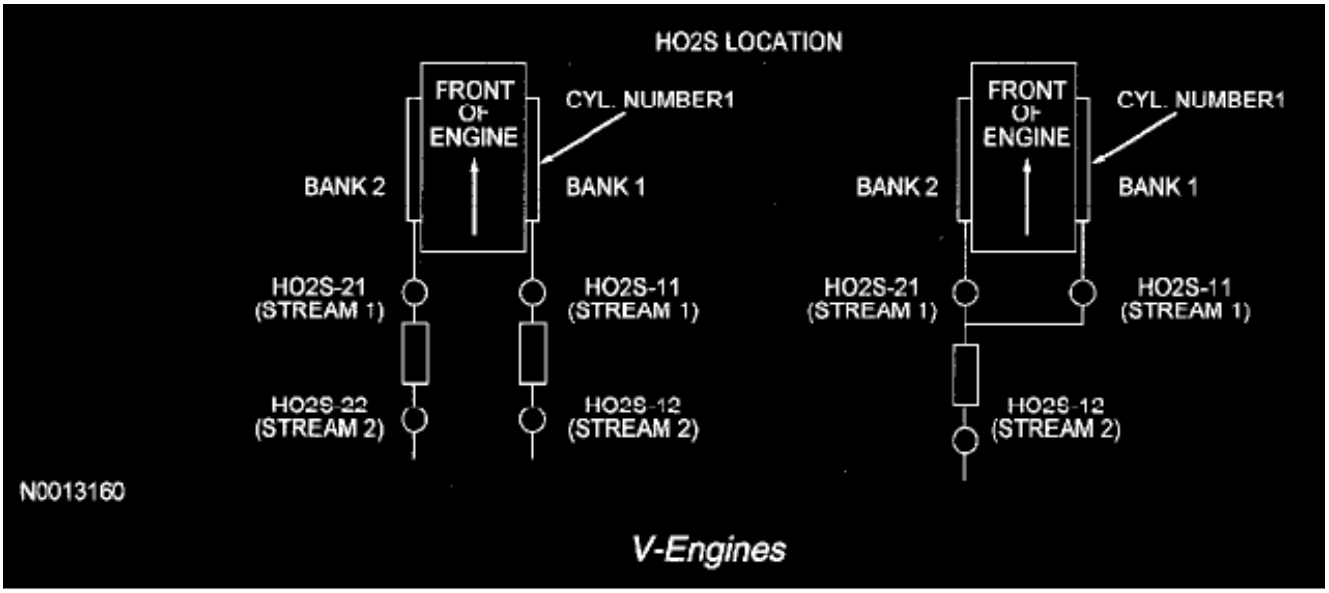
^ Tighten to 10 Nm (89 lb-inch).

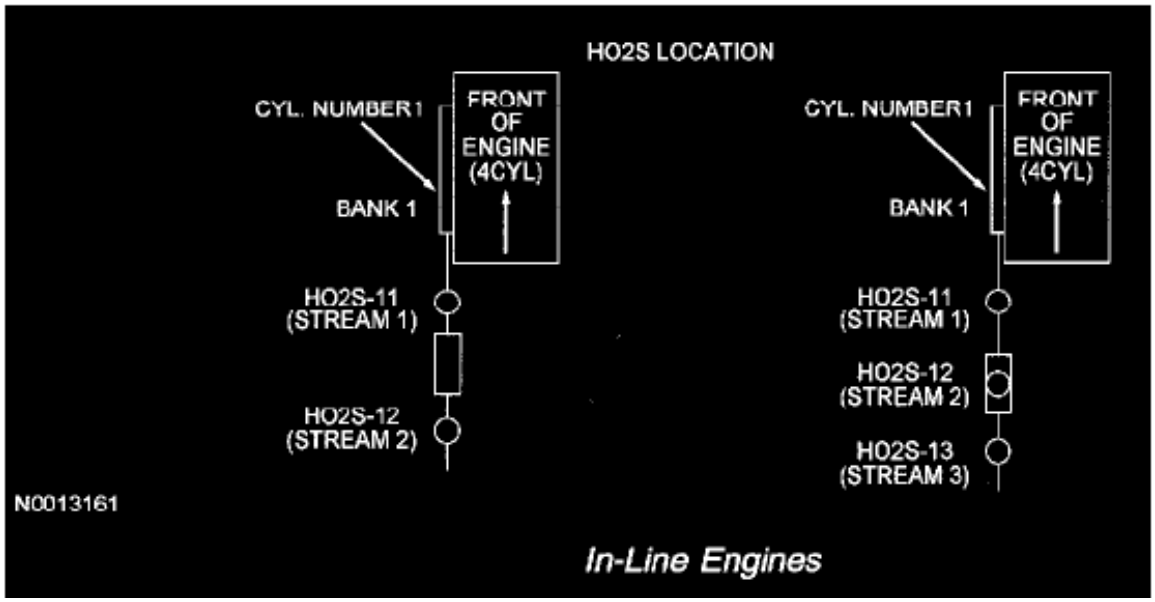
7. Install the coolant pump pulley.

^ Tighten to 25 Nm (18 lb-ft).

8. Install the accessory drive belt. 9. Attach the wiring harness retainer.

10. Connect the heater hose. 11. Install the fan blade and fan shroud. 12. Install the air cleaner outlet tube. 13. Fill the cooling system.





Catalytic Converter: Description and Operation

CATALYST AND EXHAUST SYSTEMS

Overview

V-Engines

In-Line Engines

The catalytic converter and exhaust systems work together to control the release of harmful engine exhaust emissions into the atmosphere. The engine exhaust gas consists mainly of nitrogen (N),

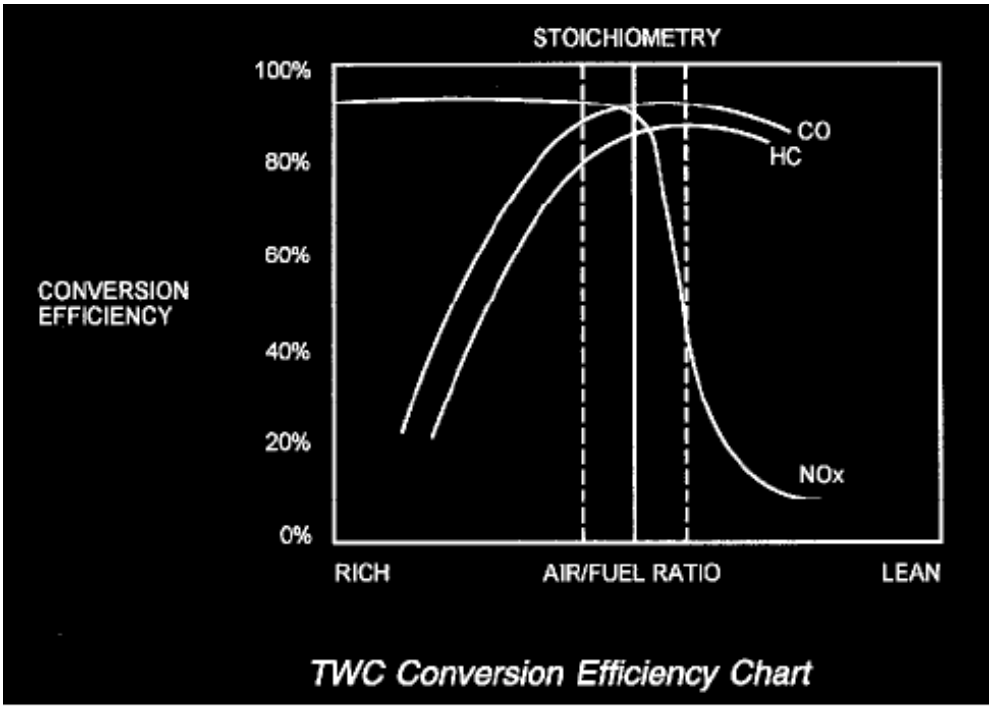
carbon dioxide (CO2) and water vapor (H2O). However, it also contains carbon monoxide (CO), oxides of nitrogen (NOx), hydrogen (H), and various unburned hydrocarbons (HCs). The major air pollutants of CO, NOx,and HCs, and their emission into the atmosphere must be controlled.

The exhaust system generally consists of an exhaust manifold, front exhaust pipe, front heated oxygen sensor (HO2S), rear exhaust pipe, catalyst HO2S, a muffler, and an exhaust tailpipe. The catalytic converter is typically installed between the front and rear exhaust pipes. On some vehicle applications, more than one catalyst is used between the front and rear exhaust pipes. Catalytic converter efficiency is monitored by the on board diagnostic (OBD) system strategy in the powertrain control module (PCM). For information on the OBD catalyst monitor, refer to the description for the Catalyst Efficiency Monitor. See: Powertrain Management/Computers and Control Systems/Testing and Inspection/Monitors, Trips, Drive Cycles and Readiness Codes/Catalyst Efficiency Monitor

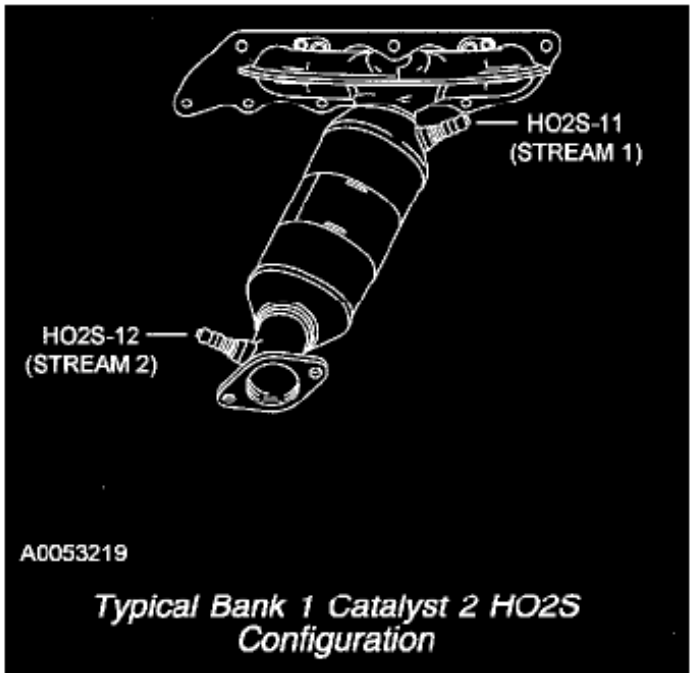
For most vehicles, only 2 HO2Ss are used in an exhaust stream. The front sensors (HO2S11/HO2S21) before the catalyst are used for primary fuel control while the ones after the catalyst (HO2S12/HO2S22) are used to monitor catalyst efficiency. However, some partial zero emission vehicles (PZEV) use 3 HO2Ss for each engine bank. The stream 1 sensors (HO2S11/HO2S21) located before the catalyst are used for primary fuel control, the stream 2 sensors (HO2S12/HO2S22) are used to monitor the light-off catalyst, and the stream 3 sensors (HO2S13/HO2S23) located after the catalyst are used for long term fuel trim control to optimize catalyst efficiency (fore aft oxygen sensor control).

Catalytic Converter

A catalyst is a material that remains unchanged when it initiates and increases the speed of a chemical reaction. A catalyst also enables a chemical reaction to occur at a lower temperature. The concentration of exhaust gas products released to the atmosphere must be controlled. The catalytic



TWC Conversion Efficiency Chart



Typical Bank 1 Catalyst 2 HO2S Configuration

converter assists in this task. It contains a catalyst in the form of a specially treated ceramic honeycomb structure saturated with catalytically active precious metals. As the exhaust gases come in contact with the catalyst, they are changed into mostly harmless products. The catalyst initiates and speeds up heat producing chemical reactions of the exhaust gas components so they are used up as much as possible.

Light Off Catalyst

As the catalyst heats up, converter efficiency rises rapidly. The point at which conversion efficiency exceeds 50% is called catalyst light off. For most catalysts this point occurs at 246°C to 302°C (475°F to 575°F). A fast light catalyst is a 3-way catalyst (TWC) that is located as close to the exhaust manifold as possible. Because the light off catalyst is located close to the exhaust manifold it lights off faster and reduces emissions more quickly than the catalyst located under the body. Once the catalyst lights off, the catalyst quickly reaches the maximum conversion efficiency for that catalyst.

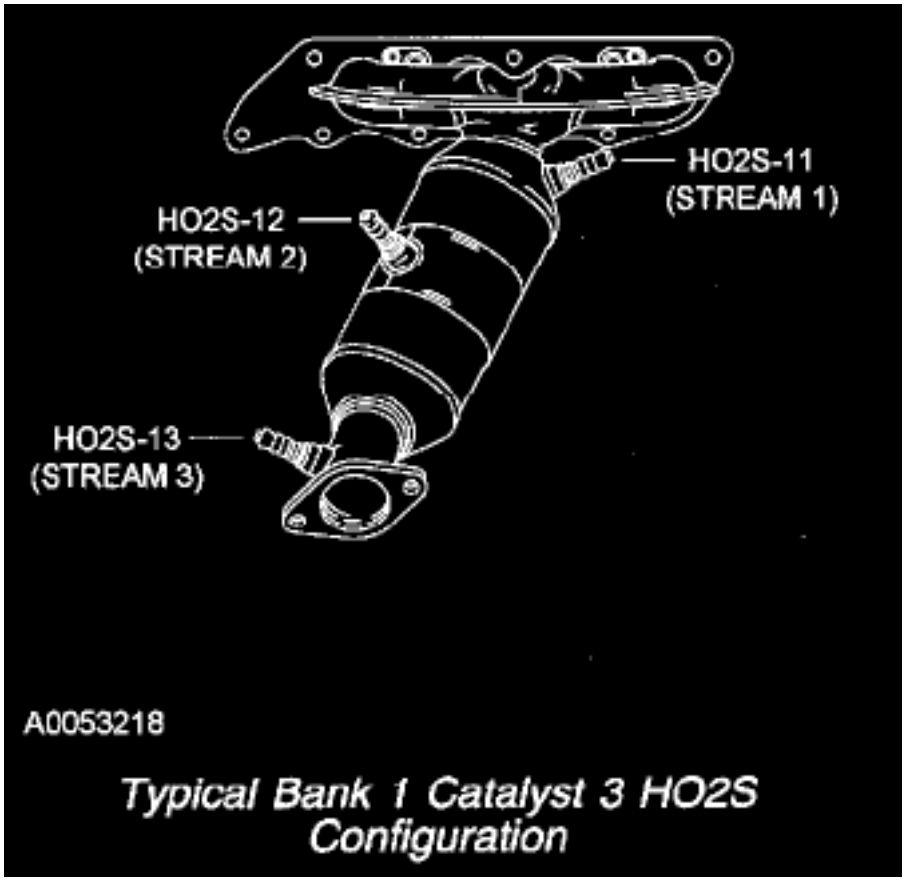
Three-Way Catalyst (TWC) Conversion Efficiency

TWC Conversion Efficiency Chart

A TWC requires a stoichiometric fuel ratio, 14.7 pounds of air to 1 pound of fuel (14.7:1), for high conversion efficiency. In order to achieve these high efficiencies, the air/fuel ratio must be tightly controlled with a narrow window of stoichiometry. Deviations outside of this window greatly decrease the conversion efficiency. For example a rich mixture decreases the HC and CO conversion efficiency while a lean mixture decreases the NOx conversion efficiency.

Exhaust System

Typical Bank 1 Catalyst 2 HO2S Configuration



Typical Bank 1 Catalyst 3 HO2S Configuration

Typical Bank 1 Catalyst 3 HO2S Configuration

The purpose of the exhaust system is to convey engine emissions from the exhaust manifold to the atmosphere. Engine exhaust emissions are directed from the engine exhaust manifold to the catalytic converter through the front exhaust pipe. A HO2S is mounted on the front exhaust pipe before the catalyst. The catalytic converter reduces the concentration of CO, unburned HCs, and NOx in the exhaust emissions to an acceptable level. The reduced exhaust emissions are directed from the catalytic converter past another HO2S mounted in the rear exhaust pipe and then on into the muffler. Finally, the exhaust emissions are directed to the atmosphere through an exhaust tailpipe.

On some PZEV, there is a total of 3 HO2S in the exhaust stream. One near the exhaust manifold (stream 1), one in the middle of the light-off catalyst (stream 2), and the third (stream 3) is mounted after the light-off catalyst.

Underbody Catalyst

The underbody catalyst is located after the light off catalyst. The underbody catalyst may be in line with the light off catalyst, or the underbody catalyst may be common to 2 light off catalysts, forming a Y pipe configuration. For an exact configuration of the catalyst and exhaust system for a specific vehicle, refer to Exhaust System for the exhaust system-exploded view.

Three-Way Catalytic (TWC) Converter

The TWC converter contains either platinum (Pt) and rhodium (Rh) or palladium (Pd) and rhodium (Rh). The TWC converter catalyzes the oxidation reactions of unburned HCs and CO and the reduction reaction of NOx. The 3-way conversion can be best accomplished by always operating the engine air fuel/ratio at or close to stoichiometry.

Exhaust Manifold Runners

The exhaust manifold runners collect exhaust gases from engine cylinders. The number of exhaust manifolds and exhaust manifold runners depends on the engine configuration and number of cylinders.

Exhaust Pipes

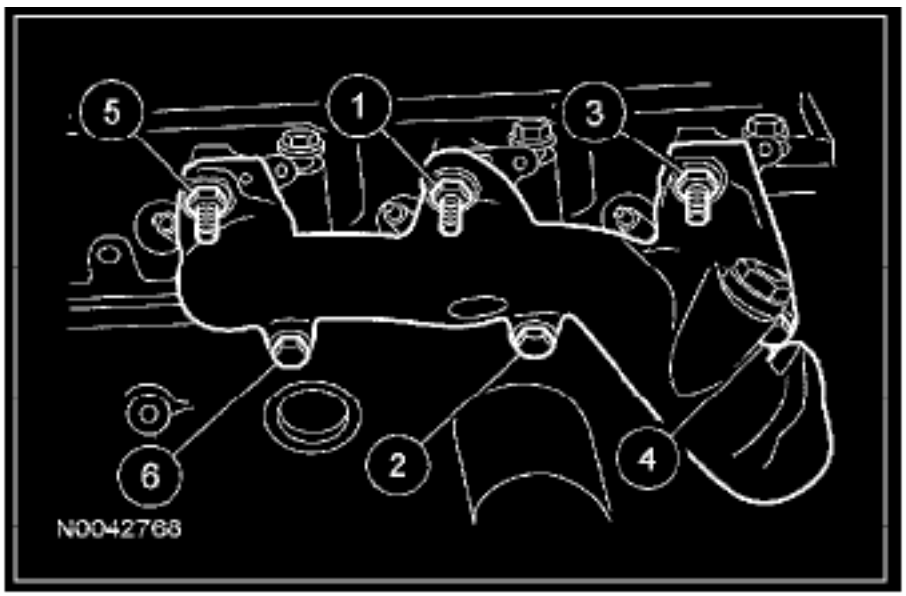
Exhaust pipes are usually treated during manufacturing with an anti-corrosive coating agent to increase the life of the product. The pipes serve as guides for the flow of exhaust gases from the engine exhaust manifold through the catalytic converter and the muffler.

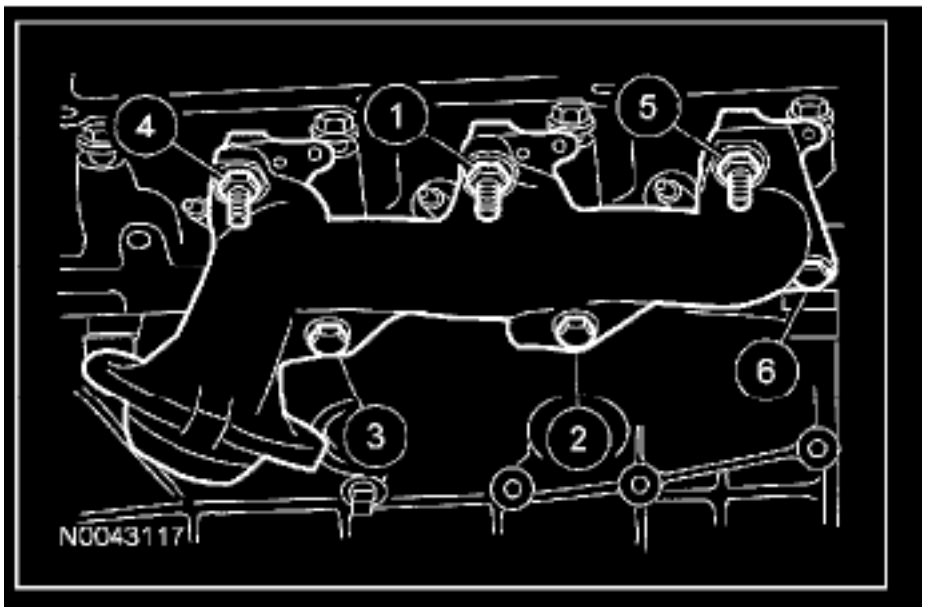
Heated Oxygen Sensor (HO2S)

The HO2Ss provide the PCM with information related to the oxygen content of the exhaust gas.

Muffler

Mufflers are usually treated during manufacturing with an anti-corrosive coating agent to increase the life of the product. The muffler reduces the level of noise produced by the engine, and also reduces the noise produced by exhaust gases as they travel from the catalytic converter to the atmosphere.





Exhaust Manifold: Specifications

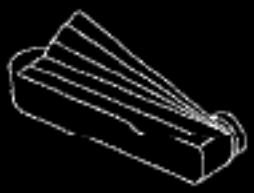
LH exhaust manifold (New Studs and Bolts):

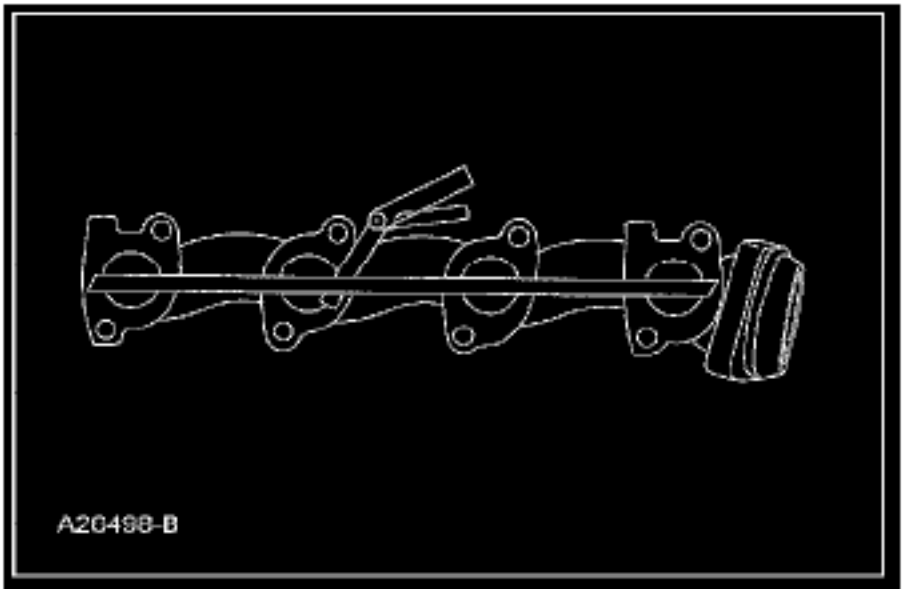
Stage 1 .... 10 Nm (89 lb-inch) Stage 2 .... 23 Nm (17 lb-ft)

RH exhaust manifold (New Studs and Bolts):

Stage 1 ..... 10 Nm (89 lb-inch) Stage 2 ..... 23 Nm (17 lb-ft)

Special Tool(s)

 ST1271-A	Feeler Gauge Set 303-D027 (D81L-4201-A) or equivalent



Exhaust Manifold: Testing and Inspection

Exhaust Manifold Cleaning and Inspection

1. Clean the exhaust manifold using a suitable solvent. Use a plastic scraping tool to clean the gasket sealing surfaces.

2. NOTE: New exhaust manifold gaskets, studs, nuts and/or bolts must be installed when an exhaust manifold is serviced.

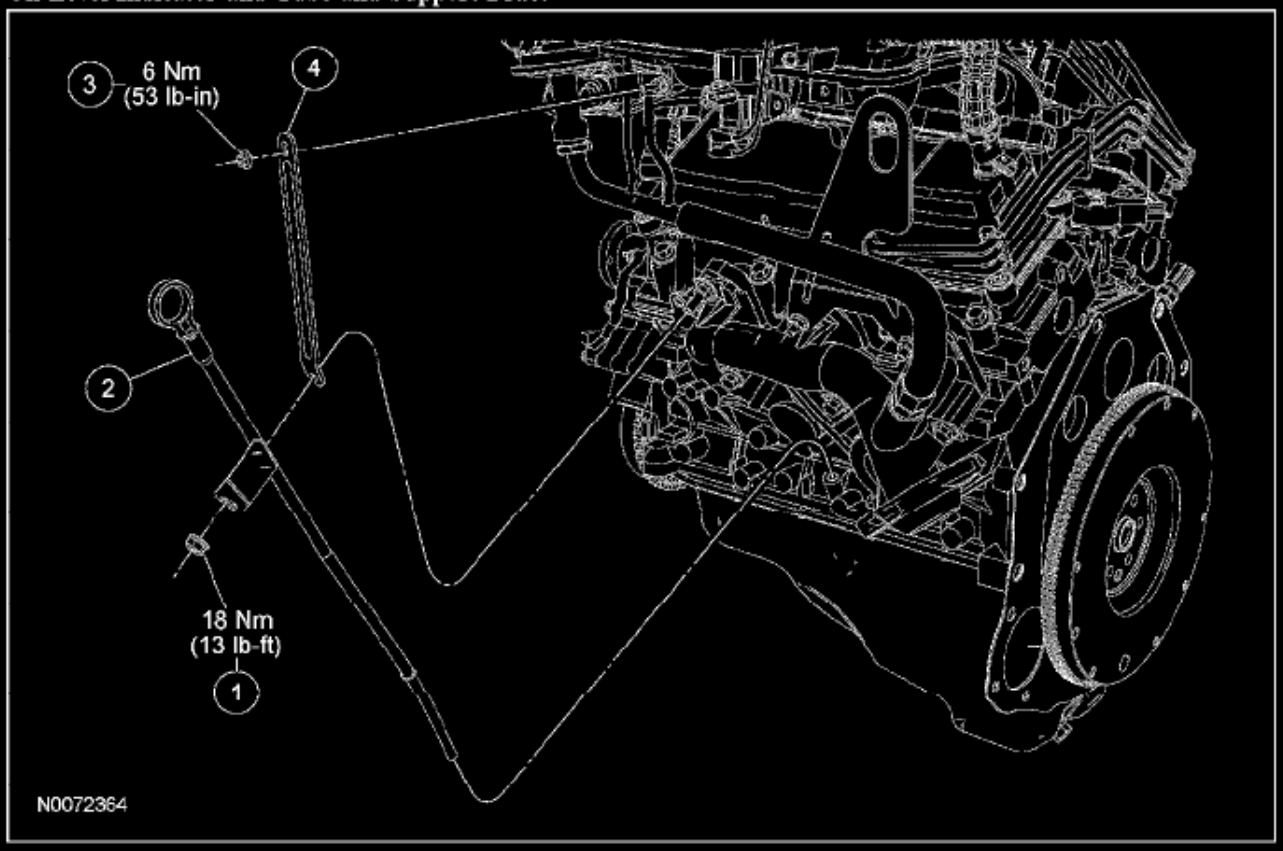
NOTE: Use a straightedge that is calibrated by the manufacturer to be flat within 0.005 mm (0.0002 inch) per running foot of length, such as Snap-On(R) GA438A or equivalent. For example, if the straightedge is 61 cm (24 inch) long, the machined edge must be flat within 0.010 mm (0.0004 inch) from end to end.

Using the precision straight edge and a feeler gauge, check the exhaust manifold sealing surface for warpage. If the warpage is greater than 0.76 mm (0.0299 inch), install a new exhaust manifold.

Material

Item	Specification
Motorcraft Metal Surface Prep ZC-31	—
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4

Oil Level Indicator and Tube and Support Brace



Item	Part Number	Description
1	N804178-S	Oil level indicator and tube assembly nut
2	6754	Oil level indicator and tube assembly

Item	Part Number	Description
3	N808338-S	Upper intake manifold support brace nut
4	95444	Upper intake manifold support brace

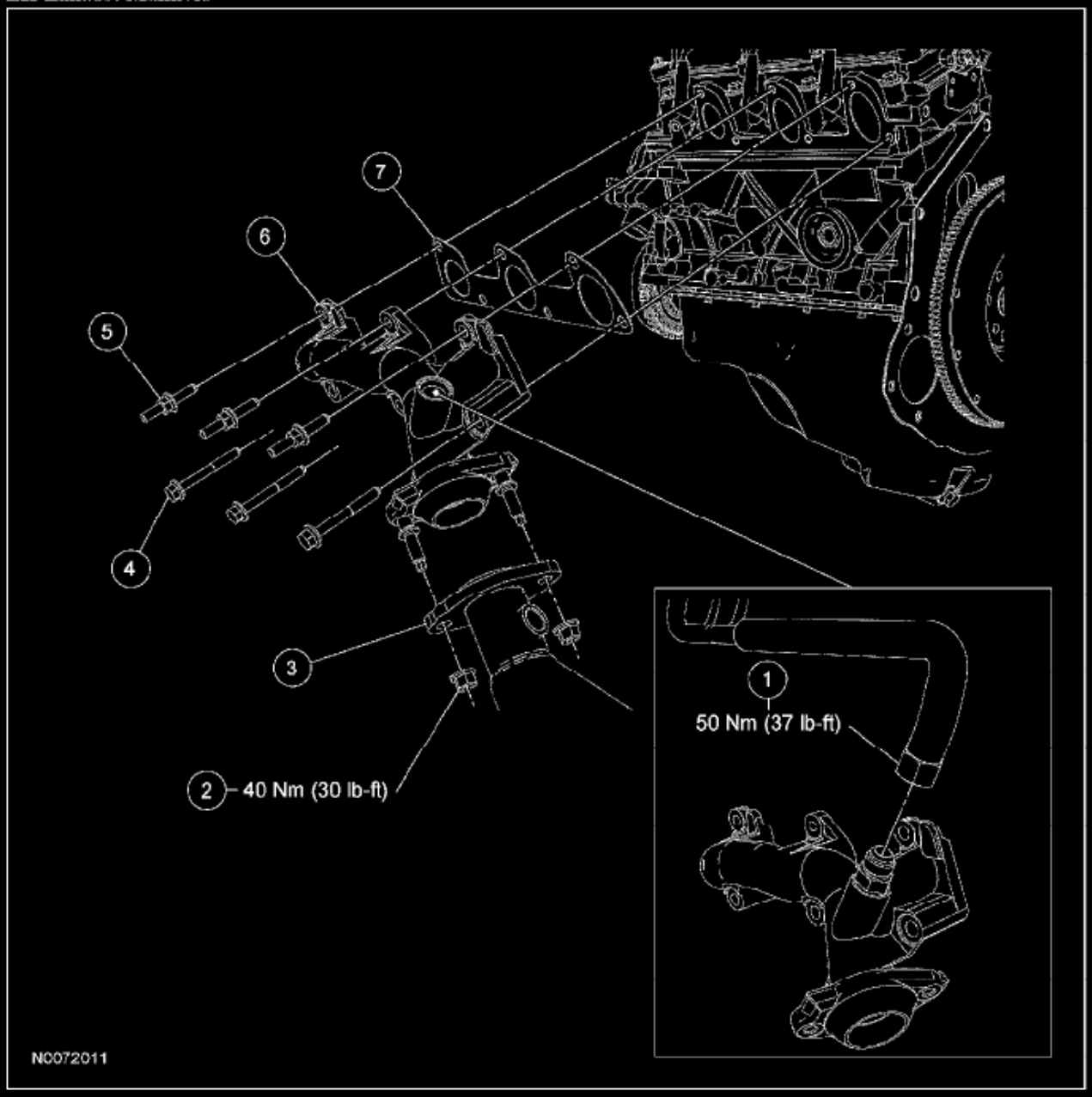
(Continued)

Exhaust Manifold: Service and Repair Exhaust Manifold - LH

Exhaust Manifold - LH

Oil Level Indicator and Tube and Support Brace

LH Exhaust Manifold



Item	Part Number	Description
1	9D477	Exhaust manifold-to-EGR valve tube
2	W705443-S	Exhaust flange nut (2 required)
3	5F250	Exhaust pipe
4	N811573-S	LH exhaust manifold bolt (3 required)
5	N811572-S	LH exhaust manifold stud bolt (3 required)

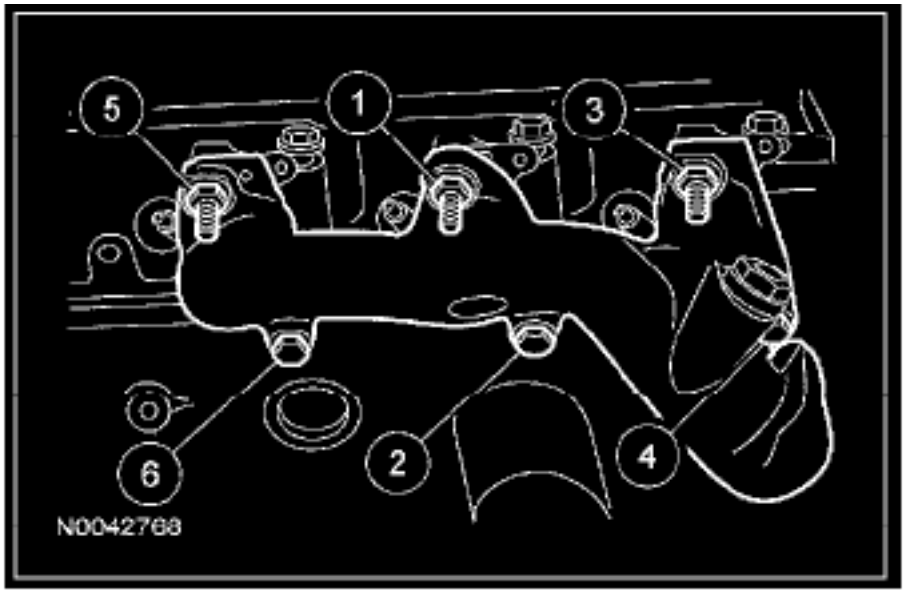
Item	Part Number	Description
6	9431	LH exhaust manifold
7	9448	LH exhaust manifold gasket

(Continued)

LH Exhaust Manifold

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the battery ground cable. 3. Remove the exhaust flange nuts. 4. Remove the nut and the oil level indicator and tube assembly. 5. Remove the nut and the upper intake manifold support brace. 6. Detach the exhaust manifold-to-EGR valve tube from the exhaust manifold. 7. Remove the bolts, stud bolts, exhaust manifold and gasket.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1
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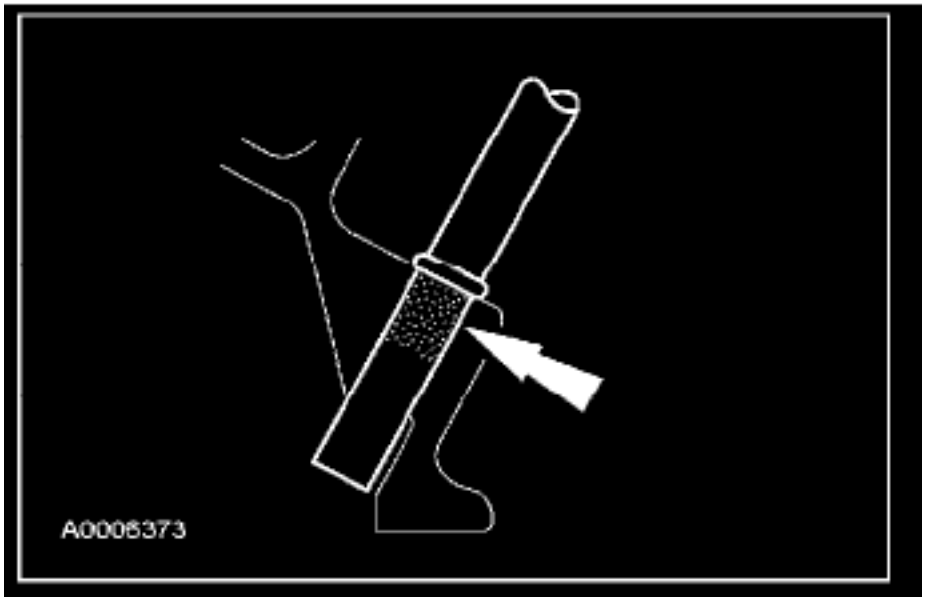

A0005373

^ Discard the bolts, stud bolts and exhaust manifold gasket.

8. Clean and inspect the exhaust manifold.

Installation

1. NOTE: Install a new exhaust manifold gasket, bolts and stud bolts.

Install the exhaust manifold gasket, exhaust manifold, bolts and stud bolts. ^

Tighten in the sequence shown in 2 stages: ^

Stage 1: Tighten to 10 Nm (89 lb-inch).

^ Stage 2: Tighten to 23 Nm (17 lb-ft).

2. Attach the exhaust manifold-to-EGR valve tube to the exhaust manifold.

^ Tighten to 50 Nm (37 lb-ft).

3. Install the upper intake manifold support brace and nut.

^ Tighten to 7 Nm (62 lb-inch).

4. NOTE: The end of the oil level indicator tube should be cleaned with metal surface prep before application of the sealant.

Install the oil level indicator and tube assembly. ^

Coat the oil level indicator tube with silicone gasket and sealant.

5. Install the oil level indicator tube bracket nut.

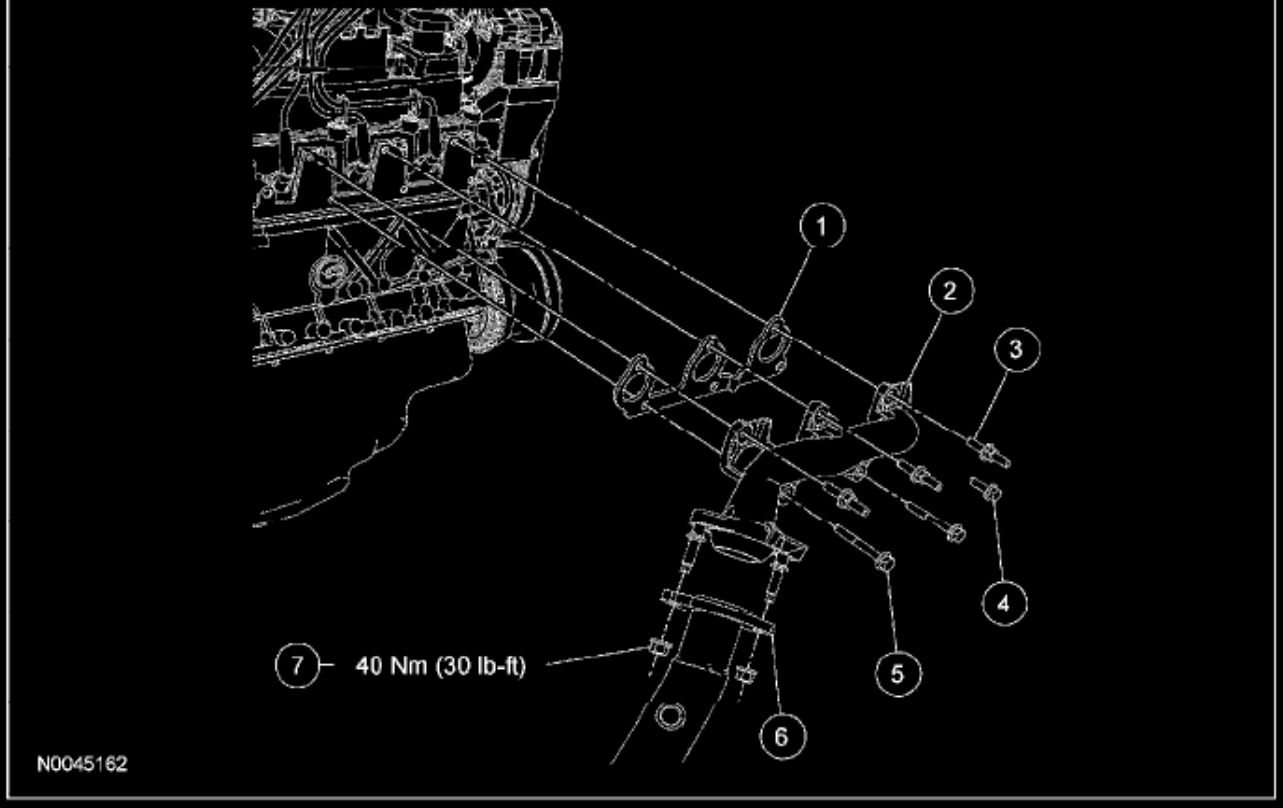
^ Tighten to 18 Nm (13 lb-ft).

6. Install the exhaust flange nuts.

^ Tighten to 40 Nm (30 lb-ft).

7. Connect the battery ground cable.

Exhaust Manifold — RH



Item	Part Number	Description
1	9448	RH exhaust manifold gasket
2	9430	RH exhaust manifold
3	N811572-S	RH exhaust manifold stud bolt (3 required)
4	N811571-S	RH exhaust manifold bolt
5	N811573-S	RH exhaust manifold bolt (2 required)
6	5F250	Exhaust pipe
7	W705443-S	Exhaust flange nut (2 required)

Exhaust Manifold: Service and Repair Exhaust Manifold - RH

Exhaust Manifold - RH

Exhaust Manifold - RH

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Remove the exhaust flange nuts. 3. Remove the bolts, stud bolts, exhaust manifold and gasket.

^ Discard the bolts, stud bolts and exhaust manifold gasket.

4. Clean and inspect the exhaust manifold.

Installation

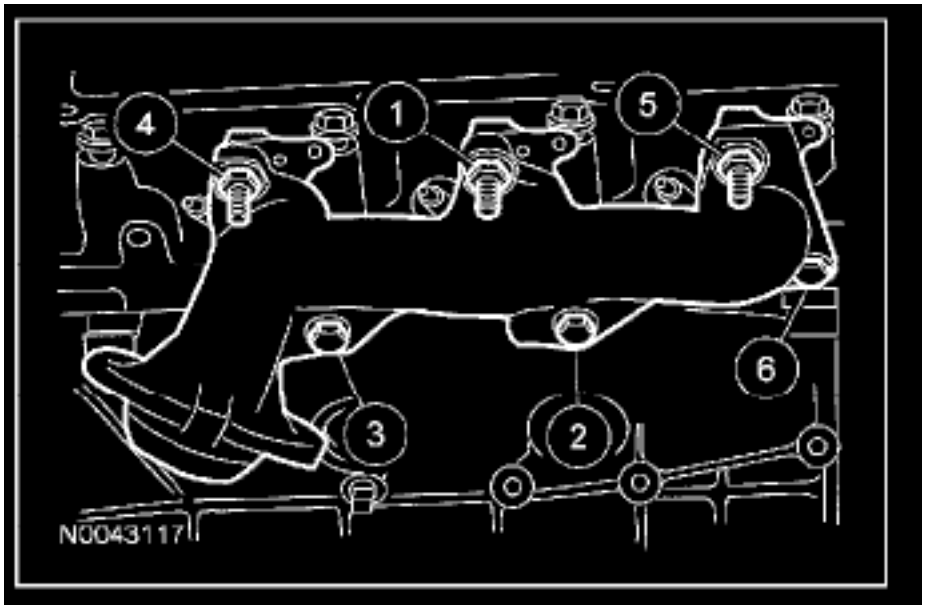
1. NOTE: Install a new exhaust manifold gasket, bolts and stud bolts.

Install the exhaust manifold gasket, exhaust manifold, bolts and stud bolts. ^

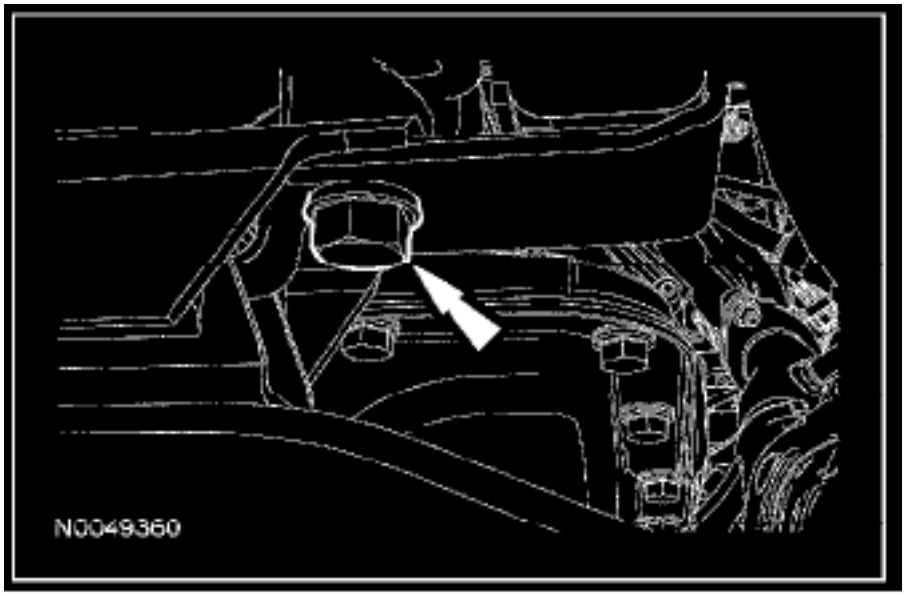
Tighten in the sequence shown in 2 stages. ^

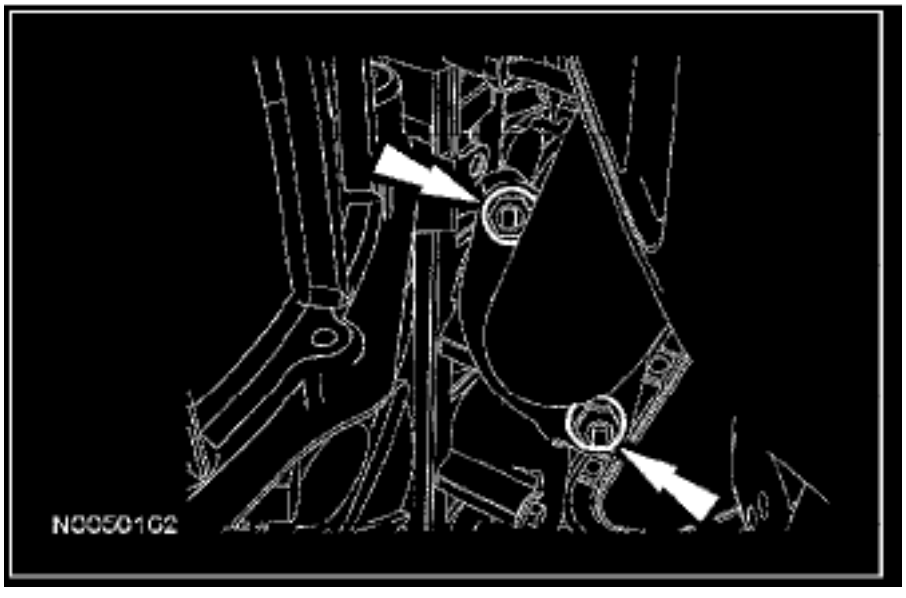
Stage 1: Tighten to 10 Nm (89 lb-inch).

^ Stage 2: Tighten to 23 Nm (17 lb-ft).



2. Install the exhaust flange nuts.


N0049360


N0050162

Exhaust Pipe: Service and Repair

Exhaust Y-Pipe - 3.0L, 4.0L

Removal

CAUTION: Do not use oil or grease-based lubricants on the isolators. These lubricants may cause deterioration of the rubber. This can lead to separation of the isolator from the exhaust hanger bracket during vehicle operation.

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the heated oxygen sensor (HO2S) and catalyst monitor sensor electrical connectors. 3. Remove the RH side of the exhaust Y-pipe assembly-to-muffler and tailpipe assembly bolts, flagnuts and gasket.

^ Discard the flagnuts and gasket.

4. Remove the transmission mount and isolator-to-transmission bolt.

5. Remove the LH side of the exhaust Y-pipe-to-RH side of the exhaust Y-pipe nuts.

^ Discard the nuts.

6. Using a suitable jack, support the RH side of the exhaust Y-pipe.

7. NOTE: 3.0L shown, 4.0L similar.

NOTE: Do not remove the RH side of the exhaust Y-pipe-to-exhaust manifold nuts.

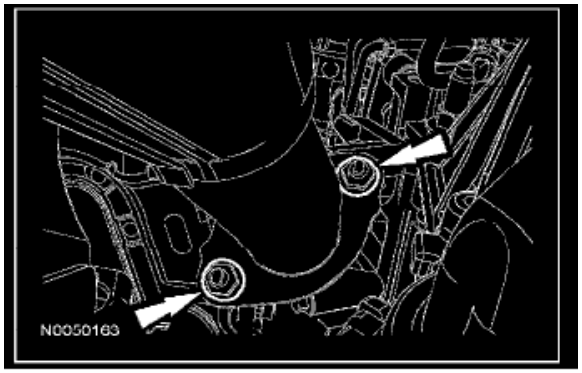
Loosen the RH side of the exhaust Y-pipe-to-exhaust manifold nuts.

8. Using a suitable jack, support the LH side of the exhaust Y-pipe.

9. NOTE: 3.0L shown, 4.0L similar.

Remove the LH side of the exhaust Y-pipe-to-exhaust manifold nuts. ^

Discard the nuts.


N0050163

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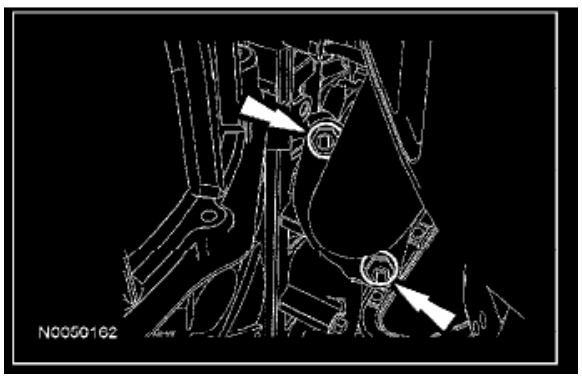

N0050162

10. Remove the LH side of the exhaust Y-pipe. 11. Remove the LH side of the exhaust Y-pipe-to-RH side of the exhaust Y-pipe gasket.

^ Discard the gasket.

12. NOTE: 3.0L shown, 4.0L similar.

Remove the RH side of the exhaust Y-pipe-to-exhaust manifold nuts and remove the RH side of the exhaust Y-pipe. ^

Discard the nuts.

Installation

CAUTION: Do not use oil or grease-based lubricants on the isolators. These lubricants may cause deterioration of the rubber. This can lead to separation of the isolator from the exhaust hanger bracket during vehicle operation.

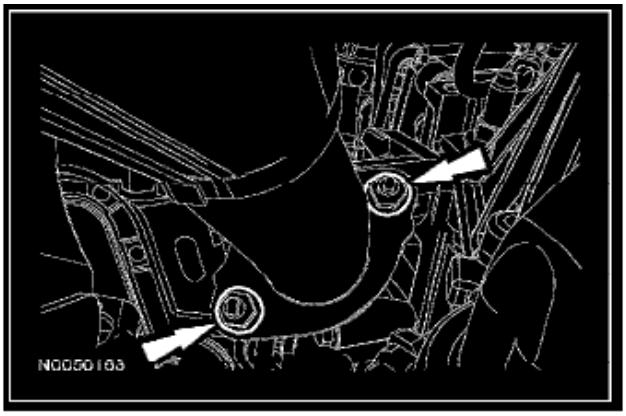
NOTE: Clean all the mating surface of the exhaust Y-pipe.

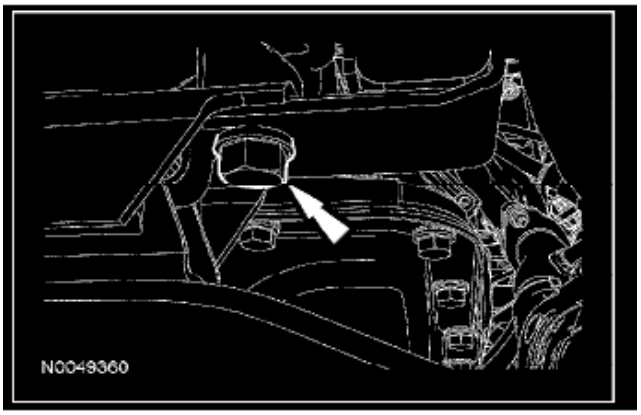
1. NOTE: 3.0L shown, 4.0L similar.

Position the RH side of the exhaust Y-pipe into the vehicle and loosely install the new RH side of the exhaust Y-pipe-to-exhaust manifold nuts.

2. Install a new LH side of the exhaust Y-pipe-to-RH side of the exhaust Y-pipe gasket.

3. NOTE: 3.0L shown, 4.0L similar.


N0050163


N0049360

N0050162

Position the LH side of the exhaust Y-pipe into the vehicle and loosely install the new LH side of the exhaust Y-pipe-to-exhaust manifold nuts.

4. Loosely install the new LH side of the exhaust Y-pipe-to-RH side of the exhaust Y-pipe nuts. 5. Install the transmission mount and isolator-to-transmission bolt.

^ Tighten to 90 Nm (66 lb-ft).

6. Install a new RH side of the exhaust Y-pipe-to-muffler and tailpipe assembly gasket. 7. Loosely install the RH side of the exhaust Y-pipe-to-muffler and tailpipe assembly bolts and new flagnuts.

8. NOTE: RH side shown, LH side similar.

NOTE: 3.0L shown, 4.0L similar.

Tighten the exhaust Y-pipe assembly-to-exhaust manifold nuts. ^

Tighten to 40 Nm (30 lb-ft).

9. Tighten the LH side of the exhaust Y-pipe-to-RH side of exhaust Y-pipe nuts.

^ Tighten to 40 Nm (30 lb-ft).

10. Tighten the RH side of the exhaust Y-pipe-to-muffler and tailpipe assembly bolts.

^ Tighten to 40 Nm (30 lb-ft).

11. Connect the HO2S and catalyst monitor sensors electrical connectors. 12. Check to see if the exhaust system isolators are at zero load. If the exhaust system isolators are not at zero load, carry out the exhaust system

alignment procedure.

Muffler: Service and Repair

Muffler and Tailpipe

Removal

CAUTION: Do not use oil or grease-based lubricants on the isolators. These lubricants may cause deterioration of the rubber. This can lead to separation of the isolator from the exhaust hanger bracket during vehicle operation.

All vehicles

1. With the vehicle in NEUTRAL, position it on a hoist.

Vehicles with 2.3L

2. Remove the exhaust downpipe-to-muffler and tailpipe assembly bolts, flagnuts and gasket.

^ Discard the flagnuts and gasket. Vehicles with 3.0L and 4.0L

3. Remove the RH side of the exhaust Y-pipe-to-muffler and tailpipe assembly bolts, flagnuts and gasket.

^ Discard the flagnuts and gasket. All vehicles

4. Disconnect the 3 rubber isolators and remove the muffler and tailpipe assembly.

Installation

CAUTION: Do not use oil or grease-based lubricants on the isolators. These lubricants may cause deterioration of the rubber. This can lead to separation of the isolator from the exhaust hanger bracket during vehicle operation.

NOTE: Clean all the mating surface of the muffler and tailpipe assembly.

All vehicles

1. Position the muffler and tailpipe assembly into the vehicle and connect the 3 rubber isolators.

Vehicles with 2.3L

2. Install a new exhaust downpipe-to-muffler and tailpipe assembly gasket. 3. Install the exhaust downpipe-to-muffler and tailpipe assembly bolts and new flagnuts.

^ Tighten to 40 Nm (30 lb-ft).

Vehicles with 3.0L and 4.0L

4. Install a new RH side of the exhaust Y-pipe-to-muffler and tailpipe assembly gasket. 5. Install the RH side of the exhaust Y-pipe-to-muffler and tailpipe assembly bolts and new flagnuts.

^ Tighten to 40 Nm (30 lb-ft).

All vehicles

6. Check to see if the exhaust system isolators are at zero load. If the exhaust system isolators are not at zero load, carry out the exhaust system

alignment procedure.

ETC System with a 3-Track APP Sensor Failure Mode and Effects Management:

Effect	Failure Mode ▪
No Effect on Driveability	A loss of redundancy or loss of a non-critical input could result in a concern that does not affect driveability. The powertrain malfunction indicator (wrench) illuminates, but the throttle control and torque control systems function normally. A DTC is set to indicate the component or circuit with the concern.
Disable Speed Control	If certain concerns are detected, speed control is disabled. Throttle control and torque control continue to function normally.

(Continued)

Electronic Throttle Control Module: Description and Operation

TORQUE BASED ELECTRONIC THROTTLE CONTROL (ETC)

Overview

The torque based ETC is a hardware and software strategy that delivers an engine output torque (via throttle angle) based on driver demand (pedal position). It uses an electronic throttle body, the powertrain control module (PCM), and an accelerator pedal assembly to control the throttle opening and engine torque.

Torque based ETC enables aggressive automatic transmission shift schedules (earlier upshifts and later downshifts). This is possible by adjusting the throttle angle to achieve the same wheel torque during shifts, and by calculating this desired torque, the system prevents engine lugging (low RPM and low manifold vacuum) while still delivering the performance and torque requested by the driver. It also enables many fuel economy/emission improvement technologies such as variable camshaft timing (VCT) (deliver same torque during transitions).

Torque based ETC also results in less intrusive vehicle and engine speed limiting, along with smoother traction control.

Other benefits of ETC are: -

eliminate cruise control actuators

- eliminate idle air control (IAC) valve

- better airflow range

- packaging (no cable)

- more responsive powertrain at altitude and improved shift quality

The ETC system illuminates a powertrain malfunction indicator (wrench) on the instrument cluster when a concern is present. Concerns are accompanied by diagnostic trouble codes (DTCs) and may also illuminate the malfunction indicator lamp (MIL).

Electronic Throttle Body (ETB)

The ETB has the following characteristics: -

The throttle actuator control (TAC) motor is a DC motor controlled by the PCM (requires 2-wires).

- There are 2 designs: parallel and in-line. The parallel design has the motor under the bore parallel to the plate shaft. The motor housing is integrated into the main housing. The in-line design has a separate motor housing.

- An internal spring is used in both designs to return the throttle plate to a default position. The default position is typically a throttle angle of 7 to 8 degrees from the hard stop angle.

- The closed throttle plate hard stop is used to prevent the throttle from binding in the bore (approximately 0.75 degree). This hard stop setting is not adjustable and is set to result in less airflow than the minimum engine airflow required at idle.

- The required idle airflow is provided by the plate angle in the throttle body assembly. This plate angle controls idle, idle quality, and eliminates the need for an IAC valve.

- There is 1 reference voltage and 1 signal return circuit between the PCM and the ETB. The reference voltage circuit and the signal return circuit is shared with the reference voltage circuits and signal return circuits used by the APP sensor. There are also 2 TP signal circuits for redundancy. The redundant TP signals are required for increased monitoring reasons. The first TP signal (TP1) has a negative slope (increasing angle, decreasing voltage) and the second signal (TP2) has a positive slope (increasing angle, increasing voltage). The TP2 signal reaches a limit of approximately 4.5 volts at approximately 45 degrees of throttle angle.

Accelerator Pedal Position (APP) Sensor

Depending on the application either a 2-track or 3-track APP sensor is used.

Electronic Throttle Control (ETC) System Strategy

ETC System With A 3-Track APP Sensor Failure Mode And Effects Management (Part 1)

ETC System with a 3-Track APP Sensor Failure Mode and Effects Management:

Effect	Failure Mode [a]
RPM Guard with Pedal Follower	In this mode, torque control is disabled due to the loss of a critical sensor or PCM concern. The throttle is controlled in pedal-follower mode as a function of the pedal position sensor input only. A maximum allowed RPM is determined based on the position of the accelerator pedal (RPM Guard). If the actual RPM exceeds this limit, spark and fuel are used to bring the RPM below the limit. The powertrain malfunction indicator (wrench) and the MIL illuminate in this mode and a DTC for an ETC-related component is set. EGR, VCT, and IMRC outputs are set to default values.
RPM Guard with Default Throttle	In this mode, the throttle plate control is disabled due to the loss of throttle position, the throttle plate position controller, or other major electronic throttle body concern. Depending on the concern detected, the throttle plate is either commanded to the default (limp home) position or the motor is disabled and the spring returns the throttle plate to the default (limp home) position. A maximum allowed RPM is determined based on the position of the accelerator pedal (RPM Guard). If the actual RPM exceeds this limit, spark and fuel are used to bring the RPM below the limit. The powertrain malfunction indicator (wrench) and the MIL illuminate in this mode and a DTC P2110 is set. EGR, VCT, and IMRC outputs are set to default values.
RPM Guard with High Forced Idle	This mode is caused by the loss of 2 or 3 pedal position sensor inputs due to sensor, wiring, or PCM concerns. The system is unable to determine driver demand, and the throttle is controlled to a fixed high idle airflow. There is no response to the driver input. The maximum allowed RPM is a fixed value (RPM Guard). If the actual RPM exceeds this limit, spark and fuel are used to bring the RPM below the limit. The powertrain malfunction indicator (wrench) and the MIL illuminate in this mode and a DTC P2104 is set. EGR, VCT, and IMRC outputs are set to default values.
Shutdown	If a significant processor concern is detected, the monitor forces vehicle shutdown by disabling all fuel injectors. The powertrain malfunction indicator (wrench) illuminates in this mode and a DTC P2105 is set.

a ETC illuminates or displays a message on the message center immediately; MIL illuminates after 2 driving cycles

ETC System With A 3-Track APP Sensor Failure Mode And Effects Management (Part 2)

ETC System with a 2-Track APP Sensor Failure Mode and Effects Management:

Effect	Failure Mode
No Effect on Driveability	A loss of redundancy or loss of a non-critical input could result in a concern that does not affect driveability. The powertrain malfunction indicator (wrench) and the MIL do not illuminate. However, speed control and power take off (PTO) may be disabled. A DTC is set to indicate the component or circuit with the concern.
Delayed APP Sensor Response with Brake Override	This mode is caused by the loss of 1 APP sensor input due to sensor, wiring, or PCM concerns. The system is unable to verify the APP sensor input and driver demand. The throttle plate response to the APP sensor input is delayed as the accelerator pedal is applied. The engine returns to idle RPM whenever the brake pedal is applied. The powertrain malfunction indicator (wrench) illuminates, but the MIL does not illuminate in this mode. An APP sensor related DTC is set.
Time-Based Driver Demand with Brake Override	This mode is caused by the loss of one brake pedal position (BPP) and one APP sensor input or both APP sensor inputs due to sensor, wiring, or PCM concerns. The system is unable to determine driver demand. There is no response when the accelerator pedal is applied. The engine returns to idle RPM whenever the brake pedal is applied. When the brake pedal is released, the PCM slowly increases the APP signal to a fixed value. The powertrain malfunction indicator (wrench) illuminates, but the MIL does not illuminate in this mode. An APP or BPP sensor related DTC is set.
RPM Guard with Pedal Follower	In this mode, torque control is disabled due to the loss of a critical sensor or PCM concern. The throttle is controlled in pedal-follower mode as a function of the APP sensor input only. A maximum allowed RPM is determined based on the position of the accelerator pedal (RPM Guard). If the actual RPM exceeds this limit, spark and fuel are used to bring the RPM below the limit. The powertrain malfunction indicator (wrench) and the MIL illuminate in this mode and a DTC for an ETC-related component is set. EGR, VCT, and IMRC outputs are set to default values and speed control is disabled.
RPM Guard with Default Throttle	In this mode, the throttle plate control is disabled due to the loss of both TP sensor inputs, loss of throttle plate control, stuck throttle plate, significant processor concerns, or other major electronic throttle body concern. The spring returns the throttle plate to the default (limp home) position. A maximum allowed RPM is determined based on the position of the accelerator pedal (RPM Guard). If the actual RPM exceeds this limit, spark and fuel are used to bring the RPM below the limit. The powertrain malfunction indicator (wrench) and the MIL illuminate in this mode and a DTC for an ETC-related component is set. EGR, VCT, and IMRC outputs are set to default values and speed control is disabled.

Electronic Throttle Monitor Operation:

DTCs [a]	
P060X, P061X	PCM processor concern (MIL, powertrain malfunction indicator [wrench])
P2104 (ETC system with a 3-track APP sensor)	ETC FMEM forced idle, 2 or 3 pedal sensor concerns (MIL, powertrain malfunction indicator [wrench])
P2105 (ETC system with a 3-track APP sensor)	ETC FMEM forced engine shutdown; PCM concern (MIL, powertrain malfunction indicator [wrench])
P2110 (ETC system with a 3-track APP sensor)	ETC FMEM forced limited RPM; Concern with both TP sensors; throttle plate position control concern (MIL, powertrain malfunction indicator [wrench])
U0300	ETC software version mismatch between processors internal to the PCM (non-MIL, powertrain malfunction indicator [wrench])

a Monitor execution is continuous. Monitor false detection duration is less than 1 second to register a concern.

ETC System With A 2-Track APP Sensor Failure Mode And Effects Management

Electronic Throttle Monitor Operation

Accelerator Pedal Position (APP) Sensor Check:

DTCs[a]	
P1575 (ETC system with a 2-track APP sensor)	APP sensor out of self-test range
P2122, P2123, P2127, P2128, P2132, P2133	APP sensor circuit continuity test (powertrain malfunction indicator [wrench], non-MIL)
P2121, P2126, P2131 (ETC system with a 3-track APP sensor)	APP range/performance (powertrain malfunction indicator [wrench], non-MIL)
P2138 (ETC system with a 2-track APP sensor)	APP to APP signal correlation (powertrain malfunction indicator [wrench], non-MIL)

a Correlation and range/performance - sensor disagreement between processors internal to the PCM. Monitor execution is continuous. Monitor false detection duration is less than 1 second to register a concern. Refer to Powertrain DTC Charts and Descriptions, Diagnostic Trouble Code (DTC) Charts and Descriptions for additional DTC information.

Throttle Position (TP) Sensor Check:

DTCs [a]	
P0122, P0123, P0222, P0223	TP circuit continuity test (MIL, powertrain malfunction indicator [wrench])
P0121, P0221 (ETC system with a 3-track APP sensor)	TP range/performance (non-MIL)
P1124 (ETC system with a 2-track APP sensor)	TP sensor out of self-test range
P2135	TP to TP sensor correlation test (powertrain malfunction indicator [wrench], non-MIL)

a Correlation and range/performance - sensor disagreement between processors internal to the PCM, TP inconsistent with requested throttle plate position. Monitor execution is continuous. Monitor false detection duration is less than 1 second to register a concern. Refer to Powertrain DTC Charts and Descriptions, Diagnostic Trouble Code (DTC) Charts and Descriptions for additional DTC information.

Electronic TAC Operation Check:

DTCs [a]	
P115E	Throttle actuator airflow trim at maximum limit (non-MIL)
P2072 (ETC system with a 3-track APP sensor)	Throttle body ice blockage (non-MIL)
P2100 (ETC system with a 3-track APP sensor)	Throttle actuator circuit open, short to power, short to ground (MIL)
P2101	Throttle actuator range/performance test (MIL)
P2107	Processor and TAC motor circuit test (MIL)
P2111	Throttle actuator system stuck open (MIL)
P2112	Throttle actuator system stuck closed (MIL)

a Note: For all DTCs, in addition to the MIL, the powertrain malfunction indicator (wrench) is on for the concern that caused the FMEM action. Monitor execution is continuous. Monitor false detection duration is less than 5 seconds to register a concern.

The torque based ETC strategy was developed to improve fuel economy and to accommodate variable camshaft timing (VCT). This is possible by not coupling the throttle angle to the driver

pedal position. Uncoupling the throttle angle (produce engine torque) from the pedal position (driver demand) allows the powertrain control strategy to optimize fuel control and transmission shift schedules while delivering the requested wheel torque.

The ETC monitor system is distributed across 2 processors within the PCM: the main powertrain control processor unit (CPU) and a separate monitoring processor. The primary monitoring function is carried out by the independent plausibility check (IPC) software, which resides on the main processor. It is responsible for determining the driver-demanded torque and comparing it to an estimate of the actual torque delivered. If the generated torque exceeds driver demand by a specified amount, appropriate corrective action is taken.

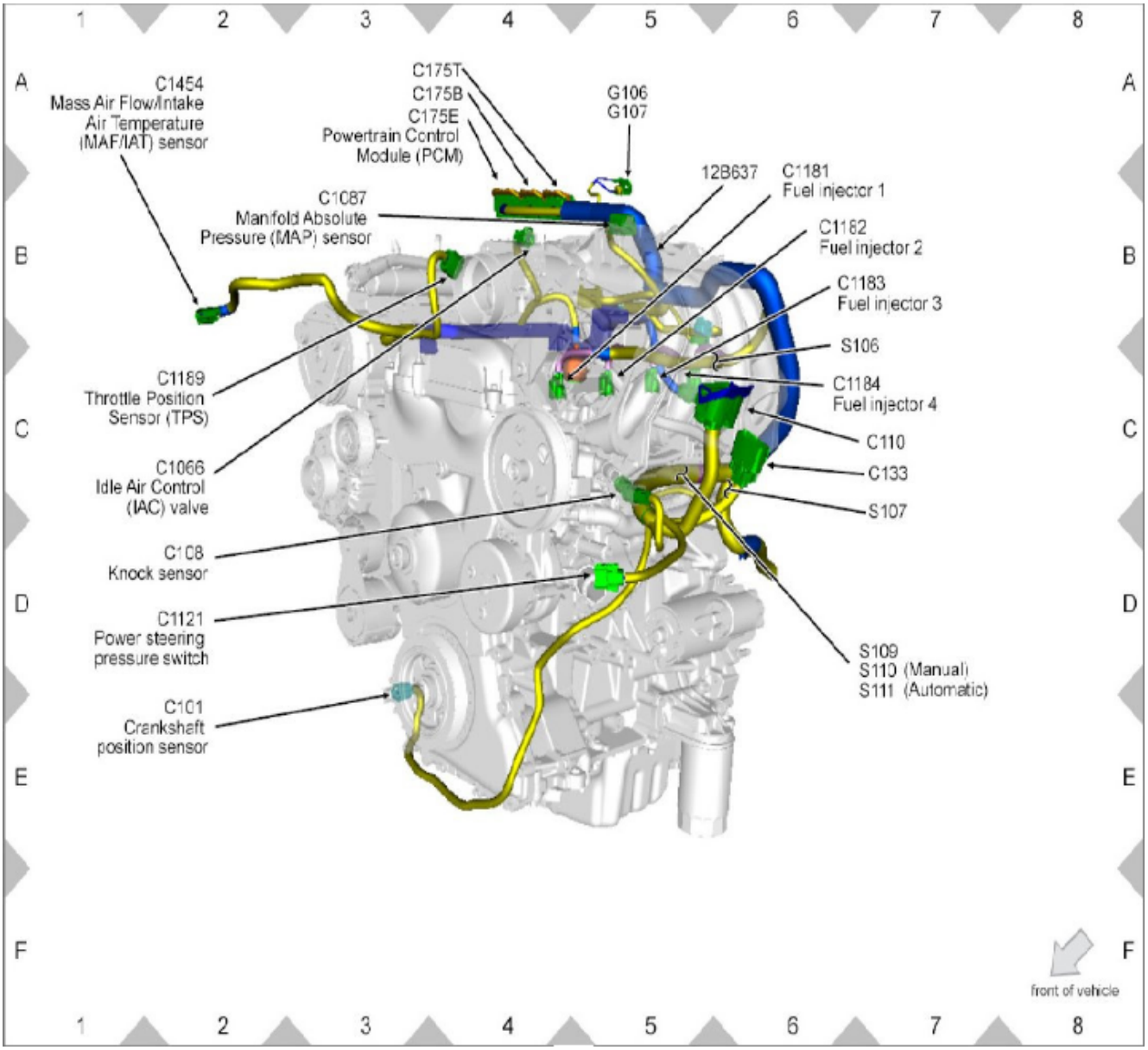
APP and TP Sensor Inputs

Accelerator Pedal Position (APP) Sensor Check

Throttle Position (TP) Sensor Check

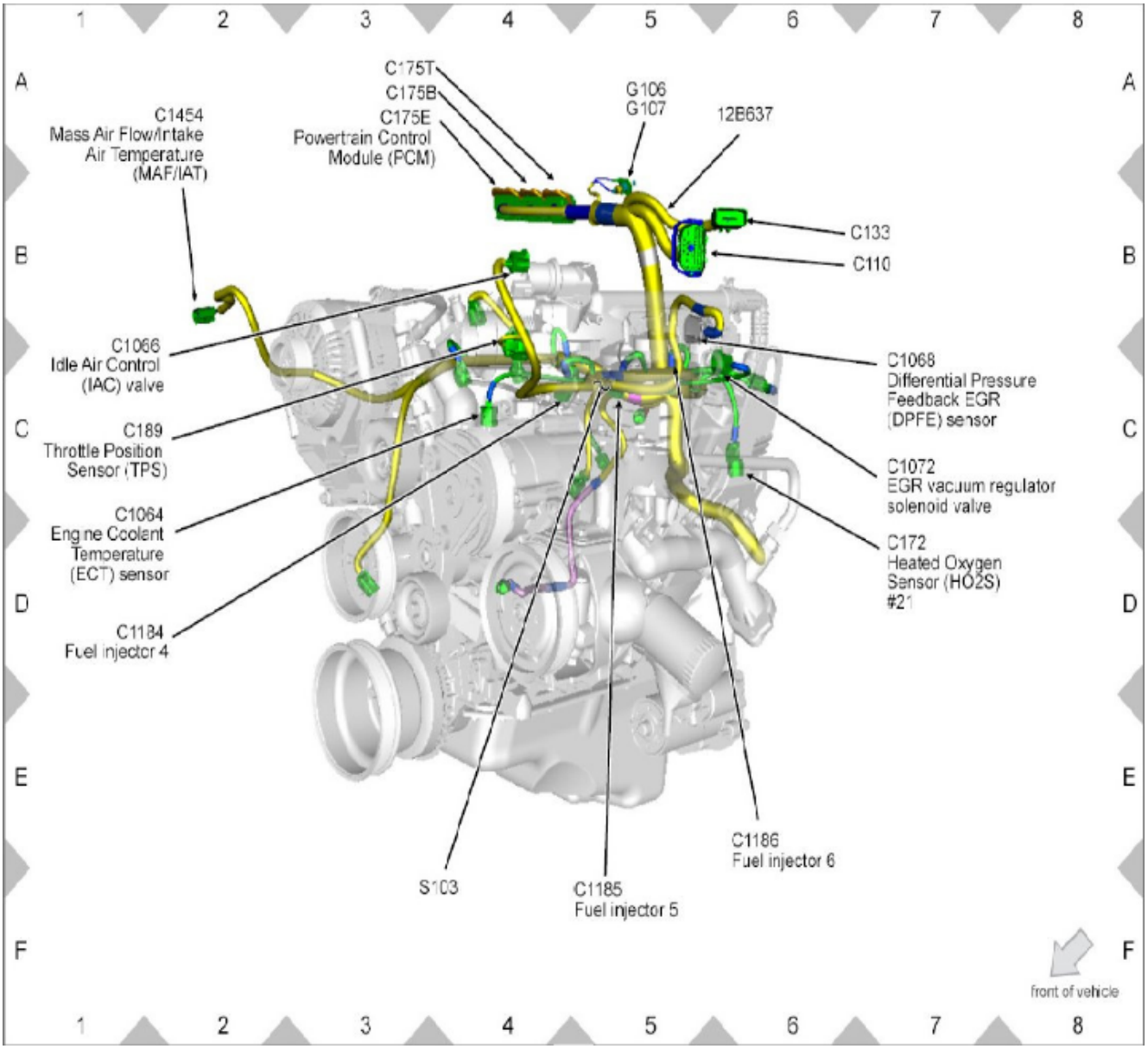
Electronic Throttle Actuator Control (TAC) Output

Electronic TAC Operation Check

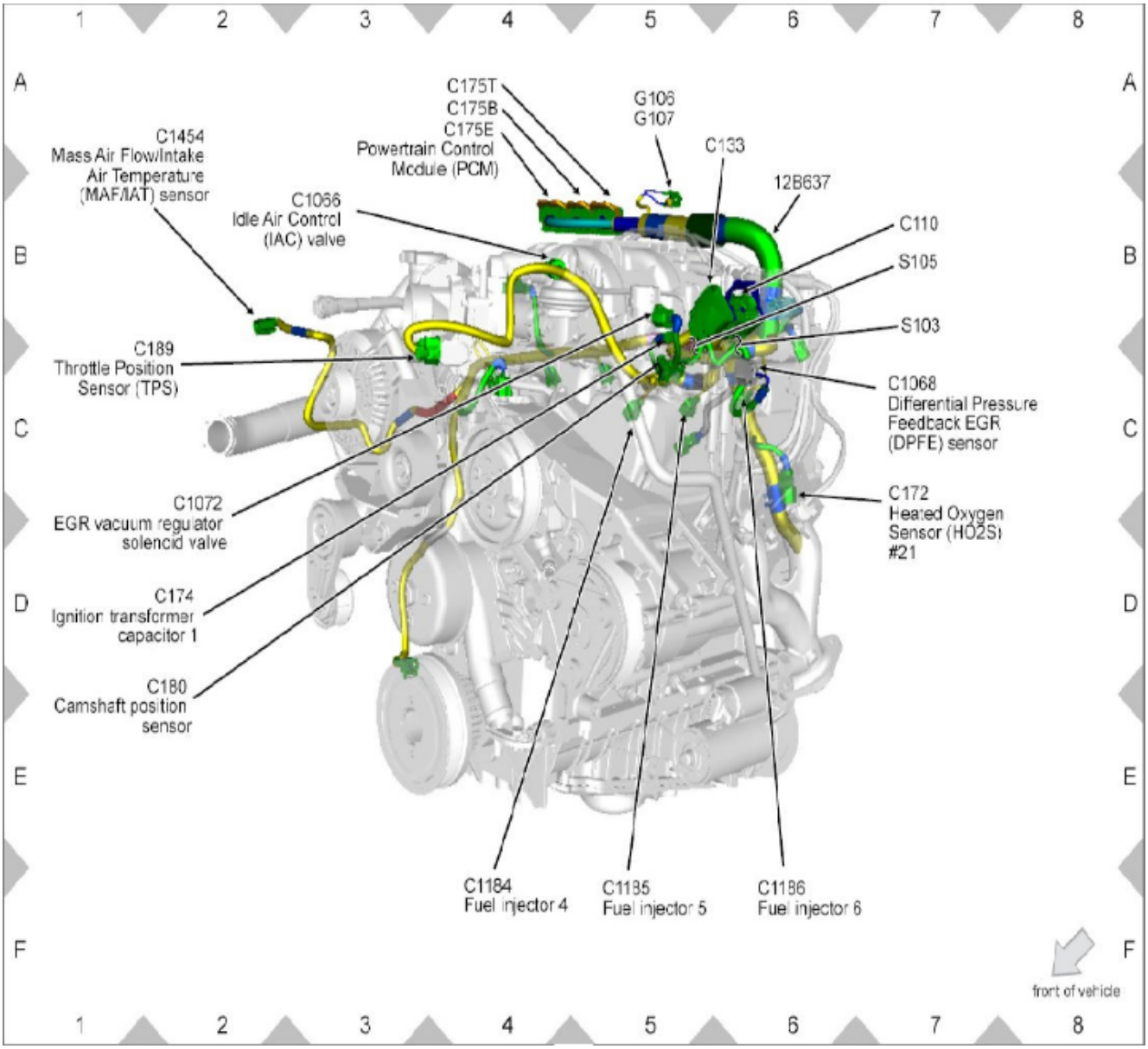


Engine Control Module: Locations

View 151-3


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
12B637
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT)
C133
C110
C1066
Idle Air Control (IAC) valve
C189
Throttle Position Sensor (TPS)
C1064
Engine Coolant Temperature (ECT) sensor
C1184
Fuel injector 4
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
C1186
Fuel injector 6
S103
C1185
Fuel injector 5
front of vehicle

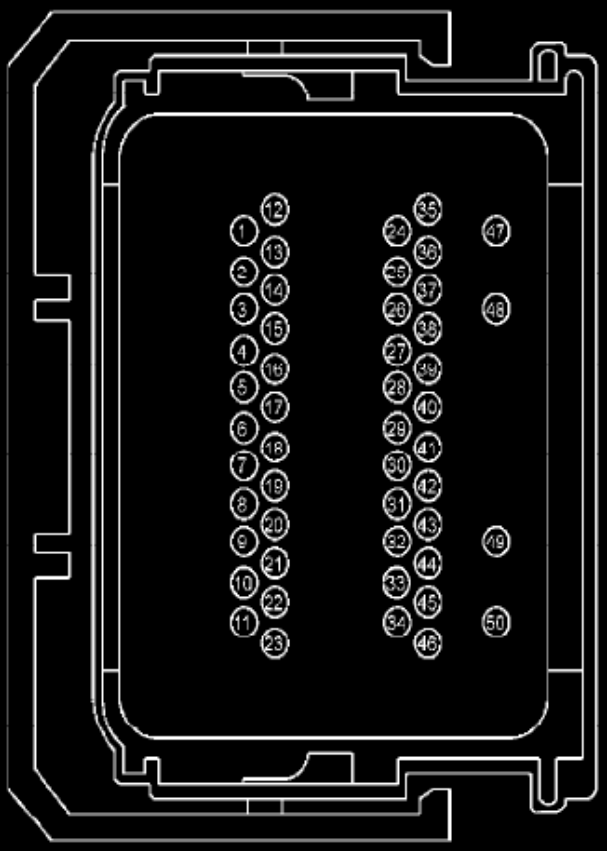
View 151-5


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
C133
12B637
C110
S105
S103
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor
C1066
Idle Air Control (IAC) valve
C189
Throttle Position Sensor (TPS)
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
C174
Ignition transformer capacitor 1
C180
Camshaft position sensor
C1184
Fuel injector 4
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-7

Connector: C175B

Description:	Harness:	Base Part #:
POWERTRAIN CONTROL MODULE (PCM)	12B637	12A650



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VCM05 (VT-OG)	20	CTRL MOD. - VEHICLE SPEED OUTPUT (VSOUT)	
2	CDC12 (YE)	20	CTRL MOD. - POWERTRAIN # STARTER MOTOR CONTROL (SMC)	
3	VE922 (VT-GN)	20	TRANSDUCER - FUEL TANK PRESSURE (FTPT)	
4	*	*	not used	
5	*	*	not used	
6	*	*	not used	
7	CBP21 (BU-GY)	20	FUSE - 21 OR CIRCUIT BREAKER	M/T
7	CET40 (GN-OG)	20	SWITCH - TRANSMISSION RANGE # PARK/NEUTRAL (TRSW-PN)	A/T
8	CCB15 (BN-GN)	20	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL CLOSED	
9	*	*	not used	
10	GD108 (BK-VT)	18	GROUND - CHASSIS/BATTERY	
11	VDB04 (WH-BU)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED HIGH	
12	VE225 (YE-OG)	20	CTRL MOD. - POWERTRAIN # FUEL PUMP MODULE COMMAND (FPC)	
13	CE114 (GN-BU)	20	CTRL MOD. - POWERTRAIN # CANISTER VENT SOLENOID (CANVNT)	
14	CH302 (WH-BN)	20	CTRL MOD. - POWERTRAIN # A/C CLUTCH CONTROL RELAY/WOT AC CUTOFF (ACCR)	
15	CH425 (GN-BU)	20	SWITCH - AC HEAD PRESSURE (ACPSW)	
16	*	*	not used	
17	*	*	not used	
18	*	*	not used	
19	*	*	not used	
20	*	*	not used	
21	VE518 (BN-WH)	18	MONITOR - FUEL PUMP (FPM)	
22	*	*	not used	
23	VDB05 (WH)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED LOW	
24	*	*	not used	
25	*	*	not used	
26	*	*	not used	
27	*	*	not used	
28	*	*	not used	
29	CET34 (BN-GN)	20	SWITCH - TRANSMISSION CONTROL/OVERDRIVE CANCEL (TCS)	
30	*	*	not used	
31	*	*	not used	
32	*	*	not used	
33	CDC36	20	SWITCH - START INTERLOCK	M/T

Engine Control Module: Diagrams

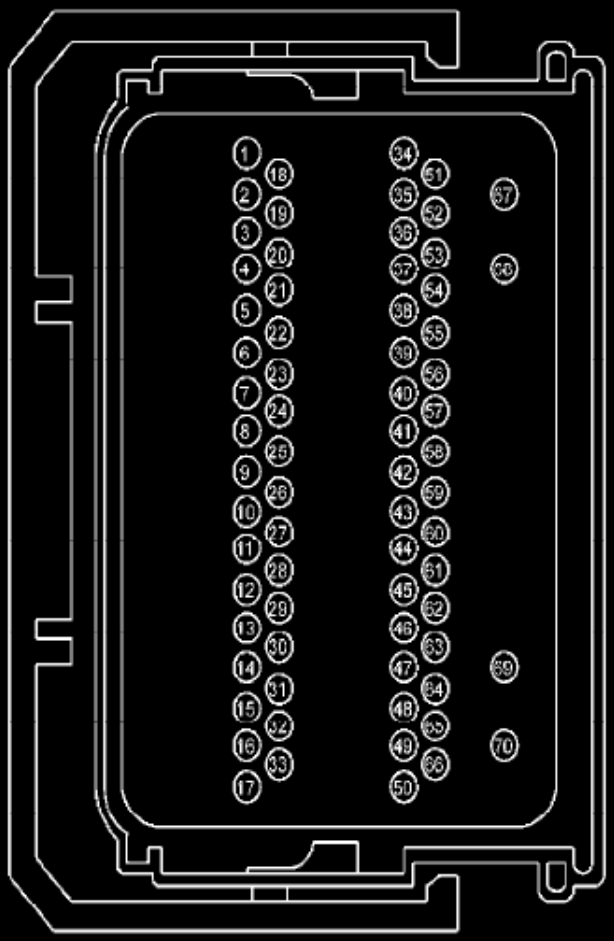
C175B (Part 1)

	(GN-BN)		CLUTCH PEDAL	
34	CCS09 (GN)	20	SWITCH - POWER STEERING PRESSURE (PSPS)	
35	CBB39 (VT-WH)	18	FUSE - 39 OR CIRCUIT BREAKER	
36	CBB39 (VT-WH)	18	FUSE - 39 OR CIRCUIT BREAKER	
37	*	*	not used	
38	*	*	not used	
39	CE904 (GN-VT)	20	SWITCH - CLUTCH PEDAL POSITION # TOP OF TRAVEL (CPP-TT)	M/T
40	LE424 (YE-GN)	20	CTRL MOD. - POWERTRAIN # VOLTAGE REFERENCE COWL (C-VREV)	
41	RE407 (YE-VT)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN COWL (C-SIGRTN) (SIGRTN C)	
42	*	*	not used	
43	*	*	not used	
44	CUB08 (BN)	20	CONNECTOR - DIAGNOSTIC # FLASH EEPROM POWER SUPPLY (FEPS)	
45	SBB21 (GY-RD)	20	FUSE - 21 OR CIRCUIT BREAKER	
46	*	*	not used	
47	GD108 (BK-VT)	18	GROUND - CHASSIS/BATTERY	
48	GD108 (BK-VT)	18	GROUND - CHASSIS/BATTERY	
49	GD108 (BK-VT)	18	GROUND - CHASSIS/BATTERY	
50	GD108 (BK-VT)	18	GROUND - CHASSIS/BATTERY	

C175B (Part 2)

Connector: C175E

Description:	Harness:	Base Part #:
POWERTRAIN CONTROL MODULE (PCM)	12B637	12A650



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	*	*	not used	
3	CE328 (YE-VT)	18	CTRL MOD. - POWERTRAIN # POS. CRANKCASE VENTIL. FITTING HEATER CONTROL (PCVFHC)	3.0L/4.0L
4	*	*	not used	
5	*	*	not used	
6	CE132 (BN-YE)	18	CTRL MOD. - POWERTRAIN # ELECTRIC VAPOR MANAGEMENT VALVE (EVMV)	
7	VH101 (WH-VT)	20	CTRL MOD. - CLIMATE # BLOWER MOTOR CONTROL	2.3L
8	CE101 (WH-VT)	18	CTRL MOD. - POWERTRAIN # EXHAUST GAS RECIRCUL. MOTOR (STEPPER CONTR. 1) (EGRMC) (+)	2.3L
9	*	*	not used	
10	*	*	not used	
11	*	*	not used	
12	CE125 (WH)	18	CTRL MOD. - POWERTRAIN # DISTRIBUTORLESS IGNITION SYSTEM COIL DRIVER C (DIS)	2.3L
12	CE123 (YE-GY)	18	CTRL MOD. POWERTRAIN # DISTRIBUTORLESS IGNITION SYSTEM COIL DRIVER A (DIS)	3.0L/4.0L
13	CE102 (YE-BU)	18	CTRL MOD. - POWERTRAIN # EXHAUST GAS RECIRCUL. MOTOR (STEPPER CONTR. 2) (EGRMC) (-)	2.3L
14	*	*	not used	
15	*	*	not used	
16	CE125 (WH)	18	CTRL MOD. - POWERTRAIN # DISTRIBUTORLESS IGNITION SYSTEM COIL DRIVER C (DIS)	3.0L/4.0L
17	CE124 (BU-BN)	18	CTRL MOD. - POWERTRAIN # DISTRIBUTORLESS IGNITION SYSTEM COIL DRIVER B (DIS)	
18	VE716 (YE)	20	SENSOR - ENGINE COOLANT TEMPERATURE (ECT)	3.0L/4.0L
19	*	*	not used	
20	*	*	not used	
21	VE713 (GN-OG)	20	SENSOR - DELTA PRESSURE FEEDBACK EGR (DPFE)	3.0L/4.0L
22	VE740 (VT-GY)	20	SENSOR - INTAKE AIR TEMPERATURE (IAT)	
23	*	*	not used	
24	*	*	not used	
25	VE807 (YE-VT)	20	SENSOR - MASS AIR FLOW LH BANK OR 1ST BANK OR UNIQUE (MAF)	
26	RF320 (BU)	20	CTRL MOD. - POWERTRAIN # MASS AIR FLOW SEN. LH BANK OR 1ST BANK (MAFRTN)	
27	*	*	not used	
28	VE735 (VT-GN)	18	SENSOR - HEATED OXYGEN PRE CAT. 1ST OR UNIQUE (HO2S11)	

C175E (Part 1)

29	VE737 (WH-BU)	18	SENSOR - HEATED OXYGEN PRE CAT. 2ND (HO2S21)	3.0L/4.0L
30	*	*	not used	
31	*	*	not used	
32	*	*	not used	
33	CE301 (GY-OG)	20	CTRL MOD. - POWERTRAIN # IDLE AIR CONTROL VALVE (IAC)	
34	*	*	not used	
35	CE206 (GY-TE)	20	CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 2 (INJ)	
36	CE208 (YE-OG)	20	CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 4 (INJ)	
37	CE210 (GN-WH)	20	CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 6 (INJ)	3.0L/4.0L
38	*	*	not used	
39	CE103 (BU-BN)	18	CTRL MOD. - POWERTRAIN # EXHAUST GAS RECIRCUL MOTOR (STEPPER CONTR. 3) (EGRMC)	2.3L
40	*	*	not used	
41	CE116 (VT-BN)	20	CTRL MOD. POWERTRAIN # CYLINDER HEAD TEMPERATURE INDICATOR LIGHT (CHTIL)	2.3L
42	*	*	not used	
43	*	*	not used	
44	*	*	not used	
45	VE706 (BN-BU)	18	SENSOR - CAMSHAFT POSITION BANK 1 IN+EX/ IN (CMP1) [CID-H] (CID1)	
46	RE135 (GN-BN)	18	CTRL MOD. - POWERTRAIN # CRANKSHAFT POSITION SENSOR (CKPN)	
47	VE711 (YE-VT)	18	SENSOR - CRANKSHAFT POSITION (CKPP)	
48	RE323 (WH-BN)	20	CTRL MOD. - POWERTRAIN # KNOCK SENSOR 1ST OR UNIQUE (KS1N) [KSL1-]	
49	VE801 (VT-OG)	20	SENSOR - KNOCK 1ST OR UNIQUE (KS1P) [KSL1+]	
50	*	*	not used	
51	*	*	not used	
52	CE205 (GN-BU)	20	CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 1 (INJ)	
53	CE207 (VT-GY)	20	CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 3 (INJ)	
54	CE209 (BN)	20	CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 5 (INJ)	3.0L/4.0L
55	*	*	not used	
56	CE104 (GN)	18	CTRL MOD. - POWERTRAIN # EXHAUST GAS RECIRCUL MOTOR (STEPPER CONTR. 4) (EGRMC)	2.3L
57	LE423 (GN-VT)	20	CTRL MOD. - POWERTRAIN # VOLTAGE REFERENCE ENGINE (VREF) (E-VREV)	
58	RE405 (GN-WH)	18	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	
59	*	*	not used	
60	*	*	not used	

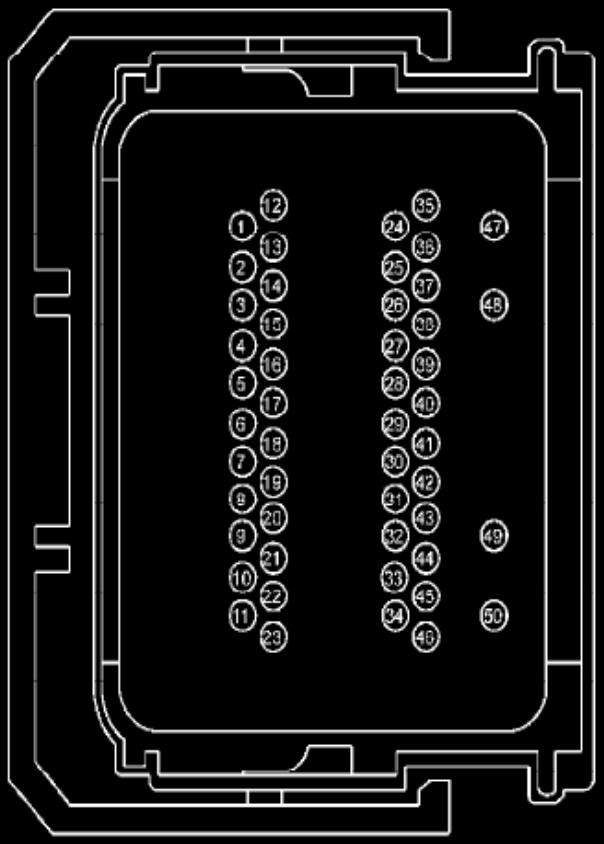
C175E (Part 2)

61	VE819 (GN-VT)	20	SENSOR - THROTTLE POSITION # POSITIVE SLOPE (TP2-PS)	
62	VE803 (BU-GN)	20	SENSOR - MANIFOLD ABSOLUTE PRESSURE (MAP)	2.3L
63	CE133 (VT WH)	20	CTRL MOD. - POWERTRAIN # ELECTRONIC VACUUM REGULATOR (EVR)	3.0L/4.0L
64	*	*	not used	
65	*	*	not used	
66	*	*	not used	
67	*	*	not used	
68	*	*	not used	
69	CE235 (GN-BN)	18	CTRL MOD. - POWERTRAIN # HEATER OXYGEN SEN. PRE CAT. 1ST OR UNIQUE (HTR11)	
70	CE236 (GY-VT)	18	CTRL MOD. - POWERTRAIN # HEATER OXYGEN SEN. PRE CAT. 2ND (HTR21)	3.0L/4.0L

C175E (Part 3)

Connector: C175T

Description:	Harness:	Base Part #:
POWERTRAIN CONTROL MODULE (PCM)	12B637	12A650



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	*	*	not used	
3	RET04 (YE-OG)	20	CTRL MOD. - POWERTRAIN # SENSOR OUTPUT SHAFT SPEED (OSS)	
4	VE739 (GY-YE)	20	SENSOR - INTERMEDIATE SHAFT SPEED SENSOR	A/T
5	*	*	not used	
6	*	*	not used	
7	*	*	not used	
8	*	*	not used	
9	*	*	not used	
10	*	*	not used	
11	VET27 (BN-YE)	20	CTRL MOD. - POWERTRAIN # SOLENOID PRESSURE CONTROL 2 (PC2) [EPC] [VFS]	A/T
12	*	*	not used	
13	*	*	not used	
14	*	*	not used	
15	VET33 (WH-OG)	20	SENSOR - TURBINE/TRANSMISSION SHAFT SPEED (TSS)	A/T
16	VET129 (VT-WH)	20	SENSOR - TRANSMISSION RANGE # 1 (TR1)	A/T
17	VET30 (YE)	20	SENSOR - TRANSMISSION RANGE # 2 (TR2)	A/T
18	*	*	not used	
19	*	*	not used	
20	*	*	not used	
21	*	*	not used	
22	*	*	not used	
23	*	*	not used	
24	VE731 (YE-GN)	18	SENSOR - HEATED OXYGEN POST CAT. 1ST OR UNIQUE (HO2S12)	
25	VE733 (WH)	18	SENSOR - HEATED OXYGEN POST CAT. 2ND (HO2S22)	3.0L, 4.0L
26	*	*	not used	
27	VET28 (GY-VT)	20	SENSOR - TRANSMISSION RANGE # (TR-3A)	A/T
28	VET31 (BU-OG)	20	SENSOR - TRANSMISSION RANGE # 4 (TR4)	A/T
29	CET06 (GN-BN)	20	SENSOR - TRANSMISSION FLUID TEMPERATURE (TFT)	A/T
30	*	*	not used	
31	*	*	not used	
32	*	*	not used	
33	*	*	not used	
34	*	*	not used	
35	*	*	not used	
36	*	*	not used	
37	*	*	not used	
38	*	*	not used	
39	*	*	not used	
40	*	*	not used	

C175T (Part 1)

41	RE406 (GY-VT)	18	CTRL MOD. - POWERTRAIN # SIGNAL RETURN TRANSMISSION (T-SIGRTN) (SIGRTN-B)	
42	CET05 (BU-GN)	20	CTRL MOD. - POWERTRAIN # SOLENOID SHIFT CONTROL LOW-SIDE A (SSA)	A/T
43	CET18 (GY-YE)	20	CTRL MOD. - POWERTRAIN # SOLENOID SHIFT CONTROL LOW-SIDE B (SSB)	A/T
44	CET07 (GY-OG)	20	CTRL MOD. - POWERTRAIN # SOLENOID SHIFT CONTROL LOW-SIDE C (SSC)	A/T
45	CET44 (BU-BN)	20	CTRL MOD. - POWERTRAIN # SOLENOID SHIFT CONTROL LOW-SIDE D (SSD)	A/T
46	CET19 (VT GY)	20	CTRL MOD. - POWERTRAIN # TORQUE CONVERTER CLUTCH HIGH IMPEDENCE (TCCH)	A/T
47	CE233 (WH-OG)	18	CTRL MOD. - POWERTRAIN # HEATER OXYGEN SEN. POST CAT. 1ST OR UNIQUE (HTR12)	
48	CE234 (BU-WH)	18	CTRL MOD. - POWERTRAIN # HEATER OXYGEN SEN. POST CAT. 2ND (HTR22)	3.0L, 4.0L
49	*	*	not used	
50	*	*	not used	

C175T (Part 2)

Engine Control Module: Procedures

FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)

Description

The EEPROM is contained in an integrated circuit internal to the powertrain control module (PCM). The EEPROM contains the vehicle strategy including calibration information specific to the vehicle, and is capable of being programmed or flashed repeatedly.

As part of the calibration there is an area referred to as the vehicle identification (VID) block. The VID block is programmed when installing a new PCM as described under Programming the VID Block for a Replacement PCM. Failure to carry out this procedure may generate DTCs PI635 or P1639. The VID block in an existing PCM can also be tailored to accommodate various hardware or parameter changes made to the vehicle since production. Failure to carry out this procedure properly may generate DTC P1635, Tire/Axle Ratio out of Acceptable Range. An incorrect tire/axle ratio is one of the main causes for DTC P1639. This is described under Making Changes to the VID Block and also under Making Changes to the PCM Calibration. The VID block contains many items used by the strategy for a variety of functions. Some of these items include the vehicle identification number (VIN), octane adjust, fuel octane, fuel type, vehicle speed limit, tire size, axle ratio, the presence of speed control, and 4-wheel drive electronic shift-on-the-fly (ESOF) versus manual shift-on-the-fly (MSOF). Only items applicable to the vehicle hardware and supported by the VID block is displayed on the scan tool.

When changing items in the VID block, the strategy places range limits on certain items such as tire and axle ratio. The number of times the VID block may be reconfigured is limited. When this limit is reached, the scan tool displays a message indicating the need to flash the PCM again to reset the VID block.

Programming can be carried out by a local Ford dealer or any non-Ford facility. Refer to the scan tool manufacturer's instruction manual for details.

Programming the VID Block for a Replacement PCM

A new PCM contains the latest strategy and calibration level for a particular vehicle. However, the VID block is blank and needs programming. There are 2 procedures available. The first is an automatic data transfer from the old PCM to the new PCM, and the second is manual data entry into the new PCM.

Automatic data transfer is carried out if the old PCM is capable of communicating. This is done by using a scan tool to retrieve data from the old PCM before removing it from the vehicle. The stored data can then be downloaded to the new PCM after it has been installed.

Carry out manual data entry if the old module is damaged or incapable of communicating. Remove and install a new PCM. Using a compatible scan tool, select and carry out the module/parameter programming, referring to the scan tool manufacturer's instruction manual. Make certain that all parameters are included. Failure to properly program tire size in revolutions per mile, (rev/mile equals 63,360 divided by the tire circumference in inches), axle ratio, 4x4/4x2, and/or MSOF/ESOF may result in DTCs P1635 and P1639. You may be instructed to contact the As-Built Data Center for the information needed to manually update the VID block with the scan tool. Contact the center only if the old PCM cannot be used or the data is corrupt. For Ford and Lincoln Mercury technicians, contact your National Hotline or the Professional Technician Society (PTS) website for As-Built data listed under the Service Publications Index. Non-Ford technicians use the Motorcraft(R) website at www.motorcraft.com. From the Motorcraft(R) homepage, use the search function to find the Module Programming or As-Built Data.

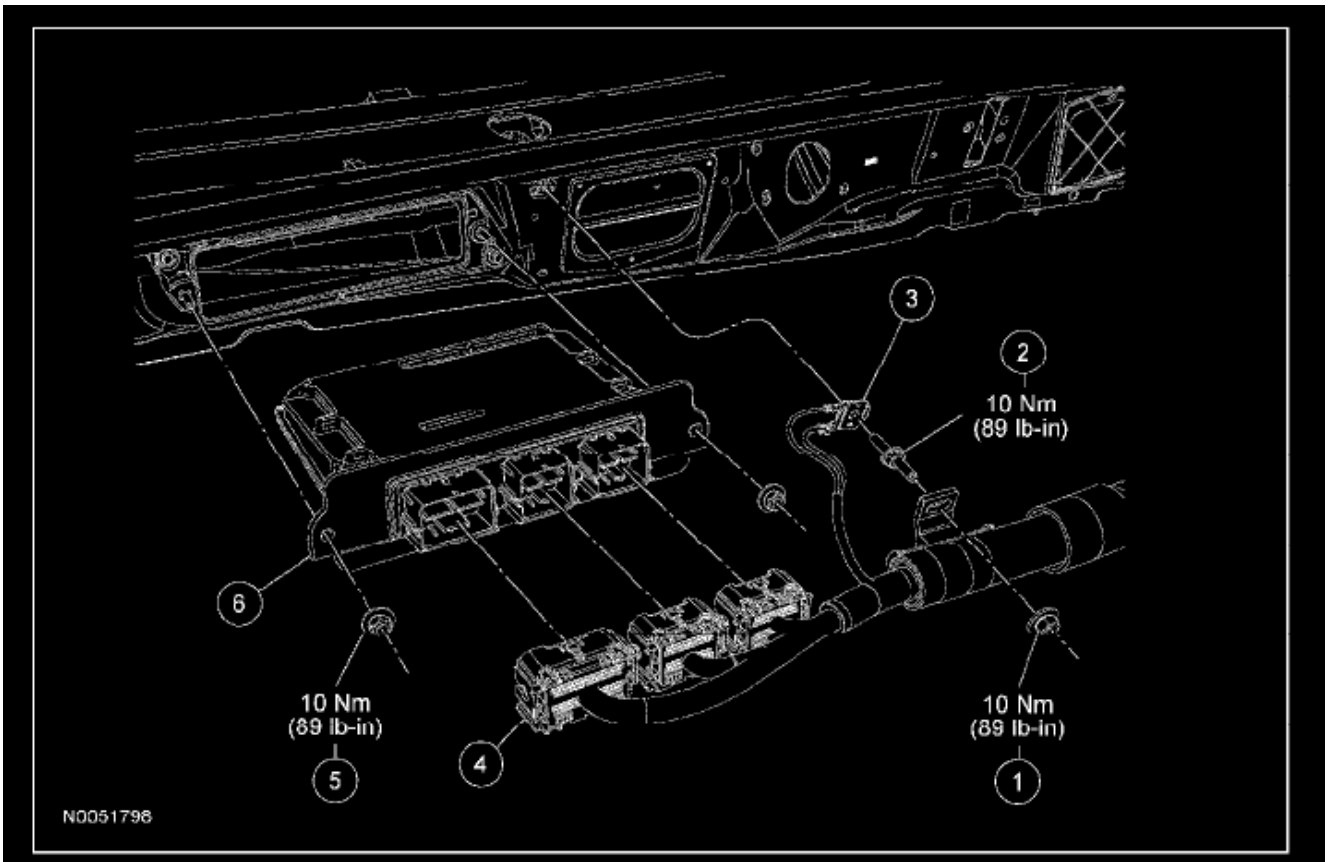
For Ford and Lincoln Mercury technicians, check the Programmable Module Installation link on the PTS website for quick Programmable Module data information by vehicle.

Making Changes to the VID Block

A PCM which is programmed may require changes to be made to certain VID information to accommodate the vehicle hardware. Refer to Module Reprogramming on the scan tool.

Making Changes to the PCM Calibration

At certain times, the entire EEPROM needs to be completely reprogrammed. This is due to changes made to the strategy or calibration after production, or the need to reset the VID block because it has reached its limit. Refer to Module Reprogramming on the scan tool.



Item	Part Number	Description
1	N621906	PCM wiring harness retainer nut
2	N806925	Ground wire stud bolt
3	—	Ground wire terminals (2 required) (part of 12B637)
4	14A464	PCM electrical connectors (3 required) (part of 12B637)
5	N621906	PCM nuts
6	12A651	PCM

Engine Control Module: Removal and Replacement

POWERTRAIN CONTROL MODULE (PCM)

Removal

1. Retrieve the module configuration. Carry out the module configuration retrieval steps of the Programmable Module Installation procedure. 2. Remove the PCM wiring harness retainer nut. 3. Remove the ground wire stud bolt. 4. Disconnect the 3 PCM electrical connectors. 5. Remove the 2 nuts and the PCM.

Installation

1. Install the PCM and the 2 nuts.

- Tighten to 10 Nm (89 lb-in).

2. Connect the 3 PCM electrical connectors. 3. Position the ground wire terminals and install the stud bolt.

- Tighten to 10 Nm (89 lb-in).

4. Install the PCM wiring harness retainer nut.

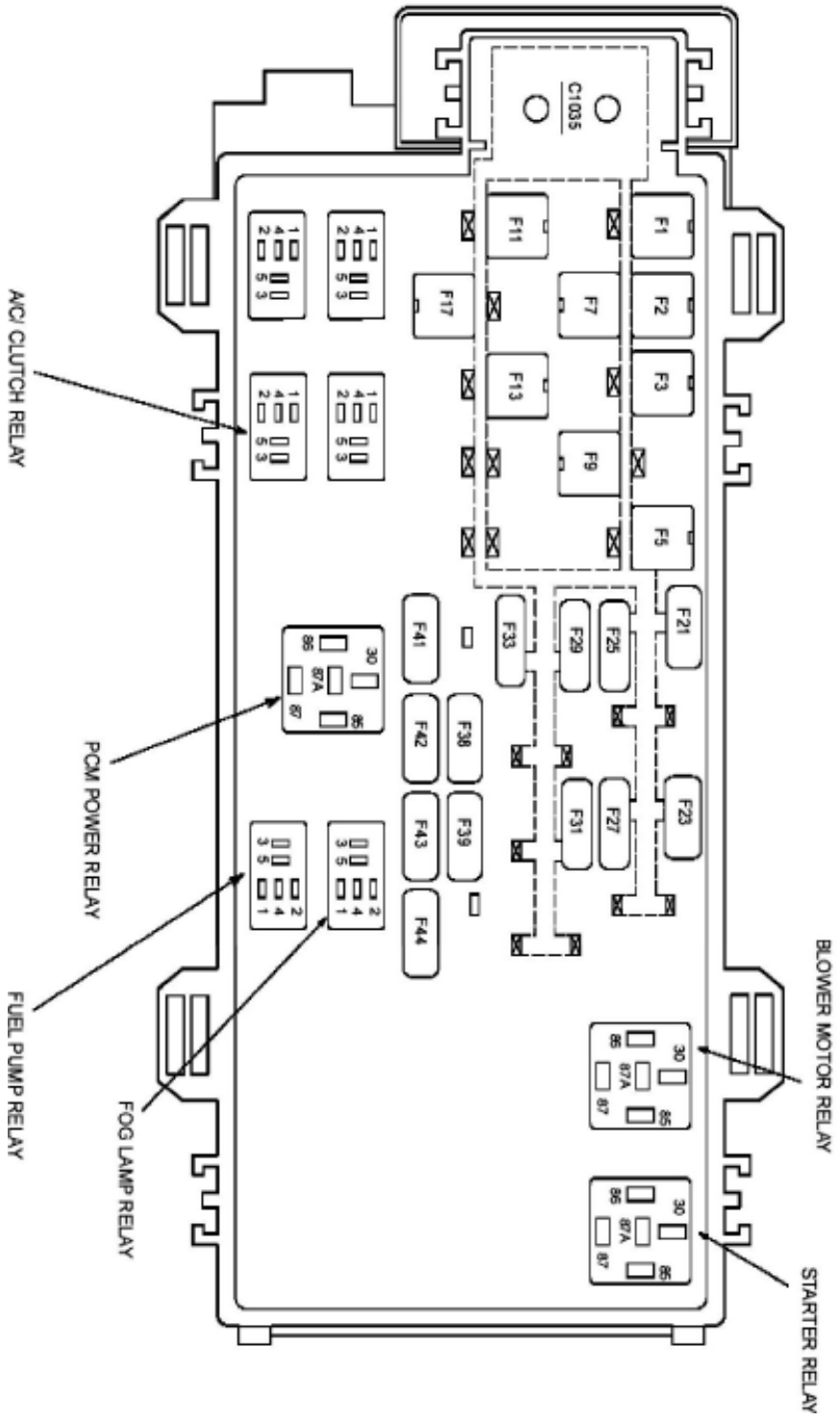
- Tighten to 10 Nm (89 lb-in).

5. NOTE: If a new PCM is installed, the parameters must be reset in both the PCM and the instrument cluster module or the vehicle will experience

a PATS no-start. This will occur even if the vehicle is not equipped with PATS. PATS vehicles and non-PATS vehicles have parameters in the instrument cluster module and the PCM and they both must be reset whenever a new PCM is installed.

Restore the module configurations for the instrument cluster module and the PCM. Carry out the module configuration restore steps of the Programmable Module Installation procedure.

BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L

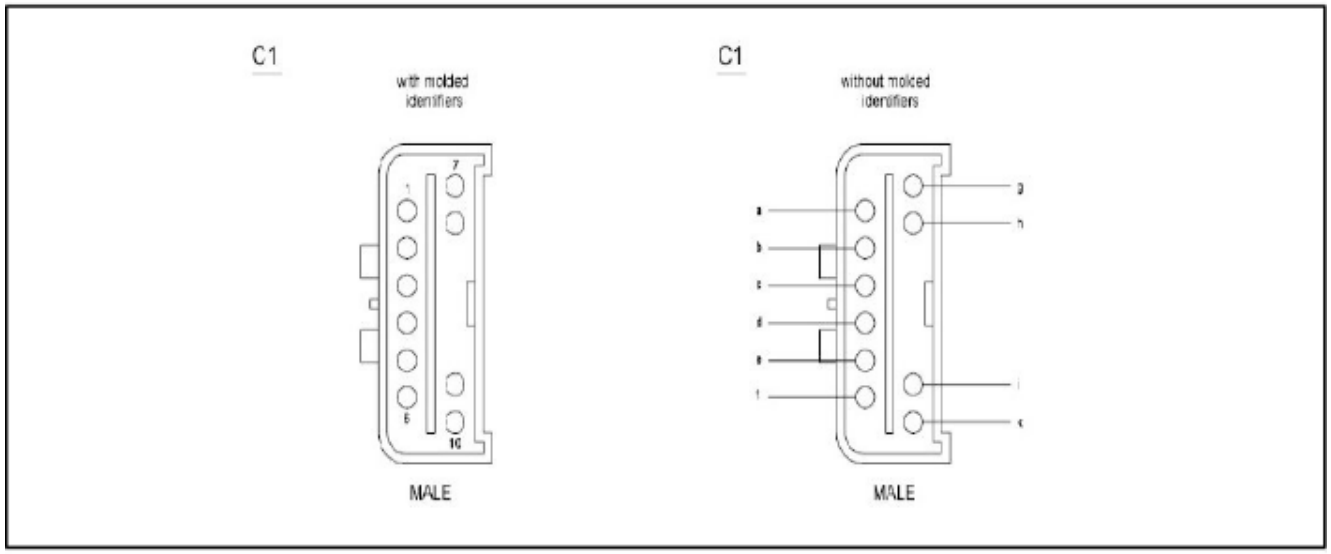


Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



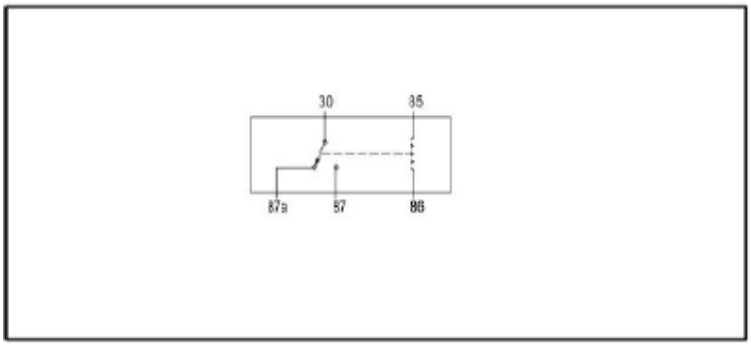
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

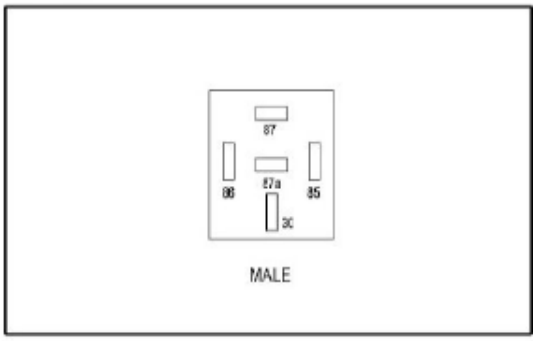
Main Relay (Computer/Fuel System): Testing and Inspection

Relay □ Mini ISO

Schematic



Terminals

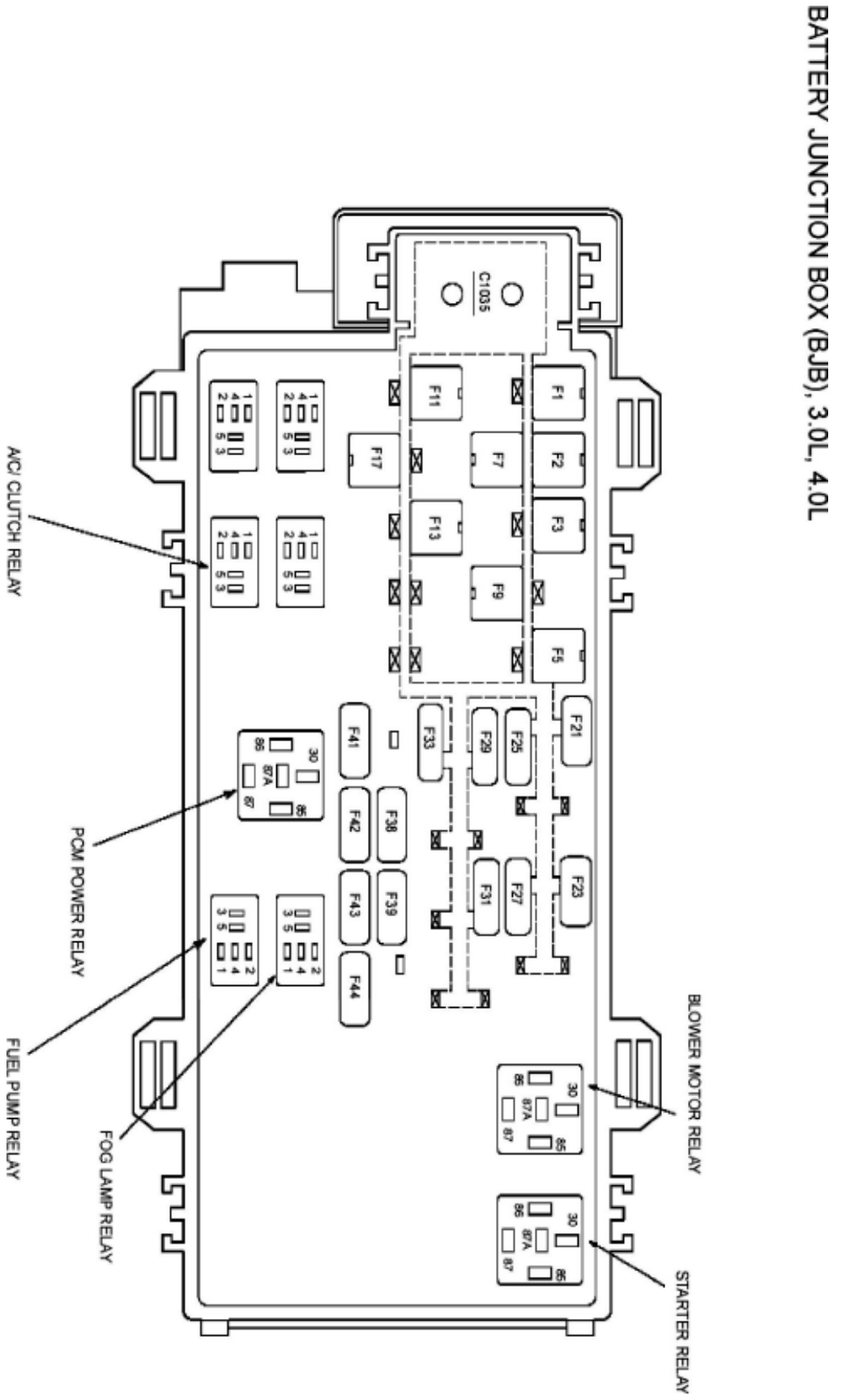


Component testing procedure (no voltage applied)

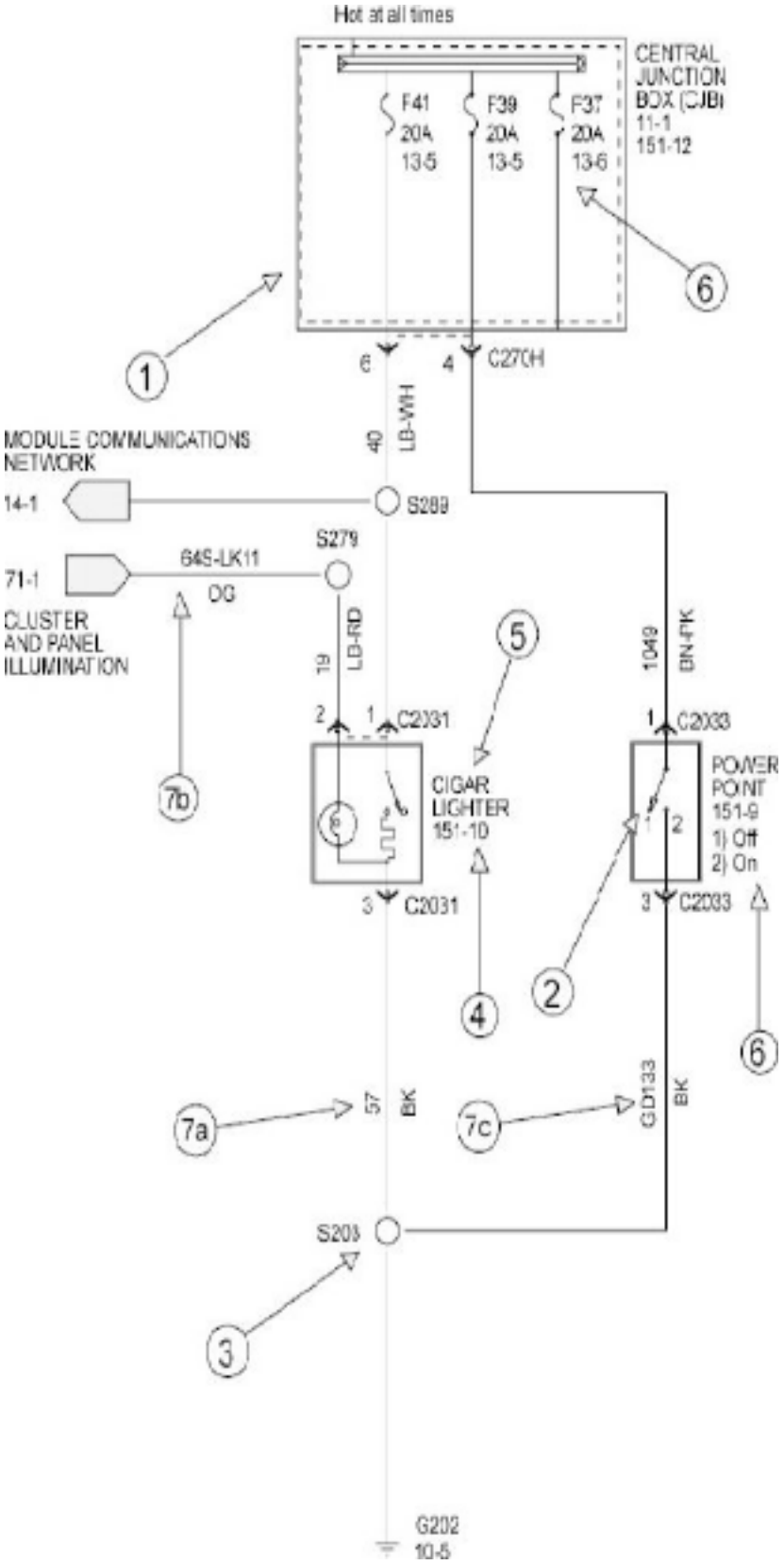
Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	45 □ 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.


BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L
C1035
F1
F2
F3
F5
F7
F9
F11
F13
F17
F21
F23
F25
F27
F29
F31
F33
F36
F39
F41
F42
F43
F44
A/C CLUTCH RELAY
PCM POWER RELAY
FUEL PUMP RELAY
FOG LAMP RELAY
BLOWER MOTOR RELAY
STARTER RELAY

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Powertrain Management > Relays and Modules - Powertrain Management > Relays and Modules - Fuel Delivery and Air Induction > Fuel Pump Relay > Component Information > Diagrams > Diagram Information and Instructions



Fuel Pump Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

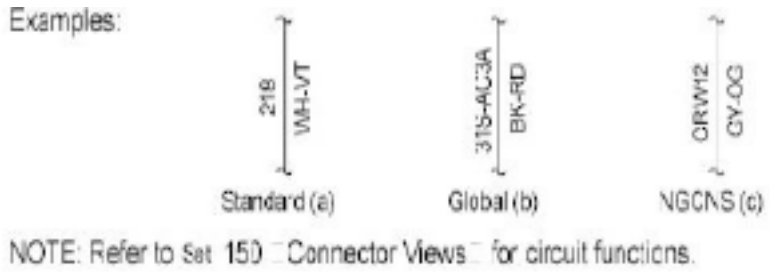
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

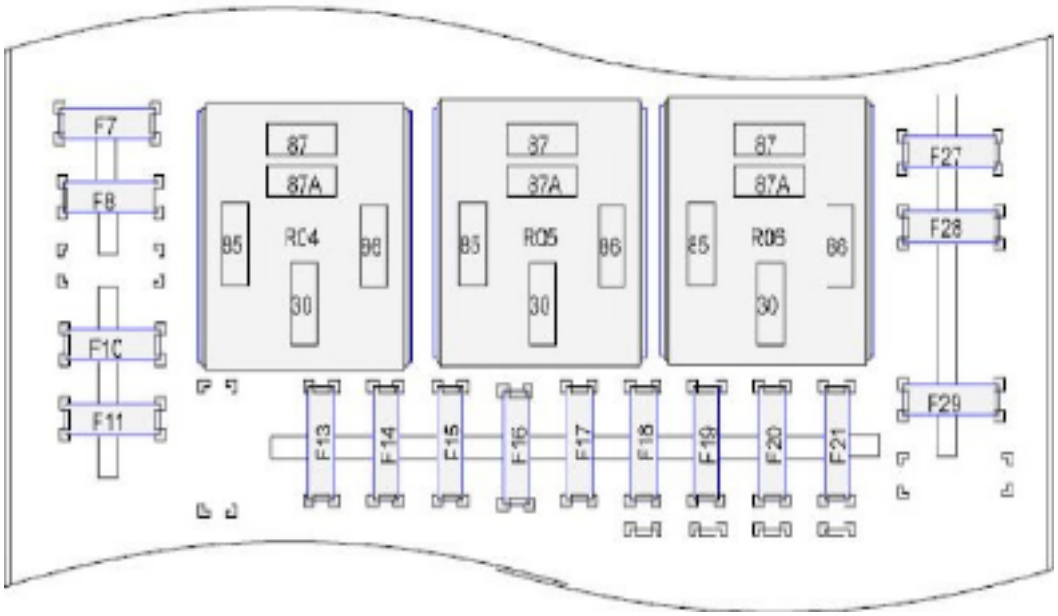
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

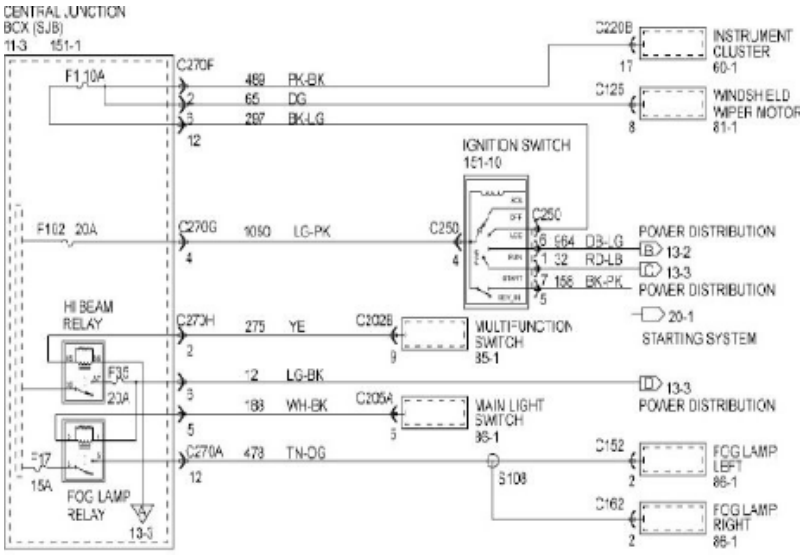
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

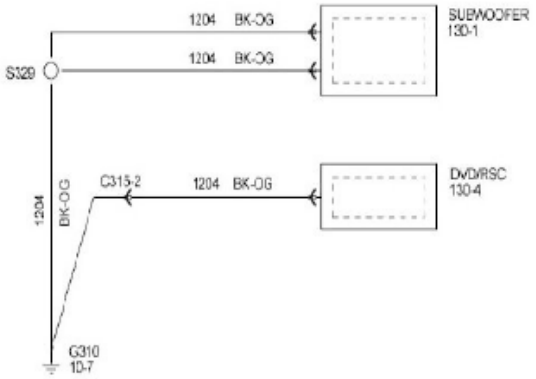
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by

each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

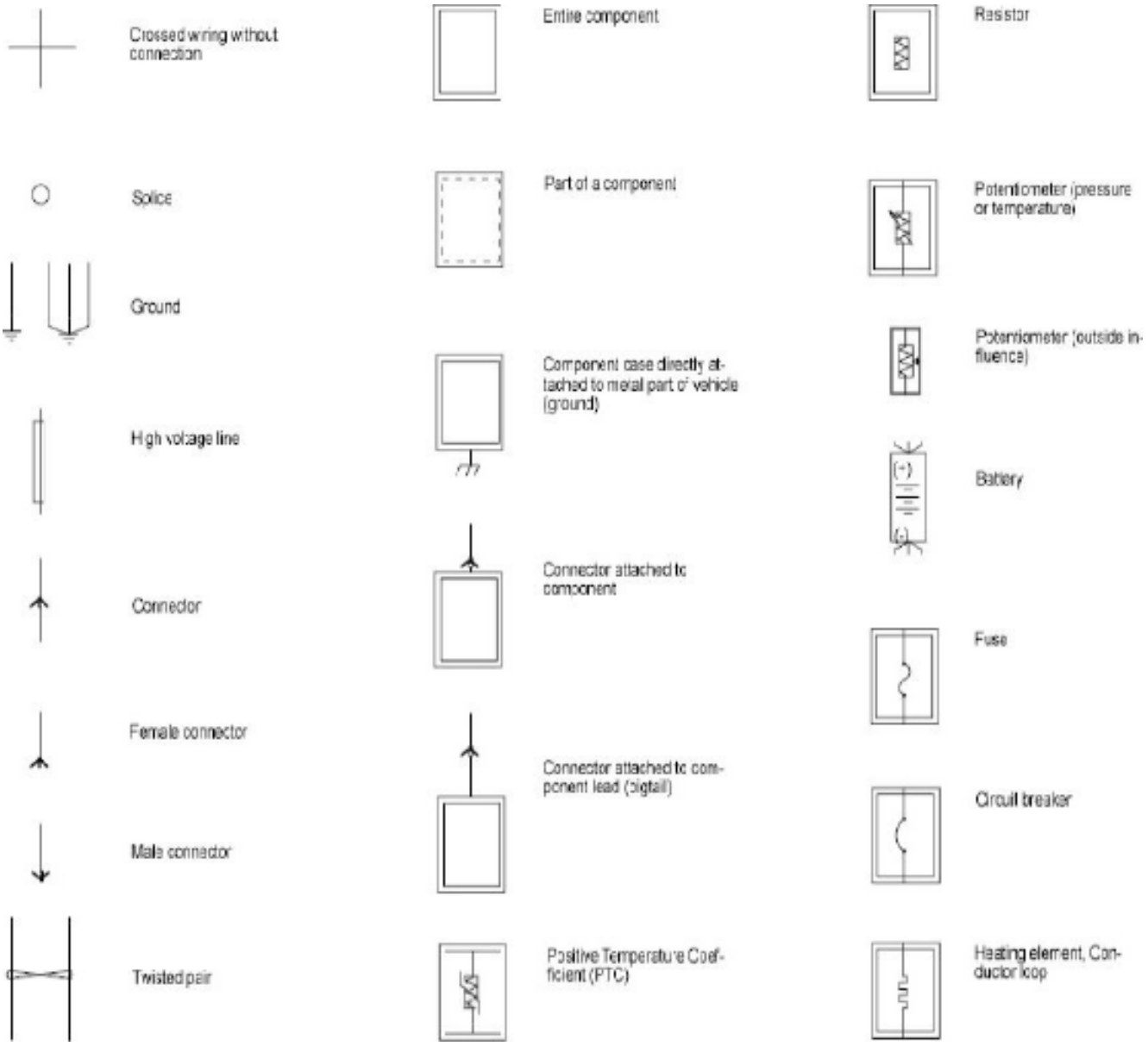
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

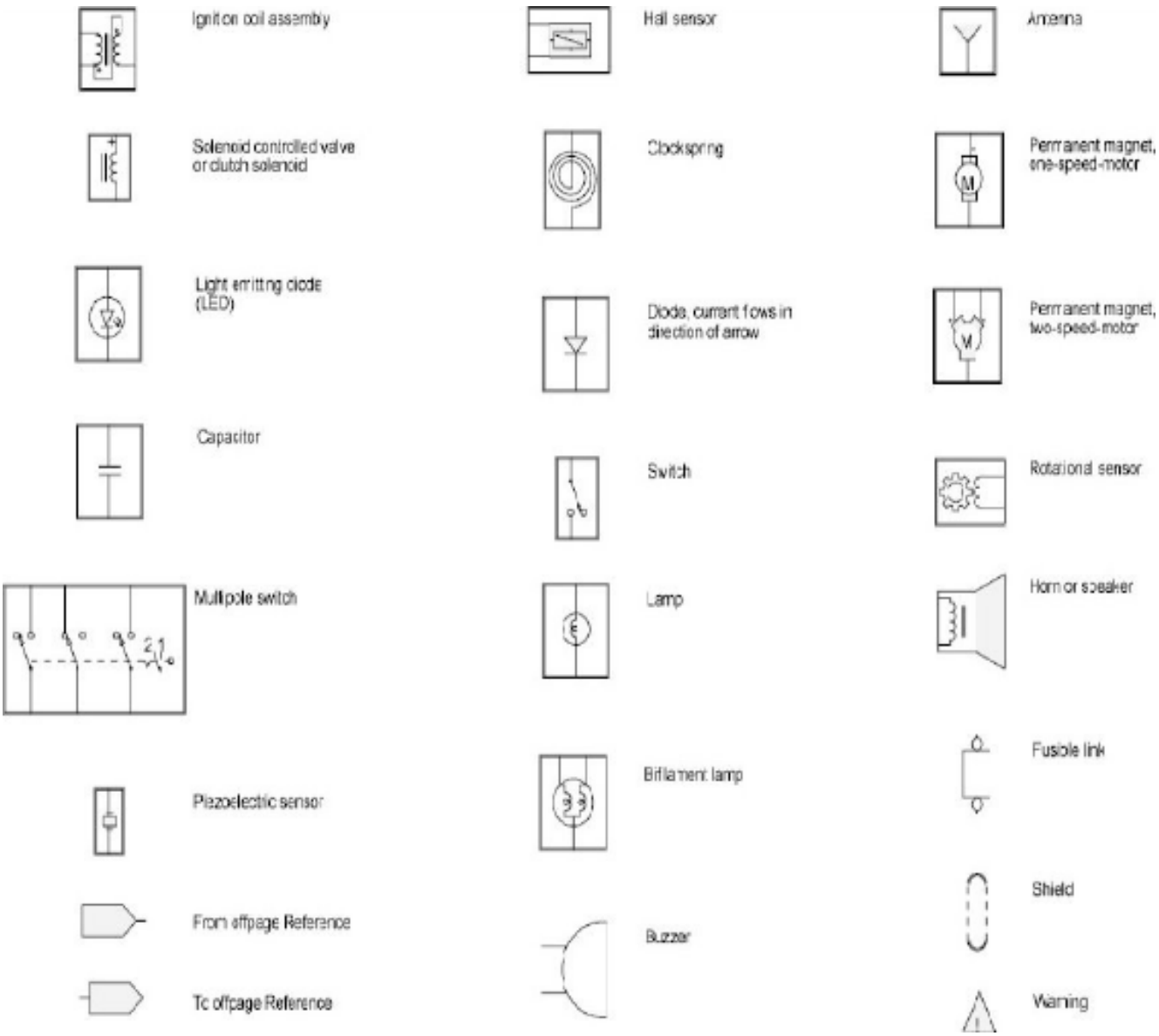
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

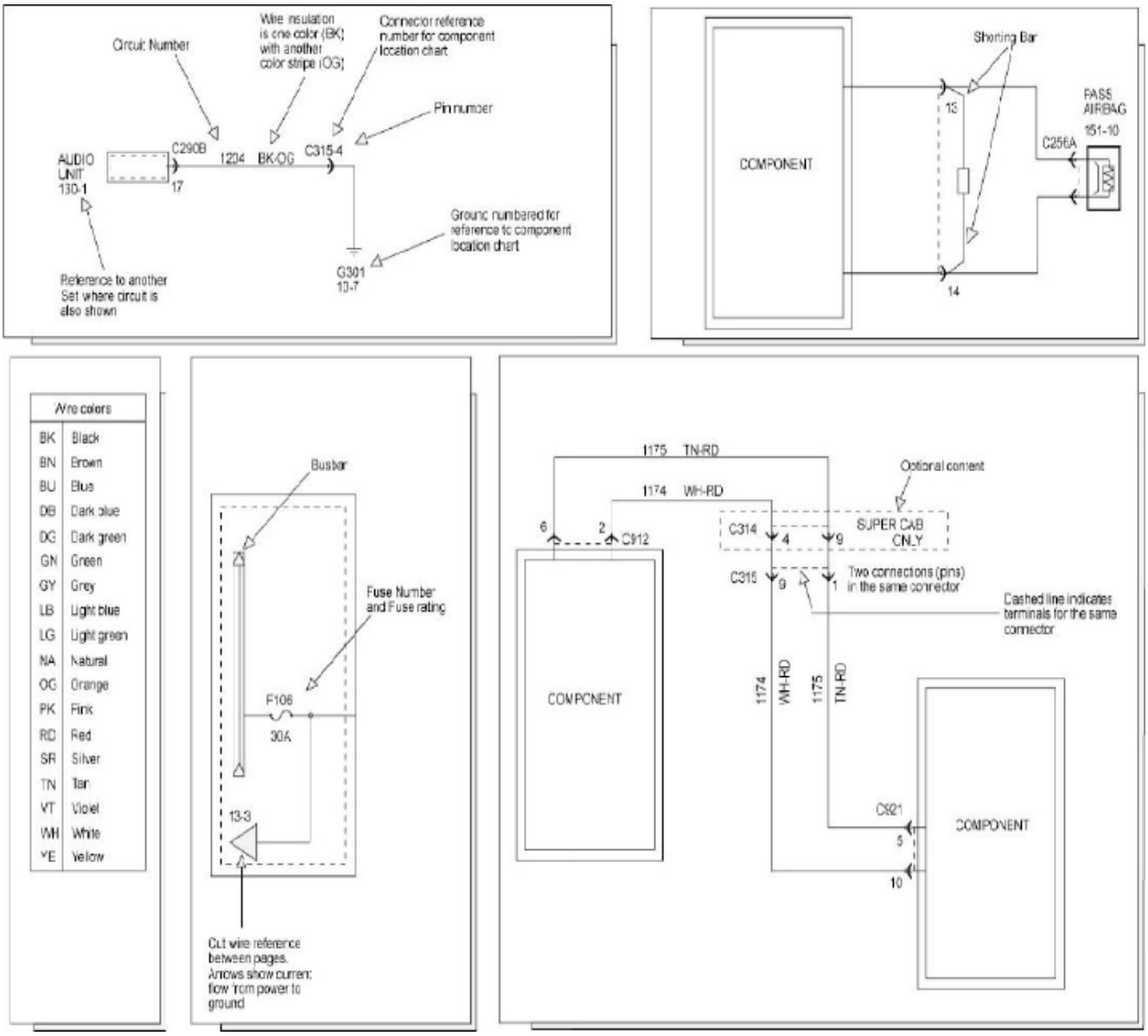
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

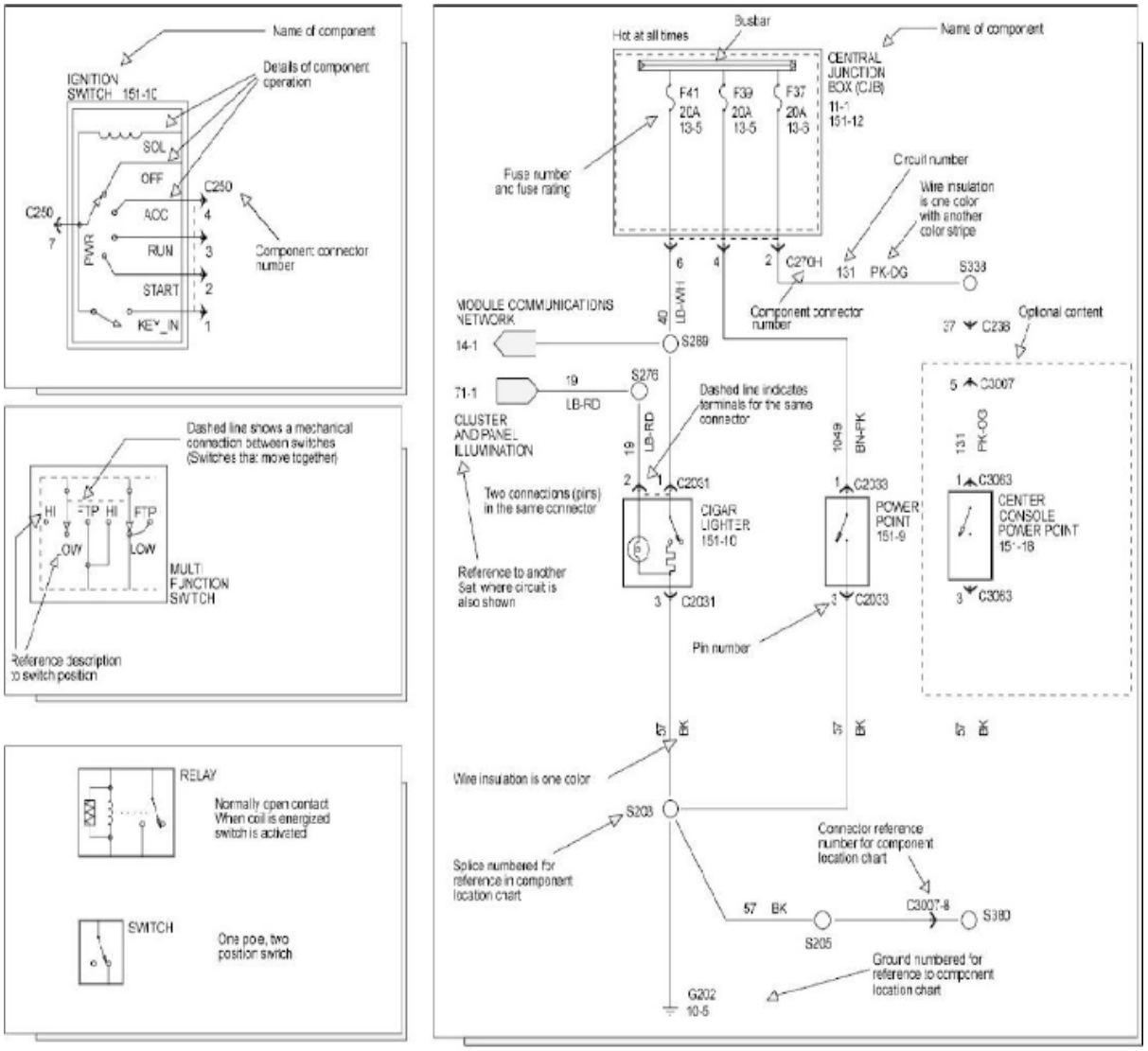
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

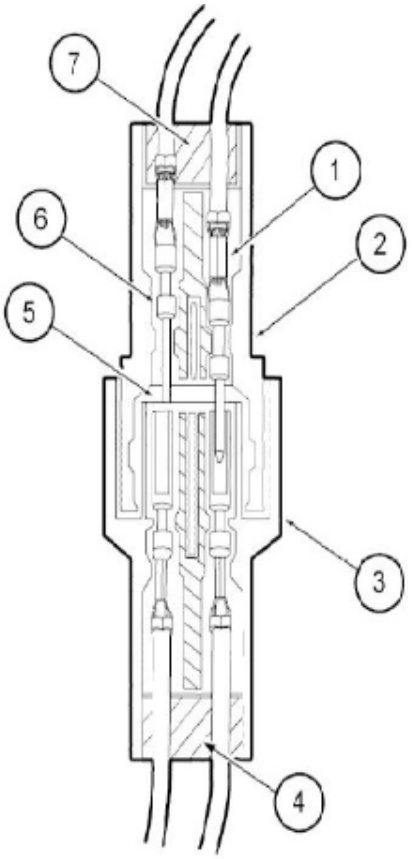


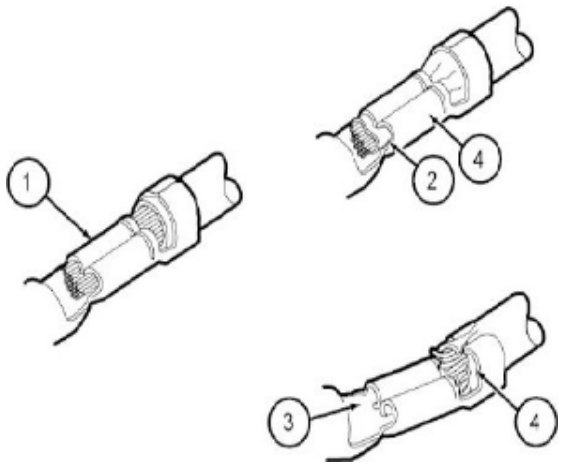
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)





Fuel Pump Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

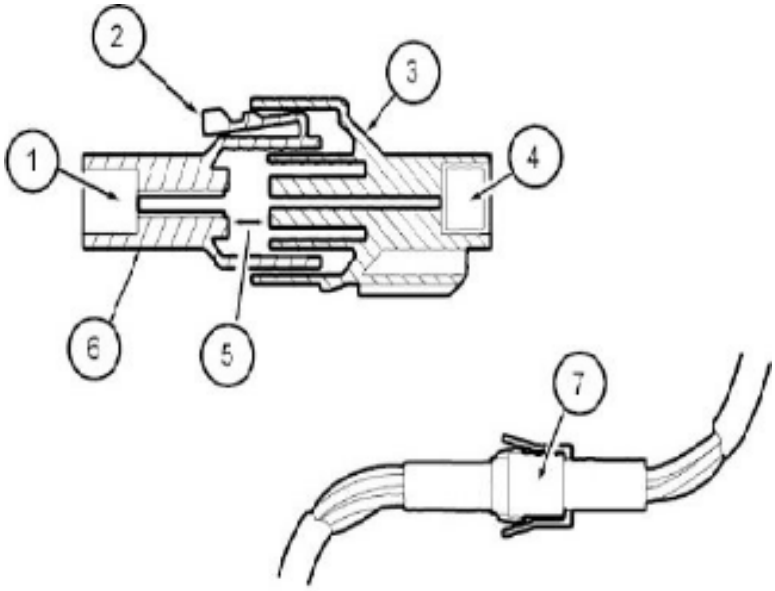
5 = Intermittent contact

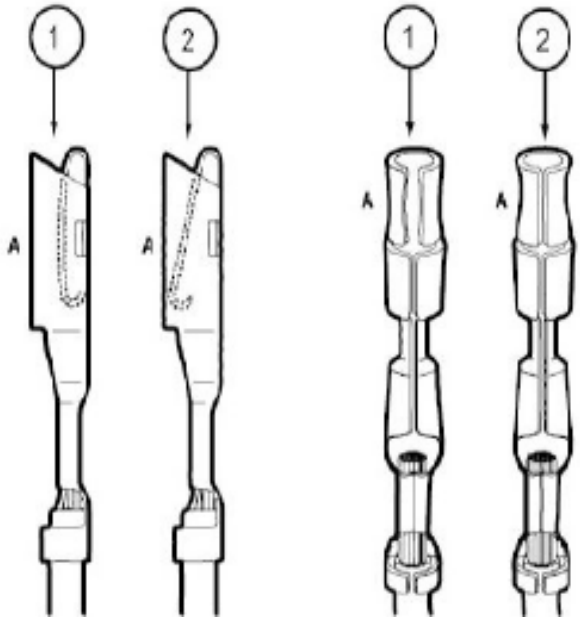
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping





1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

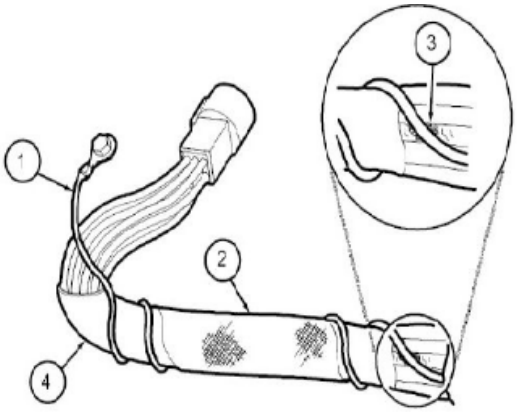
Deformed (enlarged) female terminals

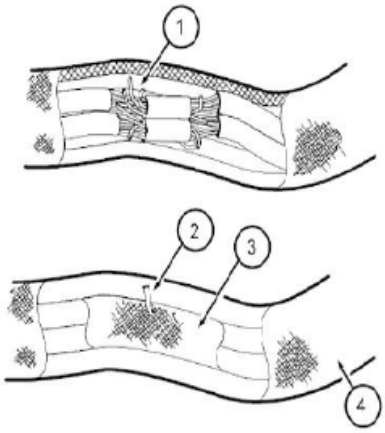
1 = Enlarged

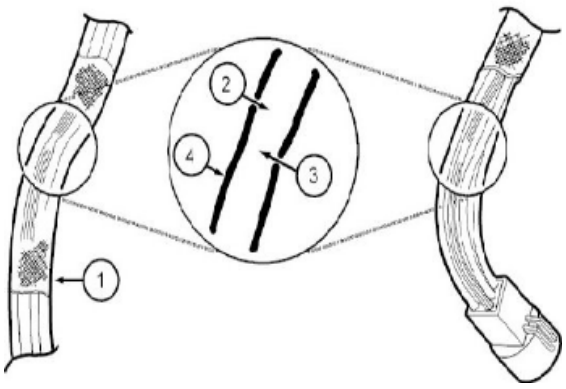
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.







Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

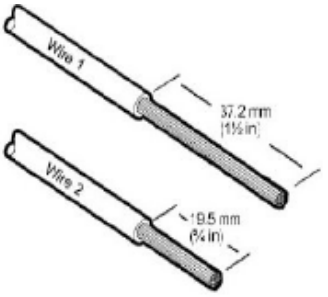
Splice covered 2

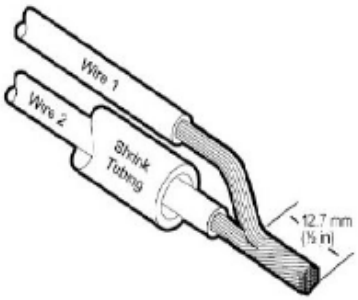
= Wire strand

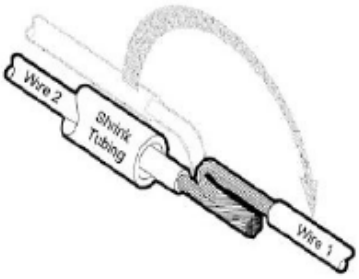
3 = Splice tape

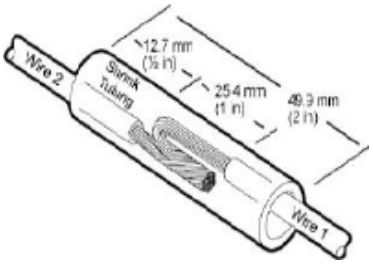
4 = Harness tape

Broken wire strands in harness









1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. lnstall heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

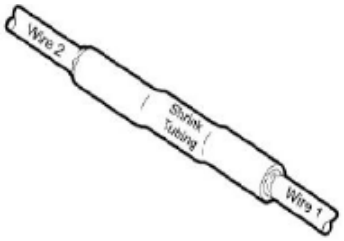
NOTE: -

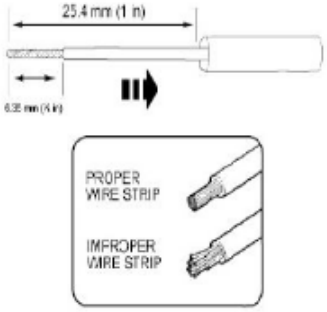
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

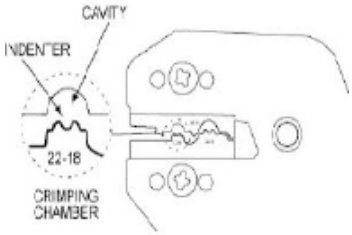
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

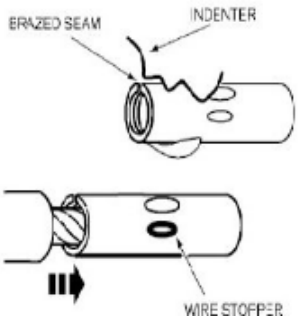
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.









7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

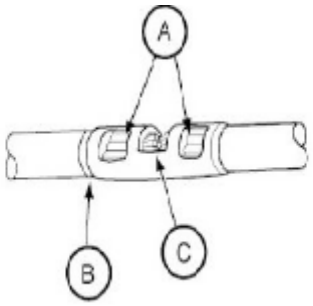
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

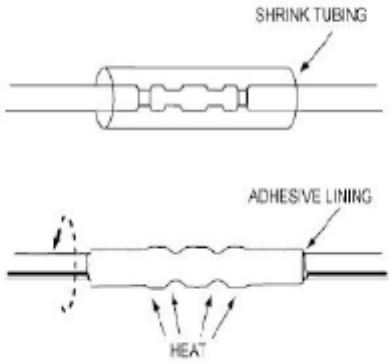
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4" strip, cut 9 strands	* 1/4" strip, cut 2 strands	1/4" strip, no fold	1/4" strip, no fold	1/4" strip, no fold	5/8" strip, fold 2x dia.	1" strip, fold 3x dia.
	16-14	* 1/4" strip, cut 7 strands	1/4" strip, no fold	1/4" strip, no fold	1/4" strip, no fold	5/8" strip fold 2x dia.	1" strip, fold 3x dia.	1 1/4" strip, fold 4x dia.	Not Recommended
	12-10	1/4" strip, no fold	1/4" strip, no fold	5/8" strip, fold 2x dia.	1" strip, fold 3x dia.	1 1/4" strip, fold 4x dia.	Not Recommended	Not Recommended	Not Recommended

* Pigtail only

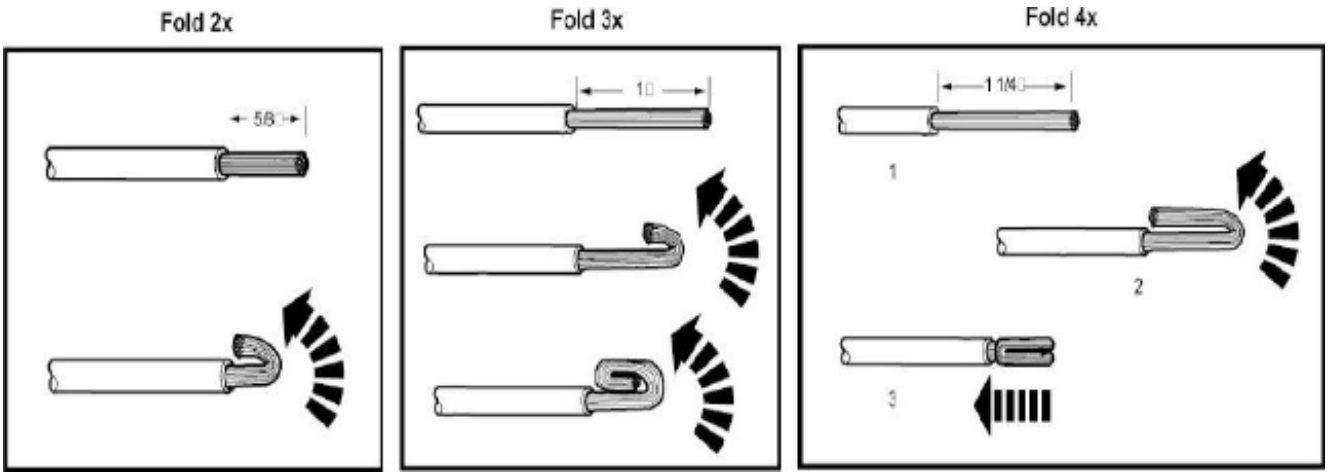
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



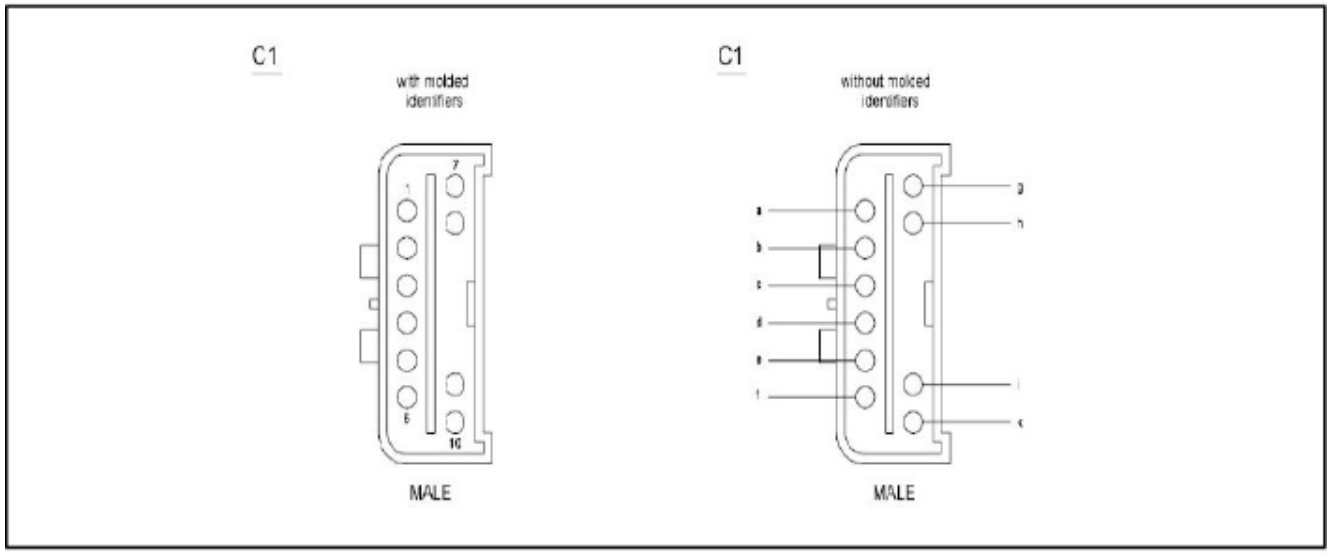
The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



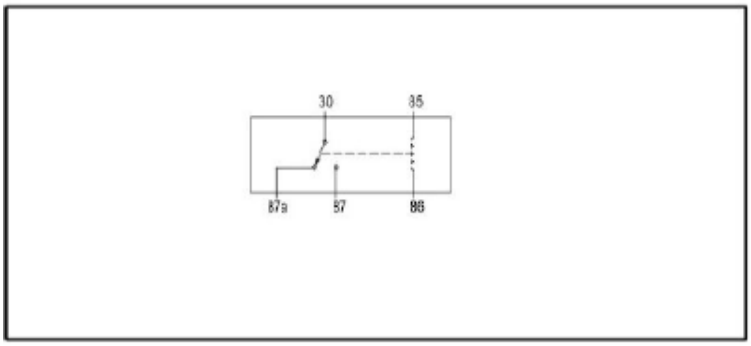
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

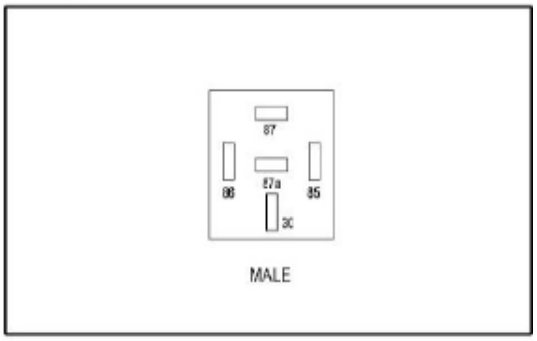
Fuel Pump Relay: Testing and Inspection Mini ISO Relay

Relay □ Mini ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	45 □ 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

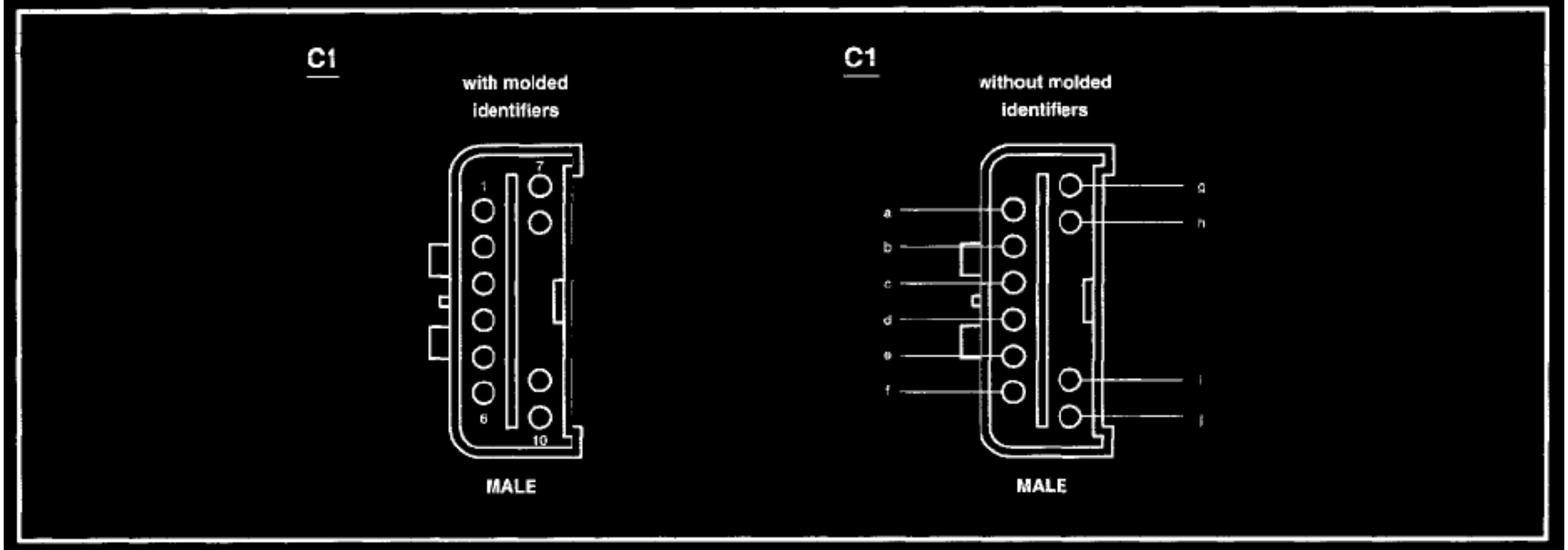
Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step–by–step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals

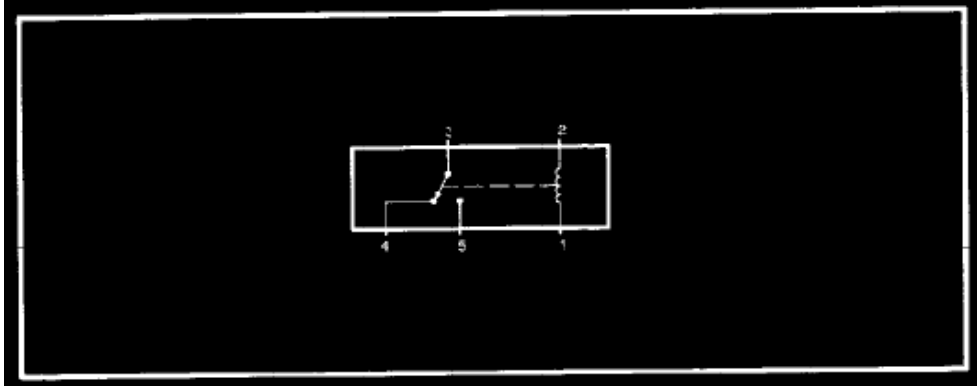


The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

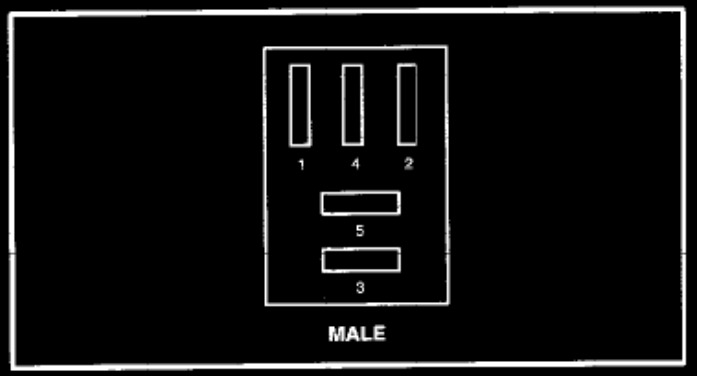
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Relay – Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63–102Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil – Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

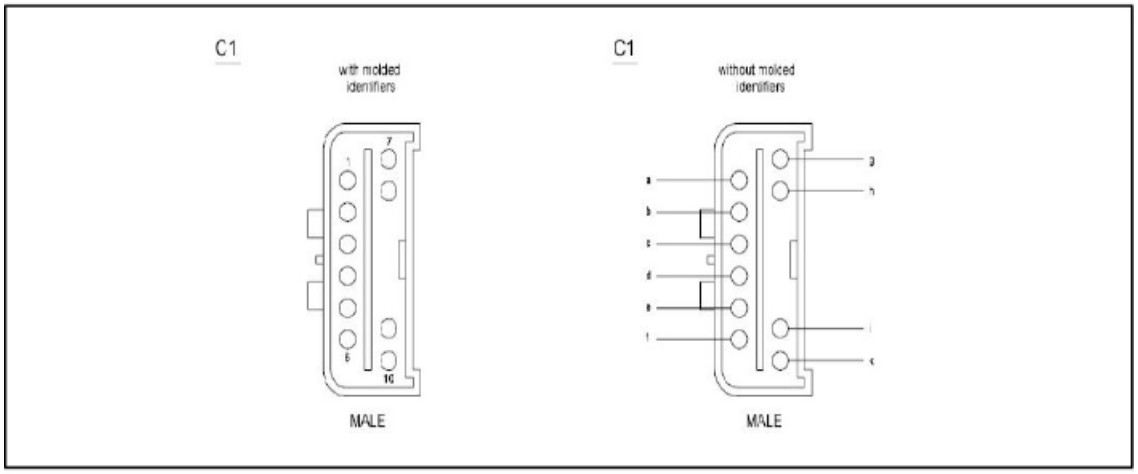
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



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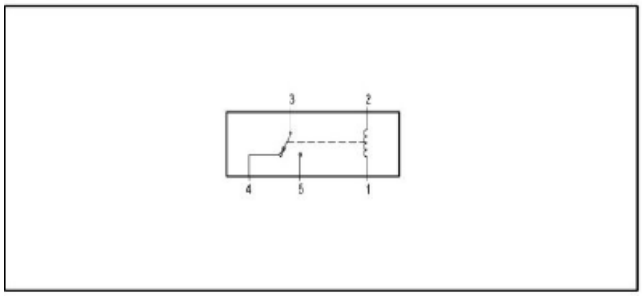
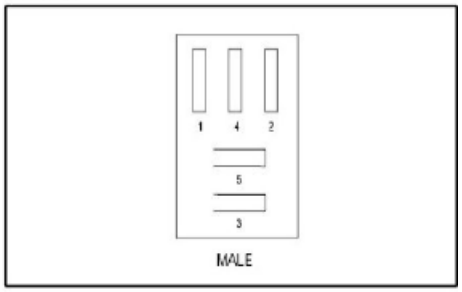
Relay - Micro ISO

Schematic



Terminals



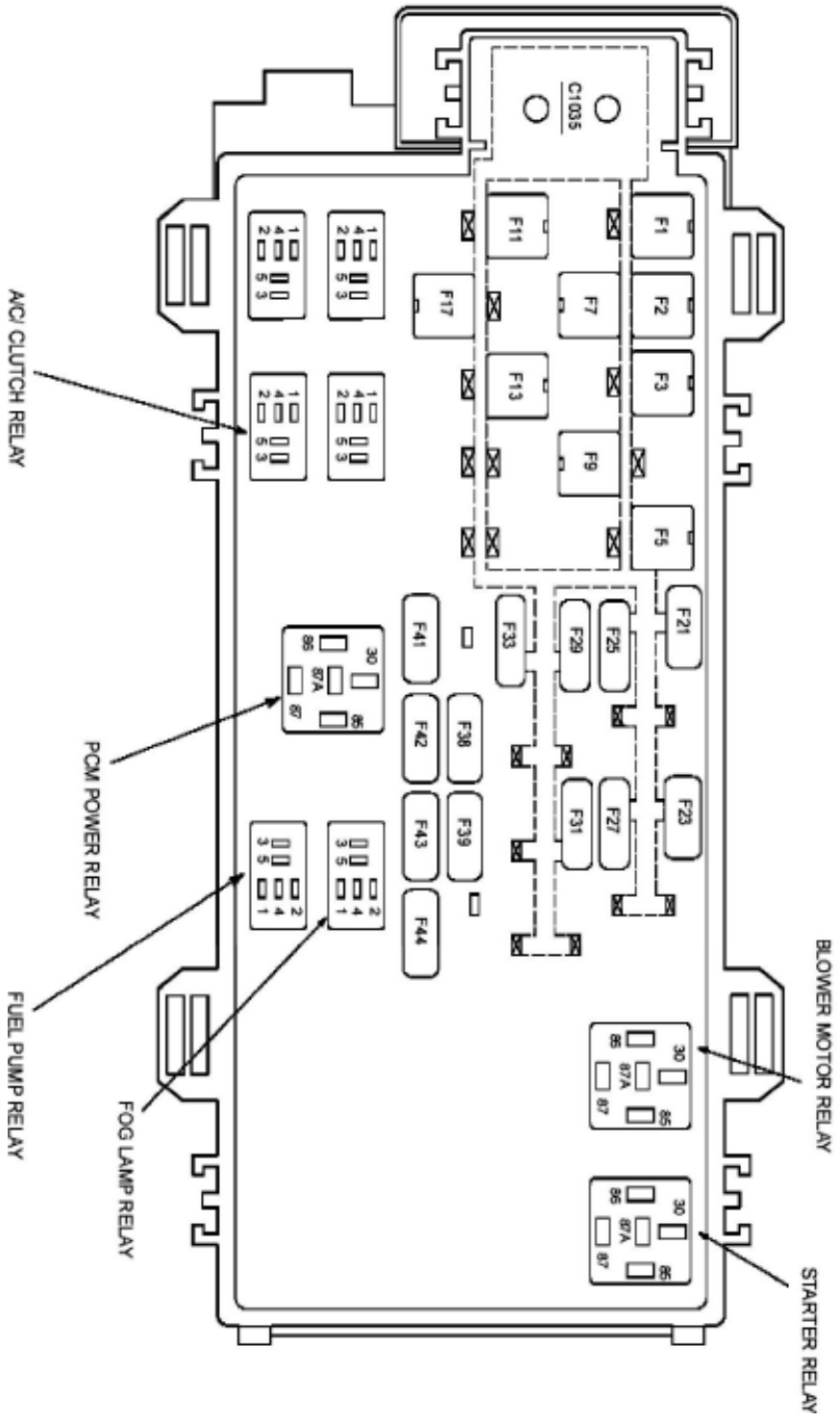
Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63-102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil - Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L

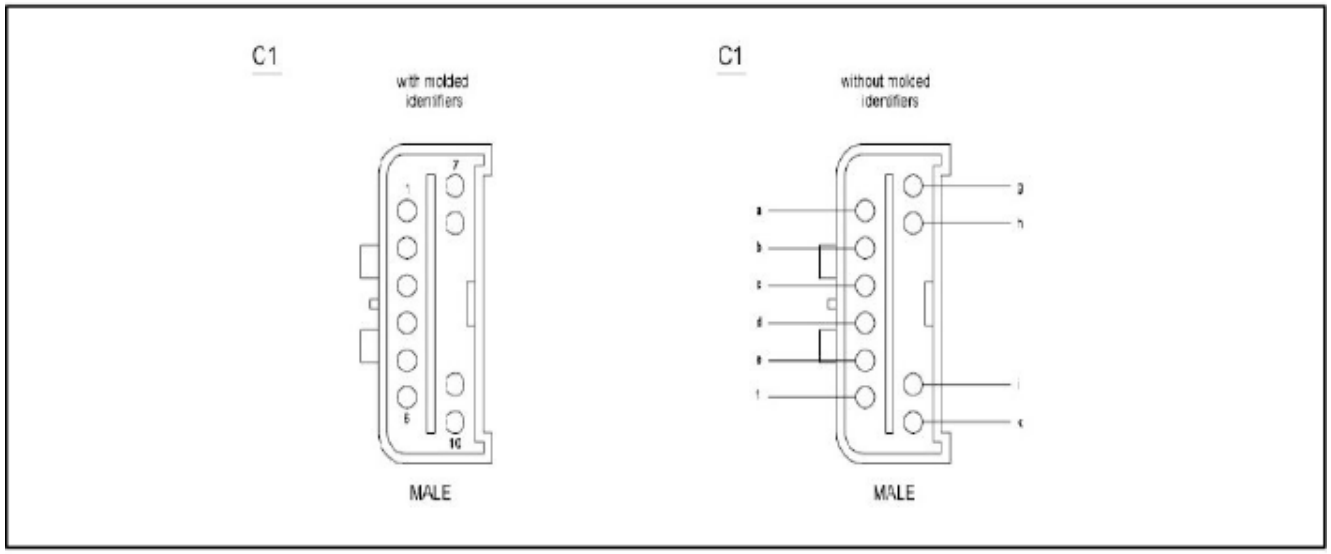


Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



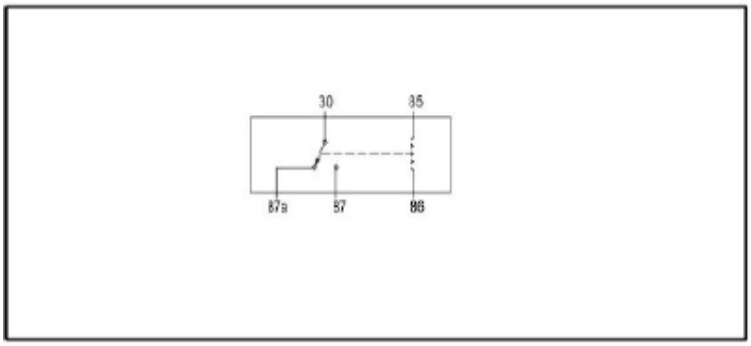
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

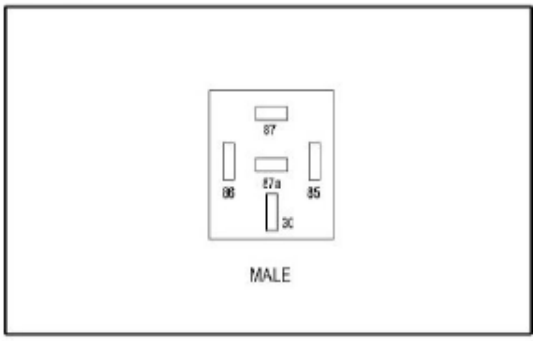
Main Relay (Computer/Fuel System): Testing and Inspection

Relay □ Mini ISO

Schematic



Terminals

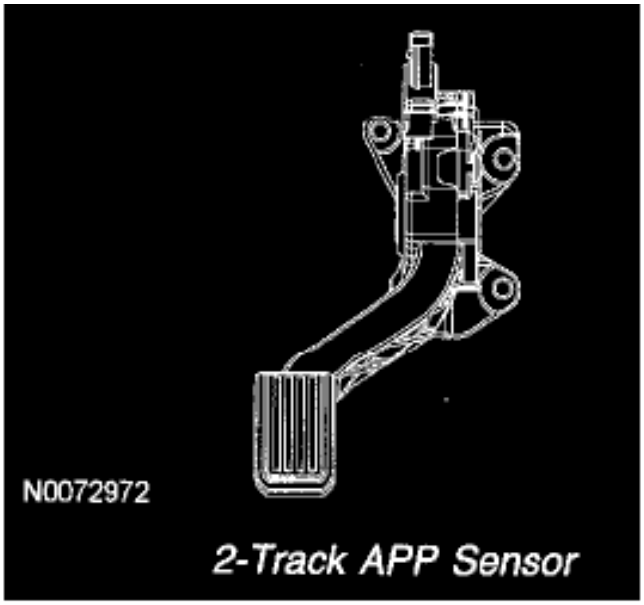


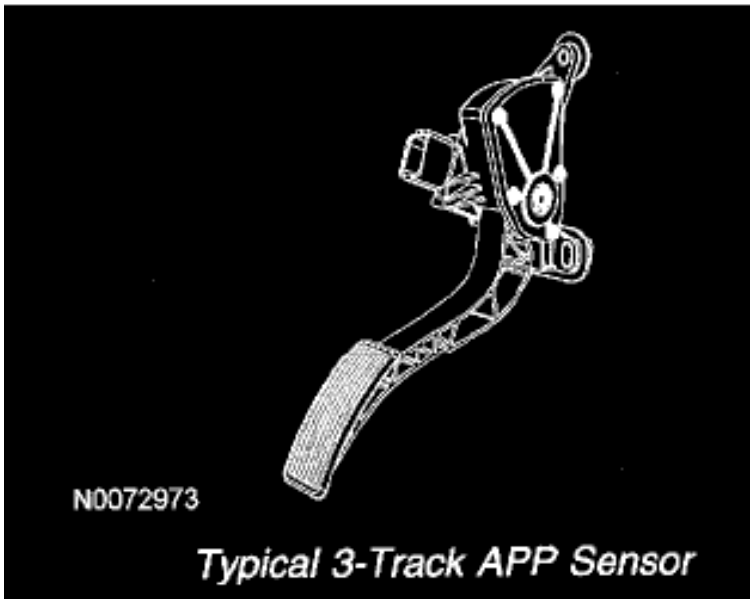
Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	45 □ 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.





Accelerator Pedal Position Sensor: Description and Operation

ACCELERATOR PEDAL POSITION (APP) SENSOR

The APP sensor is an input to the powertrain control module (PCM) and is used to determine the amount of torque requested by the operator. Depending on the application either a 2-track or 3-track APP sensor is used.

2-Track APP Sensor

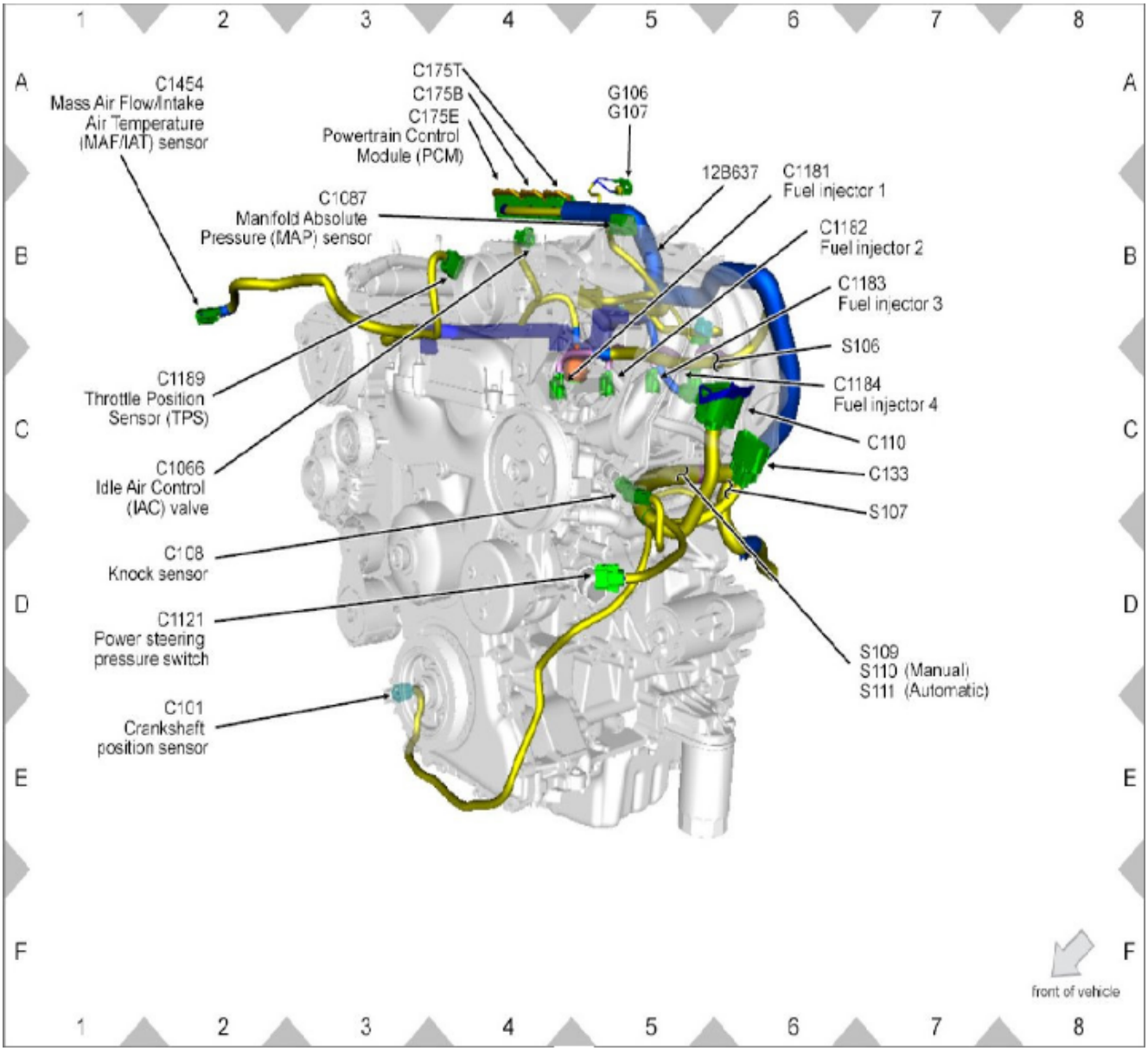
2-Track APP Sensor

There are 2 pedal position signals in the sensor. Both signals, APP1 and APP2, have a positive slope (increasing angle, increasing voltage), but are offset and increase at different rates. The 2 pedal position signals make sure the PCM receives a correct input even if 1 signal has a concern. The PCM determines if a signal is incorrect by calculating where it should be, inferred from the other signals. If a concern is present with one of the circuits the other input is used. There are 2 reference voltage circuits, 2 signal return circuits, and 2 signal circuits (a total of 6 circuits and pins) between the PCM and the APP sensor assembly. The reference voltage circuits and the signal return circuits are shared with the reference voltage circuit and signal return circuit used by the electronic throttle body (ETB) throttle position sensor. The pedal position signal is converted to pedal travel degrees (rotary angle) by the PCM. The software then converts these degrees to counts, which is the input to the torque based strategy.

3-Track APP Sensor

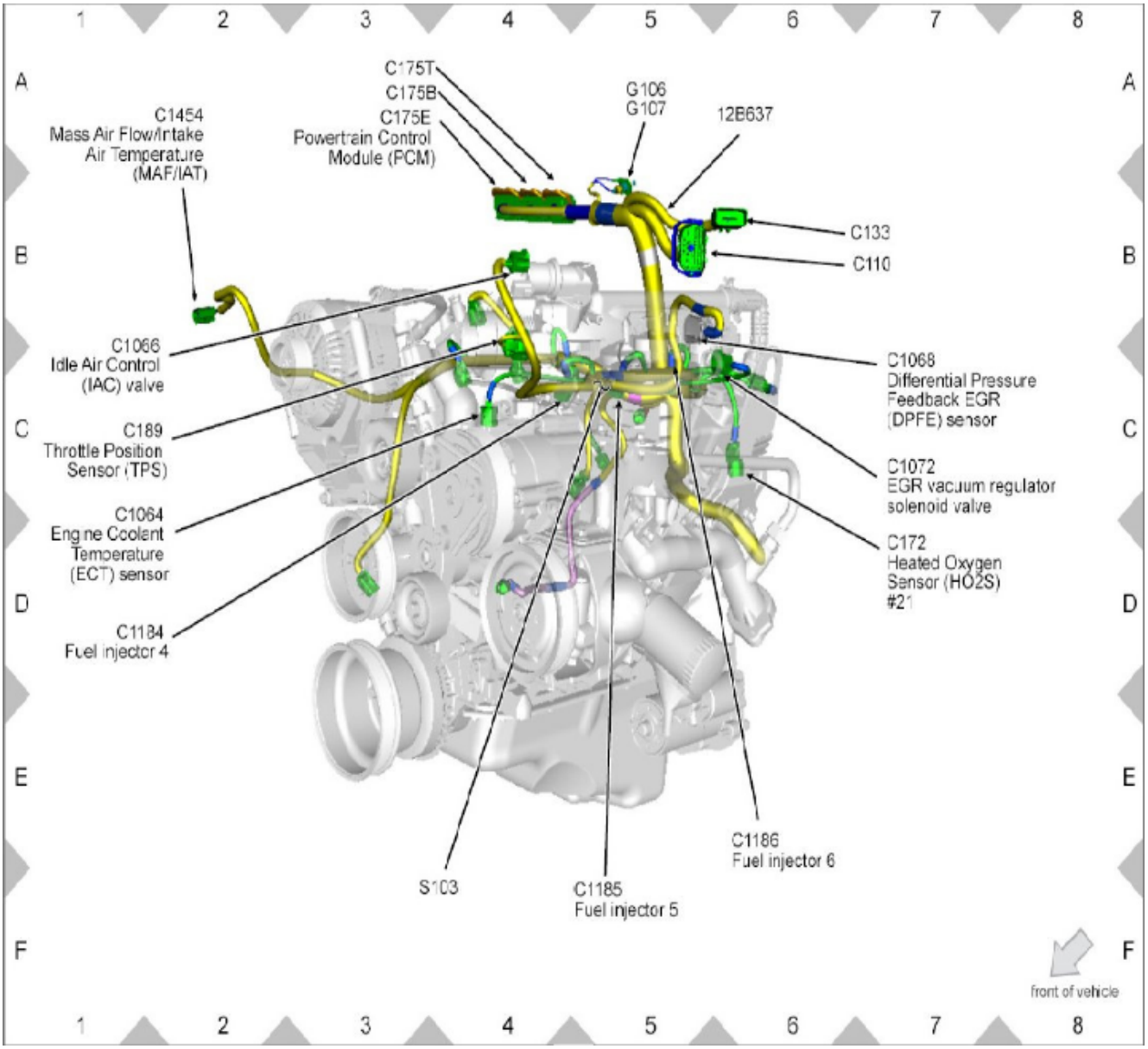
Typical 3-Track APP Sensor

There are 3 pedal position signals in the sensor. Signal 1, APP1, has a negative slope (increasing angle, decreasing voltage) and signals 2 and 3, APP2 and APP3, both have a positive slope (increasing angle, increasing voltage). During normal operation APP1 is used as the indication of pedal position by the strategy. The 3 pedal position signals make sure the PCM receives a correct input even if 1 signal has a concern. The PCM determines if a signal is incorrect by calculating where it should be, inferred from the other signals. If a concern is present with one of the circuits the other inputs are used. The pedal position signal is converted to pedal travel degrees (rotary angle) by the PCM. The software then converts these degrees to counts, which is the input to the torque based strategy. There are 2 reference voltage circuits, 2 signal return circuits, and 3 signal circuits (a total of 7 circuits and pins) between the PCM and the APP sensor assembly. The reference voltage circuits and the signal return circuits are shared with the reference voltage circuit and signal return circuit used by the electronic throttle body (ETB) throttle position sensor.

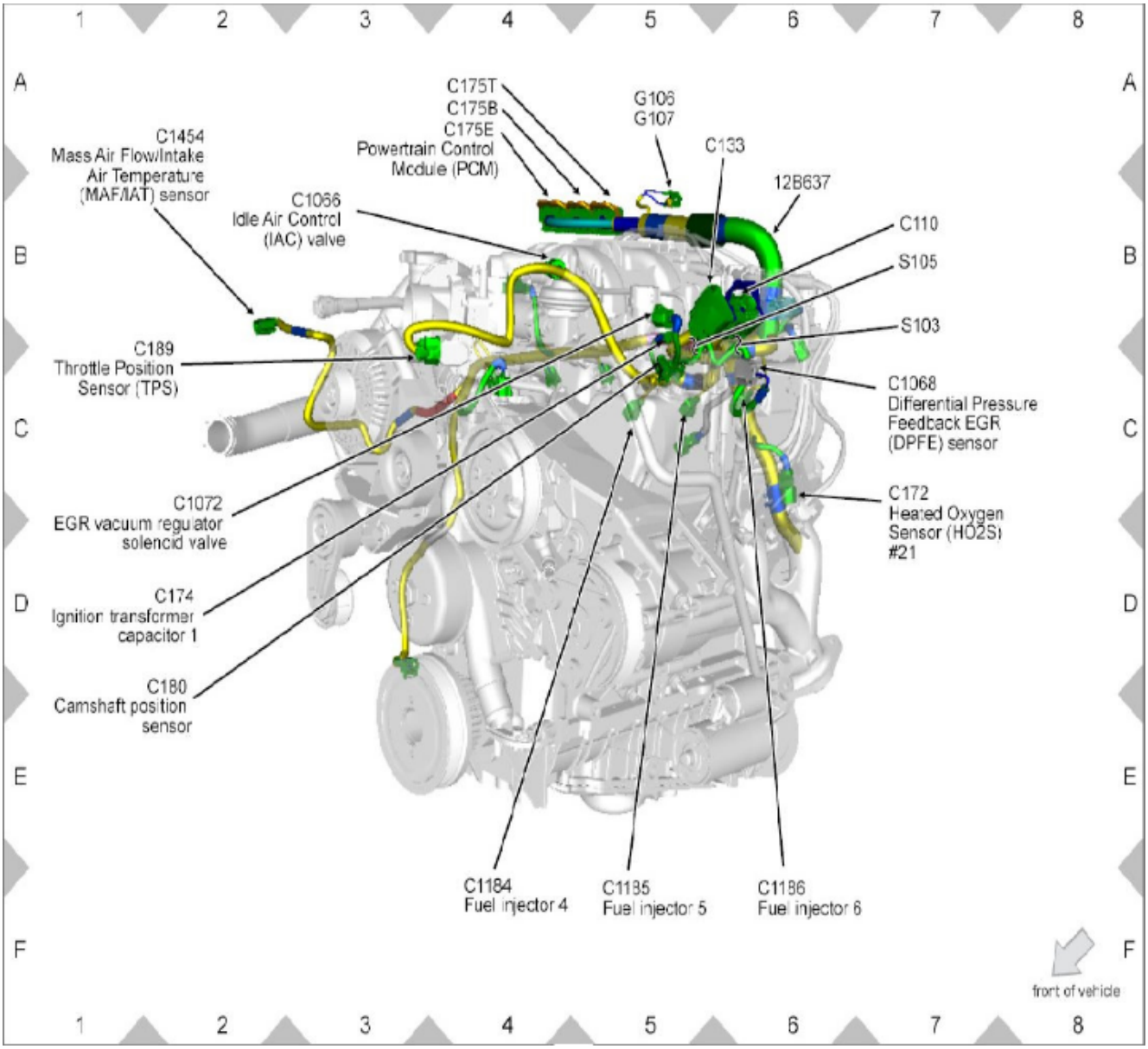


Air Flow Meter/Sensor: Locations

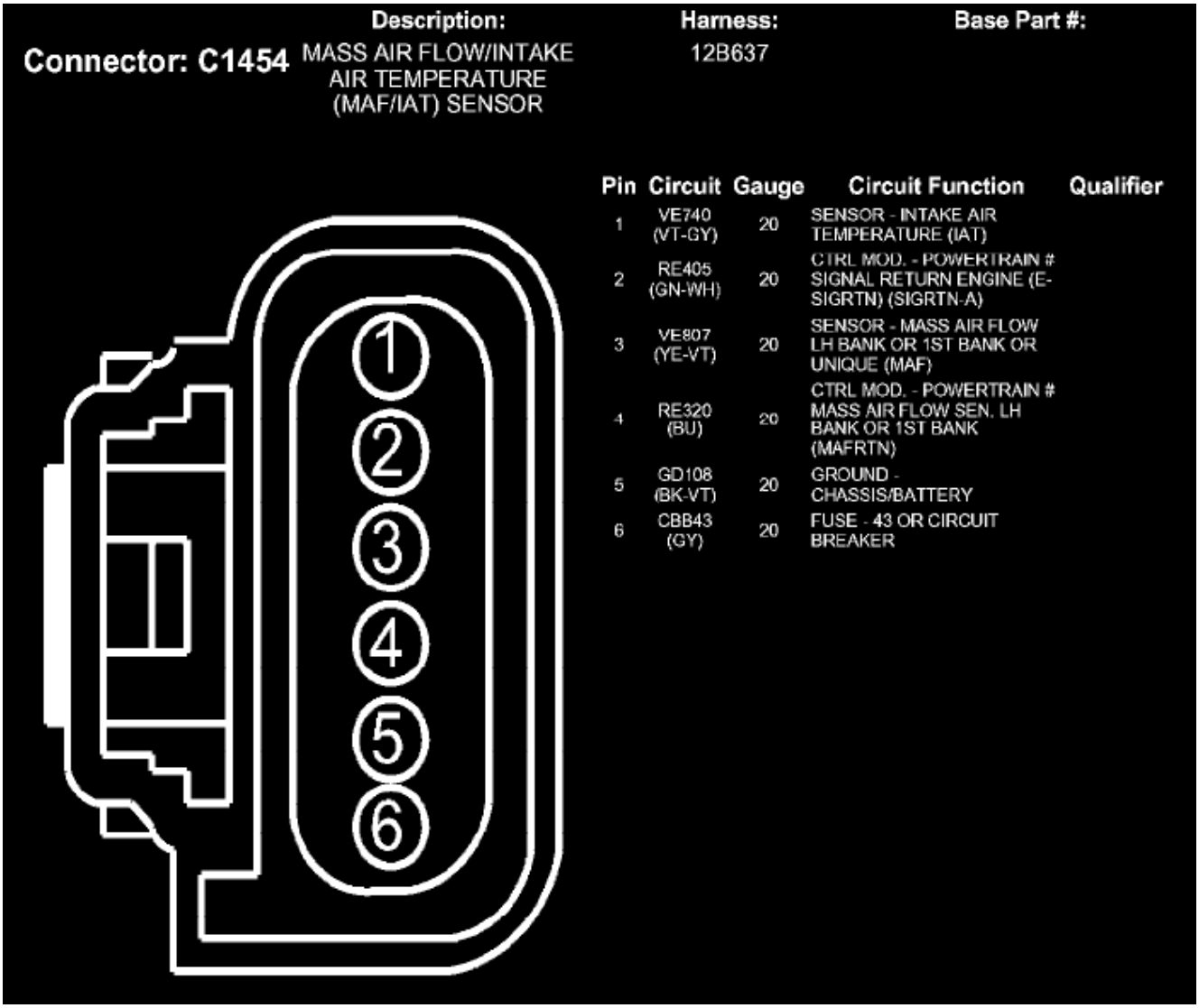
View 151-3


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
12B637
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT)
C133
C110
C1066
Idle Air Control (IAC) valve
C189
Throttle Position Sensor (TPS)
C1064
Engine Coolant Temperature (ECT) sensor
C1184
Fuel injector 4
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
S103
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-5


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
C133
12B637
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor
C1066
Idle Air Control (IAC) valve
C110
S105
S103
C189
Throttle Position Sensor (TPS)
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
C174
Ignition transformer capacitor 1
C180
Camshaft position sensor
C1184
Fuel injector 4
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-7



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE740 (VT-GY)	20	SENSOR - INTAKE AIR TEMPERATURE (IAT)	
2	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	
3	VE807 (YE-VT)	20	SENSOR - MASS AIR FLOW LH BANK OR 1ST BANK OR UNIQUE (MAF)	
4	RE320 (BU)	20	CTRL MOD. - POWERTRAIN # MASS AIR FLOW SEN. LH BANK OR 1ST BANK (MAFRTN)	
5	GD108 (BK-VT)	20	GROUND - CHASSIS/BATTERY	
6	CBB43 (GY)	20	FUSE - 43 OR CIRCUIT BREAKER	

C1454

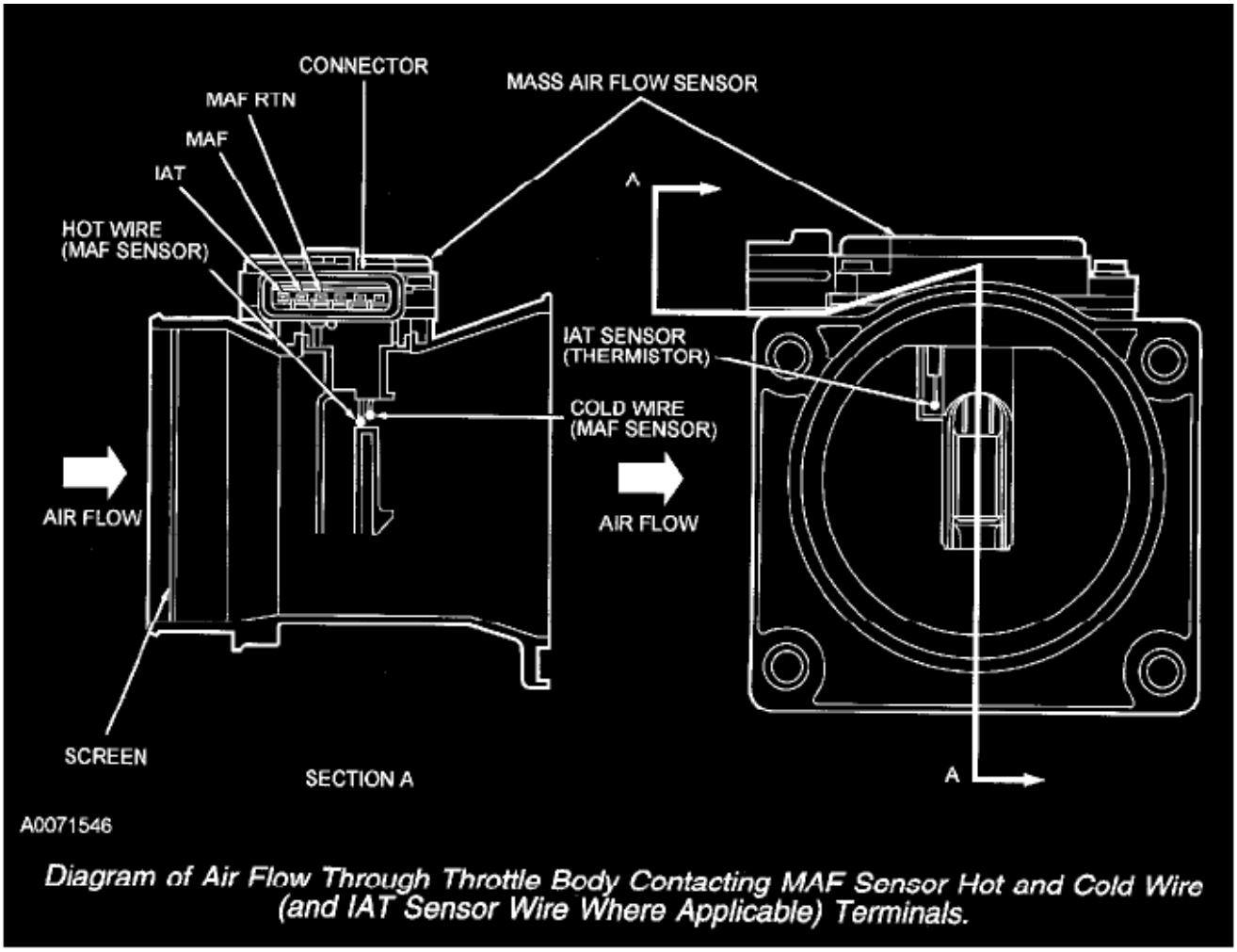
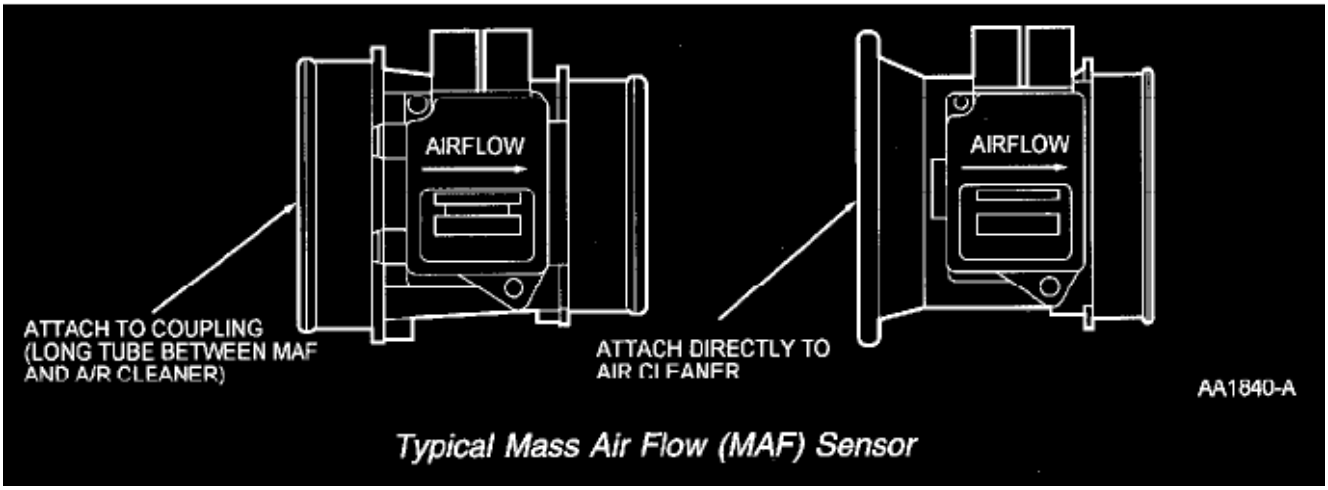


Diagram of Air Flow Through Throttle Body Contacting MAF Sensor Hot and Cold Wire (and IAT Sensor Wire Where Applicable) Terminals.



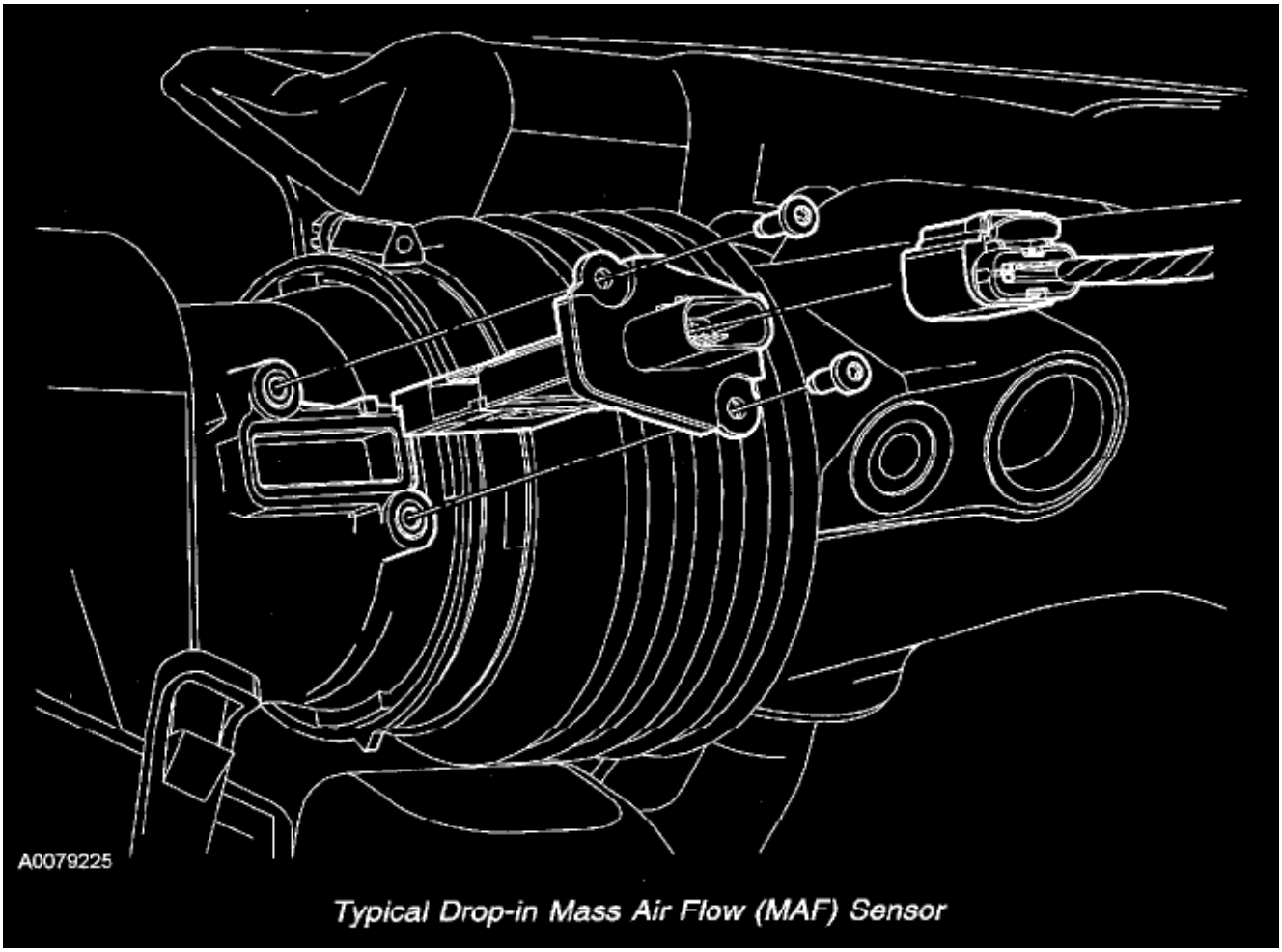
Typical Mass Air Flow (MAF) Sensor

Air Flow Meter/Sensor: Description and Operation

MASS AIR FLOW (MAF) SENSOR

Diagram Of Air Flow Through Throttle Body Contacting MAF Sensor Hot And Cold Wire (and IAT Sensor Wire Where Applicable) Terminals

Typical Mass Air Flow (MAF) Sensor

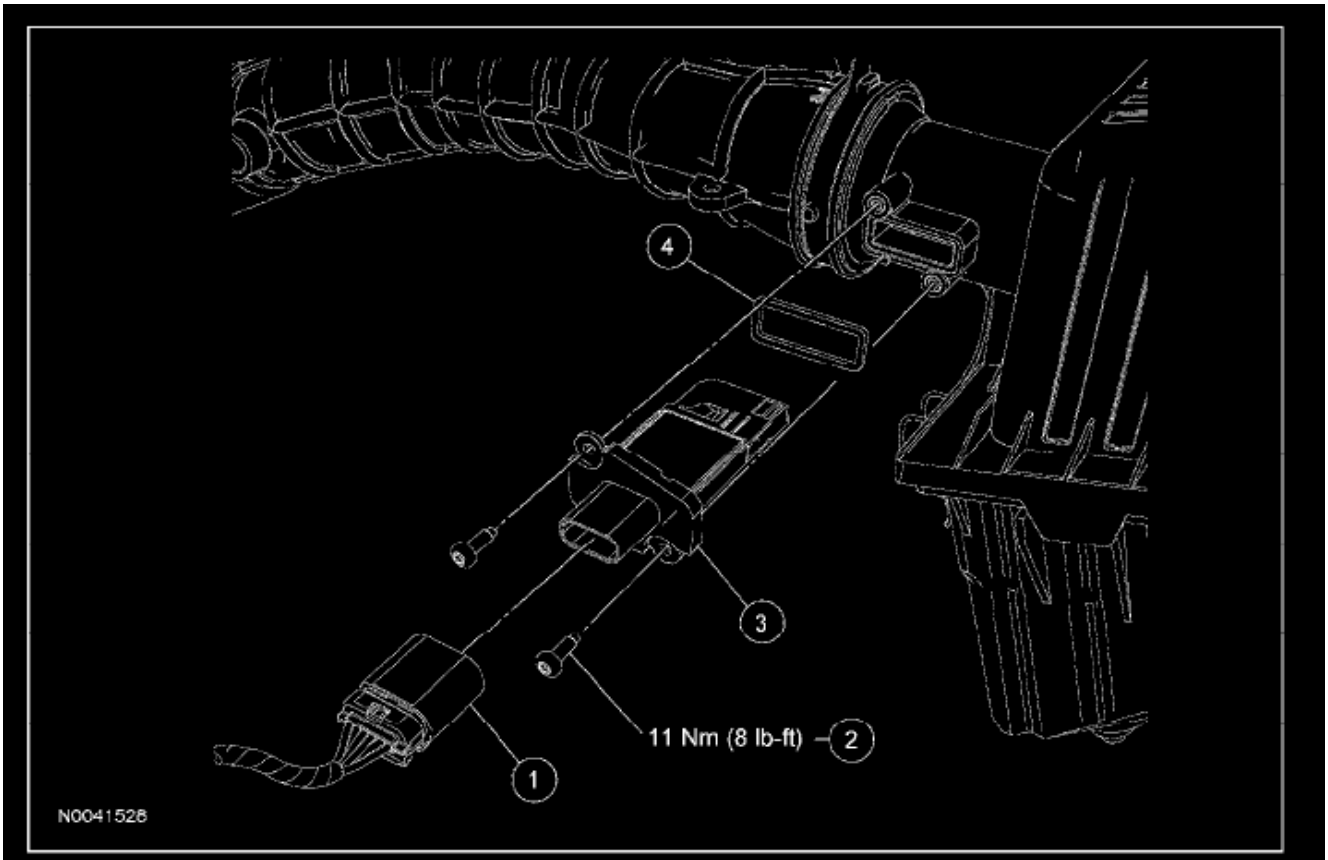


Typical Drop-in Mass Air Flow (MAF) Sensor

Typical Drop-in Mass Air Flow (MAF) Sensor

The MAF sensor uses a hot wire sensing element to measure the amount of air entering the engine. Air passing over the hot wire causes it to cool. This hot wire is maintained at 200°C (392°F) above the ambient temperature as measured by a constant cold wire. The current required to maintain the temperature of the hot wire is proportional to the mass air flow. The MAF sensor then outputs an analog voltage signal to the PCM proportional to the intake air mass. The PCM calculates the required fuel injector pulse width in order to provide the desired air/fuel ratio. This input is also used in determining transmission electronic pressure control (EPC), shift and torque converter clutch scheduling.

The MAF sensor is located between the air cleaner and the throttle body or inside the air cleaner assembly. Most MAF sensors have integrated bypass technology with an integrated intake air temperature (IAT) sensor. The hot wire electronic sensing element must be replaced as an assembly. Replacing only the element may change the air flow calibration.



Item	Part Number	Description
1	14A464	Mass air flow (MAF) sensor electrical connector (part of 12B637)
2	W709287	MAF sensor bolt (2 required)
3	12B605	MAF sensor
4	—	MAF sensor gasket

Air Flow Meter/Sensor: Service and Repair

MASS AIR FLOW (MAF) SENSOR

Removal and Installation

1. Disconnect the mass air flow (MAF) sensor electrical connector. 2. Remove the 2 bolts, the MAF sensor and discard the gasket.

- To install, tighten to 11 Nm (8 lb-ft).

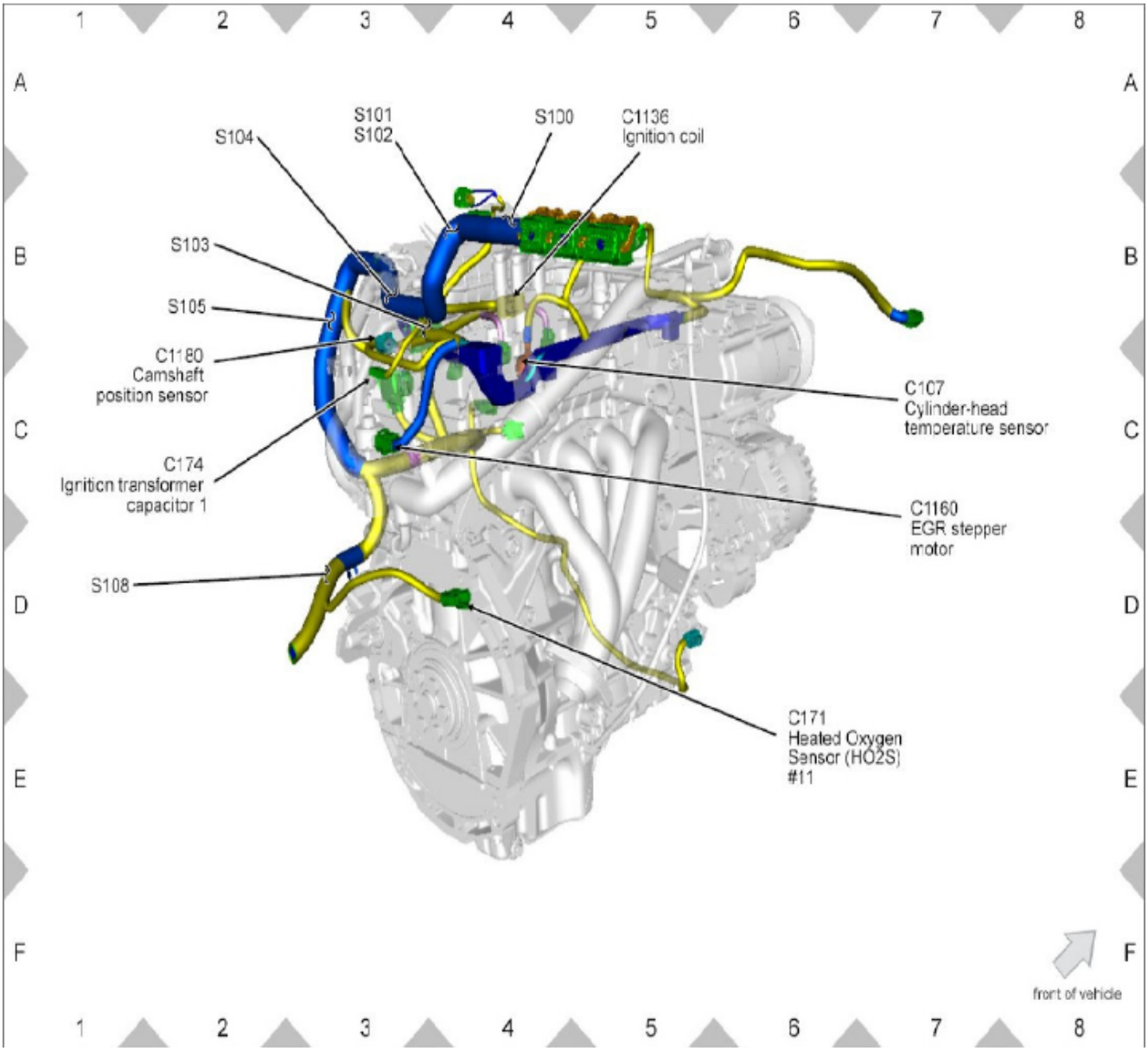
3. CAUTION: Do not tamper with the mass air flow (MAF) sensing elements located in the airflow bypass. Tampering may result in

failure.

NOTE: The MAF sensor module and body are calibrated and installed as a unit.

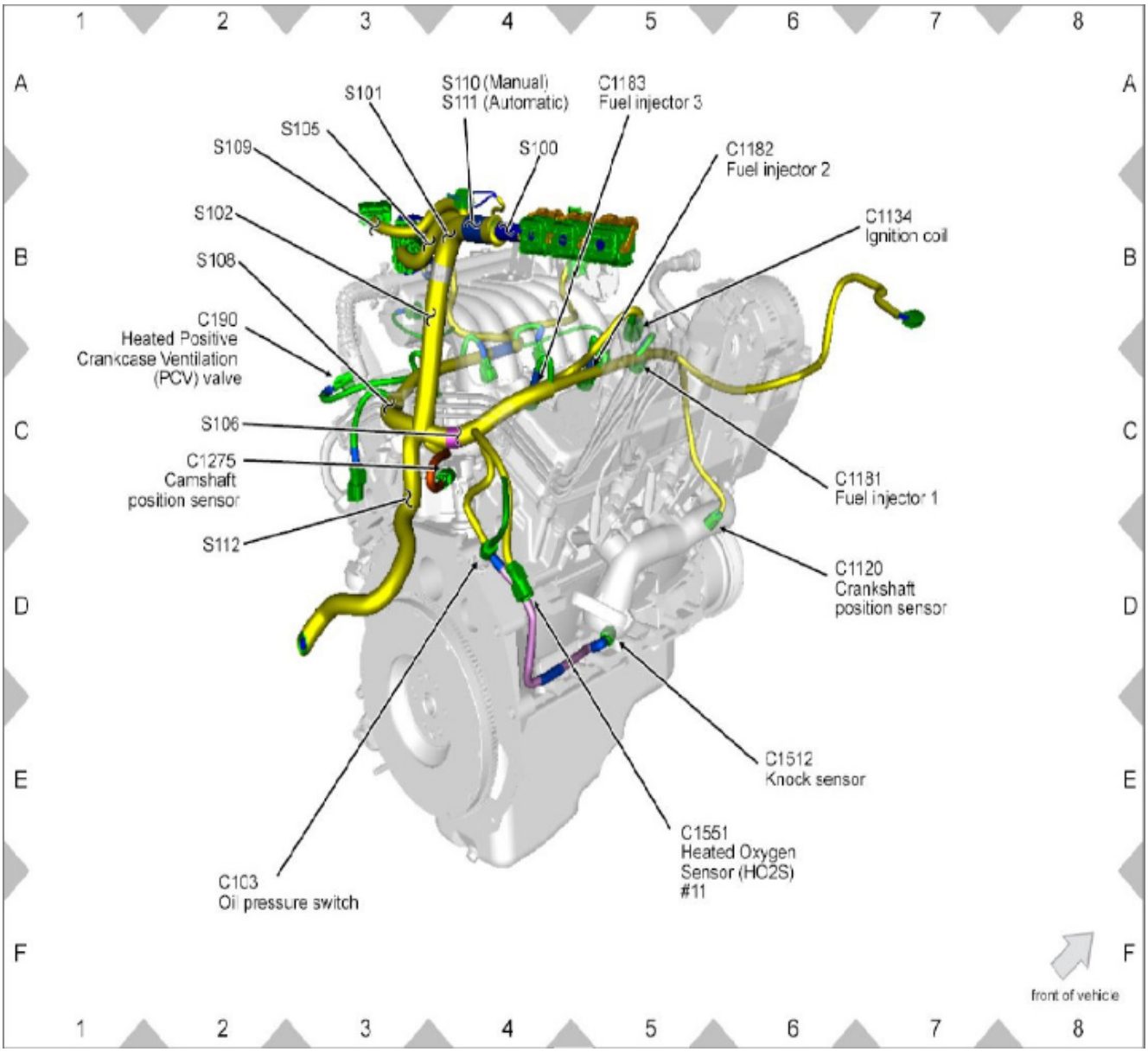
To install, reverse the removal procedure. -

Install a new gasket.

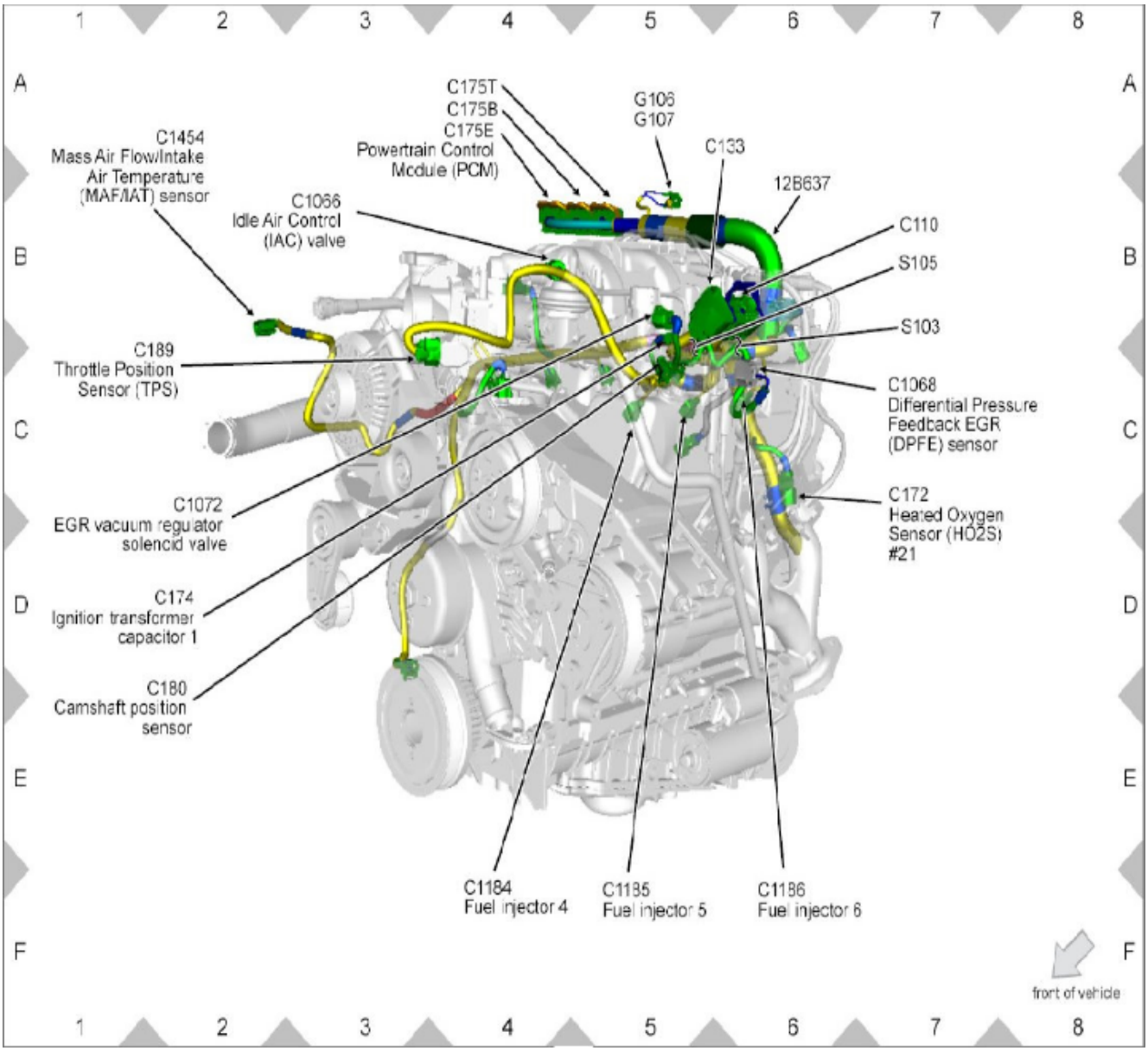


Camshaft Position Sensor: Locations

View 151-4


S101
S110 (Manual)
S111 (Automatic)
C1183
Fuel injector 3
S105
S109
S100
C1182
Fuel injector 2
S102
C1134
Ignition coil
S108
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
C1275
Camshaft
position sensor
C1181
Fuel injector 1
S112
C1120
Crankshaft
position sensor
C1512
Knock sensor
C1551
Heated Oxygen
Sensor (HO2S)
#11
C103
Oil pressure switch
front of vehicle

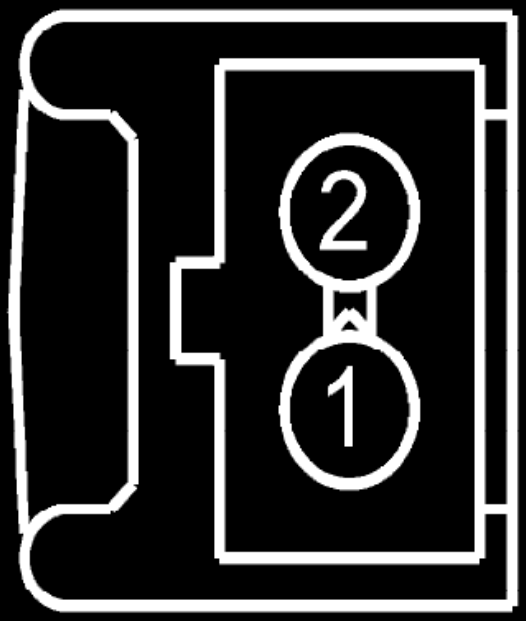
View 151-6


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
C133
12B637
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor
C1066
Idle Air Control (IAC) valve
C110
S105
S103
C189
Throttle Position Sensor (TPS)
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
C174
Ignition transformer capacitor 1
C180
Camshaft position sensor
C1184
Fuel injector 4
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-7

Connector: C180

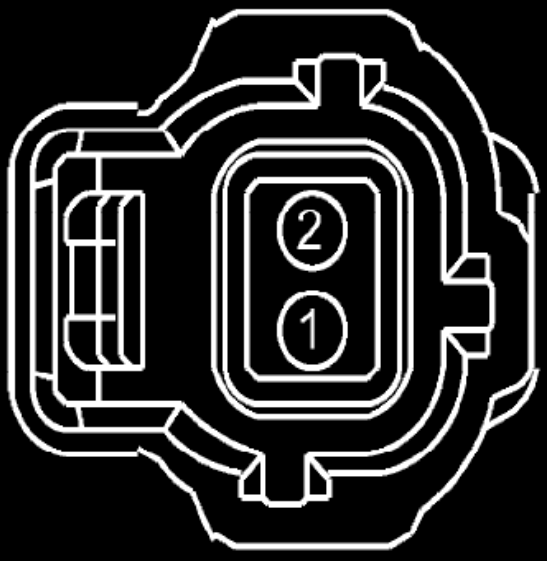
Description:	Harness:	Base Part #:
CAMSHAFT POSITION SENSOR	12B637	6B288



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE706 (BN-BU)	18	SENSOR - CAMSHAFT POSITION BANK 1 IN+EX/IN (CMP1) [CID-H] (CID1)	4.0L
2	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	4.0L

Connector: C1180

Description:	Harness:	Base Part #:
CAMSHAFT POSITION SENSOR	12B637	6B288



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	2.3L
2	VE706 (BN-BU)	18	SENSOR - CAMSHAFT POSITION BANK 1 IN+EX/ IN (CMP1) [CID-H] (CID1)	2.3L

Camshaft Position Sensor: Diagrams

C180

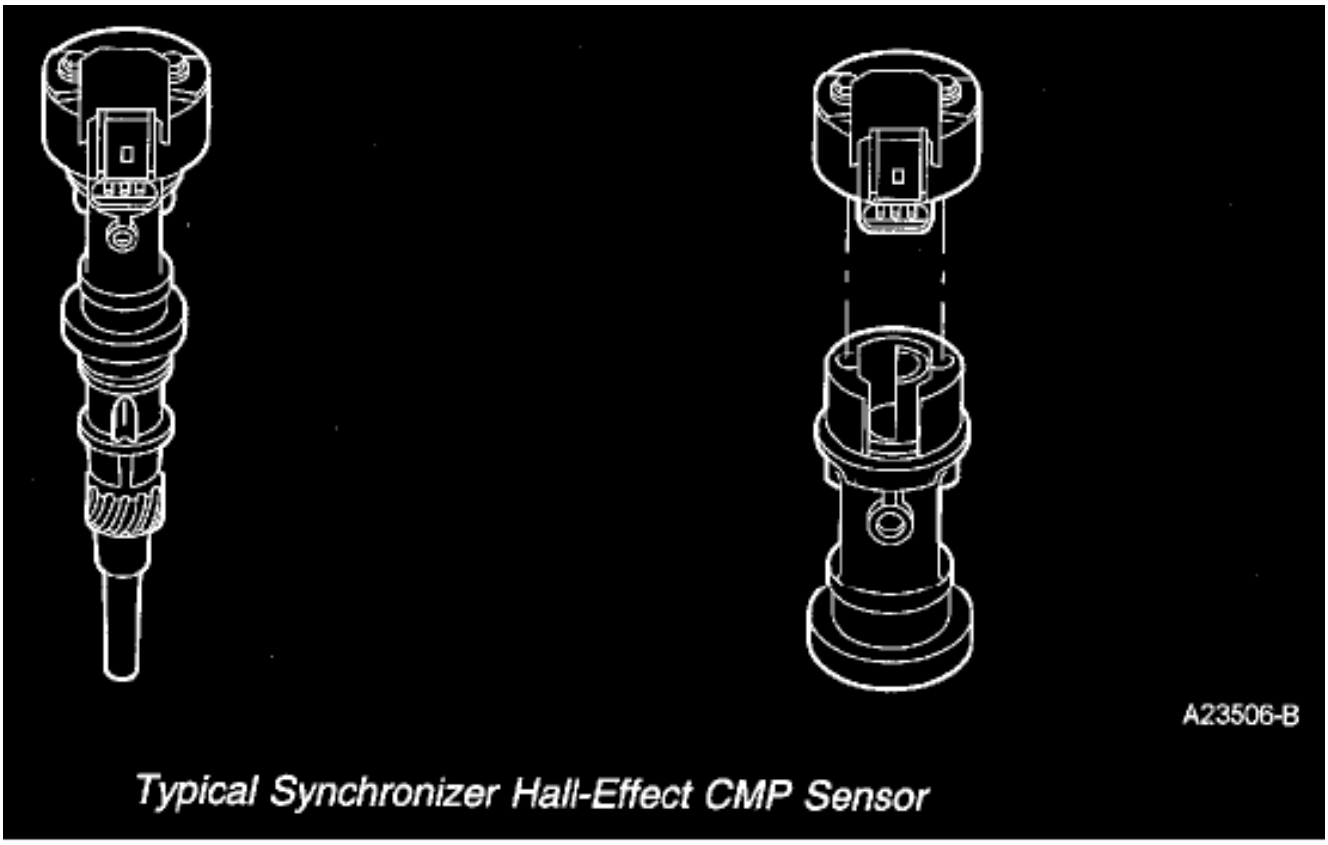
C1180

Connector: C1275

Description:	Harness:	Base Part #:
CAMSHAFT POSITION SENSOR	12B637	6B288

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	3.0L
2	VE706 (BN-BU)	18	SENSOR - CAMSHAFT POSITION BANK 1 IN+EX/ IN (CMP1) [CID-H] (CID1)	3.0L

C1275



Typical Synchronizer Hall-Effect CMP Sensor

Typical Variable Reluctance CMP Sensor

Camshaft Position Sensor: Description and Operation

CAMSHAFT POSITION (CMP) SENSOR

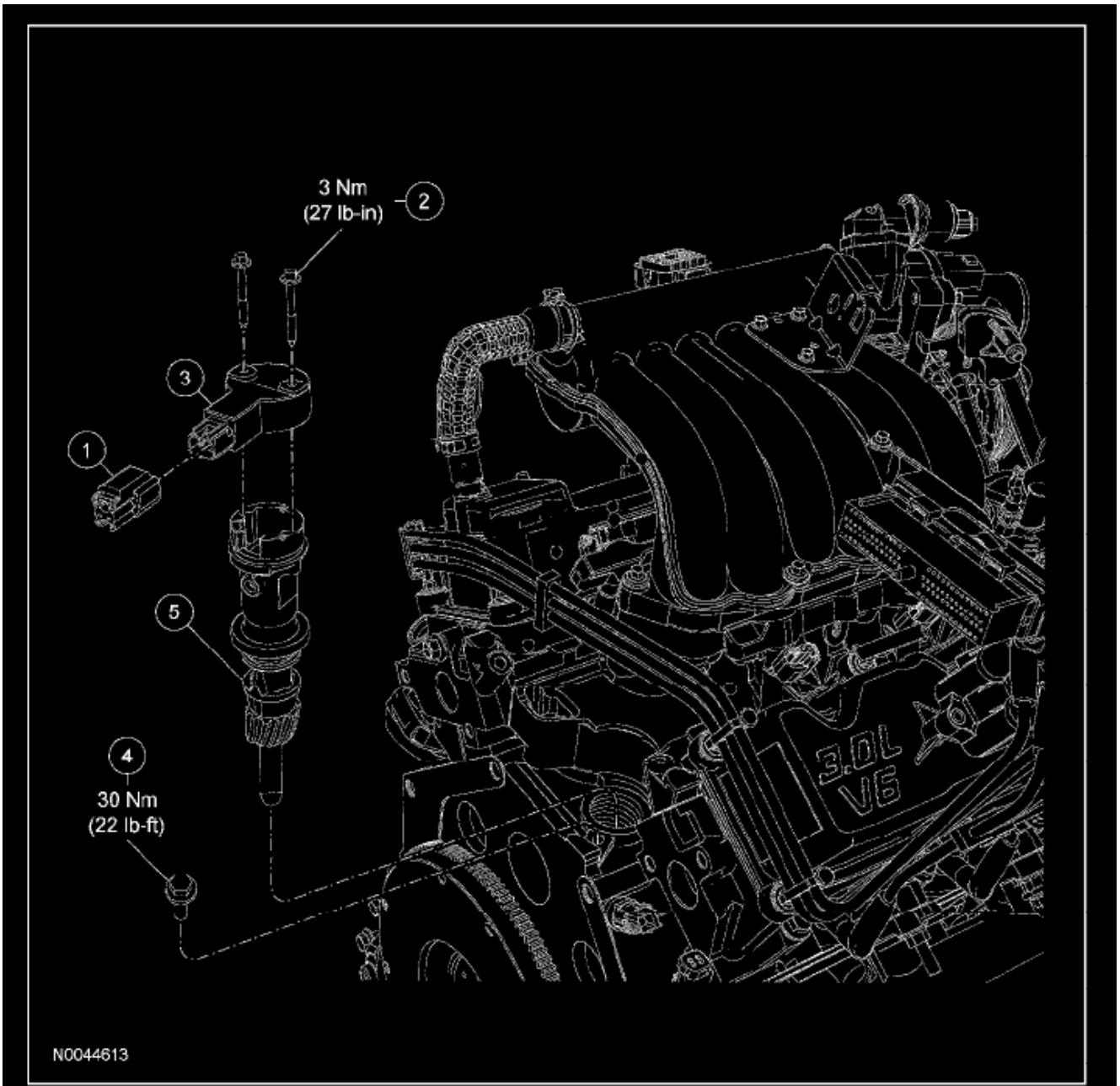
Typical Synchronizer Hall-Effect CMP Sensor

Typical Variable Reluctance CMP Sensor

The CMP sensor detects the position of the camshaft. The CMP sensor identifies when piston number 1 is on its compression stroke. A signal is then sent to the PCM and used for synchronizing the sequential firing of the fuel injectors. Coil on plug (COP) ignition applications use the CMP signal to select the correct ignition coil to fire.

Vehicles with 2 CMP sensors are equipped with variable camshaft timing (VCT). They use the second sensor to identify the position of the camshaft on bank 2 as an input to the PCM.

There are 2 types of CMP sensors: the 3-pin connector Hall-effect type sensor and the 2-pin connector variable reluctance type sensor.



Item	Part Number	Description
1	—	Camshaft position (CMP) sensor electrical connector (part of 12B637)
2	W701219	CMP sensor bolt (2 required)

(Continued)

Item	Part Number	Description
3	6B288	CMP sensor
4	—	Camshaft synchronizer bolt
5	12A362	Camshaft synchronizer

Camshaft Position Sensor: Service and Repair

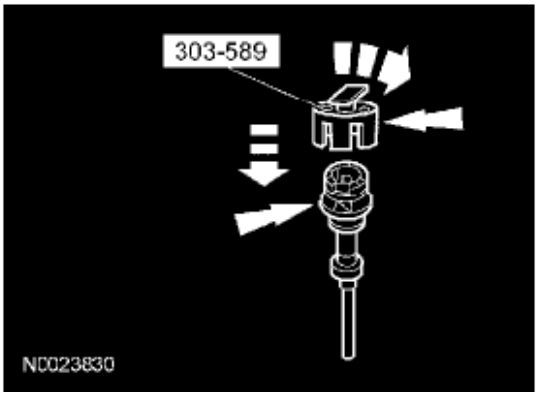
CAMSHAFT SYNCHRONIZER

Exploded View

Special Tool(s)

Special Tool(s)

ST2362-A	Synchronizer Alignment Gauge 303-589



Special Tool(s)

Removal

1. Disconnect the camshaft position (CMP) sensor electrical connector.

2. NOTE: Prior to the removal of the CMP sensor, note the position of the CMP sensor electrical connector. The installation procedure requires that

the electrical connector be located in the same position.

Remove the 2 bolts and the CMP sensor.

3. Remove the camshaft synchronizer bolt. 4. Remove the camshaft synchronizer. Inspect the O-ring seal and install a new O-ring seal if damaged.

Installation

1. CAUTION:

- After installation, do not loosen the synchronizer bolt and rotate the synchronizer assembly. The synchronizer assembly is not adjustable. Do not loosen the synchronizer bolt after the alignment tool has been removed in order to align the camshaft position (CMP) sensor electrical connector for any reason. If the electrical connector is not in the correct position, the synchronizer assembly must be removed. The alignment tool and the assembly must be reinstalled if the engine has not been rotated from top dead center (TDC) of the compression stroke on the No. 1 cylinder. Failure to follow this procedure will result in the fuel system being out of time with the engine, possibly causing engine damage.

- Do not turn the crankshaft or camshaft during the removal and installation procedure or the fuel system timing will be out of time with the engine, possibly causing engine damage.

- A special tool must be used during the installation of the new synchronizer assembly. Failure to follow this procedure will result in the fuel system being out of time with the engine, possibly causing engine damage.

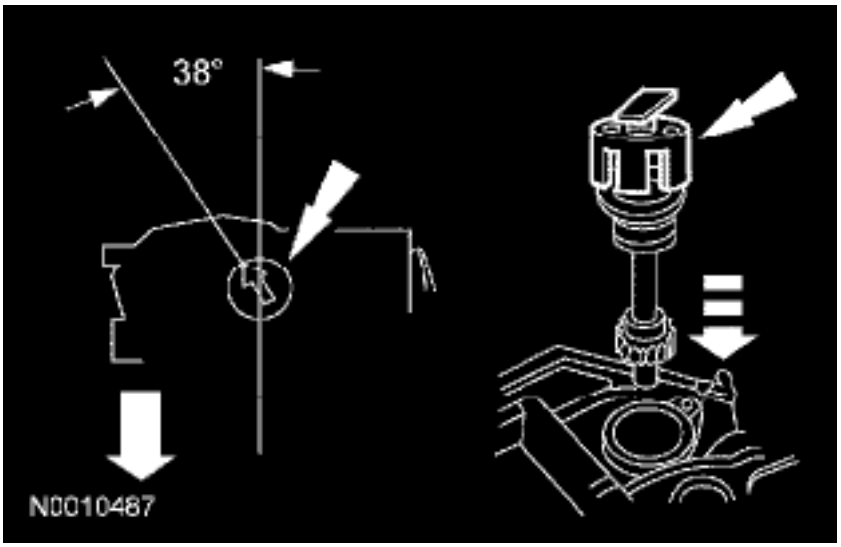
Install the special tool on the camshaft synchronizer by rotating the tool until it engages the notch in the camshaft synchronizer housing and the armature.

2. CAUTION: It is very important to coat the gear on the camshaft synchronizer with engine oil prior to installation. Failure to do so may

result in gear failure.

NOTE: During installation, the arrow on the special tool will rotate clockwise until the oil pump intermediate shaft and the camshaft gear engages.

Install the camshaft synchronizer housing assembly so the arrow on the special tool is 38 degrees from the centerline of the engine.



3. Install the camshaft synchronizer housing bolt.

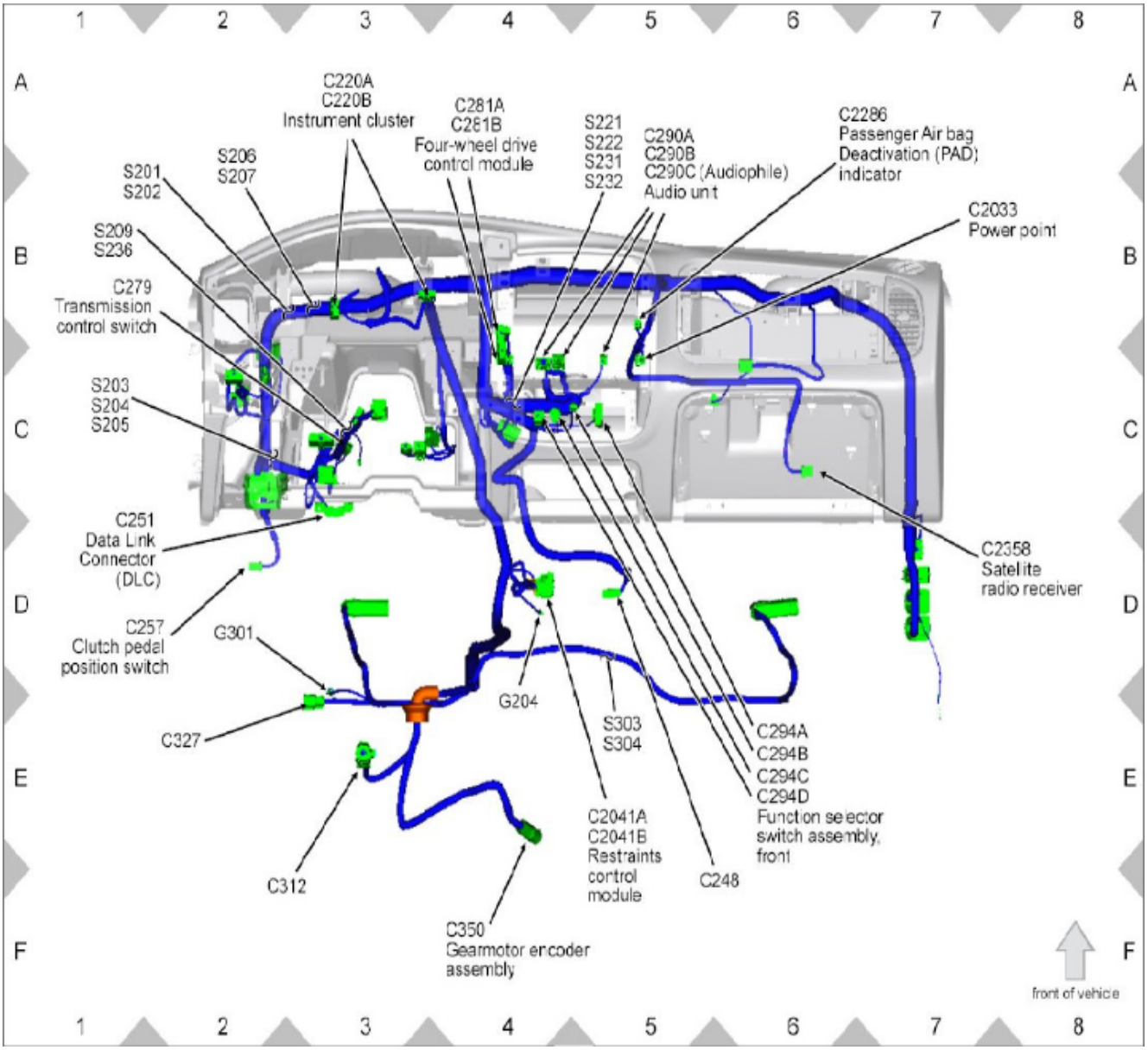
- Tighten to 30 Nm (22 lb-ft).

4. Position the CMP sensor and install the 2 bolts.

- Tighten to 3 Nm (27 lb-in).

5. Connect the CMP sensor electrical connector.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Powertrain Management > Sensors and Switches - Powertrain Management > Sensors and Switches - Computers and Control Systems > Clutch Switch, ECM > Component Information > Locations



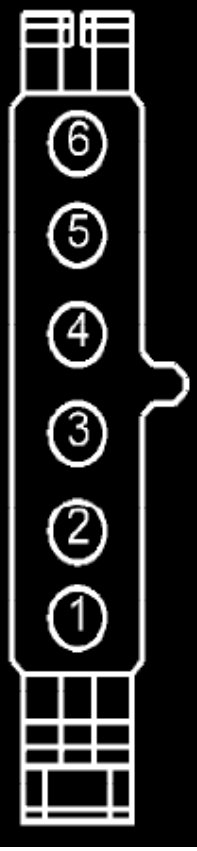
View 151-12

Connector: C257

Description: CLUTCH PEDAL POSITION SWITCH

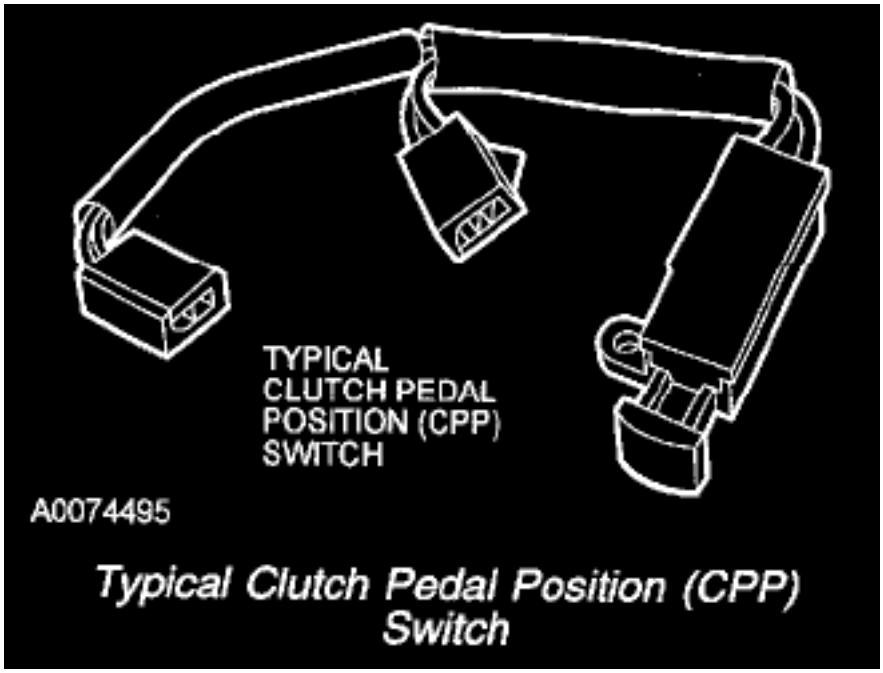
Harness: 14401

Base Part #: 11A152



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE904 (GN-VT)	22	SWITCH - CLUTCH PEDAL POSITION # TOP OF TRAVEL (CPP-TT)	
2	GD174 (BK-WH)	22	GROUND - TUNNEL	
3	CCB15 (BN-GN)	22	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL CLOSED	
4	CCB15 (BN-GN)	22	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL CLOSED	
5	GD174 (BK-WH)	22	GROUND - TUNNEL	
6	CDC36 (GN-BN)	22	SWITCH - START INTERLOCK CLUTCH PEDAL	

C257



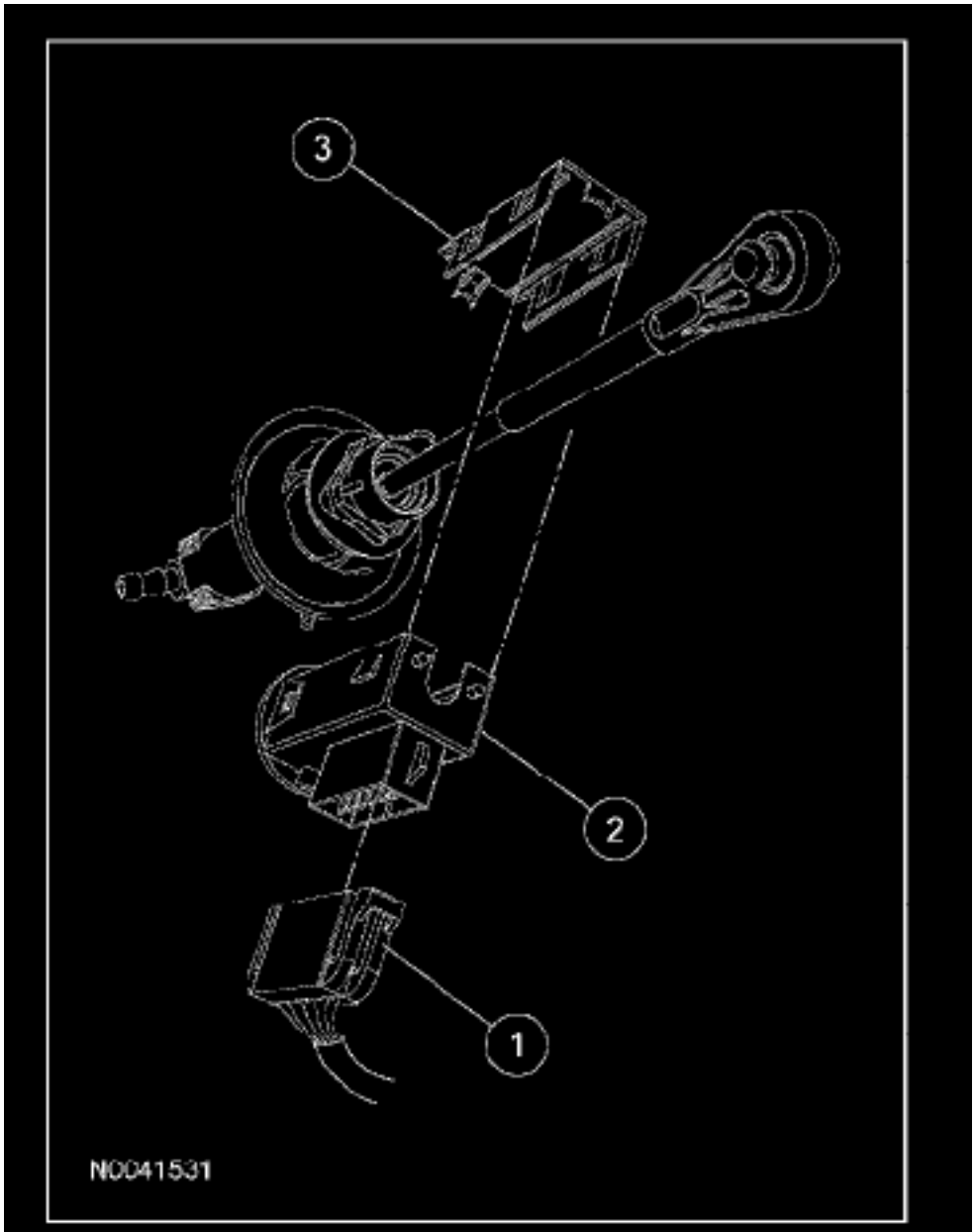
Typical Clutch Pedal Position (CPP) Switch

Clutch Switch: Description and Operation

CLUTCH PEDAL POSITION (CPP) SWITCH

Typical Clutch Pedal Position (CPP) Switch

The CPP switch is an input to the PCM indicating the clutch pedal position. The PCM provides a low current voltage on the CPP circuit. When the CPP switch is closed, this voltage is pulled low through the SIG RTN circuit. The CPP input to the PCM is used to detect a reduction in engine load. The PCM uses the load information for mass air flow and fuel calculations.



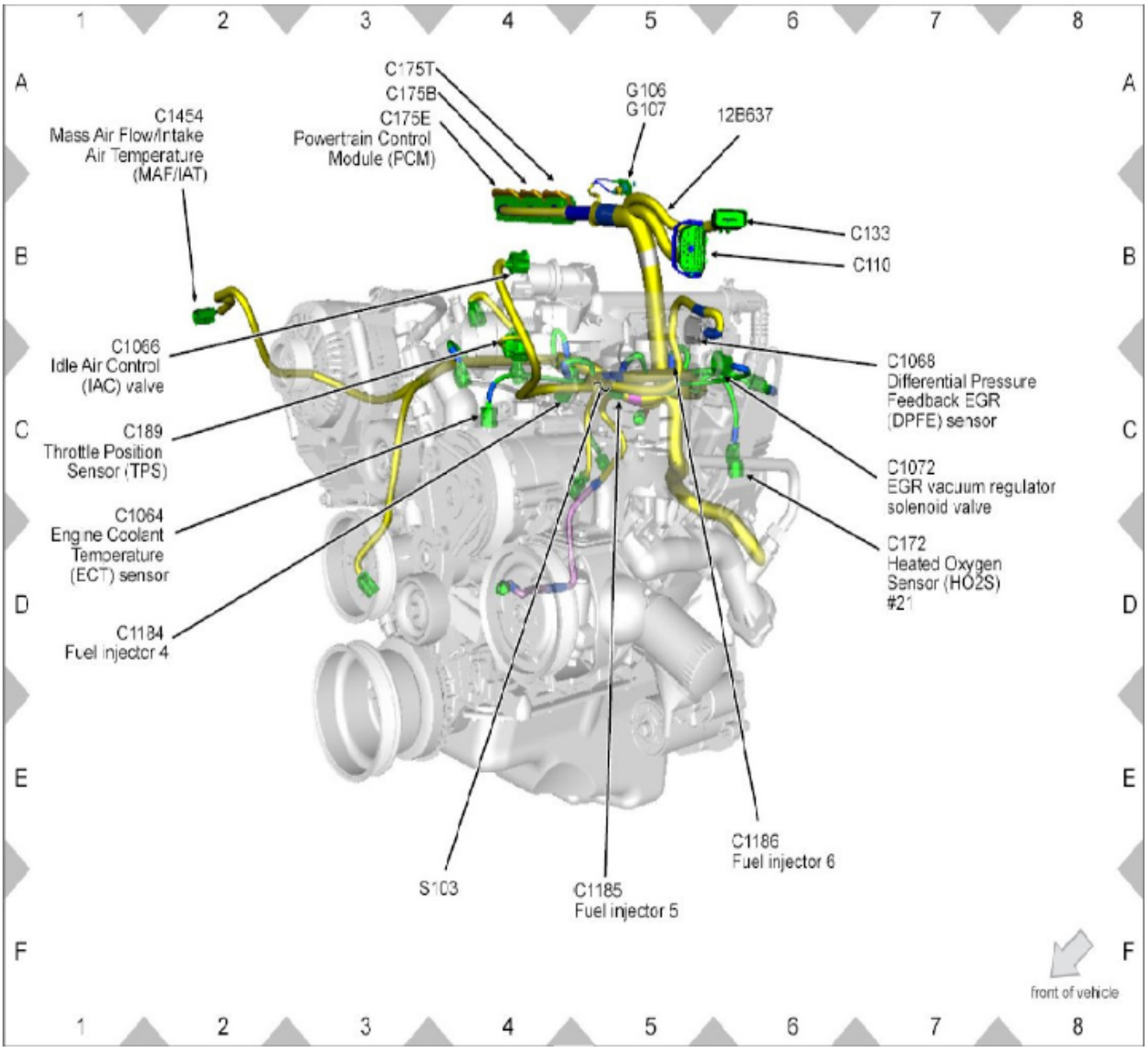
Item	Part Number	Description
1	—	Clutch pedal position (CPP) switch electrical connector
2	7C534	CPP switch
3	—	CPP switch cover (part of 7C534)

Clutch Switch: Service and Repair

CLUTCH PEDAL POSITION (CPP) SWITCH

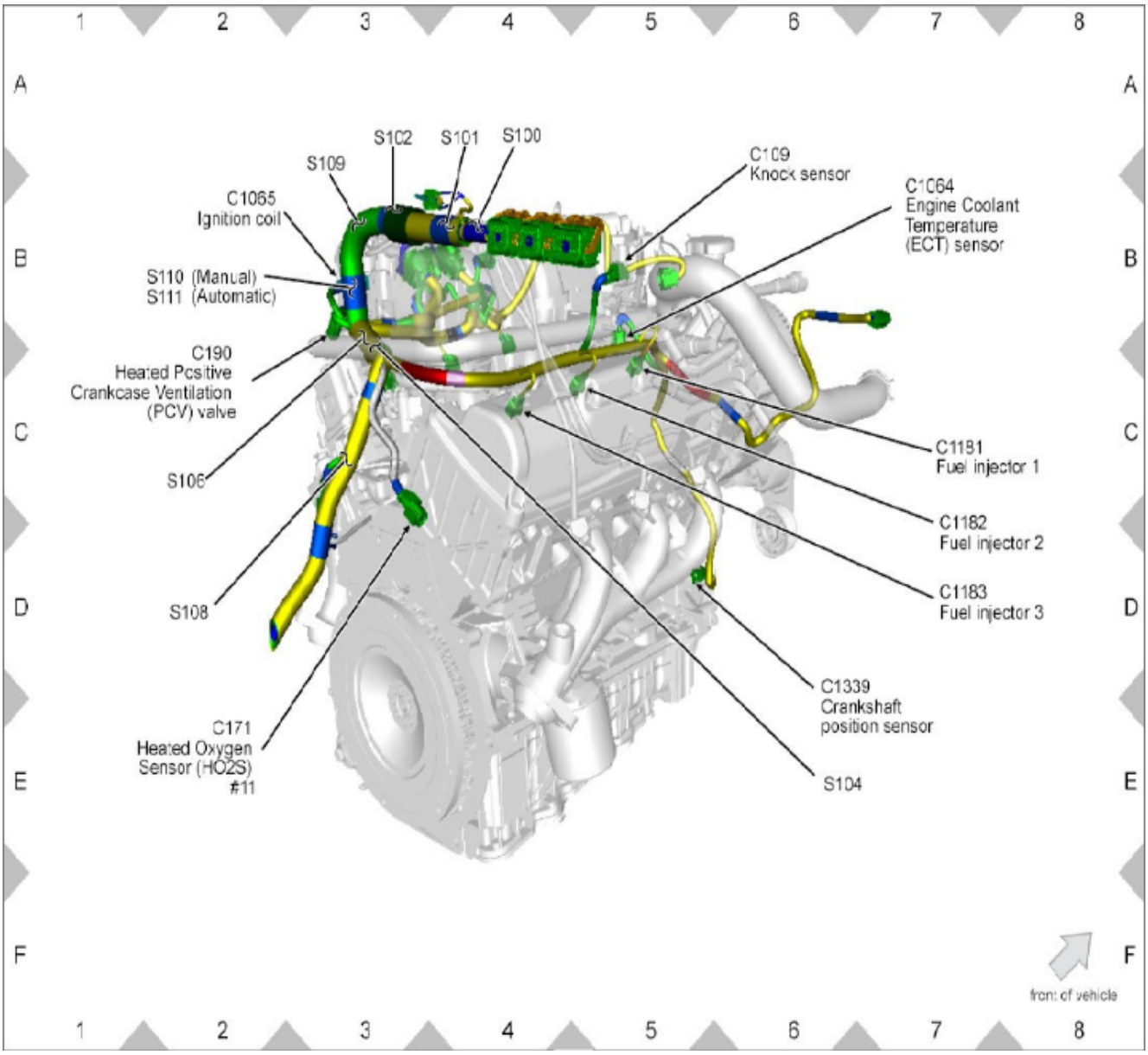
Removal and Installation

1. Disconnect the clutch pedal position (CPP) switch electrical connector. 2. Spread the CPP switch apart. Remove from the pedal rod. 3. To install, reverse the removal procedure.



Coolant Temperature Sensor/Switch (For Computer): Locations

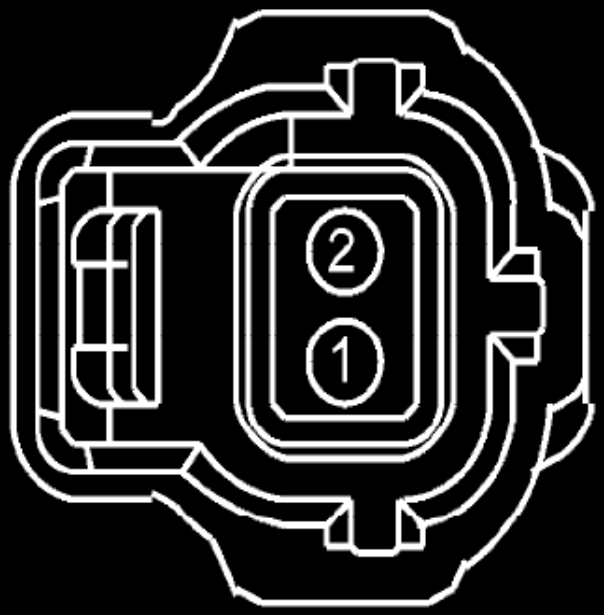
View 151-5


S102
S101
S100
S109
C109
Knock sensor
C1065
Ignition coil
C1064
Engine Coolant
Temperature
(ECT) sensor
S110 (Manual)
S111 (Automatic)
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
C1181
Fuel injector 1
C1182
Fuel injector 2
S108
C1183
Fuel injector 3
C1339
Crankshaft
position sensor
C171
Heated Oxygen
Sensor (HO2S)
#11
S104
front of vehicle

View 151-8

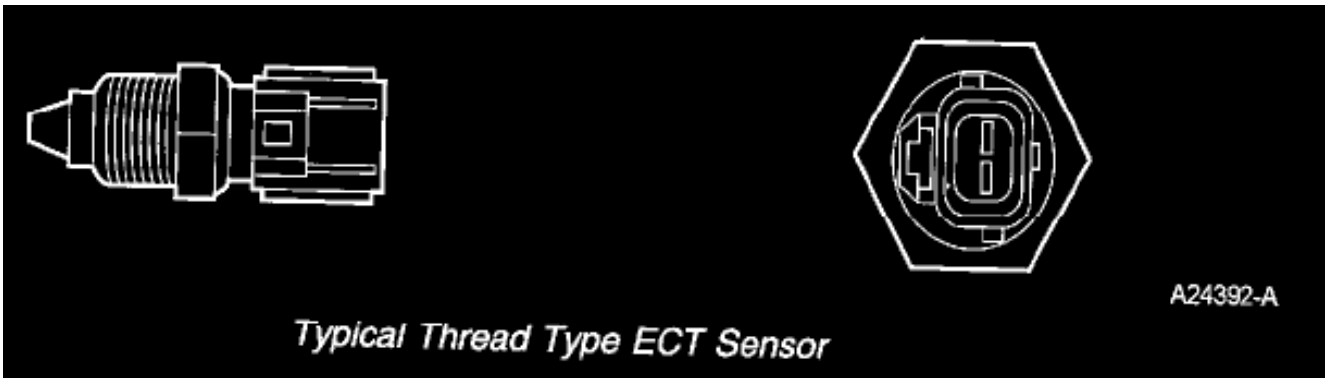
Connector: C1064

Description:	Harness:	Base Part #:
ENGINE COOLANT TEMPERATURE (ECT) SENSOR	12B637	12A648



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE716 (YE)	20	SENSOR - ENGINE COOLANT TEMPERATURE (ECT)	3.0L, 4.0L
2	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	3.0L, 4.0L

C1064



Typical Thread Type ECT Sensor

Coolant Temperature Sensor/Switch (For Computer): Description and Operation

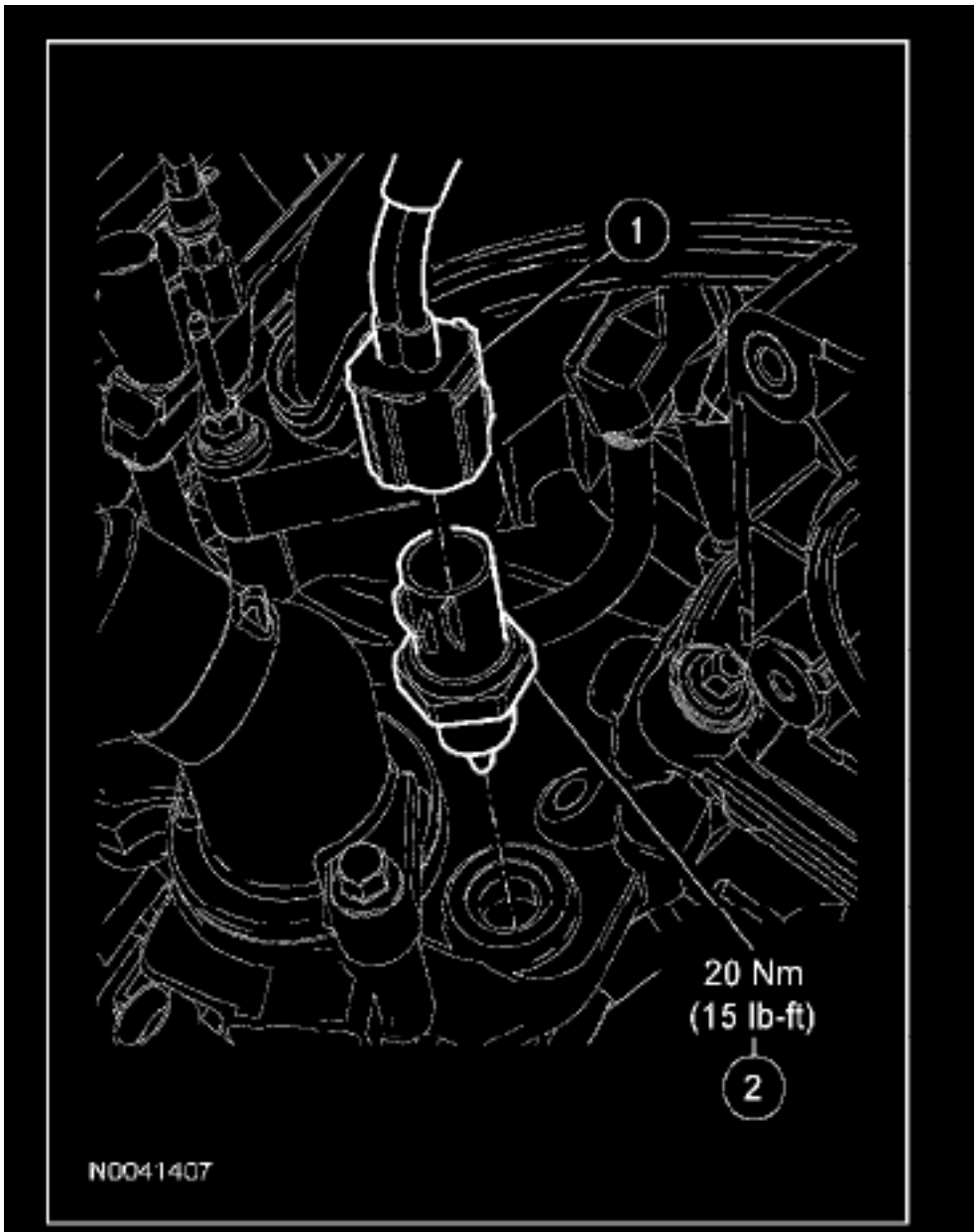
ENGINE COOLANT TEMPERATURE (ECT) SENSOR

Typical Thread Type ECT Sensor

The ECT sensor is a thermistor device in which resistance changes with temperature. The electrical resistance of a thermistor decreases as the temperature increases, and the resistance increases as the temperature decreases. The varying resistance changes the voltage drop across the sensor terminals and provides electrical signals to the PCM corresponding to temperature.

Thermistor-type sensors are considered passive sensors. A passive sensor is connected to a voltage divider network so that varying the resistance of the passive sensor causes a variation in total current flow. Voltage that is dropped across a fixed resistor in a series with the sensor resistor determines the voltage signal at the PCM. This voltage signal is equal to the reference voltage minus the voltage drop across the fixed resistor.

The ECT measures the temperature of the engine coolant. The PCM uses the ECT input for fuel control and for cooling fan control. There are 3 types of ECT sensors, threaded, push-in, and twist-lock. The ECT sensor is located in an engine coolant passage.



Item	Part Number	Description
1	14A464	Engine coolant temperature (ECT) sensor electrical connector (part of 12B637)
2	12A648	ECT sensor

Coolant Temperature Sensor/Switch (For Computer): Service and Repair

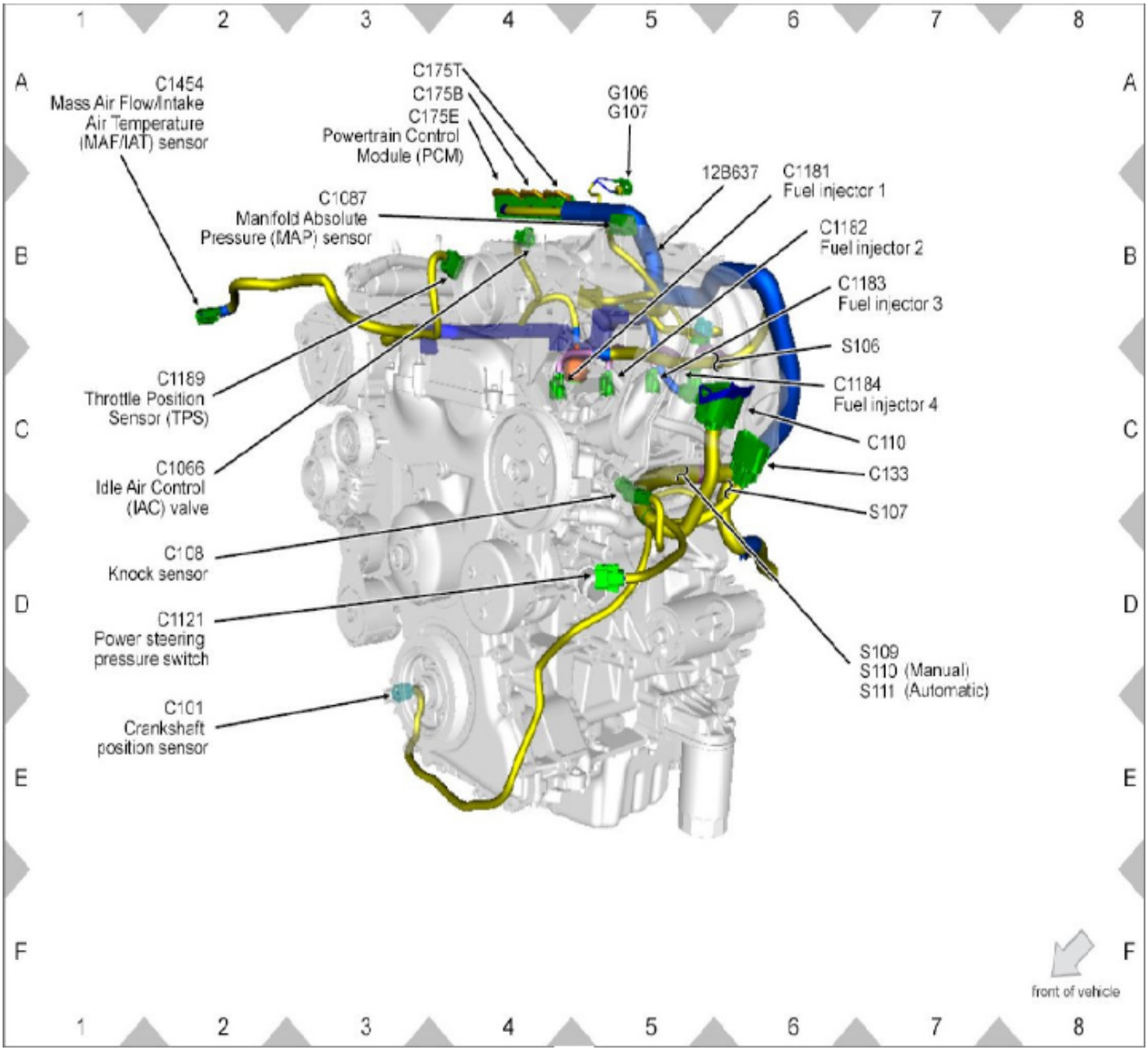
ENGINE COOLANT TEMPERATURE (ECT) SENSOR

Removal and Installation

1. Drain the cooling system. 2. Disconnect the engine coolant temperature (ECT) sensor electrical connector. 3. Remove the ECT sensor.

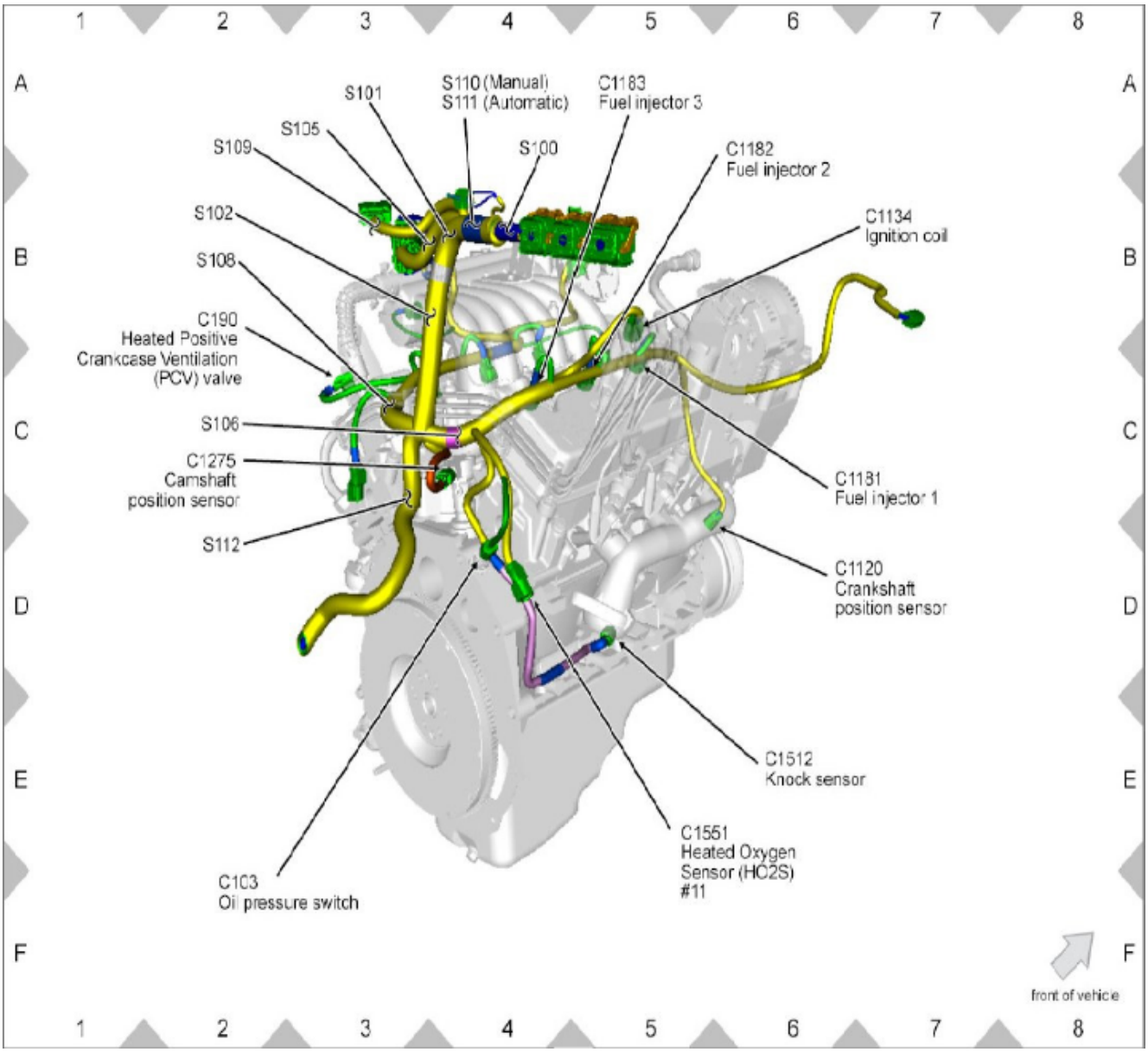
- To install, tighten to 20 Nm (15 lb-ft).

4. To install, reverse the removal procedure.

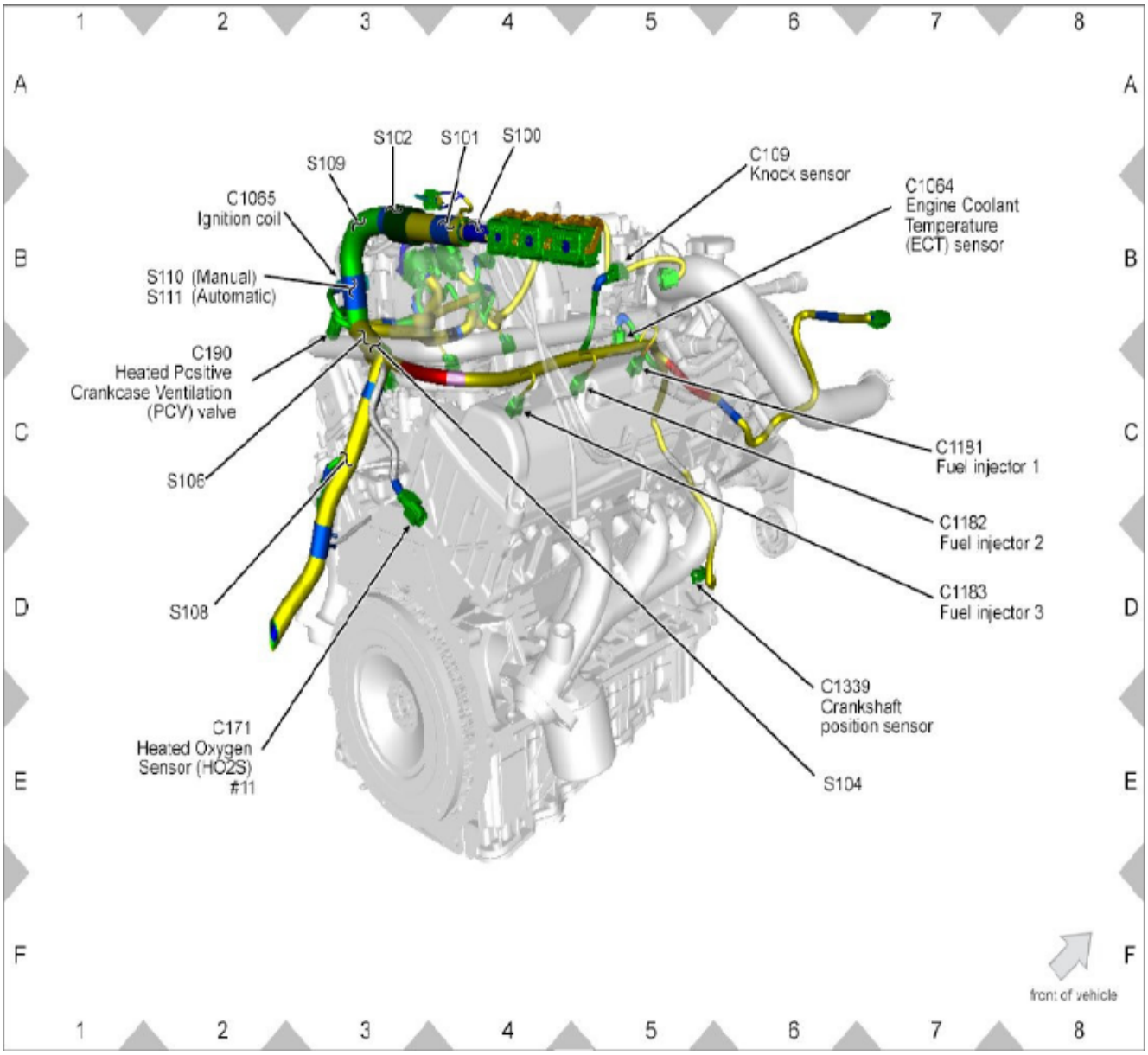


Crankshaft Position Sensor: Locations

View 151-3


S101
S110 (Manual)
S111 (Automatic)
C1183
Fuel injector 3
S105
S109
S100
C1182
Fuel injector 2
S102
C1134
Ignition coil
S108
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
C1275
Camshaft
position sensor
C1181
Fuel injector 1
S112
C1120
Crankshaft
position sensor
C1512
Knock sensor
C1551
Heated Oxygen
Sensor (HO2S)
#11
C103
Oil pressure switch
front of vehicle

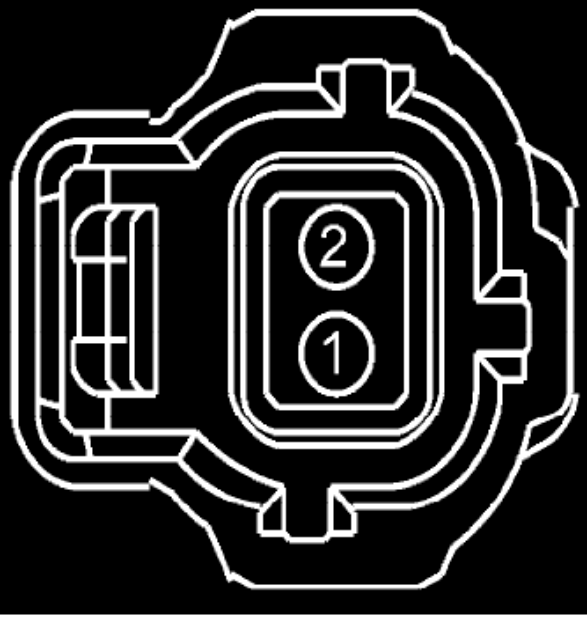
View 151-6


S102
S101
S100
S109
C109
Knock sensor
C1065
Ignition coil
C1064
Engine Coolant
Temperature
(ECT) sensor
S110 (Manual)
S111 (Automatic)
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
C1181
Fuel injector 1
C1182
Fuel injector 2
S108
C1183
Fuel injector 3
C1339
Crankshaft
position sensor
C171
Heated Oxygen
Sensor (HO2S)
#11
S104
front of vehicle

View 151-8

Connector: C101

Description:	Harness:	Base Part #:
CRANKSHAFT POSITION SENSOR	12B637	6C315



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE711 (YE-VT)	18	SENSOR - CRANKSHAFT POSITION (CKPP)	2.3L
2	RE135 (GN-BN)	18	CTRL MOD. - POWERTRAIN # CRANKSHAFT POSITION SENSOR (CKPN)	2.3L

Connector: C1120

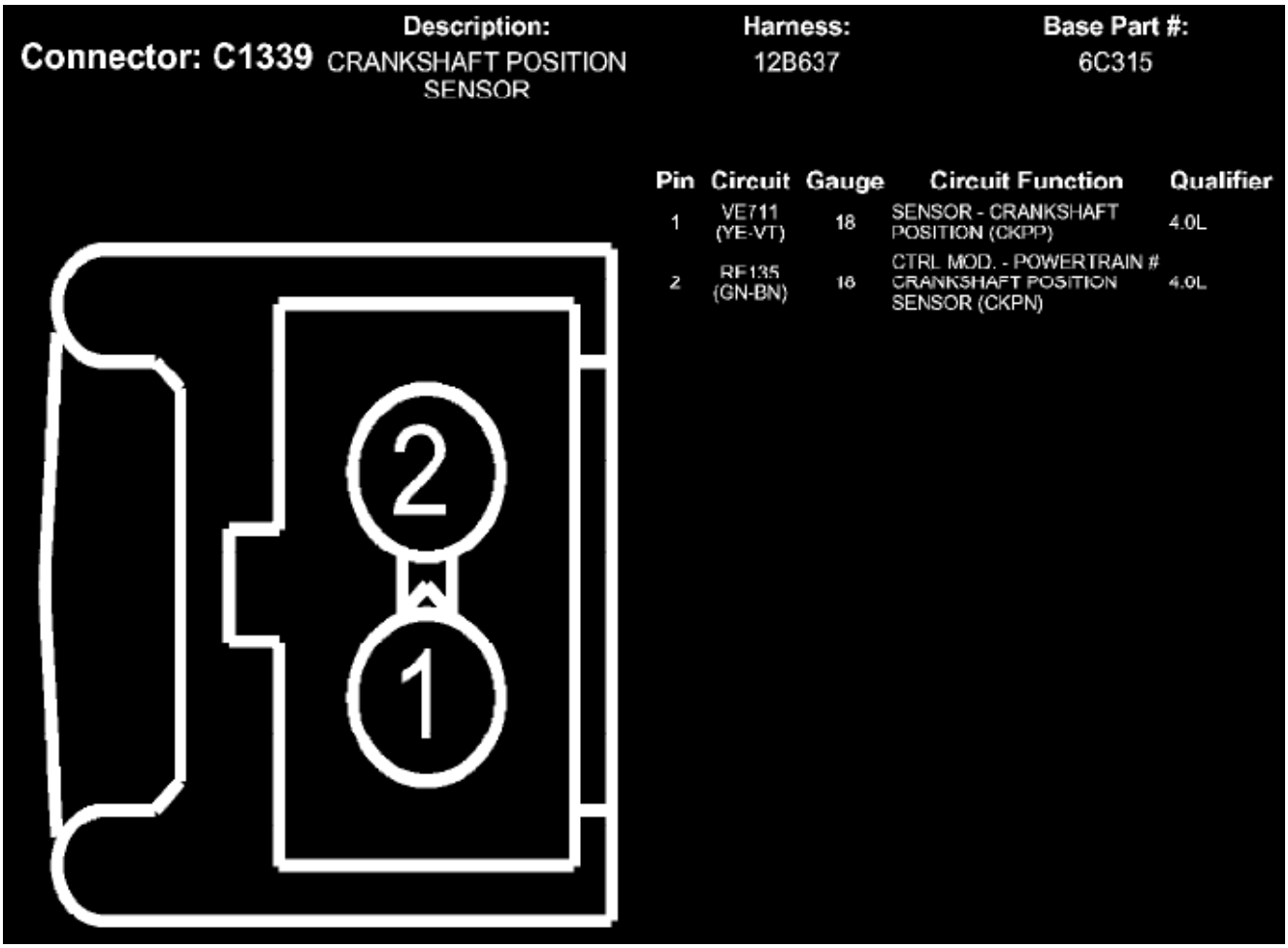
Description:	Harness:	Base Part #:
CRANKSHAFT POSITION SENSOR	12B637	6C315

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RE135 (GN-BN)	18	CTRL MOD. - POWERTRAIN # CRANKSHAFT POSITION SENSOR (CKPN)	3.0L
2	VE711 (YE-VT)	18	SENSOR - CRANKSHAFT POSITION (CKPP)	3.0L

Crankshaft Position Sensor: Diagrams

C101

C1120


Connector: C1339
Description:
CRANKSHAFT POSITION SENSOR
Harness:
12B637
Base Part #:
6C315
Pin Circuit Gauge Circuit Function Qualifier
1 VE711 (YE-VT) 18 SENSOR - CRANKSHAFT POSITION (CKPP) 4.0L
2 RF135 (GN-BN) 18 CTRL MOD. - POWERTRAIN # CRANKSHAFT POSITION SENSOR (CKPN) 4.0L
2
1

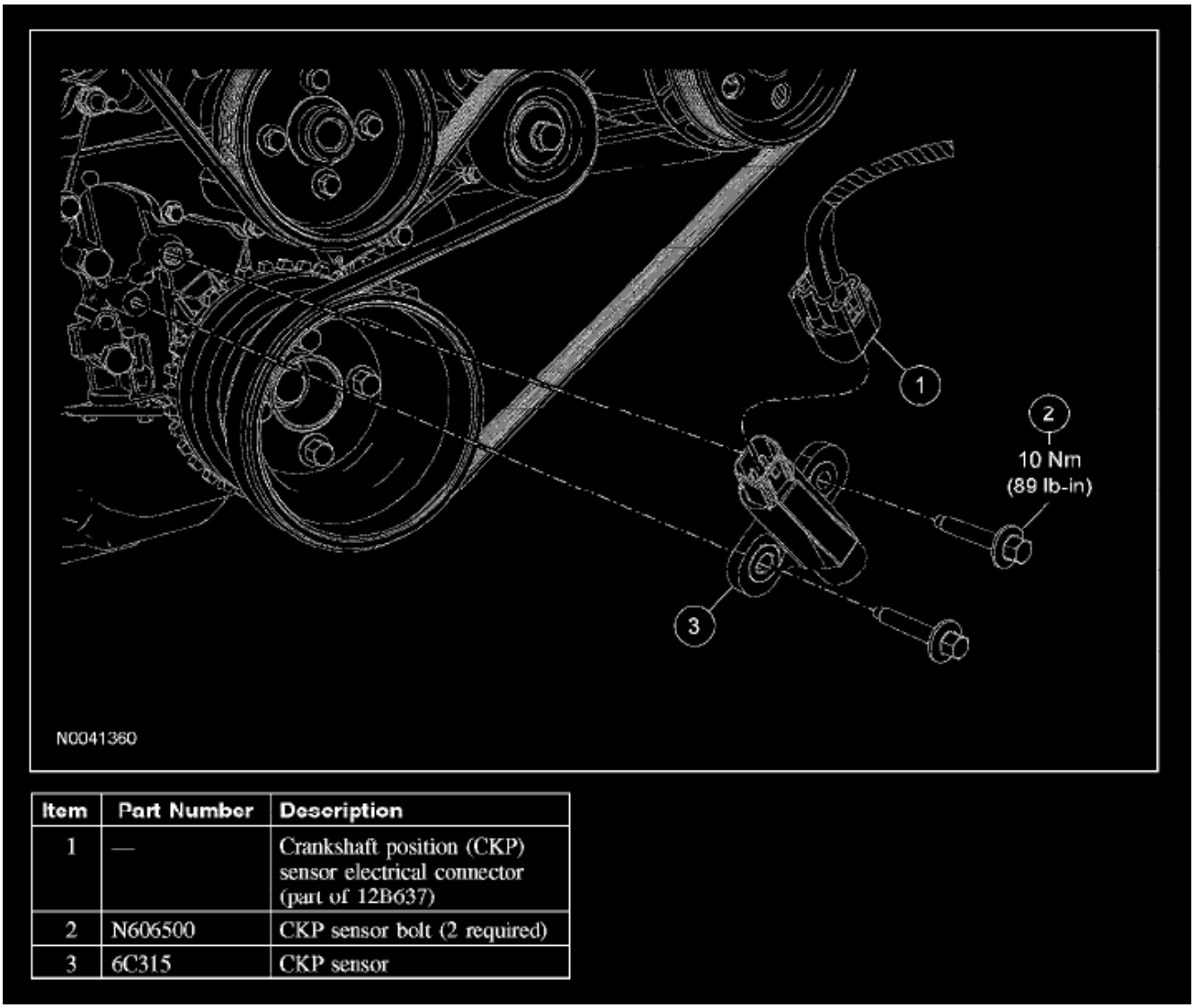
C1339

Crankshaft Position Sensor: Description and Operation

CRANKSHAFT POSITION (CKP) SENSOR

Typical Crankshaft Position (CKP) Sensor

The CKP sensor is a magnetic transducer mounted on the engine block adjacent to a pulse wheel located on the crankshaft. By monitoring the crankshaft mounted pulse wheel, the CKP is the primary sensor for ignition information to the PCM. The pulse wheel has a total of 35 teeth spaced 10 degrees apart with one empty space for a missing tooth. The 6.8L 10-cylinder pulse wheel has 39 teeth spaced 9 degrees apart and one 9 degree empty space for a missing tooth. By monitoring the pulse wheel, the CKP sensor signal indicates crankshaft position and speed information to the PCM. By monitoring the missing tooth, the CKP sensor is also able to identify piston travel in order to synchronize the ignition system and provide a way of tracking the angular position of the crankshaft relative to a fixed reference for the CKP sensor configuration. The PCM also uses the CKP signal to determine if a misfire has occurred by measuring rapid decelerations between teeth.



Item	Part Number	Description
1	—	Crankshaft position (CKP) sensor electrical connector (part of 12B637)
2	N606500	CKP sensor bolt (2 required)
3	6C315	CKP sensor

Crankshaft Position Sensor: Service and Repair

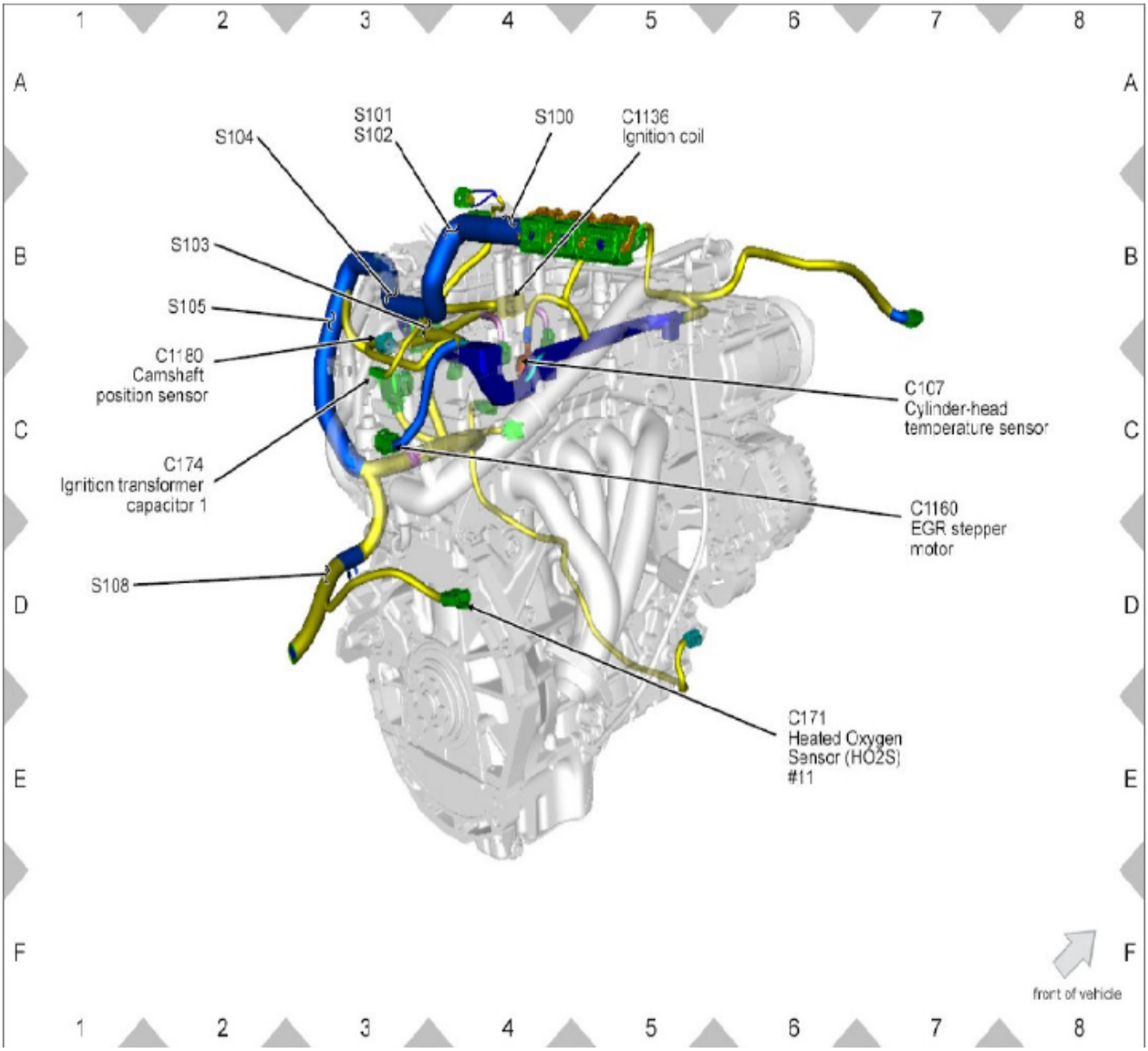
CRANKSHAFT POSITION (CKP) SENSOR

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the crankshaft position (CKP) sensor electrical connector. 3. Remove the 2 bolts and the CKP sensor.

- To install, tighten to 10 Nm (89 lb-in).

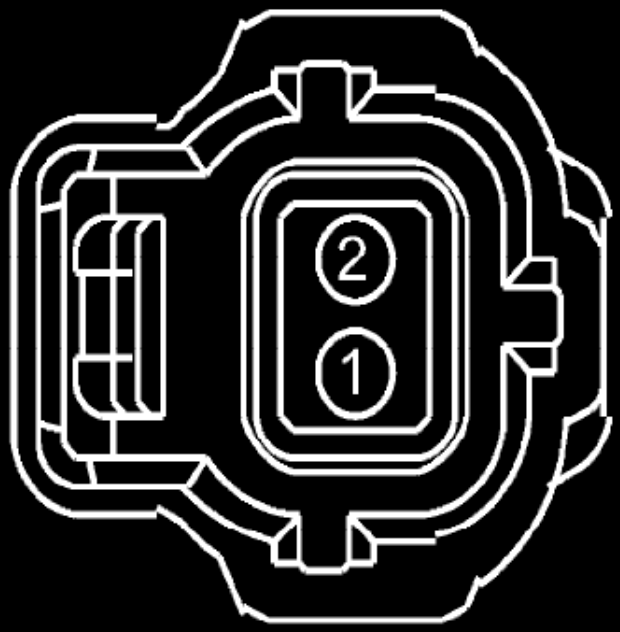
4. To install, reverse the removal procedure.


S104
S101
S102
S100
C1136
Ignition coil
S103
S105
C1180
Camshaft
position sensor
C107
Cylinder-head
temperature sensor
C174
Ignition transformer
capacitor 1
C1160
EGR stepper
motor
S108
C171
Heated Oxygen
Sensor (HO2S)
#11
front of vehicle

View 151-4

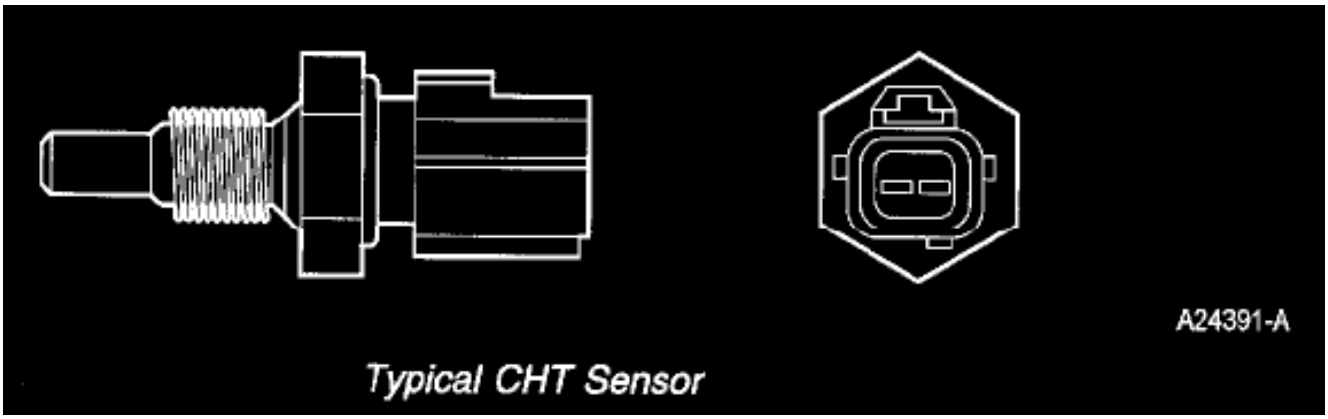
Connector: C107

Description:	Harness:	Base Part #:
CYLINDERHEAD TEMPERATURE SENSOR	12B637	6G004



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE116 (VT-BN)	20	CTRL MOD. - POWERTRAIN # CYLINDER HEAD TEMPERATURE INDICATOR LIGHT (CHTIL)	2.3L
2	RE405 (GN/WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	2.3L

C107



Engine Temperature Sensor: Description and Operation

CYLINDER HEAD TEMPERATURE (CHT) SENSOR

Typical CHT Sensor

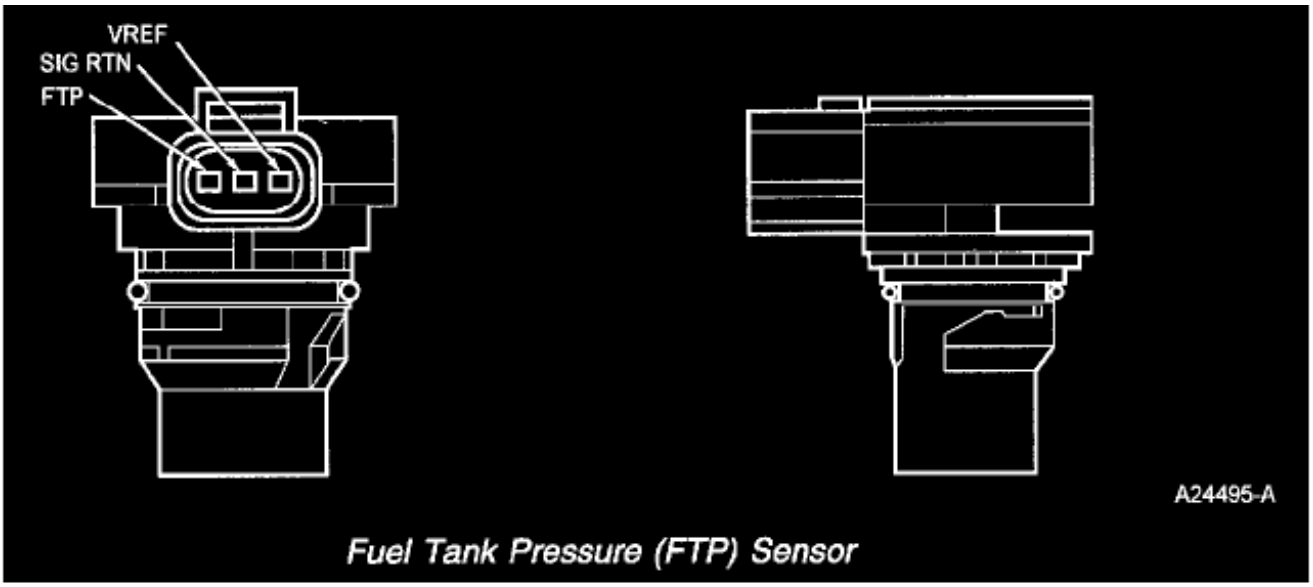
The CHT sensor is a thermistor device in which resistance changes with the temperature. The electrical resistance of a thermistor decreases as temperature increases, and the resistance increases as the temperature decreases. The varying resistance affects the voltage drop across the sensor terminals and provides electrical signals to the PCM corresponding to temperature.

The CHT sensor is installed in the cylinder head and measures the metal temperature. The CHT sensor can provide complete engine temperature information and can be used to infer coolant temperature. If the CHT sensor conveys an overheating condition to the PCM, the PCM initiates a fail-safe cooling strategy based on information from the CHT sensor. A cooling system concern such as low coolant or coolant loss could cause an overheating condition. As a result, damage to major engine components could occur. Using both the CHT sensor and fail-safe cooling strategy, the PCM prevents damage by allowing air cooling of the engine and limp home capability.

Fuel Level Sensor: Description and Operation

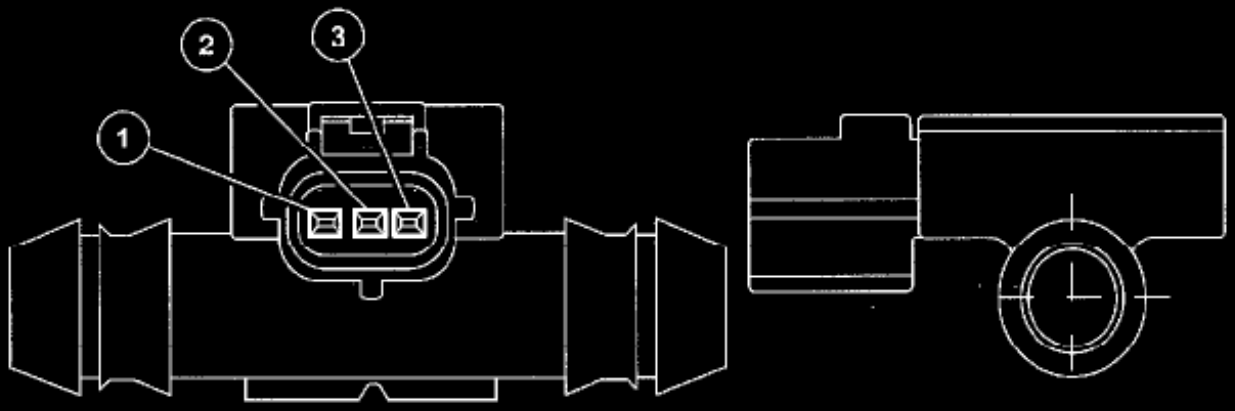
FUEL LEVEL INPUT (FLI)

The FLI is a communications network message. Most vehicle applications use a potentiometer type FLI sensor connected to a float in the FP module to determine fuel level.



Fuel Tank Pressure (FTP) Sensor

In-Line Fuel Tank Pressure (FTP) Sensor



Item	Part Number	Description
1	—	VREF
2	—	SIG RTN
3	—	FTP

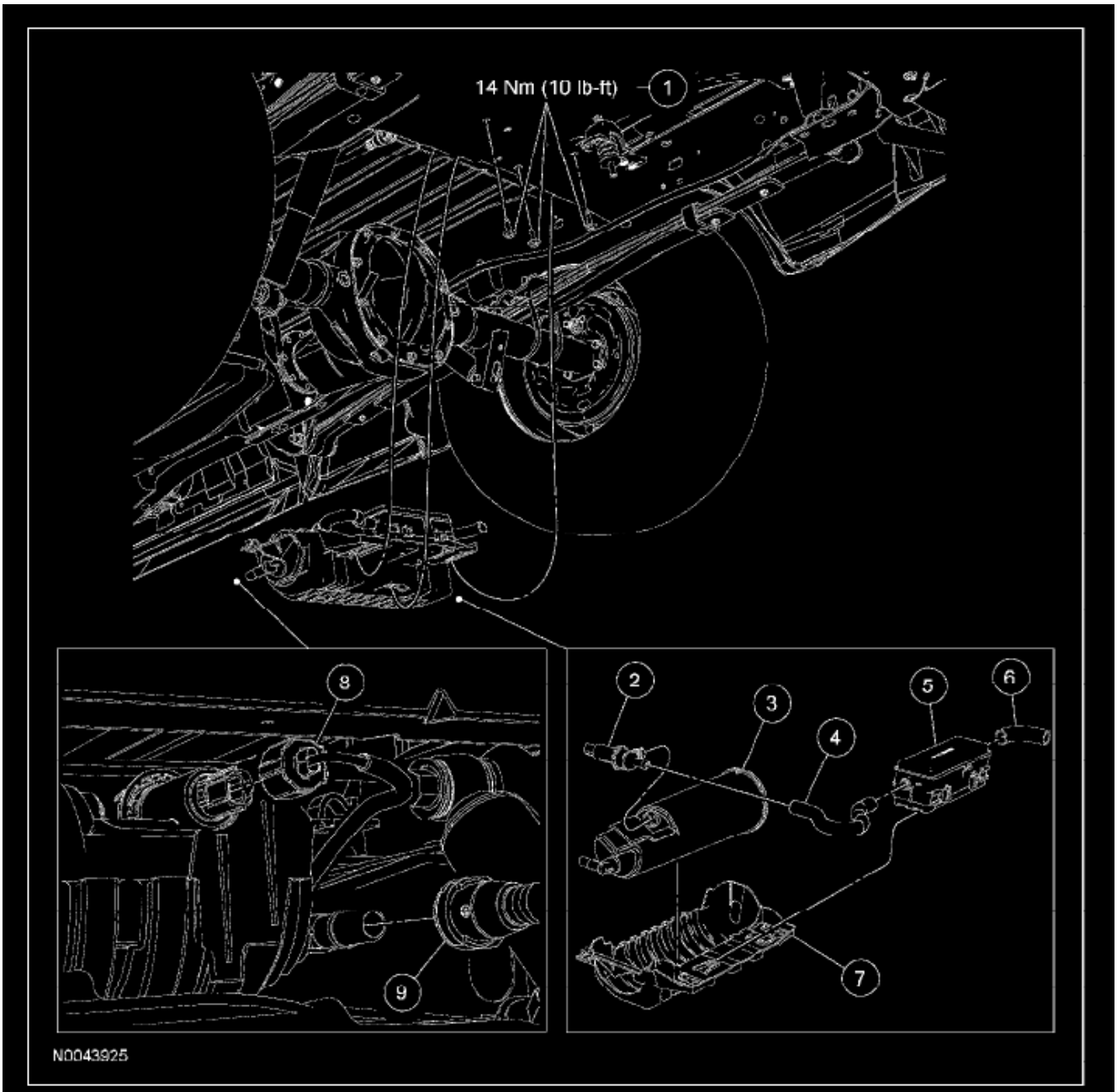
Fuel Tank Pressure Sensor: Description and Operation

FUEL TANK PRESSURE (FTP) SENSOR

Fuel Tank Pressure (FTP) Sensor

In-Line Fuel Tank Pressure (FTP) Sensor

The FTP sensor or in-line FTP sensor is used to measure the fuel tank pressure.



Item	Part Number	Description
1	W503932	Evaporative emissions (EVAP) canister and bracket assembly bolts
2	9F945	EVAP canister vent solenoid
3	9D653	EVAP canister

(Continued)

Item	Part Number	Description
4	9F459	EVAP canister vent solenoid-to-EVAP dust separator hose
5	9B328	EVAP dust separator
6	9F459	EVAP dust separator hose
7	9D665	EVAP canister bracket

(Continued)

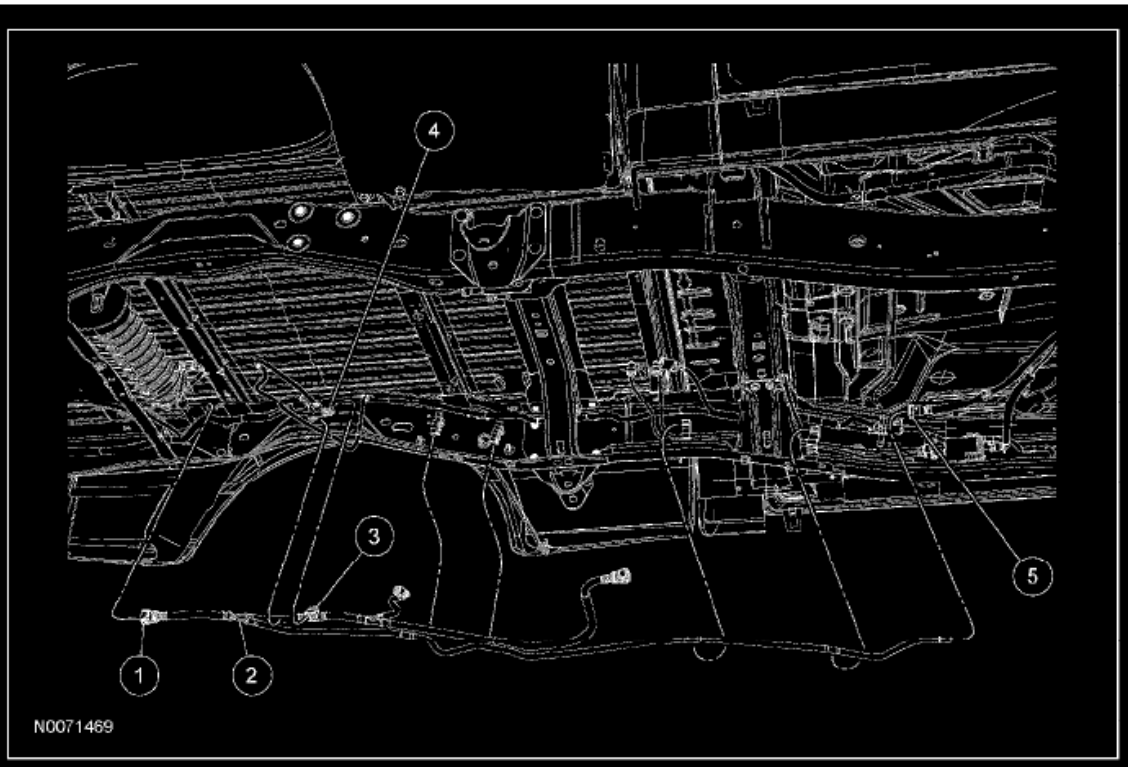
Fuel Tank Pressure Sensor: Service and Repair

FUEL TANK PRESSURE SENSOR

Exploded View

Part 1

Item	Part Number	Description
8	—	EVAP canister vent solenoid electrical connector (part of 14405)
9	—	Rear fuel tank vapor tube and fuel tank pressure sensor assembly-to-EVAP canister quick connect coupling (part of 9G291)



Item	Part Number	Description
1	—	Rear fuel tank vapor tube and fuel tank pressure sensor assembly-to-evaporative emission (EVAP) canister quick connect coupling (part of 9G291)
2	9G291	Rear fuel tank vapor tube and fuel tank pressure sensor assembly
3	—	Fuel tank pressure sensor (part of 9G291)
4	—	Fuel tank pressure sensor electrical connector (part of 14405)
5	—	Front fuel tank vapor tube-to-rear fuel tank vapor tube and fuel tank pressure sensor assembly quick connect coupling (part of 9L291)

Part 2

Removal and Installation

WARNING:

- When working on or near the evaporative emission (EVAP) system, disconnect the battery ground cable from the battery. The EVAP system contains fuel vapor and condensed fuel vapor, so an

electrical spark may cause a fire or explosion. Failure to follow this instruction may result in serious personal injury.

- Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

1. Remove the fuel tank. 2. Disconnect the fuel tank pressure sensor electrical connector.

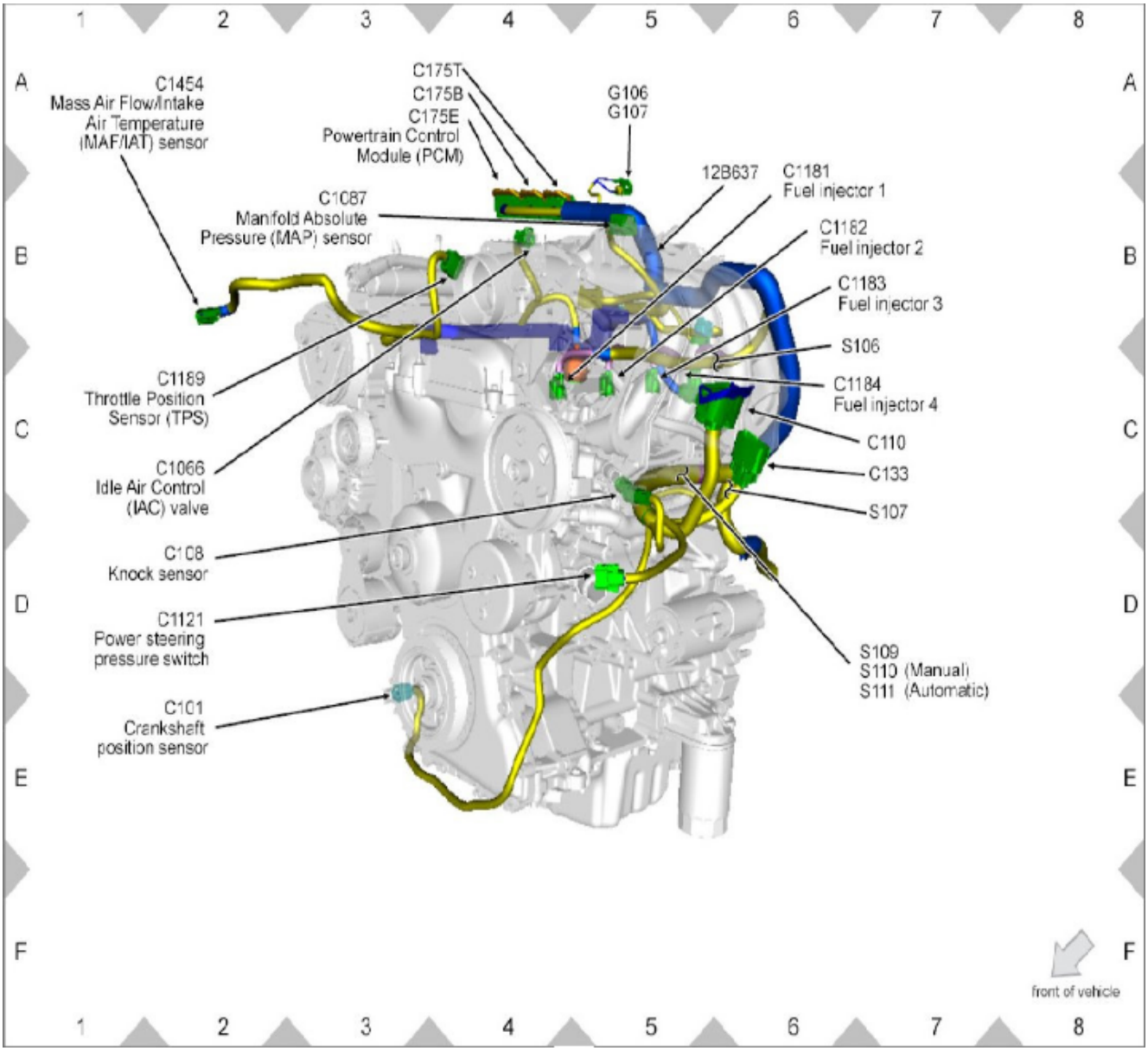
3. NOTE: The rear fuel tank vapor tube and fuel tank pressure sensor are an assembly and must be serviced as an assembly.

Disconnect the rear fuel tank vapor tube and fuel tank pressure sensor assembly-to-evaporative emissions (EVAP) canister quick connect coupling.

4. Disconnect the front fuel tank vapor tube-to-rear fuel tank vapor tube and fuel tank pressure sensor assembly quick connect coupling. 5. Remove the rear fuel tank vapor tube and fuel tank pressure sensor assembly. 6. To install, reverse the removal procedure.

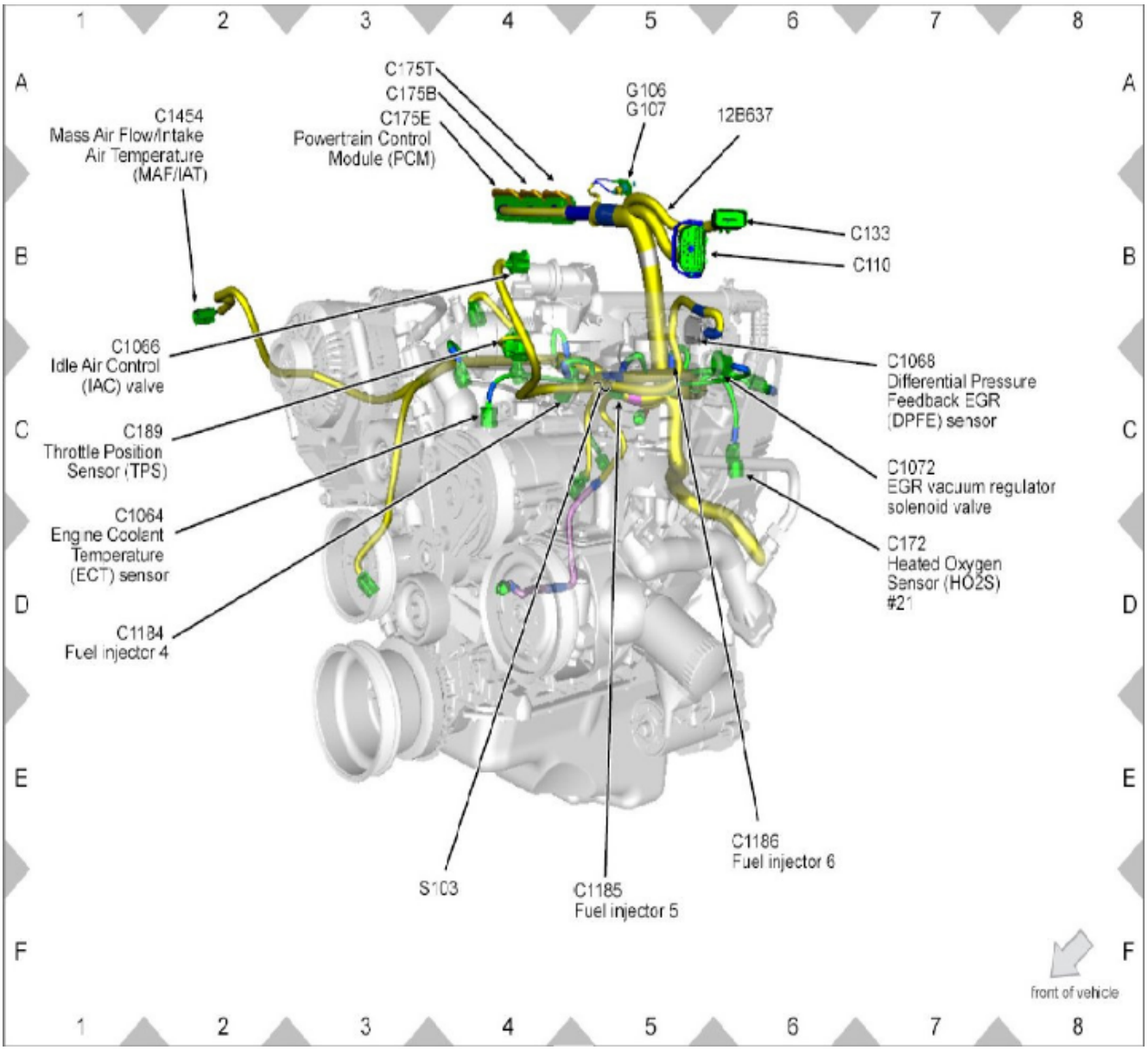
- Carry out the leak test. See: Emission Control Systems/Evaporative Emissions System/Testing and Inspection

- Carry out the evaporative emission repair verification drive cycle.

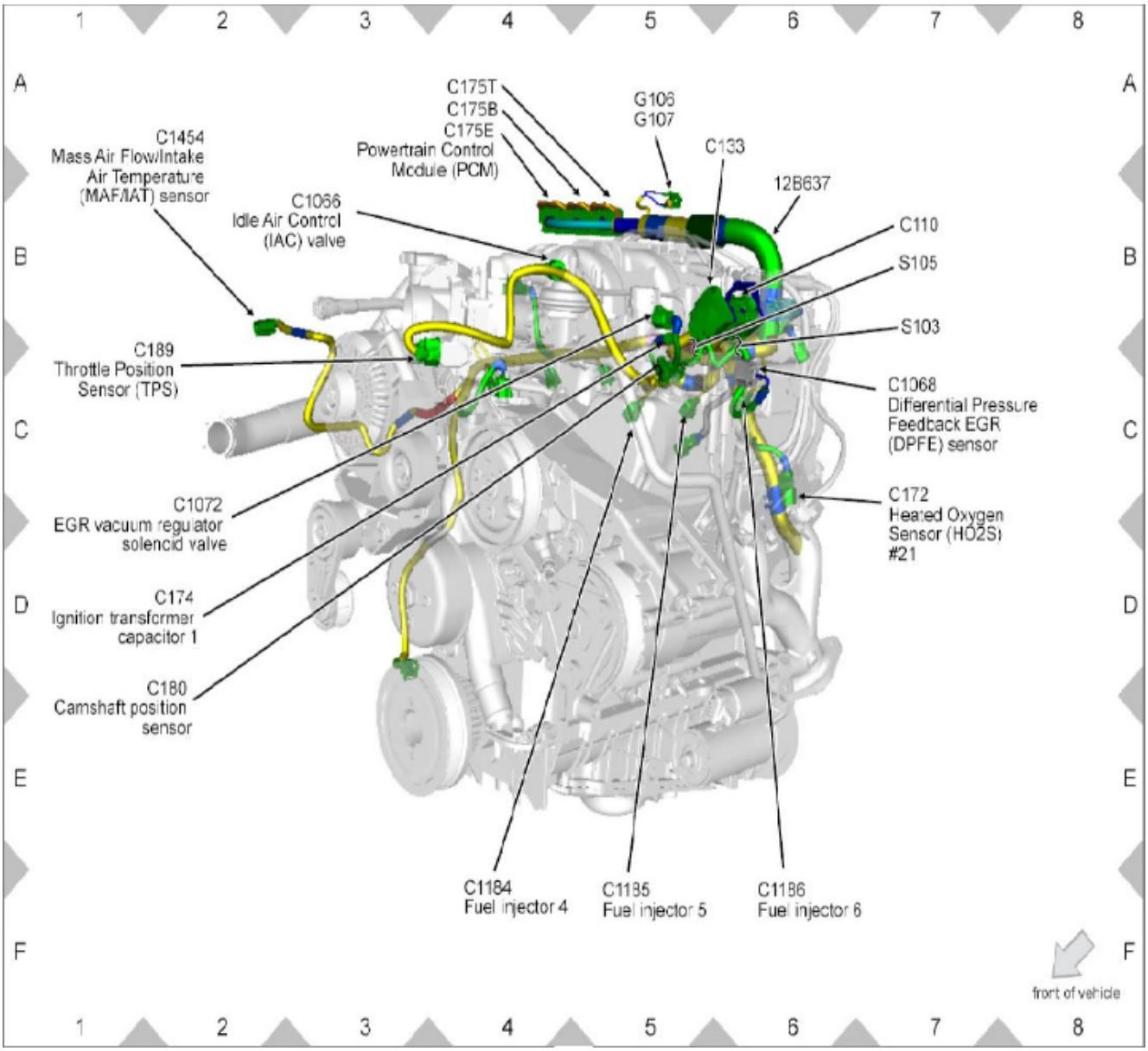


Intake Air Temperature Sensor: Locations

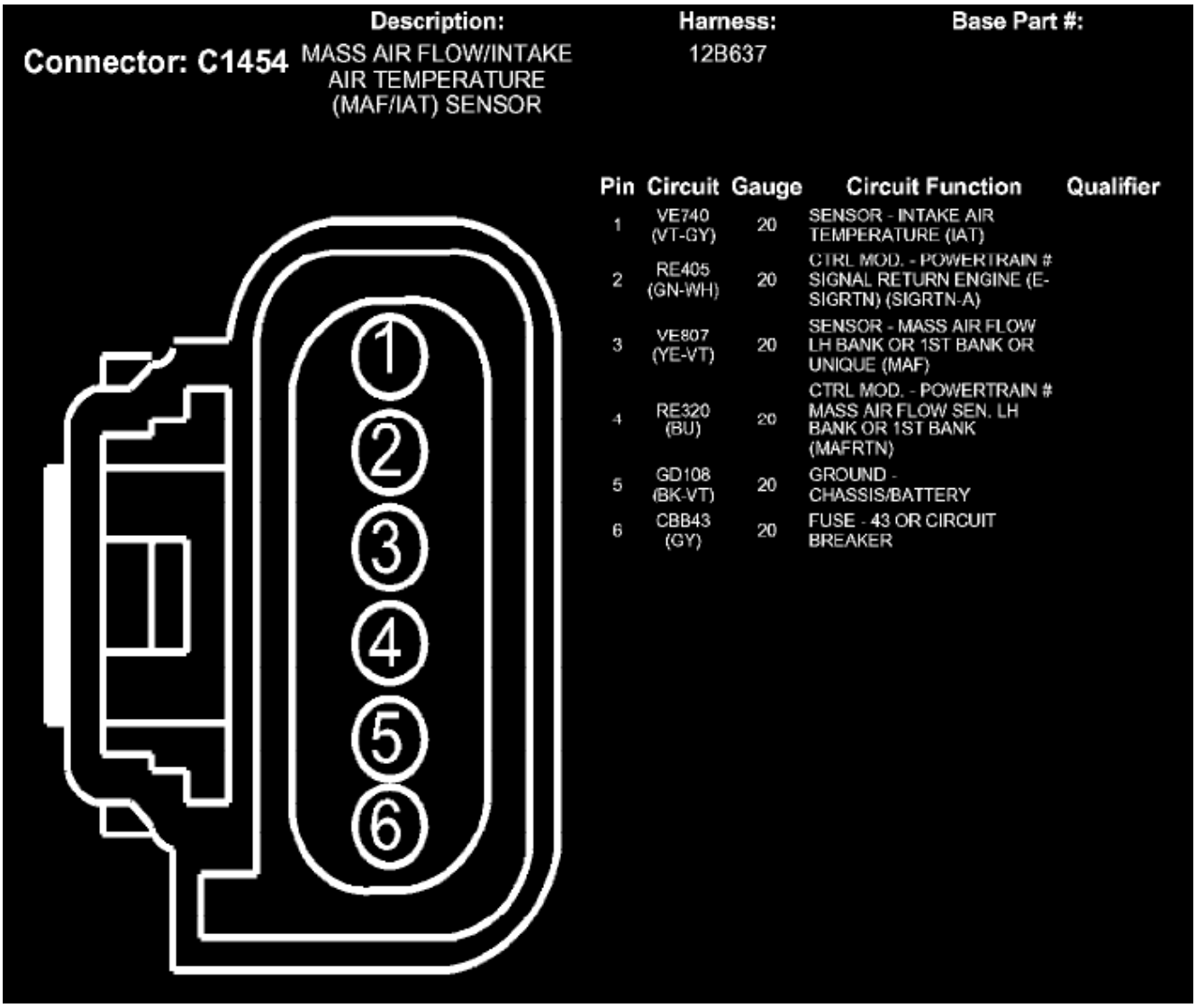
View 151-3


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
12B637
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT)
C133
C110
C1066
Idle Air Control (IAC) valve
C189
Throttle Position Sensor (TPS)
C1064
Engine Coolant Temperature (ECT) sensor
C1184
Fuel injector 4
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
S103
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-5

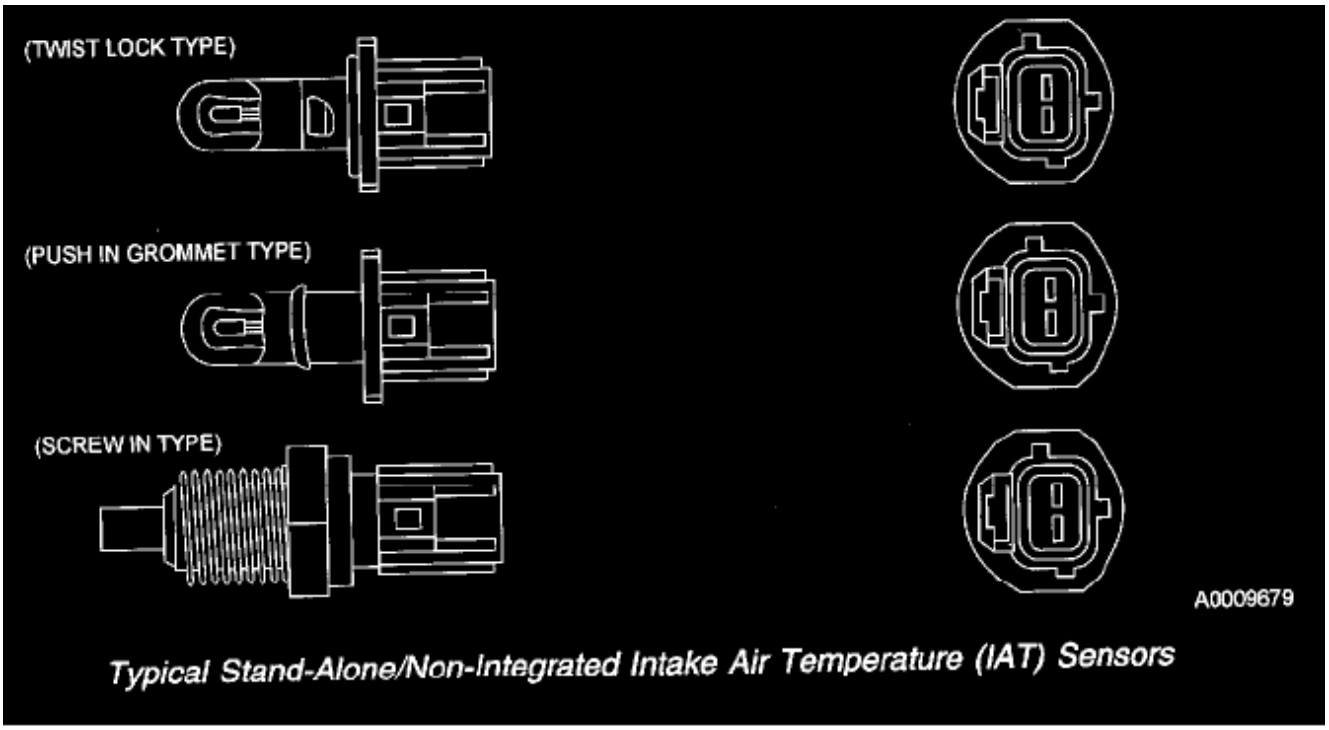

C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
C133
12B637
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor
C1066
Idle Air Control (IAC) valve
C110
S105
S103
C189
Throttle Position Sensor (TPS)
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
C174
Ignition transformer capacitor 1
C180
Camshaft position sensor
C1184
Fuel injector 4
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-7

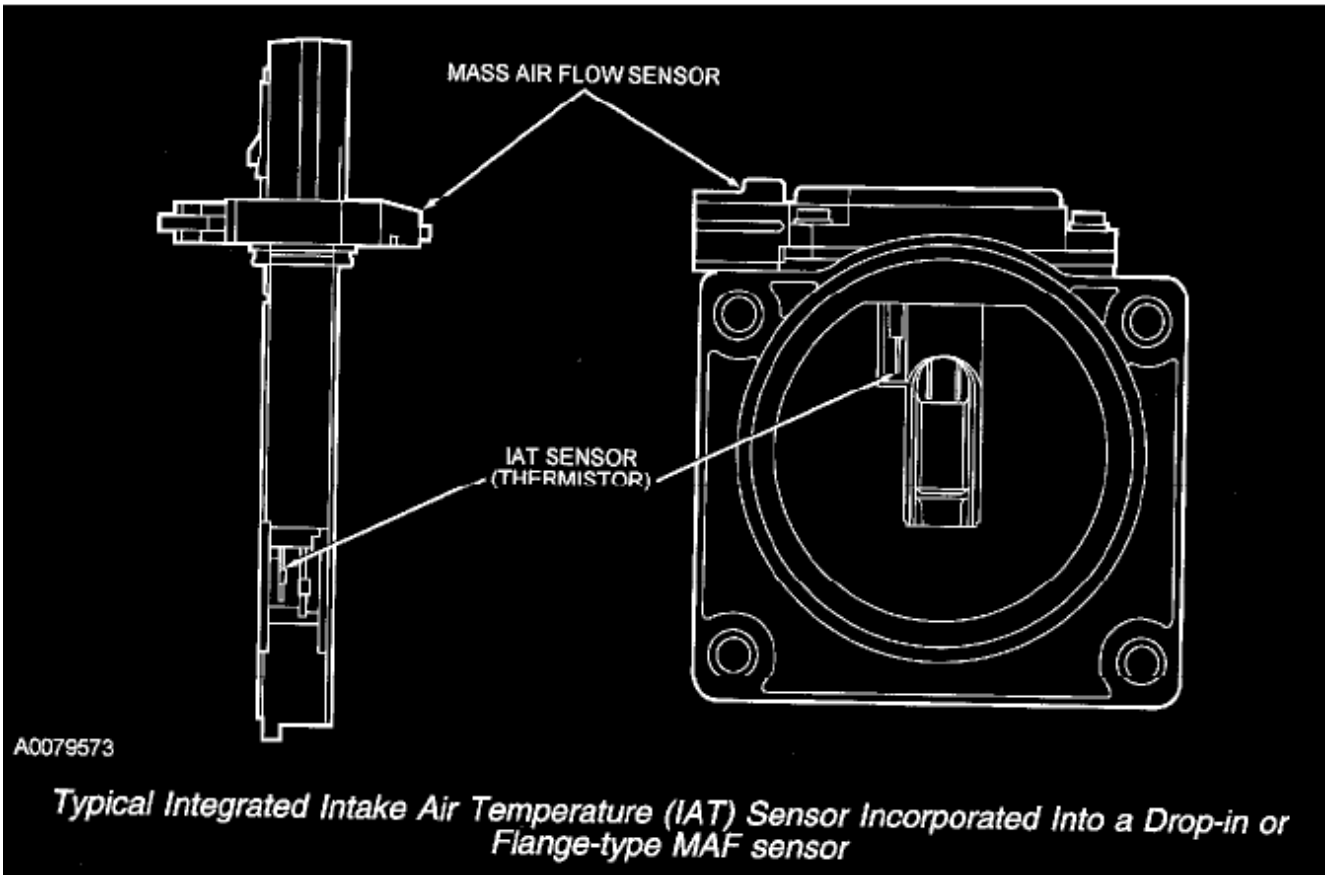


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE740 (VT-GY)	20	SENSOR - INTAKE AIR TEMPERATURE (IAT)	
2	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	
3	VE807 (YE-VT)	20	SENSOR - MASS AIR FLOW LH BANK OR 1ST BANK OR UNIQUE (MAF)	
4	RE320 (BU)	20	CTRL MOD. - POWERTRAIN # MASS AIR FLOW SEN. LH BANK OR 1ST BANK (MAFRTN)	
5	GD108 (BK-VT)	20	GROUND - CHASSIS/BATTERY	
6	CBB43 (GY)	20	FUSE - 43 OR CIRCUIT BREAKER	

C1454



Typical Stand-Alone/Non-Integrated Intake Air Temperature (IAT) Sensors



Typical Integrated Intake Air Temperature (IAT) Sensor Incorporated Into a Drop-in or Flange-type MAF sensor

Intake Air Temperature Sensor: Description and Operation

Intake Air Temperature (IAT) Sensor

Typical Stand-Alone/Non-Integrated Intake Air Temperature (IAT) Sensors

Typical Integrated Intake Air Temperature (IAT) Sensor Incorporated Into A Drop-in Or Flange-type MAF Sensor

The IAT sensor is a thermistor device in which resistance changes with temperature. The electrical resistance of a thermistor decreases as the temperature increases, and the resistance increases as the temperature decreases. The varying resistance affects the voltage drop across the sensor terminals and provides electrical signals to the PCM corresponding to temperature.

Thermistor-type sensors are considered passive sensors. A passive sensor is connected to a voltage divider network so that varying the resistance of the passive sensor causes a variation in total current flow. Voltage that is dropped across a fixed resistor in a series with the sensor resistor determines the voltage signal at the PCM. This voltage signal is equal to the reference voltage minus the voltage drop across the fixed resistor.

The IAT provides air temperature information to the PCM. The PCM uses the air temperature information as a correction factor in the calculation of

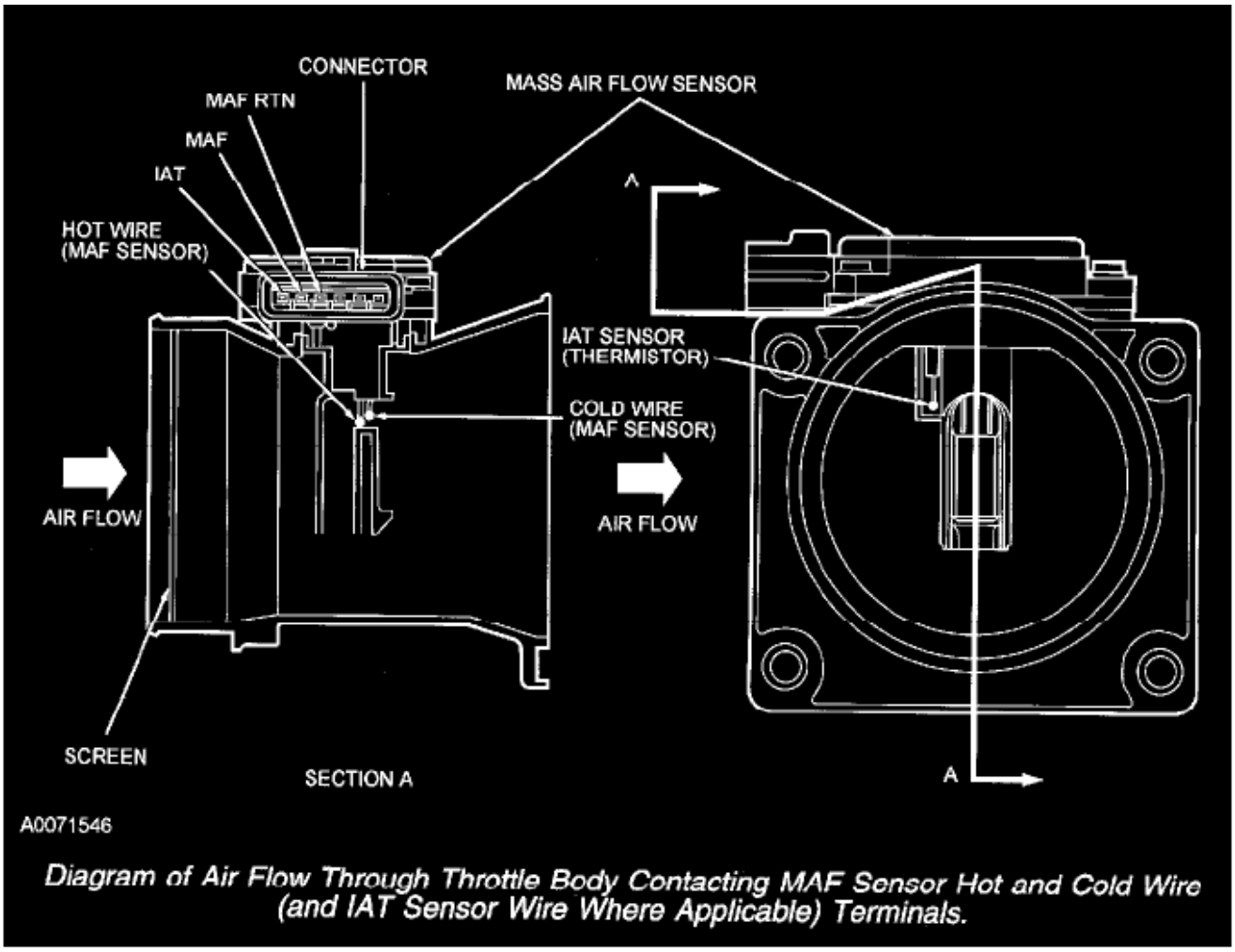
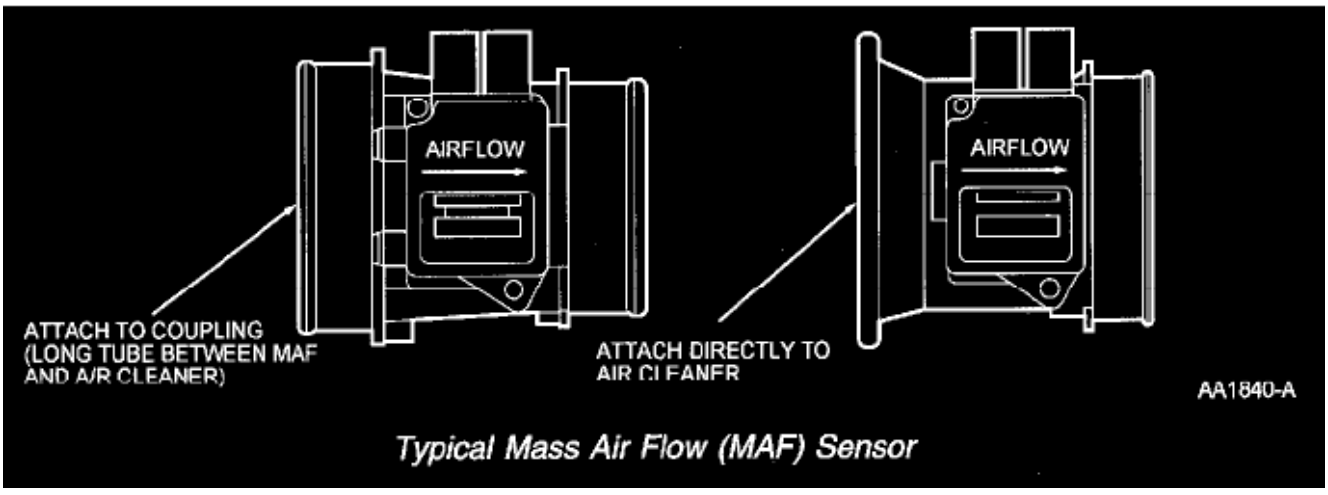


Diagram of Air Flow Through Throttle Body Contacting MAF Sensor Hot and Cold Wire (and IAT Sensor Wire Where Applicable) Terminals.



Typical Mass Air Flow (MAF) Sensor

fuel, spark, and air flow.

The IAT sensor provides a quicker temperature change response time than the ECT or CHT sensor.

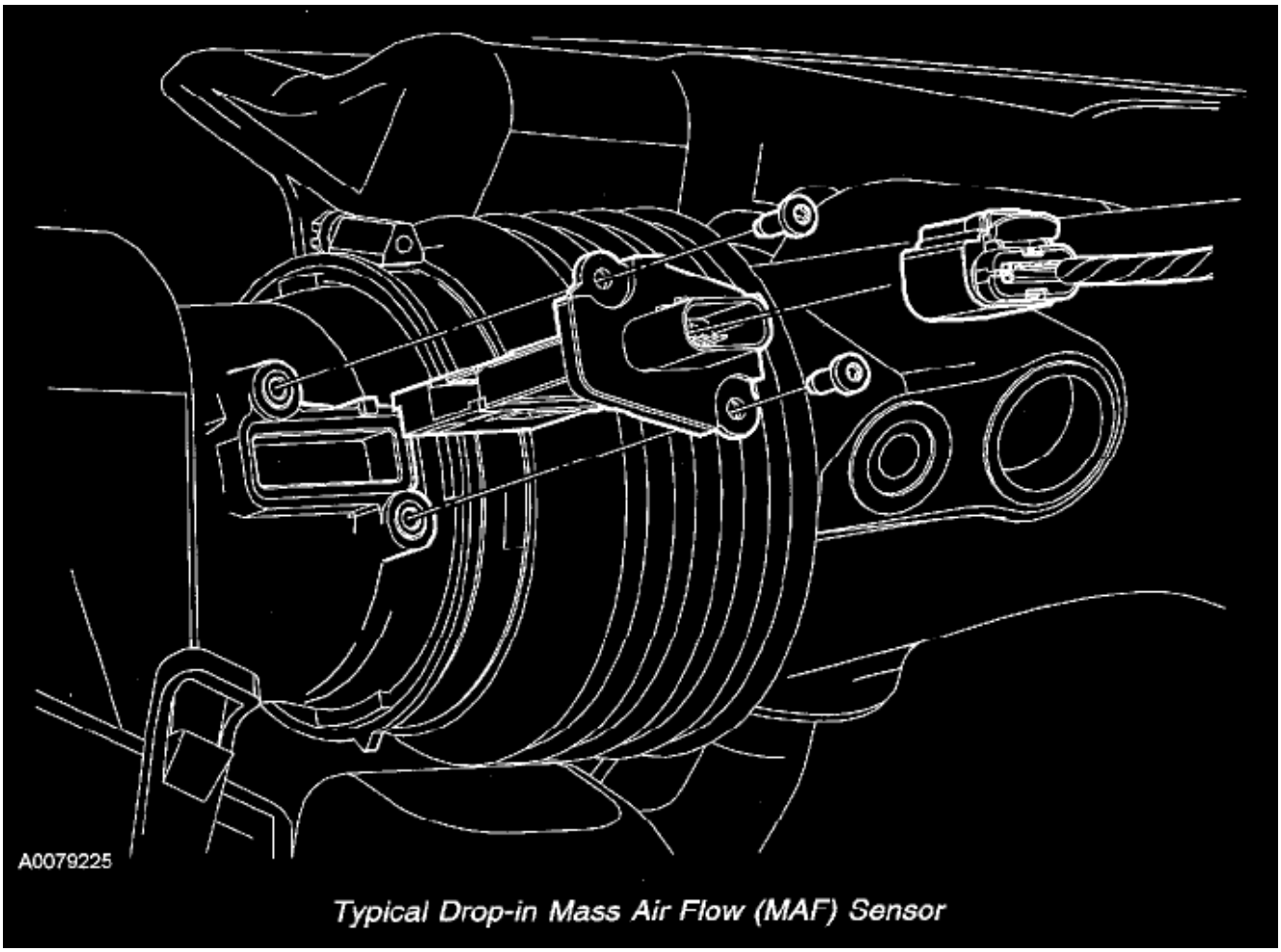
Currently there are 2 design types of IAT sensors used, a stand-alone/non-integrated type and a integrated type. Both types function the same, however the integrated type is incorporated into the mass air flow (MAF) sensor instead of being a stand alone sensor.

Supercharged vehicles use 2 IAT sensors. Both sensors are thermistor type devices and operate as described above. One is located before the supercharger at the air cleaner for standard OBD/cold weather input, while a second sensor (IAT2) is located after the supercharger in the intake manifold. The IAT2 sensor located after the supercharger provides air temperature information to the PCM to control spark and to help determine charge air cooler (CAC) efficiency.

Mass Air Flow (MAF) Sensor

Diagram Of Air Flow Through Throttle Body Contacting MAF Sensor Hot And Cold Wire (and IAT Sensor Wire Where Applicable) Terminals

Typical Mass Air Flow (MAF) Sensor

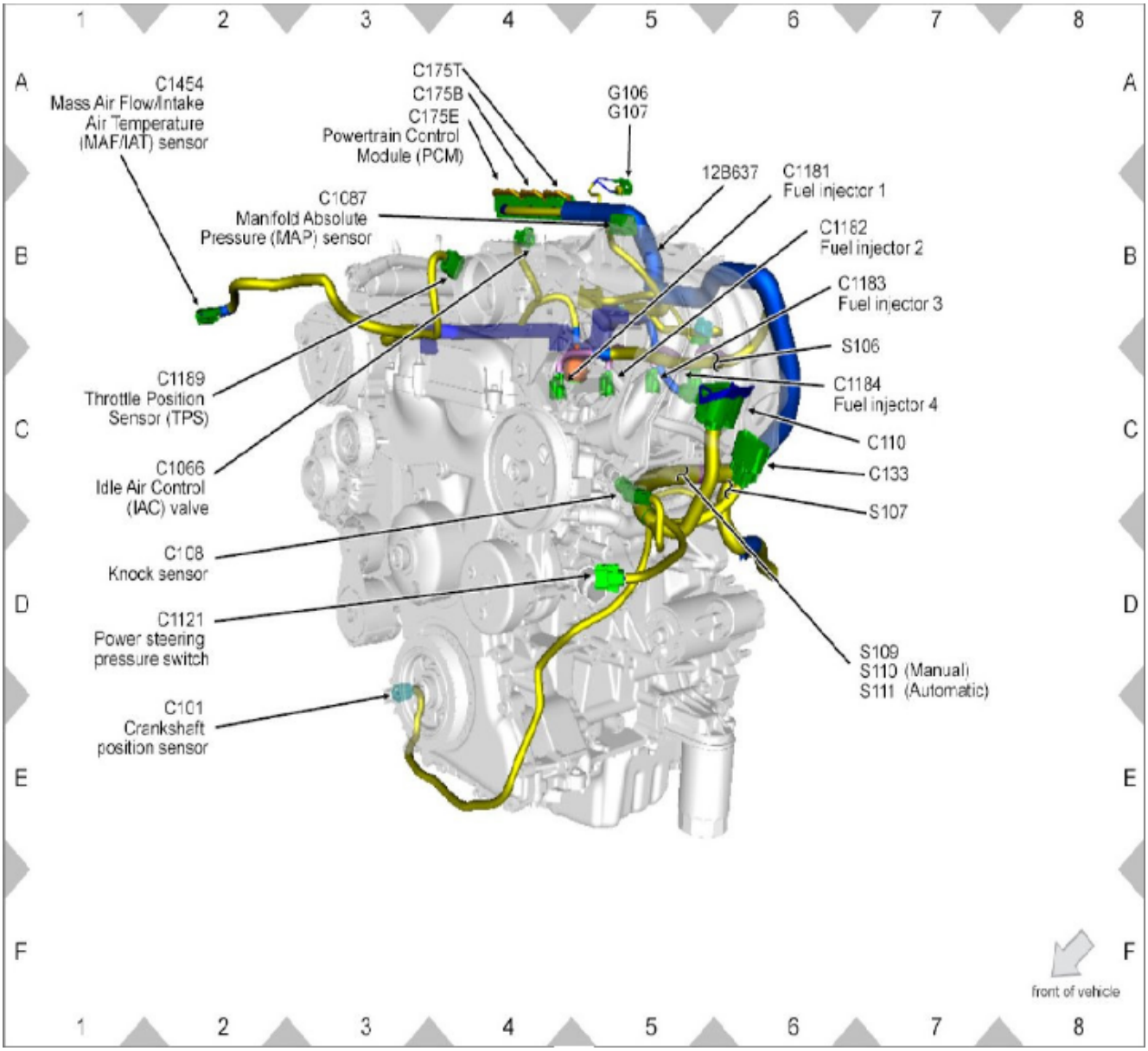


Typical Drop-in Mass Air Flow (MAF) Sensor

Typical Drop-in Mass Air Flow (MAF) Sensor

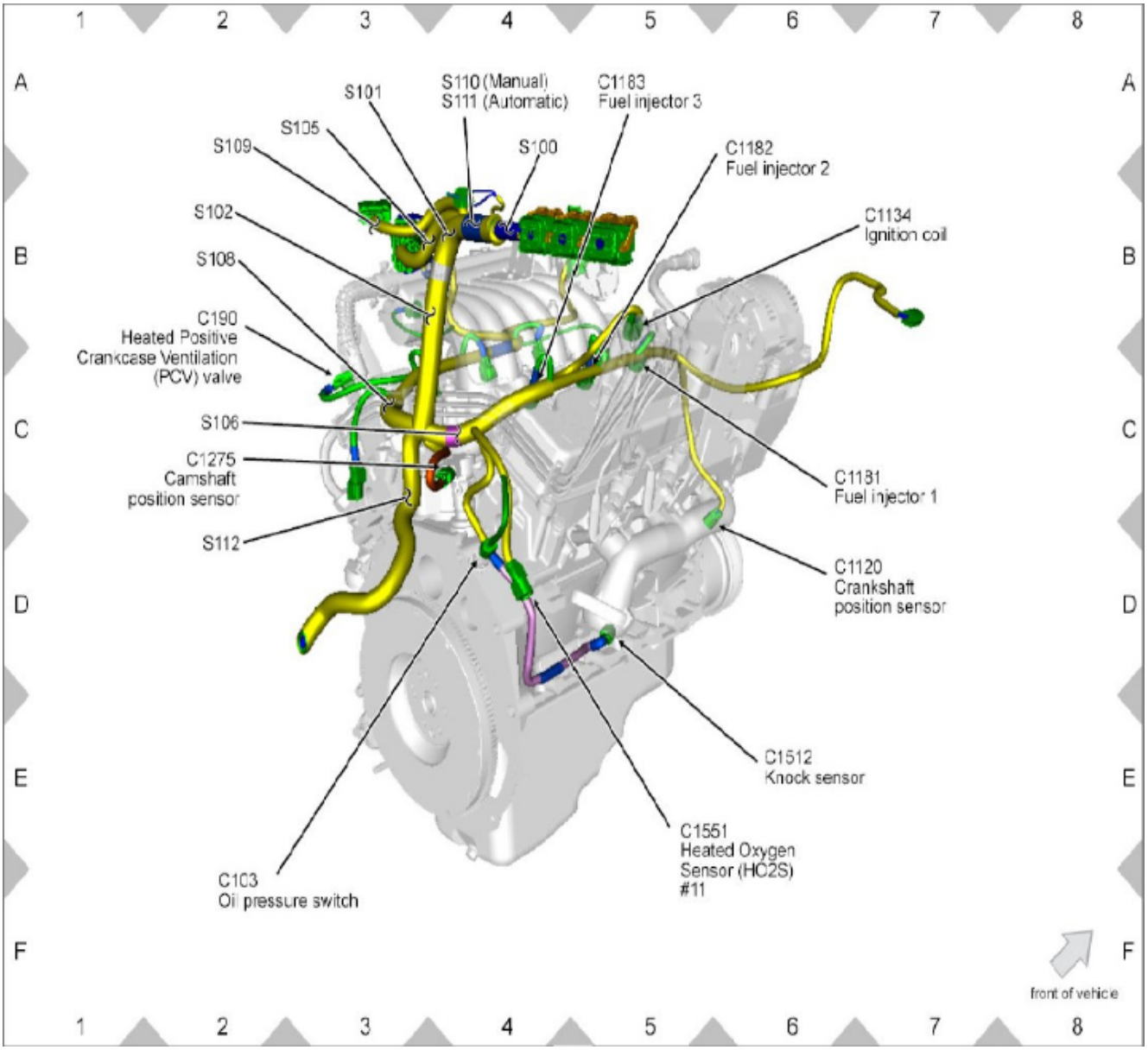
The MAF sensor uses a hot wire sensing element to measure the amount of air entering the engine. Air passing over the hot wire causes it to cool. This hot wire is maintained at 200°C (392°F) above the ambient temperature as measured by a constant cold wire. The current required to maintain the temperature of the hot wire is proportional to the mass air flow. The MAF sensor then outputs an analog voltage signal to the PCM proportional to the intake air mass. The PCM calculates the required fuel injector pulse width in order to provide the desired air/fuel ratio. This input is also used in determining transmission electronic pressure control (EPC), shift and torque converter clutch scheduling.

The MAF sensor is located between the air cleaner and the throttle body or inside the air cleaner assembly. Most MAF sensors have integrated bypass technology with an integrated intake air temperature (IAT) sensor. The hot wire electronic sensing element must be replaced as an assembly. Replacing only the element may change the air flow calibration.

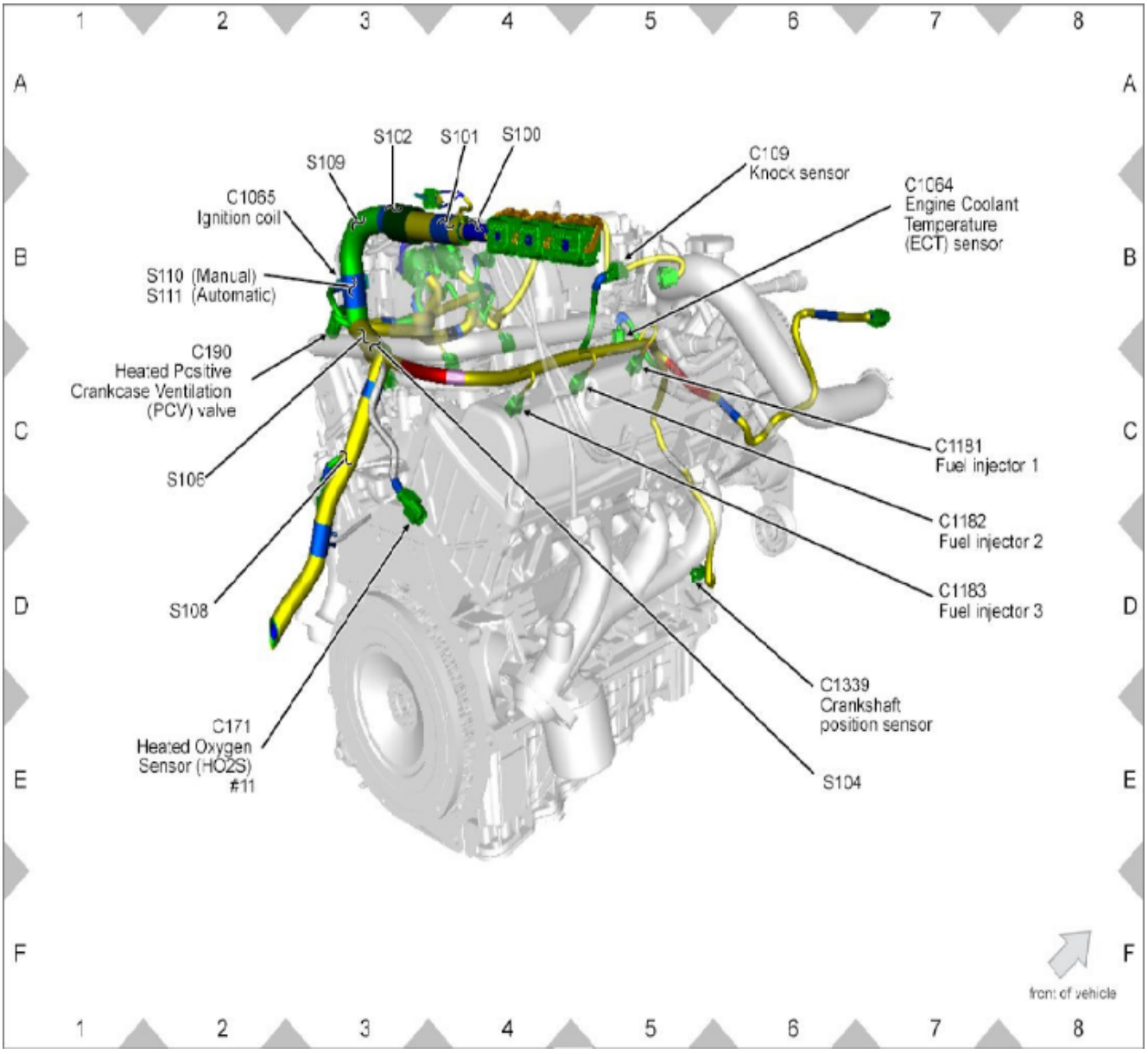


Knock Sensor: Locations

View 151-3


S101
S110 (Manual)
S111 (Automatic)
C1183
Fuel injector 3
S105
S109
S100
C1182
Fuel injector 2
S102
C1134
Ignition coil
S108
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
C1275
Camshaft
position sensor
S112
C1181
Fuel injector 1
C1120
Crankshaft
position sensor
C1512
Knock sensor
C1551
Heated Oxygen
Sensor (HO2S)
#11
C103
Oil pressure switch
front of vehicle

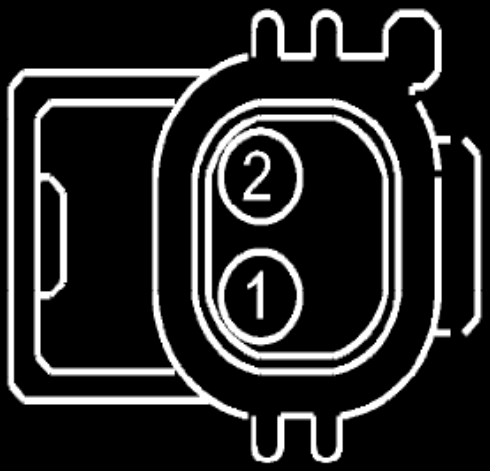
View 151-6


S102
S101
S100
S109
C1065
Ignition coil
S110 (Manual)
S111 (Automatic)
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
S108
C171
Heated Oxygen
Sensor (HO2S)
#11
C109
Knock sensor
C1064
Engine Coolant
Temperature
(ECT) sensor
C1181
Fuel injector 1
C1182
Fuel injector 2
C1183
Fuel injector 3
C1339
Crankshaft
position sensor
S104
front of vehicle

View 151-8

Connector: C108

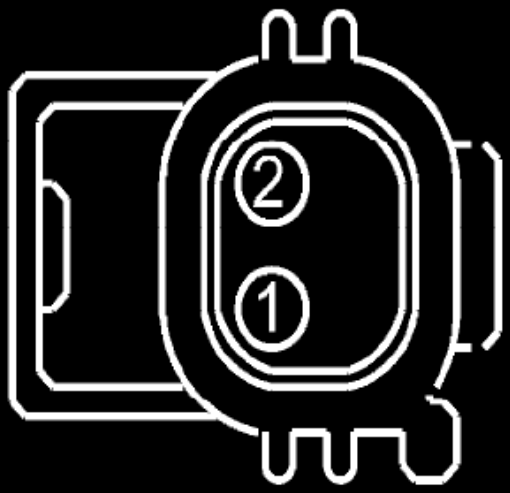
Description:	Harness:	Base Part #:
KNOCK SENSOR	12B637	12A699



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RE323 (WH-BN)	20	CTRL MOD. - POWERTRAIN # KNOCK SENSOR 1ST OR UNIQUE (KS1N) [KSL1-]	2.3L
2	VE801 (VT-OG)	20	SENSOR - KNOCK 1ST OR UNIQUE (KS1P) [KSL1+]	2.3L

Connector: C109

Description:	Harness:	Base Part #:
KNOCK SENSOR	12B637	12A699



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE801 (VT-OG)	20	SENSOR - KNOCK 1ST OR UNIQUE (KS1P) [KSL1+]	4.0L
2	RE323 (WH-BN)	20	CTRL MOD. - POWERTRAIN # KNOCK SENSOR 1ST OR UNIQUE (KS1N) [KSL1-]	4.0L

Knock Sensor: Diagrams

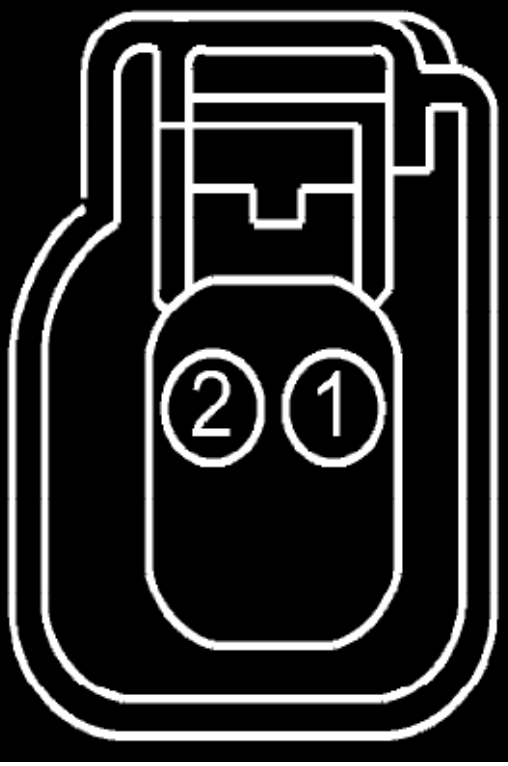
C108

C109

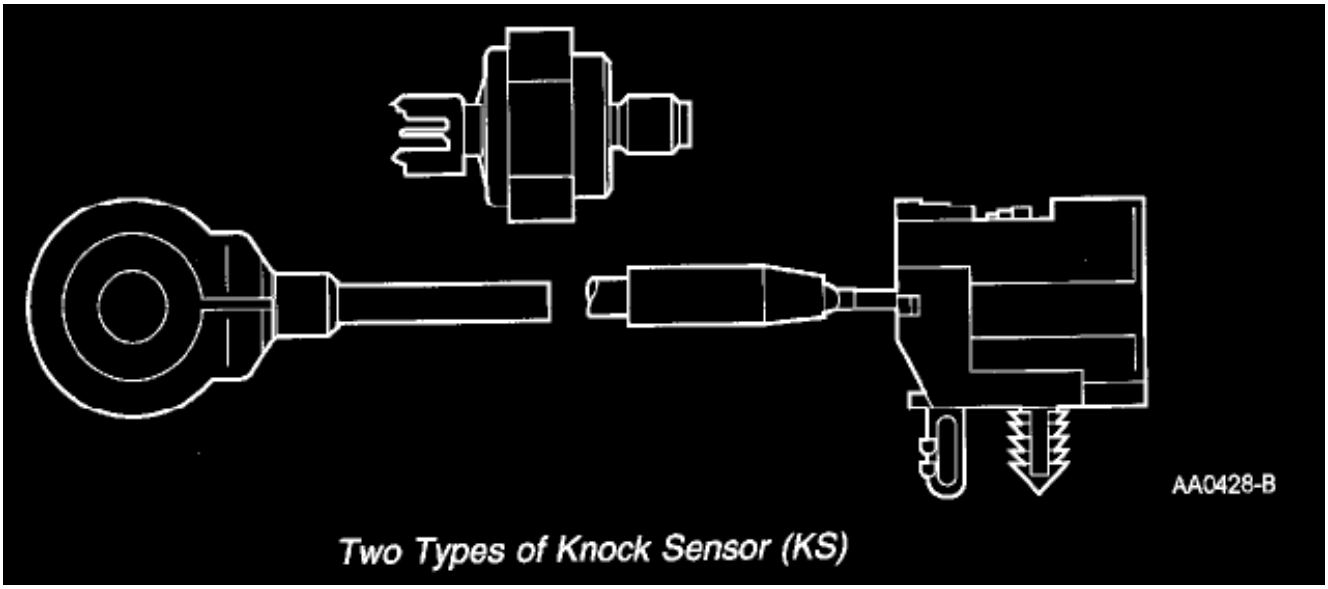
Connector: C1512

Description:	Harness:	Base Part #:
KNOCK SENSOR	12B637	12A699

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE801 (VT-OG)	20	SENSOR - KNOCK 1ST OR UNIQUE (KS1P) [KSL1+]	3.0L
2	RE323 (WH BN)	20	CTRL MOD. - POWERTRAIN # KNOCK SENSOR 1ST OR UNIQUE (KS1N) [KSL1-]	3.0L



C1512



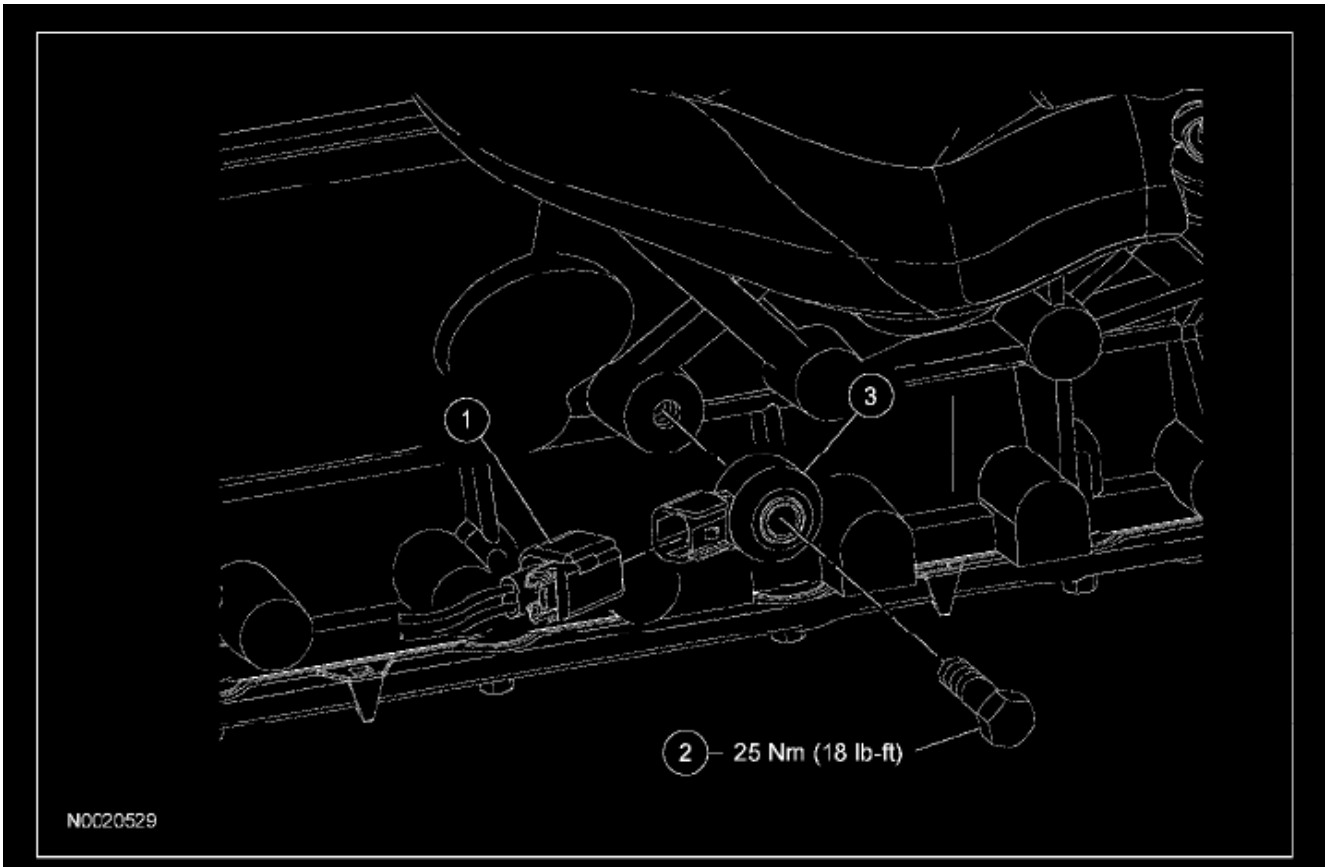
Two Types of Knock Sensor (KS)

Knock Sensor: Description and Operation

Knock Sensor (KS)

Two Types Of Knock Sensor (KS)

The KS is a tuned accelerometer on the engine which converts engine vibration to an electrical signal. The PCM uses this signal to determine the presence of engine knock and to retard spark timing.



Item	Part Number	Description
1	14A464	Knock sensor (KS) electrical connector (part of 12B637)
2	W5000225	KS bolt
3	12A699	KS

Knock Sensor: Service and Repair

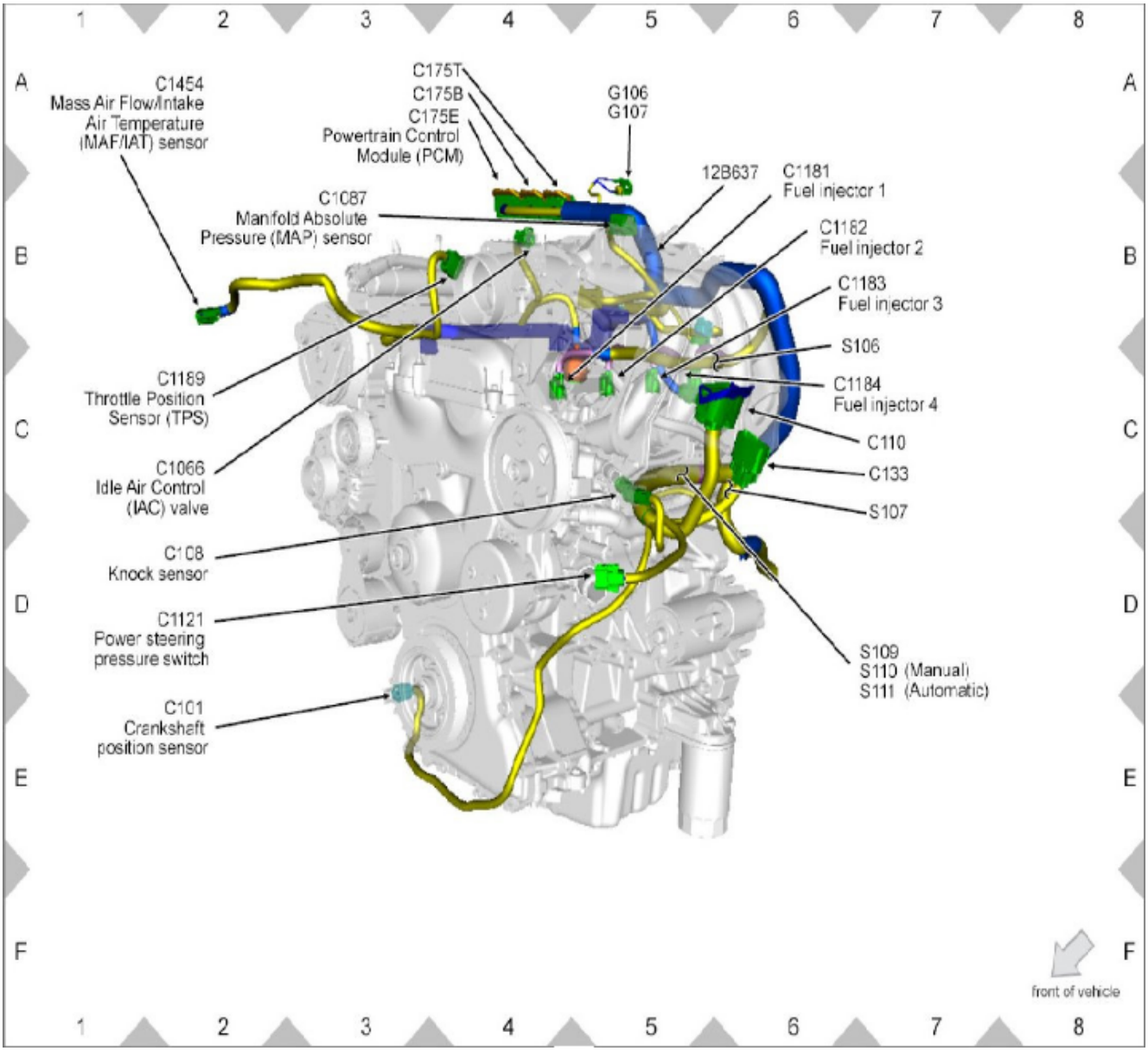
KNOCK SENSOR (KS)

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the knock sensor (KS) electrical connector. 3. Remove the bolt and the KS.

- To install, tighten to 25 Nm (18 lb-ft).

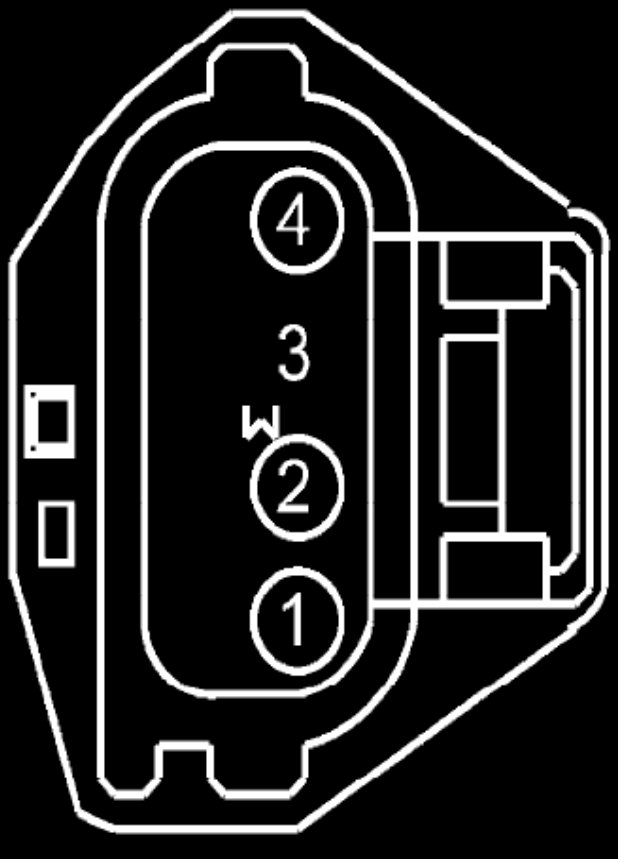
4. To install, reverse the removal procedure.


C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor
C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
12B637
C1181
Fuel injector 1
C1087
Manifold Absolute Pressure (MAP) sensor
C1182
Fuel injector 2
C1183
Fuel injector 3
S106
C1189
Throttle Position Sensor (TPS)
C1184
Fuel injector 4
C110
C1066
Idle Air Control (IAC) valve
C133
S107
C108
Knock sensor
C1121
Power steering pressure switch
S109
S110 (Manual)
S111 (Automatic)
C101
Crankshaft position sensor
front of vehicle

View 151-3

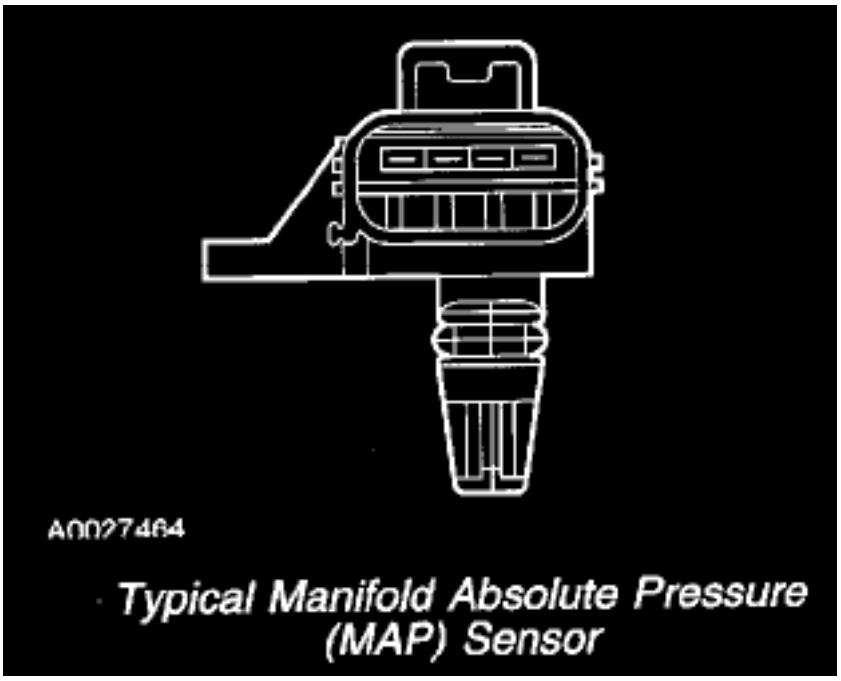
Connector: C1087

Description:	Harness:	Base Part #:
MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR	12B637	19F479



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE803 (BU-GN)	20	SENSOR - MANIFOLD ABSOLUTE PRESSURE (MAP)	2.3L
2	LE423 (GN-VT)	20	CTRL MOD. - POWERTRAIN # VOLTAGE REFERENCE ENGINE (VREF) (E-VREV)	2.3L
3	*	*	not used	
4	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN A)	2.3L

C1087

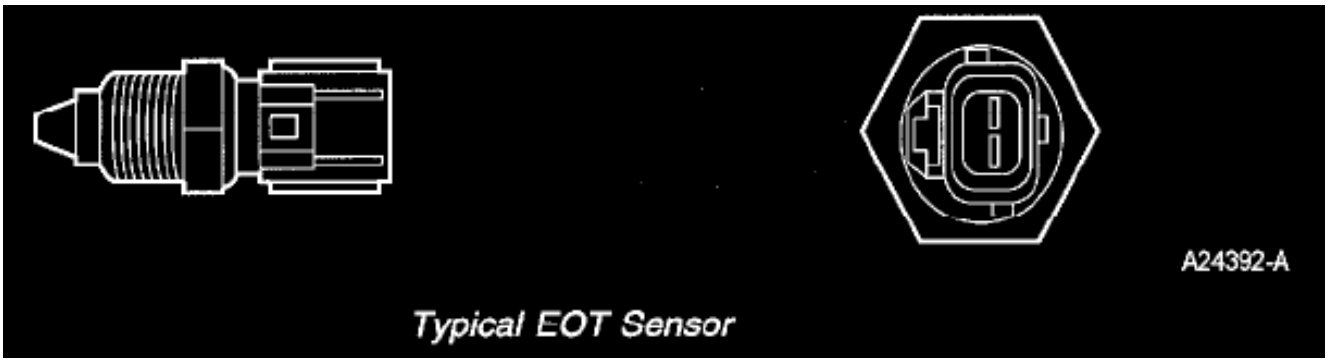


Manifold Pressure/Vacuum Sensor: Description and Operation

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR

Typical Manifold Absolute Pressure (MAP) Sensor

The MAP sensor measures intake manifold absolute pressure. The PCM uses information from the MAP sensor to measure how much exhaust gas is introduced into the intake manifold.



Typical EOT Sensor

Oil Temperature Sensor For ECM: Description and Operation

ENGINE OIL TEMPERATURE (EOT) SENSOR

Typical EOT Sensor

The EOT sensor is a thermistor device in which resistance changes with temperature. The electrical resistance of a thermistor decreases as the temperature increases and the resistance increases as the temperature decreases. The varying resistance changes the voltage drop across the sensor terminals and provides electrical signals to the PCM corresponding to temperature.

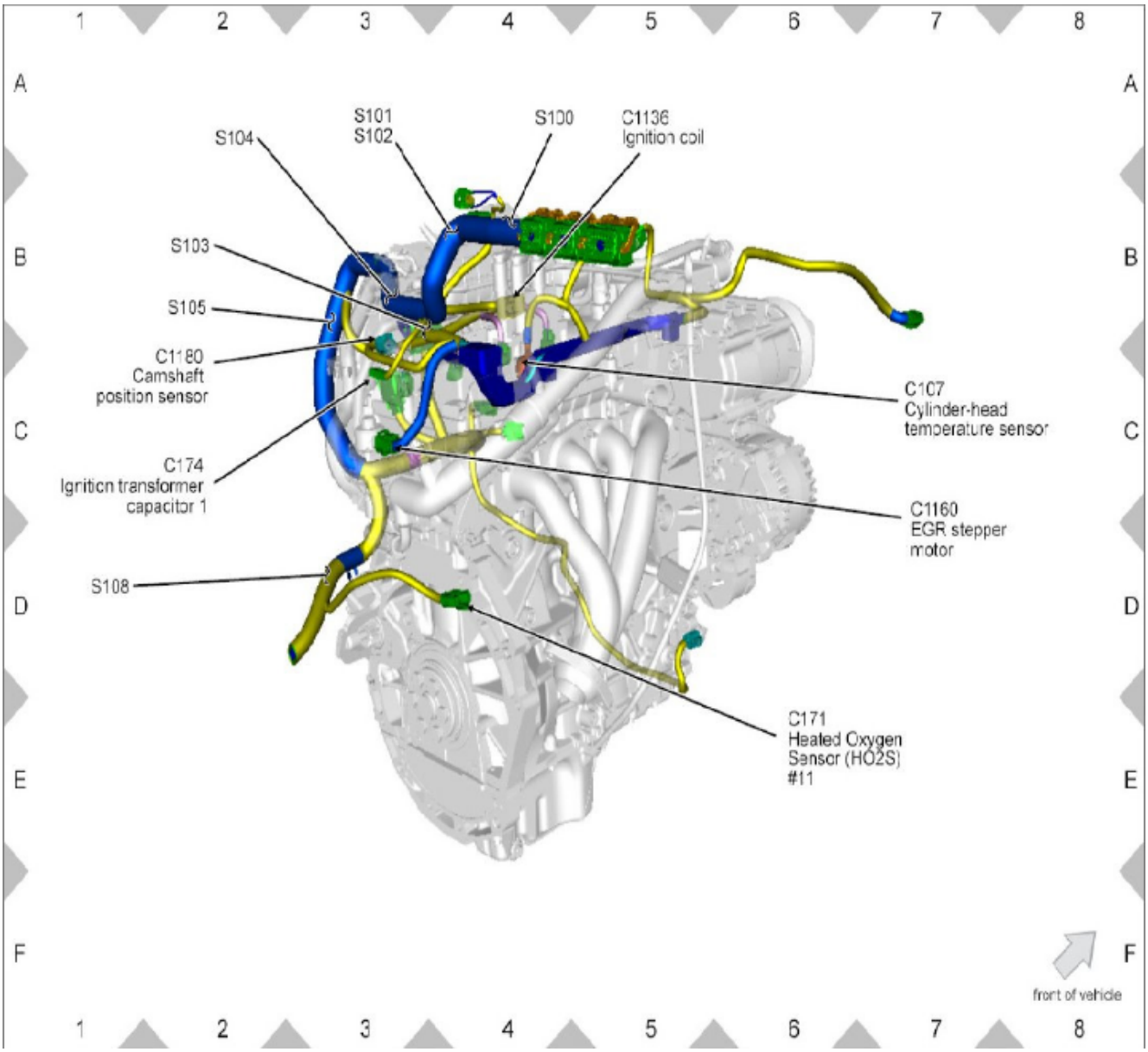
Thermistor-type sensors are considered passive sensors. A passive sensor is connected to a voltage divider network so that varying the resistance of the passive sensor causes a variation in total current flow. Voltage that is dropped across a fixed resistor in a series with the sensor resistor determines the voltage signal at the PCM. This voltage signal is equal to the reference voltage minus the voltage drop across the fixed resistor.

The EOT sensor measures the temperature of the engine oil. The sensor is typically threaded into the engine oil lubrication system. The PCM can use the EOT sensor input to determine the following:

- On variable camshaft timing (VCT) applications the EOT input is used to adjust the VCT control gains and logic for camshaft timing.

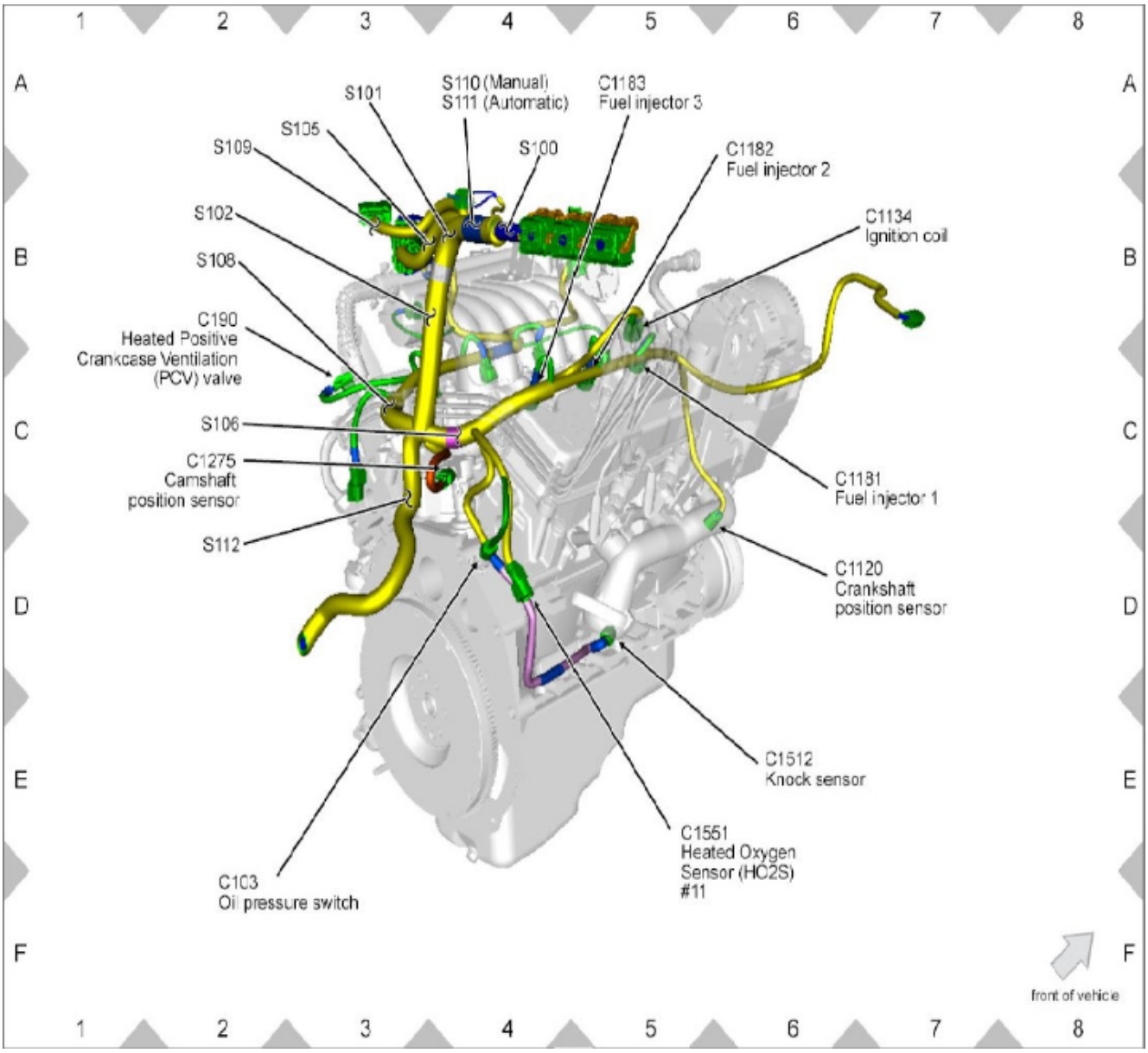
- The PCM can use EOT sensor input in conjunction with other PCM inputs to determine oil degradation.

- The PCM can use EOT sensor input to initiate a soft engine shutdown. To prevent engine damage from occurring as a result of high oil temperatures, the PCM has the ability to initiate a soft engine shutdown. Whenever engine RPM exceeds a calibrated level for a certain period of time, the PCM begins reducing power by disabling engine cylinders.

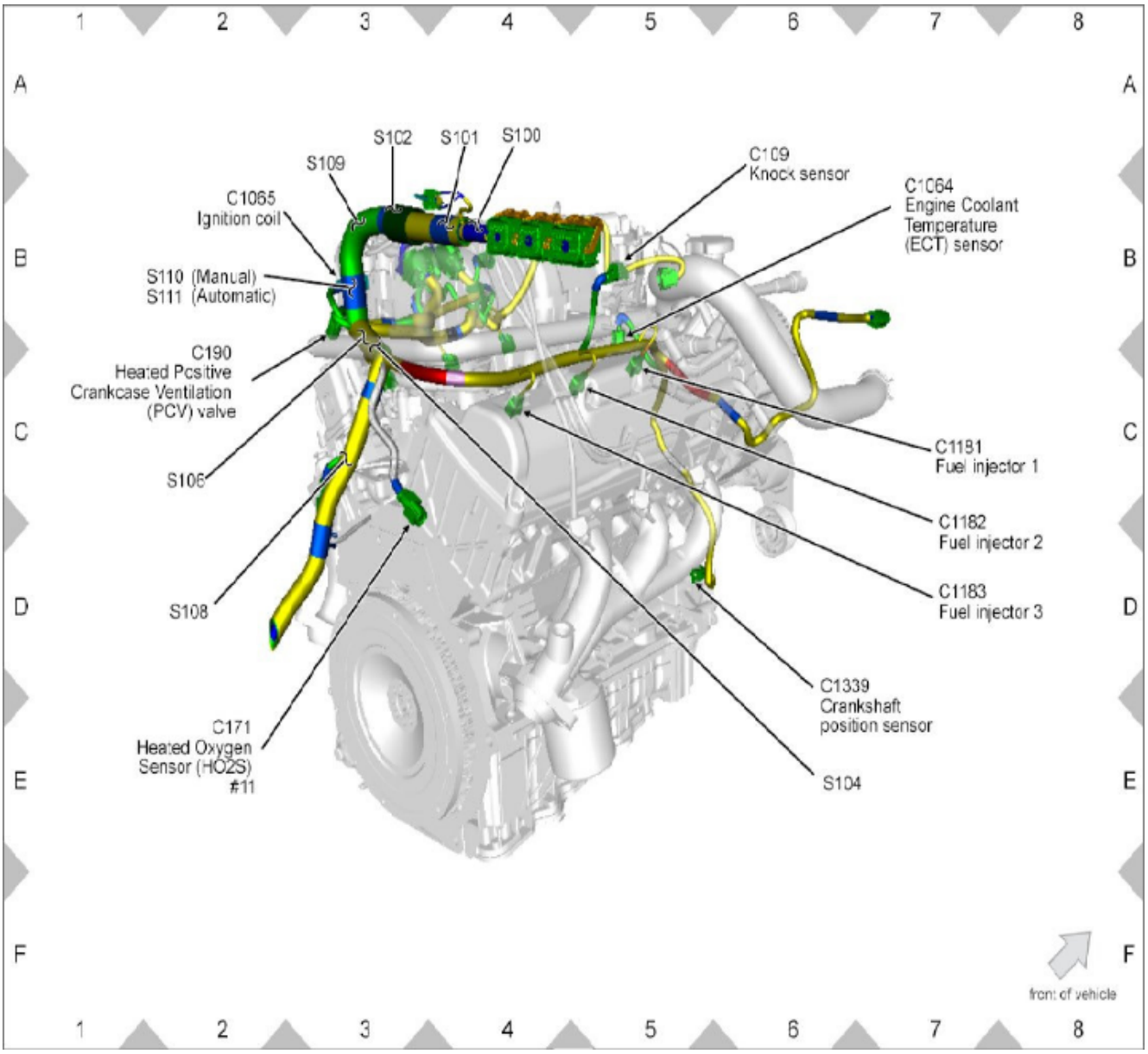


Oxygen Sensor: Locations Heated Oxygen Sensor (HO2S) #11

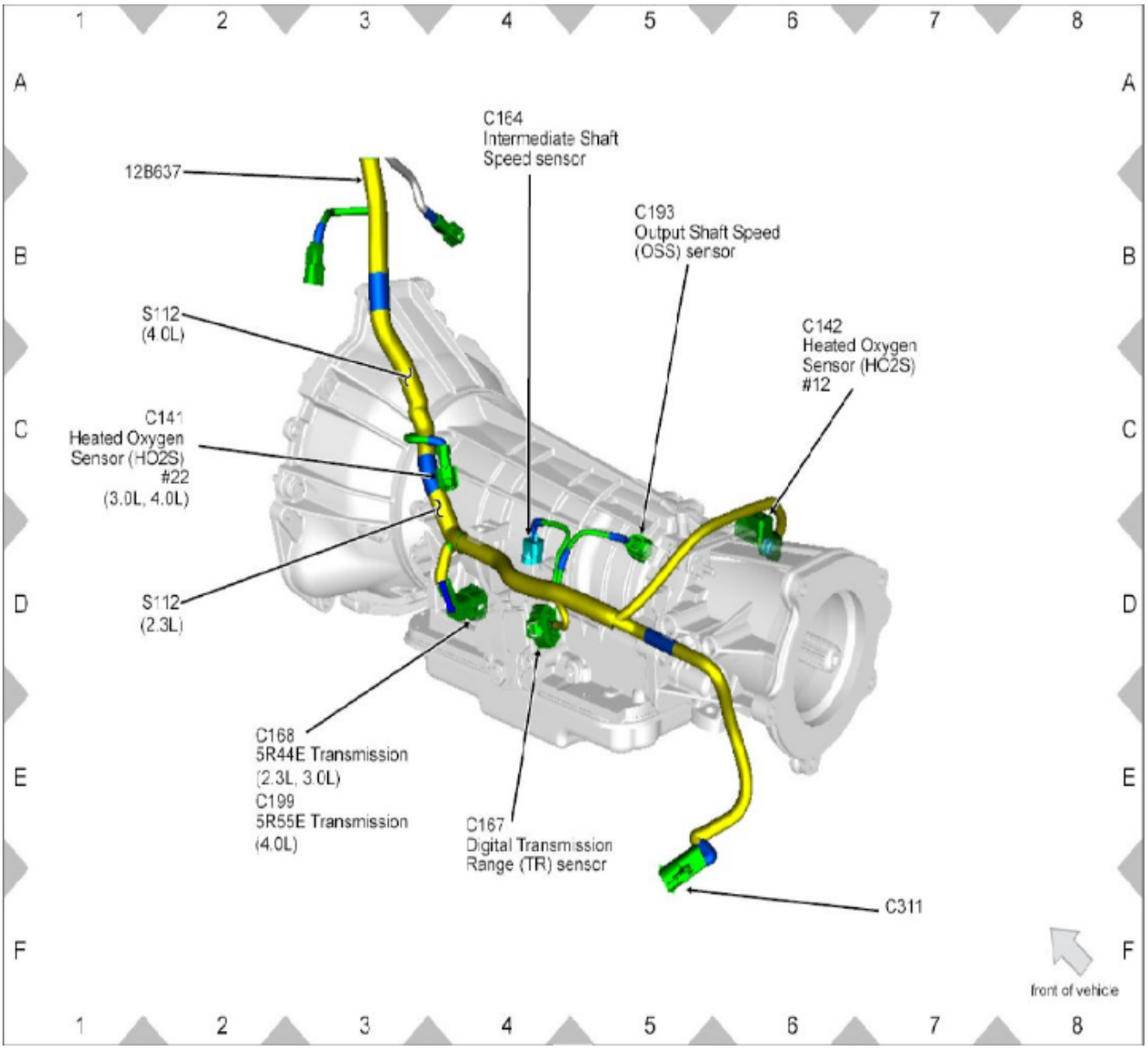
View 151-4


S101
S110 (Manual)
S111 (Automatic)
C1183
Fuel injector 3
S105
S109
S100
C1182
Fuel injector 2
S102
C1134
Ignition coil
S108
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
C1275
Camshaft
position sensor
S112
C1181
Fuel injector 1
C1120
Crankshaft
position sensor
C1512
Knock sensor
C1551
Heated Oxygen
Sensor (HO2S)
#11
C103
Oil pressure switch
front of vehicle

View 151-6

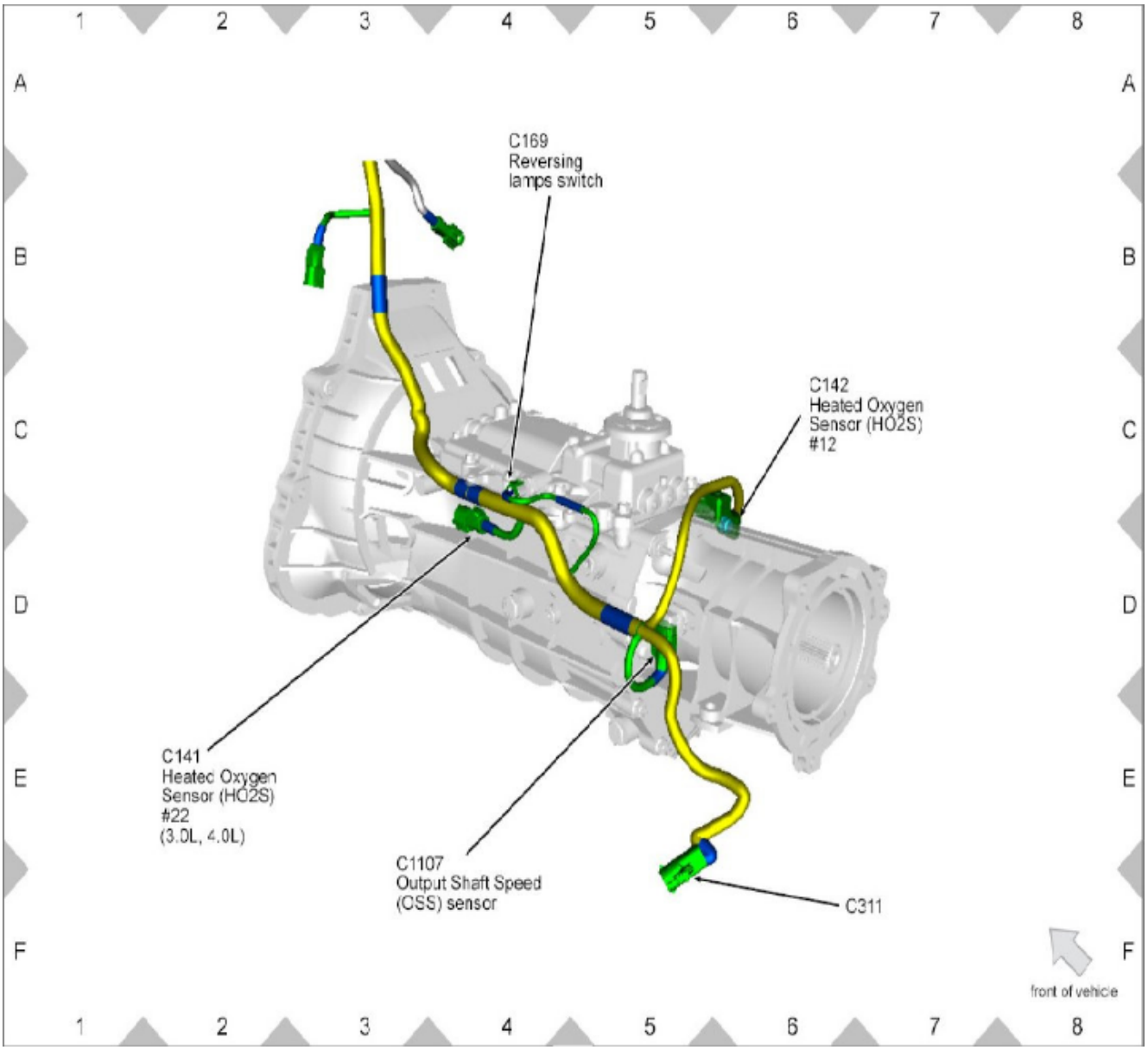

S102
S101
S100
S109
C1065
Ignition coil
S110 (Manual)
S111 (Automatic)
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
S108
C171
Heated Oxygen
Sensor (HO2S)
#11
C109
Knock sensor
C1064
Engine Coolant
Temperature
(ECT) sensor
C1181
Fuel injector 1
C1182
Fuel injector 2
C1183
Fuel injector 3
C1339
Crankshaft
position sensor
S104
front of vehicle

View 151-8

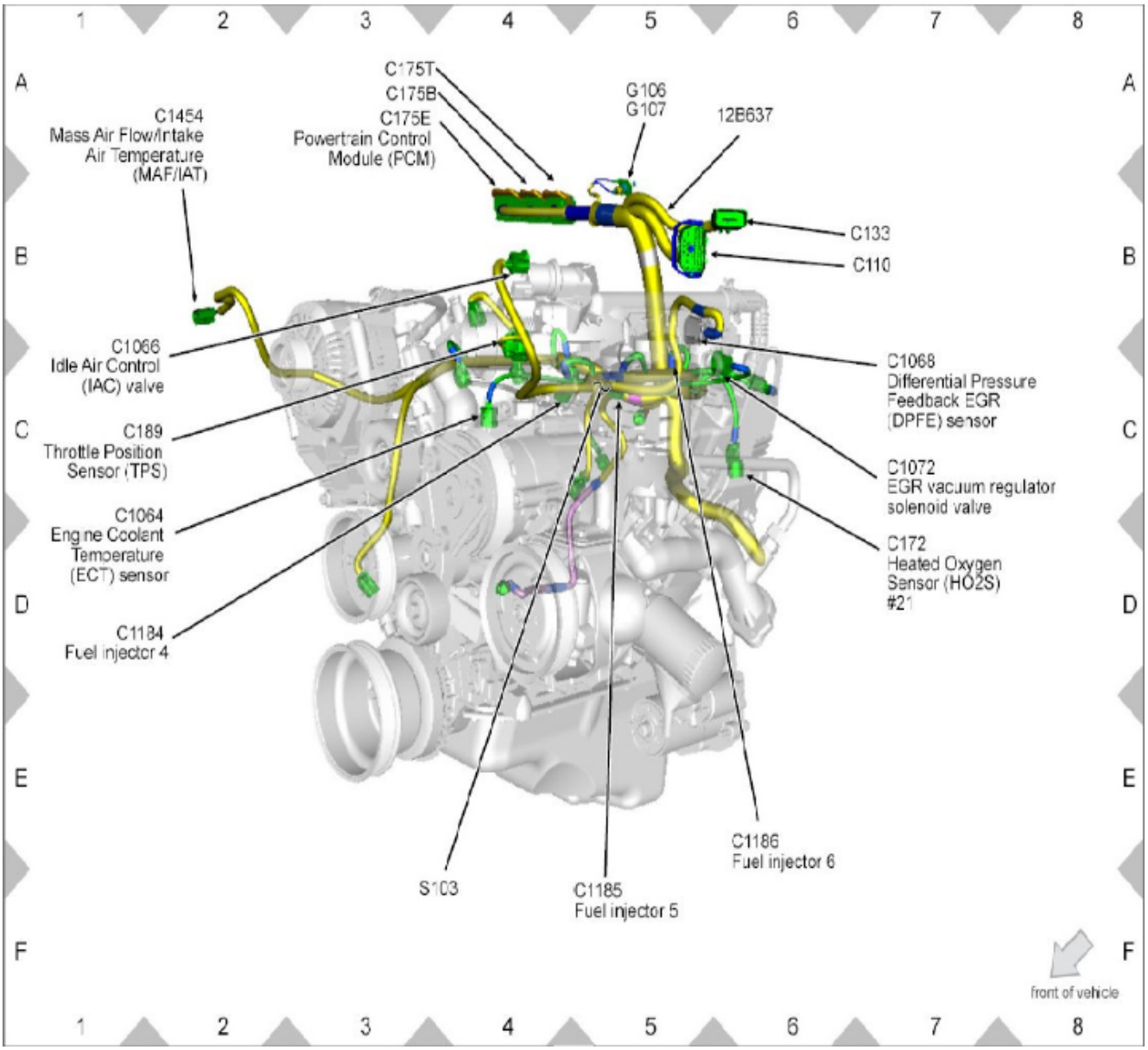


Oxygen Sensor: Locations Heated Oxygen Sensor (HO2S) #12

View 151-10

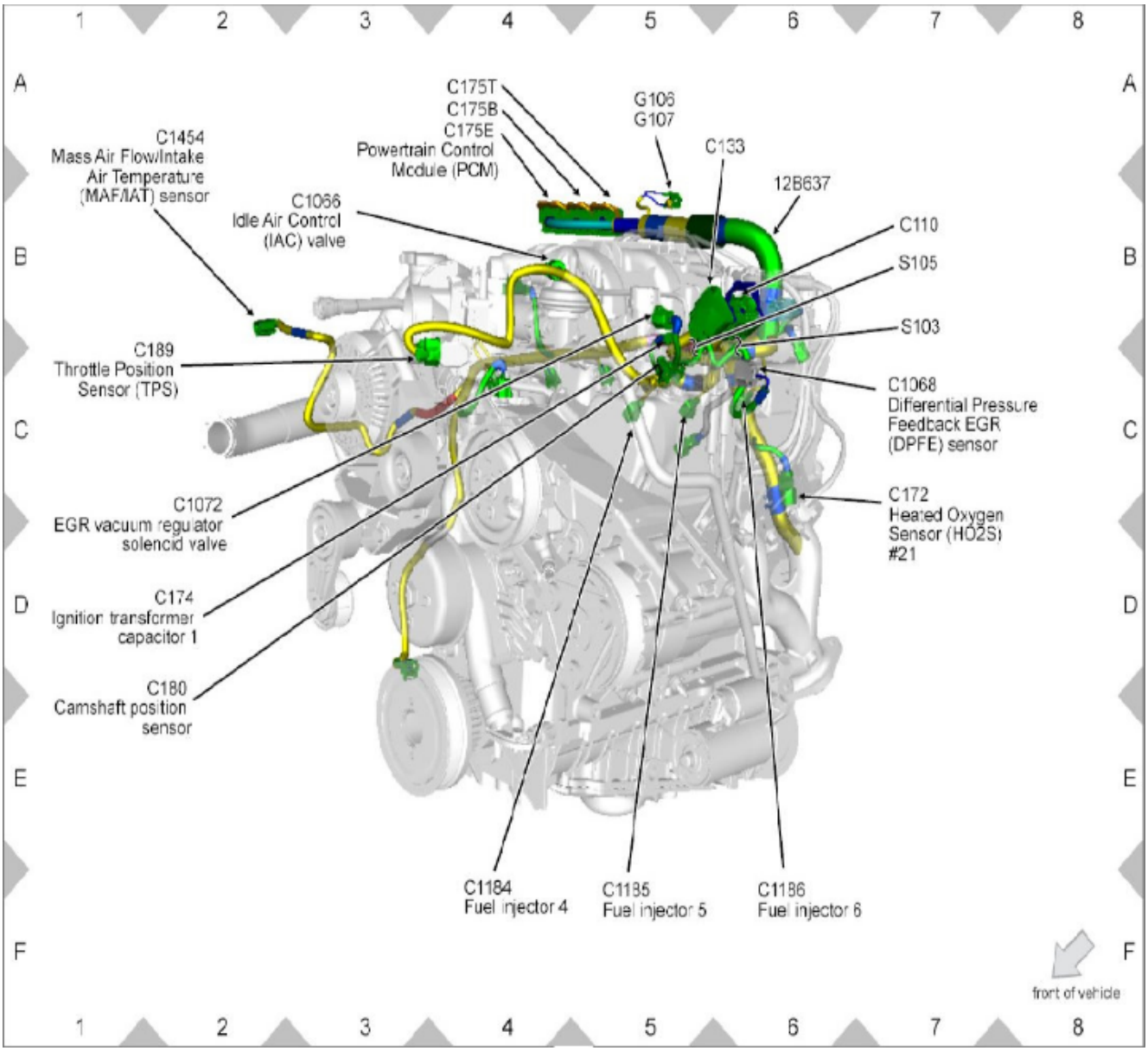

C169
Reversing
lamps switch
C142
Heated Oxygen
Sensor (HO2S)
#12
C141
Heatec Oxygen
Sensor (HO2S)
#22
(3.0L, 4.0L)
C1107
Output Shaft Speed
(CSS) sensor
C311
front of vehicle

View 151-9

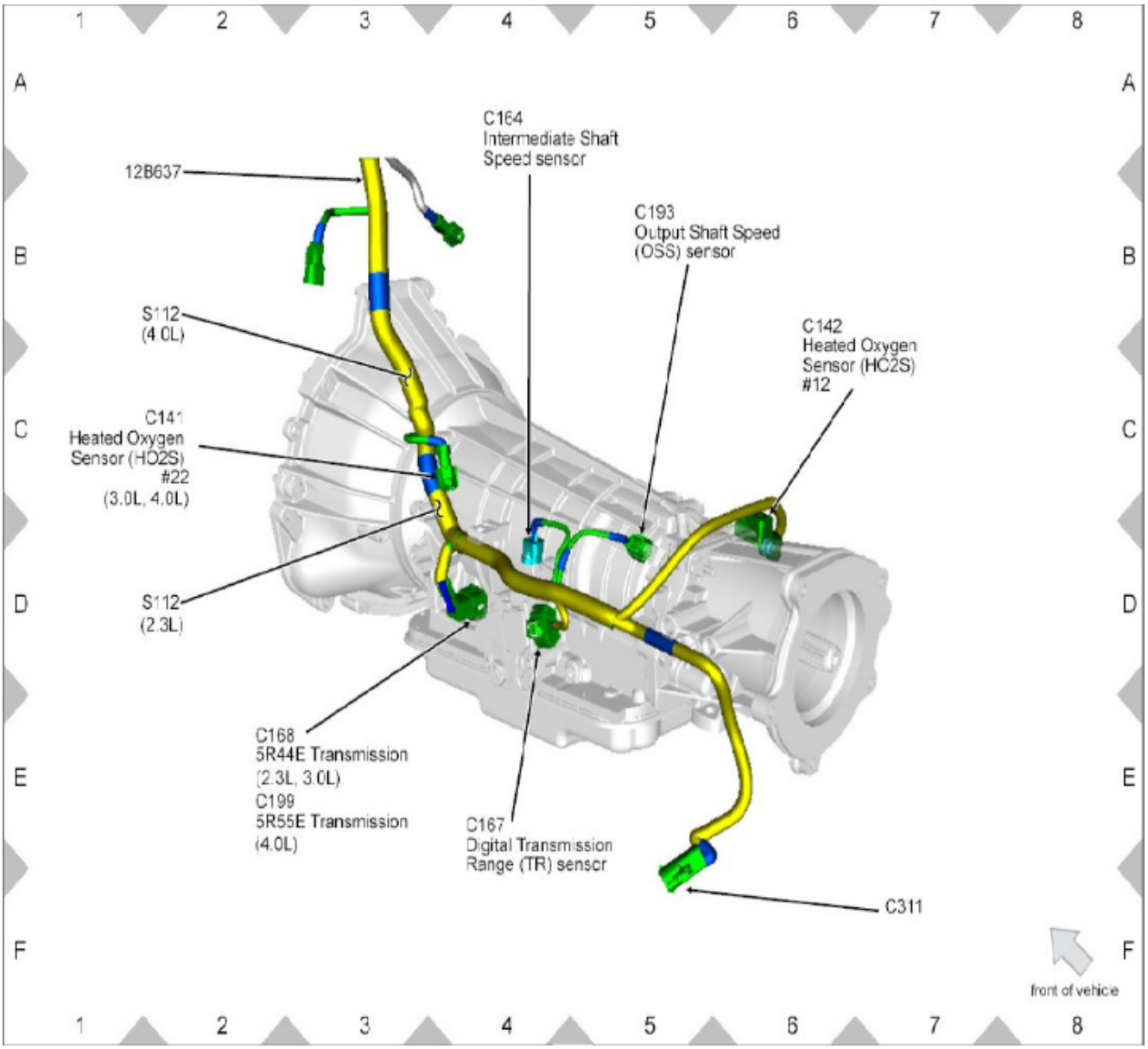


Oxygen Sensor: Locations Heated Oxygen Sensor (HO2S) #21

View 151-5

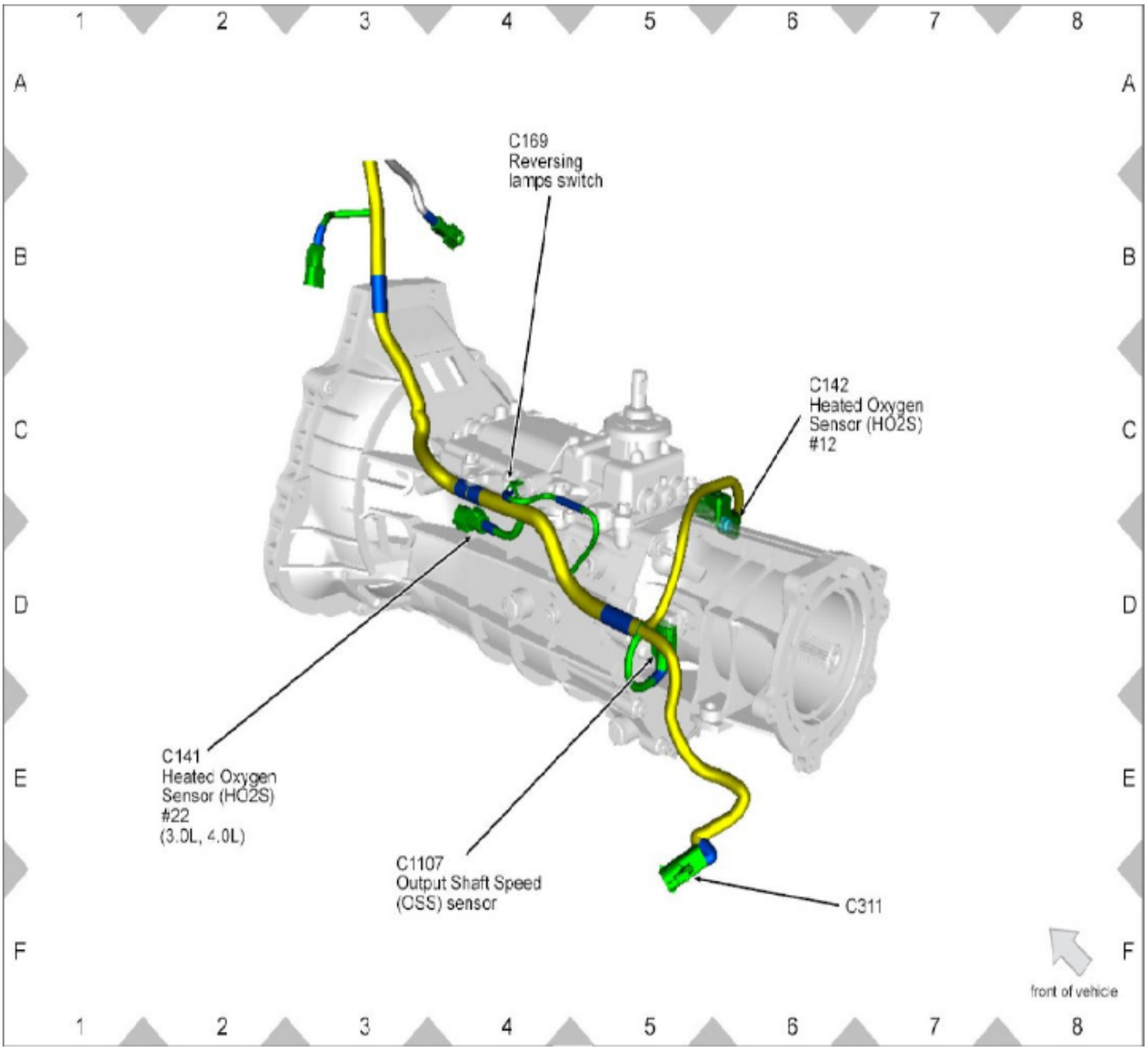

C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
C133
12B637
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor
C1066
Idle Air Control (IAC) valve
C110
S105
S103
C189
Throttle Position Sensor (TPS)
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
C174
Ignition transformer capacitor 1
C180
Camshaft position sensor
C1184
Fuel injector 4
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-7



Oxygen Sensor: Locations Heated Oxygen Sensor (HO2S) #22

View 151-10


C169
Reversing
lamps switch
C142
Heated Oxygen
Sensor (HO2S)
#12
C141
Heatec Oxygen
Sensor (HO2S)
#22
(3.0L, 4.0L)
C1107
Output Shaft Speed
(CSS) sensor
C311
front of vehicle

View 151-9

Connector: C141

Description:	Harness:	Base Part #:
HEATED OXYGEN SENSOR (HO2S) #22	12B637	9G444

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE234 (BU-WH)	18	CTRL MOD. - POWERTRAIN # HEATER OXYGEN SEN. POST CAT. 2ND (HTR22)	3.0L, 4.0L
2	CBB43 (GY)	18	FUSE - 43 OR CIRCUIT BREAKER	3.0L, 4.0L
3	VE733 (WH)	18	SENSOR - HEATED OXYGEN POST CAT. 2ND HO2S22)	3.0L, 4.0L
4	RE406 (GY-VT)	18	CTRL MOD. - POWERTRAIN # SIGNAL RETURN TRANSMISSION (T-SIGRTN) (SIGRTN-B)	3.0L, 4.0L

C141

Connector: C142

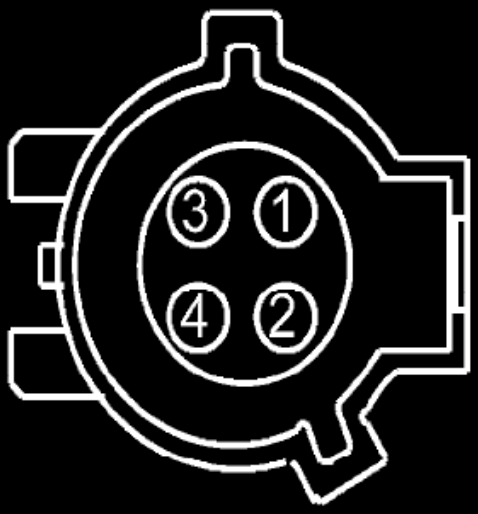
Description:	Harness:	Base Part #:
HEATED OXYGEN SENSOR (HO2S) #12	12B637	9G444

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE233 (WH-OG)	18	CTRL MOD. - POWERTRAIN # HEATER OXYGEN SEN. POST CAT. 1ST OR UNIQUE (HTR12)	
2	CBB43 (GY)	18	FUSE - 43 OR CIRCUIT BREAKER	
3	VE731 (YE-GN)	18	SENSOR - HEATED OXYGEN POST CAT. 1ST OR UNIQUE (HO2S12)	
4	RE406 (GY-VT)	18	CTRL MOD. - POWERTRAIN # SIGNAL RETURN TRANSMISSION (T-SIGRTN) (SIGRTN-B)	

C142

Connector: C171

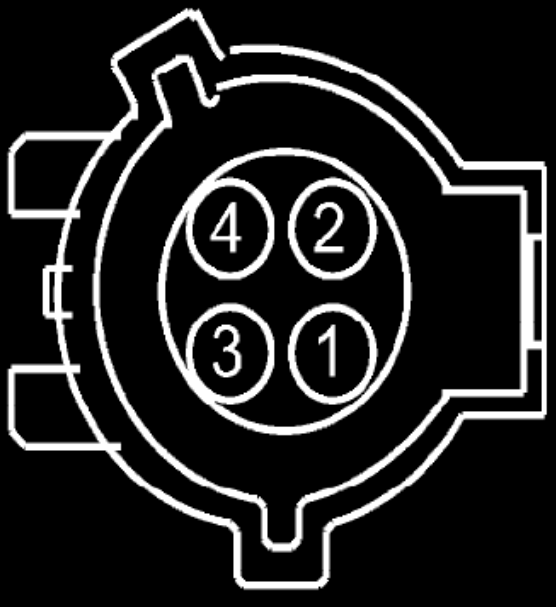
Description:	Harness:	Base Part #:
HEATED OXYGEN SENSOR (HO2S) #11	12B637	9F472



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE235 (GN-BN)	18	CTRL MOD. - POWERTRAIN # HEATER OXYGEN SEN. PRE CAT. 1ST OR UNIQUE (HTR11)	2.3L, 4.0L
2	CBB43 (GY)	18	FUSE - 43 OR CIRCUIT BREAKER	2.3L, 4.0L
3	VE735 (VT-GN)	18	SENSOR - HEATED OXYGEN PRE CAT. 1ST OR UNIQUE (HO2S11)	2.3L, 4.0L
4	RE405 (GN-WH)	18	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	2.3L, 4.0L

Connector: C1551

Description:	Harness:	Base Part #:
HEATED OXYGEN SENSOR (HO2S) #11	12B637	9F472



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBB43 (GY)	18	FUSE - 43 OR CIRCUIT BREAKER	3.0L
2	CE235 (GN-BN)	18	CTRL MOD. - POWERTRAIN # HEATER OXYGEN SEN. PRE CAT. 1ST OR UNIQUE (HTR11)	3.0L
3	RE405 (GN-WH)	18	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E SIGRTN) (SIGRTN-A)	3.0L
4	VE735 (VT-GN)	18	SENSOR - HEATED OXYGEN PRE CAT. 1ST OR UNIQUE (HO2S11)	3.0L

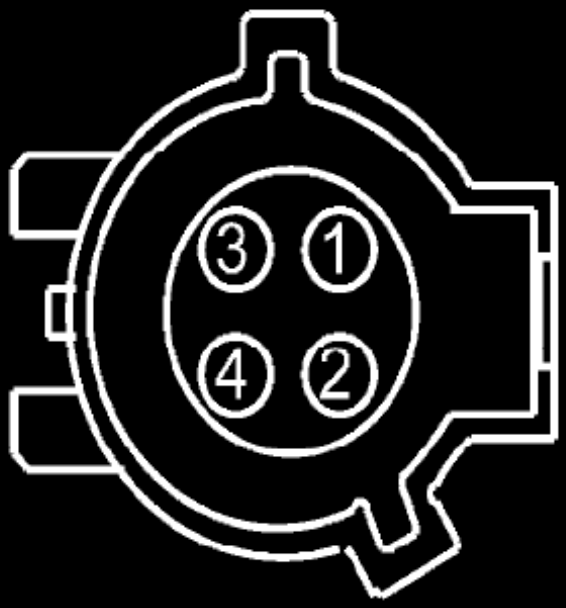
Oxygen Sensor: Diagrams Heated Oxygen Sensor (HO2S) #11

C171

C1551

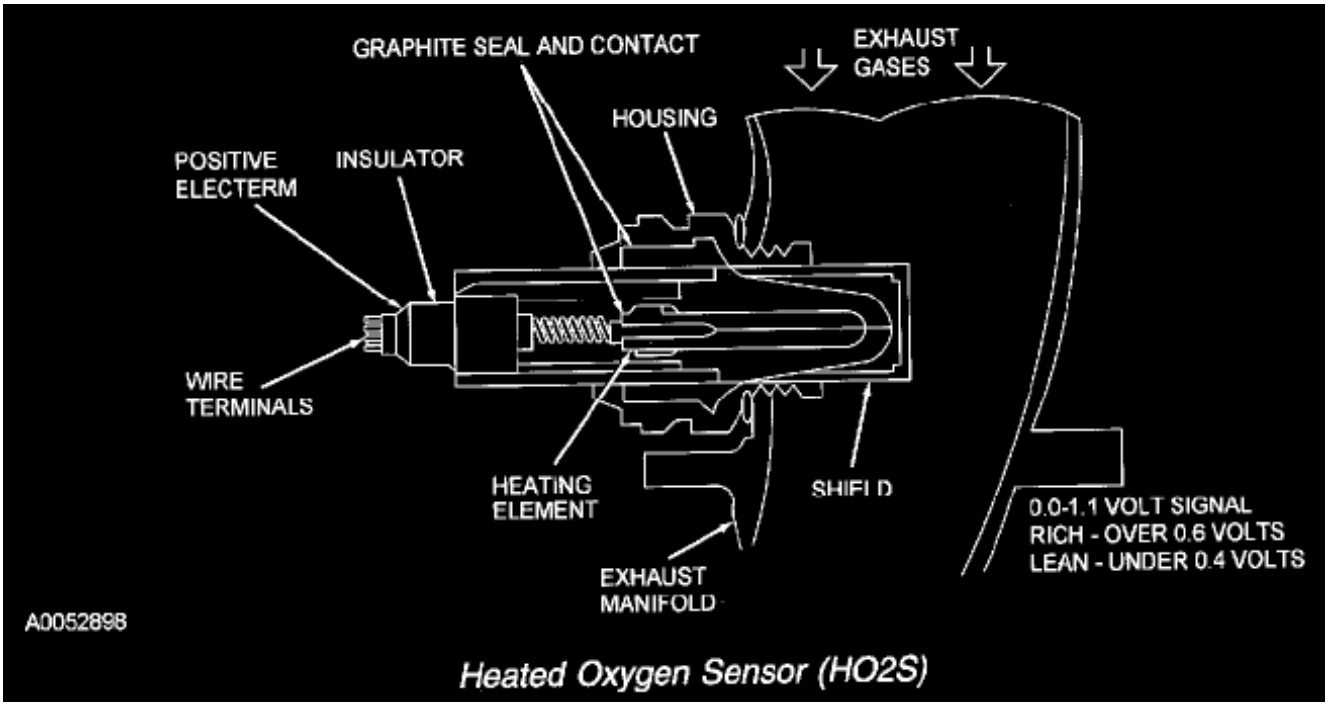
Connector: C172

Description:	Harness:	Base Part #:
HEATED OXYGEN SENSOR (HO2S) #21	12B637	9F472



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE236 (GY-VT)	18	CTRL MOD. - POWERTRAIN # HEATER OXYGEN SEN. PRE CAT. 2ND (HTR21)	3.0L, 4.0L
2	CBB43 (GY)	18	FUSE - 43 OR CIRCUIT BREAKER	3.0L, 4.0L
3	VE737 (WH-BU)	18	SENSOR - HEATED OXYGEN PRE CAT. 2ND (HO2S21)	3.0L, 4.0L
4	RE405 (GN-WH)	18	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	3.0L, 4.0L

C172



Heated Oxygen Sensor (HO2S)

Oxygen Sensor: Description and Operation

Heated Oxygen Sensor (HO2S)

Heated Oxygen Sensor (HO2S)

The HO2S detects the presence of oxygen in the exhaust and produces a variable voltage according to the amount of oxygen detected. A high concentration of oxygen (lean air/fuel ratio) in the exhaust produces a voltage signal less than 0.4 volt. A low concentration of oxygen (rich air/fuel ratio) produces a voltage signal greater than 0.6 volt. The HO2S provides feedback to the PCM indicating air/fuel ratio in order to achieve a near stoichiometric air/fuel ratio of 14.7:1 during closed loop engine operation. The HO2S generates a voltage between 0.0 and 1.1 volts.

Embedded with the sensing element is the HO2S heater. The heating element heats the sensor to a temperature of 800°C (1,472°F). At approximately 300°C (572°F) the engine can enter closed loop operation. The VPWR circuit supplies voltage to the heater. The PCM turns the heater on by providing the ground when the correct conditions occur. The heater allows the engine to enter closed loop operation sooner. The use of this heater requires the HO2S heater control to be duty cycled, to prevent damage to the heater.

Universal HO2S

The universal HO2S, sometimes referred to as a wideband oxygen sensor, uses the typical HO2S combined with a current controller in the PCM to infer an air/fuel ratio relative to the stoichiometric air/fuel ratio. This is accomplished by balancing the amount of oxygen ions pumped in or out of a measurement chamber within the sensor. The typical HO2S within the universal HO2S is used to detect the oxygen content of the exhaust gas in the measurement chamber. The oxygen content inside the measurement chamber is maintained at the stoichiometric air/fuel ratio by pumping oxygen ions in and out of the measurement chamber. As the exhaust gasses get richer or leaner, the amount of oxygen that must be pumped in or out to maintain a stoichiometric air/fuel ratio in the measurement chamber varies in proportion to the air/fuel ratio. The amount of current required to

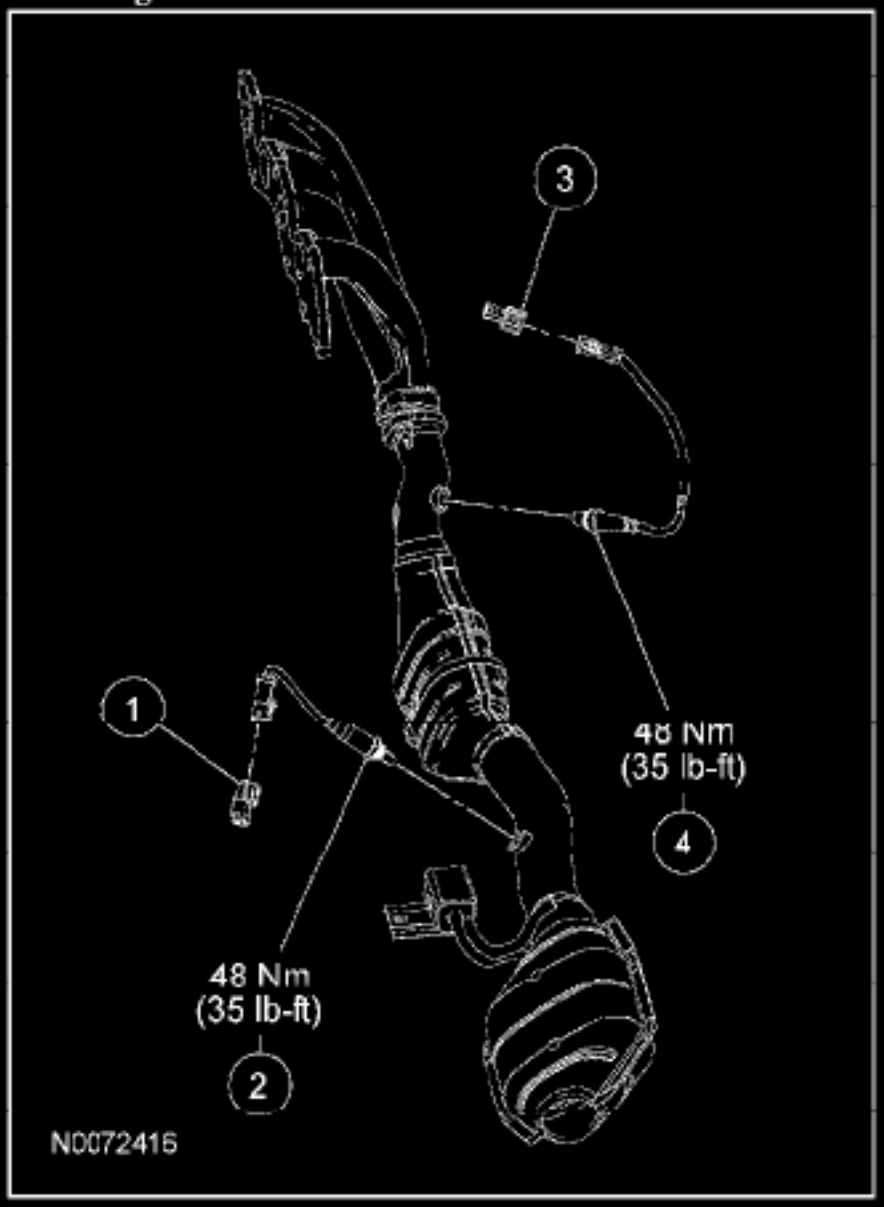
pump the oxygen ions in or out of the measurement chamber is used to measure the air/fuel ratio. The measured air/fuel ratio is actually the output from the current controller in the PCM and not a signal that comes directly from the sensor.

The universal HO2S also uses a self-contained reference chamber to make sure an oxygen differential is always present. The oxygen for the reference chamber is supplied by pumping small amounts of oxygen ions from the measurement chamber into the reference chamber. The universal HO2S does not need access to outside air.

Part to part variance is compensated for by placing a resistor in the connector. This resistor is used to trim the current measured by the current controller in the PCM.

Embedded with the sensing element is the universal H02S heater. The heater allows the engine to enter closed loop operation sooner. The heating element heats the sensor to a temperature of 780°C (1,436°F). The VPWR circuit supplies voltage to the heater. The PCM controls the heater on and off by providing the ground to maintain the sensor at the correct temperature for maximum accuracy.

2.3L Engines



Item	Part Number	Description
1	—	Catalyst monitor sensor electrical connector
2	9G444	Catalyst monitor sensor
3	—	Heated oxygen sensor (HO2S) electrical connector (part of 12B637)
4	9F472	HO2S

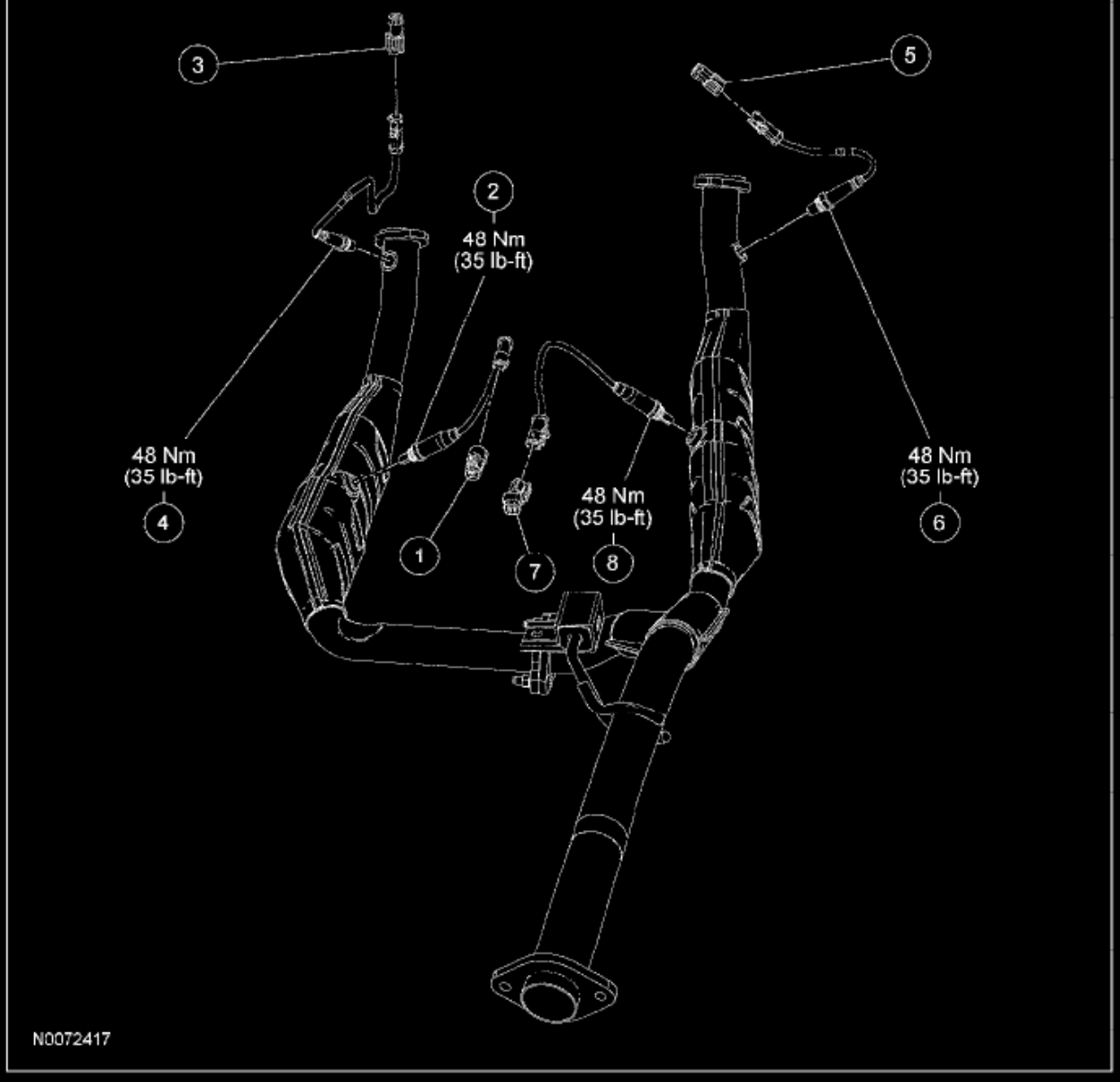
Oxygen Sensor: Service and Repair Heated Oxygen Sensor (HO2S)

HEATED OXYGEN SENSOR (HO2S)

Exploded View

2.3L Engines

3.0L Engines



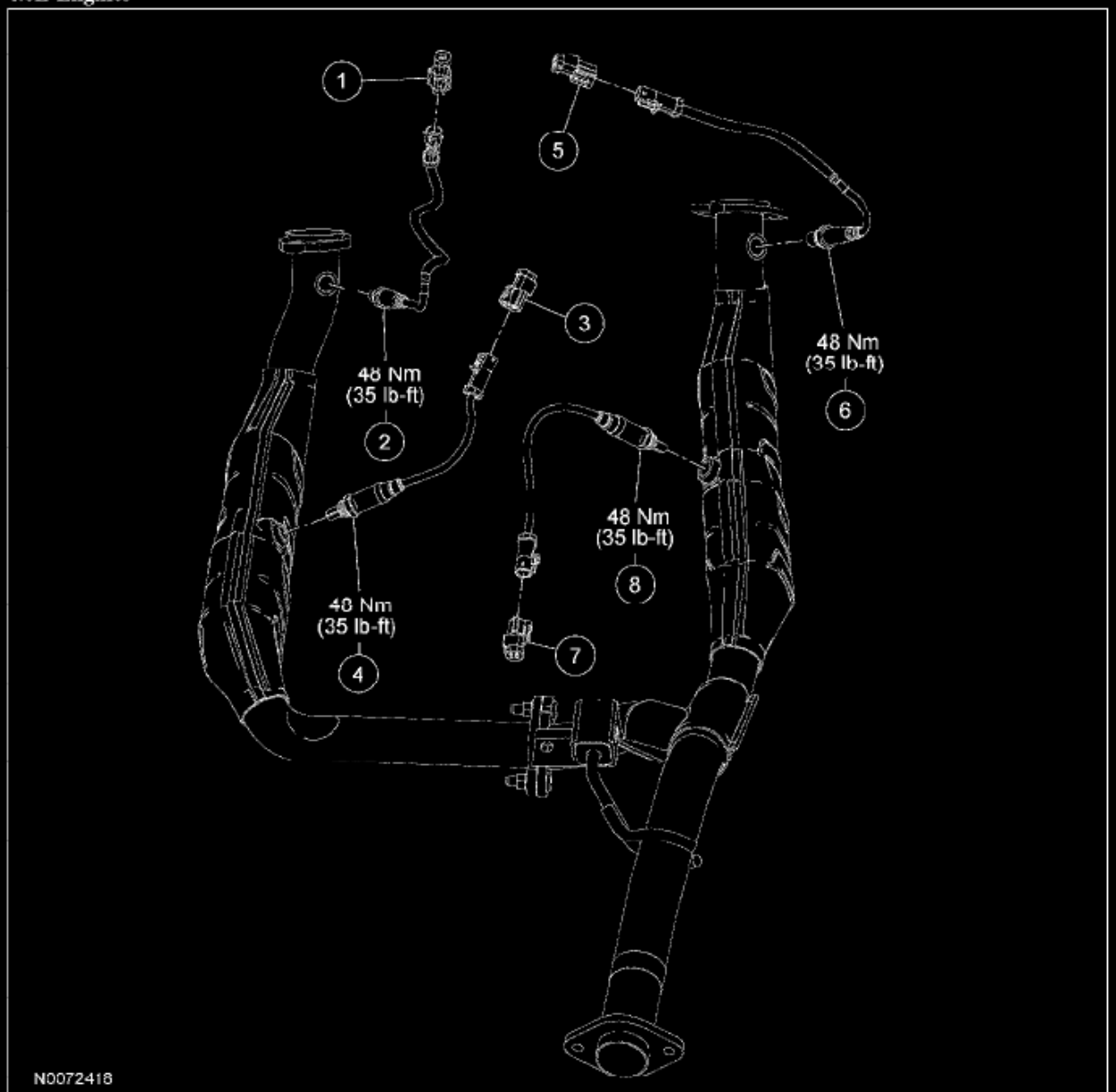
Item	Part Number	Description
1	—	Catalyst monitor sensor electrical connector (part of 14A464)
2	9G444	Catalyst monitor sensor
3	—	Heated oxygen sensor (HO2S) electrical connector (part of 12B637)
4	9F472	HO2S

(Continued)

Item	Part Number	Description
5	—	HO2S electrical connector (part of 12B637)
6	9F472	HO2S
7	—	Catalyst monitor sensor electrical connector (part of 14A464)
8	9G444	Catalyst monitor sensor

3.0L Engines

4.0L Engines



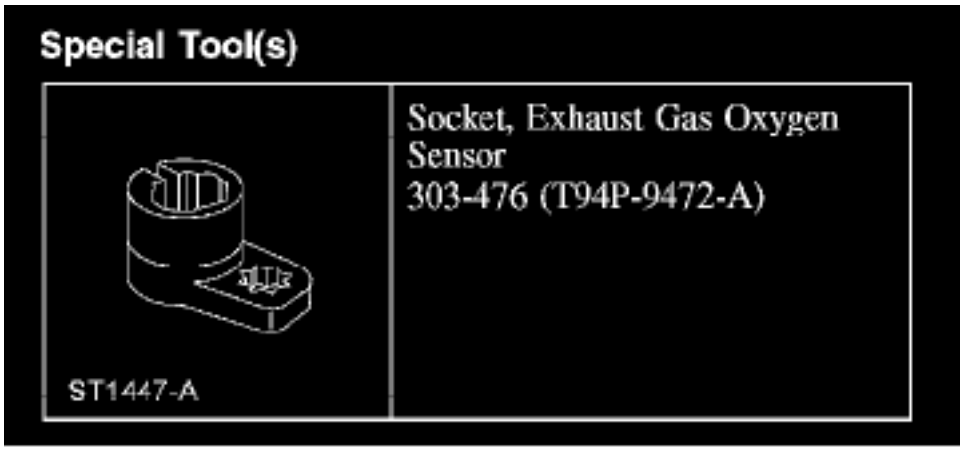
Item	Part Number	Description
1	—	Heated oxygen sensor (HO2S) electrical connector (part of 12B637)
2	9F472	HO2S
3	—	Catalyst monitor sensor electrical connector (part of 14A464)
4	9G444	Catalyst monitor sensor

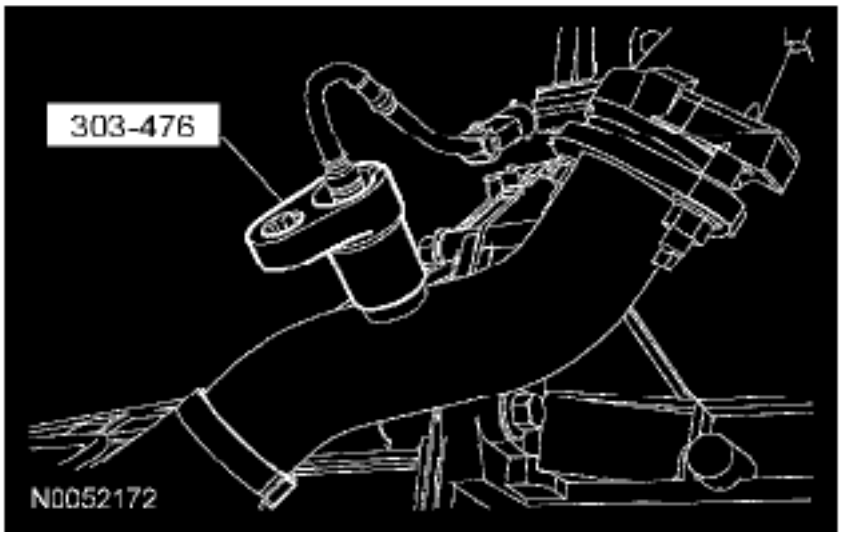
(Continued)

Item	Part Number	Description
5	—	HO2S electrical connector (part of 12B637)
6	9F472	HO2S
7	—	Catalyst monitor sensor electrical connector (part of 14A464)
8	9G444	Catalyst monitor sensor

4.0L Engines

Special Tool(s)





Special Tool(s)

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist.

2. NOTE: If necessary, lubricate the heated oxygen sensor (HO2S) with lock lubricant to assist in removal.

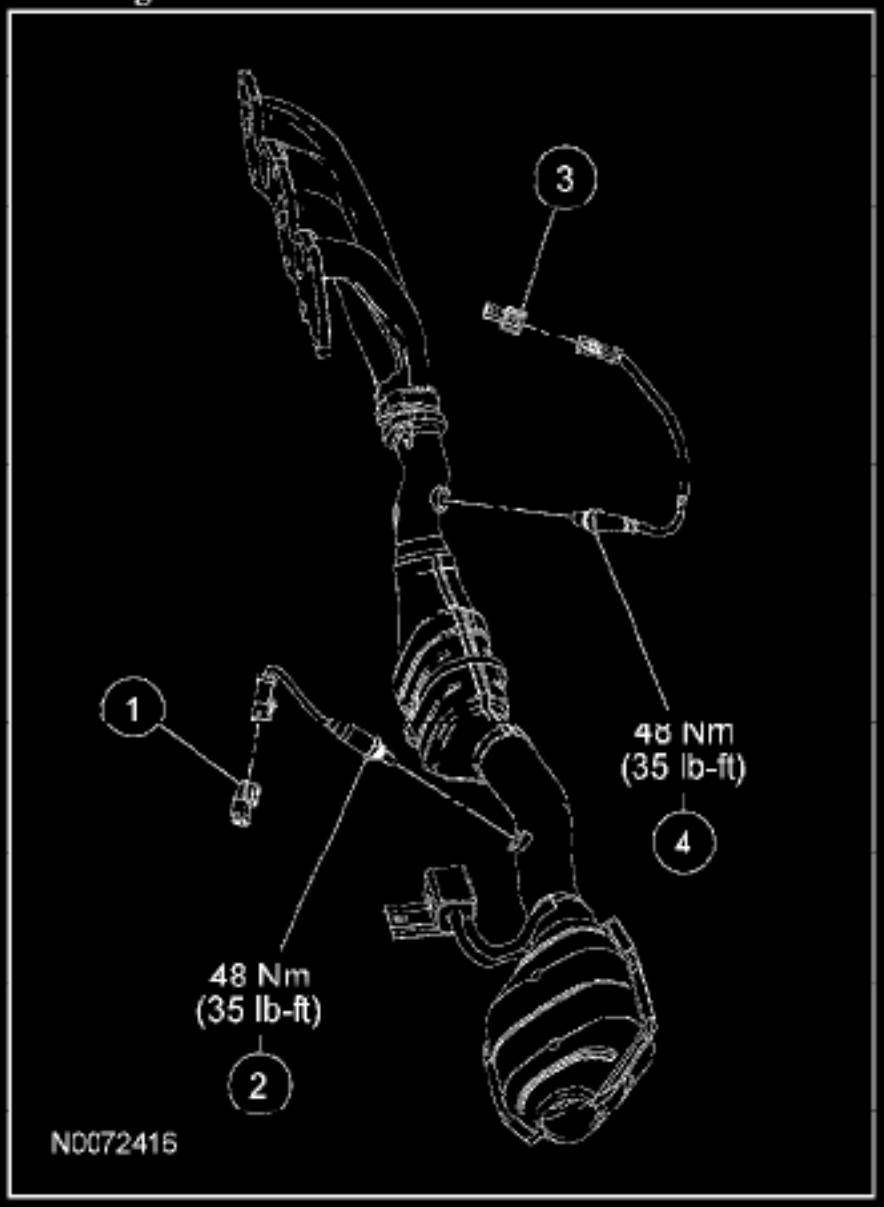
Using the special tool, remove the HO2S. -

To install, tighten to 48 Nm (35 lb-ft).

3. NOTE: Apply a light coat of anti-seize lubricant to the threads of the HO2S.

To install, reverse the removal procedure.

2.3L Engines



Item	Part Number	Description
1	—	Catalyst monitor sensor electrical connector
2	9G444	Catalyst monitor sensor
3	—	Heated oxygen sensor (HO2S) electrical connector (part of 12B637)
4	9F472	HO2S

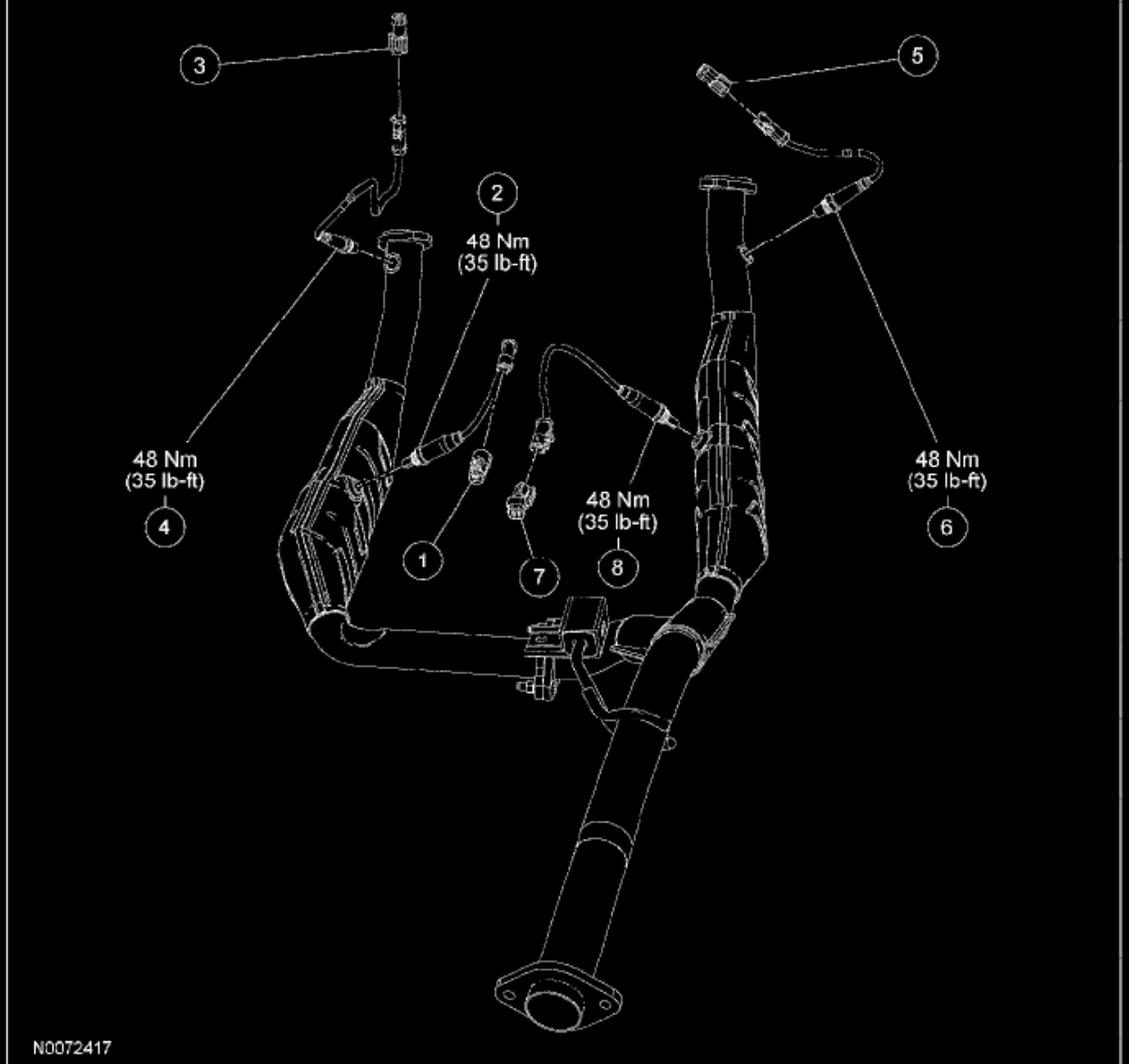
Oxygen Sensor: Service and Repair Catalyst Monitor Sensor

CATALYST MONITOR SENSOR

Exploded View

2.3L Engines

3.0L Engines



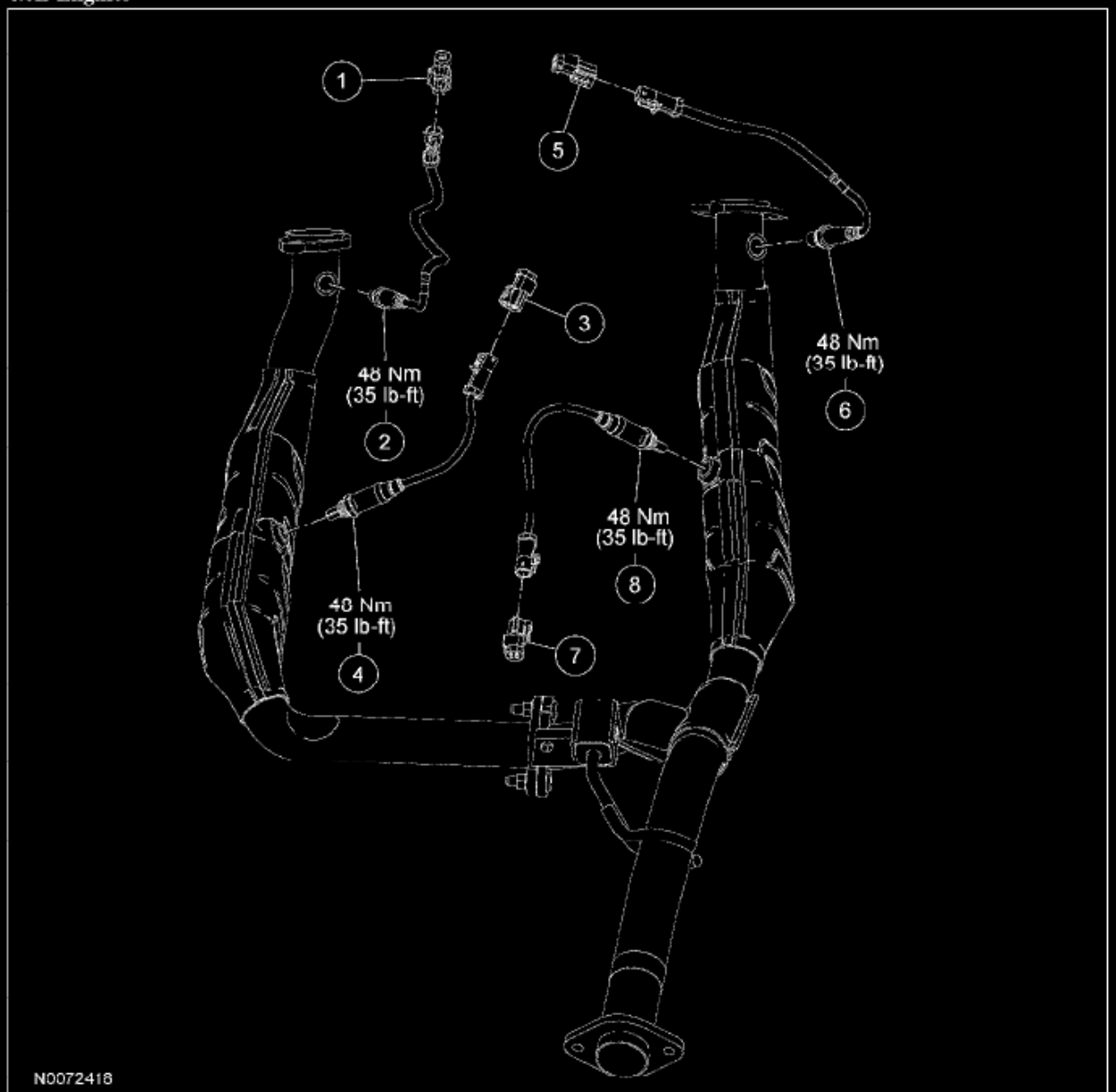
Item	Part Number	Description
1	—	Catalyst monitor sensor electrical connector (part of 14A464)
2	9G444	Catalyst monitor sensor
3	—	Heated oxygen sensor (HO2S) electrical connector (part of 12B637)
4	9F472	HO2S

(Continued)

Item	Part Number	Description
5	—	HO2S electrical connector (part of 12B637)
6	9F472	HO2S
7	—	Catalyst monitor sensor electrical connector (part of 14A464)
8	9G444	Catalyst monitor sensor

3.0L Engines

4.0L Engines



Item	Part Number	Description
1	—	Heated oxygen sensor (HO2S) electrical connector (part of 12B637)
2	9F472	HO2S
3	—	Catalyst monitor sensor electrical connector (part of 14A464)
4	9G444	Catalyst monitor sensor

(Continued)

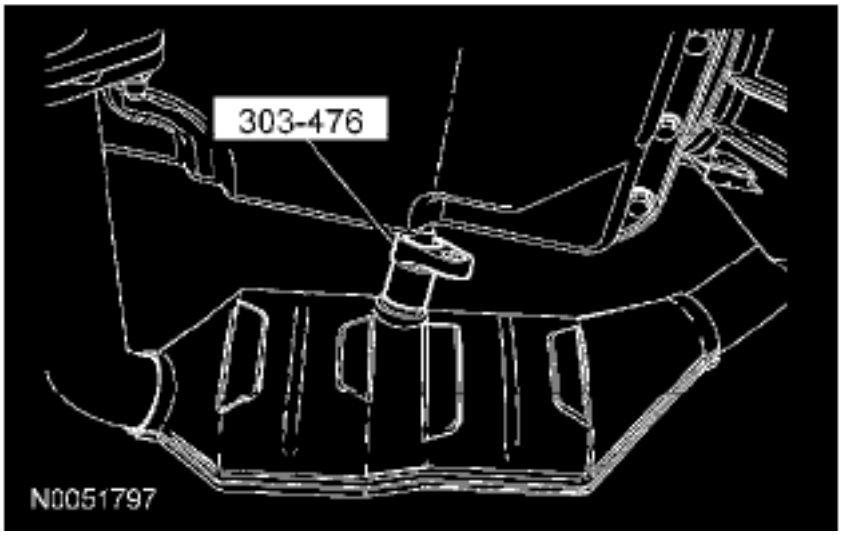
Item	Part Number	Description
5	—	HO2S electrical connector (part of 12B637)
6	9F472	HO2S
7	—	Catalyst monitor sensor electrical connector (part of 14A464)
8	9G444	Catalyst monitor sensor

4.0L Engines

Special Tool(s)

Special Tool(s)

ST1447-A	Socket, Exhaust Gas Oxygen Sensor 303-476 (T94P-9472-A)



Special Tool(s)

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the catalyst monitor sensor electrical connector.

3. NOTE: If necessary, lubricate the catalyst monitor sensor with lock lubricant to assist in removal.

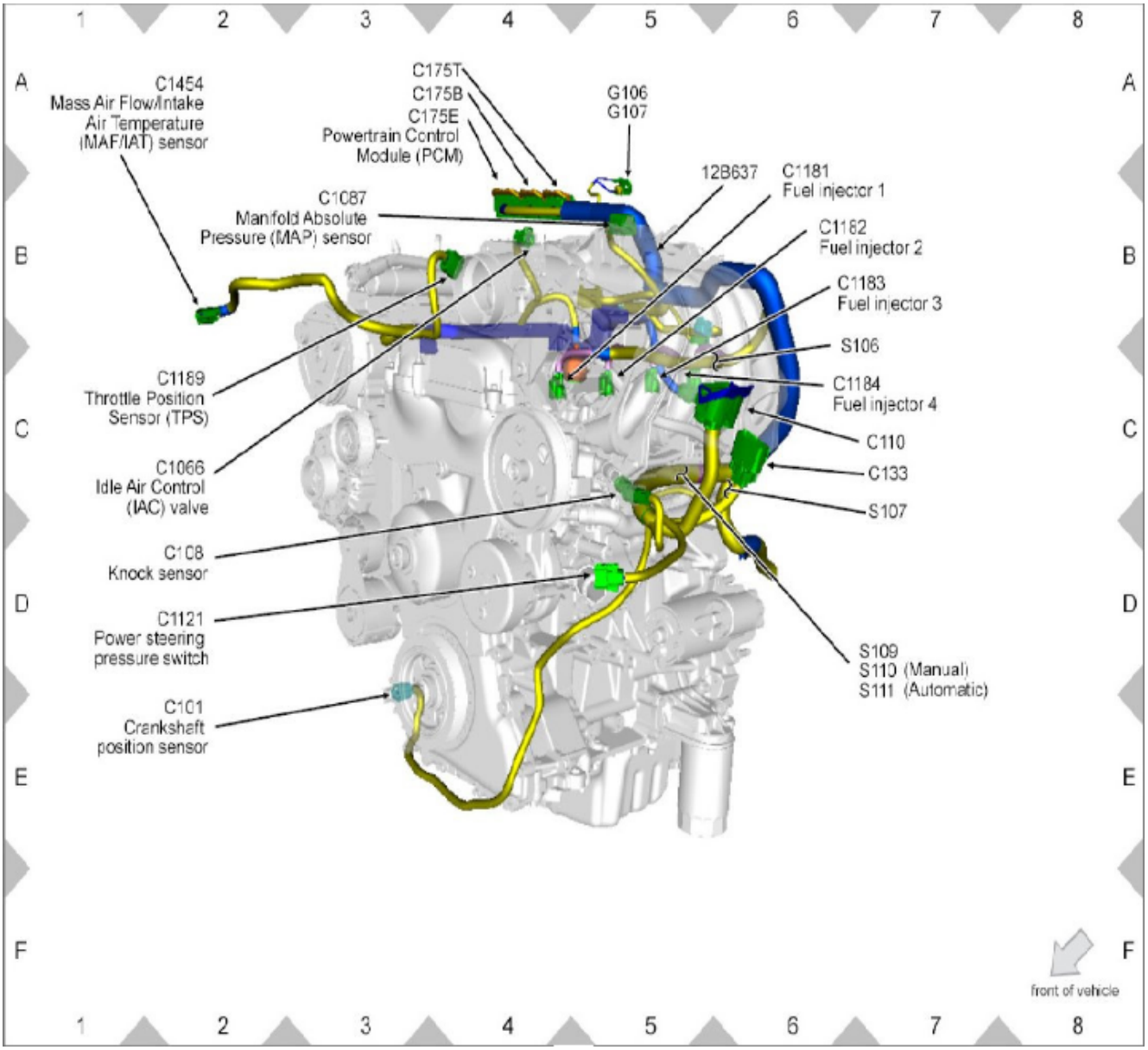
Using the special tool, remove the catalyst monitor sensor. -

To install, tighten to 48 Nm (35 lb-ft).

4. NOTE: Apply a light coat of anti-seize lubricant to the threads of the catalyst monitor sensor.

To install, reverse the removal procedure.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Powertrain Management > Sensors and Switches - Powertrain Management > Sensors and Switches - Computers and Control Systems > Power Steering Pressure Switch > Component Information > Locations



View 151-3

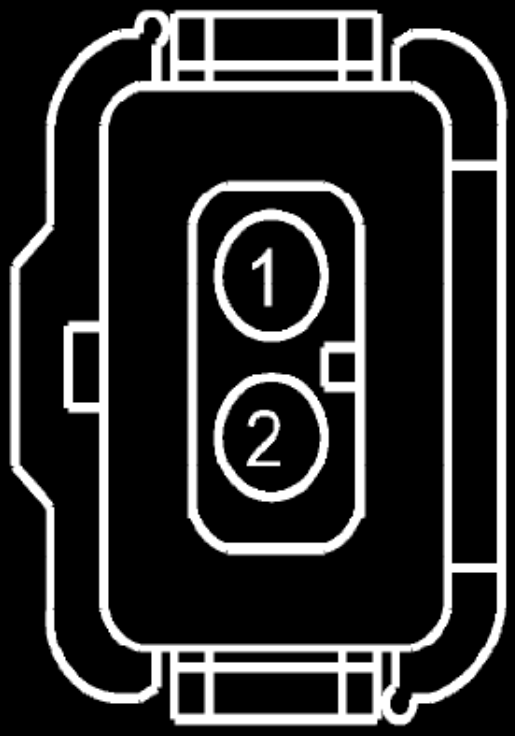
Connector: C1121

Description: POWER STEERING PRESSURE SWITCH

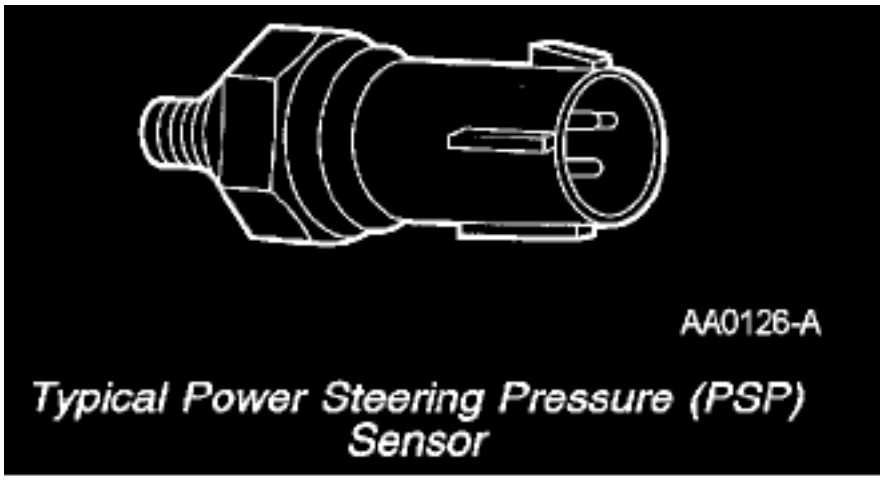
Harness: 12B637

Base Part #:

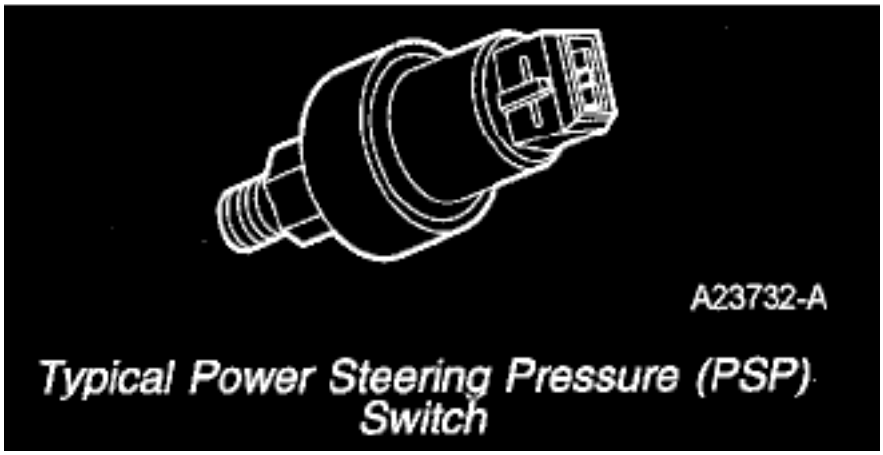
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CCS09 (GN)	20	SWITCH - POWER STEERING PRESSURE (PSPS)	2.3L
2	RE407 (YE-VT)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN COWL (C-SIGRTN) (SIGRTN-C)	2.3L



C1121



Typical Power Steering Pressure (PSP) Sensor



Typical Power Steering Pressure (PSP) Switch

Power Steering Pressure Switch: Description and Operation

Power Steering Pressure (PSP) Sensor

Typical Power Steering Pressure (PSP) Sensor

The PSP sensor monitors the hydraulic pressure within the power steering system. The PSP sensor voltage input to the PCM changes as the hydraulic pressure changes. The PCM uses the input signal from the PSP sensor to compensate for additional loads on the engine by adjusting the

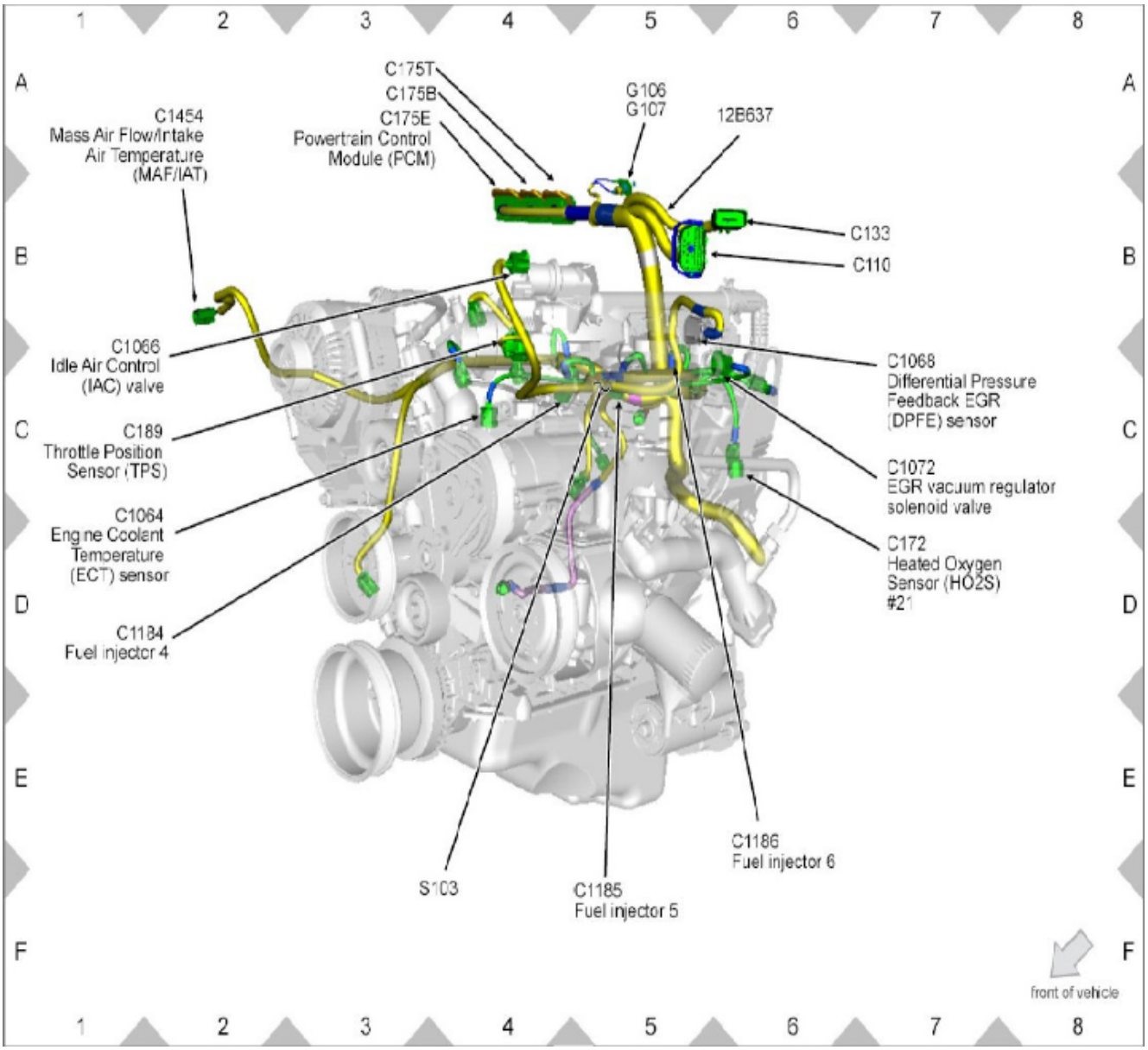
idle RPM and preventing engine stall during parking maneuvers. Also, the PSP sensor signals the PCM to adjust the transmission electronic pressure control (EPC) pressure during increased engine load, for example, during parking maneuvers.

Power Steering Pressure (PSP) Switch

Typical Power Steering Pressure (PSP) Switch

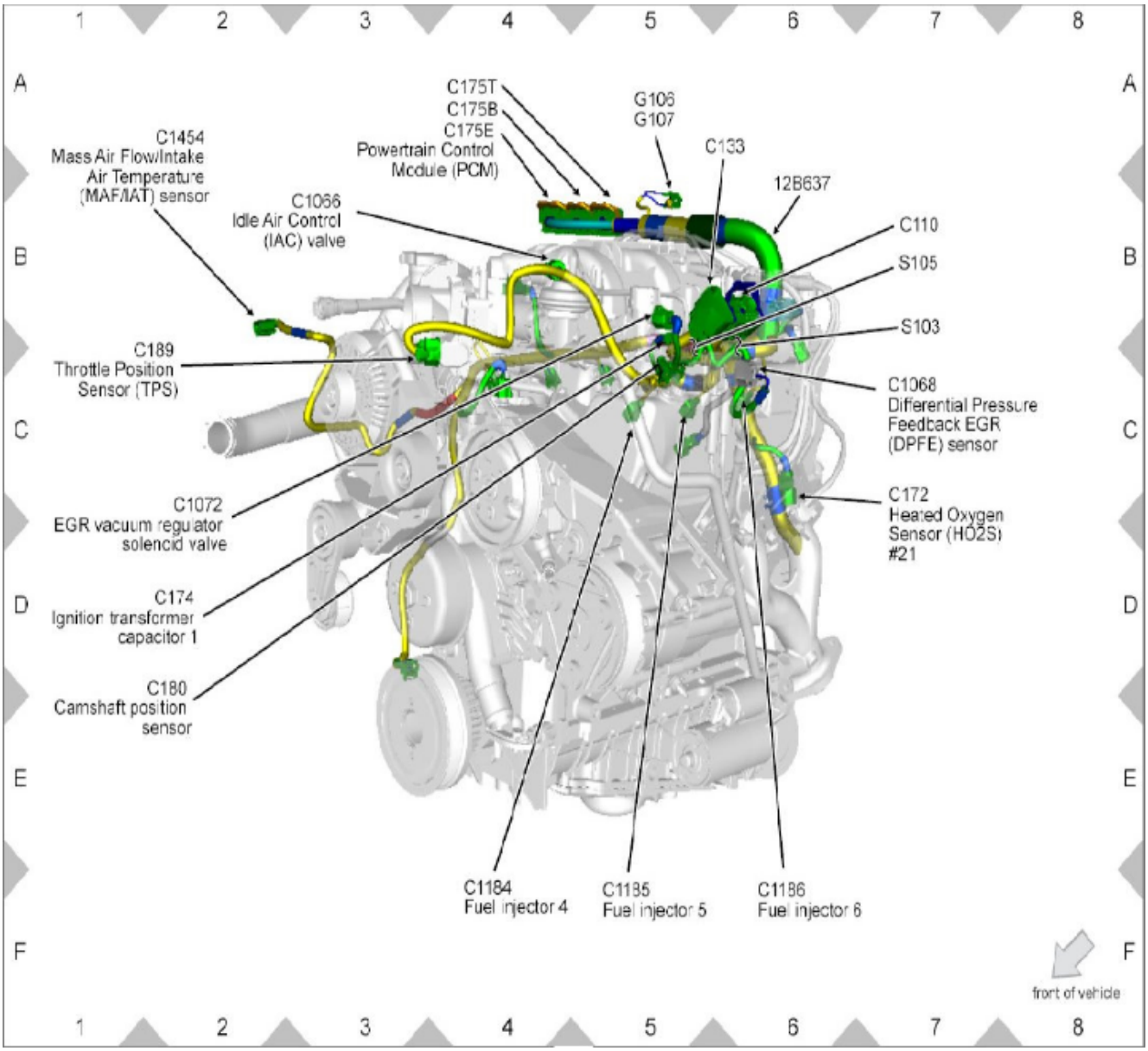
The PSP switch monitors the hydraulic pressure within the power steering system. The PSP switch is a normally closed switch that opens as the hydraulic pressure increases. The PCM provides a low current voltage on the PSP circuit. When the PSP switch is closed, this voltage is pulled low through the SIG RTN circuit. The PCM uses the input signal from the PSP switch to compensate for additional loads on the engine by adjusting the idle RPM and preventing engine stall during parking maneuvers. Also, the PSP switch signals the PCM to adjust the transmission electronic pressure control (EPC) pressure during increased engine load, for example during parking maneuvers.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Powertrain Management > Sensors and Switches - Powertrain Management > Sensors and Switches - Computers and Control Systems > Pressure Feedback Exhaust Sensor, EGR > Component Information > Locations



Pressure Feedback Exhaust Sensor: Locations

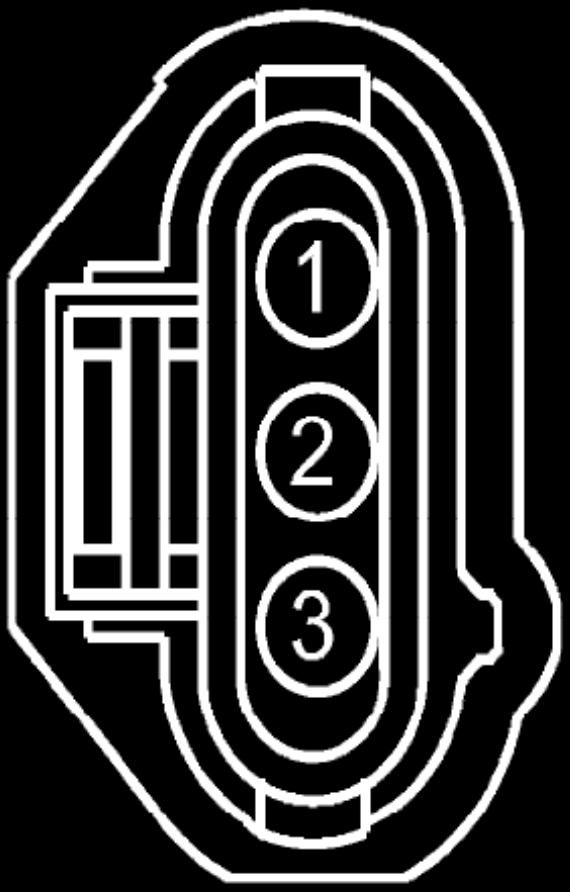
View 151-5


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
C133
12B637
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor
C1066
Idle Air Control (IAC) valve
C110
S105
S103
C189
Throttle Position Sensor (TPS)
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
C174
Ignition transformer capacitor 1
C180
Camshaft position sensor
C1184
Fuel injector 4
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-7

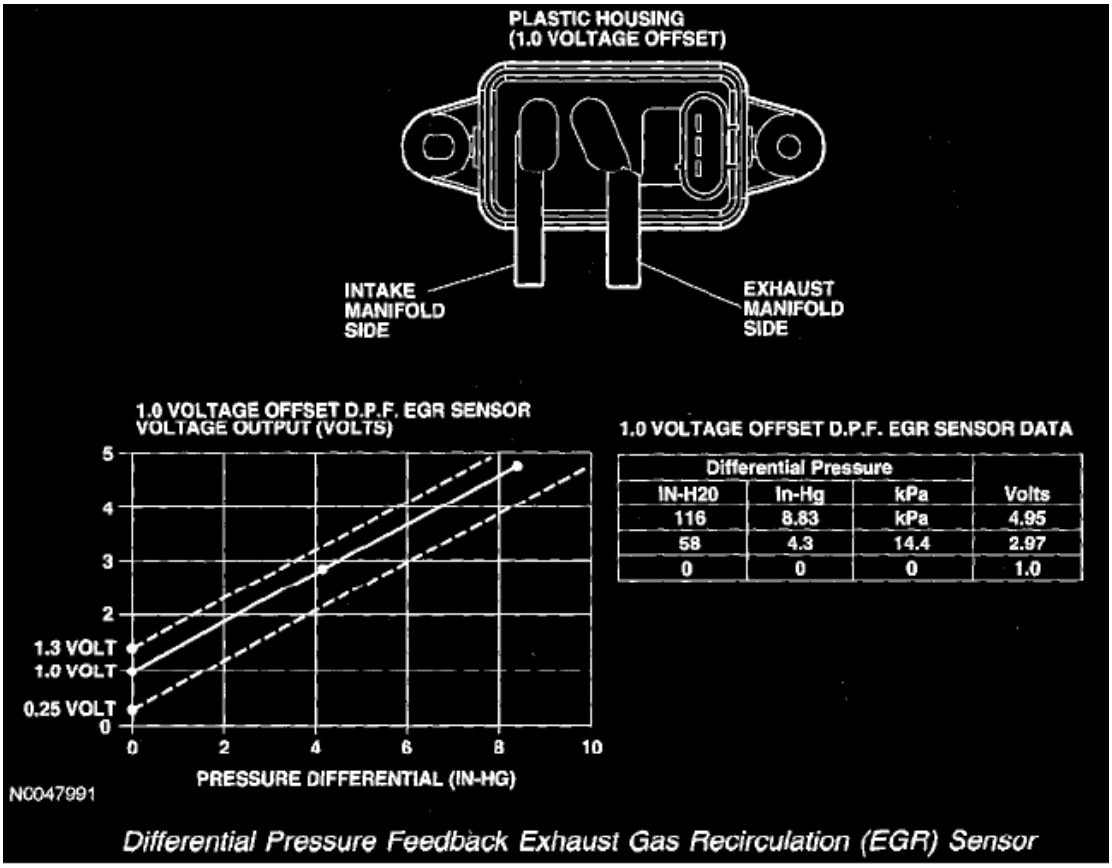
Connector: C1068

Description:	Harness:	Base Part #:
DIFFERENTIAL PRESSURE FEEDBACK EGR DPFE) SENSOR	12B637	9J460



Pin	Circuit	Gauge	Circuit Function	Quali
1	VE713 (GN-OG)	20	SENSOR - DELTA PRESSURE FEEDBACK EGR (DPFE)	3.0L, 4.
2	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	3.0L, 4.
3	LE423 (GN-VT)	20	CTRL MOD. - POWERTRAIN # VOLTAGE REFERENCE ENGINE (VREF) (E-VREV)	3.0L, 4.

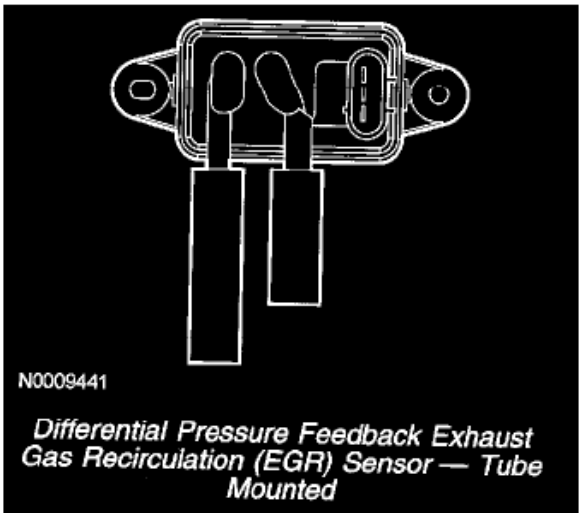
C1068



1.0 VOLTAGE OFFSET D.P.F. EGR SENSOR DATA

Differential Pressure			
IN-H20	In-Hg	kPa	Volts
116	8.83	kPa	4.95
58	4.3	14.4	2.97
0	0	0	1.0

Differential Pressure Feedback Exhaust Gas Recirculation (EGR) Sensor



Differential Pressure Feedback Exhaust Gas Recirculation (EGR) Sensor — Tube Mounted

Pressure Feedback Exhaust Sensor: Description and Operation

Differential Pressure Feedback Exhaust Gas Recirculation (EGR) Sensor

Differential Pressure Feedback Exhaust Gas Recirculation (EGR) Sensor

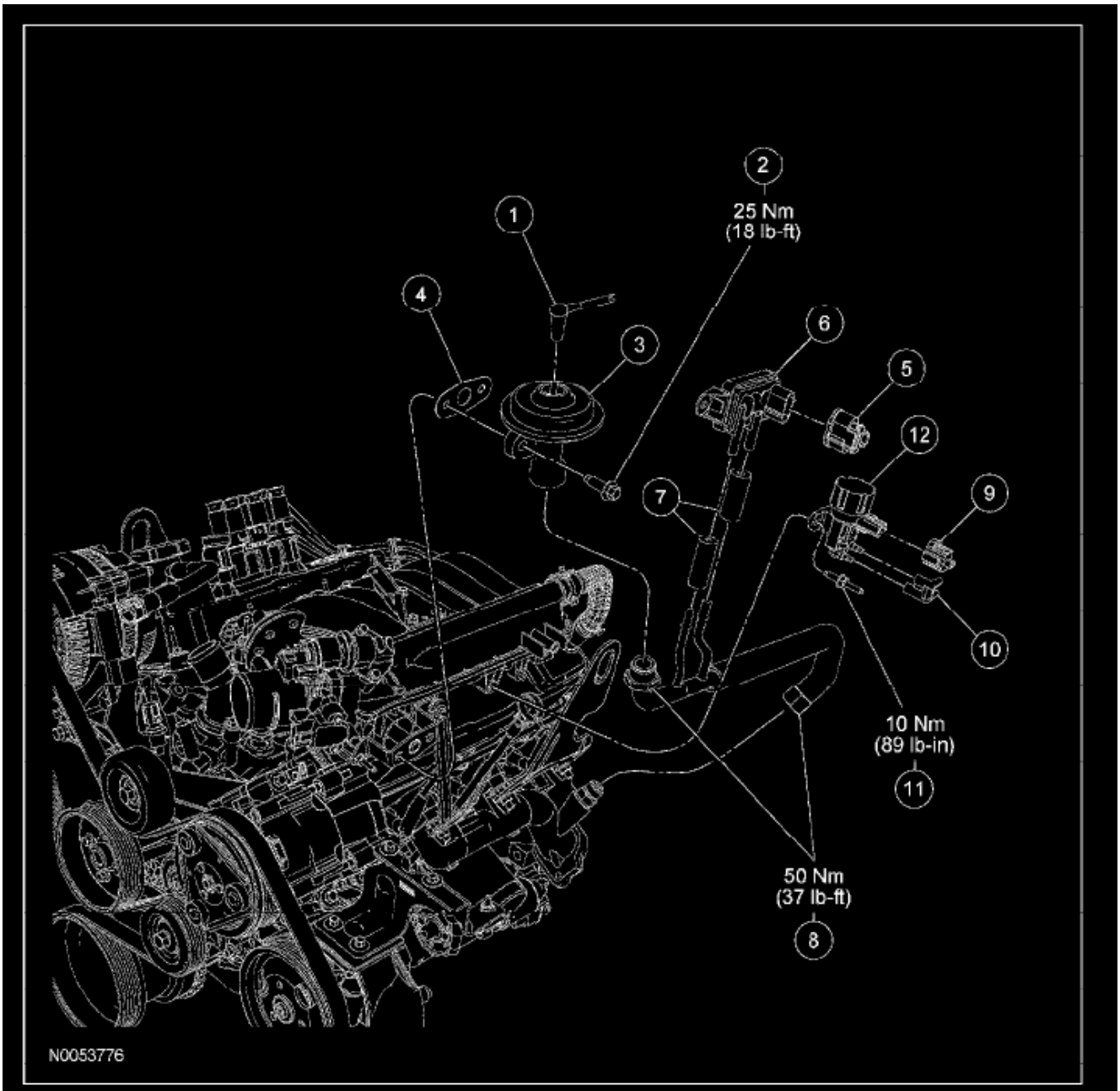
The differential pressure feedback EGR sensor is a ceramic, capacitive-type pressure transducer that monitors the differential pressure across a metering orifice located in the orifice tube assembly. The differential pressure feedback EGR sensor receives this signal through 2 hoses referred to as the downstream pressure hose (REF SIGNAL) and upstream pressure hose (HI SIGNAL). The HI and REF hose connections are marked on the differential pressure feedback EGR sensor housing for identification (note that the HI signal uses a larger diameter hose). The differential pressure feedback EGR sensor outputs a voltage proportional to the pressure drop across the metering orifice and supplies it to the PCM as EGR flow rate feedback.

Differential Pressure Feedback Exhaust Gas Recirculation (EGR) Sensor - Tube Mounted

Differential Pressure Feedback Exhaust Gas Recirculation (EGR) Sensor - Tube Mounted

The tube mounted differential pressure feedback EGR sensor is identical in operation as the larger plastic differential pressure feedback EGR sensors and uses a 1.0 volt offset. The HI and REF

hose connections are marked on the side of the sensor.



Item	Part Number	Description
1	9E499	EGR vacuum hose fitting
2	W500224	EGR valve bolt (2 required)
3	9D475	EGR valve
4	9D476	EGR valve gasket

(Continued)

Item	Part Number	Description
5	14A464	Differential pressure feedback EGR sensor electrical connector (part of 12B637)
6	9J460	Differential pressure feedback EGR sensor

(Continued)

Pressure Feedback Exhaust Sensor: Service and Repair

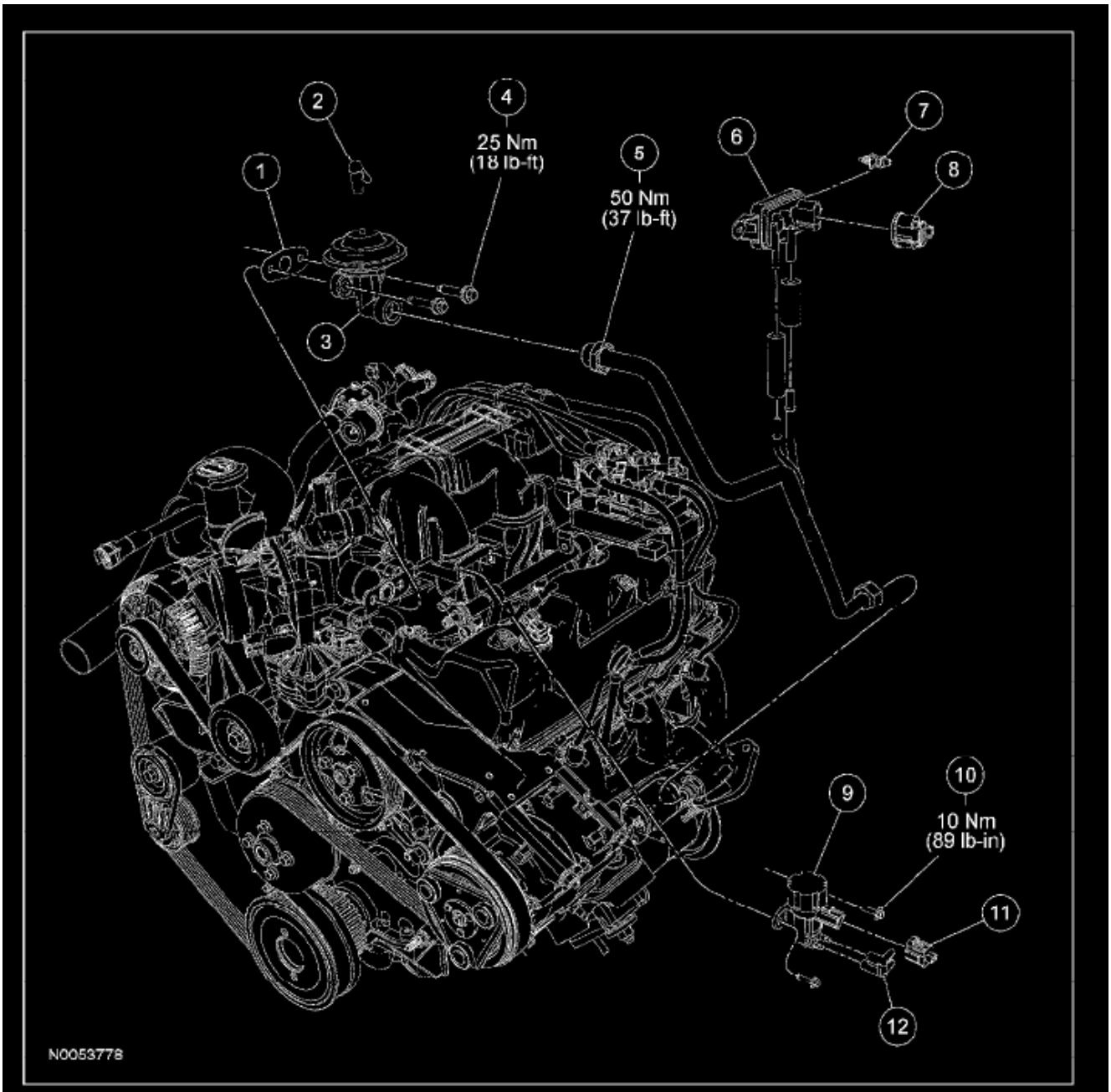
DIFFERENTIAL PRESSURE FEEDBACK EXHAUST GAS RECIRCULATION (EGR) SENSOR

Exploded View

Part 1

Item	Part Number	Description
7	9P761	Differential pressure feedback EGR sensor hoses
8	9D477	Exhaust manifold-to-EGR valve tube
9	14A464	EGR vacuum regulator solenoid electrical connector (part of 12B637)
10	9E499	EGR vacuum regulator solenoid vacuum hose fitting
11	W708628	EGR vacuum regulator solenoid stud bolt
12	9J459	EGR vacuum regulator solenoid

Part 2



Item	Part Number	Description
1	9D476	EGR valve gasket
2	9E499	EGR valve vacuum connector
3	9D475	EGR valve assembly
4	W701232	EGR valve bolt (2 required)

(Continued)

Item	Part Number	Description
5	9E469	EGR tube
6	9J460	Differential pressure feedback EGR sensor
7	13A506	Pushpin wire retainer

(Continued)

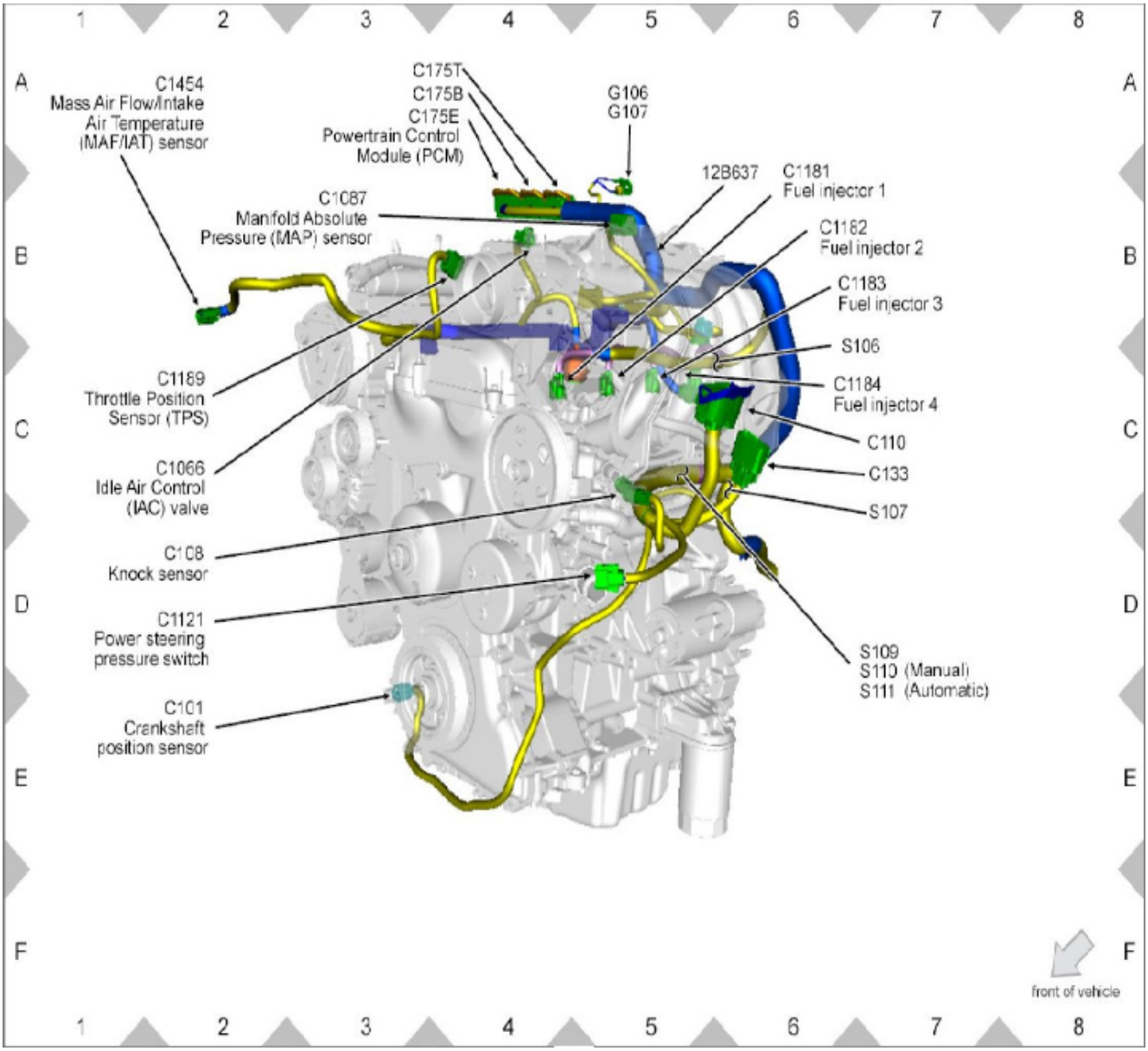
Part 1

Item	Part Number	Description
8	14A464	Differential pressure feedback EGR sensor electrical connector
9	9J459	EGR vacuum regulator solenoid
10	W704310	EGR vacuum regulator solenoid bolt (2 required)
11	14A464	EGR vacuum regulator solenoid electrical connector
12	9E499	EGR vacuum regulator solenoid vacuum connector

Part 2

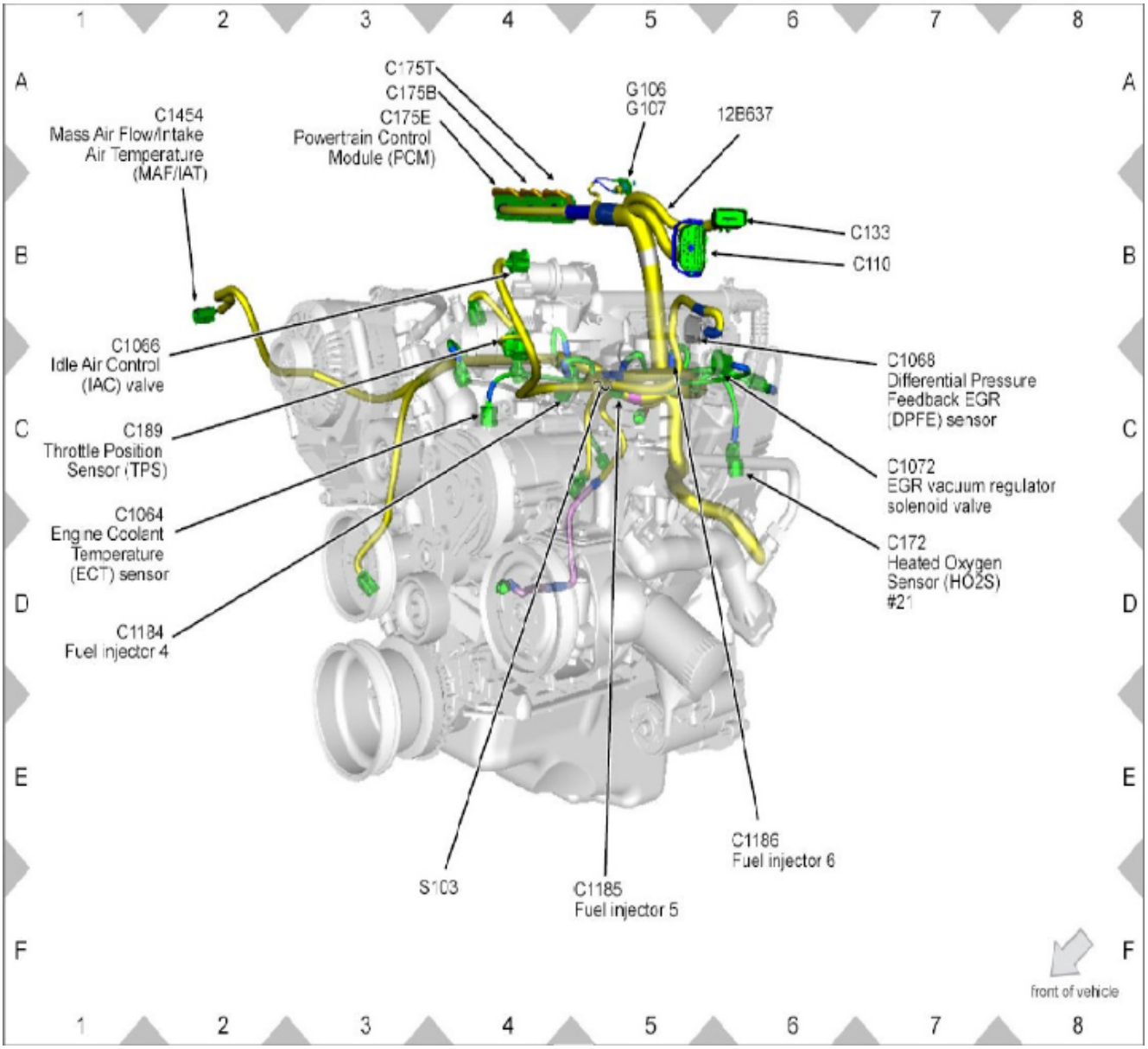
Removal and Installation

1. Disconnect the pushpin retainer from the differential pressure feedback EGR sensor. 2. Disconnect the differential pressure feedback EGR sensor electrical connector. 3. Remove the differential pressure feedback EGR sensor from the hoses. 4. To install, reverse the removal procedure.

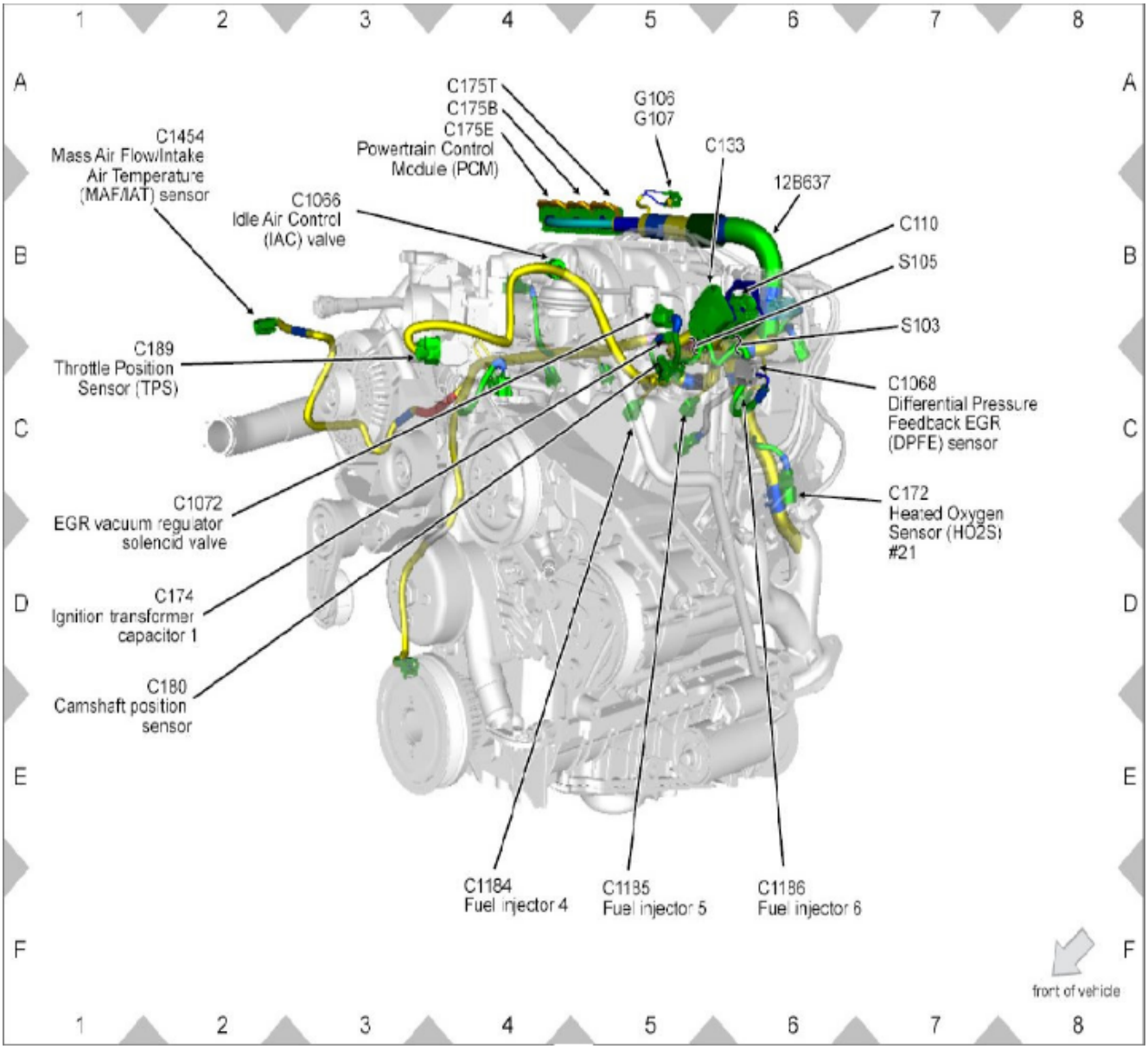


Throttle Position Sensor: Locations

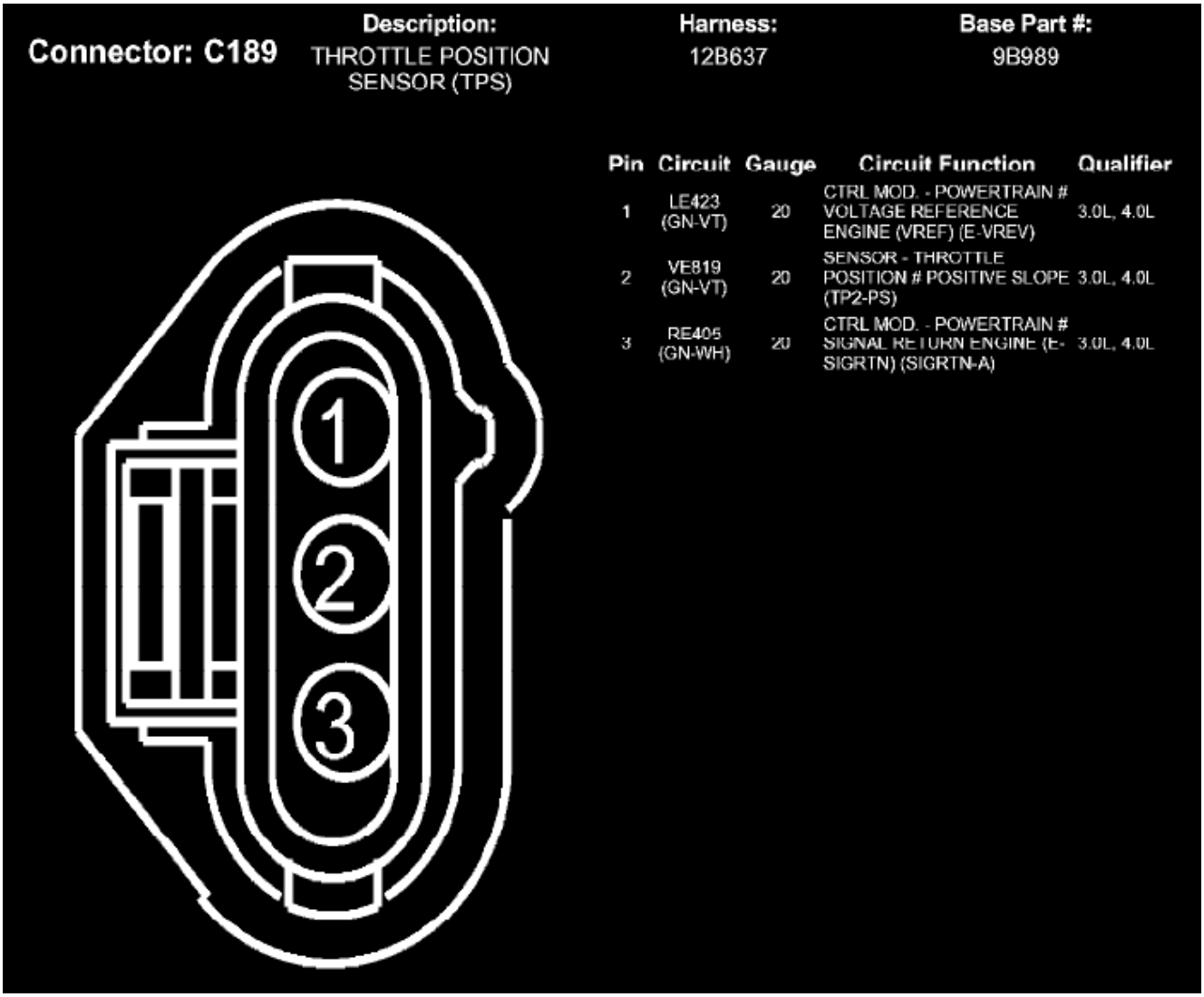
View 151-3


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
12B637
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT)
C133
C110
C1066
Idle Air Control (IAC) valve
C189
Throttle Position Sensor (TPS)
C1064
Engine Coolant Temperature (ECT) sensor
C1184
Fuel injector 4
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
S103
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-5


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
C133
12B637
C110
S105
S103
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor
C1066
Idle Air Control (IAC) valve
C189
Throttle Position Sensor (TPS)
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
C174
Ignition transformer capacitor 1
C180
Camshaft position sensor
C1184
Fuel injector 4
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-7



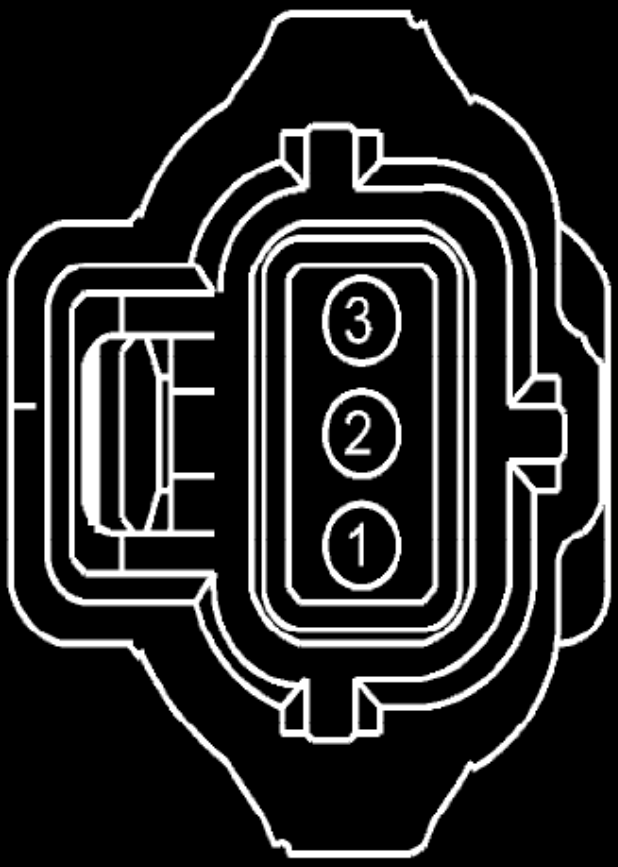
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	LE423 (GN-VT)	20	CTRL MOD. - POWERTRAIN # VOLTAGE REFERENCE ENGINE (VREF) (E-VREV)	3.0L, 4.0L
2	VE819 (GN-VT)	20	SENSOR - THROTTLE POSITION # POSITIVE SLOPE (TP2-PS)	3.0L, 4.0L
3	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	3.0L, 4.0L

Throttle Position Sensor: Diagrams

C189

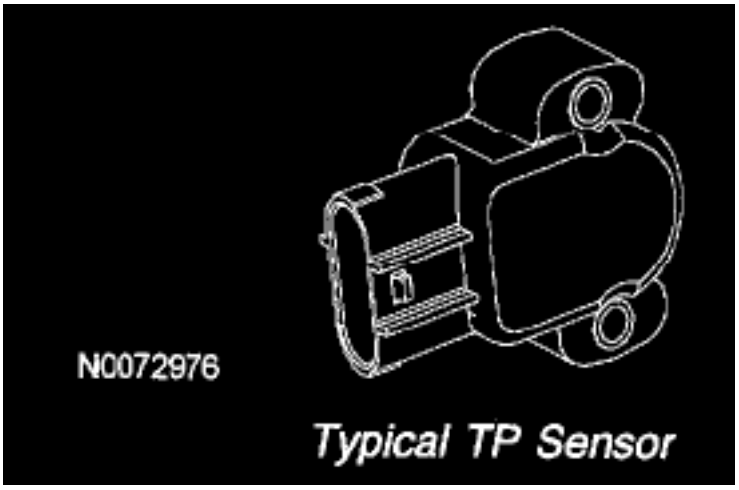
Connector: C1189

Description:	Harness:	Base Part #:
THROTTLE POSITION SENSOR (TPS)	12B637	9B989



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	2.3L
2	VE819 (GN-VT)	20	SENSOR - THROTTLE POSITION # POSITIVE SLOPE (TP2-PS)	2.3L
3	LE423 (GN-VT)	20	CTRL MOD. - POWERTRAIN # VOLTAGE REFERENCE ENGINE (VREF) (E-VREV)	2.3L

C1189



Throttle Position Sensor: Description and Operation

Electronic Throttle Body (ETB) Throttle Position Sensor

The ETB throttle position sensor has 2 signal circuits in the sensor for redundancy. The redundant ETB throttle position signals are required for increased monitoring. The first ETB throttle position sensor signal (TP1) has a negative slope (increasing angle, decreasing voltage) and the second signal (TP2) has a positive slope (increasing angle, increasing voltage). The 2 ETB throttle position sensor signals make sure the PCM receives a correct input even if 1 signal has a concern. There is 1 reference voltage circuit and 1 signal return circuit for the sensor. The reference voltage circuit and the signal return circuit is shared with the reference voltage circuits and signal return circuits used by the APP sensor.

Throttle Position (TP) Sensor

Typical TP Sensor

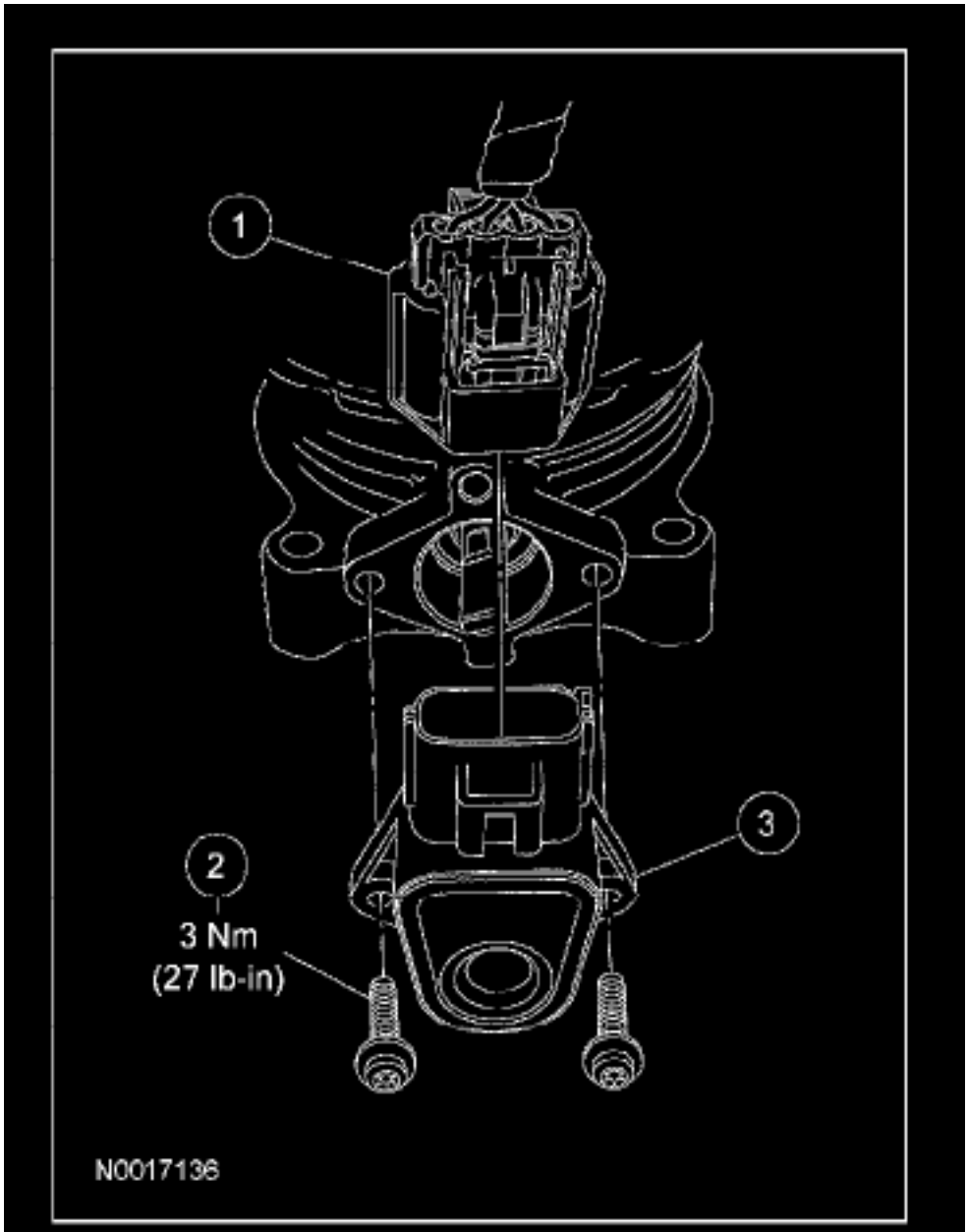
The TP sensor is a rotary potentiometer sensor that provides a signal to the PCM that is linearly proportional to the throttle plate/shaft position. The sensor housing has a 3-blade electrical connector that may be gold plated. The gold plating increases the corrosion resistance on the terminals and increases the connector durability. The TP sensor is mounted on the throttle body. As the TP sensor is rotated by the throttle shaft, 4 operating conditions are determined by the PCM from the TP. The operating conditions are: -

closed throttle (includes idle or deceleration)

- part throttle (includes cruise or moderate acceleration)

- wide open throttle (includes maximum acceleration or de-choke on crank)

- throttle angle rate



Item	Part Number	Description
1	14A464	Throttle position (TP) sensor electrical connector (part of 12B637)
2	W707535	TP sensor screw (2 required)
3	9E928	TP sensor

Throttle Position Sensor: Service and Repair

THROTTLE POSITION (TP) SENSOR

Removal and Installation

1. Disconnect the throttle position (TP) sensor electrical connector.

2. CAUTION: Failure to remove the throttle position (TP) sensor screws in the following manner will result in damage to the screws. First,

loosen the screws 1 to 2 full turns using a hand tool, and then use a suitable high-speed driver to complete the removal.

Remove and discard the 2 bolts and the TP sensor. -

To install, tighten to 3 Nm (27 lb-in).

3. CAUTION: Do not use a high-speed driver to install the new screws or damage to the throttle position (TP) sensor may occur.

NOTE: -

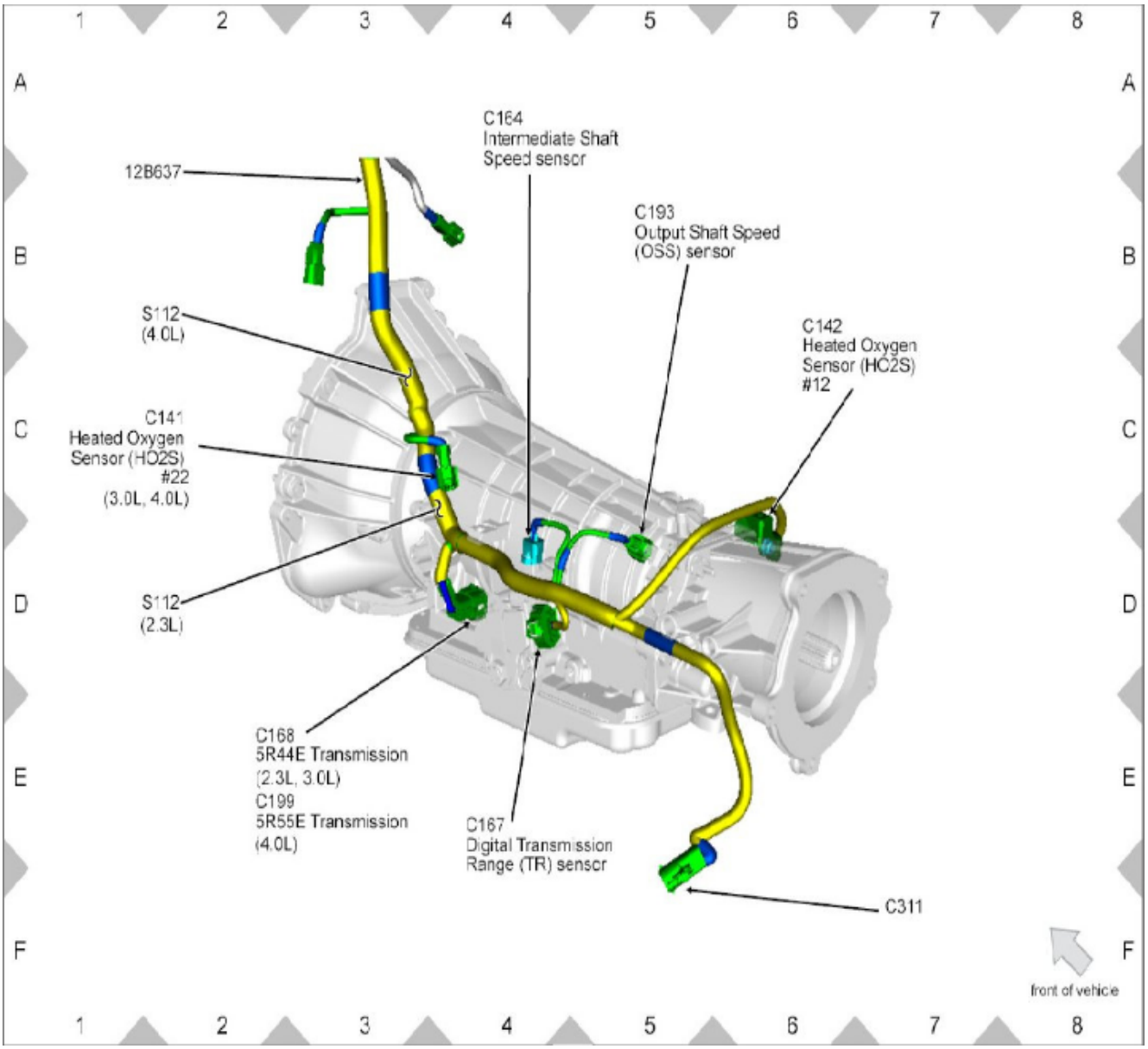
Do not reuse the TP sensor and screws. A new TP sensor and screws must be installed.

- Failure to install the TP sensor in this manner may result in excessive idle speeds. Slide the rotary tangs into position over the throttle shaft blade, then rotate the TP sensor.

To install, reverse the removal procedure. -

Install a new TP sensor and screws.

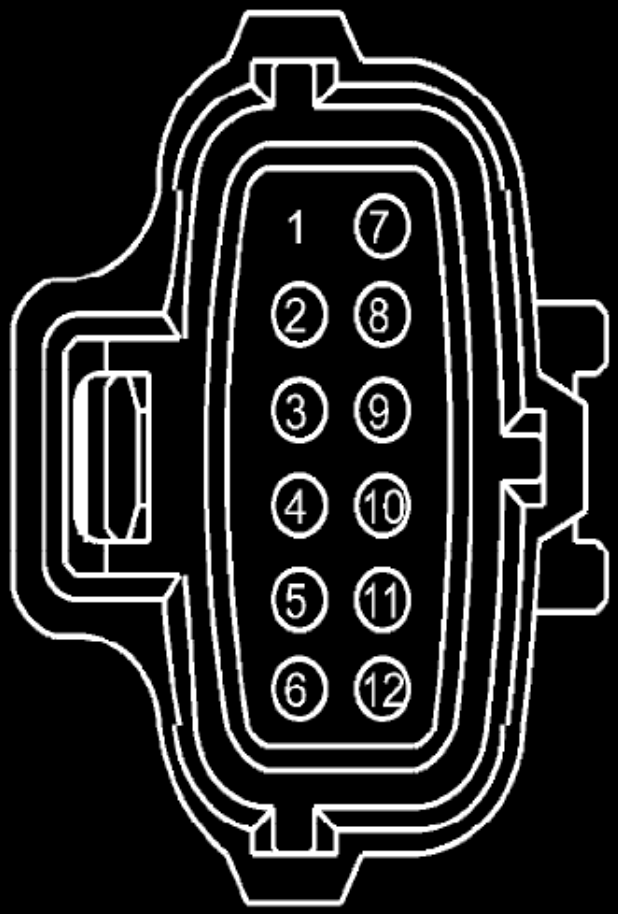
Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Powertrain Management > Sensors and Switches - Powertrain Management > Sensors and Switches - Computers and Control Systems > Transmission Position Switch/Sensor, A/T > Component Information > Locations



View 151-10

Connector: C167

Description:	Harness:	Base Part #:
DIGITAL TRANSMISSION RANGE (TR) SENSOR	12B637	7F293



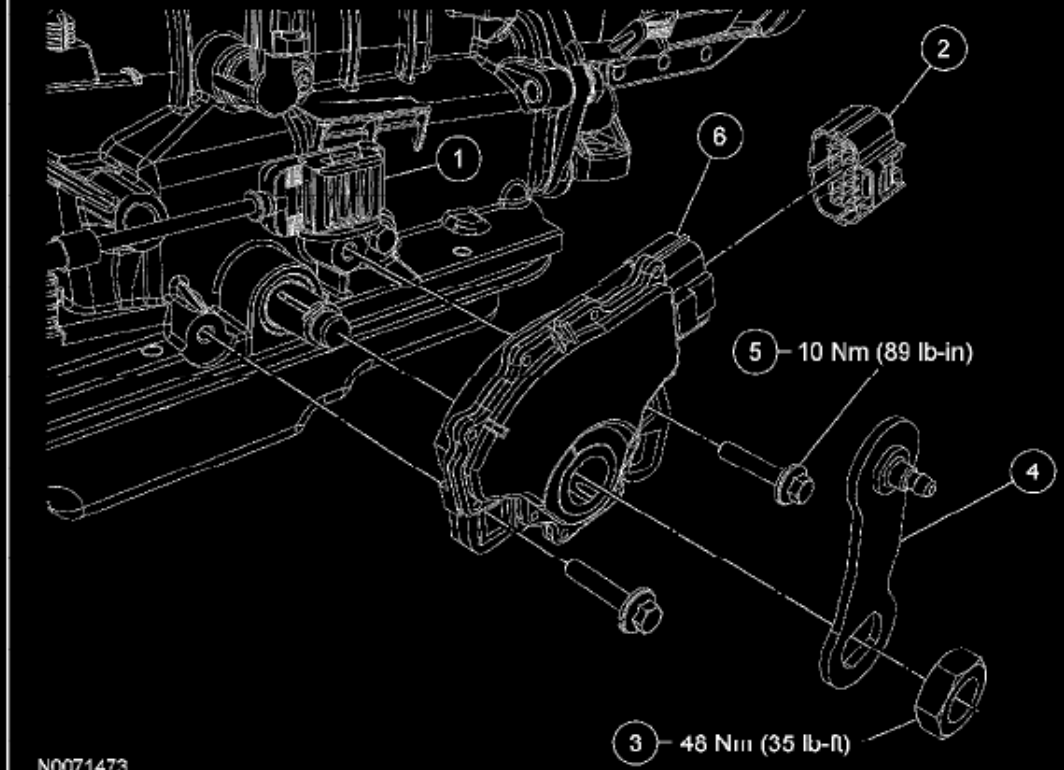
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	RE406 (GY-VT)	18	SIGNAL RETURN	
3	VET28 (GY-VT)	20	TR3A	
4	VET29 (VT-WH)	20	TR1	
5	VET30 (YE)	20	TR2	
6	VET31 (BU-OG)	20	TR4	
7	GD108 (BK-VT)	18	GROUND	4x4
8	CCF20 (GY-VT)	20	NETURAL SENSE	4x4
9	CBP20 (YE-VT)	18	FUSED POWER FEED	
10	CET40 (GN-OG)	20	STARTER CONTROL	
11	CET41 (BN-YE)	18	BACK UP	
12	CBP21 (BU-GY)	20	STARTER TO STARTER INTERRUPT RELAY	

C167

Special Tool(s)

ST1633-A	Alignment Gauge, TR Sensor 307-351 (T97L-70010-A)

Digital Transmission Range (TR) Sensor



Item	Part Number	Description
1	7E395-A	Selector lever cable
2	—	Digital transmission range (TR) sensor electrical connector
3	W701211-S	Manual control lever nut
4	7A256-A	Manual control lever
5	N806933-S	Digital TR sensor screw (2 required)
6	7F293-A	Digital TR sensor

Transmission Position Switch/Sensor: Service and Repair

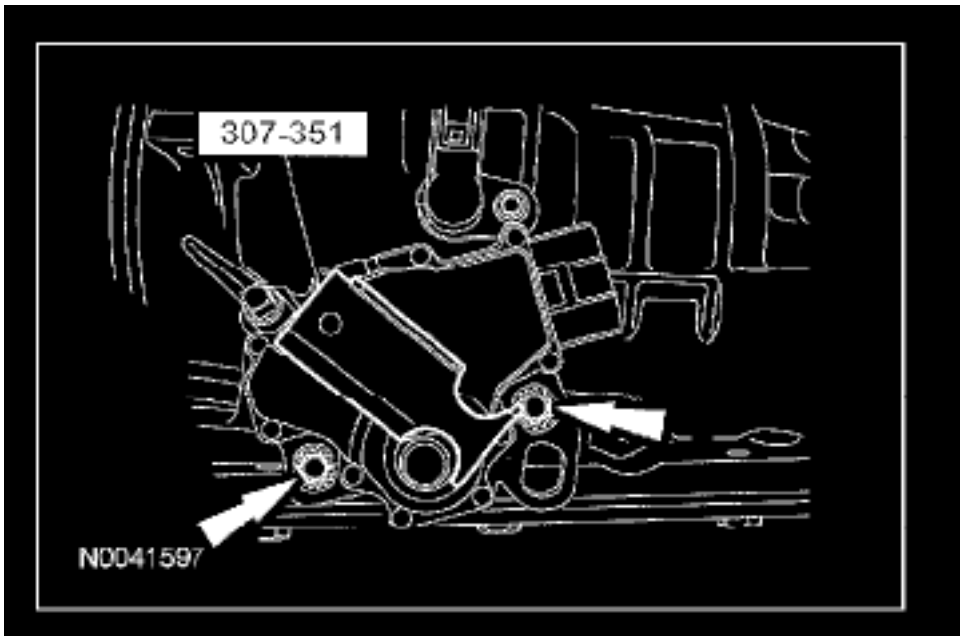
Digital Transmission Range (TR) Sensor

Digital Transmission Range (TR) Sensor

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the selector lever cable from the manual control lever. 3. Disconnect the digital transmission range (TR) sensor electrical connector. 4. Remove the manual control outer lever nut and manual control outer lever. 5. Remove the screws and the digital TR sensor.

Installation



1. CAUTION: The digital transmission range (TR) sensor must fit flush against the boss on the case to prevent damage to the sensor.

Install the digital TR sensor and loosely install the screws.

2. CAUTION: Tightening one screw before tightening the other may cause the sensor to bind or become damaged.

NOTE: The manual lever must be in the NEUTRAL position.

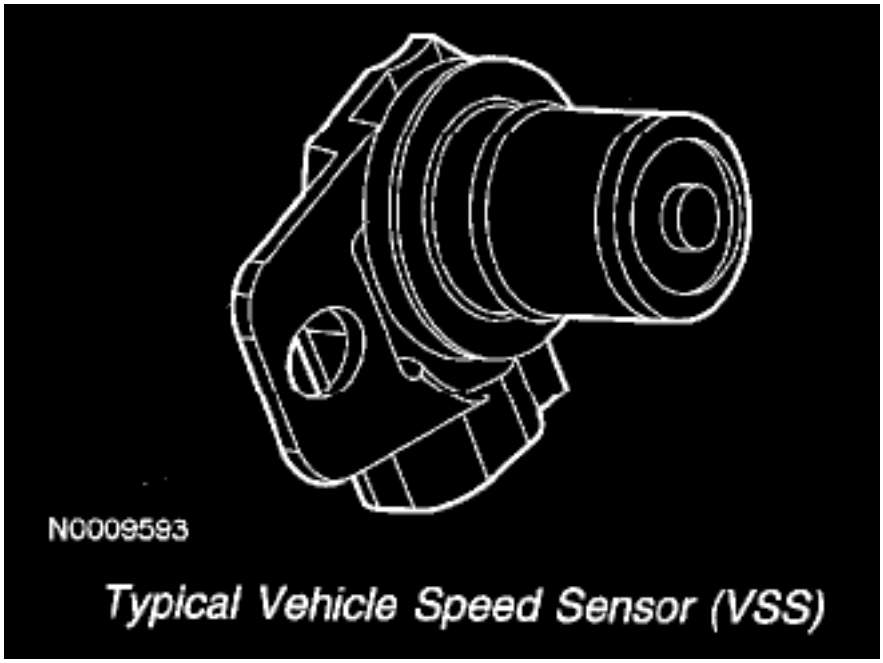
Using the special tool, align the digital TR sensor and tighten screws in an alternating sequence. ^

Tighten to 10 Nm (89 lb-inch).

3. Install the manual control outer lever and nut.

^ Tighten to 48 Nm (35 lb-ft).

4. Connect the digital TR sensor electrical connector. 5. Connect the selector lever cable to the manual control lever. 6. Verify that the selector lever cable is adjusted correctly.



Vehicle Speed Sensor: Description and Operation

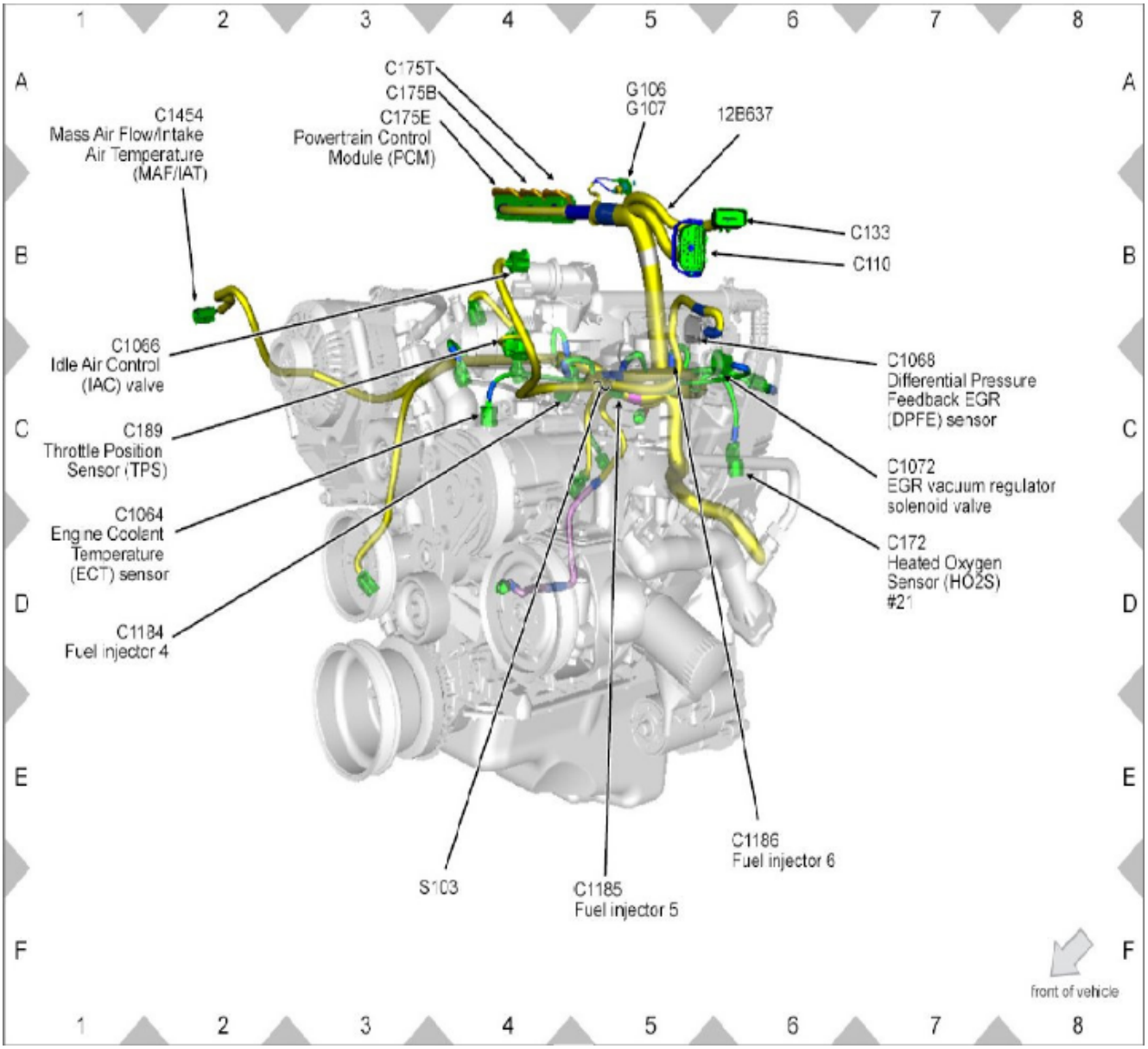
Output Shaft Speed (OSS) Sensor

The OSS sensor provides the PCM with information about the rotational speed of an output shaft. The PCM uses the information to control and diagnose powertrain behavior. In some applications, the sensor is also used as the source of vehicle speed. The sensor may be physically located in different places on the vehicle, depending upon the specific application. The design of each speed sensor is unique and depends on which powertrain control feature uses the information that is generated.

Vehicle Speed Sensor (VSS)

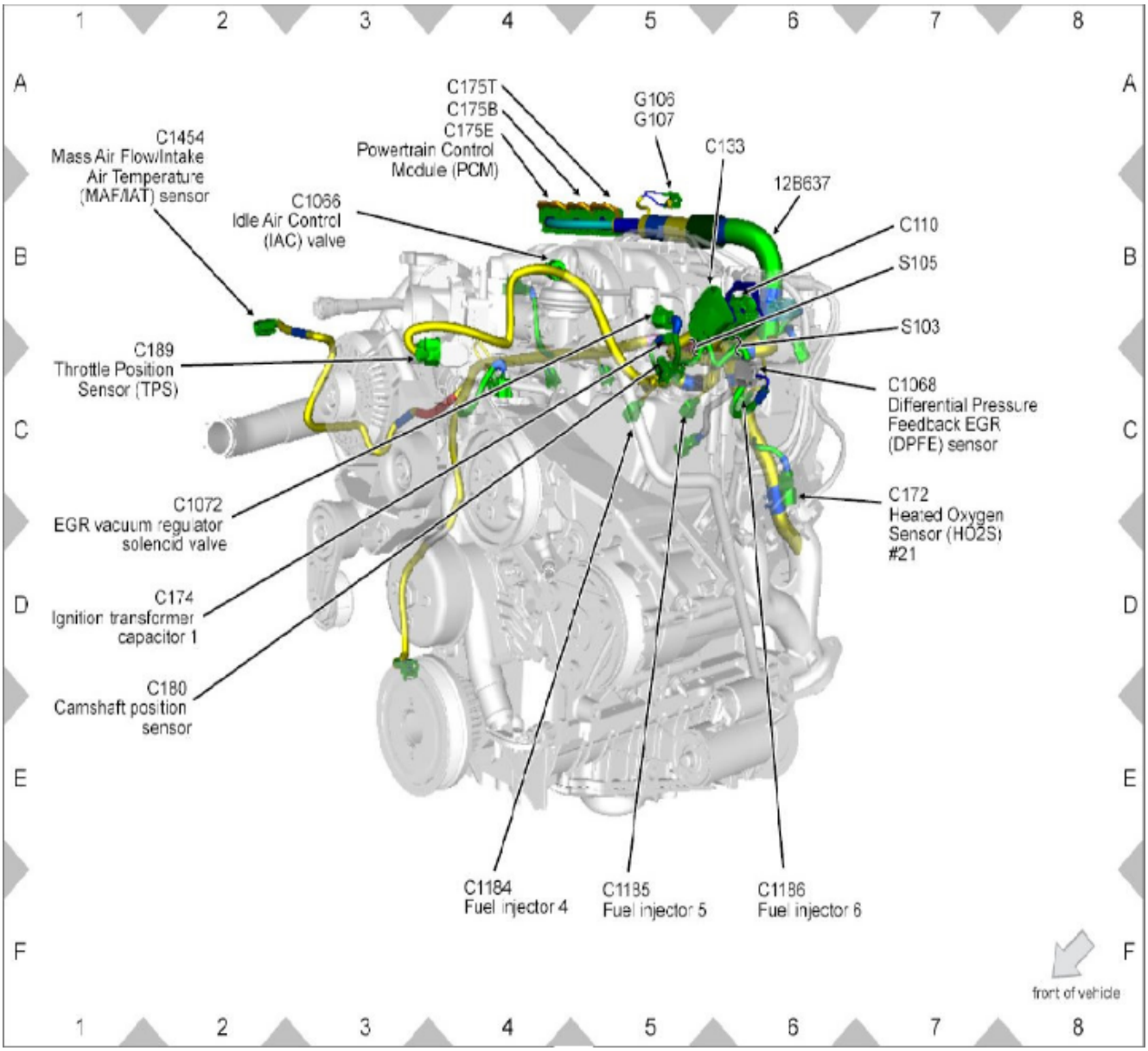
Typical Vehicle Speed Sensor (VSS)

The VSS is a variable reluctance or Hall-effect sensor that generates a waveform with a frequency that is proportional to the speed of the vehicle. If the vehicle is moving at a relatively low velocity, the sensor produces a signal with a low frequency. As the vehicle velocity increases, the sensor generates a signal with a higher frequency. The PCM uses the frequency signal generated by the VSS (and other inputs) to control such parameters as fuel injection, ignition control, transmission/transaxle shift scheduling, and torque converter clutch scheduling.



Pressure Feedback Exhaust Sensor: Locations

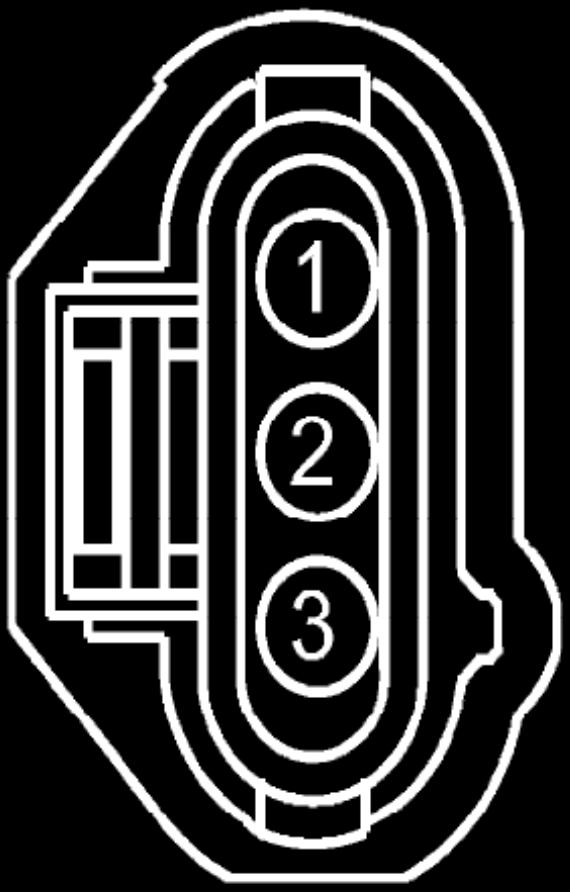
View 151-5


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
C133
12B637
C110
S105
S103
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor
C1066
Idle Air Control (IAC) valve
C189
Throttle Position Sensor (TPS)
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
C174
Ignition transformer capacitor 1
C180
Camshaft position sensor
C1184
Fuel injector 4
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-7

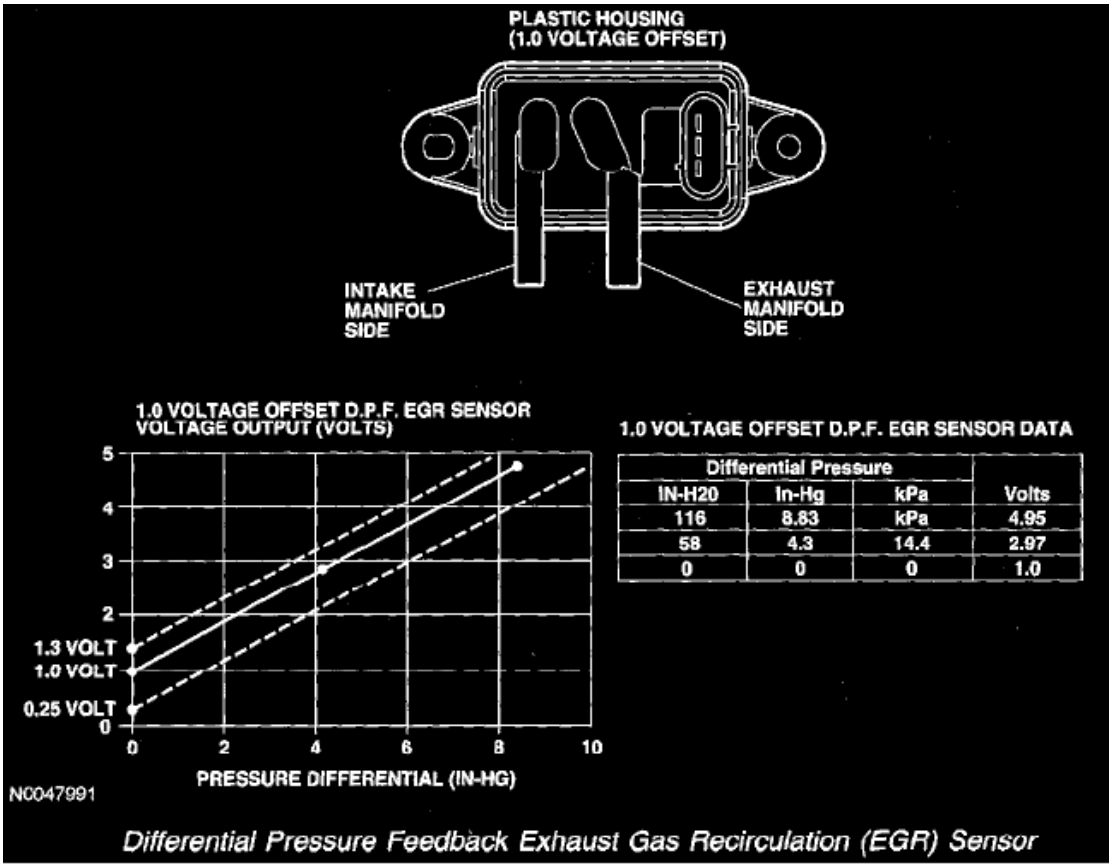
Connector: C1068

Description:	Harness:	Base Part #:
DIFFERENTIAL PRESSURE FEEDBACK EGR DPFE) SENSOR	12B637	9J460



Pin	Circuit	Gauge	Circuit Function	Quali
1	VE713 (GN-OG)	20	SENSOR - DELTA PRESSURE FEEDBACK EGR (DPFE)	3.0L, 4.
2	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	3.0L, 4.
3	LE423 (GN-VT)	20	CTRL MOD. - POWERTRAIN # VOLTAGE REFERENCE ENGINE (VREF) (E-VREV)	3.0L, 4.

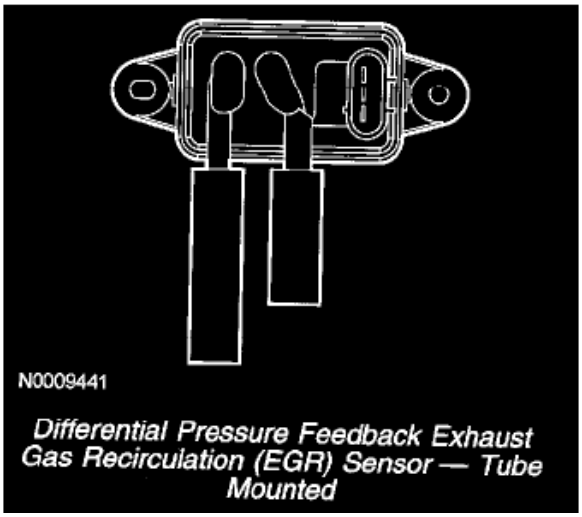
C1068



1.0 VOLTAGE OFFSET D.P.F. EGR SENSOR DATA

Differential Pressure			
IN-H20	In-Hg	kPa	Volts
116	8.83	kPa	4.95
58	4.3	14.4	2.97
0	0	0	1.0

Differential Pressure Feedback Exhaust Gas Recirculation (EGR) Sensor



Differential Pressure Feedback Exhaust Gas Recirculation (EGR) Sensor — Tube Mounted

Pressure Feedback Exhaust Sensor: Description and Operation

Differential Pressure Feedback Exhaust Gas Recirculation (EGR) Sensor

Differential Pressure Feedback Exhaust Gas Recirculation (EGR) Sensor

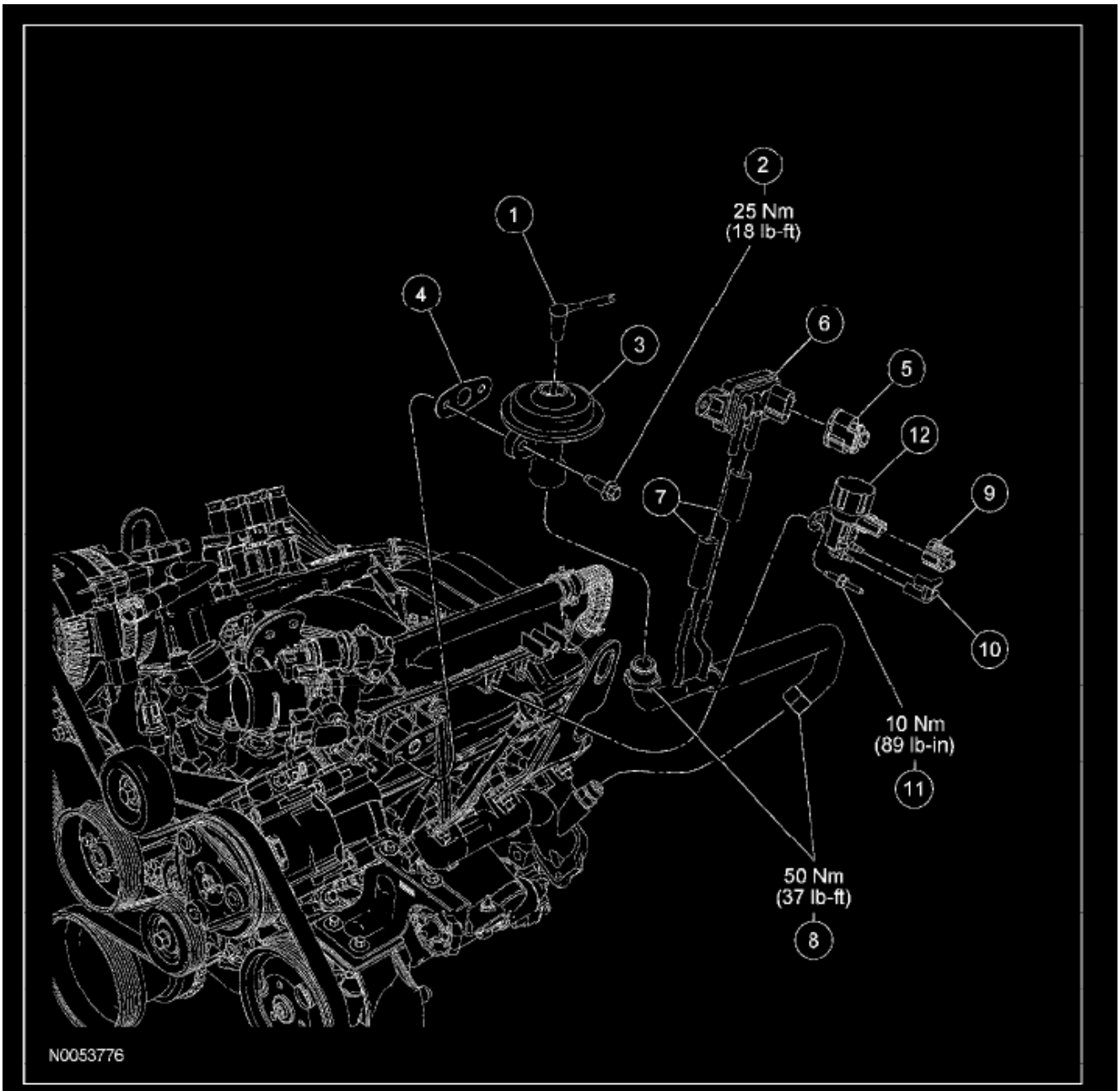
The differential pressure feedback EGR sensor is a ceramic, capacitive-type pressure transducer that monitors the differential pressure across a metering orifice located in the orifice tube assembly. The differential pressure feedback EGR sensor receives this signal through 2 hoses referred to as the downstream pressure hose (REF SIGNAL) and upstream pressure hose (HI SIGNAL). The HI and REF hose connections are marked on the differential pressure feedback EGR sensor housing for identification (note that the HI signal uses a larger diameter hose). The differential pressure feedback EGR sensor outputs a voltage proportional to the pressure drop across the metering orifice and supplies it to the PCM as EGR flow rate feedback.

Differential Pressure Feedback Exhaust Gas Recirculation (EGR) Sensor - Tube Mounted

Differential Pressure Feedback Exhaust Gas Recirculation (EGR) Sensor - Tube Mounted

The tube mounted differential pressure feedback EGR sensor is identical in operation as the larger plastic differential pressure feedback EGR sensors and uses a 1.0 volt offset. The HI and REF

hose connections are marked on the side of the sensor.



Item	Part Number	Description
1	9E499	EGR vacuum hose fitting
2	W500224	EGR valve bolt (2 required)
3	9D475	EGR valve
4	9D476	EGR valve gasket

(Continued)

Item	Part Number	Description
5	14A464	Differential pressure feedback EGR sensor electrical connector (part of 12B637)
6	9J460	Differential pressure feedback EGR sensor

(Continued)

Pressure Feedback Exhaust Sensor: Service and Repair

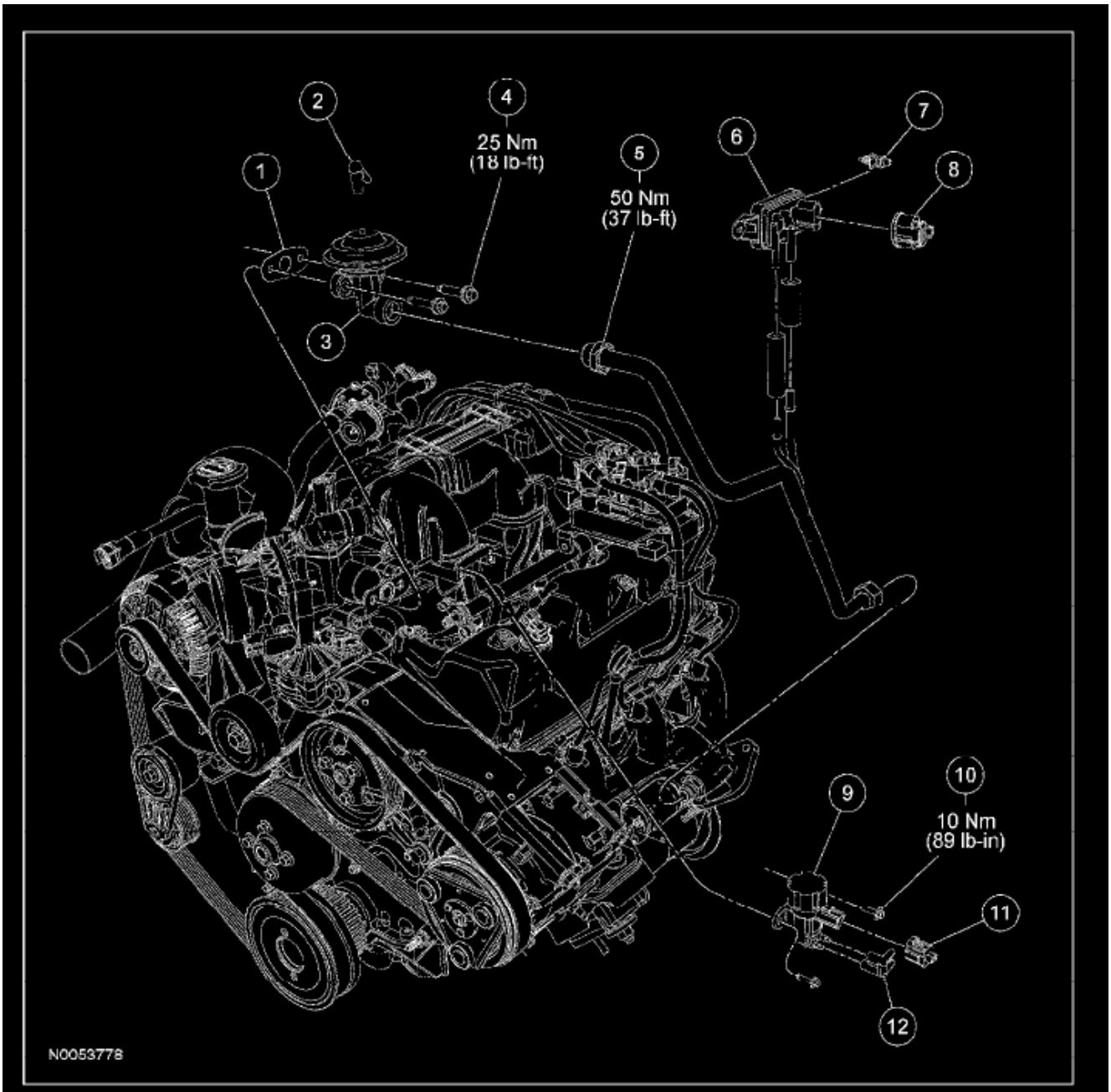
DIFFERENTIAL PRESSURE FEEDBACK EXHAUST GAS RECIRCULATION (EGR) SENSOR

Exploded View

Part 1

Item	Part Number	Description
7	9P761	Differential pressure feedback EGR sensor hoses
8	9D477	Exhaust manifold-to-EGR valve tube
9	14A464	EGR vacuum regulator solenoid electrical connector (part of 12B637)
10	9E499	EGR vacuum regulator solenoid vacuum hose fitting
11	W708628	EGR vacuum regulator solenoid stud bolt
12	9J459	EGR vacuum regulator solenoid

Part 2



Item	Part Number	Description
1	9D476	EGR valve gasket
2	9E499	EGR valve vacuum connector
3	9D475	EGR valve assembly
4	W701232	EGR valve bolt (2 required)

(Continued)

Item	Part Number	Description
5	9E469	EGR tube
6	9J460	Differential pressure feedback EGR sensor
7	13A506	Pushpin wire retainer

(Continued)

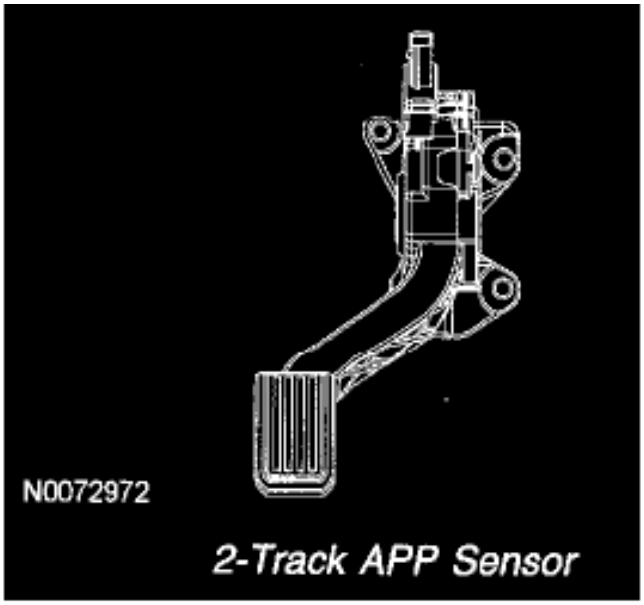
Part 1

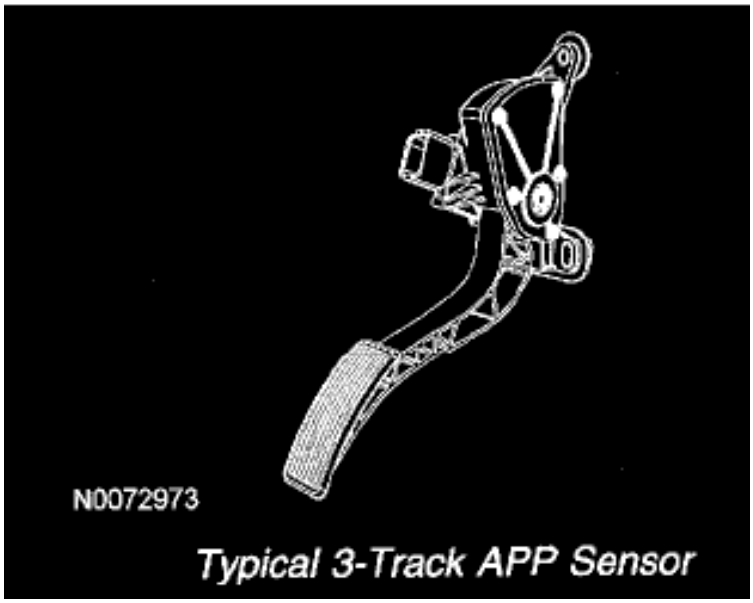
Item	Part Number	Description
8	14A464	Differential pressure feedback EGR sensor electrical connector
9	9J459	EGR vacuum regulator solenoid
10	W704310	EGR vacuum regulator solenoid bolt (2 required)
11	14A464	EGR vacuum regulator solenoid electrical connector
12	9E499	EGR vacuum regulator solenoid vacuum connector

Part 2

Removal and Installation

1. Disconnect the pushpin retainer from the differential pressure feedback EGR sensor. 2. Disconnect the differential pressure feedback EGR sensor electrical connector. 3. Remove the differential pressure feedback EGR sensor from the hoses. 4. To install, reverse the removal procedure.





Accelerator Pedal Position Sensor: Description and Operation

ACCELERATOR PEDAL POSITION (APP) SENSOR

The APP sensor is an input to the powertrain control module (PCM) and is used to determine the amount of torque requested by the operator. Depending on the application either a 2-track or 3-track APP sensor is used.

2-Track APP Sensor

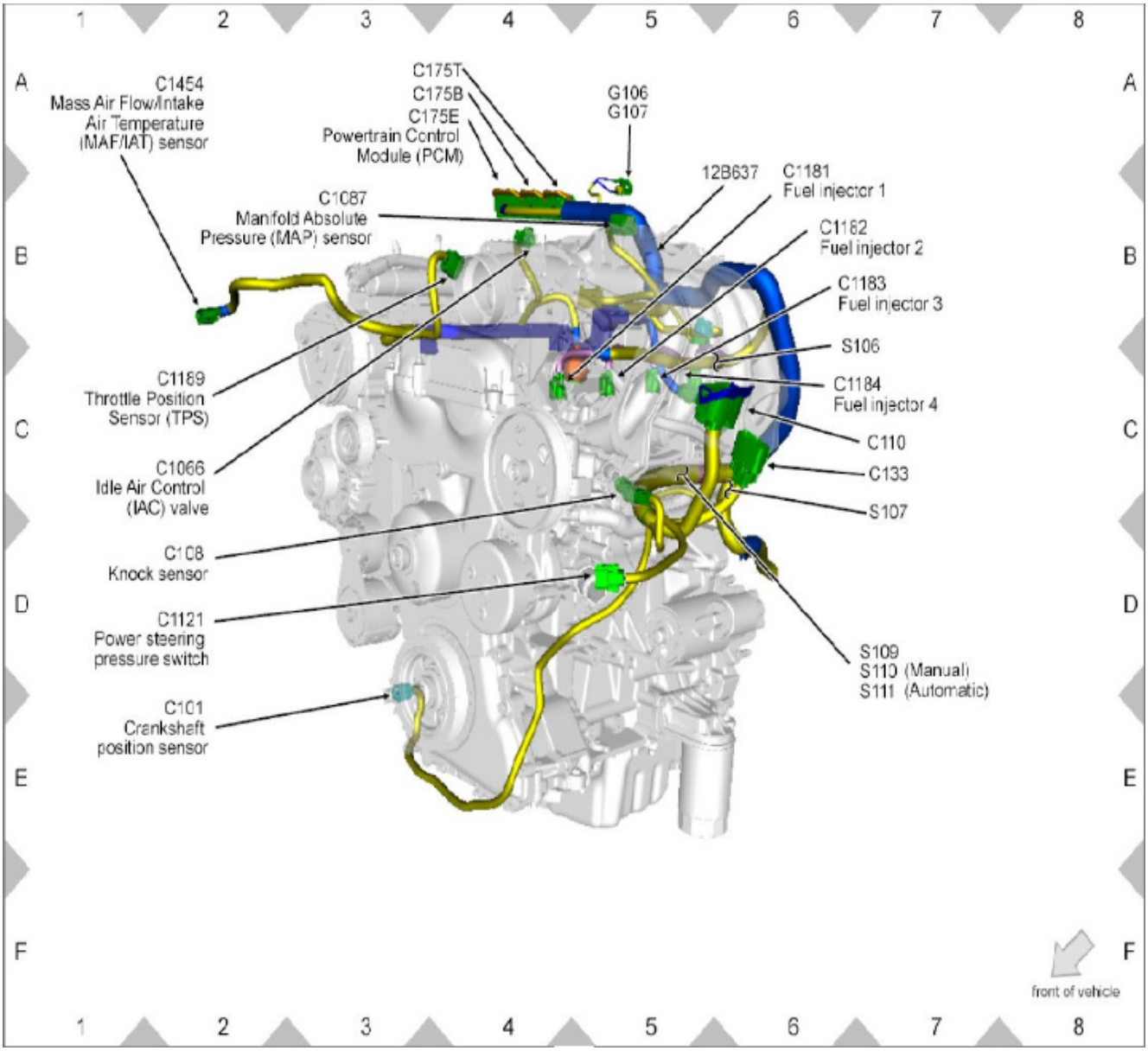
2-Track APP Sensor

There are 2 pedal position signals in the sensor. Both signals, APP1 and APP2, have a positive slope (increasing angle, increasing voltage), but are offset and increase at different rates. The 2 pedal position signals make sure the PCM receives a correct input even if 1 signal has a concern. The PCM determines if a signal is incorrect by calculating where it should be, inferred from the other signals. If a concern is present with one of the circuits the other input is used. There are 2 reference voltage circuits, 2 signal return circuits, and 2 signal circuits (a total of 6 circuits and pins) between the PCM and the APP sensor assembly. The reference voltage circuits and the signal return circuits are shared with the reference voltage circuit and signal return circuit used by the electronic throttle body (ETB) throttle position sensor. The pedal position signal is converted to pedal travel degrees (rotary angle) by the PCM. The software then converts these degrees to counts, which is the input to the torque based strategy.

3-Track APP Sensor

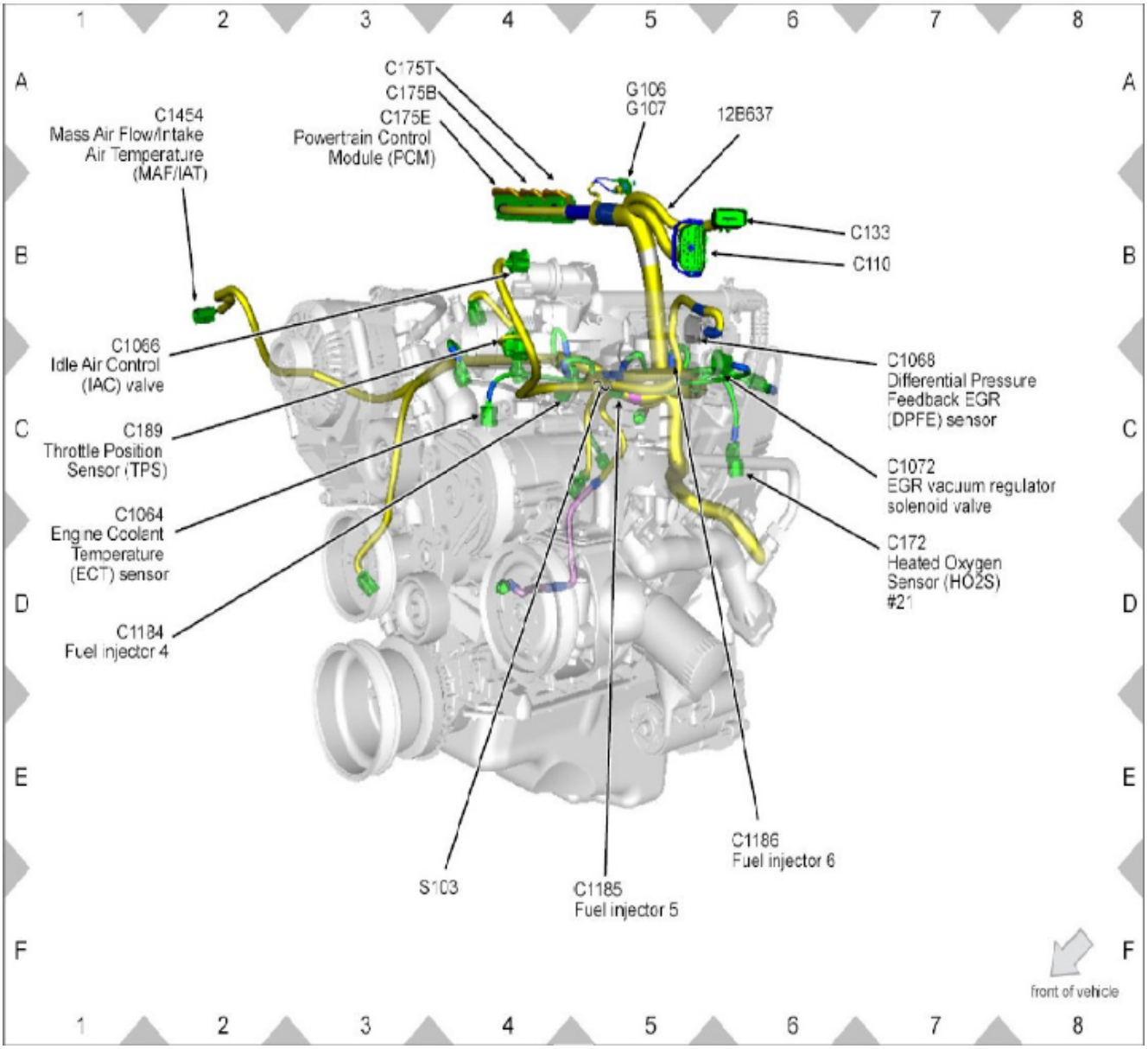
Typical 3-Track APP Sensor

There are 3 pedal position signals in the sensor. Signal 1, APP1, has a negative slope (increasing angle, decreasing voltage) and signals 2 and 3, APP2 and APP3, both have a positive slope (increasing angle, increasing voltage). During normal operation APP1 is used as the indication of pedal position by the strategy. The 3 pedal position signals make sure the PCM receives a correct input even if 1 signal has a concern. The PCM determines if a signal is incorrect by calculating where it should be, inferred from the other signals. If a concern is present with one of the circuits the other inputs are used. The pedal position signal is converted to pedal travel degrees (rotary angle) by the PCM. The software then converts these degrees to counts, which is the input to the torque based strategy. There are 2 reference voltage circuits, 2 signal return circuits, and 3 signal circuits (a total of 7 circuits and pins) between the PCM and the APP sensor assembly. The reference voltage circuits and the signal return circuits are shared with the reference voltage circuit and signal return circuit used by the electronic throttle body (ETB) throttle position sensor.

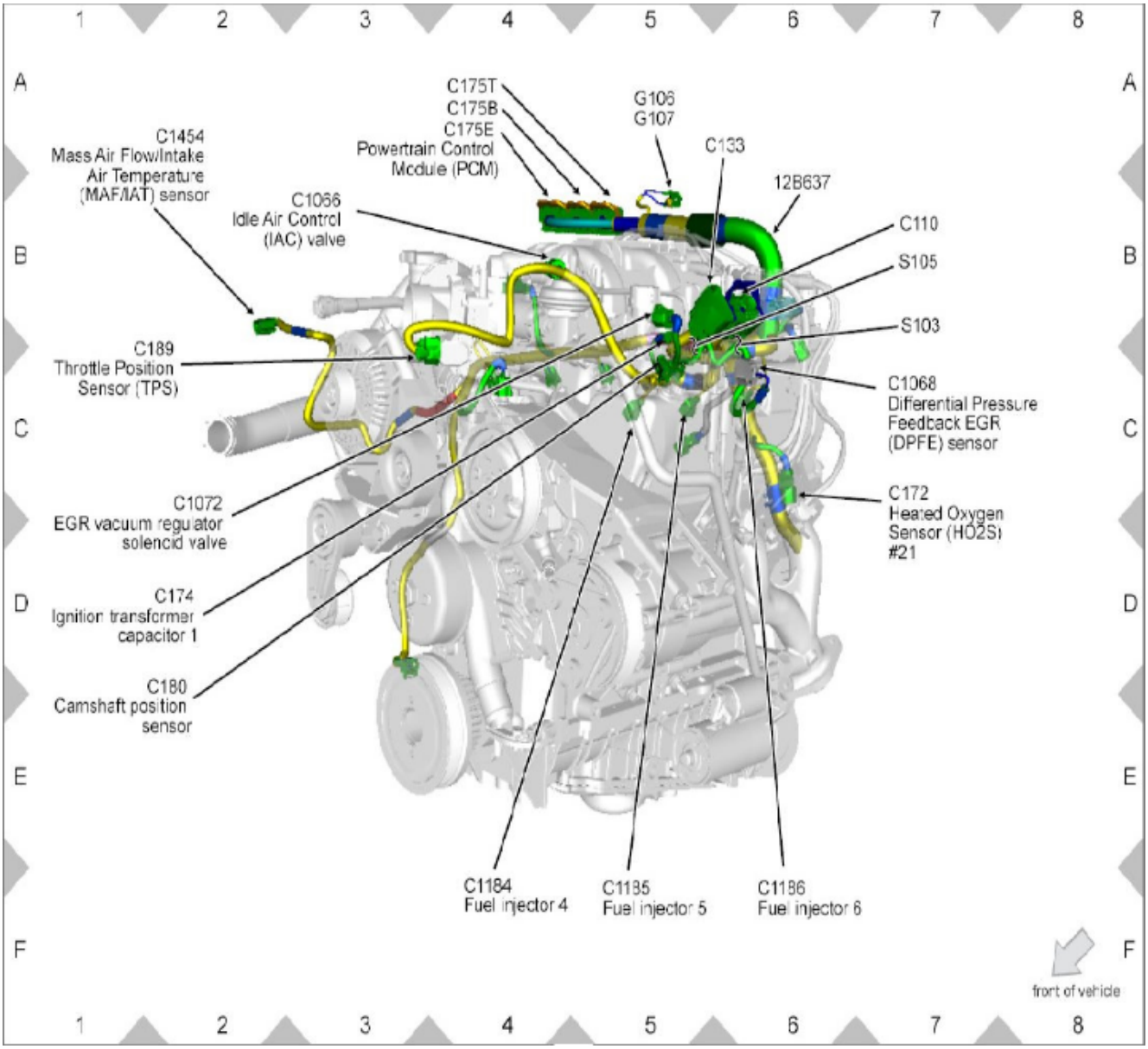


Air Flow Meter/Sensor: Locations

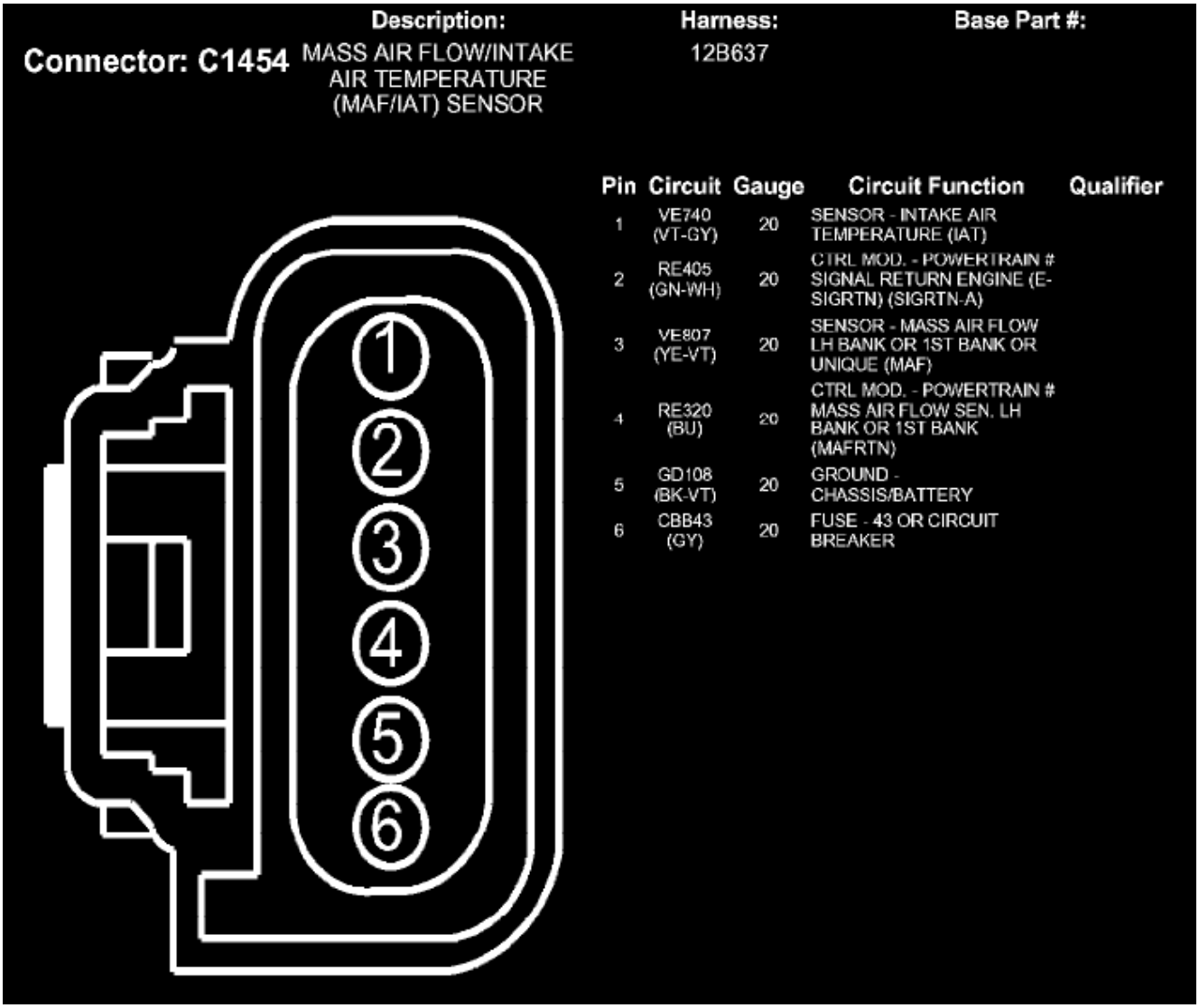
View 151-3


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
12B637
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT)
C133
C110
C1066
Idle Air Control (IAC) valve
C189
Throttle Position Sensor (TPS)
C1064
Engine Coolant Temperature (ECT) sensor
C1184
Fuel injector 4
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
S103
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-5


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
C133
12B637
C110
S105
S103
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor
C1066
Idle Air Control (IAC) valve
C189
Throttle Position Sensor (TPS)
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
C174
Ignition transformer capacitor 1
C180
Camshaft position sensor
C1184
Fuel injector 4
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-7



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE740 (VT-GY)	20	SENSOR - INTAKE AIR TEMPERATURE (IAT)	
2	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	
3	VE807 (YE-VT)	20	SENSOR - MASS AIR FLOW LH BANK OR 1ST BANK OR UNIQUE (MAF)	
4	RE320 (BU)	20	CTRL MOD. - POWERTRAIN # MASS AIR FLOW SEN. LH BANK OR 1ST BANK (MAFRTN)	
5	GD108 (BK-VT)	20	GROUND - CHASSIS/BATTERY	
6	CBB43 (GY)	20	FUSE - 43 OR CIRCUIT BREAKER	

C1454

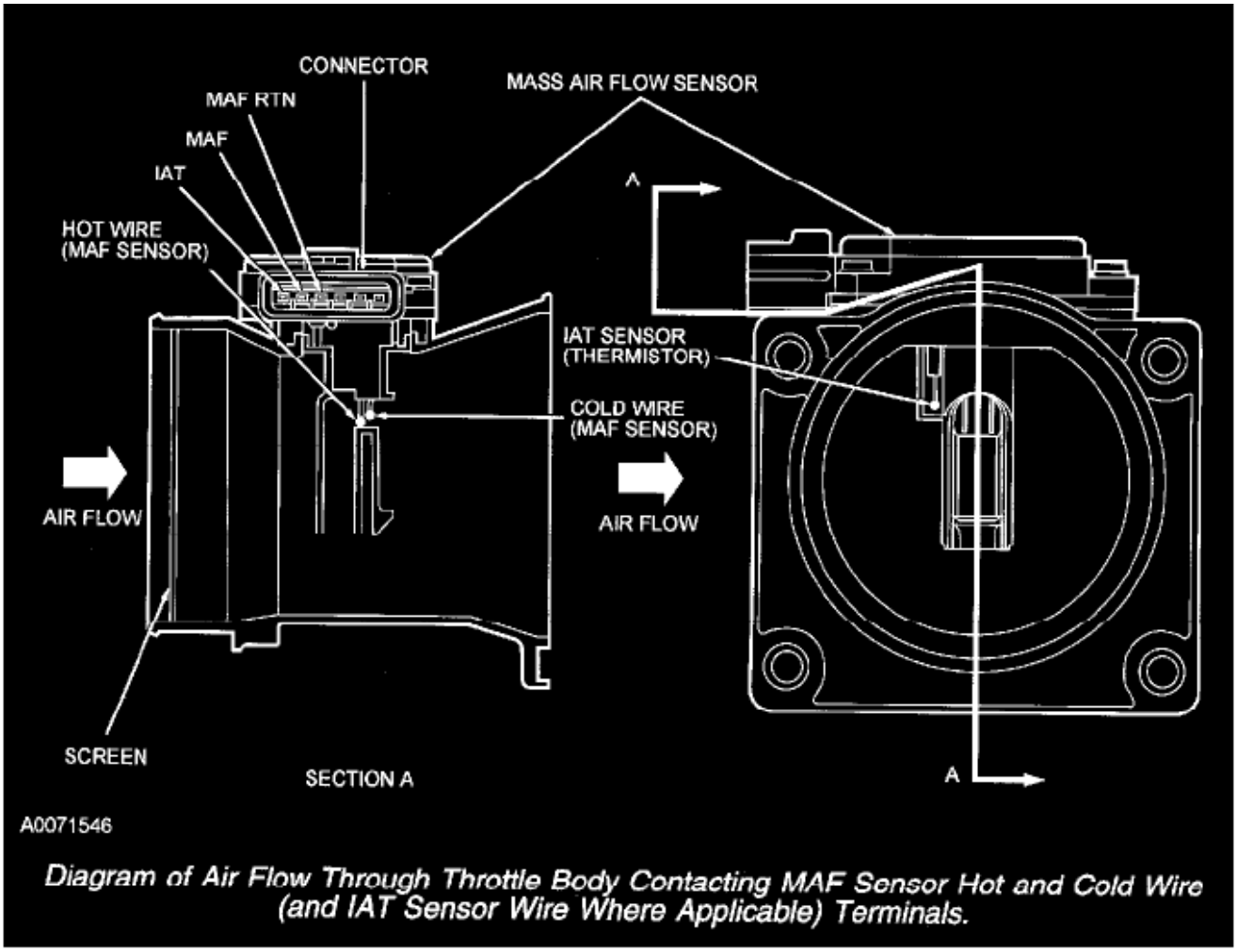
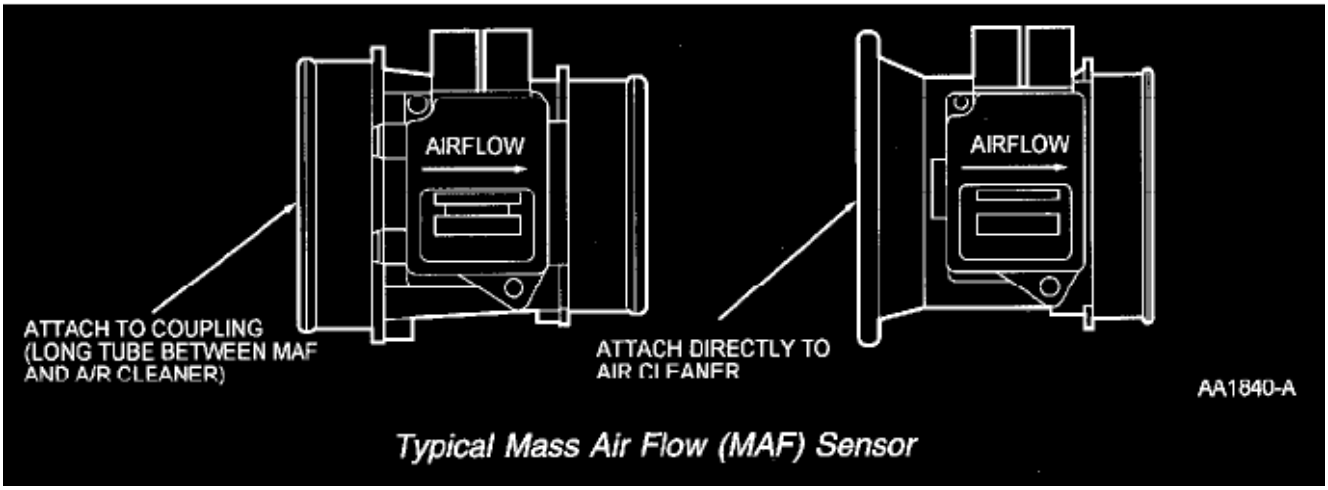


Diagram of Air Flow Through Throttle Body Contacting MAF Sensor Hot and Cold Wire (and IAT Sensor Wire Where Applicable) Terminals.



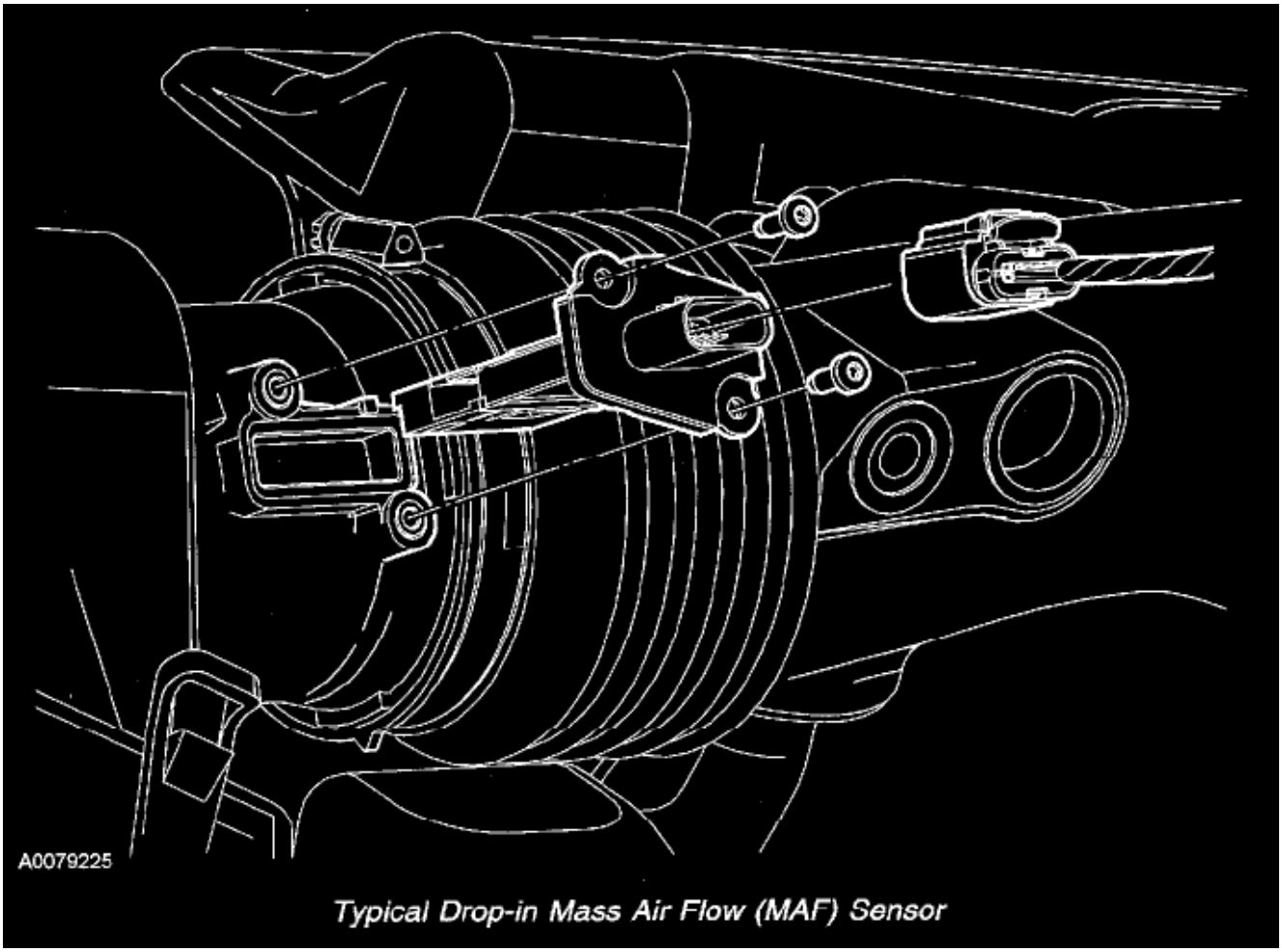
Typical Mass Air Flow (MAF) Sensor

Air Flow Meter/Sensor: Description and Operation

MASS AIR FLOW (MAF) SENSOR

Diagram Of Air Flow Through Throttle Body Contacting MAF Sensor Hot And Cold Wire (and IAT Sensor Wire Where Applicable) Terminals

Typical Mass Air Flow (MAF) Sensor

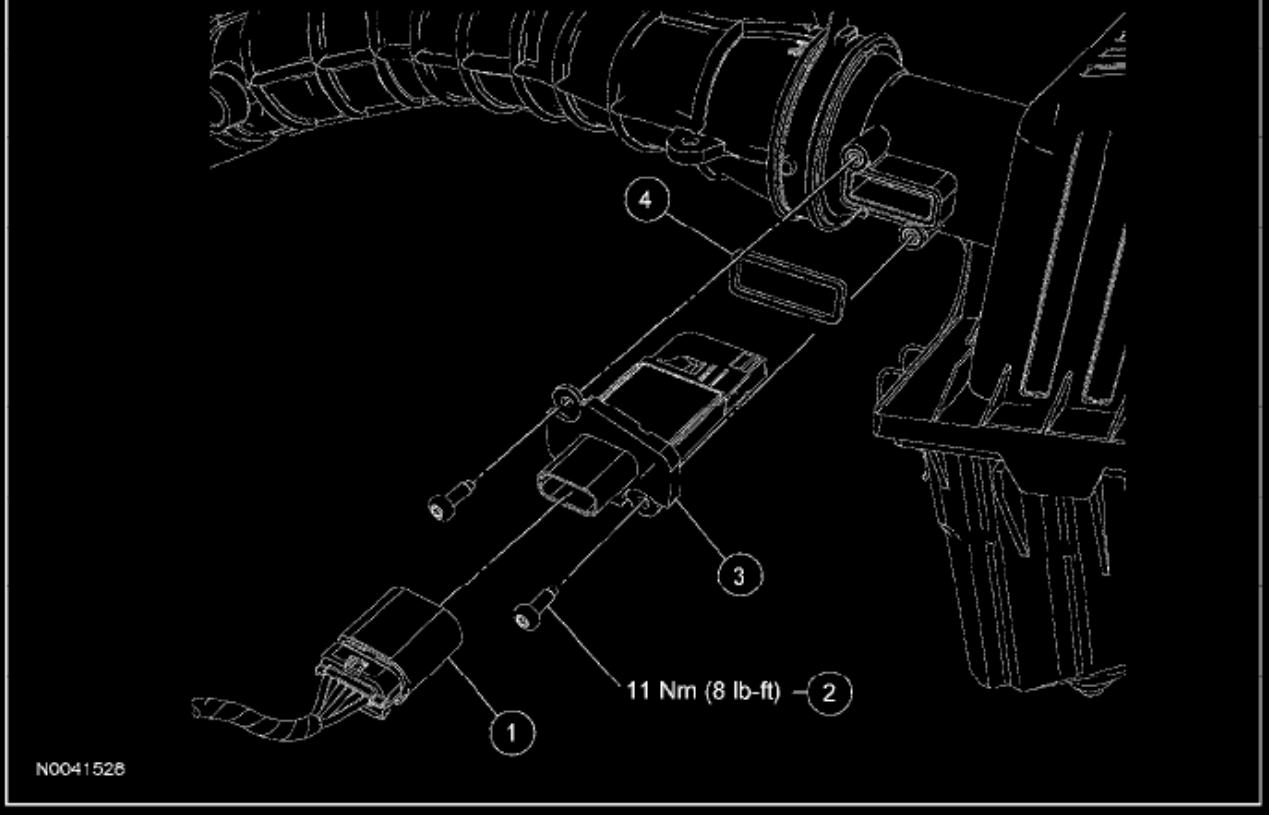


Typical Drop-in Mass Air Flow (MAF) Sensor

Typical Drop-in Mass Air Flow (MAF) Sensor

The MAF sensor uses a hot wire sensing element to measure the amount of air entering the engine. Air passing over the hot wire causes it to cool. This hot wire is maintained at 200°C (392°F) above the ambient temperature as measured by a constant cold wire. The current required to maintain the temperature of the hot wire is proportional to the mass air flow. The MAF sensor then outputs an analog voltage signal to the PCM proportional to the intake air mass. The PCM calculates the required fuel injector pulse width in order to provide the desired air/fuel ratio. This input is also used in determining transmission electronic pressure control (EPC), shift and torque converter clutch scheduling.

The MAF sensor is located between the air cleaner and the throttle body or inside the air cleaner assembly. Most MAF sensors have integrated bypass technology with an integrated intake air temperature (IAT) sensor. The hot wire electronic sensing element must be replaced as an assembly. Replacing only the element may change the air flow calibration.



Item	Part Number	Description
1	14A464	Mass air flow (MAF) sensor electrical connector (part of 12B637)
2	W709287	MAF sensor bolt (2 required)
3	12B605	MAF sensor
4	—	MAF sensor gasket

Air Flow Meter/Sensor: Service and Repair

MASS AIR FLOW (MAF) SENSOR

Removal and Installation

1. Disconnect the mass air flow (MAF) sensor electrical connector. 2. Remove the 2 bolts, the MAF sensor and discard the gasket.

- To install, tighten to 11 Nm (8 lb-ft).

3. CAUTION: Do not tamper with the mass air flow (MAF) sensing elements located in the airflow bypass. Tampering may result in

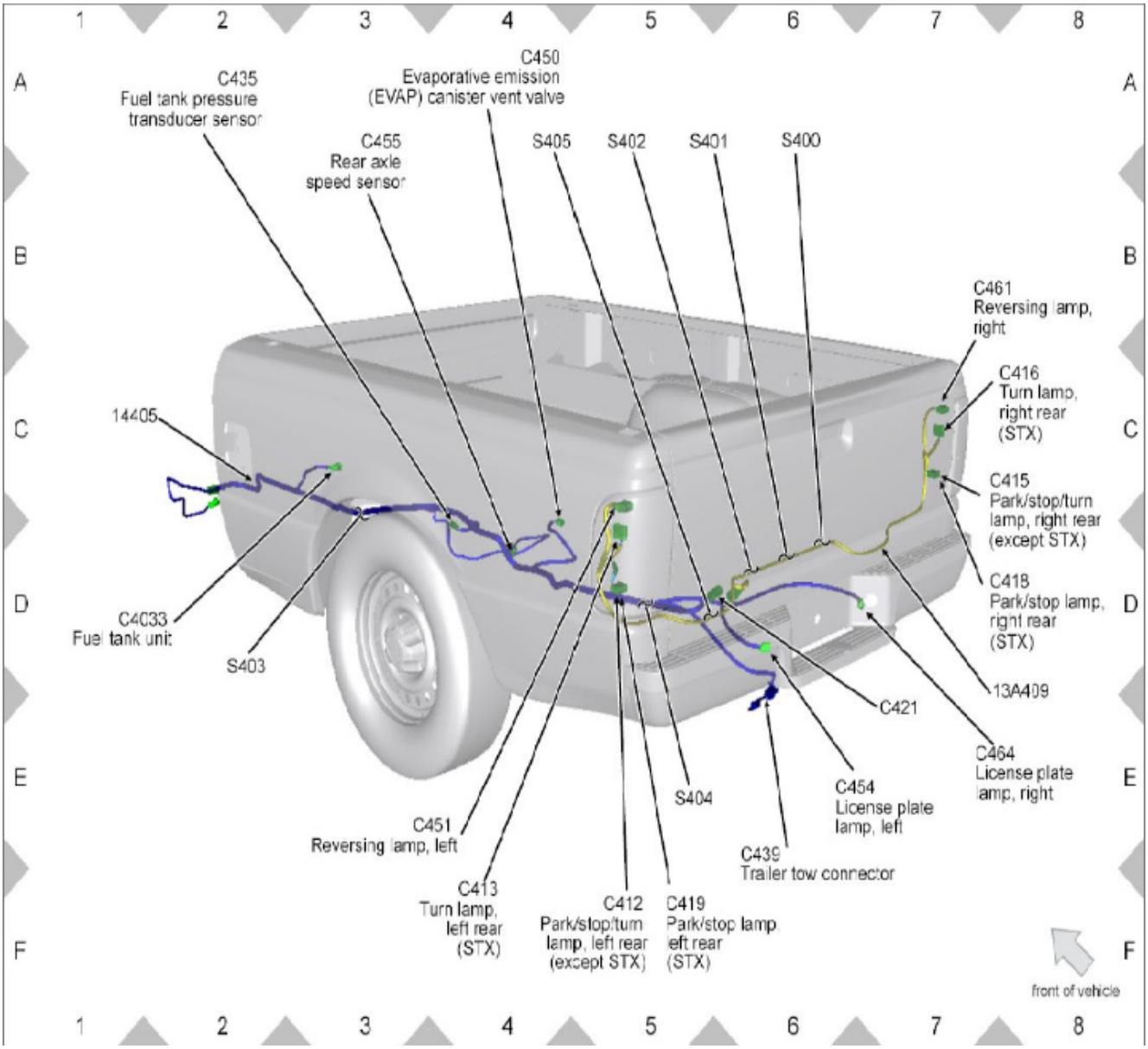
failure.

NOTE: The MAF sensor module and body are calibrated and installed as a unit.

To install, reverse the removal procedure. -

Install a new gasket.

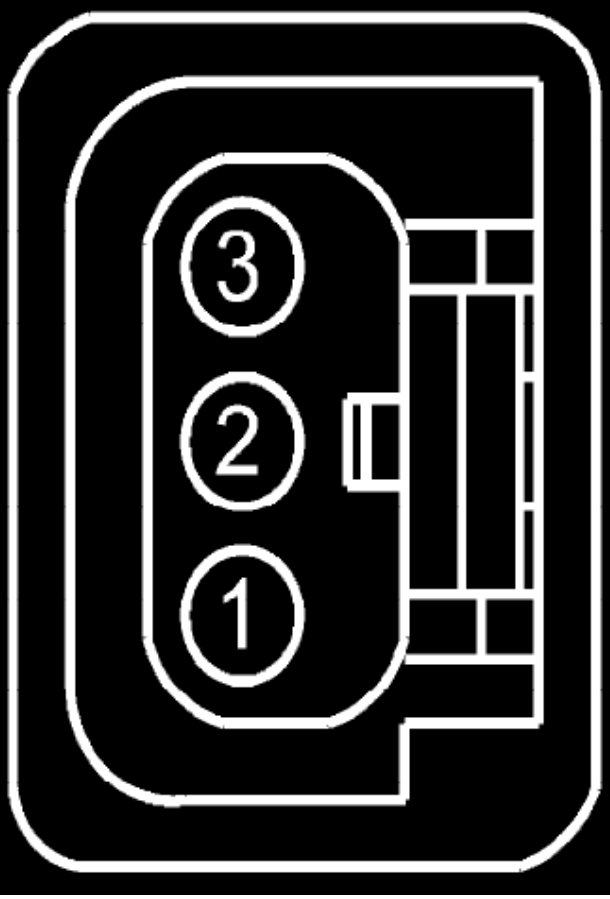
Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Powertrain Management > Sensors and Switches - Powertrain Management > Sensors and Switches - Fuel Delivery and Air Induction > Fuel Pressure Sensor/Switch > Component Information > Locations



View 151-27

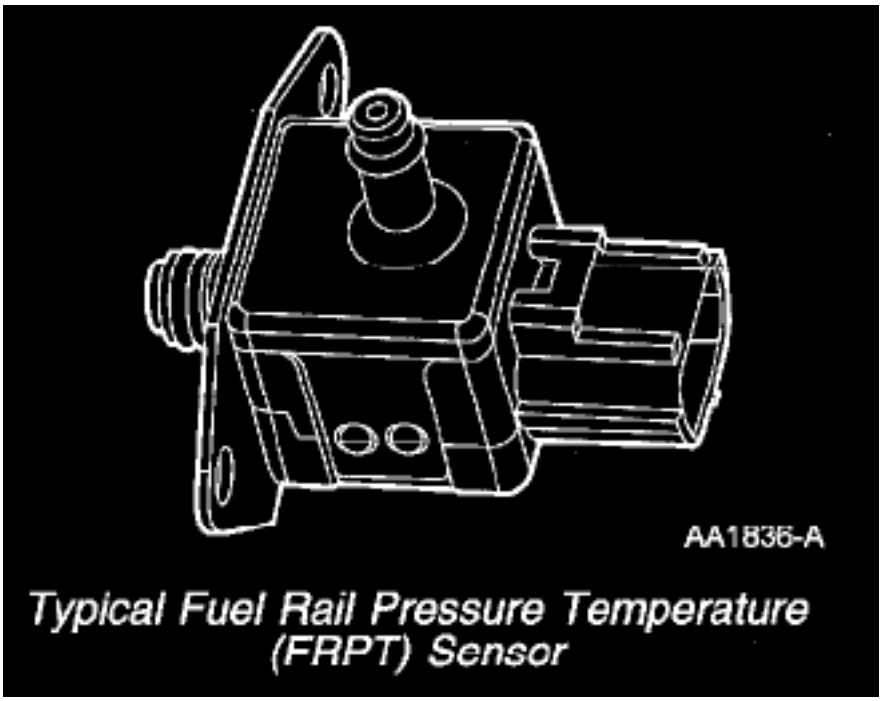
Connector: C435

Description:	Harness:	Base Part #:
FUEL TANK PRESSURE TRANSDUCER SENSOR	14405	9C968



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	LE424 (YE-GN)	20	CTRL MOD. - POWERTRAIN # VOLTAGE REFERENCE COWL (C-VREV)	
2	RE407 (YE-VT)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN COWL (C-SIGRTN) (SIGRTN-C)	
3	VE922 (VT-GN)	20	TRANSDUCER - FUEL TANK PRESSURE (FTPT)	

C435



Typical Fuel Rail Pressure Temperature (FRPT) Sensor

Fuel Pressure Sensor/Switch: Description and Operation

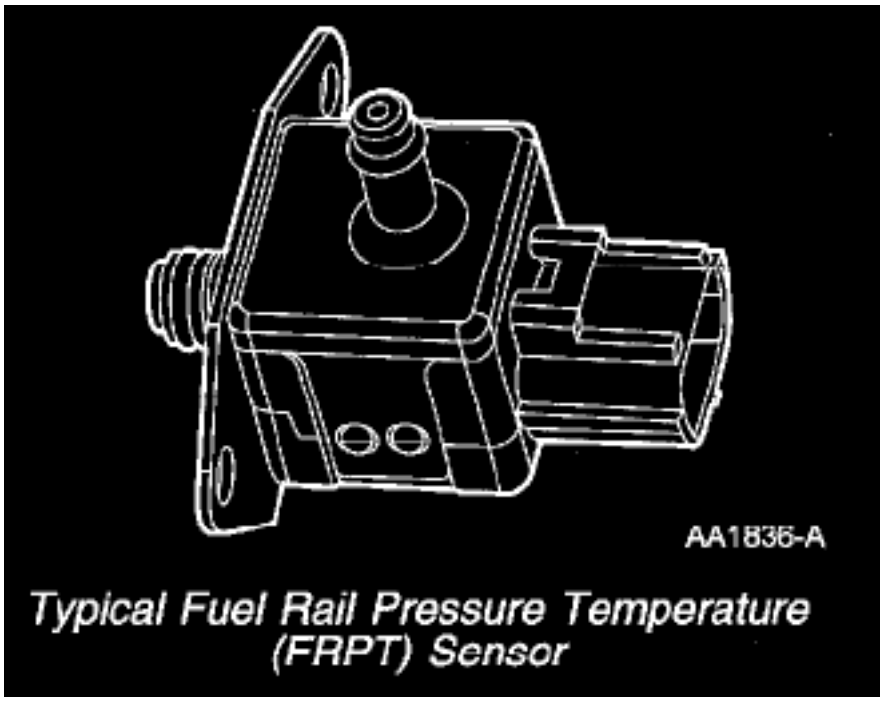
FUEL RAIL PRESSURE TEMPERATURE (FRPT) SENSOR

Typical Fuel Rail Pressure Temperature (FRPT) Sensor

The FRPT sensor measures the pressure and temperature of the fuel in the fuel rail and sends these signals to the PCM. The sensor uses the intake manifold vacuum as a reference to determine the pressure difference between the fuel rail and the intake manifold. The relationship between fuel pressure and fuel temperature is used to determine the possible presence of fuel vapor in the fuel rail.

The temperature sensing portion of the FRPT sensor is a thermistor device in which resistance changes with temperature. The electrical resistance of the thermistor decreases as the temperature increases, and the resistance increases as the temperature decreases. The varying resistance changes the voltage drop across the sensor terminals and provides electrical signals to the PCM corresponding to temperature.

Both the pressure and temperature signals are used to control the speed of the fuel pump. The speed of the fuel pump sustains fuel rail pressure which preserves fuel in its liquid state. The dynamic range of the fuel injectors increase because of the higher rail pressure, which allows the injector pulse width to decrease.



Typical Fuel Rail Pressure Temperature (FRPT) Sensor

Fuel Temperature Sensor: Description and Operation

FUEL RAIL PRESSURE TEMPERATURE (FRPT) SENSOR

Typical Fuel Rail Pressure Temperature (FRPT) Sensor

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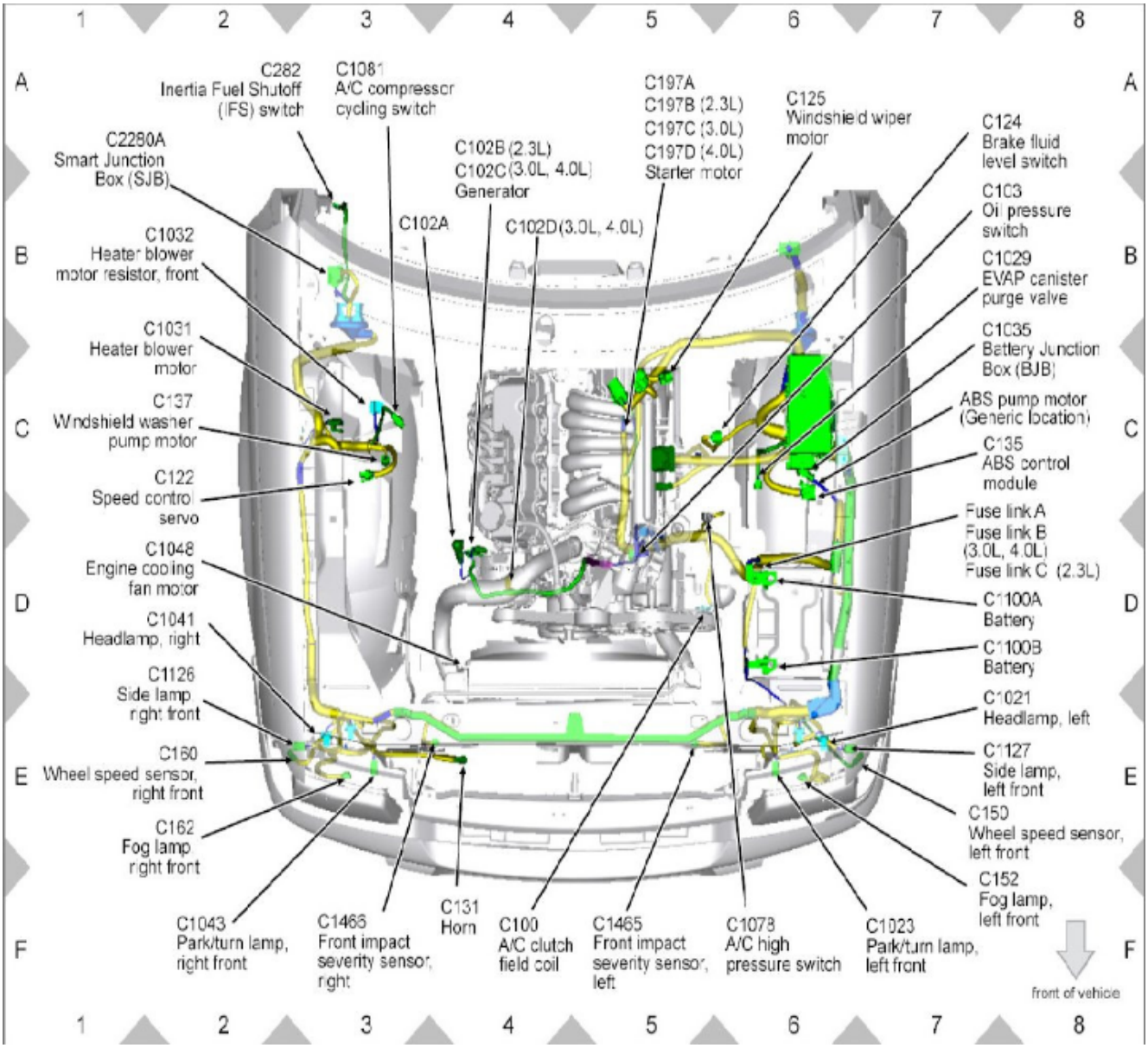
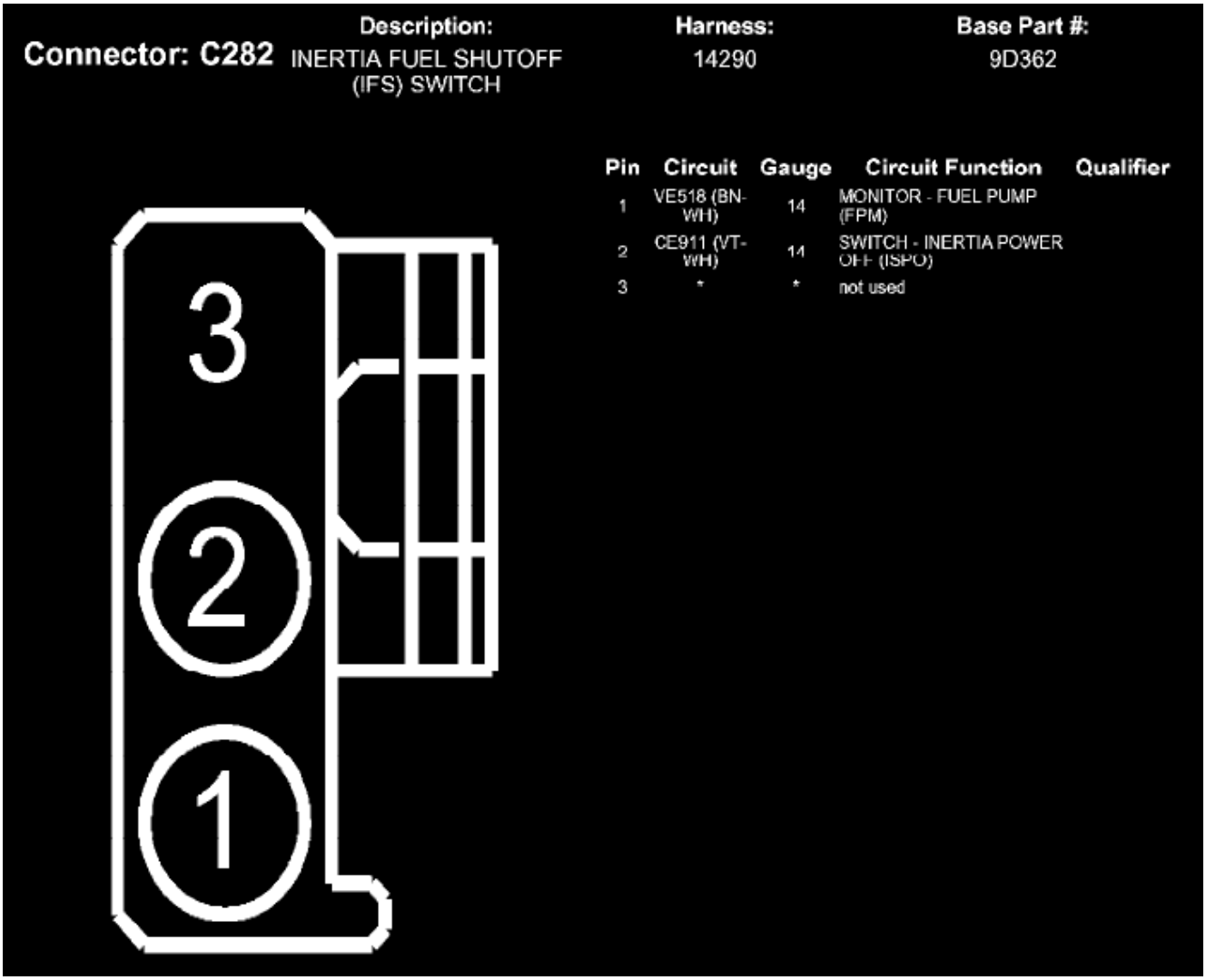
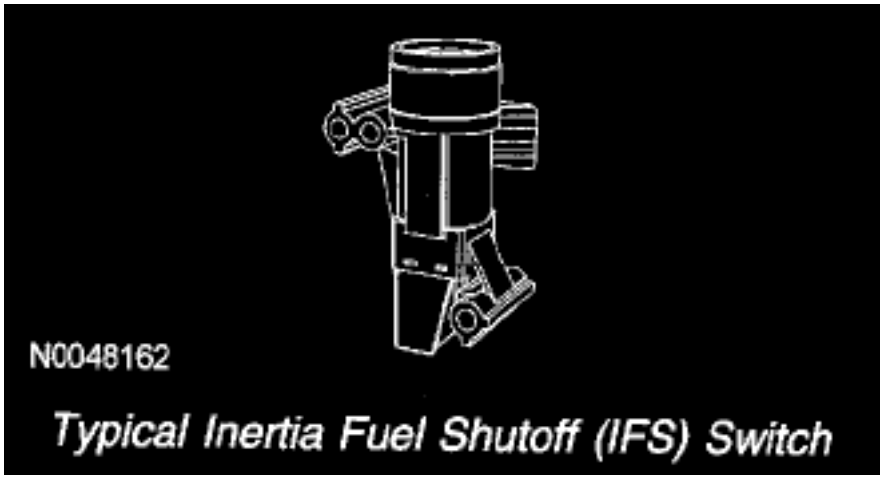
Both the pressure and temperature signals are used to control the speed of the fuel pump. The speed of the fuel pump sustains fuel rail pressure which preserves fuel in its liquid state. The dynamic range of the fuel injectors increase because of the higher rail pressure, which allows the injector pulse width to decrease.


C282
Inertia Fuel Shutoff (IFS) switch
C1081
A/C compressor cycling switch
C2280A
Smart Junction Box (SJB)
C102B (2.3L)
C102C (3.0L, 4.0L)
Generator
C102A
C102D (3.0L, 4.0L)
C197A
C197B (2.3L)
C197C (3.0L)
C197D (4.0L)
Starter motor
C125
Windshield wiper motor
C124
Brake fluid level switch
C103
Oil pressure switch
C1032
Heater blower motor resistor, front
C1029
EVAP canister purge valve
C1031
Heater blower motor
C1035
Battery Junction Box (BJB)
C137
Windshield washer pump motor
ABS pump motor (Generic location)
C135
ABS control module
C122
Speed control servo
Fuse link A
Fuse link B (3.0L, 4.0L)
Fuse link C (2.3L)
C1048
Engine cooling fan motor
C1100A
Battery
C1041
Headlamp, right
C1100B
Battery
C1126
Side lamp, right front
C1021
Headlamp, left
C160
Wheel speed sensor, right front
C1127
Side lamp, left front
C162
Fog lamp, right front
C150
Wheel speed sensor, left front
C152
Fog lamp, left front
C1043
Park/turn lamp, right front
C1466
Front impact severity sensor, right
C131
Horn
C100
A/C clutch field coil
C1465
Front impact severity sensor, left
C1078
A/C high pressure switch
C1023
Park/turn lamp, left front
front of vehicle

View 151-1


Connector: C282
Description:
INERTIA FUEL SHUTOFF (IFS) SWITCH
Harness:
14290
Base Part #:
9D362
3
2
1
Pin Circuit Gauge Circuit Function Qualifier
1 VE518 (BN-WH) 14 MONITOR - FUEL PUMP (FPM)
2 CE911 (VT-WH) 14 SWITCH - INERTIA POWER OFF (ISPO)
3 * * not used

C282

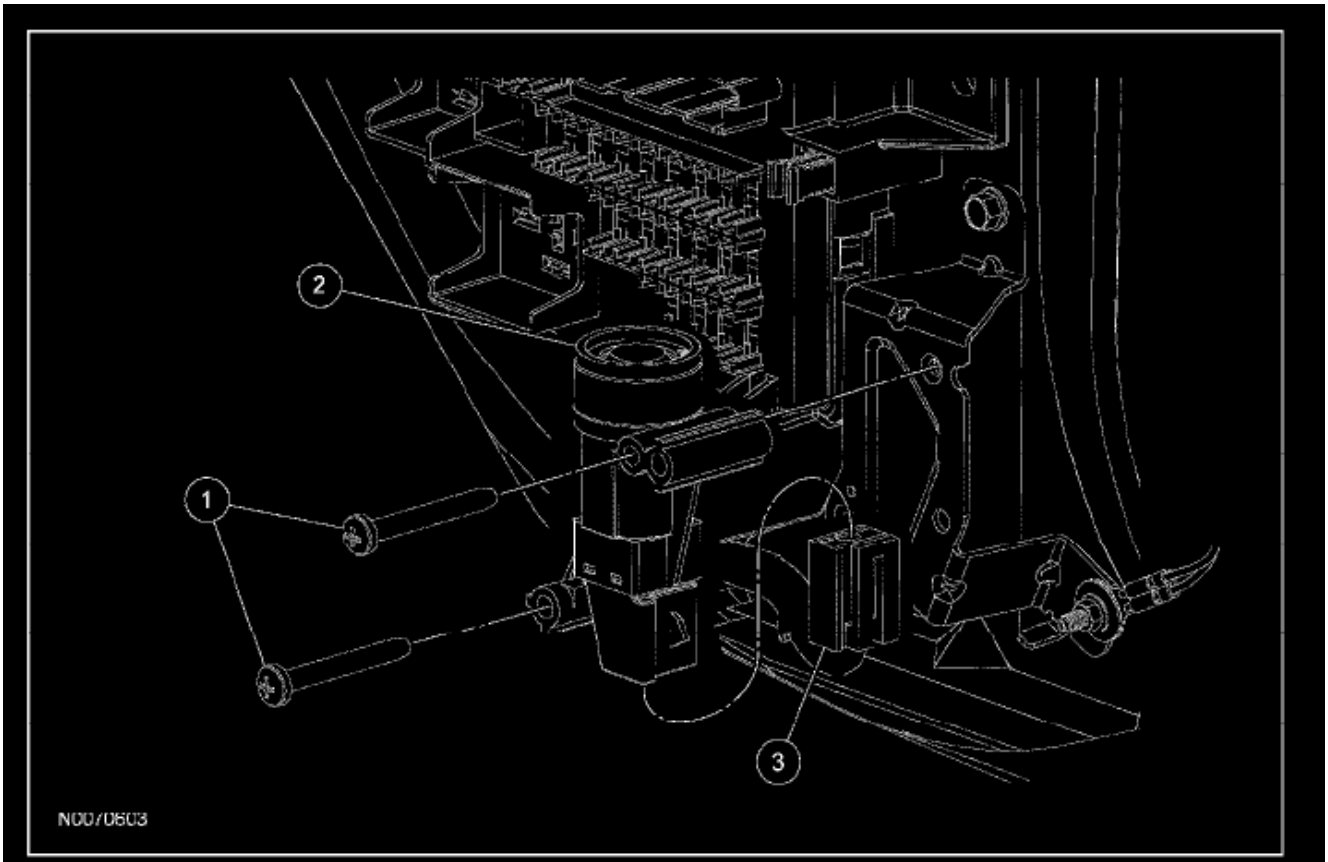


Inertia Fuel Shutoff Switch: Description and Operation

INERTIA FUEL SHUTOFF (IFS) SWITCH

Typical Inertia Fuel Shutoff (IFS) Switch

The IFS switch is used in conjunction with the electric fuel pump. The purpose of the IFS switch is to shutoff the fuel pump if a collision occurs. It consists of a steel ball held in place by a magnet. When a sharp impact occurs, the ball breaks loose from the magnet, rolls up a conical ramp and strikes a target plate which opens the electrical contacts of the switch and shuts off the electric fuel pump. Once the switch is open, it must be manually reset before restarting the vehicle. Refer to the Owner's Literature, Roadside Emergencies for the location of the IFS switch.



Item	Part Number	Description
1	W504467	Inertia fuel shutoff (IFS) switch screws
2	9341	IFS switch
3	—	IFS switch electrical connector (part of 180101)

Inertia Fuel Shutoff Switch: Service and Repair

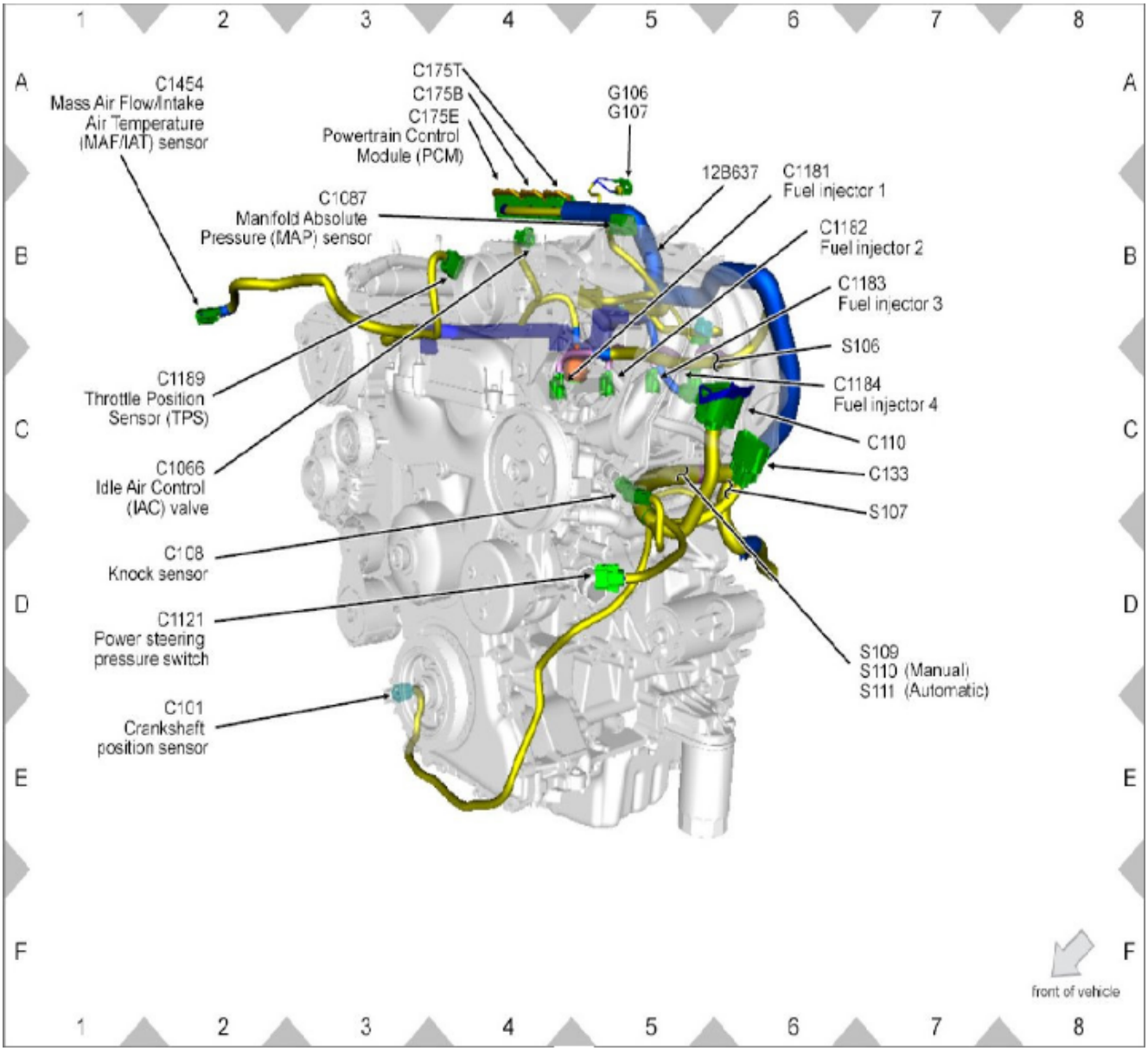
INERTIA FUEL SHUTOFF (IFS) SWITCH

Removal and Installation

1. NOTE: The inertia fuel shutoff (IFS) switch is located behind the RH cowl panel.

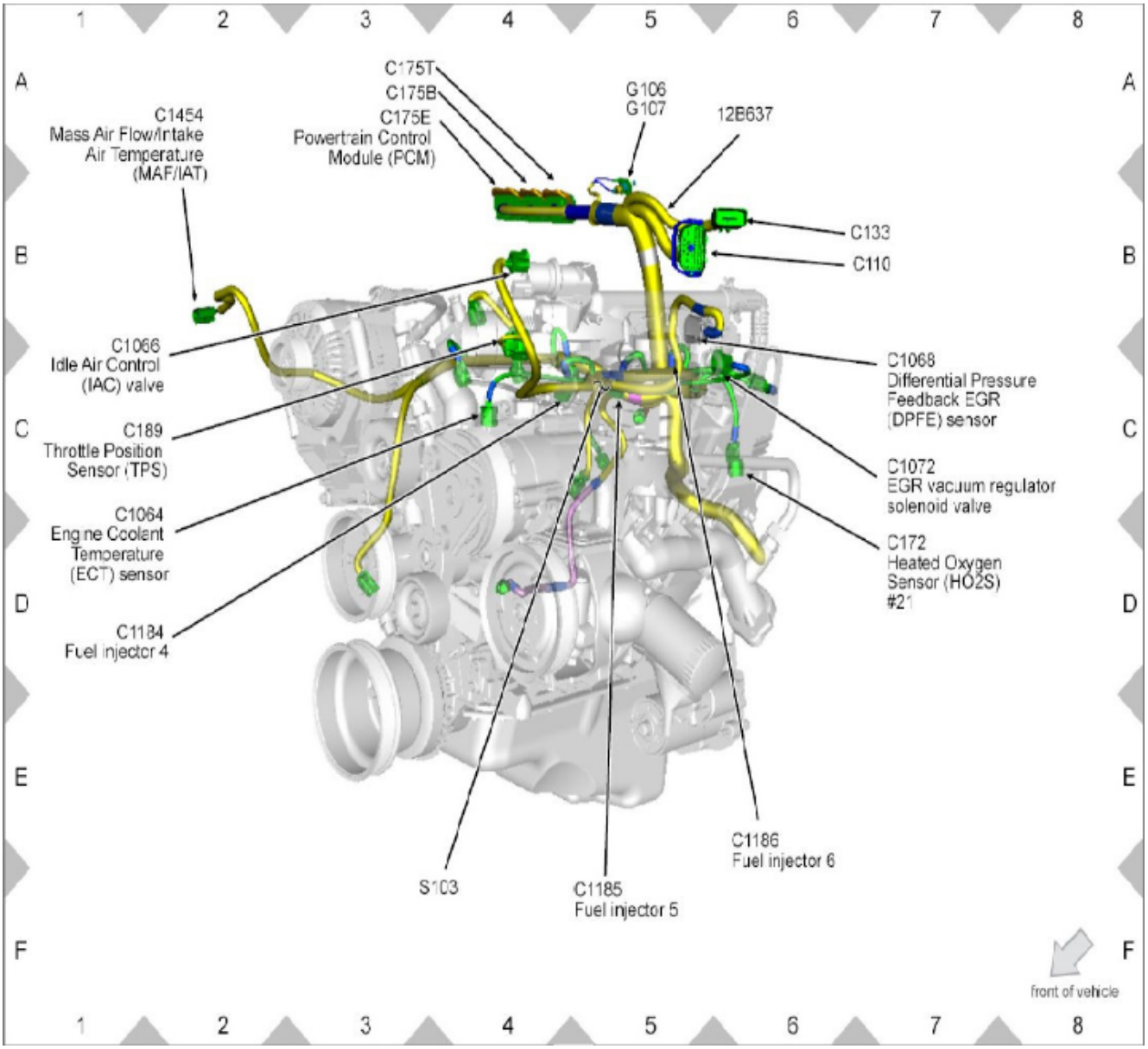
Remove the RH scuff plate and cowl panel.

2. Remove the screws and the IFS switch. 3. Disconnect the IFS switch electrical connector. 4. To install, reverse the removal procedure.

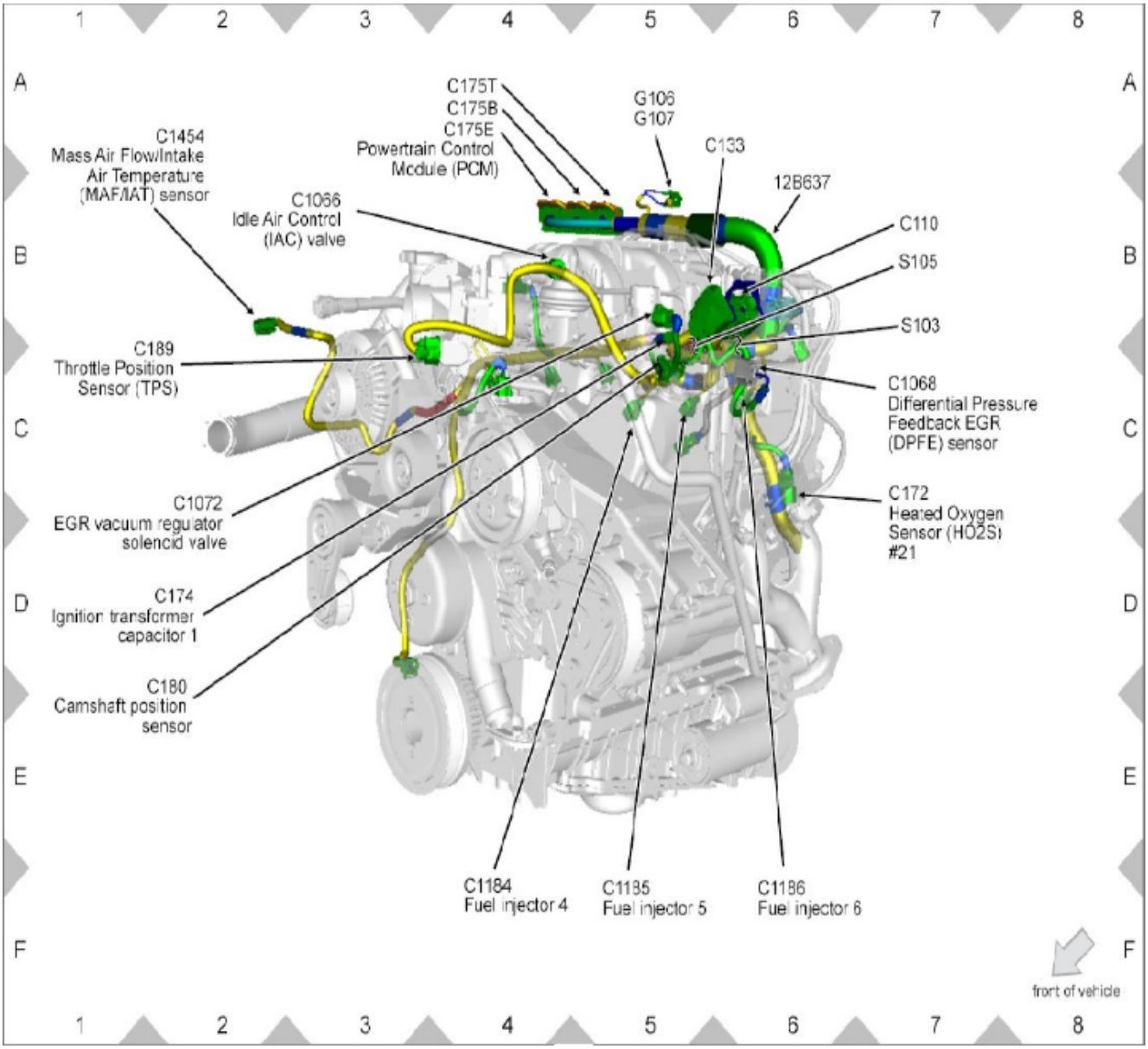


Throttle Position Sensor: Locations

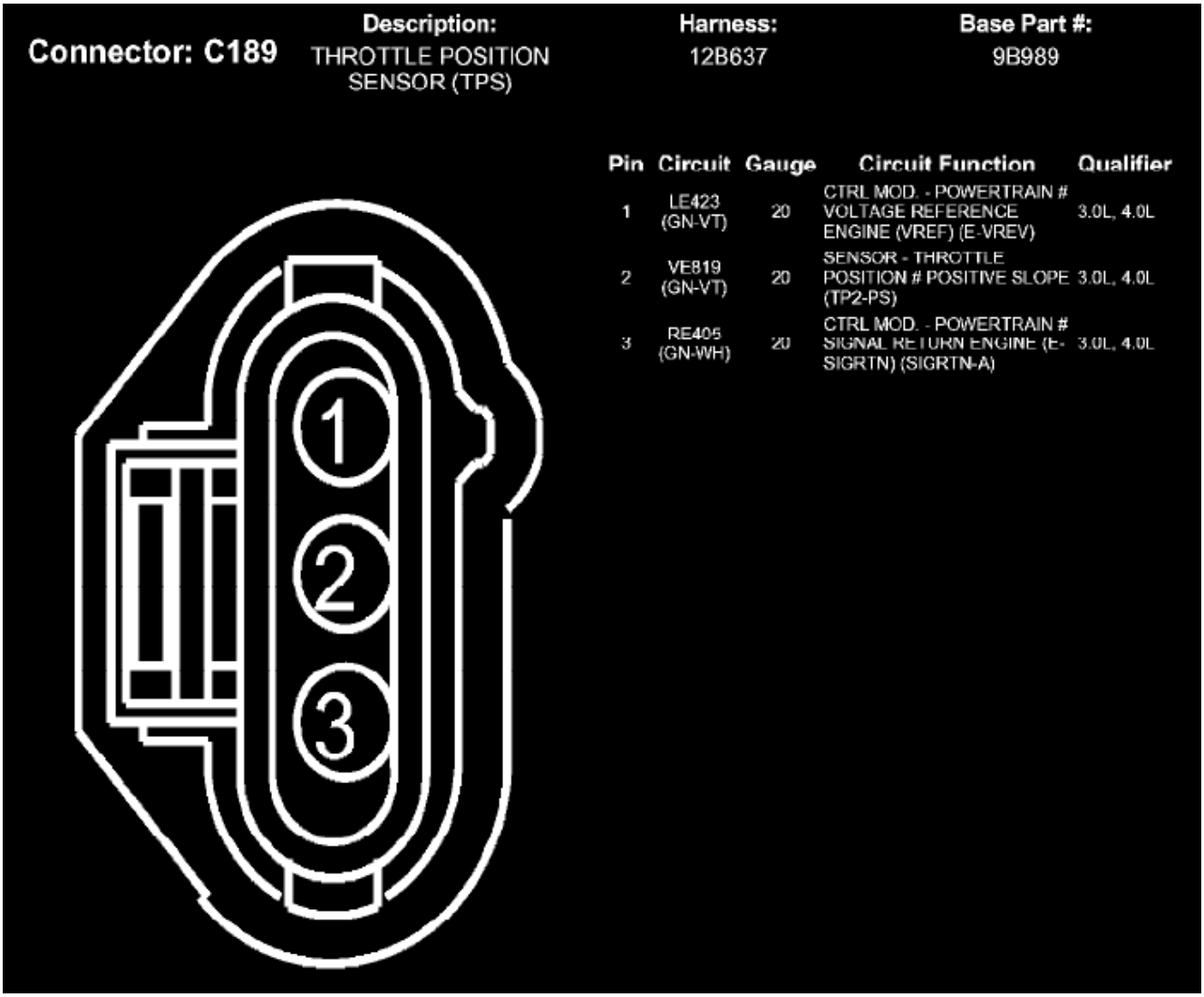
View 151-3


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
12B637
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT)
C133
C110
C1066
Idle Air Control (IAC) valve
C189
Throttle Position Sensor (TPS)
C1064
Engine Coolant Temperature (ECT) sensor
C1184
Fuel injector 4
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
S103
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-5


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
C133
12B637
C110
S105
S103
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor
C1066
Idle Air Control (IAC) valve
C189
Throttle Position Sensor (TPS)
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
C174
Ignition transformer capacitor 1
C180
Camshaft position sensor
C1184
Fuel injector 4
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

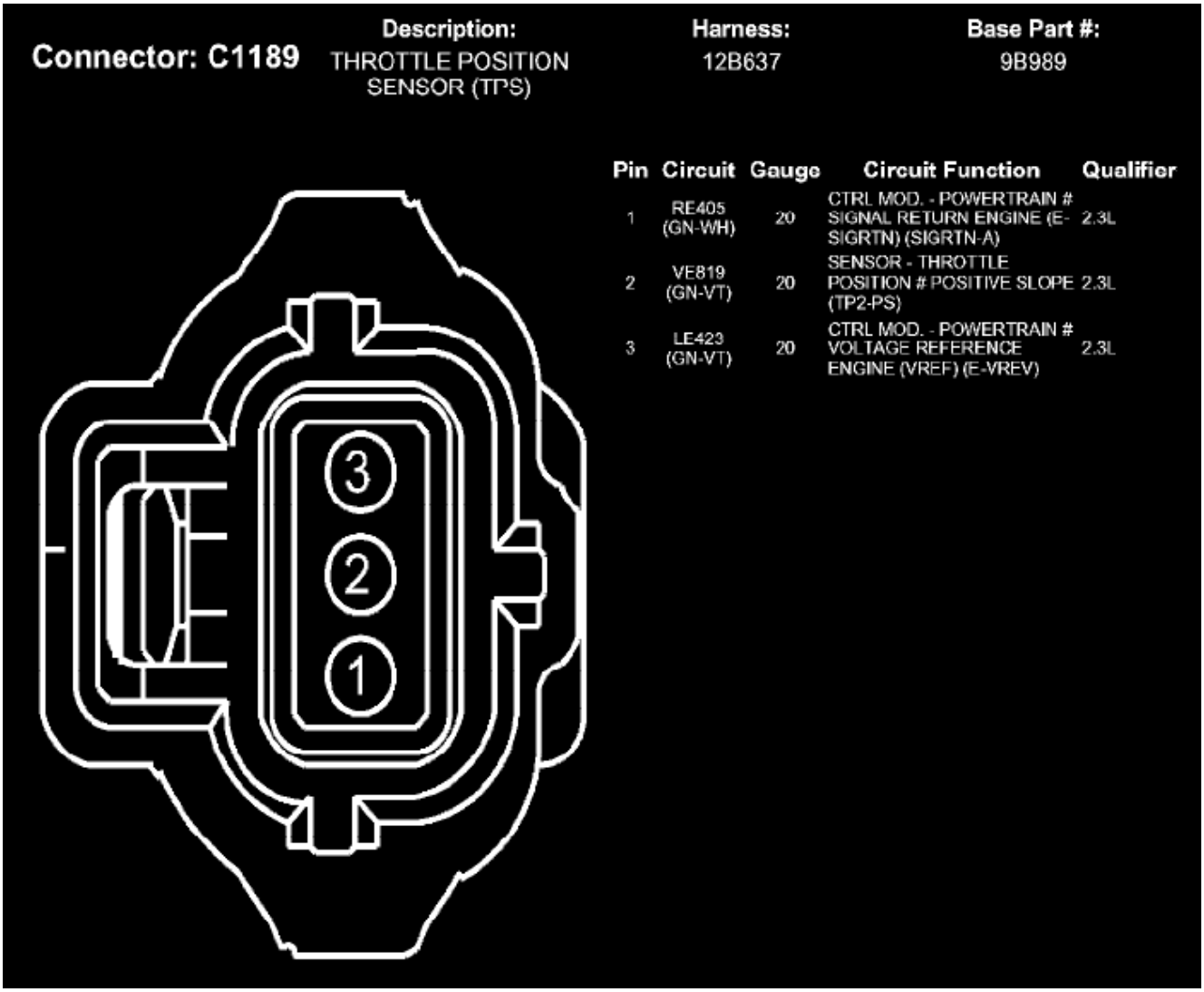
View 151-7



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	LE423 (GN-VT)	20	CTRL MOD. - POWERTRAIN # VOLTAGE REFERENCE ENGINE (VREF) (E-VREV)	3.0L, 4.0L
2	VE819 (GN-VT)	20	SENSOR - THROTTLE POSITION # POSITIVE SLOPE (TP2-PS)	3.0L, 4.0L
3	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	3.0L, 4.0L

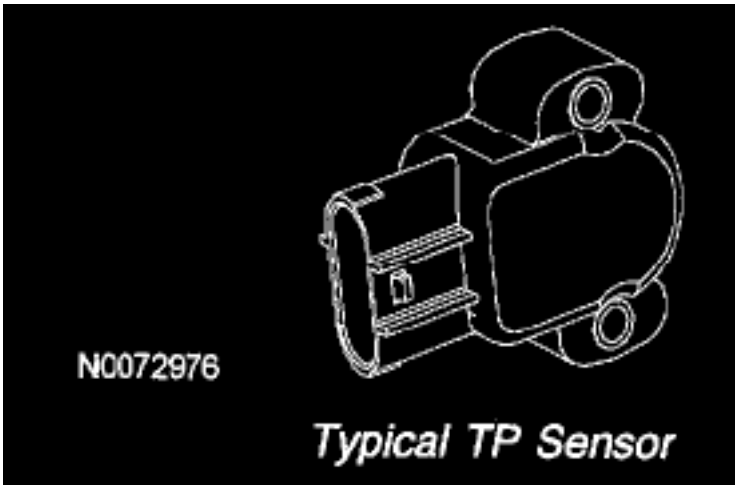
Throttle Position Sensor: Diagrams

C189



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	2.3L
2	VE819 (GN-VT)	20	SENSOR - THROTTLE POSITION # POSITIVE SLOPE (TP2-PS)	2.3L
3	LE423 (GN-VT)	20	CTRL MOD. - POWERTRAIN # VOLTAGE REFERENCE ENGINE (VREF) (E-VREV)	2.3L

C1189



Throttle Position Sensor: Description and Operation

Electronic Throttle Body (ETB) Throttle Position Sensor

The ETB throttle position sensor has 2 signal circuits in the sensor for redundancy. The redundant ETB throttle position signals are required for increased monitoring. The first ETB throttle position sensor signal (TP1) has a negative slope (increasing angle, decreasing voltage) and the second signal (TP2) has a positive slope (increasing angle, increasing voltage). The 2 ETB throttle position sensor signals make sure the PCM receives a correct input even if 1 signal has a concern. There is 1 reference voltage circuit and 1 signal return circuit for the sensor. The reference voltage circuit and the signal return circuit is shared with the reference voltage circuits and signal return circuits used by the APP sensor.

Throttle Position (TP) Sensor

Typical TP Sensor

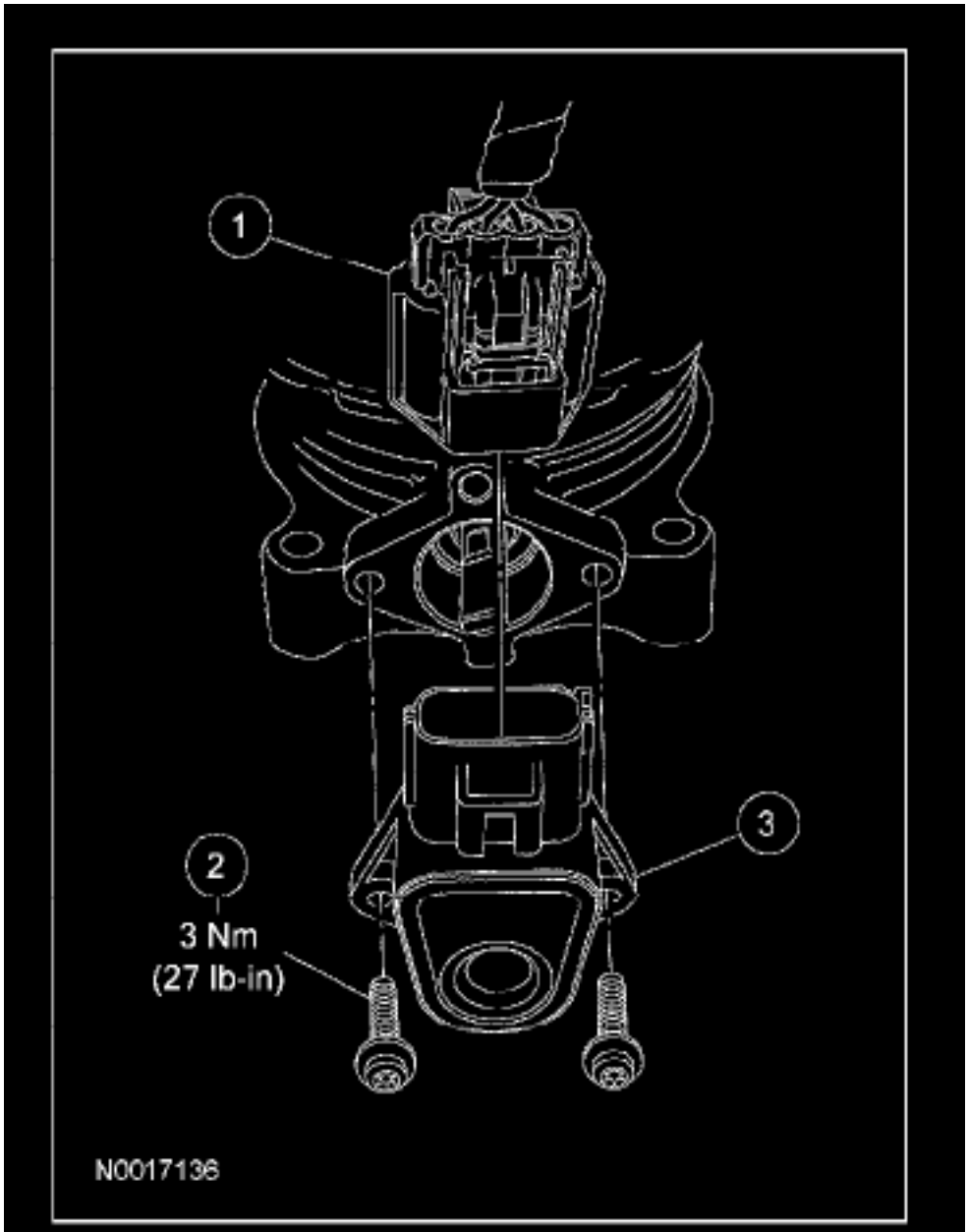
The TP sensor is a rotary potentiometer sensor that provides a signal to the PCM that is linearly proportional to the throttle plate/shaft position. The sensor housing has a 3-blade electrical connector that may be gold plated. The gold plating increases the corrosion resistance on the terminals and increases the connector durability. The TP sensor is mounted on the throttle body. As the TP sensor is rotated by the throttle shaft, 4 operating conditions are determined by the PCM from the TP. The operating conditions are: -

closed throttle (includes idle or deceleration)

- part throttle (includes cruise or moderate acceleration)

- wide open throttle (includes maximum acceleration or de-choke on crank)

- throttle angle rate



Item	Part Number	Description
1	14A464	Throttle position (TP) sensor electrical connector (part of 12B637)
2	W707535	TP sensor screw (2 required)
3	9E928	TP sensor

Throttle Position Sensor: Service and Repair

THROTTLE POSITION (TP) SENSOR

Removal and Installation

1. Disconnect the throttle position (TP) sensor electrical connector.

2. CAUTION: Failure to remove the throttle position (TP) sensor screws in the following manner will result in damage to the screws. First,

loosen the screws 1 to 2 full turns using a hand tool, and then use a suitable high-speed driver to complete the removal.

Remove and discard the 2 bolts and the TP sensor. -

To install, tighten to 3 Nm (27 lb-in).

3. CAUTION: Do not use a high-speed driver to install the new screws or damage to the throttle position (TP) sensor may occur.

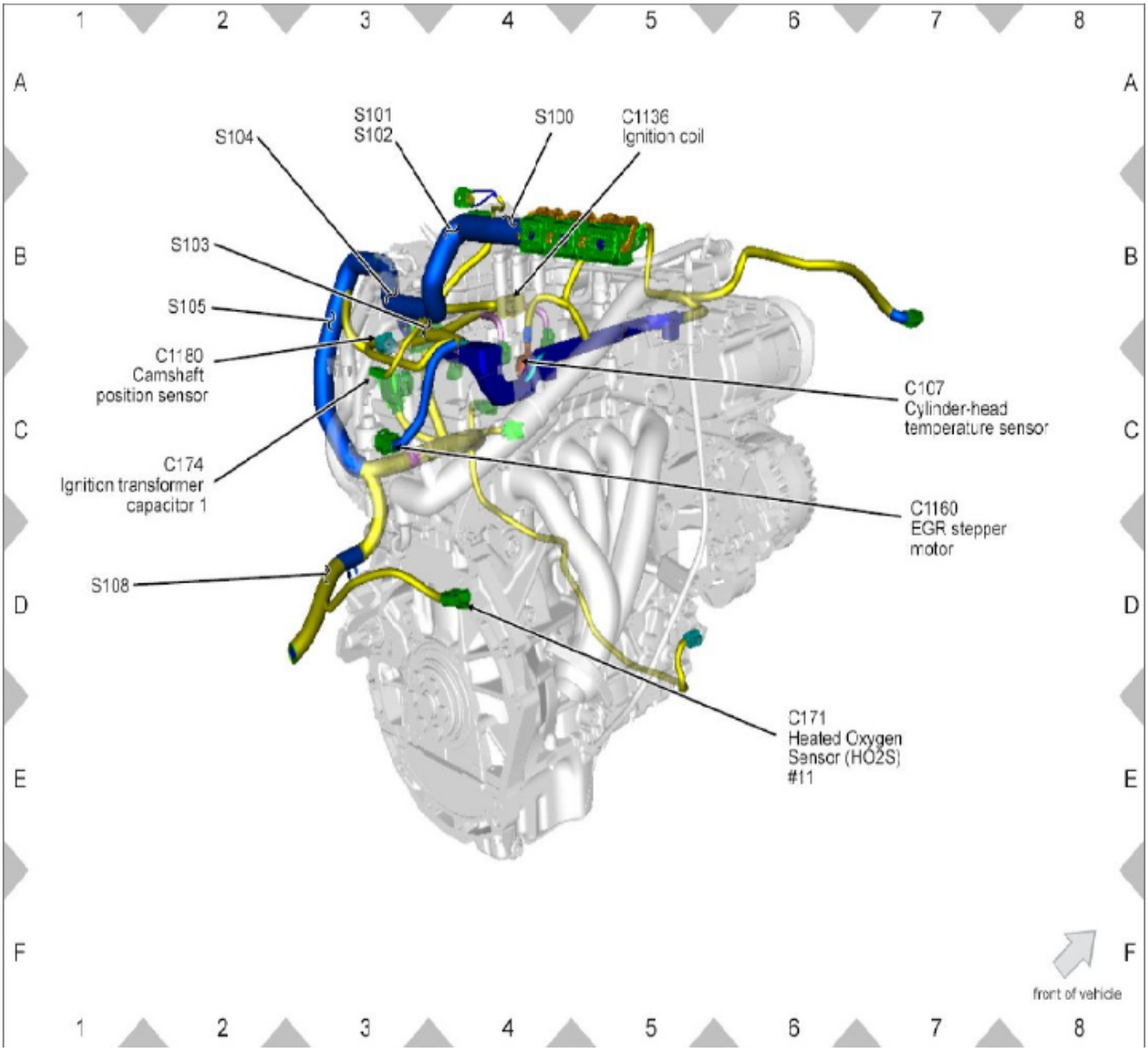
NOTE: -

Do not reuse the TP sensor and screws. A new TP sensor and screws must be installed.

- Failure to install the TP sensor in this manner may result in excessive idle speeds. Slide the rotary tangs into position over the throttle shaft blade, then rotate the TP sensor.

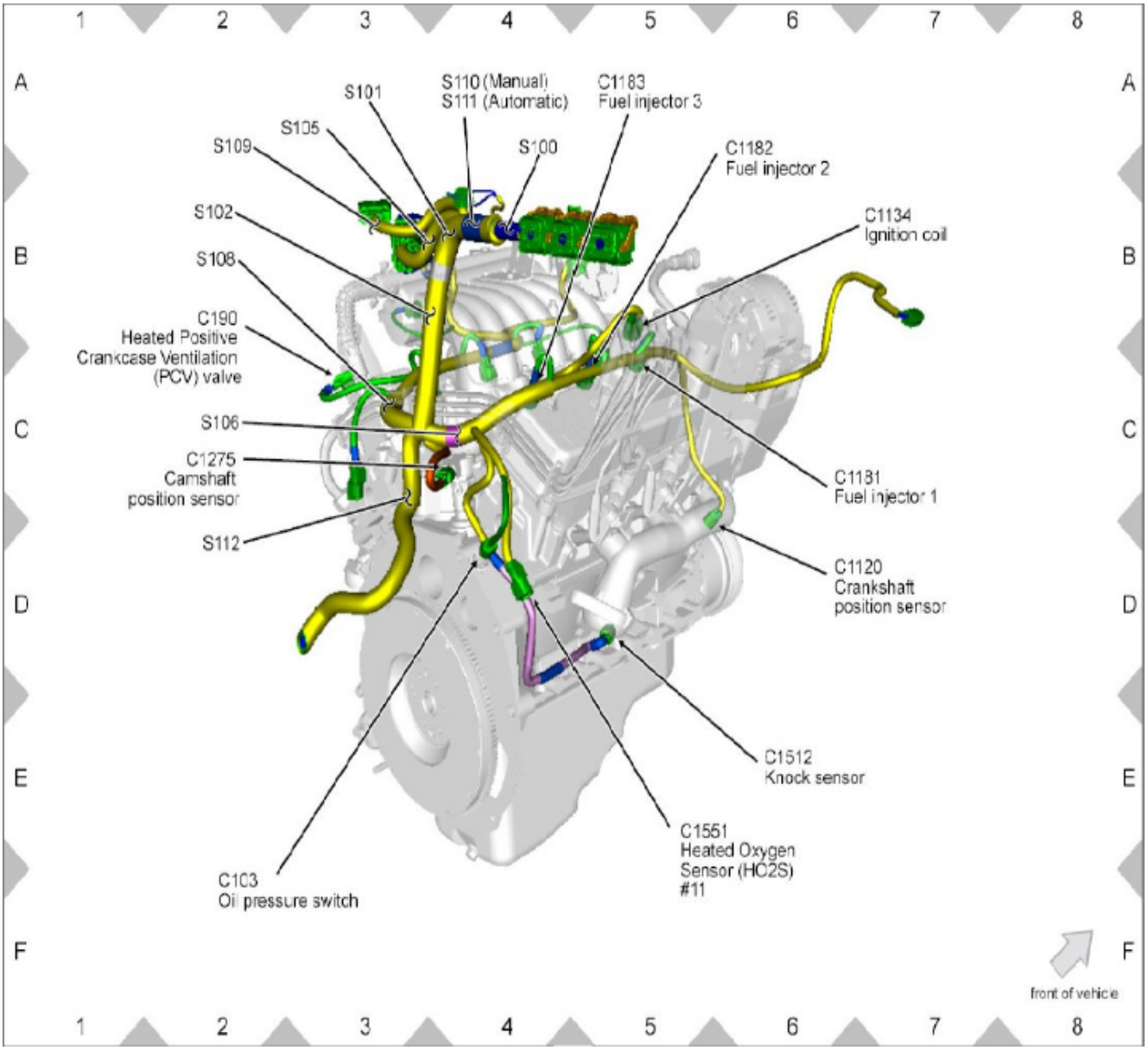
To install, reverse the removal procedure. -

Install a new TP sensor and screws.

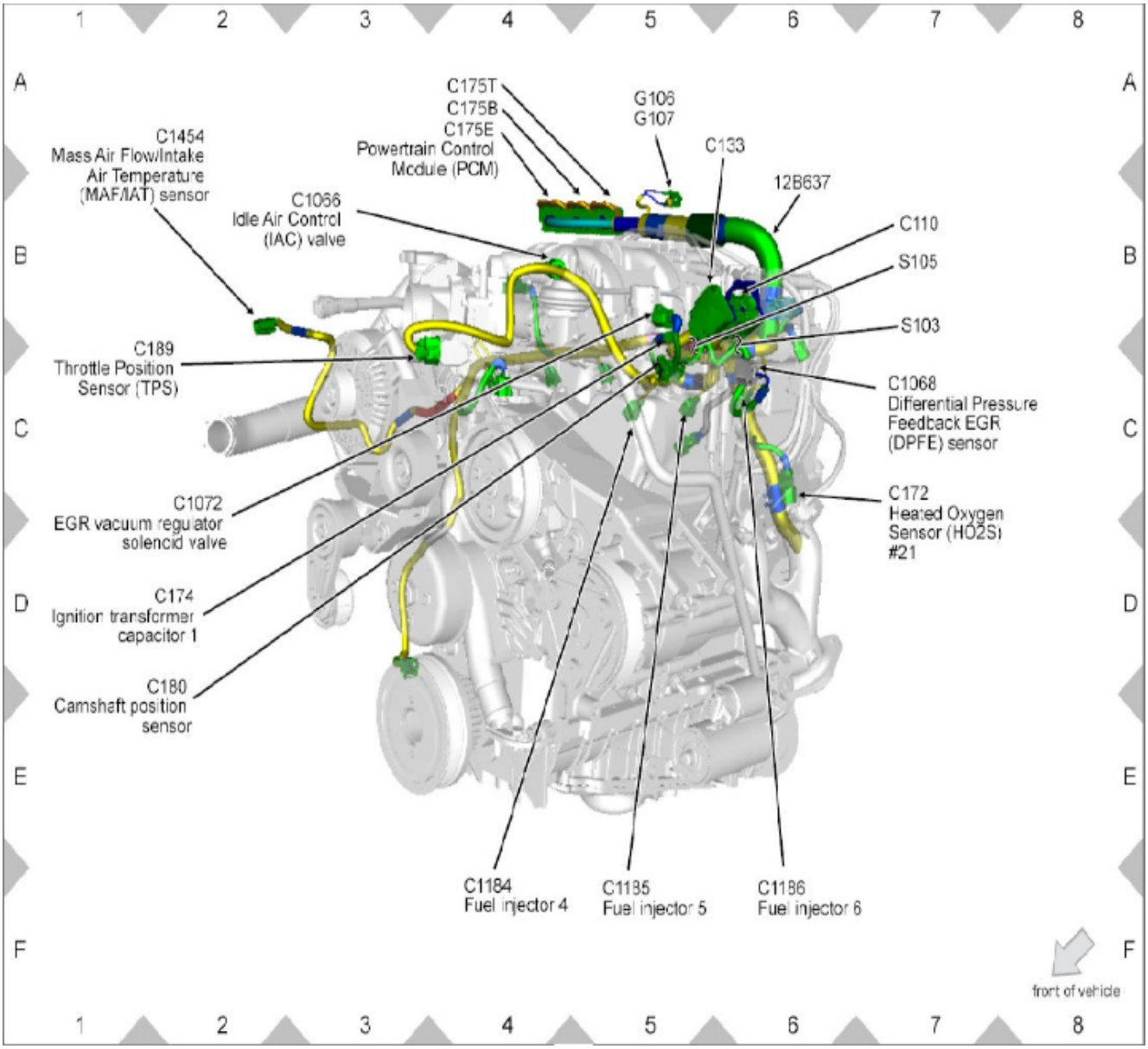


Camshaft Position Sensor: Locations

View 151-4


S101
S110 (Manual)
S111 (Automatic)
C1183
Fuel injector 3
S105
S109
S100
C1182
Fuel injector 2
S102
C1134
Ignition coil
S108
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
C1275
Camshaft
position sensor
S112
C1181
Fuel injector 1
C1120
Crankshaft
position sensor
C1512
Knock sensor
C1551
Heated Oxygen
Sensor (HO2S)
#11
C103
Oil pressure switch
front of vehicle

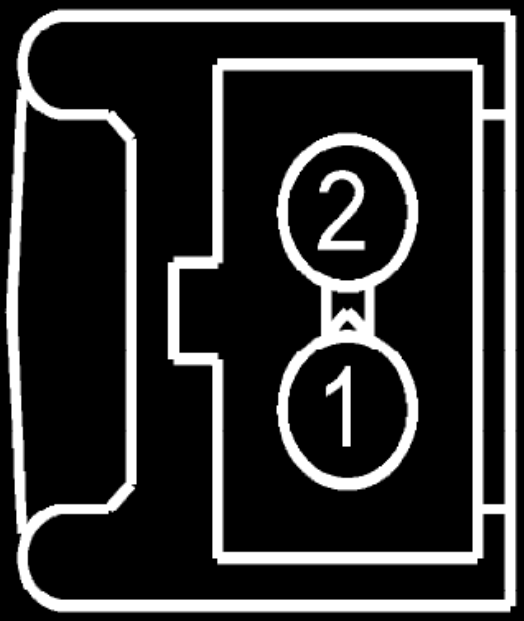
View 151-6


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
C133
12B637
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor
C1066
Idle Air Control (IAC) valve
C110
S105
S103
C189
Throttle Position Sensor (TPS)
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
C174
Ignition transformer capacitor 1
C180
Camshaft position sensor
C1184
Fuel injector 4
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-7

Connector: C180

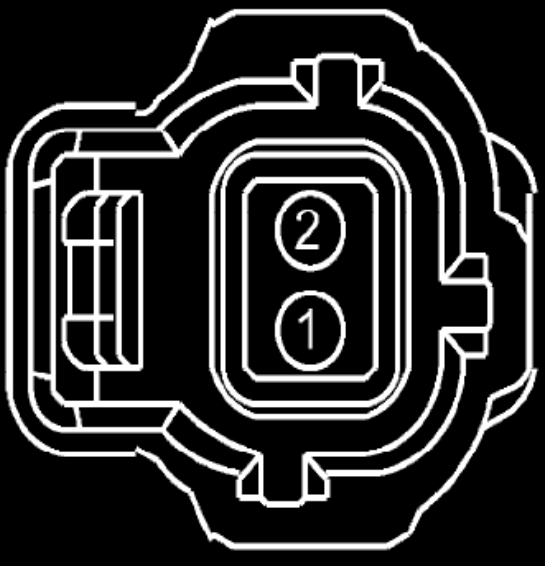
Description:	Harness:	Base Part #:
CAMSHAFT POSITION SENSOR	12B637	6B288



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE706 (BN-BU)	18	SENSOR - CAMSHAFT POSITION BANK 1 IN+EX/IN (CMP1) [CID-H] (CID1)	4.0L
2	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	4.0L

Connector: C1180

Description:	Harness:	Base Part #:
CAMSHAFT POSITION SENSOR	12B637	6B288



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	2.3L
2	VE706 (BN-BU)	18	SENSOR - CAMSHAFT POSITION BANK 1 IN+EX/ IN (CMP1) [CID-H] (CID1)	2.3L

Camshaft Position Sensor: Diagrams

C180

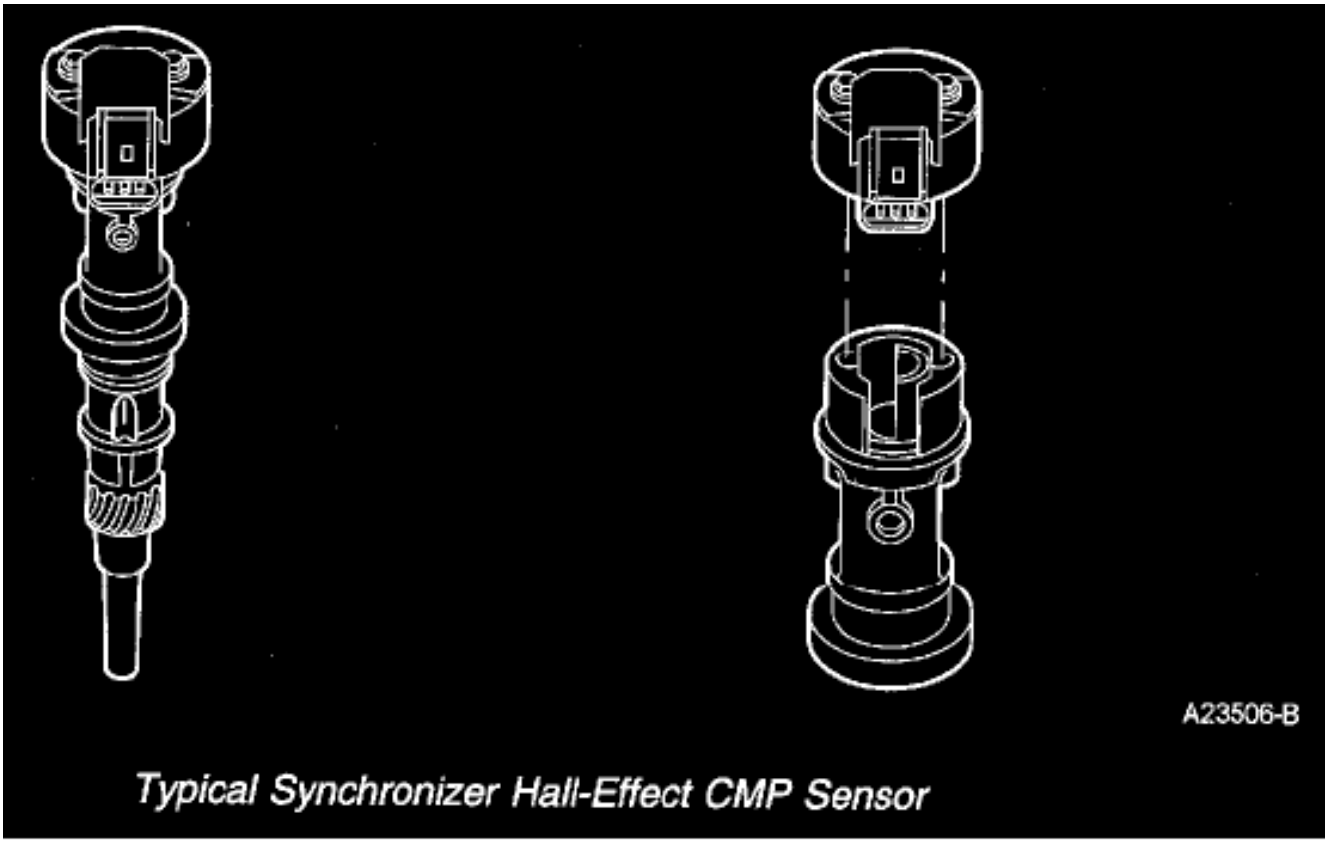
C1180

Connector: C1275

Description:	Harness:	Base Part #:
CAMSHAFT POSITION SENSOR	12B637	6B288

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	3.0L
2	VE706 (BN-BU)	18	SENSOR - CAMSHAFT POSITION BANK 1 IN+EX/ IN (CMP1) [CID-H] (CID1)	3.0L

C1275



Typical Synchronizer Hall-Effect CMP Sensor

Typical Variable Reluctance CMP Sensor

Camshaft Position Sensor: Description and Operation

CAMSHAFT POSITION (CMP) SENSOR

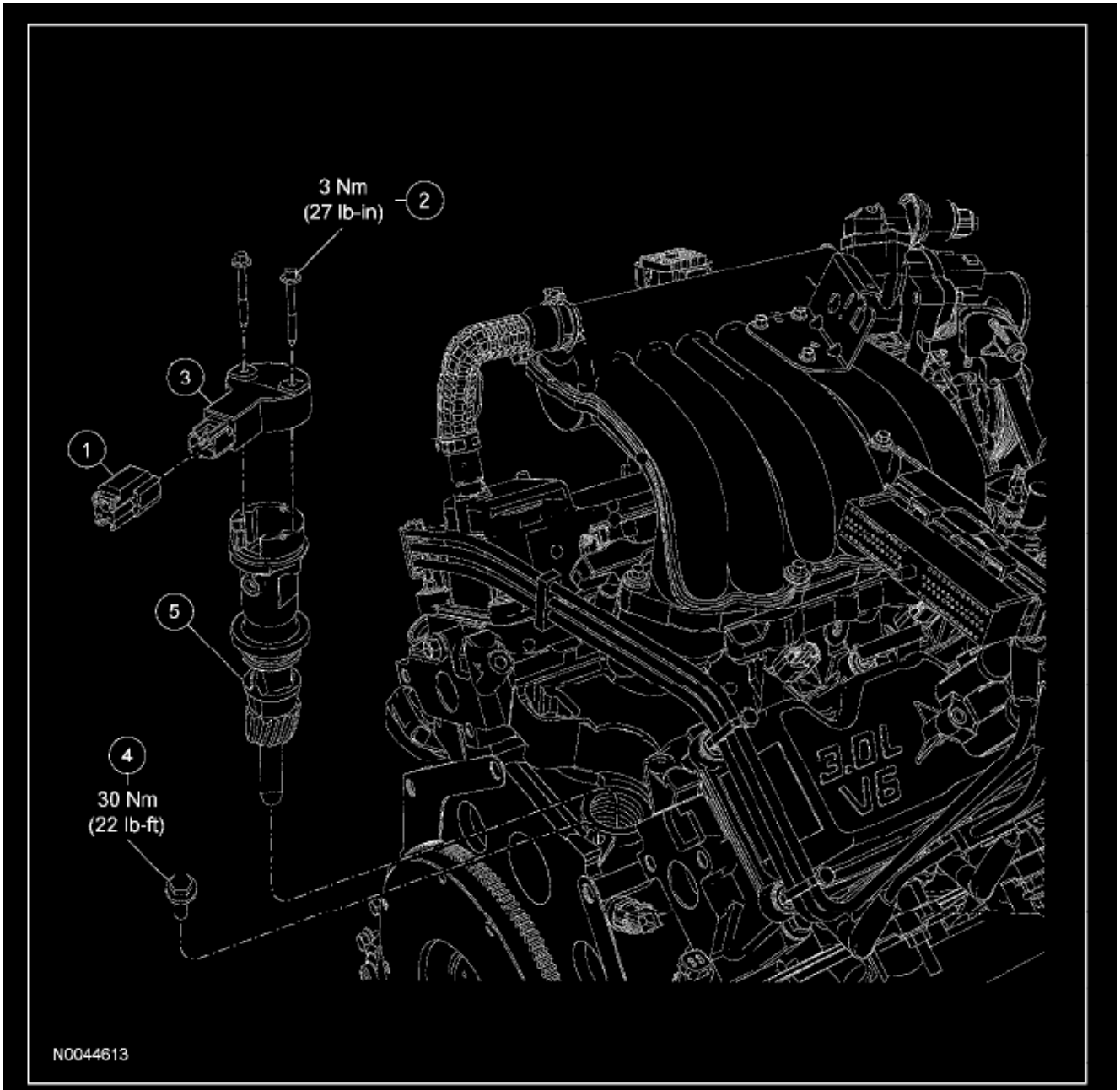
Typical Synchronizer Hall-Effect CMP Sensor

Typical Variable Reluctance CMP Sensor

The CMP sensor detects the position of the camshaft. The CMP sensor identifies when piston number 1 is on its compression stroke. A signal is then sent to the PCM and used for synchronizing the sequential firing of the fuel injectors. Coil on plug (COP) ignition applications use the CMP signal to select the correct ignition coil to fire.

Vehicles with 2 CMP sensors are equipped with variable camshaft timing (VCT). They use the second sensor to identify the position of the camshaft on bank 2 as an input to the PCM.

There are 2 types of CMP sensors: the 3-pin connector Hall-effect type sensor and the 2-pin connector variable reluctance type sensor.



Item	Part Number	Description
1	—	Camshaft position (CMP) sensor electrical connector (part of 12B637)
2	W701219	CMP sensor bolt (2 required)

(Continued)

Item	Part Number	Description
3	6B288	CMP sensor
4	—	Camshaft synchronizer bolt
5	12A362	Camshaft synchronizer

Camshaft Position Sensor: Service and Repair

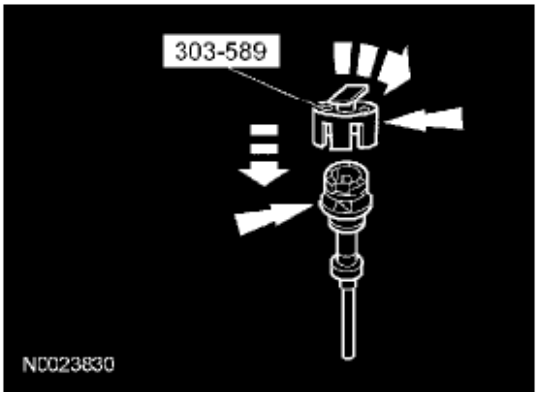
CAMSHAFT SYNCHRONIZER

Exploded View

Special Tool(s)

Special Tool(s)

ST2362-A	Synchronizer Alignment Gauge 303-589



Special Tool(s)

Removal

1. Disconnect the camshaft position (CMP) sensor electrical connector.

2. NOTE: Prior to the removal of the CMP sensor, note the position of the CMP sensor electrical connector. The installation procedure requires that

the electrical connector be located in the same position.

Remove the 2 bolts and the CMP sensor.

3. Remove the camshaft synchronizer bolt. 4. Remove the camshaft synchronizer. Inspect the O-ring seal and install a new O-ring seal if damaged.

Installation

1. CAUTION:

- After installation, do not loosen the synchronizer bolt and rotate the synchronizer assembly. The synchronizer assembly is not adjustable. Do not loosen the synchronizer bolt after the alignment tool has been removed in order to align the camshaft position (CMP) sensor electrical connector for any reason. If the electrical connector is not in the correct position, the synchronizer assembly must be removed. The alignment tool and the assembly must be reinstalled if the engine has not been rotated from top dead center (TDC) of the compression stroke on the No. 1 cylinder. Failure to follow this procedure will result in the fuel system being out of time with the engine, possibly causing engine damage.

- Do not turn the crankshaft or camshaft during the removal and installation procedure or the fuel system timing will be out of time with the engine, possibly causing engine damage.

- A special tool must be used during the installation of the new synchronizer assembly. Failure to follow this procedure will result in the fuel system being out of time with the engine, possibly causing engine damage.

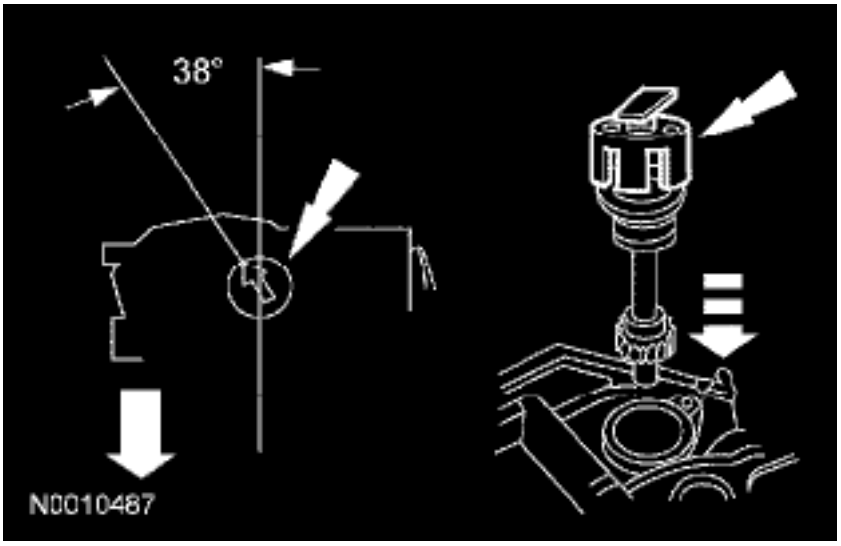
Install the special tool on the camshaft synchronizer by rotating the tool until it engages the notch in the camshaft synchronizer housing and the armature.

2. CAUTION: It is very important to coat the gear on the camshaft synchronizer with engine oil prior to installation. Failure to do so may

result in gear failure.

NOTE: During installation, the arrow on the special tool will rotate clockwise until the oil pump intermediate shaft and the camshaft gear engages.

Install the camshaft synchronizer housing assembly so the arrow on the special tool is 38 degrees from the centerline of the engine.



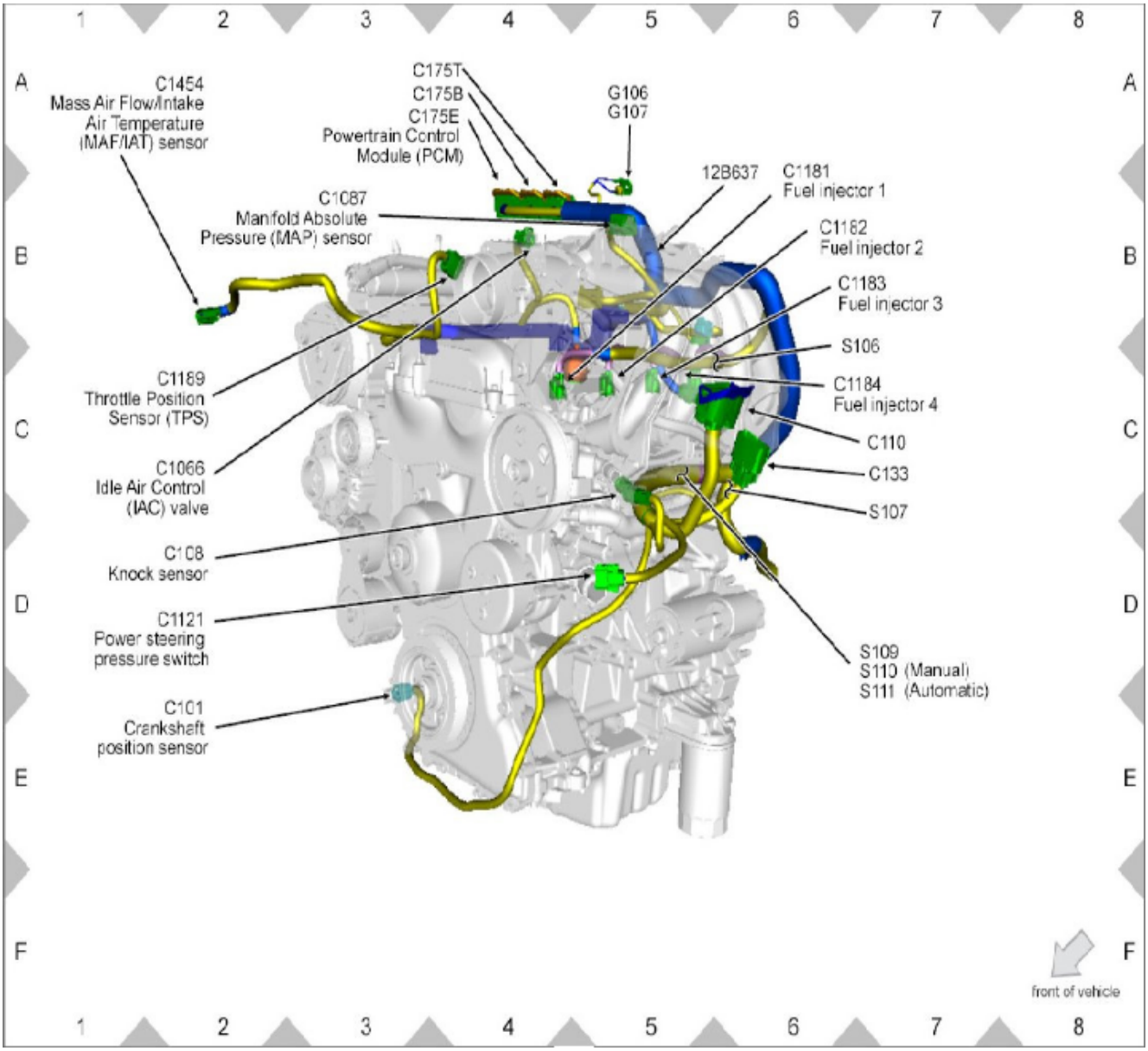
3. Install the camshaft synchronizer housing bolt.

- Tighten to 30 Nm (22 lb-ft).

4. Position the CMP sensor and install the 2 bolts.

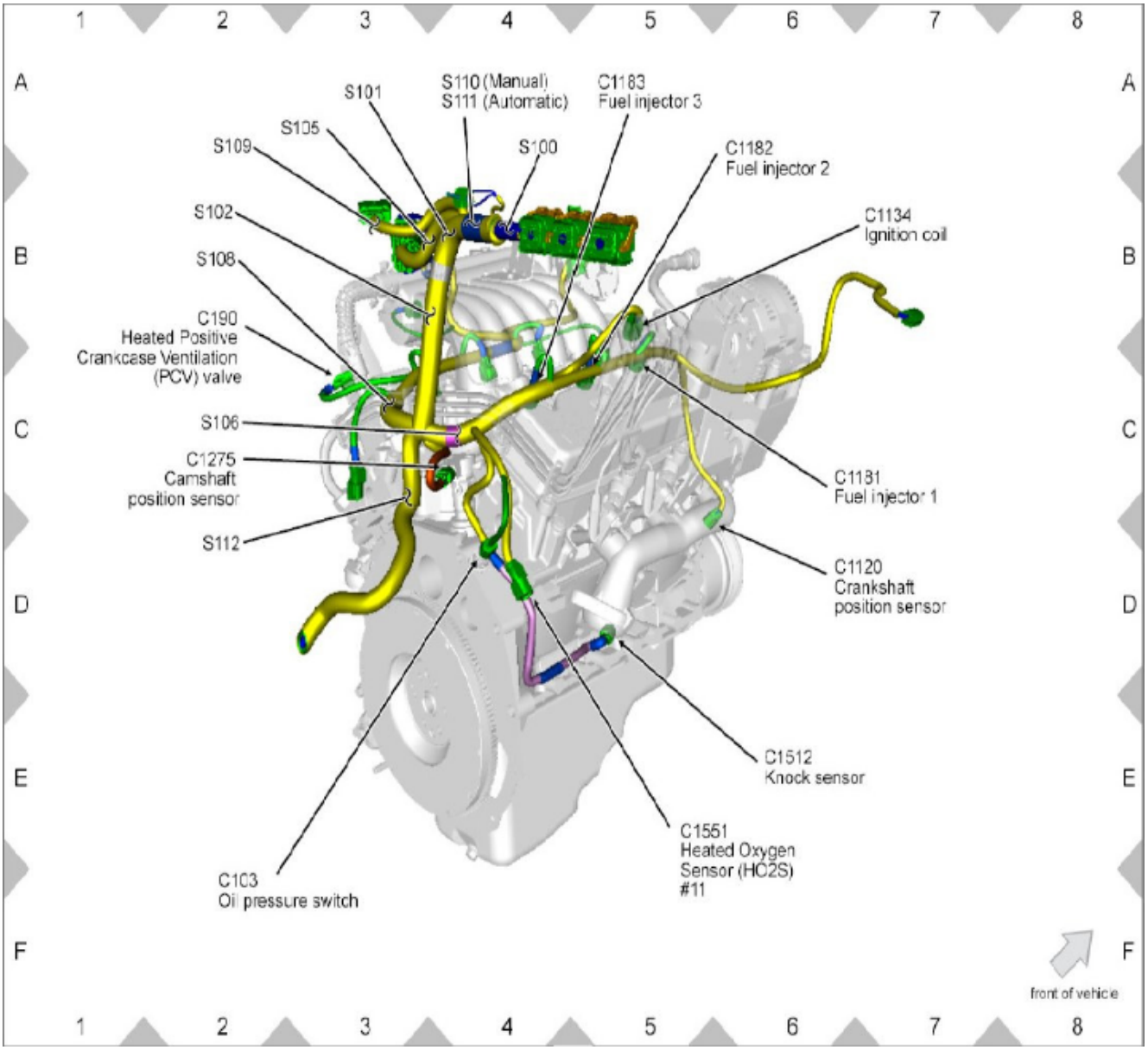
- Tighten to 3 Nm (27 lb-in).

5. Connect the CMP sensor electrical connector.

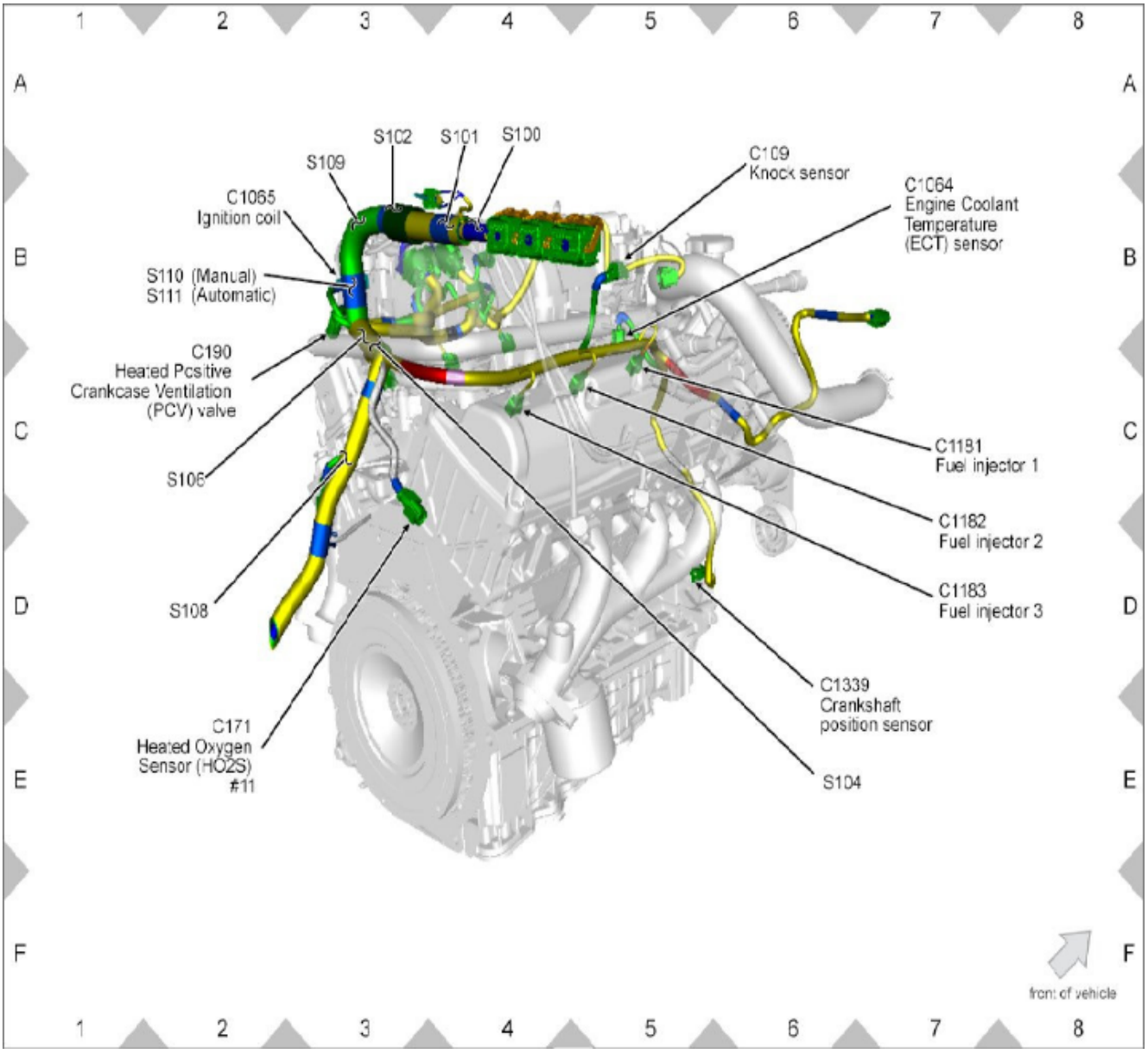


Crankshaft Position Sensor: Locations

View 151-3


S101
S110 (Manual)
S111 (Automatic)
C1183
Fuel injector 3
S105
S109
S100
C1182
Fuel injector 2
S102
C1134
Ignition coil
S108
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
C1275
Camshaft
position sensor
S112
C1181
Fuel injector 1
C1120
Crankshaft
position sensor
C1512
Knock sensor
C1551
Heated Oxygen
Sensor (HO2S)
#11
C103
Oil pressure switch
front of vehicle

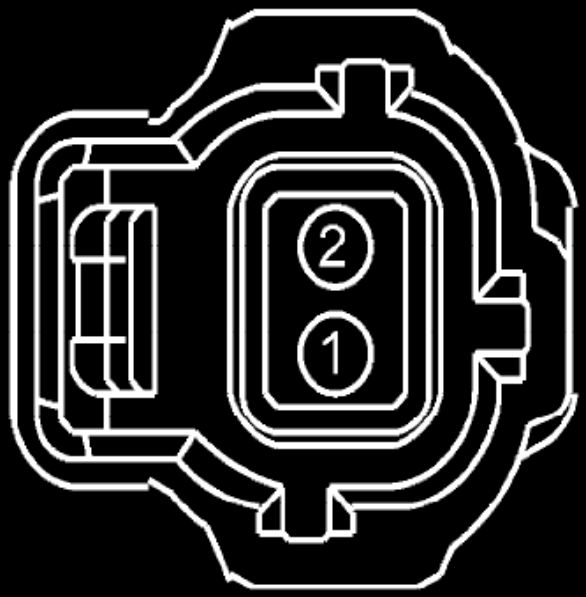
View 151-6


S102
S101
S100
S109
C1065
Ignition coil
S110 (Manual)
S111 (Automatic)
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
S108
C171
Heated Oxygen
Sensor (HO2S)
#11
C109
Knock sensor
C1064
Engine Coolant
Temperature
(ECT) sensor
C1181
Fuel injector 1
C1182
Fuel injector 2
C1183
Fuel injector 3
C1339
Crankshaft
position sensor
S104
front of vehicle

View 151-8

Connector: C101

Description:	Harness:	Base Part #:
CRANKSHAFT POSITION SENSOR	12B637	6C315



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE711 (YE-VT)	18	SENSOR - CRANKSHAFT POSITION (CKPP)	2.3L
2	RE135 (GN-BN)	18	CTRL MOD. - POWERTRAIN # CRANKSHAFT POSITION SENSOR (CKPN)	2.3L

Connector: C1120

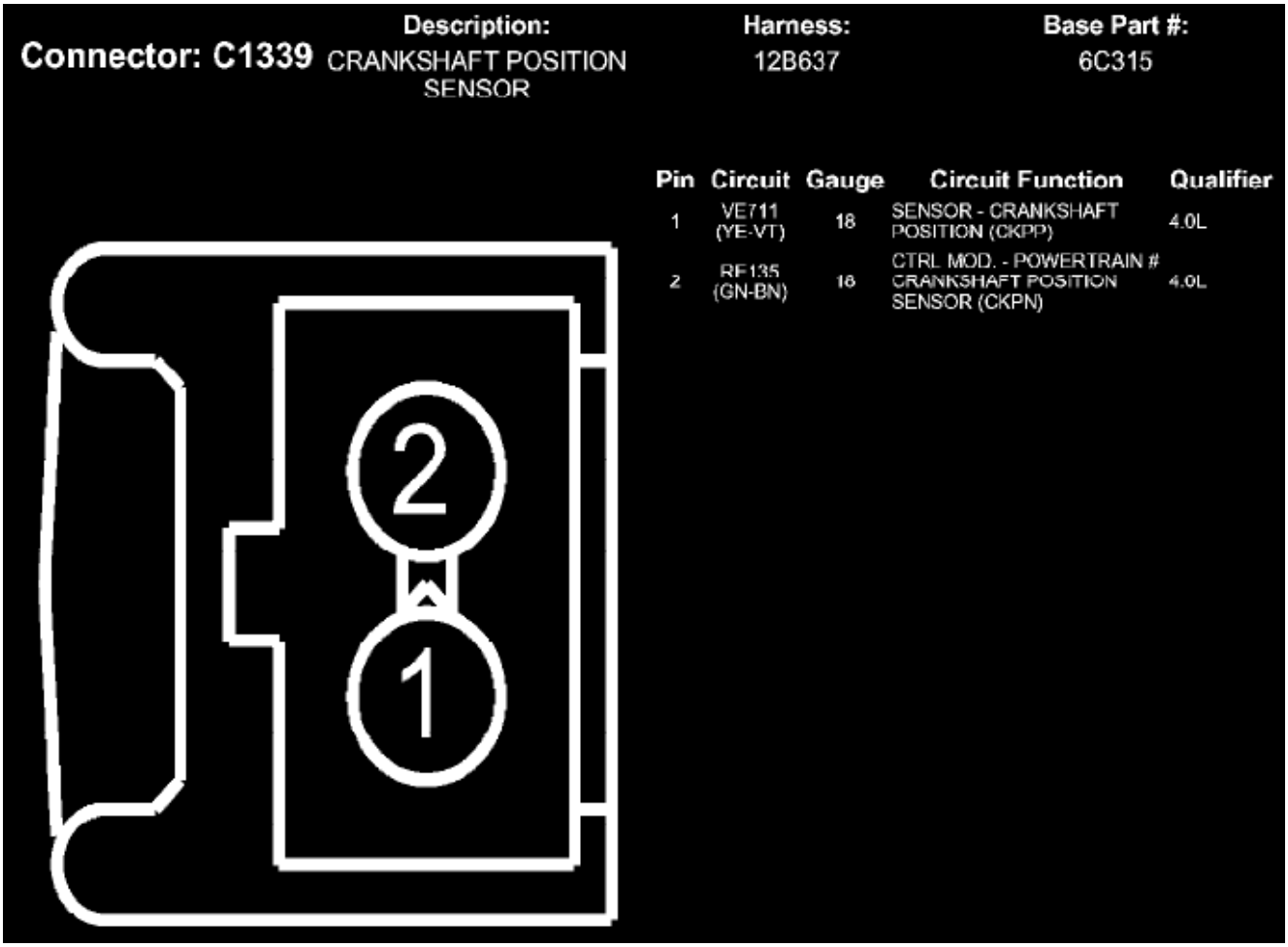
Description:	Harness:	Base Part #:
CRANKSHAFT POSITION SENSOR	12B637	6C315

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RE135 (GN-BN)	18	CTRL MOD. - POWERTRAIN # CRANKSHAFT POSITION SENSOR (CKPN)	3.0L
2	VE711 (YE-VT)	18	SENSOR - CRANKSHAFT POSITION (CKPP)	3.0L

Crankshaft Position Sensor: Diagrams

C101

C1120


Connector: C1339
Description:
CRANKSHAFT POSITION SENSOR
Harness:
12B637
Base Part #:
6C315
Pin Circuit Gauge Circuit Function Qualifier
1 VE711 (YE-VT) 18 SENSOR - CRANKSHAFT POSITION (CKPP) 4.0L
2 RF135 (GN-BN) 18 CTRL MOD. - POWERTRAIN # CRANKSHAFT POSITION SENSOR (CKPN) 4.0L
2
1

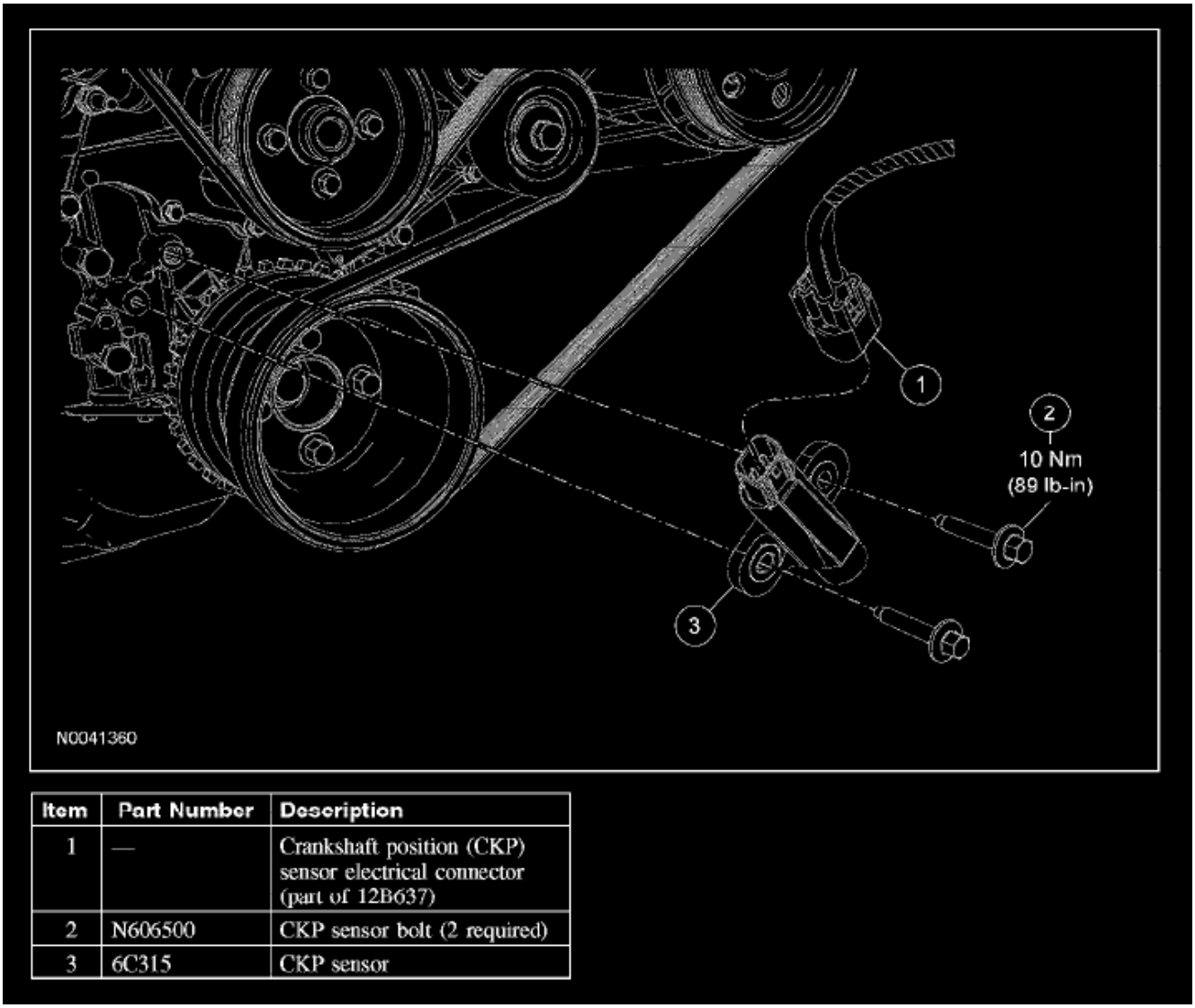
C1339

Crankshaft Position Sensor: Description and Operation

CRANKSHAFT POSITION (CKP) SENSOR

Typical Crankshaft Position (CKP) Sensor

The CKP sensor is a magnetic transducer mounted on the engine block adjacent to a pulse wheel located on the crankshaft. By monitoring the crankshaft mounted pulse wheel, the CKP is the primary sensor for ignition information to the PCM. The pulse wheel has a total of 35 teeth spaced 10 degrees apart with one empty space for a missing tooth. The 6.8L 10-cylinder pulse wheel has 39 teeth spaced 9 degrees apart and one 9 degree empty space for a missing tooth. By monitoring the pulse wheel, the CKP sensor signal indicates crankshaft position and speed information to the PCM. By monitoring the missing tooth, the CKP sensor is also able to identify piston travel in order to synchronize the ignition system and provide a way of tracking the angular position of the crankshaft relative to a fixed reference for the CKP sensor configuration. The PCM also uses the CKP signal to determine if a misfire has occurred by measuring rapid decelerations between teeth.



Item	Part Number	Description
1	—	Crankshaft position (CKP) sensor electrical connector (part of 12B637)
2	N606500	CKP sensor bolt (2 required)
3	6C315	CKP sensor

Crankshaft Position Sensor: Service and Repair

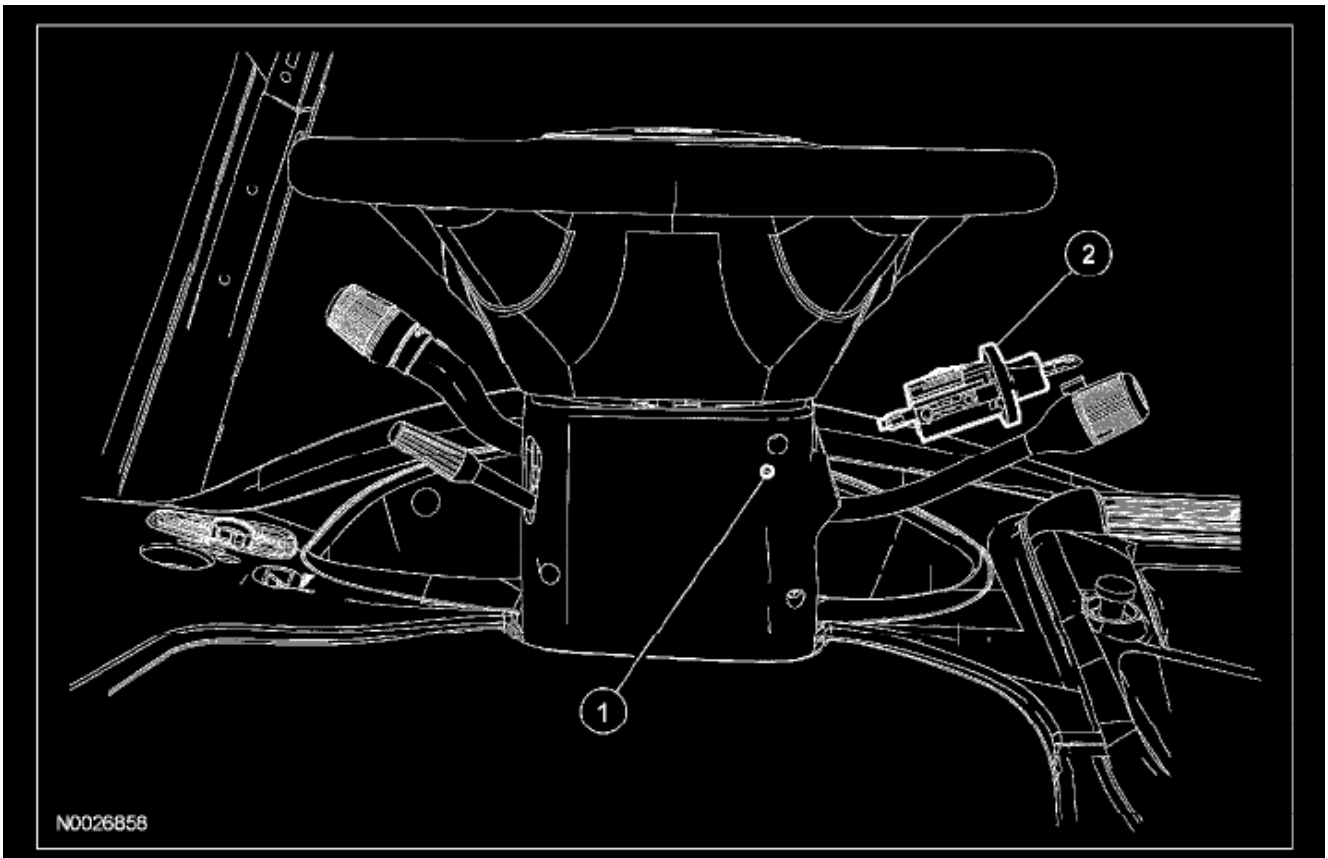
CRANKSHAFT POSITION (CKP) SENSOR

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the crankshaft position (CKP) sensor electrical connector. 3. Remove the 2 bolts and the CKP sensor.

- To install, tighten to 10 Nm (89 lb-in).

4. To install, reverse the removal procedure.



Item	Part Number	Description
1	—	Ignition lock cylinder release hole (part of 3530)
2	11582	Ignition lock cylinder

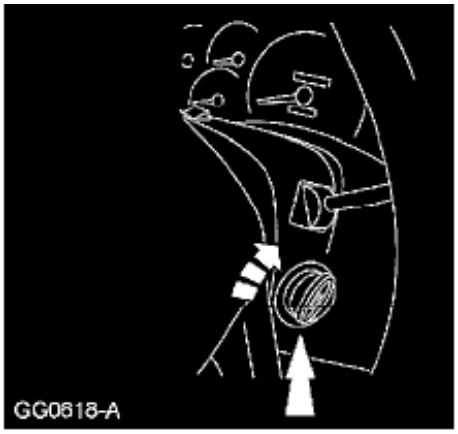
Ignition Switch Lock Cylinder: Service and Repair Ignition Lock Cylinder - Functional

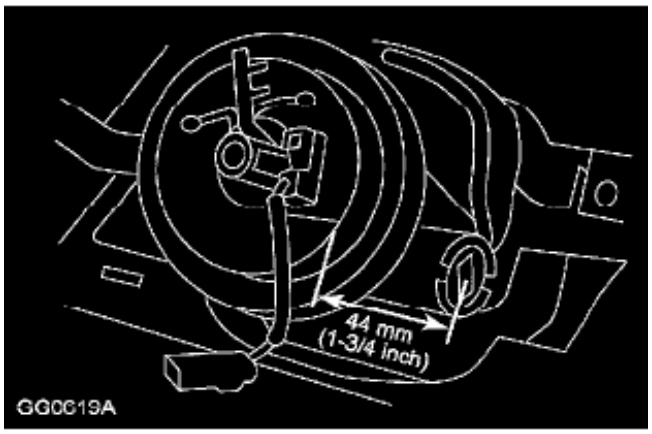
IGNITION LOCK CYLINDER - FUNCTIONAL

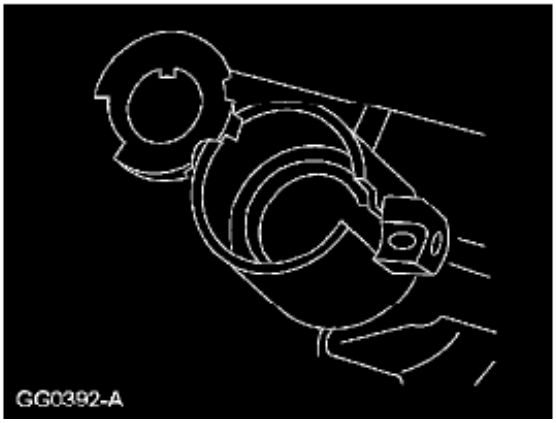
Removal and Installation

1. Disconnect the battery ground cable. 2. Insert the ignition key and turn to the RUN position. 3. Press the ignition lock cylinder release pin and remove the ignition lock cylinder. 4. To install, reverse the removal procedure.

- Verify ignition lock cylinder operation.







Ignition Switch Lock Cylinder: Service and Repair Ignition Lock Cylinder - Non Functional

IGNITION LOCK CYLINDER - NON FUNCTIONAL

Removal and Installation

1. NOTE: Make sure the front wheels are in the straight-ahead position.

Remove the steering wheel assembly.

2. Twist off the cap from the ignition lock cylinder.

3. NOTE: The lock cylinder is repaired by discarding the inoperative lock cylinder and building a new lock cylinder using the appropriate lock

repair package (F85Z-11582-AA). The lock repair package includes a detailed instruction sheet to build the new lock cylinder to the current key code of the vehicle.

Remove the ignition lock cylinder. -

Use a 1/8-inch diameter drill bit to drill out the lock cylinder retaining pin.

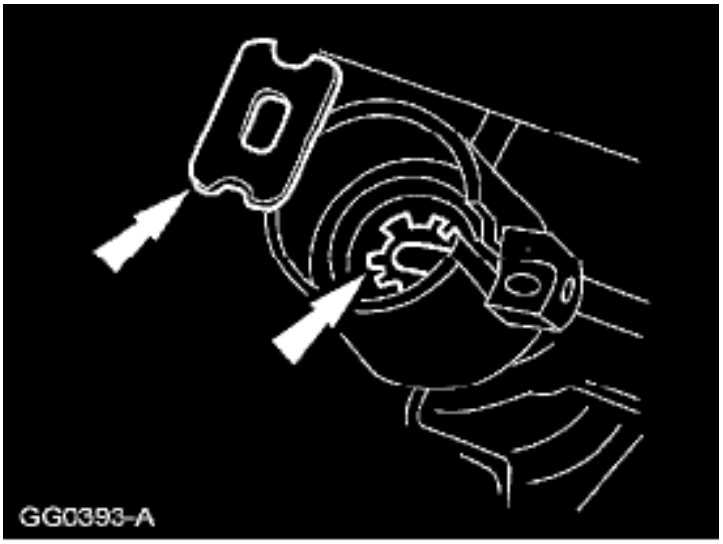
- Use a 3/8-inch drill bit to drill down the middle of the ignition lock key slot until the ignition lock cylinder breaks loose.

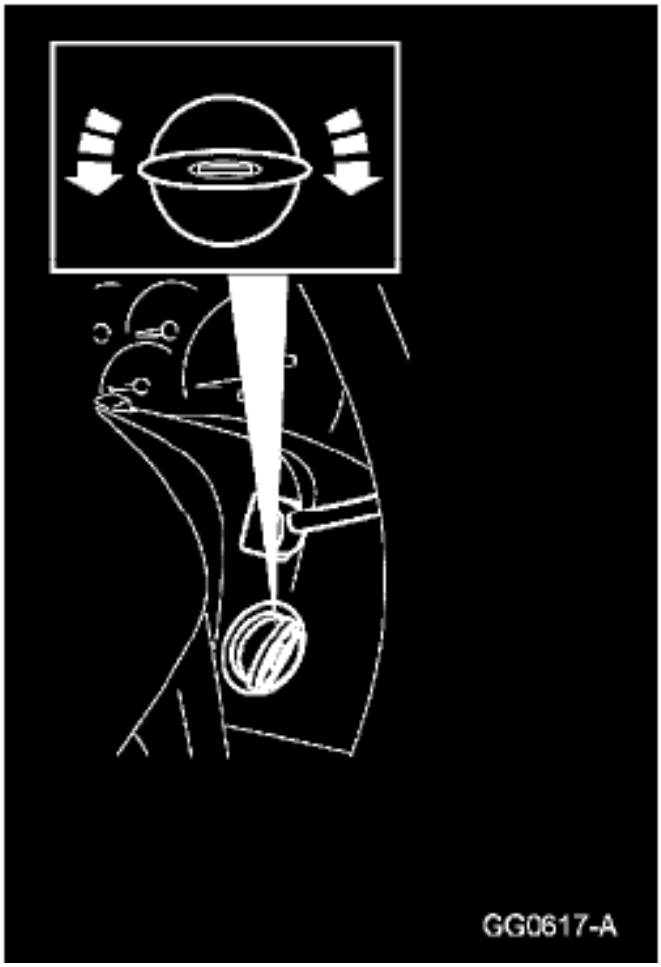
- Remove and discard the ignition lock cylinder and clean the drill shavings from the steering column.

4. Remove the bearing retainer.

5. Remove the bearing and gear.

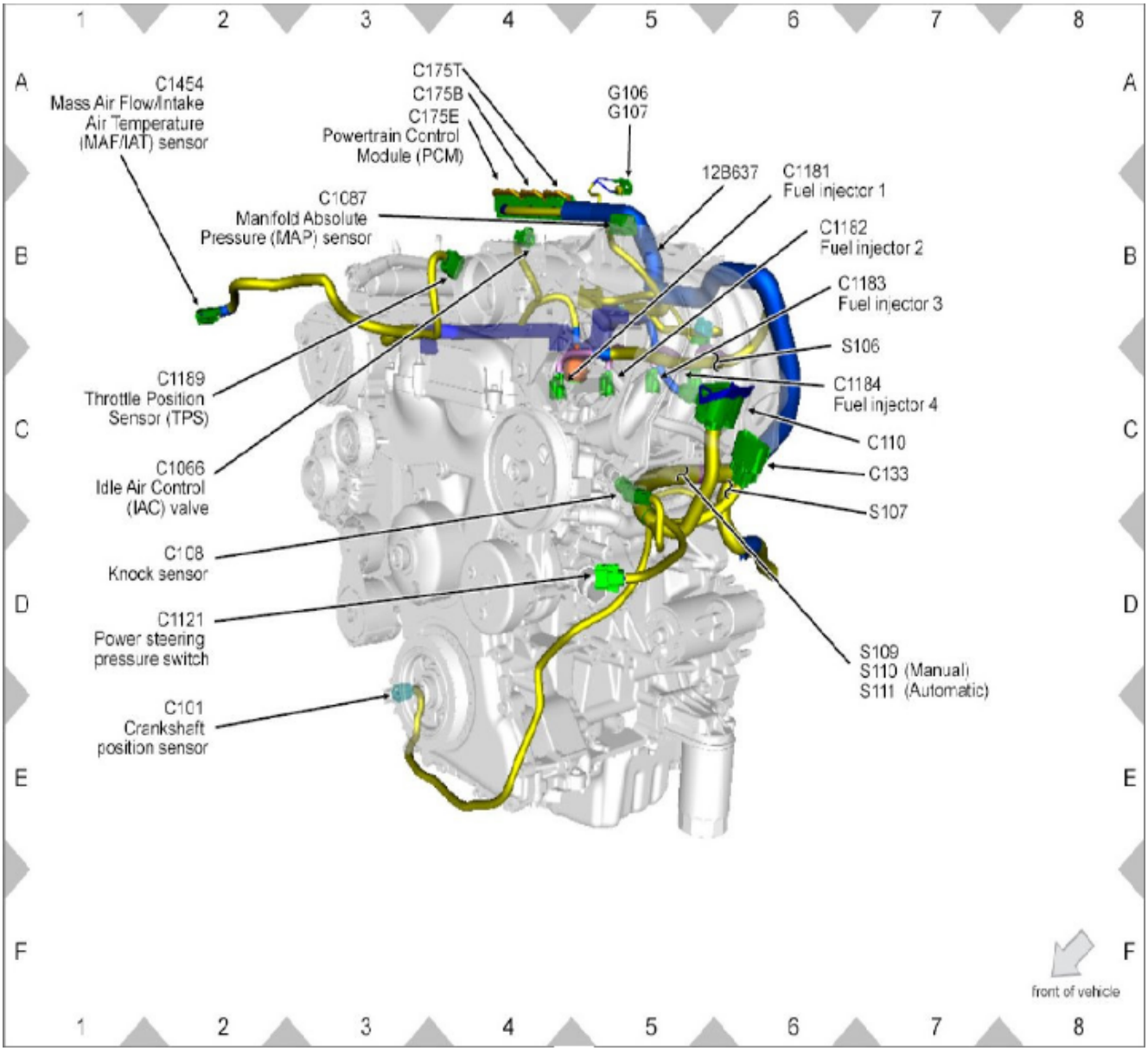
- Thoroughly clean all drill shavings from the steering column and inspect it for damage.





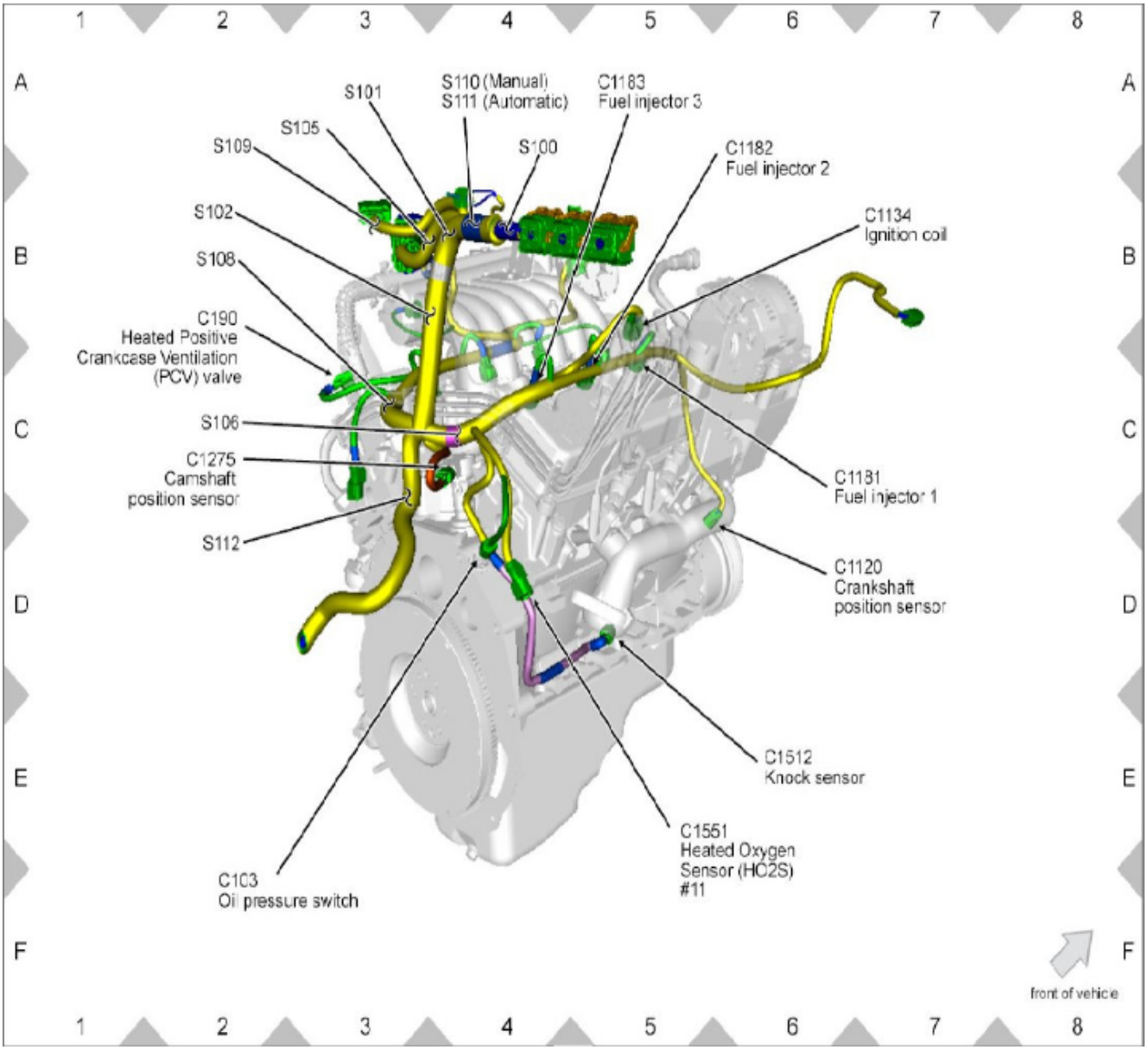
6. To install, reverse the removal procedure.

- Install a new ignition lock cylinder.
- Verify ignition lock cylinder operation.

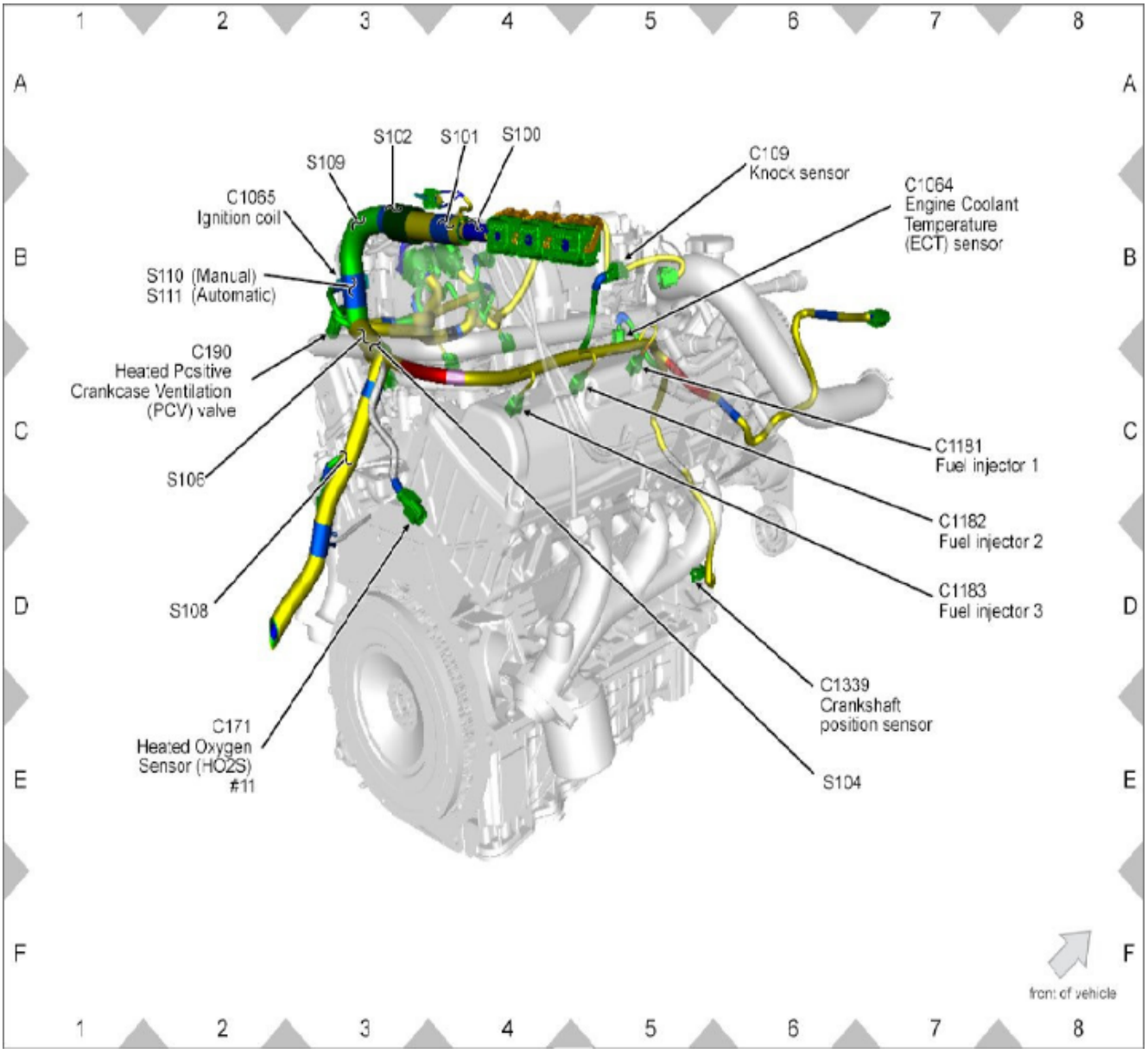


Knock Sensor: Locations

View 151-3


S101
S110 (Manual)
S111 (Automatic)
C1183
Fuel injector 3
S105
S109
S100
C1182
Fuel injector 2
S102
C1134
Ignition coil
S108
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
C1275
Camshaft
position sensor
S112
C1181
Fuel injector 1
C1120
Crankshaft
position sensor
C1512
Knock sensor
C1551
Heated Oxygen
Sensor (HO2S)
#11
C103
Oil pressure switch
front of vehicle

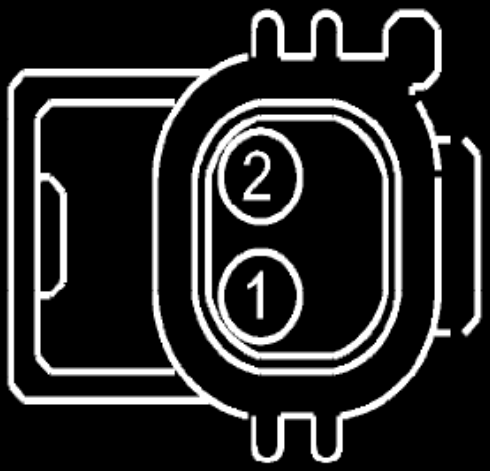
View 151-6


S102
S101
S100
S109
C1065
Ignition coil
S110 (Manual)
S111 (Automatic)
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
S108
C171
Heated Oxygen
Sensor (HO2S)
#11
C109
Knock sensor
C1064
Engine Coolant
Temperature
(ECT) sensor
C1181
Fuel injector 1
C1182
Fuel injector 2
C1183
Fuel injector 3
C1339
Crankshaft
position sensor
S104
front of vehicle

View 151-8

Connector: C108

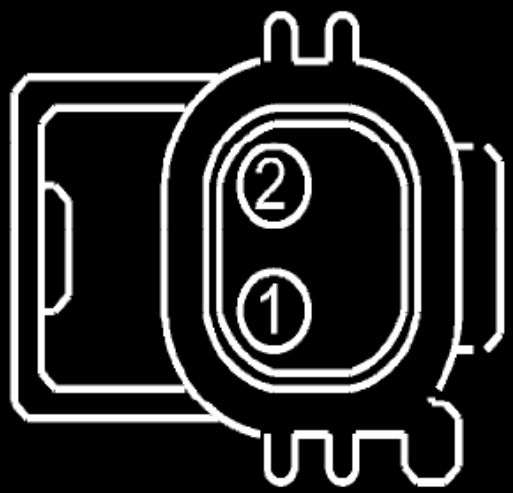
Description:	Harness:	Base Part #:
KNOCK SENSOR	12B637	12A699



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RE323 (WH-BN)	20	CTRL MOD. - POWERTRAIN # KNOCK SENSOR 1ST OR UNIQUE (KS1N) [KSL1-]	2.3L
2	VE801 (VT-OG)	20	SENSOR - KNOCK 1ST OR UNIQUE (KS1P) [KSL1+]	2.3L

Connector: C109

Description:	Harness:	Base Part #:
KNOCK SENSOR	12B637	12A699



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE801 (VT-OG)	20	SENSOR - KNOCK 1ST OR UNIQUE (KS1P) [KSL1+]	4.0L
2	RE323 (WH-BN)	20	CTRL MOD. - POWERTRAIN # KNOCK SENSOR 1ST OR UNIQUE (KS1N) [KSL1-]	4.0L

Knock Sensor: Diagrams

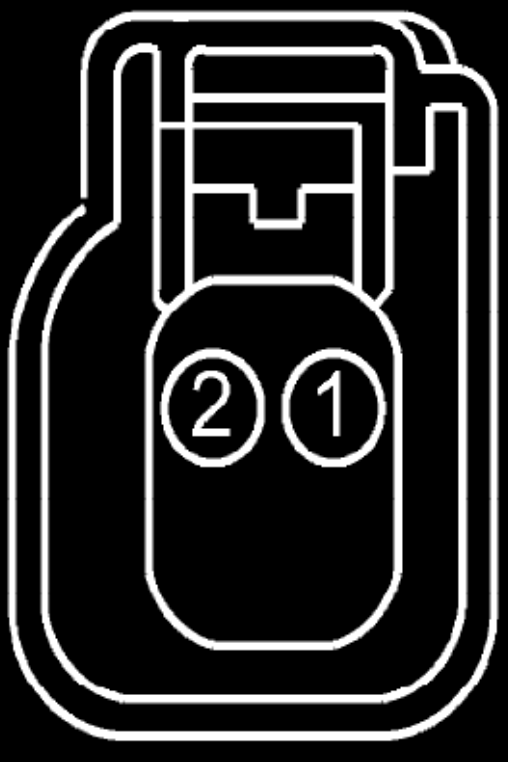
C108

C109

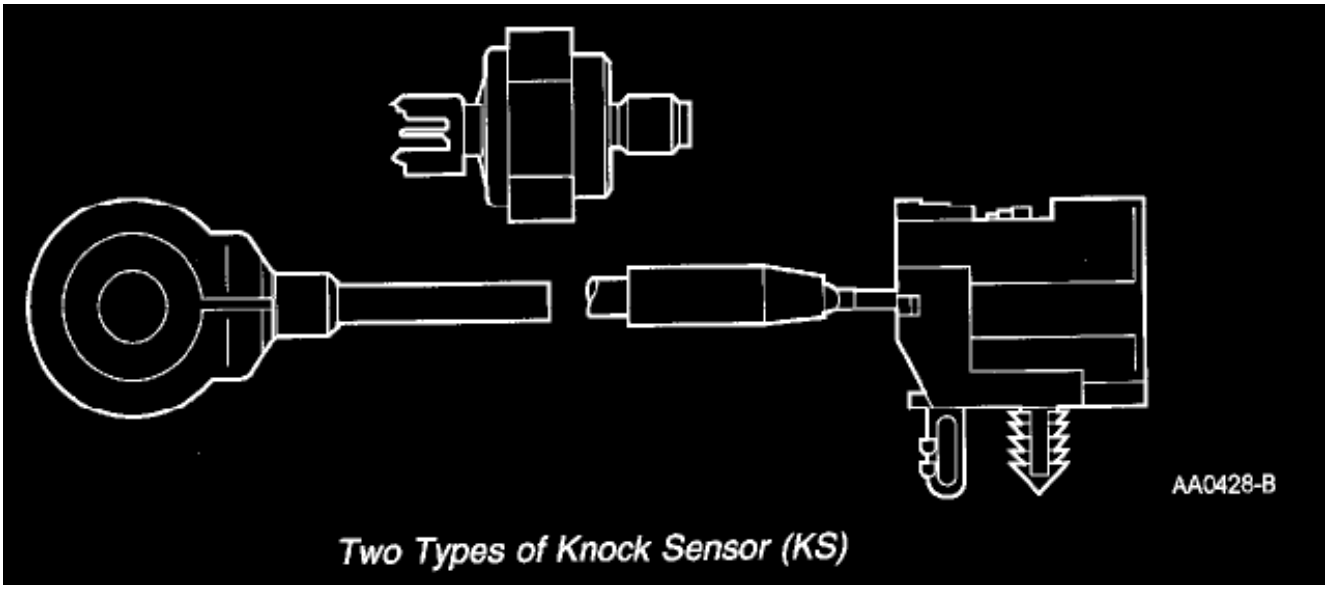
Connector: C1512

Description:	Harness:	Base Part #:
KNOCK SENSOR	12B637	12A699

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE801 (VT-OG)	20	SENSOR - KNOCK 1ST OR UNIQUE (KS1P) [KSL1+]	3.0L
2	RE323 (WH BN)	20	CTRL MOD. - POWERTRAIN # KNOCK SENSOR 1ST OR UNIQUE (KS1N) [KSL1-]	3.0L



C1512



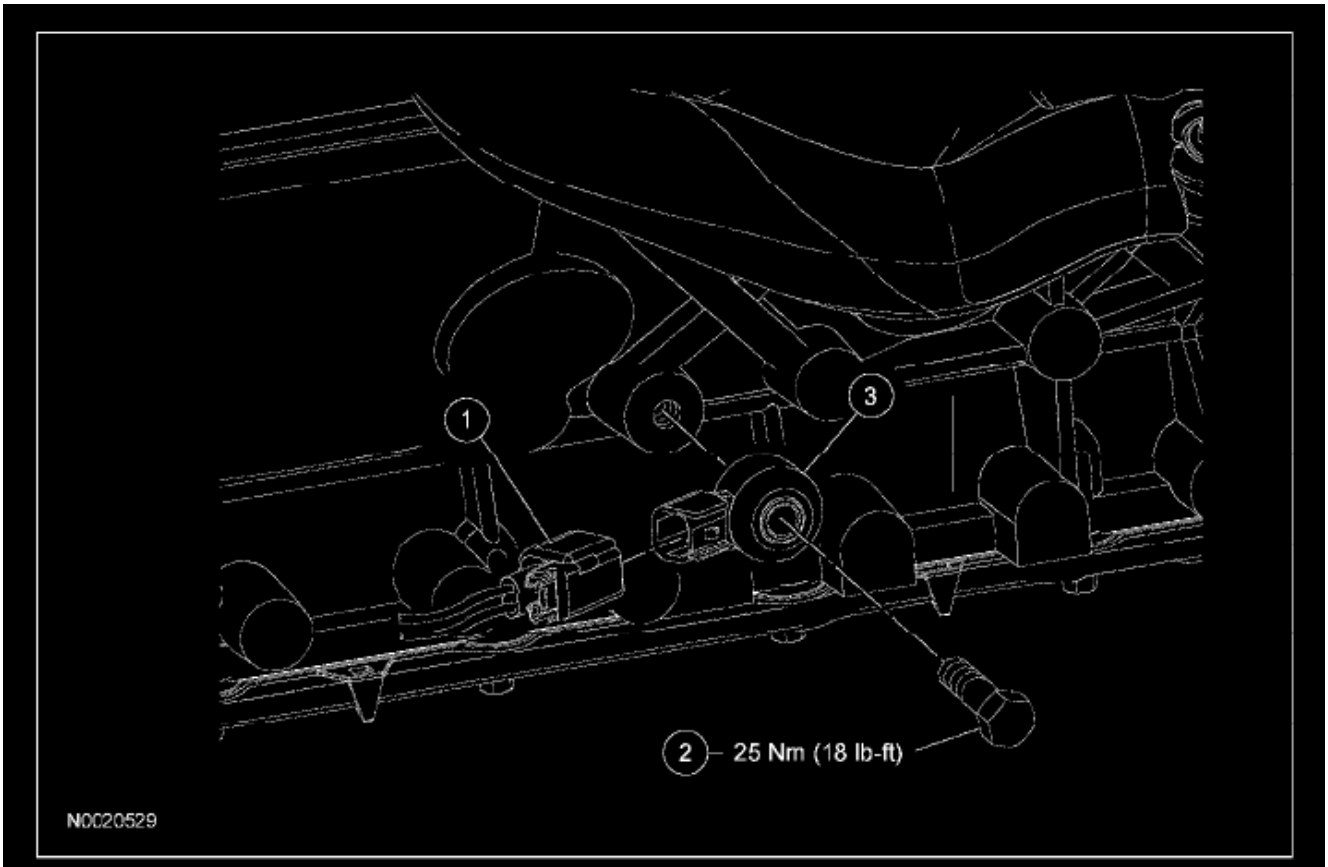
Two Types of Knock Sensor (KS)

Knock Sensor: Description and Operation

Knock Sensor (KS)

Two Types Of Knock Sensor (KS)

The KS is a tuned accelerometer on the engine which converts engine vibration to an electrical signal. The PCM uses this signal to determine the presence of engine knock and to retard spark timing.



Item	Part Number	Description
1	14A464	Knock sensor (KS) electrical connector (part of 12B637)
2	W5000225	KS bolt
3	12A699	KS

Knock Sensor: Service and Repair

KNOCK SENSOR (KS)

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the knock sensor (KS) electrical connector. 3. Remove the bolt and the KS.

- To install, tighten to 25 Nm (18 lb-ft).

4. To install, reverse the removal procedure.

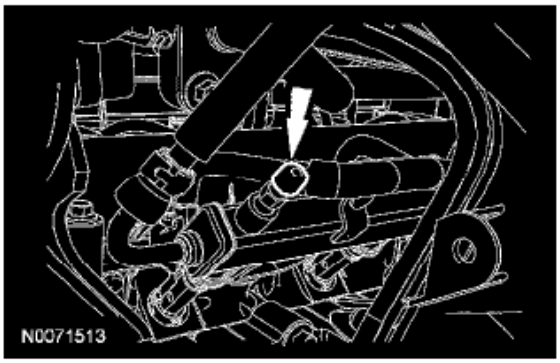
Fuel Pressure: Specifications

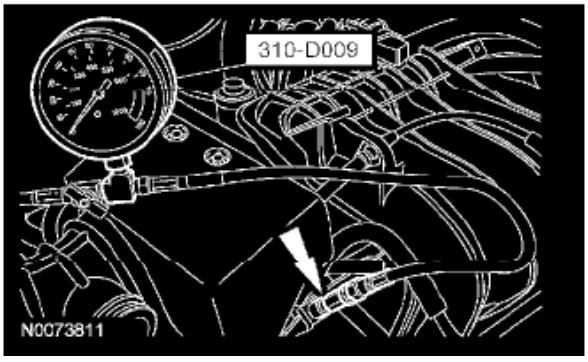
Item.....Specification

Engine running.....414-448 kPa (60-65 psi) Key ON, engine OFF.....414-448 kPa (60-65 psi)

Special Tool(s)

ST3038-A	Fuel Pressure Test Kit 310-D009 (D95L-7211A)





Fuel Pressure: Testing and Inspection

FUEL SYSTEM PRESSURE TEST

Special Tool(s)

Special Tool(s)

WARNING:

- Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

- Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.

- Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

- When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.

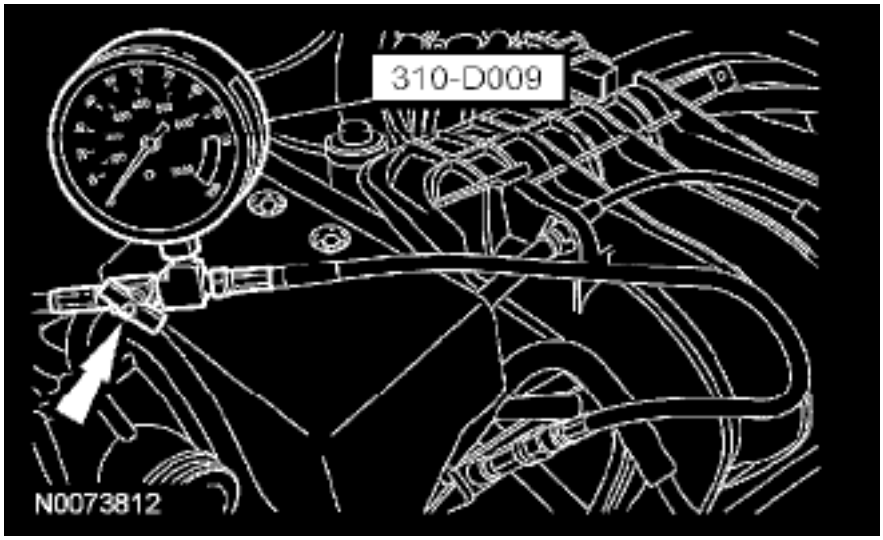
1. NOTE: 2.3L shown, 3.0L and 4.0L similar.

Remove the cap from the fuel pressure relief valve located on the fuel rail.

2. NOTE: 2.3L shown, 3.0L and 4.0L similar.

Install the special tool onto the fuel pressure relief valve.

3. Test the fuel system pressure to make sure it is within the specified range.



4. NOTE:

- 2.3L shown, 3.0L and 4.0L similar.

- Open the drain valve slowly to relieve the fuel system pressure. This may drain fuel from the system. Place fuel in a suitable container.

Upon completion of the fuel system pressure test, open the drain valve on the special tool and relieve the fuel system pressure.

5. NOTE: It may take more than one key cycle to pressurize the fuel system.

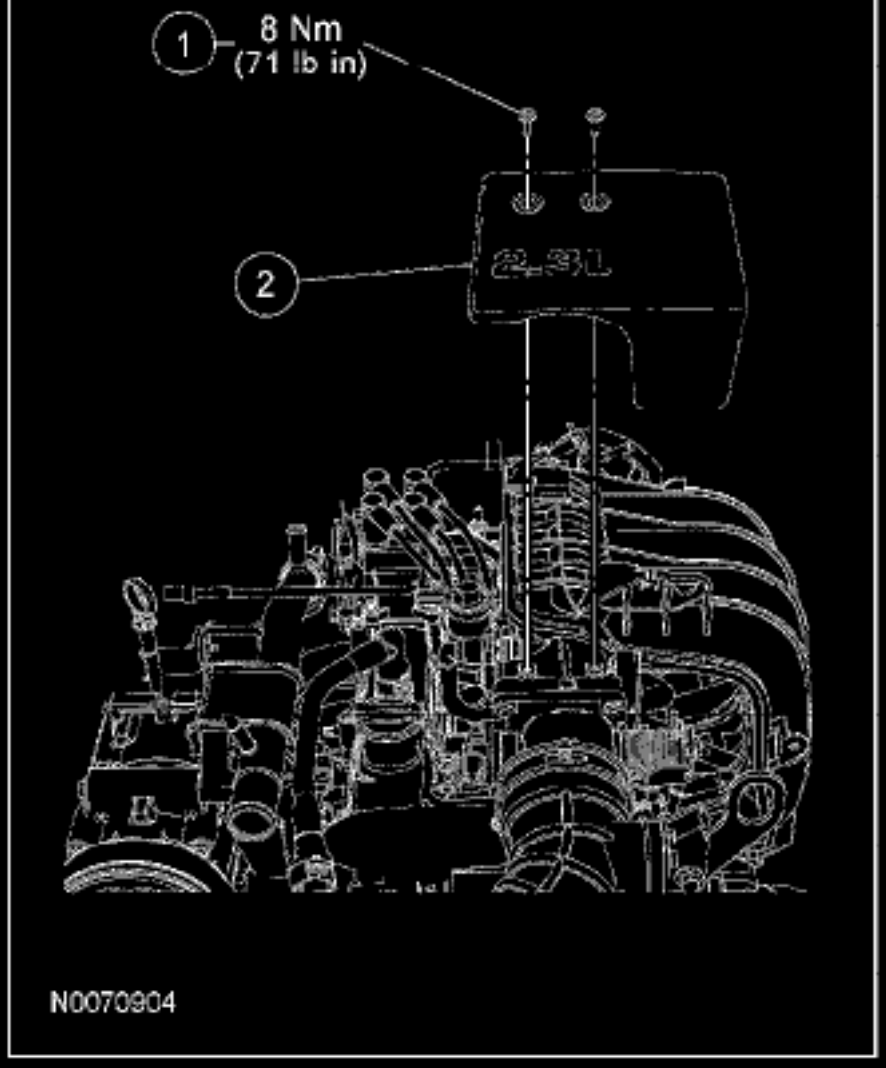
Cycle the ignition key and wait 3 seconds to pressurize the fuel system. Check for leaks before starting the engine.

Idle Speed: Specifications

Typical Diagnostic Reference Value

Measured/PID Values 750 RPM .... Hot Idle

2.3L Throttle Body (TB) Cover



Item	Part Number	Description
1	—	Throttle body (TB) cover bolt (2 required)
2	9E766	TB cover

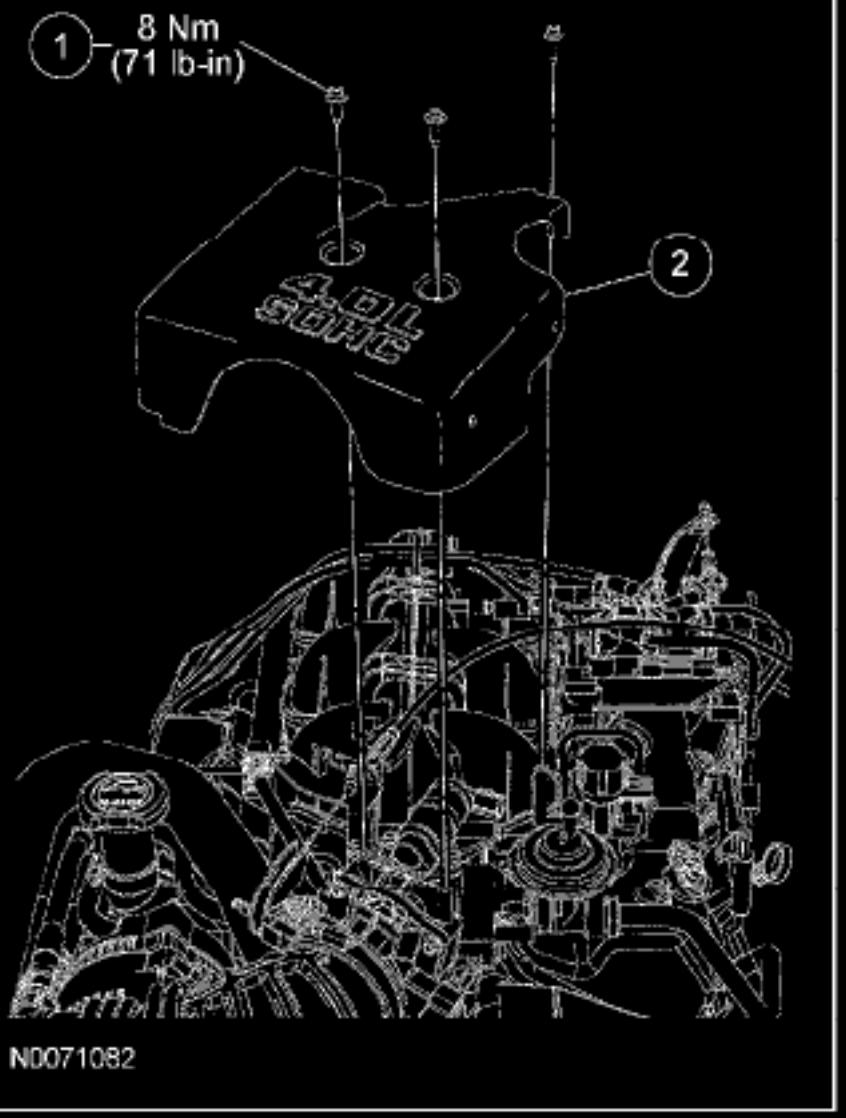
Air Cleaner Fresh Air Duct/Hose: Service and Repair

INTAKE AIR SYSTEM COMPONENTS

Exploded View

2.3L Throttle Body (TB) Cover

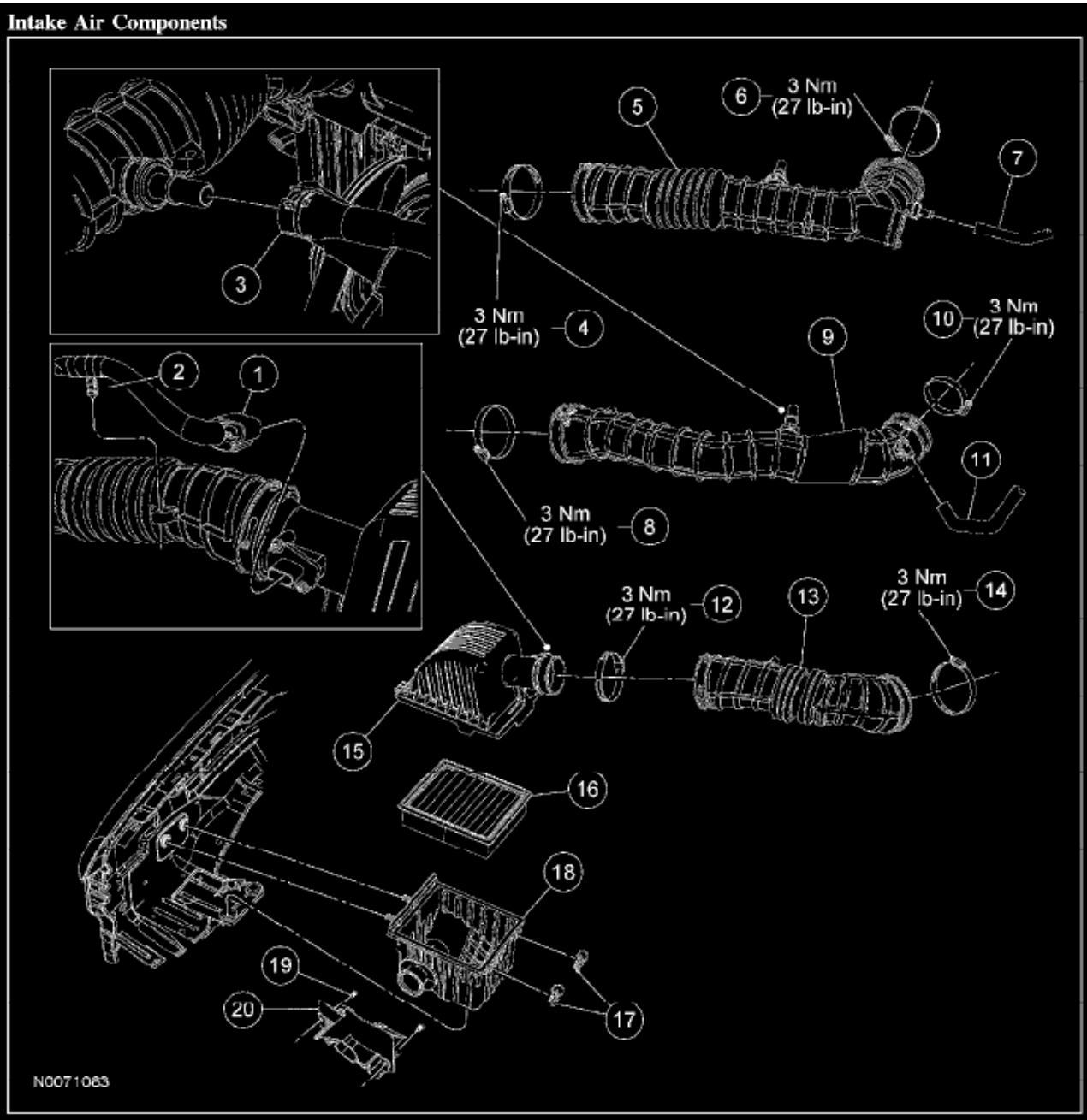
4.0L SOHC Throttle Body (TB) Cover



Item	Part Number	Description
1	W704704	Throttle body (TB) cover bolt (2 required)
2	9E766	TB cover

4.0L SOHC Throttle Body (TB) Cover

Intake Air Components



Item	Part Number	Description
1	—	Mass air flow (MAF) sensor electrical connector (part of 12B637)
2	13A506	Wiring harness retainer (2 required [2.3L engines]) (1 required [3.0L and 4.0L engines]) (part of 12B637)
3	—	Crankcase ventilation tube quick connect coupling

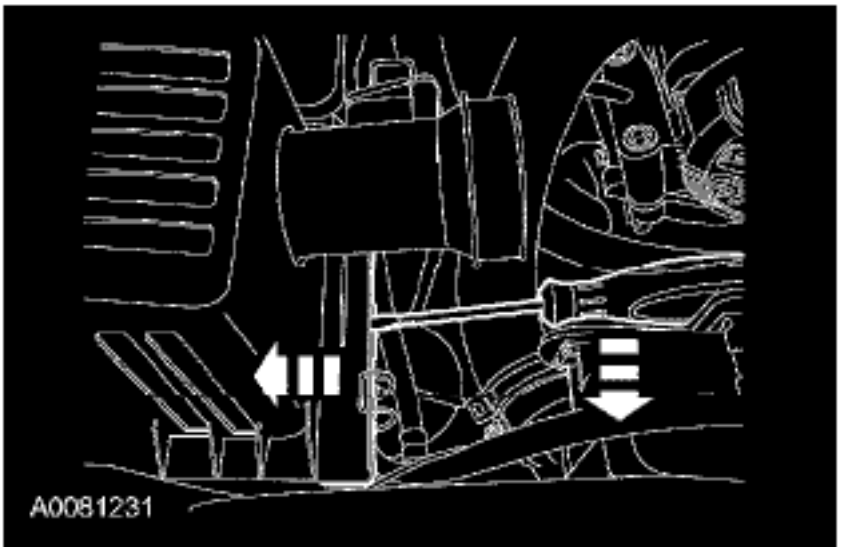
(Continued)

Item	Part Number	Description
4	6C632	Engine air cleaner (ACL) outlet tube-to-air cleaner clamp (2.3L)
5	9B659	ACL outlet tube (2.3L)
6	6C632	ACL outlet tube-to-throttle body (TB) clamp (2.3L)
7	9C490	Brake booster vacuum hose
8	6C632	ACL outlet tube-to-air cleaner clamp (3.0L)

(Continued)

Intake Air Components (Part 1)

Item	Part Number	Description
9	9B659	ACL outlet tube (3.0L)
10	6C632	ACL outlet tube-to-TB clamp (3.0L)
11	9C490	Brake booster vacuum hose
12	6C632	ACL outlet tube-to-air cleaner clamp (4.0L)
13	9B659	ACL outlet tube (4.0L)
14	6C632	ACL outlet tube-to-TB clamp (4.0L)
15	9643	ACL cover
16	9601	ACL element
17	9628	ACL-to-ACL cover clips
18	9A612	ACL
19	N810040	Air nozzle pushpins
20	9E961	Air nozzle

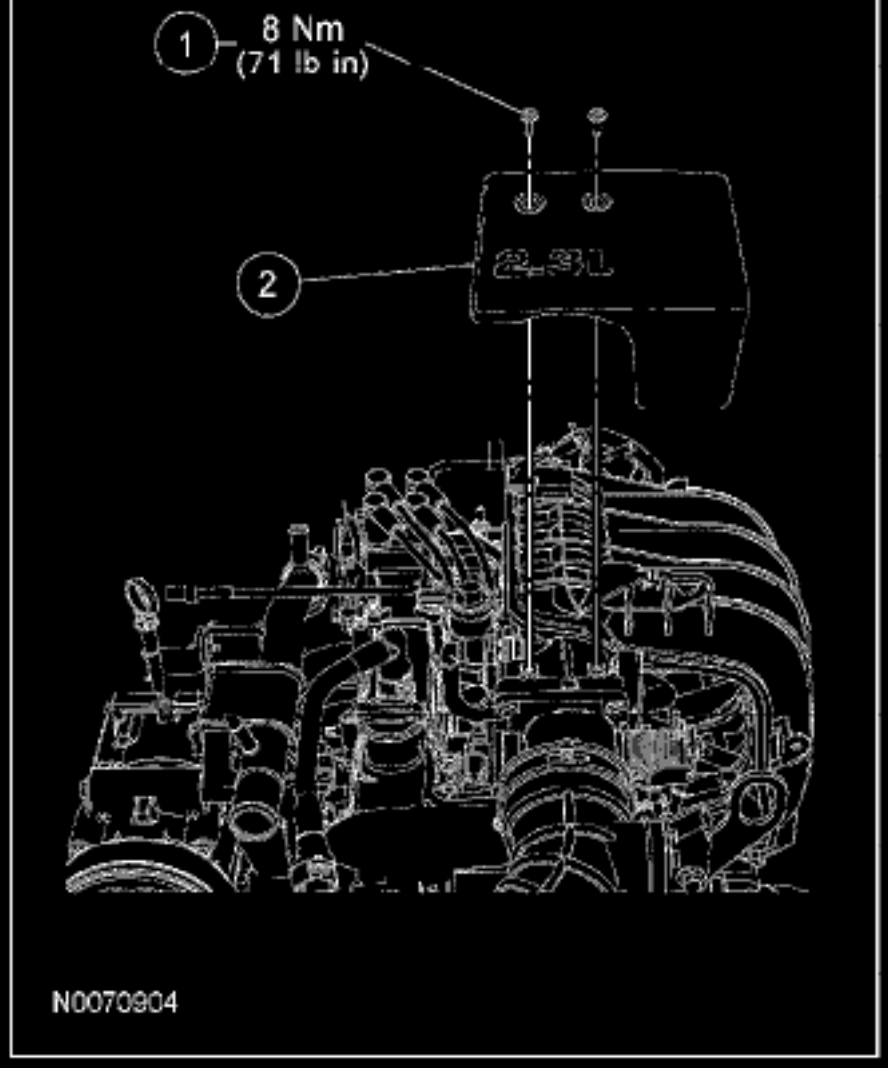


Intake Air Components (Part 2)

Removal and Installation

1. If necessary, pry the engine air cleaner (ACL) from the base support bracket when removing the ACL.

2.3L Throttle Body (TB) Cover



Item	Part Number	Description
1	—	Throttle body (TB) cover bolt (2 required)
2	9E766	TB cover

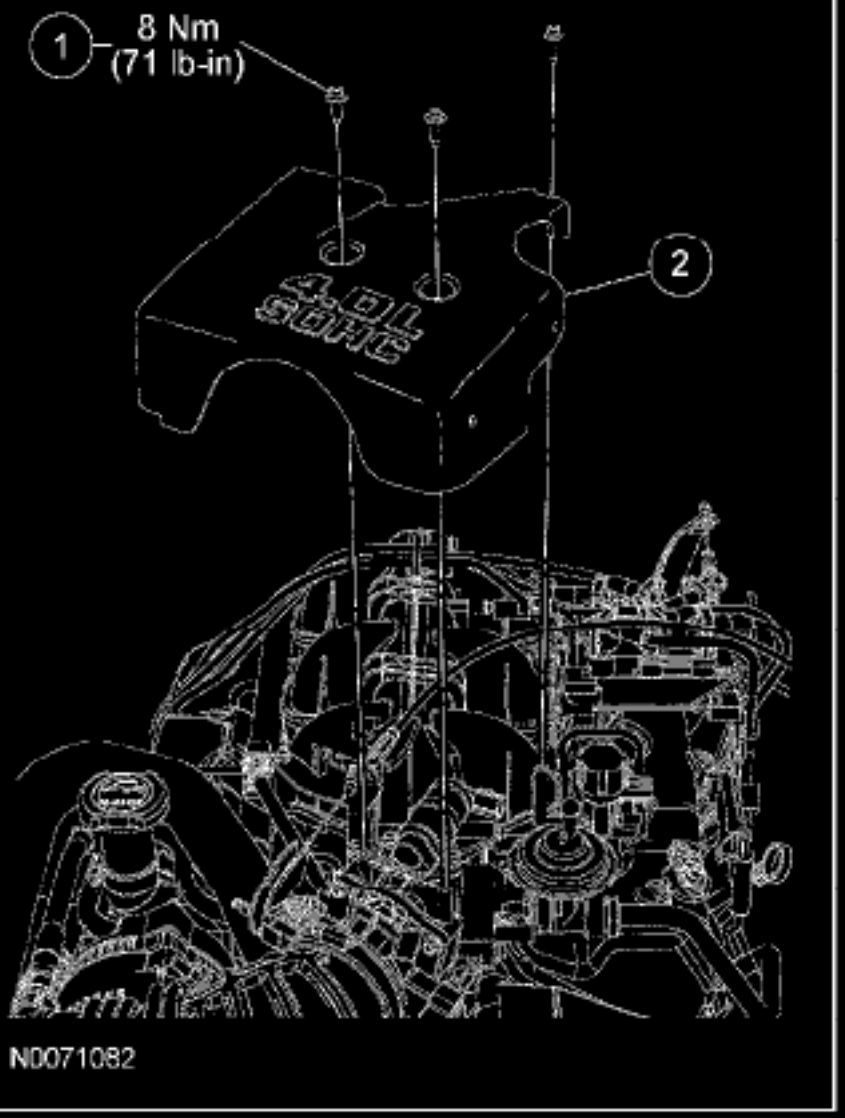
Air Filter Element: Service and Repair

INTAKE AIR SYSTEM COMPONENTS

Exploded View

2.3L Throttle Body (TB) Cover

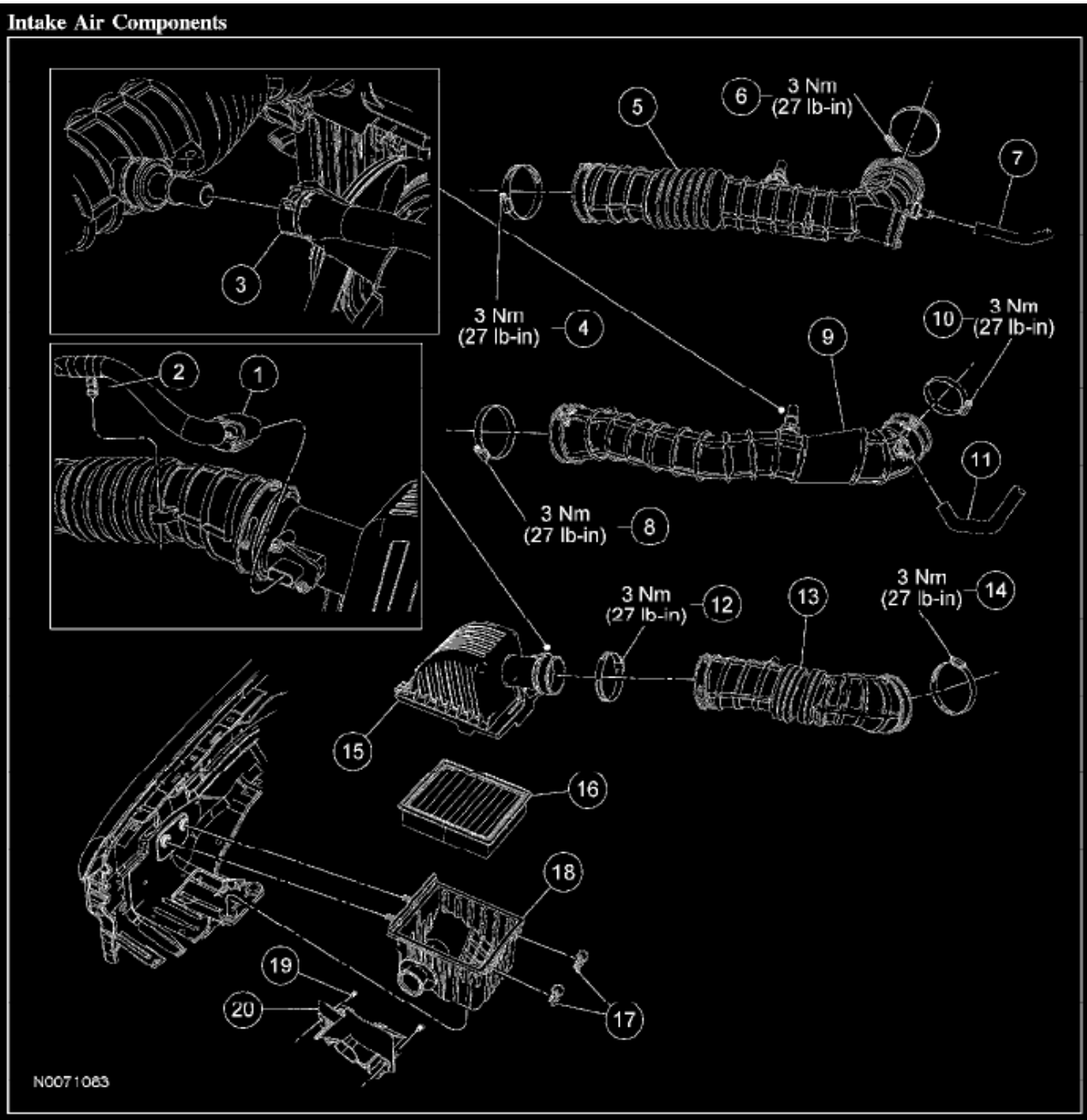
4.0L SOHC Throttle Body (TB) Cover



Item	Part Number	Description
1	W704704	Throttle body (TB) cover bolt (2 required)
2	9E766	TB cover

4.0L SOHC Throttle Body (TB) Cover

Intake Air Components



Item	Part Number	Description
1	—	Mass air flow (MAF) sensor electrical connector (part of 12B637)
2	13A506	Wiring harness retainer (2 required [2.3L engines]) (1 required [3.0L and 4.0L engines]) (part of 12B637)
3	—	Crankcase ventilation tube quick connect coupling

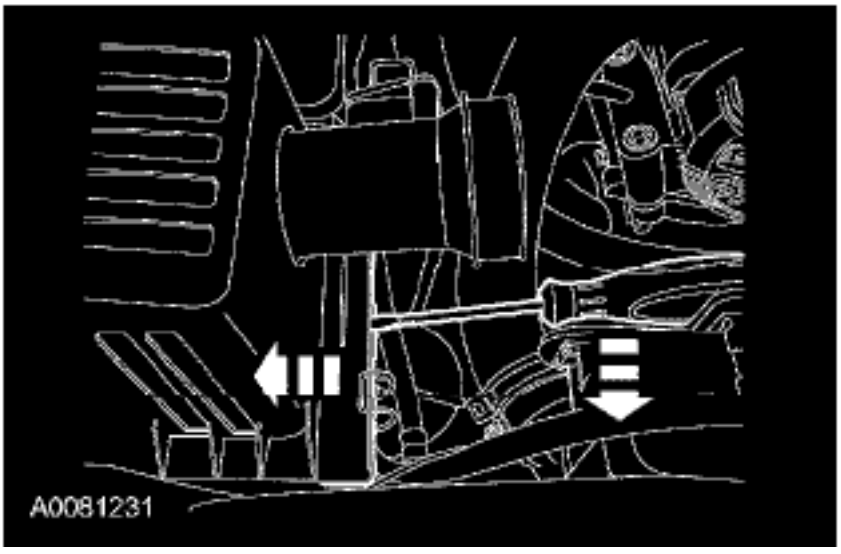
(Continued)

Item	Part Number	Description
4	6C632	Engine air cleaner (ACL) outlet tube-to-air cleaner clamp (2.3L)
5	9B659	ACL outlet tube (2.3L)
6	6C632	ACL outlet tube-to-throttle body (TB) clamp (2.3L)
7	9C490	Brake booster vacuum hose
8	6C632	ACL outlet tube-to-air cleaner clamp (3.0L)

(Continued)

Intake Air Components (Part 1)

Item	Part Number	Description
9	9B659	ACL outlet tube (3.0L)
10	6C632	ACL outlet tube-to-TB clamp (3.0L)
11	9C490	Brake booster vacuum hose
12	6C632	ACL outlet tube-to-air cleaner clamp (4.0L)
13	9B659	ACL outlet tube (4.0L)
14	6C632	ACL outlet tube-to-TB clamp (4.0L)
15	9643	ACL cover
16	9601	ACL element
17	9628	ACL-to-ACL cover clips
18	9A612	ACL
19	N810040	Air nozzle pushpins
20	9E961	Air nozzle



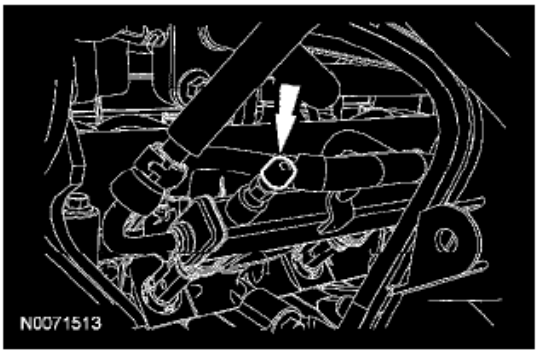
Intake Air Components (Part 2)

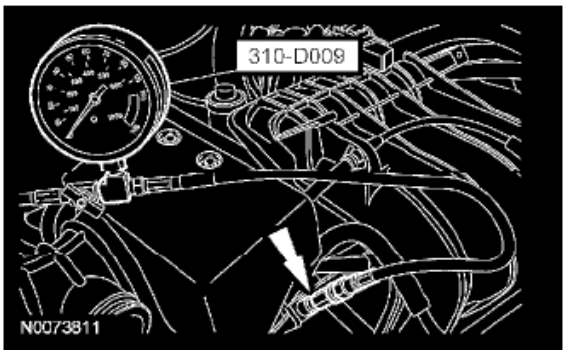
Removal and Installation

1. If necessary, pry the engine air cleaner (ACL) from the base support bracket when removing the ACL.

Special Tool(s)

ST3038-A	Fuel Pressure Test Kit 310-D009 (D95L-7211A)





Fuel Pressure Release: Service and Repair

FUEL SYSTEM PRESSURE RELEASE

Special Tool(s)

Special Tool(s)

WARNING:

- Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

- Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.

- Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

- When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.

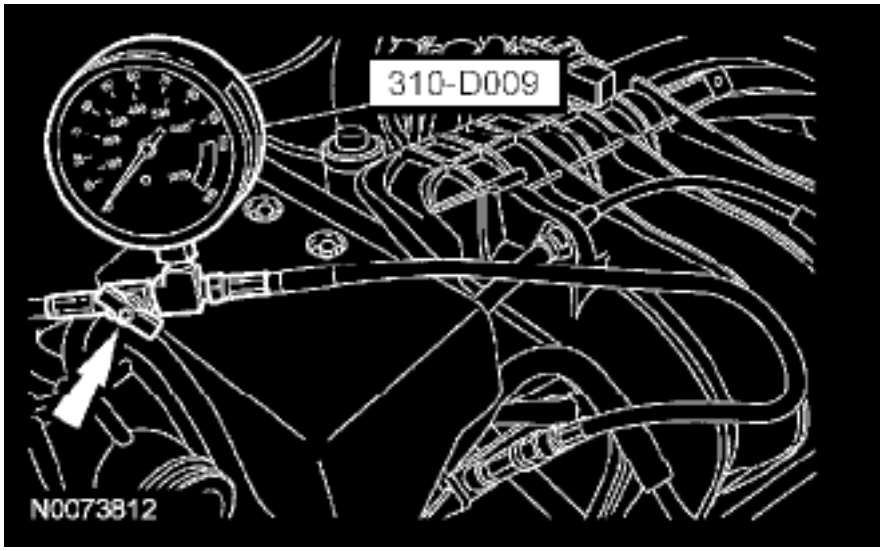
1. Disconnect the battery ground cable.

2. NOTE: 2.3L shown, 3.0L and 4.0L similar.

Remove the cap from the fuel pressure relief valve located on the fuel rail.

3. NOTE: 2.3L shown, 3.0L and 4.0L similar.

Install the special tool onto the fuel pressure relief valve.



4. NOTE:

- 2.3L shown, 3.0L and 4.0L similar.

- Open the drain valve slowly to relieve the system pressure. This may drain fuel from the system. Place fuel in a suitable container.

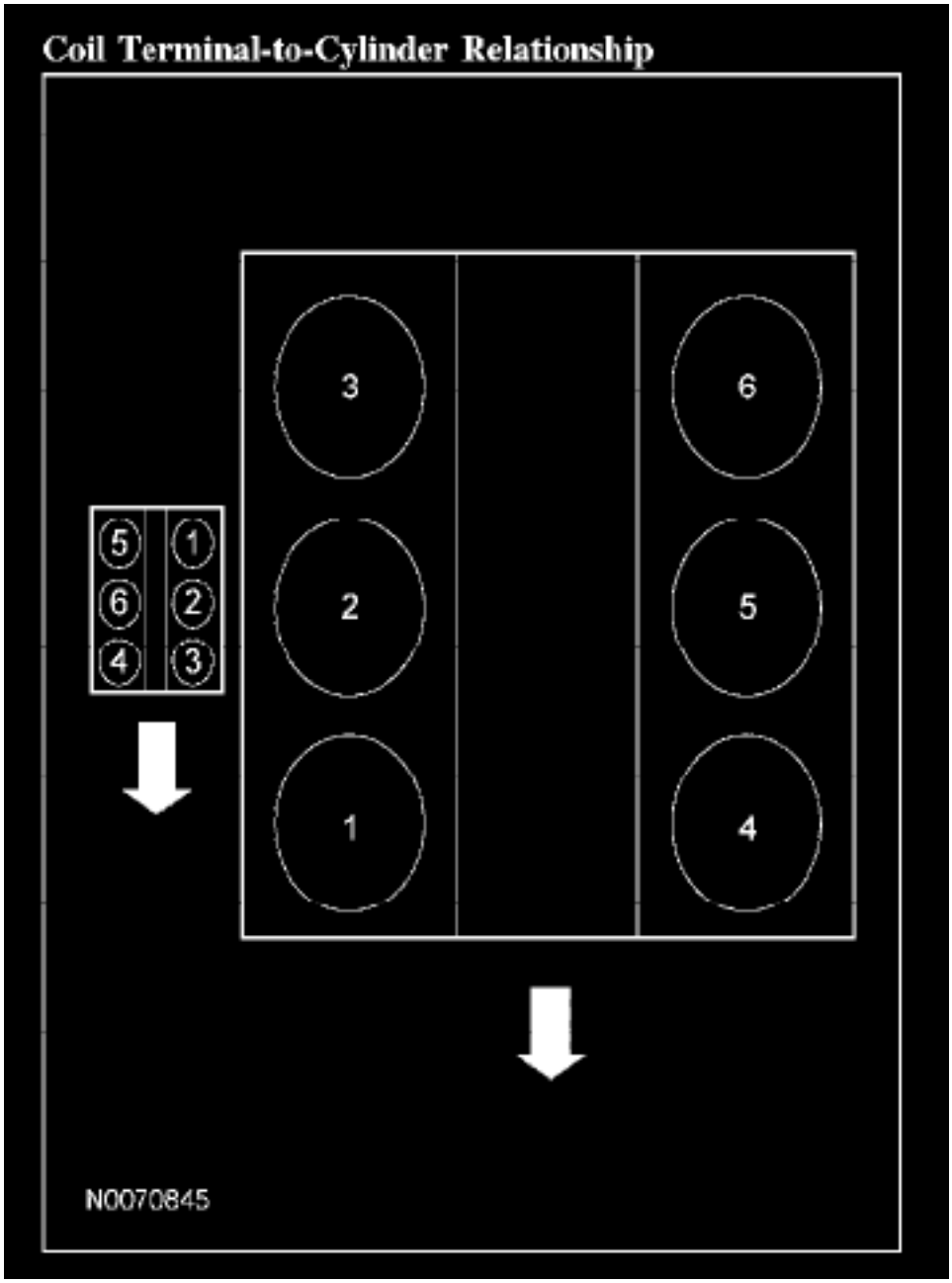
Open the drain valve on the special tool and relieve the fuel system pressure.

5. NOTE: It may take more than one key cycle to pressurize the fuel system.

Upon completion of the fuel system repairs, cycle the ignition key and wait 3 seconds to pressurize the fuel system. Check for leaks before starting the engine.

Firing Order: Specifications

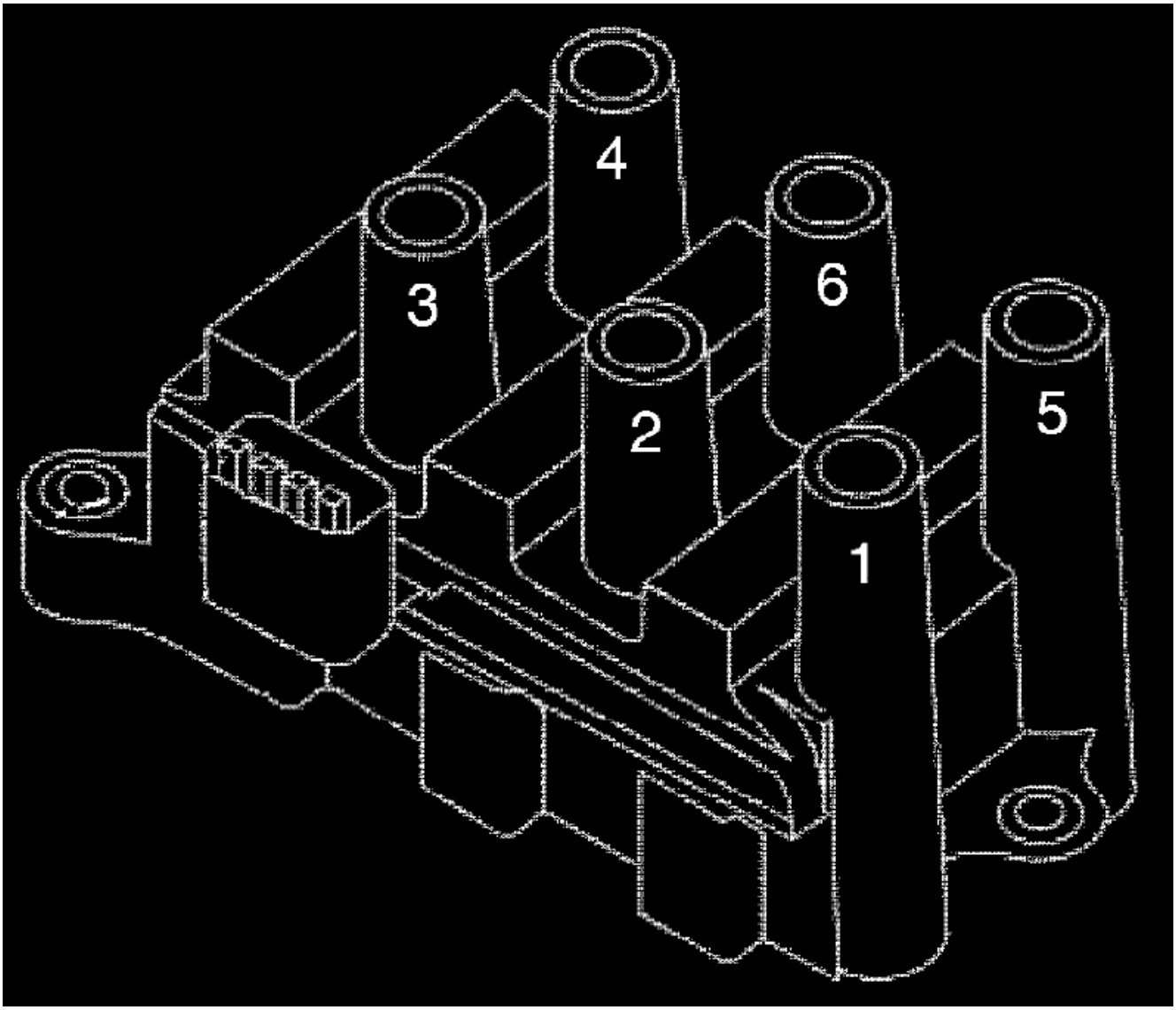
Item	Specification
Firing order	1-4-2-5-3-6



Firing Order: Locations

Coil Terminal-to-Cylinder Relationship

Number One Cylinder

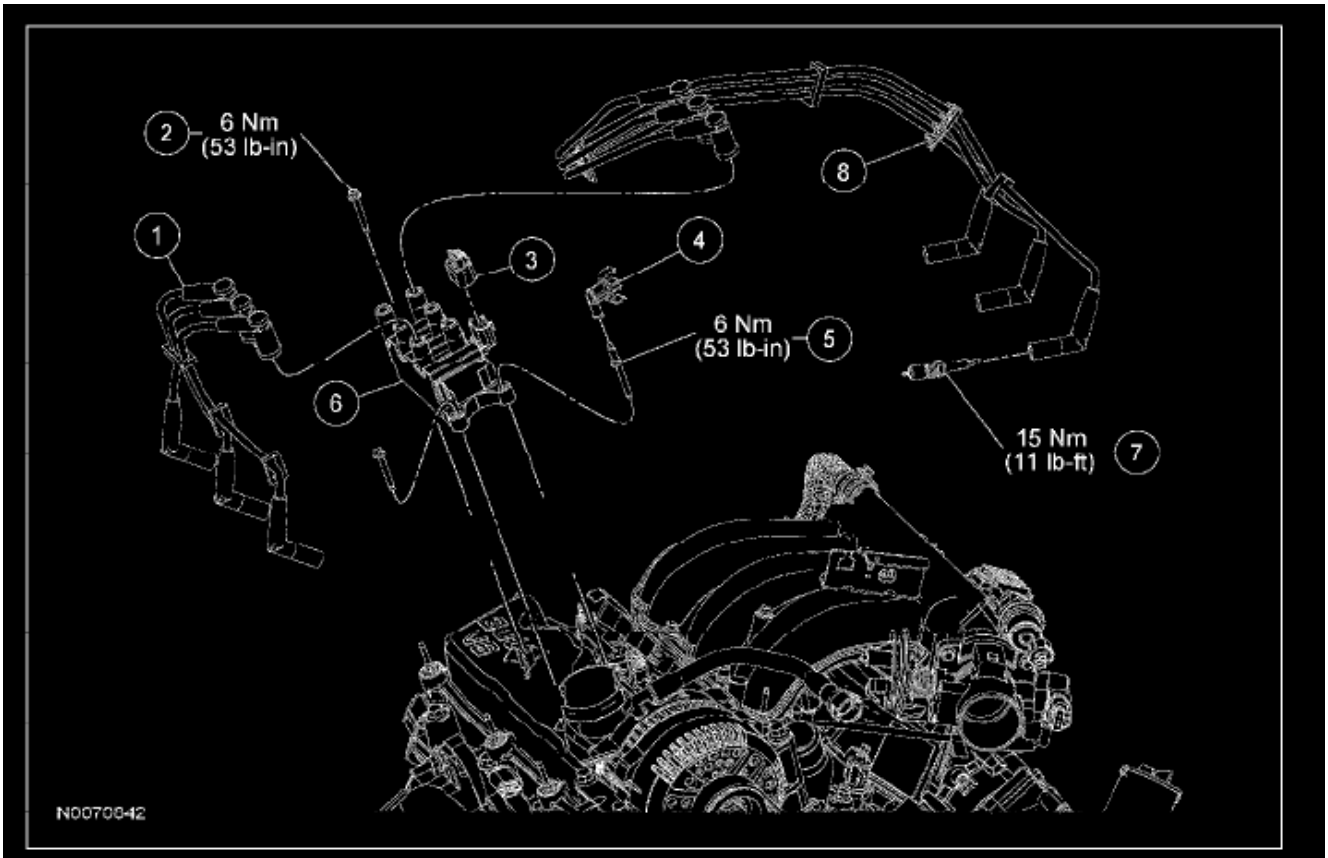


Spark Plug Cable Routing

Item	Specification
Firing order	1-4-2-5-3-6

Ignition Timing: Specifications

Item	Specification
Base ignition timing (not adjustable)	10 degrees before top dead center (BTDC)



Item	Part Number	Description
1	12259	Spark plug wire set
2	W706995	Ignition coil bolt (2 required)
3	—	Ignition coil electrical connector (part of 12B637)
4	18D331	Heater hose retainer
5	W706825	Ignition coil stud bolt

Item	Part Number	Description
6	12029	Ignition coil
7	12405	Spark plug (6 required)
8	12297	Spark plug wire retainer (7 required)

(Continued)

Special Tool(s)

Remover, Spark Plug Wire
303-106 (T74P-6666-A)

Ignition Cable: Service and Repair

SPARK PLUG WIRES

Exploded View

Special Tool(s)

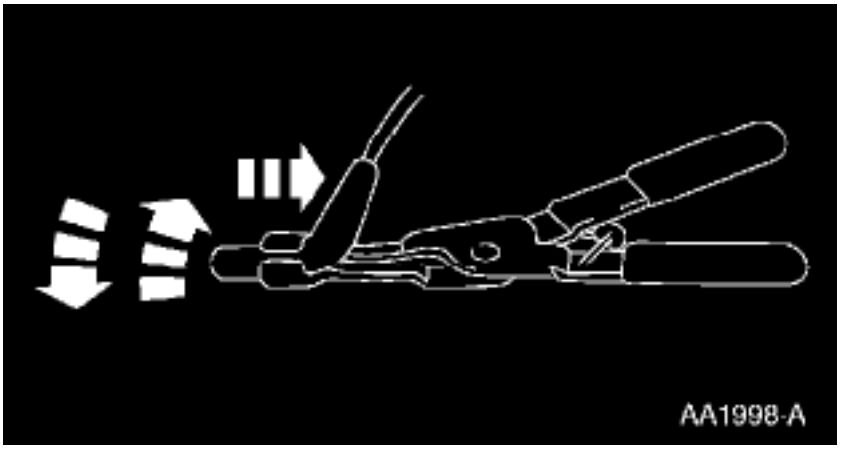
Special Tool(s)

Removal and Installation

CAUTION: Spark plug wires must be connected correctly. Failure to follow this instruction may result in poor engine performance.

1. CAUTION: Do not pull on the spark plug wire as it may separate from the spark plug wire connector inside the spark plug wire boot.

Use the Spark Plug Wire Remover to grasp and twist the spark plug wire boot back and forth on the spark plug insulator to release the connectors.



2. Disconnect the spark plug wires from the ignition coil by twisting while pulling upward. 3. Open the spark plug wire separators and remove the spark plug wires.

4. CAUTION: Correct installation of the spark plug wires is critical to vehicle operation. If one spark plug wire is not correctly installed on

the spark plug or ignition coil, both spark plugs connected to that segment of the ignition coil may not fire under load.

To install, reverse the removal procedure. -

Use a small, clean tool to coat the entire interior surface of the boots with silicone brake caliper grease.

Spark Plug: Specifications General Specifications

Item.....Specification

Spark plug gap.....1.31-1.45 mm 0.052-0.057 in)

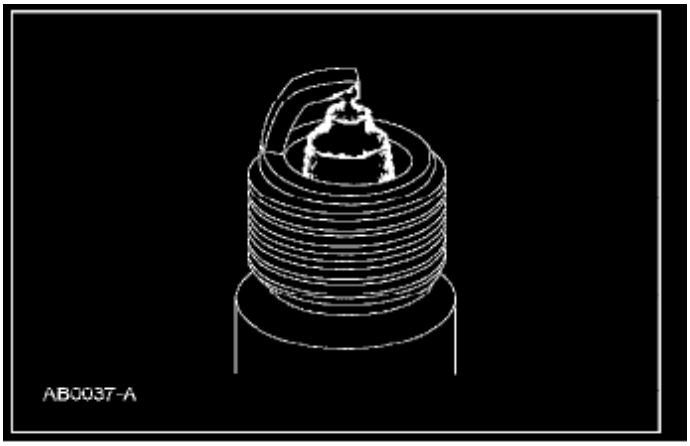
Torque Specifications

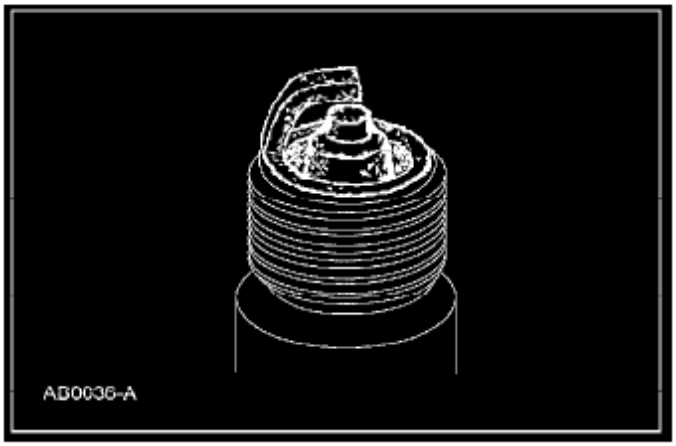
Description	Nm	lb-ft	lb-in
Ignition coil bolts	6	—	53
Spark plugs	15	11	—

Torque Specifications

Spark Plug: Application and ID

Item	Specification
Spark plug	AGSF-32FM


AB0037-A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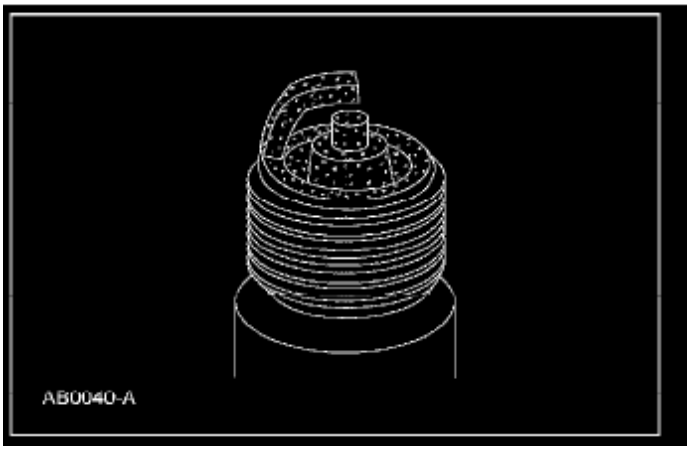

AB0040-A

Spark Plug: Testing and Inspection

Spark Plug Inspection

1. Inspect the spark plug for a bridged gap.

^ Check for deposit build-up closing the gap between the electrodes. Deposits are caused by oil or carbon fouling.

^ Clean the spark plug.

2. Check for oil fouling.

^ Check for wet, black deposits on the insulator shell bore electrodes, caused by excessive oil entering the combustion chamber through worn rings and pistons, excessive valve-to-guide clearance or worn or loose bearings.

^ Correct the oil leak concern.

^ Install a new spark plug.

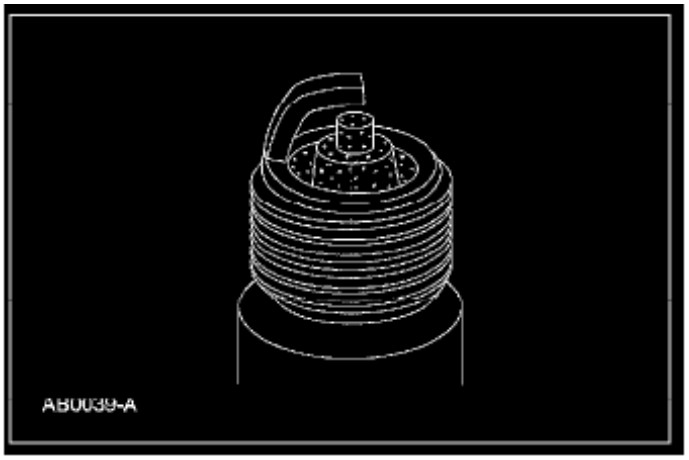
3. Inspect for carbon fouling. Look for black, dry, fluffy carbon deposits on the insulator tips, exposed shell surfaces and electrodes, caused by a

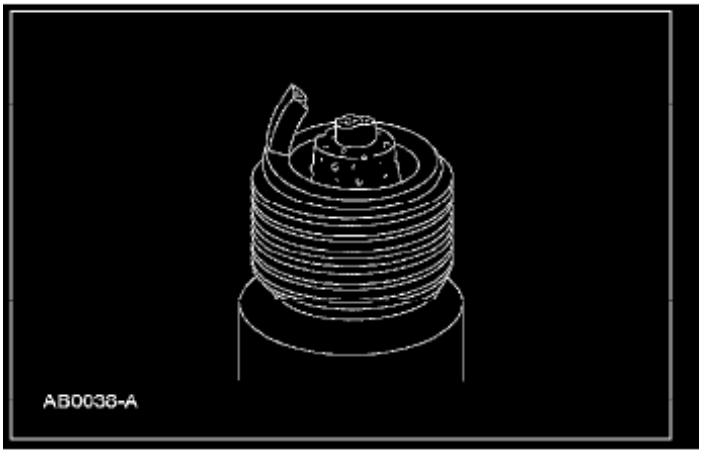
spark plug with an incorrect heat range, dirty air cleaner, too rich a fuel mixture or excessive idling.
^

Install new spark plugs.

4. Inspect for normal burning.

^ Check for light tan or gray deposits on the firing tip.


AB0039-A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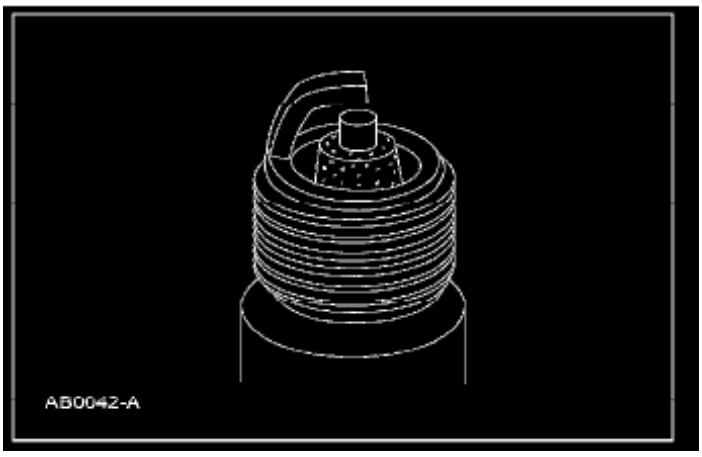

AB0042-A

5. Inspect for pre-ignition, identified by melted electrodes and a possibly damaged insulator. Metallic deposits on the insulator indicate engine

damage. This may be caused by incorrect ignition timing, wrong type of fuel or the unauthorized installation of a Heli-Coil(R) insert in place of the spark plug threads. ^

Install a new spark plug.

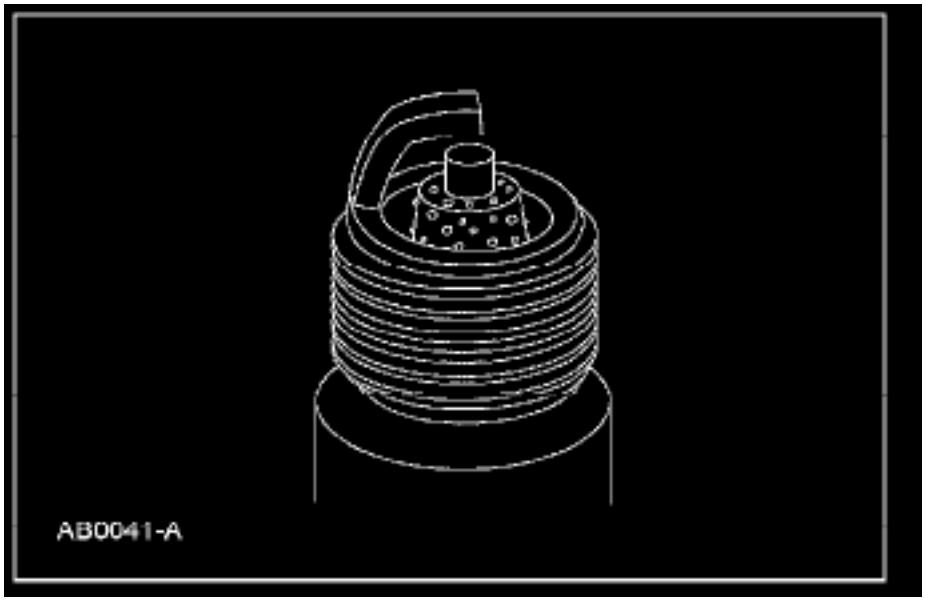
6. Inspect for overheating, identified by white or light gray spots and with a bluish-burnt appearance of electrodes. This is caused by engine

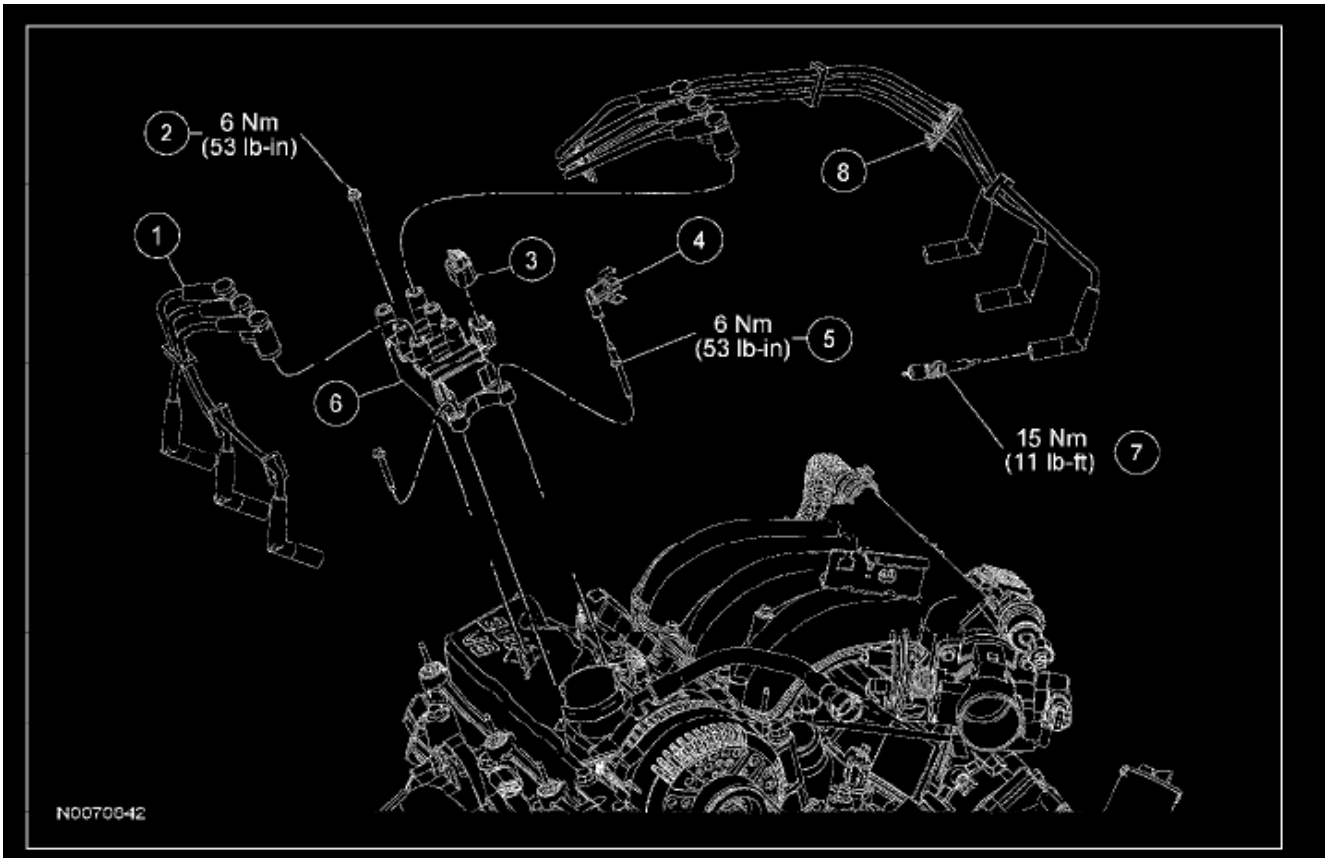
overheating, wrong type of fuel, loose spark plugs, spark plugs with an incorrect heat range, low fuel pump pressure or incorrect ignition timing. ^

Install a new spark plug.

7. Inspect for fused deposits, identified by melted or spotty deposits resembling bubbles or blisters. These are caused by sudden acceleration.

^ Install new spark plugs.


AB0041-A



Item	Part Number	Description
1	12259	Spark plug wire set
2	W706995	Ignition coil bolt (2 required)
3	—	Ignition coil electrical connector (part of 12B637)
4	18D331	Heater hose retainer
5	W706825	Ignition coil stud bolt

Item	Part Number	Description
6	12029	Ignition coil
7	12405	Spark plug (6 required)
8	12297	Spark plug wire retainer (7 required)

(Continued)

Special Tool(s)

ST1394-A	Remover, Spark Plug Wire 303-106 (T74P-6666-A)

Spark Plug: Service and Repair

SPARK PLUGS

Exploded View

Special Tool(s)

Special Tool(s)

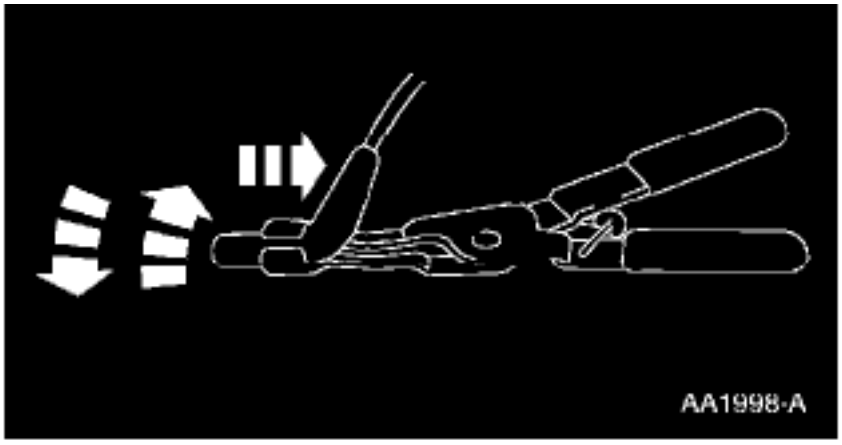
Removal and Installation

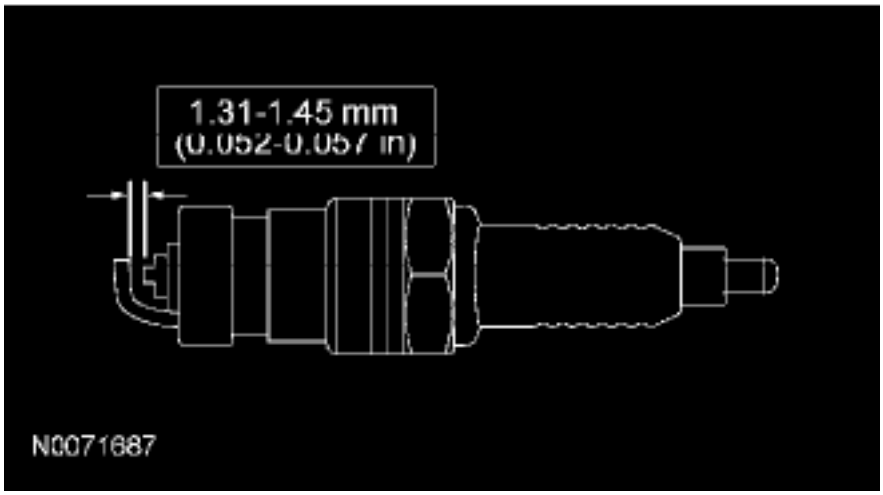
1. CAUTION:

- Spark plug wires must be connected correctly. Failure to follow this instruction may result in poor engine performance.

- Do not pull on the spark plug wire as it may separate from the spark plug wire connector inside the spark plug wire boot.

Use the Spark Plug Wire Remover to grasp and twist the spark plug wire boot back and forth on the spark plug insulator to release the connectors.





2. Loosen the spark plugs. 3. Remove any foreign material from the spark plug areas of the cylinder head with compressed air. 4. Remove the spark plugs.

- To install, tighten to 15 Nm (11 lb-ft).

5. Inspect the spark plugs. 6. Adjust the spark plug gap as necessary.

7. To install, reverse the removal procedure.

- Use a small, clean tool to coat the entire interior surface of the boot with silicone brake caliper grease.

Compression Pressure Limit Chart

Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure
924 kPa (134 psi)	696 kPa (101 psi)	1,131 kPa (164 psi)	848 kPa (123 psi)	1,338 kPa (194 psi)	1,000 kPa (146 psi)	1,544 kPa (224 psi)	1,158 kPa (168 psi)
938 kPa (136 psi)	703 kPa (102 psi)	1,145 kPa (166 psi)	855 kPa (124 psi)	1,351 kPa (196 psi)	1,014 kPa (147 psi)	1,558 kPa (226 psi)	1,165 kPa (169 psi)

Compression Pressure Limit Chart (Continued)

Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure
952 kPa (138 psi)	717 kPa (104 psi)	1,158 kPa (168 psi)	869 kPa (126 psi)	1,365 kPa (198 psi)	1,020 kPa (148 psi)	1,572 kPa (228 psi)	1,179 kPa (171 psi)
965 kPa (140 psi)	724 kPa (106 psi)	1,172 kPa (170 psi)	876 kPa (127 psi)	1,379 kPa (200 psi)	1,034 kPa (150 psi)	1,586 kPa (230 psi)	1,186 kPa (172 psi)
979 kPa (142 psi)	738 kPa (107 psi)	1,186 kPa (172 psi)	889 kPa (129 psi)	1,303 kPa (202 psi)	1,041 kPa (151 psi)	1,600 kPa (232 psi)	1,200 kPa (174 psi)
933 kPa (144 psi)	745 kPa (109 psi)	1,200 kPa (174 psi)	903 kPa (131 psi)	1,407 kPa (204 psi)	1,055 kPa (153 psi)	1,055 kPa (153 psi)	1,207 kPa (175 psi)
1,007 kPa (146 psi)	758 kPa (110 psi)	1,214 kPa (176 psi)	910 kPa (132 psi)	1,420 kPa (206 psi)	1,062 kPa (154 psi)	1,627 kPa (154 psi)	1,220 kPa (177 psi)
1,020 kPa (148 psi)	765 kPa (111 psi)	1,227 kPa (178 psi)	917 kPa (133 psi)	1,434 kPa (208 psi)	1,075 kPa (156 psi)	1,641 kPa (238 psi)	1,227 kPa (178 psi)
1,034 kPa (150 psi)	779 kPa (113 psi)	1,241 kPa (180 psi)	931 kPa (135 psi)	1,448 kPa (210 psi)	1,083 kPa (157 psi)	1,655 kPa (240 psi)	1,241 kPa (180 psi)
1,048 kPa (152 psi)	786 kPa (114 psi)	1,255 kPa (182 psi)	936 kPa (136 psi)	1,462 kPa (212 psi)	1,089 kPa (158 psi)	1,669 kPa (242 psi)	1,248 kPa (181 psi)
1,062 kPa (154 psi)	793 kPa (115 psi)	1,269 kPa (184 psi)	952 kPa (138 psi)	1,476 kPa (214 psi)	1,103 kPa (160 psi)	1,682 kPa (244 psi)	1,262 kPa (183 psi)
1,076 kPa (156 psi)	807 kPa (117 psi)	1,282 kPa (186 psi)	965 kPa (140 psi)	1,489 kPa (216 psi)	1,117 kPa (162 psi)	1,696 kPa (246 psi)	1,269 kPa (184 psi)
1,089 kPa (158 psi)	814 kPa (118 psi)	1,296 kPa (188 psi)	972 kPa (141 psi)	1,503 kPa (218 psi)	1,124 kPa (163 psi)	1,710 kPa (248 psi)	1,202 kPa (186 psi)
1,103 kPa (160 psi)	827 kPa (120 psi)	1,310 kPa (190 psi)	979 kPa (142 psi)	1,517 kPa (220 psi)	1,138 kPa (165 psi)	1,724 kPa (250 psi)	1,289 kPa (187 psi)
1,110 kPa (161 psi)	834 kPa (121 psi)	1,324 kPa (192 psi)	993 kPa (144 psi)	1,631 kPa (222 psi)	1,145 kPa (166 psi)	—	—

Compression Check: Specifications

Compression Pressure Limit Chart

The indicated compression pressures are considered within specification if the lowest reading cylinder is at least 75% of the highest reading.

Compression Pressure Limit Chart (Part 1)

Compression Pressure Limit Chart (Part 2)

Compression Pressure Limit Chart

Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure
924 kPa (134 psi)	696 kPa (101 psi)	1,131 kPa (164 psi)	848 kPa (123 psi)	1,338 kPa (194 psi)	1,000 kPa (146 psi)	1,544 kPa (224 psi)	1,158 kPa (168 psi)
938 kPa (136 psi)	703 kPa (102 psi)	1,145 kPa (166 psi)	855 kPa (124 psi)	1,351 kPa (196 psi)	1,014 kPa (147 psi)	1,558 kPa (226 psi)	1,165 kPa (169 psi)

Compression Pressure Limit Chart (Continued)

Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure	Maximum Pressure	Minimum Pressure
952 kPa (138 psi)	717 kPa (104 psi)	1,158 kPa (168 psi)	869 kPa (126 psi)	1,365 kPa (198 psi)	1,020 kPa (148 psi)	1,572 kPa (228 psi)	1,179 kPa (171 psi)
965 kPa (140 psi)	724 kPa (106 psi)	1,172 kPa (170 psi)	876 kPa (127 psi)	1,379 kPa (200 psi)	1,034 kPa (150 psi)	1,586 kPa (230 psi)	1,186 kPa (172 psi)
979 kPa (142 psi)	738 kPa (107 psi)	1,186 kPa (172 psi)	889 kPa (129 psi)	1,393 kPa (202 psi)	1,041 kPa (151 psi)	1,600 kPa (232 psi)	1,200 kPa (174 psi)
933 kPa (144 psi)	745 kPa (109 psi)	1,200 kPa (174 psi)	903 kPa (131 psi)	1,407 kPa (204 psi)	1,055 kPa (153 psi)	1,055 kPa (153 psi)	1,207 kPa (175 psi)
1,007 kPa (146 psi)	758 kPa (110 psi)	1,214 kPa (176 psi)	910 kPa (132 psi)	1,420 kPa (206 psi)	1,062 kPa (154 psi)	1,627 kPa (154 psi)	1,220 kPa (177 psi)
1,020 kPa (148 psi)	765 kPa (111 psi)	1,227 kPa (178 psi)	917 kPa (133 psi)	1,434 kPa (208 psi)	1,075 kPa (156 psi)	1,641 kPa (238 psi)	1,227 kPa (178 psi)
1,034 kPa (150 psi)	779 kPa (113 psi)	1,241 kPa (180 psi)	931 kPa (135 psi)	1,448 kPa (210 psi)	1,083 kPa (157 psi)	1,655 kPa (240 psi)	1,241 kPa (180 psi)
1,048 kPa (152 psi)	786 kPa (114 psi)	1,255 kPa (182 psi)	936 kPa (136 psi)	1,462 kPa (212 psi)	1,089 kPa (158 psi)	1,669 kPa (242 psi)	1,248 kPa (181 psi)
1,062 kPa (154 psi)	793 kPa (115 psi)	1,269 kPa (184 psi)	952 kPa (138 psi)	1,476 kPa (214 psi)	1,103 kPa (160 psi)	1,682 kPa (244 psi)	1,262 kPa (183 psi)
1,076 kPa (156 psi)	807 kPa (117 psi)	1,282 kPa (186 psi)	965 kPa (140 psi)	1,489 kPa (216 psi)	1,117 kPa (162 psi)	1,696 kPa (246 psi)	1,269 kPa (184 psi)
1,089 kPa (158 psi)	814 kPa (118 psi)	1,296 kPa (188 psi)	972 kPa (141 psi)	1,503 kPa (218 psi)	1,124 kPa (163 psi)	1,710 kPa (248 psi)	1,202 kPa (186 psi)
1,103 kPa (160 psi)	827 kPa (120 psi)	1,310 kPa (190 psi)	979 kPa (142 psi)	1,517 kPa (220 psi)	1,138 kPa (165 psi)	1,724 kPa (250 psi)	1,289 kPa (187 psi)
1,110 kPa (161 psi)	834 kPa (121 psi)	1,324 kPa (192 psi)	993 kPa (144 psi)	1,631 kPa (222 psi)	1,145 kPa (166 psi)	—	—

Compression Check: Testing and Inspection

Compression Test - Compression Gauge Check

1. Make sure the oil in the crankcase is of the correct viscosity and at the correct level and that the battery is correctly charged. Operate the vehicle

until the engine is at normal operating temperature. Turn the ignition switch to the OFF position, then remove all the spark plugs.

2. Set the throttle plates in the wide-open position. 3. Install a compression gauge such as the Compression Tester in the No. 1 cylinder. 4. Install an auxiliary starter switch in the starting circuit. With the ignition switch in the OFF position, and using the auxiliary starter switch, crank

the engine a minimum of 5 compression strokes and record the highest reading. Note the approximate number of compression strokes required to obtain the highest reading.

5. Repeat the test on each cylinder, cranking the engine approximately the same number of compression strokes.

Compression Test - Test Results

The indicated compression pressures are considered within specification if the lowest reading cylinder is at least 75% of the highest reading. Refer to the Compression Pressure Limit Chart.

Compression Pressure Limit Chart

Compression Pressure Limit Chart (Part 1)

Compression Pressure Limit Chart (Part 2)

If one or more cylinders read low, squirt approximately one tablespoon of engine oil on top of the pistons in the low-reading cylinders. Repeat the

compression pressure check on these cylinders.

Compression Test - Interpreting Compression Readings

1. If compression improves considerably, piston rings are faulty. 2. If compression does not improve, valves are sticking or seating incorrectly. 3. If 2 adjacent cylinders indicate low compression pressures and squirting oil on each piston does not increase compression, the head gasket may be

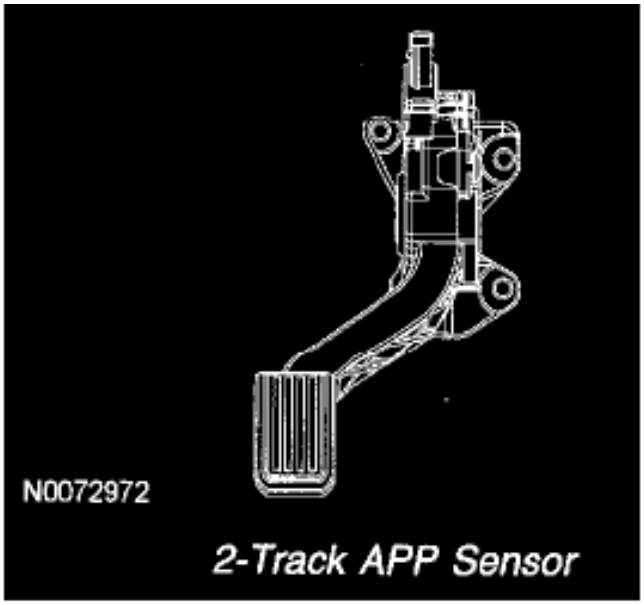
leaking between cylinders. Engine oil or coolant in cylinders could result from this condition.

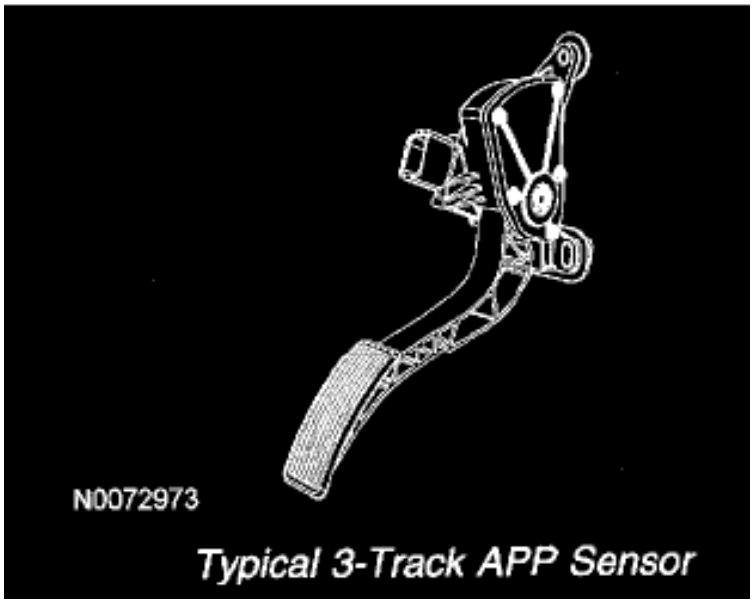
Use the Compression Pressure Limit Chart when checking cylinder compression so that the lowest reading is within 75% of the highest reading.

Valve Clearance: Specifications

Valve Clearance

This engine is equipped with hydraulic valve lifters. No adjustment is required.


N0072972
2-Track APP Sensor


N0072973
Typical 3-Track APP Sensor

Accelerator Pedal Position Sensor: Description and Operation

ACCELERATOR PEDAL POSITION (APP) SENSOR

The APP sensor is an input to the powertrain control module (PCM) and is used to determine the amount of torque requested by the operator. Depending on the application either a 2-track or 3-track APP sensor is used.

2-Track APP Sensor

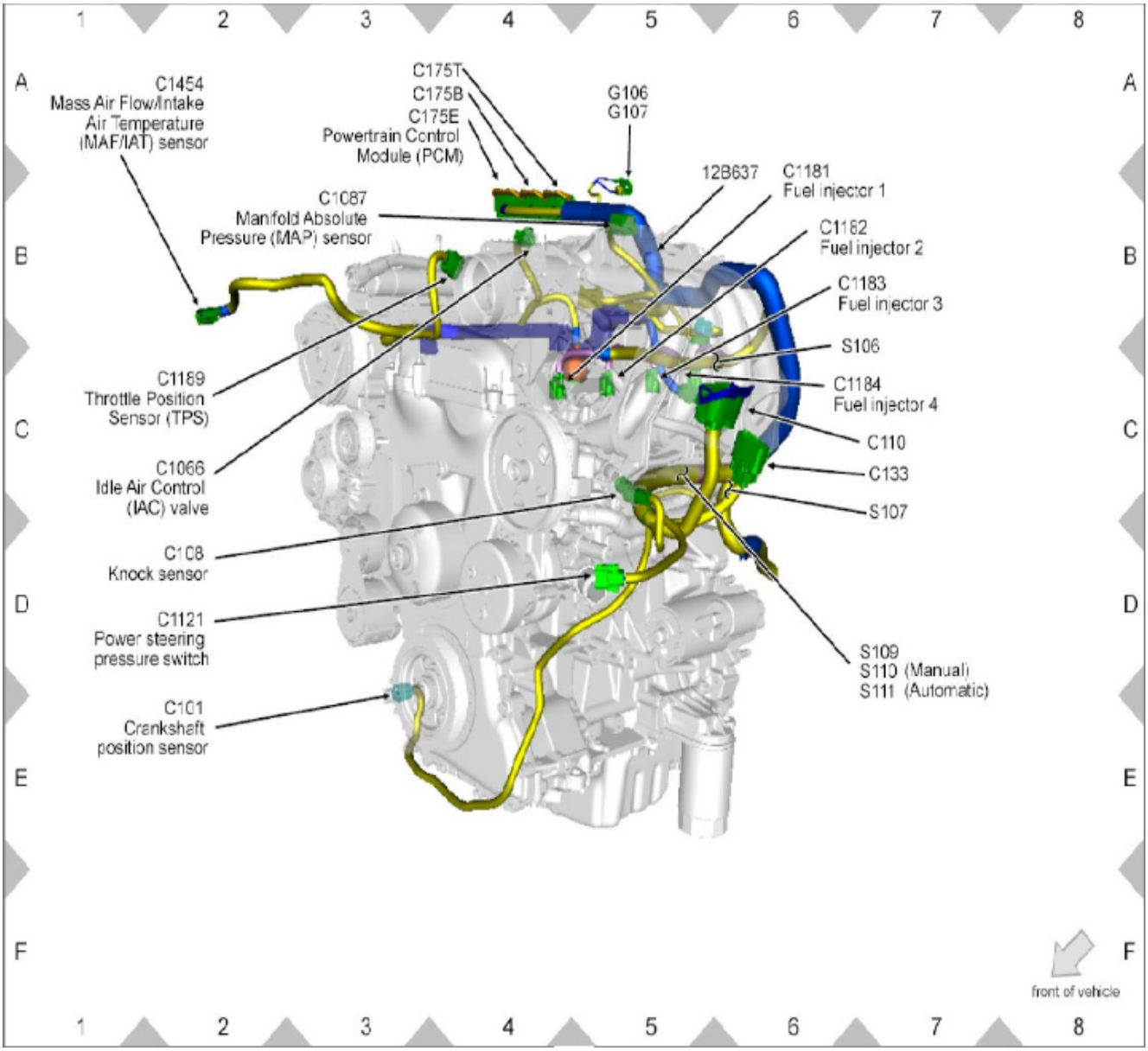
2-Track APP Sensor

There are 2 pedal position signals in the sensor. Both signals, APP1 and APP2, have a positive slope (increasing angle, increasing voltage), but are offset and increase at different rates. The 2 pedal position signals make sure the PCM receives a correct input even if 1 signal has a concern. The PCM determines if a signal is incorrect by calculating where it should be, inferred from the other signals. If a concern is present with one of the circuits the other input is used. There are 2 reference voltage circuits, 2 signal return circuits, and 2 signal circuits (a total of 6 circuits and pins) between the PCM and the APP sensor assembly. The reference voltage circuits and the signal return circuits are shared with the reference voltage circuit and signal return circuit used by the electronic throttle body (ETB) throttle position sensor. The pedal position signal is converted to pedal travel degrees (rotary angle) by the PCM. The software then converts these degrees to counts, which is the input to the torque based strategy.

3-Track APP Sensor

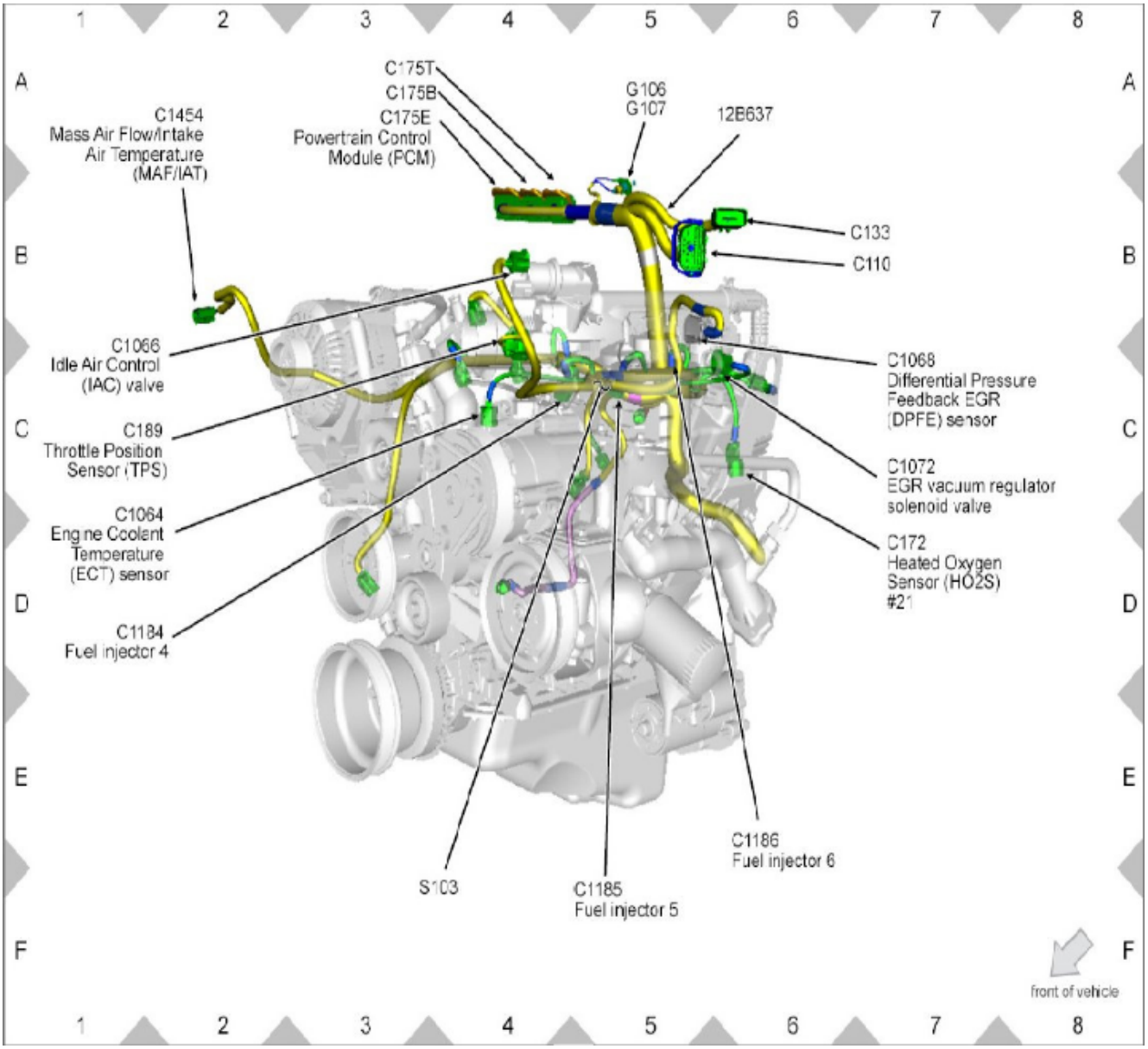
Typical 3-Track APP Sensor

There are 3 pedal position signals in the sensor. Signal 1, APP1, has a negative slope (increasing angle, decreasing voltage) and signals 2 and 3, APP2 and APP3, both have a positive slope (increasing angle, increasing voltage). During normal operation APP1 is used as the indication of pedal position by the strategy. The 3 pedal position signals make sure the PCM receives a correct input even if 1 signal has a concern. The PCM determines if a signal is incorrect by calculating where it should be, inferred from the other signals. If a concern is present with one of the circuits the other inputs are used. The pedal position signal is converted to pedal travel degrees (rotary angle) by the PCM. The software then converts these degrees to counts, which is the input to the torque based strategy. There are 2 reference voltage circuits, 2 signal return circuits, and 3 signal circuits (a total of 7 circuits and pins) between the PCM and the APP sensor assembly. The reference voltage circuits and the signal return circuits are shared with the reference voltage circuit and signal return circuit used by the electronic throttle body (ETB) throttle position sensor.

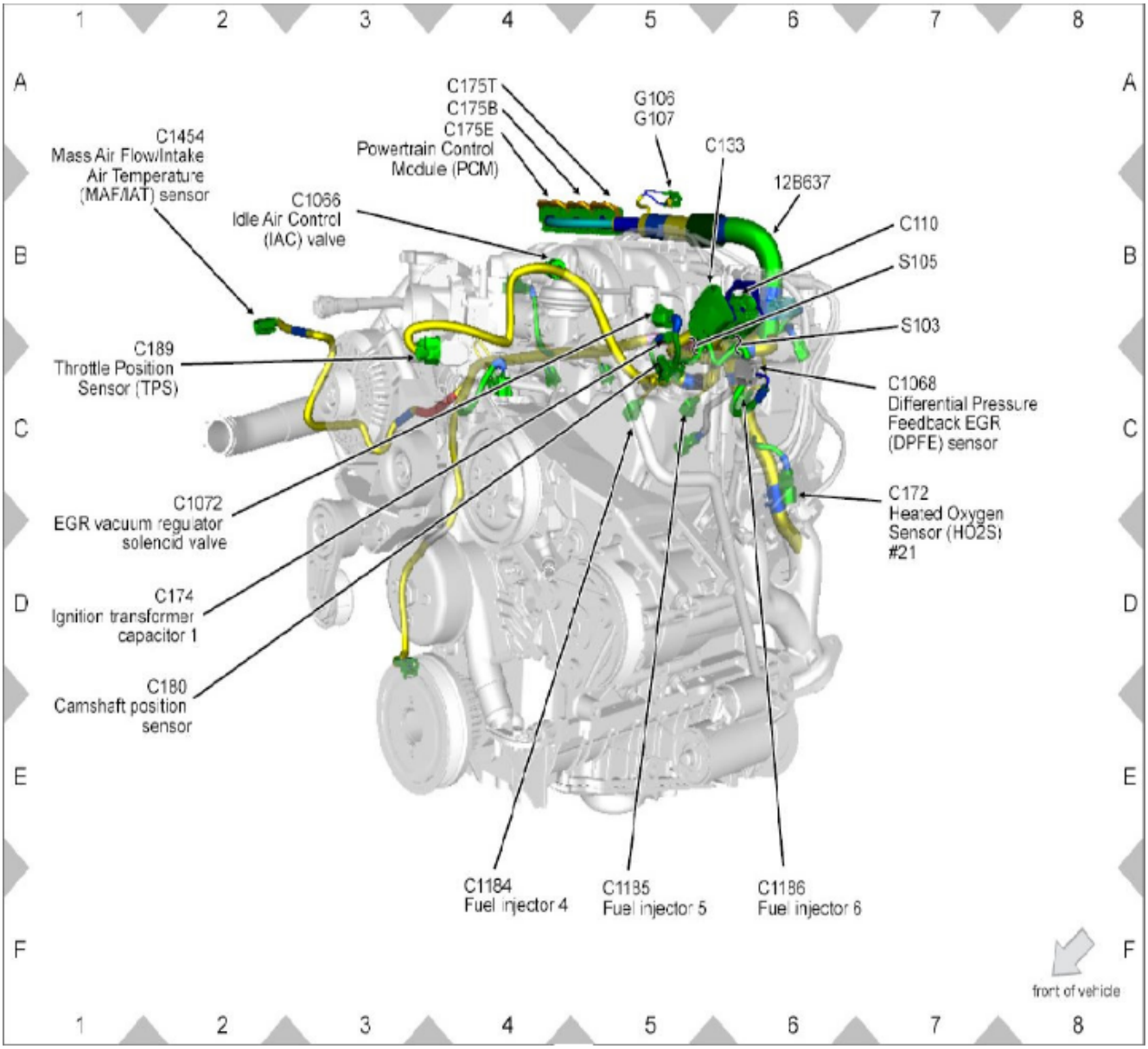


Air Flow Meter/Sensor: Locations

View 151-3


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
12B637
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT)
C133
C110
C1066
Idle Air Control (IAC) valve
C189
Throttle Position Sensor (TPS)
C1064
Engine Coolant Temperature (ECT) sensor
C1184
Fuel injector 4
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
S103
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

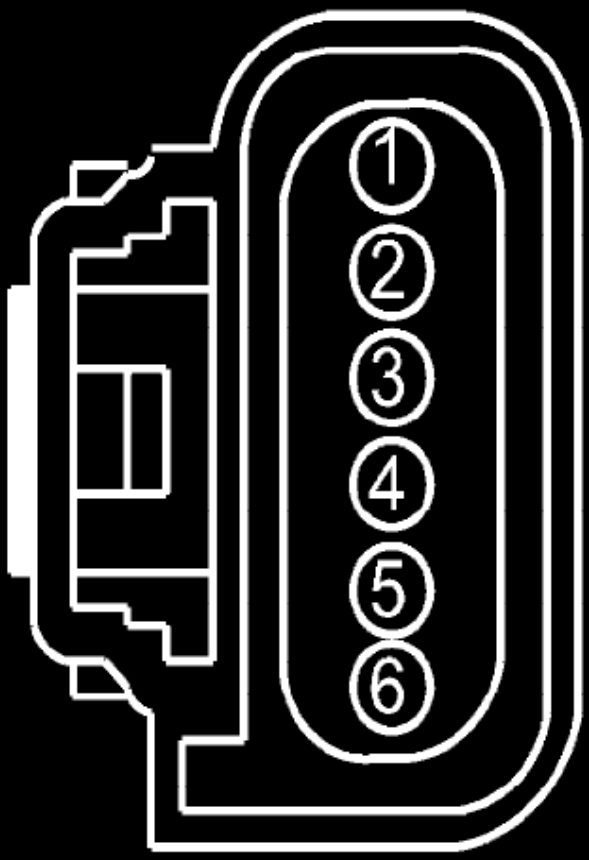
View 151-5


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
C133
12B637
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor
C1066
Idle Air Control (IAC) valve
C110
S105
S103
C189
Throttle Position Sensor (TPS)
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
C174
Ignition transformer capacitor 1
C180
Camshaft position sensor
C1184
Fuel injector 4
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-7

Connector: C1454

Description:	Harness:	Base Part #:
MASS AIR FLOW/INTAKE AIR TEMPERATURE (MAF/IAT) SENSOR	12B637	



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE740 (VT-GY)	20	SENSOR - INTAKE AIR TEMPERATURE (IAT)	
2	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	
3	VE807 (YE-VT)	20	SENSOR - MASS AIR FLOW LH BANK OR 1ST BANK OR UNIQUE (MAF)	
4	RE320 (BU)	20	CTRL MOD. - POWERTRAIN # MASS AIR FLOW SEN. LH BANK OR 1ST BANK (MAFRTN)	
5	GD108 (BK-VT)	20	GROUND - CHASSIS/BATTERY	
6	CBB43 (GY)	20	FUSE - 43 OR CIRCUIT BREAKER	

C1454

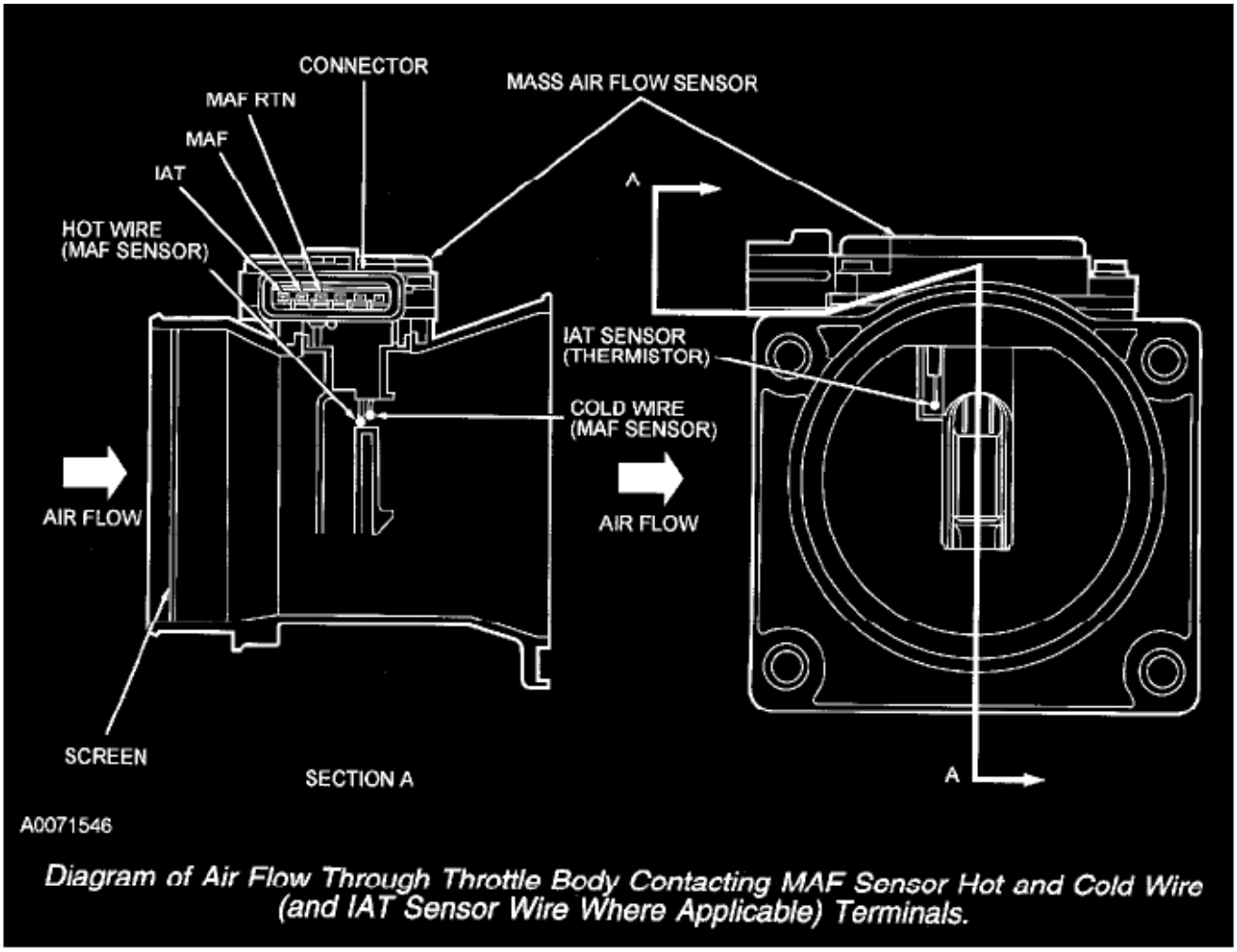
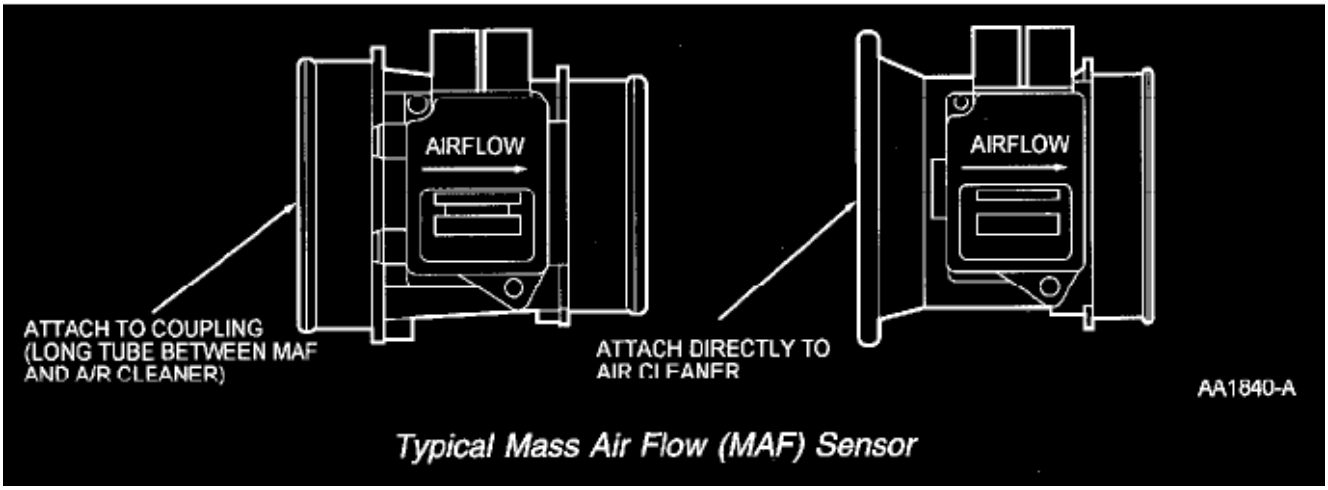


Diagram of Air Flow Through Throttle Body Contacting MAF Sensor Hot and Cold Wire (and IAT Sensor Wire Where Applicable) Terminals.



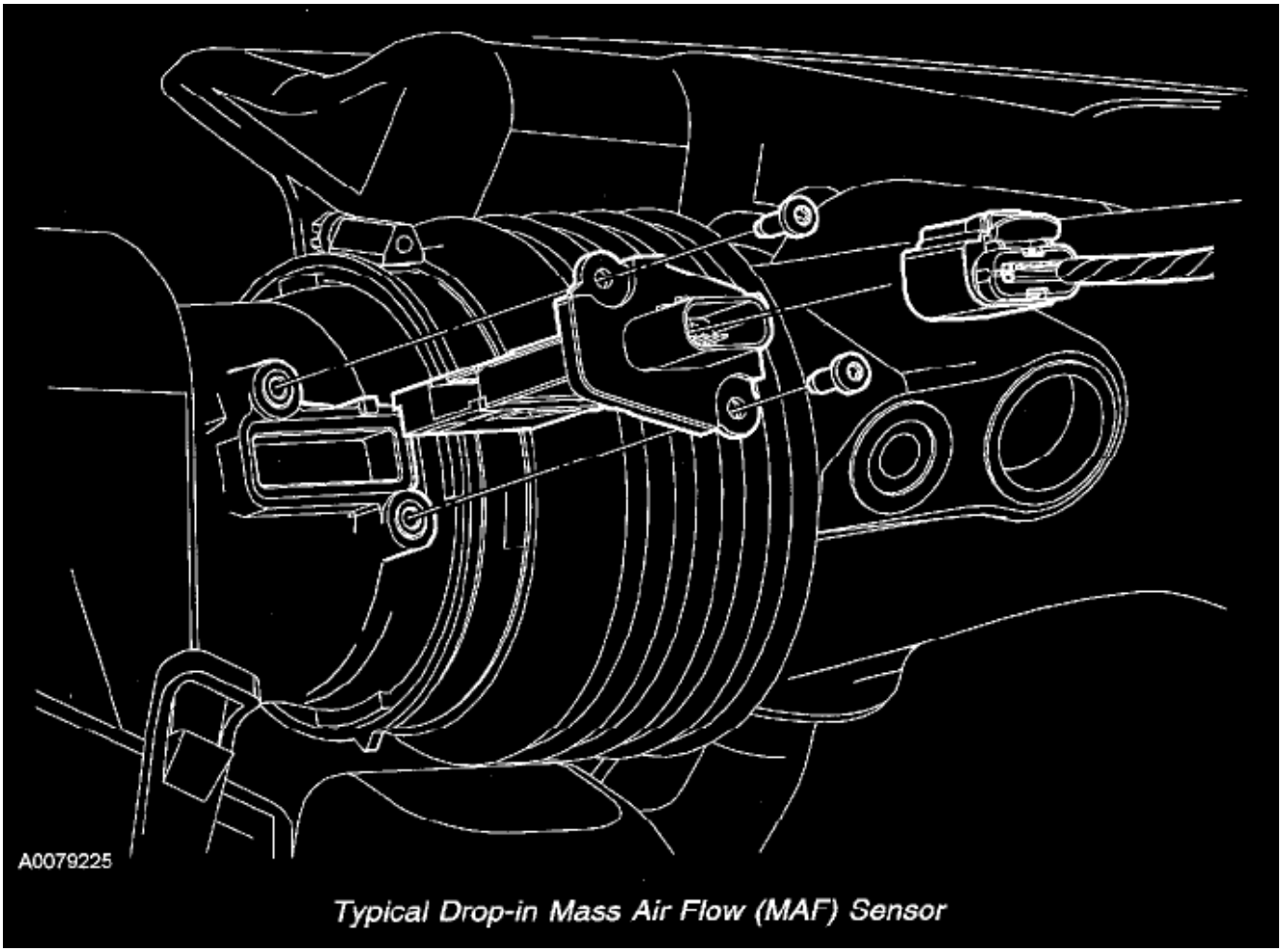
Typical Mass Air Flow (MAF) Sensor

Air Flow Meter/Sensor: Description and Operation

MASS AIR FLOW (MAF) SENSOR

Diagram Of Air Flow Through Throttle Body Contacting MAF Sensor Hot And Cold Wire (and IAT Sensor Wire Where Applicable) Terminals

Typical Mass Air Flow (MAF) Sensor

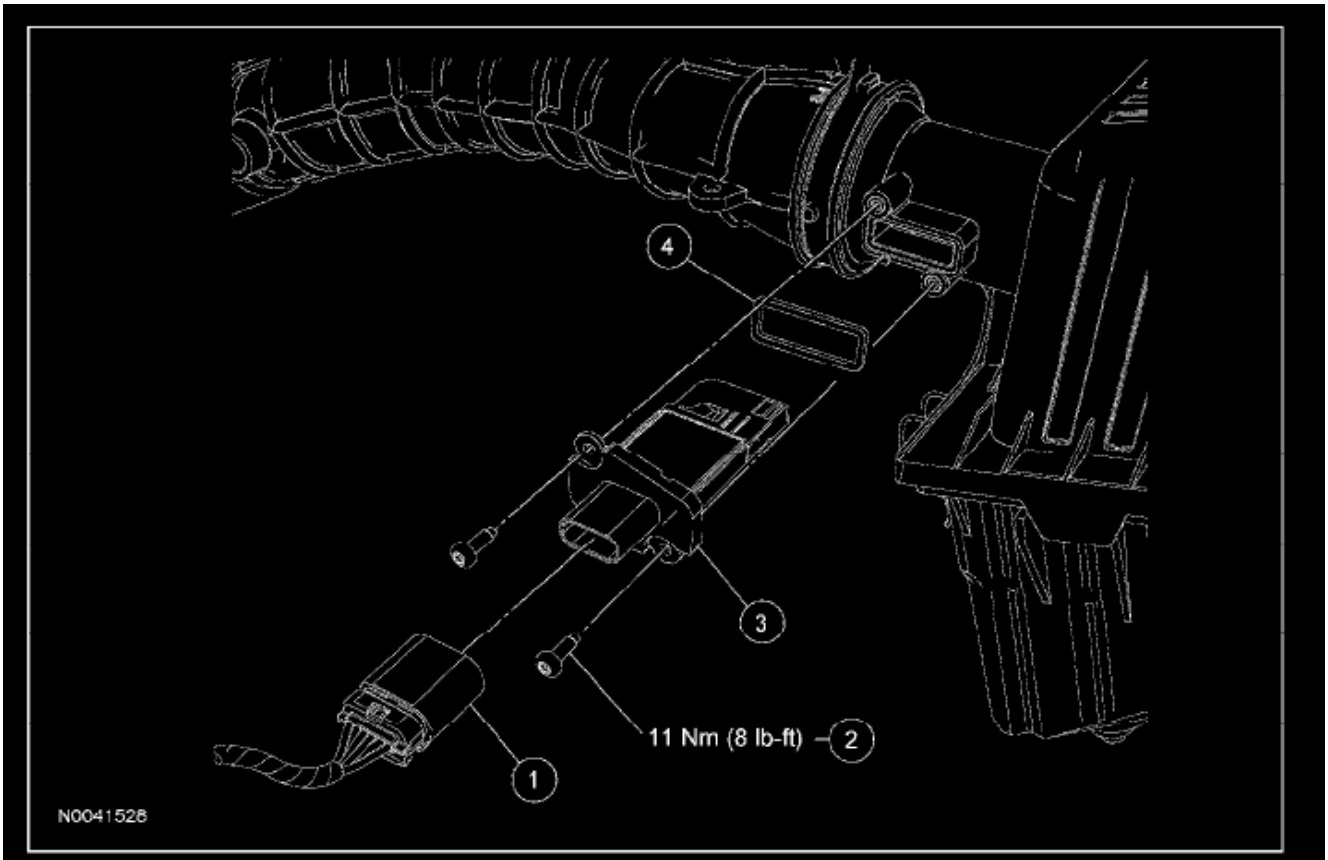


Typical Drop-in Mass Air Flow (MAF) Sensor

Typical Drop-in Mass Air Flow (MAF) Sensor

The MAF sensor uses a hot wire sensing element to measure the amount of air entering the engine. Air passing over the hot wire causes it to cool. This hot wire is maintained at 200°C (392°F) above the ambient temperature as measured by a constant cold wire. The current required to maintain the temperature of the hot wire is proportional to the mass air flow. The MAF sensor then outputs an analog voltage signal to the PCM proportional to the intake air mass. The PCM calculates the required fuel injector pulse width in order to provide the desired air/fuel ratio. This input is also used in determining transmission electronic pressure control (EPC), shift and torque converter clutch scheduling.

The MAF sensor is located between the air cleaner and the throttle body or inside the air cleaner assembly. Most MAF sensors have integrated bypass technology with an integrated intake air temperature (IAT) sensor. The hot wire electronic sensing element must be replaced as an assembly. Replacing only the element may change the air flow calibration.



Item	Part Number	Description
1	14A464	Mass air flow (MAF) sensor electrical connector (part of 12B637)
2	W709287	MAF sensor bolt (2 required)
3	12B605	MAF sensor
4	—	MAF sensor gasket

Air Flow Meter/Sensor: Service and Repair

MASS AIR FLOW (MAF) SENSOR

Removal and Installation

1. Disconnect the mass air flow (MAF) sensor electrical connector. 2. Remove the 2 bolts, the MAF sensor and discard the gasket.

- To install, tighten to 11 Nm (8 lb-ft).

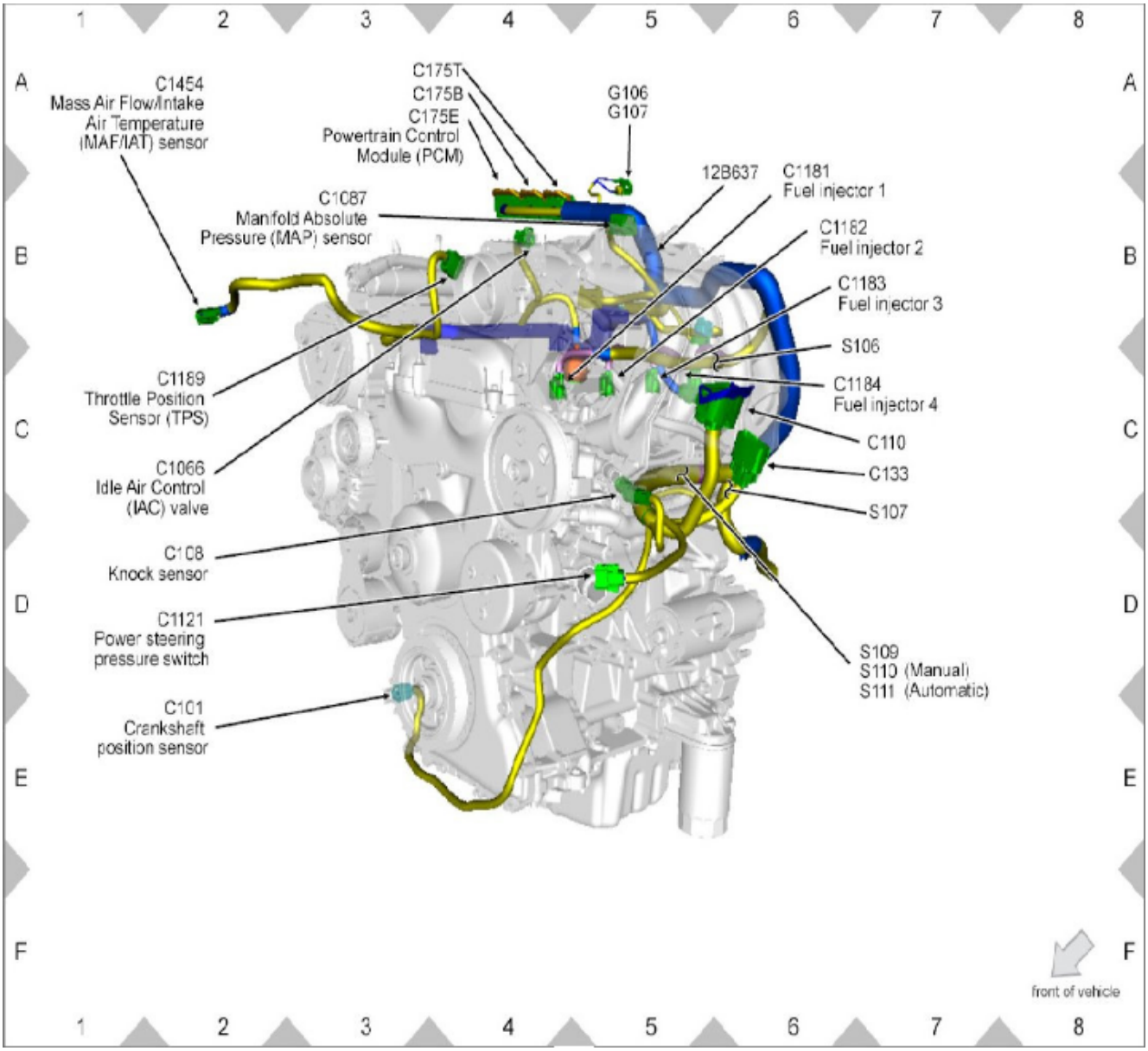
3. CAUTION: Do not tamper with the mass air flow (MAF) sensing elements located in the airflow bypass. Tampering may result in

failure.

NOTE: The MAF sensor module and body are calibrated and installed as a unit.

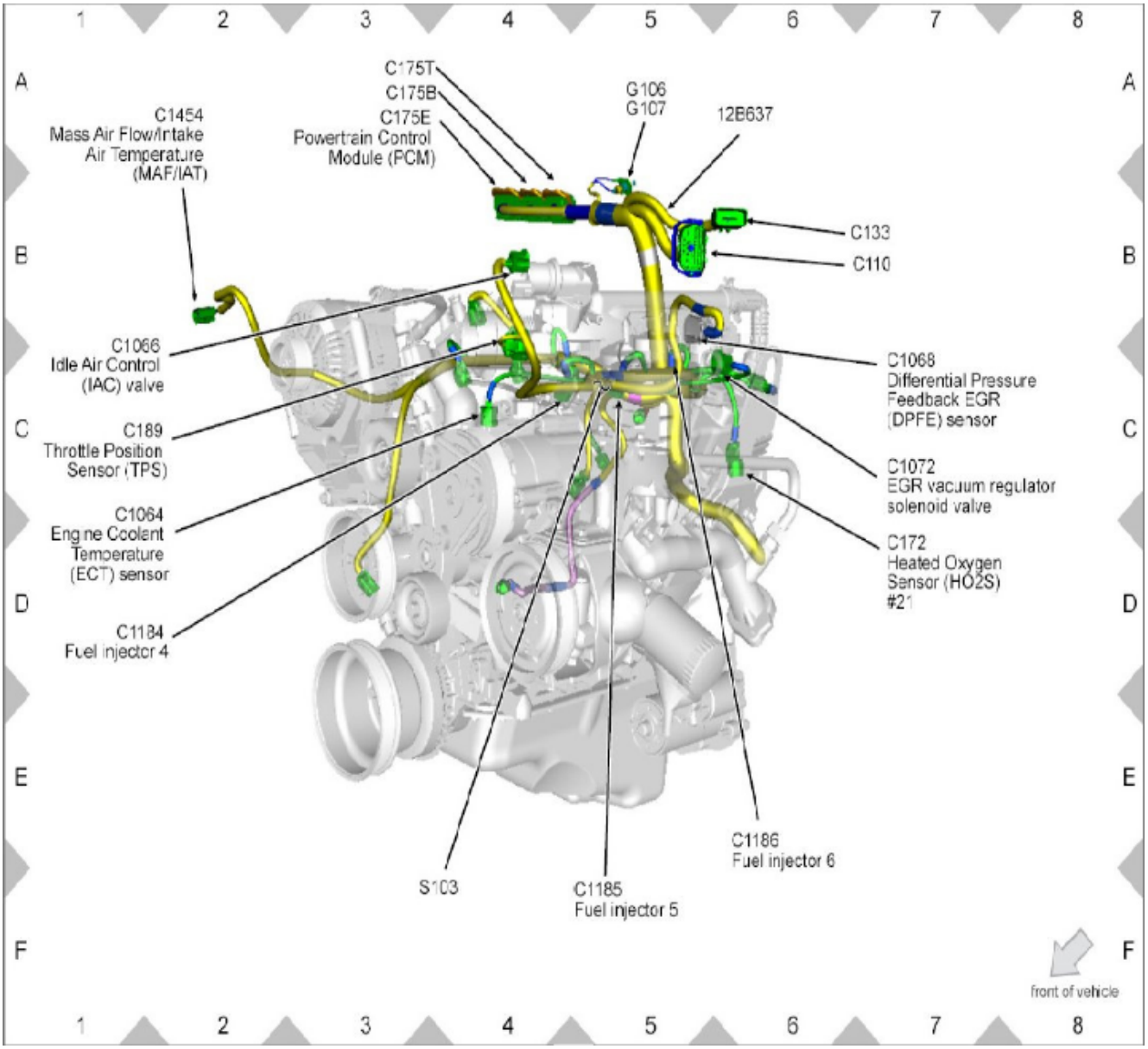
To install, reverse the removal procedure. -

Install a new gasket.

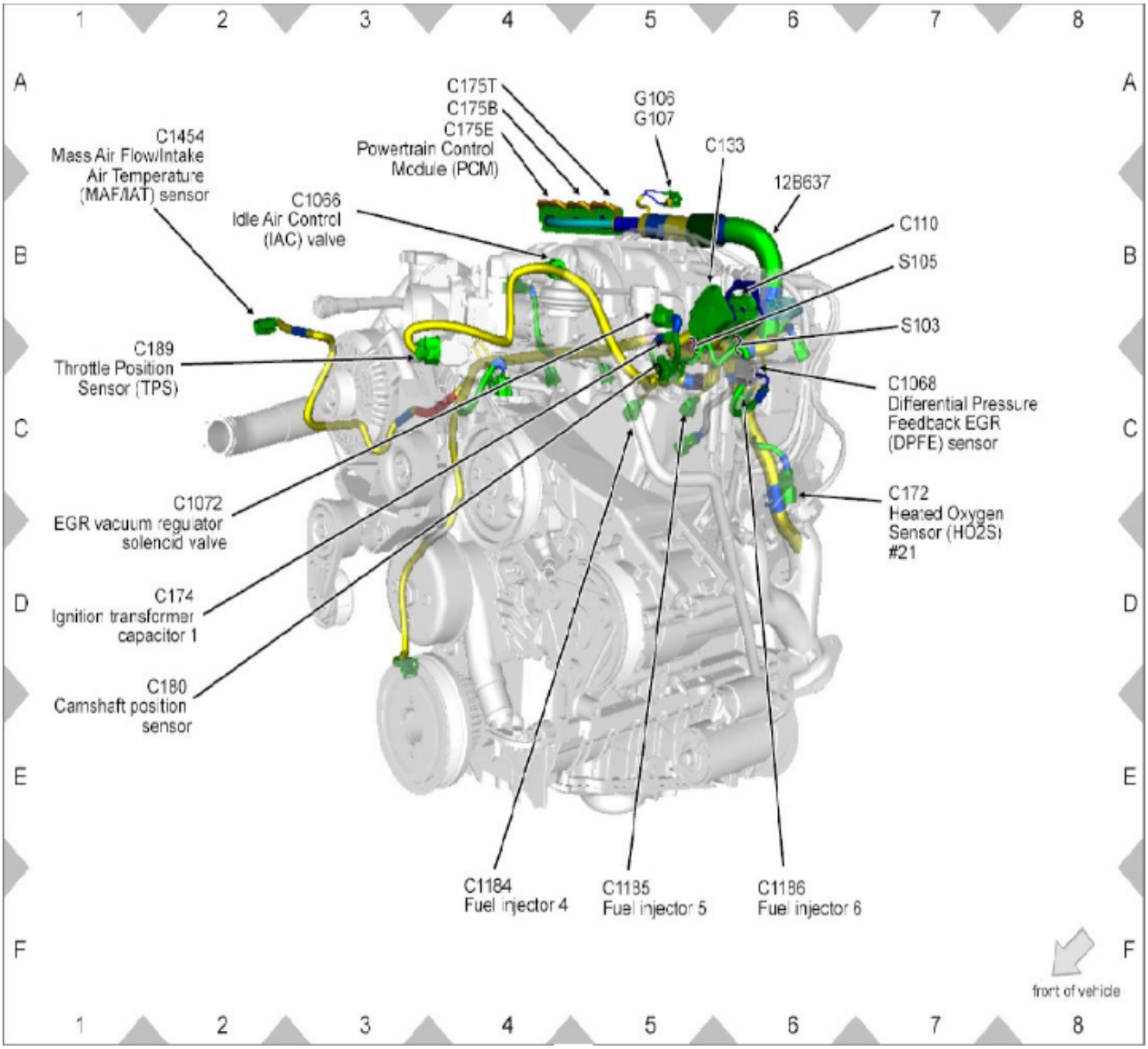


Intake Air Temperature Sensor: Locations

View 151-3


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
12B637
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT)
C133
C110
C1066
Idle Air Control (IAC) valve
C189
Throttle Position Sensor (TPS)
C1064
Engine Coolant Temperature (ECT) sensor
C1184
Fuel injector 4
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
S103
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-5


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
C133
12B637
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor
C1066
Idle Air Control (IAC) valve
C110
S105
S103
C189
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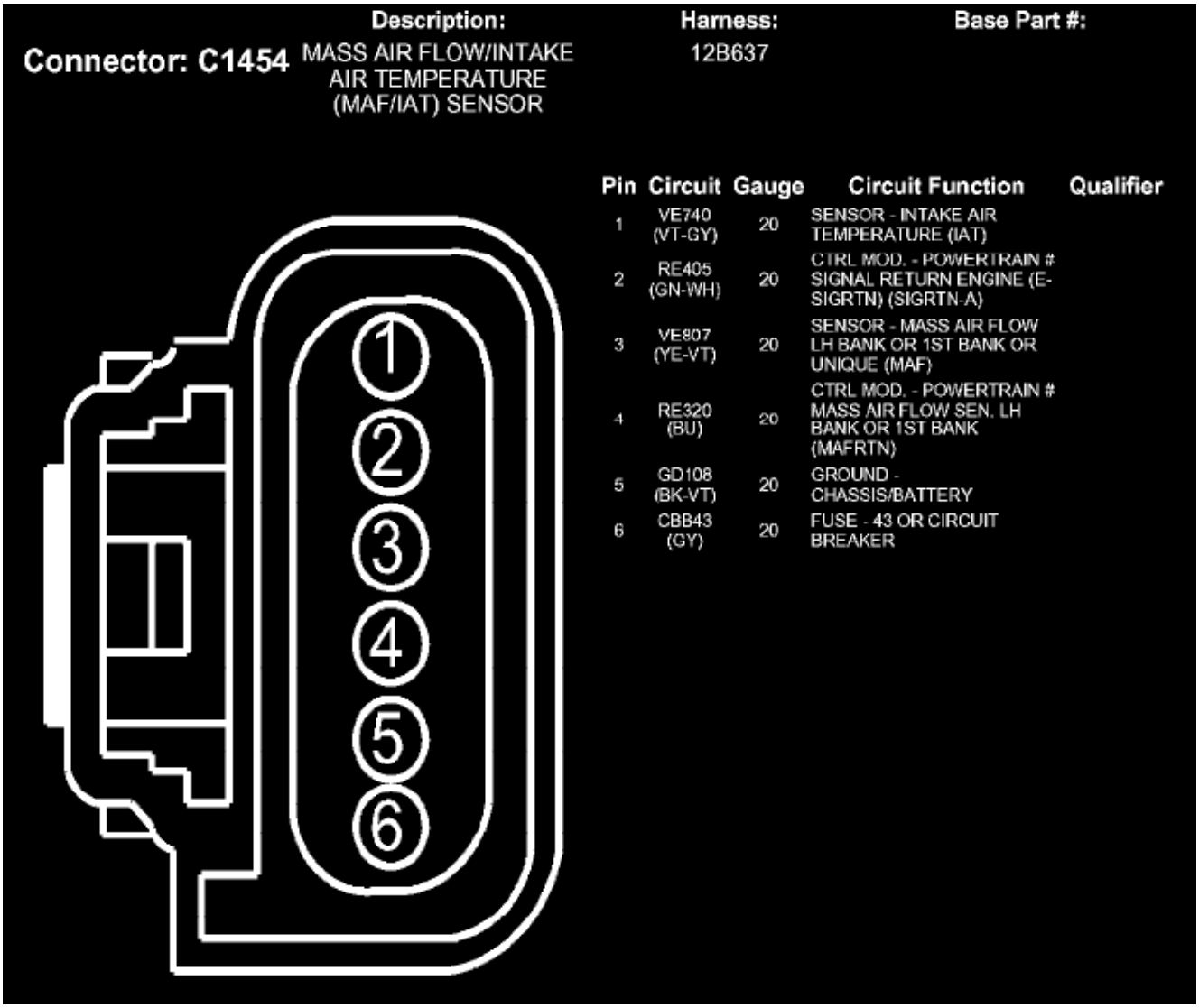
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
C174
Ignition transformer capacitor 1
C180
Camshaft position sensor
C1184
Fuel injector 4
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-7



Pin	Circuit	Gauge	Circuit Function	Qualifier
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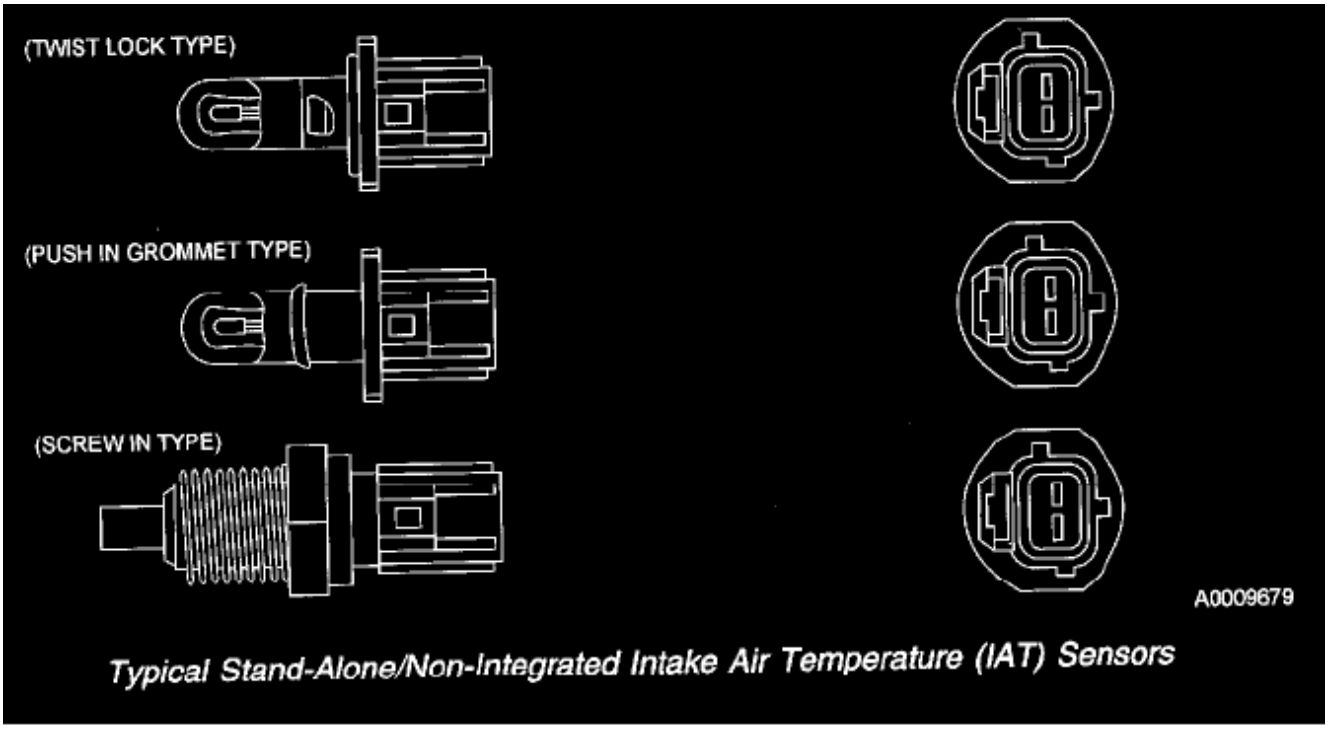
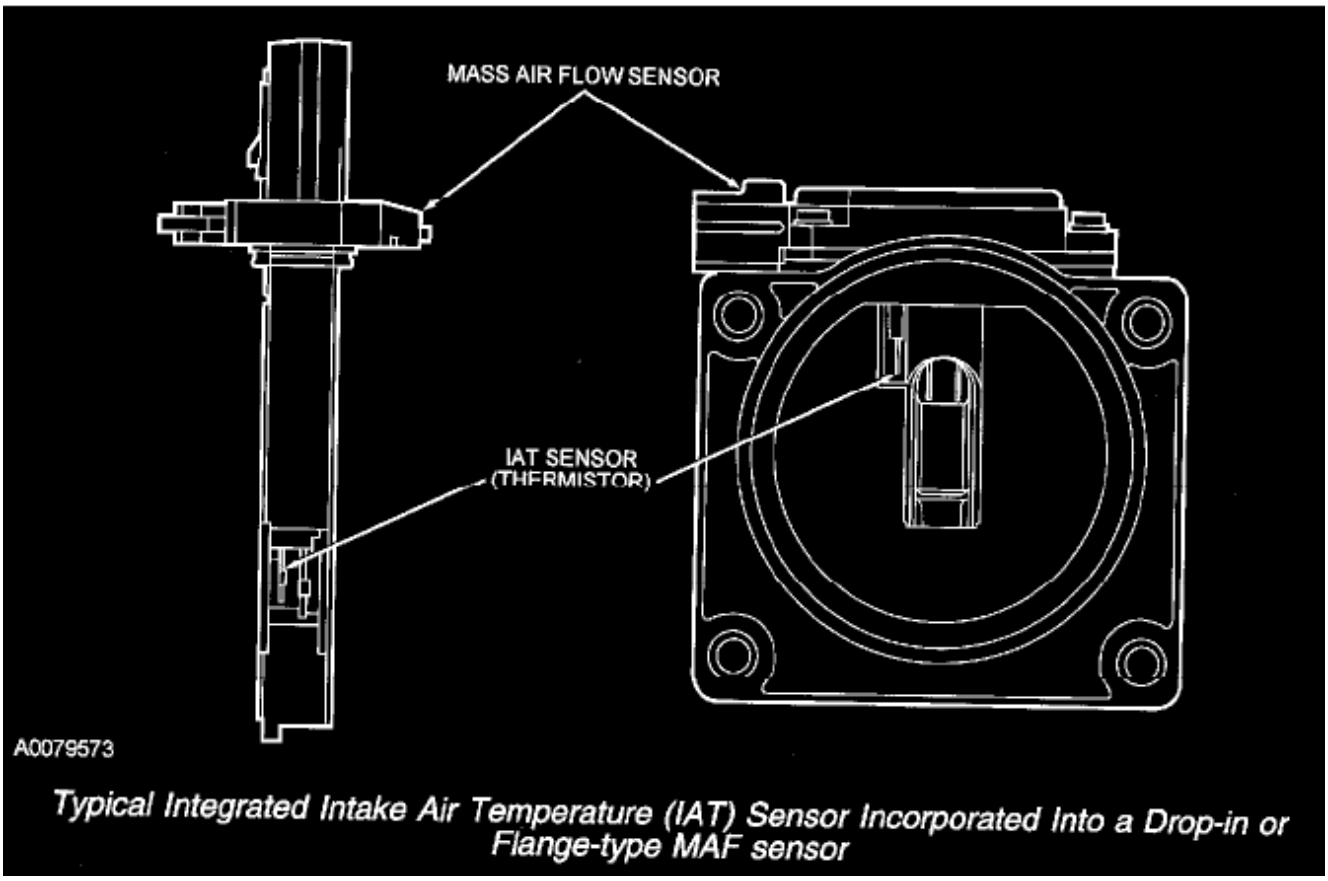
2	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	
3	VE807 (YE-VT)	20	SENSOR - MASS AIR FLOW LH BANK OR 1ST BANK OR UNIQUE (MAF)	
4	RE320 (BU)	20	CTRL MOD. - POWERTRAIN # MASS AIR FLOW SEN. LH BANK OR 1ST BANK (MAFRTN)	
5	GD108 (BK-VT)	20	GROUND - CHASSIS/BATTERY	
6	CBB43 (GY)	20	FUSE - 43 OR CIRCUIT BREAKER	

C1454



Typical Stand-Alone/Non-Integrated Intake Air Temperature (IAT) Sensors



Typical Integrated Intake Air Temperature (IAT) Sensor Incorporated Into a Drop-in or Flange-type MAF sensor

Intake Air Temperature Sensor: Description and Operation

Intake Air Temperature (IAT) Sensor

Typical Stand-Alone/Non-Integrated Intake Air Temperature (IAT) Sensors

Typical Integrated Intake Air Temperature (IAT) Sensor Incorporated Into A Drop-in Or Flange-type MAF Sensor

The IAT sensor is a thermistor device in which resistance changes with temperature. The electrical resistance of a thermistor decreases as the temperature increases, and the resistance increases as the temperature decreases. The varying resistance affects the voltage drop across the sensor terminals and provides electrical signals to the PCM corresponding to temperature.

Thermistor-type sensors are considered passive sensors. A passive sensor is connected to a voltage divider network so that varying the resistance of the passive sensor causes a variation in total current flow. Voltage that is dropped across a fixed resistor in a series with the sensor resistor determines the voltage signal at the PCM. This voltage signal is equal to the reference voltage minus the voltage drop across the fixed resistor.

The IAT provides air temperature information to the PCM. The PCM uses the air temperature information as a correction factor in the calculation of

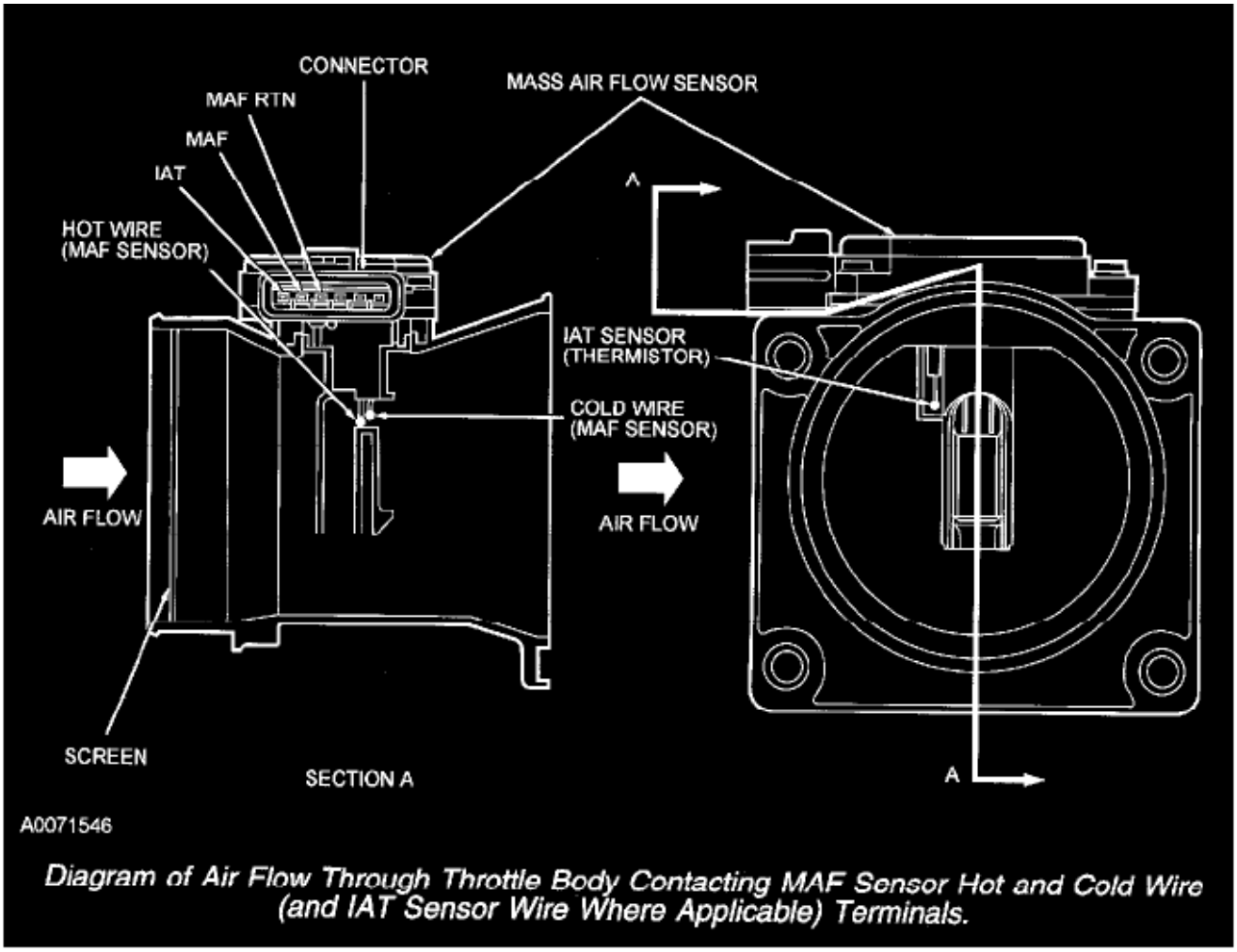
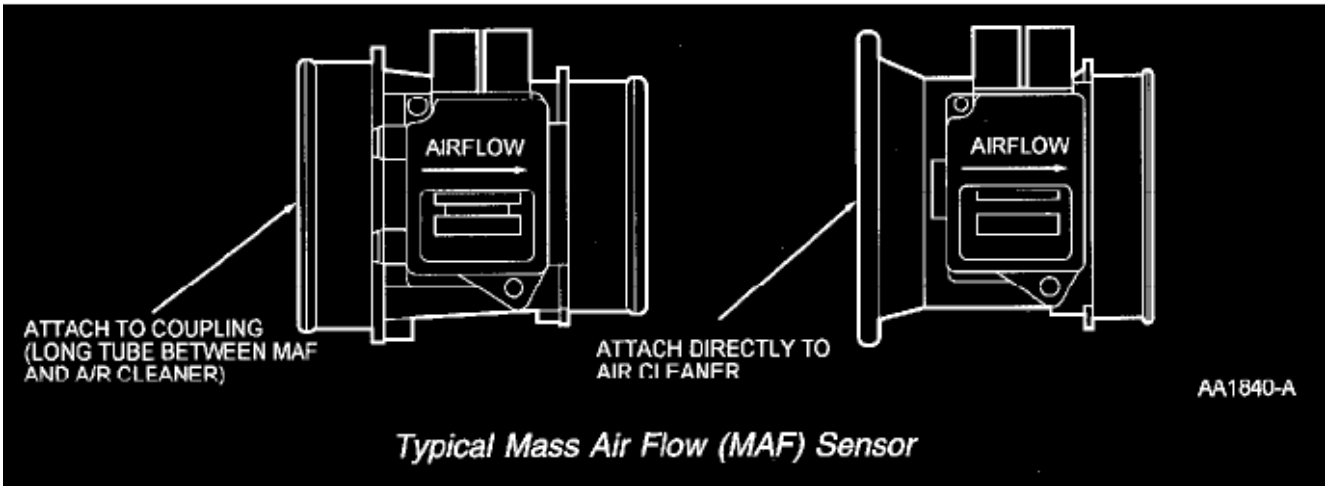


Diagram of Air Flow Through Throttle Body Contacting MAF Sensor Hot and Cold Wire (and IAT Sensor Wire Where Applicable) Terminals.



Typical Mass Air Flow (MAF) Sensor

fuel, spark, and air flow.

The IAT sensor provides a quicker temperature change response time than the ECT or CHT sensor.

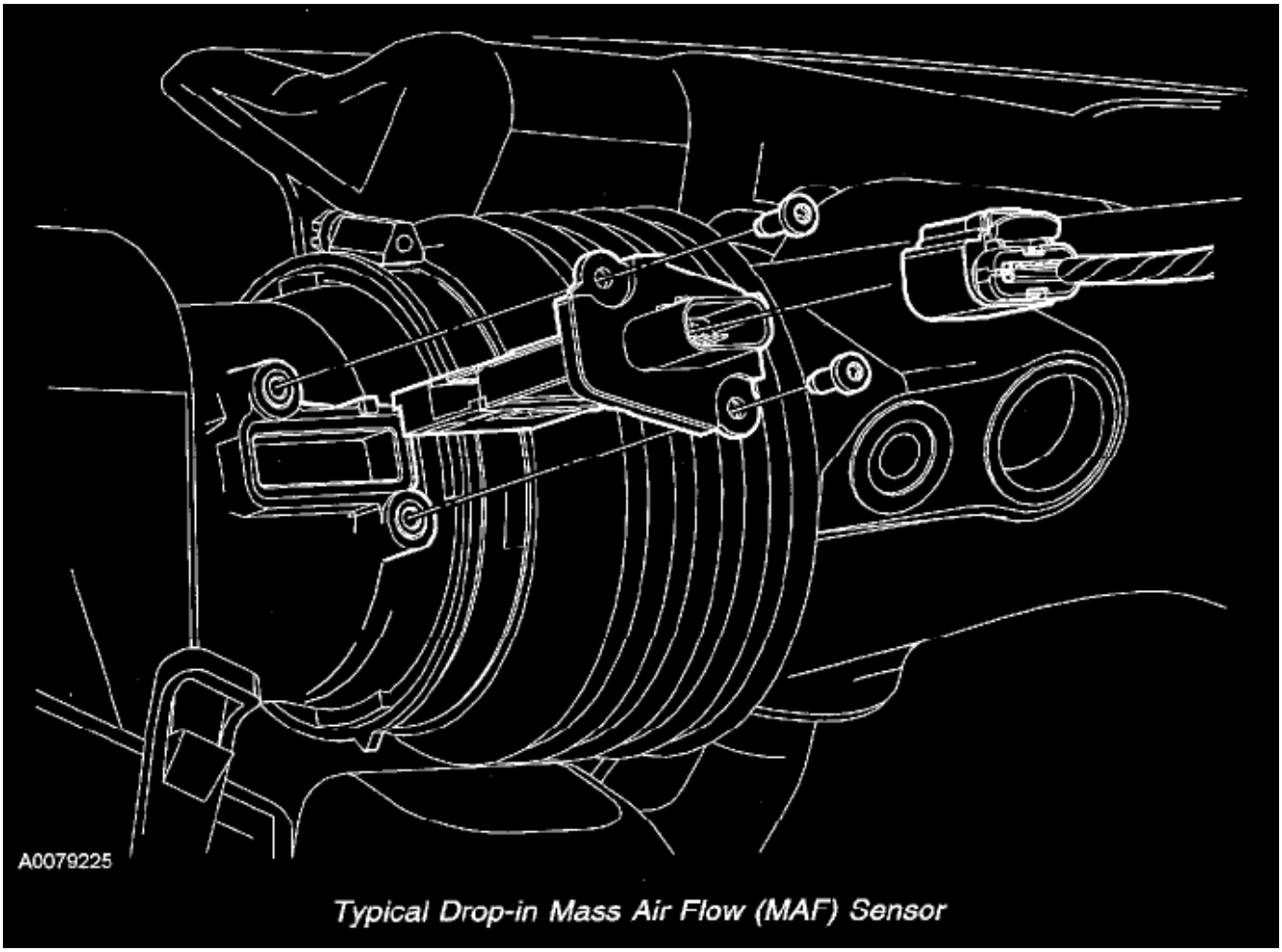
Currently there are 2 design types of IAT sensors used, a stand-alone/non-integrated type and a integrated type. Both types function the same, however the integrated type is incorporated into the mass air flow (MAF) sensor instead of being a stand alone sensor.

Supercharged vehicles use 2 IAT sensors. Both sensors are thermistor type devices and operate as described above. One is located before the supercharger at the air cleaner for standard OBD/cold weather input, while a second sensor (IAT2) is located after the supercharger in the intake manifold. The IAT2 sensor located after the supercharger provides air temperature information to the PCM to control spark and to help determine charge air cooler (CAC) efficiency.

Mass Air Flow (MAF) Sensor

Diagram Of Air Flow Through Throttle Body Contacting MAF Sensor Hot And Cold Wire (and IAT Sensor Wire Where Applicable) Terminals

Typical Mass Air Flow (MAF) Sensor

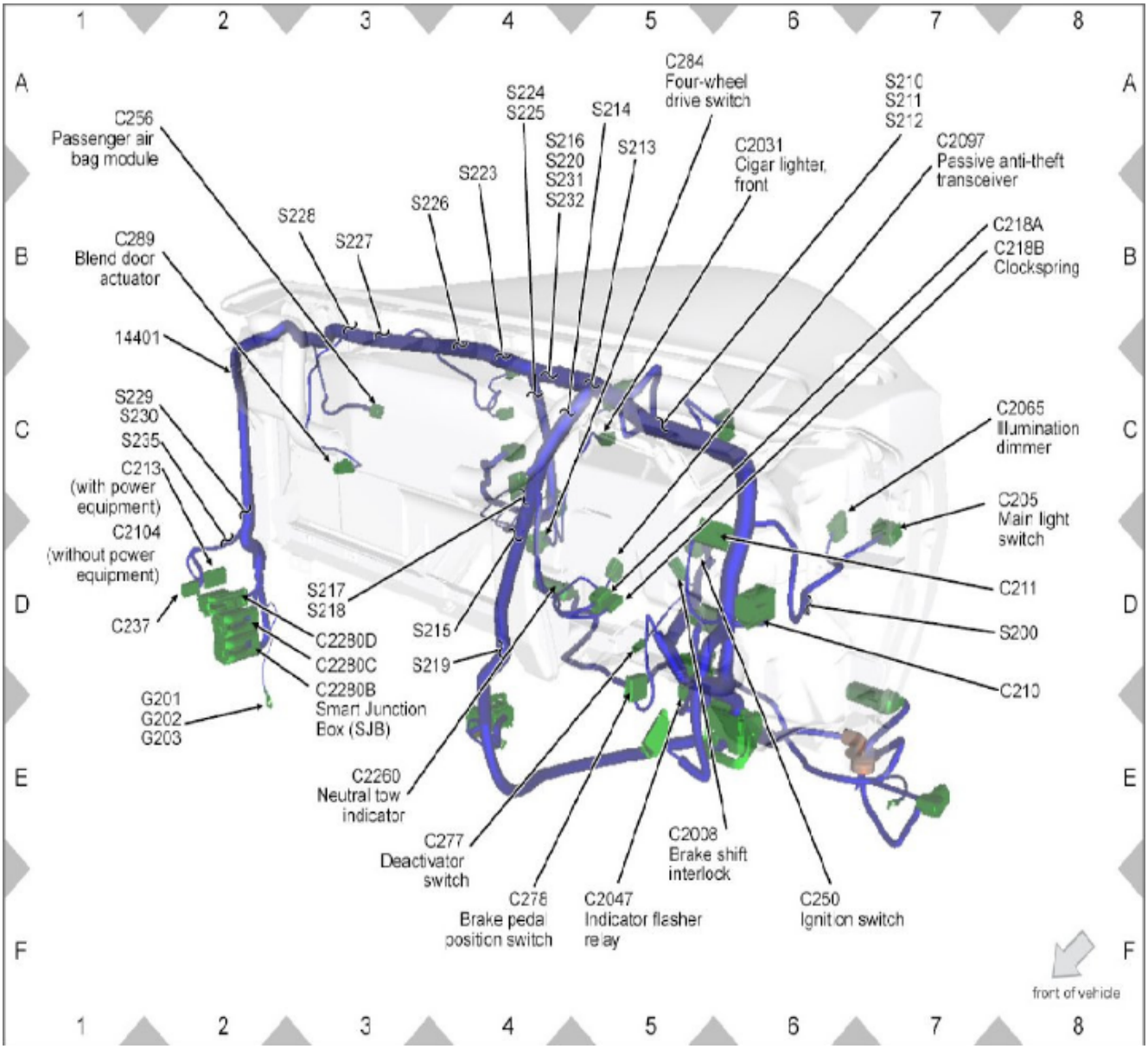


Typical Drop-in Mass Air Flow (MAF) Sensor

Typical Drop-in Mass Air Flow (MAF) Sensor

The MAF sensor uses a hot wire sensing element to measure the amount of air entering the engine. Air passing over the hot wire causes it to cool. This hot wire is maintained at 200°C (392°F) above the ambient temperature as measured by a constant cold wire. The current required to maintain the temperature of the hot wire is proportional to the mass air flow. The MAF sensor then outputs an analog voltage signal to the PCM proportional to the intake air mass. The PCM calculates the required fuel injector pulse width in order to provide the desired air/fuel ratio. This input is also used in determining transmission electronic pressure control (EPC), shift and torque converter clutch scheduling.

The MAF sensor is located between the air cleaner and the throttle body or inside the air cleaner assembly. Most MAF sensors have integrated bypass technology with an integrated intake air temperature (IAT) sensor. The hot wire electronic sensing element must be replaced as an assembly. Replacing only the element may change the air flow calibration.


1
2
3
4
5
6
7
8
A
B
C
D
E
F
C256
Passenger air bag module
C289
Blend door actuator
14401
S229
S230
S235
C213
(with power equipment)
C2104
(without power equipment)
C237
G201
G202
G203
S228
S227
S226
S223
S224
S225
S216
S220
S231
S232
S214
S213
C284
Four-wheel drive switch
C2031
Cigar lighter, front
S210
S211
S212
C2097
Passive anti-theft transceiver
C218A
C218B
Clockspring
C2065
Illumination dimmer
C205
Main light switch
C211
S200
C210
S217
S218
S215
S219
C2280D
C2280C
C2280B
Smart Junction Box (SJB)
C2260
Neutral tow indicator
C277
Deactivator switch
C278
Brake pedal position switch
C2047
Indicator flasher relay
C2008
Brake shift interlock
C250
Ignition switch
front of vehicle

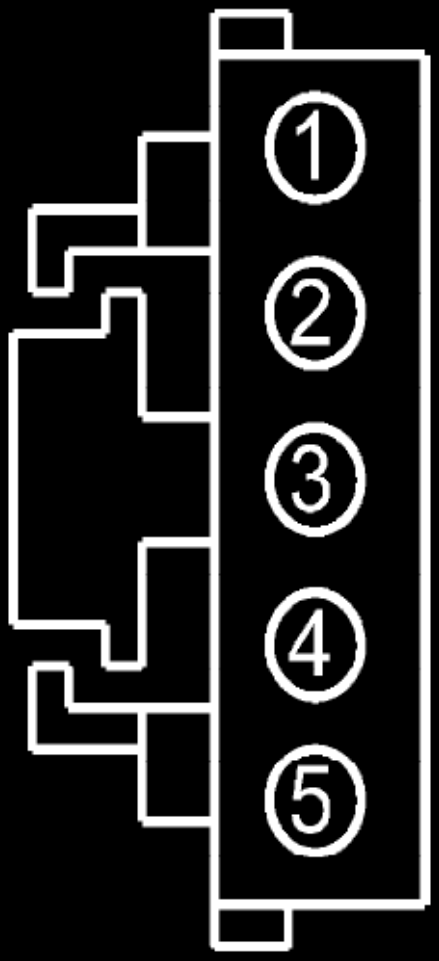
View 151-11

Connector: C278

Description: BRAKE PEDAL POSITION SWITCH

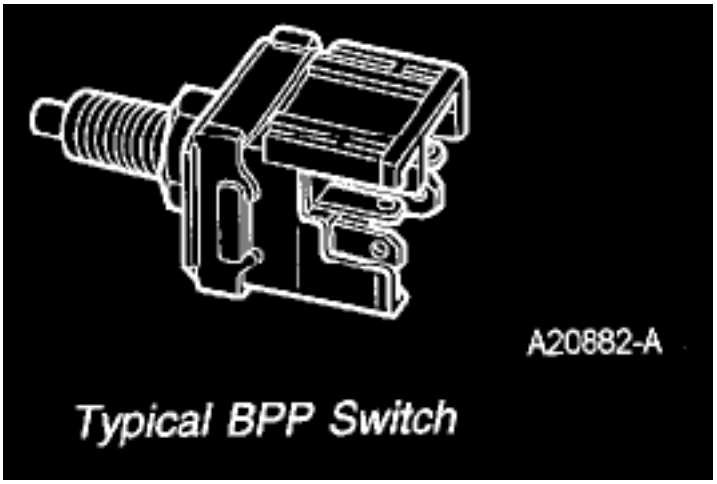
Harness: 14401

Base Part #:



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	SBP19 (BU-RD)	16	FUSE - 19 OR CIRCUIT BREAKER	
2	CCB08 (VT-WH)	16	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL OPEN	
3	SBP32 (VT-RD)	22	FUSE - 32 OR CIRCUIT BREAKER	
4	CCB15 (BN-GN)	22	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL CLOSED	
5	GD161 (BK-YE)	22	GROUND - SEAT BRACKET REAR LEFT	

C278



Brake Signal: Description and Operation

Brake Pedal Position (BPP) Switch

Typical BPP Switch

The BPP switch is sometimes referred to as the stoplamp switch. The BPP switch provides a signal to the PCM indicating that the brakes are applied. The BPP switch is normally open and is mounted on the brake pedal support. Depending on the vehicle application the BPP switch can be hardwired as follows: -

to the PCM supplying battery positive voltage (B+) when the vehicle brake pedal is applied.

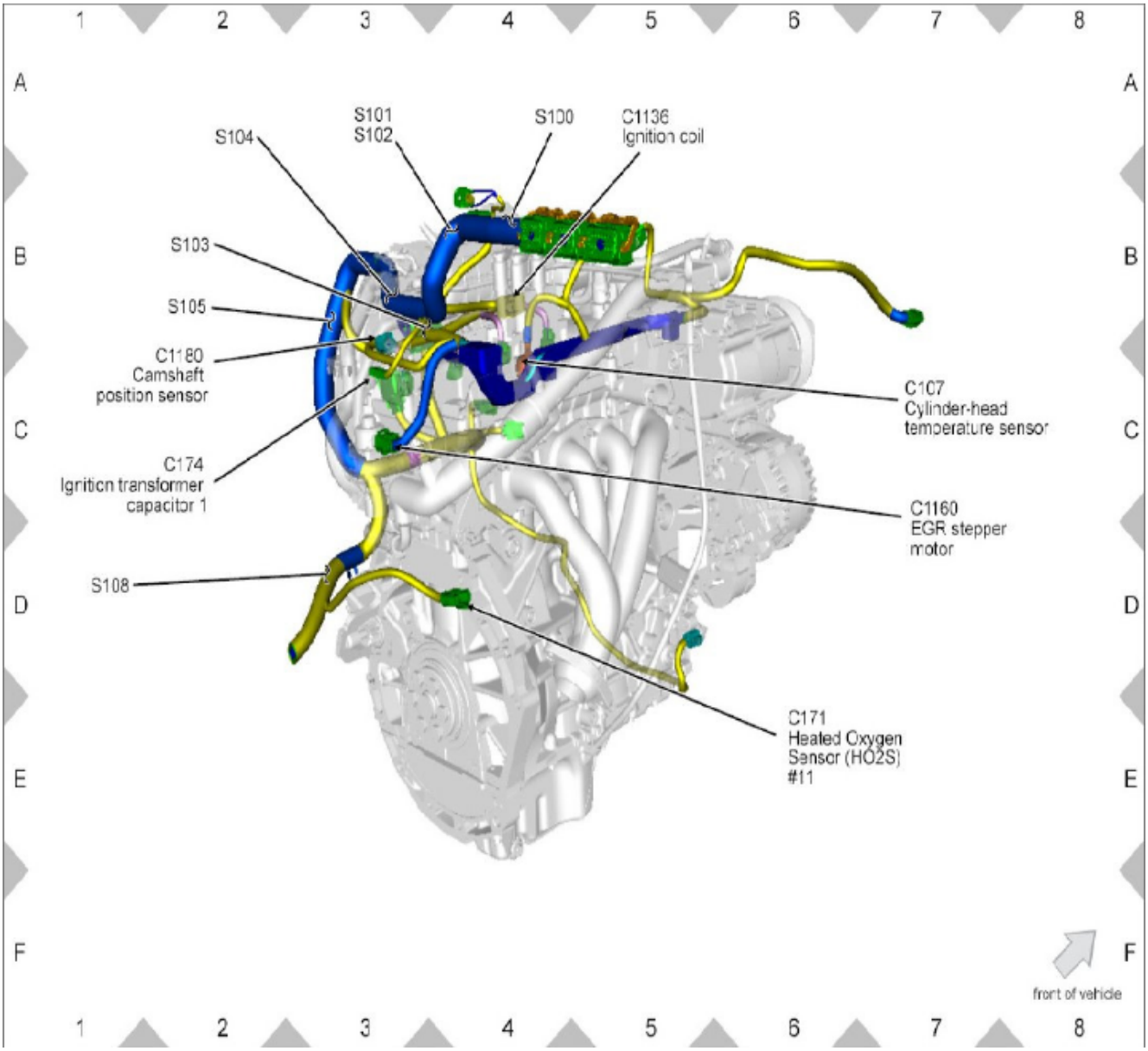
- to the antilock brake system (ABS) module, or lighting control module (LCM), the BPP signal is then broadcast over the network to be received by the PCM.

- to the ABS traction control/stability assist module. The ABS module interprets the BPP switch input along with other ABS inputs and generates an output called the driver brake application (DBA) signal. The DBA signal is then sent to the PCM and to other BPP signal users.

Brake Pedal Switch (BPS)/Brake Deactivator Switch

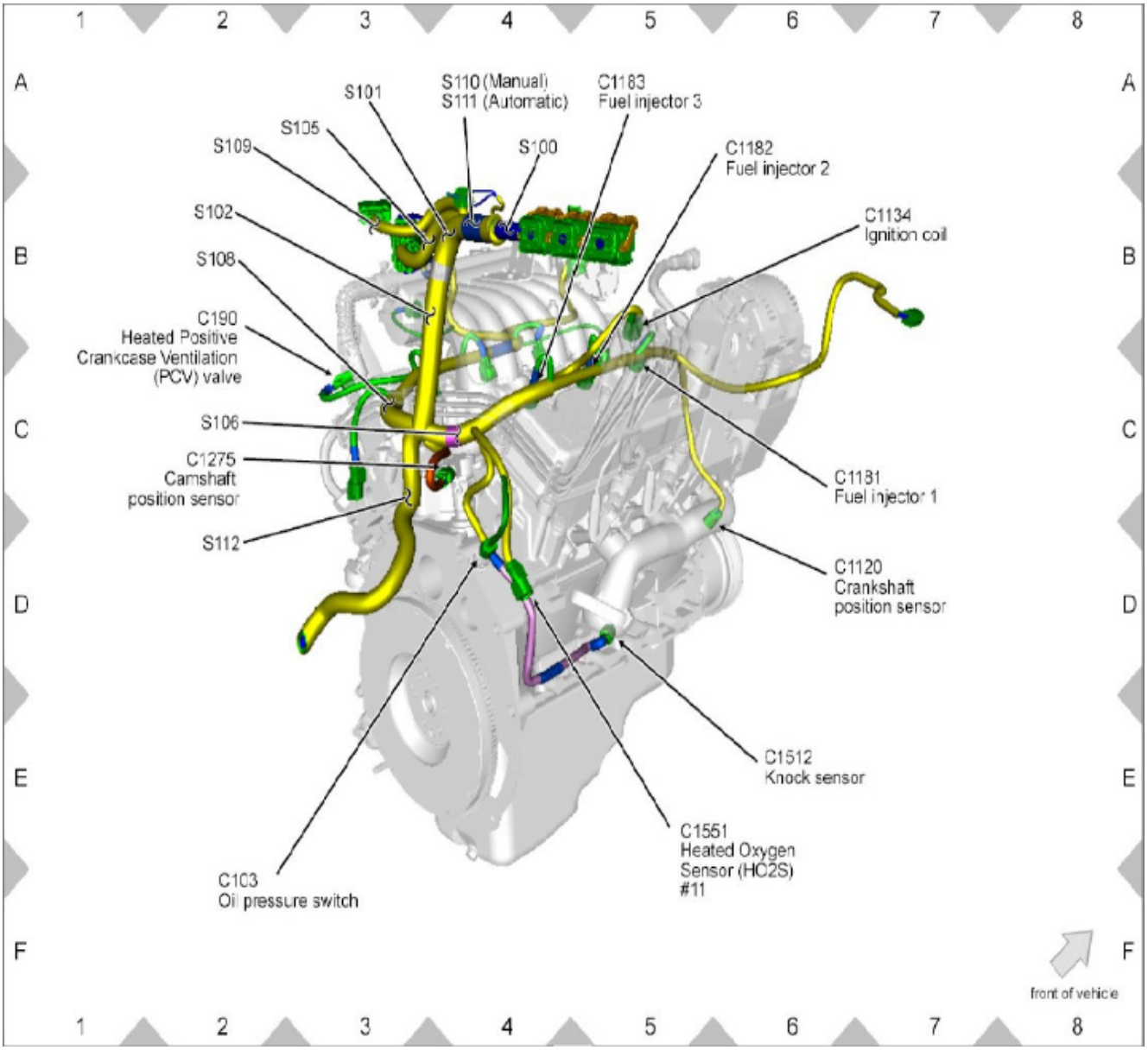
The BPS, also called the brake deactivator switch, is for vehicle speed control deactivation. A normally closed switch supplies battery positive voltage (B+) to the PCM when the brake pedal is not applied. When the brake pedal is applied, the normally closed switch opens and power is removed from the PCM.

On some applications the normally closed BPS, along with the normally open BPP switch, are used for a brake rationality test within the PCM. The PCM misfire monitor profile learn function may be disabled if a brake switch concern occurs. If one or both brake pedal inputs to the PCM is not changing states when they were expected to, a diagnostic trouble code (DTC) is set by the PCM strategy.

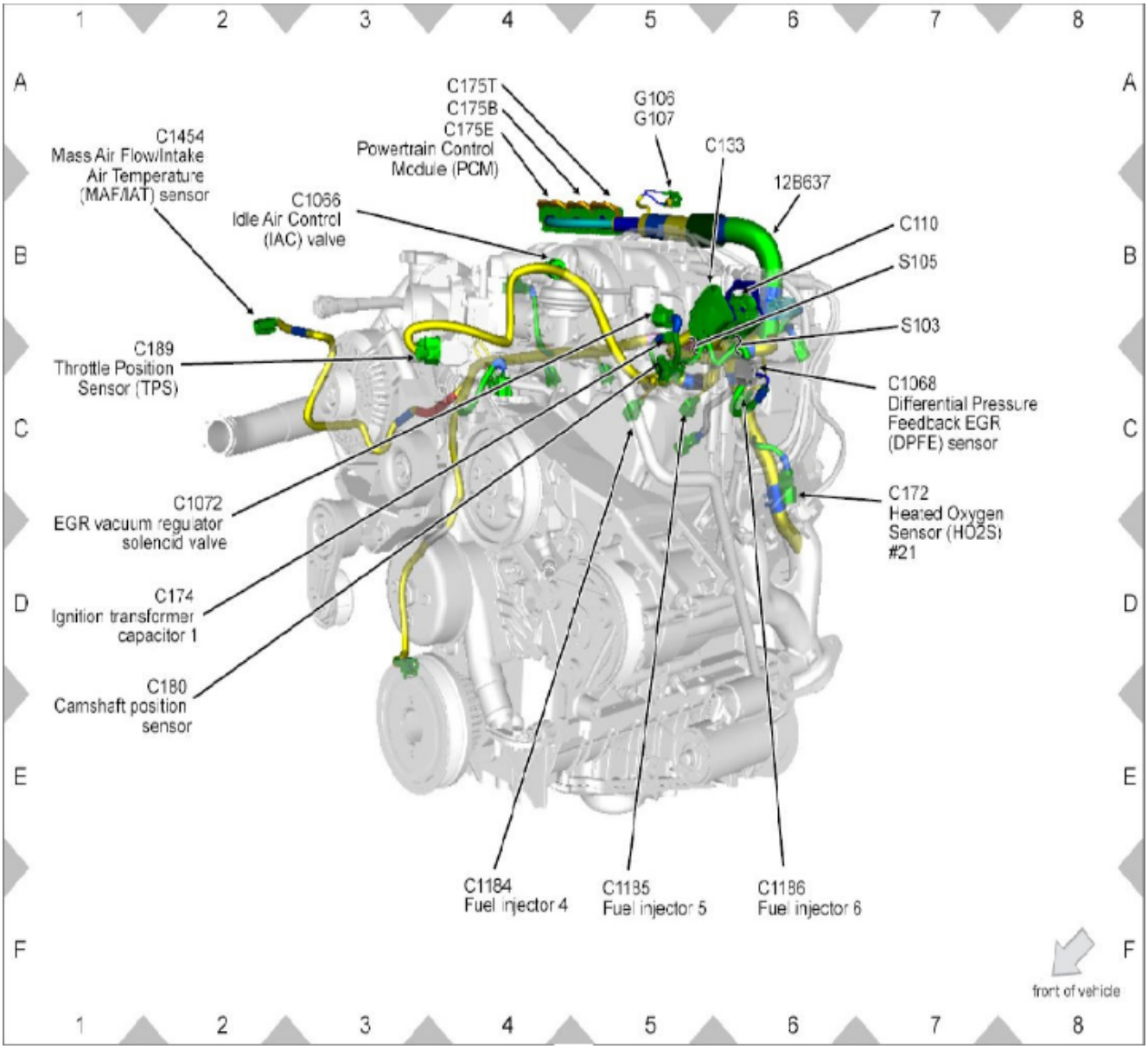


Camshaft Position Sensor: Locations

View 151-4


S101
S110 (Manual)
S111 (Automatic)
C1183
Fuel injector 3
S105
S109
S100
C1182
Fuel injector 2
S102
C1134
Ignition coil
S108
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
C1275
Camshaft
position sensor
S112
C1181
Fuel injector 1
C1120
Crankshaft
position sensor
C1512
Knock sensor
C1551
Heated Oxygen
Sensor (HO2S)
#11
C103
Oil pressure switch
front of vehicle

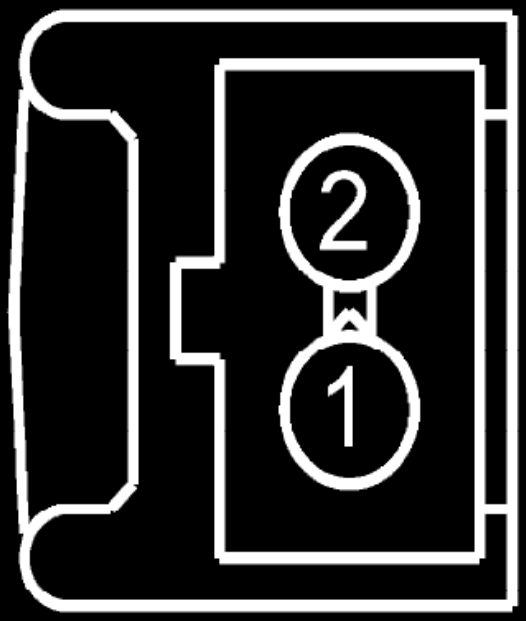
View 151-6


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
C133
12B637
C110
S105
S103
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor
C1066
Idle Air Control (IAC) valve
C189
Throttle Position Sensor (TPS)
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
C174
Ignition transformer capacitor 1
C180
Camshaft position sensor
C1184
Fuel injector 4
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-7

Connector: C180

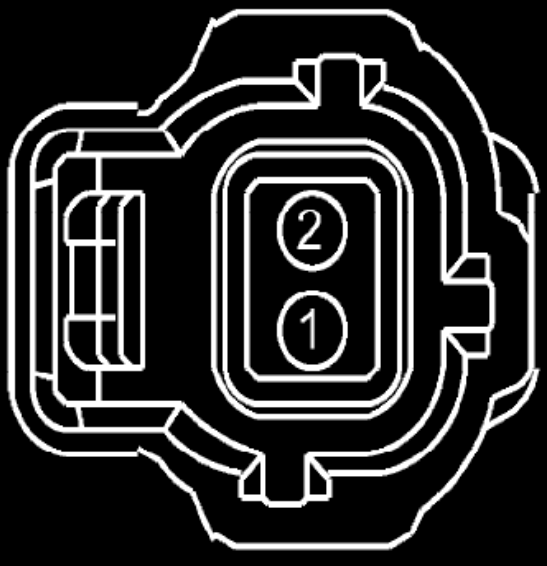
Description:	Harness:	Base Part #:
CAMSHAFT POSITION SENSOR	12B637	6B288



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE706 (BN-BU)	18	SENSOR - CAMSHAFT POSITION BANK 1 IN+EX/IN (CMP1) [CID-H] (CID1)	4.0L
2	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	4.0L

Connector: C1180

Description:	Harness:	Base Part #:
CAMSHAFT POSITION SENSOR	12B637	6B288



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	2.3L
2	VE706 (BN-BU)	18	SENSOR - CAMSHAFT POSITION BANK 1 IN+EX/ IN (CMP1) [CID-H] (CID1)	2.3L

Camshaft Position Sensor: Diagrams

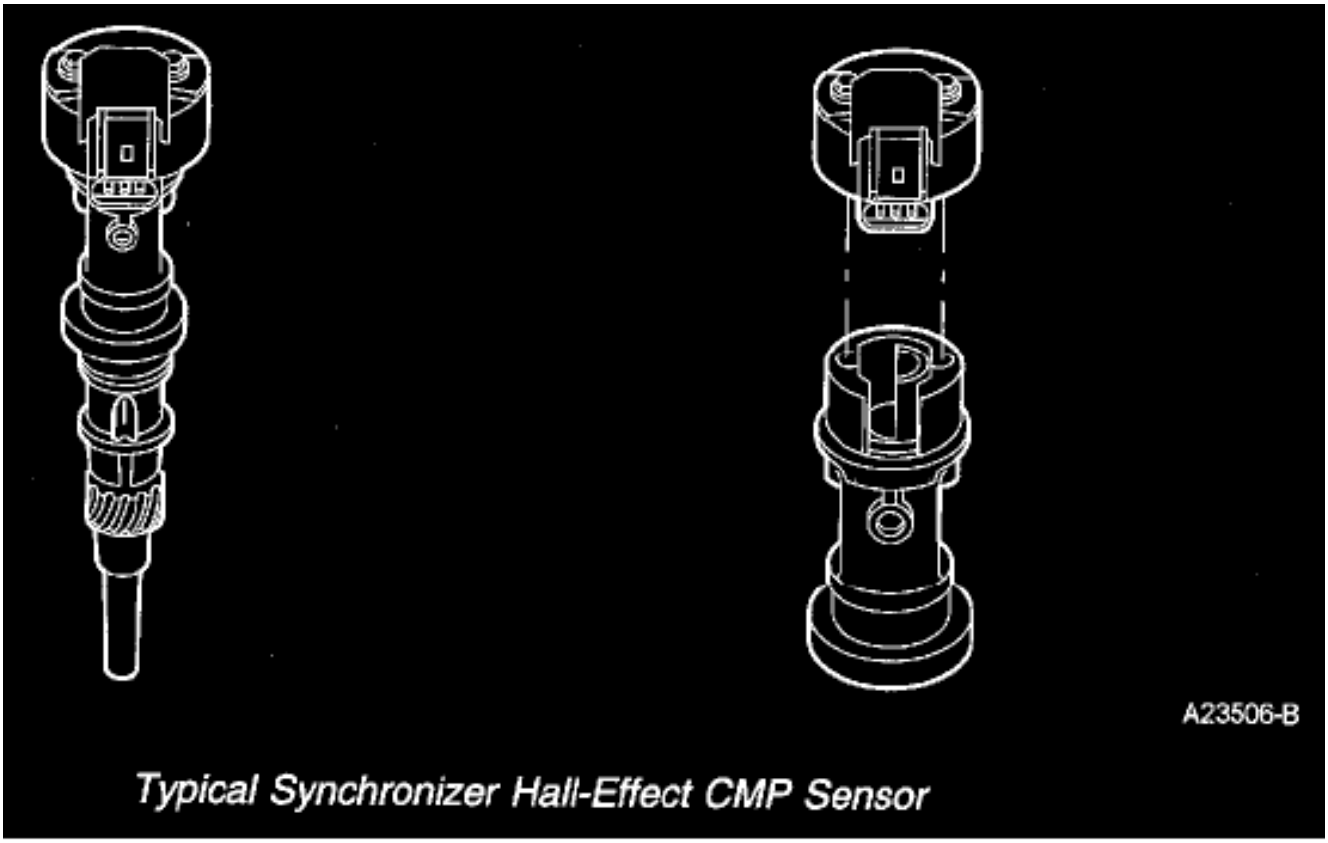
C180

C1180

Connector: C1275	Description:	Harness:	Base Part #:
	CAMSHAFT POSITION SENSOR	12B637	6B288

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	3.0L
2	VE706 (BN-BU)	18	SENSOR - CAMSHAFT POSITION BANK 1 IN+EX/ IN (CMP1) [CID-H] (CID1)	3.0L

C1275



Typical Synchronizer Hall-Effect CMP Sensor

Typical Variable Reluctance CMP Sensor

Camshaft Position Sensor: Description and Operation

CAMSHAFT POSITION (CMP) SENSOR

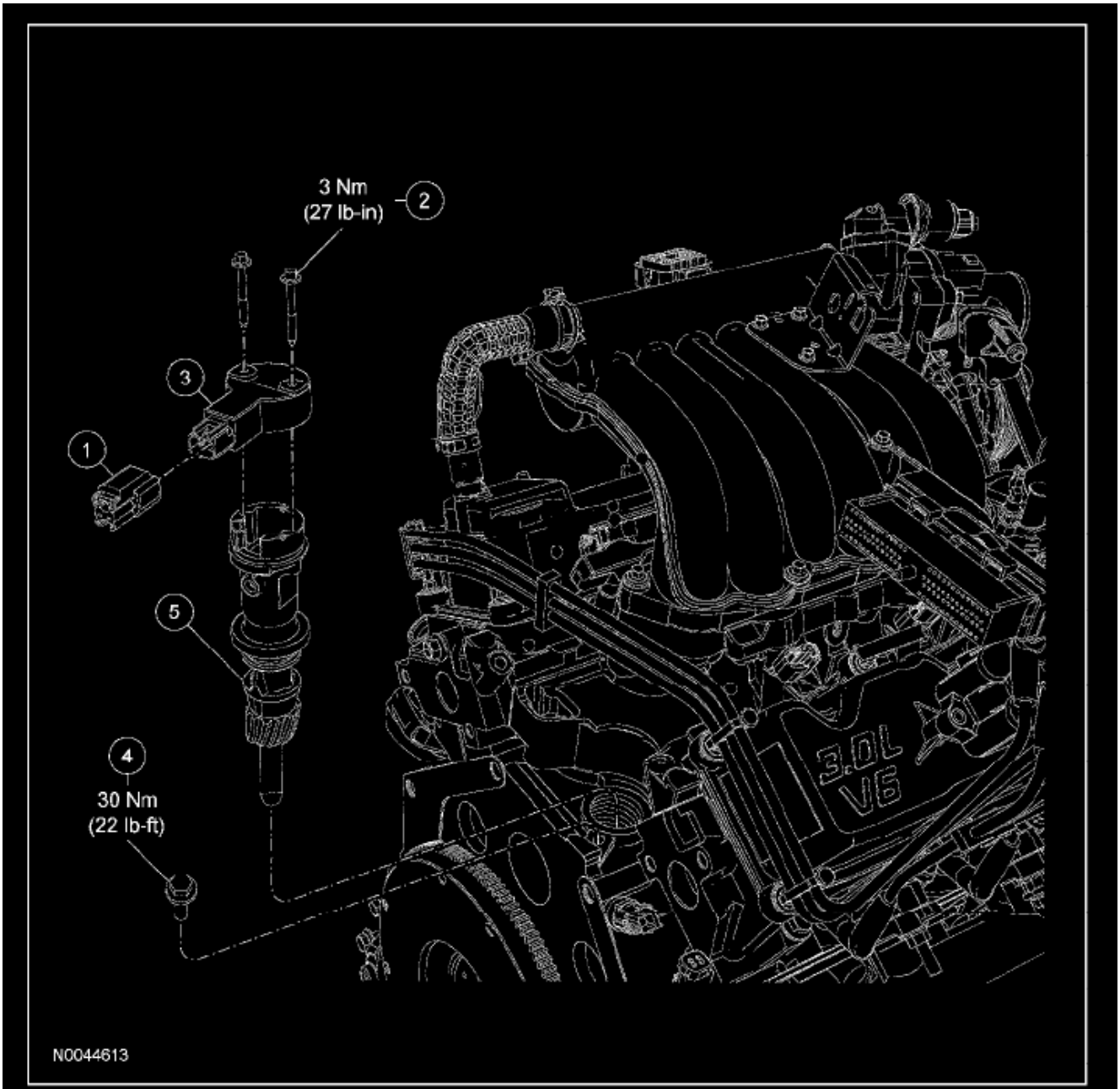
Typical Synchronizer Hall-Effect CMP Sensor

Typical Variable Reluctance CMP Sensor

The CMP sensor detects the position of the camshaft. The CMP sensor identifies when piston number 1 is on its compression stroke. A signal is then sent to the PCM and used for synchronizing the sequential firing of the fuel injectors. Coil on plug (COP) ignition applications use the CMP signal to select the correct ignition coil to fire.

Vehicles with 2 CMP sensors are equipped with variable camshaft timing (VCT). They use the second sensor to identify the position of the camshaft on bank 2 as an input to the PCM.

There are 2 types of CMP sensors: the 3-pin connector Hall-effect type sensor and the 2-pin connector variable reluctance type sensor.



Item	Part Number	Description
1	—	Camshaft position (CMP) sensor electrical connector (part of 12B637)
2	W701219	CMP sensor bolt (2 required)

(Continued)

Item	Part Number	Description
3	6B288	CMP sensor
4	—	Camshaft synchronizer bolt
5	12A362	Camshaft synchronizer

Camshaft Position Sensor: Service and Repair

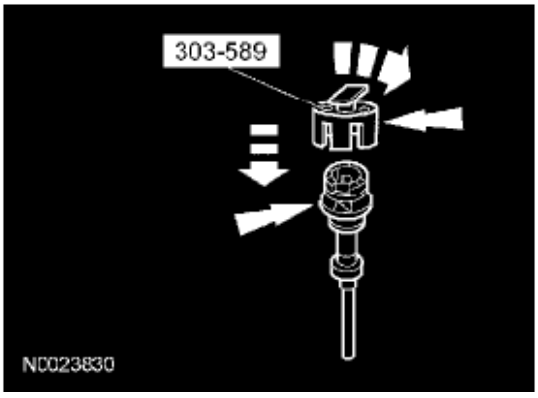
CAMSHAFT SYNCHRONIZER

Exploded View

Special Tool(s)

Special Tool(s)

ST2362-A	Synchronizer Alignment Gauge 303-589



Special Tool(s)

Removal

1. Disconnect the camshaft position (CMP) sensor electrical connector.

2. NOTE: Prior to the removal of the CMP sensor, note the position of the CMP sensor electrical connector. The installation procedure requires that

the electrical connector be located in the same position.

Remove the 2 bolts and the CMP sensor.

3. Remove the camshaft synchronizer bolt. 4. Remove the camshaft synchronizer. Inspect the O-ring seal and install a new O-ring seal if damaged.

Installation

1. CAUTION:

- After installation, do not loosen the synchronizer bolt and rotate the synchronizer assembly. The synchronizer assembly is not adjustable. Do not loosen the synchronizer bolt after the alignment tool has been removed in order to align the camshaft position (CMP) sensor electrical connector for any reason. If the electrical connector is not in the correct position, the synchronizer assembly must be removed. The alignment tool and the assembly must be reinstalled if the engine has not been rotated from top dead center (TDC) of the compression stroke on the No. 1 cylinder. Failure to follow this procedure will result in the fuel system being out of time with the engine, possibly causing engine damage.

- Do not turn the crankshaft or camshaft during the removal and installation procedure or the fuel system timing will be out of time with the engine, possibly causing engine damage.

- A special tool must be used during the installation of the new synchronizer assembly. Failure to follow this procedure will result in the fuel system being out of time with the engine, possibly causing engine damage.

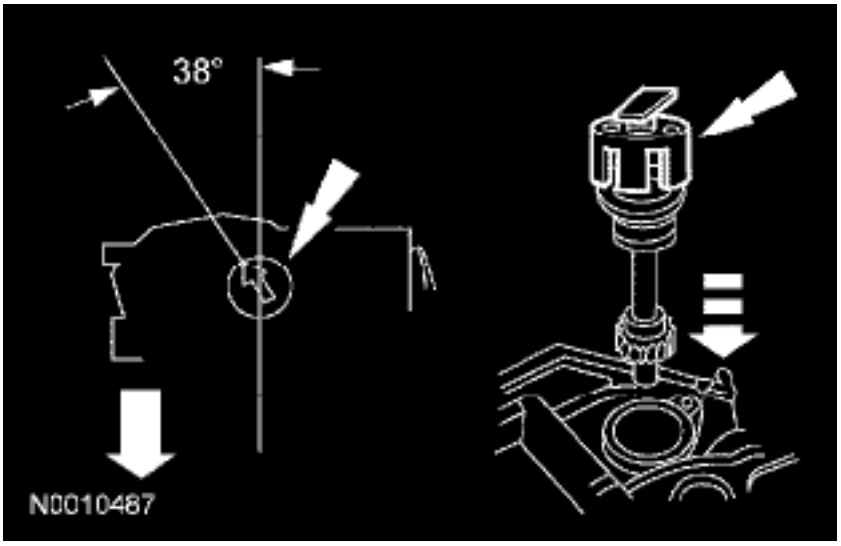
Install the special tool on the camshaft synchronizer by rotating the tool until it engages the notch in the camshaft synchronizer housing and the armature.

2. CAUTION: It is very important to coat the gear on the camshaft synchronizer with engine oil prior to installation. Failure to do so may

result in gear failure.

NOTE: During installation, the arrow on the special tool will rotate clockwise until the oil pump intermediate shaft and the camshaft gear engages.

Install the camshaft synchronizer housing assembly so the arrow on the special tool is 38 degrees from the centerline of the engine.



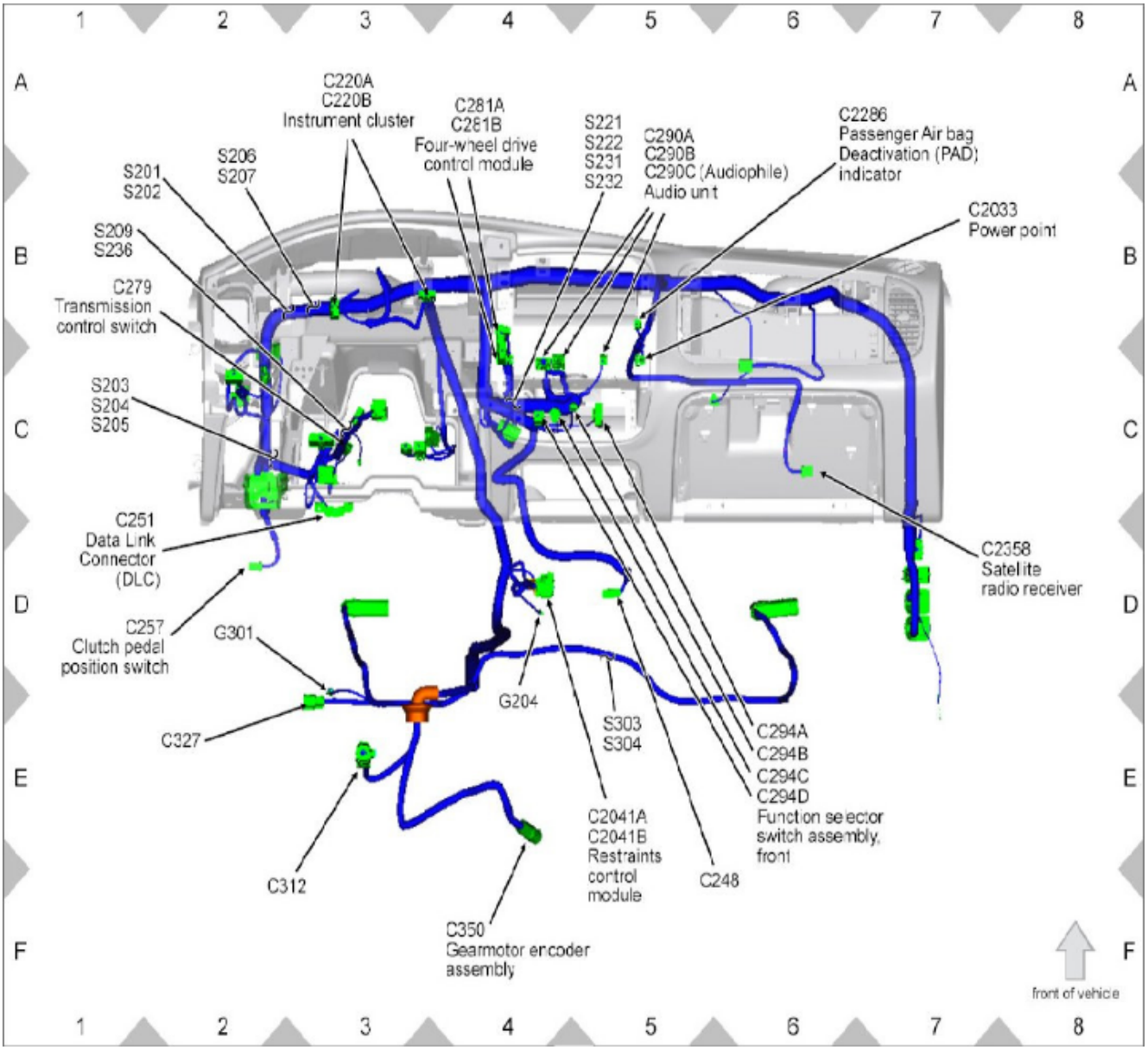
3. Install the camshaft synchronizer housing bolt.

- Tighten to 30 Nm (22 lb-ft).

4. Position the CMP sensor and install the 2 bolts.

- Tighten to 3 Nm (27 lb-in).

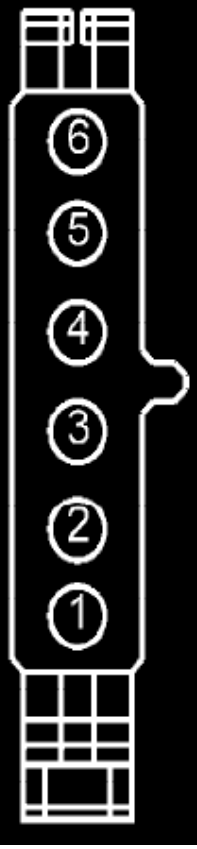
5. Connect the CMP sensor electrical connector.


1
2
3
4
5
6
7
8
A
B
C
D
E
F
C220A
C220B
Instrument cluster
C281A
C281B
Four-wheel drive control module
S221
S222
S231
S232
C290A
C290B
C290C (Audiophile)
Audio unit
C2286
Passenger Air bag Deactivation (PAD) indicator
C2033
Power point
S201
S202
S206
S207
S209
S236
C279
Transmission control switch
S203
S204
S205
C251
Data Link Connector (DLC)
C257
Clutch pedal position switch
G301
C327
C312
G204
S303
S304
C2041A
C2041B
Restraints control module
C248
C294A
C294B
C294C
C294D
Function selector switch assembly, front
C2358
Satellite radio receiver
C350
Gearmotor encoder assembly
front of vehicle

View 151-12

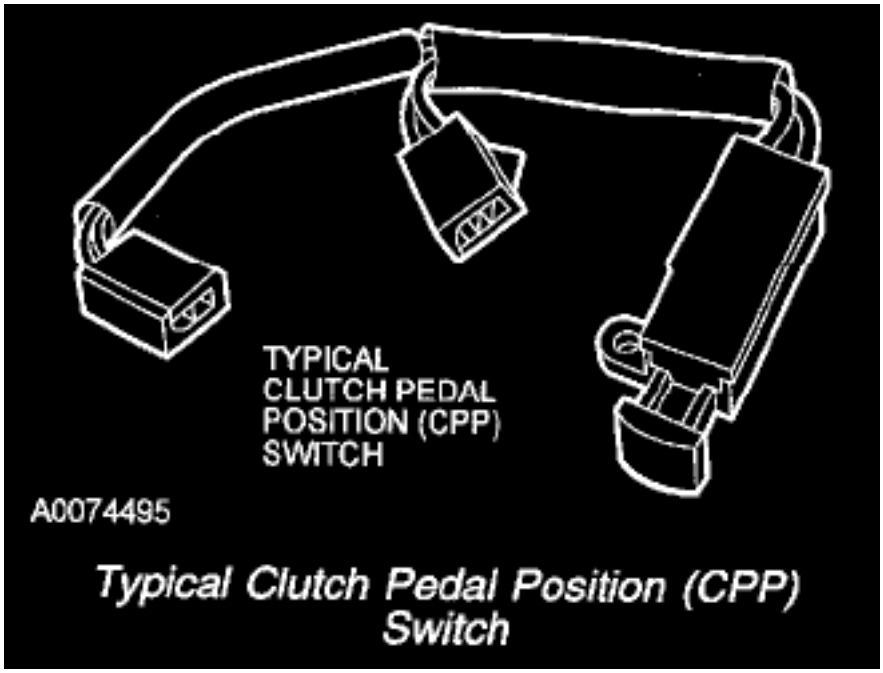
Connector: C257

Description:	Harness:	Base Part #:
CLUTCH PEDAL POSITION SWITCH	14401	11A152



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE904 (GN-VT)	22	SWITCH - CLUTCH PEDAL POSITION # TOP OF TRAVEL (CPP-TT)	
2	GD174 (BK-WH)	22	GROUND - TUNNEL	
3	CCB15 (BN-GN)	22	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL CLOSED	
4	CCB15 (BN-GN)	22	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL CLOSED	
5	GD174 (BK-WH)	22	GROUND - TUNNEL	
6	CDC36 (GN-BN)	22	SWITCH - START INTERLOCK CLUTCH PEDAL	

C257



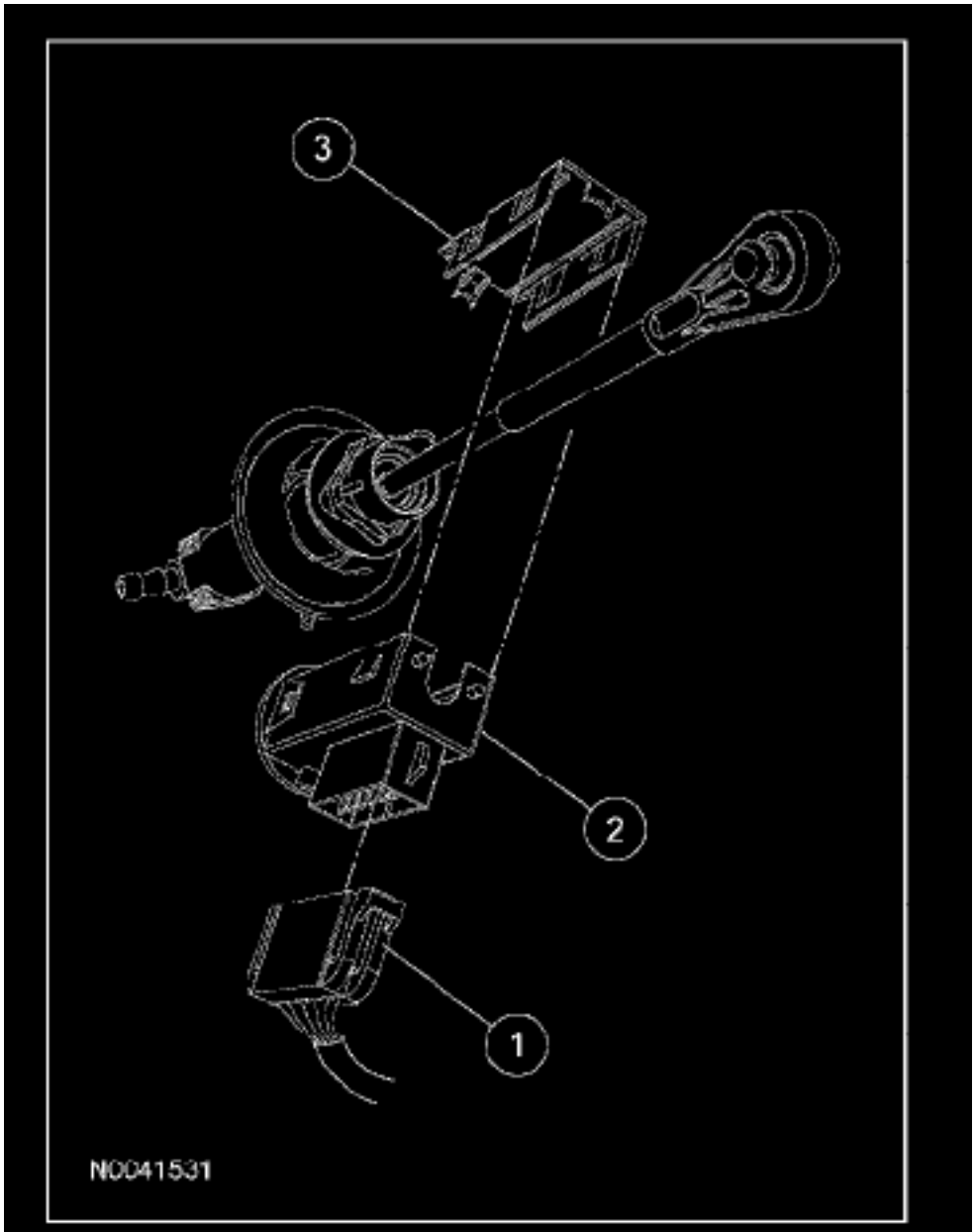
Typical Clutch Pedal Position (CPP) Switch

Clutch Switch: Description and Operation

CLUTCH PEDAL POSITION (CPP) SWITCH

Typical Clutch Pedal Position (CPP) Switch

The CPP switch is an input to the PCM indicating the clutch pedal position. The PCM provides a low current voltage on the CPP circuit. When the CPP switch is closed, this voltage is pulled low through the SIG RTN circuit. The CPP input to the PCM is used to detect a reduction in engine load. The PCM uses the load information for mass air flow and fuel calculations.



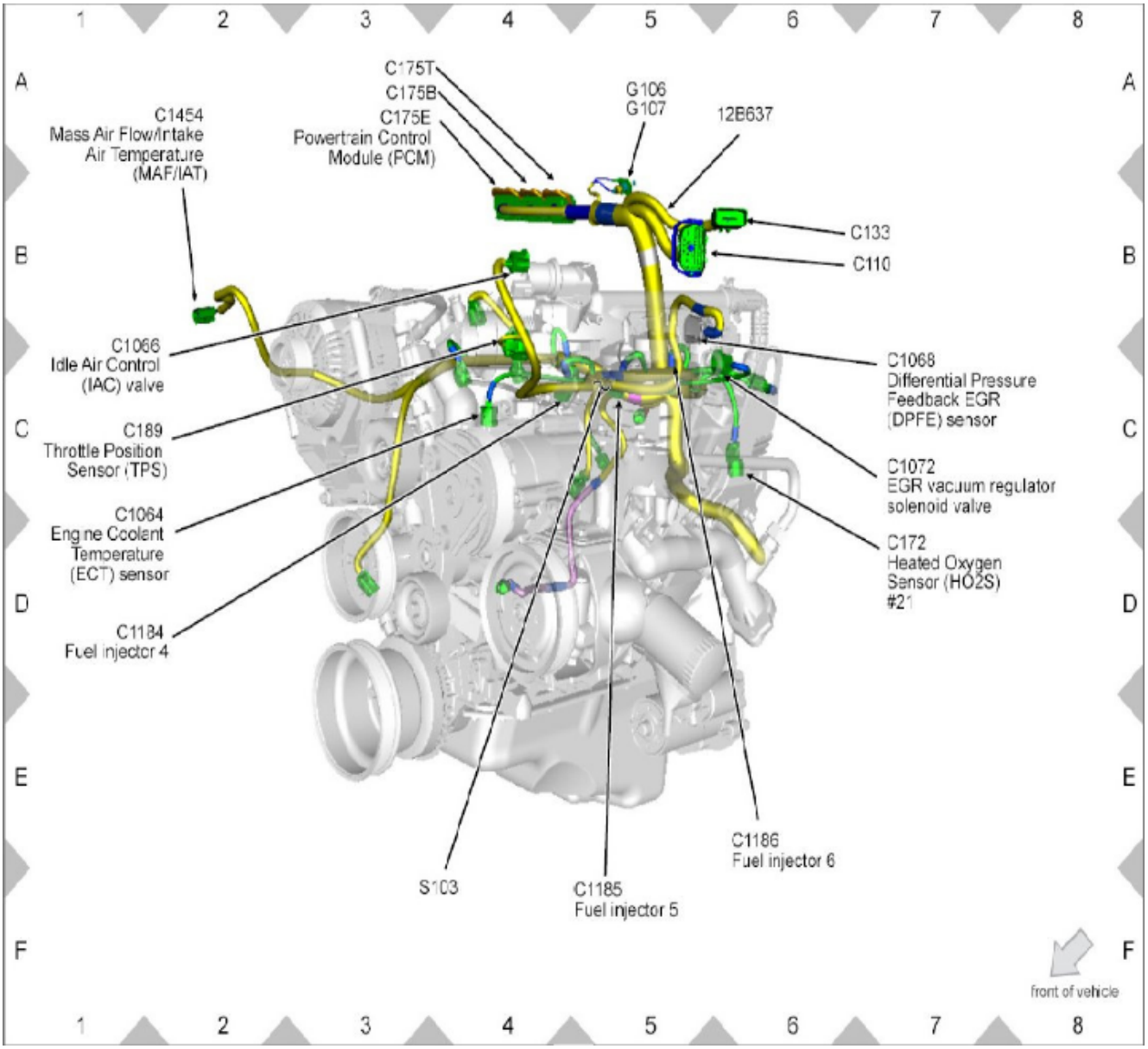
Item	Part Number	Description
1	—	Clutch pedal position (CPP) switch electrical connector
2	7C534	CPP switch
3	—	CPP switch cover (part of 7C534)

Clutch Switch: Service and Repair

CLUTCH PEDAL POSITION (CPP) SWITCH

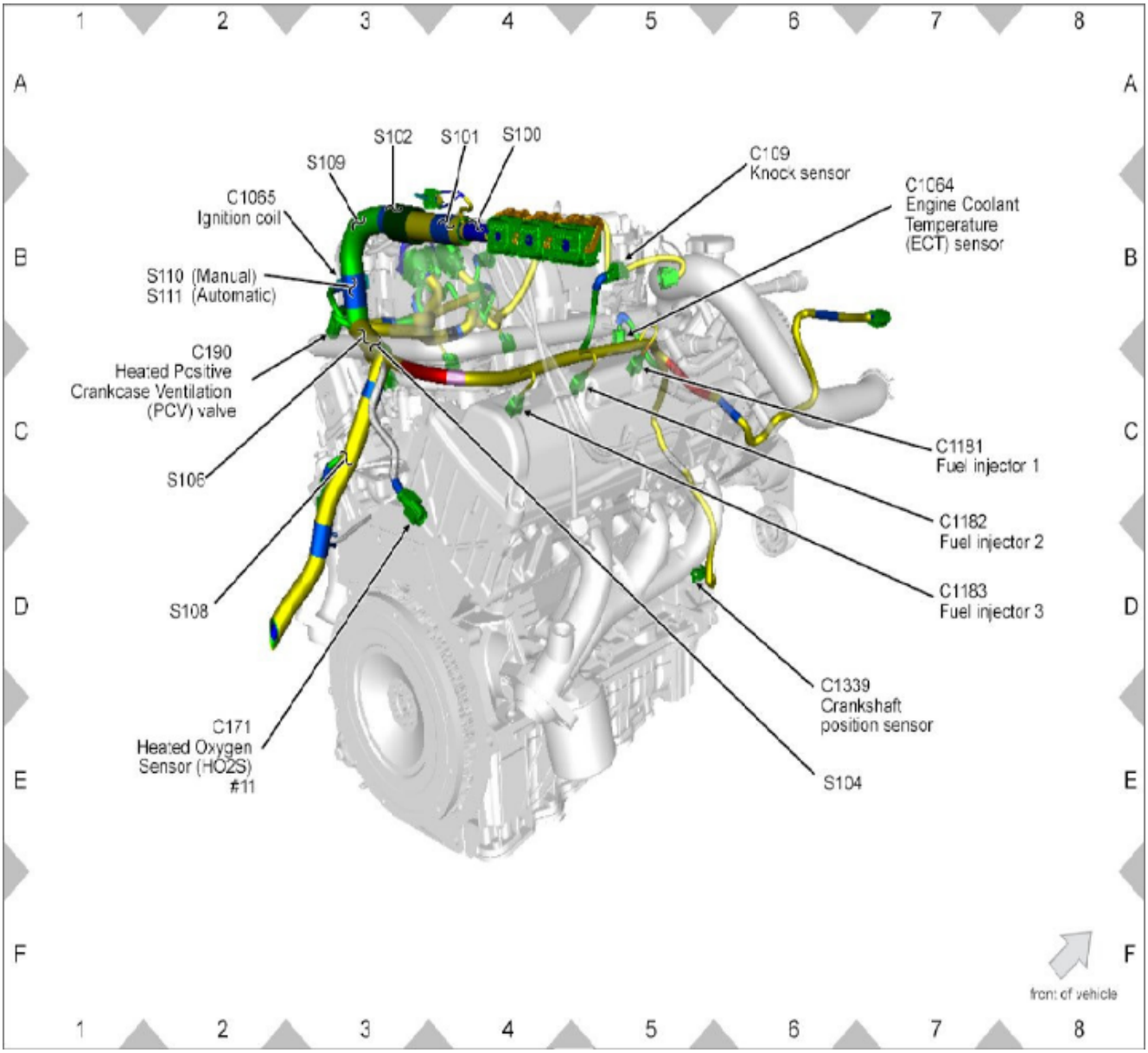
Removal and Installation

1. Disconnect the clutch pedal position (CPP) switch electrical connector. 2. Spread the CPP switch apart. Remove from the pedal rod. 3. To install, reverse the removal procedure.



Coolant Temperature Sensor/Switch (For Computer): Locations

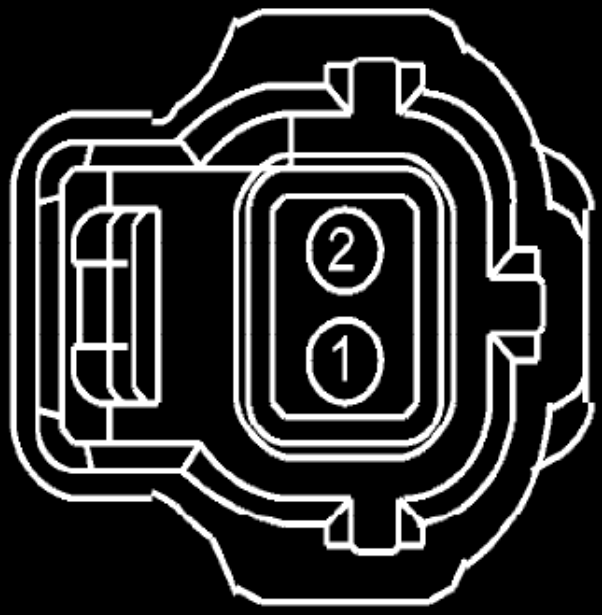
View 151-5


S102
S101
S100
S109
C1065
Ignition coil
S110 (Manual)
S111 (Automatic)
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
S108
C171
Heated Oxygen
Sensor (HO2S)
#11
C109
Knock sensor
C1064
Engine Coolant
Temperature
(ECT) sensor
C1181
Fuel injector 1
C1182
Fuel injector 2
C1183
Fuel injector 3
C1339
Crankshaft
position sensor
S104
front of vehicle

View 151-8

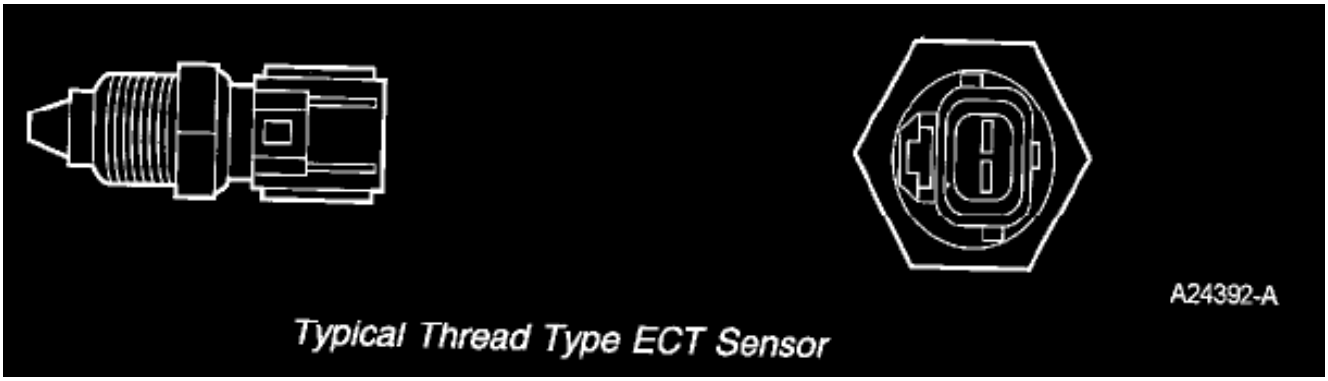
Connector: C1064

Description:	Harness:	Base Part #:
ENGINE COOLANT TEMPERATURE (ECT) SENSOR	12B637	12A648



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE716 (YE)	20	SENSOR - ENGINE COOLANT TEMPERATURE (ECT)	3.0L, 4.0L
2	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	3.0L, 4.0L

C1064



Coolant Temperature Sensor/Switch (For Computer): Description and Operation

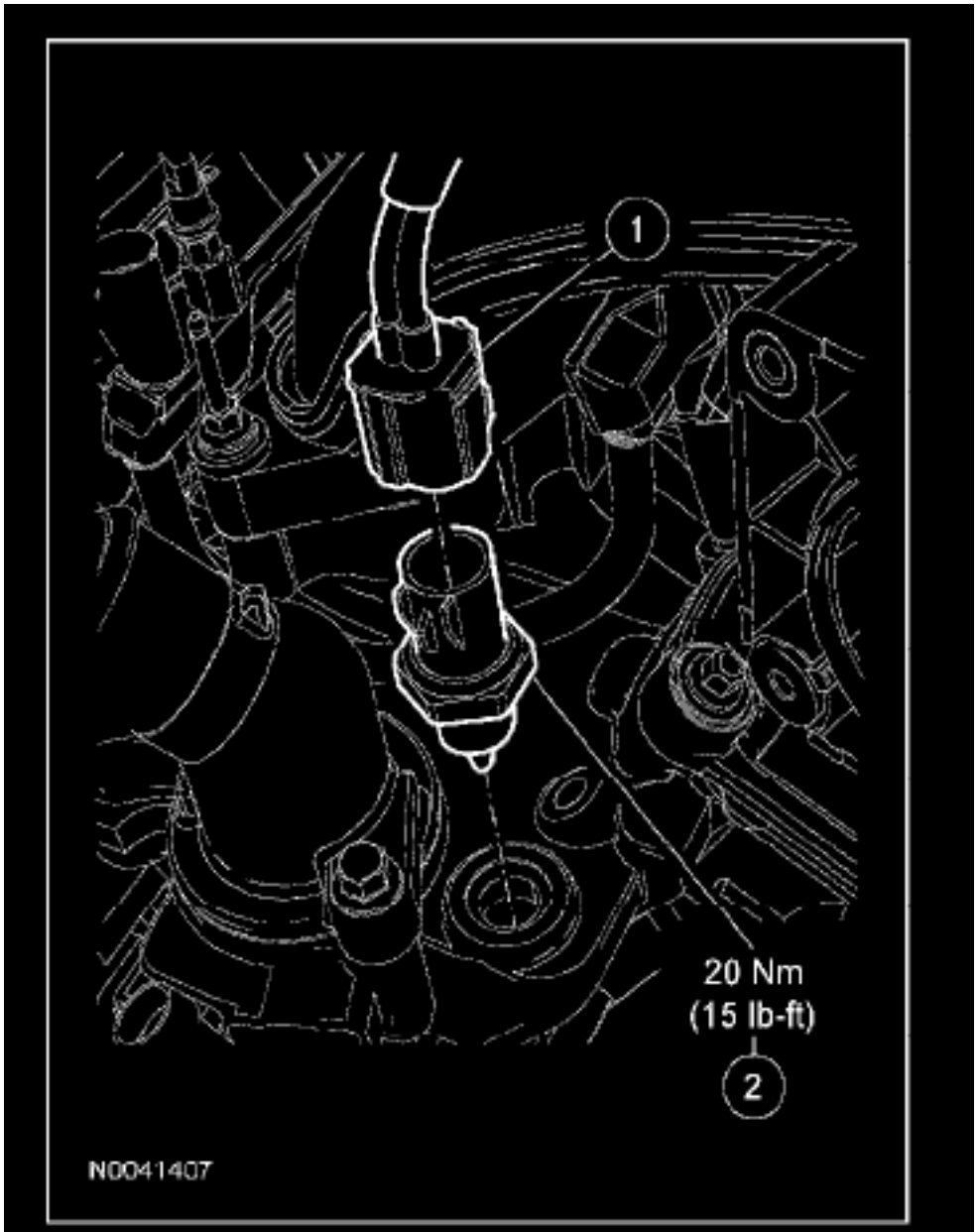
ENGINE COOLANT TEMPERATURE (ECT) SENSOR

Typical Thread Type ECT Sensor

The ECT sensor is a thermistor device in which resistance changes with temperature. The electrical resistance of a thermistor decreases as the temperature increases, and the resistance increases as the temperature decreases. The varying resistance changes the voltage drop across the sensor terminals and provides electrical signals to the PCM corresponding to temperature.

Thermistor-type sensors are considered passive sensors. A passive sensor is connected to a voltage divider network so that varying the resistance of the passive sensor causes a variation in total current flow. Voltage that is dropped across a fixed resistor in a series with the sensor resistor determines the voltage signal at the PCM. This voltage signal is equal to the reference voltage minus the voltage drop across the fixed resistor.

The ECT measures the temperature of the engine coolant. The PCM uses the ECT input for fuel control and for cooling fan control. There are 3 types of ECT sensors, threaded, push-in, and twist-lock. The ECT sensor is located in an engine coolant passage.



Item	Part Number	Description
1	14A464	Engine coolant temperature (ECT) sensor electrical connector (part of 12B637)
2	12A648	ECT sensor

Coolant Temperature Sensor/Switch (For Computer): Service and Repair

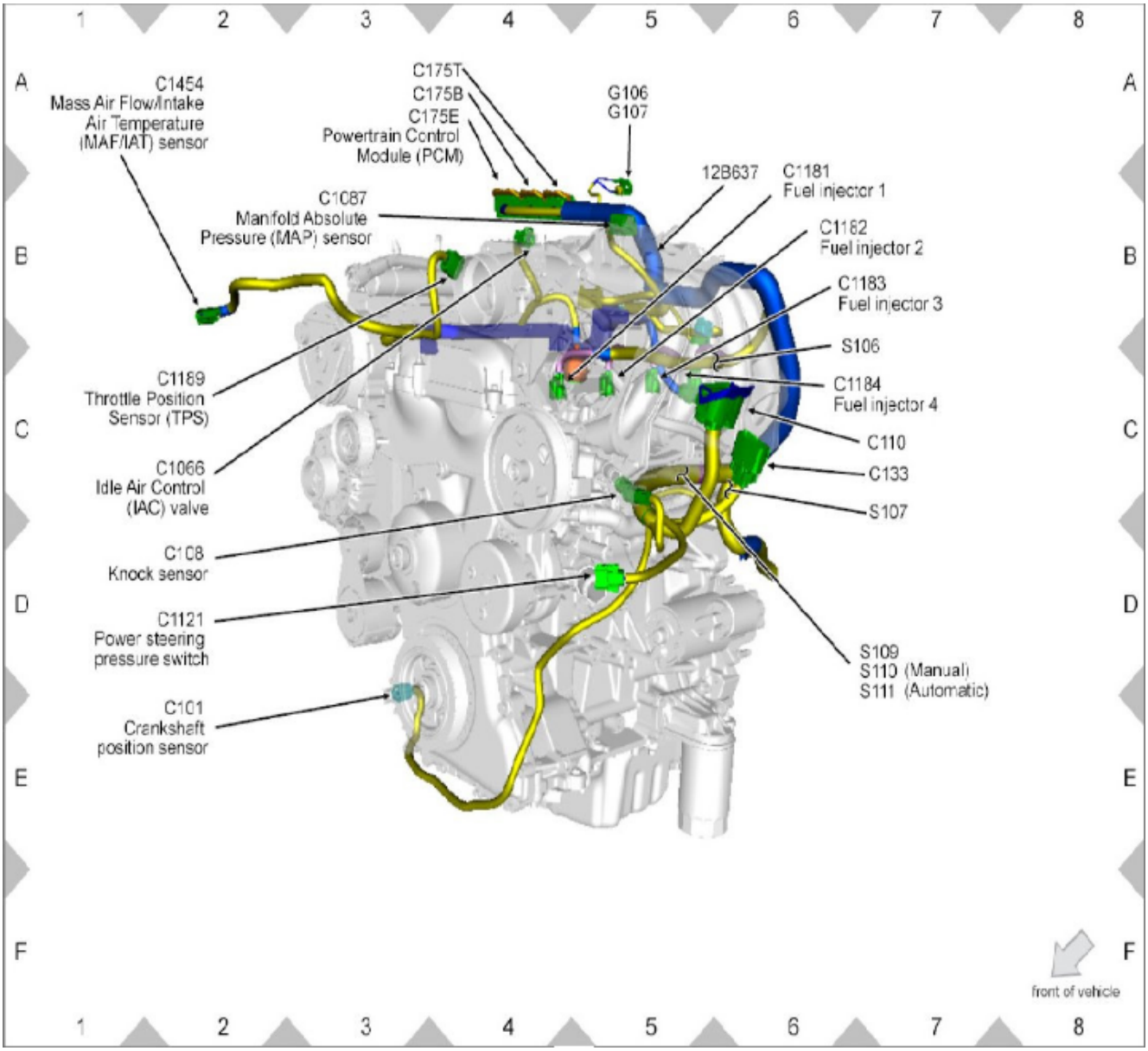
ENGINE COOLANT TEMPERATURE (ECT) SENSOR

Removal and Installation

1. Drain the cooling system. 2. Disconnect the engine coolant temperature (ECT) sensor electrical connector. 3. Remove the ECT sensor.

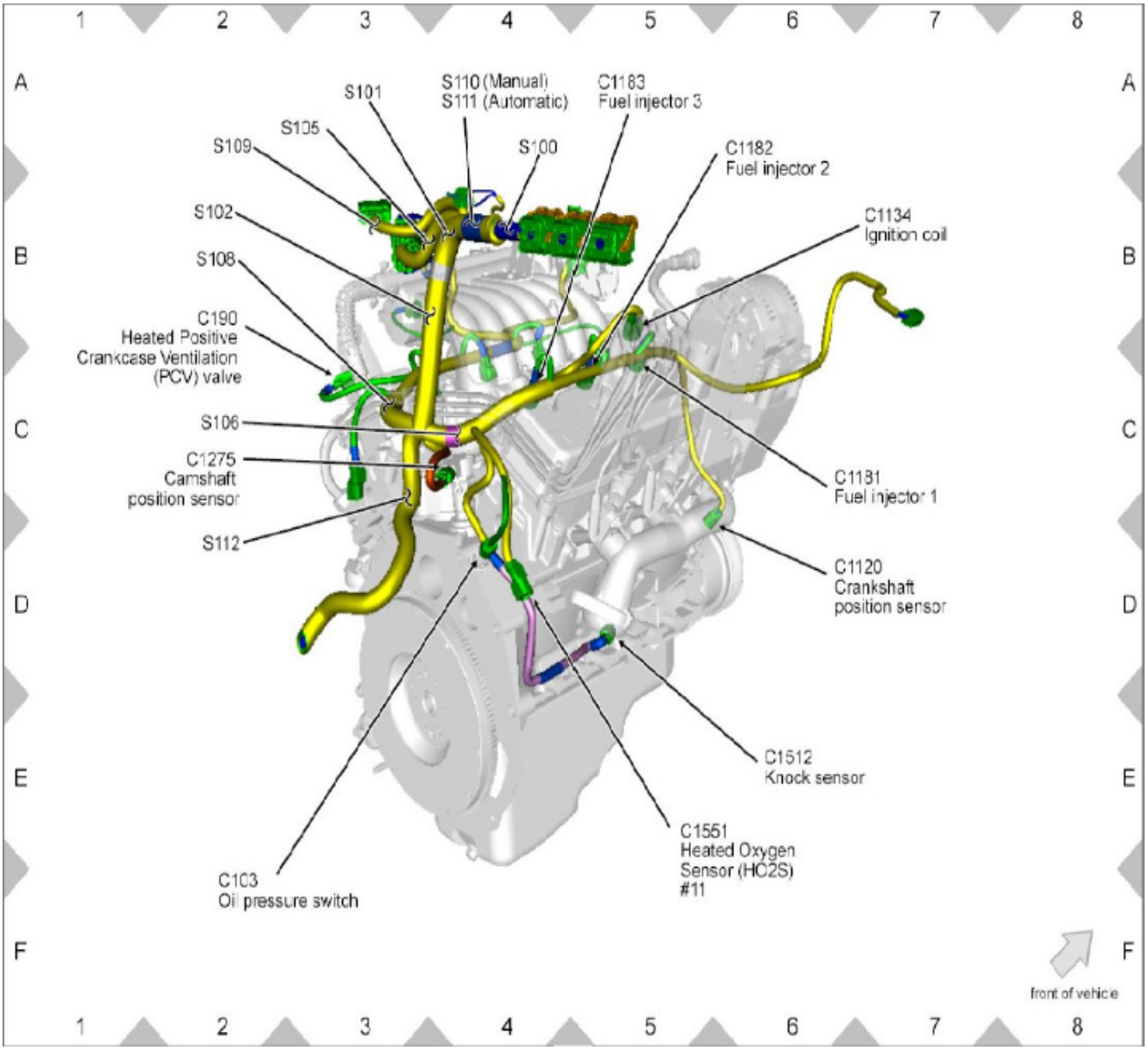
- To install, tighten to 20 Nm (15 lb-ft).

4. To install, reverse the removal procedure.

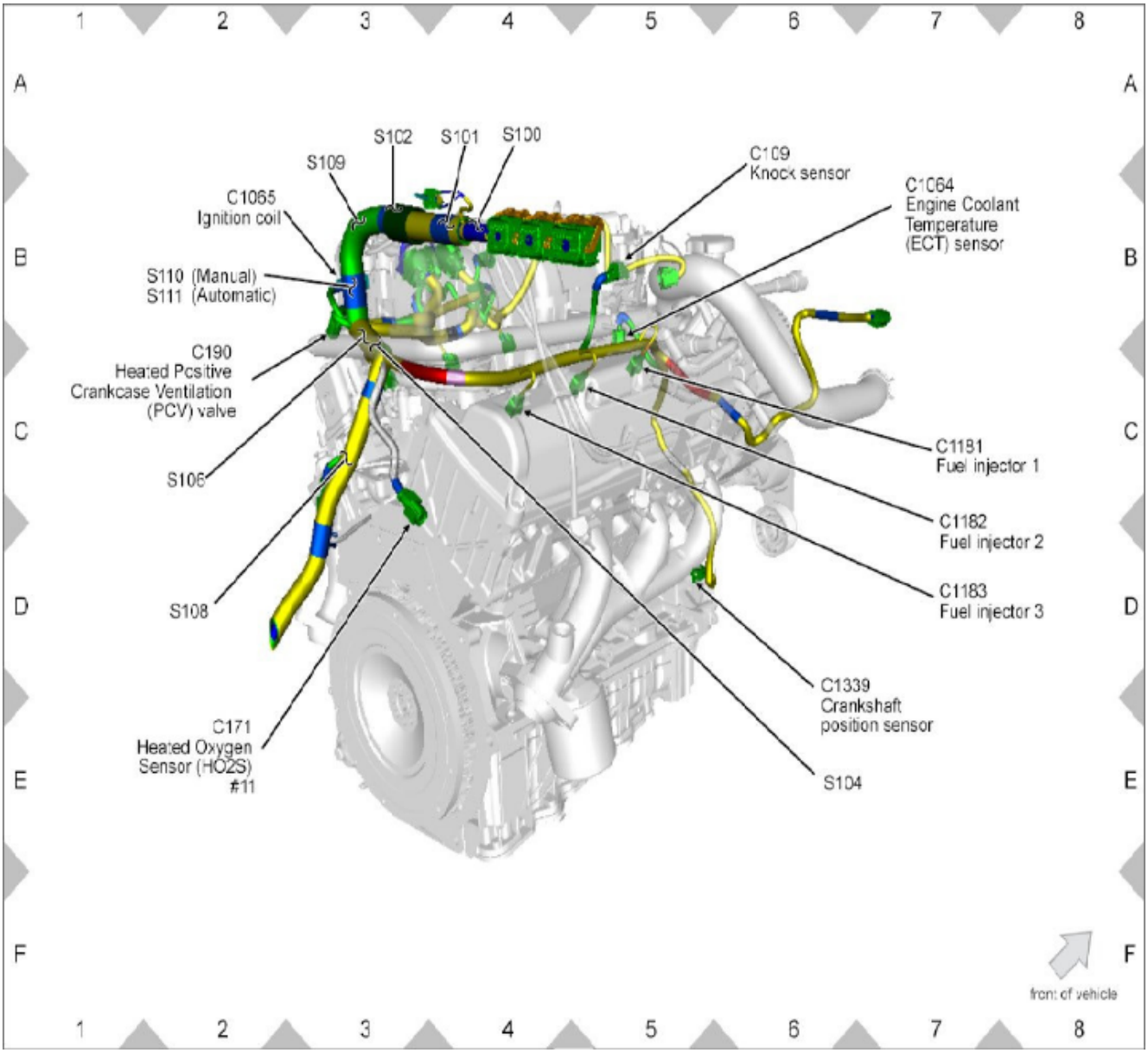


Crankshaft Position Sensor: Locations

View 151-3


S101
S110 (Manual)
S111 (Automatic)
C1183
Fuel injector 3
S105
S109
S100
C1182
Fuel injector 2
S102
C1134
Ignition coil
S108
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
C1275
Camshaft
position sensor
S112
C1181
Fuel injector 1
C1120
Crankshaft
position sensor
C1512
Knock sensor
C1551
Heated Oxygen
Sensor (HO2S)
#11
C103
Oil pressure switch
front of vehicle

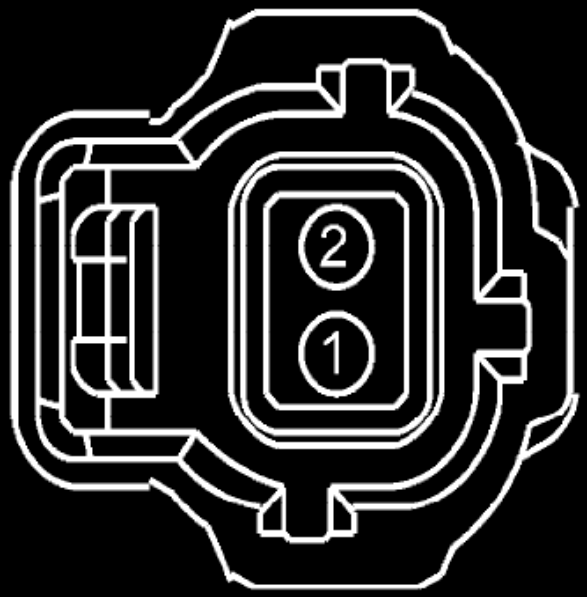
View 151-6


S102
S101
S100
S109
C1065
Ignition coil
S110 (Manual)
S111 (Automatic)
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
S108
C171
Heated Oxygen
Sensor (HO2S)
#11
C109
Knock sensor
C1064
Engine Coolant
Temperature
(ECT) sensor
C1181
Fuel injector 1
C1182
Fuel injector 2
C1183
Fuel injector 3
C1339
Crankshaft
position sensor
S104
front of vehicle

View 151-8

Connector: C101

Description:	Harness:	Base Part #:
CRANKSHAFT POSITION SENSOR	12B637	6C315



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE711 (YE-VT)	18	SENSOR - CRANKSHAFT POSITION (CKPP)	2.3L
2	RE135 (GN-BN)	18	CTRL MOD. - POWERTRAIN # CRANKSHAFT POSITION SENSOR (CKPN)	2.3L

Connector: C1120

Description:	Harness:	Base Part #:
CRANKSHAFT POSITION SENSOR	12B637	6C315

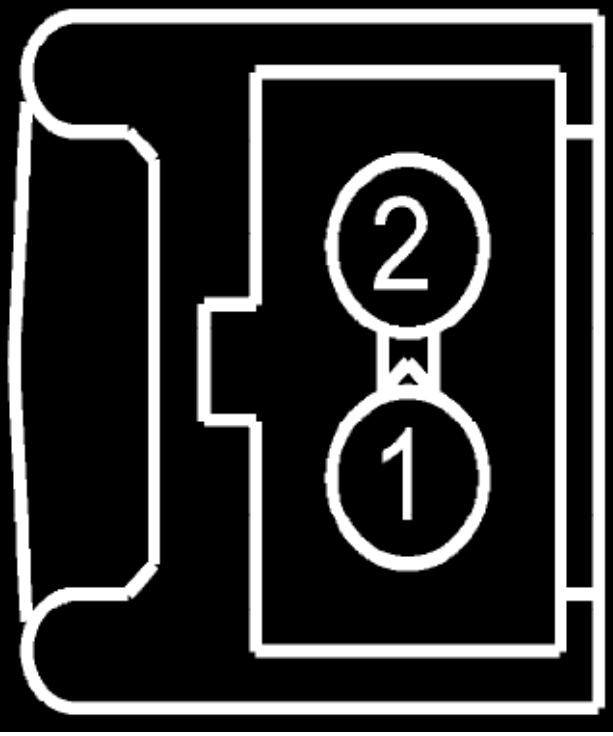
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RE135 (GN-BN)	18	CTRL MOD. - POWERTRAIN # CRANKSHAFT POSITION SENSOR (CKPN)	3.0L
2	VE711 (YE-VT)	18	SENSOR - CRANKSHAFT POSITION (CKPP)	3.0L

Crankshaft Position Sensor: Diagrams

C101

C1120

Connector: C1339 | **Description:** CRANKSHAFT POSITION SENSOR | **Harness:** 12B637 | **Base Part #:** 6C315



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE711 (YE-VT)	18	SENSOR - CRANKSHAFT POSITION (CKPP)	4.0L
2	RF135 (GN-BN)	18	CTRL MOD. - POWERTRAIN # CRANKSHAFT POSITION SENSOR (CKPN)	4.0L

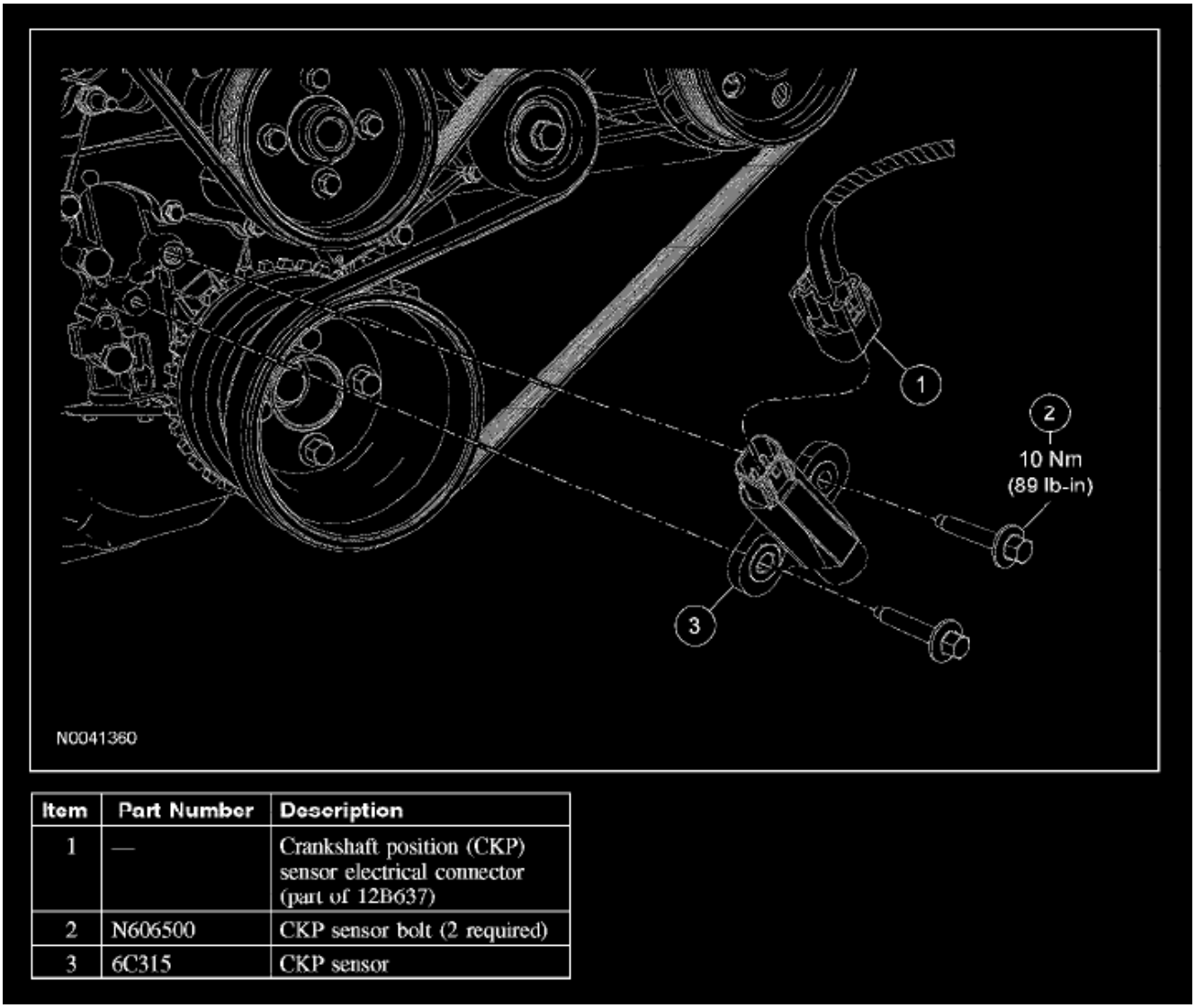
C1339

Crankshaft Position Sensor: Description and Operation

CRANKSHAFT POSITION (CKP) SENSOR

Typical Crankshaft Position (CKP) Sensor

The CKP sensor is a magnetic transducer mounted on the engine block adjacent to a pulse wheel located on the crankshaft. By monitoring the crankshaft mounted pulse wheel, the CKP is the primary sensor for ignition information to the PCM. The pulse wheel has a total of 35 teeth spaced 10 degrees apart with one empty space for a missing tooth. The 6.8L 10-cylinder pulse wheel has 39 teeth spaced 9 degrees apart and one 9 degree empty space for a missing tooth. By monitoring the pulse wheel, the CKP sensor signal indicates crankshaft position and speed information to the PCM. By monitoring the missing tooth, the CKP sensor is also able to identify piston travel in order to synchronize the ignition system and provide a way of tracking the angular position of the crankshaft relative to a fixed reference for the CKP sensor configuration. The PCM also uses the CKP signal to determine if a misfire has occurred by measuring rapid decelerations between teeth.



Item	Part Number	Description
1	—	Crankshaft position (CKP) sensor electrical connector (part of 12B637)
2	N606500	CKP sensor bolt (2 required)
3	6C315	CKP sensor

Crankshaft Position Sensor: Service and Repair

CRANKSHAFT POSITION (CKP) SENSOR

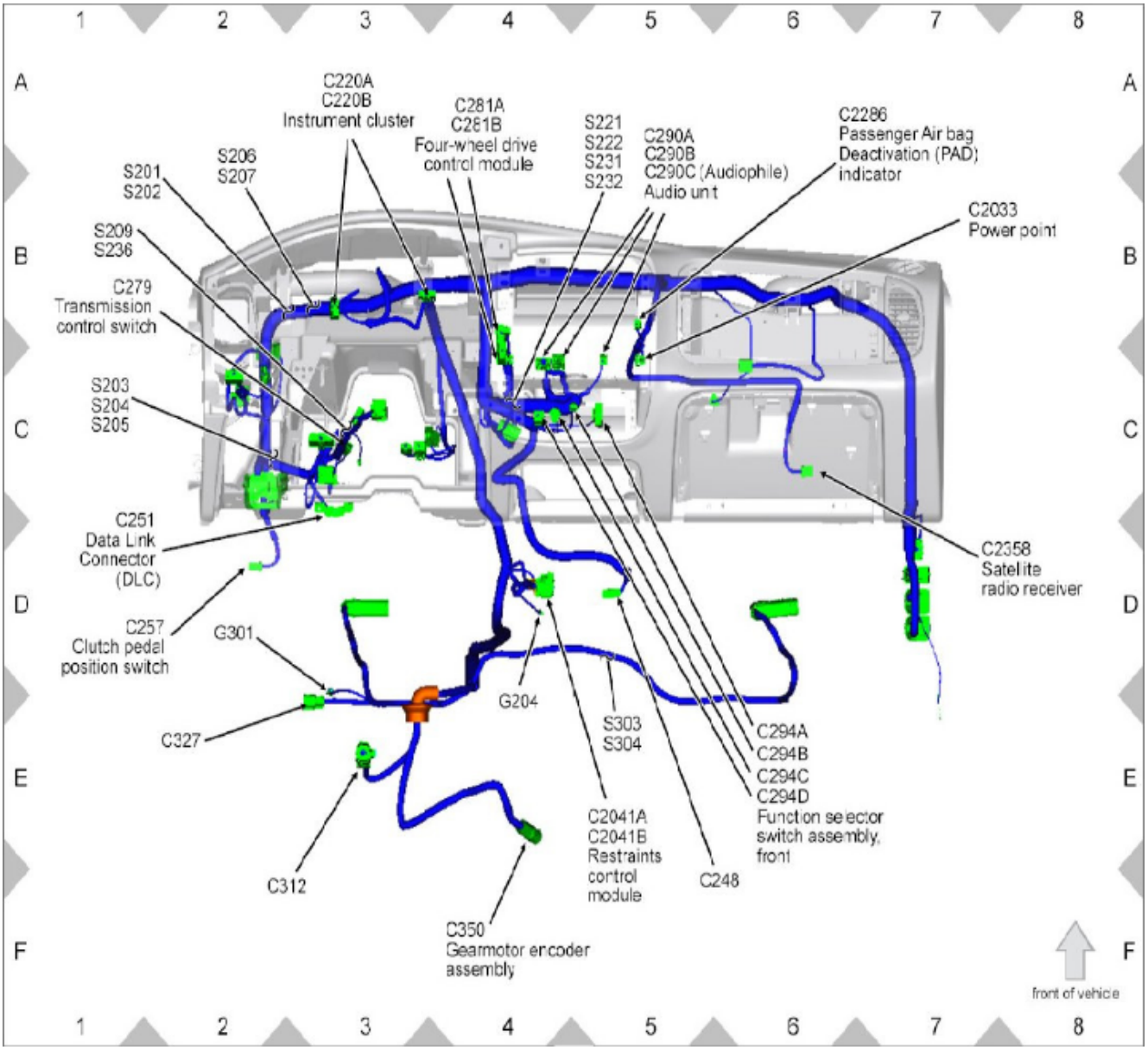
Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the crankshaft position (CKP) sensor electrical connector. 3. Remove the 2 bolts and the CKP sensor.

- To install, tighten to 10 Nm (89 lb-in).

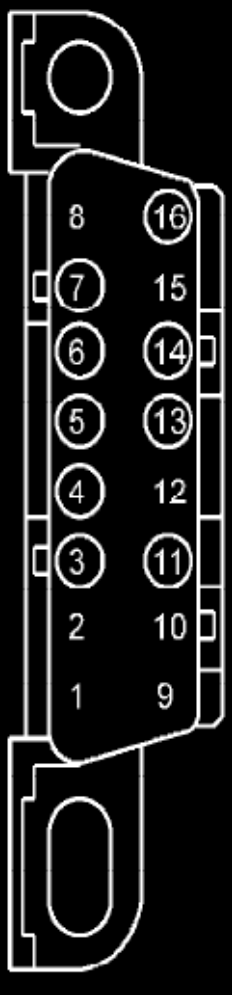
4. To install, reverse the removal procedure.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Powertrain Management > Computers and Control Systems > Data Link Connector > Component Information > Locations



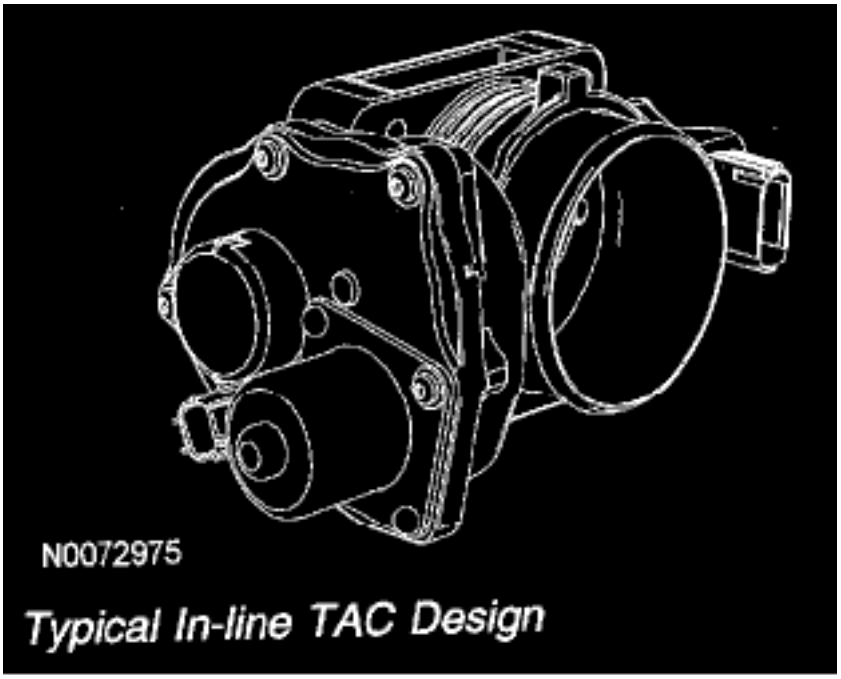
View 151-12

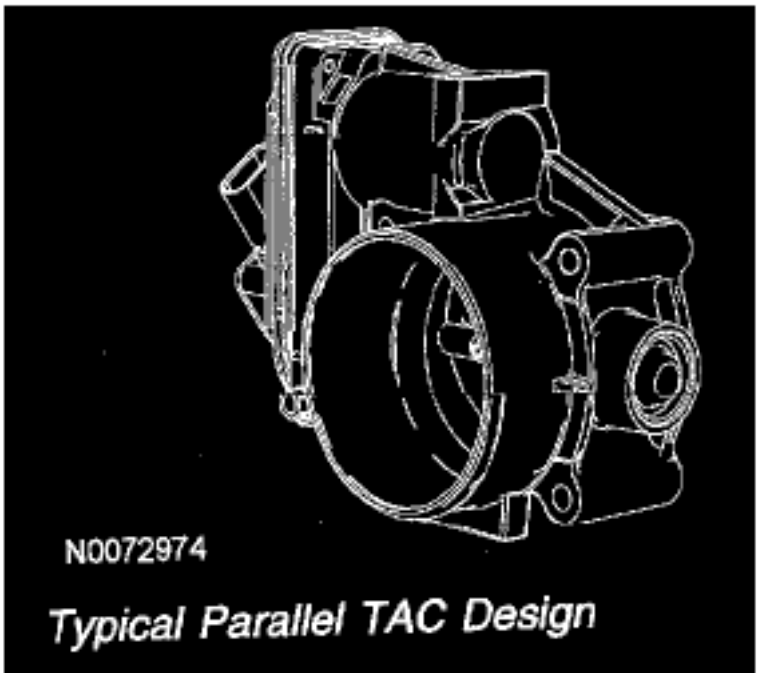
Connector: C251 | **Description:** DATA LINK CONNECTOR (DLC) | **Harness:** 14401 | **Base Part #:** 14489



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	*	*	not used	
3	VDB06 (GY-OG)	20	CONNECTOR - DIAGNOSTIC # CAN BUS MEDIUM SPEED HIGH	
4	GD161 (BK-YE)	20	GROUND - SEAT BRACKET REAR LEFT	
5	GD174 (BK-WH)	18	GROUND - TUNNEL	
6	VDB04 (WH-BU)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED HIGH	
7	VDB10 (GY)	22	CONNECTOR - DIAGNOSTIC # K LINE ISO 9141	
8	*	*	not used	
9	*	*	not used	
10	*	*	not used	
11	VDB07 (VT-OG)	20	CONNECTOR - DIAGNOSTIC # CAN BUS MEDIUM SPEED LOW	
12	*	*	not used	
13	CDB08 (BN)	22	CONNECTOR - DIAGNOSTIC # FLASH EEPROM POWER SUPPLY (FEPS)	
14	VDB05 (WH)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED LOW	
15	*	*	not used	
16	SBP29 (GY-RD)	18	FUSE - 29 OR CIRCUIT BREAKER	

C251





Electronic Throttle Actuator: Description and Operation

ELECTRONIC THROTTLE ACTUATOR CONTROL (TAC)

Typical In-line TAC Design

Typical Parallel TAC Design

The electronic TAC is a DC motor controlled by the PCM (requires 2 wires). There are 2 designs for the TAC, parallel and in-line. The parallel design has the motor under the bore parallel to the plate shaft. The motor housing is integrated into the main housing. The in-line design has a separate motor housing. An internal spring is used in both designs to return the throttle plate to a default position. The default position is typically a throttle angle of 7 to 8 degrees from the hard stop angle. The closed throttle plate hard stop is used to prevent the throttle from binding in the bore (approximately 0.75 degree). This hard stop setting is not adjustable and is set to result in less airflow than the minimum engine airflow required at idle.

ETC System with a 3-Track APP Sensor Failure Mode and Effects Management:

Effect	Failure Mode ▪
No Effect on Driveability	A loss of redundancy or loss of a non-critical input could result in a concern that does not affect driveability. The powertrain malfunction indicator (wrench) illuminates, but the throttle control and torque control systems function normally. A DTC is set to indicate the component or circuit with the concern.
Disable Speed Control	If certain concerns are detected, speed control is disabled. Throttle control and torque control continue to function normally.

(Continued)

Electronic Throttle Control Module: Description and Operation

TORQUE BASED ELECTRONIC THROTTLE CONTROL (ETC)

Overview

The torque based ETC is a hardware and software strategy that delivers an engine output torque (via throttle angle) based on driver demand (pedal position). It uses an electronic throttle body, the powertrain control module (PCM), and an accelerator pedal assembly to control the throttle opening and engine torque.

Torque based ETC enables aggressive automatic transmission shift schedules (earlier upshifts and later downshifts). This is possible by adjusting the throttle angle to achieve the same wheel torque during shifts, and by calculating this desired torque, the system prevents engine lugging (low RPM and low manifold vacuum) while still delivering the performance and torque requested by the driver. It also enables many fuel economy/emission improvement technologies such as variable camshaft timing (VCT) (deliver same torque during transitions).

Torque based ETC also results in less intrusive vehicle and engine speed limiting, along with smoother traction control.

Other benefits of ETC are: -

eliminate cruise control actuators

- eliminate idle air control (IAC) valve

- better airflow range

- packaging (no cable)

- more responsive powertrain at altitude and improved shift quality

The ETC system illuminates a powertrain malfunction indicator (wrench) on the instrument cluster when a concern is present. Concerns are accompanied by diagnostic trouble codes (DTCs) and may also illuminate the malfunction indicator lamp (MIL).

Electronic Throttle Body (ETB)

The ETB has the following characteristics: -

The throttle actuator control (TAC) motor is a DC motor controlled by the PCM (requires 2-wires).

- There are 2 designs: parallel and in-line. The parallel design has the motor under the bore parallel to the plate shaft. The motor housing is integrated into the main housing. The in-line design has a separate motor housing.

- An internal spring is used in both designs to return the throttle plate to a default position. The default position is typically a throttle angle of 7 to 8 degrees from the hard stop angle.

- The closed throttle plate hard stop is used to prevent the throttle from binding in the bore (approximately 0.75 degree). This hard stop setting is not adjustable and is set to result in less airflow than the minimum engine airflow required at idle.

- The required idle airflow is provided by the plate angle in the throttle body assembly. This plate angle controls idle, idle quality, and eliminates the need for an IAC valve.

- There is 1 reference voltage and 1 signal return circuit between the PCM and the ETB. The reference voltage circuit and the signal return circuit is shared with the reference voltage circuits and signal return circuits used by the APP sensor. There are also 2 TP signal circuits for redundancy. The redundant TP signals are required for increased monitoring reasons. The first TP signal (TP1) has a negative slope (increasing angle, decreasing voltage) and the second signal (TP2) has a positive slope (increasing angle, increasing voltage). The TP2 signal reaches a limit of approximately 4.5 volts at approximately 45 degrees of throttle angle.

Accelerator Pedal Position (APP) Sensor

Depending on the application either a 2-track or 3-track APP sensor is used.

Electronic Throttle Control (ETC) System Strategy

ETC System With A 3-Track APP Sensor Failure Mode And Effects Management (Part 1)

ETC System with a 3-Track APP Sensor Failure Mode and Effects Management:

Effect	Failure Mode [a]
RPM Guard with Pedal Follower	In this mode, torque control is disabled due to the loss of a critical sensor or PCM concern. The throttle is controlled in pedal-follower mode as a function of the pedal position sensor input only. A maximum allowed RPM is determined based on the position of the accelerator pedal (RPM Guard). If the actual RPM exceeds this limit, spark and fuel are used to bring the RPM below the limit. The powertrain malfunction indicator (wrench) and the MIL illuminate in this mode and a DTC for an ETC-related component is set. EGR, VCT, and IMRC outputs are set to default values.
RPM Guard with Default Throttle	In this mode, the throttle plate control is disabled due to the loss of throttle position, the throttle plate position controller, or other major electronic throttle body concern. Depending on the concern detected, the throttle plate is either commanded to the default (limp home) position or the motor is disabled and the spring returns the throttle plate to the default (limp home) position. A maximum allowed RPM is determined based on the position of the accelerator pedal (RPM Guard). If the actual RPM exceeds this limit, spark and fuel are used to bring the RPM below the limit. The powertrain malfunction indicator (wrench) and the MIL illuminate in this mode and a DTC P2110 is set. EGR, VCT, and IMRC outputs are set to default values.
RPM Guard with High Forced Idle	This mode is caused by the loss of 2 or 3 pedal position sensor inputs due to sensor, wiring, or PCM concerns. The system is unable to determine driver demand, and the throttle is controlled to a fixed high idle airflow. There is no response to the driver input. The maximum allowed RPM is a fixed value (RPM Guard). If the actual RPM exceeds this limit, spark and fuel are used to bring the RPM below the limit. The powertrain malfunction indicator (wrench) and the MIL illuminate in this mode and a DTC P2104 is set. EGR, VCT, and IMRC outputs are set to default values.
Shutdown	If a significant processor concern is detected, the monitor forces vehicle shutdown by disabling all fuel injectors. The powertrain malfunction indicator (wrench) illuminates in this mode and a DTC P2105 is set.

a ETC illuminates or displays a message on the message center immediately; MIL illuminates after 2 driving cycles

ETC System With A 3-Track APP Sensor Failure Mode And Effects Management (Part 2)

ETC System with a 2-Track APP Sensor Failure Mode and Effects Management:

Effect	Failure Mode
No Effect on Driveability	A loss of redundancy or loss of a non-critical input could result in a concern that does not affect driveability. The powertrain malfunction indicator (wrench) and the MIL do not illuminate. However, speed control and power take off (PTO) may be disabled. A DTC is set to indicate the component or circuit with the concern.
Delayed APP Sensor Response with Brake Override	This mode is caused by the loss of 1 APP sensor input due to sensor, wiring, or PCM concerns. The system is unable to verify the APP sensor input and driver demand. The throttle plate response to the APP sensor input is delayed as the accelerator pedal is applied. The engine returns to idle RPM whenever the brake pedal is applied. The powertrain malfunction indicator (wrench) illuminates, but the MIL does not illuminate in this mode. An APP sensor related DTC is set.
Time-Based Driver Demand with Brake Override	This mode is caused by the loss of one brake pedal position (BPP) and one APP sensor input or both APP sensor inputs due to sensor, wiring, or PCM concerns. The system is unable to determine driver demand. There is no response when the accelerator pedal is applied. The engine returns to idle RPM whenever the brake pedal is applied. When the brake pedal is released, the PCM slowly increases the APP signal to a fixed value. The powertrain malfunction indicator (wrench) illuminates, but the MIL does not illuminate in this mode. An APP or BPP sensor related DTC is set.
RPM Guard with Pedal Follower	In this mode, torque control is disabled due to the loss of a critical sensor or PCM concern. The throttle is controlled in pedal-follower mode as a function of the APP sensor input only. A maximum allowed RPM is determined based on the position of the accelerator pedal (RPM Guard). If the actual RPM exceeds this limit, spark and fuel are used to bring the RPM below the limit. The powertrain malfunction indicator (wrench) and the MIL illuminate in this mode and a DTC for an ETC-related component is set. EGR, VCT, and IMRC outputs are set to default values and speed control is disabled.
RPM Guard with Default Throttle	In this mode, the throttle plate control is disabled due to the loss of both TP sensor inputs, loss of throttle plate control, stuck throttle plate, significant processor concerns, or other major electronic throttle body concern. The spring returns the throttle plate to the default (limp home) position. A maximum allowed RPM is determined based on the position of the accelerator pedal (RPM Guard). If the actual RPM exceeds this limit, spark and fuel are used to bring the RPM below the limit. The powertrain malfunction indicator (wrench) and the MIL illuminate in this mode and a DTC for an ETC-related component is set. EGR, VCT, and IMRC outputs are set to default values and speed control is disabled.

Electronic Throttle Monitor Operation:

DTCs [a]	
P060X, P061X	PCM processor concern (MIL, powertrain malfunction indicator [wrench])
P2104 (ETC system with a 3-track APP sensor)	ETC FMEM forced idle, 2 or 3 pedal sensor concerns (MIL, powertrain malfunction indicator [wrench])
P2105 (ETC system with a 3-track APP sensor)	ETC FMEM forced engine shutdown; PCM concern (MIL, powertrain malfunction indicator [wrench])
P2110 (ETC system with a 3-track APP sensor)	ETC FMEM forced limited RPM; Concern with both TP sensors; throttle plate position control concern (MIL, powertrain malfunction indicator [wrench])
U0300	ETC software version mismatch between processors internal to the PCM (non-MIL, powertrain malfunction indicator [wrench])

a Monitor execution is continuous. Monitor false detection duration is less than 1 second to register a concern.

ETC System With A 2-Track APP Sensor Failure Mode And Effects Management

Electronic Throttle Monitor Operation

Accelerator Pedal Position (APP) Sensor Check:

DTCs[a]	
P1575 (ETC system with a 2-track APP sensor)	APP sensor out of self-test range
P2122, P2123, P2127, P2128, P2132, P2133	APP sensor circuit continuity test (powertrain malfunction indicator [wrench], non-MIL)
P2121, P2126, P2131 (ETC system with a 3-track APP sensor)	APP range/performance (powertrain malfunction indicator [wrench], non-MIL)
P2138 (ETC system with a 2-track APP sensor)	APP to APP signal correlation (powertrain malfunction indicator [wrench], non-MIL)

a Correlation and range/performance - sensor disagreement between processors internal to the PCM. Monitor execution is continuous. Monitor false detection duration is less than 1 second to register a concern. Refer to Powertrain DTC Charts and Descriptions, Diagnostic Trouble Code (DTC) Charts and Descriptions for additional DTC information.

Throttle Position (TP) Sensor Check:

DTCs [a]	
P0122, P0123, P0222, P0223	TP circuit continuity test (MIL, powertrain malfunction indicator [wrench])
P0121, P0221 (ETC system with a 3-track APP sensor)	TP range/performance (non-MIL)
P1124 (ETC system with a 2-track APP sensor)	TP sensor out of self-test range
P2135	TP to TP sensor correlation test (powertrain malfunction indicator [wrench], non-MIL)

a Correlation and range/performance - sensor disagreement between processors internal to the PCM, TP inconsistent with requested throttle plate position. Monitor execution is continuous. Monitor false detection duration is less than 1 second to register a concern. Refer to Powertrain DTC Charts and Descriptions, Diagnostic Trouble Code (DTC) Charts and Descriptions for additional DTC information.

Electronic TAC Operation Check:

DTCs [a]	
P115E	Throttle actuator airflow trim at maximum limit (non-MIL)
P2072 (ETC system with a 3-track APP sensor)	Throttle body ice blockage (non-MIL)
P2100 (ETC system with a 3-track APP sensor)	Throttle actuator circuit open, short to power, short to ground (MIL)
P2101	Throttle actuator range/performance test (MIL)
P2107	Processor and TAC motor circuit test (MIL)
P2111	Throttle actuator system stuck open (MIL)
P2112	Throttle actuator system stuck closed (MIL)

a Note: For all DTCs, in addition to the MIL, the powertrain malfunction indicator (wrench) is on for the concern that caused the FMEM action. Monitor execution is continuous. Monitor false detection duration is less than 5 seconds to register a concern.

The torque based ETC strategy was developed to improve fuel economy and to accommodate variable camshaft timing (VCT). This is possible by not coupling the throttle angle to the driver pedal position. Uncoupling the throttle angle (produce engine torque) from the pedal position (driver

demand) allows the powertrain control strategy to optimize fuel control and transmission shift schedules while delivering the requested wheel torque.

The ETC monitor system is distributed across 2 processors within the PCM: the main powertrain control processor unit (CPU) and a separate monitoring processor. The primary monitoring function is carried out by the independent plausibility check (IPC) software, which resides on the main processor. It is responsible for determining the driver-demanded torque and comparing it to an estimate of the actual torque delivered. If the generated torque exceeds driver demand by a specified amount, appropriate corrective action is taken.

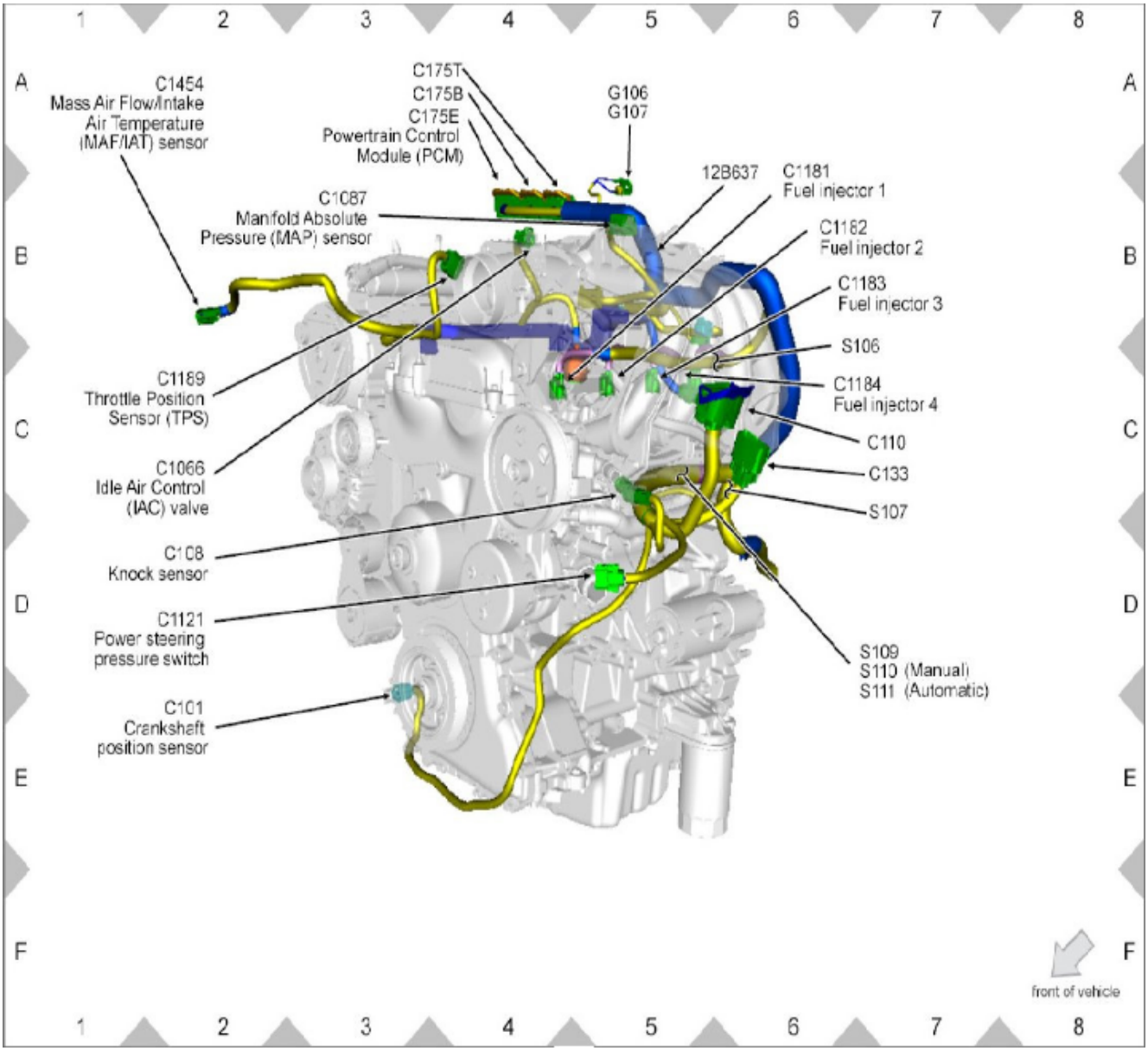
APP and TP Sensor Inputs

Accelerator Pedal Position (APP) Sensor Check

Throttle Position (TP) Sensor Check

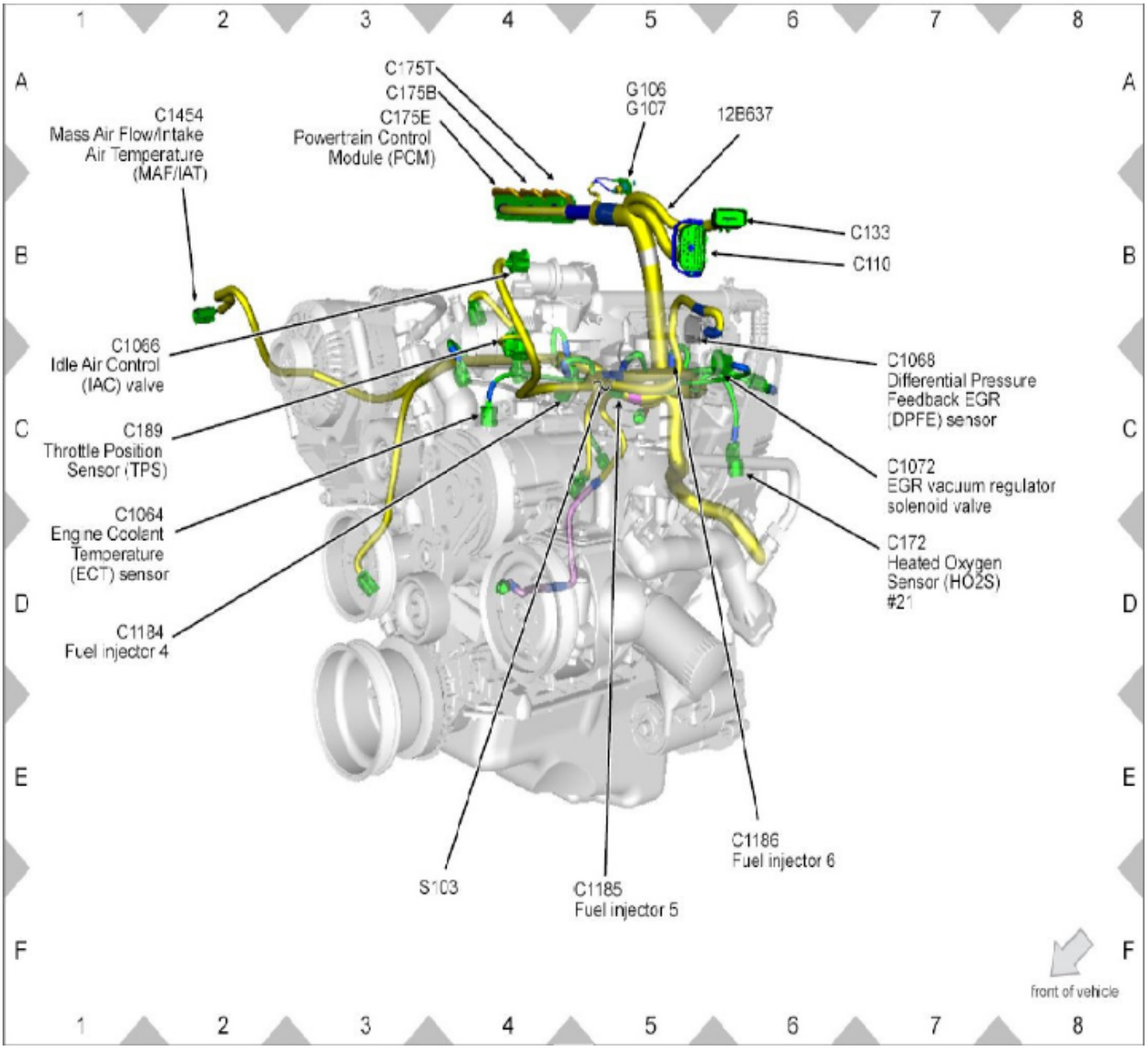
Electronic Throttle Actuator Control (TAC) Output

Electronic TAC Operation Check

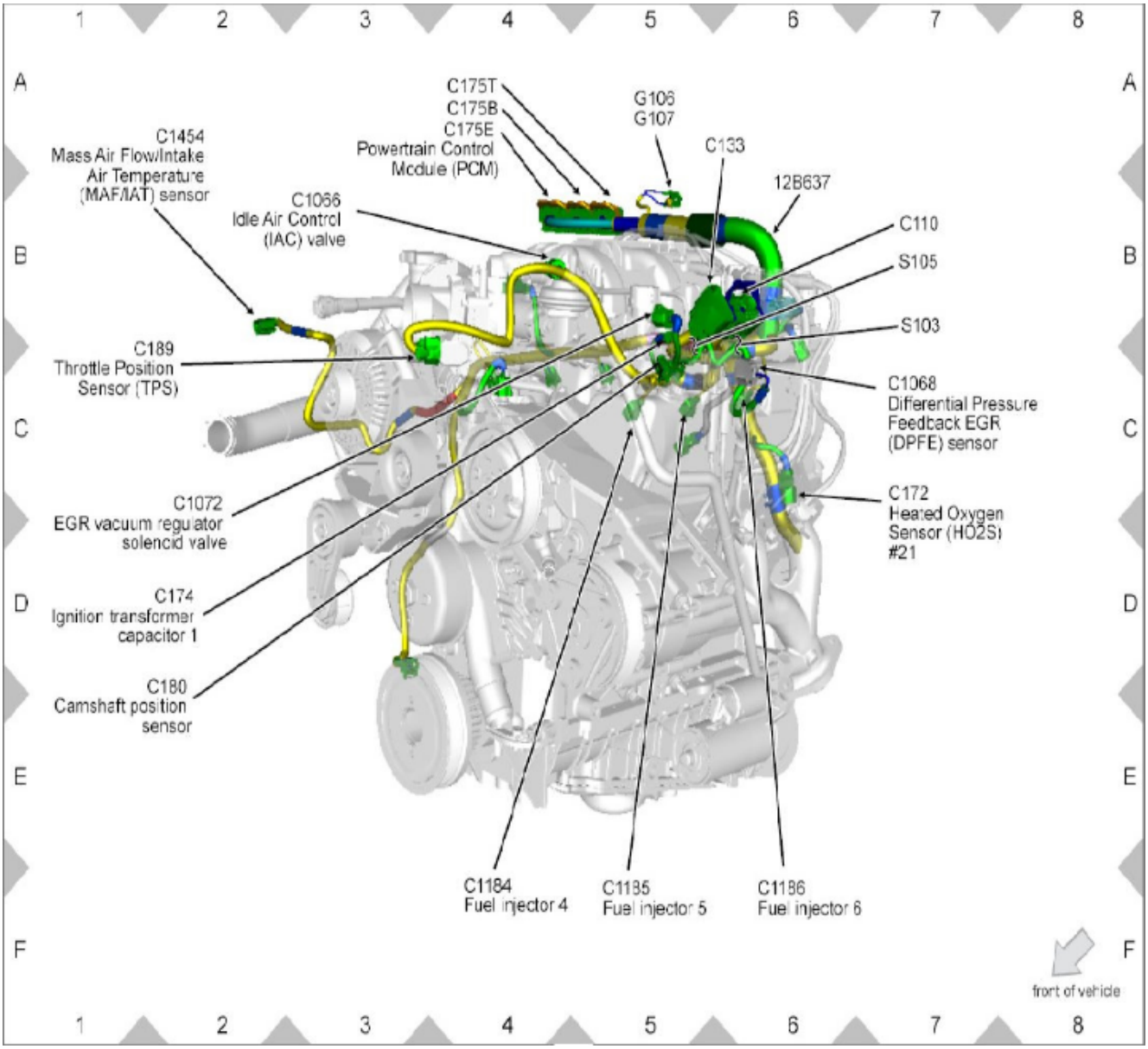


Engine Control Module: Locations

View 151-3


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
12B637
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT)
C133
C110
C1066
Idle Air Control (IAC) valve
C189
Throttle Position Sensor (TPS)
C1064
Engine Coolant Temperature (ECT) sensor
C1184
Fuel injector 4
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
S103
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

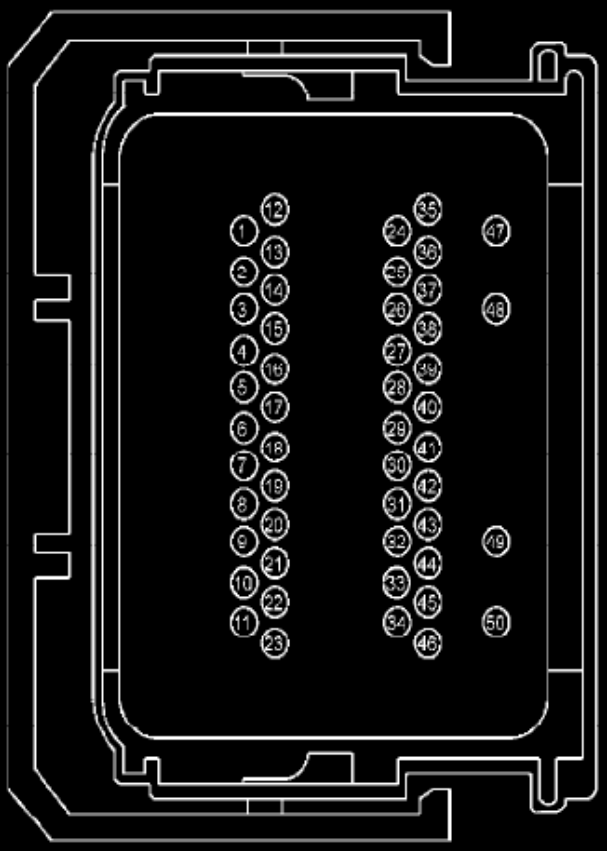
View 151-5


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
C133
12B637
C110
S105
S103
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor
C1066
Idle Air Control (IAC) valve
C189
Throttle Position Sensor (TPS)
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
C174
Ignition transformer capacitor 1
C180
Camshaft position sensor
C1184
Fuel injector 4
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-7

Connector: C175B

Description:	Harness:	Base Part #:
POWERTRAIN CONTROL MODULE (PCM)	12B637	12A650



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VCM05 (VT-OG)	20	CTRL MOD. - VEHICLE SPEED OUTPUT (VSOUT)	
2	CDC12 (YE)	20	CTRL MOD. - POWERTRAIN # STARTER MOTOR CONTROL (SMC)	
3	VE922 (VT-GN)	20	TRANSDUCER - FUEL TANK PRESSURE (FTPT)	
4	*	*	not used	
5	*	*	not used	
6	*	*	not used	
7	CBP21 (BU-GY)	20	FUSE - 21 OR CIRCUIT BREAKER	M/T
7	CET40 (GN-OG)	20	SWITCH - TRANSMISSION RANGE # PARK/NEUTRAL (TRSW-PN)	A/T
8	CCB15 (BN-GN)	20	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL CLOSED	
9	*	*	not used	
10	GD108 (BK-VT)	18	GROUND - CHASSIS/BATTERY	
11	VDB04 (WH-BU)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED HIGH	
12	VE225 (YE-OG)	20	CTRL MOD. - POWERTRAIN # FUEL PUMP MODULE COMMAND (FPC)	
13	CE114 (GN-BU)	20	CTRL MOD. - POWERTRAIN # CANISTER VENT SOLENOID (CANVNT)	
14	CH302 (WH-BN)	20	CTRL MOD. - POWERTRAIN # A/C CLUTCH CONTROL RELAY/WOT AC CUTOFF (ACCR)	
15	CH425 (GN-BU)	20	SWITCH - AC HEAD PRESSURE (ACPSW)	
16	*	*	not used	
17	*	*	not used	
18	*	*	not used	
19	*	*	not used	
20	*	*	not used	
21	VE518 (BN-WH)	18	MONITOR - FUEL PUMP (FPM)	
22	*	*	not used	
23	VDB05 (WH)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED LOW	
24	*	*	not used	
25	*	*	not used	
26	*	*	not used	
27	*	*	not used	
28	*	*	not used	
29	CET34 (BN-GN)	20	SWITCH - TRANSMISSION CONTROL/OVERDRIVE CANCEL (TCS)	
30	*	*	not used	
31	*	*	not used	
32	*	*	not used	
33	CDC36	20	SWITCH - START INTERLOCK	M/T

Engine Control Module: Diagrams

C175B (Part 1)

	(GN-BN)		CLUTCH PEDAL	
34	CCS09 (GN)	20	SWITCH - POWER STEERING PRESSURE (PSPS)	
35	CBB39 (VT-WH)	18	FUSE - 39 OR CIRCUIT BREAKER	
36	CBB39 (VT-WH)	18	FUSE - 39 OR CIRCUIT BREAKER	
37	*	*	not used	
38	*	*	not used	
39	CE904 (GN-VT)	20	SWITCH - CLUTCH PEDAL POSITION # TOP OF TRAVEL (CPP-TT)	M/T
40	LE424 (YE-GN)	20	CTRL MOD. - POWERTRAIN # VOLTAGE REFERENCE COWL (C-VREV)	
41	RE407 (YE-VT)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN COWL (C-SIGRTN) (SIGRTN C)	
42	*	*	not used	
43	*	*	not used	
44	CUB08 (BN)	20	CONNECTOR - DIAGNOSTIC # FLASH EEPROM POWER SUPPLY (FEPS)	
45	SBB21 (GY-RD)	20	FUSE - 21 OR CIRCUIT BREAKER	
46	*	*	not used	
47	GD108 (BK-VT)	18	GROUND - CHASSIS/BATTERY	
48	GD108 (BK-VT)	18	GROUND - CHASSIS/BATTERY	
49	GD108 (BK-VT)	18	GROUND - CHASSIS/BATTERY	
50	GD108 (BK-VT)	18	GROUND - CHASSIS/BATTERY	

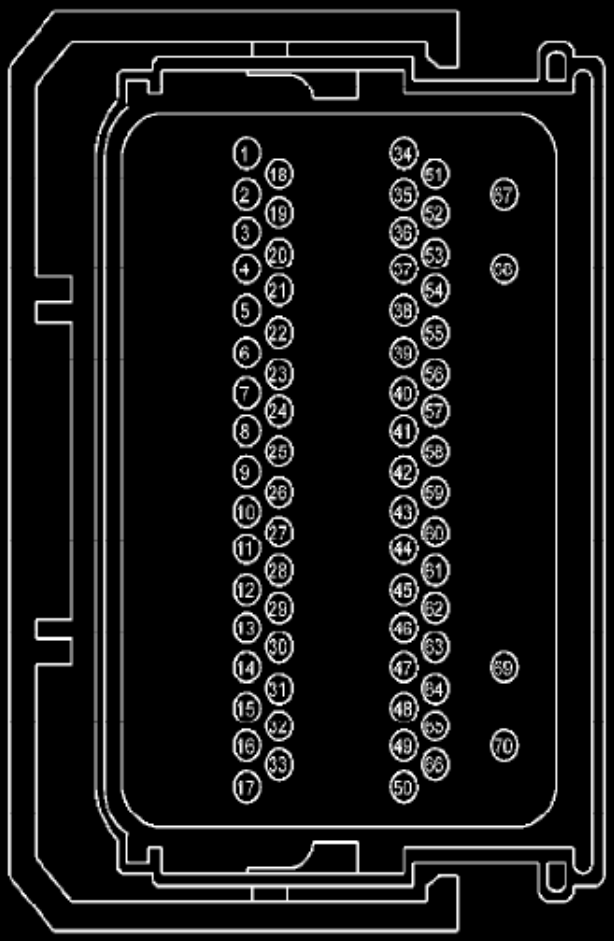
C175B (Part 2)

Connector: C175E

Description: POWERTRAIN CONTROL MODULE (PCM)

Harness: 12B637

Base Part #: 12A650



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	*	*	not used	
3	CE328 (YE-VT)	18	CTRL MOD. - POWERTRAIN # POS. CRANKCASE VENTIL. FITTING HEATER CONTROL (PCVFHC)	3.0L/4.0L
4	*	*	not used	
5	*	*	not used	
6	CE132 (BN-YE)	18	CTRL MOD. - POWERTRAIN # ELECTRIC VAPOR MANAGEMENT VALVE (EVMV)	
7	VH101 (WH-VT)	20	CTRL MOD. - CLIMATE # BLOWER MOTOR CONTROL	2.3L
8	CE101 (WH-VT)	18	CTRL MOD. - POWERTRAIN # EXHAUST GAS RECIRCUL. MOTOR (STEPPER CONTR. 1) (EGRMC) (+)	2.3L
9	*	*	not used	
10	*	*	not used	
11	*	*	not used	
12	CE125 (WH)	18	CTRL MOD. - POWERTRAIN # DISTRIBUTORLESS IGNITION SYSTEM COIL DRIVER C (DIS)	2.3L
12	CE123 (YE-GY)	18	CTRL MOD. POWERTRAIN # DISTRIBUTORLESS IGNITION SYSTEM COIL DRIVER A (DIS)	3.0L/4.0L
13	CE102 (YE-BU)	18	CTRL MOD. - POWERTRAIN # EXHAUST GAS RECIRCUL. MOTOR (STEPPER CONTR. 2) (EGRMC) (-)	2.3L
14	*	*	not used	
15	*	*	not used	
16	CE125 (WH)	18	CTRL MOD. - POWERTRAIN # DISTRIBUTORLESS IGNITION SYSTEM COIL DRIVER C (DIS)	3.0L/4.0L
17	CE124 (BU-BN)	18	CTRL MOD. - POWERTRAIN # DISTRIBUTORLESS IGNITION SYSTEM COIL DRIVER B (DIS)	
18	VE716 (YE)	20	SENSOR - ENGINE COOLANT TEMPERATURE (ECT)	3.0L/4.0L
19	*	*	not used	
20	*	*	not used	
21	VE713 (GN-OG)	20	SENSOR - DELTA PRESSURE FEEDBACK EGR (DPFE)	3.0L/4.0L
22	VE740 (VT-GY)	20	SENSOR - INTAKE AIR TEMPERATURE (IAT)	
23	*	*	not used	
24	*	*	not used	
25	VE807 (YE-VT)	20	SENSOR - MASS AIR FLOW LH BANK OR 1ST BANK OR UNIQUE (MAF)	
26	RF320 (BU)	20	CTRL MOD. - POWERTRAIN # MASS AIR FLOW SEN. LH BANK OR 1ST BANK (MAFRTN)	
27	*	*	not used	
28	VE735 (VT-GN)	18	SENSOR - HEATED OXYGEN PRE CAT. 1ST OR UNIQUE (HO2S11)	

C175E (Part 1)

29	VE737 (WH-BU)	18	SENSOR - HEATED OXYGEN PRE CAT. 2ND (HO2S21)	3.0L/4.0L
30	*	*	not used	
31	*	*	not used	
32	*	*	not used	
33	CE301 (GY-OG)	20	CTRL MOD. - POWERTRAIN # IDLE AIR CONTROL VALVE (IAC)	
34	*	*	not used	
35	CE206 (GY-TE)	20	CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 2 (INJ)	
36	CE208 (YE-OG)	20	CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 4 (INJ)	
37	CE210 (GN-WH)	20	CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 6 (INJ)	3.0L/4.0L
38	*	*	not used	
39	CE103 (BU-BN)	18	CTRL MOD. - POWERTRAIN # EXHAUST GAS RECIRCUL MOTOR (STEPPER CONTR. 3) (EGRMC)	2.3L
40	*	*	not used	
41	CE116 (VT-BN)	20	CTRL MOD. POWERTRAIN # CYLINDER HEAD TEMPERATURE INDICATOR LIGHT (CHTIL)	2.3L
42	*	*	not used	
43	*	*	not used	
44	*	*	not used	
45	VE706 (BN-BU)	18	SENSOR - CAMSHAFT POSITION BANK 1 IN+EX/ IN (CMP1) [CID-H] (CID1)	
46	RE135 (GN-BN)	18	CTRL MOD. - POWERTRAIN # CRANKSHAFT POSITION SENSOR (CKPN)	
47	VE711 (YE-VT)	18	SENSOR - CRANKSHAFT POSITION (CKPP)	
48	RE323 (WH-BN)	20	CTRL MOD. - POWERTRAIN # KNOCK SENSOR 1ST OR UNIQUE (KS1N) [KSL1-]	
49	VE801 (VT-OG)	20	SENSOR - KNOCK 1ST OR UNIQUE (KS1P) [KSL1+]	
50	*	*	not used	
51	*	*	not used	
52	CE205 (GN-BU)	20	CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 1 (INJ)	
53	CE207 (VT-GY)	20	CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 3 (INJ)	
54	CE209 (BN)	20	CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 5 (INJ)	3.0L/4.0L
55	*	*	not used	
56	CE104 (GN)	18	CTRL MOD. - POWERTRAIN # EXHAUST GAS RECIRCUL MOTOR (STEPPER CONTR. 4) (EGRMC)	2.3L
57	LE423 (GN-VT)	20	CTRL MOD. - POWERTRAIN # VOLTAGE REFERENCE ENGINE (VREF) (E-VREV)	
58	RE405 (GN-WH)	18	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	
59	*	*	not used	
60	*	*	not used	

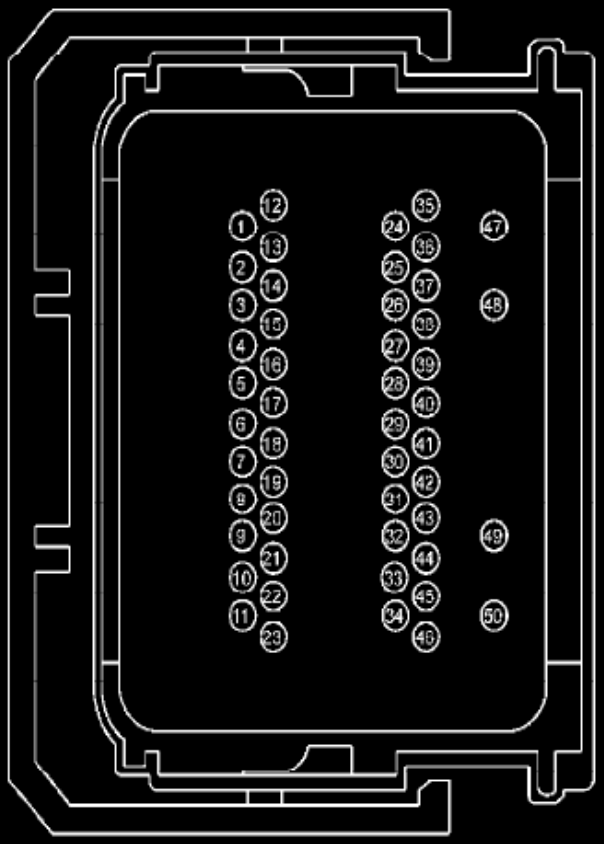
C175E (Part 2)

61	VE819 (GN-VT)	20	SENSOR - THROTTLE POSITION # POSITIVE SLOPE (TP2-PS)	
62	VE803 (BU-GN)	20	SENSOR - MANIFOLD ABSOLUTE PRESSURE (MAP)	2.3L
63	CE133 (VT WH)	20	CTRL MOD. - POWERTRAIN # ELECTRONIC VACUUM REGULATOR (EVR)	3.0L/4.0L
64	*	*	not used	
65	*	*	not used	
66	*	*	not used	
67	*	*	not used	
68	*	*	not used	
69	CE235 (GN-BN)	18	CTRL MOD. - POWERTRAIN # HEATER OXYGEN SEN. PRE CAT. 1ST OR UNIQUE (HTR11)	
70	CE236 (GY-VT)	18	CTRL MOD. - POWERTRAIN # HEATER OXYGEN SEN. PRE CAT. 2ND (HTR21)	3.0L/4.0L

C175E (Part 3)

Connector: C175T

Description:	Harness:	Base Part #:
POWERTRAIN CONTROL MODULE (PCM)	12B637	12A650



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	*	*	not used	
3	RET04 (YE-OG)	20	CTRL MOD. - POWERTRAIN # SENSOR OUTPUT SHAFT SPEED (OSS)	
4	VE739 (GY-YE)	20	SENSOR - INTERMEDIATE SHAFT SPEED SENSOR	A/T
5	*	*	not used	
6	*	*	not used	
7	*	*	not used	
8	*	*	not used	
9	*	*	not used	
10	*	*	not used	
11	VET27 (BN-YE)	20	CTRL MOD. - POWERTRAIN # SOLENOID PRESSURE CONTROL 2 (PC2) [EPC] [VFS]	A/T
12	*	*	not used	
13	*	*	not used	
14	*	*	not used	
15	VET33 (WH-OG)	20	SENSOR - TURBINE/TRANSMISSION SHAFT SPEED (TSS)	A/T
16	VET129 (VT-WH)	20	SENSOR - TRANSMISSION RANGE # 1 (TR1)	A/T
17	VET30 (YE)	20	SENSOR - TRANSMISSION RANGE # 2 (TR2)	A/T
18	*	*	not used	
19	*	*	not used	
20	*	*	not used	
21	*	*	not used	
22	*	*	not used	
23	*	*	not used	
24	VE731 (YE-GN)	18	SENSOR - HEATED OXYGEN POST CAT. 1ST OR UNIQUE (HO2S12)	
25	VE733 (WH)	18	SENSOR - HEATED OXYGEN POST CAT. 2ND (HO2S22)	3.0L, 4.0L
26	*	*	not used	
27	VET28 (GY-VT)	20	SENSOR - TRANSMISSION RANGE # (TR-3A)	A/T
28	VET31 (BU-OG)	20	SENSOR - TRANSMISSION RANGE # 4 (TR4)	A/T
29	CET06 (GN-BN)	20	SENSOR - TRANSMISSION FLUID TEMPERATURE (TFT)	A/T
30	*	*	not used	
31	*	*	not used	
32	*	*	not used	
33	*	*	not used	
34	*	*	not used	
35	*	*	not used	
36	*	*	not used	
37	*	*	not used	
38	*	*	not used	
39	*	*	not used	
40	*	*	not used	

C175T (Part 1)

41	RE406 (GY-VT)	18	CTRL MOD. - POWERTRAIN # SIGNAL RETURN TRANSMISSION (T-SIGRTN) (SIGRTN-B)	
42	CET05 (BU-GN)	20	CTRL MOD. - POWERTRAIN # SOLENOID SHIFT CONTROL LOW-SIDE A (SSA)	A/T
43	CET18 (GY-YE)	20	CTRL MOD. - POWERTRAIN # SOLENOID SHIFT CONTROL LOW-SIDE B (SSB)	A/T
44	CET07 (GY-OG)	20	CTRL MOD. - POWERTRAIN # SOLENOID SHIFT CONTROL LOW-SIDE C (SSC)	A/T
45	CET44 (BU-BN)	20	CTRL MOD. - POWERTRAIN # SOLENOID SHIFT CONTROL LOW-SIDE D (SSD)	A/T
46	CET19 (VT GY)	20	CTRL MOD. - POWERTRAIN # TORQUE CONVERTER CLUTCH HIGH IMPEDENCE (TCCH)	A/T
47	CE233 (WH-OG)	18	CTRL MOD. - POWERTRAIN # HEATER OXYGEN SEN. POST CAT. 1ST OR UNIQUE (HTR12)	
48	CE234 (BU-WH)	18	CTRL MOD. - POWERTRAIN # HEATER OXYGEN SEN. POST CAT. 2ND (HTR22)	3.0L, 4.0L
49	*	*	not used	
50	*	*	not used	

C175T (Part 2)

Engine Control Module: Procedures

FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)

Description

The EEPROM is contained in an integrated circuit internal to the powertrain control module (PCM). The EEPROM contains the vehicle strategy including calibration information specific to the vehicle, and is capable of being programmed or flashed repeatedly.

As part of the calibration there is an area referred to as the vehicle identification (VID) block. The VID block is programmed when installing a new PCM as described under Programming the VID Block for a Replacement PCM. Failure to carry out this procedure may generate DTCs PI635 or P1639. The VID block in an existing PCM can also be tailored to accommodate various hardware or parameter changes made to the vehicle since production. Failure to carry out this procedure properly may generate DTC P1635, Tire/Axle Ratio out of Acceptable Range. An incorrect tire/axle ratio is one of the main causes for DTC P1639. This is described under Making Changes to the VID Block and also under Making Changes to the PCM Calibration. The VID block contains many items used by the strategy for a variety of functions. Some of these items include the vehicle identification number (VIN), octane adjust, fuel octane, fuel type, vehicle speed limit, tire size, axle ratio, the presence of speed control, and 4-wheel drive electronic shift-on-the-fly (ESOF) versus manual shift-on-the-fly (MSOF). Only items applicable to the vehicle hardware and supported by the VID block is displayed on the scan tool.

When changing items in the VID block, the strategy places range limits on certain items such as tire and axle ratio. The number of times the VID block may be reconfigured is limited. When this limit is reached, the scan tool displays a message indicating the need to flash the PCM again to reset the VID block.

Programming can be carried out by a local Ford dealer or any non-Ford facility. Refer to the scan tool manufacturer's instruction manual for details.

Programming the VID Block for a Replacement PCM

A new PCM contains the latest strategy and calibration level for a particular vehicle. However, the VID block is blank and needs programming. There are 2 procedures available. The first is an automatic data transfer from the old PCM to the new PCM, and the second is manual data entry into the new PCM.

Automatic data transfer is carried out if the old PCM is capable of communicating. This is done by using a scan tool to retrieve data from the old PCM before removing it from the vehicle. The stored data can then be downloaded to the new PCM after it has been installed.

Carry out manual data entry if the old module is damaged or incapable of communicating. Remove and install a new PCM. Using a compatible scan tool, select and carry out the module/parameter programming, referring to the scan tool manufacturer's instruction manual. Make certain that all parameters are included. Failure to properly program tire size in revolutions per mile, (rev/mile equals 63,360 divided by the tire circumference in inches), axle ratio, 4x4/4x2, and/or MSOF/ESOF may result in DTCs P1635 and P1639. You may be instructed to contact the As-Built Data Center for the information needed to manually update the VID block with the scan tool. Contact the center only if the old PCM cannot be used or the data is corrupt. For Ford and Lincoln Mercury technicians, contact your National Hotline or the Professional Technician Society (PTS) website for As-Built data listed under the Service Publications Index. Non-Ford technicians use the Motorcraft(R) website at www.motorcraft.com. From the Motorcraft(R) homepage, use the search function to find the Module Programming or As-Built Data.

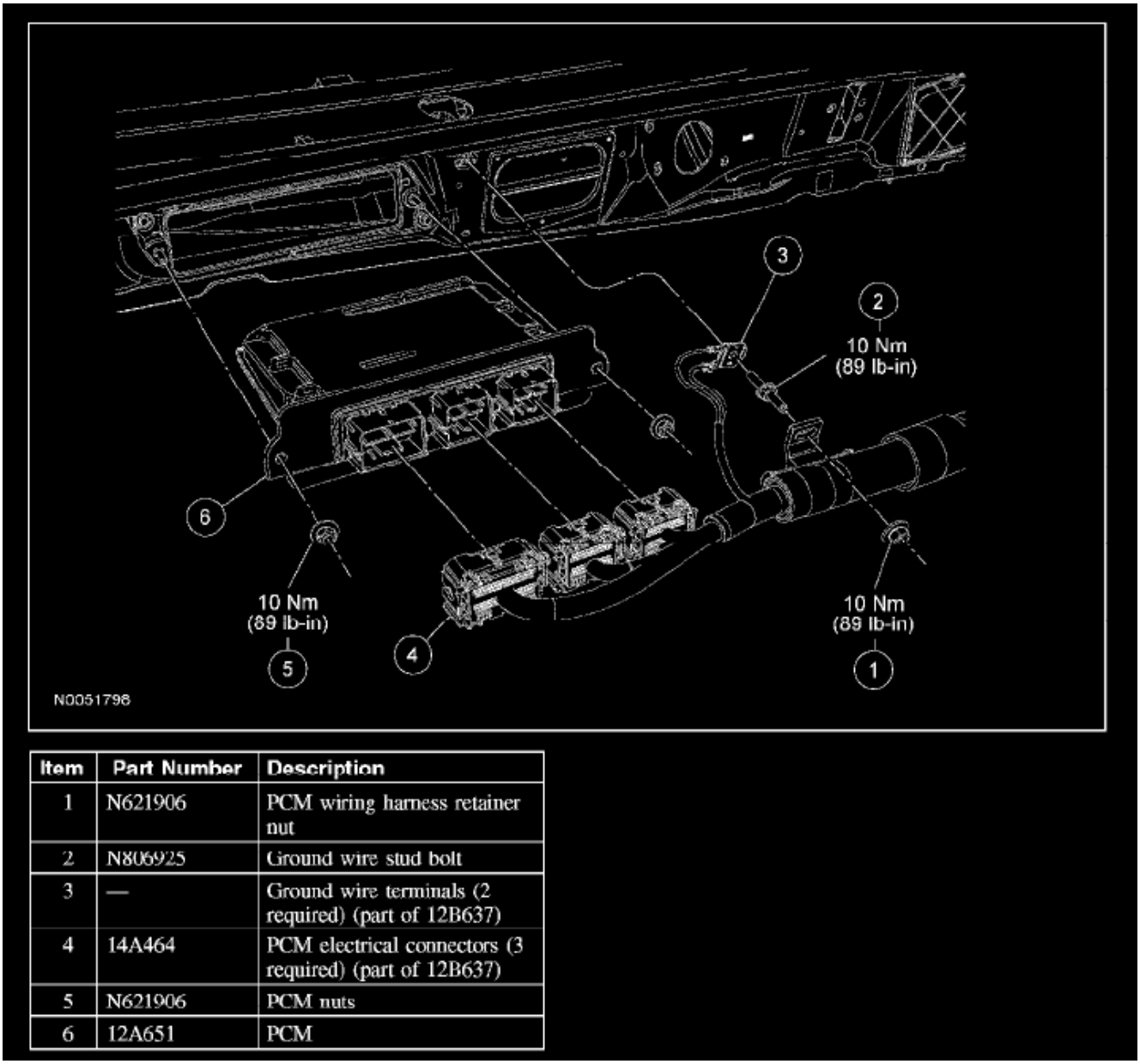
For Ford and Lincoln Mercury technicians, check the Programmable Module Installation link on the PTS website for quick Programmable Module data information by vehicle.

Making Changes to the VID Block

A PCM which is programmed may require changes to be made to certain VID information to accommodate the vehicle hardware. Refer to Module Reprogramming on the scan tool.

Making Changes to the PCM Calibration

At certain times, the entire EEPROM needs to be completely reprogrammed. This is due to changes made to the strategy or calibration after production, or the need to reset the VID block because it has reached its limit. Refer to Module Reprogramming on the scan tool.



Item	Part Number	Description
1	N621906	PCM wiring harness retainer nut
2	N806925	Ground wire stud bolt
3	—	Ground wire terminals (2 required) (part of 12B637)
4	14A464	PCM electrical connectors (3 required) (part of 12B637)
5	N621906	PCM nuts
6	12A651	PCM

Engine Control Module: Removal and Replacement

POWERTRAIN CONTROL MODULE (PCM)

Removal

1. Retrieve the module configuration. Carry out the module configuration retrieval steps of the Programmable Module Installation procedure. 2. Remove the PCM wiring harness retainer nut. 3. Remove the ground wire stud bolt. 4. Disconnect the 3 PCM electrical connectors. 5. Remove the 2 nuts and the PCM.

Installation

1. Install the PCM and the 2 nuts.

- Tighten to 10 Nm (89 lb-in).

2. Connect the 3 PCM electrical connectors. 3. Position the ground wire terminals and install the stud bolt.

- Tighten to 10 Nm (89 lb-in).

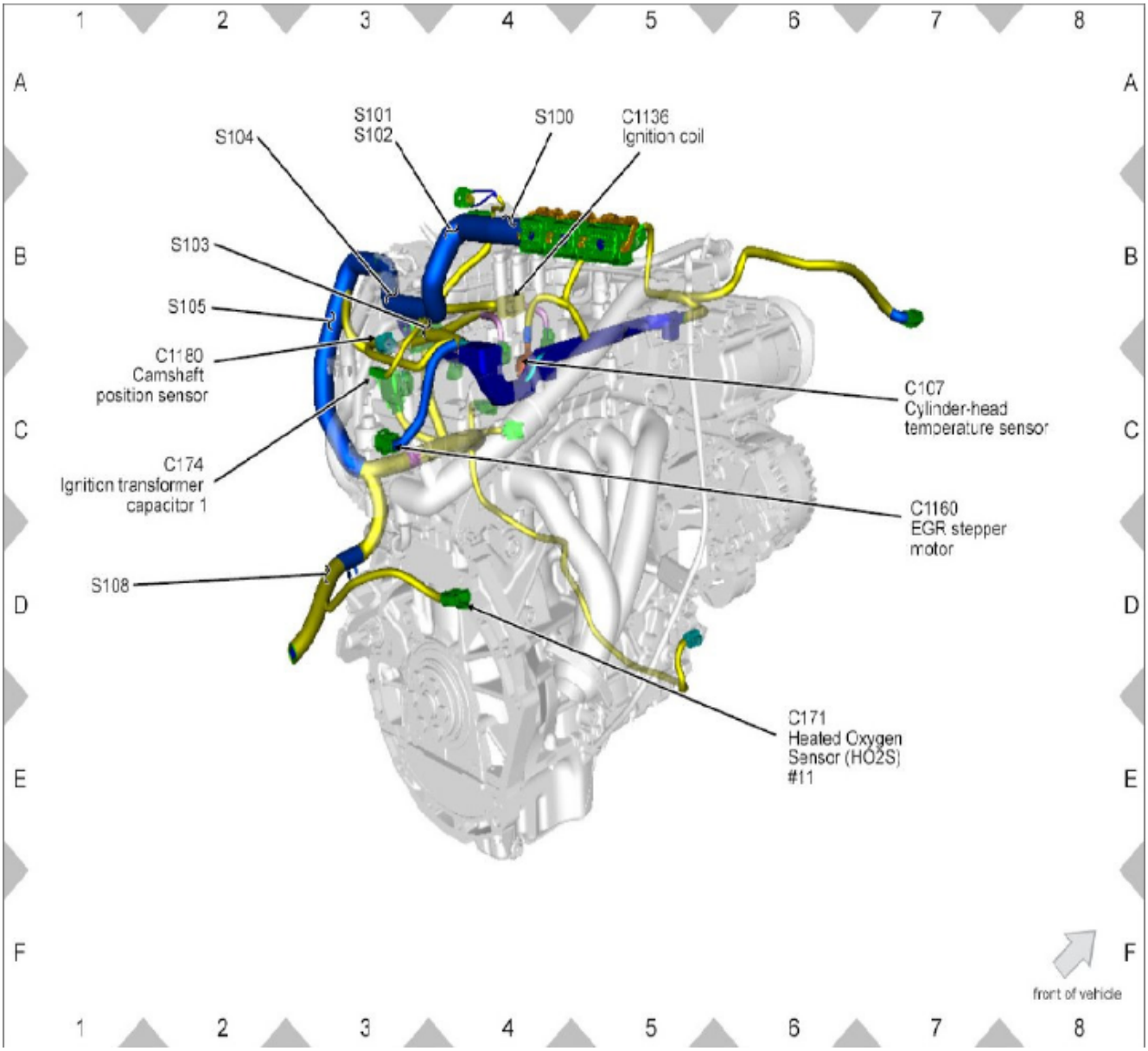
4. Install the PCM wiring harness retainer nut.

- Tighten to 10 Nm (89 lb-in).

5. NOTE: If a new PCM is installed, the parameters must be reset in both the PCM and the instrument cluster module or the vehicle will experience

a PATS no-start. This will occur even if the vehicle is not equipped with PATS. PATS vehicles and non-PATS vehicles have parameters in the instrument cluster module and the PCM and they both must be reset whenever a new PCM is installed.

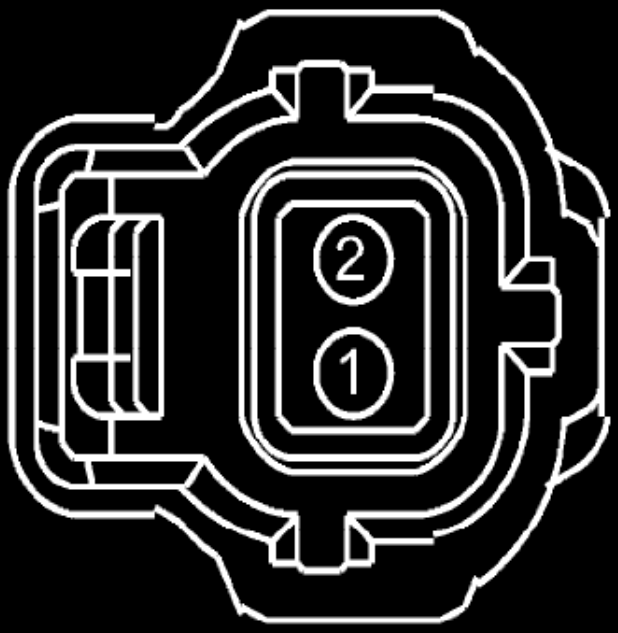
Restore the module configurations for the instrument cluster module and the PCM. Carry out the module configuration restore steps of the Programmable Module Installation procedure.


1
2
3
4
5
6
7
8
A
B
C
D
E
F
S104
S101
S102
S100
C1136
Ignition coil
S103
S105
C1180
Camshaft
position sensor
C174
Ignition transformer
capacitor 1
S108
C107
Cylinder-head
temperature sensor
C1160
EGR stepper
motor
C171
Heated Oxygen
Sensor (HO2S)
#11
front of vehicle

View 151-4

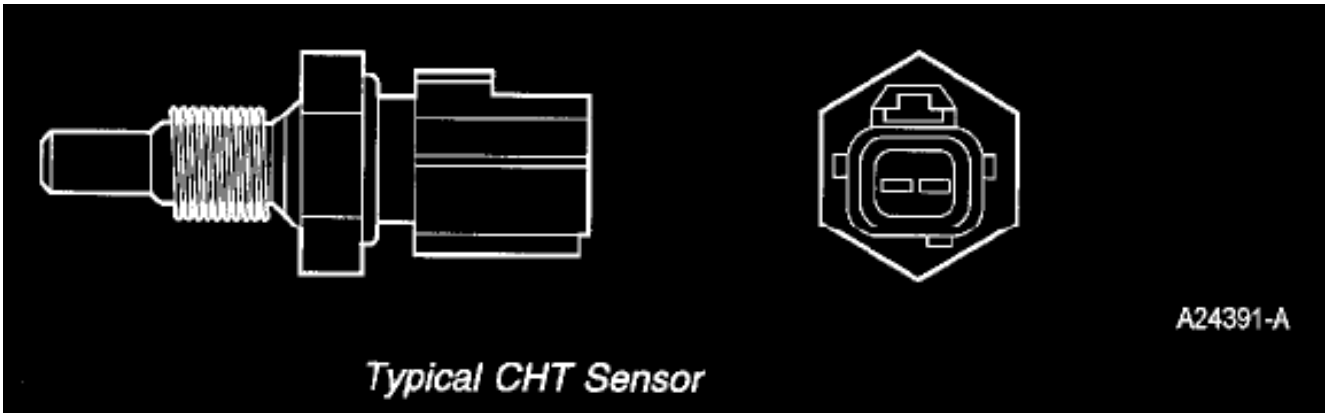
Connector: C107

Description:	Harness:	Base Part #:
CYLINDERHEAD TEMPERATURE SENSOR	12B637	6G004



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE116 (VT-BN)	20	CTRL MOD. - POWERTRAIN # CYLINDER HEAD TEMPERATURE INDICATOR LIGHT (CHTIL)	2.3L
2	RE405 (GN/WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	2.3L

C107



Typical CHT Sensor

Engine Temperature Sensor: Description and Operation

CYLINDER HEAD TEMPERATURE (CHT) SENSOR

Typical CHT Sensor

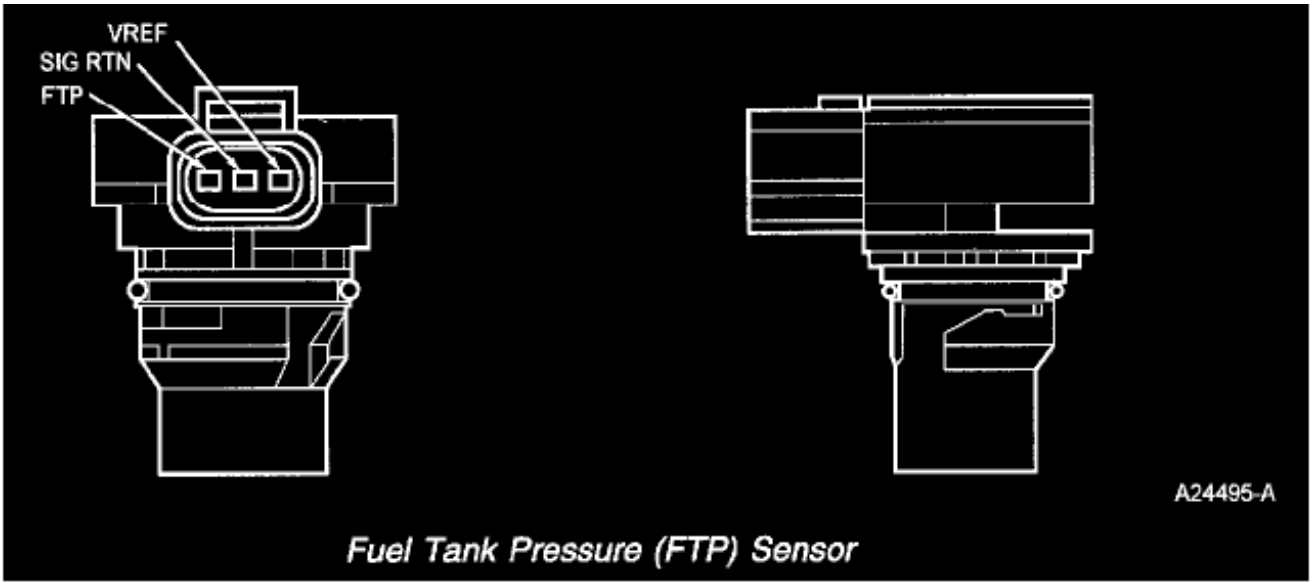
The CHT sensor is a thermistor device in which resistance changes with the temperature. The electrical resistance of a thermistor decreases as temperature increases, and the resistance increases as the temperature decreases. The varying resistance affects the voltage drop across the sensor terminals and provides electrical signals to the PCM corresponding to temperature.

The CHT sensor is installed in the cylinder head and measures the metal temperature. The CHT sensor can provide complete engine temperature information and can be used to infer coolant temperature. If the CHT sensor conveys an overheating condition to the PCM, the PCM initiates a fail-safe cooling strategy based on information from the CHT sensor. A cooling system concern such as low coolant or coolant loss could cause an overheating condition. As a result, damage to major engine components could occur. Using both the CHT sensor and fail-safe cooling strategy, the PCM prevents damage by allowing air cooling of the engine and limp home capability.

Fuel Level Sensor: Description and Operation

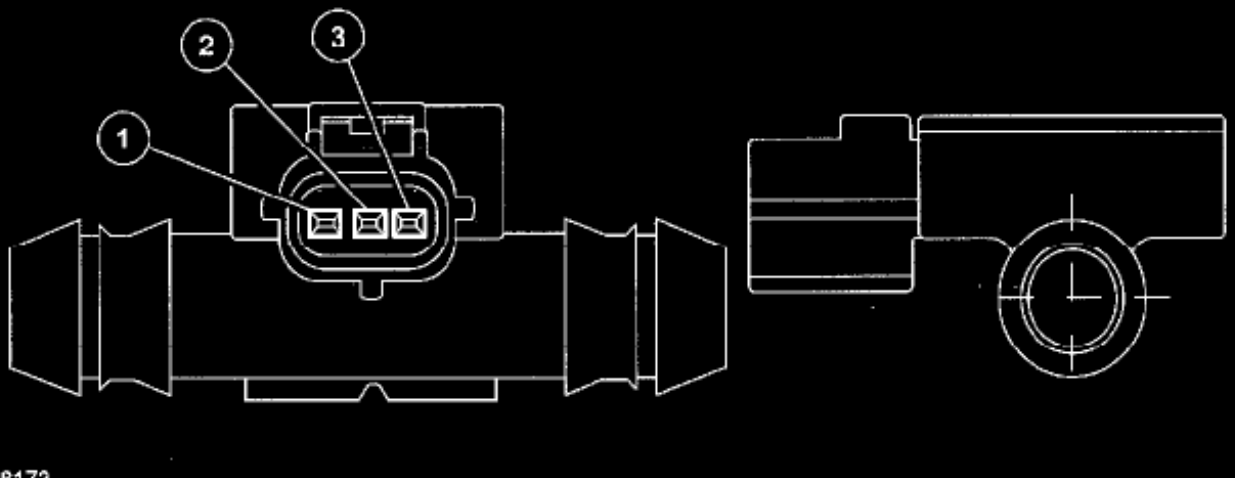
FUEL LEVEL INPUT (FLI)

The FLI is a communications network message. Most vehicle applications use a potentiometer type FLI sensor connected to a float in the FP module to determine fuel level.



Fuel Tank Pressure (FTP) Sensor

In-Line Fuel Tank Pressure (FTP) Sensor



N0048173

Item	Part Number	Description
1	—	VREF
2	—	SIG RTN
3	—	FTP

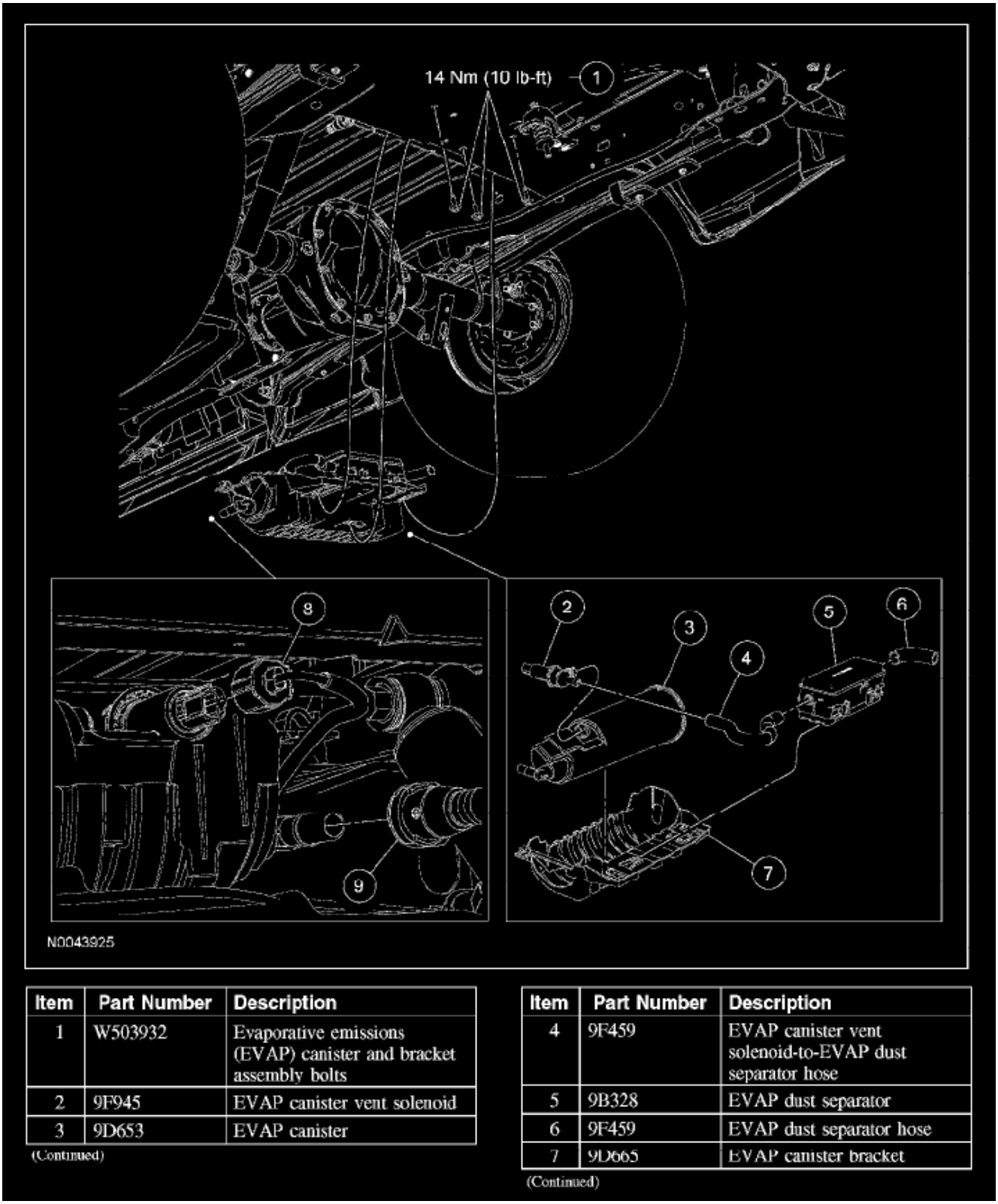
Fuel Tank Pressure Sensor: Description and Operation

FUEL TANK PRESSURE (FTP) SENSOR

Fuel Tank Pressure (FTP) Sensor

In-Line Fuel Tank Pressure (FTP) Sensor

The FTP sensor or in-line FTP sensor is used to measure the fuel tank pressure.



Item	Part Number	Description
1	W503932	Evaporative emissions (EVAP) canister and bracket assembly bolts
2	9F945	EVAP canister vent solenoid
3	9D653	EVAP canister

(Continued)

Item	Part Number	Description
4	9F459	EVAP canister vent solenoid-to-EVAP dust separator hose
5	9B328	EVAP dust separator
6	9F459	EVAP dust separator hose
7	9D665	EVAP canister bracket

(Continued)

Fuel Tank Pressure Sensor: Service and Repair

FUEL TANK PRESSURE SENSOR

Exploded View

Part 1

Item	Part Number	Description
8	—	EVAP canister vent solenoid electrical connector (part of 14405)
9	—	Rear fuel tank vapor tube and fuel tank pressure sensor assembly-to-EVAP canister quick connect coupling (part of 9G291)

Item	Part Number	Description
1	—	Rear fuel tank vapor tube and fuel tank pressure sensor assembly-to-evaporative emission (EVAP) canister quick connect coupling (part of 9G291)
2	9G291	Rear fuel tank vapor tube and fuel tank pressure sensor assembly
3	—	Fuel tank pressure sensor (part of 9G291)
4	—	Fuel tank pressure sensor electrical connector (part of 14405)
5	—	Front fuel tank vapor tube-to-rear fuel tank vapor tube and fuel tank pressure sensor assembly quick connect coupling (part of 9L291)

Part 2

Removal and Installation

WARNING:

- When working on or near the evaporative emission (EVAP) system, disconnect the battery ground cable from the battery. The EVAP system contains fuel vapor and condensed fuel vapor, so an electrical spark may cause a fire or explosion. Failure to follow this instruction may result in serious personal injury.

- Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

1. Remove the fuel tank. 2. Disconnect the fuel tank pressure sensor electrical connector.

3. NOTE: The rear fuel tank vapor tube and fuel tank pressure sensor are an assembly and must be serviced as an assembly.

Disconnect the rear fuel tank vapor tube and fuel tank pressure sensor assembly-to-evaporative emissions (EVAP) canister quick connect coupling.

4. Disconnect the front fuel tank vapor tube-to-rear fuel tank vapor tube and fuel tank pressure sensor assembly quick connect coupling. 5. Remove the rear fuel tank vapor tube and fuel tank pressure sensor assembly. 6. To install, reverse the removal procedure.

- Carry out the leak test. See: Emission Control Systems/Evaporative Emissions System/Testing and Inspection

- Carry out the evaporative emission repair verification drive cycle.

Connector: C1066
Description:
IDLE AIR CONTROL IAC) VALVE
Harness:
12B637
Base Part #:
9F715
Pin
Circuit
Gauge
Circuit Function
Qualifier
1
CBB43 (GY)
18
FUSE - 43 OR CIRCUIT BREAKER
2
CE301 (GY-OG)
20
CTRL MOD. - POWERTRAIN # IDLE AIR CONTROL VALVE (IAC)
2
1

C1066

Idle Speed/Throttle Actuator - Electronic: Description and Operation

IDLE AIR CONTROL (IAC) VALVE

NOTE: The IAC valve assembly is not adjustable and cannot be cleaned, also some IAC valves are normally open and others are normally closed. Some IAC valves require engine vacuum to operate.

The IAC valve assembly controls the engine idle speed and provides a dashpot function. The IAC valve assembly meters intake air around the throttle plate through a bypass within the IAC valve assembly and throttle body. The PCM determines the desired idle speed or bypass air and signals the IAC valve assembly through a specified duty cycle. The IAC valve responds by positioning the IAC valve to control the amount of bypassed air. The PCM monitors engine RPM and increases or decreases the IAC duty cycle in order to achieve the desired RPM.

The PCM uses the IAC valve assembly to control:

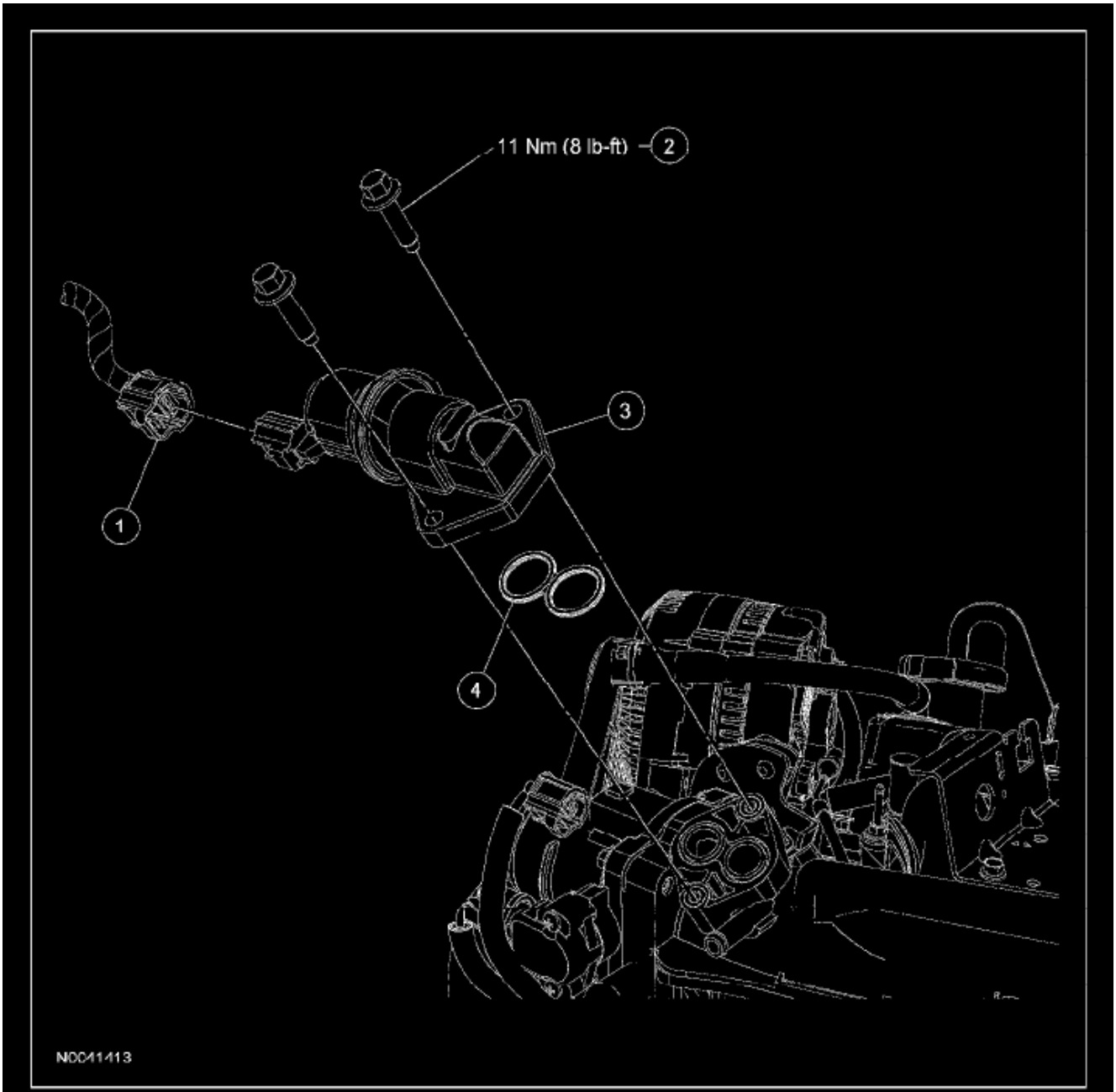
- no touch start

- cold engine fast idle for rapid warm-up

- idle (corrects for engine load)

- stumble or stalling on deceleration (provides a dashpot function)

- over-temperature idle boost



Item	Part Number	Description
1	14A464	Idle air control (IAC) valve electrical connector (part of 12B637)
2	W500214	IAC valve bolt (2 required)

(Continued)

Item	Part Number	Description
3	9F715	IAC valve
4	—	IAC valve gasket

Idle Speed/Throttle Actuator - Electronic: Service and Repair

IDLE AIR CONTROL (IAC) VALVE

Removal and Installation

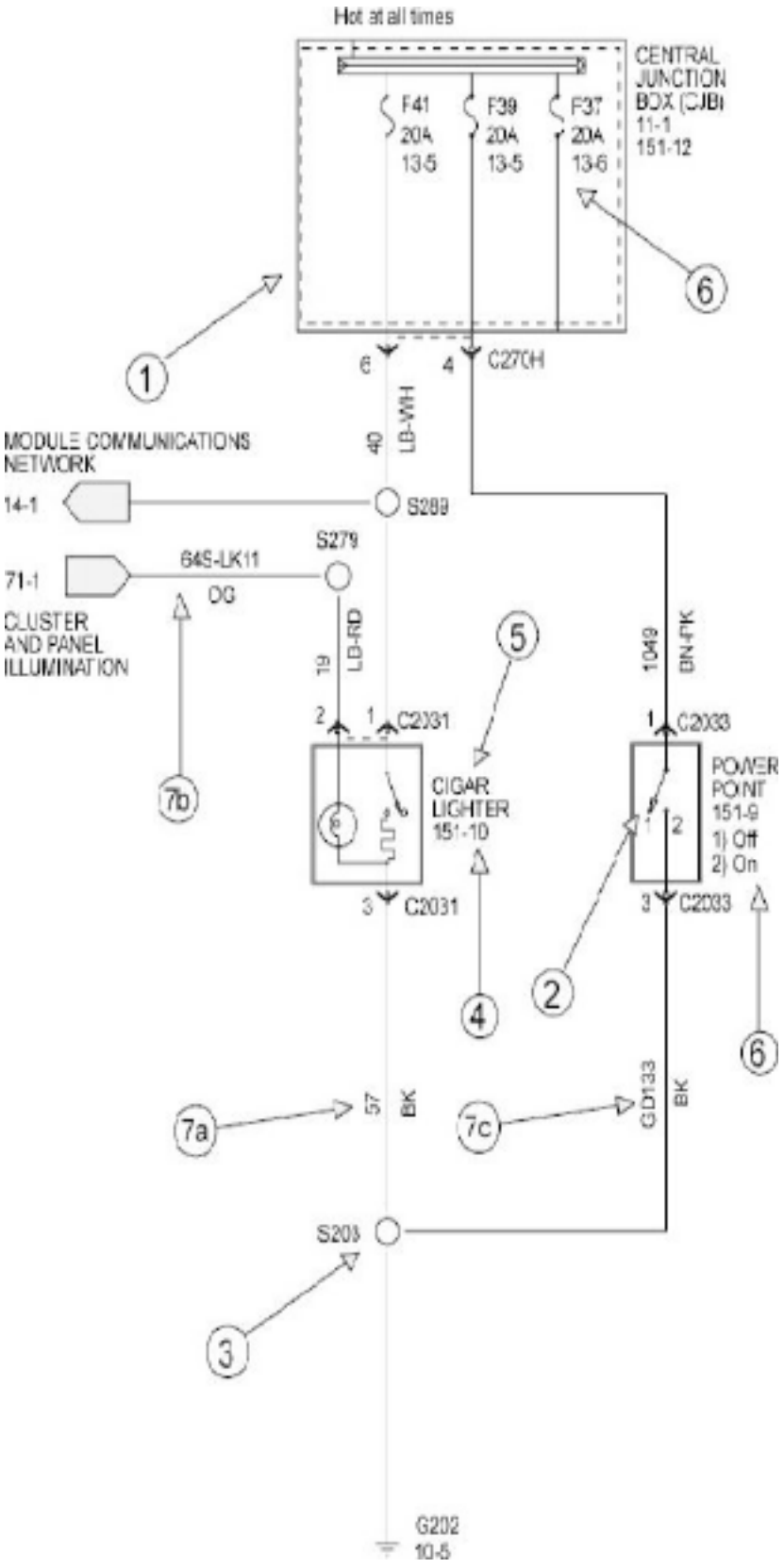
1. Disconnect the idle air control (IAC) valve electrical connector. 2. Remove the 2 bolts, the IAC valve and discard the gasket.

- To install, tighten to 11 Nm (8 lb-ft).

3. NOTE: Install a new IAC valve gasket.

To install, reverse the removal procedure.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Powertrain Management > Computers and Control Systems > Information Bus > Component Information > Diagrams > Diagram Information and Instructions



Information Bus: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

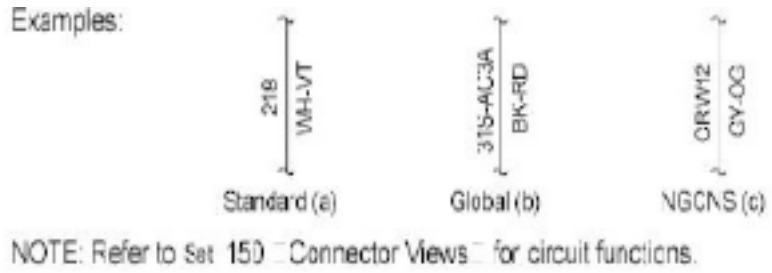
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

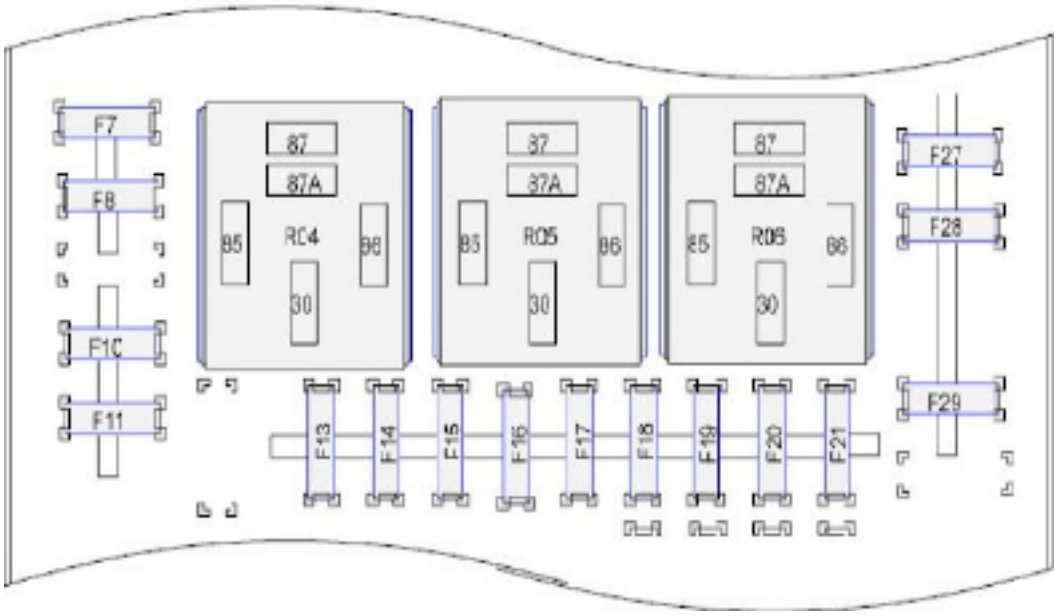
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

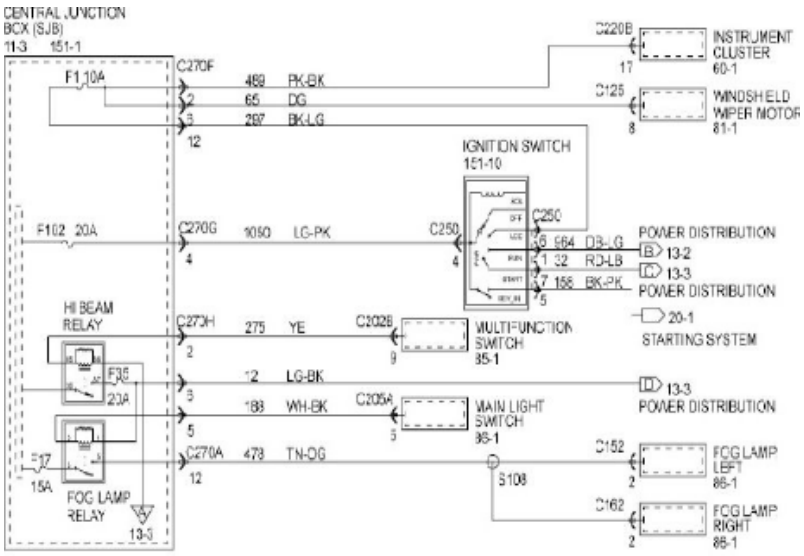
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

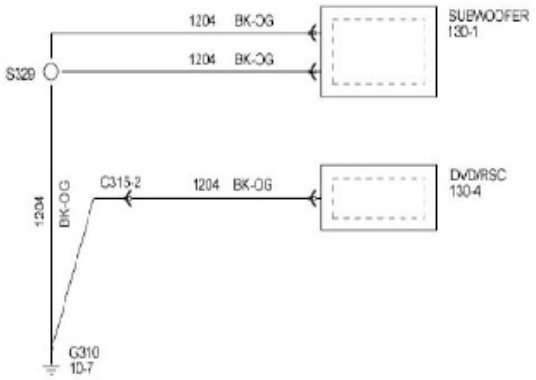
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

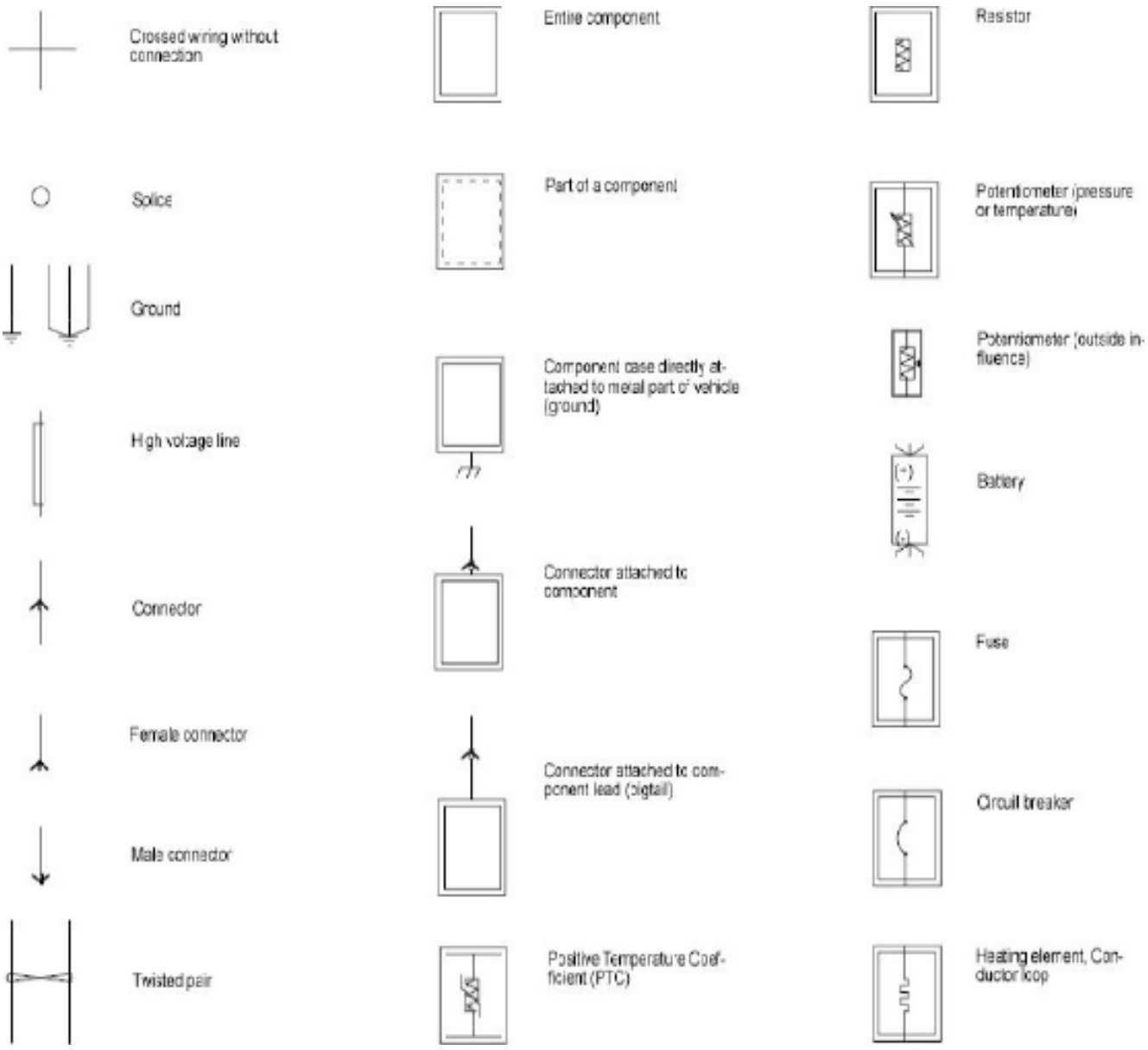
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

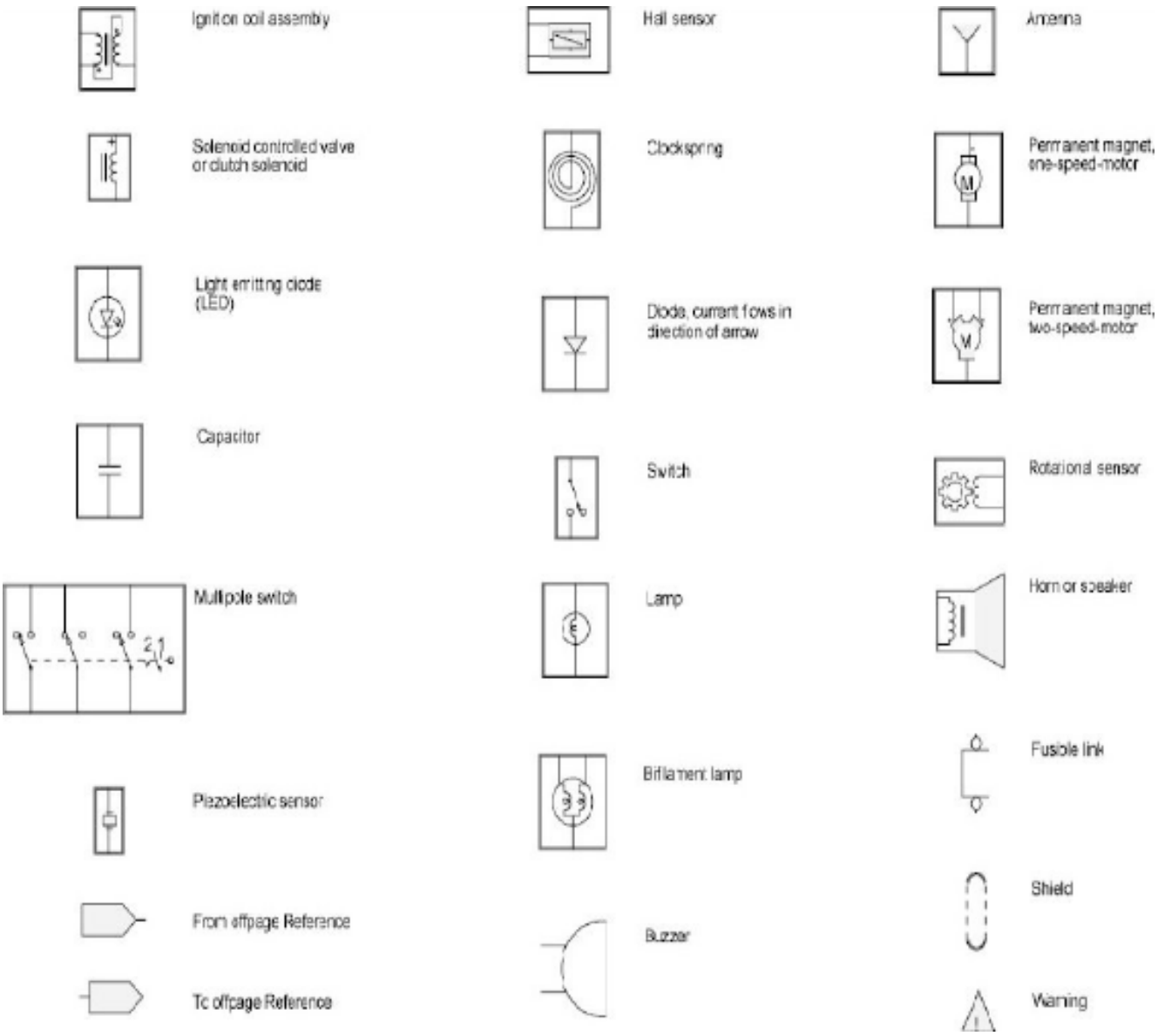
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

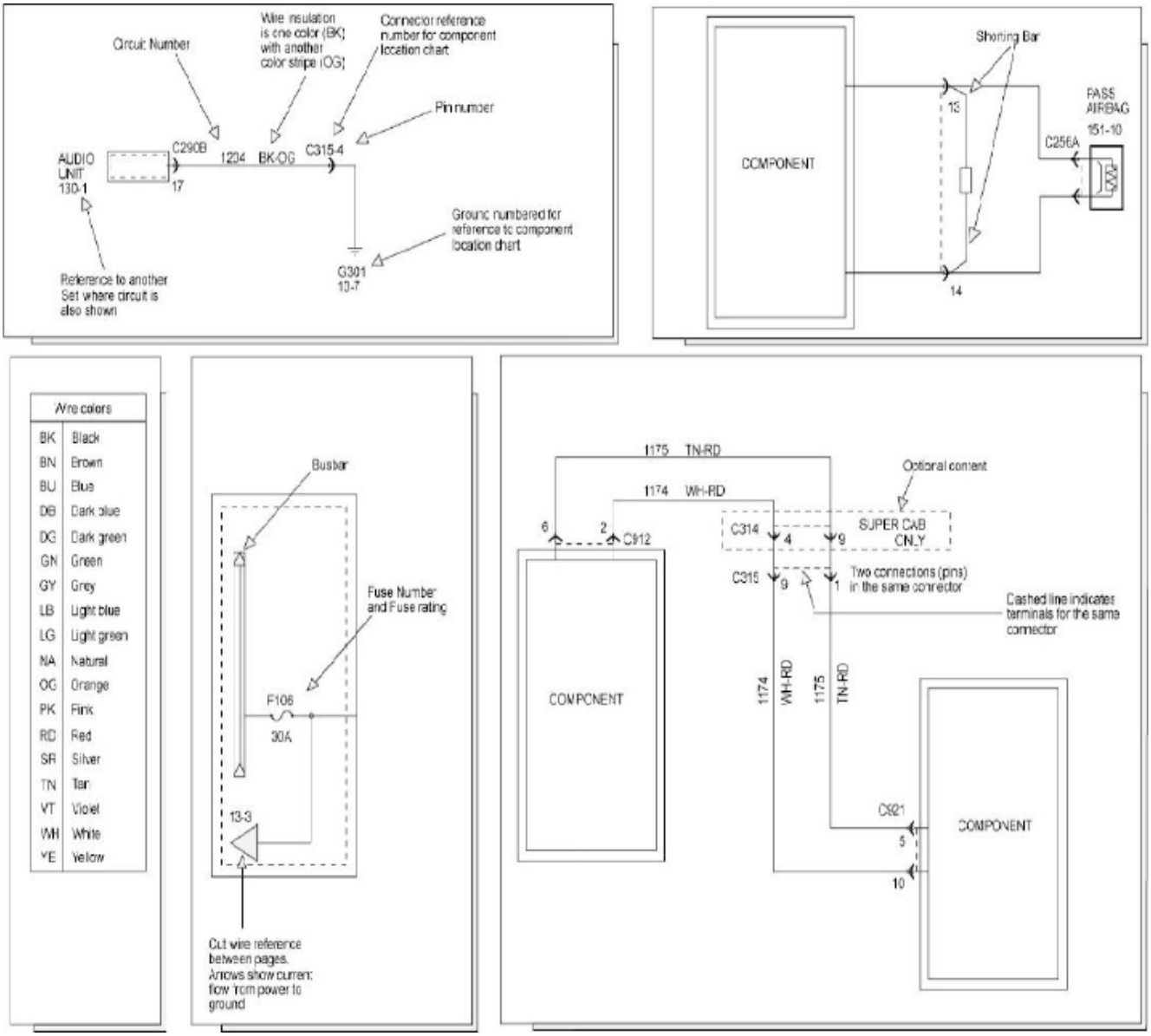
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

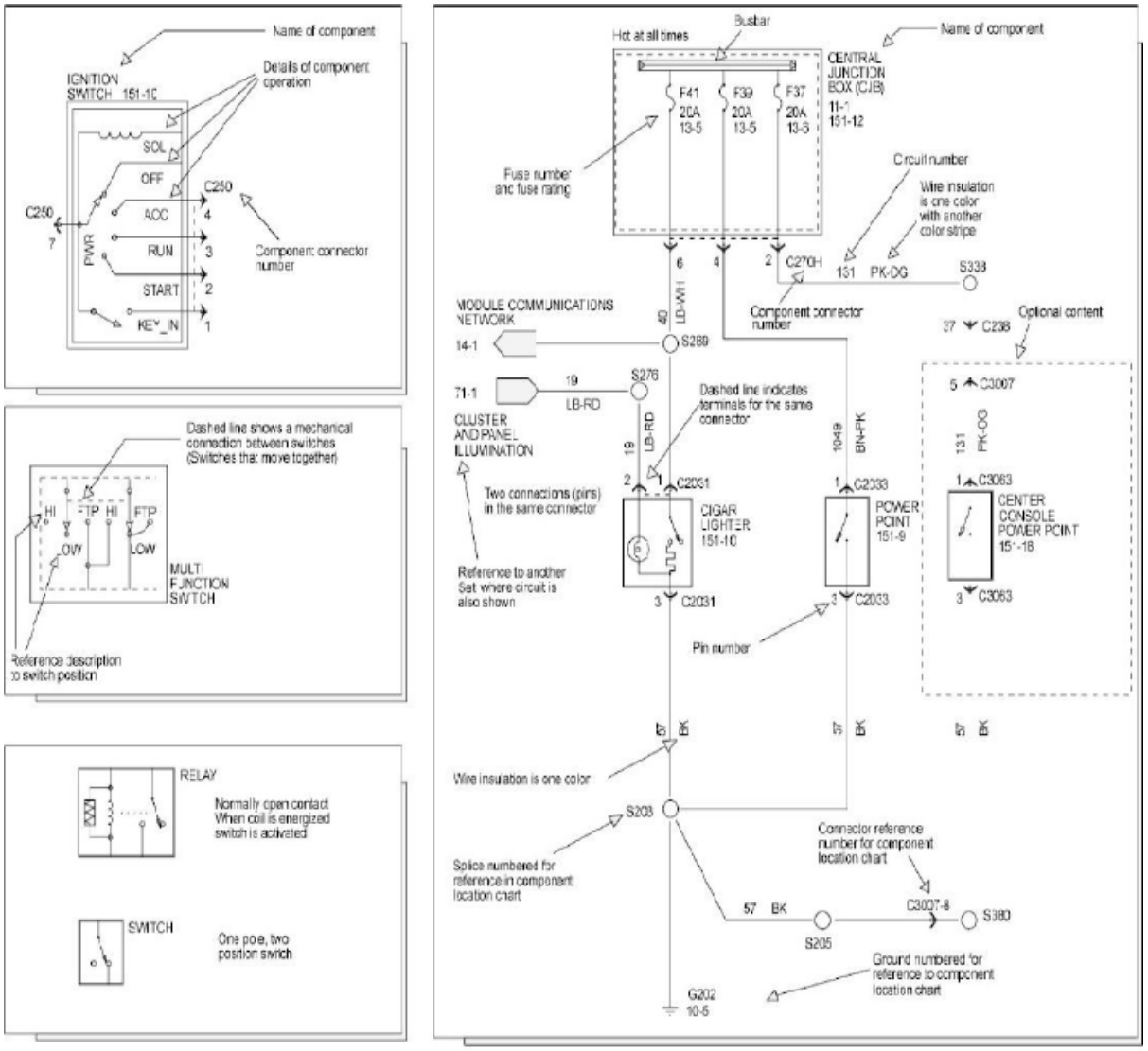
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

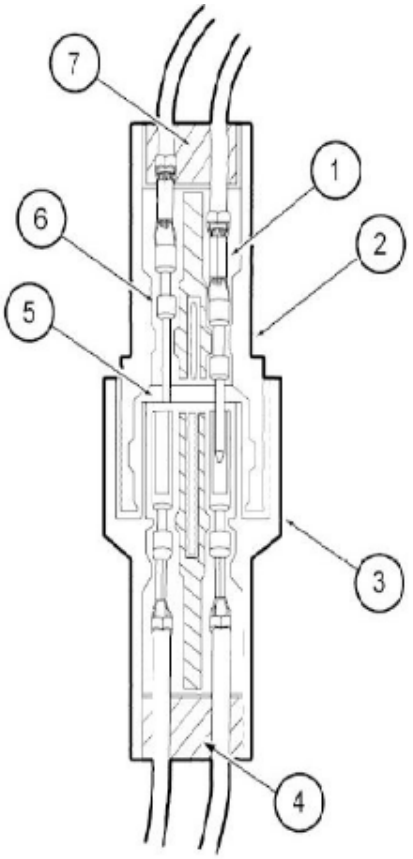


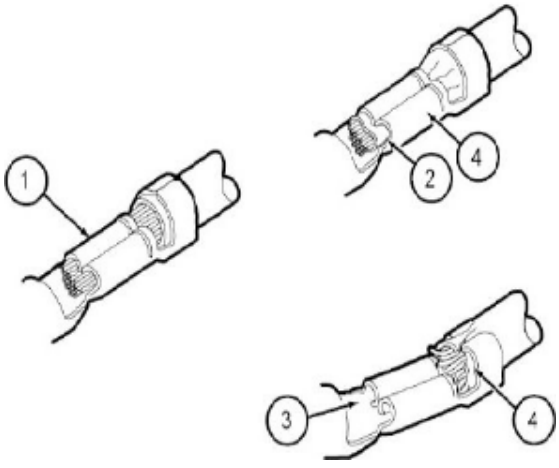
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Information Bus: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

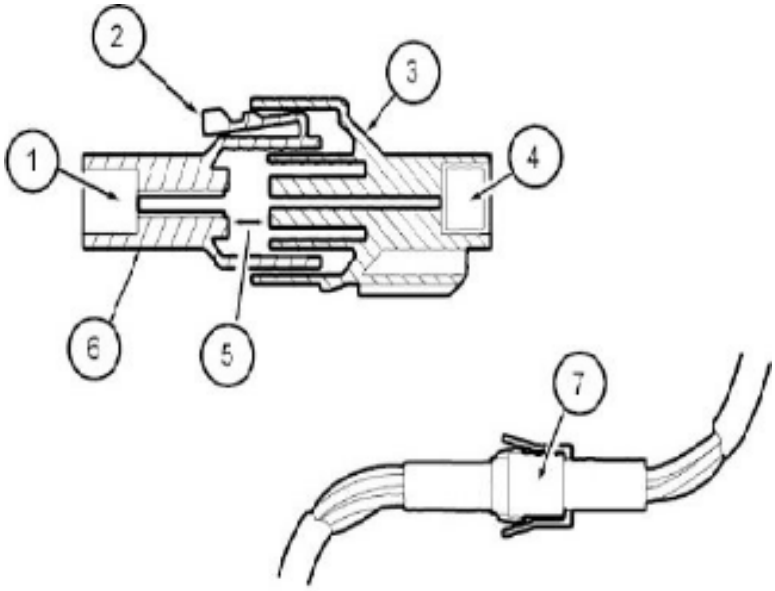
5 = Intermittent contact

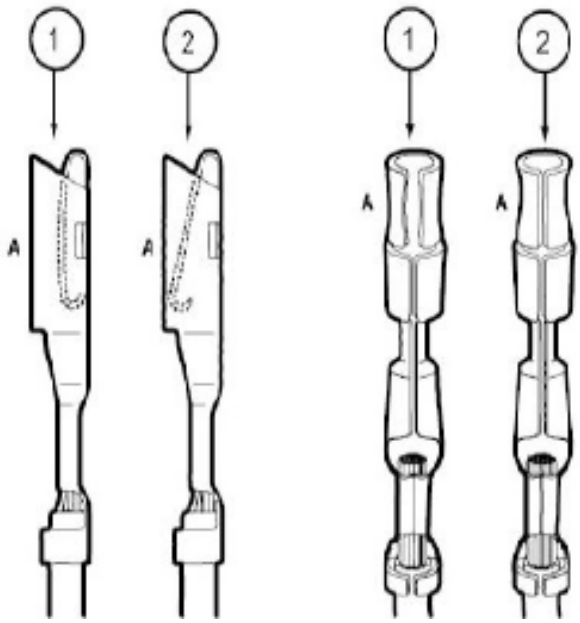
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

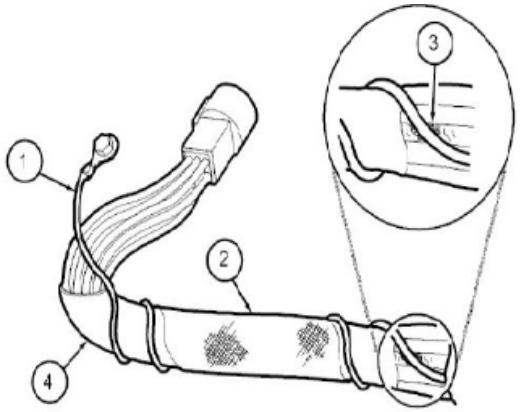
Deformed (enlarged) female terminals

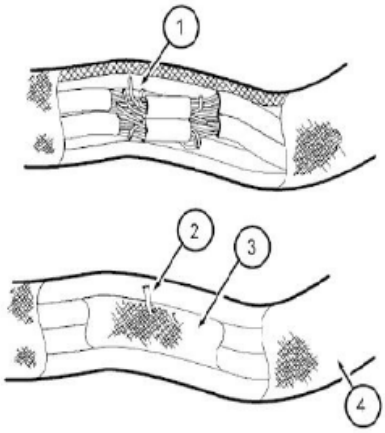
1 = Enlarged

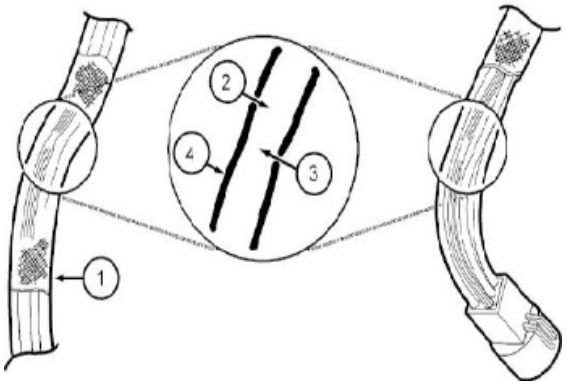
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

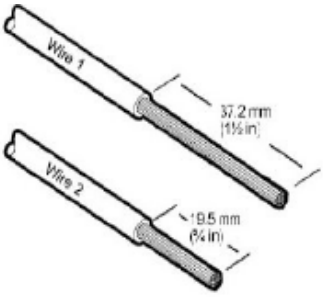
Splice covered 2

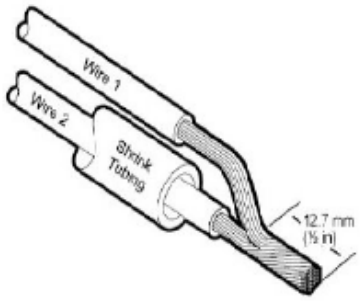
= Wire strand

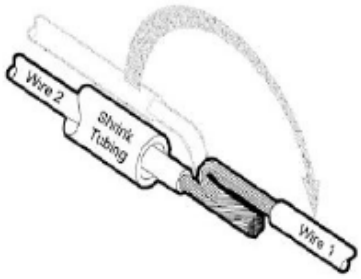
3 = Splice tape

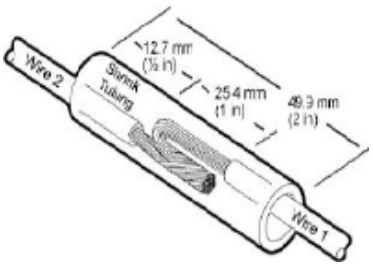
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.9 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

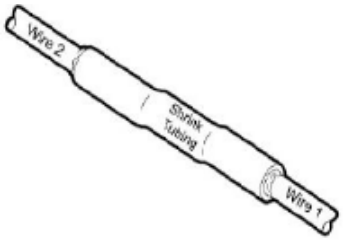
NOTE: -

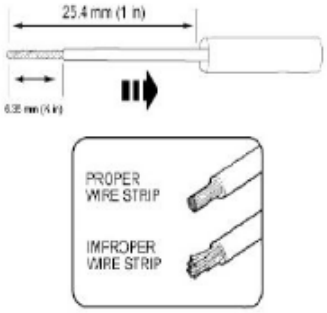
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

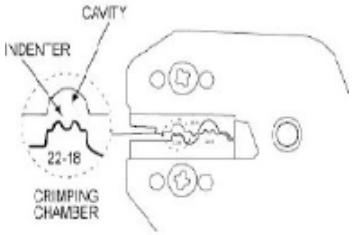
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

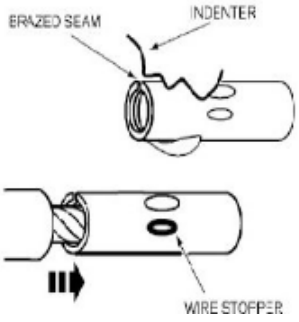
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
6.35 mm (¼ in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

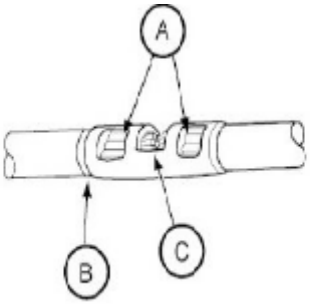
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

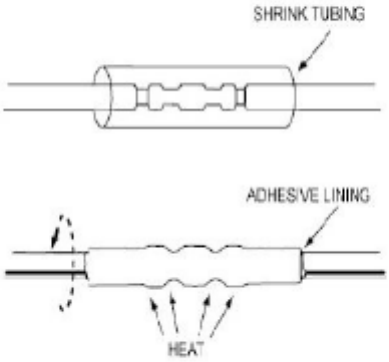
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4□ strip, cut 9 strands	* 1/4□ strip, cut 2 strands	1/4□ strip, no fold	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip, fold 2x dia.	1□ strip, fold 3x dia.
	16-14	* 1/4□ strip, cut 7 strands	1/4□ strip, no fold	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip fold 2x dia	1□ strip, fold 3x dia.	1 1/4□ strip, fold 4x dia.	Not Recommended
	12-10	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip, fold 2x dia.	1□ strip fold 3x dia.	1 1/4□ strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Pigtail only

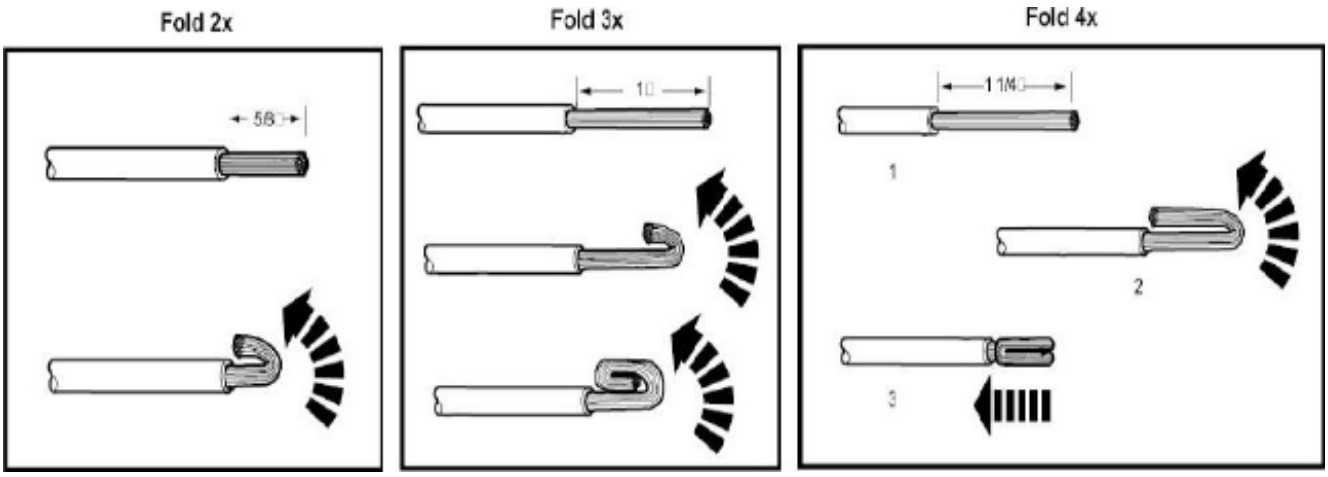
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

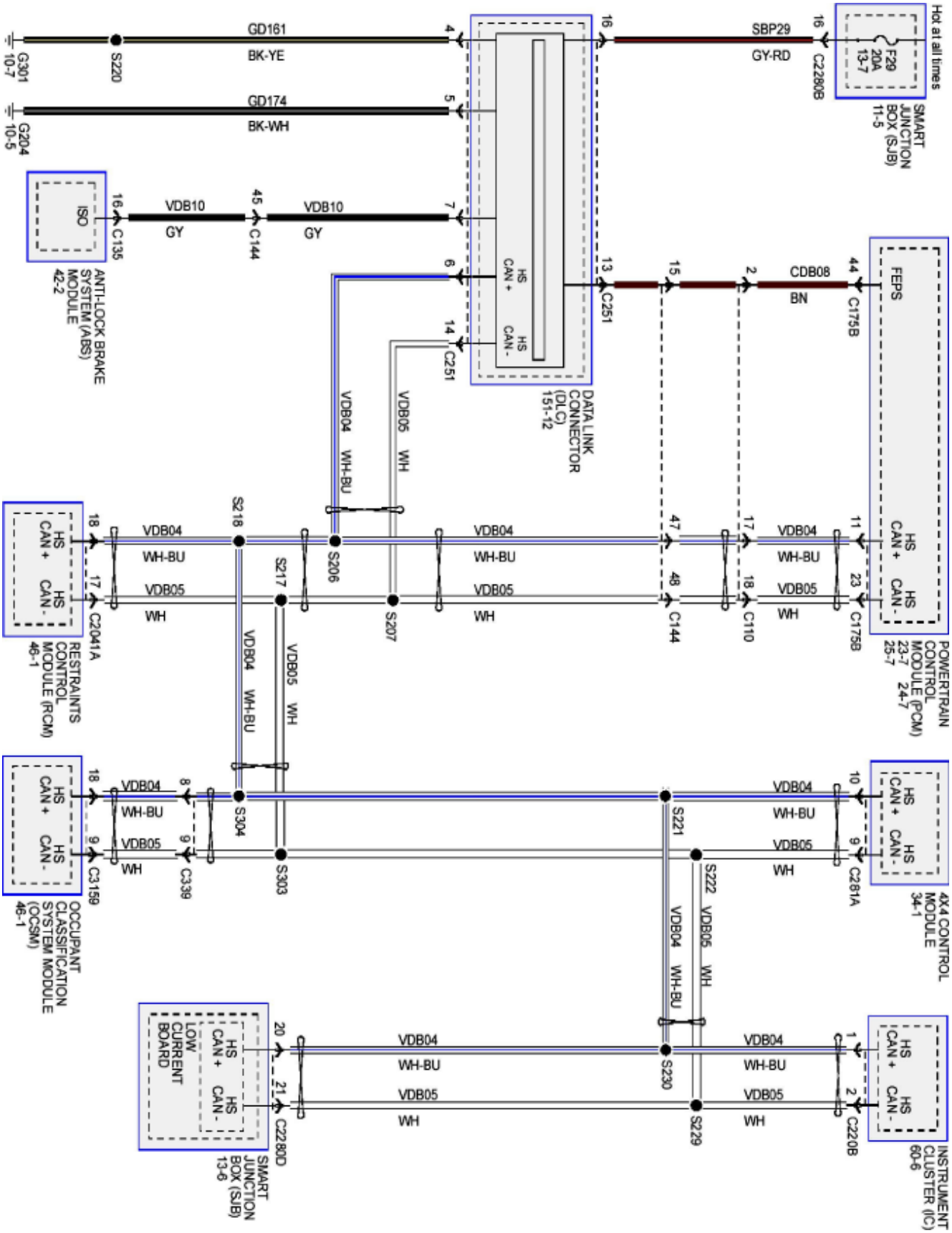
11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



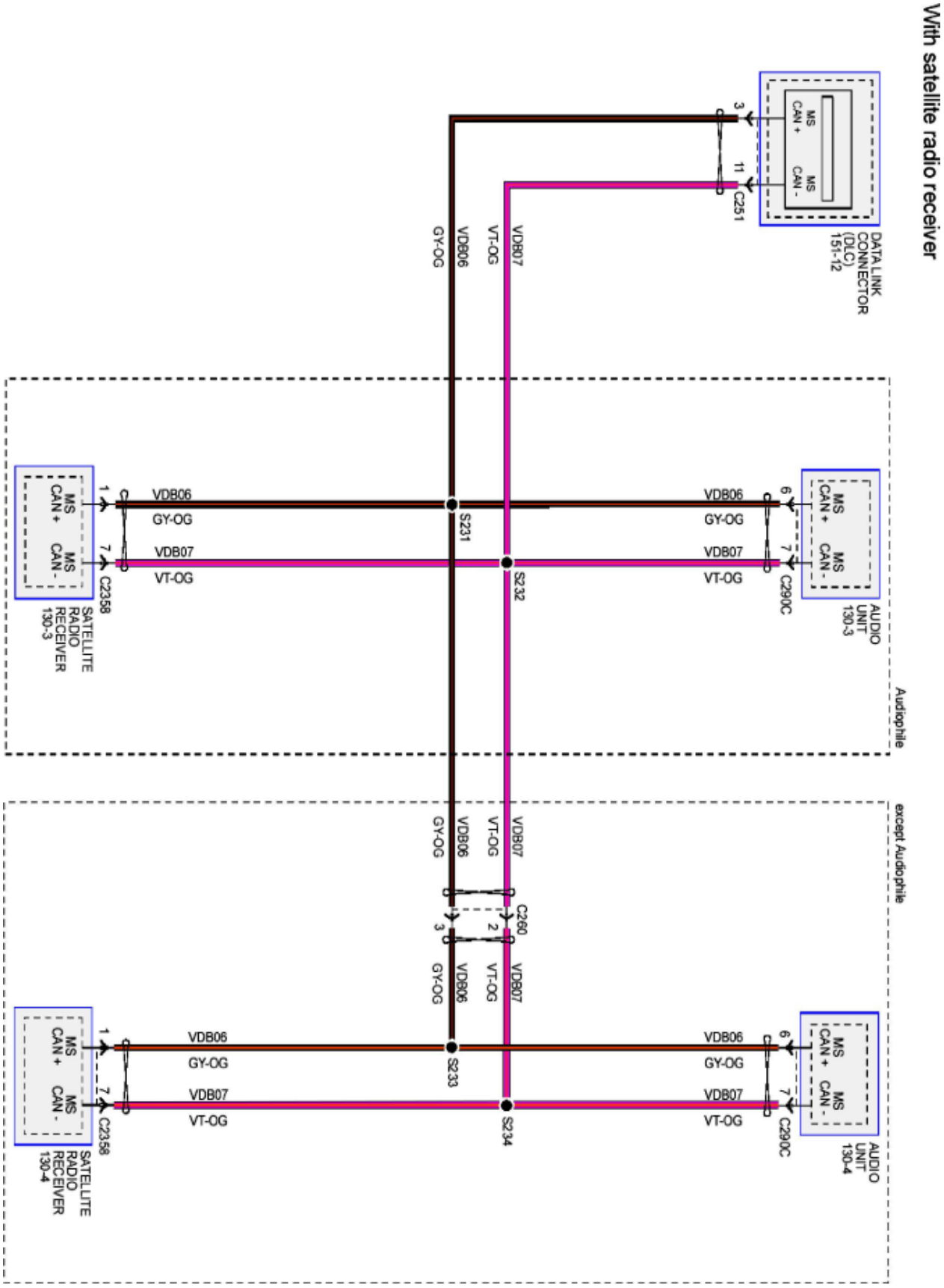
The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.


Hot at all times
SBP29
GY-RD
F29
20A
SMART JUNCTION BOX (SJB)
GD161
BK-YE
GD174
BK-WH
G301
G204
S220
DATA LINK CONNECTOR (DLC)
HS CAN +
HS CAN -
ISO
VDB10
GY
ANTI-LOCK BRAKE SYSTEM (ABS) MODULE
CDB08
BN
FEPS
POWERTRAIN CONTROL MODULE (PCM)
VDB04
WH-BU
VDB05
WH
S206
S207
S217
S218
RESTRAINTS CONTROL MODULE (RCM)
S303
S304
OCCUPANT CLASSIFICATION SYSTEM MODULE (OCSM)
S221
S222
4X4 CONTROL MODULE
S229
S230
LOW CURRENT BOARD
INSTRUMENT CLUSTER (IC)

Information Bus: Electrical Diagrams

PLEASE NOTE: Some diagrams may appear to be missing because of gaps in the number sequences. These "gaps" are actually for diagrams that do not apply to the vehicle model selected.

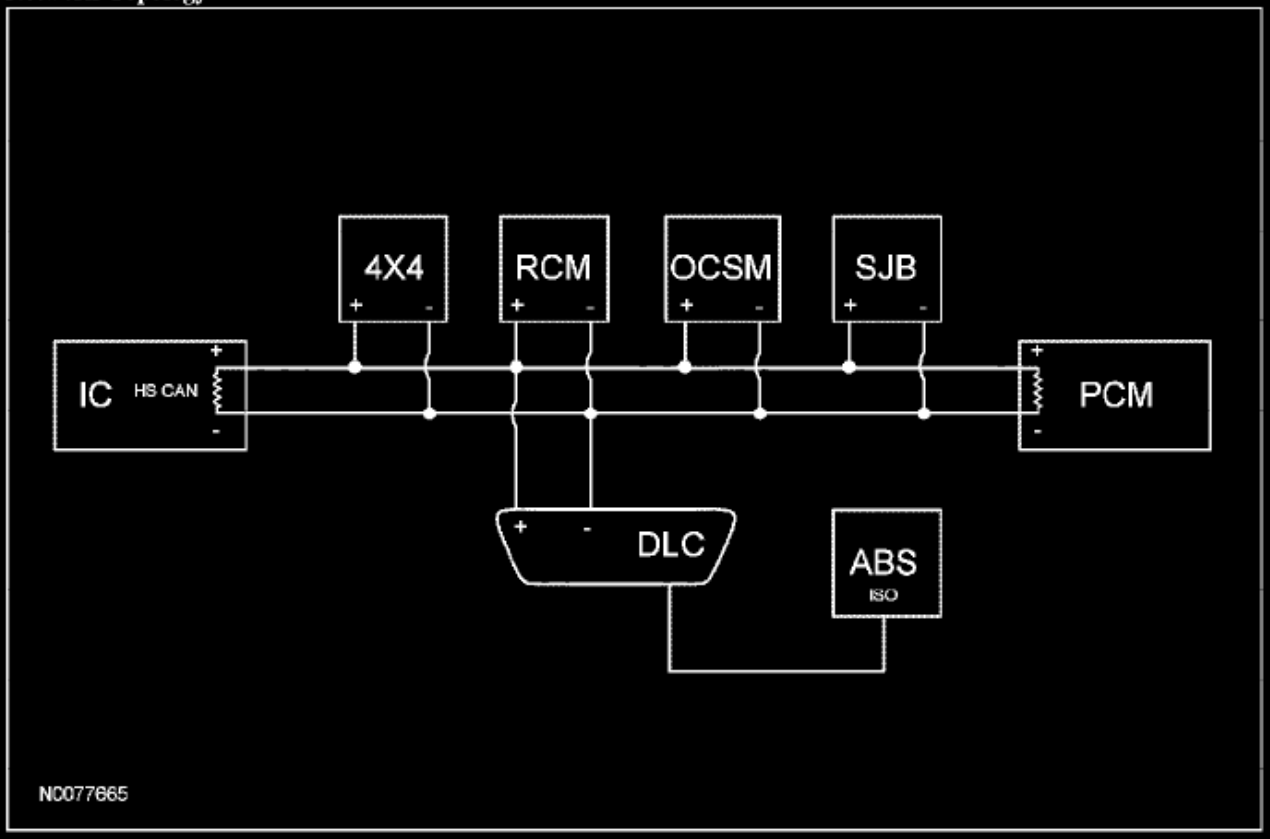
14-1


With satellite radio receiver
DATA LINK CONNECTOR (DLC) 151-12
MS CAN +
MS CAN -
3
11
C251
GY-OG
VDB06
VT-OG
VDB07
Audiophile
except Audiophile
AUDIO UNIT 130-3
AUDIO UNIT 130-4
SATELLITE RADIO RECEIVER 130-3
SATELLITE RADIO RECEIVER 130-4
C290C
C2358
C260
S231
S232
S233
S234
1
6
7
2

Diagrams: Other diagrams referred to by number (i.e. 13-2, 24-6, 10-2, etc.) within these diagrams can be found at Diagrams By Number. See: Diagrams/Electrical Diagrams/Diagrams By Number

Locations: Location Views (reference numbers starting with 151-) referred to within these diagrams can be found at Location Views. See: Locations/Component Locations

Network Topology



Module Name	Network Type	Termination Module
ABS module	ISO	N/A
Instrument cluster (IC)	HS-CAN	Yes
4X4 control module (if equipped)	HS-CAN	No
Occupant classification system module (OCSM)	HS-CAN	No
PCM	HS-CAN	Yes
Restraints control module (RCM)	HS-CAN	No
SJB	HS-CAN	No

Information Bus: Description and Operation

COMMUNICATIONS NETWORK

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

Vehicle communication utilizes both International Standards Organization (ISO) 9141 and controller area network (CAN) communications. ISO 9141 is used for diagnostic use only, and CAN is used for many modules to communicate with each other on a common network. CAN in-vehicle networking, is a method for transferring data among distributed electronic modules via a serial data bus. Without serial networking, intermodule communication requires dedicated, point to point wiring resulting in bulky, expensive, complex, and difficult to install wiring harnesses. Applying a serial

data network reduces the number of wires, combining the signals on a single network. Information is sent to individual control modules that control each function.

The vehicle has 2 module communication networks:

- ISO 9141

- High speed (HS) CAN

Both networks are connected to the data link connector (DLC). This makes diagnosis and testing of these systems easier by allowing one scan tool to be able to diagnose and control any module on both networks from one connector. The DLC can be found under the instrument panel.

Network Topology

ISO 9141 Network Operation

The ISO 9141 communications network is a single wire network. The ISO 9141 communication network is used only by the ABS module.

HS-CAN Network Operation

The HS-CAN network communicates using bussed messages. The HS-CAN network uses an unshielded twisted pair cable, data bus (+) and data bus (-) circuits. In addition to scan tool communication, this network allows sharing of information between all modules on the network.

The HS-CAN is a high speed communication network used for the following modules: -

PCM

- RCM

- SJB

- 4X4 control module (if equipped)

- Occupant classification system module (OCSM)

- Instrument cluster (IC)

Network Termination

The CAN network uses a network termination circuit to improve communication reliability. The network termination of the CAN bus takes place inside the termination modules by termination resistors. Termination modules are located at either end of the bus network. As network messages are broadcast, in the form of voltage signals, the network voltage signals are stabilized by the termination resistors. Each termination module has a 120 ohm resistor across the positive and negative bus connection in the termination module. With 2 termination modules on each network, and the 120 ohm resistors located in a parallel circuit configuration, the total network impedance, or total resistance is 60 ohms.

Network termination improves bus message reliability by: -

stabilizing bus voltage.

- eliminating electrical interference.

Information Bus: Initial Inspection and Diagnostic Overview

Inspection and Verification

INSPECTION AND VERIFICATION

1. Verify the customer concern. 2. Visually inspect for obvious signs of electrical damage.

VISUAL INSPECTION CHART

Electrical -

Battery junction box (BJB) fuse(s): -

9 (40A) (no communication with the smart junction box [SJB])

- 21 (10A) (no communication with the PCM)

- 39 (15A) (no communication with the PCM)

- SJB fuse(s): -

8 (10A) (no communication with the restraints control module [RCM], occupant classification system module [OCSM])

- 9 (5A) (no communication with the instrument cluster [IC])

- 10 (10A) (no communication with the IC, 4X4 control module)

- 11 (10A) (no communication with the SJB)

- 20 (10A) (no communication with the ABS module)

- 28 (15A) (no power to the 4X4 control module)

- 29 (20A) (no power to the scan tool)

- 33 (5A) (no communication with the IC)

- Data link connector (DLC)

- Wiring, terminals or connectors

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. NOTE: Make sure to use the latest scan tool software release.

If the cause is not visually evident, connect the scan tool to the DLC.

NOTE: The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

If the scan tool does not communicate with the VCM: -

Check the VCM connection to the vehicle.

- Check the scan tool connection to the VCM.

- GO to Pinpoint Test I, to diagnose No Power To The Scan Tool. See: Pinpoint Tests/Test I: No Power To The Scan Tool

5. NOTE: During the network test, the scan tool will first attempt to communicate with the PCM, after establishing communication with the PCM,

the scan tool will then attempt to communicate with all other modules on the vehicle.

Carry out the network test. -

If the network test passes, retrieve and record the continuous memory DTCs and proceed to Step 6.

- If the network test fails, GO to Symptom Chart to identify the module not communicating. See: Symptom Related Diagnostic Procedures

6. If the DTCs retrieved are related to the concern, go to DTC charts. For all other DTCs, refer to Body Control Systems (Multifunction Electronic

Control Module). See: Diagnostic Trouble Code Descriptions/Module Communications Network

7. If no DTCs related to the concern are retrieved, GO to Symptom Chart. See: Symptom Related Diagnostic Procedures

Principles of Operation

PRINCIPLES OF OPERATION

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

Vehicle communication utilizes both International Standards Organization (ISO) 9141 and controller area network (CAN) communications. ISO 9141 is used for diagnostic use only, and CAN is a method for transferring data among distributed electronic modules via a serial data bus.

The vehicle is equipped with 2 communication networks:

- ISO 9141

- High speed (HS) CAN

ISO 9141 Network Communication Fault Chart

Failure Description	Symptom
ISO circuit open	No communication
ISO circuit short to voltage	No communication
ISO circuit short to ground	No communication
Module loss of voltage or ground	No communication
Module internal failure	No communication

ISO 9141 Communications Network

The ISO 9141 communications network is a single wire network. The ISO 9141 communications network does not permit intermodule communication. When the scan tool communicates to modules on the ISO 9141 communication network, the scan tool must request all information; the modules cannot initiate communications.

The following fault chart describes the specific ISO 9141 network failures and their resulting symptom:

ISO 9141 Network Communication Fault Chart

HS-CAN

The HS-CAN network uses an unshielded twisted pair cable of data (+) and data (-) circuits. The data (+) and the data (-) circuits are each regulated to approximately 2.5 volts during neutral or rested network traffic. As bus messages are sent on the data (+) circuit, voltage is increased by approximately 1.0 volt. Inversely, the data (-) circuit is reduced by approximately 1.0 volt when a bus message is sent. Multiple bus messages can be sent over the network CAN circuits allowing multiple modules to communicate with each other.

The HS-CAN is a high speed communication network used for the instrument cluster (IC), PCM, the 4X4 control module, the restraints control module (RCM), the OCSM communications and the smart junction box (SJB), and designed for real time information transfer and control. The HS-CAN network will not communicate while certain faults are present, but will operate with diminished performance with other faults present. The HS-CAN bus may remain operational when 1 of the 2 termination resistors are not present.

In the event that one of the 2 network circuits (HS-CAN + or HS-CAN -) becomes open to a module on the network, unreliable network communication to all modules on the network may result. The module to which the network circuit is open may repeatedly send network messages indicating there has been partial data received. This type of message is referred to as a negative-acknowledge (NACK) message.

Repeated NACK messages may "load" the network with too much activity causing intermittent no communication to other network modules and/or the scan tool.

The following fault chart describes the specific HS-CAN network failures and their resulting symptom:

HS-CAN Network Communication Fault Chart

Failure Description	Symptom
HS-CAN (+) shorted to HS-CAN (-)	No communication
HS-CAN (+) short to voltage	No communication
HS-CAN (-) short to voltage	No communication
HS-CAN (+) short to ground	No communication
HS-CAN (-) short to ground	Unreliable communication possible to all modules on the network
HS-CAN (+) open	Unreliable communication possible to all modules on the network
HS-CAN (-) open	Unreliable communication possible to all modules on the network
Module loss of voltage or ground	No communication
Module internal failure	No communication

CAN Network Module Communication Message Chart

Broadcast Message	Originating Module	Network Type	Receiving Module(s)
Airbag indicator request	Restraints control module (RCM)	HS-CAN	• Instrument cluster (IC)
Barometric pressure	PCM	HS-CAN	• Smart junction box (SJB)
Brake switch status	PCM	HS-CAN	• 4X4 control module
Clutch pedal position	PCM	HS-CAN	• 4X4 control module
Door ajar status	SJB	HS-CAN	• IC
Engine coolant temperature	PCM	HS-CAN	• IC
Engine fail-safe cooling mode status	PCM	HS-CAN	• IC
Engine malfunction indicator lamp (MIL) request	PCM	HS-CAN	• IC
Engine RPM	PCM	HS-CAN	• IC
Fog lamp relay status	SJB	HS-CAN	• IC
Fuel cap off indicator request	PCM	HS-CAN	• IC
Fuel level input status (instant)	IC	HS-CAN	• PCM
Ignition switch position	SJB	HS-CAN	• IC • 4X4 control module
Occupant classification system (OCS) data	Occupant classification system module (OCSM)	HS-CAN	• RCM
Occupant classification system serial number and calibration	OCSM	HS-CAN	• RCM
Odometer count	PCM	HS-CAN	• IC
Parking brake status	IC	HS-CAN	• SJB

HS-CAN Network Communication Fault Chart

The following chart describes the specific CAN messages broadcast by each module, and the module(s) that receive the message:

CAN Network Module Communication Message Chart (Part 1)

CAN Network Module Communication Message Chart (Continued)

Broadcast Message	Originating Module	Network Type	Receiving Module(s)
Passive anti-theft system (PATS) ok to start	IC	HS-CAN	• PCM
PATS security data	IC	HS-CAN	• PCM
PATS security data	PCM	HS-CAN	• IC
PATS theft condition	PCM	HS-CAN	• IC
RCM serial number	RCM	HS-CAN	• OCSM
Safety belt indicator status	IC	HS-CAN	• RCM
Safety Belt-Minder®chime/flash request	RCM	HS-CAN	• IC
Safety belt (passenger) status	RCM	HS-CAN	• OCSM
Safety Belt-Minder® programming mode active/inactive	RCM	HS-CAN	• IC
Speed control indicator request	SJB	HS-CAN	• IC
Throttle position	PCM	HS-CAN	• RCM
Tire pressure monitoring system (TPMS) sensor status (LF, RF, RR, LR, spare)	SJB	HS-CAN	• IC
TPMS system status	SJB	HS-CAN	• IC
Transmission overdrive indicator status	PCM	HS-CAN	• IC
Transmission selector (PRNDL) range	PCM	HS-CAN	• IC • 4X4 control module
Transmission type	PCM	HS-CAN	• IC • 4X4 control module
Vehicle speed	PCM	HS-CAN	• IC • RCM • SJB • 4X4 control module
VIN information	PCM	HS-CAN	• OCSM • RCM
4X4 coupling mode and status	4X4 control module	HS-CAN	• IC • PCM
4X4 high indicator request	4X4 control module	HS-CAN	• IC
4X4 low indicator request	4X4 control module	HS-CAN	• IC
4X4 system type	4X4 control module	HS-CAN	• IC • PCM

CAN Network Module Communication Message Chart (Part 2)

Inspection and Verification

INSPECTION AND VERIFICATION

This provides step-by-step module configuration procedures. Carry out the PMI procedures when another Vehicle System directs to carry out configuration or when DTCs from the given list are present. See: Programming and Relearning

Principles of Operation

PRINCIPLES OF OPERATION

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

Configurable modules accommodate a variety of vehicle options, eliminating the need for many unique modules for one vehicle line. These modules must be configured when replaced as part of a repair procedure.

Configurable modules should not be exchanged between vehicles since the settings are unique to each vehicle. Failure to configure a new module may result in improper operation and/or any of the following DTCs setting:

- B2477 and/or B2141 - sets when a body/chassis module is not configured or is configured incorrectly.

- B2900 - sets when there is a VIN mismatch between the module with the B2900 and the PCM. The stored VIN in either module may be incorrect.

- P0602, P0605 and/or P1639 - sets when the PCM vehicle identification (VID) block is not configured.

- U0300 and/or U0301 - sets when the configuration between 2 or more modules do not match.

- U2050 and/or U2051 - sets when a valid strategy/calibration is not present.

The following are the 3 different methods of configuration:

- Programmable module installation (PMI)

- Module reprogramming ("flashing")

- Programmable parameters

Some modules do not support all 3 methods.

Definition of Terms

The following are definitions of configuration terms:

Programmable Module Installation (PMI) PMI is a scan tool process which configures settings in a new module. Data used for the PMI process is automatically downloaded from the original module and stored when a scan tool session is started. If this data cannot be retrieved from the module being replaced, the scan tool may prompt for As-Built data entry or display a list of parameter values that need to be manually selected. Some modules are reprogrammed during PMI when a strategy/calibration update is available.

NOTE: It is important that the scan tool identifies the vehicle and obtains configuration data prior to removing any modules. The new module must be able to communicate with the scan tool in order to carry out PMI. See: Programming and Relearning

To carry out PMI, refer to Programmable Module Installation. See: Programming and Relearning

Module Reprogramming Module reprogramming (also referred to as "flashing") is a scan tool process which updates the strategy/calibration in a module. Module reprogramming is automatically carried out during PMI when a later strategy/calibration is available.

Reprogramming a module with the same level of software will not improve module operation or repair a hardware failure.

NOTE: -

Module reprogramming should be limited to circumstances where a published Technical Service Bulletin (TSB) procedure recommends doing so.

- A module cannot communicate with other modules on the communication network while being reprogrammed. Clear any network communication DTCs which may have been set in other modules during reprogramming.

Programmable Parameters Programmable parameters are customer preference items that may be modified by the dealer via scan tool or in some cases modified by the customer following a procedure listed in the vehicle Owner's Literature. While many configuration options are programmable parameters.

Adaptive Learning and Calibration

Some modules require a separate learning procedure be carried out if replaced as part of a repair procedure. For adaptive learning and calibration instructions, refer to the specific module removal and installation procedures.

Vehicle Identification (VID) Block

Some PCMs contain a memory area called a vehicle identification (VID) block. The PCM VID block commonly stores powertrain configuration items such as VIN, tire size, axle ratio, and whether or not the vehicle is equipped with speed control.

As-Built Data

As-Built data is a VIN specific module configuration record. During vehicle build, the configuration from all modules is downloaded and stored in the As-Built database. As-Built data will not reflect customer preference items that have been changed from the default state. These items will need to be changed using programmable parameters after the module is configured.

NOTE: It is not necessary to obtain As-Built data unless directed to do so by the scan tool. This data may be accessed from the technician service publication website.

The following chart lists module As-Built data addresses: may exist for a module, only a few of these options are programmable parameters.

Module Addresses for As-Built Data Entry

Module Name	Module Address
4X4 Control Module	761
Instrument Cluster (IC)	720
Restraints Control Module (RCM)	737
Smart Junction Box (SJB)	726

Module Configuration and Parameter Index

Module Name	Reprogram/ Flash Capable	Requires PMI	Requires Adaptive Learning	Requires Calibration	Available Programmable Parameters
ABS module	No	No	No	No	• None
4X4 control module	Yes	No	No	No	• None
Instrument cluster (IC)	Yes	Yes	No	No	• None
Occupant classification system module (OCSM)	Yes	No	No	• Seat weight sensor re-zero	• None
PCM	Yes	Yes	Yes	No	• Axle ratio • Tire/wheel size
Restraints control module (RCM)	Yes	Yes	No	No	• Driver seat Belt-Minder® • Passenger seat Belt-Minder®
Smart junction box (SJB)	Yes	Yes	No	No	• Window one-touch down

Module Addresses for As-Built Data Entry

Module Configuration and Parameter Index

Communication Network DTC Chart

NOTE: DTC U1900 will set in a module that is reporting a communication fault from another module on the data bus. The module that reports the fault is not the problem module.

DTC	Description	Source	Action
U0002	High Speed CAN Communication Bus Performance	Instrument cluster (IC)	GO to Pinpoint Test H.
U0100	Lost Communication With ECM/PCM	SJB	The fault is not currently present. CLEAR the DTC. REPEAT the network test with the scan tool. FOLLOW the appropriate pinpoint test for the module which fails the network test.
U0100	Lost Communication With ECM/PCM	4X4 control module	The fault is not currently present. CLEAR the DTC. REPEAT the network test with the scan tool. FOLLOW the appropriate pinpoint test for the module which fails the network test.
U0102	Lost Communication With Transfer Case Control Module (4X4CM)	IC	GO to Pinpoint Test F.

Communication Network DTC Chart (Continued)

DTC	Description	Source	Action
U0140	Lost Communication With Body Control Module (SJB)	IC	GO to Pinpoint Test D.
U0151	Lost Communication With Restraints Control Module	IC	GO to Pinpoint Test C.
U0155	Lost Communication With Instrument Panel Cluster (IC) Control Module	SJB	REFER to Lighting and Horns, daytime running lamps (DRL).
U0294	Lost Communication With Powertrain Control Module	IC	GO to Pinpoint Test A.
U1900	CAN Communication Bus Fault - Receive Error	Occupant classification system module (OCSM)	GO to Symptom Chart for module that failed network test.
U1900	CAN Communication Bus Fault - Receive Error	RCM	GO to Symptom Chart for module that failed network test.
U2023	Fault Received From External Node	SJB	RETRIEVE and FOLLOW non-network DTCs from other modules. REFER to Body Control Systems.
U2023	Fault Received From External Node	IC	RETRIEVE and FOLLOW non-network DTCs from other modules. REFER to Body Control Systems.
U2472	Unexpected Ignition State	IC	REFER to Inst., Gauges, Warn Ind..
U2510	CAN - Invalid Data For Vehicle Security	IC	REFER to Antitheft and Alarm Systems.
U2511	CAN - Data Mis-Match (Receive data does not match expected)	IC	REFER to Antitheft and Alarm Systems.

Information Bus: Diagnostic Trouble Code Descriptions

U0002-U0102

U0140-U2511

DTC Chart

DTC	Description	Source	Action
B2477	Module Configuration Failure	• Instrument cluster (IC) • Restraints control module (RCM) • Smart junction box (SJB)	CARRY OUT PMI. REFER to Programmable Module Installation.
P0602	Powertrain Control Module Programming Error	• PCM	CARRY OUT PMI. REFER to Programmable Module Installation.
P0605	Internal Control Module Read Only Memory (ROM) Error	• PCM	CARRY OUT PMI. REFER to Programmable Module Installation.
P1639	Vehicle ID Block Corrupted, Not Programmed	• PCM	CARRY OUT PMI. REFER to Programmable Module Installation.
U0300	Internal Control Module Software Incompatibility	• PCM	CARRY OUT PMI. REFER to Programmable Module Installation.
U0301	Software Incompatibility with Engine/Powertrain Control Module	• PCM	CARRY OUT PMI. REFER to Programmable Module Installation.
U2050	No Application Present	• Instrument cluster (IC) • Occupant classification system module (OCSM) • RCM • SJB • 4X4 control module	CARRY OUT PMI. REFER to Programmable Module Installation.
U2051	One or More Calibration Files Missing / Corrupt	• OCSM • RCM	CARRY OUT PMI. REFER to Programmable Module Installation.

B2477 / P0602-P1639 / U0300-U2051

Symptom Chart

Condition	Possible Sources	Action
• The PCM does not respond to the scan tool, or no high speed controller area network (HS-CAN) communication	• Fuse • Wiring, terminals or connectors • PCM • Restraints control module (RCM) • Occupant classification system module (OCSM) • 4X4 control module • Instrument cluster (IC) • SJB	• GO to Pinpoint Test A.
• The occupant classification system module (OCSM) does not respond to the scan tool	• Fuse • Wiring, terminals or connectors • ABS module	• GO to Pinpoint Test B.
• The restraints control module (RCM) does not respond to the scan tool	• Fuse • Wiring, terminals or connectors • RCM	• GO to Pinpoint Test C.

Information Bus: Symptom Related Diagnostic Procedures

Symptom Chart (Part 1)

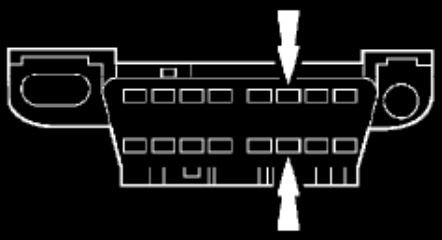
Symptom Chart (Continued)

Condition	Possible Sources	Action
• The satellite radio receiver does not communicate with the scan tool	• Fuse • Wiring, terminals or connectors • Satellite radio receiver	• REFER to Radio, Stereo, and Compact Disc.
• The smart junction box (SJB) does not respond to the scan tool	• Fuse • Wiring, terminals or connectors • SJB	• GO to Pinpoint Test D.
• The instrument cluster (IC) does not respond to the scan tool	• Fuse • Wiring, terminals or connectors • IC	• GO to Pinpoint Test E.
• The four wheel drive (4X4) control module does not respond to the scan tool	• Fuse • Wiring, terminals or connectors • 4X4 control module	• GO to Pinpoint Test F.
• The ABS module does not respond to the scan tool or no International Standards Organization (ISO) 9141 network communication	• Fuse • Wiring, terminals or connectors • ABS module	• GO to Pinpoint Test G.
• Intermittent no high speed controller area network (HS-CAN) communication, one or more modules are not responding during network test	• Wiring, terminals or connectors	• GO to Pinpoint Test H.
• No high speed controller area network (HS-CAN) communication, all modules are not responding	• Fuse • Wiring, terminals or connectors • PCM • RCM • OCSM • 4X4 control module • IC • SJB	• GO to Pinpoint Test A.
• No power to the scan tool	• Fuse • Wiring, terminals or connectors • Scan tool	• GO to Pinpoint Test I.

Symptom Chart (Part 2)

PINPOINT TEST A: THE PCM DOES NOT RESPOND TO THE SCAN TOOL OR NO HIGH SPEED CONTROLLER AREA NETWORK (HS-CAN) COMMUNICATION

⚠ **CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step		Result / Action to Take
A1	**CHECK THE DATA LINK CONNECTOR (DLC) PINS FOR DAMAGE** **NOTE:** Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test. • Key in OFF position. • Disconnect the scan tool cable from the DLC. • Inspect DLC pins 6 and 14 for damage.  A0093867 • **Are DLC pins 6 and 14 OK?**	**Yes** GO to **A2**. **No** REPAIR the DLC as necessary. CLEAR the DTCs. REPEAT the network test with the scan tool.
A2	**CHECK THE HS-CAN TERMINATION RESISTANCE** • Key in OFF position. • **NOTE:** Failure to disconnect the battery will result in false resistance readings. Disconnect the vehicle battery. • Disconnect the scan tool cable from the DLC.	

(Continued)

Information Bus: Pinpoint Tests

Test A: The PCM Does Not Respond To The Scan Tool Or No High Speed Controller Area Network (HS-CAN) Communication

PINPOINT TEST A: THE PCM DOES NOT RESPOND TO THE SCAN TOOL OR NO HIGH SPEED CONTROLLER AREA NETWORK (HS-CAN) COMMUNICATION

Normal Operation

The PCM communicates with the scan tool through the high speed controller area network (HS-CAN). Circuits VDB04 (WH/BU) (HS-CAN +) and VDB05 (WH) (HS-CAN -) provide the network connection to the PCM. The PCM shares the HS-CAN with the 4X4 control module, the restraints control module (RCM), the occupant classification system module (OCSM), the SJB, and the instrument cluster (IC). Circuits CBB39 (VT/WH) and SBB21 (GY/RD) provide voltage, and redundant circuit GD108 (BK/VT) provides ground.

This pinpoint test is intended to diagnose the following:

- Fuse

- Wiring, terminals or connectors

- PCM

- RCM

- Occupant classification system module (OCSM)

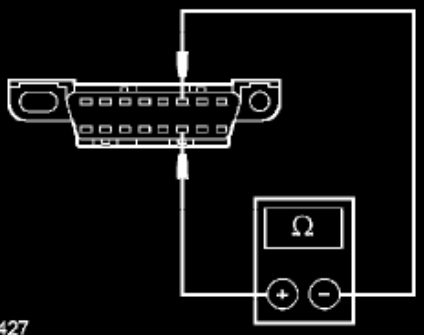
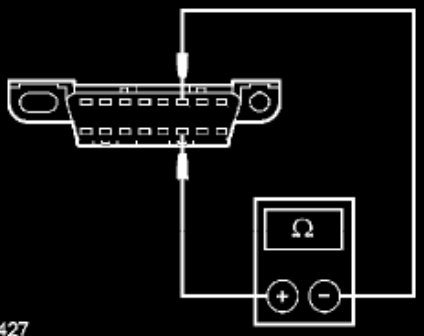
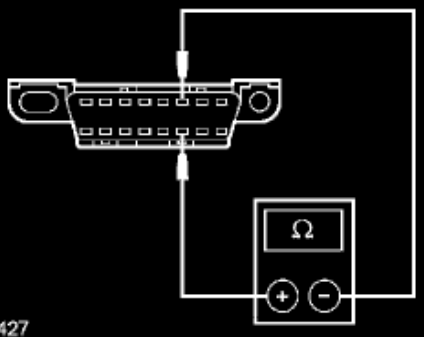
- 4X4 control module

- IC

- SJB

A1-A2

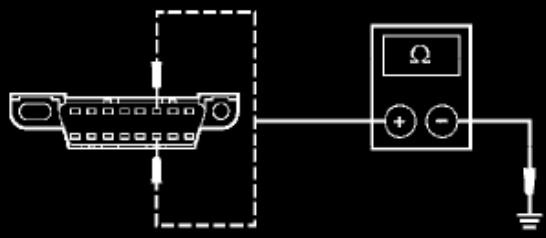
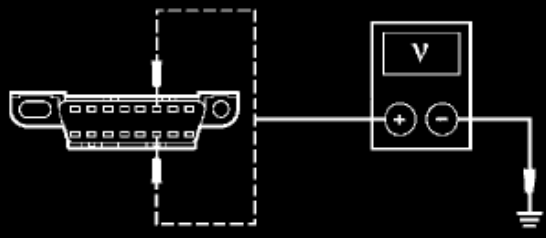
PINPOINT TEST A: THE PCM DOES NOT RESPOND TO THE SCAN TOOL OR NO HIGH SPEED CONTROLLER AREA NETWORK (HS-CAN) COMMUNICATION (Continued)

Test Step		Result / Action to Take
A2	CHECK THE HS-CAN TERMINATION RESISTANCE (Continued)	
	• Measure the resistance between the DLC C251-6, circuit VDB04 (WH), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.  N0026427 • **Is the resistance between 54 and 66 ohms?**	**Yes** GO to **A5**. **No** GO to **A3**.
A3	CHECK THE HS-CAN TERMINATION RESISTOR	
	• Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.  N0026427 • **Is the resistance between 108 and 132 ohms?**	**Yes** GO to **A9**. **No** GO to **A4**.
A4	CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TOGETHER	
	• Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.  N0026427 • **Is the resistance less than 5 ohms?**	**Yes** GO to **A10**. **No** GO to **A9**.

(Continued)

A2-A4

PINPOINT TEST A: THE PCM DOES NOT RESPOND TO THE SCAN TOOL OR NO HIGH SPEED CONTROLLER AREA NETWORK (HS-CAN) COMMUNICATION (Continued)

Test Step		Result / Action to Take
A5	CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TO GROUND	
• Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and ground; and between the DLC C251-14, circuit VDB05 (WH), harness side and ground.  N0002963 • **Are the resistances greater than 10,000 ohms?**		**Yes** GO to **A6**. **No** GO to **A16**.
A6	CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TO VOLTAGE	
• Connect the vehicle battery. • Key in ON position. • Measure the voltage between the DLC C251-6, circuit VDB04 (WH/BU), harness side and ground; and between the DLC C251-14, circuit VDB05 (WH), harness side and ground.  N0002964 • **Is the voltage greater than 6 volts?**		**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool. **No** GO to **A7**.
A7	CHECK THE PCM VOLTAGE SUPPLY CIRCUITS FOR AN OPEN	
• Key in OFF position. • Disconnect: PCM C175b. • Key in ON position. • Measure the voltage between the PCM, harness side and ground as follows:		

PCM Connector-Pin	Circuit
C175b-35	CBB39 (VT/WH)
C175b-36	CBB39 (VT/WH)
C175b-45	SBB21 (GY/RD)

	• **Are the voltages greater than 10 volts?**	**Yes** GO to **A8**. **No** VERIFY the battery junction box (BJB) fuse 21 (10A) and fuse 39 (15A) is OK. If OK, REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.
A8	CHECK THE PCM GROUND CIRCUITS	
• Key in OFF position.		

(Continued)

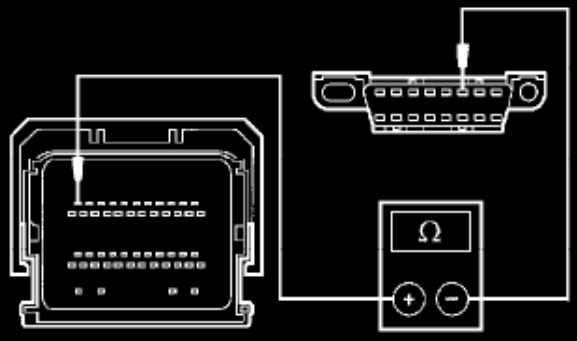
A5-A8

PINPOINT TEST A: THE PCM DOES NOT RESPOND TO THE SCAN TOOL OR NO HIGH SPEED CONTROLLER AREA NETWORK (HS-CAN) COMMUNICATION (Continued)

Test Step		Result / Action to Take
A8	CHECK THE PCM GROUND CIRCUITS (Continued)	
	• Measure the resistance between the PCM, harness side and ground as follows:	

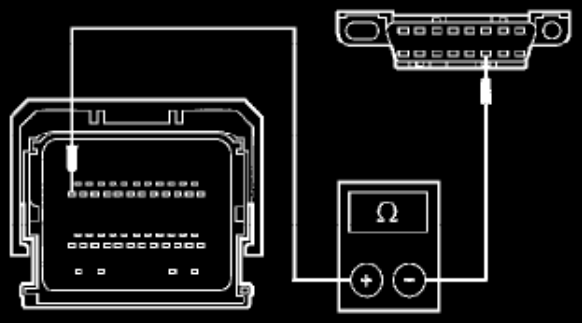
PCM Connector-Pin	Circuit
C175b-10	GD108 (BK/VT)
C175b-47	GD108 (BK/VT)
C175b-48	GD108 (BK/VT)
C175b-49	GD108 (BK/VT)
C175b-50	GD108 (BK/VT)

	• **Are the resistances less than 5 ohms?**	**Yes** GO to **A22**. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.
A9	CHECK THE CAN CIRCUITS BETWEEN THE DLC AND THE PCM FOR AN OPEN	
	• Measure the resistance between the PCM C175b-11, circuit VDB04 (WH/BU), harness side and the DLC C251-6, circuit VDB04 (WH/BU), harness side.	



N0002560

	• Measure the resistance between the PCM C175b-23, circuit VDB05 (WH), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.	



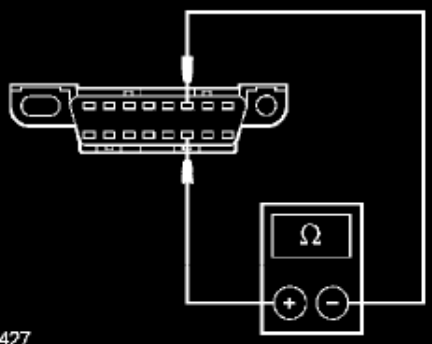
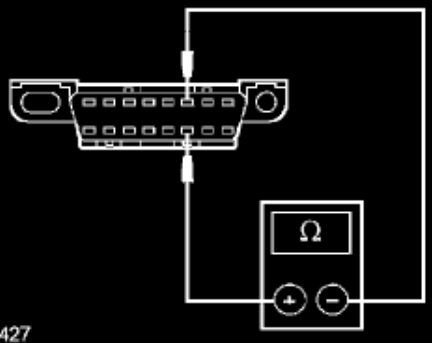
N0002561

	• **Are the resistances less than 5 ohms?**	**Yes** GO to **A18**. **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.
A10	CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE PCM DISCONNECTED	
	• Disconnect: PCM C175b.	

(Continucd)

A8-A10

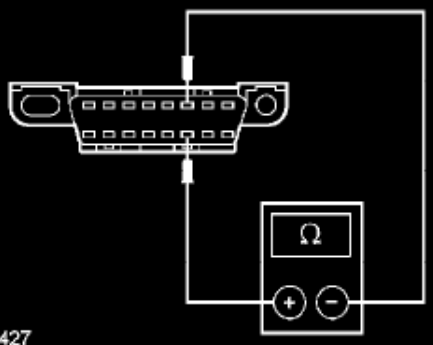
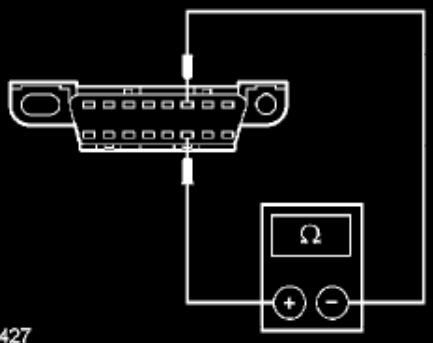
PINPOINT TEST A: THE PCM DOES NOT RESPOND TO THE SCAN TOOL OR NO HIGH SPEED CONTROLLER AREA NETWORK (HS-CAN) COMMUNICATION (Continued)

Test Step		Result / Action to Take
A10	**CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE PCM DISCONNECTED (Continued)**	
	• Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.  N0026427 • **Is the resistance less than 5 ohms?**	**Yes** GO to **A11**. **No** GO to **A22**.
A11	**CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE 4X4 CONTROL MODULE DISCONNECTED**	
	• Disconnect: 4X4 Control Module C281a. • Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.  N0026427 • **Is the resistance less than 5 ohms?**	**Yes** GO to **A12**. **No** GO to **A23**.
A12	**CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE INSTRUMENT CLUSTER (IC) DISCONNECTED**	
	• Disconnect. IC C220b.	

(Continued)

A10-A12

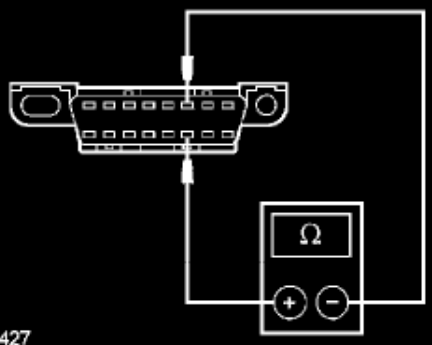
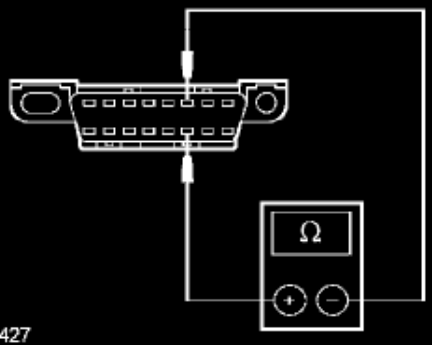
PINPOINT TEST A: THE PCM DOES NOT RESPOND TO THE SCAN TOOL OR NO HIGH SPEED CONTROLLER AREA NETWORK (HS-CAN) COMMUNICATION (Continued)

	Test Step	Result / Action to Take
A12	**CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE INSTRUMENT CLUSTER (IC) DISCONNECTED (Continued)**	
	• Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.  N0026427 • **Is the resistance less than 5 ohms?**	**Yes** GO to **A13**. **No** GO to **A24**.
A13	**CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE SJB DISCONNECTED**	
	• Disconnect: SJB C2280d. • Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.  N0026427 • **Is the resistance less than 5 ohms?**	**Yes** GO to **A14**. **No** GO to **A25**.
A14	**CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE RCM DISCONNECTED**	
	• Depower the supplemental restraint system (SRS). Refer to Air Bag Systems. • Disconnect: RCM C2041a.	

(Continued)

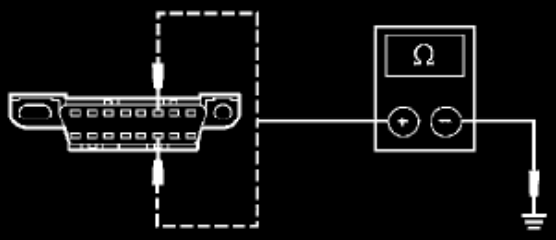
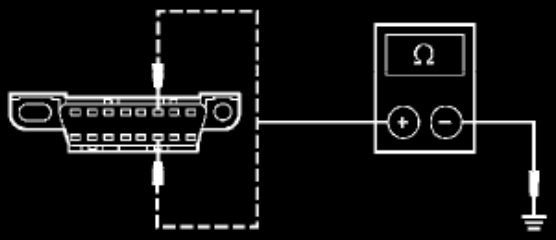
A12-A14

PINPOINT TEST A: THE PCM DOES NOT RESPOND TO THE SCAN TOOL OR NO HIGH SPEED CONTROLLER AREA NETWORK (HS-CAN) COMMUNICATION (Continued)

	Test Step	Result / Action to Take
A14	**CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE RCM DISCONNECTED (Continued)**	
	• Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.  N0026427 • **Is the resistance less than 5 ohms?**	**Yes** GO to **A15**. **No** GO to **A26**.
A15	**CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TOGETHER WITH THE OCCUPANT CLASSIFICATION SYSTEM MODULE (OCSM) DISCONNECTED**	
	• Disconnect: OCSM C3159. • Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.  N0026427 • **Is the resistance less than 5 ohms?**	**Yes** REPAIR the circuit. CONNECT all modules. REPOWER the SRS. REFER to Air Bag Systems. CLEAR the DTCs. REPEAT the network test with the scan tool. **No** GO to **A27**.
A16	**CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE PCM DISCONNECTED**	
	• Disconnect: PCM C175b.	

(Continued)

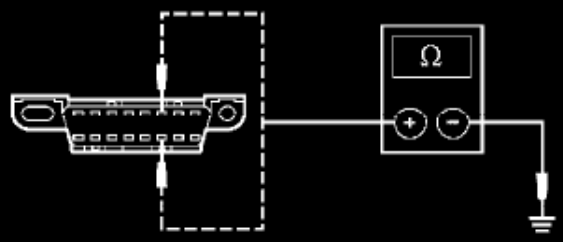
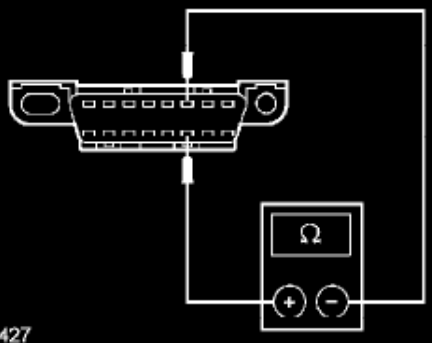
PINPOINT TEST A: THE PCM DOES NOT RESPOND TO THE SCAN TOOL OR NO HIGH SPEED CONTROLLER AREA NETWORK (HS-CAN) COMMUNICATION (Continued)

	Test Step	Result / Action to Take
A16	**CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE PCM DISCONNECTED (Continued)**	
	• Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and ground; and between the DLC C251-14, circuit VDB05 (WH), harness side and ground.  N0002963 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to **A22**. **No** GO to **A17**.
A17	**CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE 4X4 CONTROL MODULE DISCONNECTED**	
	• Disconnect: 4X4 Control Module C281a. • Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and ground; and between the DLC C251-14, circuit VDB05 (WH), harness side and ground.  N0002963 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to **A23**. **No** GO to **A18**.
A18	**CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE IC DISCONNECTED**	
	• Disconnect: IC C220b.	

(Continued)

A16-A18

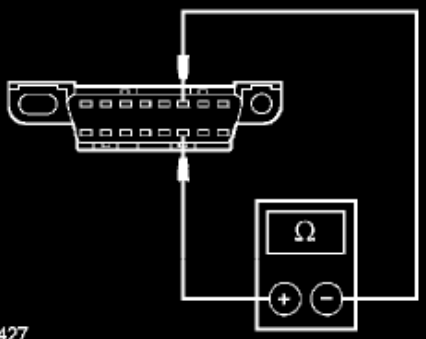
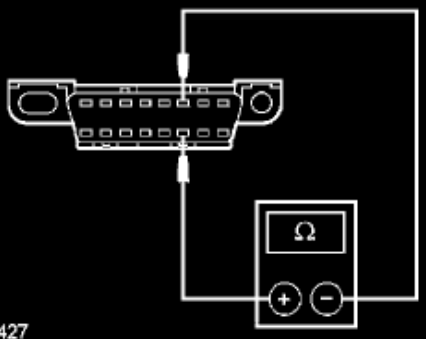
PINPOINT TEST A: THE PCM DOES NOT RESPOND TO THE SCAN TOOL OR NO HIGH SPEED CONTROLLER AREA NETWORK (HS-CAN) COMMUNICATION (Continued)

Test Step		Result / Action to Take
A18	CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE IC DISCONNECTED (Continued)	
	• Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and ground; and between the DLC C251-14, circuit VDB05 (WH), harness side and ground.  N0002963 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to **A24**. **No** GO to **A19**.
A19	CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE SJB DISCONNECTED	
	• Disconnect: SJB C2280d. • Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.  N0026427 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to **A25**. **No** GO to **A20**.
A20	CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE RCM DISCONNECTED	
	• Depower the SRS. Refer to Air Bag Systems. • Disconnect: RCM C2041a.	

(Continued)

A18-A20

PINPOINT TEST A: THE PCM DOES NOT RESPOND TO THE SCAN TOOL OR NO HIGH SPEED CONTROLLER AREA NETWORK (HS-CAN) COMMUNICATION (Continued)

Test Step		Result / Action to Take
A20	**CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE RCM DISCONNECTED (Continued)**	
	• Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.  N0026427 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to **A26**. **No** GO to **A21**.
A21	**CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TO GROUND WITH THE OCSM DISCONNECTED**	
	• Disconnect: OCSM C3159. • Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.  N0026427 • **Are the resistances greater than 10,000 ohms?**	**Yes** GO to **A27**. **No** REPAIR the circuit. CONNECT all modules. REPOWER the SRS. REFER to Air Bag Systems. CLEAR the DTCs. REPEAT the network test with the scan tool.
A22	**CHECK FOR CORRECT PCM OPERATION**	
	• Disconnect all the PCM connectors. • Check for: — corrosion — damaged pins — pushed-out pins • Connect all the PCM module connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new PCM. CLEAR the DTCs. REPEAT the network test with the scan tool. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

(Continued)

PINPOINT TEST A: THE PCM DOES NOT RESPOND TO THE SCAN TOOL OR NO HIGH SPEED CONTROLLER AREA NETWORK (HS-CAN) COMMUNICATION (Continued)

Test Step		Result / Action to Take
A23	CHECK FOR CORRECT 4X4 CONTROL MODULE OPERATION	
	• Disconnect all the 4X4 control module connectors. • Check for: — corrosion — damaged pins — pushed-out pins • Connect the 4X4 control module connectors and make sure they seat correctly. • Verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new 4X4 control module. CLEAR the DTCs. REPEAT the network test with the scan tool. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.
A24	CHECK FOR CORRECT IC OPERATION	
	• Disconnect the IC connector. • Check for: — corrosion — damaged pins — pushed-out pins • Connect the IC connector and make sure it seats correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new IC. CLEAR the DTCs. REPEAT the network test with the scan tool. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.
A25	CHECK FOR CORRECT SJB OPERATION	
	• Disconnect all the SJB connectors. • Check for: — corrosion — damaged pins — pushed-out pins • Connect the SJB connectors and make sure they seat correctly. • Verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB. CLEAR the DTCs. REPEAT the network test with the scan tool. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.
A26	CHECK FOR CORRECT RCM MODULE OPERATION	
	• Disconnect all the RCM module connectors. • Check for: — corrosion — damaged pins — pushed-out pins • Connect all the RCM module connectors and make sure they seat correctly. • Verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new RCM module. CLEAR the DTCs. REPEAT the network test with the scan tool. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. REPOWER the SRS. REFER to Air Bag Systems. CLEAR the DTCs. REPEAT the network test with the scan tool.
A27	CHECK FOR CORRECT OCSM OPERATION	
	• Disconnect the OCSM connector. • Check for: — corrosion — damaged pins — pushed-out pins • Connect the OCSM connector and make sure it seats correctly. • Verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new OCSM. CLEAR the DTCs. REPEAT the network test with the scan tool. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. REPOWER the SRS. REFER to Air Bag Systems. REPOWER the SRS. CLEAR the DTCs. REPEAT the network test with the scan tool.

A23-A27

Test B: The Occupant Classification System Module (OCSM) Does Not Communicate With the Scan Tool

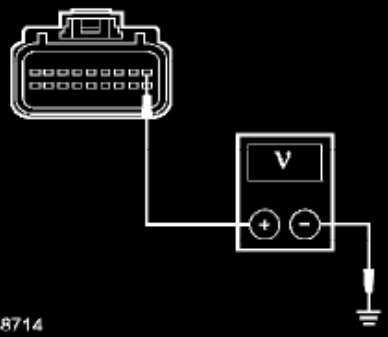
PINPOINT TEST B: THE OCCUPANT CLASSIFICATION SYSTEM MODULE (OCSM) DOES NOT COMMUNICATE WITH THE SCAN TOOL

Normal Operation

The OCSM communicates with the scan tool through the high speed controller area network (HS-CAN). Circuits VDB04 (WH/BU) (HS-CAN +) and VDB05 (WH) (HS-CAN -) provide the network connection to the OCSM. The OCSM shares the HS-CAN with the PCM, the 4X4 control module, the restraints control module (RCM), the SJB, and the instrument cluster (IC). Voltage for the RCM is provided by circuit CBP08 (GY/YE) and circuit GD174 (BK/WH) provides ground.

PINPOINT TEST B: THE OCCUPANT CLASSIFICATION SYSTEM MODULE (OCSM) DOES NOT COMMUNICATE WITH THE SCAN TOOL

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step		Result / Action to Take
B1	CHECK THE OCSM VOLTAGE SUPPLY CIRCUITS FOR AN OPEN	
	• Key in OFF position. • Disconnect: OCSM C3159. • Key in ON position. • Measure the voltage between the OCSM C3159-1, circuit CBP08 (GY/YE), harness side and ground  • **Is the voltage greater than 10 volts?**	**Yes** GO to **B2**. **No** VERIFY the SJB fuse 46 (7.5A) is OK. If OK, REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.
B2	CHECK THE GROUND CIRCUIT FOR AN OPEN	
	• Key in OFF position.	

(Continued)

This pinpoint test is intended to diagnose the following:

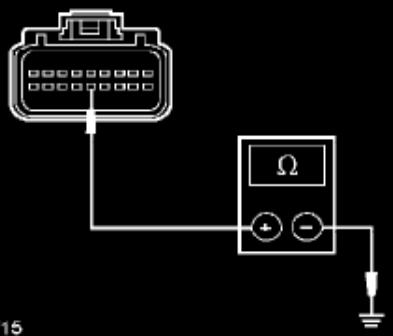
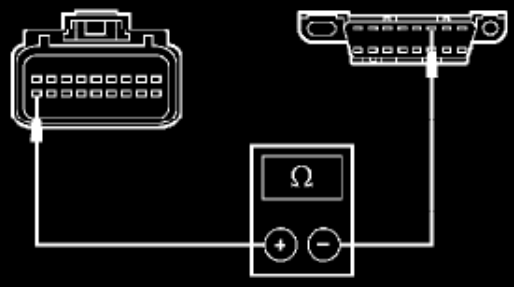
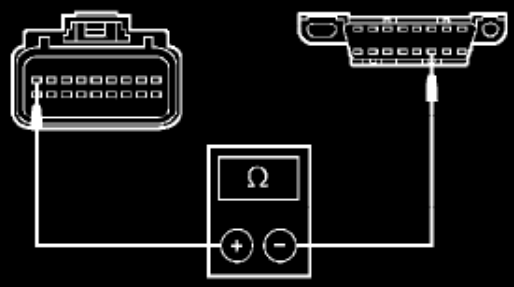
- Fuse

- Wiring, terminals or connectors

- OCSM

B1-B2

PINPOINT TEST B: THE OCCUPANT CLASSIFICATION SYSTEM MODULE (OCSM) DOES NOT COMMUNICATE WITH THE SCAN TOOL (Continued)

Test Step		Result / Action to Take
B2	CHECK THE GROUND CIRCUIT FOR AN OPEN (Continued)	
	• Measure the resistance between the OCSM C3159-14, circuit GD174 (BK/WH), harness side and ground.  N0058715 • **Is the resistance less than 5 ohms?**	**Yes** GO to **B3**. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.
B3	CHECK THE HS-CAN CIRCUITS BETWEEN THE DATA LINK CONNECTOR (DLC) AND THE OCSM FOR AN OPEN	
	• Measure the resistance between the OCSM C3159-18, circuit VDB04 (WH/BU), harness side and the DLC C251-6, circuit VDB04 (WH/BU), harness side.  N0026670 • Measure the resistance between the OCSM C3159-9, circuit VDB05 (WH), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.  N0026671 • **Are the resistances less than 5 ohms?**	**Yes** GO to **B4**. **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.

(Continued)

B2-B3

PINPOINT TEST B: THE OCCUPANT CLASSIFICATION SYSTEM MODULE (OCSM) DOES NOT COMMUNICATE WITH THE SCAN TOOL (Continued)

Test Step		Result / Action to Take
B4	CHECK FOR CORRECT OCSM OPERATION	
	• Disconnect the OCSM connector. • Check for: — corrosion — damaged pins — pushed-out pins • Connect the OCSM connector and make sure it seats correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new OCSM. REPEAT the network test with the scan tool. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

B4

Test C: The Restraints Control Module (RCM) Does Not Respond to the Scan Tool

PINPOINT TEST C: THE RESTRAINTS CONTROL MODULE (RCM) DOES NOT RESPOND TO THE SCAN TOOL

Normal Operation

The RCM communicates with the scan tool through the high speed controller area network (HS-CAN). Circuits VDB04 (WH/BU) (HS-CAN +) and VDB05 (WH) (HS-CAN -) provide the network connection to the RCM. The RCM module shares the HS-CAN with the PCM, the 4X4 control module, the occupant classification system module (OCSM), the SJB, and the instrument cluster (IC). Voltage for the RCM is provided by circuit CBP08 (GY/YE), and the RCM is case grounded.

This pinpoint test is intended to diagnose the following:

- Fuse

- Wiring, terminals or connectors

- Case ground open

- RCM

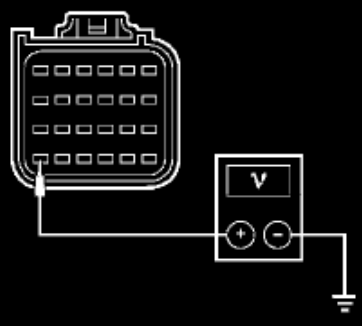
PINPOINT TEST C: THE RESTRAINTS CONTROL MODULE (RCM) DOES NOT RESPOND TO THE SCAN TOOL

WARNING: Remove restraint system diagnostic tools from the vehicle prior to road testing. If tools are not removed, the supplemental restraint system (SRS) device may not deploy in a crash. Failure to follow this instruction may result in serious personal injury or death in a crash and possibly violate vehicle safety standards.

WARNING: Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.

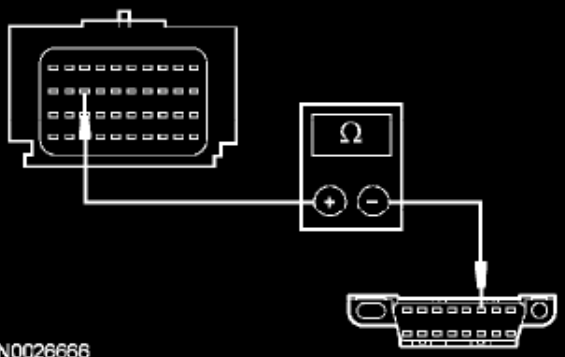
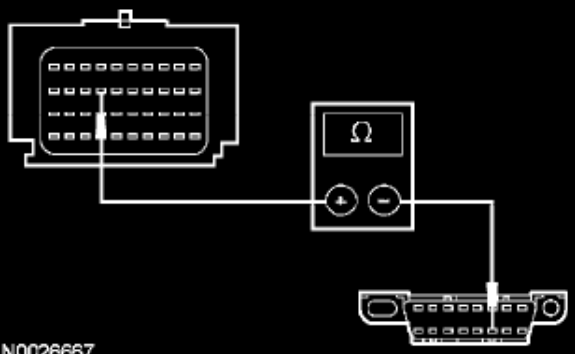
WARNING: Never probe the electrical connectors on safety belt buckle/retractor pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors, which increases the risk of serious personal injury or death.

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step		Result / Action to Take
C1	CHECK THE RCM PINS FOR DAMAGE	
	• Key in OFF position. • Depower the SRS. Refer to Air Bag Systems. • Disconnect: RCM C2041a and C2041b. • Inspect the RCM C2041a, harness side and RCM C2041a, component side, pins 17 and 18 for damage. • **Are the RCM connector pins 17 and 18 OK?**	**Yes** GO to **C2**. **No** REPAIR the RCM connector pins as necessary. REPOWER the SRS. REFER to Air Bag Systems. CLEAR the DTCs. REPEAT the network test with the scan tool.
C2	CHECK THE RCM VOLTAGE SUPPLY CIRCUIT FOR AN OPEN	
	• Deactivate the SRS. Refer to Air Bag Systems. • Repower the SRS. Refer to Air Bag Systems. • Key in ON position. • Measure the voltage between the RCM C2041b-24, circuit CBP08 (GY/YE), harness side and ground.  A0093807 • **Is the voltage greater than 10 volts?**	**Yes** GO to **C3**. **No** VERIFY the SJB fuse 8 (10A) is OK. If OK, REPAIR the circuit. REACTIVATE the SRS. REFER to Air Bag Systems. CLEAR the DTCs. REPEAT the network test with the scan tool.
C3	CHECK THE RCM CASE GROUND	
	• Key in OFF position. • Measure the resistance between the RCM case and a good sheet metal ground near the RCM. • **Is the resistance less than 25 ohms?**	**Yes** GO to **C4**. **No** REPAIR the RCM case ground as necessary. REACTIVATE the SRS. REFER to Air Bag Systems. CLEAR the DTCs. REPEAT the network test with the scan tool.

(Continued)

PINPOINT TEST C: THE RESTRAINTS CONTROL MODULE (RCM) DOES NOT RESPOND TO THE SCAN TOOL (Continued)

Test Step		Result / Action to Take
C4	CHECK THE HS-CAN CIRCUITS BETWEEN THE DATA LINK CONNECTOR (DLC) AND THE RCM FOR AN OPEN	
	• Measure the resistance between the RCM C2041a-18, circuit VDB04 (WH/BU), harness side and the DLC C251-6, circuit VDB04 (WH/BU), harness side.  N0026666 • Measure the resistance between the RCM C2041a-17, circuit VDB05 (WH), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.  N0026667 • **Are the resistances less than 5 ohms?**	**Yes** GO to **C5**. **No** REPAIR the circuit in question. REACTIVATE the SRS. REFER to Air Bag Systems. CLEAR the DTCs. REPEAT the network test with the scan tool.
C5	CHECK FOR CORRECT RCM OPERATION	
	• Disconnect all the RCM connectors. • Check for: — corrosion — damaged pins — pushed-out pins • Connect all the RCM connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new RCM. REACTIVATE the SRS. REFER to Air Bag Systems. CLEAR the DTCs. REPEAT the network test with the scan tool. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. REACTIVATE the SRS. REFER to Air Bag Systems. CLEAR the DTCs. REPEAT the network test with the scan tool.

C4-C5

Test D: The Smart Junction Box (SJB) Does Not Respond to the Scan Tool

PINPOINT TEST D: THE SMART JUNCTION BOX (SJB) DOES NOT RESPOND TO THE SCAN TOOL

Normal Operation

The SJB communicates with the scan tool through the high speed controller area network (HS-CAN). Circuits VDB04 (WH/BU) (HS-CAN +) and VDB05 (WH) (HS-CAN -) provide the network connection to the SJB. The SJB shares the HS-CAN with the PCM, the restraints control module (RCM), the occupant classification system module (OCSM), the 4X4 control module, and the instrument cluster (IC). Voltage is supplied through circuit SBB05 (GY/RD), and ground is provided through circuit GD174 (BK/WH).

This pinpoint test is intended to diagnose the following:

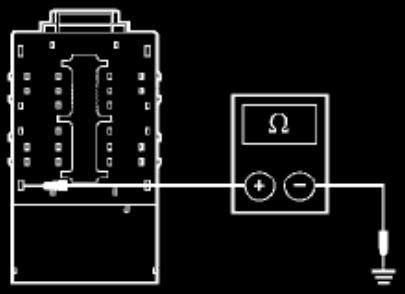
- Fuse

- Wiring, terminals or connectors

- SJB

PINPOINT TEST D: THE SMART JUNCTION BOX (SJB) DOES NOT RESPOND TO THE SCAN TOOL

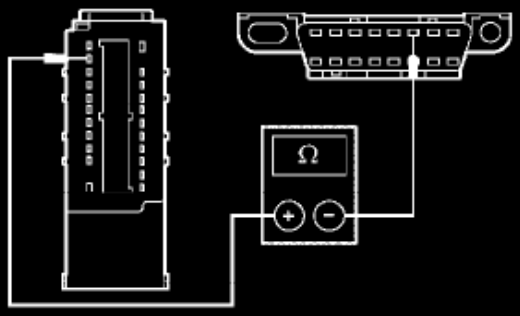
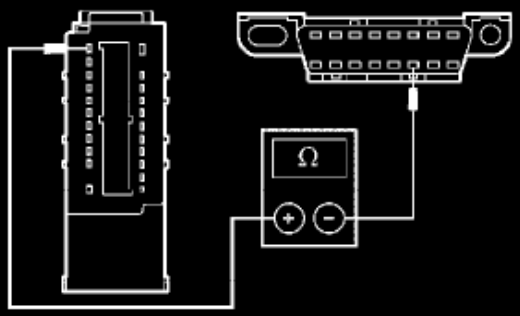
⚠ **CAUTION: Use the correct probe adapter(s) when taking measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step		Result / Action to Take
D1	CHECK THE SJB FUSE FOR AN OPEN	
	• Disconnect: SJB Fuse 11 (10A). • Inspect the fuse for an open. • **Is the fuse open?**	**Yes** GO to **D4**. **No** GO to **D2**.
D2	CHECK THE SJB GROUND CIRCUIT FOR AN OPEN	
	• Key in OFF position. • Disconnect: SJB C2280c. • Measure the resistance between the SJB C2280c-1, circuit GD174 (BK/WH), harness side and ground.  N0053249 • **Is the resistance less than 5 ohms?**	**Yes** GO to **D3**. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.
D3	CHECK THE HS-CAN CIRCUITS BETWEEN THE DATA LINK CONNECTOR (DLC) AND THE SJB FOR AN OPEN	
	• Disconnect: SJB C2280d.	

(Continued)

D1-D3

PINPOINT TEST D: THE SMART JUNCTION BOX (SJB) DOES NOT RESPOND TO THE SCAN TOOL (Continued)

Test Step	Result / Action to Take
D3 **CHECK THE HS-CAN CIRCUITS BETWEEN THE DATA LINK CONNECTOR (DLC) AND THE SJB FOR AN OPEN (Continued)** • Measure the resistance between the SJB C2280d-20, circuit VDB04 (WH/BU), harness side and the DLC C251-6, circuit VDB04 (WH/BU), harness side.  N0053239 • Measure the resistance between the SJB C2280d-21, circuit VDB05 (WH), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.  N0053240 • **Are the resistances less than 5 ohms?**	**Yes** GO to **D4**. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.
D4 **CHECK FOR CORRECT SJB OPERATION** • Disconnect all the SJB connectors. • Check for: — corrosion — damaged pins — pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB. CLEAR the DTCs. REPEAT the network test with the scan tool. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

D3-D4

Test E: The Instrument Cluster (IC) Does Not Respond to the Scan Tool

PINPOINT TEST E: THE INSTRUMENT CLUSTER (IC) DOES NOT RESPOND TO THE SCAN TOOL

Normal Operation

The instrument cluster (IC) communicates with the scan tool through the high speed controller area network (HS-CAN). Circuits VDB04 (WH/BU) (HS-CAN +) and VDB05 (WH) (HS-CAN -) provide the network connection to the IC. The IC shares the HS-CAN with the PCM, the restraints control module (RCM), the occupant classification system module (OCSM), the 4X4 control module, and the SJB. Voltage is supplied by circuits SBP33 (RD), CBP09 (VT/GY) and CBP10 (YE/OG). Ground is supplied by circuits GD161 (BK/YE) and GD174 (BK/WH).

This pinpoint test is intended to diagnose the following:

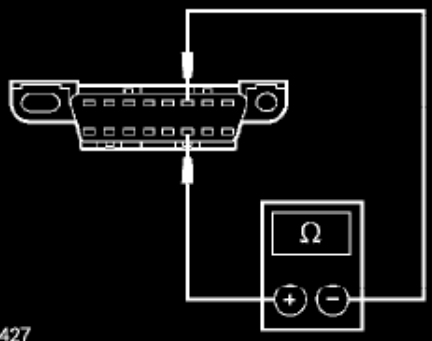
- Fuse

- Wiring, terminals or connectors

- IC

PINPOINT TEST E: THE INSTRUMENT CLUSTER (IC) DOES NOT RESPOND TO THE SCAN TOOL

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step		Result / Action to Take
E1	CHECK THE HS-CAN TERMINATION RESISTANCE	
	• Key in OFF position. • **NOTE:** Failure to disconnect the battery will result in false resistance readings. Disconnect the battery. • Disconnect the scan tool cable from the data link connector (DLC). • Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.  N0026427 • **Is the resistance between 54 and 66 ohms?**	**Yes** GO to **E2**. **No** GO to **E4**.
E2	CHECK THE IC VOLTAGE SUPPLY CIRCUITS FOR AN OPEN	
	• Disconnect: IC C220b. • Connect the battery. • Key in ON position. • Measure the voltage between the IC, harness side and ground as follows: **Connector-Pin / Circuit** C220b-8 — CBP10 (YE/OG) C220b-10 — SBP33 (RD) C220b-12 — CBP09 (VT/GY) • **Are the voltages greater than 10 volts?**	**Yes** GO to **E3**. **No** VERIFY the SJB fuses 9 (5A), 10 (10A) and 33 (5A) are OK. If OK, REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.

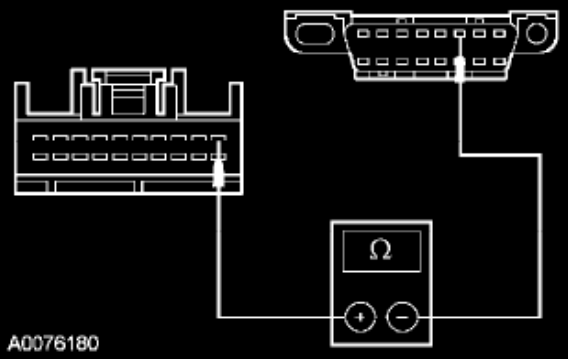
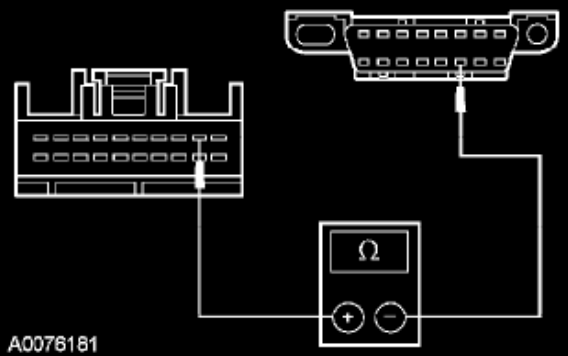
(Continued)

E1-E2

PINPOINT TEST E: THE INSTRUMENT CLUSTER (IC) DOES NOT RESPOND TO THE SCAN TOOL (Continued)

Test Step		Result / Action to Take
E3	**CHECK THE IC GROUND CIRCUITS FOR AN OPEN**	
	• Key in OFF position. • Disconnect: IC C220a. • Measure the resistance between the IC, harness side and ground as follows:	

Connector-Pin	Circuit
C220a-1	GD161 (BK/YE)
C220b-3	GD174 (BK/WH)

	• **Are the resistances less than 5 ohms?**	**Yes** GO to **E4**. **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.
E4	**CHECK THE HS-CAN CIRCUITS BETWEEN THE IC AND THE DLC FOR AN OPEN**	
	• Measure the resistance between the IC C220b-1, circuit VDB04 (WH/BU), harness side and the DLC C251-6, circuit VDB04 (WH/BU), harness side.	
	 A0076180	
	• Measure the resistance between the IC C220b-2, circuit VDB05 (WH), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.	
	 A0076181	
	• **Are the resistances less than 5 ohms?**	**Yes** GO to **E5**. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.
E5	**CHECK FOR CORRECT IC OPERATION**	
	• Disconnect the IC connector. • Check for: — corrosion — damaged pins — pushed-out pins • Connect the IC connector and make sure it seats correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new IC. CLEAR the DTCs. REPEAT the network test with the scan tool. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

E3-E5

Test F: The Four Wheel Drive (4X4) Control Module Does Not Respond To The Scan Tool

PINPOINT TEST F: THE FOUR WHEEL DRIVE (4X4) CONTROL MODULE DOES NOT RESPOND TO THE SCAN TOOL

Normal Operation

The 4X4 control module communicates with the scan tool through the high speed controller area network (HS-CAN). Circuits VDB04 (WH/BU) (HS-CAN +) and VDB05 (WH) (HS-CAN -) provide the network connection to the 4X4 control module. The 4X4 control module shares the HS-CAN with the PCM, the restraints control module (RCM), the occupant classification system module (OCSM), the instrument cluster (IC), and the SJB.

PINPOINT TEST F: THE FOUR WHEEL DRIVE (4X4) CONTROL MODULE DOES NOT RESPOND TO THE SCAN TOOL

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step		Result / Action to Take
F1	**CHECK THE 4X4 CONTROL MODULE VOLTAGE SUPPLY CIRCUITS FOR AN OPEN** • Key in OFF position. • Disconnect: 4X4 Control Module C281a. • Disconnect: 4X4 Control Module C281b. • Key in ON position. • Measure the voltage between the 4X4 control module, harness side and ground as follows: **Connector-Pin** / **Circuit** C2281-8 — CBP10 (YE/OG) C2281-6 — SBB27 (BU/RD) C2281-7 — SBP28 (GN/RD) • **Are the voltages greater than 10 volts?**	**Yes** GO to **F2**. **No** VERIFY the battery junction box (BJB) fuse 27 (20A), and SJB fuses 10 (10A) and 28 (15A) are OK. If OK, REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.
F2	**CHECK THE 4X4 CONTROL MODULE GROUND CIRCUITS FOR AN OPEN** • Key in OFF position. • Disconnect: IC C220a. • Measure the resistance between the 4X4 control module, harness side and ground as follows: **Connector-Pin** / **Circuit** C2281-10 — GD161 (BK/YE) C2281-3 — GD174 (BK/WH) • **Are the resistances less than 5 ohms?**	**Yes** GO to **F3**. **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.

(Continued)

Voltage is supplied by circuits SBB27 (BU/RD), SBP28 (GN/RD) and CBP10 (YE/OG). Ground is supplied by circuits GD161 (BK/YE) and GD174 (BK/WH).

This pinpoint test is intended to diagnose the following:

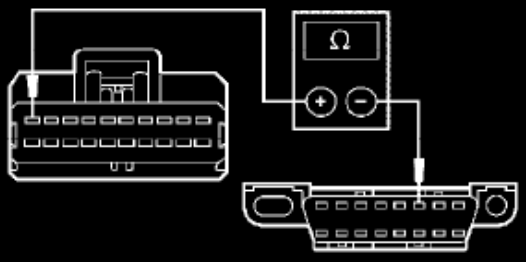
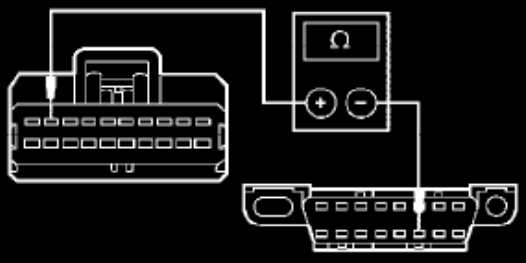
- Fuse

- Wiring, terminals or connectors

- 4X4 control module

F1-F2

PINPOINT TEST F: THE FOUR WHEEL DRIVE (4X4) CONTROL MODULE DOES NOT RESPOND TO THE SCAN TOOL (Continued)

Test Step		Result / Action to Take
F3	CHECK THE HIGH SPEED CAN CIRCUITS BETWEEN THE DATA LINK CONNECTOR (DLC) AND THE 4X4 CONTROL MODULE FOR AN OPEN	
	• Measure the resistance between the 4X4 control module C281a-10, circuit VDB04 (WH/BU), harness side and the DLC C251-6, circuit VDB04 (WH/BU), harness side.  N0053241 • Measure the resistance between the 4X4 control module C281a-9, circuit VDB05 (WH), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.  N0053242 • **Are the resistances less than 5 ohms?**	**Yes** GO to **F4**. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.
F4	CHECK FOR CORRECT 4X4 CONTROL MODULE OPERATION	
	• Disconnect all the 4X4 control module connectors. • Check for: — corrosion — damaged pins — pushed-out pins • Connect all the 4X4 control module connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a 4X4 control module. CLEAR the DTCs. REPEAT the network test with the scan tool. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

F3-F4

Test G: The ABS Module Does Not Respond To The Scan Tool Or No International Standards Organization (ISO) 9141 Network Communic

PINPOINT TEST G: THE ABS MODULE DOES NOT RESPOND TO THE SCAN TOOL OR NO INTERNATIONAL STANDARDS ORGANIZATION (ISO) 9141 NETWORK COMMUNICATION

Normal Operation

The scan tool communicates with the ISO 9141 network through the data link connector (DLC). The SJB communicates with the scan tool through the ISO 9141 communications network, circuit 70 (LB/WH).

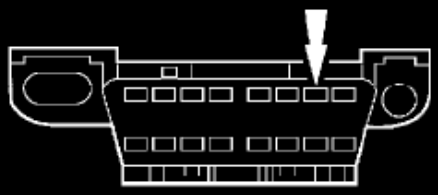
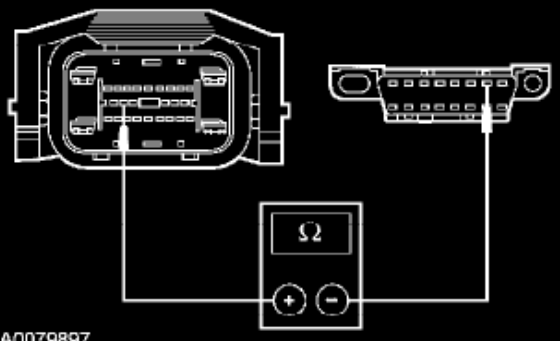
This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors

- DLC

PINPOINT TEST G: PINPOINT TEST G: THE ABS MODULE DOES NOT RESPOND TO THE SCAN TOOL OR NO INTERNATIONAL STANDARDS ORGANIZATION (ISO) 9141 NETWORK COMMUNICATION

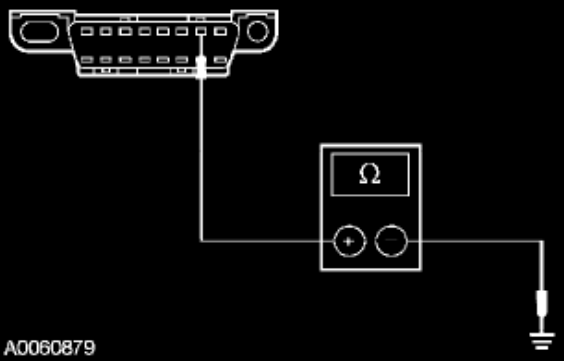
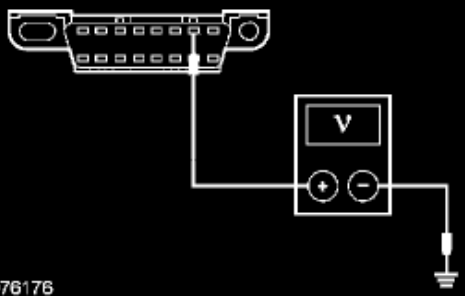
CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step		Result / Action to Take
G1	**CHECK THE DLC PINS FOR DAMAGE** **NOTE:** Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test. • Key in OFF position. • Disconnect the scan tool cable from the DLC. • Inspect DLC pin 7 for damage.  N0053184 • **Is DLC pin 7 OK?**	**Yes** GO to **G2**. **No** REPAIR the DLC as necessary. CLEAR the DTCs. REPEAT the network test with the scan tool.
G2	**CHECK THE ISO 9141 CIRCUIT BETWEEN THE ABS MODULE AND THE DLC FOR AN OPEN** • Disconnect: ABS Module C135. • Measure the resistance between the ABS module C135-16, circuit VDB10 (GY), harness side and the DLC C251-7, circuit VDB10 (GY), harness side.  A0079897 • **Is the resistance less than 5 ohms?**	**Yes** GO to **G3**. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.

(Continued)

G1-G2

PINPOINT TEST G: PINPOINT TEST G: THE ABS MODULE DOES NOT RESPOND TO THE SCAN TOOL OR NO INTERNATIONAL STANDARDS ORGANIZATION (ISO) 9141 NETWORK COMMUNICATION (Continued)

Test Step	Result / Action to Take
G3 CHECK THE ISO 9141 NETWORK FOR A SHORT TO GROUND	
• Measure the resistance between the DLC C251-7, circuit VDB10 (GY), harness side and ground.  A0060879 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to **G4**. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.
G4 CHECK THE ISO CIRCUIT FOR A SHORT TO VOLTAGE	
NOTE: The ABS module must be disconnected for this test step to be accurate. • Key in ON position. • Measure the voltage between the DLC C251-7, circuit VDB10 (GY), harness side and ground.  A0076176 • **Is any voltage indicated?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool. **No** GO to **G5**.
G5 CHECK THE ABS MODULE VOLTAGE SUPPLY	
• Measure the voltage between the ABS module, harness side and ground as follows: **ABS Module Connector-Pin / Circuit** C135-11 — SBB15 (WH/RD) C135-20 — CBP20 (YE/VT) C135-28 — SBB17 (RD) • **Are the voltages greater than 10 volts?**	**Yes** GO to **G6**. **No** VERIFY battery junction box (BJB) fuses 17 (40A) and 33 (30A) and SJB fuse 20 (10A) are OK. If OK, REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.
G6 CHECK THE ABS MODULE GROUND CIRCUITS	
• Key in OFF position. • Measure the resistance between the ABS module, harness side and ground as follows:	

(Continued)

G3-G6

PINPOINT TEST G: PINPOINT TEST G: THE ABS MODULE DOES NOT RESPOND TO THE SCAN TOOL OR NO INTERNATIONAL STANDARDS ORGANIZATION (ISO) 9141 NETWORK COMMUNICATION (Continued)

Test Step		Result / Action to Take
G6	CHECK THE ABS MODULE GROUND CIRCUITS (Continued)	
		Yes GO to **G7**. **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.

ABS Module Connector-Pin	Circuit
C135-1	GD122 (BK)
C135-18	GD122 (BK)

- **Are the resistances less than 5 ohms?**

G7	CHECK FOR CORRECT ABS MODULE OPERATION	
	• Disconnect the ABS module connector. • Check for: — corrosion — damaged pins — pushed-out pins • Connect the ABS module connector and make sure it seats correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new ABS module. CLEAR the DTCs. REPEAT the network test with the scan tool. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the network test with the scan tool.

PINPOINT TEST H: INTERMITTENT NO HIGH SPEED CONTROLLER AREA NETWORK (HS-CAN) COMMUNICATION, ONE OR MORE MODULES ARE NOT RESPONDING DURING NETWORK TEST

NOTE: Various modules will set network DTCs during this test procedure. Clear DTCs from all modules after the diagnostic procedure is completed.

Test Step		Result / Action to Take
H1	CHECK THE DATA LINK CONNECTOR (DLC) PINS FOR DAMAGE	
	• Key in OFF position. • Disconnect the scan tool cable from the DLC.	

(Continued)

Test H: Intermittent No High Speed Controller Area Network (HS-CAN) Communication, One Or More Modules Are Not Responding Durin

PINPOINT TEST H: INTERMITTENT NO HIGH SPEED CONTROLLER AREA NETWORK (HS-CAN) COMMUNICATION, ONE OR MORE MODULES ARE NOT RESPONDING DURING NETWORK TEST

Normal Operation

The HS-CAN network is used for communication between the PCM, the power steering control module (PSCM), the ABS module, the restraints control module (RCM), the 4X4 control module (if equipped) and the instrument cluster (IC). An open circuit VDB04 (WH/BU) (HS-CAN +) or VDB05 (WH) (HS-CAN -) may cause intermittent or unreliable communication to all modules on the HS-CAN.

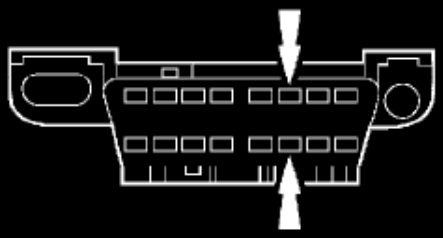
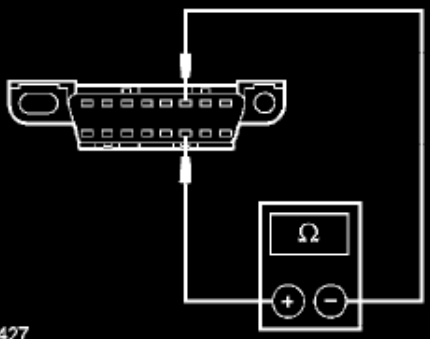
In the event that one of the 2 network circuits (HS-CAN + or HS-CAN -) becomes open to a module on the network, unreliable network communication to all modules on the network may result.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors

H1

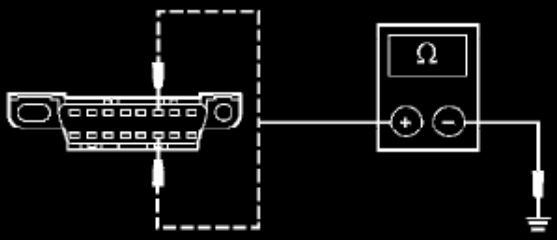
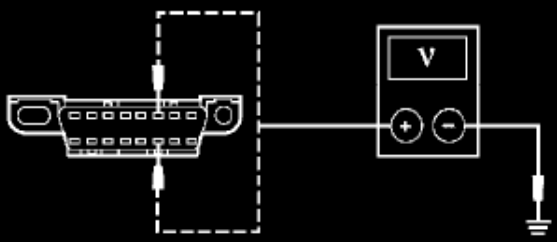
PINPOINT TEST H: INTERMITTENT NO HIGH SPEED CONTROLLER AREA NETWORK (HS-CAN) COMMUNICATION, ONE OR MORE MODULES ARE NOT RESPONDING DURING NETWORK TEST (Continued)

Test Step		Result / Action to Take
H1	**CHECK THE DATA LINK CONNECTOR (DLC) PINS FOR DAMAGE (Continued)**	
	• Inspect DLC pins 6 and 14 for damage.  A0093867 • **Are DLC pins 6 and 14 OK?**	**Yes** GO to **H2**. **No** REPAIR the DLC as necessary. CLEAR the DTCs. REPEAT the network test with the scan tool.
H2	**CHECK THE HS-CAN TERMINATION RESISTANCE**	
	• Key in OFF position. • **NOTE:** Failure to disconnect the battery will result in false resistance readings. Disconnect the battery. • Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and the DLC C251-14, circuit VDB05 (WH), harness side.  N0026427 • **Is the resistance between 54 and 66 ohms?**	**Yes** GO to **H3**. **No** GO to Pinpoint Test A.

(Continued)

H1-H2

PINPOINT TEST H: INTERMITTENT NO HIGH SPEED CONTROLLER AREA NETWORK (HS-CAN) COMMUNICATION, ONE OR MORE MODULES ARE NOT RESPONDING DURING NETWORK TEST (Continued)

Test Step		Result / Action to Take
H3	**CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TO GROUND** • Measure the resistance between the DLC C251-6, circuit VDB04 (WH/BU), harness side and ground; and between the DLC C251-14, circuit VDB05 (WH), harness side and ground.  N0002963 • **Are the resistances greater than 5,000 ohms?**	**Yes** GO to **H4**. **No** GO to Pinpoint Test A.
H4	**CHECK THE HS-CAN (+) AND HS-CAN (-) CIRCUITS FOR A SHORT TO VOLTAGE** • Connect the battery. • Key in ON position. • Measure the voltage between the DLC C251-6, circuit VDB04 (WH/BU), harness side and ground; and between the DLC C251-14, circuit VDB05 (WH), harness side and ground.  N0002964 • **Is the voltage greater than 6 volts?**	**Yes** REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool. **No** GO to **H5**.

(Continued)

H3-H4

PINPOINT TEST H: INTERMITTENT NO HIGH SPEED CONTROLLER AREA NETWORK (HS-CAN) COMMUNICATION, ONE OR MORE MODULES ARE NOT RESPONDING DURING NETWORK TEST (Continued)

	Test Step	Result / Action to Take
H5	**CHECK FOR RESTORED COMMUNICATION WITH THE PCM DISABLED**	
	NOTE: An IDS session must be established prior to disabling the PCM in this test step. If the PCM has failed communication during multiple attempts to identify the vehicle, first identify the vehicle manually by entering a PCM part number, calibration number or tear tag when prompted by IDS. **NOTE:** When a vehicle is manually identified by a PCM part number, calibration number or tear tag, the IDS will not automatically run a network test. The network test must be manually selected and run. **NOTE:** When re-running the network test, the network test application must be first closed or the screen display will revert back to the prior run network test results. • Disconnect: BJB Fuses 21 (10A) and 39 (15A). • Enter the following diagnostic mode on the scan tool: Network Test. • Repeat the network test. • **Do all other modules pass the network test?**	**Yes** INSTALL the removed fuses. GO to Pinpoint Test A. **No** INSTALL the removed fuses. GO to **H6**.
H6	**CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE SJB DISABLED**	
	NOTE: When re-running the network test, the network test application must be first closed or the screen display will revert back to the prior run network test results. • Disconnect: SJB Fuse 11 (10A). • Enter the following diagnostic mode on the scan tool: Network Test. • Repeat the network test. • **Do all other modules pass the network test?**	**Yes** INSTALL the removed fuse. GO to Pinpoint Test D. **No** GO to **H7**.
H7	**CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE SJB DISCONNECTED**	
	• Disconnect: SJB C2280c. • Enter the following diagnostic mode on the scan tool: Network Test. • Repeat the network test. • **Do all modules pass the network test?**	**Yes** INSTALL the removed fuse. CONNECT the SJB. GO to Pinpoint Test D. **No** CONNECT the SJB. GO to **H8**.
H8	**CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE IC DISABLED**	
	NOTE: When re-running the network test, the network test application must be first closed or the screen display will revert back to the prior run network test results. • Disconnect: SJB Fuse 9 (5A), 10 (10A) and 33 (5A). • Enter the following diagnostic mode on the scan tool: Network Test. • Repeat the network test. • **Do all other modules pass the network test?**	**Yes** INSTALL the removed fuses. If the vehicle is equipped with 4X4, GO to **H9**. If the vehicle is not equipped with 4X4, GO to Pinpoint Test E. **No** INSTALL the removed fuses. If the vehicle is equipped with 4X4, GO to **H10**. If the vehicle is not equipped with 4X4, GO to **H11**.
H9	**CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE IC DISCONNECTED**	
	NOTE: When re-running the network test, the network test application must be first closed or the screen display will revert back to the prior run network test results. • Disconnect: IC C220b. • Enter the following diagnostic mode on the scan tool: Network Test. • Repeat the network test. • **Do all other modules pass the network test?**	**Yes** INSTALL the removed fuses. GO to Pinpoint Test E. **No** INSTALL the removed fuses. GO to **H10**.

(Continued)

H5-H9

PINPOINT TEST H: INTERMITTENT NO HIGH SPEED CONTROLLER AREA NETWORK (HS-CAN) COMMUNICATION, ONE OR MORE MODULES ARE NOT RESPONDING DURING NETWORK TEST (Continued)

	Test Step	Result / Action to Take
H10	**CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE 4X4 CONTROL MODULE DISABLED**	
	NOTE: When re-running the network test, the network test application must be first closed or the screen display will revert back to the prior run network test results. • Disconnect: BJB Fuse 27 (20A) and SJB Fuses 10 (10A) and 28 (15A). • Enter the following diagnostic mode on the scan tool: Network Test. • Repeat the network test. • **Do all other modules pass the network test?**	**Yes** INSTALL the removed fuse. GO to Pinpoint Test F. **No** INSTALL the removed fuse. GO to **H11**.
H11	**CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE RESTRAINTS CONTROL MODULE (RCM) AND OCCUPANT CLASSIFICATION SYSTEM MODULE (OCSM) DISABLED**	
	NOTE: When re-running the network test, the network test application must be first closed or the screen display will revert back to the prior run network test results. • Disconnect: SJB Fuse 8 (10A). • Enter the following diagnostic mode on the scan tool: Network Test. • Repeat the network test. • **Do all other modules pass the network test?**	**Yes** INSTALL the removed fuse. GO to **H12**. **No** INSTALL the removed fuse. An intermittent fault is not present. GO to Pinpoint Test A.
H12	**CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE OCCUPANT CLASSIFICATION SYSTEM MODULE (OCSM) DISCONNECTED**	
	NOTE: When re-running the network test, the network test application must be first closed or the screen display will revert back to the prior run network test results. • Disconnect: OCSM C3159. • Enter the following diagnostic mode on the scan tool: Network Test. • Repeat the network test. • **Do all other modules pass the network test?**	**Yes** CONNECT the OCSM. GO to Pinpoint Test B. **No** CONNECT the OCSM. GO to **H13**.
H13	**CHECK FOR RESTORED NETWORK COMMUNICATION WITH THE RESTRAINTS CONTROL MODULE (RCM) DISABLED**	
	NOTE: When re-running the network test, the network test application must be first closed or the screen display will revert back to the prior run network test results. • Disconnect: RCM C2041a. • Enter the following diagnostic mode on the scan tool: Network Test. • Repeat the network test. • **Do all other modules pass the network test?**	**Yes** CONNECT the RCM. GO to Pinpoint Test C. **No** CONNECT the RCM. An intermittent fault is not present. GO to Pinpoint Test A.

H10-H13

Test I: No Power To The Scan Tool

PINPOINT TEST I: NO POWER TO THE SCAN TOOL

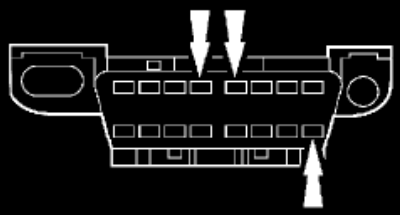
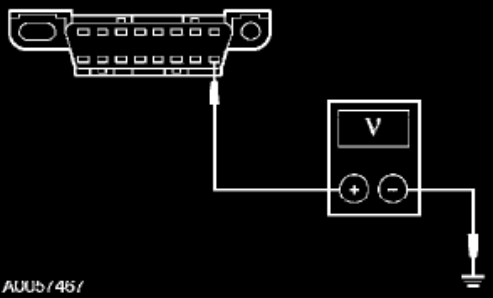
Normal Operation

The scan tool is connected to the data link connector (DLC) to communicate with the high speed controller area network (HS-CAN) and International Standards Organization (ISO) 9141 communications networks.

This pinpoint test is intended to diagnose the following:

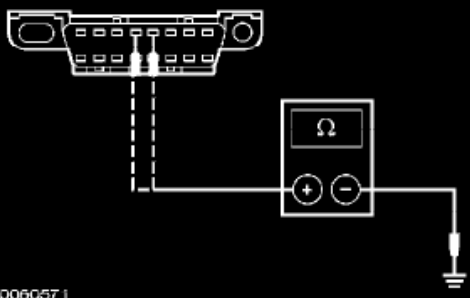
- Fuse
- Wiring, terminals or connectors
- DLC
- Scan tool

PINPOINT TEST I: NO POWER TO THE SCAN TOOL

Test Step		Result / Action to Take
I1	CHECK THE DLC PINS FOR DAMAGE	
	NOTE: Most faults are due to connector and/or wiring concerns. Carry out a thorough inspection and verification before proceeding with the pinpoint test. • Disconnect the scan tool cable from the DLC. • Inspect DLC pins 4, 5 and 16 for damage.  N0050767 • **Are DLC pins 4, 5 and 16 OK?**	**Yes** GO to I2. **No** REPAIR the DLC as necessary. CLEAR the DTCs. REPEAT the network test with the scan tool.
I2	CHECK THE DLC VOLTAGE SUPPLY CIRCUITS FOR AN OPEN	
	• Measure the voltage between the DLC C251-16, circuit SBP29 (GY/RD), harness side and ground.  A0057467 • **Is the voltage greater than 10 volts?**	**Yes** GO to I3. **No** VERIFY the SJB fuse 29 (20A) is OK. If OK, REPAIR the circuit. CLEAR the DTCs. REPEAT the network test with the scan tool.

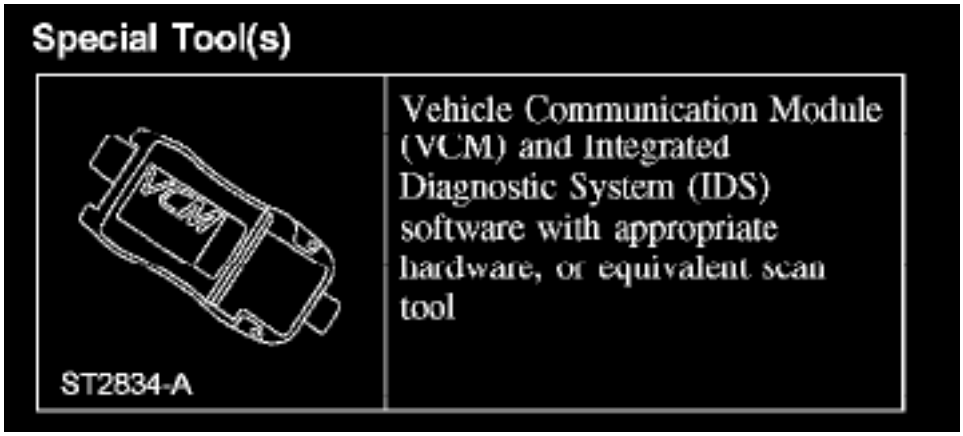
(Continued)

PINPOINT TEST I: NO POWER TO THE SCAN TOOL (Continued)

Test Step		Result / Action to Take
I3	CHECK THE DLC GROUND CIRCUITS	
	• Measure the resistance between the DLC C251-4, circuit GD161 (BK/YE), harness side and ground; and between the DLC C251-5, circuit GD174 (BK/WH), harness side and ground.  A0060571 • **Are the resistances less than 5 ohms?**	**Yes** REPAIR the scan tool. REPEAT the network test with the scan tool. **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the network test with the scan tool.

I1-I2

I3



Information Bus: Programming and Relearning

PROGRAMMABLE MODULE INSTALLATION

Special Tool(s)

Special Tool(s)

Programmable Module Installation (PMI) Using The Integrated Diagnostic System (IDS) When The Original Module Is Available

NOTE: Following module installation, some modules require a separate learning procedure be carried out. For instructions, refer to the specific module removal and installation procedures.

1. Connect the IDS and identify the vehicle as normal. 2. From the Toolbox icon, select Module Programming and press the check mark. 3. Select Programmable Module Installation. 4. Select the module that is being replaced. 5. Follow the on-screen instructions, turn the ignition key to the OFF position, and press the check mark. 6. Install the new module and press the check mark. 7. Follow the on-screen instructions, turn the ignition key to the ON position, and press the check mark. 8. The IDS downloads the data into the new module and displays Module Configuration Complete. 9. Test module for correct operation.

Programmable Module Installation (PMI) Using The Integrated Diagnostic System (IDS) When The Original Module Is Not Available

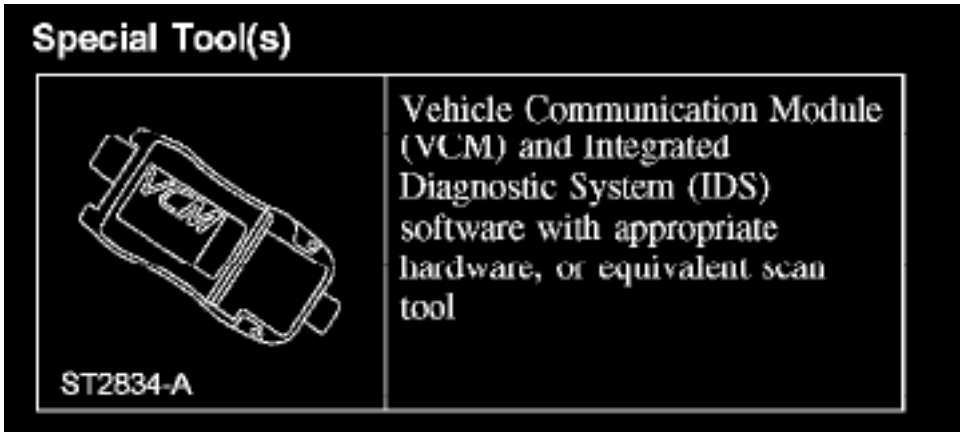
NOTE: Following module installation, some modules require a separate learning procedure be carried out. For adaptive learning and calibration instructions, refer to the specific module removal and installation procedures.

1. Install the new module. 2. Connect the IDS and identify the vehicle as normal. 3. From the Toolbox icon, select Module Programming and press the check mark. 4. Select Programmable Module Installation. 5. Select the module that was replaced. 6. Follow the on-screen instructions, turn the ignition key to the OFF position, and press the check mark. 7. Follow the on-screen instructions, turn the ignition key to the ON position, and press the check mark. 8. If the data is not available, the IDS displays a screen stating to contact the As-Built Data Center. Retrieve the data from the technician service

publication website at this time and press the check mark.

9. Enter the module data and press the check mark.

10. The IDS downloads the data into the new module and displays Module Configuration Complete. 11. Test module for correct operation.



Information Bus: Service and Repair

PROGRAMMABLE MODULE INSTALLATION

Special Tool(s)

Special Tool(s)

Programmable Module Installation (PMI) Using The Integrated Diagnostic System (IDS) When The Original Module Is Available

NOTE: Following module installation, some modules require a separate learning procedure be carried out. For instructions, refer to the specific module removal and installation procedures.

1. Connect the IDS and identify the vehicle as normal. 2. From the Toolbox icon, select Module Programming and press the check mark. 3. Select Programmable Module Installation. 4. Select the module that is being replaced. 5. Follow the on-screen instructions, turn the ignition key to the OFF position, and press the check mark. 6. Install the new module and press the check mark. 7. Follow the on-screen instructions, turn the ignition key to the ON position, and press the check mark. 8. The IDS downloads the data into the new module and displays Module Configuration Complete. 9. Test module for correct operation.

Programmable Module Installation (PMI) Using The Integrated Diagnostic System (IDS) When The Original Module Is Not Available

NOTE: Following module installation, some modules require a separate learning procedure be carried out. For adaptive learning and calibration instructions, refer to the specific module removal and installation procedures.

1. Install the new module. 2. Connect the IDS and identify the vehicle as normal. 3. From the Toolbox icon, select Module Programming and press the check mark. 4. Select Programmable Module Installation. 5. Select the module that was replaced. 6. Follow the on-screen instructions, turn the ignition key to the OFF position, and press the check mark. 7. Follow the on-screen instructions, turn the ignition key to the ON position, and press the check mark. 8. If the data is not available, the IDS displays a screen stating to contact the As-Built Data Center. Retrieve the data from the technician service

publication website at this time and press the check mark.

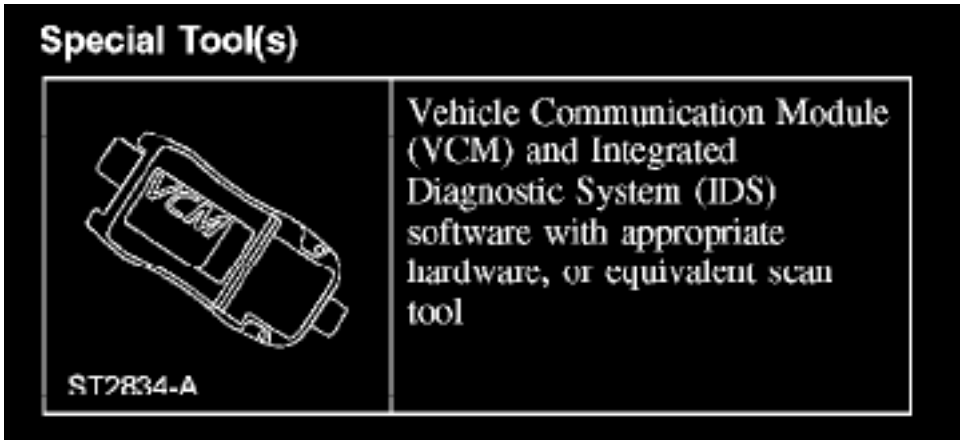
9. Enter the module data and press the check mark.

10. The IDS downloads the data into the new module and displays Module Configuration Complete. 11. Test module for correct operation.

Special Tool(s)

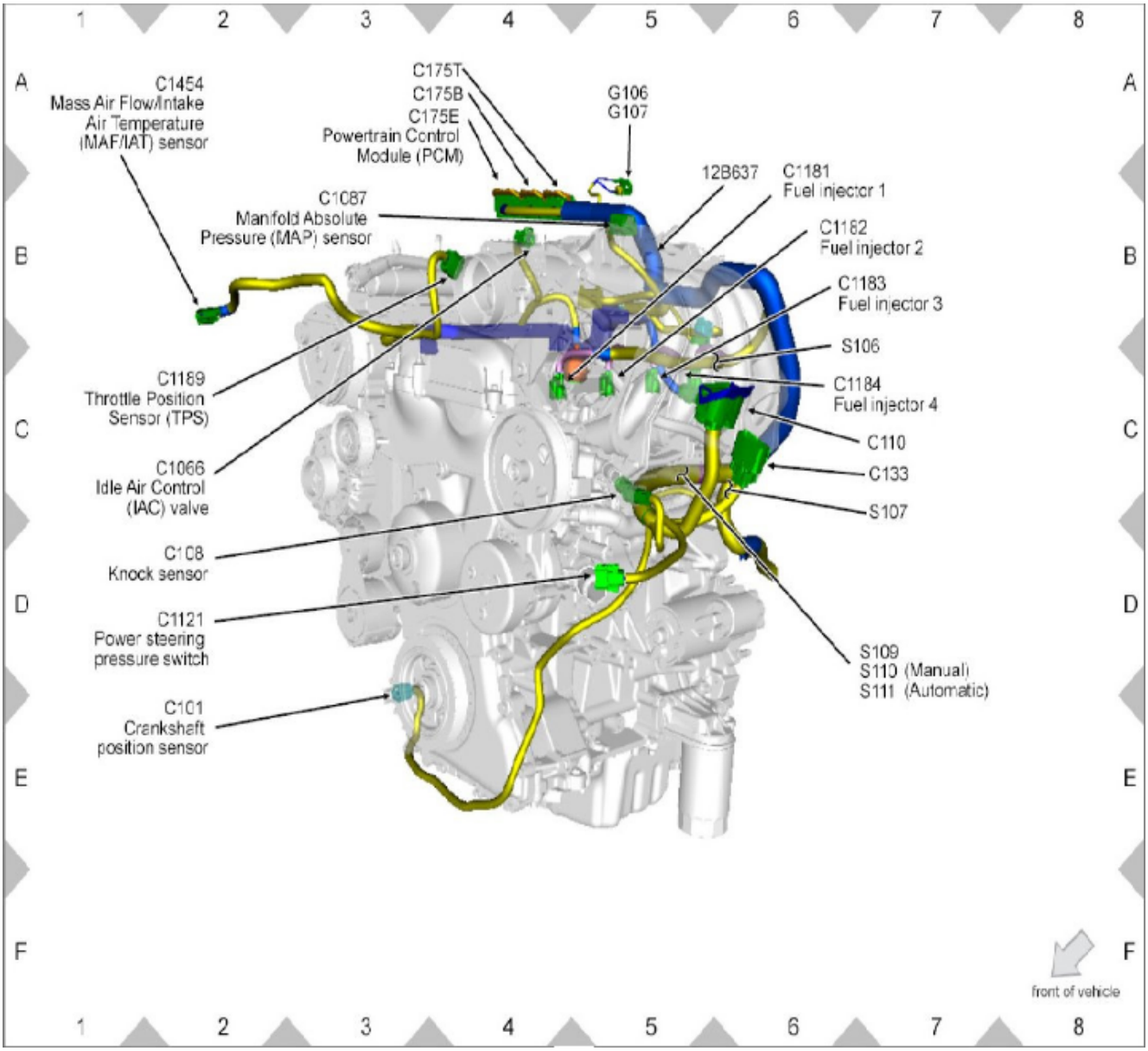
ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
ST2574-A	Flex Probe Kit 105-R025C or equivalent

Special Tool(s)



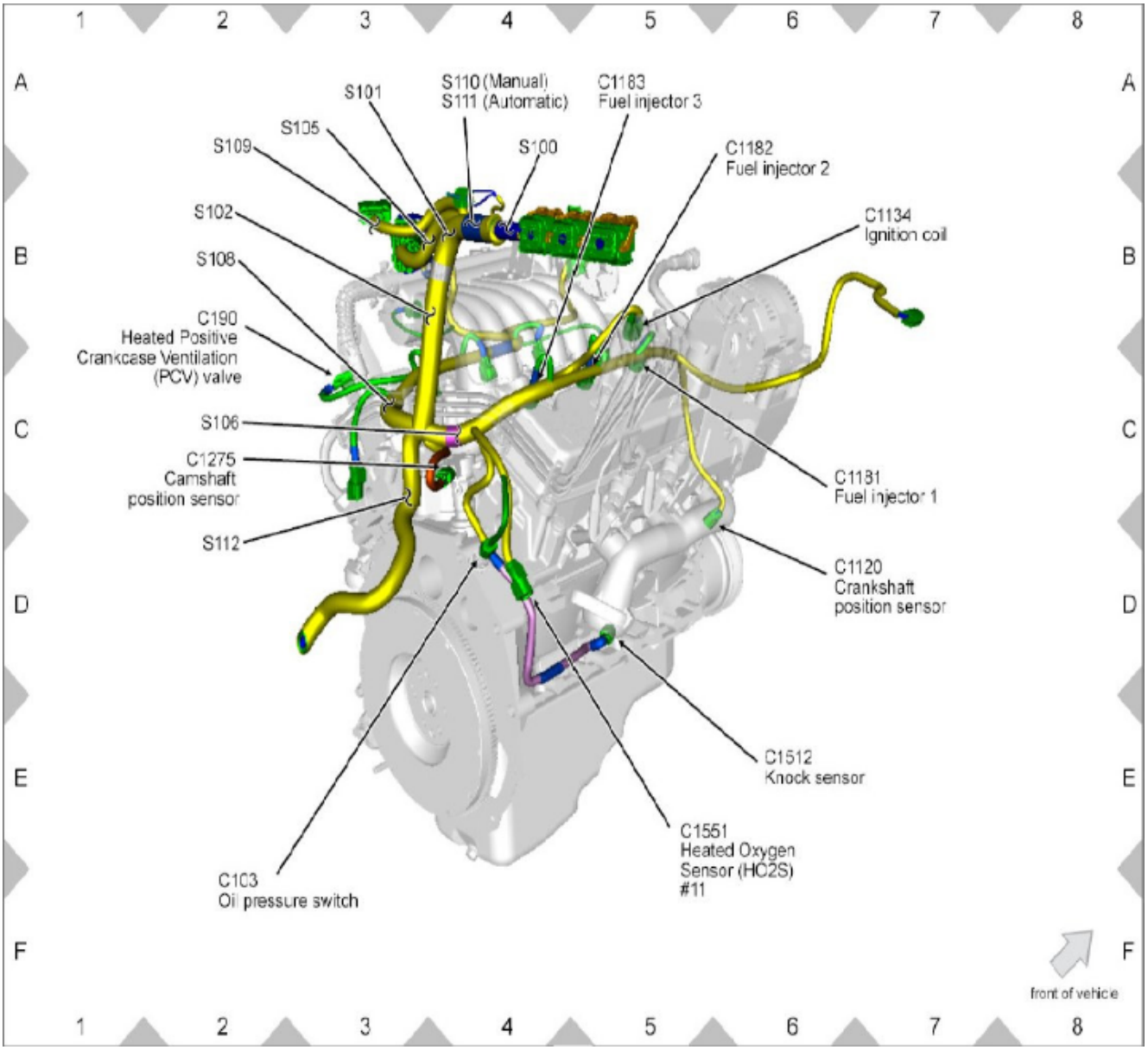
Special Tool(s)

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Powertrain Management > Computers and Control Systems > Knock Sensor > Component Information > Locations

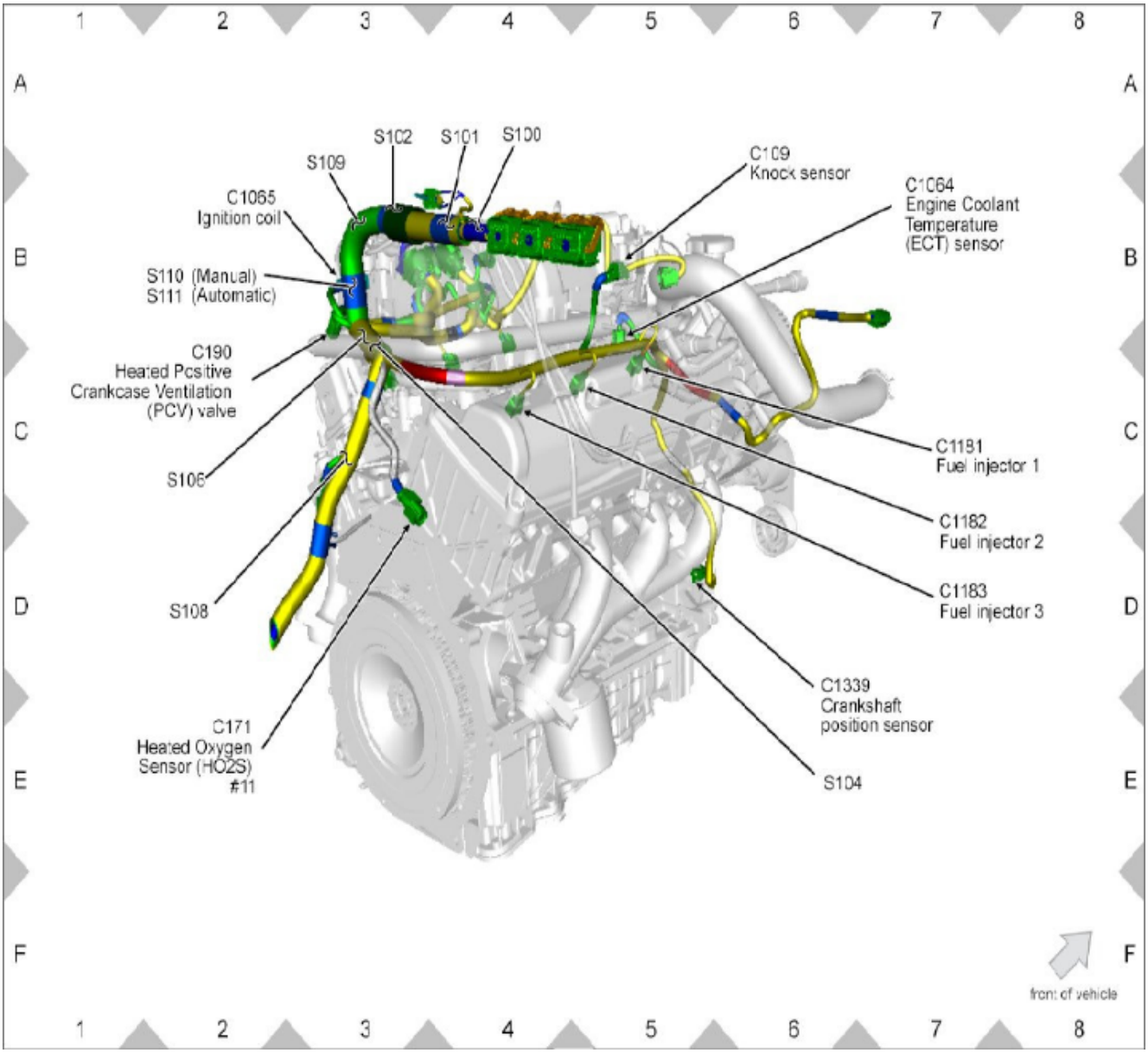


Knock Sensor: Locations

View 151-3


S101
S110 (Manual)
S111 (Automatic)
C1183
Fuel injector 3
S105
S109
S100
C1182
Fuel injector 2
S102
C1134
Ignition coil
S108
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
C1275
Camshaft
position sensor
S112
C1181
Fuel injector 1
C1120
Crankshaft
position sensor
C1512
Knock sensor
C1551
Heated Oxygen
Sensor (HO2S)
#11
C103
Oil pressure switch
front of vehicle

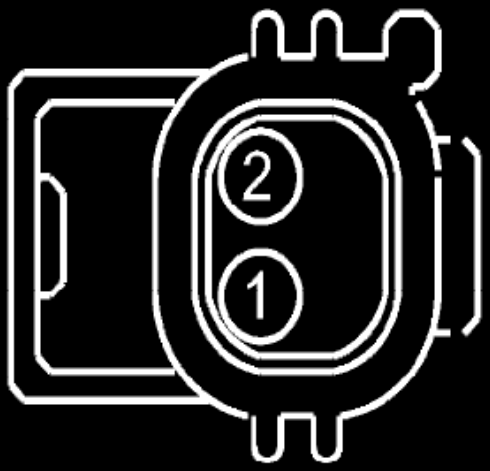
View 151-6


S102
S101
S100
S109
C1065
Ignition coil
S110 (Manual)
S111 (Automatic)
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
S108
C171
Heated Oxygen
Sensor (HO2S)
#11
C109
Knock sensor
C1064
Engine Coolant
Temperature
(ECT) sensor
C1181
Fuel injector 1
C1182
Fuel injector 2
C1183
Fuel injector 3
C1339
Crankshaft
position sensor
S104
front of vehicle

View 151-8

Connector: C108

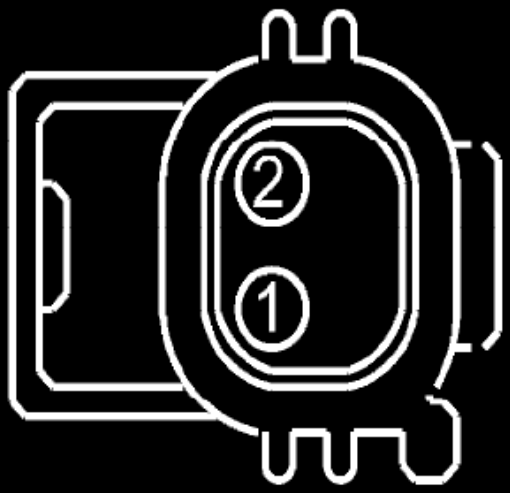
Description:	Harness:	Base Part #:
KNOCK SENSOR	12B637	12A699



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RE323 (WH-BN)	20	CTRL MOD. - POWERTRAIN # KNOCK SENSOR 1ST OR UNIQUE (KS1N) [KSL1-]	2.3L
2	VE801 (VT-OG)	20	SENSOR - KNOCK 1ST OR UNIQUE (KS1P) [KSL1+]	2.3L

Connector: C109

Description:	Harness:	Base Part #:
KNOCK SENSOR	12B637	12A699



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE801 (VT-OG)	20	SENSOR - KNOCK 1ST OR UNIQUE (KS1P) [KSL1+]	4.0L
2	RE323 (WH-BN)	20	CTRL MOD. - POWERTRAIN # KNOCK SENSOR 1ST OR UNIQUE (KS1N) [KSL1-]	4.0L

Knock Sensor: Diagrams

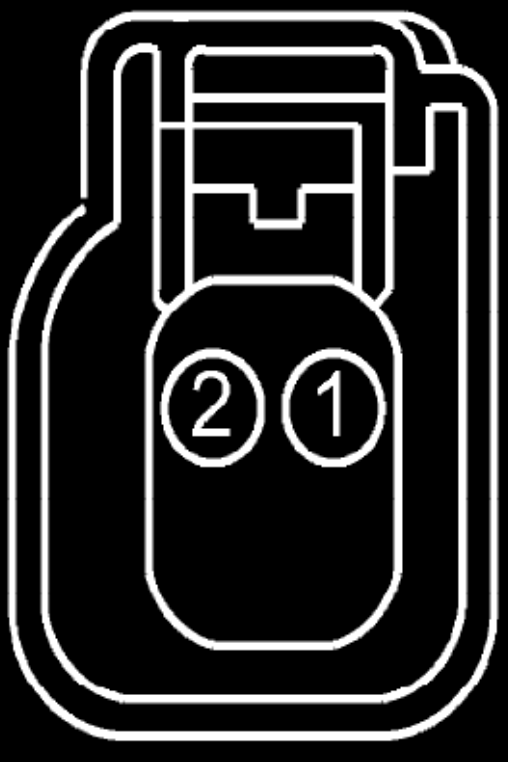
C108

C109

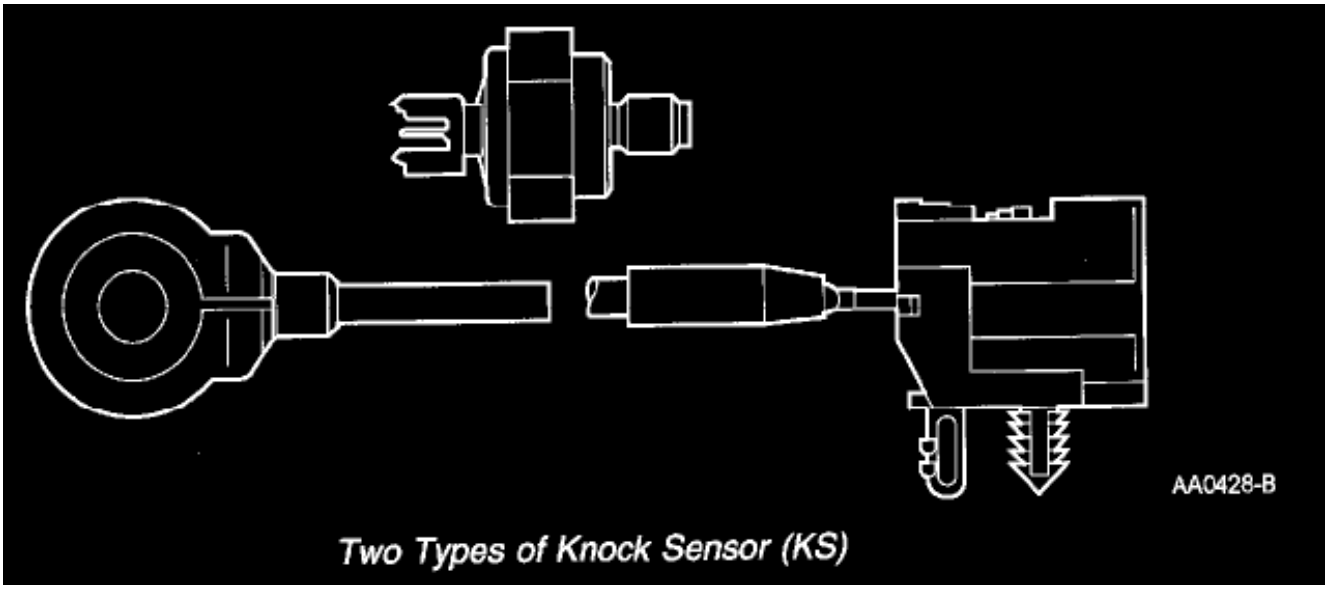
Connector: C1512

Description:	Harness:	Base Part #:
KNOCK SENSOR	12B637	12A699

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE801 (VT-OG)	20	SENSOR - KNOCK 1ST OR UNIQUE (KS1P) [KSL1+]	3.0L
2	RE323 (WH BN)	20	CTRL MOD. - POWERTRAIN # KNOCK SENSOR 1ST OR UNIQUE (KS1N) [KSL1-]	3.0L



C1512



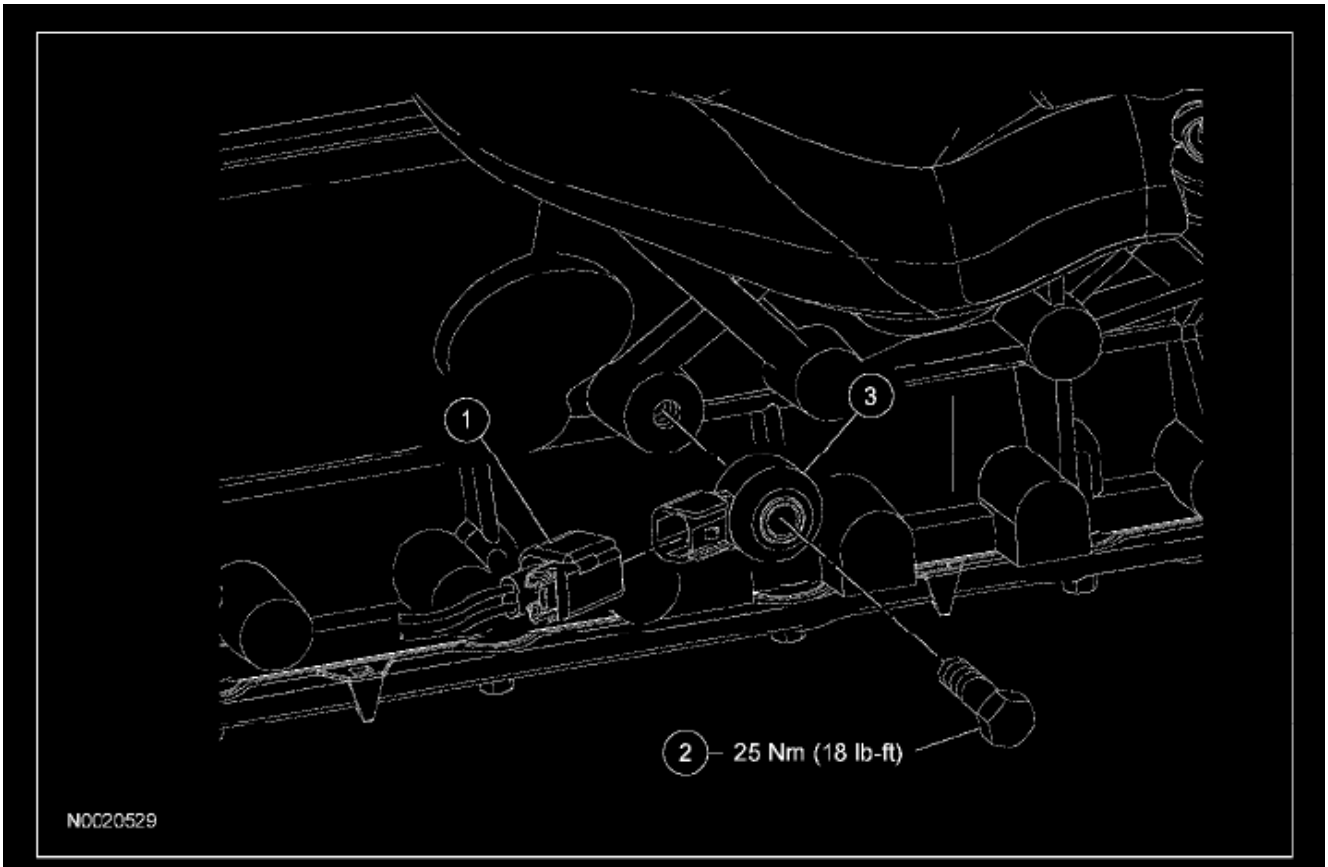
Two Types of Knock Sensor (KS)

Knock Sensor: Description and Operation

Knock Sensor (KS)

Two Types Of Knock Sensor (KS)

The KS is a tuned accelerometer on the engine which converts engine vibration to an electrical signal. The PCM uses this signal to determine the presence of engine knock and to retard spark timing.



Item	Part Number	Description
1	14A464	Knock sensor (KS) electrical connector (part of 12B637)
2	W5000225	KS bolt
3	12A699	KS

Knock Sensor: Service and Repair

KNOCK SENSOR (KS)

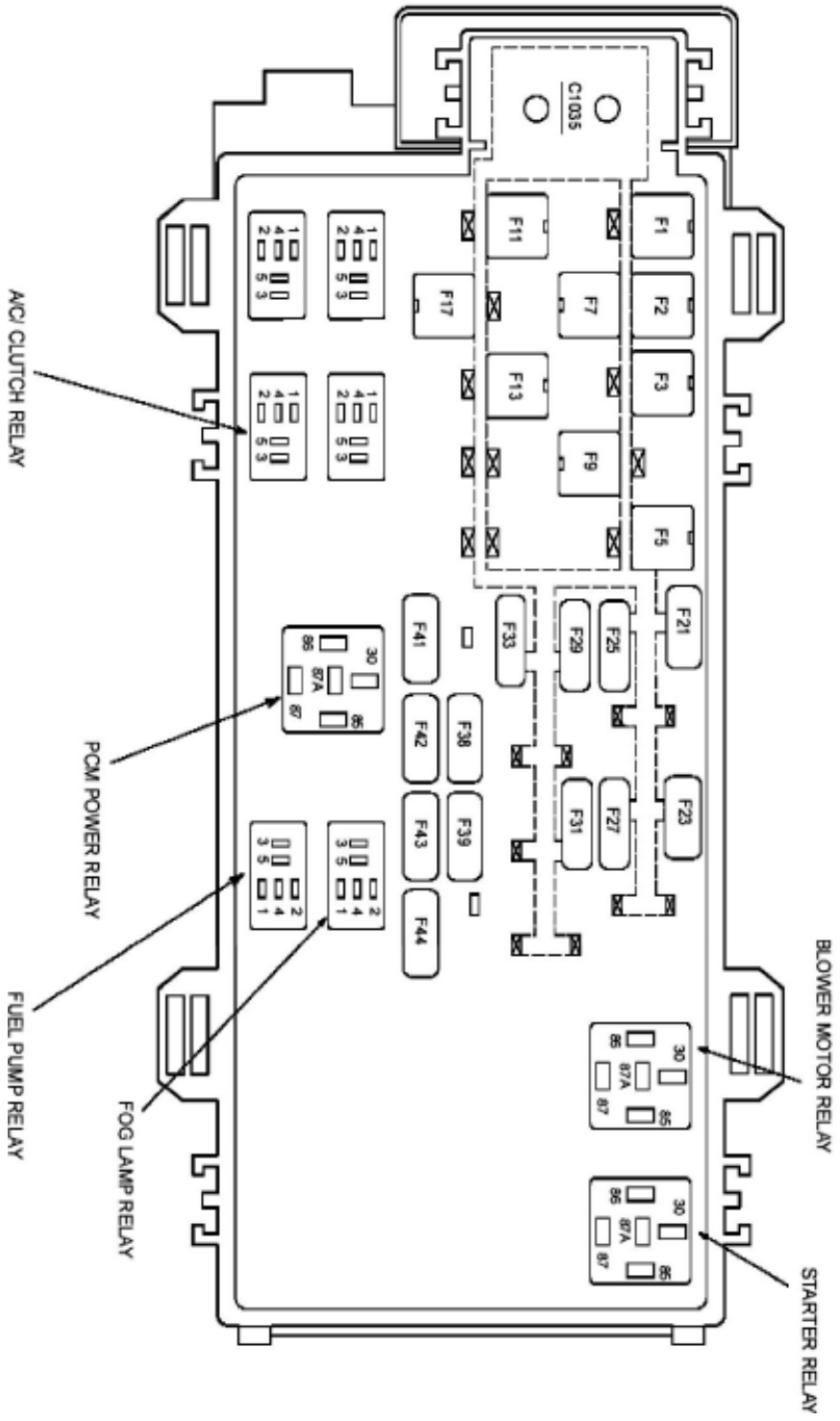
Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the knock sensor (KS) electrical connector. 3. Remove the bolt and the KS.

- To install, tighten to 25 Nm (18 lb-ft).

4. To install, reverse the removal procedure.

BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L

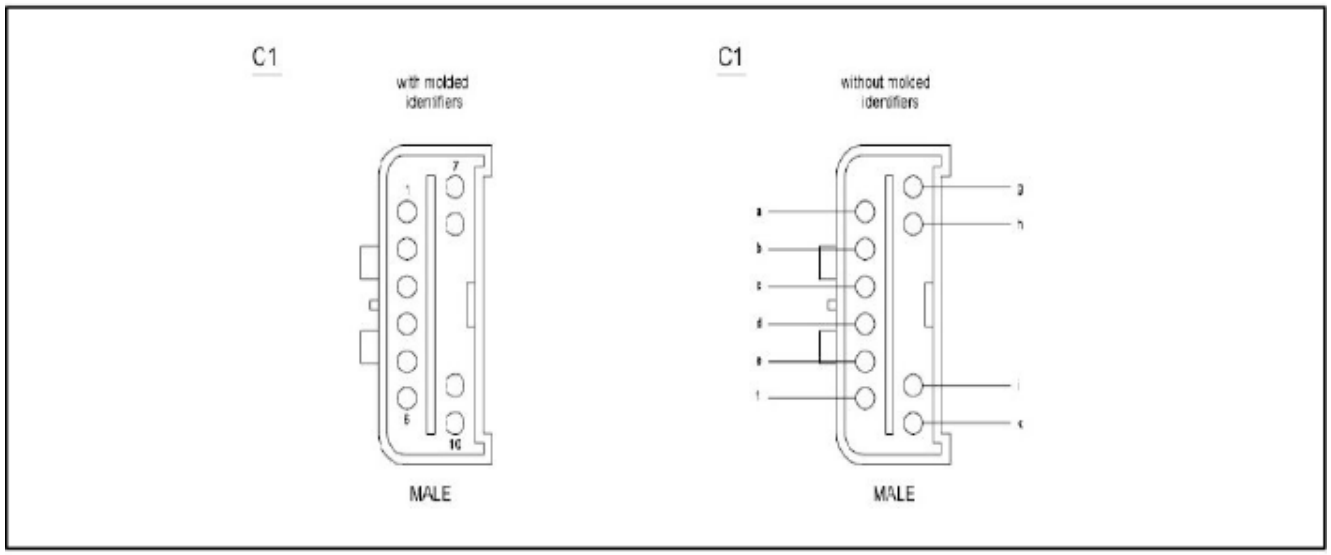


Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



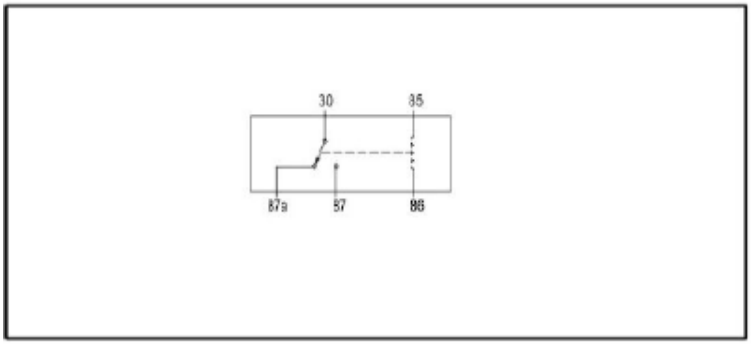
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

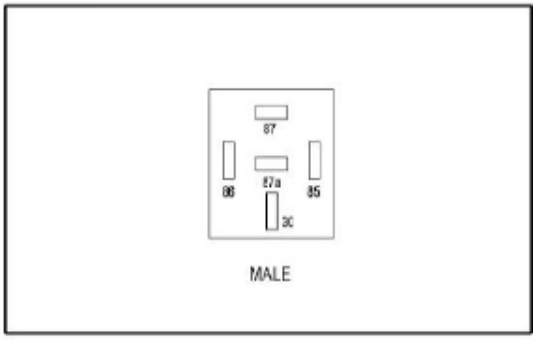
Main Relay (Computer/Fuel System): Testing and Inspection

Relay □ Mini ISO

Schematic



Terminals

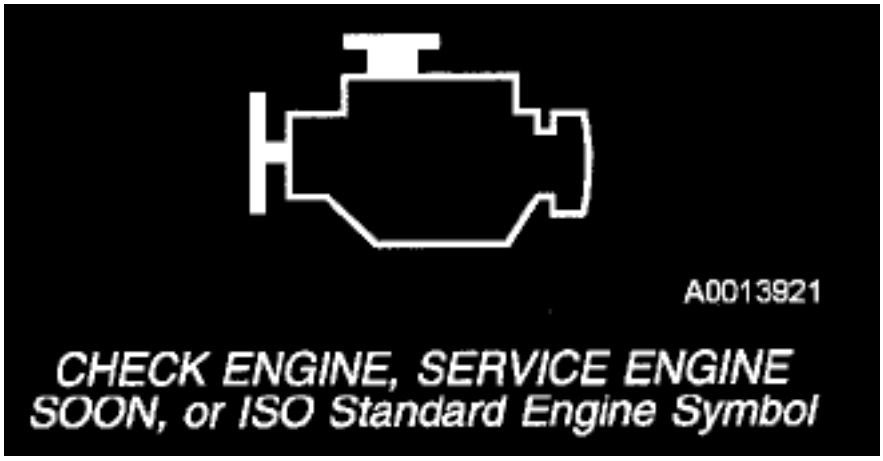


Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.



Malfunction Indicator Lamp: Description and Operation

MALFUNCTION INDICATOR LAMP (MIL)

Check Engine, Service Engine Soon, Or ISO Standard Engine Symbol

The MIL notifies the driver that the powertrain control module (PCM) has detected an on board diagnostic (OBD) emission-related component or system concern. When this occurs, an OBD diagnostic trouble code (DTC) sets.

- The MIL is located in the instrument cluster and is labeled CHECK ENGINE, SERVICE ENGINE SOON or the international standards organization (ISO) standard engine symbol.

- The MIL is illuminated during the instrument cluster prove out for approximately 4 seconds.

- The MIL remains illuminated after instrument cluster prove out if: -

an emission-related concern and DTC exists.

- the PCM does not send a control message to the instrument cluster (applications with the MIL controlled through the communication link).

- the PCM is operating in the hardware limited operation strategy (HLOS).

- The MIL remains off during the instrument cluster prove out if an indicator or instrument cluster concern is present.

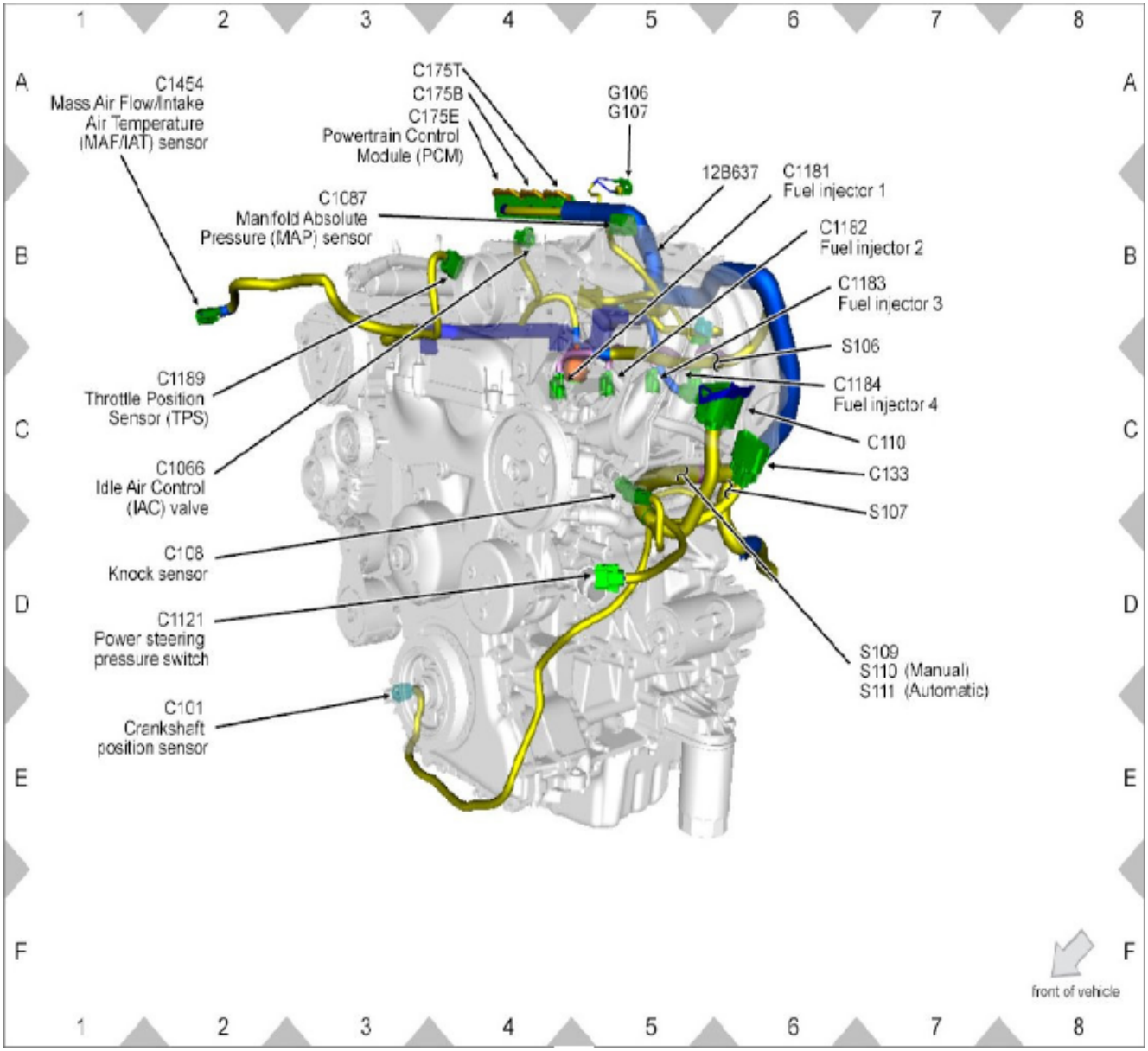
- To turn off the MIL after a repair, a reset command from the scan tool must be sent, or 3 consecutive drive cycles must be completed without a concern.

- For all MIL concerns, go to Symptom Charts. See: Testing and Inspection/Symptom Related Diagnostic Procedures

- If the MIL flashes at a steady rate, a severe misfire condition may exist.

- If the MIL flashes erratically, the PCM can reset while cranking if the battery voltage is low.

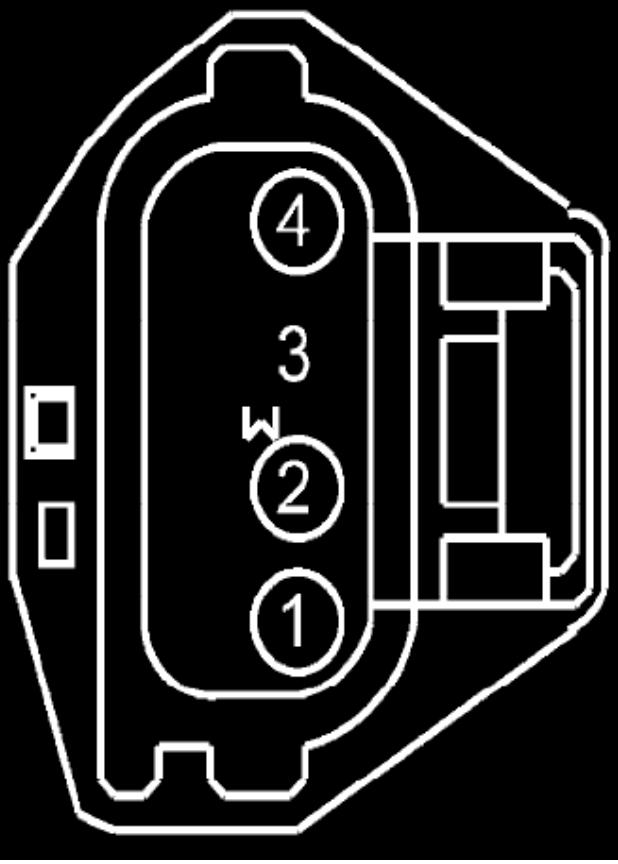
- The MIL flashes after a period of time with the key in the RUN position (engine not running) if DTC P1000 is set.


C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor
C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
12B637
C1181
Fuel injector 1
C1087
Manifold Absolute Pressure (MAP) sensor
C1182
Fuel injector 2
C1183
Fuel injector 3
S106
C1189
Throttle Position Sensor (TPS)
C1184
Fuel injector 4
C110
C1066
Idle Air Control (IAC) valve
C133
S107
C108
Knock sensor
C1121
Power steering pressure switch
S109
S110 (Manual)
S111 (Automatic)
C101
Crankshaft position sensor
front of vehicle

View 151-3

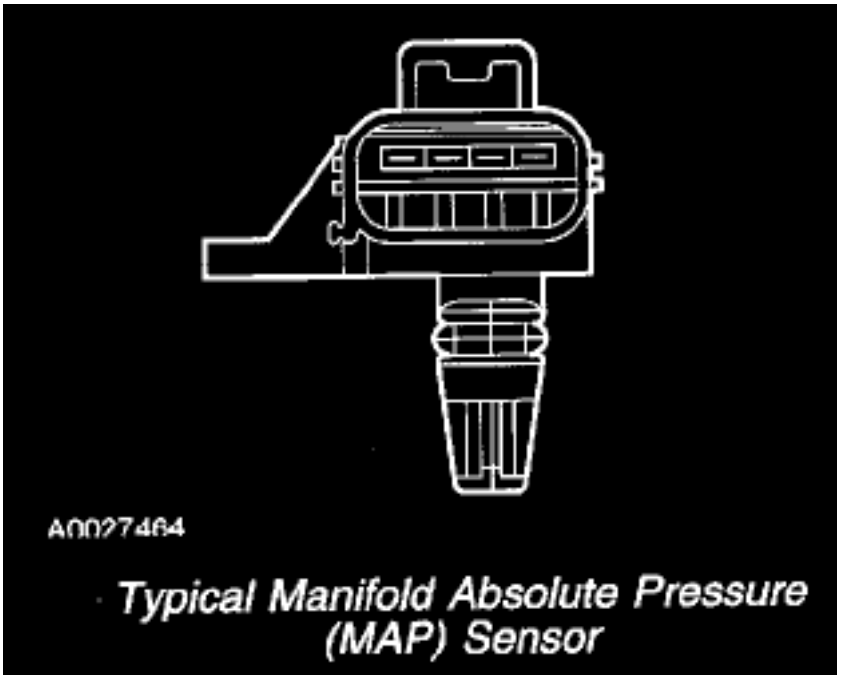
Connector: C1087

Description:	Harness:	Base Part #:
MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR	12B637	19F479



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE803 (BU-GN)	20	SENSOR - MANIFOLD ABSOLUTE PRESSURE (MAP)	2.3L
2	LE423 (GN-VT)	20	CTRL MOD. - POWERTRAIN # VOLTAGE REFERENCE ENGINE (VREF) (E-VREV)	2.3L
3	*	*	not used	
4	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN A)	2.3L

C1087

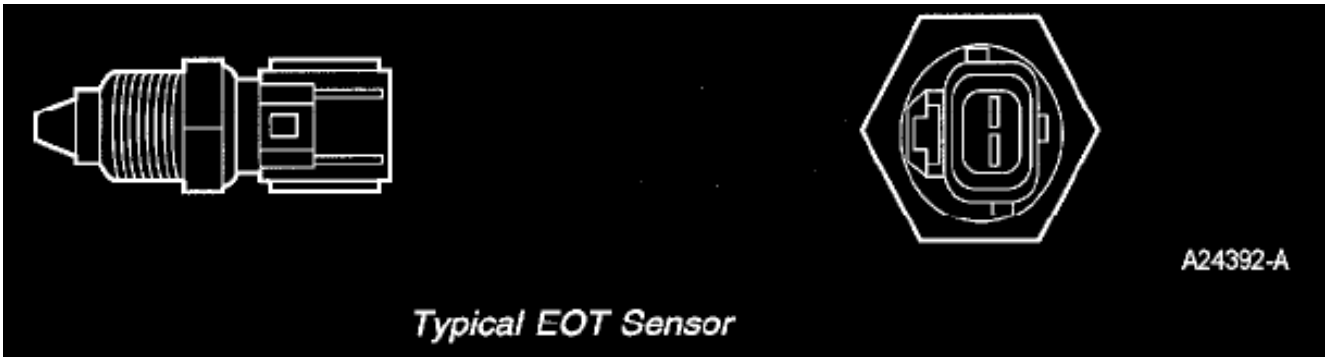


Manifold Pressure/Vacuum Sensor: Description and Operation

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR

Typical Manifold Absolute Pressure (MAP) Sensor

The MAP sensor measures intake manifold absolute pressure. The PCM uses information from the MAP sensor to measure how much exhaust gas is introduced into the intake manifold.



Typical EOT Sensor

Oil Temperature Sensor For ECM: Description and Operation

ENGINE OIL TEMPERATURE (EOT) SENSOR

Typical EOT Sensor

The EOT sensor is a thermistor device in which resistance changes with temperature. The electrical resistance of a thermistor decreases as the temperature increases and the resistance increases as the temperature decreases. The varying resistance changes the voltage drop across the sensor terminals and provides electrical signals to the PCM corresponding to temperature.

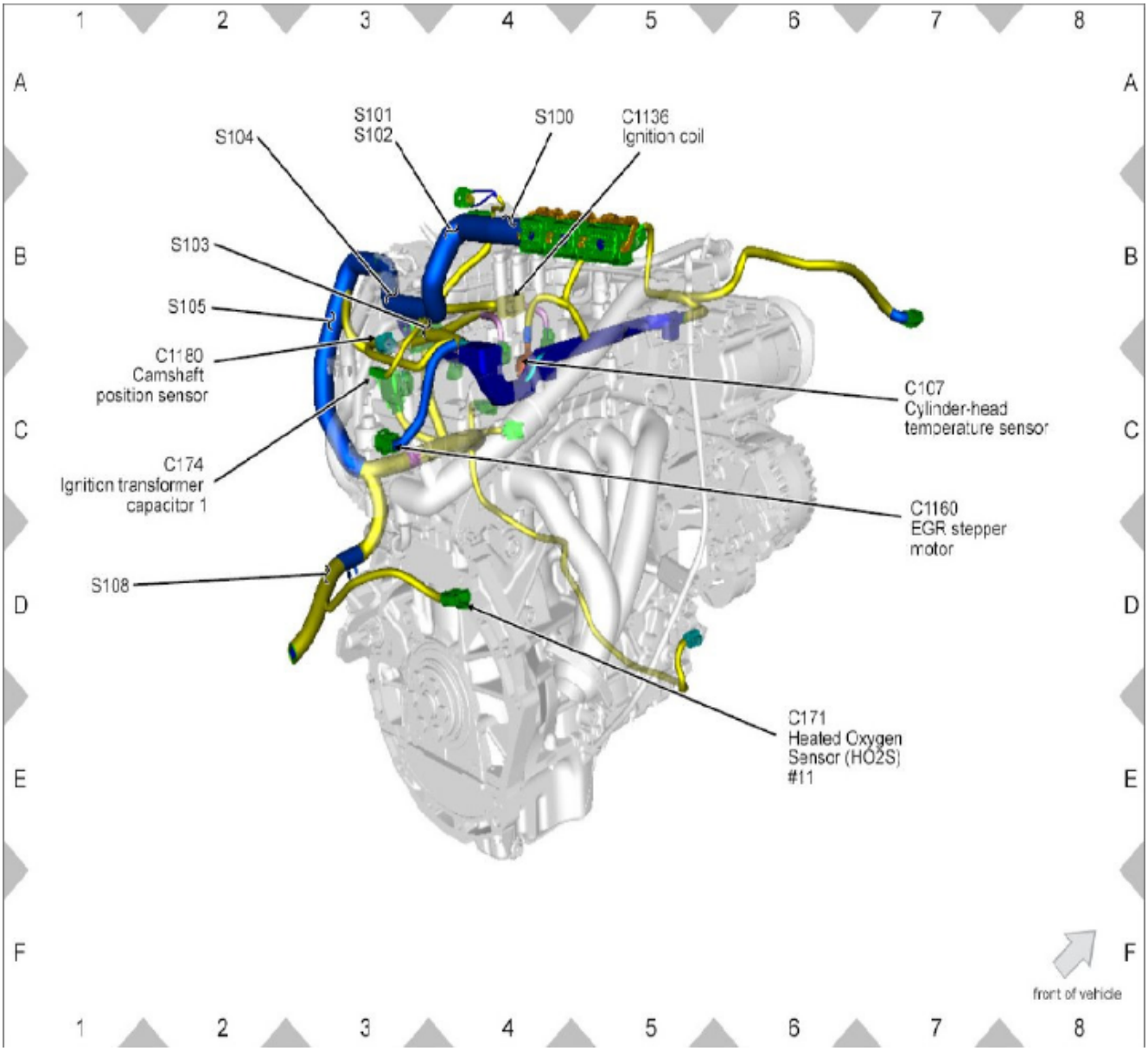
Thermistor-type sensors are considered passive sensors. A passive sensor is connected to a voltage divider network so that varying the resistance of the passive sensor causes a variation in total current flow. Voltage that is dropped across a fixed resistor in a series with the sensor resistor determines the voltage signal at the PCM. This voltage signal is equal to the reference voltage minus the voltage drop across the fixed resistor.

The EOT sensor measures the temperature of the engine oil. The sensor is typically threaded into the engine oil lubrication system. The PCM can use the EOT sensor input to determine the following:

- On variable camshaft timing (VCT) applications the EOT input is used to adjust the VCT control gains and logic for camshaft timing.

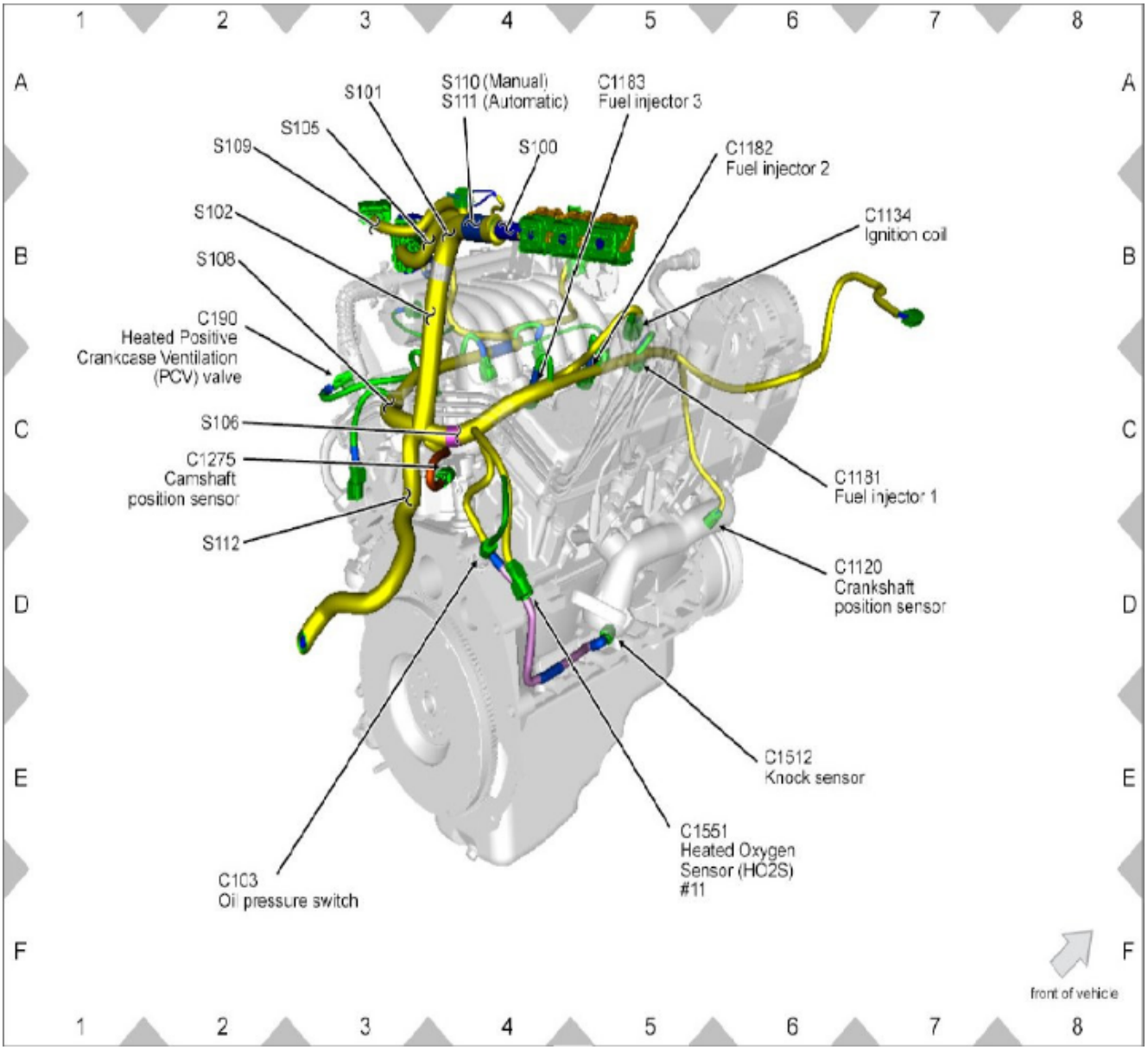
- The PCM can use EOT sensor input in conjunction with other PCM inputs to determine oil degradation.

- The PCM can use EOT sensor input to initiate a soft engine shutdown. To prevent engine damage from occurring as a result of high oil temperatures, the PCM has the ability to initiate a soft engine shutdown. Whenever engine RPM exceeds a calibrated level for a certain period of time, the PCM begins reducing power by disabling engine cylinders.

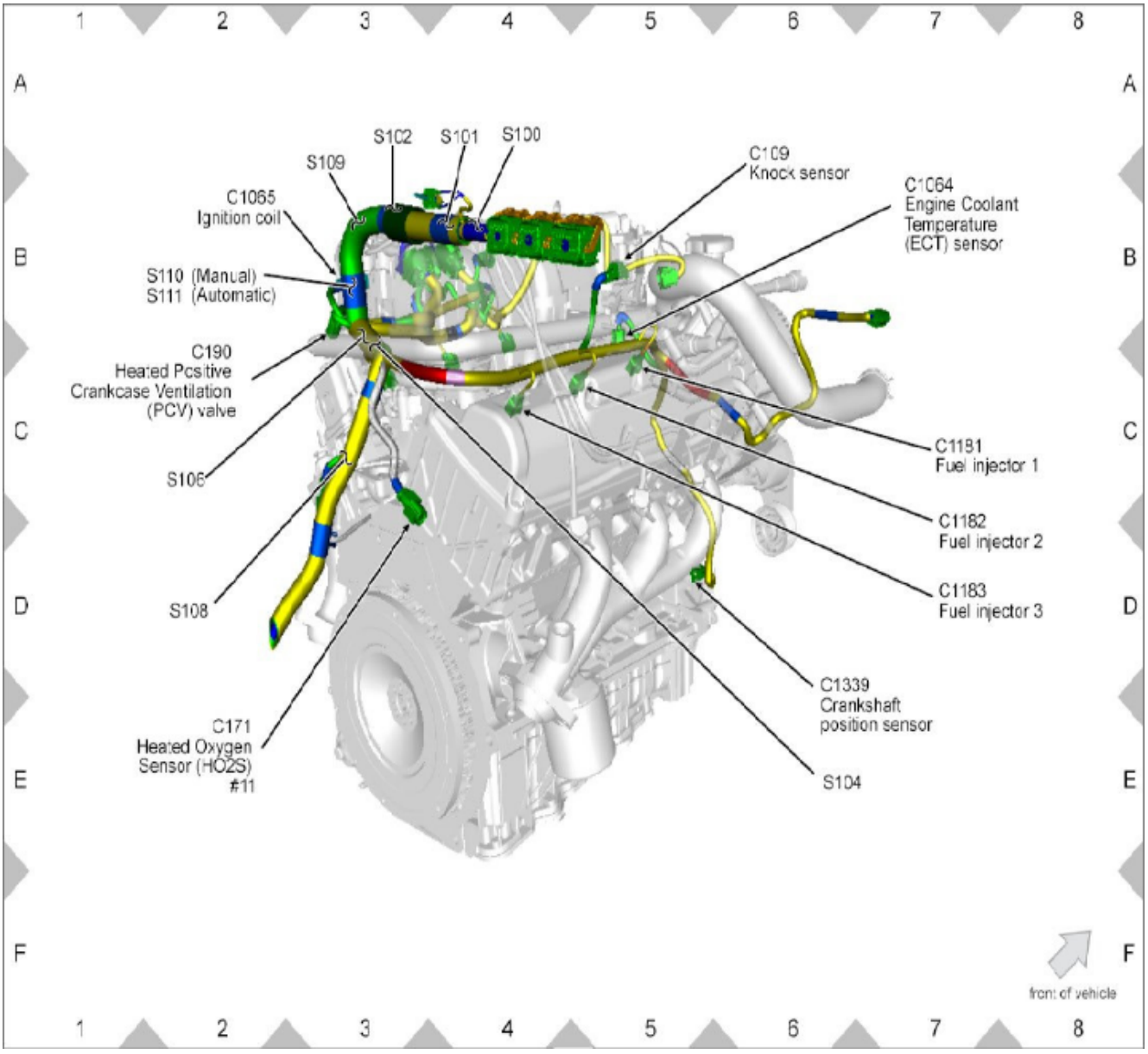


Oxygen Sensor: Locations Heated Oxygen Sensor (HO2S) #11

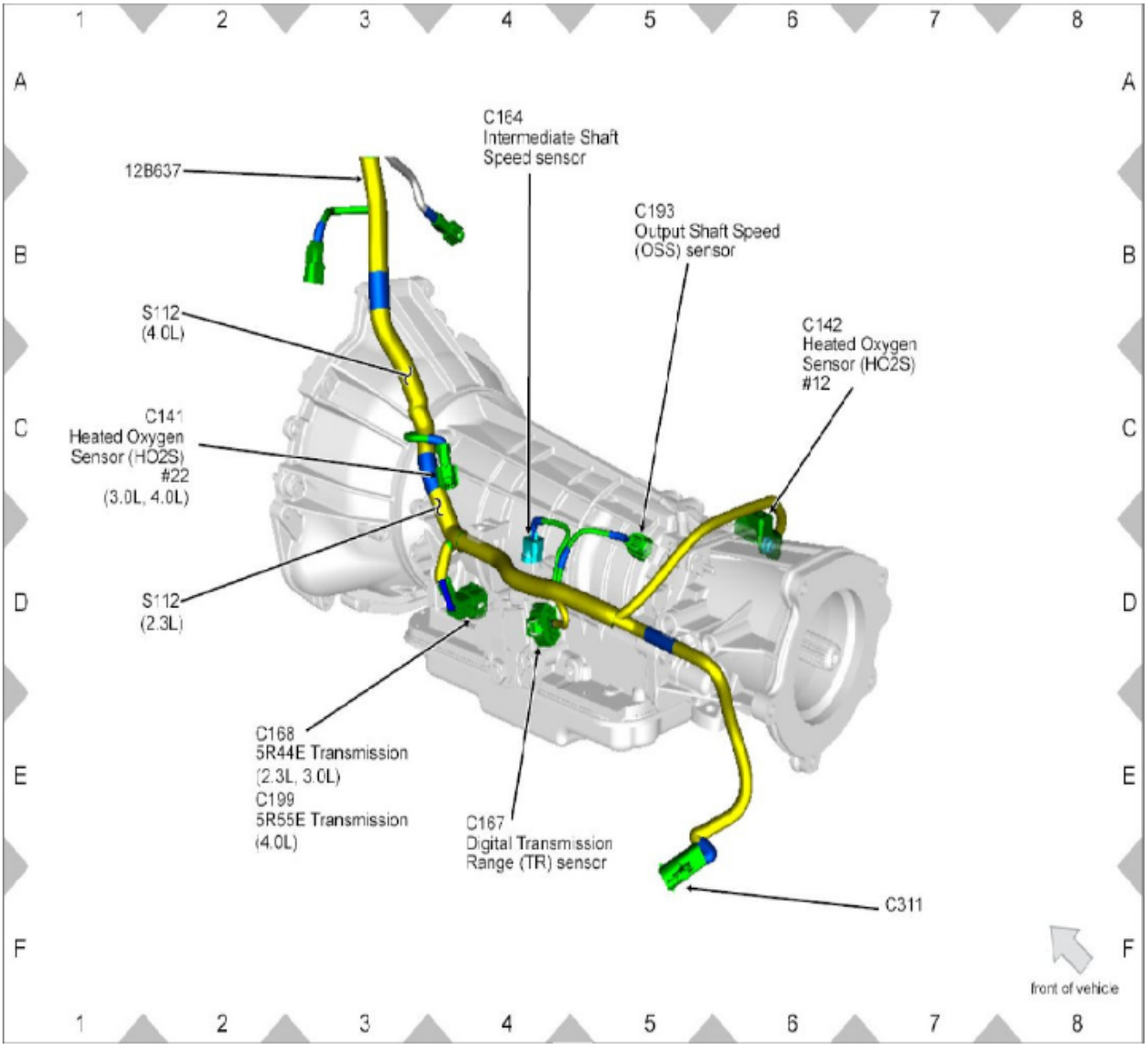
View 151-4


S101
S110 (Manual)
S111 (Automatic)
C1183
Fuel injector 3
S105
S109
S100
C1182
Fuel injector 2
S102
C1134
Ignition coil
S108
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
C1275
Camshaft
position sensor
S112
C1181
Fuel injector 1
C1120
Crankshaft
position sensor
C1512
Knock sensor
C1551
Heated Oxygen
Sensor (HO2S)
#11
C103
Oil pressure switch
front of vehicle

View 151-6

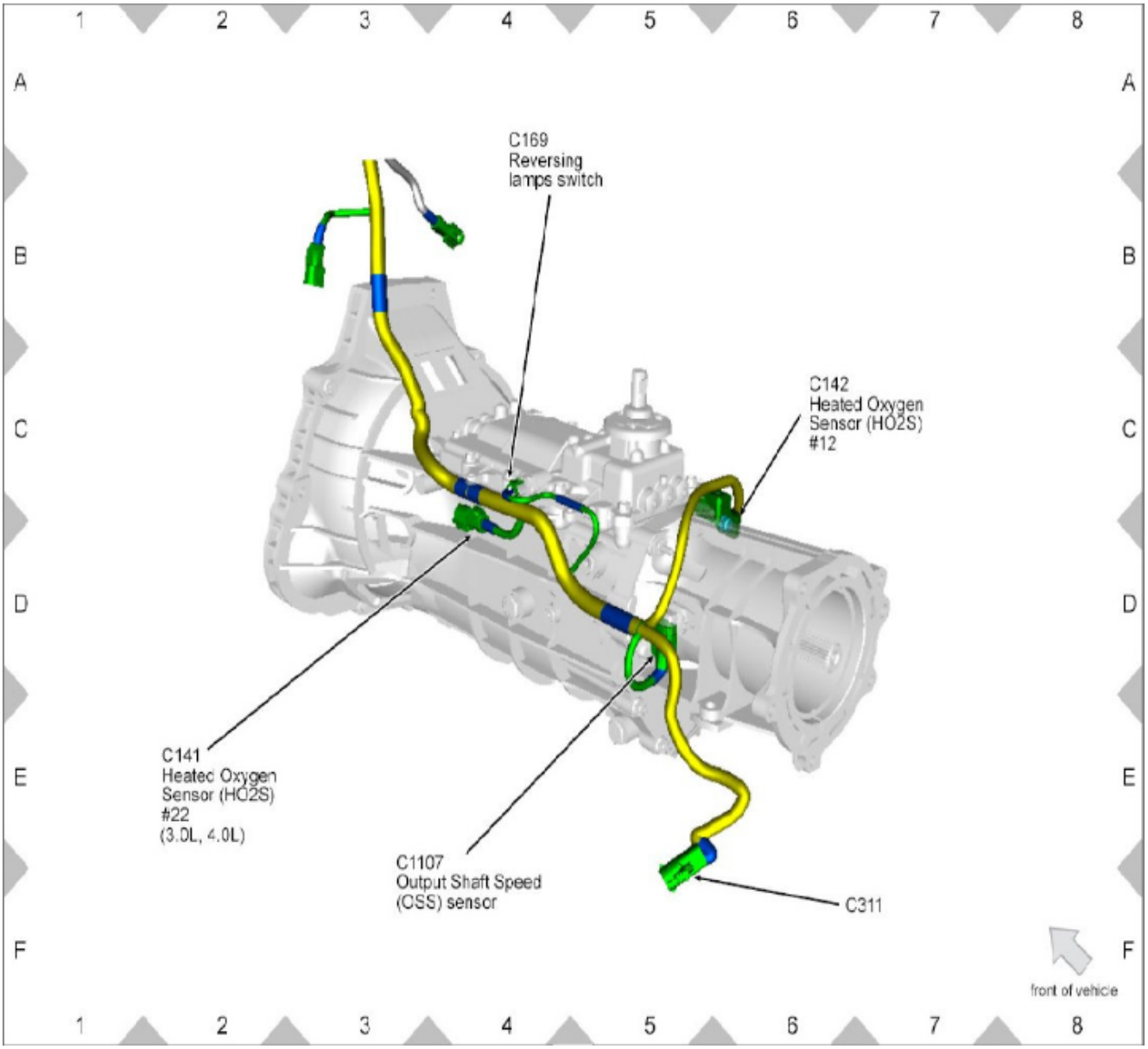

S102
S101
S100
S109
C1065
Ignition coil
S110 (Manual)
S111 (Automatic)
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
S108
C171
Heated Oxygen
Sensor (HO2S)
#11
C109
Knock sensor
C1064
Engine Coolant
Temperature
(ECT) sensor
C1181
Fuel injector 1
C1182
Fuel injector 2
C1183
Fuel injector 3
C1339
Crankshaft
position sensor
S104
front of vehicle

View 151-8

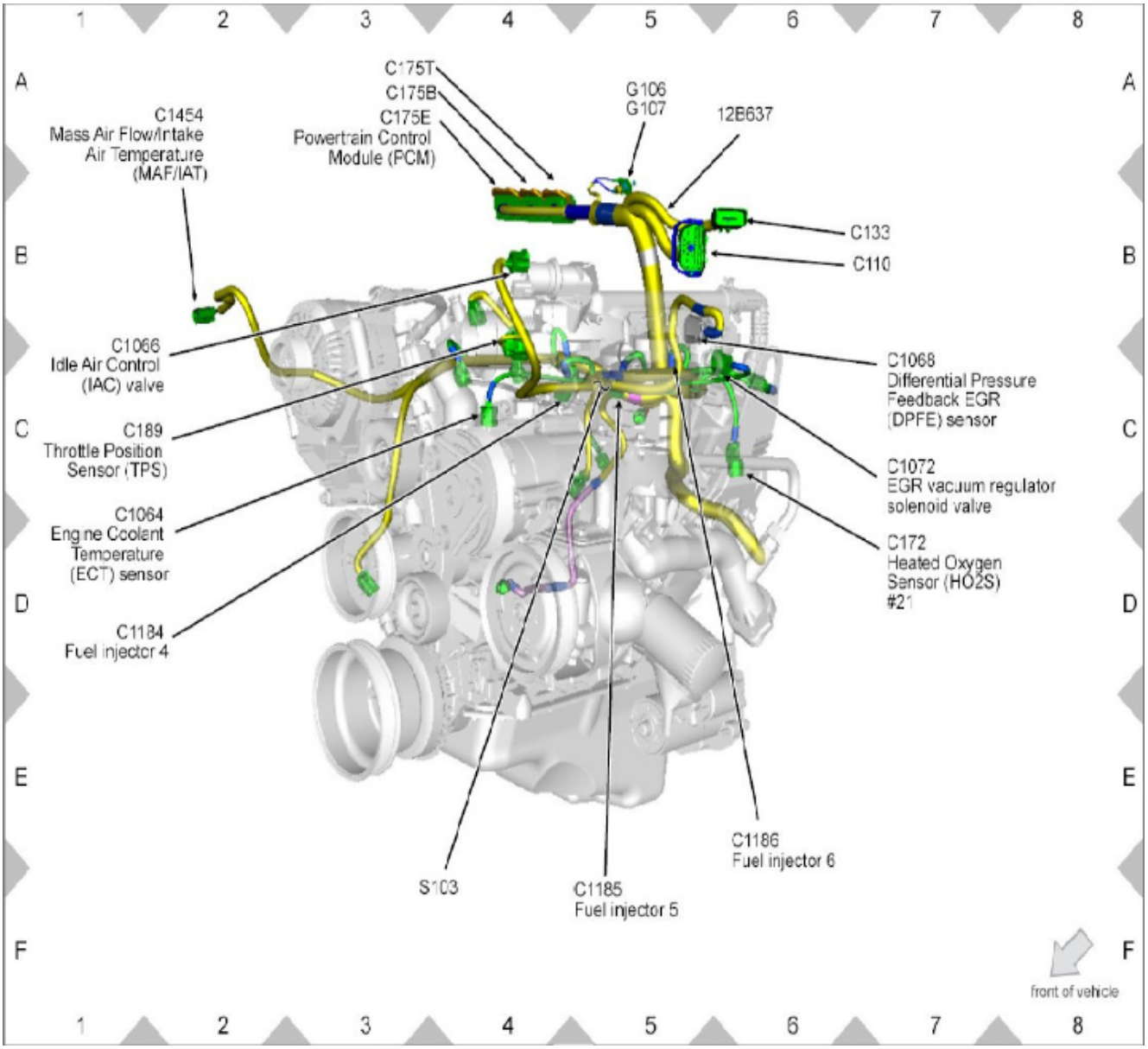


Oxygen Sensor: Locations Heated Oxygen Sensor (HO2S) #12

View 151-10

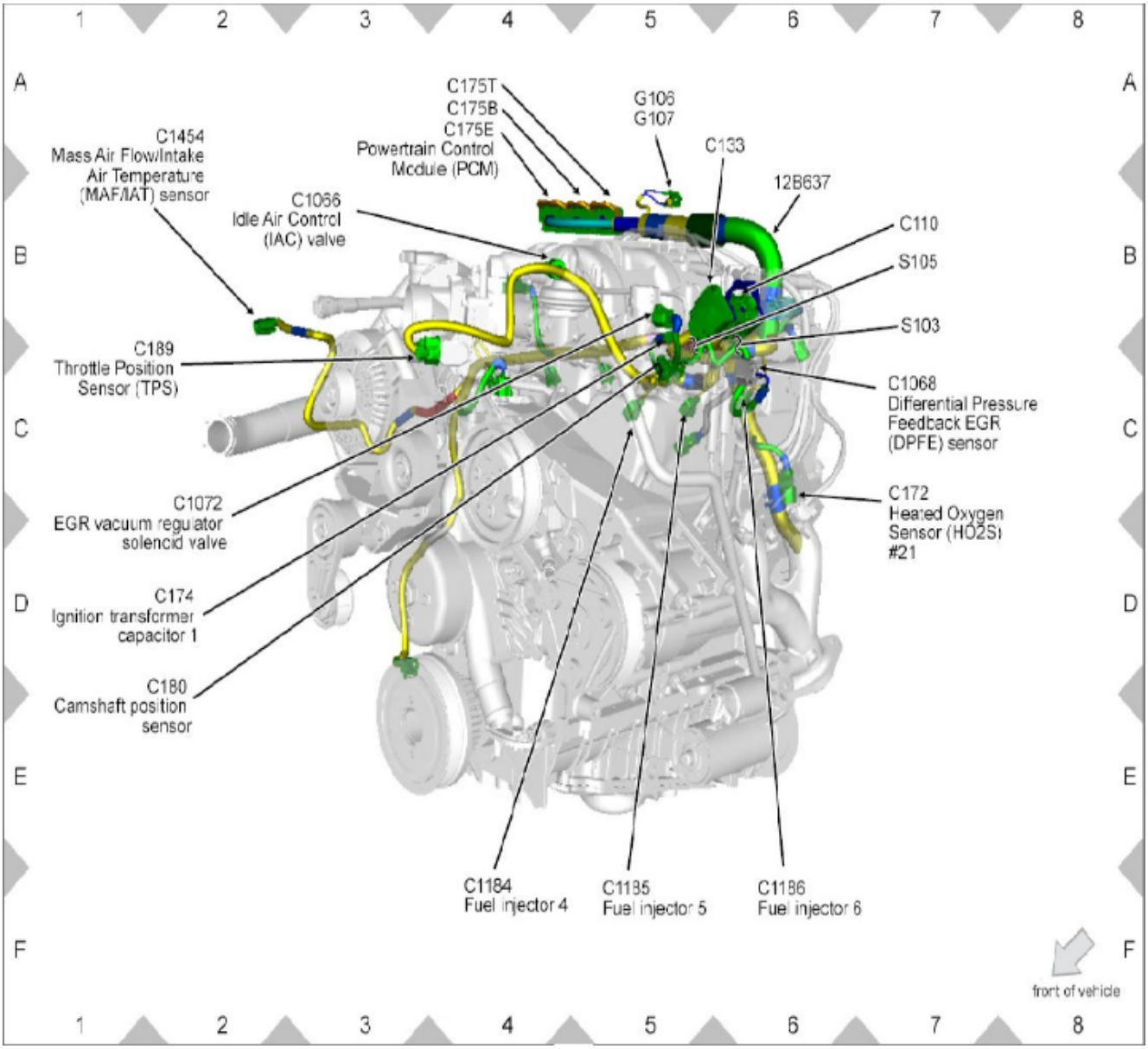

C169
Reversing lamps switch
C142
Heated Oxygen Sensor (HO2S) #12
C141
Heatec Oxygen Sensor (HO2S) #22
(3.0L, 4.0L)
C1107
Output Shaft Speed (OSS) sensor
C311
front of vehicle

View 151-9

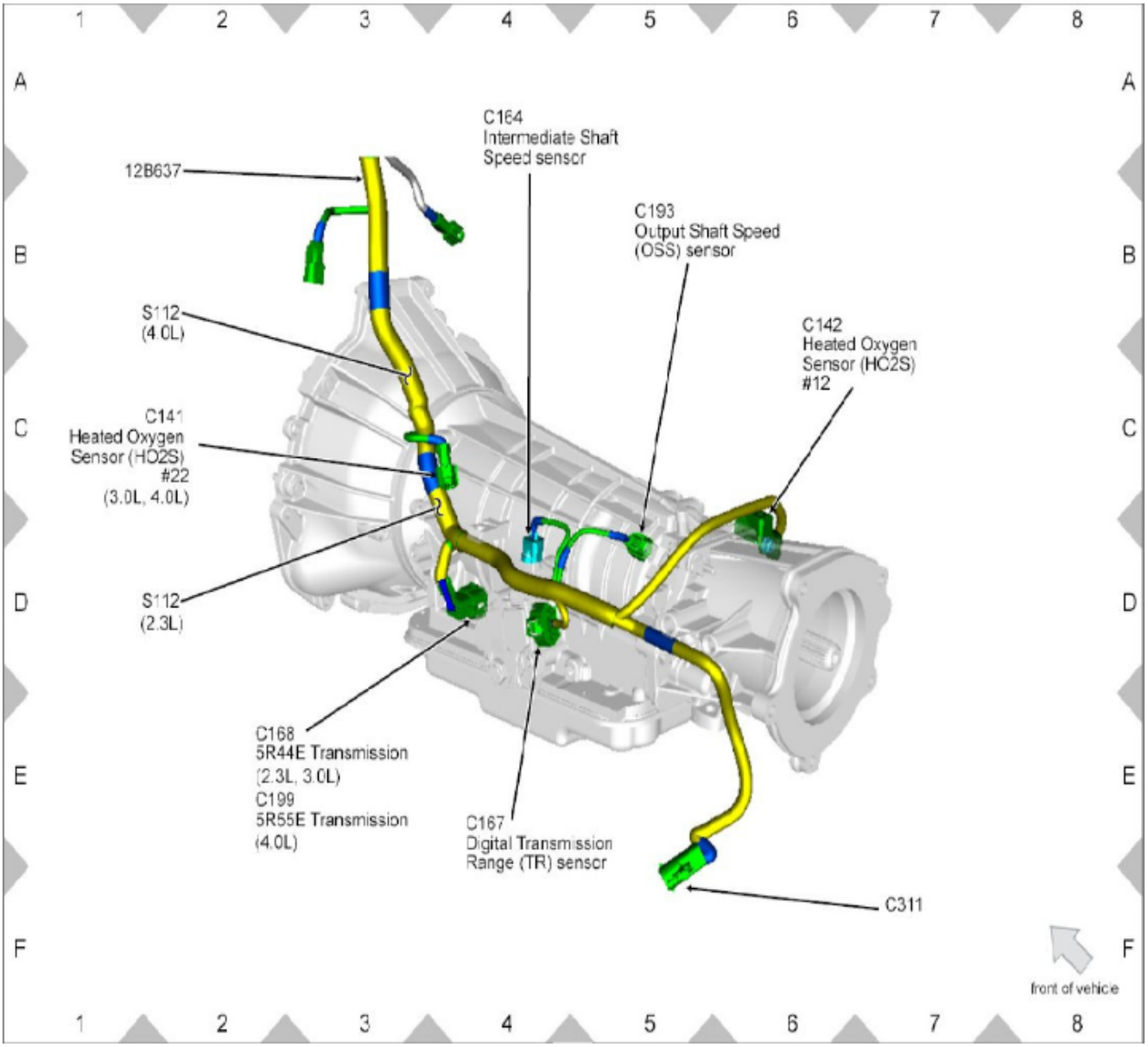


Oxygen Sensor: Locations Heated Oxygen Sensor (HO2S) #21

View 151-5

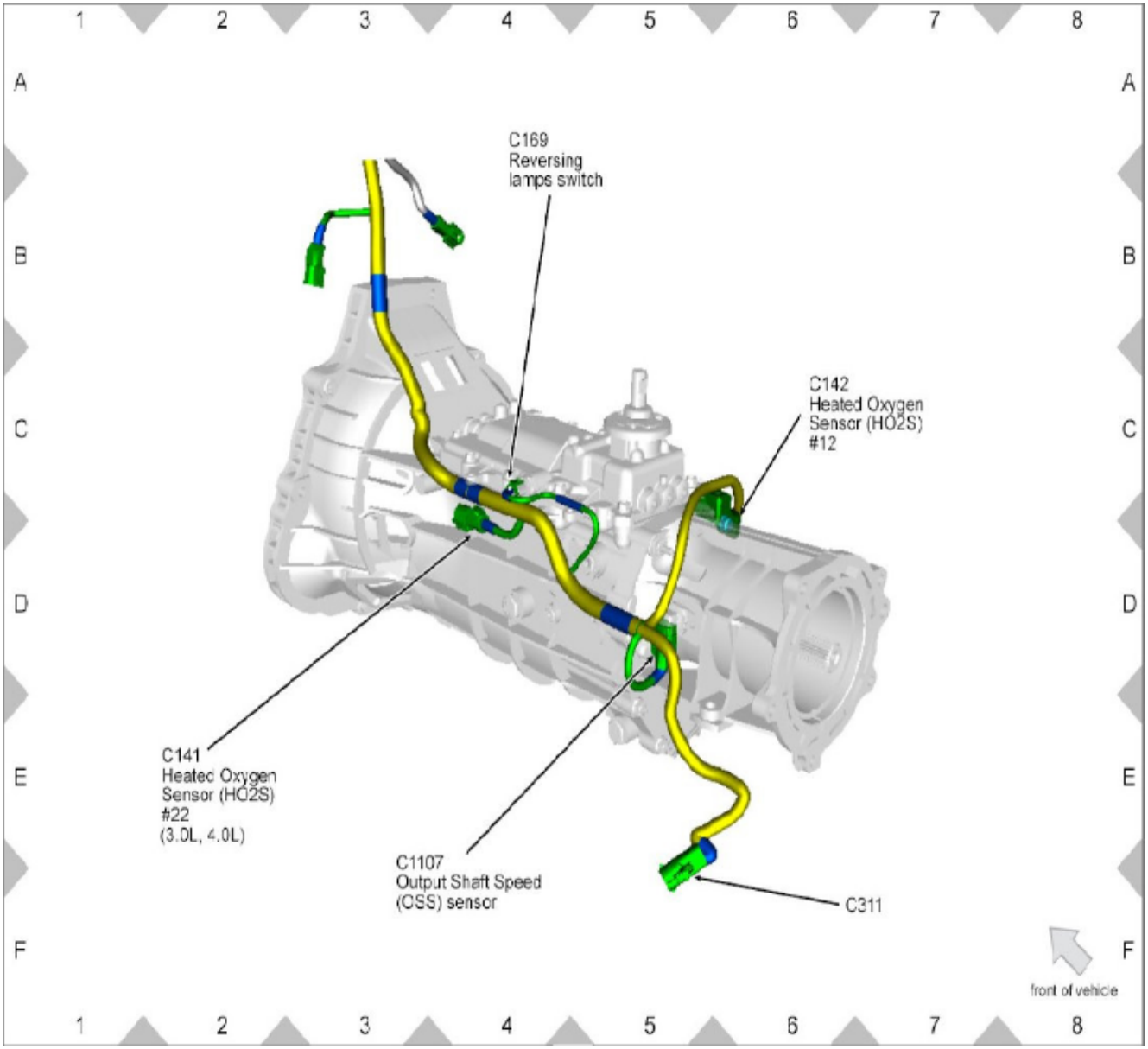

C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
C133
12B637
C110
S105
S103
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor
C1066
Idle Air Control (IAC) valve
C189
Throttle Position Sensor (TPS)
C1072
EGR vacuum regulator solenoid valve
C174
Ignition transformer capacitor 1
C180
Camshaft position sensor
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C172
Heated Oxygen Sensor (HO2S) #21
C1184
Fuel injector 4
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-7



Oxygen Sensor: Locations Heated Oxygen Sensor (HO2S) #22

View 151-10


C169
Reversing lamps switch
C142
Heated Oxygen Sensor (HO2S) #12
C141
Heatec Oxygen Sensor (HO2S) #22
(3.0L, 4.0L)
C1107
Output Shaft Speed (OSS) sensor
C311
front of vehicle

View 151-9

Connector: C141

Description:	Harness:	Base Part #:
HEATED OXYGEN SENSOR (HO2S) #22	12B637	9G444

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE234 (BU-WH)	18	CTRL MOD. - POWERTRAIN # HEATER OXYGEN SEN. POST CAT. 2ND (HTR22)	3.0L, 4.0L
2	CBB43 (GY)	18	FUSE - 43 OR CIRCUIT BREAKER	3.0L, 4.0L
3	VE733 (WH)	18	SENSOR - HEATED OXYGEN POST CAT. 2ND HO2S22)	3.0L, 4.0L
4	RE406 (GY-VT)	18	CTRL MOD. - POWERTRAIN # SIGNAL RETURN TRANSMISSION (T-SIGRTN) (SIGRTN-B)	3.0L, 4.0L

C141

Connector: C142

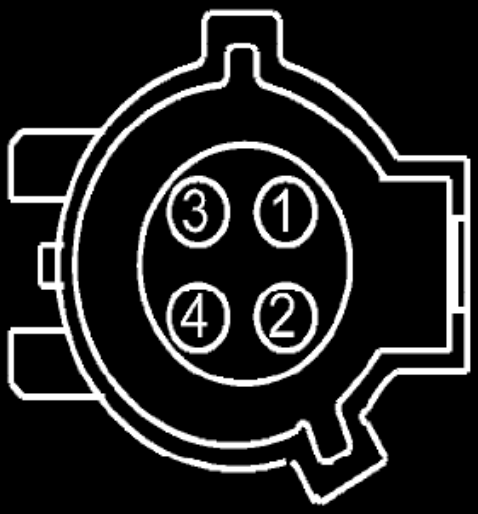
Description:	Harness:	Base Part #:
HEATED OXYGEN SENSOR (HO2S) #12	12B637	9G444

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE233 (WH-OG)	18	CTRL MOD. - POWERTRAIN # HEATER OXYGEN SEN. POST CAT. 1ST OR UNIQUE (HTR12)	
2	CBB43 (GY)	18	FUSE - 43 OR CIRCUIT BREAKER	
3	VE731 (YE-GN)	18	SENSOR - HEATED OXYGEN POST CAT. 1ST OR UNIQUE (HO2S12)	
4	RE406 (GY-VT)	18	CTRL MOD. - POWERTRAIN # SIGNAL RETURN TRANSMISSION (T-SIGRTN) (SIGRTN-B)	

C142

Connector: C171

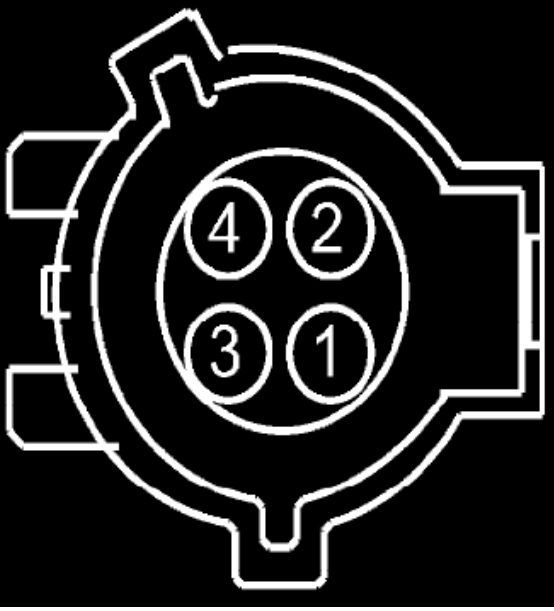
Description:	Harness:	Base Part #:
HEATED OXYGEN SENSOR (HO2S) #11	12B637	9F472



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE235 (GN-BN)	18	CTRL MOD. - POWERTRAIN # HEATER OXYGEN SEN. PRE CAT. 1ST OR UNIQUE (HTR11)	2.3L, 4.0L
2	CBB43 (GY)	18	FUSE - 43 OR CIRCUIT BREAKER	2.3L, 4.0L
3	VE735 (VT-GN)	18	SENSOR - HEATED OXYGEN PRE CAT. 1ST OR UNIQUE (HO2S11)	2.3L, 4.0L
4	RE405 (GN-WH)	18	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	2.3L, 4.0L

Connector: C1551

Description:	Harness:	Base Part #:
HEATED OXYGEN SENSOR (HO2S) #11	12B637	9F472



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBB43 (GY)	18	FUSE - 43 OR CIRCUIT BREAKER	3.0L
2	CE235 (GN-BN)	18	CTRL MOD. - POWERTRAIN # HEATER OXYGEN SEN. PRE CAT. 1ST OR UNIQUE (HTR11)	3.0L
3	RE405 (GN-WH)	18	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	3.0L
4	VE735 (VT-GN)	18	SENSOR - HEATED OXYGEN PRE CAT. 1ST OR UNIQUE (HO2S11)	3.0L

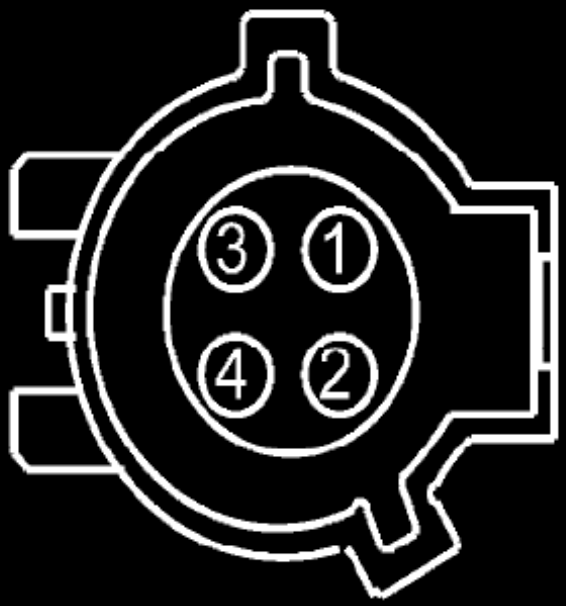
Oxygen Sensor: Diagrams Heated Oxygen Sensor (HO2S) #11

C171

C1551

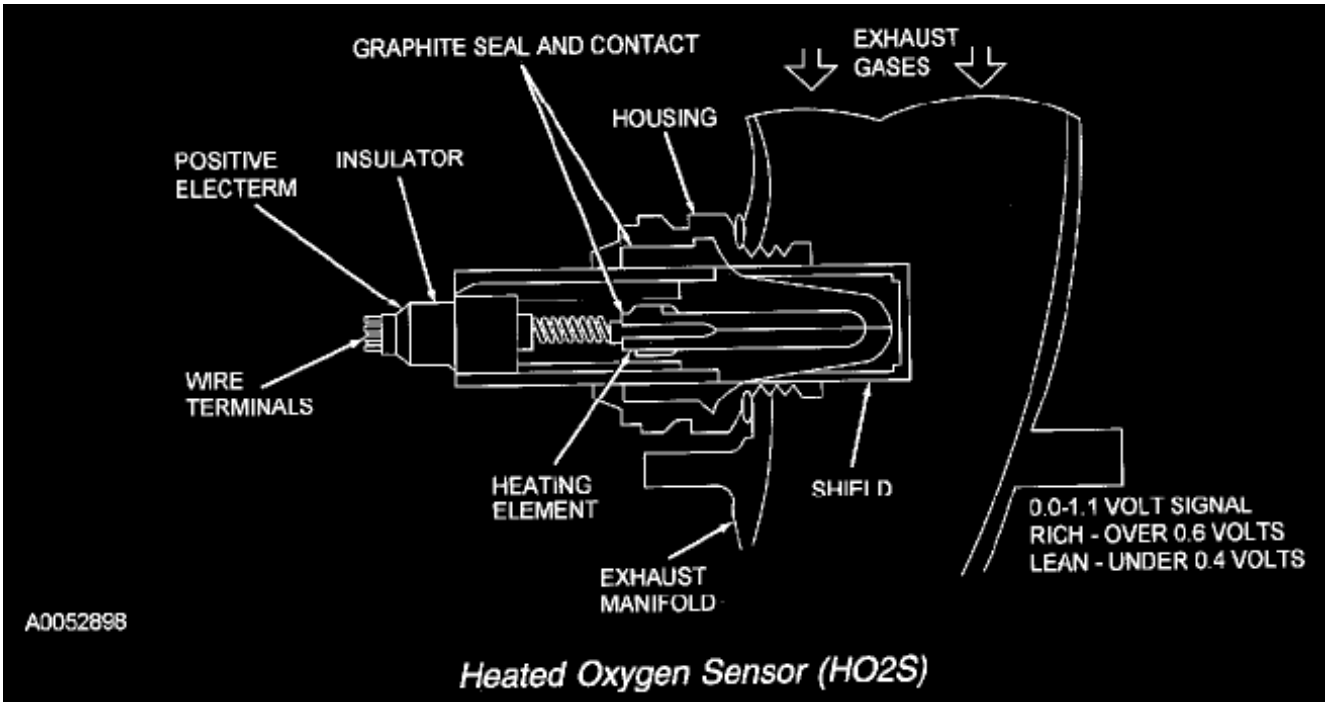
Connector: C172

Description:	Harness:	Base Part #:
HEATED OXYGEN SENSOR (HO2S) #21	12B637	9F472



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE236 (GY-VT)	18	CTRL MOD. - POWERTRAIN # HEATER OXYGEN SEN. PRE CAT. 2ND (HTR21)	3.0L, 4.0L
2	CBB43 (GY)	18	FUSE - 43 OR CIRCUIT BREAKER	3.0L, 4.0L
3	VE737 (WH-BU)	18	SENSOR - HEATED OXYGEN PRE CAT. 2ND (HO2S21)	3.0L, 4.0L
4	RE405 (GN-WH)	18	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	3.0L, 4.0L

C172



Heated Oxygen Sensor (HO2S)

Oxygen Sensor: Description and Operation

Heated Oxygen Sensor (HO2S)

Heated Oxygen Sensor (HO2S)

The HO2S detects the presence of oxygen in the exhaust and produces a variable voltage according to the amount of oxygen detected. A high concentration of oxygen (lean air/fuel ratio) in the exhaust produces a voltage signal less than 0.4 volt. A low concentration of oxygen (rich air/fuel ratio) produces a voltage signal greater than 0.6 volt. The HO2S provides feedback to the PCM indicating air/fuel ratio in order to achieve a near stoichiometric air/fuel ratio of 14.7:1 during closed loop engine operation. The HO2S generates a voltage between 0.0 and 1.1 volts.

Embedded with the sensing element is the HO2S heater. The heating element heats the sensor to a temperature of 800°C (1,472°F). At approximately 300°C (572°F) the engine can enter closed loop operation. The VPWR circuit supplies voltage to the heater. The PCM turns the heater on by providing the ground when the correct conditions occur. The heater allows the engine to enter closed loop operation sooner. The use of this heater requires the HO2S heater control to be duty cycled, to prevent damage to the heater.

Universal HO2S

The universal HO2S, sometimes referred to as a wideband oxygen sensor, uses the typical HO2S combined with a current controller in the PCM to infer an air/fuel ratio relative to the stoichiometric air/fuel ratio. This is accomplished by balancing the amount of oxygen ions pumped in or out of a measurement chamber within the sensor. The typical HO2S within the universal HO2S is used to detect the oxygen content of the exhaust gas in the measurement chamber. The oxygen content inside the measurement chamber is maintained at the stoichiometric air/fuel ratio by pumping oxygen ions in and out of the measurement chamber. As the exhaust gasses get richer or leaner, the amount of oxygen that must be pumped in or out to maintain a stoichiometric air/fuel ratio in the measurement chamber varies in proportion to the air/fuel ratio. The amount of current required to

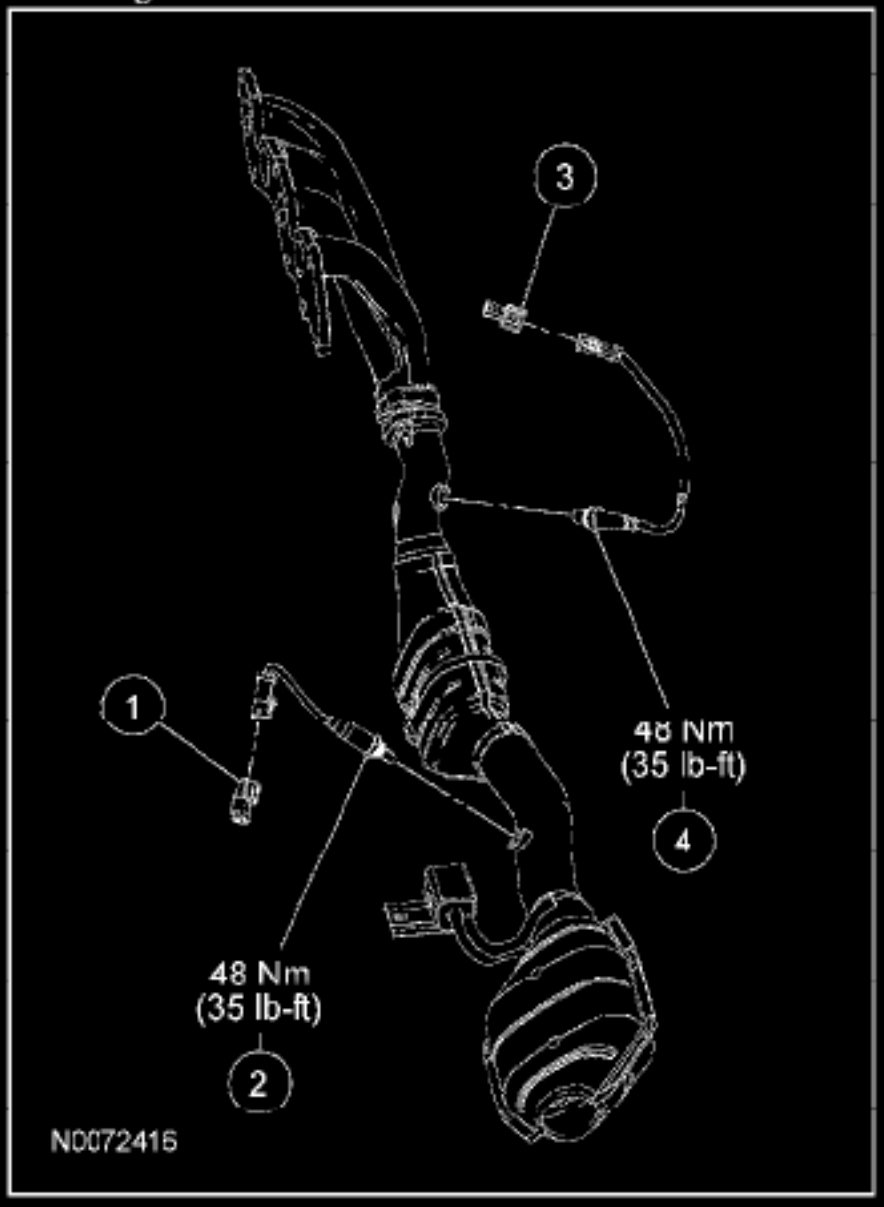
pump the oxygen ions in or out of the measurement chamber is used to measure the air/fuel ratio. The measured air/fuel ratio is actually the output from the current controller in the PCM and not a signal that comes directly from the sensor.

The universal HO2S also uses a self-contained reference chamber to make sure an oxygen differential is always present. The oxygen for the reference chamber is supplied by pumping small amounts of oxygen ions from the measurement chamber into the reference chamber. The universal HO2S does not need access to outside air.

Part to part variance is compensated for by placing a resistor in the connector. This resistor is used to trim the current measured by the current controller in the PCM.

Embedded with the sensing element is the universal H02S heater. The heater allows the engine to enter closed loop operation sooner. The heating element heats the sensor to a temperature of 780°C (1,436°F). The VPWR circuit supplies voltage to the heater. The PCM controls the heater on and off by providing the ground to maintain the sensor at the correct temperature for maximum accuracy.

2.3L Engines



Item	Part Number	Description
1	—	Catalyst monitor sensor electrical connector
2	9G444	Catalyst monitor sensor
3	—	Heated oxygen sensor (HO2S) electrical connector (part of 12B637)
4	9F472	HO2S

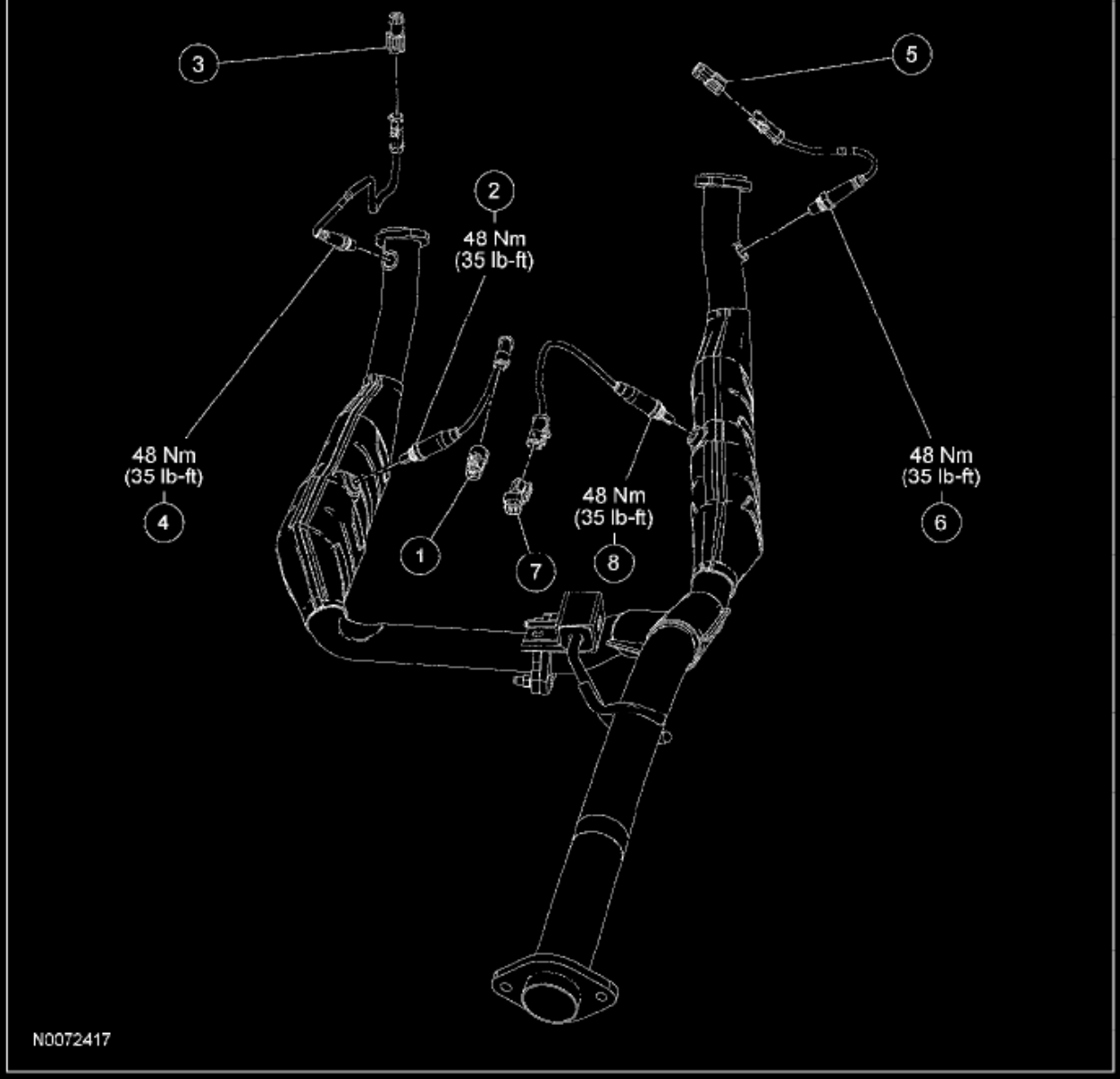
Oxygen Sensor: Service and Repair Heated Oxygen Sensor (HO2S)

HEATED OXYGEN SENSOR (HO2S)

Exploded View

2.3L Engines

3.0L Engines



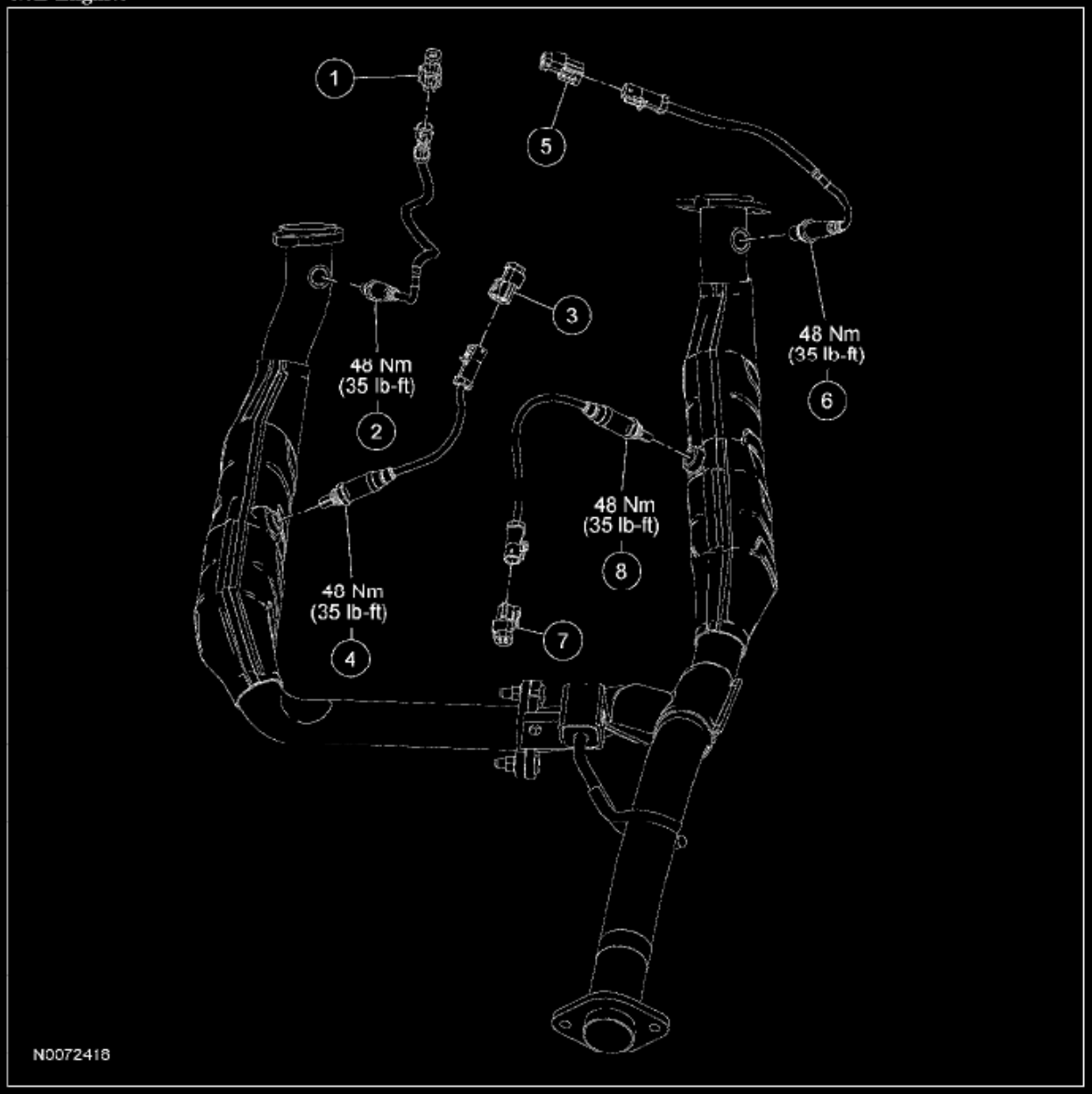
Item	Part Number	Description
1	—	Catalyst monitor sensor electrical connector (part of 14A464)
2	9G444	Catalyst monitor sensor
3	—	Heated oxygen sensor (HO2S) electrical connector (part of 12B637)
4	9F472	HO2S

(Continued)

Item	Part Number	Description
5	—	HO2S electrical connector (part of 12B637)
6	9F472	HO2S
7	—	Catalyst monitor sensor electrical connector (part of 14A464)
8	9G444	Catalyst monitor sensor

3.0L Engines

4.0L Engines



Item	Part Number	Description
1	—	Heated oxygen sensor (HO2S) electrical connector (part of 12B637)
2	9F472	HO2S
3	—	Catalyst monitor sensor electrical connector (part of 14A464)
4	9G444	Catalyst monitor sensor

(Continued)

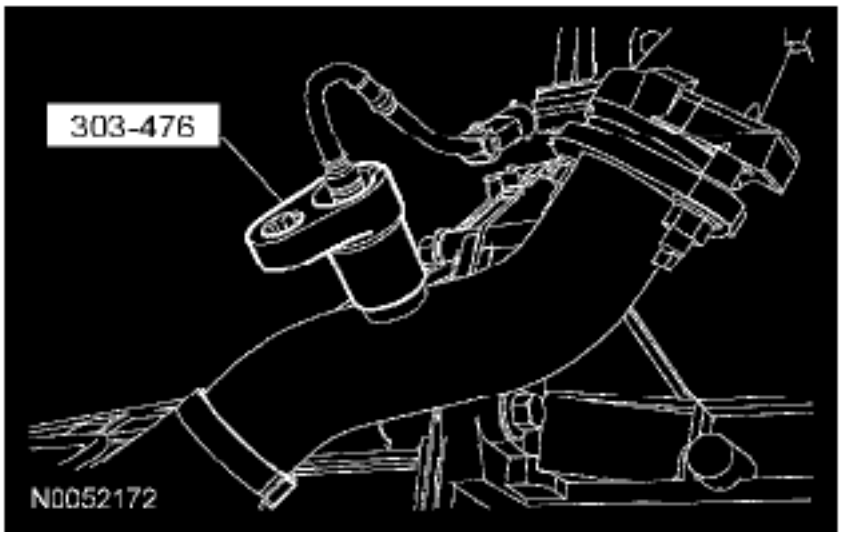
Item	Part Number	Description
5	—	HO2S electrical connector (part of 12B637)
6	9F472	HO2S
7	—	Catalyst monitor sensor electrical connector (part of 14A464)
8	9G444	Catalyst monitor sensor

4.0L Engines

Special Tool(s)

Special Tool(s)

Socket, Exhaust Gas Oxygen Sensor
303-476 (T94P-9472-A)



Special Tool(s)

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist.

2. NOTE: If necessary, lubricate the heated oxygen sensor (HO2S) with lock lubricant to assist in removal.

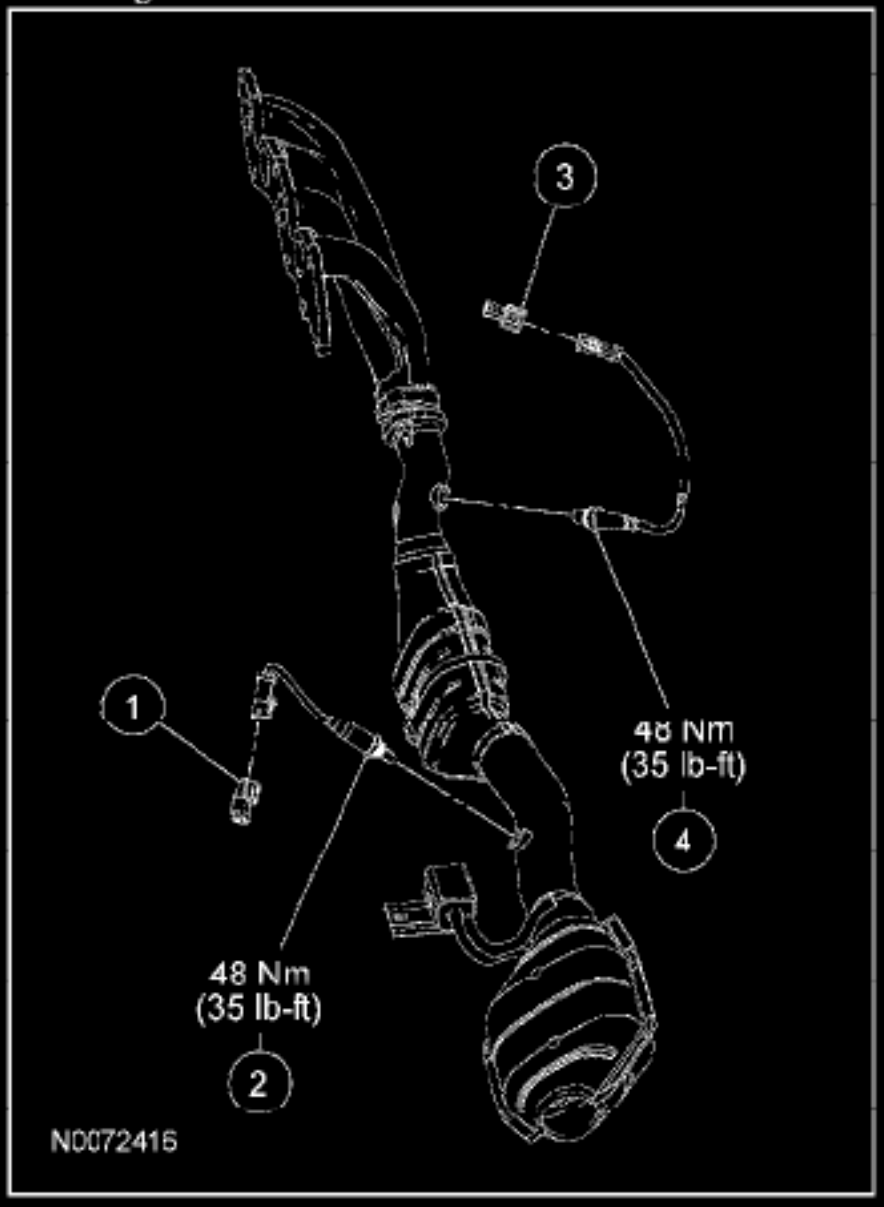
Using the special tool, remove the HO2S. -

To install, tighten to 48 Nm (35 lb-ft).

3. NOTE: Apply a light coat of anti-seize lubricant to the threads of the HO2S.

To install, reverse the removal procedure.

2.3L Engines



Item	Part Number	Description
1	—	Catalyst monitor sensor electrical connector
2	9G444	Catalyst monitor sensor
3	—	Heated oxygen sensor (HO2S) electrical connector (part of 12B637)
4	9F472	HO2S

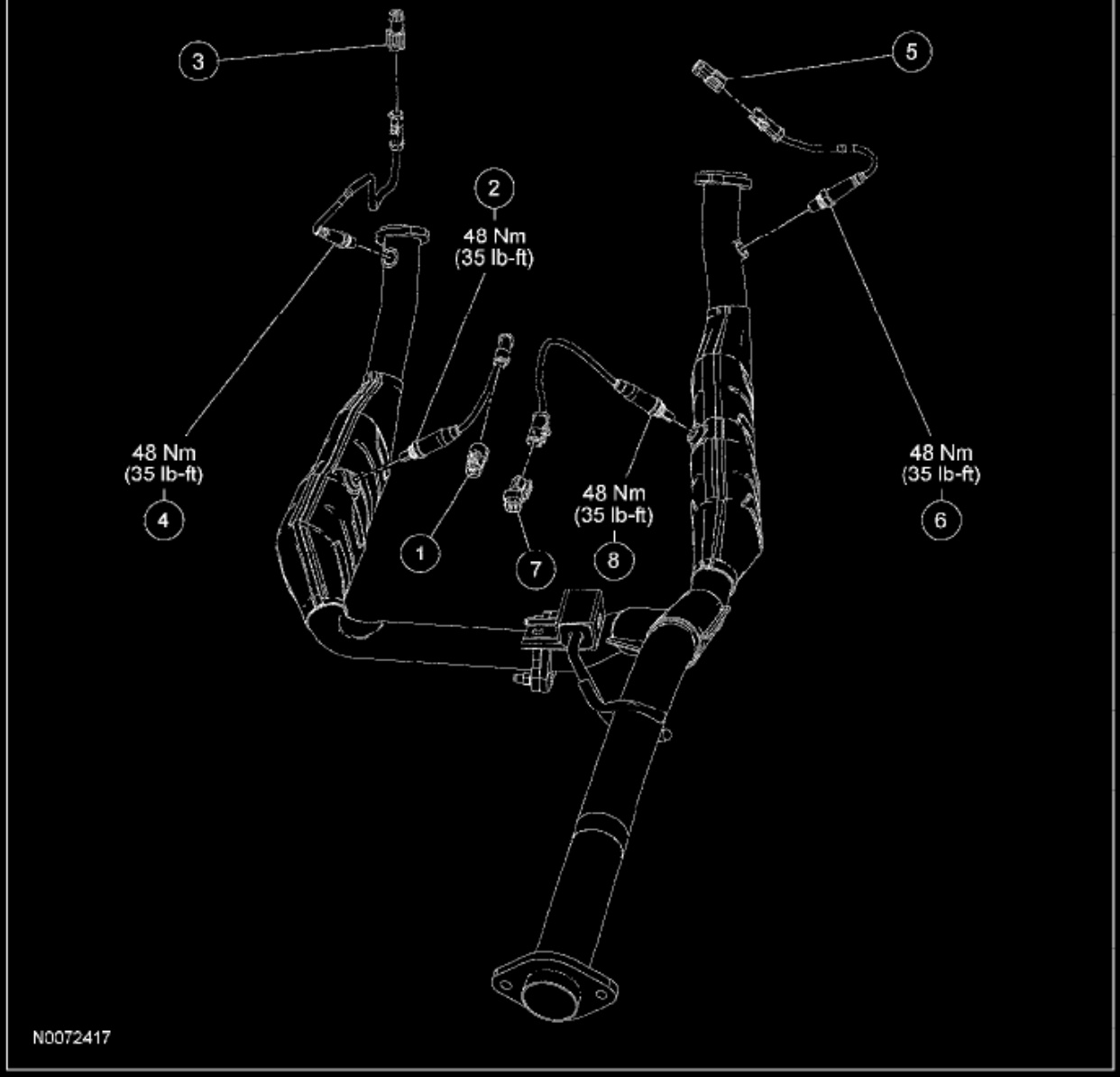
Oxygen Sensor: Service and Repair Catalyst Monitor Sensor

CATALYST MONITOR SENSOR

Exploded View

2.3L Engines

3.0L Engines



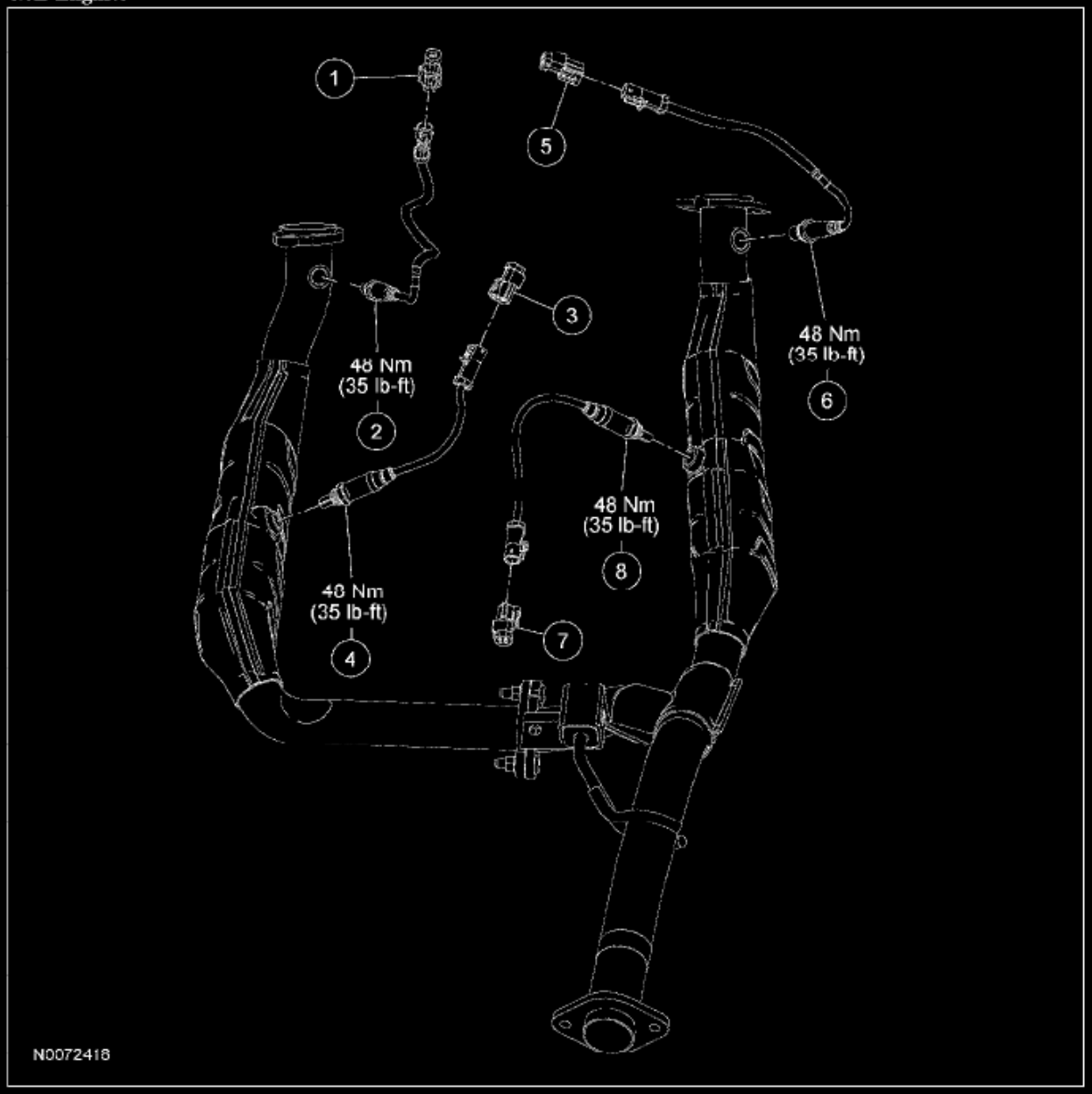
Item	Part Number	Description
1	—	Catalyst monitor sensor electrical connector (part of 14A464)
2	9G444	Catalyst monitor sensor
3	—	Heated oxygen sensor (HO2S) electrical connector (part of 12B637)
4	9F472	HO2S

(Continued)

Item	Part Number	Description
5	—	HO2S electrical connector (part of 12B637)
6	9F472	HO2S
7	—	Catalyst monitor sensor electrical connector (part of 14A464)
8	9G444	Catalyst monitor sensor

3.0L Engines

4.0L Engines



Item	Part Number	Description
1	—	Heated oxygen sensor (HO2S) electrical connector (part of 12B637)
2	9F472	HO2S
3	—	Catalyst monitor sensor electrical connector (part of 14A464)
4	9G444	Catalyst monitor sensor

(Continued)

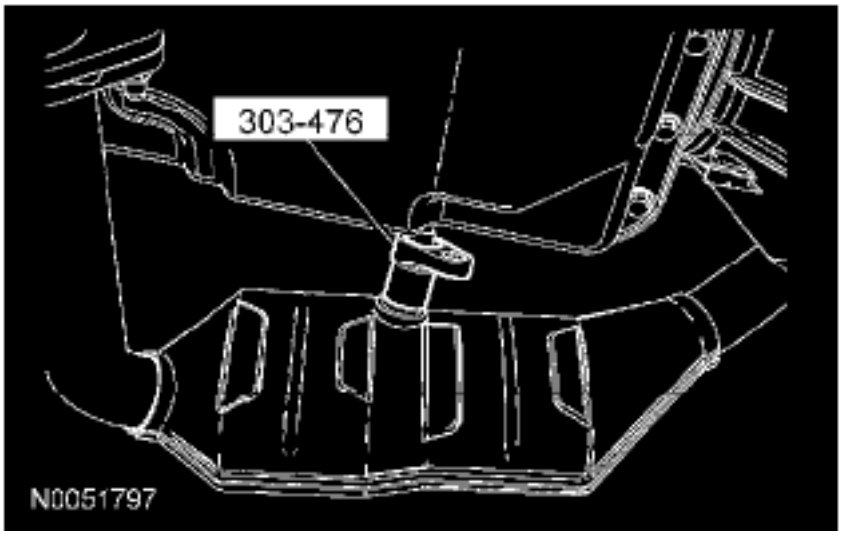
Item	Part Number	Description
5	—	HO2S electrical connector (part of 12B637)
6	9F472	HO2S
7	—	Catalyst monitor sensor electrical connector (part of 14A464)
8	9G444	Catalyst monitor sensor

4.0L Engines

Special Tool(s)

Special Tool(s)

ST1447-A	Socket, Exhaust Gas Oxygen Sensor 303-476 (T94P-9472-A)



Special Tool(s)

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the catalyst monitor sensor electrical connector.

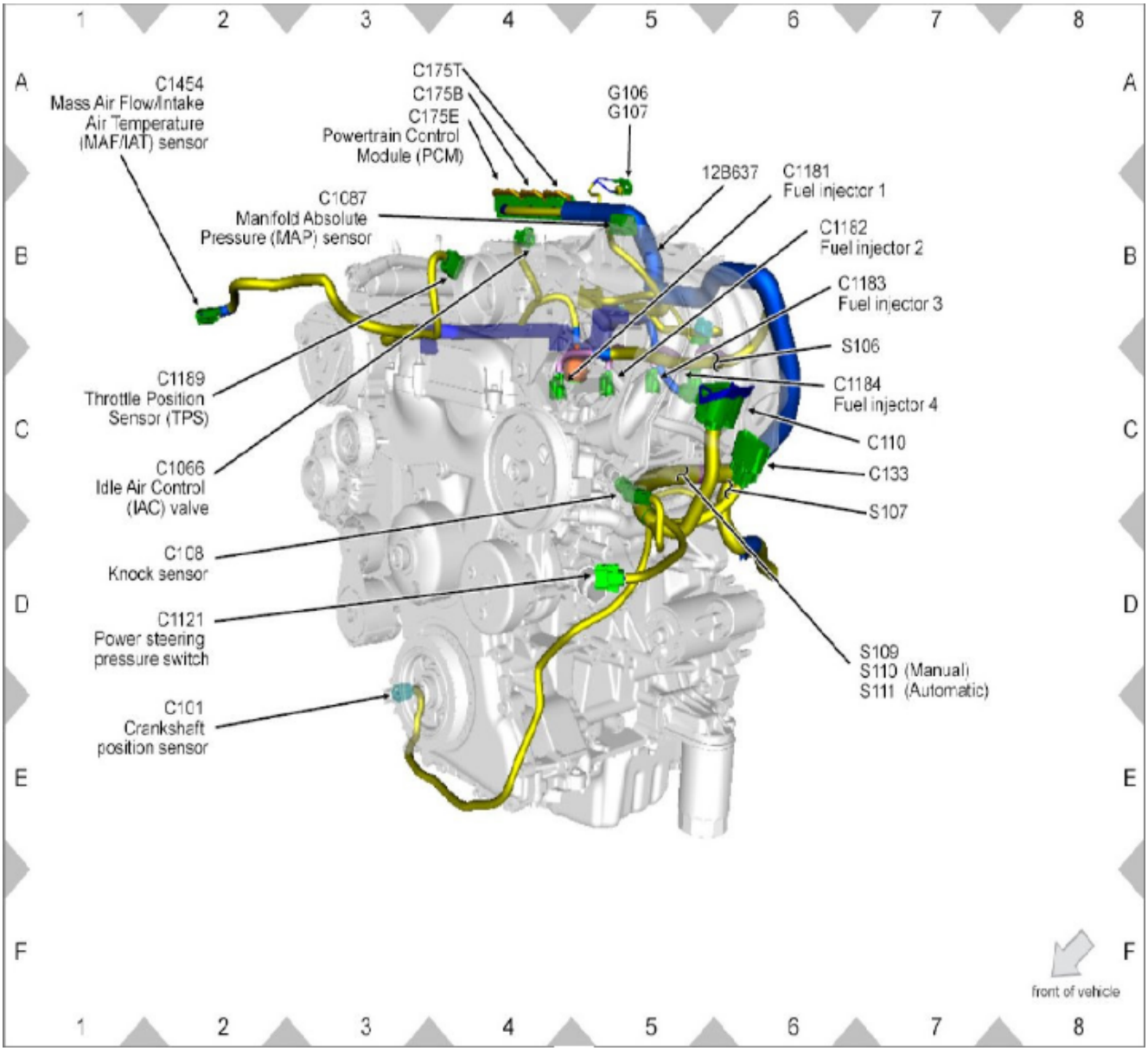
3. NOTE: If necessary, lubricate the catalyst monitor sensor with lock lubricant to assist in removal.

Using the special tool, remove the catalyst monitor sensor. -

To install, tighten to 48 Nm (35 lb-ft).

4. NOTE: Apply a light coat of anti-seize lubricant to the threads of the catalyst monitor sensor.

To install, reverse the removal procedure.

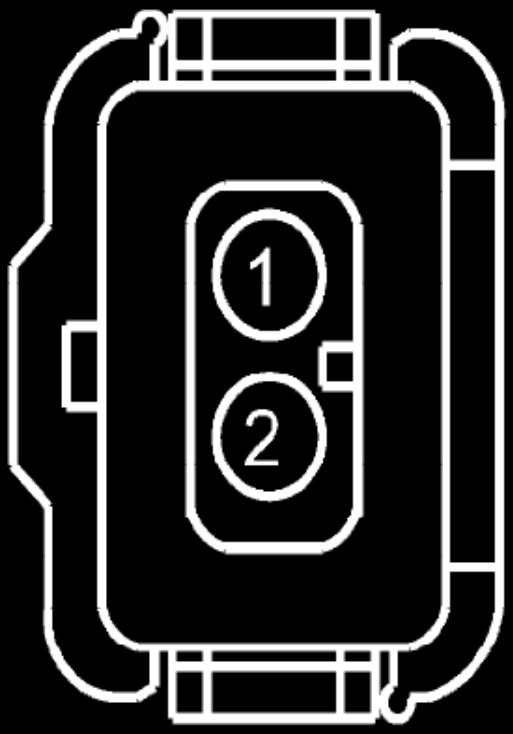

C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor
C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
12B637
C1181
Fuel injector 1
C1087
Manifold Absolute Pressure (MAP) sensor
C1182
Fuel injector 2
C1183
Fuel injector 3
S106
C1189
Throttle Position Sensor (TPS)
C1184
Fuel injector 4
C110
C1066
Idle Air Control (IAC) valve
C133
S107
C108
Knock sensor
C1121
Power steering pressure switch
S109
S110 (Manual)
S111 (Automatic)
C101
Crankshaft position sensor
front of vehicle

View 151-3

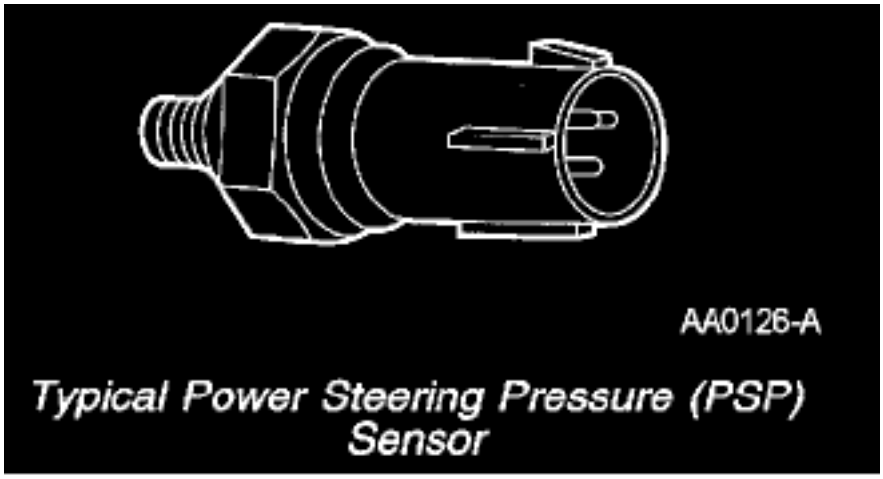
Connector: C1121

Description:	Harness:	Base Part #:
POWER STEERING PRESSURE SWITCH	12B637	

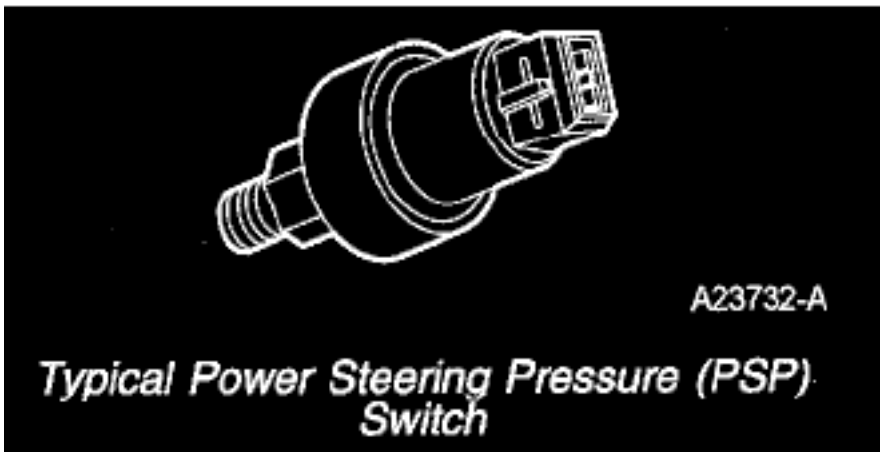
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CCS09 (GN)	20	SWITCH - POWER STEERING PRESSURE (PSPS)	2.3L
2	RE407 (YE-VT)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN COWL (C-SIGRTN) (SIGRTN-C)	2.3L



C1121



Typical Power Steering Pressure (PSP) Sensor



Typical Power Steering Pressure (PSP) Switch

Power Steering Pressure Switch: Description and Operation

Power Steering Pressure (PSP) Sensor

Typical Power Steering Pressure (PSP) Sensor

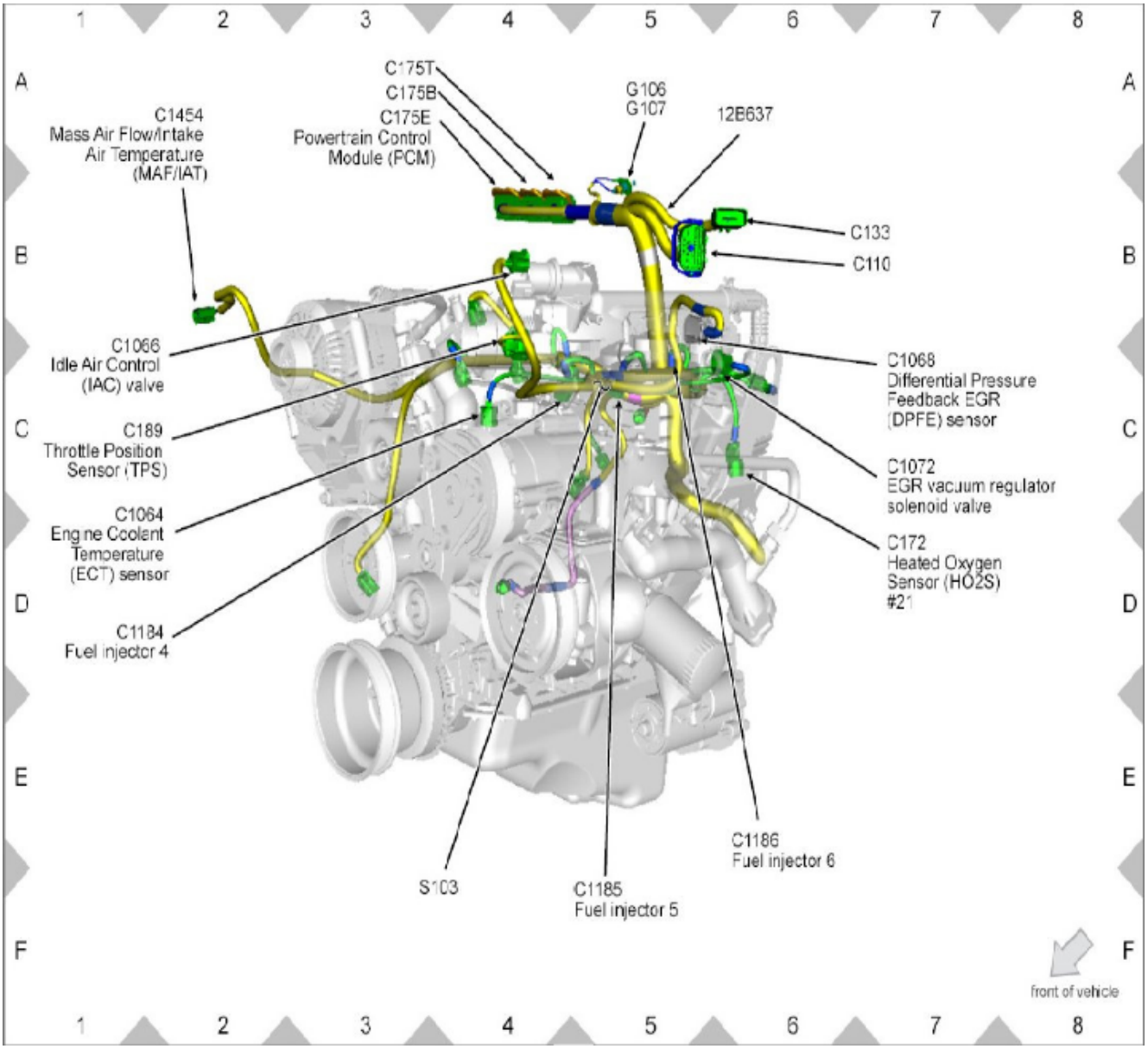
The PSP sensor monitors the hydraulic pressure within the power steering system. The PSP sensor voltage input to the PCM changes as the hydraulic pressure changes. The PCM uses the input signal from the PSP sensor to compensate for additional loads on the engine by adjusting the

idle RPM and preventing engine stall during parking maneuvers. Also, the PSP sensor signals the PCM to adjust the transmission electronic pressure control (EPC) pressure during increased engine load, for example, during parking maneuvers.

Power Steering Pressure (PSP) Switch

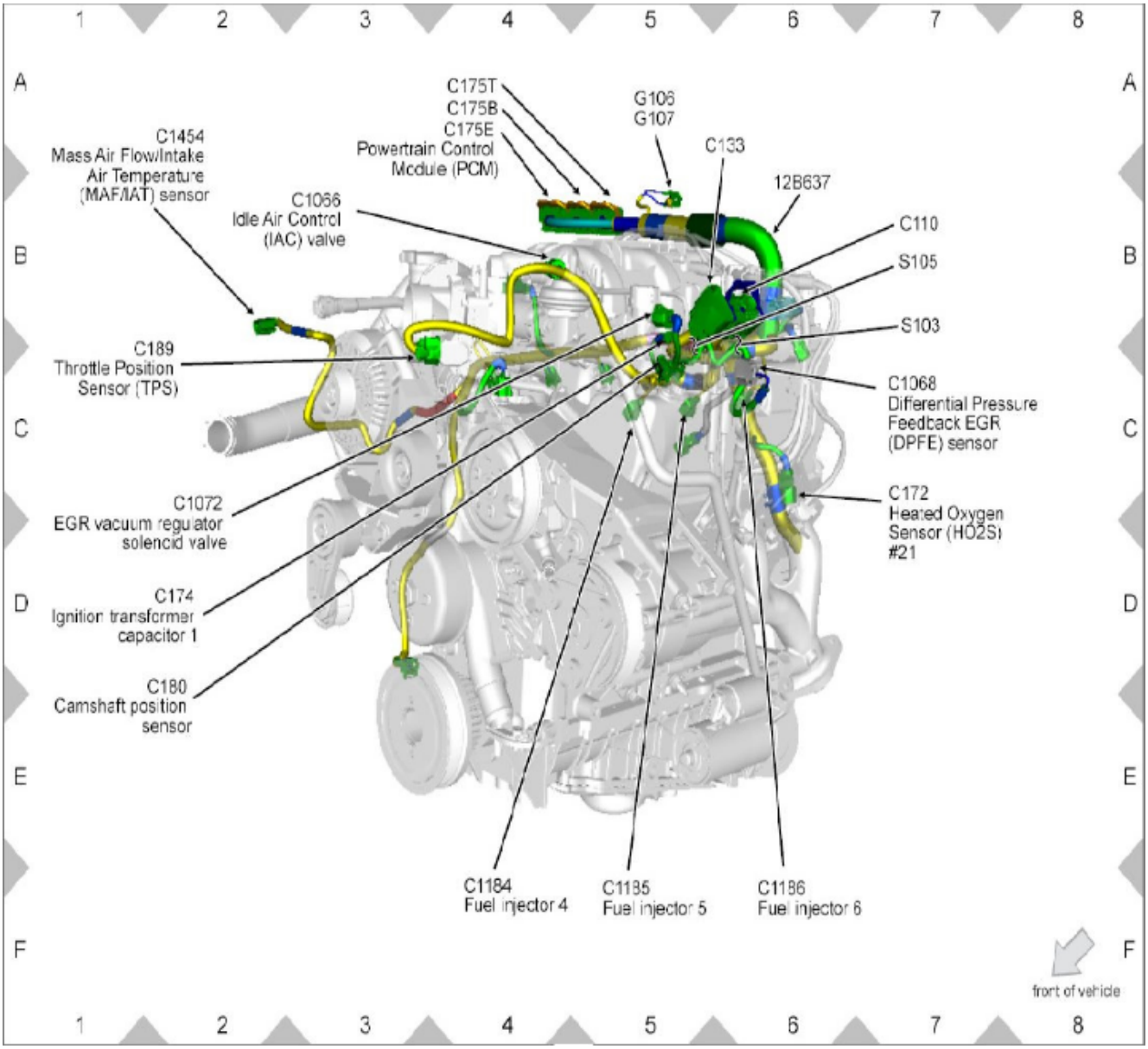
Typical Power Steering Pressure (PSP) Switch

The PSP switch monitors the hydraulic pressure within the power steering system. The PSP switch is a normally closed switch that opens as the hydraulic pressure increases. The PCM provides a low current voltage on the PSP circuit. When the PSP switch is closed, this voltage is pulled low through the SIG RTN circuit. The PCM uses the input signal from the PSP switch to compensate for additional loads on the engine by adjusting the idle RPM and preventing engine stall during parking maneuvers. Also, the PSP switch signals the PCM to adjust the transmission electronic pressure control (EPC) pressure during increased engine load, for example during parking maneuvers.



Pressure Feedback Exhaust Sensor: Locations

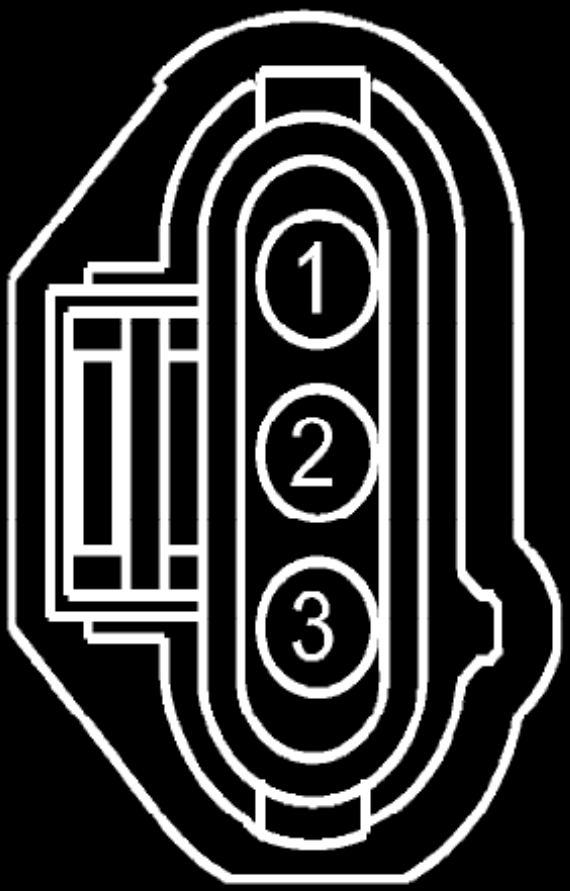
View 151-5


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
C133
12B637
C110
S105
S103
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor
C1066
Idle Air Control (IAC) valve
C189
Throttle Position Sensor (TPS)
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
C174
Ignition transformer capacitor 1
C180
Camshaft position sensor
C1184
Fuel injector 4
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-7

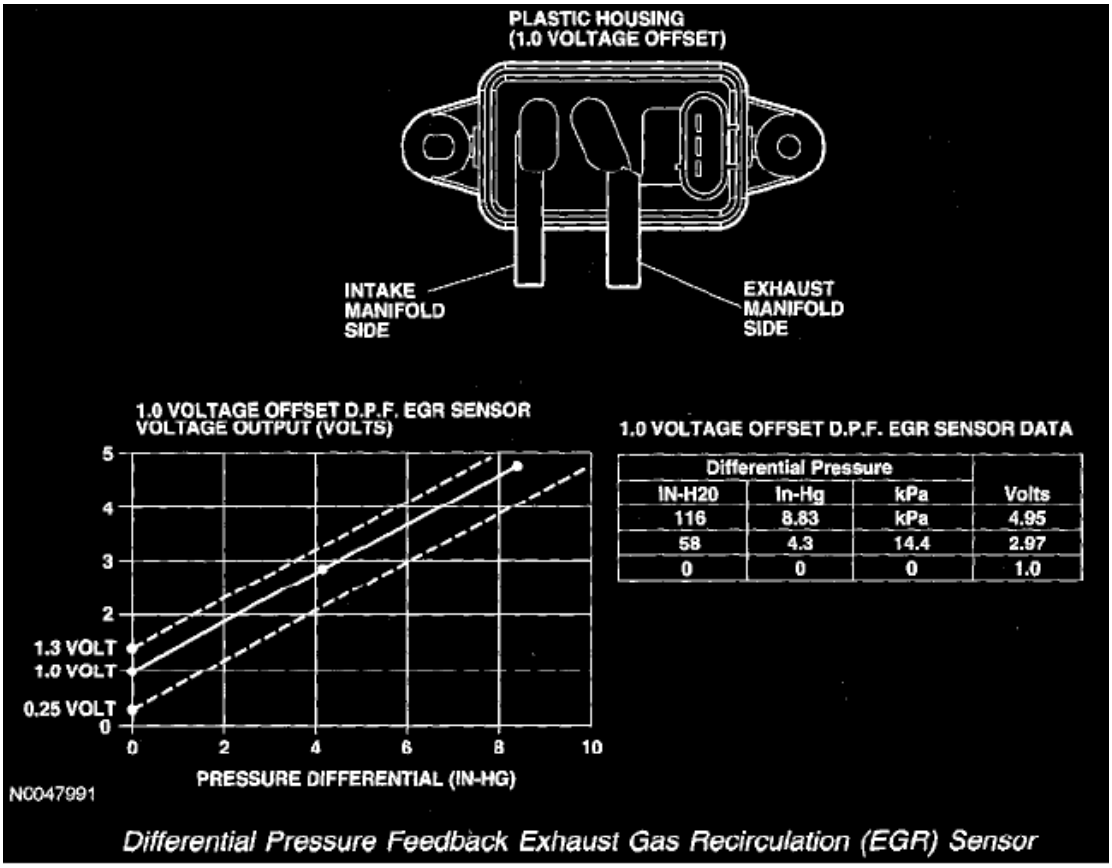
Connector: C1068

Description:	Harness:	Base Part #:
DIFFERENTIAL PRESSURE FEEDBACK EGR DPFE) SENSOR	12B637	9J460



Pin	Circuit	Gauge	Circuit Function	Quali
1	VE713 (GN-OG)	20	SENSOR - DELTA PRESSURE FEEDBACK EGR (DPFE)	3.0L, 4.
2	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	3.0L, 4.
3	LE423 (GN-VT)	20	CTRL MOD. - POWERTRAIN # VOLTAGE REFERENCE ENGINE (VREF) (E-VREV)	3.0L, 4.

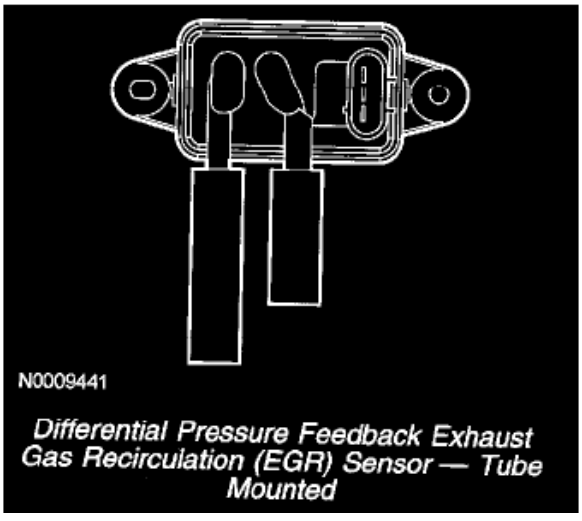
C1068



1.0 VOLTAGE OFFSET D.P.F. EGR SENSOR DATA

Differential Pressure			
IN-H20	In-Hg	kPa	Volts
116	8.83	kPa	4.95
58	4.3	14.4	2.97
0	0	0	1.0

Differential Pressure Feedback Exhaust Gas Recirculation (EGR) Sensor



Differential Pressure Feedback Exhaust Gas Recirculation (EGR) Sensor — Tube Mounted

Pressure Feedback Exhaust Sensor: Description and Operation

Differential Pressure Feedback Exhaust Gas Recirculation (EGR) Sensor

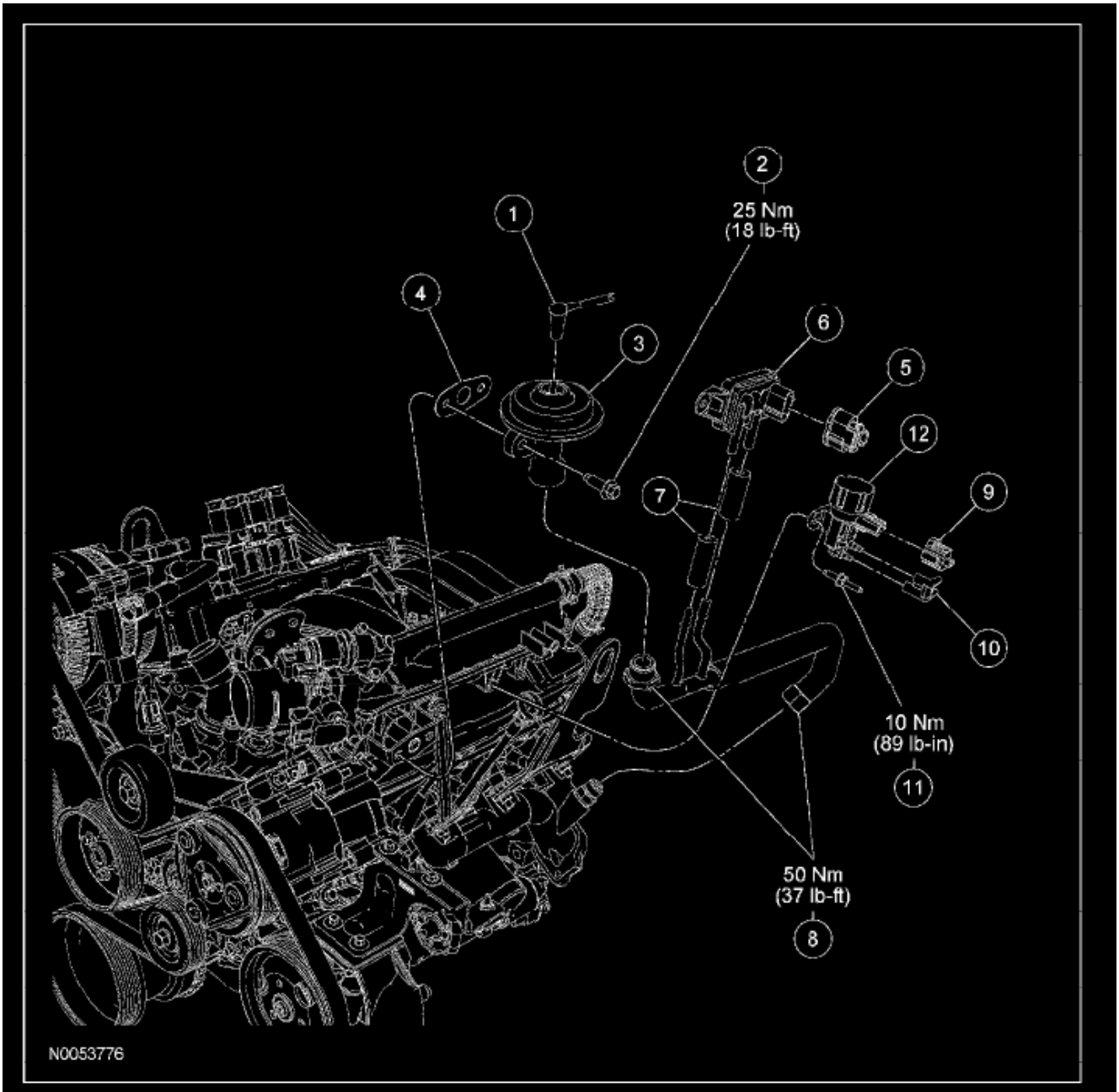
Differential Pressure Feedback Exhaust Gas Recirculation (EGR) Sensor

The differential pressure feedback EGR sensor is a ceramic, capacitive-type pressure transducer that monitors the differential pressure across a metering orifice located in the orifice tube assembly. The differential pressure feedback EGR sensor receives this signal through 2 hoses referred to as the downstream pressure hose (REF SIGNAL) and upstream pressure hose (HI SIGNAL). The HI and REF hose connections are marked on the differential pressure feedback EGR sensor housing for identification (note that the HI signal uses a larger diameter hose). The differential pressure feedback EGR sensor outputs a voltage proportional to the pressure drop across the metering orifice and supplies it to the PCM as EGR flow rate feedback.

Differential Pressure Feedback Exhaust Gas Recirculation (EGR) Sensor - Tube Mounted

Differential Pressure Feedback Exhaust Gas Recirculation (EGR) Sensor - Tube Mounted

The tube mounted differential pressure feedback EGR sensor is identical in operation as the larger plastic differential pressure feedback EGR sensors and uses a 1.0 volt offset. The HI and REF hose connections are marked on the side of the sensor.



Item	Part Number	Description
1	9E499	EGR vacuum hose fitting
2	W500224	EGR valve bolt (2 required)
3	9D475	EGR valve
4	9D476	EGR valve gasket

(Continued)

Item	Part Number	Description
5	14A464	Differential pressure feedback EGR sensor electrical connector (part of 12B637)
6	9J460	Differential pressure feedback EGR sensor

(Continued)

Pressure Feedback Exhaust Sensor: Service and Repair

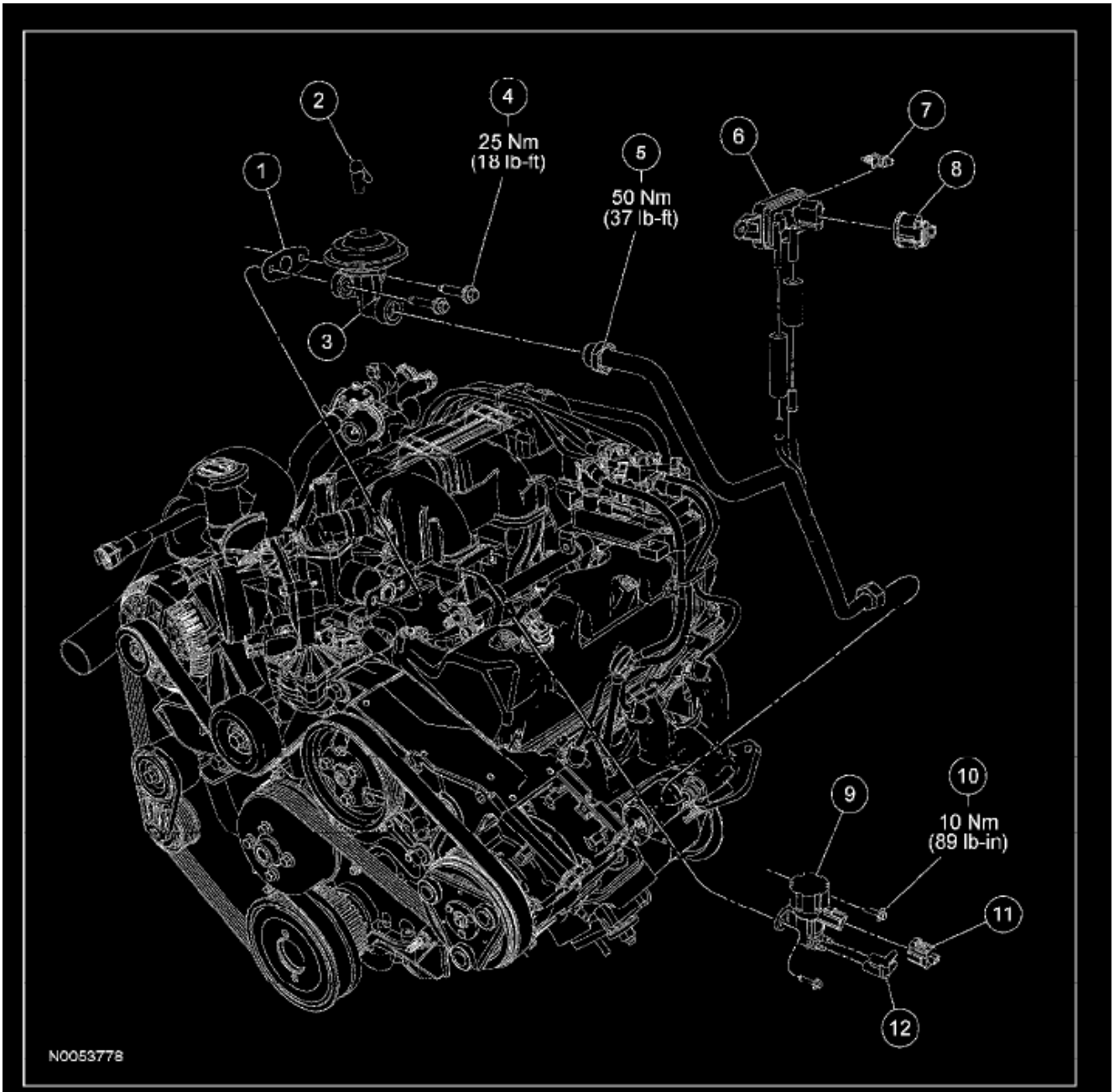
DIFFERENTIAL PRESSURE FEEDBACK EXHAUST GAS RECIRCULATION (EGR) SENSOR

Exploded View

Part 1

Item	Part Number	Description
7	9P761	Differential pressure feedback EGR sensor hoses
8	9D477	Exhaust manifold-to-EGR valve tube
9	14A464	EGR vacuum regulator solenoid electrical connector (part of 12B637)
10	9E499	EGR vacuum regulator solenoid vacuum hose fitting
11	W708628	EGR vacuum regulator solenoid stud bolt
12	9J459	EGR vacuum regulator solenoid

Part 2



Item	Part Number	Description
1	9D476	EGR valve gasket
2	9E499	EGR valve vacuum connector
3	9D475	EGR valve assembly
4	W701232	EGR valve bolt (2 required)

(Continued)

Item	Part Number	Description
5	9E469	EGR tube
6	9J460	Differential pressure feedback EGR sensor
7	13A506	Pushpin wire retainer

(Continued)

Part 1

Item	Part Number	Description
8	14A464	Differential pressure feedback EGR sensor electrical connector
9	9J459	EGR vacuum regulator solenoid
10	W704310	EGR vacuum regulator solenoid bolt (2 required)
11	14A464	EGR vacuum regulator solenoid electrical connector
12	9E499	EGR vacuum regulator solenoid vacuum connector

Part 2

Removal and Installation

1. Disconnect the pushpin retainer from the differential pressure feedback EGR sensor. 2. Disconnect the differential pressure feedback EGR sensor electrical connector. 3. Remove the differential pressure feedback EGR sensor from the hoses. 4. To install, reverse the removal procedure.

ETC System with a 3-Track APP Sensor Failure Mode and Effects Management:

Effect	Failure Mode ▪
No Effect on Driveability	A loss of redundancy or loss of a non-critical input could result in a concern that does not affect driveability. The powertrain malfunction indicator (wrench) illuminates, but the throttle control and torque control systems function normally. A DTC is set to indicate the component or circuit with the concern.
Disable Speed Control	If certain concerns are detected, speed control is disabled. Throttle control and torque control continue to function normally.

(Continued)

Electronic Throttle Control Module: Description and Operation

TORQUE BASED ELECTRONIC THROTTLE CONTROL (ETC)

Overview

The torque based ETC is a hardware and software strategy that delivers an engine output torque (via throttle angle) based on driver demand (pedal position). It uses an electronic throttle body, the powertrain control module (PCM), and an accelerator pedal assembly to control the throttle opening and engine torque.

Torque based ETC enables aggressive automatic transmission shift schedules (earlier upshifts and later downshifts). This is possible by adjusting the throttle angle to achieve the same wheel torque during shifts, and by calculating this desired torque, the system prevents engine lugging (low RPM and low manifold vacuum) while still delivering the performance and torque requested by the driver. It also enables many fuel economy/emission improvement technologies such as variable camshaft timing (VCT) (deliver same torque during transitions).

Torque based ETC also results in less intrusive vehicle and engine speed limiting, along with smoother traction control.

Other benefits of ETC are: -

eliminate cruise control actuators

- eliminate idle air control (IAC) valve

- better airflow range

- packaging (no cable)

- more responsive powertrain at altitude and improved shift quality

The ETC system illuminates a powertrain malfunction indicator (wrench) on the instrument cluster when a concern is present. Concerns are accompanied by diagnostic trouble codes (DTCs) and may also illuminate the malfunction indicator lamp (MIL).

Electronic Throttle Body (ETB)

The ETB has the following characteristics: -

The throttle actuator control (TAC) motor is a DC motor controlled by the PCM (requires 2-wires).

- There are 2 designs: parallel and in-line. The parallel design has the motor under the bore parallel to the plate shaft. The motor housing is integrated into the main housing. The in-line design has a separate motor housing.

- An internal spring is used in both designs to return the throttle plate to a default position. The default position is typically a throttle angle of 7 to 8 degrees from the hard stop angle.

- The closed throttle plate hard stop is used to prevent the throttle from binding in the bore (approximately 0.75 degree). This hard stop setting is not adjustable and is set to result in less airflow than the minimum engine airflow required at idle.

- The required idle airflow is provided by the plate angle in the throttle body assembly. This plate angle controls idle, idle quality, and eliminates the need for an IAC valve.

- There is 1 reference voltage and 1 signal return circuit between the PCM and the ETB. The reference voltage circuit and the signal return circuit is shared with the reference voltage circuits and signal return circuits used by the APP sensor. There are also 2 TP signal circuits for redundancy. The redundant TP signals are required for increased monitoring reasons. The first TP signal (TP1) has a negative slope (increasing angle, decreasing voltage) and the second signal (TP2) has a positive slope (increasing angle, increasing voltage). The TP2 signal reaches a limit of approximately 4.5 volts at approximately 45 degrees of throttle angle.

Accelerator Pedal Position (APP) Sensor

Depending on the application either a 2-track or 3-track APP sensor is used.

Electronic Throttle Control (ETC) System Strategy

ETC System With A 3-Track APP Sensor Failure Mode And Effects Management (Part 1)

ETC System with a 3-Track APP Sensor Failure Mode and Effects Management:

Effect	Failure Mode [a]
RPM Guard with Pedal Follower	In this mode, torque control is disabled due to the loss of a critical sensor or PCM concern. The throttle is controlled in pedal-follower mode as a function of the pedal position sensor input only. A maximum allowed RPM is determined based on the position of the accelerator pedal (RPM Guard). If the actual RPM exceeds this limit, spark and fuel are used to bring the RPM below the limit. The powertrain malfunction indicator (wrench) and the MIL illuminate in this mode and a DTC for an ETC-related component is set. EGR, VCT, and IMRC outputs are set to default values.
RPM Guard with Default Throttle	In this mode, the throttle plate control is disabled due to the loss of throttle position, the throttle plate position controller, or other major electronic throttle body concern. Depending on the concern detected, the throttle plate is either commanded to the default (limp home) position or the motor is disabled and the spring returns the throttle plate to the default (limp home) position. A maximum allowed RPM is determined based on the position of the accelerator pedal (RPM Guard). If the actual RPM exceeds this limit, spark and fuel are used to bring the RPM below the limit. The powertrain malfunction indicator (wrench) and the MIL illuminate in this mode and a DTC P2110 is set. EGR, VCT, and IMRC outputs are set to default values.
RPM Guard with High Forced Idle	This mode is caused by the loss of 2 or 3 pedal position sensor inputs due to sensor, wiring, or PCM concerns. The system is unable to determine driver demand, and the throttle is controlled to a fixed high idle airflow. There is no response to the driver input. The maximum allowed RPM is a fixed value (RPM Guard). If the actual RPM exceeds this limit, spark and fuel are used to bring the RPM below the limit. The powertrain malfunction indicator (wrench) and the MIL illuminate in this mode and a DTC P2104 is set. EGR, VCT, and IMRC outputs are set to default values.
Shutdown	If a significant processor concern is detected, the monitor forces vehicle shutdown by disabling all fuel injectors. The powertrain malfunction indicator (wrench) illuminates in this mode and a DTC P2105 is set.

a ETC illuminates or displays a message on the message center immediately; MIL illuminates after 2 driving cycles

ETC System With A 3-Track APP Sensor Failure Mode And Effects Management (Part 2)

ETC System with a 2-Track APP Sensor Failure Mode and Effects Management:

Effect	Failure Mode
No Effect on Driveability	A loss of redundancy or loss of a non-critical input could result in a concern that does not affect driveability. The powertrain malfunction indicator (wrench) and the MIL do not illuminate. However, speed control and power take off (PTO) may be disabled. A DTC is set to indicate the component or circuit with the concern.
Delayed APP Sensor Response with Brake Override	This mode is caused by the loss of 1 APP sensor input due to sensor, wiring, or PCM concerns. The system is unable to verify the APP sensor input and driver demand. The throttle plate response to the APP sensor input is delayed as the accelerator pedal is applied. The engine returns to idle RPM whenever the brake pedal is applied. The powertrain malfunction indicator (wrench) illuminates, but the MIL does not illuminate in this mode. An APP sensor related DTC is set.
Time-Based Driver Demand with Brake Override	This mode is caused by the loss of one brake pedal position (BPP) and one APP sensor input or both APP sensor inputs due to sensor, wiring, or PCM concerns. The system is unable to determine driver demand. There is no response when the accelerator pedal is applied. The engine returns to idle RPM whenever the brake pedal is applied. When the brake pedal is released, the PCM slowly increases the APP signal to a fixed value. The powertrain malfunction indicator (wrench) illuminates, but the MIL does not illuminate in this mode. An APP or BPP sensor related DTC is set.
RPM Guard with Pedal Follower	In this mode, torque control is disabled due to the loss of a critical sensor or PCM concern. The throttle is controlled in pedal-follower mode as a function of the APP sensor input only. A maximum allowed RPM is determined based on the position of the accelerator pedal (RPM Guard). If the actual RPM exceeds this limit, spark and fuel are used to bring the RPM below the limit. The powertrain malfunction indicator (wrench) and the MIL illuminate in this mode and a DTC for an ETC-related component is set. EGR, VCT, and IMRC outputs are set to default values and speed control is disabled.
RPM Guard with Default Throttle	In this mode, the throttle plate control is disabled due to the loss of both TP sensor inputs, loss of throttle plate control, stuck throttle plate, significant processor concerns, or other major electronic throttle body concern. The spring returns the throttle plate to the default (limp home) position. A maximum allowed RPM is determined based on the position of the accelerator pedal (RPM Guard). If the actual RPM exceeds this limit, spark and fuel are used to bring the RPM below the limit. The powertrain malfunction indicator (wrench) and the MIL illuminate in this mode and a DTC for an ETC-related component is set. EGR, VCT, and IMRC outputs are set to default values and speed control is disabled.

Electronic Throttle Monitor Operation:

DTCs [a]	
P060X, P061X	PCM processor concern (MIL, powertrain malfunction indicator [wrench])
P2104 (ETC system with a 3-track APP sensor)	ETC FMEM forced idle, 2 or 3 pedal sensor concerns (MIL, powertrain malfunction indicator [wrench])
P2105 (ETC system with a 3-track APP sensor)	ETC FMEM forced engine shutdown; PCM concern (MIL, powertrain malfunction indicator [wrench])
P2110 (ETC system with a 3-track APP sensor)	ETC FMEM forced limited RPM; Concern with both TP sensors; throttle plate position control concern (MIL, powertrain malfunction indicator [wrench])
U0300	ETC software version mismatch between processors internal to the PCM (non-MIL, powertrain malfunction indicator [wrench])

a Monitor execution is continuous. Monitor false detection duration is less than 1 second to register a concern.

ETC System With A 2-Track APP Sensor Failure Mode And Effects Management

Electronic Throttle Monitor Operation

Accelerator Pedal Position (APP) Sensor Check:

DTCs[a]	
P1575 (ETC system with a 2-track APP sensor)	APP sensor out of self-test range
P2122, P2123, P2127, P2128, P2132, P2133	APP sensor circuit continuity test (powertrain malfunction indicator [wrench], non-MIL)
P2121, P2126, P2131 (ETC system with a 3-track APP sensor)	APP range/performance (powertrain malfunction indicator [wrench], non-MIL)
P2138 (ETC system with a 2-track APP sensor)	APP to APP signal correlation (powertrain malfunction indicator [wrench], non-MIL)

a Correlation and range/performance - sensor disagreement between processors internal to the PCM. Monitor execution is continuous. Monitor false detection duration is less than 1 second to register a concern. Refer to Powertrain DTC Charts and Descriptions, Diagnostic Trouble Code (DTC) Charts and Descriptions for additional DTC information.

Throttle Position (TP) Sensor Check:

DTCs [a]	
P0122, P0123, P0222, P0223	TP circuit continuity test (MIL, powertrain malfunction indicator [wrench])
P0121, P0221 (ETC system with a 3-track APP sensor)	TP range/performance (non-MIL)
P1124 (ETC system with a 2-track APP sensor)	TP sensor out of self-test range
P2135	TP to TP sensor correlation test (powertrain malfunction indicator [wrench], non-MIL)

a Correlation and range/performance - sensor disagreement between processors internal to the PCM, TP inconsistent with requested throttle plate position. Monitor execution is continuous. Monitor false detection duration is less than 1 second to register a concern. Refer to Powertrain DTC Charts and Descriptions, Diagnostic Trouble Code (DTC) Charts and Descriptions for additional DTC information.

Electronic TAC Operation Check:

DTCs [a]	
P115E	Throttle actuator airflow trim at maximum limit (non-MIL)
P2072 (ETC system with a 3-track APP sensor)	Throttle body ice blockage (non-MIL)
P2100 (ETC system with a 3-track APP sensor)	Throttle actuator circuit open, short to power, short to ground (MIL)
P2101	Throttle actuator range/performance test (MIL)
P2107	Processor and TAC motor circuit test (MIL)
P2111	Throttle actuator system stuck open (MIL)
P2112	Throttle actuator system stuck closed (MIL)

a Note: For all DTCs, in addition to the MIL, the powertrain malfunction indicator (wrench) is on for the concern that caused the FMEM action. Monitor execution is continuous. Monitor false detection duration is less than 5 seconds to register a concern.

The torque based ETC strategy was developed to improve fuel economy and to accommodate variable camshaft timing (VCT). This is possible by not coupling the throttle angle to the driver

pedal position. Uncoupling the throttle angle (produce engine torque) from the pedal position (driver demand) allows the powertrain control strategy to optimize fuel control and transmission shift schedules while delivering the requested wheel torque.

The ETC monitor system is distributed across 2 processors within the PCM: the main powertrain control processor unit (CPU) and a separate monitoring processor. The primary monitoring function is carried out by the independent plausibility check (IPC) software, which resides on the main processor. It is responsible for determining the driver-demanded torque and comparing it to an estimate of the actual torque delivered. If the generated torque exceeds driver demand by a specified amount, appropriate corrective action is taken.

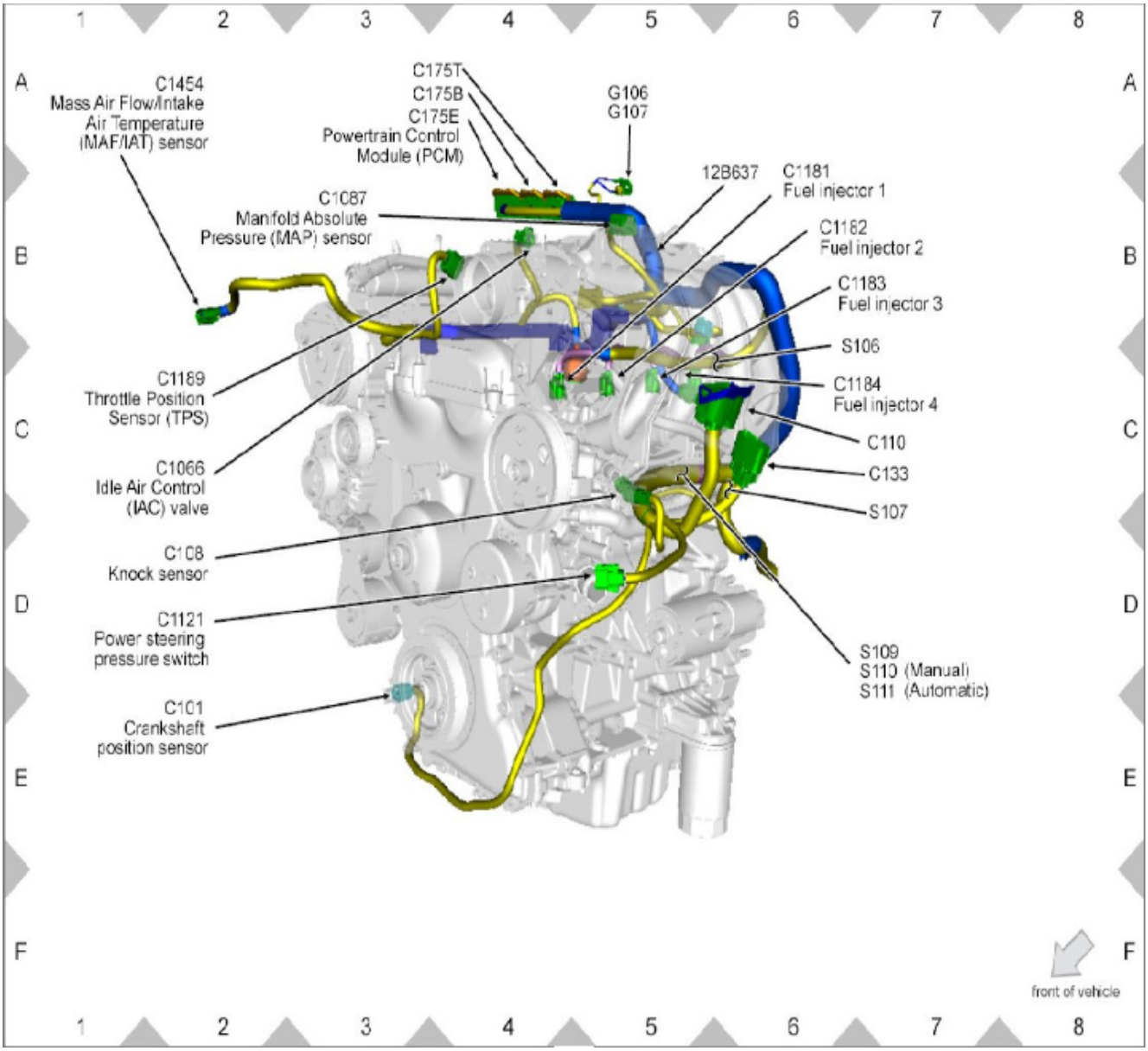
APP and TP Sensor Inputs

Accelerator Pedal Position (APP) Sensor Check

Throttle Position (TP) Sensor Check

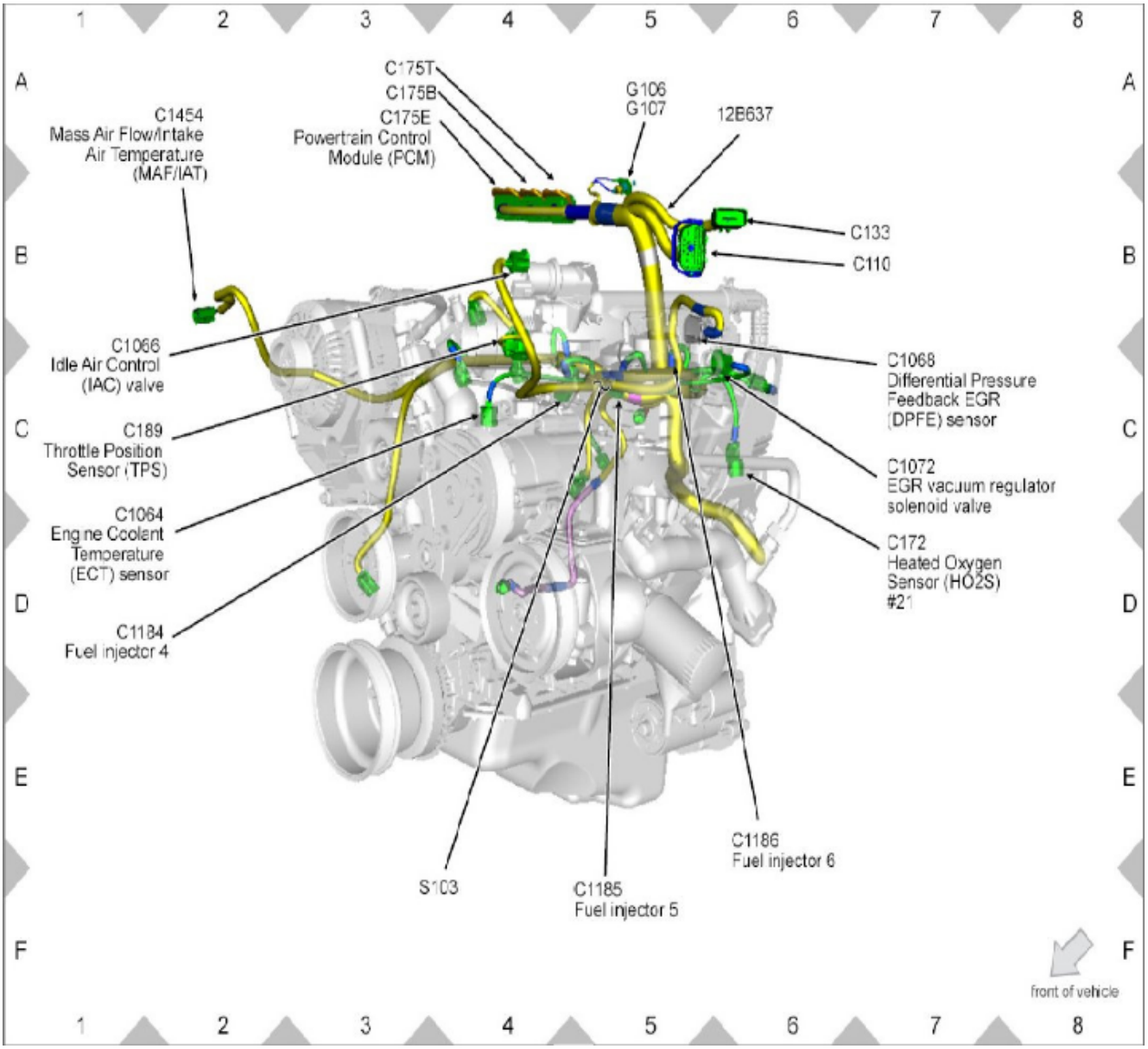
Electronic Throttle Actuator Control (TAC) Output

Electronic TAC Operation Check

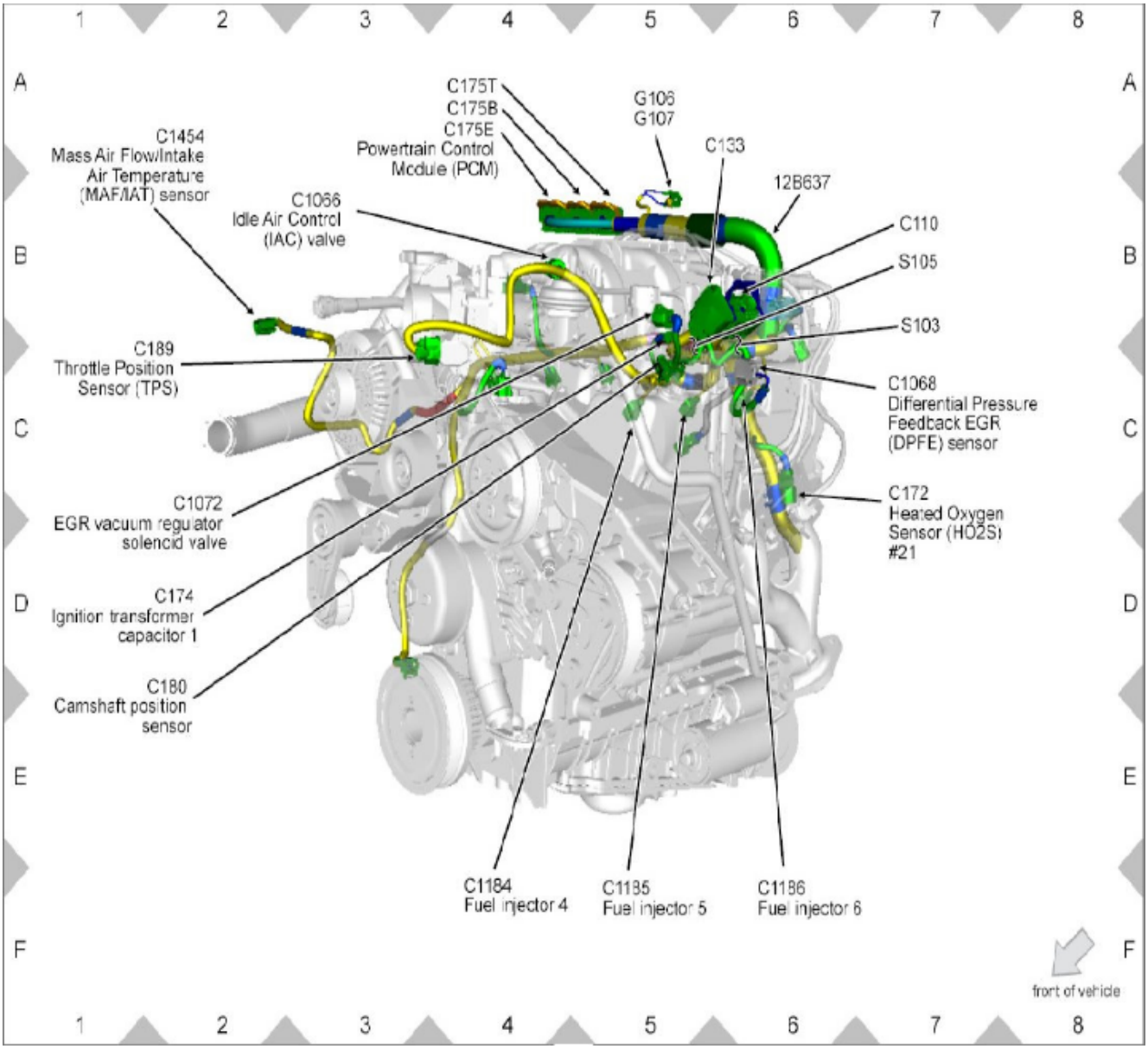


Engine Control Module: Locations

View 151-3


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
12B637
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT)
C133
C110
C1066
Idle Air Control (IAC) valve
C189
Throttle Position Sensor (TPS)
C1064
Engine Coolant Temperature (ECT) sensor
C1184
Fuel injector 4
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
C1186
Fuel injector 6
S103
C1185
Fuel injector 5
front of vehicle

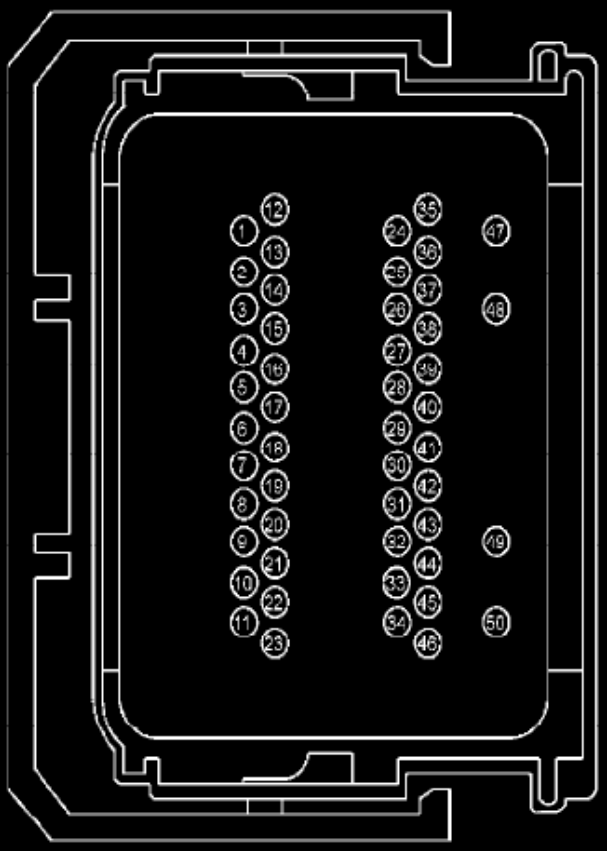
View 151-5


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
C133
12B637
C110
S105
S103
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor
C1066
Idle Air Control (IAC) valve
C189
Throttle Position Sensor (TPS)
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
C174
Ignition transformer capacitor 1
C180
Camshaft position sensor
C1184
Fuel injector 4
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-7

Connector: C175B

Description:	Harness:	Base Part #:
POWERTRAIN CONTROL MODULE (PCM)	12B637	12A650



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VCM05 (VT-OG)	20	CTRL MOD. - VEHICLE SPEED OUTPUT (VSOUT)	
2	CDC12 (YE)	20	CTRL MOD. - POWERTRAIN # STARTER MOTOR CONTROL (SMC)	
3	VE922 (VT-GN)	20	TRANSDUCER - FUEL TANK PRESSURE (FTPT)	
4	*	*	not used	
5	*	*	not used	
6	*	*	not used	
7	CBP21 (BU-GY)	20	FUSE - 21 OR CIRCUIT BREAKER	M/T
7	CET40 (GN-OG)	20	SWITCH - TRANSMISSION RANGE # PARK/NEUTRAL (TRSW-PN)	A/T
8	CCB15 (BN-GN)	20	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL CLOSED	
9	*	*	not used	
10	GD108 (BK-VT)	18	GROUND - CHASSIS/BATTERY	
11	VDB04 (WH-BU)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED HIGH	
12	VE225 (YE-OG)	20	CTRL MOD. - POWERTRAIN # FUEL PUMP MODULE COMMAND (FPC)	
13	CE114 (GN-BU)	20	CTRL MOD. - POWERTRAIN # CANISTER VENT SOLENOID (CANVNT)	
14	CH302 (WH-BN)	20	CTRL MOD. - POWERTRAIN # A/C CLUTCH CONTROL RELAY/WOT AC CUTOFF (ACCR)	
15	CH425 (GN-BU)	20	SWITCH - AC HEAD PRESSURE (ACPSW)	
16	*	*	not used	
17	*	*	not used	
18	*	*	not used	
19	*	*	not used	
20	*	*	not used	
21	VE518 (BN-WH)	18	MONITOR - FUEL PUMP (FPM)	
22	*	*	not used	
23	VDB05 (WH)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED LOW	
24	*	*	not used	
25	*	*	not used	
26	*	*	not used	
27	*	*	not used	
28	*	*	not used	
29	CET34 (BN-GN)	20	SWITCH - TRANSMISSION CONTROL/OVERDRIVE CANCEL (TCS)	
30	*	*	not used	
31	*	*	not used	
32	*	*	not used	
33	CDC36	20	SWITCH - START INTERLOCK	M/T

Engine Control Module: Diagrams

C175B (Part 1)

	(GN-BN)		CLUTCH PEDAL	
34	CCS09 (GN)	20	SWITCH - POWER STEERING PRESSURE (PSPS)	
35	CBB39 (VT-WH)	18	FUSE - 39 OR CIRCUIT BREAKER	
36	CBB39 (VT-WH)	18	FUSE - 39 OR CIRCUIT BREAKER	
37	*	*	not used	
38	*	*	not used	
39	CE904 (GN-VT)	20	SWITCH - CLUTCH PEDAL POSITION # TOP OF TRAVEL (CPP-TT)	M/T
40	LE424 (YE-GN)	20	CTRL MOD. - POWERTRAIN # VOLTAGE REFERENCE COWL (C-VREV)	
41	RE407 (YE-VT)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN COWL (C-SIGRTN) (SIGRTN C)	
42	*	*	not used	
43	*	*	not used	
44	CUB08 (BN)	20	CONNECTOR - DIAGNOSTIC # FLASH EEPROM POWER SUPPLY (FEPS)	
45	SBB21 (GY-RD)	20	FUSE - 21 OR CIRCUIT BREAKER	
46	*	*	not used	
47	GD108 (BK-VT)	18	GROUND - CHASSIS/BATTERY	
48	GD108 (BK-VT)	18	GROUND - CHASSIS/BATTERY	
49	GD108 (BK-VT)	18	GROUND - CHASSIS/BATTERY	
50	GD108 (BK-VT)	18	GROUND - CHASSIS/BATTERY	

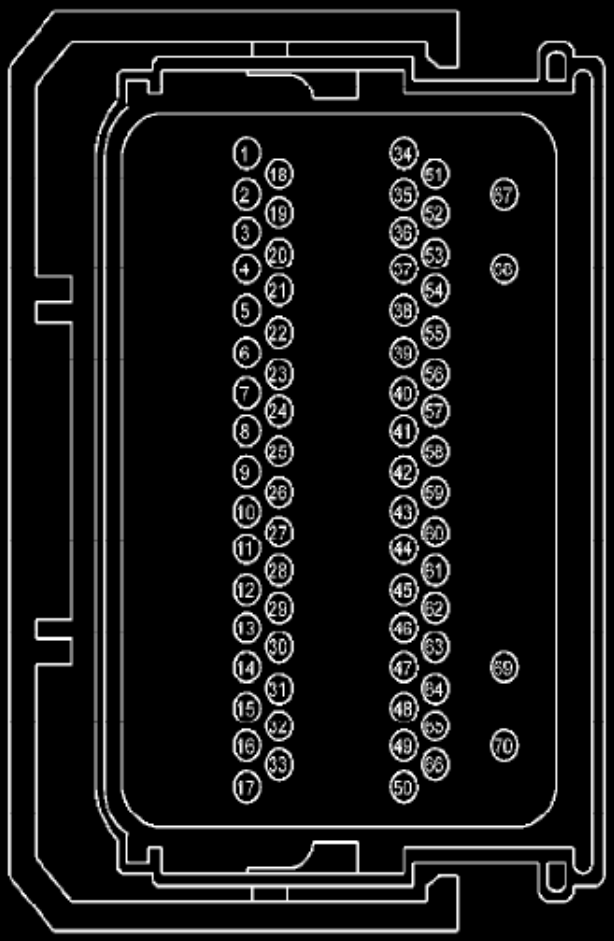
C175B (Part 2)

Connector: C175E

Description: POWERTRAIN CONTROL MODULE (PCM)

Harness: 12B637

Base Part #: 12A650



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	*	*	not used	
3	CE328 (YE-VT)	18	CTRL MOD. - POWERTRAIN # POS. CRANKCASE VENTIL. FITTING HEATER CONTROL (PCVFHC)	3.0L/4.0L
4	*	*	not used	
5	*	*	not used	
6	CE132 (BN-YE)	18	CTRL MOD. - POWERTRAIN # ELECTRIC VAPOR MANAGEMENT VALVE (EVMV)	
7	VH101 (WH-VT)	20	CTRL MOD. - CLIMATE # BLOWER MOTOR CONTROL	2.3L
8	CE101 (WH-VT)	18	CTRL MOD. - POWERTRAIN # EXHAUST GAS RECIRCUL. MOTOR (STEPPER CONTR. 1) (EGRMC) (+)	2.3L
9	*	*	not used	
10	*	*	not used	
11	*	*	not used	
12	CE125 (WH)	18	CTRL MOD. - POWERTRAIN # DISTRIBUTORLESS IGNITION SYSTEM COIL DRIVER C (DIS)	2.3L
12	CE123 (YE-GY)	18	CTRL MOD. POWERTRAIN # DISTRIBUTORLESS IGNITION SYSTEM COIL DRIVER A (DIS)	3.0L/4.0L
13	CE102 (YE-BU)	18	CTRL MOD. - POWERTRAIN # EXHAUST GAS RECIRCUL. MOTOR (STEPPER CONTR. 2) (EGRMC) (-)	2.3L
14	*	*	not used	
15	*	*	not used	
16	CE125 (WH)	18	CTRL MOD. - POWERTRAIN # DISTRIBUTORLESS IGNITION SYSTEM COIL DRIVER C (DIS)	3.0L/4.0L
17	CE124 (BU-BN)	18	CTRL MOD. - POWERTRAIN # DISTRIBUTORLESS IGNITION SYSTEM COIL DRIVER B (DIS)	
18	VE716 (YE)	20	SENSOR - ENGINE COOLANT TEMPERATURE (ECT)	3.0L/4.0L
19	*	*	not used	
20	*	*	not used	
21	VE713 (GN-OG)	20	SENSOR - DELTA PRESSURE FEEDBACK EGR (DPFE)	3.0L/4.0L
22	VE740 (VT-GY)	20	SENSOR - INTAKE AIR TEMPERATURE (IAT)	
23	*	*	not used	
24	*	*	not used	
25	VE807 (YE-VT)	20	SENSOR - MASS AIR FLOW LH BANK OR 1ST BANK OR UNIQUE (MAF)	
26	RF320 (BU)	20	CTRL MOD. - POWERTRAIN # MASS AIR FLOW SEN. LH BANK OR 1ST BANK (MAFRTN)	
27	*	*	not used	
28	VE735 (VT-GN)	18	SENSOR - HEATED OXYGEN PRE CAT. 1ST OR UNIQUE (HO2S11)	

C175E (Part 1)

29	VE737 (WH-BU)	18	SENSOR - HEATED OXYGEN PRE CAT. 2ND (HO2S21)	3.0L/4.0L
30	*	*	not used	
31	*	*	not used	
32	*	*	not used	
33	CE301 (GY-OG)	20	CTRL MOD. - POWERTRAIN # IDLE AIR CONTROL VALVE (IAC)	
34	*	*	not used	
35	CE206 (GY-TE)	20	CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 2 (INJ)	
36	CE208 (YE-OG)	20	CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 4 (INJ)	
37	CE210 (GN-WH)	20	CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 6 (INJ)	3.0L/4.0L
38	*	*	not used	
39	CE103 (BU-BN)	18	CTRL MOD. - POWERTRAIN # EXHAUST GAS RECIRCUL MOTOR (STEPPER CONTR. 3) (EGRMC)	2.3L
40	*	*	not used	
41	CE116 (VT-BN)	20	CTRL MOD. POWERTRAIN # CYLINDER HEAD TEMPERATURE INDICATOR LIGHT (CHTIL)	2.3L
42	*	*	not used	
43	*	*	not used	
44	*	*	not used	
45	VE706 (BN-BU)	18	SENSOR - CAMSHAFT POSITION BANK 1 IN+EX/ IN (CMP1) [CID-H] (CID1)	
46	RE135 (GN-BN)	18	CTRL MOD. - POWERTRAIN # CRANKSHAFT POSITION SENSOR (CKPN)	
47	VE711 (YE-VT)	18	SENSOR - CRANKSHAFT POSITION (CKPP)	
48	RE323 (WH-BN)	20	CTRL MOD. - POWERTRAIN # KNOCK SENSOR 1ST OR UNIQUE (KS1N) [KSL1-]	
49	VE801 (VT-OG)	20	SENSOR - KNOCK 1ST OR UNIQUE (KS1P) [KSL1+]	
50	*	*	not used	
51	*	*	not used	
52	CE205 (GN-BU)	20	CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 1 (INJ)	
53	CE207 (VT-GY)	20	CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 3 (INJ)	
54	CE209 (BN)	20	CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 5 (INJ)	3.0L/4.0L
55	*	*	not used	
56	CE104 (GN)	18	CTRL MOD. - POWERTRAIN # EXHAUST GAS RECIRCUL MOTOR (STEPPER CONTR. 4) (EGRMC)	2.3L
57	LE423 (GN-VT)	20	CTRL MOD. - POWERTRAIN # VOLTAGE REFERENCE ENGINE (VREF) (E-VREV)	
58	RE405 (GN-WH)	18	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	
59	*	*	not used	
60	*	*	not used	

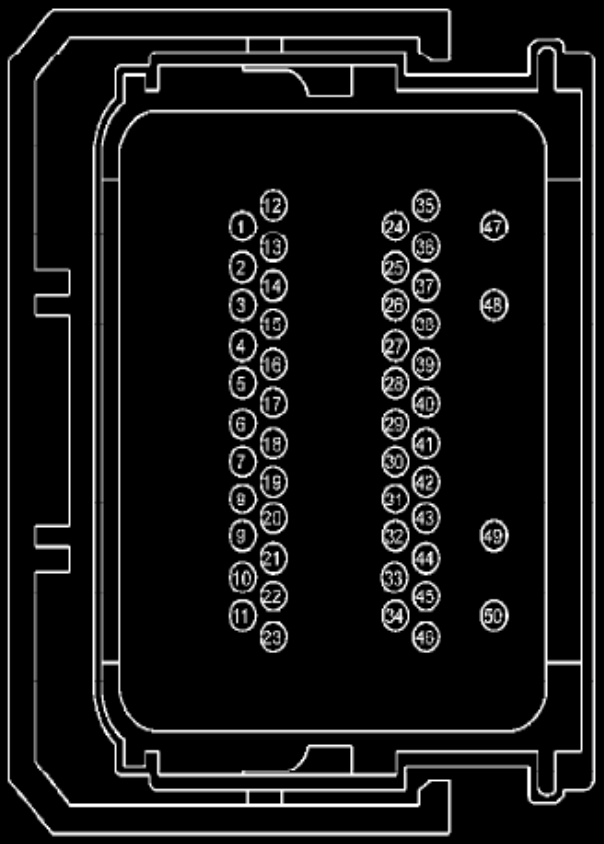
C175E (Part 2)

61	VE819 (GN-VT)	20	SENSOR - THROTTLE POSITION # POSITIVE SLOPE (TP2-PS)	
62	VE803 (BU-GN)	20	SENSOR - MANIFOLD ABSOLUTE PRESSURE (MAP)	2.3L
63	CE133 (VT WH)	20	CTRL MOD. - POWERTRAIN # ELECTRONIC VACUUM REGULATOR (EVR)	3.0L/4.0L
64	*	*	not used	
65	*	*	not used	
66	*	*	not used	
67	*	*	not used	
68	*	*	not used	
69	CE235 (GN-BN)	18	CTRL MOD. - POWERTRAIN # HEATER OXYGEN SEN. PRE CAT. 1ST OR UNIQUE (HTR11)	
70	CE236 (GY-VT)	18	CTRL MOD. - POWERTRAIN # HEATER OXYGEN SEN. PRE CAT. 2ND (HTR21)	3.0L/4.0L

C175E (Part 3)

Connector: C175T

Description:	Harness:	Base Part #:
POWERTRAIN CONTROL MODULE (PCM)	12B637	12A650



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	*	*	not used	
3	RET04 (YE-OG)	20	CTRL MOD. - POWERTRAIN # SENSOR OUTPUT SHAFT SPEED (OSS)	
4	VE739 (GY-YE)	20	SENSOR - INTERMEDIATE SHAFT SPEED SENSOR	A/T
5	*	*	not used	
6	*	*	not used	
7	*	*	not used	
8	*	*	not used	
9	*	*	not used	
10	*	*	not used	
11	VET27 (BN-YE)	20	CTRL MOD. - POWERTRAIN # SOLENOID PRESSURE CONTROL 2 (PC2) [EPC] [VFS]	A/T
12	*	*	not used	
13	*	*	not used	
14	*	*	not used	
15	VET33 (WH-OG)	20	SENSOR - TURBINE/TRANSMISSION SHAFT SPEED (TSS)	A/T
16	VET129 (VT-WH)	20	SENSOR - TRANSMISSION RANGE # 1 (TR1)	A/T
17	VET30 (YE)	20	SENSOR - TRANSMISSION RANGE # 2 (TR2)	A/T
18	*	*	not used	
19	*	*	not used	
20	*	*	not used	
21	*	*	not used	
22	*	*	not used	
23	*	*	not used	
24	VE731 (YE-GN)	18	SENSOR - HEATED OXYGEN POST CAT. 1ST OR UNIQUE (HO2S12)	
25	VE733 (WH)	18	SENSOR - HEATED OXYGEN POST CAT. 2ND (HO2S22)	3.0L, 4.0L
26	*	*	not used	
27	VET28 (GY-VT)	20	SENSOR - TRANSMISSION RANGE # (TR-3A)	A/T
28	VET31 (BU-OG)	20	SENSOR - TRANSMISSION RANGE # 4 (TR4)	A/T
29	CET06 (GN-BN)	20	SENSOR - TRANSMISSION FLUID TEMPERATURE (TFT)	A/T
30	*	*	not used	
31	*	*	not used	
32	*	*	not used	
33	*	*	not used	
34	*	*	not used	
35	*	*	not used	
36	*	*	not used	
37	*	*	not used	
38	*	*	not used	
39	*	*	not used	
40	*	*	not used	

C175T (Part 1)

41	RE406 (GY-VT)	18	CTRL MOD. - POWERTRAIN # SIGNAL RETURN TRANSMISSION (T-SIGRTN) (SIGRTN-B)	
42	CET05 (BU-GN)	20	CTRL MOD. - POWERTRAIN # SOLENOID SHIFT CONTROL LOW-SIDE A (SSA)	A/T
43	CET18 (GY-YE)	20	CTRL MOD. - POWERTRAIN # SOLENOID SHIFT CONTROL LOW-SIDE B (SSB)	A/T
44	CET07 (GY-OG)	20	CTRL MOD. - POWERTRAIN # SOLENOID SHIFT CONTROL LOW-SIDE C (SSC)	A/T
45	CET44 (BU-BN)	20	CTRL MOD. - POWERTRAIN # SOLENOID SHIFT CONTROL LOW-SIDE D (SSD)	A/T
46	CET19 (VT GY)	20	CTRL MOD. - POWERTRAIN # TORQUE CONVERTER CLUTCH HIGH IMPEDENCE (TCCH)	A/T
47	CE233 (WH-OG)	18	CTRL MOD. - POWERTRAIN # HEATER OXYGEN SEN. POST CAT. 1ST OR UNIQUE (HTR12)	
48	CE234 (BU-WH)	18	CTRL MOD. - POWERTRAIN # HEATER OXYGEN SEN. POST CAT. 2ND (HTR22)	3.0L, 4.0L
49	*	*	not used	
50	*	*	not used	

C175T (Part 2)

Engine Control Module: Procedures

FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)

Description

The EEPROM is contained in an integrated circuit internal to the powertrain control module (PCM). The EEPROM contains the vehicle strategy including calibration information specific to the vehicle, and is capable of being programmed or flashed repeatedly.

As part of the calibration there is an area referred to as the vehicle identification (VID) block. The VID block is programmed when installing a new PCM as described under Programming the VID Block for a Replacement PCM. Failure to carry out this procedure may generate DTCs PI635 or P1639. The VID block in an existing PCM can also be tailored to accommodate various hardware or parameter changes made to the vehicle since production. Failure to carry out this procedure properly may generate DTC P1635, Tire/Axle Ratio out of Acceptable Range. An incorrect tire/axle ratio is one of the main causes for DTC P1639. This is described under Making Changes to the VID Block and also under Making Changes to the PCM Calibration. The VID block contains many items used by the strategy for a variety of functions. Some of these items include the vehicle identification number (VIN), octane adjust, fuel octane, fuel type, vehicle speed limit, tire size, axle ratio, the presence of speed control, and 4-wheel drive electronic shift-on-the-fly (ESOF) versus manual shift-on-the-fly (MSOF). Only items applicable to the vehicle hardware and supported by the VID block is displayed on the scan tool.

When changing items in the VID block, the strategy places range limits on certain items such as tire and axle ratio. The number of times the VID block may be reconfigured is limited. When this limit is reached, the scan tool displays a message indicating the need to flash the PCM again to reset the VID block.

Programming can be carried out by a local Ford dealer or any non-Ford facility. Refer to the scan tool manufacturer's instruction manual for details.

Programming the VID Block for a Replacement PCM

A new PCM contains the latest strategy and calibration level for a particular vehicle. However, the VID block is blank and needs programming. There are 2 procedures available. The first is an automatic data transfer from the old PCM to the new PCM, and the second is manual data entry into the new PCM.

Automatic data transfer is carried out if the old PCM is capable of communicating. This is done by using a scan tool to retrieve data from the old PCM before removing it from the vehicle. The stored data can then be downloaded to the new PCM after it has been installed.

Carry out manual data entry if the old module is damaged or incapable of communicating. Remove and install a new PCM. Using a compatible scan tool, select and carry out the module/parameter programming, referring to the scan tool manufacturer's instruction manual. Make certain that all parameters are included. Failure to properly program tire size in revolutions per mile, (rev/mile equals 63,360 divided by the tire circumference in inches), axle ratio, 4x4/4x2, and/or MSOF/ESOF may result in DTCs P1635 and P1639. You may be instructed to contact the As-Built Data Center for the information needed to manually update the VID block with the scan tool. Contact the center only if the old PCM cannot be used or the data is corrupt. For Ford and Lincoln Mercury technicians, contact your National Hotline or the Professional Technician Society (PTS) website for As-Built data listed under the Service Publications Index. Non-Ford technicians use the Motorcraft(R) website at www.motorcraft.com. From the Motorcraft(R) homepage, use the search function to find the Module Programming or As-Built Data.

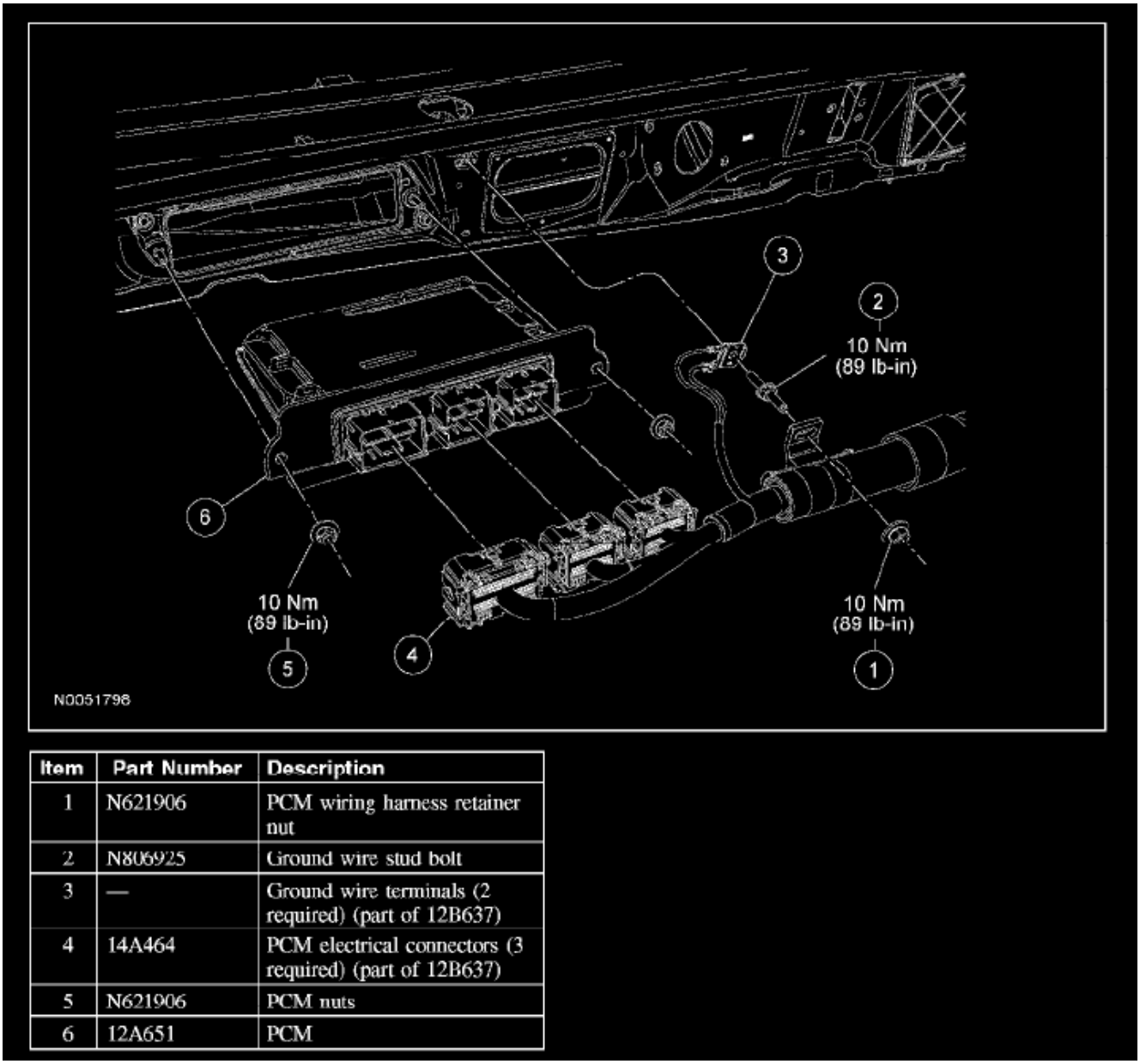
For Ford and Lincoln Mercury technicians, check the Programmable Module Installation link on the PTS website for quick Programmable Module data information by vehicle.

Making Changes to the VID Block

A PCM which is programmed may require changes to be made to certain VID information to accommodate the vehicle hardware. Refer to Module Reprogramming on the scan tool.

Making Changes to the PCM Calibration

At certain times, the entire EEPROM needs to be completely reprogrammed. This is due to changes made to the strategy or calibration after production, or the need to reset the VID block because it has reached its limit. Refer to Module Reprogramming on the scan tool.



Item	Part Number	Description
1	N621906	PCM wiring harness retainer nut
2	N806925	Ground wire stud bolt
3	—	Ground wire terminals (2 required) (part of 12B637)
4	14A464	PCM electrical connectors (3 required) (part of 12B637)
5	N621906	PCM nuts
6	12A651	PCM

Engine Control Module: Removal and Replacement

POWERTRAIN CONTROL MODULE (PCM)

Removal

1. Retrieve the module configuration. Carry out the module configuration retrieval steps of the Programmable Module Installation procedure. 2. Remove the PCM wiring harness retainer nut. 3. Remove the ground wire stud bolt. 4. Disconnect the 3 PCM electrical connectors. 5. Remove the 2 nuts and the PCM.

Installation

1. Install the PCM and the 2 nuts.

- Tighten to 10 Nm (89 lb-in).

2. Connect the 3 PCM electrical connectors. 3. Position the ground wire terminals and install the stud bolt.

- Tighten to 10 Nm (89 lb-in).

4. Install the PCM wiring harness retainer nut.

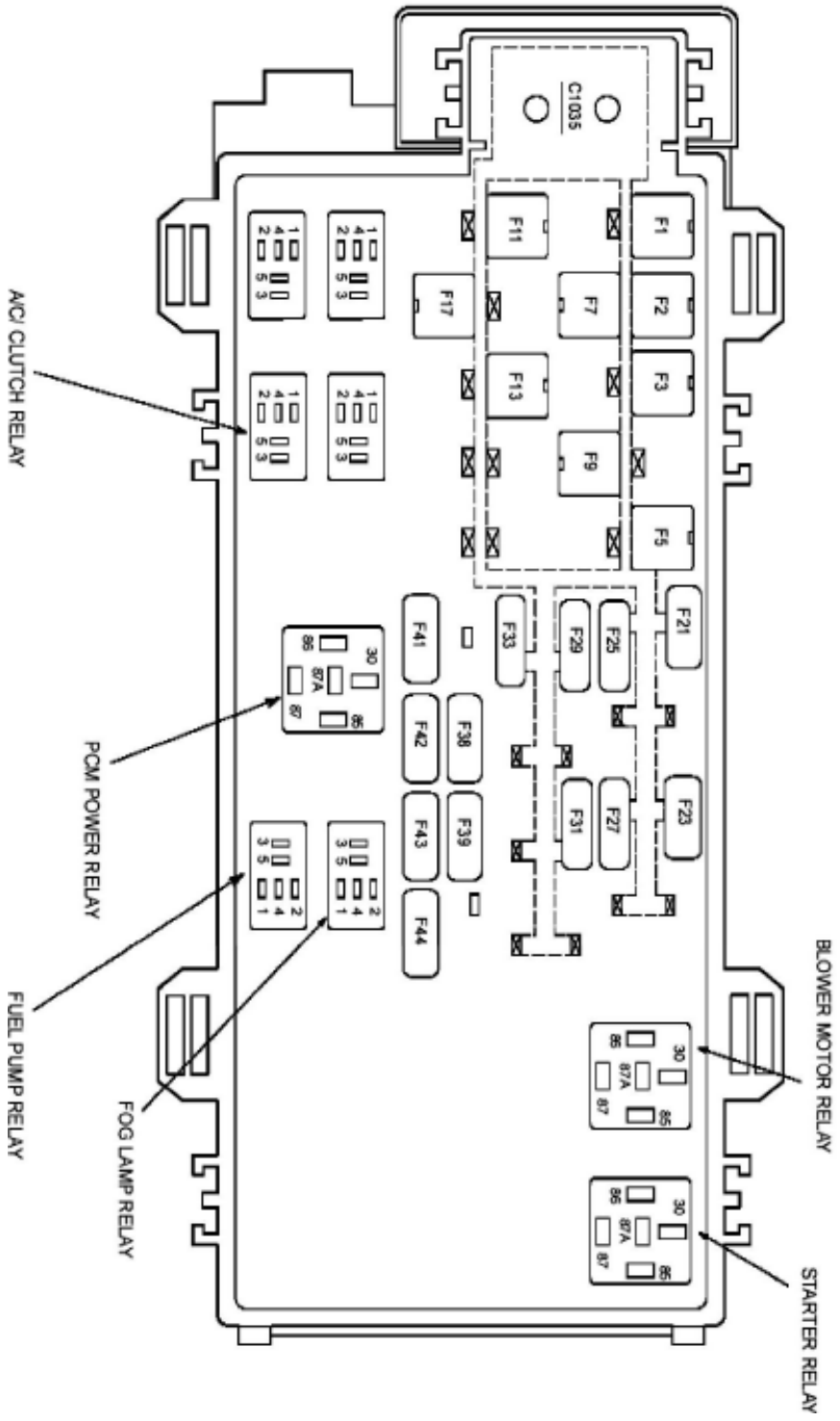
- Tighten to 10 Nm (89 lb-in).

5. NOTE: If a new PCM is installed, the parameters must be reset in both the PCM and the instrument cluster module or the vehicle will experience

a PATS no-start. This will occur even if the vehicle is not equipped with PATS. PATS vehicles and non-PATS vehicles have parameters in the instrument cluster module and the PCM and they both must be reset whenever a new PCM is installed.

Restore the module configurations for the instrument cluster module and the PCM. Carry out the module configuration restore steps of the Programmable Module Installation procedure.

BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L

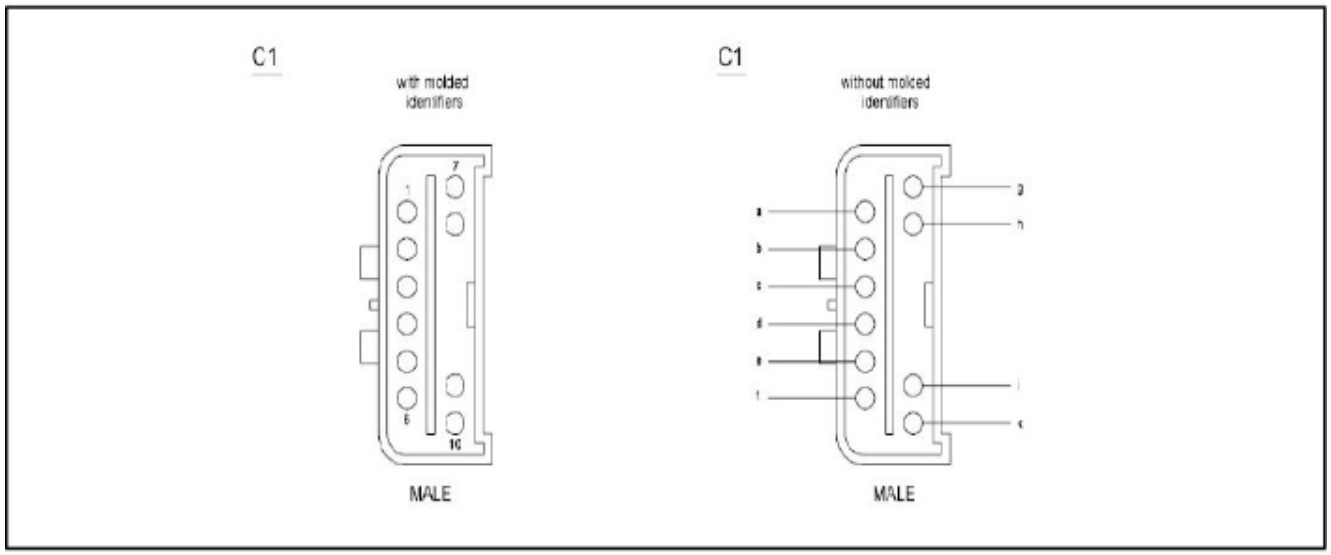


Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step by step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



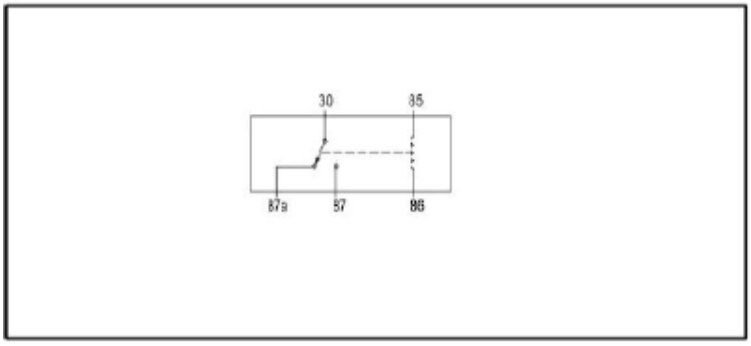
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

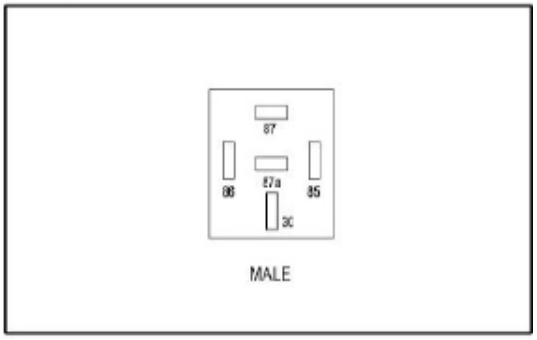
Main Relay (Computer/Fuel System): Testing and Inspection

Relay □ Mini ISO

Schematic



Terminals

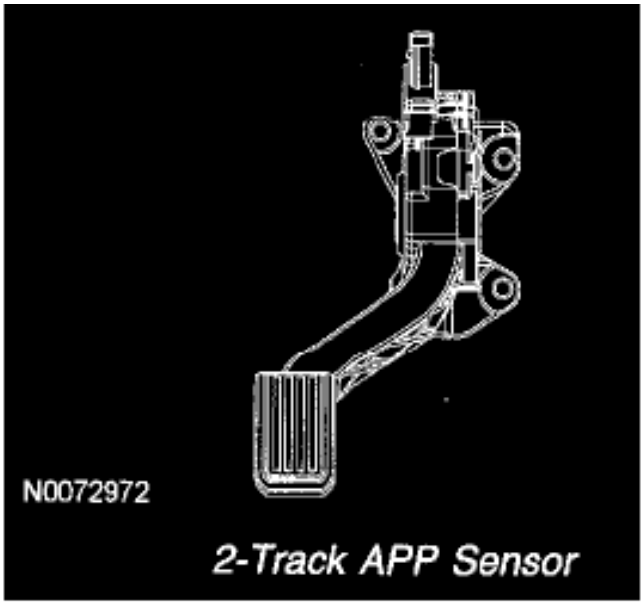


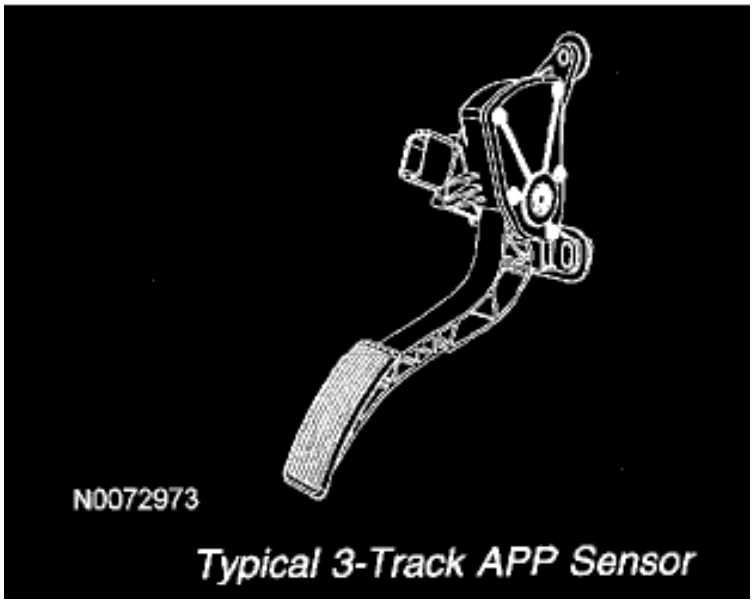
Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.





Accelerator Pedal Position Sensor: Description and Operation

ACCELERATOR PEDAL POSITION (APP) SENSOR

The APP sensor is an input to the powertrain control module (PCM) and is used to determine the amount of torque requested by the operator. Depending on the application either a 2-track or 3-track APP sensor is used.

2-Track APP Sensor

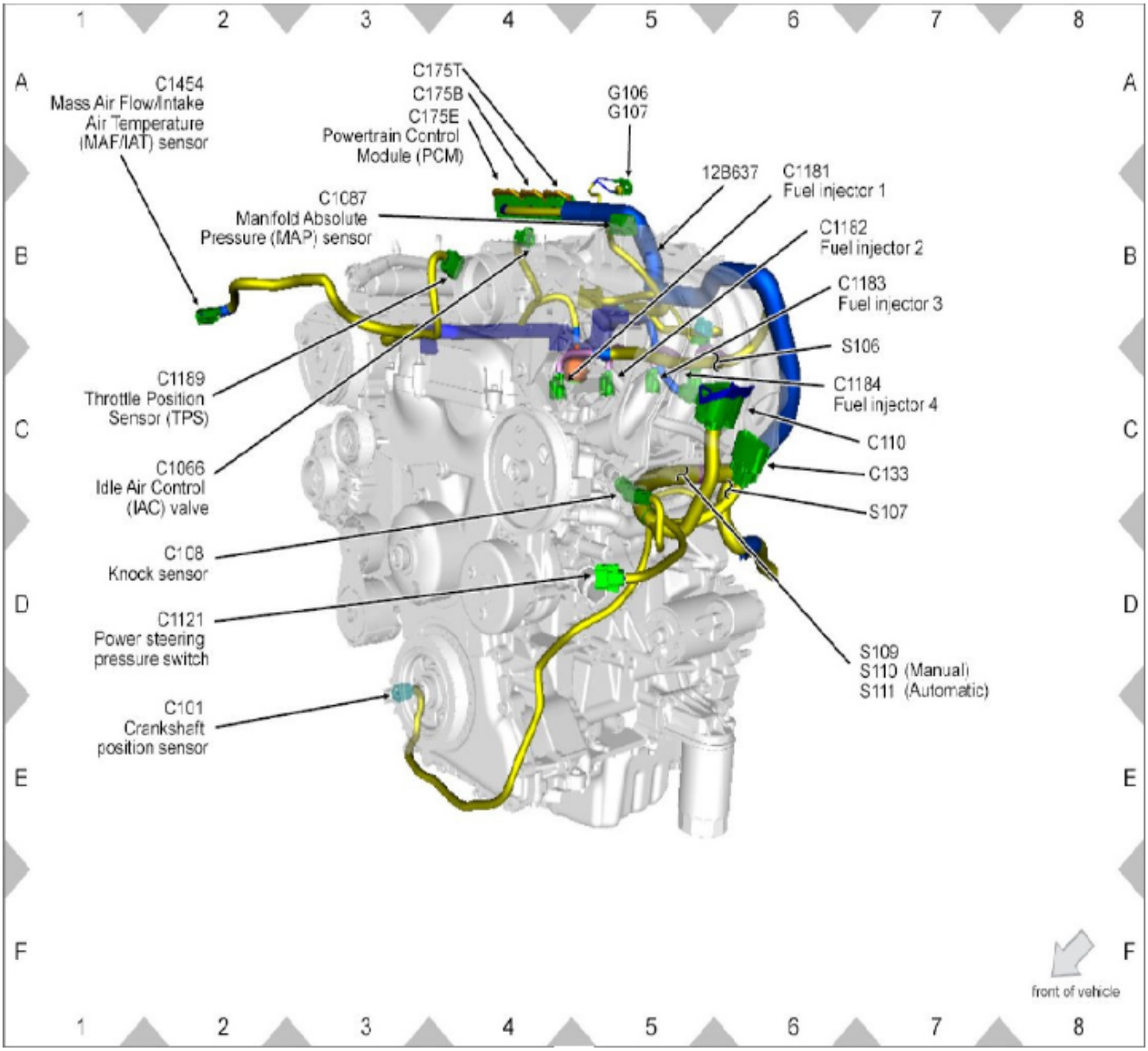
2-Track APP Sensor

There are 2 pedal position signals in the sensor. Both signals, APP1 and APP2, have a positive slope (increasing angle, increasing voltage), but are offset and increase at different rates. The 2 pedal position signals make sure the PCM receives a correct input even if 1 signal has a concern. The PCM determines if a signal is incorrect by calculating where it should be, inferred from the other signals. If a concern is present with one of the circuits the other input is used. There are 2 reference voltage circuits, 2 signal return circuits, and 2 signal circuits (a total of 6 circuits and pins) between the PCM and the APP sensor assembly. The reference voltage circuits and the signal return circuits are shared with the reference voltage circuit and signal return circuit used by the electronic throttle body (ETB) throttle position sensor. The pedal position signal is converted to pedal travel degrees (rotary angle) by the PCM. The software then converts these degrees to counts, which is the input to the torque based strategy.

3-Track APP Sensor

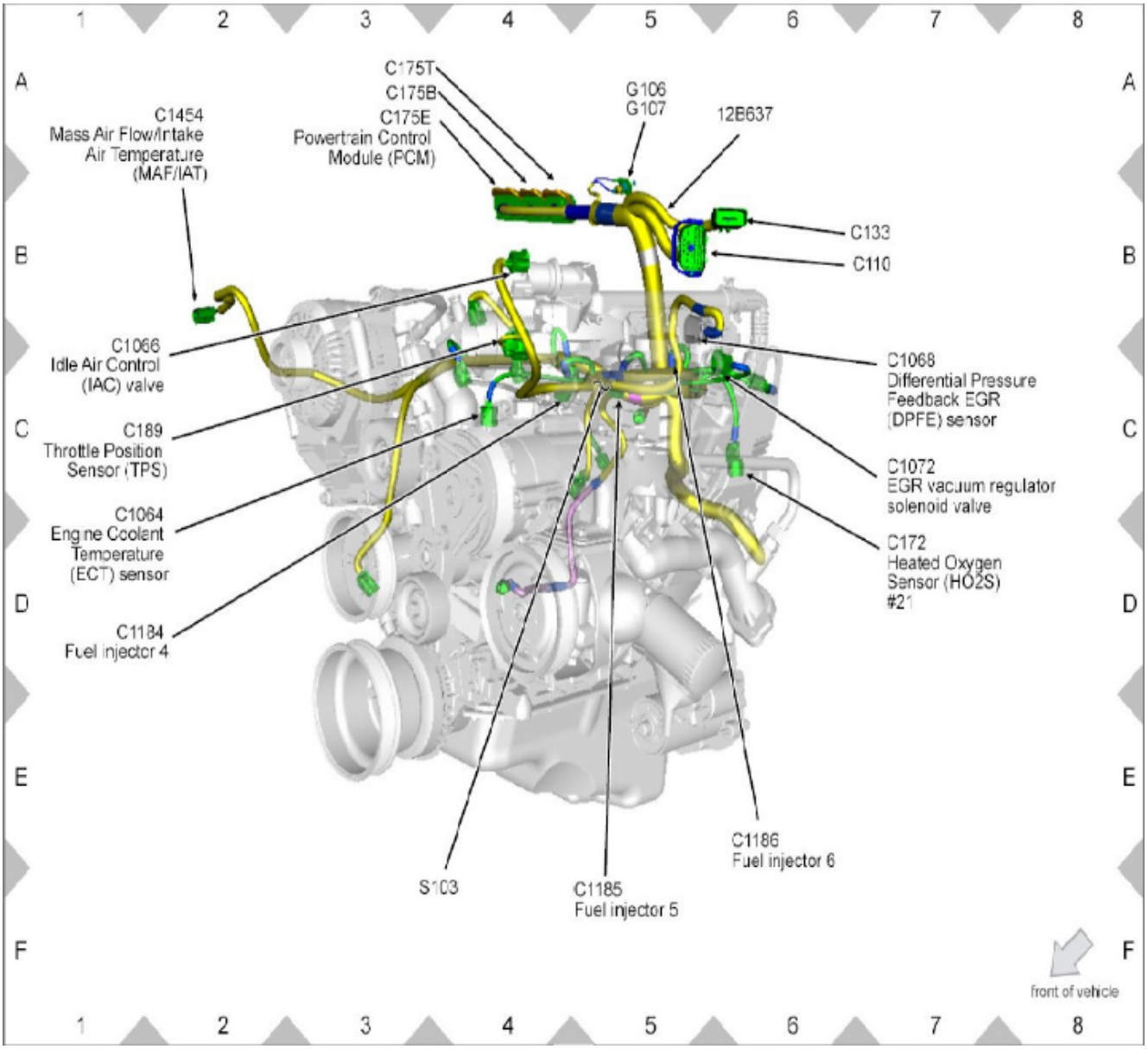
Typical 3-Track APP Sensor

There are 3 pedal position signals in the sensor. Signal 1, APP1, has a negative slope (increasing angle, decreasing voltage) and signals 2 and 3, APP2 and APP3, both have a positive slope (increasing angle, increasing voltage). During normal operation APP1 is used as the indication of pedal position by the strategy. The 3 pedal position signals make sure the PCM receives a correct input even if 1 signal has a concern. The PCM determines if a signal is incorrect by calculating where it should be, inferred from the other signals. If a concern is present with one of the circuits the other inputs are used. The pedal position signal is converted to pedal travel degrees (rotary angle) by the PCM. The software then converts these degrees to counts, which is the input to the torque based strategy. There are 2 reference voltage circuits, 2 signal return circuits, and 3 signal circuits (a total of 7 circuits and pins) between the PCM and the APP sensor assembly. The reference voltage circuits and the signal return circuits are shared with the reference voltage circuit and signal return circuit used by the electronic throttle body (ETB) throttle position sensor.

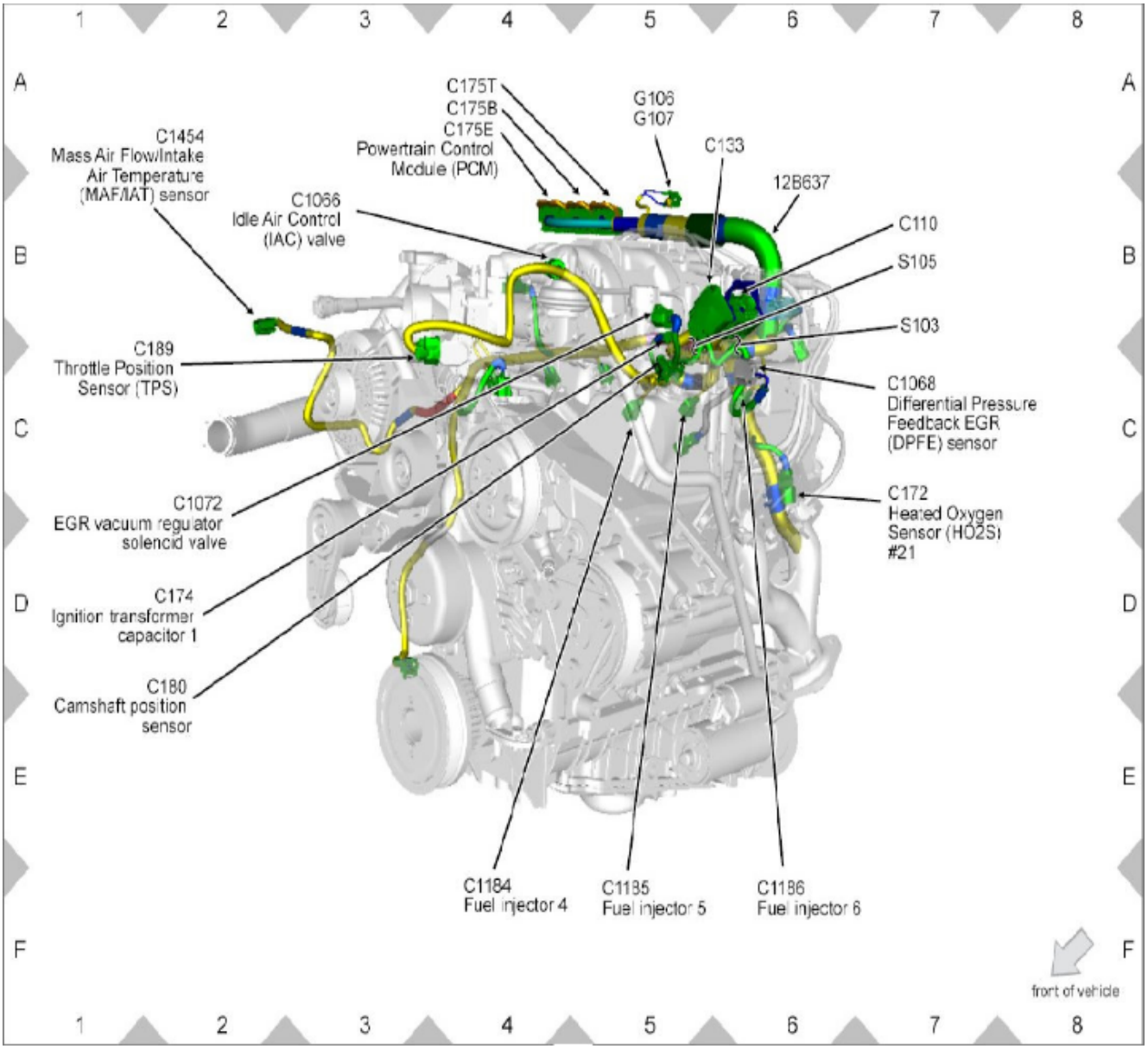


Air Flow Meter/Sensor: Locations

View 151-3


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
12B637
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT)
C133
C110
C1066
Idle Air Control (IAC) valve
C189
Throttle Position Sensor (TPS)
C1064
Engine Coolant Temperature (ECT) sensor
C1184
Fuel injector 4
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
S103
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

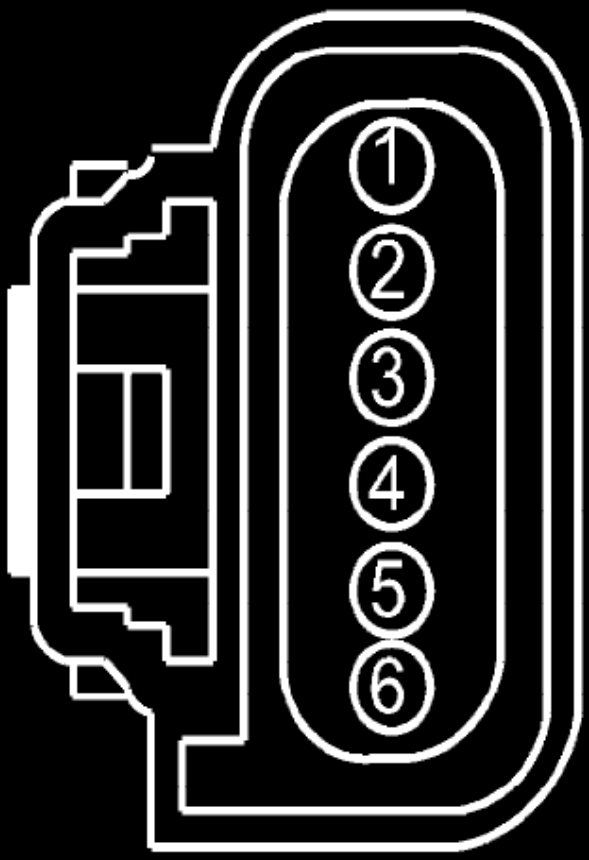
View 151-5


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
C133
12B637
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor
C1066
Idle Air Control (IAC) valve
C110
S105
S103
C189
Throttle Position Sensor (TPS)
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
C174
Ignition transformer capacitor 1
C180
Camshaft position sensor
C1184
Fuel injector 4
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-7

Connector: C1454

Description:	Harness:	Base Part #:
MASS AIR FLOW/INTAKE AIR TEMPERATURE (MAF/IAT) SENSOR	12B637	



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE740 (VT-GY)	20	SENSOR - INTAKE AIR TEMPERATURE (IAT)	
2	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	
3	VE807 (YE-VT)	20	SENSOR - MASS AIR FLOW LH BANK OR 1ST BANK OR UNIQUE (MAF)	
4	RE320 (BU)	20	CTRL MOD. - POWERTRAIN # MASS AIR FLOW SEN. LH BANK OR 1ST BANK (MAFRTN)	
5	GD108 (BK-VT)	20	GROUND - CHASSIS/BATTERY	
6	CBB43 (GY)	20	FUSE - 43 OR CIRCUIT BREAKER	

C1454

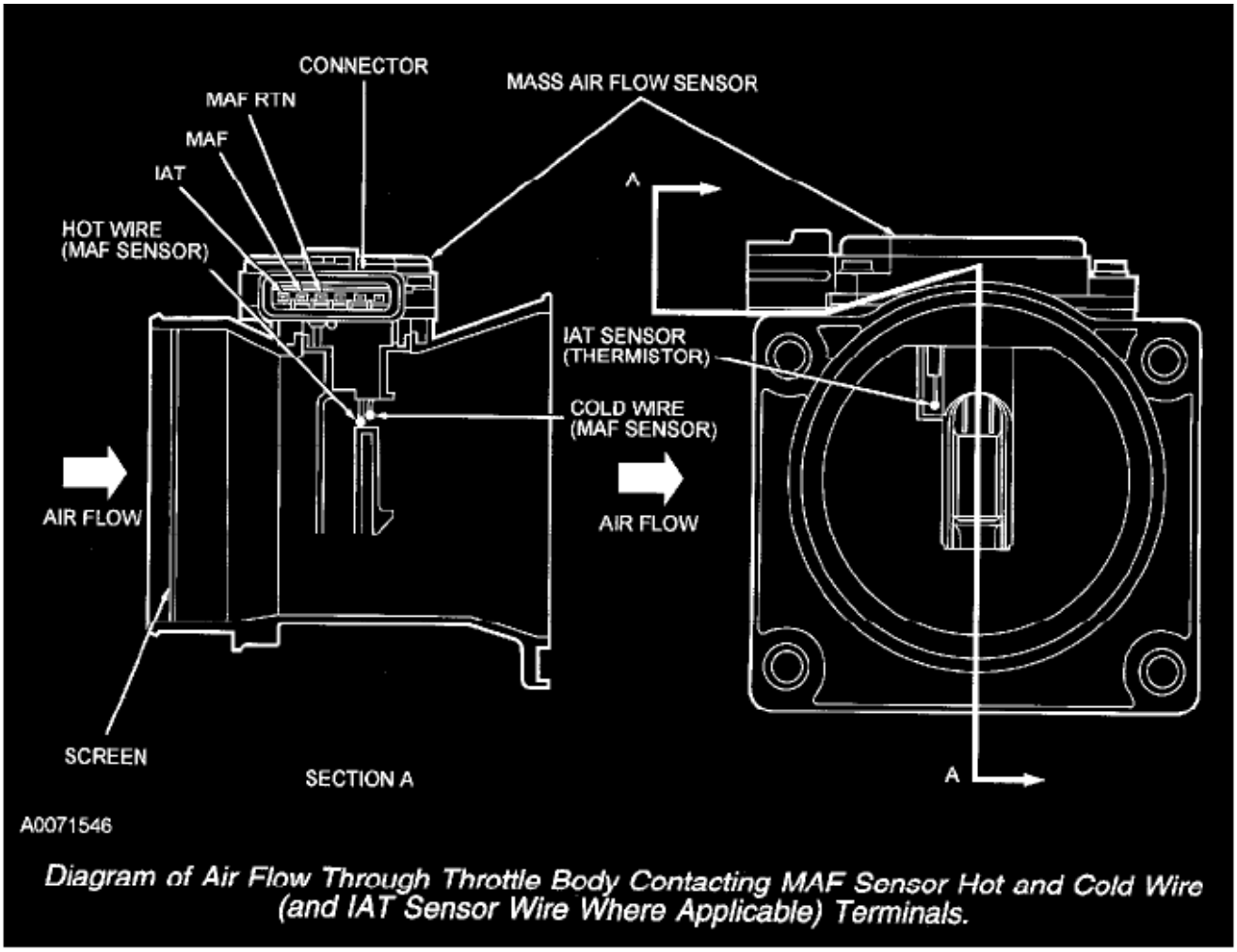
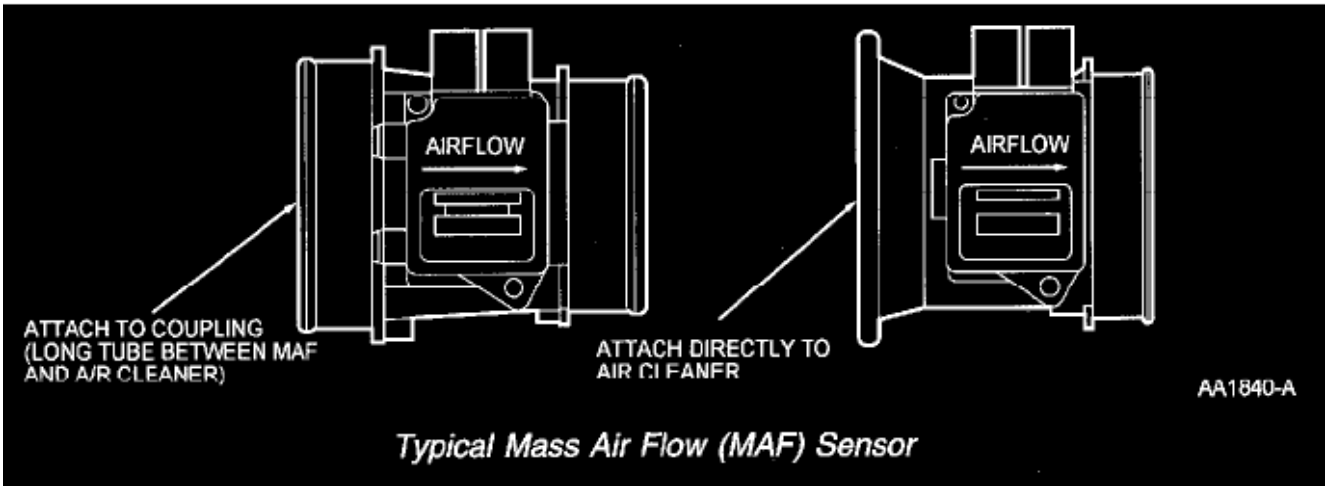


Diagram of Air Flow Through Throttle Body Contacting MAF Sensor Hot and Cold Wire (and IAT Sensor Wire Where Applicable) Terminals.



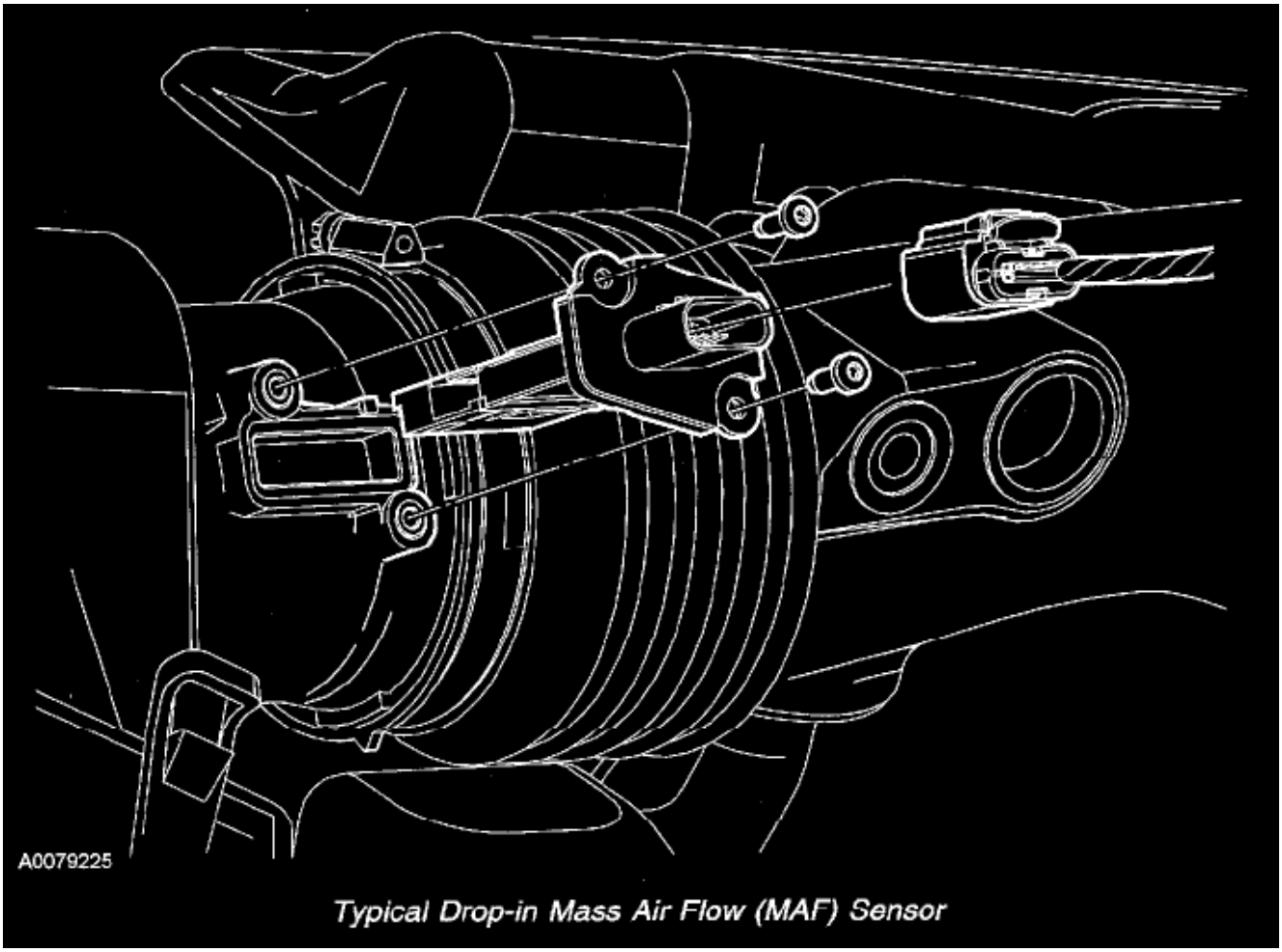
Typical Mass Air Flow (MAF) Sensor

Air Flow Meter/Sensor: Description and Operation

MASS AIR FLOW (MAF) SENSOR

Diagram Of Air Flow Through Throttle Body Contacting MAF Sensor Hot And Cold Wire (and IAT Sensor Wire Where Applicable) Terminals

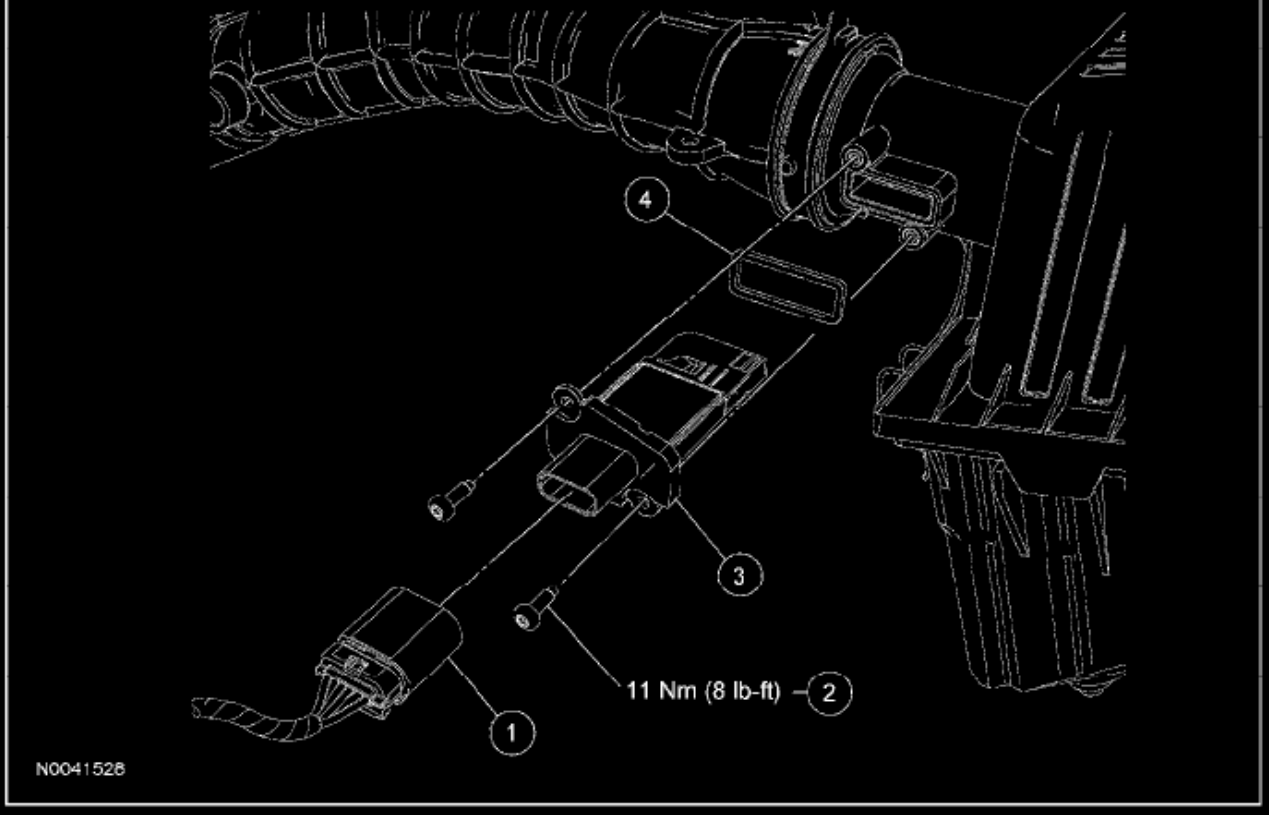
Typical Mass Air Flow (MAF) Sensor



Typical Drop-in Mass Air Flow (MAF) Sensor

The MAF sensor uses a hot wire sensing element to measure the amount of air entering the engine. Air passing over the hot wire causes it to cool. This hot wire is maintained at 200°C (392°F) above the ambient temperature as measured by a constant cold wire. The current required to maintain the temperature of the hot wire is proportional to the mass air flow. The MAF sensor then outputs an analog voltage signal to the PCM proportional to the intake air mass. The PCM calculates the required fuel injector pulse width in order to provide the desired air/fuel ratio. This input is also used in determining transmission electronic pressure control (EPC), shift and torque converter clutch scheduling.

The MAF sensor is located between the air cleaner and the throttle body or inside the air cleaner assembly. Most MAF sensors have integrated bypass technology with an integrated intake air temperature (IAT) sensor. The hot wire electronic sensing element must be replaced as an assembly. Replacing only the element may change the air flow calibration.



Item	Part Number	Description
1	14A464	Mass air flow (MAF) sensor electrical connector (part of 12B637)
2	W709287	MAF sensor bolt (2 required)
3	12B605	MAF sensor
4	—	MAF sensor gasket

Air Flow Meter/Sensor: Service and Repair

MASS AIR FLOW (MAF) SENSOR

Removal and Installation

1. Disconnect the mass air flow (MAF) sensor electrical connector. 2. Remove the 2 bolts, the MAF sensor and discard the gasket.

- To install, tighten to 11 Nm (8 lb-ft).

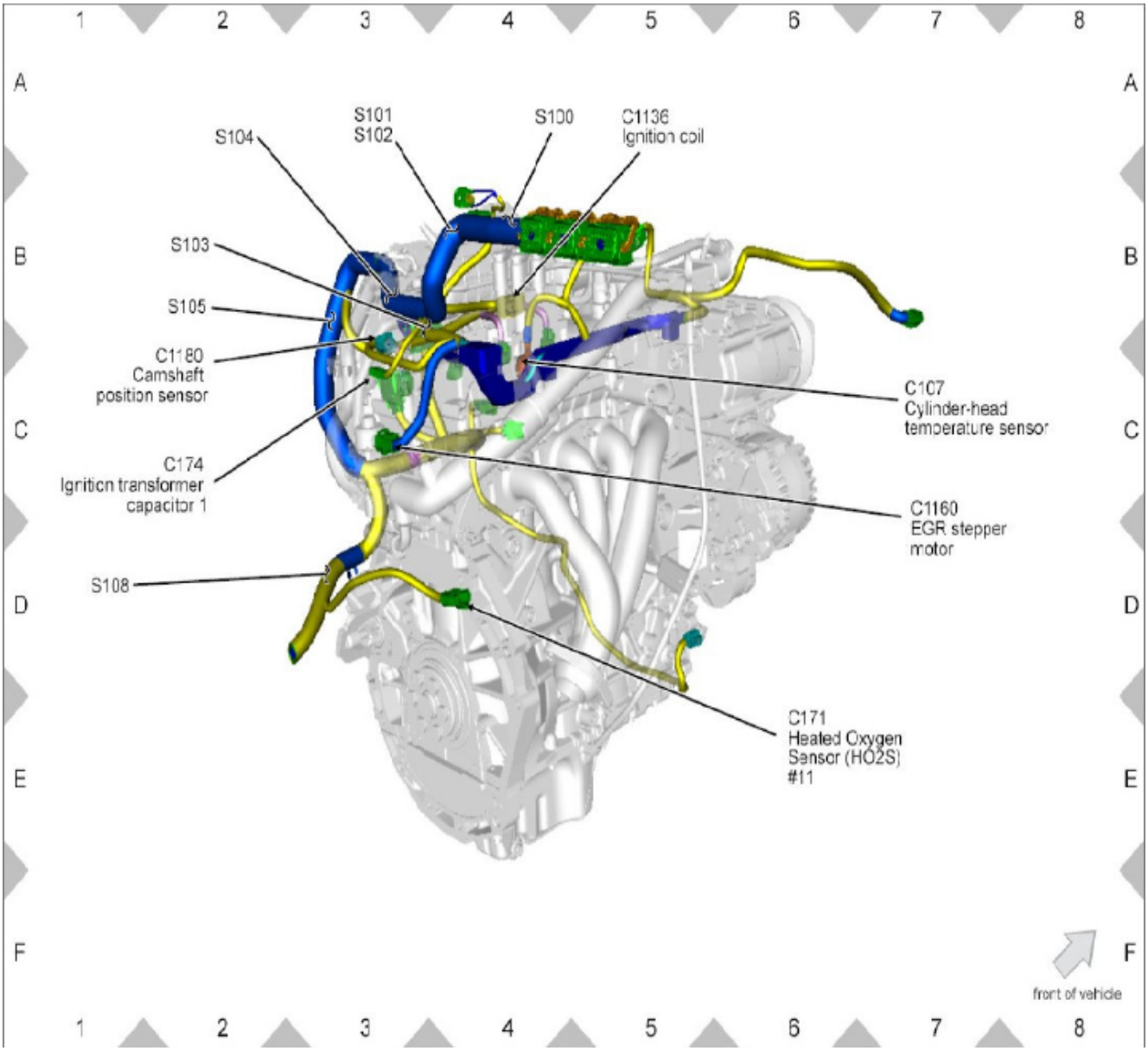
3. CAUTION: Do not tamper with the mass air flow (MAF) sensing elements located in the airflow bypass. Tampering may result in

failure.

NOTE: The MAF sensor module and body are calibrated and installed as a unit.

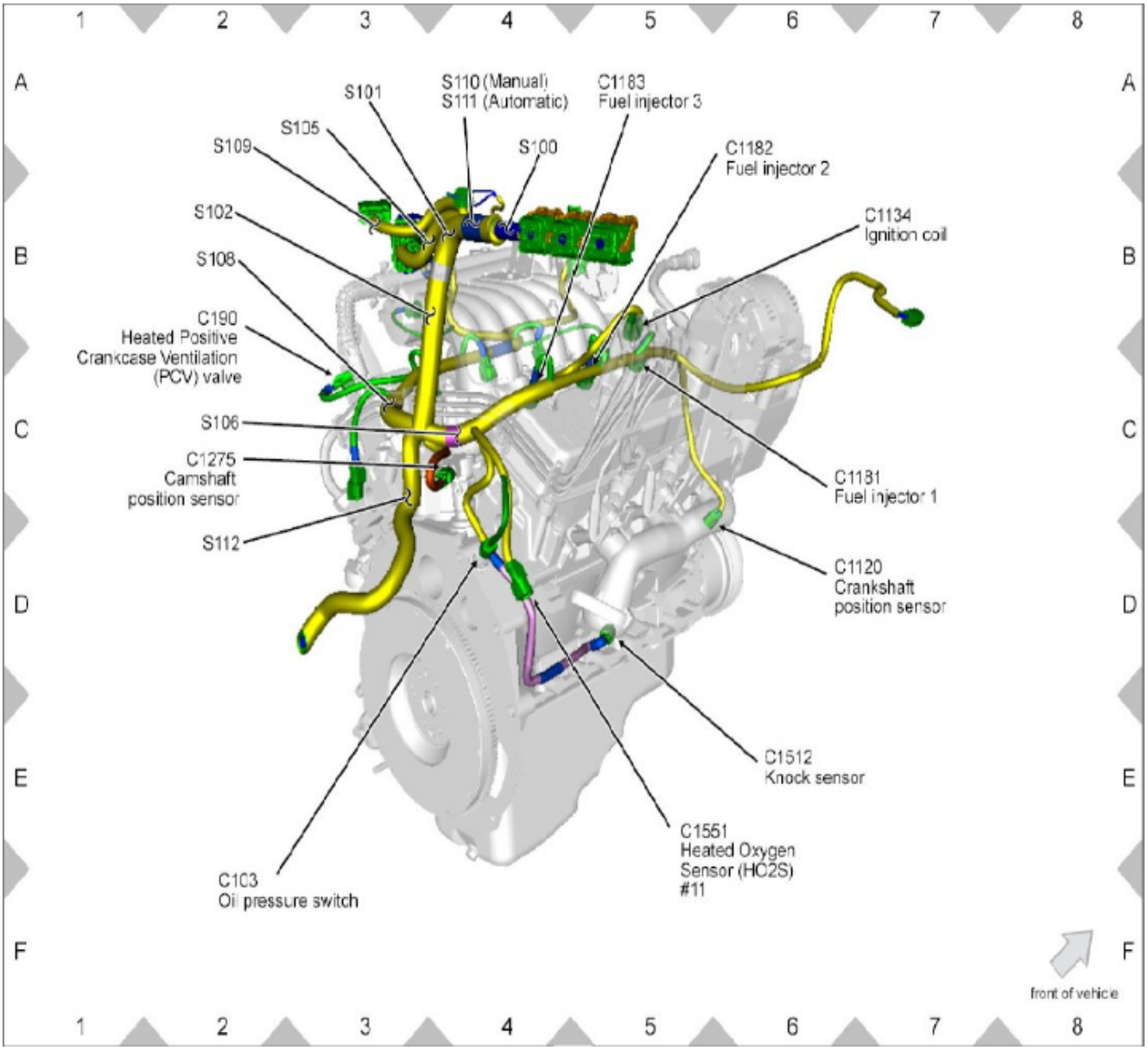
To install, reverse the removal procedure. -

Install a new gasket.

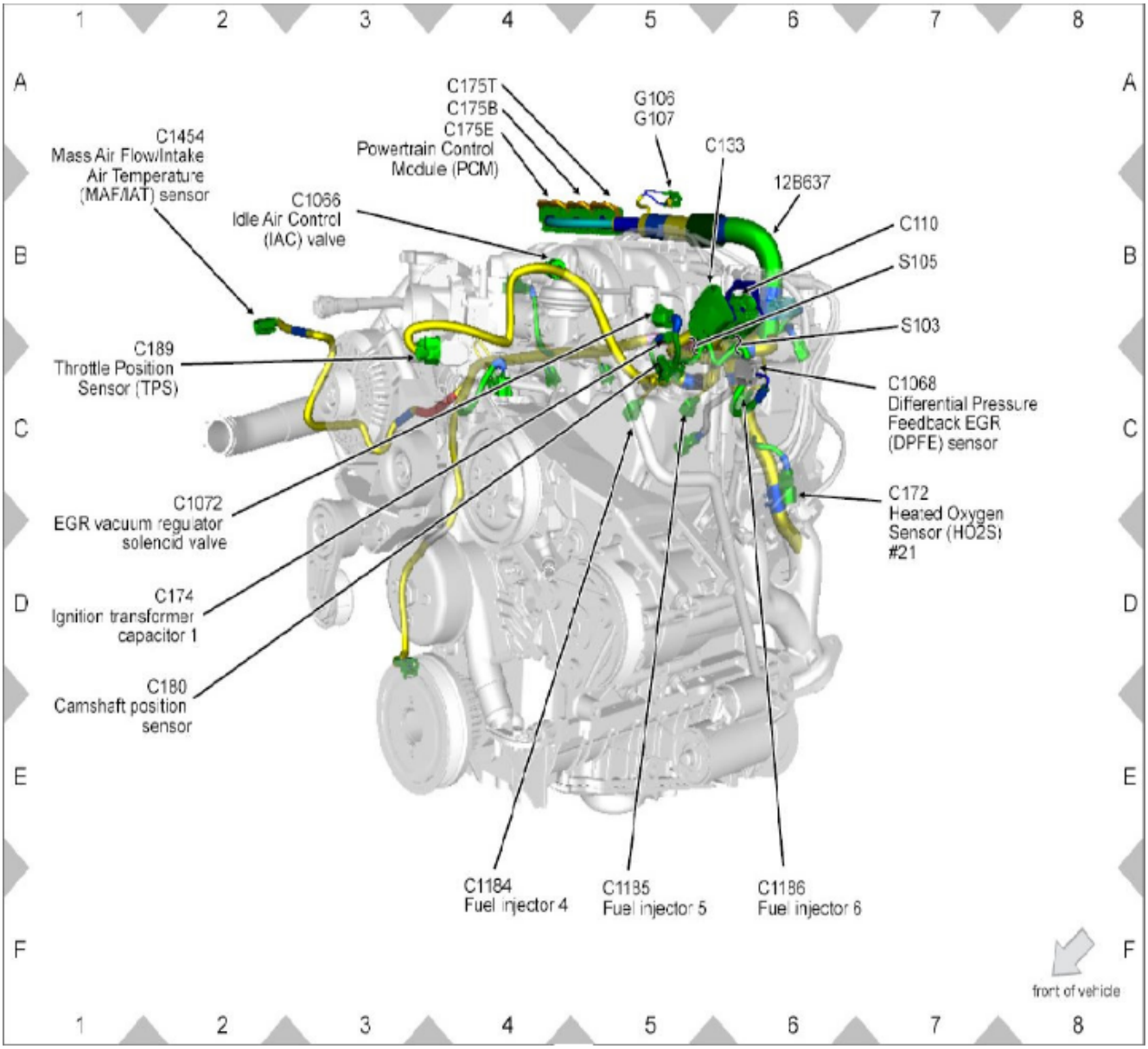


Camshaft Position Sensor: Locations

View 151-4


S101
S110 (Manual)
S111 (Automatic)
C1183
Fuel injector 3
S105
S109
S100
C1182
Fuel injector 2
S102
C1134
Ignition coil
S108
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
C1275
Camshaft
position sensor
S112
C1181
Fuel injector 1
C1120
Crankshaft
position sensor
C1512
Knock sensor
C1551
Heated Oxygen
Sensor (HO2S)
#11
C103
Oil pressure switch
front of vehicle

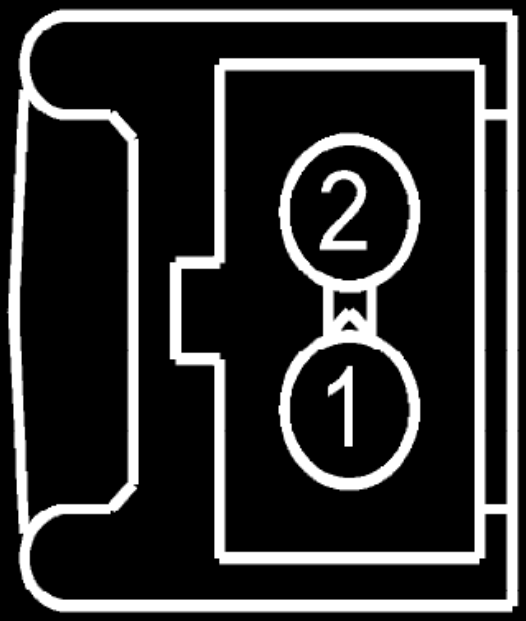
View 151-6


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
C133
12B637
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor
C1066
Idle Air Control (IAC) valve
C110
S105
S103
C189
Throttle Position Sensor (TPS)
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
C174
Ignition transformer capacitor 1
C180
Camshaft position sensor
C1184
Fuel injector 4
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-7

Connector: C180

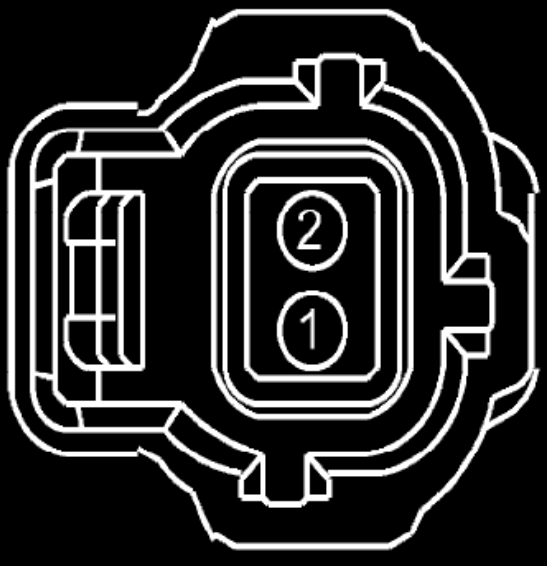
Description:	Harness:	Base Part #:
CAMSHAFT POSITION SENSOR	12B637	6B288



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE706 (BN-BU)	18	SENSOR - CAMSHAFT POSITION BANK 1 IN+EX/IN (CMP1) [CID-H] (CID1)	4.0L
2	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	4.0L

Connector: C1180

Description:	Harness:	Base Part #:
CAMSHAFT POSITION SENSOR	12B637	6B288



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	2.3L
2	VE706 (BN-BU)	18	SENSOR - CAMSHAFT POSITION BANK 1 IN+EX/ IN (CMP1) [CID-H] (CID1)	2.3L

Camshaft Position Sensor: Diagrams

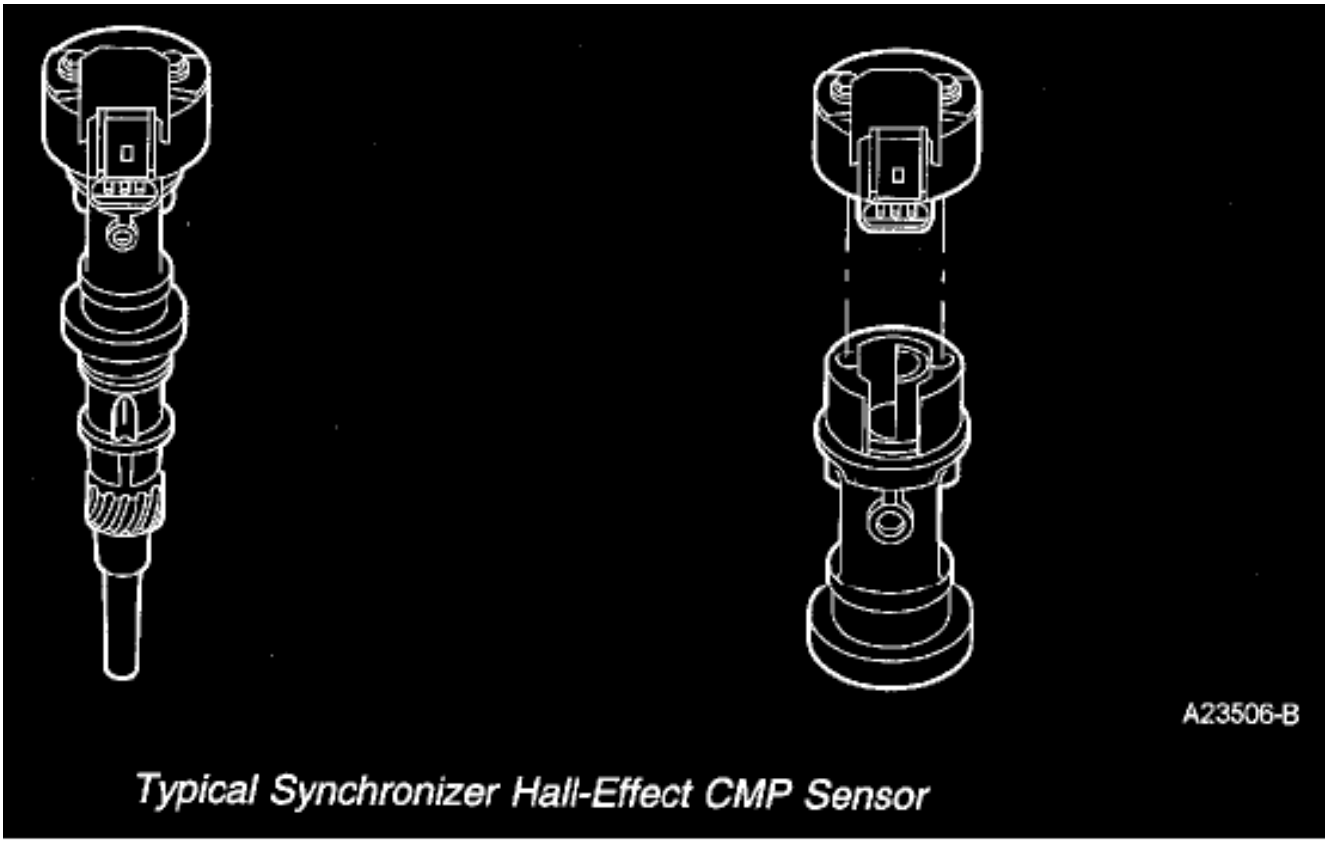
C180

C1180

Connector: C1275	Description:	Harness:	Base Part #:
	CAMSHAFT POSITION SENSOR	12B637	6B288

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	3.0L
2	VE706 (BN-BU)	18	SENSOR - CAMSHAFT POSITION BANK 1 IN+EX/ IN (CMP1) [CID-H] (CID1)	3.0L

C1275



Typical Synchronizer Hall-Effect CMP Sensor

Typical Variable Reluctance CMP Sensor

Camshaft Position Sensor: Description and Operation

CAMSHAFT POSITION (CMP) SENSOR

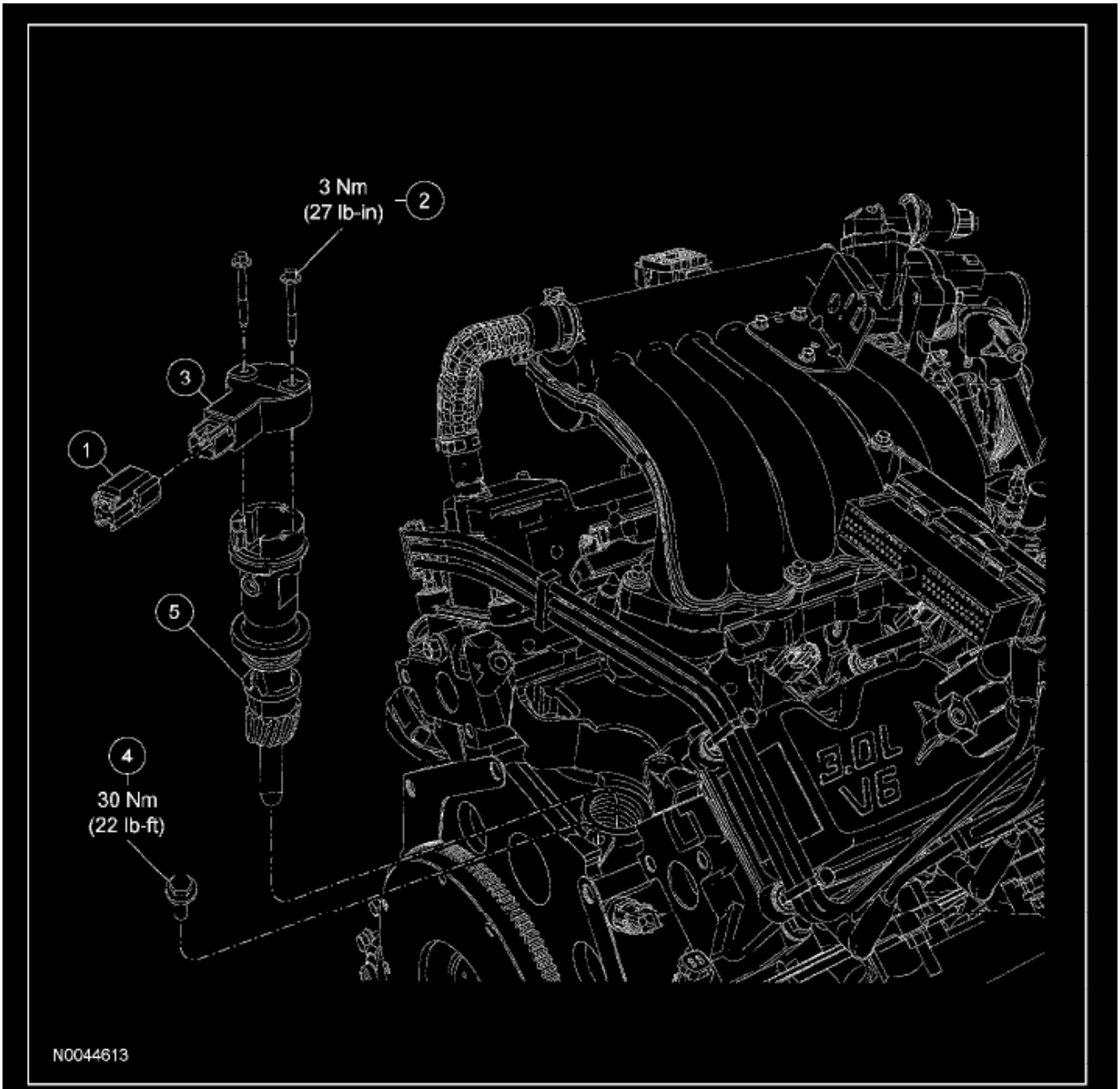
Typical Synchronizer Hall-Effect CMP Sensor

Typical Variable Reluctance CMP Sensor

The CMP sensor detects the position of the camshaft. The CMP sensor identifies when piston number 1 is on its compression stroke. A signal is then sent to the PCM and used for synchronizing the sequential firing of the fuel injectors. Coil on plug (COP) ignition applications use the CMP signal to select the correct ignition coil to fire.

Vehicles with 2 CMP sensors are equipped with variable camshaft timing (VCT). They use the second sensor to identify the position of the camshaft on bank 2 as an input to the PCM.

There are 2 types of CMP sensors: the 3-pin connector Hall-effect type sensor and the 2-pin connector variable reluctance type sensor.



Item	Part Number	Description
1	—	Camshaft position (CMP) sensor electrical connector (part of 12B637)
2	W701219	CMP sensor bolt (2 required)

(Continued)

Item	Part Number	Description
3	6B288	CMP sensor
4	—	Camshaft synchronizer bolt
5	12A362	Camshaft synchronizer

Camshaft Position Sensor: Service and Repair

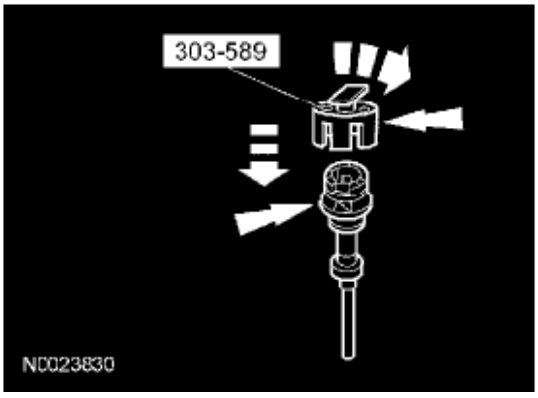
CAMSHAFT SYNCHRONIZER

Exploded View

Special Tool(s)

Special Tool(s)

ST2362-A	Synchronizer Alignment Gauge 303-589



Special Tool(s)

Removal

1. Disconnect the camshaft position (CMP) sensor electrical connector.

2. NOTE: Prior to the removal of the CMP sensor, note the position of the CMP sensor electrical connector. The installation procedure requires that

the electrical connector be located in the same position.

Remove the 2 bolts and the CMP sensor.

3. Remove the camshaft synchronizer bolt. 4. Remove the camshaft synchronizer. Inspect the O-ring seal and install a new O-ring seal if damaged.

Installation

1. CAUTION:

- After installation, do not loosen the synchronizer bolt and rotate the synchronizer assembly. The synchronizer assembly is not adjustable. Do not loosen the synchronizer bolt after the alignment tool has been removed in order to align the camshaft position (CMP) sensor electrical connector for any reason. If the electrical connector is not in the correct position, the synchronizer assembly must be removed. The alignment tool and the assembly must be reinstalled if the engine has not been rotated from top dead center (TDC) of the compression stroke on the No. 1 cylinder. Failure to follow this procedure will result in the fuel system being out of time with the engine, possibly causing engine damage.

- Do not turn the crankshaft or camshaft during the removal and installation procedure or the fuel system timing will be out of time with the engine, possibly causing engine damage.

- A special tool must be used during the installation of the new synchronizer assembly. Failure to follow this procedure will result in the fuel system being out of time with the engine, possibly causing engine damage.

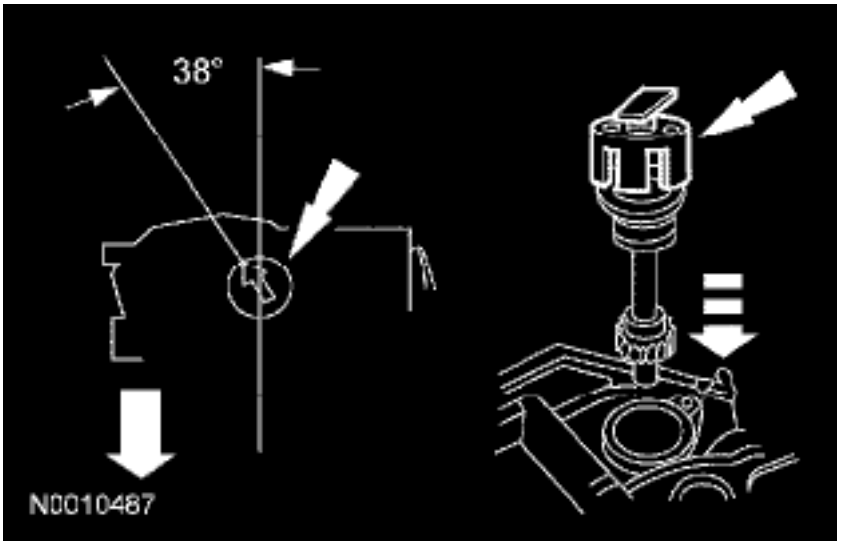
Install the special tool on the camshaft synchronizer by rotating the tool until it engages the notch in the camshaft synchronizer housing and the armature.

2. CAUTION: It is very important to coat the gear on the camshaft synchronizer with engine oil prior to installation. Failure to do so may

result in gear failure.

NOTE: During installation, the arrow on the special tool will rotate clockwise until the oil pump intermediate shaft and the camshaft gear engages.

Install the camshaft synchronizer housing assembly so the arrow on the special tool is 38 degrees from the centerline of the engine.



3. Install the camshaft synchronizer housing bolt.

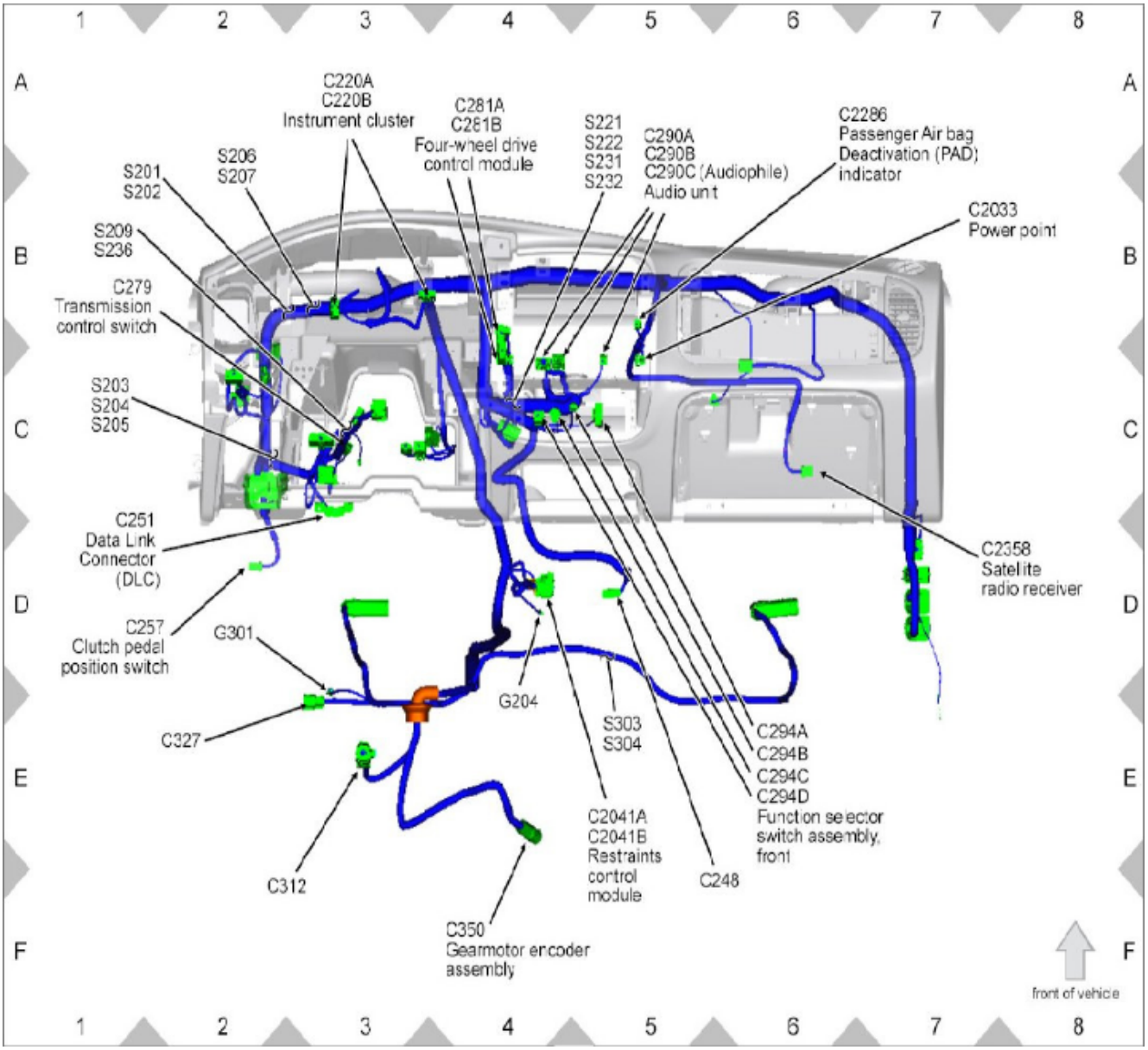
- Tighten to 30 Nm (22 lb-ft).

4. Position the CMP sensor and install the 2 bolts.

- Tighten to 3 Nm (27 lb-in).

5. Connect the CMP sensor electrical connector.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Powertrain Management > Computers and Control Systems > Sensors and Switches - Computers and Control Systems > Clutch Switch, ECM > Component Information > Locations



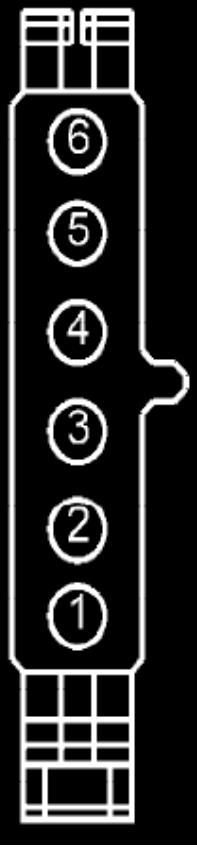
View 151-12

Connector: C257

Description: CLUTCH PEDAL POSITION SWITCH

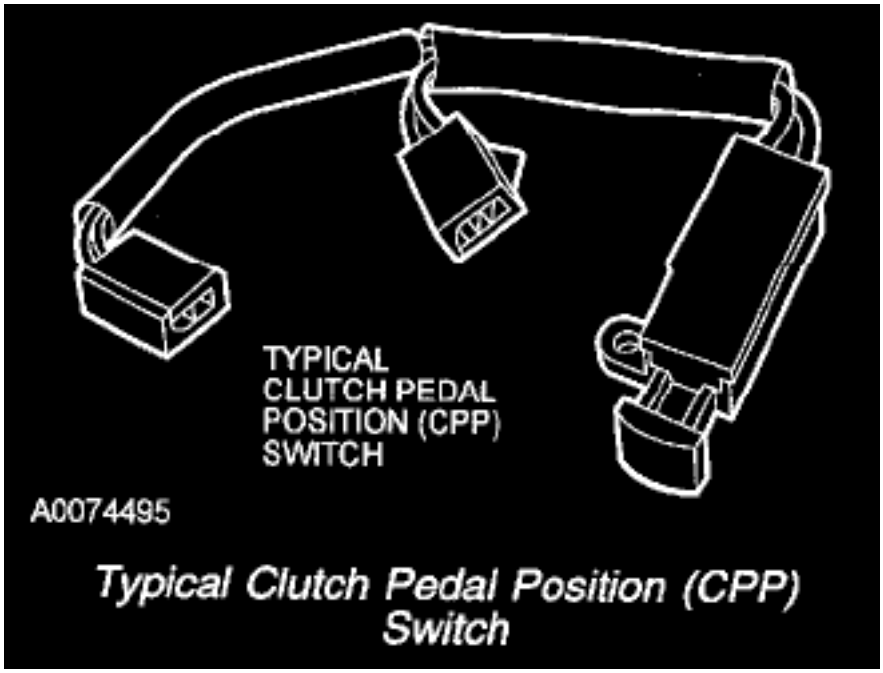
Harness: 14401

Base Part #: 11A152



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE904 (GN-VT)	22	SWITCH - CLUTCH PEDAL POSITION # TOP OF TRAVEL (CPP-TT)	
2	GD174 (BK-WH)	22	GROUND - TUNNEL	
3	CCB15 (BN-GN)	22	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL CLOSED	
4	CCB15 (BN-GN)	22	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL CLOSED	
5	GD174 (BK-WH)	22	GROUND - TUNNEL	
6	CDC36 (GN-BN)	22	SWITCH - START INTERLOCK CLUTCH PEDAL	

C257



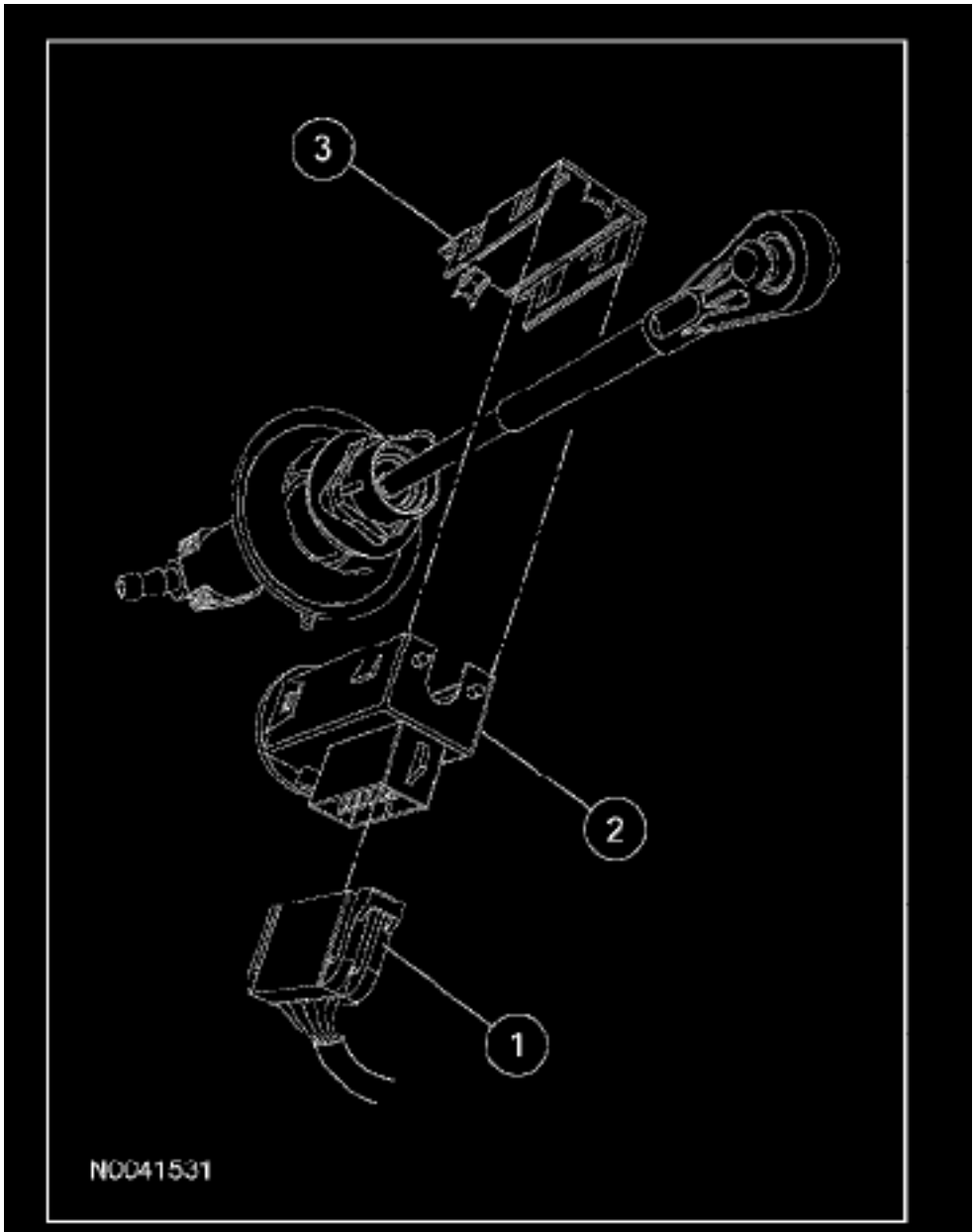
Typical Clutch Pedal Position (CPP) Switch

Clutch Switch: Description and Operation

CLUTCH PEDAL POSITION (CPP) SWITCH

Typical Clutch Pedal Position (CPP) Switch

The CPP switch is an input to the PCM indicating the clutch pedal position. The PCM provides a low current voltage on the CPP circuit. When the CPP switch is closed, this voltage is pulled low through the SIG RTN circuit. The CPP input to the PCM is used to detect a reduction in engine load. The PCM uses the load information for mass air flow and fuel calculations.



Item	Part Number	Description
1	—	Clutch pedal position (CPP) switch electrical connector
2	7C534	CPP switch
3	—	CPP switch cover (part of 7C534)

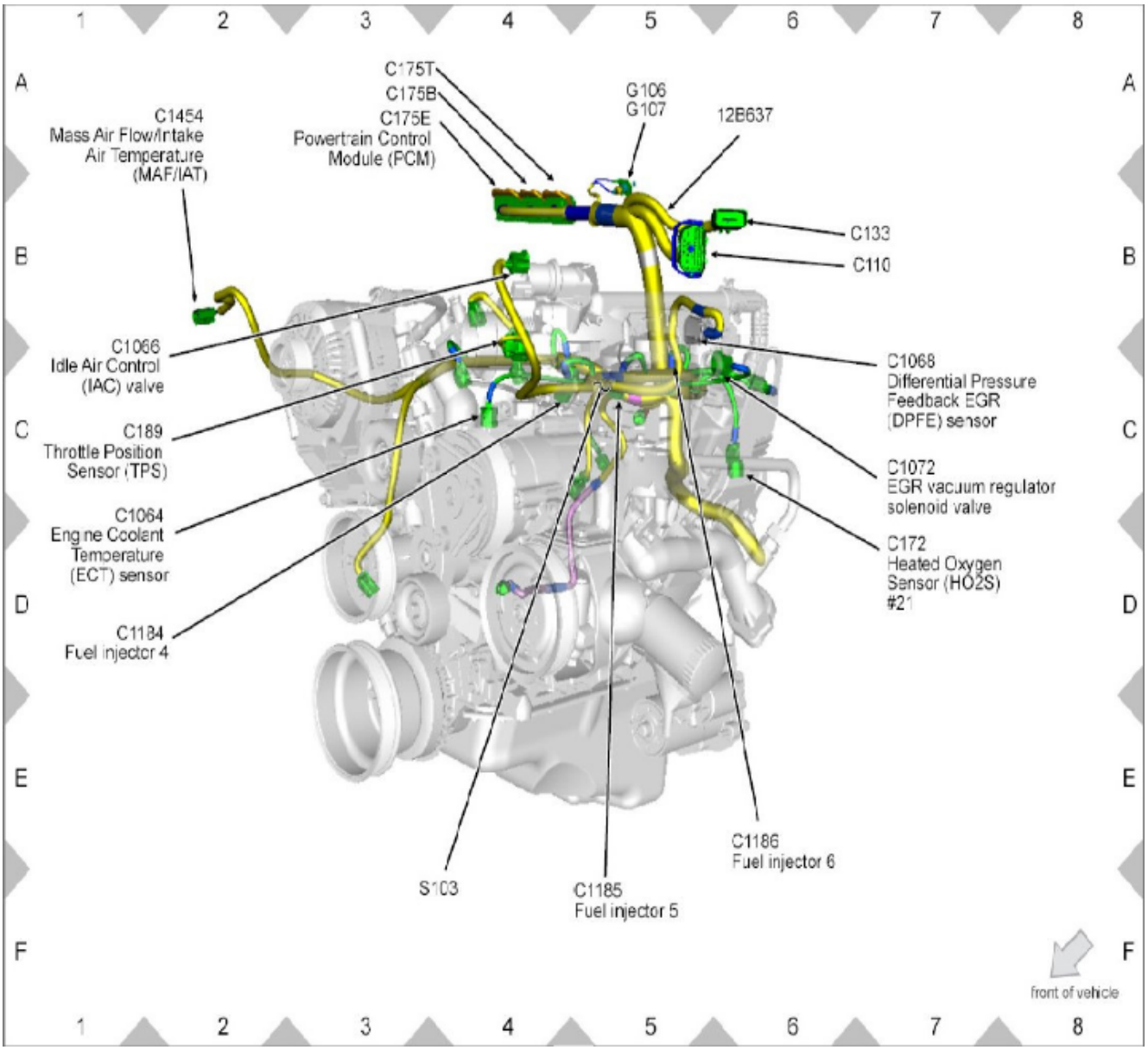
Clutch Switch: Service and Repair

CLUTCH PEDAL POSITION (CPP) SWITCH

Removal and Installation

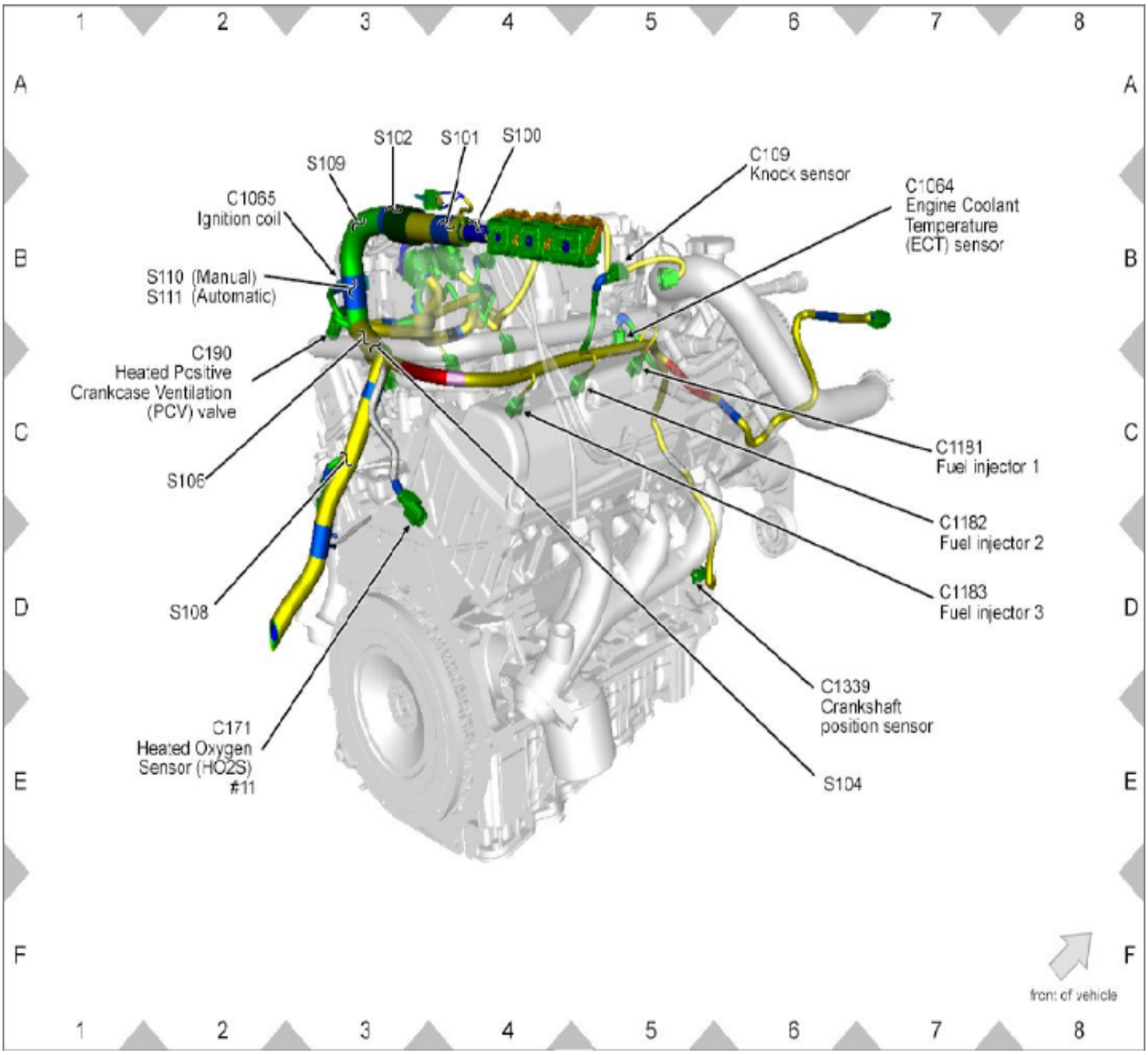
1. Disconnect the clutch pedal position (CPP) switch electrical connector. 2. Spread the CPP switch apart. Remove from the pedal rod. 3. To install, reverse the removal procedure.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Powertrain Management > Computers and Control Systems > Sensors and Switches - Computers and Control Systems > Coolant Temperature Sensor/Switch (For Computer) > Component Information > Locations



Coolant Temperature Sensor/Switch (For Computer): Locations

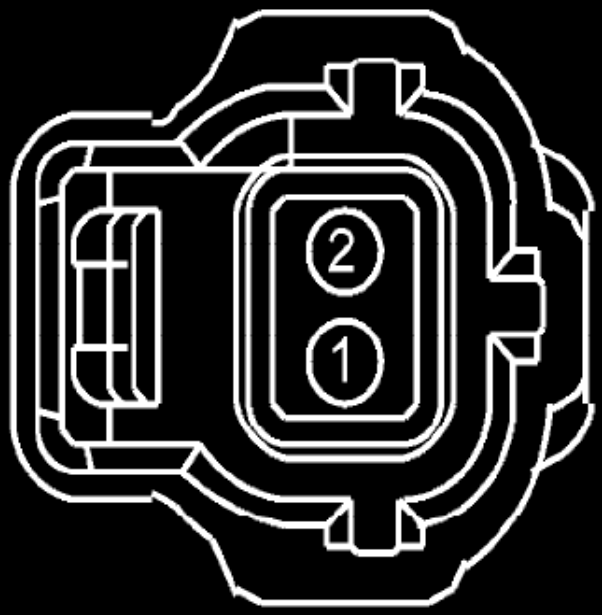
View 151-5


S102
S101
S100
S109
C1065
Ignition coil
S110 (Manual)
S111 (Automatic)
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
S108
C171
Heated Oxygen
Sensor (HO2S)
#11
C109
Knock sensor
C1064
Engine Coolant
Temperature
(ECT) sensor
C1181
Fuel injector 1
C1182
Fuel injector 2
C1183
Fuel injector 3
C1339
Crankshaft
position sensor
S104
front of vehicle

View 151-8

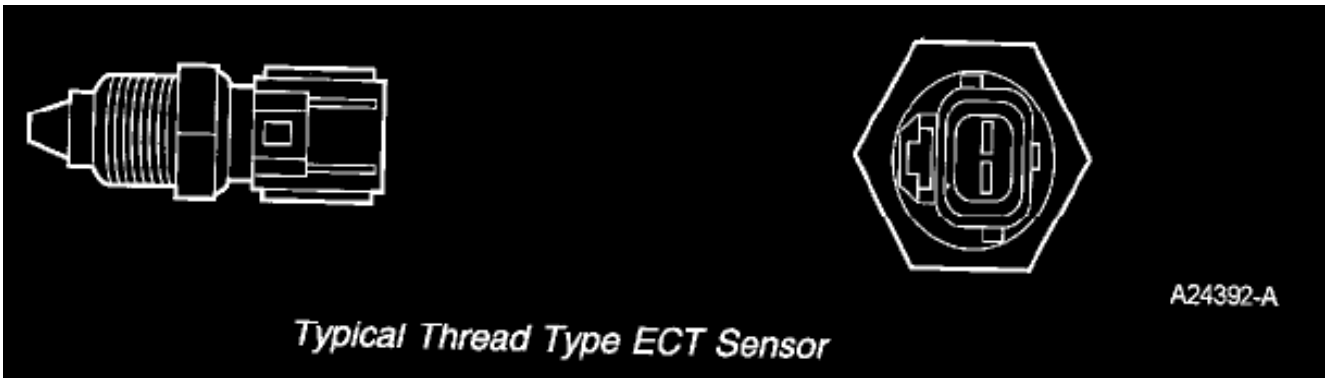
Connector: C1064

Description:	Harness:	Base Part #:
ENGINE COOLANT TEMPERATURE (ECT) SENSOR	12B637	12A648



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE716 (YE)	20	SENSOR - ENGINE COOLANT TEMPERATURE (ECT)	3.0L, 4.0L
2	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	3.0L, 4.0L

C1064



Coolant Temperature Sensor/Switch (For Computer): Description and Operation

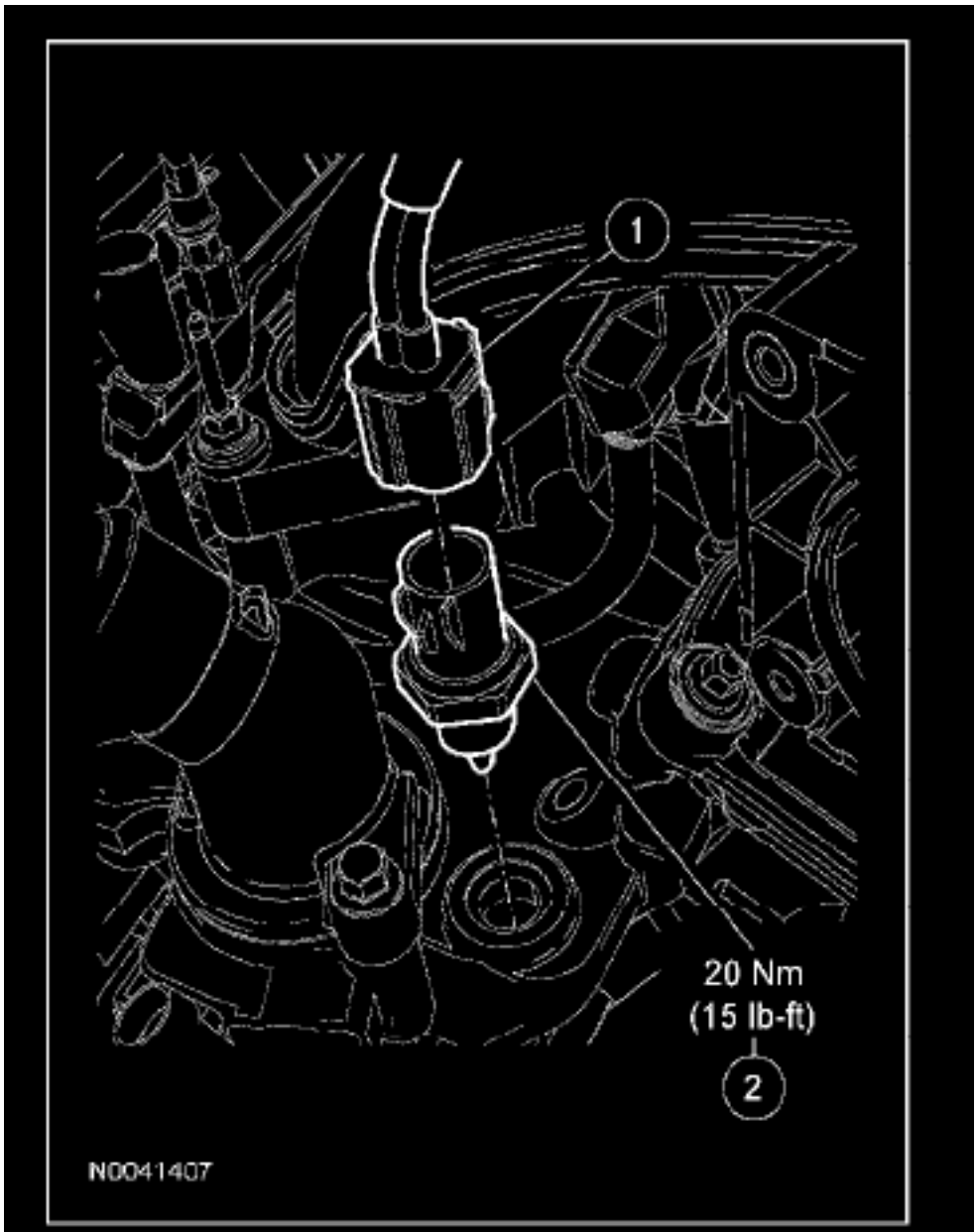
ENGINE COOLANT TEMPERATURE (ECT) SENSOR

Typical Thread Type ECT Sensor

The ECT sensor is a thermistor device in which resistance changes with temperature. The electrical resistance of a thermistor decreases as the temperature increases, and the resistance increases as the temperature decreases. The varying resistance changes the voltage drop across the sensor terminals and provides electrical signals to the PCM corresponding to temperature.

Thermistor-type sensors are considered passive sensors. A passive sensor is connected to a voltage divider network so that varying the resistance of the passive sensor causes a variation in total current flow. Voltage that is dropped across a fixed resistor in a series with the sensor resistor determines the voltage signal at the PCM. This voltage signal is equal to the reference voltage minus the voltage drop across the fixed resistor.

The ECT measures the temperature of the engine coolant. The PCM uses the ECT input for fuel control and for cooling fan control. There are 3 types of ECT sensors, threaded, push-in, and twist-lock. The ECT sensor is located in an engine coolant passage.



Item	Part Number	Description
1	14A464	Engine coolant temperature (ECT) sensor electrical connector (part of 12B637)
2	12A648	ECT sensor

Coolant Temperature Sensor/Switch (For Computer): Service and Repair

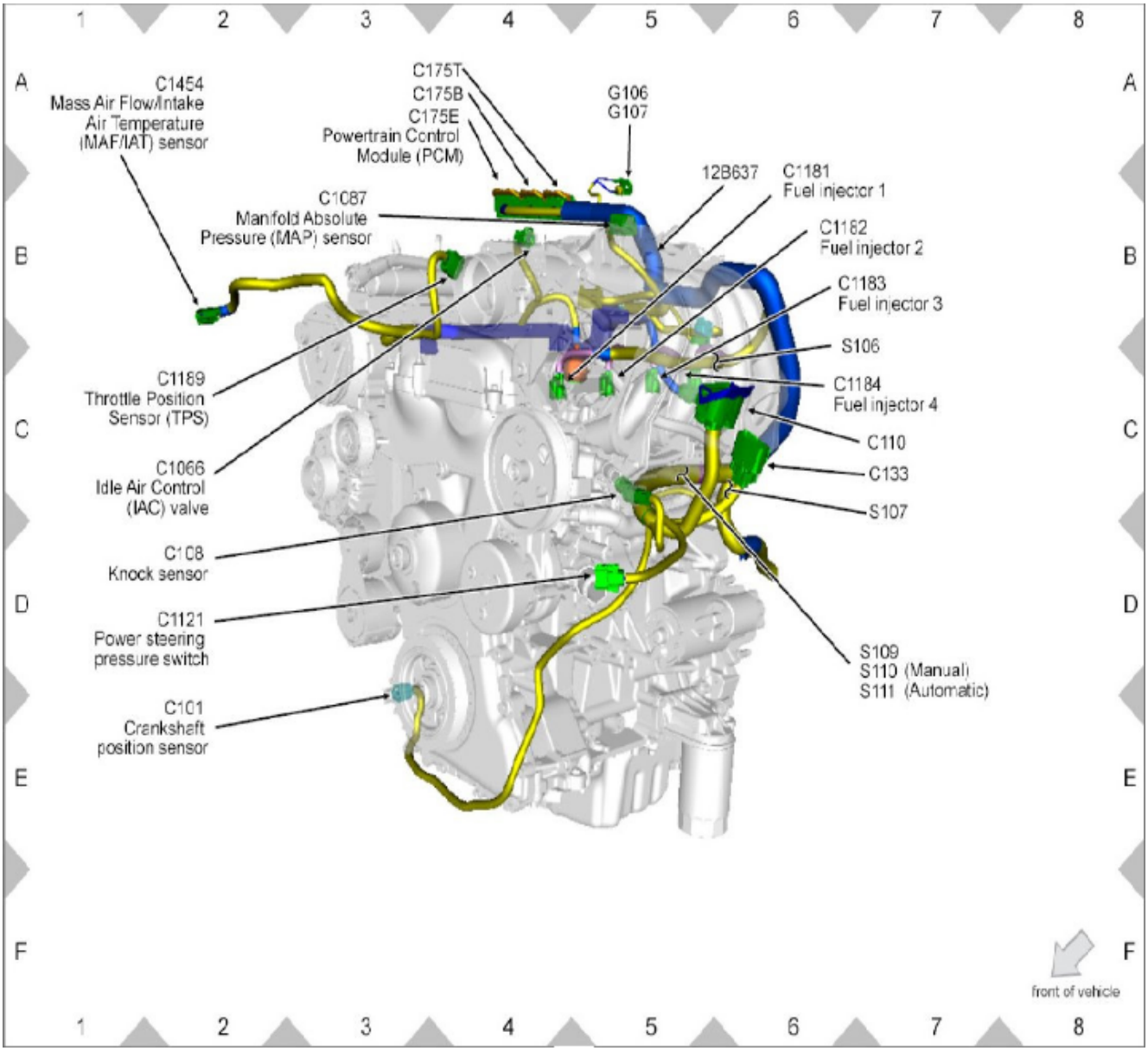
ENGINE COOLANT TEMPERATURE (ECT) SENSOR

Removal and Installation

1. Drain the cooling system. 2. Disconnect the engine coolant temperature (ECT) sensor electrical connector. 3. Remove the ECT sensor.

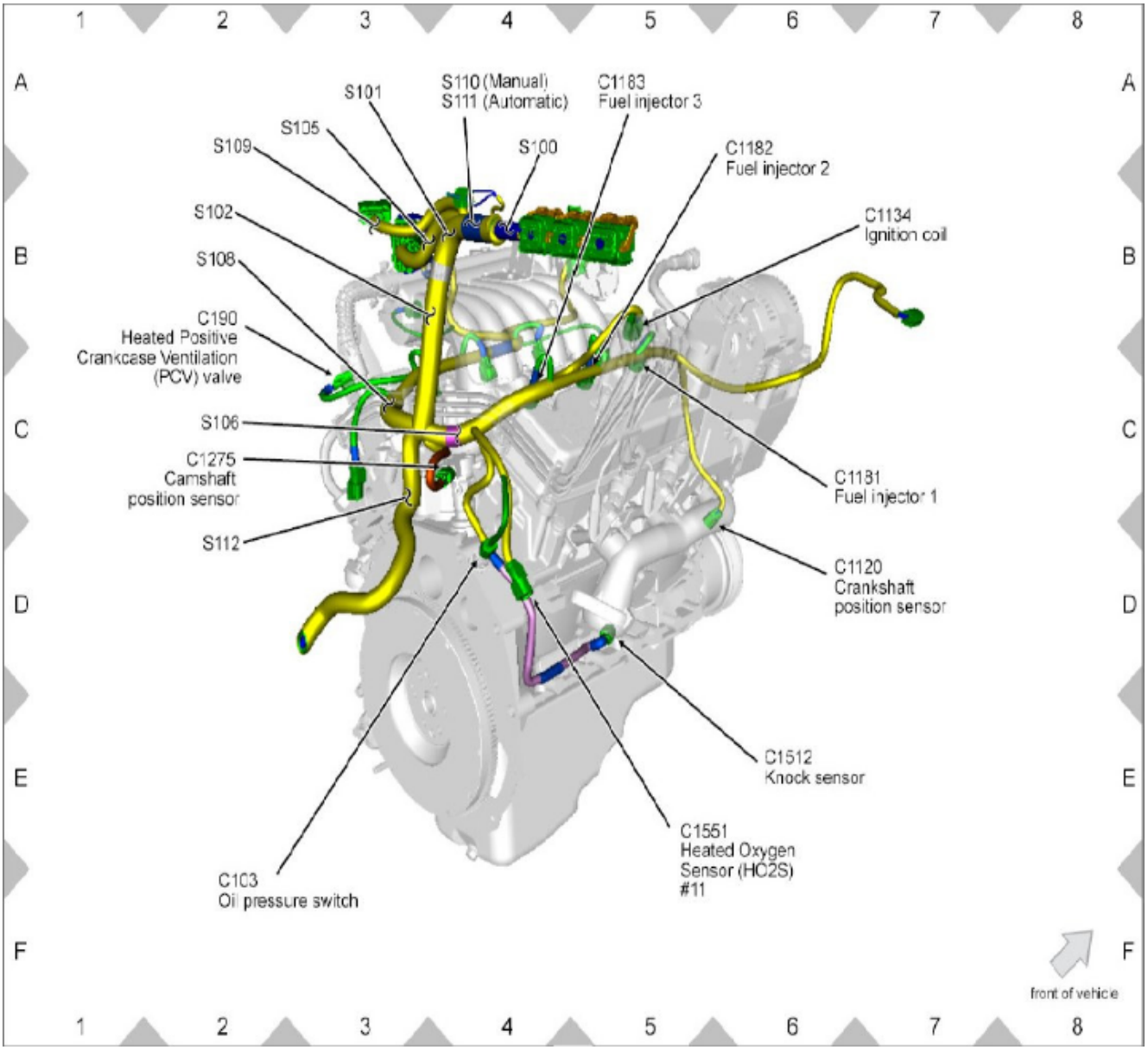
- To install, tighten to 20 Nm (15 lb-ft).

4. To install, reverse the removal procedure.

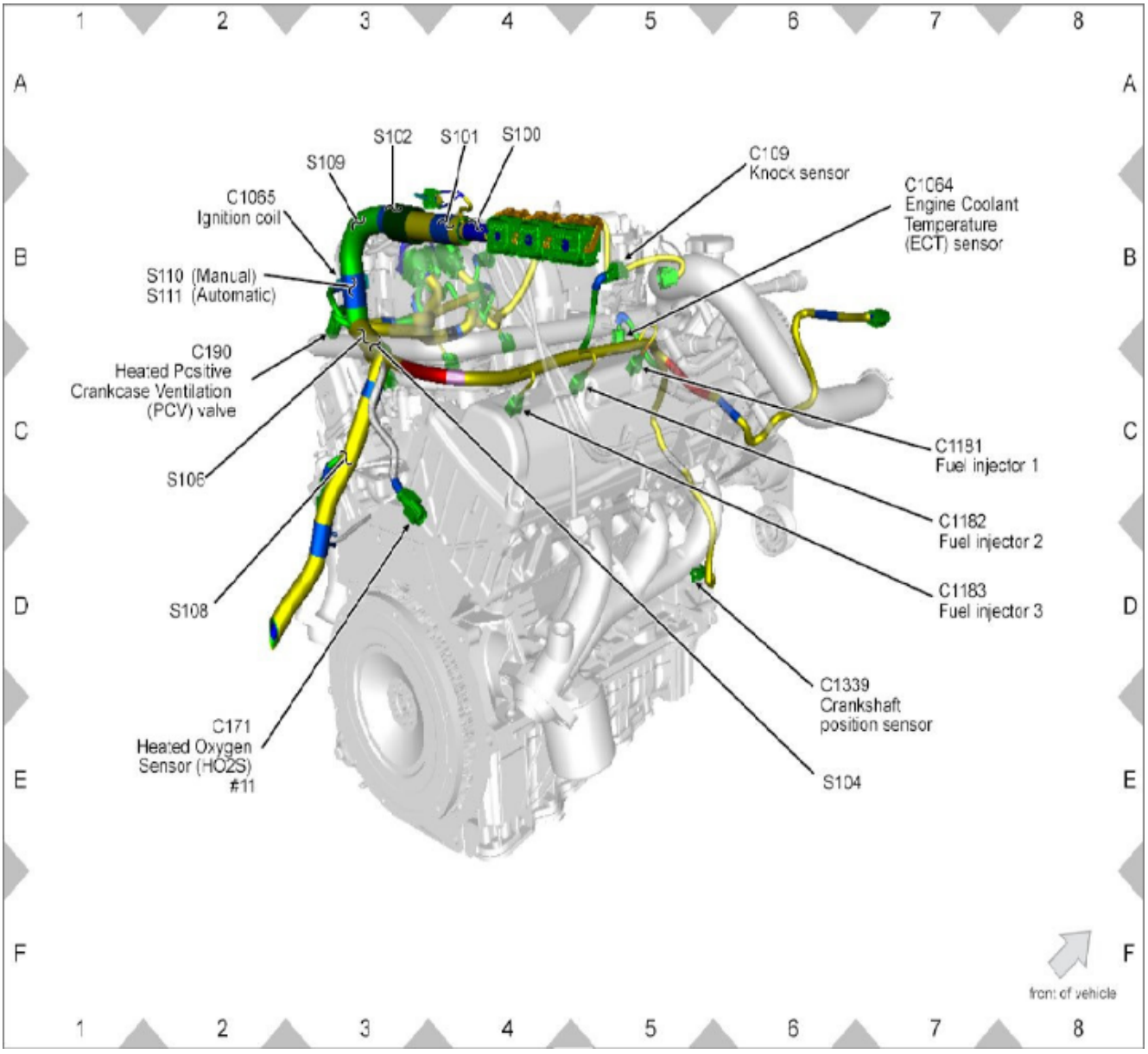


Crankshaft Position Sensor: Locations

View 151-3


S101
S110 (Manual)
S111 (Automatic)
C1183
Fuel injector 3
S105
S109
S100
C1182
Fuel injector 2
S102
C1134
Ignition coil
S108
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
C1275
Camshaft
position sensor
S112
C1181
Fuel injector 1
C1120
Crankshaft
position sensor
C1512
Knock sensor
C1551
Heated Oxygen
Sensor (HO2S)
#11
C103
Oil pressure switch
front of vehicle

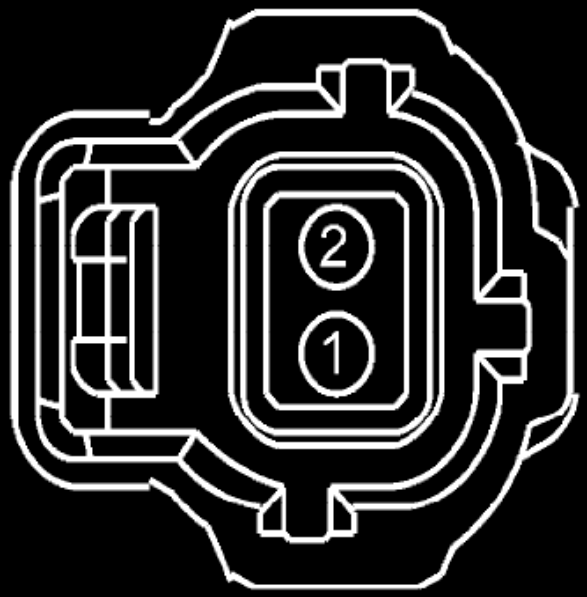
View 151-6


S102
S101
S100
S109
C1065
Ignition coil
S110 (Manual)
S111 (Automatic)
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
S108
C171
Heated Oxygen
Sensor (HO2S)
#11
C109
Knock sensor
C1064
Engine Coolant
Temperature
(ECT) sensor
C1181
Fuel injector 1
C1182
Fuel injector 2
C1183
Fuel injector 3
C1339
Crankshaft
position sensor
S104
front of vehicle

View 151-8

Connector: C101

Description:	Harness:	Base Part #:
CRANKSHAFT POSITION SENSOR	12B637	6C315



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE711 (YE-VT)	18	SENSOR - CRANKSHAFT POSITION (CKPP)	2.3L
2	RE135 (GN-BN)	18	CTRL MOD. - POWERTRAIN # CRANKSHAFT POSITION SENSOR (CKPN)	2.3L

Connector: C1120

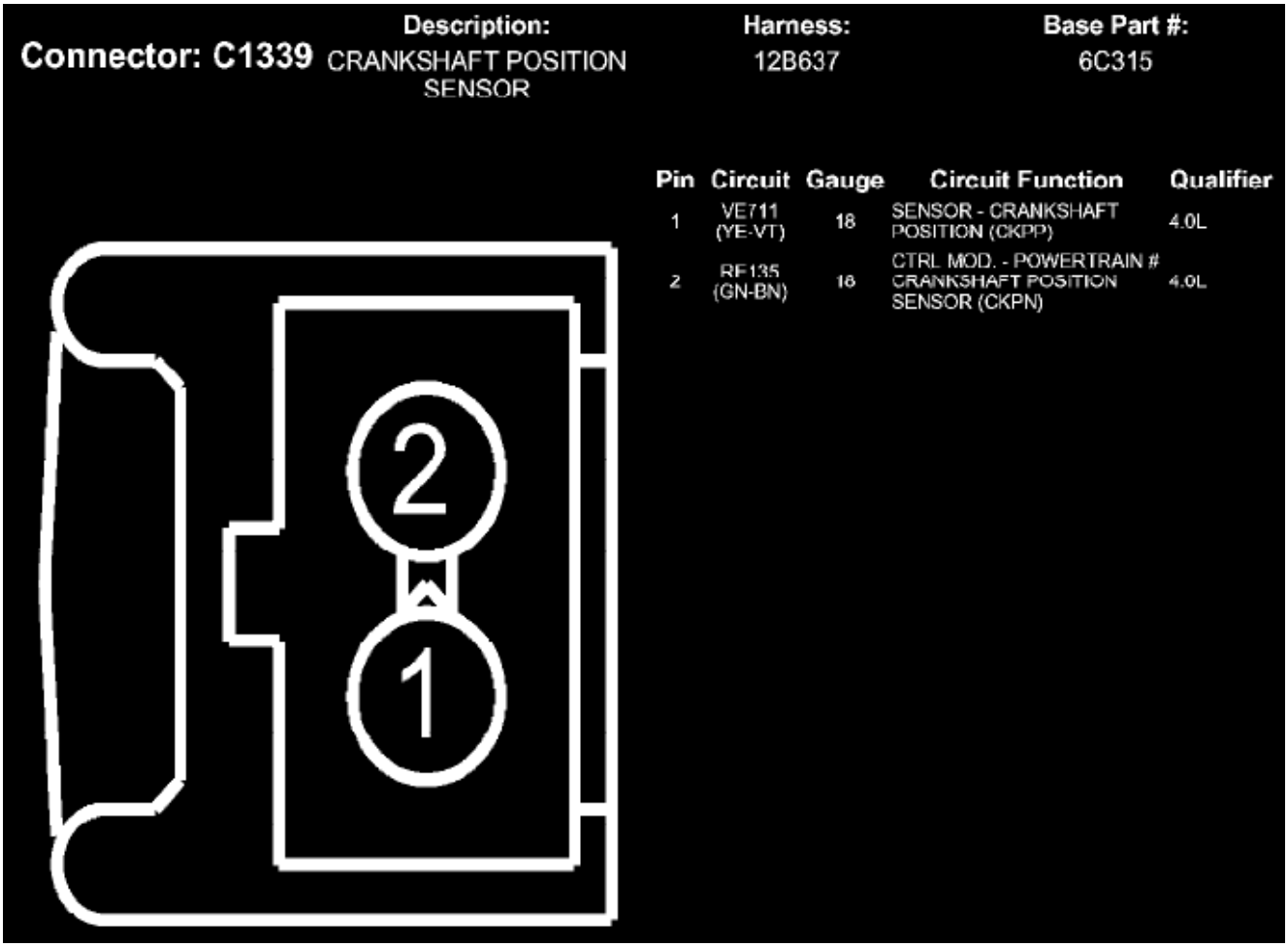
Description:	Harness:	Base Part #:
CRANKSHAFT POSITION SENSOR	12B637	6C315

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RE135 (GN-BN)	18	CTRL MOD. - POWERTRAIN # CRANKSHAFT POSITION SENSOR (CKPN)	3.0L
2	VE711 (YE-VT)	18	SENSOR - CRANKSHAFT POSITION (CKPP)	3.0L

Crankshaft Position Sensor: Diagrams

C101

C1120


Connector: C1339
Description:
CRANKSHAFT POSITION SENSOR
Harness:
12B637
Base Part #:
6C315
Pin Circuit Gauge Circuit Function Qualifier
1 VE711 (YE-VT) 18 SENSOR - CRANKSHAFT POSITION (CKPP) 4.0L
2 RF135 (GN-BN) 18 CTRL MOD. - POWERTRAIN # CRANKSHAFT POSITION SENSOR (CKPN) 4.0L
2
1

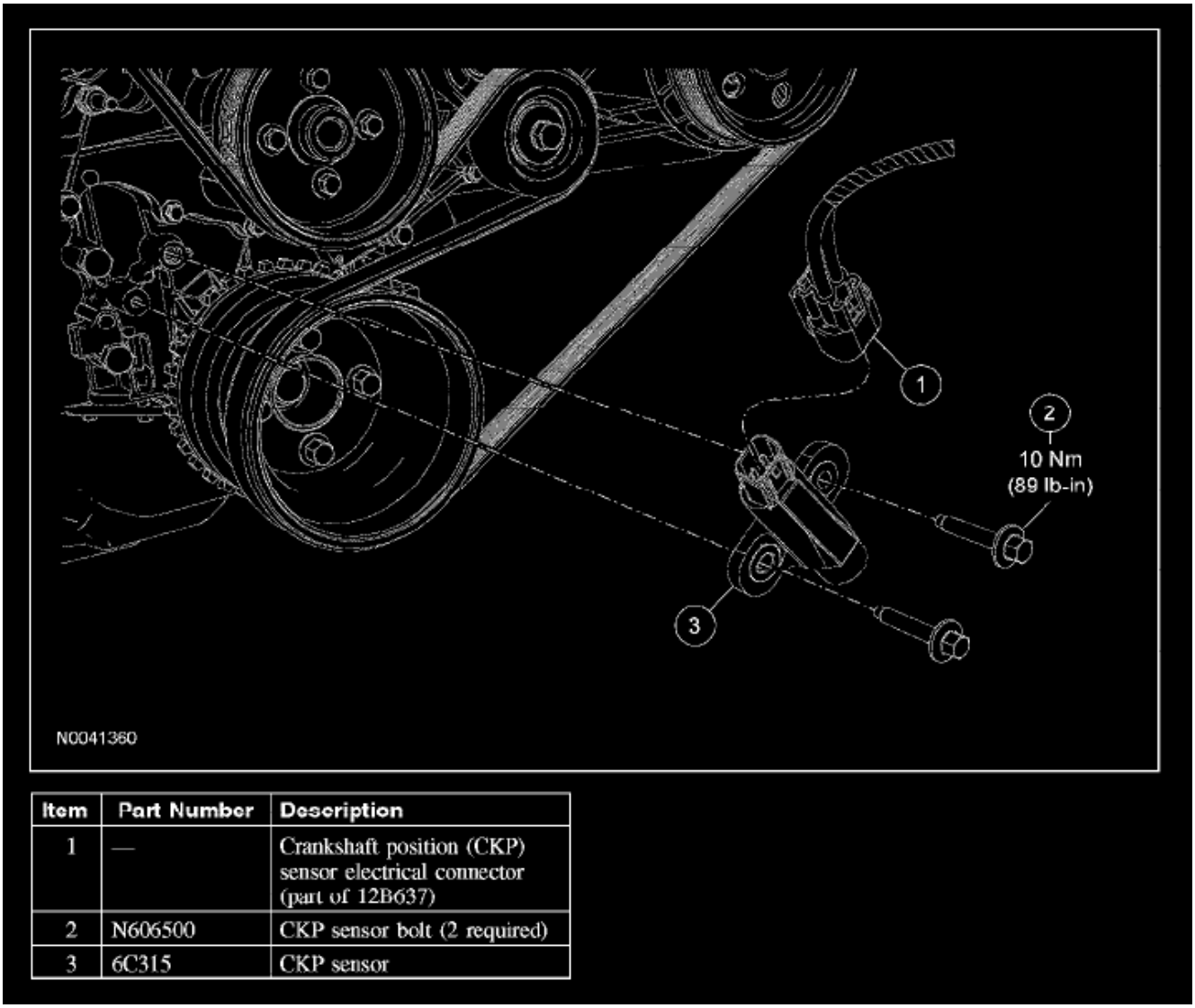
C1339

Crankshaft Position Sensor: Description and Operation

CRANKSHAFT POSITION (CKP) SENSOR

Typical Crankshaft Position (CKP) Sensor

The CKP sensor is a magnetic transducer mounted on the engine block adjacent to a pulse wheel located on the crankshaft. By monitoring the crankshaft mounted pulse wheel, the CKP is the primary sensor for ignition information to the PCM. The pulse wheel has a total of 35 teeth spaced 10 degrees apart with one empty space for a missing tooth. The 6.8L 10-cylinder pulse wheel has 39 teeth spaced 9 degrees apart and one 9 degree empty space for a missing tooth. By monitoring the pulse wheel, the CKP sensor signal indicates crankshaft position and speed information to the PCM. By monitoring the missing tooth, the CKP sensor is also able to identify piston travel in order to synchronize the ignition system and provide a way of tracking the angular position of the crankshaft relative to a fixed reference for the CKP sensor configuration. The PCM also uses the CKP signal to determine if a misfire has occurred by measuring rapid decelerations between teeth.



Item	Part Number	Description
1	—	Crankshaft position (CKP) sensor electrical connector (part of 12B637)
2	N606500	CKP sensor bolt (2 required)
3	6C315	CKP sensor

Crankshaft Position Sensor: Service and Repair

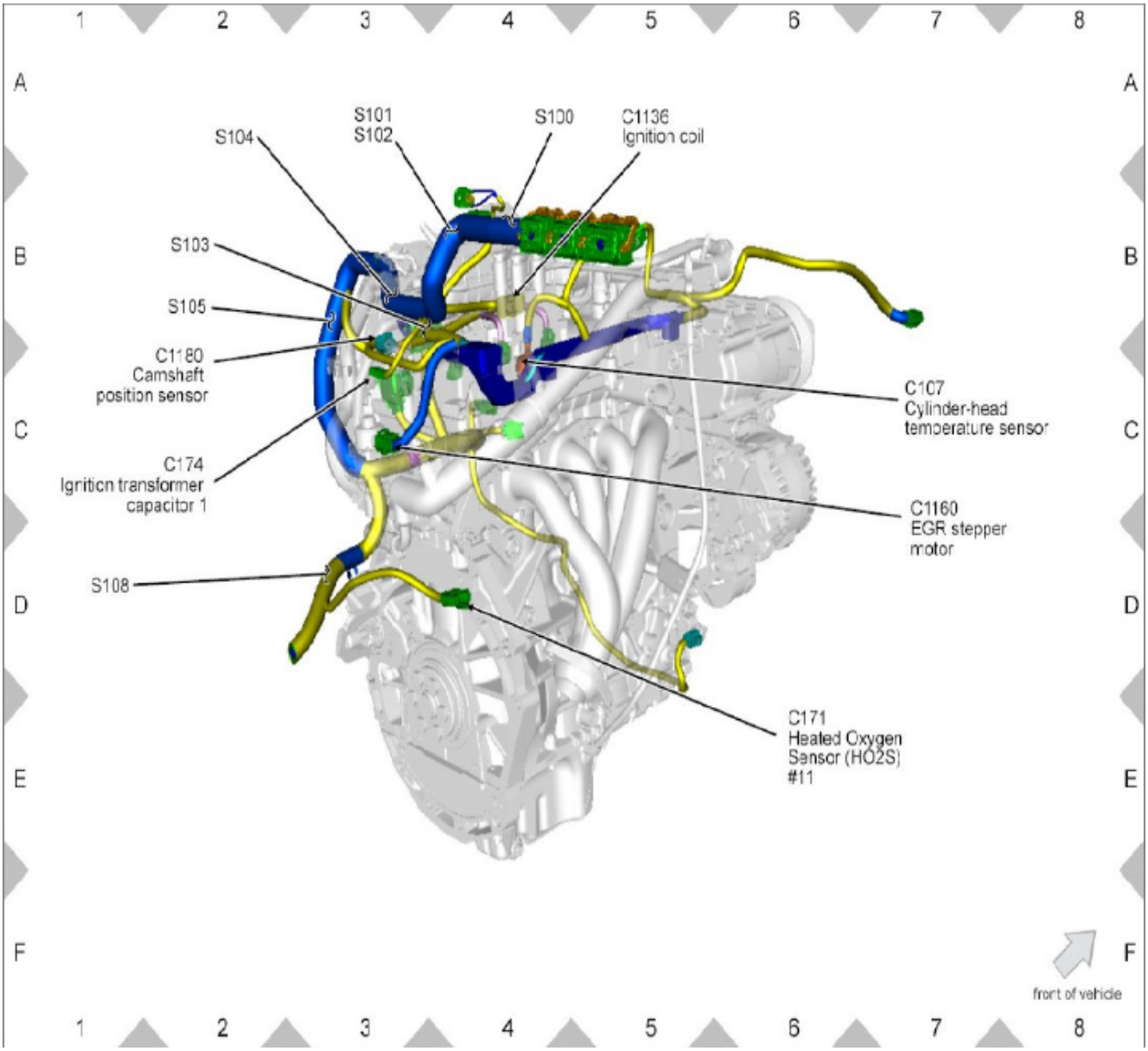
CRANKSHAFT POSITION (CKP) SENSOR

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the crankshaft position (CKP) sensor electrical connector. 3. Remove the 2 bolts and the CKP sensor.

- To install, tighten to 10 Nm (89 lb-in).

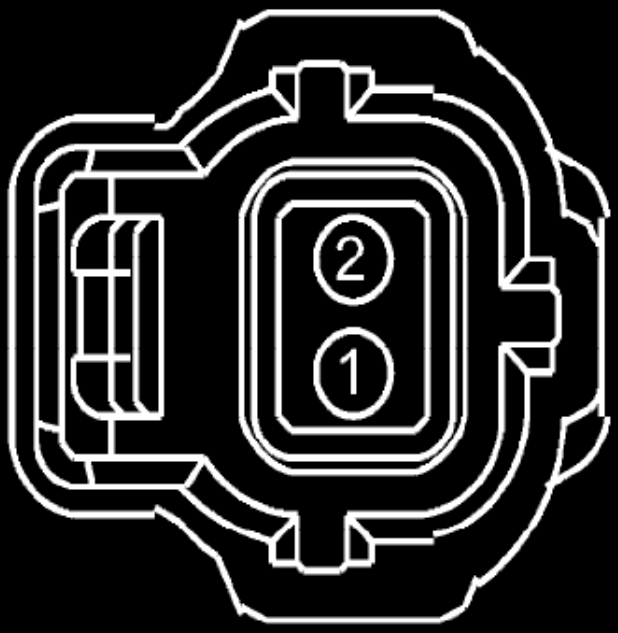
4. To install, reverse the removal procedure.


S104
S101
S102
S100
C1136
Ignition coil
S103
S105
C1180
Camshaft
position sensor
C107
Cylinder-head
temperature sensor
C174
Ignition transformer
capacitor 1
C1160
EGR stepper
motor
S108
C171
Heated Oxygen
Sensor (HO2S)
#11
front of vehicle

View 151-4

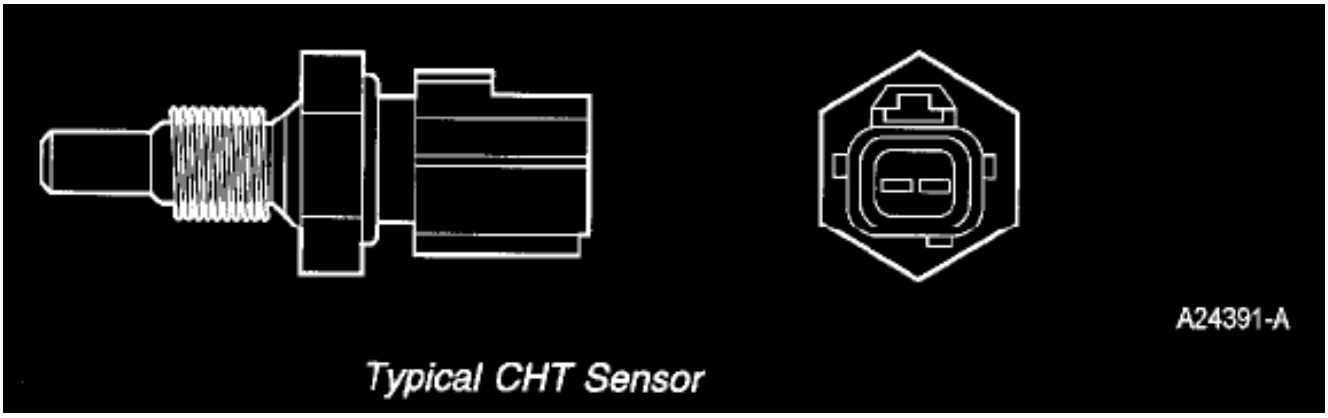
Connector: C107

Description:	Harness:	Base Part #:
CYLINDERHEAD TEMPERATURE SENSOR	12B637	6G004



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE116 (VT-BN)	20	CTRL MOD. - POWERTRAIN # CYLINDER HEAD TEMPERATURE INDICATOR LIGHT (CHTIL)	2.3L
2	RE405 (GN/WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	2.3L

C107



Typical CHT Sensor

Engine Temperature Sensor: Description and Operation

CYLINDER HEAD TEMPERATURE (CHT) SENSOR

Typical CHT Sensor

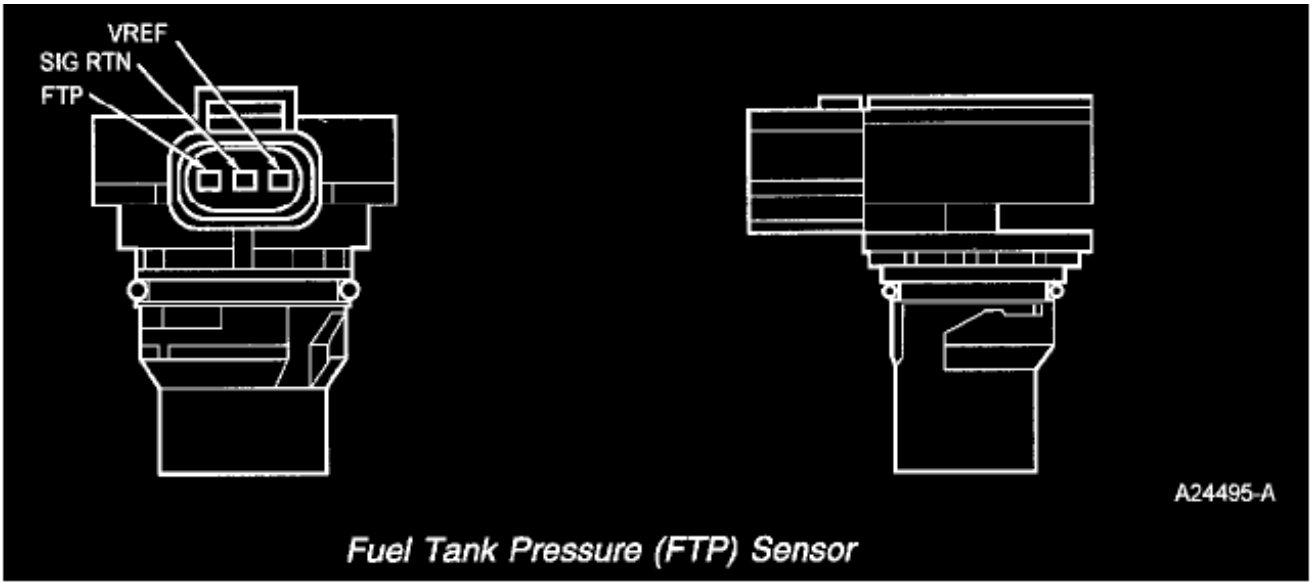
The CHT sensor is a thermistor device in which resistance changes with the temperature. The electrical resistance of a thermistor decreases as temperature increases, and the resistance increases as the temperature decreases. The varying resistance affects the voltage drop across the sensor terminals and provides electrical signals to the PCM corresponding to temperature.

The CHT sensor is installed in the cylinder head and measures the metal temperature. The CHT sensor can provide complete engine temperature information and can be used to infer coolant temperature. If the CHT sensor conveys an overheating condition to the PCM, the PCM initiates a fail-safe cooling strategy based on information from the CHT sensor. A cooling system concern such as low coolant or coolant loss could cause an overheating condition. As a result, damage to major engine components could occur. Using both the CHT sensor and fail-safe cooling strategy, the PCM prevents damage by allowing air cooling of the engine and limp home capability.

Fuel Level Sensor: Description and Operation

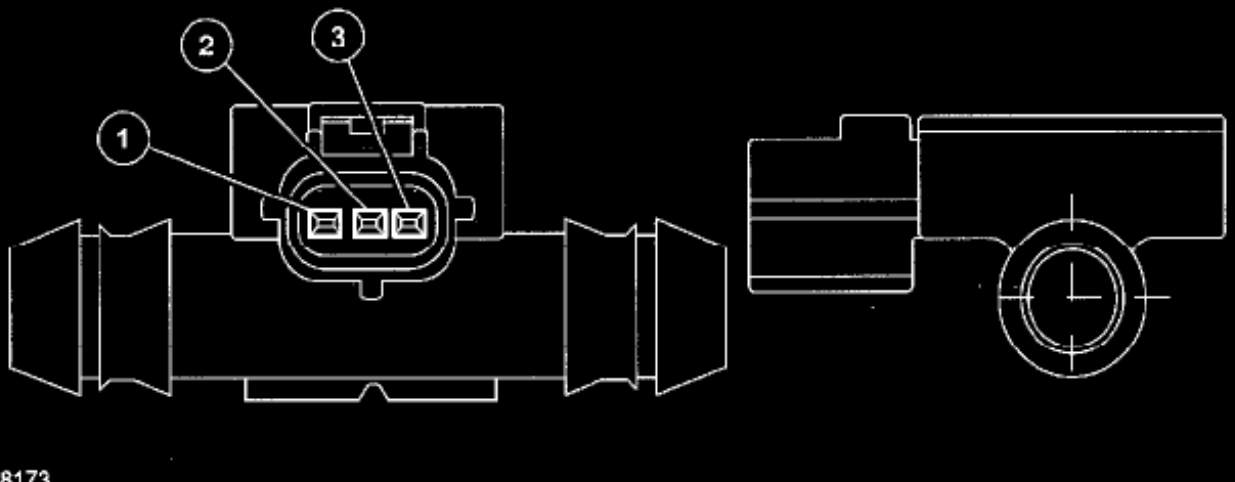
FUEL LEVEL INPUT (FLI)

The FLI is a communications network message. Most vehicle applications use a potentiometer type FLI sensor connected to a float in the FP module to determine fuel level.



Fuel Tank Pressure (FTP) Sensor

In-Line Fuel Tank Pressure (FTP) Sensor



N0048173

Item	Part Number	Description
1	—	VREF
2	—	SIG RTN
3	—	FTP

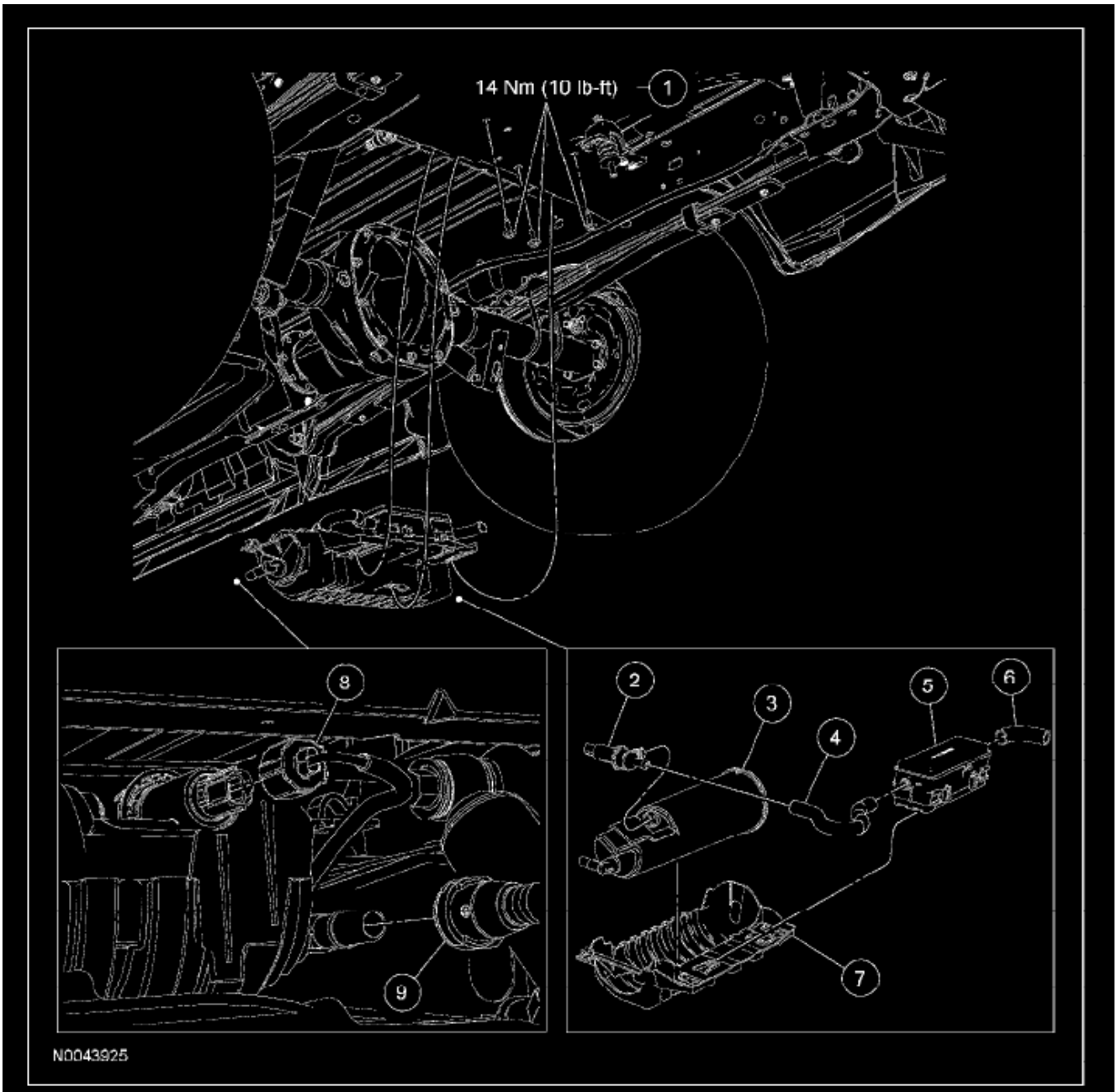
Fuel Tank Pressure Sensor: Description and Operation

FUEL TANK PRESSURE (FTP) SENSOR

Fuel Tank Pressure (FTP) Sensor

In-Line Fuel Tank Pressure (FTP) Sensor

The FTP sensor or in-line FTP sensor is used to measure the fuel tank pressure.



Item	Part Number	Description
1	W503932	Evaporative emissions (EVAP) canister and bracket assembly bolts
2	9F945	EVAP canister vent solenoid
3	9D653	EVAP canister

(Continued)

Item	Part Number	Description
4	9F459	EVAP canister vent solenoid-to-EVAP dust separator hose
5	9B328	EVAP dust separator
6	9F459	EVAP dust separator hose
7	9D665	EVAP canister bracket

(Continued)

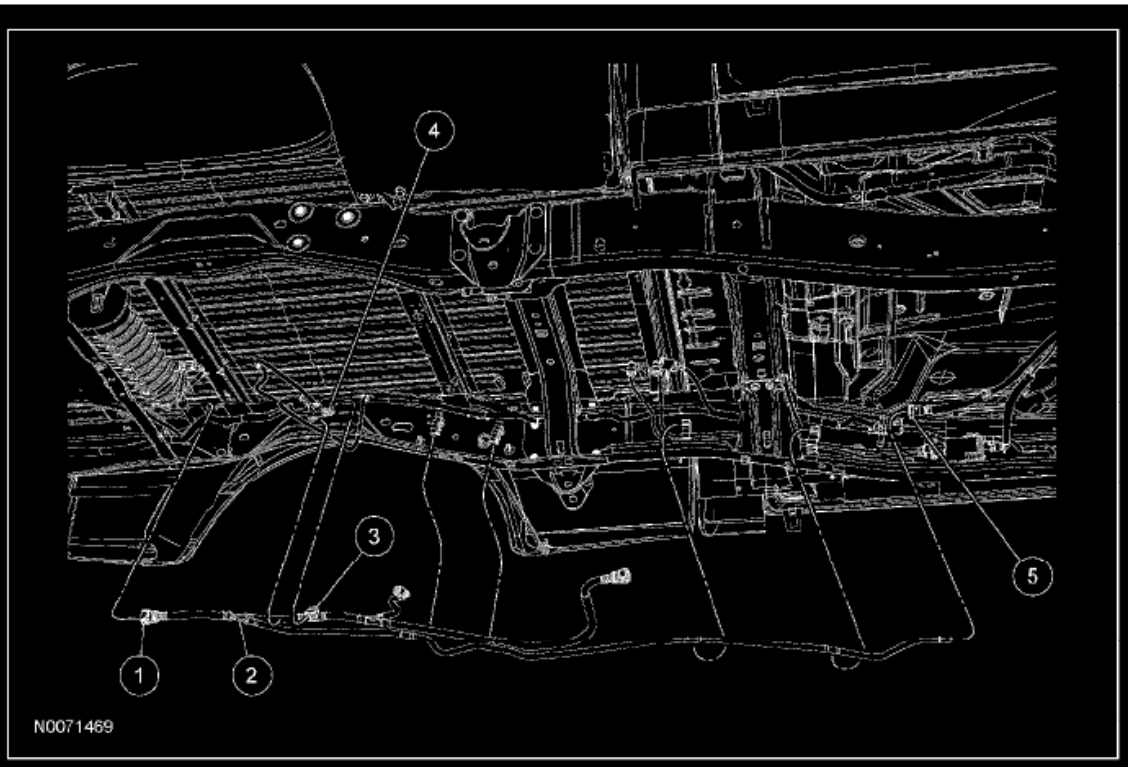
Fuel Tank Pressure Sensor: Service and Repair

FUEL TANK PRESSURE SENSOR

Exploded View

Part 1

Item	Part Number	Description
8	—	EVAP canister vent solenoid electrical connector (part of 14405)
9	—	Rear fuel tank vapor tube and fuel tank pressure sensor assembly-to-EVAP canister quick connect coupling (part of 9G291)



Item	Part Number	Description
1	—	Rear fuel tank vapor tube and fuel tank pressure sensor assembly-to-evaporative emission (EVAP) canister quick connect coupling (part of 9G291)
2	9G291	Rear fuel tank vapor tube and fuel tank pressure sensor assembly
3	—	Fuel tank pressure sensor (part of 9G291)
4	—	Fuel tank pressure sensor electrical connector (part of 14405)
5	—	Front fuel tank vapor tube-to-rear fuel tank vapor tube and fuel tank pressure sensor assembly quick connect coupling (part of 9L291)

Part 2

Removal and Installation

WARNING:

- When working on or near the evaporative emission (EVAP) system, disconnect the battery ground cable from the battery. The EVAP system contains fuel vapor and condensed fuel vapor, so an

electrical spark may cause a fire or explosion. Failure to follow this instruction may result in serious personal injury.

- Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

1. Remove the fuel tank. 2. Disconnect the fuel tank pressure sensor electrical connector.

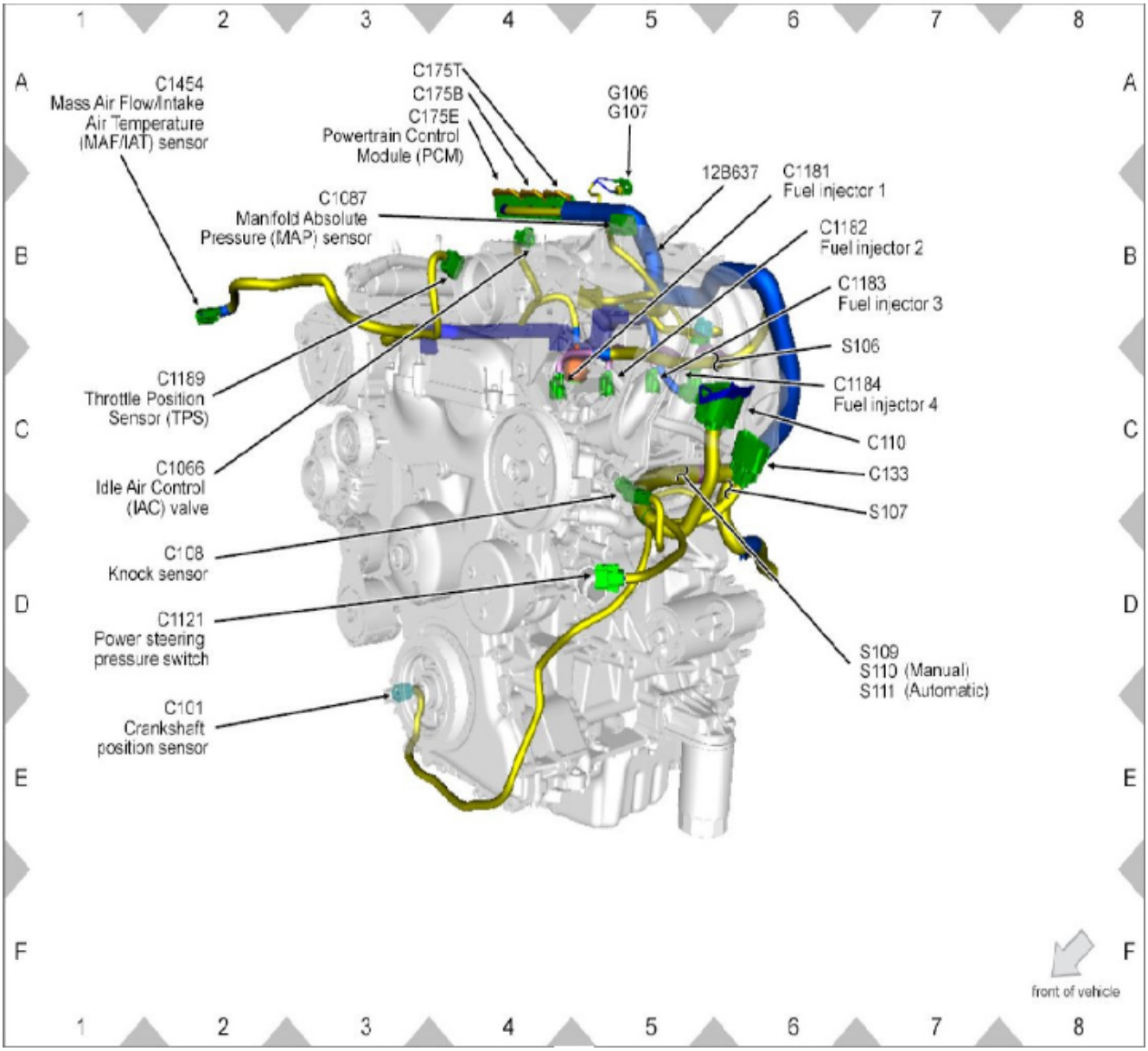
3. NOTE: The rear fuel tank vapor tube and fuel tank pressure sensor are an assembly and must be serviced as an assembly.

Disconnect the rear fuel tank vapor tube and fuel tank pressure sensor assembly-to-evaporative emissions (EVAP) canister quick connect coupling.

4. Disconnect the front fuel tank vapor tube-to-rear fuel tank vapor tube and fuel tank pressure sensor assembly quick connect coupling. 5. Remove the rear fuel tank vapor tube and fuel tank pressure sensor assembly. 6. To install, reverse the removal procedure.

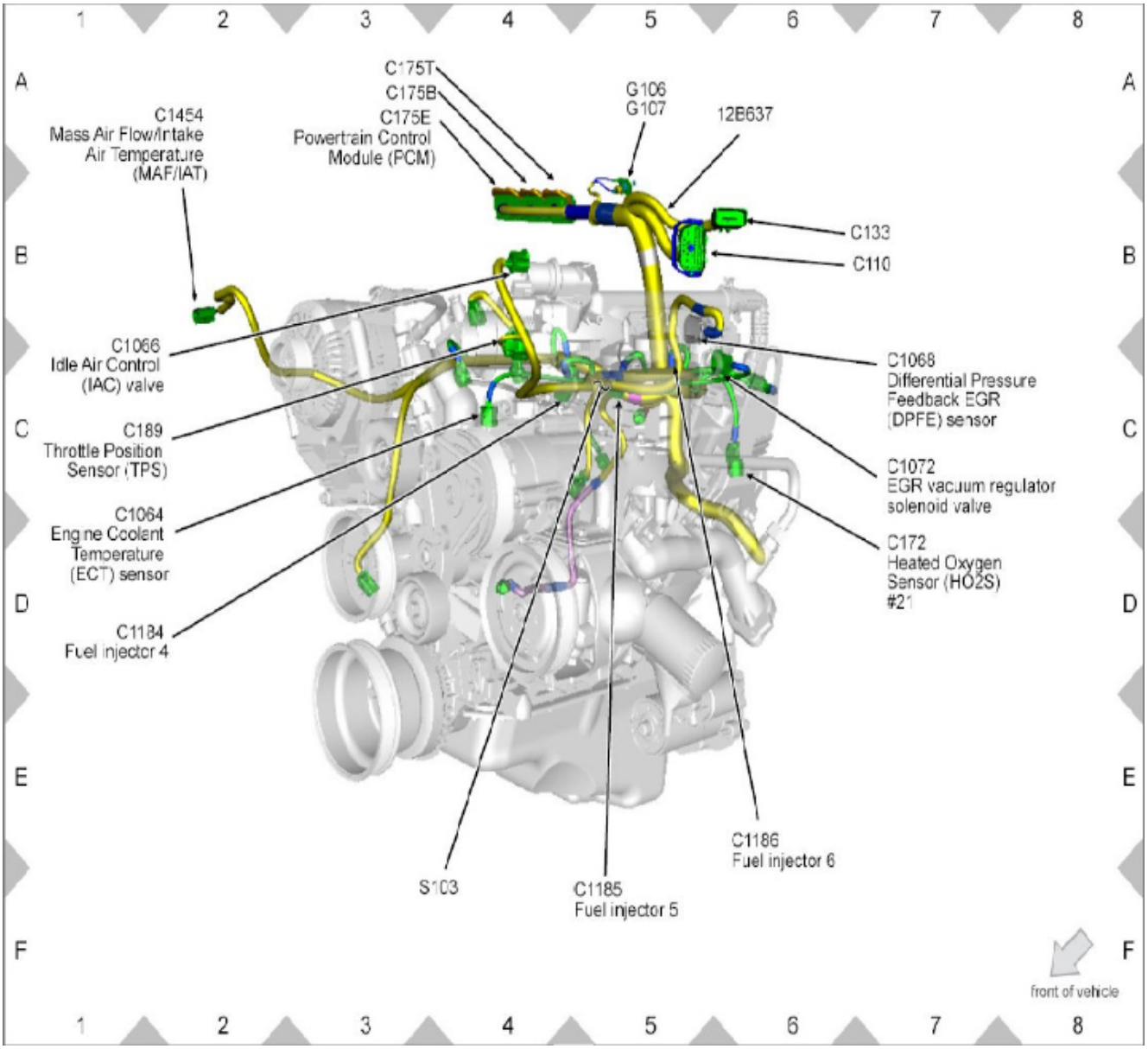
- Carry out the leak test. See: Emission Control Systems/Evaporative Emissions System/Testing and Inspection

- Carry out the evaporative emission repair verification drive cycle.

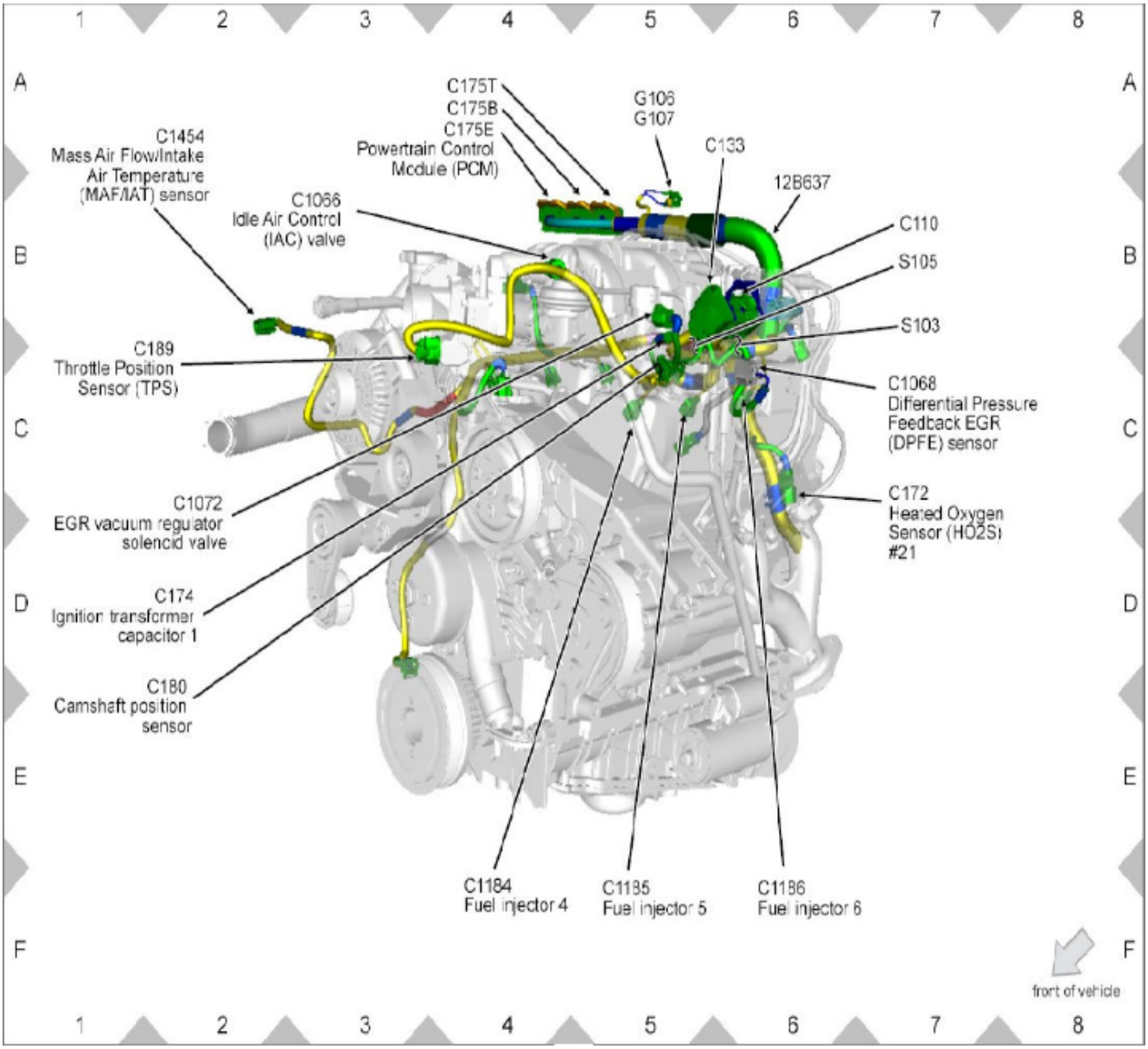


Intake Air Temperature Sensor: Locations

View 151-3


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
12B637
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT)
C133
C110
C1066
Idle Air Control (IAC) valve
C189
Throttle Position Sensor (TPS)
C1064
Engine Coolant Temperature (ECT) sensor
C1184
Fuel injector 4
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
S103
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

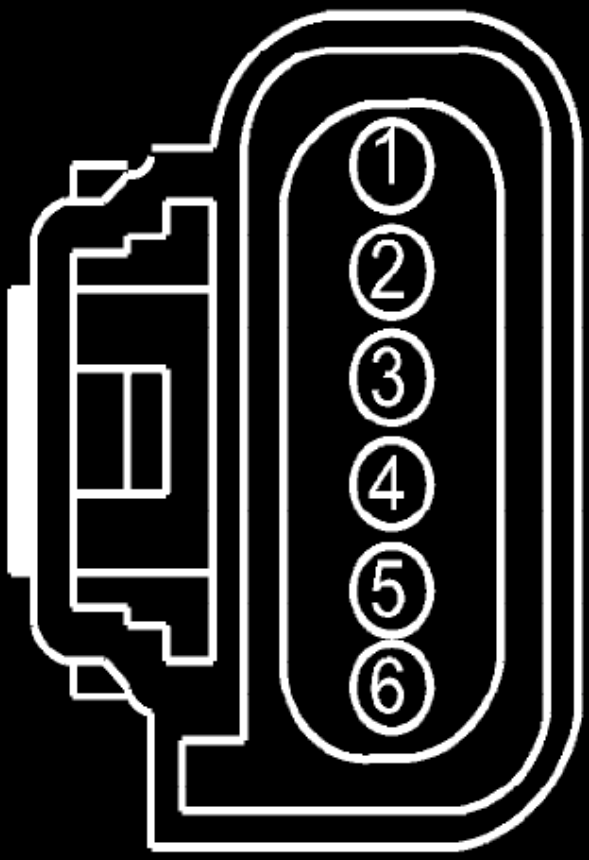
View 151-5


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
C133
12B637
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor
C1066
Idle Air Control (IAC) valve
C110
S105
S103
C189
Throttle Position Sensor (TPS)
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
C174
Ignition transformer capacitor 1
C180
Camshaft position sensor
C1184
Fuel injector 4
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-7

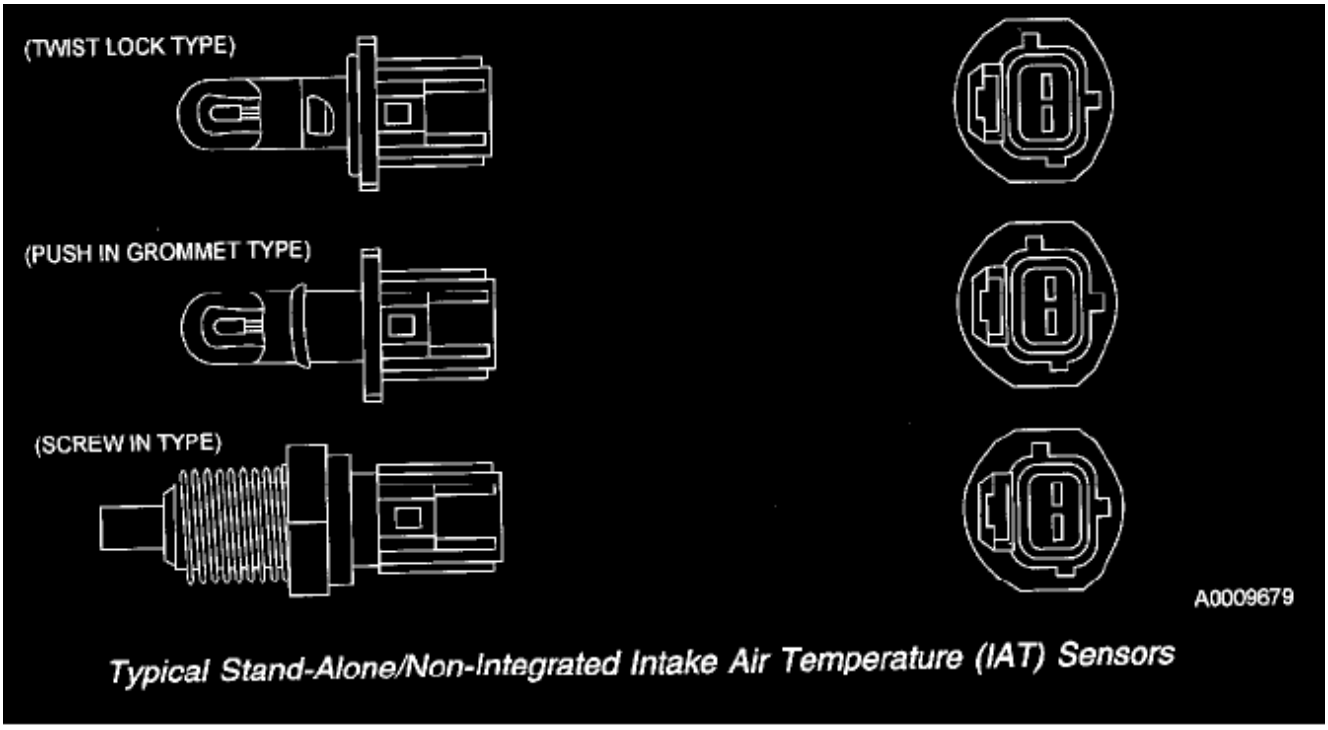
Connector: C1454

Description:	Harness:	Base Part #:
MASS AIR FLOW/INTAKE AIR TEMPERATURE (MAF/IAT) SENSOR	12B637	

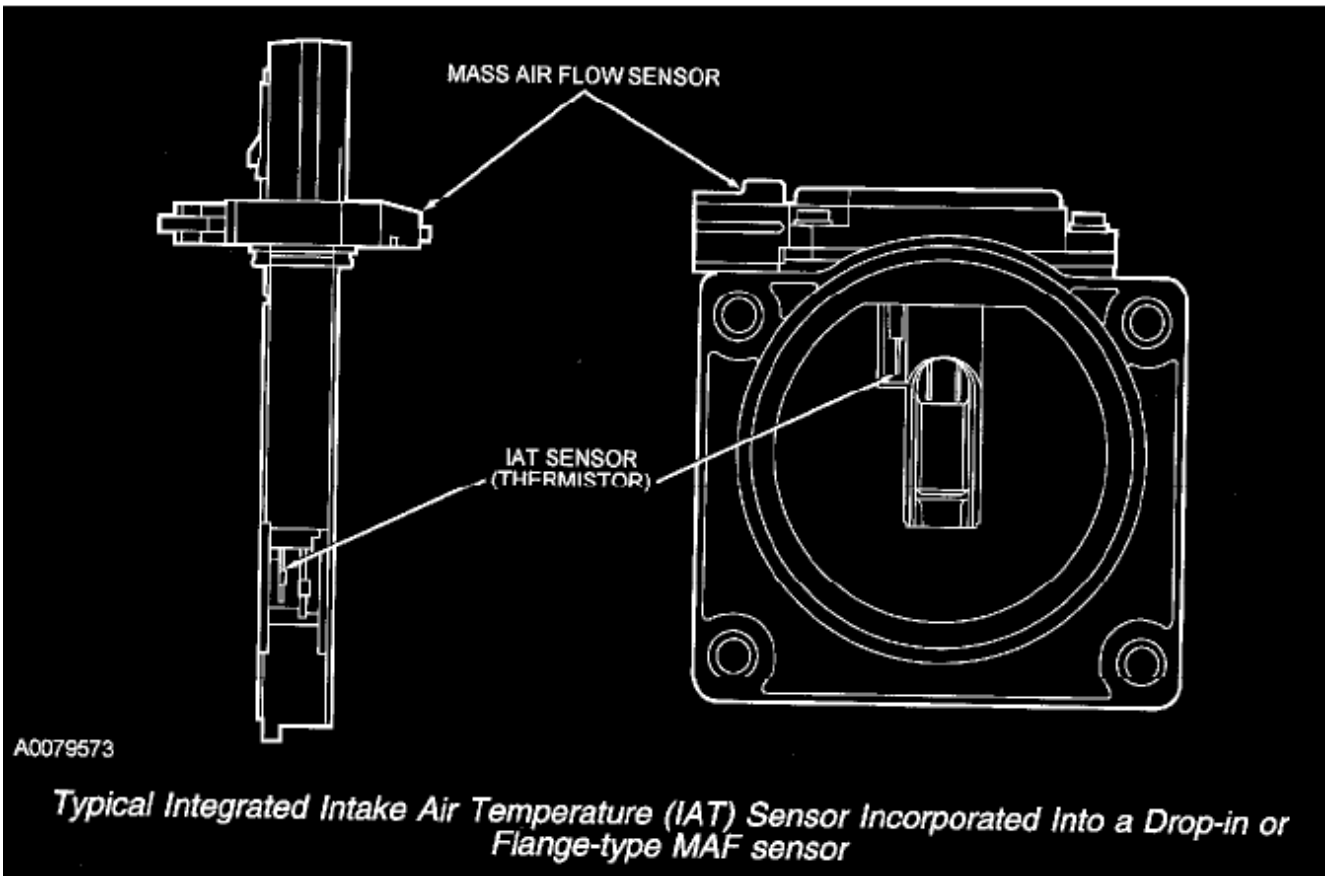


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE740 (VT-GY)	20	SENSOR - INTAKE AIR TEMPERATURE (IAT)	
2	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	
3	VE807 (YE-VT)	20	SENSOR - MASS AIR FLOW LH BANK OR 1ST BANK OR UNIQUE (MAF)	
4	RE320 (BU)	20	CTRL MOD. - POWERTRAIN # MASS AIR FLOW SEN. LH BANK OR 1ST BANK (MAFRTN)	
5	GD108 (BK-VT)	20	GROUND - CHASSIS/BATTERY	
6	CBB43 (GY)	20	FUSE - 43 OR CIRCUIT BREAKER	

C1454



Typical Stand-Alone/Non-Integrated Intake Air Temperature (IAT) Sensors



Typical Integrated Intake Air Temperature (IAT) Sensor Incorporated Into a Drop-in or Flange-type MAF sensor

Intake Air Temperature Sensor: Description and Operation

Intake Air Temperature (IAT) Sensor

Typical Stand-Alone/Non-Integrated Intake Air Temperature (IAT) Sensors

Typical Integrated Intake Air Temperature (IAT) Sensor Incorporated Into A Drop-in Or Flange-type MAF Sensor

The IAT sensor is a thermistor device in which resistance changes with temperature. The electrical resistance of a thermistor decreases as the temperature increases, and the resistance increases as the temperature decreases. The varying resistance affects the voltage drop across the sensor terminals and provides electrical signals to the PCM corresponding to temperature.

Thermistor-type sensors are considered passive sensors. A passive sensor is connected to a voltage divider network so that varying the resistance of the passive sensor causes a variation in total current flow. Voltage that is dropped across a fixed resistor in a series with the sensor resistor determines the voltage signal at the PCM. This voltage signal is equal to the reference voltage minus the voltage drop across the fixed resistor.

The IAT provides air temperature information to the PCM. The PCM uses the air temperature information as a correction factor in the calculation of

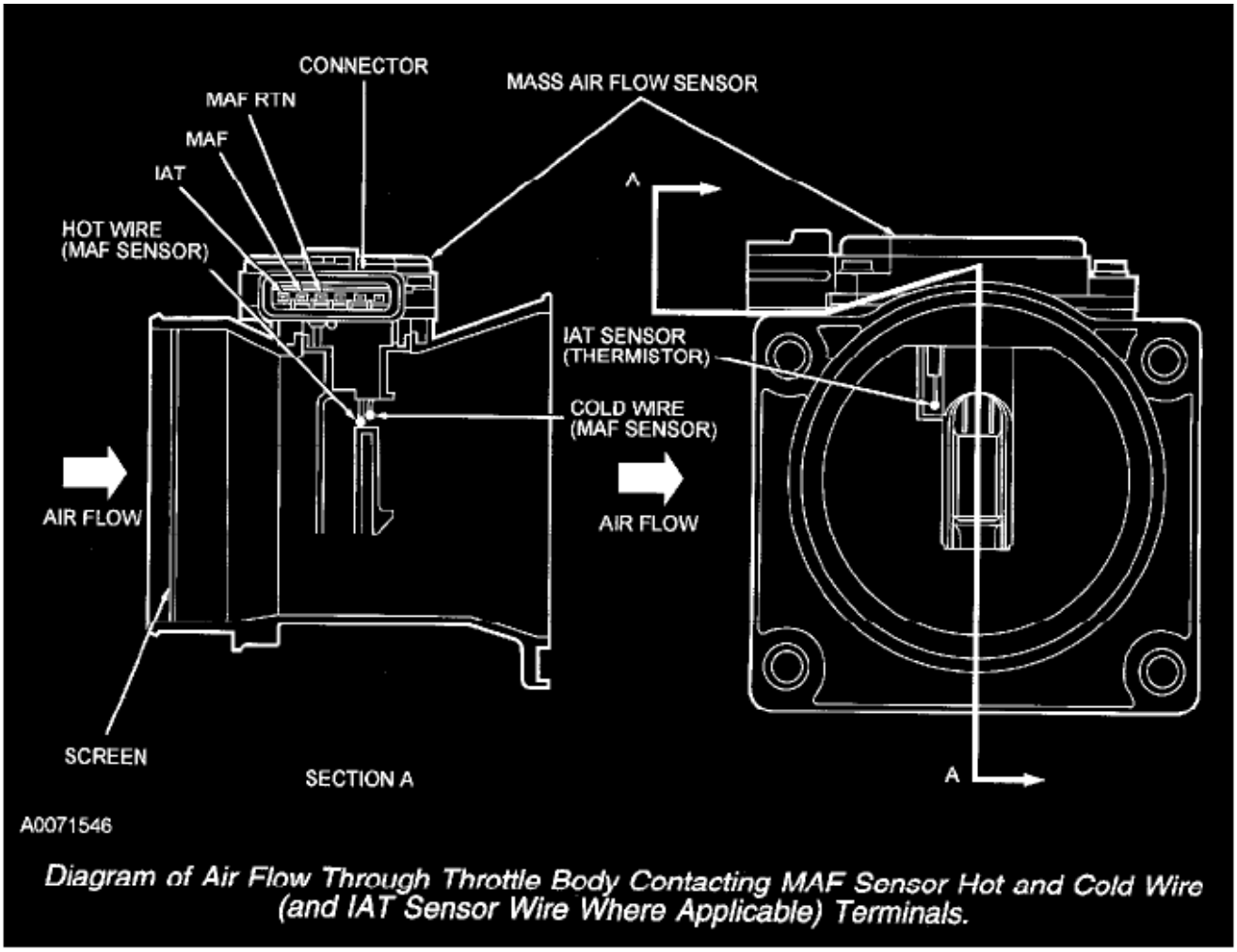
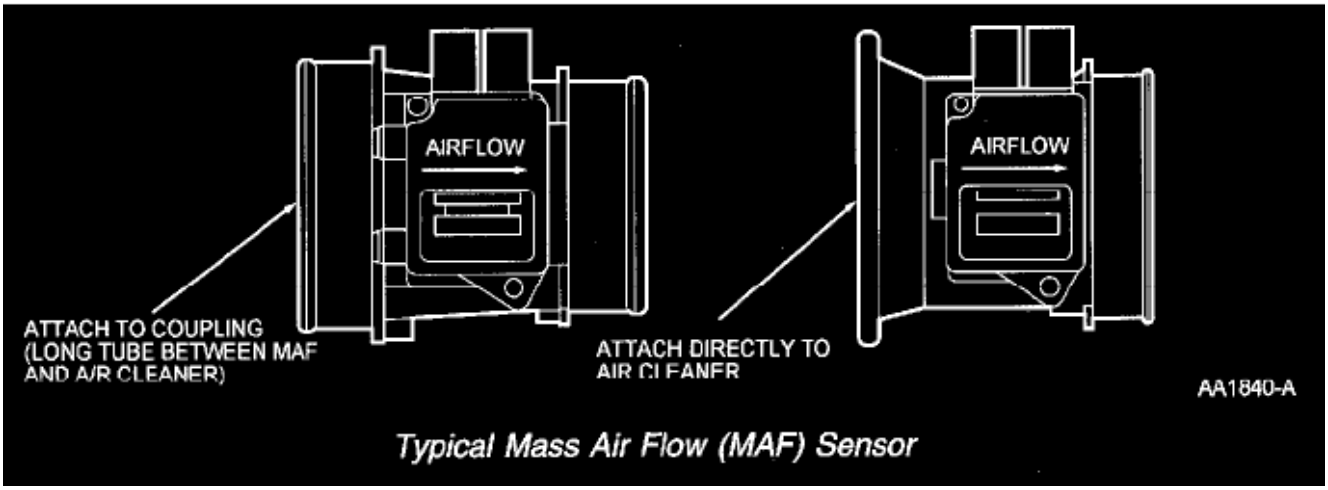


Diagram of Air Flow Through Throttle Body Contacting MAF Sensor Hot and Cold Wire (and IAT Sensor Wire Where Applicable) Terminals.



Typical Mass Air Flow (MAF) Sensor

fuel, spark, and air flow.

The IAT sensor provides a quicker temperature change response time than the ECT or CHT sensor.

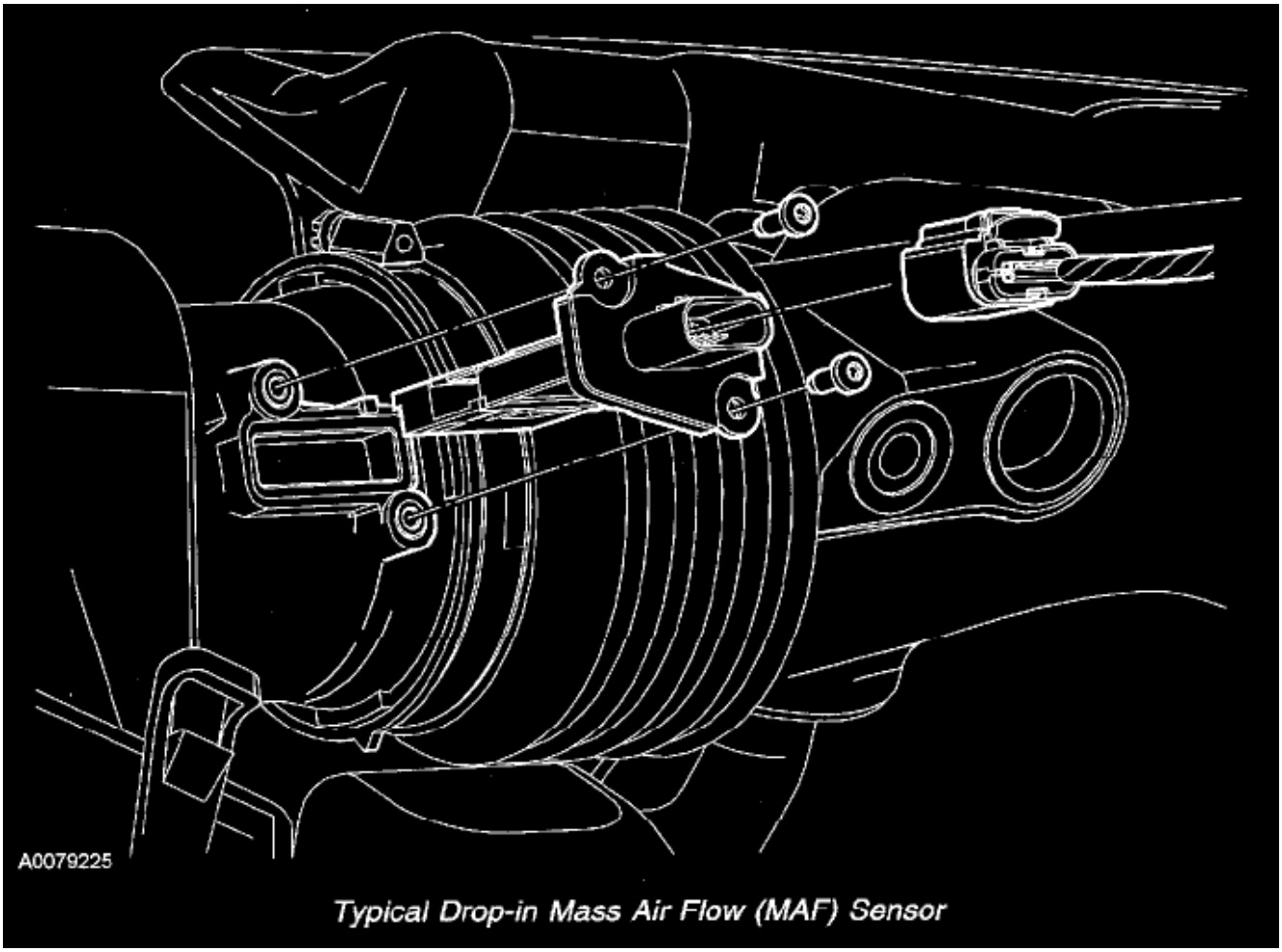
Currently there are 2 design types of IAT sensors used, a stand-alone/non-integrated type and a integrated type. Both types function the same, however the integrated type is incorporated into the mass air flow (MAF) sensor instead of being a stand alone sensor.

Supercharged vehicles use 2 IAT sensors. Both sensors are thermistor type devices and operate as described above. One is located before the supercharger at the air cleaner for standard OBD/cold weather input, while a second sensor (IAT2) is located after the supercharger in the intake manifold. The IAT2 sensor located after the supercharger provides air temperature information to the PCM to control spark and to help determine charge air cooler (CAC) efficiency.

Mass Air Flow (MAF) Sensor

Diagram Of Air Flow Through Throttle Body Contacting MAF Sensor Hot And Cold Wire (and IAT Sensor Wire Where Applicable) Terminals

Typical Mass Air Flow (MAF) Sensor

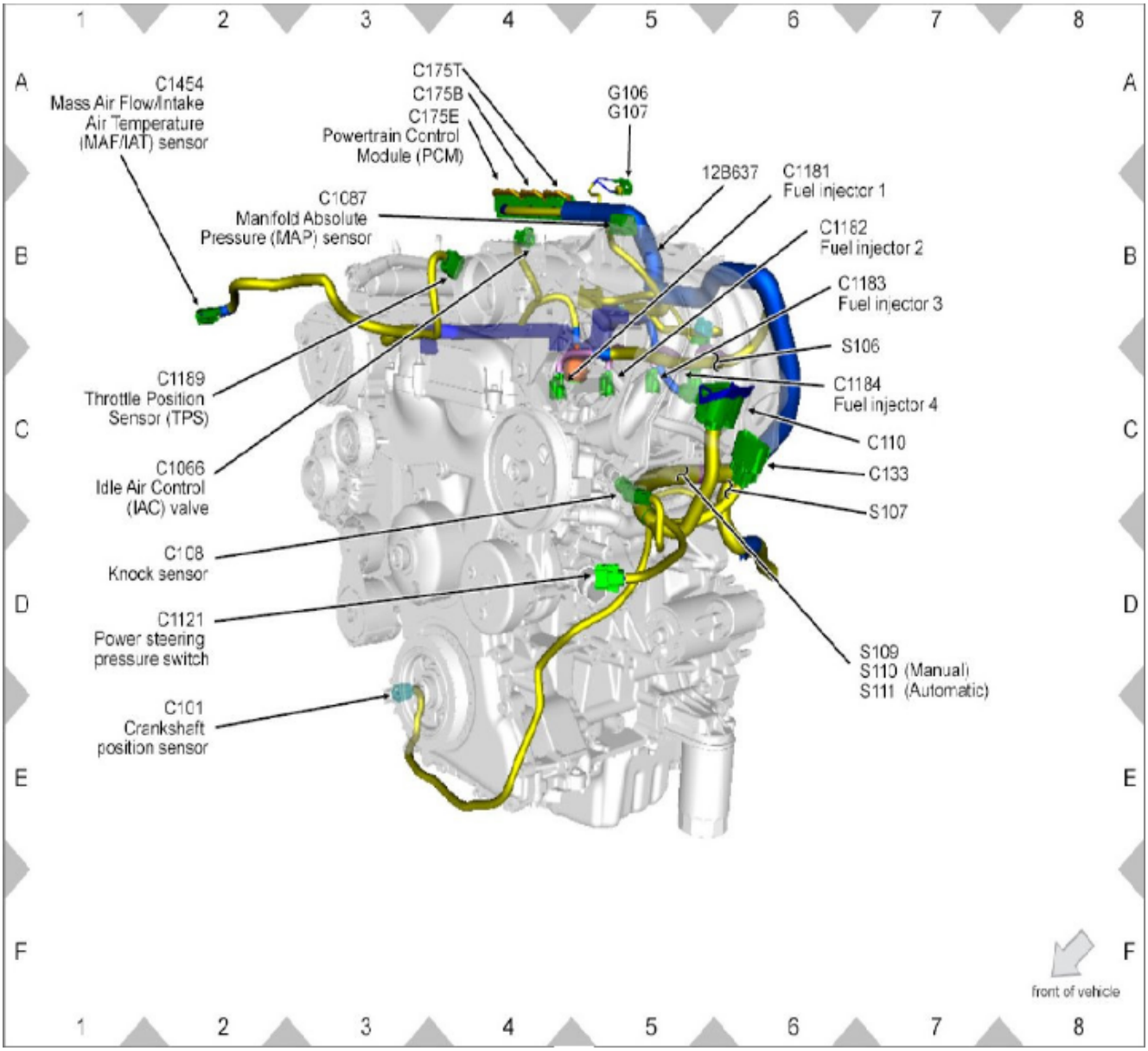


Typical Drop-in Mass Air Flow (MAF) Sensor

Typical Drop-in Mass Air Flow (MAF) Sensor

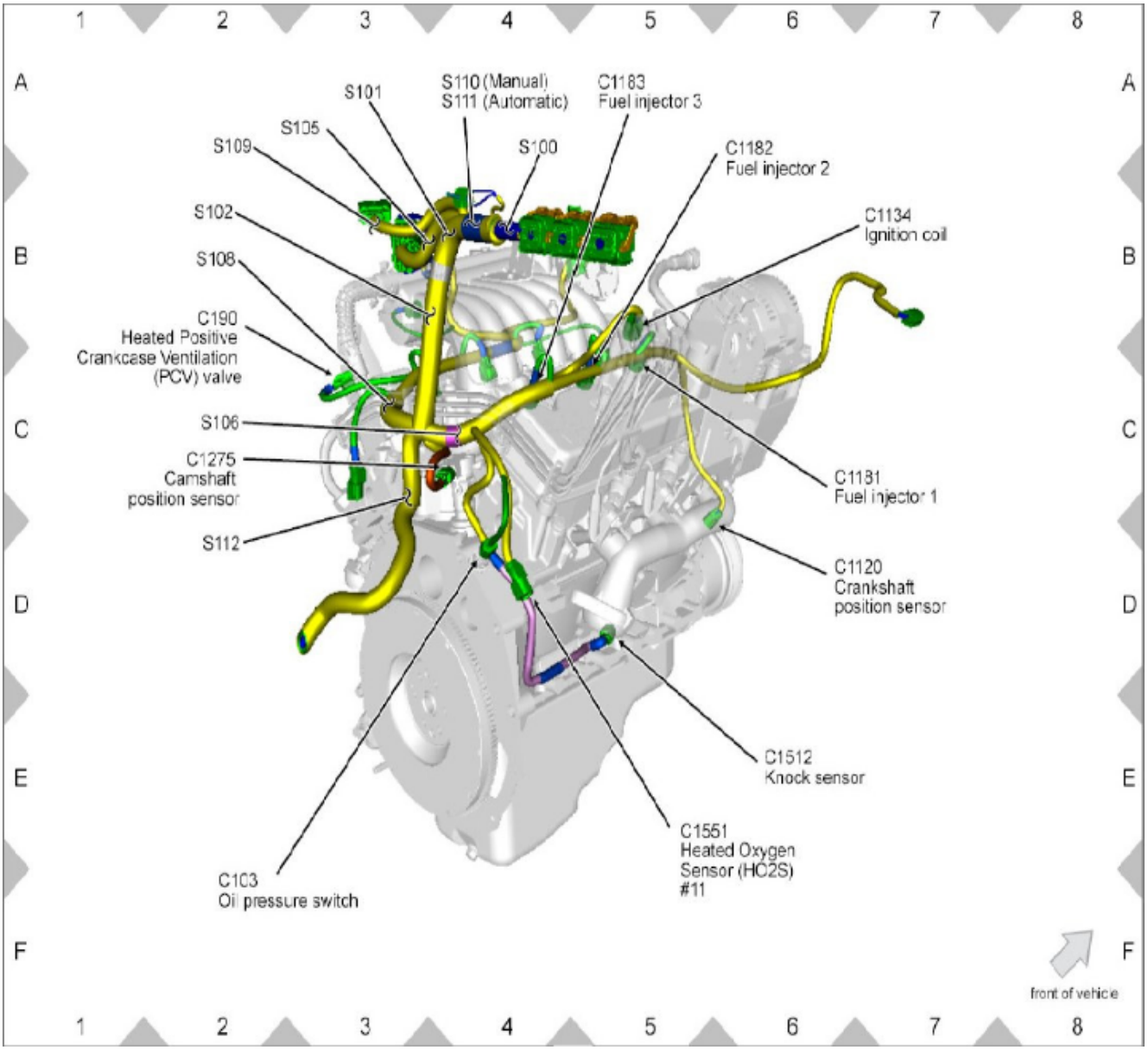
The MAF sensor uses a hot wire sensing element to measure the amount of air entering the engine. Air passing over the hot wire causes it to cool. This hot wire is maintained at 200°C (392°F) above the ambient temperature as measured by a constant cold wire. The current required to maintain the temperature of the hot wire is proportional to the mass air flow. The MAF sensor then outputs an analog voltage signal to the PCM proportional to the intake air mass. The PCM calculates the required fuel injector pulse width in order to provide the desired air/fuel ratio. This input is also used in determining transmission electronic pressure control (EPC), shift and torque converter clutch scheduling.

The MAF sensor is located between the air cleaner and the throttle body or inside the air cleaner assembly. Most MAF sensors have integrated bypass technology with an integrated intake air temperature (IAT) sensor. The hot wire electronic sensing element must be replaced as an assembly. Replacing only the element may change the air flow calibration.

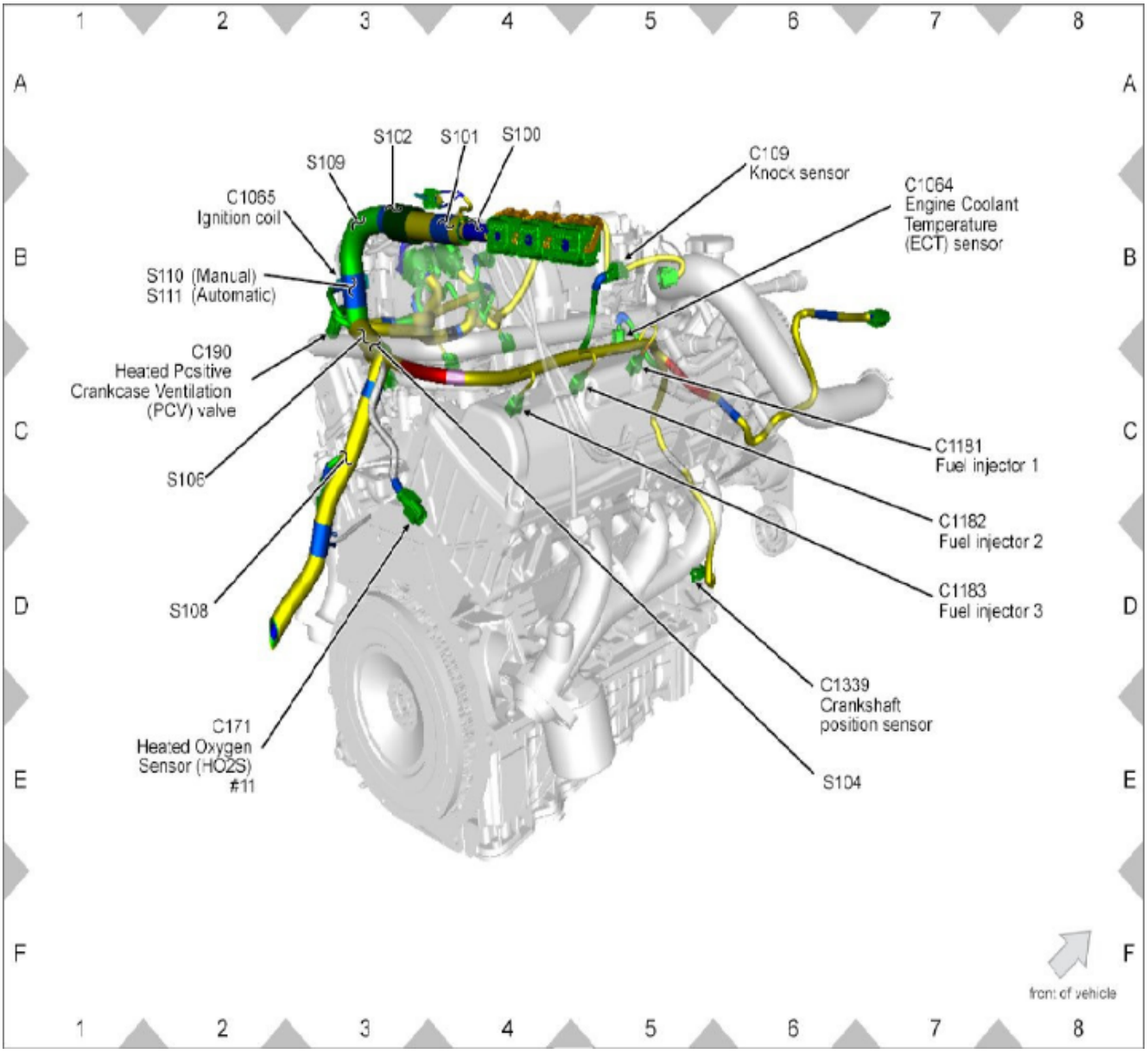


Knock Sensor: Locations

View 151-3


S101
S110 (Manual)
S111 (Automatic)
C1183
Fuel injector 3
S105
S109
S100
C1182
Fuel injector 2
S102
C1134
Ignition coil
S108
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
C1275
Camshaft
position sensor
S112
C1181
Fuel injector 1
C1120
Crankshaft
position sensor
C1512
Knock sensor
C1551
Heated Oxygen
Sensor (HO2S)
#11
C103
Oil pressure switch
front of vehicle

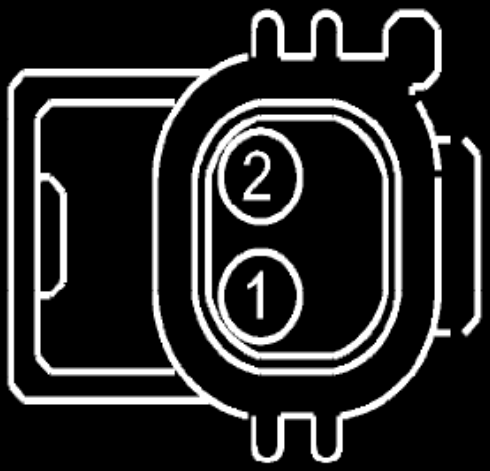
View 151-6


S102
S101
S100
S109
C109
Knock sensor
C1065
Ignition coil
C1064
Engine Coolant
Temperature
(ECT) sensor
S110 (Manual)
S111 (Automatic)
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
C1181
Fuel injector 1
C1182
Fuel injector 2
S108
C1183
Fuel injector 3
C1339
Crankshaft
position sensor
C171
Heated Oxygen
Sensor (HO2S)
#11
S104
front of vehicle

View 151-8

Connector: C108

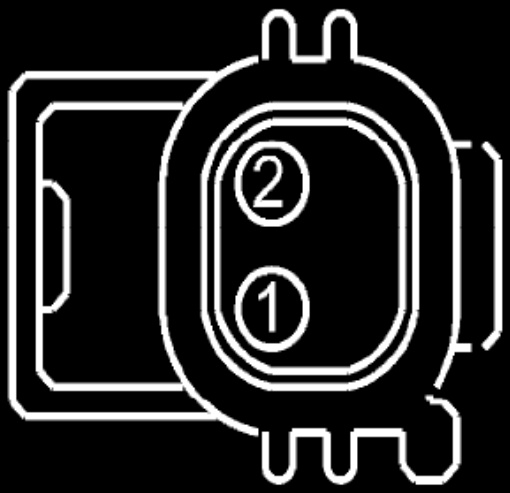
Description:	Harness:	Base Part #:
KNOCK SENSOR	12B637	12A699



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RE323 (WH-BN)	20	CTRL MOD. - POWERTRAIN # KNOCK SENSOR 1ST OR UNIQUE (KS1N) [KSL1-]	2.3L
2	VE801 (VT-OG)	20	SENSOR - KNOCK 1ST OR UNIQUE (KS1P) [KSL1+]	2.3L

Connector: C109

Description:	Harness:	Base Part #:
KNOCK SENSOR	12B637	12A699



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE801 (VT-OG)	20	SENSOR - KNOCK 1ST OR UNIQUE (KS1P) [KSL1+]	4.0L
2	RE323 (WH-BN)	20	CTRL MOD. - POWERTRAIN # KNOCK SENSOR 1ST OR UNIQUE (KS1N) [KSL1-]	4.0L

Knock Sensor: Diagrams

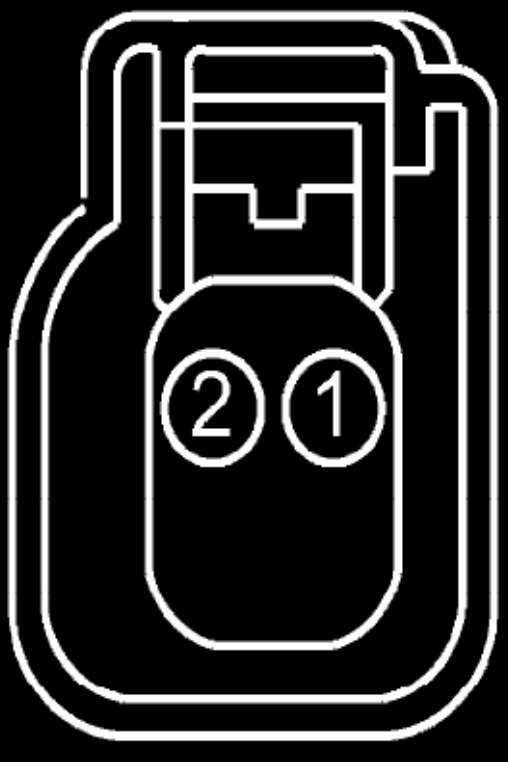
C108

C109

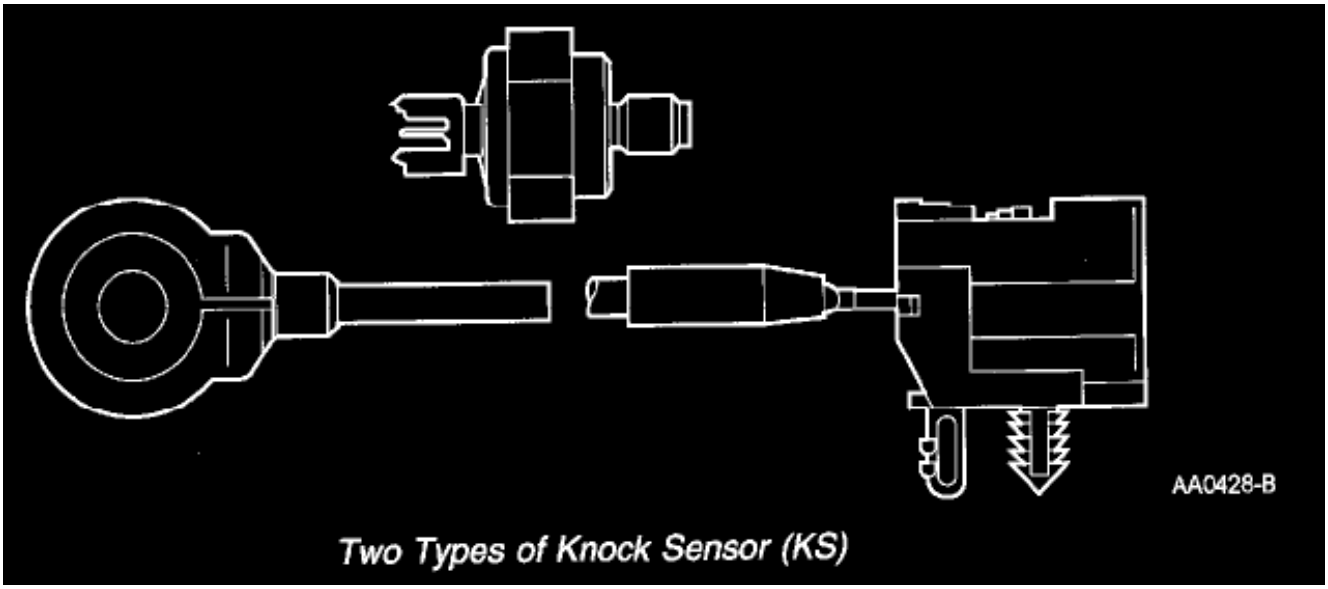
Connector: C1512

Description:	Harness:	Base Part #:
KNOCK SENSOR	12B637	12A699

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE801 (VT-OG)	20	SENSOR - KNOCK 1ST OR UNIQUE (KS1P) [KSL1+]	3.0L
2	RE323 (WH BN)	20	CTRL MOD. - POWERTRAIN # KNOCK SENSOR 1ST OR UNIQUE (KS1N) [KSL1-]	3.0L



C1512



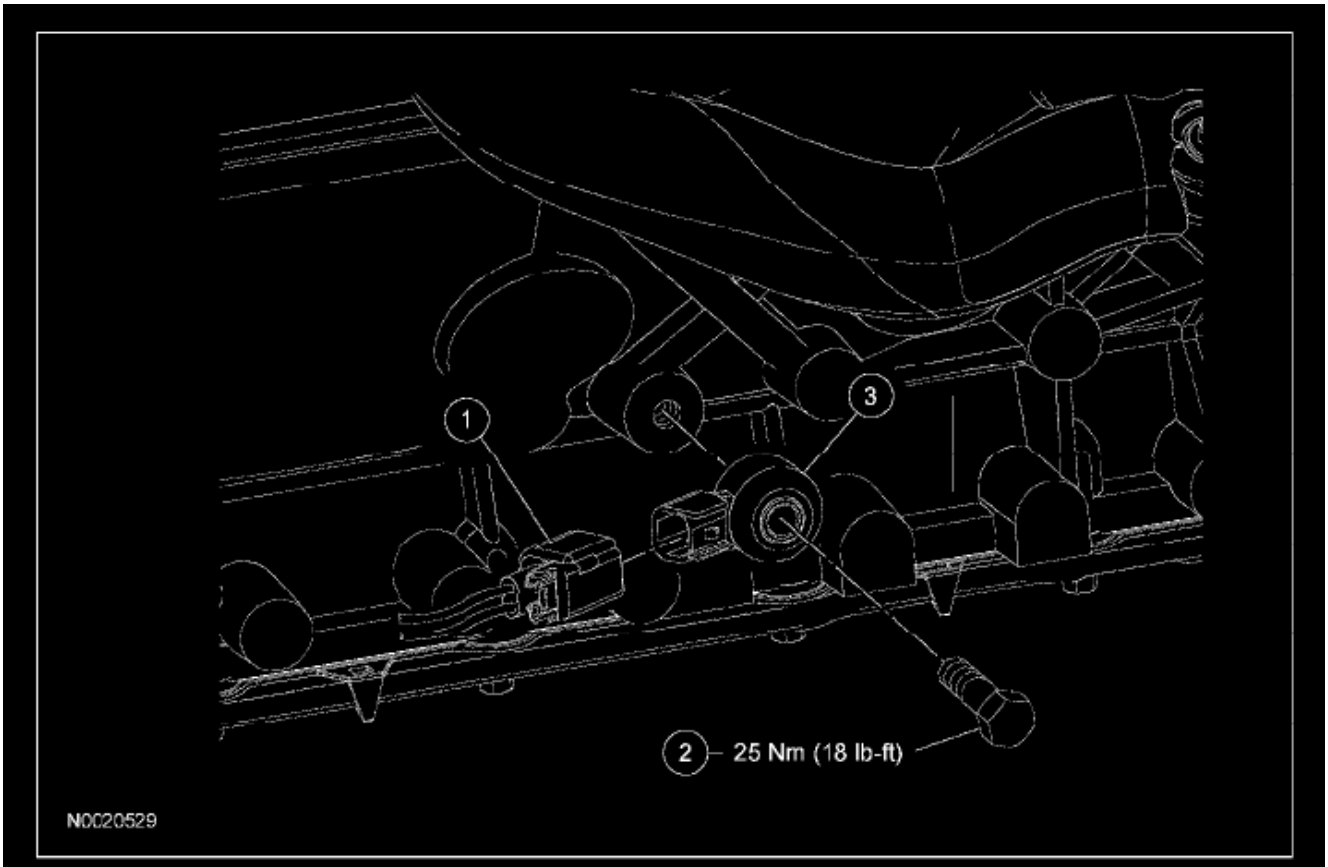
Two Types of Knock Sensor (KS)

Knock Sensor: Description and Operation

Knock Sensor (KS)

Two Types Of Knock Sensor (KS)

The KS is a tuned accelerometer on the engine which converts engine vibration to an electrical signal. The PCM uses this signal to determine the presence of engine knock and to retard spark timing.



Item	Part Number	Description
1	14A464	Knock sensor (KS) electrical connector (part of 12B637)
2	W5000225	KS bolt
3	12A699	KS

Knock Sensor: Service and Repair

KNOCK SENSOR (KS)

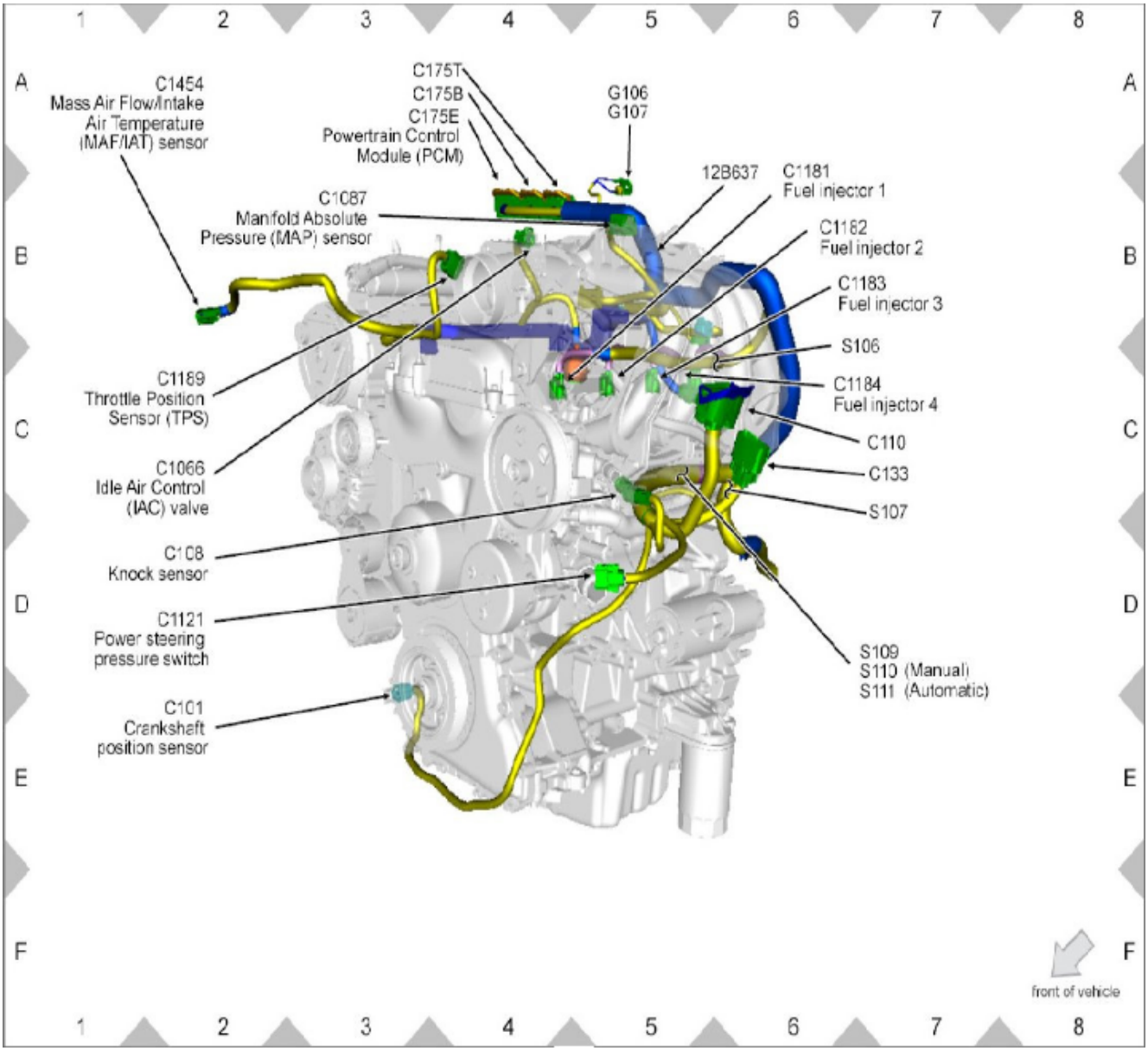
Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the knock sensor (KS) electrical connector. 3. Remove the bolt and the KS.

- To install, tighten to 25 Nm (18 lb-ft).

4. To install, reverse the removal procedure.

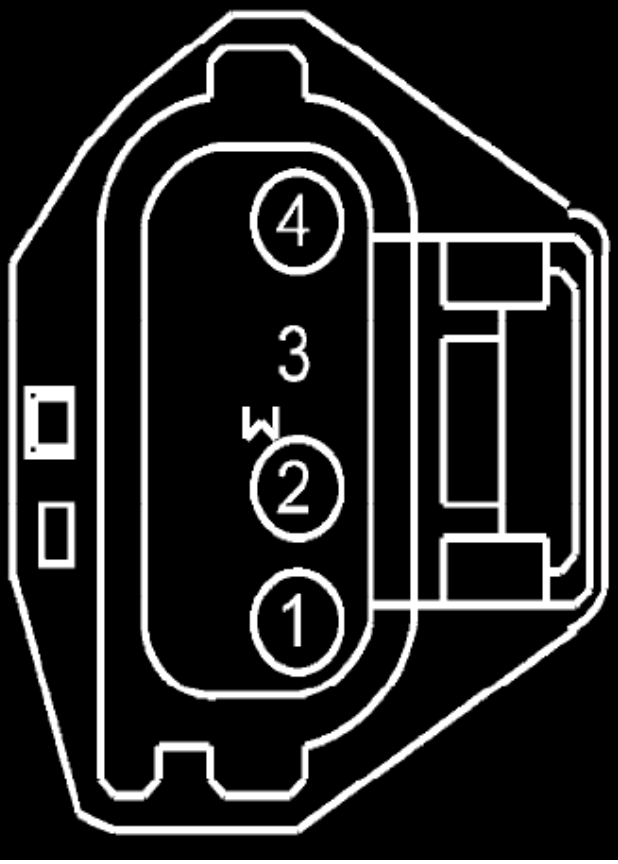
Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Powertrain Management > Computers and Control Systems > Sensors and Switches - Computers and Control Systems > Manifold Pressure/Vacuum Sensor > Component Information > Locations



View 151-3

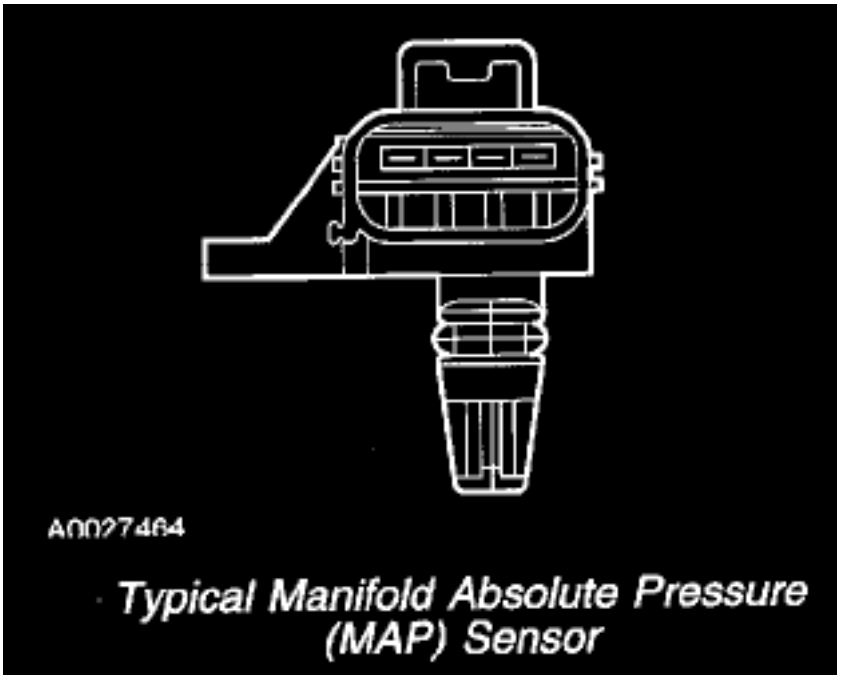
Connector: C1087

Description:	Harness:	Base Part #:
MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR	12B637	19F479



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE803 (BU-GN)	20	SENSOR - MANIFOLD ABSOLUTE PRESSURE (MAP)	2.3L
2	LE423 (GN-VT)	20	CTRL MOD. - POWERTRAIN # VOLTAGE REFERENCE ENGINE (VREF) (E-VREV)	2.3L
3	*	*	not used	
4	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN A)	2.3L

C1087

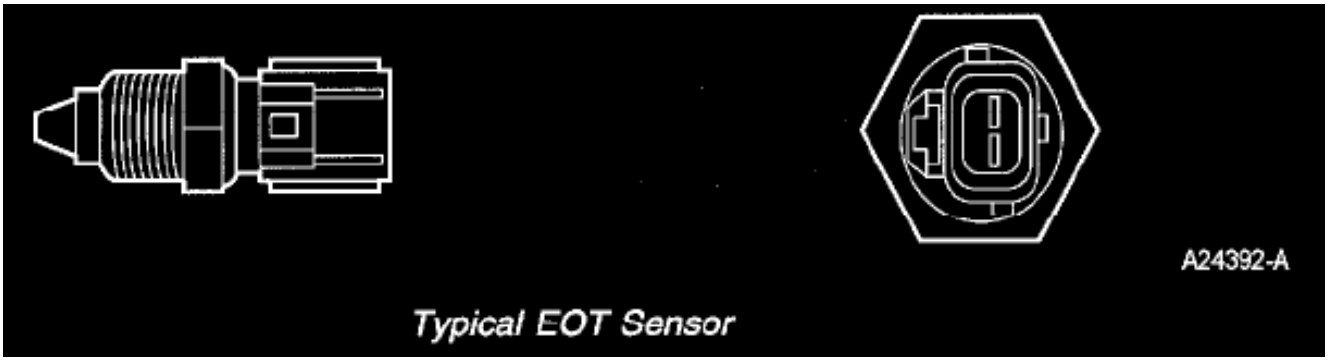


Manifold Pressure/Vacuum Sensor: Description and Operation

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR

Typical Manifold Absolute Pressure (MAP) Sensor

The MAP sensor measures intake manifold absolute pressure. The PCM uses information from the MAP sensor to measure how much exhaust gas is introduced into the intake manifold.



Typical EOT Sensor

Oil Temperature Sensor For ECM: Description and Operation

ENGINE OIL TEMPERATURE (EOT) SENSOR

Typical EOT Sensor

The EOT sensor is a thermistor device in which resistance changes with temperature. The electrical resistance of a thermistor decreases as the temperature increases and the resistance increases as the temperature decreases. The varying resistance changes the voltage drop across the sensor terminals and provides electrical signals to the PCM corresponding to temperature.

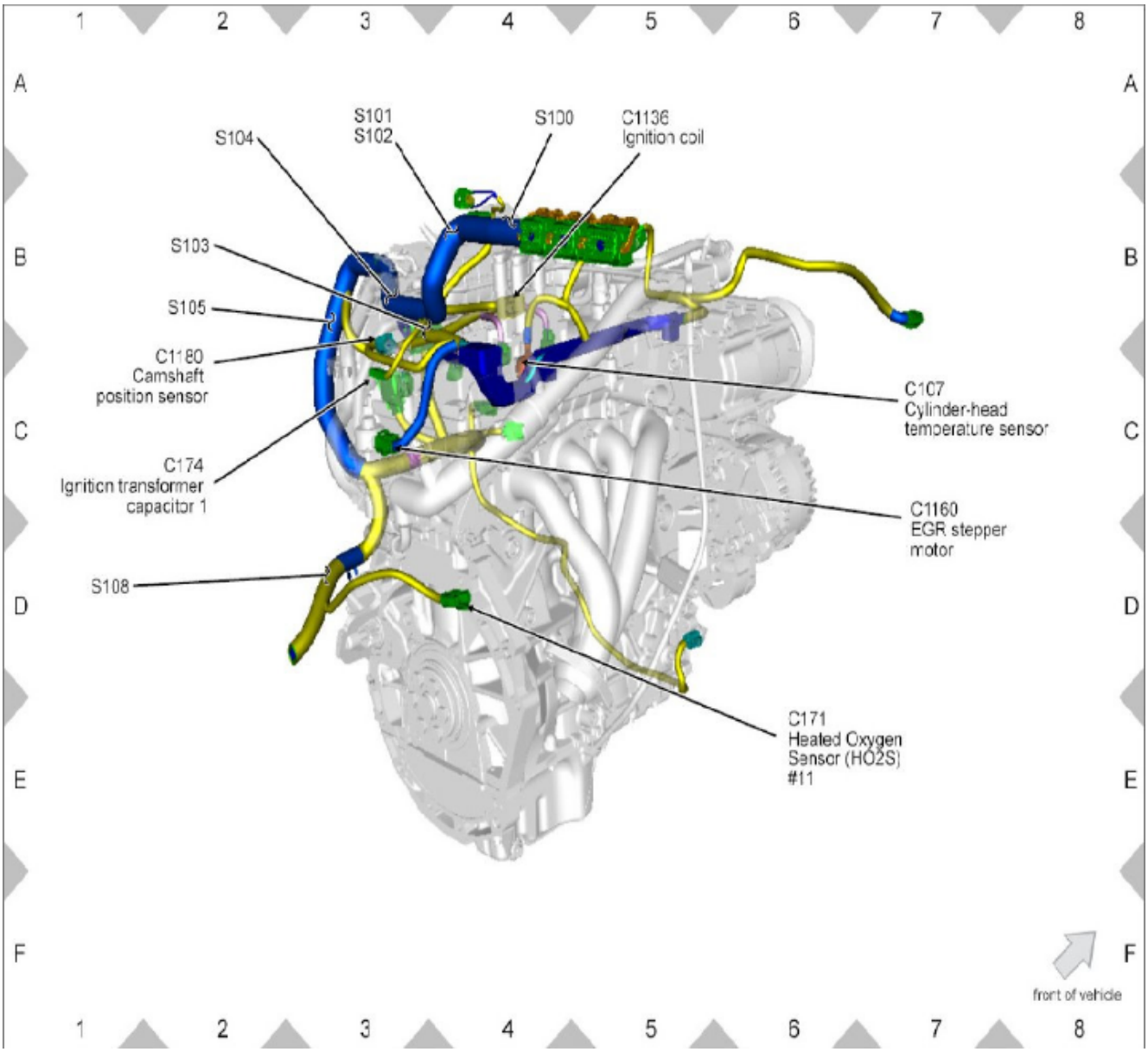
Thermistor-type sensors are considered passive sensors. A passive sensor is connected to a voltage divider network so that varying the resistance of the passive sensor causes a variation in total current flow. Voltage that is dropped across a fixed resistor in a series with the sensor resistor determines the voltage signal at the PCM. This voltage signal is equal to the reference voltage minus the voltage drop across the fixed resistor.

The EOT sensor measures the temperature of the engine oil. The sensor is typically threaded into the engine oil lubrication system. The PCM can use the EOT sensor input to determine the following:

- On variable camshaft timing (VCT) applications the EOT input is used to adjust the VCT control gains and logic for camshaft timing.

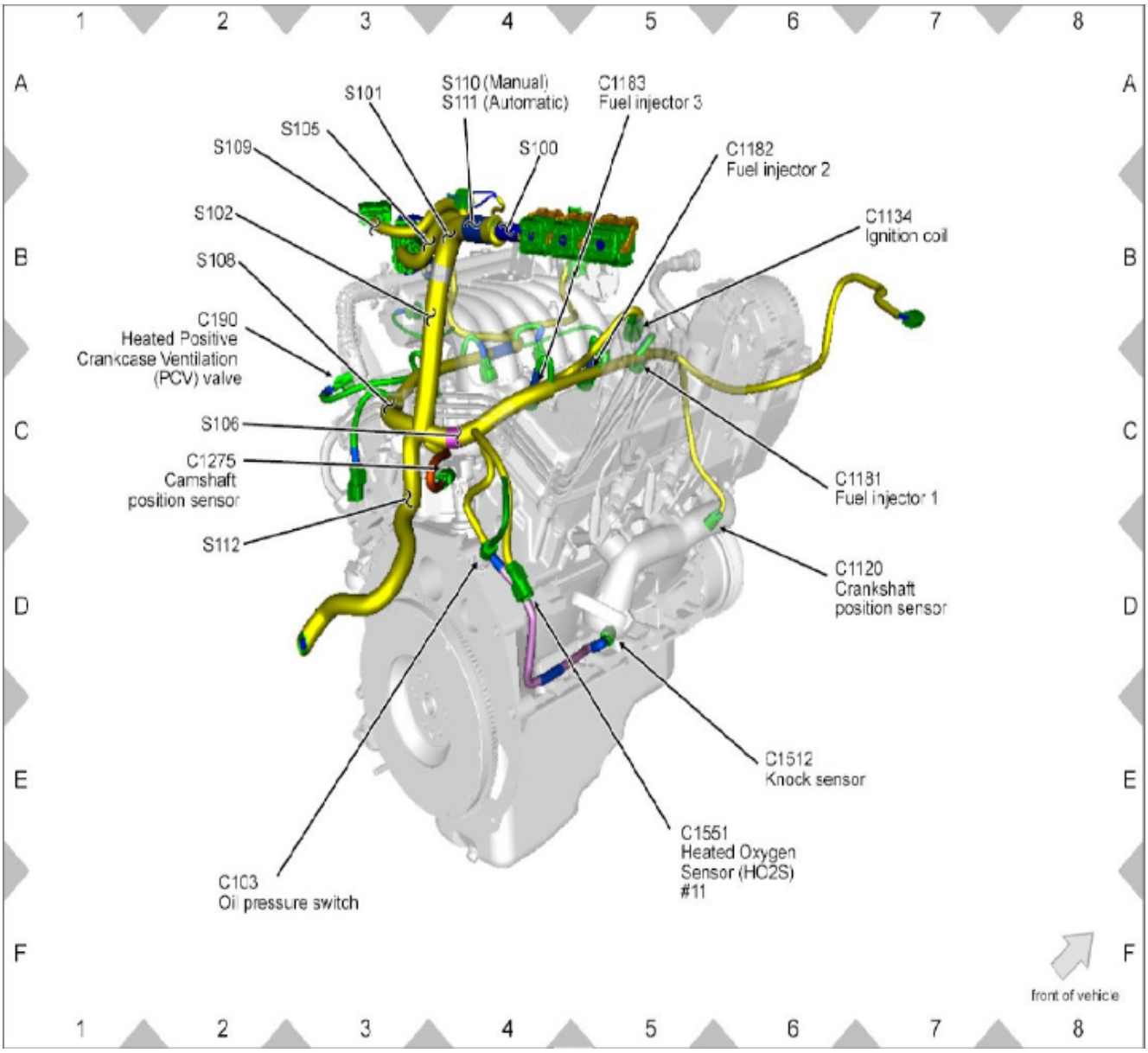
- The PCM can use EOT sensor input in conjunction with other PCM inputs to determine oil degradation.

- The PCM can use EOT sensor input to initiate a soft engine shutdown. To prevent engine damage from occurring as a result of high oil temperatures, the PCM has the ability to initiate a soft engine shutdown. Whenever engine RPM exceeds a calibrated level for a certain period of time, the PCM begins reducing power by disabling engine cylinders.

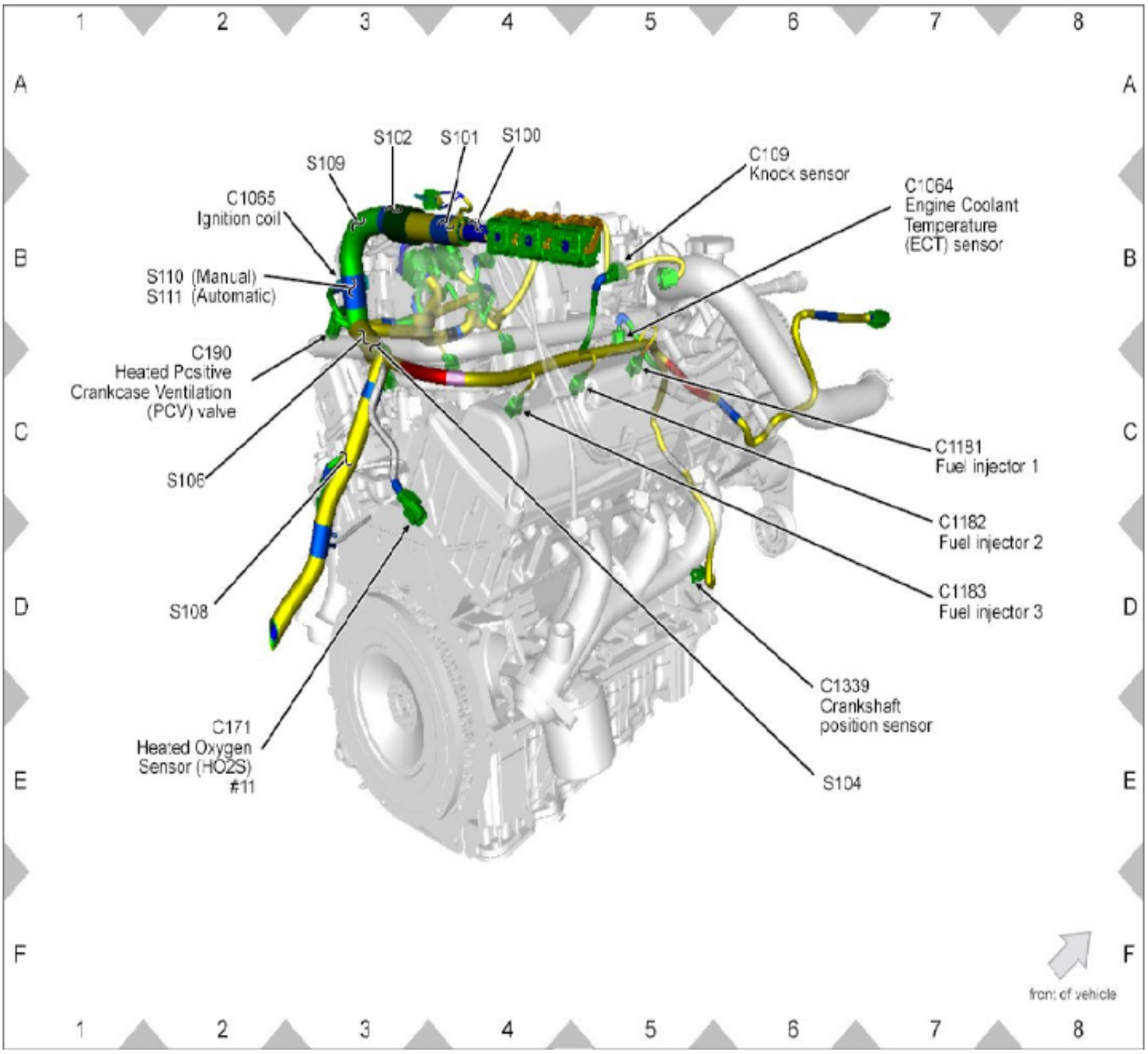


Oxygen Sensor: Locations Heated Oxygen Sensor (HO2S) #11

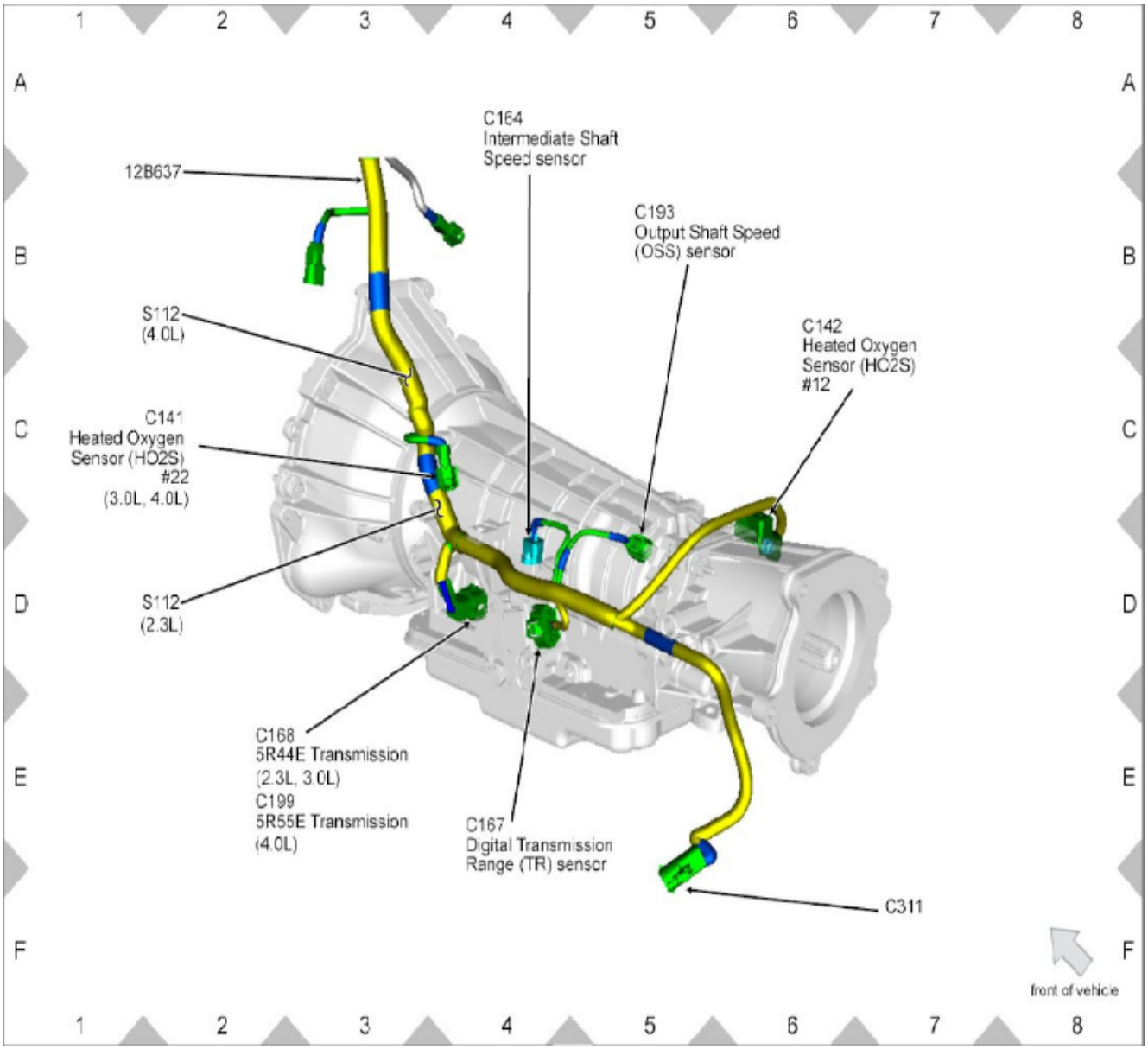
View 151-4


S101
S110 (Manual)
S111 (Automatic)
C1183
Fuel injector 3
S105
S109
S100
C1182
Fuel injector 2
S102
C1134
Ignition coil
S108
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
C1275
Camshaft
position sensor
S112
C1181
Fuel injector 1
C1120
Crankshaft
position sensor
C1512
Knock sensor
C1551
Heated Oxygen
Sensor (HO2S)
#11
C103
Oil pressure switch
front of vehicle

View 151-6

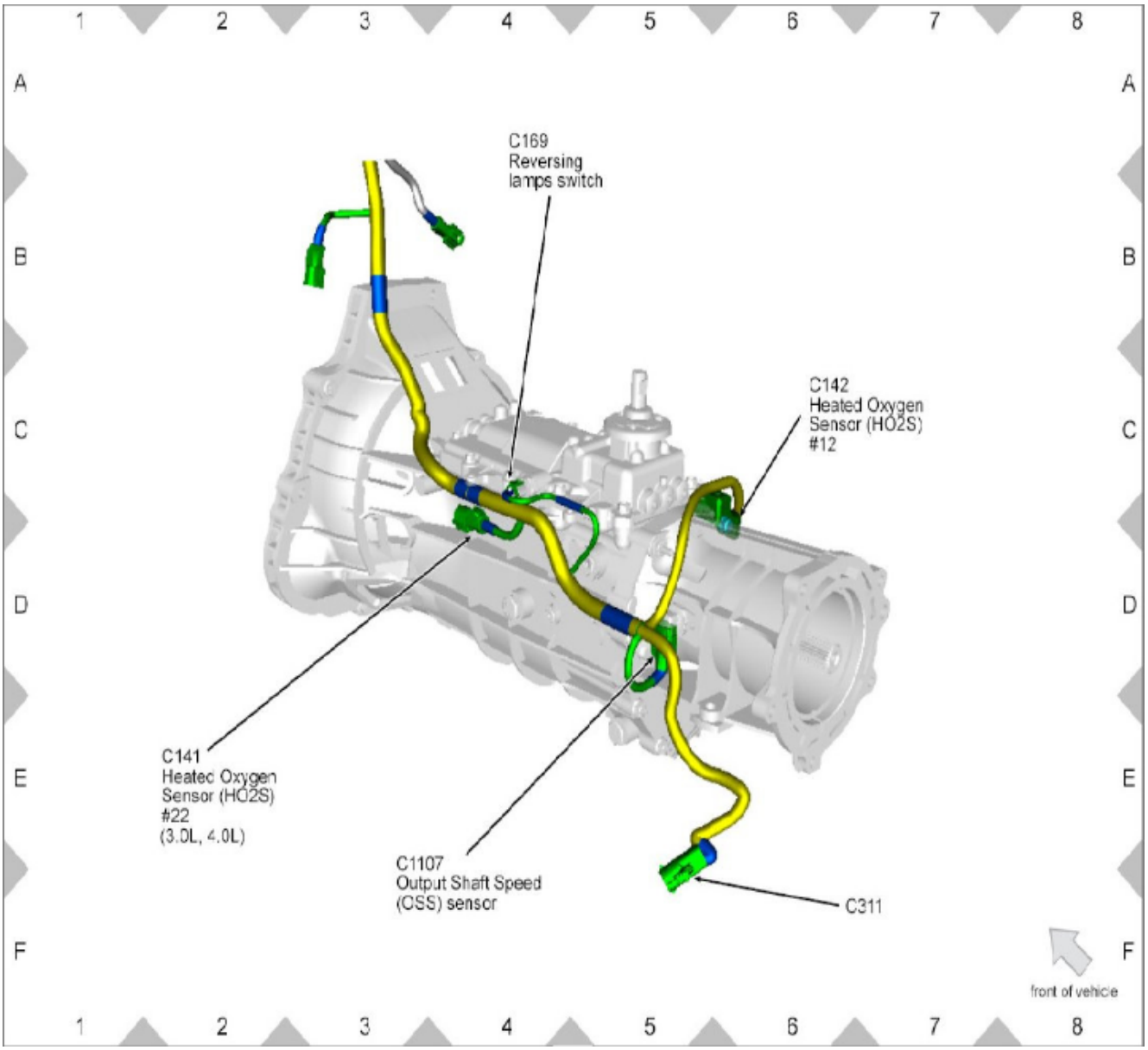

S102
S101
S100
S109
C109
Knock sensor
C1065
Ignition coil
C1064
Engine Coolant Temperature (ECT) sensor
S110 (Manual)
S111 (Automatic)
C190
Heated Positive Crankcase Ventilation (PCV) valve
C1181
Fuel injector 1
S106
C1182
Fuel injector 2
C1183
Fuel injector 3
S108
C1339
Crankshaft position sensor
C171
Heated Oxygen Sensor (HO2S) #11
S104
front of vehicle

View 151-8

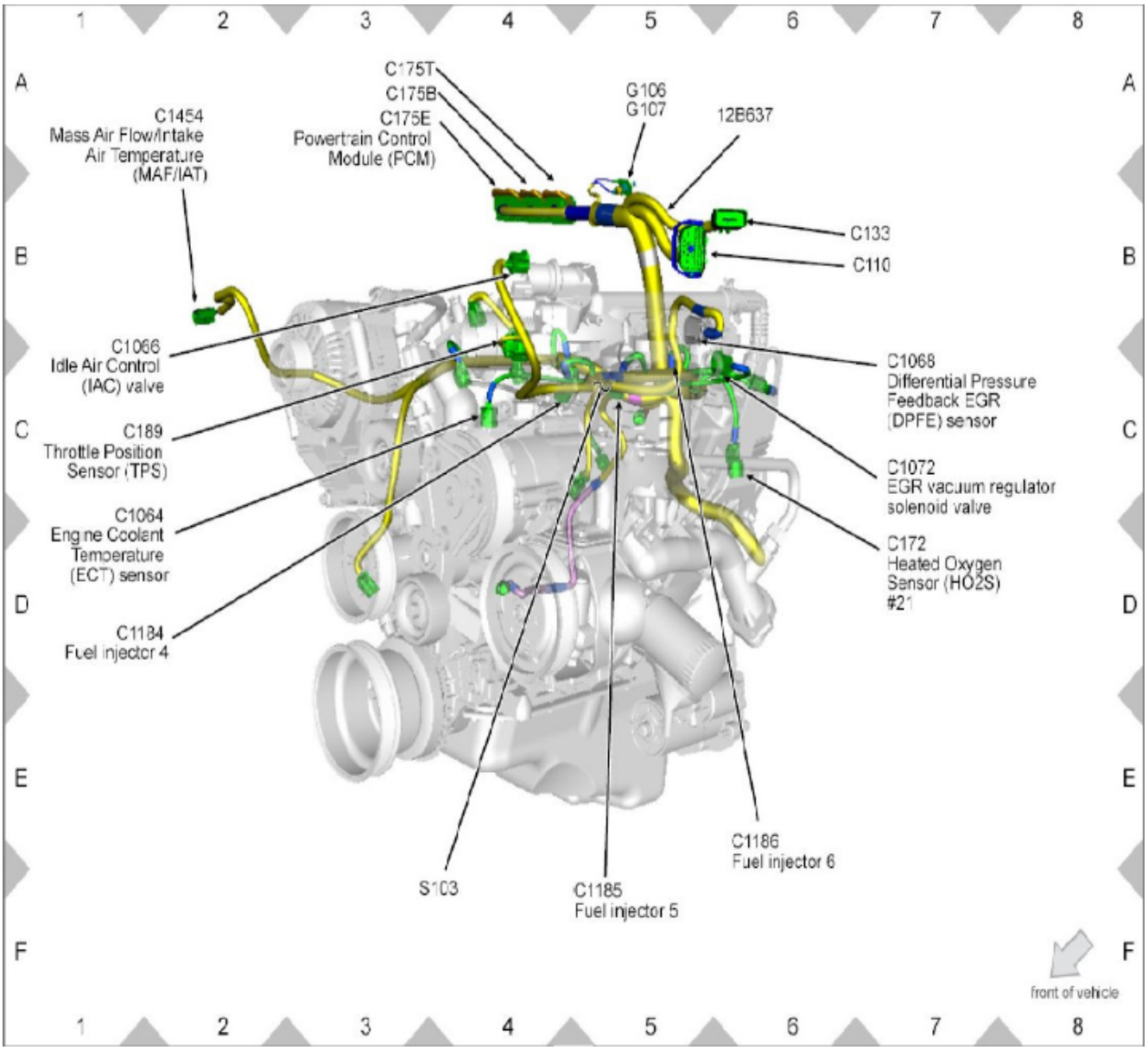


Oxygen Sensor: Locations Heated Oxygen Sensor (HO2S) #12

View 151-10

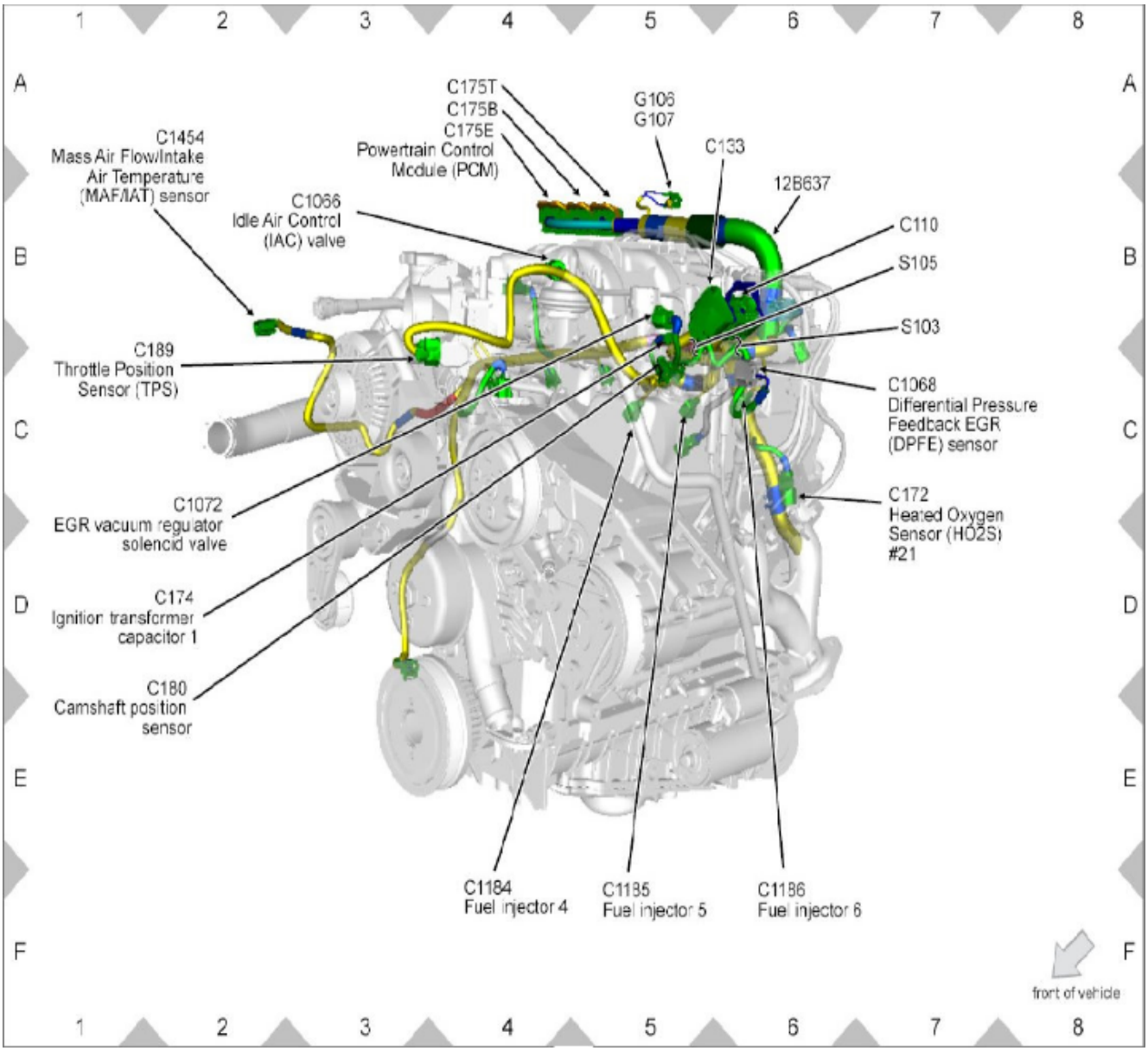

C169
Reversing lamps switch
C142
Heated Oxygen Sensor (HO2S) #12
C141
Heatec Oxygen Sensor (HO2S) #22
(3.0L, 4.0L)
C1107
Output Shaft Speed (OSS) sensor
C311
front of vehicle

View 151-9

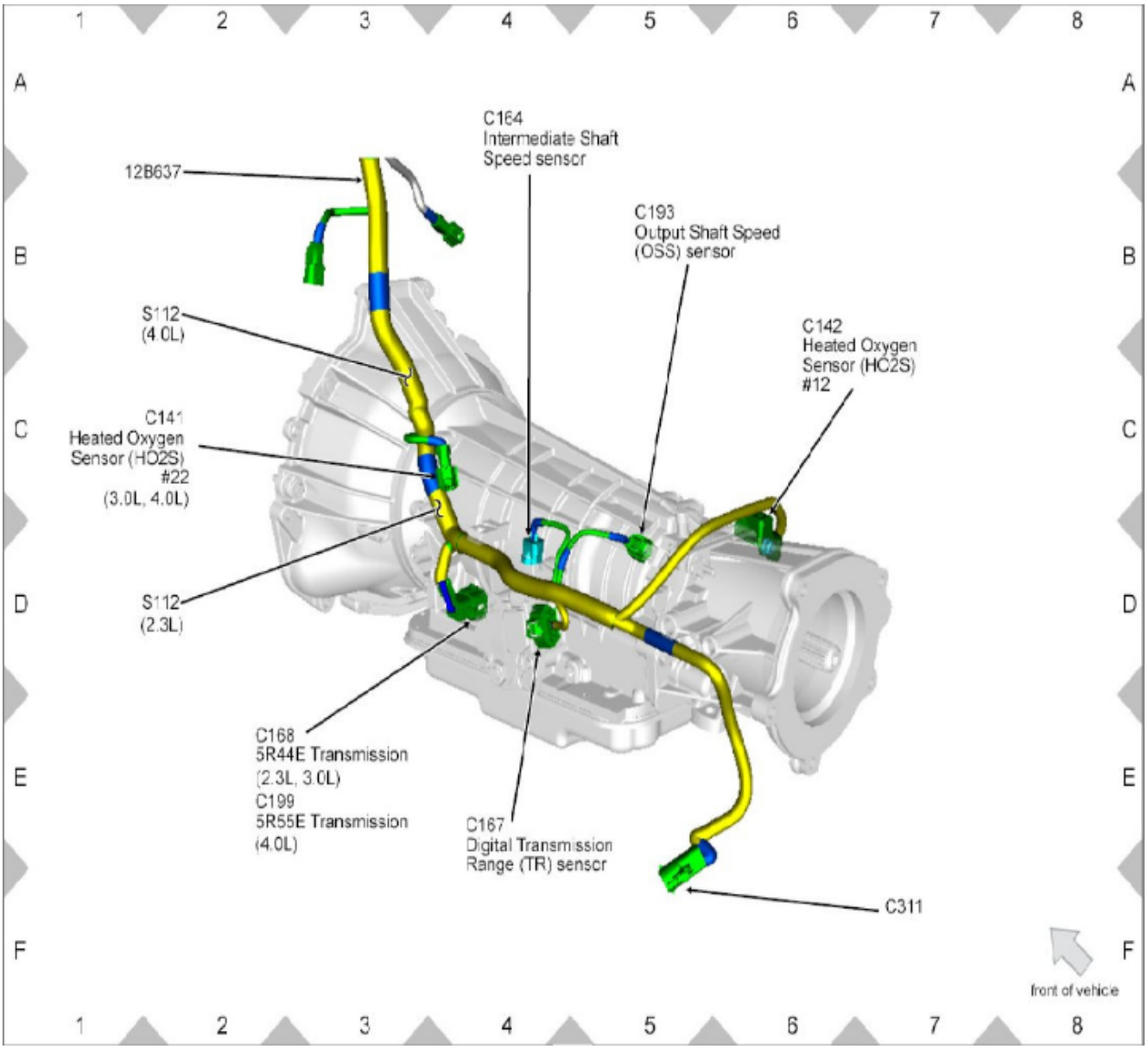


Oxygen Sensor: Locations Heated Oxygen Sensor (HO2S) #21

View 151-5

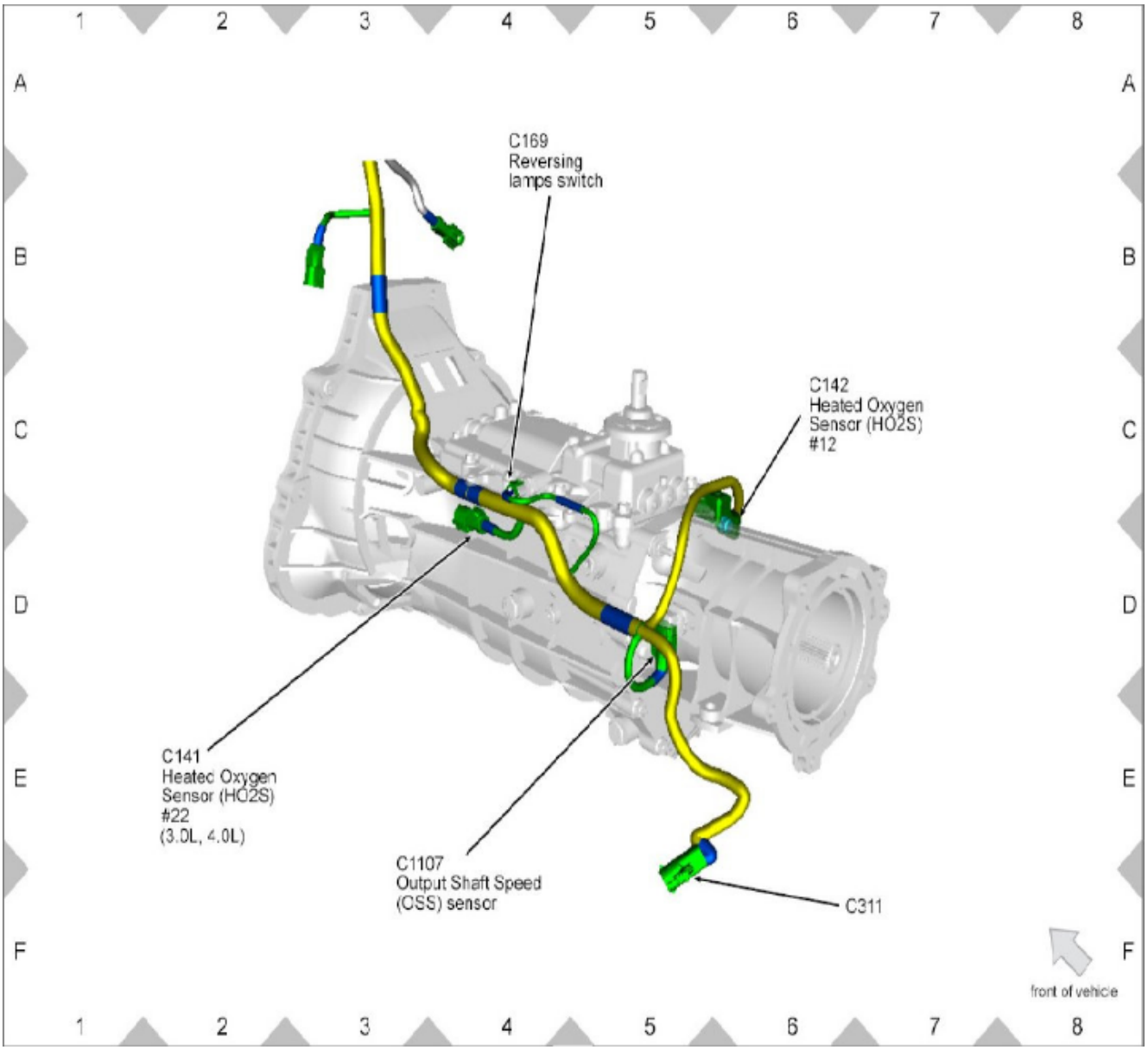

C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
C133
12B637
C110
S105
S103
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor
C1066
Idle Air Control (IAC) valve
C189
Throttle Position Sensor (TPS)
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
C174
Ignition transformer capacitor 1
C180
Camshaft position sensor
C1184
Fuel injector 4
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-7



Oxygen Sensor: Locations Heated Oxygen Sensor (HO2S) #22

View 151-10


C169
Reversing lamps switch
C142
Heated Oxygen Sensor (HO2S) #12
C141
Heatec Oxygen Sensor (HO2S) #22
(3.0L, 4.0L)
C1107
Output Shaft Speed (OSS) sensor
C311
front of vehicle

View 151-9

Connector: C141

Description:	Harness:	Base Part #:
HEATED OXYGEN SENSOR (HO2S) #22	12B637	9G444

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE234 (BU-WH)	18	CTRL MOD. - POWERTRAIN # HEATER OXYGEN SEN. POST CAT. 2ND (HTR22)	3.0L, 4.0L
2	CBB43 (GY)	18	FUSE - 43 OR CIRCUIT BREAKER	3.0L, 4.0L
3	VE733 (WH)	18	SENSOR - HEATED OXYGEN POST CAT. 2ND HO2S22)	3.0L, 4.0L
4	RE406 (GY-VT)	18	CTRL MOD. - POWERTRAIN # SIGNAL RETURN TRANSMISSION (T-SIGRTN) (SIGRTN-B)	3.0L, 4.0L

C141

Connector: C142

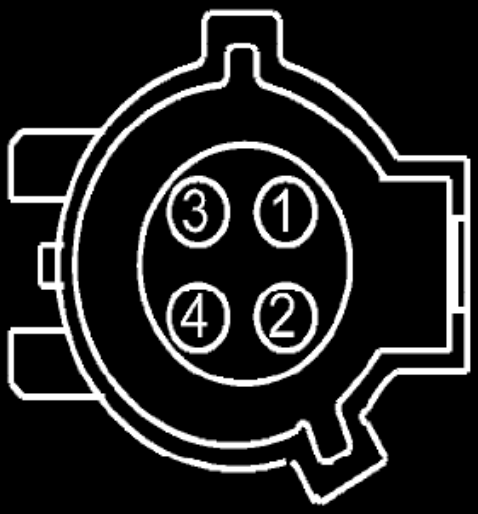
Description:	Harness:	Base Part #:
HEATED OXYGEN SENSOR (HO2S) #12	12B637	9G444

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE233 (WH-OG)	18	CTRL MOD. - POWERTRAIN # HEATER OXYGEN SEN. POST CAT. 1ST OR UNIQUE (HTR12)	
2	CBB43 (GY)	18	FUSE - 43 OR CIRCUIT BREAKER	
3	VE731 (YE-GN)	18	SENSOR - HEATED OXYGEN POST CAT. 1ST OR UNIQUE (HO2S12)	
4	RE406 (GY-VT)	18	CTRL MOD. - POWERTRAIN # SIGNAL RETURN TRANSMISSION (T-SIGRTN) (SIGRTN-B)	

C142

Connector: C171

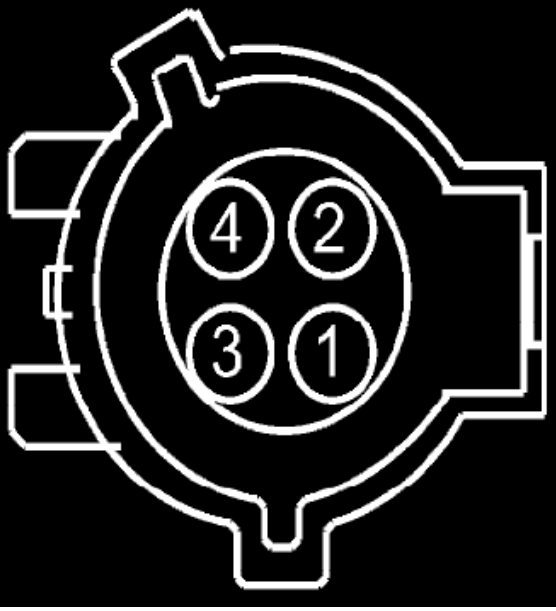
Description:	Harness:	Base Part #:
HEATED OXYGEN SENSOR (HO2S) #11	12B637	9F472



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE235 (GN-BN)	18	CTRL MOD. - POWERTRAIN # HEATER OXYGEN SEN. PRE CAT. 1ST OR UNIQUE (HTR11)	2.3L, 4.0L
2	CBB43 (GY)	18	FUSE - 43 OR CIRCUIT BREAKER	2.3L, 4.0L
3	VE735 (VT-GN)	18	SENSOR - HEATED OXYGEN PRE CAT. 1ST OR UNIQUE (HO2S11)	2.3L, 4.0L
4	RE405 (GN-WH)	18	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	2.3L, 4.0L

Connector: C1551

Description:	Harness:	Base Part #:
HEATED OXYGEN SENSOR (HO2S) #11	12B637	9F472



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBB43 (GY)	18	FUSE - 43 OR CIRCUIT BREAKER	3.0L
2	CE235 (GN-BN)	18	CTRL MOD. - POWERTRAIN # HEATER OXYGEN SEN. PRE CAT. 1ST OR UNIQUE (HTR11)	3.0L
3	RE405 (GN-WH)	18	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E SIGRTN) (SIGRTN-A)	3.0L
4	VE735 (VT-GN)	18	SENSOR - HEATED OXYGEN PRE CAT. 1ST OR UNIQUE (HO2S11)	3.0L

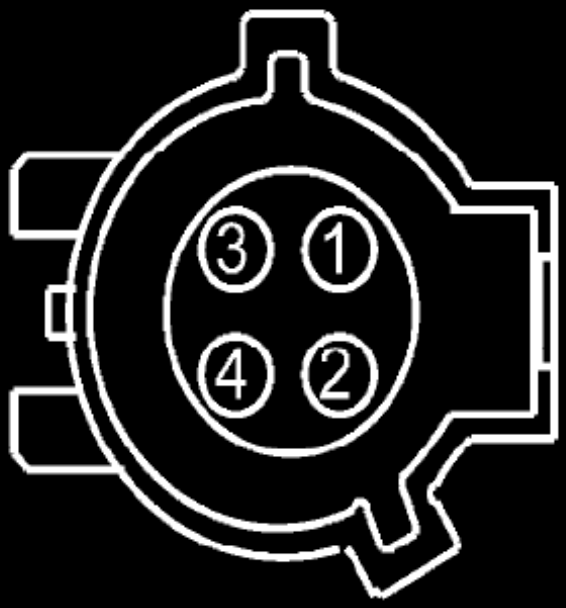
Oxygen Sensor: Diagrams Heated Oxygen Sensor (HO2S) #11

C171

C1551

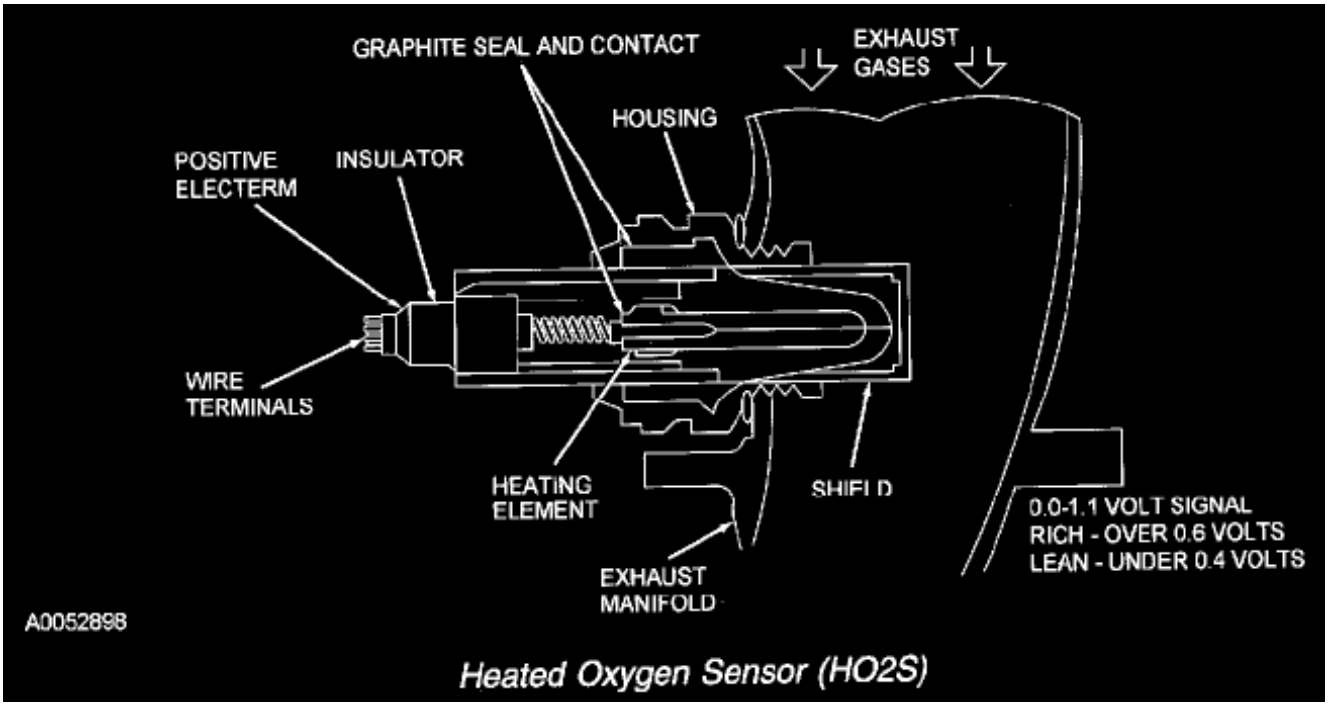
Connector: C172

Description:	Harness:	Base Part #:
HEATED OXYGEN SENSOR (HO2S) #21	12B637	9F472



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE236 (GY-VT)	18	CTRL MOD. - POWERTRAIN # HEATER OXYGEN SEN. PRE CAT. 2ND (HTR21)	3.0L, 4.0L
2	CBB43 (GY)	18	FUSE - 43 OR CIRCUIT BREAKER	3.0L, 4.0L
3	VE737 (WH-BU)	18	SENSOR - HEATED OXYGEN PRE CAT. 2ND (HO2S21)	3.0L, 4.0L
4	RE405 (GN-WH)	18	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	3.0L, 4.0L

C172



Heated Oxygen Sensor (HO2S)

Oxygen Sensor: Description and Operation

Heated Oxygen Sensor (HO2S)

Heated Oxygen Sensor (HO2S)

The HO2S detects the presence of oxygen in the exhaust and produces a variable voltage according to the amount of oxygen detected. A high concentration of oxygen (lean air/fuel ratio) in the exhaust produces a voltage signal less than 0.4 volt. A low concentration of oxygen (rich air/fuel ratio) produces a voltage signal greater than 0.6 volt. The HO2S provides feedback to the PCM indicating air/fuel ratio in order to achieve a near stoichiometric air/fuel ratio of 14.7:1 during closed loop engine operation. The HO2S generates a voltage between 0.0 and 1.1 volts.

Embedded with the sensing element is the HO2S heater. The heating element heats the sensor to a temperature of 800°C (1,472°F). At approximately 300°C (572°F) the engine can enter closed loop operation. The VPWR circuit supplies voltage to the heater. The PCM turns the heater on by providing the ground when the correct conditions occur. The heater allows the engine to enter closed loop operation sooner. The use of this heater requires the HO2S heater control to be duty cycled, to prevent damage to the heater.

Universal HO2S

The universal HO2S, sometimes referred to as a wideband oxygen sensor, uses the typical HO2S combined with a current controller in the PCM to infer an air/fuel ratio relative to the stoichiometric air/fuel ratio. This is accomplished by balancing the amount of oxygen ions pumped in or out of a measurement chamber within the sensor. The typical HO2S within the universal HO2S is used to detect the oxygen content of the exhaust gas in the measurement chamber. The oxygen content inside the measurement chamber is maintained at the stoichiometric air/fuel ratio by pumping oxygen ions in and out of the measurement chamber. As the exhaust gasses get richer or leaner, the amount of oxygen that must be pumped in or out to maintain a stoichiometric air/fuel ratio in the measurement chamber varies in proportion to the air/fuel ratio. The amount of current required to

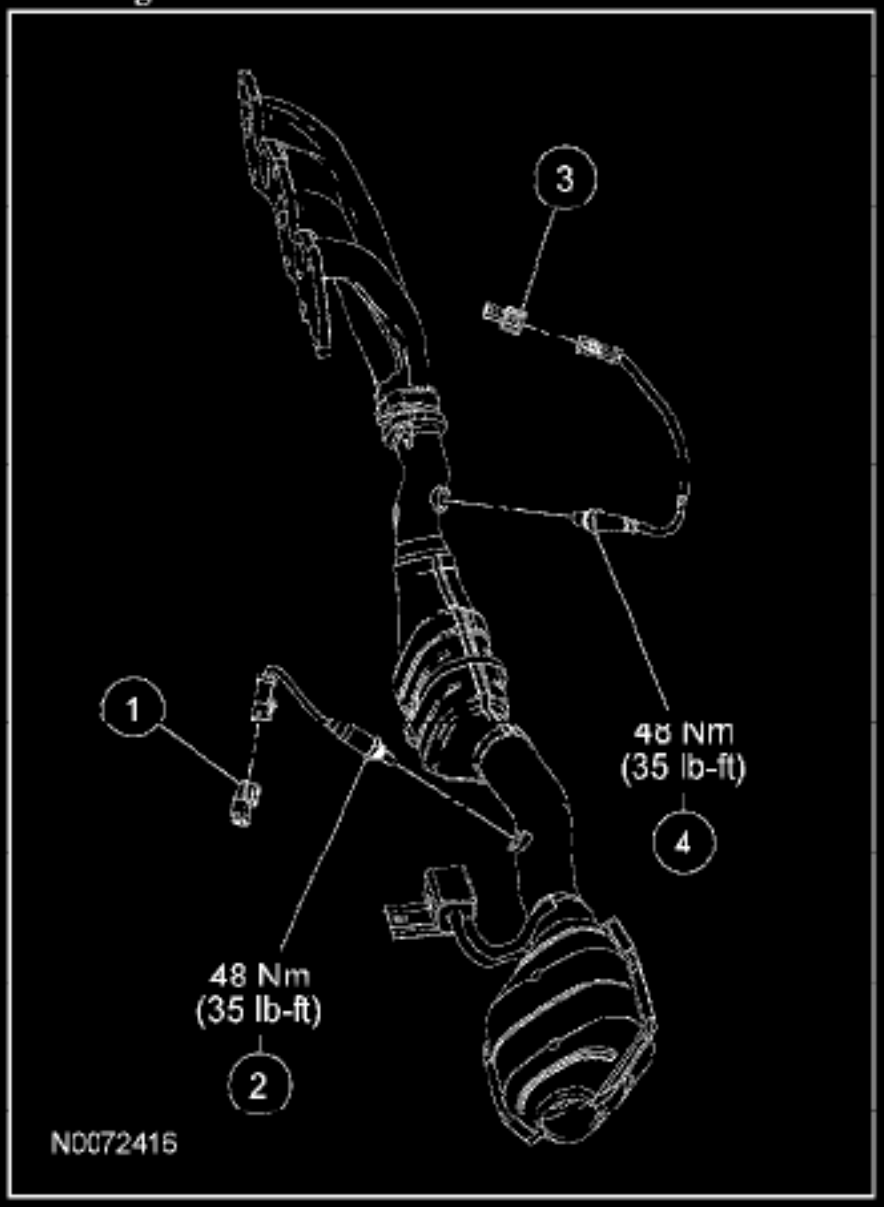
pump the oxygen ions in or out of the measurement chamber is used to measure the air/fuel ratio. The measured air/fuel ratio is actually the output from the current controller in the PCM and not a signal that comes directly from the sensor.

The universal HO2S also uses a self-contained reference chamber to make sure an oxygen differential is always present. The oxygen for the reference chamber is supplied by pumping small amounts of oxygen ions from the measurement chamber into the reference chamber. The universal HO2S does not need access to outside air.

Part to part variance is compensated for by placing a resistor in the connector. This resistor is used to trim the current measured by the current controller in the PCM.

Embedded with the sensing element is the universal H02S heater. The heater allows the engine to enter closed loop operation sooner. The heating element heats the sensor to a temperature of 780°C (1,436°F). The VPWR circuit supplies voltage to the heater. The PCM controls the heater on and off by providing the ground to maintain the sensor at the correct temperature for maximum accuracy.

2.3L Engines



Item	Part Number	Description
1	—	Catalyst monitor sensor electrical connector
2	9G444	Catalyst monitor sensor
3	—	Heated oxygen sensor (HO2S) electrical connector (part of 12B637)
4	9F472	HO2S

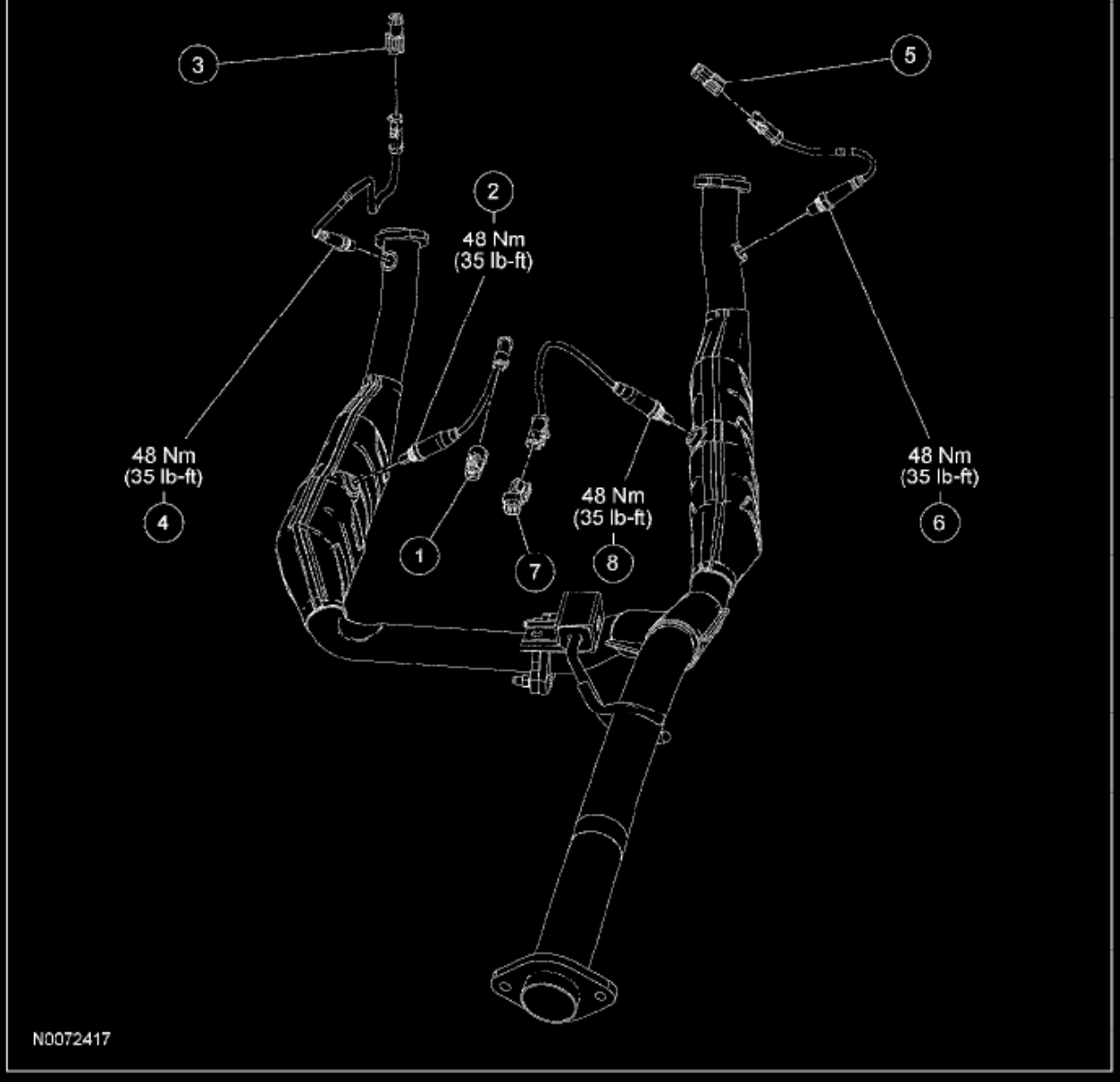
Oxygen Sensor: Service and Repair Heated Oxygen Sensor (HO2S)

HEATED OXYGEN SENSOR (HO2S)

Exploded View

2.3L Engines

3.0L Engines



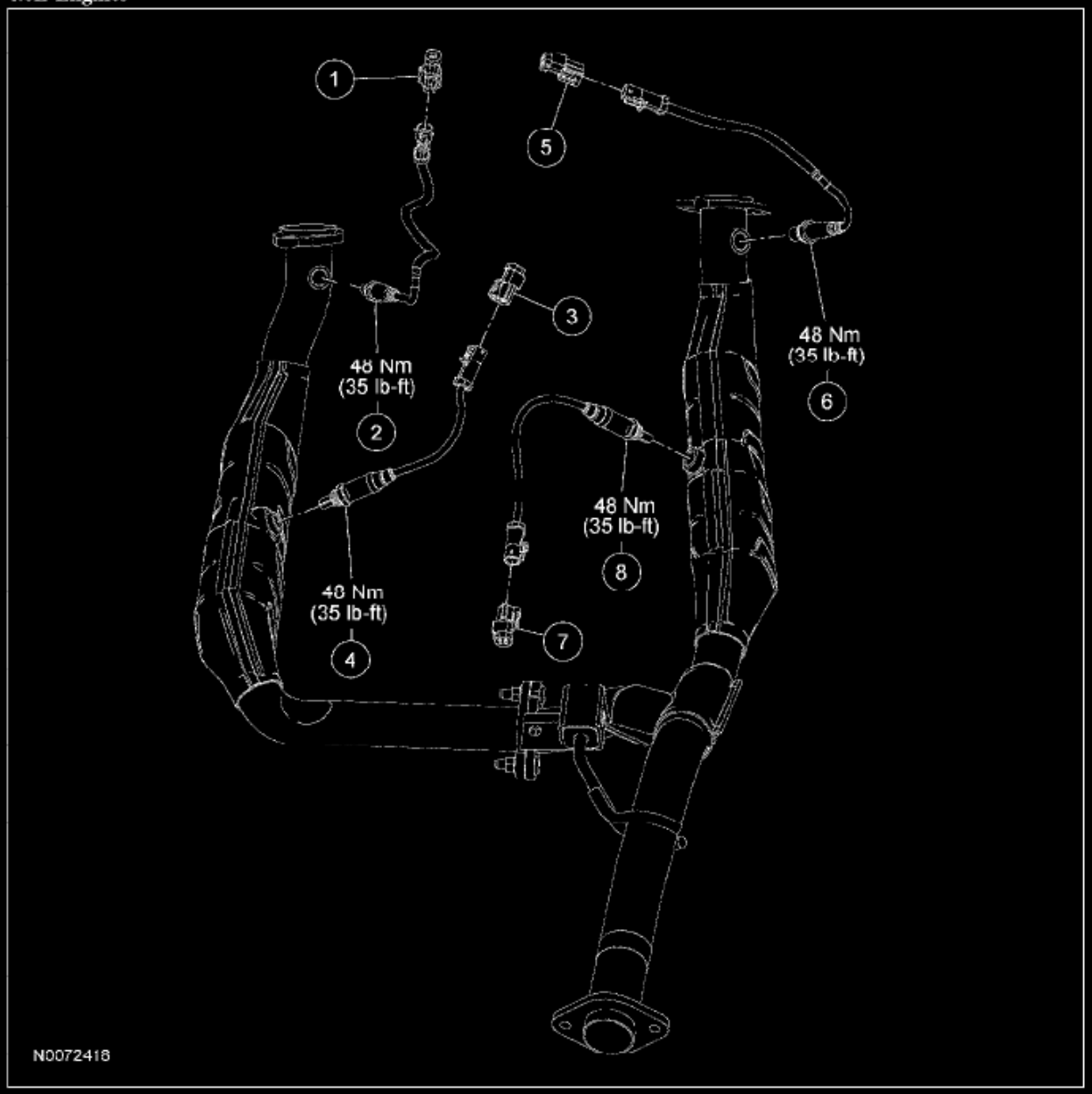
Item	Part Number	Description
1	—	Catalyst monitor sensor electrical connector (part of 14A464)
2	9G444	Catalyst monitor sensor
3	—	Heated oxygen sensor (HO2S) electrical connector (part of 12B637)
4	9F472	HO2S

(Continued)

Item	Part Number	Description
5	—	HO2S electrical connector (part of 12B637)
6	9F472	HO2S
7	—	Catalyst monitor sensor electrical connector (part of 14A464)
8	9G444	Catalyst monitor sensor

3.0L Engines

4.0L Engines



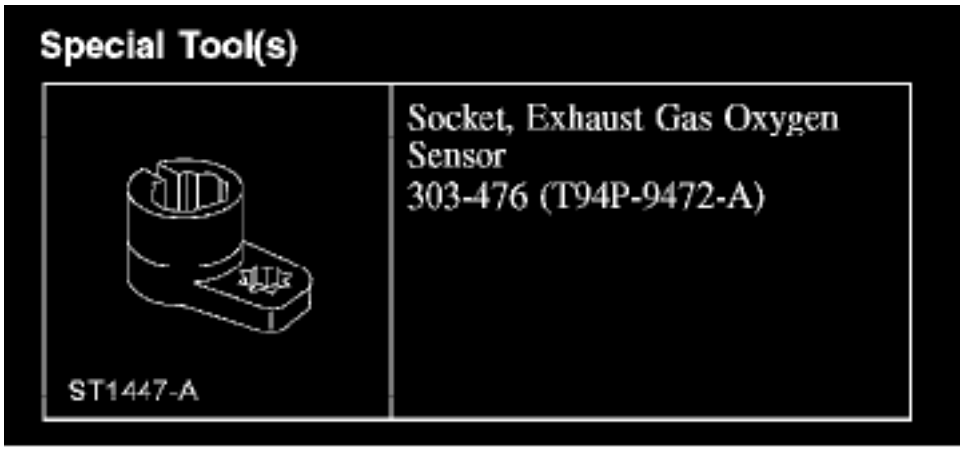
Item	Part Number	Description
1	—	Heated oxygen sensor (HO2S) electrical connector (part of 12B637)
2	9F472	HO2S
3	—	Catalyst monitor sensor electrical connector (part of 14A464)
4	9G444	Catalyst monitor sensor

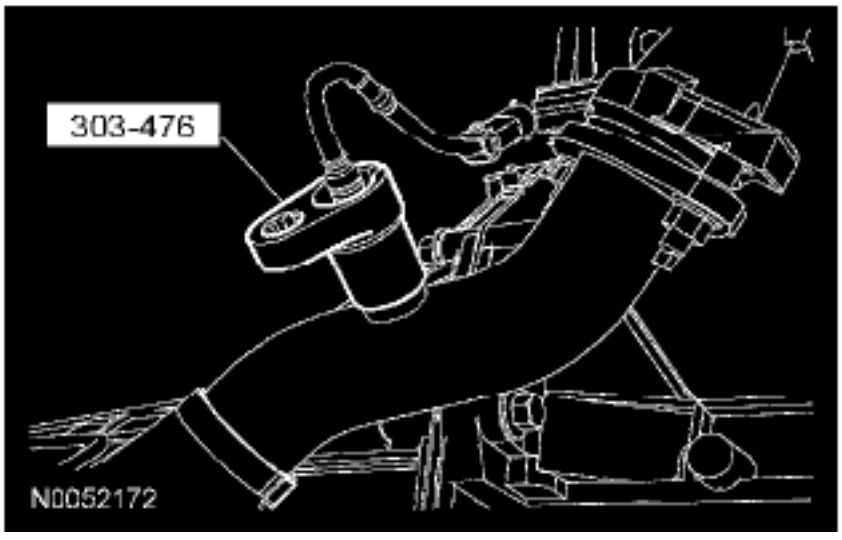
(Continued)

Item	Part Number	Description
5	—	HO2S electrical connector (part of 12B637)
6	9F472	HO2S
7	—	Catalyst monitor sensor electrical connector (part of 14A464)
8	9G444	Catalyst monitor sensor

4.0L Engines

Special Tool(s)





Special Tool(s)

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist.

2. NOTE: If necessary, lubricate the heated oxygen sensor (HO2S) with lock lubricant to assist in removal.

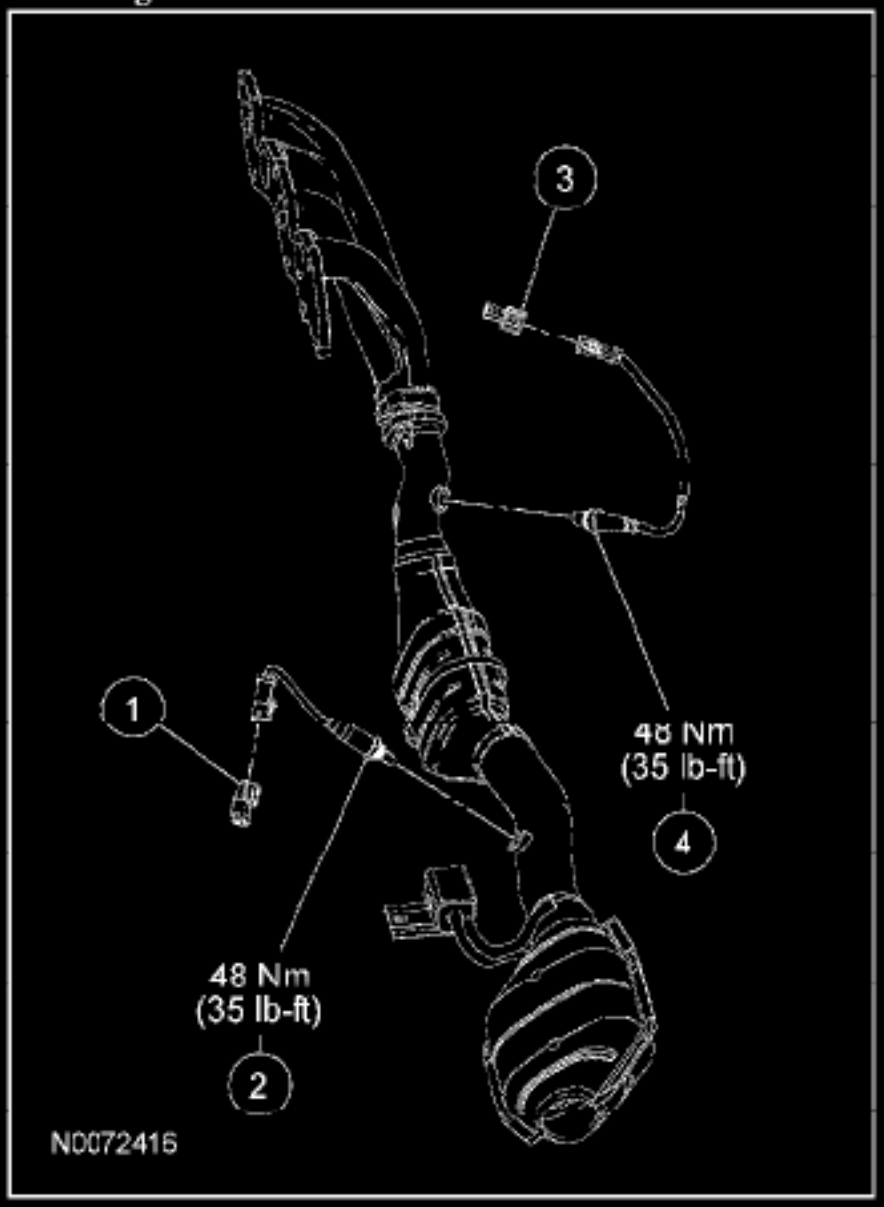
Using the special tool, remove the HO2S. -

To install, tighten to 48 Nm (35 lb-ft).

3. NOTE: Apply a light coat of anti-seize lubricant to the threads of the HO2S.

To install, reverse the removal procedure.

2.3L Engines



Item	Part Number	Description
1	—	Catalyst monitor sensor electrical connector
2	9G444	Catalyst monitor sensor
3	—	Heated oxygen sensor (HO2S) electrical connector (part of 12B637)
4	9F472	HO2S

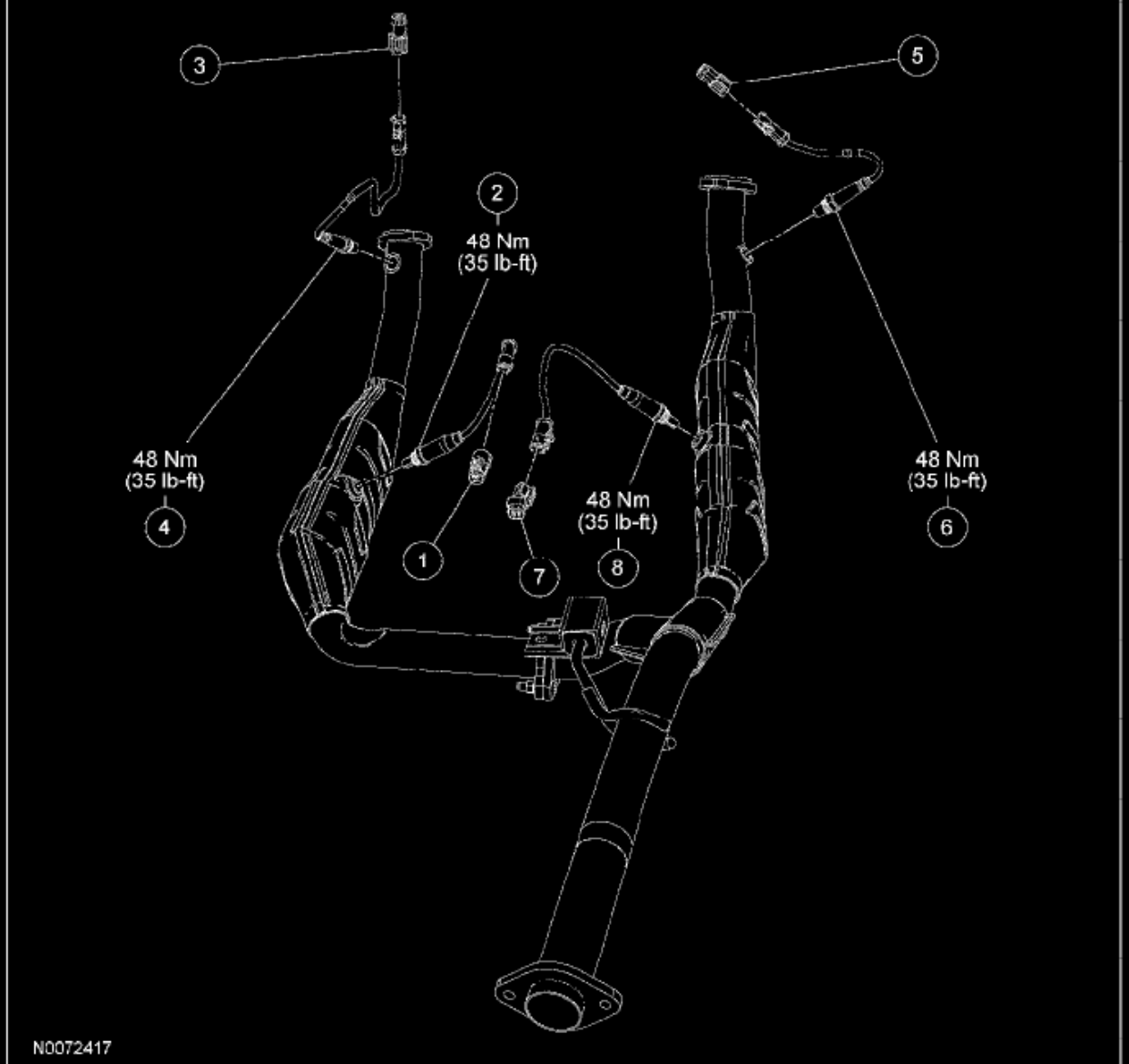
Oxygen Sensor: Service and Repair Catalyst Monitor Sensor

CATALYST MONITOR SENSOR

Exploded View

2.3L Engines

3.0L Engines



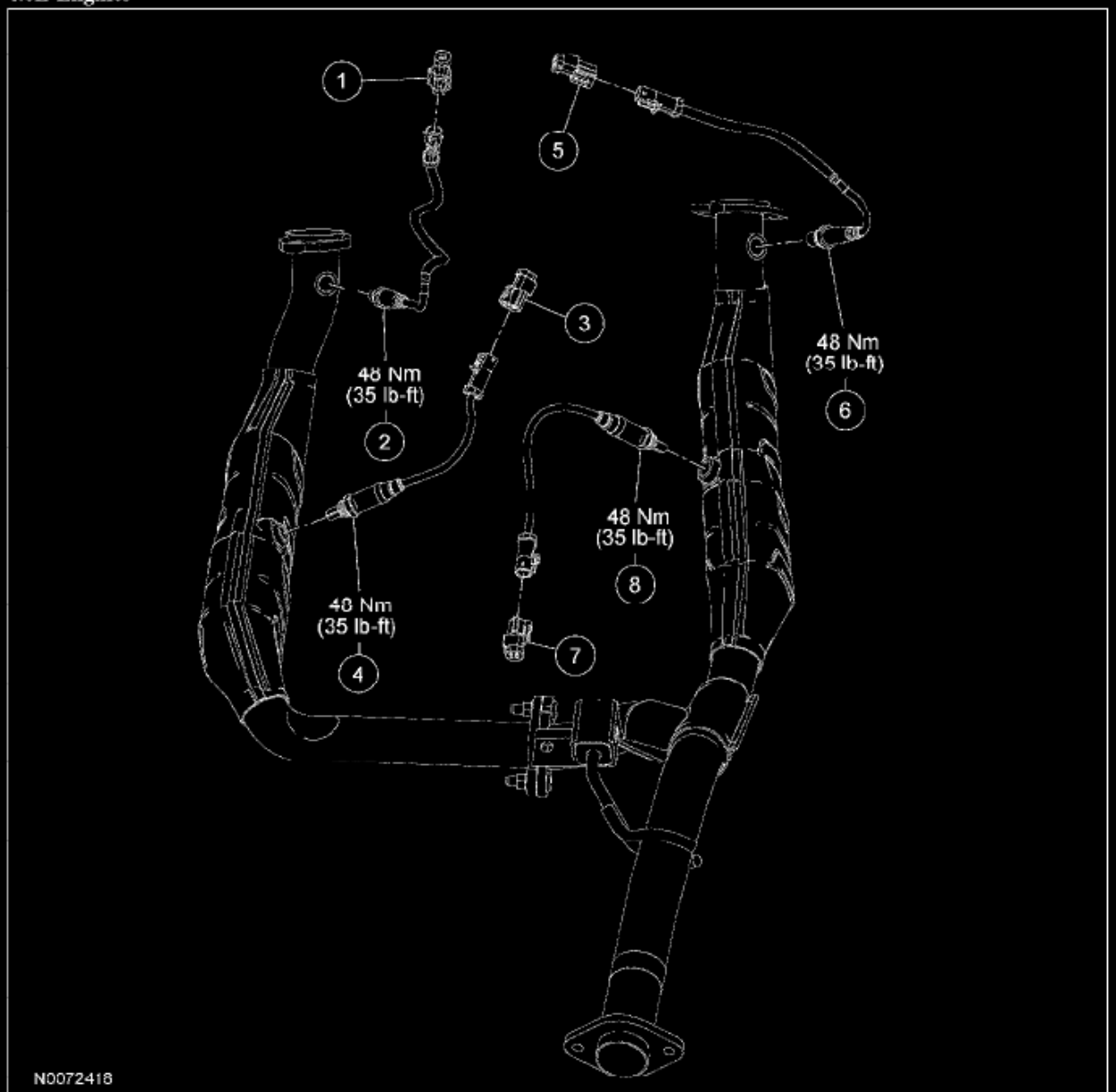
Item	Part Number	Description
1	—	Catalyst monitor sensor electrical connector (part of 14A464)
2	9G444	Catalyst monitor sensor
3	—	Heated oxygen sensor (HO2S) electrical connector (part of 12B637)
4	9F472	HO2S

(Continued)

Item	Part Number	Description
5	—	HO2S electrical connector (part of 12B637)
6	9F472	HO2S
7	—	Catalyst monitor sensor electrical connector (part of 14A464)
8	9G444	Catalyst monitor sensor

3.0L Engines

4.0L Engines



Item	Part Number	Description
1	—	Heated oxygen sensor (HO2S) electrical connector (part of 12B637)
2	9F472	HO2S
3	—	Catalyst monitor sensor electrical connector (part of 14A464)
4	9G444	Catalyst monitor sensor

(Continued)

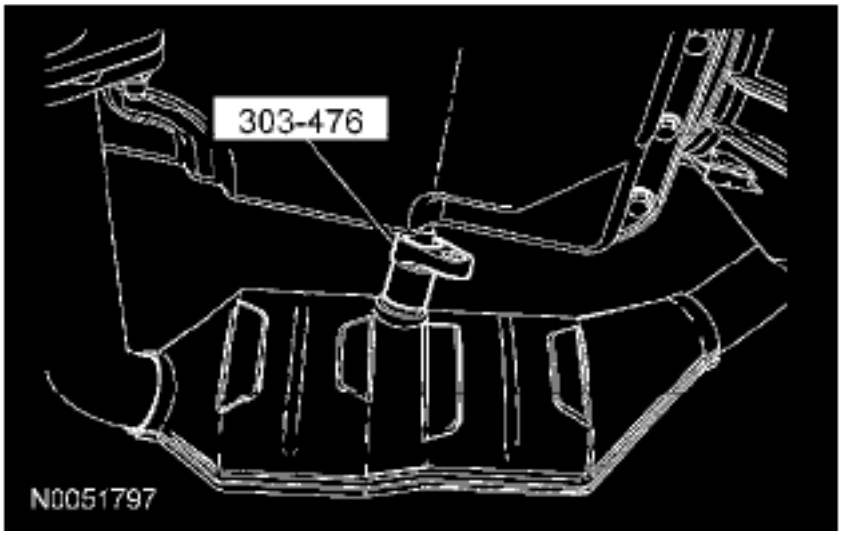
Item	Part Number	Description
5	—	HO2S electrical connector (part of 12B637)
6	9F472	HO2S
7	—	Catalyst monitor sensor electrical connector (part of 14A464)
8	9G444	Catalyst monitor sensor

4.0L Engines

Special Tool(s)

Special Tool(s)

ST1447-A	Socket, Exhaust Gas Oxygen Sensor 303-476 (T94P-9472-A)



Special Tool(s)

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the catalyst monitor sensor electrical connector.

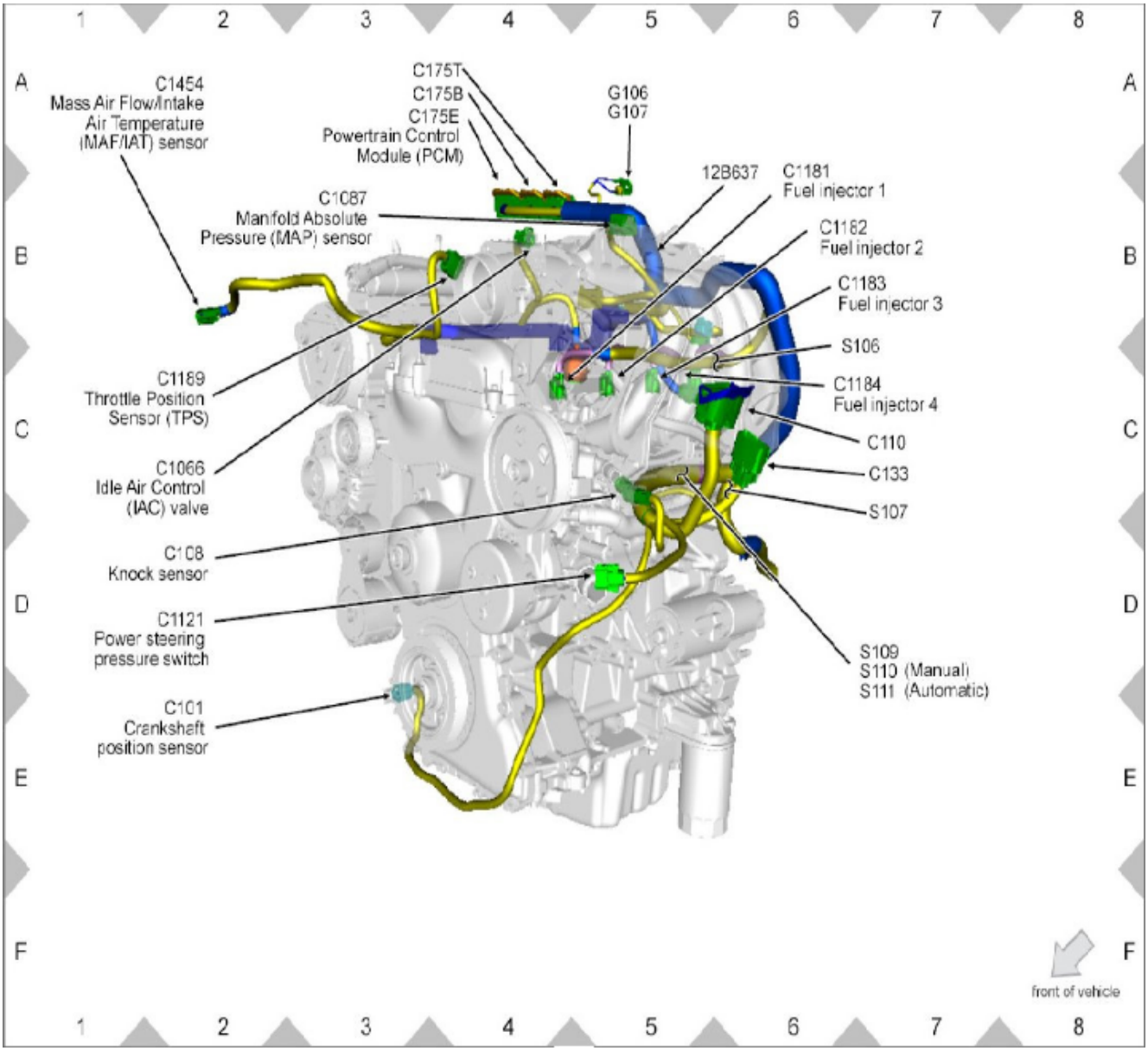
3. NOTE: If necessary, lubricate the catalyst monitor sensor with lock lubricant to assist in removal.

Using the special tool, remove the catalyst monitor sensor. -

To install, tighten to 48 Nm (35 lb-ft).

4. NOTE: Apply a light coat of anti-seize lubricant to the threads of the catalyst monitor sensor.

To install, reverse the removal procedure.

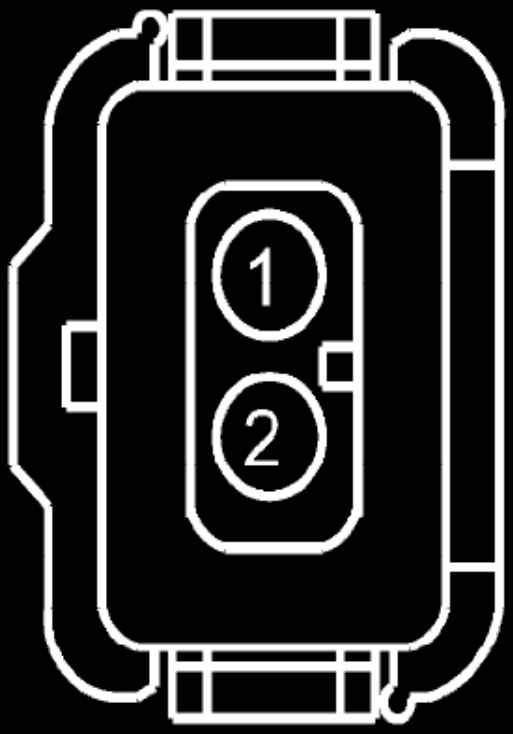

C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor
C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
12B637
C1181
Fuel injector 1
C1087
Manifold Absolute Pressure (MAP) sensor
C1182
Fuel injector 2
C1183
Fuel injector 3
S106
C1189
Throttle Position Sensor (TPS)
C1184
Fuel injector 4
C110
C1066
Idle Air Control (IAC) valve
C133
S107
C108
Knock sensor
C1121
Power steering pressure switch
S109
S110 (Manual)
S111 (Automatic)
C101
Crankshaft position sensor
front of vehicle

View 151-3

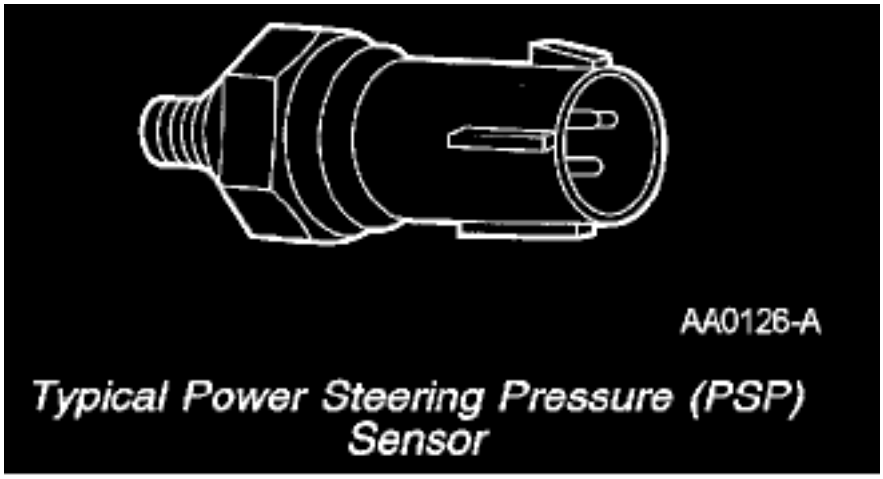
Connector: C1121

Description:	Harness:	Base Part #:
POWER STEERING PRESSURE SWITCH	12B637	

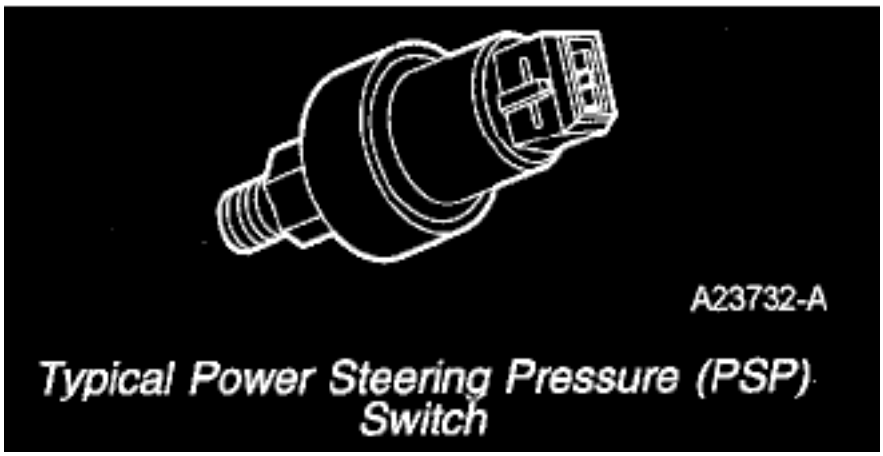
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CCS09 (GN)	20	SWITCH - POWER STEERING PRESSURE (PSPS)	2.3L
2	RE407 (YE-VT)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN COWL (C-SIGRTN) (SIGRTN-C)	2.3L



C1121



Typical Power Steering Pressure (PSP) Sensor



Typical Power Steering Pressure (PSP) Switch

Power Steering Pressure Switch: Description and Operation

Power Steering Pressure (PSP) Sensor

Typical Power Steering Pressure (PSP) Sensor

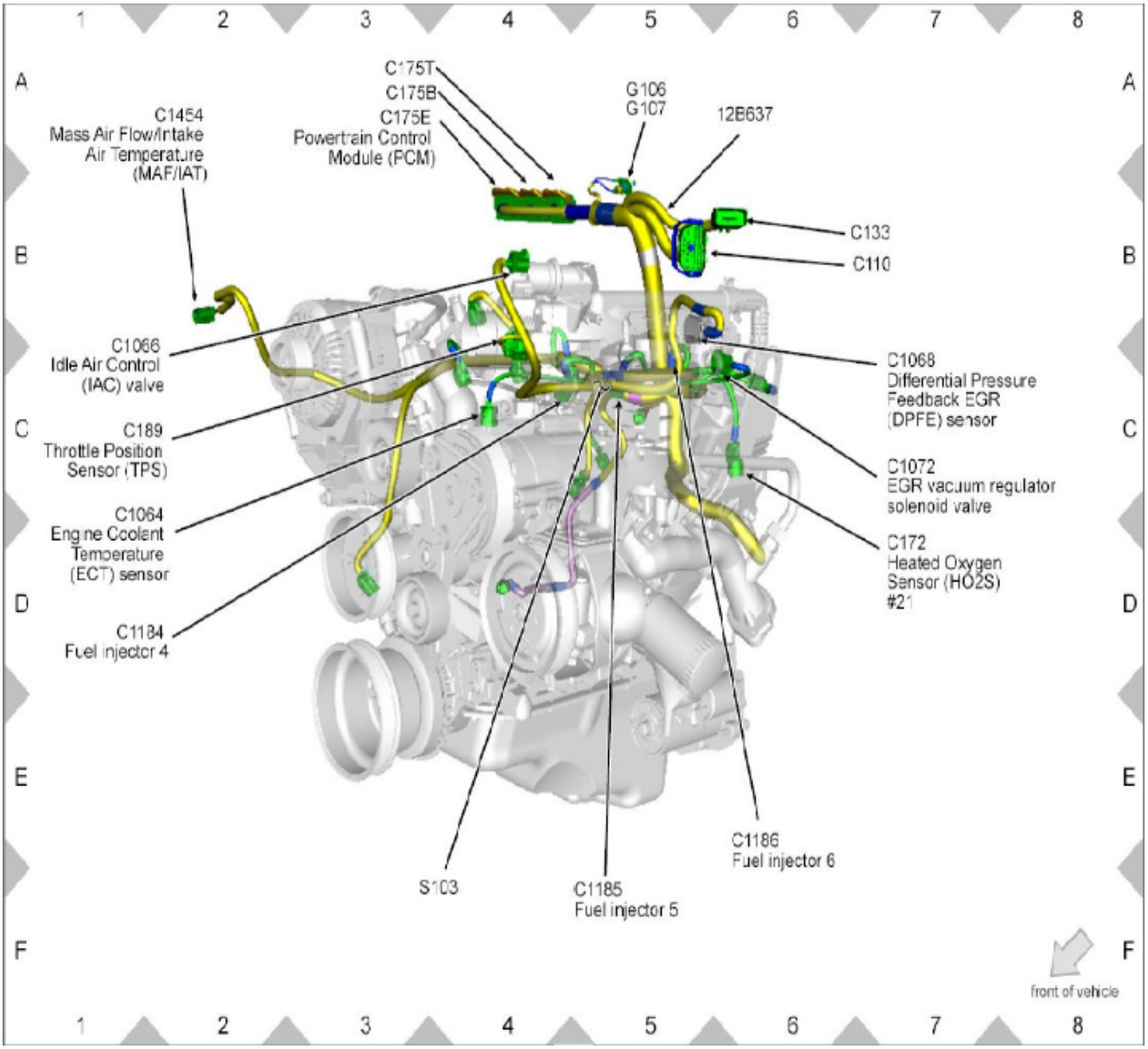
The PSP sensor monitors the hydraulic pressure within the power steering system. The PSP sensor voltage input to the PCM changes as the hydraulic pressure changes. The PCM uses the input signal from the PSP sensor to compensate for additional loads on the engine by adjusting the

idle RPM and preventing engine stall during parking maneuvers. Also, the PSP sensor signals the PCM to adjust the transmission electronic pressure control (EPC) pressure during increased engine load, for example, during parking maneuvers.

Power Steering Pressure (PSP) Switch

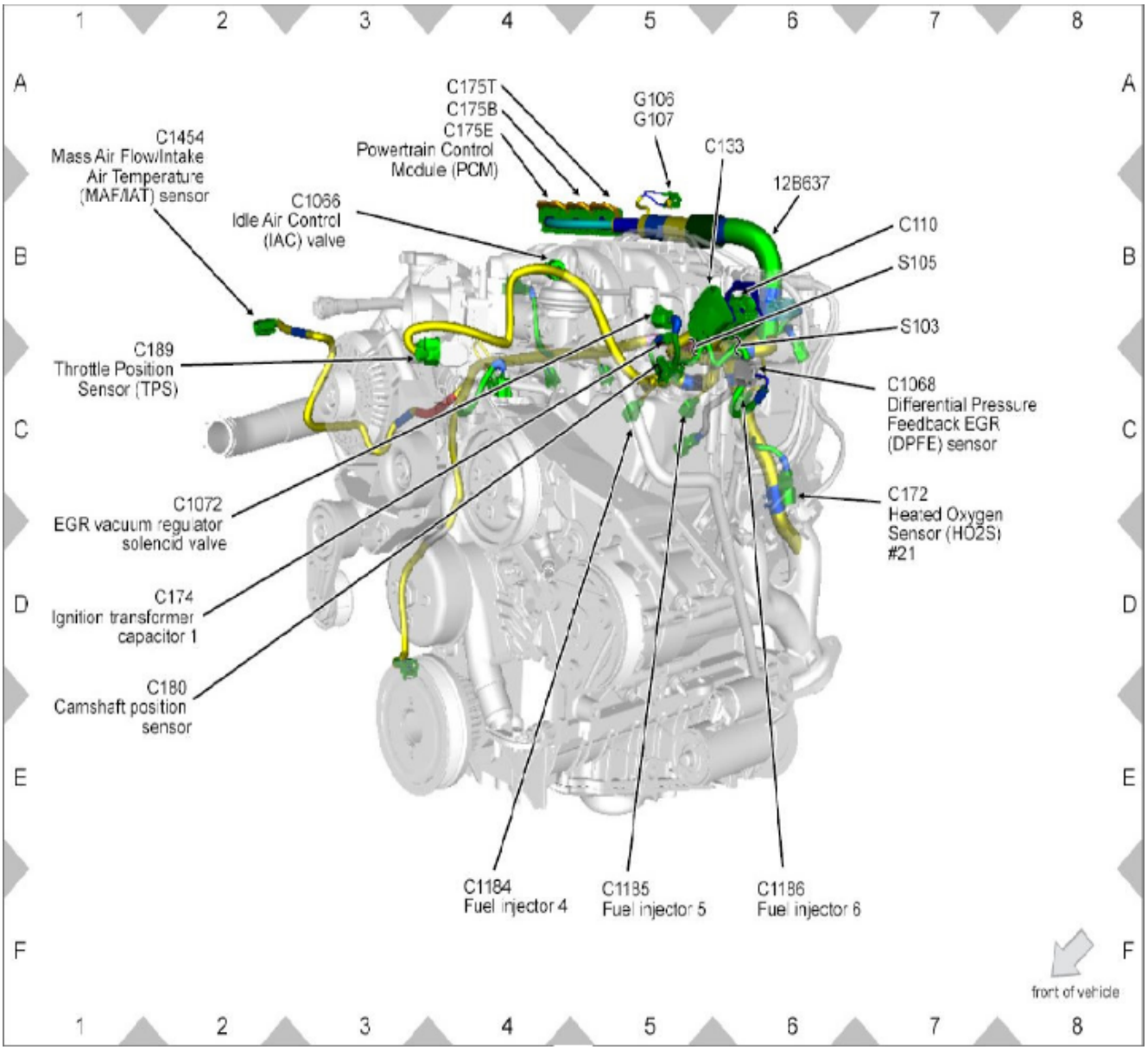
Typical Power Steering Pressure (PSP) Switch

The PSP switch monitors the hydraulic pressure within the power steering system. The PSP switch is a normally closed switch that opens as the hydraulic pressure increases. The PCM provides a low current voltage on the PSP circuit. When the PSP switch is closed, this voltage is pulled low through the SIG RTN circuit. The PCM uses the input signal from the PSP switch to compensate for additional loads on the engine by adjusting the idle RPM and preventing engine stall during parking maneuvers. Also, the PSP switch signals the PCM to adjust the transmission electronic pressure control (EPC) pressure during increased engine load, for example during parking maneuvers.



Pressure Feedback Exhaust Sensor: Locations

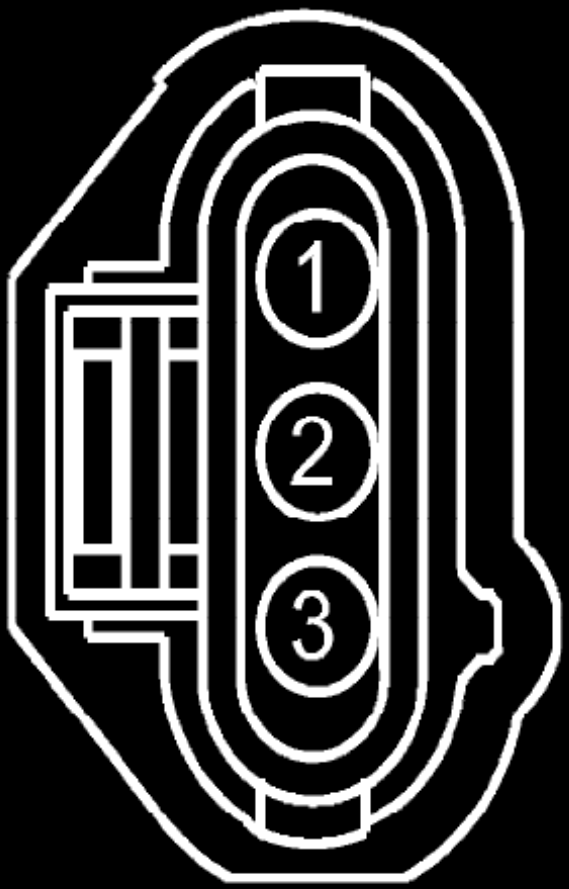
View 151-5


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
C133
12B637
C110
S105
S103
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor
C1066
Idle Air Control (IAC) valve
C189
Throttle Position Sensor (TPS)
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
C174
Ignition transformer capacitor 1
C180
Camshaft position sensor
C1184
Fuel injector 4
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-7

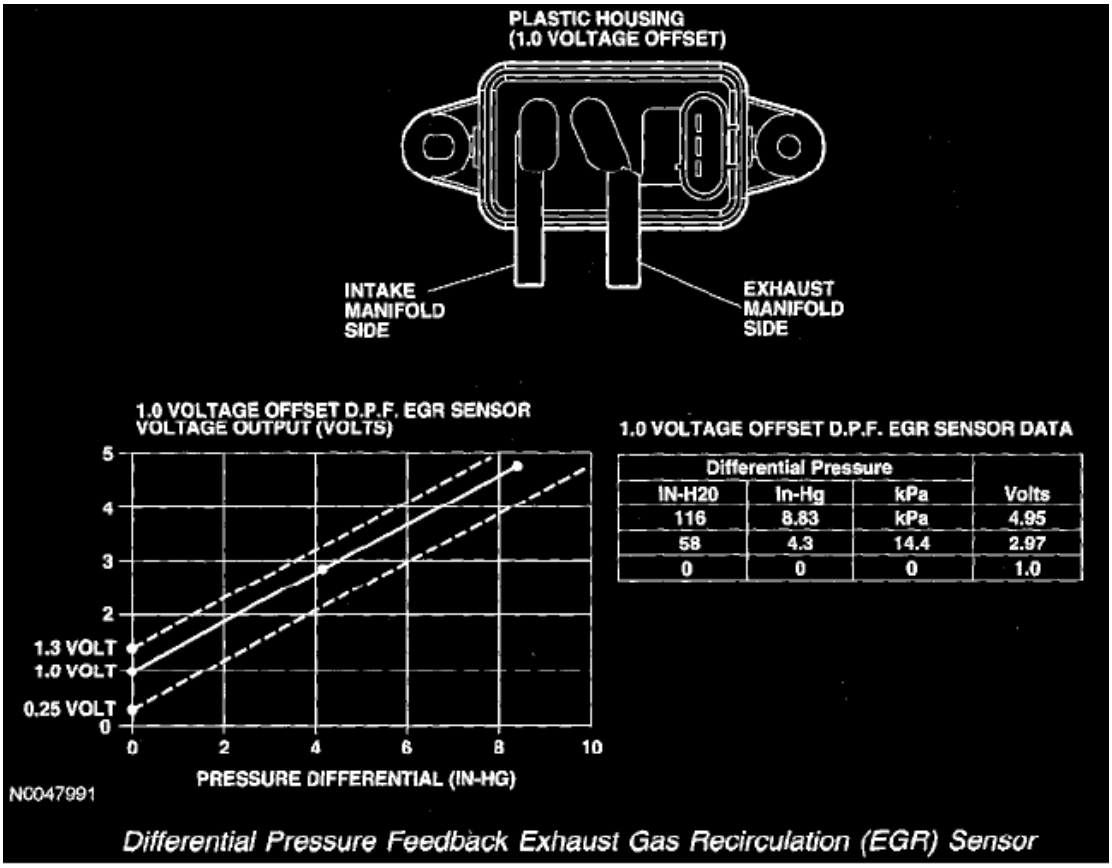
Connector: C1068

Description:	Harness:	Base Part #:
DIFFERENTIAL PRESSURE FEEDBACK EGR DPFE) SENSOR	12B637	9J460



Pin	Circuit	Gauge	Circuit Function	Quali
1	VE713 (GN-OG)	20	SENSOR - DELTA PRESSURE FEEDBACK EGR (DPFE)	3.0L, 4.
2	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	3.0L, 4.
3	LE423 (GN-VT)	20	CTRL MOD. - POWERTRAIN # VOLTAGE REFERENCE ENGINE (VREF) (E-VREV)	3.0L, 4.

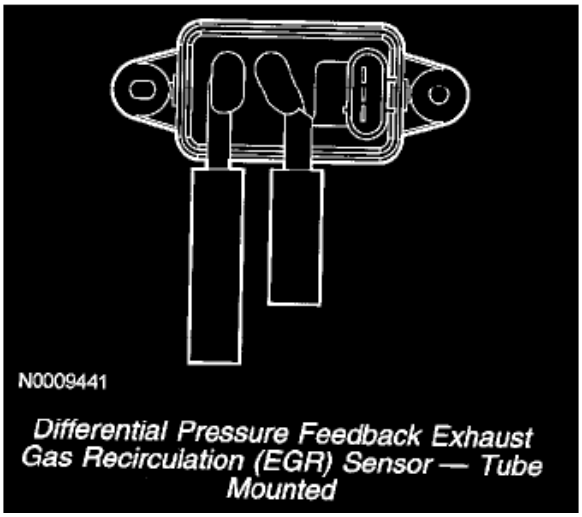
C1068



1.0 VOLTAGE OFFSET D.P.F. EGR SENSOR DATA

Differential Pressure			
IN-H20	In-Hg	kPa	Volts
116	8.83	kPa	4.95
58	4.3	14.4	2.97
0	0	0	1.0

Differential Pressure Feedback Exhaust Gas Recirculation (EGR) Sensor



Differential Pressure Feedback Exhaust Gas Recirculation (EGR) Sensor — Tube Mounted

Pressure Feedback Exhaust Sensor: Description and Operation

Differential Pressure Feedback Exhaust Gas Recirculation (EGR) Sensor

Differential Pressure Feedback Exhaust Gas Recirculation (EGR) Sensor

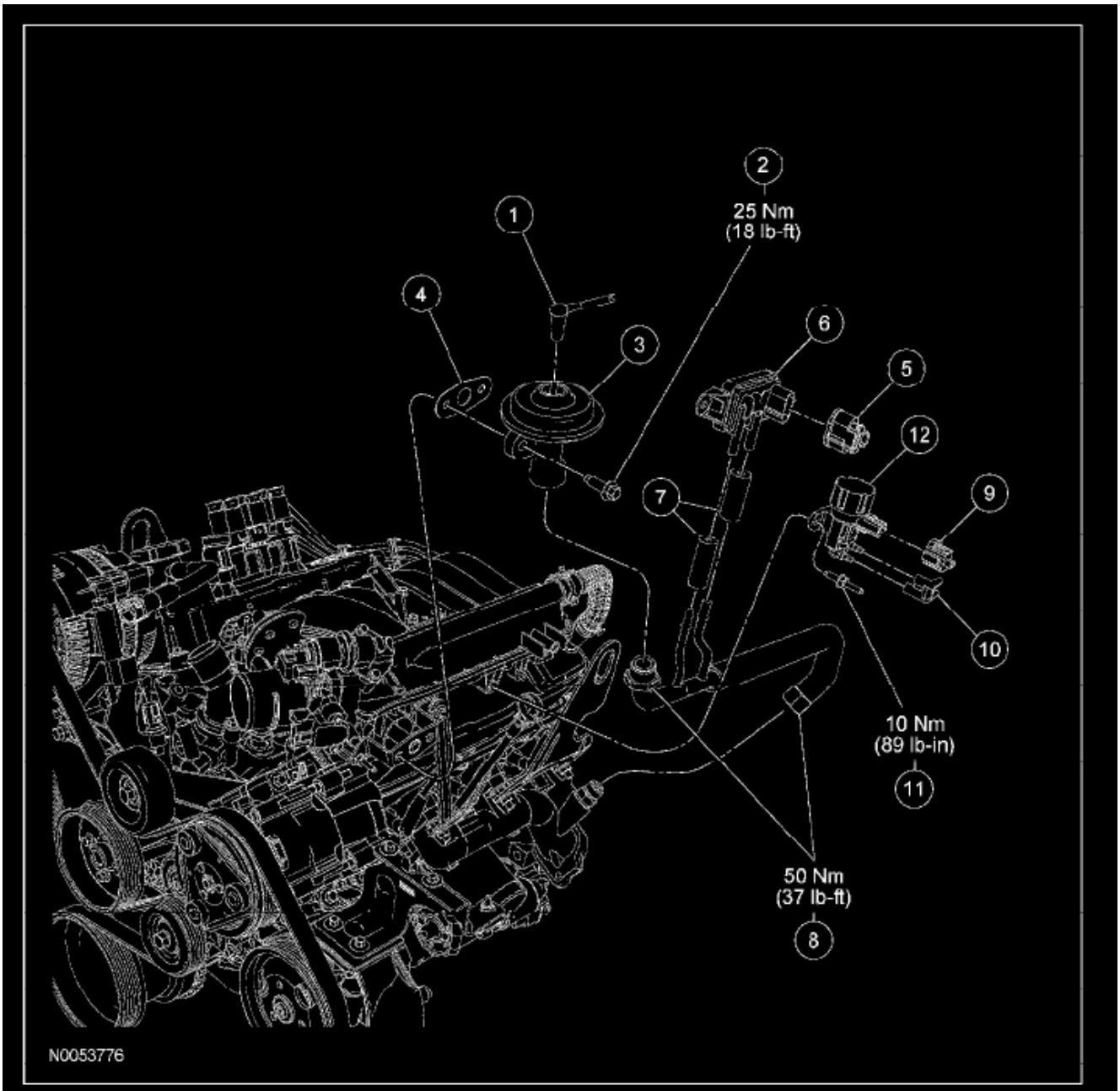
The differential pressure feedback EGR sensor is a ceramic, capacitive-type pressure transducer that monitors the differential pressure across a metering orifice located in the orifice tube assembly. The differential pressure feedback EGR sensor receives this signal through 2 hoses referred to as the downstream pressure hose (REF SIGNAL) and upstream pressure hose (HI SIGNAL). The HI and REF hose connections are marked on the differential pressure feedback EGR sensor housing for identification (note that the HI signal uses a larger diameter hose). The differential pressure feedback EGR sensor outputs a voltage proportional to the pressure drop across the metering orifice and supplies it to the PCM as EGR flow rate feedback.

Differential Pressure Feedback Exhaust Gas Recirculation (EGR) Sensor - Tube Mounted

Differential Pressure Feedback Exhaust Gas Recirculation (EGR) Sensor - Tube Mounted

The tube mounted differential pressure feedback EGR sensor is identical in operation as the larger plastic differential pressure feedback EGR sensors and uses a 1.0 volt offset. The HI and REF

hose connections are marked on the side of the sensor.



Item	Part Number	Description
1	9E499	EGR vacuum hose fitting
2	W500224	EGR valve bolt (2 required)
3	9D475	EGR valve
4	9D476	EGR valve gasket

(Continued)

Item	Part Number	Description
5	14A464	Differential pressure feedback EGR sensor electrical connector (part of 12B637)
6	9J460	Differential pressure feedback EGR sensor

(Continued)

Pressure Feedback Exhaust Sensor: Service and Repair

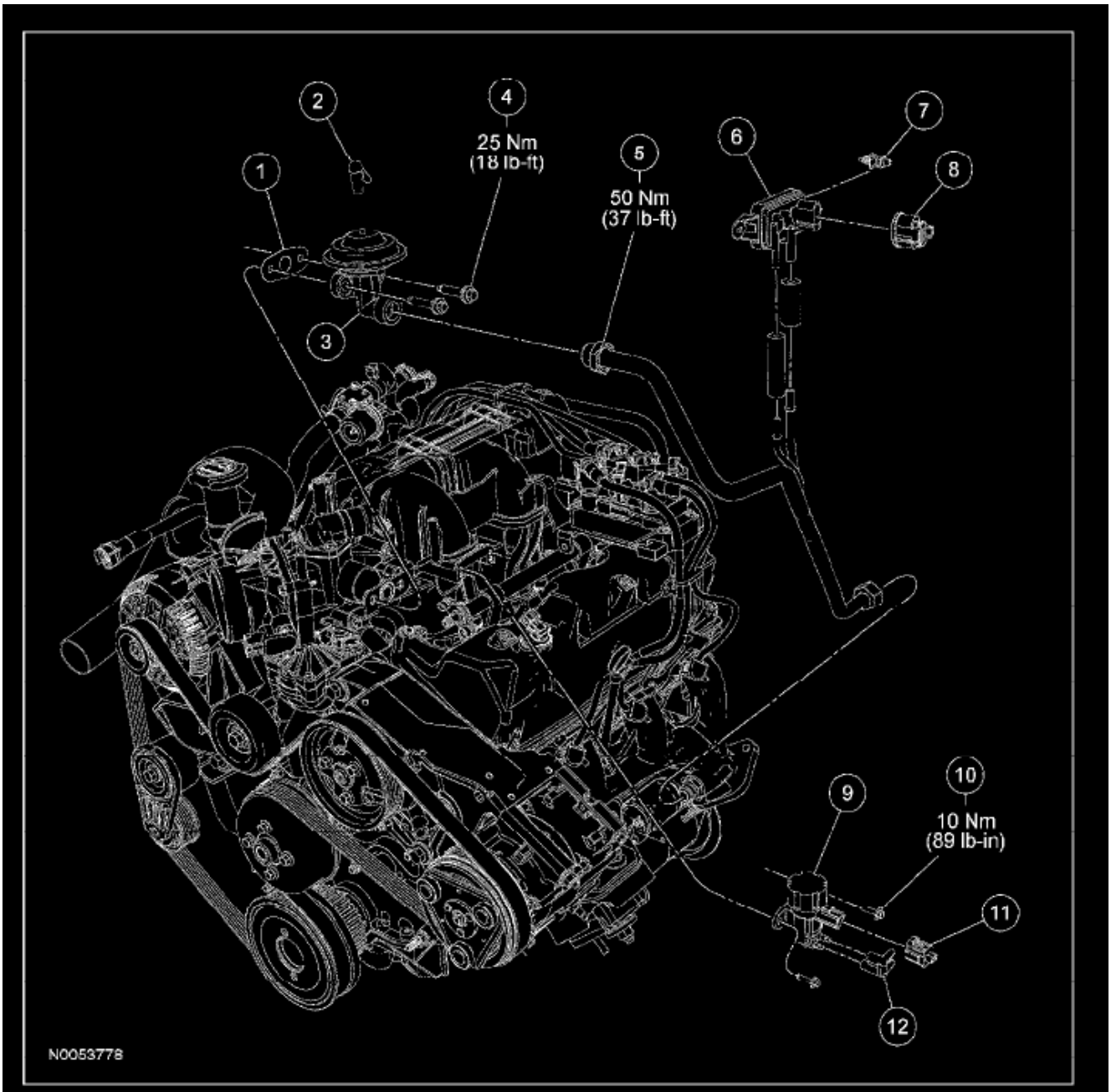
DIFFERENTIAL PRESSURE FEEDBACK EXHAUST GAS RECIRCULATION (EGR) SENSOR

Exploded View

Part 1

Item	Part Number	Description
7	9P761	Differential pressure feedback EGR sensor hoses
8	9D477	Exhaust manifold-to-EGR valve tube
9	14A464	EGR vacuum regulator solenoid electrical connector (part of 12B637)
10	9E499	EGR vacuum regulator solenoid vacuum hose fitting
11	W708628	EGR vacuum regulator solenoid stud bolt
12	9J459	EGR vacuum regulator solenoid

Part 2



Item	Part Number	Description
1	9D476	EGR valve gasket
2	9E499	EGR valve vacuum connector
3	9D475	EGR valve assembly
4	W701232	EGR valve bolt (2 required)

(Continued)

Item	Part Number	Description
5	9E469	EGR tube
6	9J460	Differential pressure feedback EGR sensor
7	13A506	Pushpin wire retainer

(Continued)

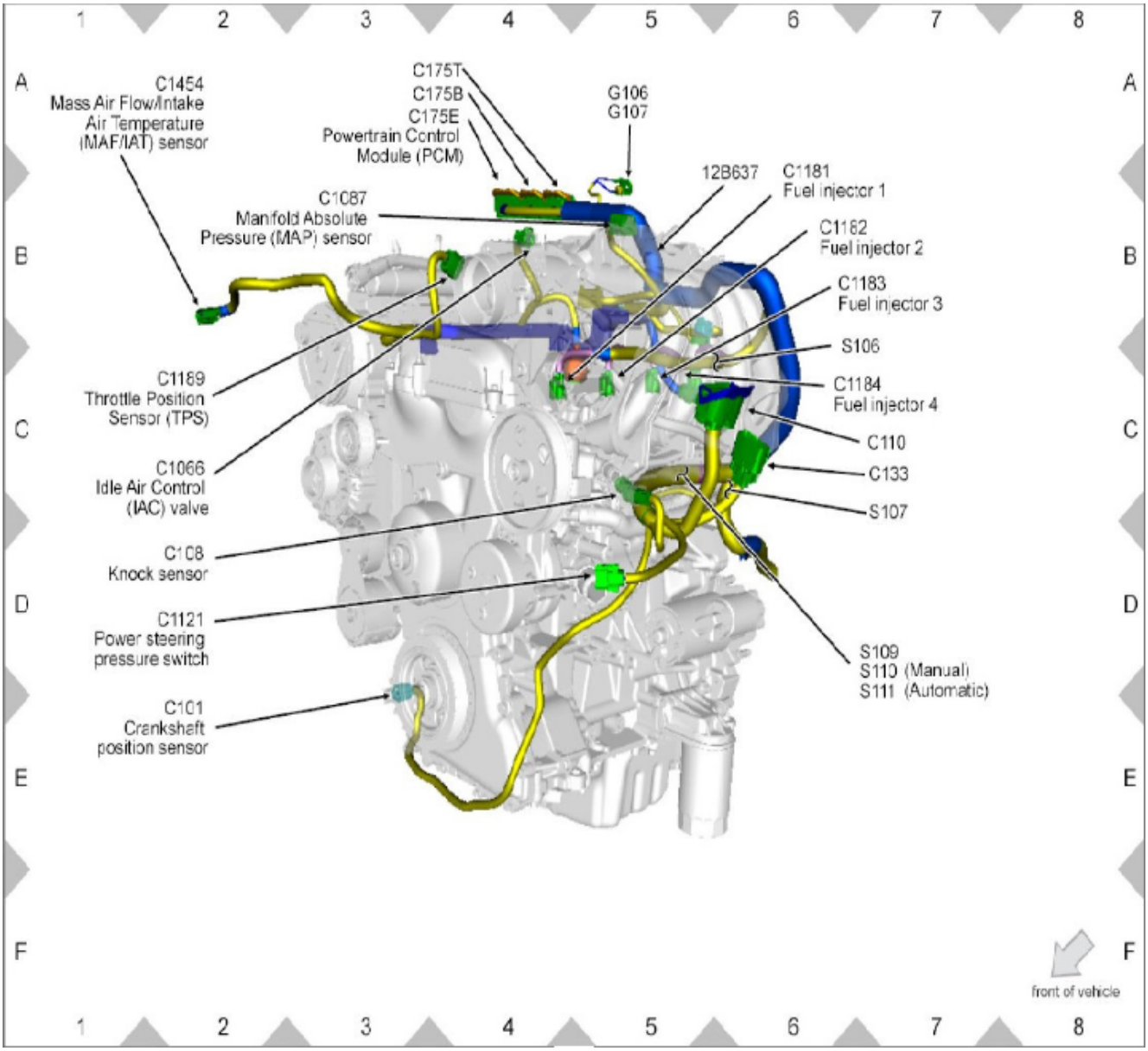
Part 1

Item	Part Number	Description
8	14A464	Differential pressure feedback EGR sensor electrical connector
9	9J459	EGR vacuum regulator solenoid
10	W704310	EGR vacuum regulator solenoid bolt (2 required)
11	14A464	EGR vacuum regulator solenoid electrical connector
12	9E499	EGR vacuum regulator solenoid vacuum connector

Part 2

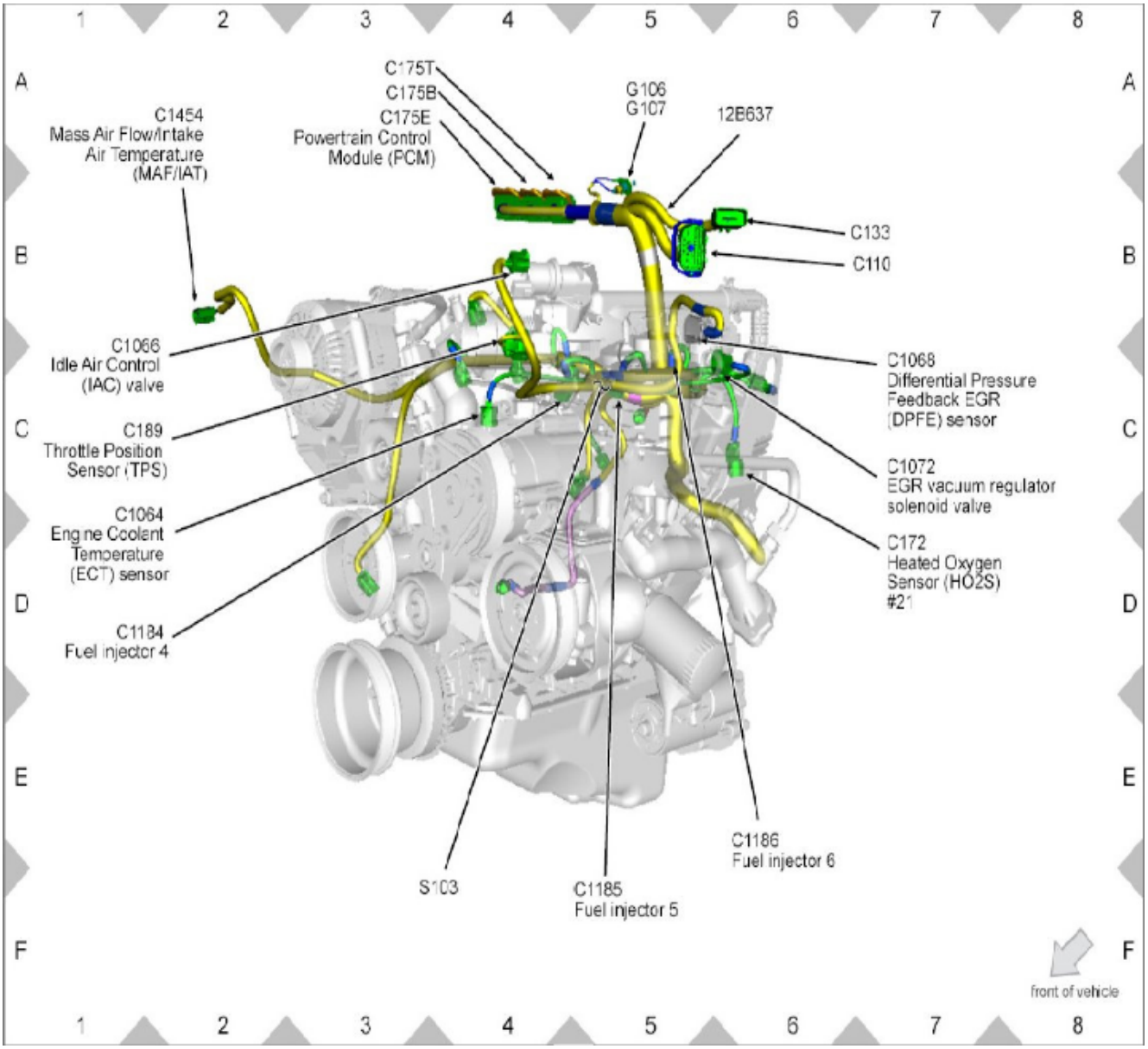
Removal and Installation

1. Disconnect the pushpin retainer from the differential pressure feedback EGR sensor. 2. Disconnect the differential pressure feedback EGR sensor electrical connector. 3. Remove the differential pressure feedback EGR sensor from the hoses. 4. To install, reverse the removal procedure.

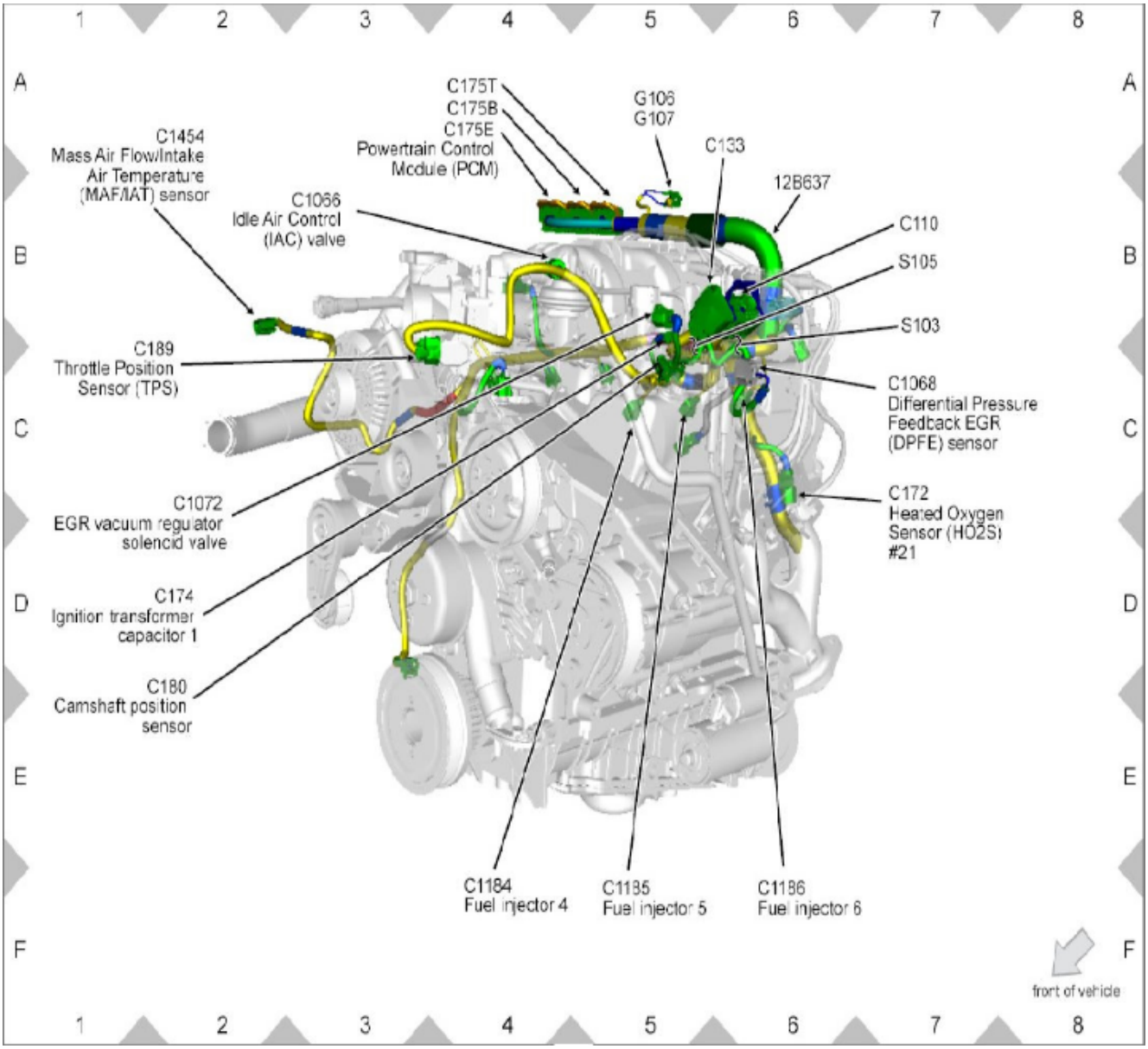


Throttle Position Sensor: Locations

View 151-3


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
12B637
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT)
C133
C110
C1066
Idle Air Control (IAC) valve
C189
Throttle Position Sensor (TPS)
C1064
Engine Coolant Temperature (ECT) sensor
C1184
Fuel injector 4
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
S103
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

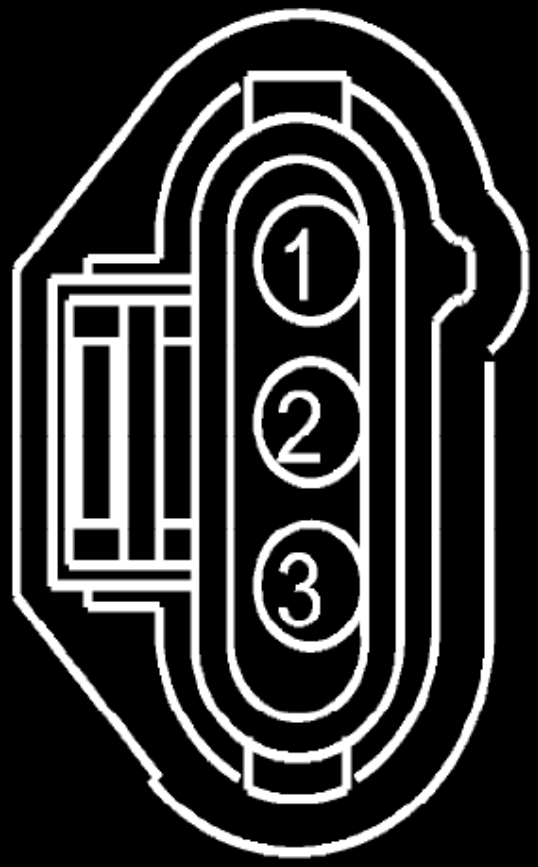
View 151-5


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
C133
12B637
C110
S105
S103
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor
C1066
Idle Air Control (IAC) valve
C189
Throttle Position Sensor (TPS)
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
C174
Ignition transformer capacitor 1
C180
Camshaft position sensor
C1184
Fuel injector 4
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-7

Connector: C189

Description:	Harness:	Base Part #:
THROTTLE POSITION SENSOR (TPS)	12B637	9B989



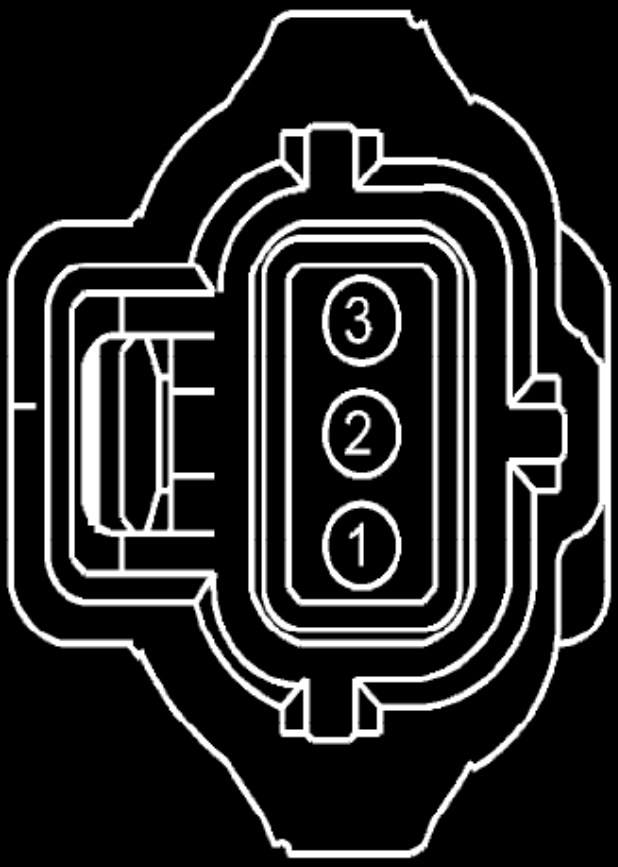
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	LE423 (GN-VT)	20	CTRL MOD. - POWERTRAIN # VOLTAGE REFERENCE ENGINE (VREF) (E-VREV)	3.0L, 4.0L
2	VE819 (GN-VT)	20	SENSOR - THROTTLE POSITION # POSITIVE SLOPE (TP2-PS)	3.0L, 4.0L
3	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	3.0L, 4.0L

Throttle Position Sensor: Diagrams

C189

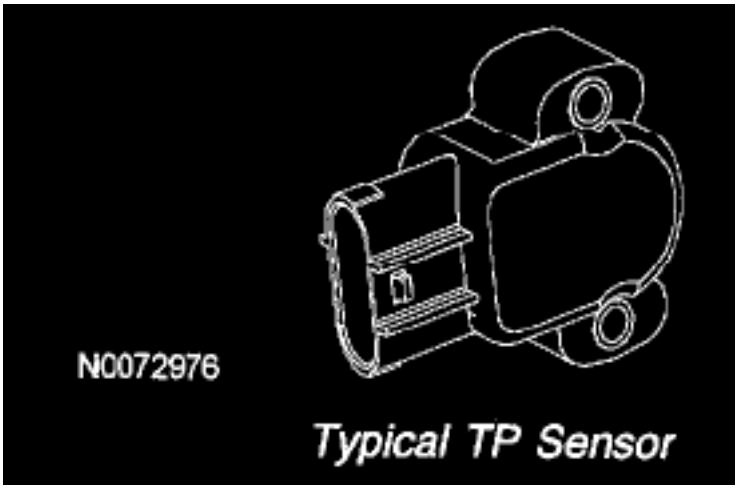
Connector: C1189

Description:	Harness:	Base Part #:
THROTTLE POSITION SENSOR (TPS)	12B637	9B989



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	2.3L
2	VE819 (GN-VT)	20	SENSOR - THROTTLE POSITION # POSITIVE SLOPE (TP2-PS)	2.3L
3	LE423 (GN-VT)	20	CTRL MOD. - POWERTRAIN # VOLTAGE REFERENCE ENGINE (VREF) (E-VREV)	2.3L

C1189



Throttle Position Sensor: Description and Operation

Electronic Throttle Body (ETB) Throttle Position Sensor

The ETB throttle position sensor has 2 signal circuits in the sensor for redundancy. The redundant ETB throttle position signals are required for increased monitoring. The first ETB throttle position sensor signal (TP1) has a negative slope (increasing angle, decreasing voltage) and the second signal (TP2) has a positive slope (increasing angle, increasing voltage). The 2 ETB throttle position sensor signals make sure the PCM receives a correct input even if 1 signal has a concern. There is 1 reference voltage circuit and 1 signal return circuit for the sensor. The reference voltage circuit and the signal return circuit is shared with the reference voltage circuits and signal return circuits used by the APP sensor.

Throttle Position (TP) Sensor

Typical TP Sensor

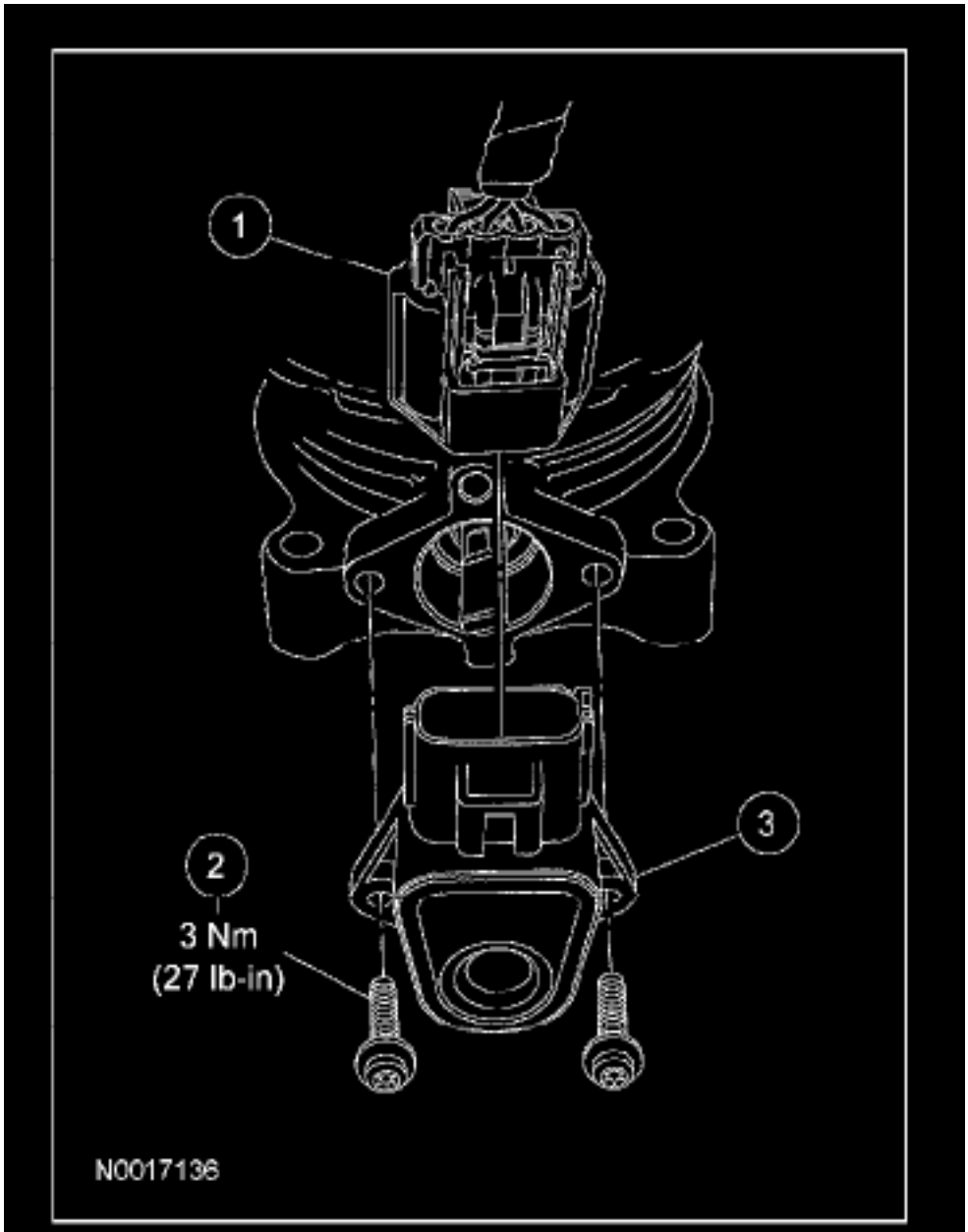
The TP sensor is a rotary potentiometer sensor that provides a signal to the PCM that is linearly proportional to the throttle plate/shaft position. The sensor housing has a 3-blade electrical connector that may be gold plated. The gold plating increases the corrosion resistance on the terminals and increases the connector durability. The TP sensor is mounted on the throttle body. As the TP sensor is rotated by the throttle shaft, 4 operating conditions are determined by the PCM from the TP. The operating conditions are: -

closed throttle (includes idle or deceleration)

- part throttle (includes cruise or moderate acceleration)

- wide open throttle (includes maximum acceleration or de-choke on crank)

- throttle angle rate



Item	Part Number	Description
1	14A464	Throttle position (TP) sensor electrical connector (part of 12B637)
2	W707535	TP sensor screw (2 required)
3	9E928	TP sensor

Throttle Position Sensor: Service and Repair

THROTTLE POSITION (TP) SENSOR

Removal and Installation

1. Disconnect the throttle position (TP) sensor electrical connector.

2. CAUTION: Failure to remove the throttle position (TP) sensor screws in the following manner will result in damage to the screws. First,

loosen the screws 1 to 2 full turns using a hand tool, and then use a suitable high-speed driver to complete the removal.

Remove and discard the 2 bolts and the TP sensor. -

To install, tighten to 3 Nm (27 lb-in).

3. CAUTION: Do not use a high-speed driver to install the new screws or damage to the throttle position (TP) sensor may occur.

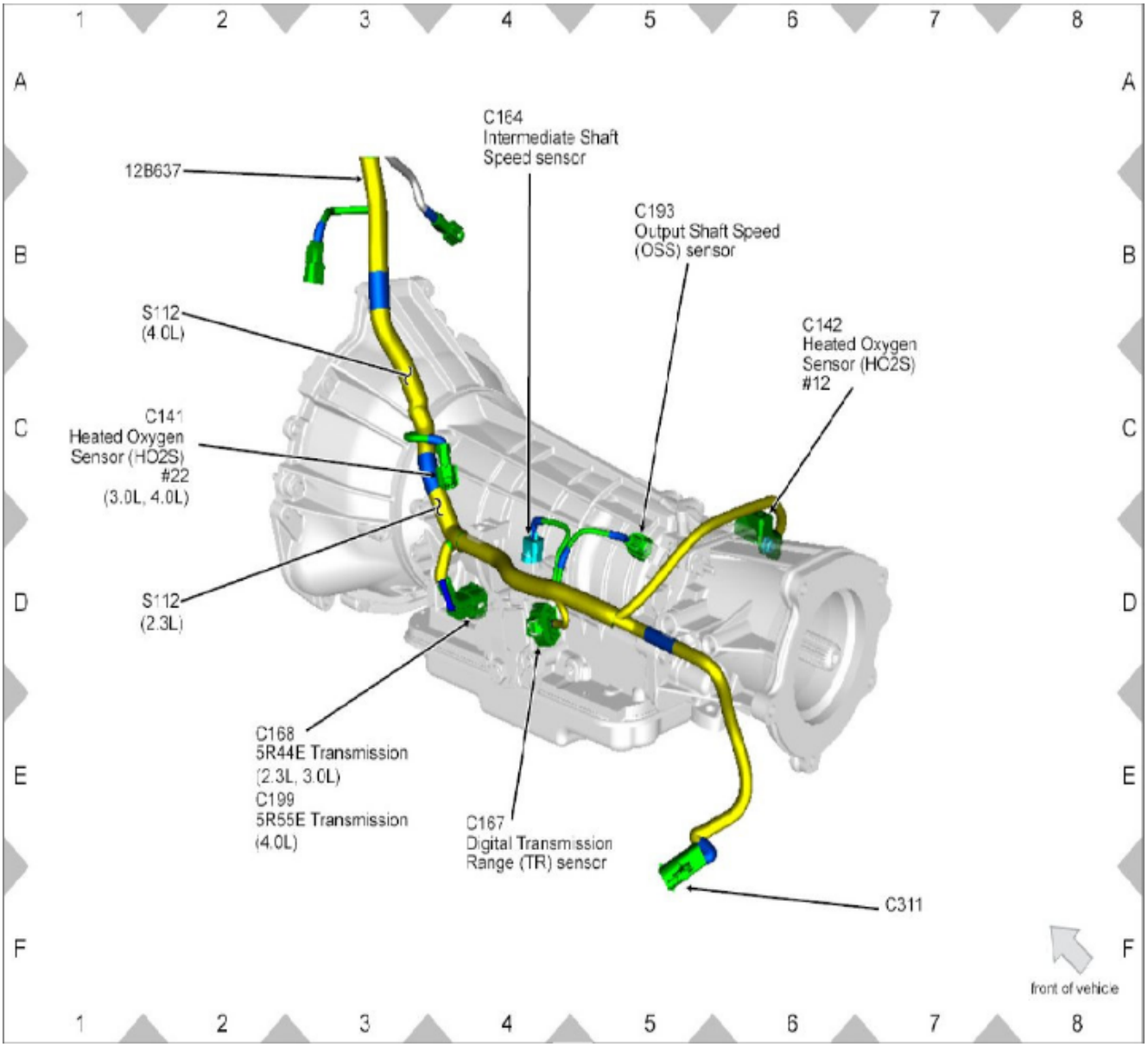
NOTE: -

Do not reuse the TP sensor and screws. A new TP sensor and screws must be installed.

- Failure to install the TP sensor in this manner may result in excessive idle speeds. Slide the rotary tangs into position over the throttle shaft blade, then rotate the TP sensor.

To install, reverse the removal procedure. -

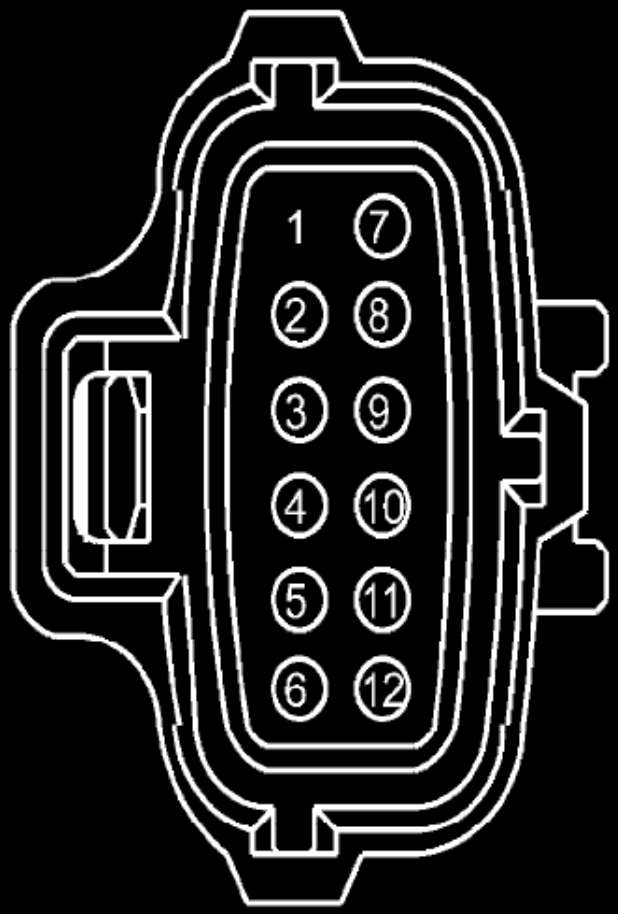
Install a new TP sensor and screws.


C164
Intermediate Shaft Speed sensor
12B637
C193
Output Shaft Speed (OSS) sensor
S112
(4.0L)
C142
Heated Oxygen Sensor (HO2S) #12
C141
Heated Oxygen Sensor (HO2S) #22
(3.0L, 4.0L)
S112
(2.3L)
C168
5R44E Transmission
(2.3L, 3.0L)
C199
5R55E Transmission
(4.0L)
C167
Digital Transmission Range (TR) sensor
C311
front of vehicle

View 151-10

Connector: C167

Description:	Harness:	Base Part #:
DIGITAL TRANSMISSION RANGE (TR) SENSOR	12B637	7F293



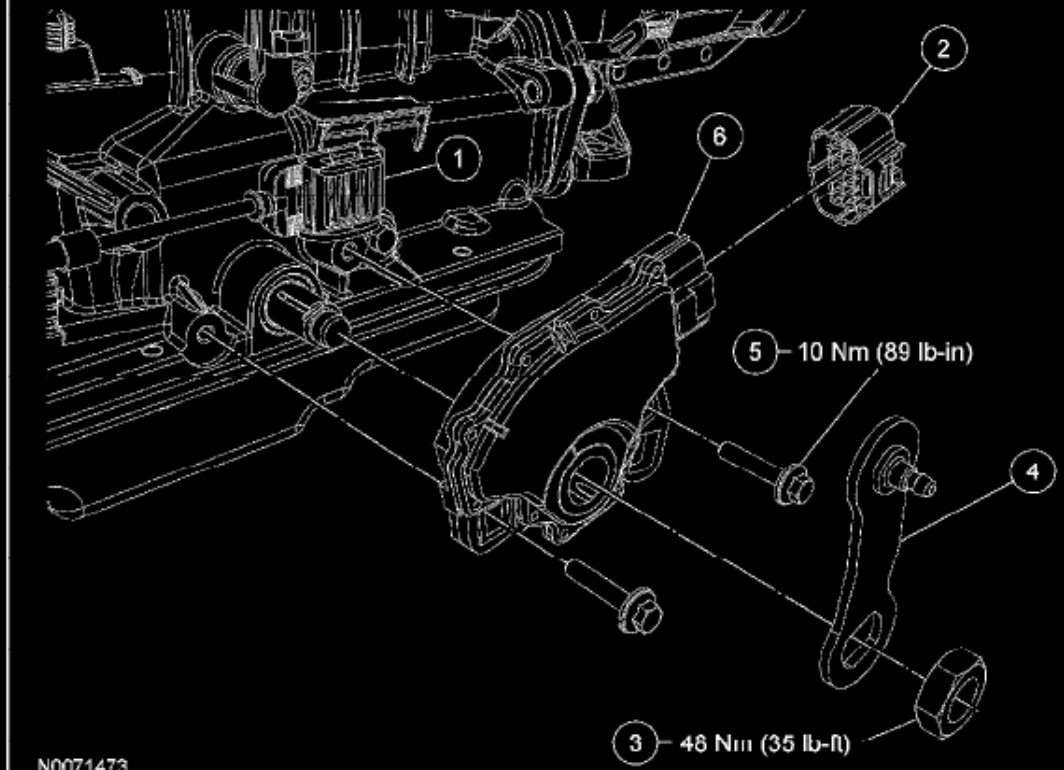
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	RE406 (GY-VT)	18	SIGNAL RETURN	
3	VET28 (GY-VT)	20	TR3A	
4	VET29 (VT-WH)	20	TR1	
5	VET30 (YE)	20	TR2	
6	VET31 (BU-OG)	20	TR4	
7	GD108 (BK-VT)	18	GROUND	4x4
8	CCF20 (GY-VT)	20	NETURAL SENSE	4x4
9	CBP20 (YE-VT)	18	FUSED POWER FEED	
10	CET40 (GN-OG)	20	STARTER CONTROL	
11	CET41 (BN-YE)	18	BACK UP	
12	CBP21 (BU-GY)	20	STARTER TO STARTER INTERRUPT RELAY	

C167

Special Tool(s)

ST1633-A	Alignment Gauge, TR Sensor 307-351 (T97L-70010-A)

Digital Transmission Range (TR) Sensor



Item	Part Number	Description
1	7E395-A	Selector lever cable
2	—	Digital transmission range (TR) sensor electrical connector
3	W701211-S	Manual control lever nut
4	7A256-A	Manual control lever
5	N806933-S	Digital TR sensor screw (2 required)
6	7F293-A	Digital TR sensor

Transmission Position Switch/Sensor: Service and Repair

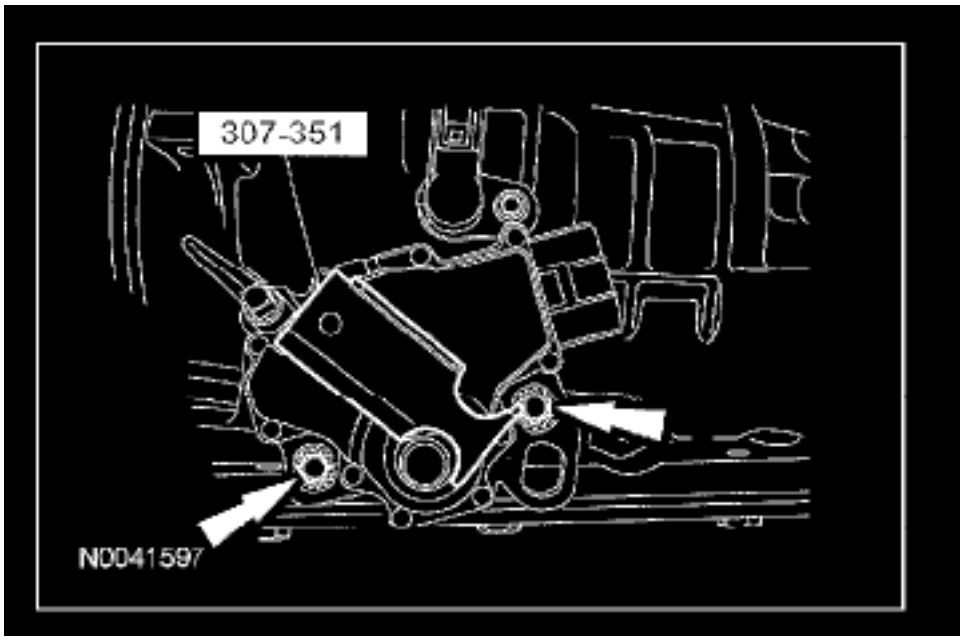
Digital Transmission Range (TR) Sensor

Digital Transmission Range (TR) Sensor

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the selector lever cable from the manual control lever. 3. Disconnect the digital transmission range (TR) sensor electrical connector. 4. Remove the manual control outer lever nut and manual control outer lever. 5. Remove the screws and the digital TR sensor.

Installation



1. CAUTION: The digital transmission range (TR) sensor must fit flush against the boss on the case to prevent damage to the sensor.

Install the digital TR sensor and loosely install the screws.

2. CAUTION: Tightening one screw before tightening the other may cause the sensor to bind or become damaged.

NOTE: The manual lever must be in the NEUTRAL position.

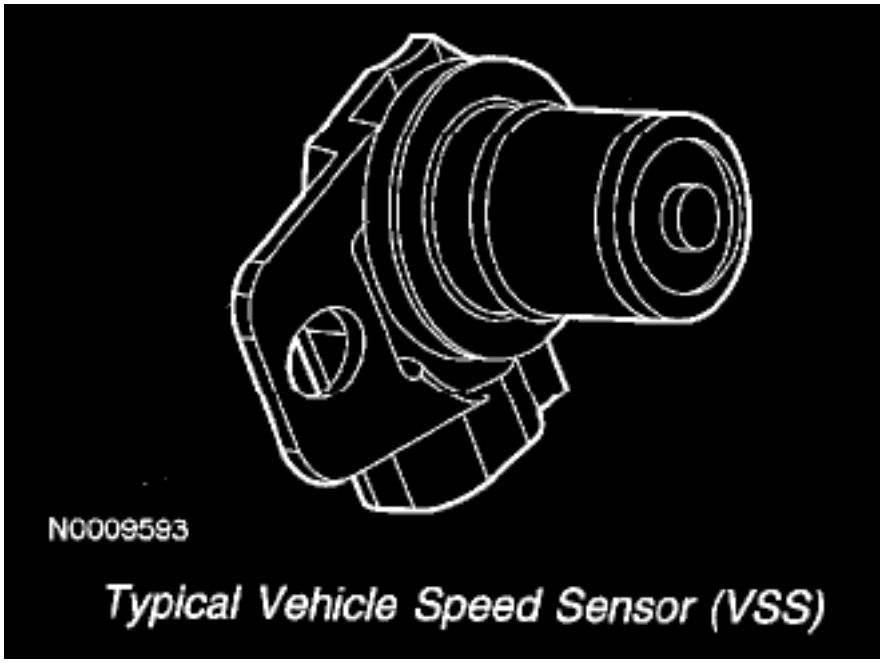
Using the special tool, align the digital TR sensor and tighten screws in an alternating sequence. ^

Tighten to 10 Nm (89 lb-inch).

3. Install the manual control outer lever and nut.

^ Tighten to 48 Nm (35 lb-ft).

4. Connect the digital TR sensor electrical connector. 5. Connect the selector lever cable to the manual control lever. 6. Verify that the selector lever cable is adjusted correctly.



Vehicle Speed Sensor: Description and Operation

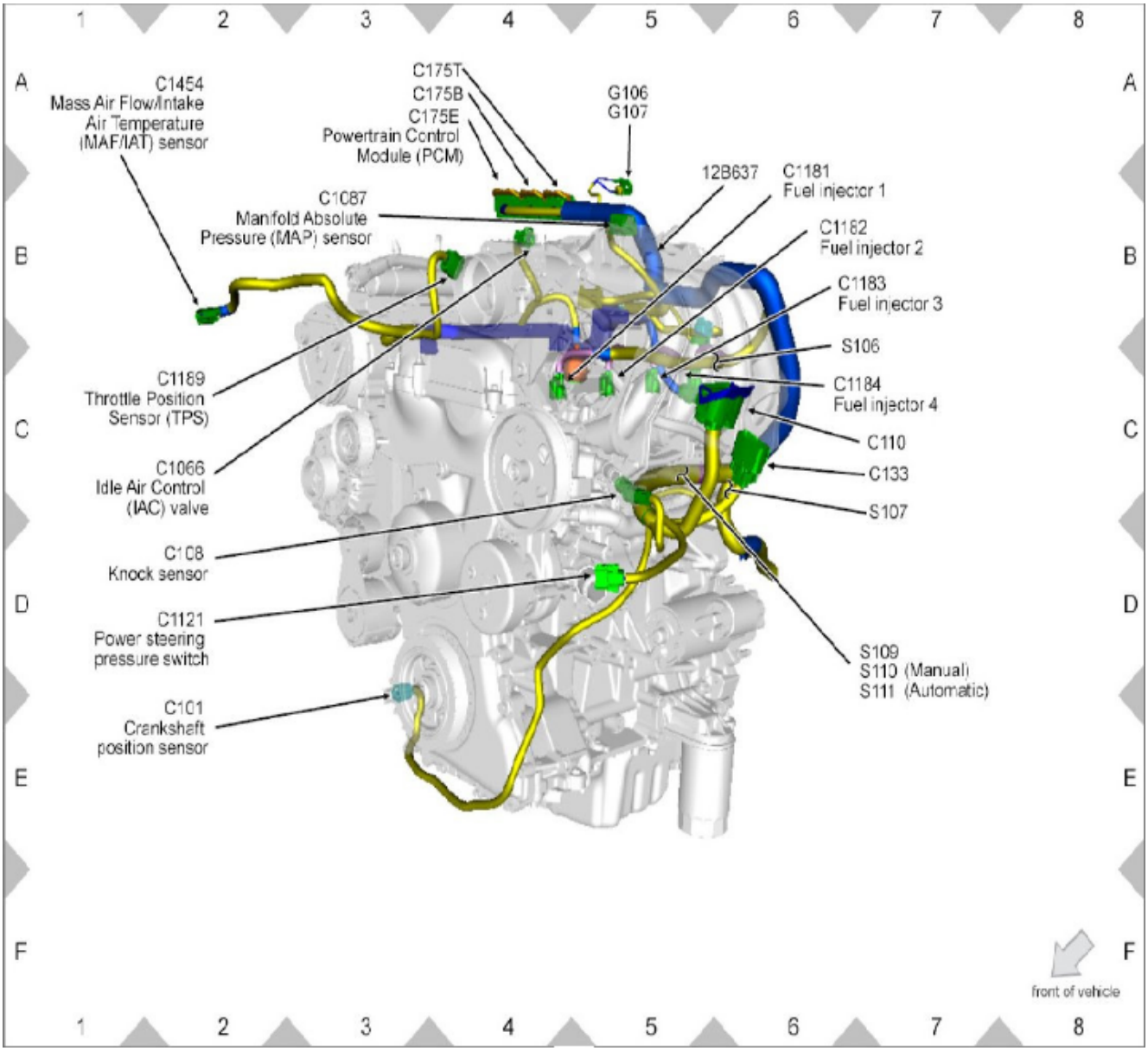
Output Shaft Speed (OSS) Sensor

The OSS sensor provides the PCM with information about the rotational speed of an output shaft. The PCM uses the information to control and diagnose powertrain behavior. In some applications, the sensor is also used as the source of vehicle speed. The sensor may be physically located in different places on the vehicle, depending upon the specific application. The design of each speed sensor is unique and depends on which powertrain control feature uses the information that is generated.

Vehicle Speed Sensor (VSS)

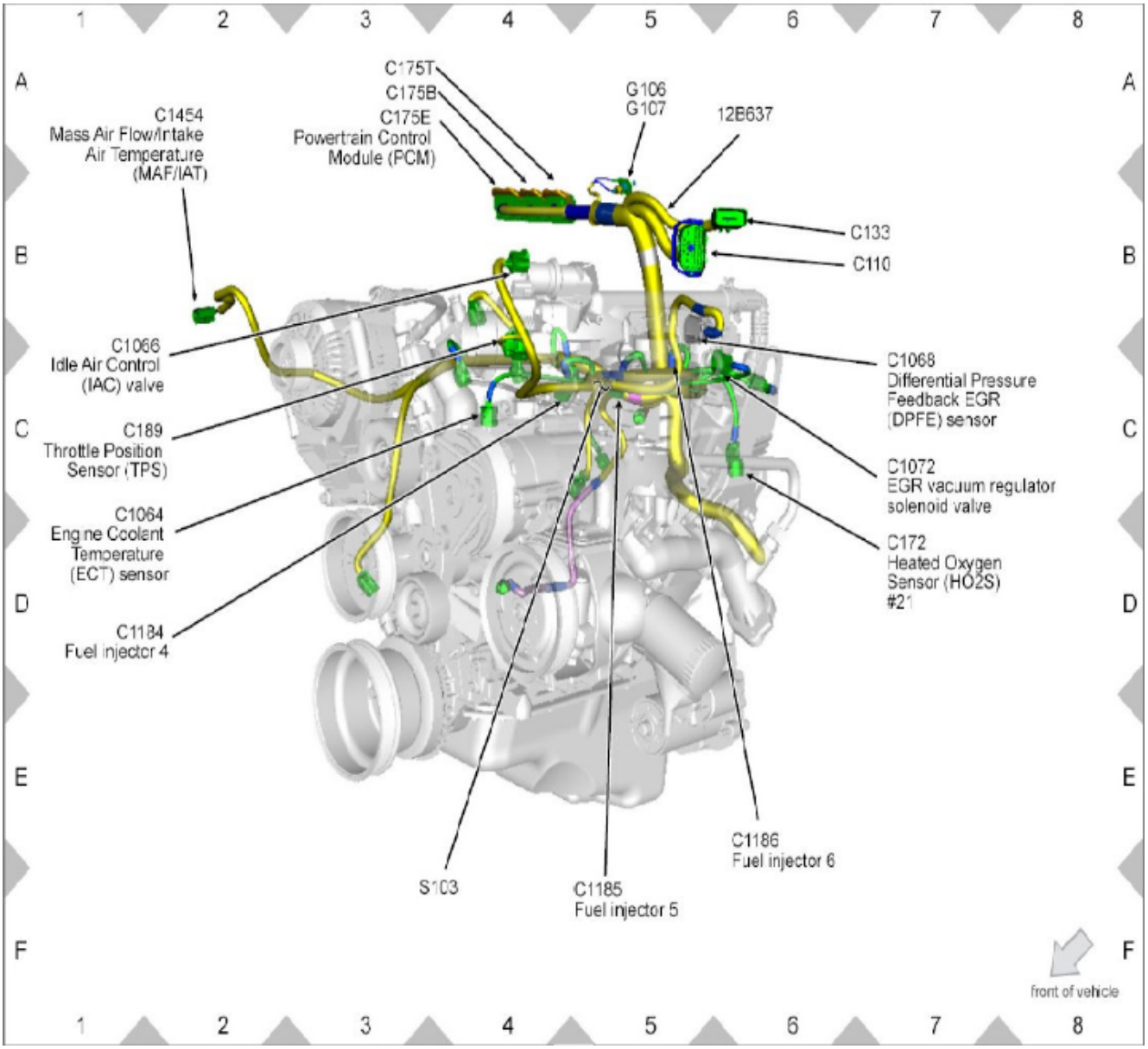
Typical Vehicle Speed Sensor (VSS)

The VSS is a variable reluctance or Hall-effect sensor that generates a waveform with a frequency that is proportional to the speed of the vehicle. If the vehicle is moving at a relatively low velocity, the sensor produces a signal with a low frequency. As the vehicle velocity increases, the sensor generates a signal with a higher frequency. The PCM uses the frequency signal generated by the VSS (and other inputs) to control such parameters as fuel injection, ignition control, transmission/transaxle shift scheduling, and torque converter clutch scheduling.

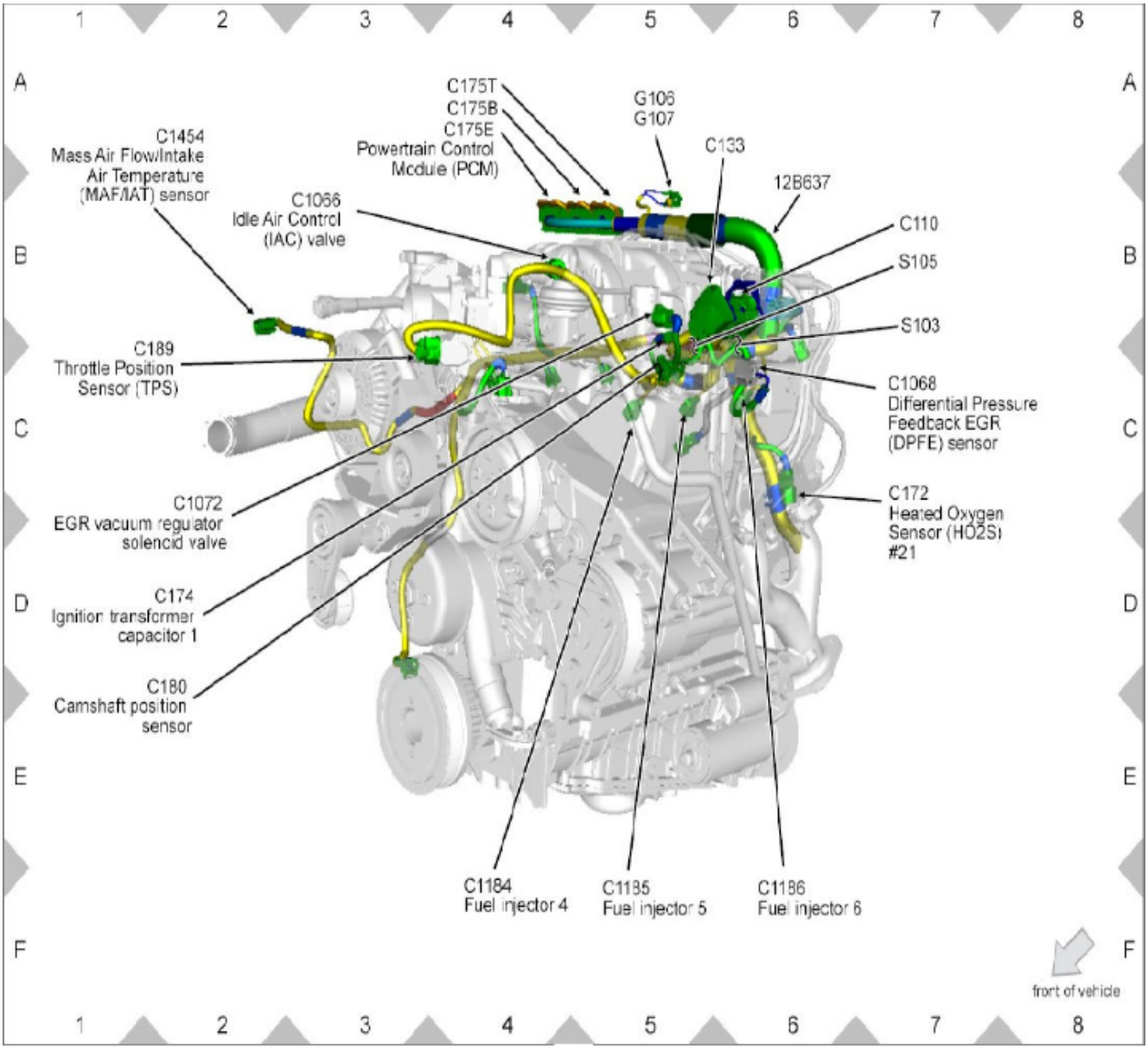


Throttle Position Sensor: Locations

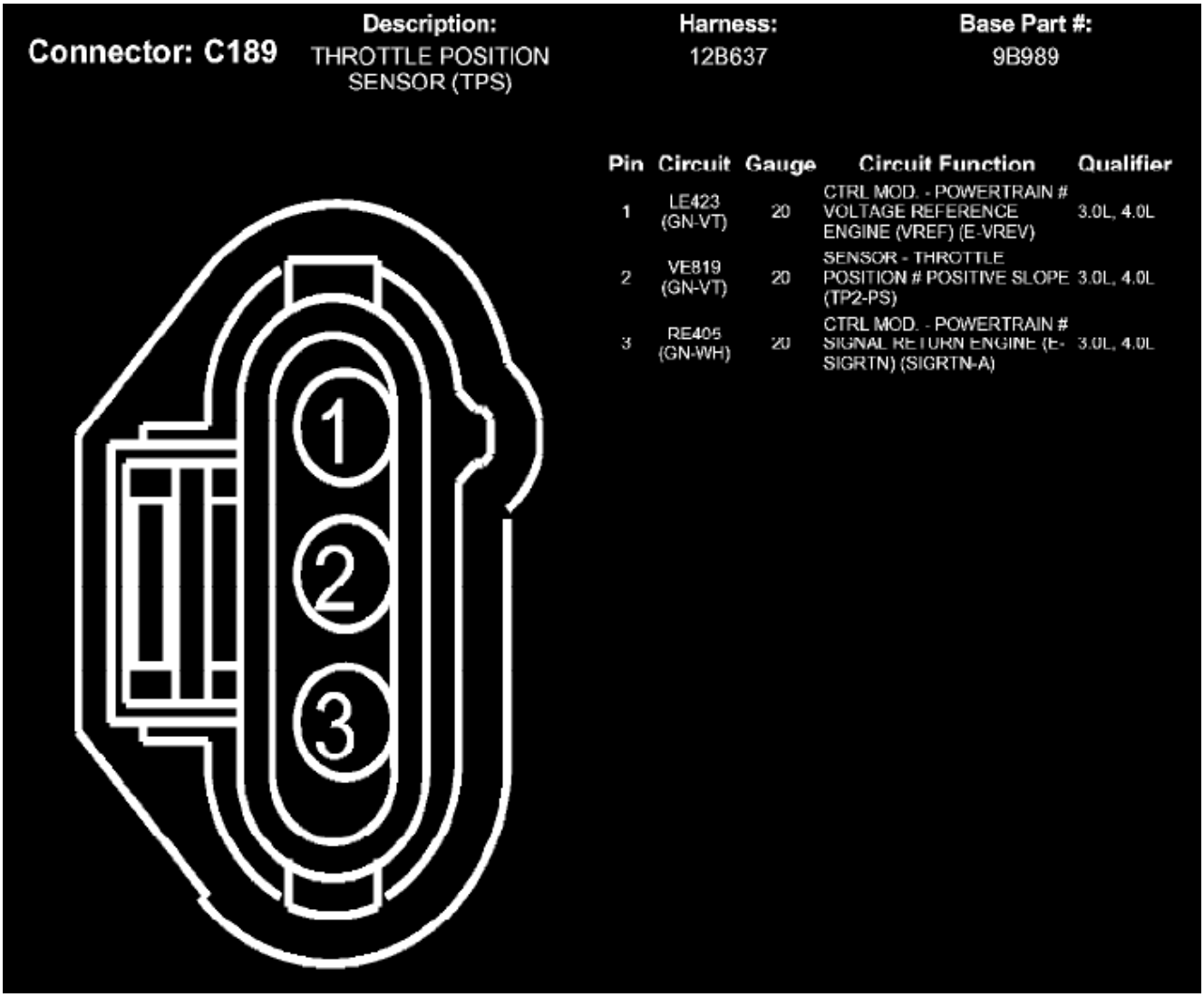
View 151-3


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
12B637
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT)
C133
C110
C1066
Idle Air Control (IAC) valve
C189
Throttle Position Sensor (TPS)
C1064
Engine Coolant Temperature (ECT) sensor
C1184
Fuel injector 4
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
S103
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-5


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
C133
12B637
C110
S105
S103
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor
C1066
Idle Air Control (IAC) valve
C189
Throttle Position Sensor (TPS)
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
C174
Ignition transformer capacitor 1
C180
Camshaft position sensor
C1184
Fuel injector 4
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-7



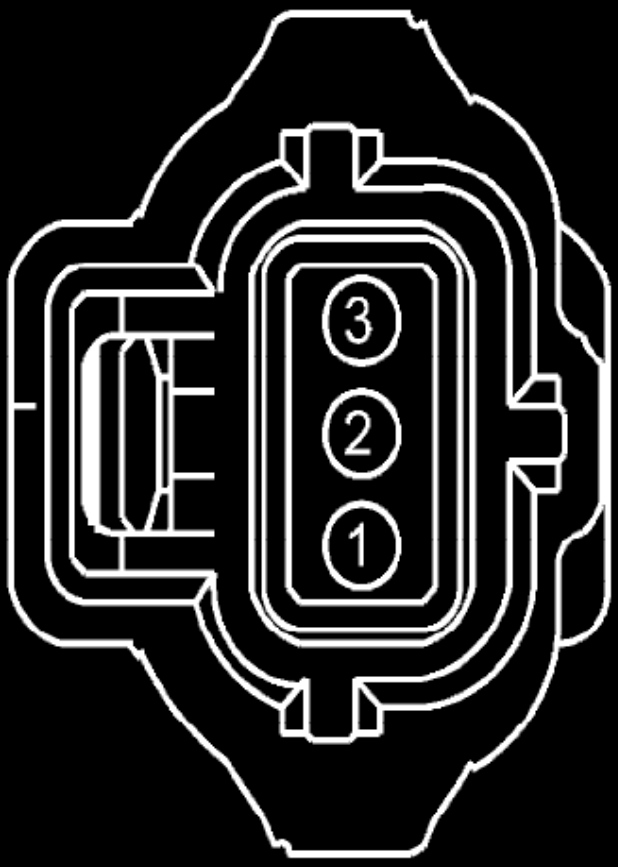
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	LE423 (GN-VT)	20	CTRL MOD. - POWERTRAIN # VOLTAGE REFERENCE ENGINE (VREF) (E-VREV)	3.0L, 4.0L
2	VE819 (GN-VT)	20	SENSOR - THROTTLE POSITION # POSITIVE SLOPE (TP2-PS)	3.0L, 4.0L
3	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	3.0L, 4.0L

Throttle Position Sensor: Diagrams

C189

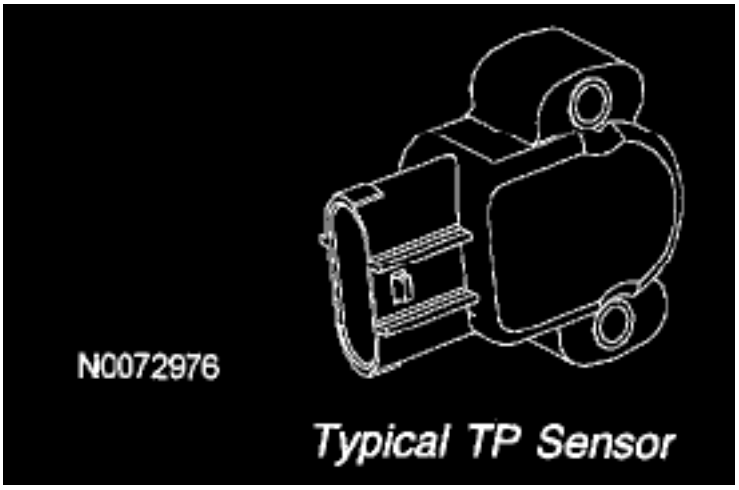
Connector: C1189

Description:	Harness:	Base Part #:
THROTTLE POSITION SENSOR (TPS)	12B637	9B989



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	2.3L
2	VE819 (GN-VT)	20	SENSOR - THROTTLE POSITION # POSITIVE SLOPE (TP2-PS)	2.3L
3	LE423 (GN-VT)	20	CTRL MOD. - POWERTRAIN # VOLTAGE REFERENCE ENGINE (VREF) (E-VREV)	2.3L

C1189



Throttle Position Sensor: Description and Operation

Electronic Throttle Body (ETB) Throttle Position Sensor

The ETB throttle position sensor has 2 signal circuits in the sensor for redundancy. The redundant ETB throttle position signals are required for increased monitoring. The first ETB throttle position sensor signal (TP1) has a negative slope (increasing angle, decreasing voltage) and the second signal (TP2) has a positive slope (increasing angle, increasing voltage). The 2 ETB throttle position sensor signals make sure the PCM receives a correct input even if 1 signal has a concern. There is 1 reference voltage circuit and 1 signal return circuit for the sensor. The reference voltage circuit and the signal return circuit is shared with the reference voltage circuits and signal return circuits used by the APP sensor.

Throttle Position (TP) Sensor

Typical TP Sensor

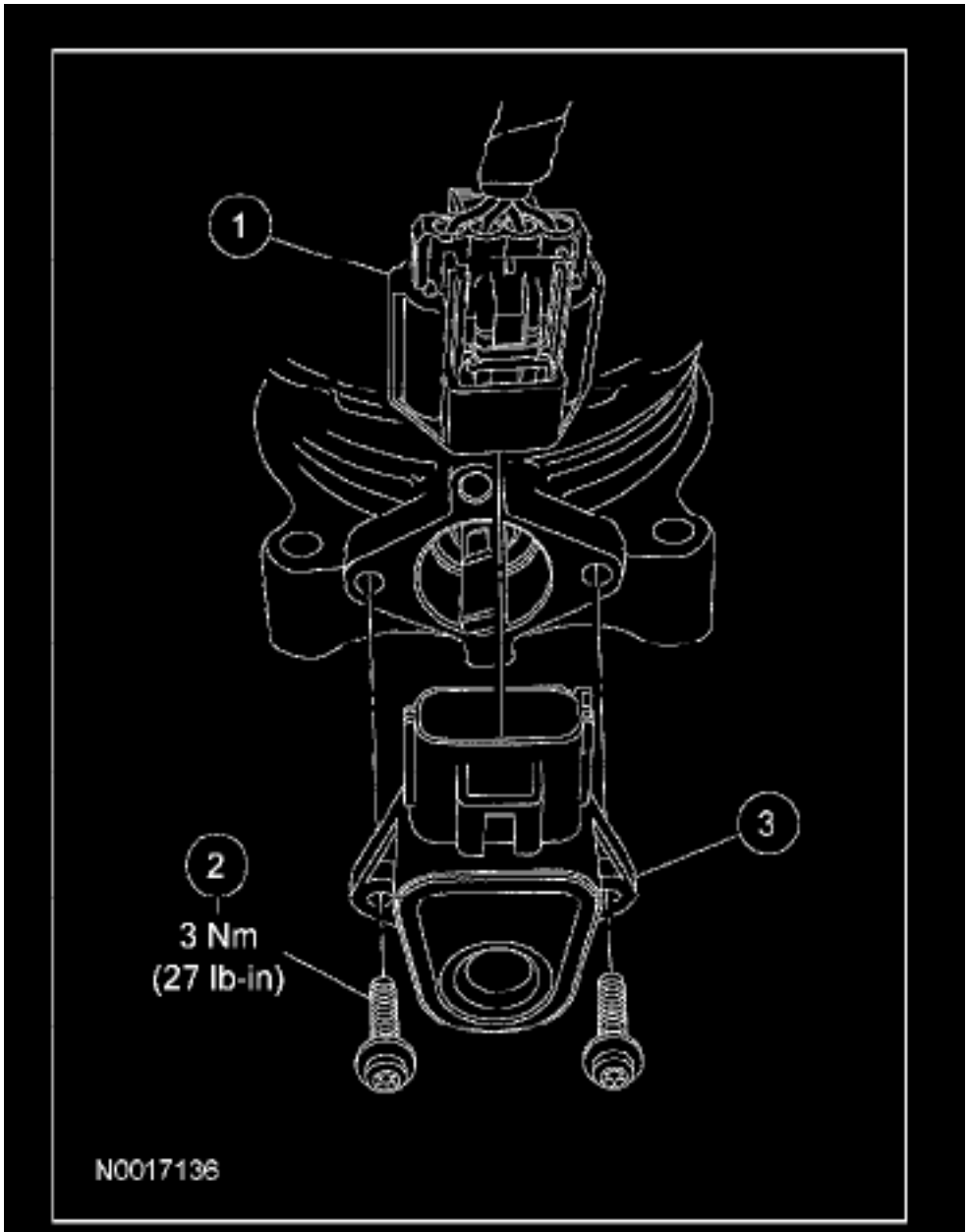
The TP sensor is a rotary potentiometer sensor that provides a signal to the PCM that is linearly proportional to the throttle plate/shaft position. The sensor housing has a 3-blade electrical connector that may be gold plated. The gold plating increases the corrosion resistance on the terminals and increases the connector durability. The TP sensor is mounted on the throttle body. As the TP sensor is rotated by the throttle shaft, 4 operating conditions are determined by the PCM from the TP. The operating conditions are: -

closed throttle (includes idle or deceleration)

- part throttle (includes cruise or moderate acceleration)

- wide open throttle (includes maximum acceleration or de-choke on crank)

- throttle angle rate



Item	Part Number	Description
1	14A464	Throttle position (TP) sensor electrical connector (part of 12B637)
2	W707535	TP sensor screw (2 required)
3	9E928	TP sensor

Throttle Position Sensor: Service and Repair

THROTTLE POSITION (TP) SENSOR

Removal and Installation

1. Disconnect the throttle position (TP) sensor electrical connector.

2. CAUTION: Failure to remove the throttle position (TP) sensor screws in the following manner will result in damage to the screws. First,

loosen the screws 1 to 2 full turns using a hand tool, and then use a suitable high-speed driver to complete the removal.

Remove and discard the 2 bolts and the TP sensor. -

To install, tighten to 3 Nm (27 lb-in).

3. CAUTION: Do not use a high-speed driver to install the new screws or damage to the throttle position (TP) sensor may occur.

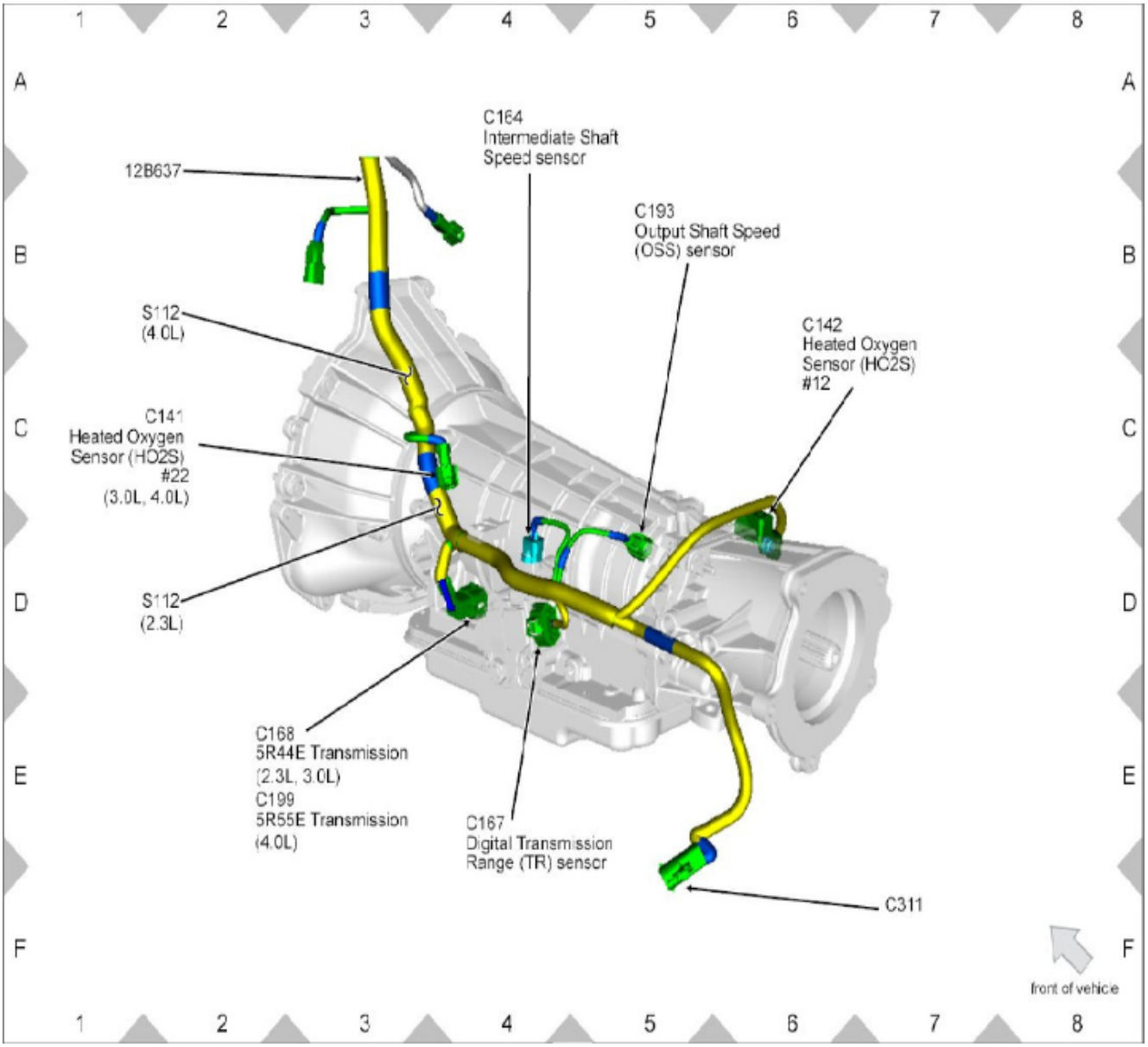
NOTE: -

Do not reuse the TP sensor and screws. A new TP sensor and screws must be installed.

- Failure to install the TP sensor in this manner may result in excessive idle speeds. Slide the rotary tangs into position over the throttle shaft blade, then rotate the TP sensor.

To install, reverse the removal procedure. -

Install a new TP sensor and screws.


C164
Intermediate Shaft Speed sensor
12B637
C193
Output Shaft Speed (OSS) sensor
S112
(4.0L)
C142
Heated Oxygen Sensor (HO2S) #12
C141
Heated Oxygen Sensor (HO2S) #22
(3.0L, 4.0L)
S112
(2.3L)
C168
5R44E Transmission
(2.3L, 3.0L)
C199
5R55E Transmission
(4.0L)
C167
Digital Transmission Range (TR) sensor
C311
front of vehicle

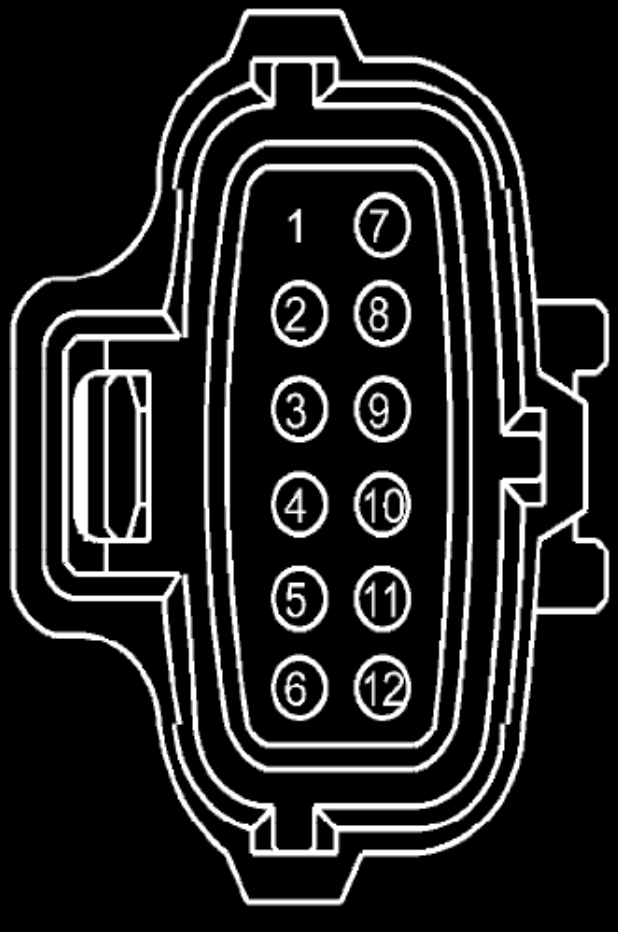
View 151-10

Connector: C167

Description: DIGITAL TRANSMISSION RANGE (TR) SENSOR

Harness: 12B637

Base Part #: 7F293



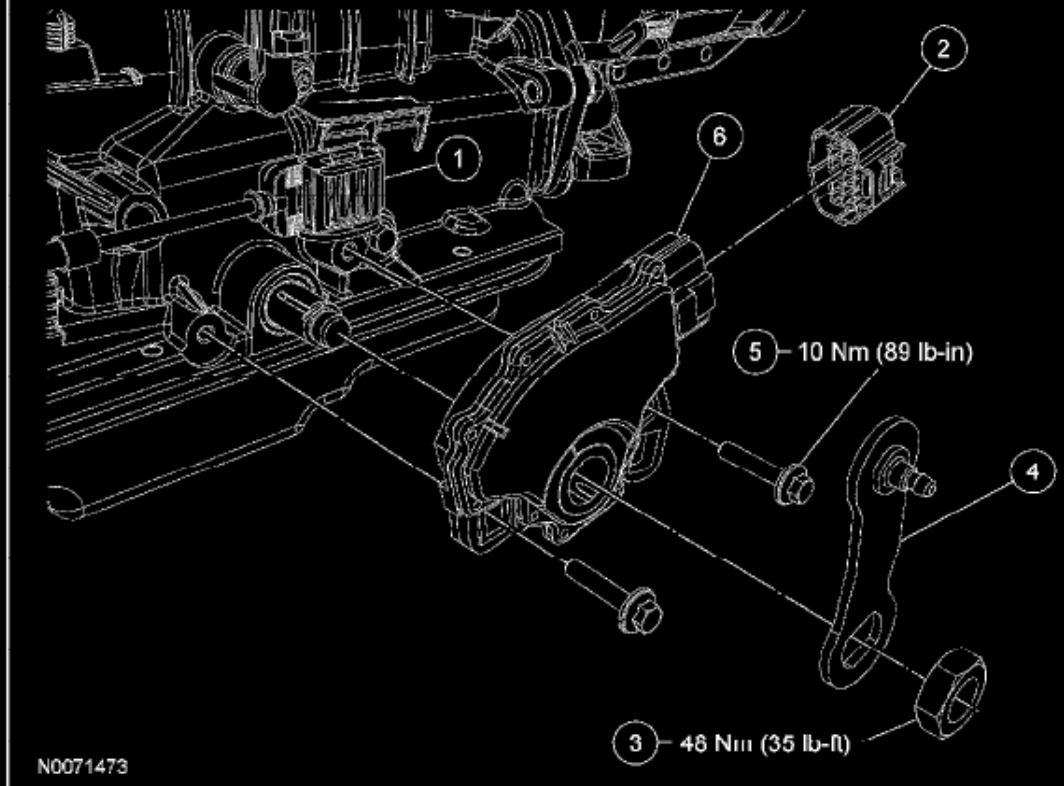
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	RE406 (GY-VT)	18	SIGNAL RETURN	
3	VET28 (GY-VT)	20	TR3A	
4	VET29 (VT-WH)	20	TR1	
5	VET30 (YE)	20	TR2	
6	VET31 (BU-OG)	20	TR4	
7	GD108 (BK-VT)	18	GROUND	4x4
8	CCF20 (GY-VT)	20	NETURAL SENSE	4x4
9	CBP20 (YE-VT)	18	FUSED POWER FEED	
10	CET40 (GN-OG)	20	STARTER CONTROL	
11	CET41 (BN-YE)	18	BACK UP	
12	CBP21 (BU-GY)	20	STARTER TO STARTER INTERRUPT RELAY	

C167

Special Tool(s)

ST1633-A	Alignment Gauge, TR Sensor 307-351 (T97L-70010-A)

Digital Transmission Range (TR) Sensor



Item	Part Number	Description
1	7E395-A	Selector lever cable
2	—	Digital transmission range (TR) sensor electrical connector
3	W701271-S	Manual control lever nut
4	7A256-A	Manual control lever
5	N806933-S	Digital TR sensor screw (2 required)
6	7F293-A	Digital TR sensor

Transmission Position Switch/Sensor: Service and Repair

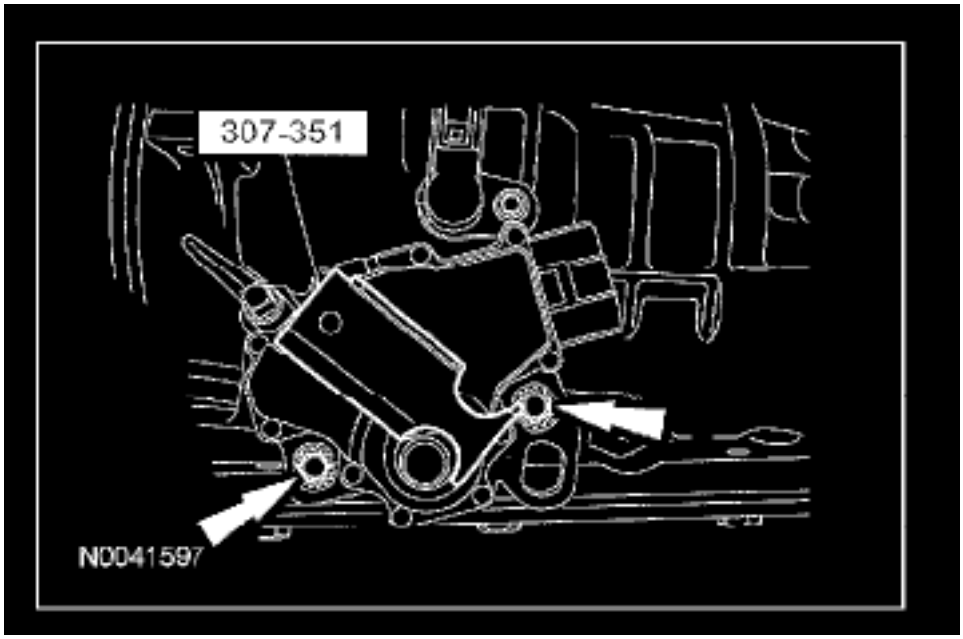
Digital Transmission Range (TR) Sensor

Digital Transmission Range (TR) Sensor

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the selector lever cable from the manual control lever. 3. Disconnect the digital transmission range (TR) sensor electrical connector. 4. Remove the manual control outer lever nut and manual control outer lever. 5. Remove the screws and the digital TR sensor.

Installation



1. CAUTION: The digital transmission range (TR) sensor must fit flush against the boss on the case to prevent damage to the sensor.

Install the digital TR sensor and loosely install the screws.

2. CAUTION: Tightening one screw before tightening the other may cause the sensor to bind or become damaged.

NOTE: The manual lever must be in the NEUTRAL position.

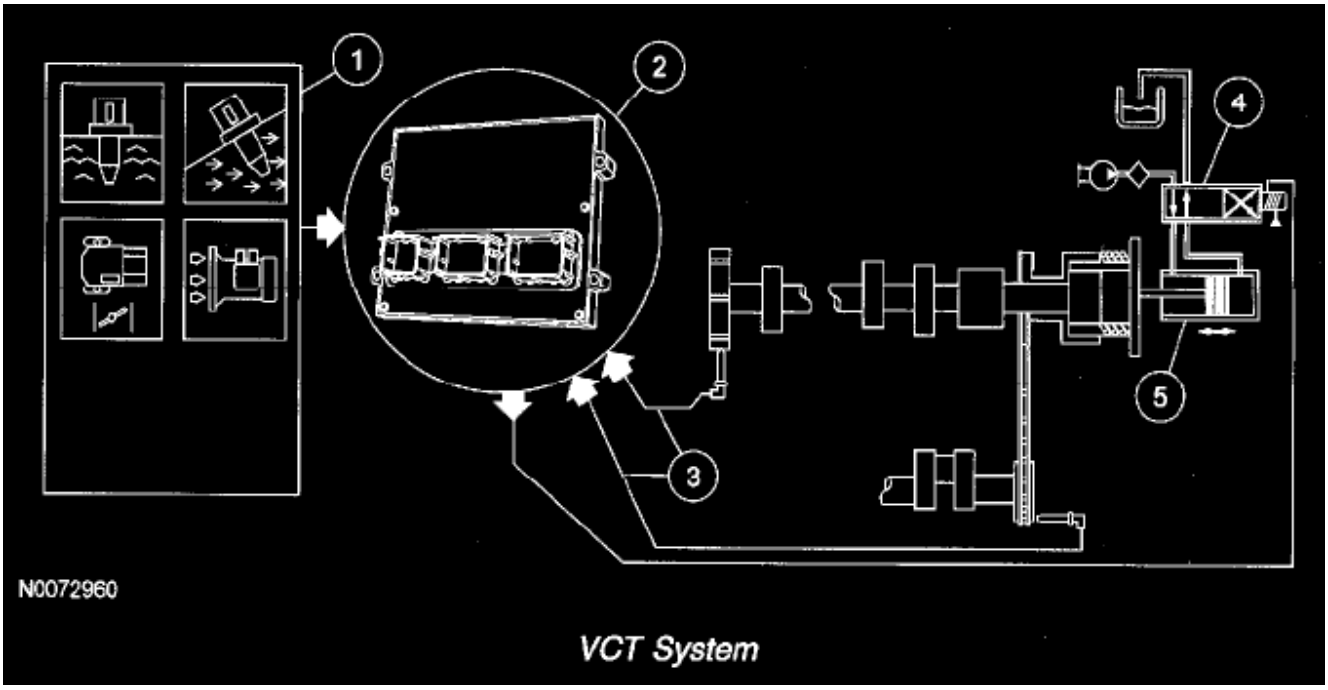
Using the special tool, align the digital TR sensor and tighten screws in an alternating sequence. ^

Tighten to 10 Nm (89 lb-inch).

3. Install the manual control outer lever and nut.

^ Tighten to 48 Nm (35 lb-ft).

4. Connect the digital TR sensor electrical connector. 5. Connect the selector lever cable to the manual control lever. 6. Verify that the selector lever cable is adjusted correctly.



VCT System

Variable Valve Timing Actuator: Description and Operation

VARIABLE CAMSHAFT TIMING (VCT) SYSTEM

Overview

The VCT enables rotation of the camshaft(s) relative to the crankshaft rotation as a function of engine operating conditions. There are 4 types of VCT systems.

- Exhaust phase shifting (EPS) system - the exhaust cam is the active cam being retarded.

- Intake phase shifting (IPS) system - the intake cam is the active cam being advanced.

- Dual equal phase shifting (DEPS) system - both intake and exhaust cams are phase shifted and equally advanced or retarded.

- Dual independent phase shifting (DIPS) system - where both the intake and exhaust cams are shifted independently.

All systems have 4 operational modes: idle, part throttle, wide open throttle (WOT), and default mode. At idle and low engine speeds with closed throttle, the powertrain control module (PCM) determines the phase angle based on air flow, engine oil temperature and engine coolant temperature. At part and wide open throttle the PCM determines the phase angle based on engine RPM, load, and throttle position. VCT systems provide reduced emissions and enhanced engine power, fuel economy and idle quality. IPS systems also have the added benefit of improved torque. In addition, some VCT system applications can eliminate the need for an external exhaust gas recirculation (EGR) system. The elimination of the EGR system is accomplished by controlling the overlap time between the intake valve opening and exhaust valve closing. Currently, both the IPS and DEPS systems are used.

Variable Camshaft Timing (VCT) System

VCT System

The VCT system consists of an electric hydraulic positioning control solenoid, a camshaft position (CMP) sensor, and a trigger wheel. The CMP trigger wheel has a number of equally spaced teeth equal to the number (n) of cylinders on a bank plus one extra tooth (n+1). Four cylinder and V8 engines use a CMP 4+1 tooth trigger wheel. V6 engines use a CMP 3+1 tooth trigger wheel. The extra tooth placed between the equally spaced teeth represents the CMP signal for that bank. A crankshaft position (CKP) sensor provides the PCM with crankshaft positioning information in 10 degree increments.

1. The PCM receives input signals from the intake air temperature (IAT) sensor, engine coolant temperature (ECT) sensor, engine oil temperature

(EOT) sensor, CMP, throttle position (TP) sensor, mass air flow (MAF) sensor, and CKP to determine the operating conditions of the engine. At idle and low engine speeds with closed throttle, the PCM controls the camshaft position based on ECT, EOT, IAT, and MAF. During part and wide open throttle, the camshaft position is determined by engine RPM, load and throttle position. The VCT system does not operate until the engine is at normal operating temperature.

2. The VCT system is enabled by the PCM when the correct conditions are met. 3. The CKP signal is used as a reference for CMP positioning. 4. The VCT solenoid valve is an integral part of the VCT system. The solenoid valve controls the flow of engine oil in the VCT actuator assembly.

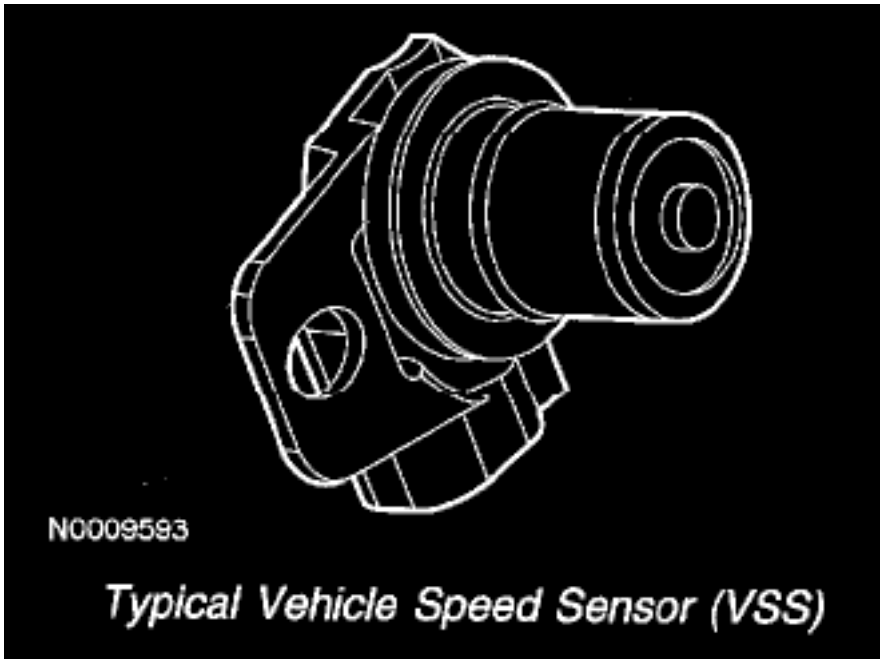
As the PCM controls the duty cycle of the solenoid valve, oil pressure/flow advances or retards the cam timing. Duty cycles near 0% or 100% represent rapid movement of the camshaft. Retaining a fixed camshaft position is accomplished by dithering (oscillating) the solenoid valve duty cycle.

The PCM calculates and determines the desired camshaft position. It continually updates the VCT solenoid duty cycle until the desired position is achieved. A difference between the desired and actual camshaft position represents a position error in the PCM VCT control loop. The PCM

disables the VCT and places the camshaft in a default position if a concern is detected. A related DTC is also set when the concern is detected.

5. When the VCT solenoid is energized, engine oil is allowed to flow to the VCT actuator assembly which advances or retards the camshaft timing.

One half of the VCT actuator is coupled to the camshaft and the other half is connected to the timing chain. Oil chambers between the 2 halves couple the camshaft to the timing chain. When the flow of oil is shifted from one side of the chamber to the other, the differential change in oil pressure forces the camshaft to rotate in either an advance or retard position depending on the oil flow.



Vehicle Speed Sensor: Description and Operation

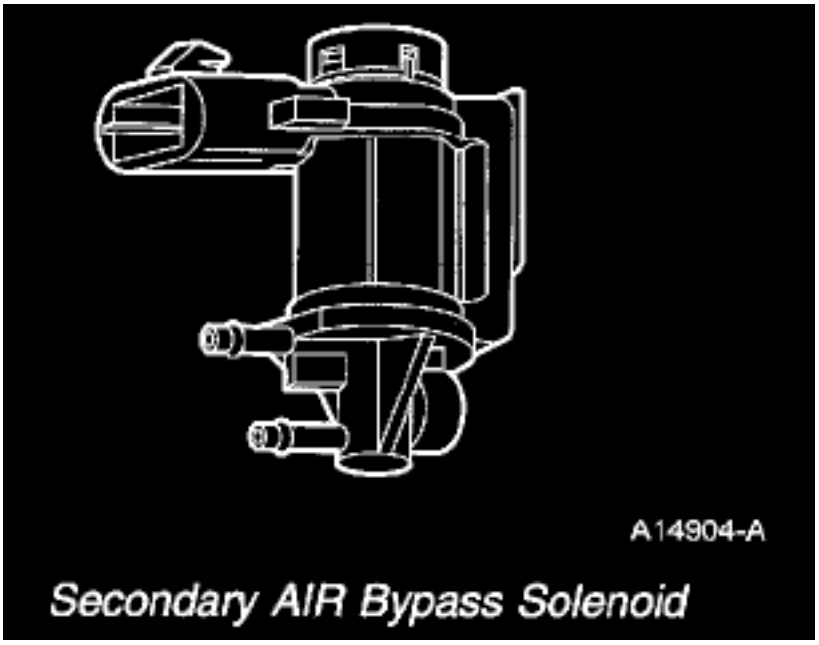
Output Shaft Speed (OSS) Sensor

The OSS sensor provides the PCM with information about the rotational speed of an output shaft. The PCM uses the information to control and diagnose powertrain behavior. In some applications, the sensor is also used as the source of vehicle speed. The sensor may be physically located in different places on the vehicle, depending upon the specific application. The design of each speed sensor is unique and depends on which powertrain control feature uses the information that is generated.

Vehicle Speed Sensor (VSS)

Typical Vehicle Speed Sensor (VSS)

The VSS is a variable reluctance or Hall-effect sensor that generates a waveform with a frequency that is proportional to the speed of the vehicle. If the vehicle is moving at a relatively low velocity, the sensor produces a signal with a low frequency. As the vehicle velocity increases, the sensor generates a signal with a higher frequency. The PCM uses the frequency signal generated by the VSS (and other inputs) to control such parameters as fuel injection, ignition control, transmission/transaxle shift scheduling, and torque converter clutch scheduling.

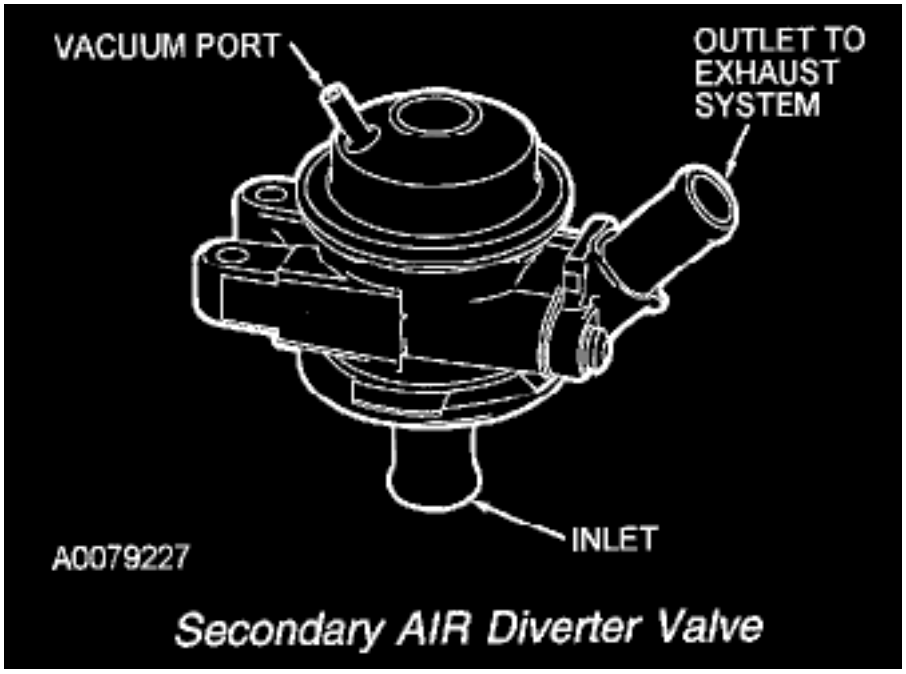


Air Diverter Solenoid: Description and Operation

SECONDARY AIR INJECTION (AIR) BYPASS SOLENOID

Secondary AIR Bypass Solenoid

The secondary AIR bypass solenoid is used by the PCM to control vacuum to the secondary air injection diverter (AIR diverter) valve. The secondary AIR bypass solenoid is a normally closed solenoid. The secondary AIR bypass solenoid also has a filtered vent feature to permit vacuum release.

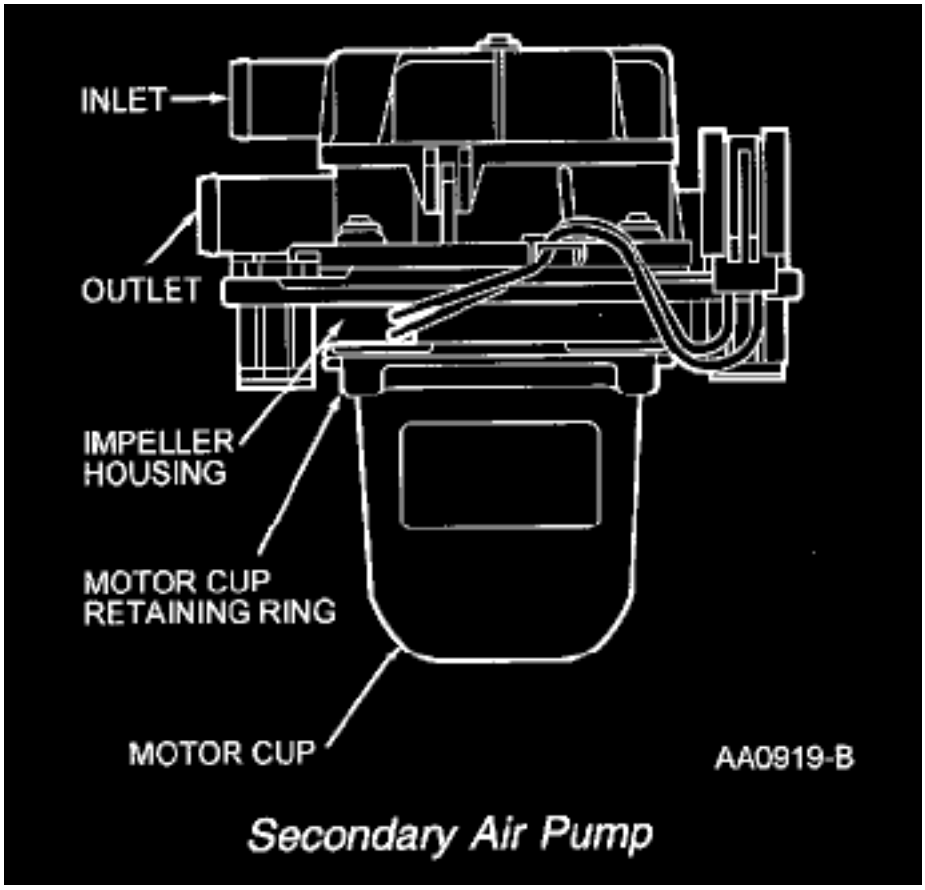


Air Diverter Valve: Description and Operation

SECONDARY AIR DIVERTER VALVE

Secondary AIR Diverter Valve

The secondary AIR diverter valve is used with the secondary AIR pump to provide on/off control of air to the exhaust manifold and catalytic converter. When the secondary AIR pump is on and vacuum is supplied to the AIR diverter valve, air passes the integral check valve disk. When the secondary AIR pump is off, and vacuum is removed from the AIR diverter valve, the integral check valve disk is held on the seat and stops air from being drawn into the exhaust system and prevents the back flow of the exhaust into the secondary AIR system.



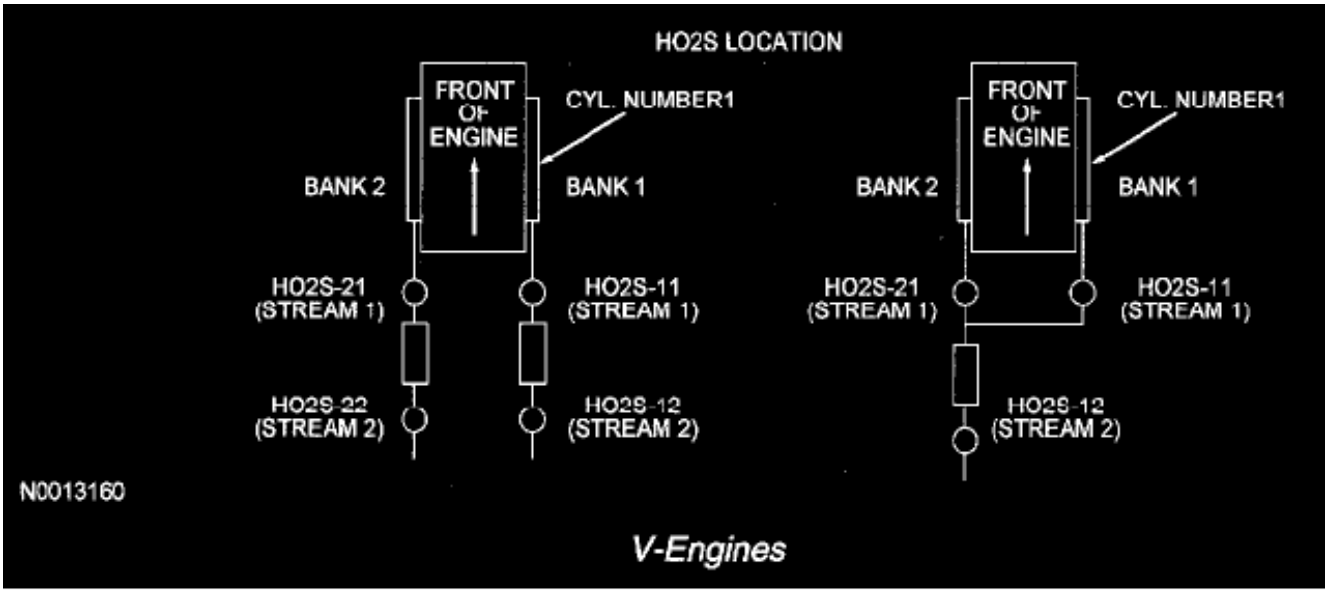
Secondary Air Pump

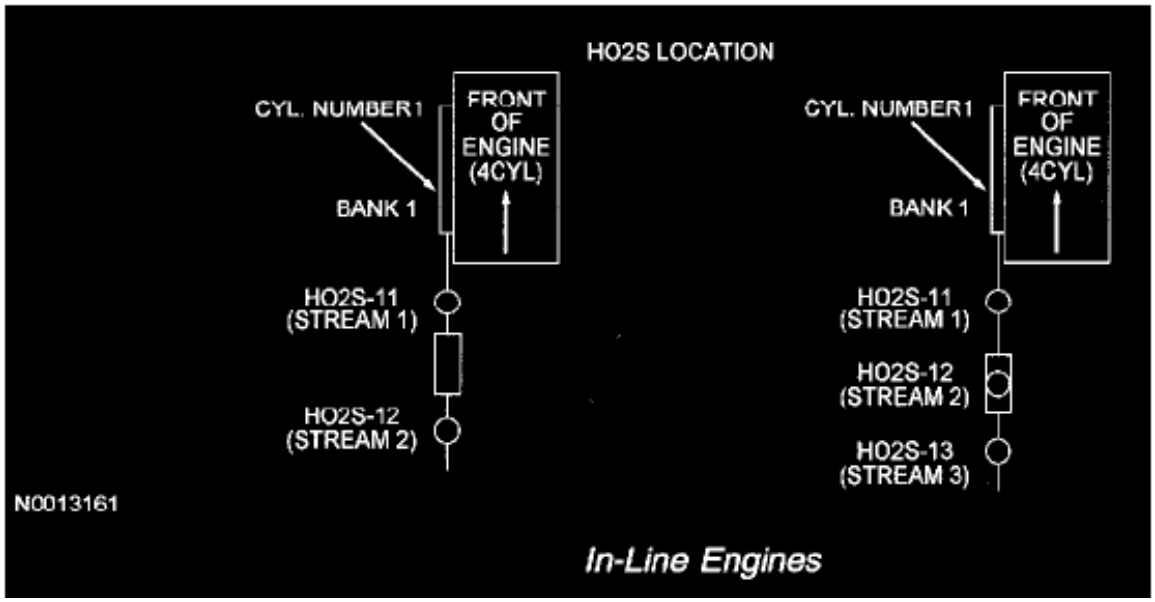
Air Injection Pump: Description and Operation

SECONDARY AIR PUMP

Secondary Air Pump

The secondary AIR pump provides pressurized air to the secondary AIR system. The secondary AIR pump functions independently of RPM and is controlled by the PCM. The secondary AIR pump is only used for short periods of time. Delivery of air is dependent on the amount of system backpressure and system voltage. The secondary AIR pump draws dry filtered air from the intake air system downstream of the MAF/IAT sensor.





Catalytic Converter: Description and Operation

CATALYST AND EXHAUST SYSTEMS

Overview

V-Engines

In-Line Engines

The catalytic converter and exhaust systems work together to control the release of harmful engine exhaust emissions into the atmosphere. The engine exhaust gas consists mainly of nitrogen (N),

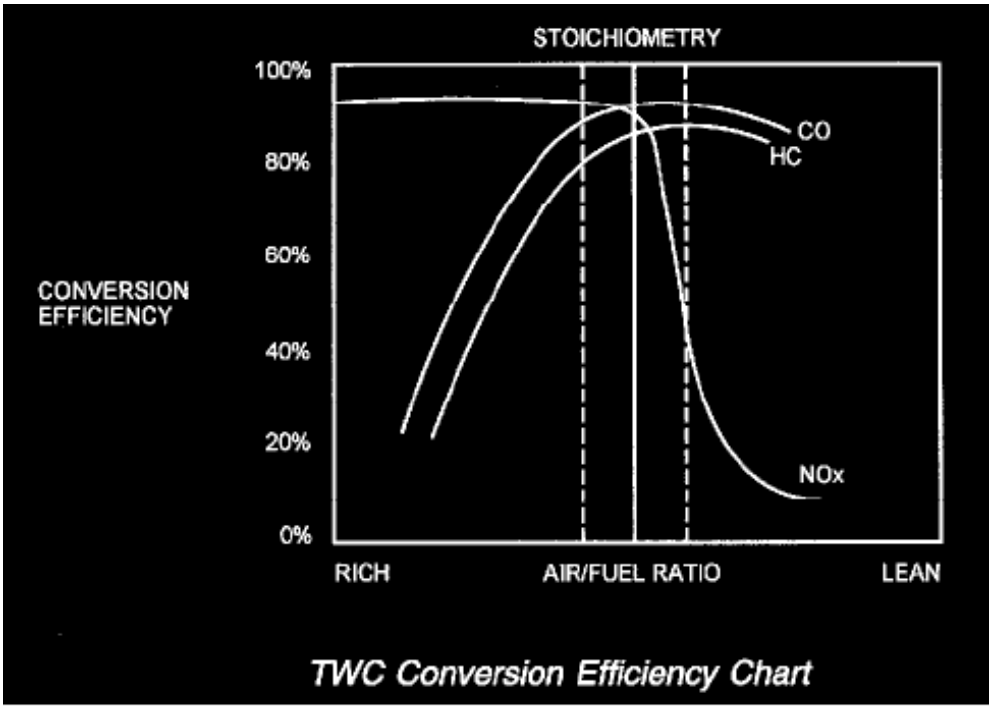
carbon dioxide (CO2) and water vapor (H2O). However, it also contains carbon monoxide (CO), oxides of nitrogen (NOx), hydrogen (H), and various unburned hydrocarbons (HCs). The major air pollutants of CO, NOx,and HCs, and their emission into the atmosphere must be controlled.

The exhaust system generally consists of an exhaust manifold, front exhaust pipe, front heated oxygen sensor (HO2S), rear exhaust pipe, catalyst HO2S, a muffler, and an exhaust tailpipe. The catalytic converter is typically installed between the front and rear exhaust pipes. On some vehicle applications, more than one catalyst is used between the front and rear exhaust pipes. Catalytic converter efficiency is monitored by the on board diagnostic (OBD) system strategy in the powertrain control module (PCM). For information on the OBD catalyst monitor, refer to the description for the Catalyst Efficiency Monitor. See: Computers and Control Systems/Testing and Inspection/Monitors, Trips, Drive Cycles and Readiness Codes/Catalyst Efficiency Monitor

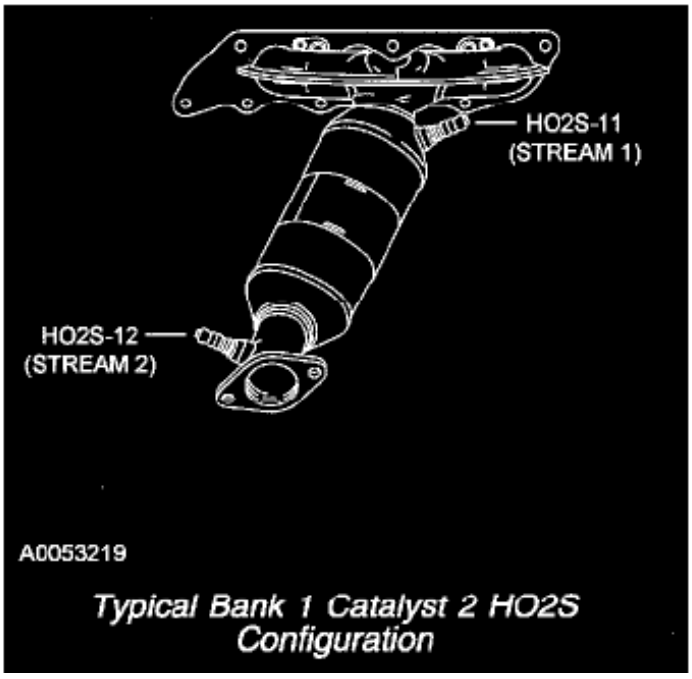
For most vehicles, only 2 HO2Ss are used in an exhaust stream. The front sensors (HO2S11/HO2S21) before the catalyst are used for primary fuel control while the ones after the catalyst (HO2S12/HO2S22) are used to monitor catalyst efficiency. However, some partial zero emission vehicles (PZEV) use 3 HO2Ss for each engine bank. The stream 1 sensors (HO2S11/HO2S21) located before the catalyst are used for primary fuel control, the stream 2 sensors (HO2S12/HO2S22) are used to monitor the light-off catalyst, and the stream 3 sensors (HO2S13/HO2S23) located after the catalyst are used for long term fuel trim control to optimize catalyst efficiency (fore aft oxygen sensor control).

Catalytic Converter

A catalyst is a material that remains unchanged when it initiates and increases the speed of a chemical reaction. A catalyst also enables a chemical reaction to occur at a lower temperature. The concentration of exhaust gas products released to the atmosphere must be controlled. The catalytic



TWC Conversion Efficiency Chart



Typical Bank 1 Catalyst 2 HO2S Configuration

converter assists in this task. It contains a catalyst in the form of a specially treated ceramic honeycomb structure saturated with catalytically active precious metals. As the exhaust gases come in contact with the catalyst, they are changed into mostly harmless products. The catalyst initiates and speeds up heat producing chemical reactions of the exhaust gas components so they are used up as much as possible.

Light Off Catalyst

As the catalyst heats up, converter efficiency rises rapidly. The point at which conversion efficiency exceeds 50% is called catalyst light off. For most catalysts this point occurs at 246°C to 302°C (475°F to 575°F). A fast light catalyst is a 3-way catalyst (TWC) that is located as close to the exhaust manifold as possible. Because the light off catalyst is located close to the exhaust manifold it lights off faster and reduces emissions more quickly than the catalyst located under the body. Once the catalyst lights off, the catalyst quickly reaches the maximum conversion efficiency for that catalyst.

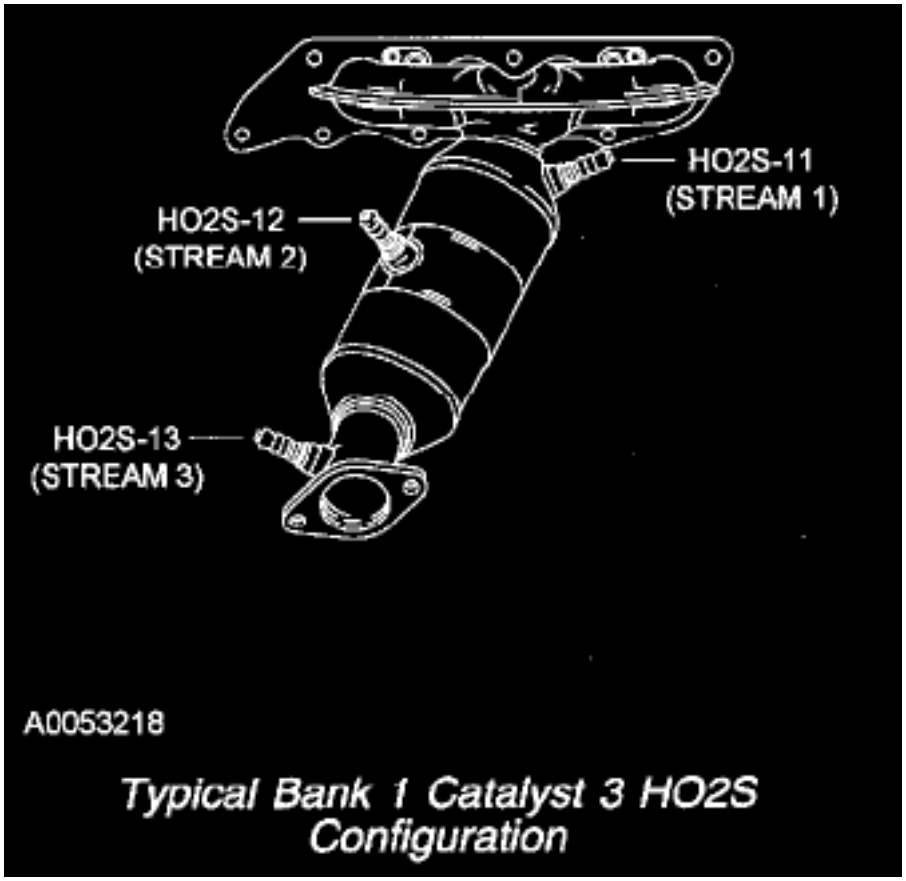
Three-Way Catalyst (TWC) Conversion Efficiency

TWC Conversion Efficiency Chart

A TWC requires a stoichiometric fuel ratio, 14.7 pounds of air to 1 pound of fuel (14.7:1), for high conversion efficiency. In order to achieve these high efficiencies, the air/fuel ratio must be tightly controlled with a narrow window of stoichiometry. Deviations outside of this window greatly decrease the conversion efficiency. For example a rich mixture decreases the HC and CO conversion efficiency while a lean mixture decreases the NOx conversion efficiency.

Exhaust System

Typical Bank 1 Catalyst 2 HO2S Configuration



Typical Bank 1 Catalyst 3 HO2S Configuration

Typical Bank 1 Catalyst 3 HO2S Configuration

The purpose of the exhaust system is to convey engine emissions from the exhaust manifold to the atmosphere. Engine exhaust emissions are directed from the engine exhaust manifold to the catalytic converter through the front exhaust pipe. A HO2S is mounted on the front exhaust pipe before the catalyst. The catalytic converter reduces the concentration of CO, unburned HCs, and NOx in the exhaust emissions to an acceptable level. The reduced exhaust emissions are directed from the catalytic converter past another HO2S mounted in the rear exhaust pipe and then on into the muffler. Finally, the exhaust emissions are directed to the atmosphere through an exhaust tailpipe.

On some PZEV, there is a total of 3 HO2S in the exhaust stream. One near the exhaust manifold (stream 1), one in the middle of the light-off catalyst (stream 2), and the third (stream 3) is mounted after the light-off catalyst.

Underbody Catalyst

The underbody catalyst is located after the light off catalyst. The underbody catalyst may be in line with the light off catalyst, or the underbody catalyst may be common to 2 light off catalysts, forming a Y pipe configuration. For an exact configuration of the catalyst and exhaust system for a specific vehicle, refer to Exhaust System for the exhaust system-exploded view.

Three-Way Catalytic (TWC) Converter

The TWC converter contains either platinum (Pt) and rhodium (Rh) or palladium (Pd) and rhodium (Rh). The TWC converter catalyzes the oxidation reactions of unburned HCs and CO and the reduction reaction of NOx. The 3-way conversion can be best accomplished by always operating the engine air fuel/ratio at or close to stoichiometry.

Exhaust Manifold Runners

The exhaust manifold runners collect exhaust gases from engine cylinders. The number of exhaust manifolds and exhaust manifold runners depends on the engine configuration and number of cylinders.

Exhaust Pipes

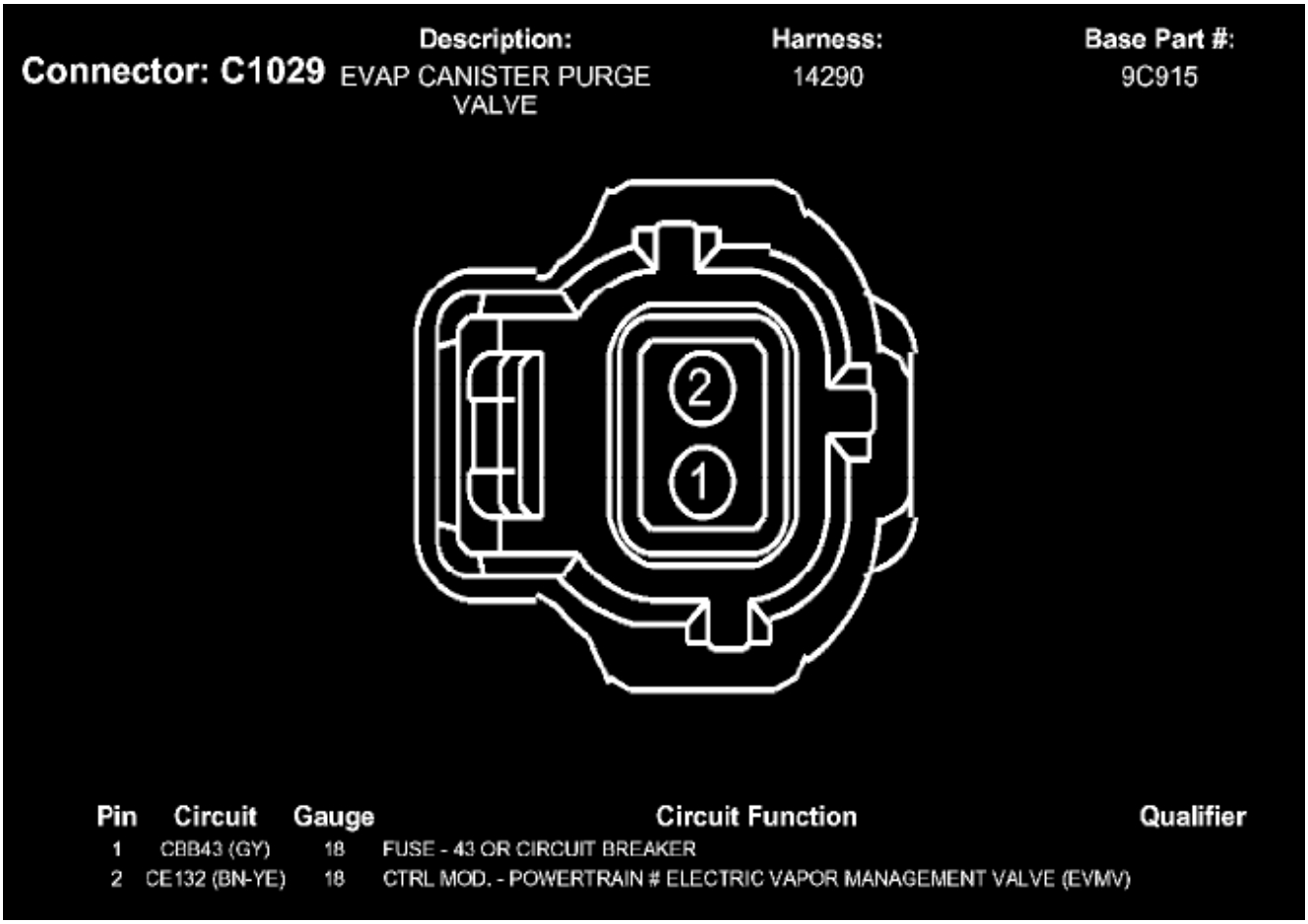
Exhaust pipes are usually treated during manufacturing with an anti-corrosive coating agent to increase the life of the product. The pipes serve as guides for the flow of exhaust gases from the engine exhaust manifold through the catalytic converter and the muffler.

Heated Oxygen Sensor (HO2S)

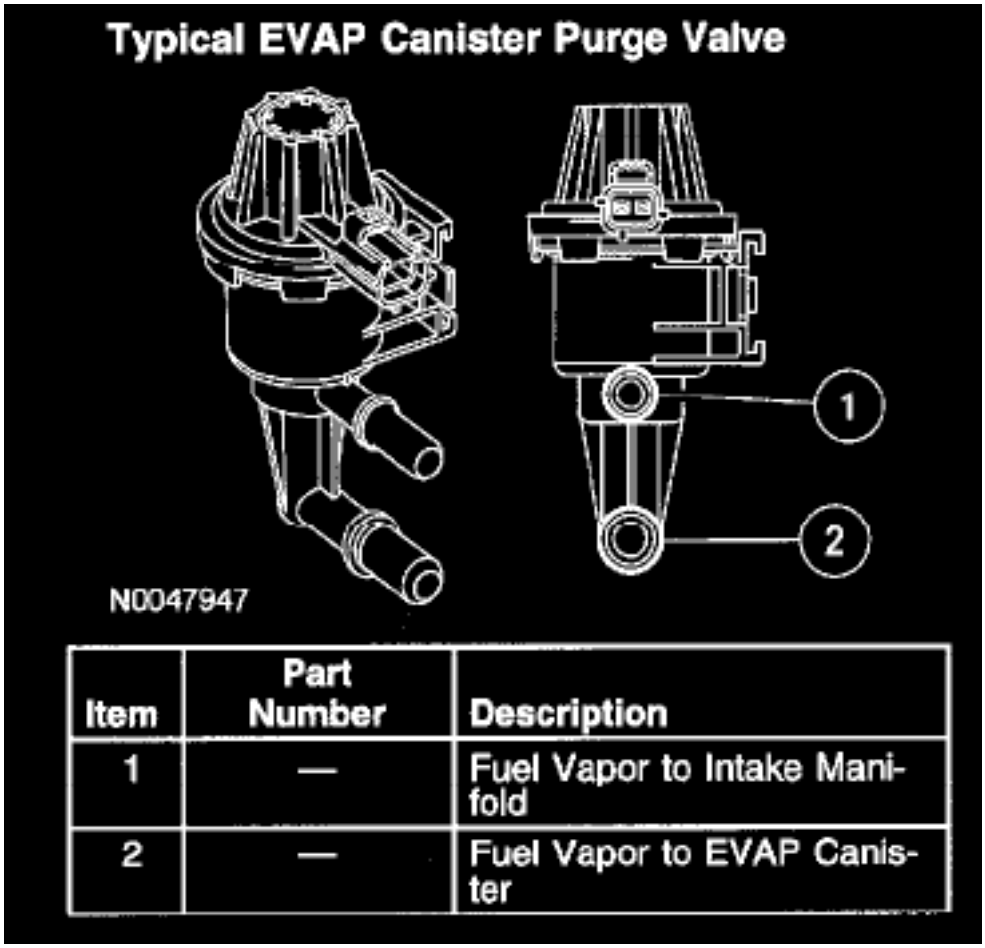
The HO2Ss provide the PCM with information related to the oxygen content of the exhaust gas.

Muffler

Mufflers are usually treated during manufacturing with an anti-corrosive coating agent to increase the life of the product. The muffler reduces the level of noise produced by the engine, and also reduces the noise produced by exhaust gases as they travel from the catalytic converter to the atmosphere.


Connector: C1029
Description:
EVAP CANISTER PURGE VALVE
Harness:
14290
Base Part #:
9C915
2
1
Pin Circuit Gauge Circuit Function Qualifier
1 CBB43 (GY) 18 FUSE - 43 OR CIRCUIT BREAKER
2 CE132 (BN-YE) 18 CTRL MOD. - POWERTRAIN # ELECTRIC VAPOR MANAGEMENT VALVE (EVMV)

C1029



Item	Part Number	Description
1	—	Fuel Vapor to Intake Manifold
2	—	Fuel Vapor to EVAP Canister

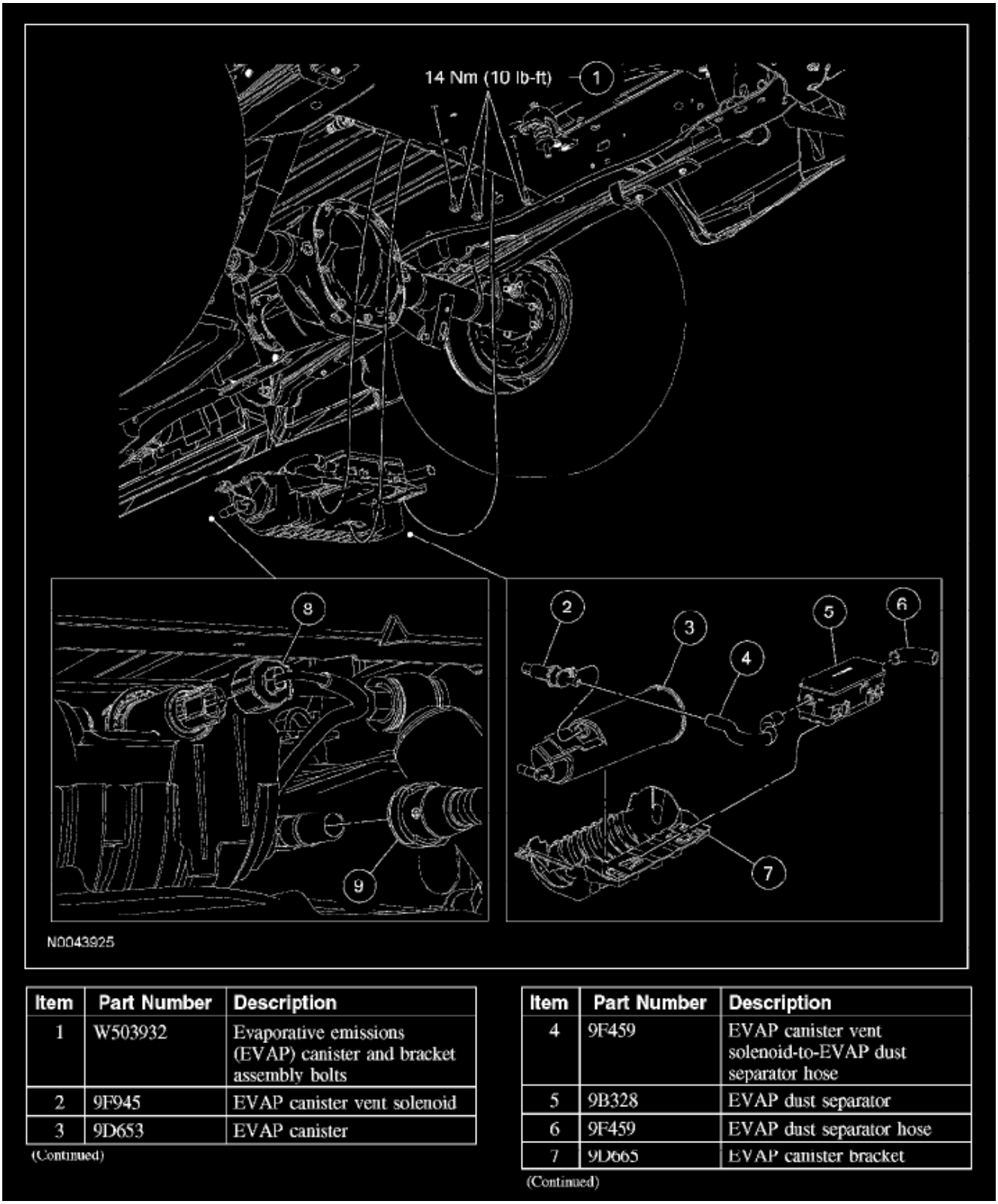
Canister Purge Control Valve: Description and Operation

EVAPORATIVE EMISSION (EVAP) CANISTER PURGE VALVE

Typical EVAP Canister Purge Valve

NOTE: The EVAP canister purge valve may also be referred to as a vapor management valve (VMV).

The EVAP canister purge valve is part of the enhanced EVAP system that is controlled by the PCM. This valve controls the flow of vapors (purging) from the EVAP canister to the intake manifold during various engine operating modes. The EVAP canister purge valve is a normally closed valve. The EVAP canister purge valve controls the flow of vapors by way of a solenoid, eliminating the need for an electronic vacuum regulator and vacuum diaphragm. The PCM outputs a signal between 0 mA and 1,000 mA to control the EVAP canister purge valve.



Item	Part Number	Description
1	W503932	Evaporative emissions (EVAP) canister and bracket assembly bolts
2	9F945	EVAP canister vent solenoid
3	9D653	EVAP canister

(Continued)

Item	Part Number	Description
4	9F459	EVAP canister vent solenoid-to-EVAP dust separator hose
5	9B328	EVAP dust separator
6	9F459	EVAP dust separator hose
7	9D665	EVAP canister bracket

(Continued)

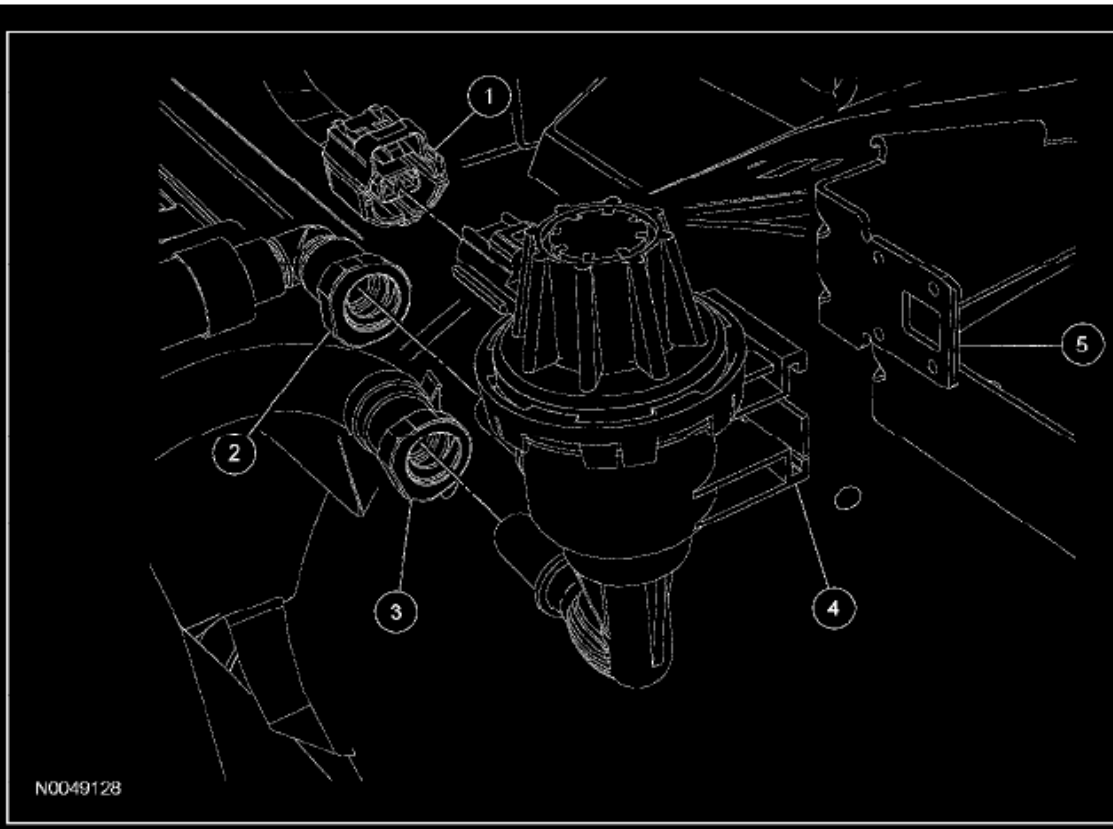
Canister Purge Control Valve: Service and Repair

EVAPORATIVE EMISSION CANISTER PURGE VALVE

Exploded View

Part 1

Item	Part Number	Description
8	—	EVAP canister vent solenoid electrical connector (part of 14405)
9	—	Rear fuel tank vapor tube and fuel tank pressure sensor assembly-to-EVAP canister quick connect coupling (part of 9G291)



Item	Part Number	Description
1	—	Evaporative emission (EVAP) canister purge valve electrical connector (part of 14401)
2	—	Intake manifold vapor tube-to-EVAP canister purge valve quick connect coupling (part of 9G297)
3	—	Front fuel tank vapor tube-to-EVAP canister purge valve quick connect coupling (part of 9G271)
4	9C915	EVAP canister purge valve
5	9C915	EVAP canister purge valve bracket

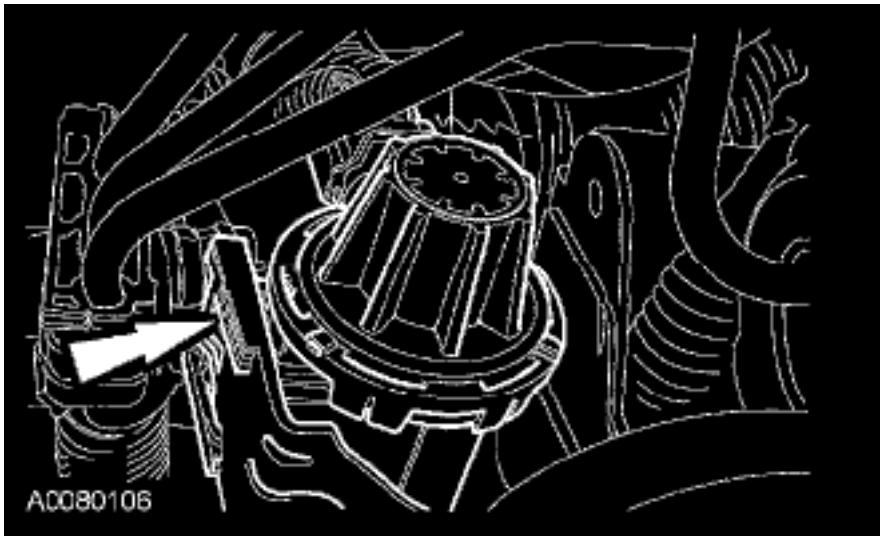
Part 2

Removal and Installation

WARNING:

- When working on or near the evaporative emission (EVAP) system, disconnect the battery ground cable from the battery. The EVAP system contains fuel vapor and condensed fuel vapor, so an electrical spark may cause a fire or explosion. Failure to follow this instruction may result in serious personal injury.

- Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.



1. Disconnect the battery ground cable. 2. Slide the evaporative emission (EVAP) canister purge valve off the bracket.

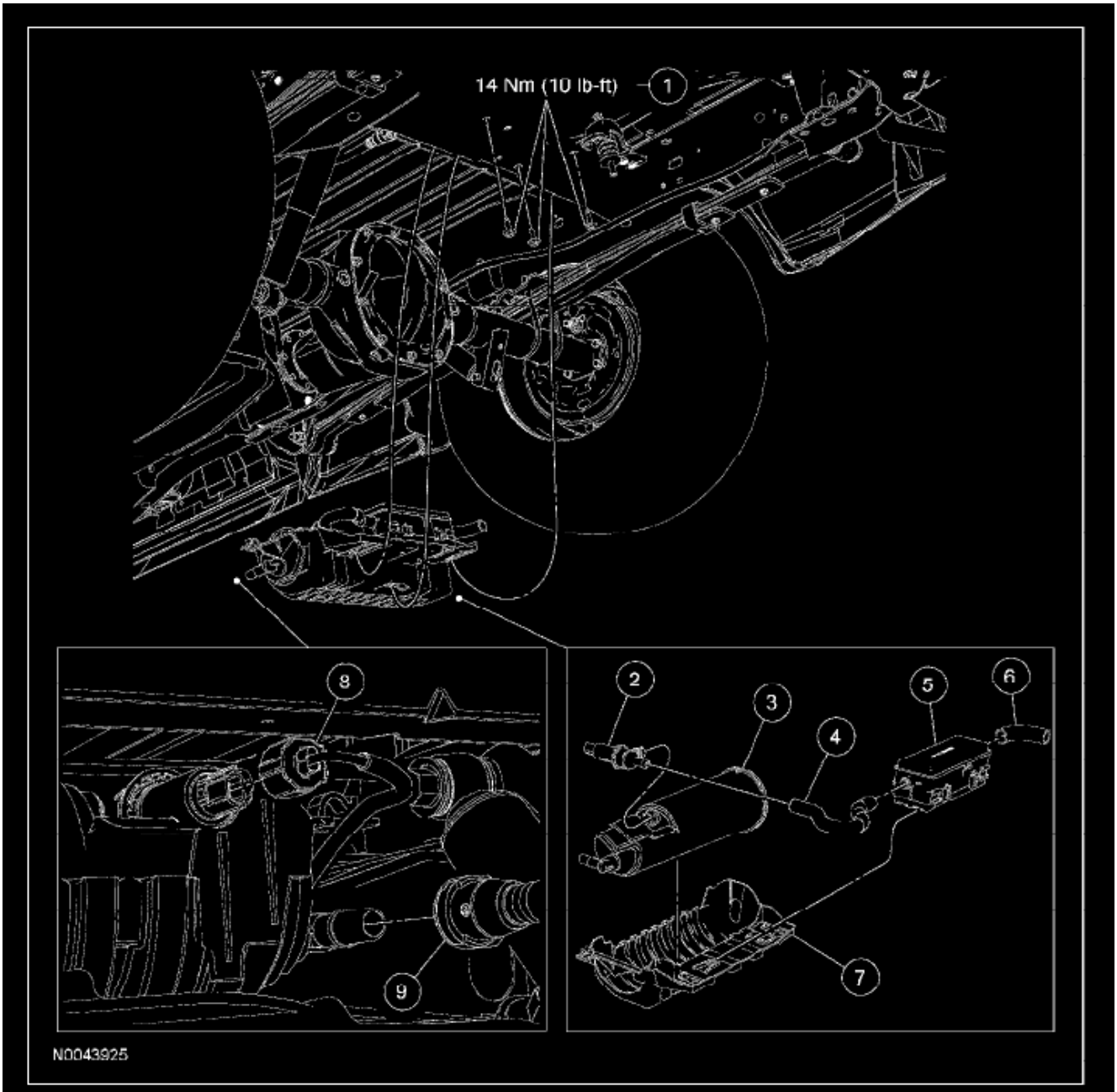
3. Disconnect the intake manifold vapor tube-to-EVAP canister purge valve quick connect coupling, fuel tank vapor tube-to-EVAP canister purge

valve quick connect coupling and the EVAP canister purge valve electrical connector.

4. Remove the valve. 5. To install, reverse the removal procedure.

- Carry out the leak test. See: Testing and Inspection

- Carry out the evaporative emission repair verification drive cycle.



Item	Part Number	Description
1	W503932	Evaporative emissions (EVAP) canister and bracket assembly bolts
2	9F945	EVAP canister vent solenoid
3	9D653	EVAP canister

(Continued)

Item	Part Number	Description
4	9F459	EVAP canister vent solenoid-to-EVAP dust separator hose
5	9B328	EVAP dust separator
6	9F459	EVAP dust separator hose
7	9D665	EVAP canister bracket

(Continued)

Evaporative Canister Filter: Service and Repair

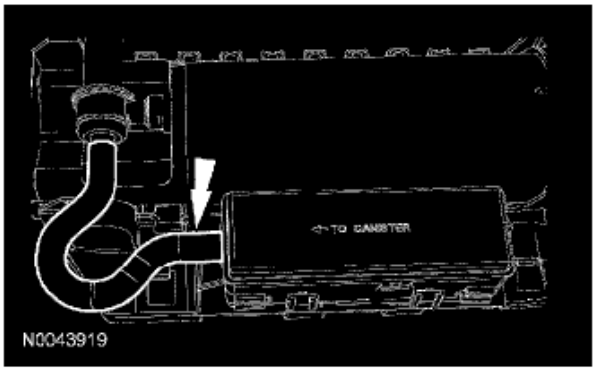
DUST SEPARATOR

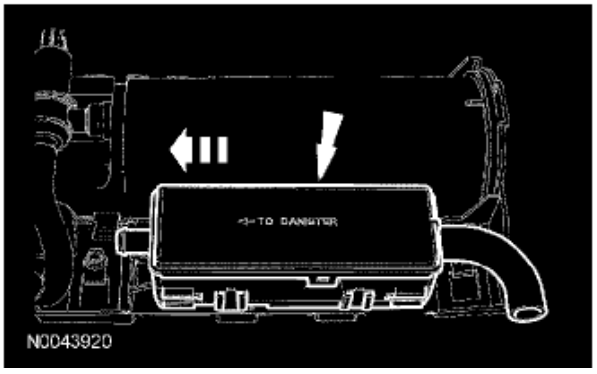
Removal and Installation

Exploded View

Part 1

Item	Part Number	Description
8	—	EVAP canister vent solenoid electrical connector (part of 14405)
9	—	Rear fuel tank vapor tube and fuel tank pressure sensor assembly-to-EVAP canister quick connect coupling (part of 9G291)





Part 2

WARNING:

- When working on or near the evaporative emission (EVAP) system, disconnect the battery ground cable from the battery. The EVAP system contains fuel vapor and condensed fuel vapor, so an electrical spark may cause a fire or explosion. Failure to follow this instruction may result in serious personal injury.

- Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the battery ground cable. 3. Disconnect the rear fuel tank vapor tube and fuel tank pressure sensor assembly-to-evaporative emissions (EVAP) canister quick connect coupling. 4. Disconnect the EVAP canister vent solenoid electrical connector. 5. Remove the EVAP canister and bracket assembly bolts.

- To install, tighten to 14 Nm (10 lb-ft).

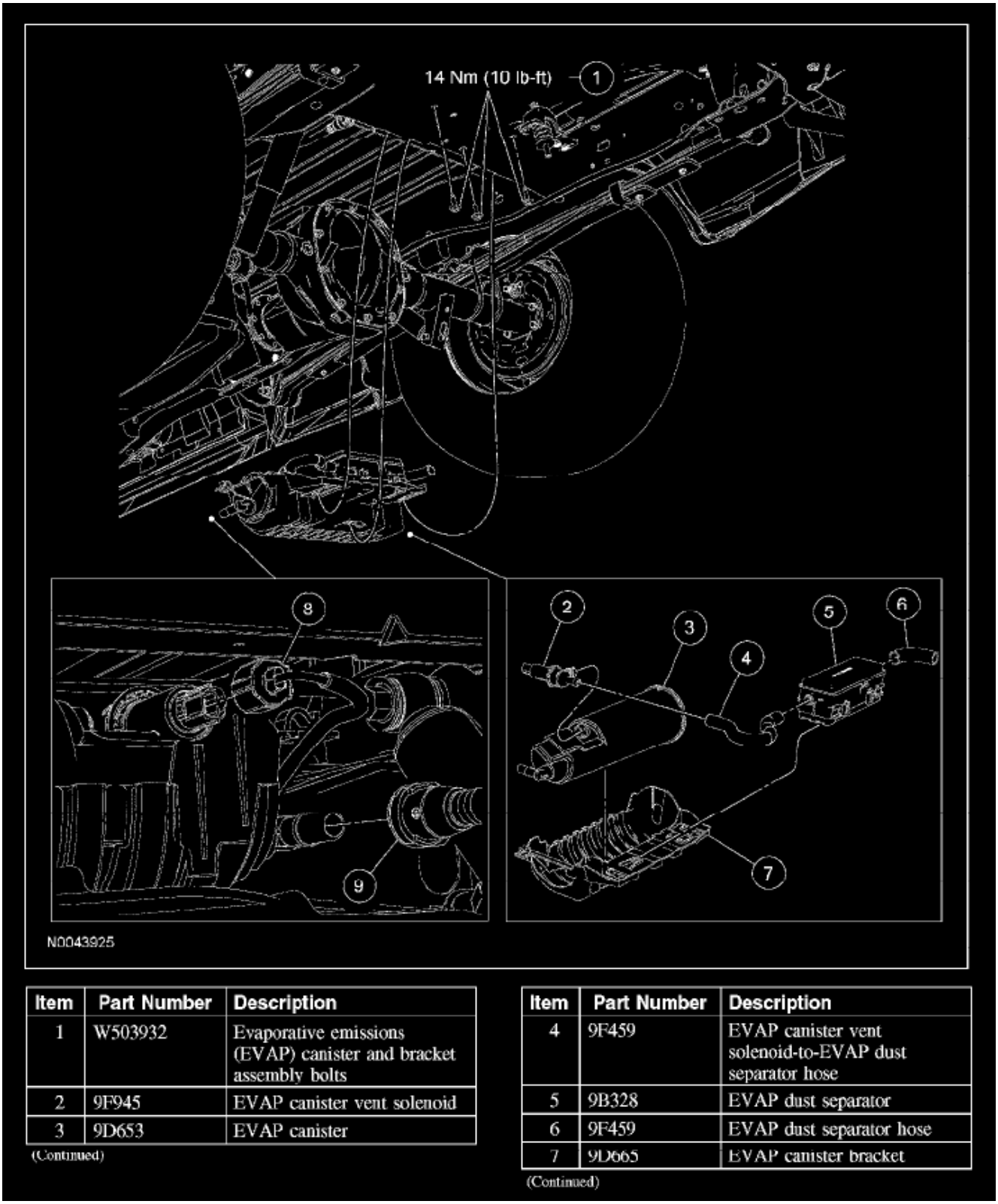
6. Remove the EVAP canister and bracket assembly. 7. Disconnect the EVAP canister vent solenoid-to-dust separator hose from the dust separator.

8. Remove the dust separator from the bracket.

9. To install, reverse the removal procedure.

- Carry out the leak test. See: Testing and Inspection

- Carry out the evaporative emission repair verification drive cycle.



Item	Part Number	Description
1	W503932	Evaporative emissions (EVAP) canister and bracket assembly bolts
2	9F945	EVAP canister vent solenoid
3	9D653	EVAP canister

(Continued)

Item	Part Number	Description
4	9F459	EVAP canister vent solenoid-to-EVAP dust separator hose
5	9B328	EVAP dust separator
6	9F459	EVAP dust separator hose
7	9D665	EVAP canister bracket

(Continued)

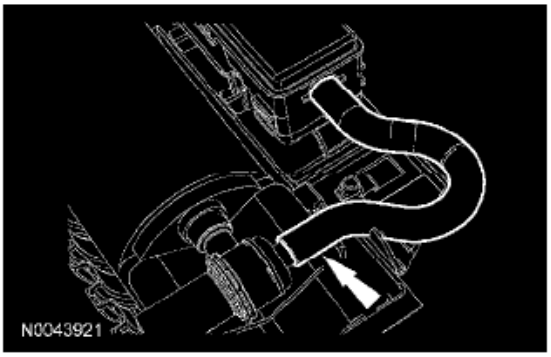
Evaporative Emission Control Canister: Service and Repair

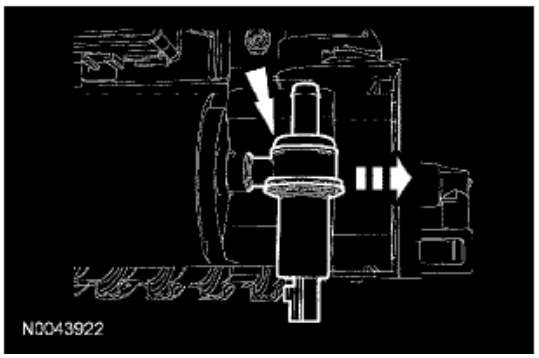
EVAPORATIVE EMISSION CANISTER

Exploded View

Part 1

Item	Part Number	Description
8	—	EVAP canister vent solenoid electrical connector (part of 14405)
9	—	Rear fuel tank vapor tube and fuel tank pressure sensor assembly-to-EVAP canister quick connect coupling (part of 9G291)





Part 2

Removal and Installation

WARNING:

- When working on or near the evaporative emission (EVAP) system, disconnect the battery ground cable from the battery. The EVAP system contains fuel vapor and condensed fuel vapor, so an electrical spark may cause a fire or explosion. Failure to follow this instruction may result in serious personal injury.

- Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the battery ground cable. 3. Disconnect the rear fuel tank vapor tube and fuel tank pressure sensor assembly-to-evaporative emissions (EVAP) canister quick connect coupling. 4. Disconnect the EVAP canister vent solenoid electrical connector. 5. Remove the EVAP canister and bracket assembly bolts.

- To install, tighten to 14 Nm (10 lb-ft).

6. Remove the EVAP canister and bracket assembly. 7. Disconnect the EVAP canister vent solenoid-to-dust separator hose from the EVAP

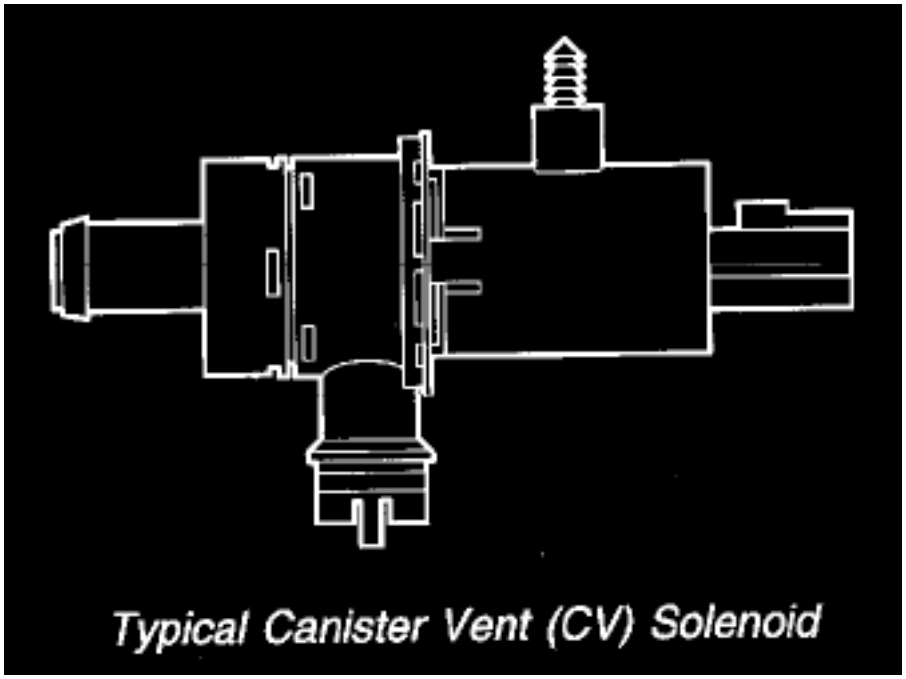
8. Remove the EVAP canister vent solenoid from the EVAP canister.

9. Remove the EVAP canister from the bracket.

10. To install, reverse the removal procedure.

- Carry out the leak test. See: Testing and Inspection

- Carry out the evaporative emission repair verification drive cycle.

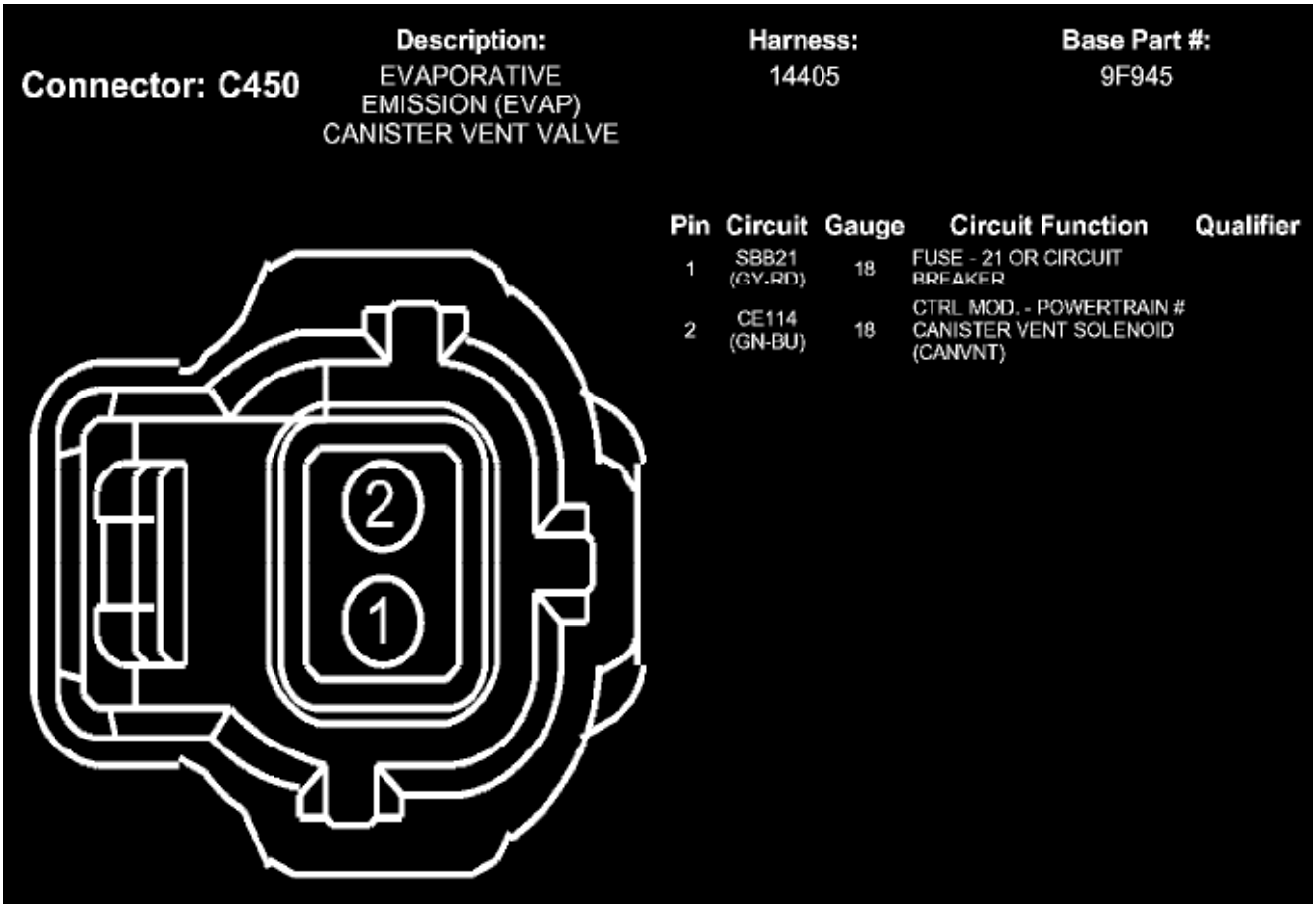


Leak Detection Solenoid: Description and Operation

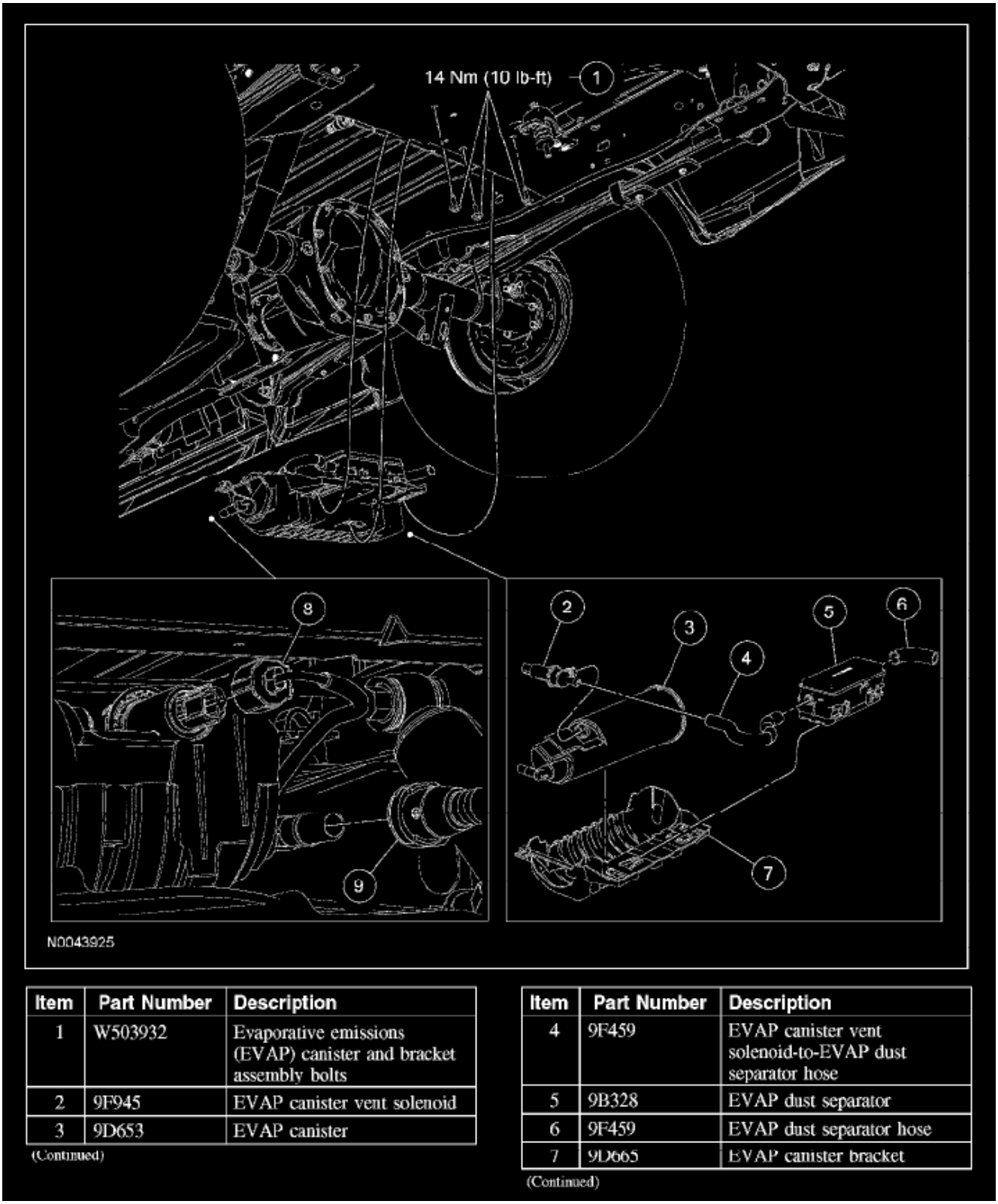
CANISTER VENT (CV) SOLENOID

Typical Canister Vent (CV) Solenoid

During the evaporative emissions (EVAP) leak check monitor, the CV solenoid seals the EVAP canister from the atmospheric pressure. This allows the EVAP canister purge valve to obtain the target vacuum in the fuel tank during the EVAP leak check monitor.


Connector: C450
Description:
EVAPORATIVE EMISSION (EVAP) CANISTER VENT VALVE
Harness:
14405
Base Part #:
9F945
Pin Circuit Gauge Circuit Function Qualifier
1 SBB21 (GY-RD) 18 FUSE - 21 OR CIRCUIT BREAKER
2 CE114 (GN-BU) 18 CTRL MOD. - POWERTRAIN # CANISTER VENT SOLENOID (CANVNT)
2
1

C450



Item	Part Number	Description
1	W503932	Evaporative emissions (EVAP) canister and bracket assembly bolts
2	9F945	EVAP canister vent solenoid
3	9D653	EVAP canister

(Continued)

Item	Part Number	Description
4	9F459	EVAP canister vent solenoid-to-EVAP dust separator hose
5	9B328	EVAP dust separator
6	9F459	EVAP dust separator hose
7	9D665	EVAP canister bracket

(Continued)

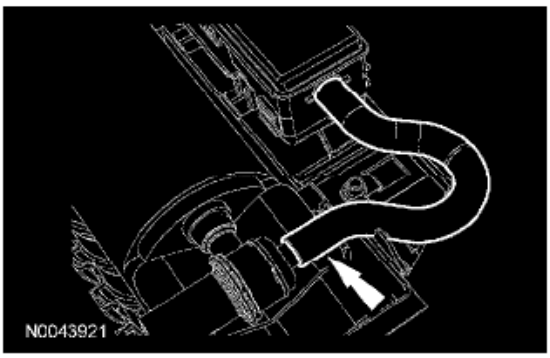
Leak Detection Valve: Service and Repair

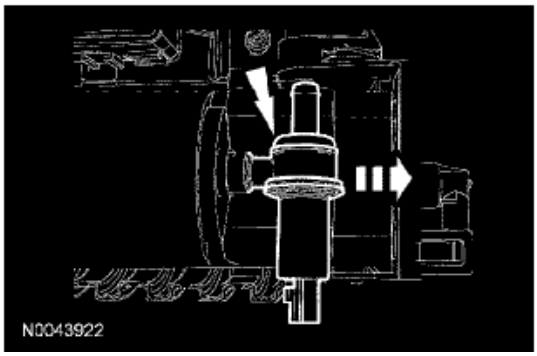
EVAPORATIVE EMISSION CANISTER VENT SOLENOID

Exploded View

Part 1

Item	Part Number	Description
8	—	EVAP canister vent solenoid electrical connector (part of 14405)
9	—	Rear fuel tank vapor tube and fuel tank pressure sensor assembly-to-EVAP canister quick connect coupling (part of 9G291)





Part 2

Removal and Installation

WARNING:

- When working on or near the evaporative emission (EVAP) system, disconnect the battery ground cable from the battery. The EVAP system contains fuel vapor and condensed fuel vapor, so an electrical spark may cause a fire or explosion. Failure to follow this instruction may result in serious personal injury.

- Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the battery ground cable. 3. Disconnect the rear fuel tank vapor tube and fuel tank pressure sensor assembly-to-evaporative emissions (EVAP) canister quick connect coupling. 4. Disconnect the EVAP canister vent solenoid electrical connector. 5. Remove the EVAP canister and bracket assembly bolts.

- To install, tighten to 14 Nm (10 lb-ft).

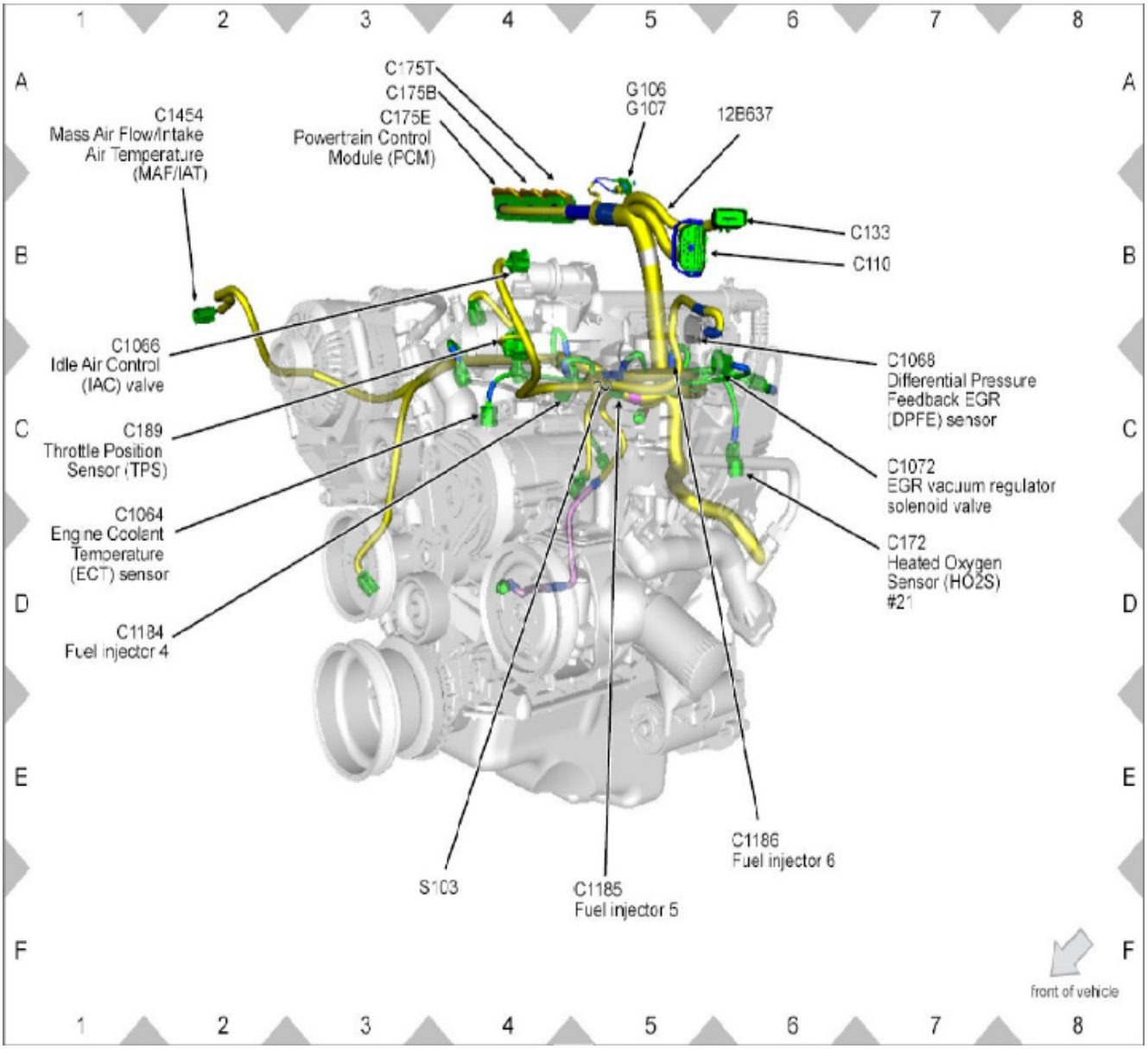
6. Remove the EVAP canister and bracket assembly. 7. Disconnect the EVAP canister vent solenoid-to-dust separator hose from the EVAP canister vent solenoid.

8. Remove the EVAP canister vent solenoid from the EVAP canister.

9. To install, reverse the removal procedure.

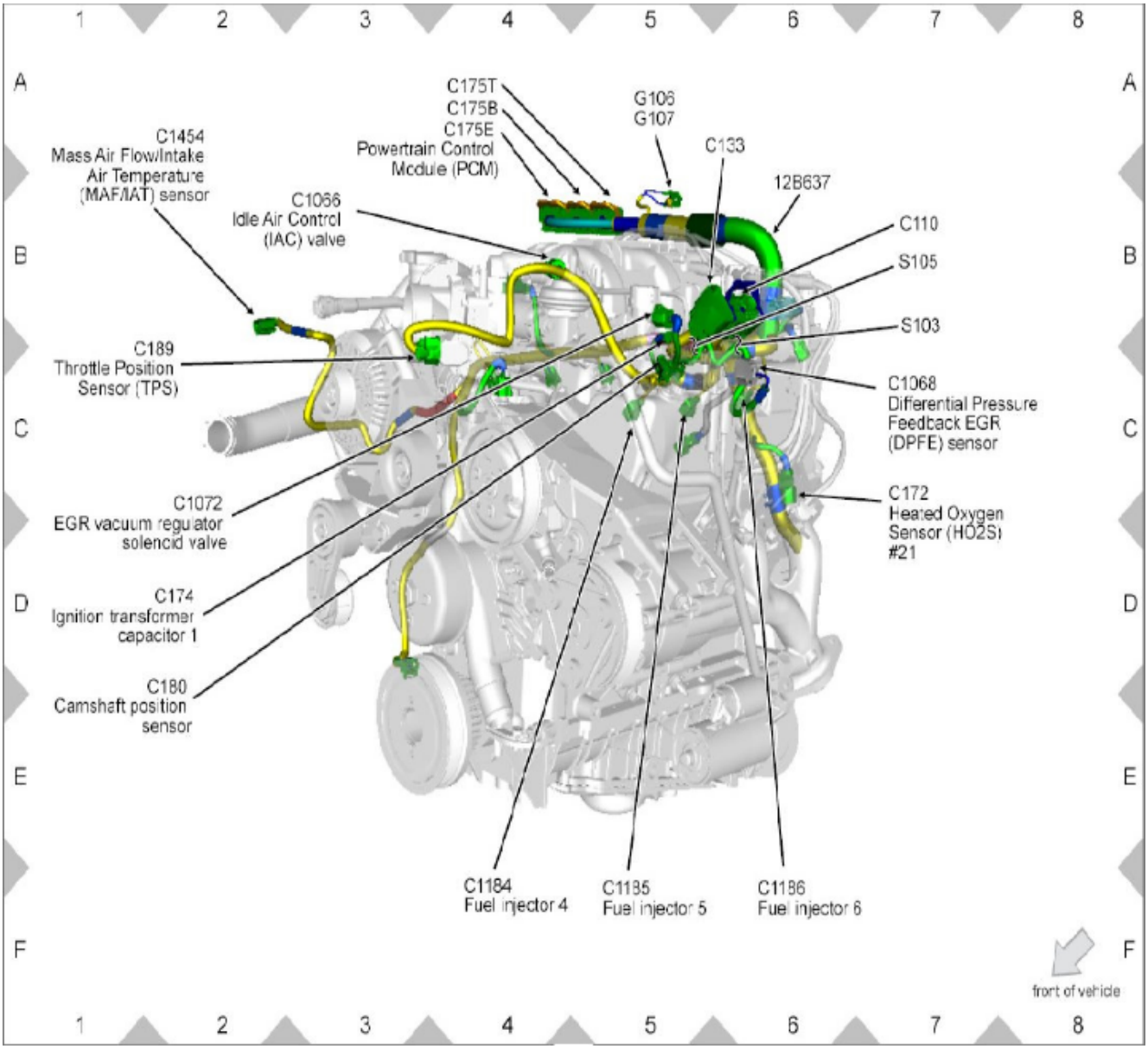
- Carry out the leak test. See: Testing and Inspection

- Carry out the evaporative emission repair verification drive cycle.



EGR Electronic Vacuum Regulator Solenoid: Locations

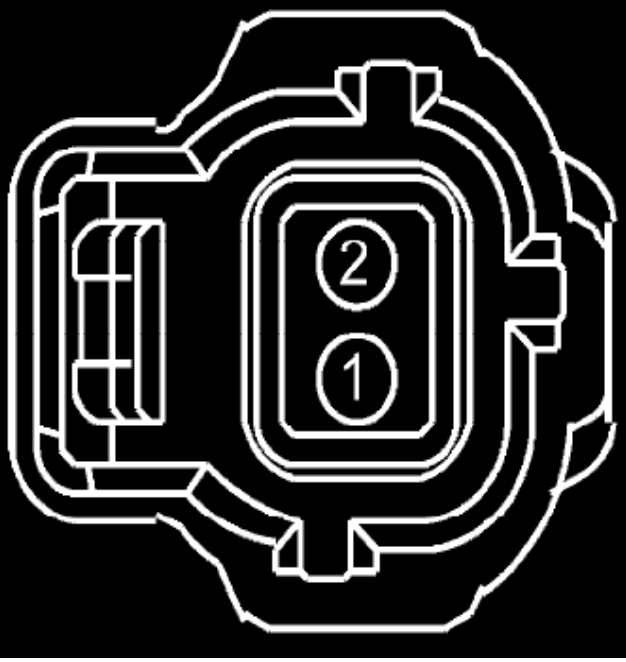
View 151-5


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
C133
12B637
C110
S105
S103
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor
C1066
Idle Air Control (IAC) valve
C189
Throttle Position Sensor (TPS)
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
C174
Ignition transformer capacitor 1
C180
Camshaft position sensor
C1184
Fuel injector 4
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-7

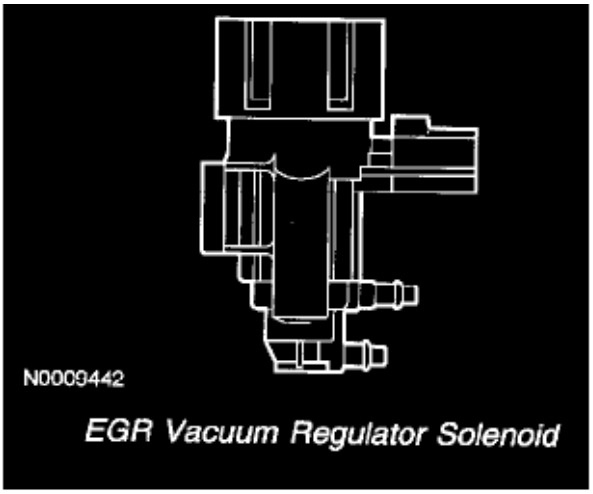
Connector: C1072

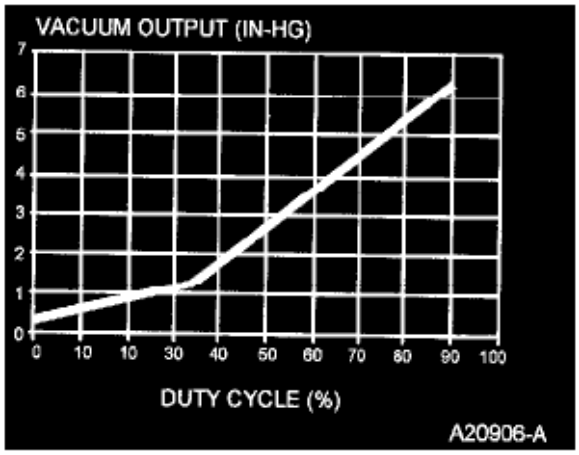
Description:	Harness:	Base Part #:
EGR VACUUM REGULATOR SOLENOID VALVE	12B637	



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBB43 (GY)	18	FUSE - 43 OR CIRCUIT BREAKER	3.0L, 4.0L
2	CE133 (VT-WH)	20	CTRL MOD. - POWERTRAIN # ELECTRONIC VACUUM REGULATOR (EVR)	3.0L, 4.0L

C1072





EGR VACUUM REGULATOR SOLENOID DATA

Duty Cycle (%)	Vacuum Output					
	Minimum		Nominal		Maximum	
	In-Hg	kPa	In-Hg	kPa	In-Hg	kPa
0	0	0	0.38	1.28	0.75	2.53
33	0.55	1.86	1.3	4.39	2.05	6.9
90	5.69	19.2	6.32	21.3	6.95	23.47
EGR vacuum regulator resistance: 26-40 Ohms						

EGR Electronic Vacuum Regulator Solenoid: Description and Operation

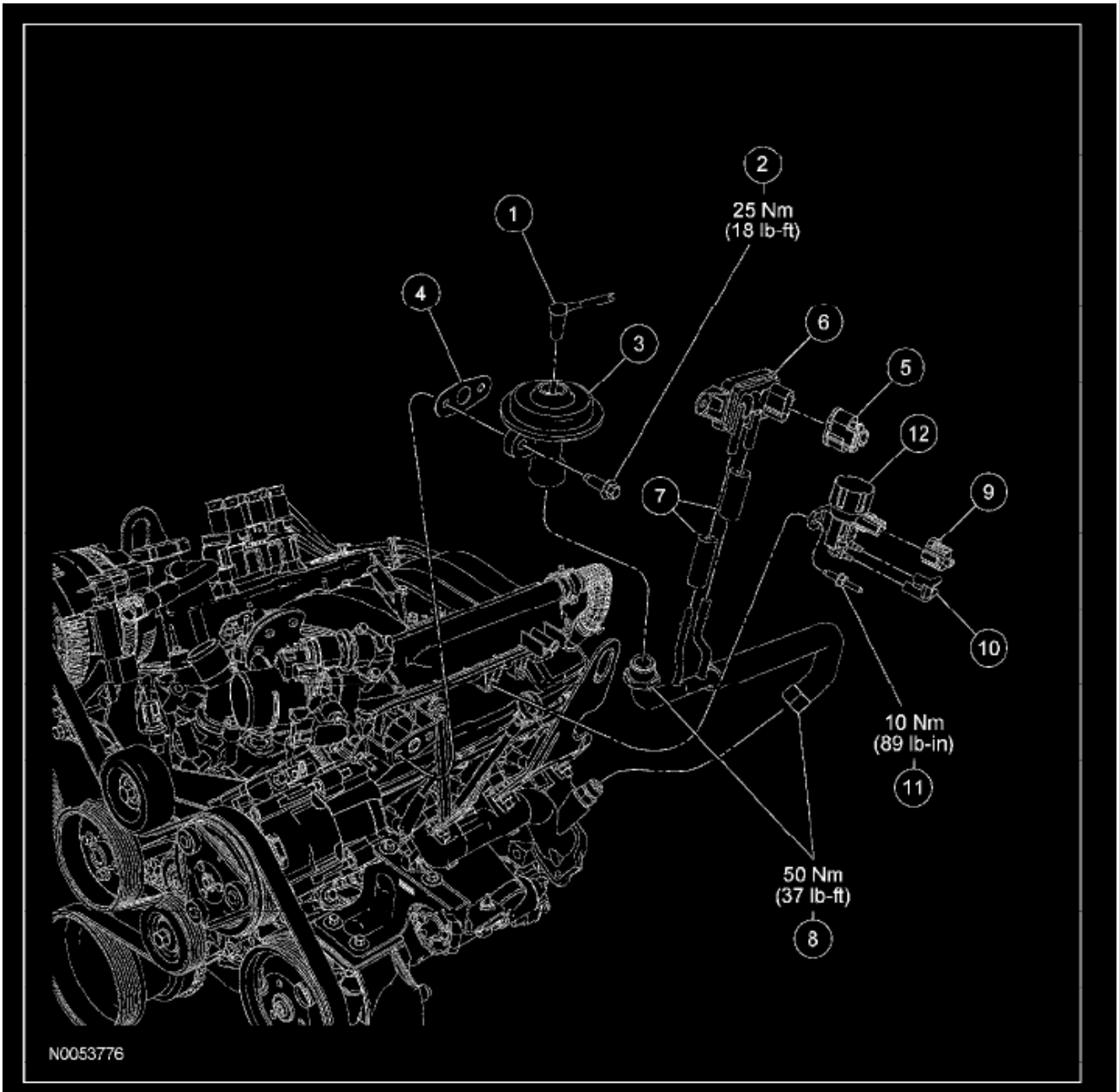
EXHAUST GAS RECIRCULATION (EGR) VACUUM REGULATOR SOLENOID

EGR Vacuum Regulator Solenoid

Vacuum Output (IN-HG)

EGR Vacuum Regulator Solenoid Data

The EGR vacuum regulator solenoid is an electromagnetic device used to regulate the vacuum supply to the EGR valve. The solenoid contains a coil which magnetically controls the position of a disc to regulate the vacuum. As the duty cycle to the coil increases, the vacuum signal passed through the solenoid to the EGR valve also increases. Vacuum not directed to the EGR valve is vented through the solenoid vent to atmosphere. Note that at 0% duty cycle (no electrical signal applied), the EGR vacuum regulator solenoid allows some vacuum to pass, but not enough to open the EGR valve.



Item	Part Number	Description
1	9E499	EGR vacuum hose fitting
2	W500224	EGR valve bolt (2 required)
3	9D475	EGR valve
4	9D476	EGR valve gasket

(Continued)

Item	Part Number	Description
5	14A464	Differential pressure feedback EGR sensor electrical connector (part of 12B637)
6	9J460	Differential pressure feedback EGR sensor

(Continued)

EGR Electronic Vacuum Regulator Solenoid: Service and Repair

EXHAUST GAS RECIRCULATION (EGR) VACUUM REGULATOR SOLENOID

Exploded View

Part 1

Item	Part Number	Description
7	9P761	Differential pressure feedback EGR sensor hoses
8	9D477	Exhaust manifold-to-EGR valve tube
9	14A464	EGR vacuum regulator solenoid electrical connector (part of 12B637)
10	9E499	EGR vacuum regulator solenoid vacuum hose fitting
11	W708628	EGR vacuum regulator solenoid stud bolt
12	9J459	EGR vacuum regulator solenoid

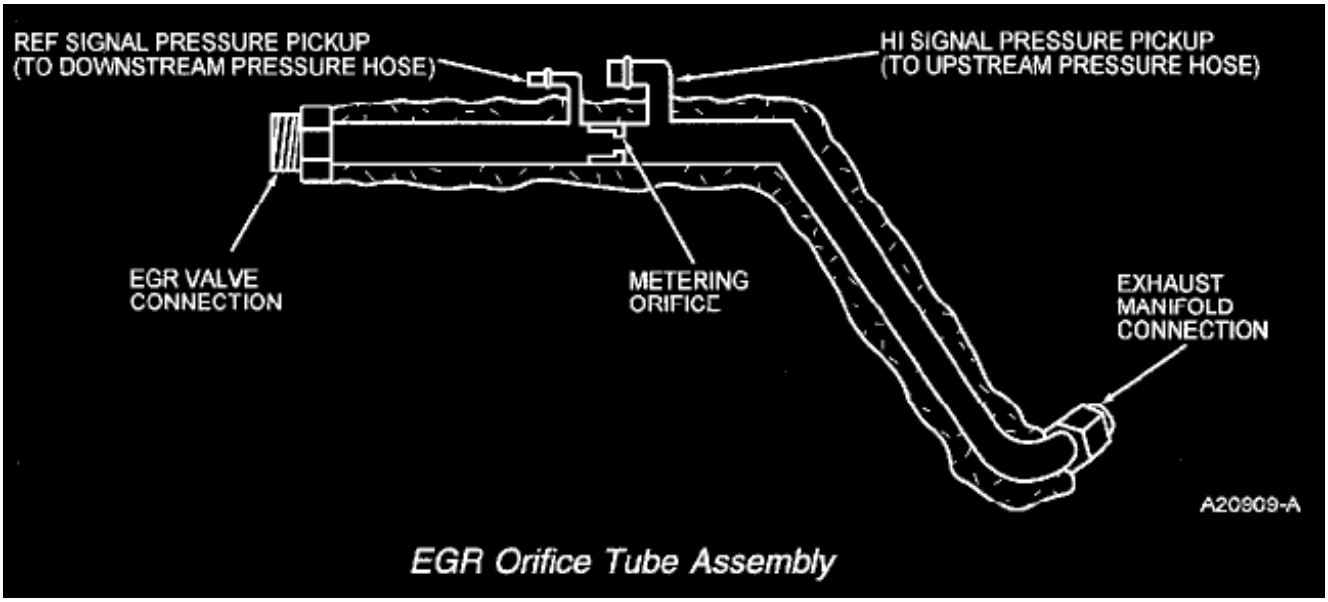
Part 2

Removal and Installation

1. Disconnect the EGR vacuum regulator solenoid electrical and vacuum connectors. 2. Remove the stud bolt and the EGR vacuum regulator solenoid.

- To install, tighten to 10 Nm (89 lb-in).

3. To install, reverse the removal procedure.



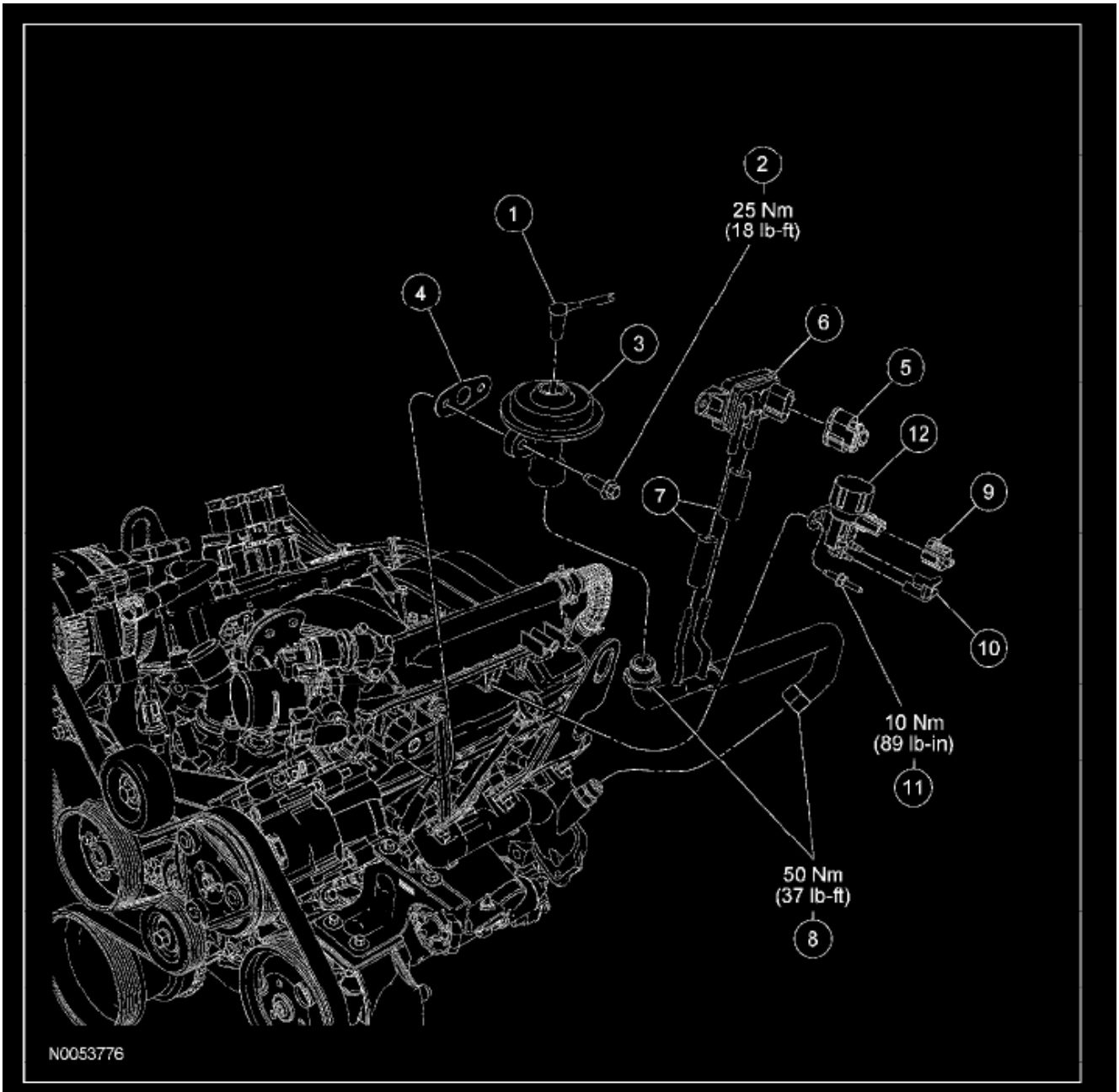
EGR Orifice Tube Assembly

EGR Tube: Description and Operation

EXHAUST GAS RECIRCULATION (EGR) ORIFICE TUBE ASSEMBLY

EGR Orifice Tube Assembly

The orifice tube assembly is a section of tubing connecting the exhaust system to the intake manifold. The assembly provides the flow path for the EGR to the intake manifold and also contains the metering orifice and 2 pressure pick-up tubes. The internal metering orifice creates a measurable pressure drop across it as the EGR valve opens and closes. This pressure differential across the orifice is picked up by the differential pressure feedback EGR sensor which provides feedback to the PCM.



Item	Part Number	Description
1	9E499	EGR vacuum hose fitting
2	W500224	EGR valve bolt (2 required)
3	9D475	EGR valve
4	9D476	EGR valve gasket

(Continued)

Item	Part Number	Description
5	14A464	Differential pressure feedback EGR sensor electrical connector (part of 12B637)
6	9J460	Differential pressure feedback EGR sensor

(Continued)

EGR Tube: Service and Repair

EXHAUST MANIFOLD TO EXHAUST GAS RECIRCULATION (EGR) VALVE TUBE

Exploded View

Part 1

Item	Part Number	Description
7	9P761	Differential pressure feedback EGR sensor hoses
8	9D477	Exhaust manifold-to-EGR valve tube
9	14A464	EGR vacuum regulator solenoid electrical connector (part of 12B637)
10	9E499	EGR vacuum regulator solenoid vacuum hose fitting
11	W708628	EGR vacuum regulator solenoid stud bolt
12	9J459	EGR vacuum regulator solenoid

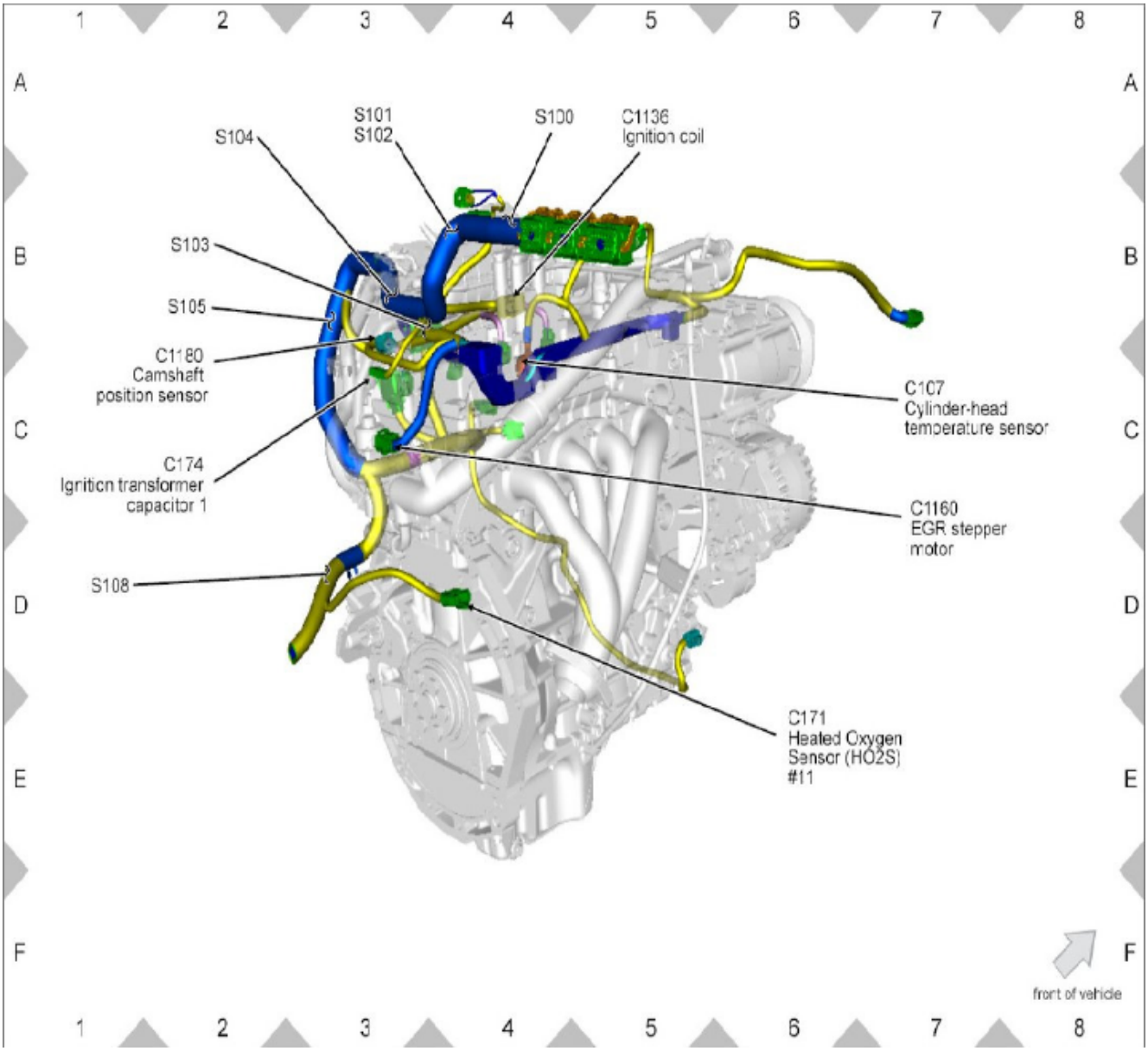
Part 2

Removal and Installation

1. Detach the differential pressure feedback EGR sensor from the exhaust manifold-to-EGR valve tube hoses. 2. Loosen the fittings and remove the exhaust manifold-to-EGR valve tube.

- To install, tighten to 50 Nm (37 lb-ft).

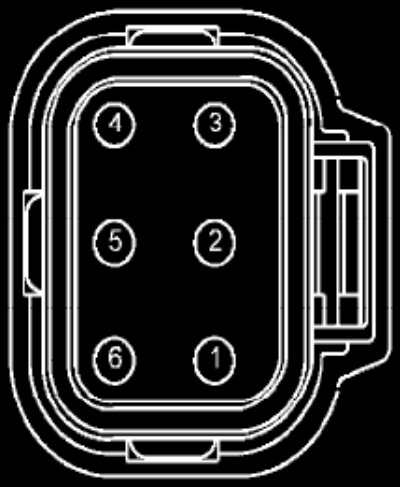
3. To install, reverse the removal procedure.


1
2
3
4
5
6
7
8
A
B
C
D
E
F
S104
S101
S102
S100
C1136
Ignition coil
S103
S105
C1180
Camshaft
position sensor
C174
Ignition transformer
capacitor 1
S108
C107
Cylinder-head
temperature sensor
C1160
EGR stepper
motor
C171
Heated Oxygen
Sensor (HO2S)
#11
front of vehicle

View 151-4

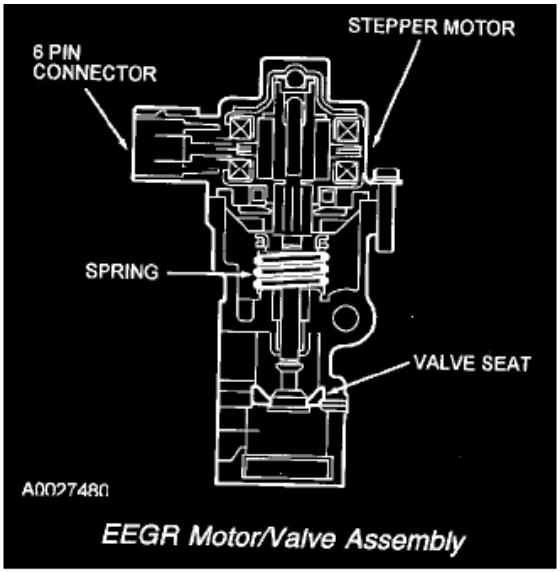
Connector: C1160

Description:	Harness:	Base Part #:
EGR STEPPER MOTOR	12B637	9D475

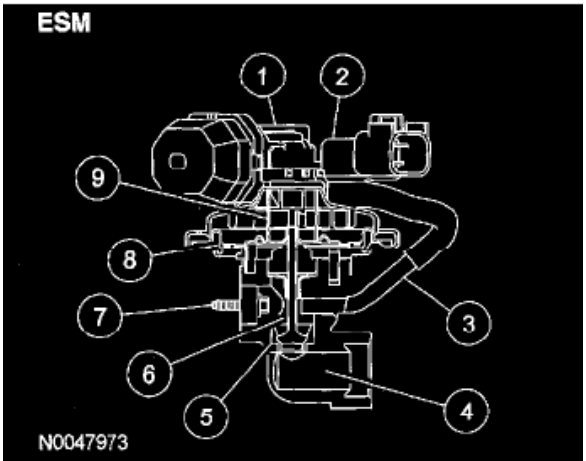


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE101 (WH-VT)	18	CTRL MOD. - POWERTRAIN # EXHAUST GAS RECIRCUL. MOTOR (STEPPER CONTR. 1) (EGRMC) (+)	2.3L
2	CBB43 (GY)	18	FUSE - 43 OR CIRCUIT BREAKER	2.3L
3	CE102 (YE-BU)	18	CTRL MOD. - POWERTRAIN # EXHAUST GAS RECIRCUL. MOTOR (STEPPER CONTR. 2) (EGRMC) (-)	2.3L
4	CE103 (BU-BN)	18	CTRL MOD. - POWERTRAIN # EXHAUST GAS RECIRCUL. MOTOR (STEPPER CONTR. 3) (EGRMC)	2.3L
5	CBB43 (GY)	18	FUSE - 43 OR CIRCUIT BREAKER	2.3L
6	CE104 (GN)	18	CTRL MOD. - POWERTRAIN # EXHAUST GAS RECIRCUL. MOTOR (STEPPER CONTR. 4) (EGRMC)	2.3L

C1160



EEGR Motor/Valve Assembly



Item	Part Number	Description
1	—	EGR Vacuum Regulator Integrated into Upper Body
2	—	Differential Pressure Feedback EGR and MAP Sensor
3	—	Upstream Differential Pressure Feedback EGR Port
4	—	Exhaust Flow
5	—	Valve Seat
6	—	Pin/Pintle
7	—	To Intake Manifold Plenum
8	—	Diaphragm
9	—	EGR Spring

EGR Valve: Description and Operation

Electric Exhaust Gas Recirculation (EEGR) Valve

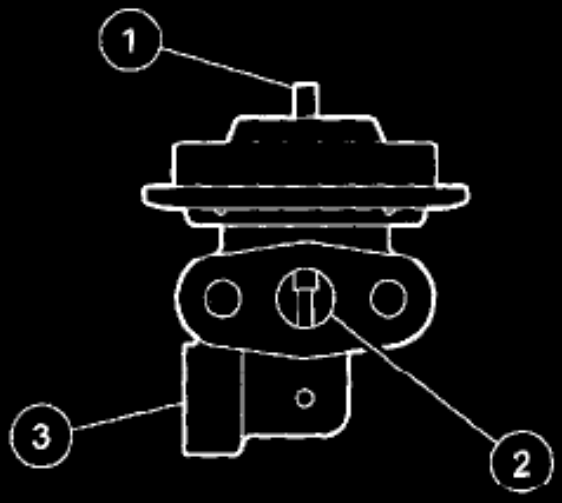
EEGR Motor/Valve Assembly

Depending on the application, the EEGR valve is a water cooled or an air cooled motor/valve assembly. The motor is commanded to move in 52 discrete steps as it acts directly on the EEGR valve. The position of the valve determines the rate of EGR. The built-in spring works to close the valve (against the motor opening force).

Exhaust Gas Recirculation (EGR) System Module (ESM)

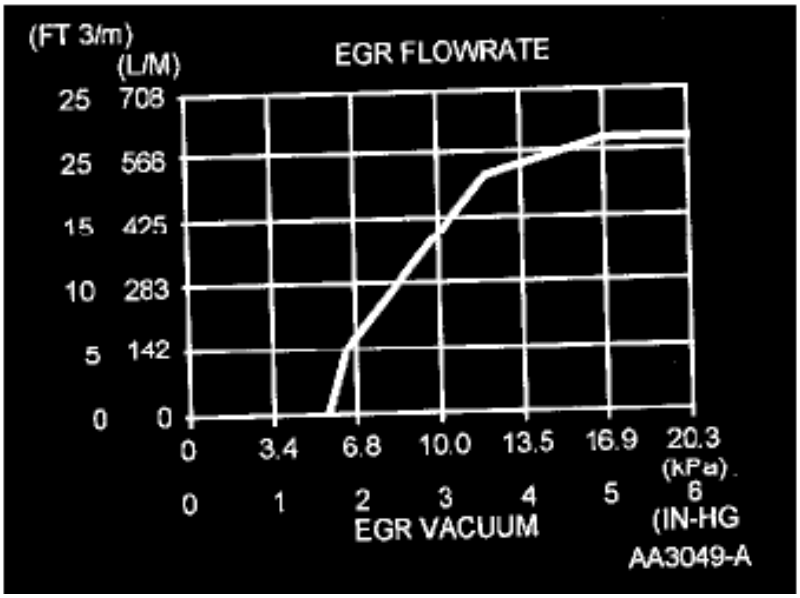
ESM

Typical EGR Valve



N0047972

Item	Part Number	Description
1	—	Vacuum Connection from EGR Vacuum Regulator Solenoid
2	—	Intake Manifold Connector
3	—	Orifice Tube Connection



The ESM is an integrated differential pressure feedback EGR system that functions in the same manner as a conventional differential pressure feedback EGR system. The various system components have been integrated into a single component called the ESM. The flange of the valve portion of the ESM bolts directly to the intake manifold with a metal gasket that forms the metering orifice. This arrangement increases system reliability, response time, and system precision. By relocating the EGR orifice from the exhaust to the intake side of the EGR valve, the downstream pressure signal measures manifold absolute pressure (MAP). This MAP signal is used for EGR correction and inferred barometric pressure (BARO) at key on. The system provides the powertrain control module (PCM) with a differential pressure feedback EGR signal, identical to a traditional differential pressure feedback EGR system.

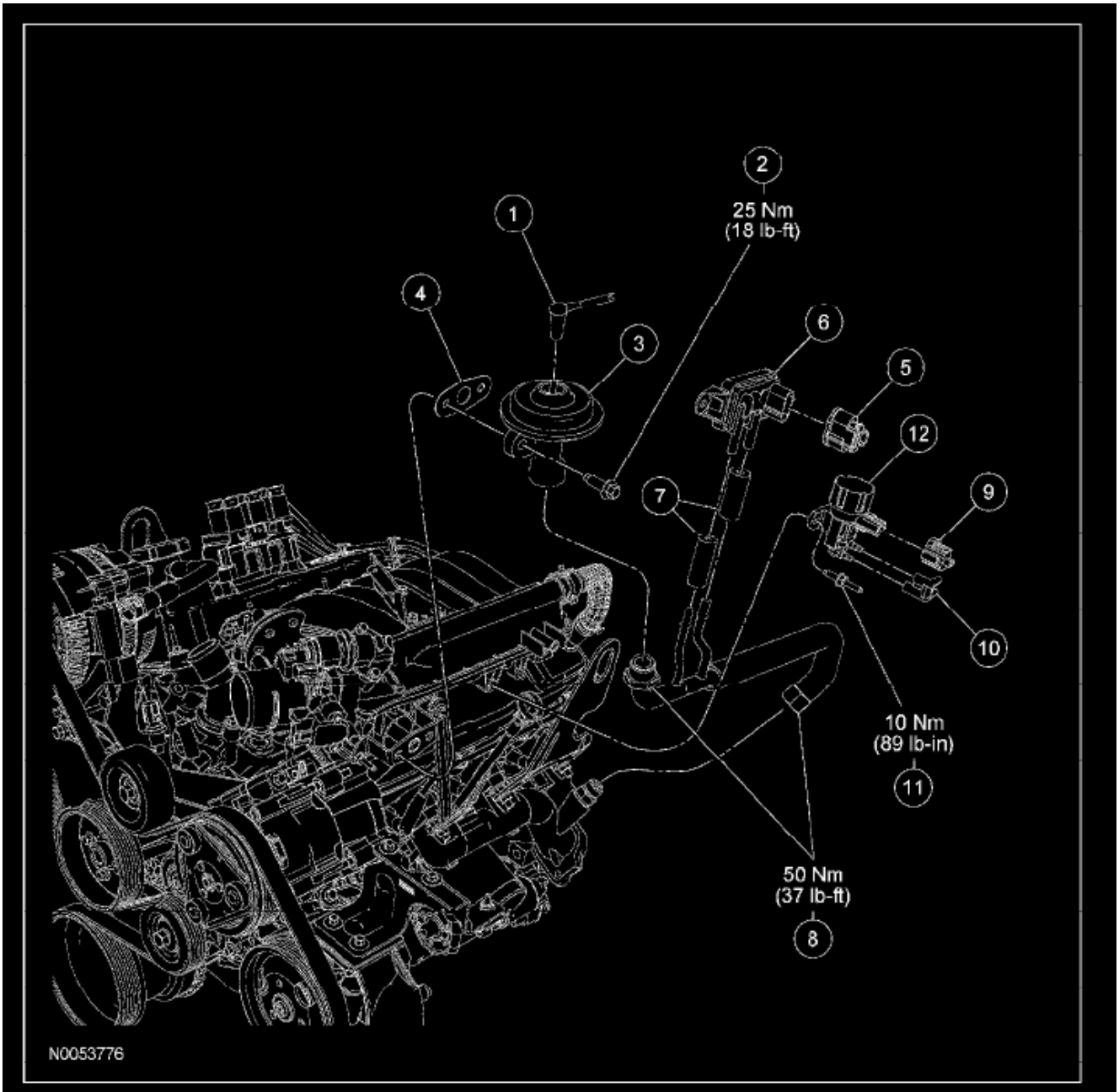
Exhaust Gas Recirculation (EGR) Valve

Typical EGR Valve

EGR Flowrate

The EGR valve in the differential pressure feedback EGR system is a conventional, vacuum-actuated. The valve increases or decreases the flow of EGR. As vacuum applied to the EGR valve diaphragm overcomes the spring force, the valve begins to open. As the vacuum signal weakens, at 5.4 kPa (1.6 in-Hg) or less, the spring force closes the valve. The EGR valve is fully open at about 15 kPa (4.5 in-Hg).

Since EGR flow requirement varies greatly, providing repair specifications on flow rate is impractical. The on board diagnostic (OBD) system monitors the EGR valve function and triggers a diagnostic trouble code (DTC) if the test criteria is not met. The EGR valve flow rate is not measured directly as part of the diagnostic procedures.



Item	Part Number	Description
1	9E499	EGR vacuum hose fitting
2	W500224	EGR valve bolt (2 required)
3	9D475	EGR valve
4	9D476	EGR valve gasket

(Continued)

Item	Part Number	Description
5	14A464	Differential pressure feedback EGR sensor electrical connector (part of 12B637)
6	9J460	Differential pressure feedback EGR sensor

(Continued)

EGR Valve: Service and Repair

EXHAUST GAS RECIRCULATION (EGR) VALVE

Exploded View

Part 1

Item	Part Number	Description
7	9P761	Differential pressure feedback EGR sensor hoses
8	9D477	Exhaust manifold-to-EGR valve tube
9	14A464	EGR vacuum regulator solenoid electrical connector (part of 12B637)
10	9E499	EGR vacuum regulator solenoid vacuum hose fitting
11	W708628	EGR vacuum regulator solenoid stud bolt
12	9J459	EGR vacuum regulator solenoid

Part 2

Removal and Installation

1. Detach the EGR valve vacuum connector. 2. Detach the exhaust manifold-to-EGR valve tube fitting.

- To install, tighten to 50 Nm (37 lb-ft).

3. Remove the bolts, the EGR valve and the gasket.

- Discard the gasket.

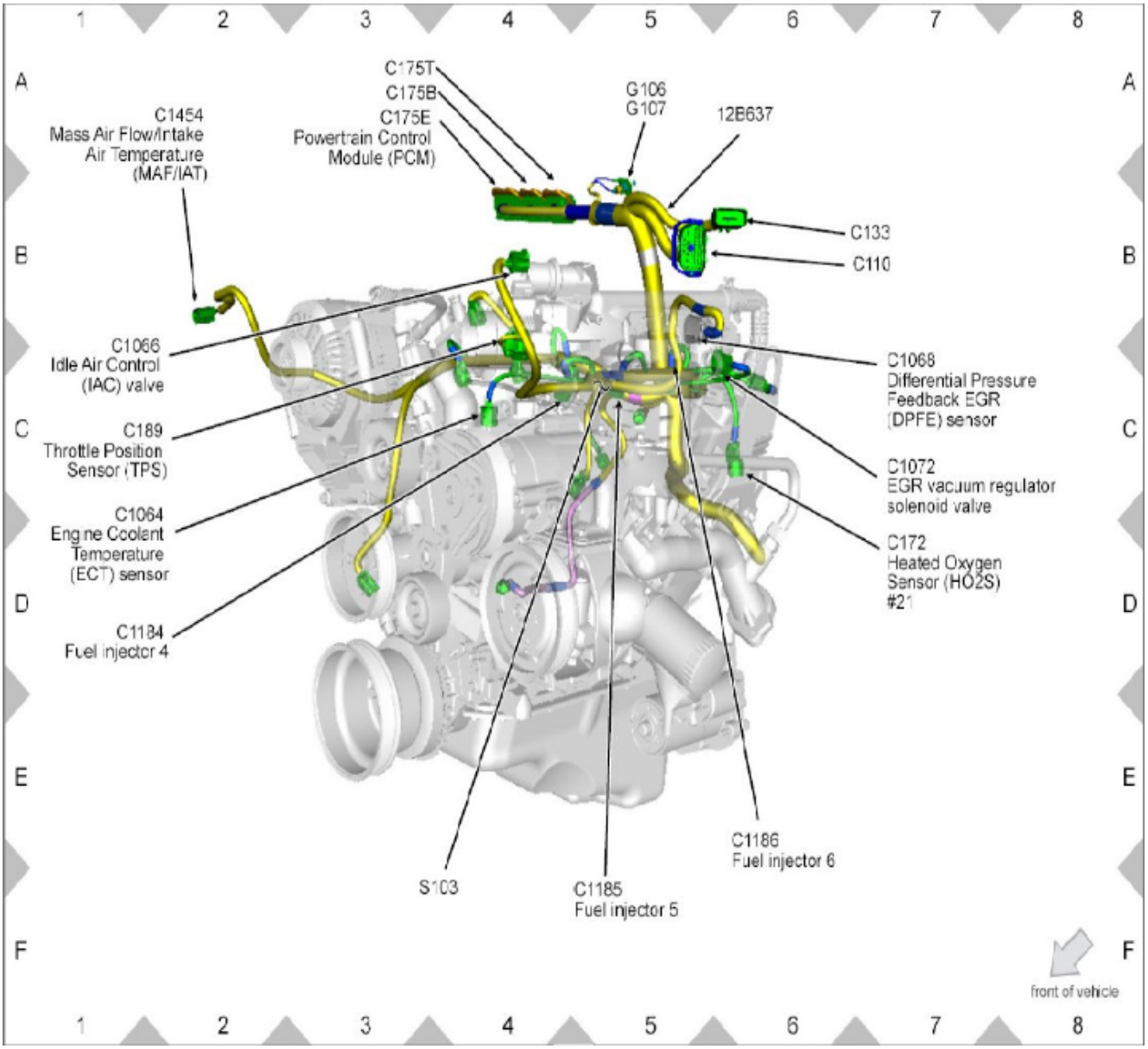
- To install, tighten to 25 Nm (18 lb-ft).

4. NOTE: The EGR valve sealing surfaces are soft metals.

To install, reverse the removal procedure. -

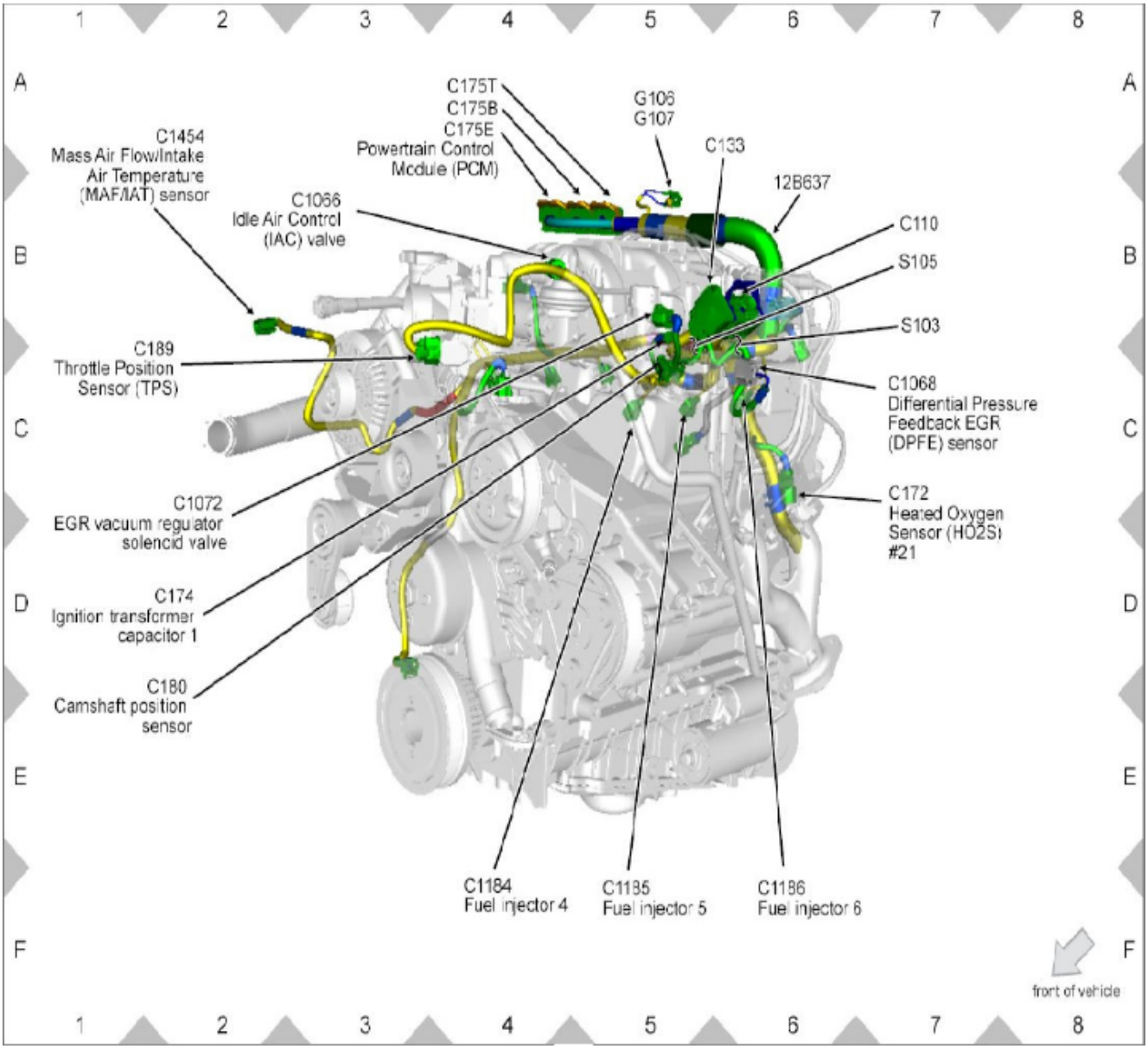
Carefully clean the EGR valve sealing surfaces.

- Install a new EGR valve gasket.



Pressure Feedback Exhaust Sensor: Locations

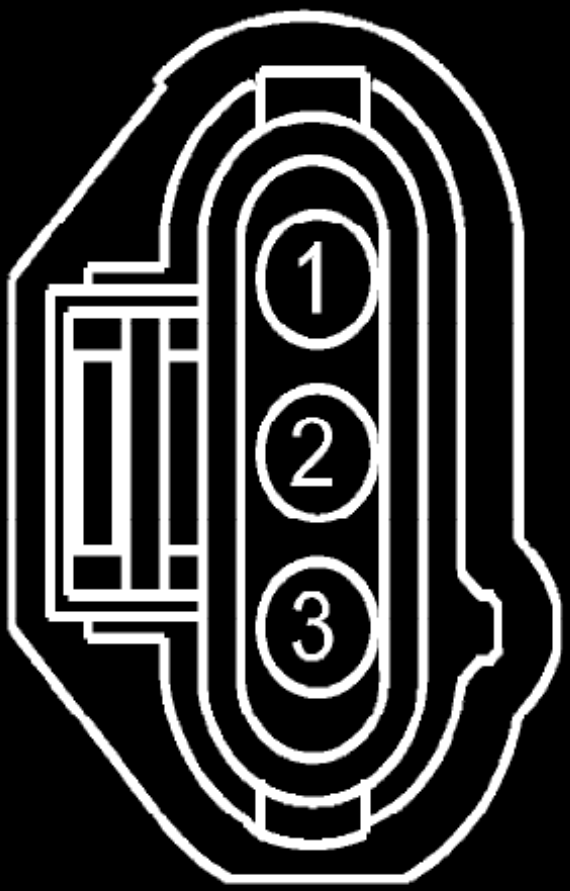
View 151-5


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
C133
12B637
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor
C1066
Idle Air Control (IAC) valve
C110
S105
S103
C189
Throttle Position Sensor (TPS)
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
C174
Ignition transformer capacitor 1
C180
Camshaft position sensor
C1184
Fuel injector 4
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-7

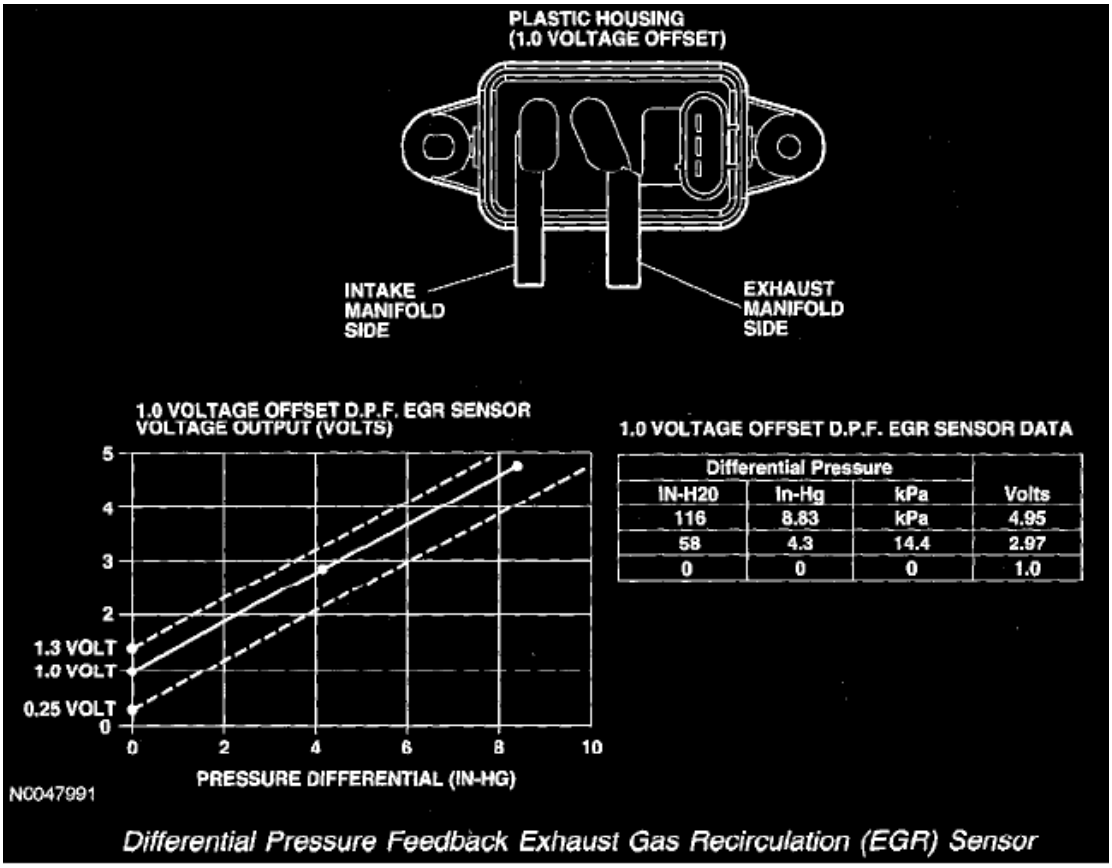
Connector: C1068

Description:	Harness:	Base Part #:
DIFFERENTIAL PRESSURE FEEDBACK EGR DPFE) SENSOR	12B637	9J460



Pin	Circuit	Gauge	Circuit Function	Quali
1	VE713 (GN-OG)	20	SENSOR - DELTA PRESSURE FEEDBACK EGR (DPFE)	3.0L, 4.
2	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	3.0L, 4.
3	LE423 (GN-VT)	20	CTRL MOD. - POWERTRAIN # VOLTAGE REFERENCE ENGINE (VREF) (E-VREV)	3.0L, 4.

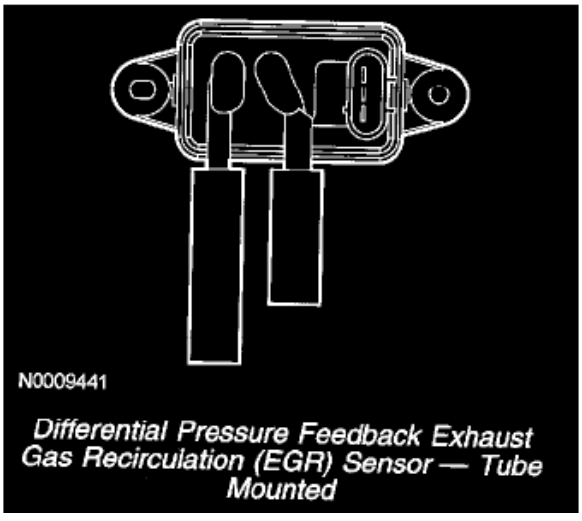
C1068



1.0 VOLTAGE OFFSET D.P.F. EGR SENSOR DATA

Differential Pressure			
IN-H20	In-Hg	kPa	Volts
116	8.83	kPa	4.95
58	4.3	14.4	2.97
0	0	0	1.0

Differential Pressure Feedback Exhaust Gas Recirculation (EGR) Sensor



Differential Pressure Feedback Exhaust Gas Recirculation (EGR) Sensor — Tube Mounted

Pressure Feedback Exhaust Sensor: Description and Operation

Differential Pressure Feedback Exhaust Gas Recirculation (EGR) Sensor

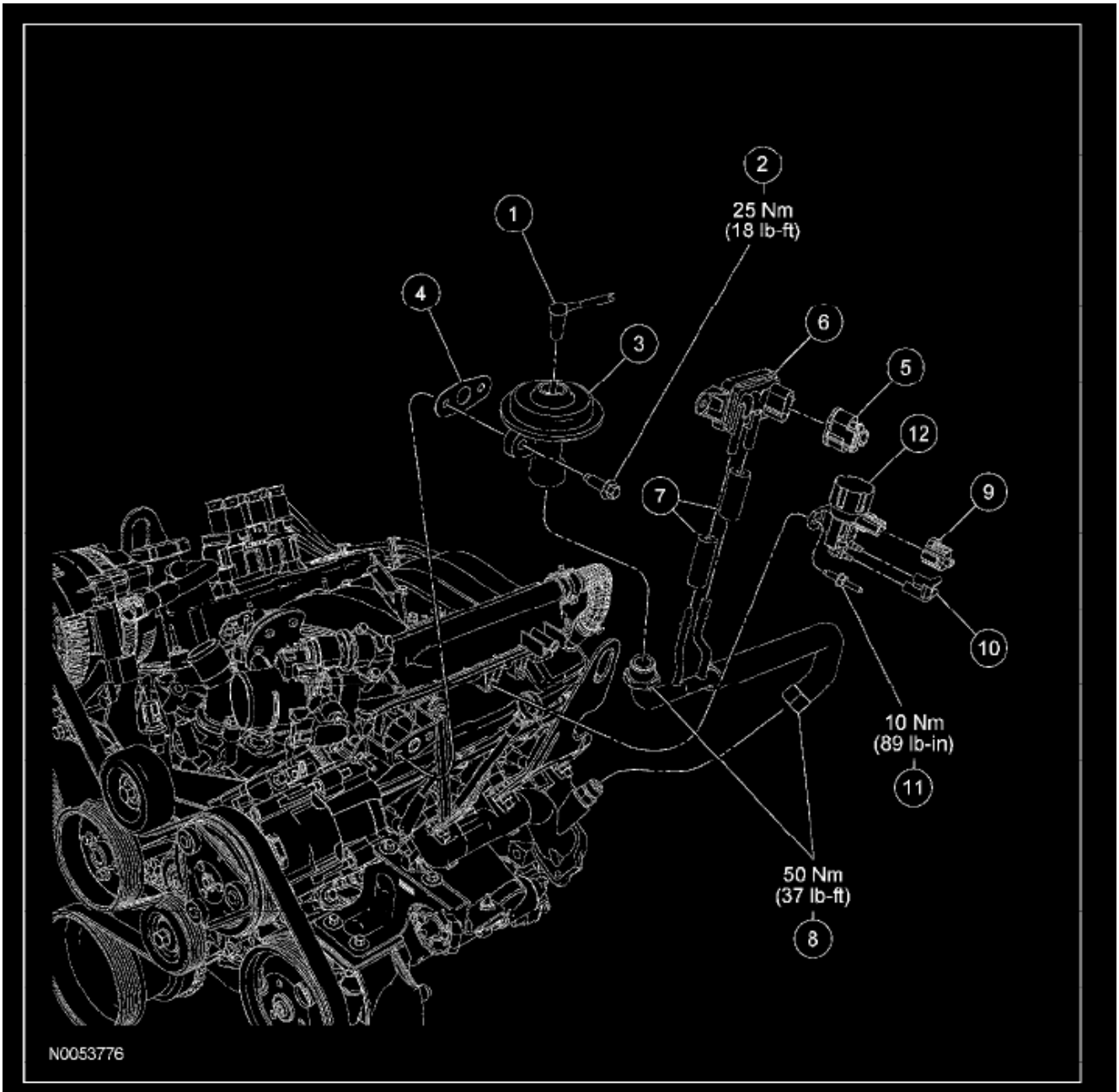
Differential Pressure Feedback Exhaust Gas Recirculation (EGR) Sensor

The differential pressure feedback EGR sensor is a ceramic, capacitive-type pressure transducer that monitors the differential pressure across a metering orifice located in the orifice tube assembly. The differential pressure feedback EGR sensor receives this signal through 2 hoses referred to as the downstream pressure hose (REF SIGNAL) and upstream pressure hose (HI SIGNAL). The HI and REF hose connections are marked on the differential pressure feedback EGR sensor housing for identification (note that the HI signal uses a larger diameter hose). The differential pressure feedback EGR sensor outputs a voltage proportional to the pressure drop across the metering orifice and supplies it to the PCM as EGR flow rate feedback.

Differential Pressure Feedback Exhaust Gas Recirculation (EGR) Sensor - Tube Mounted

Differential Pressure Feedback Exhaust Gas Recirculation (EGR) Sensor - Tube Mounted

The tube mounted differential pressure feedback EGR sensor is identical in operation as the larger plastic differential pressure feedback EGR sensors and uses a 1.0 volt offset. The HI and REF hose connections are marked on the side of the sensor.



Item	Part Number	Description
1	9E499	EGR vacuum hose fitting
2	W500224	EGR valve bolt (2 required)
3	9D475	EGR valve
4	9D476	EGR valve gasket

(Continued)

Item	Part Number	Description
5	14A464	Differential pressure feedback EGR sensor electrical connector (part of 12B637)
6	9J460	Differential pressure feedback EGR sensor

(Continued)

Pressure Feedback Exhaust Sensor: Service and Repair

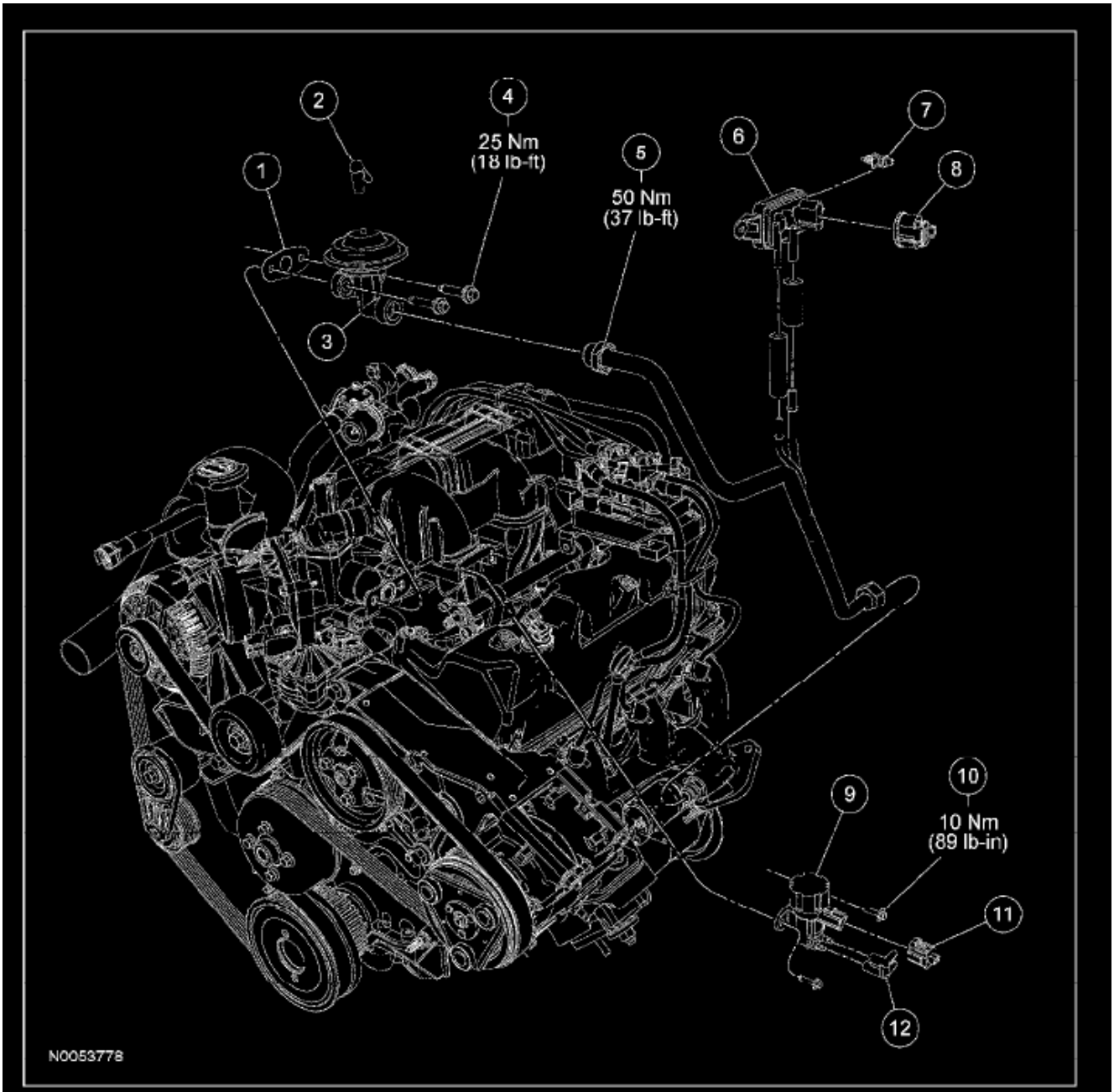
DIFFERENTIAL PRESSURE FEEDBACK EXHAUST GAS RECIRCULATION (EGR) SENSOR

Exploded View

Part 1

Item	Part Number	Description
7	9P761	Differential pressure feedback EGR sensor hoses
8	9D477	Exhaust manifold-to-EGR valve tube
9	14A464	EGR vacuum regulator solenoid electrical connector (part of 12B637)
10	9E499	EGR vacuum regulator solenoid vacuum hose fitting
11	W708628	EGR vacuum regulator solenoid stud bolt
12	9J459	EGR vacuum regulator solenoid

Part 2



Item	Part Number	Description
1	9D476	EGR valve gasket
2	9E499	EGR valve vacuum connector
3	9D475	EGR valve assembly
4	W701232	EGR valve bolt (2 required)

(Continued)

Item	Part Number	Description
5	9E469	EGR tube
6	9J460	Differential pressure feedback EGR sensor
7	13A506	Pushpin wire retainer

(Continued)

Part 1

Item	Part Number	Description
8	14A464	Differential pressure feedback EGR sensor electrical connector
9	9J459	EGR vacuum regulator solenoid
10	W704310	EGR vacuum regulator solenoid bolt (2 required)
11	14A464	EGR vacuum regulator solenoid electrical connector
12	9E499	EGR vacuum regulator solenoid vacuum connector

Part 2

Removal and Installation

1. Disconnect the pushpin retainer from the differential pressure feedback EGR sensor. 2. Disconnect the differential pressure feedback EGR sensor electrical connector. 3. Remove the differential pressure feedback EGR sensor from the hoses. 4. To install, reverse the removal procedure.

PART NUMBER	PART NAME
8L5Z-6C324-A	PVC Connector And Hose Asy

PCV Valve Hose: Customer Interest Engine - Blue Smoke On Start Up

TSB 07-22-10

11/12/07

3.0L 2V VULCAN ENGINE - BLUE SMOKE ON START Up

FORD: 2004-2008 Ranger

ISSUE Some 2004-2008 Ranger vehicles equipped with a 3.0L 2V Vulcan engine may exhibit blue smoke on start up after approximately a 4 hour cold soak. This may be due to small amounts of oil commonly found in the PCV system collecting in the upper intake manifold PCV channel. Under certain parking conditions, this oil can be drawn into the combustion chamber, creating momentary blue smoke that may be visible by the customer.

ACTION Follow the Service Procedure steps to reduce blue smoke on start up.

SERVICE PROCEDURE

1. Remove the clamp on the PCV tube assembly at the PCV valve.

2. Remove the upper intake manifold per the Workshop Manual (WSM), Section 303-01B. Leave the PCV tube assembly attached to the upper intake

manifold.

3. Remove the clamp on the PCV tube assembly at the upper intake manifold PCV port, and remove the PCV Tube Assembly from the upper intake

manifold PCV channel.

4. Drain the residual oil from the upper intake manifold PCV channel by holding the PCV channel vertical with the port facing down.

5. While holding the upper intake manifold in the vertical position, spray Brake Cleaner into the PCV channel. Use regulated compressed air to aid in

drying the PCV channel.

6. Lubricate the 0-Ring at the end of the new PCV Tube Assembly with water or diluted soapy water solution.

7. Install the new PCV Tube Assembly into the clean upper intake manifold PCV channel.

8. Install the upper intake manifold per WSM, Section 303-01B.

Parts Block

WARRANTY STATUS: Eligible Under Provisions Of New Vehicle Limited Warranty Coverage
IMPORTANT: Warranty coverage limits/policies are not altered by a TSB. Warranty coverage limits are determined by the identified causal part.

OPERATION DESCRIPTION TIME

072210A 2004-2008 Ranger 3.0L: 0.8 Hr.

Replace The PCV Tube, Includes Time To Remove Clean, Install Upper Intake Manifold (Do Not Use With 9424A, 6666A)

DEALER CODING

CONDITION

BASIC PART NO. CODE

6C324 D8

NOTE: The information in Technical Service Bulletins is intended for use by trained, professional technicians with the knowledge, tools, and equipment to do the job properly and safely. It informs these technicians of conditions that may occur on some vehicles, or provides information that could assist in proper vehicle service. The procedures should not be performed by "do-it-yourselfers". Do not assume that a condition described affects your car or truck. Contact a Ford, Lincoln, or Mercury dealership to determine whether the Bulletin applies to your vehicle.

Disclaimer

PART NUMBER	PART NAME
8L5Z-6C324-A	PVC Connector And Hose Asy

PCV Valve Hose: All Technical Service Bulletins Engine - Blue Smoke On Start Up

TSB 07-22-10

11/12/07

3.0L 2V VULCAN ENGINE - BLUE SMOKE ON START Up

FORD: 2004-2008 Ranger

ISSUE Some 2004-2008 Ranger vehicles equipped with a 3.0L 2V Vulcan engine may exhibit blue smoke on start up after approximately a 4 hour cold soak. This may be due to small amounts of oil commonly found in the PCV system collecting in the upper intake manifold PCV channel. Under certain parking conditions, this oil can be drawn into the combustion chamber, creating momentary blue smoke that may be visible by the customer.

ACTION Follow the Service Procedure steps to reduce blue smoke on start up.

SERVICE PROCEDURE

1. Remove the clamp on the PCV tube assembly at the PCV valve.

2. Remove the upper intake manifold per the Workshop Manual (WSM), Section 303-01B. Leave the PCV tube assembly attached to the upper intake

manifold.

3. Remove the clamp on the PCV tube assembly at the upper intake manifold PCV port, and remove the PCV Tube Assembly from the upper intake

manifold PCV channel.

4. Drain the residual oil from the upper intake manifold PCV channel by holding the PCV channel vertical with the port facing down.

5. While holding the upper intake manifold in the vertical position, spray Brake Cleaner into the PCV channel. Use regulated compressed air to aid in

drying the PCV channel.

6. Lubricate the 0-Ring at the end of the new PCV Tube Assembly with water or diluted soapy water solution.

7. Install the new PCV Tube Assembly into the clean upper intake manifold PCV channel.

8. Install the upper intake manifold per WSM, Section 303-01B.

Parts Block

WARRANTY STATUS: Eligible Under Provisions Of New Vehicle Limited Warranty Coverage
IMPORTANT: Warranty coverage limits/policies are not altered by a TSB. Warranty coverage limits are determined by the identified causal part.

OPERATION DESCRIPTION TIME

072210A 2004-2008 Ranger 3.0L: 0.8 Hr.

Replace The PCV Tube, Includes Time To Remove Clean, Install Upper Intake Manifold (Do Not Use With 9424A, 6666A)

DEALER CODING

CONDITION

BASIC PART NO. CODE

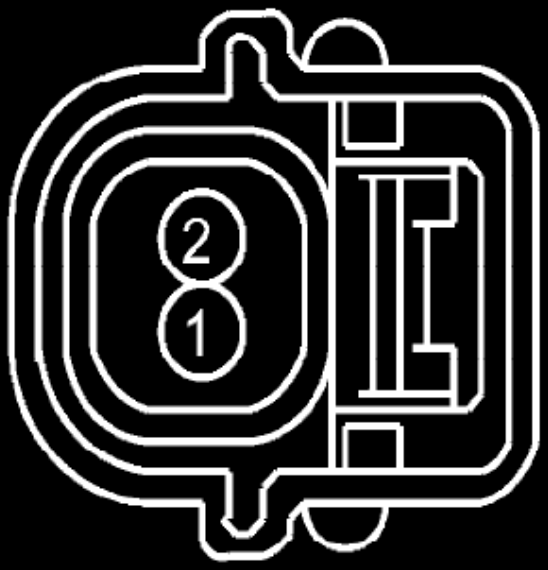
6C324 D8

NOTE: The information in Technical Service Bulletins is intended for use by trained, professional technicians with the knowledge, tools, and equipment to do the job properly and safely. It informs these technicians of conditions that may occur on some vehicles, or provides information that could assist in proper vehicle service. The procedures should not be performed by "do-it-yourselfers". Do not assume that a condition described affects your car or truck. Contact a Ford, Lincoln, or Mercury dealership to determine whether the Bulletin applies to your vehicle.

Disclaimer

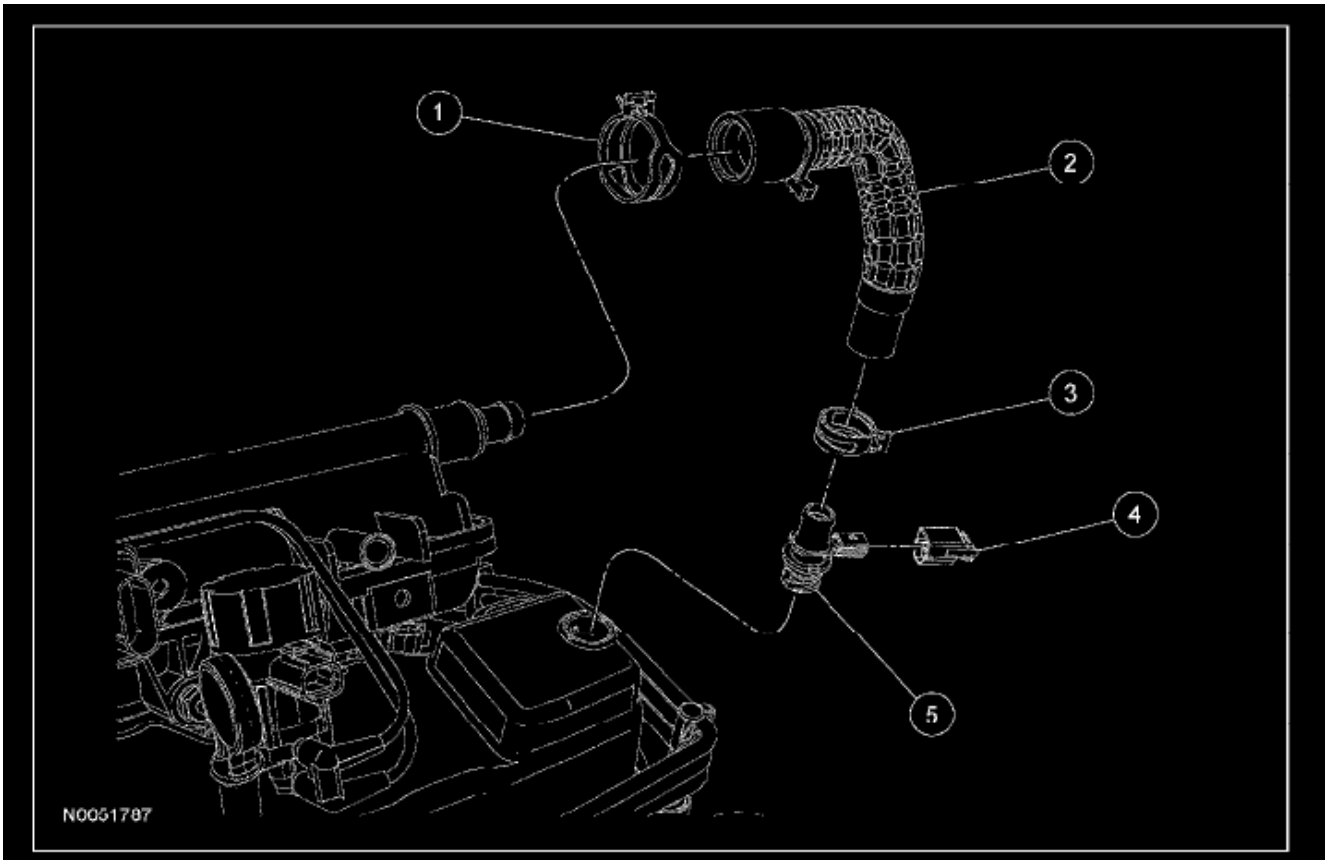
Connector: C190

Description:	Harness:	Base Part #:
HEATED POSITIVE CRANKCASE VENTILATION (PCV) VALVE	12B637	6A666



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE328 (YE-VT)	18	CTRL MOD. - POWERTRAIN # POS. CRANKCASE VENTIL. FITTING HEATER CONTROL (PCVFHC)	3.0L/4.0L
2	CBB43 (GY)	18	FUSE - 43 OR CIRCUIT BREAKER	3.0L/4.0L

C190



Item	Part Number	Description
1	15161	Hose spring clamp
2	6762	PCV valve tube
3	6C324	Hose spring clamp
4	—	PCV valve electrical connector
5	22102	PCV valve

Positive Crankcase Ventilation Valve: Service and Repair

POSITIVE CRANKCASE VENTILATION (PCV) VALVE

Removal and Installation

1. Disconnect the PCV valve.

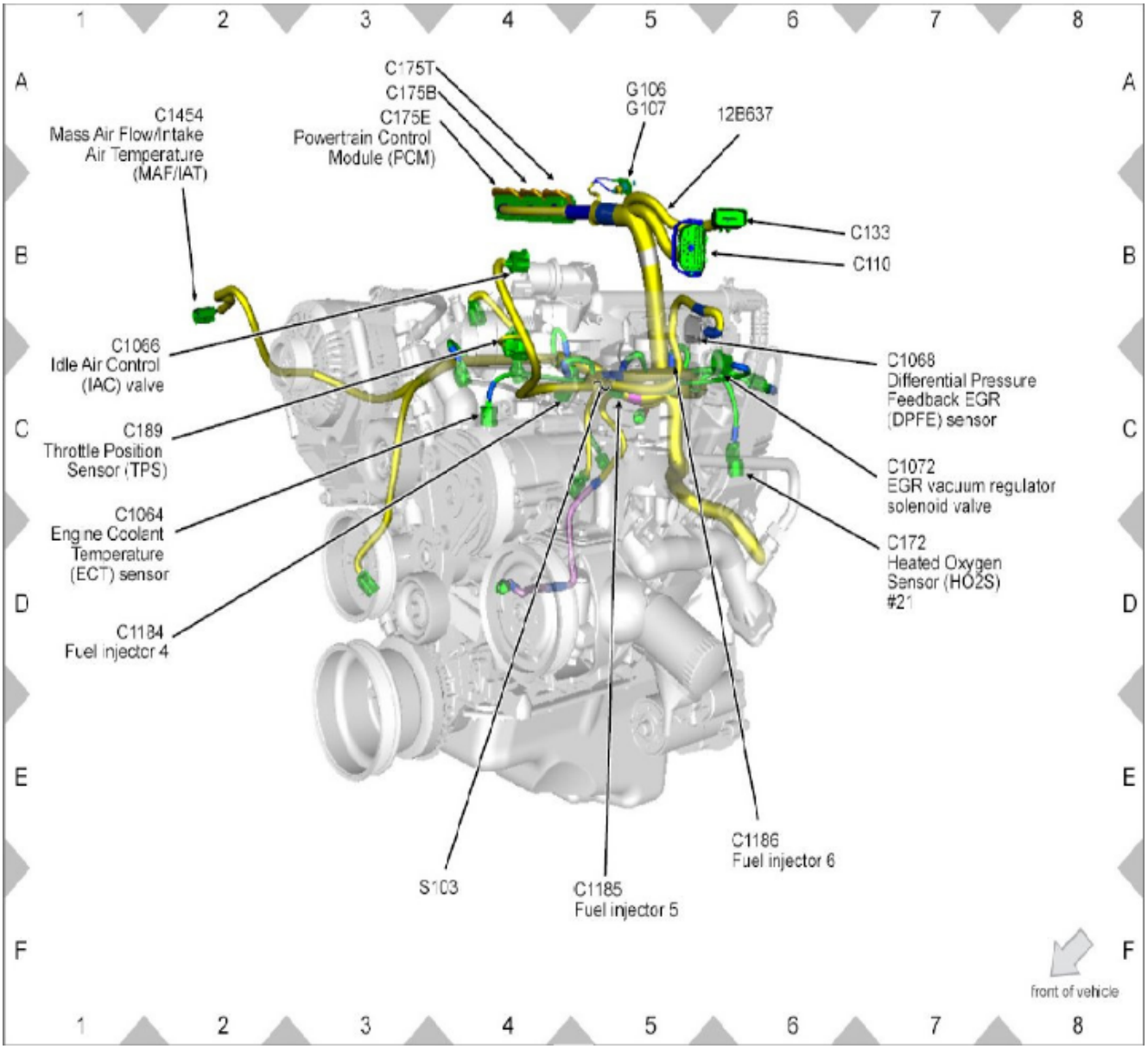
- Disconnect the PCV valve electrical connector.

- Disconnect the PCV valve tube from the PCV valve.

2. NOTE: A new PCV valve must be installed if removed from the cam cover.

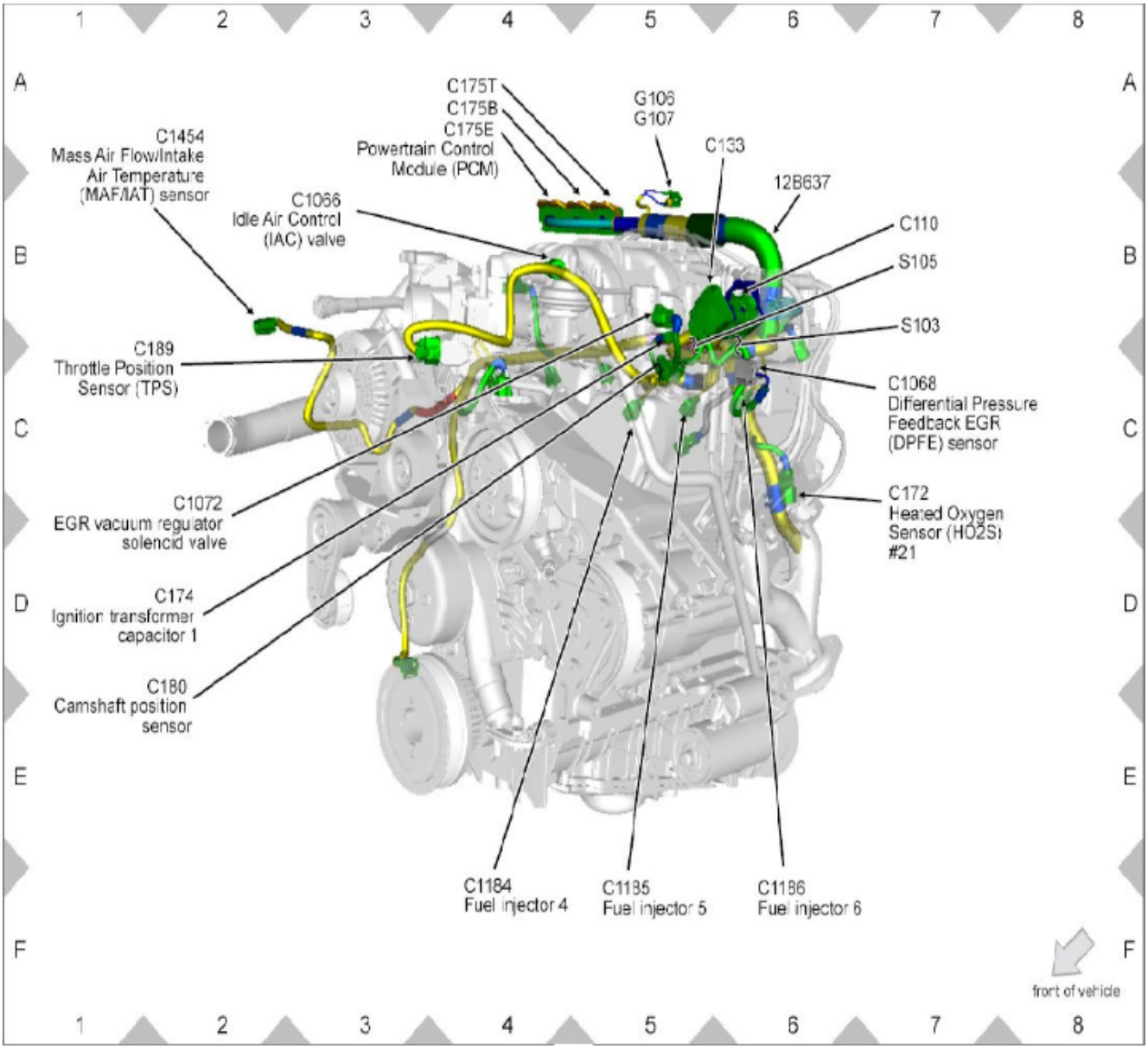
Rotate to release and remove the PCV valve.

3. To install, reverse the removal procedure.



Pressure Feedback Exhaust Sensor: Locations

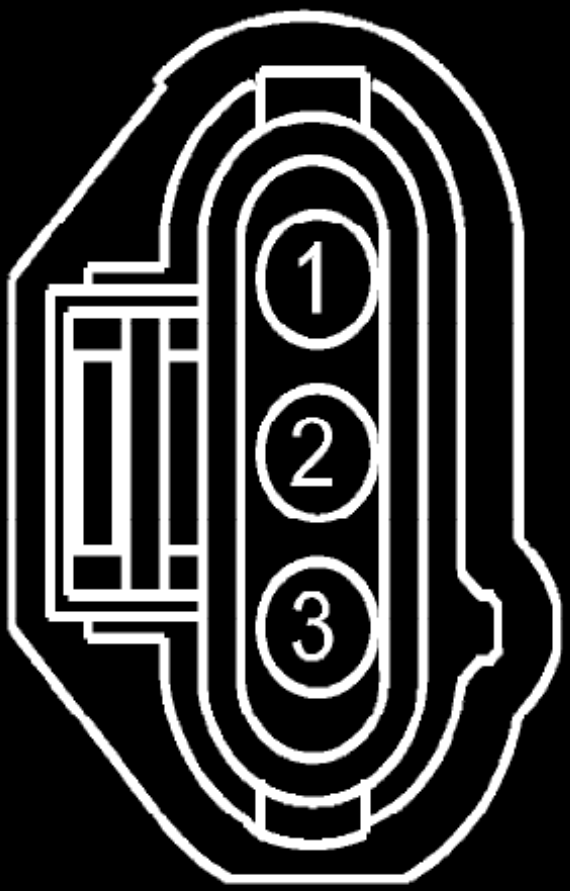
View 151-5


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
C133
12B637
C110
S105
S103
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor
C1066
Idle Air Control (IAC) valve
C189
Throttle Position Sensor (TPS)
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
C174
Ignition transformer capacitor 1
C180
Camshaft position sensor
C1184
Fuel injector 4
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-7

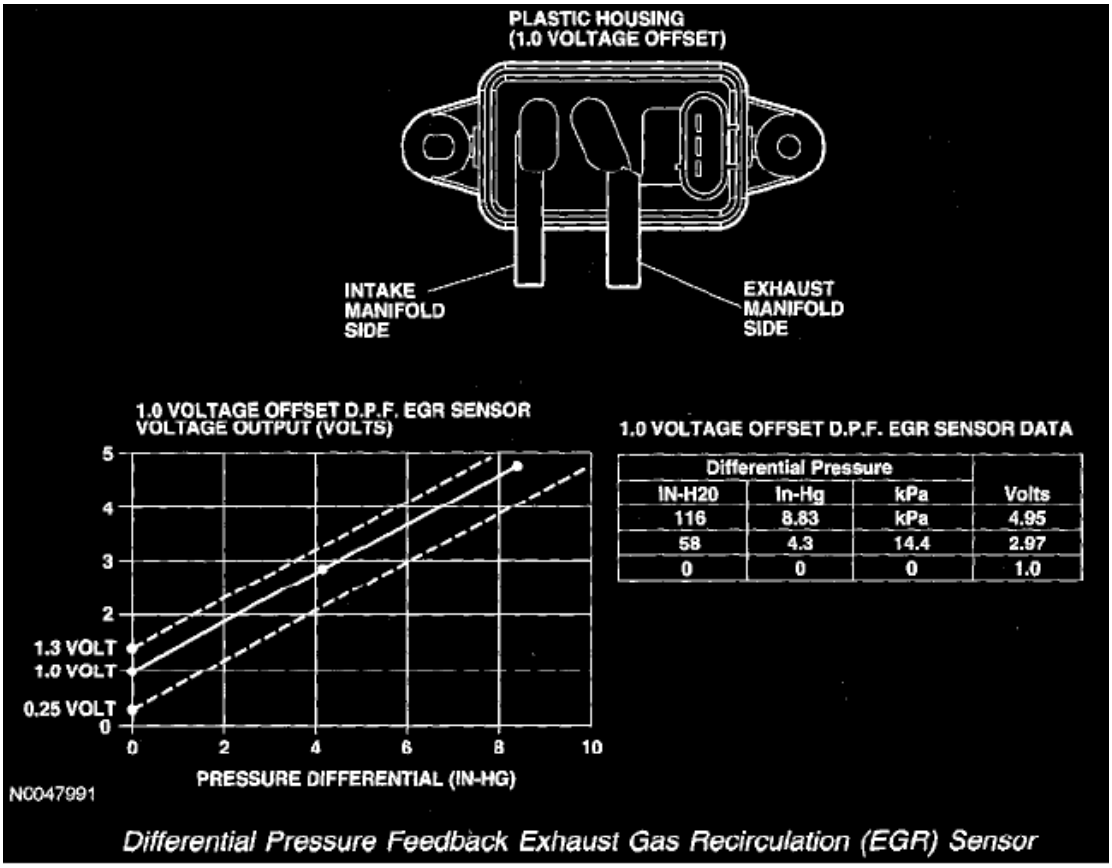
Connector: C1068

Description:	Harness:	Base Part #:
DIFFERENTIAL PRESSURE FEEDBACK EGR DPFE) SENSOR	12B637	9J460



Pin	Circuit	Gauge	Circuit Function	Quali
1	VE713 (GN-OG)	20	SENSOR - DELTA PRESSURE FEEDBACK EGR (DPFE)	3.0L, 4.
2	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	3.0L, 4.
3	LE423 (GN-VT)	20	CTRL MOD. - POWERTRAIN # VOLTAGE REFERENCE ENGINE (VREF) (E-VREV)	3.0L, 4.

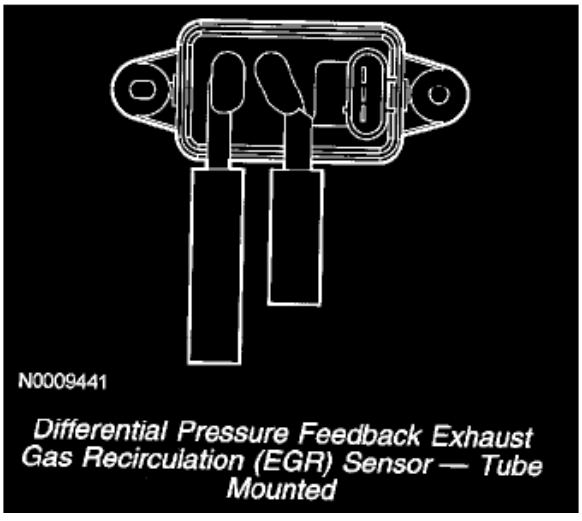
C1068



1.0 VOLTAGE OFFSET D.P.F. EGR SENSOR DATA

Differential Pressure			
IN-H20	In-Hg	kPa	Volts
116	8.83	kPa	4.95
58	4.3	14.4	2.97
0	0	0	1.0

Differential Pressure Feedback Exhaust Gas Recirculation (EGR) Sensor



Differential Pressure Feedback Exhaust Gas Recirculation (EGR) Sensor — Tube Mounted

Pressure Feedback Exhaust Sensor: Description and Operation

Differential Pressure Feedback Exhaust Gas Recirculation (EGR) Sensor

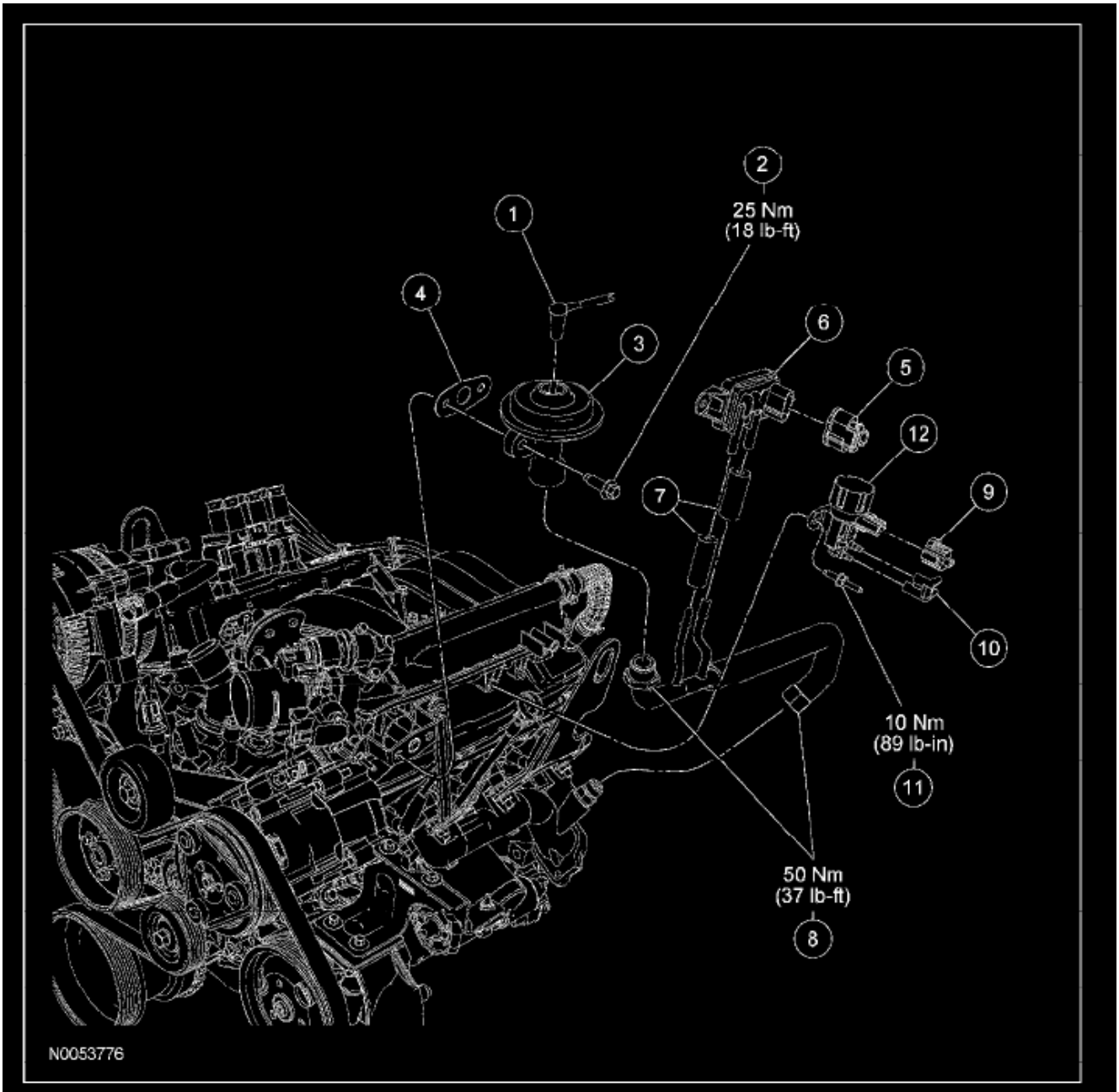
Differential Pressure Feedback Exhaust Gas Recirculation (EGR) Sensor

The differential pressure feedback EGR sensor is a ceramic, capacitive-type pressure transducer that monitors the differential pressure across a metering orifice located in the orifice tube assembly. The differential pressure feedback EGR sensor receives this signal through 2 hoses referred to as the downstream pressure hose (REF SIGNAL) and upstream pressure hose (HI SIGNAL). The HI and REF hose connections are marked on the differential pressure feedback EGR sensor housing for identification (note that the HI signal uses a larger diameter hose). The differential pressure feedback EGR sensor outputs a voltage proportional to the pressure drop across the metering orifice and supplies it to the PCM as EGR flow rate feedback.

Differential Pressure Feedback Exhaust Gas Recirculation (EGR) Sensor - Tube Mounted

Differential Pressure Feedback Exhaust Gas Recirculation (EGR) Sensor - Tube Mounted

The tube mounted differential pressure feedback EGR sensor is identical in operation as the larger plastic differential pressure feedback EGR sensors and uses a 1.0 volt offset. The HI and REF hose connections are marked on the side of the sensor.



Item	Part Number	Description
1	9E499	EGR vacuum hose fitting
2	W500224	EGR valve bolt (2 required)
3	9D475	EGR valve
4	9D476	EGR valve gasket

(Continued)

Item	Part Number	Description
5	14A464	Differential pressure feedback EGR sensor electrical connector (part of 12B637)
6	9J460	Differential pressure feedback EGR sensor

(Continued)

Pressure Feedback Exhaust Sensor: Service and Repair

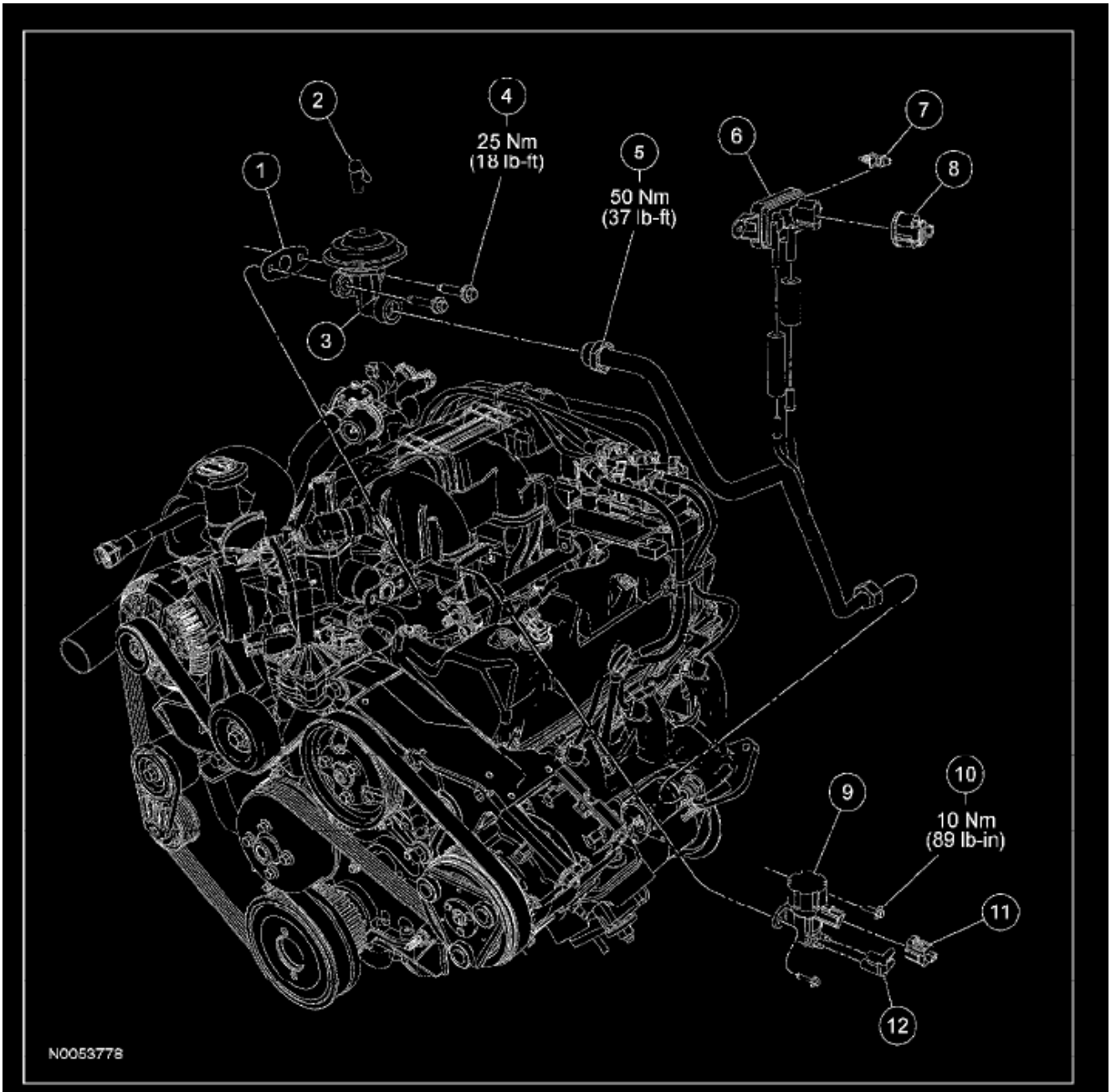
DIFFERENTIAL PRESSURE FEEDBACK EXHAUST GAS RECIRCULATION (EGR) SENSOR

Exploded View

Part 1

Item	Part Number	Description
7	9P761	Differential pressure feedback EGR sensor hoses
8	9D477	Exhaust manifold-to-EGR valve tube
9	14A464	EGR vacuum regulator solenoid electrical connector (part of 12B637)
10	9E499	EGR vacuum regulator solenoid vacuum hose fitting
11	W708628	EGR vacuum regulator solenoid stud bolt
12	9J459	EGR vacuum regulator solenoid

Part 2



Item	Part Number	Description
1	9D476	EGR valve gasket
2	9E499	EGR valve vacuum connector
3	9D475	EGR valve assembly
4	W701232	EGR valve bolt (2 required)

(Continued)

Item	Part Number	Description
5	9E469	EGR tube
6	9J460	Differential pressure feedback EGR sensor
7	13A506	Pushpin wire retainer

(Continued)

Part 1

Item	Part Number	Description
8	14A464	Differential pressure feedback EGR sensor electrical connector
9	9J459	EGR vacuum regulator solenoid
10	W704310	EGR vacuum regulator solenoid bolt (2 required)
11	14A464	EGR vacuum regulator solenoid electrical connector
12	9E499	EGR vacuum regulator solenoid vacuum connector

Part 2

Removal and Installation

1. Disconnect the pushpin retainer from the differential pressure feedback EGR sensor. 2. Disconnect the differential pressure feedback EGR sensor electrical connector. 3. Remove the differential pressure feedback EGR sensor from the hoses. 4. To install, reverse the removal procedure.

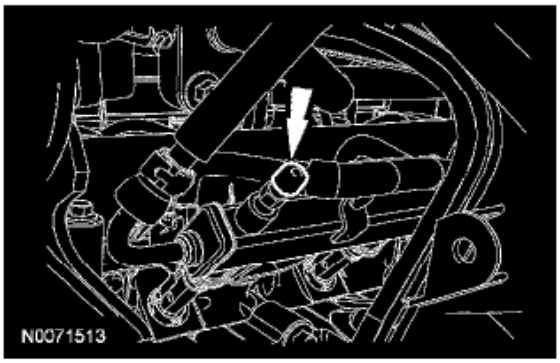
Fuel Pressure: Specifications

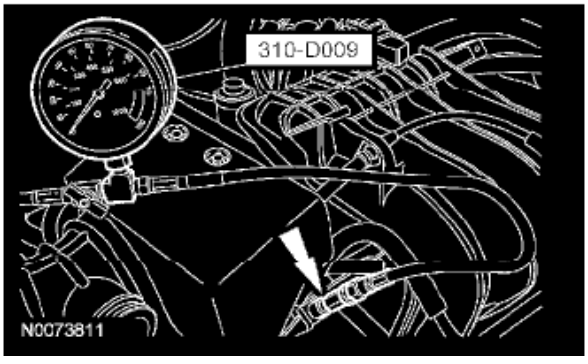
Item.....Specification

Engine running.....414-448 kPa (60-65 psi) Key ON, engine OFF.....414-448 kPa (60-65 psi)

Special Tool(s)

ST3038-A	Fuel Pressure Test Kit 310-D009 (D95L-7211A)





Fuel Pressure: Testing and Inspection

FUEL SYSTEM PRESSURE TEST

Special Tool(s)

Special Tool(s)

WARNING:

- Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

- Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.

- Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

- When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.

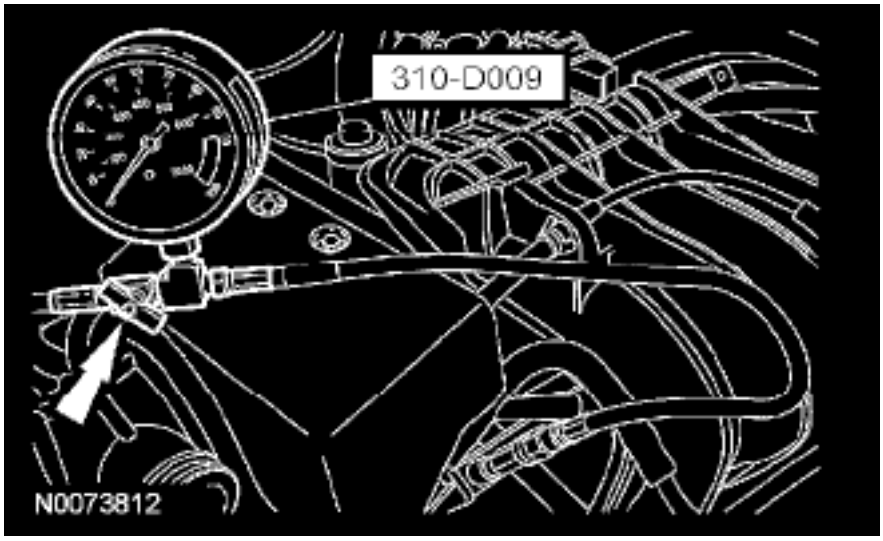
1. NOTE: 2.3L shown, 3.0L and 4.0L similar.

Remove the cap from the fuel pressure relief valve located on the fuel rail.

2. NOTE: 2.3L shown, 3.0L and 4.0L similar.

Install the special tool onto the fuel pressure relief valve.

3. Test the fuel system pressure to make sure it is within the specified range.



4. NOTE:

- 2.3L shown, 3.0L and 4.0L similar.

- Open the drain valve slowly to relieve the fuel system pressure. This may drain fuel from the system. Place fuel in a suitable container.

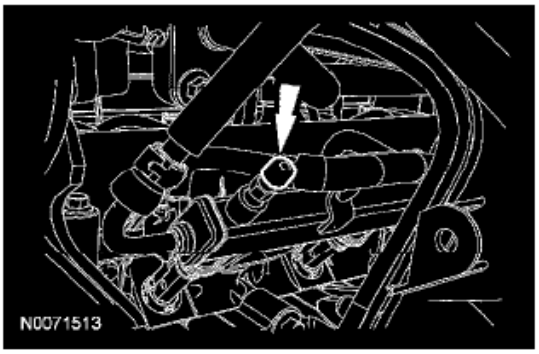
Upon completion of the fuel system pressure test, open the drain valve on the special tool and relieve the fuel system pressure.

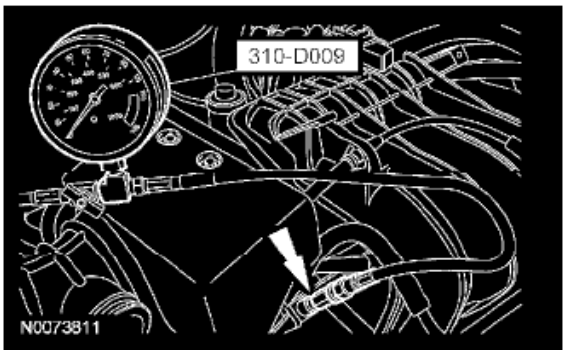
5. NOTE: It may take more than one key cycle to pressurize the fuel system.

Cycle the ignition key and wait 3 seconds to pressurize the fuel system. Check for leaks before starting the engine.

Special Tool(s)

ST3038-A	Fuel Pressure Test Kit 310-D009 (D95L-7211A)





Fuel Pressure Release: Service and Repair

FUEL SYSTEM PRESSURE RELEASE

Special Tool(s)

Special Tool(s)

WARNING:

- Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

- Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.

- Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

- When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.

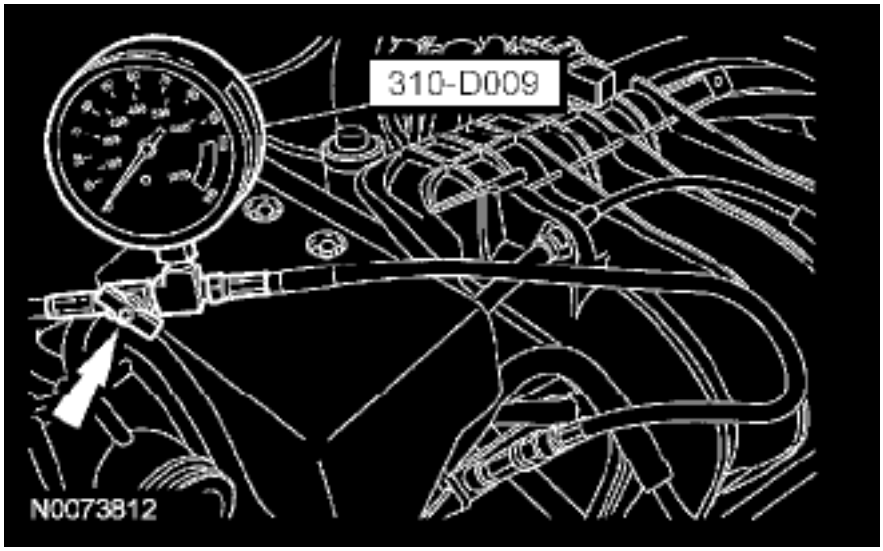
1. Disconnect the battery ground cable.

2. NOTE: 2.3L shown, 3.0L and 4.0L similar.

Remove the cap from the fuel pressure relief valve located on the fuel rail.

3. NOTE: 2.3L shown, 3.0L and 4.0L similar.

Install the special tool onto the fuel pressure relief valve.



4. NOTE:

- 2.3L shown, 3.0L and 4.0L similar.

- Open the drain valve slowly to relieve the system pressure. This may drain fuel from the system. Place fuel in a suitable container.

Open the drain valve on the special tool and relieve the fuel system pressure.

5. NOTE: It may take more than one key cycle to pressurize the fuel system.

Upon completion of the fuel system repairs, cycle the ignition key and wait 3 seconds to pressurize the fuel system. Check for leaks before starting the engine.

Idle Speed: Specifications

Typical Diagnostic Reference Value

Measured/PID Values 750 RPM .... Hot Idle

Torque Specifications

Description	Nm	lb-in
Accelerator control splash shield bolts (2.3L)	3	27
Accelerator control splash shield bolt (3.0L)	6	53
Accelerator control splash shield bolts (4.0L)	3	27
Accelerator pedal pivot bolt	9	80

Torque Specifications

Accelerator Pedal: Initial Inspection and Diagnostic Overview

Principles of Operation

PRINCIPLES OF OPERATION

The acceleration control allows the operator to control the vehicle speed. The throttle is controlled by the accelerator cable which is attached to the accelerator pedal. As the operator presses on the accelerator pedal, the accelerator pedal pulls on the accelerator cable which opens the throttle.

Inspection and Verification

INSPECTION AND VERIFICATION

1. Verify the customer's concern by operating the acceleration control system to duplicate the condition. 2. Inspect to determine if any of the following mechanical concerns apply.

VISUAL INSPECTION CHART

Mechanical -

Damaged accelerator pedal and shaft

- Damaged linkage

- Damaged accelerator cable

- High engine idle speed

- Damaged throttle body (TB)

3. If the inspection reveals an obvious concern that can be readily identified, repair it as required. 4. If the concern remains after the inspection, determine the symptom(s) and go to the Symptom Chart. See: Symptom Related Diagnostic

Procedures

Symptom Chart

Condition	Possible Sources	Action
• Excessive effort is needed to depress the accelerator pedal and shaft	• Accelerator cable binding • Worn or damaged throttle body (TB)	• INSTALL a new accelerator cable. • INSTALL a new throttle body.
• The accelerator pedal and shaft feels rough or raspy	• Frayed or binding accelerator cable • Worn or damaged TB	• INSTALL a new accelerator cable. • INSTALL a new throttle body.
• The accelerator pedal and shaft binds or sticks	• Kinked accelerator cable • Foreign material caught in accelerator pedal linkage • Worn or damaged TB	• INSTALL a new accelerator cable. • CHECK the accelerator pedal linkage. • INSTALL a new TB.

Symptom Chart (Continued)

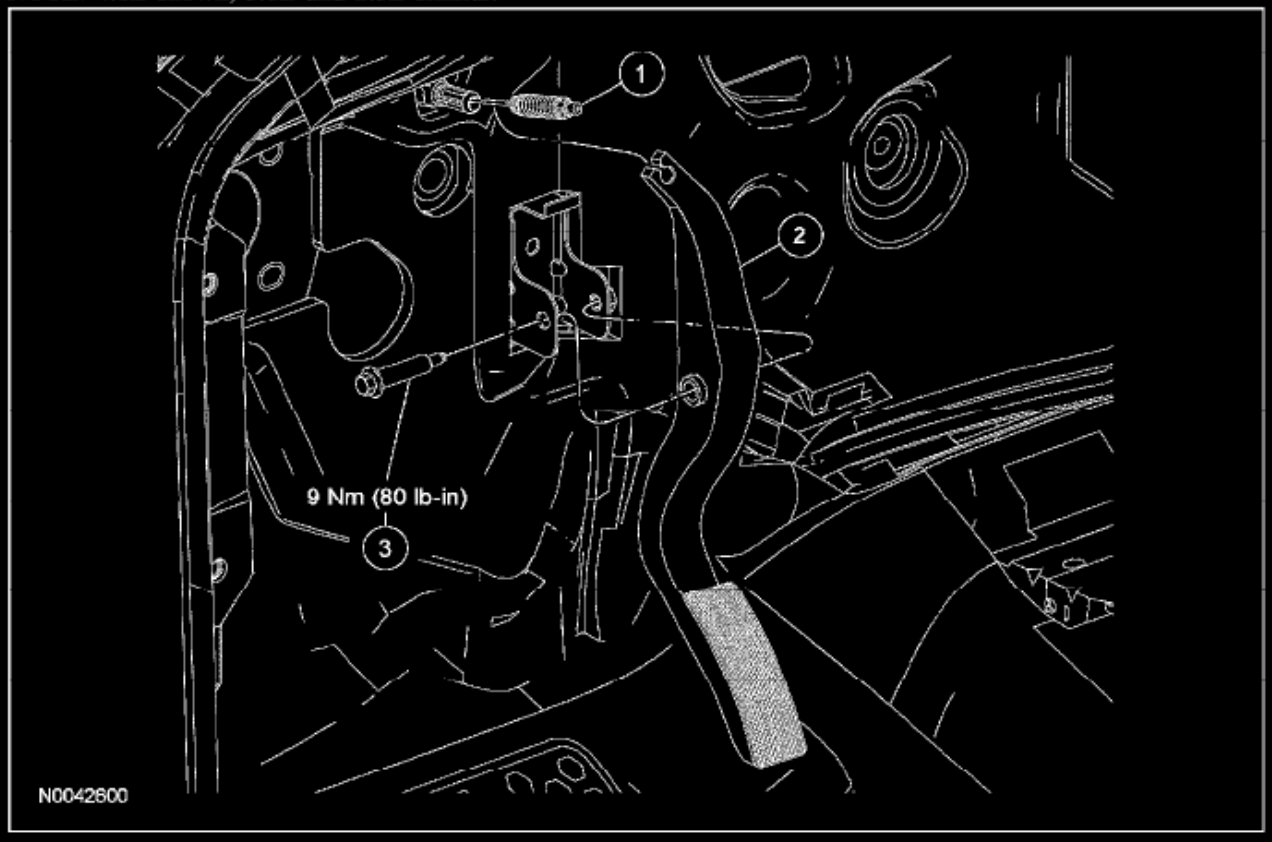
Condition	Possible Sources	Action
• The engine idle speed is high	• Kinked accelerator cable • Foreign material caught in accelerator pedal linkage • Accelerator pedal caught under mispositioned floor mat • Incorrect engine idle speed	• INSTALL a new accelerator cable. • CHECK the accelerator pedal linkage. • REFER to Computers and Control Systems for diagnosis and testing of the idle control system.

Accelerator Pedal: Symptom Related Diagnostic Procedures

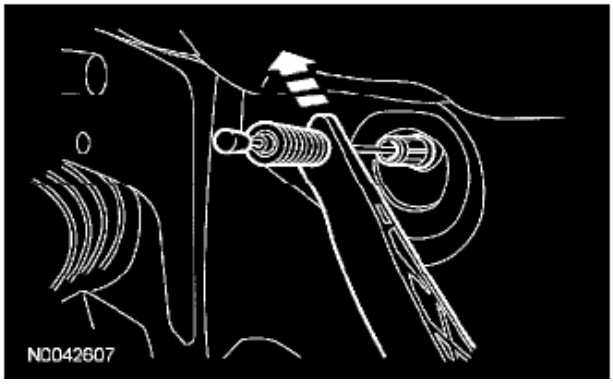
Symptom Chart (Part 1)

Symptom Chart (Part 2)

NOTE: 4.0L shown, 3.0L and 2.3L similar.



Item	Part Number	Description
1	9A758	Accelerator cable
2	9275	Accelerator pedal
3	N804397	Accelerator pedal pivot bolt



Accelerator Pedal: Service and Repair

ACCELERATOR PEDAL

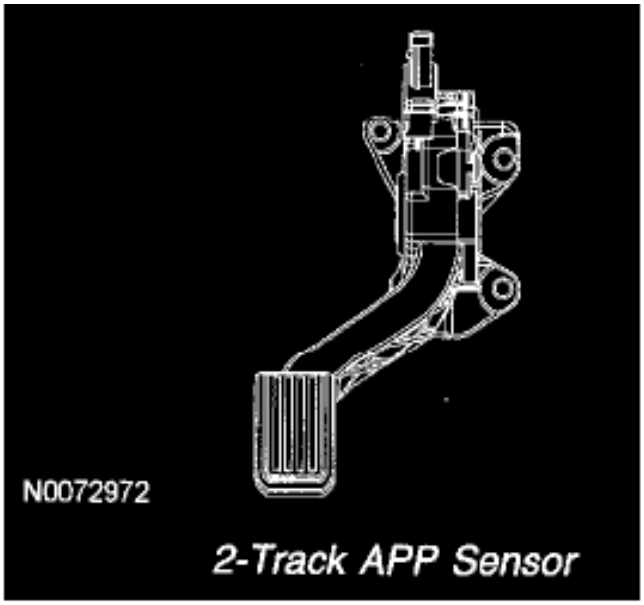
Removal and Installation

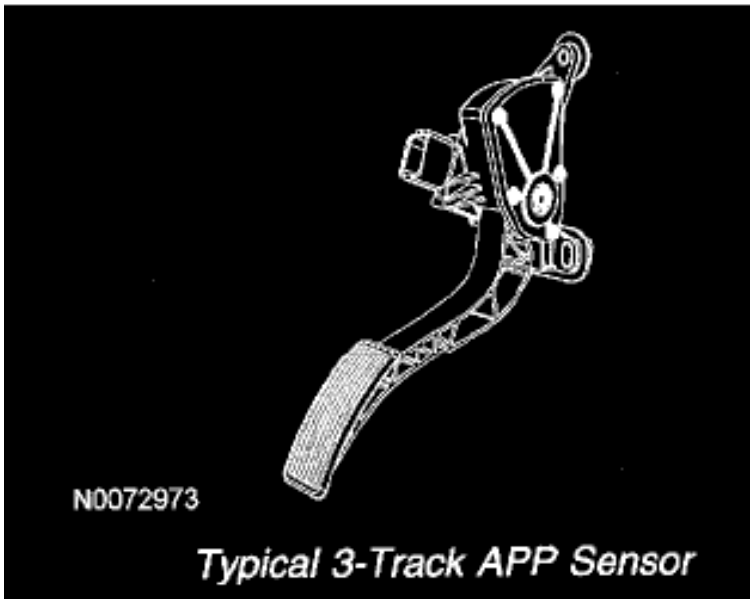
1. Disconnect the accelerator cable from the accelerator pedal.

2. Remove the accelerator pedal pivot bolt and the accelerator pedal.

- To install, tighten to 9 Nm (80 lb-in).

3. To install, reverse the removal procedure.


N0072972
2-Track APP Sensor


N0072973
Typical 3-Track APP Sensor

Accelerator Pedal Position Sensor: Description and Operation

ACCELERATOR PEDAL POSITION (APP) SENSOR

The APP sensor is an input to the powertrain control module (PCM) and is used to determine the amount of torque requested by the operator. Depending on the application either a 2-track or 3-track APP sensor is used.

2-Track APP Sensor

2-Track APP Sensor

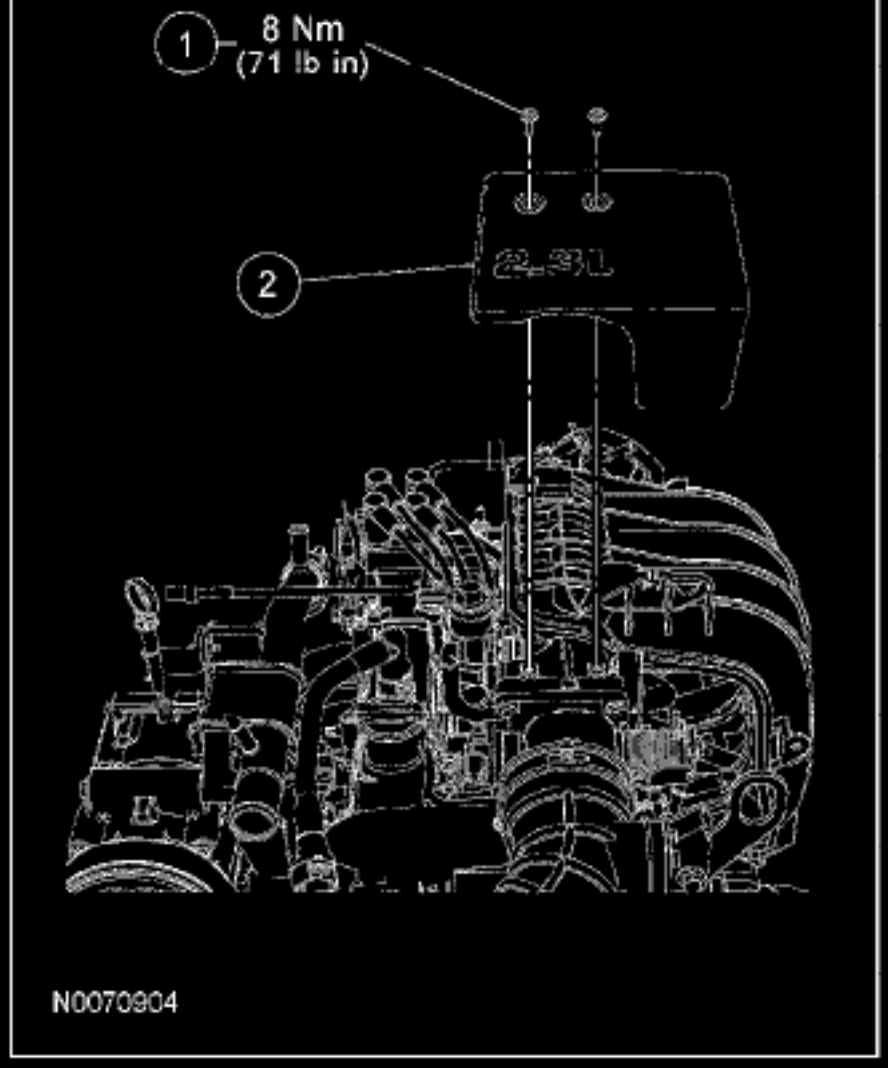
There are 2 pedal position signals in the sensor. Both signals, APP1 and APP2, have a positive slope (increasing angle, increasing voltage), but are offset and increase at different rates. The 2 pedal position signals make sure the PCM receives a correct input even if 1 signal has a concern. The PCM determines if a signal is incorrect by calculating where it should be, inferred from the other signals. If a concern is present with one of the circuits the other input is used. There are 2 reference voltage circuits, 2 signal return circuits, and 2 signal circuits (a total of 6 circuits and pins) between the PCM and the APP sensor assembly. The reference voltage circuits and the signal return circuits are shared with the reference voltage circuit and signal return circuit used by the electronic throttle body (ETB) throttle position sensor. The pedal position signal is converted to pedal travel degrees (rotary angle) by the PCM. The software then converts these degrees to counts, which is the input to the torque based strategy.

3-Track APP Sensor

Typical 3-Track APP Sensor

There are 3 pedal position signals in the sensor. Signal 1, APP1, has a negative slope (increasing angle, decreasing voltage) and signals 2 and 3, APP2 and APP3, both have a positive slope (increasing angle, increasing voltage). During normal operation APP1 is used as the indication of pedal position by the strategy. The 3 pedal position signals make sure the PCM receives a correct input even if 1 signal has a concern. The PCM determines if a signal is incorrect by calculating where it should be, inferred from the other signals. If a concern is present with one of the circuits the other inputs are used. The pedal position signal is converted to pedal travel degrees (rotary angle) by the PCM. The software then converts these degrees to counts, which is the input to the torque based strategy. There are 2 reference voltage circuits, 2 signal return circuits, and 3 signal circuits (a total of 7 circuits and pins) between the PCM and the APP sensor assembly. The reference voltage circuits and the signal return circuits are shared with the reference voltage circuit and signal return circuit used by the electronic throttle body (ETB) throttle position sensor.

2.3L Throttle Body (TB) Cover



Item	Part Number	Description
1	—	Throttle body (TB) cover bolt (2 required)
2	9E766	TB cover

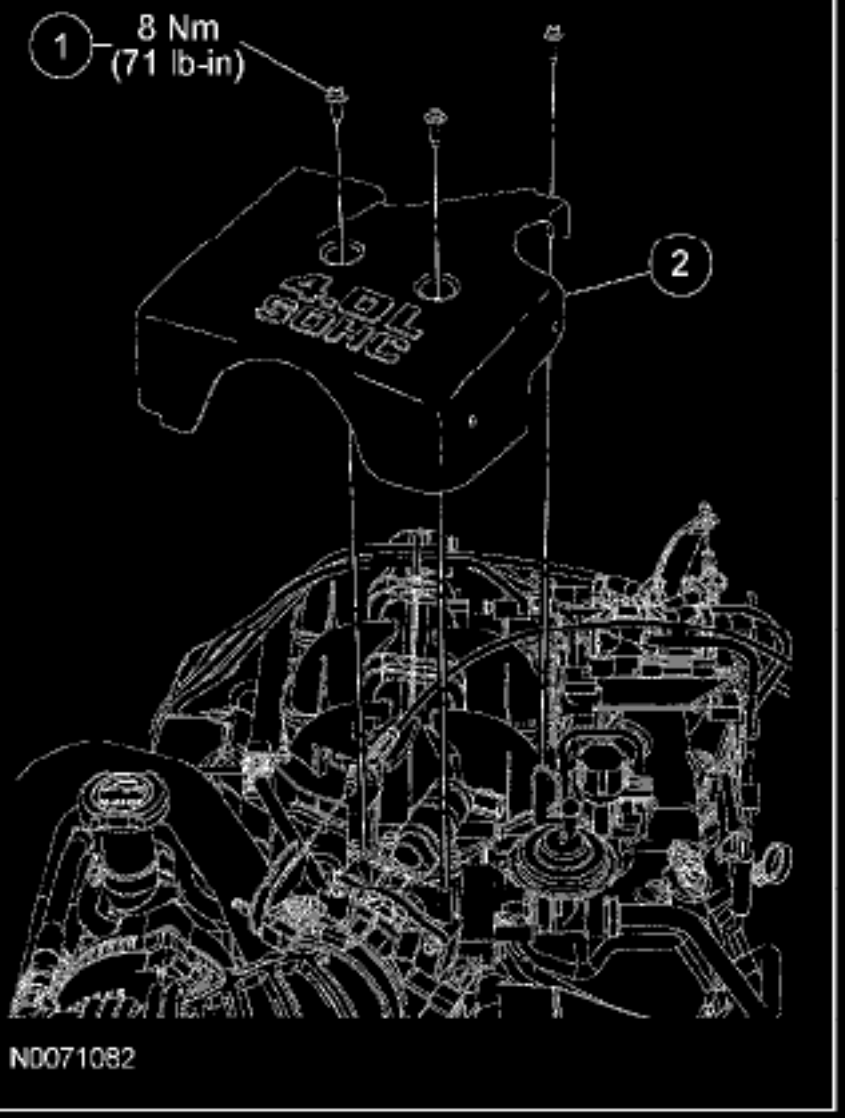
Air Cleaner Fresh Air Duct/Hose: Service and Repair

INTAKE AIR SYSTEM COMPONENTS

Exploded View

2.3L Throttle Body (TB) Cover

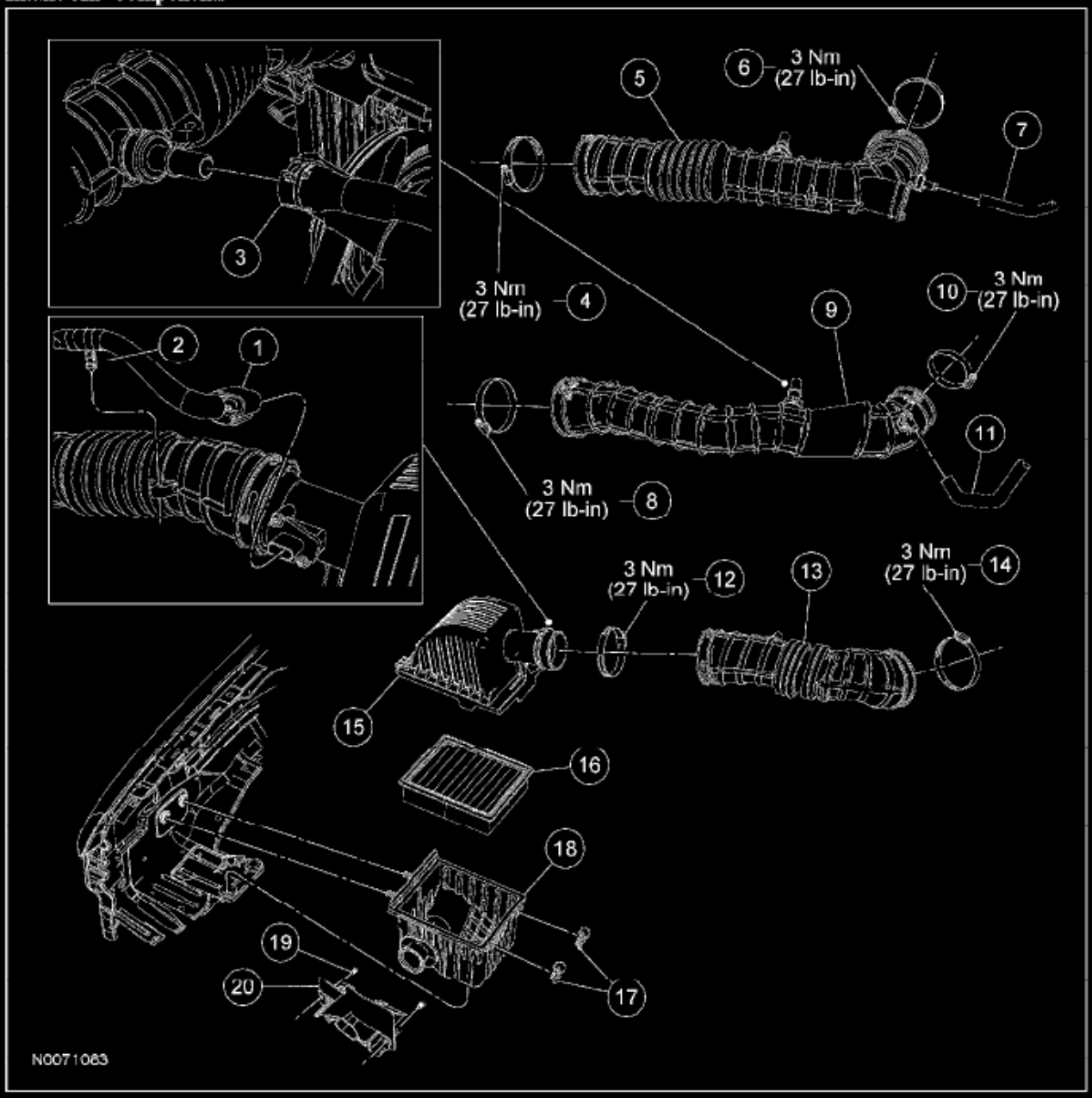
4.0L SOHC Throttle Body (TB) Cover



Item	Part Number	Description
1	W704704	Throttle body (TB) cover bolt (2 required)
2	9E766	TB cover

4.0L SOHC Throttle Body (TB) Cover

Intake Air Components



Item	Part Number	Description
1	—	Mass air flow (MAF) sensor electrical connector (part of 12B637)
2	13A506	Wiring harness retainer (2 required [2.3L engines]) (1 required [3.0L and 4.0L engines]) (part of 12B637)
3	—	Crankcase ventilation tube quick connect coupling

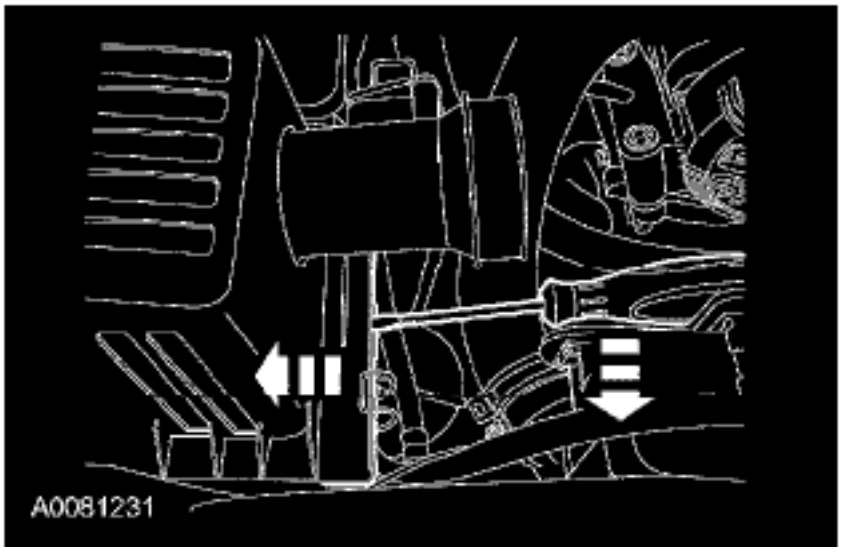
(Continued)

Item	Part Number	Description
4	6C632	Engine air cleaner (ACL) outlet tube-to-air cleaner clamp (2.3L)
5	9B659	ACL outlet tube (2.3L)
6	6C632	ACL outlet tube-to-throttle body (TB) clamp (2.3L)
7	9C490	Brake booster vacuum hose
8	6C632	ACL outlet tube-to-air cleaner clamp (3.0L)

(Continued)

Intake Air Components (Part 1)

Item	Part Number	Description
9	9B659	ACL outlet tube (3.0L)
10	6C632	ACL outlet tube-to-TB clamp (3.0L)
11	9C490	Brake booster vacuum hose
12	6C632	ACL outlet tube-to-air cleaner clamp (4.0L)
13	9B659	ACL outlet tube (4.0L)
14	6C632	ACL outlet tube-to-TB clamp (4.0L)
15	9643	ACL cover
16	9601	ACL element
17	9628	ACL-to-ACL cover clips
18	9A612	ACL
19	N810040	Air nozzle pushpins
20	9E961	Air nozzle

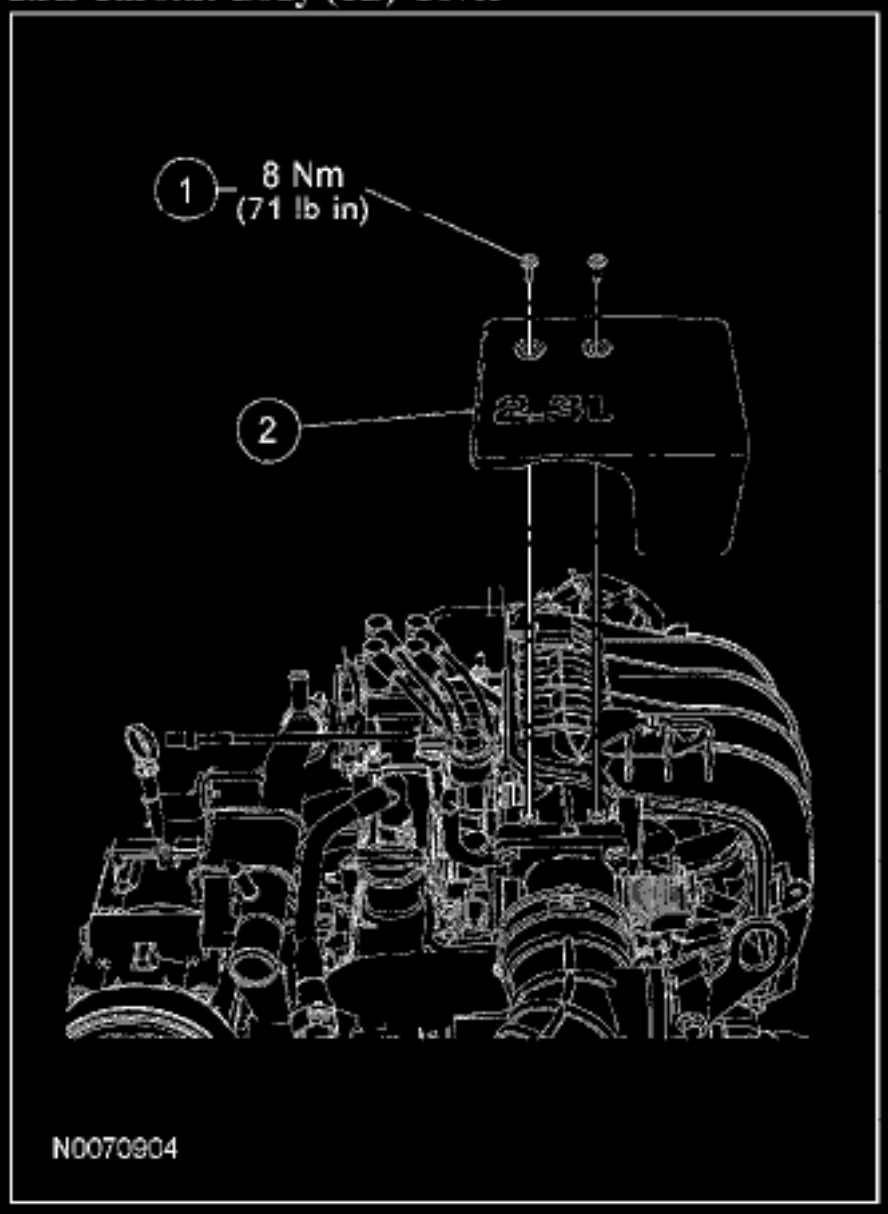


Intake Air Components (Part 2)

Removal and Installation

1. If necessary, pry the engine air cleaner (ACL) from the base support bracket when removing the ACL.

2.3L Throttle Body (TB) Cover



Item	Part Number	Description
1	—	Throttle body (TB) cover bolt (2 required)
2	9E766	TB cover

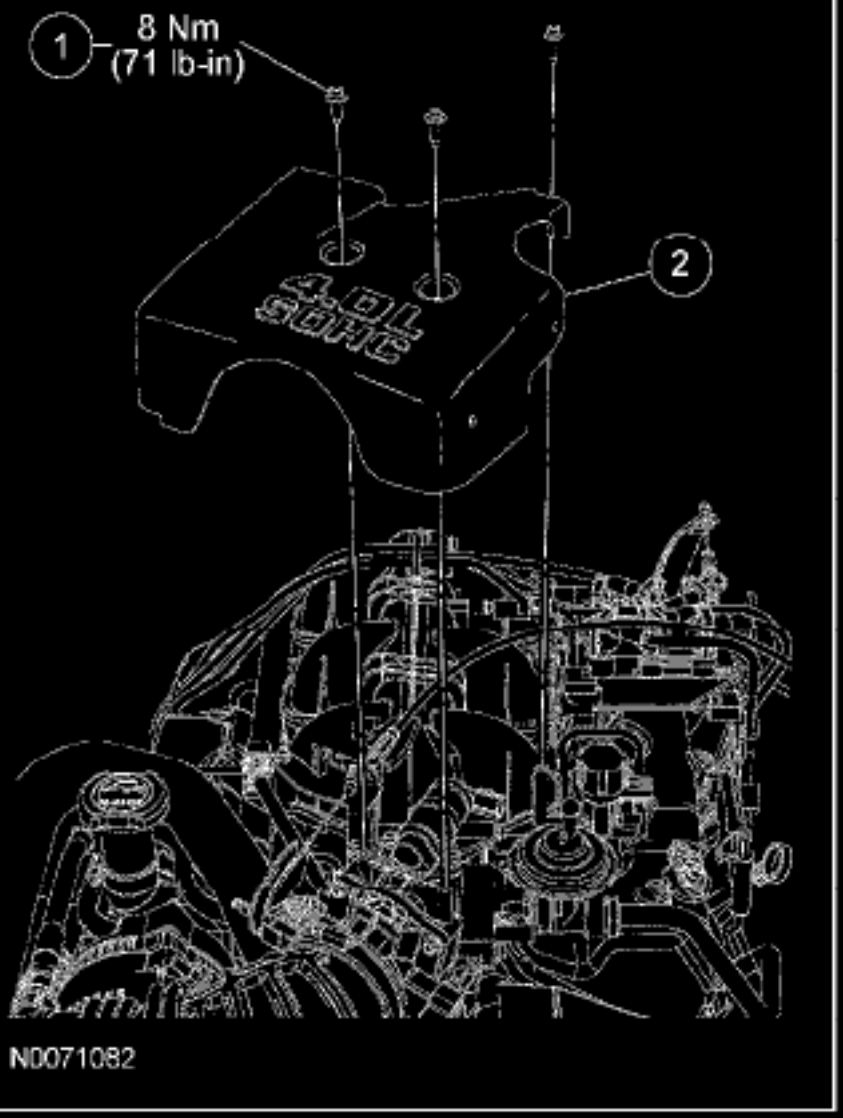
Air Filter Element: Service and Repair

INTAKE AIR SYSTEM COMPONENTS

Exploded View

2.3L Throttle Body (TB) Cover

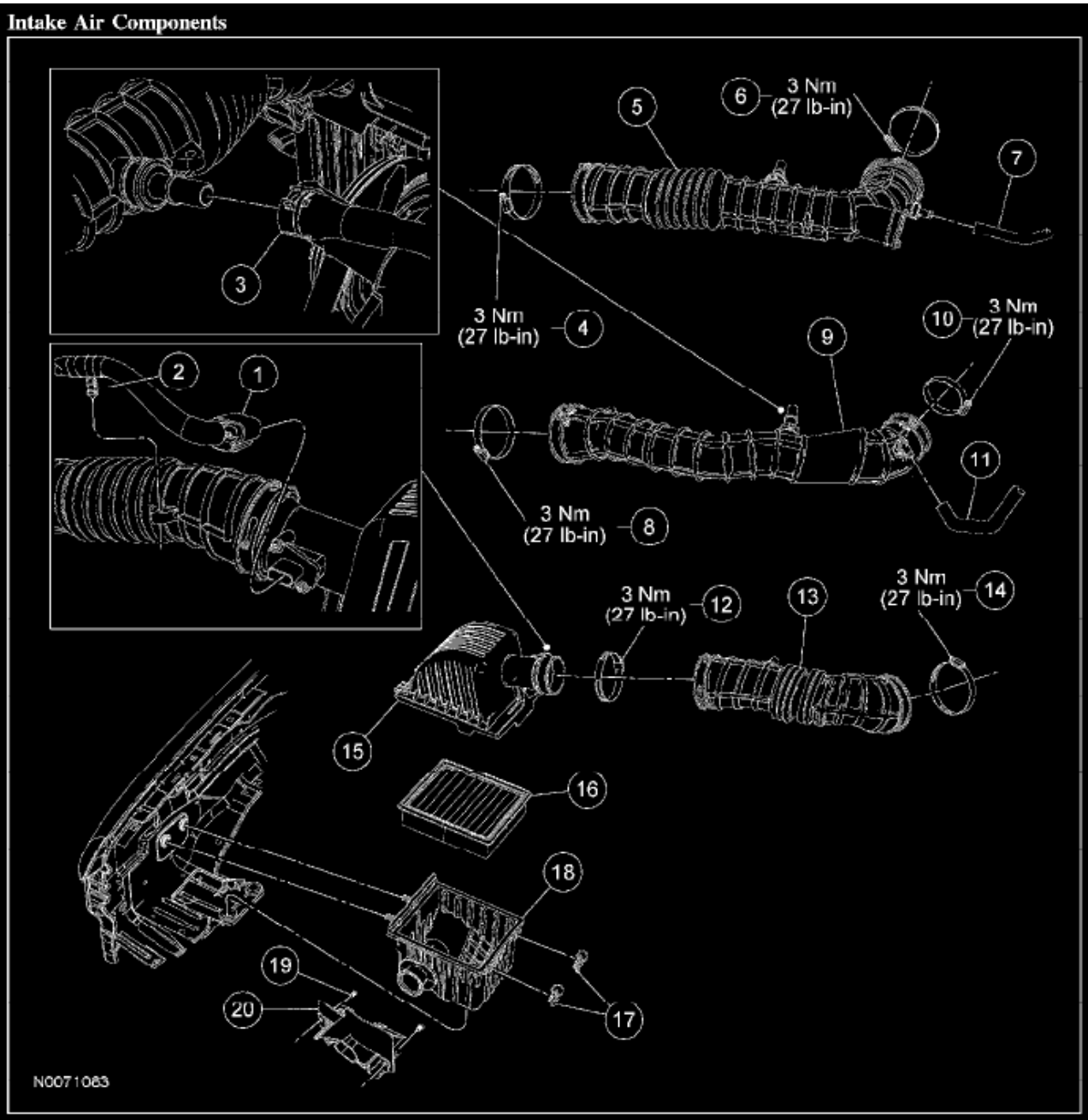
4.0L SOHC Throttle Body (TB) Cover



Item	Part Number	Description
1	W704704	Throttle body (TB) cover bolt (2 required)
2	9E766	TB cover

4.0L SOHC Throttle Body (TB) Cover

Intake Air Components



Item	Part Number	Description
1	—	Mass air flow (MAF) sensor electrical connector (part of 12B637)
2	13A506	Wiring harness retainer (2 required [2.3L engines]) (1 required [3.0L and 4.0L engines]) (part of 12B637)
3	—	Crankcase ventilation tube quick connect coupling

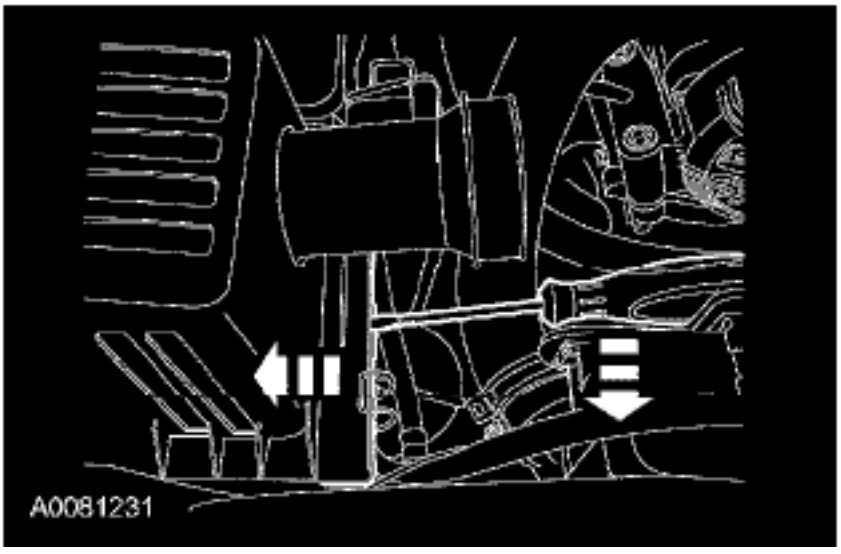
(Continued)

Item	Part Number	Description
4	6C632	Engine air cleaner (ACL) outlet tube-to-air cleaner clamp (2.3L)
5	9B659	ACL outlet tube (2.3L)
6	6C632	ACL outlet tube-to-throttle body (TB) clamp (2.3L)
7	9C490	Brake booster vacuum hose
8	6C632	ACL outlet tube-to-air cleaner clamp (3.0L)

(Continued)

Intake Air Components (Part 1)

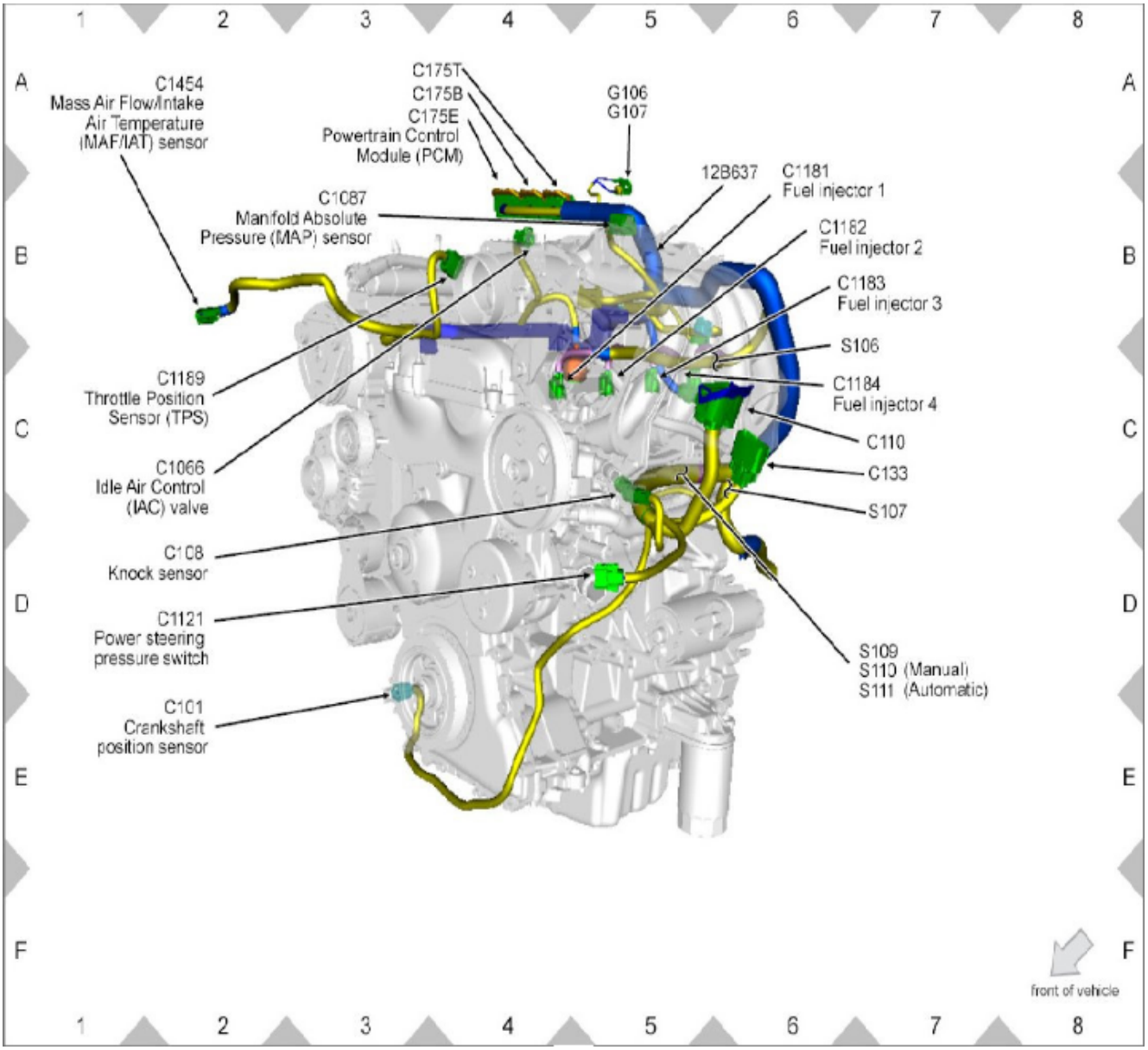
Item	Part Number	Description
9	9B659	ACL outlet tube (3.0L)
10	6C632	ACL outlet tube-to-TB clamp (3.0L)
11	9C490	Brake booster vacuum hose
12	6C632	ACL outlet tube-to-air cleaner clamp (4.0L)
13	9B659	ACL outlet tube (4.0L)
14	6C632	ACL outlet tube-to-TB clamp (4.0L)
15	9643	ACL cover
16	9601	ACL element
17	9628	ACL-to-ACL cover clips
18	9A612	ACL
19	N810040	Air nozzle pushpins
20	9E961	Air nozzle



Intake Air Components (Part 2)

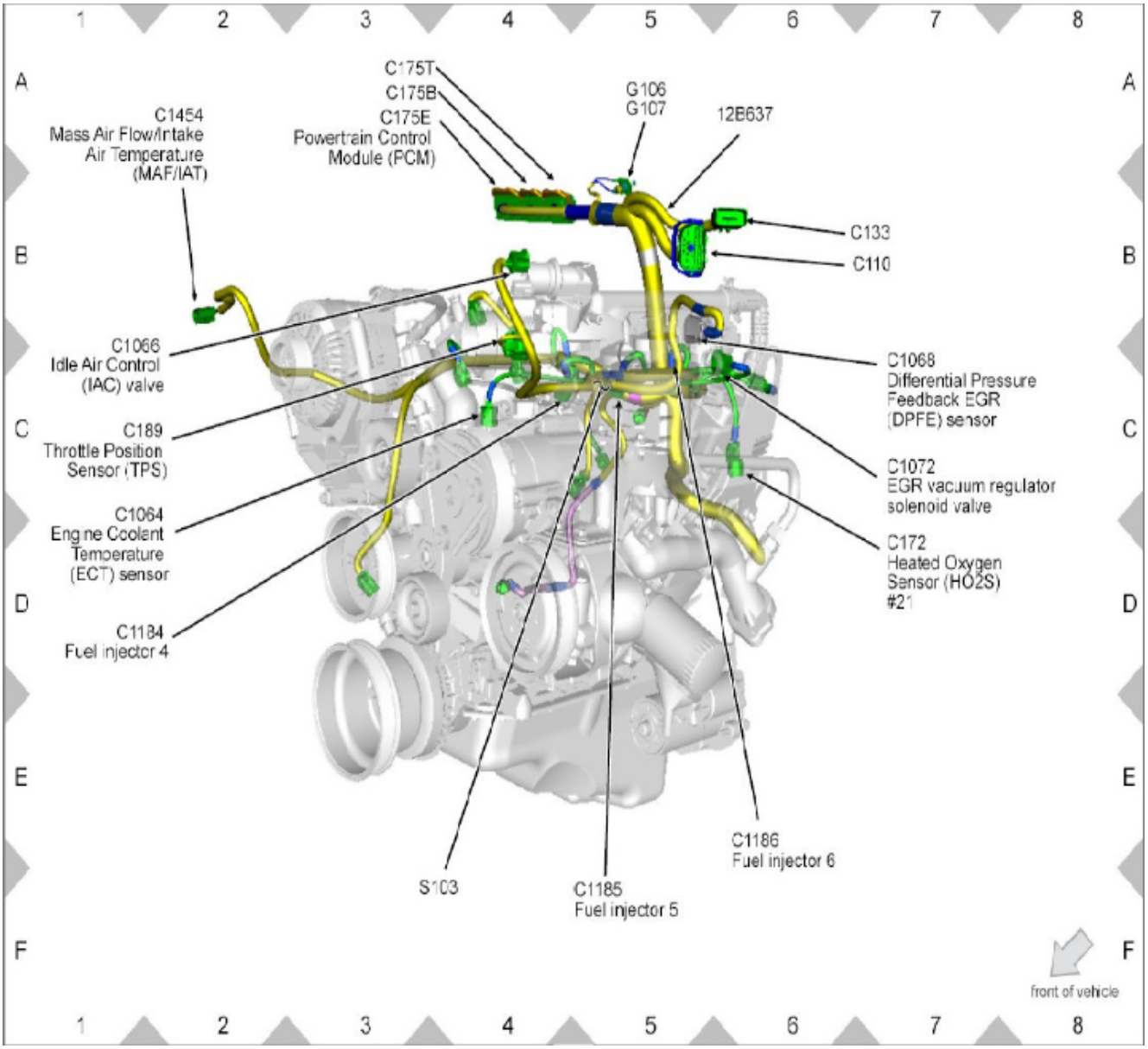
Removal and Installation

1. If necessary, pry the engine air cleaner (ACL) from the base support bracket when removing the ACL.

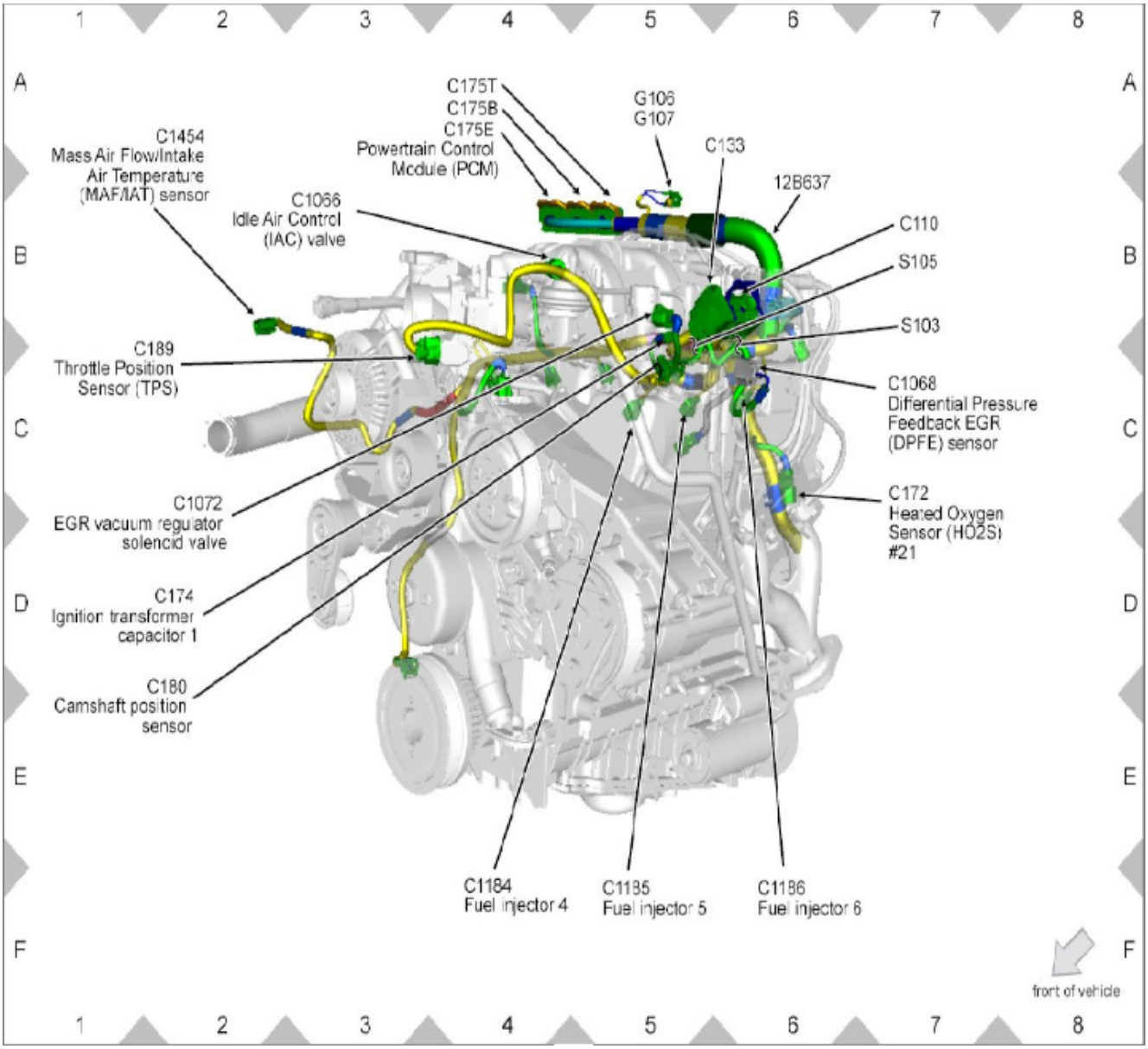


Air Flow Meter/Sensor: Locations

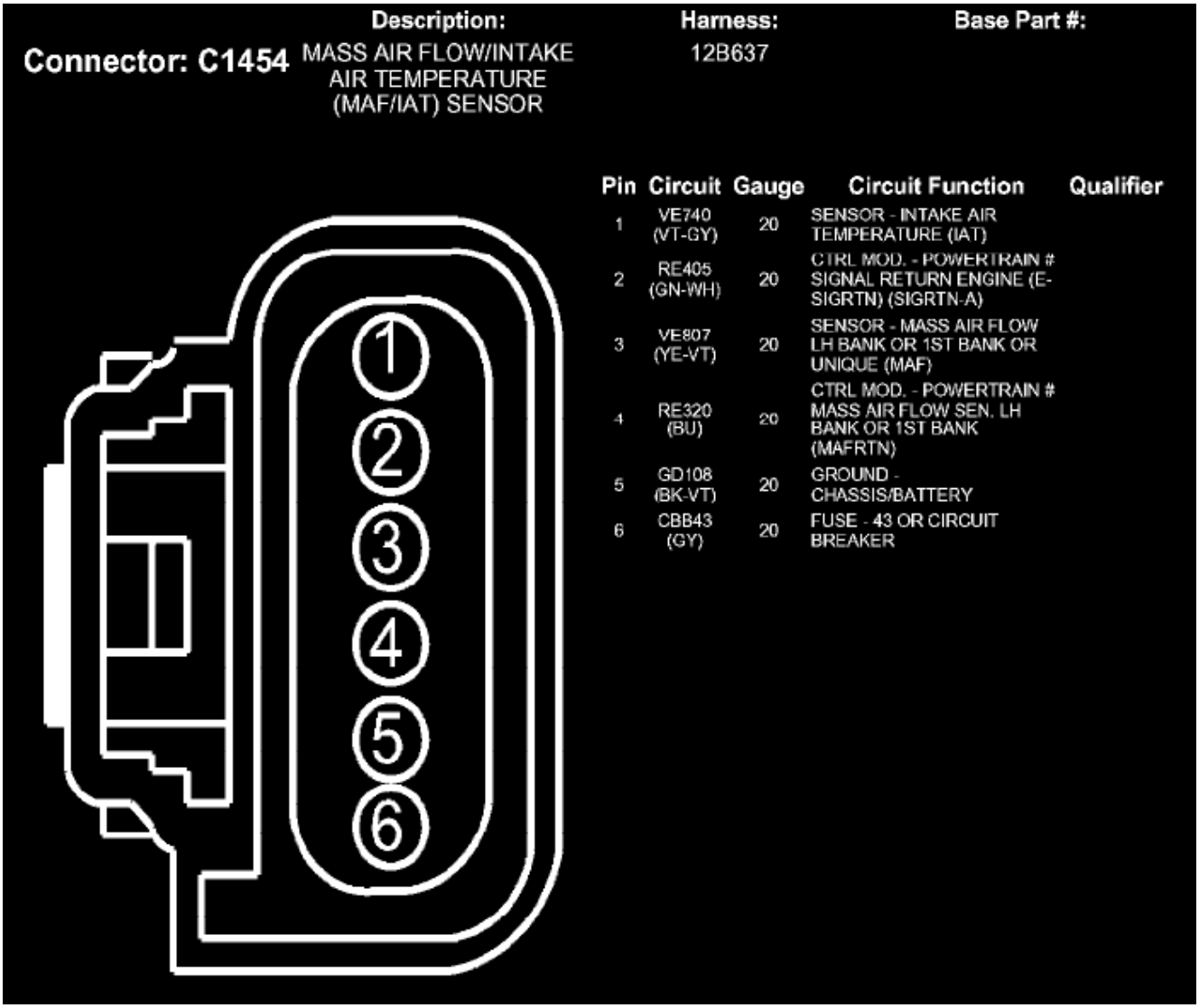
View 151-3


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
12B637
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT)
C133
C110
C1066
Idle Air Control (IAC) valve
C189
Throttle Position Sensor (TPS)
C1064
Engine Coolant Temperature (ECT) sensor
C1184
Fuel injector 4
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
S103
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-5


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
C133
12B637
C110
S105
S103
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor
C1066
Idle Air Control (IAC) valve
C189
Throttle Position Sensor (TPS)
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
C174
Ignition transformer capacitor 1
C180
Camshaft position sensor
C1184
Fuel injector 4
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-7



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE740 (VT-GY)	20	SENSOR - INTAKE AIR TEMPERATURE (IAT)	
2	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	
3	VE807 (YE-VT)	20	SENSOR - MASS AIR FLOW LH BANK OR 1ST BANK OR UNIQUE (MAF)	
4	RE320 (BU)	20	CTRL MOD. - POWERTRAIN # MASS AIR FLOW SEN. LH BANK OR 1ST BANK (MAFRTN)	
5	GD108 (BK-VT)	20	GROUND - CHASSIS/BATTERY	
6	CBB43 (GY)	20	FUSE - 43 OR CIRCUIT BREAKER	

C1454

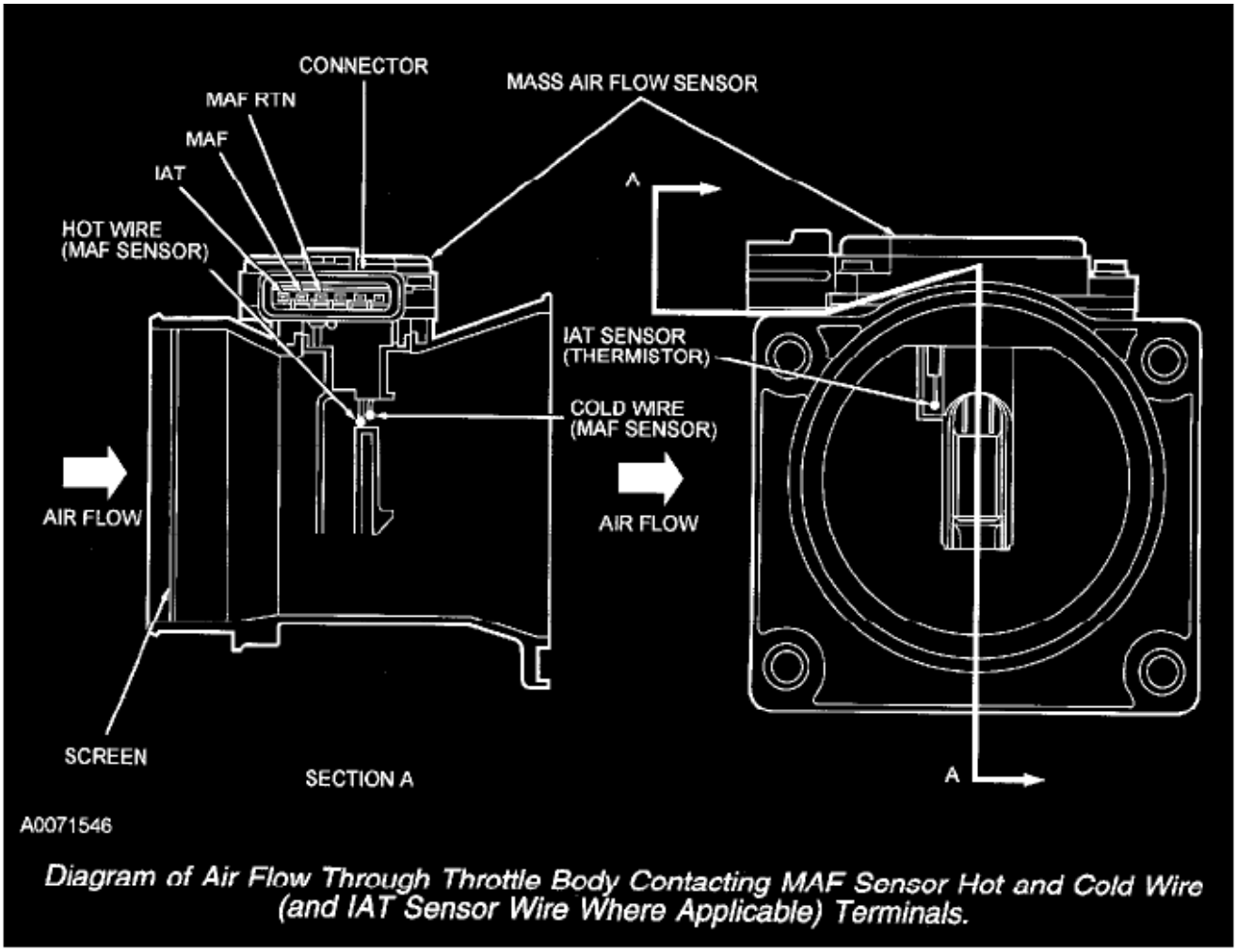
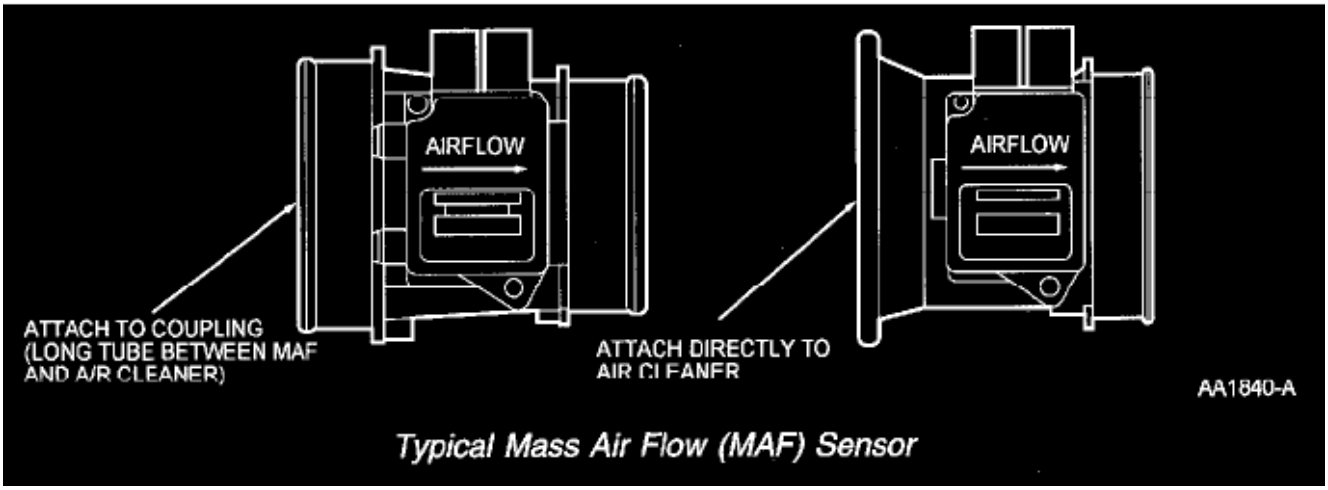


Diagram of Air Flow Through Throttle Body Contacting MAF Sensor Hot and Cold Wire (and IAT Sensor Wire Where Applicable) Terminals.



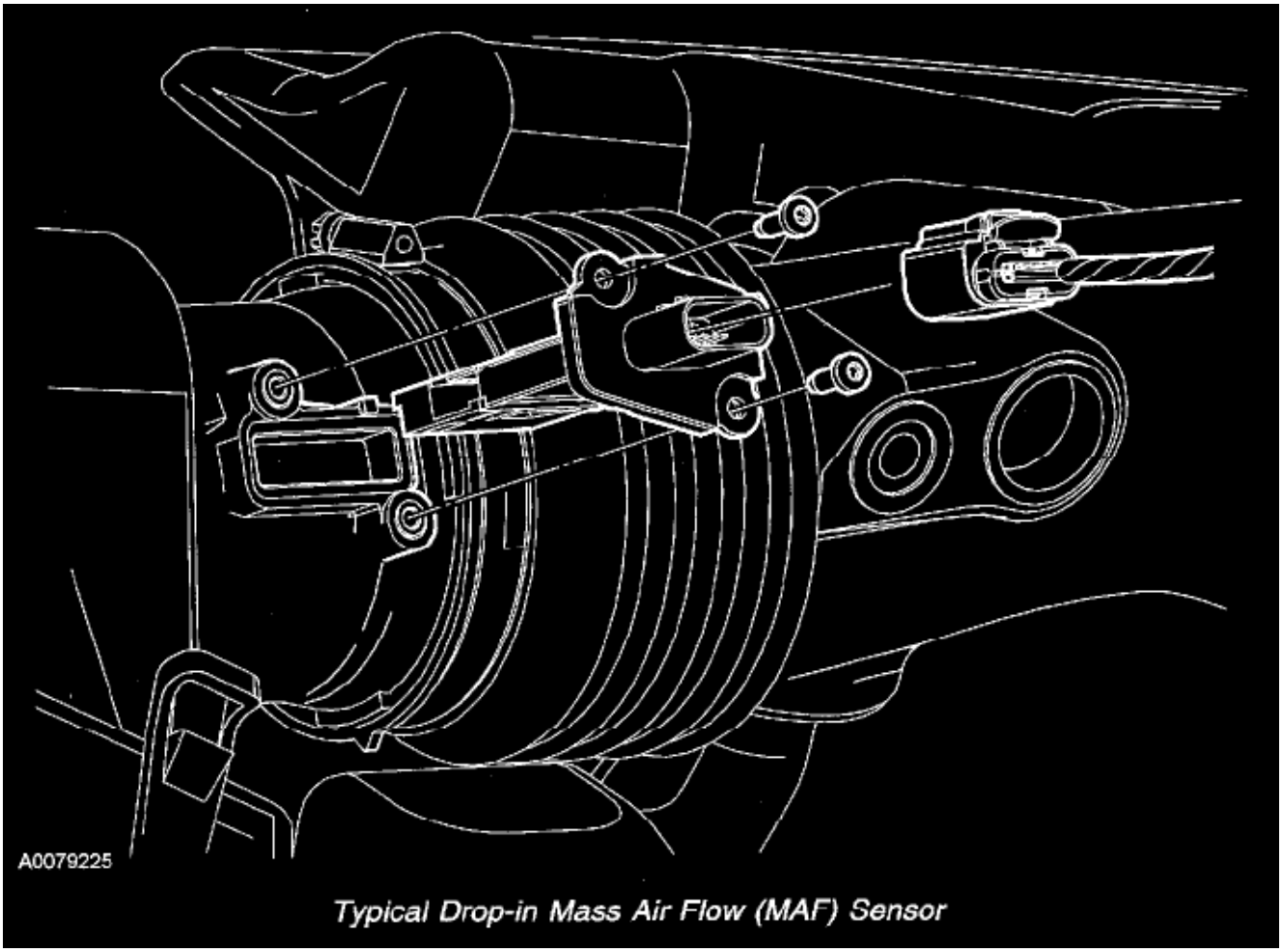
Typical Mass Air Flow (MAF) Sensor

Air Flow Meter/Sensor: Description and Operation

MASS AIR FLOW (MAF) SENSOR

Diagram Of Air Flow Through Throttle Body Contacting MAF Sensor Hot And Cold Wire (and IAT Sensor Wire Where Applicable) Terminals

Typical Mass Air Flow (MAF) Sensor

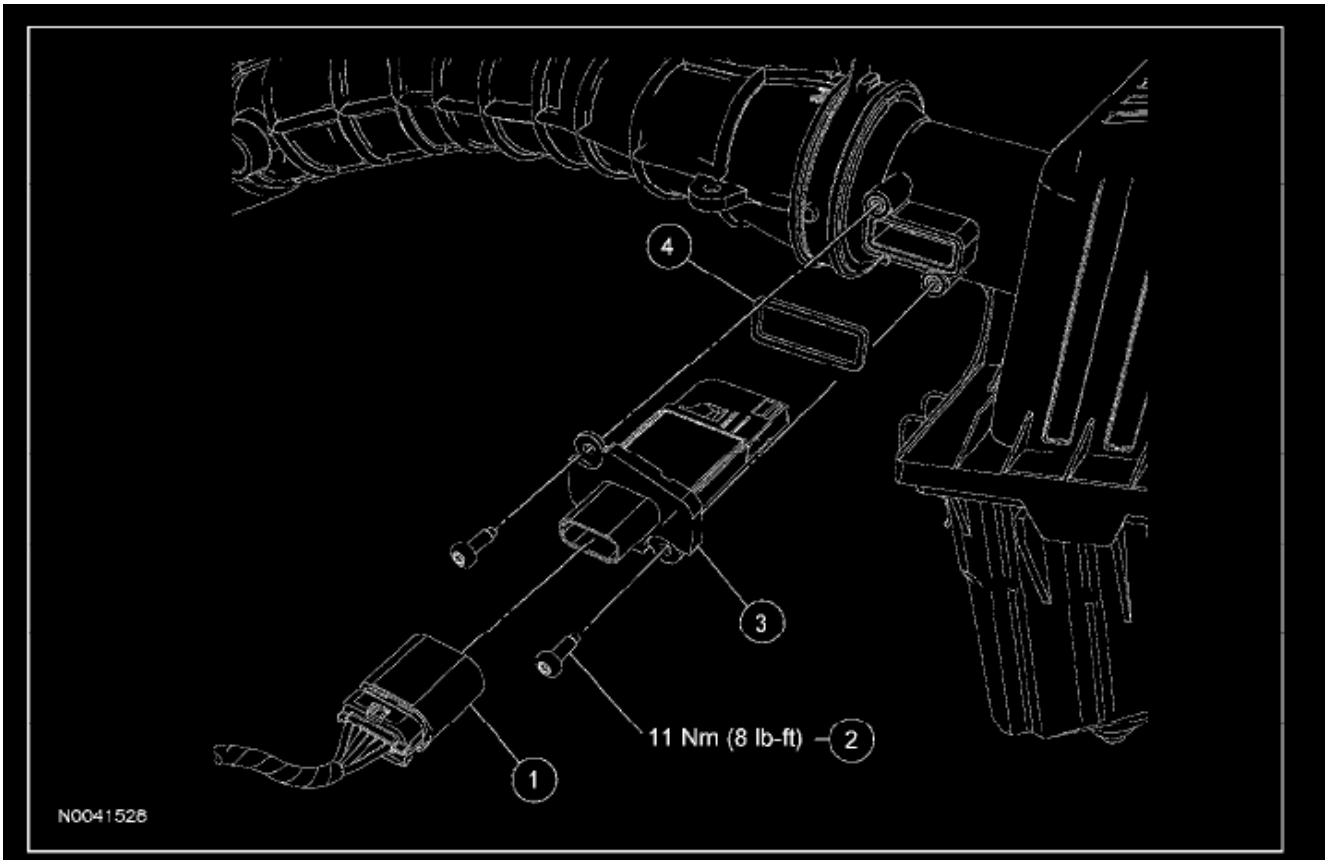


Typical Drop-in Mass Air Flow (MAF) Sensor

Typical Drop-in Mass Air Flow (MAF) Sensor

The MAF sensor uses a hot wire sensing element to measure the amount of air entering the engine. Air passing over the hot wire causes it to cool. This hot wire is maintained at 200°C (392°F) above the ambient temperature as measured by a constant cold wire. The current required to maintain the temperature of the hot wire is proportional to the mass air flow. The MAF sensor then outputs an analog voltage signal to the PCM proportional to the intake air mass. The PCM calculates the required fuel injector pulse width in order to provide the desired air/fuel ratio. This input is also used in determining transmission electronic pressure control (EPC), shift and torque converter clutch scheduling.

The MAF sensor is located between the air cleaner and the throttle body or inside the air cleaner assembly. Most MAF sensors have integrated bypass technology with an integrated intake air temperature (IAT) sensor. The hot wire electronic sensing element must be replaced as an assembly. Replacing only the element may change the air flow calibration.



Item	Part Number	Description
1	14A464	Mass air flow (MAF) sensor electrical connector (part of 12B637)
2	W709287	MAF sensor bolt (2 required)
3	12B605	MAF sensor
4	—	MAF sensor gasket

Air Flow Meter/Sensor: Service and Repair

MASS AIR FLOW (MAF) SENSOR

Removal and Installation

1. Disconnect the mass air flow (MAF) sensor electrical connector. 2. Remove the 2 bolts, the MAF sensor and discard the gasket.

- To install, tighten to 11 Nm (8 lb-ft).

3. CAUTION: Do not tamper with the mass air flow (MAF) sensing elements located in the airflow bypass. Tampering may result in

failure.

NOTE: The MAF sensor module and body are calibrated and installed as a unit.

To install, reverse the removal procedure. -

Install a new gasket.

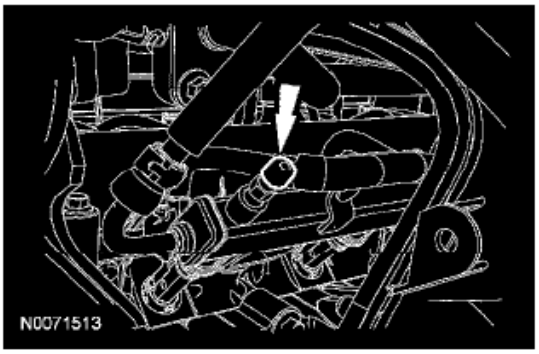
Fuel Filler Cap Warning Indicator: Description and Operation

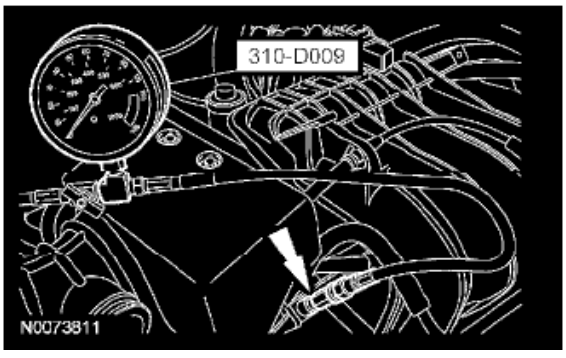
CHECK FUEL CAP INDICATOR

The check fuel cap indicator is a communications network message sent by the PCM. The PCM sends the message to illuminate the lamp when the strategy determines there is a concern in the EVAP system due to the fuel filler cap or capless fuel tank filler pipe not being sealed correctly. This would be detected by the inability to pull vacuum in the fuel tank, after a fueling event.

Special Tool(s)

ST3038-A	Fuel Pressure Test Kit 310-D009 (D95L-7211A)





Fuel Pressure Release: Service and Repair

FUEL SYSTEM PRESSURE RELEASE

Special Tool(s)

Special Tool(s)

WARNING:

- Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

- Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.

- Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

- When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.

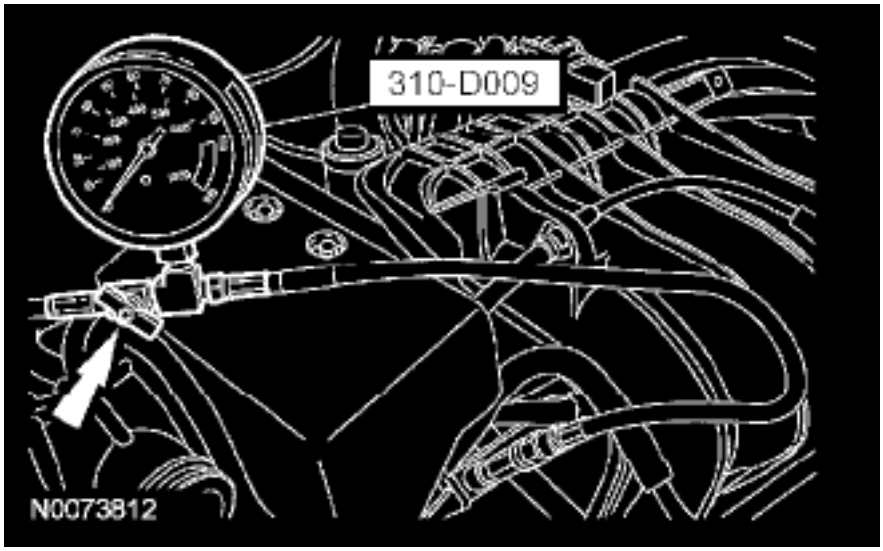
1. Disconnect the battery ground cable.

2. NOTE: 2.3L shown, 3.0L and 4.0L similar.

Remove the cap from the fuel pressure relief valve located on the fuel rail.

3. NOTE: 2.3L shown, 3.0L and 4.0L similar.

Install the special tool onto the fuel pressure relief valve.



4. NOTE:

- 2.3L shown, 3.0L and 4.0L similar.

- Open the drain valve slowly to relieve the system pressure. This may drain fuel from the system. Place fuel in a suitable container.

Open the drain valve on the special tool and relieve the fuel system pressure.

5. NOTE: It may take more than one key cycle to pressurize the fuel system.

Upon completion of the fuel system repairs, cycle the ignition key and wait 3 seconds to pressurize the fuel system. Check for leaks before starting the engine.

Fuel Injector: Electrical Specifications

Fuel Injector Resistance ..... 11 - 18 Ohms

Fuel Injector: Pressure, Vacuum and Temperature Specifications

Fuel Injector Flow and Leakage ..... Refer to Pinpoint Test HC12 through HC14 at Computers and Control Systems.

Connector: C1181
Description:
FUEL INJECTOR 1
Harness:
12B637
Base Part #:
9F593
Pin
Circuit
Gauge
Circuit Function
Qualifier
1
CE205 (GN-BU)
20
CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 1 (INJ)
2
VE518 (BN-WH)
16
MONITOR - FUEL PUMP (FPM)
1
2

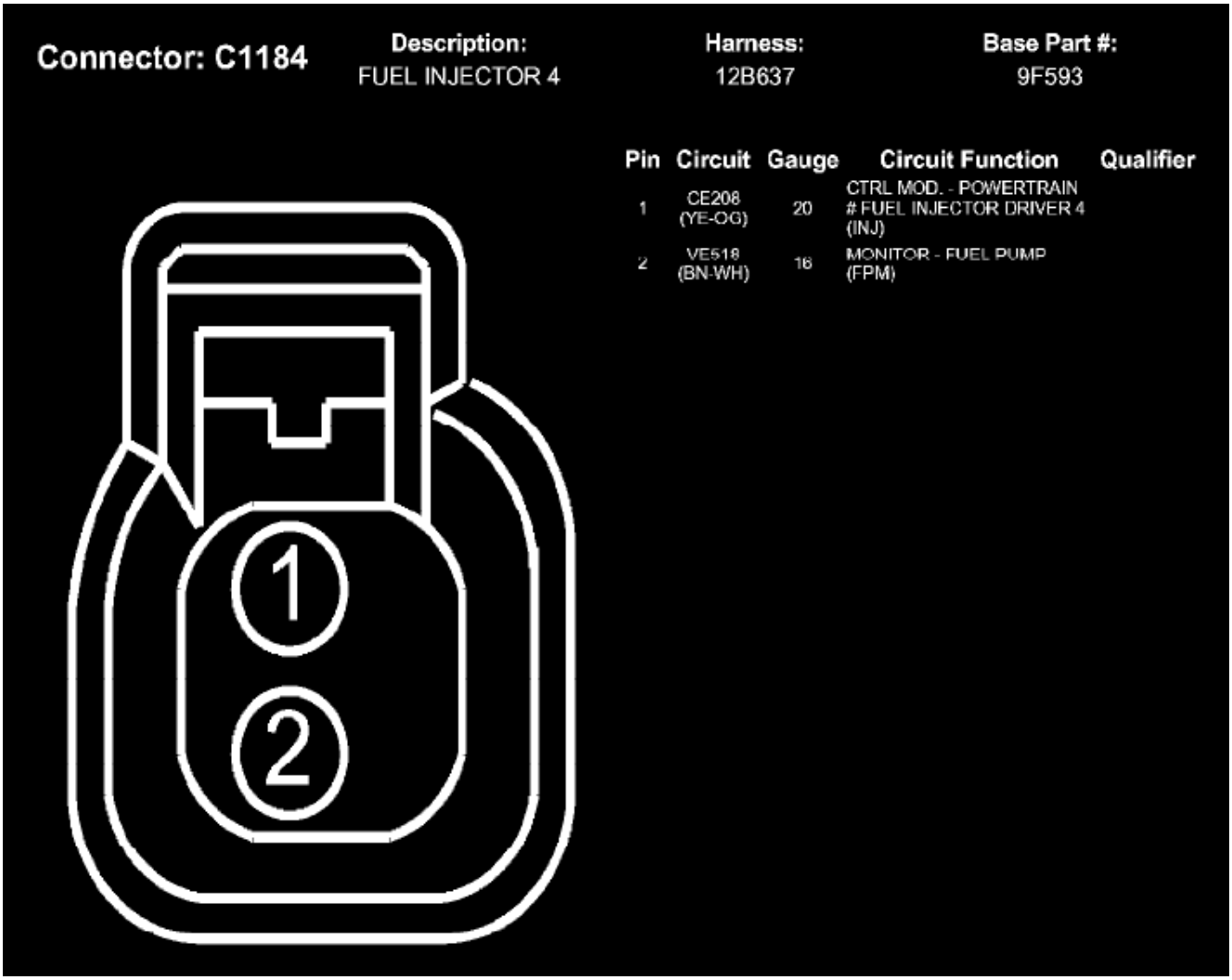
C1181

Connector: C1182
Description:
FUEL INJECTOR 2
Harness:
12B637
Base Part #:
9F593
Pin Circuit Gauge Circuit Function Qualifier
1 CE206 (GY-YE) 20 CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 2 (INJ)
2 VE518 (BN-WH) 16 MONITOR - FUEL PUMP (FPM)
1
2

C1182

Connector: C1183
Description:
FUEL INJECTOR 3
Harness:
12B637
Base Part #:
9F593
Pin Circuit Gauge Circuit Function Qualifier
1 CE207 (VT-GY) 20 CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 3 (INJ)
2 VE518 (BN-WH) 16 MONITOR - FUEL PUMP (FPM)
1
2

C1183


Connector: C1184
Description:
FUEL INJECTOR 4
Harness:
12B637
Base Part #:
9F593
Pin Circuit Gauge Circuit Function Qualifier
1 CE208 (YE-OG) 20 CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 4 (INJ)
2 VE518 (BN-WH) 16 MONITOR - FUEL PUMP (FPM)
1
2

C1184

Fuel Injector: Diagrams

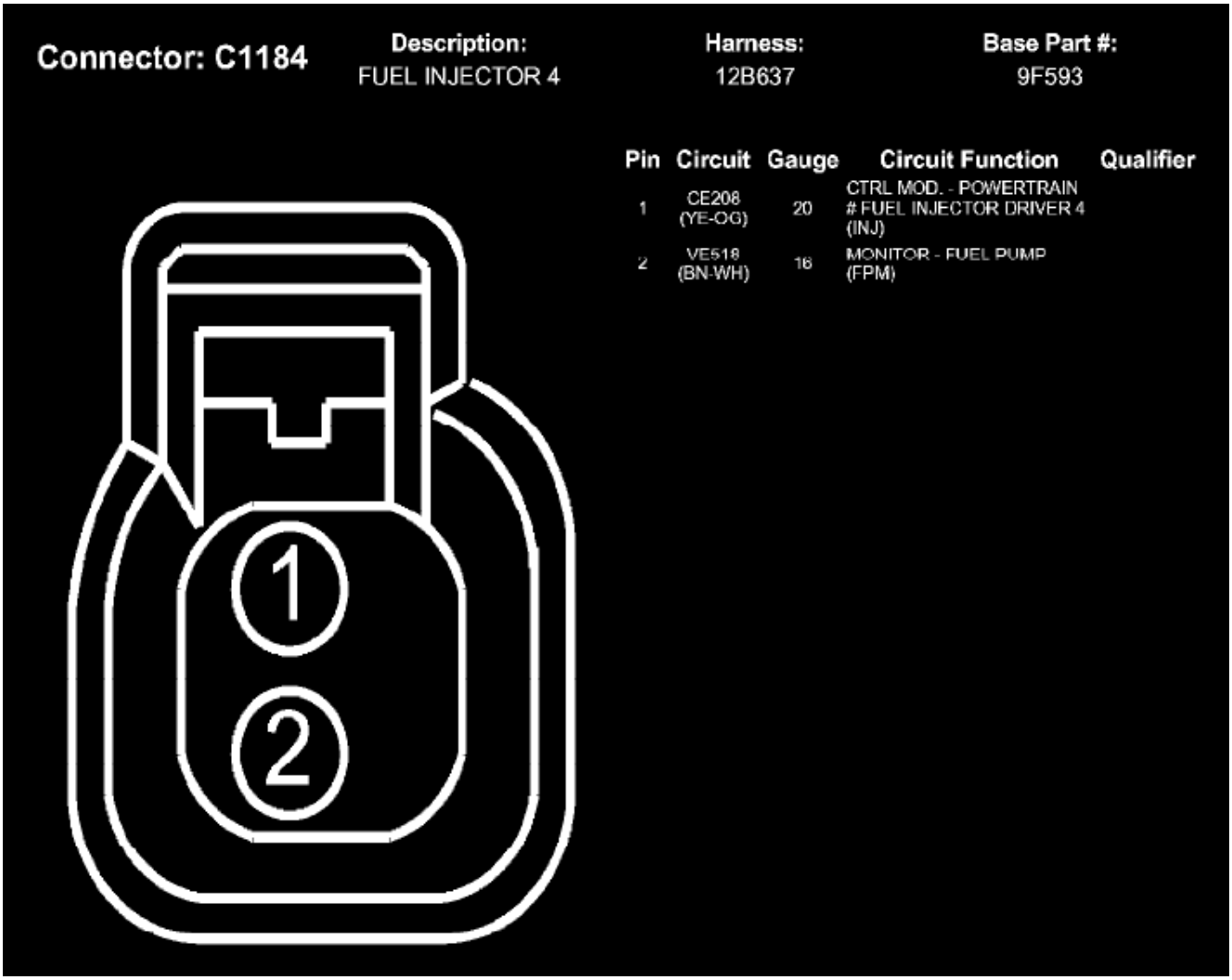
C1181

Connector: C1182
Description:
FUEL INJECTOR 2
Harness:
12B637
Base Part #:
9F593
Pin Circuit Gauge Circuit Function Qualifier
1 CE206 (GY-YE) 20 CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 2 (INJ)
2 VE518 (BN-WH) 16 MONITOR - FUEL PUMP (FPM)
1
2

C1182

Connector: C1183
Description:
FUEL INJECTOR 3
Harness:
12B637
Base Part #:
9F593
Pin Circuit Gauge Circuit Function Qualifier
1 CE207 (VT-GY) 20 CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 3 (INJ)
2 VE518 (BN-WH) 16 MONITOR - FUEL PUMP (FPM)
1
2

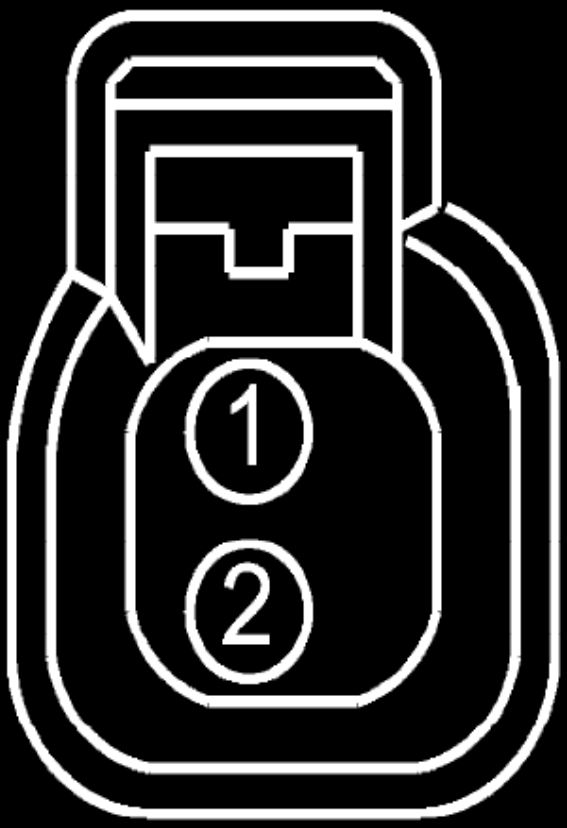
C1183


Connector: C1184
Description:
FUEL INJECTOR 4
Harness:
12B637
Base Part #:
9F593
Pin Circuit Gauge Circuit Function Qualifier
1 CE208 (YE-OG) 20 CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 4 (INJ)
2 VE518 (BN-WH) 16 MONITOR - FUEL PUMP (FPM)
1
2

C1184

Connector: C1185

Description:	Harness:	Base Part #:
FUEL INJECTOR 5	12B637	9F593

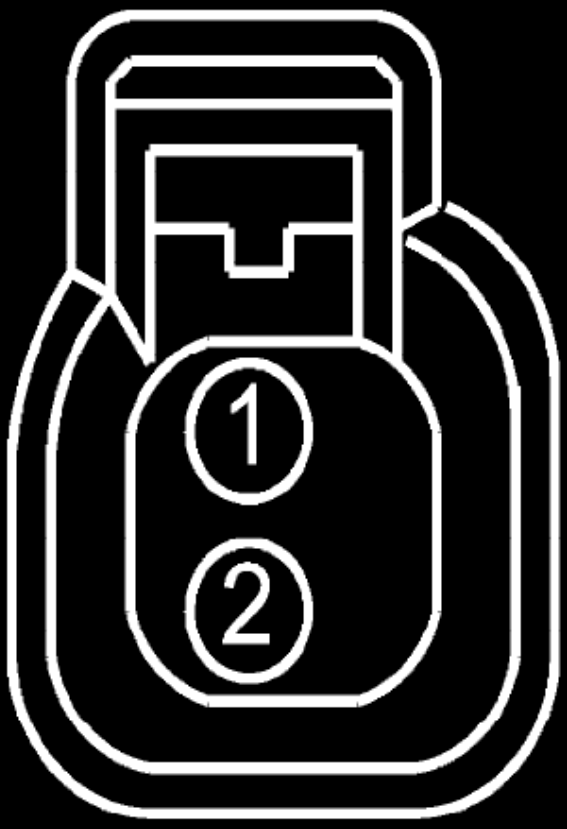


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE209 (BN)	20	CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 5 (INJ)	3.0L, 4.0L
2	VE518 (BN-WH)	16	MONITOR - FUEL PUMP (FPM)	3.0L, 4.0L

C1185

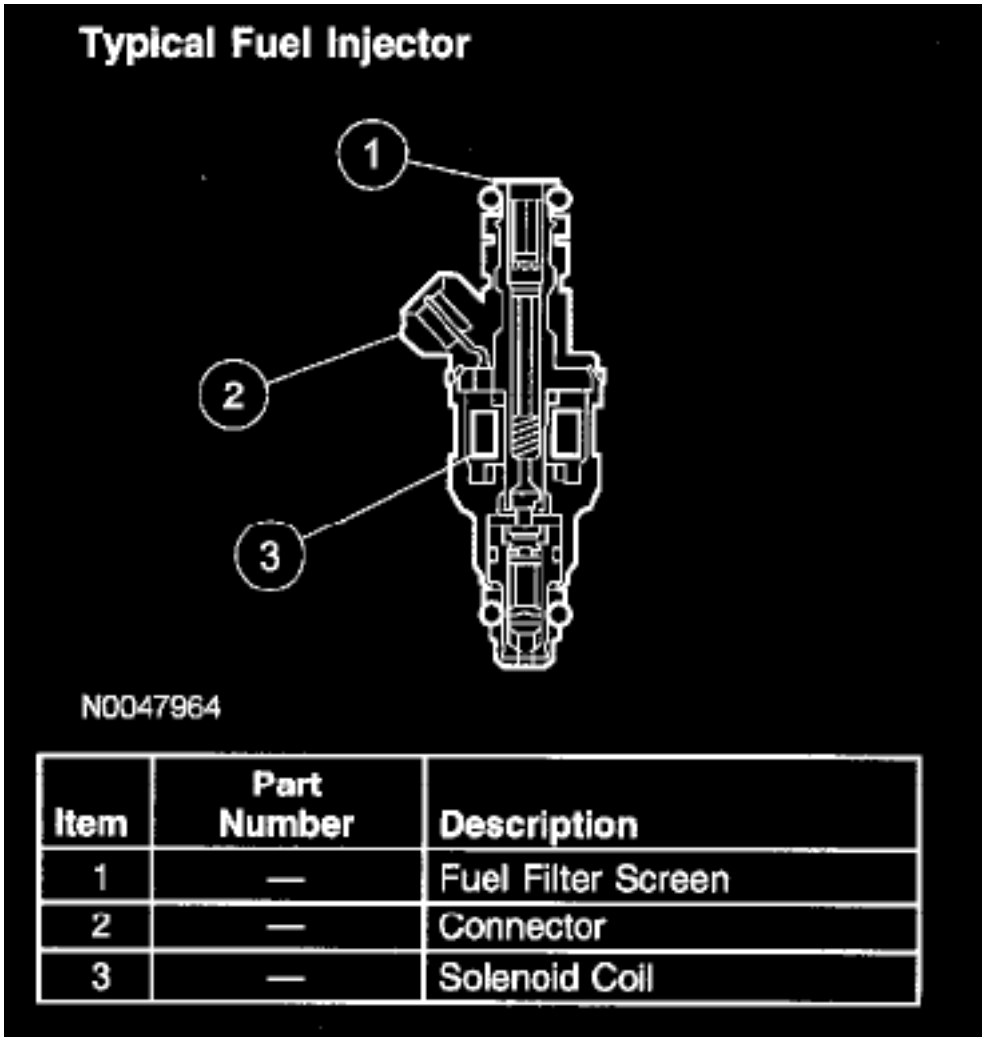
Connector: C1186

Description:	Harness:	Base Part #:
FUEL INJECTOR 6	12B637	9F593



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE210 (GN-WH)	20	CTRL MOD. - POWERTRAIN # FUEL INJECTOR DRIVER 6 (INJ)	3.0L, 4.0L
2	VE518 (BN-WH)	16	MONITOR - FUEL PUMP (FPM)	3.0L, 4.0L

C1186



Item	Part Number	Description
1	—	Fuel Filter Screen
2	—	Connector
3	—	Solenoid Coil

Fuel Injector: Description and Operation

FUEL INJECTORS

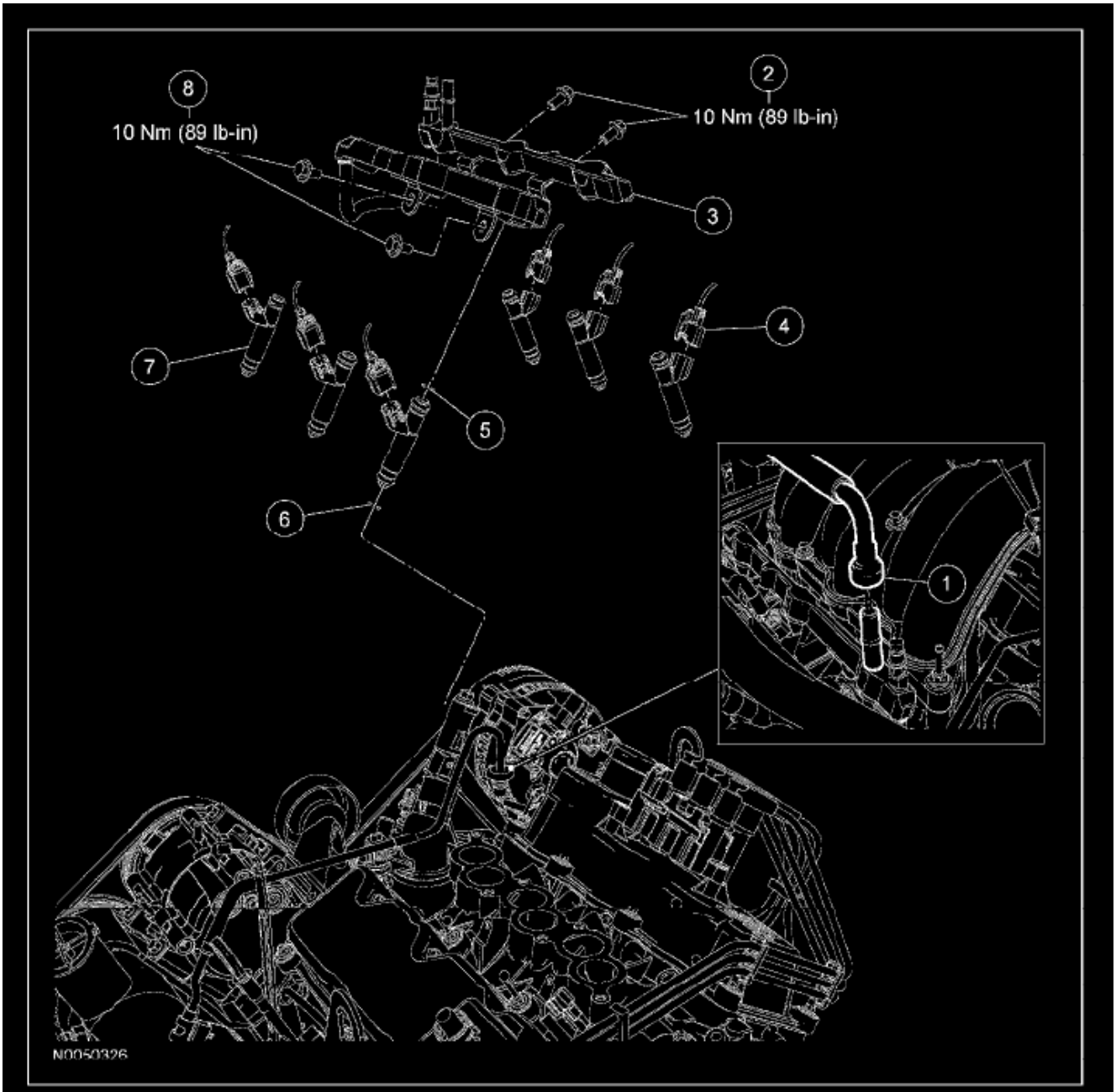
Typical Fuel Injector

CAUTION: Do not apply battery positive voltage (B+) directly to the fuel injector electrical connector terminals. The solenoids may be damaged internally in a matter of seconds.

The fuel injector is a solenoid-operated valve that meters fuel flow to the engine. The fuel injector is opened and closed a constant number of times per crankshaft revolution. The amount of fuel is controlled by the length of time the fuel injector is held open.

The fuel injector is normally closed, and is operated by a 12-volt source from either the electronic engine control (EEC) power relay or fuel pump relay. The ground signal is controlled by the PCM.

The injector is the deposit resistant injector (DRI) type and does not have to be cleaned. However, it can be flow checked and, if found outside of specification, a new fuel injector should be installed.



Item	Part Number	Description
1	—	Fuel supply tube spring lock coupling (part of 9J338)
2	N808779	Fuel rail bolts (2 required)
3	9F792	Fuel rail

(Continued)

Item	Part Number	Description
4	—	Fuel injector electrical connector (6 required) (part of 12B637)
5	—	Fuel injector upper O-ring seal (6 required)

(Continued)

Fuel Injector: Service and Repair

FUEL INJECTORS

Exploded View

Part 1

Item	Part Number	Description
6	—	Fuel injector lower O-ring seal (6 required)
7	9F593	Fuel injector (6 required)
8	N808779	Fuel rail bolts (2 required)

Part 2

Removal

WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

1. Disconnect the battery ground cable. 2. Release the fuel pressure. 3. Remove the upper intake manifold. 4. Disconnect the 6 fuel injector electrical connectors. 5. Disconnect the fuel supply tube spring lock coupling. 6. Remove the 4 fuel rail bolts and remove the fuel rail and the fuel injectors as an assembly. 7. Remove the 6 fuel injectors from the fuel rail.

- Remove and discard the fuel injector O-ring seals.

Installation

1. NOTE: Lubricate the new O-ring seals with clean engine oil prior to installation.

Install new O-ring seals on the fuel injectors and install the fuel injectors onto the fuel rail.

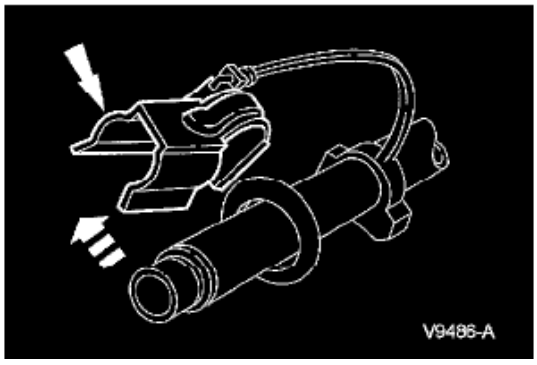
2. Install the fuel rail and fuel injectors as an assembly, and install the 4 bolts.

- Tighten to 10 Nm (89 lb-in).

3. Connect the fuel supply tube spring lock coupling. 4. Connect the 6 fuel injector electrical connectors. 5. Install the upper intake manifold. 6. Connect the battery ground cable.

Special Tool(s)

ST1147-A	Disconnect Tool, Spring Lock Coupling (1/2-inch Green) 310-D005 (D87L-9280-B) or equivalent
ST1399-A	Disconnect Tool, Spring Lock Coupling 310-S039 (T90T-9550-S)



Fuel Line Coupler: Service and Repair Spring Lock Couplings

SPRING LOCK COUPLINGS

Special Tool(s)

Special Tool(s)

Disconnect - Type I

WARNING:

- Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

- Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.

- Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

- When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.

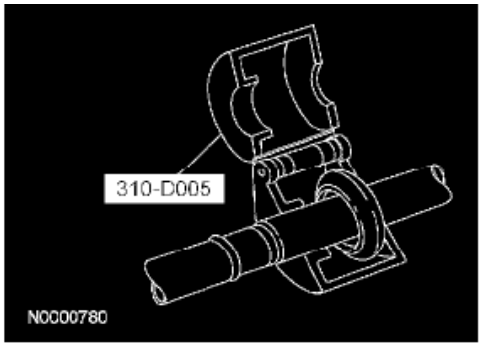
CAUTION:

- Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is essential that absolute cleanliness is observed when working with these components or component damage may occur. Always install blanking plugs to any open orifices or tubes.

- When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube or damage to the tube or connector retaining clip may occur. Apply clean engine oil to the end of the tube before inserting the tube into the connector.

1. Relieve the fuel pressure. 2. If equipped, remove the fuel tube safety clip.

3. Install the special tool.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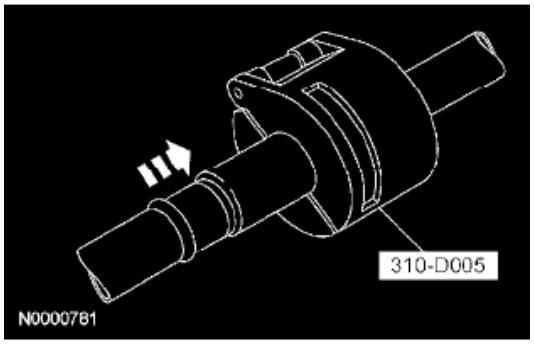
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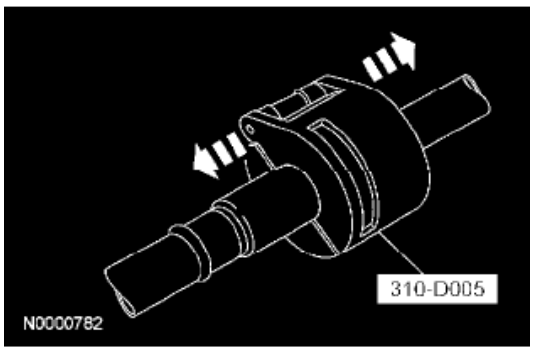
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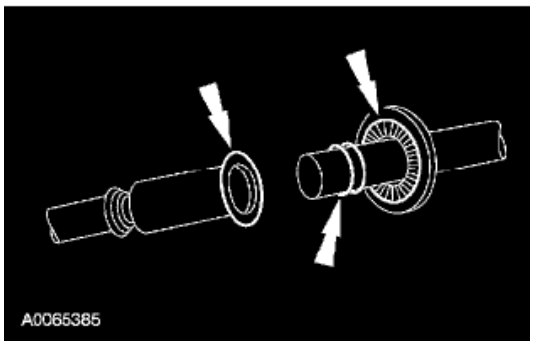

A0065385

4. Close and push the special tool into the open side of the cage.

5. Separate the spring lock coupling.

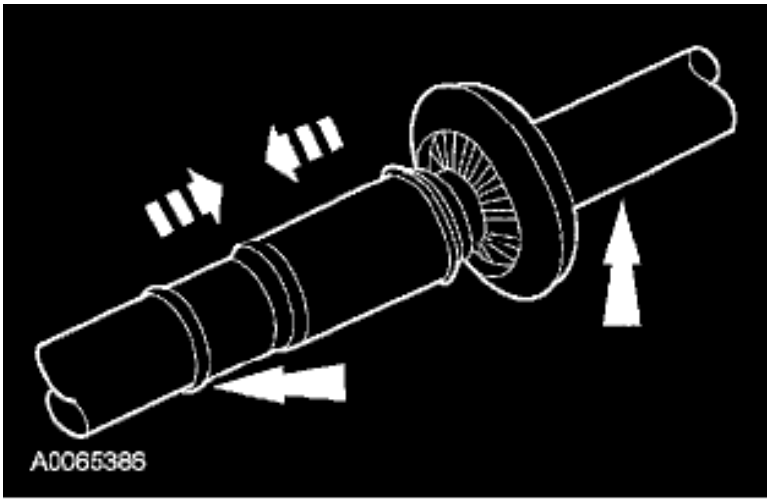
Connect - Type I

1. NOTE: Apply clean engine oil to the O-ring seals.

Inspect and clean both the spring lock coupling ends. Install new O-ring seals and garter springs if necessary.

2. NOTE: Make sure the fuel tube clicks into place when installing the tube. To make sure that the fuel tube is fully seated, pull on the tube.

Fit the male end into the female end and push until the garter spring snaps over the flared end of the female end.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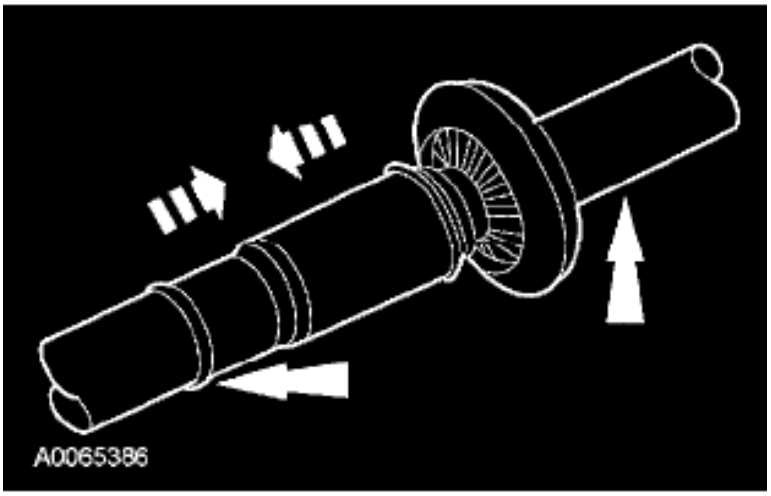
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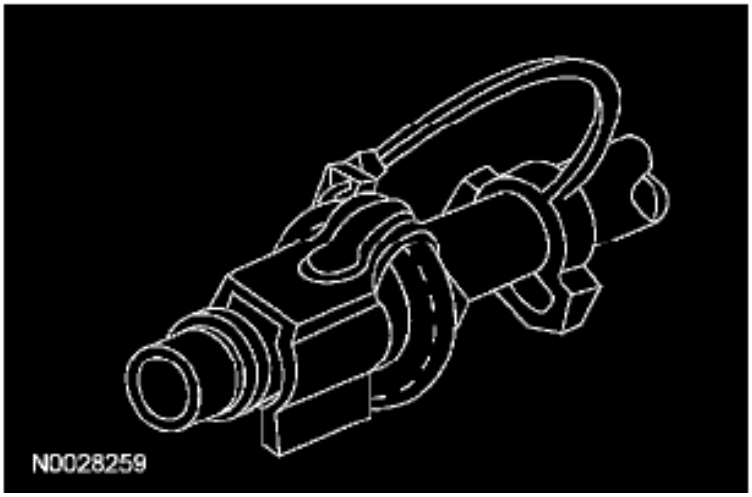
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3. Make sure the spring lock coupling is engaged by pulling on the tube.

4. If equipped, install the safety clip.

Disconnect - Type II

WARNING:

- Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

- Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.

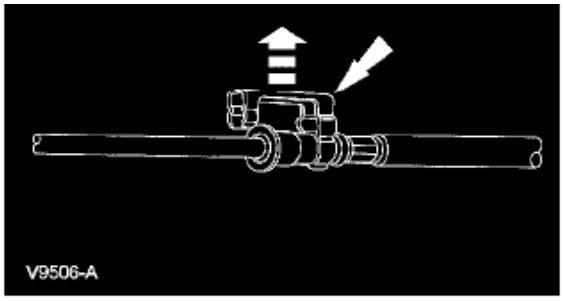
- Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

- When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.

CAUTION:

- Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is essential that absolute cleanliness is observed when working with these components or component damage may occur. Always install blanking plugs to any open orifices or tubes.

- When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube or damage to the tube or connector retaining clip may occur. Apply clean engine oil to the end of the tube before inserting the tube into the connector.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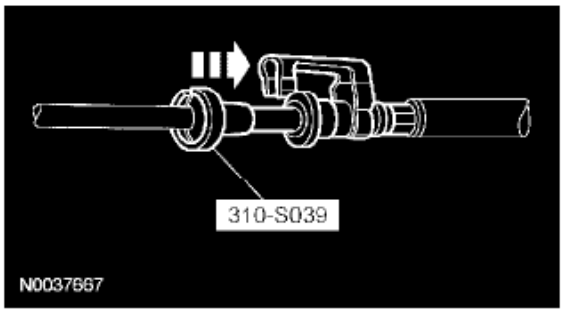
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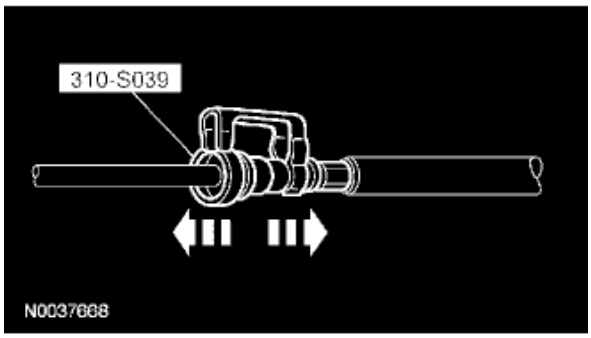
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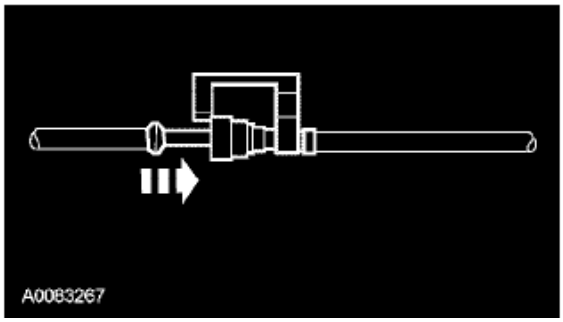
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1. Release the fuel system pressure. 2. If equipped, remove the fuel tube safety clip from the male hose.

3. Install the special tool and push into the spring lock coupling.

4. Separate the spring lock coupling.

Connect - Type II

1. Inspect and clean both spring lock coupling ends.

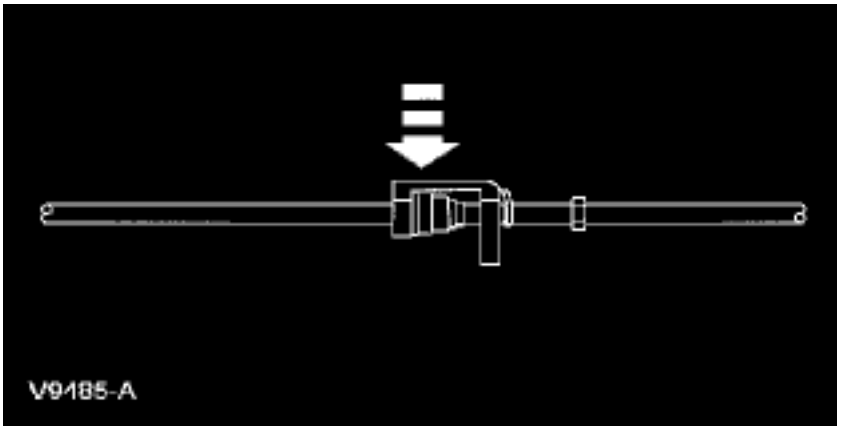
2. NOTE:

- Make sure the fuel tube clicks into place when installing the tube. To make sure that the fuel tube is fully seated, pull on the tube.

- Lubricate the tube end with clean engine oil to ease assembly.

Align and push the fuel tube spring lock coupling until a click is heard.

3. Pull on the spring lock coupling to make sure it is fully seated. If equipped, install the fuel tube safety clip on the male end.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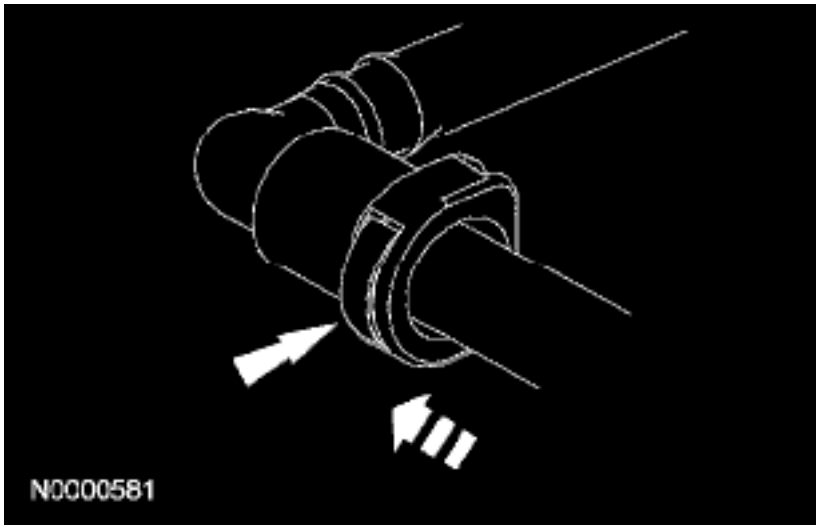


Fuel Line Coupler: Service and Repair Quick Connect Coupling

QUICK CONNECT COUPLING

Disconnect - Type I

WARNING:

- When working on or near the evaporative emission (EVAP) system, disconnect the battery ground cable from the battery. The EVAP system contains fuel vapor and condensed fuel vapor, so an electrical spark may cause a fire or explosion. Failure to follow this instruction may result in serious personal injury.

- Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

- Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.

- Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

- When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.

CAUTION:

- Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is essential that absolute cleanliness is observed when working with these components or component damage may occur. Always install blanking plugs to any open orifices or tubes.

- When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube or damage to the tube or connector retaining clip may occur. Apply clean engine oil to the end of the tube before inserting the tube into the connector.

- Do not use any tools. The use of tools may cause a deformity in the clip components which may cause fuel leaks.

1. If servicing a liquid fuel tube, release the fuel system pressure. 2. Disconnect the fuel tube quick connect coupling.

- Press the fuel tube quick connect coupling button and pull the fuel tube to disconnect.

Connect - Type I

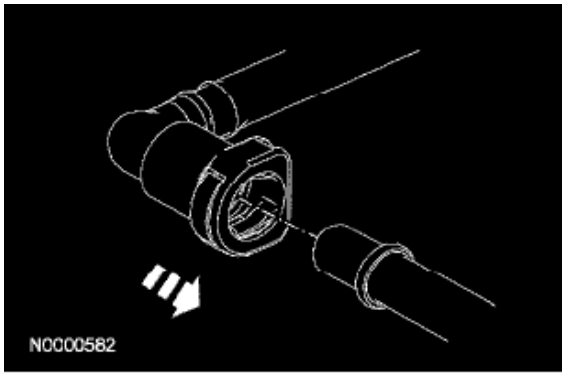
1. Inspect the quick connect coupling and the tube for damage. Remove any dirt or obstructions.

2. NOTE:

- Make sure the fuel tube clicks into place when installing the tube. To make sure that the fuel tube is fully seated, pull on the tube.

- Apply clean engine oil to O-ring seals.

Install the quick connect coupling onto the tube until it is fully seated.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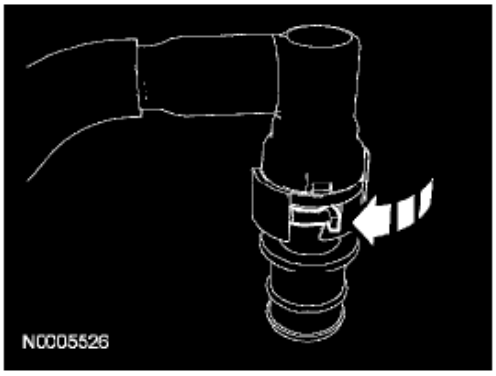
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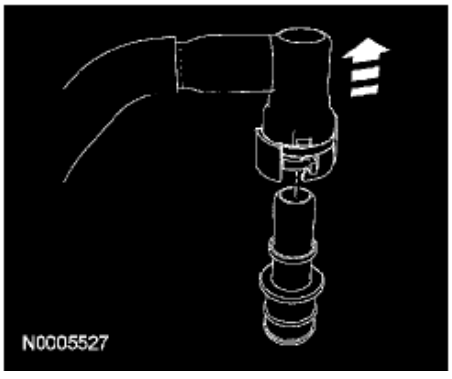
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Disconnect - Type II

WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

CAUTION:

- Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is essential that absolute cleanliness is observed when working with these components or component damage may occur. Always install blanking plugs to any open orifices or tubes.

- When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube or damage to the tube or connector retaining clip may occur. Apply clean engine oil to the end of the tube before inserting the tube into the connector.

- Do not use any tools. The use of tools may cause a deformity in the clip components which may cause fuel leaks.

1. Release the locking tab on the quick connect coupling.

2. Separate the quick connect coupling from the fitting.

Connect - Type II

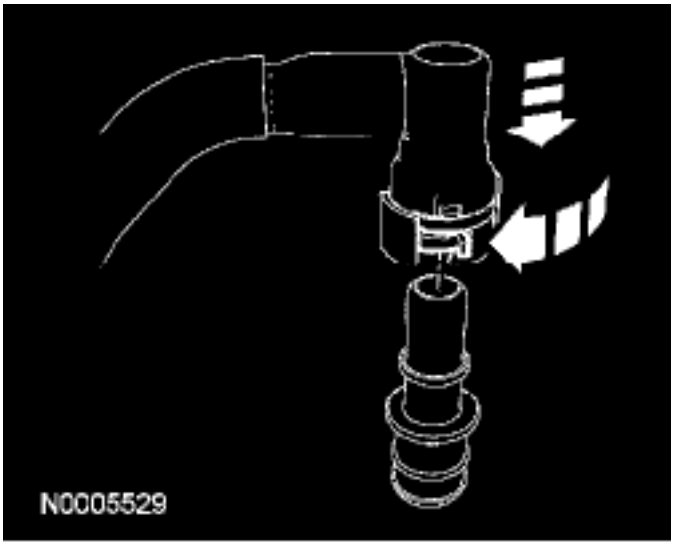
1. Inspect the quick connect coupling and the tube for damage. Remove any dirt or obstructions.

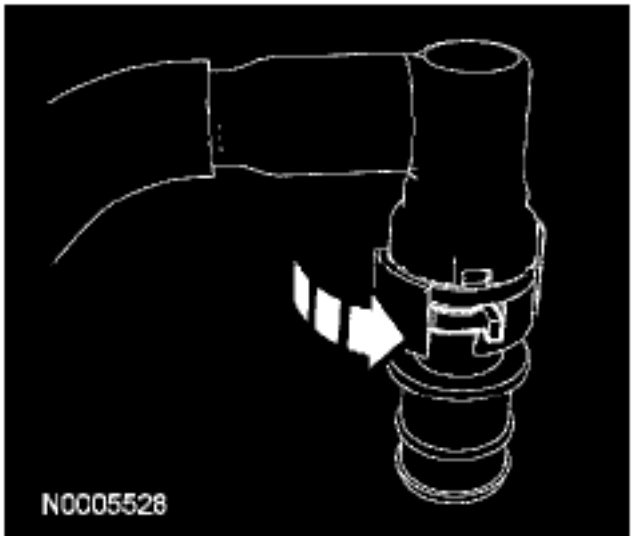
2. NOTE:

- Make sure the fuel tube clicks into place when installing the tube. To make sure that the fuel tube is fully seated, pull on the tube.

- Apply clean engine oil to O-ring seals.

Release the locking tab and install the quick connect coupling onto the fitting.





3. Position the locking tab into the latched position.

Disconnect - Type III

WARNING:

- When working on or near the evaporative emission (EVAP) system, disconnect the battery ground cable from the battery. The EVAP system contains fuel vapor and condensed fuel vapor, so an electrical spark may cause a fire or explosion. Failure to follow this instruction may result in serious personal injury.

- Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

- Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

- Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.

- When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.

CAUTION:

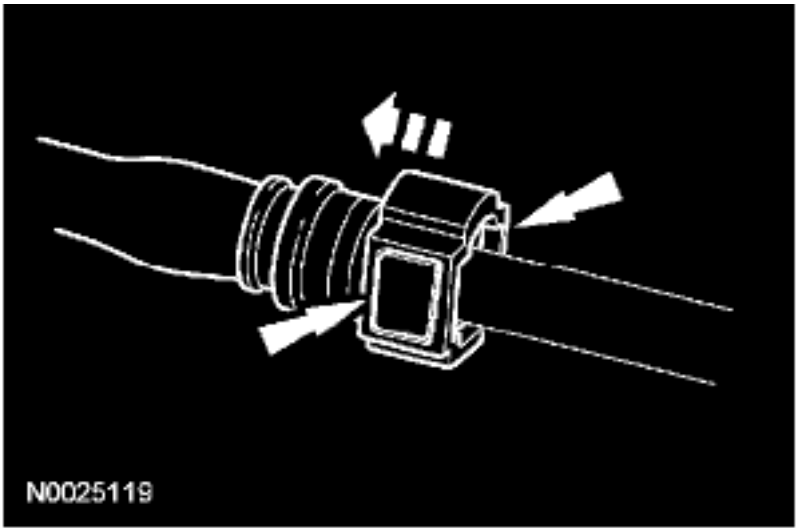
- When reusing liquid or vapor tube connectors, make sure to use compressed air to remove any foreign material from the connector retaining clip area before separating from the tube or damage to the tube or connector retaining clip may occur. Apply clean engine oil to the end of the tube before inserting the tube into the connector.

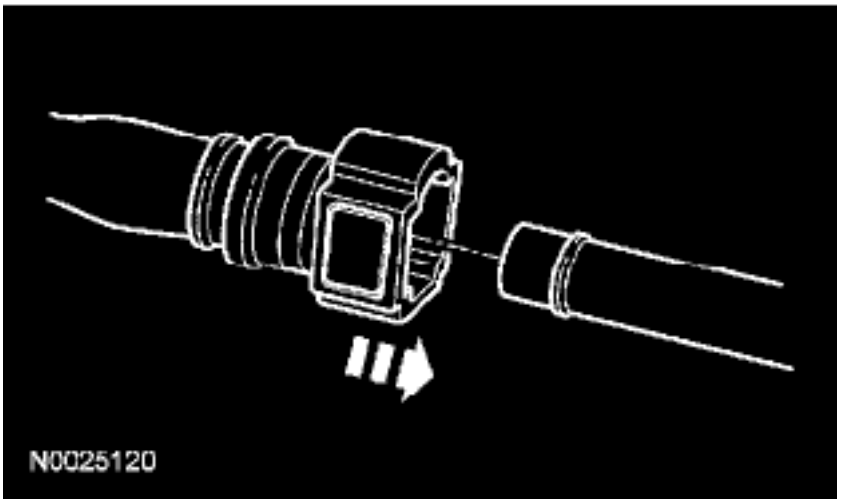
- Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is essential that absolute cleanliness is observed when working with these components or component damage may occur. Always install blanking plugs to any open orifices or tubes.

- Do not use any tools. The use of tools may cause a deformity in the clip components which may cause fuel leaks.

1. If servicing a liquid fuel tube, release the fuel system pressure. 2. Disconnect the battery ground cable. 3. Disconnect the fuel tube quick connect coupling.

- Press the 2 fuel tube quick connect coupling buttons and pull the fuel tube to disconnect.





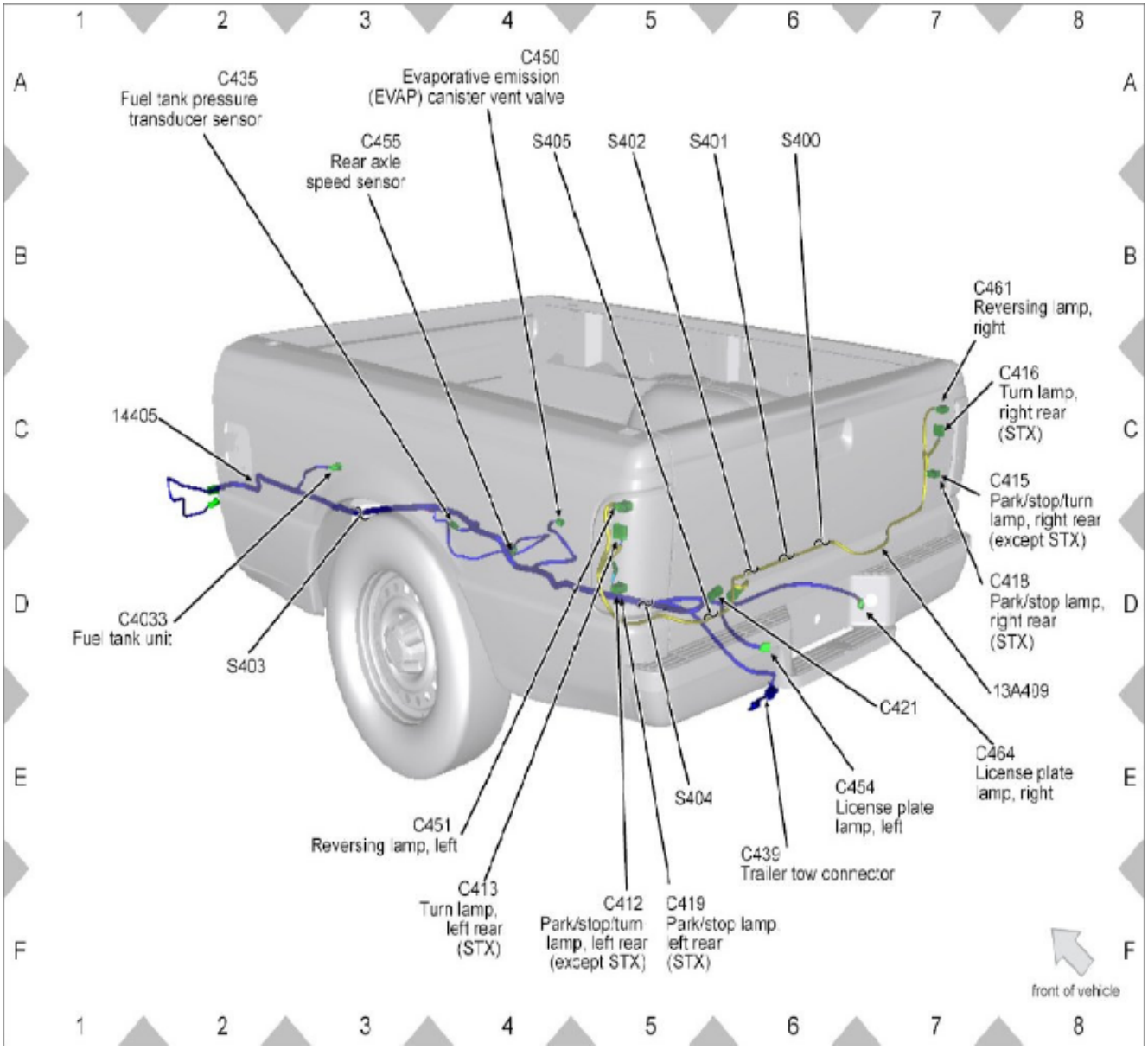
Connect - Type IV

1. NOTE:

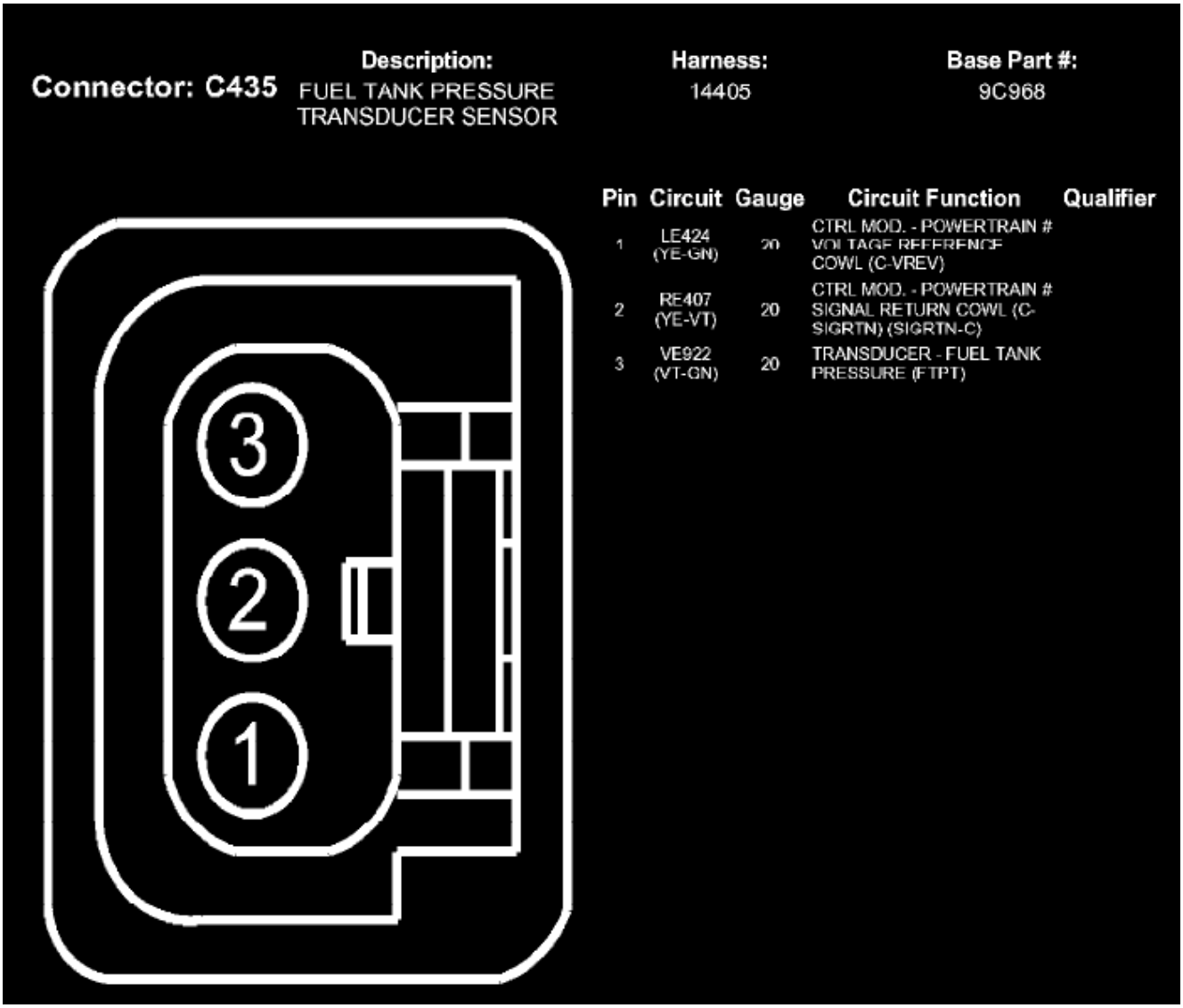
- Make sure the fuel tube clicks into place when installing the tube. To make sure that the fuel tube is fully seated, pull on the tube.

- Apply clean engine oil to O-ring seals.

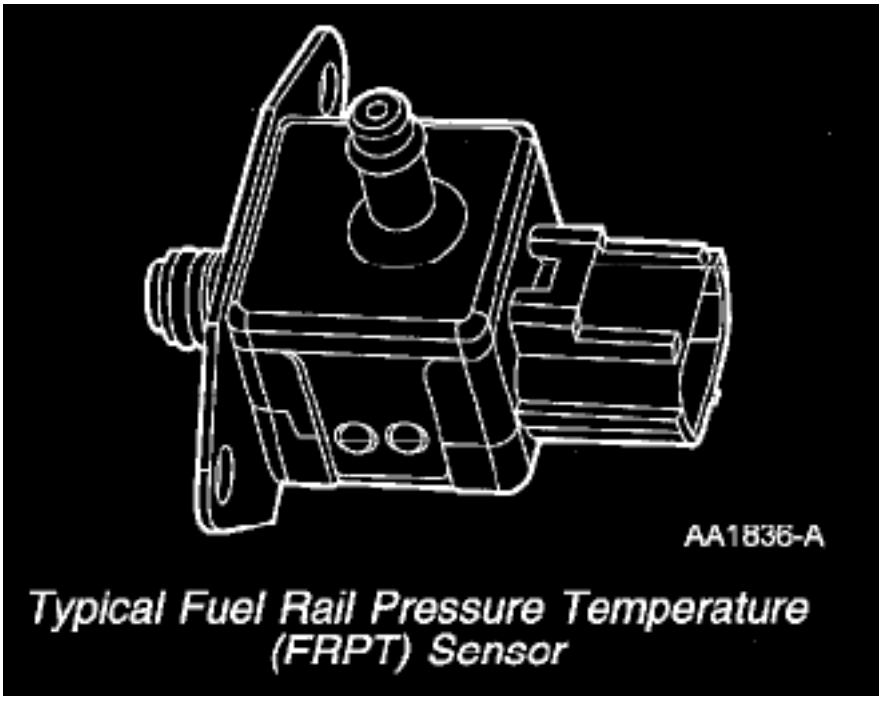
Install the quick connect coupling onto the tube until it is fully seated.


C435
Fuel tank pressure transducer sensor
C450
Evaporative emission (EVAP) canister vent valve
C455
Rear axle speed sensor
S405
S402
S401
S400
C461
Reversing lamp, right
C416
Turn lamp, right rear (STX)
14405
C415
Park/stop/turn lamp, right rear (except STX)
C4033
Fuel tank unit
S403
C418
Park/stop lamp, right rear (STX)
13A409
C421
C464
License plate lamp, right
C454
License plate lamp, left
S404
C451
Reversing lamp, left
C439
Trailer tow connector
C413
Turn lamp, left rear (STX)
C412
Park/stop/tum lamp, left rear (except STX)
C419
Park/stop lamp left rear (STX)
front of vehicle

View 151-27


Connector: C435
Description:
FUEL TANK PRESSURE TRANSDUCER SENSOR
Harness:
14405
Base Part #:
9C968
3
2
1
Pin Circuit Gauge Circuit Function Qualifier
1 LE424 (YE-GN) 20 CTRL MOD. - POWERTRAIN # VOLTAGE REFERENCE COWL (C-VREV)
2 RE407 (YE-VT) 20 CTRL MOD. - POWERTRAIN # SIGNAL RETURN COWL (C-SIGRTN) (SIGRTN-C)
3 VE922 (VT-GN) 20 TRANSDUCER - FUEL TANK PRESSURE (FTPT)

C435



Fuel Pressure Sensor/Switch: Description and Operation

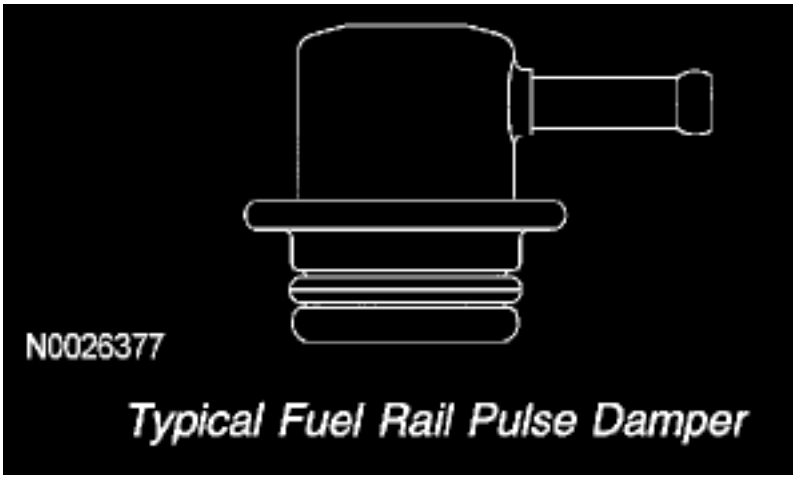
FUEL RAIL PRESSURE TEMPERATURE (FRPT) SENSOR

Typical Fuel Rail Pressure Temperature (FRPT) Sensor

The FRPT sensor measures the pressure and temperature of the fuel in the fuel rail and sends these signals to the PCM. The sensor uses the intake manifold vacuum as a reference to determine the pressure difference between the fuel rail and the intake manifold. The relationship between fuel pressure and fuel temperature is used to determine the possible presence of fuel vapor in the fuel rail.

The temperature sensing portion of the FRPT sensor is a thermistor device in which resistance changes with temperature. The electrical resistance of the thermistor decreases as the temperature increases, and the resistance increases as the temperature decreases. The varying resistance changes the voltage drop across the sensor terminals and provides electrical signals to the PCM corresponding to temperature.

Both the pressure and temperature signals are used to control the speed of the fuel pump. The speed of the fuel pump sustains fuel rail pressure which preserves fuel in its liquid state. The dynamic range of the fuel injectors increase because of the higher rail pressure, which allows the injector pulse width to decrease.



Fuel Pressure Pulsation Damper: Description and Operation

FUEL RAIL PULSE DAMPER

Typical Fuel Rail Pulse Damper

The fuel rail pulse damper is located on the fuel rail and reduces the fuel system noise caused by the pulsing of the fuel injectors. The vacuum port located on the damper is connected to manifold vacuum to avoid fuel spillage if the pulse damper diaphragm ruptures. The fuel rail pulse damper should not be confused with a fuel pressure regulator; it does not regulate the fuel rail pressure.

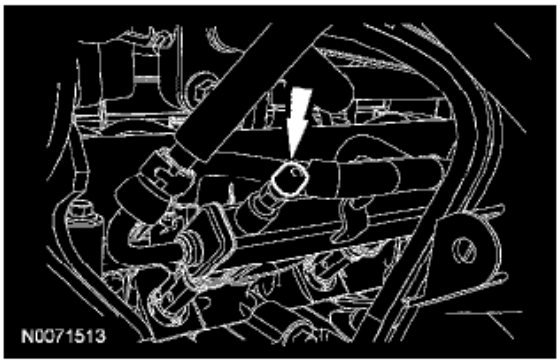
Fuel Pressure: Specifications

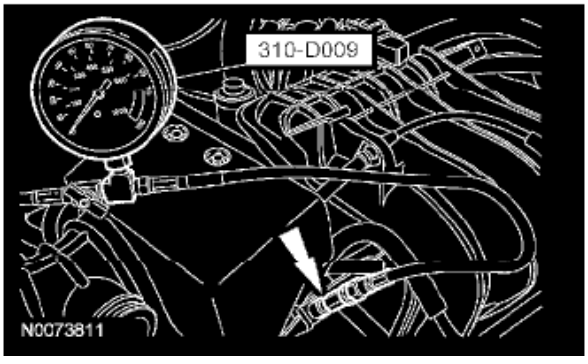
Item.....Specification

Engine running.....414-448 kPa (60-65 psi) Key ON, engine OFF.....414-448 kPa (60-65 psi)

Special Tool(s)

ST3038-A	Fuel Pressure Test Kit 310-D009 (D95L-7211A)





Fuel Pressure: Testing and Inspection

FUEL SYSTEM PRESSURE TEST

Special Tool(s)

Special Tool(s)

WARNING:

- Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

- Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.

- Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

- When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.

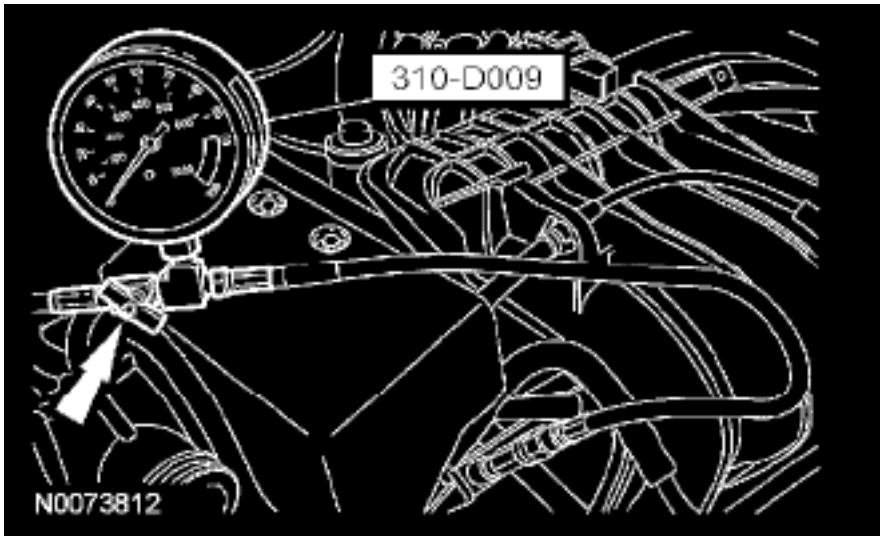
1. NOTE: 2.3L shown, 3.0L and 4.0L similar.

Remove the cap from the fuel pressure relief valve located on the fuel rail.

2. NOTE: 2.3L shown, 3.0L and 4.0L similar.

Install the special tool onto the fuel pressure relief valve.

3. Test the fuel system pressure to make sure it is within the specified range.



4. NOTE:

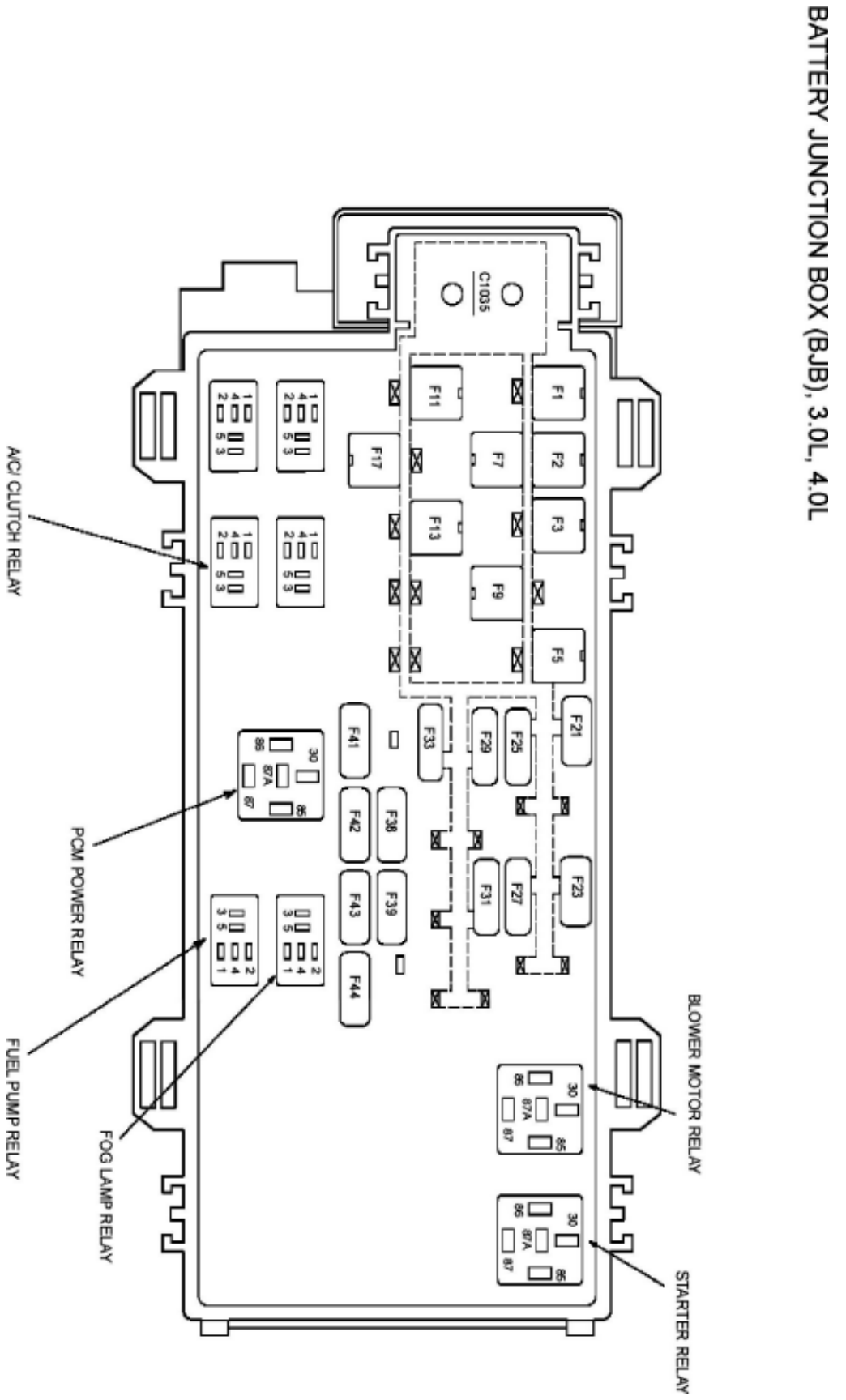
- 2.3L shown, 3.0L and 4.0L similar.

- Open the drain valve slowly to relieve the fuel system pressure. This may drain fuel from the system. Place fuel in a suitable container.

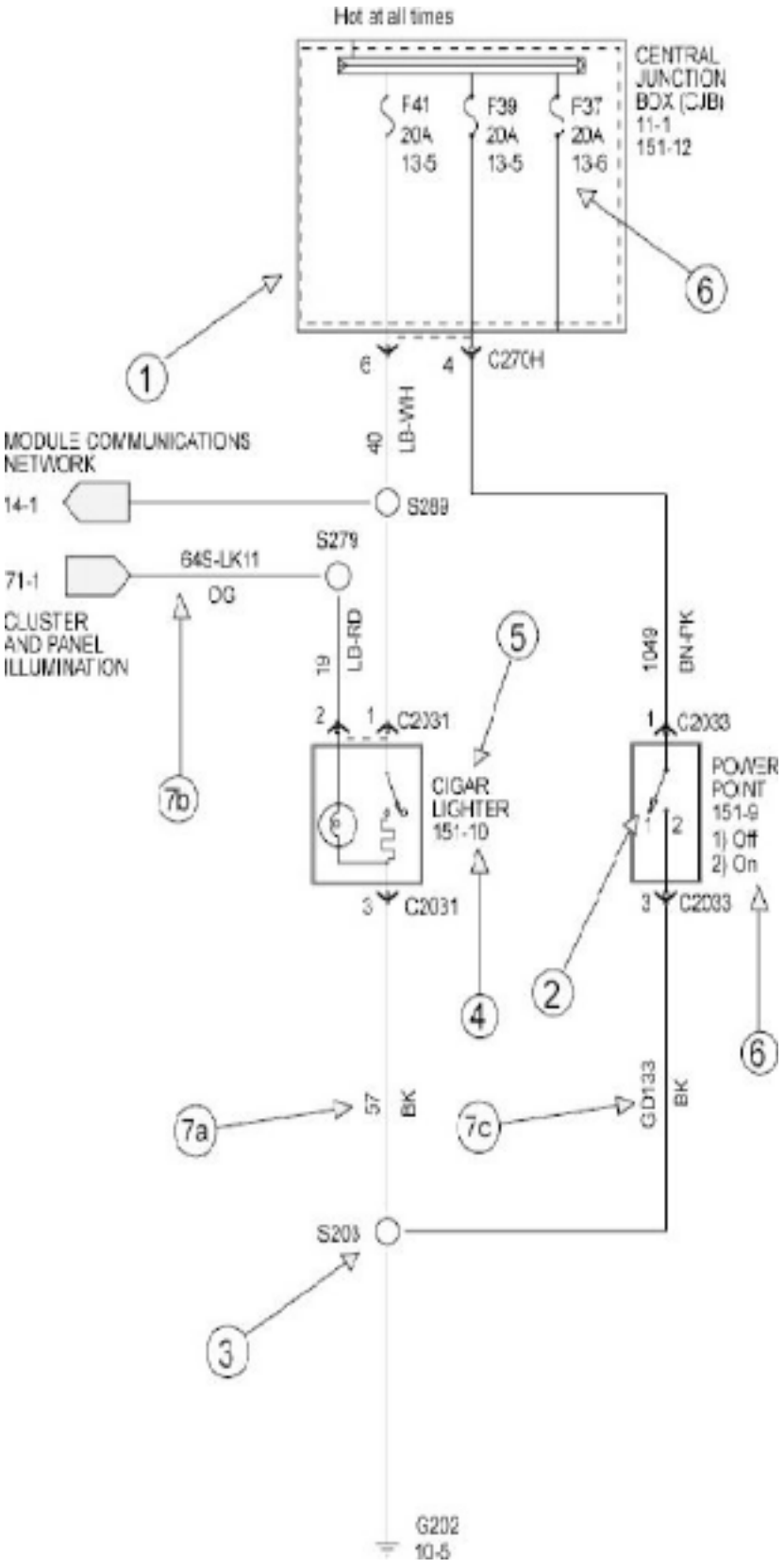
Upon completion of the fuel system pressure test, open the drain valve on the special tool and relieve the fuel system pressure.

5. NOTE: It may take more than one key cycle to pressurize the fuel system.

Cycle the ignition key and wait 3 seconds to pressurize the fuel system. Check for leaks before starting the engine.


BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L
C1035
F1
F2
F3
F5
F7
F9
F11
F13
F17
F21
F23
F25
F27
F29
F31
F33
F38
F39
F41
F42
F43
F44
A/C CLUTCH RELAY
PCM POWER RELAY
FUEL PUMP RELAY
FOG LAMP RELAY
BLOWER MOTOR RELAY
STARTER RELAY

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Powertrain Management > Fuel Delivery and Air Induction > Fuel Pump > Fuel Pump Relay > Component Information > Diagrams > Diagram Information and Instructions



Fuel Pump Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

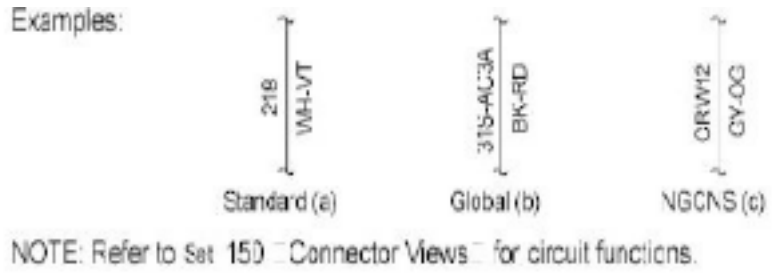
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

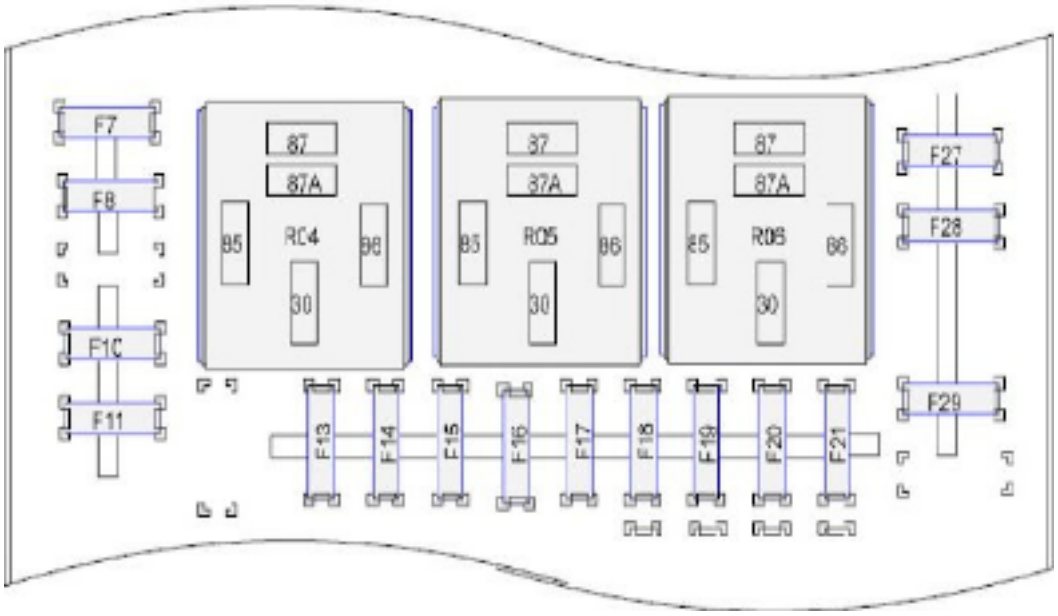
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

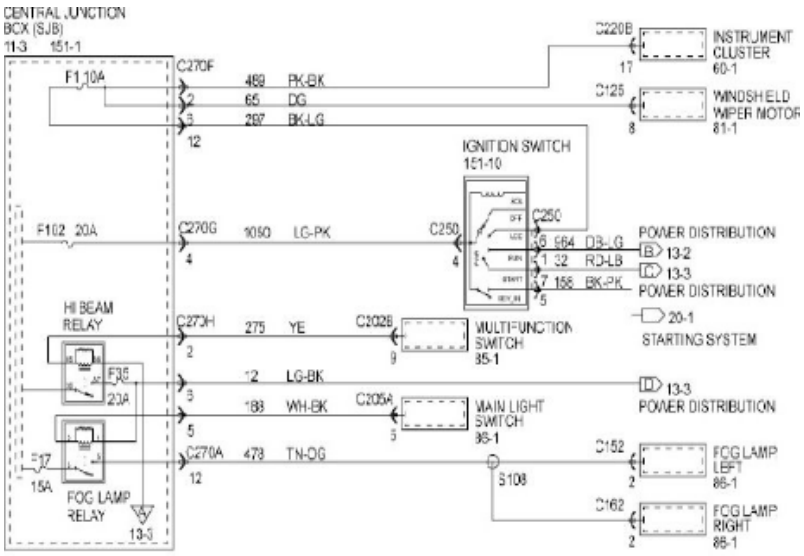
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

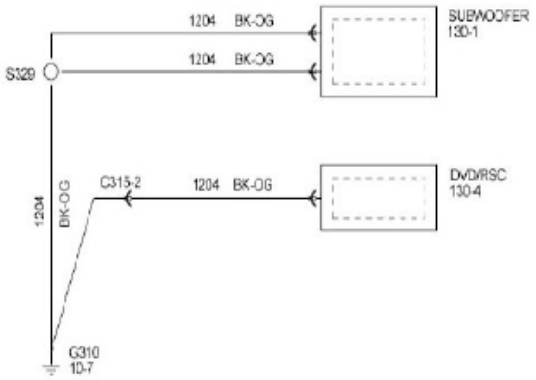
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

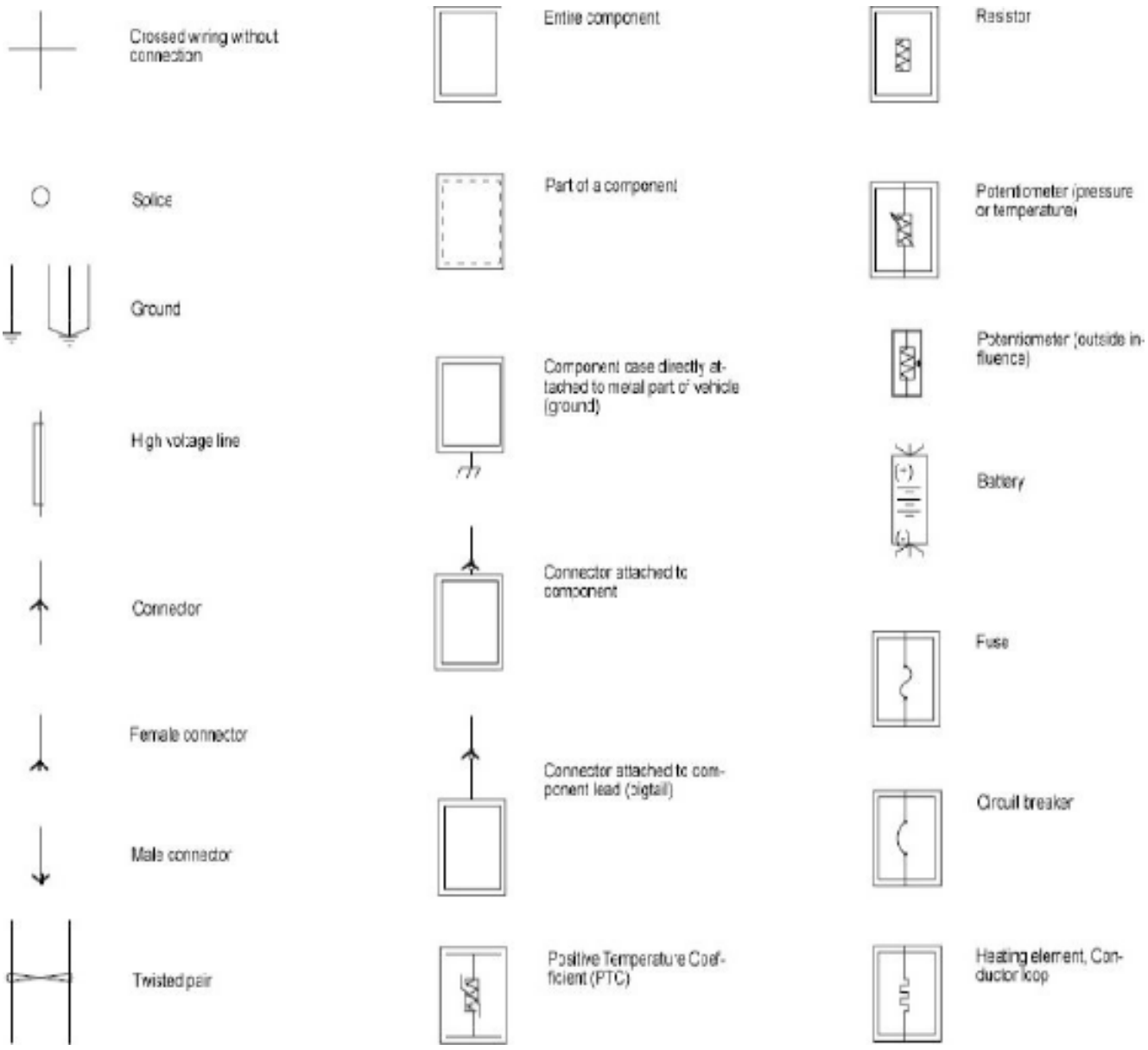
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

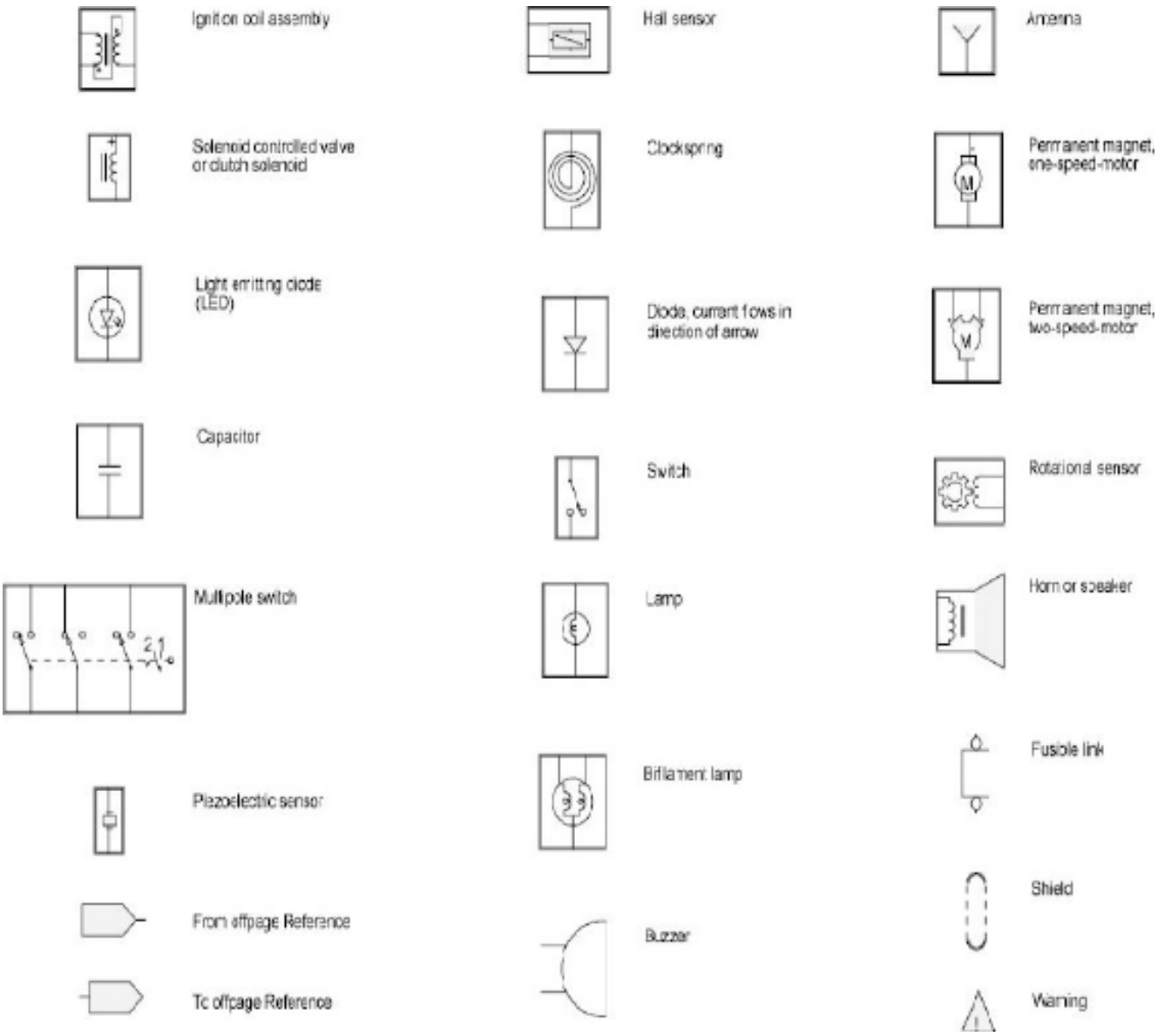
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

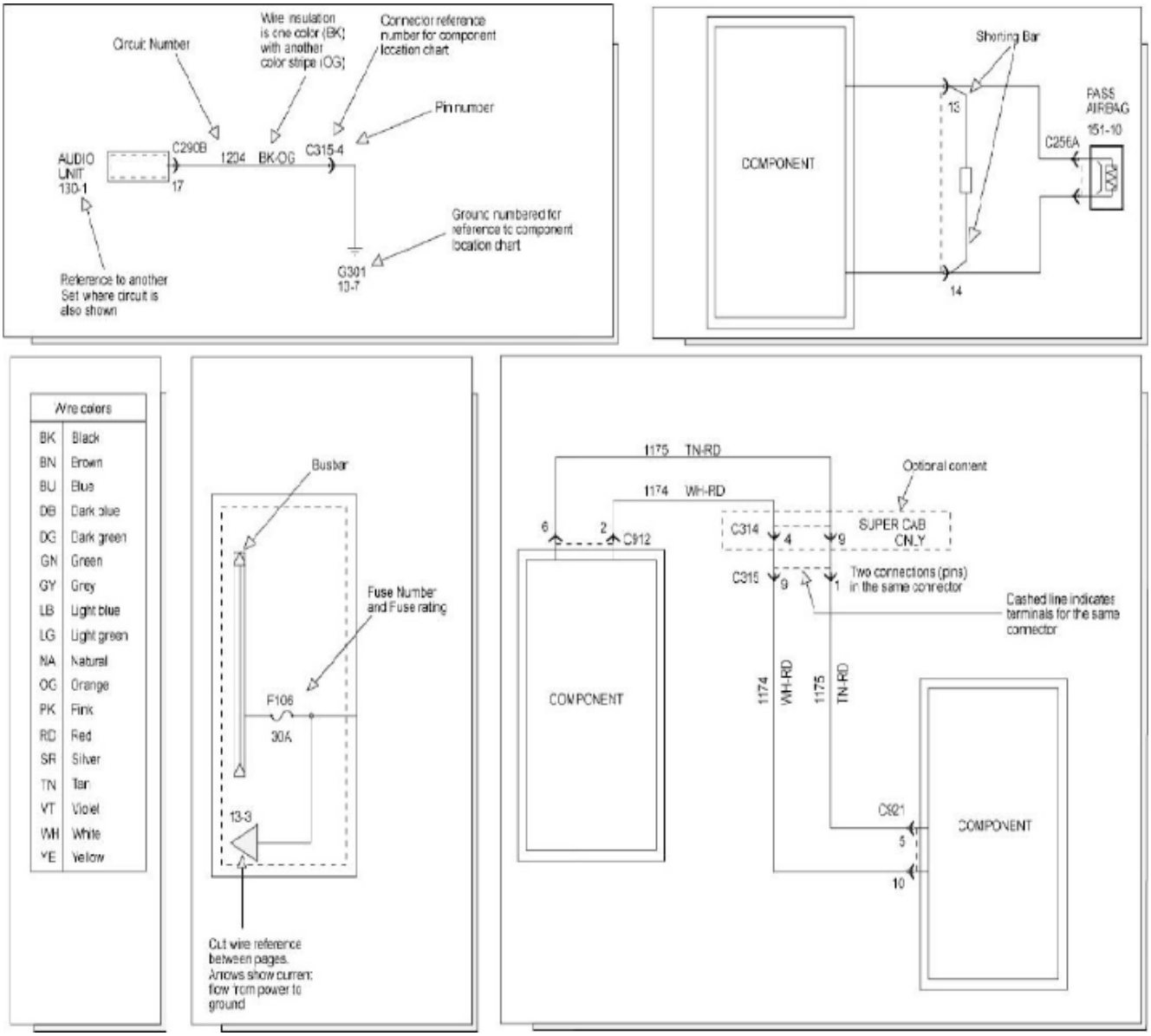
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

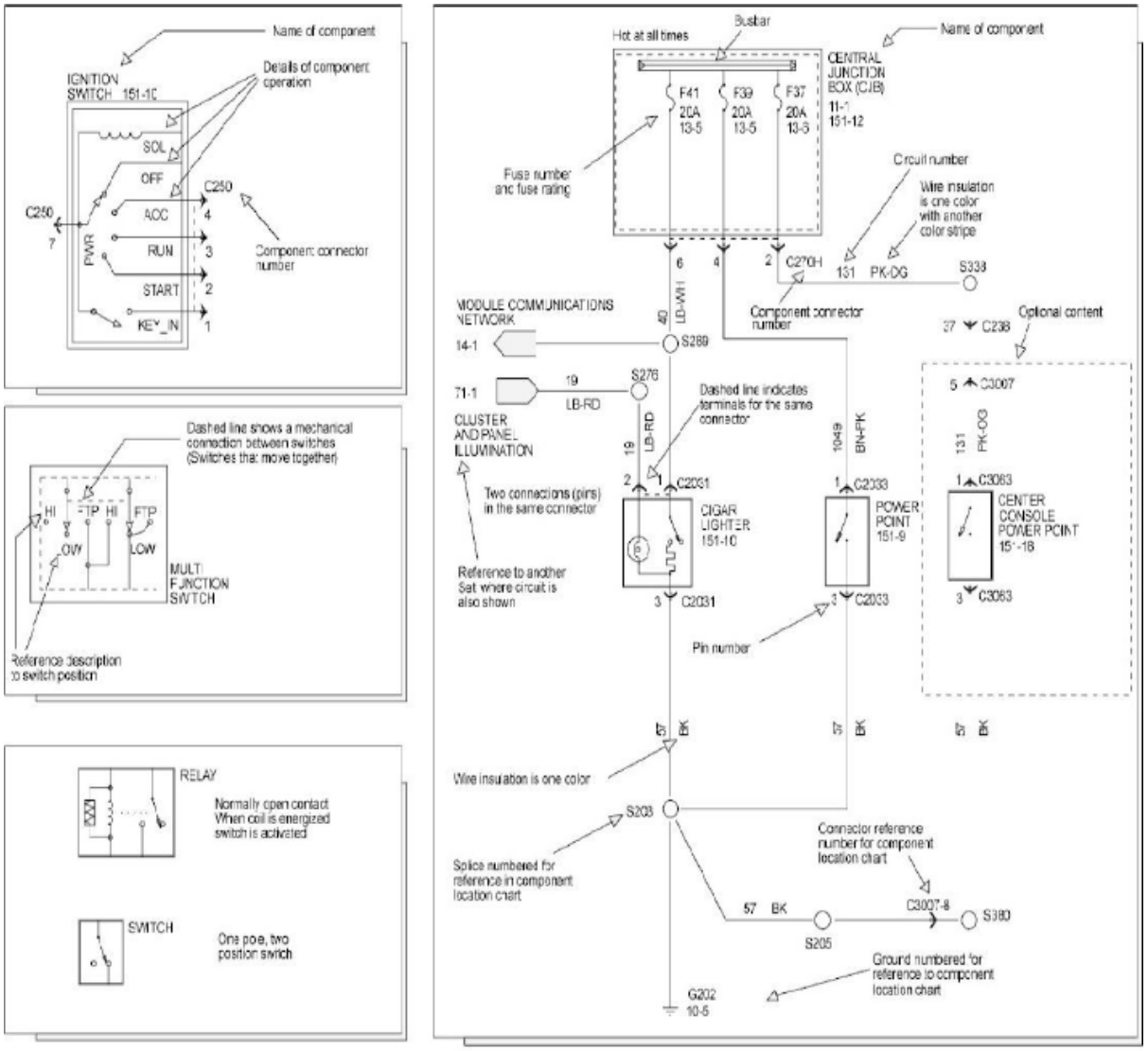
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

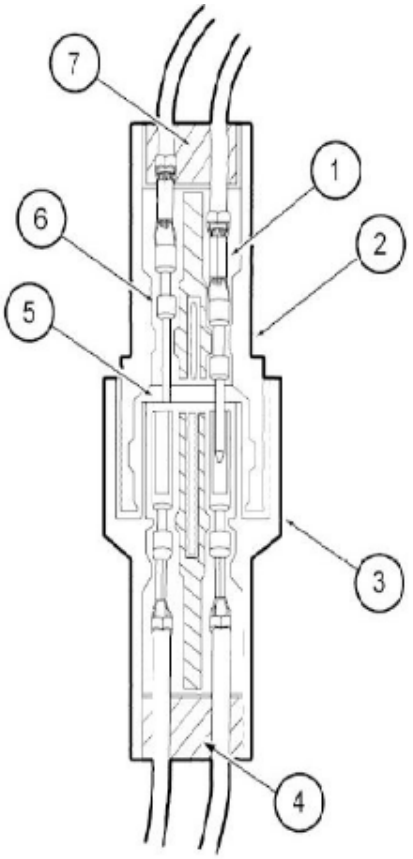


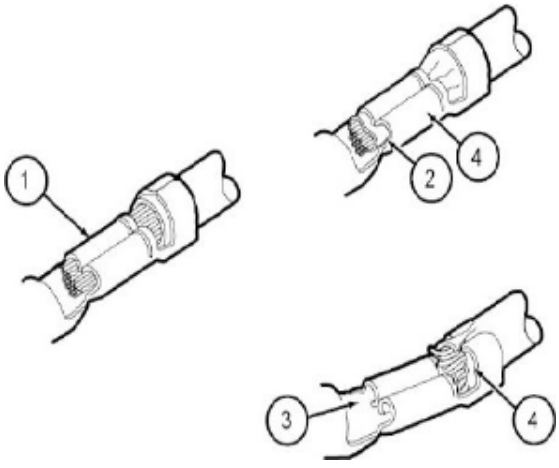
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Fuel Pump Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

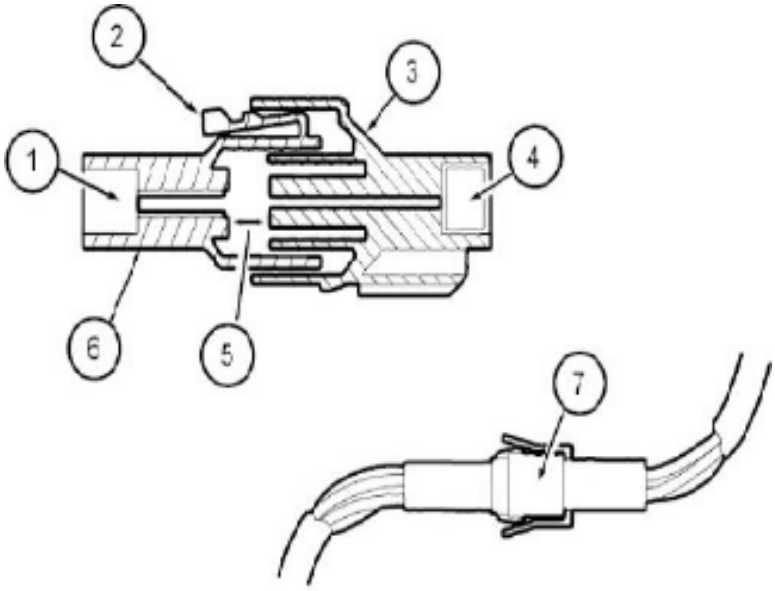
5 = Intermittent contact

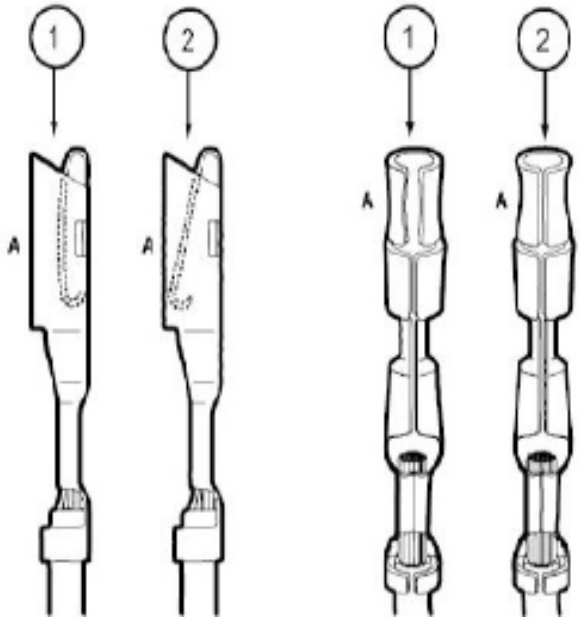
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

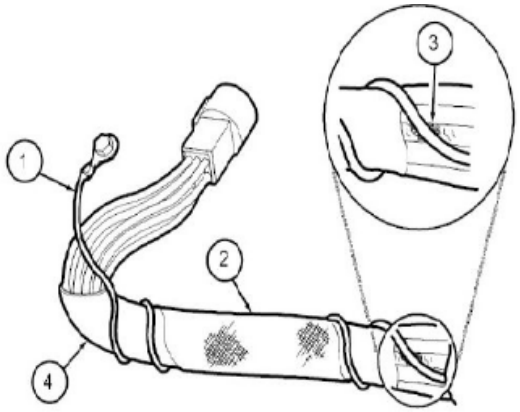
Deformed (enlarged) female terminals

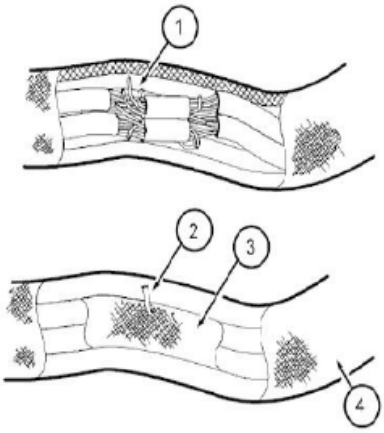
1 = Enlarged

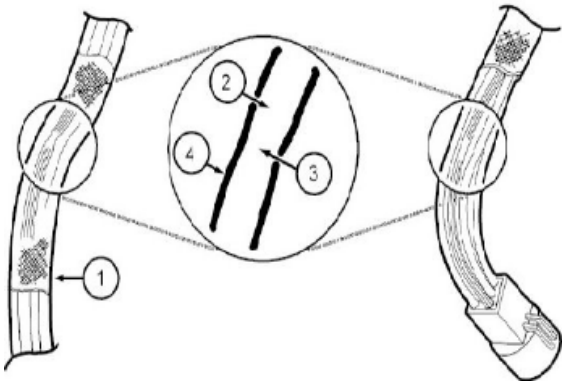
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

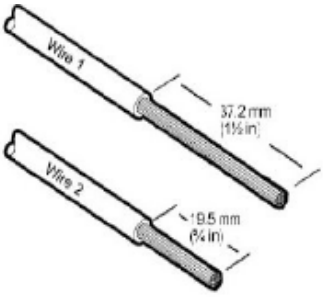
Splice covered 2

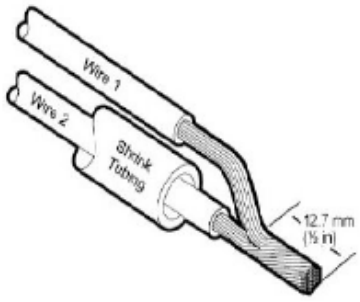
= Wire strand

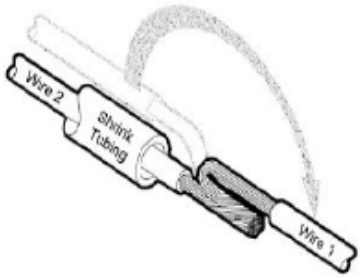
3 = Splice tape

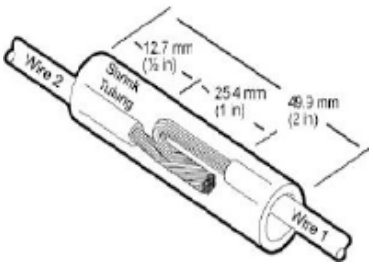
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

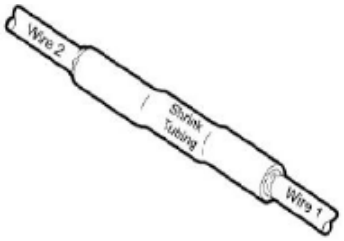
NOTE: -

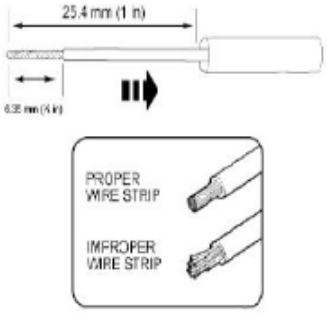
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

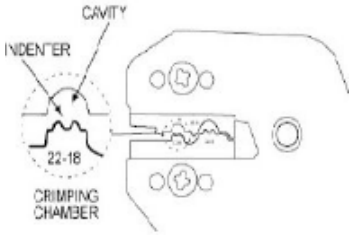
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

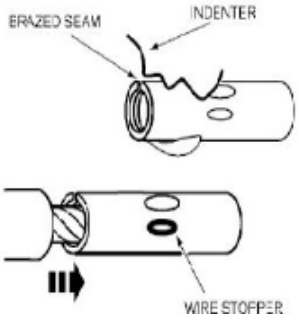
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
6.35 mm (¼ in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

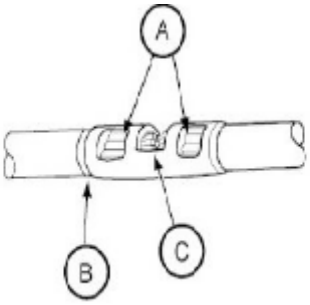
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

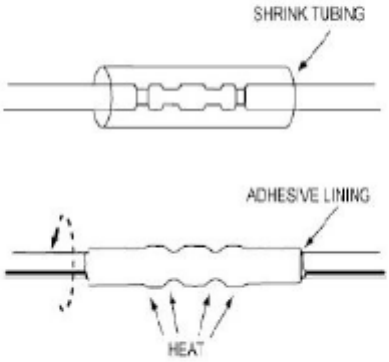
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4□ strip, cut 9 strands	* 1/4□ strip, cut 2 strands	1/4□ strip, no fold	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip, fold 2x dia.	1□ strip, fold 3x dia.
	16-14	* 1/4□ strip, cut 7 strands	1/4□ strip, no fold	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip fold 2x dia	1□ strip, fold 3x dia.	1 1/4□ strip, fold 4x dia.	Not Recommended
	12-10	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip, fold 2x dia.	1□ strip fold 3x cia.	1 1/4□ strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Pigtail only

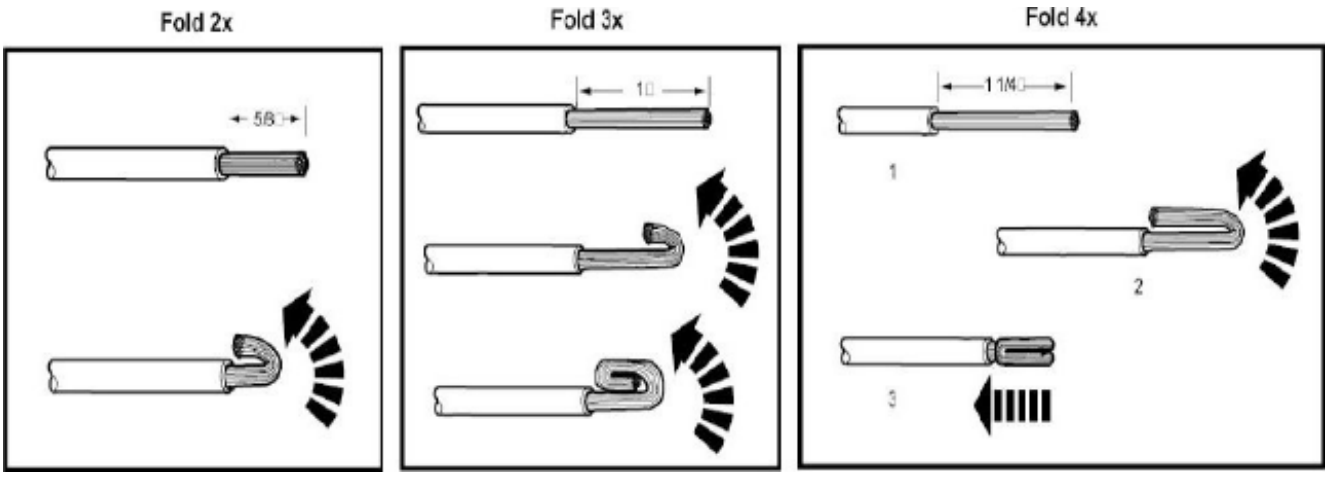
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



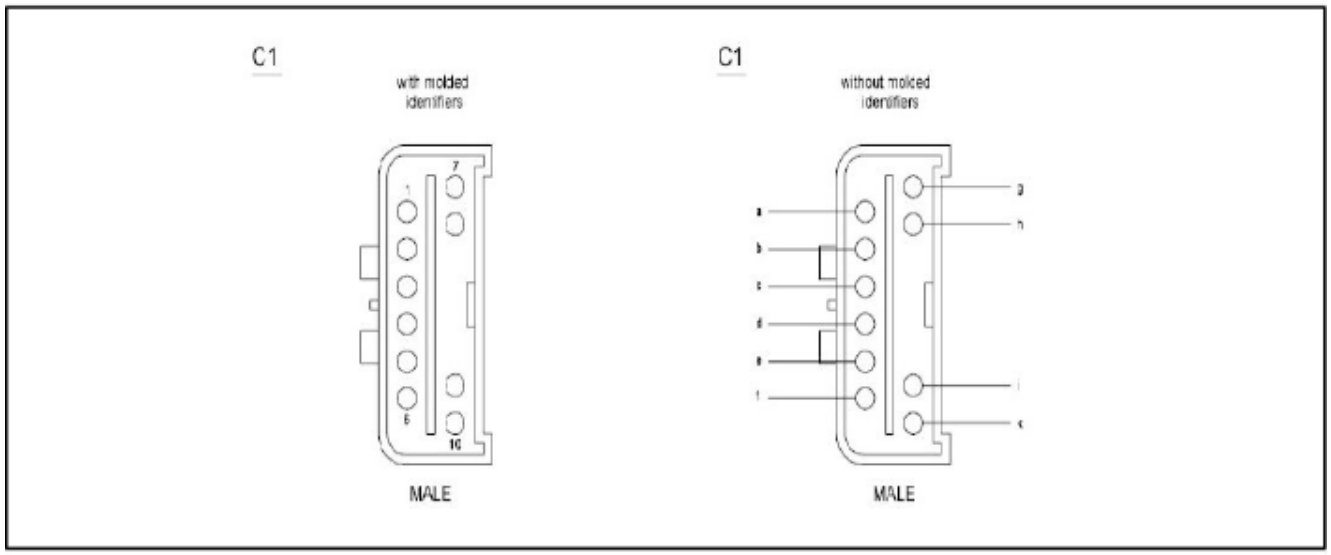
The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



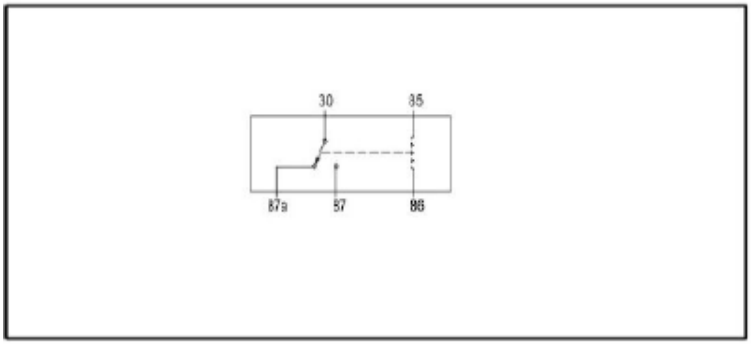
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

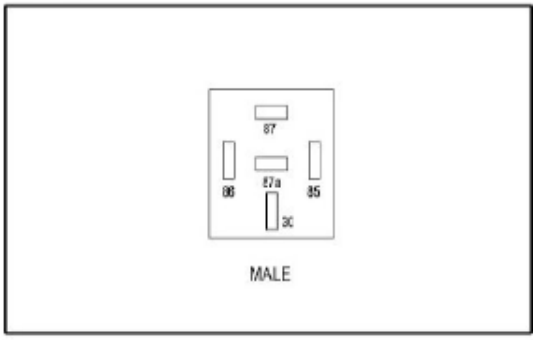
Fuel Pump Relay: Testing and Inspection Mini ISO Relay

Relay □ Mini ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

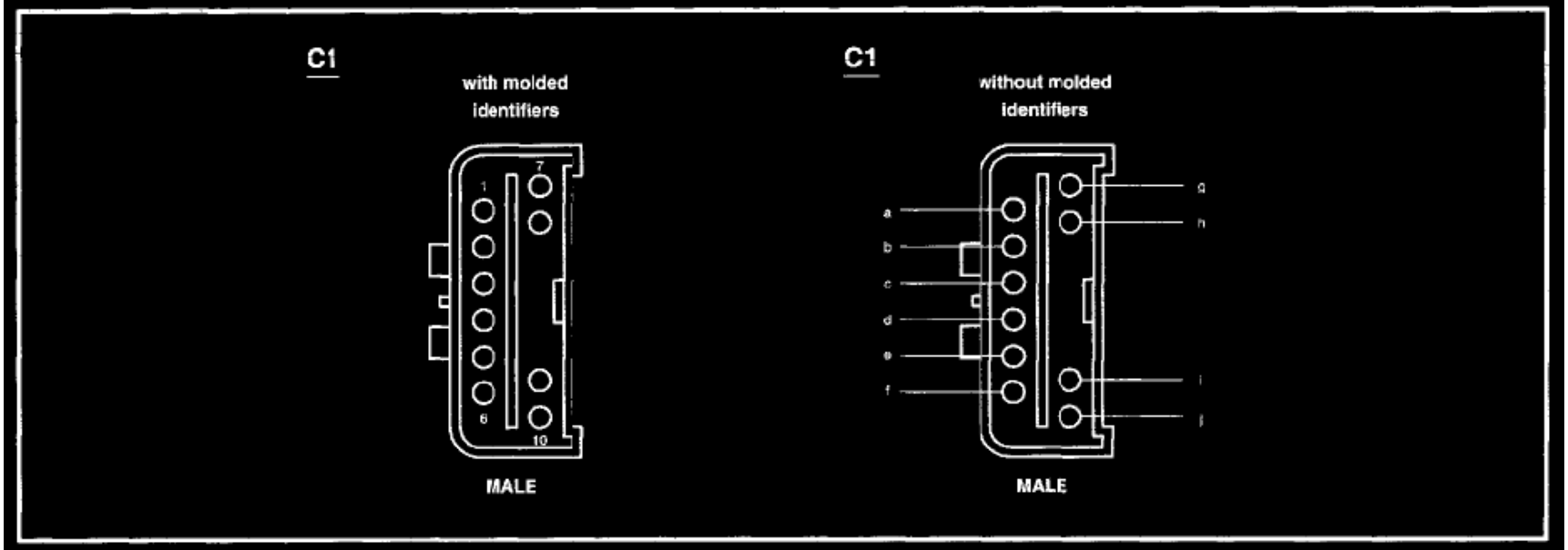
Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step–by–step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



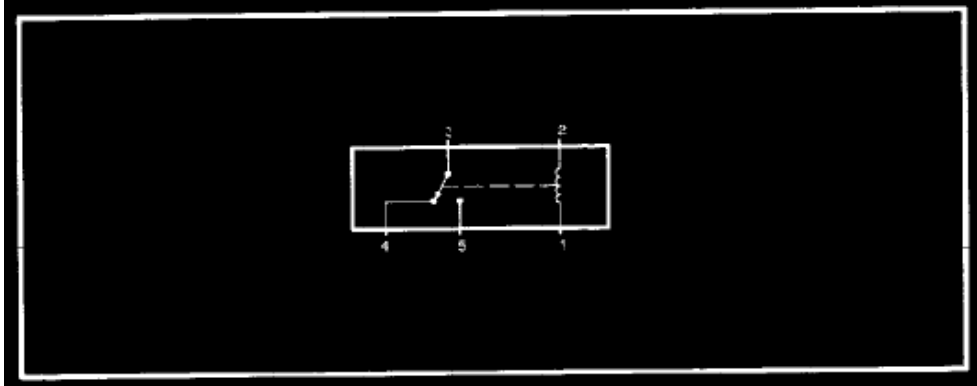
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

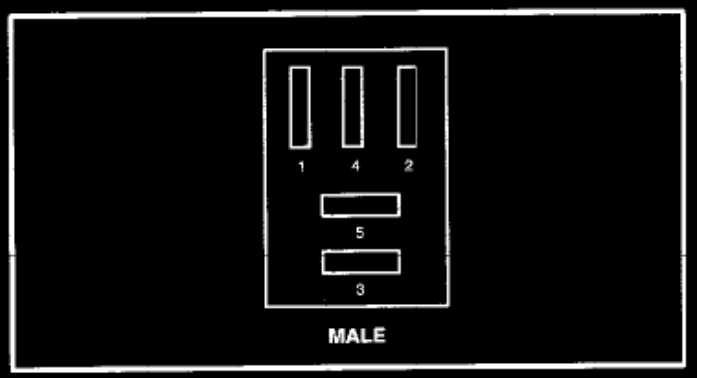
Fuel Pump Relay: Testing and Inspection Micro ISO Relay

Relay – Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63–102Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil – Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

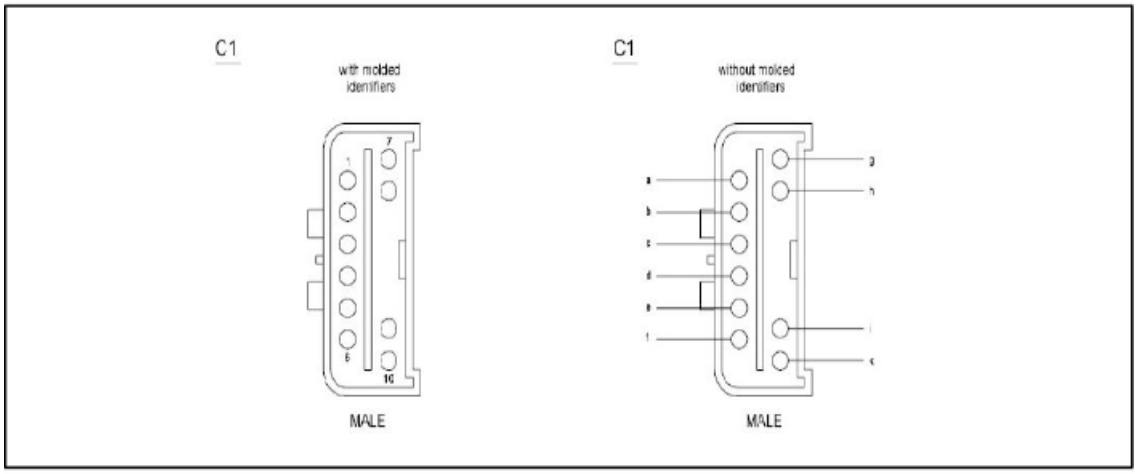
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals

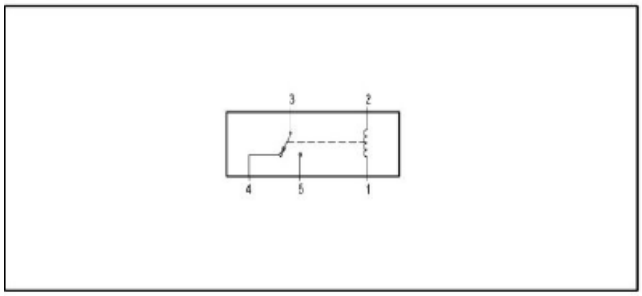


The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

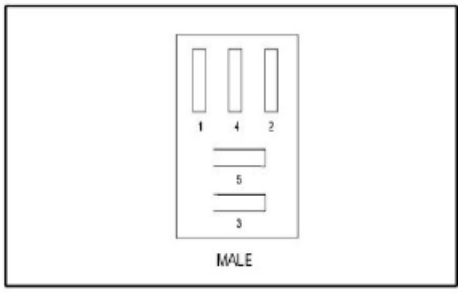
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Relay - Micro ISO

Schematic



Terminals

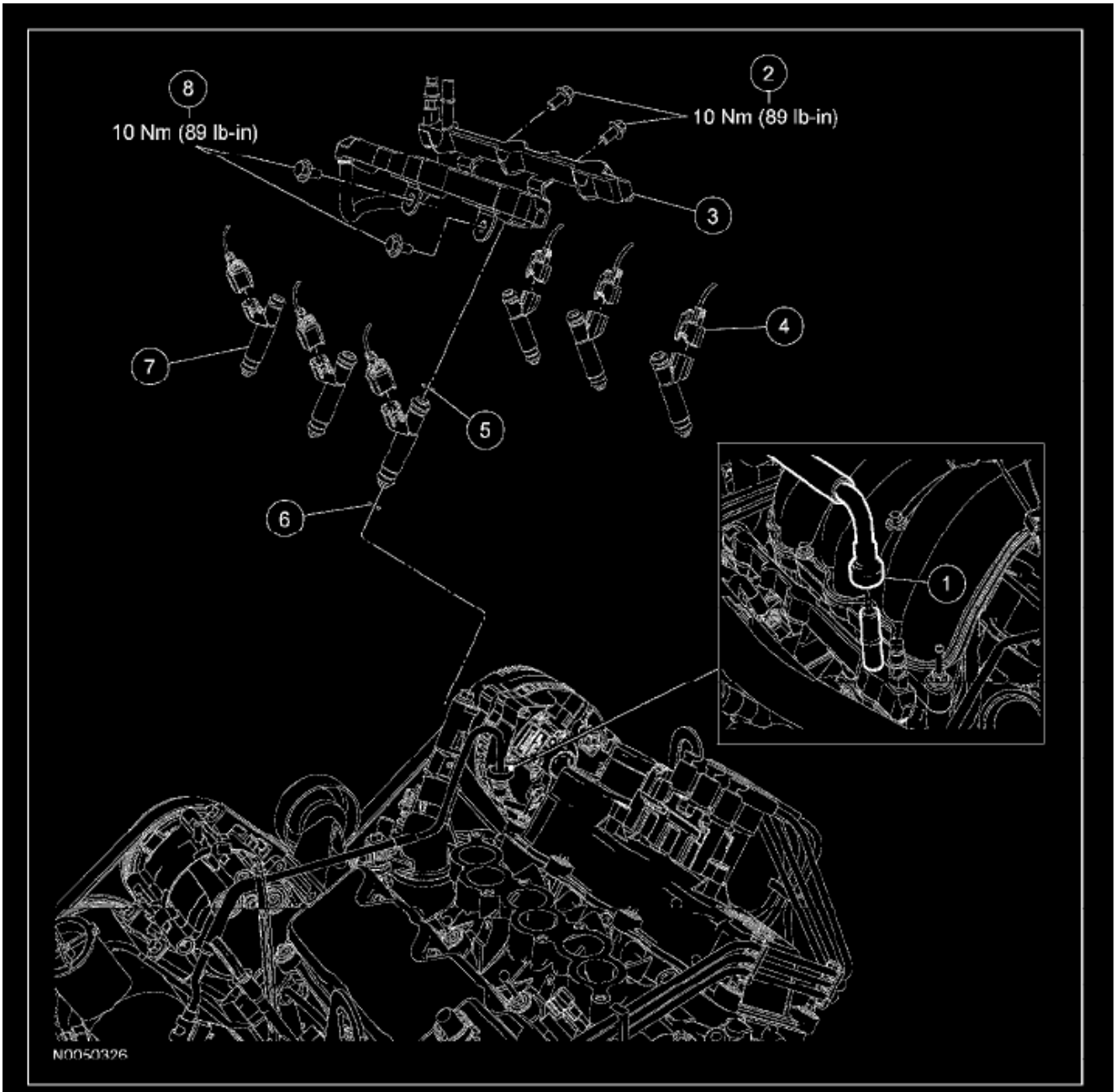


Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63-102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil - Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.



Item	Part Number	Description
1	—	Fuel supply tube spring lock coupling (part of 9J338)
2	N808779	Fuel rail bolts (2 required)
3	9F792	Fuel rail

(Continued)

Item	Part Number	Description
4	—	Fuel injector electrical connector (6 required) (part of 12B637)
5	—	Fuel injector upper O-ring seal (6 required)

(Continued)

Fuel Rail: Service and Repair

FUEL RAIL

Exploded View

Part 1

Item	Part Number	Description
6	—	Fuel injector lower O-ring seal (6 required)
7	9F593	Fuel injector (6 required)
8	N808779	Fuel rail bolts (2 required)

Part 2

Removal

WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

1. Disconnect the battery ground cable. 2. Release the fuel pressure. 3. Remove the upper intake manifold. 4. Disconnect the 6 fuel injector electrical connectors. 5. Disconnect the fuel supply tube spring lock coupling. 6. Remove the 4 fuel rail bolts and remove the fuel rail and the fuel injectors as an assembly. 7. Remove the 6 fuel injectors from the fuel rail.

- Remove and discard the fuel injector O-ring seals.

Installation

1. NOTE: Lubricate the new O-ring seals with clean engine oil prior to installation.

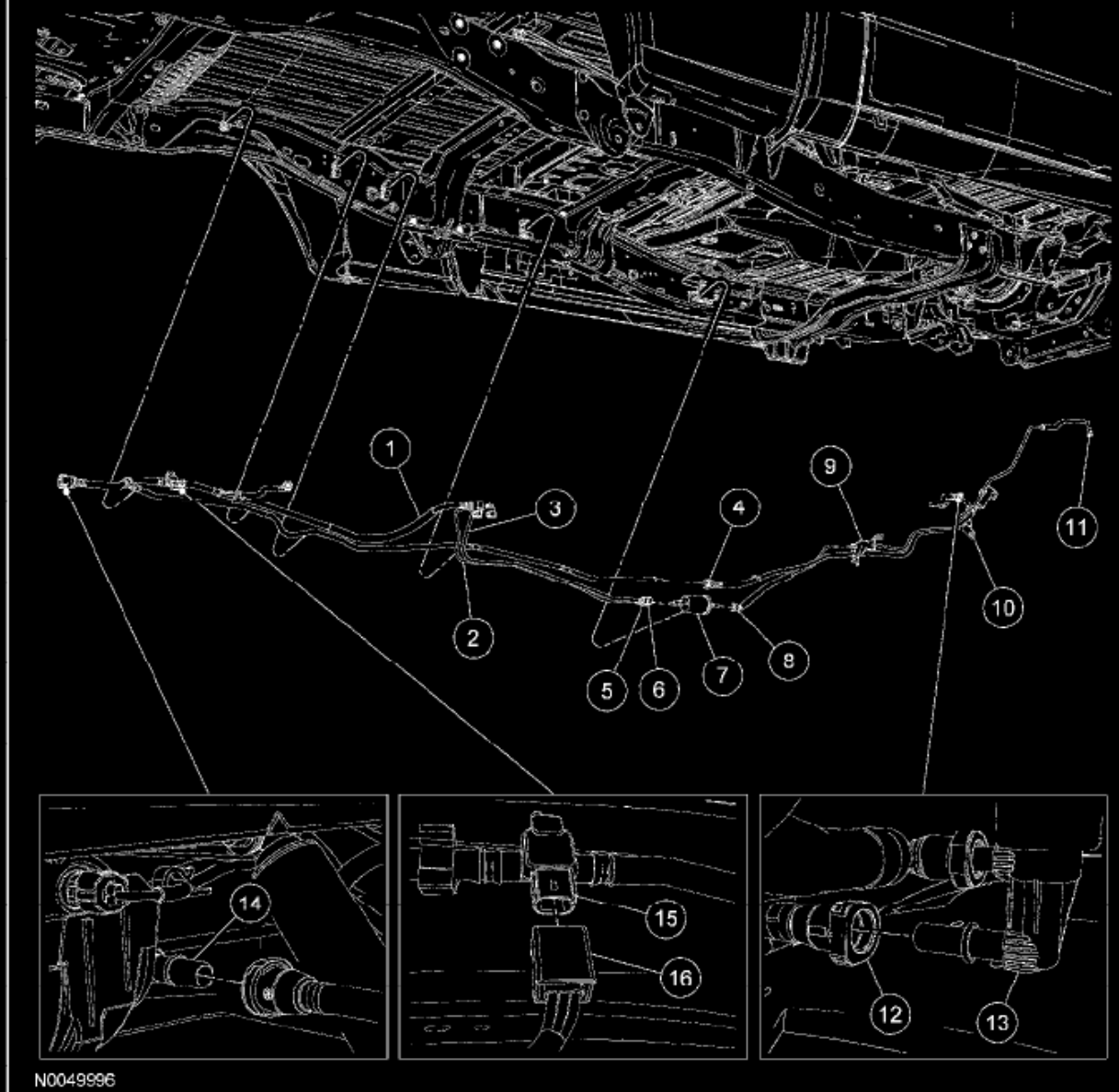
Install new O-ring seals on the fuel injectors and install the fuel injectors onto the fuel rail.

2. Install the fuel rail and fuel injectors as an assembly, and install the 4 bolts.

- Tighten to 10 Nm (89 lb-in).

3. Connect the fuel supply tube spring lock coupling. 4. Connect the 6 fuel injector electrical connectors. 5. Install the upper intake manifold. 6. Connect the battery ground cable.

NOTE: 3.0L rear wheel drive (RWD) short wheelbase shown, others similar.



Item	Part Number	Description
1	—	Rear fuel tank vapor tube and fuel tank pressure sensor assembly (part of 9G291)
2	—	Fuel return tube (part of 9G291)

(Continued)

Item	Part Number	Description
3	—	Fuel supply tube (part of 9G291)

(Continued)

Fuel Supply Line: Service and Repair

FUEL LINES

Exploded View

Part 1

Item	Part Number	Description
4	—	Front fuel tank vapor tube-to-rear fuel tank vapor tube and fuel tank pressure sensor assembly quick connect coupling (part of 9L291)
5		Fuel return tube to fuel filter quick connect coupling (part of 9G291)
6	—	Fuel supply tube-to-fuel filter quick connect coupling (part of 9G291)
7	9155	Fuel filter
8	—	Fuel supply tube-to-fuel filter quick connect coupling (part of 9L291)
9	—	Fuel supply tube and front fuel tank vapor tube-to-transmission case bracket
10	—	Fuel supply tube and front fuel tank vapor tube-to-transmission case bellhousing bracket
11	—	Fuel supply tube-to-fuel rail spring lock coupling (part of 9L291)
12	—	Front fuel tank vapor tube-to-evaporative emission (EVAP) canister purge valve quick connect coupling (part of 9L291)
13	9C915	EVAP canister purge valve
14	—	Rear fuel tank vapor tube and fuel tank pressure sensor assembly-to-EVAP canister quick connect coupling (part of 9G291)
15	—	Fuel tank pressure sensor (part of 9G291)
16	—	Fuel tank pressure sensor electrical connector (part of 14405)

Part 2

Removal and Installation

All vehicles

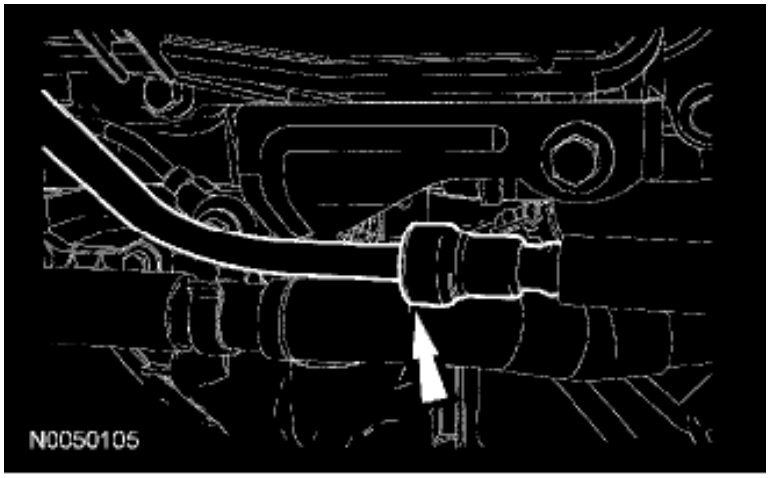
1. Remove the fuel tank.

Vehicles with 3.0L and 4.0L engine

2. Remove the transmission.

Vehicles with 2.3L engine

3. Disconnect the fuel supply tube-to-fuel rail supply tube spring lock coupling.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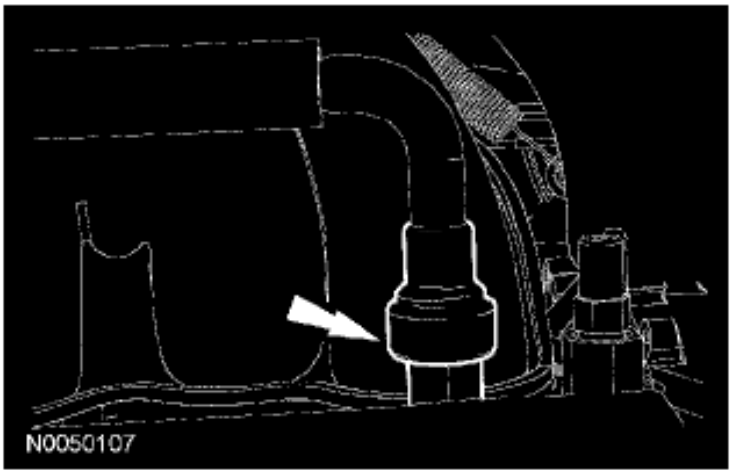
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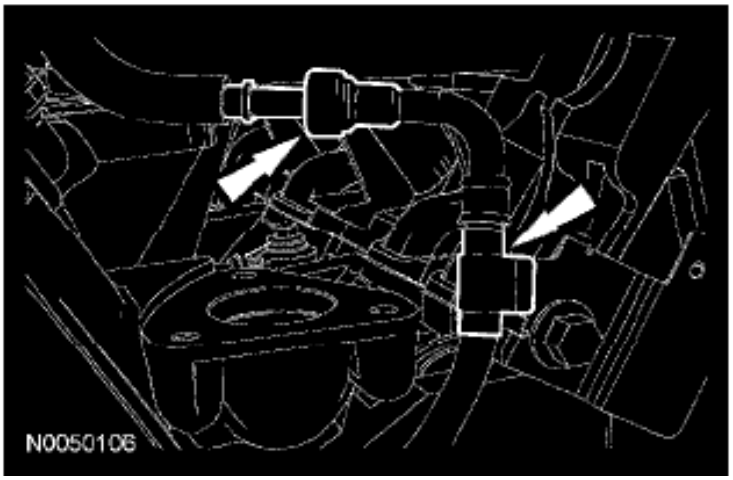

N0050106

Vehicles with 3.0L engine

4. Disconnect the fuel supply tube-to-fuel rail spring lock coupling.

Vehicles with 4.0L engine

5. Disconnect the fuel supply tube-to-fuel rail spring lock coupling and disconnect the fuel supply tube from the bracket.

All vehicles

6. Disconnect the front fuel tank vapor tube-to-evaporative emission (EVAP) canister purge valve quick connect coupling. 7. Disconnect the fuel tubes-to-fuel filter quick connect couplings. 8. Disconnect the front fuel tank vapor tube-to-rear fuel tank vapor tube and fuel tank pressure sensor assembly quick connect coupling.

Vehicles with 2.3L engine

9. Disconnect the wiring harness pin-type retainers from the fuel and vapor tube-to-rear transmission bracket, center of transmission housing, and fuel

and vapor tube-to-transmission bellhousing bracket.

10. Disconnect the fuel supply tube and front fuel tank vapor tube from the fuel and vapor tube-to-rear transmission bracket, and the fuel and vapor

tube-to-transmission bellhousing bracket.

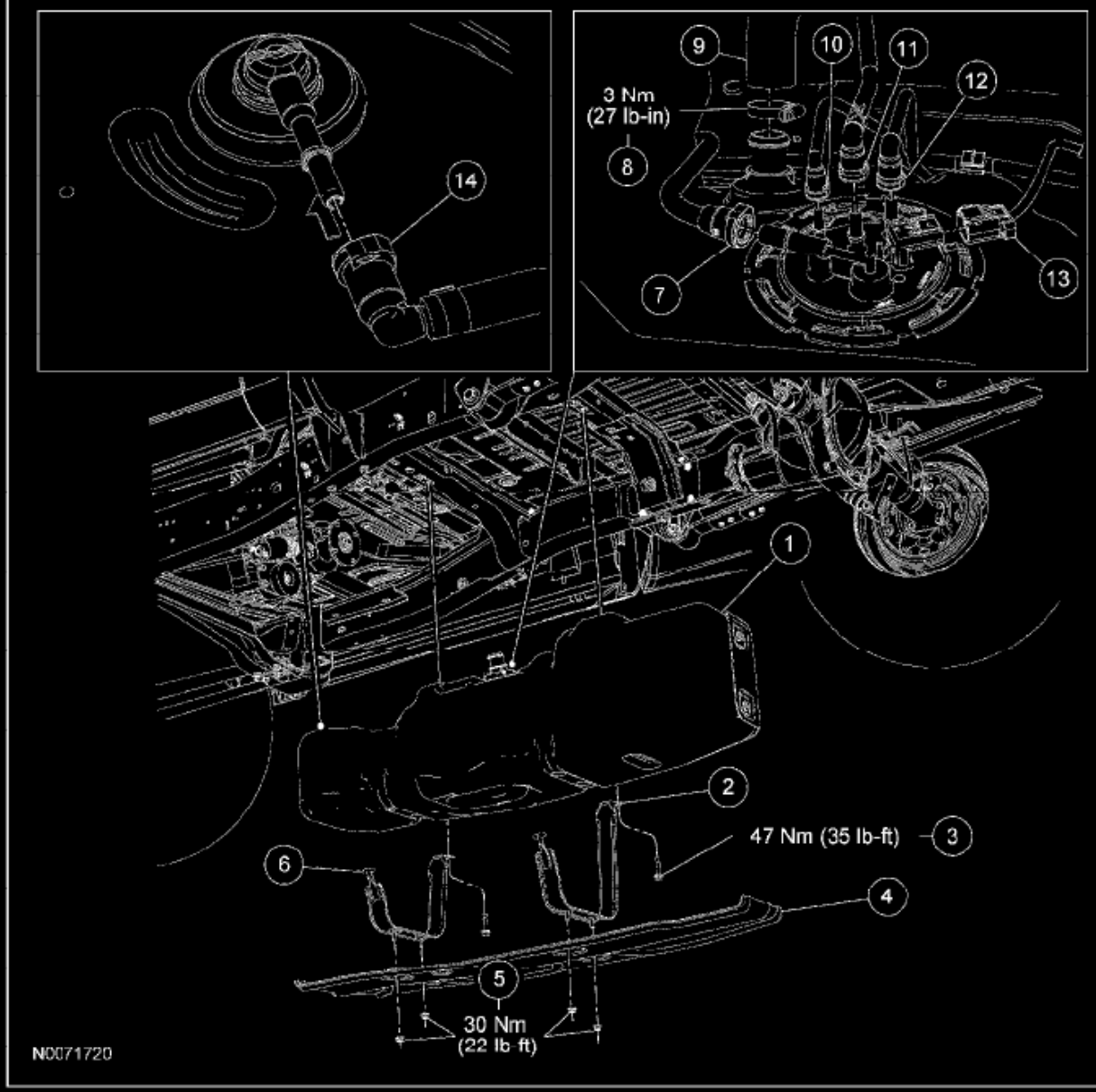
All vehicles

11. Remove the fuel supply tube and the front fuel tank vapor tube from the vehicle. 12. Disconnect the rear fuel tank vapor tube and fuel tank pressure sensor assembly-to-EVAP canister quick connect coupling. 13. Disconnect the fuel tank pressure sensor electrical connector. 14. Disconnect the fuel supply tube, fuel return tube, and rear fuel tank vapor tube and fuel tank pressure sensor assembly from the frame clips and

remove from the vehicle.

15. To install, reverse the removal procedure.

Fuel Tank



Item	Part Number	Description
1	9002	Fuel tank
2	9057	Rear fuel tank support strap
3	W506435	Fuel tank support strap bolt (2 required)

(Continued)

Item	Part Number	Description
4	9A147	Fuel tank skid plate (if equipped)
5	W520112	Fuel tank skid plate nuts (if equipped) (4 required)
6	9054	Front fuel tank support strap

(Continued)

Fuel Filler Hose: Service and Repair

FUEL TANK FILLER PIPE

Exploded View

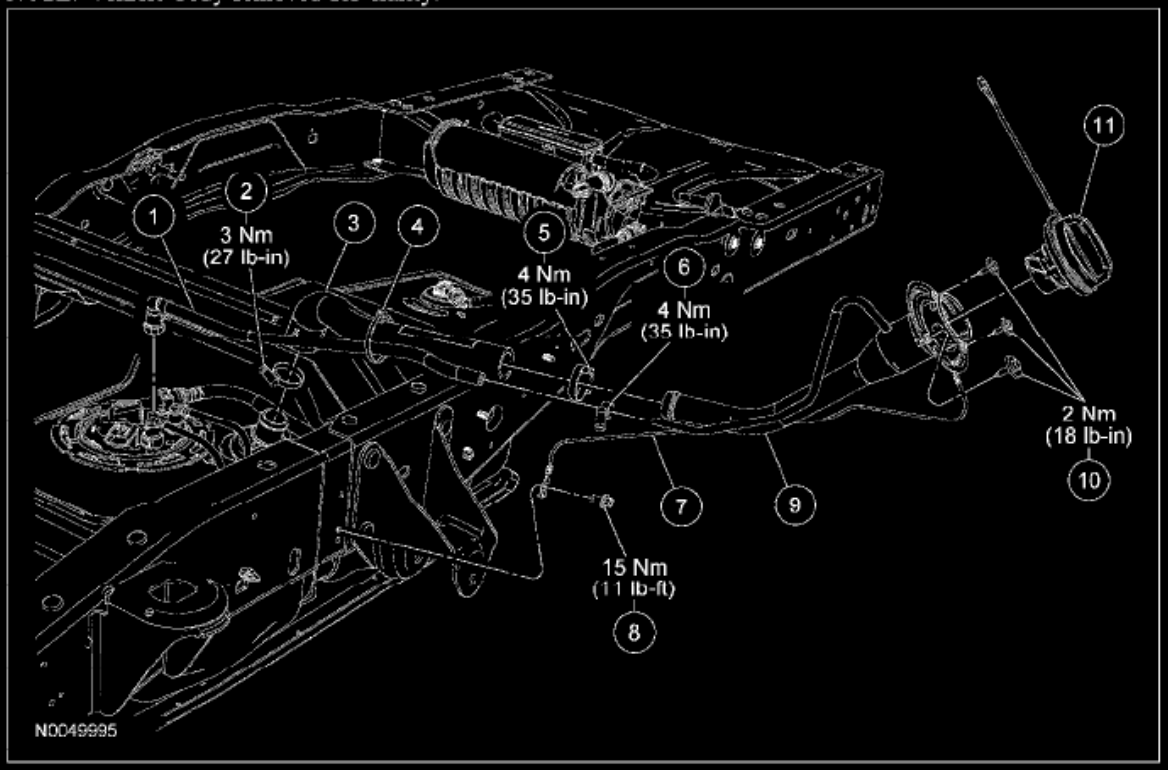
Fuel Tank (Part 1)

Item	Part Number	Description
7	—	Rear fuel tank vapor tube and fuel tank pressure sensor-to-fuel pump quick connect coupling (part of 9G291)
8	—	Fuel tank filler pipe hose-to-fuel tank clamp (part of 9034)
9	—	Fuel tank filler pipe (part of 9034)
10	—	Fuel supply tube-to-fuel pump quick connect coupling (part of 9G291)
11	—	Fuel tank filler pipe vapor tube-to-fuel pump quick connect coupling (part of 9034)
12	—	Fuel return tube-to-fuel pump quick connect coupling (part of 9G291)
13	—	Fuel pump electrical connector
14	—	Rear fuel tank vapor tube and fuel tank pressure sensor-to-fuel tank vent valve quick connect coupling (part of 9G291)

Fuel Tank (Part 2)

Fuel Tank Filler Pipe

NOTE: Vehicle body removed for clarity.



Item	Part Number	Description
1	—	Fuel tank filler pipe vent tube (part of 9034)
2	—	Fuel tank filler pipe hose-to-fuel tank clamp (part of 9034)

(Continued)

Item	Part Number	Description
3	—	Fuel tank filler pipe hose (part of 9034)
4	—	Fuel tank filler pipe tie strap (part of 9034)

(Continued)

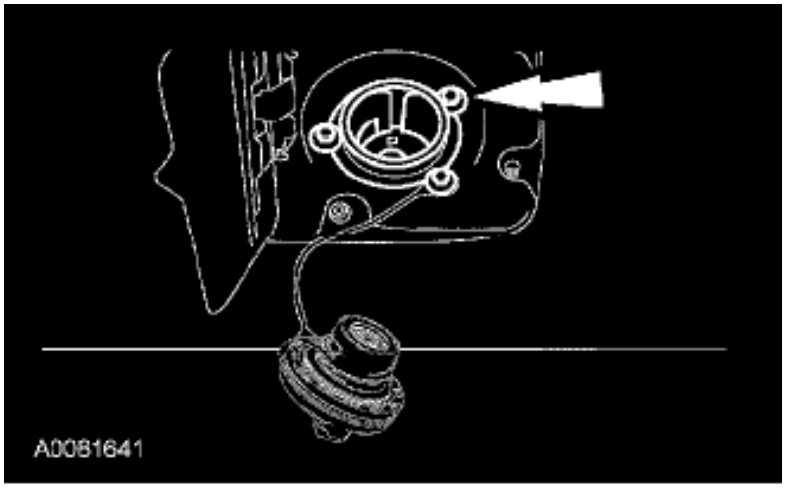
Item	Part Number	Description
5	—	Fuel tank filler pipe hose-to-fuel tank filler pipe clamp (part of 9034)
6	—	Fuel tank filler pipe vent tube-to-fuel tank filler pipe clamp (part of 9034)
7	—	Fuel tank filler pipe ground strap (part of 9034)
8	W505261	Fuel tank filler pipe ground strap bolt
9	—	Fuel tank filler pipe (part of 9034)
10	W711589-S439	Fuel tank filler pipe-to-body housing screws (3 required)
11	—	Fuel tank filler pipe cap (part of 9030)

Fuel Tank Filler Pipe (Part 1)

Fuel Tank Filler Pipe (Part 2)

Removal and Installation

WARNING: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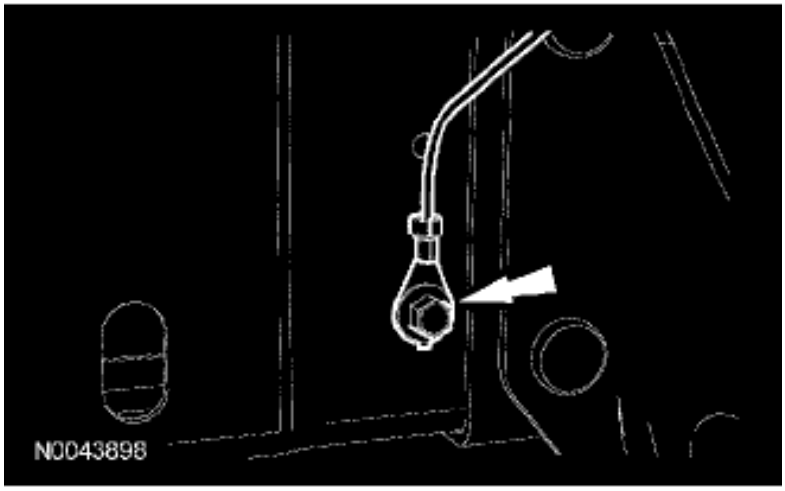
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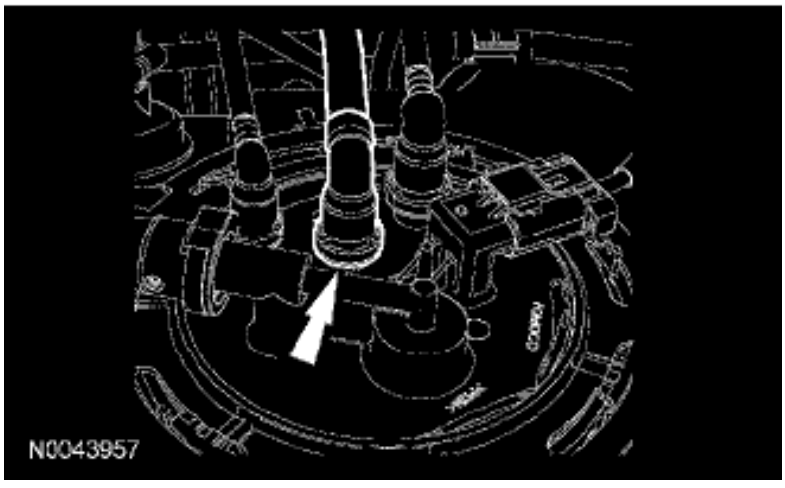

N0043957

- Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

- Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.

- Remove the fuel filler cap slowly. The fuel system may be under pressure. If the fuel filler cap is venting vapor or if you hear a hissing sound, wait until it stops before completely removing the fuel filler cap. Otherwise, fuel may spray out. Failure to follow these instructions may result in serious personal injury.

1. With the vehicle in NEUTRAL, position it on a hoist 2. Disconnect the battery ground cable. 3. Remove the fuel tank filler pipe screws.

- To install, tighten to 2 Nm (18 lb-in).

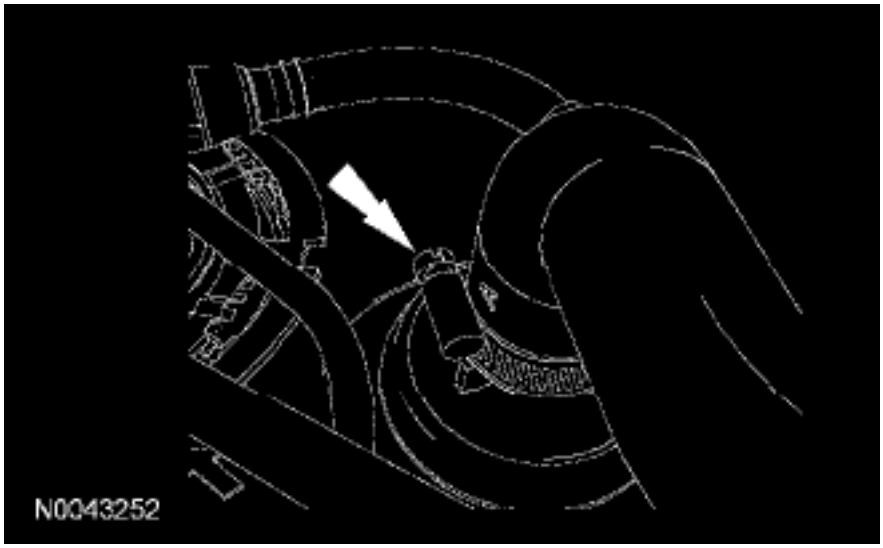
4. Remove the fuel tank filler pipe ground strap and bolt from the frame.

- To install, tighten to 15 Nm (11 lb-ft).

5. Disconnect the fuel tank filler pipe vent hose quick connect coupling at the fuel pump.

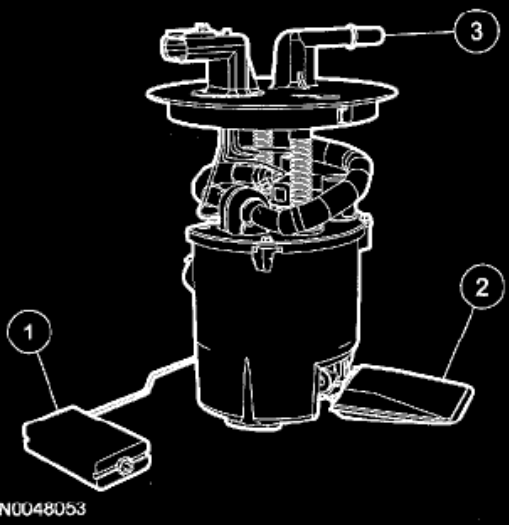
6. Loosen the fuel tank filler pipe hose clamp on the fuel tank. Remove the fuel tank filler pipe hose from the fuel tank.

- To install, tighten to 3 Nm (27 lb-in).



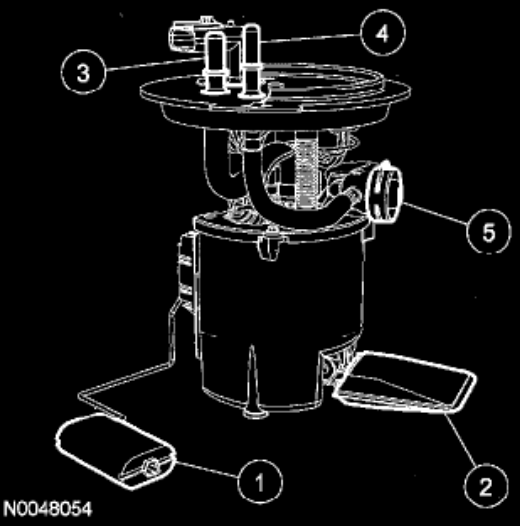
7. Remove the fuel tank filler pipe from the vehicle. 8. To install, reverse the removal procedure.

Typical Electronic Returnless Fuel Pump (FP) Module



Item	Part Number	Description
1	—	Fuel Level Float
2	—	Fuel Intake Filter
3	—	Fuel Supply

Typical Mechanical Returnless Fuel Pump (FP) Module



Item	Part Number	Description
1	—	Fuel Level Float
2	—	Fuel Intake Filter
3	—	Fuel Supply
4	—	Fuel Return from Fuel Filter
5	—	Fuel Pressure Regulator

Fuel Gauge Sender: Description and Operation

Fuel Pump (FP) Module

Typical Electronic Returnless Fuel Pump (FP) Module

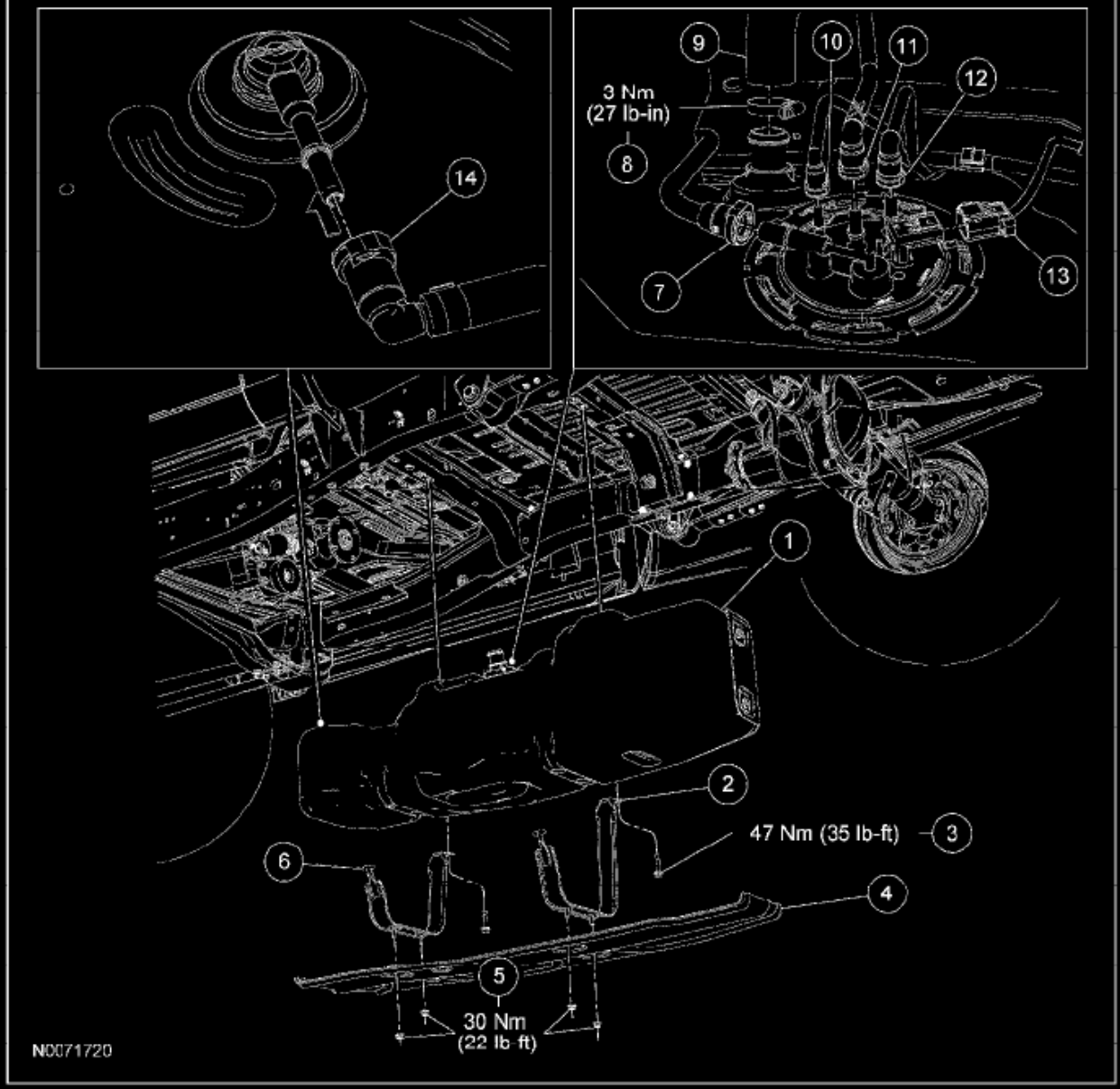
Typical Mechanical Returnless Fuel Pump (FP) Module

The FP module is a device that contains the fuel pump and sender assembly. The fuel pump is located inside the FP module reservoir and supplies fuel through the FP module manifold to the engine and FP module jet pump. The jet pump continuously refills the reservoir with fuel, and a check valve located in the manifold outlet maintains system pressure when the fuel pump is not energized. A flapper valve located in the bottom of the reservoir allows fuel to enter the reservoir and prime the fuel pump during the initial fill.

Fuel Pump (FP) Module and Reservoir

The FP module is mounted inside the fuel tank in a reservoir. The pump has a discharge check valve that maintains the system pressure after the key has been turned off to minimize starting concerns. The reservoir prevents fuel flow interruptions during extreme vehicle maneuvers with low tank fill levels.

Fuel Tank



Item	Part Number	Description
1	9002	Fuel tank
2	9057	Rear fuel tank support strap
3	W506435	Fuel tank support strap bolt (2 required)

(Continued)

Item	Part Number	Description
4	9A147	Fuel tank skid plate (if equipped)
5	W520112	Fuel tank skid plate nuts (if equipped) (4 required)
6	9054	Front fuel tank support strap

(Continued)

Fuel Tank Mounting Straps: Service and Repair

FUEL TANK SUPPORT STRAPS

Exploded View

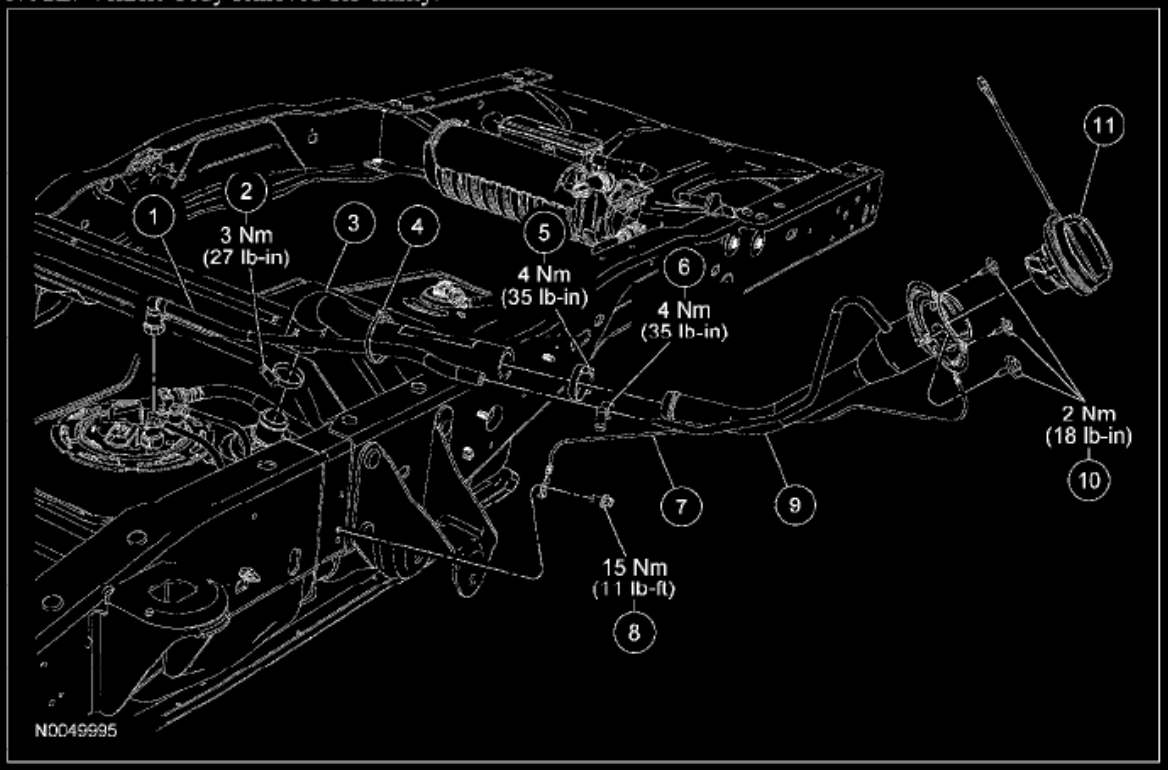
Fuel Tank (Part 1)

Item	Part Number	Description
7	—	Rear fuel tank vapor tube and fuel tank pressure sensor-to-fuel pump quick connect coupling (part of 9G291)
8	—	Fuel tank filler pipe hose-to-fuel tank clamp (part of 9034)
9	—	Fuel tank filler pipe (part of 9034)
10	—	Fuel supply tube-to-fuel pump quick connect coupling (part of 9G291)
11	—	Fuel tank filler pipe vapor tube-to-fuel pump quick connect coupling (part of 9034)
12	—	Fuel return tube-to-fuel pump quick connect coupling (part of 9G291)
13	—	Fuel pump electrical connector
14	—	Rear fuel tank vapor tube and fuel tank pressure sensor-to-fuel tank vent valve quick connect coupling (part of 9G291)

Fuel Tank (Part 2)

Fuel Tank Filler Pipe

NOTE: Vehicle body removed for clarity.



Item	Part Number	Description
1	—	Fuel tank filler pipe vent tube (part of 9034)
2	—	Fuel tank filler pipe hose-to-fuel tank clamp (part of 9034)

(Continued)

Item	Part Number	Description
3	—	Fuel tank filler pipe hose (part of 9034)
4	—	Fuel tank filler pipe tie strap (part of 9034)

(Continued)

Item	Part Number	Description
5	—	Fuel tank filler pipe hose-to-fuel tank filler pipe clamp (part of 9034)
6	—	Fuel tank filler pipe vent tube-to-fuel tank filler pipe clamp (part of 9034)
7	—	Fuel tank filler pipe ground strap (part of 9034)
8	W505261	Fuel tank filler pipe ground strap bolt
9	—	Fuel tank filler pipe (part of 9034)
10	W711589-S439	Fuel tank filler pipe-to-body housing screws (3 required)
11	—	Fuel tank filler pipe cap (part of 9030)

Fuel Tank Filler Pipe (Part 1)

Fuel Tank Filler Pipe (Part 2)

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. 2. If equipped, remove the 4 skid plate nuts and the skid plate.

- To install, tighten to 30 Nm (22 lb-ft).

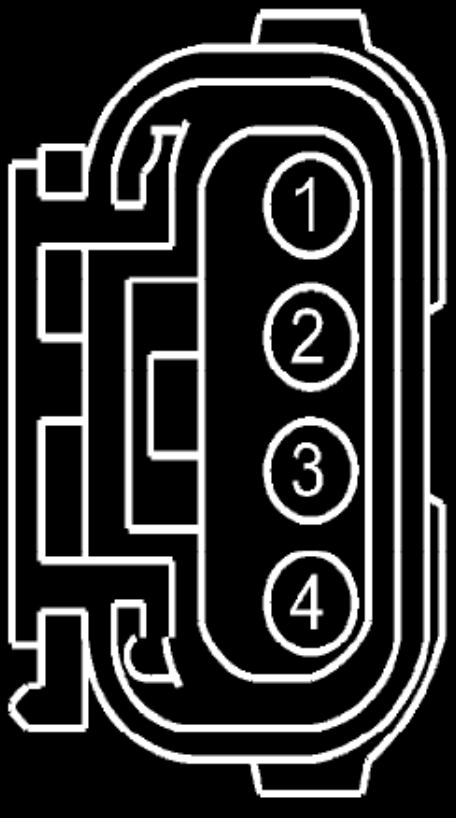
3. Support the fuel tank. 4. Remove the fuel tank support strap bolts and fuel tank support straps.

- To install, tighten to 47 Nm (35 lb-ft).

5. To install, reverse the removal procedure.

Connector: C4033

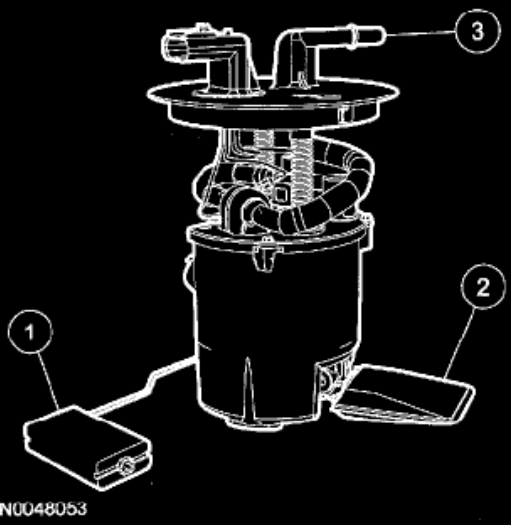
Description:	Harness:	Base Part #:
FUEL TANK UNIT	14405	9H307



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD174 (BK-WH)	20	GROUND - TUNNEL	
2	VMC11 (YE-VT)	20	SENSOR - FUEL LEVEL (FLI)	
3	GD121 (BK-YE)	14	GROUND - FENDER FRONT LEFT # 2ND STUD	
4	CE911 (VT-WH)	14	SWITCH - INERTIA POWER OFF (ISPO)	

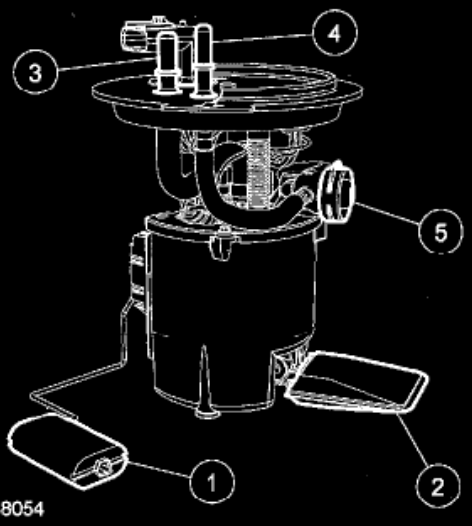
C4033

Typical Electronic Returnless Fuel Pump (FP) Module



Item	Part Number	Description
1	—	Fuel Level Float
2	—	Fuel Intake Filter
3	—	Fuel Supply

Typical Mechanical Returnless Fuel Pump (FP) Module



Item	Part Number	Description
1	—	Fuel Level Float
2	—	Fuel Intake Filter
3	—	Fuel Supply
4	—	Fuel Return from Fuel Filter
5	—	Fuel Pressure Regulator

Fuel Tank Unit: Description and Operation

Fuel Pump (FP) Module

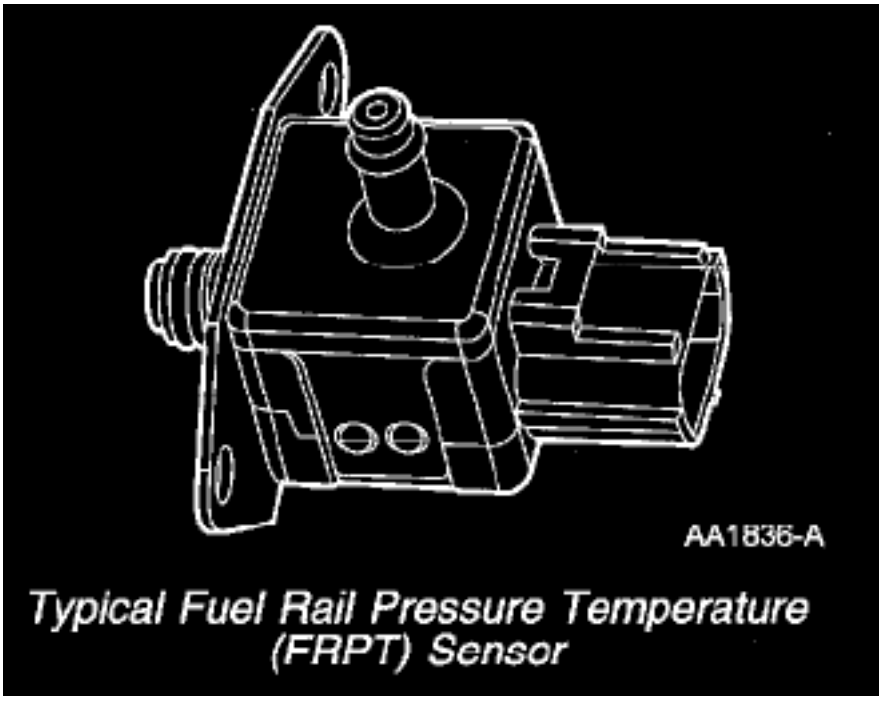
Typical Electronic Returnless Fuel Pump (FP) Module

Typical Mechanical Returnless Fuel Pump (FP) Module

The FP module is a device that contains the fuel pump and sender assembly. The fuel pump is located inside the FP module reservoir and supplies fuel through the FP module manifold to the engine and FP module jet pump. The jet pump continuously refills the reservoir with fuel, and a check valve located in the manifold outlet maintains system pressure when the fuel pump is not energized. A flapper valve located in the bottom of the reservoir allows fuel to enter the reservoir and prime the fuel pump during the initial fill.

Fuel Pump (FP) Module and Reservoir

The FP module is mounted inside the fuel tank in a reservoir. The pump has a discharge check valve that maintains the system pressure after the key has been turned off to minimize starting concerns. The reservoir prevents fuel flow interruptions during extreme vehicle maneuvers with low tank fill levels.



Fuel Temperature Sensor: Description and Operation

FUEL RAIL PRESSURE TEMPERATURE (FRPT) SENSOR

Typical Fuel Rail Pressure Temperature (FRPT) Sensor

The FRPT sensor measures the pressure and temperature of the fuel in the fuel rail and sends these signals to the PCM. The sensor uses the intake manifold vacuum as a reference to determine the pressure difference between the fuel rail and the intake manifold. The relationship between fuel pressure and fuel temperature is used to determine the possible presence of fuel vapor in the fuel rail.

The temperature sensing portion of the FRPT sensor is a thermistor device in which resistance changes with temperature. The electrical resistance of the thermistor decreases as the temperature increases, and the resistance increases as the temperature decreases. The varying resistance changes the voltage drop across the sensor terminals and provides electrical signals to the PCM corresponding to temperature.

Both the pressure and temperature signals are used to control the speed of the fuel pump. The speed of the fuel pump sustains fuel rail pressure which preserves fuel in its liquid state. The dynamic range of the fuel injectors increase because of the higher rail pressure, which allows the injector pulse width to decrease.

Connector: C1066
Description:
IDLE AIR CONTROL IAC) VALVE
Harness:
12B637
Base Part #:
9F715
Pin
Circuit
Gauge
Circuit Function
Qualifier
1
CBB43 (GY)
18
FUSE - 43 OR CIRCUIT BREAKER
2
CE301 (GY-OG)
20
CTRL MOD. - POWERTRAIN # IDLE AIR CONTROL VALVE (IAC)
2
1

C1066

Idle Speed/Throttle Actuator - Electronic: Description and Operation

IDLE AIR CONTROL (IAC) VALVE

NOTE: The IAC valve assembly is not adjustable and cannot be cleaned, also some IAC valves are normally open and others are normally closed. Some IAC valves require engine vacuum to operate.

The IAC valve assembly controls the engine idle speed and provides a dashpot function. The IAC valve assembly meters intake air around the throttle plate through a bypass within the IAC valve assembly and throttle body. The PCM determines the desired idle speed or bypass air and signals the IAC valve assembly through a specified duty cycle. The IAC valve responds by positioning the IAC valve to control the amount of bypassed air. The PCM monitors engine RPM and increases or decreases the IAC duty cycle in order to achieve the desired RPM.

The PCM uses the IAC valve assembly to control:

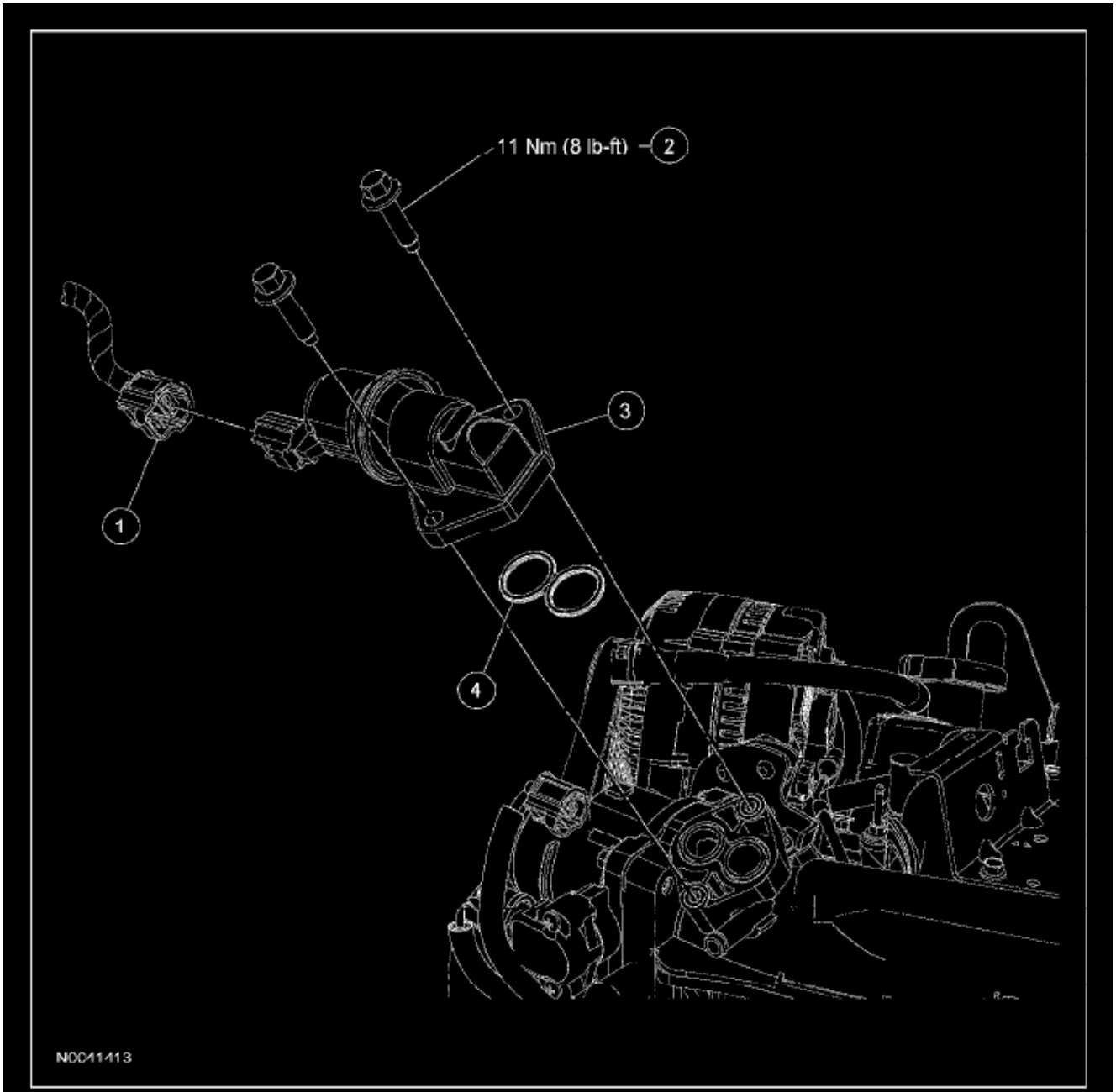
- no touch start

- cold engine fast idle for rapid warm-up

- idle (corrects for engine load)

- stumble or stalling on deceleration (provides a dashpot function)

- over-temperature idle boost



Item	Part Number	Description
1	14A464	Idle air control (IAC) valve electrical connector (part of 12B637)
2	W500214	IAC valve bolt (2 required)

(Continued)

Item	Part Number	Description
3	9F715	IAC valve
4	—	IAC valve gasket

Idle Speed/Throttle Actuator - Electronic: Service and Repair

IDLE AIR CONTROL (IAC) VALVE

Removal and Installation

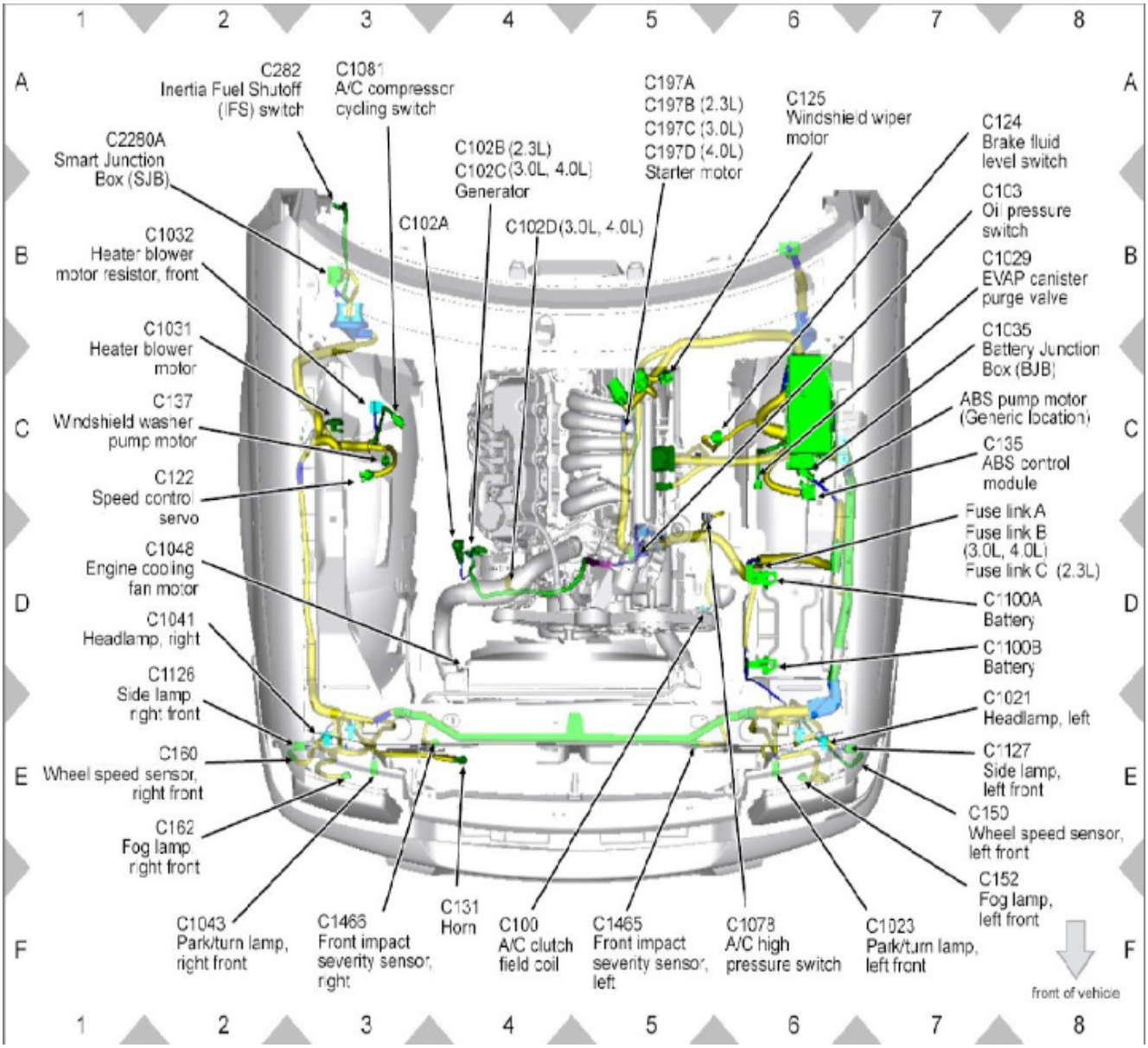
1. Disconnect the idle air control (IAC) valve electrical connector. 2. Remove the 2 bolts, the IAC valve and discard the gasket.

- To install, tighten to 11 Nm (8 lb-ft).

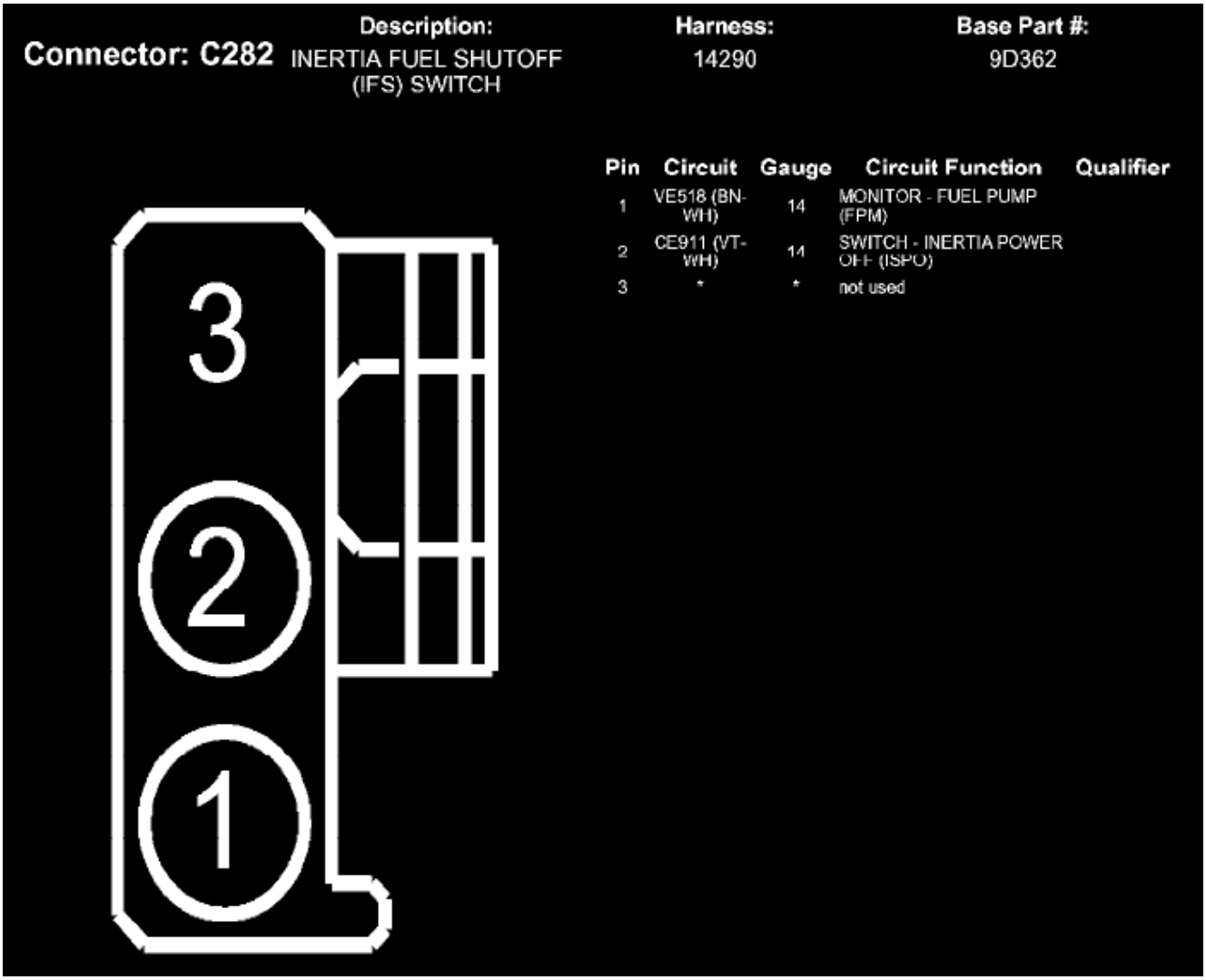
3. NOTE: Install a new IAC valve gasket.

To install, reverse the removal procedure.

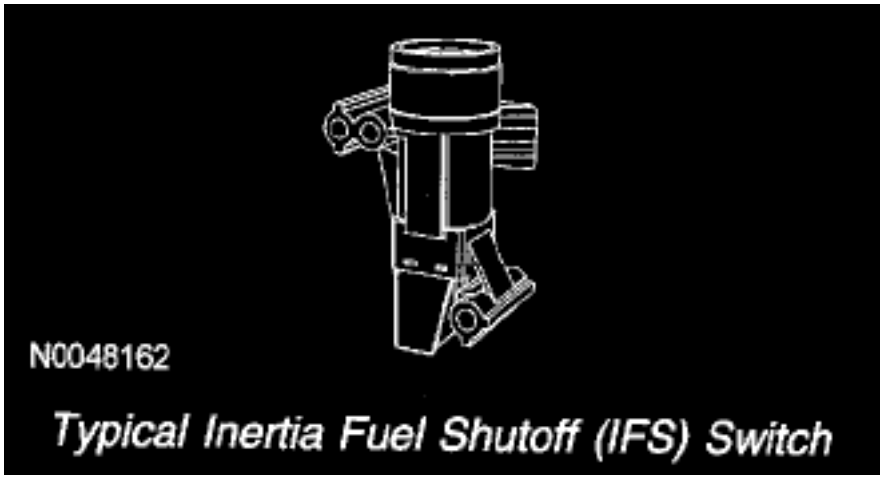
Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Powertrain Management > Fuel Delivery and Air Induction > Inertia Fuel Shutoff Switch > Component Information > Locations



View 151-1


Connector: C282
Description:
INERTIA FUEL SHUTOFF (IFS) SWITCH
Harness:
14290
Base Part #:
9D362
3
2
1
Pin Circuit Gauge Circuit Function Qualifier
1 VE518 (BN-WH) 14 MONITOR - FUEL PUMP (FPM)
2 CE911 (VT-WH) 14 SWITCH - INERTIA POWER OFF (ISPO)
3 * * not used

C282

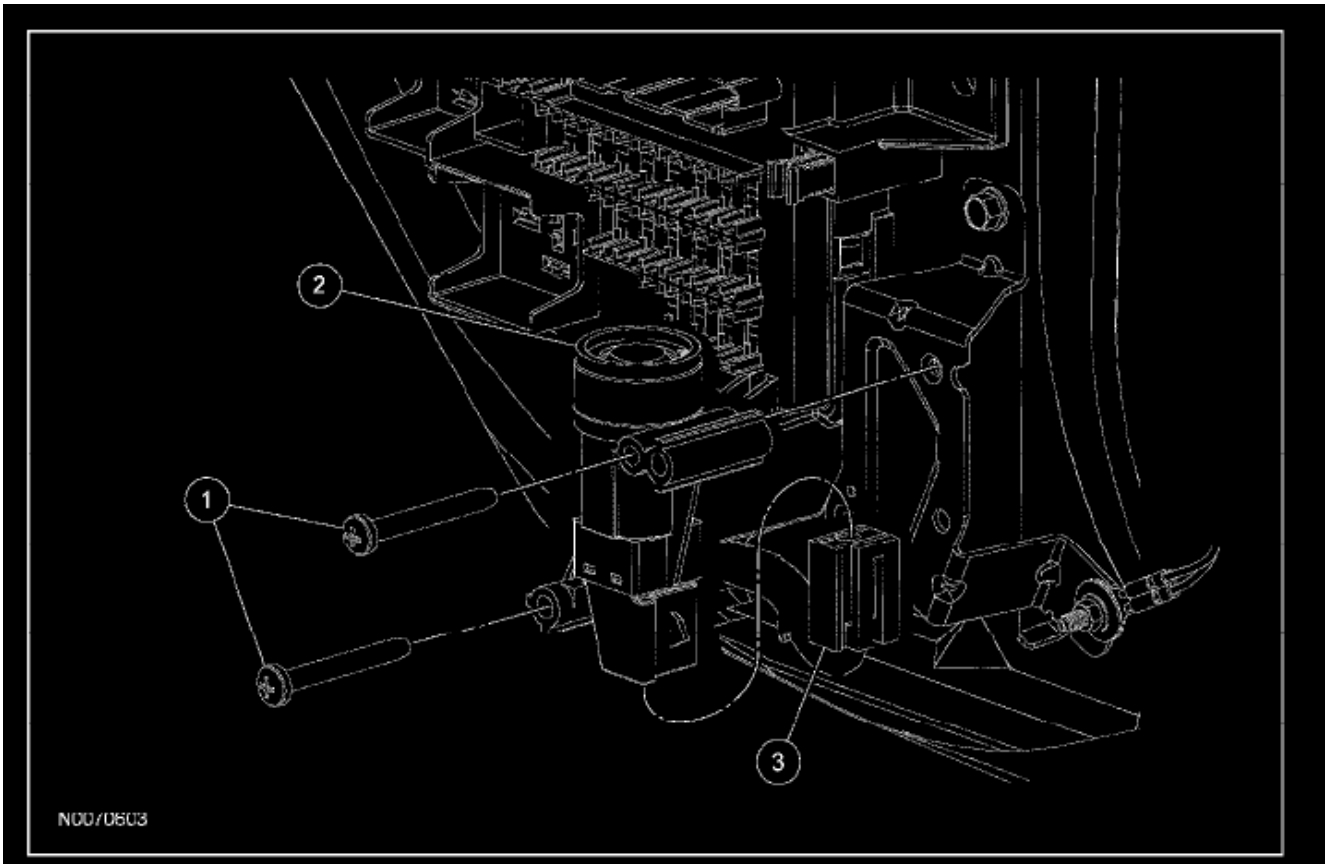


Inertia Fuel Shutoff Switch: Description and Operation

INERTIA FUEL SHUTOFF (IFS) SWITCH

Typical Inertia Fuel Shutoff (IFS) Switch

The IFS switch is used in conjunction with the electric fuel pump. The purpose of the IFS switch is to shutoff the fuel pump if a collision occurs. It consists of a steel ball held in place by a magnet. When a sharp impact occurs, the ball breaks loose from the magnet, rolls up a conical ramp and strikes a target plate which opens the electrical contacts of the switch and shuts off the electric fuel pump. Once the switch is open, it must be manually reset before restarting the vehicle. Refer to the Owner's Literature, Roadside Emergencies for the location of the IFS switch.



Item	Part Number	Description
1	W504467	Inertia fuel shutoff (IFS) switch screws
2	9341	IFS switch
3	—	IFS switch electrical connector (part of 180101)

Inertia Fuel Shutoff Switch: Service and Repair

INERTIA FUEL SHUTOFF (IFS) SWITCH

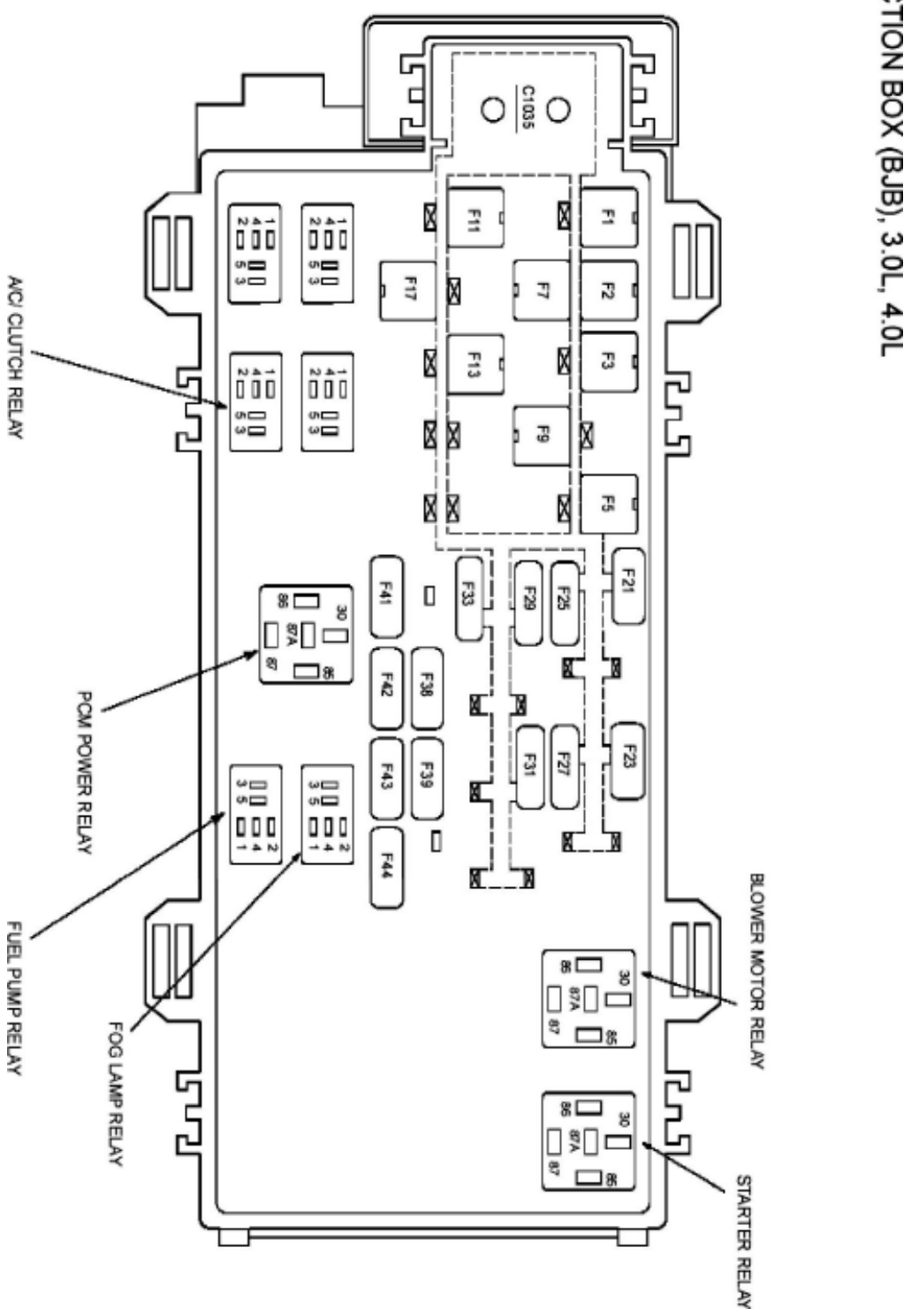
Removal and Installation

1. NOTE: The inertia fuel shutoff (IFS) switch is located behind the RH cowl panel.

Remove the RH scuff plate and cowl panel.

2. Remove the screws and the IFS switch. 3. Disconnect the IFS switch electrical connector. 4. To install, reverse the removal procedure.

BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L

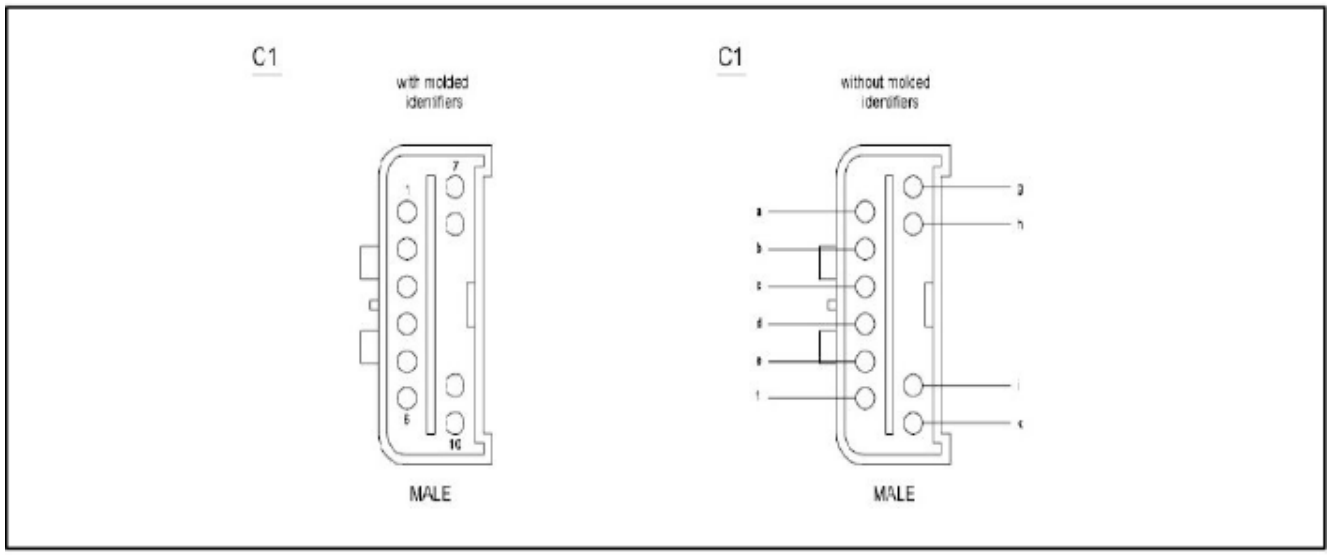


Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



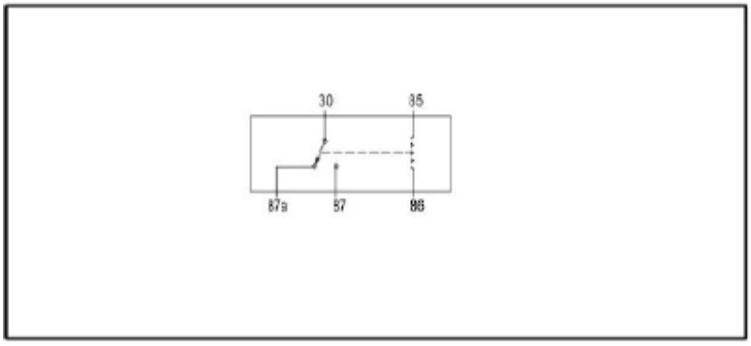
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

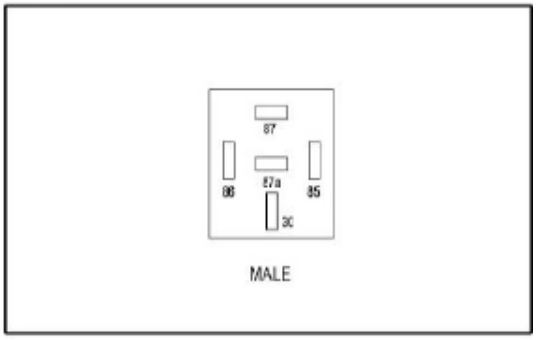
Main Relay (Computer/Fuel System): Testing and Inspection

Relay □ Mini ISO

Schematic



Terminals

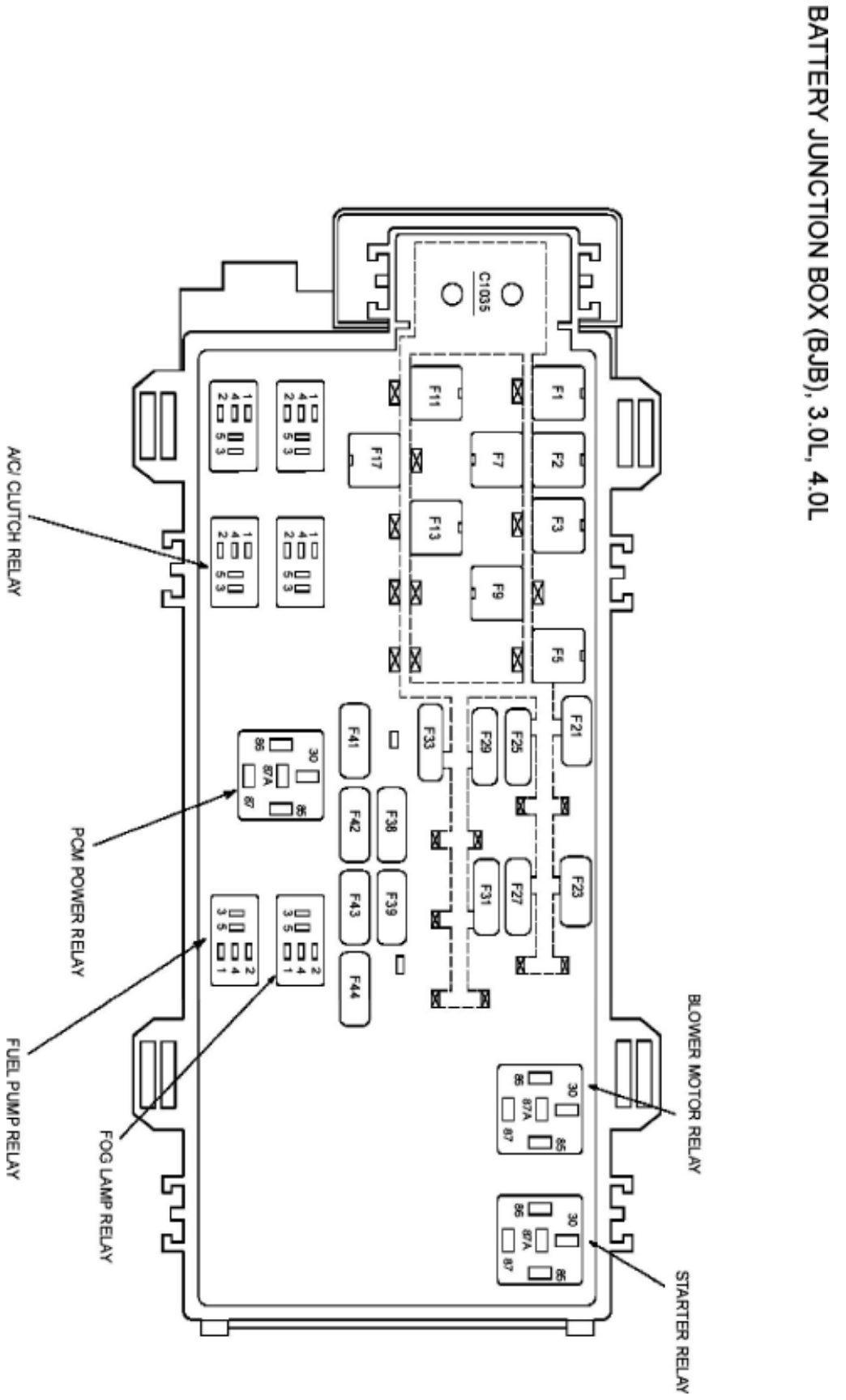


Component testing procedure (no voltage applied)

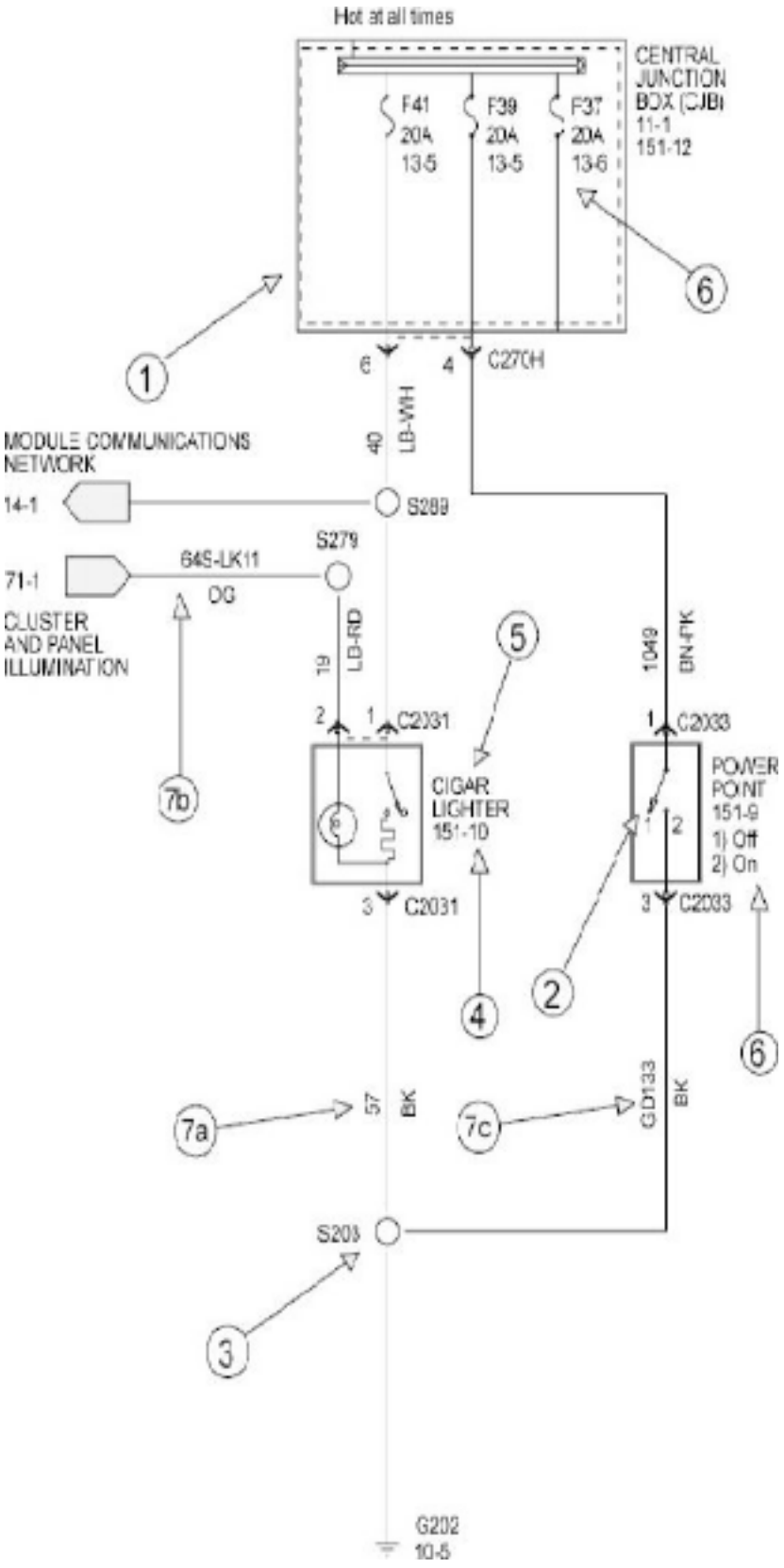
Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 30 and 35 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.


BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L
C1035
F1
F2
F3
F5
F7
F9
F11
F13
F17
F21
F23
F25
F27
F29
F31
F33
F38
F39
F41
F42
F43
F44
A/C CLUTCH RELAY
PCM POWER RELAY
FUEL PUMP RELAY
FOG LAMP RELAY
BLOWER MOTOR RELAY
STARTER RELAY

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Powertrain Management > Fuel Delivery and Air Induction > Relays and Modules - Fuel Delivery and Air Induction > Fuel Pump Relay > Component Information > Diagrams > Diagram Information and Instructions



Fuel Pump Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

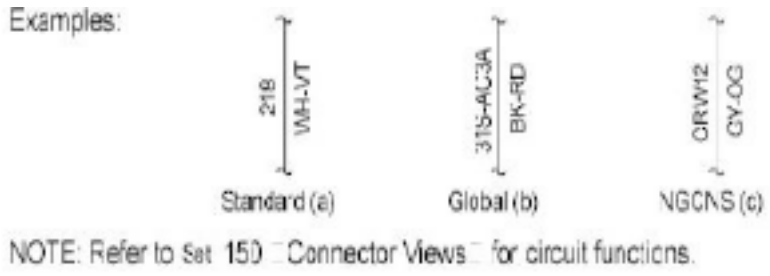
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

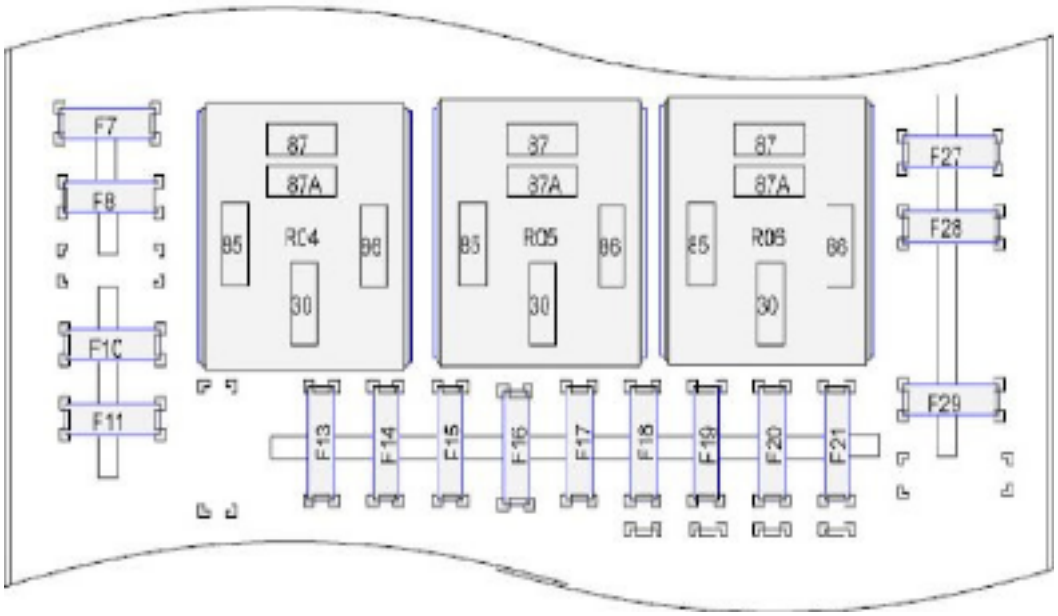
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

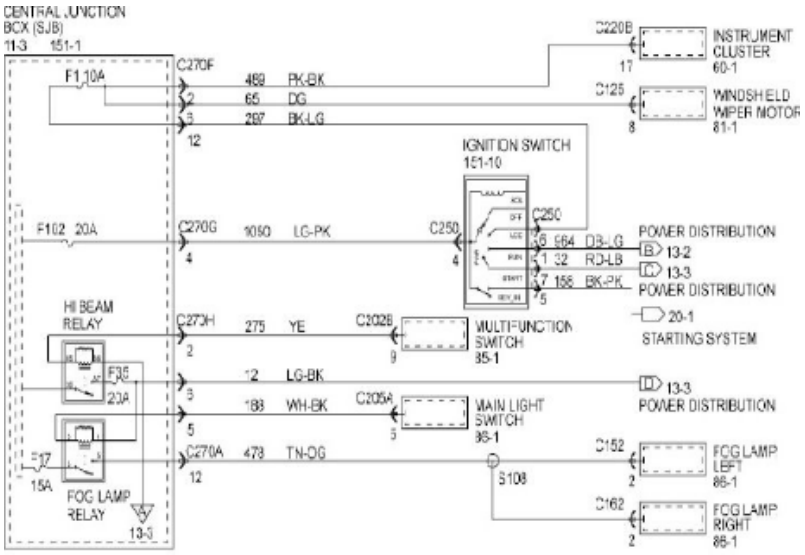
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

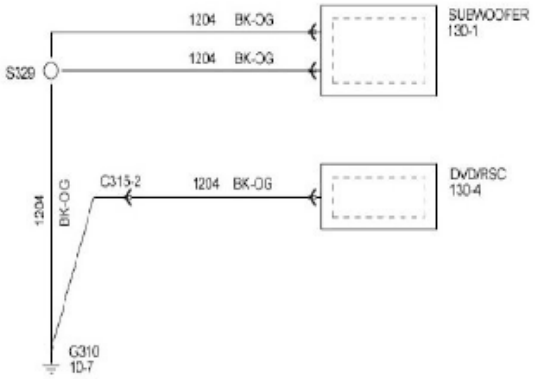
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by

each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

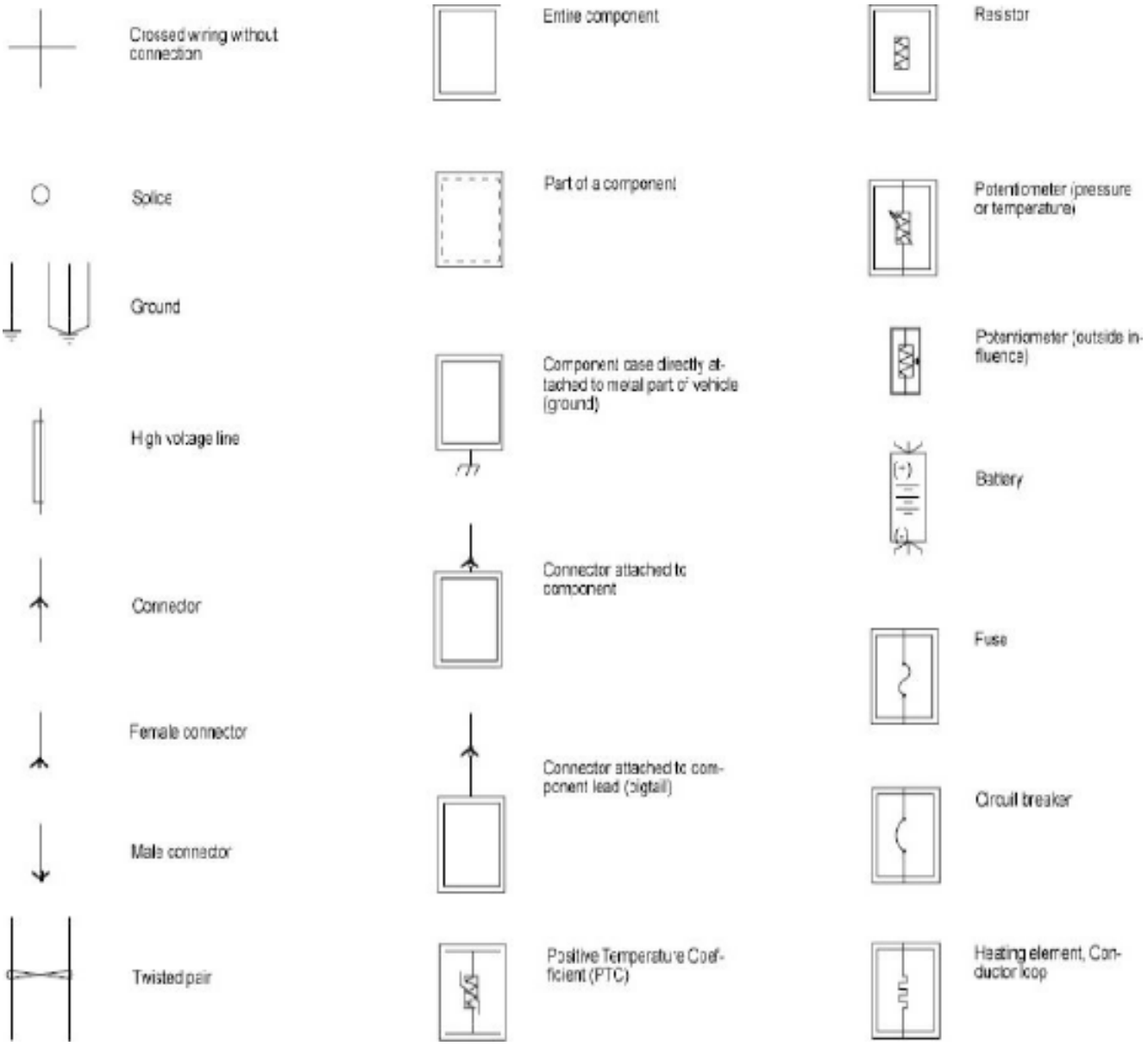
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

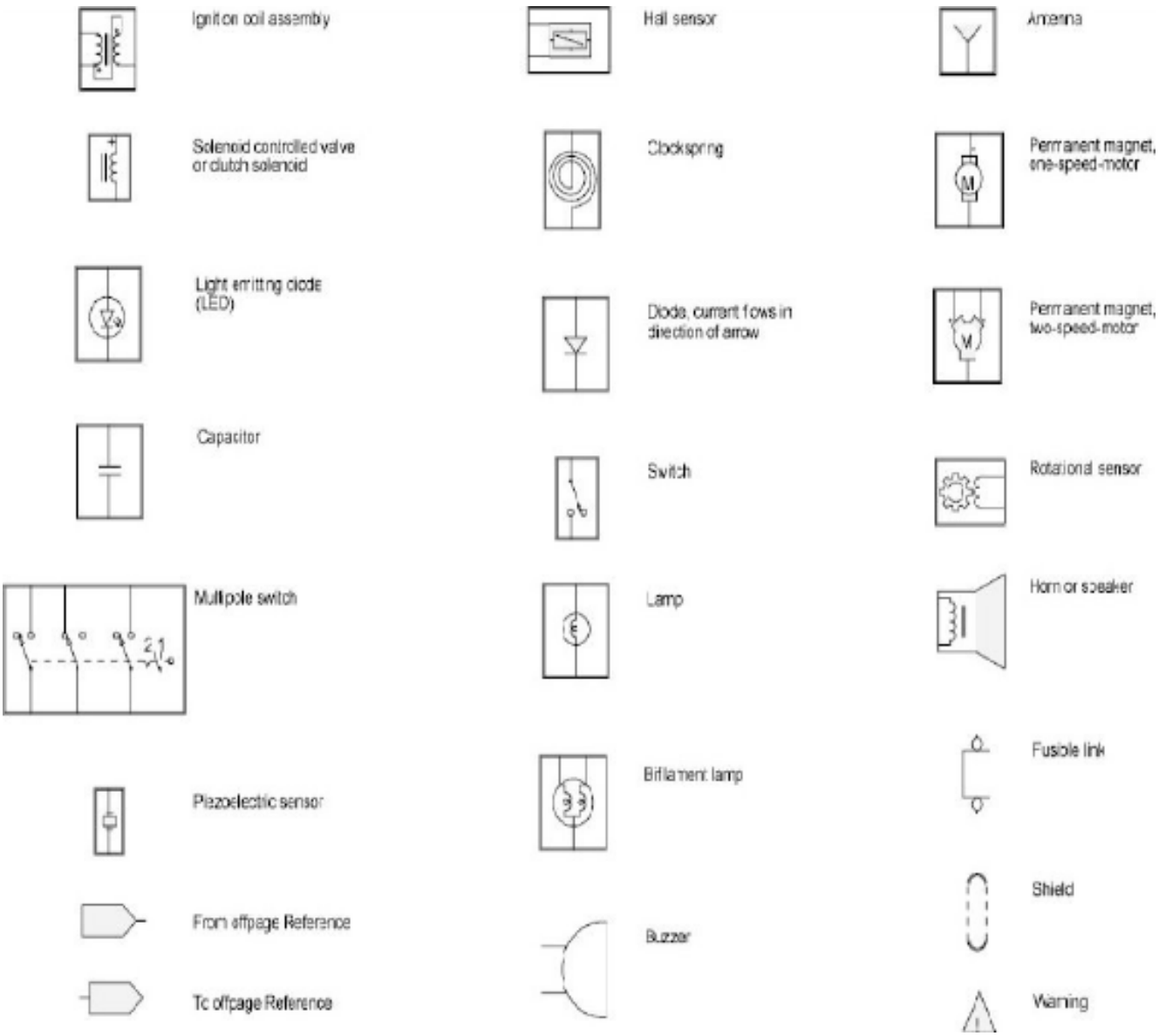
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

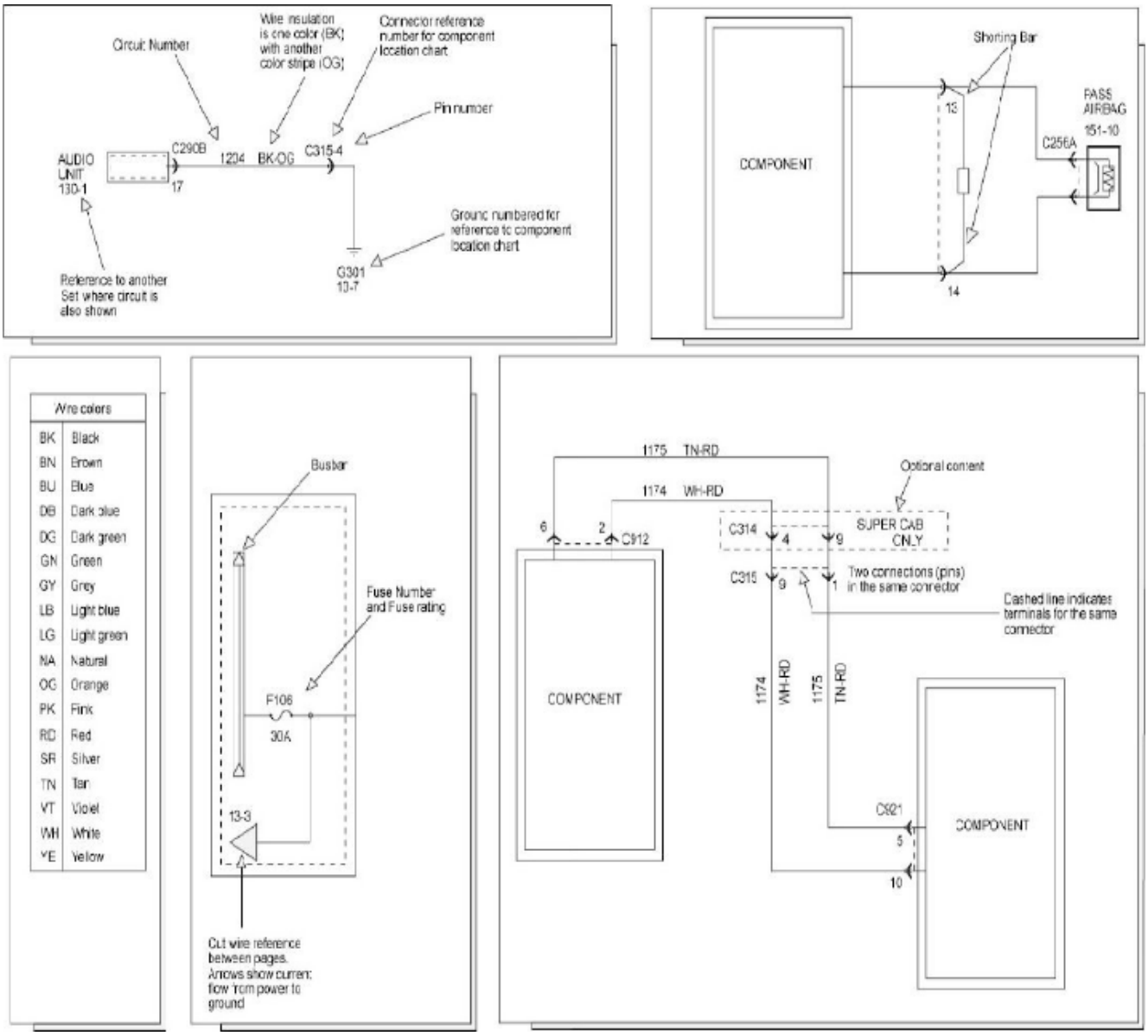
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

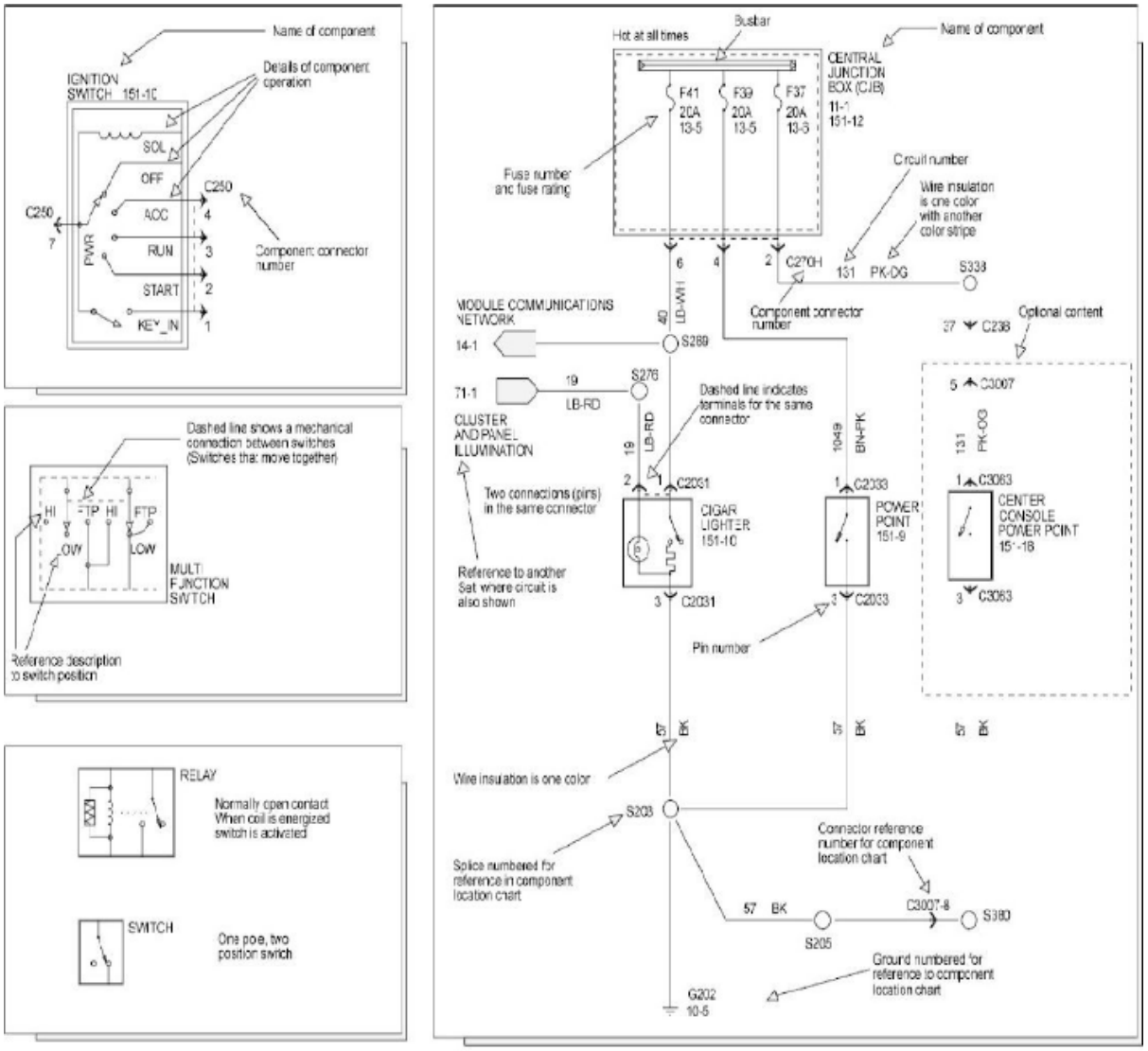
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

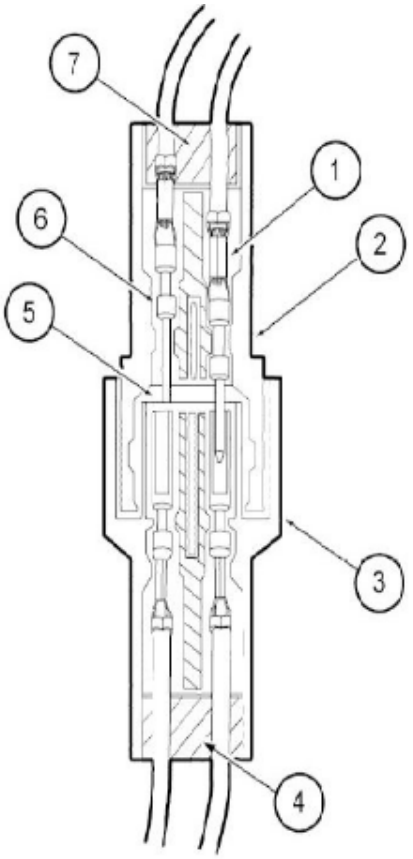


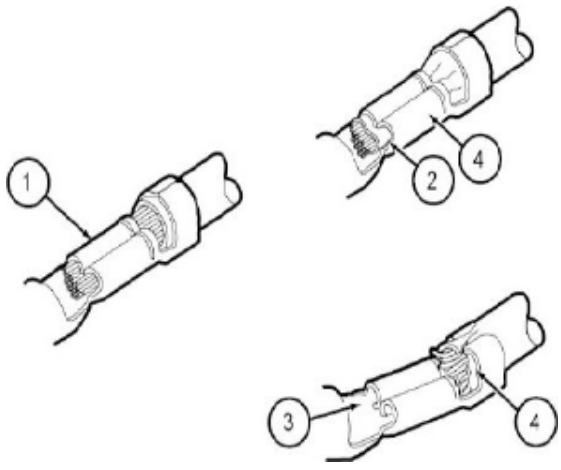
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)





Fuel Pump Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

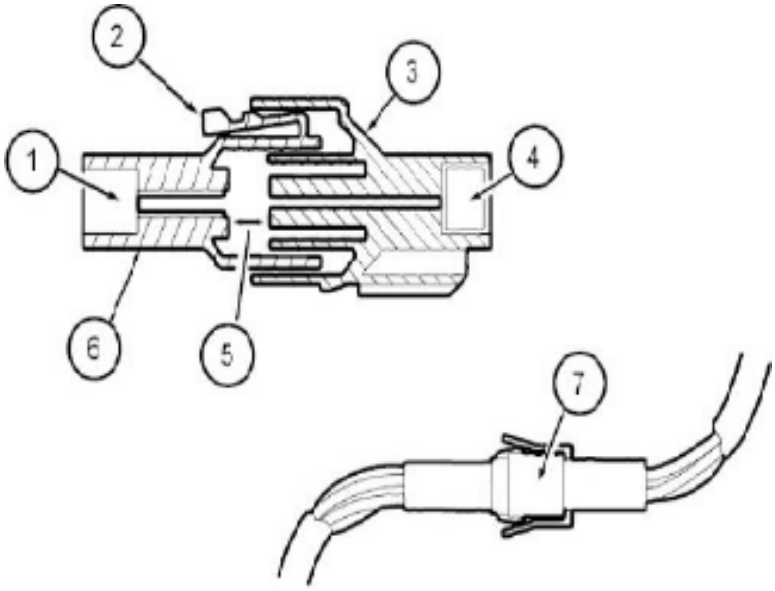
5 = Intermittent contact

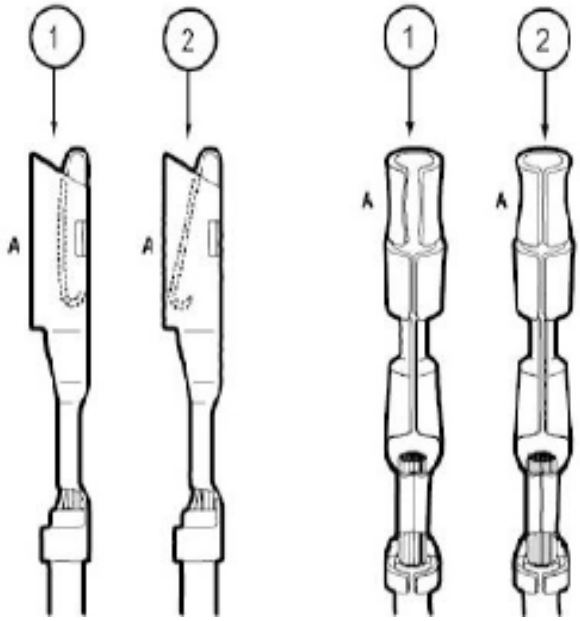
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping





1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

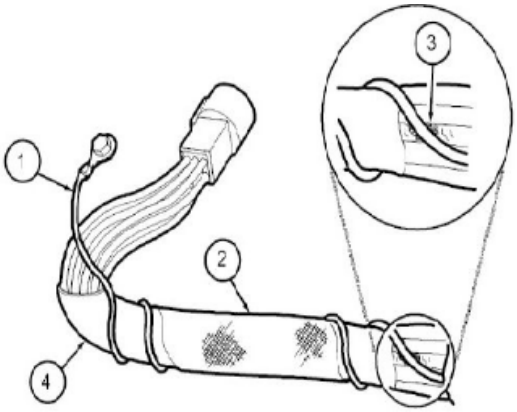
Deformed (enlarged) female terminals

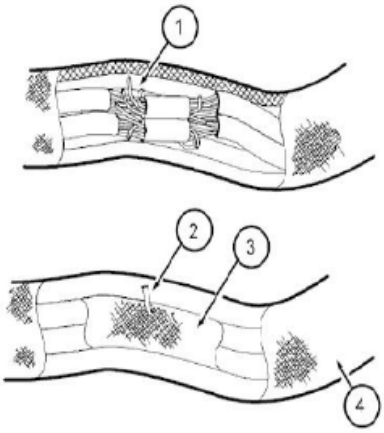
1 = Enlarged

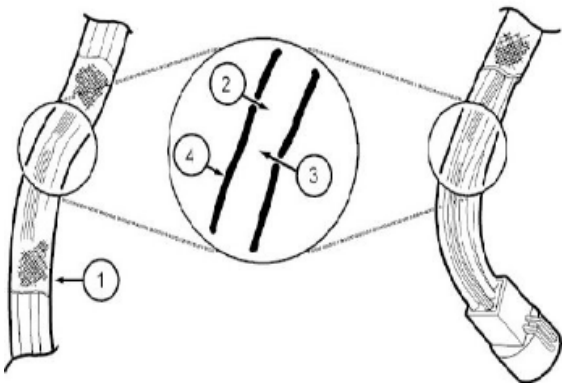
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.







Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

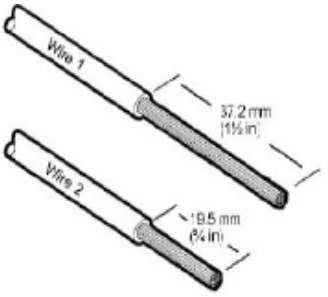
Splice covered 2

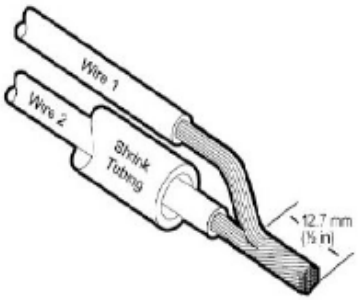
= Wire strand

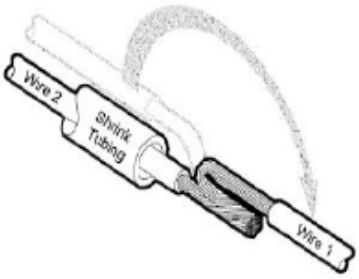
3 = Splice tape

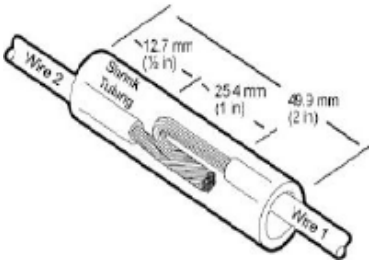
4 = Harness tape

Broken wire strands in harness









1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. lnstall heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

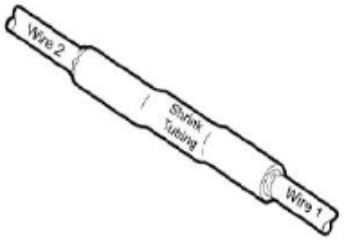
NOTE: -

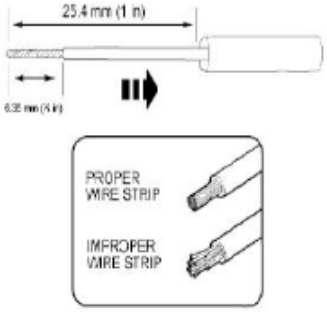
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

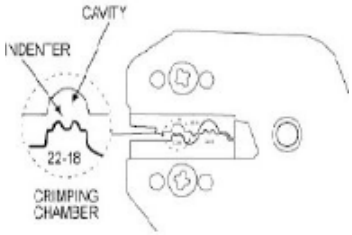
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

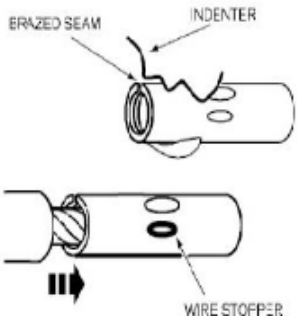
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.









7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

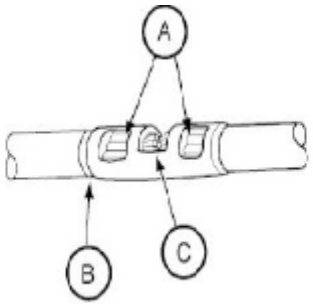
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

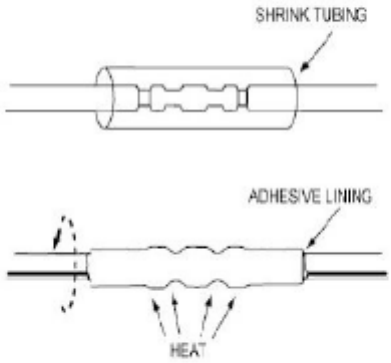
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4 strip, cut 9 strands	* 1/4 strip, cut 2 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip, fold 3x dia.
	16-14	* 1/4 strip, cut 7 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip fold 2x dia	1 strip, fold 3x dia.	1 1/4 strip, fold 4x dia.	Not Recommended
	12-10	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip, fold 3x cia.	1 1/4 strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Pigtail only

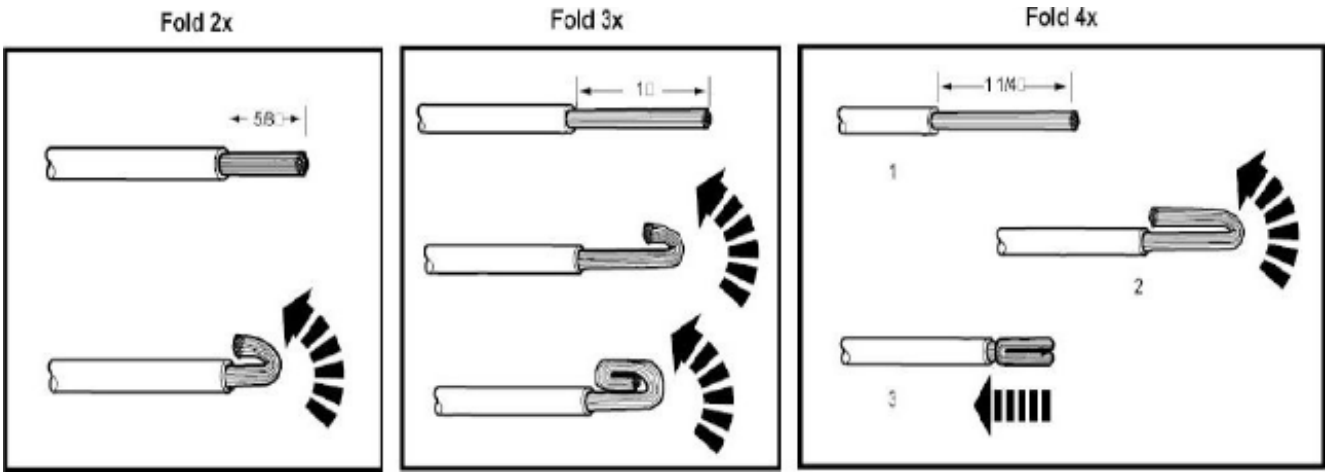
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



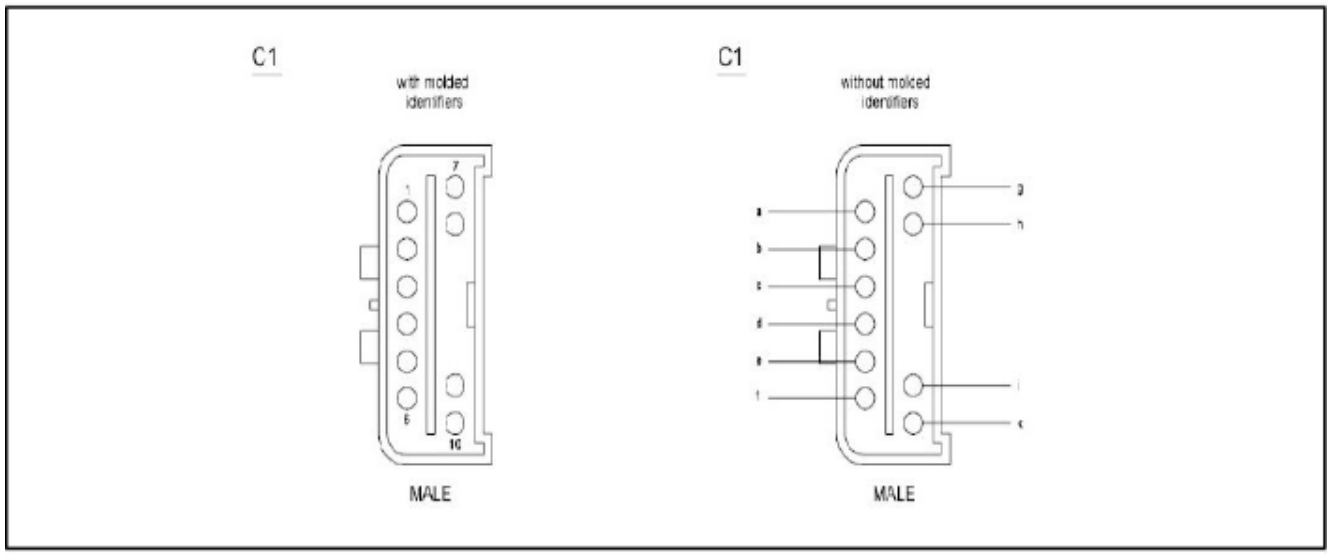
The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



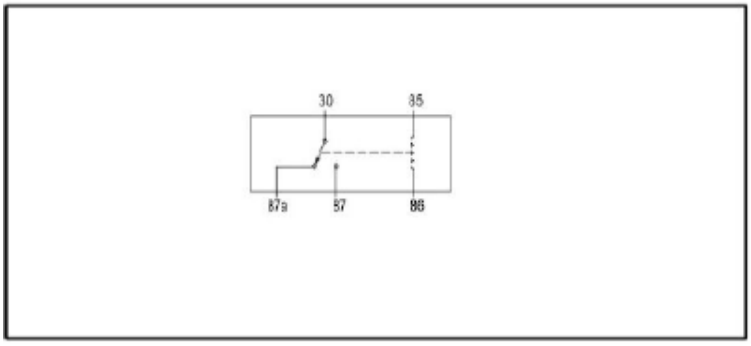
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

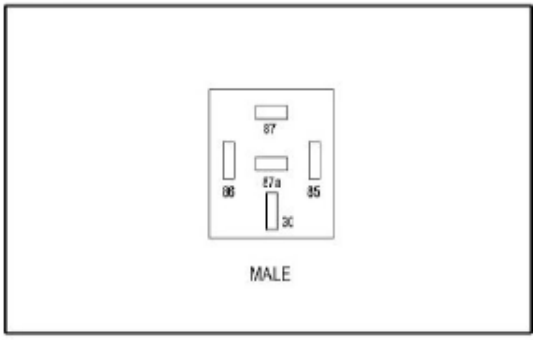
Fuel Pump Relay: Testing and Inspection Mini ISO Relay

Relay □ Mini ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

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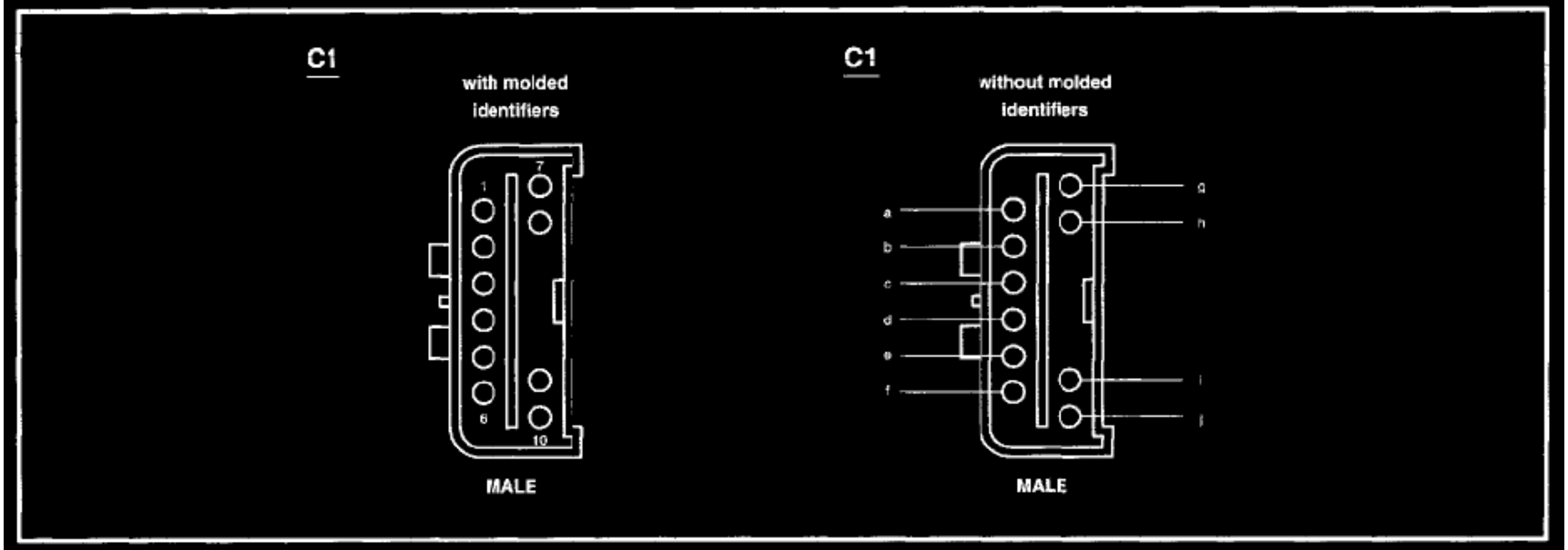

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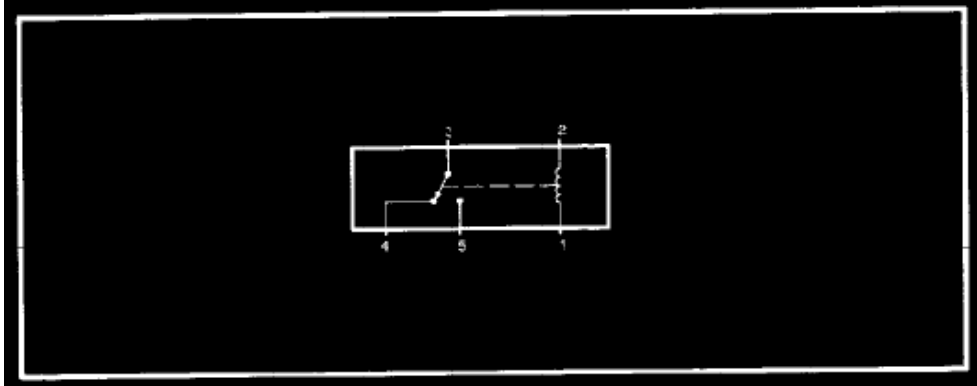
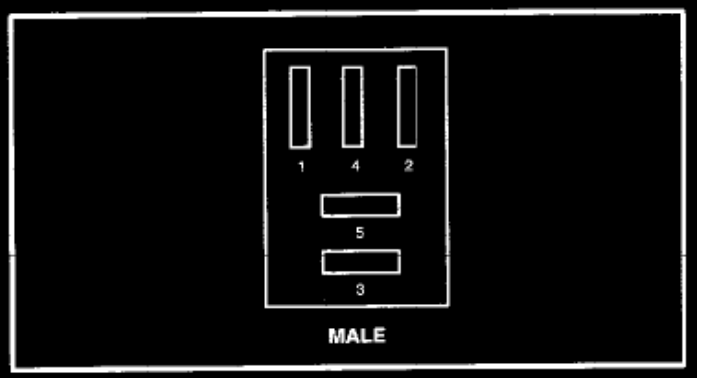
Fuel Pump Relay: Testing and Inspection Micro ISO Relay

Relay – Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63–102Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil – Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

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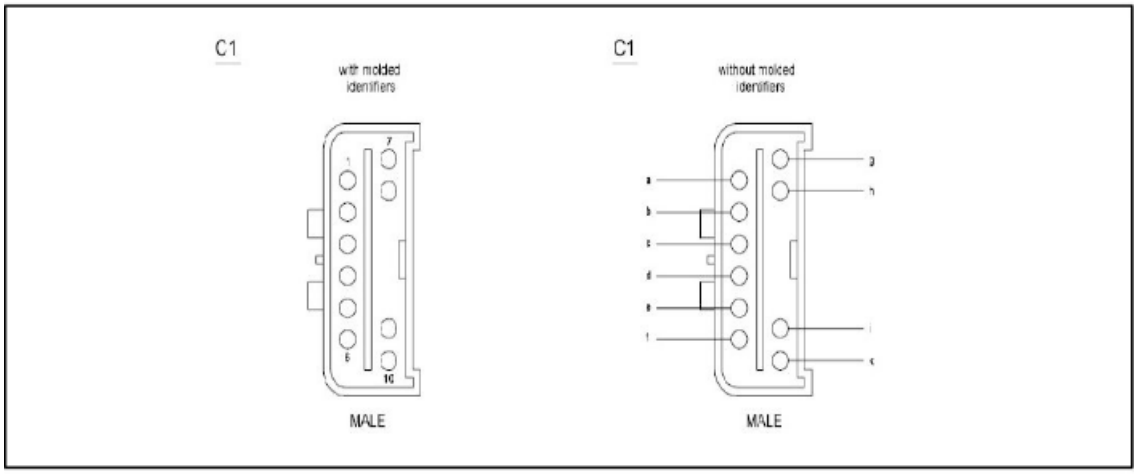

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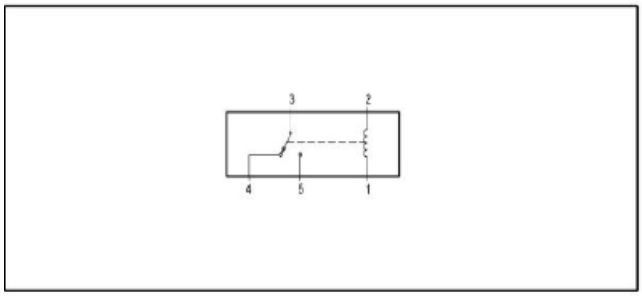
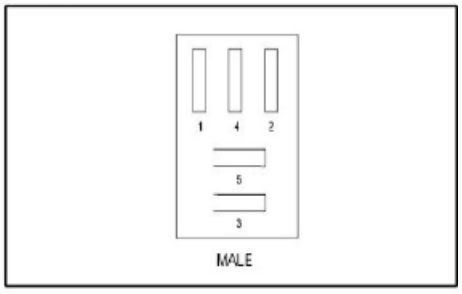
Relay □ Micro ISO

Schematic



Terminals



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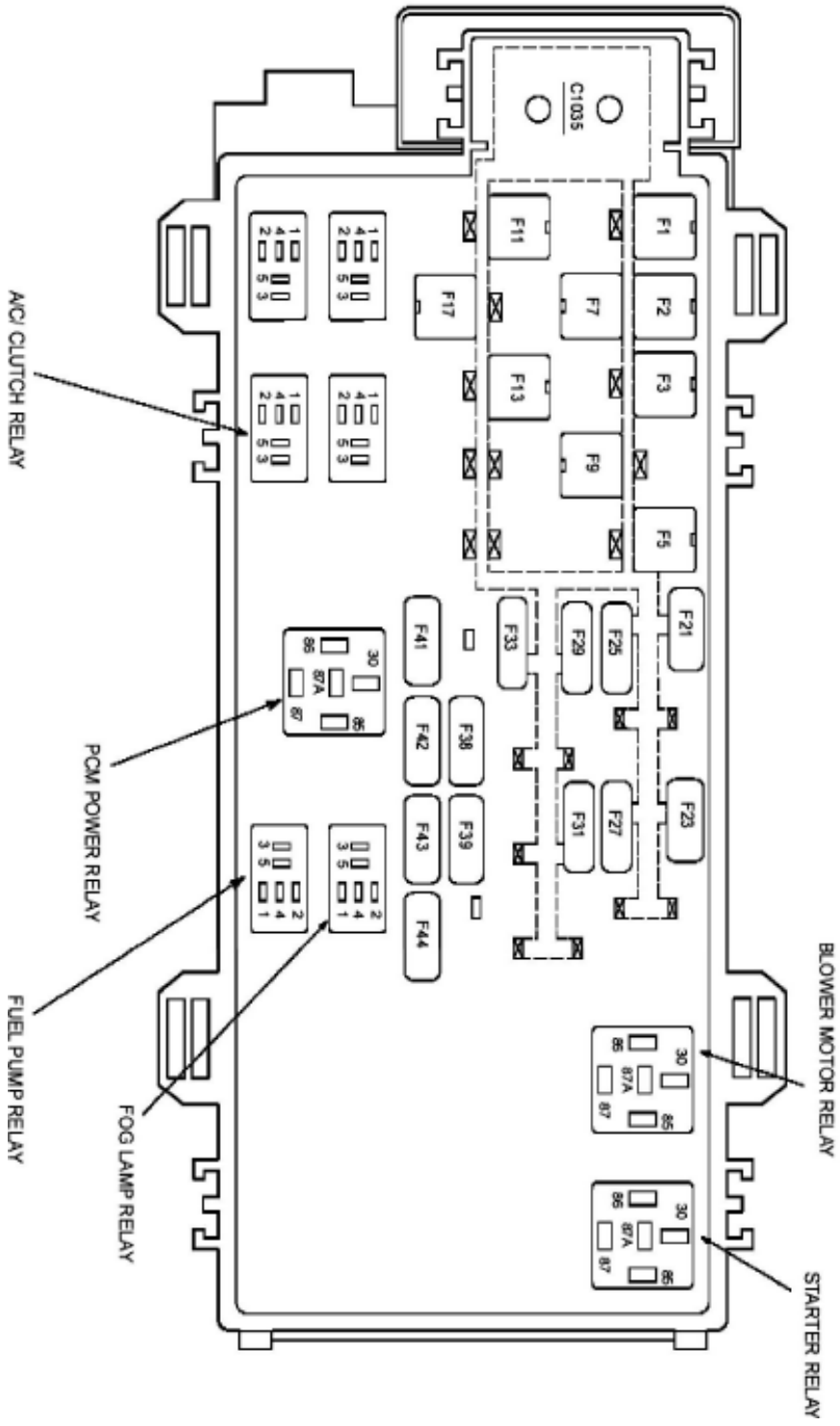
Coil	1 and 2	63□102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil □ Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L



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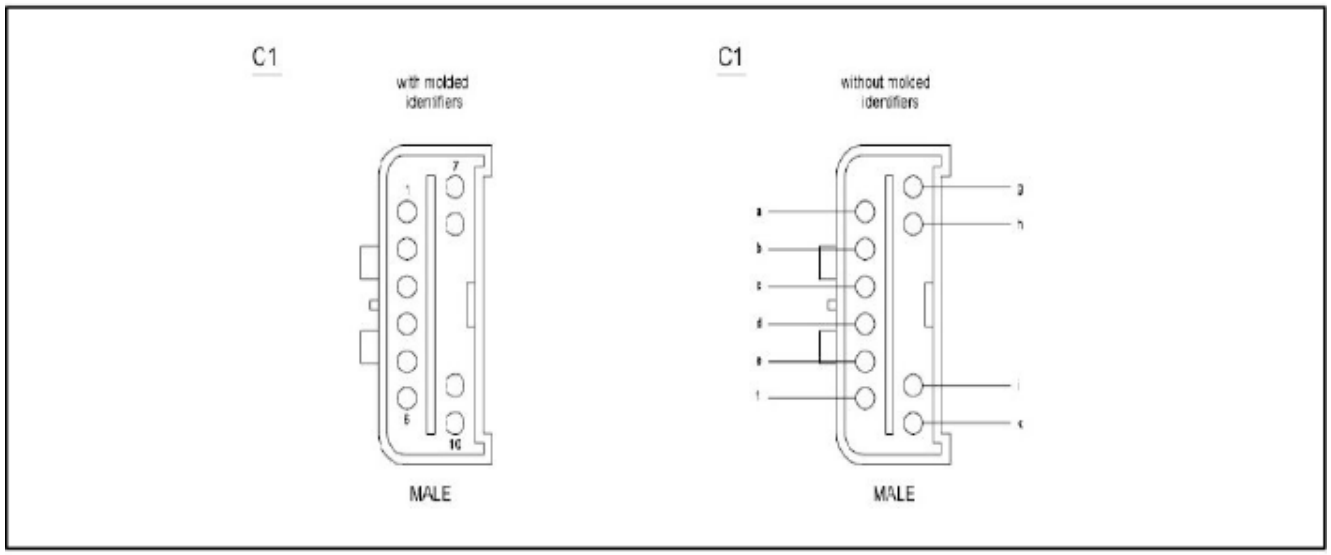
Terminals



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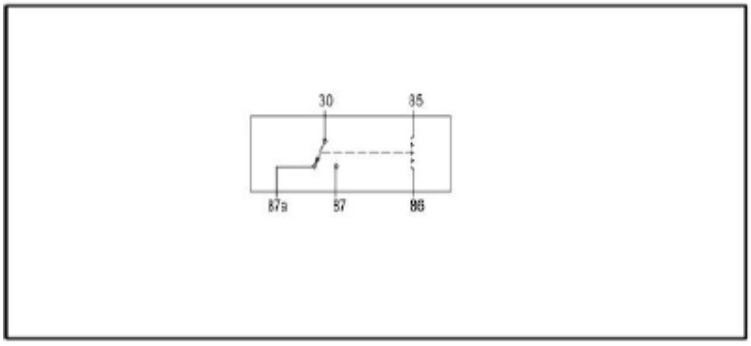
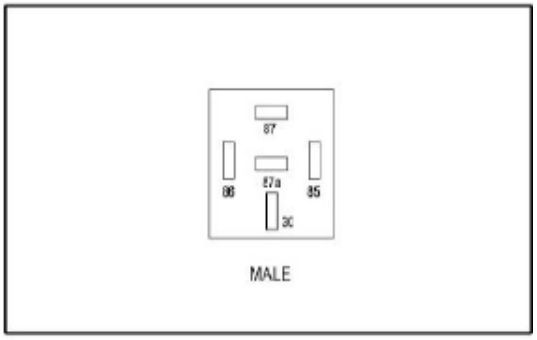
Main Relay (Computer/Fuel System): Testing and Inspection

Relay □ Mini ISO

Schematic



Terminals

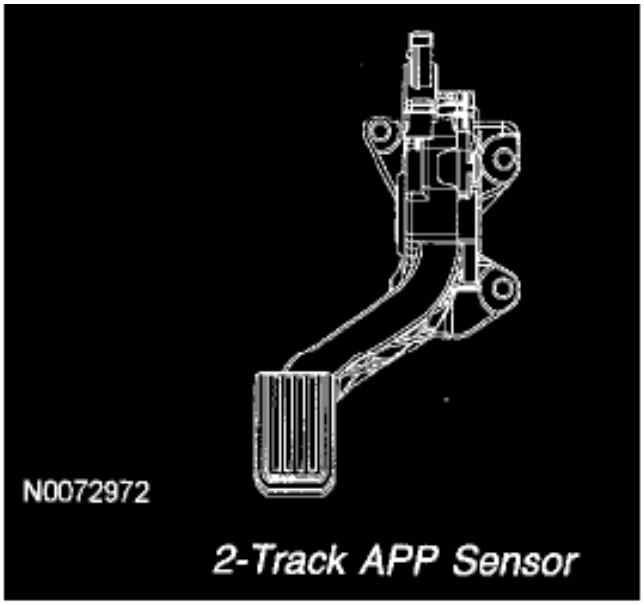


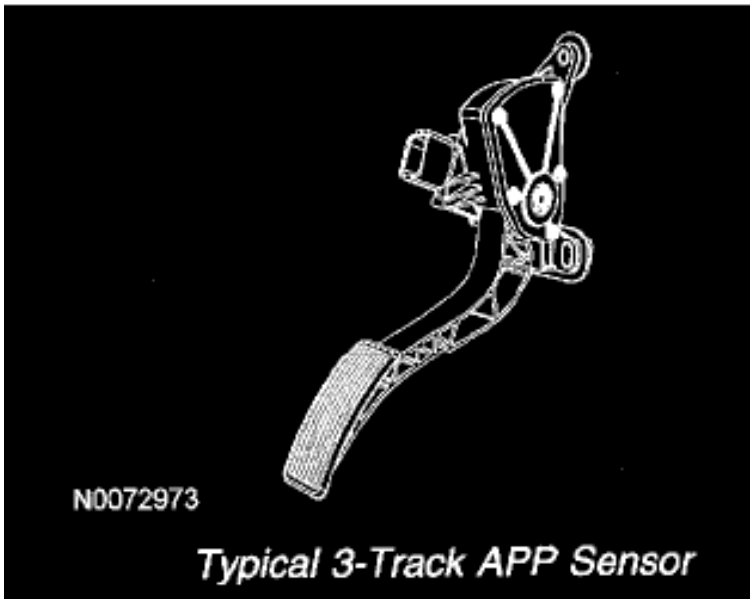
Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.


N0072972
2-Track APP Sensor


N0072973
Typical 3-Track APP Sensor

Accelerator Pedal Position Sensor: Description and Operation

ACCELERATOR PEDAL POSITION (APP) SENSOR

The APP sensor is an input to the powertrain control module (PCM) and is used to determine the amount of torque requested by the operator. Depending on the application either a 2-track or 3-track APP sensor is used.

2-Track APP Sensor

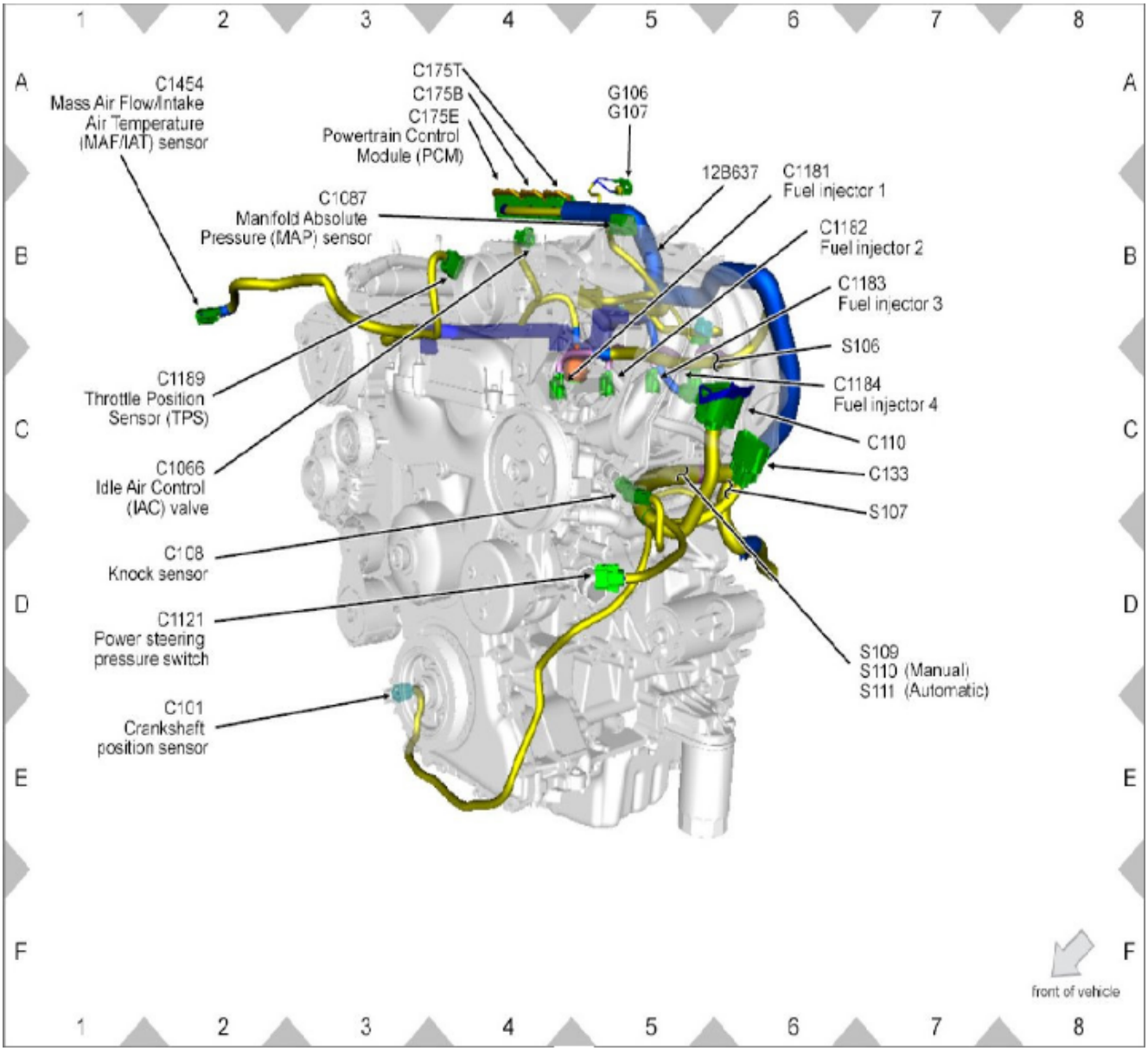
2-Track APP Sensor

There are 2 pedal position signals in the sensor. Both signals, APP1 and APP2, have a positive slope (increasing angle, increasing voltage), but are offset and increase at different rates. The 2 pedal position signals make sure the PCM receives a correct input even if 1 signal has a concern. The PCM determines if a signal is incorrect by calculating where it should be, inferred from the other signals. If a concern is present with one of the circuits the other input is used. There are 2 reference voltage circuits, 2 signal return circuits, and 2 signal circuits (a total of 6 circuits and pins) between the PCM and the APP sensor assembly. The reference voltage circuits and the signal return circuits are shared with the reference voltage circuit and signal return circuit used by the electronic throttle body (ETB) throttle position sensor. The pedal position signal is converted to pedal travel degrees (rotary angle) by the PCM. The software then converts these degrees to counts, which is the input to the torque based strategy.

3-Track APP Sensor

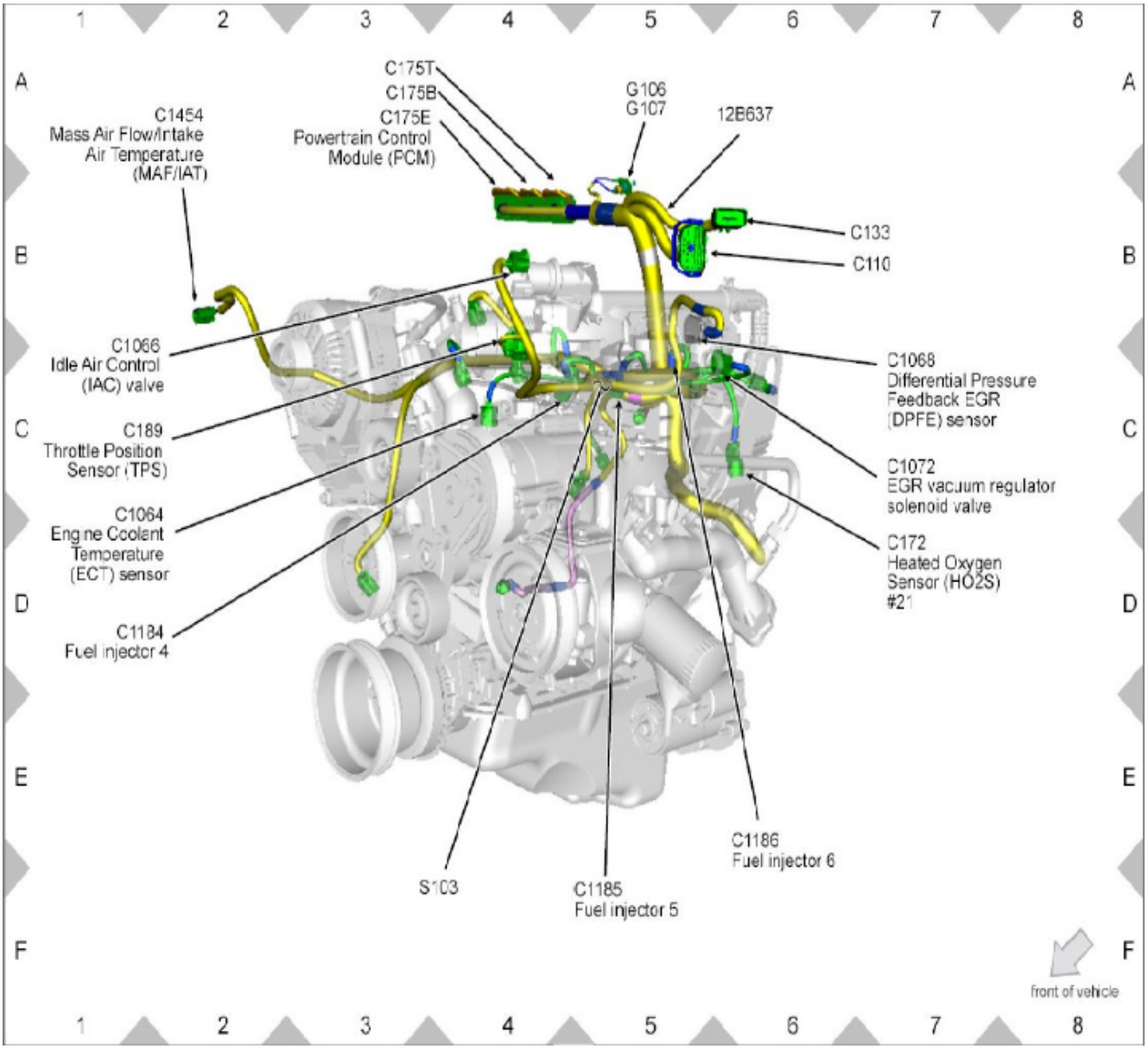
Typical 3-Track APP Sensor

There are 3 pedal position signals in the sensor. Signal 1, APP1, has a negative slope (increasing angle, decreasing voltage) and signals 2 and 3, APP2 and APP3, both have a positive slope (increasing angle, increasing voltage). During normal operation APP1 is used as the indication of pedal position by the strategy. The 3 pedal position signals make sure the PCM receives a correct input even if 1 signal has a concern. The PCM determines if a signal is incorrect by calculating where it should be, inferred from the other signals. If a concern is present with one of the circuits the other inputs are used. The pedal position signal is converted to pedal travel degrees (rotary angle) by the PCM. The software then converts these degrees to counts, which is the input to the torque based strategy. There are 2 reference voltage circuits, 2 signal return circuits, and 3 signal circuits (a total of 7 circuits and pins) between the PCM and the APP sensor assembly. The reference voltage circuits and the signal return circuits are shared with the reference voltage circuit and signal return circuit used by the electronic throttle body (ETB) throttle position sensor.

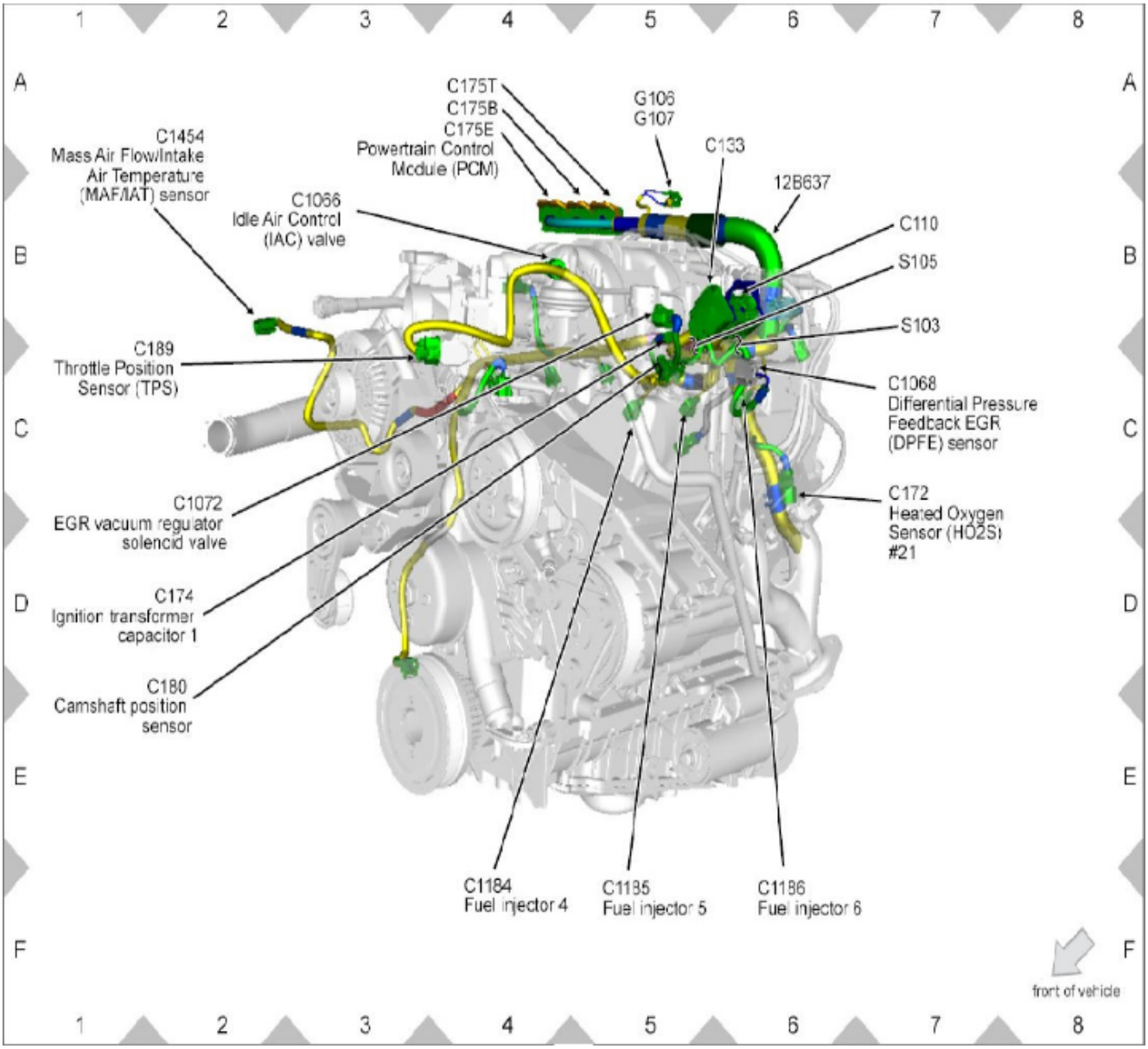


Air Flow Meter/Sensor: Locations

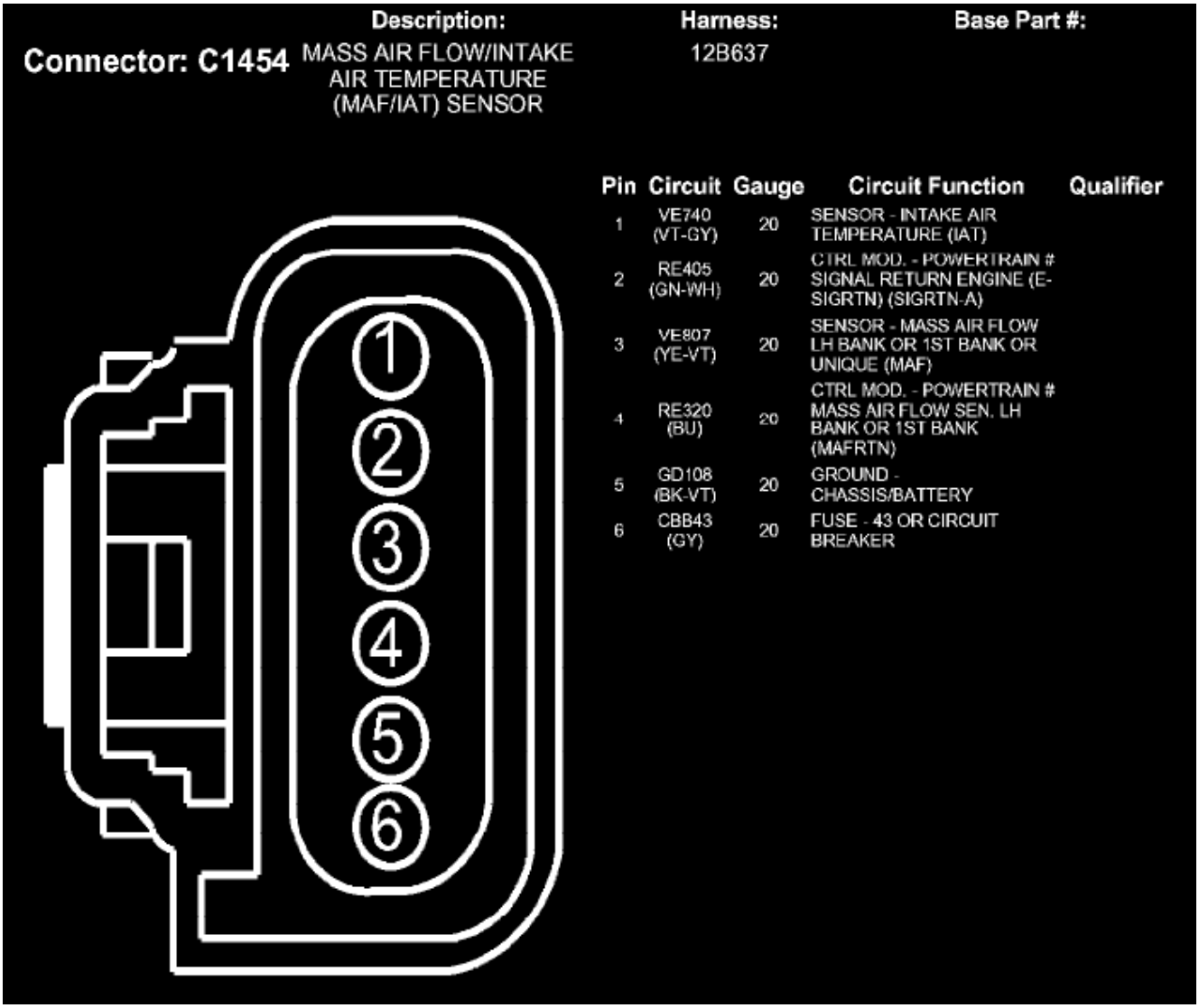
View 151-3


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
12B637
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT)
C133
C110
C1066
Idle Air Control (IAC) valve
C189
Throttle Position Sensor (TPS)
C1064
Engine Coolant Temperature (ECT) sensor
C1184
Fuel injector 4
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
S103
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-5


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
C133
12B637
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor
C1066
Idle Air Control (IAC) valve
C110
S105
S103
C189
Throttle Position Sensor (TPS)
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
C174
Ignition transformer capacitor 1
C180
Camshaft position sensor
C1184
Fuel injector 4
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-7



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE740 (VT-GY)	20	SENSOR - INTAKE AIR TEMPERATURE (IAT)	
2	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	
3	VE807 (YE-VT)	20	SENSOR - MASS AIR FLOW LH BANK OR 1ST BANK OR UNIQUE (MAF)	
4	RE320 (BU)	20	CTRL MOD. - POWERTRAIN # MASS AIR FLOW SEN. LH BANK OR 1ST BANK (MAFRTN)	
5	GD108 (BK-VT)	20	GROUND - CHASSIS/BATTERY	
6	CBB43 (GY)	20	FUSE - 43 OR CIRCUIT BREAKER	

C1454

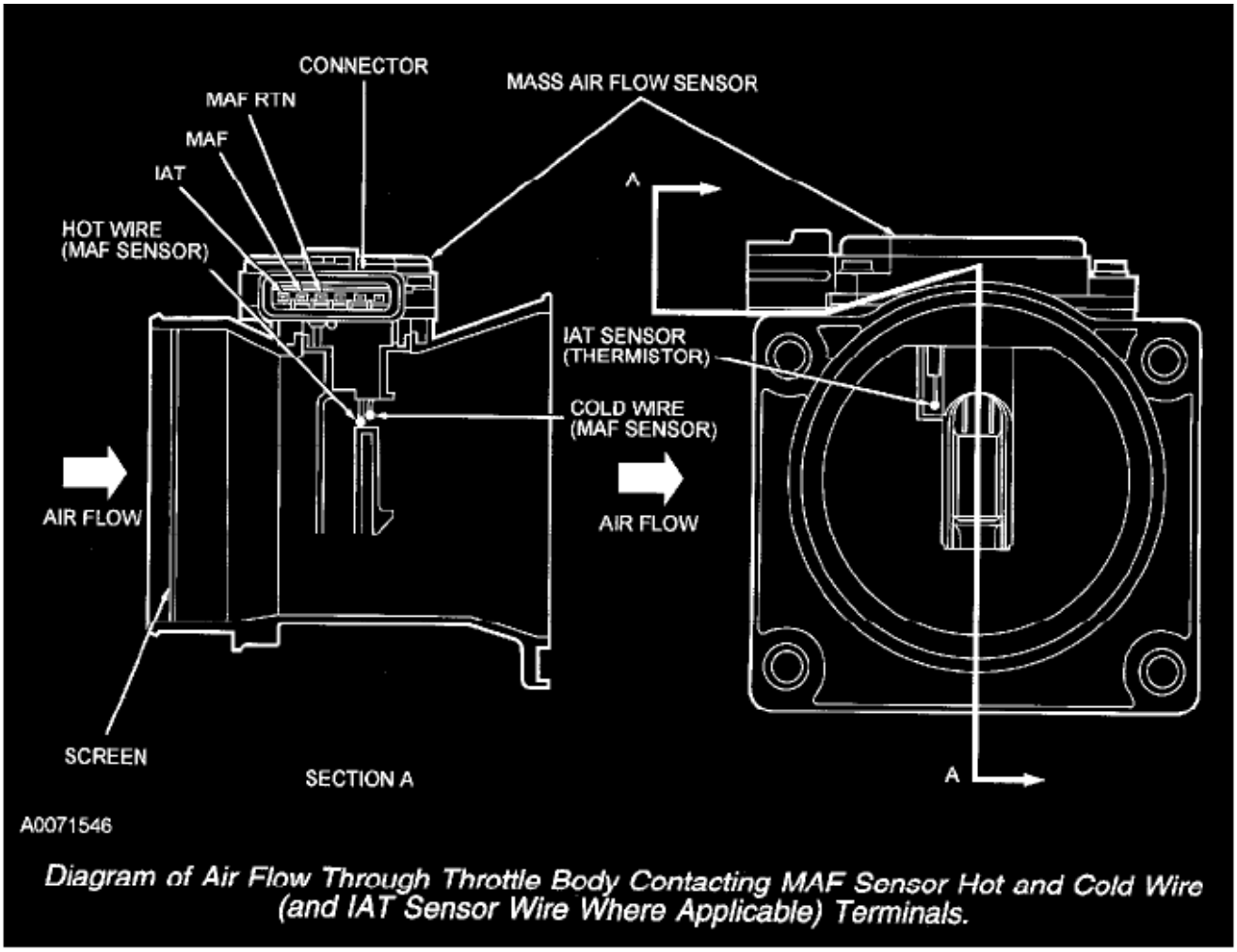
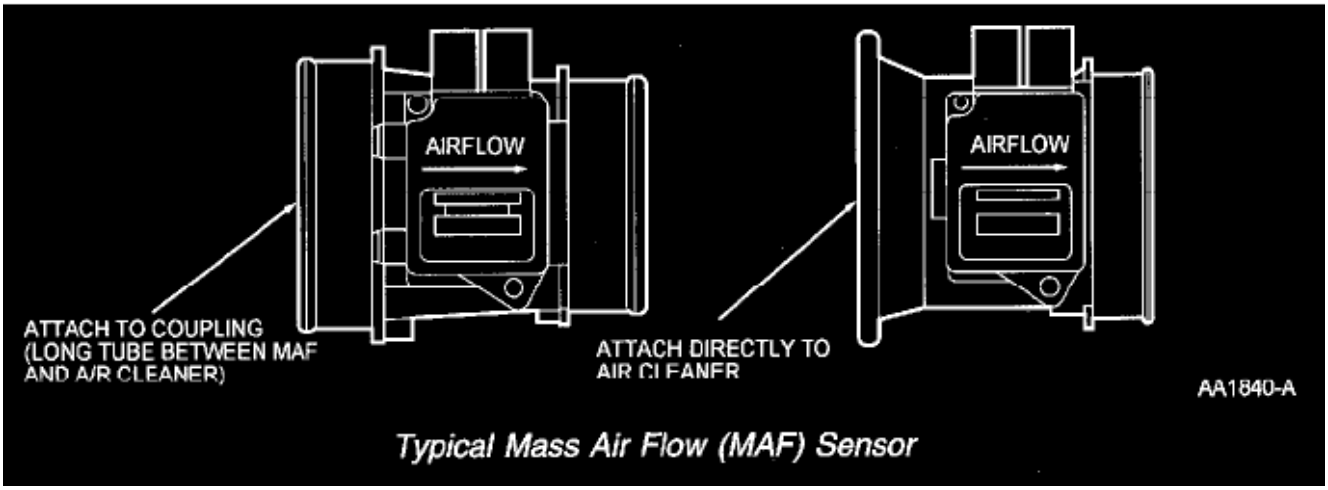


Diagram of Air Flow Through Throttle Body Contacting MAF Sensor Hot and Cold Wire (and IAT Sensor Wire Where Applicable) Terminals.



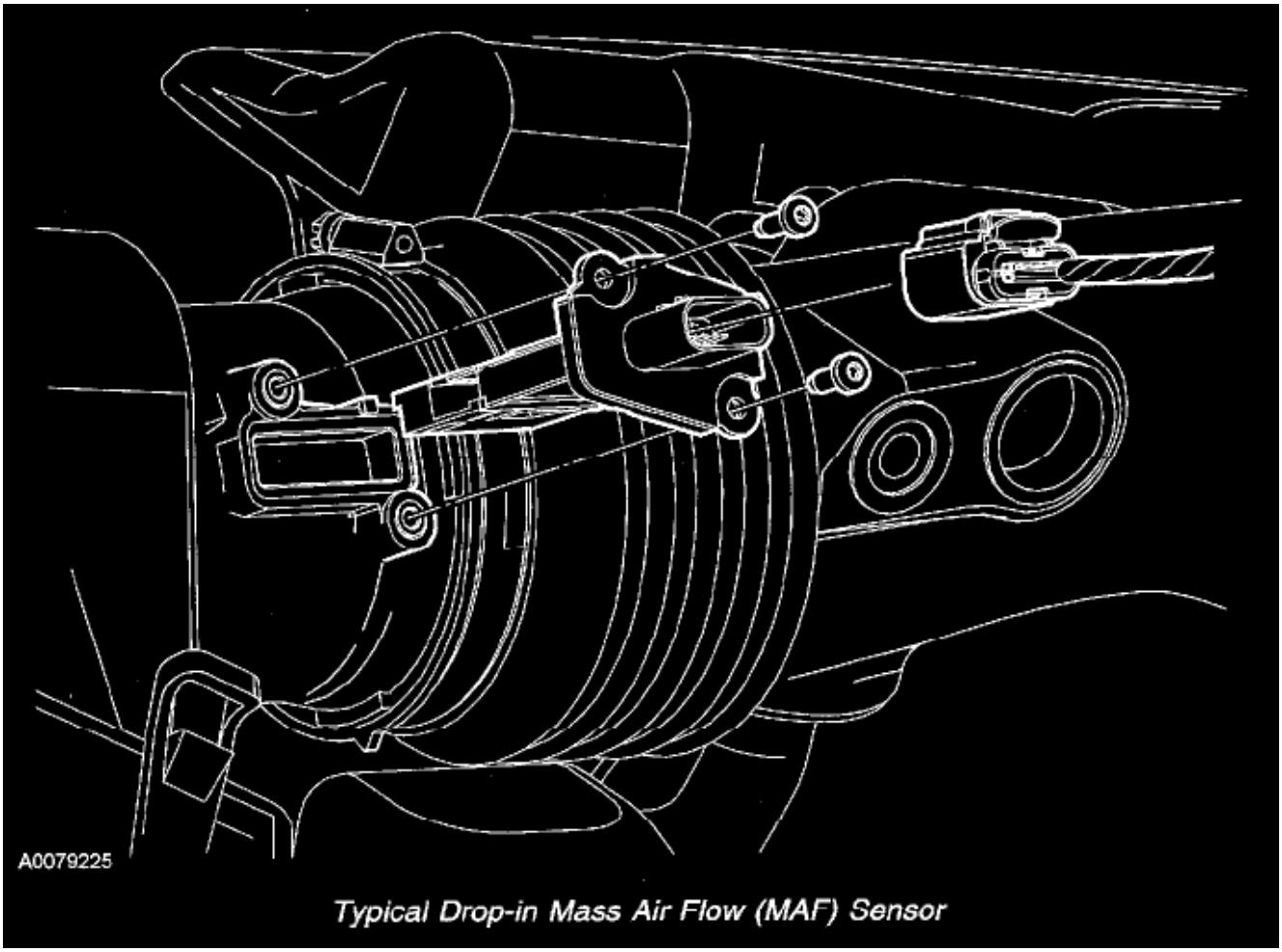
Typical Mass Air Flow (MAF) Sensor

Air Flow Meter/Sensor: Description and Operation

MASS AIR FLOW (MAF) SENSOR

Diagram Of Air Flow Through Throttle Body Contacting MAF Sensor Hot And Cold Wire (and IAT Sensor Wire Where Applicable) Terminals

Typical Mass Air Flow (MAF) Sensor

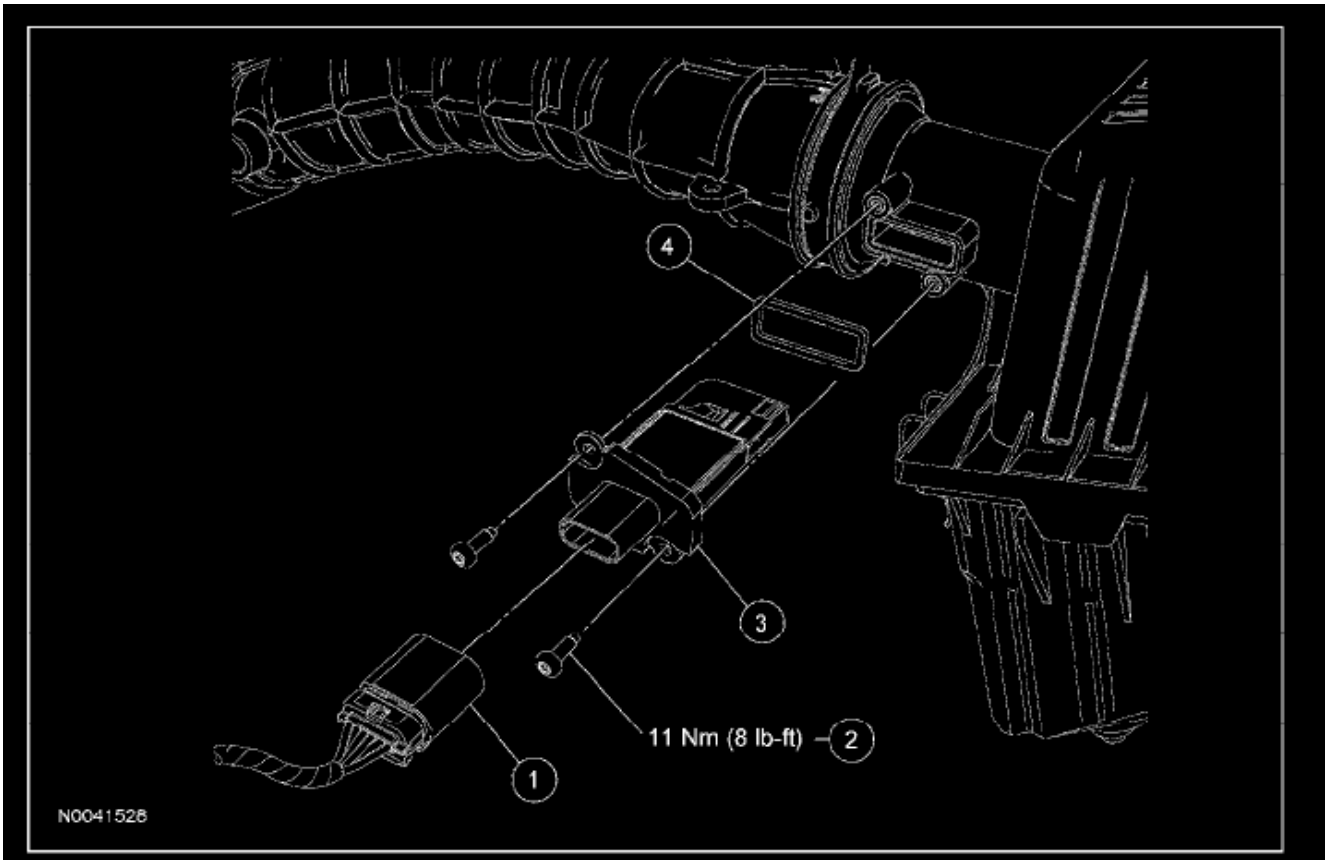


Typical Drop-in Mass Air Flow (MAF) Sensor

Typical Drop-in Mass Air Flow (MAF) Sensor

The MAF sensor uses a hot wire sensing element to measure the amount of air entering the engine. Air passing over the hot wire causes it to cool. This hot wire is maintained at 200°C (392°F) above the ambient temperature as measured by a constant cold wire. The current required to maintain the temperature of the hot wire is proportional to the mass air flow. The MAF sensor then outputs an analog voltage signal to the PCM proportional to the intake air mass. The PCM calculates the required fuel injector pulse width in order to provide the desired air/fuel ratio. This input is also used in determining transmission electronic pressure control (EPC), shift and torque converter clutch scheduling.

The MAF sensor is located between the air cleaner and the throttle body or inside the air cleaner assembly. Most MAF sensors have integrated bypass technology with an integrated intake air temperature (IAT) sensor. The hot wire electronic sensing element must be replaced as an assembly. Replacing only the element may change the air flow calibration.



Item	Part Number	Description
1	14A464	Mass air flow (MAF) sensor electrical connector (part of 12B637)
2	W709287	MAF sensor bolt (2 required)
3	12B605	MAF sensor
4	—	MAF sensor gasket

Air Flow Meter/Sensor: Service and Repair

MASS AIR FLOW (MAF) SENSOR

Removal and Installation

1. Disconnect the mass air flow (MAF) sensor electrical connector. 2. Remove the 2 bolts, the MAF sensor and discard the gasket.

- To install, tighten to 11 Nm (8 lb-ft).

3. CAUTION: Do not tamper with the mass air flow (MAF) sensing elements located in the airflow bypass. Tampering may result in

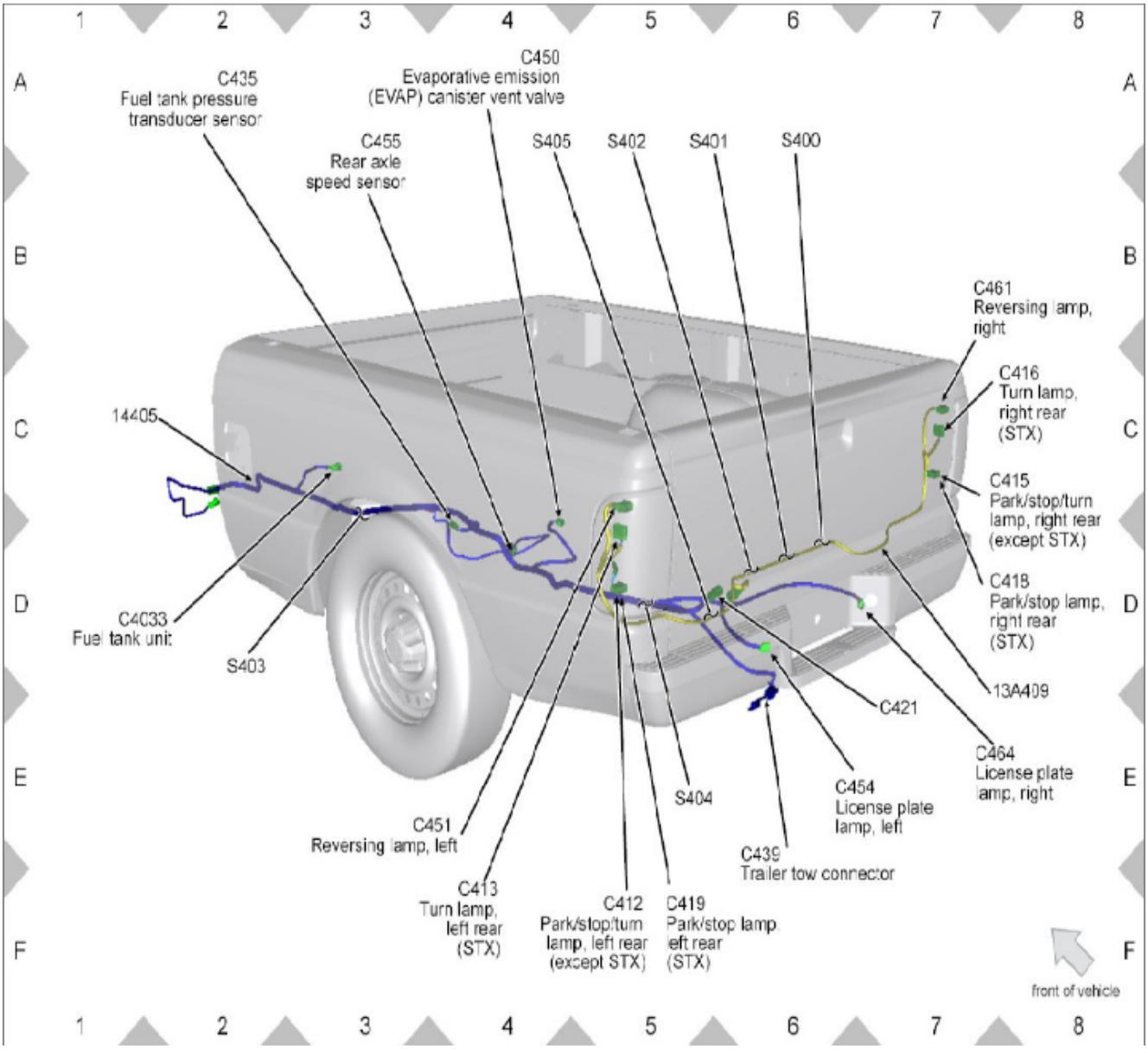
failure.

NOTE: The MAF sensor module and body are calibrated and installed as a unit.

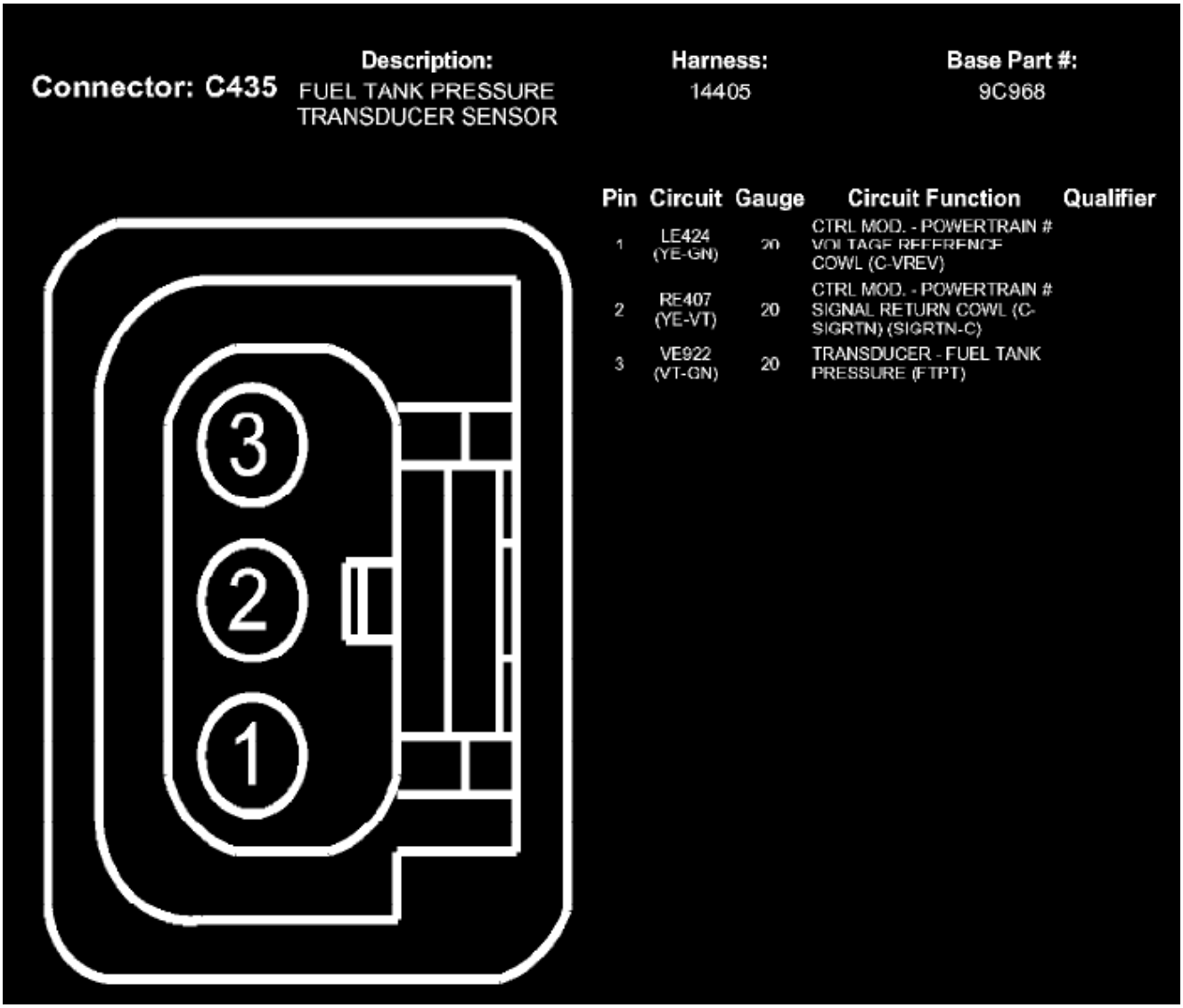
To install, reverse the removal procedure. -

Install a new gasket.

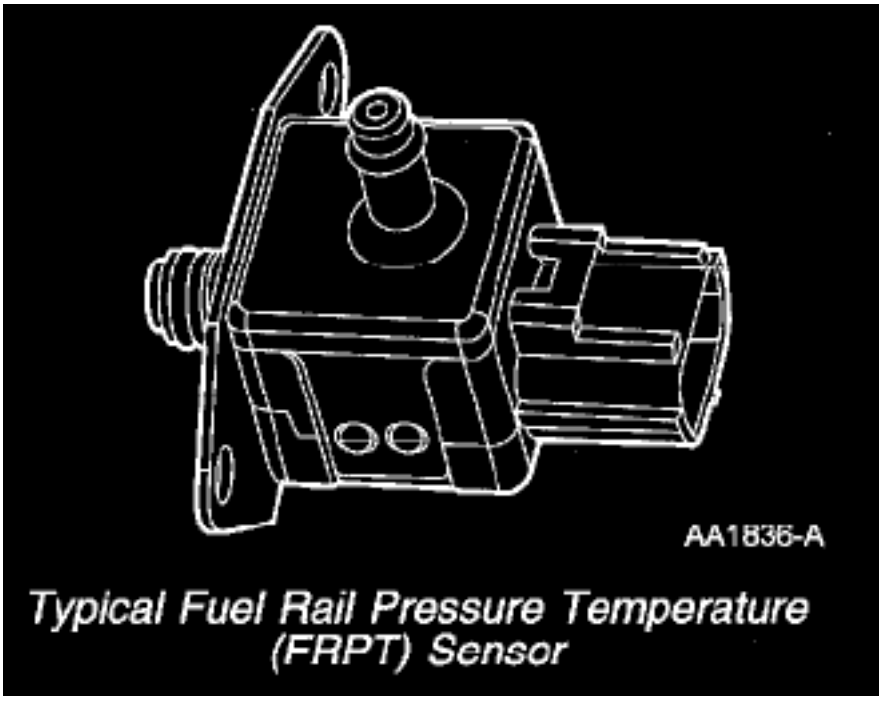
Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Powertrain Management > Fuel Delivery and Air Induction > Sensors and Switches - Fuel Delivery and Air Induction > Fuel Pressure Sensor/Switch > Component Information > Locations



View 151-27


Connector: C435
Description:
FUEL TANK PRESSURE TRANSDUCER SENSOR
Harness:
14405
Base Part #:
9C968
Pin Circuit Gauge Circuit Function Qualifier
1 LE424 (YE-GN) 20 CTRL MOD. - POWERTRAIN # VOLTAGE REFERENCE COWL (C-VREV)
2 RE407 (YE-VT) 20 CTRL MOD. - POWERTRAIN # SIGNAL RETURN COWL (C-SIGRTN) (SIGRTN-C)
3 VE922 (VT-GN) 20 TRANSDUCER - FUEL TANK PRESSURE (FTPT)
3
2
1

C435



Typical Fuel Rail Pressure Temperature (FRPT) Sensor

Fuel Pressure Sensor/Switch: Description and Operation

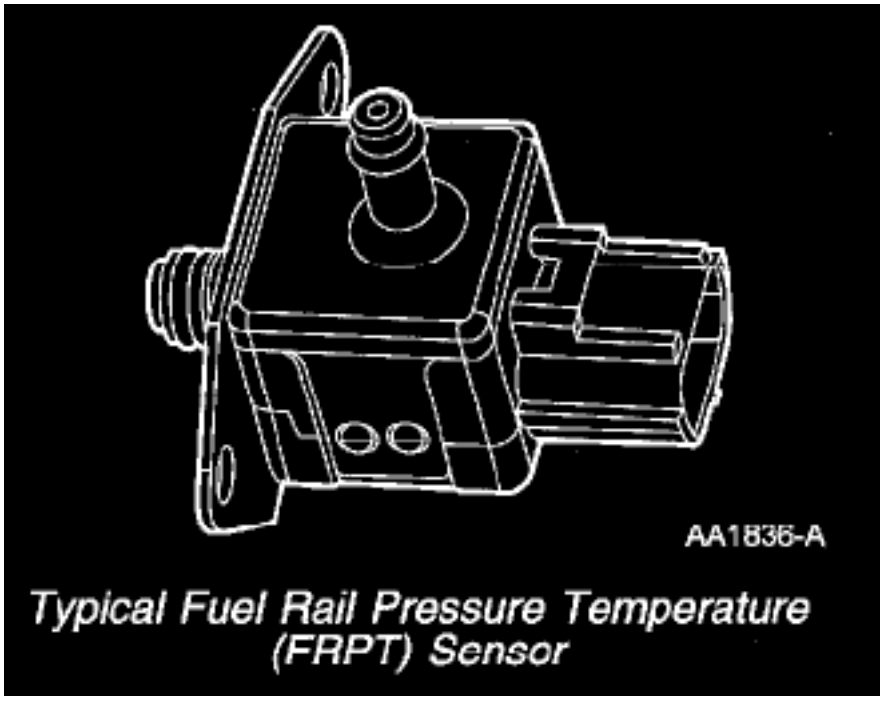
FUEL RAIL PRESSURE TEMPERATURE (FRPT) SENSOR

Typical Fuel Rail Pressure Temperature (FRPT) Sensor

The FRPT sensor measures the pressure and temperature of the fuel in the fuel rail and sends these signals to the PCM. The sensor uses the intake manifold vacuum as a reference to determine the pressure difference between the fuel rail and the intake manifold. The relationship between fuel pressure and fuel temperature is used to determine the possible presence of fuel vapor in the fuel rail.

The temperature sensing portion of the FRPT sensor is a thermistor device in which resistance changes with temperature. The electrical resistance of the thermistor decreases as the temperature increases, and the resistance increases as the temperature decreases. The varying resistance changes the voltage drop across the sensor terminals and provides electrical signals to the PCM corresponding to temperature.

Both the pressure and temperature signals are used to control the speed of the fuel pump. The speed of the fuel pump sustains fuel rail pressure which preserves fuel in its liquid state. The dynamic range of the fuel injectors increase because of the higher rail pressure, which allows the injector pulse width to decrease.



Fuel Temperature Sensor: Description and Operation

FUEL RAIL PRESSURE TEMPERATURE (FRPT) SENSOR

Typical Fuel Rail Pressure Temperature (FRPT) Sensor

The FRPT sensor measures the pressure and temperature of the fuel in the fuel rail and sends these signals to the PCM. The sensor uses the intake manifold vacuum as a reference to determine the pressure difference between the fuel rail and the intake manifold. The relationship between fuel pressure and fuel temperature is used to determine the possible presence of fuel vapor in the fuel rail.

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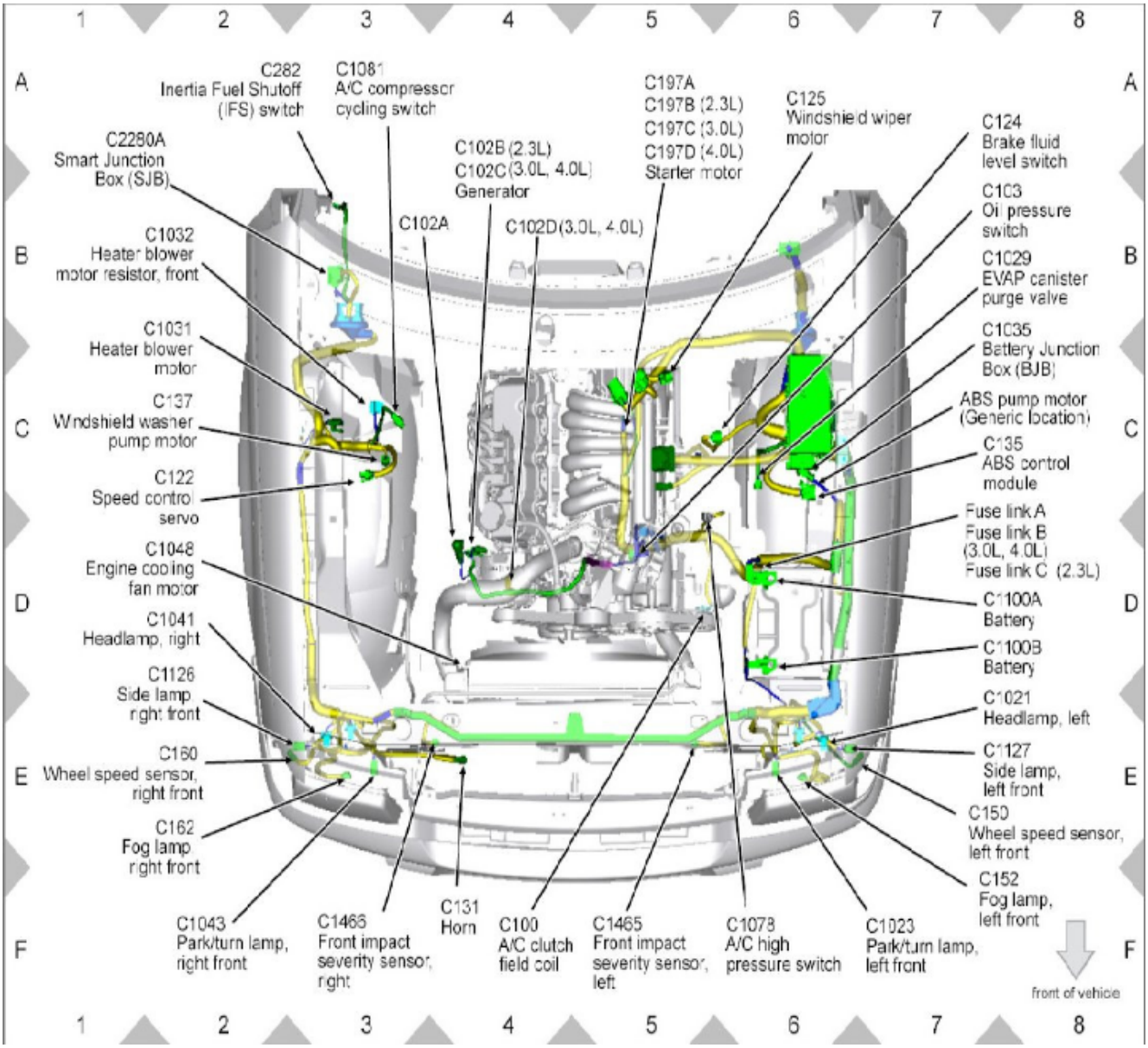
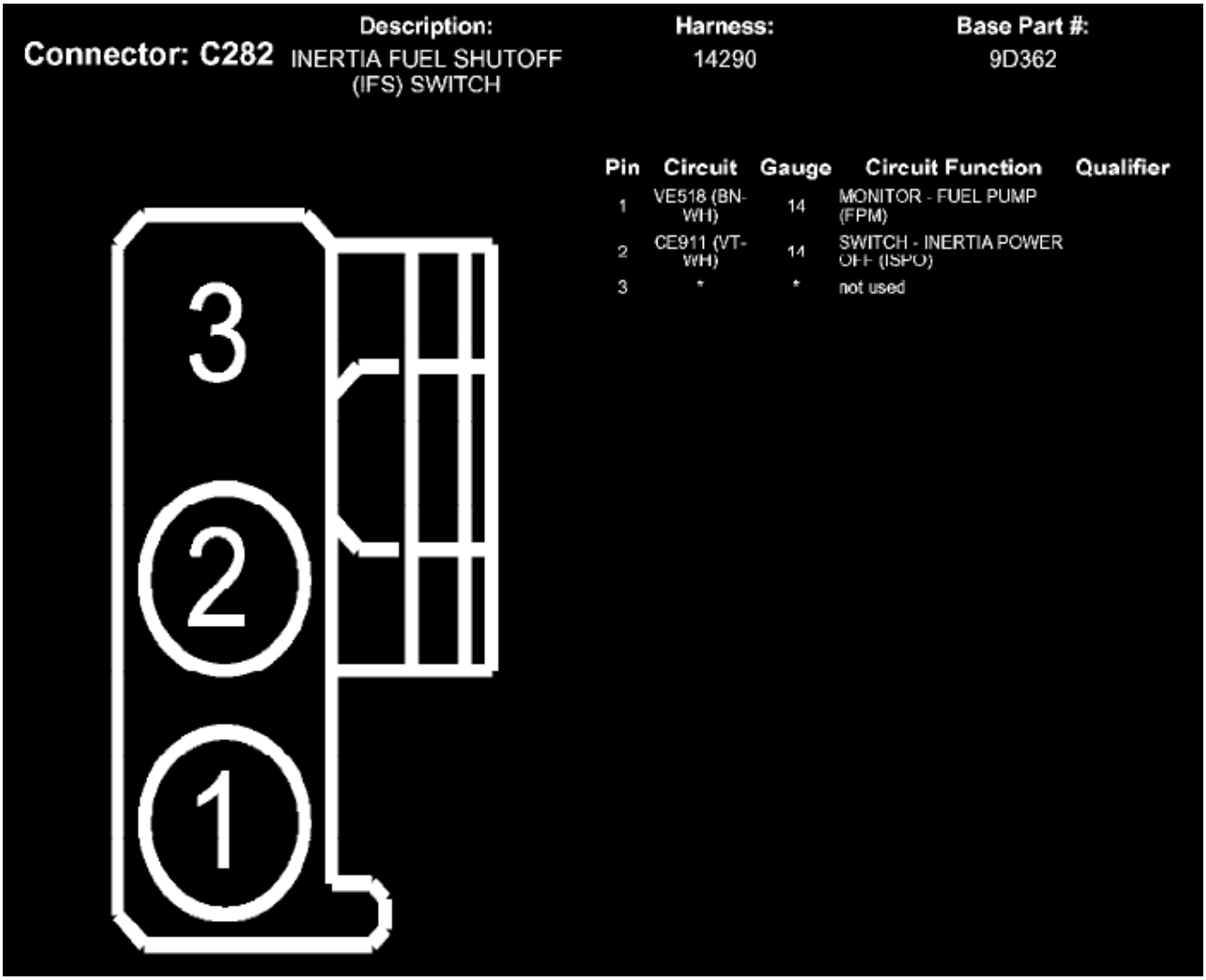
Both the pressure and temperature signals are used to control the speed of the fuel pump. The speed of the fuel pump sustains fuel rail pressure which preserves fuel in its liquid state. The dynamic range of the fuel injectors increase because of the higher rail pressure, which allows the injector pulse width to decrease.

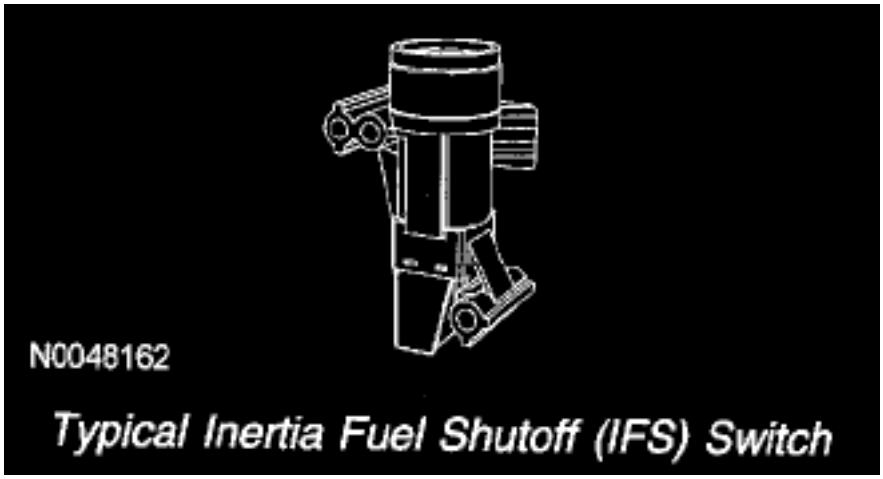
Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Powertrain Management > Fuel Delivery and Air Induction > Sensors and Switches - Fuel Delivery and Air Induction > Inertia Fuel Shutoff Switch > Component Information > Locations



View 151-1


Connector: C282
Description:
INERTIA FUEL SHUTOFF (IFS) SWITCH
Harness:
14290
Base Part #:
9D362
Pin
Circuit
Gauge
Circuit Function
Qualifier
1
VE518 (BN-WH)
14
MONITOR - FUEL PUMP (FPM)
2
CE911 (VT-WH)
14
SWITCH - INERTIA POWER OFF (ISPO)
3
*
*
not used
3
2
1

C282

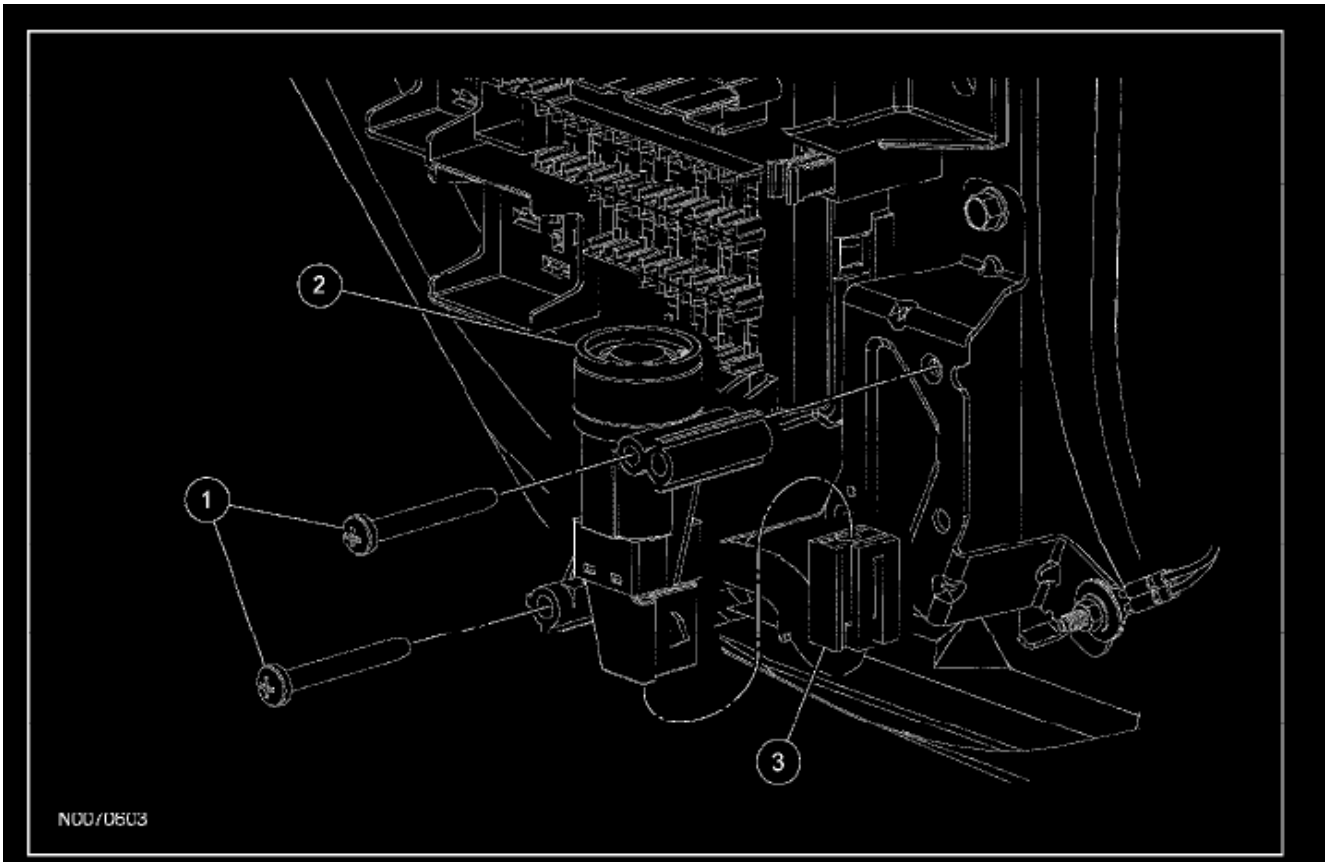


Inertia Fuel Shutoff Switch: Description and Operation

INERTIA FUEL SHUTOFF (IFS) SWITCH

Typical Inertia Fuel Shutoff (IFS) Switch

The IFS switch is used in conjunction with the electric fuel pump. The purpose of the IFS switch is to shutoff the fuel pump if a collision occurs. It consists of a steel ball held in place by a magnet. When a sharp impact occurs, the ball breaks loose from the magnet, rolls up a conical ramp and strikes a target plate which opens the electrical contacts of the switch and shuts off the electric fuel pump. Once the switch is open, it must be manually reset before restarting the vehicle. Refer to the Owner's Literature, Roadside Emergencies for the location of the IFS switch.



Item	Part Number	Description
1	W504467	Inertia fuel shutoff (IFS) switch screws
2	9341	IFS switch
3	—	IFS switch electrical connector (part of 180101)

Inertia Fuel Shutoff Switch: Service and Repair

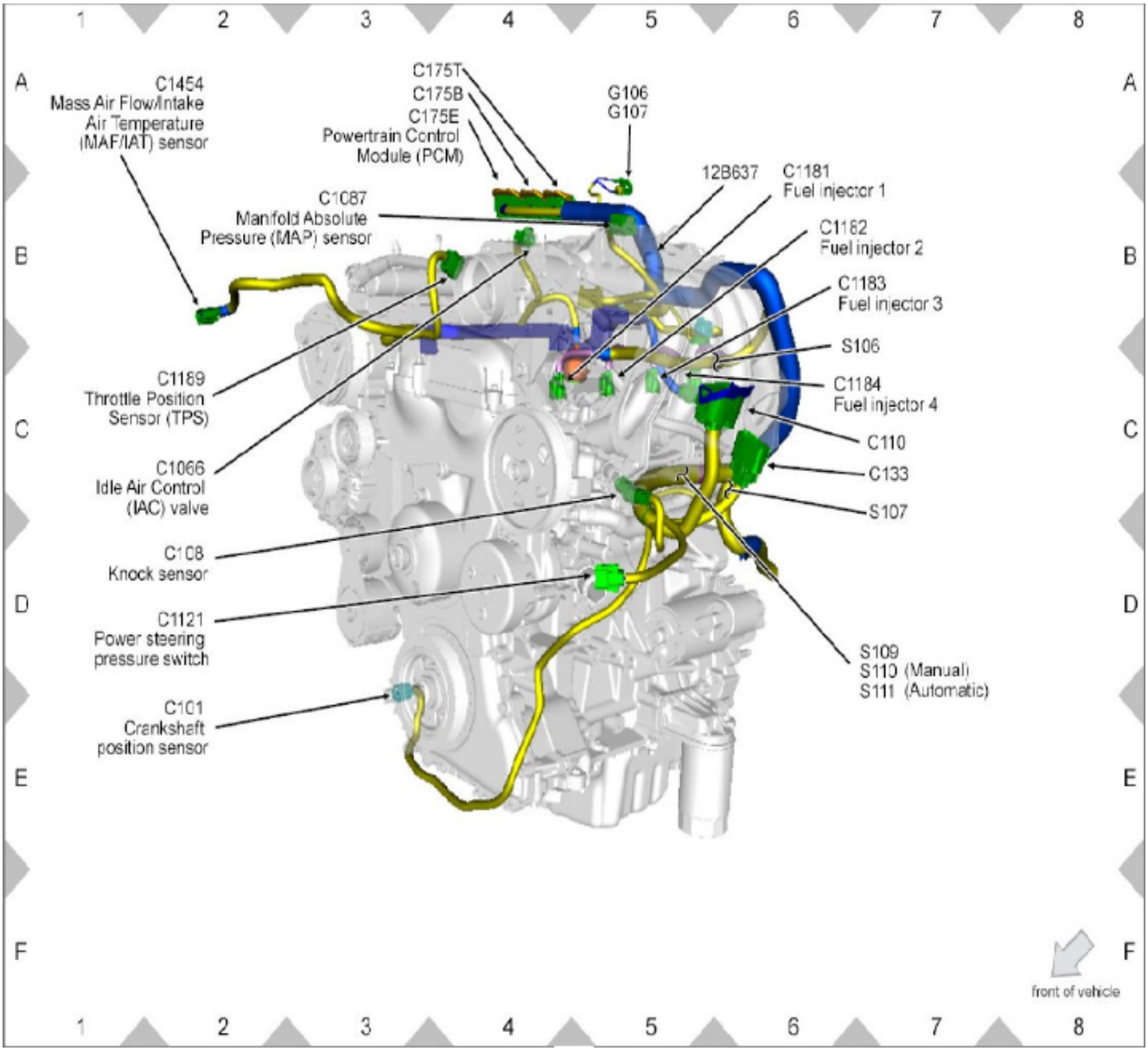
INERTIA FUEL SHUTOFF (IFS) SWITCH

Removal and Installation

1. NOTE: The inertia fuel shutoff (IFS) switch is located behind the RH cowl panel.

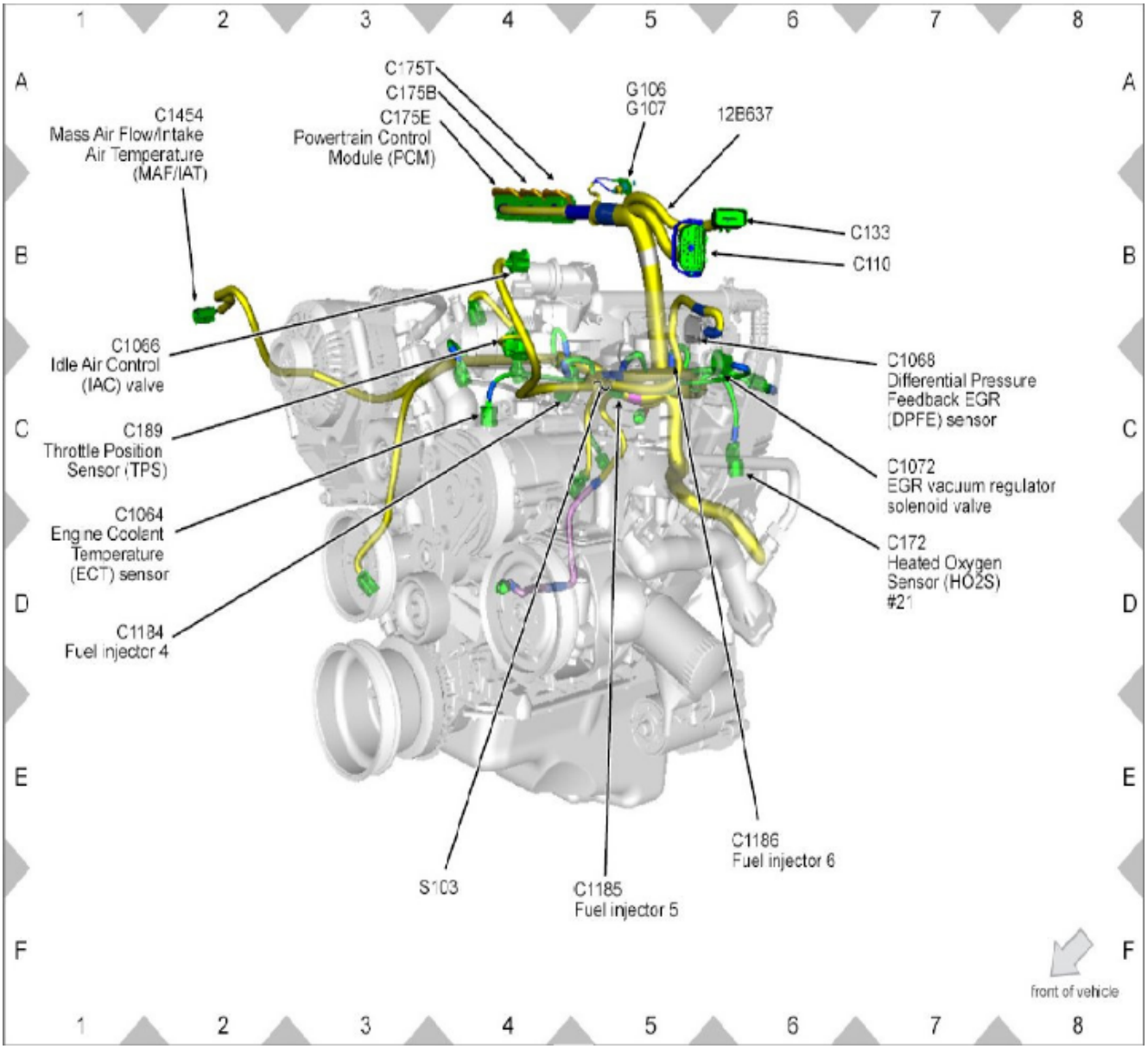
Remove the RH scuff plate and cowl panel.

2. Remove the screws and the IFS switch. 3. Disconnect the IFS switch electrical connector. 4. To install, reverse the removal procedure.

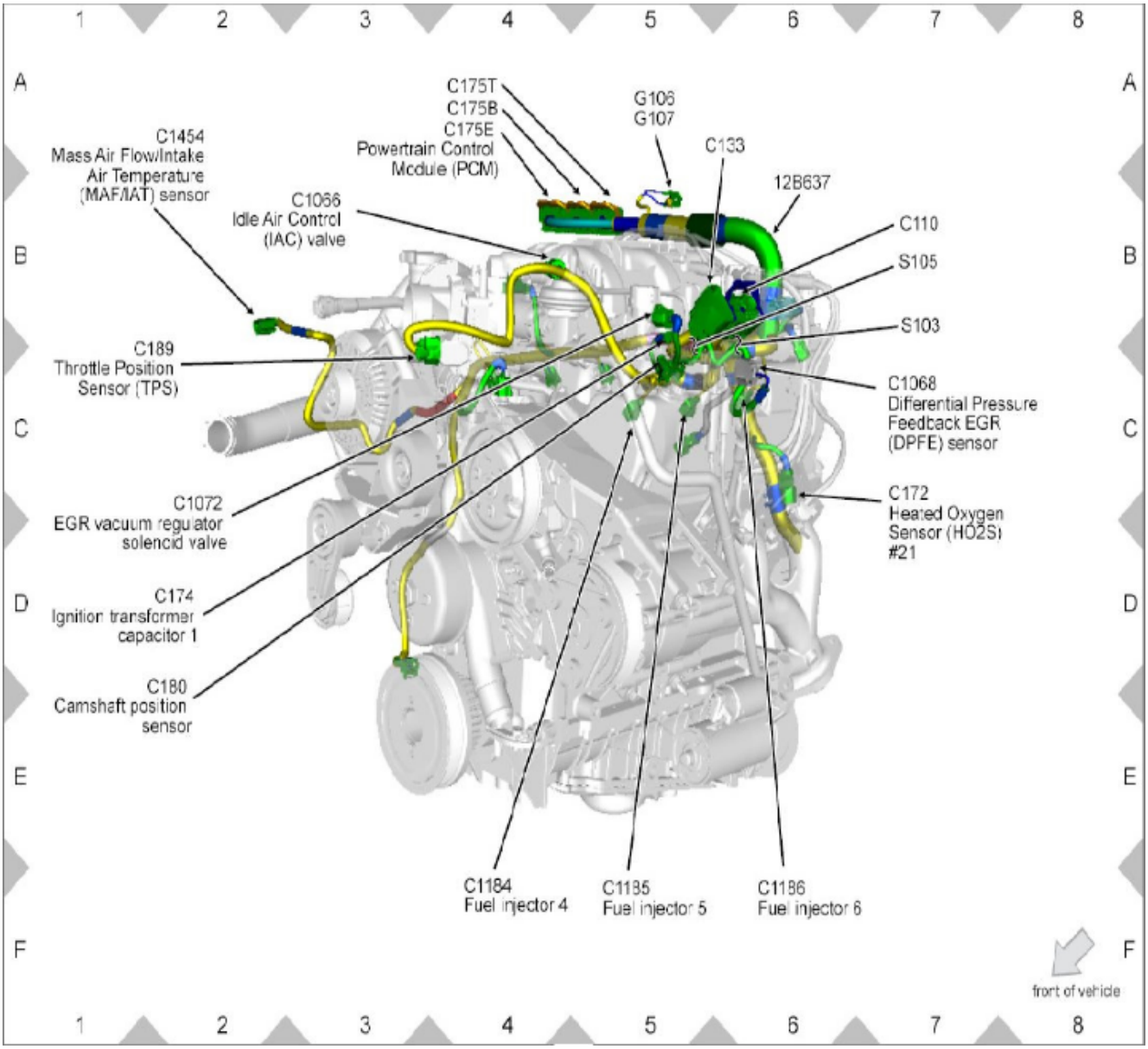


Throttle Position Sensor: Locations

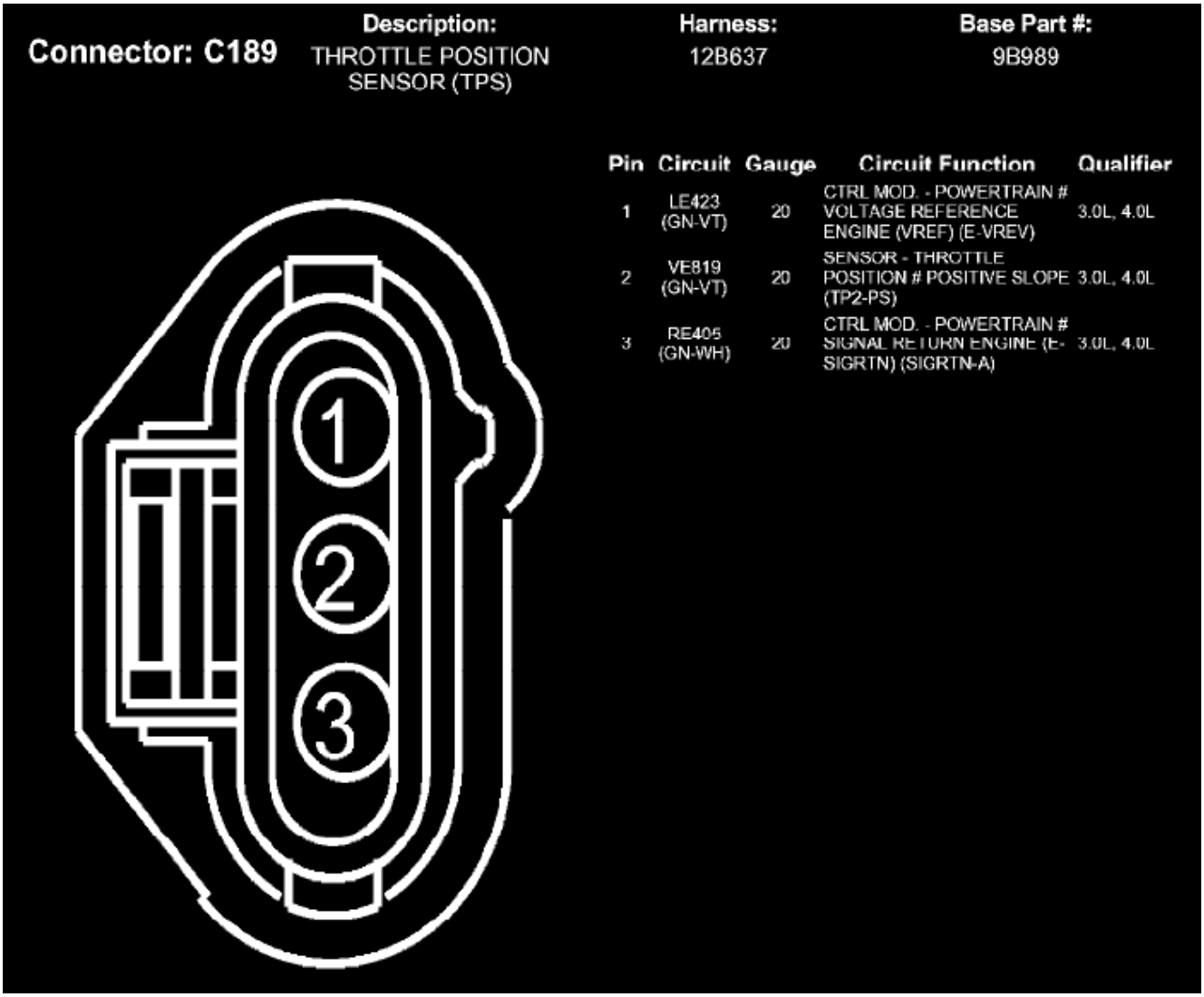
View 151-3


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
12B637
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT)
C133
C110
C1066
Idle Air Control (IAC) valve
C189
Throttle Position Sensor (TPS)
C1064
Engine Coolant Temperature (ECT) sensor
C1184
Fuel injector 4
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
S103
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-5


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
C133
12B637
C110
S105
S103
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor
C1066
Idle Air Control (IAC) valve
C189
Throttle Position Sensor (TPS)
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
C174
Ignition transformer capacitor 1
C180
Camshaft position sensor
C1184
Fuel injector 4
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-7



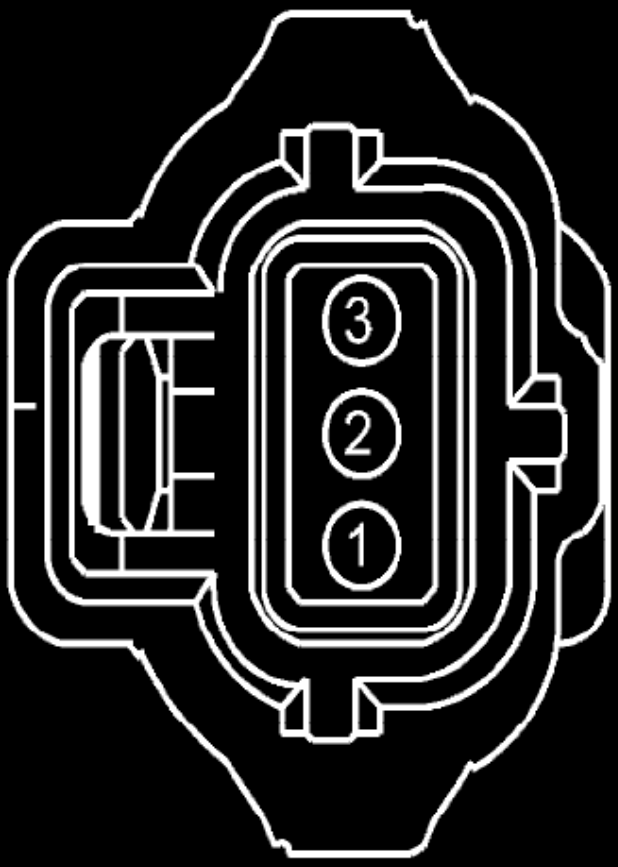
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	LE423 (GN-VT)	20	CTRL MOD. - POWERTRAIN # VOLTAGE REFERENCE ENGINE (VREF) (E-VREV)	3.0L, 4.0L
2	VE819 (GN-VT)	20	SENSOR - THROTTLE POSITION # POSITIVE SLOPE (TP2-PS)	3.0L, 4.0L
3	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	3.0L, 4.0L

Throttle Position Sensor: Diagrams

C189

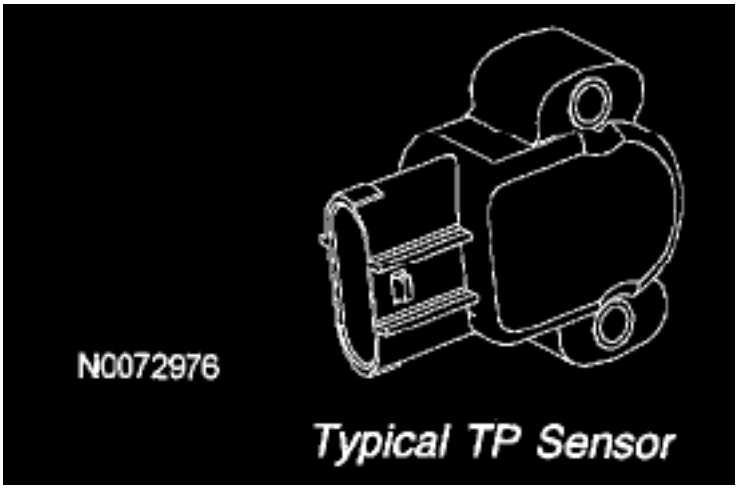
Connector: C1189

Description:	Harness:	Base Part #:
THROTTLE POSITION SENSOR (TPS)	12B637	9B989



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	2.3L
2	VE819 (GN-VT)	20	SENSOR - THROTTLE POSITION # POSITIVE SLOPE (TP2-PS)	2.3L
3	LE423 (GN-VT)	20	CTRL MOD. - POWERTRAIN # VOLTAGE REFERENCE ENGINE (VREF) (E-VREV)	2.3L

C1189



Throttle Position Sensor: Description and Operation

Electronic Throttle Body (ETB) Throttle Position Sensor

The ETB throttle position sensor has 2 signal circuits in the sensor for redundancy. The redundant ETB throttle position signals are required for increased monitoring. The first ETB throttle position sensor signal (TP1) has a negative slope (increasing angle, decreasing voltage) and the second signal (TP2) has a positive slope (increasing angle, increasing voltage). The 2 ETB throttle position sensor signals make sure the PCM receives a correct input even if 1 signal has a concern. There is 1 reference voltage circuit and 1 signal return circuit for the sensor. The reference voltage circuit and the signal return circuit is shared with the reference voltage circuits and signal return circuits used by the APP sensor.

Throttle Position (TP) Sensor

Typical TP Sensor

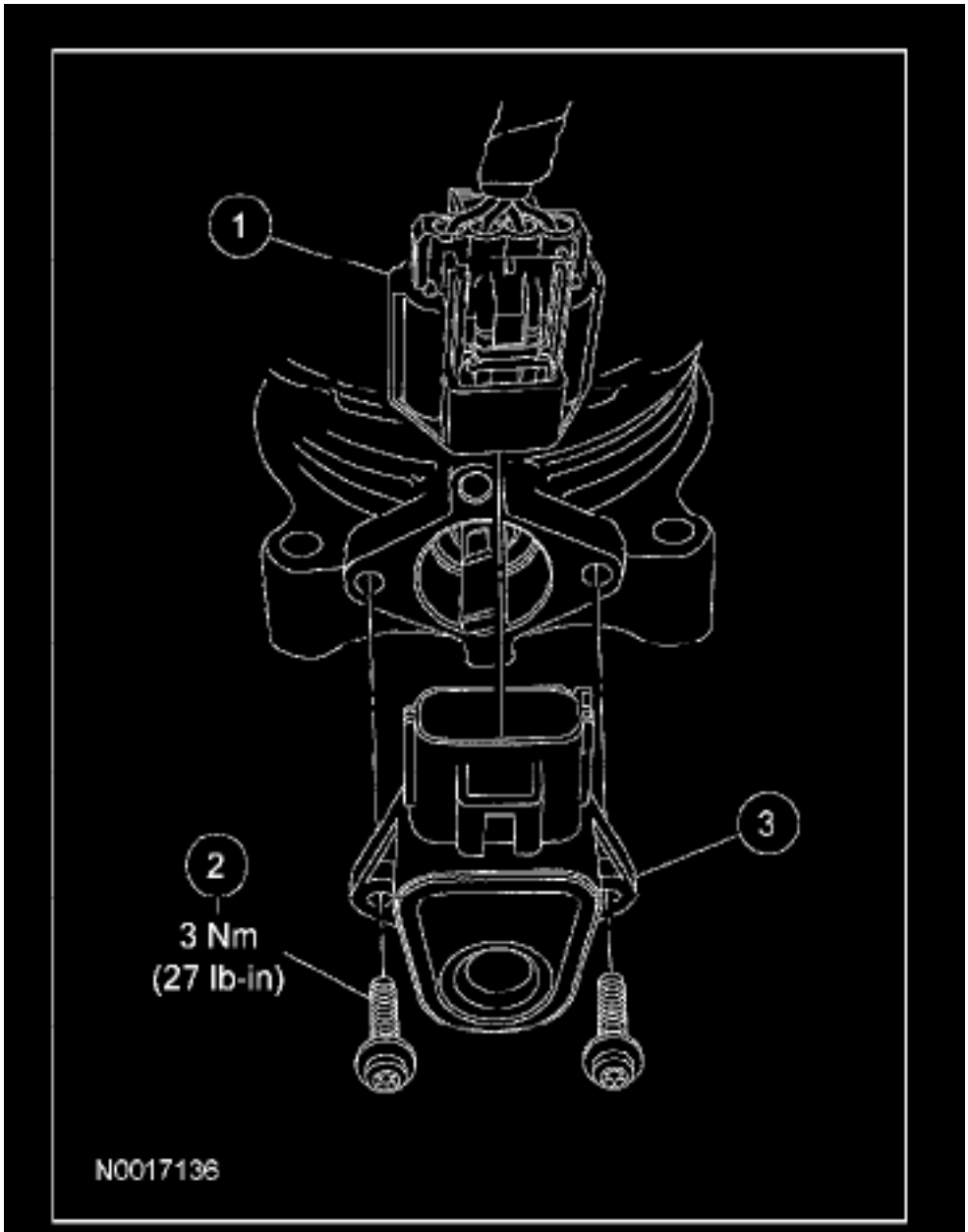
The TP sensor is a rotary potentiometer sensor that provides a signal to the PCM that is linearly proportional to the throttle plate/shaft position. The sensor housing has a 3-blade electrical connector that may be gold plated. The gold plating increases the corrosion resistance on the terminals and increases the connector durability. The TP sensor is mounted on the throttle body. As the TP sensor is rotated by the throttle shaft, 4 operating conditions are determined by the PCM from the TP. The operating conditions are: -

closed throttle (includes idle or deceleration)

- part throttle (includes cruise or moderate acceleration)

- wide open throttle (includes maximum acceleration or de-choke on crank)

- throttle angle rate



Item	Part Number	Description
1	14A464	Throttle position (TP) sensor electrical connector (part of 12B637)
2	W707535	TP sensor screw (2 required)
3	9E928	TP sensor

Throttle Position Sensor: Service and Repair

THROTTLE POSITION (TP) SENSOR

Removal and Installation

1. Disconnect the throttle position (TP) sensor electrical connector.

2. CAUTION: Failure to remove the throttle position (TP) sensor screws in the following manner will result in damage to the screws. First,

loosen the screws 1 to 2 full turns using a hand tool, and then use a suitable high-speed driver to complete the removal.

Remove and discard the 2 bolts and the TP sensor. -

To install, tighten to 3 Nm (27 lb-in).

3. CAUTION: Do not use a high-speed driver to install the new screws or damage to the throttle position (TP) sensor may occur.

NOTE: -

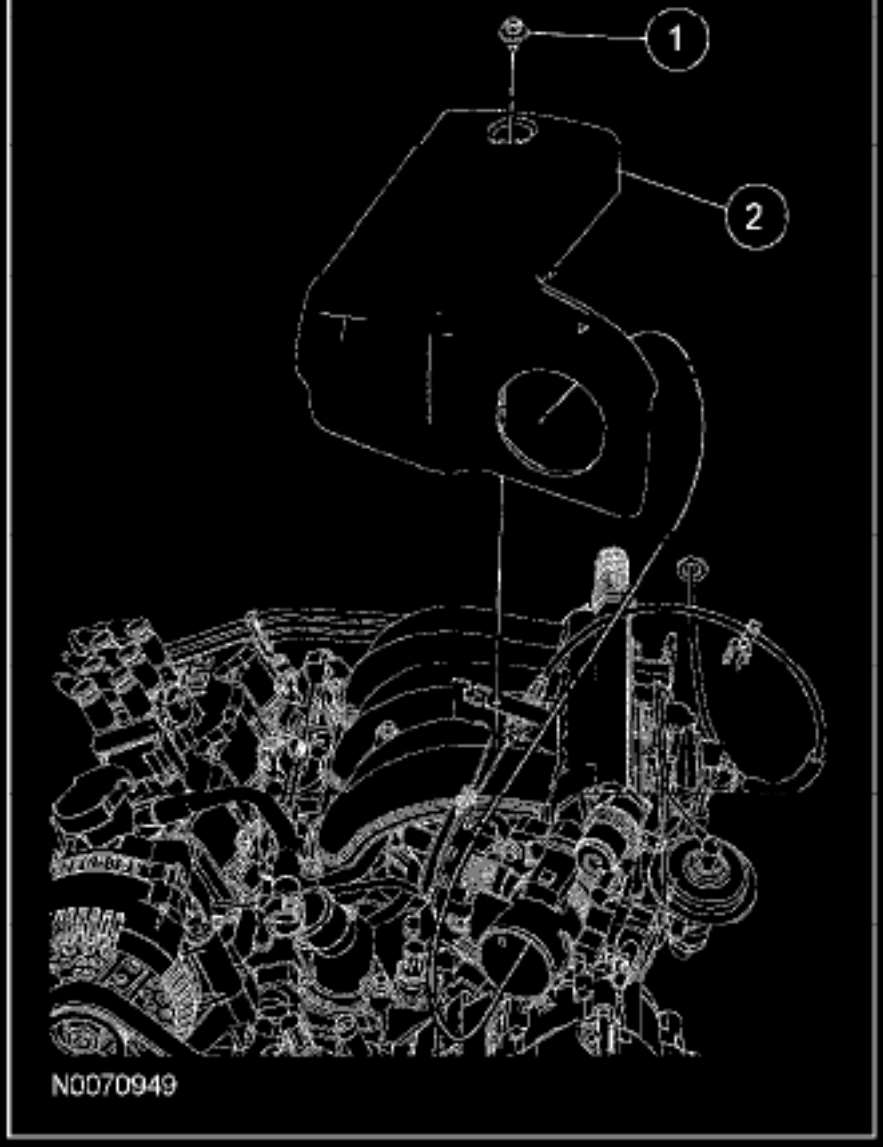
Do not reuse the TP sensor and screws. A new TP sensor and screws must be installed.

- Failure to install the TP sensor in this manner may result in excessive idle speeds. Slide the rotary tangs into position over the throttle shaft blade, then rotate the TP sensor.

To install, reverse the removal procedure. -

Install a new TP sensor and screws.

Throttle Body (TB) Cover



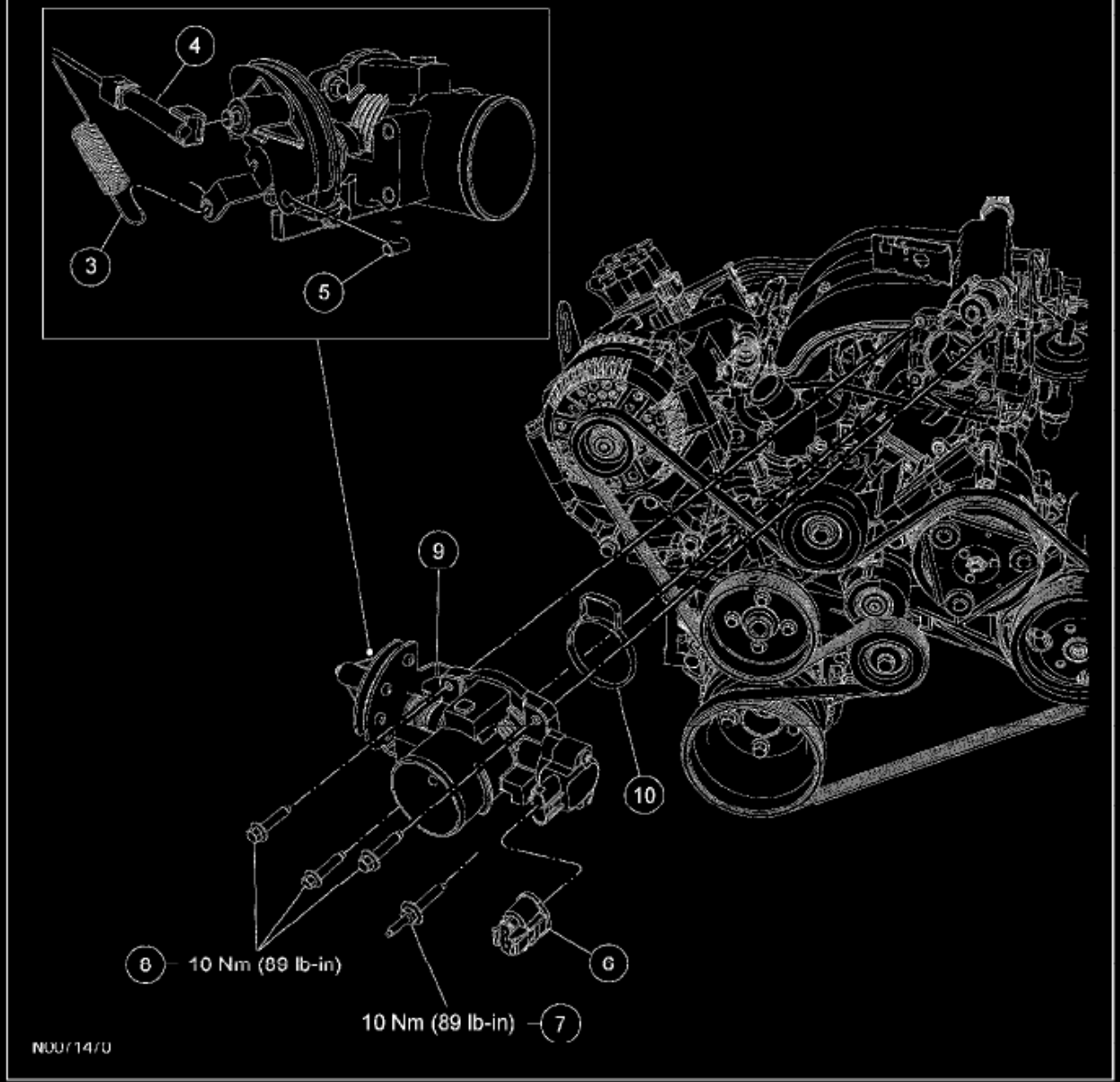
Item	Part Number	Description
1	N800312	Throttle body (TB) cover bolt
2	9E766	TB cover

Throttle Body: Service and Repair

THROTTLE BODY

Throttle Body (TB) Cover

Throttle Body (TB)



Item	Part Number	Description
3	9737	TB return spring
4	9A825	Speed control cable
5	9A758	Accelerator cable
6	—	Throttle position (TP) sensor electrical connector (part of 12B637)
7	W701632	TB stud bolt
8	W701669	TB bolts (3 required)
9	9E926	TB assembly
10	9E936	TB gasket

Throttle Body (TB)

Removal and Installation

1. Remove the air cleaner outlet pipe. 2. Remove the bolt and the throttle body (TB) cover. 3. Disconnect the throttle position (TP) sensor electrical connector. 4. Disconnect the accelerator cable, the speed control cable and the TB return spring. 5. Remove the 3 bolts, the stud bolt and the TB.

- Discard the TB gasket.

- To install, tighten to 10 Nm (89 lb-in).

6. If servicing the TB, remove the TP sensor.

7. NOTE: Clean all TB sealing surfaces and install a new TB gasket.

To install, reverse the removal procedure.

Throttle Cable/Linkage: Initial Inspection and Diagnostic Overview

Principles of Operation

PRINCIPLES OF OPERATION

The acceleration control allows the operator to control the vehicle speed. The throttle is controlled by the accelerator cable which is attached to the accelerator pedal. As the operator presses on the accelerator pedal, the accelerator pedal pulls on the accelerator cable which opens the throttle.

Inspection and Verification

INSPECTION AND VERIFICATION

1. Verify the customer's concern by operating the acceleration control system to duplicate the condition. 2. Inspect to determine if any of the following mechanical concerns apply.

VISUAL INSPECTION CHART

Mechanical -

Damaged accelerator pedal and shaft

- Damaged linkage

- Damaged accelerator cable

- High engine idle speed

- Damaged throttle body (TB)

3. If the inspection reveals an obvious concern that can be readily identified, repair it as required. 4. If the concern remains after the inspection, determine the symptom(s) and go to the Symptom Chart. See: Accelerator Pedal/Testing and

Inspection/Symptom Related Diagnostic Procedures

Symptom Chart

Condition	Possible Sources	Action
• Excessive effort is needed to depress the accelerator pedal and shaft	• Accelerator cable binding • Worn or damaged throttle body (TB)	• INSTALL a new accelerator cable. • INSTALL a new throttle body.
• The accelerator pedal and shaft feels rough or raspy	• Frayed or binding accelerator cable • Worn or damaged TB	• INSTALL a new accelerator cable. • INSTALL a new throttle body.
• The accelerator pedal and shaft binds or sticks	• Kinked accelerator cable • Foreign material caught in accelerator pedal linkage • Worn or damaged TB	• INSTALL a new accelerator cable. • CHECK the accelerator pedal linkage. • INSTALL a new TB.

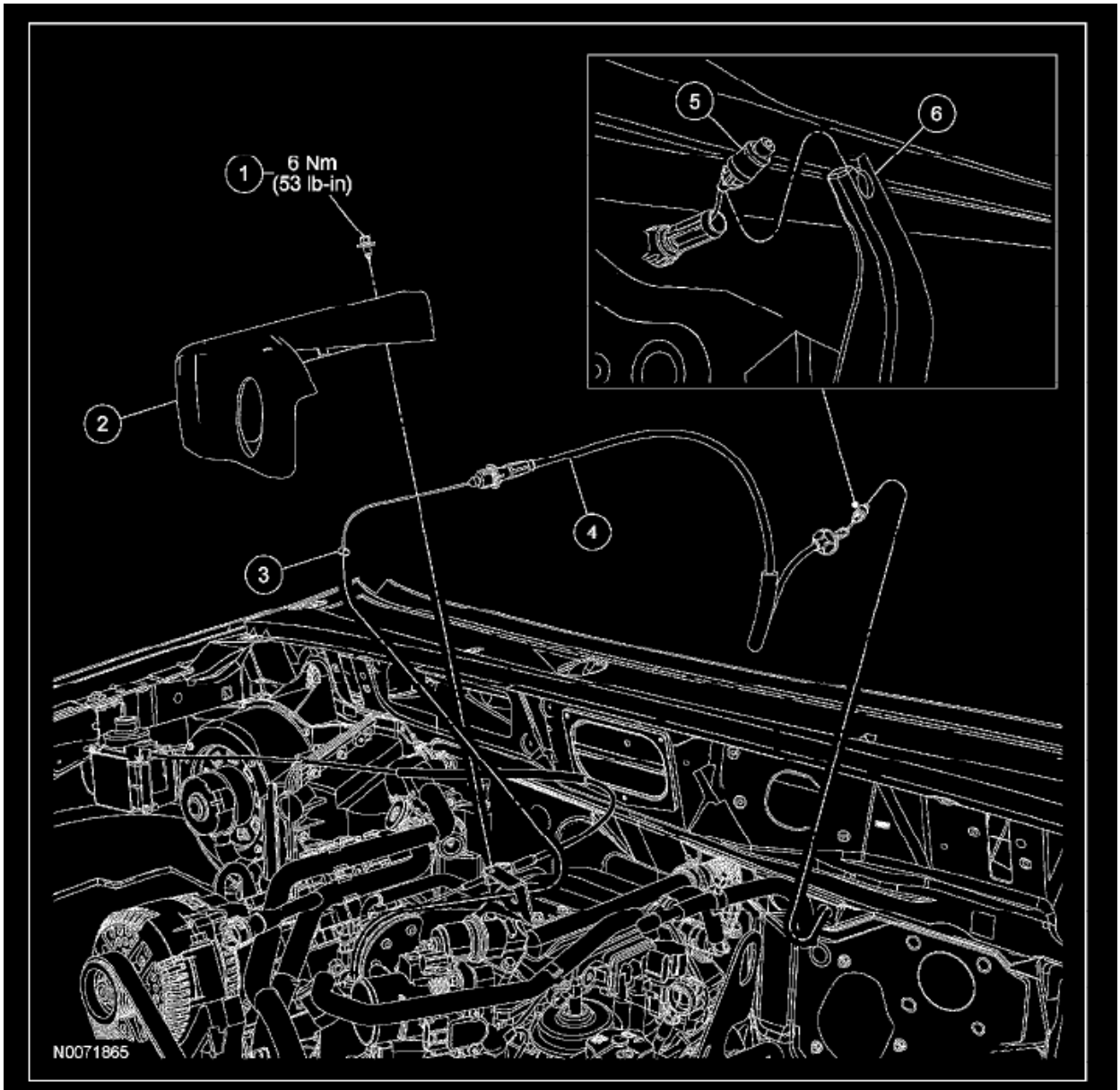
Symptom Chart (Continued)

Condition	Possible Sources	Action
• The engine idle speed is high	• Kinked accelerator cable • Foreign material caught in accelerator pedal linkage • Accelerator pedal caught under mispositioned floor mat • Incorrect engine idle speed	• INSTALL a new accelerator cable. • CHECK the accelerator pedal linkage. • REFER to Computers and Control Systems for diagnosis and testing of the idle control system.

Throttle Cable/Linkage: Symptom Related Diagnostic Procedures

Symptom Chart (Part 1)

Symptom Chart (Part 2)



Item	Part Number	Description
1	N800312	Accelerator control splash shield bolt
2	9E766	Accelerator control splash shield

(Continued)

Item	Part Number	Description
3	—	Accelerator cable-to-throttle lever (part of 9A758)
4	9A758	Accelerator cable

(Continued)

Item	Part Number	Description
5	—	Accelerator cable-to-accelerator pedal (part of 9A758)
6	9725	Accelerator pedal

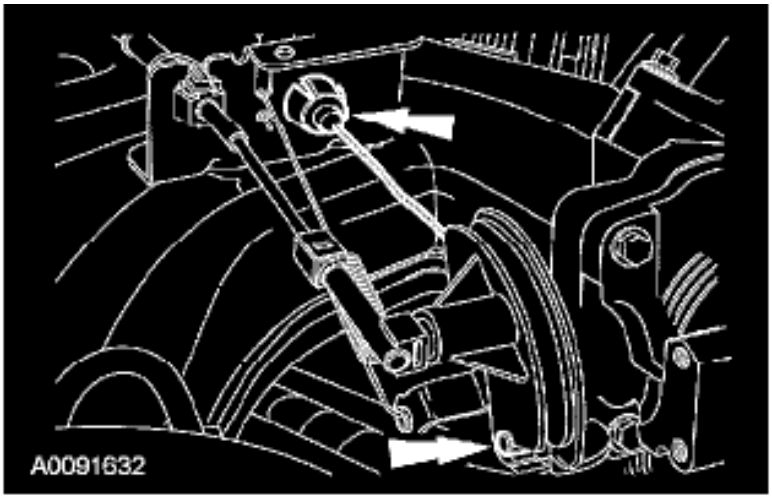
Throttle Cable/Linkage: Service and Repair

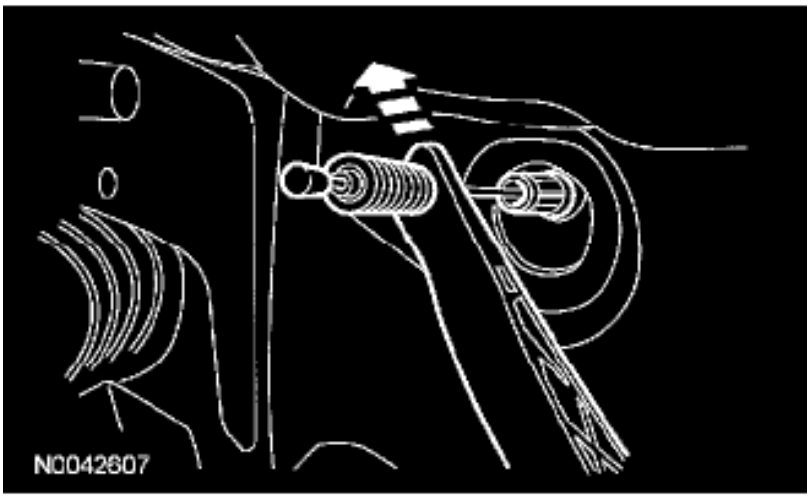
ACCELERATOR CABLE

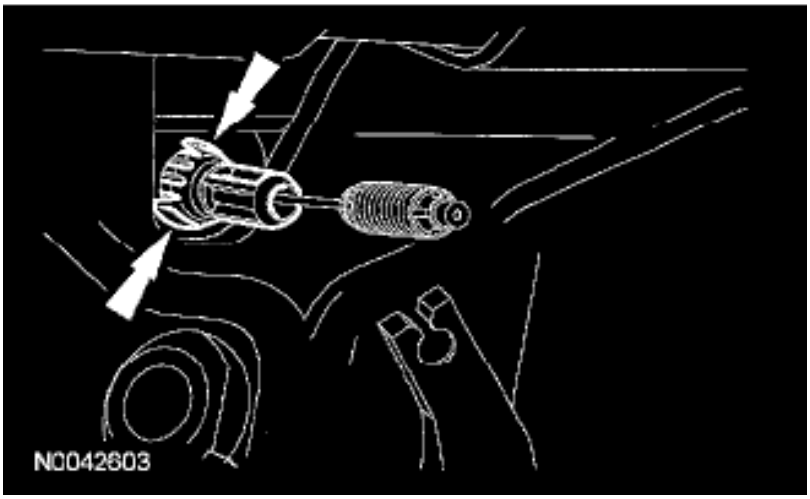
Removal and Installation

Part 1

Part 2


A0091632


N0042607


N0042603

1. Remove the air cleaner outlet tube. 2. Remove the bolts and remove the accelerator control splash shield.

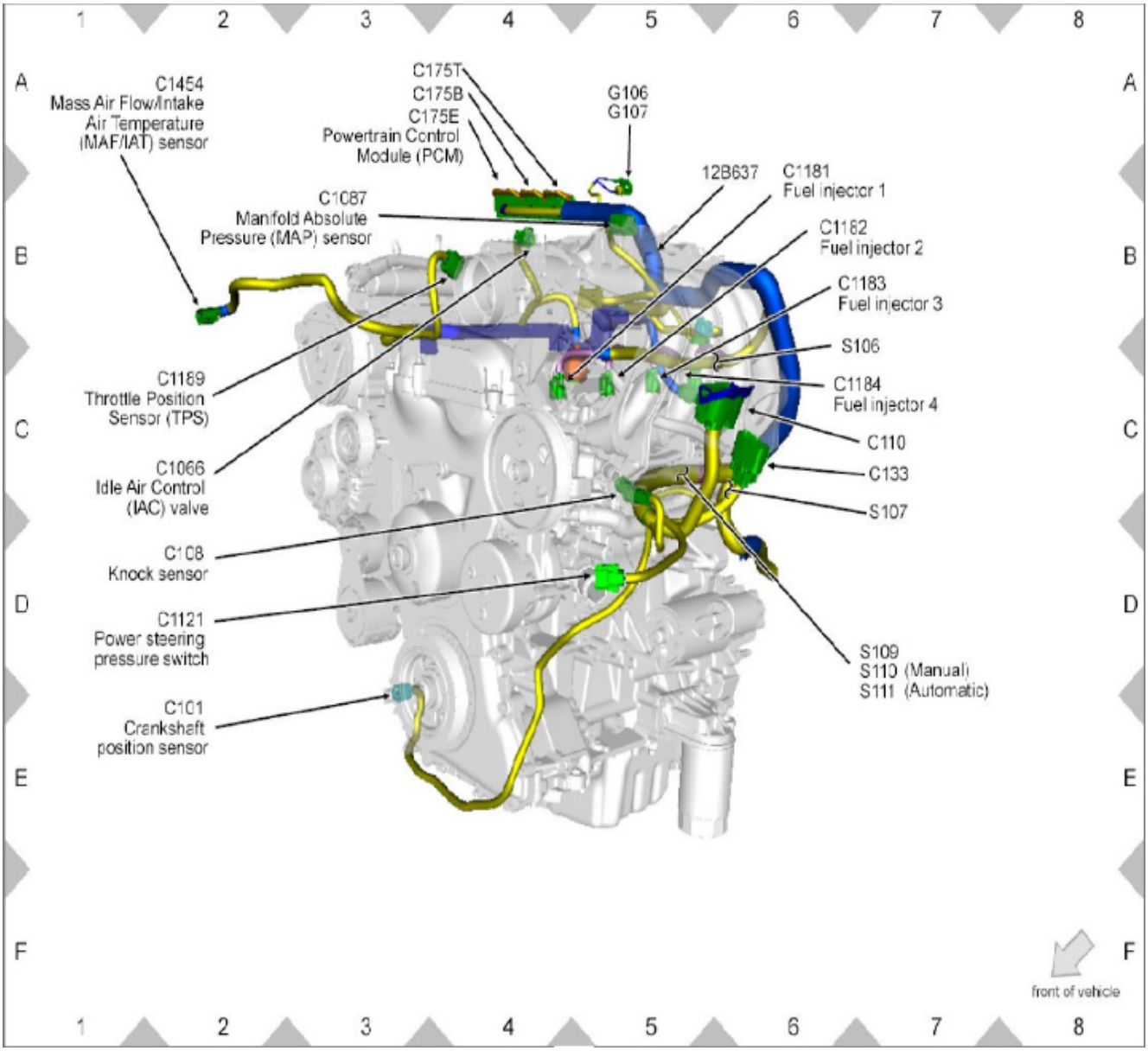
- To install, tighten to 6 Nm (53 lb-in).

3. Disconnect the accelerator cable from the throttle lever and the bracket.

4. Disconnect the accelerator cable from the accelerator pedal.

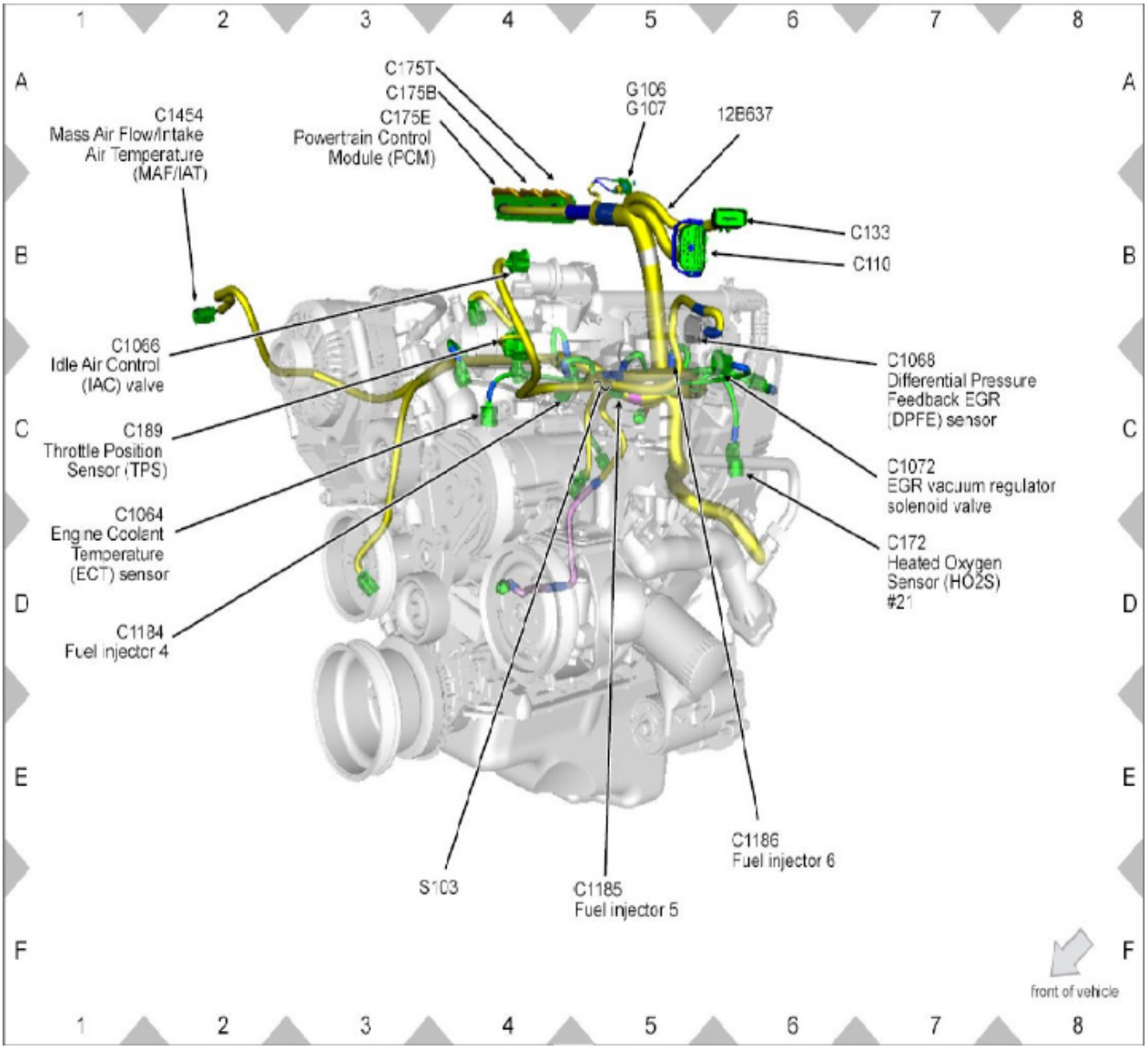
5. Depress the clips and remove the accelerator cable from the vehicle.

6. To install, reverse the removal procedure.

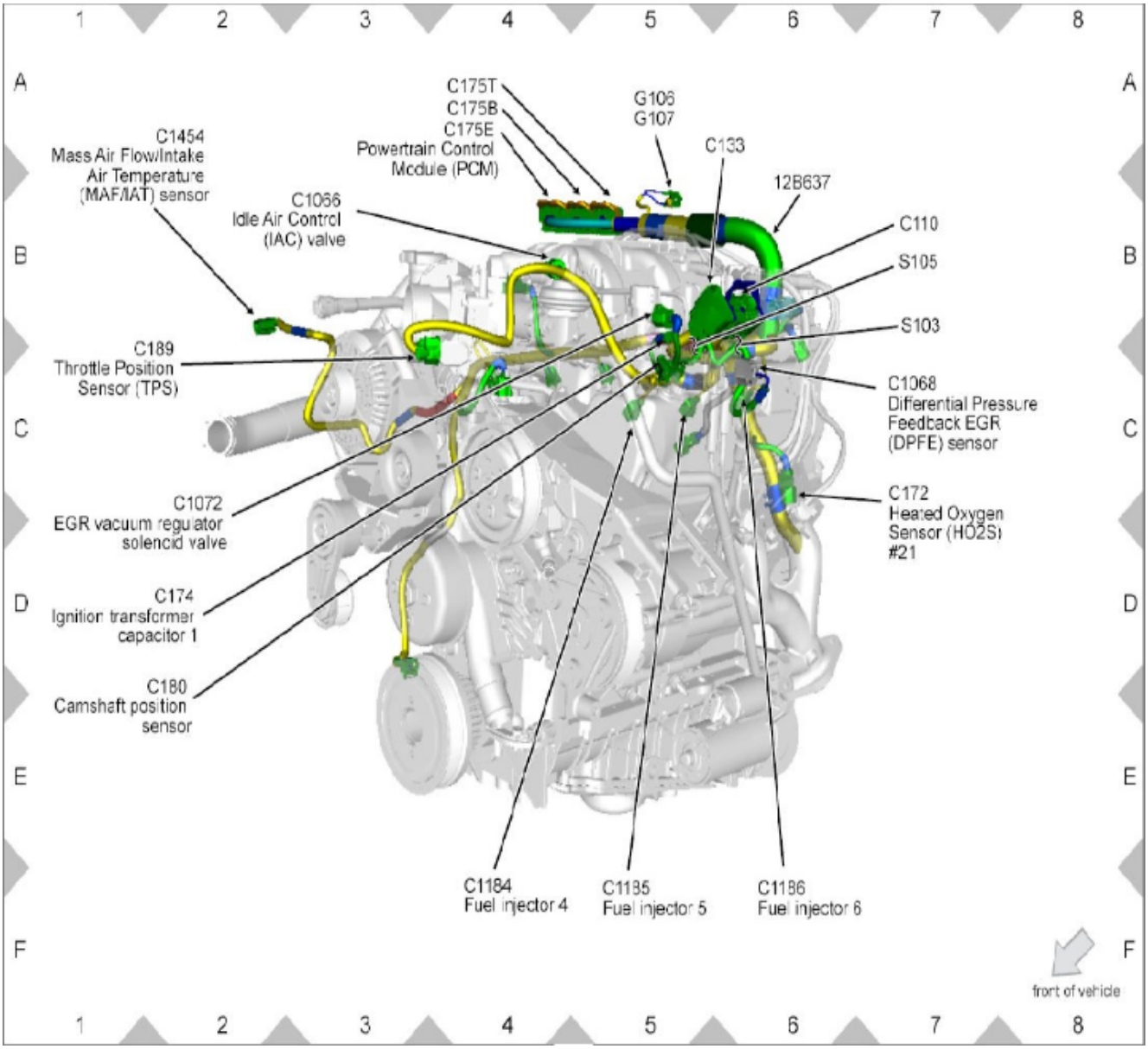


Throttle Position Sensor: Locations

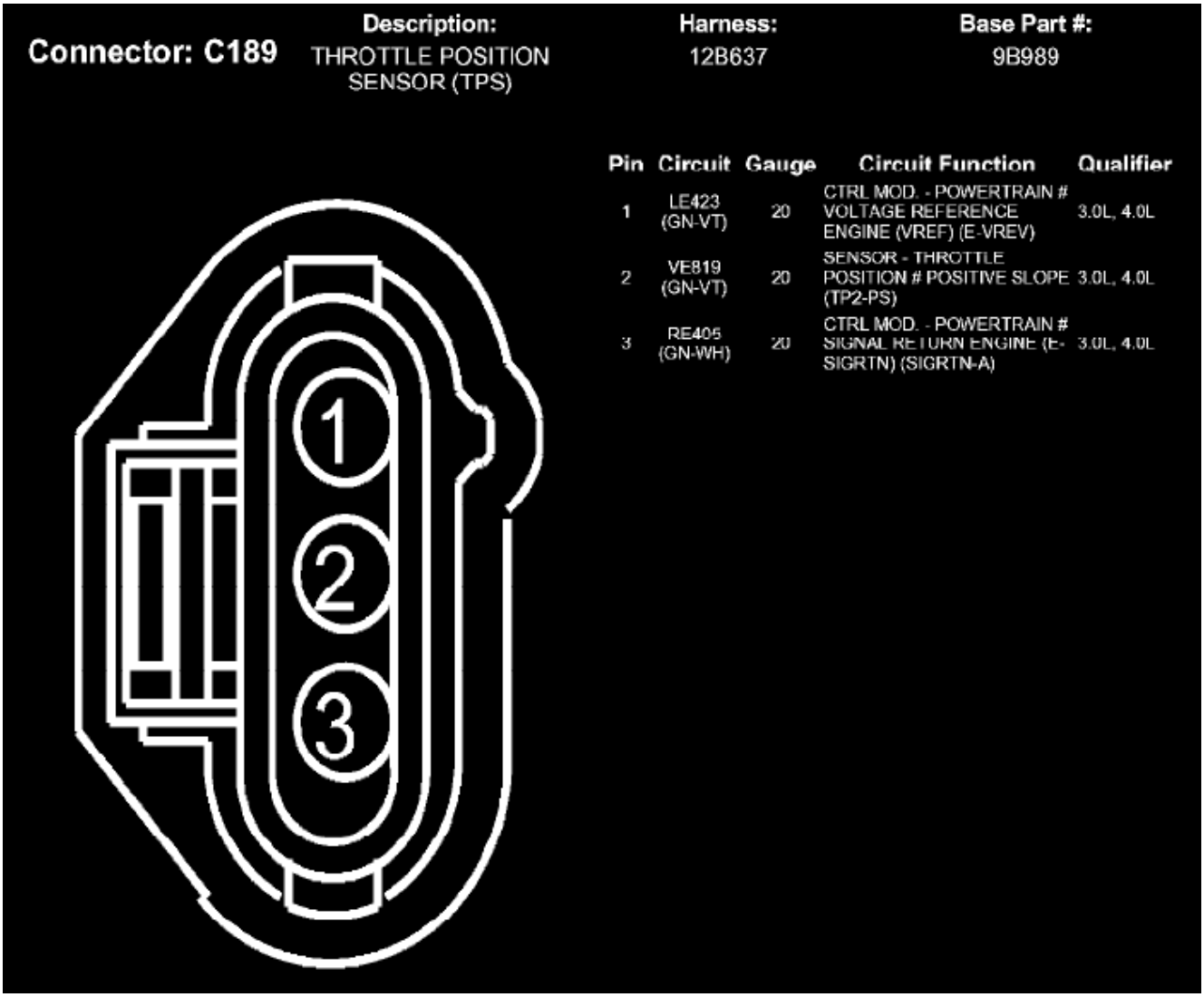
View 151-3


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
12B637
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT)
C133
C110
C1066
Idle Air Control (IAC) valve
C189
Throttle Position Sensor (TPS)
C1064
Engine Coolant Temperature (ECT) sensor
C1184
Fuel injector 4
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
S103
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-5


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
C133
12B637
C110
S105
S103
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor
C1066
Idle Air Control (IAC) valve
C189
Throttle Position Sensor (TPS)
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
C174
Ignition transformer capacitor 1
C180
Camshaft position sensor
C1184
Fuel injector 4
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-7



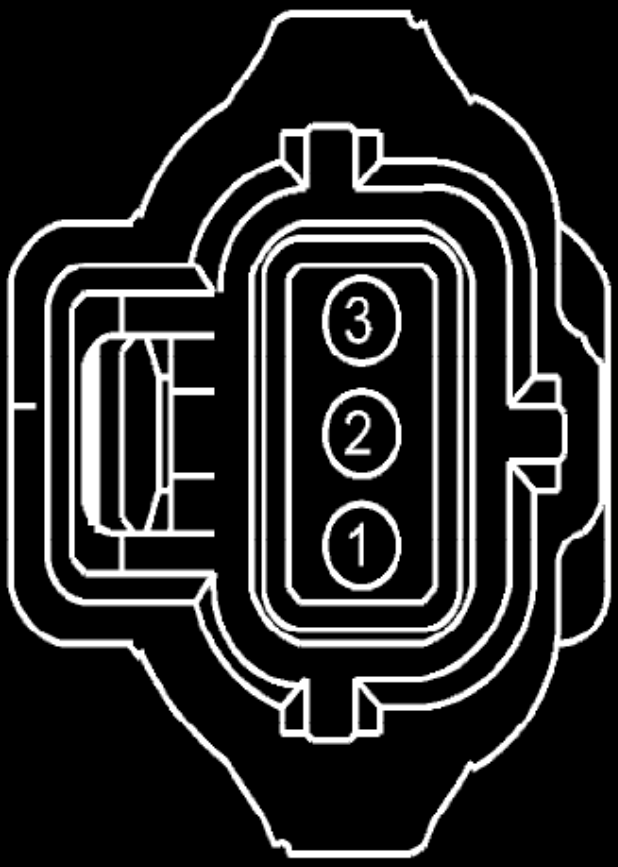
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	LE423 (GN-VT)	20	CTRL MOD. - POWERTRAIN # VOLTAGE REFERENCE ENGINE (VREF) (E-VREV)	3.0L, 4.0L
2	VE819 (GN-VT)	20	SENSOR - THROTTLE POSITION # POSITIVE SLOPE (TP2-PS)	3.0L, 4.0L
3	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	3.0L, 4.0L

Throttle Position Sensor: Diagrams

C189

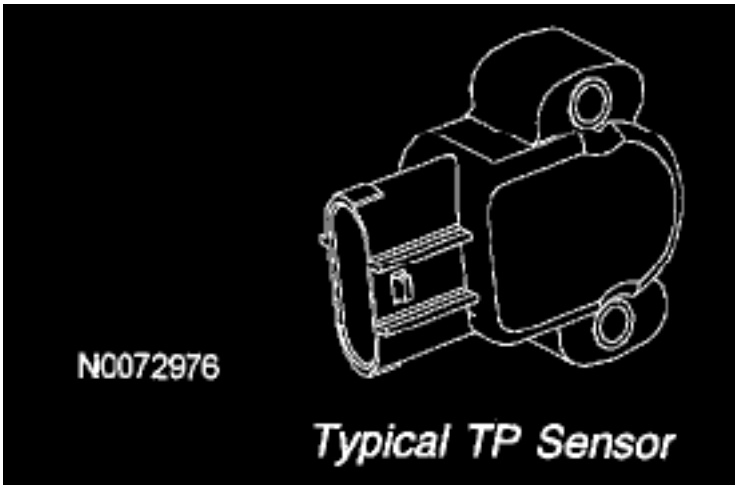
Connector: C1189

Description:	Harness:	Base Part #:
THROTTLE POSITION SENSOR (TPS)	12B637	9B989



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	2.3L
2	VE819 (GN-VT)	20	SENSOR - THROTTLE POSITION # POSITIVE SLOPE (TP2-PS)	2.3L
3	LE423 (GN-VT)	20	CTRL MOD. - POWERTRAIN # VOLTAGE REFERENCE ENGINE (VREF) (E-VREV)	2.3L

C1189



Throttle Position Sensor: Description and Operation

Electronic Throttle Body (ETB) Throttle Position Sensor

The ETB throttle position sensor has 2 signal circuits in the sensor for redundancy. The redundant ETB throttle position signals are required for increased monitoring. The first ETB throttle position sensor signal (TP1) has a negative slope (increasing angle, decreasing voltage) and the second signal (TP2) has a positive slope (increasing angle, increasing voltage). The 2 ETB throttle position sensor signals make sure the PCM receives a correct input even if 1 signal has a concern. There is 1 reference voltage circuit and 1 signal return circuit for the sensor. The reference voltage circuit and the signal return circuit is shared with the reference voltage circuits and signal return circuits used by the APP sensor.

Throttle Position (TP) Sensor

Typical TP Sensor

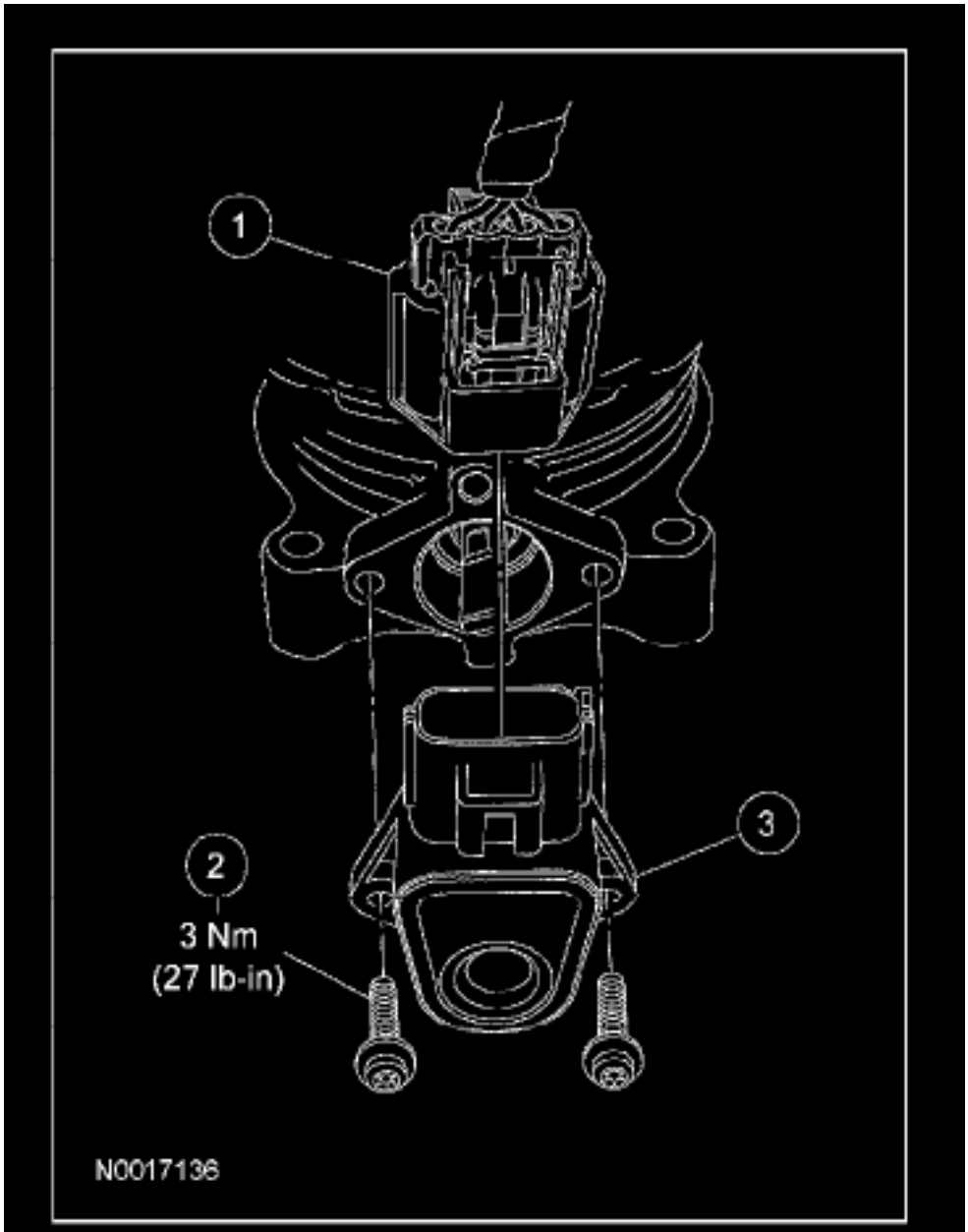
The TP sensor is a rotary potentiometer sensor that provides a signal to the PCM that is linearly proportional to the throttle plate/shaft position. The sensor housing has a 3-blade electrical connector that may be gold plated. The gold plating increases the corrosion resistance on the terminals and increases the connector durability. The TP sensor is mounted on the throttle body. As the TP sensor is rotated by the throttle shaft, 4 operating conditions are determined by the PCM from the TP. The operating conditions are: -

closed throttle (includes idle or deceleration)

- part throttle (includes cruise or moderate acceleration)

- wide open throttle (includes maximum acceleration or de-choke on crank)

- throttle angle rate



Item	Part Number	Description
1	14A464	Throttle position (TP) sensor electrical connector (part of 12B637)
2	W707535	TP sensor screw (2 required)
3	9E928	TP sensor

Throttle Position Sensor: Service and Repair

THROTTLE POSITION (TP) SENSOR

Removal and Installation

1. Disconnect the throttle position (TP) sensor electrical connector.

2. CAUTION: Failure to remove the throttle position (TP) sensor screws in the following manner will result in damage to the screws. First,

loosen the screws 1 to 2 full turns using a hand tool, and then use a suitable high-speed driver to complete the removal.

Remove and discard the 2 bolts and the TP sensor. -

To install, tighten to 3 Nm (27 lb-in).

3. CAUTION: Do not use a high-speed driver to install the new screws or damage to the throttle position (TP) sensor may occur.

NOTE: -

Do not reuse the TP sensor and screws. A new TP sensor and screws must be installed.

- Failure to install the TP sensor in this manner may result in excessive idle speeds. Slide the rotary tangs into position over the throttle shaft blade, then rotate the TP sensor.

To install, reverse the removal procedure. -

Install a new TP sensor and screws.

Variable Induction Control Actuator: Description and Operation

INTAKE MANIFOLD TUNING VALVE (IMTV)

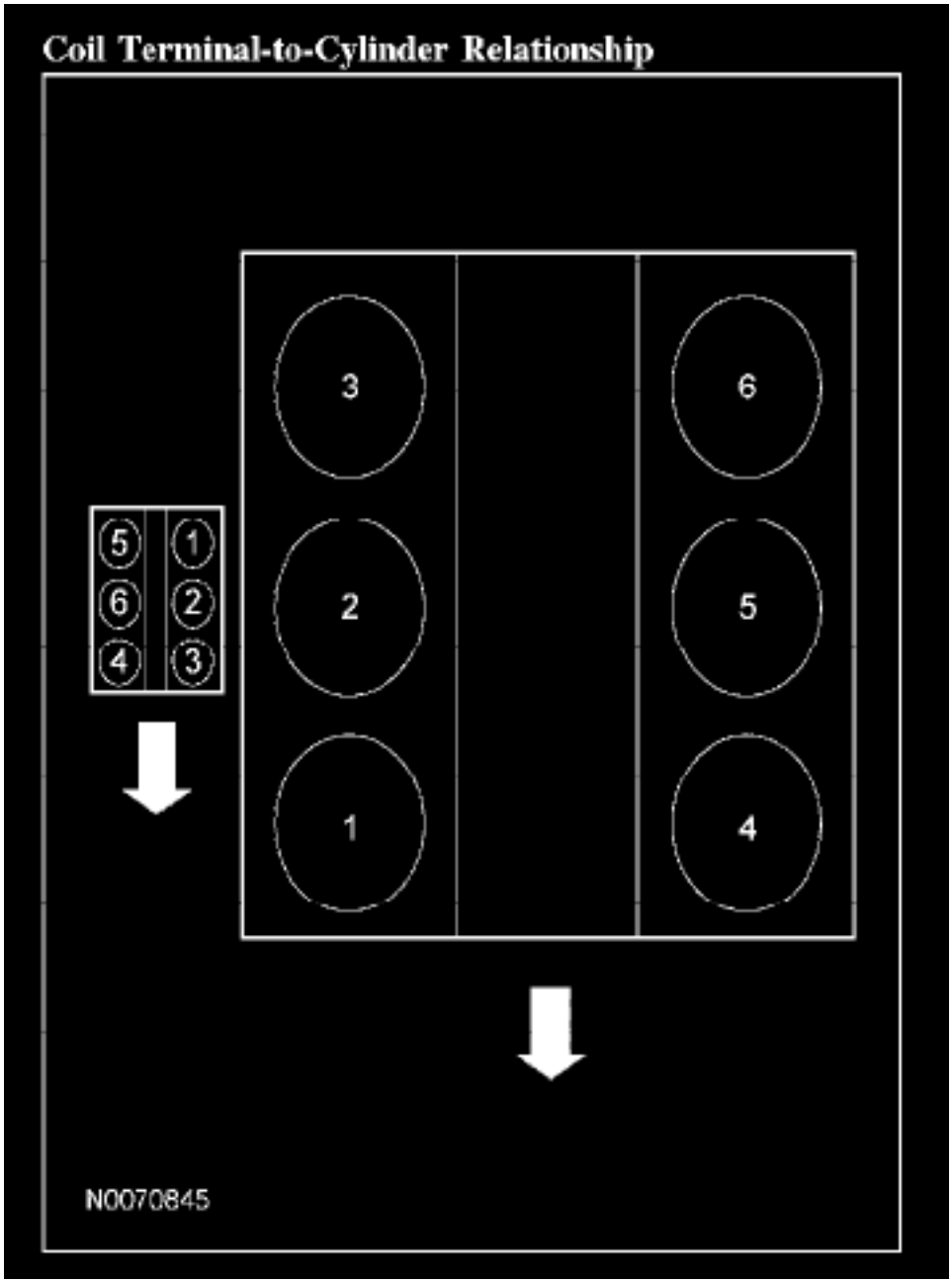
WARNING: Substantial opening and closing torque is applied by this system. To prevent injury, be careful to keep fingers away from lever mechanisms when actuated.

The IMTV is a motorized actuated unit mounted directly to the intake manifold. The IMTV actuator controls a shutter device attached to the actuator shaft. There is no monitor input to the PCM with this system to indicate shutter position.

The motorized IMTV unit is not energized below approximately 2,600 RPM. The shutter is in the closed position not allowing airflow blend to occur in the intake manifold. The motorized unit is energized above approximately 2,600 RPM. The motorized unit is commanded on by the PCM initially at a 100 percent duty cycle to move the shutter to the open position, and then falling to approximately 50 percent to continue to hold the shutter open.

Firing Order: Specifications

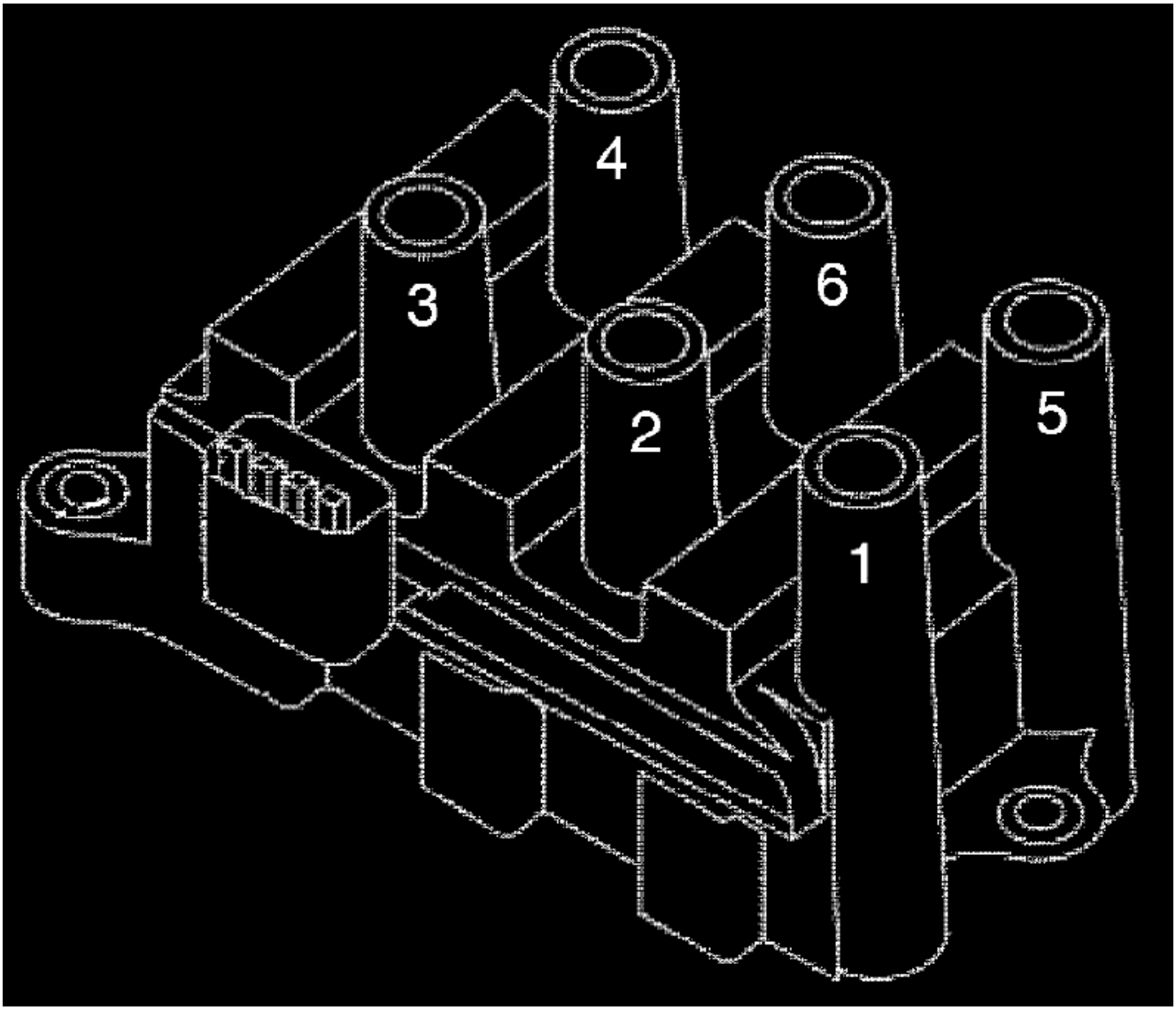
Item	Specification
Firing order	1-4-2-5-3-6



Firing Order: Locations

Coil Terminal-to-Cylinder Relationship

Number One Cylinder

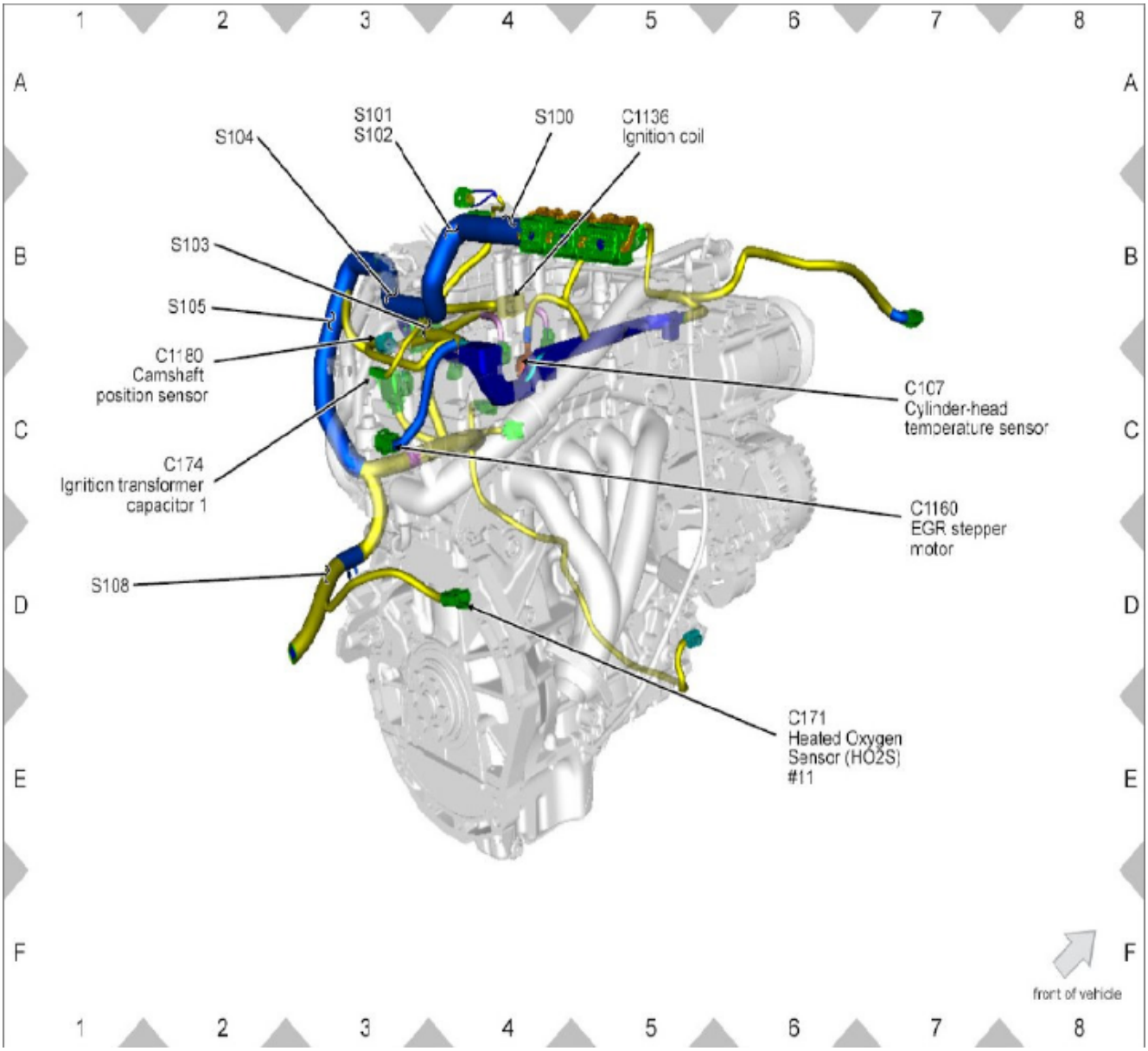


Spark Plug Cable Routing

Item	Specification
Firing order	1-4-2-5-3-6

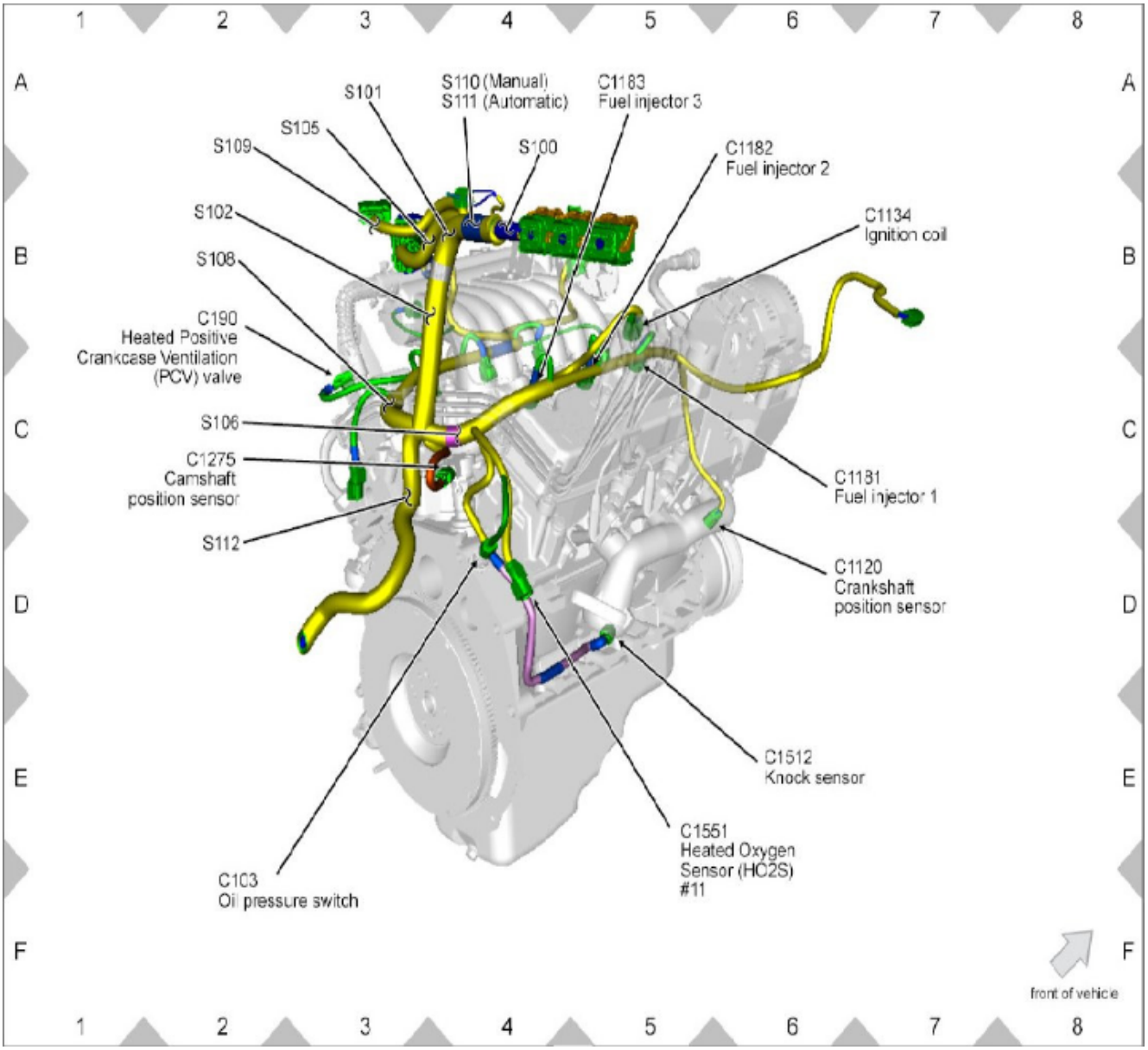
Ignition Timing: Specifications

Item	Specification
Base ignition timing (not adjustable)	10 degrees before top dead center (BTDC)

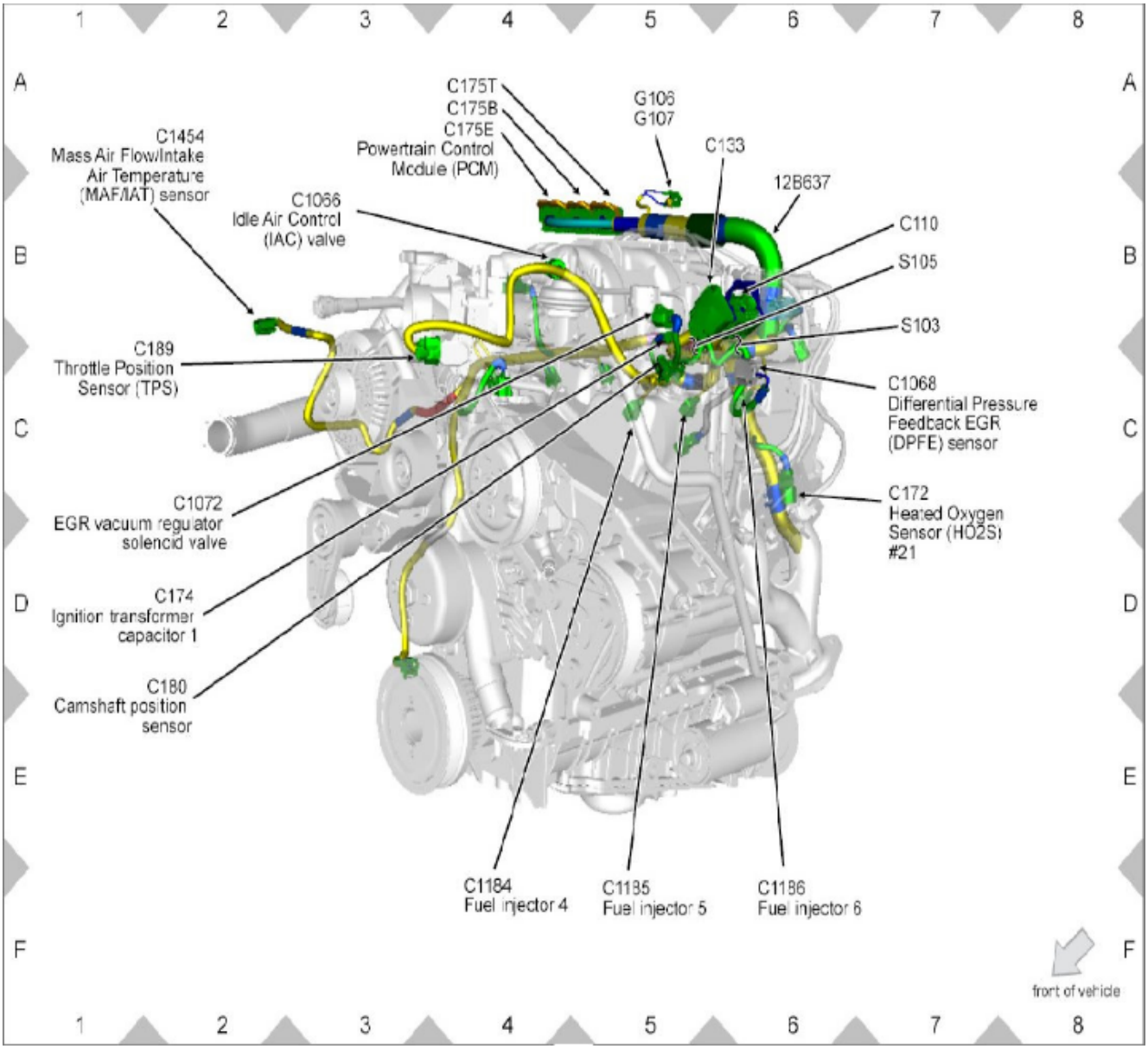


Camshaft Position Sensor: Locations

View 151-4


S101
S110 (Manual)
S111 (Automatic)
C1183
Fuel injector 3
S105
S109
S100
C1182
Fuel injector 2
S102
C1134
Ignition coil
S108
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
C1275
Camshaft
position sensor
S112
C1181
Fuel injector 1
C1120
Crankshaft
position sensor
C1512
Knock sensor
C1551
Heated Oxygen
Sensor (HO2S)
#11
C103
Oil pressure switch
front of vehicle

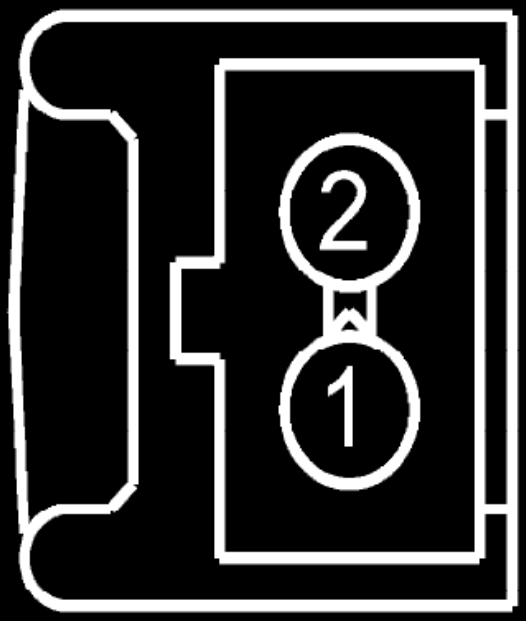
View 151-6


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
C133
12B637
C110
S105
S103
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor
C1066
Idle Air Control (IAC) valve
C189
Throttle Position Sensor (TPS)
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
C174
Ignition transformer capacitor 1
C180
Camshaft position sensor
C1184
Fuel injector 4
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-7

Connector: C180

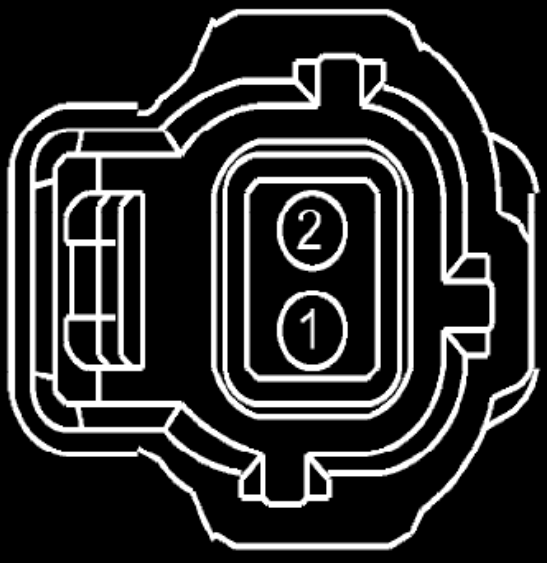
Description:	Harness:	Base Part #:
CAMSHAFT POSITION SENSOR	12B637	6B288



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE706 (BN-BU)	18	SENSOR - CAMSHAFT POSITION BANK 1 IN+EX/IN (CMP1) [CID-H] (CID1)	4.0L
2	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	4.0L

Connector: C1180

Description:	Harness:	Base Part #:
CAMSHAFT POSITION SENSOR	12B637	6B288



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	2.3L
2	VE706 (BN-BU)	18	SENSOR - CAMSHAFT POSITION BANK 1 IN+EX/ IN (CMP1) [CID-H] (CID1)	2.3L

Camshaft Position Sensor: Diagrams

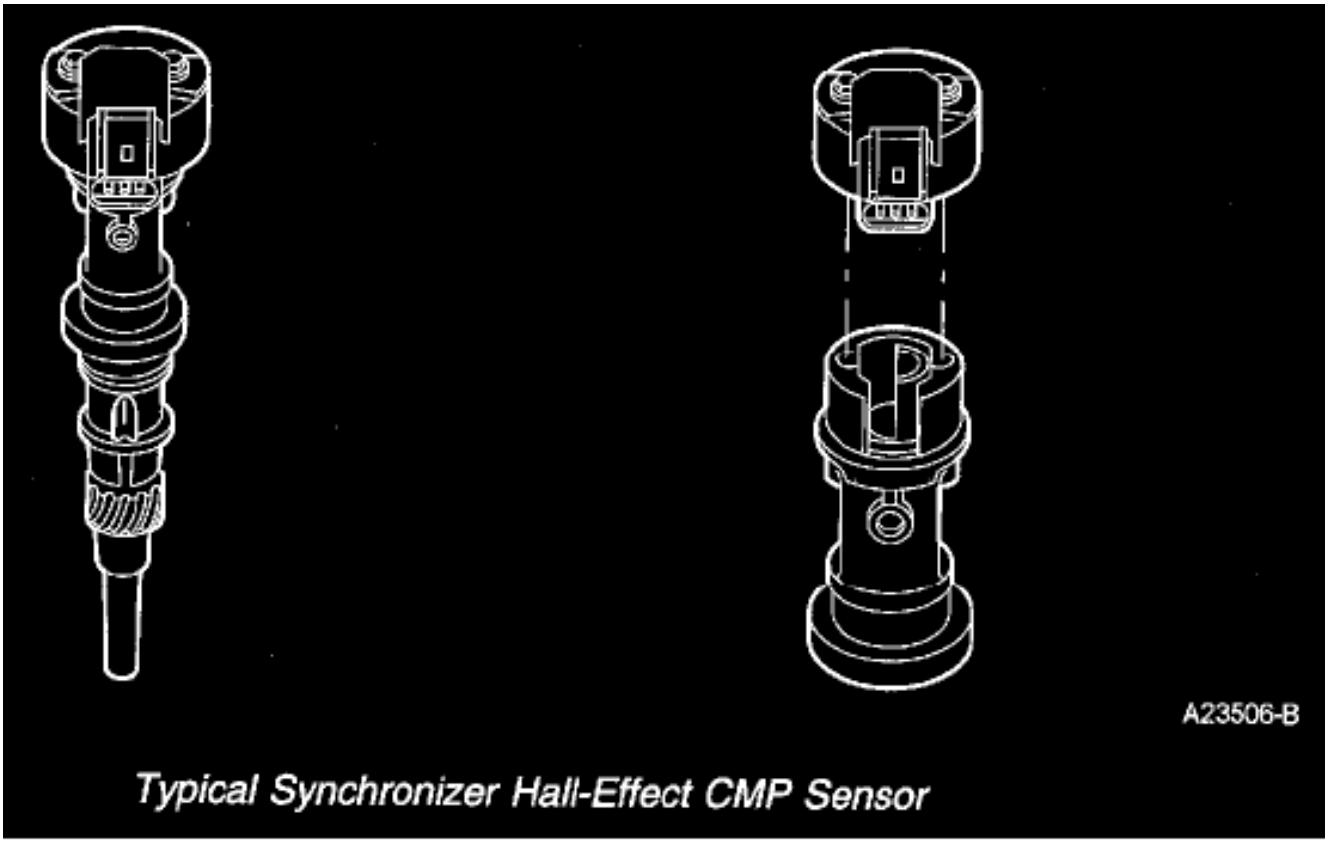
C180

C1180

Connector: C1275	Description:	Harness:	Base Part #:
	CAMSHAFT POSITION SENSOR	12B637	6B288

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	3.0L
2	VE706 (BN-BU)	18	SENSOR - CAMSHAFT POSITION BANK 1 IN+EX/ IN (CMP1) [CID-H] (CID1)	3.0L

C1275



Typical Synchronizer Hall-Effect CMP Sensor

Typical Variable Reluctance CMP Sensor

Camshaft Position Sensor: Description and Operation

CAMSHAFT POSITION (CMP) SENSOR

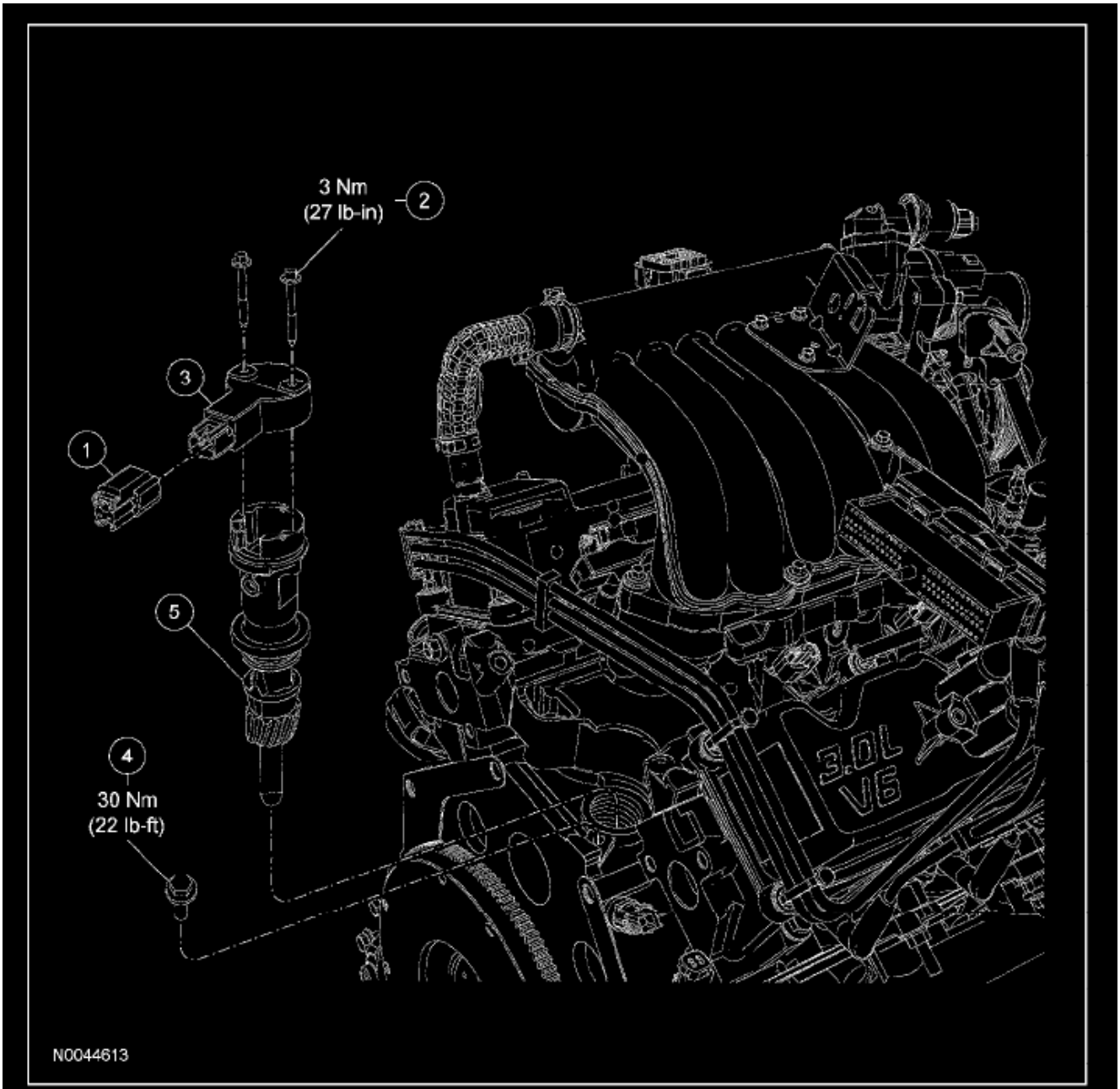
Typical Synchronizer Hall-Effect CMP Sensor

Typical Variable Reluctance CMP Sensor

The CMP sensor detects the position of the camshaft. The CMP sensor identifies when piston number 1 is on its compression stroke. A signal is then sent to the PCM and used for synchronizing the sequential firing of the fuel injectors. Coil on plug (COP) ignition applications use the CMP signal to select the correct ignition coil to fire.

Vehicles with 2 CMP sensors are equipped with variable camshaft timing (VCT). They use the second sensor to identify the position of the camshaft on bank 2 as an input to the PCM.

There are 2 types of CMP sensors: the 3-pin connector Hall-effect type sensor and the 2-pin connector variable reluctance type sensor.



Item	Part Number	Description
1	—	Camshaft position (CMP) sensor electrical connector (part of 12B637)
2	W701219	CMP sensor bolt (2 required)

(Continued)

Item	Part Number	Description
3	6B288	CMP sensor
4	—	Camshaft synchronizer bolt
5	12A362	Camshaft synchronizer

Camshaft Position Sensor: Service and Repair

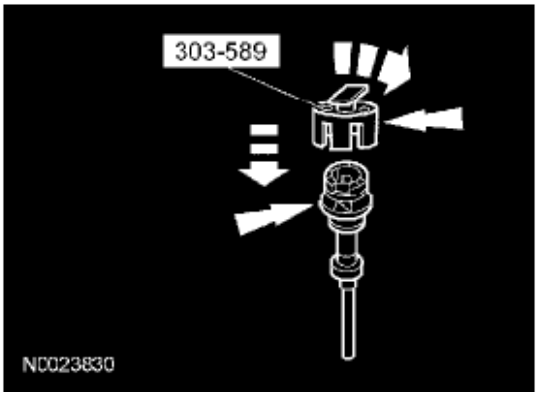
CAMSHAFT SYNCHRONIZER

Exploded View

Special Tool(s)

Special Tool(s)

ST2362-A	Synchronizer Alignment Gauge 303-589



Special Tool(s)

Removal

1. Disconnect the camshaft position (CMP) sensor electrical connector.

2. NOTE: Prior to the removal of the CMP sensor, note the position of the CMP sensor electrical connector. The installation procedure requires that

the electrical connector be located in the same position.

Remove the 2 bolts and the CMP sensor.

3. Remove the camshaft synchronizer bolt. 4. Remove the camshaft synchronizer. Inspect the O-ring seal and install a new O-ring seal if damaged.

Installation

1. CAUTION:

- After installation, do not loosen the synchronizer bolt and rotate the synchronizer assembly. The synchronizer assembly is not adjustable. Do not loosen the synchronizer bolt after the alignment tool has been removed in order to align the camshaft position (CMP) sensor electrical connector for any reason. If the electrical connector is not in the correct position, the synchronizer assembly must be removed. The alignment tool and the assembly must be reinstalled if the engine has not been rotated from top dead center (TDC) of the compression stroke on the No. 1 cylinder. Failure to follow this procedure will result in the fuel system being out of time with the engine, possibly causing engine damage.

- Do not turn the crankshaft or camshaft during the removal and installation procedure or the fuel system timing will be out of time with the engine, possibly causing engine damage.

- A special tool must be used during the installation of the new synchronizer assembly. Failure to follow this procedure will result in the fuel system being out of time with the engine, possibly causing engine damage.

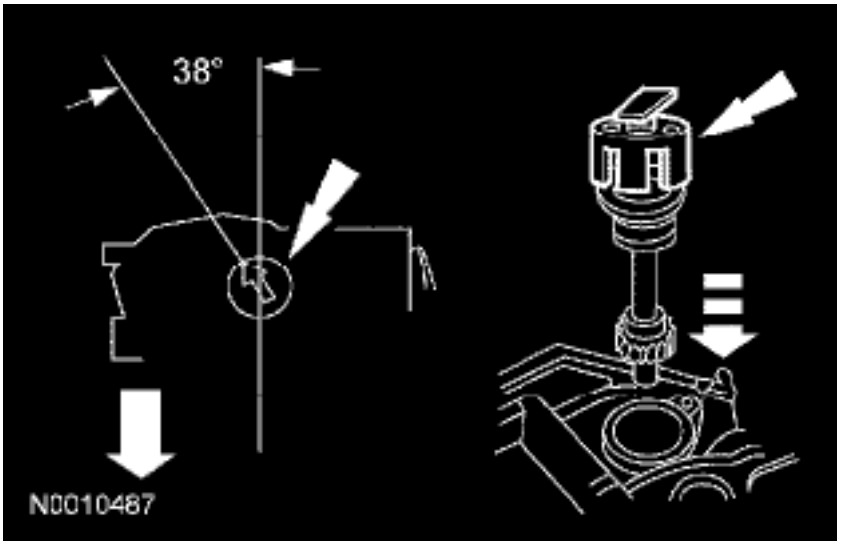
Install the special tool on the camshaft synchronizer by rotating the tool until it engages the notch in the camshaft synchronizer housing and the armature.

2. CAUTION: It is very important to coat the gear on the camshaft synchronizer with engine oil prior to installation. Failure to do so may

result in gear failure.

NOTE: During installation, the arrow on the special tool will rotate clockwise until the oil pump intermediate shaft and the camshaft gear engages.

Install the camshaft synchronizer housing assembly so the arrow on the special tool is 38 degrees from the centerline of the engine.



3. Install the camshaft synchronizer housing bolt.

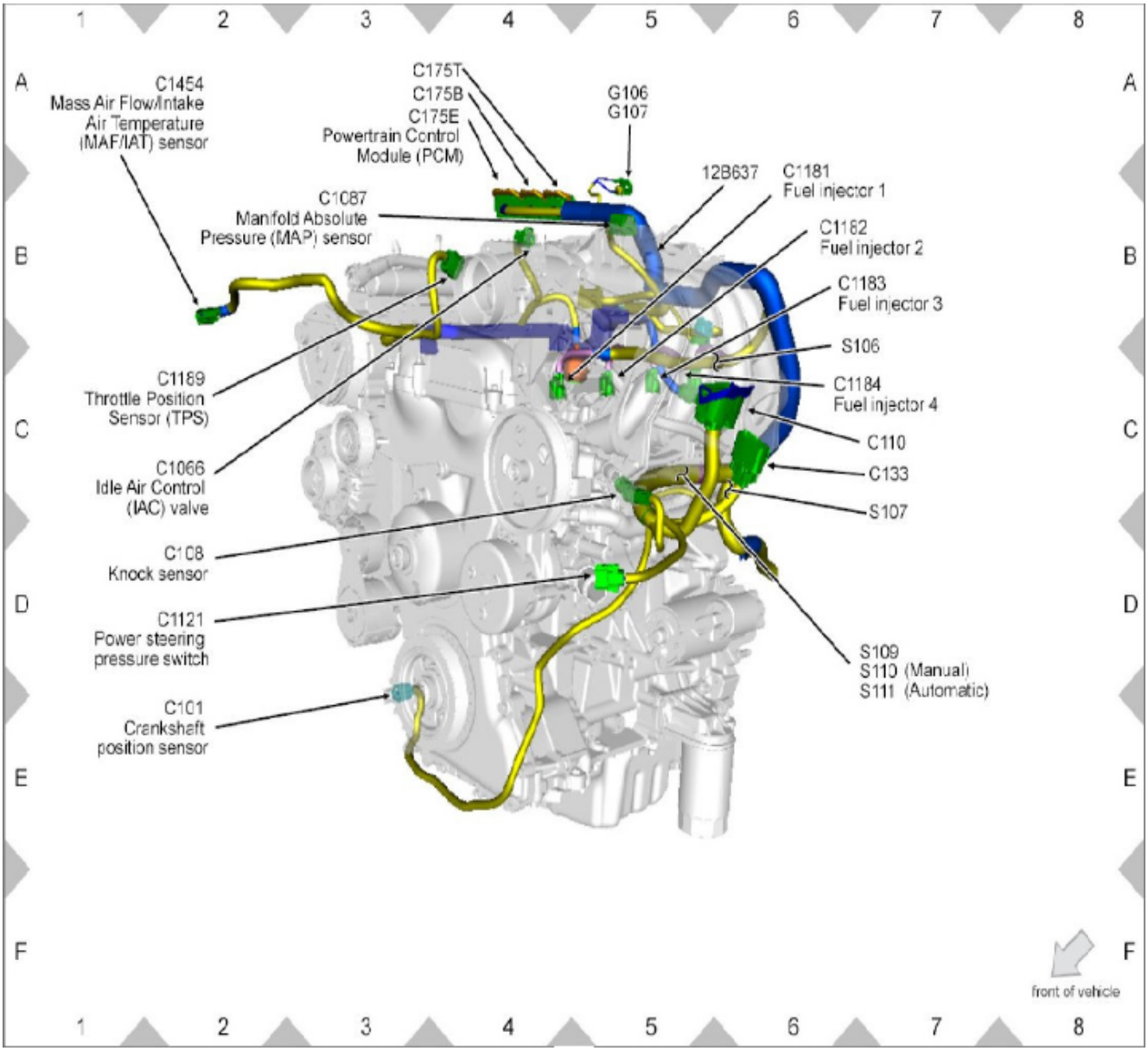
- Tighten to 30 Nm (22 lb-ft).

4. Position the CMP sensor and install the 2 bolts.

- Tighten to 3 Nm (27 lb-in).

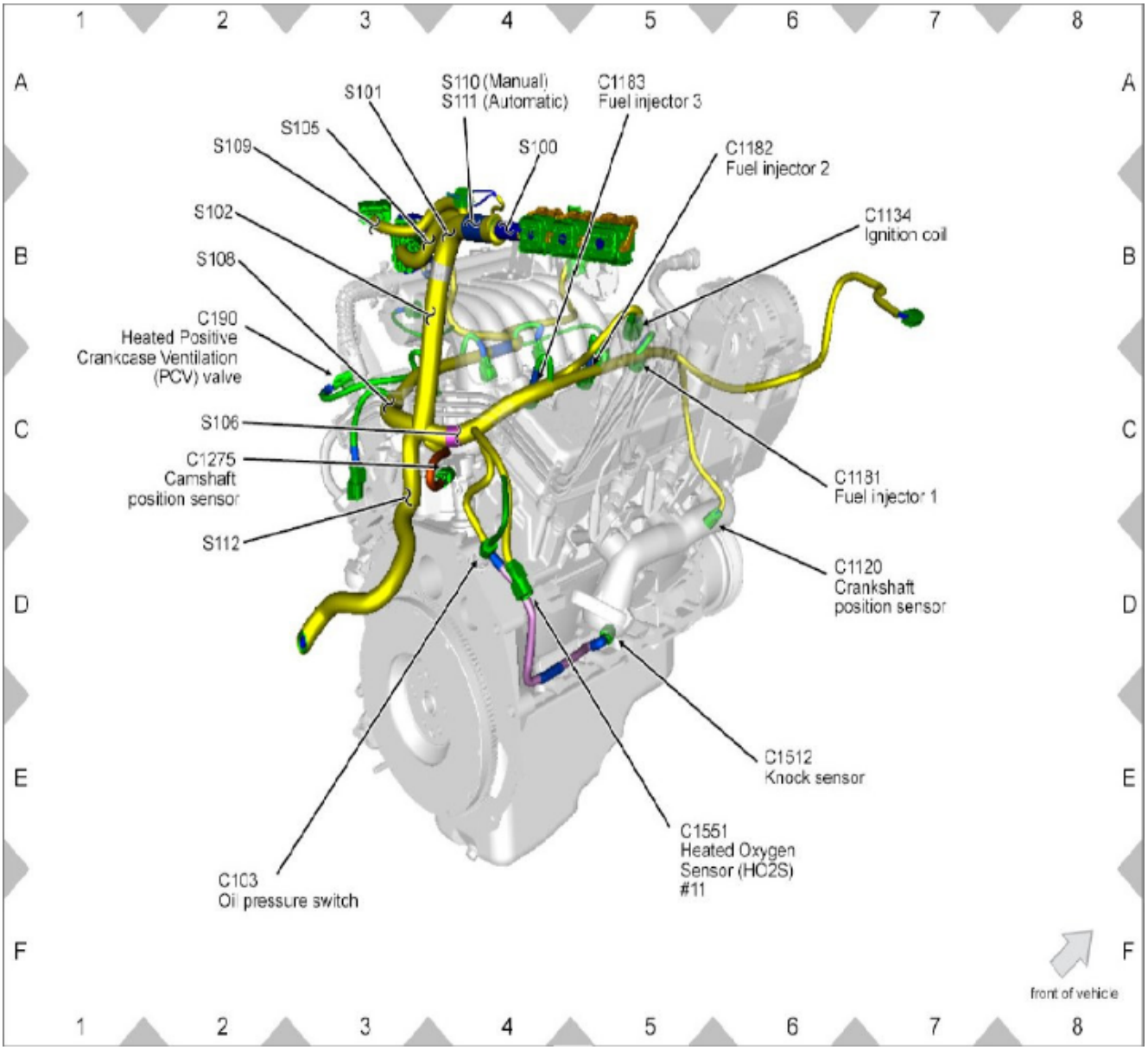
5. Connect the CMP sensor electrical connector.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Powertrain Management > Ignition System > Crankshaft Position Sensor > Component Information > Locations

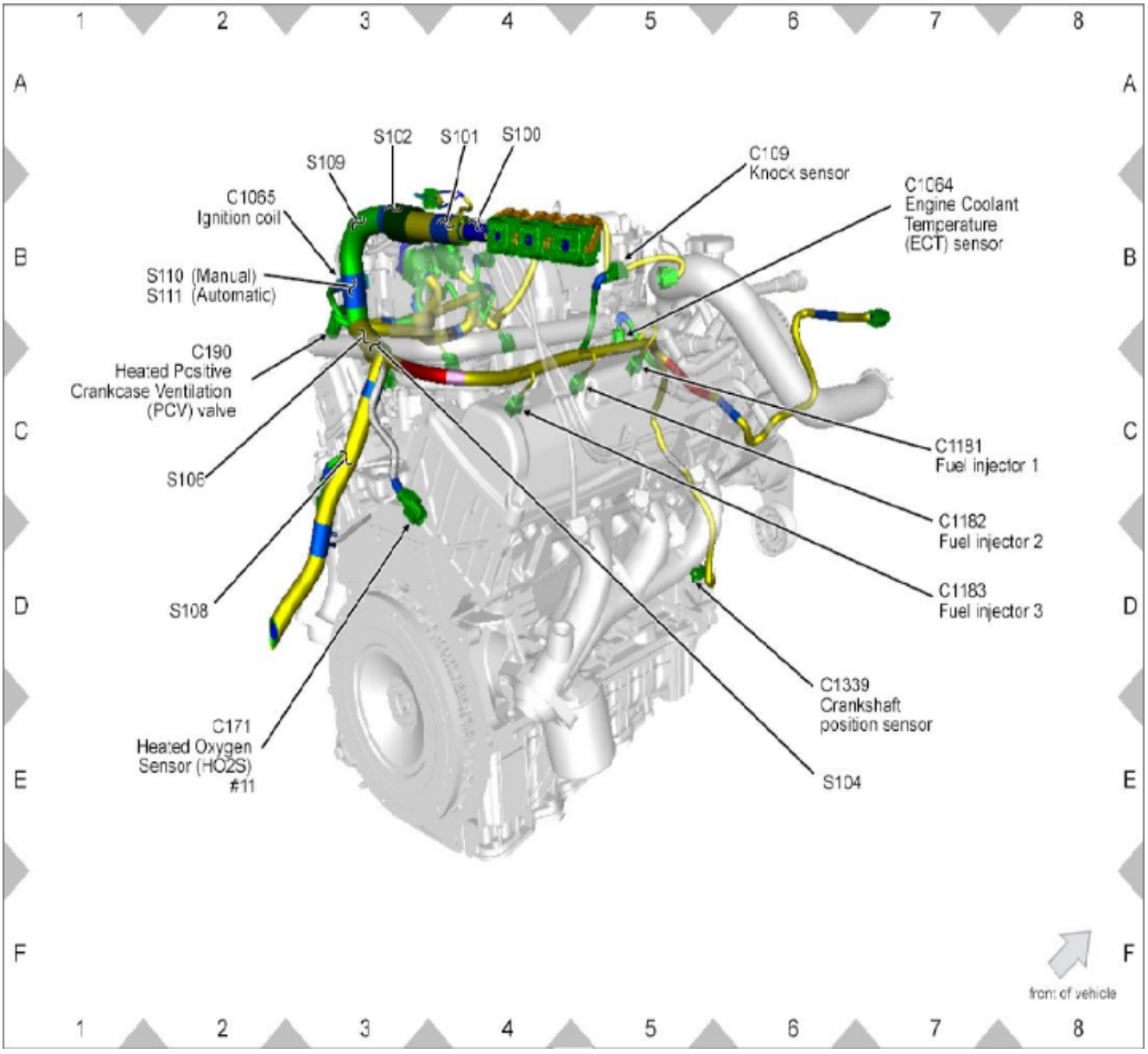


Crankshaft Position Sensor: Locations

View 151-3


S101
S110 (Manual)
S111 (Automatic)
C1183
Fuel injector 3
S105
S109
S100
C1182
Fuel injector 2
S102
C1134
Ignition coil
S108
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
C1275
Camshaft
position sensor
S112
C1181
Fuel injector 1
C1120
Crankshaft
position sensor
C1512
Knock sensor
C1551
Heated Oxygen
Sensor (HO2S)
#11
C103
Oil pressure switch
front of vehicle

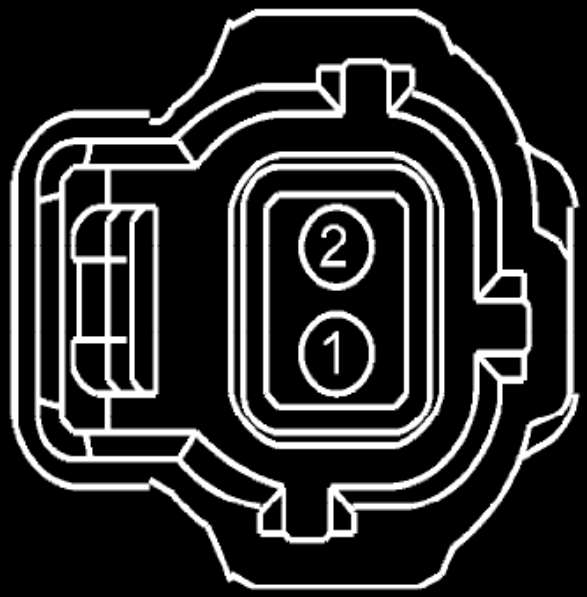
View 151-6


S102
S101
S100
S109
C1065
Ignition coil
C109
Knock sensor
C1064
Engine Coolant Temperature (ECT) sensor
S110 (Manual)
S111 (Automatic)
C190
Heated Positive Crankcase Ventilation (PCV) valve
S106
C1181
Fuel injector 1
C1182
Fuel injector 2
C1183
Fuel injector 3
S108
C1339
Crankshaft position sensor
C171
Heated Oxygen Sensor (HO2S) #11
S104
front of vehicle

View 151-8

Connector: C101

Description:	Harness:	Base Part #:
CRANKSHAFT POSITION SENSOR	12B637	6C315



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE711 (YE-VT)	18	SENSOR - CRANKSHAFT POSITION (CKPP)	2.3L
2	RE135 (GN-BN)	18	CTRL MOD. - POWERTRAIN # CRANKSHAFT POSITION SENSOR (CKPN)	2.3L

Connector: C1120

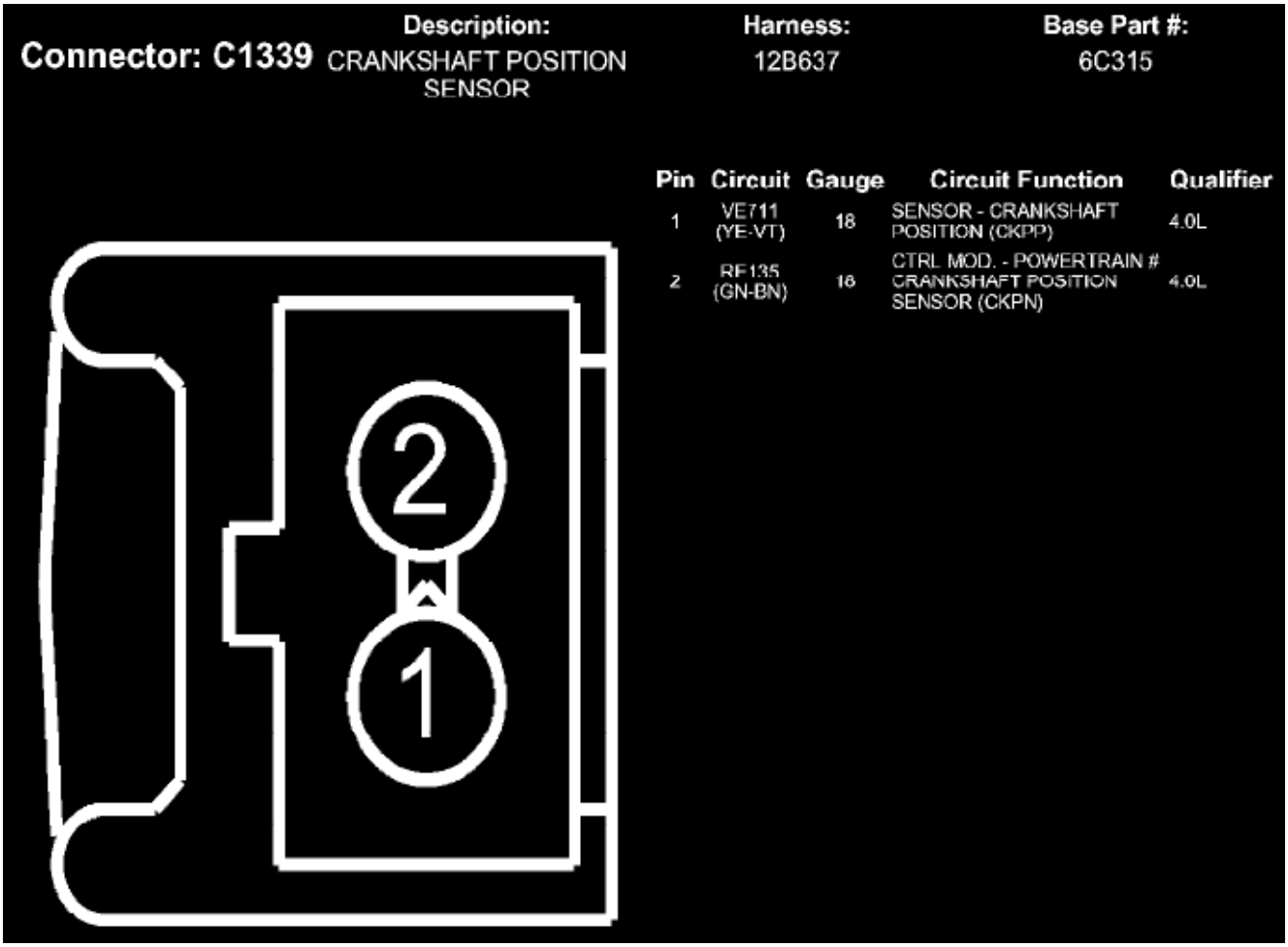
Description:	Harness:	Base Part #:
CRANKSHAFT POSITION SENSOR	12B637	6C315

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RE135 (GN-BN)	18	CTRL MOD. - POWERTRAIN # CRANKSHAFT POSITION SENSOR (CKPN)	3.0L
2	VE711 (YE-VT)	18	SENSOR - CRANKSHAFT POSITION (CKPP)	3.0L

Crankshaft Position Sensor: Diagrams

C101

C1120


Connector: C1339
Description:
CRANKSHAFT POSITION SENSOR
Harness:
12B637
Base Part #:
6C315
Pin
Circuit
Gauge
Circuit Function
Qualifier
1
VE711 (YE-VT)
18
SENSOR - CRANKSHAFT POSITION (CKPP)
4.0L
2
RF135 (GN-BN)
18
CTRL MOD. - POWERTRAIN # CRANKSHAFT POSITION SENSOR (CKPN)
4.0L
2
1

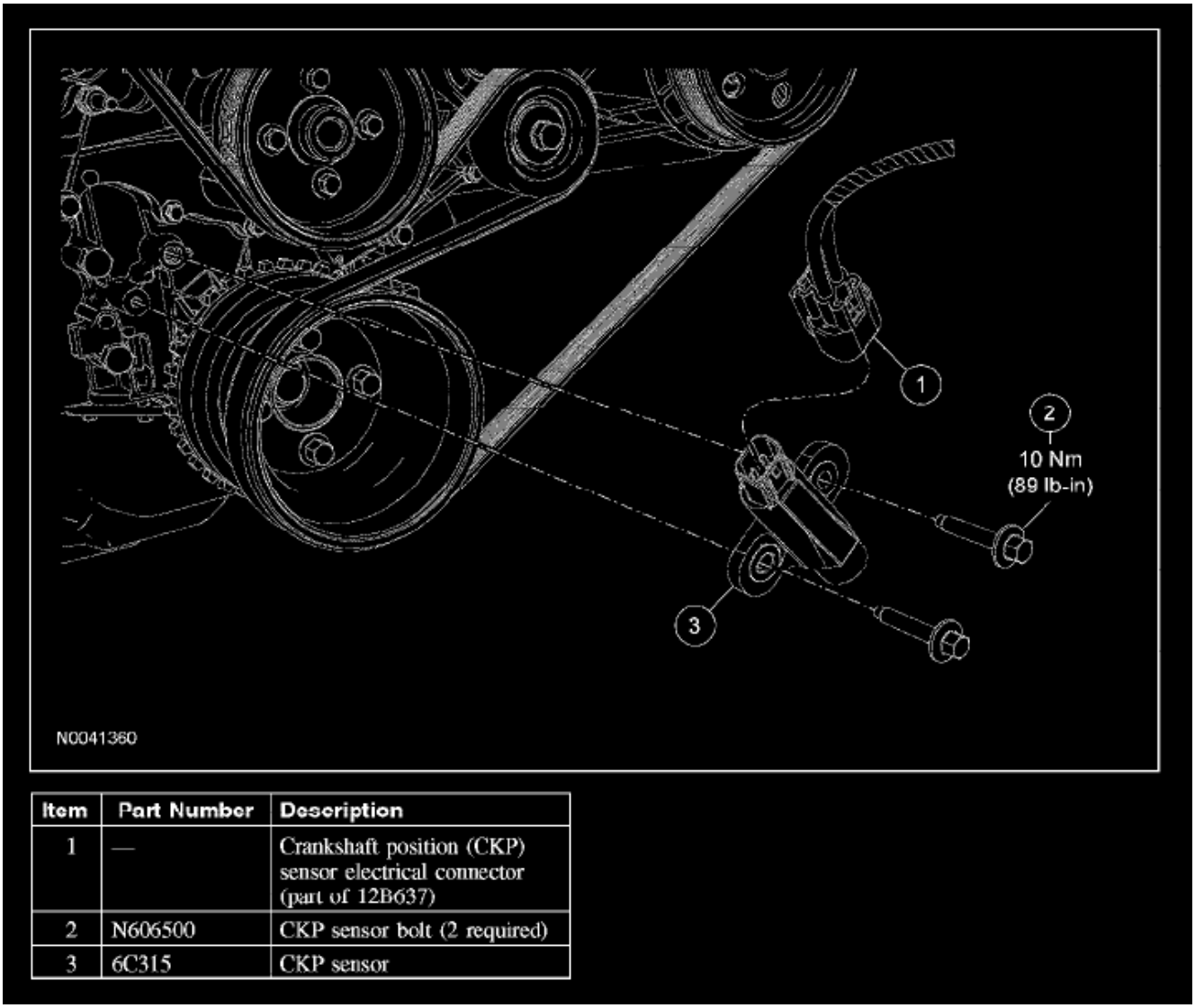
C1339

Crankshaft Position Sensor: Description and Operation

CRANKSHAFT POSITION (CKP) SENSOR

Typical Crankshaft Position (CKP) Sensor

The CKP sensor is a magnetic transducer mounted on the engine block adjacent to a pulse wheel located on the crankshaft. By monitoring the crankshaft mounted pulse wheel, the CKP is the primary sensor for ignition information to the PCM. The pulse wheel has a total of 35 teeth spaced 10 degrees apart with one empty space for a missing tooth. The 6.8L 10-cylinder pulse wheel has 39 teeth spaced 9 degrees apart and one 9 degree empty space for a missing tooth. By monitoring the pulse wheel, the CKP sensor signal indicates crankshaft position and speed information to the PCM. By monitoring the missing tooth, the CKP sensor is also able to identify piston travel in order to synchronize the ignition system and provide a way of tracking the angular position of the crankshaft relative to a fixed reference for the CKP sensor configuration. The PCM also uses the CKP signal to determine if a misfire has occurred by measuring rapid decelerations between teeth.



Item	Part Number	Description
1	—	Crankshaft position (CKP) sensor electrical connector (part of 12B637)
2	N606500	CKP sensor bolt (2 required)
3	6C315	CKP sensor

Crankshaft Position Sensor: Service and Repair

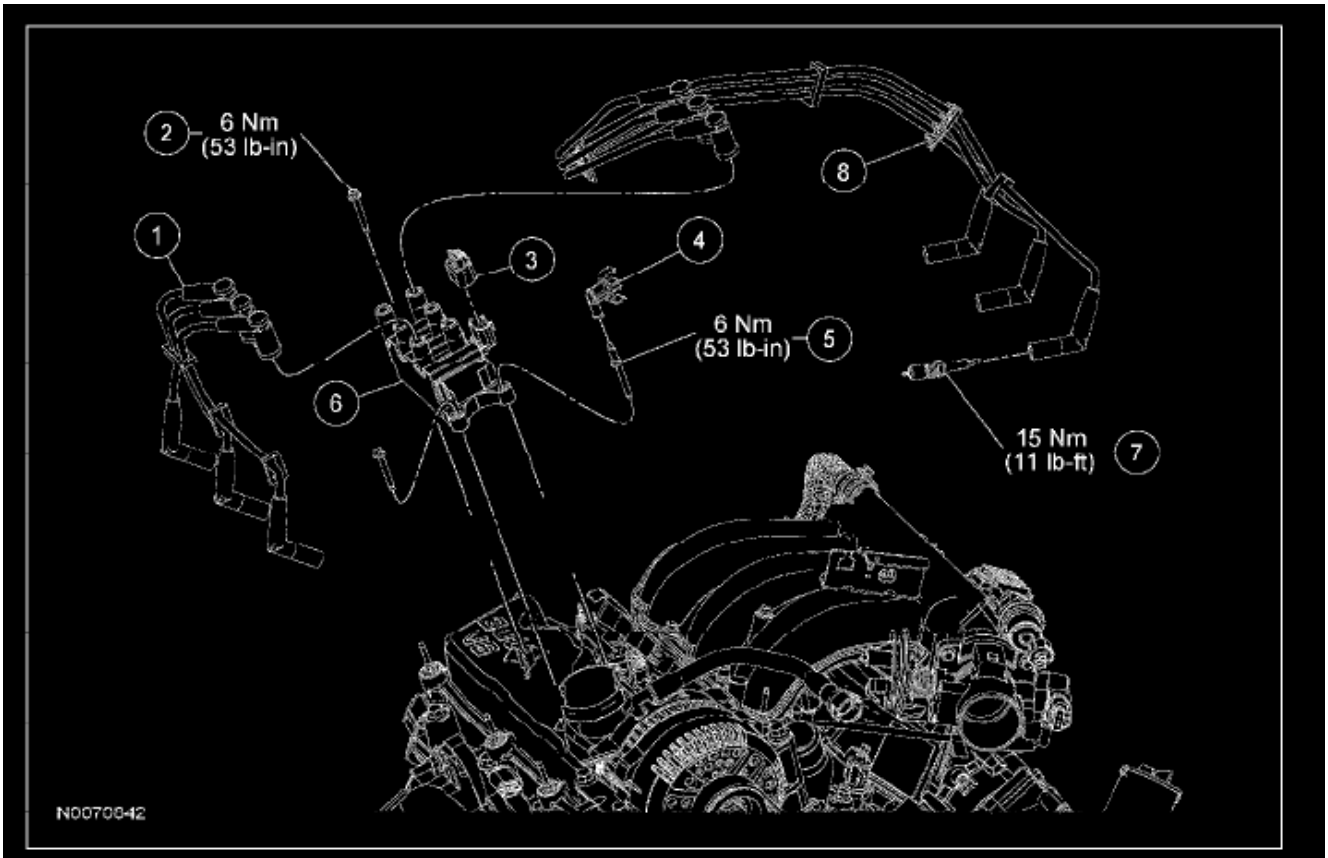
CRANKSHAFT POSITION (CKP) SENSOR

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the crankshaft position (CKP) sensor electrical connector. 3. Remove the 2 bolts and the CKP sensor.

- To install, tighten to 10 Nm (89 lb-in).

4. To install, reverse the removal procedure.



Item	Part Number	Description
1	12259	Spark plug wire set
2	W706995	Ignition coil bolt (2 required)
3	—	Ignition coil electrical connector (part of 12B637)
4	18D331	Heater hose retainer
5	W706825	Ignition coil stud bolt

Item	Part Number	Description
6	12029	Ignition coil
7	12405	Spark plug (6 required)
8	12297	Spark plug wire retainer (7 required)

(Continued)

Special Tool(s)

Remover, Spark Plug Wire
303-106 (T74P-6666-A)

Ignition Cable: Service and Repair

SPARK PLUG WIRES

Exploded View

Special Tool(s)

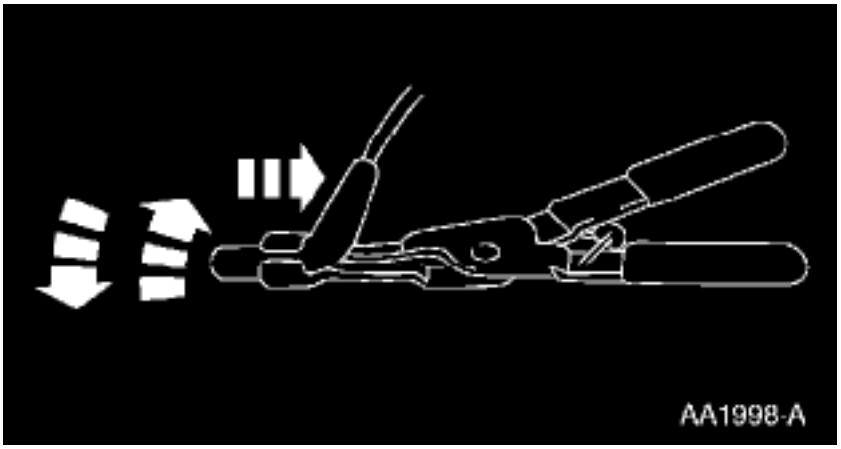
Special Tool(s)

Removal and Installation

CAUTION: Spark plug wires must be connected correctly. Failure to follow this instruction may result in poor engine performance.

1. CAUTION: Do not pull on the spark plug wire as it may separate from the spark plug wire connector inside the spark plug wire boot.

Use the Spark Plug Wire Remover to grasp and twist the spark plug wire boot back and forth on the spark plug insulator to release the connectors.



2. Disconnect the spark plug wires from the ignition coil by twisting while pulling upward. 3. Open the spark plug wire separators and remove the spark plug wires.

4. CAUTION: Correct installation of the spark plug wires is critical to vehicle operation. If one spark plug wire is not correctly installed on

the spark plug or ignition coil, both spark plugs connected to that segment of the ignition coil may not fire under load.

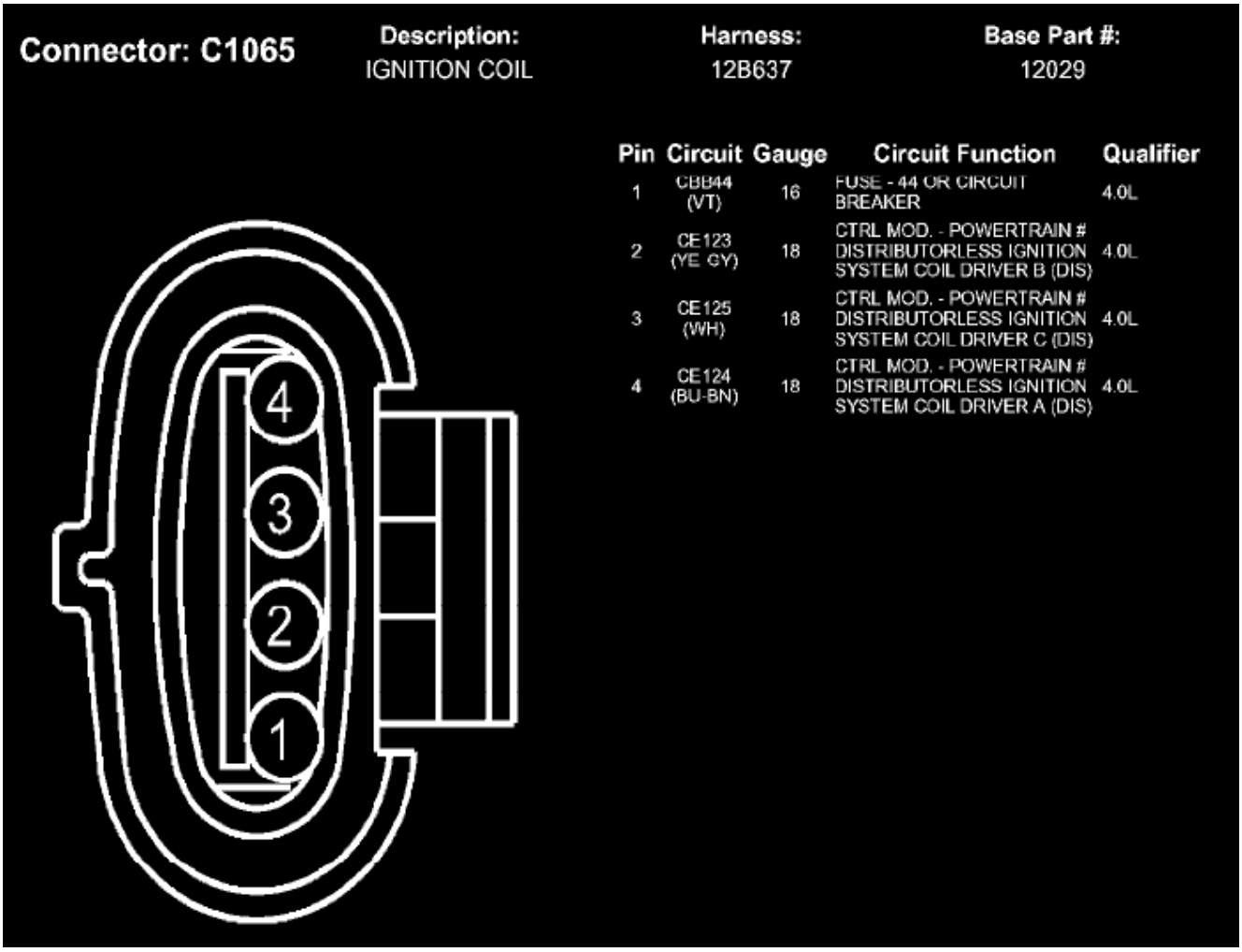
To install, reverse the removal procedure. -

Use a small, clean tool to coat the entire interior surface of the boots with silicone brake caliper grease.

Torque Specifications

Description	Nm	lb-ft	lb-in
Ignition coil bolts	6	—	53
Spark plugs	15	11	—

Torque Specifications

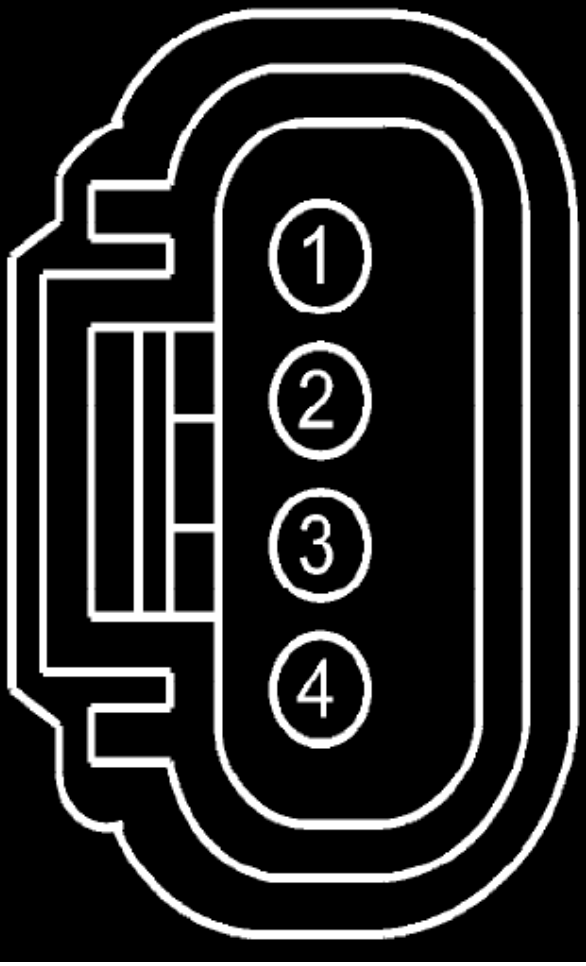


Ignition Coil: Diagrams Ignition Coil

C1065

Connector: C1134

Description:	Harness:	Base Part #:
IGNITION COIL	12B637	12029



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE124 (BU-BN)	18	CTRL MOD. - POWERTRAIN # DISTRIBUTORLESS IGNITION SYSTEM COIL DRIVER B (DIS)	3.0L
2	CE125 (WH)	18	CTRL MOD. - POWERTRAIN # DISTRIBUTORLESS IGNITION SYSTEM COIL DRIVER C (DIS)	3.0L
3	CE123 (YE-GY)	18	CTRL MOD. - POWERTRAIN # DISTRIBUTORLESS IGNITION SYSTEM COIL DRIVER A (DIS)	3.0L
4	CBB44 (VT)	18	FUSE - 44 OR CIRCUIT BREAKER	3.0L

C1134

Connector: C1136

Description:	Harness:	Base Part #:
IGNITION COIL	12B637	12029

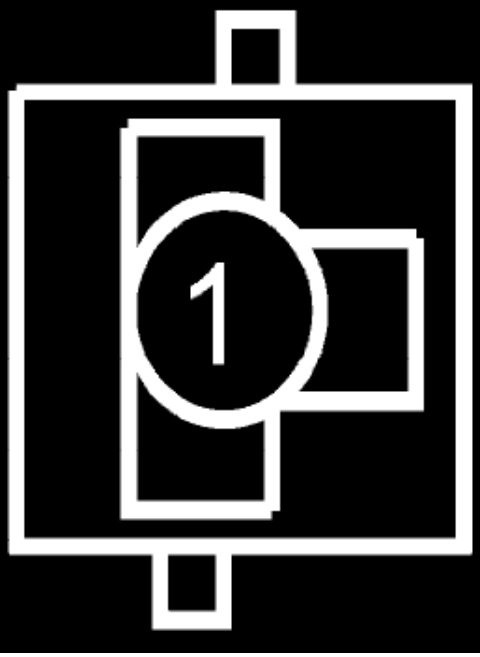
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE124 (BU-BN)	18	CTRL MOD. - POWERTRAIN # DISTRIBUTORLESS IGNITION SYSTEM COIL DRIVER B (DIS)	2.3L
2	CBB44 (VT)	16	FUSE - 44 OR CIRCUIT BREAKER	2.3L
3	CE125 (WH)	18	CTRL MOD. - POWERTRAIN # DISTRIBUTORLESS IGNITION SYSTEM COIL DRIVER C (DIS)	2.3L

C1136

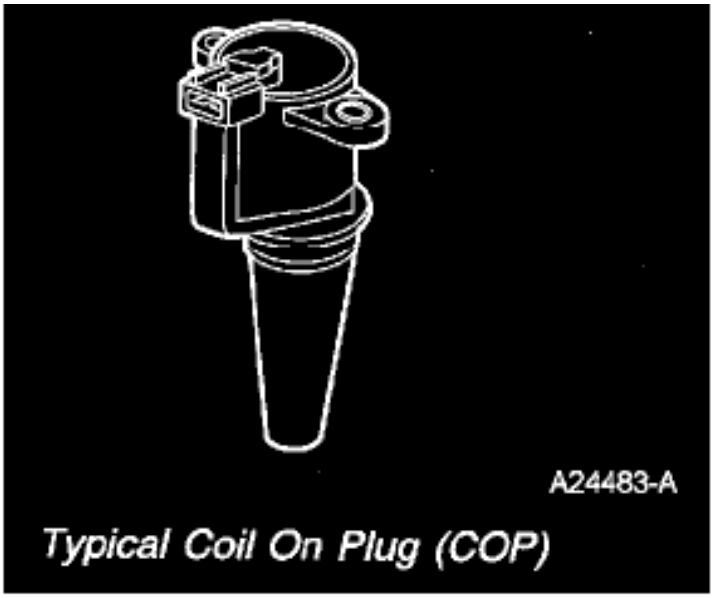
Connector: C174

Description:	Harness:	Base Part #:
IGNITION TRANSFORMER CAPACITOR 1	12B637	18801

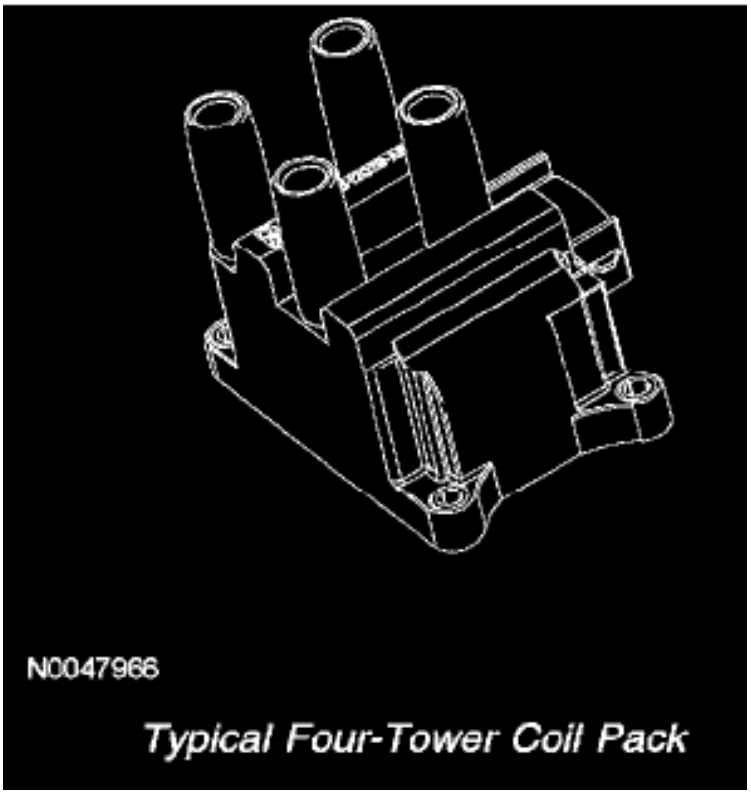
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBB44 (VT)	16	FUSE - 44 OR CIRCUIT BREAKER	2.3L, 4.0L



C174



Typical Coil On Plug (COP)



Typical Four-Tower Coil Pack

Ignition Coil: Description and Operation

Coil On Plug (COP)

Typical Coil On Plug (COP)

The COP ignition operates similar to a standard coil pack ignition except each plug has one coil per plug. The COP has 3 different modes of operation: engine crank, engine running, and CMP failure mode effects management (FMEM).

Coil Pack

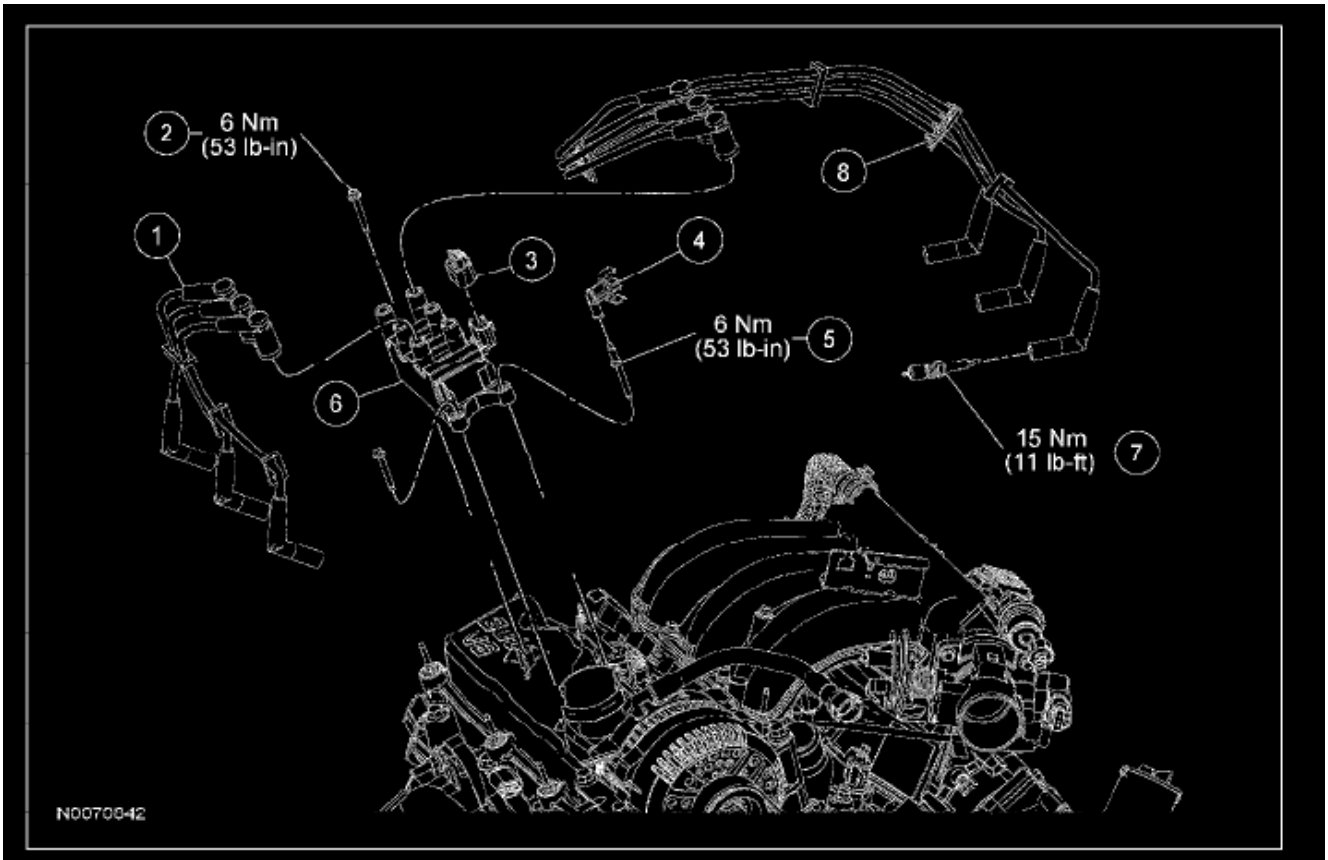
Typical Four-Tower Coil Pack

Typical Six-Tower Coil Pack

The PCM provides a grounding switch for the coil primary circuit. When the switch is closed, voltage is applied to the coil primary circuit. This creates a magnetic field around the primary coil. The PCM opens the switch, causing the magnetic field to collapse, inducing the high voltage in the secondary coil windings and firing the spark plug. The spark plugs are paired so that as one spark plug fires on the compression stroke, the other spark plug fires on the exhaust stroke. The next time the coil is fired the order is reversed. The next pair of spark plugs fire according to the engine firing order.

Coil packs come in 4-tower, 6-tower horizontal and series 5 6-tower models. Two adjacent coil towers share a common coil and are called a matched pair. For 6-tower coil pack (6 cylinder) applications, the matched pairs are 1 and 5, 2 and 6, and 3 and 4. For 4-tower coil pack (4 cylinder) applications, the matched pairs are 1 and 4, and 2 and 3.

When the coil is fired by the PCM, spark is delivered through the matched pair towers to their respective spark plugs. The spark plugs are fired simultaneously and are paired so that as one fires on the compression stroke, the other spark plug fires on the exhaust stroke. The next time the coil is fired, the situation is reversed. The next pair of spark plugs fire according to the engine firing order.



Item	Part Number	Description
1	12259	Spark plug wire set
2	W706995	Ignition coil bolt (2 required)
3	—	Ignition coil electrical connector (part of 12B637)
4	18D331	Heater hose retainer
5	W706825	Ignition coil stud bolt

Item	Part Number	Description
6	12029	Ignition coil
7	12405	Spark plug (6 required)
8	12297	Spark plug wire retainer (7 required)

(Continued)

Ignition Coil: Service and Repair

IGNITION COIL PACK

Exploded View

Removal and Installation

1. Disconnect the ignition coil electrical connector.

2. CAUTION:

- Spark plug wires must be connected correctly. Failure to follow this instruction may result in poor engine performance.

- Do not pull on the spark plug wire as it may separate from the spark plug wire connector inside the spark plug wire boot.

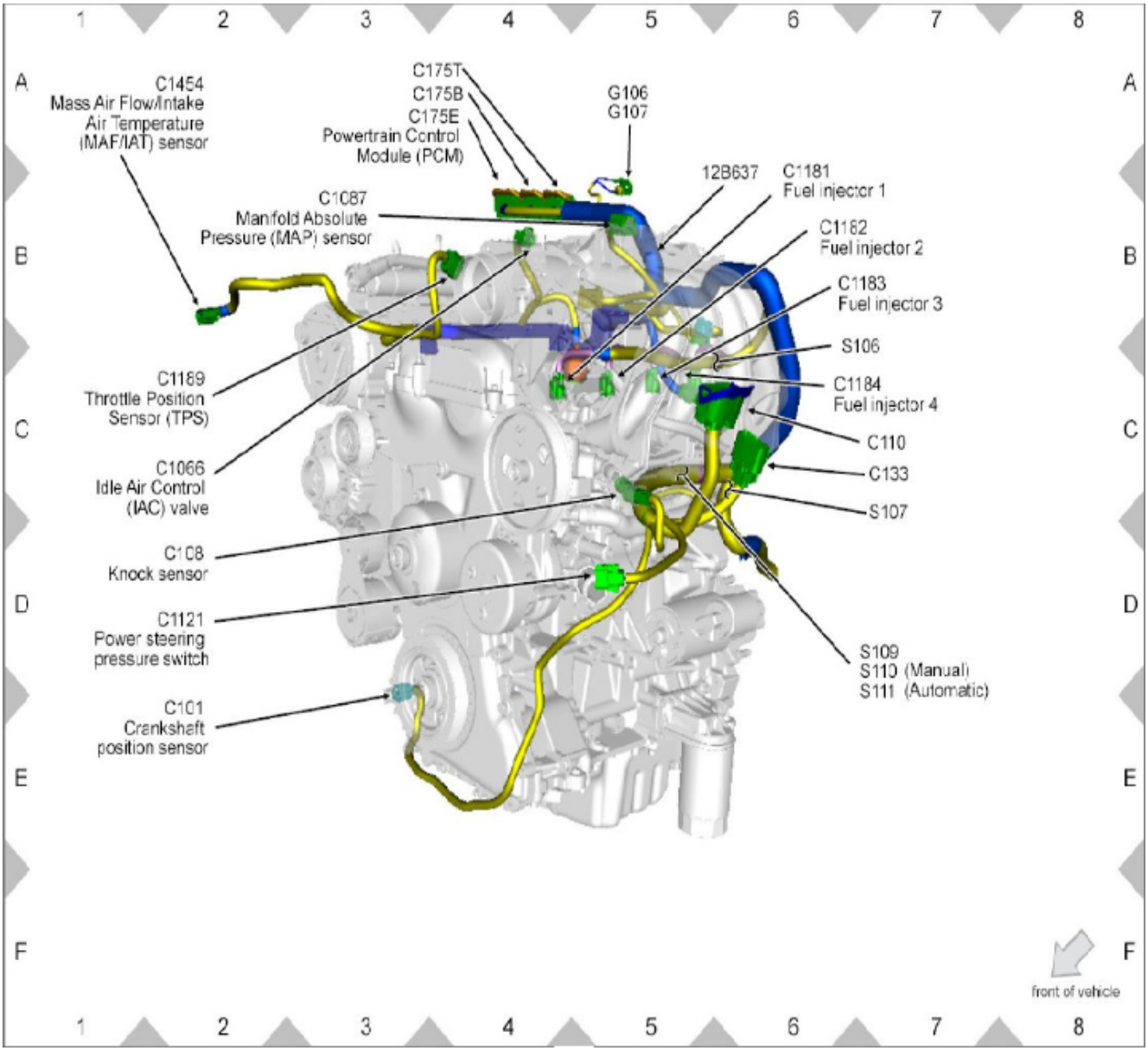
Disconnect the spark plug wires from the ignition coil by twisting while pulling upward.

3. Disconnect the heater hose retainer from the stud bolt. 4. Remove the 2 bolts, the stud bolt and the ignition coil.

- To install, tighten to 6 Nm (53 lb-in).

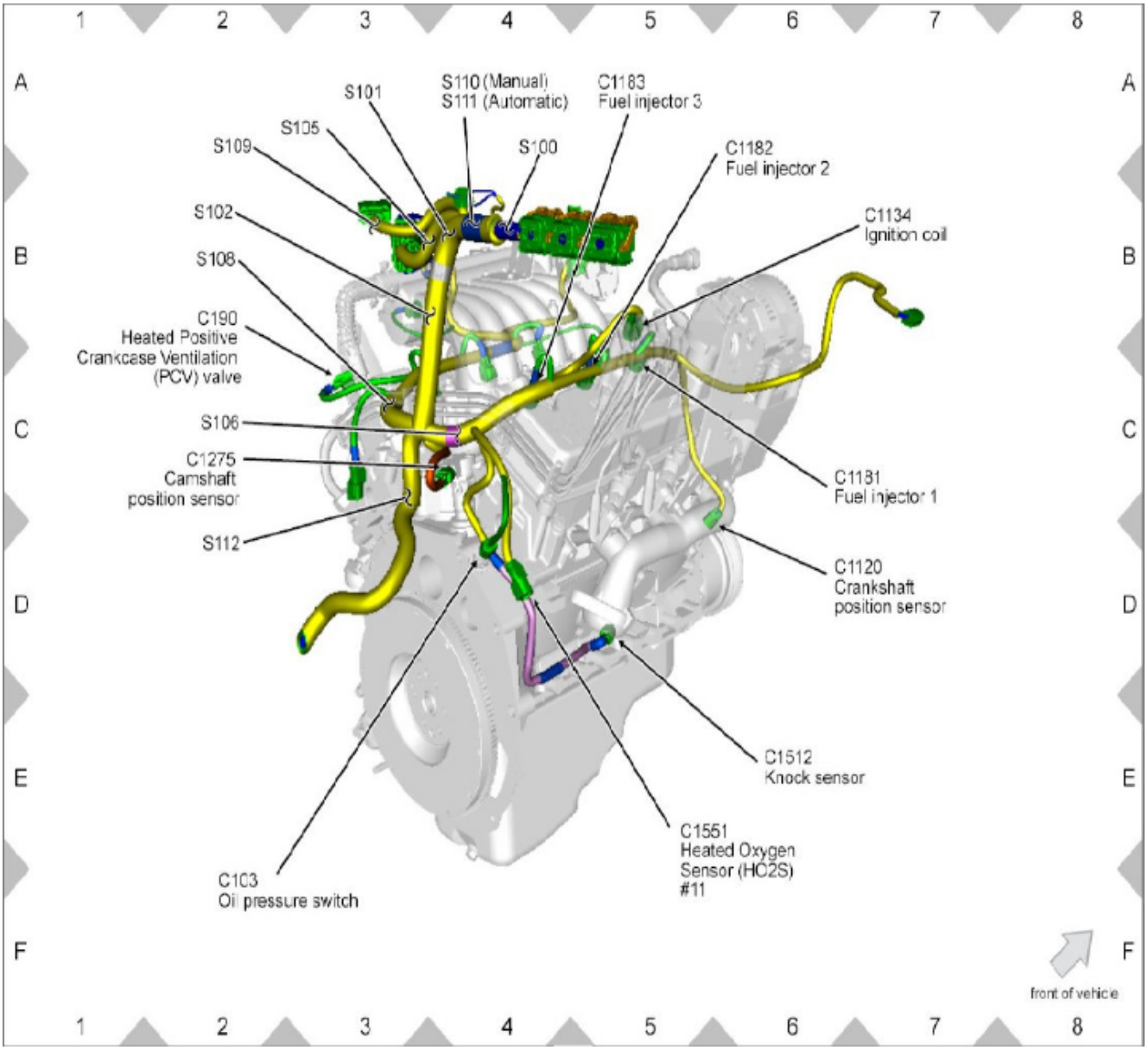
5. To install, reverse the removal procedure.

- Use a small, clean tool to coat the entire interior surface of the boot with silicone brake caliper grease.

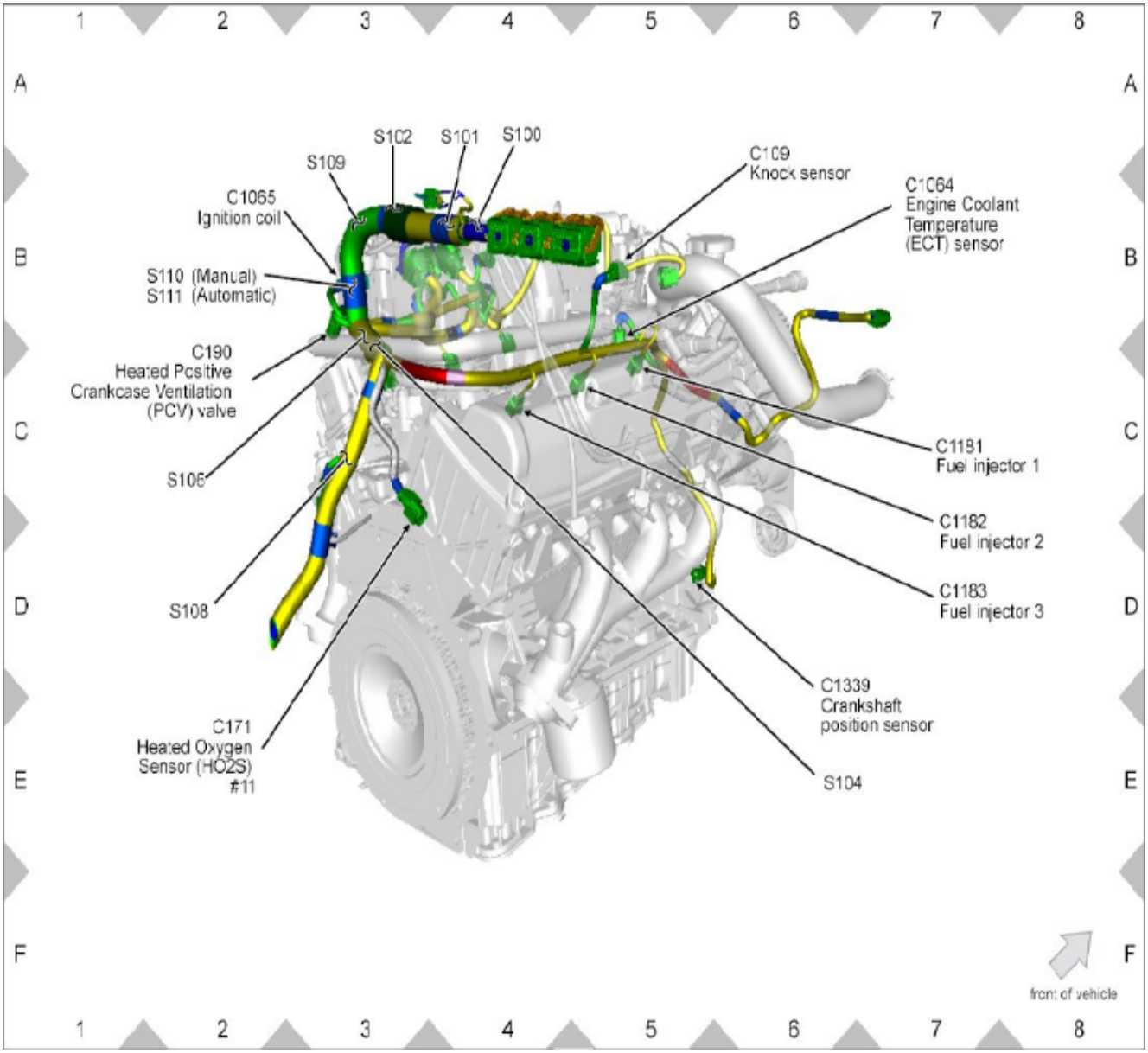


Knock Sensor: Locations

View 151-3


S101
S110 (Manual)
S111 (Automatic)
C1183
Fuel injector 3
S105
S109
S100
C1182
Fuel injector 2
S102
C1134
Ignition coil
S108
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
C1275
Camshaft
position sensor
S112
C1181
Fuel injector 1
C1120
Crankshaft
position sensor
C1512
Knock sensor
C1551
Heated Oxygen
Sensor (HO2S)
#11
C103
Oil pressure switch
front of vehicle

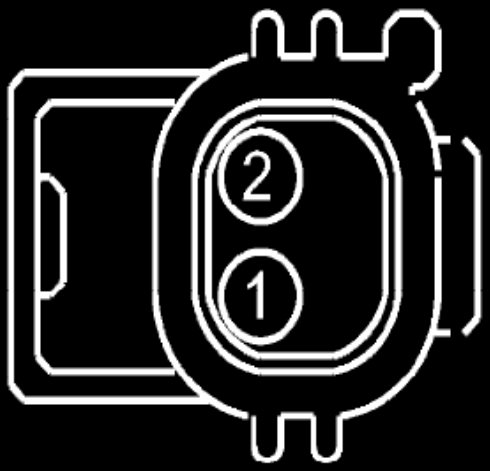
View 151-6


S102
S101
S100
S109
C1065
Ignition coil
S110 (Manual)
S111 (Automatic)
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
S108
C171
Heated Oxygen
Sensor (HO2S)
#11
C109
Knock sensor
C1064
Engine Coolant
Temperature
(ECT) sensor
C1181
Fuel injector 1
C1182
Fuel injector 2
C1183
Fuel injector 3
C1339
Crankshaft
position sensor
S104
front of vehicle

View 151-8

Connector: C108

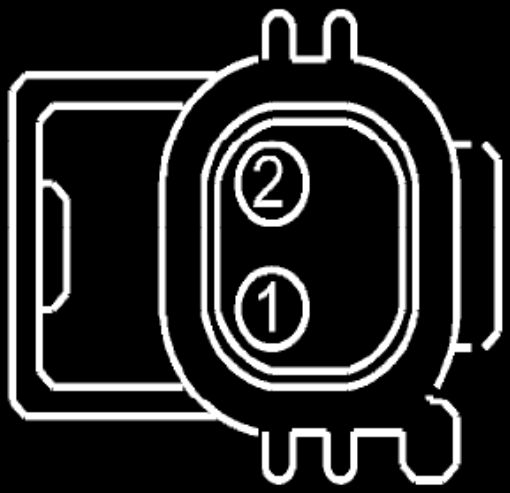
Description:	Harness:	Base Part #:
KNOCK SENSOR	12B637	12A699



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RE323 (WH-BN)	20	CTRL MOD. - POWERTRAIN # KNOCK SENSOR 1ST OR UNIQUE (KS1N) [KSL1-]	2.3L
2	VE801 (VT-OG)	20	SENSOR - KNOCK 1ST OR UNIQUE (KS1P) [KSL1+]	2.3L

Connector: C109

Description:	Harness:	Base Part #:
KNOCK SENSOR	12B637	12A699



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE801 (VT-OG)	20	SENSOR - KNOCK 1ST OR UNIQUE (KS1P) [KSL1+]	4.0L
2	RE323 (WH-BN)	20	CTRL MOD. - POWERTRAIN # KNOCK SENSOR 1ST OR UNIQUE (KS1N) [KSL1-]	4.0L

Knock Sensor: Diagrams

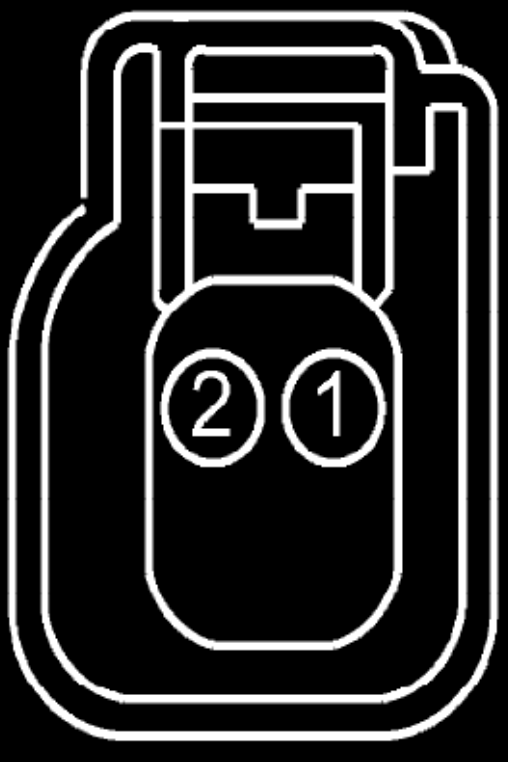
C108

C109

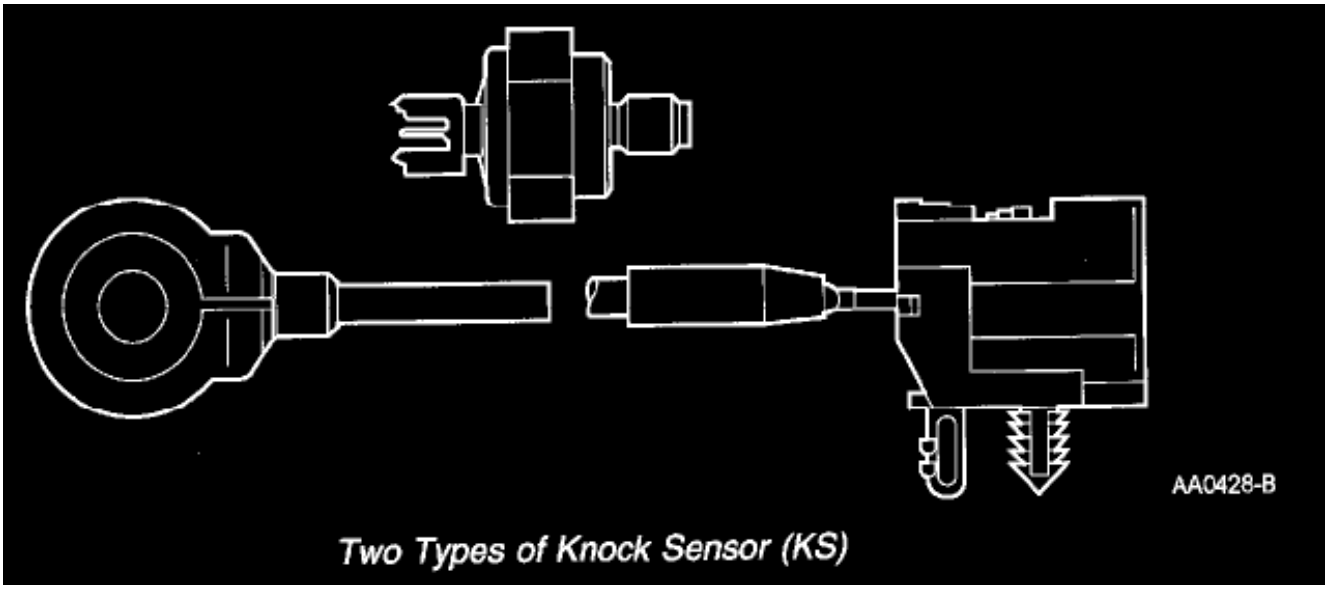
Connector: C1512

Description:	Harness:	Base Part #:
KNOCK SENSOR	12B637	12A699

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE801 (VT-OG)	20	SENSOR - KNOCK 1ST OR UNIQUE (KS1P) [KSL1+]	3.0L
2	RE323 (WH BN)	20	CTRL MOD. - POWERTRAIN # KNOCK SENSOR 1ST OR UNIQUE (KS1N) [KSL1-]	3.0L



C1512



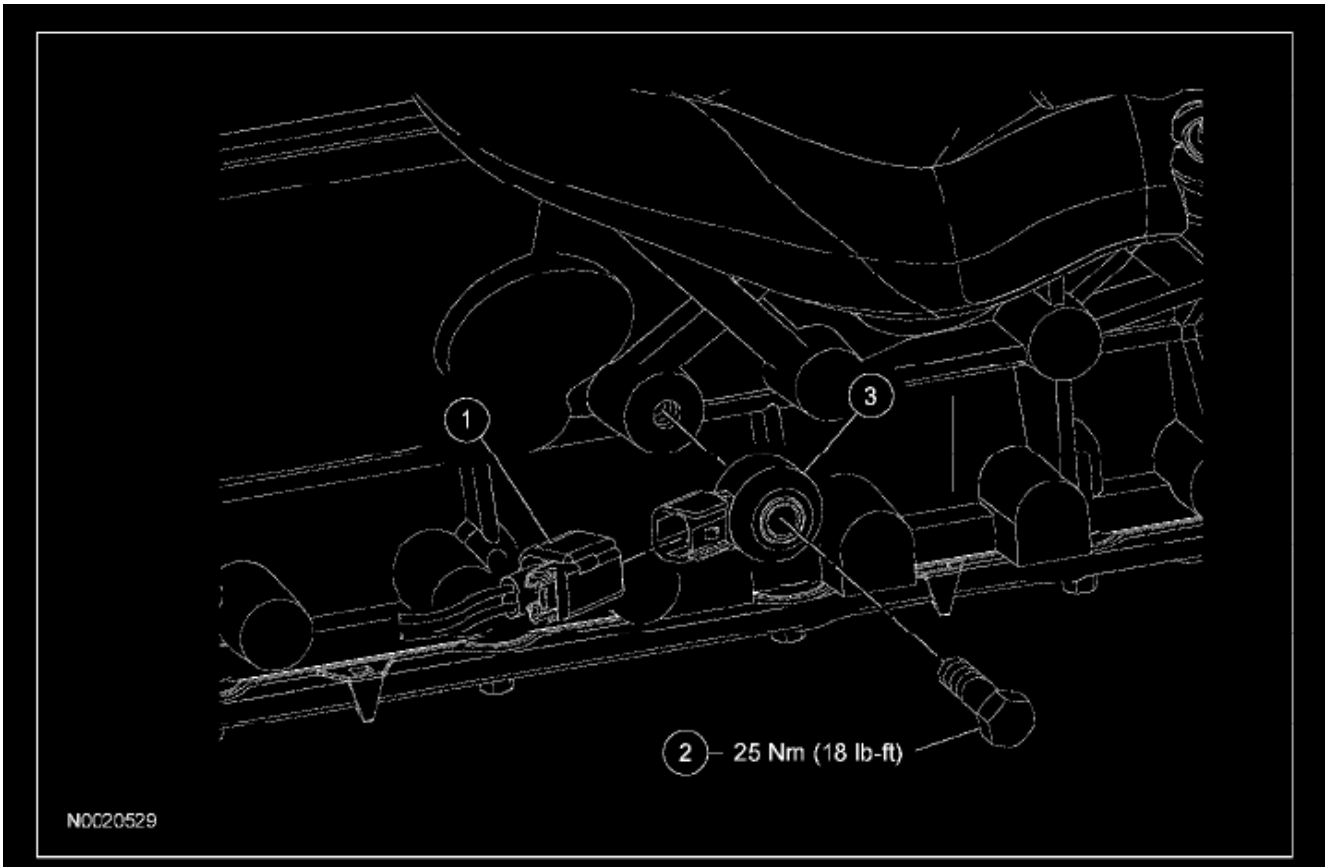
Two Types of Knock Sensor (KS)

Knock Sensor: Description and Operation

Knock Sensor (KS)

Two Types Of Knock Sensor (KS)

The KS is a tuned accelerometer on the engine which converts engine vibration to an electrical signal. The PCM uses this signal to determine the presence of engine knock and to retard spark timing.



Item	Part Number	Description
1	14A464	Knock sensor (KS) electrical connector (part of 12B637)
2	W5000225	KS bolt
3	12A699	KS

Knock Sensor: Service and Repair

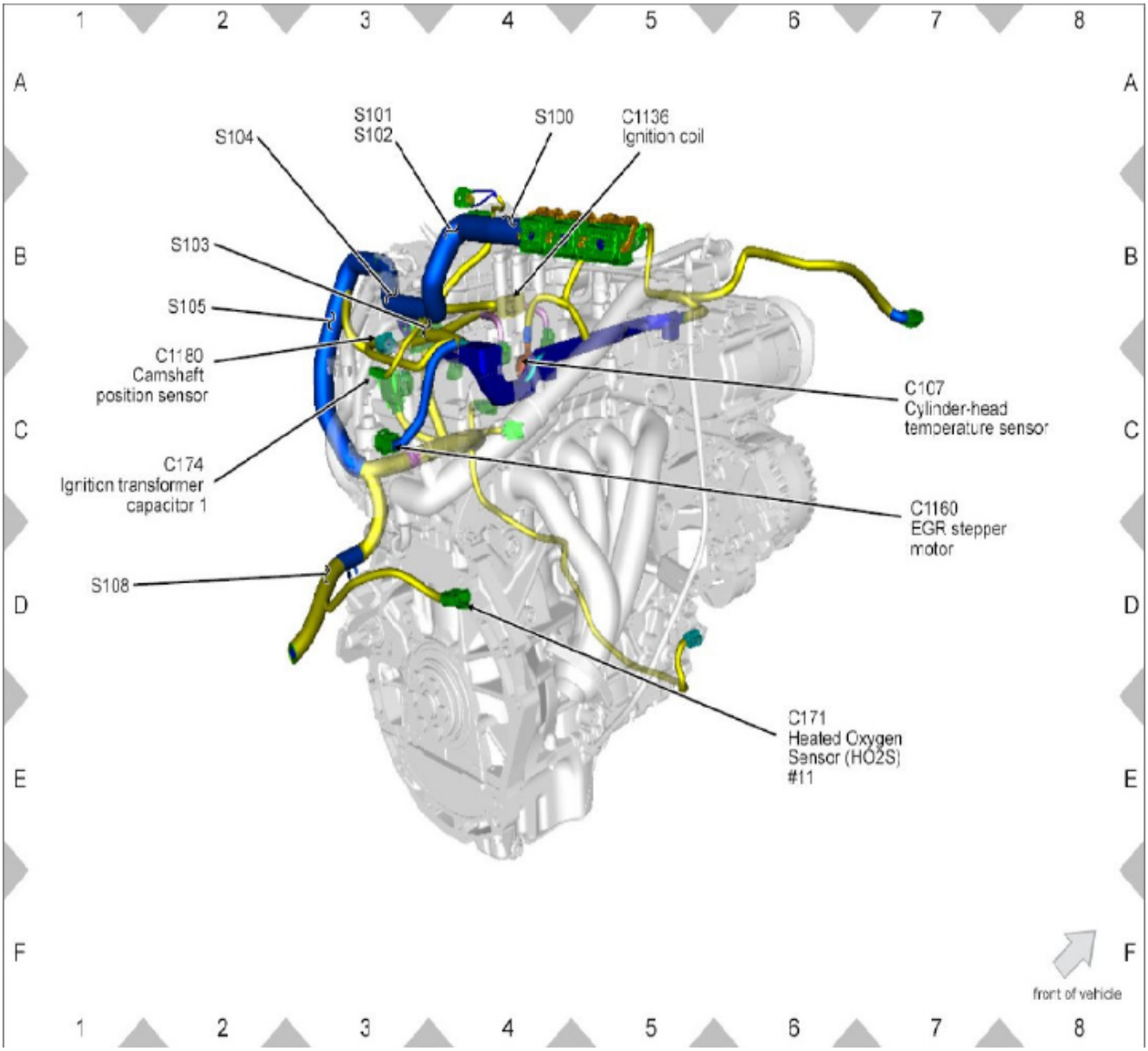
KNOCK SENSOR (KS)

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the knock sensor (KS) electrical connector. 3. Remove the bolt and the KS.

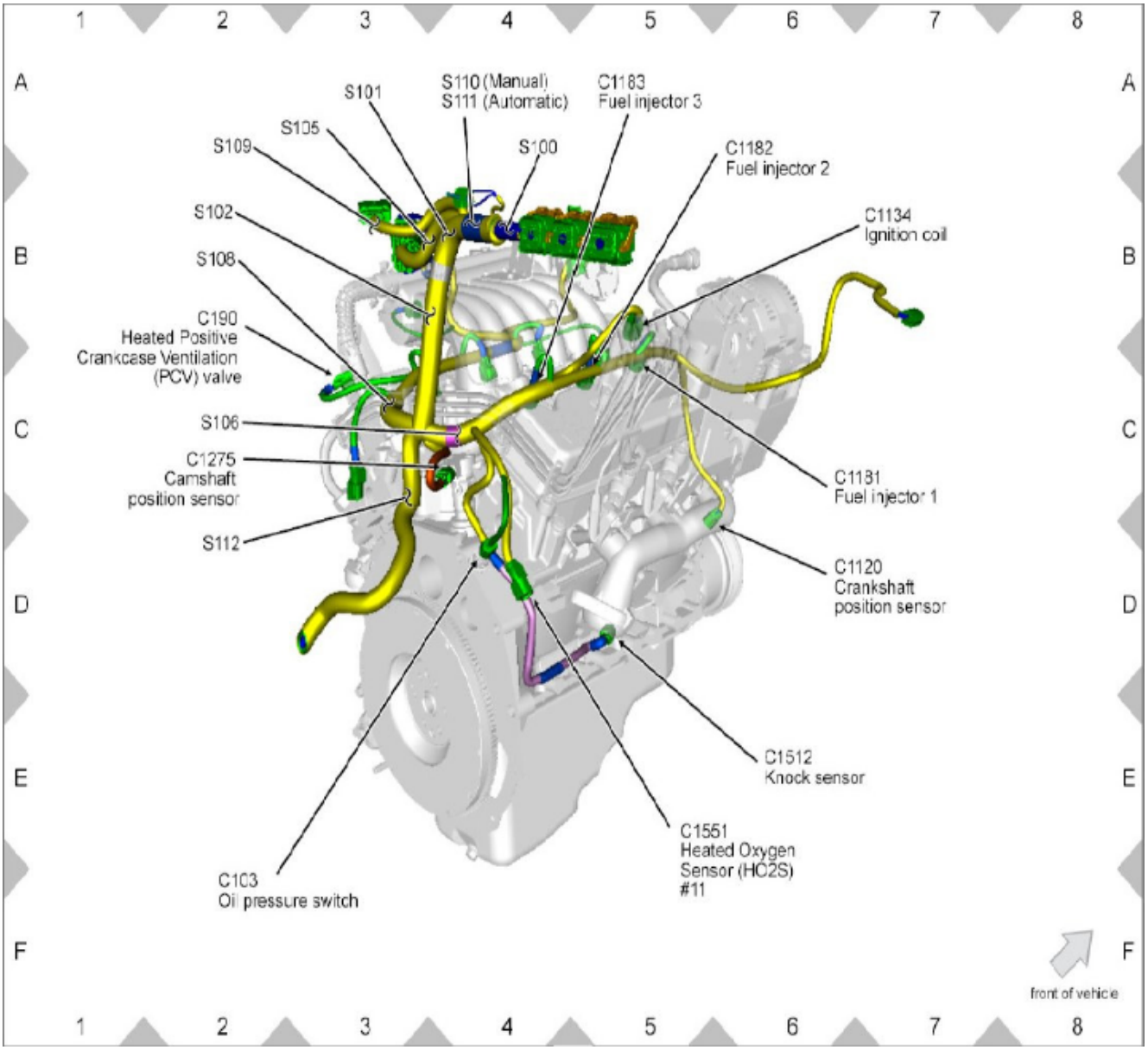
- To install, tighten to 25 Nm (18 lb-ft).

4. To install, reverse the removal procedure.

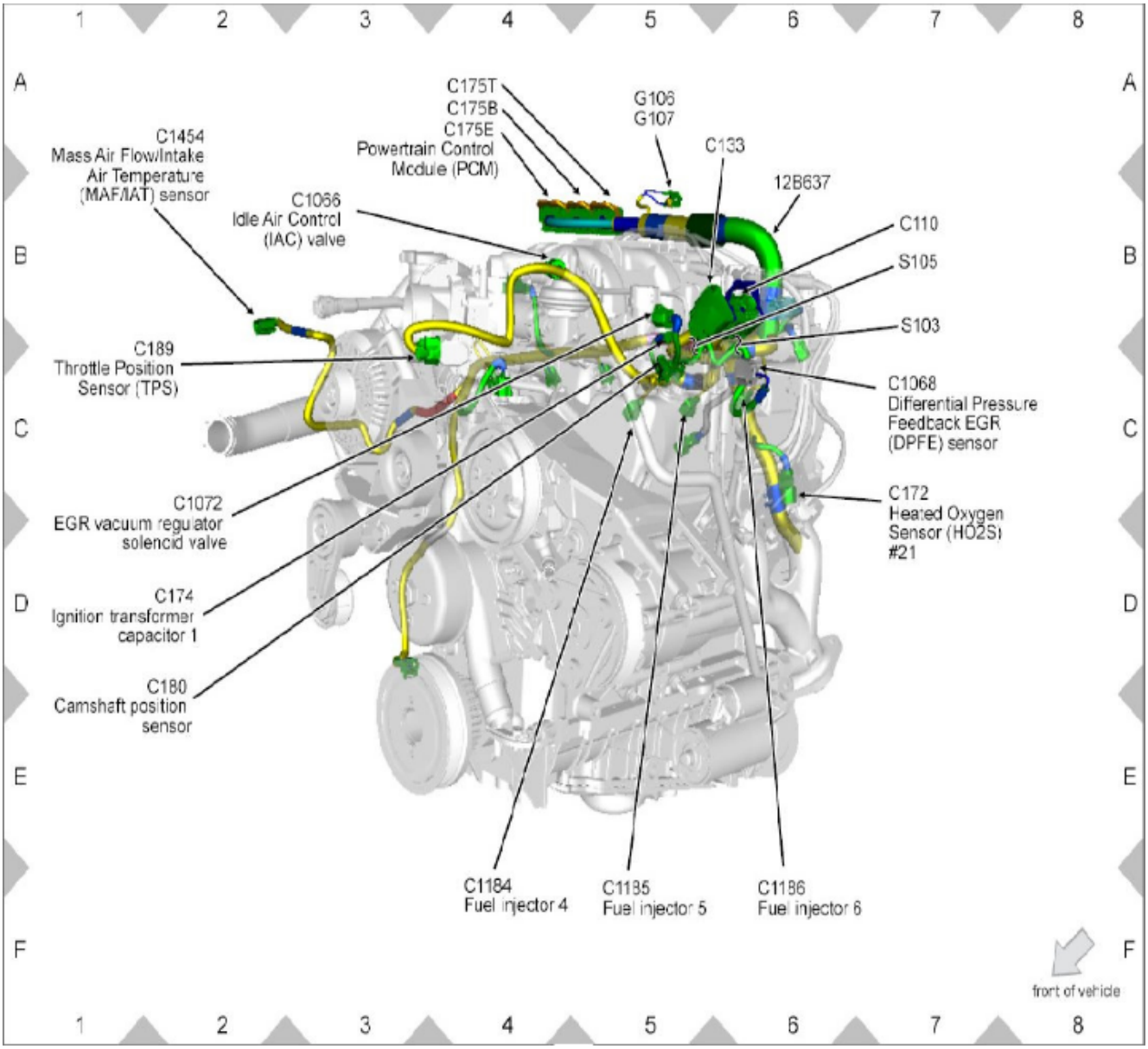


Camshaft Position Sensor: Locations

View 151-4


S101
S110 (Manual)
S111 (Automatic)
C1183
Fuel injector 3
S105
S109
S100
C1182
Fuel injector 2
S102
C1134
Ignition coil
S108
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
C1275
Camshaft
position sensor
S112
C1181
Fuel injector 1
C1120
Crankshaft
position sensor
C1512
Knock sensor
C1551
Heated Oxygen
Sensor (HO2S)
#11
C103
Oil pressure switch
front of vehicle

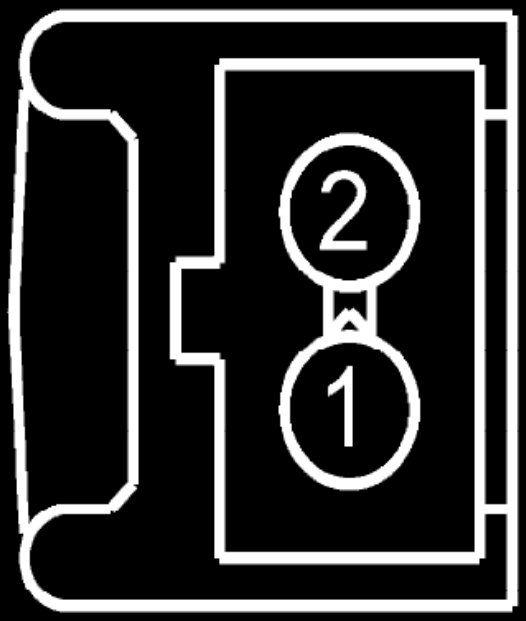
View 151-6


C175T
C175B
C175E
Powertrain Control Module (PCM)
G106
G107
C133
12B637
C1454
Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor
C1066
Idle Air Control (IAC) valve
C110
S105
S103
C189
Throttle Position Sensor (TPS)
C1068
Differential Pressure Feedback EGR (DPFE) sensor
C1072
EGR vacuum regulator solenoid valve
C172
Heated Oxygen Sensor (HO2S) #21
C174
Ignition transformer capacitor 1
C180
Camshaft position sensor
C1184
Fuel injector 4
C1185
Fuel injector 5
C1186
Fuel injector 6
front of vehicle

View 151-7

Connector: C180

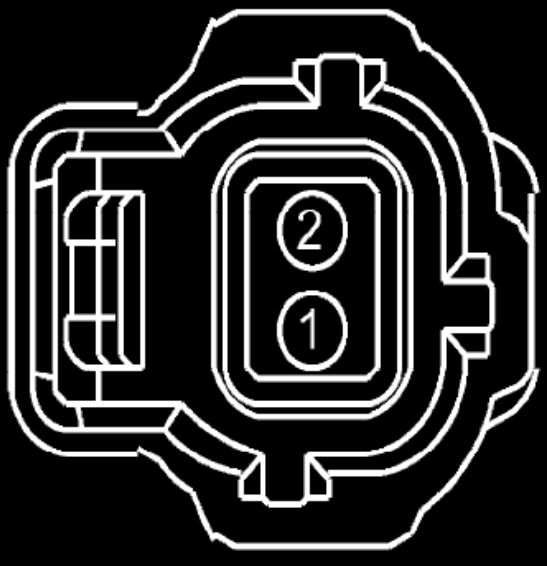
Description:	Harness:	Base Part #:
CAMSHAFT POSITION SENSOR	12B637	6B288



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE706 (BN-BU)	18	SENSOR - CAMSHAFT POSITION BANK 1 IN+EX/IN (CMP1) [CID-H] (CID1)	4.0L
2	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	4.0L

Connector: C1180

Description:	Harness:	Base Part #:
CAMSHAFT POSITION SENSOR	12B637	6B288



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	2.3L
2	VE706 (BN-BU)	18	SENSOR - CAMSHAFT POSITION BANK 1 IN+EX/ IN (CMP1) [CID-H] (CID1)	2.3L

Camshaft Position Sensor: Diagrams

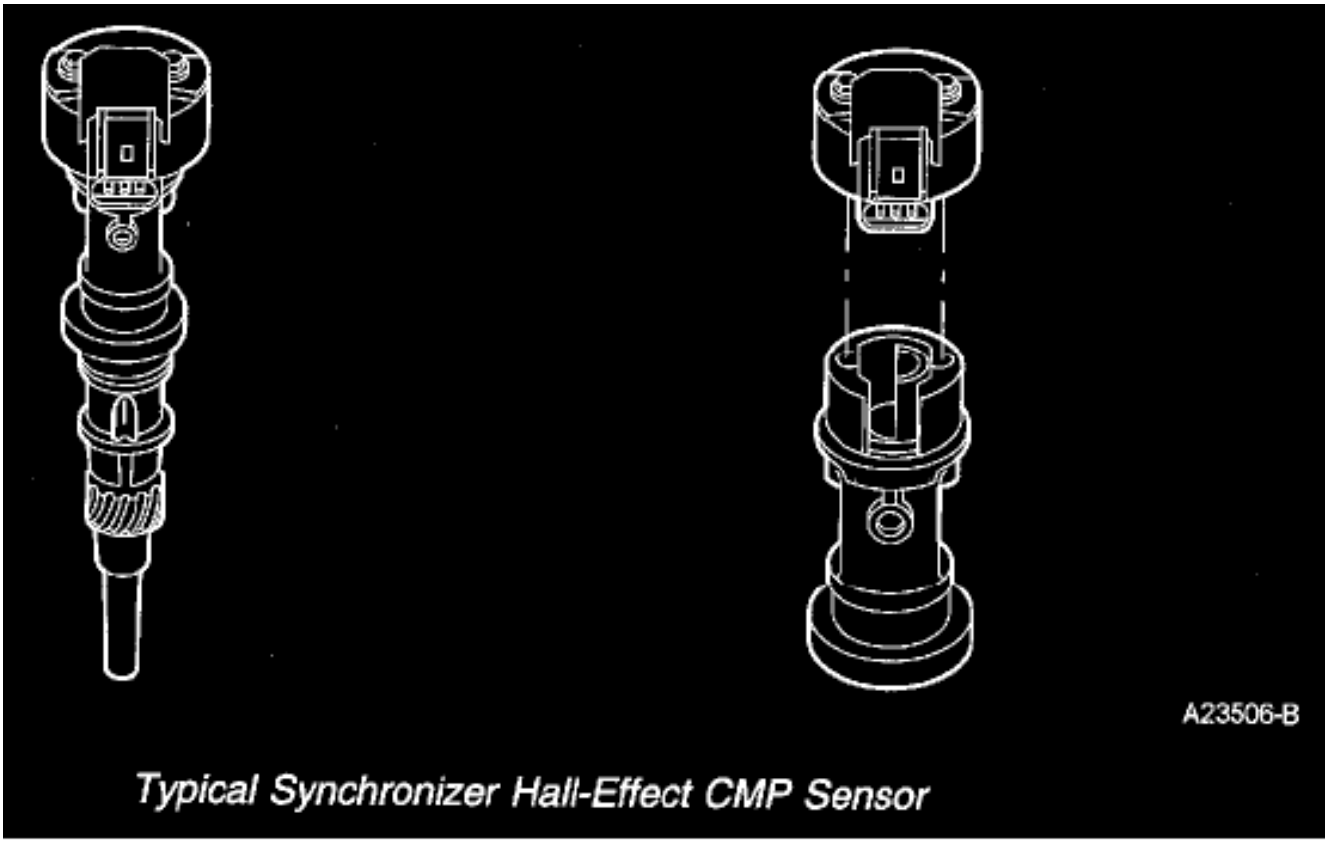
C180

C1180

Connector: C1275	Description:	Harness:	Base Part #:
	CAMSHAFT POSITION SENSOR	12B637	6B288

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RE405 (GN-WH)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN ENGINE (E-SIGRTN) (SIGRTN-A)	3.0L
2	VE706 (BN-BU)	18	SENSOR - CAMSHAFT POSITION BANK 1 IN+EX/ IN (CMP1) [CID-H] (CID1)	3.0L

C1275



Typical Synchronizer Hall-Effect CMP Sensor

Typical Variable Reluctance CMP Sensor

Camshaft Position Sensor: Description and Operation

CAMSHAFT POSITION (CMP) SENSOR

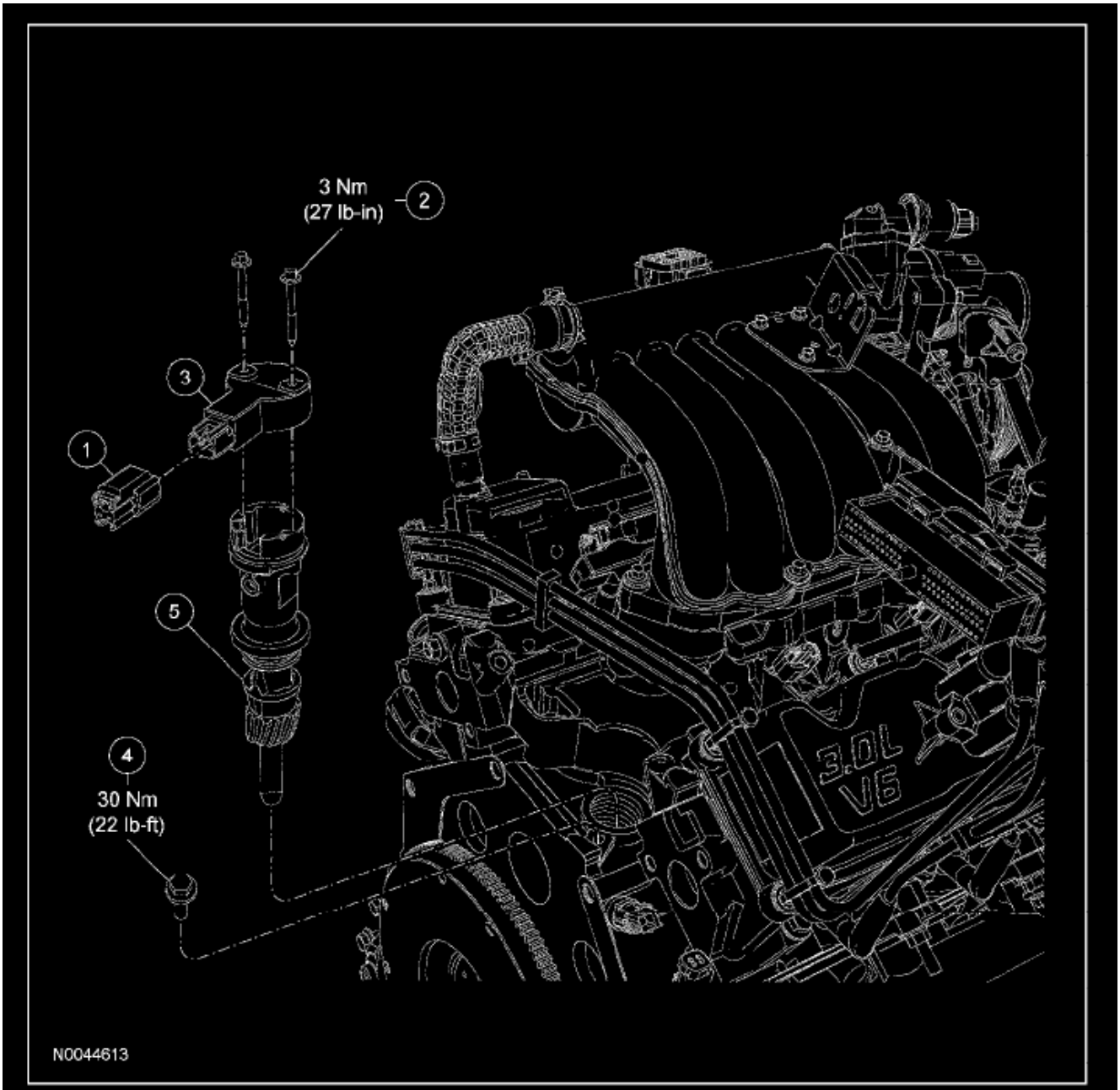
Typical Synchronizer Hall-Effect CMP Sensor

Typical Variable Reluctance CMP Sensor

The CMP sensor detects the position of the camshaft. The CMP sensor identifies when piston number 1 is on its compression stroke. A signal is then sent to the PCM and used for synchronizing the sequential firing of the fuel injectors. Coil on plug (COP) ignition applications use the CMP signal to select the correct ignition coil to fire.

Vehicles with 2 CMP sensors are equipped with variable camshaft timing (VCT). They use the second sensor to identify the position of the camshaft on bank 2 as an input to the PCM.

There are 2 types of CMP sensors: the 3-pin connector Hall-effect type sensor and the 2-pin connector variable reluctance type sensor.



Item	Part Number	Description
1	—	Camshaft position (CMP) sensor electrical connector (part of 12B637)
2	W701219	CMP sensor bolt (2 required)

(Continued)

Item	Part Number	Description
3	6B288	CMP sensor
4	—	Camshaft synchronizer bolt
5	12A362	Camshaft synchronizer

Camshaft Position Sensor: Service and Repair

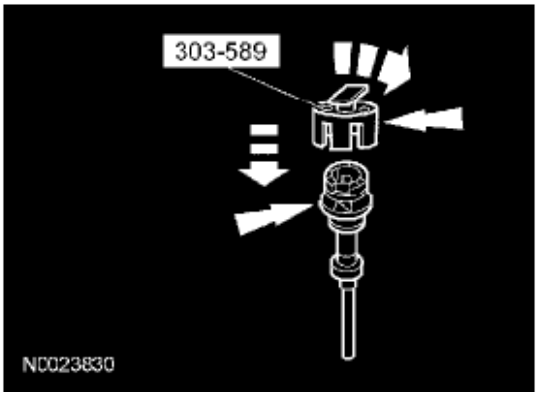
CAMSHAFT SYNCHRONIZER

Exploded View

Special Tool(s)

Special Tool(s)

ST2362-A	Synchronizer Alignment Gauge 303-589



Special Tool(s)

Removal

1. Disconnect the camshaft position (CMP) sensor electrical connector.

2. NOTE: Prior to the removal of the CMP sensor, note the position of the CMP sensor electrical connector. The installation procedure requires that

the electrical connector be located in the same position.

Remove the 2 bolts and the CMP sensor.

3. Remove the camshaft synchronizer bolt. 4. Remove the camshaft synchronizer. Inspect the O-ring seal and install a new O-ring seal if damaged.

Installation

1. CAUTION:

- After installation, do not loosen the synchronizer bolt and rotate the synchronizer assembly. The synchronizer assembly is not adjustable. Do not loosen the synchronizer bolt after the alignment tool has been removed in order to align the camshaft position (CMP) sensor electrical connector for any reason. If the electrical connector is not in the correct position, the synchronizer assembly must be removed. The alignment tool and the assembly must be reinstalled if the engine has not been rotated from top dead center (TDC) of the compression stroke on the No. 1 cylinder. Failure to follow this procedure will result in the fuel system being out of time with the engine, possibly causing engine damage.

- Do not turn the crankshaft or camshaft during the removal and installation procedure or the fuel system timing will be out of time with the engine, possibly causing engine damage.

- A special tool must be used during the installation of the new synchronizer assembly. Failure to follow this procedure will result in the fuel system being out of time with the engine, possibly causing engine damage.

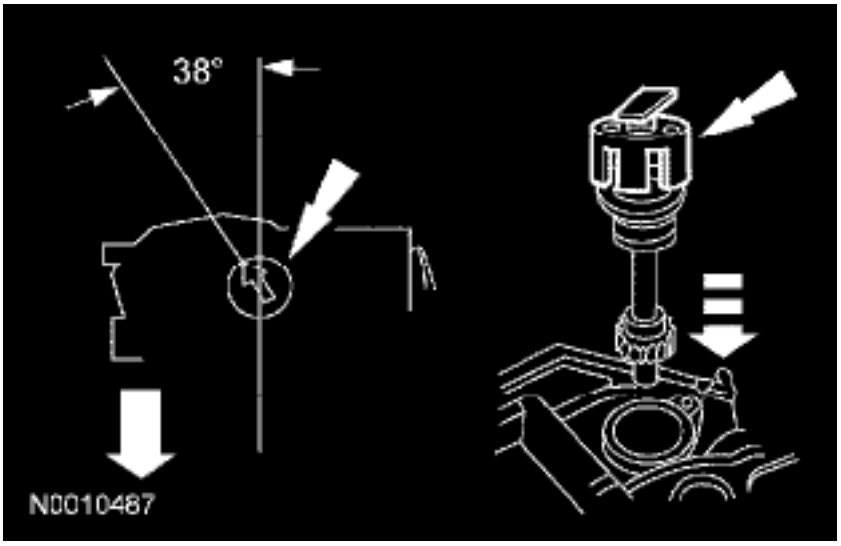
Install the special tool on the camshaft synchronizer by rotating the tool until it engages the notch in the camshaft synchronizer housing and the armature.

2. CAUTION: It is very important to coat the gear on the camshaft synchronizer with engine oil prior to installation. Failure to do so may

result in gear failure.

NOTE: During installation, the arrow on the special tool will rotate clockwise until the oil pump intermediate shaft and the camshaft gear engages.

Install the camshaft synchronizer housing assembly so the arrow on the special tool is 38 degrees from the centerline of the engine.



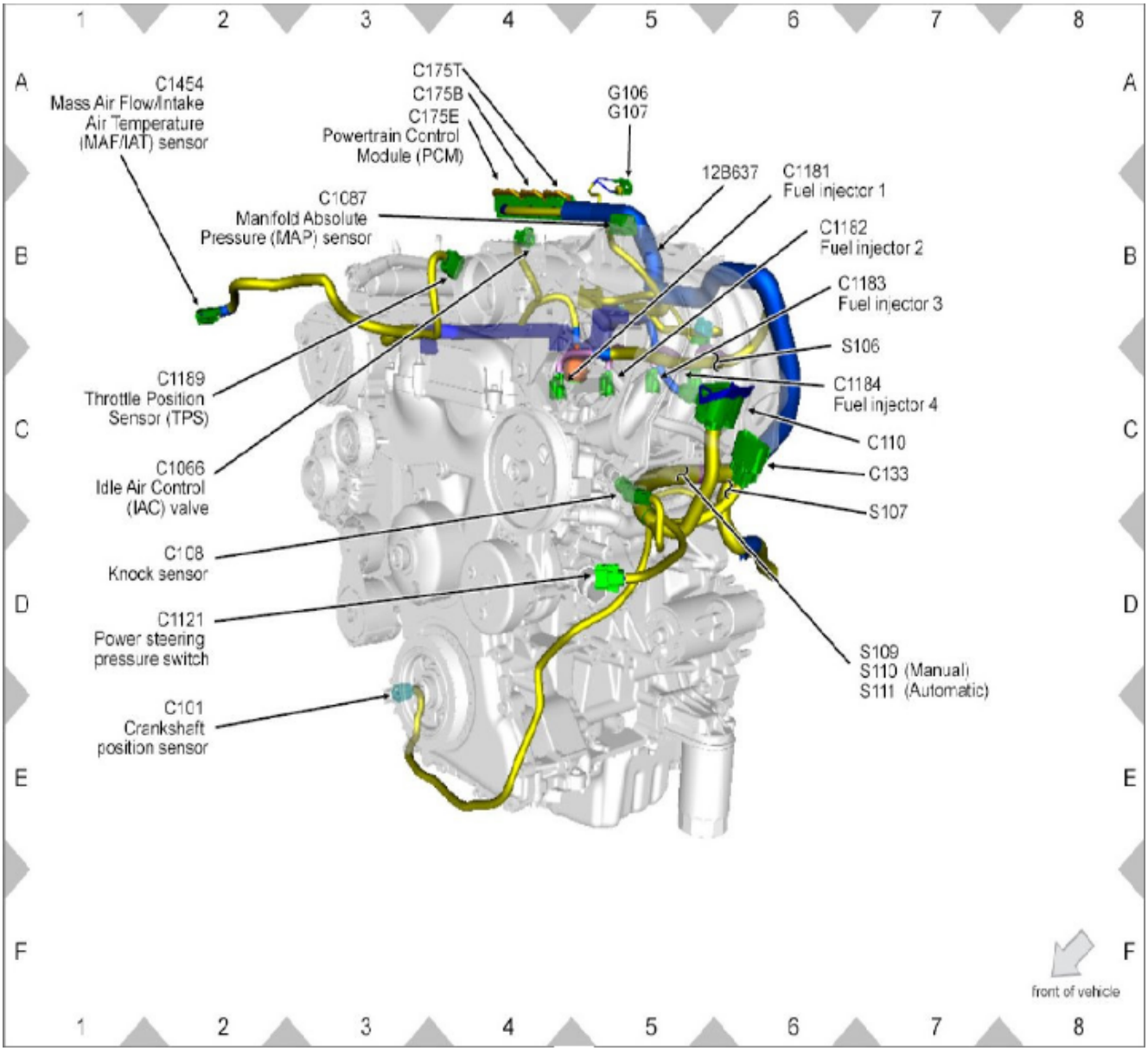
3. Install the camshaft synchronizer housing bolt.

- Tighten to 30 Nm (22 lb-ft).

4. Position the CMP sensor and install the 2 bolts.

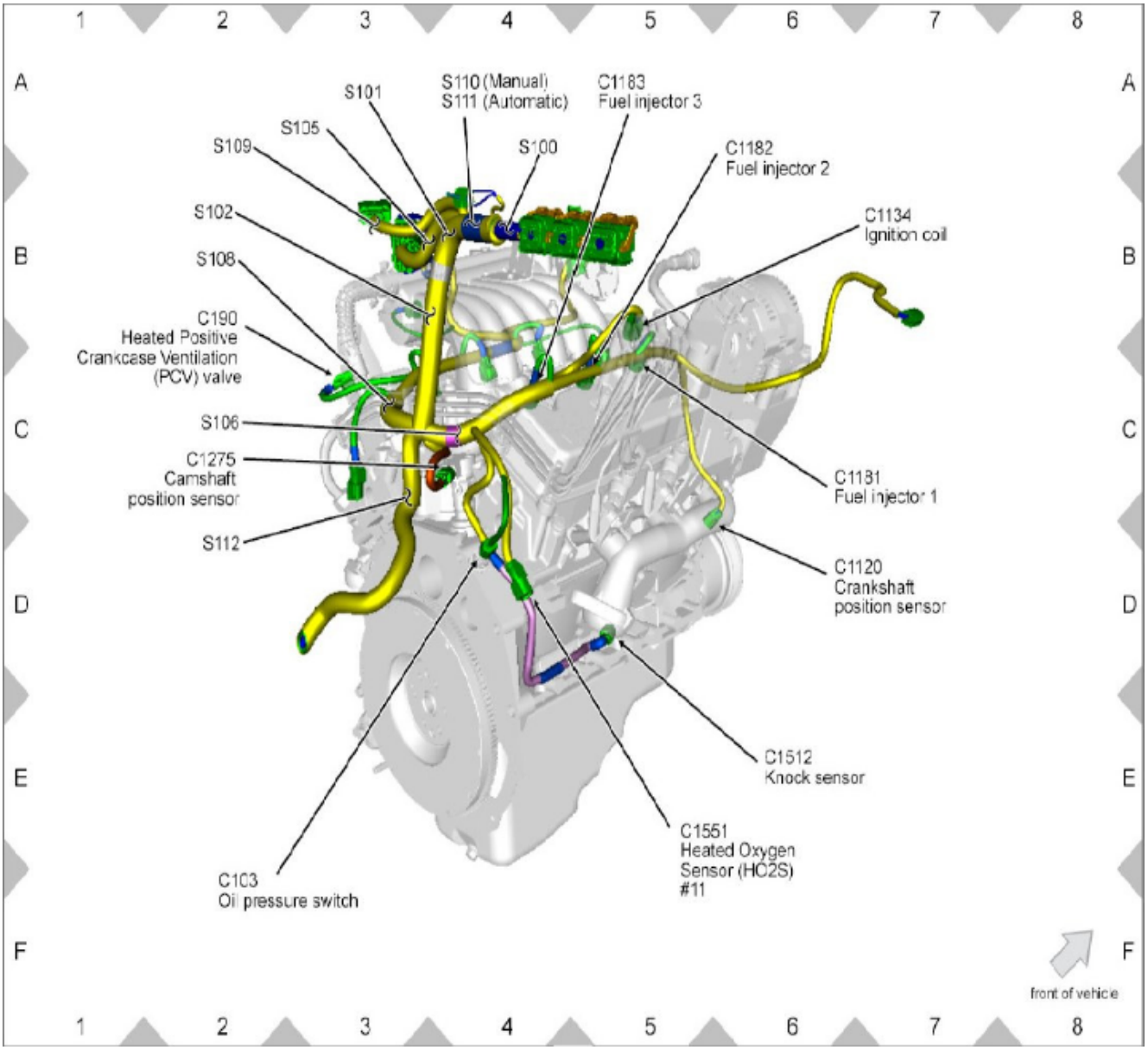
- Tighten to 3 Nm (27 lb-in).

5. Connect the CMP sensor electrical connector.

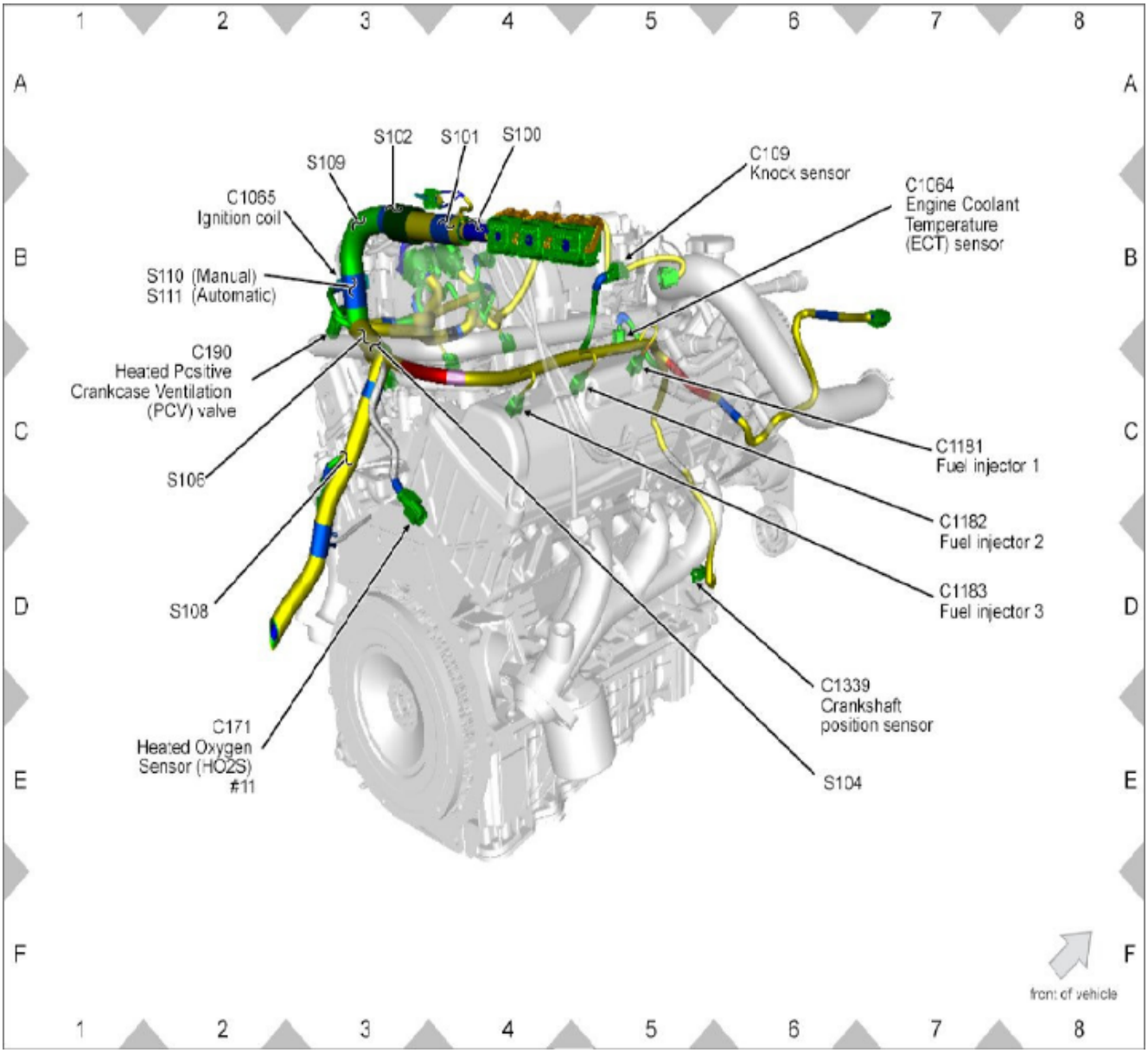


Crankshaft Position Sensor: Locations

View 151-3


S101
S110 (Manual)
S111 (Automatic)
C1183
Fuel injector 3
S105
S109
S100
C1182
Fuel injector 2
S102
C1134
Ignition coil
S108
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
C1275
Camshaft
position sensor
S112
C1181
Fuel injector 1
C1120
Crankshaft
position sensor
C1512
Knock sensor
C1551
Heated Oxygen
Sensor (HO2S)
#11
C103
Oil pressure switch
front of vehicle

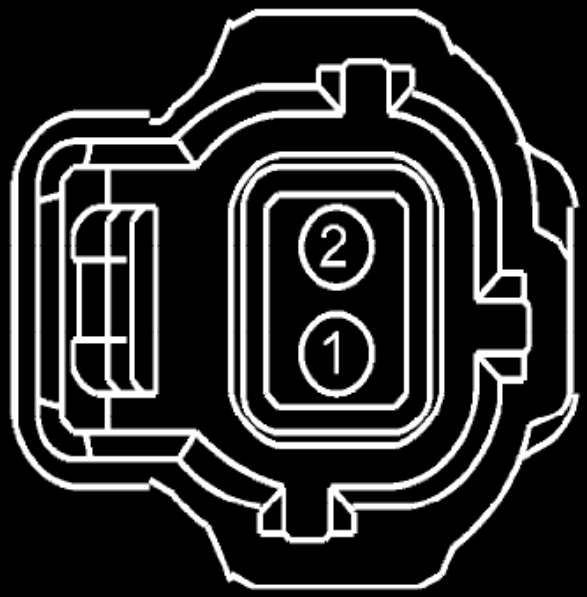
View 151-6


S102
S101
S100
S109
C1065
Ignition coil
S110 (Manual)
S111 (Automatic)
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
S108
C171
Heated Oxygen
Sensor (HO2S)
#11
C109
Knock sensor
C1064
Engine Coolant
Temperature
(ECT) sensor
C1181
Fuel injector 1
C1182
Fuel injector 2
C1183
Fuel injector 3
C1339
Crankshaft
position sensor
S104
front of vehicle

View 151-8

Connector: C101

Description:	Harness:	Base Part #:
CRANKSHAFT POSITION SENSOR	12B637	6C315



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE711 (YE-VT)	18	SENSOR - CRANKSHAFT POSITION (CKPP)	2.3L
2	RE135 (GN-BN)	18	CTRL MOD. - POWERTRAIN # CRANKSHAFT POSITION SENSOR (CKPN)	2.3L

Connector: C1120

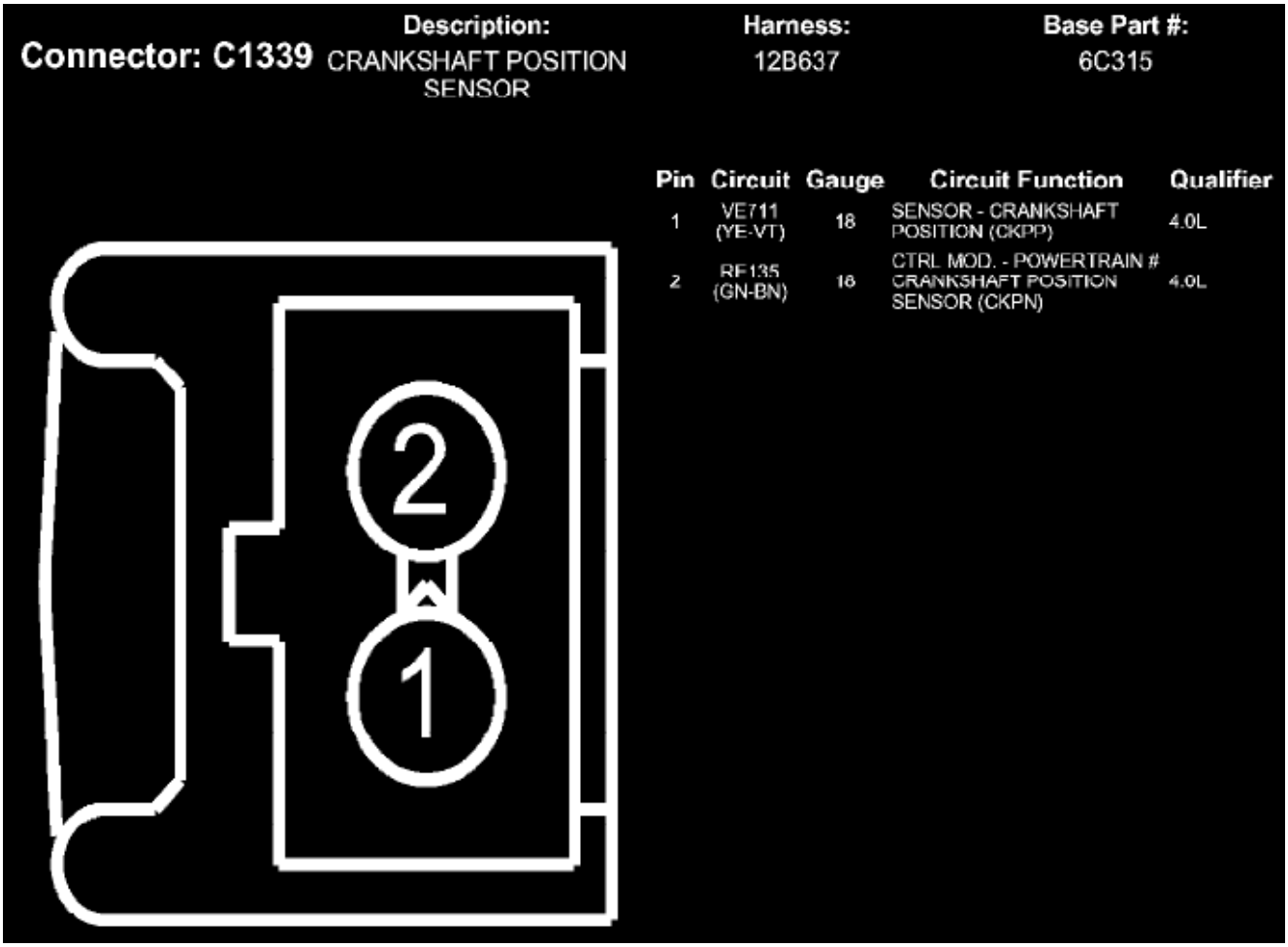
Description:	Harness:	Base Part #:
CRANKSHAFT POSITION SENSOR	12B637	6C315

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RE135 (GN-BN)	18	CTRL MOD. - POWERTRAIN # CRANKSHAFT POSITION SENSOR (CKPN)	3.0L
2	VE711 (YE-VT)	18	SENSOR - CRANKSHAFT POSITION (CKPP)	3.0L

Crankshaft Position Sensor: Diagrams

C101

C1120


Connector: C1339
Description:
CRANKSHAFT POSITION SENSOR
Harness:
12B637
Base Part #:
6C315
Pin Circuit Gauge Circuit Function Qualifier
1 VE711 (YE-VT) 18 SENSOR - CRANKSHAFT POSITION (CKPP) 4.0L
2 RF135 (GN-BN) 18 CTRL MOD. - POWERTRAIN # CRANKSHAFT POSITION SENSOR (CKPN) 4.0L
2
1

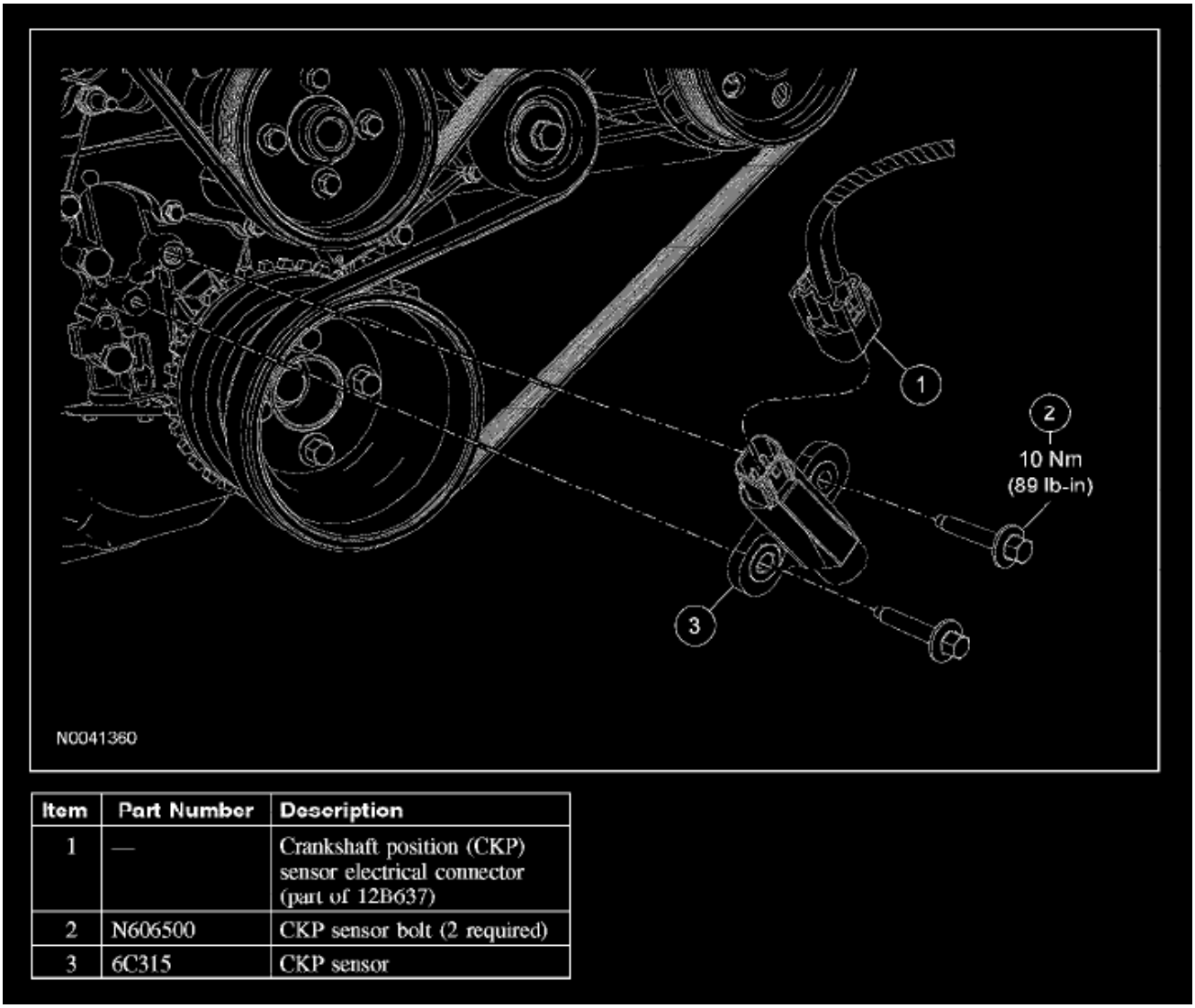
C1339

Crankshaft Position Sensor: Description and Operation

CRANKSHAFT POSITION (CKP) SENSOR

Typical Crankshaft Position (CKP) Sensor

The CKP sensor is a magnetic transducer mounted on the engine block adjacent to a pulse wheel located on the crankshaft. By monitoring the crankshaft mounted pulse wheel, the CKP is the primary sensor for ignition information to the PCM. The pulse wheel has a total of 35 teeth spaced 10 degrees apart with one empty space for a missing tooth. The 6.8L 10-cylinder pulse wheel has 39 teeth spaced 9 degrees apart and one 9 degree empty space for a missing tooth. By monitoring the pulse wheel, the CKP sensor signal indicates crankshaft position and speed information to the PCM. By monitoring the missing tooth, the CKP sensor is also able to identify piston travel in order to synchronize the ignition system and provide a way of tracking the angular position of the crankshaft relative to a fixed reference for the CKP sensor configuration. The PCM also uses the CKP signal to determine if a misfire has occurred by measuring rapid decelerations between teeth.



Item	Part Number	Description
1	—	Crankshaft position (CKP) sensor electrical connector (part of 12B637)
2	N606500	CKP sensor bolt (2 required)
3	6C315	CKP sensor

Crankshaft Position Sensor: Service and Repair

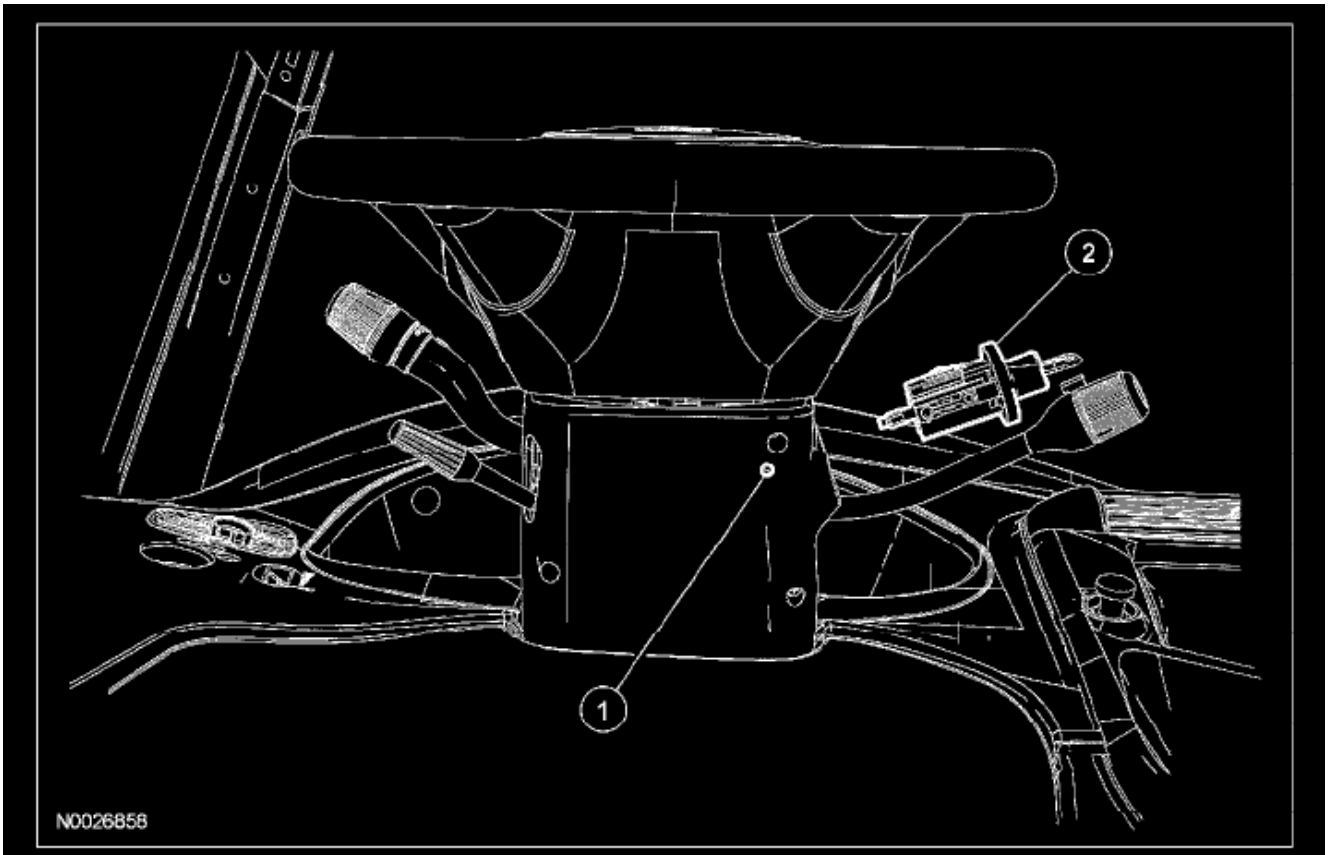
CRANKSHAFT POSITION (CKP) SENSOR

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the crankshaft position (CKP) sensor electrical connector. 3. Remove the 2 bolts and the CKP sensor.

- To install, tighten to 10 Nm (89 lb-in).

4. To install, reverse the removal procedure.



Item	Part Number	Description
1	—	Ignition lock cylinder release hole (part of 3530)
2	11582	Ignition lock cylinder

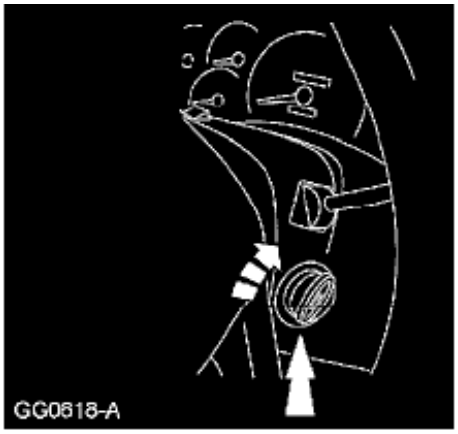
Ignition Switch Lock Cylinder: Service and Repair Ignition Lock Cylinder - Functional

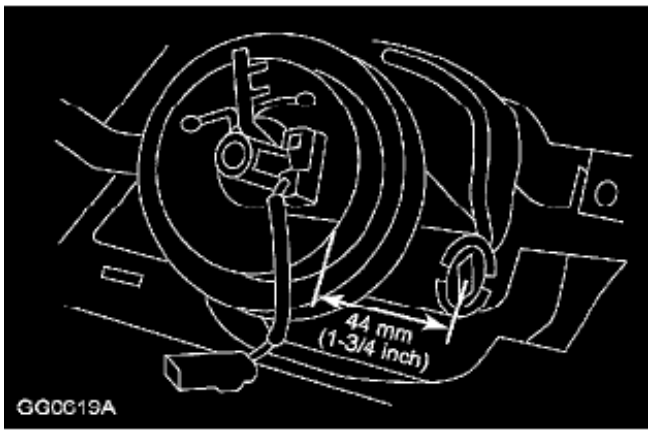
IGNITION LOCK CYLINDER - FUNCTIONAL

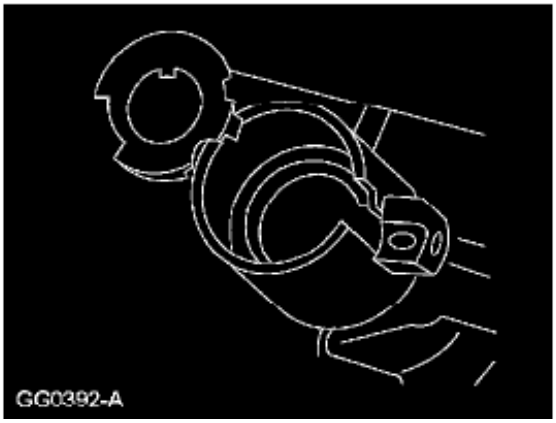
Removal and Installation

1. Disconnect the battery ground cable. 2. Insert the ignition key and turn to the RUN position. 3. Press the ignition lock cylinder release pin and remove the ignition lock cylinder. 4. To install, reverse the removal procedure.

- Verify ignition lock cylinder operation.







Ignition Switch Lock Cylinder: Service and Repair Ignition Lock Cylinder - Non Functional

IGNITION LOCK CYLINDER - NON FUNCTIONAL

Removal and Installation

1. NOTE: Make sure the front wheels are in the straight-ahead position.

Remove the steering wheel assembly.

2. Twist off the cap from the ignition lock cylinder.

3. NOTE: The lock cylinder is repaired by discarding the inoperative lock cylinder and building a new lock cylinder using the appropriate lock

repair package (F85Z-11582-AA). The lock repair package includes a detailed instruction sheet to build the new lock cylinder to the current key code of the vehicle.

Remove the ignition lock cylinder. -

Use a 1/8-inch diameter drill bit to drill out the lock cylinder retaining pin.

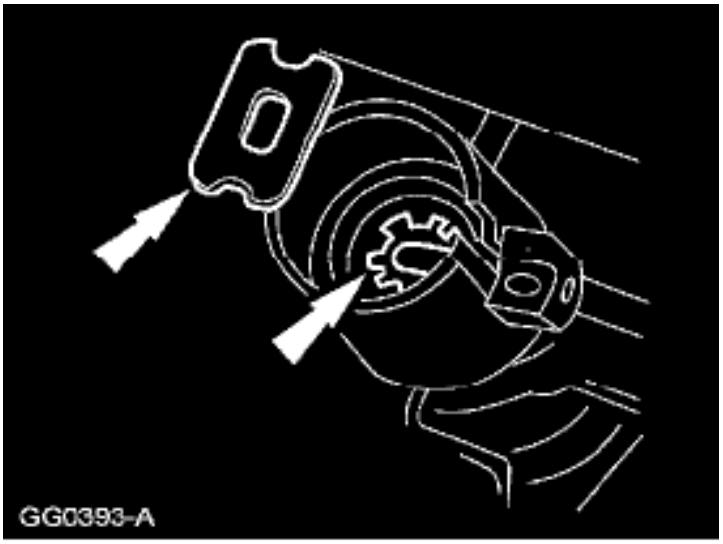
- Use a 3/8-inch drill bit to drill down the middle of the ignition lock key slot until the ignition lock cylinder breaks loose.

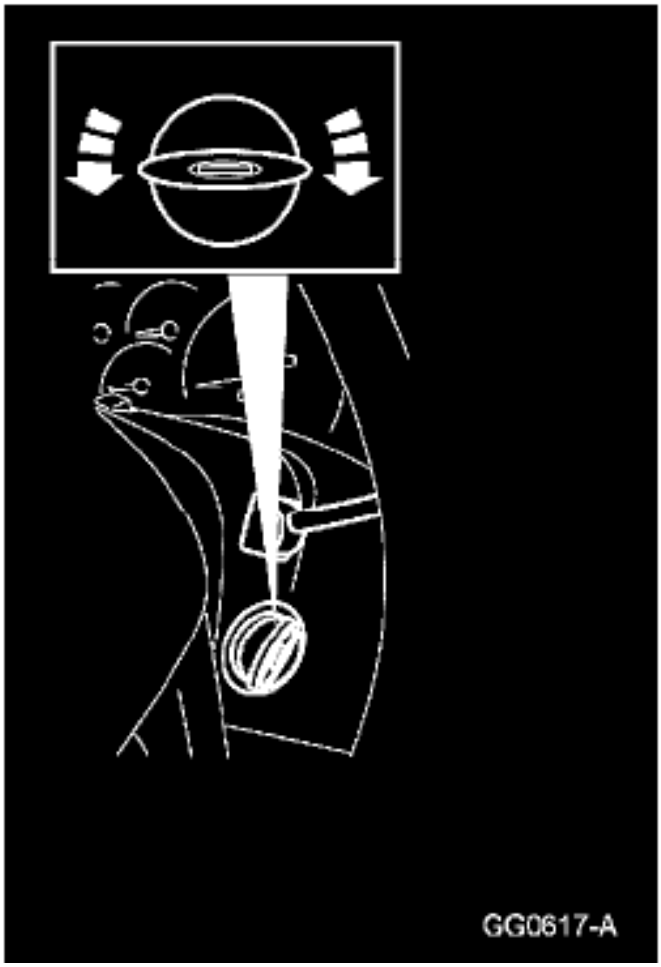
- Remove and discard the ignition lock cylinder and clean the drill shavings from the steering column.

4. Remove the bearing retainer.

5. Remove the bearing and gear.

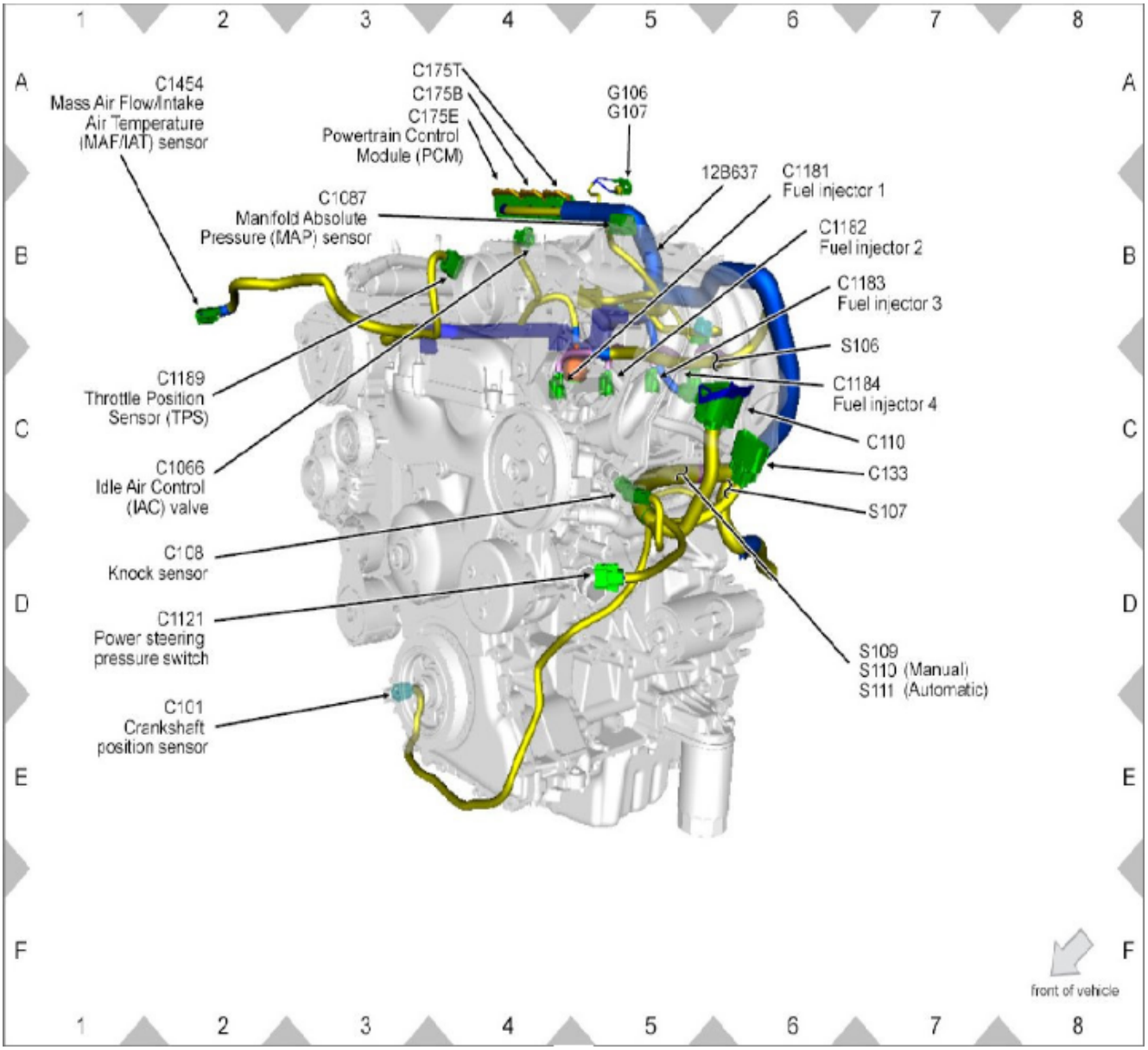
- Thoroughly clean all drill shavings from the steering column and inspect it for damage.





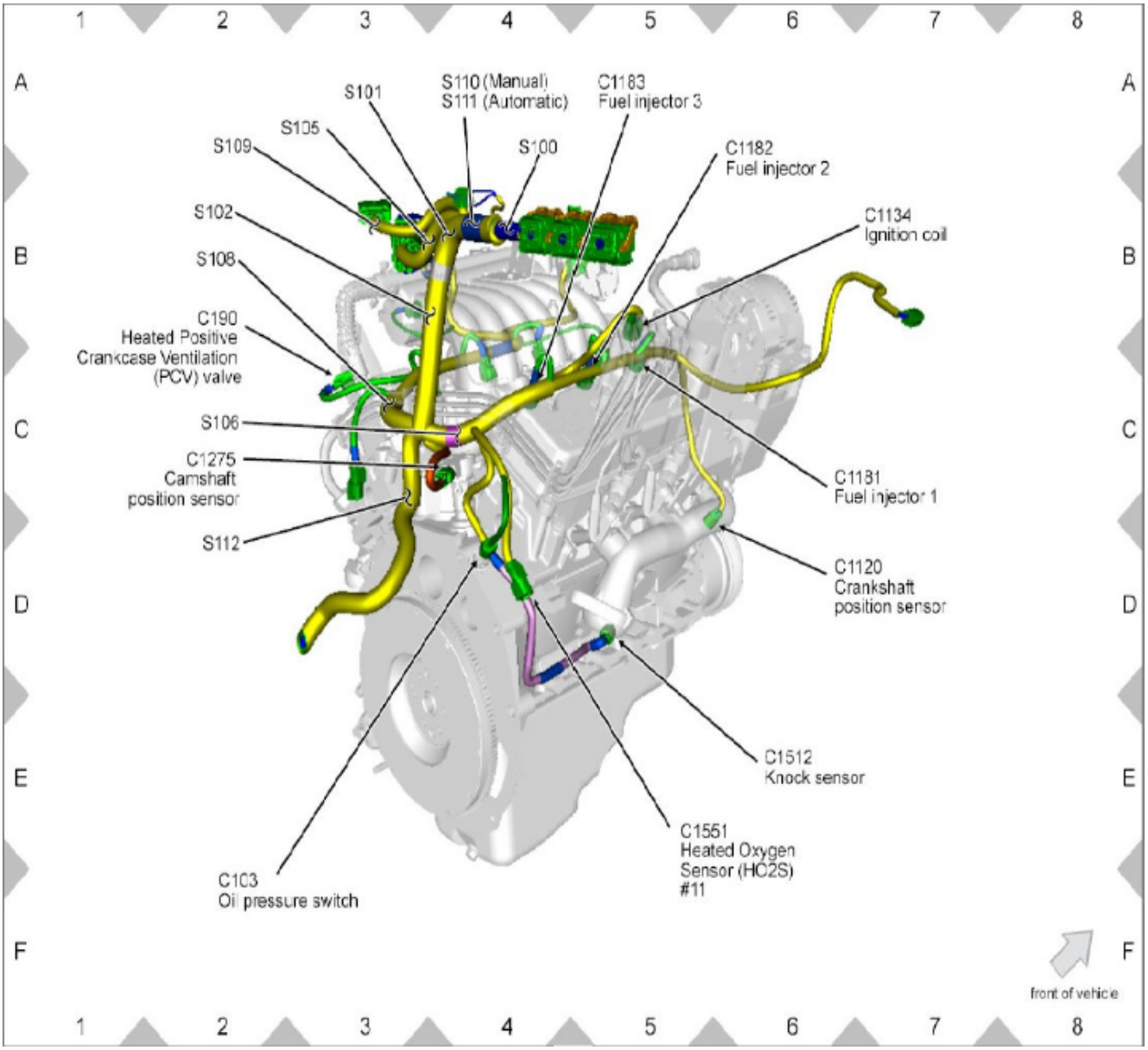
6. To install, reverse the removal procedure.

- Install a new ignition lock cylinder.
- Verify ignition lock cylinder operation.

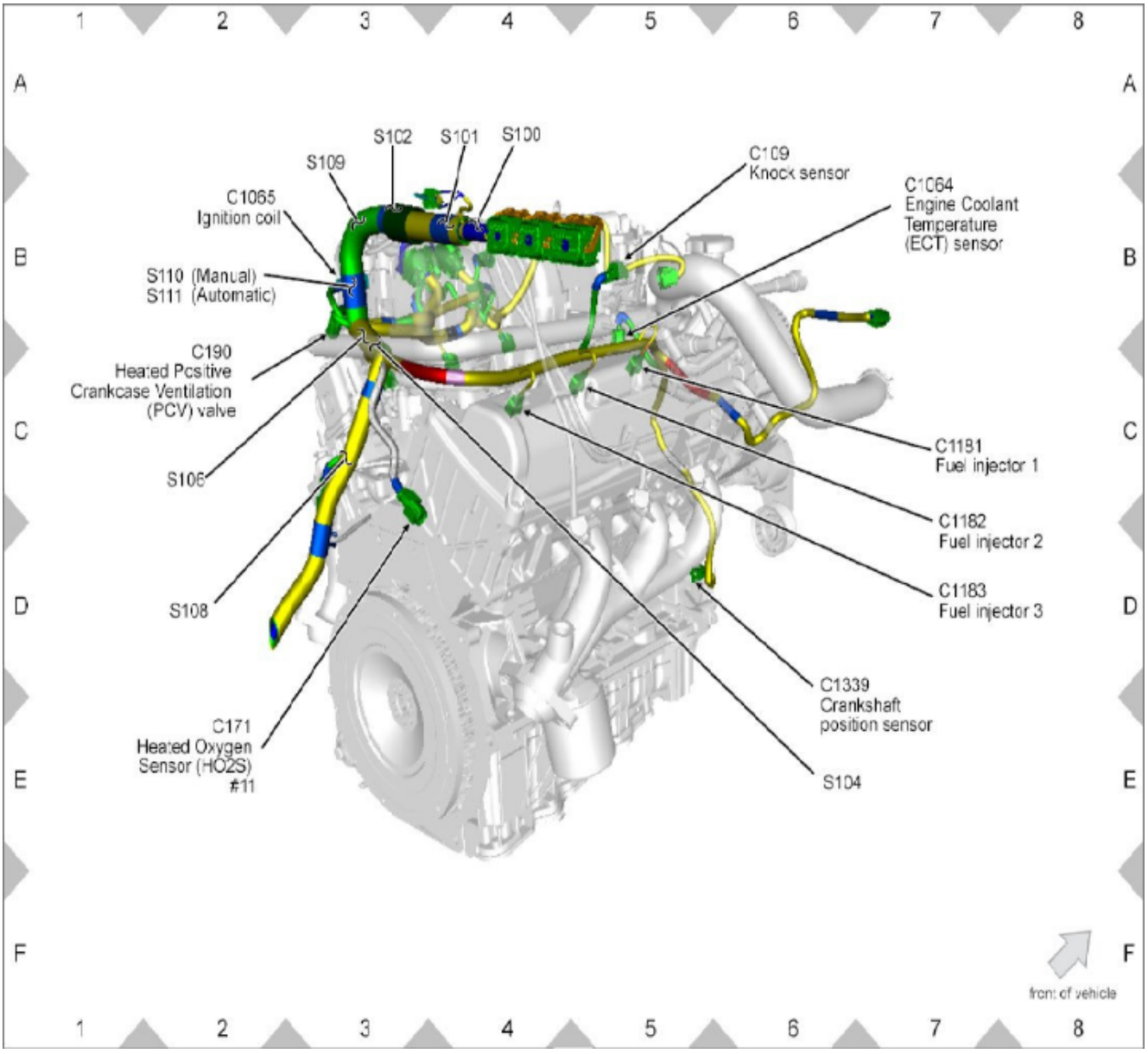


Knock Sensor: Locations

View 151-3


S101
S110 (Manual)
S111 (Automatic)
C1183
Fuel injector 3
S105
S109
S100
C1182
Fuel injector 2
S102
C1134
Ignition coil
S108
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
C1275
Camshaft
position sensor
S112
C1181
Fuel injector 1
C1120
Crankshaft
position sensor
C1512
Knock sensor
C1551
Heated Oxygen
Sensor (HO2S)
#11
C103
Oil pressure switch
front of vehicle

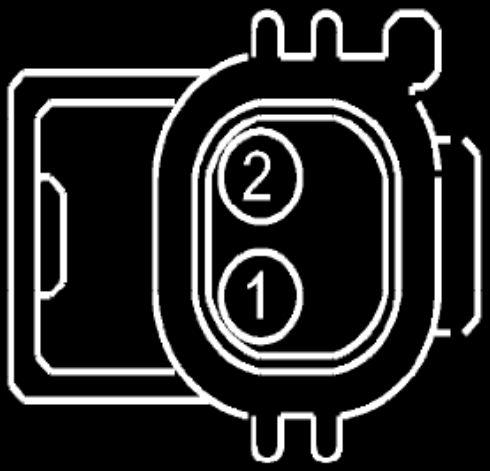
View 151-6


S102
S101
S100
S109
C1065
Ignition coil
S110 (Manual)
S111 (Automatic)
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
S108
C171
Heated Oxygen
Sensor (HO2S)
#11
C109
Knock sensor
C1064
Engine Coolant
Temperature
(ECT) sensor
C1181
Fuel injector 1
C1182
Fuel injector 2
C1183
Fuel injector 3
C1339
Crankshaft
position sensor
S104
front of vehicle

View 151-8

Connector: C108

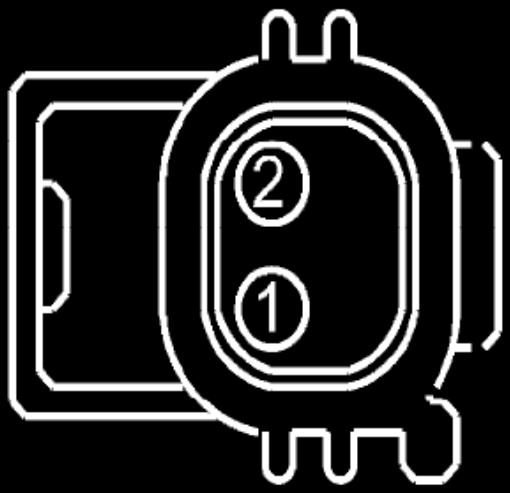
Description:	Harness:	Base Part #:
KNOCK SENSOR	12B637	12A699



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RE323 (WH-BN)	20	CTRL MOD. - POWERTRAIN # KNOCK SENSOR 1ST OR UNIQUE (KS1N) [KSL1-]	2.3L
2	VE801 (VT-OG)	20	SENSOR - KNOCK 1ST OR UNIQUE (KS1P) [KSL1+]	2.3L

Connector: C109

Description:	Harness:	Base Part #:
KNOCK SENSOR	12B637	12A699



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE801 (VT-OG)	20	SENSOR - KNOCK 1ST OR UNIQUE (KS1P) [KSL1+]	4.0L
2	RE323 (WH-BN)	20	CTRL MOD. - POWERTRAIN # KNOCK SENSOR 1ST OR UNIQUE (KS1N) [KSL1-]	4.0L

Knock Sensor: Diagrams

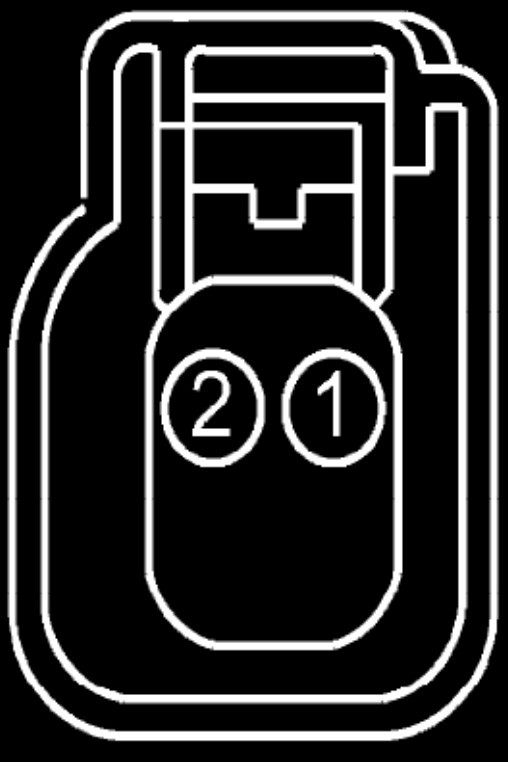
C108

C109

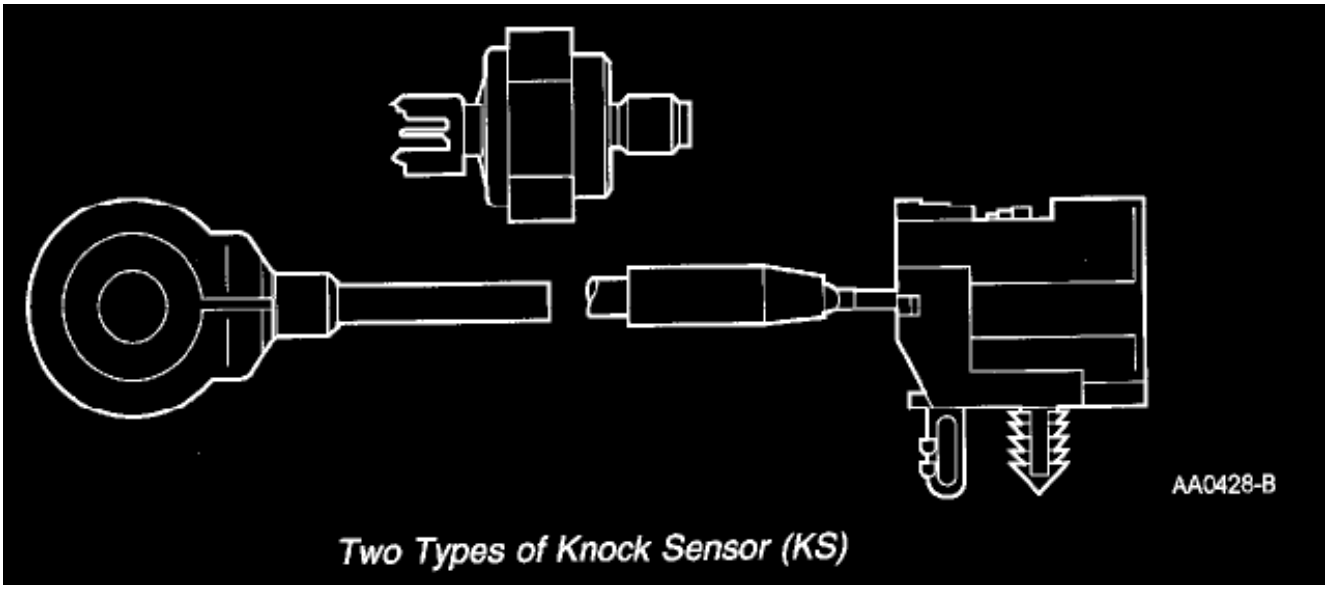
Connector: C1512

Description:	Harness:	Base Part #:
KNOCK SENSOR	12B637	12A699

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VE801 (VT-OG)	20	SENSOR - KNOCK 1ST OR UNIQUE (KS1P) [KSL1+]	3.0L
2	RE323 (WH BN)	20	CTRL MOD. - POWERTRAIN # KNOCK SENSOR 1ST OR UNIQUE (KS1N) [KSL1-]	3.0L



C1512



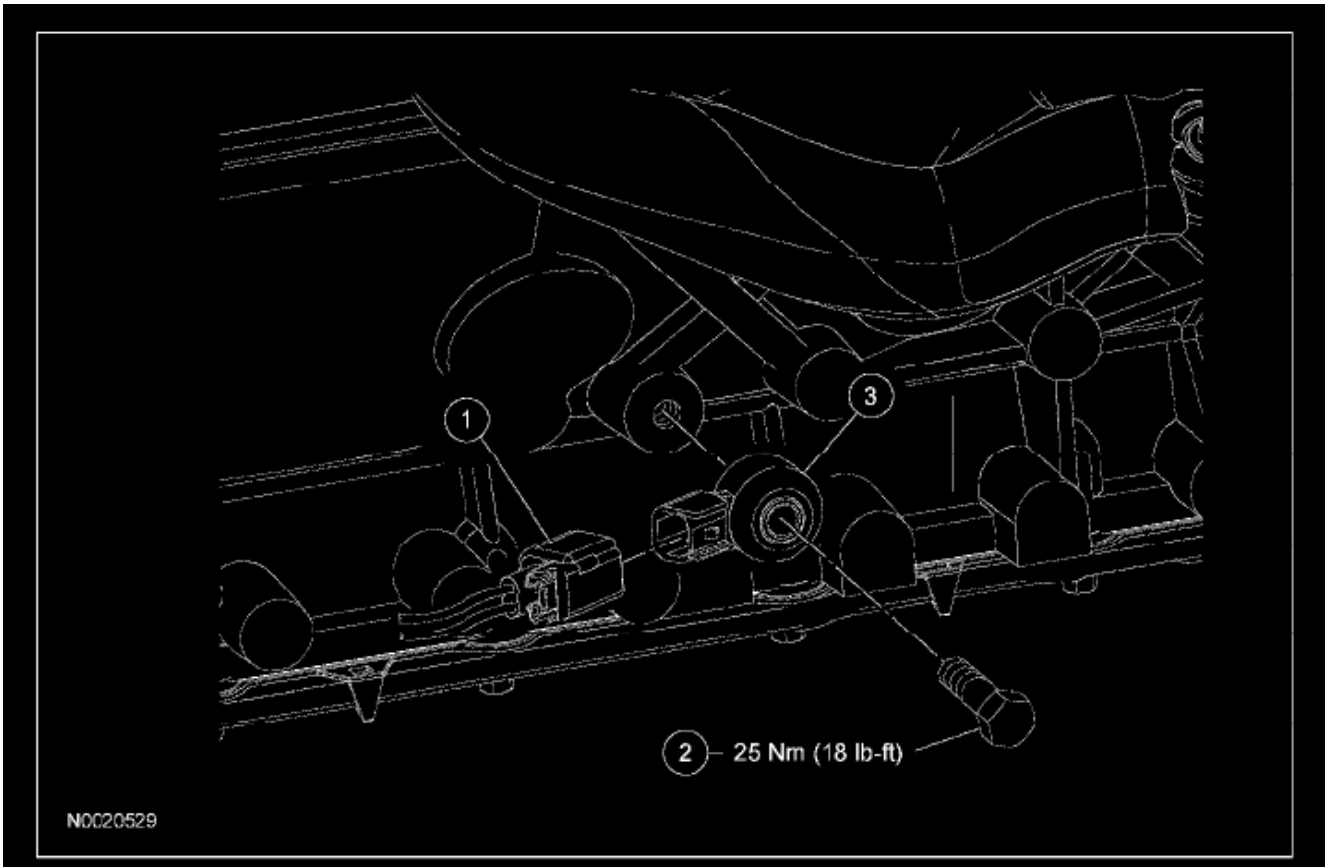
Two Types of Knock Sensor (KS)

Knock Sensor: Description and Operation

Knock Sensor (KS)

Two Types Of Knock Sensor (KS)

The KS is a tuned accelerometer on the engine which converts engine vibration to an electrical signal. The PCM uses this signal to determine the presence of engine knock and to retard spark timing.



Item	Part Number	Description
1	14A464	Knock sensor (KS) electrical connector (part of 12B637)
2	W5000225	KS bolt
3	12A699	KS

Knock Sensor: Service and Repair

KNOCK SENSOR (KS)

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the knock sensor (KS) electrical connector. 3. Remove the bolt and the KS.

- To install, tighten to 25 Nm (18 lb-ft).

4. To install, reverse the removal procedure.

Spark Plug: Specifications General Specifications

Item.....Specification

Spark plug gap.....1.31-1.45 mm 0.052-0.057 in)

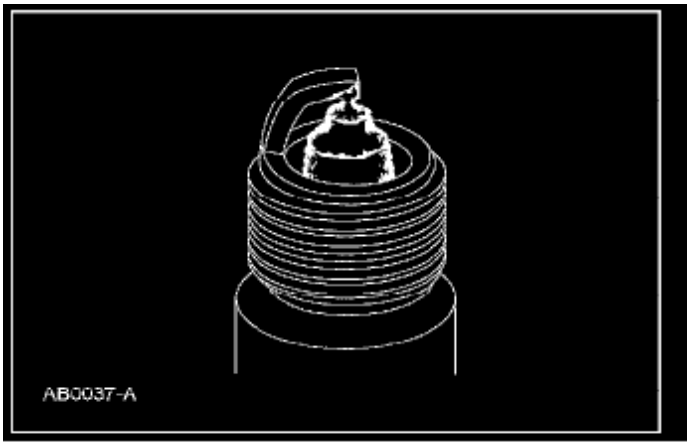
Torque Specifications

Description	Nm	lb-ft	lb-in
Ignition coil bolts	6	—	53
Spark plugs	15	11	—

Torque Specifications

Spark Plug: Application and ID

Item	Specification
Spark plug	AGSF-32FM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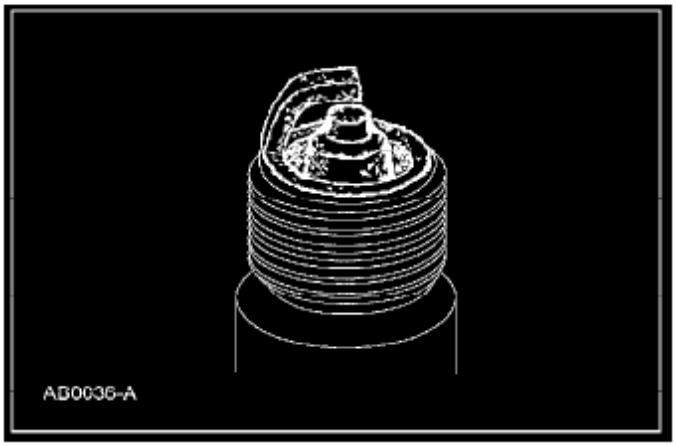
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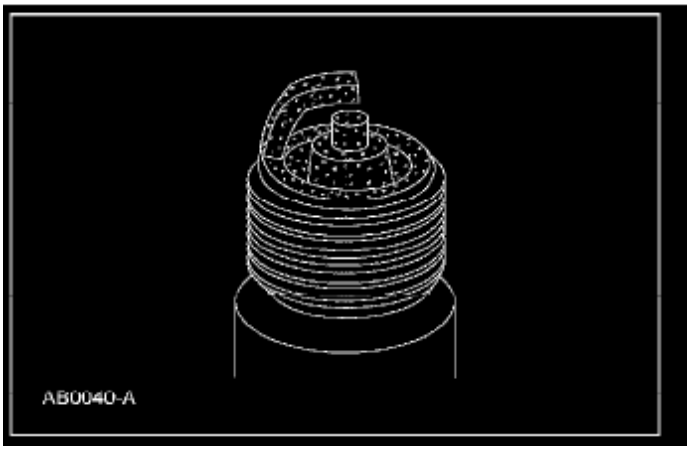
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Spark Plug: Testing and Inspection

Spark Plug Inspection

1. Inspect the spark plug for a bridged gap.

^ Check for deposit build-up closing the gap between the electrodes. Deposits are caused by oil or carbon fouling.

^ Clean the spark plug.

2. Check for oil fouling.

^ Check for wet, black deposits on the insulator shell bore electrodes, caused by excessive oil entering the combustion chamber through worn rings and pistons, excessive valve-to-guide clearance or worn or loose bearings.

^ Correct the oil leak concern.

^ Install a new spark plug.

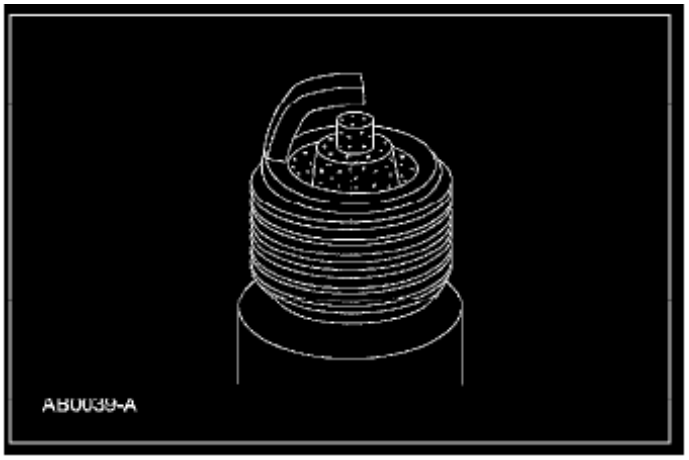
3. Inspect for carbon fouling. Look for black, dry, fluffy carbon deposits on the insulator tips, exposed shell surfaces and electrodes, caused by a

spark plug with an incorrect heat range, dirty air cleaner, too rich a fuel mixture or excessive idling.
^

Install new spark plugs.

4. Inspect for normal burning.

^ Check for light tan or gray deposits on the firing tip.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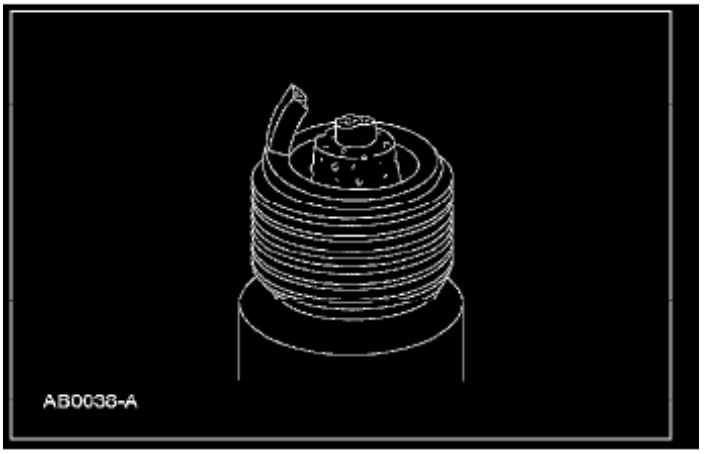
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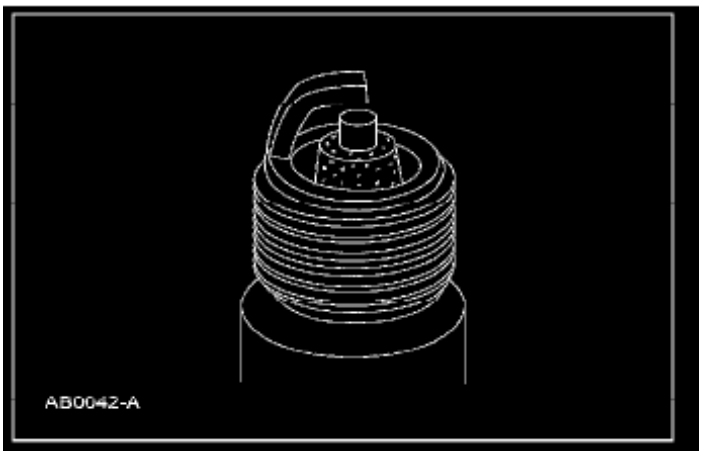
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5. Inspect for pre-ignition, identified by melted electrodes and a possibly damaged insulator. Metallic deposits on the insulator indicate engine

damage. This may be caused by incorrect ignition timing, wrong type of fuel or the unauthorized installation of a Heli-Coil(R) insert in place of the spark plug threads. ^

Install a new spark plug.

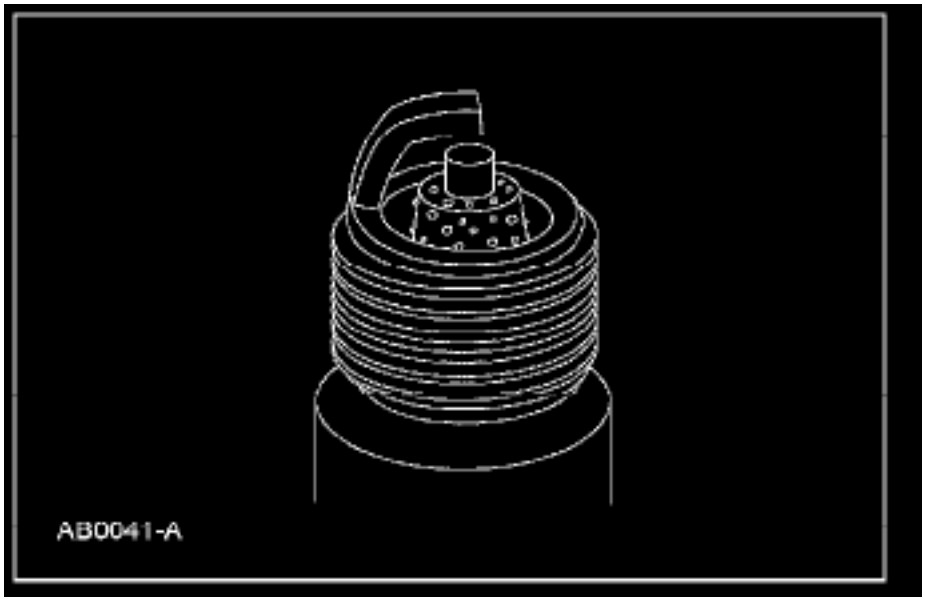
6. Inspect for overheating, identified by white or light gray spots and with a bluish-burnt appearance of electrodes. This is caused by engine

overheating, wrong type of fuel, loose spark plugs, spark plugs with an incorrect heat range, low fuel pump pressure or incorrect ignition timing. ^

Install a new spark plug.

7. Inspect for fused deposits, identified by melted or spotty deposits resembling bubbles or blisters. These are caused by sudden acceleration.

^ Install new spark plugs.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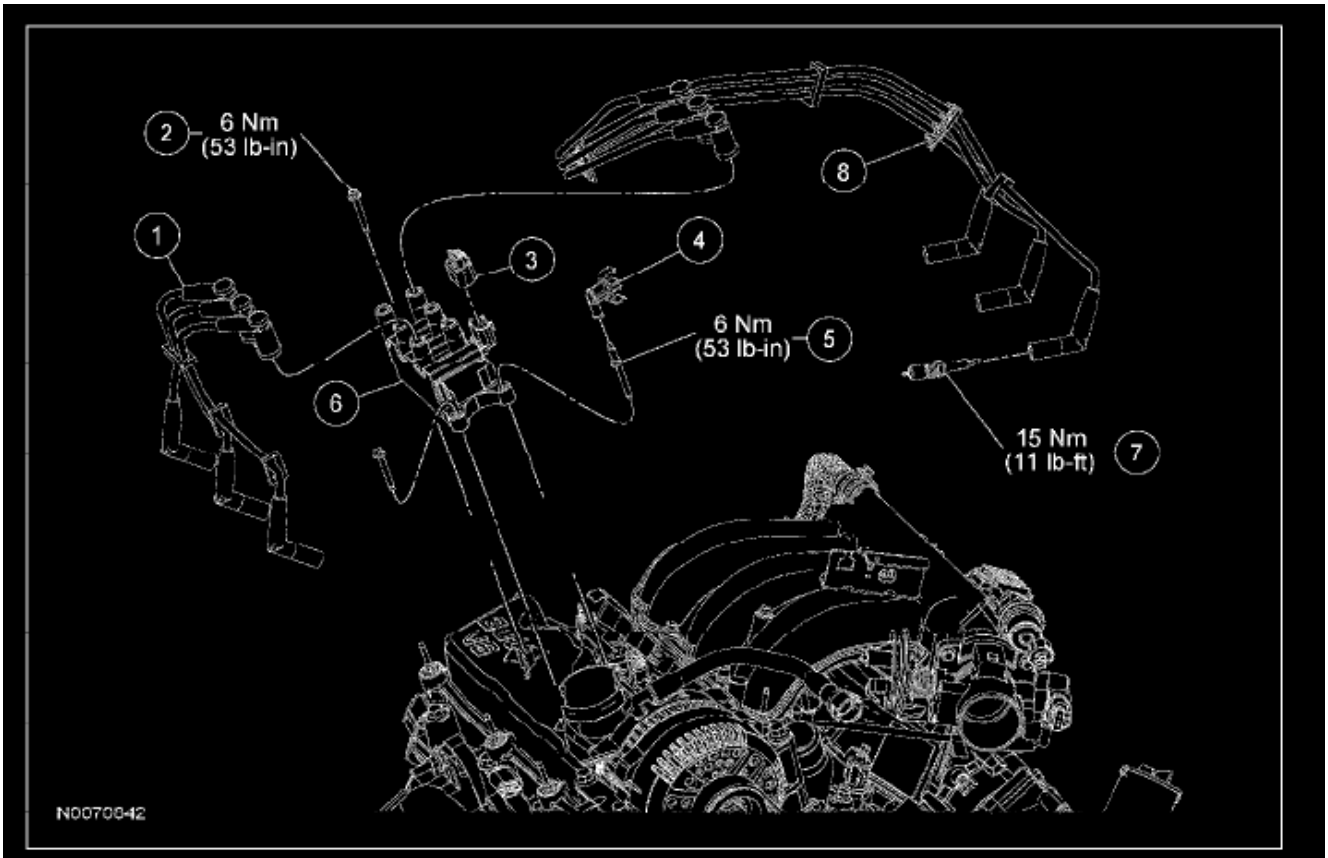


Item	Part Number	Description
1	12259	Spark plug wire set
2	W706995	Ignition coil bolt (2 required)
3	—	Ignition coil electrical connector (part of 12B637)
4	18D331	Heater hose retainer
5	W706825	Ignition coil stud bolt

Item	Part Number	Description
6	12029	Ignition coil
7	12405	Spark plug (6 required)
8	12297	Spark plug wire retainer (7 required)

(Continued)

Special Tool(s)

Remover, Spark Plug Wire
303-106 (T74P-6666-A)

Spark Plug: Service and Repair

SPARK PLUGS

Exploded View

Special Tool(s)

Special Tool(s)

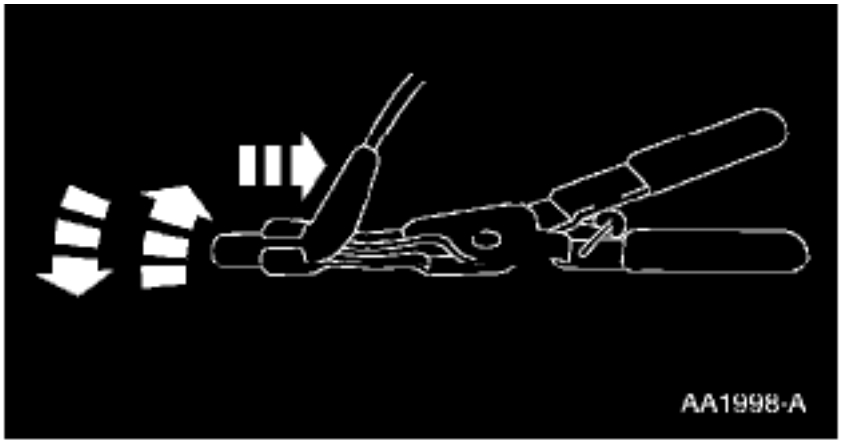
Removal and Installation

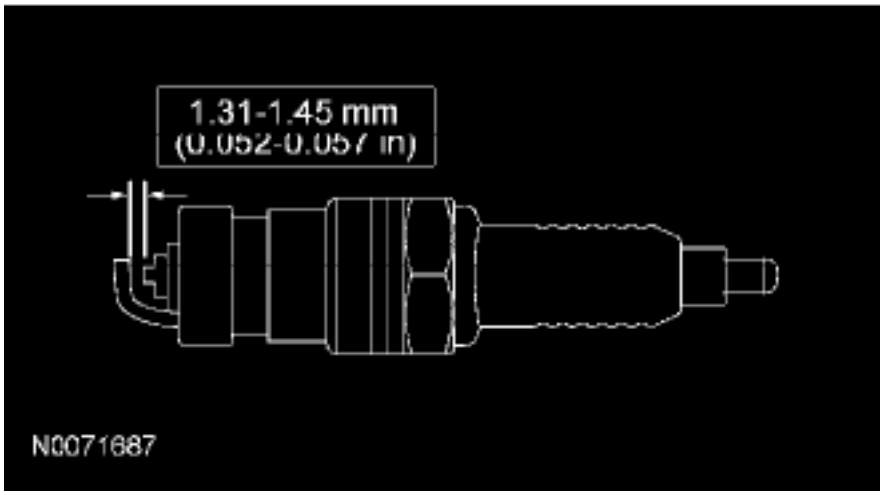
1. CAUTION:

- Spark plug wires must be connected correctly. Failure to follow this instruction may result in poor engine performance.

- Do not pull on the spark plug wire as it may separate from the spark plug wire connector inside the spark plug wire boot.

Use the Spark Plug Wire Remover to grasp and twist the spark plug wire boot back and forth on the spark plug insulator to release the connectors.





2. Loosen the spark plugs. 3. Remove any foreign material from the spark plug areas of the cylinder head with compressed air. 4. Remove the spark plugs.

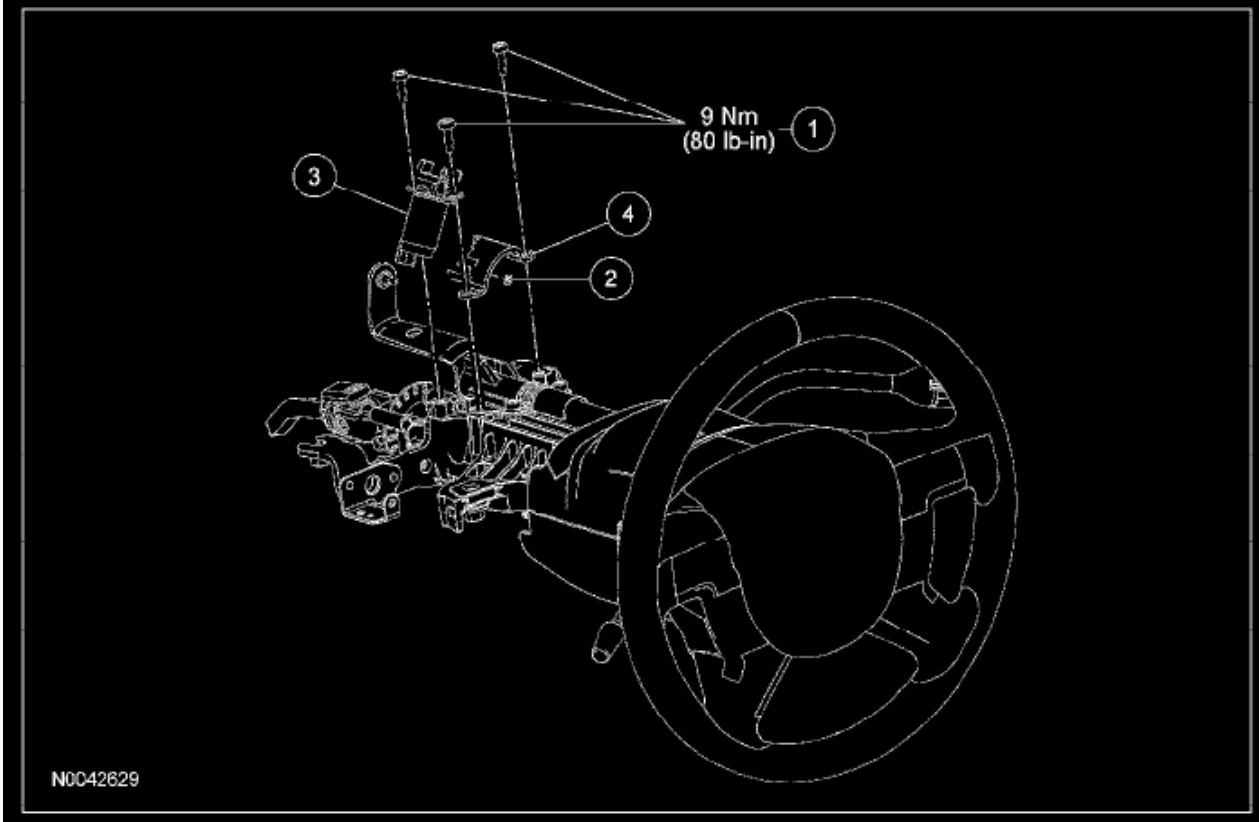
- To install, tighten to 15 Nm (11 lb-ft).

5. Inspect the spark plugs. 6. Adjust the spark plug gap as necessary.

7. To install, reverse the removal procedure.

- Use a small, clean tool to coat the entire interior surface of the boot with silicone brake caliper grease.

Brake Shift Interlock Actuator



Item	Part Number	Description
1	N806584-S	Brake shift interlock actuator bolts
2	W623450-S	Brake shift interlock actuator clip
3	3F770-A	Brake shift interlock actuator
4	7A216-A	Insert plate

Shift Interlock Solenoid: Service and Repair

Brake Shift Interlock Actuator

Brake Shift Interlock Actuator

Removal and Installation

1. Remove the steering column assembly. 2. Remove the insert plate and the brake shift interlock actuator bolts.

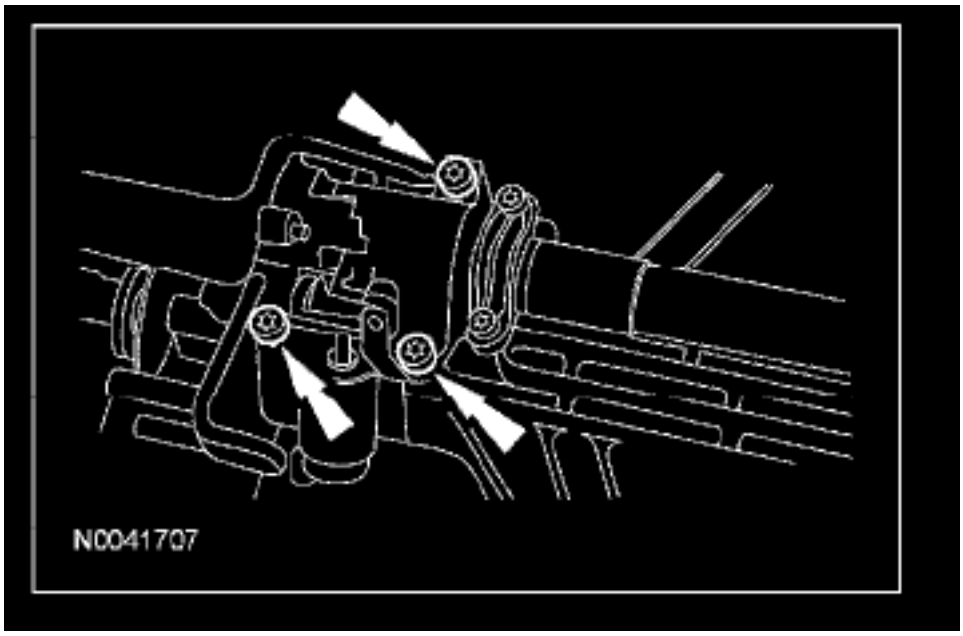
3. NOTE: The brake shift interlock actuator clip is an assembly aid for the assembly plant and does not need to be replaced.

Remove the insert plate from the brake shift interlock actuator. ^

Remove and discard the brake shift interlock actuator clip.

4. To install, reverse the removal procedure.

^ Tighten to 9 Nm (80 lb-inch).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Solenoid Operation Chart

Gearshift Selector Position	PCM Commanded Gear	Solenoid States				
		SSA	SSB	SSC	SSD	Engine Braking
P/N	P/N	On	Off	Off	Off	No
R	R	On	Off	Off	Off	No
(D) (Overdrive)	1	On	Off	Off	Off	No
	2[a]	On	Off	On	Off	No
	3	On	On	Off	Off	No
	4	Off	Off	Off	Off	No
	5	Off	Off	On	Off	No
Drive	1	On	Off	Off	Off	No
	2[a]	On	Off	On	Off	No
	3	On	On	Off	On[b]	No
	4	Off	Off	Off	On	Yes
2	3	On	On	Off	On	Yes
1	1	On	Off	Off	On	Yes

a PCM Controlled
b On time calibration dependent

Shift Solenoid: Specifications

Solenoid Operation Chart

Solenoid Operation Chart

Solenoid Operation Chart

Gearshift Selector Position	PCM Commanded Gear	Solenoid States				
		SSA	SSB	SSC	SSD	Engine Braking
P/N	P/N	On	Off	Off	Off	No
R	R	On	Off	Off	Off	No
(D) (Overdrive)	1	On	Off	Off	Off	No
	2[a]	On	Off	On	Off	No
	3	On	On	Off	Off	No
	4	Off	Off	Off	Off	No
	5	Off	Off	On	Off	No
Drive	1	On	Off	Off	Off	No
	2[a]	On	Off	On	Off	No
	3	On	On	Off	On[b]	No
	4	Off	Off	Off	On	Yes
2	3	On	On	Off	On	Yes
1	1	On	Off	Off	On	Yes

a PCM Controlled
b On time calibration dependent

SSA ALWAYS "ON":	Transmission Range Selector Lever Position		
	OD	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	1	3	1

SSA ALWAYS "ON":	Transmission Range Selector Lever Position		
	OD	2	1
2	2	Ratio 1.1	2
3	3	3	3
4	1	3	1
5	2	Ratio 1.1	2

Shift Solenoid: Testing and Inspection

Pinpoint Tests - OSC Equipped Vehicle Anytime an electrical connector or solenoid body is disconnected, inspect the connector for terminal condition, corrosion and contamination. Also inspect the connector seal for damage. Clean, repair or install a new connector as required.

Shift Solenoid Pre-Diagnosis Use the following shift solenoid operation information while carrying out Pinpoint Test A.

Solenoid Operation Chart

Solenoid Operation Chart

Shift Solenoid Failure Mode Chart "Always On" Failed OFF due to PCM and/or vehicle wiring concerns, solenoid electrically, mechanically or hydraulically stuck ON.

SSB ALWAYS "ON":	Transmission Range Selector Lever Position		
	OD	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	3	3	3
2	Ratio 1.1	Ratio 1.1	Ratio 1.1
3	3	3	3
4	3	3	3
5	Ratio 1.1	Ratio 1.1	Ratio 1.1

SSC ALWAYS "ON":	Transmission Range Selector Lever Position		
	OD	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	2	3	1
2	2	Ratio 1.1	2
3	Ratio 1.1	3	3
4	5	3	3
5	5	Ratio 1.1	Ratio 1.1

SSD ALWAYS "ON":	Transmission Range Selector Lever Position		
	OD	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	1	3	1
2	1	3	1
3	3	3	3
4	4	3	3
5	4	3	3

SSA ALWAYS "OFF":	Transmission Range Selector Lever Position		
	OD	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	4	3	3

SSA ALWAYS "OFF":	Transmission Range Selector Lever Position		
	OD	2	1
2	5	Ratio 1.1	Ratio 1.1
3	3	3	3
4	4	3	3
5	5	Ratio 1.1	Ratio 1.1

Shift Solenoid Failure Mode Chart "Always Off" Failed ON due to PCM and/or vehicle wiring concerns, solenoid electrically, mechanically or hydraulically stuck OFF.

SSB ALWAYS "OFF":	Transmission Range Selector Lever Position		
	OD	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	1	3	1
2	2	Ratio 1.1	2
3	1[a] (2[b])	3	1
4	4	3	3
5	5	Ratio 1.1	Ratio 1.1

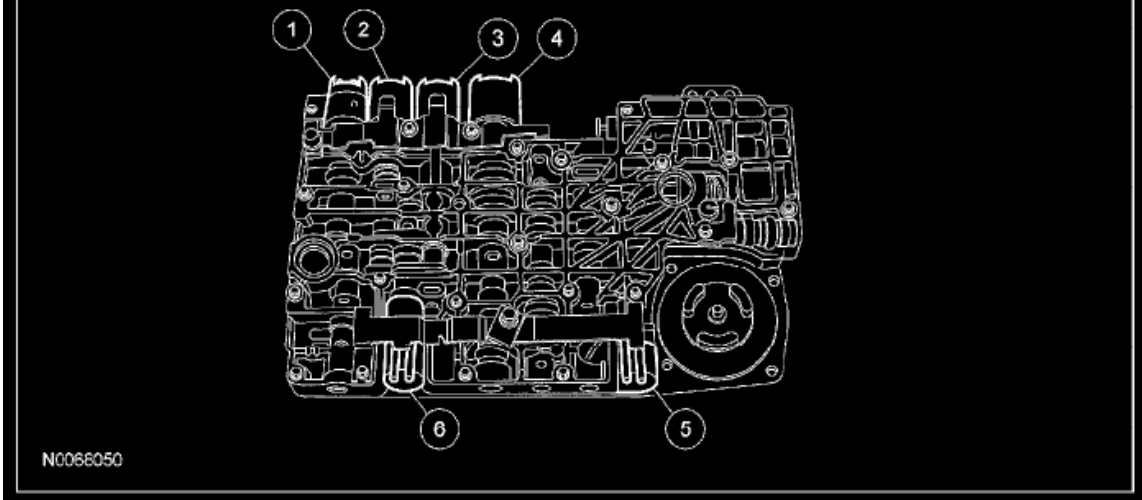
a During Downshift Only
b During Upshift Only

SSC ALWAYS "OFF":	Transmission Range Selector Lever Position		
	OD	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	1	3	1
2	1	3	1
3	3	3	3
4	4	3	3
5	4	3	3

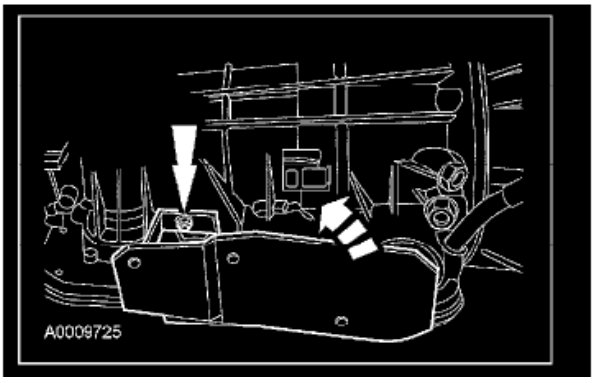
SSD ALWAYS "OFF":	Transmission Range Selector Lever Position		
	OD	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	1	3	1
2	2	Ratio 1.1	2
3	3	3	3
4	4	3	3
5	5	Ratio 1.1	Ratio 1.1

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V



Item	Part Number	Description
1	7F037	Torque converter clutch (TCC)
2	7G484	Shift solenoid (SSD)
3	7G484	Shift solenoid (SSB)
4	7H144	Electronic pressure control (EPC)
5	7G484	Shift solenoid (SSA)
6	7G484	Shift solenoid (SSC)



Shift Solenoid: Service and Repair

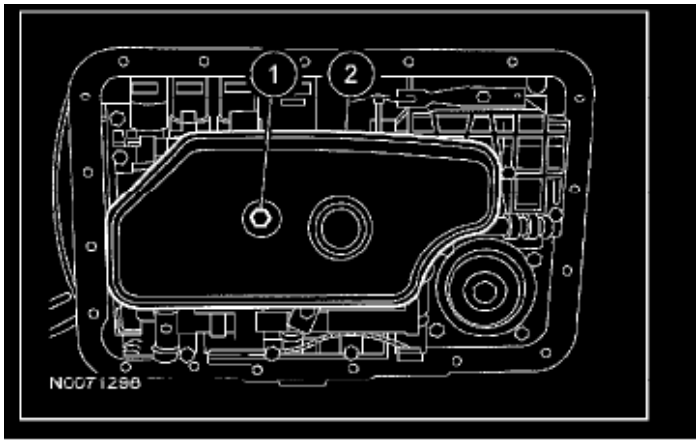
Solenoids - Shift, Torque Converter Clutch, Electronic Pressure Control

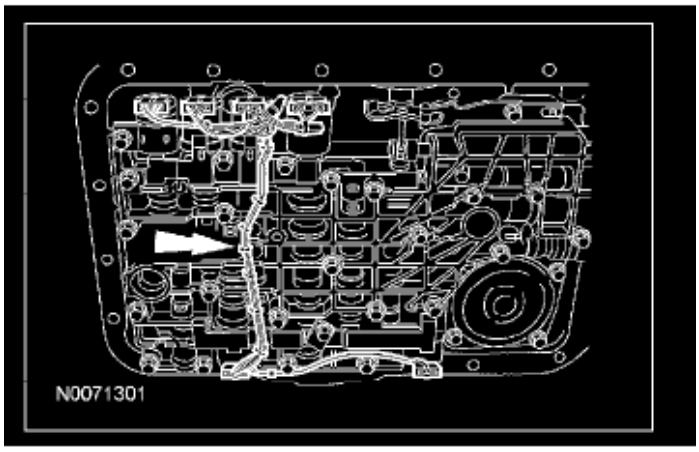
Removal

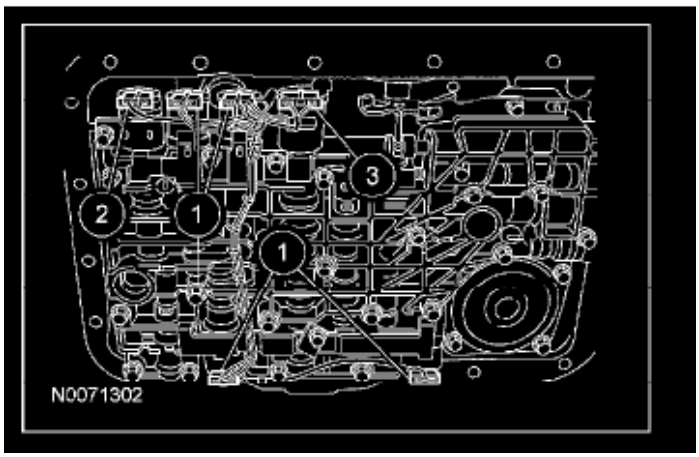
1. With the vehicle in NEUTRAL, position it on a hoist.

2. NOTE: If equipped, the transmission servo heat shield needs to be unclipped from the fluid pan rail and positioned aside for fluid pan removal.

If equipped, loosen the nut and position the heat shield aside.







3. Place a drain pan under the transmission fluid pan. 4. Drain the transmission fluid. 5. Remove the transmission fluid filter.

1 Remove the transmission fluid filter screw.

2 Remove the transmission fluid filter.

6. NOTE: Main control assembly does not need to be removed for solenoid service.

Remove wire loom guide and protector. ^

Carefully lift up on wire loom guide and protector and disengage the retaining pins from the solenoid clamps.

7. Disconnect the appropriate solenoid electrical connector.

1 Disconnect shift solenoids electrical connectors.

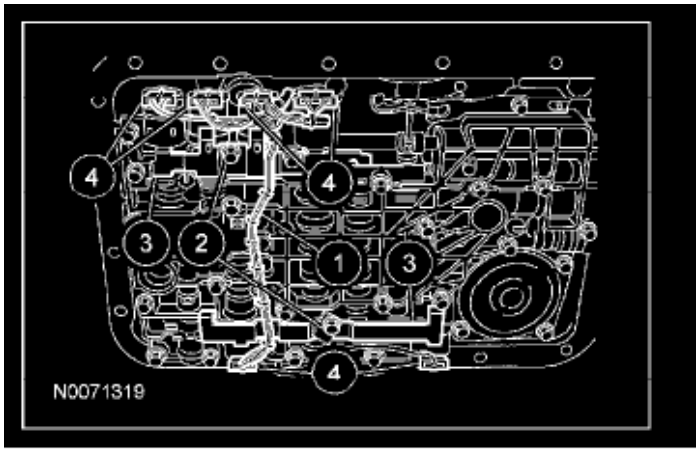
2 Disconnect the torque converter clutch (TCC) solenoid electrical connector.

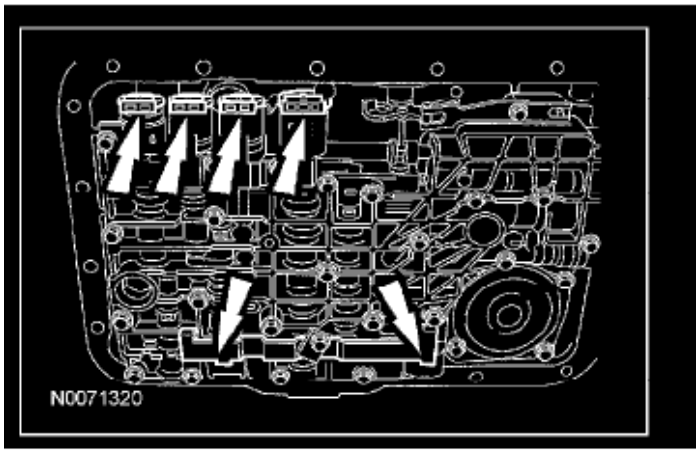
3 Disconnect the electronic pressure control (EPC) solenoid electrical connector.

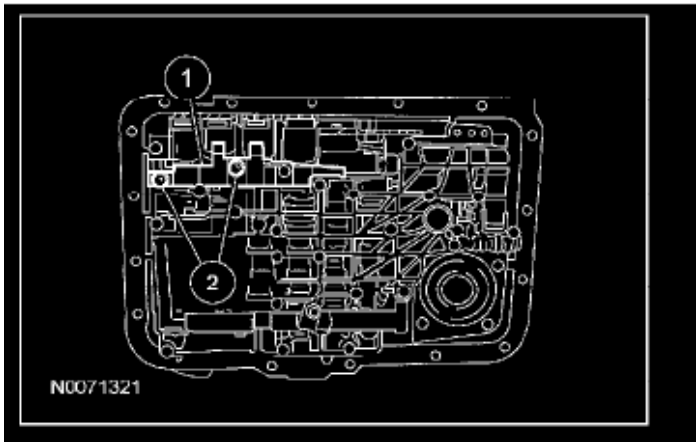
8. CAUTION: The torque converter clutch (TCC) solenoid and converter modulator valve may pop out of its bore. This may damage the

solenoid or converter modulator valve.

CAUTION: Shift solenoid (SSC) may pop out of its bore. This may damage the solenoid.







Remove the shift solenoids. 1

Remove the wire harness.

2 Remove the solenoid clamp screws.

3 Remove the solenoid clamp.

4 Remove the appropriate solenoid(s).

Installation

1. Install the new solenoid(s).

2. NOTE: The solenoid clamp must be installed in the torque converter clutch (TCC) and electronic pressure control (EPC) solenoid grooves, shift

solenoid pockets and the No. 204 plug.

Install the solenoid clamp. 1

Position the solenoid clamp on the main control valve body.

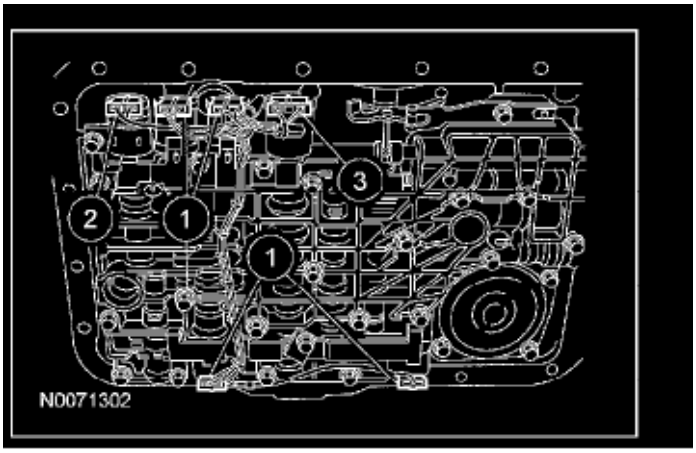
2 Install the solenoid clamp screws.

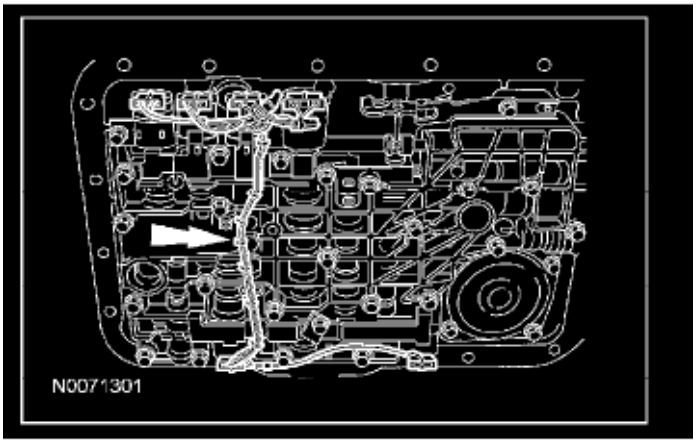
3. Connect the 6 solenoid electrical connectors.

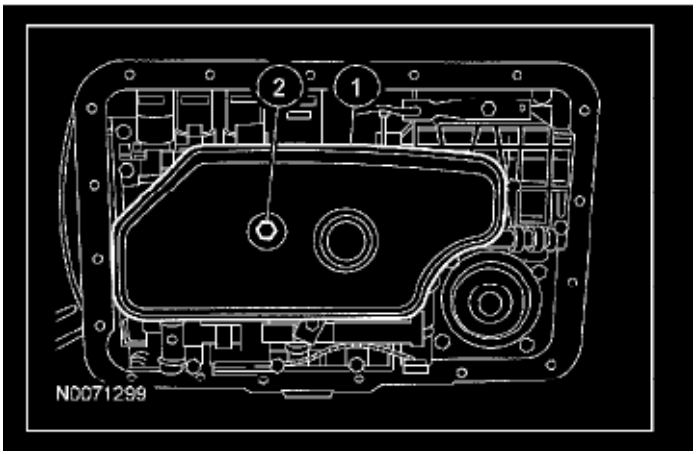
1 Connect shift solenoid SSA, SSB, SSC, SSD electrical connectors.

2 Connect the TCC solenoid electrical connector.

3 Connect the EPC solenoid electrical connector.







4. CAUTION: Excessive pressure may break the retaining pins.

Install the main control valve body wire loom. ^

Align the retaining pins to the holes in the solenoid clamps and gently press in the main control valve body wire loom guide and protector.

5. Install the transmission fluid filter.

1 Install the transmission fluid filter.

2 Install the transmission fluid filter screw. ^

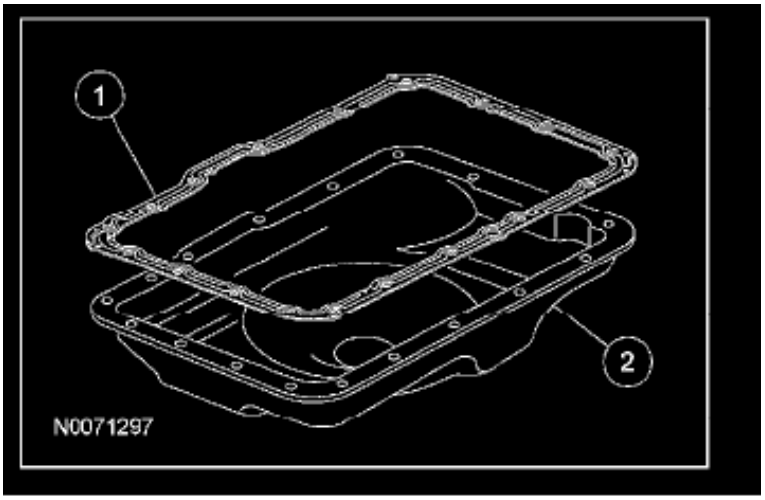
Tighten to 10 Nm (89 lb-inch).

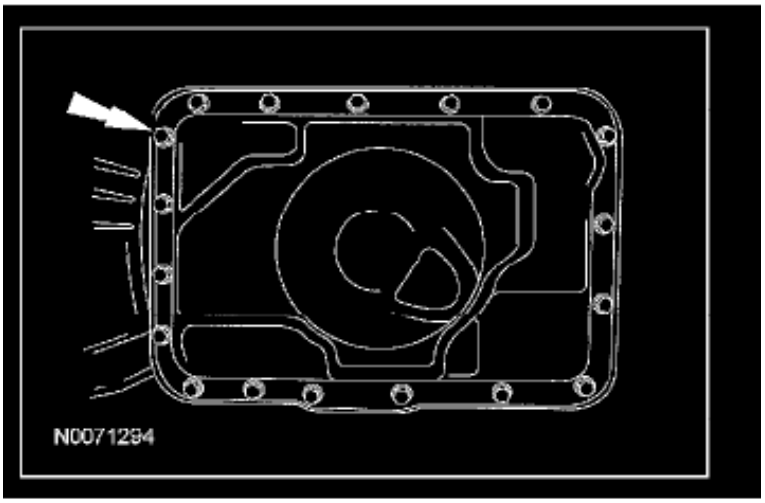
6. NOTE: The transmission fluid pan gasket is reusable. Clean and inspect for damage, if not damaged, the gasket should be reused.

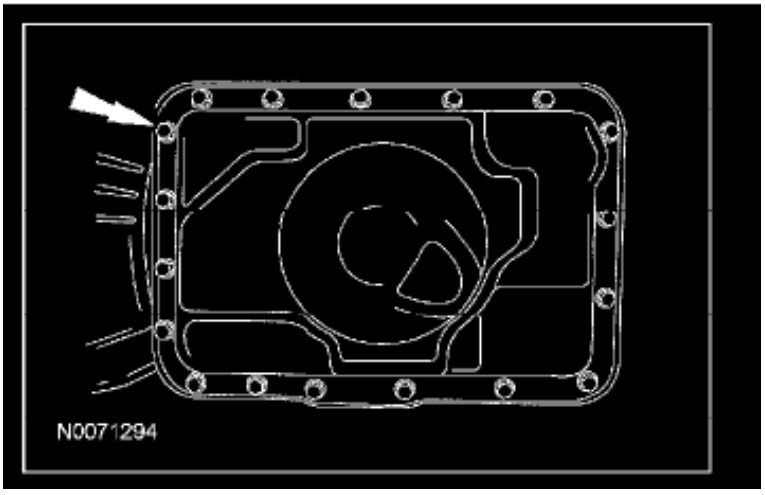
Install the transmission fluid pan. 1

Position the transmission fluid pan gasket on the transmission fluid pan.

2 Align and install the transmission fluid pan.







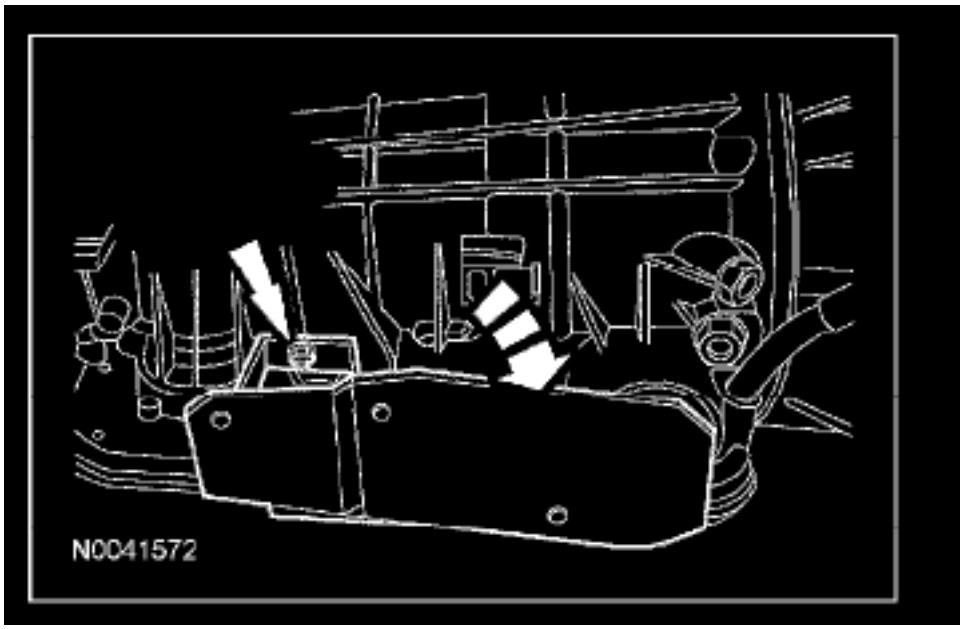
7. Loosely install the transmission fluid pan screws.

8. Tighten the transmission fluid pan screws in a crisscross pattern.

^ Tighten to 10 Nm (89 lb-inch).

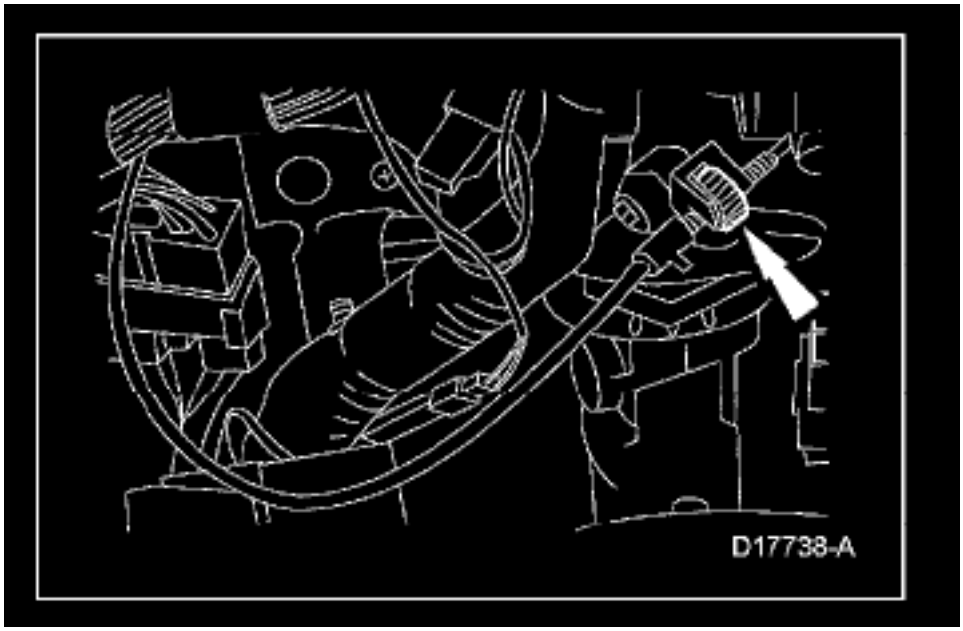
9. If equipped, position the servo heat shield over the servos and clip it to the pan rail.

^ Tighten to 10 Nm (89 lb-inch).



10. NOTE: Start with a minimum of 3.7L (4 qt) clean automatic transmission fluid.

Fill transmission with clean automatic transmission fluid to the correct fluid level.



Shift Indicator: Adjustments

Selector Lever Indicator Adjustment

1. Remove the upper instrument panel steering column cover. 2. Place the selector lever in the (D) position.

^ Rotate the selector lever clockwise until it bottoms out (1st gear), then rotate 2 detents counterclockwise ((D) position).

3. Hang the 1.4 kg (3 lb) weight on the gearshift lever. 4. Center the pointer in the middle of the (D) position.

^ Rotate the thumb-wheel located on the bottom of the steering column to adjust the pointer.

5. Remove the 1.4 kg (3 lb) weight. 6. Carefully move the selector lever into each detent and compare with the transmission settings.

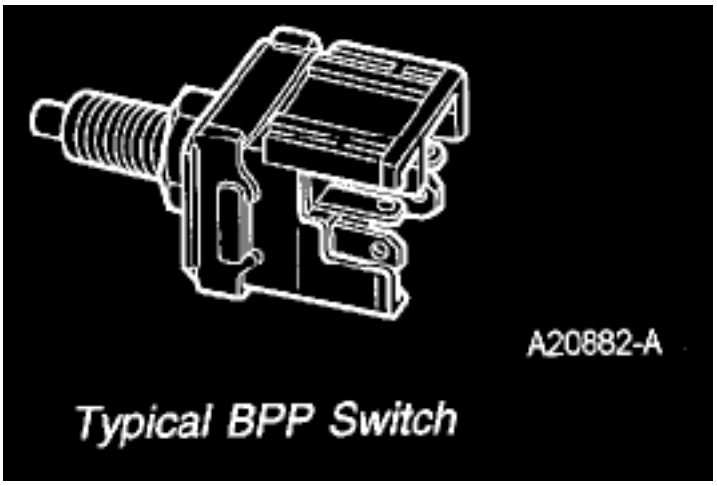
^ Readjust if necessary.

7. Install the upper instrument panel steering column cover.

Transmission Mode Indicator - A/T: Description and Operation

TRANSMISSION CONTROL INDICATOR LAMP (TCIL)

The TCIL is an output signal from the PCM that controls the lamp on/off function depending on the engagement or disengagement of overdrive.



Brake Switch - TCC: Description and Operation

BRAKE PEDAL POSITION (BPP) SWITCH

Typical BPP Switch

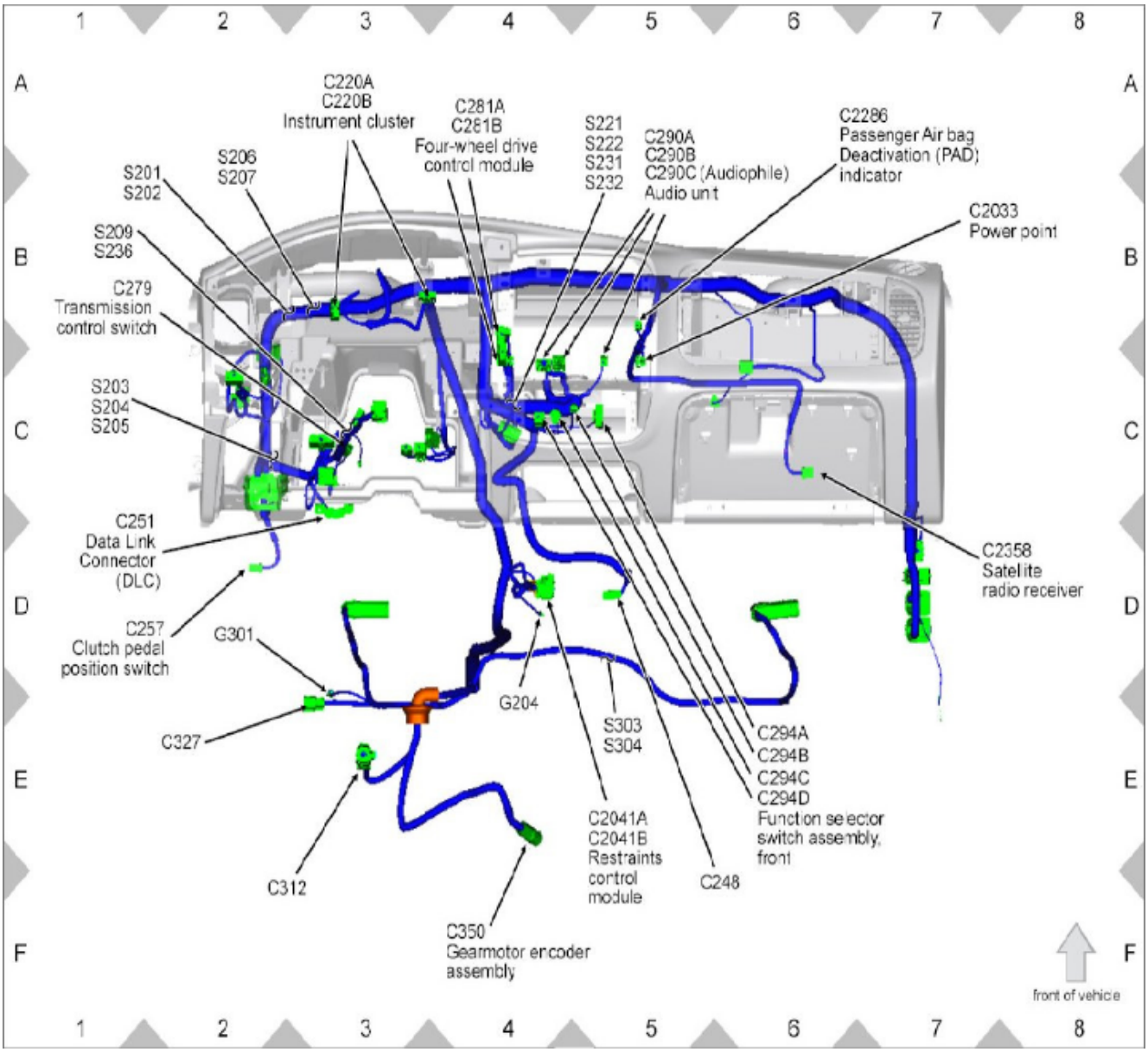
The BPP switch is sometimes referred to as the stoplamp switch. The BPP switch provides a signal to the PCM indicating that the brakes are applied. The BPP switch is normally open and is mounted on the brake pedal support. Depending on the vehicle application the BPP switch can be hardwired as follows:

- to the PCM supplying battery positive voltage (B+) when the vehicle brake pedal is applied.

- to the antilock brake system (ABS) module, or lighting control module (LCM), the BPP signal is then broadcast over the network to be received by the PCM.

- to the ABS traction control/stability assist module. The ABS module interprets the BPP switch input along with other ABS inputs and generates an output called the driver brake application (DBA) signal. The DBA signal is then sent to the PCM and to other BPP signal users.

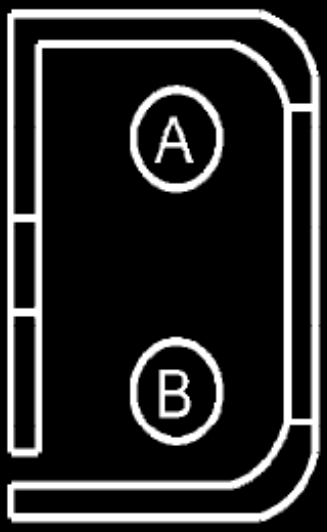
Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Powertrain Management > Transmission Control Systems > Sensors and Switches - Transmission and Drivetrain > Sensors and Switches - A/T > Transmission Mode Switch, A/T > Component Information > Locations



View 151-12

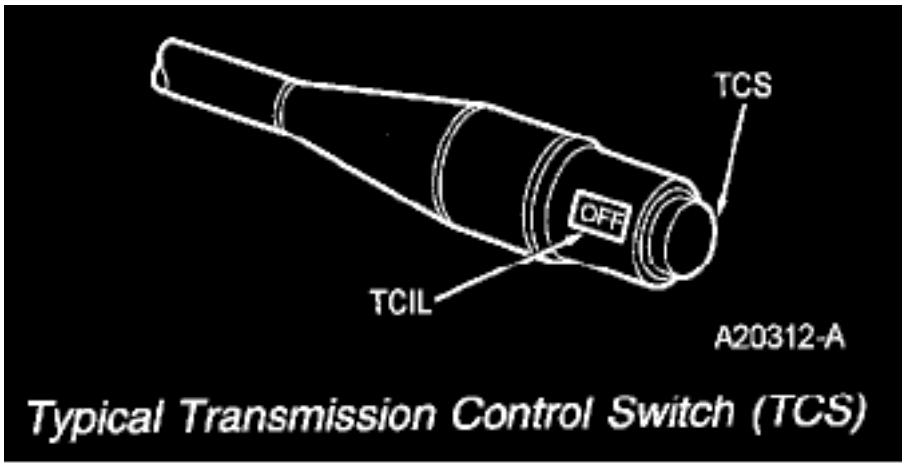
Connector: C279

Description:	Harness:	Base Part #:
TRANSMISSION CONTROL SWITCH	14401	7G550

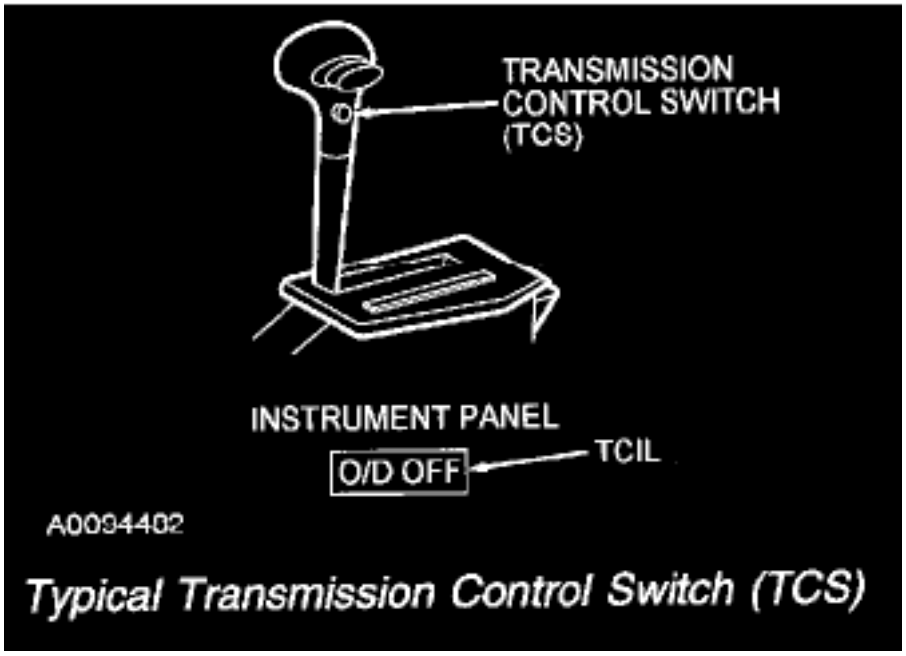


Pin	Circuit	Gauge	Circuit Function	Qualifier
A	CBP20 (YE-VT)	20	FUSE - 20 OR CIRCUIT BREAKER	
B	CE134 (BN-GN)	20	SWITCH - TRANSMISSION CONTROL/OVERDRIVE CANCEL (TCS)	

C279



Typical Transmission Control Switch (TCS)



Typical Transmission Control Switch (TCS)

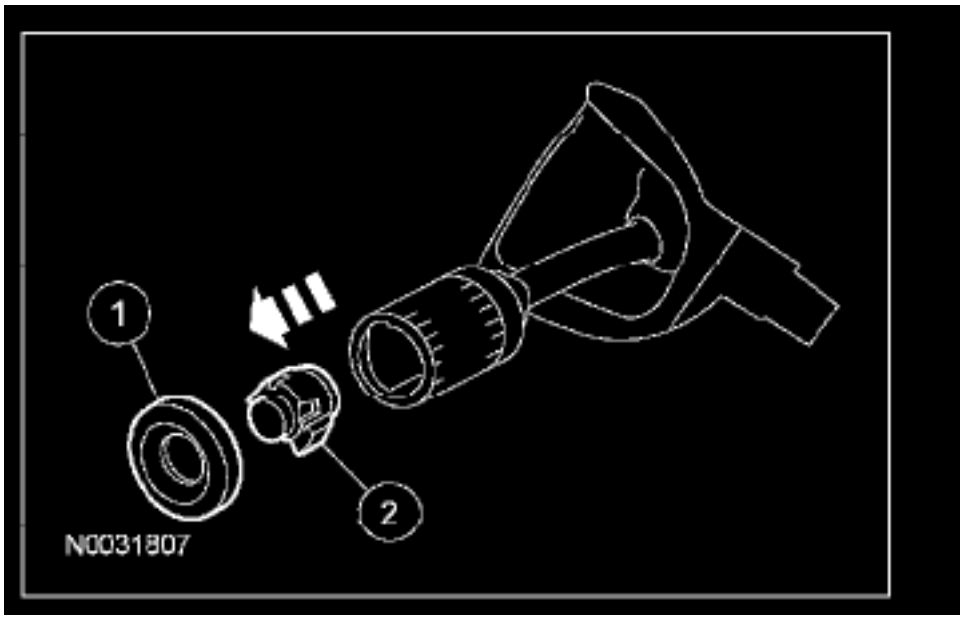
Transmission Mode Switch: Description and Operation

TRANSMISSION CONTROL SWITCH (TCS)

Typical Transmission Control Switch (TCS)

Typical Transmission Control Switch (TCS)

The TCS signals the PCM with VPWR whenever the TCS is pressed. On vehicles with this feature, the transmission control indicator lamp (TCIL) illuminates when the TCS is cycled to disengage overdrive.



Transmission Mode Switch: Service and Repair

Transmission Control (TC) Switch

Removal and Installation

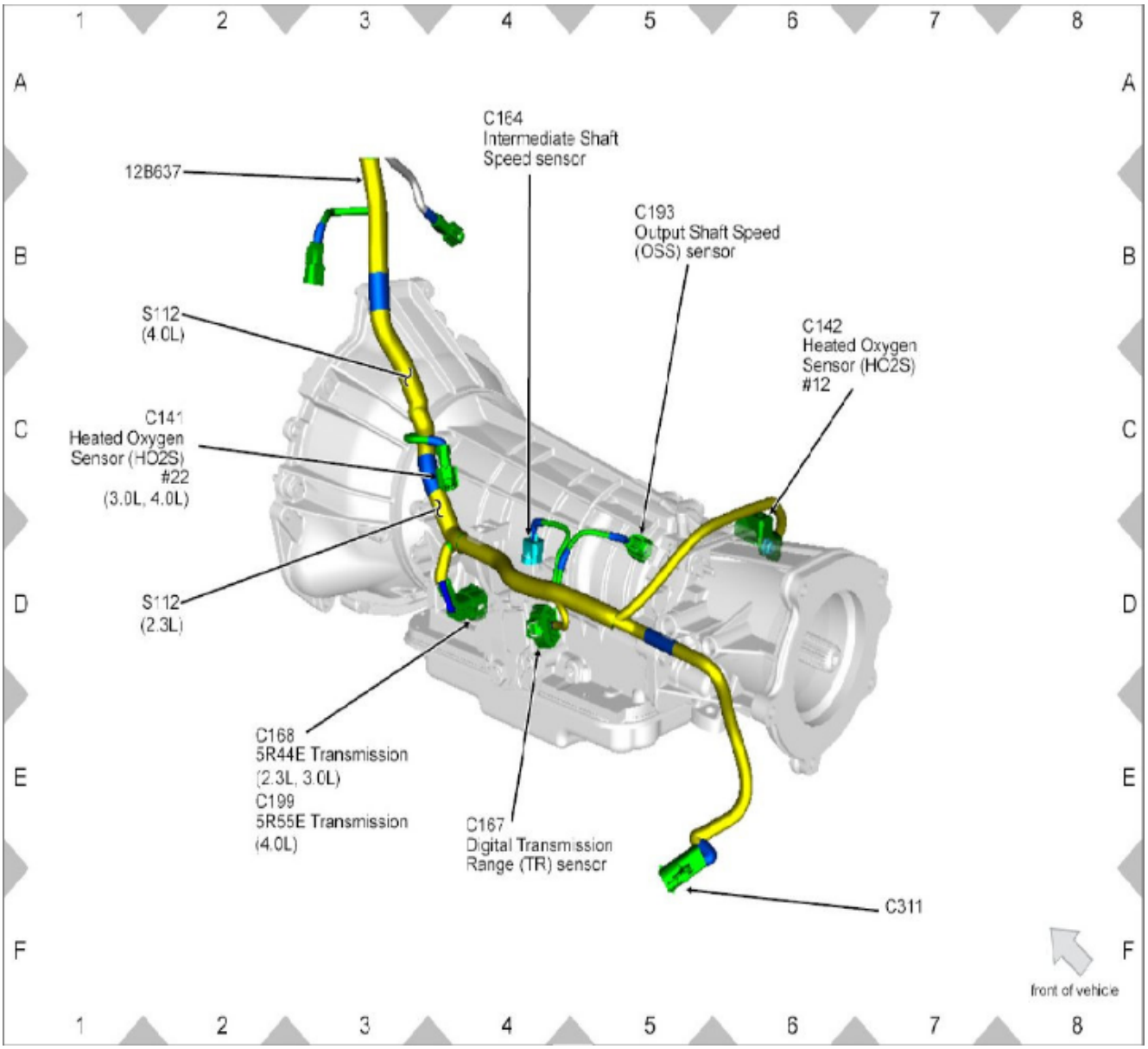
1. Remove the transmission control (TC) switch.

1 Remove the TC switch cover.

2 Remove the TC switch.

2. To install, reverse the removal procedure.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Powertrain Management > Transmission Control Systems > Sensors and Switches - Transmission and Drivetrain > Sensors and Switches - A/T > Transmission Position Switch/Sensor, A/T > Component Information > Locations



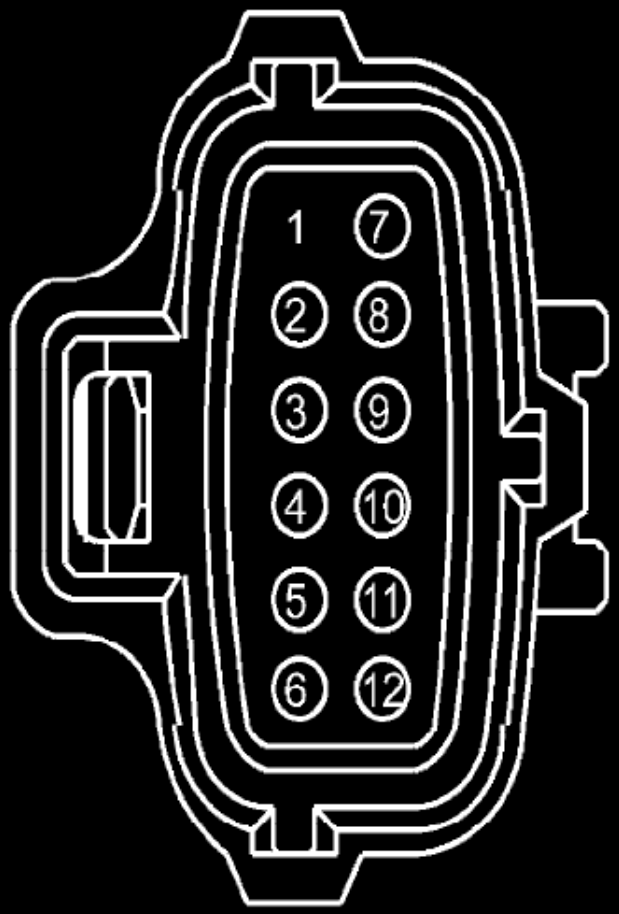
View 151-10

Connector: C167

Description: DIGITAL TRANSMISSION RANGE (TR) SENSOR

Harness: 12B637

Base Part #: 7F293



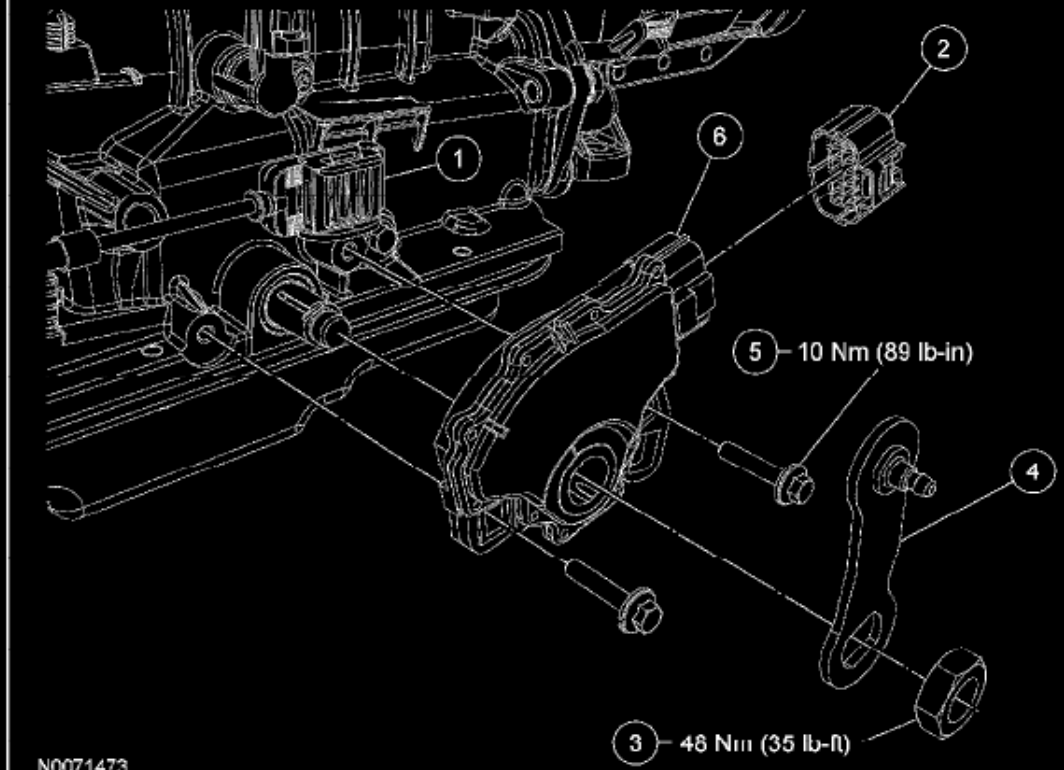
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	RE406 (GY-VT)	18	SIGNAL RETURN	
3	VET28 (GY-VT)	20	TR3A	
4	VET29 (VT-WH)	20	TR1	
5	VET30 (YE)	20	TR2	
6	VET31 (BU-OG)	20	TR4	
7	GD108 (BK-VT)	18	GROUND	4x4
8	CCF20 (GY-VT)	20	NETURAL SENSE	4x4
9	CBP20 (YE-VT)	18	FUSED POWER FEED	
10	CET40 (GN-OG)	20	STARTER CONTROL	
11	CET41 (BN-YE)	18	BACK UP	
12	CBP21 (BU-GY)	20	STARTER TO STARTER INTERRUPT RELAY	

C167

Special Tool(s)

ST1633-A	Alignment Gauge, TR Sensor 307-351 (T97L-70010-A)

Digital Transmission Range (TR) Sensor



Item	Part Number	Description
1	7E395-A	Selector lever cable
2	—	Digital transmission range (TR) sensor electrical connector
3	W701211-S	Manual control lever nut
4	7A256-A	Manual control lever
5	N806933-S	Digital TR sensor screw (2 required)
6	7F293-A	Digital TR sensor

Transmission Position Switch/Sensor: Service and Repair

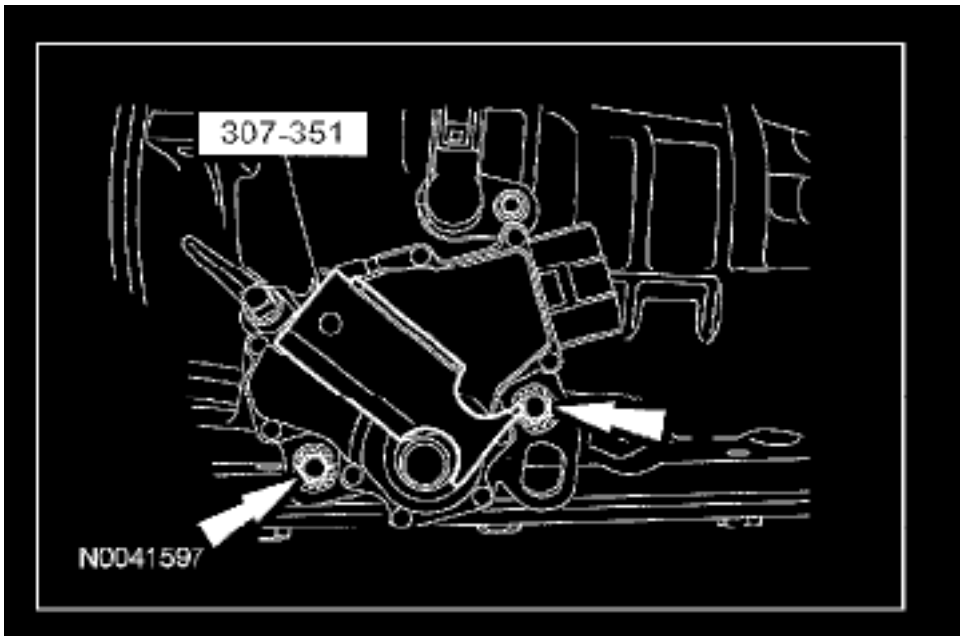
Digital Transmission Range (TR) Sensor

Digital Transmission Range (TR) Sensor

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the selector lever cable from the manual control lever. 3. Disconnect the digital transmission range (TR) sensor electrical connector. 4. Remove the manual control outer lever nut and manual control outer lever. 5. Remove the screws and the digital TR sensor.

Installation



1. CAUTION: The digital transmission range (TR) sensor must fit flush against the boss on the case to prevent damage to the sensor.

Install the digital TR sensor and loosely install the screws.

2. CAUTION: Tightening one screw before tightening the other may cause the sensor to bind or become damaged.

NOTE: The manual lever must be in the NEUTRAL position.

Using the special tool, align the digital TR sensor and tighten screws in an alternating sequence. ^

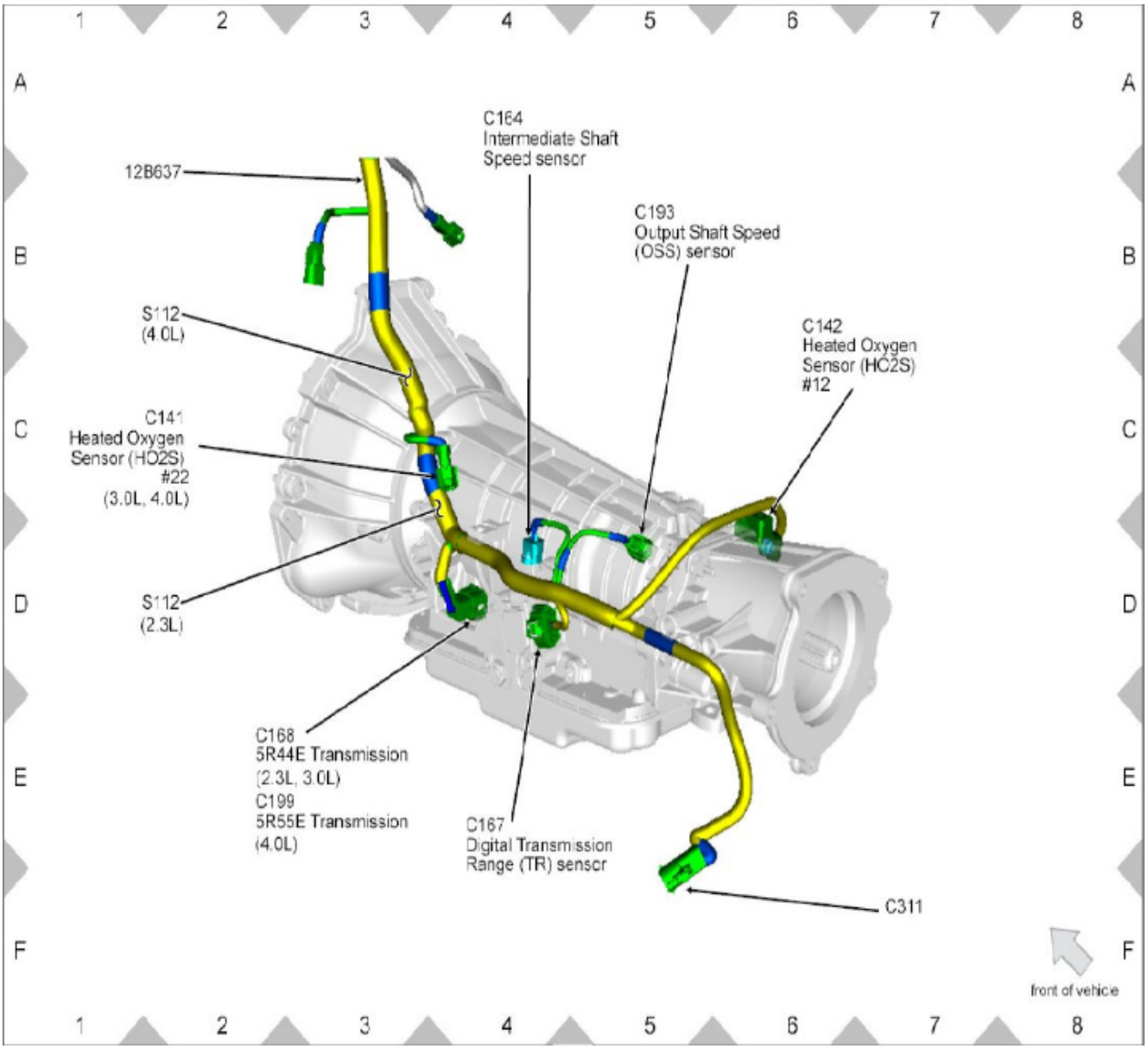
Tighten to 10 Nm (89 lb-inch).

3. Install the manual control outer lever and nut.

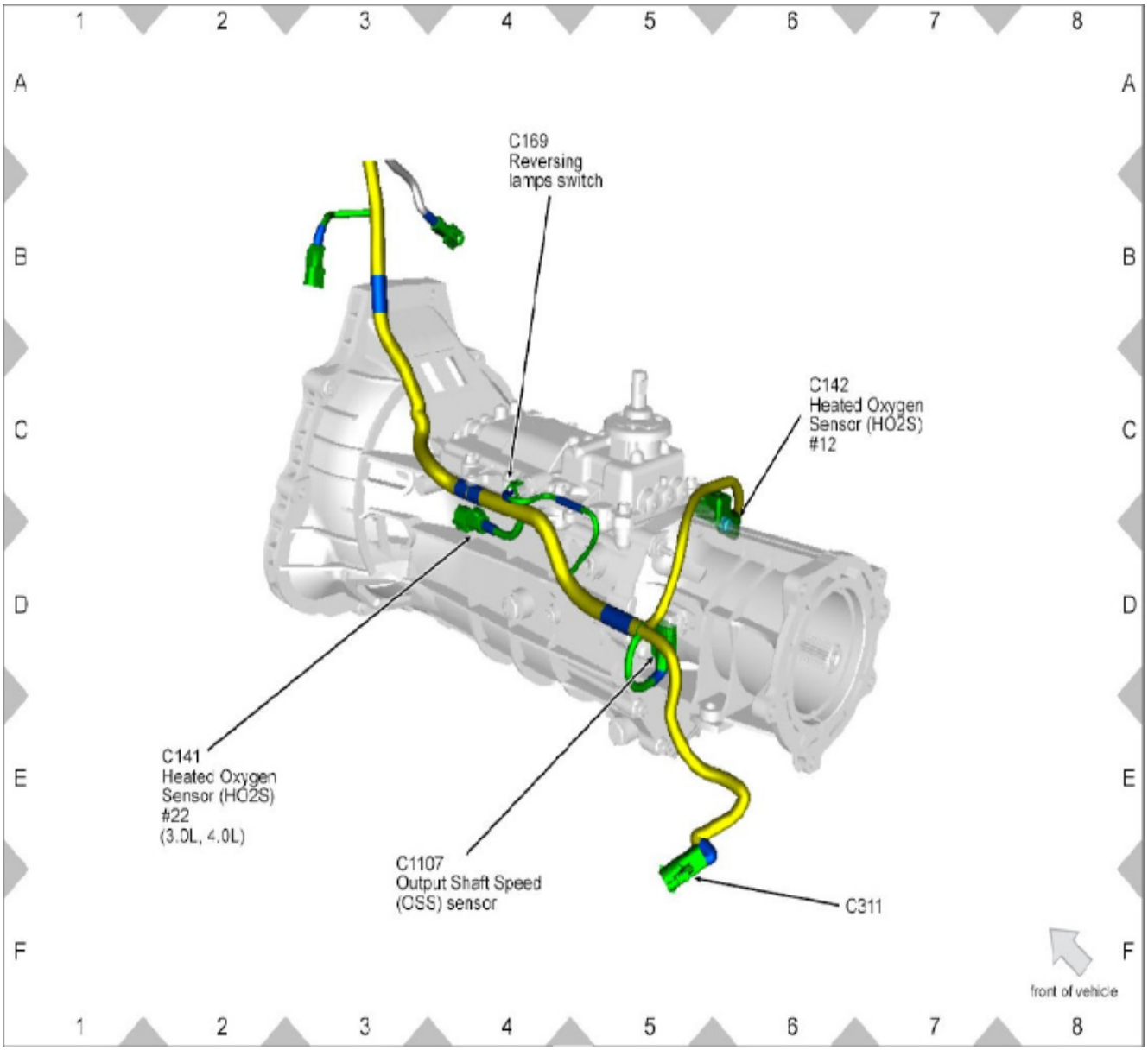
^ Tighten to 48 Nm (35 lb-ft).

4. Connect the digital TR sensor electrical connector. 5. Connect the selector lever cable to the manual control lever. 6. Verify that the selector lever cable is adjusted correctly.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Powertrain Management > Transmission Control Systems > Sensors and Switches - Transmission and Drivetrain > Sensors and Switches - A/T > Transmission Speed Sensor, A/T > Component Information > Locations > Intermediate Shaft Speed Sensor

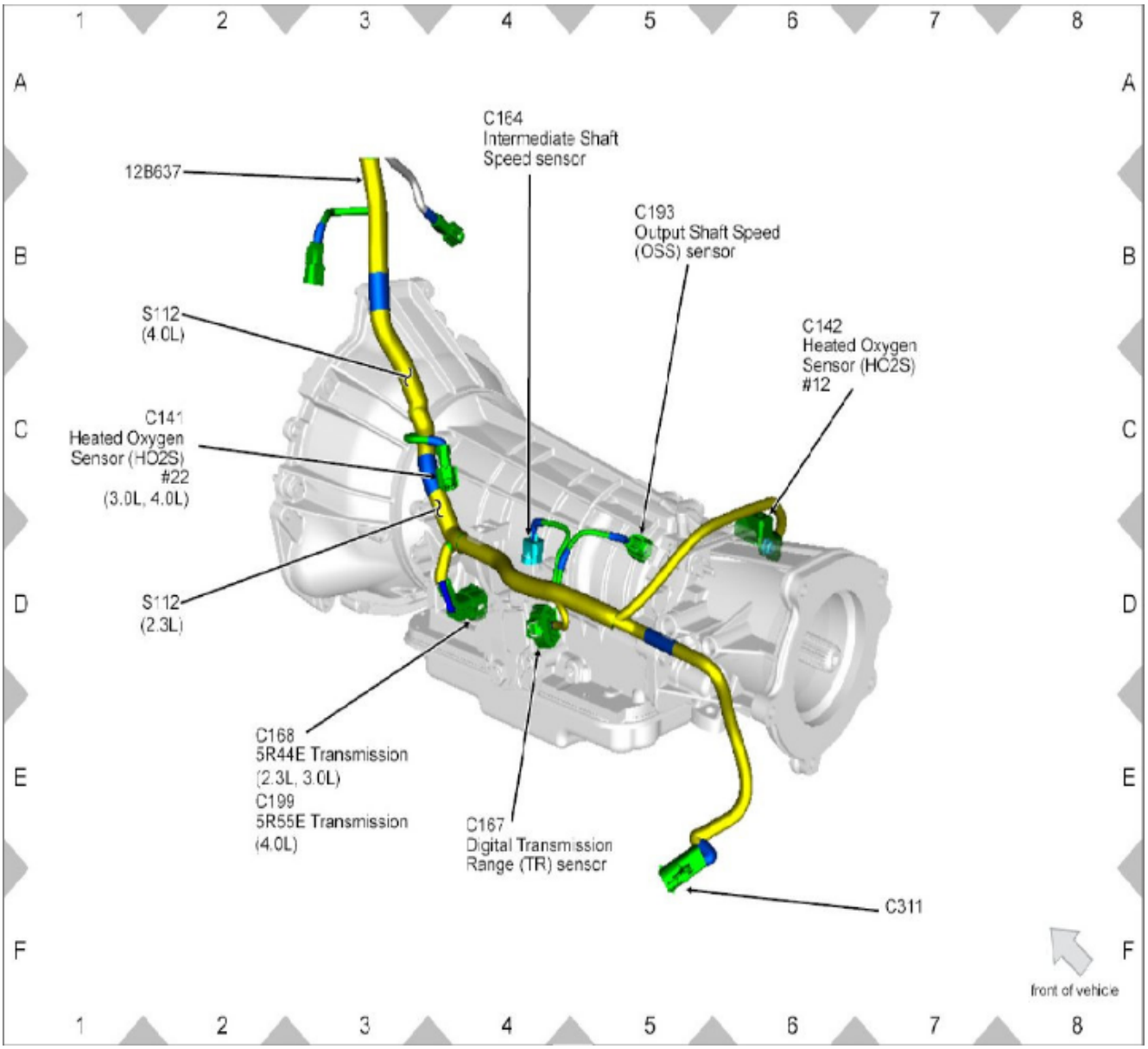


View 151-10

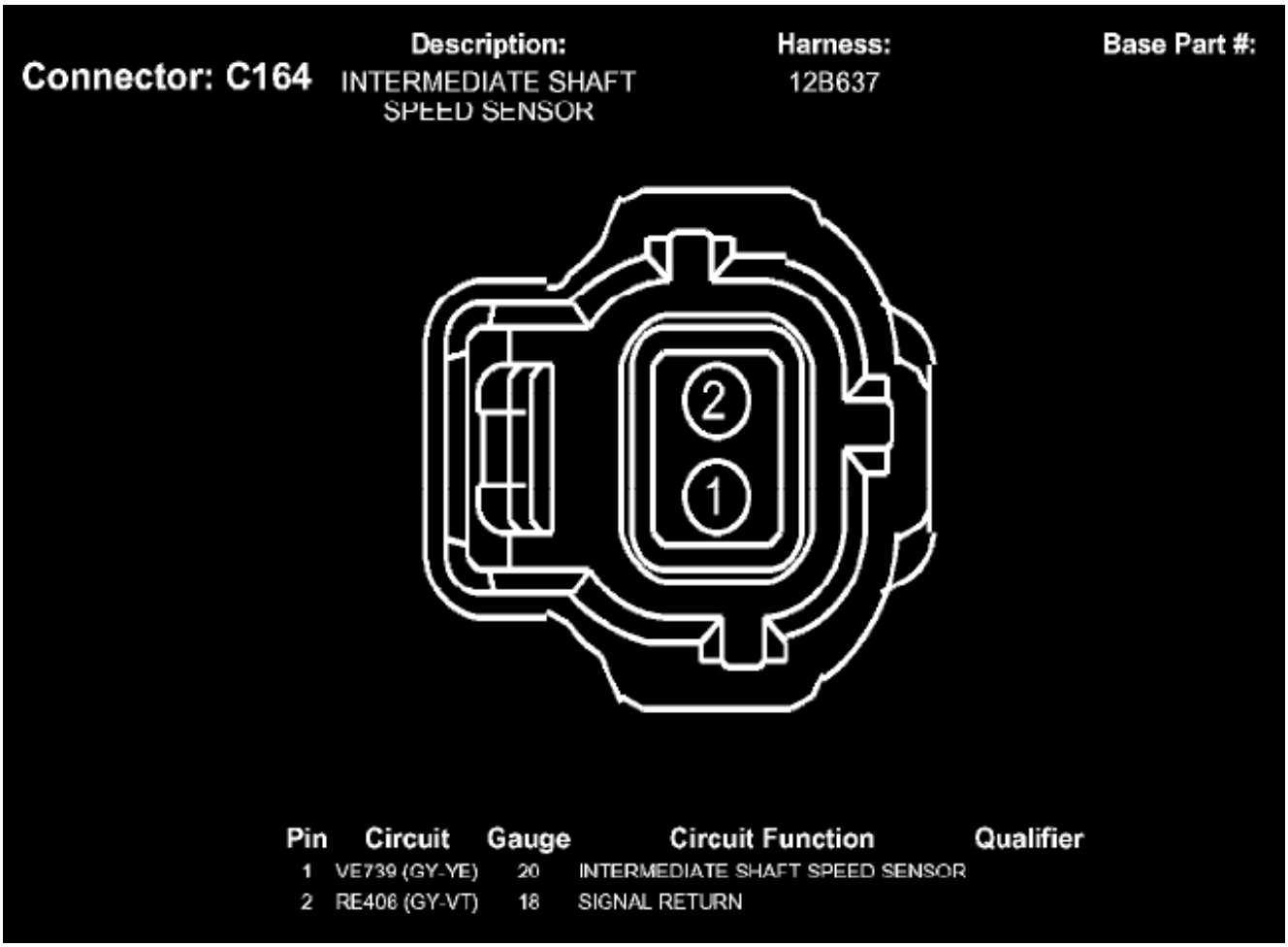


Transmission Speed Sensor: Locations Output Shaft Speed (OSS) Sensor

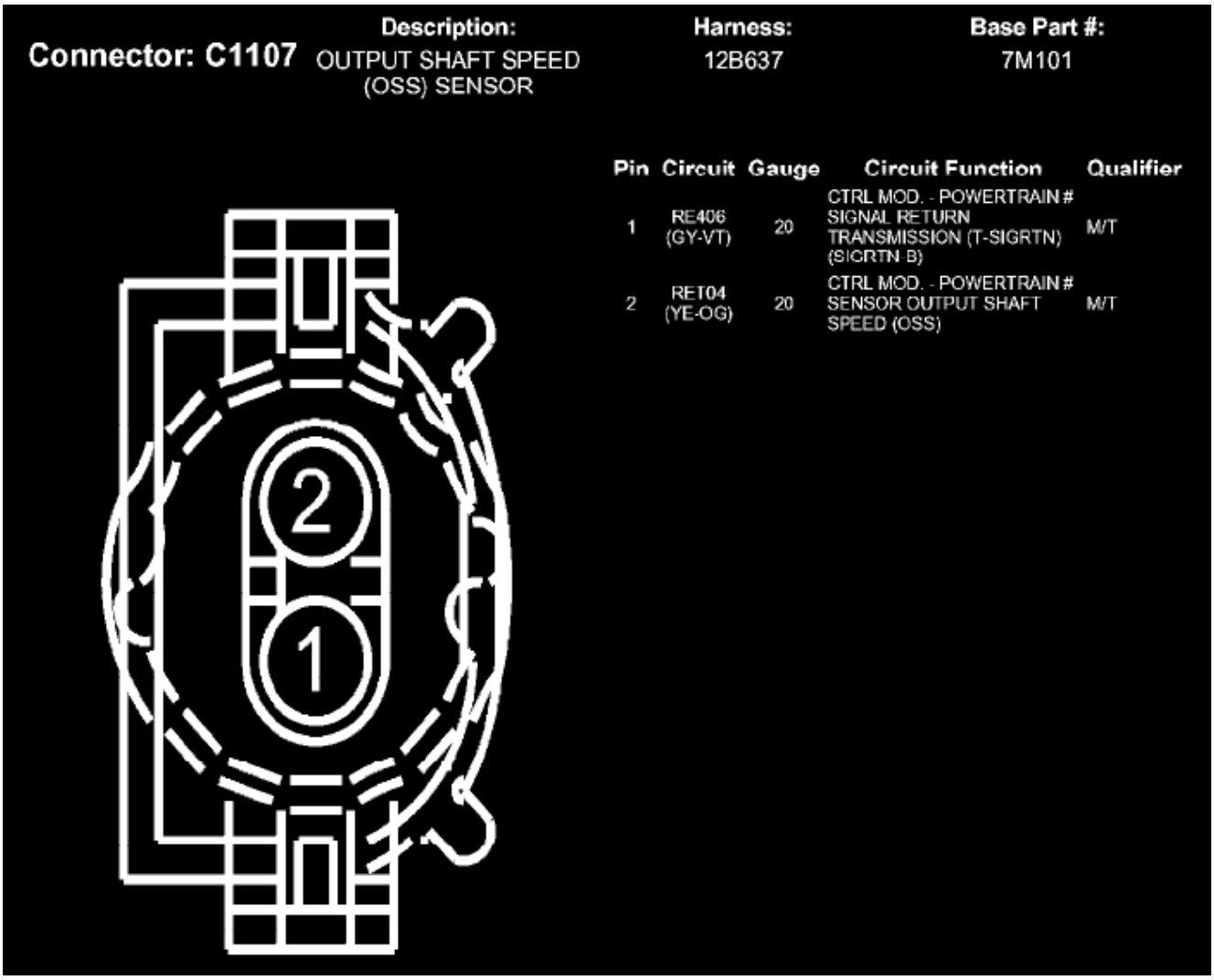
View 151-9


C164
Intermediate Shaft
Speed sensor
12B637
C193
Output Shaft Speed
(OSS) sensor
S112
(4.0L)
C142
Heated Oxygen
Sensor (HO2S)
#12
C141
Heated Oxygen
Sensor (HO2S)
#22
(3.0L, 4.0L)
S112
(2.3L)
C168
5R44E Transmission
(2.3L, 3.0L)
C199
5R55E Transmission
(4.0L)
C167
Digital Transmission
Range (TR) sensor
C311
front of vehicle

View 151-10


Connector: C164
Description:
INTERMEDIATE SHAFT SPEED SENSOR
Harness:
12B637
Base Part #:
2
1
Pin Circuit Gauge Circuit Function Qualifier
1 VE739 (GY-YE) 20 INTERMEDIATE SHAFT SPEED SENSOR
2 RE406 (GY-VT) 18 SIGNAL RETURN

C164

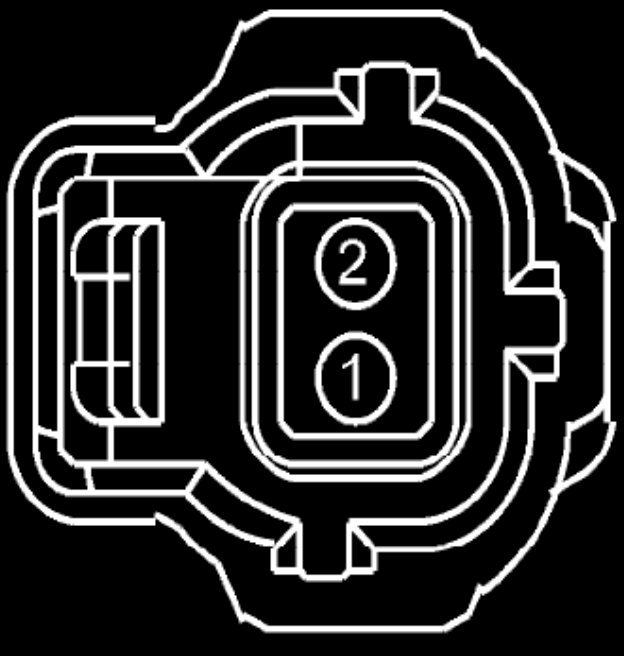


Transmission Speed Sensor: Diagrams Output Shaft Speed (OSS) Sensor

C1107

Connector: C193

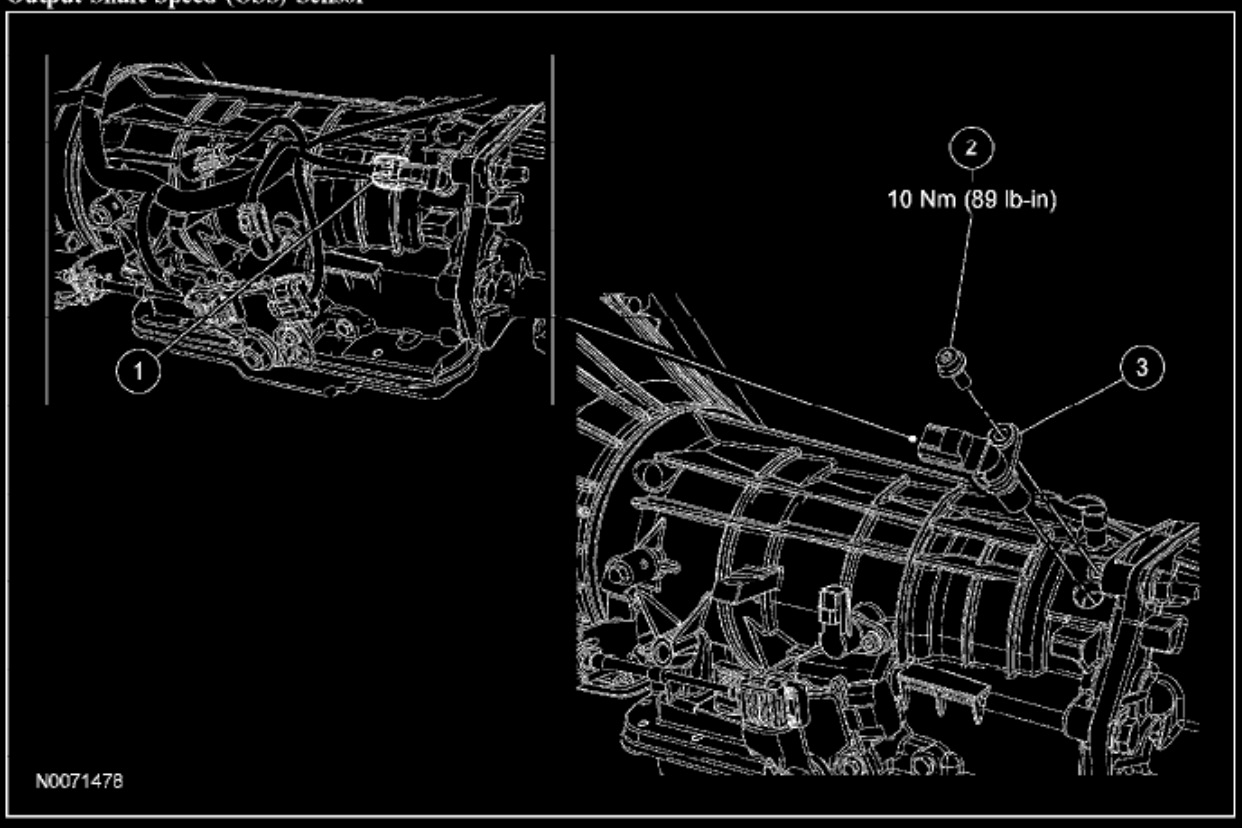
Description:	Harness:	Base Part #:
OUTPUT SHAFT SPEED (OSS) SENSOR	12B637	7H133



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RET04 (YE-OG)	20	OUTPUT SHAFT SPEED (OSS) SENSOR	A/T
2	RE406 (GY-VT)	18	SIGNAL RETURN	A/T

C193

Output Shaft Speed (OSS) Sensor



Item	Part Number	Description
1	—	Output shaft speed (OSS) sensor electrical connector
2	W702297-S	OSS sensor screw
3	7H103-B	OSS sensor

Transmission Speed Sensor: Service and Repair Output Shaft Speed (OSS) Sensor

Output Shaft Speed (OSS) Sensor

Output Shaft Speed (OSS) Sensor

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the output shaft speed (OSS) sensor electrical connector. 3. Remove the OSS sensor screw. 4. Remove the OSS sensor from the transmission.

Installation

1. NOTE: Inspect the OSS sensor O-ring for damage. If damaged, install a new O-ring Inspect and lubricate the O-ring with petroleum jelly.

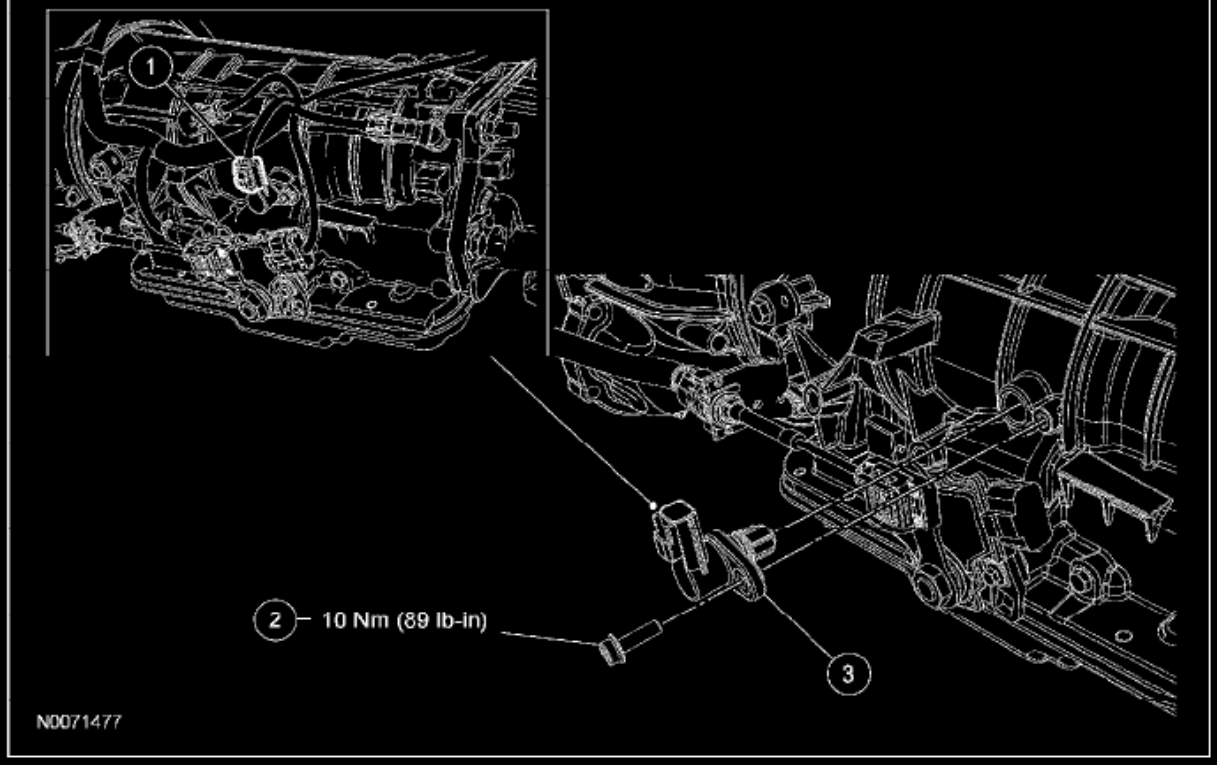
Install the OSS sensor into the transmission.

2. Install the OSS sensor screw.

^ Tighten to 10 Nm (89 lb-inch).

3. Connect the OSS sensor electrical connector.

Intermediate Shaft Speed Sensor



Item	Part Number	Description
1	—	Intermediate shaft speed sensor electrical connector
2	W702769-S	Intermediate shaft speed sensor screw
3	7M183-A	Intermediate shaft speed sensor

Transmission Speed Sensor: Service and Repair Intermediate Shaft Speed Sensor

Intermediate Shaft Speed Sensor

Intermediate Shaft Speed Sensor

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the intermediate shaft speed sensor electrical connector. 3. Remove the intermediate shaft speed sensor screw. 4. Remove the intermediate shaft speed sensor from the transmission.

Installation

1. NOTE: Inspect the intermediate shaft speed sensor O-ring for damage. If damaged, install a new O-ring

Inspect and lubricate the O-ring with petroleum jelly.

Install the intermediate shaft speed sensor into the transmission.

2. Install the intermediate shaft speed sensor screw.

^ Tighten to 10 Nm (89 lb-inch).

3. Connect the intermediate shaft speed sensor electrical connector. 4. Lower the vehicle.

NOTE: The information in Technical Service Bulletins is intended for use by trained, professional technicians with the knowledge, tools, and equipment to do the job properly and safely. It informs these technicians of conditions that may occur on some vehicles, or provides information that could assist in proper vehicle service. The procedures should not be performed by "do-it-yourselfers". Do not assume that a condition described affects your car or truck. Contact a Ford, Lincoln, or Mercury dealership to determine whether the Bulletin applies to your vehicle.

PROM - Programmable Read Only Memory: Customer Interest Engine, A/T Controls - Delayed A/T Engagement

TSB 08-5-2

03/17/08

DELAYED AUTOMATIC TRANSMISSION ENGAGEMENT - BUILT ON OR BEFORE 02/14/2008

FORD: 2007-2008 Ranger

This article supersedes TSB 08-2-5 to add a production fix date.

ISSUE Some 2007-2008 Ranger vehicles equipped with an automatic transmission and built on or before 02/14/2008 may exhibit a delayed shift engagement into drive or reverse.

ACTION Reprogram the powertrain control module (PCM) to the latest calibration using IDS release 52.11 and higher or 53.1 and higher. This new calibration is not included in the VCM 2007.11 DVD. Calibration files may also be obtained at the website.

NOTE

TO MAXIMIZE THE BENEFIT OF THIS CALIBRATION, PCM KEEP ALIVE MEMORY (KAM) MUST BE RESET.

NOTE

AUTHORIZATION DECAL NOT REQUIRED.

WARRANTY STATUS: Eligible Under Provisions Of New Vehicle Limited Warranty Coverage IMPORTANT: Warranty coverage limits/policies are not altered by a TSB. Warranty coverage limits are determined by the identified causal part.

OPERATION DESCRIPTION TIME

080502A 2007-2008 Ranger With 0.7Hr.

Automatic Transmission: Check DTCs And Reprogram The PCM, Includes Time To Clear KAM and, Road Test Authorization Decal Not Required (Do Not Use With 12650D)

DEALER CODING

CONDITION

BASIC PART NO. CODE

RECAL 04

Disclaimer

NOTE: The information in Technical Service Bulletins is intended for use by trained, professional technicians with the knowledge, tools, and equipment to do the job properly and safely. It informs these technicians of conditions that may occur on some vehicles, or provides information that could assist in proper vehicle service. The procedures should not be performed by "do-it-yourselfers". Do not assume that a condition described affects your car or truck. Contact a Ford, Lincoln, or Mercury dealership to determine whether the Bulletin applies to your vehicle.

PROM - Programmable Read Only Memory: All Technical Service Bulletins Engine, A/T Controls - Delayed A/T Engagement

TSB 08-5-2

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DEALER CODING

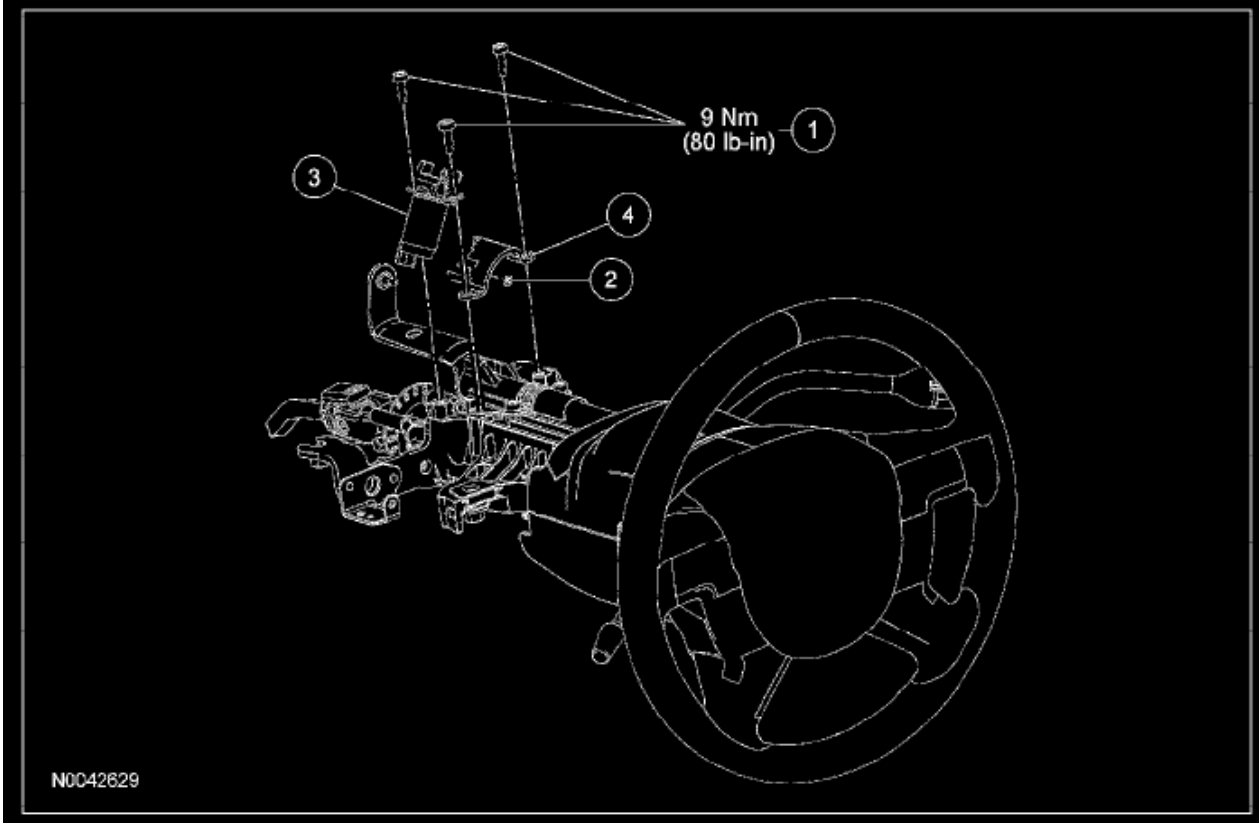
CONDITION

BASIC PART NO. CODE

RECAL 04

Disclaimer

Brake Shift Interlock Actuator



Item	Part Number	Description
1	N806584-S	Brake shift interlock actuator bolts
2	W623450-S	Brake shift interlock actuator clip
3	3F770-A	Brake shift interlock actuator
4	7A216-A	Insert plate

Shift Interlock Solenoid: Service and Repair

Brake Shift Interlock Actuator

Brake Shift Interlock Actuator

Removal and Installation

1. Remove the steering column assembly. 2. Remove the insert plate and the brake shift interlock actuator bolts.

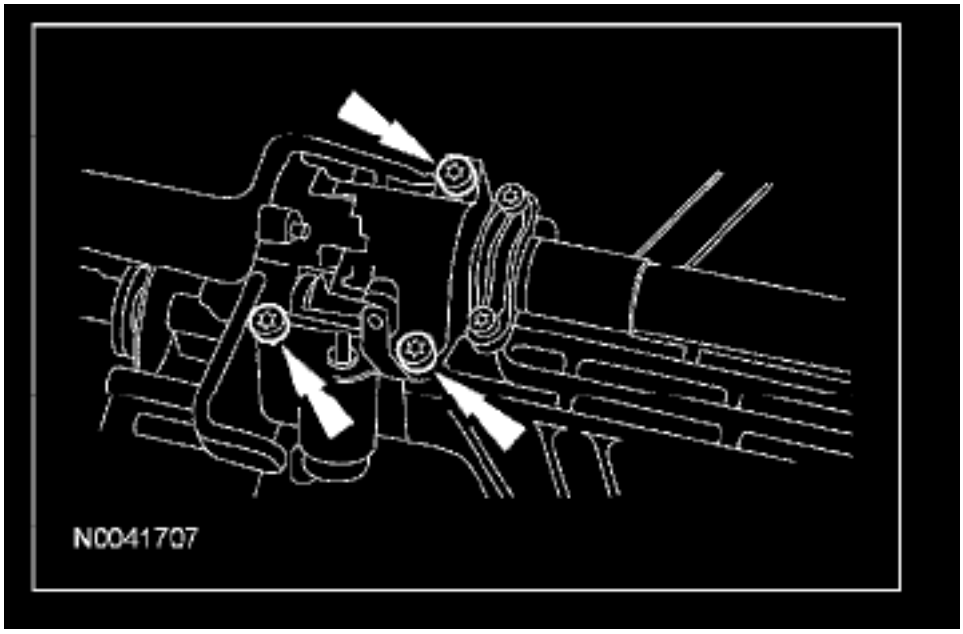
3. NOTE: The brake shift interlock actuator clip is an assembly aid for the assembly plant and does not need to be replaced.

Remove the insert plate from the brake shift interlock actuator. ^

Remove and discard the brake shift interlock actuator clip.

4. To install, reverse the removal procedure.

^ Tighten to 9 Nm (80 lb-inch).


N0041707

Solenoid Operation Chart

Gearshift Selector Position	PCM Commanded Gear	Solenoid States				
		SSA	SSB	SSC	SSD	Engine Braking
P/N	P/N	On	Off	Off	Off	No
R	R	On	Off	Off	Off	No
(D) (Overdrive)	1	On	Off	Off	Off	No
	2[a]	On	Off	On	Off	No
	3	On	On	Off	Off	No
	4	Off	Off	Off	Off	No
	5	Off	Off	On	Off	No
Drive	1	On	Off	Off	Off	No
	2[a]	On	Off	On	Off	No
	3	On	On	Off	On[b]	No
	4	Off	Off	Off	On	Yes
2	3	On	On	Off	On	Yes
1	1	On	Off	Off	On	Yes

a PCM Controlled
b On time calibration dependent

Shift Solenoid: Specifications

Solenoid Operation Chart

Solenoid Operation Chart

Solenoid Operation Chart

Gearshift Selector Position	PCM Commanded Gear	Solenoid States				
		SSA	SSB	SSC	SSD	Engine Braking
P/N	P/N	On	Off	Off	Off	No
R	R	On	Off	Off	Off	No
(D) (Overdrive)	1	On	Off	Off	Off	No
	2[a]	On	Off	On	Off	No
	3	On	On	Off	Off	No
	4	Off	Off	Off	Off	No
	5	Off	Off	On	Off	No
Drive	1	On	Off	Off	Off	No
	2[a]	On	Off	On	Off	No
	3	On	On	Off	On[b]	No
	4	Off	Off	Off	On	Yes
2	3	On	On	Off	On	Yes
1	1	On	Off	Off	On	Yes

a PCM Controlled
b On time calibration dependent

SSA ALWAYS "ON":	Transmission Range Selector Lever Position		
	OD	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	1	3	1

SSA ALWAYS "ON":	Transmission Range Selector Lever Position		
	OD	2	1
2	2	Ratio 1.1	2
3	3	3	3
4	1	3	1
5	2	Ratio 1.1	2

Shift Solenoid: Testing and Inspection

Pinpoint Tests - OSC Equipped Vehicle Anytime an electrical connector or solenoid body is disconnected, inspect the connector for terminal condition, corrosion and contamination. Also

inspect the connector seal for damage. Clean, repair or install a new connector as required.

Shift Solenoid Pre-Diagnosis Use the following shift solenoid operation information while carrying out Pinpoint Test A.

Solenoid Operation Chart

Solenoid Operation Chart

Shift Solenoid Failure Mode Chart "Always On" Failed OFF due to PCM and/or vehicle wiring concerns, solenoid electrically, mechanically or hydraulically stuck ON.

SSB ALWAYS "ON":	Transmission Range Selector Lever Position		
	OD	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	3	3	3
2	Ratio 1.1	Ratio 1.1	Ratio 1.1
3	3	3	3
4	3	3	3
5	Ratio 1.1	Ratio 1.1	Ratio 1.1

SSC ALWAYS "ON":	Transmission Range Selector Lever Position		
	OD	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	2	3	1
2	2	Ratio 1.1	2
3	Ratio 1.1	3	3
4	5	3	3
5	5	Ratio 1.1	Ratio 1.1

SSD ALWAYS "ON":	Transmission Range Selector Lever Position		
	OD	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	1	3	1
2	1	3	1
3	3	3	3
4	4	3	3
5	4	3	3

SSA ALWAYS "OFF":	Transmission Range Selector Lever Position		
	OD	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	4	3	3

SSA ALWAYS "OFF":	Transmission Range Selector Lever Position		
	OD	2	1
2	5	Ratio 1.1	Ratio 1.1
3	3	3	3
4	4	3	3
5	5	Ratio 1.1	Ratio 1.1

Shift Solenoid Failure Mode Chart "Always Off" Failed ON due to PCM and/or vehicle wiring concerns, solenoid electrically, mechanically or hydraulically stuck OFF.

SSB ALWAYS "OFF":	Transmission Range Selector Lever Position		
	OD	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	1	3	1
2	2	Ratio 1.1	2
3	1[a] (2[b])	3	1
4	4	3	3
5	5	Ratio 1.1	Ratio 1.1

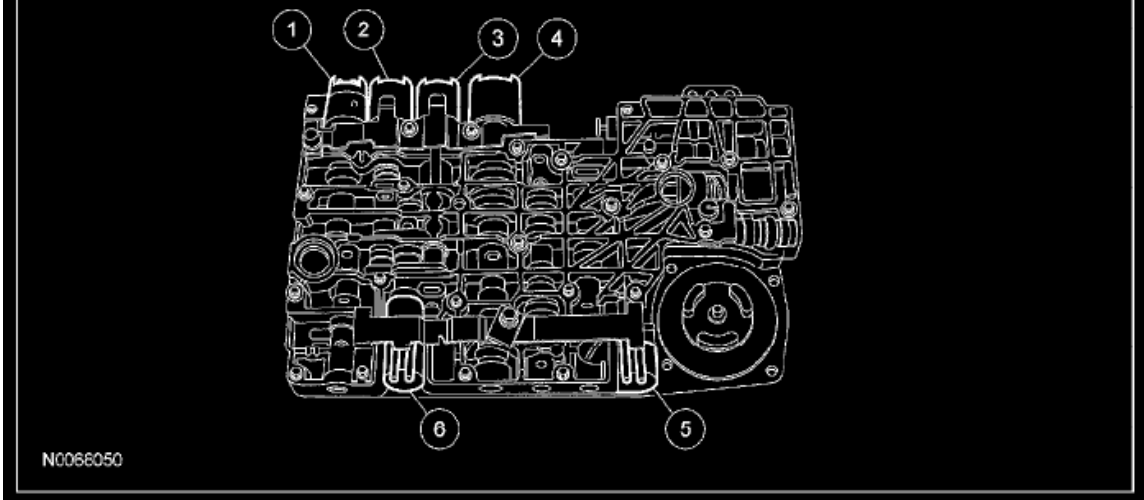
a During Downshift Only
b During Upshift Only

SSC ALWAYS "OFF":	Transmission Range Selector Lever Position		
	OD	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	1	3	1
2	1	3	1
3	3	3	3
4	4	3	3
5	4	3	3

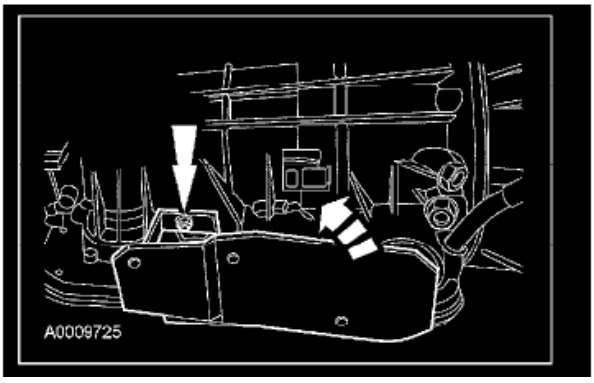
SSD ALWAYS "OFF":	Transmission Range Selector Lever Position		
	OD	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	1	3	1
2	2	Ratio 1.1	2
3	3	3	3
4	4	3	3
5	5	Ratio 1.1	Ratio 1.1

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V



Item	Part Number	Description
1	7F037	Torque converter clutch (TCC)
2	7G484	Shift solenoid (SSD)
3	7G484	Shift solenoid (SSB)
4	7H144	Electronic pressure control (EPC)
5	7G484	Shift solenoid (SSA)
6	7G484	Shift solenoid (SSC)



Shift Solenoid: Service and Repair

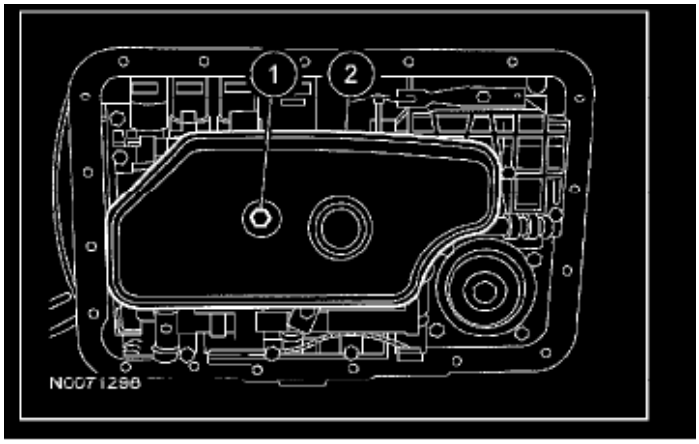
Solenoids - Shift, Torque Converter Clutch, Electronic Pressure Control

Removal

1. With the vehicle in NEUTRAL, position it on a hoist.

2. NOTE: If equipped, the transmission servo heat shield needs to be unclipped from the fluid pan rail and positioned aside for fluid pan removal.

If equipped, loosen the nut and position the heat shield aside.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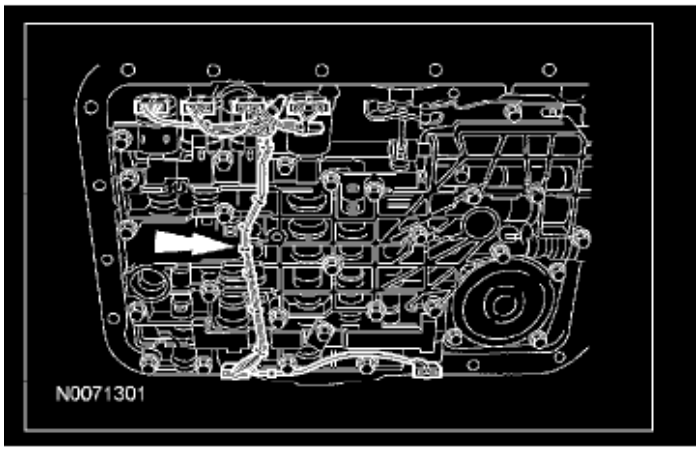
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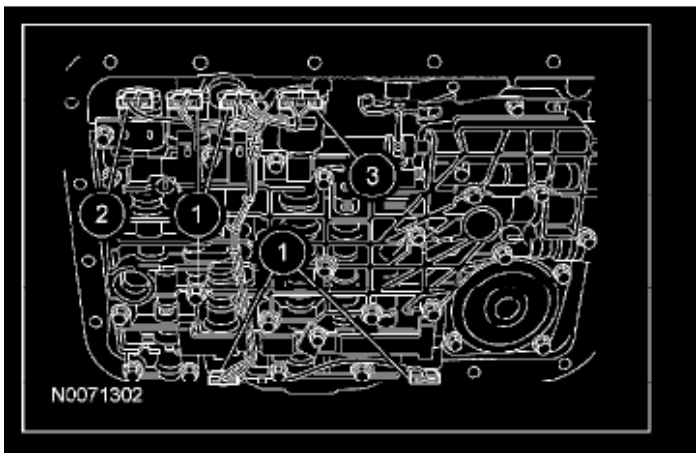
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3. Place a drain pan under the transmission fluid pan. 4. Drain the transmission fluid. 5. Remove the transmission fluid filter.

1 Remove the transmission fluid filter screw.

2 Remove the transmission fluid filter.

6. NOTE: Main control assembly does not need to be removed for solenoid service.

Remove wire loom guide and protector. ^

Carefully lift up on wire loom guide and protector and disengage the retaining pins from the solenoid clamps.

7. Disconnect the appropriate solenoid electrical connector.

1 Disconnect shift solenoids electrical connectors.

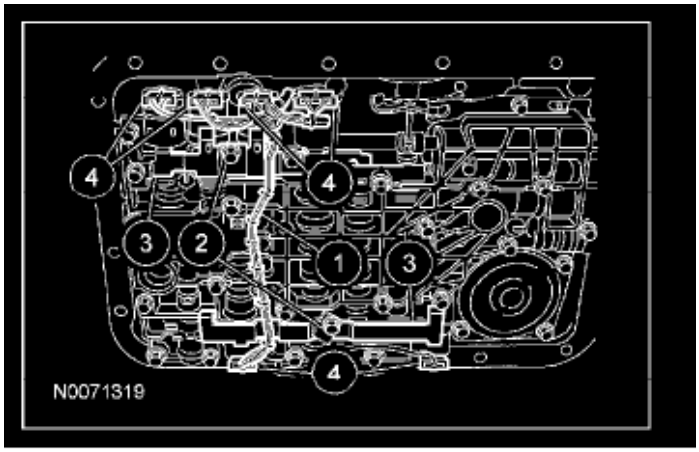
2 Disconnect the torque converter clutch (TCC) solenoid electrical connector.

3 Disconnect the electronic pressure control (EPC) solenoid electrical connector.

8. CAUTION: The torque converter clutch (TCC) solenoid and converter modulator valve may pop out of its bore. This may damage the

solenoid or converter modulator valve.

CAUTION: Shift solenoid (SSC) may pop out of its bore. This may damage the solenoid.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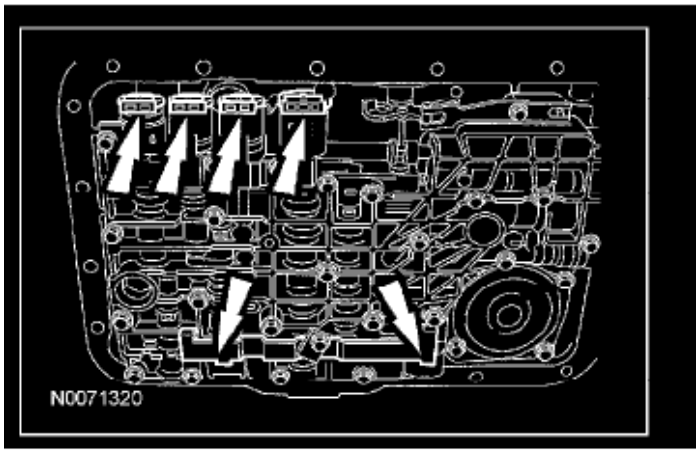
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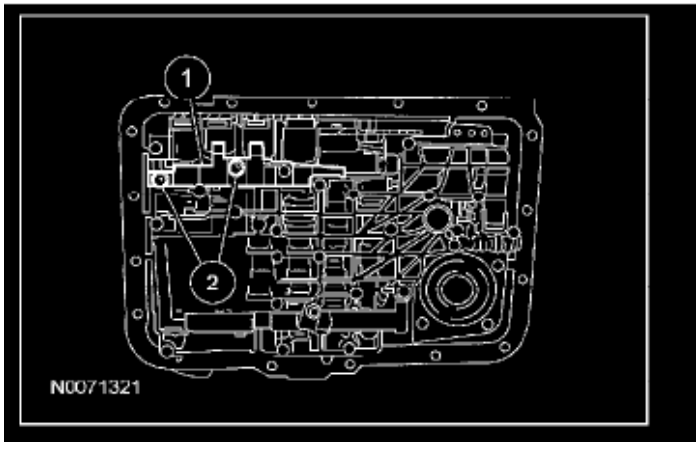
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Remove the shift solenoids. 1

Remove the wire harness.

2 Remove the solenoid clamp screws.

3 Remove the solenoid clamp.

4 Remove the appropriate solenoid(s).

Installation

1. Install the new solenoid(s).

2. NOTE: The solenoid clamp must be installed in the torque converter clutch (TCC) and electronic pressure control (EPC) solenoid grooves, shift

solenoid pockets and the No. 204 plug.

Install the solenoid clamp. 1

Position the solenoid clamp on the main control valve body.

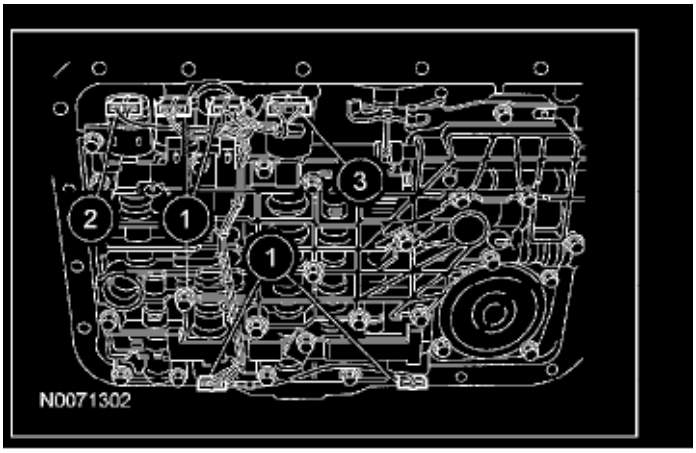
2 Install the solenoid clamp screws.

3. Connect the 6 solenoid electrical connectors.

1 Connect shift solenoid SSA, SSB, SSC, SSD electrical connectors.

2 Connect the TCC solenoid electrical connector.

3 Connect the EPC solenoid electrical connector.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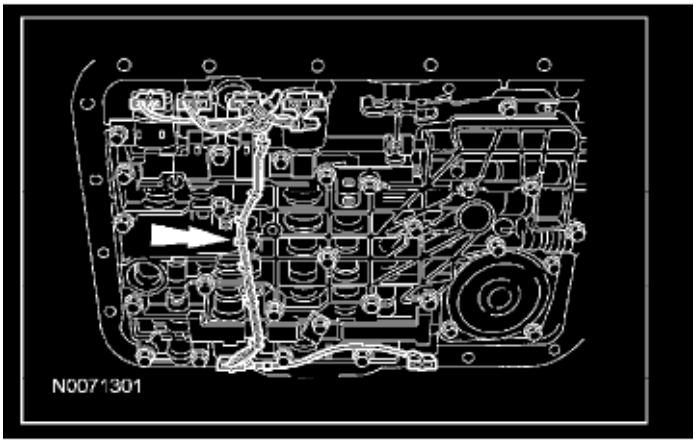
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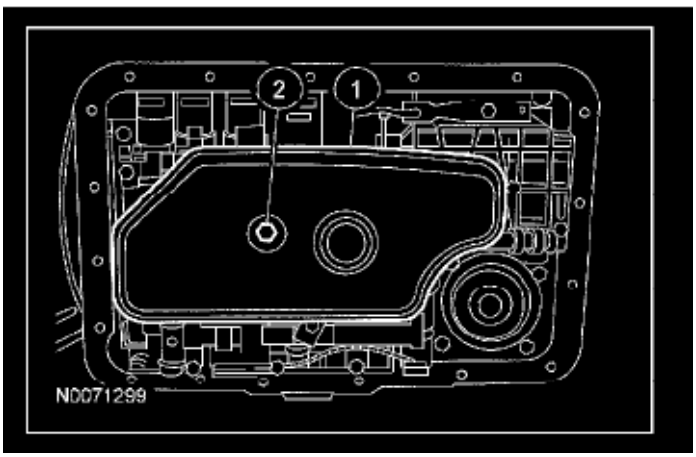
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4. CAUTION: Excessive pressure may break the retaining pins.

Install the main control valve body wire loom. ^

Align the retaining pins to the holes in the solenoid clamps and gently press in the main control valve body wire loom guide and protector.

5. Install the transmission fluid filter.

1 Install the transmission fluid filter.

2 Install the transmission fluid filter screw. ^

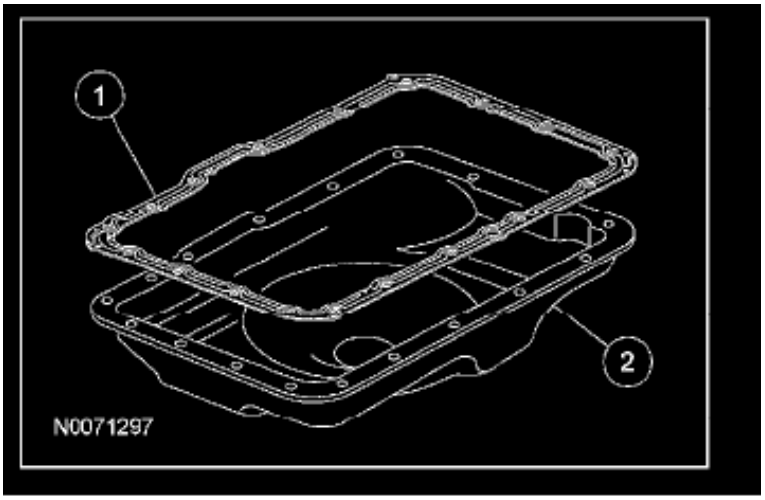
Tighten to 10 Nm (89 lb-inch).

6. NOTE: The transmission fluid pan gasket is reusable. Clean and inspect for damage, if not damaged, the gasket should be reused.

Install the transmission fluid pan. 1

Position the transmission fluid pan gasket on the transmission fluid pan.

2 Align and install the transmission fluid pan.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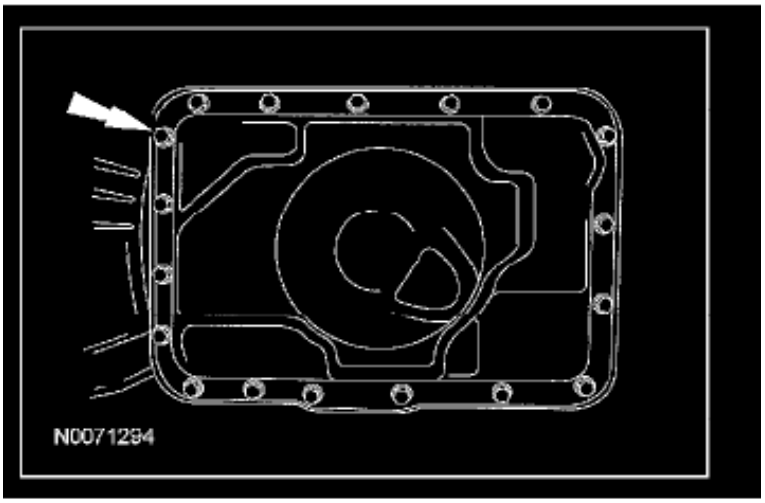
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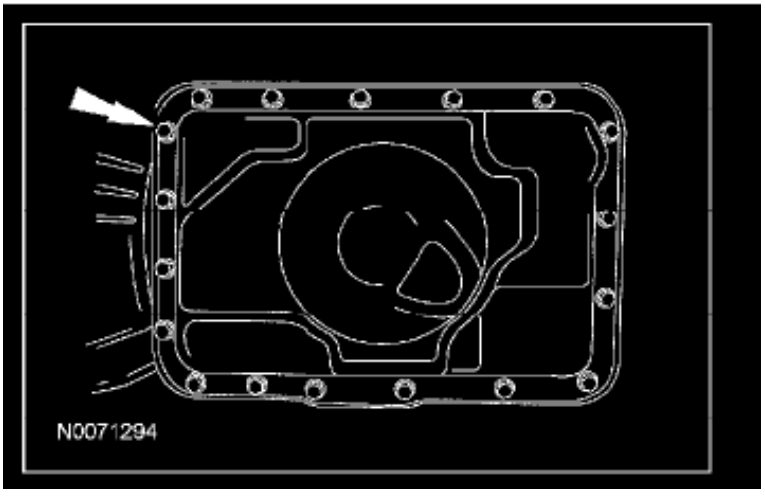
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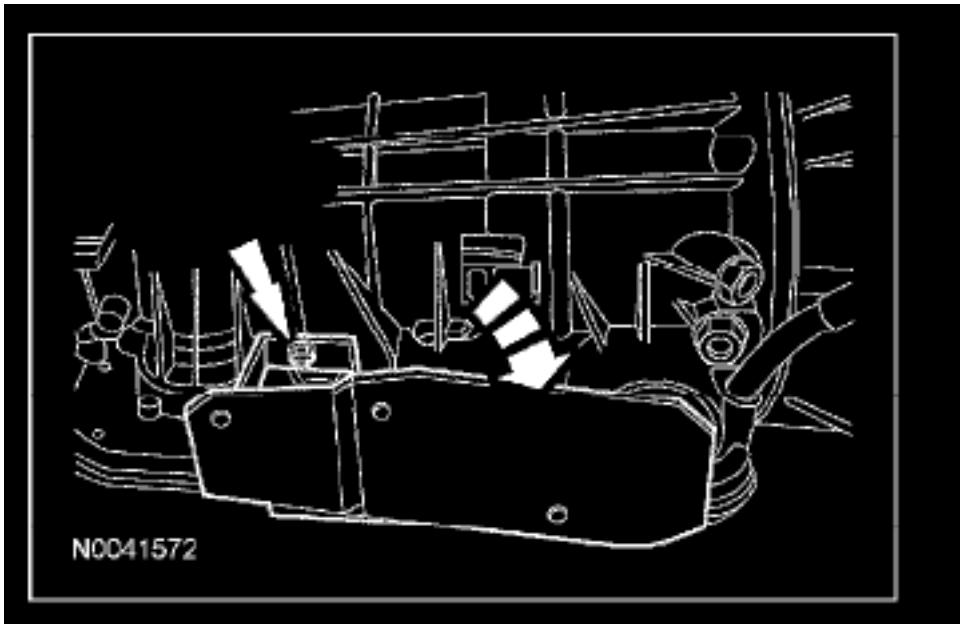
7. Loosely install the transmission fluid pan screws.

8. Tighten the transmission fluid pan screws in a crisscross pattern.

^ Tighten to 10 Nm (89 lb-inch).

9. If equipped, position the servo heat shield over the servos and clip it to the pan rail.

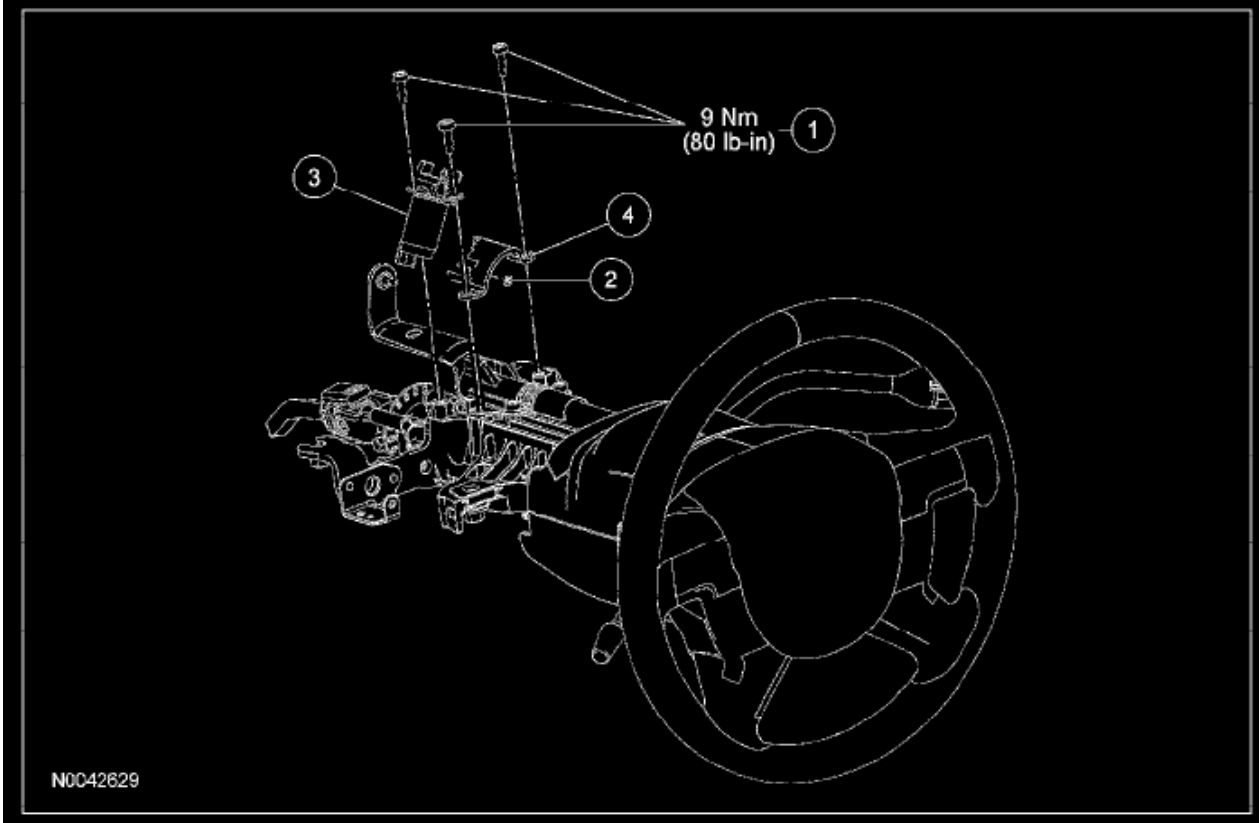
^ Tighten to 10 Nm (89 lb-inch).



10. NOTE: Start with a minimum of 3.7L (4 qt) clean automatic transmission fluid.

Fill transmission with clean automatic transmission fluid to the correct fluid level.

Brake Shift Interlock Actuator



Item	Part Number	Description
1	N806584-S	Brake shift interlock actuator bolts
2	W623450-S	Brake shift interlock actuator clip
3	3F770-A	Brake shift interlock actuator
4	7A216-A	Insert plate

Shift Interlock Solenoid: Service and Repair

Brake Shift Interlock Actuator

Brake Shift Interlock Actuator

Removal and Installation

1. Remove the steering column assembly. 2. Remove the insert plate and the brake shift interlock actuator bolts.

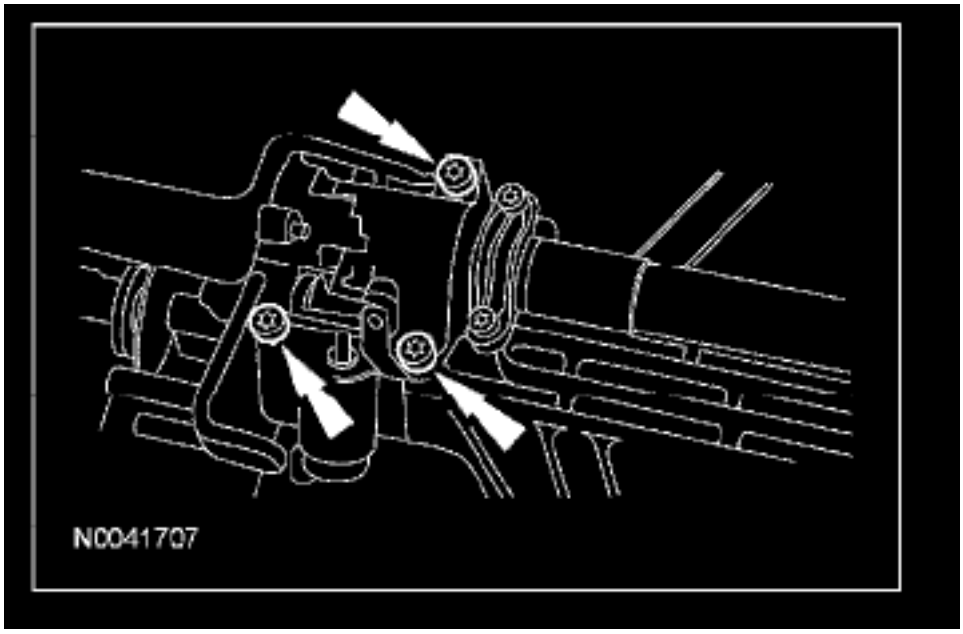
3. NOTE: The brake shift interlock actuator clip is an assembly aid for the assembly plant and does not need to be replaced.

Remove the insert plate from the brake shift interlock actuator. ^

Remove and discard the brake shift interlock actuator clip.

4. To install, reverse the removal procedure.

^ Tighten to 9 Nm (80 lb-inch).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Solenoid Operation Chart

Gearshift Selector Position	PCM Commanded Gear	Solenoid States				
		SSA	SSB	SSC	SSD	Engine Braking
P/N	P/N	On	Off	Off	Off	No
R	R	On	Off	Off	Off	No
(D) (Overdrive)	1	On	Off	Off	Off	No
	2[a]	On	Off	On	Off	No
	3	On	On	Off	Off	No
	4	Off	Off	Off	Off	No
	5	Off	Off	On	Off	No
Drive	1	On	Off	Off	Off	No
	2[a]	On	Off	On	Off	No
	3	On	On	Off	On[b]	No
	4	Off	Off	Off	On	Yes
2	3	On	On	Off	On	Yes
1	1	On	Off	Off	On	Yes

a PCM Controlled
b On time calibration dependent

Shift Solenoid: Specifications

Solenoid Operation Chart

Solenoid Operation Chart

Solenoid Operation Chart

Gearshift Selector Position	PCM Commanded Gear	Solenoid States				
		SSA	SSB	SSC	SSD	Engine Braking
P/N	P/N	On	Off	Off	Off	No
R	R	On	Off	Off	Off	No
(D) (Overdrive)	1	On	Off	Off	Off	No
	2[a]	On	Off	On	Off	No
	3	On	On	Off	Off	No
	4	Off	Off	Off	Off	No
	5	Off	Off	On	Off	No
Drive	1	On	Off	Off	Off	No
	2[a]	On	Off	On	Off	No
	3	On	On	Off	On[b]	No
	4	Off	Off	Off	On	Yes
2	3	On	On	Off	On	Yes
1	1	On	Off	Off	On	Yes

a PCM Controlled
b On time calibration dependent

SSA ALWAYS "ON":	Transmission Range Selector Lever Position		
	OD	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	1	3	1

SSA ALWAYS "ON":	Transmission Range Selector Lever Position		
	OD	2	1
2	2	Ratio 1.1	2
3	3	3	3
4	1	3	1
5	2	Ratio 1.1	2

Shift Solenoid: Testing and Inspection

Pinpoint Tests - OSC Equipped Vehicle Anytime an electrical connector or solenoid body is disconnected, inspect the connector for terminal condition, corrosion and contamination. Also

inspect the connector seal for damage. Clean, repair or install a new connector as required.

Shift Solenoid Pre-Diagnosis Use the following shift solenoid operation information while carrying out Pinpoint Test A.

Solenoid Operation Chart

Solenoid Operation Chart

Shift Solenoid Failure Mode Chart "Always On" Failed OFF due to PCM and/or vehicle wiring concerns, solenoid electrically, mechanically or hydraulically stuck ON.

SSB ALWAYS "ON":	Transmission Range Selector Lever Position		
	OD	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	3	3	3
2	Ratio 1.1	Ratio 1.1	Ratio 1.1
3	3	3	3
4	3	3	3
5	Ratio 1.1	Ratio 1.1	Ratio 1.1

SSC ALWAYS "ON":	Transmission Range Selector Lever Position		
	OD	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	2	3	1
2	2	Ratio 1.1	2
3	Ratio 1.1	3	3
4	5	3	3
5	5	Ratio 1.1	Ratio 1.1

SSD ALWAYS "ON":	Transmission Range Selector Lever Position		
	OD	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	1	3	1
2	1	3	1
3	3	3	3
4	4	3	3
5	4	3	3

SSA ALWAYS "OFF":	Transmission Range Selector Lever Position		
	OD	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	4	3	3

SSA ALWAYS "OFF":	Transmission Range Selector Lever Position		
	OD	2	1
2	5	Ratio 1.1	Ratio 1.1
3	3	3	3
4	4	3	3
5	5	Ratio 1.1	Ratio 1.1

Shift Solenoid Failure Mode Chart "Always Off" Failed ON due to PCM and/or vehicle wiring concerns, solenoid electrically, mechanically or hydraulically stuck OFF.

SSB ALWAYS "OFF":	Transmission Range Selector Lever Position		
	OD	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	1	3	1
2	2	Ratio 1.1	2
3	1[a] (2[b])	3	1
4	4	3	3
5	5	Ratio 1.1	Ratio 1.1

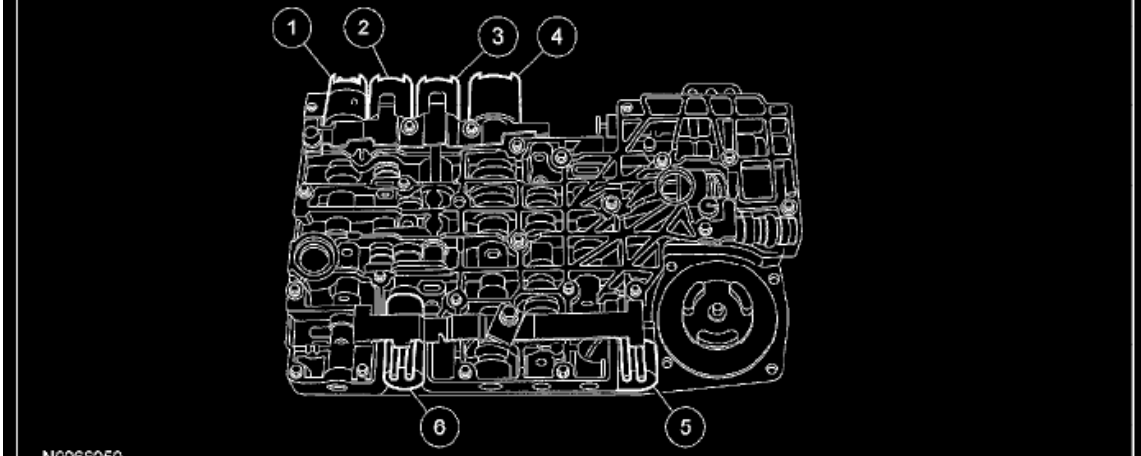
a During Downshift Only
b During Upshift Only

SSC ALWAYS "OFF":	Transmission Range Selector Lever Position		
	OD	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	1	3	1
2	1	3	1
3	3	3	3
4	4	3	3
5	4	3	3

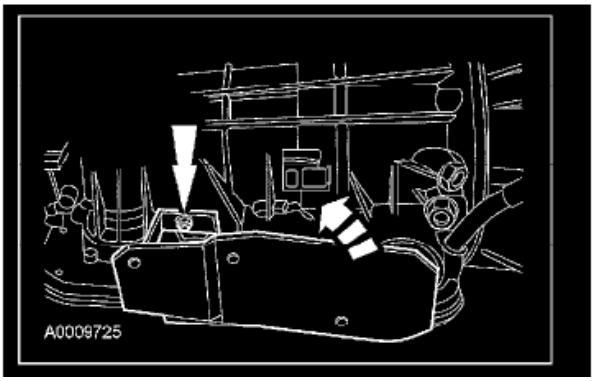
SSD ALWAYS "OFF":	Transmission Range Selector Lever Position		
	OD	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	1	3	1
2	2	Ratio 1.1	2
3	3	3	3
4	4	3	3
5	5	Ratio 1.1	Ratio 1.1

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V



Item	Part Number	Description
1	7F037	Torque converter clutch (TCC)
2	7G484	Shift solenoid (SSD)
3	7G484	Shift solenoid (SSB)
4	7H144	Electronic pressure control (EPC)
5	7G484	Shift solenoid (SSA)
6	7G484	Shift solenoid (SSC)



Shift Solenoid: Service and Repair

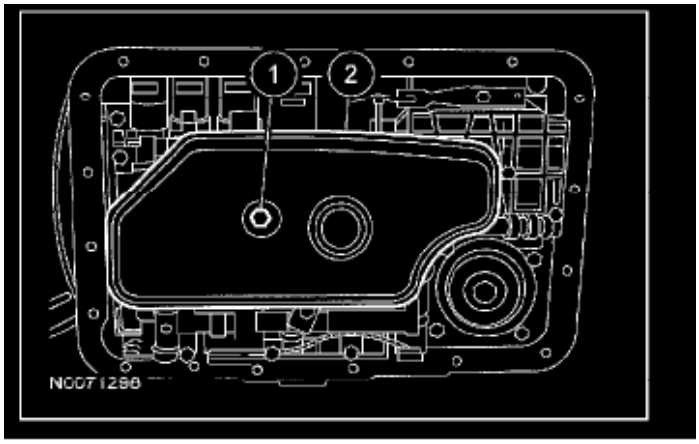
Solenoids - Shift, Torque Converter Clutch, Electronic Pressure Control

Removal

1. With the vehicle in NEUTRAL, position it on a hoist.

2. NOTE: If equipped, the transmission servo heat shield needs to be unclipped from the fluid pan rail and positioned aside for fluid pan removal.

If equipped, loosen the nut and position the heat shield aside.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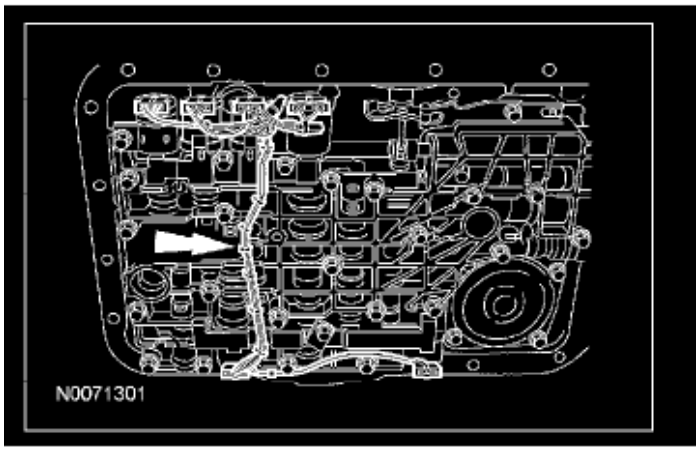
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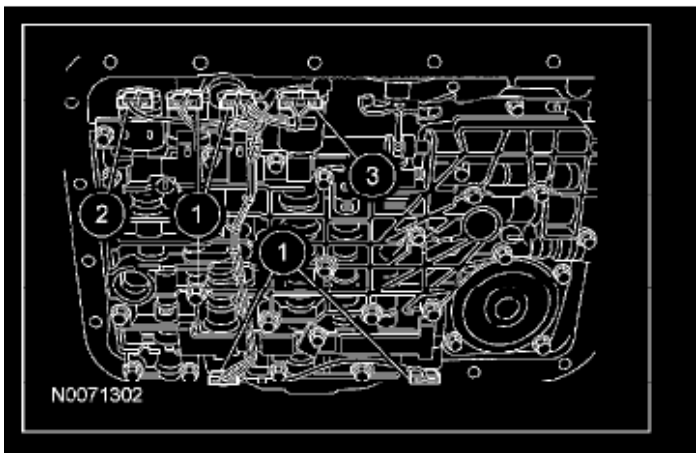
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3. Place a drain pan under the transmission fluid pan. 4. Drain the transmission fluid. 5. Remove the transmission fluid filter.

1 Remove the transmission fluid filter screw.

2 Remove the transmission fluid filter.

6. NOTE: Main control assembly does not need to be removed for solenoid service.

Remove wire loom guide and protector. ^

Carefully lift up on wire loom guide and protector and disengage the retaining pins from the solenoid clamps.

7. Disconnect the appropriate solenoid electrical connector.

1 Disconnect shift solenoids electrical connectors.

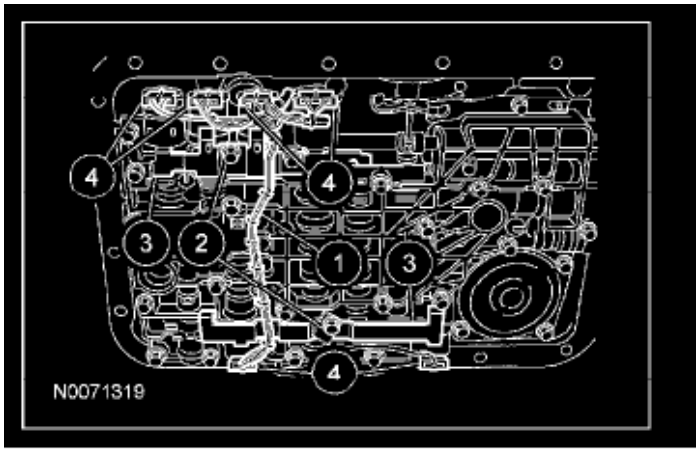
2 Disconnect the torque converter clutch (TCC) solenoid electrical connector.

3 Disconnect the electronic pressure control (EPC) solenoid electrical connector.

8. CAUTION: The torque converter clutch (TCC) solenoid and converter modulator valve may pop out of its bore. This may damage the

solenoid or converter modulator valve.

CAUTION: Shift solenoid (SSC) may pop out of its bore. This may damage the solenoid.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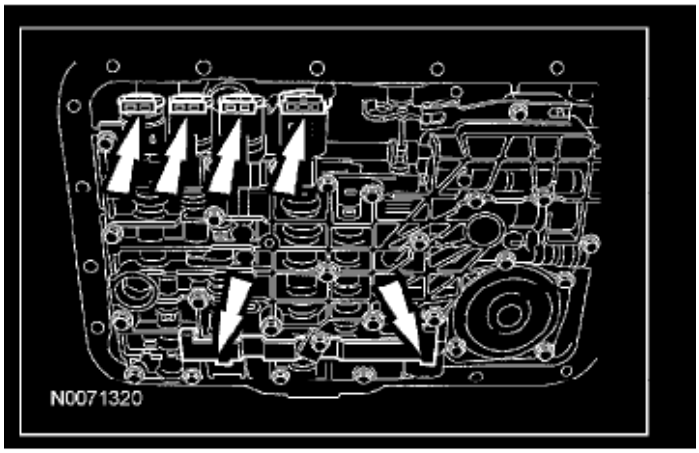
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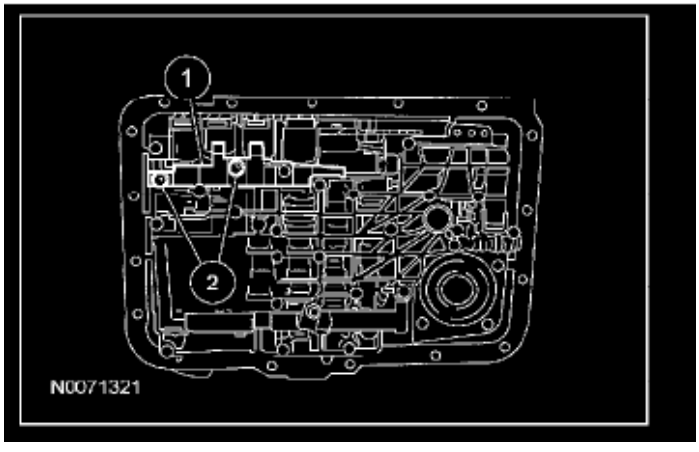
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Remove the shift solenoids. 1

Remove the wire harness.

2 Remove the solenoid clamp screws.

3 Remove the solenoid clamp.

4 Remove the appropriate solenoid(s).

Installation

1. Install the new solenoid(s).

2. NOTE: The solenoid clamp must be installed in the torque converter clutch (TCC) and electronic pressure control (EPC) solenoid grooves, shift

solenoid pockets and the No. 204 plug.

Install the solenoid clamp. 1

Position the solenoid clamp on the main control valve body.

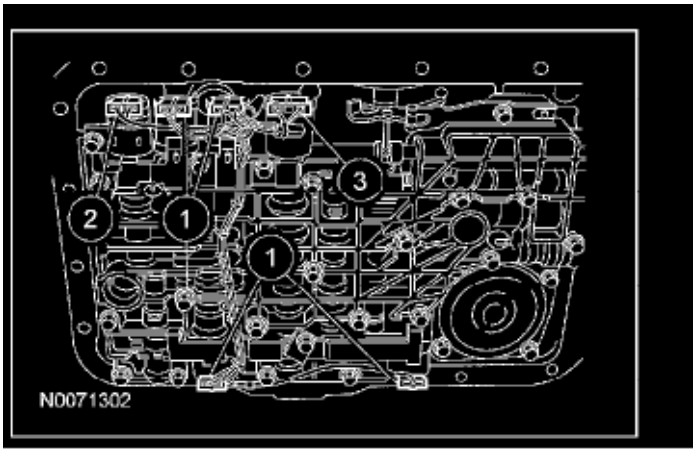
2 Install the solenoid clamp screws.

3. Connect the 6 solenoid electrical connectors.

1 Connect shift solenoid SSA, SSB, SSC, SSD electrical connectors.

2 Connect the TCC solenoid electrical connector.

3 Connect the EPC solenoid electrical connector.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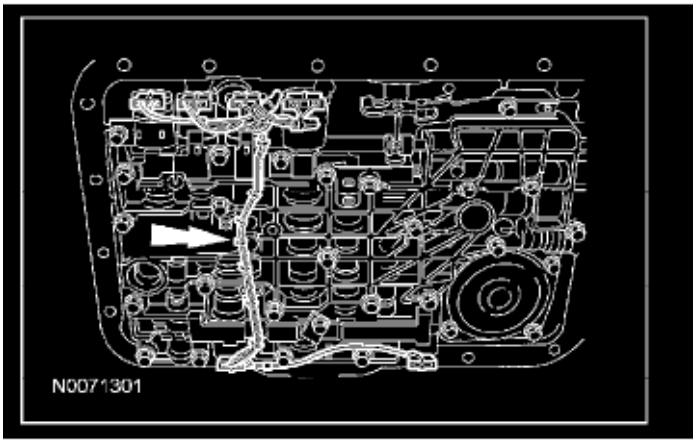
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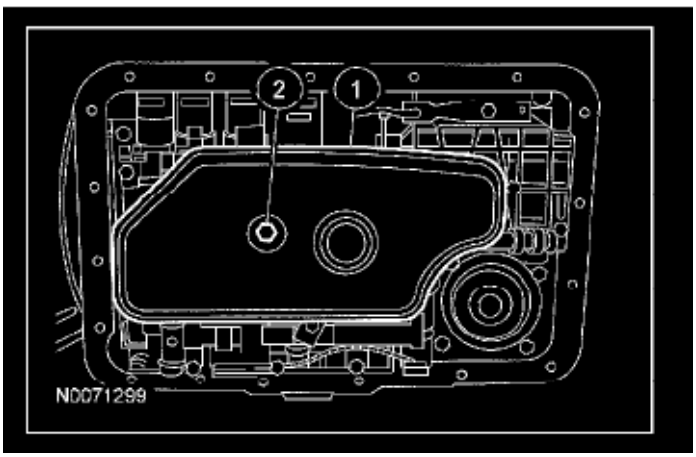
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4. CAUTION: Excessive pressure may break the retaining pins.

Install the main control valve body wire loom. ^

Align the retaining pins to the holes in the solenoid clamps and gently press in the main control valve body wire loom guide and protector.

5. Install the transmission fluid filter.

1 Install the transmission fluid filter.

2 Install the transmission fluid filter screw. ^

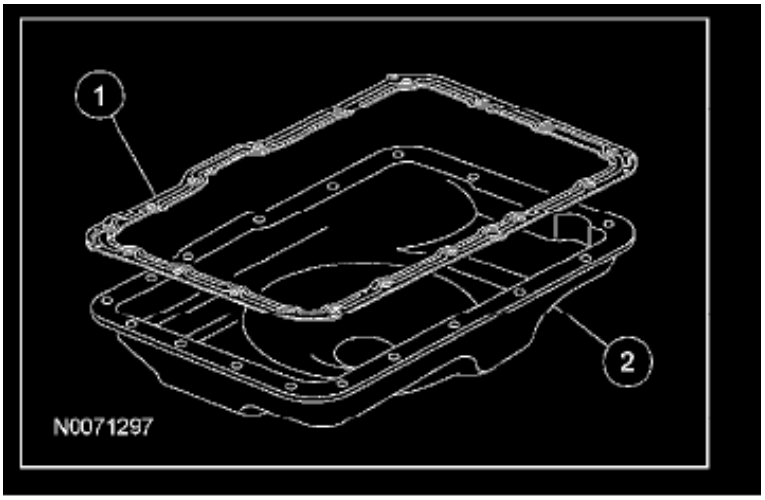
Tighten to 10 Nm (89 lb-inch).

6. NOTE: The transmission fluid pan gasket is reusable. Clean and inspect for damage, if not damaged, the gasket should be reused.

Install the transmission fluid pan. 1

Position the transmission fluid pan gasket on the transmission fluid pan.

2 Align and install the transmission fluid pan.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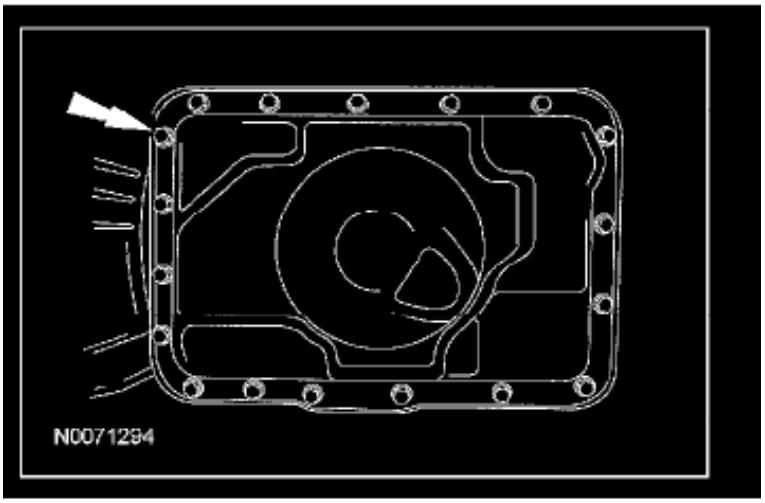
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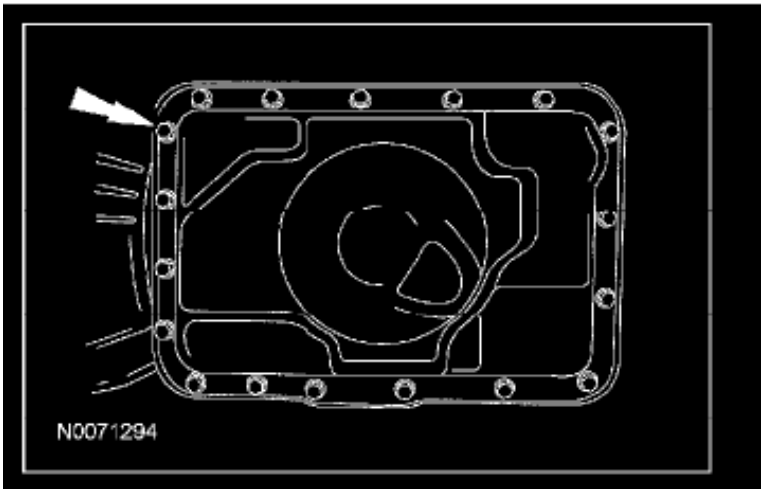
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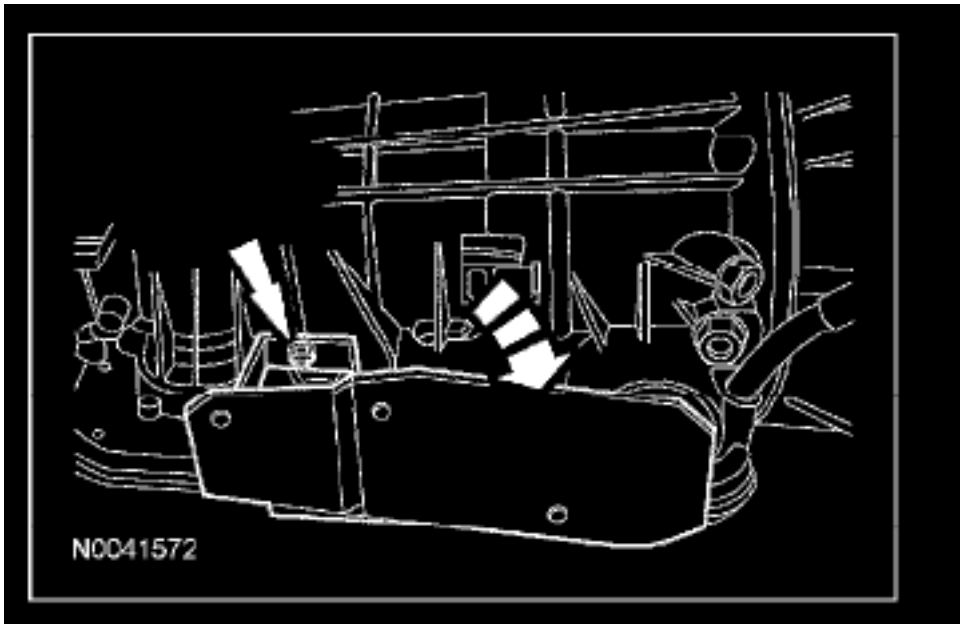
7. Loosely install the transmission fluid pan screws.

8. Tighten the transmission fluid pan screws in a crisscross pattern.

^ Tighten to 10 Nm (89 lb-inch).

9. If equipped, position the servo heat shield over the servos and clip it to the pan rail.

^ Tighten to 10 Nm (89 lb-inch).



10. NOTE: Start with a minimum of 3.7L (4 qt) clean automatic transmission fluid.

Fill transmission with clean automatic transmission fluid to the correct fluid level.

Band Adjustment And Torque Chart

Description	No. of Turns To Back Off	Locknut		Adjusting Screw	
		Nm	Lb-Ft	Nm	Lb-Ft
Intermediate Band	2.0	61	45	14	10
Front Band	2.0	61	45	14	10

Band: Specifications Band Adjustment and Torque Chart

Band Adjustment And Torque Chart

Band and Clutch Application Chart A

	Front Band	Intermediate Band	Low/Reverse Band	Forward Clutch	Direct Clutch	Coast Clutch
REVERSE			A		A	
1st				A		
1st[a]				A		
2nd	A			A		
2nd[ab]	A			A		
3rd		A		A		
3rd[a]		A		A		
4th				A	A	

Band and Clutch Application Chart A (Continued)

	Front Band	Intermediate Band	Low/Reverse Band	Forward Clutch	Direct Clutch	Coast Clutch
4th[a]				A	A	A
5th	A			A	A	
Manual 1st			A	A		A
Manual 2nd (third gear)		A		A		A

a Overdrive cancelled.
b PCM controlled.

A = Applied
H = Hold
OR = Overrunning
NE = No Effect

Band: Specifications Band and Clutch Application Chart A

Band and Clutch Application Chart A

Band and Clutch Application Chart A (Part 1)

Band and Clutch Application Chart A (Part 2)

Band and Clutch Application Chart B

	Front One-Way Clutch		Rear One-Way Clutch			
	Drive	Coast	Drive	Coast	Eng Brake	TCIL
Park					NE	
Reverse	H	OR	NE	NE	NE	
Neutral					NE	
1st	H	NE	H	NE	NO	OFF
1st[a]	H	NE	H	NE	NO	ON
2nd	OR	OR	H	NE	NO	OFF
2nd[ab]	OR	OR	H	NE	NO	ON
3rd	H	NE	OR	OR	NO	OFF
3rd[a]	H	NE	OR	OR	NO	ON
4th	H	NE	OR	OR	NO	OFF
4th[a]	H	NE	OR	OR	YES	ON
5th	OR	OR	OR	OR	NO	OFF
Manual 1st	H	NE	H	NE	YES	
Manual 2nd (third gear)	H	NE	OR	OR	YES	

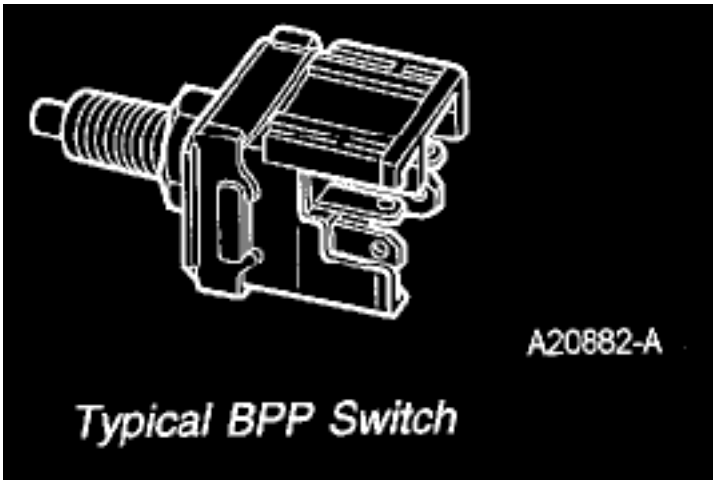
a Overdrive cancelled.
b PCM controlled.

A = Applied
H = Hold
OR = Overrunning
NE = No Effect

Band: Specifications Band and Clutch Application Chart B

Band and Clutch Application Chart B

Band and Clutch Application Chart B



Brake Switch - TCC: Description and Operation

BRAKE PEDAL POSITION (BPP) SWITCH

Typical BPP Switch

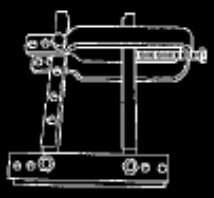
The BPP switch is sometimes referred to as the stoplamp switch. The BPP switch provides a signal to the PCM indicating that the brakes are applied. The BPP switch is normally open and is mounted on the brake pedal support. Depending on the vehicle application the BPP switch can be hardwired as follows:

- to the PCM supplying battery positive voltage (B+) when the vehicle brake pedal is applied.

- to the antilock brake system (ABS) module, or lighting control module (LCM), the BPP signal is then broadcast over the network to be received by the PCM.

- to the ABS traction control/stability assist module. The ABS module interprets the BPP switch input along with other ABS inputs and generates an output called the driver brake application (DBA) signal. The DBA signal is then sent to the PCM and to other BPP signal users.

Special Tool(s)

ST1194-A	Remover, Transmission Extension Housing Bushing 308-070 (T77L-7697-E)
ST1790-A	Installer, Transmission Extension Housing Bushing 307-065 (T77L-7697-F)
ST1791-A	Installer, Transmission Extension Housing Fluid Seal 307-038 (T74P-77052-A)
ST1185-A	Slide Hammer 100-001 (T50T-100-A)
 ST1758-A	Remover, Torque Converter Fluid Seal 307-309 (T94P-77001-BH)

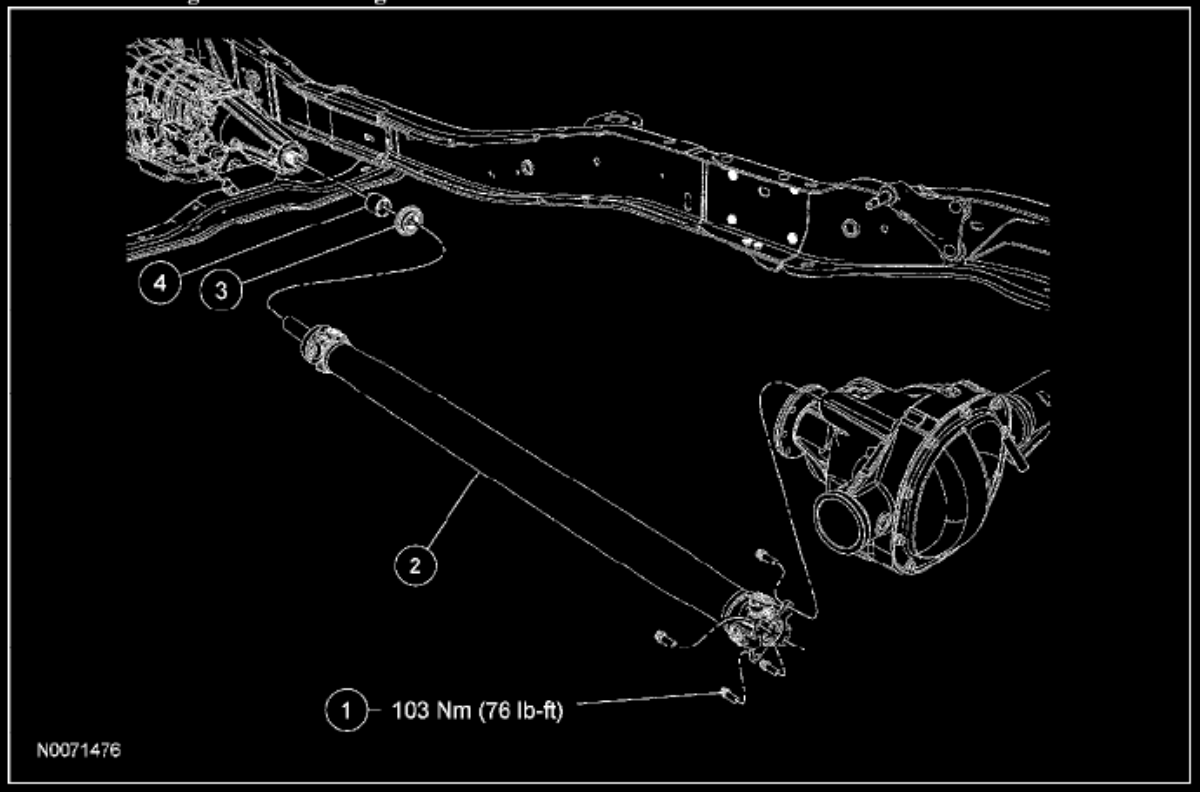
Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

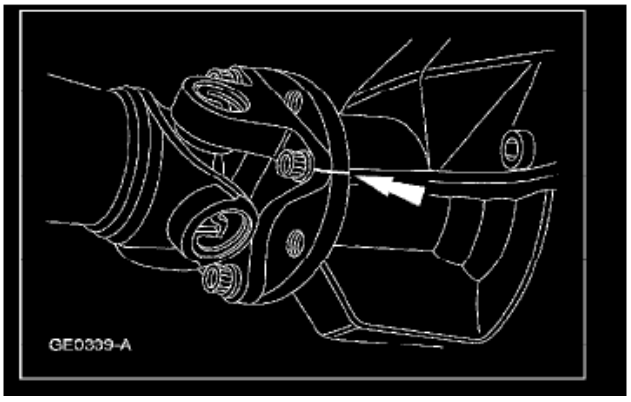
Extension Housing: Service and Repair

Extension Housing Seal and Bushing

Extension Housing Seal and Bushing



Item	Part Number	Description
1	N800594-S	Driveshaft bolt (4 required)
2	4602 H	Driveshaft
3	7052-A	Extension housing seal
4	7A034-A	Extension housing bushing



Extension Housing Seal and Bushing

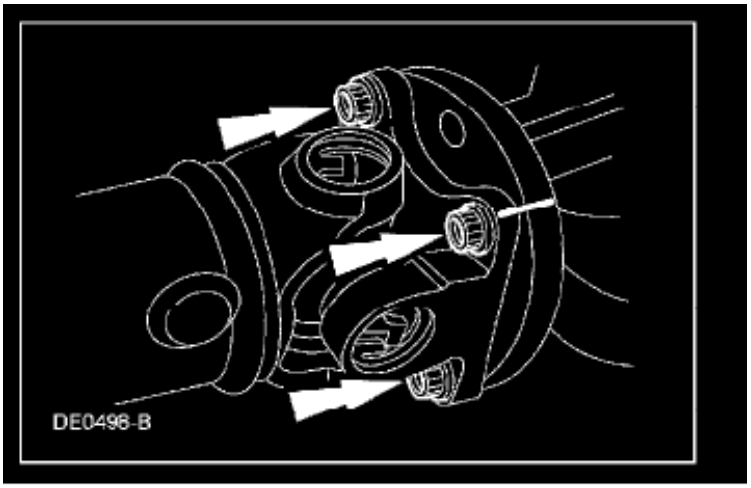
Removal

1. With the vehicle in NEUTRAL, position it on a hoist.

2. NOTE: To maintain initial driveshaft balance, mark the rear driveshaft yoke and axle flange so they can be installed in their original alignment.

Mark the rear driveshaft.

3. Remove the 4 rear driveshaft bolts.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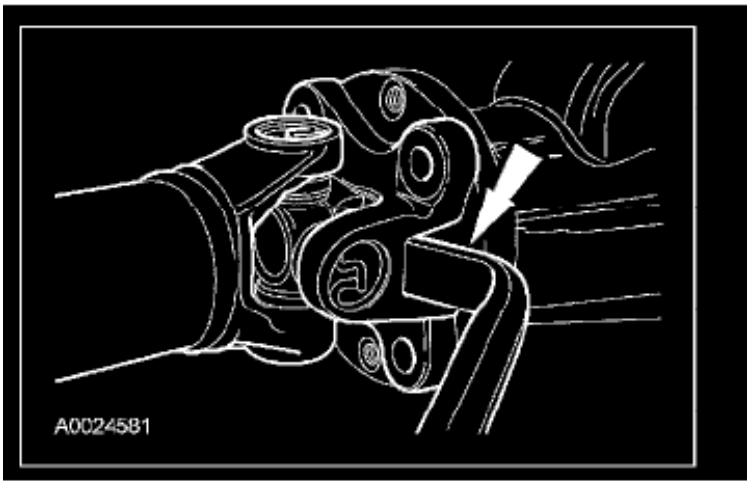
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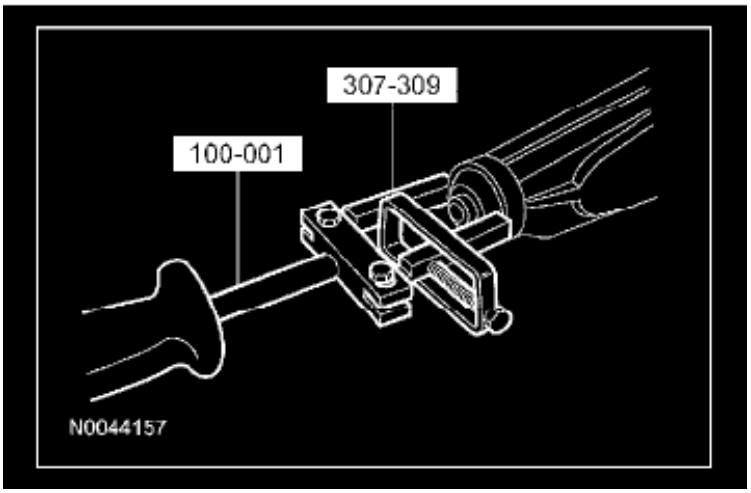

307-309
100-001
N0044157

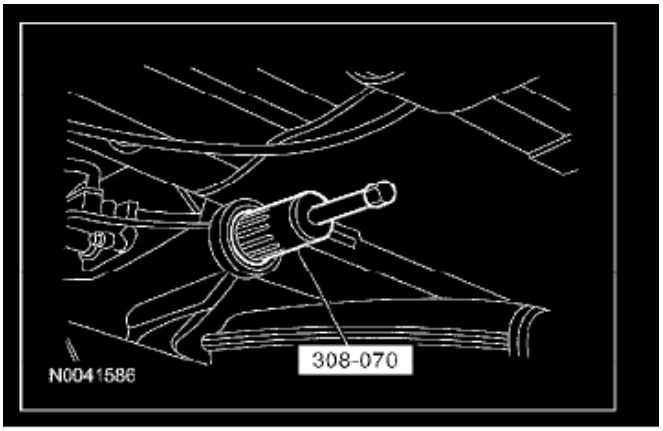
4. NOTE: Do not use a hammer.

Remove the rear driveshaft from the flange using a pry bar.

5. Using the special tools, remove the extension housing seal.

6. CAUTION: Use the extension housing bushing remover carefully so that the seal area is not damaged.

Using the special tool, remove the extension housing bushing.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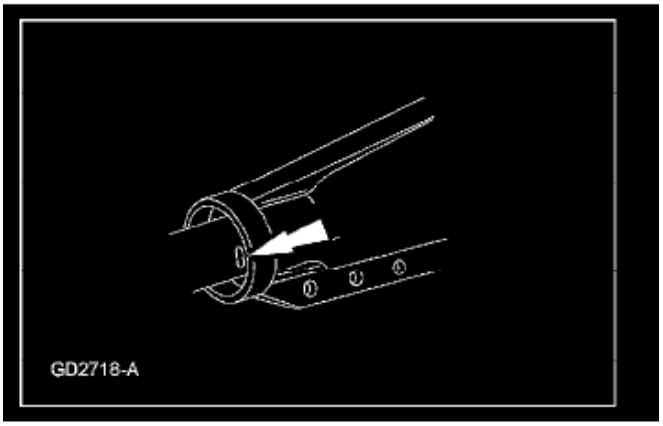
N0041586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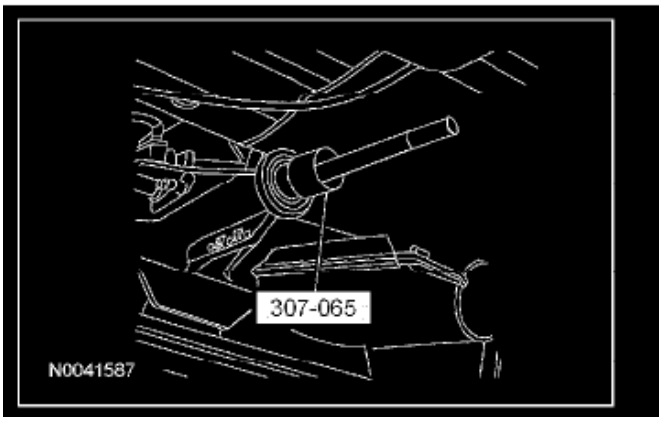

307-065
N0041587

Installation

1. CAUTION: The lube hole in the extension housing bushing must be aligned with the lube groove in the extension housing. This groove is

located at the 3 o'clock position when viewed from the rear. Failure to align the bushing can result in bushing damage.

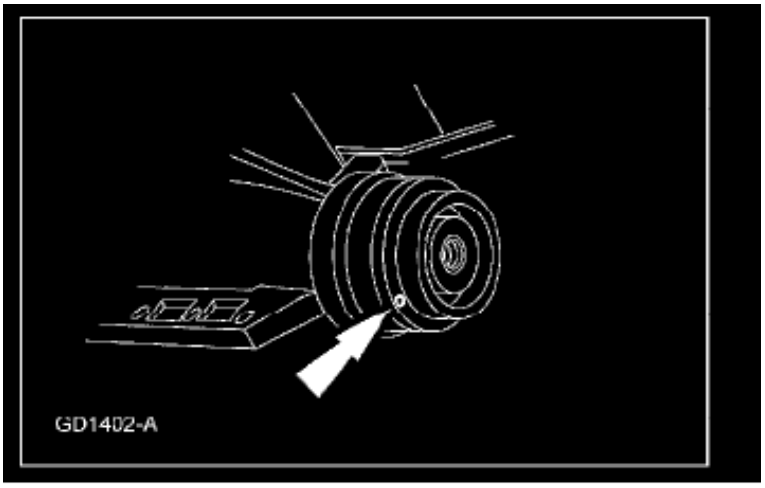
NOTE: Inspect the counterbore of the extension housing for burrs. Remove any burrs from the extension housing counterbore with an oil stone.

Position the extension housing bushing into the extension housing.

2. NOTE: The tool will bottom when bushing is in the correct position.

Using the special tool, install the extension housing bushing.

3. Position new extension housing seal with drain hole in the 6 o'clock position.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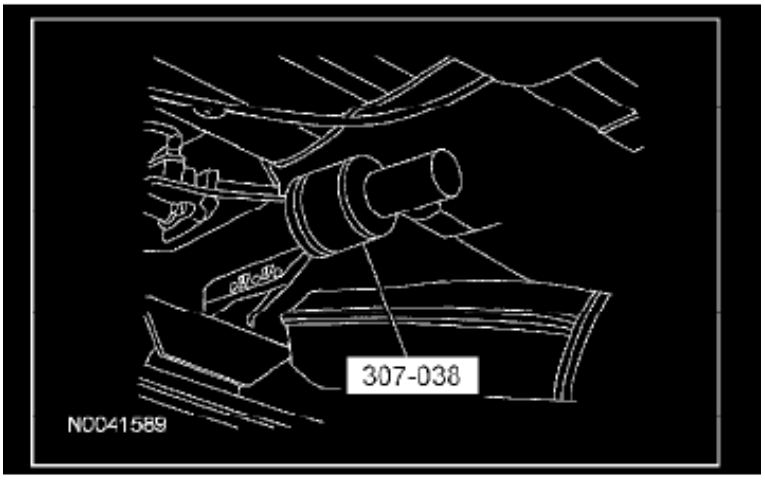
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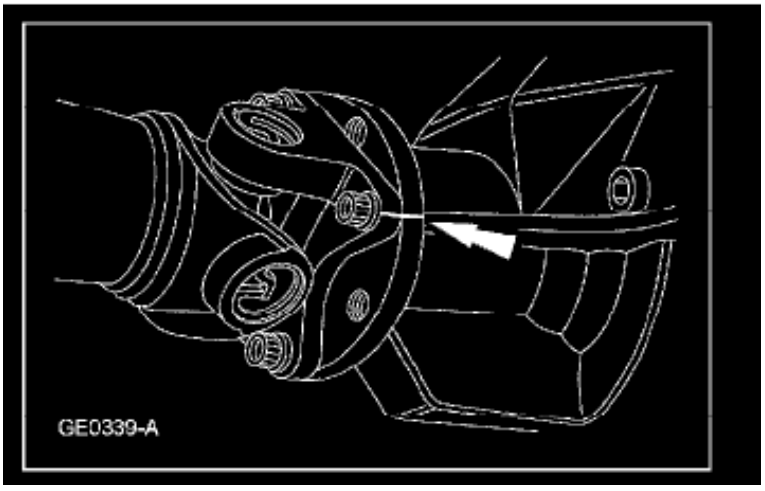

GE0339-A

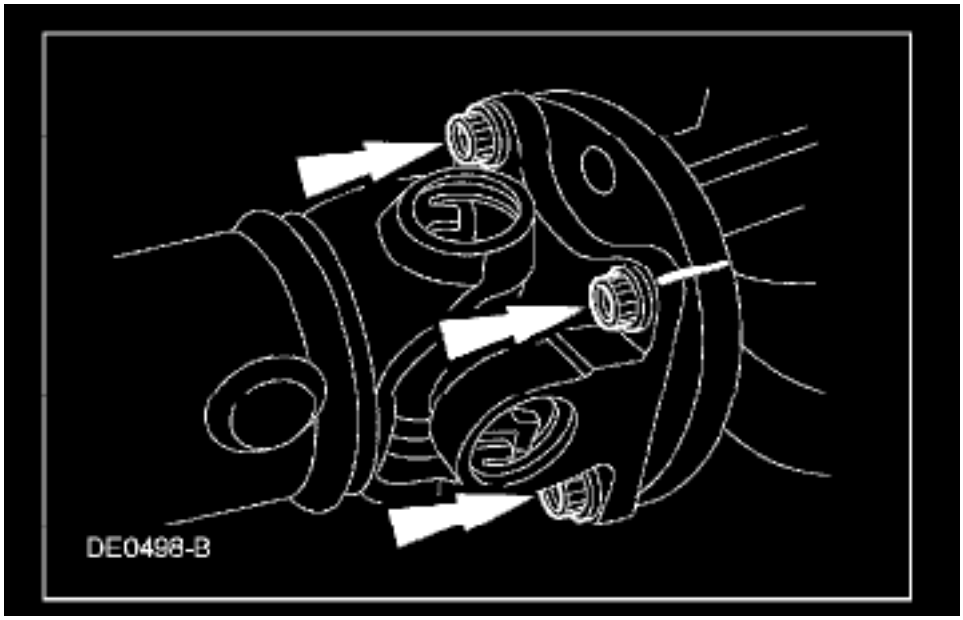
4. Using the special tool, install the extension housing seal.

5. NOTE: Inspect the driveshaft slip-yoke for wear and damage. Install a new component if required.

Align the driveshaft with the marks made during removal to make sure of correct balance.

6. With the marks aligned, install the rear driveshaft and bolts.

^ Tighten to 103 Nm (76 lb-ft).



7. Fill the transmission to the correct fluid level with clean automatic transmission fluid and check for correct transmission operation.

Fluid - A/T: Capacity Specifications

Transmission Fluid ..... 10.0 qts (9.5L)

Note: Indicates only approximate dry-fill capacity. Some applications may vary based on cooler size and if equipped with an in-tank cooler. The amount of transmission fluid and fluid level should be set by the indication on the dipstick's normal operating range.

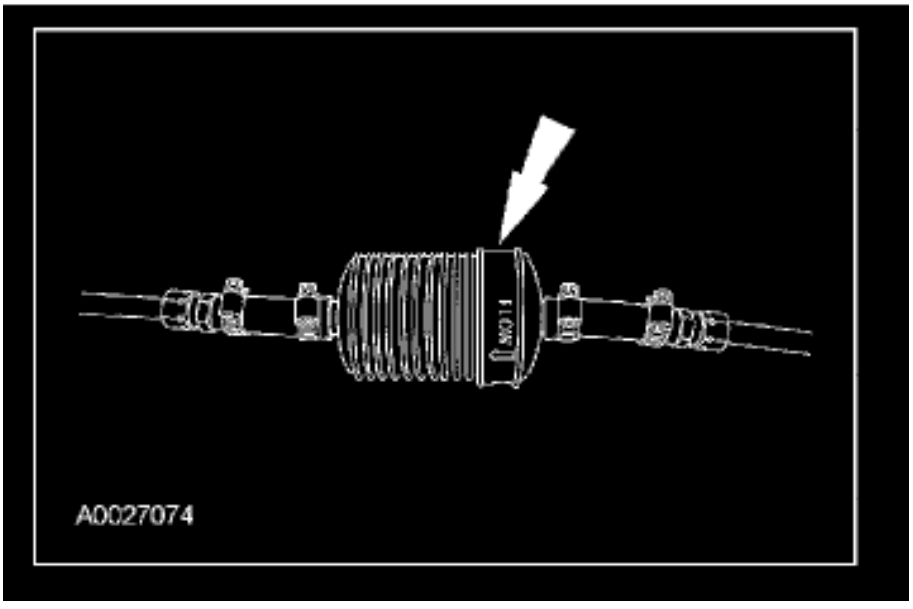
Fluid - A/T: Fluid Type Specifications

Transmission Fluid Type

Type ..... MERCON V

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V



Fluid - A/T: Service and Repair Transmission Fluid Cooler Backflushing and Cleaning

Transmission Fluid Cooler Backflushing and Cleaning

CAUTION: Whenever a transmission has been disassembled to install new parts or a new or remanufactured transmission has been installed, a new transmission fluid cooler, either in-tank, auxiliary or oil to air (OTA), if equipped will need to be installed. Using a suitable torque converter/fluid cooler cleaner, clean and backflush the transmission fluid cooler tubes.

When internal wear or damage has occurred in the transmission, metal particles, clutch plate material or band material may have been carried into the transmission fluid cooler. These contaminants are a major cause of recurring transmission concerns and must be removed from the system before the transmission is put back in use.

CAUTION: Use only clean automatic transmission fluid specified for this transmission. Do not use supplemental fluid additives, treatments or cleaning agent. The use of these materials may affect transmission operation and result in internal damage to the transmission.

NOTE: Do not use any solvents while carrying out this procedure. Only use clean automatic transmission fluid.

1. Conduct backflushing with a suitable torque converter/transmission fluid cooler cleaner. Test the equipment to make sure that a vigorous fluid

flow is present before proceeding. Install a new system filter if flow is weak or contaminated.

2. Remove and discard the in-line transmission fluid filter, if equipped.

3. To aid in attaching the cleaner to the transmission steel cooler lines, connect 2 additional rubber hoses to the transmission end of the steel

transmission cooler lines as described. ^

Connect the cleaner tank pressure line to the steel transmission cooler return line (longest line).

^ Connect a tank return hose to the steel transmission cooler pressure line (shorter line). Place the outlet end of this hose in the solvent tank reservoir.

4. Turn on the pump and allow the transmission fluid to circulate a minimum of 5 minutes (cycling switch on and off will help dislodge contaminants

in the cooler system).

5. Switch off the pump and disconnect the pressure hose from the transmission cooler return line.
6. Use compressed air to blow out the cooler(s) and lines (blow air into the transmission cooler return line) until all the fluid is removed. 7. Remove the rubber return hose from the remaining steel cooler line.

Special Tool(s)

ST2554-A	Automatic Transmission Flush and Fill Machine 211-00018 Automatic Transmission Flush and Fill Machine 199-00010 or equivalent

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

Fluid - A/T: Service and Repair Transmission Fluid Drain and Refill - Automated Equipment

Transmission Fluid Drain and Refill - Automated Equipment

Drain

CAUTION: Use only clean automatic transmission fluid. Do not use any supplemental transmission fluid additives, treatments or cleaning agents. The use of these materials can affect the operation of the transmission, resulting in internal component failure.

NOTE: Always refer to the instructions supplied with the flush and fill machine.

NOTE: This is a new procedure for draining and adding transmission fluid using a suitable transmission flush and fill machine.

1. With the vehicle in PARK, position on a hoist. 2. Use a suitable flush and fill machine to change the fluid. 3. When connecting the flush and fill machine, connect the machine to the fluid cooler tube after the fluid cooler on the cooler return tube. This will

help remove any foreign material trapped in the fluid coolers.

4. Carry out the fluid exchange process.

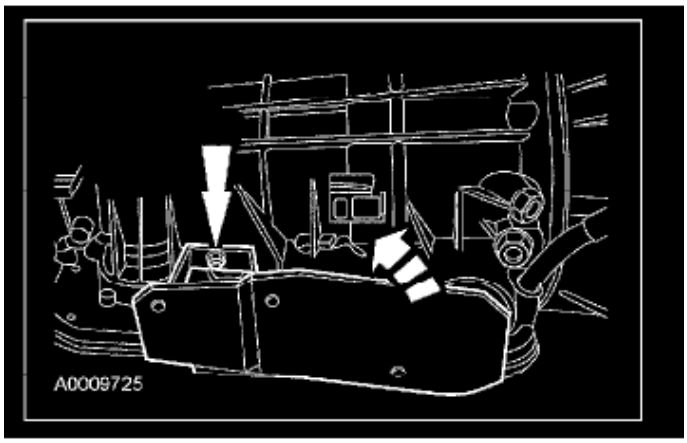
Refill

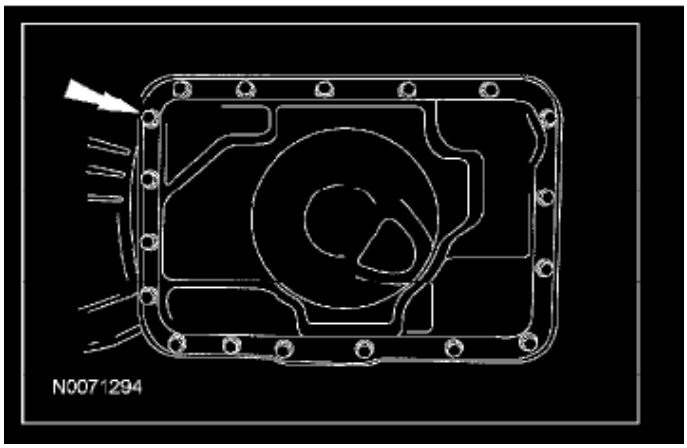
1. Use only clean automatic transmission fluid. 2. Once the fluid exchange has been completed, disconnect the flush and fill machine. Reconnect any disconnected fluid cooler tubes. 3. Lower the vehicle. 4. With the engine running and the transmission at normal operating temperature 66-77° C (150-170° F), check and adjust the transmission fluid

level and check for any leaks. If fluid is needed, add fluid in increments of 0.24L (0.5 pt) until the correct level is achieved (fluid should be in the cross-hatched area of the fluid level indicator).

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V





Fluid - A/T: Service and Repair Transmission Fluid Drain and Refill - Vehicles Not Equipped With Torque Converter Drain Plug

Transmission Fluid Drain and Refill - Vehicles Not Equipped With Torque Converter Drain Plug

Drain

CAUTION: Use only clean automatic transmission fluid. Do not use any supplemental transmission fluid additives, treatments or cleaning agents. The use of these materials may affect the operation of the transmission, resulting in internal component failure.

1. With the vehicle in PARK, position it on a hoist.

2. NOTE: If equipped, the transmission servo heat shield must be unclipped from the fluid pan rail and positioned aside for fluid pan removal.

If equipped, loosen the nut and position the heat shield aside.

3. Place a drain pan under the transmission fluid pan. 4. Drain transmission fluid.

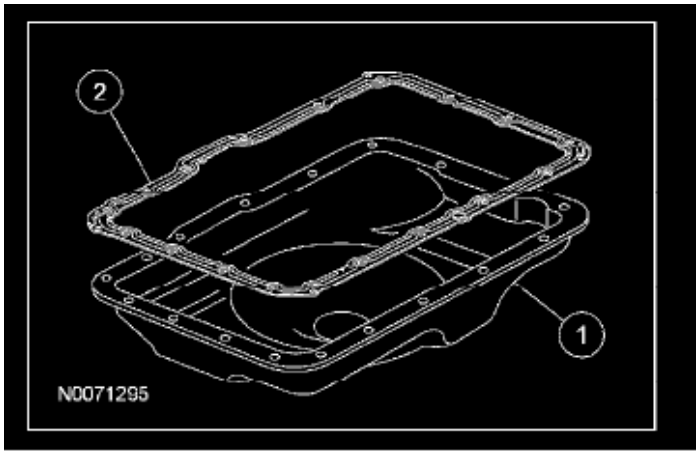
^ Remove all the transmission fluid pan screws except for 2 in the front. Loosen the 2 front transmission fluid pan screws. Pry the rear of the transmission fluid pan down and allow fluid to drain. After fluid is drained, remove the front 2 transmission fluid pan screws.

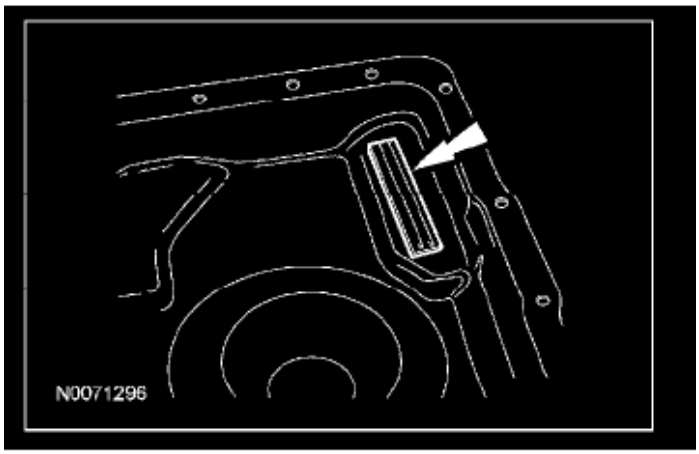
5. NOTE: The transmission fluid pan gasket is reusable. Clean and inspect for damage, if not damaged, the gasket should be reused.

Remove the transmission fluid pan. 1

Remove the transmission fluid pan.

2 Remove the transmission fluid pan gasket.


2
1
N0071295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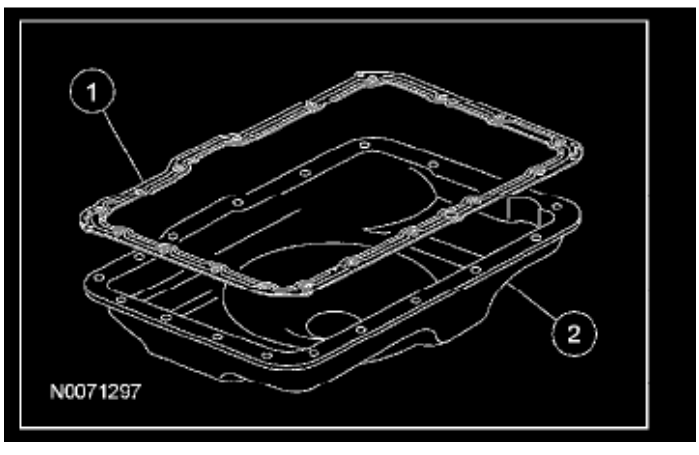

1
2
N0071297

6. Clean and inspect the transmission fluid pan and magnet. Clean all mating surfaces.

Refill

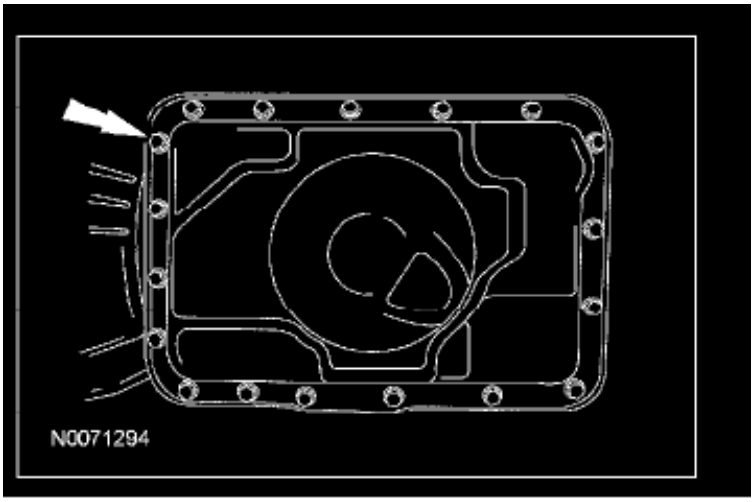
1. NOTE: The transmission fluid pan gasket is reusable. Clean and inspect for damage, if not damaged, the gasket should be reused.

Install the transmission fluid pan. 1

Position the transmission fluid pan gasket on the transmission fluid pan.

2 Install and align the transmission fluid pan.

2. Loosely install the transmission fluid pan screws.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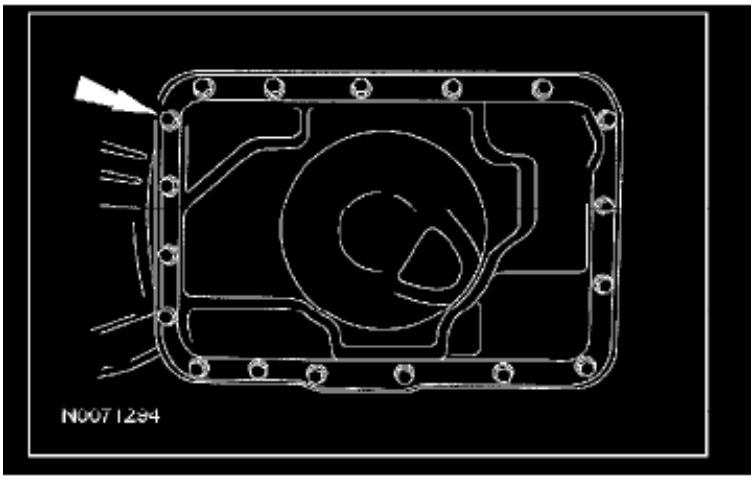
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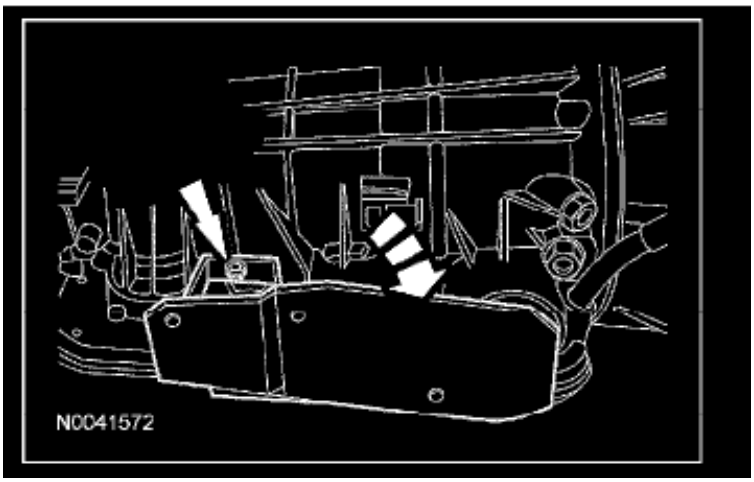

N0041572

3. Tighten the transmission fluid pan screws in a crisscross sequence.

^ Tighten to 10 Nm (89 lb-inch).

4. If equipped, position the servo heat shield over the servos and clip it to the pan rail.

^ Tighten to 10 Nm (89 lb-inch).

5. Lower the vehicle.

6. NOTE: When filling a dry transmission and converter, start with a minimum of 3.7L (4 qt).

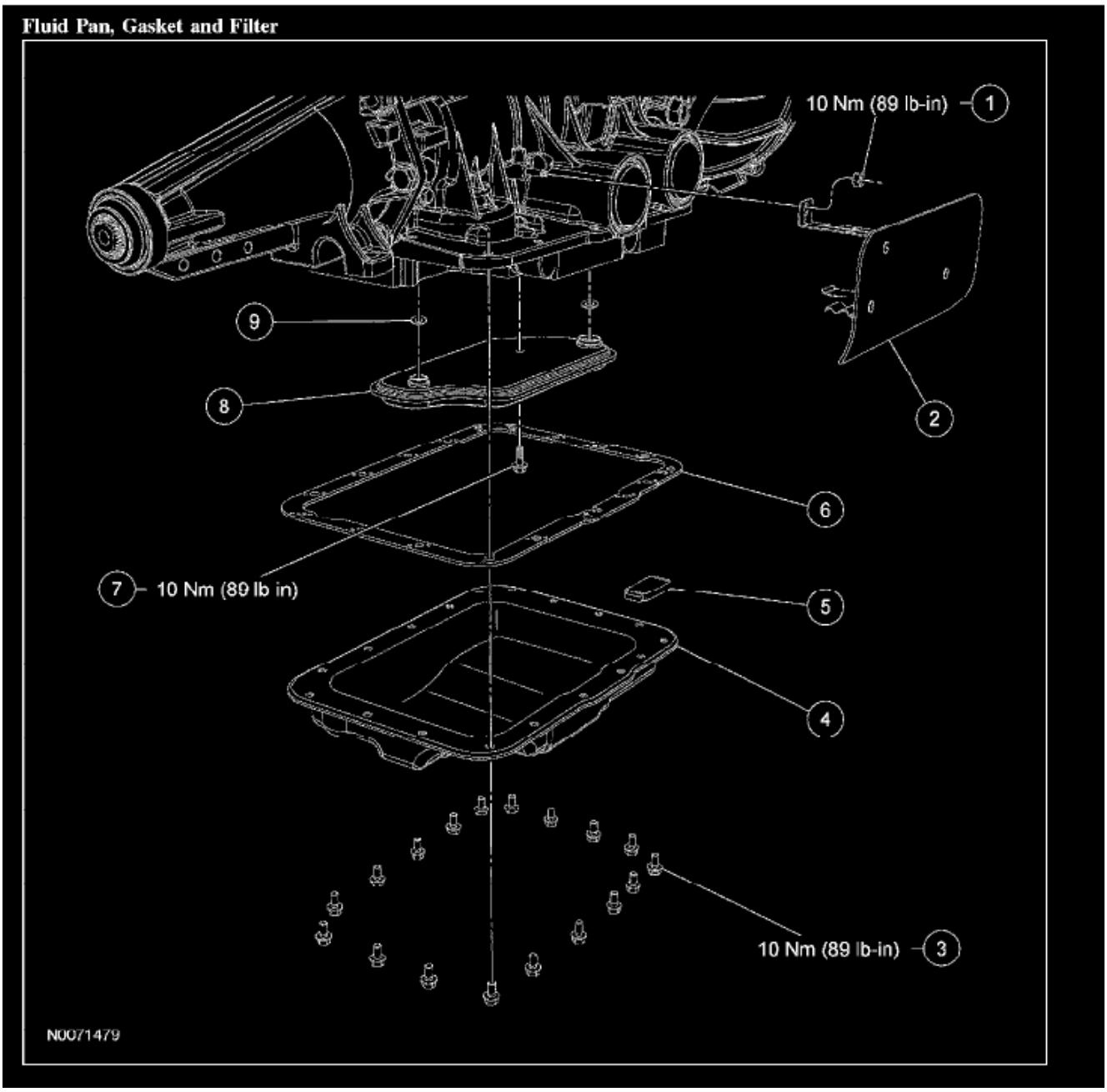
With the engine running and the transmission at normal operating temperature 66-77° C (150-170° F), check and adjust the transmission fluid level and check for any leaks. If fluid is needed, add fluid in increments of 0.24L (0.5 pt) until the correct level is achieved (fluid should be in the crosshatched area of the fluid level indicator).

7. Apply the park brake and start the engine. 8. Move the range selector lever through all the gears.
9. Check the transmission fluid level.

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

Fluid Pan, Gasket and Filter



Fluid Filter - A/T: Service and Repair Fluid Pan, Gasket and Filter

Fluid Pan, Gasket and Filter

Fluid Pan, Gasket and Filter (Part 1)

Item	Part Number	Description
1	N620040-S	Heat shield nut
2	7F013-B	Heat shield
3	W701203-S	Transmission fluid pan screw (18 required)
4	7A264-A	Transmission fluid pan
5	7L027	Magnet
6	7A191-A	Transmission fluid pan gasket
7	E800154	Transmission fluid filter screw
8	7A098-A	Transmission fluid filter
9	7A469	Transmission fluid filter O-ring (2 required)

Fluid Pan, Gasket and Filter (Part 2)

Removal

1. With the vehicle in NEUTRAL, position it on a hoist.

2. NOTE: If equipped, the transmission servo heat shield must be unclipped from the fluid pan rail and positioned aside for fluid pan removal.

If equipped, loosen the nut and position the heat shield aside.

3. Drain transmission fluid.

^ Remove all the transmission fluid pan screws except for 2 in the front. Loosen the 2 front transmission fluid pan screws. Pry the rear of the transmission fluid pan down and allow fluid to drain. After fluid is drained, remove the front 2 transmission fluid pan screws.

4. NOTE: The transmission fluid gasket is reusable. Clean and inspect for damage, if not damaged, the gasket should be reused.

Remove the transmission fluid pan.

5. Remove the transmission fluid pan gasket. 6. Remove the transmission fluid filter screw. 7. Remove the transmission fluid filter. 8. Clean and inspect the transmission fluid pan and magnet. Clean all mating surfaces.

Installation

1. CAUTION: Lubricate fluid filter O-ring seals with clean automatic transmission fluid or they may be damaged.

Lubricate and install new O-ring seals onto the transmission fluid filter.

2. Position the transmission fluid filter on the main control valve body. 3. Install the transmission fluid filter screw.

^ Tighten to 10 Nm (89 lb-inch).

4. Position the fluid pan magnet in the transmission fluid pan.

5. NOTE: The transmission fluid pan gasket is reusable. Clean and inspect for damage, it not damaged, the gasket should be reused.

Position the transmission fluid pan gasket on the transmission fluid pan.

6. Install and align the transmission fluid pan. 7. Loosely install the transmission fluid pan screws. 8. Tighten the transmission fluid pan screws in a crisscross pattern.

^ Tighten to 10 Nm (89 lb-inch).

9. If equipped, position the servo heat shield over the servos and clip it to the pan rail.

^ Tighten to 10 Nm (89 lb-inch).

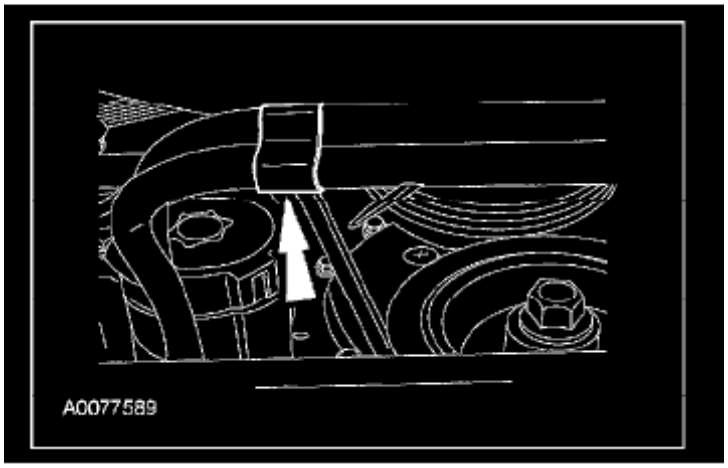
10. NOTE: Start with a minimum of 3.7L (4 qt) clean automatic transmission fluid.

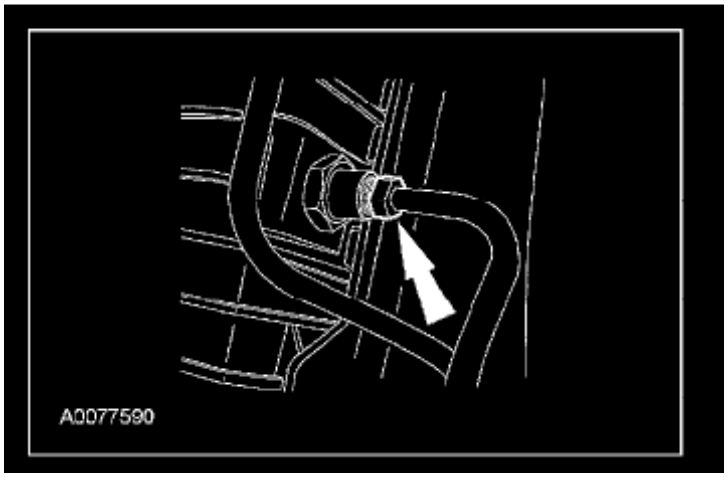
Fill transmission with clean automatic transmission fluid to the correct fluid level.

11. Apply the park brake and start the engine. 12. Move the range selector lever through all the gears. 13. Check the transmission fluid level.

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V





Fluid Filter - A/T: Service and Repair Transmission Filter - In Line

Transmission Filter - In Line

Transmission fluid in-line filter without oil-to-air (OTA) cooler

NOTE: Use the following guidelines for the in-line transmission fluid filter: ^

If the transmission was overhauled and the vehicle was equipped with an in-line fluid filter, install a new in-line fluid filter.

^ If the transmission was overhauled and the vehicle was not equipped with an in-line fluid filter, install a new in-line fluid filter kit.

^ If the transmission is being installed for a non-internal repair, do not install an in-line filter or filter kit.

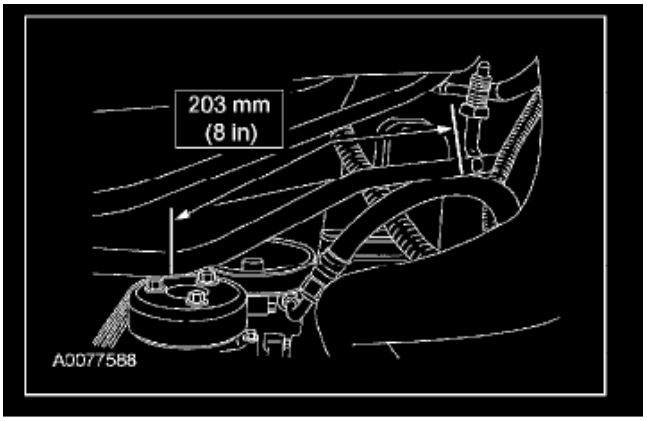
^ If installing a new or a Ford-authorized remanufactured transmission, install the in-line transmission fluid filter that is supplied.

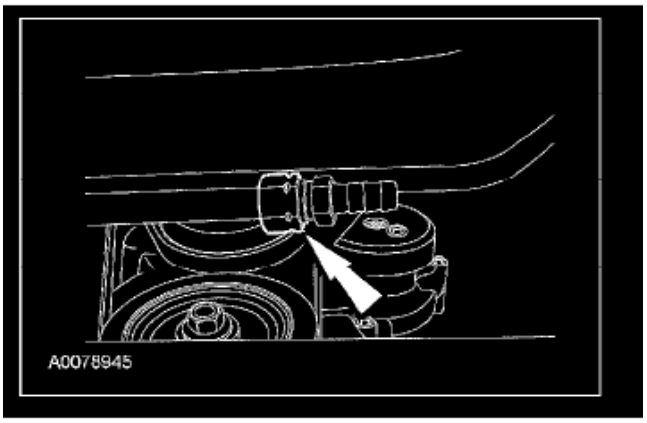
1. With the vehicle in NEUTRAL, position it on a hoist. 2. Remove the retainer clips from the cooler lines.

3. Disconnect the lower transmission cooler tube fitting.

4. Remove the section of the return line, as illustrated.

^ Clean and deburr the cut ends of the steel tubing.


203 mm
(8 in)
A0077588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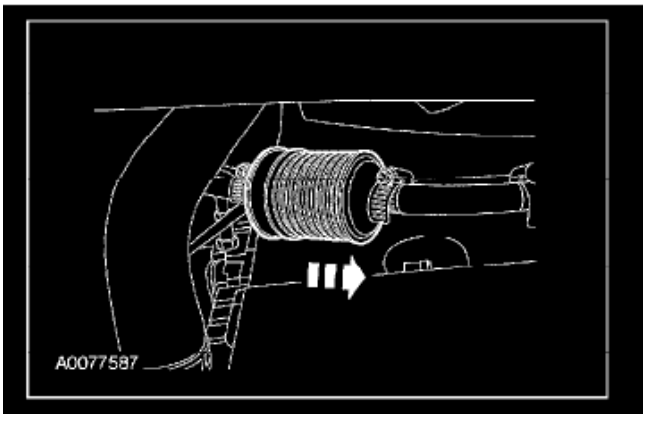

A0077587

5. NOTE: Be sure the cooler tube is fully seated in the body of the fitting before final tightening of the ferrule nut.

Install the 2 ferrule connectors finger tight onto each end of the tubing. Then tighten the nuts an additional 1-1/2 turns to seat the ferrules in the connectors.

6. CAUTION: The filter has a bypass valve in it. The red arrow on the filter indicates the direction of the fluid flow through the filter. The

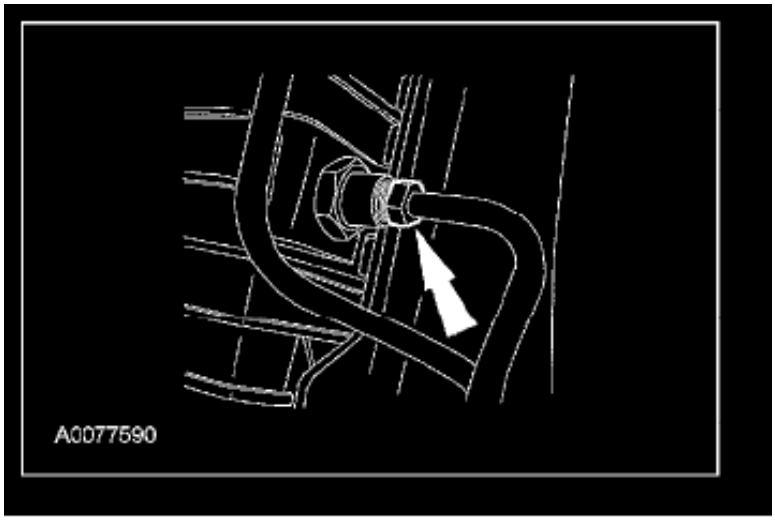
filter must be installed in the fluid cooler return line with the red arrow pointing away from the transmission fluid cooler and toward the transmission (the return line has fluid coming out of the cooler going to the transmission). If the fluid filter is not installed correctly, it will cause internal transmission damage.

NOTE: Do not install any rubber hoses or steel tubing with a bend entering the filter greater than 60 degrees.

Using suitable length of hose(s), install the filter. Tighten the clamps.

7. Connect the lower transmission cooler tube fitting.

^ Tighten to 28 Nm (21 lb-ft).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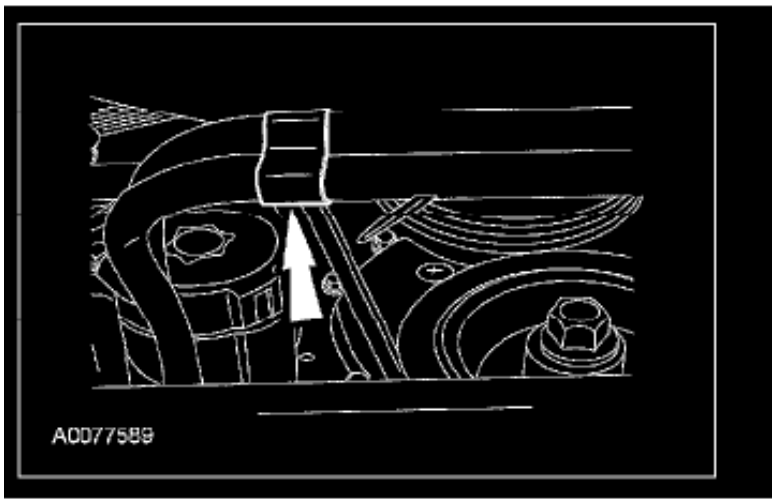
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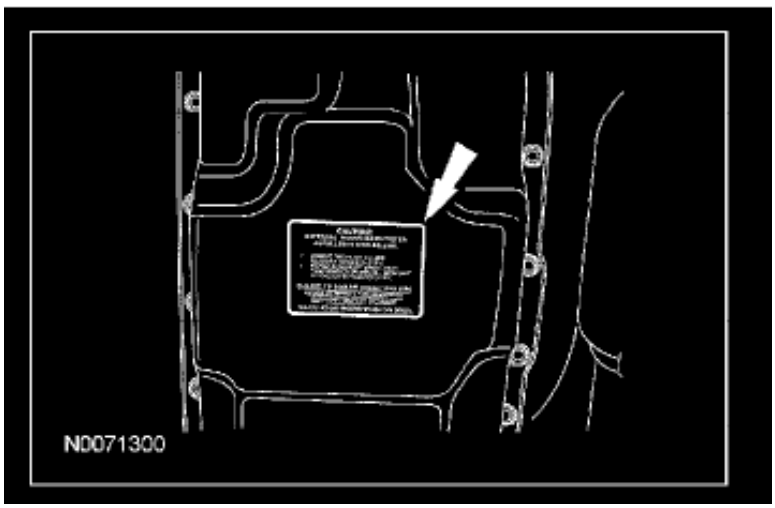

N0071300

8. Install the retainer clips on the cooler lines.

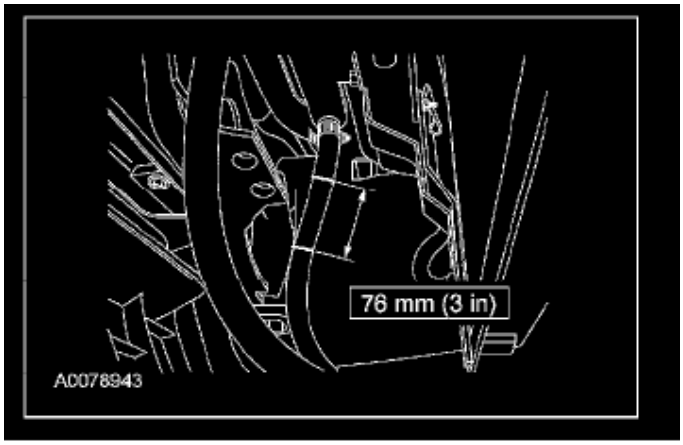
9. Clean a section of the transmission fluid pan and install the sticker.

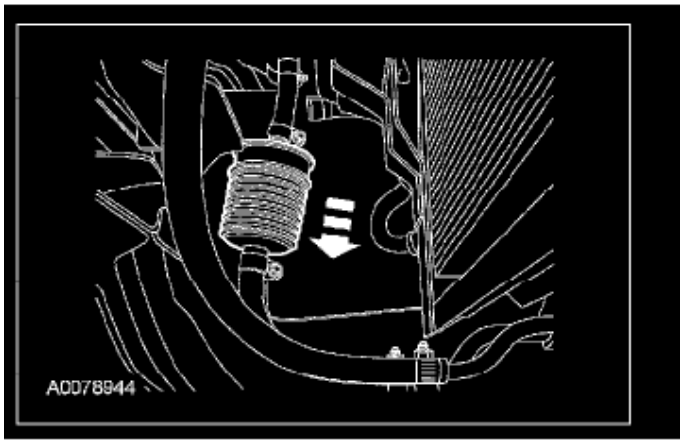
10. Fill the transmission with clean automatic transmission fluid.

^ Verify for correct operation.

^ Check the filter for leaks.

Transmission fluid in-line filter with OTA cooler 11. With the vehicle in NEUTRAL, position it on a hoist. 12. Remove the section of the return line, as illustrated.


76 mm (3 in)
A0078943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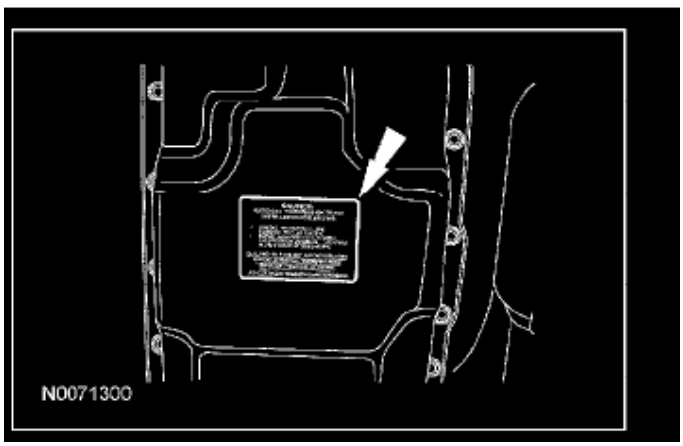

N0071300

13. CAUTION: The filter has a bypass valve in it. The red arrow on the filter indicates the direction of the fluid flow through the filter. The

filter must be installed in the fluid cooler return line with the red arrow pointing away from the transmission fluid cooler and toward the transmission (the return line has fluid coming out of the cooler going to the transmission). If the fluid filter is not installed correctly, it will cause internal transmission damage.

NOTE: Do not install any rubber hoses or steel tubing with a bend entering the filter greater than 60 degrees.

Using 2 hose clamps, install the filter.

14. Clean a section of the transmission fluid pan and install the sticker.

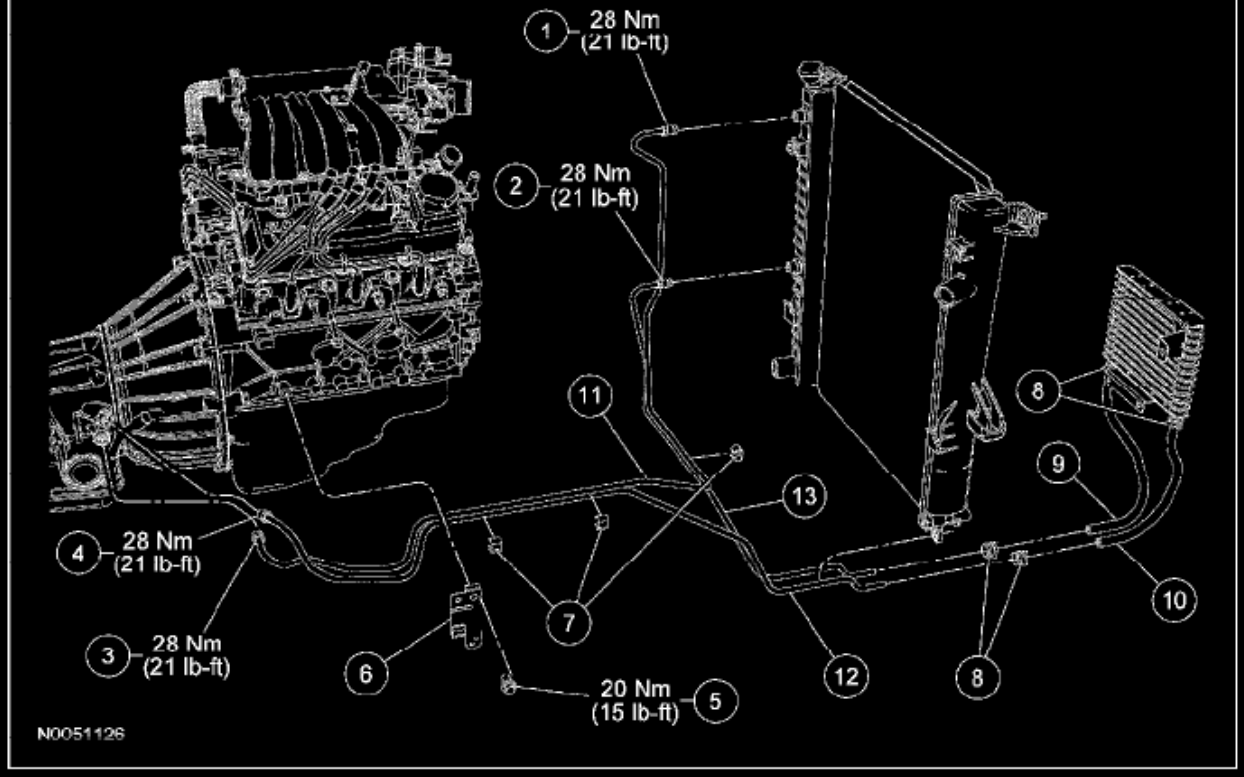
15. Fill the transmission with clean automatic transmission fluid.

^ Verify for correct operation.

^ Check the filter for leaks.

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V



Item	Part Number	Description
1	—	Transmission fluid cooler outlet tube fitting (part of 7A031)
2	—	Transmission fluid cooler lower inlet tube fitting (part of 7F113)
3	—	Transmission fluid cooler outlet tube fitting (part of 7A031)

(Continued)

Item	Part Number	Description
4	—	Transmission fluid cooler inlet tube fitting (part of 7A030)
5	N802653-S	Transmission fluid cooler tube bracket screw
6	7N291	Transmission fluid cooler tube bracket
7	388160-S	Transmission fluid cooler tube clips
8	—	Auxiliary transmission fluid cooler hose clamps

(Continued)

Fluid Line/Hose: Service and Repair

Transmission Fluid Cooler Tubes - 3.0L

Item	Part Number	Description
9	NB-6918	Auxiliary transmission fluid cooler outlet hose
10	NP-6917	Auxiliary transmission fluid cooler inlet hose
11	7A030	Transmission fluid cooler outlet tube
12	7A031	Transmission fluid cooler inlet tube
13	7F113	Transmission fluid cooler lower inlet tube

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the transmission fluid cooler lower inlet and outlet tubes from the radiator. 3. Disconnect the auxiliary transmission fluid cooler hoses from the transmission fluid cooler inlet and lower inlet tubes, and remove the lower inlet

tube.

4. Disconnect the transmission fluid cooler inlet and outlet tubes from the transmission. 5. Remove the transmission fluid cooler tube bracket and the transmission fluid cooler inlet and outlet tubes from the engine.

Installation

1. Install the transmission fluid cooler inlet and outlet tubes and the bracket onto the engine.

^ Tighten to 20 Nm (15 lb-ft).

2. Connect the transmission fluid cooler inlet and outlet tubes to the transmission.

^ Tighten to 28 Nm (21 lb-ft).

3. Connect the auxiliary transmission fluid cooler hoses and clamps to the transmission fluid cooler inlet and lower inlet tubes. 4. Connect the transmission fluid cooler lower inlet and outlet tubes to the radiator.

^ Tighten to 28 Nm (21 lb-ft).

5. Fill the transmission with clean automatic transmission fluid to the correct level and check for correct transmission operation.

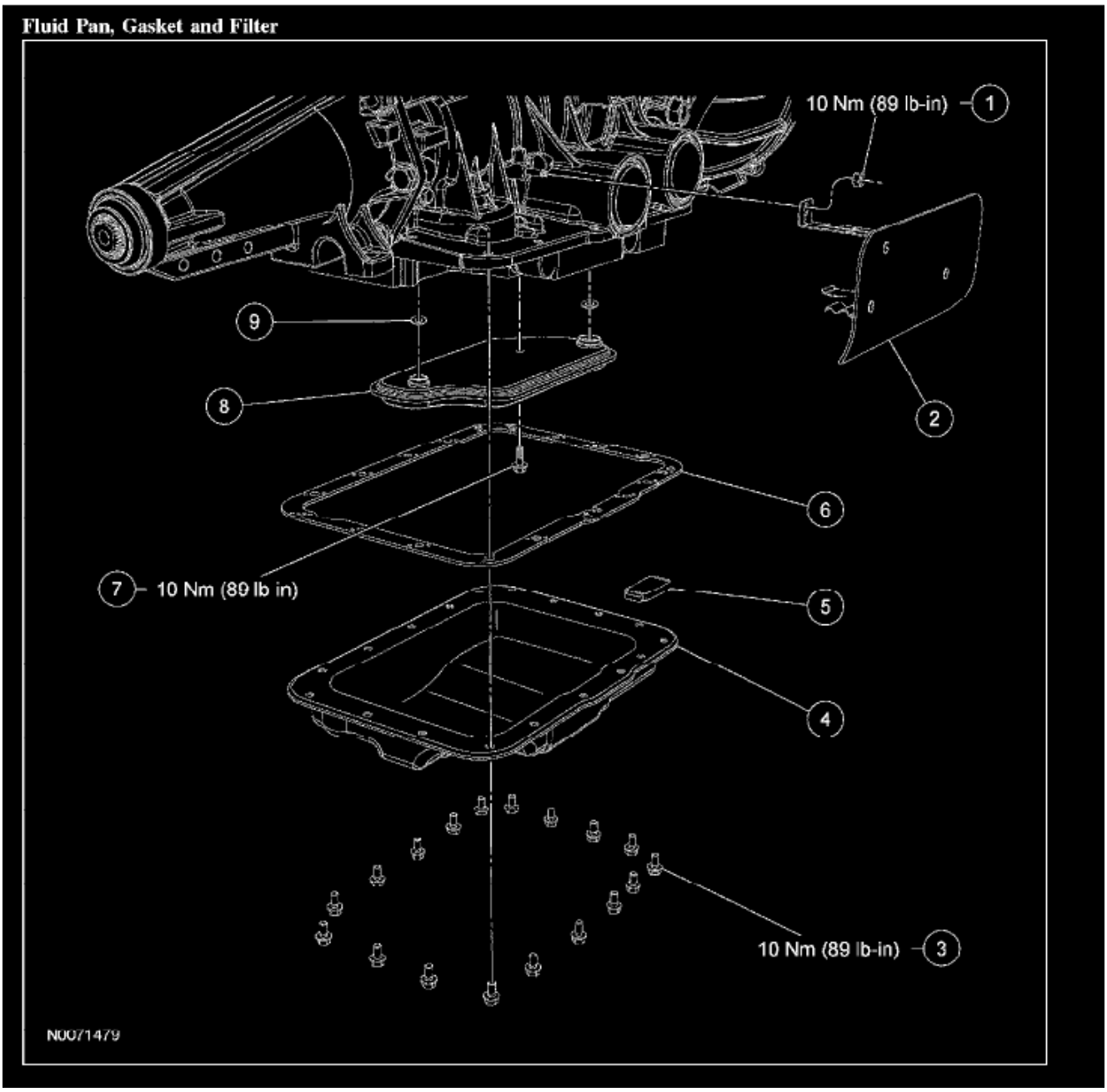
Fluid Pan: Specifications

Transmission Fluid Pan Screws ..... 10 Nm (89 lb-in) in a crisscross sequence

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

Fluid Pan, Gasket and Filter



Fluid Pan: Service and Repair

Fluid Pan, Gasket and Filter

Fluid Pan, Gasket and Filter (Part 1)

Item	Part Number	Description
1	N620040-S	Heat shield nut
2	7F013-B	Heat shield
3	W701203-S	Transmission fluid pan screw (18 required)
4	7A264-A	Transmission fluid pan
5	7L027	Magnet
6	7A191-A	Transmission fluid pan gasket
7	E800154	Transmission fluid filter screw
8	7A098-A	Transmission fluid filter
9	7A469	Transmission fluid filter O-ring (2 required)

Fluid Pan, Gasket and Filter (Part 2)

Removal

1. With the vehicle in NEUTRAL, position it on a hoist.

2. NOTE: If equipped, the transmission servo heat shield must be unclipped from the fluid pan rail and positioned aside for fluid pan removal.

If equipped, loosen the nut and position the heat shield aside.

3. Drain transmission fluid.

^ Remove all the transmission fluid pan screws except for 2 in the front. Loosen the 2 front transmission fluid pan screws. Pry the rear of the transmission fluid pan down and allow fluid to drain. After fluid is drained, remove the front 2 transmission fluid pan screws.

4. NOTE: The transmission fluid gasket is reusable. Clean and inspect for damage, if not damaged, the gasket should be reused.

Remove the transmission fluid pan.

5. Remove the transmission fluid pan gasket. 6. Remove the transmission fluid filter screw. 7. Remove the transmission fluid filter. 8. Clean and inspect the transmission fluid pan and magnet. Clean all mating surfaces.

Installation

1. CAUTION: Lubricate fluid filter O-ring seals with clean automatic transmission fluid or they may be damaged.

Lubricate and install new O-ring seals onto the transmission fluid filter.

2. Position the transmission fluid filter on the main control valve body. 3. Install the transmission fluid filter screw.

^ Tighten to 10 Nm (89 lb-inch).

4. Position the fluid pan magnet in the transmission fluid pan.

5. NOTE: The transmission fluid pan gasket is reusable. Clean and inspect for damage, it not damaged, the gasket should be reused.

Position the transmission fluid pan gasket on the transmission fluid pan.

6. Install and align the transmission fluid pan. 7. Loosely install the transmission fluid pan screws. 8. Tighten the transmission fluid pan screws in a crisscross pattern.

^ Tighten to 10 Nm (89 lb-inch).

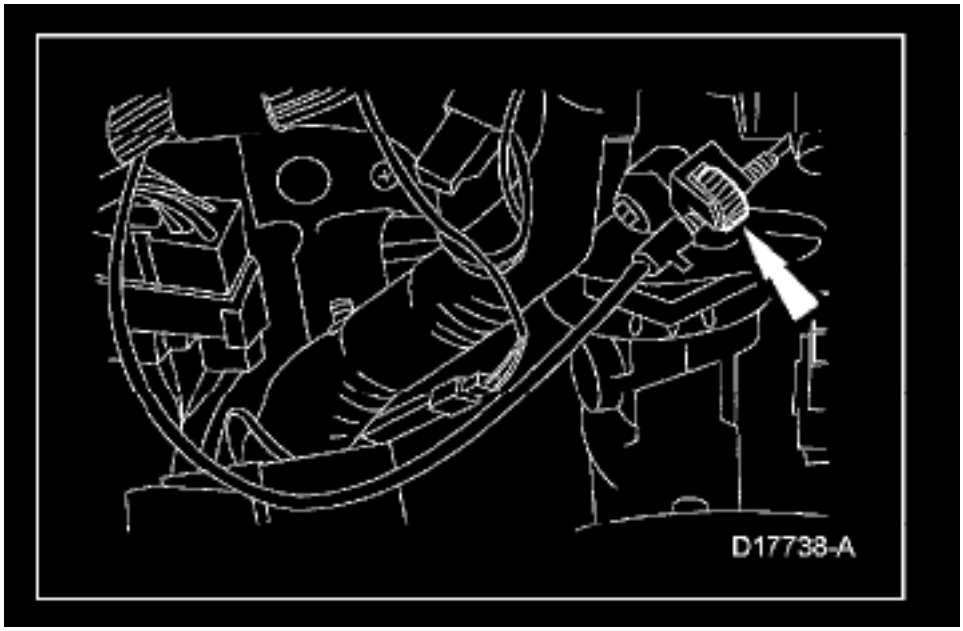
9. If equipped, position the servo heat shield over the servos and clip it to the pan rail.

^ Tighten to 10 Nm (89 lb-inch).

10. NOTE: Start with a minimum of 3.7L (4 qt) clean automatic transmission fluid.

Fill transmission with clean automatic transmission fluid to the correct fluid level.

11. Apply the park brake and start the engine. 12. Move the range selector lever through all the gears. 13. Check the transmission fluid level.



Shift Indicator: Adjustments

Selector Lever Indicator Adjustment

1. Remove the upper instrument panel steering column cover. 2. Place the selector lever in the (D) position.

^ Rotate the selector lever clockwise until it bottoms out (1st gear), then rotate 2 detents counterclockwise ((D) position).

3. Hang the 1.4 kg (3 lb) weight on the gearshift lever. 4. Center the pointer in the middle of the (D) position.

^ Rotate the thumb-wheel located on the bottom of the steering column to adjust the pointer.

5. Remove the 1.4 kg (3 lb) weight. 6. Carefully move the selector lever into each detent and compare with the transmission settings.

^ Readjust if necessary.

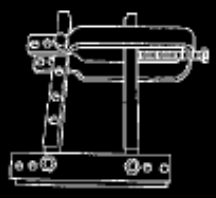
7. Install the upper instrument panel steering column cover.

Transmission Mode Indicator - A/T: Description and Operation

TRANSMISSION CONTROL INDICATOR LAMP (TCIL)

The TCIL is an output signal from the PCM that controls the lamp on/off function depending on the engagement or disengagement of overdrive.

Special Tool(s)

ST1194-A	Remover, Transmission Extension Housing Bushing 308-070 (T77L-7697-E)
ST1790-A	Installer, Transmission Extension Housing Bushing 307 065 (T77L 7697 F)
ST1791-A	Installer, Transmission Extension Housing Fluid Seal 307-038 (T74P-77052-A)
ST1185-A	Slide Hammer 100-001 (T50T-100-A)
 ST1758-A	Remover, Torque Converter Fluid Seal 307-309 (T94P-77001-BH)

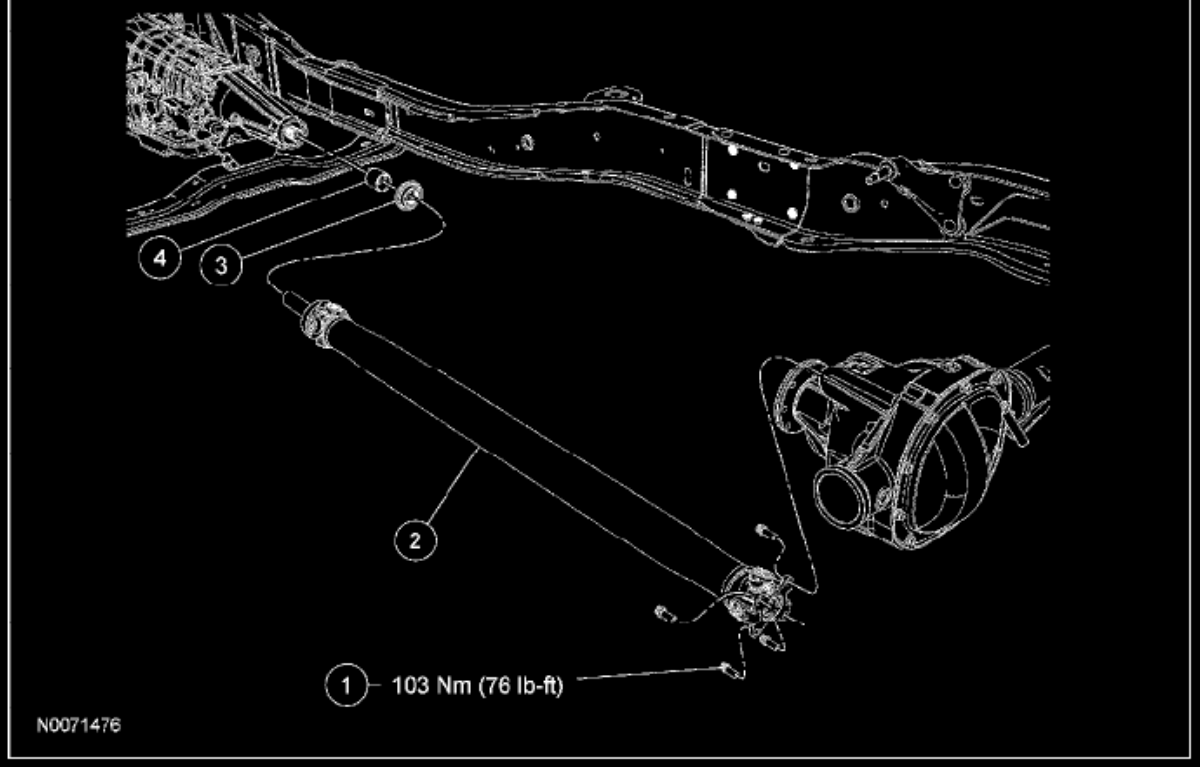
Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

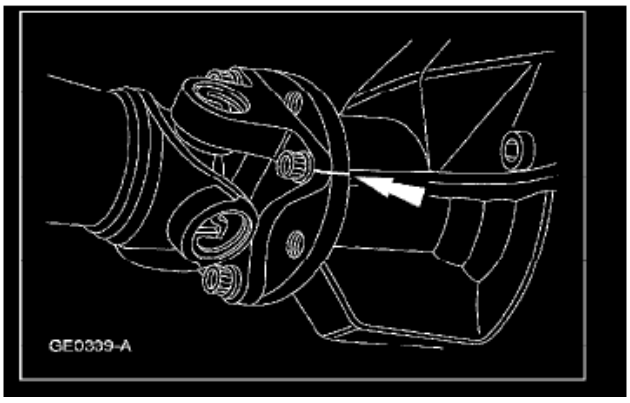
Seals and Gaskets: Service and Repair Extension Housing Seal and Bushing

Extension Housing Seal and Bushing

Extension Housing Seal and Bushing



Item	Part Number	Description
1	N800594-S	Driveshaft bolt (4 required)
2	4602 H	Driveshaft
3	7052-A	Extension housing seal
4	7A034-A	Extension housing bushing



Extension Housing Seal and Bushing

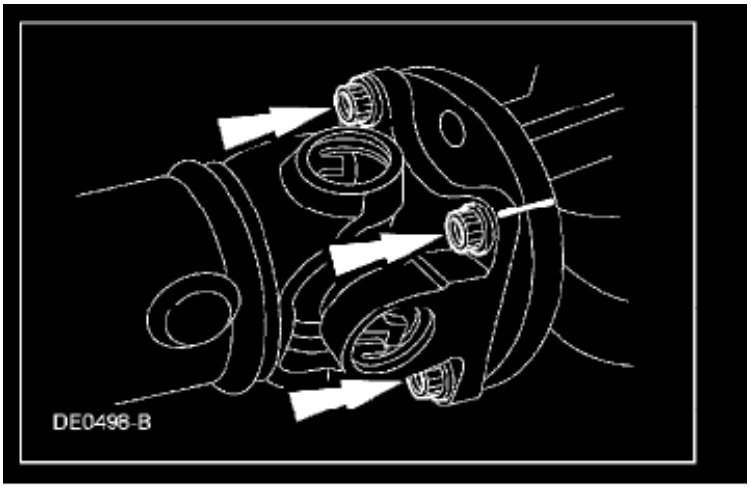
Removal

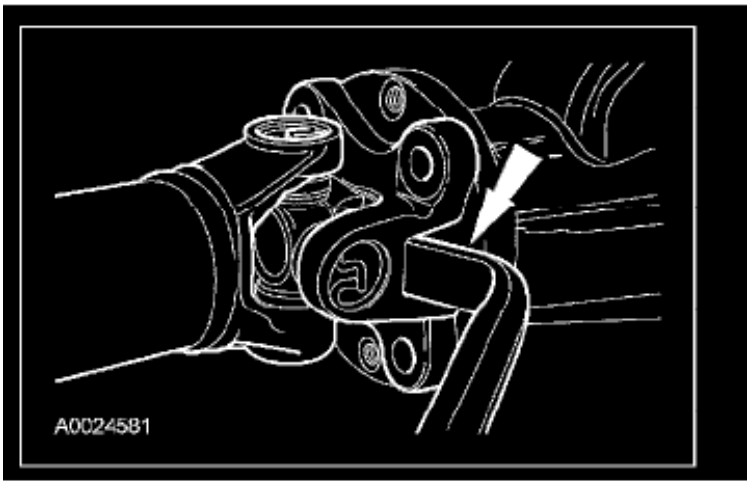
1. With the vehicle in NEUTRAL, position it on a hoist.

2. NOTE: To maintain initial driveshaft balance, mark the rear driveshaft yoke and axle flange so they can be installed in their original alignment.

Mark the rear driveshaft.

3. Remove the 4 rear driveshaft bolts.


DE0496-B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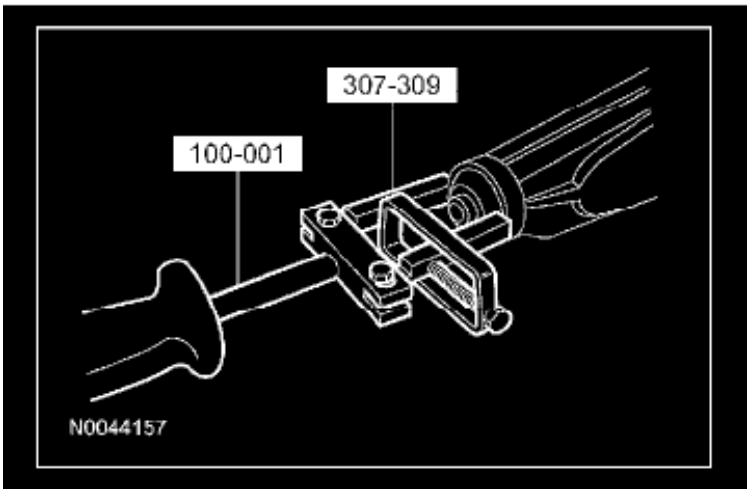

307-309
100-001
N0044157

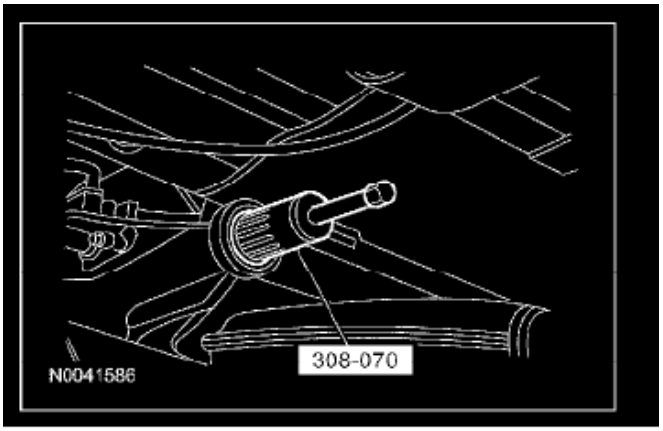
4. NOTE: Do not use a hammer.

Remove the rear driveshaft from the flange using a pry bar.

5. Using the special tools, remove the extension housing seal.

6. CAUTION: Use the extension housing bushing remover carefully so that the seal area is not damaged.

Using the special tool, remove the extension housing bushing.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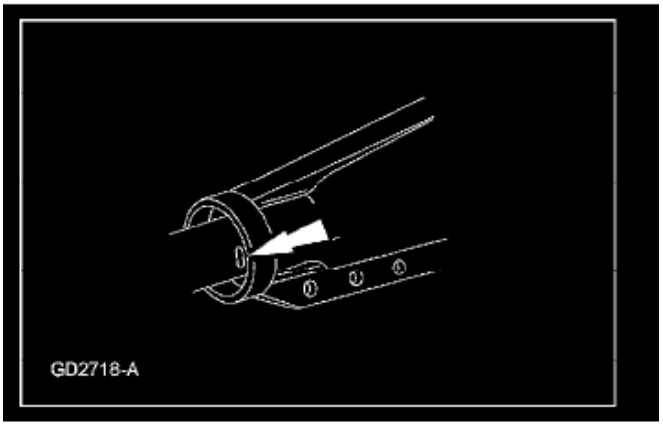
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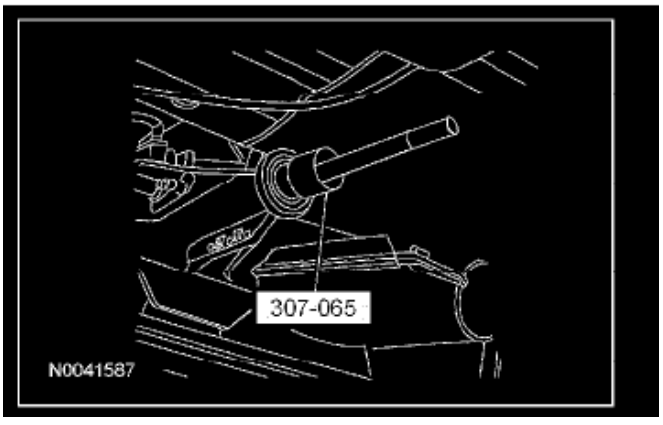

307-065
N0041587

Installation

1. CAUTION: The lube hole in the extension housing bushing must be aligned with the lube groove in the extension housing. This groove is

located at the 3 o'clock position when viewed from the rear. Failure to align the bushing can result in bushing damage.

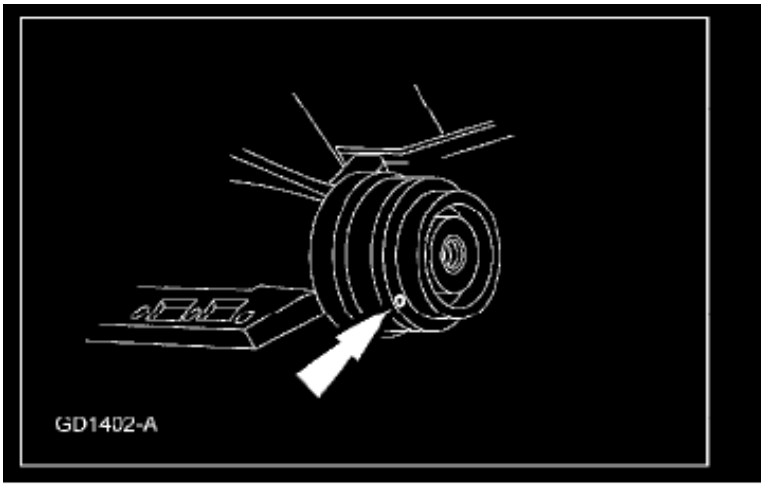
NOTE: Inspect the counterbore of the extension housing for burrs. Remove any burrs from the extension housing counterbore with an oil stone.

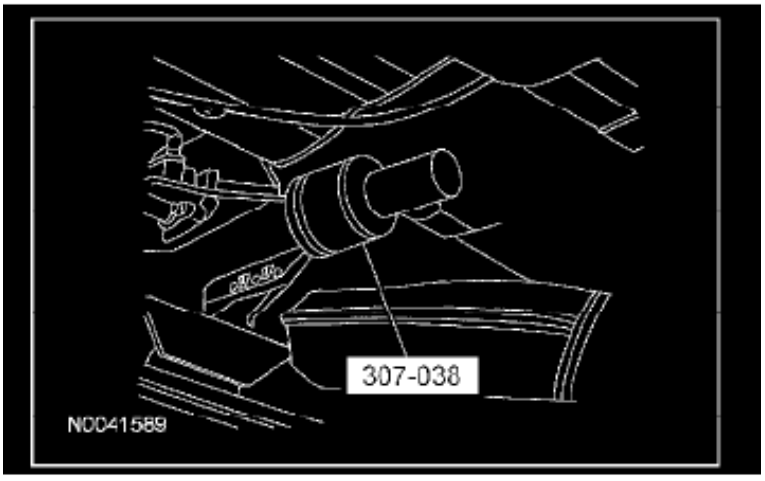
Position the extension housing bushing into the extension housing.

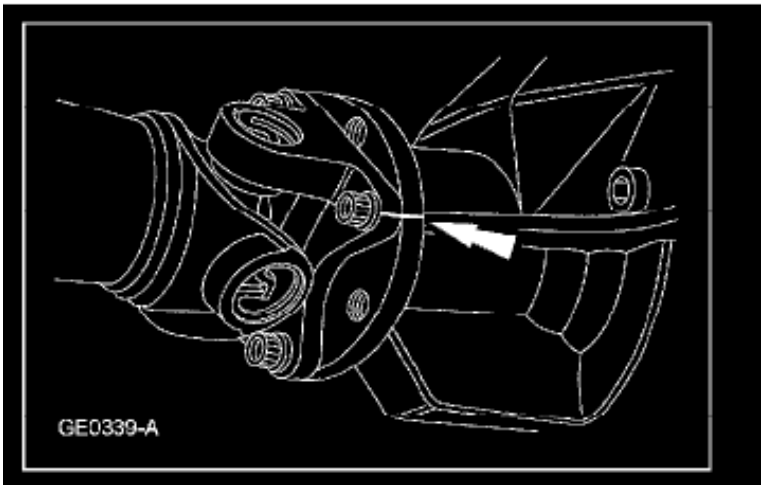
2. NOTE: The tool will bottom when bushing is in the correct position.

Using the special tool, install the extension housing bushing.

3. Position new extension housing seal with drain hole in the 6 o'clock position.


GD1402-A


307-038
N0041589


GE0339-A

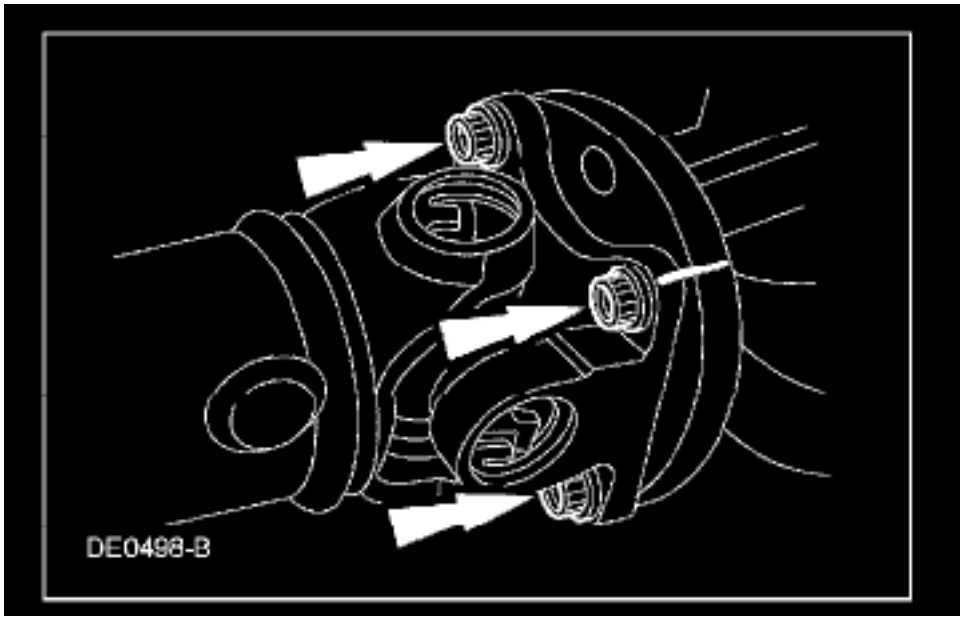
4. Using the special tool, install the extension housing seal.

5. NOTE: Inspect the driveshaft slip-yoke for wear and damage. Install a new component if required.

Align the driveshaft with the marks made during removal to make sure of correct balance.

6. With the marks aligned, install the rear driveshaft and bolts.

^ Tighten to 103 Nm (76 lb-ft).

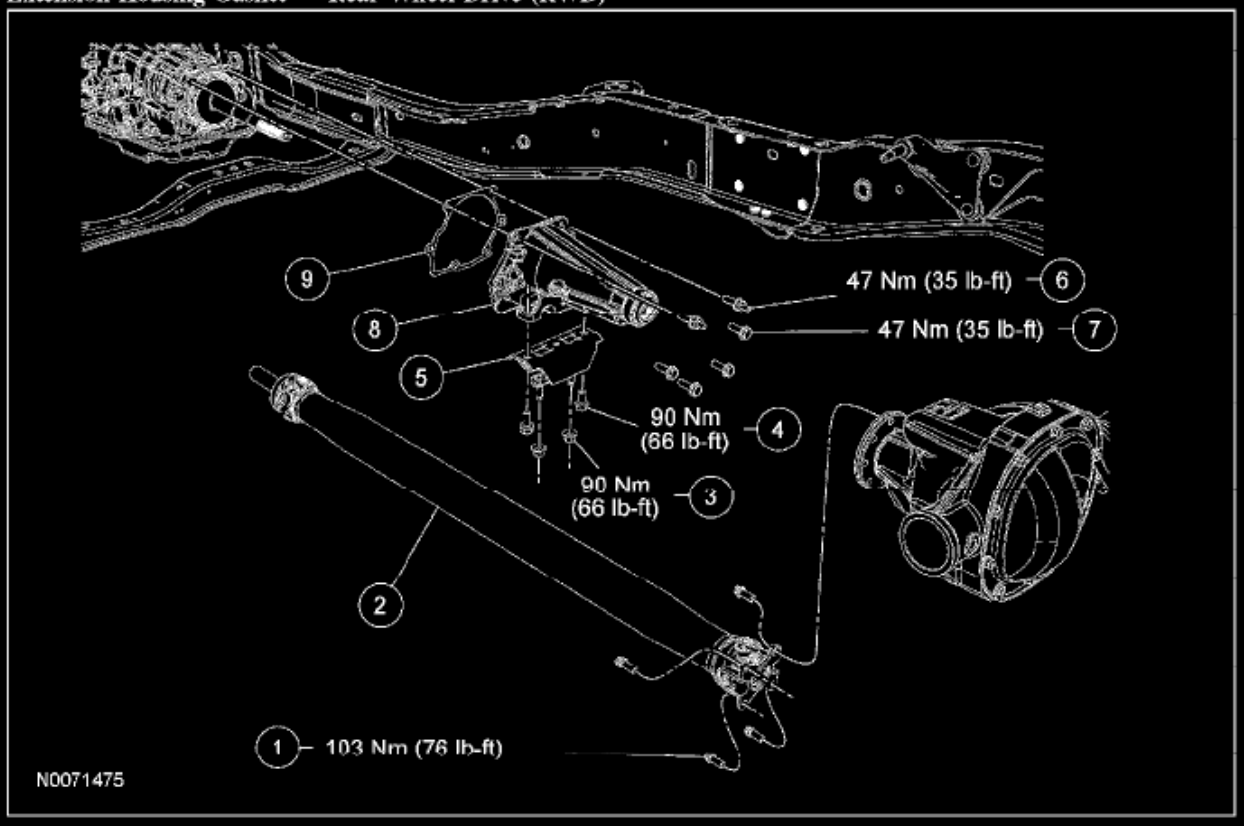


7. Fill the transmission to the correct fluid level with clean automatic transmission fluid and check for correct transmission operation.

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

Extension Housing Gasket — Rear Wheel Drive (RWD)



Item	Part Number	Description
1	N800594-S	Driveshaft bolt (4 required)
2	4e02-H	Driveshaft
3	N621945-S	Insulator nut (2 required)
4	390066	Insulator bolt (2 required)
5	6D091-A	Insulator
6	W711421-S	Extension housing stud (2 required)
7	E800152-S	Extension housing screw (4 required)

(Continued)

Item	Part Number	Description
8	7A039-C	Extension housing
9	7086-A	Extension housing gasket

Seals and Gaskets: Service and Repair Extension Housing Gasket

Extension Housing Gasket - Rear Wheel Drive (RWD)

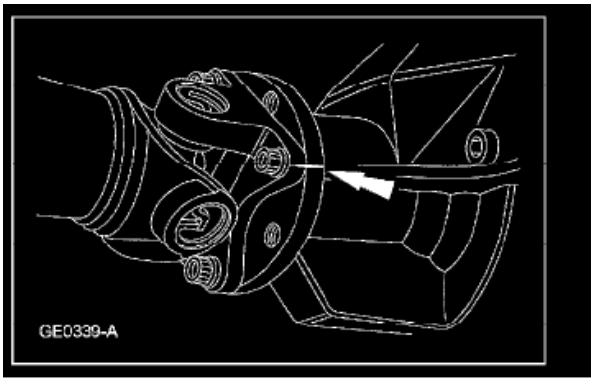
Extension Housing Gasket - Rear Wheel Drive (RWD)

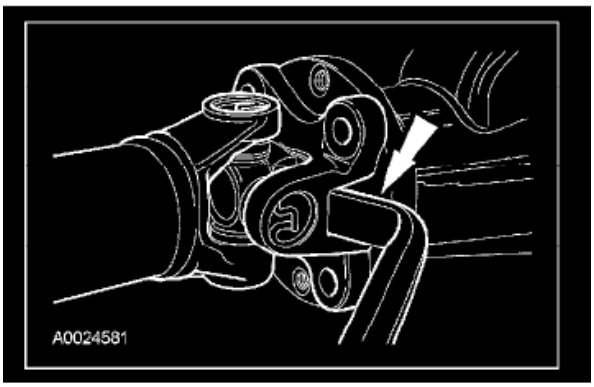
Removal

1. With the vehicle in NEUTRAL, position it on a hoist.

2. NOTE: To maintain initial driveshaft balance, mark the rear driveshaft yoke and axle flange so they can be installed in their original alignment.

Mark the rear driveshaft.


GE0339-A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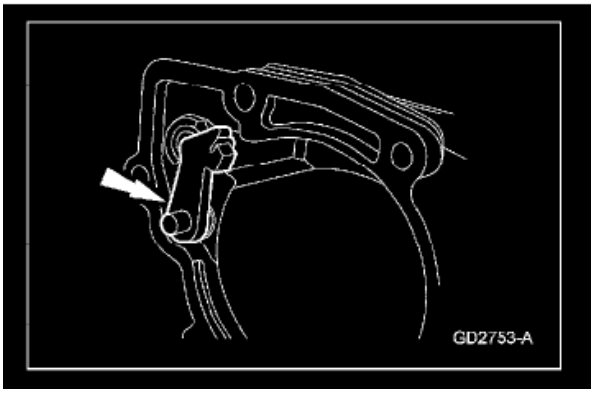

GD2753-A

3. Remove the 4 rear driveshaft bolts.

4. NOTE: Do not use a hammer.

Remove the rear driveshaft from the flange using a pry bar.

5. Remove the insulator nuts. 6. Raise and support the transmission. 7. Remove the insulator screws. 8. Remove the insulator. 9. Remove the extension housing screws and studs.

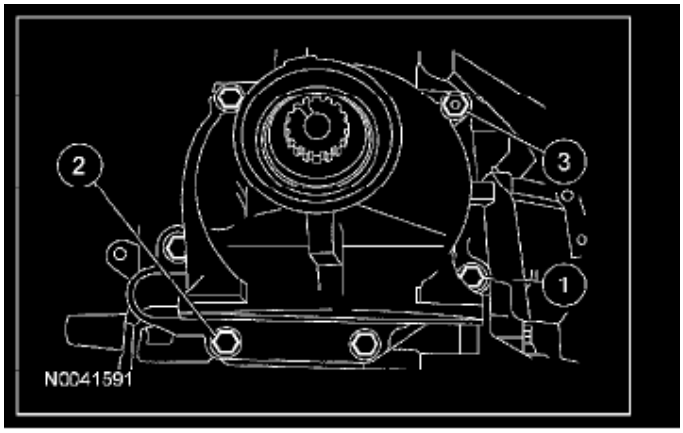
10. NOTE: The parking pawl, parking pawl return spring and parking pawl shaft could fall out during removal of the extension housing.

Remove the extension housing. Discard the extension housing gasket.

Installation

1. Clean the extension housing and install a new extension housing gasket. Make sure that the parking pawl, spring and shaft are correctly installed.

2. NOTE: Make sure the parking lever actuating rod is correctly seated into the case parking rod guide cup.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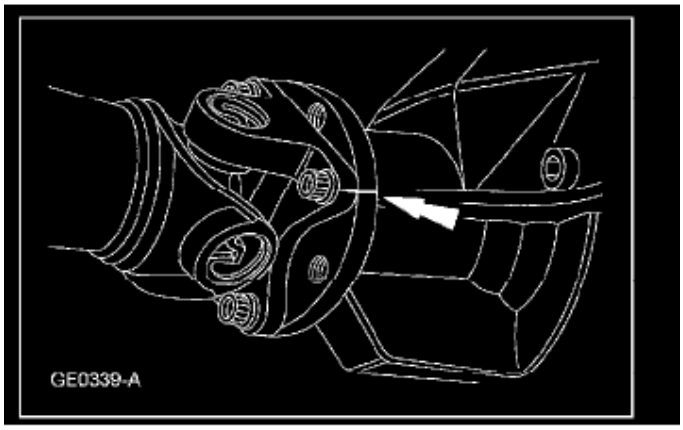
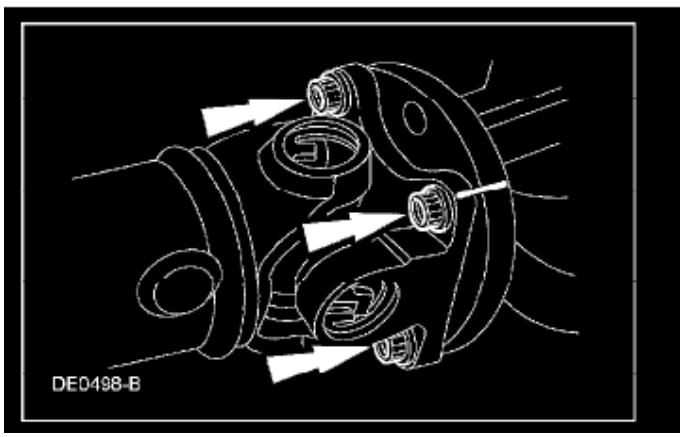

GE0339-A


DE0498-B

Install the extension housing. 1

Position the extension housing.

2 Install the extension housing screws.

3 Install the extension housing studs. ^

Tighten to 47 Nm (35 lb-ft).

3. Position the insulator on the extension housing. 4. Install the insulator-to-extension housing screws. 5. Install the insulator into the crossmember and tighten the insulator nuts.

^ Tighten to 90 Nm (66 lb-ft).

6. NOTE: Align the driveshaft with the marks made during removal to make sure of correct balance.

Align and install the rear driveshaft.

7. With the marks aligned, install the rear driveshaft and bolts.

^ Tighten to 103 Nm (76 lb-ft).

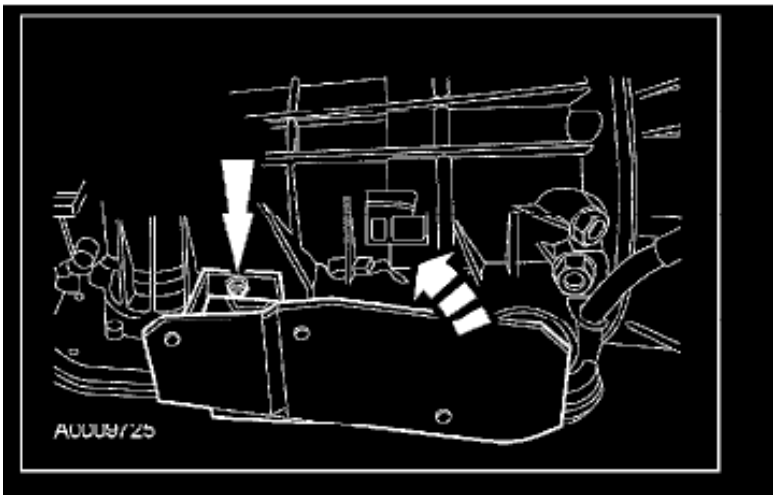
8. Fill the transmission with clean automatic transmission fluid to the correct level and check for correct transmission operation.

Special Tool(s)

ST1199-A	Installer, Shift Shaft Fluid Seal 307-050 (T74P-77498-A)
ST1633-A	Alignment Gauge, TR Sensor 307-351 (T97L-70010-A)

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V



Seals and Gaskets: Service and Repair Manual Control Lever Shaft and Seal

Manual Control Lever Shaft and Seal

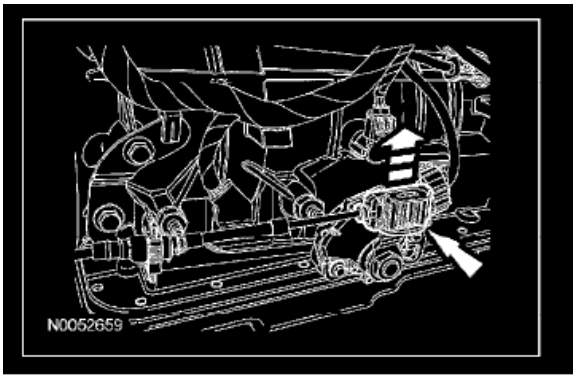
Removal

1. With the vehicle in NEUTRAL, position it on a hoist.

2. NOTE: If equipped, the transmission servo heat shield needs to be unclipped from the fluid pan rail and positioned aside for fluid pan removal.

If equipped, loosen the nut and position the heat shield aside.

3. Disconnect the selector lever cable from the manual control lever.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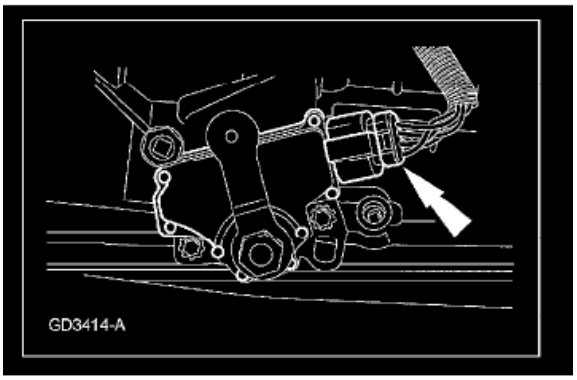
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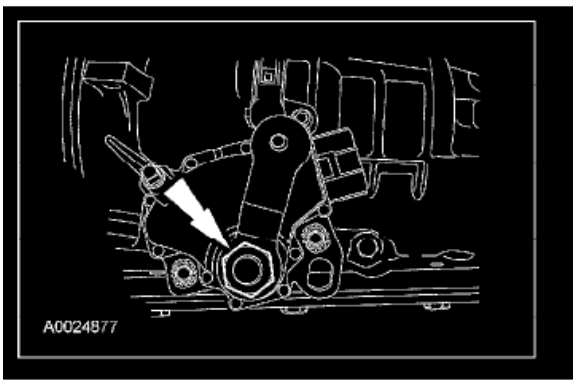
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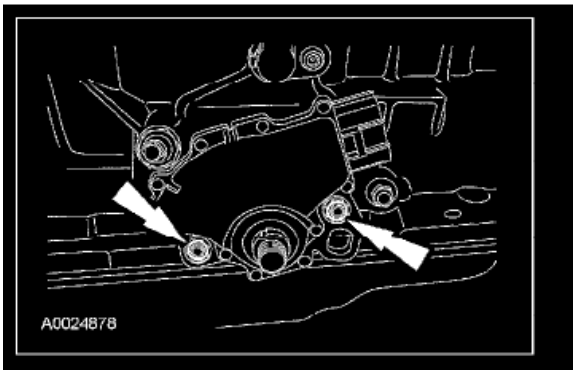
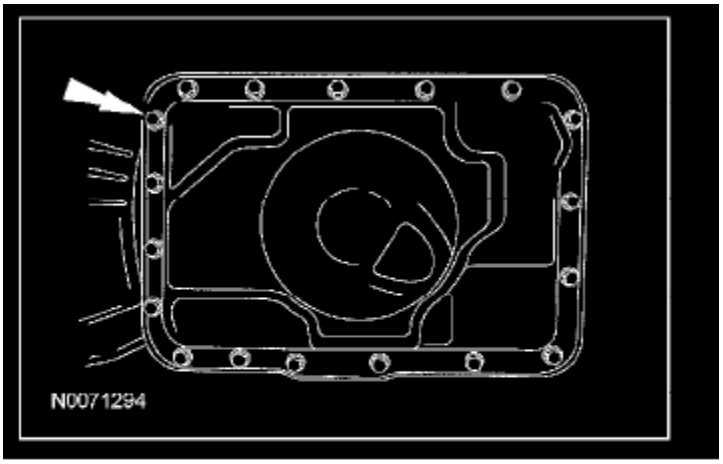

A0024878

4. Disconnect the digital transmission range (TR) sensor electrical connector.
5. Remove the manual control outer lever nut and manual control outer lever.
6. Remove the screws and the digital TR sensor.
7. Drain transmission fluid.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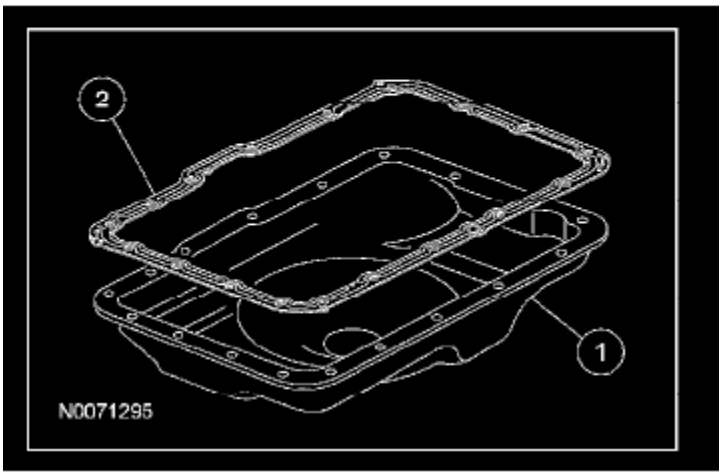
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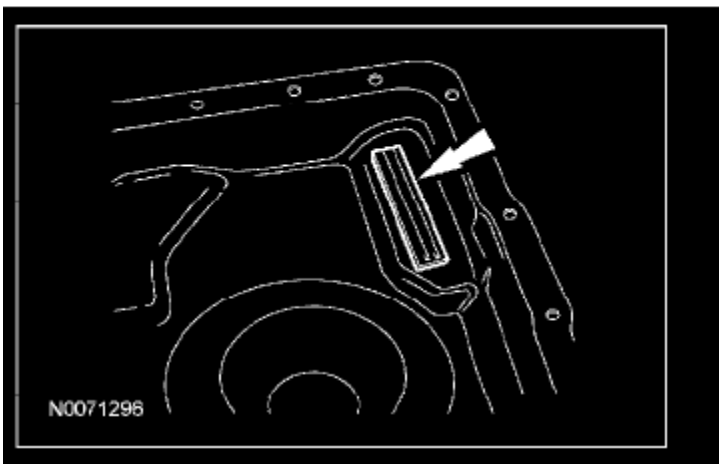
1
N0071295


N0071296

^ Remove all the transmission fluid pan screws except for 2 in the front. Loosen the 2 front transmission fluid pan screws. Pry the rear of the transmission fluid pan down and allow fluid to drain. After fluid is drained, remove the front 2 transmission fluid pan screws.

8. NOTE: The transmission fluid pan gasket is reusable. Clean and inspect for damage, if not damaged, the gasket should be reused.

Remove the transmission fluid pan. 1

Remove the transmission fluid pan.

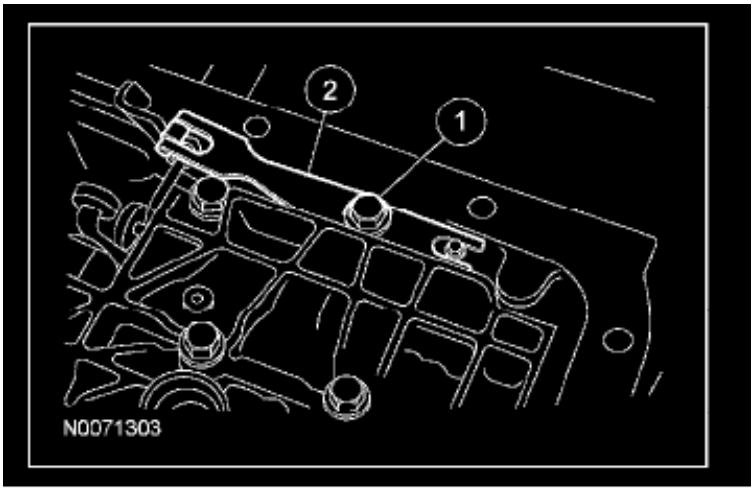
2 Remove the transmission fluid pan gasket.

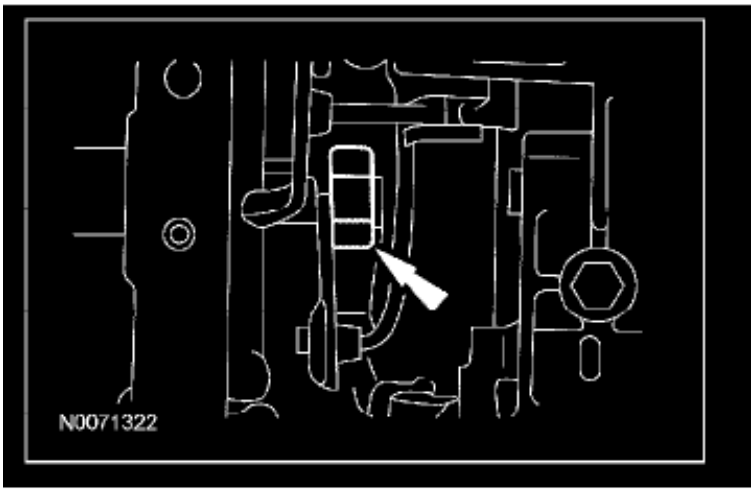
9. Clean and inspect the transmission fluid pan and magnet. Clean all mating surfaces.

10. Remove the manual control valve detent lever spring.

1 Remove the manual control valve detent lever spring screw.

2 Remove the manual control valve detent lever spring.


2
1
N0071303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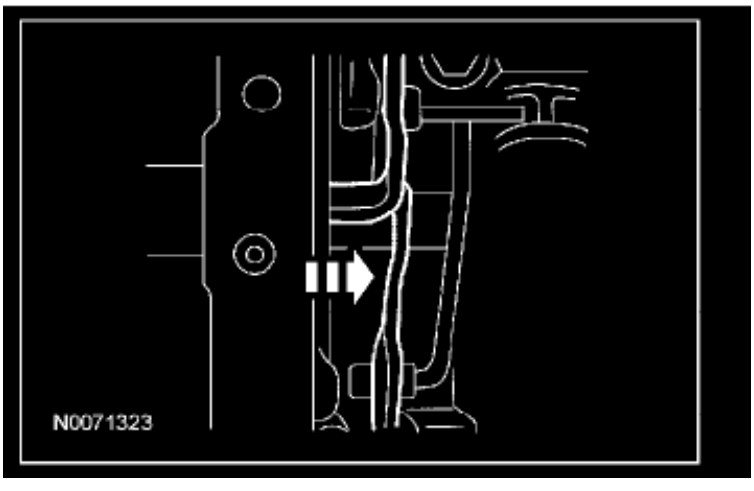

N0071323

11. CAUTION: Do not damage the valve inner lever pin.

Remove the manual valve inner lever nut.

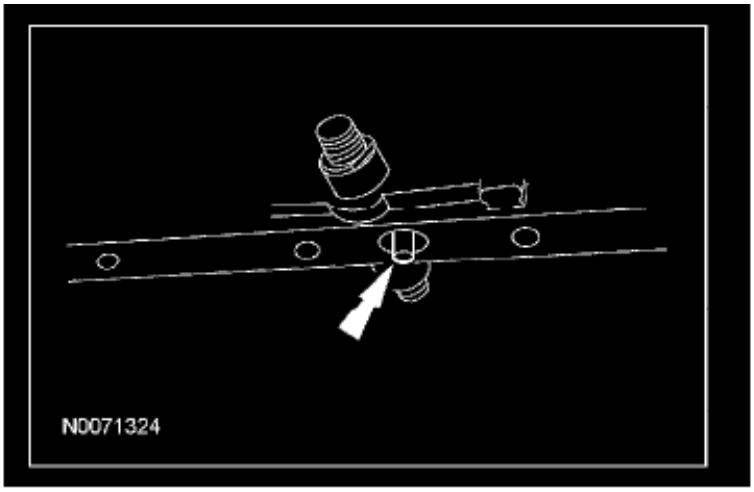
12. Separate the manual valve inner lever and the parking lever actuating rod.

13. CAUTION: Do not damage the case fluid pan rail.

Remove the manual control lever shaft spring pin. ^

Tap lightly on each side of the manual control lever shaft spring pin with a drift punch.

^ Pry the spring pin out of its bore.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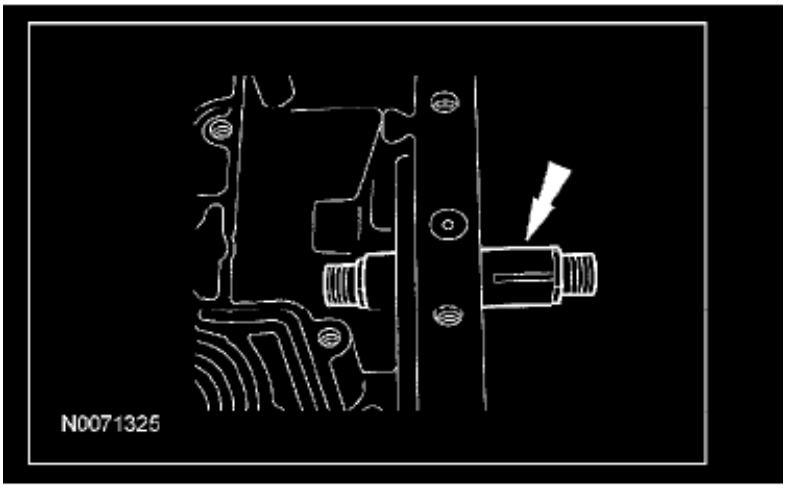
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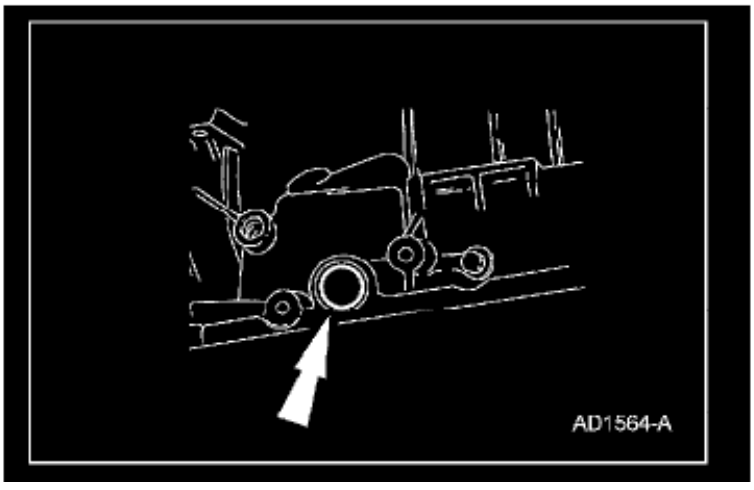

AD1564-A

14. Remove the manual control lever shaft.

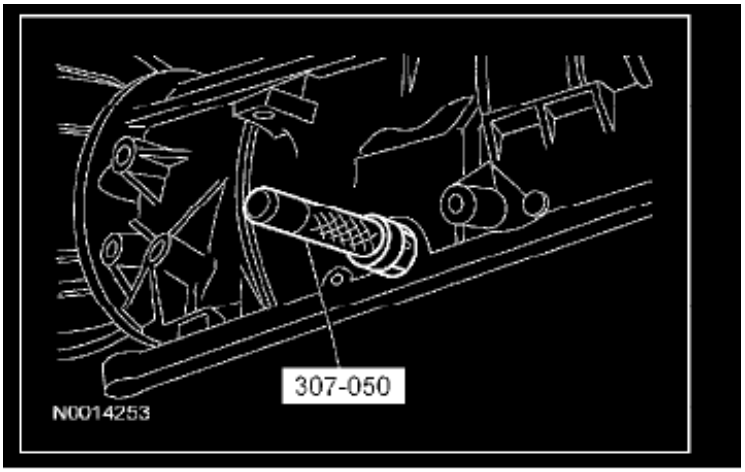
15. CAUTION: Do not damage the bore.

Remove the manual control lever shaft seal.

Installation

1. Using the special tool, install the manual control lever shaft seal.

^ Lubricate the manual control lever shaft seal with petroleum jelly.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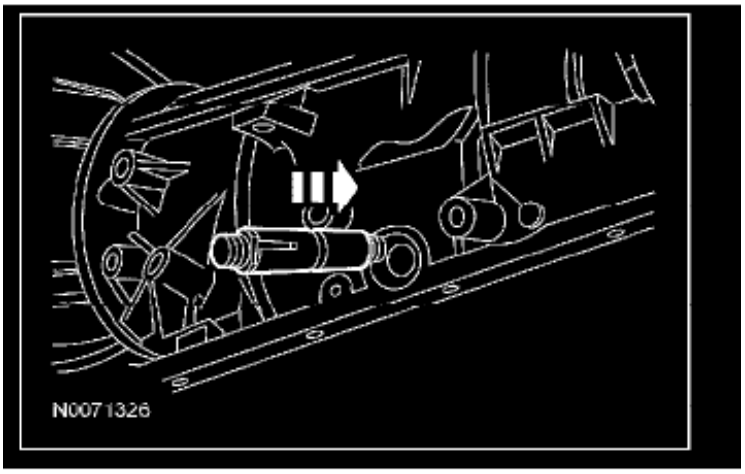
N0014253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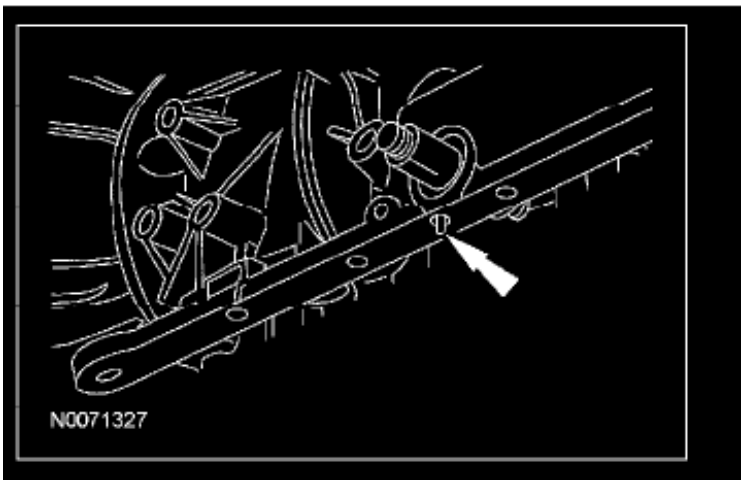

N0071327

2. Install the manual control lever shaft.

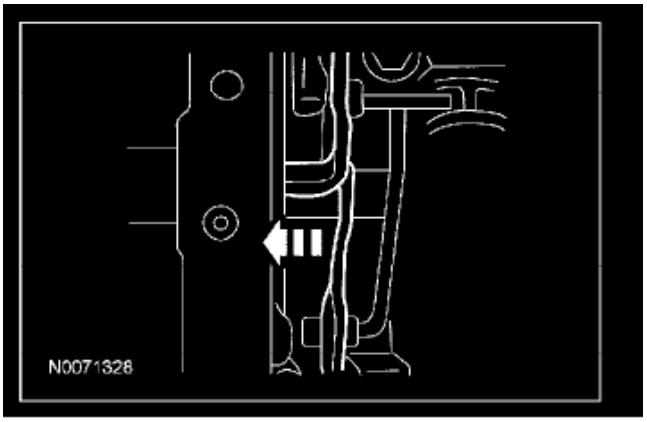
3. CAUTION: Use care not to damage the fluid pan rail surface when installing the retaining pin.

Align the manual control lever shaft alignment groove with the manual control lever shaft spring pin bore in the transmission case. ^

Tap the manual control lever shaft spring pin into the transmission case.

4. Align flats of the manual valve inner lever with flats on the manual control lever shaft. Install the manual valve inner lever and parking lever

actuating rod onto the manual control lever shaft.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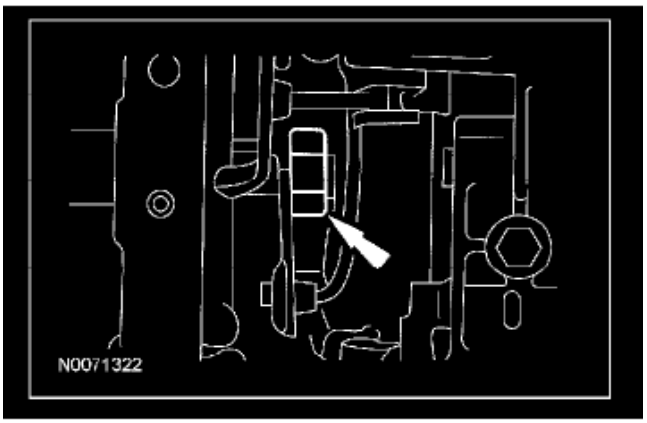
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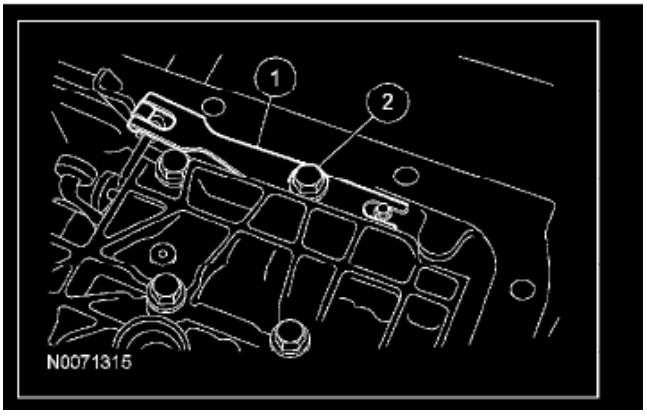

1
2
N0071315

5. CAUTION: Do not bend the manual valve inner lever pin.

Install the manual valve inner lever nut. ^

Tighten to 48 Nm (35 lb-ft).

6. NOTE: Park pawl actuating rod must be correctly installed into parking pawl and guide cup located in extension housing. Verify park linkage

function.

Verify that the output shaft is locked in the PARK position.

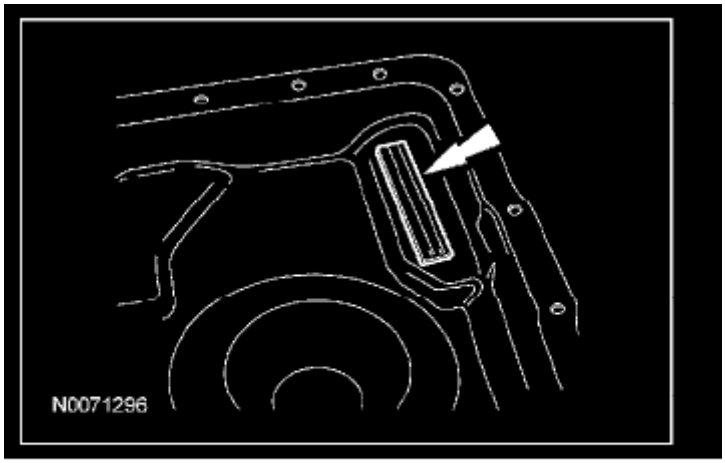
7. Rotate the manual lever into the NEUTRAL position and install the manual valve detent spring.

1 Install the spring.

2 Install the screw. ^

Tighten to 10 Nm (89 lb-inch).

8. Position the oil pan magnet in the transmission fluid pan.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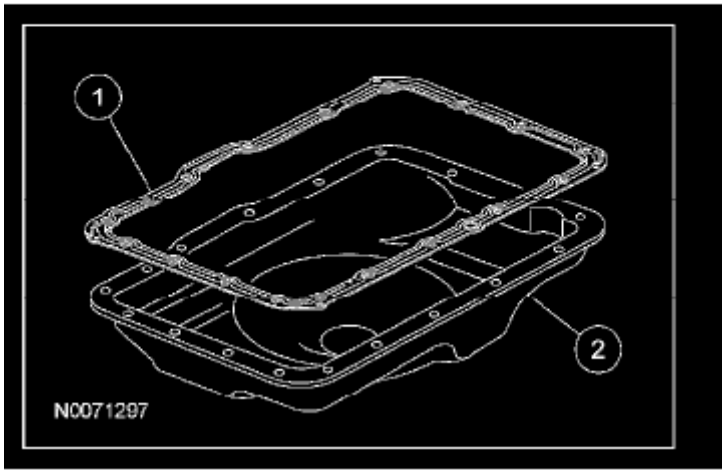
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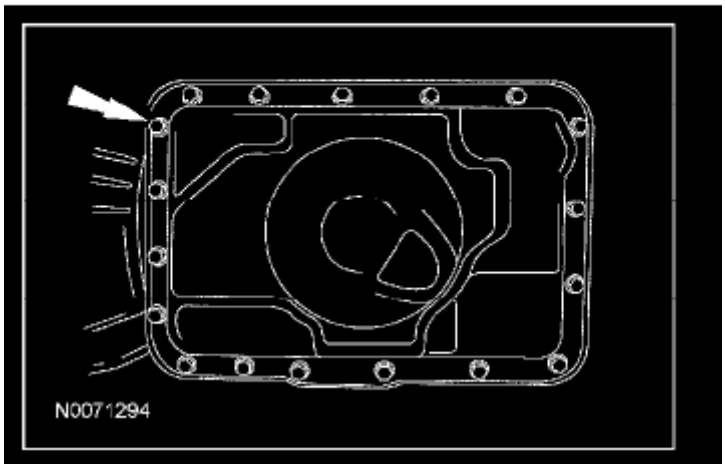

N0071294

9. NOTE: The transmission fluid pan gasket is reusable. Clean and inspect for damage, if not damaged, the gasket should be reused.

Install the transmission fluid pan. 1

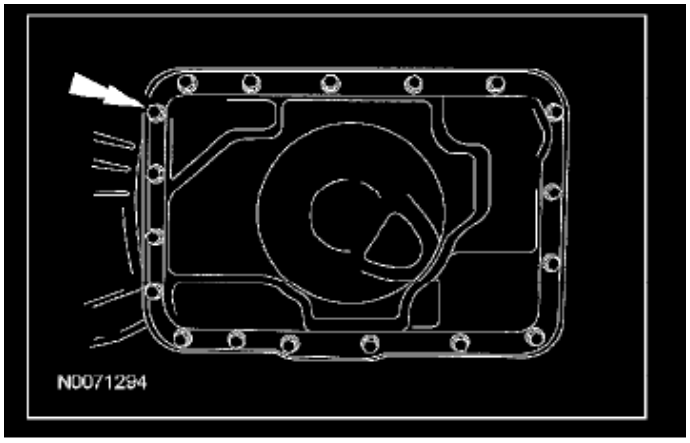
Position the transmission fluid pan gasket on the transmission fluid pan.

2 Install and align the transmission fluid pan.

10. Loosely install the transmission fluid pan screws.

11. Tighten the transmission fluid pan screws in a crisscross pattern.

^ Tighten to 10 Nm (89 lb-inch).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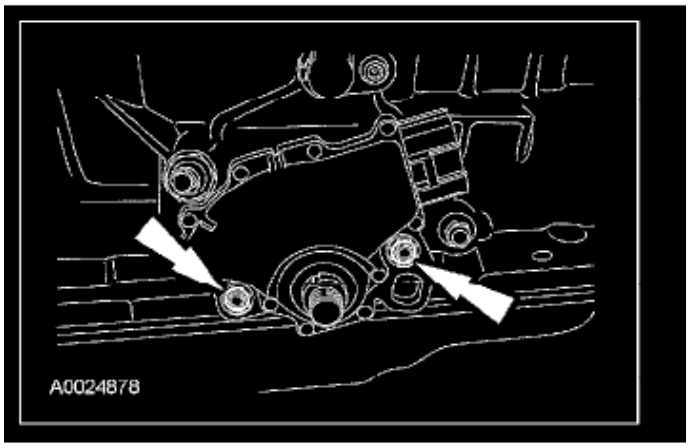
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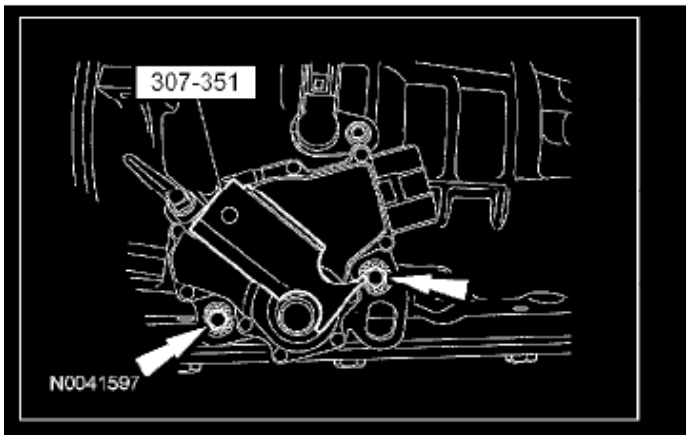

307-351
N0041597

12. CAUTION: The digital transmission range (TR) sensor must fit flush against the boss on the case to prevent damage to the sensor.

Install the digital TR sensor and loosely install the screws.

13. CAUTION: Tightening one screw before tightening the other may cause the sensor to bind or become damaged.

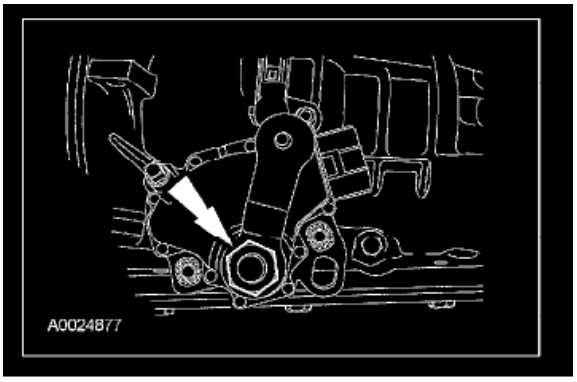
NOTE: The manual lever must be in the NEUTRAL position.

Using the special tool, align the digital TR sensor and tighten screws in an alternating sequence. ^

Tighten to 10 Nm (89 lb-inch).

14. Install the manual control outer lever and nut.

^ Tighten to 48 Nm (35 lb-ft).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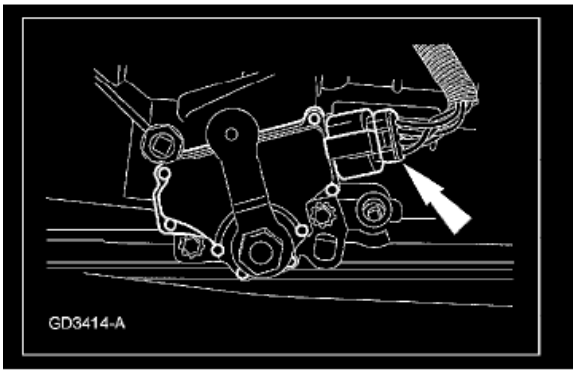
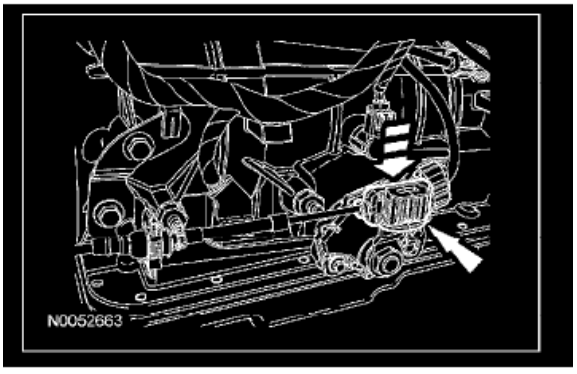

GD3414-A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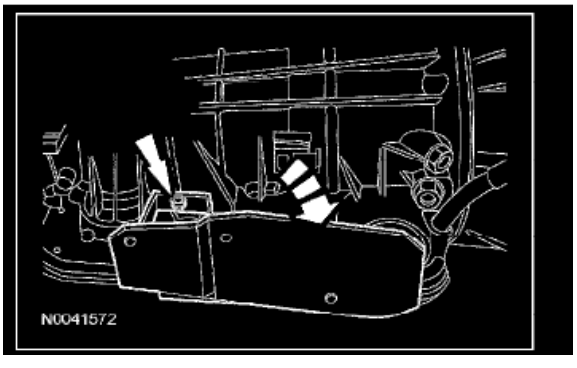

N0041572

15. Connect the digital TR sensor electrical connector.

16. Connect the selector lever cable to the manual control lever.

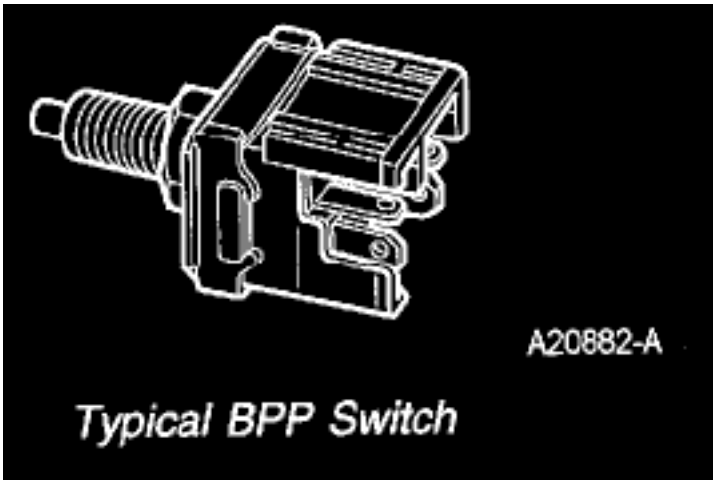
17. If equipped, position the servo heat shield over the servos and clip it to the pan rail.

^ Tighten to 10 Nm (89 lb-inch).

18. NOTE: Start with a minimum of 3.7L (4 qt) clean automatic transmission fluid.

Fill transmission with clean automatic transmission fluid to the correct fluid level.

19. Apply the park brake and start the engine. 20. Move the range selector lever through all the gears. 21. Check the transmission fluid level.



Brake Switch - TCC: Description and Operation

BRAKE PEDAL POSITION (BPP) SWITCH

Typical BPP Switch

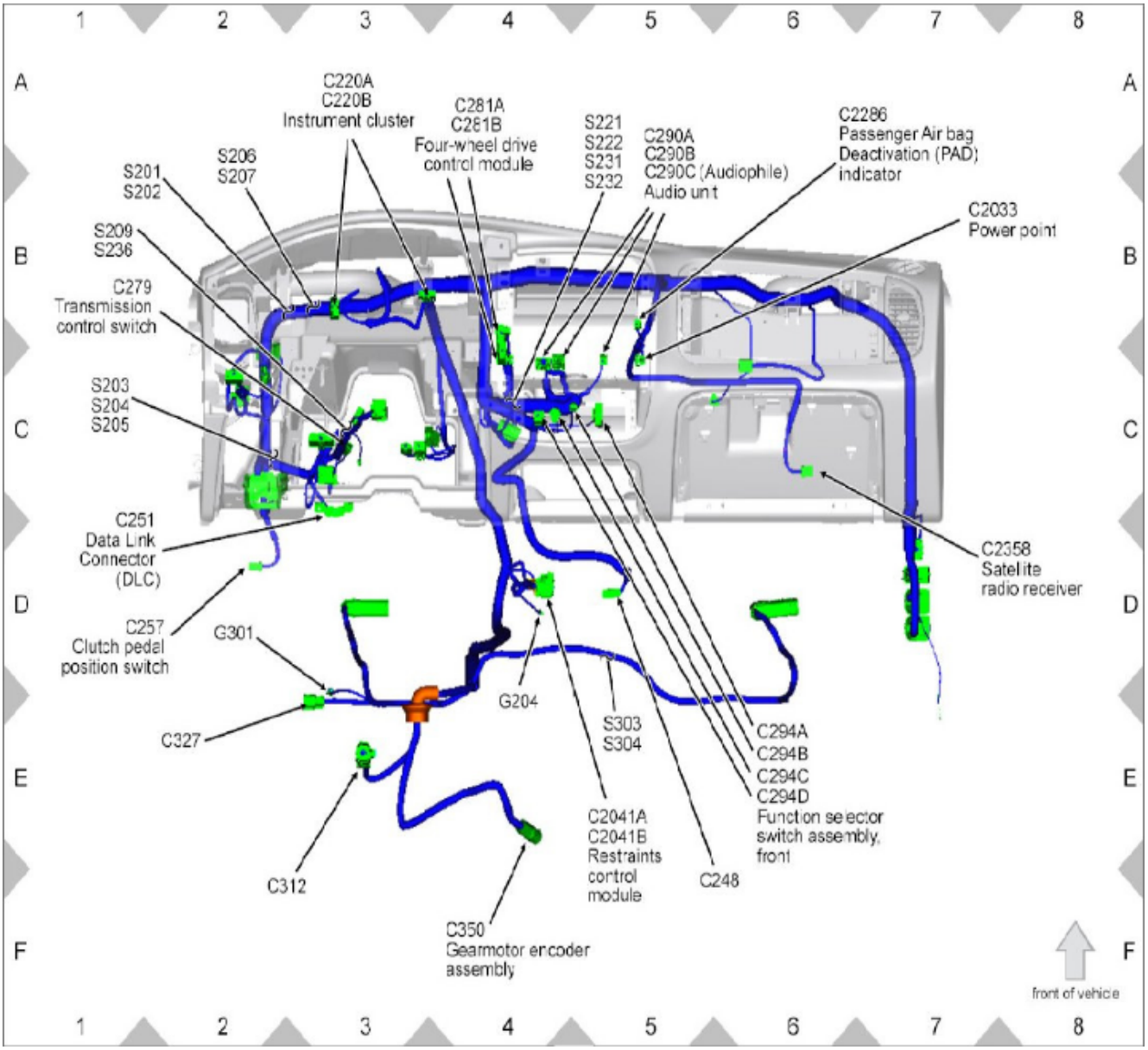
The BPP switch is sometimes referred to as the stoplamp switch. The BPP switch provides a signal to the PCM indicating that the brakes are applied. The BPP switch is normally open and is mounted on the brake pedal support. Depending on the vehicle application the BPP switch can be hardwired as follows:

- to the PCM supplying battery positive voltage (B+) when the vehicle brake pedal is applied.

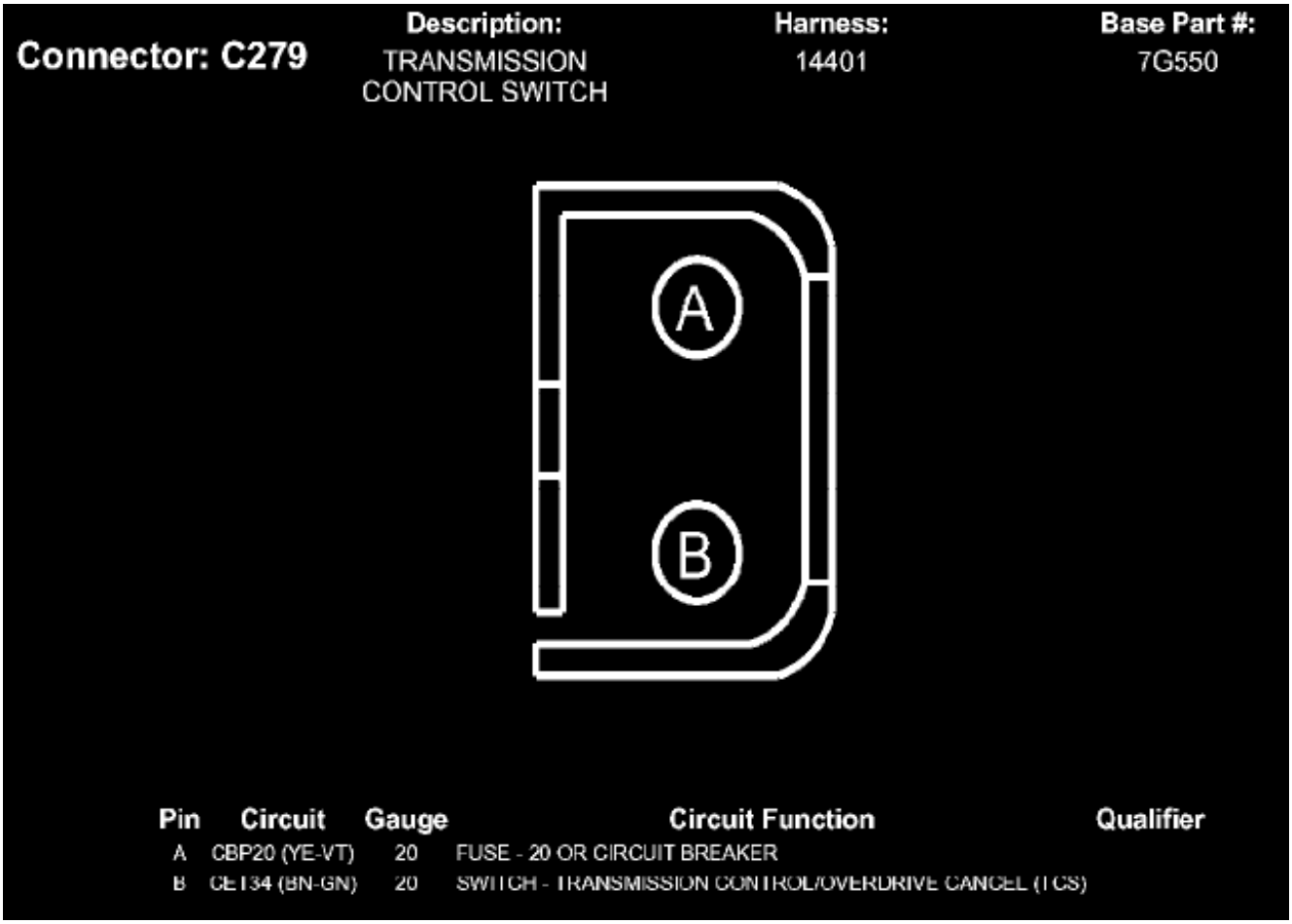
- to the antilock brake system (ABS) module, or lighting control module (LCM), the BPP signal is then broadcast over the network to be received by the PCM.

- to the ABS traction control/stability assist module. The ABS module interprets the BPP switch input along with other ABS inputs and generates an output called the driver brake application (DBA) signal. The DBA signal is then sent to the PCM and to other BPP signal users.

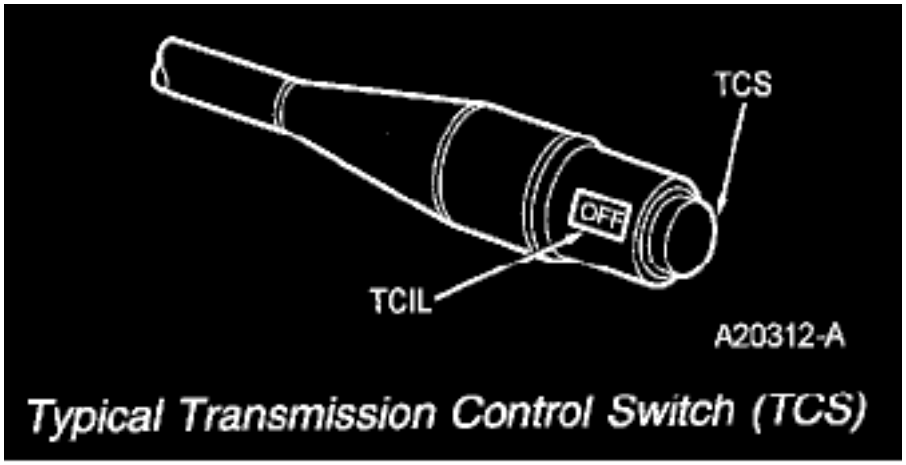
Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Transmission and Drivetrain > Automatic Transmission/Transaxle > Sensors and Switches - A/T > Transmission Mode Switch, A/T > Component Information > Locations



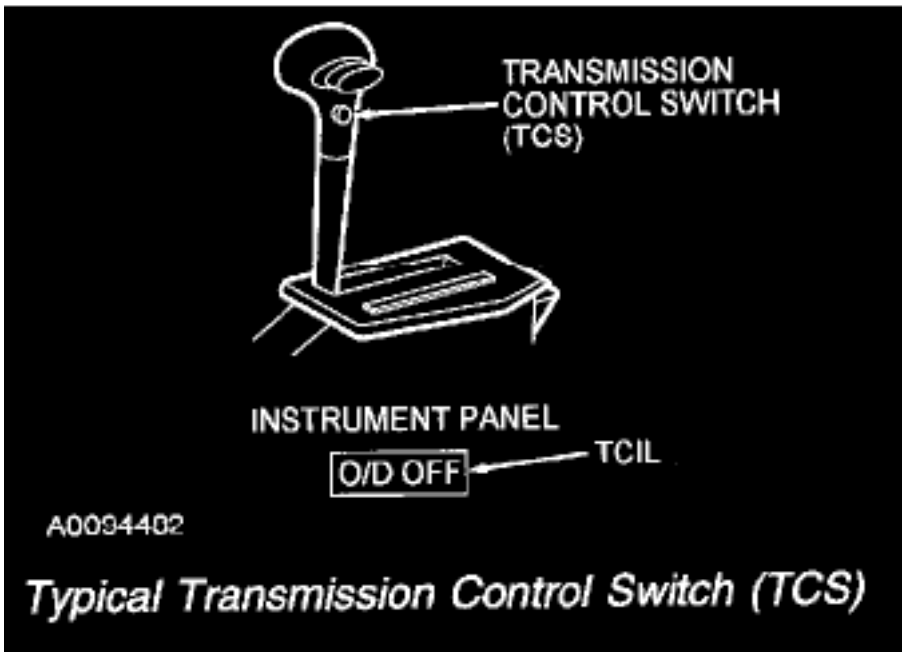
View 151-12


Connector: C279
Description:
TRANSMISSION CONTROL SWITCH
Harness:
14401
Base Part #:
7G550
A
B
Pin Circuit Gauge Circuit Function Qualifier
A CBP20 (YE-VT) 20 FUSE - 20 OR CIRCUIT BREAKER
B CE134 (BN-GN) 20 SWITCH - TRANSMISSION CONTROL/OVERDRIVE CANCEL (TCS)

C279



Typical Transmission Control Switch (TCS)



Typical Transmission Control Switch (TCS)

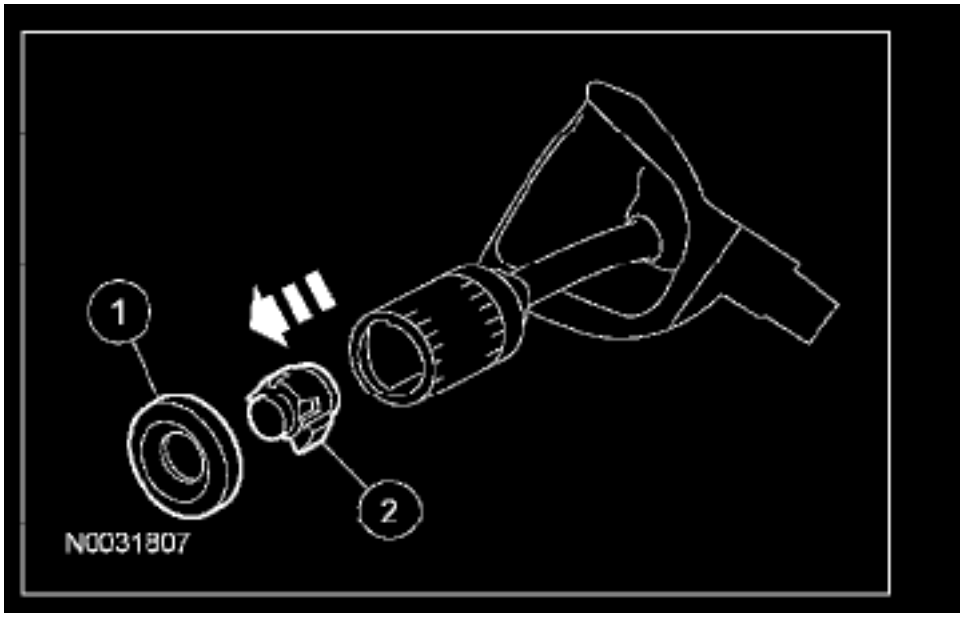
Transmission Mode Switch: Description and Operation

TRANSMISSION CONTROL SWITCH (TCS)

Typical Transmission Control Switch (TCS)

Typical Transmission Control Switch (TCS)

The TCS signals the PCM with VPWR whenever the TCS is pressed. On vehicles with this feature, the transmission control indicator lamp (TCIL) illuminates when the TCS is cycled to disengage overdrive.



Transmission Mode Switch: Service and Repair

Transmission Control (TC) Switch

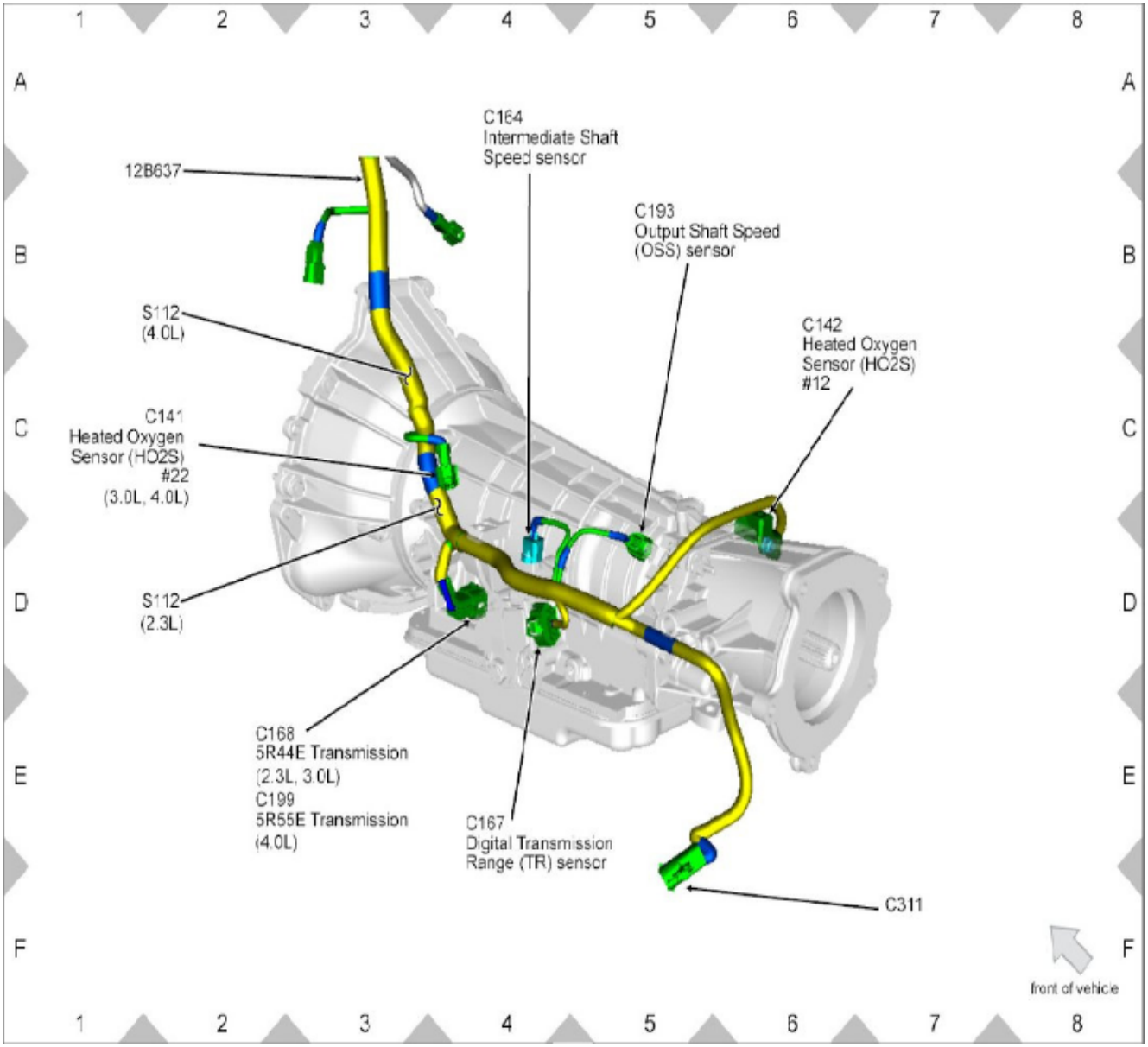
Removal and Installation

1. Remove the transmission control (TC) switch.

1 Remove the TC switch cover.

2 Remove the TC switch.

2. To install, reverse the removal procedure.


C164
Intermediate Shaft
Speed sensor
12B637
C193
Output Shaft Speed
(OSS) sensor
S112
(4.0L)
C142
Heated Oxygen
Sensor (HO2S)
#12
C141
Heated Oxygen
Sensor (HO2S)
#22
(3.0L, 4.0L)
S112
(2.3L)
C168
5R44E Transmission
(2.3L, 3.0L)
C199
5R55E Transmission
(4.0L)
C167
Digital Transmission
Range (TR) sensor
C311
front of vehicle

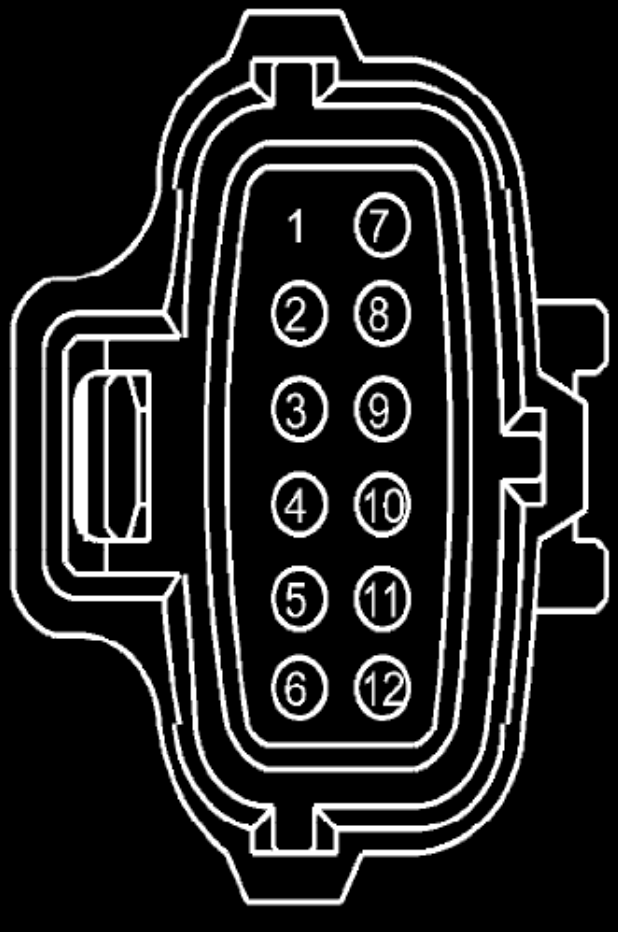
View 151-10

Connector: C167

Description: DIGITAL TRANSMISSION RANGE (TR) SENSOR

Harness: 12B637

Base Part #: 7F293



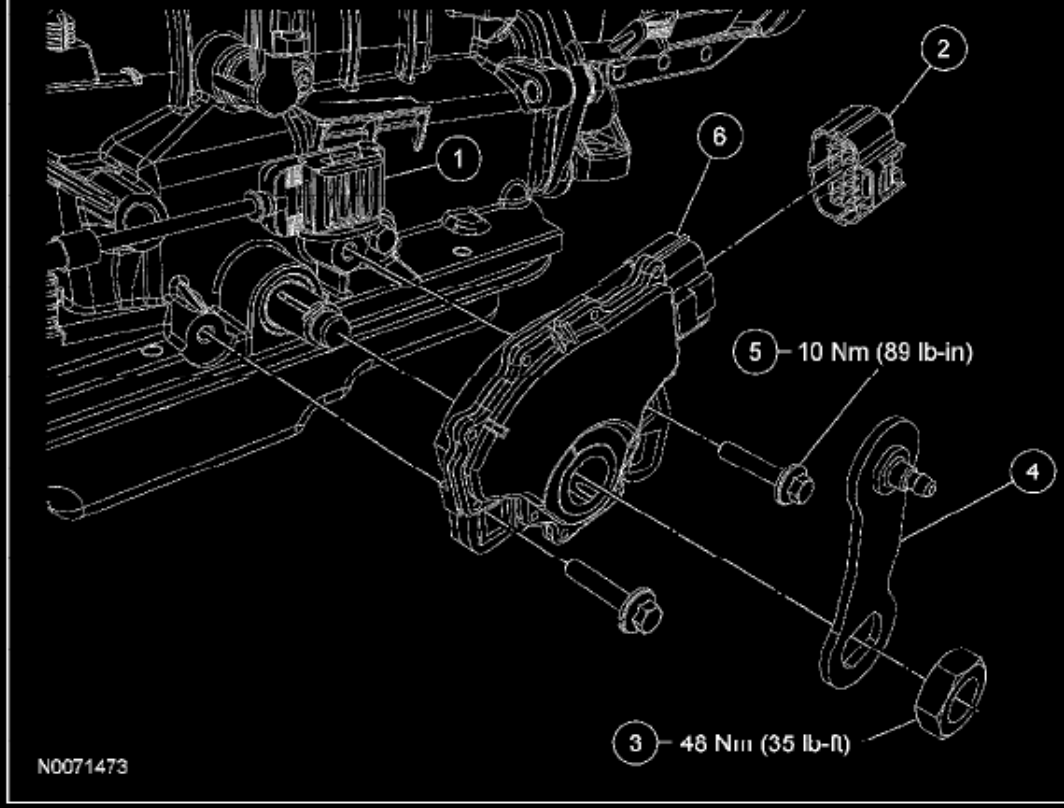
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	RE406 (GY-VT)	18	SIGNAL RETURN	
3	VET28 (GY-VT)	20	TR3A	
4	VET29 (VT-WH)	20	TR1	
5	VET30 (YE)	20	TR2	
6	VET31 (BU-OG)	20	TR4	
7	GD108 (BK-VT)	18	GROUND	4x4
8	CCF20 (GY-VT)	20	NETURAL SENSE	4x4
9	CBP20 (YE-VT)	18	FUSED POWER FEED	
10	CET40 (GN-OG)	20	STARTER CONTROL	
11	CET41 (BN-YE)	18	BACK UP	
12	CBP21 (BU-GY)	20	STARTER TO STARTER INTERRUPT RELAY	

C167

Special Tool(s)

ST1633-A	Alignment Gauge, TR Sensor 307-351 (T97L-70010-A)

Digital Transmission Range (TR) Sensor



Item	Part Number	Description
1	7E395-A	Selector lever cable
2	—	Digital transmission range (TR) sensor electrical connector
3	W701271-S	Manual control lever nut
4	7A256-A	Manual control lever
5	N806933-S	Digital TR sensor screw (2 required)
6	7F293-A	Digital TR sensor

Transmission Position Switch/Sensor: Service and Repair

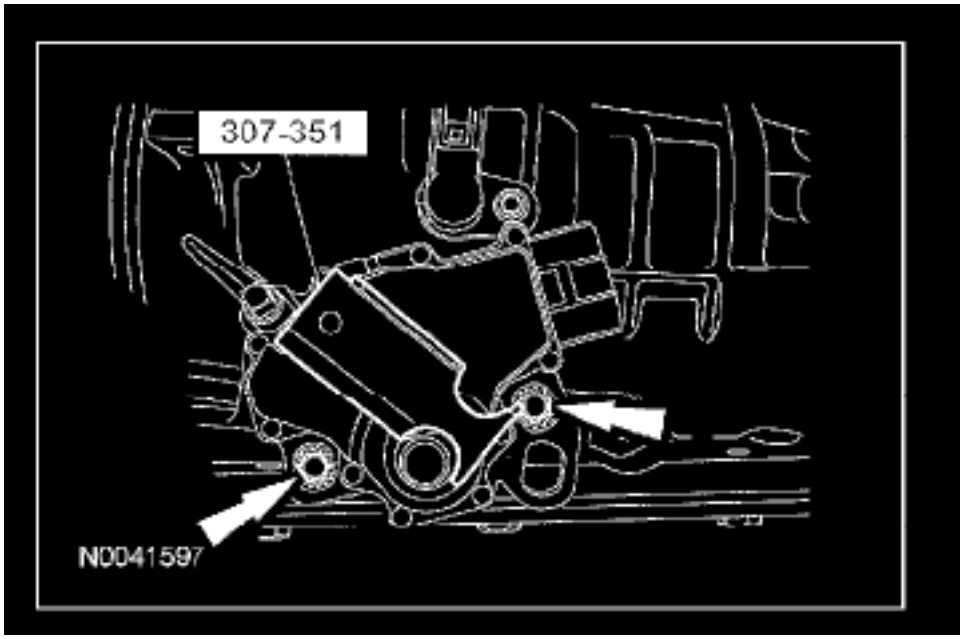
Digital Transmission Range (TR) Sensor

Digital Transmission Range (TR) Sensor

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the selector lever cable from the manual control lever. 3. Disconnect the digital transmission range (TR) sensor electrical connector. 4. Remove the manual control outer lever nut and manual control outer lever. 5. Remove the screws and the digital TR sensor.

Installation



1. CAUTION: The digital transmission range (TR) sensor must fit flush against the boss on the case to prevent damage to the sensor.

Install the digital TR sensor and loosely install the screws.

2. CAUTION: Tightening one screw before tightening the other may cause the sensor to bind or become damaged.

NOTE: The manual lever must be in the NEUTRAL position.

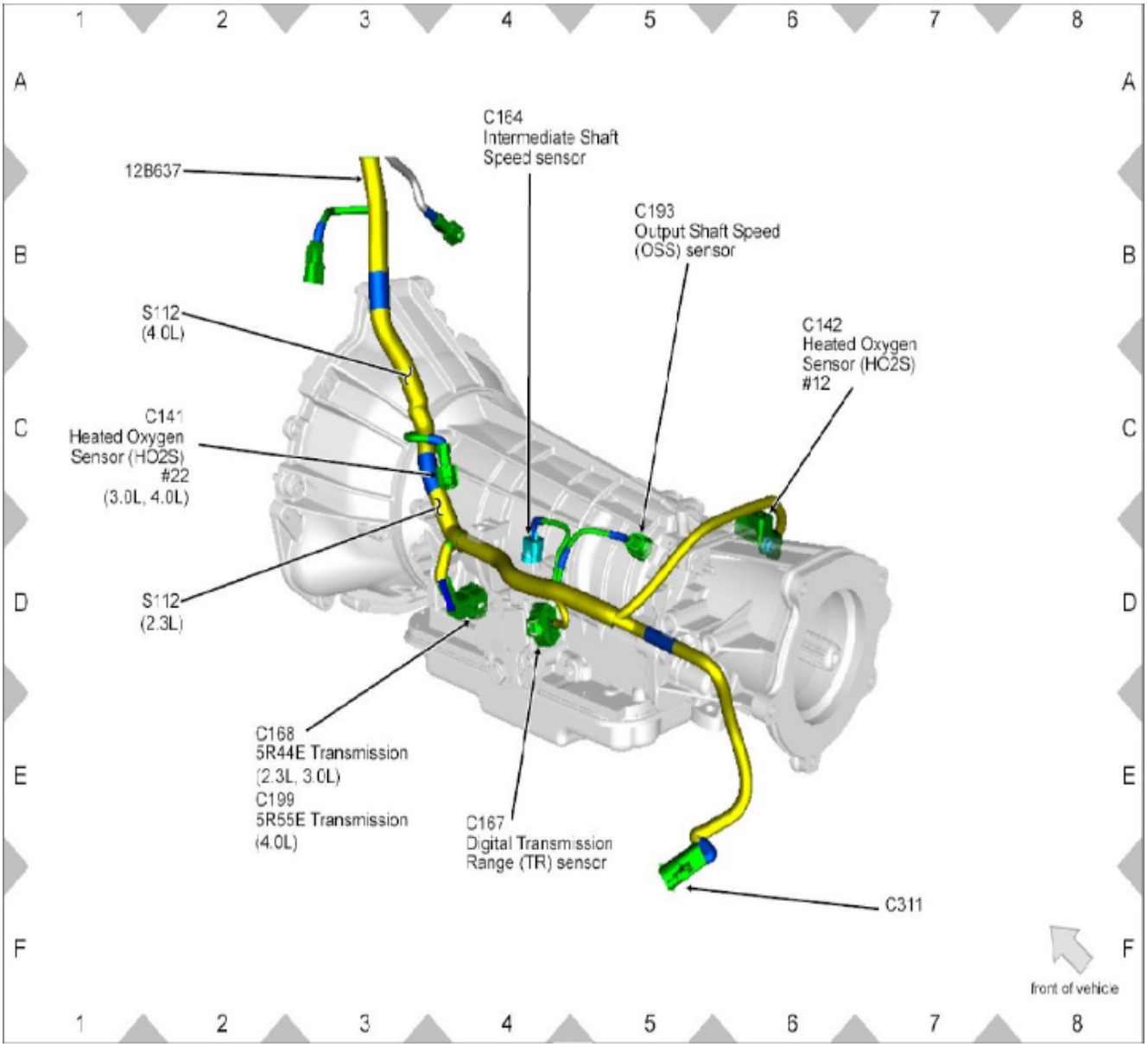
Using the special tool, align the digital TR sensor and tighten screws in an alternating sequence. ^

Tighten to 10 Nm (89 lb-inch).

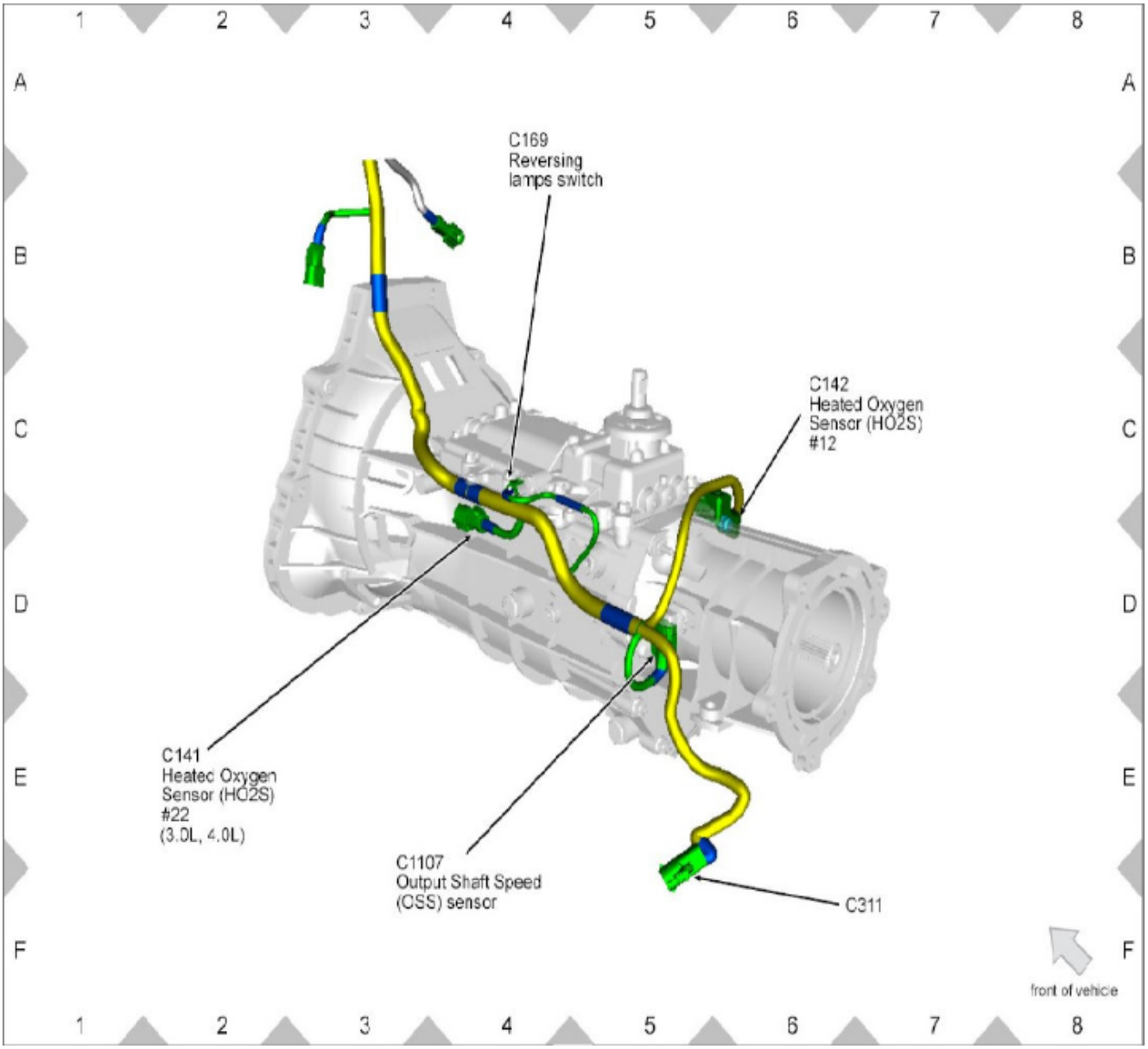
3. Install the manual control outer lever and nut.

^ Tighten to 48 Nm (35 lb-ft).

4. Connect the digital TR sensor electrical connector. 5. Connect the selector lever cable to the manual control lever. 6. Verify that the selector lever cable is adjusted correctly.

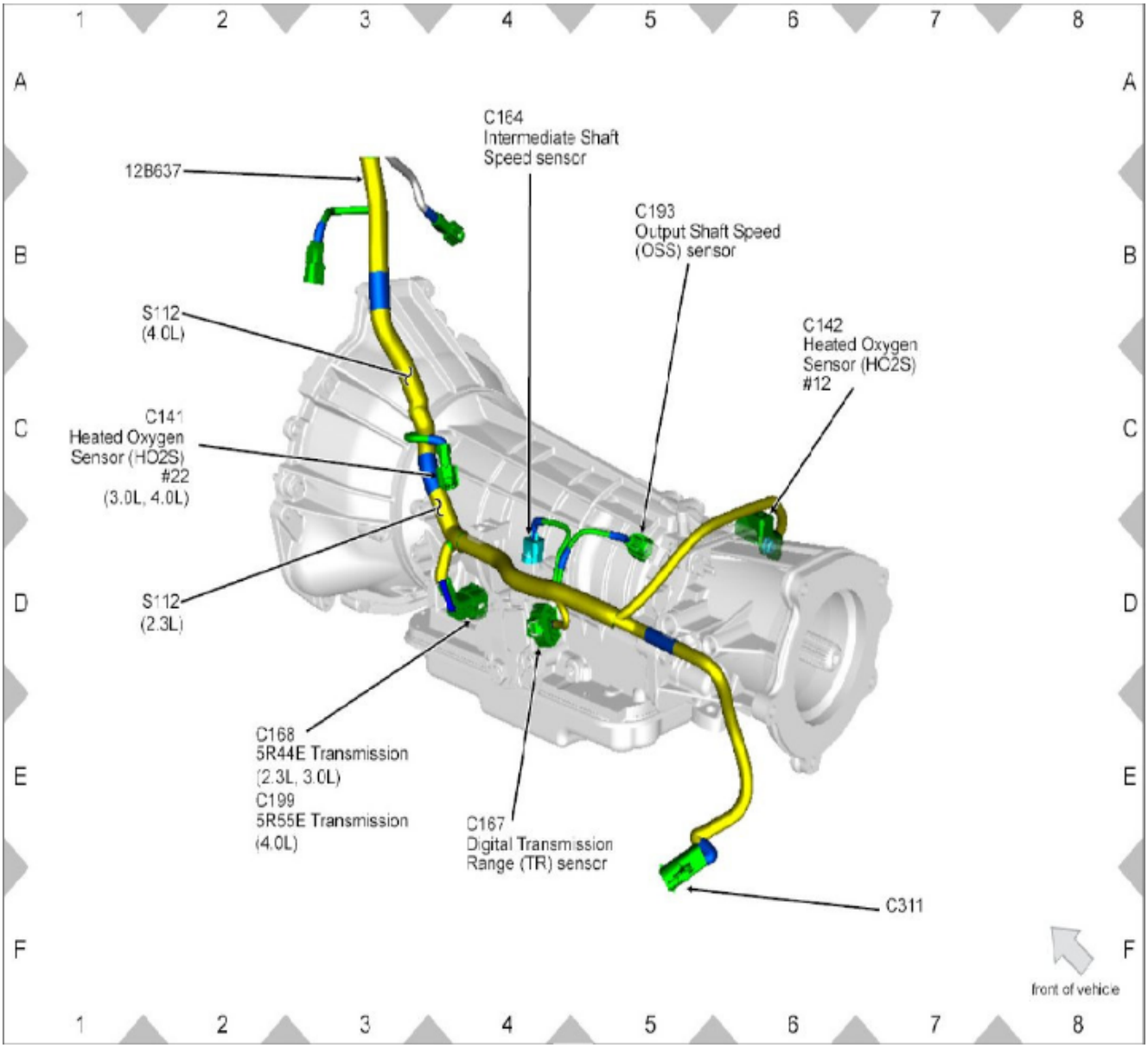

C164
Intermediate Shaft
Speed sensor
12B637
C193
Output Shaft Speed
(OSS) sensor
S112
(4.0L)
C142
Heated Oxygen
Sensor (HO2S)
#12
C141
Heated Oxygen
Sensor (HO2S)
#22
(3.0L, 4.0L)
S112
(2.3L)
C168
5R44E Transmission
(2.3L, 3.0L)
C199
5R55E Transmission
(4.0L)
C167
Digital Transmission
Range (TR) sensor
C311
front of vehicle

View 151-10

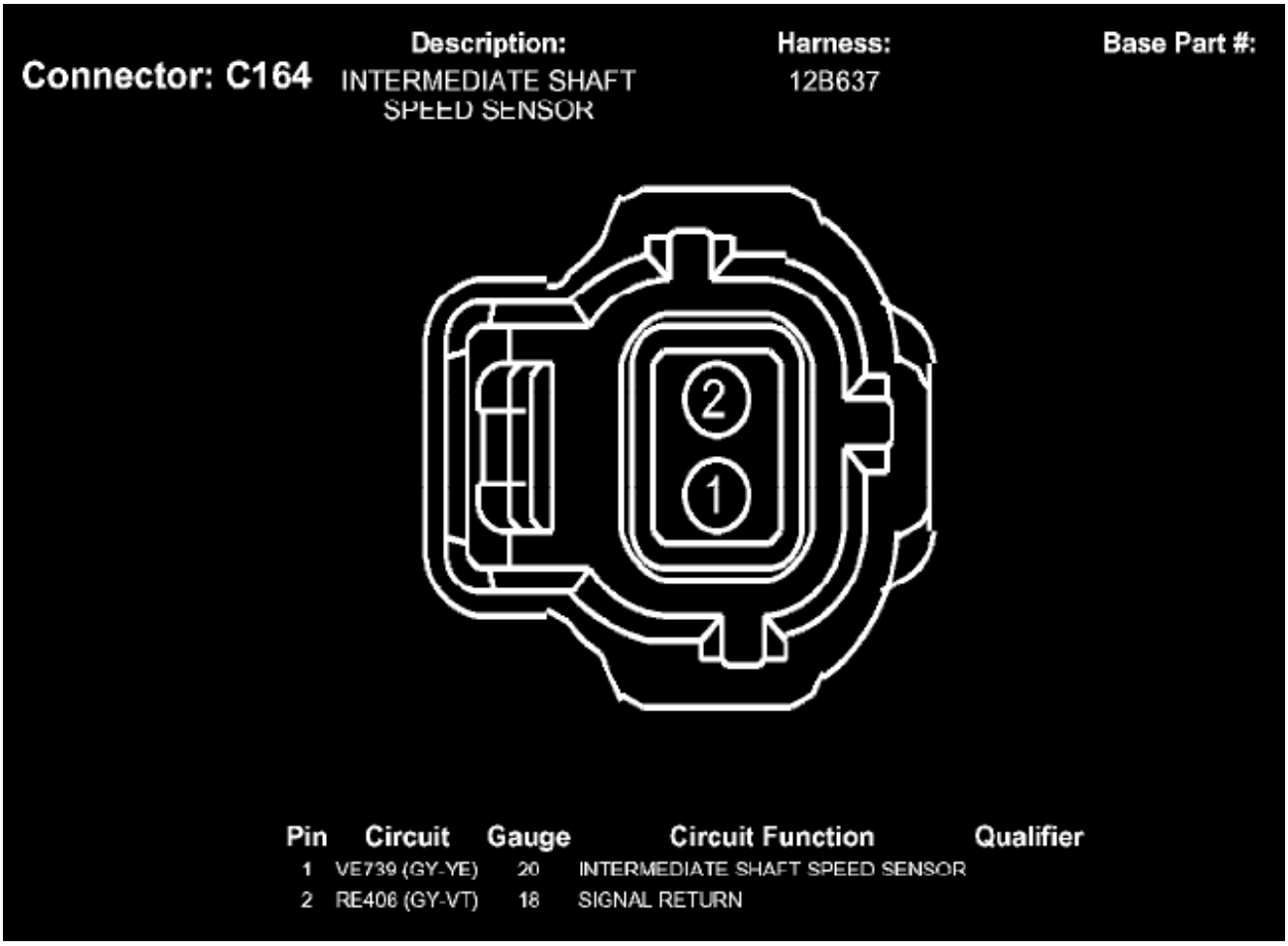


Transmission Speed Sensor: Locations Output Shaft Speed (OSS) Sensor

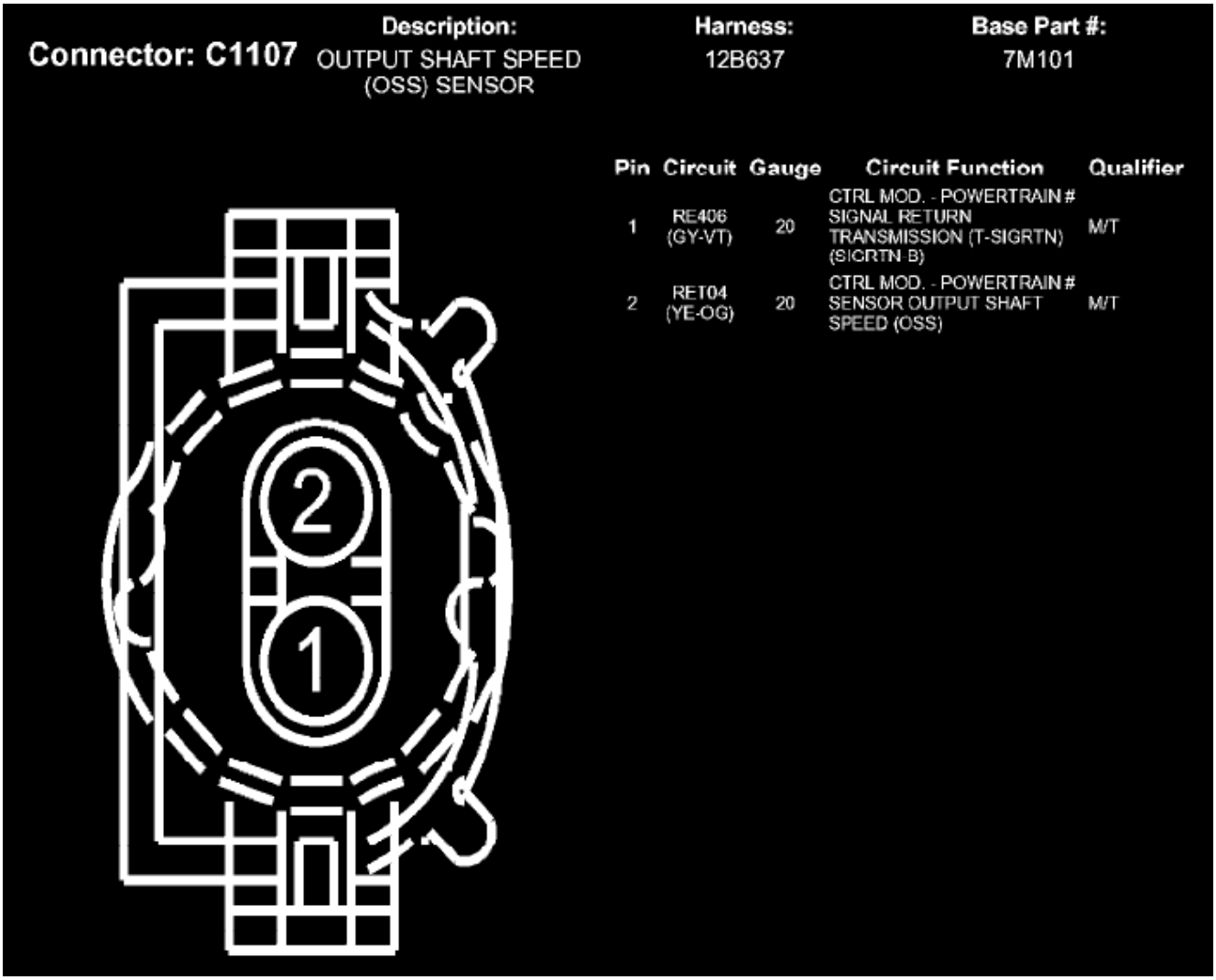
View 151-9


C164
Intermediate Shaft
Speed sensor
12B637
C193
Output Shaft Speed
(OSS) sensor
S112
(4.0L)
C142
Heated Oxygen
Sensor (HO2S)
#12
C141
Heated Oxygen
Sensor (HO2S)
#22
(3.0L, 4.0L)
S112
(2.3L)
C168
5R44E Transmission
(2.3L, 3.0L)
C199
5R55E Transmission
(4.0L)
C167
Digital Transmission
Range (TR) sensor
C311
front of vehicle

View 151-10


Connector: C164
Description:
INTERMEDIATE SHAFT SPEED SENSOR
Harness:
12B637
Base Part #:
2
1
Pin Circuit Gauge Circuit Function Qualifier
1 VE739 (GY-YE) 20 INTERMEDIATE SHAFT SPEED SENSOR
2 RE406 (GY-VT) 18 SIGNAL RETURN

C164

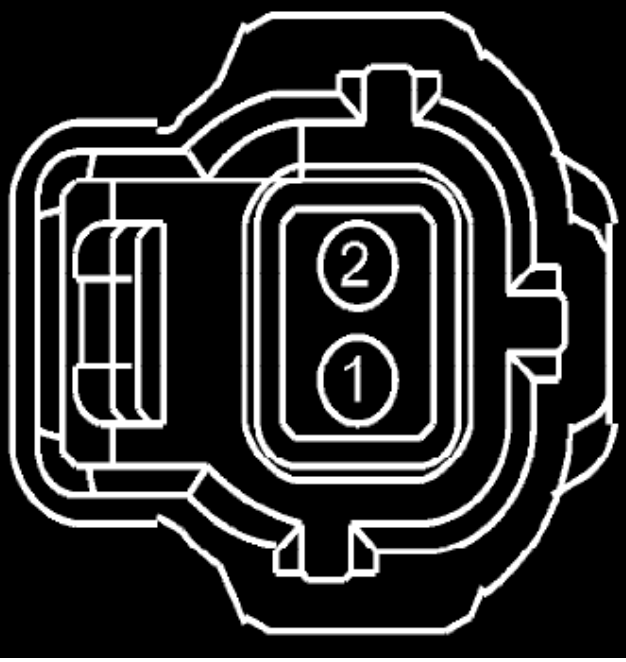


Transmission Speed Sensor: Diagrams Output Shaft Speed (OSS) Sensor

C1107

Connector: C193

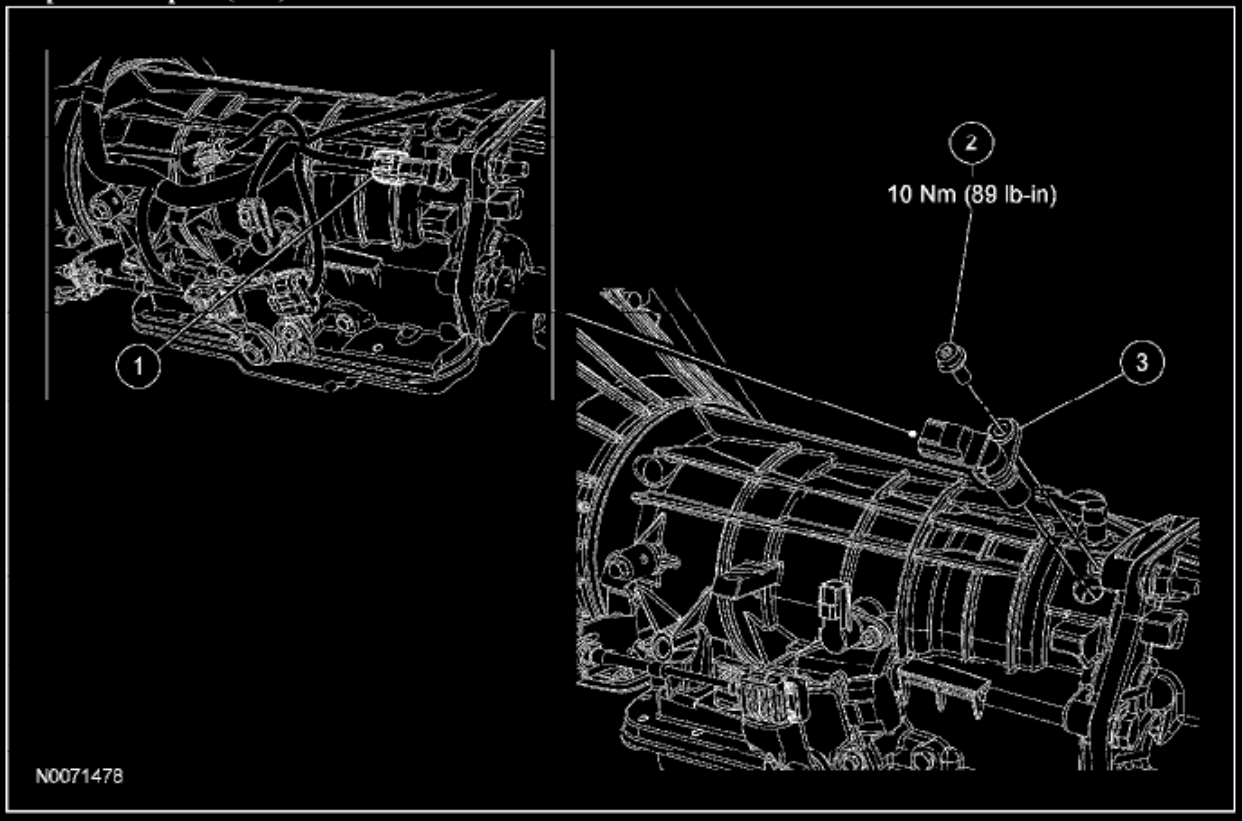
Description:	Harness:	Base Part #:
OUTPUT SHAFT SPEED (OSS) SENSOR	12B637	7H133



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RET04 (YE-OG)	20	OUTPUT SHAFT SPEED (OSS) SENSOR	A/T
2	RE406 (GY-VT)	18	SIGNAL RETURN	A/T

C193

Output Shaft Speed (OSS) Sensor



Item	Part Number	Description
1	—	Output shaft speed (OSS) sensor electrical connector
2	W702297-S	OSS sensor screw
3	7H103-B	OSS sensor

Transmission Speed Sensor: Service and Repair Output Shaft Speed (OSS) Sensor

Output Shaft Speed (OSS) Sensor

Output Shaft Speed (OSS) Sensor

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the output shaft speed (OSS) sensor electrical connector. 3. Remove the OSS sensor screw. 4. Remove the OSS sensor from the transmission.

Installation

1. NOTE: Inspect the OSS sensor O-ring for damage. If damaged, install a new O-ring Inspect and lubricate the O-ring with petroleum jelly.

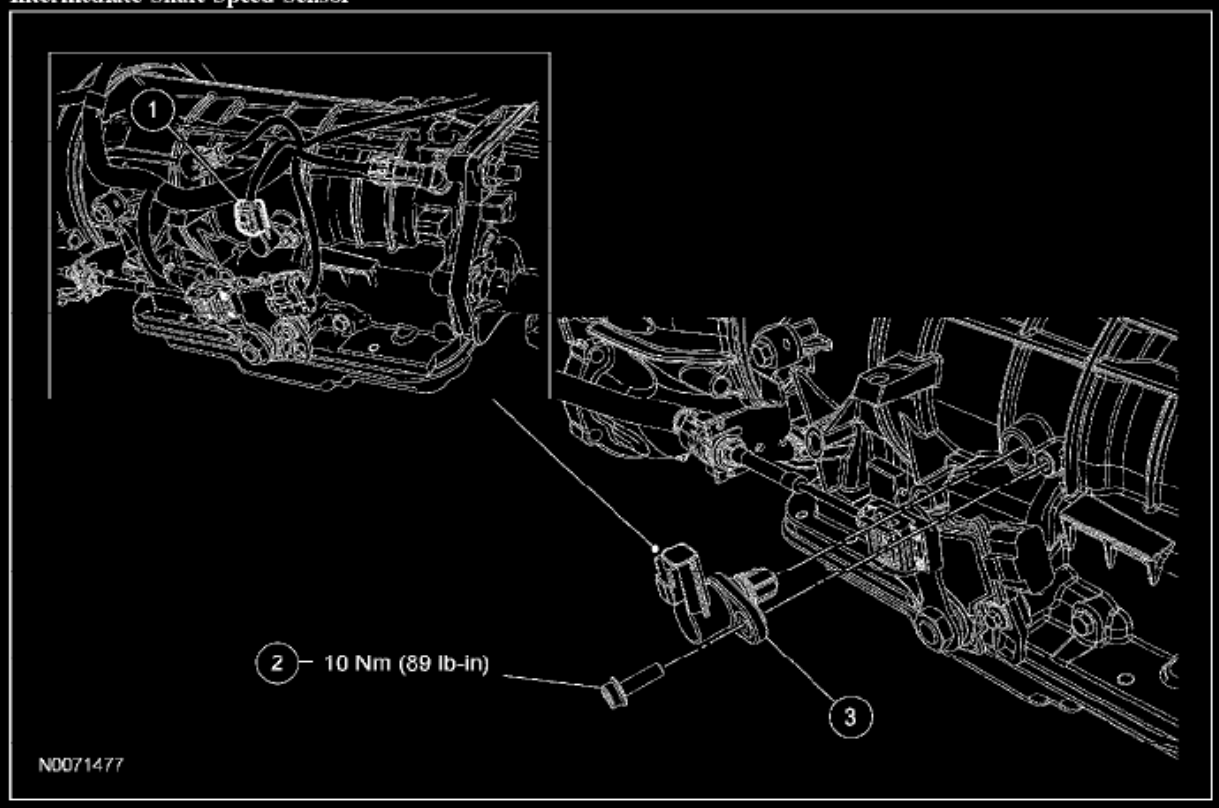
Install the OSS sensor into the transmission.

2. Install the OSS sensor screw.

^ Tighten to 10 Nm (89 lb-inch).

3. Connect the OSS sensor electrical connector.

Intermediate Shaft Speed Sensor



Item	Part Number	Description
1	—	Intermediate shaft speed sensor electrical connector
2	W702769-S	Intermediate shaft speed sensor screw
3	7M183-A	Intermediate shaft speed sensor

Transmission Speed Sensor: Service and Repair Intermediate Shaft Speed Sensor

Intermediate Shaft Speed Sensor

Intermediate Shaft Speed Sensor

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the intermediate shaft speed sensor electrical connector. 3. Remove the intermediate shaft speed sensor screw. 4. Remove the intermediate shaft speed sensor from the transmission.

Installation

1. NOTE: Inspect the intermediate shaft speed sensor O-ring for damage. If damaged, install a new O-ring

Inspect and lubricate the O-ring with petroleum jelly.

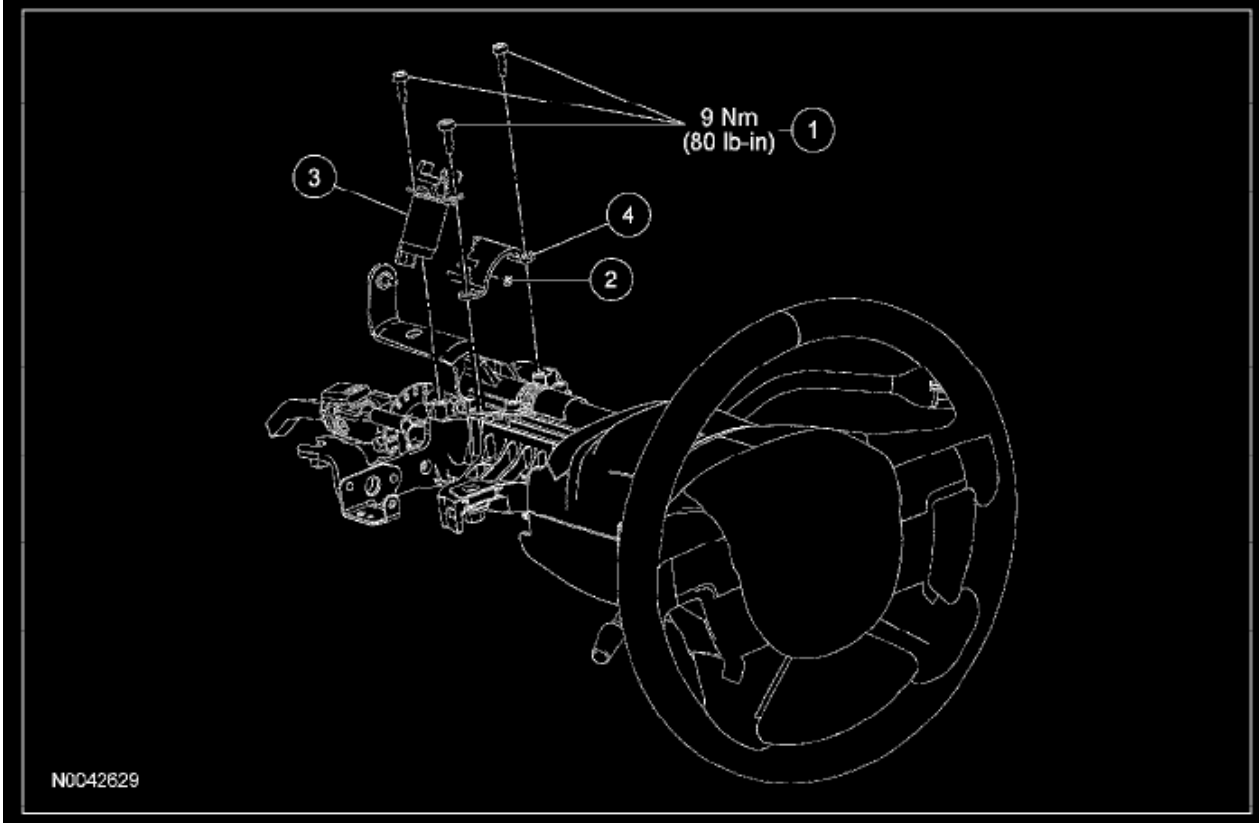
Install the intermediate shaft speed sensor into the transmission.

2. Install the intermediate shaft speed sensor screw.

^ Tighten to 10 Nm (89 lb-inch).

3. Connect the intermediate shaft speed sensor electrical connector. 4. Lower the vehicle.

Brake Shift Interlock Actuator



Item	Part Number	Description
1	N806584-S	Brake shift interlock actuator bolts
2	W623450-S	Brake shift interlock actuator clip
3	3F770-A	Brake shift interlock actuator
4	7A216-A	Insert plate

Shift Interlock Solenoid: Service and Repair

Brake Shift Interlock Actuator

Brake Shift Interlock Actuator

Removal and Installation

1. Remove the steering column assembly. 2. Remove the insert plate and the brake shift interlock actuator bolts.

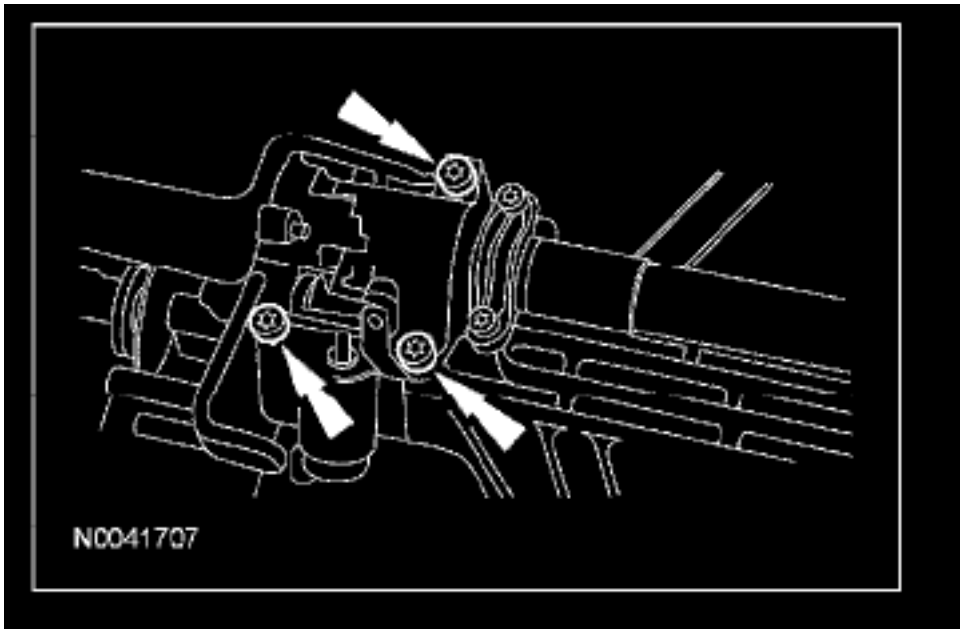
3. NOTE: The brake shift interlock actuator clip is an assembly aid for the assembly plant and does not need to be replaced.

Remove the insert plate from the brake shift interlock actuator. ^

Remove and discard the brake shift interlock actuator clip.

4. To install, reverse the removal procedure.

^ Tighten to 9 Nm (80 lb-inch).


N0041707

Solenoid Operation Chart

Gearshift Selector Position	PCM Commanded Gear	Solenoid States				
		SSA	SSB	SSC	SSD	Engine Braking
P/N	P/N	On	Off	Off	Off	No
R	R	On	Off	Off	Off	No
(D) (Overdrive)	1	On	Off	Off	Off	No
	2[a]	On	Off	On	Off	No
	3	On	On	Off	Off	No
	4	Off	Off	Off	Off	No
	5	Off	Off	On	Off	No
Drive	1	On	Off	Off	Off	No
	2[a]	On	Off	On	Off	No
	3	On	On	Off	On[b]	No
	4	Off	Off	Off	On	Yes
2	3	On	On	Off	On	Yes
1	1	On	Off	Off	On	Yes

a PCM Controlled
b On time calibration dependent

Shift Solenoid: Specifications

Solenoid Operation Chart

Solenoid Operation Chart

Solenoid Operation Chart

Gearshift Selector Position	PCM Commanded Gear	Solenoid States				
		SSA	SSB	SSC	SSD	Engine Braking
P/N	P/N	On	Off	Off	Off	No
R	R	On	Off	Off	Off	No
(D) (Overdrive)	1	On	Off	Off	Off	No
	2[a]	On	Off	On	Off	No
	3	On	On	Off	Off	No
	4	Off	Off	Off	Off	No
	5	Off	Off	On	Off	No
Drive	1	On	Off	Off	Off	No
	2[a]	On	Off	On	Off	No
	3	On	On	Off	On[b]	No
	4	Off	Off	Off	On	Yes
2	3	On	On	Off	On	Yes
1	1	On	Off	Off	On	Yes

a PCM Controlled
b On time calibration dependent

SSA ALWAYS "ON":	Transmission Range Selector Lever Position		
	OD	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	1	3	1

SSA ALWAYS "ON":	Transmission Range Selector Lever Position		
	OD	2	1
2	2	Ratio 1.1	2
3	3	3	3
4	1	3	1
5	2	Ratio 1.1	2

Shift Solenoid: Testing and Inspection

Pinpoint Tests - OSC Equipped Vehicle Anytime an electrical connector or solenoid body is disconnected, inspect the connector for terminal condition, corrosion and contamination. Also

inspect the connector seal for damage. Clean, repair or install a new connector as required.

Shift Solenoid Pre-Diagnosis Use the following shift solenoid operation information while carrying out Pinpoint Test A.

Solenoid Operation Chart

Solenoid Operation Chart

Shift Solenoid Failure Mode Chart "Always On" Failed OFF due to PCM and/or vehicle wiring concerns, solenoid electrically, mechanically or hydraulically stuck ON.

SSB ALWAYS "ON":	Transmission Range Selector Lever Position		
	OD	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	3	3	3
2	Ratio 1.1	Ratio 1.1	Ratio 1.1
3	3	3	3
4	3	3	3
5	Ratio 1.1	Ratio 1.1	Ratio 1.1

SSC ALWAYS "ON":	Transmission Range Selector Lever Position		
	OD	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	2	3	1
2	2	Ratio 1.1	2
3	Ratio 1.1	3	3
4	5	3	3
5	5	Ratio 1.1	Ratio 1.1

SSD ALWAYS "ON":	Transmission Range Selector Lever Position		
	OD	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	1	3	1
2	1	3	1
3	3	3	3
4	4	3	3
5	4	3	3

SSA ALWAYS "OFF":	Transmission Range Selector Lever Position		
	OD	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	4	3	3

SSA ALWAYS "OFF":	Transmission Range Selector Lever Position		
	OD	2	1
2	5	Ratio 1.1	Ratio 1.1
3	3	3	3
4	4	3	3
5	5	Ratio 1.1	Ratio 1.1

Shift Solenoid Failure Mode Chart "Always Off" Failed ON due to PCM and/or vehicle wiring concerns, solenoid electrically, mechanically or hydraulically stuck OFF.

SSB ALWAYS "OFF":	Transmission Range Selector Lever Position		
	OD	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	1	3	1
2	2	Ratio 1.1	2
3	1[a] (2[b])	3	1
4	4	3	3
5	5	Ratio 1.1	Ratio 1.1

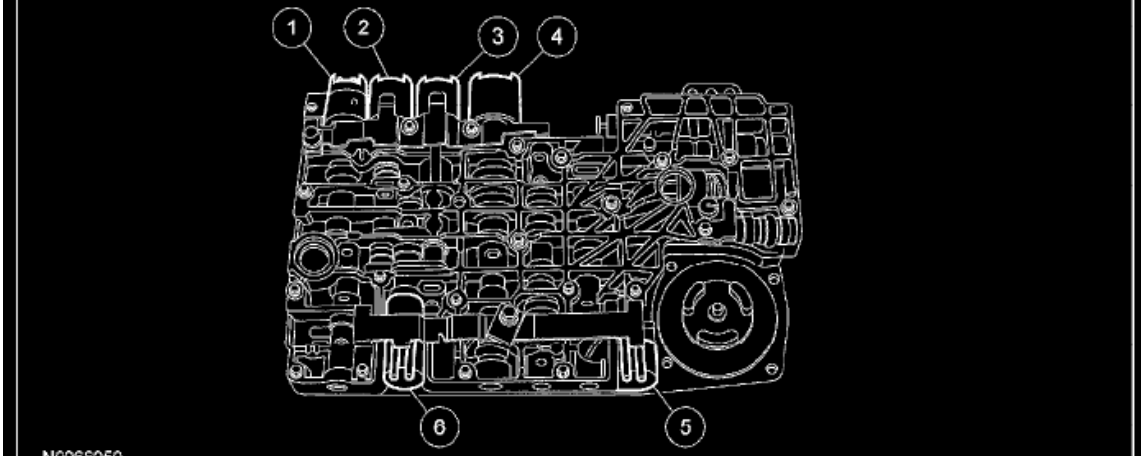
a During Downshift Only
b During Upshift Only

SSC ALWAYS "OFF":	Transmission Range Selector Lever Position		
	OD	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	1	3	1
2	1	3	1
3	3	3	3
4	4	3	3
5	4	3	3

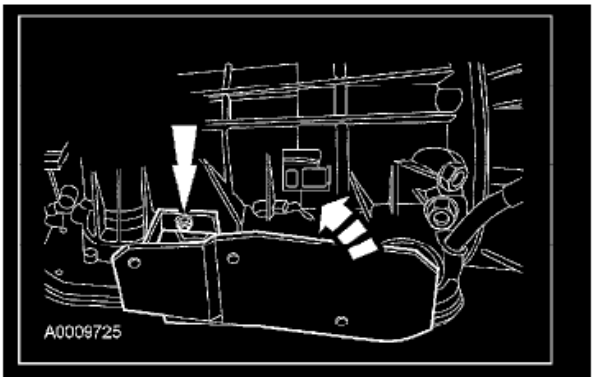
SSD ALWAYS "OFF":	Transmission Range Selector Lever Position		
	OD	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	1	3	1
2	2	Ratio 1.1	2
3	3	3	3
4	4	3	3
5	5	Ratio 1.1	Ratio 1.1

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V



Item	Part Number	Description
1	7F037	Torque converter clutch (TCC)
2	7G484	Shift solenoid (SSD)
3	7G484	Shift solenoid (SSB)
4	7H144	Electronic pressure control (EPC)
5	7G484	Shift solenoid (SSA)
6	7G484	Shift solenoid (SSC)



Shift Solenoid: Service and Repair

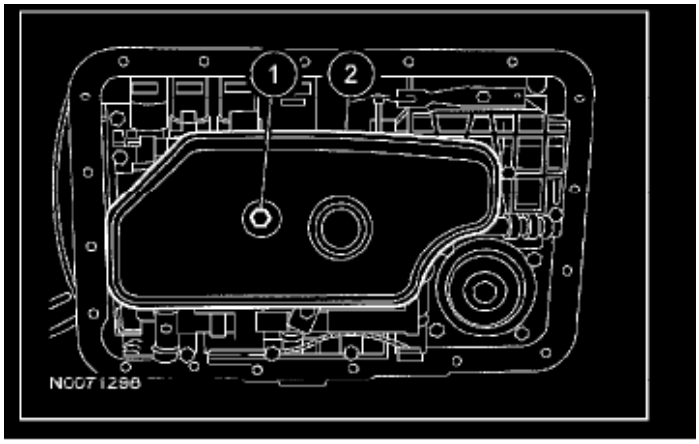
Solenoids - Shift, Torque Converter Clutch, Electronic Pressure Control

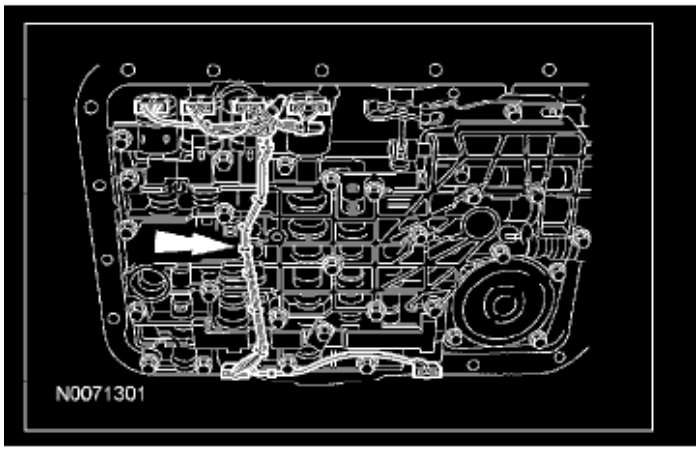
Removal

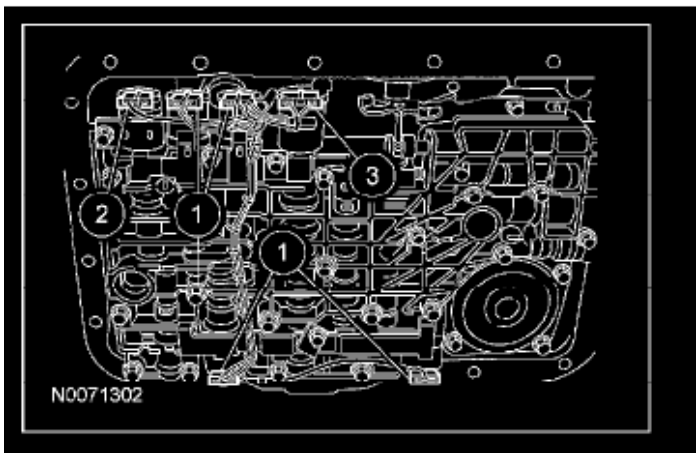
1. With the vehicle in NEUTRAL, position it on a hoist.

2. NOTE: If equipped, the transmission servo heat shield needs to be unclipped from the fluid pan rail and positioned aside for fluid pan removal.

If equipped, loosen the nut and position the heat shield aside.


1
2
N0071298


N0071301


3
2
1
1
N0071302

3. Place a drain pan under the transmission fluid pan. 4. Drain the transmission fluid. 5. Remove the transmission fluid filter.

1 Remove the transmission fluid filter screw.

2 Remove the transmission fluid filter.

6. NOTE: Main control assembly does not need to be removed for solenoid service.

Remove wire loom guide and protector. ^

Carefully lift up on wire loom guide and protector and disengage the retaining pins from the solenoid clamps.

7. Disconnect the appropriate solenoid electrical connector.

1 Disconnect shift solenoids electrical connectors.

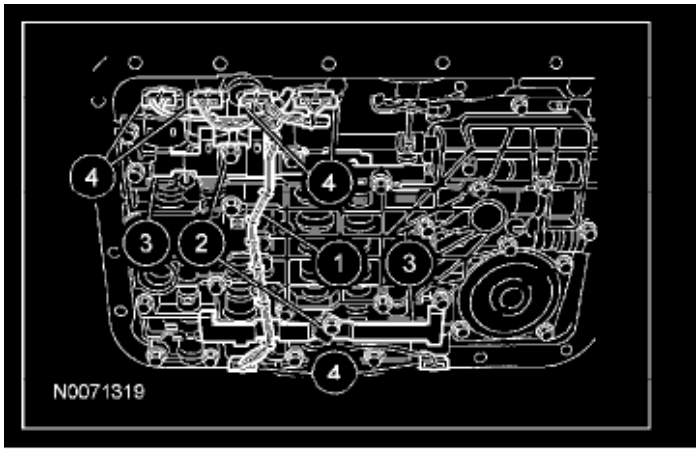
2 Disconnect the torque converter clutch (TCC) solenoid electrical connector.

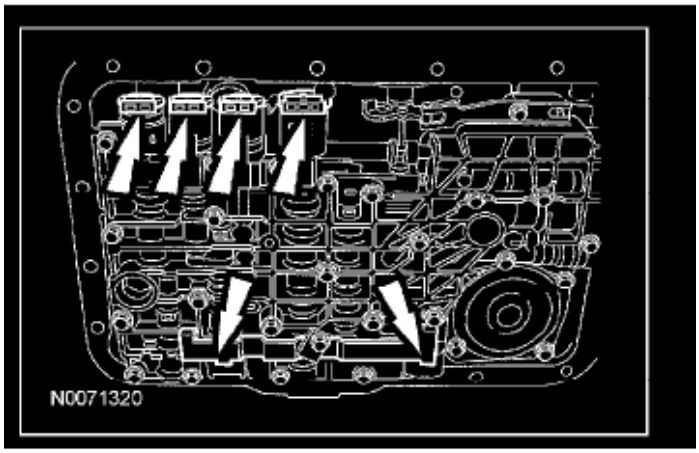
3 Disconnect the electronic pressure control (EPC) solenoid electrical connector.

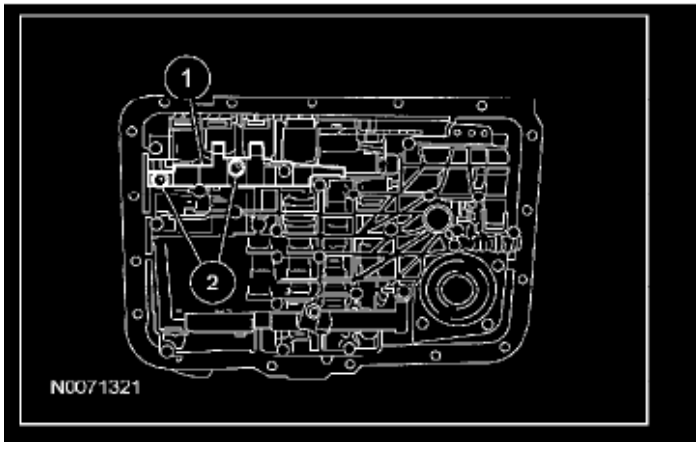
8. CAUTION: The torque converter clutch (TCC) solenoid and converter modulator valve may pop out of its bore. This may damage the

solenoid or converter modulator valve.

CAUTION: Shift solenoid (SSC) may pop out of its bore. This may damage the solenoid.


4
4
3
2
1
3
4
N0071319


N0071320


1
2
N0071321

Remove the shift solenoids. 1

Remove the wire harness.

2 Remove the solenoid clamp screws.

3 Remove the solenoid clamp.

4 Remove the appropriate solenoid(s).

Installation

1. Install the new solenoid(s).

2. NOTE: The solenoid clamp must be installed in the torque converter clutch (TCC) and electronic pressure control (EPC) solenoid grooves, shift

solenoid pockets and the No. 204 plug.

Install the solenoid clamp. 1

Position the solenoid clamp on the main control valve body.

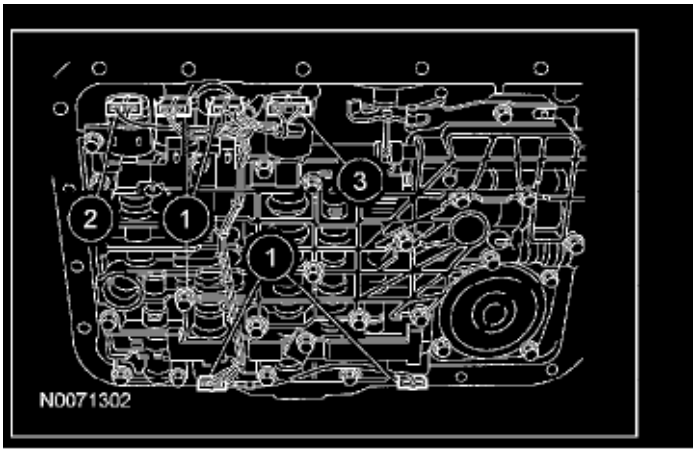
2 Install the solenoid clamp screws.

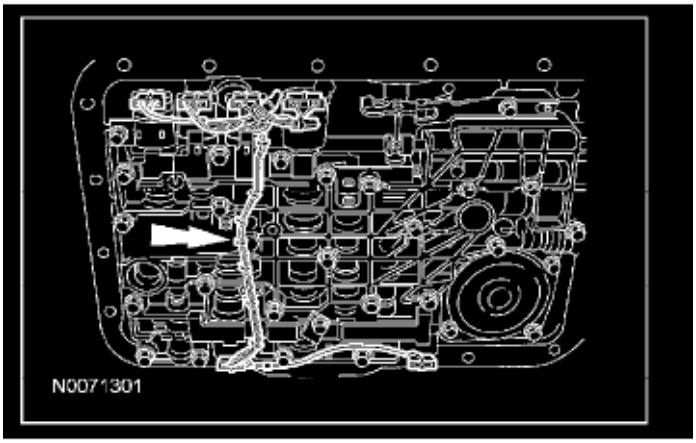
3. Connect the 6 solenoid electrical connectors.

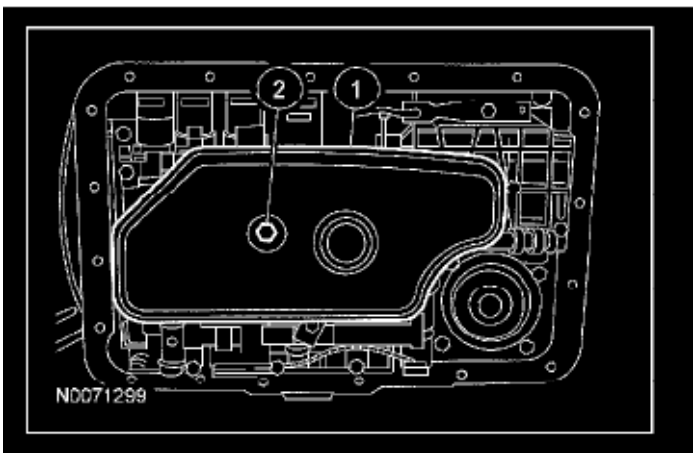
1 Connect shift solenoid SSA, SSB, SSC, SSD electrical connectors.

2 Connect the TCC solenoid electrical connector.

3 Connect the EPC solenoid electrical connector.


3
2
1
1
N0071302


N0071301


2
1
N0071299

4. CAUTION: Excessive pressure may break the retaining pins.

Install the main control valve body wire loom. ^

Align the retaining pins to the holes in the solenoid clamps and gently press in the main control valve body wire loom guide and protector.

5. Install the transmission fluid filter.

1 Install the transmission fluid filter.

2 Install the transmission fluid filter screw. ^

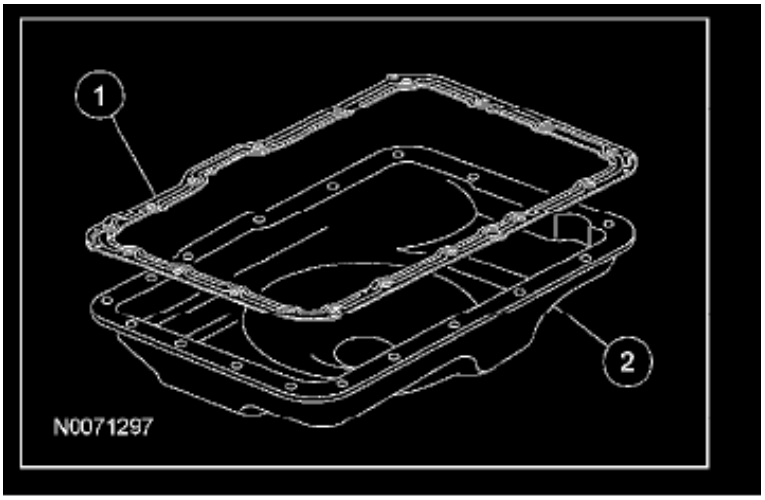
Tighten to 10 Nm (89 lb-inch).

6. NOTE: The transmission fluid pan gasket is reusable. Clean and inspect for damage, if not damaged, the gasket should be reused.

Install the transmission fluid pan. 1

Position the transmission fluid pan gasket on the transmission fluid pan.

2 Align and install the transmission fluid pan.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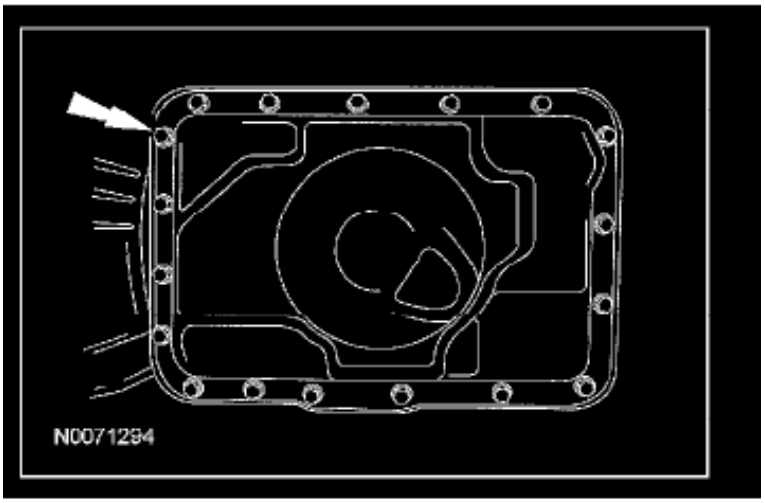
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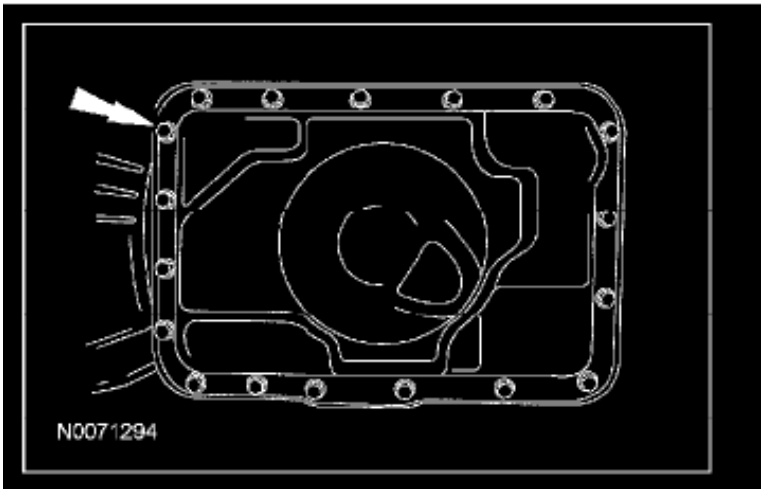
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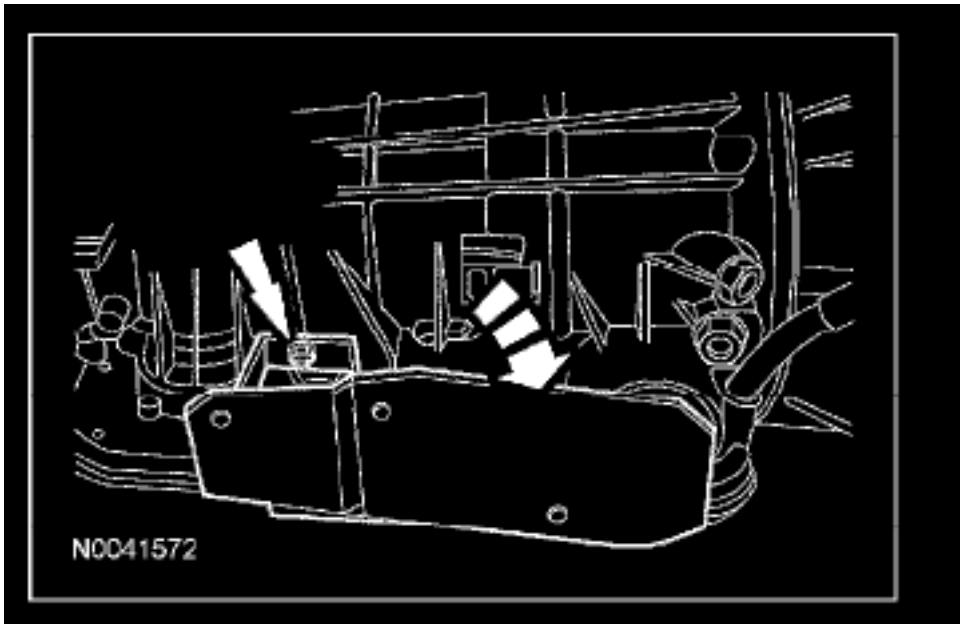
7. Loosely install the transmission fluid pan screws.

8. Tighten the transmission fluid pan screws in a crisscross pattern.

^ Tighten to 10 Nm (89 lb-inch).

9. If equipped, position the servo heat shield over the servos and clip it to the pan rail.

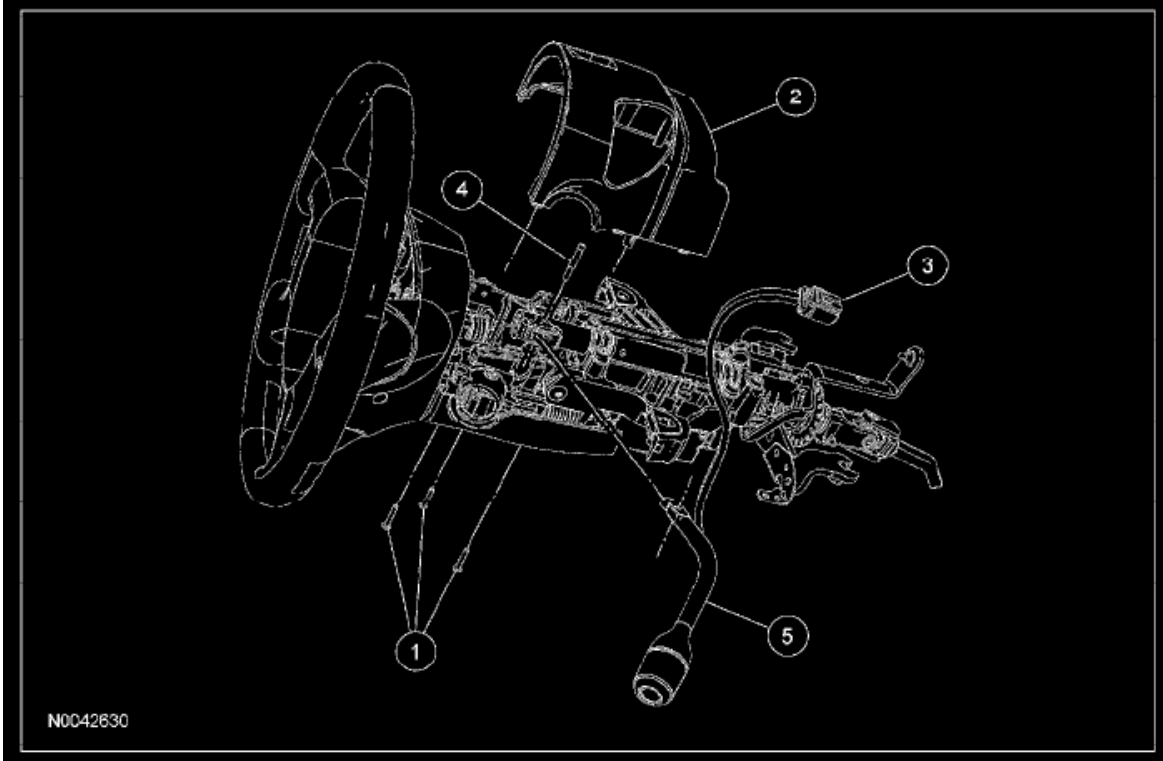
^ Tighten to 10 Nm (89 lb-inch).



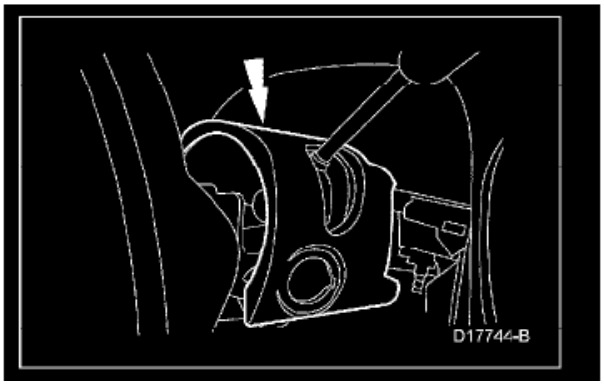
10. NOTE: Start with a minimum of 3.7L (4 qt) clean automatic transmission fluid.

Fill transmission with clean automatic transmission fluid to the correct fluid level.

Transmission Selector Lever



Item	Part Number	Description
1	391727_S	Steering column shroud screws
2	3530-A	Steering column upper shroud
3	—	Transmission control switch electrical connector
4	7W441-B	Transmission selector lever pin
5	7202-B	Transmission selector lever



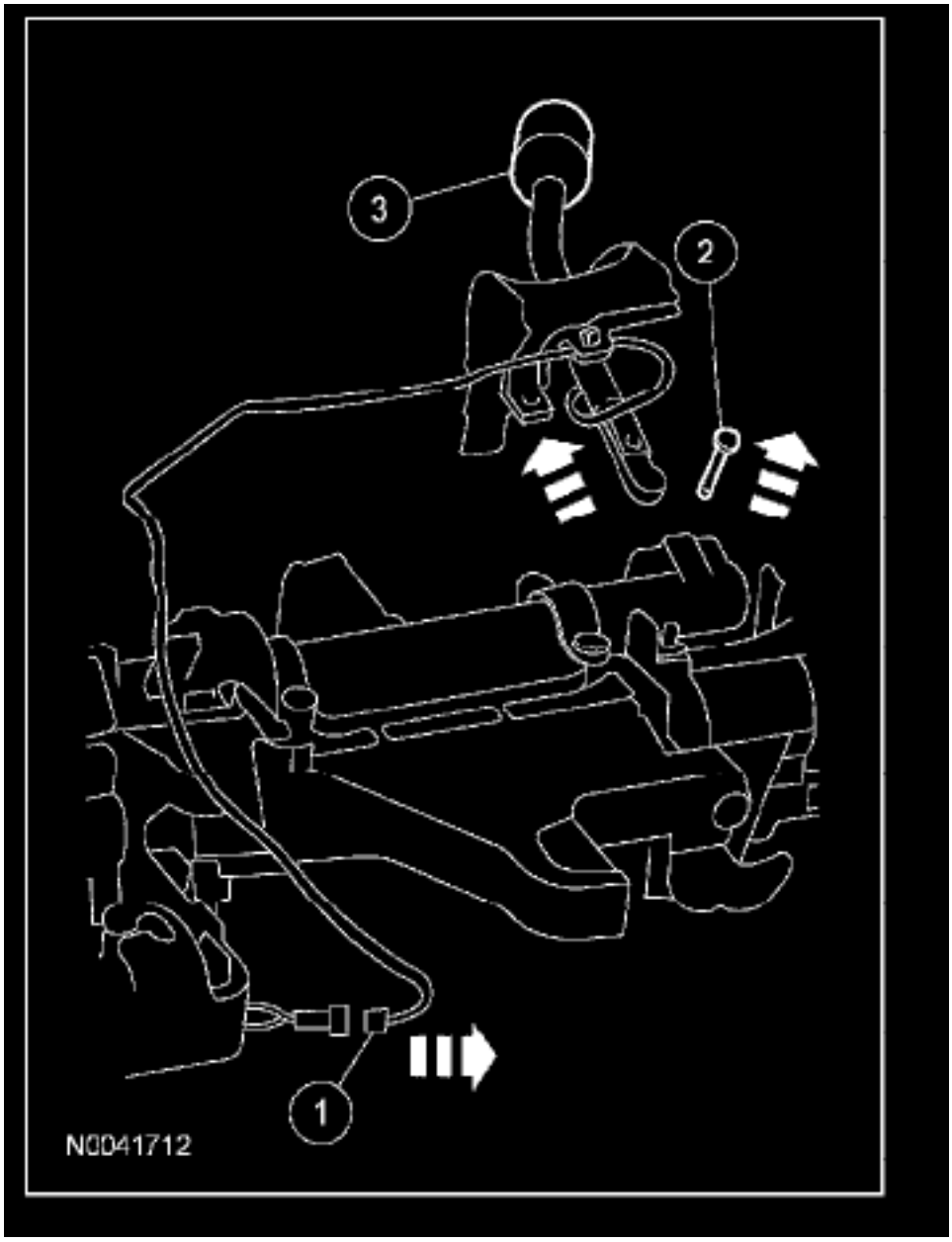
Shifter A/T: Service and Repair

Transmission Selector Lever

Transmission Selector Lever

Removal and Installation

1. Remove the ignition switch lock cylinder. 2. Remove the upper steering column shroud and the rubber shift lever cover.



3. Remove the selector lever.

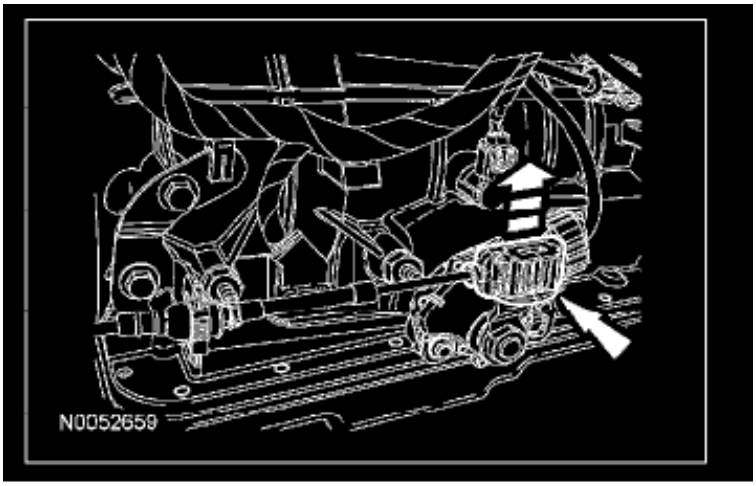
1 Disconnect the selector lever harness connector.

2 Remove and discard the selector lever pin.

3 Remove the selector lever.

4. NOTE: A new selector lever pin must be installed when the old pin is removed.

To install, reverse the removal procedure.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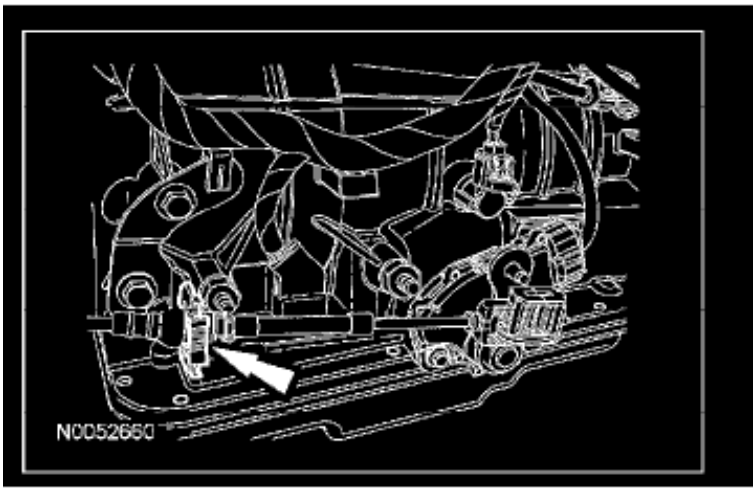
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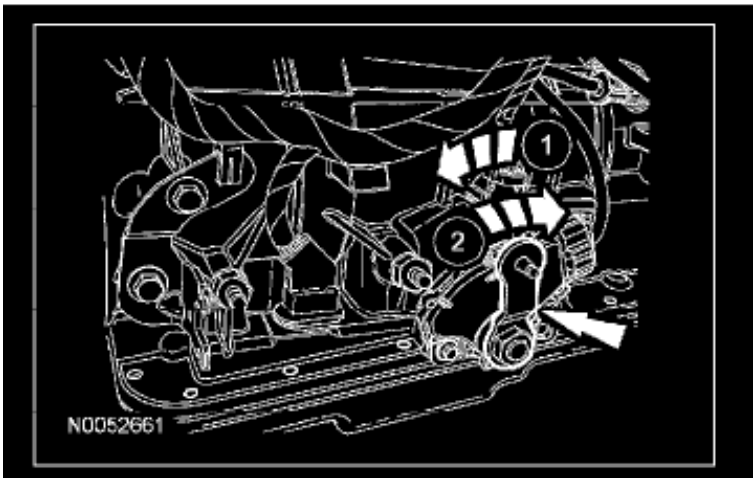
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Shift Cable: Adjustments

Selector Lever Cable Adjustment

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Place the gearshift lever in the (D) position and hang a 1.4 kg (3 lb) weight on the shift control selector lever.

^ Move the gearshift lever to the first gear position, then move back 2 detents to the (D) position.

^ Hang the 1.4 kg (3 lb) weight on the gearshift lever.

3. Verify the position of the selector lever indicator. If the selector lever indicator does not match the selector lever position the selector lever

indicator will need to be adjusted.

4. Disconnect the transmission selector lever cable from the manual control lever.

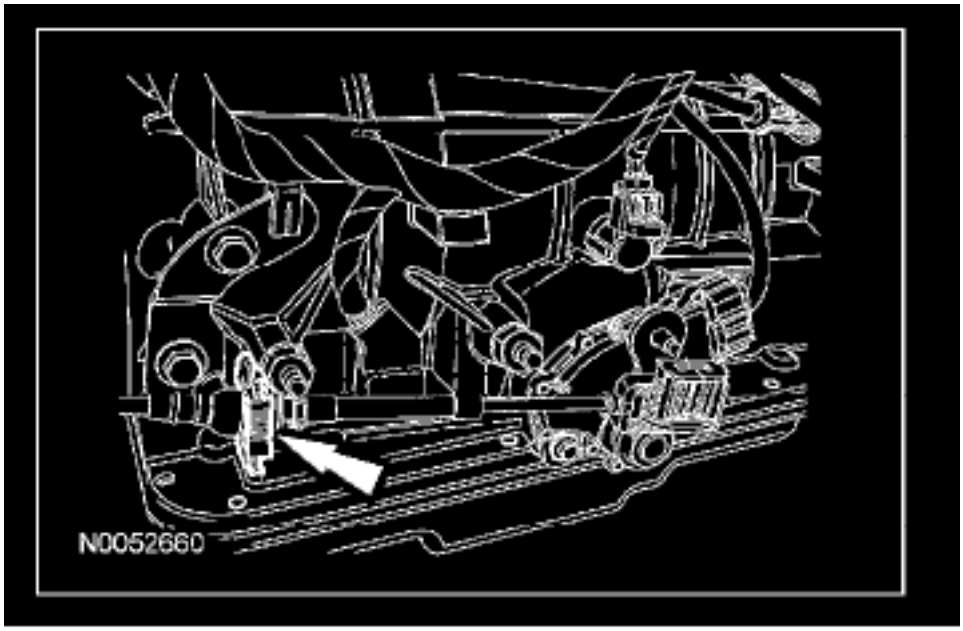
5. Remove the selector lever cable clip and remove the cable from the bracket.

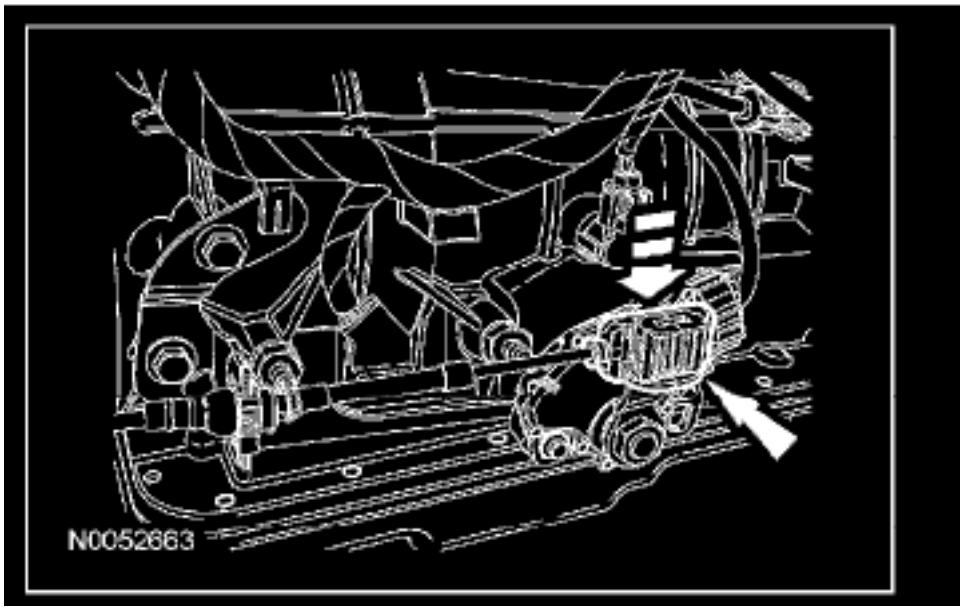
6. Place the manual control lever in the (D) position.

1 Rotate the manual control lever fully counterclockwise.

2 Rotate the manual control lever clockwise to the (D) position (2 detents).

7. Install the selector lever cable into the bracket and install the clip.





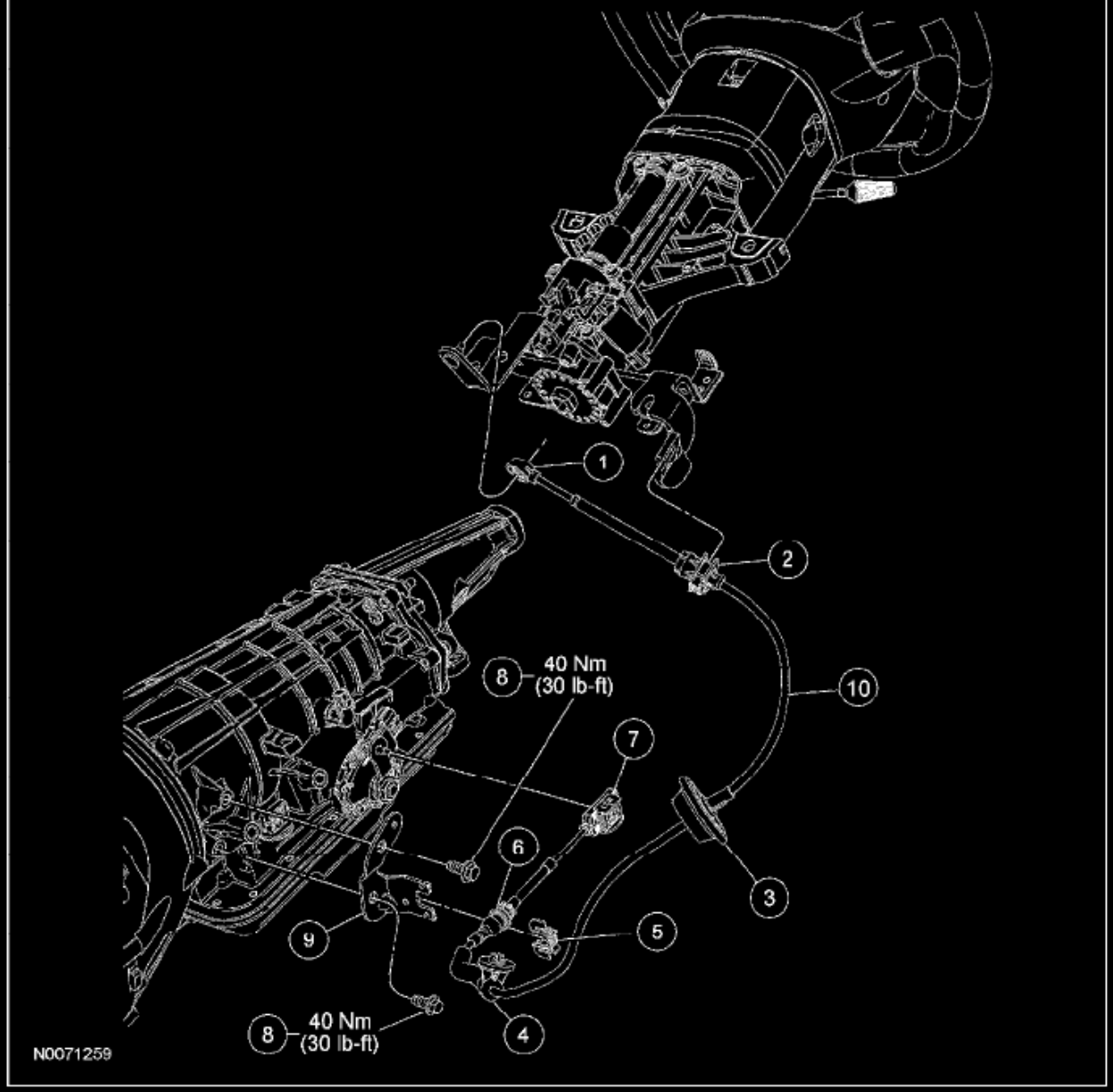
8. Connect the transmission selector lever cable to the manual control lever.

9. Remove the 1.4 kg (3 lb) weight.

10. CAUTION: To prevent damage, do not adjust the transmission selector lever cable in any position other than (D).

Verify that the vehicle will start only in PARK or NEUTRAL and that backup lamps illuminate in REVERSE. If not, repeat Steps 1 through 7 and carry out a digital transmission range (TR) sensor alignment.

Selector Lever Cable and Bracket



Item	Part Number	Description
1	—	Transmission selector lever cable eyelet (part of 7E395)
2	—	Transmission selector lever cable retaining clip (part of 7E395)

(Continued)

Item	Part Number	Description
3	—	Transmission selector lever cable grommet (part of 7E395)
4	—	Transmission selector lever cable locating clip (part of 7E395)

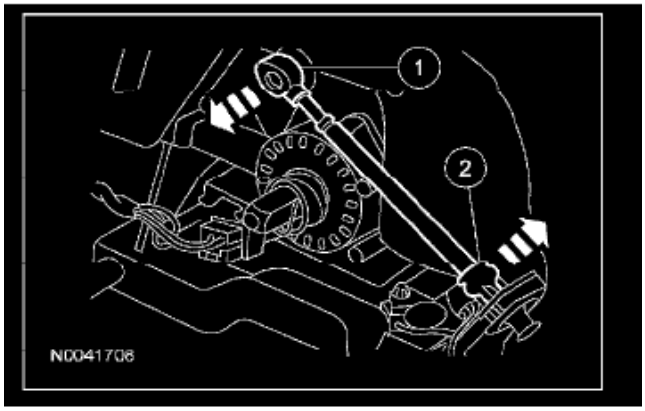
(Continued)

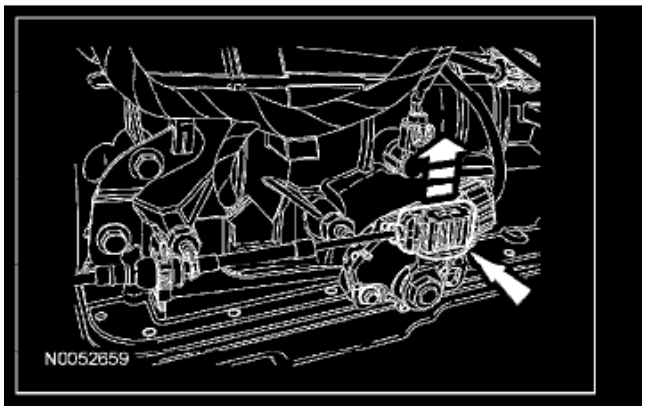
Shift Cable: Service and Repair

Selector Lever Cable and Bracket

Selector Lever Cable And Bracket (Part 1)

Item	Part Number	Description
5	7H181	Transmission selector lever cable retention clip
6	—	Transmission selector lever cable end fitting (part of 7E395)
7	—	Transmission selector lever cable eyelet end adjuster (part of 7E395)
8	N605918	Transmission selector lever cable bracket bolts
9	7B229	Transmission selector lever cable bracket
10	7E395	Transmission selector lever cable





Selector Lever Cable And Bracket (Part 2)

Removal and Installation

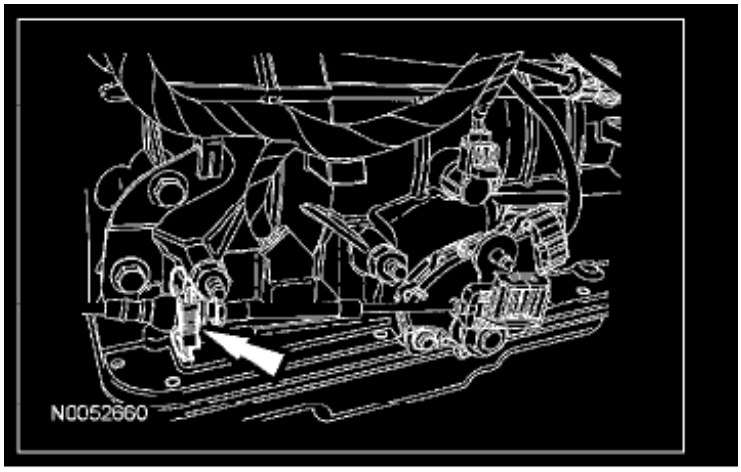
1. Disconnect the transmission selector lever cable from the steering column.

1 Disconnect the selector lever cable from the transmission column shift selector tube.

2 Disconnect the selector lever cable from the steering column bracket.

2. Push the rubber grommet and selector lever cable through the bulkhead. 3. With the vehicle in NEUTRAL, position it on a hoist. 4. Disconnect the selector lever cable from the locking clip. 5. Remove the transmission selector lever cable from the manual lever.

6. Remove the selector lever cable clip and remove the cable from the bracket.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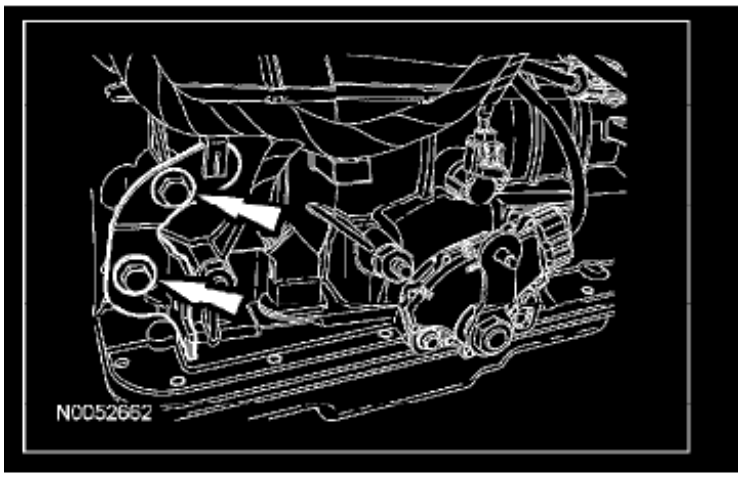
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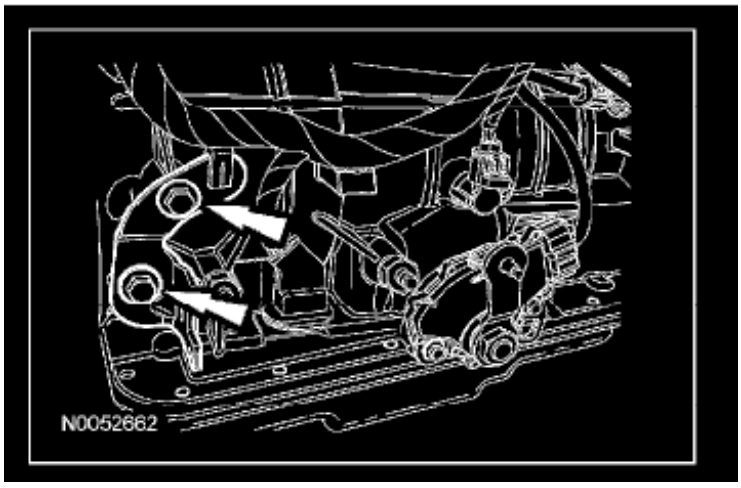
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7. Remove the transmission selector lever cable bracket from the automatic transmission.

8. To install, reverse the removal procedure.

^ Tighten to 40 Nm (30 lb-ft).

^ Move manual lever into the (D) position.

^ Adjust the transmission selector lever cable.

Torque Converter: Description and Operation

Torque Converter

The torque converter transmits and multiplies torque. The torque converter is a 4-element device: ^

Impeller assembly

^ Turbine assembly

^ Reactor assembly

^ Clutch and damper assembly

The standard torque converter components operate as follows:

Rotation of the converter housing and impeller set the fluid in motion.

The turbine reacts to the fluid motion from the impeller, transferring rotation to the geartrain through the input shaft.

The reactor redirects fluid going back into the impeller, allowing for torque multiplication.

The clutch and damper assembly dampens powertrain torsional vibration and provides a direct mechanical connection for improved efficiency.

Power is transmitted from the torque converter to the planetary gearsets and other components through the input shaft.

Stall Speed Chart

Engine	Transmission	RPM
2.3L	5R44E	2,660-3,129
3.0L	5R44E	2,970-3,510
4.0 SOHC	5R55E	2,709-3,188

Torque Converter: Testing and Inspection Stall Speed Chart

Stall Speed Chart

Stall Speed Chart

Torque Converter: Testing and Inspection Torque Converter Diagnosis

Torque Converter Diagnosis

Prior to installing new or remanufactured torque converters, all diagnostic procedures must be followed. This is to prevent the unnecessary installation of new or remanufactured torque converters. Only after a complete diagnostic evaluation can the decision be made to install a new or remanufactured torque converter.

Begin with the normal diagnostic procedures as follows: 1. Preliminary Inspection. See: Transmission Control Systems/Testing and Inspection/Initial Inspection and Diagnostic Overview/Preliminary

Inspection

2. Know and Understand the Customer's Concern. 3. Verify the Concern. Refer to the Torque Converter Operation Test. See: Transmission Control Systems/Testing and Inspection/Component Tests

and General Diagnostics/Torque Converter Operation Test

4. Carry out Diagnostic Procedures. See: Transmission Control Systems/Testing and Inspection/Initial Inspection and Diagnostic

Overview/Diagnostics ^

Run on-board diagnostics. Refer to the On-Board Diagnostics With Scan Tool. -

Repair all non-transmission related DTCs first.

- Repair all transmission DTCs.

- Rerun on-board diagnostics to verify repair.

^ Carry out Line Pressure Test. Refer to the Special Testing Procedures. See: Transmission Control Systems/Testing and Inspection/Component Tests and General Diagnostics/Special Testing Procedures

^ Carry out Stall Speed Test. Refer to the Special Testing Procedures. See: Transmission Control Systems/Testing and Inspection/Component Tests and General Diagnostics/Special Testing Procedures

^ Carry out Diagnosis by Symptom Index. Refer to Diagnosis By Symptom. See: Transmission Control Systems/Testing and Inspection/Symptom Related Diagnostic Procedures/Diagnosis By Symptom -

Use the index to locate the appropriate routine that best describes the symptom(s). The routine will list all possible components that may cause or contribute to the symptom. Check each component listed; diagnose and service as required before servicing the torque converter.

Torque Converter: Testing and Inspection Torque Converter Operation Test

Torque Converter Operation Test

This test verifies that the torque converter clutch control system and the torque converter are operating correctly.

1. Carry out Quick Test. Refer to the On-Board Diagnostics With Scan Tool. Check for DTCs. Refer to the DTC Chart. See: Transmission Control

Systems/Testing and Inspection/Initial Inspection and Diagnostic Overview/Diagnostics See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Descriptions

2. Connect a tachometer to the engine. 3. Bring the engine to normal operating temperature by driving the vehicle at highway speeds for approximately 15 minutes in (D) position. 4. After normal operating temperature is reached, maintain a constant vehicle speed of about 80 km/h (50 mph) and tap brake pedal with the left foot. 5. Engine rpm should increase when brake pedal is tapped, and decrease about 5 seconds after pedal is released. If this does not occur, refer to the

Torque Converter Operation Concerns in Diagnosis By Symptom. See: Transmission Control Systems/Testing and Inspection/Symptom Related Diagnostic Procedures/Diagnosis By Symptom

6. If the vehicle stalls in (D) or manual 2 at idle with vehicle at a stop, move the transmission range selector lever to manual 1 position. If the vehicle

stalls, refer to the Torque Converter Operation Concerns in Diagnosis By Symptom. Repair as required. If the vehicle does not stall in (D), refer to Diagnosis By Symptom. See: Transmission Control Systems/Testing and Inspection/Symptom Related Diagnostic Procedures/Diagnosis By Symptom

Torque Converter: Testing and Inspection Torque Converter

Torque Converter

1. A new or remanufactured torque converter must be installed if one or more of the following statements is true:

^ A torque converter malfunction has been determined based on complete diagnostic procedures.

^ Converter stud or studs, impeller hub or bushing are damaged.

^ Discoloration (due to overheating).

^ Evidence of transmission assembly or fluid contamination due to the following transmission or converter failure modes: -

Major metallic failure.

- Multiple clutches or clutch plate failures.

- Sufficient component wear which results in metallic contamination.

- Internal torque converter contamination present. For additional information refer to Torque Converter Contamination Inspection. See: Testing and Inspection/Component Tests and General Diagnostics/Torque Converter Contamination Inspection

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

Torque Converter: Testing and Inspection Torque Converter Contamination Inspection

Torque Converter Contamination Inspection

CAUTION: Do not use water-based cleaners or mineral spirits to clean or flush the torque converter or transmission damage will occur. Use only clean automatic transmission fluid designated for the transmission and converter being serviced.

NOTE: The torque converter drain plug and seal are not reusable. If equipped, discard the drain plug and seal, then install a new drain plug assembly.

1. If a new or remanufactured torque converter is not being installed, the following steps must be completed. 2. With the torque converter on a bench, pour a small amount of transmission fluid from the torque converter onto an absorbent white tissue or

through a paper filter and examine the fluid.

3. Observe the color and odor of the fluid. The fluid should be red, not brown or black. Odor may indicate an overheating condition such as clutch

disc or band failure.

4. Examine the stain on the tissue for evidence of particles (spec of any kind). Examine the fluid level indicator for signs of antifreeze (gum or

varnish). If particles are present in the fluid or there is evidence of engine coolant or water, a new torque converter must be installed.

5. If there are no particles or contamination present, drain the remainder of the transmission fluid from the torque converter. 6. Add 1.9L (2 qt) of clean automatic transmission fluid into the converter and agitate by hand. 7. Thoroughly drain the fluid.

Torque Specifications

Description	Nm	lb-ft	lb-in
Transmission fluid cooler radiator fitting	60	44	—
Transmission fluid cooler screws	8	—	71

Torque Specifications (Continued)

Description	Nm	lb-ft	lb-in
Transmission fluid cooler tube bracket screw	20	15	—
Transmission fluid cooler tube fittings	28	21	—

Transmission Cooler: Mechanical Specifications

Torque Specifications

Material

Item	Specification	Fill Capacity
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V	5R44E rear wheel drive (RWD) 2.3L 9.4L (9.9 qt) 5R44E RWD 3.0L 9.5L (10.0 qt) 5R44E four wheel drive (4WD) 3.0L 9.8L (10.3 qt) 5R55E RWD 4.0L SOHC 9.5L (10.0 qt) 5R55E 4WD 4.0L SOHC 9.8L (10.3 qt)

Transmission Cooler: Capacity Specifications

Material

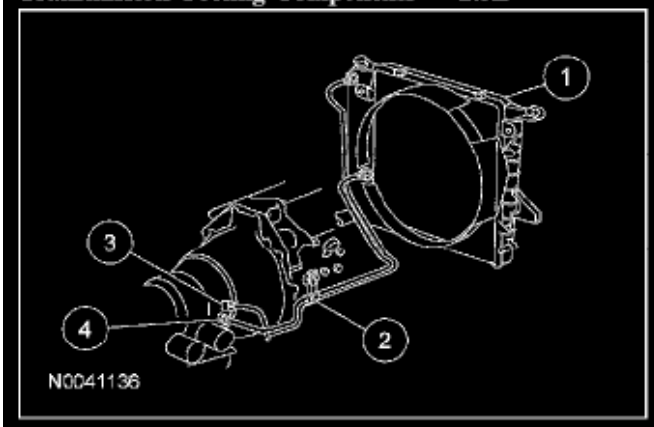
Material

Item	Specification	Fill Capacity
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V	5R44E rear wheel drive (RWD) 2.3L 9.4L (9.9 qt) 5R44E RWD 3.0L 9.5L (10.0 qt) 5R44E four wheel drive (4WD) 3.0L 9.8L (10.3 qt) 5R55E RWD 4.0L SOHC 9.5L (10.0 qt) 5R55E 4WD 4.0L SOHC 9.8L (10.3 qt)

Transmission Cooler: Fluid Type Specifications

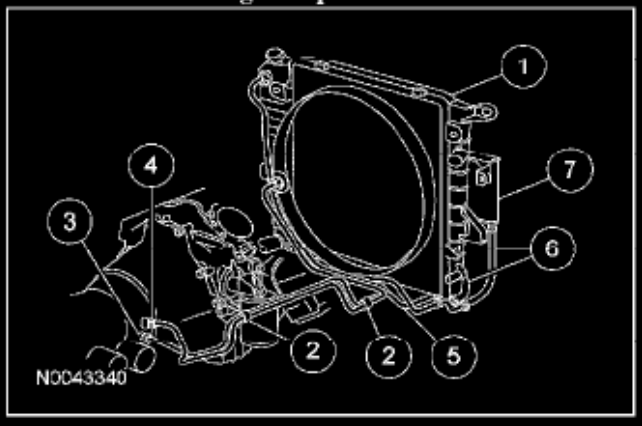
Material

Transmission Cooling Components — 2.3L



Item	Part Number	Description
1	8005	Radiator
2	7N291	Transmission fluid cooler line clip
3	7A030	Fluid cooler inlet tube
4	7A031	Fluid cooler tube

Transmission Cooling Components — 3.0L and 4.0L



Item	Part Number	Description
1	8005	Radiator
2	388160-S101	C-clips
3	7A031	Fluid cooler outlet tube
4	7A030	Fluid cooler inlet tube
5	7C410	Auxiliary fluid cooler inlet tube
6	—	Fluid cooler hoses
7	7H189	Fluid cooler

Transmission Cooler: Locations

Transmission Cooling Components - 2.3L

Transmission Cooling Components - 2.3L

Transmission Cooling Components - 3.0L and 4.0L

Transmission Cooling Components - 3.0L And 4.0L

Transmission Cooler: Initial Inspection and Diagnostic Overview

Inspection and Verification

CAUTION: Do not repair the radiator. Aluminum tabs securing radiator outlet tank are permanently damaged during disassembly.

When fluid leakage is found at any of the transmission fluid cooling components, a new component must be installed.

Symptom Chart — Transmission Cooling

Condition	Possible Sources	Action
• Transmission overheating	• Clogged transmission fluid cooler or lines • System leaks • Engine overheating • Internal transmission concerns	• REPAIR as required. • INSPECT transmission fluid cooler and lines for leaks. REPAIR as required. • REFER to Cooling System. • REFER to A/T.
• Fluid leak at the transmission in-tank cooler	• Transmission fluid cooler-to-fluid cooler fitting	• REFER to the Component Test.

Symptom Chart — Noise, Vibration and Harshness (NVH)

NOTE: Noise, vibration and harshness (NVH) symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to Vehicle/Testing. Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for the symptom, refer back to Vehicle/Testing for the next likely system and continue diagnosis.

Condition	Possible Sources	Action
• Vibration — a high frequency (20-80 Hz) that is felt through the seat or selector lever. Changes with engine speed	• Transmission cooler lines grounded out	• CHECK the transmission cooler lines. REPAIR as necessary.

Transmission Cooler: Symptom Related Diagnostic Procedures

Symptom Chart - Transmission Cooling

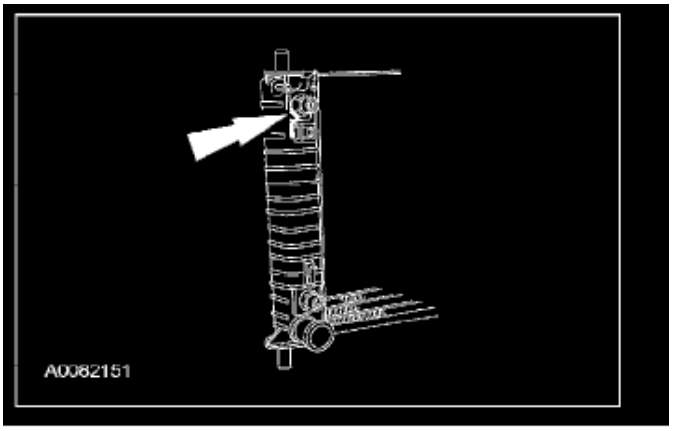
Symptom Chart - Transmission Cooling

Symptom Chart - Transmission Cooling

Symptom Chart - Noise, Vibration and Harshness (NVH)

Symptom Chart - Noise, Vibration and Harshness (NVH)

Symptom Chart - Noise, Vibration And Harshness (NVH)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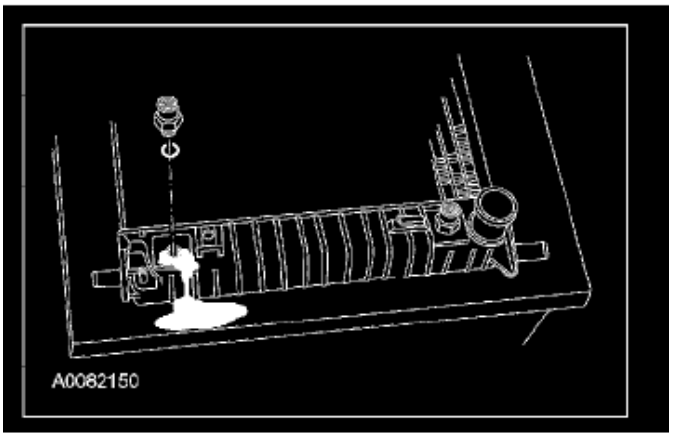
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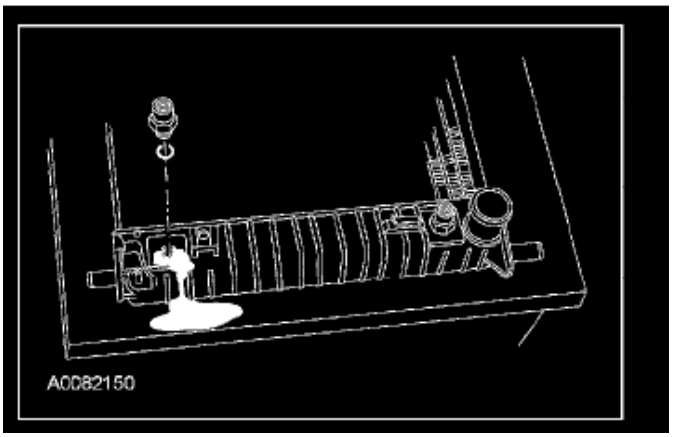
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Transmission Cooler: Component Tests and General Diagnostics

Transmission Fluid Cooler Leaks at Radiator

Transmission fluid may leak between the radiator transmission fluid cooler and the transmission fluid cooler fitting (not the cooler line into the fitting), which may result in a residue of transmission fluid on the radiator tank around the fluid cooler fitting. Insufficient thread sealer on the transmission fluid cooler fitting may be the cause.

1. Clean the area around the transmission fluid cooler fittings.

2. Verify that transmission fluid is leaking between the transmission fluid cooler and the transmission fluid cooler fitting (not the transmission fluid

cooler line fitting into the transmission fluid cooler fitting).

3. Remove the radiator from the vehicle and place it on a flat surface with the transmission fluid cooler fittings facing upward. Refer to Cooling

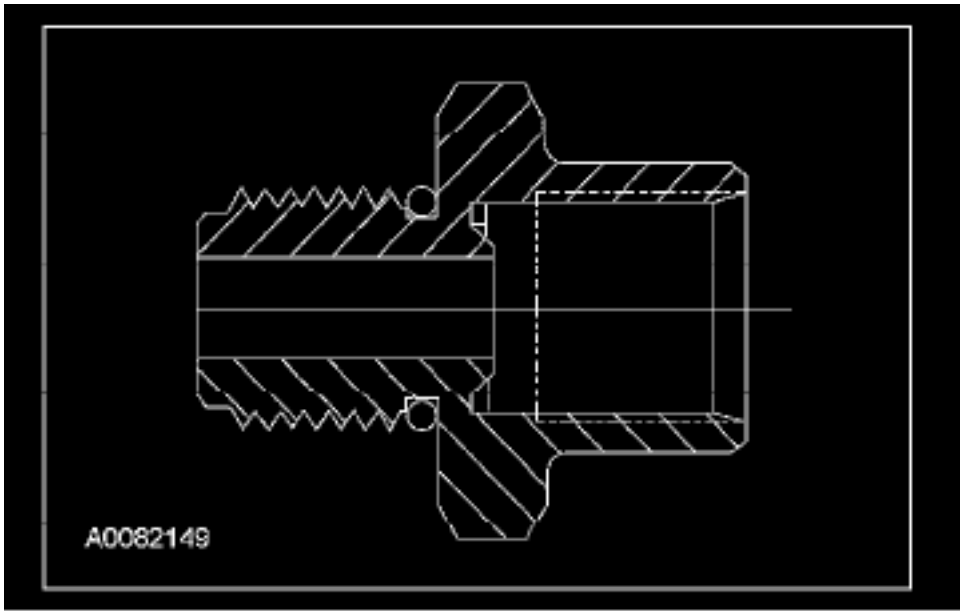
System.

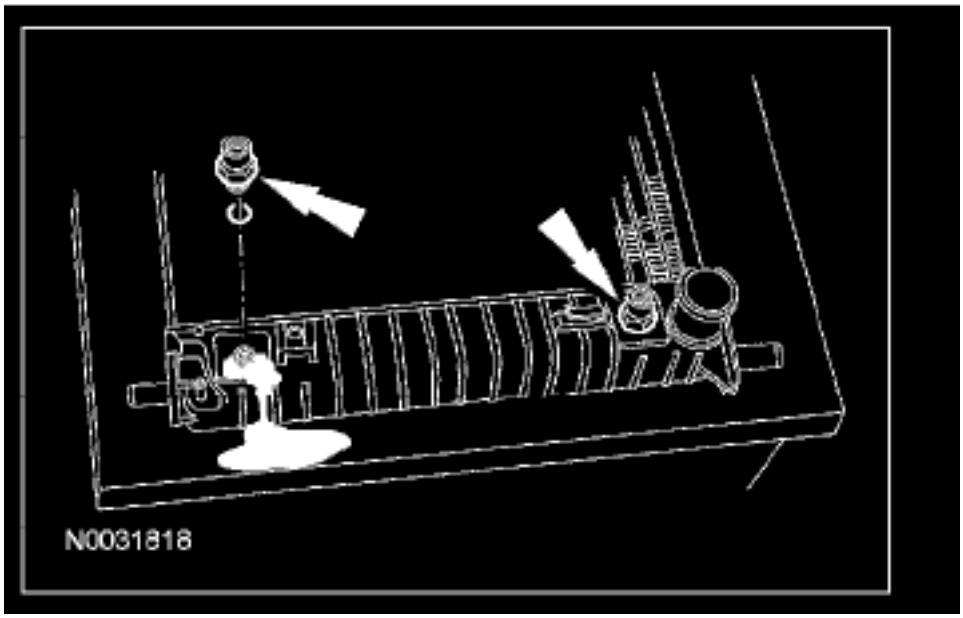
4. CAUTION: Oil-based solvents and cleaners should not be used when cleaning the radiator. Oil-based solvents and cleaners may damage

the radiator end tank seals and cause leaks.

Clean the area around the transmission fluid cooler fittings so that contaminants do not enter the transmission fluid cooler when the transmission fluid cooler fittings are removed.

5. NOTE: Remove only one transmission fluid cooler fitting at a time, otherwise the cooler may drop into the radiator.





Remove the upper transmission fluid cooler fitting.

6. Once the fitting is removed from the transmission fluid cooler, verify that there is a gasket between the transmission fluid cooler and the inside of

the radiator tank. ^

If there is no gasket, install a new radiator.

^ If there is a gasket, proceed to the next step.

7. Inspect the transmission fluid cooler fitting threads for damage.

^ If the threads are damaged, install a new radiator.

^ If the threads show no sign of damage, proceed to the next step.

8. CAUTION: Thread sealant or tape should never be used on the threads of the transmission fluid cooler fittings. The use of such

materials will create a leak path.

Install a new O-ring on the transmission fluid cooler fitting.

9. NOTE: Do not use air tools to tighten the transmission fluid cooler fitting. Use a hand-operated torque wrench only.

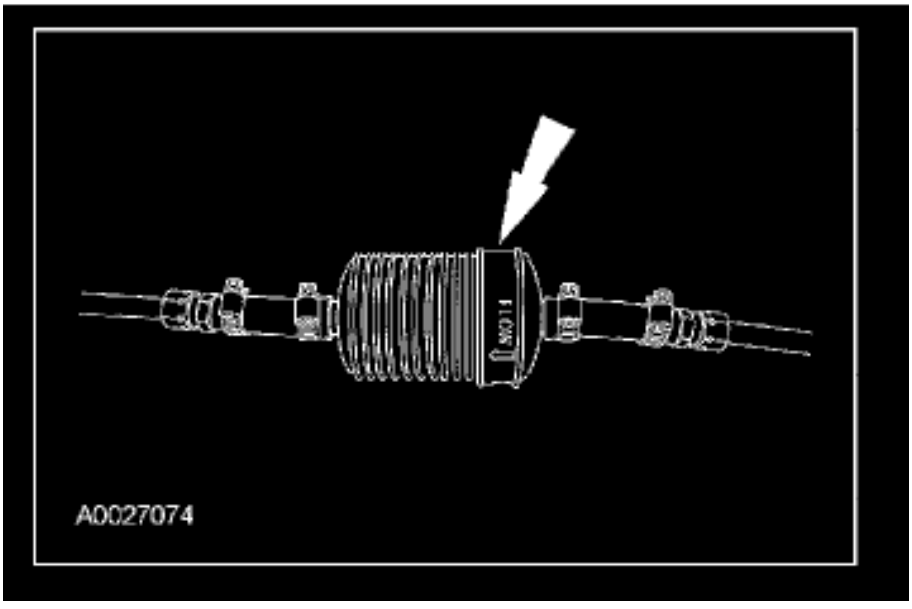
Making sure that the gasket between the transmission fluid cooler and the inside of the radiator tank is still in place, install the transmission fluid cooler fitting. ^

Tighten to 60 Nm (44 lb-ft).

10. Follow the procedure to install a new O-ring on the other transmission fluid cooler fitting. 11. Make sure that no radiator coolant has entered the transmission fluid cooler. Install the radiator in the vehicle. 12. Verify that both the transmission and the engine cooling system are at the correct fluid levels.

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V



Transmission Cooler: Procedures

Transmission Fluid Cooler Backflushing and Cleaning

CAUTION: Whenever a transmission has been disassembled to install new parts or a new or remanufactured transmission has been installed, a new transmission fluid cooler, either in-tank, auxiliary or oil to air (OTA), if equipped will need to be installed. Using a suitable torque converter/fluid cooler cleaner, clean and backflush the transmission fluid cooler tubes.

When internal wear or damage has occurred in the transmission, metal particles, clutch plate material or band material may have been carried into the transmission fluid cooler. These contaminants are a major cause of recurring transmission concerns and must be removed from the system before the transmission is put back in use.

CAUTION: Use only clean automatic transmission fluid specified for this transmission. Do not use supplemental fluid additives, treatments or cleaning agent. The use of these materials may affect transmission operation and result in internal damage to the transmission.

NOTE: Do not use any solvents while carrying out this procedure. Only use clean automatic transmission fluid.

1. Conduct backflushing with a suitable torque converter/transmission fluid cooler cleaner. Test the equipment to make sure that a vigorous fluid

flow is present before proceeding. Install a new system filter if flow is weak or contaminated.

2. Remove and discard the in-line transmission fluid filter, if equipped.

3. To aid in attaching the cleaner to the transmission steel cooler lines, connect 2 additional rubber hoses to the transmission end of the steel

transmission cooler lines as described. ^

Connect the cleaner tank pressure line to the steel transmission cooler return line (longest line).

^ Connect a tank return hose to the steel transmission cooler pressure line (shorter line). Place the outlet end of this hose in the solvent tank reservoir.

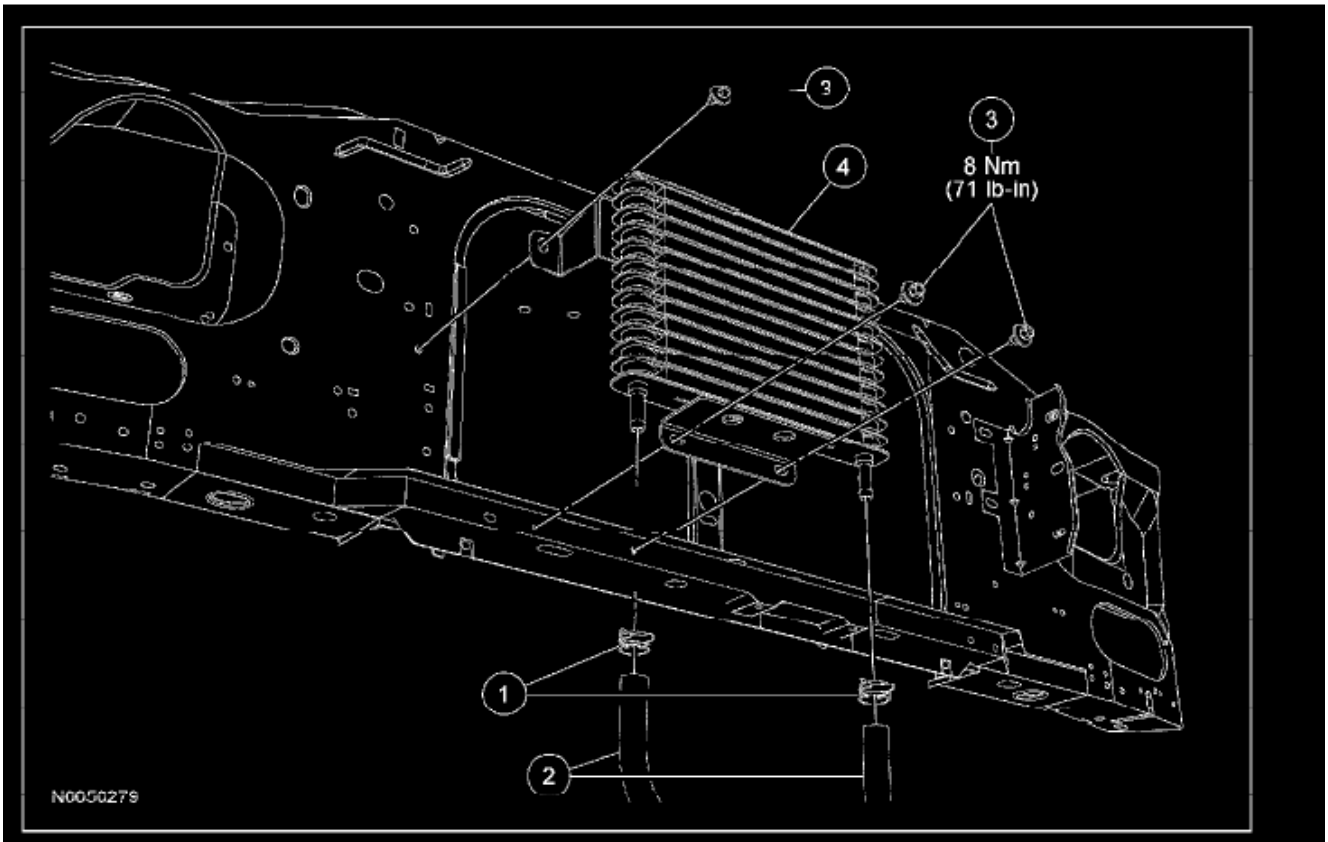
4. Turn on the pump and allow the transmission fluid to circulate a minimum of 5 minutes (cycling switch on and off will help dislodge contaminants

in the cooler system).

5. Switch off the pump and disconnect the pressure hose from the transmission cooler return line.
6. Use compressed air to blow out the cooler(s) and lines (blow air into the transmission cooler return line) until all the fluid is removed. 7. Remove the rubber return hose from the remaining steel cooler line.

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V



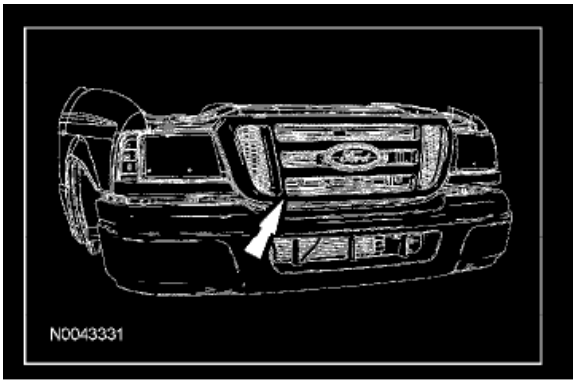
Item	Part Number	Description
1	—	Transmission fluid cooler hose clamps
2	—	Transmission fluid cooler hoses
3	—	Transmission fluid cooler screws
4	7H189	Transmission fluid cooler

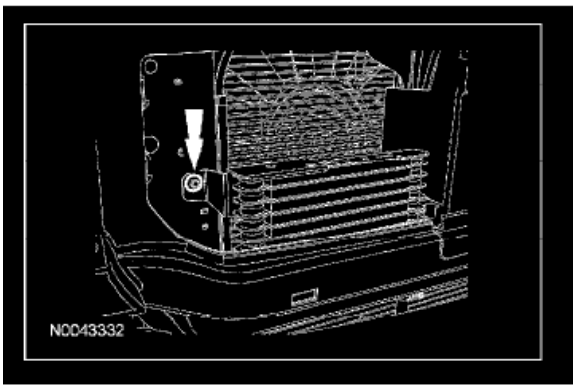
Transmission Cooler: Removal and Replacement

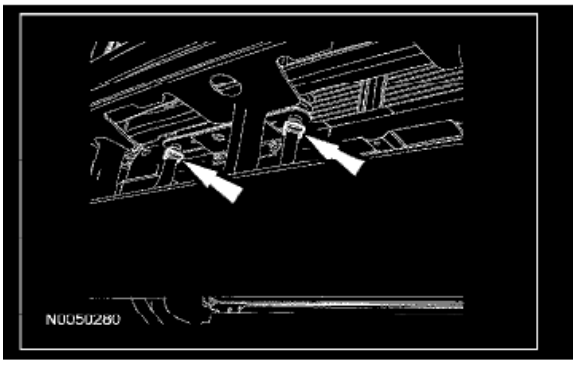
Auxiliary Transmission Fluid Cooler - 3.0L 4.0L

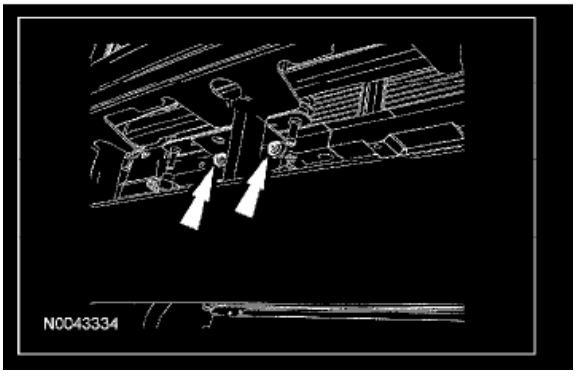
Removal

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Remove the grille.


N0043331


N0043332


N0050280

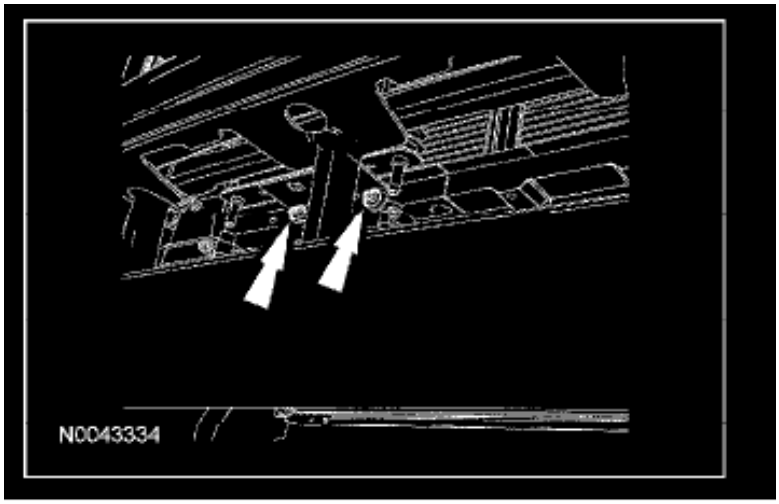

N0043334

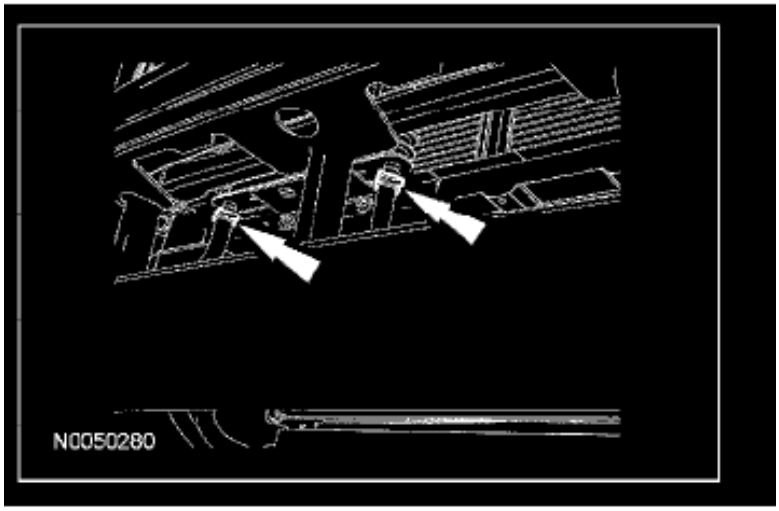
3. Remove the upper transmission fluid cooler screw.

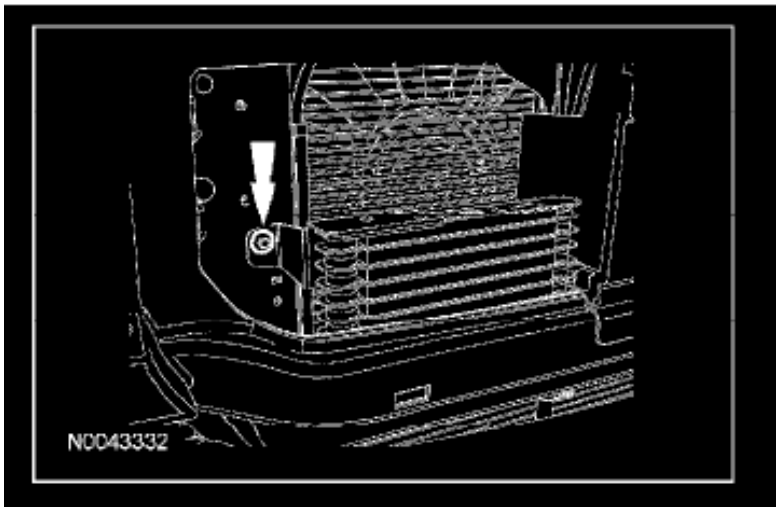
4. Remove the transmission fluid cooler hose clamps and the transmission fluid cooler hoses.

5. Remove the 2 lower transmission fluid cooler screws and remove the cooler.

Installation


N0043334


N0050280


N0043332

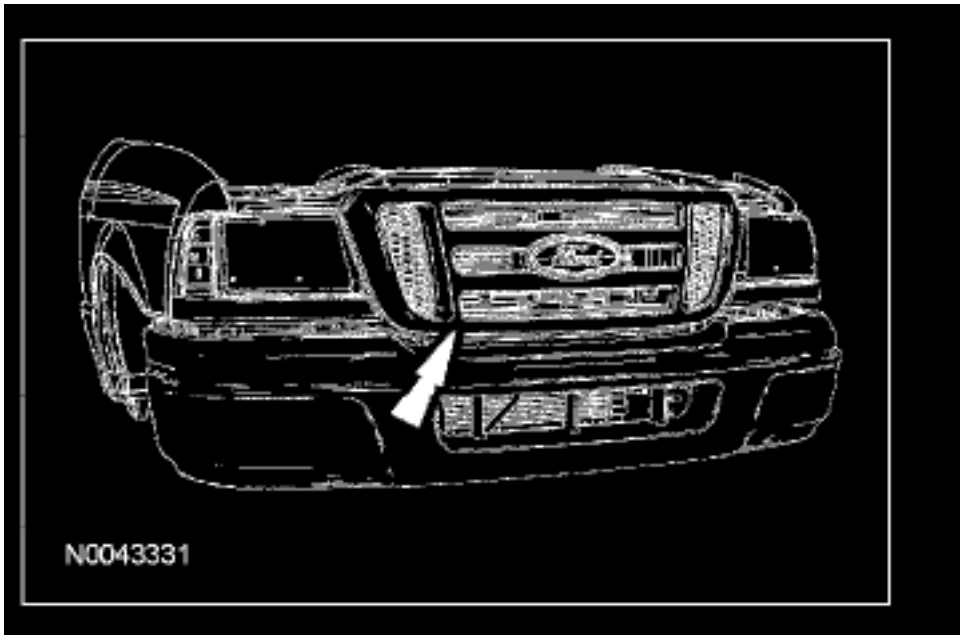
1. Position the transmission fluid cooler in the vehicle and install the lower screws.

^ Tighten to 8 Nm (71 lb-inch).

2. Install the transmission fluid cooler hoses and clamps.

3. Install the upper transmission fluid cooler screw.

4. Install the grille.



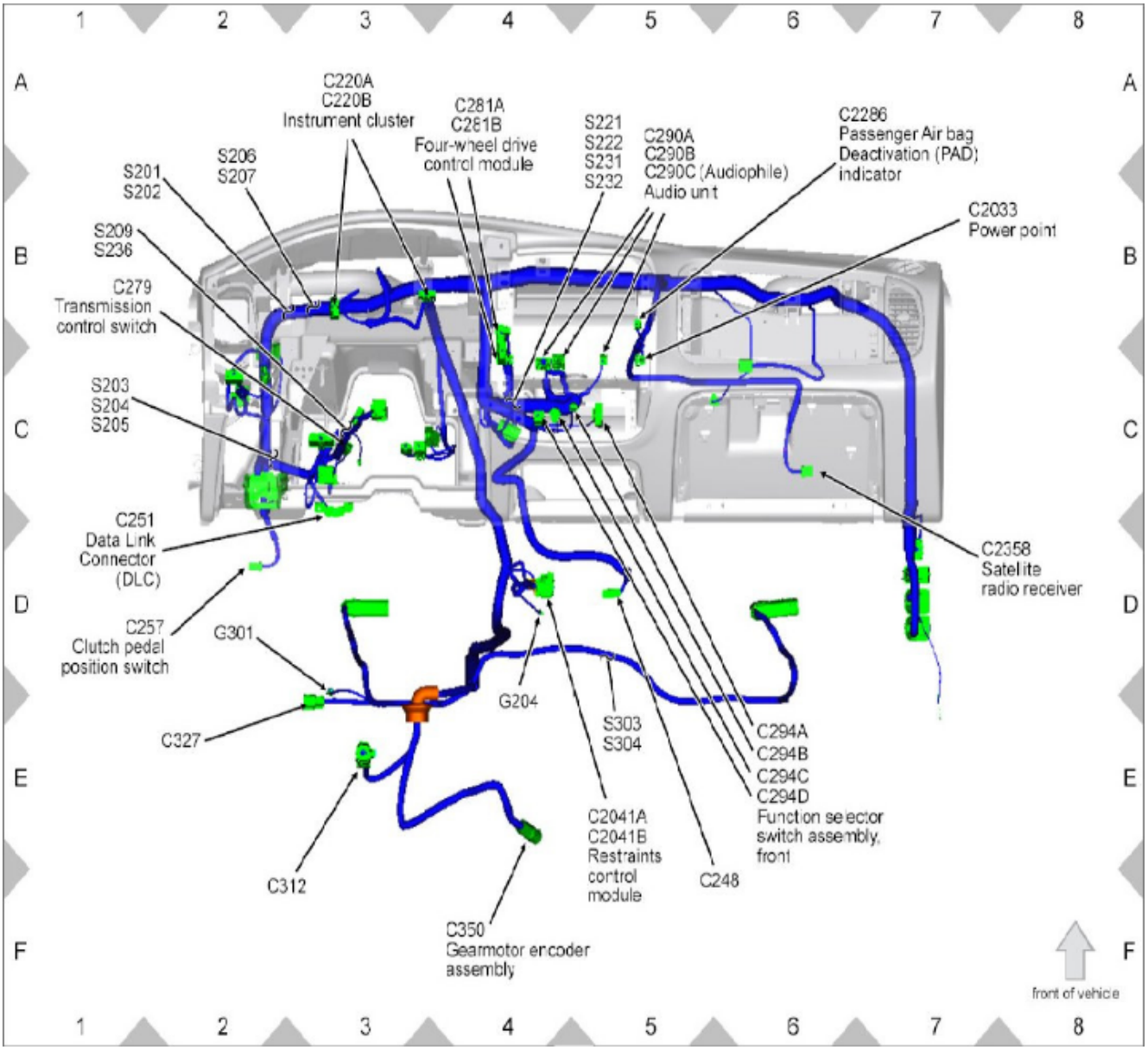
5. Fill the transmission with clean automatic transmission fluid to the correct level and check for correct transmission operation.

Transmission Mode Indicator - A/T: Description and Operation

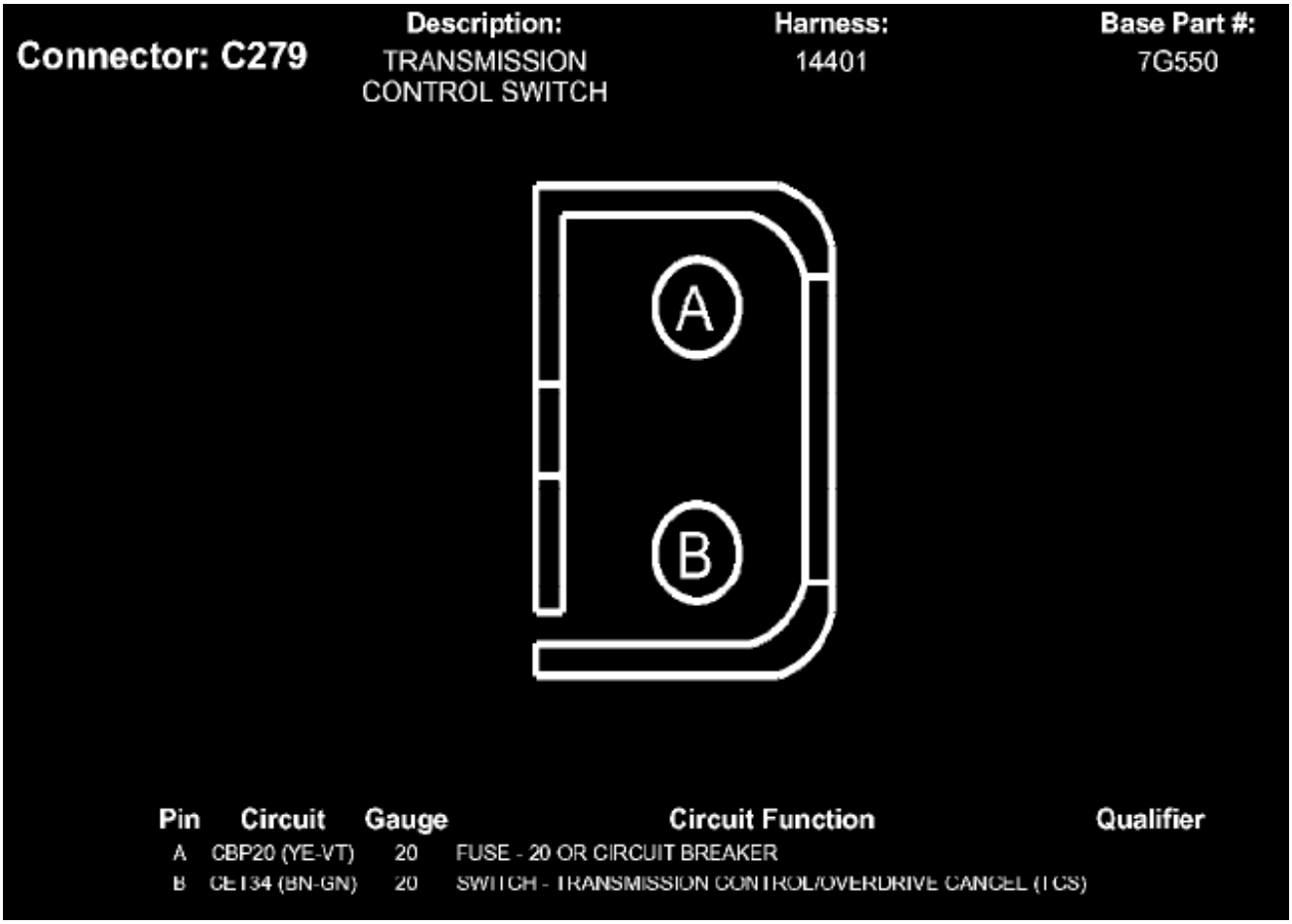
TRANSMISSION CONTROL INDICATOR LAMP (TCIL)

The TCIL is an output signal from the PCM that controls the lamp on/off function depending on the engagement or disengagement of overdrive.

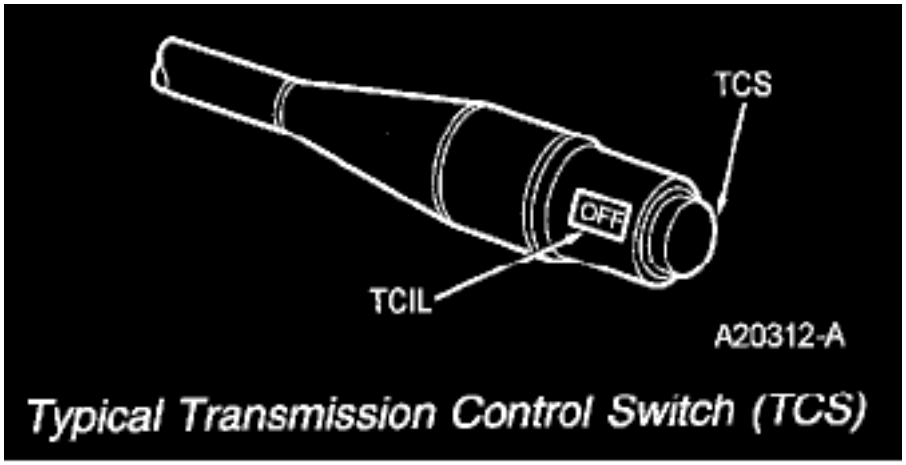
Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Transmission and Drivetrain > Automatic Transmission/Transaxle > Transmission Mode Switch, A/T > Component Information > Locations



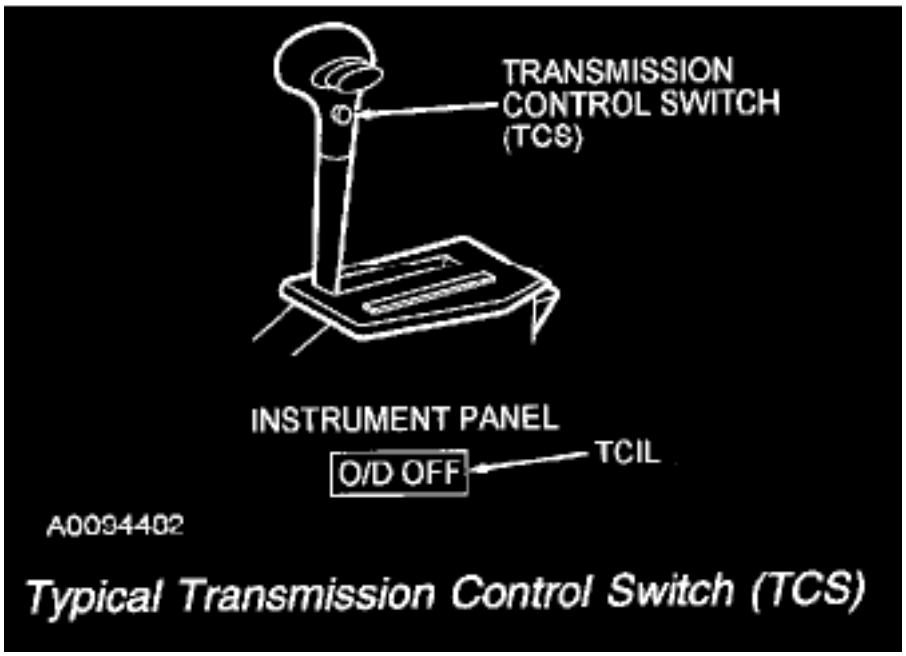
View 151-12


Connector: C279
Description:
TRANSMISSION CONTROL SWITCH
Harness:
14401
Base Part #:
7G550
A
B
Pin Circuit Gauge Circuit Function Qualifier
A CBP20 (YE-VT) 20 FUSE - 20 OR CIRCUIT BREAKER
B CE134 (BN-GN) 20 SWITCH - TRANSMISSION CONTROL/OVERDRIVE CANCEL (TCS)

C279



Typical Transmission Control Switch (TCS)



Typical Transmission Control Switch (TCS)

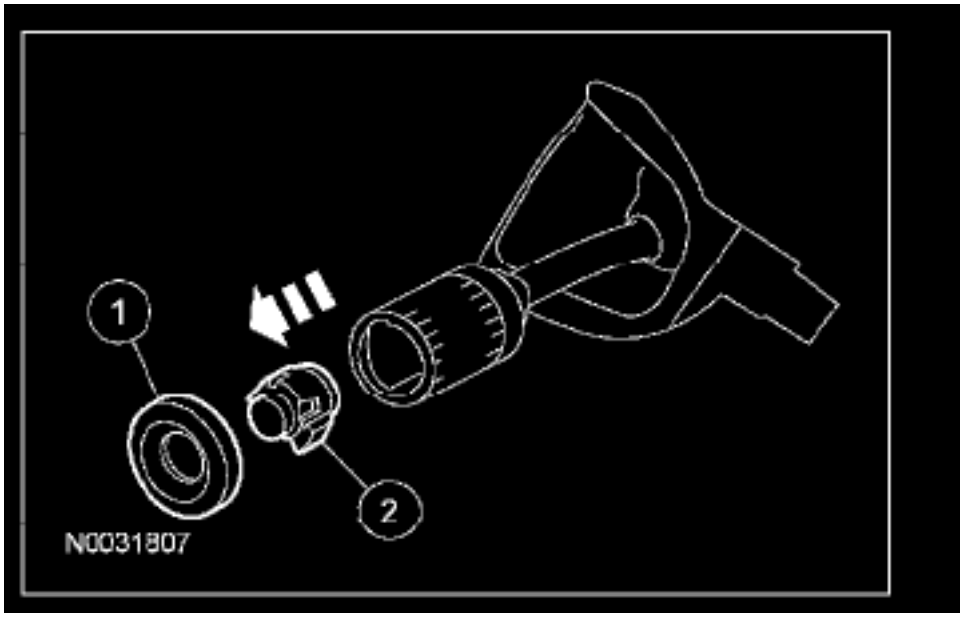
Transmission Mode Switch: Description and Operation

TRANSMISSION CONTROL SWITCH (TCS)

Typical Transmission Control Switch (TCS)

Typical Transmission Control Switch (TCS)

The TCS signals the PCM with VPWR whenever the TCS is pressed. On vehicles with this feature, the transmission control indicator lamp (TCIL) illuminates when the TCS is cycled to disengage overdrive.



Transmission Mode Switch: Service and Repair

Transmission Control (TC) Switch

Removal and Installation

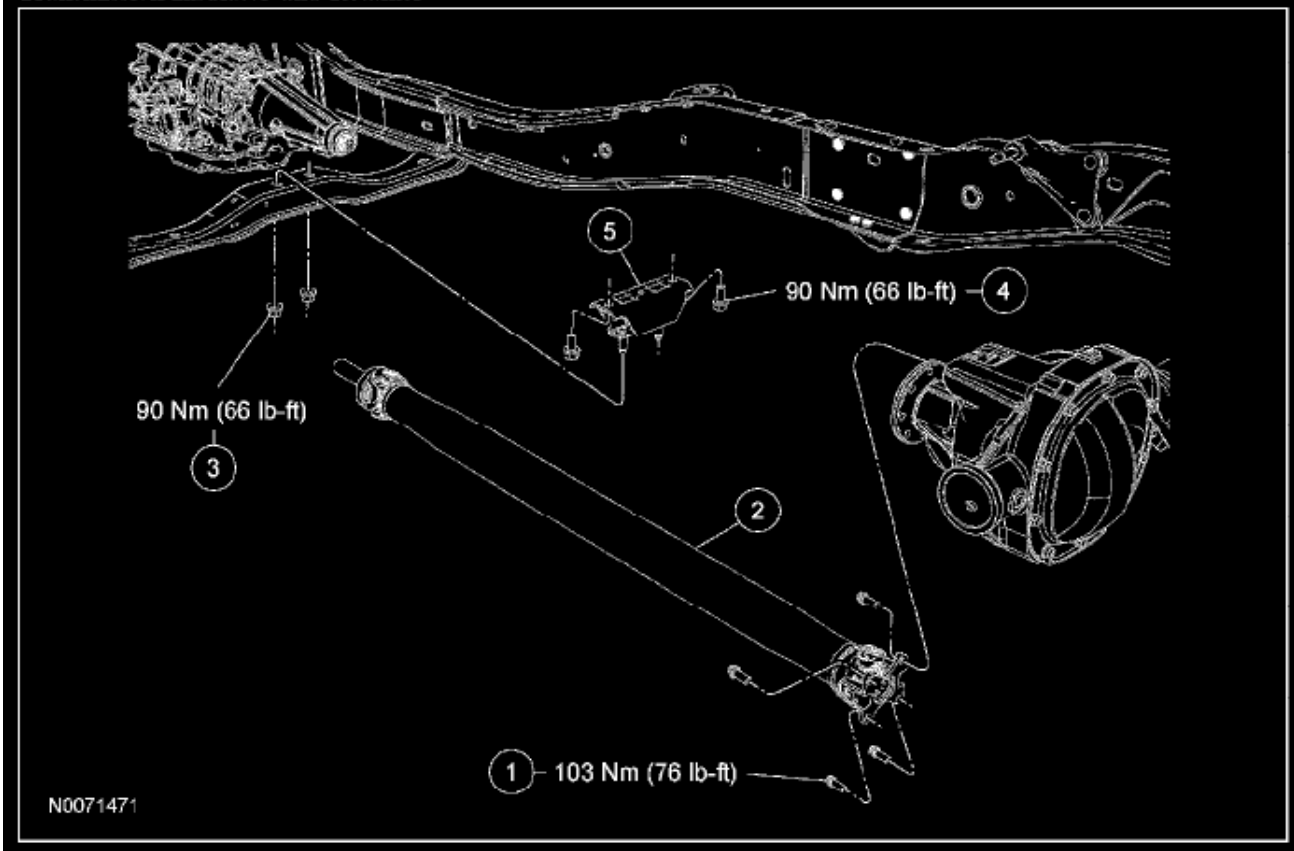
1. Remove the transmission control (TC) switch.

1 Remove the TC switch cover.

2 Remove the TC switch.

2. To install, reverse the removal procedure.

Transmission Insulator and Retainer



Item	Part Number	Description
1	N800594-S	Driveshaft bolt (4 required)
2	4602-H	Driveshaft
3	N621945-S	Insulator nut (2 required)
4	390066	Insulator bolt (2 required)
5	6D091-A	Insulator

Transmission Mount: Service and Repair

Transmission Insulator and Retainer

Transmission Insulator and Retainer

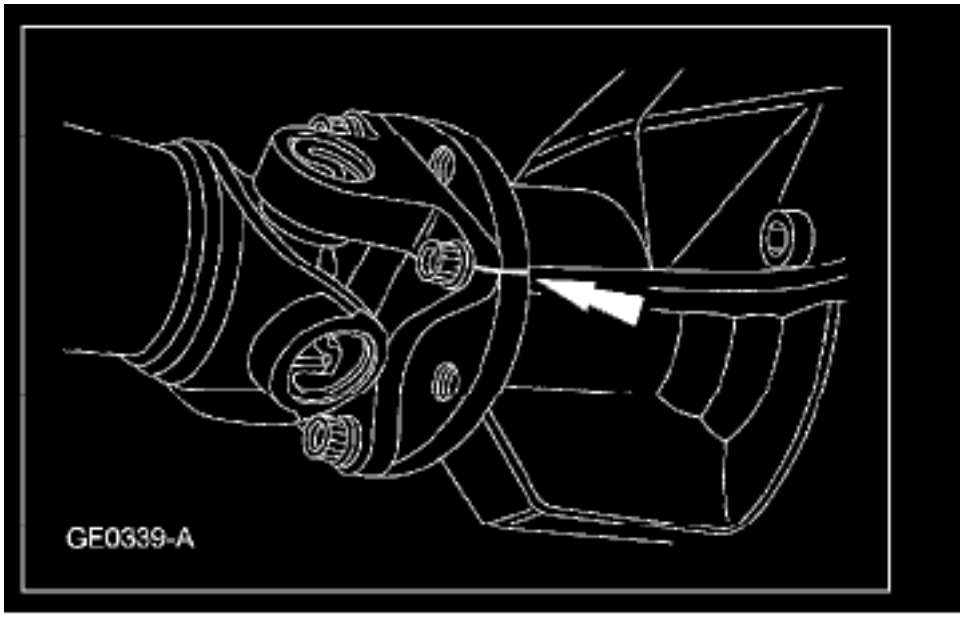
Removal

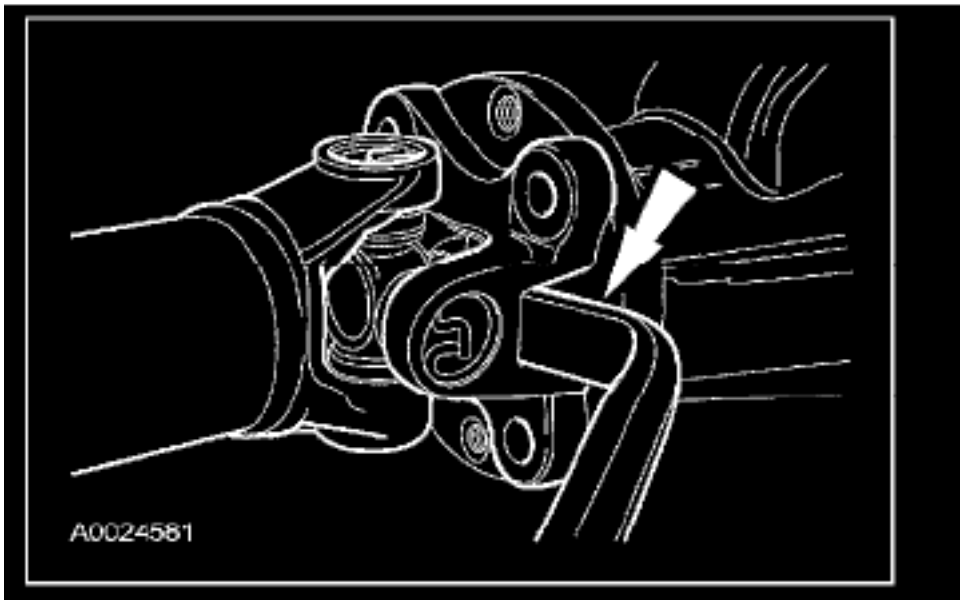
NOTE: Rear wheel drive (RWD) procedure shown, four wheel drive (4WD) similar. The front driveshaft must be removed.

1. With the vehicle in NEUTRAL, position it on a hoist.

2. NOTE: To maintain initial driveshaft balance, mark the rear driveshaft yoke and axle flange so they can be installed in their original alignment.

Mark the rear driveshaft.





3. Remove the 4 rear driveshaft bolts.

4. NOTE: Do not use a hammer.

Remove the rear driveshaft from the flange using a pry bar.

5. Remove the insulator nuts. 6. Raise and support the transmission. 7. Remove the insulator screws. 8. Remove the insulator.

Installation

1. Position the insulator on the extension housing. 2. Install the insulator-to-extension housing screws.

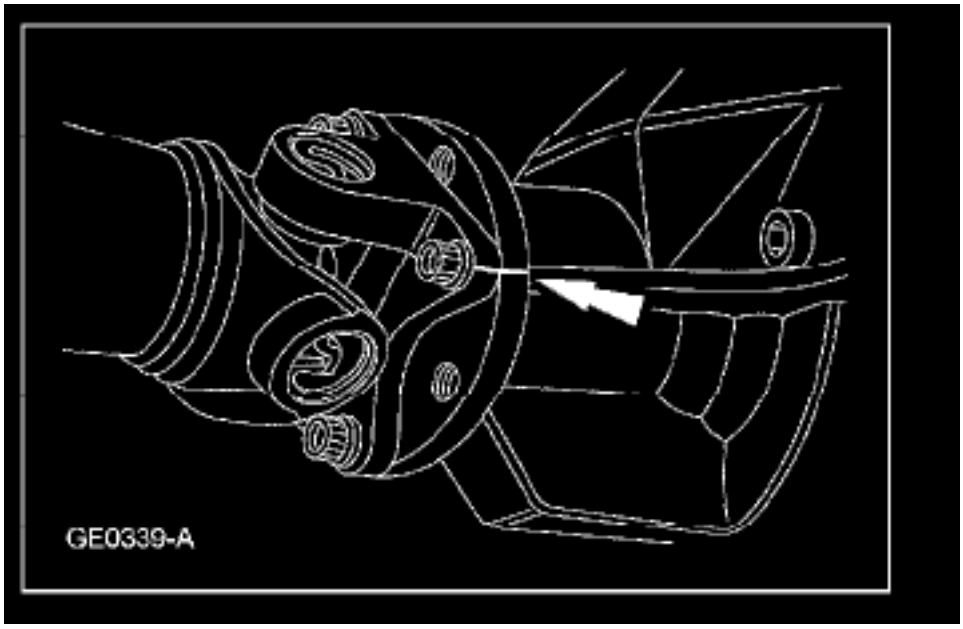
^ Tighten to 90 Nm (66 lb-ft).

3. Install the insulator into the crossmember and tighten the nuts.

^ Tighten to 90 Nm (66 lb-ft).

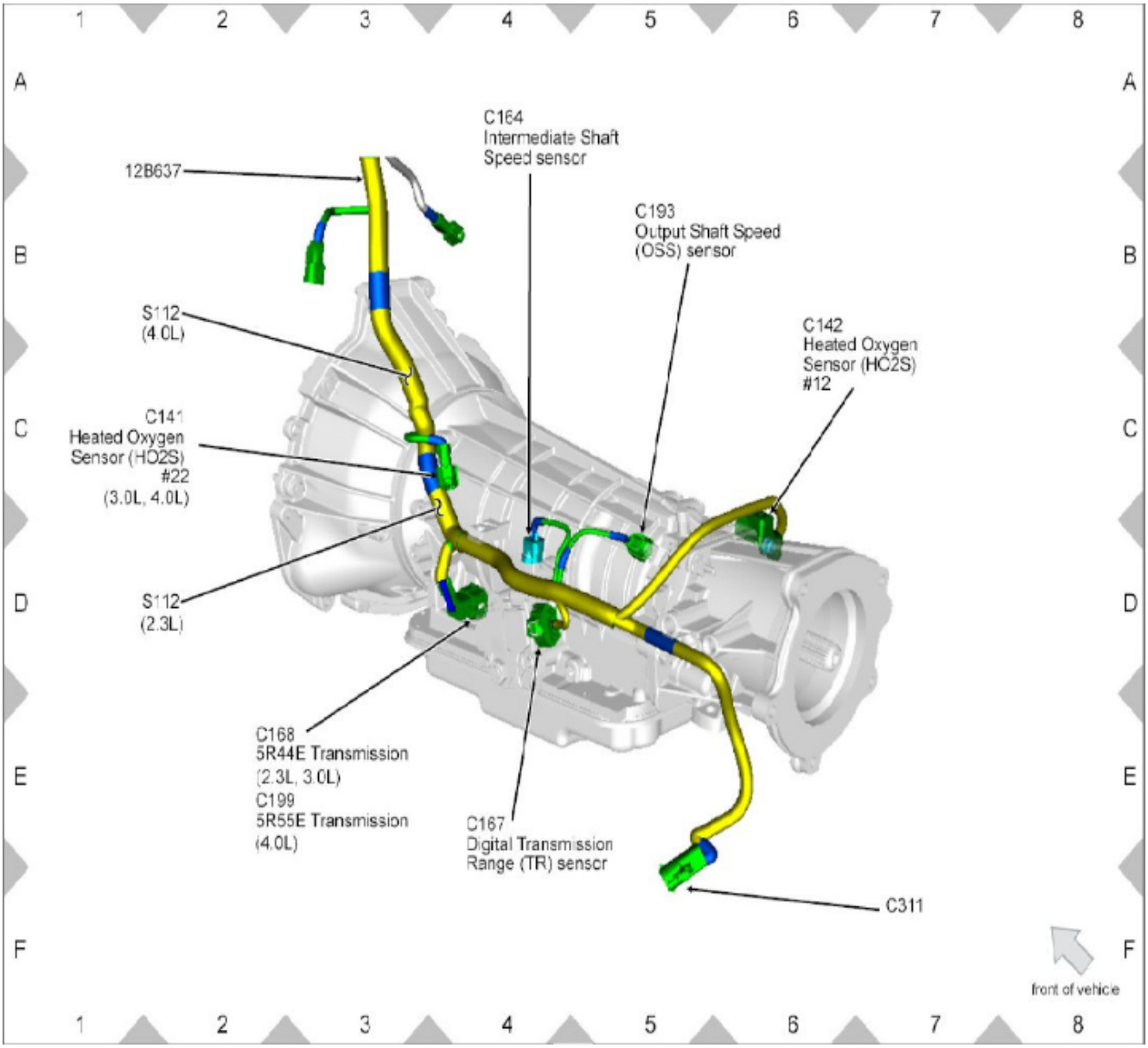
4. NOTE: Align the driveshaft with the marks made during removal to make sure of correct balance.

Align and install the rear driveshaft.



5. With the marks aligned, install the rear driveshaft and bolts.

^ Tighten to 103 Nm (76 lb-ft).


C164
Intermediate Shaft Speed sensor
12B637
C193
Output Shaft Speed (OSS) sensor
S112
(4.0L)
C142
Heated Oxygen Sensor (HO2S) #12
C141
Heated Oxygen Sensor (HO2S) #22
(3.0L, 4.0L)
S112
(2.3L)
C168
5R44E Transmission
(2.3L, 3.0L)
C199
5R55E Transmission
(4.0L)
C167
Digital Transmission Range (TR) sensor
C311
front of vehicle

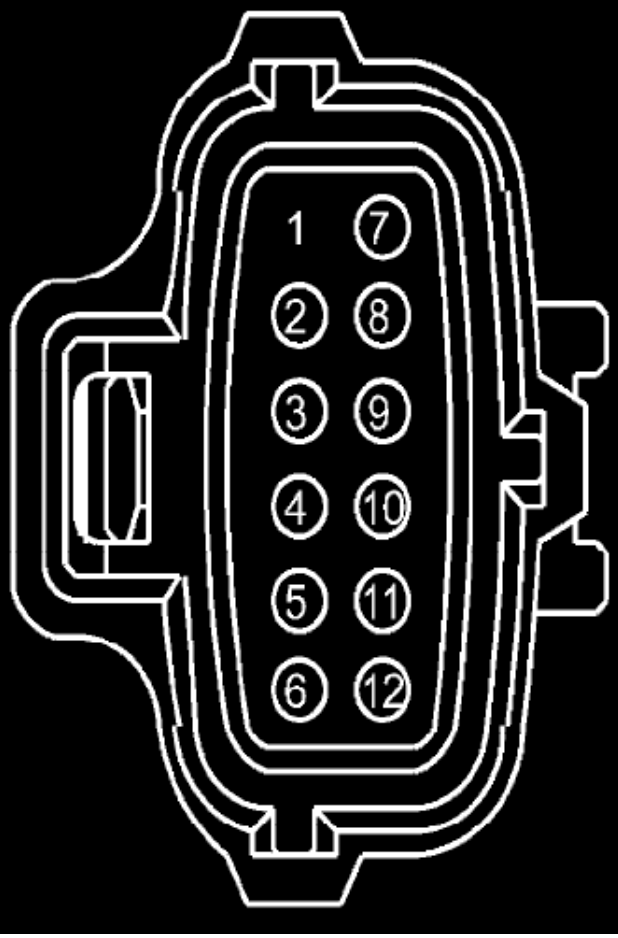
View 151-10

Connector: C167

Description: DIGITAL TRANSMISSION RANGE (TR) SENSOR

Harness: 12B637

Base Part #: 7F293



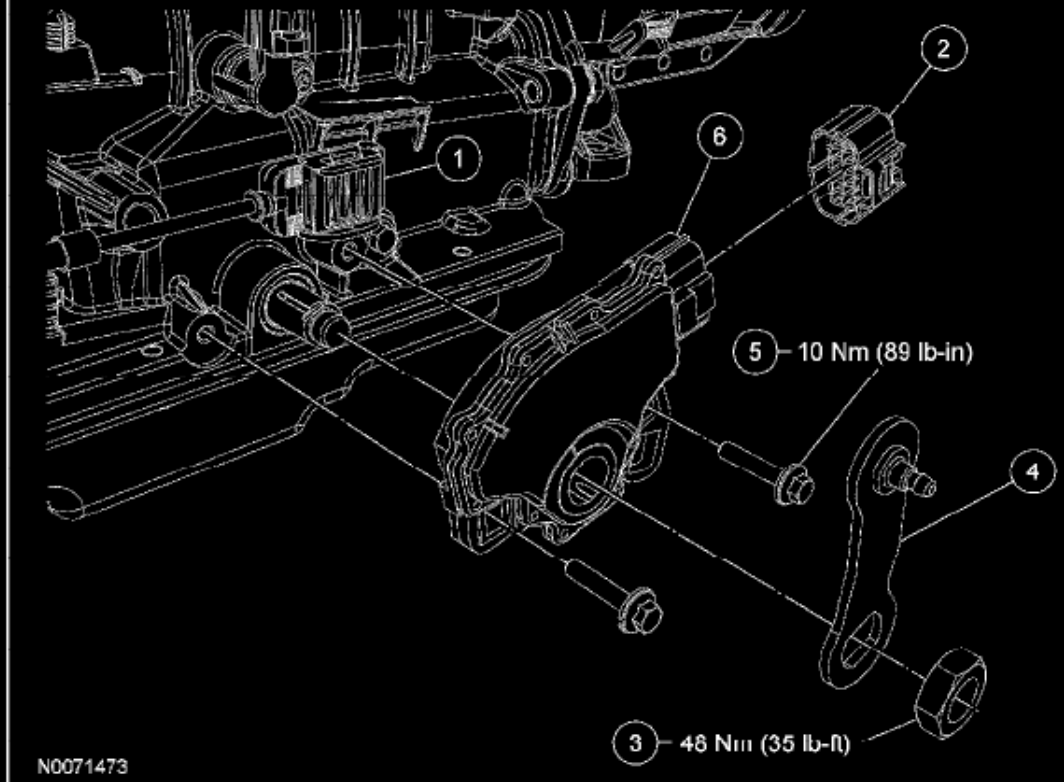
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	RE406 (GY-VT)	18	SIGNAL RETURN	
3	VET28 (GY-VT)	20	TR3A	
4	VET29 (VT-WH)	20	TR1	
5	VET30 (YE)	20	TR2	
6	VET31 (BU-OG)	20	TR4	
7	GD108 (BK-VT)	18	GROUND	4x4
8	CCF20 (GY-VT)	20	NETURAL SENSE	4x4
9	CBP20 (YE-VT)	18	FUSED POWER FEED	
10	CET40 (GN-OG)	20	STARTER CONTROL	
11	CET41 (BN-YE)	18	BACK UP	
12	CBP21 (BU-GY)	20	STARTER TO STARTER INTERRUPT RELAY	

C167

Special Tool(s)

ST1633-A	Alignment Gauge, TR Sensor 307-351 (T97L-70010-A)

Digital Transmission Range (TR) Sensor



Item	Part Number	Description
1	7E395-A	Selector lever cable
2	—	Digital transmission range (TR) sensor electrical connector
3	W701271-S	Manual control lever nut
4	7A256-A	Manual control lever
5	N806933-S	Digital TR sensor screw (2 required)
6	7F293-A	Digital TR sensor

Transmission Position Switch/Sensor: Service and Repair

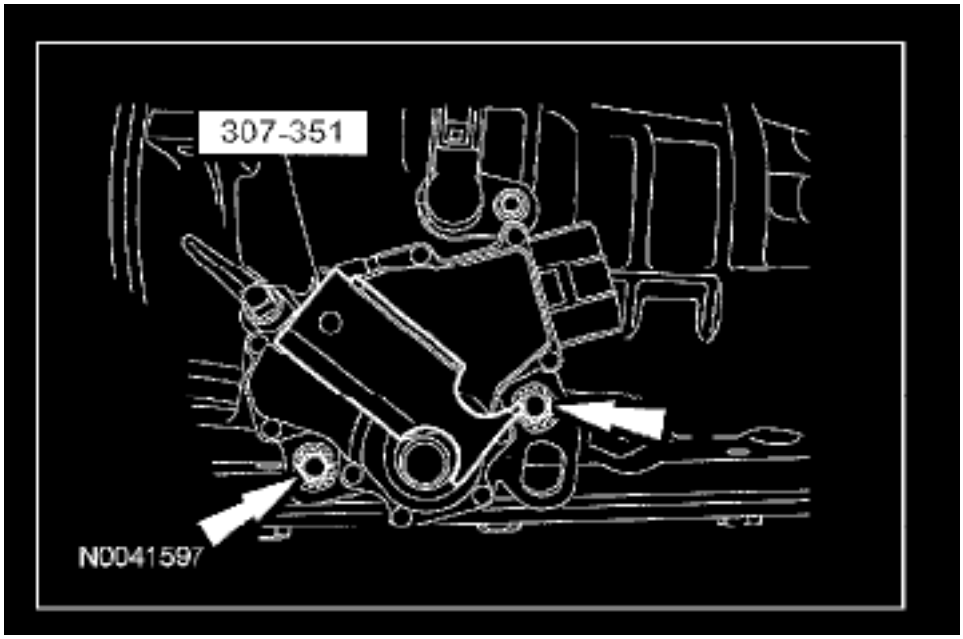
Digital Transmission Range (TR) Sensor

Digital Transmission Range (TR) Sensor

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the selector lever cable from the manual control lever. 3. Disconnect the digital transmission range (TR) sensor electrical connector. 4. Remove the manual control outer lever nut and manual control outer lever. 5. Remove the screws and the digital TR sensor.

Installation



1. CAUTION: The digital transmission range (TR) sensor must fit flush against the boss on the case to prevent damage to the sensor.

Install the digital TR sensor and loosely install the screws.

2. CAUTION: Tightening one screw before tightening the other may cause the sensor to bind or become damaged.

NOTE: The manual lever must be in the NEUTRAL position.

Using the special tool, align the digital TR sensor and tighten screws in an alternating sequence. ^

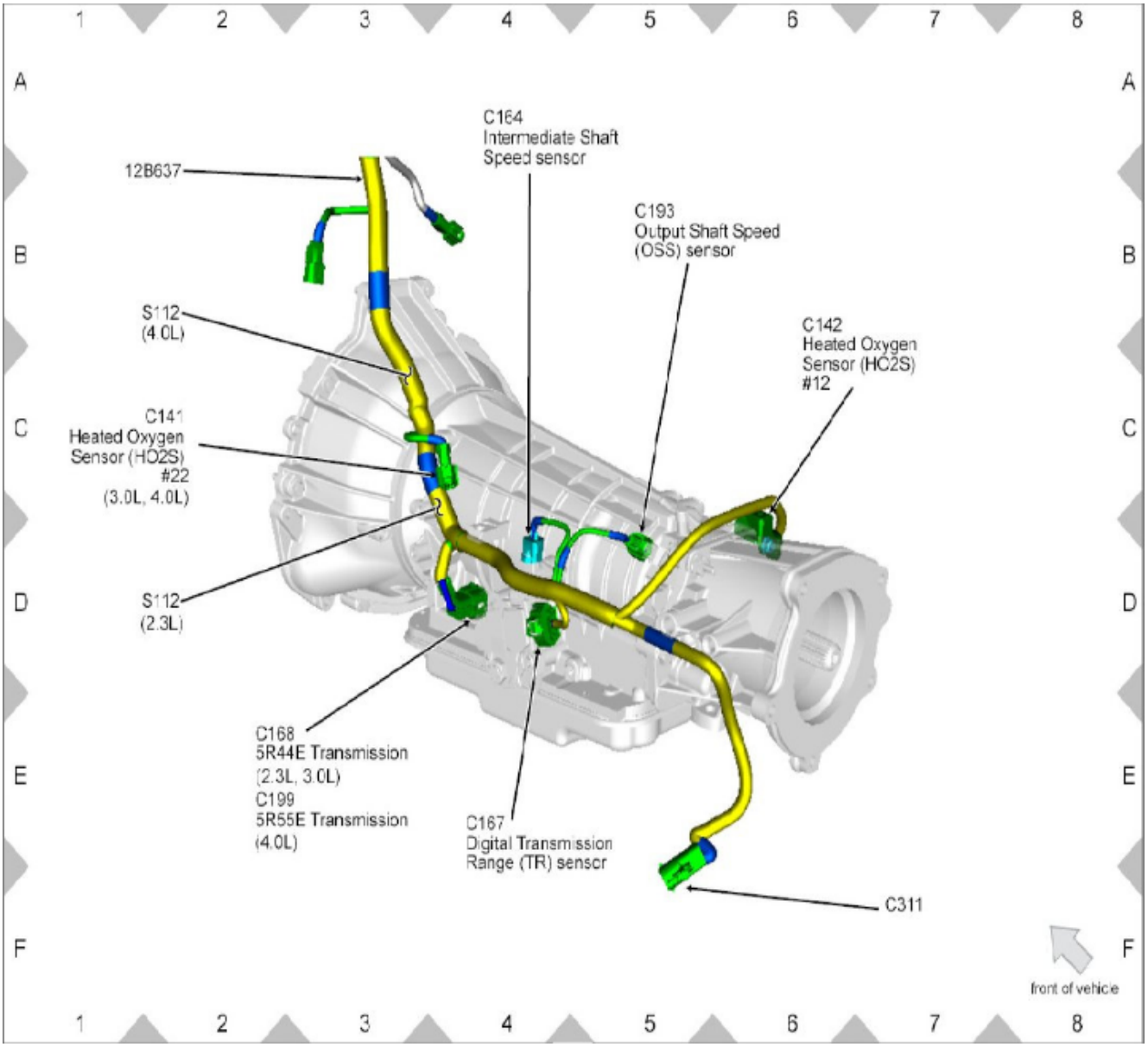
Tighten to 10 Nm (89 lb-inch).

3. Install the manual control outer lever and nut.

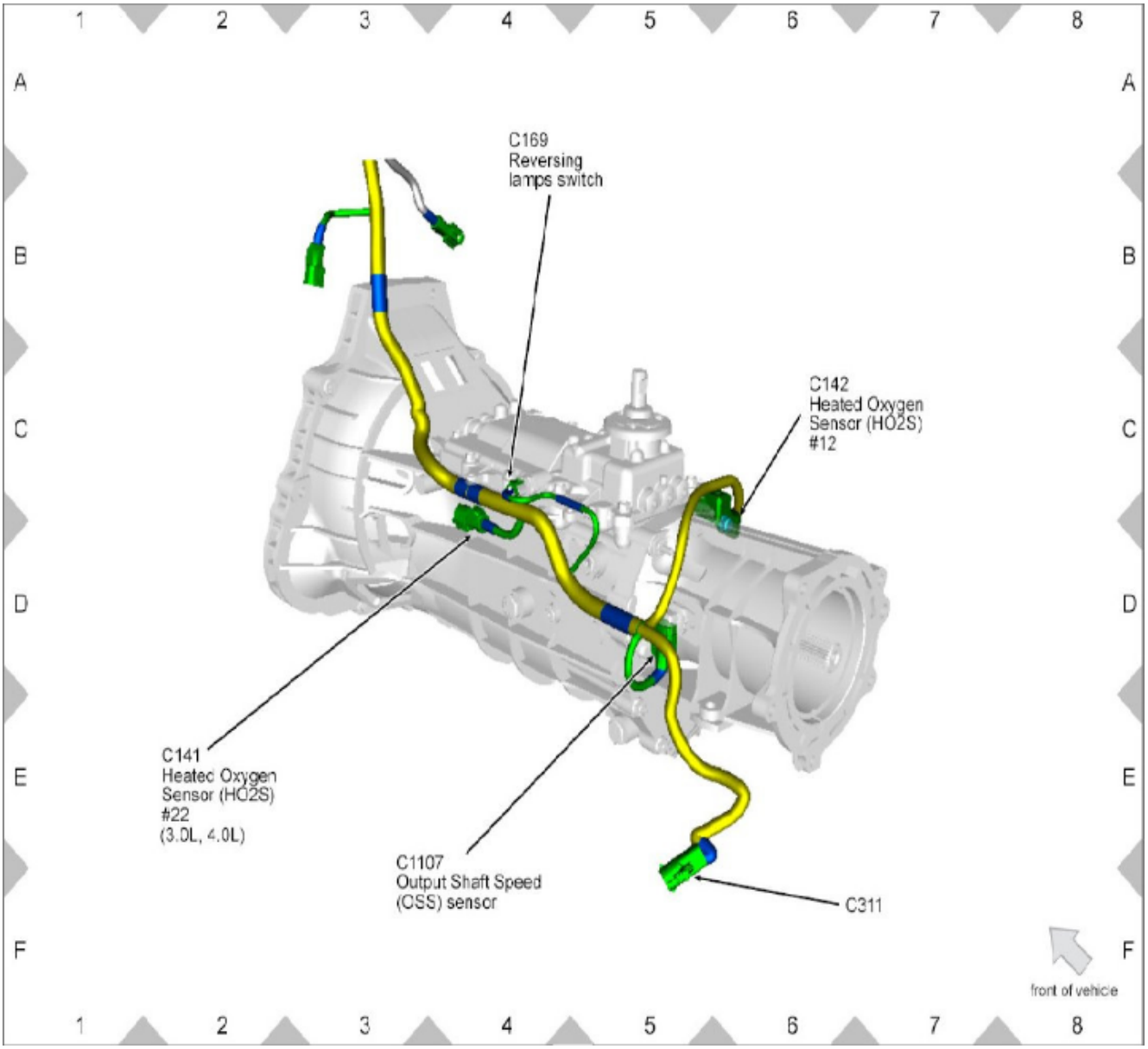
^ Tighten to 48 Nm (35 lb-ft).

4. Connect the digital TR sensor electrical connector. 5. Connect the selector lever cable to the manual control lever. 6. Verify that the selector lever cable is adjusted correctly.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Transmission and Drivetrain > Automatic Transmission/Transaxle > Transmission Speed Sensor, A/T > Component Information > Locations > Intermediate Shaft Speed Sensor

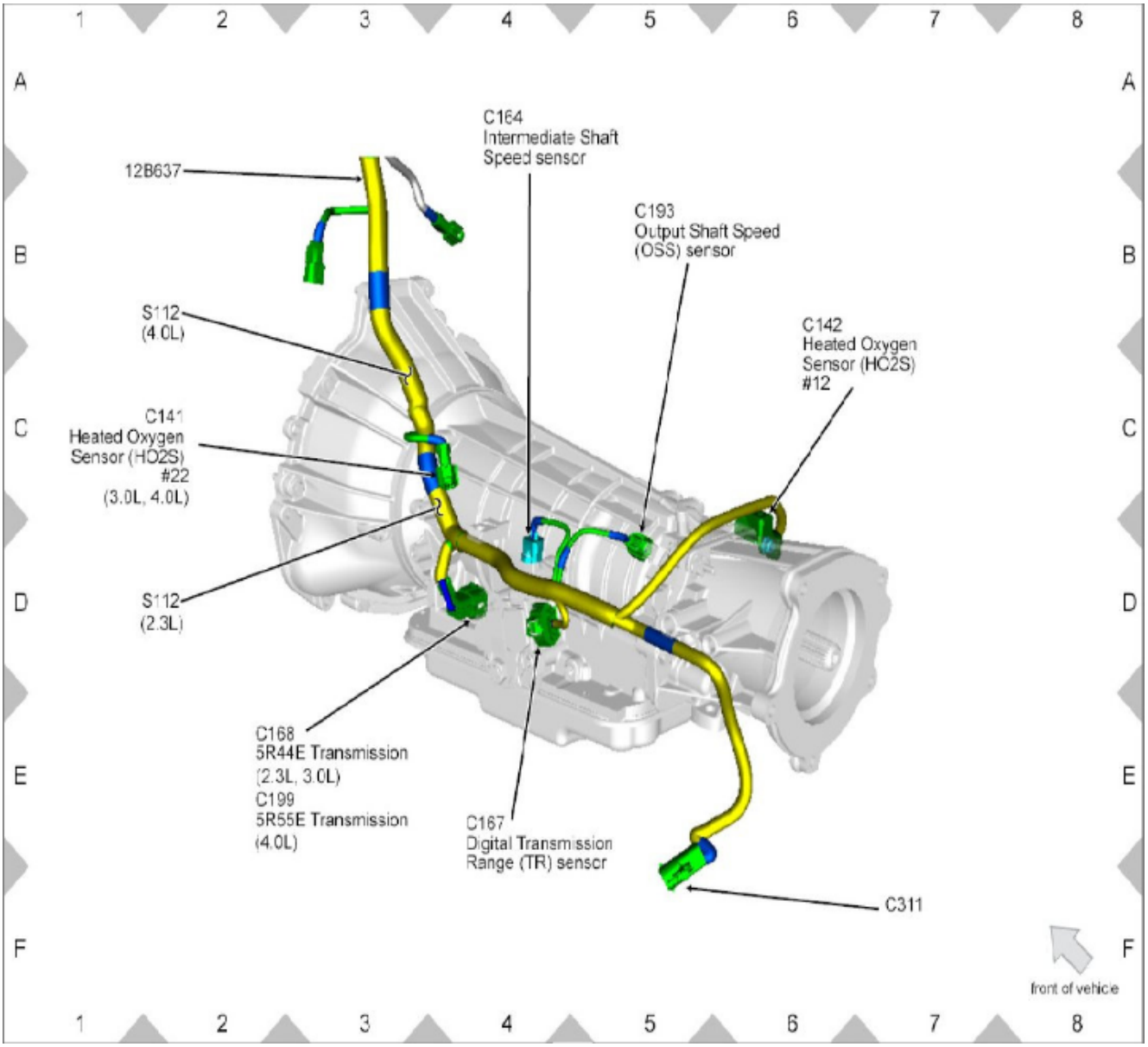


View 151-10

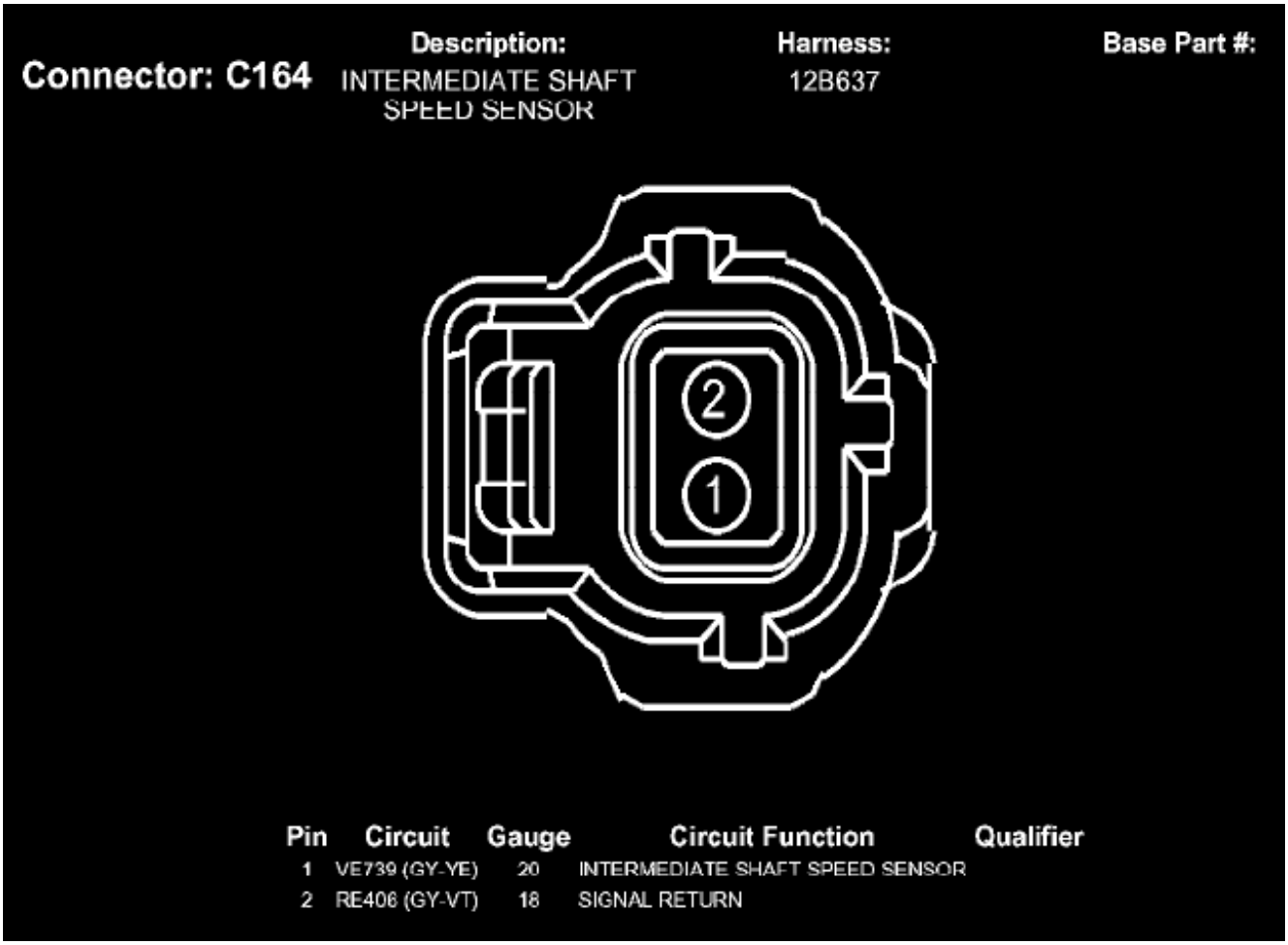


Transmission Speed Sensor: Locations Output Shaft Speed (OSS) Sensor

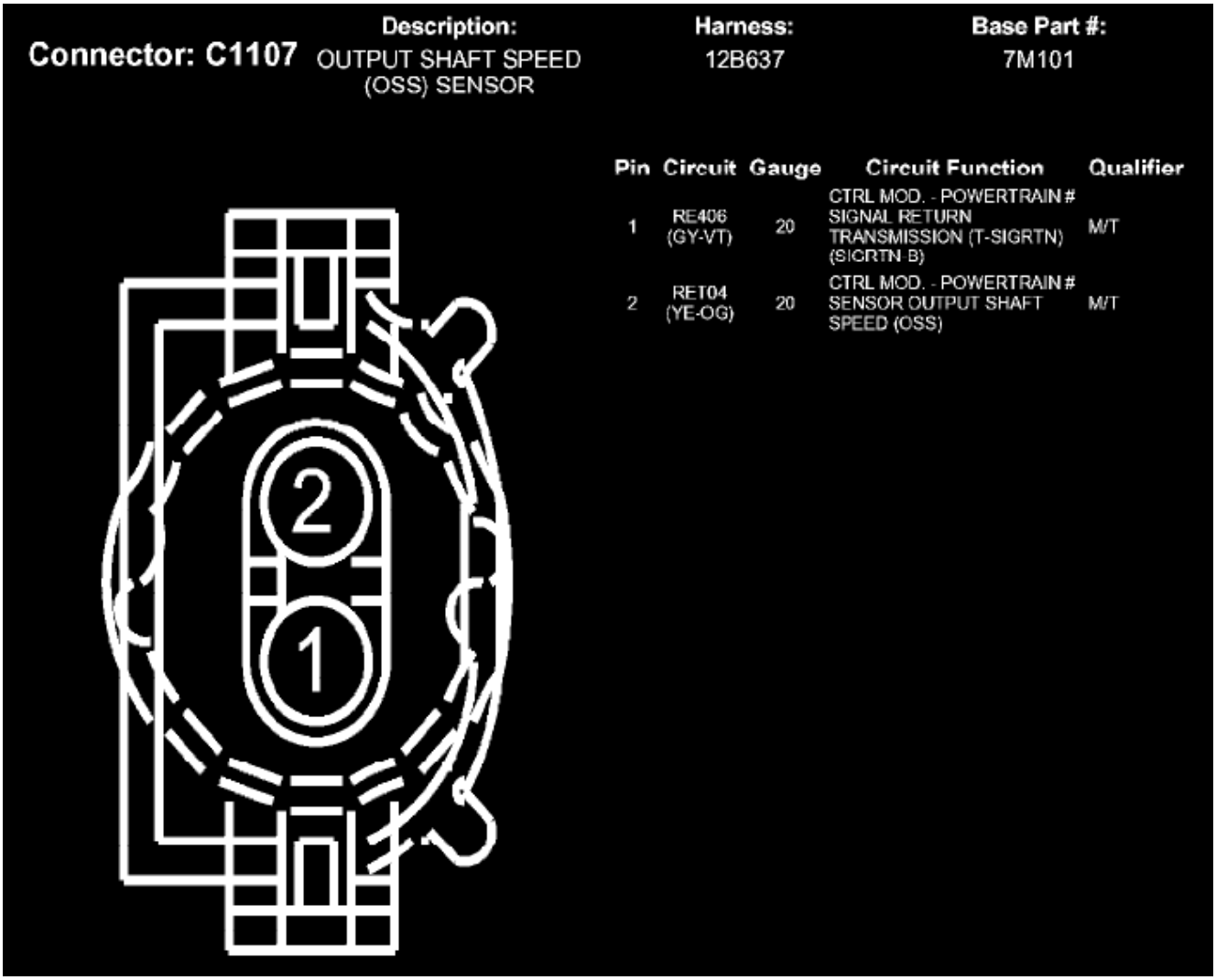
View 151-9


C164
Intermediate Shaft
Speed sensor
12B637
C193
Output Shaft Speed
(OSS) sensor
S112
(4.0L)
C142
Heated Oxygen
Sensor (HO2S)
#12
C141
Heated Oxygen
Sensor (HO2S)
#22
(3.0L, 4.0L)
S112
(2.3L)
C168
5R44E Transmission
(2.3L, 3.0L)
C199
5R55E Transmission
(4.0L)
C167
Digital Transmission
Range (TR) sensor
C311
front of vehicle

View 151-10


Connector: C164
Description:
INTERMEDIATE SHAFT SPEED SENSOR
Harness:
12B637
Base Part #:
2
1
Pin Circuit Gauge Circuit Function Qualifier
1 VE739 (GY-YE) 20 INTERMEDIATE SHAFT SPEED SENSOR
2 RE406 (GY-VT) 18 SIGNAL RETURN

C164



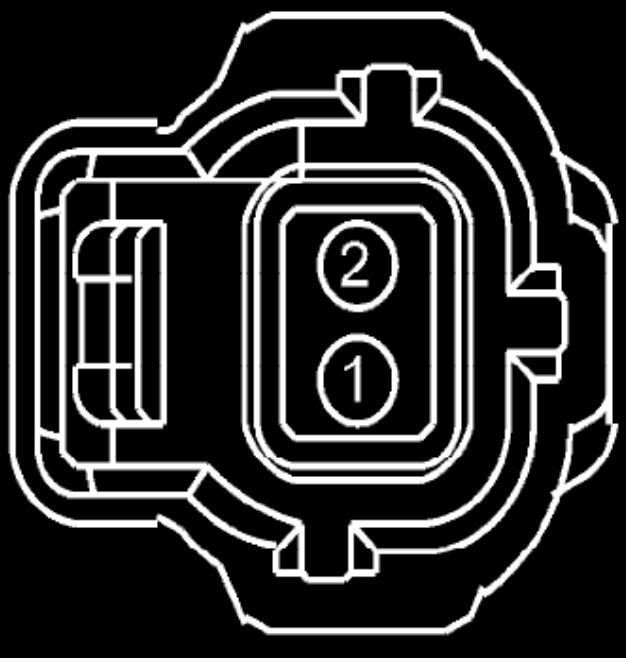
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RE406 (GY-VT)	20	CTRL MOD. - POWERTRAIN # SIGNAL RETURN TRANSMISSION (T-SIGRTN) (SIGRTN-B)	M/T
2	RET04 (YE-OG)	20	CTRL MOD. - POWERTRAIN # SENSOR OUTPUT SHAFT SPEED (OSS)	M/T

Transmission Speed Sensor: Diagrams Output Shaft Speed (OSS) Sensor

C1107

Connector: C193

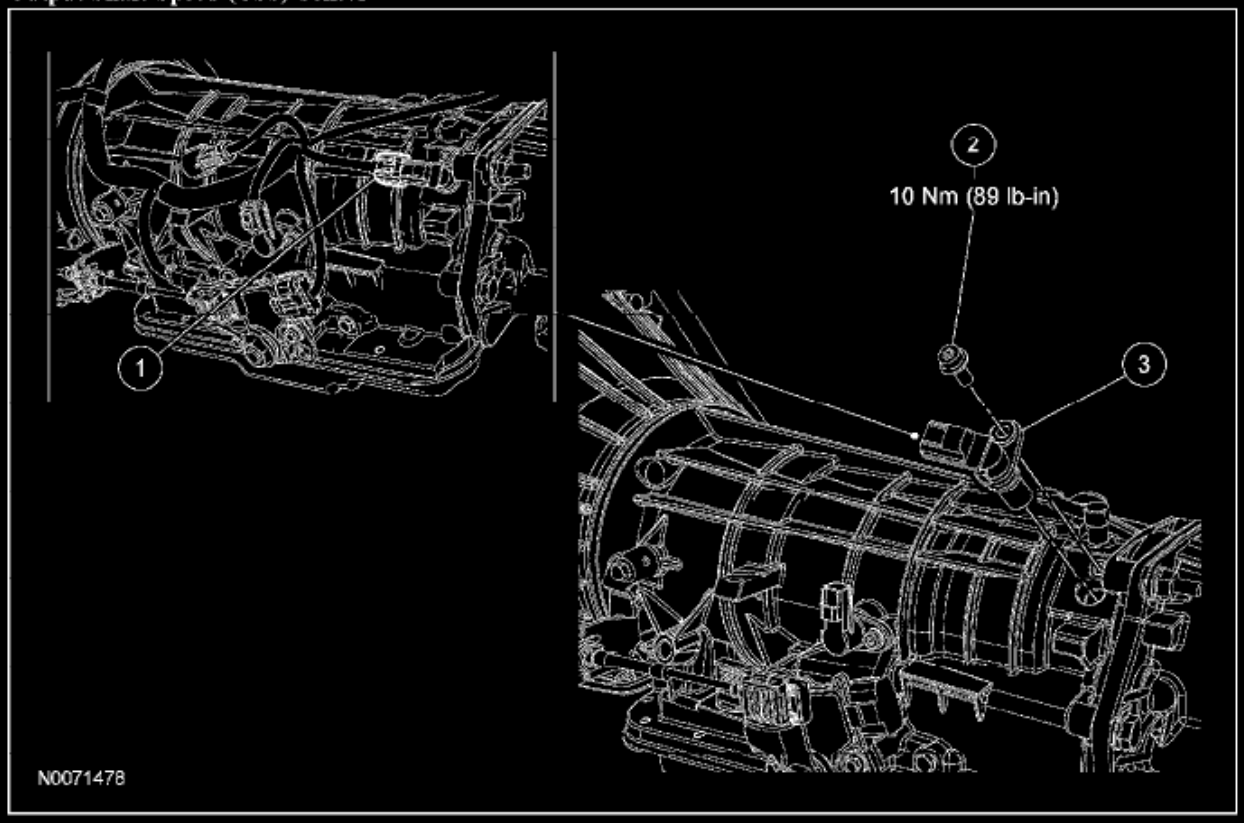
Description:	Harness:	Base Part #:
OUTPUT SHAFT SPEED (OSS) SENSOR	12B637	7H133



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RET04 (YE-OG)	20	OUTPUT SHAFT SPEED (OSS) SENSOR	A/T
2	RE406 (GY-VT)	18	SIGNAL RETURN	A/T

C193

Output Shaft Speed (OSS) Sensor



Item	Part Number	Description
1	—	Output shaft speed (OSS) sensor electrical connector
2	W702297-S	OSS sensor screw
3	7H103-B	OSS sensor

Transmission Speed Sensor: Service and Repair Output Shaft Speed (OSS) Sensor

Output Shaft Speed (OSS) Sensor

Output Shaft Speed (OSS) Sensor

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the output shaft speed (OSS) sensor electrical connector. 3. Remove the OSS sensor screw. 4. Remove the OSS sensor from the transmission.

Installation

1. NOTE: Inspect the OSS sensor O-ring for damage. If damaged, install a new O-ring Inspect and lubricate the O-ring with petroleum jelly.

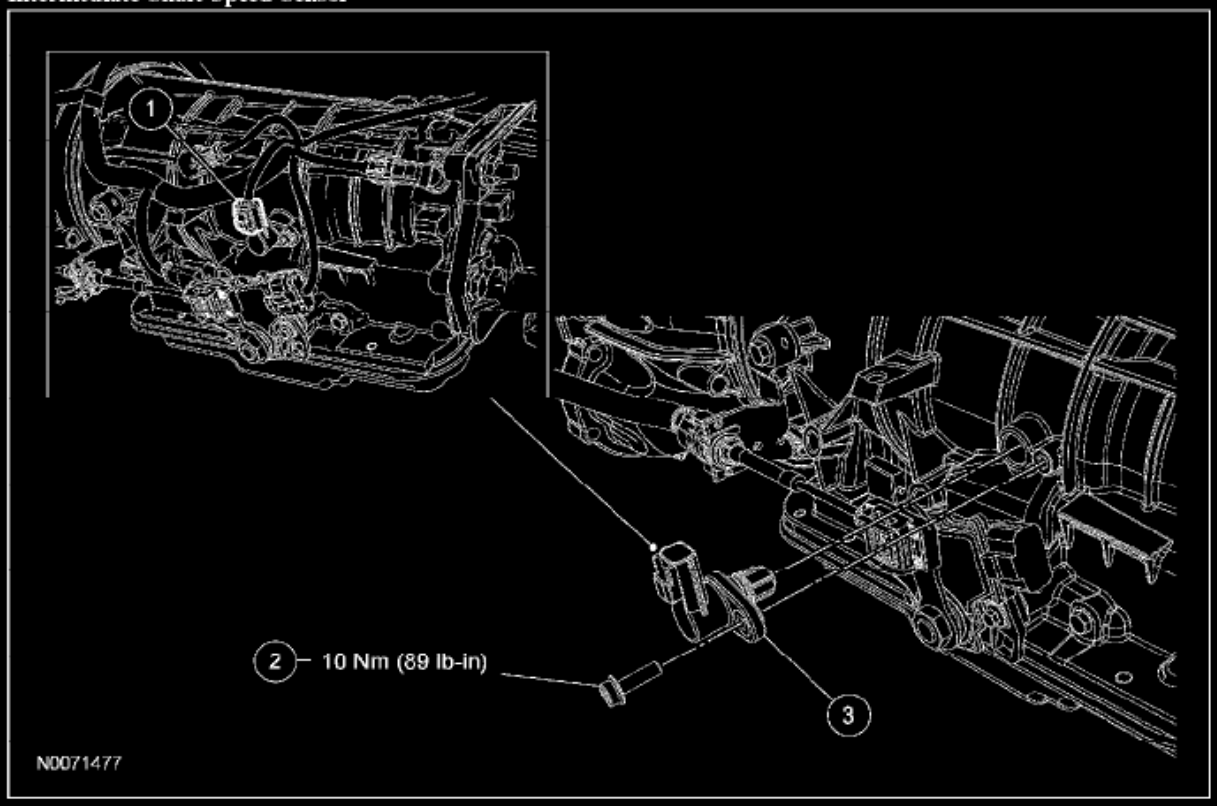
Install the OSS sensor into the transmission.

2. Install the OSS sensor screw.

^ Tighten to 10 Nm (89 lb-inch).

3. Connect the OSS sensor electrical connector.

Intermediate Shaft Speed Sensor



Item	Part Number	Description
1	—	Intermediate shaft speed sensor electrical connector
2	W702769-S	Intermediate shaft speed sensor screw
3	7M183-A	Intermediate shaft speed sensor

Transmission Speed Sensor: Service and Repair Intermediate Shaft Speed Sensor

Intermediate Shaft Speed Sensor

Intermediate Shaft Speed Sensor

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the intermediate shaft speed sensor electrical connector. 3. Remove the intermediate shaft speed sensor screw. 4. Remove the intermediate shaft speed sensor from the transmission.

Installation

1. NOTE: Inspect the intermediate shaft speed sensor O-ring for damage. If damaged, install a new O-ring

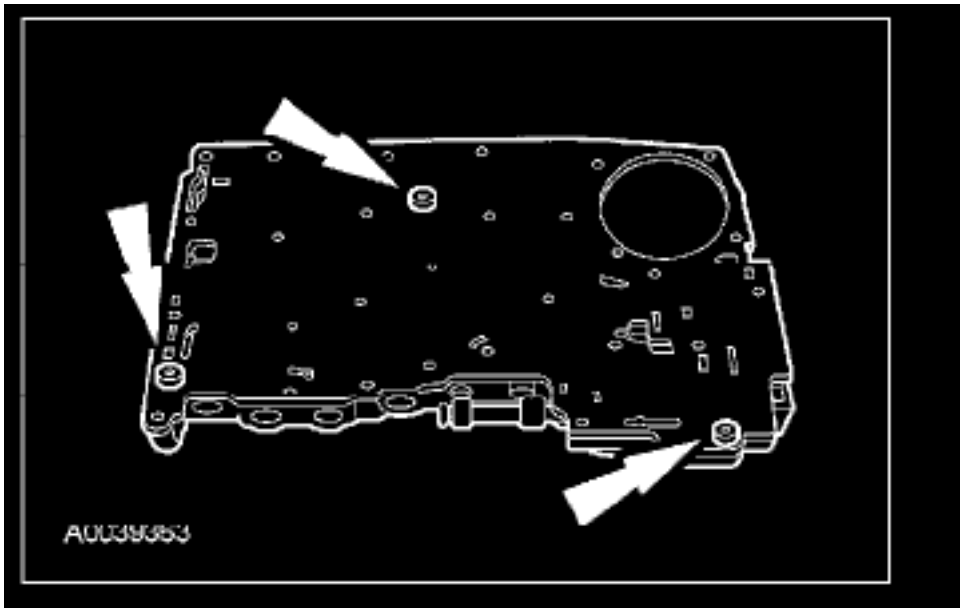
Inspect and lubricate the O-ring with petroleum jelly.

Install the intermediate shaft speed sensor into the transmission.

2. Install the intermediate shaft speed sensor screw.

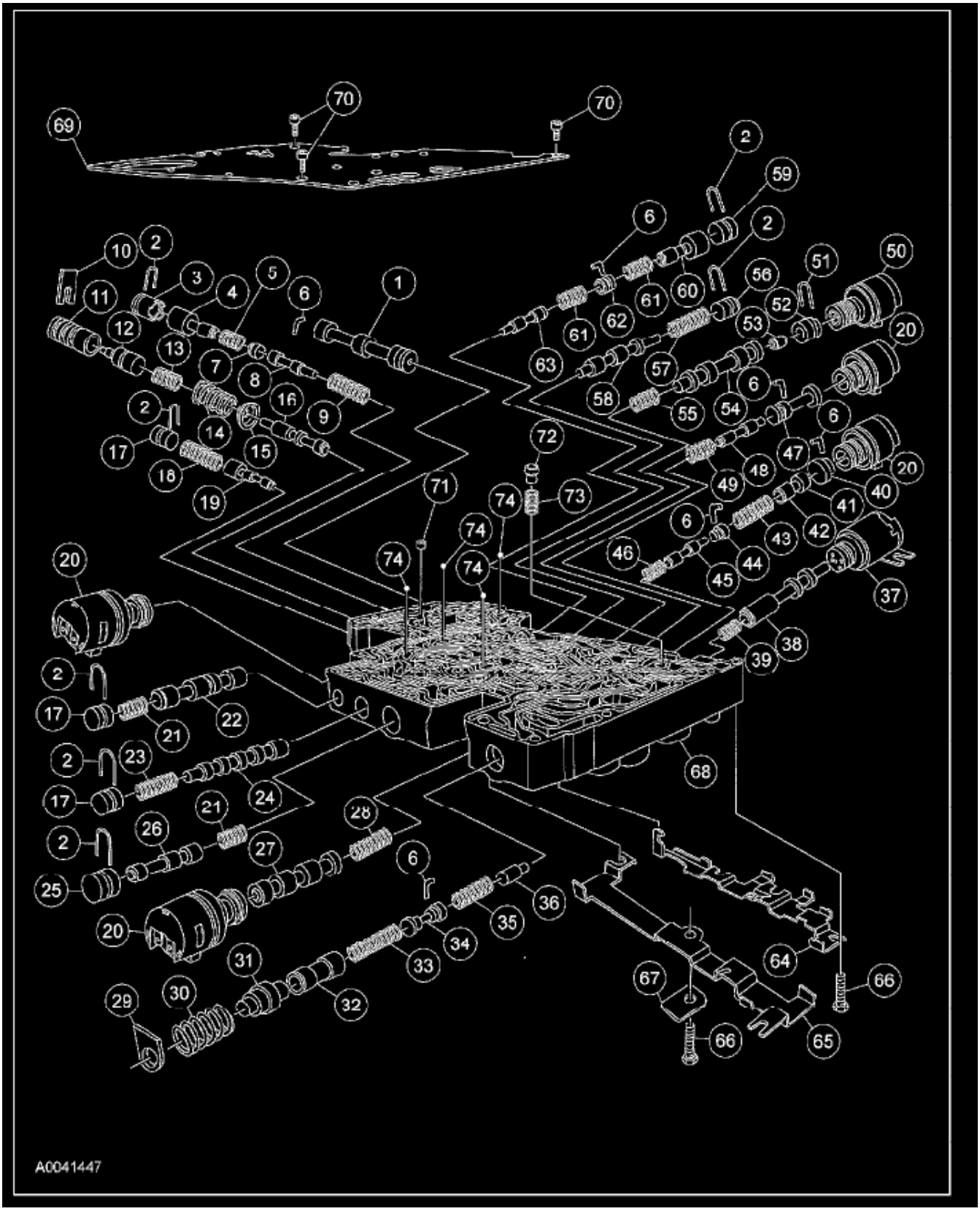
^ Tighten to 10 Nm (89 lb-inch).

3. Connect the intermediate shaft speed sensor electrical connector. 4. Lower the vehicle.



Valve Body: Locations

Main Control Valve Body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Valve Body: Diagrams

Main Control Valve Body

Item	Part Number	Description
1	—	Valve — manual
2	7E335	Retainers — valve plug (7 required)
3	7M203	Valve electronic pressure control (EPC) blowoff
4	—	Valve — forward modulator
5	—	Spring — forward modulator
6	7E335	Retainers — valve plug (6 required)
7	—	Plug — valve retainer
8	—	Valve — EPC boost
9	—	Spring — EPC boost
10	7E336	Retainer — valve plug
11	—	Sleeve — pressure boost
12	—	Valve — pressure boost
13	—	Spring — pressure boost
14	—	Spring — oil pressure regulator
15	—	Retainer — main regulator spring
16	—	Valve — pressure regulator
17	—	Plugs — valve retainer (3 required)
18	—	Spring — forward engagement
19	—	Valve — forward engagement control
20	7G484	Solenoids — shift (4 required)
21	—	Springs — 4-3 (K.D./T.D.) (2 required)
22	—	Valve — 4-3 (K.D.)
23	—	Spring — manual low (1)
24	—	Valve — manual low (1)
25	—	Plug — valve retainer
26	—	Valve — 4-3 (T.D.)
27	—	Valve — 1-2 and 4-5 shift
28	—	Spring — 1-2 and 4-5 shift
29	7E366	Retainer — valve plug
30		Spring thermostat bypass
31	—	Valve — thermostatic bypass
32	—	Valve — thermostat bypass
33	—	Spring — thermostat bypass
34	—	Plug — valve retainer
35	—	Spring — cooler limit
36	—	Valve — cooler limit

(Continued)

Item	Part Number	Description
37	7G136	Solenoid — torque converter clutch (pulse width modulated [PWM])
38	—	Valve — converter clutch
39	—	Spring — converter clutch
40	—	Plug — valve retainer
41	—	Valve — converter clutch
42	—	Spring — converter clutch
43	—	Spring — converter clutch (3.0L and 4.0L only)
44	—	Plug — valve retainer
45	—	Valve — coast clutch
46	—	Spring — coast clutch
47	—	Plug — valve retainer
48	—	Valve — 4-3 downshifts
49	—	Spring — 4-3 downshifts
50	7G383	Solenoid — EPC (variable force shift [VFS])
51	7E335	Retainer — valve plug
52	—	Plug — valve retainer
53	—	Valve — 2-3 shift
54	—	Valve — 2-3 shift
55	—	Spring — 2-3 shift
56	—	Plug — valve retainer
57	—	Spring — 3-4 shift
58	—	Valve — 3-4 shift
59	—	Plug — valve retainer
60	—	Valve — reverse modulation
61	—	Springs — reverse modulation (2 required)
62	—	Plug — valve retainer
63	—	Valve — reverse modulation
64	7L491	Clamp — SSA/SSC
65	7L491	Clamp — SSB/SSD/EPC/TCC
66	E800155	Screw — retain solenoid clamps (2 required)
67	7D132	ID plate
68	—	Body — valve
69	7Z490	Plate — separator
70	E804357	Screws — retain separator plate (3 required)
71	7D376	Extension housing lube orifice
72	7E368	Valve — converter relief (plastic)

(Continued)

Item	Part Number	Description
73	7E340	Spring — EPC limit/converter relief (2 required)

(Continued)

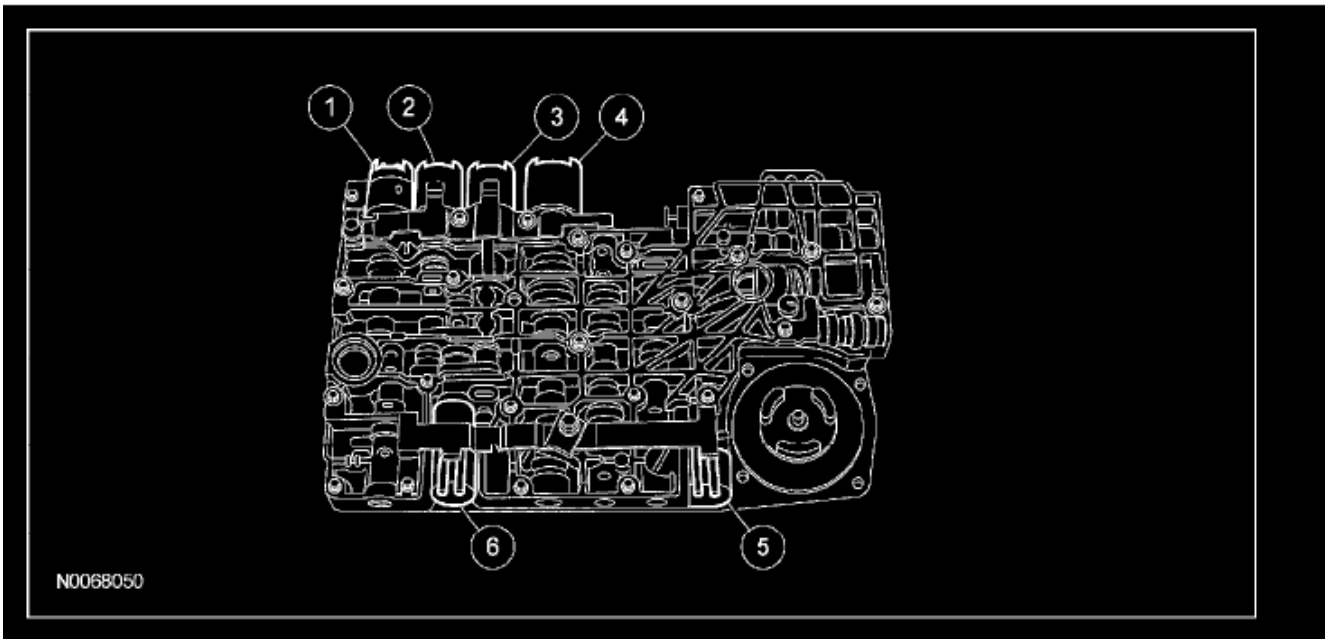
Item	Part Number	Description
74	7E195	Balls (4 required)

Special Tool(s)

ST1639-A	Aligner, Valve Body 307-333 (T95L-70010-B)
ST1639-A	Aligner, Valve Body 307-334 (T95L-70010-C)

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

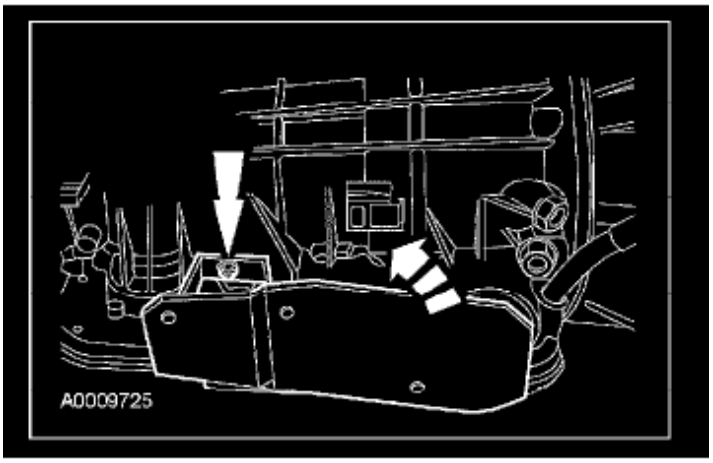


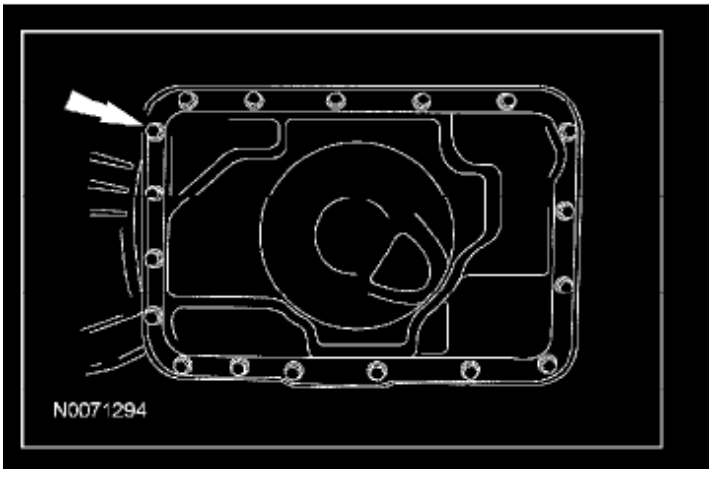
Valve Body: Removal and Replacement

Main Control Valve Body

Main Control Valve Body

Item	Part Number	Description
1	7F037	Torque converter clutch (TCC)
2	7G484	Shift solenoid (SSD)
3	7G484	Shift solenoid (SSB)
4	7H144	Electronic pressure control (EPC)
5	7G484	Shift solenoid (SSA)
6	7G484	Shift solenoid (SSC)





Removal

1. With the vehicle in NEUTRAL, position it on a hoist.

2. NOTE: If equipped, the transmission servo heat shield needs to be unclipped from the fluid pan rail and positioned aside for fluid pan removal.

If equipped, loosen the nut and position the heat shield aside.

3. Drain transmission fluid.

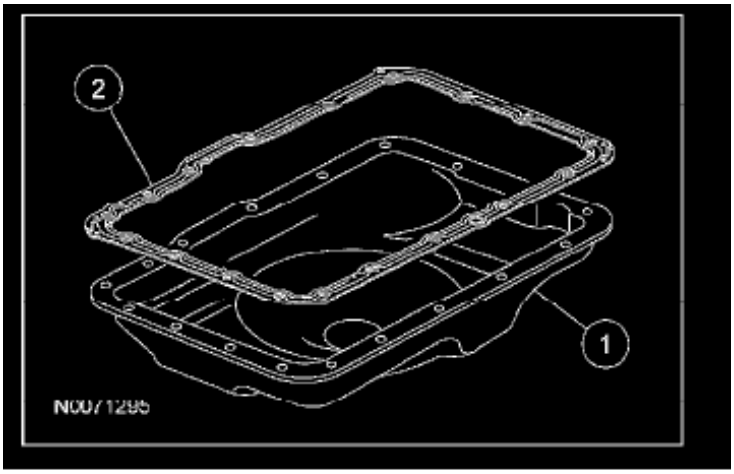
^ Remove all the transmission fluid pan screws except for 2 in the front. Loosen the 2 front transmission fluid pan screws. Pry the rear of the transmission fluid pan down and allow fluid to drain. After fluid is drained, remove the front 2 transmission fluid pan screws.

4. NOTE: The transmission fluid pan gasket is reusable. Clean and inspect for damage, if not damaged, the gasket should be reused.

Remove the transmission fluid pan. 1

Remove the transmission fluid pan.

2 Remove the transmission fluid pan gasket.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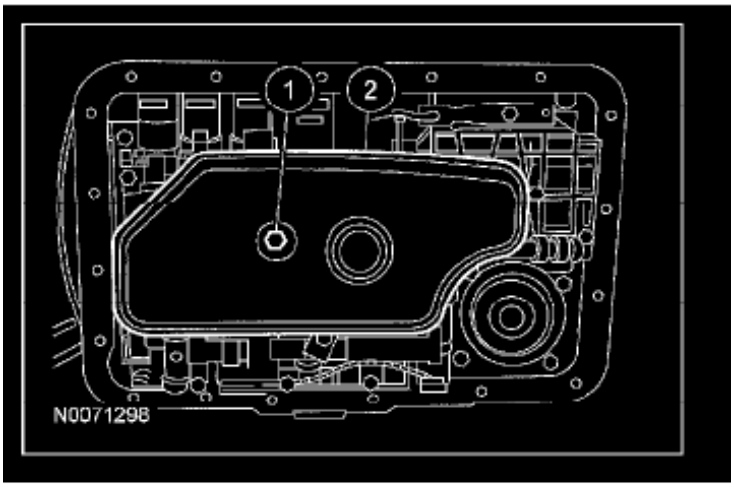
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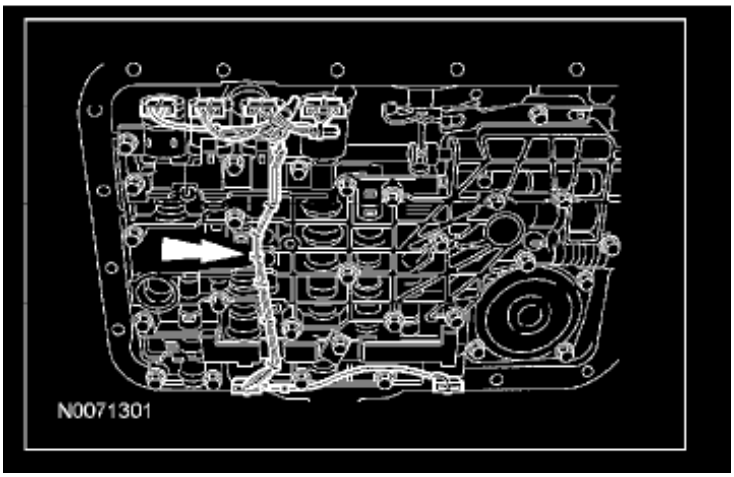

N0071301

5. Remove and discard the transmission fluid filter.

1 Remove the transmission fluid filter screw.

2 Remove the transmission fluid filter.

6. Unclip main control valve body wire harness.

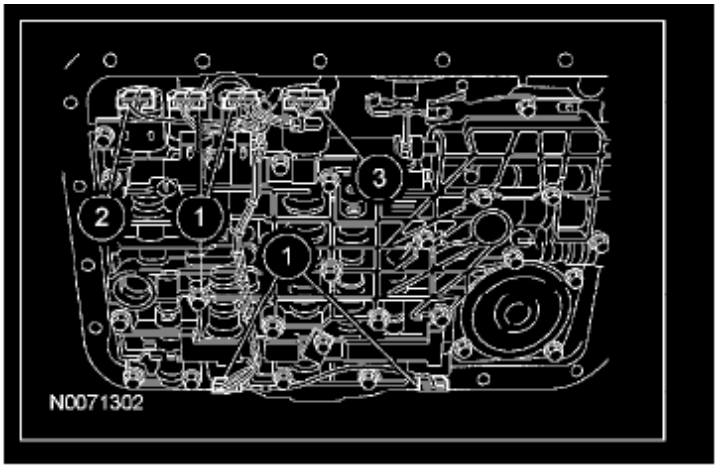
^ Lift up on wire harness guide and protector and disengage the retaining pins from the solenoid clamps.

7. Disconnect the 6 solenoid electrical connectors.

1 Disconnect the SSA, SSB, SSC and SSD electrical connectors.

2 Disconnect the torque converter clutch (TCC) solenoid electrical connector.

3 Disconnect the electronic pressure control (EPC) solenoid electrical connector.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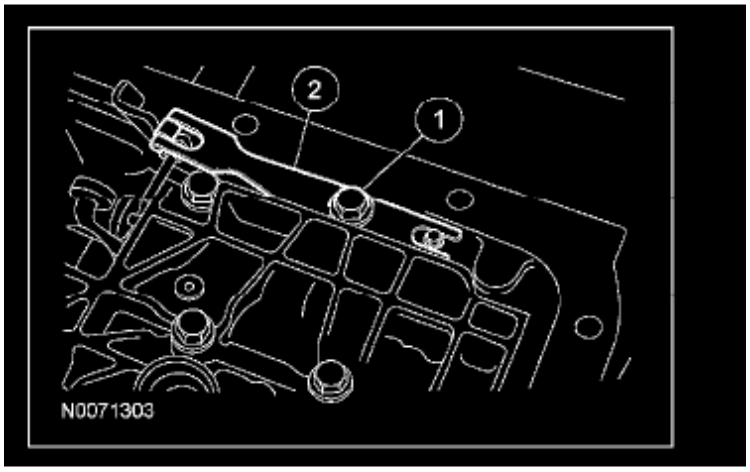
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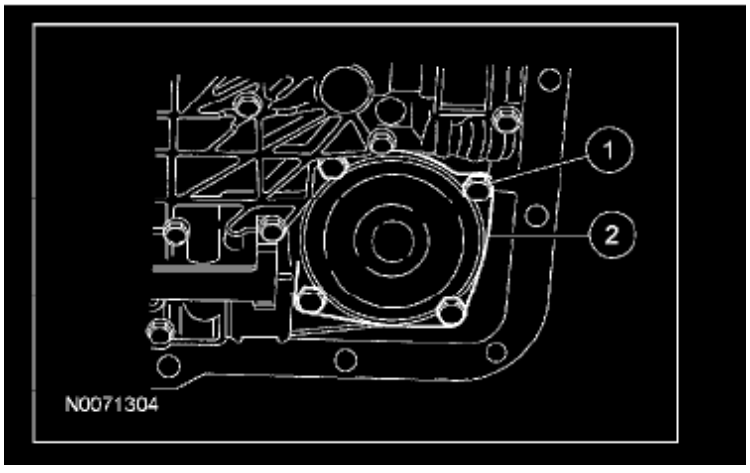
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8. Remove the manual control valve detent lever spring.

1 Remove the manual control valve detent lever spring screw.

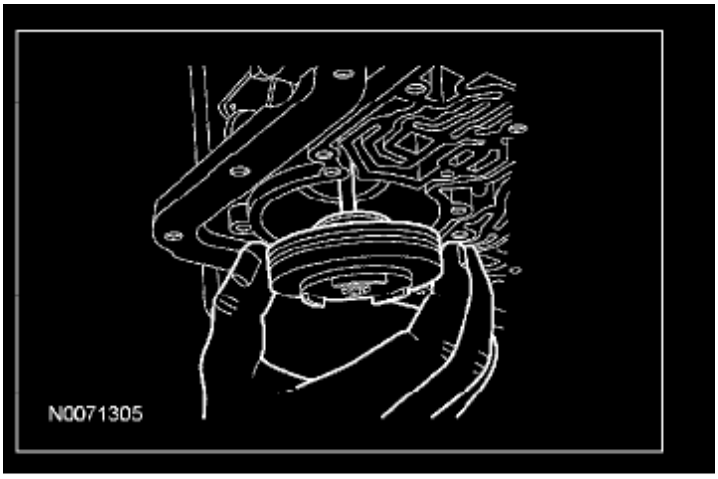
2 Remove the manual control valve detent lever spring.

9. Remove the low/reverse servo.

1 Remove the low/reverse servo cover screws.

2 Remove the low/reverse band servo cover and gasket. Discard the low/reverse servo separator plate cover gasket.

10. Remove the low/reverse band servo piston and rod.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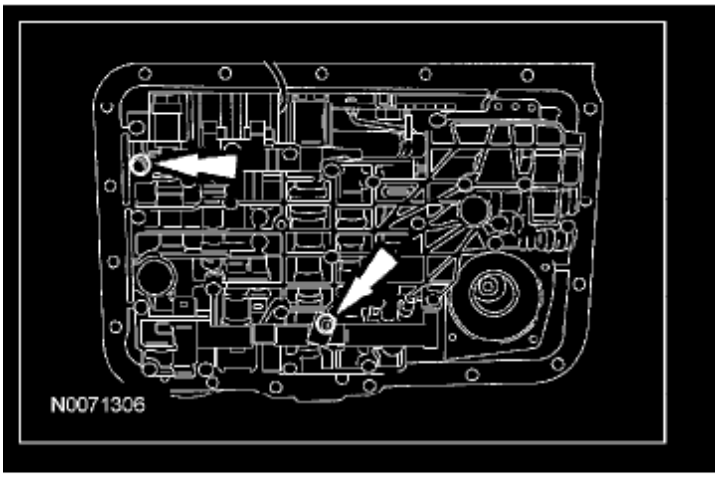
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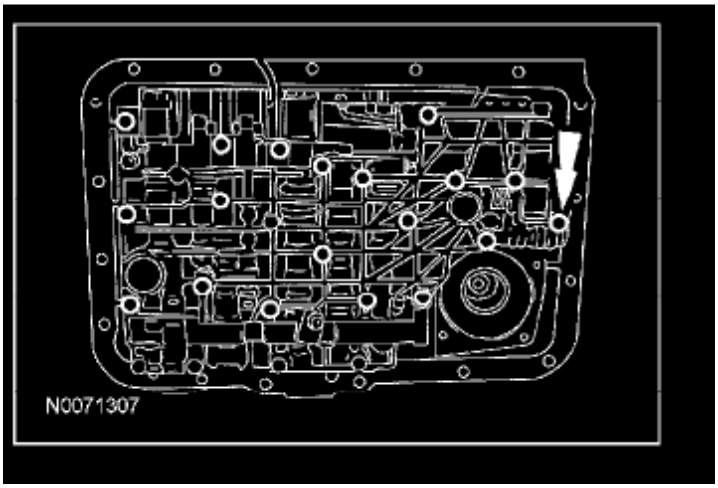

N0071307

11. Do not remove the 2 (gold) screws specified.

12. CAUTION: Support the main control valve body until all of the screws are removed, otherwise damage to the main control valve body

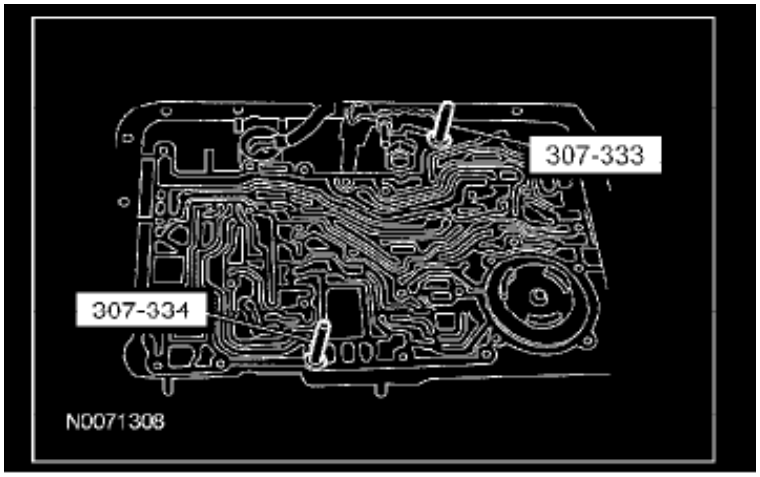
can occur.

Remove the screws.

13. Remove the main control valve body.

Installation

1. Install the special tools into the transmission case.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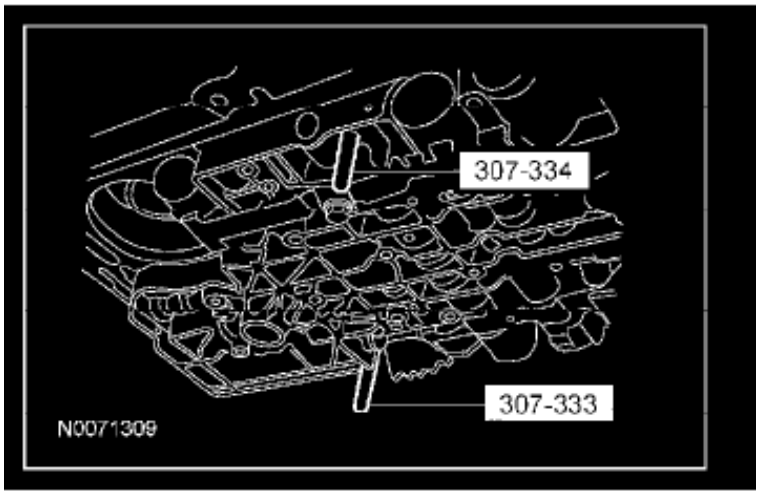
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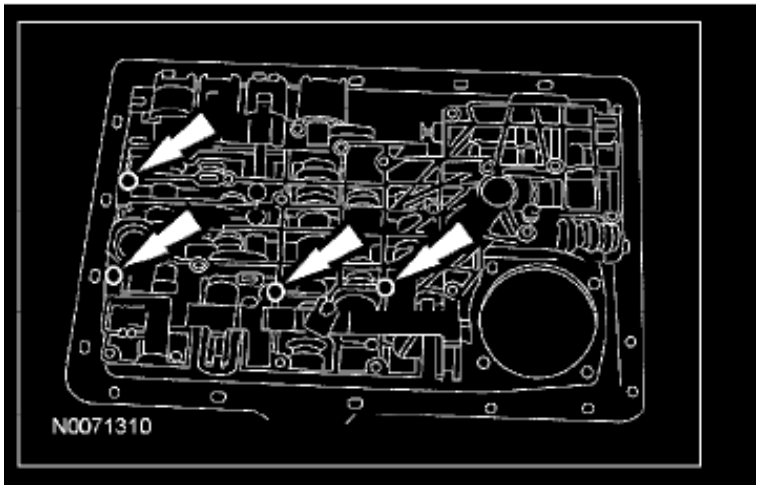

N0071310

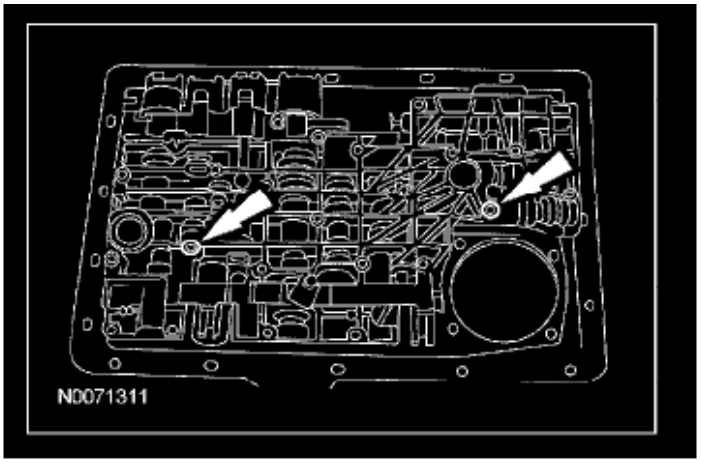
2. Position the main control valve body, using the 2 special tools as a guide.

3. NOTE: The main control valve body screws will be tightened in later steps.

Loosely install 4 M6 x 45 mm (1.8 inch) screws.

4. NOTE: The main control valve body screws will be tightened in later steps.

Loosely install 2 M6 x 35 mm (1.4 inch) screws.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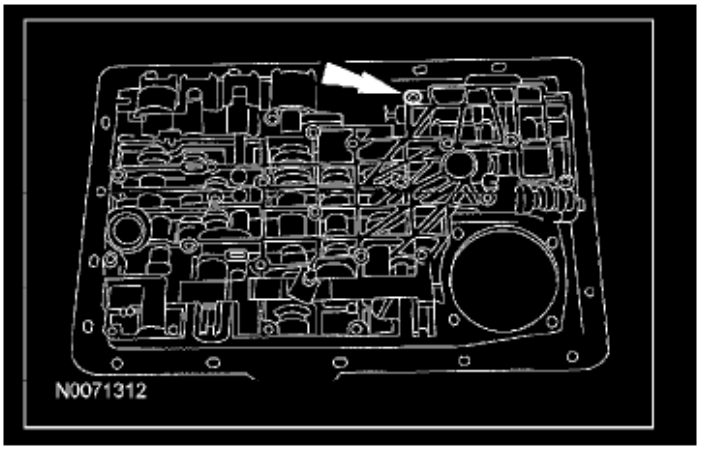
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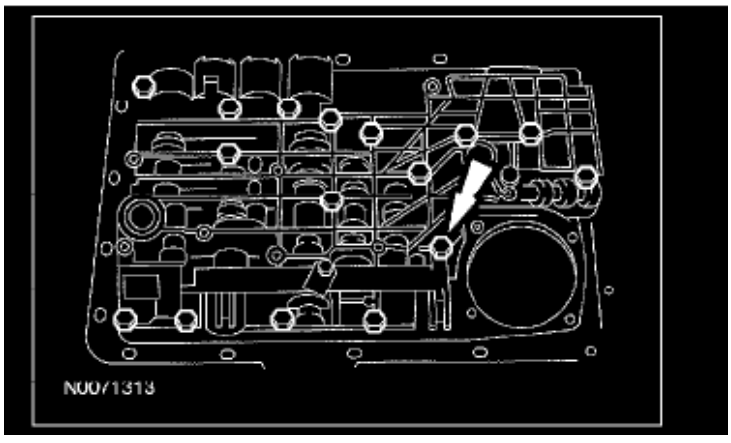

N0071313

5. Remove the special tools.

6. NOTE: The main control valve body screws will be tightened in later steps.

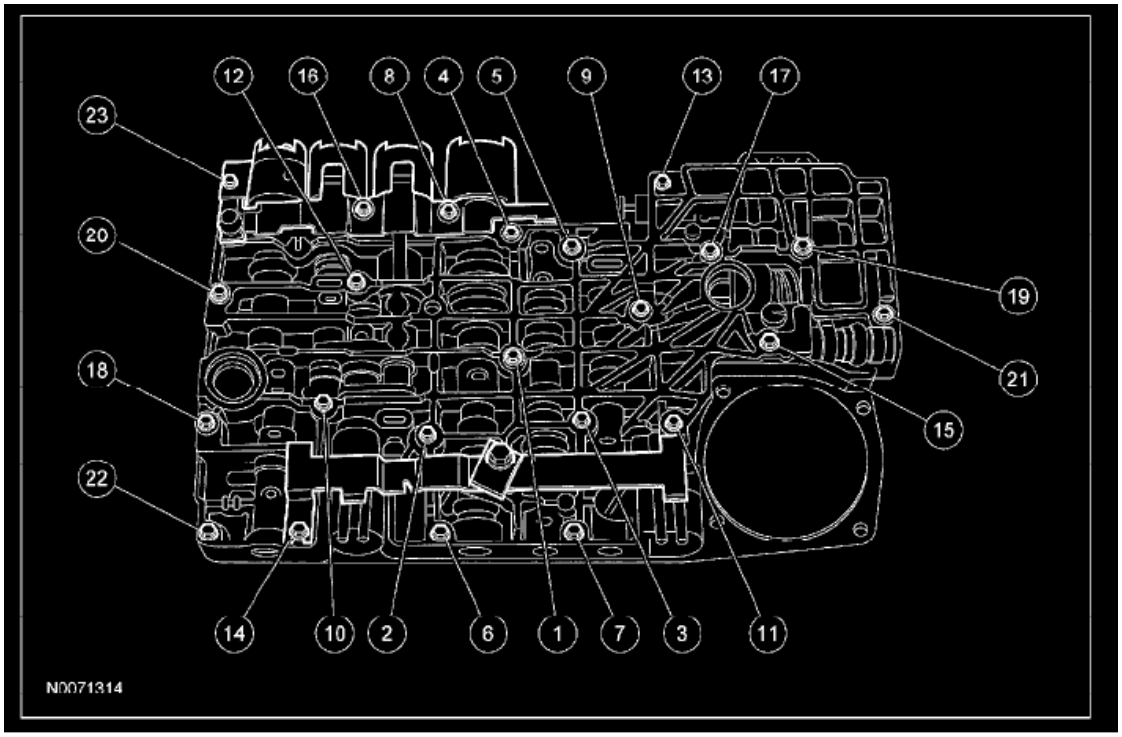
Loosely install the M6 x 30 mm (1.2 inch) screw.

7. NOTE: The main control valve body screws will be tightened in later steps.

Loosely install the 16 M6 x 40 mm (1.6 inch) main control valve body screws.

8. Tighten the main control valve body screws in the sequence shown.

^ Tighten to 10 Nm (89 lb-inch).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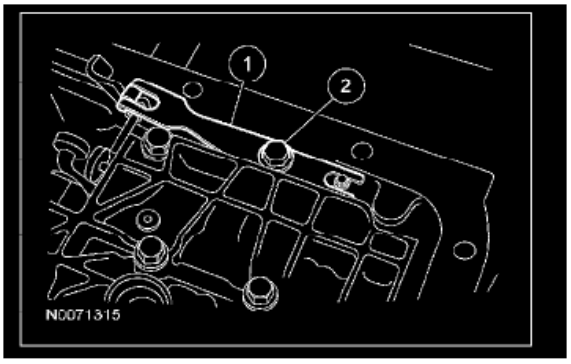
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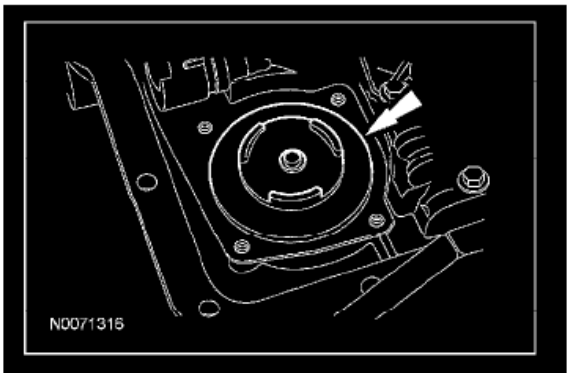

N0071316

9. Rotate the manual lever into the NEUTRAL position.

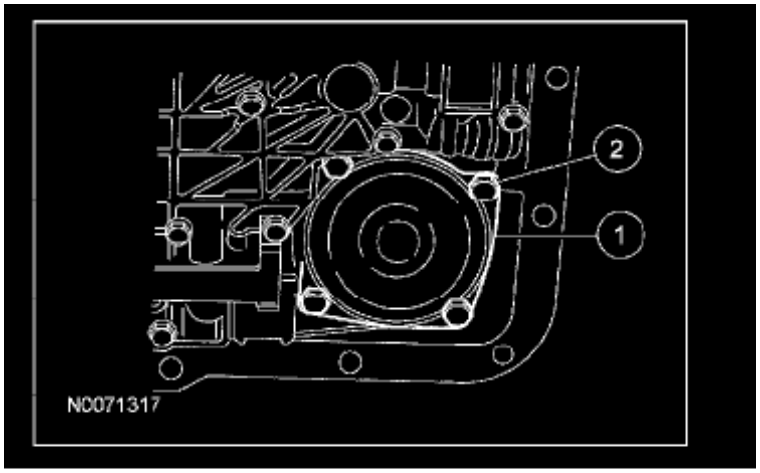
10. Install the manual control valve detent lever spring.

1 Position the manual control valve detent lever spring.

2 Install the manual control valve detent lever spring screw. ^

Tighten to 10 Nm (89 lb-inch).

11. Install the low/reverse band servo piston and rod.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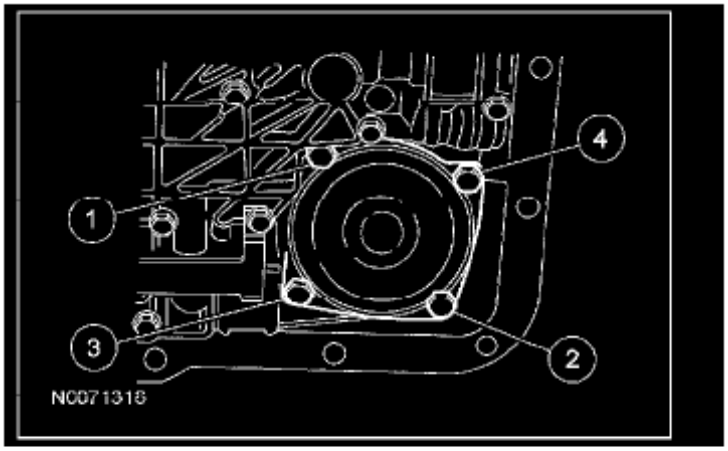
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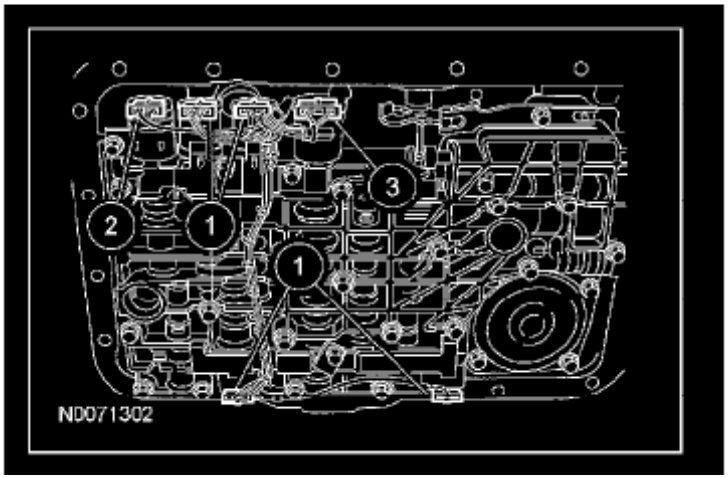
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ND071302

12. Install the low/reverse band servo cover.

1 Install the low/reverse band servo cover and gasket.

2 Loosely install the low/reverse servo piston cover screws.

13. Tighten the servo cover screws in the sequence shown.

^ Tighten to 13 Nm (10 lb-ft).

14. Connect the 6 solenoid electrical connectors.

1 Connect SSA, SSB, SSC and SSD electrical connectors.

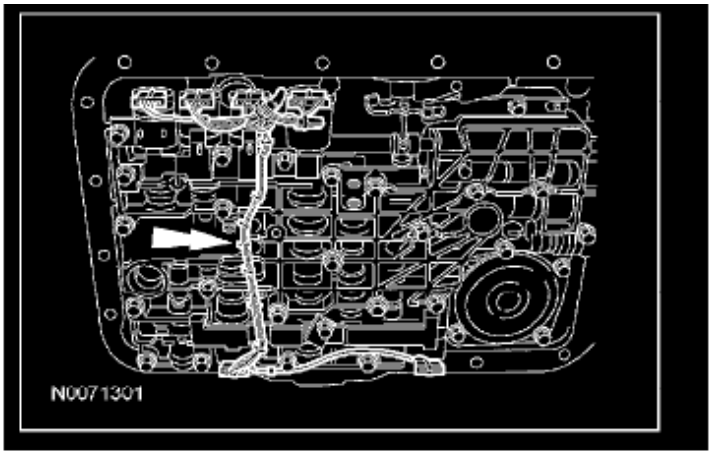
2 Connect the TCC solenoid electrical connector.

3 Connect the EPC solenoid electrical connector.

15. CAUTION: Excessive pressure may break the locating pins.

Install the main control valve body wire harness. ^

Align the retaining pins to the holes in the solenoid clamps and press in the main control valve body wire harness guide and protector.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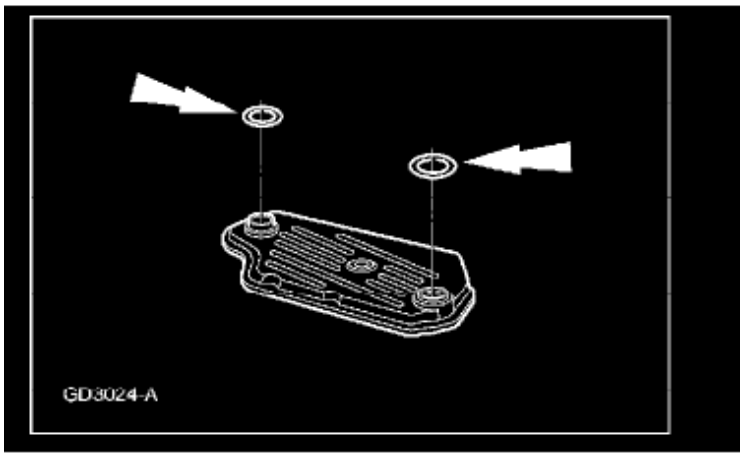
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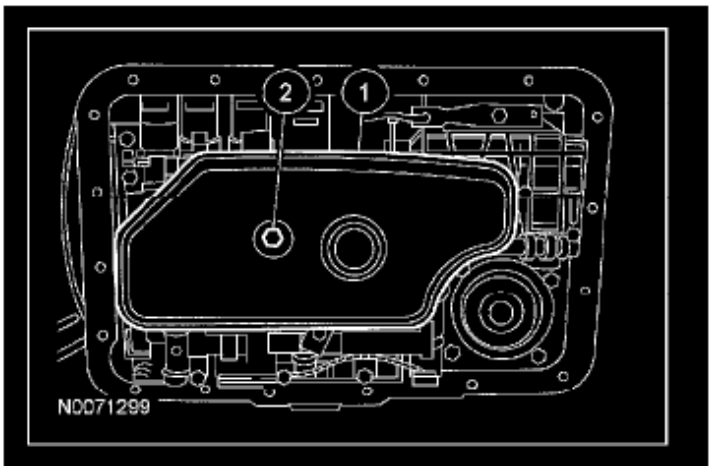
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N0071299

16. CAUTION: Lubricate fluid filter O-ring seals with clean automatic transmission fluid or they may be damaged.

Lubricate and install new O-ring seals onto the transmission fluid filter.

17. Install the transmission fluid filter.

1 Position the transmission fluid filter on the main control valve body.

2 Install the transmission fluid filter screw. ^

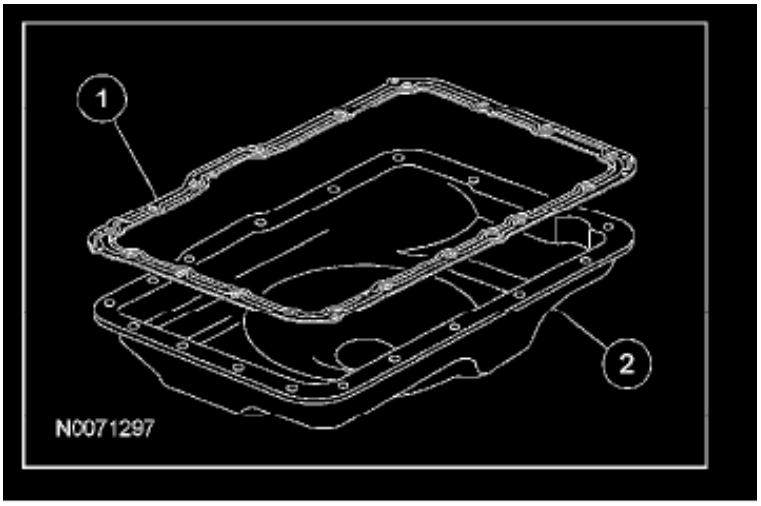
Tighten to 10 Nm (89 lb-inch).

18. NOTE: The transmission fluid pan gasket is reusable. Clean and inspect for damage, if not damaged, the gasket should be reused.

Install the transmission fluid pan. 1

Position the transmission fluid pan gasket on the transmission fluid pan.

2 Install and align the transmission fluid pan.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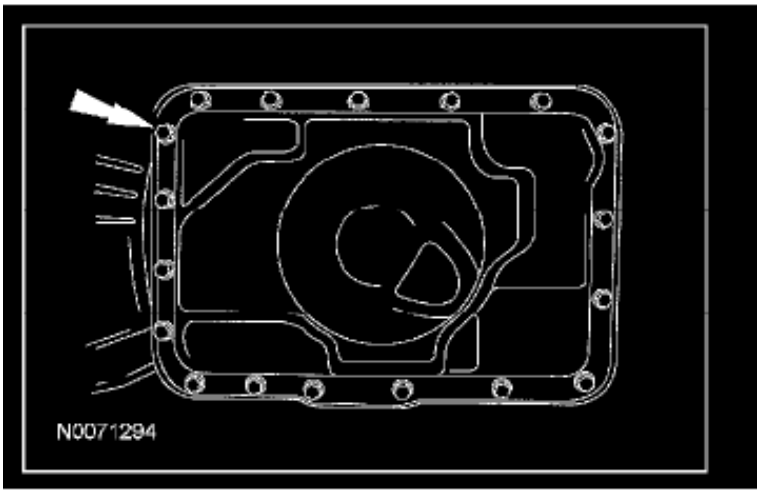
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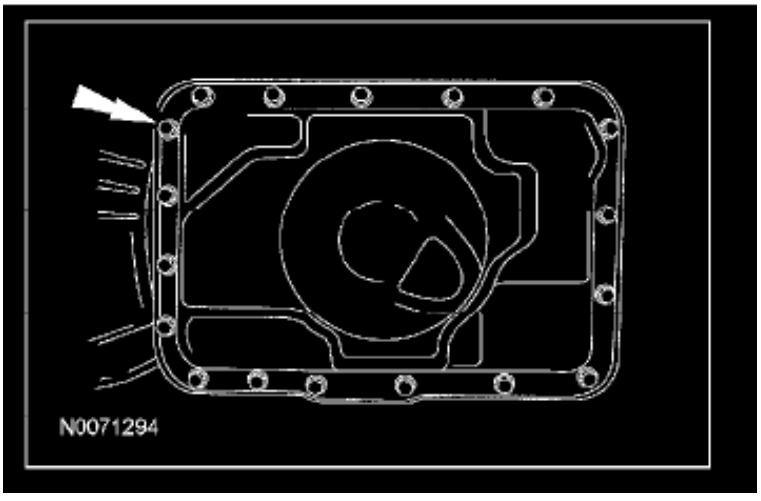

N0071294

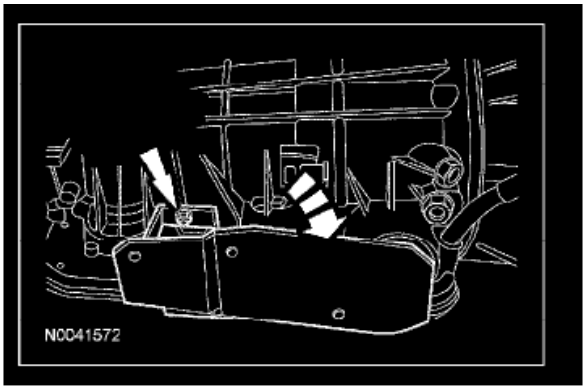
19. Loosely install the transmission fluid pan screws.

20. Tighten the transmission fluid pan screws in a crisscross pattern.

^ Tighten to 10 Nm (89 lb-inch).

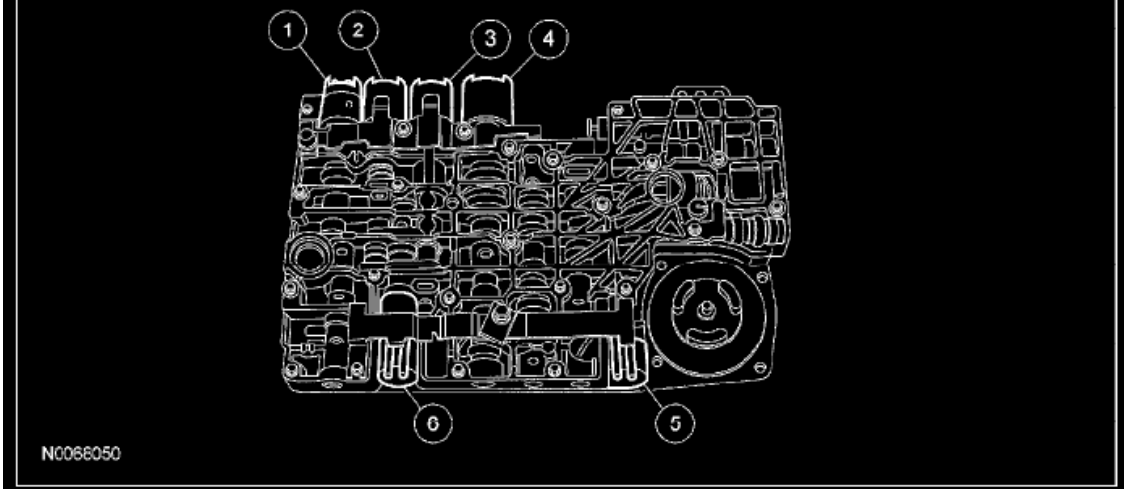
21. If equipped, position the servo heat shield over the servos and clip it to the pan rail.

^ Tighten to 10 Nm (89 lb-inch).



Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V



Item	Part Number	Description
1	7F037	Torque converter clutch (TCC)
2	7G484	Shift solenoid (SSD)
3	7G484	Shift solenoid (SSB)
4	7H144	Electronic pressure control (EPC)
5	7G484	Shift solenoid (SSA)
6	7G484	Shift solenoid (SSC)

22. NOTE: Start with a minimum of 3.7L (4 qt) clean automatic transmission fluid.

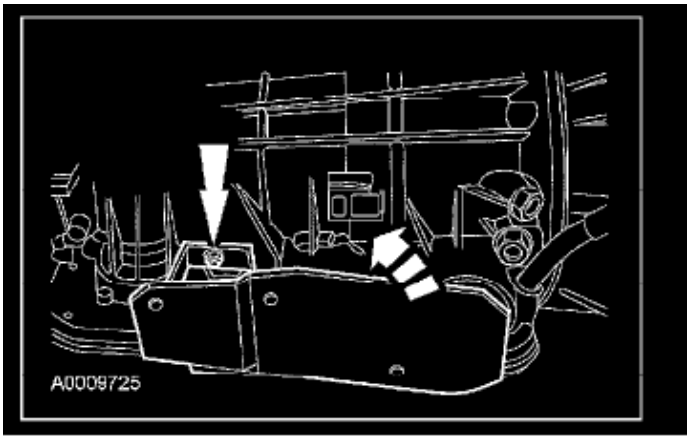
Fill transmission with clean automatic transmission fluid to the correct fluid level.

Solenoids - Shift, Torque Converter Clutch, Electronic Pressure Control

Solenoids - Shift, Torque Converter Clutch, Electronic Pressure Control

Removal

1. With the vehicle in NEUTRAL, position it on a hoist.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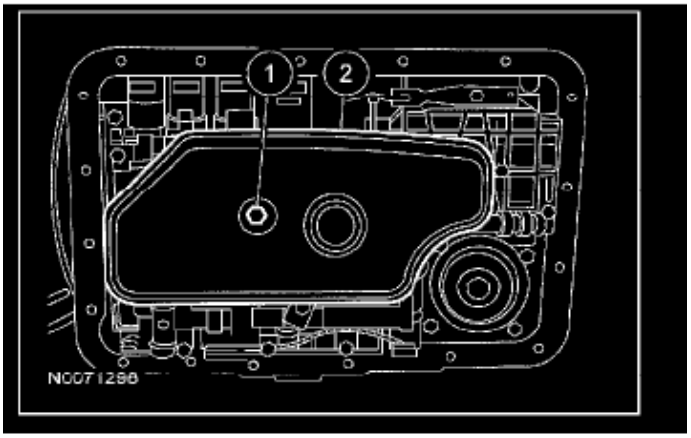
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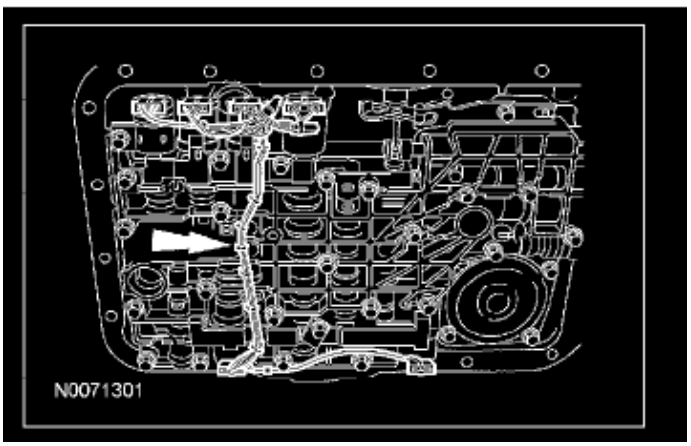

N0071301

2. NOTE: If equipped, the transmission servo heat shield needs to be unclipped from the fluid pan rail and positioned aside for fluid pan removal.

If equipped, loosen the nut and position the heat shield aside.

3. Place a drain pan under the transmission fluid pan. 4. Drain the transmission fluid. 5. Remove the transmission fluid filter.

1 Remove the transmission fluid filter screw.

2 Remove the transmission fluid filter.

6. NOTE: Main control assembly does not need to be removed for solenoid service.

Remove wire loom guide and protector. ^

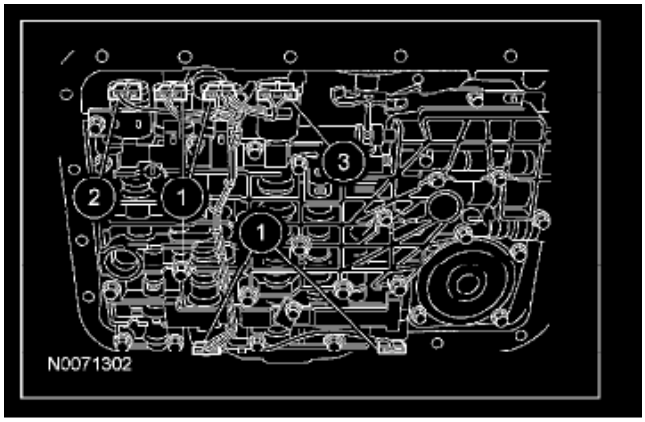
Carefully lift up on wire loom guide and protector and disengage the retaining pins from the solenoid clamps.

7. Disconnect the appropriate solenoid electrical connector.

1 Disconnect shift solenoids electrical connectors.

2 Disconnect the torque converter clutch (TCC) solenoid electrical connector.

3 Disconnect the electronic pressure control (EPC) solenoid electrical connector.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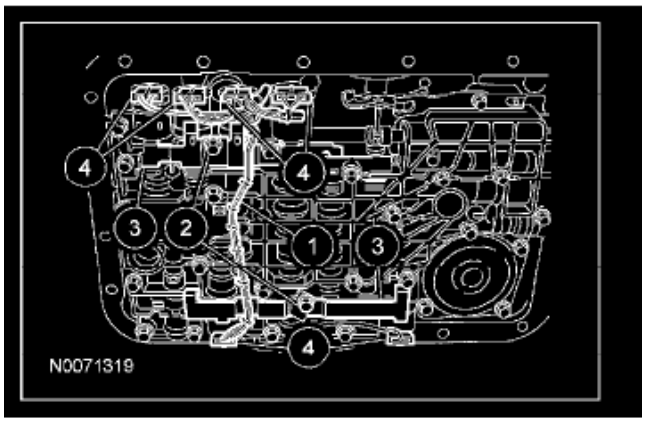
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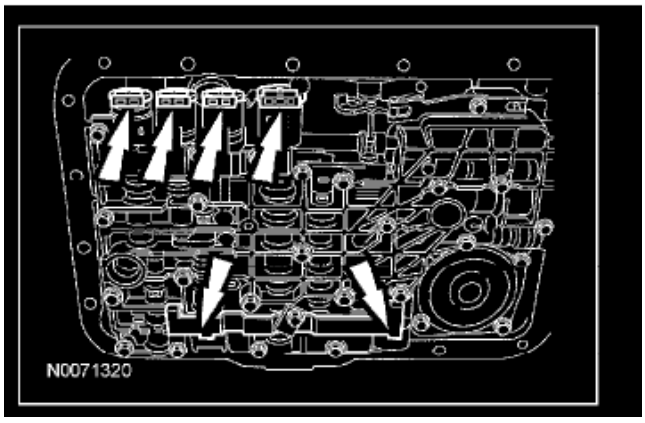

N0071320

8. CAUTION: The torque converter clutch (TCC) solenoid and converter modulator valve may pop out of its bore. This may damage the

solenoid or converter modulator valve.

CAUTION: Shift solenoid (SSC) may pop out of its bore. This may damage the solenoid.

Remove the shift solenoids. 1

Remove the wire harness.

2 Remove the solenoid clamp screws.

3 Remove the solenoid clamp.

4 Remove the appropriate solenoid(s).

Installation

1. Install the new solenoid(s).

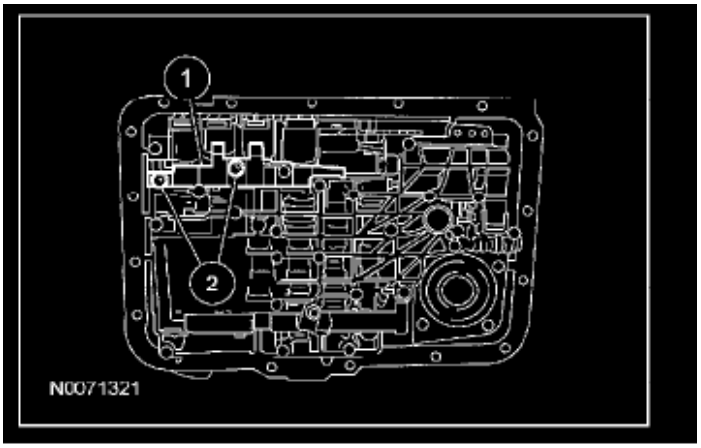
2. NOTE: The solenoid clamp must be installed in the torque converter clutch (TCC) and electronic pressure control (EPC) solenoid grooves, shift

solenoid pockets and the No. 204 plug.

Install the solenoid clamp. 1

Position the solenoid clamp on the main control valve body.

2 Install the solenoid clamp screws.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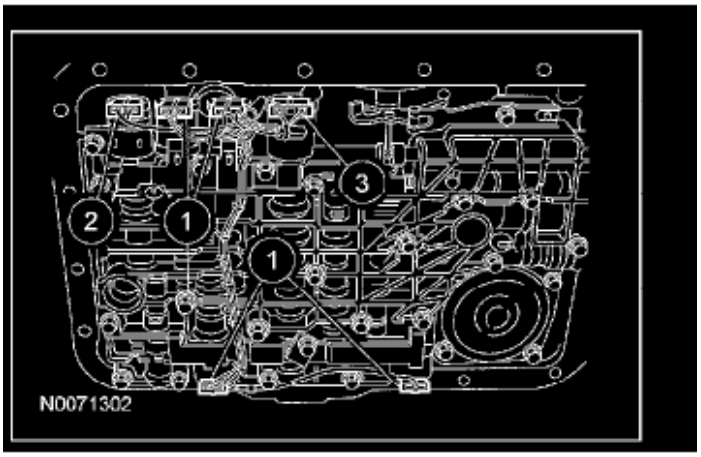
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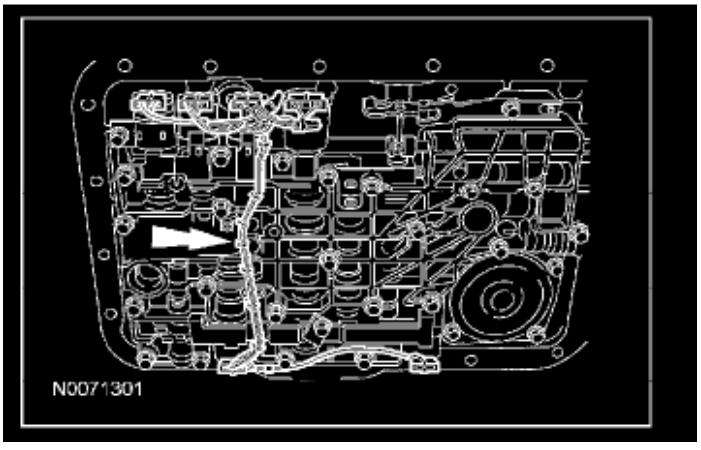

N0071301

3. Connect the 6 solenoid electrical connectors.

1 Connect shift solenoid SSA, SSB, SSC, SSD electrical connectors.

2 Connect the TCC solenoid electrical connector.

3 Connect the EPC solenoid electrical connector.

4. CAUTION: Excessive pressure may break the retaining pins.

Install the main control valve body wire loom. ^

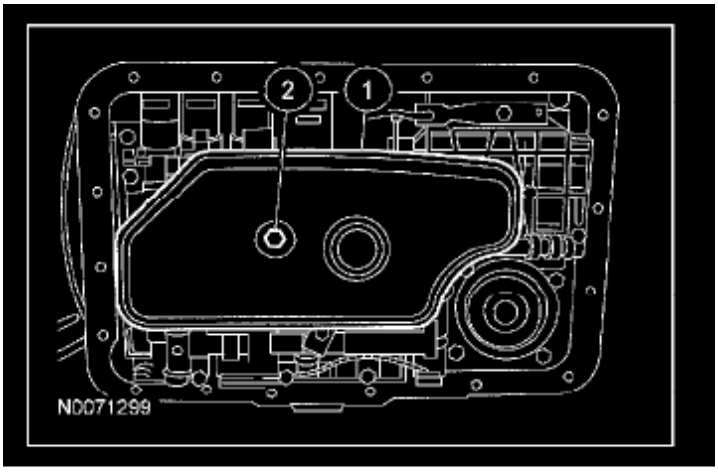
Align the retaining pins to the holes in the solenoid clamps and gently press in the main control valve body wire loom guide and protector.

5. Install the transmission fluid filter.

1 Install the transmission fluid filter.

2 Install the transmission fluid filter screw. ^

Tighten to 10 Nm (89 lb-inch).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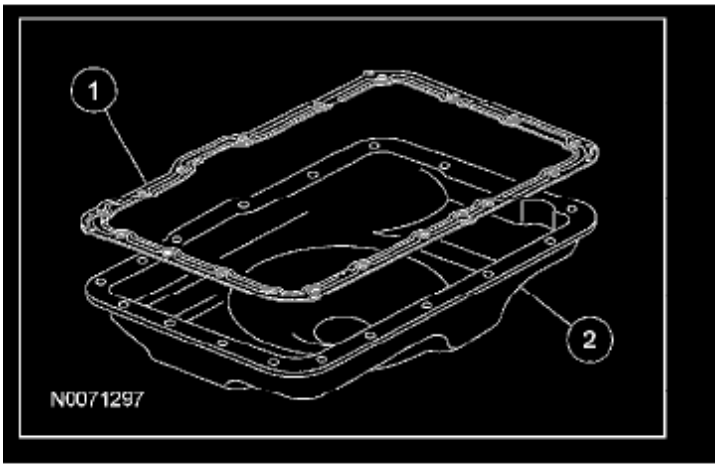
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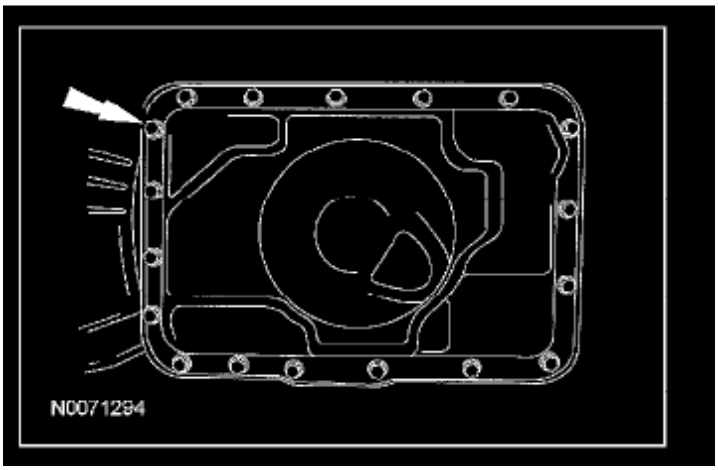

N0071294

6. NOTE: The transmission fluid pan gasket is reusable. Clean and inspect for damage, if not damaged, the gasket should be reused.

Install the transmission fluid pan. 1

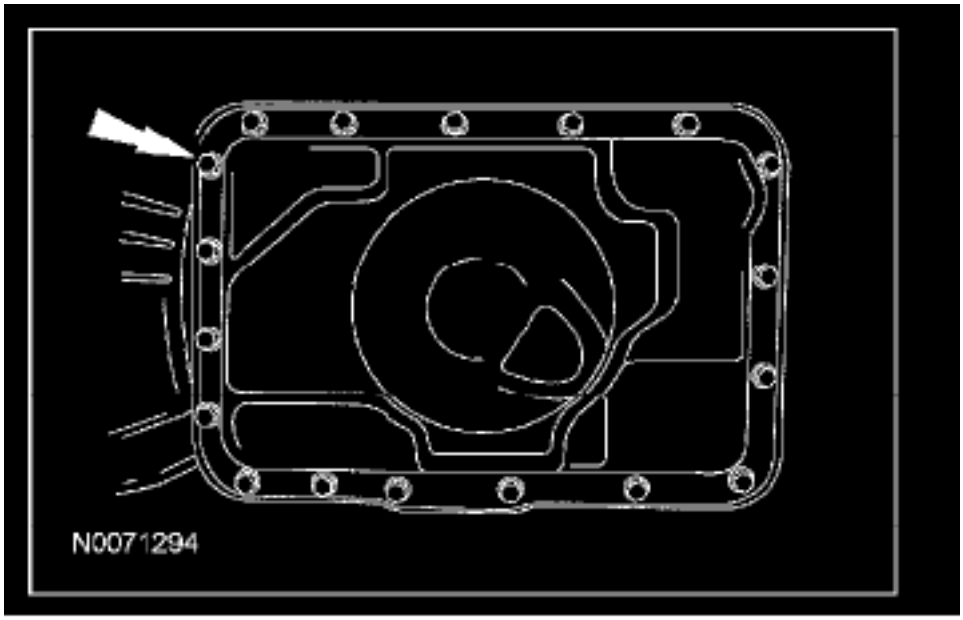
Position the transmission fluid pan gasket on the transmission fluid pan.

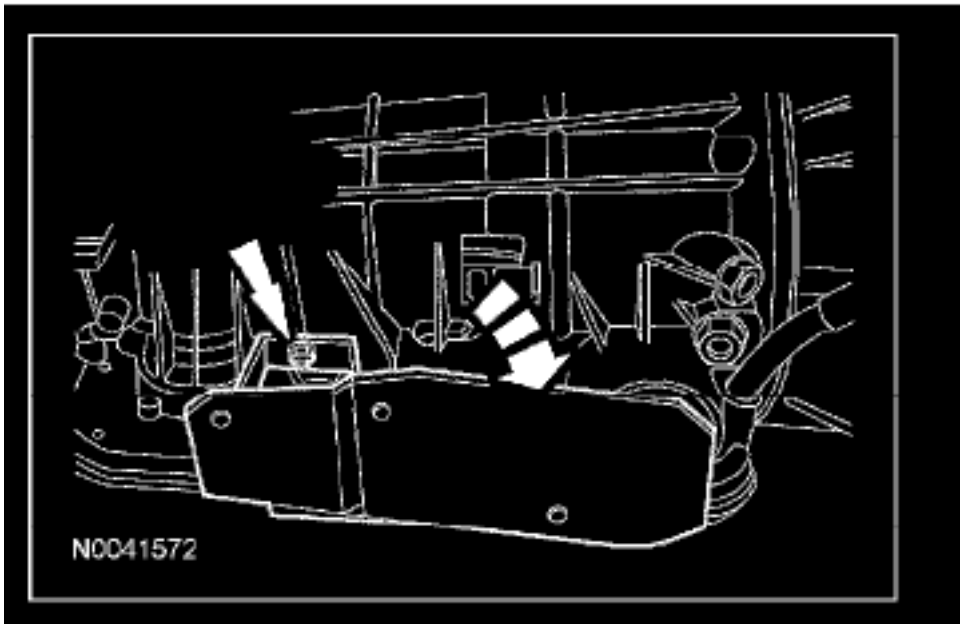
2 Align and install the transmission fluid pan.

7. Loosely install the transmission fluid pan screws.

8. Tighten the transmission fluid pan screws in a crisscross pattern.

^ Tighten to 10 Nm (89 lb-inch).





9. If equipped, position the servo heat shield over the servos and clip it to the pan rail.

^ Tighten to 10 Nm (89 lb-inch).

10. NOTE: Start with a minimum of 3.7L (4 qt) clean automatic transmission fluid.

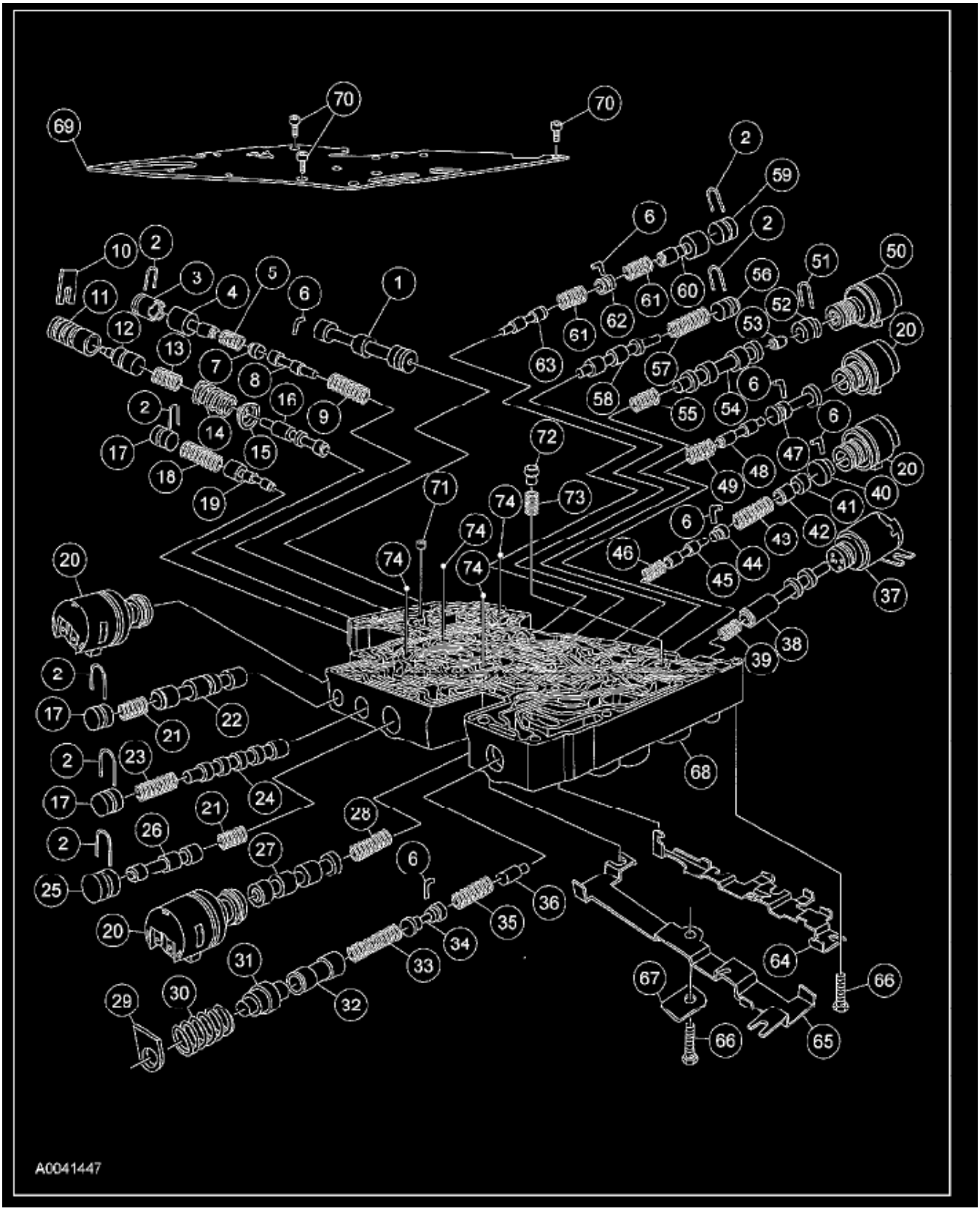
Fill transmission with clean automatic transmission fluid to the correct fluid level.

Special Tool(s)

ST1639-A	Aligner, Valve Body 307-333 (T95L-70010-B)
ST1639-A	Aligner, Valve Body 307-334 (T95L-70010-C)

Valve Body: Overhaul

Main Control Valve Body


A0041447

Item	Part Number	Description
1	—	Valve — manual
2	7E335	Retainers — valve plug (7 required)
3	7M203	Valve electronic pressure control (EPC) blowoff
4	—	Valve — forward modulator
5	—	Spring — forward modulator
6	7E335	Retainers — valve plug (6 required)
7	—	Plug — valve retainer
8	—	Valve — EPC boost
9	—	Spring — EPC boost
10	7E336	Retainer — valve plug
11	—	Sleeve — pressure boost
12	—	Valve — pressure boost
13	—	Spring — pressure boost
14	—	Spring — oil pressure regulator
15	—	Retainer — main regulator spring
16	—	Valve — pressure regulator
17	—	Plugs — valve retainer (3 required)
18	—	Spring — forward engagement
19	—	Valve — forward engagement control
20	7G484	Solenoids — shift (4 required)
21	—	Springs — 4-3 (K.D./T.D.) (2 required)
22	—	Valve — 4-3 (K.D.)
23	—	Spring — manual low (1)
24	—	Valve — manual low (1)
25	—	Plug — valve retainer
26	—	Valve — 4-3 (T.D.)
27	—	Valve — 1-2 and 4-5 shift
28	—	Spring — 1-2 and 4-5 shift
29	7E366	Retainer — valve plug
30		Spring thermostat bypass
31	—	Valve — thermostatic bypass
32	—	Valve — thermostat bypass
33	—	Spring — thermostat bypass
34	—	Plug — valve retainer
35	—	Spring — cooler limit
36	—	Valve — cooler limit

(Continued)

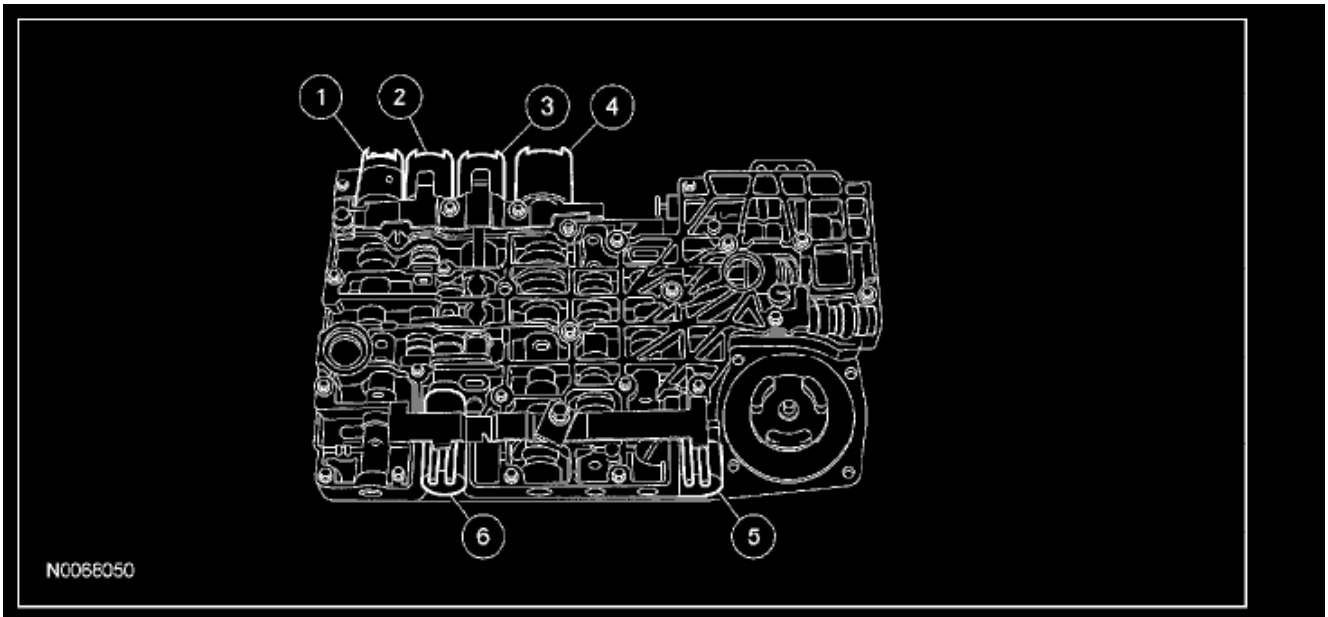
Item	Part Number	Description
37	7G136	Solenoid — torque converter clutch (pulse width modulated [PWM])
38	—	Valve — converter clutch
39	—	Spring — converter clutch
40	—	Plug — valve retainer
41	—	Valve — converter clutch
42	—	Spring — converter clutch
43	—	Spring — converter clutch (3.0L and 4.0L only)
44	—	Plug — valve retainer
45	—	Valve — coast clutch
46	—	Spring — coast clutch
47	—	Plug — valve retainer
48	—	Valve — 4-3 downshifts
49	—	Spring — 4-3 downshifts
50	7G383	Solenoid — EPC (variable force shift [VFS])
51	7E335	Retainer — valve plug
52	—	Plug — valve retainer
53	—	Valve — 2-3 shift
54	—	Valve — 2-3 shift
55	—	Spring — 2-3 shift
56	—	Plug — valve retainer
57	—	Spring — 3-4 shift
58	—	Valve — 3-4 shift
59	—	Plug — valve retainer
60	—	Valve — reverse modulation
61	—	Springs — reverse modulation (2 required)
62	—	Plug — valve retainer
63	—	Valve — reverse modulation
64	7L491	Clamp — SSA/SSC
65	7L491	Clamp — SSB/SSD/EPC/TCC
66	E800155	Screw — retain solenoid clamps (2 required)
67	7D132	ID plate
68	—	Body — valve
69	7Z490	Plate — separator
70	E804357	Screws — retain separator plate (3 required)
71	7D376	Extension housing lube orifice
72	7E368	Valve — converter relief (plastic)

(Continued)

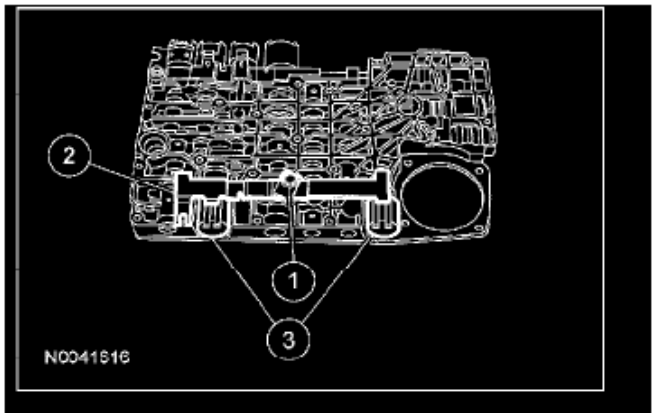
Item	Part Number	Description
73	7E340	Spring — EPC limit/converter relief (2 required)

(Continued)

Item	Part Number	Description
74	7E195	Balls (4 required)



Item	Part Number	Description
1	7F037	Torque converter clutch (TCC)
2	7G484	Shift solenoid (SSD)
3	7G484	Shift solenoid (SSB)
4	7H144	Electronic pressure control (EPC)
5	7G484	Shift solenoid (SSA)
6	7G484	Shift solenoid (SSC)



Disassembly

1. CAUTION: The SSC solenoid may pop out of its bore. This may damage the solenoid.

Remove the SSA and the SSC clamp and SSA and SSC solenoid. 1

Remove the solenoid clamp screw.

2 Remove the solenoid clamp. 3 Remove the SSA and SSC solenoids.

2. CAUTION: The torque converter clutch (TCC) solenoid may pop out of its bore. This may damage the solenoid.

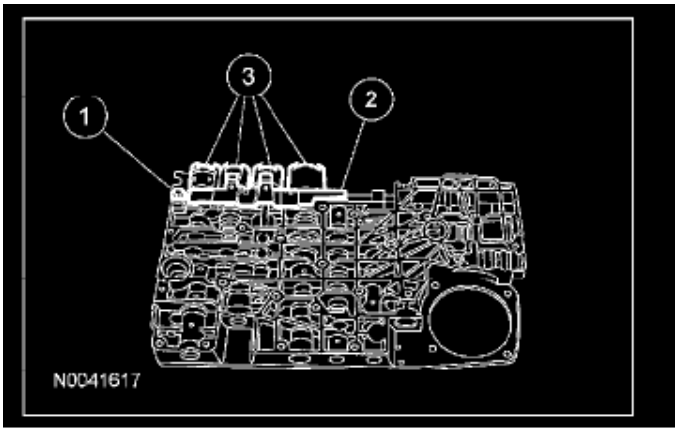
CAUTION: The converter modulator valve may come out after the torque converter clutch (TCC) solenoid. This may cause damage to the valve.

Remove the SSB, SSD, torque converter clutch (TCC) and the electronic pressure control (EPC) solenoid. 1

Remove the solenoid clamp screw.

2 Remove the solenoid clamp.

3 Remove the SSB, SSD, TCC and the EPC solenoids.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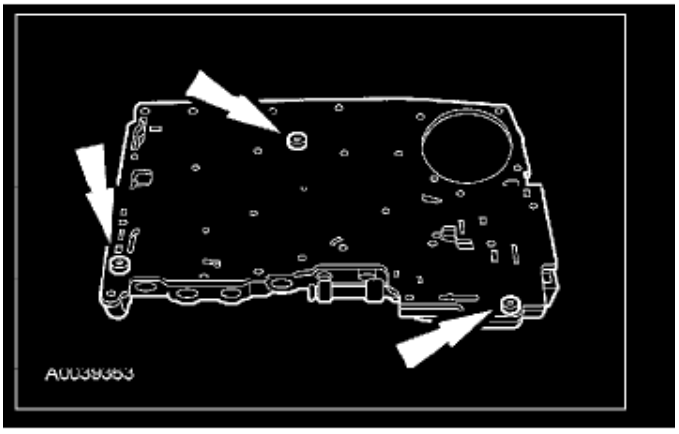
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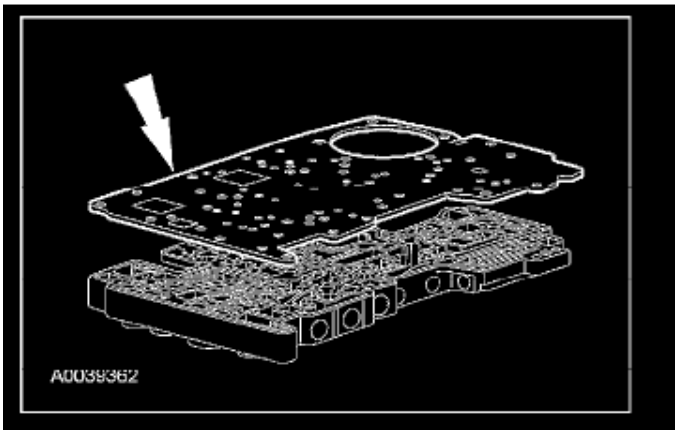

A0039362

3. Rotate the main control valve body so that the main control separating plate is facing up.

4. NOTE: Valves may come out when rotating the main control valve body.

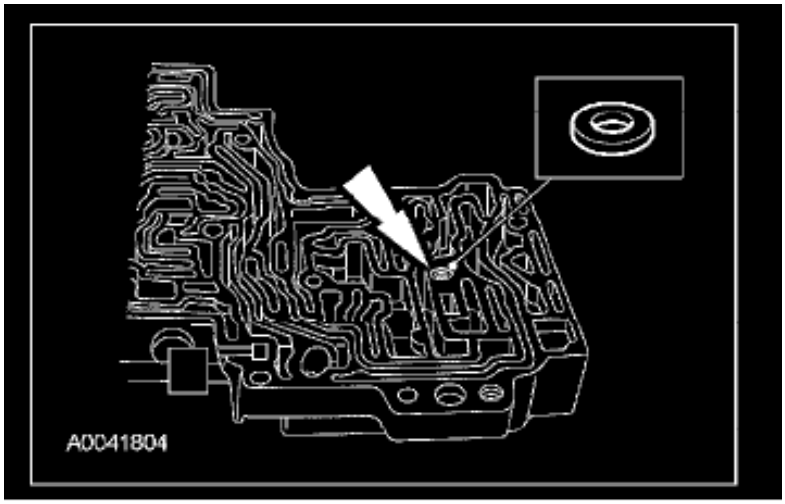
NOTE: The extension housing lube orifice and relief valves may stick to the separator plate.

NOTE: The main control separator plate has a bonded gasket.

Remove the valve body separator plate screws.

5. Remove valve body separator plate.

6. Remove the extension housing lube orifice.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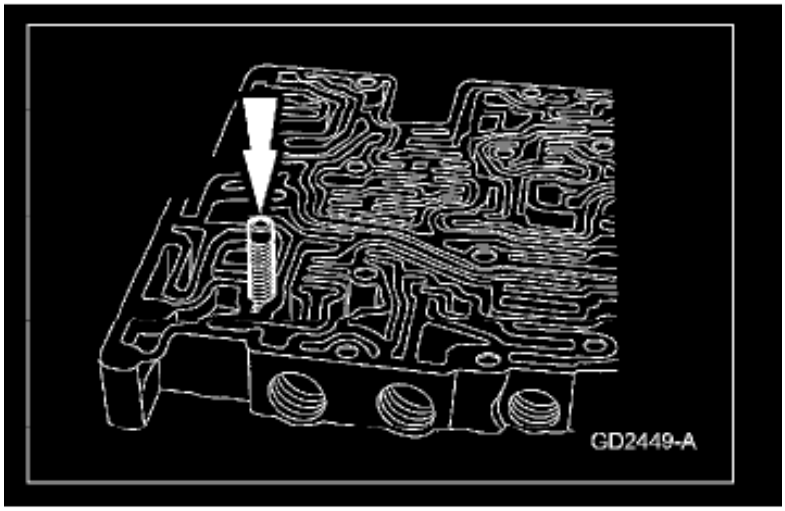
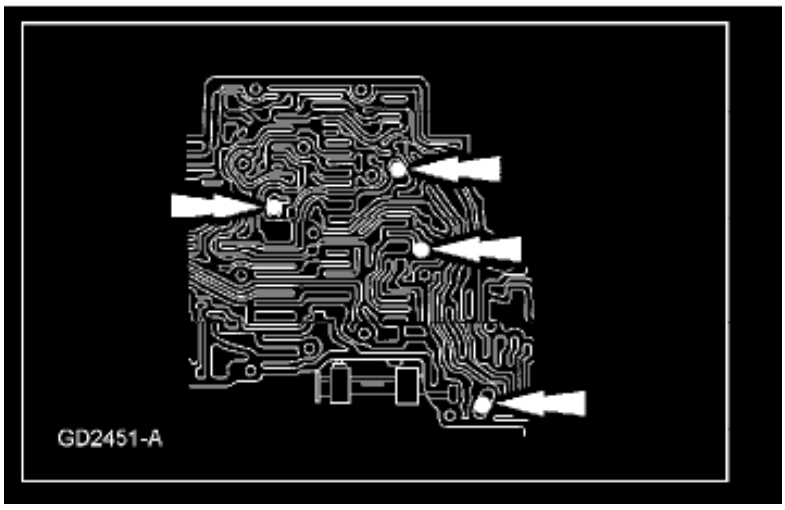

GD2449-A


GD2451-A

7. Remove the black plastic converter relief valve and spring.

8. Remove the 4 main control valve body check balls.

9. If the main control requires cleaning, completely disassemble the main control. Refer to the main control exploded view in this procedure.

Assembly

1. Thoroughly clean all parts in solvent and blow dry with moisture free compressed air.

2. CAUTION: Do not stone, file or sand the valves. This will remove the anodized finish and may result in further main control or

transmission damage.

After cleaning the main control valve body, carry out the following: ^

Inspect all valve and plug bores for scoring or burrs.

^ Check all fluid passages for obstructions.

^ Inspect all valves and plugs for burrs.

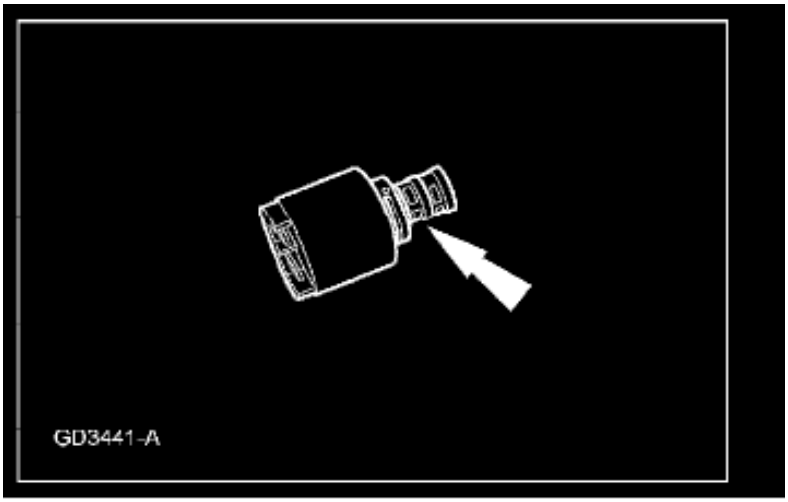
^ Inspect all mating surfaces for burrs or distortion.

^ Inspect all springs for distortion.

^ Check all valves and plugs for free movement in their respective bores. -

Valves and plugs, when dry, must fall from their own weight into their respective bores.

^ Roll the manual valve on a flat surface to check for a bent condition.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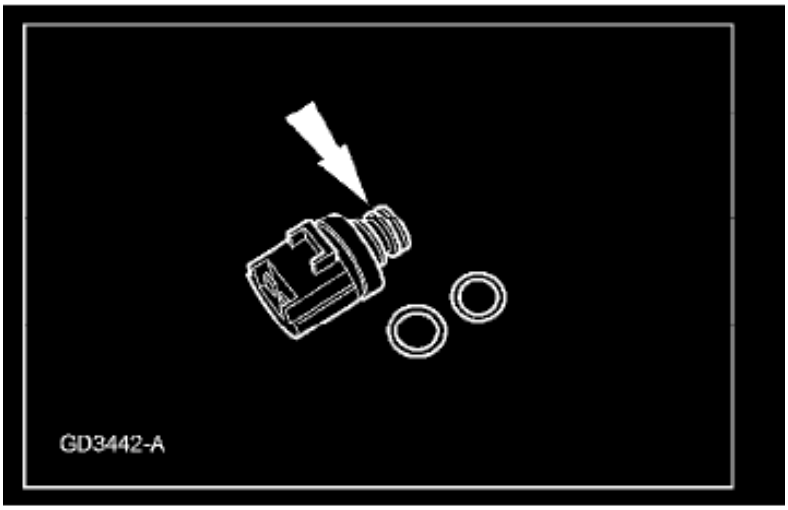
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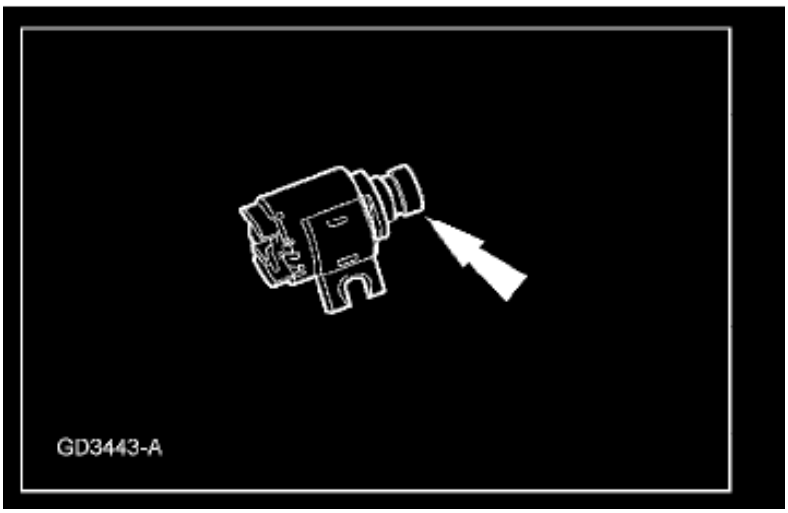
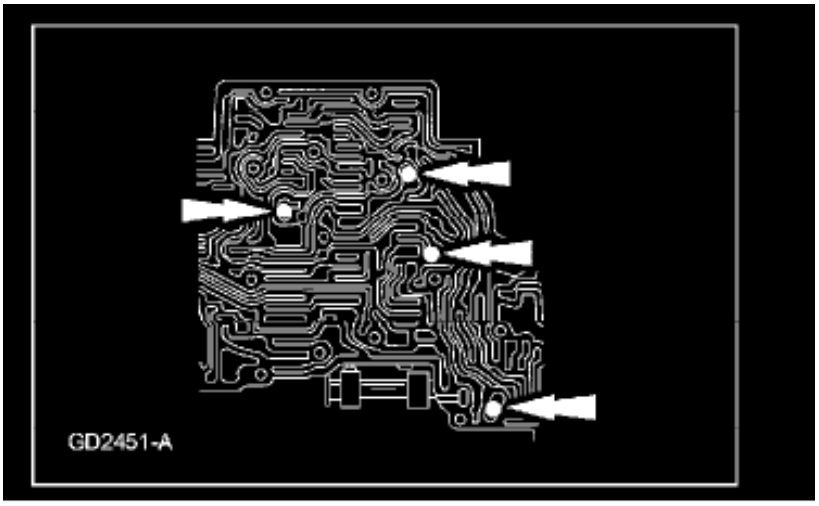

GD3443-A

3. Clean and inspect the EPC solenoid screens.

4. Remove and install new shift solenoid O-rings

5. Clean and inspect the TCC solenoid.

6. Install the 4 main control valve body check balls.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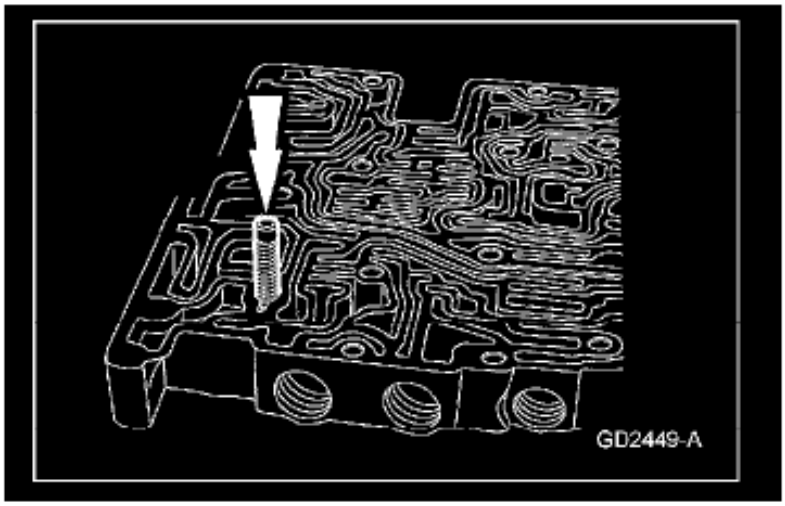
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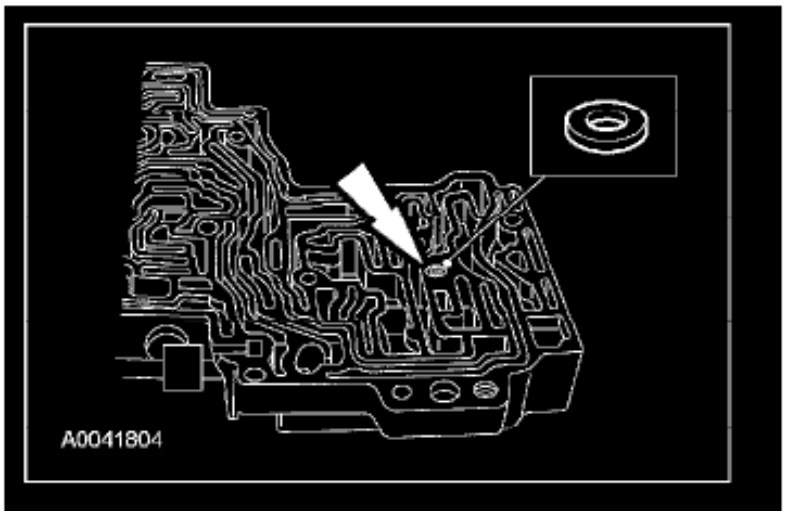

A0041804

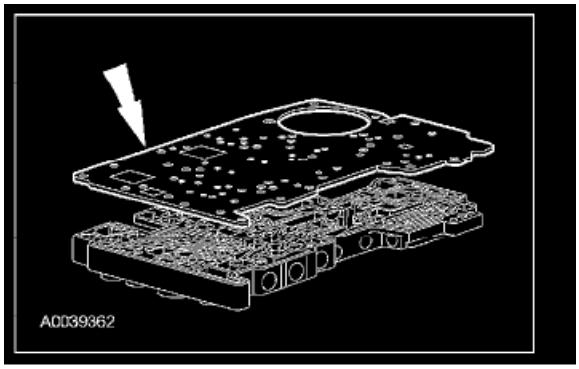
7. Install the dark color plastic converter relief valve and spring.

8. Install the extension housing lube orifice.

9. NOTE: Apply petroleum jelly on the valve body separator plate to hold it in place on the main control valve body.

NOTE: Use a new bonded separator plate.

Install the main control valve body separator plate to the main control valve body.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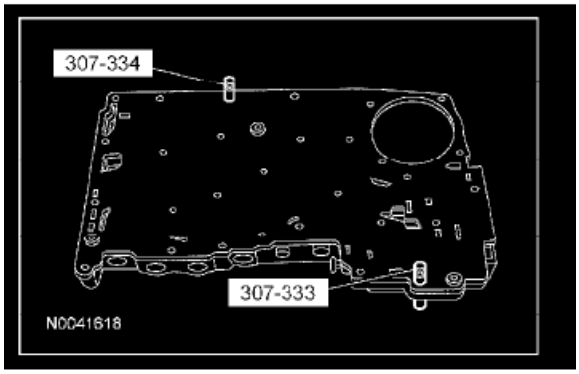
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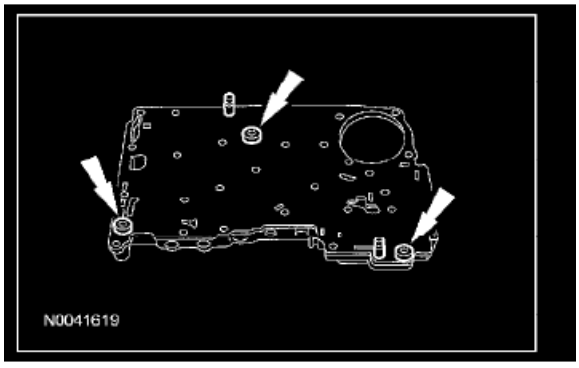
307-333
N0041618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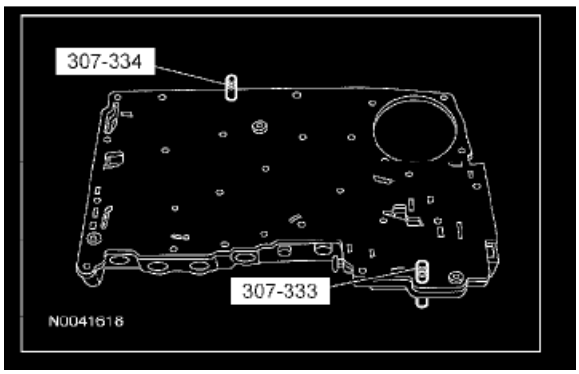

307-334
307-333
N0041618

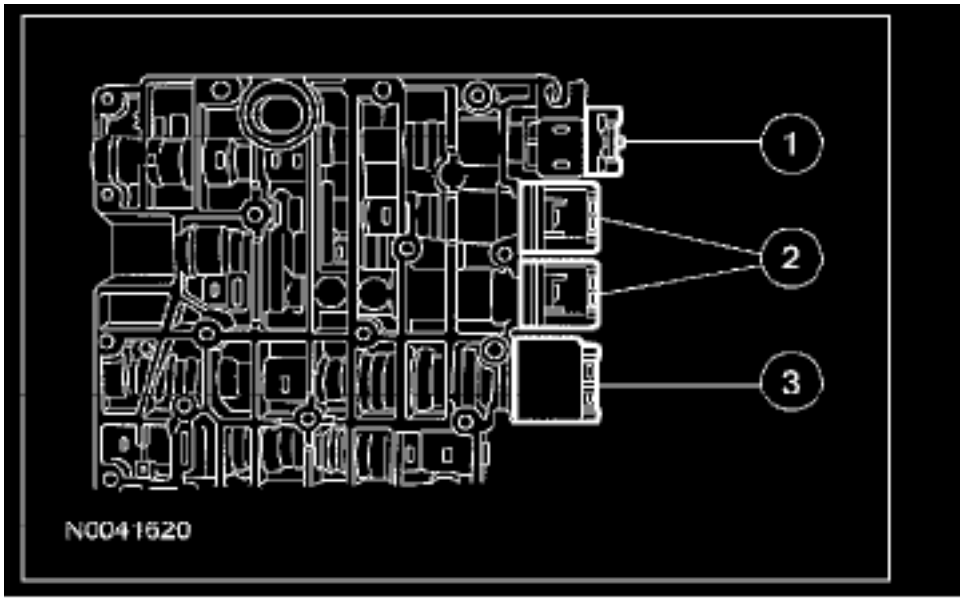
10. Install the special tools into the main control valve body.

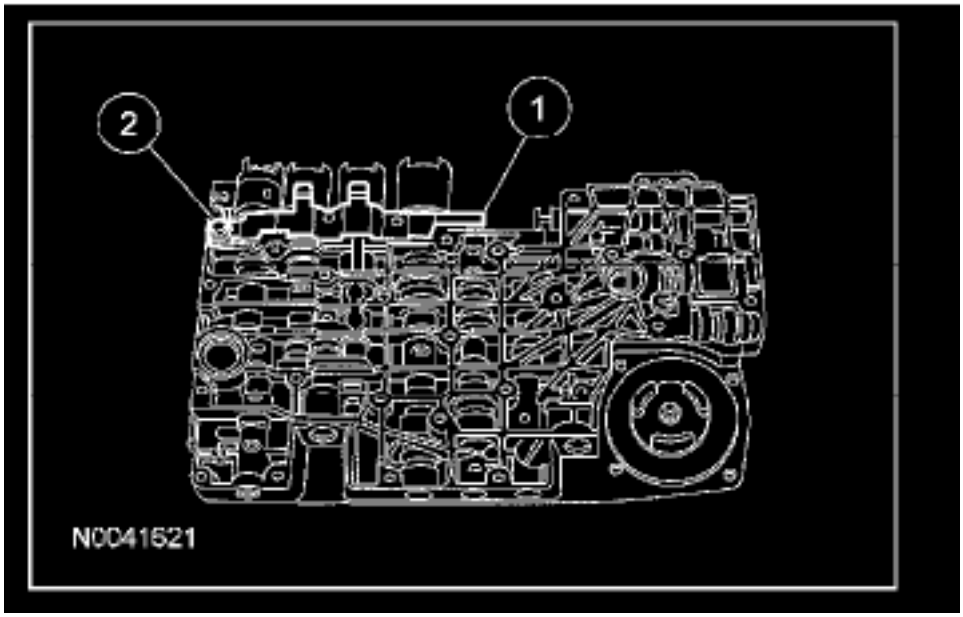
11. Install the valve body separator plate-to-main control valve body screws.

^ Tighten to 7 Nm (62 lb-inch).

12. Remove the special tools from the main control valve body.

13. Rotate the main control valve body so the valve body separator plate is facing down.





14. NOTE: All solenoid electrical connectors must face upward on installation.

NOTE: All shift solenoids are interchangeable.

NOTE: If the TCC valve came out during disassembly, use caution when installing the torque converter clutch solenoid.

Install the SSB, SSD, TCC and EPC solenoids. 1

Install the TCC solenoid.

2 Install the SSB and SSD solenoids.

3 Install the EPC solenoid.

15. NOTE: The solenoid clamp must be installed in the torque converter clutch (TCC) and electronic pressure control (EPC) solenoid grooves, shift

solenoid pockets and the No. 204 plug.

Install the solenoid clamp and the screw. 1

Position the solenoid clamp on the main control valve body.

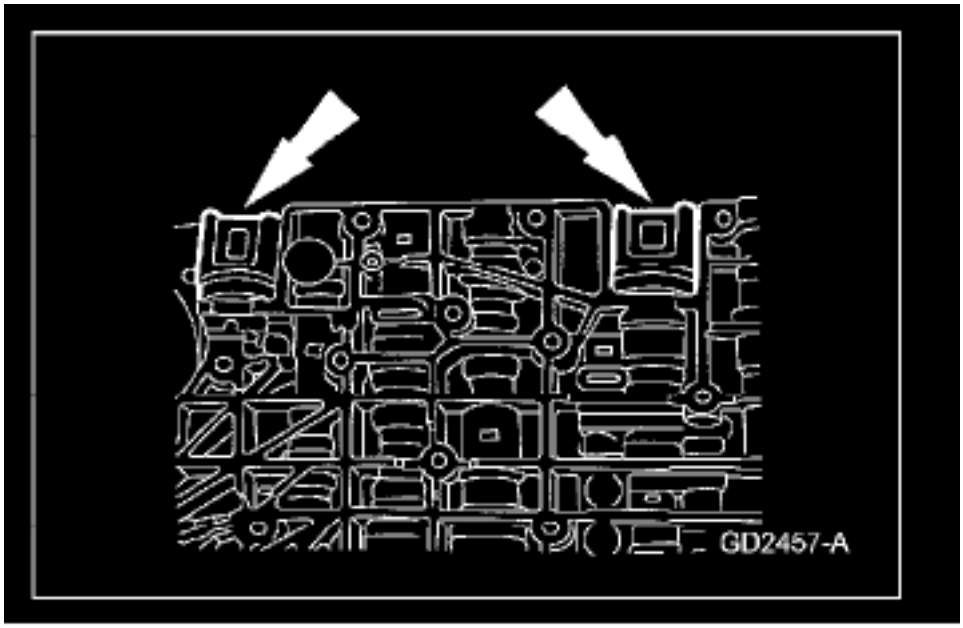
2 Install the screw. ^

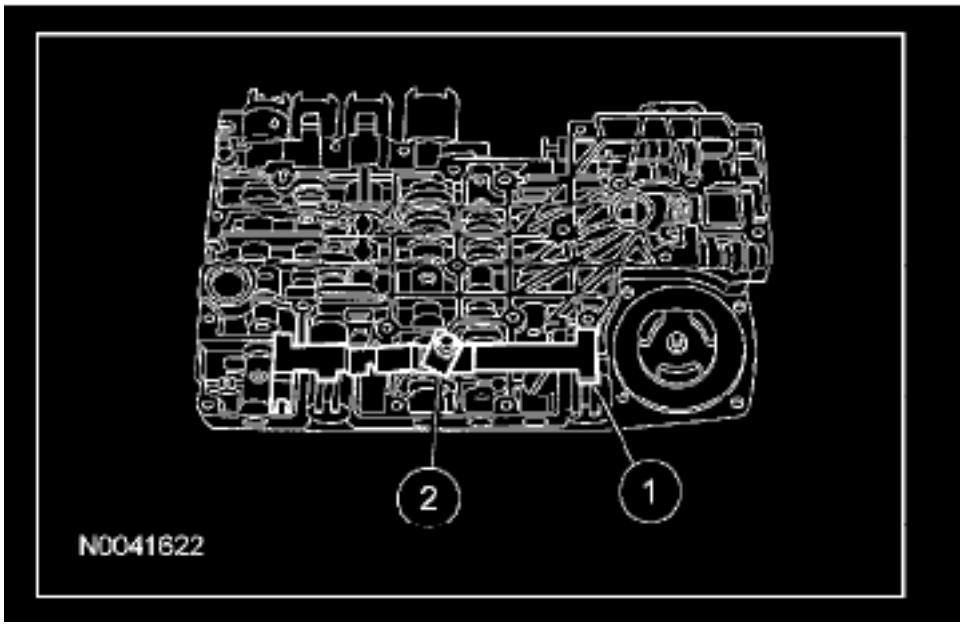
Tighten to 7 Nm (62 lb-inch).

16. NOTE: The shift solenoid electrical terminals must face up on installation.

NOTE: The shift solenoids are interchangeable.

Install the SSA and the SSC shift solenoids.





17. Install the solenoid clamp and the screw.

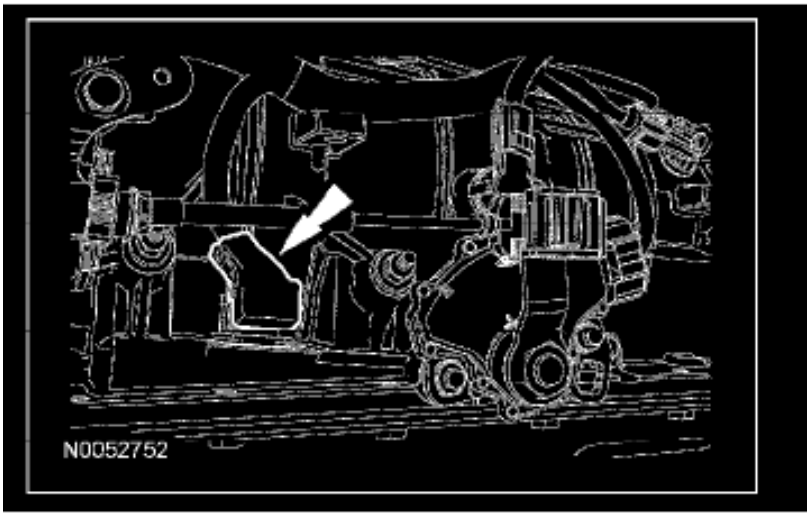
1 Position the solenoid clamp on the main control valve body.

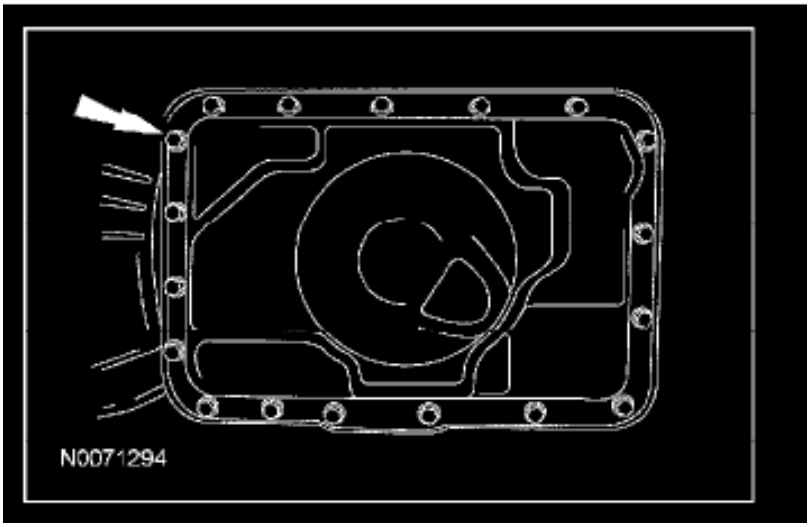
2 Install the screw. ^

Tighten to 7 Nm (62 lb-inch).

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V





Wiring Harness: Service and Repair

Internal Harness Service

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect vehicle harness from the transmission case (16-pinch) connector.

3. Drain the transmission fluid.

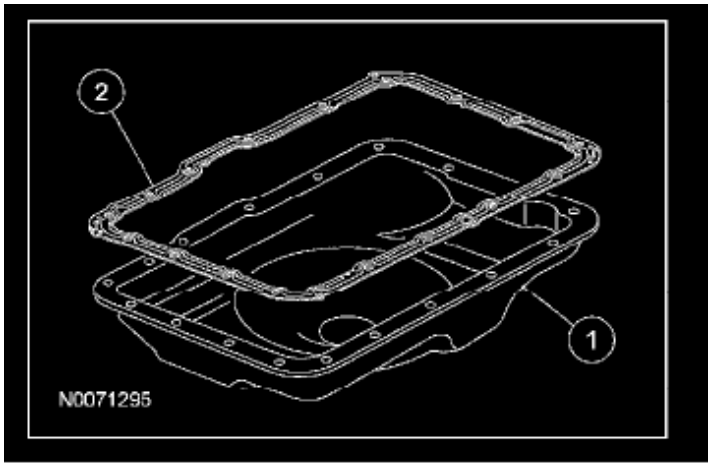
^ Remove all the transmission fluid pan screws except for 2 in the front. Loosen the 2 front transmission fluid pan screws. Pry the rear of the transmission fluid pan down and allow fluid to drain. After fluid is drained, remove the front 2 transmission fluid pan screws.

4. NOTE: The transmission fluid pan gasket is reusable. Clean and inspect for damage, if not damaged, the gasket should be reused.

Remove the transmission fluid pan. 1

Remove the transmission fluid pan.

2 Remove the transmission fluid pan gasket.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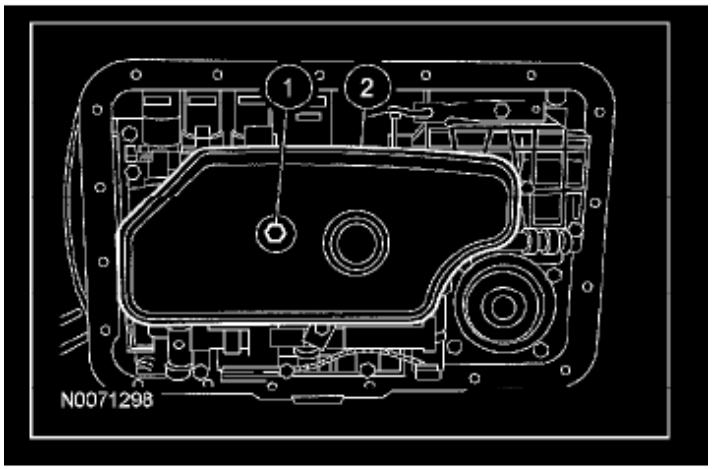
N0071295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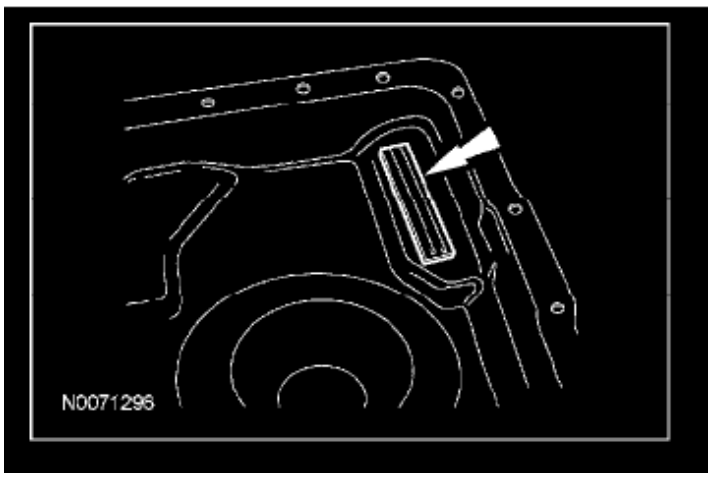
N0071298


N0071296

5. NOTE: The main control assembly does not need to be removed.

Remove the transmission fluid filter. 1

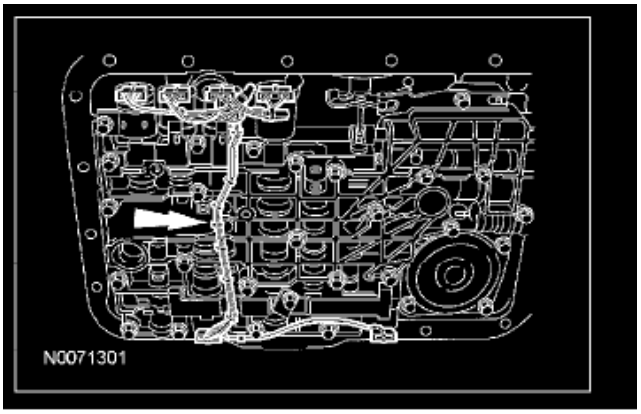
Remove the transmission fluid filter screw.

2 Remove the transmission fluid filter.

6. Clean and inspect the transmission fluid pan and magnet. Clean all mating surfaces.

7. Remove the main control valve body wire loom.

^ Carefully lift up on the wire loom guide and protector, and disengage the retaining pins from the solenoid clamps.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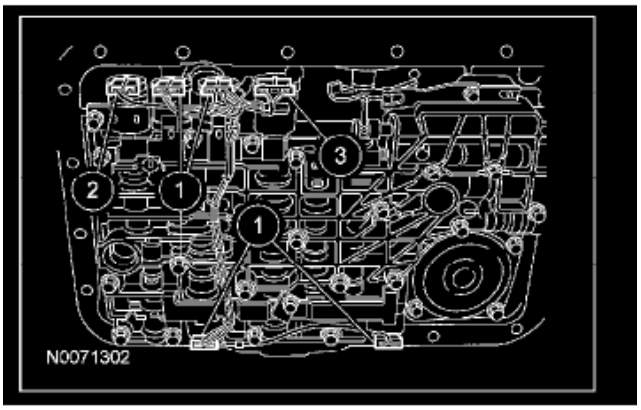
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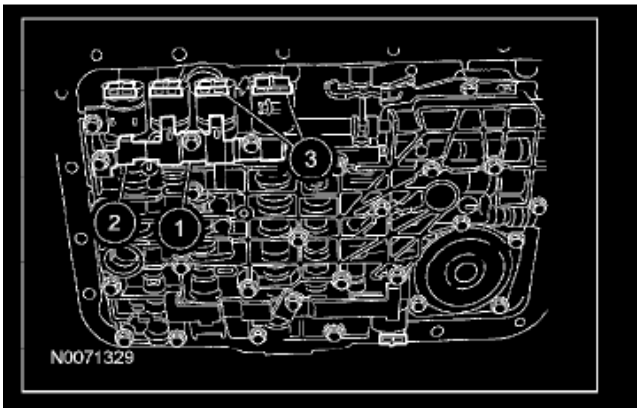
N0071302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8. Disconnect the solenoid electrical connectors.

1 Disconnect the SSA, SSB, SSC and SSD electrical connectors.

2 Disconnect the torque converter clutch (TCC) solenoid electrical connector.

3 Disconnect the electronic pressure control (EPC) solenoid electrical connector.

9. CAUTION: The torque converter clutch (TCC) solenoid and converter modulator valve may pop out of their bore. This may damage the

solenoid or converter modulator valve.

CAUTION: Shift solenoids may pop out of their bore. This may damage the solenoids.

Remove the EPC and SSB solenoids. 1

Remove the solenoid clamp screws.

2 Remove the solenoid clamp.

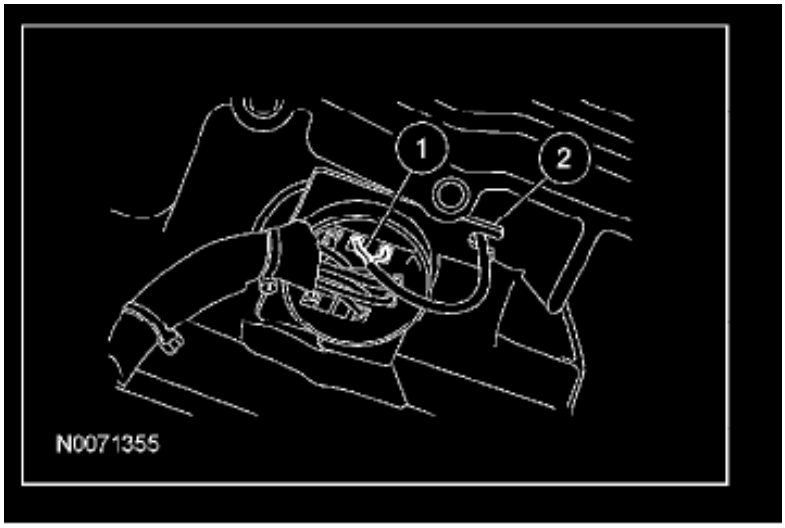
3 Remove the EPC and SSB solenoids.

10. CAUTION: Do not pry on the other wires or damage the connector case surface.

Disconnect the turbine shaft speed (TSS) sensor electrical connector from the transmission case (16-pinch) electrical connector. 1

Disconnect the TSS sensor electrical connector.

2 Remove from the TSS sensor wire locator.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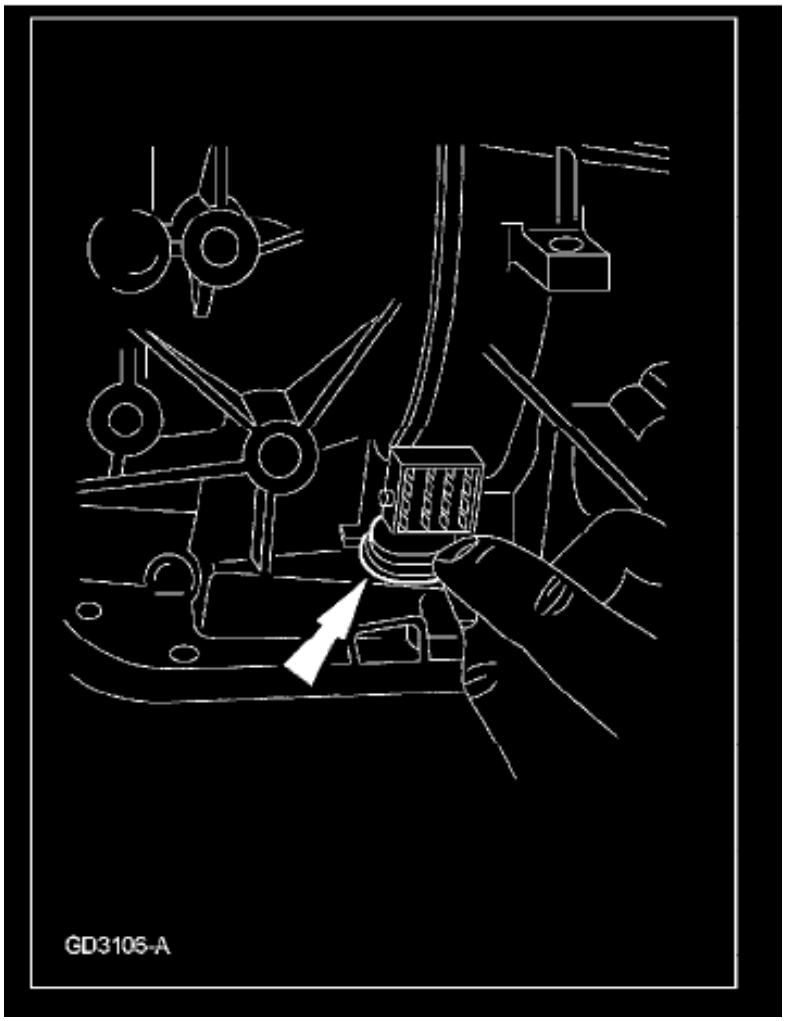

GD3105-A

11. CAUTION: Do not overstretch the retaining spring, overstretching can damage the spring.

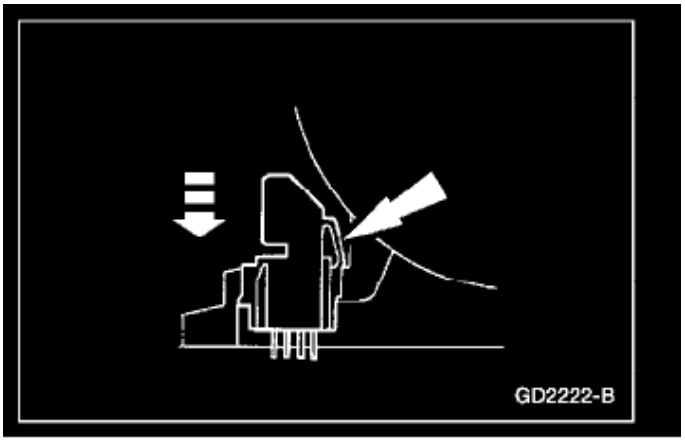
Remove the transmission case (16-pinch) electrical connector retaining spring.

12. CAUTION: Do not damage the connector or harness.

Remove the transmission case (16-pinch) electrical connector. ^

Compress the tabs on the transmission case (16-pinch) electrical connector.

^ Push the transmission case (16-pinch) electrical connector out of transmission case.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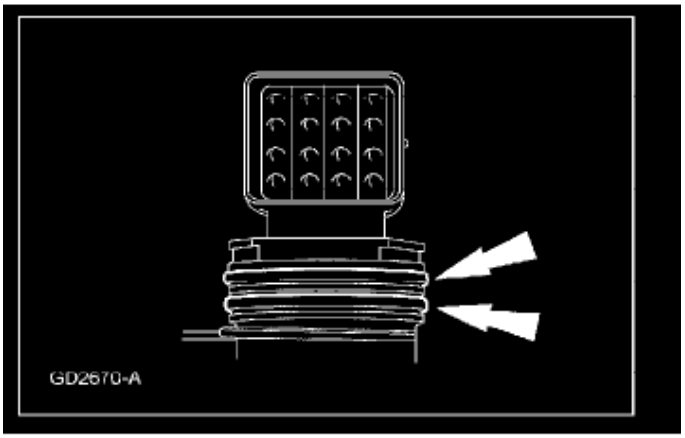
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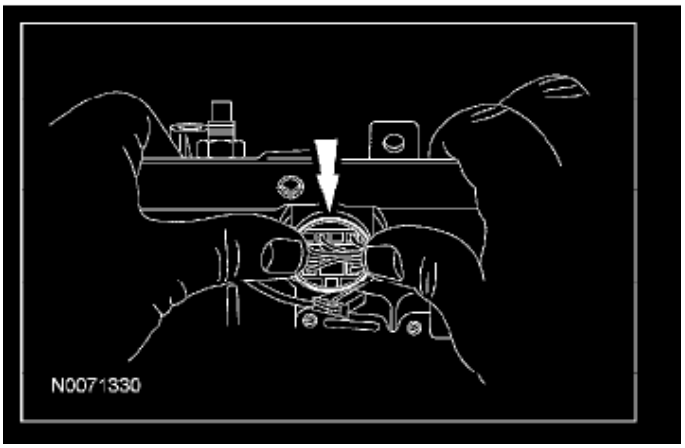

N0071330

Installation

1. NOTE: Make sure the tab is in the lock position.

NOTE: Install 2 new O-rings on the transmission case (16 pinch) electrical connector.

Install the transmission case (16-pinch) electrical connector. ^

Lubricate the transmission case (16-pinch) electrical connector O-rings with petroleum jelly.

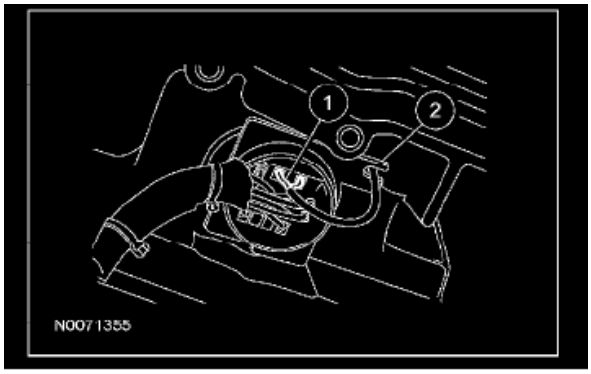
2. Press the transmission case (16-pinch) electrical connector through the case until a click is heard.

3. NOTE: Align the slot on the turbine shaft speed (TSS) sensor electrical connector with the slot in the (16-pinch) case connector.

Install the TSS sensor wire. 1

Install the TSS sensor wire into (16-pinch) case connector.

2 Install the TSS sensor wire into the locator.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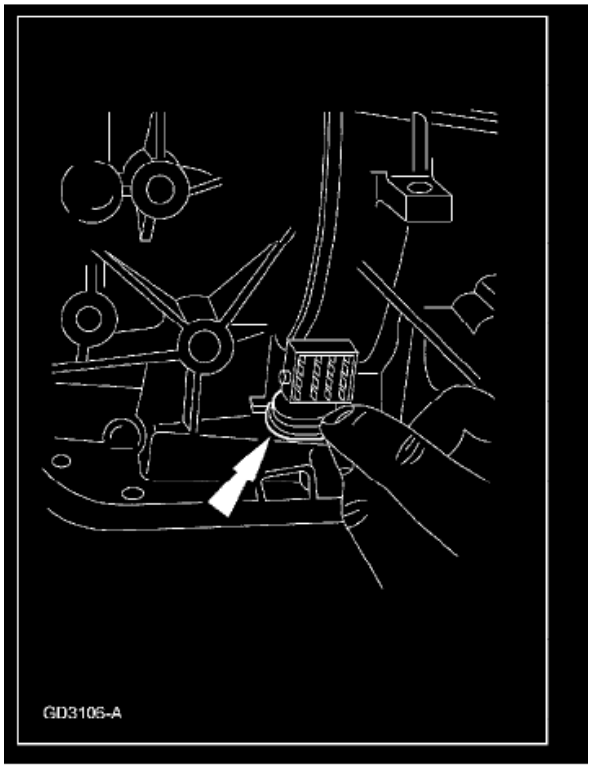
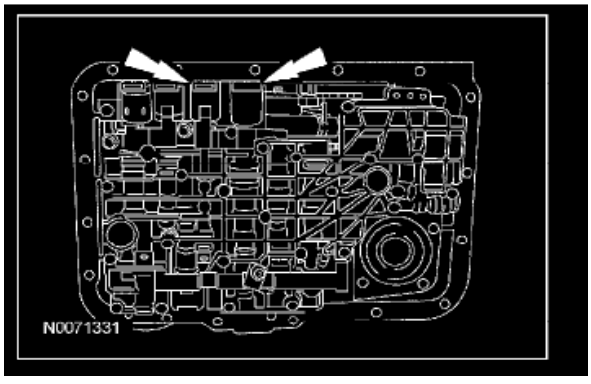

GD3106-A


N0071331

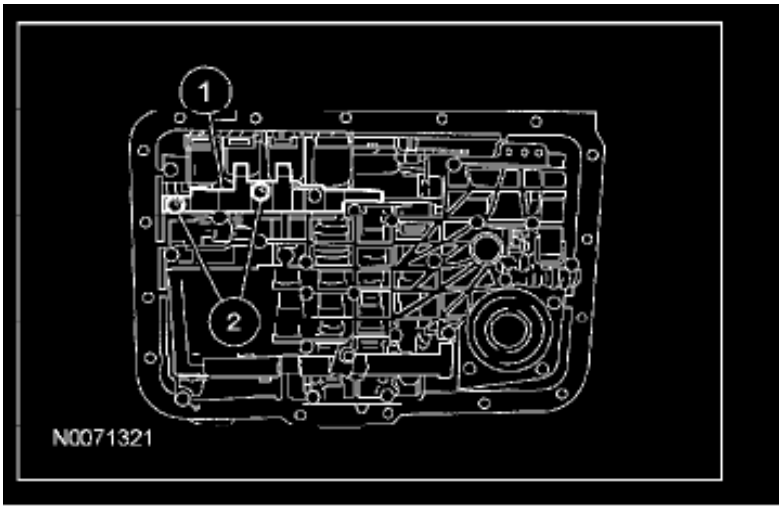
4. CAUTION: Do not overstretch the retaining spring, overstretching can damage the spring.

Install the transmission case (16-pinch) electrical connector retaining spring.

5. Install the EPC and SSB solenoids.

6. NOTE: The solenoid clamp must be installed in the torque converter clutch (TCC) and electronic pressure control (EPC) solenoid grooves, shift

solenoid pockets and the No. 204 plug.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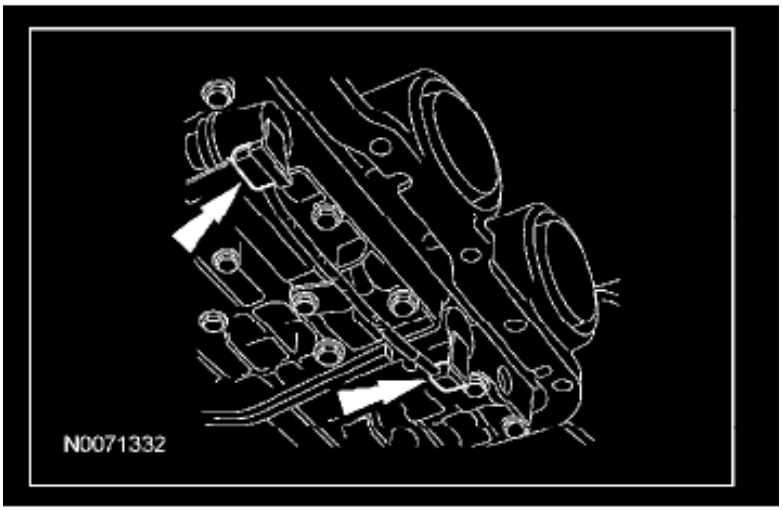
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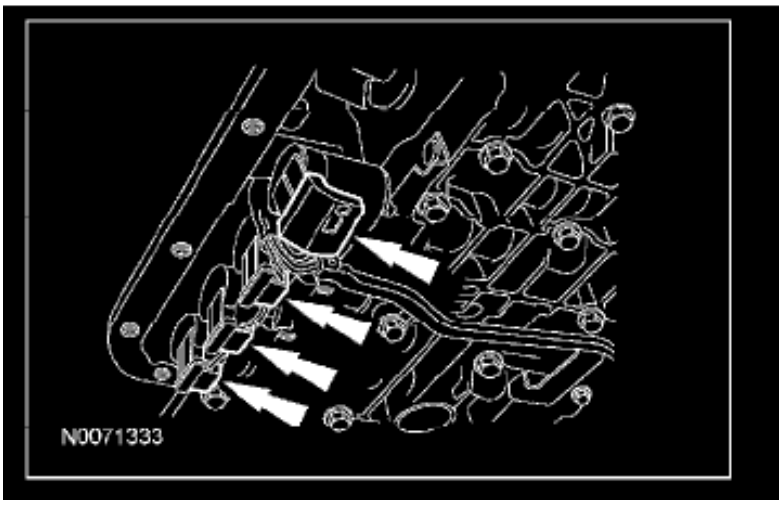

N0071333

Install the solenoid clamp. 1

Position the solenoid clamp on the main control valve body.

2 Install the solenoid clamp screws. ^

Tighten to 7 Nm (62 lb-inch).

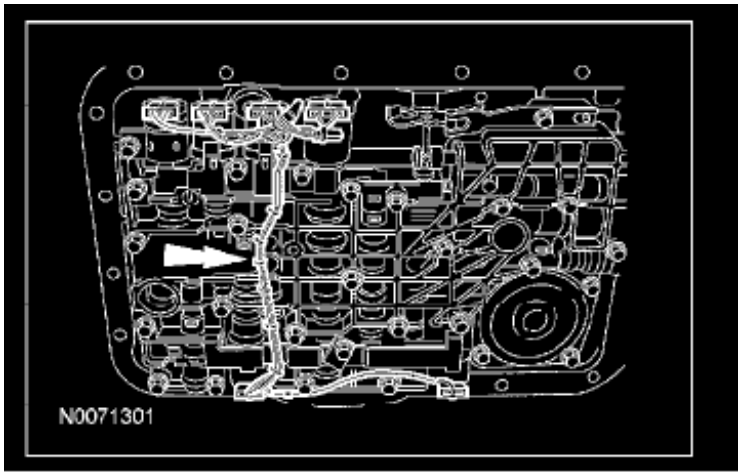
7. Connect the SSA and SSC shift solenoid (SS) electrical connectors.

8. Connect the TCC, SSD, SSB and EPC solenoid electrical connectors.

9. CAUTION: Excessive pressure may break the retaining pins.

Install the wire harness guide and protector. ^

Align the retaining pins to the holes in the solenoid clamps and gently press in the wire harness guide and protector.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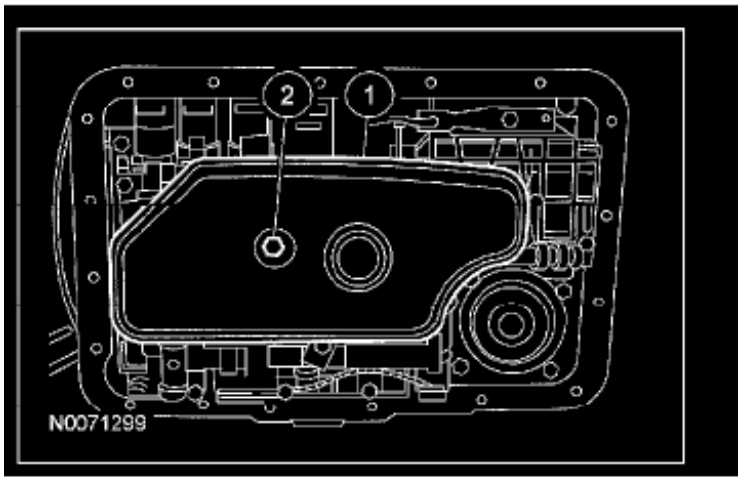
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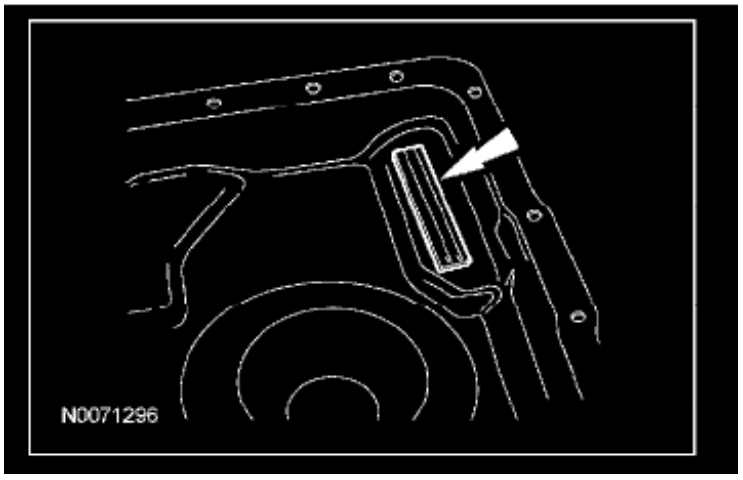

N0071296

10. Install the transmission fluid filter.

1 Position the transmission fluid filter on the main control valve body.

2 Install the transmission fluid filter screw. ^

Tighten to 10 Nm (89 lb-inch).

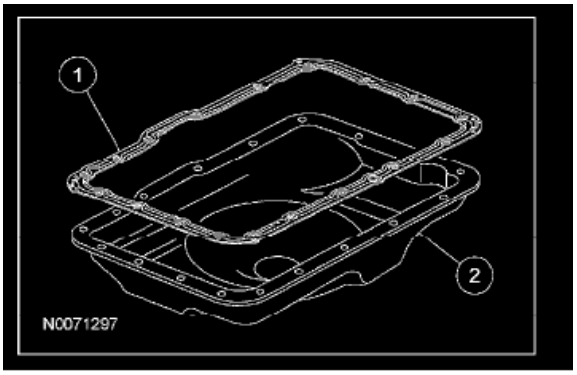
11. Position the oil pan magnet in the transmission fluid pan.

12. NOTE: The transmission fluid pan gasket is reusable. Clean and inspect for damage, if not damaged, the gasket should be reused.

Install the transmission fluid pan. 1

Position the transmission fluid pan gasket on the transmission fluid pan.

2 Install and align the transmission fluid pan.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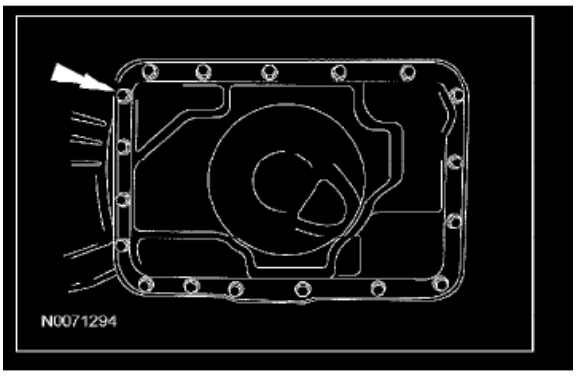
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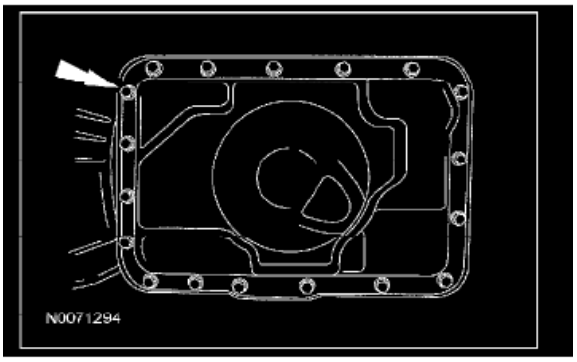
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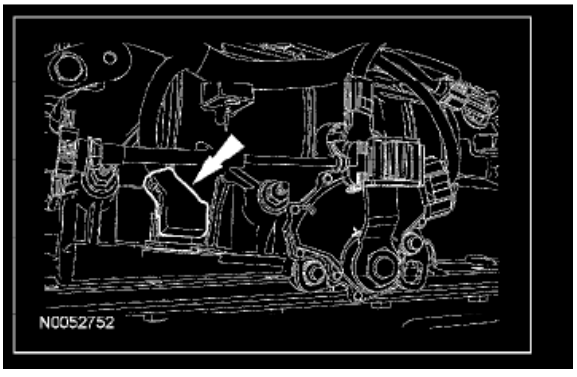
N0052752

13. Loosely install the transmission fluid pan screws.

14. Tighten the transmission fluid pan screws in a crisscross pattern.

^ Tighten to 10 Nm (89 lb-inch).

15. Connect the vehicle harness to the transmission (16 pinch) connector. Make sure the lock is fully engaged.

16. NOTE: Start with a minimum of 3.7L (4 qt) clean automatic transmission fluid.

Fill the transmission with clean automatic transmission fluid to the correct fluid level.

Clutch Disc: Customer Interest M/T - Squeaking Noise During Clutch Pedal Operation

TSB 09-25-6

12/28/09

NOISE FROM CLUTCH SLAVE CYLINDER WHEN CLUTCH - ENGAGED/DISENGAGED

FORD: 2004-2009 Ranger

This article supersedes TSB 08-22-8 to update the vehicle model years covered.

ISSUE Some 2004-2009 Ranger vehicles equipped with a manual transmission may exhibit a squeaking noise when engaging or disengaging the clutch. This may be due to the inter[ace between the clutch slave cylinder and clutch fingers. The noise may be duplicated by cycling the clutch with the vehicle standing still and the engine off.

ACTION Follow the Service Procedure steps to correct the condition.

SERVICE PROCEDURE

1. Use a stethoscope to confirm the source of the noise is coming from the clutch slave cylinder located in the transmission bell housing.

a. If the noise is from the clutch slave cylinder, obtain the Dow Corning(R) Molykote(R) G-n Metal Assembly Paste and Clutch Kit and proceed to

Step 2.

b. If the noise is not from the clutch slave cylinder, do not continue with this procedure. Follow normal diagnostics per the Workshop Manual

(WSM).

NOTE

THE USE OF DOW CORNING(R) MOLYKOTE(R) G-N METAL ASSEMBLY PASTE IS A CRITICAL COMPONENT OF THIS PROCEDURE AND MUST BE APPLIED AS INDICATED.

2. A 2.8 oz. (79.3 g) tube of Dow Corning® Molykote(R) G-n Metal Assembly Paste may be obtained from a local source or one of the following

suppliers:

a. Dealers in the United States contact Motion Industries at 1-586-726-6262.

b. Dealers in Canada contact Paisley Products at 1-514-344-0218 extension 226.

3. Remove the transmission. Refer to the WSM, Section 308 for removal and installation procedures.

4. Replace the clutch disc and pressure plate.

5. Replace the clutch slave cylinder. Apply a thin film of Dow Corning® Molykote(R) G-n Metal Assembly Paste to the new clutch slave cylinder

bearing face as well as on each of the clutch fingers of the pressure plate.

NOTE

ONLY 1-2 OUNCES (28-57 g) OF GREASE IS REQUIRED PER VEHICLE.

6. Install the transmission.

NOTE

DOW CORNING® MOLYKOTE(R) G-N METAL ASSEMBLY PASTE MUST BE OBTAINED LOCALLY.

WARRANTY STATUS: Eligible Under Provisions Of New Vehicle Limited Warranty Coverage
IMPORTANT: Warranty coverage limits/policies are not altered by a TSB. Warranty coverage limits are determined by the identified causal part.

OPERATION DESCRIPTION TIME

092506A 2004-2009 Ranger 4X2 3.1 Hrs.

4.0L SOHC: Replace The

NOTE: The information in Technical Service Bulletins is intended for use by trained, professional technicians with the knowledge, tools, and equipment to do the job properly and safely. It informs these technicians of conditions that may occur on some vehicles, or provides information that could assist in proper vehicle service. The procedures should not be performed by "do-it-yourselfers". Do not assume that a condition described affects your car or truck. Contact a Ford, Lincoln, or Mercury dealership to determine whether the Bulletin applies to your vehicle.

Clutch Disc, Pressure Plate, Slave Cylinder And Apply Grease, Includes Diagnosis (Do Not Use With Any Other Labor Operation)

092506A 2004-2009 Ranger 4X4 4.9 Hrs.

4.0L SOHC: Replace The Clutch Disc, Pressure Plate, Slave Cylinder And Apply Grease, Includes Diagnosis (Do Not Use With Any Other Labor Operation)

092506A 2004-2008 Ranger 4X2 3.1 Hrs.

3.0L MFI/FFV: Replace The Clutch Disc, Pressure Plate, Slave Cylinder And Apply Grease, Includes Diagnosis (Do Not Use With Any Other Labor Operation)

092506A 2004-2008 Ranger 4X2 3.3 Hrs.

2.3L: Replace The Clutch Disc, Pressure Plate, Slave Cylinder And Apply Grease, Includes Diagnosis (Do Not Use With Any Other Labor Operation)

092506A 2004-2008 Ranger 4X4 4.4 Hrs.

3.0L MFI/FFV: Replace The Clutch Disc, Pressure Plate, Slave Cylinder And Apply Grease, Includes Diagnosis (Do Not Use With Any Other Labor Operation)

DEALER CODING

CONDITION

BASIC PART NO. CODE

7A508 49

Disclaimer

Clutch Disc: All Technical Service Bulletins M/T - Squeaking Noise During Clutch Pedal Operation

TSB 09-25-6

12/28/09

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5. Replace the clutch slave cylinder. Apply a thin film of Dow Corning® Molykote(R) G-n Metal Assembly Paste to the new clutch slave cylinder

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6. Install the transmission.

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WARRANTY STATUS: Eligible Under Provisions Of New Vehicle Limited Warranty Coverage
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OPERATION DESCRIPTION TIME

092506A 2004-2009 Ranger 4X2 3.1 Hrs.

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Clutch Disc, Pressure Plate, Slave Cylinder And Apply Grease, Includes Diagnosis (Do Not Use With Any Other Labor Operation)

092506A 2004-2009 Ranger 4X4 4.9 Hrs.

4.0L SOHC: Replace The Clutch Disc, Pressure Plate, Slave Cylinder And Apply Grease, Includes Diagnosis (Do Not Use With Any Other Labor Operation)

092506A 2004-2008 Ranger 4X2 3.1 Hrs.

3.0L MFI/FFV: Replace The Clutch Disc, Pressure Plate, Slave Cylinder And Apply Grease, Includes Diagnosis (Do Not Use With Any Other Labor Operation)

092506A 2004-2008 Ranger 4X2 3.3 Hrs.

2.3L: Replace The Clutch Disc, Pressure Plate, Slave Cylinder And Apply Grease, Includes Diagnosis (Do Not Use With Any Other Labor Operation)

092506A 2004-2008 Ranger 4X4 4.4 Hrs.

3.0L MFI/FFV: Replace The Clutch Disc, Pressure Plate, Slave Cylinder And Apply Grease, Includes Diagnosis (Do Not Use With Any Other Labor Operation)

DEALER CODING

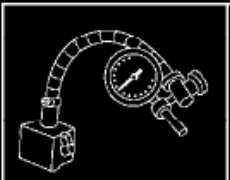
CONDITION

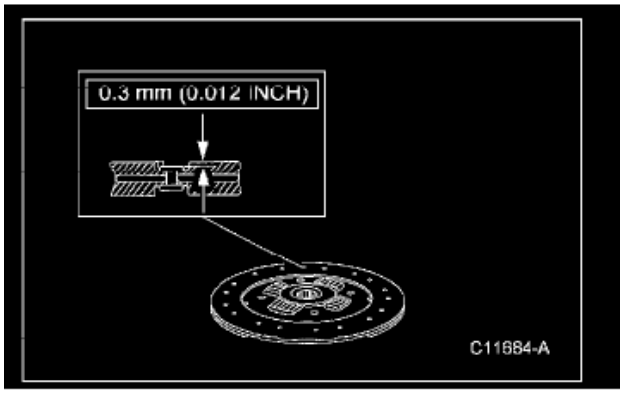
BASIC PART NO. CODE

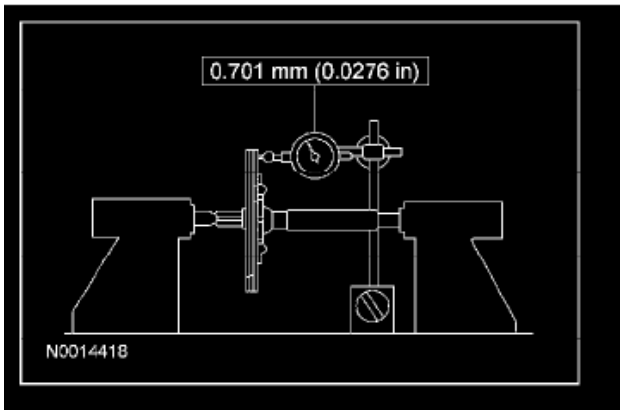
7A508 49

Disclaimer

Special Tool(s)

 ST1266-A	Dial Indicator Gauge with Holding Fixture 100-D002 (D78P-4201-B) or equivalent





Clutch Disc: Testing and Inspection

Clutch Disc Check

1. NOTE: Install a new clutch disc if any of these conditions are present. Always install a new clutch pressure plate when installing a new clutch.

NOTE: For clutch discs that have oil or grease contamination, eliminate the source of the contamination.

NOTE: If the clutch disc springs are loose enough to rattle they will not cause noise when the vehicle is operating.

Inspect the clutch for the following: ^

Oil or grease contamination

^ Worn or loose facings

^ Distortion

^ Broken springs

^ Burrs or uneven wear on the splines

^ Wear or damage on the clutch disc surface

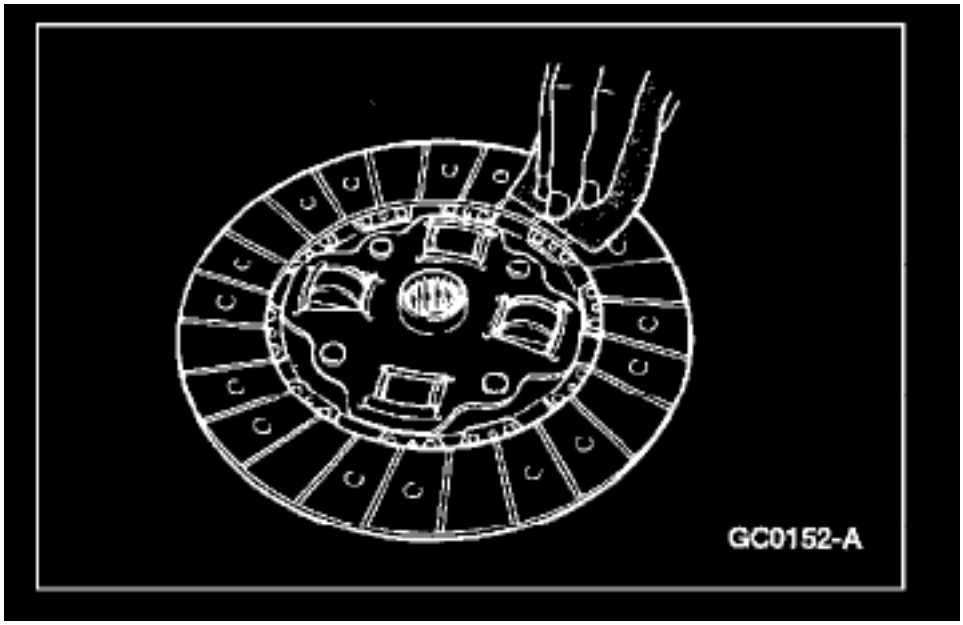
2. Check for a worn clutch disc lining. Measure the minimum allowable depth to the rivet heads with a slide caliper.

^ Check for loose clutch disc lining rivets.

3. Using a suitable dial indicator, check the maximum allowable runout of the clutch disc.

^ Install a new clutch disc if the runout is excessive.

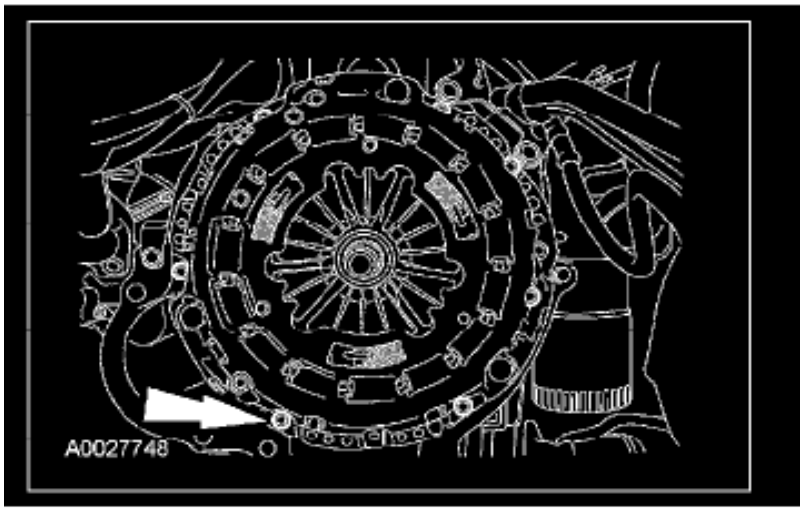
4. Use an emery cloth to remove minor imperfections in the clutch disc lining surface.

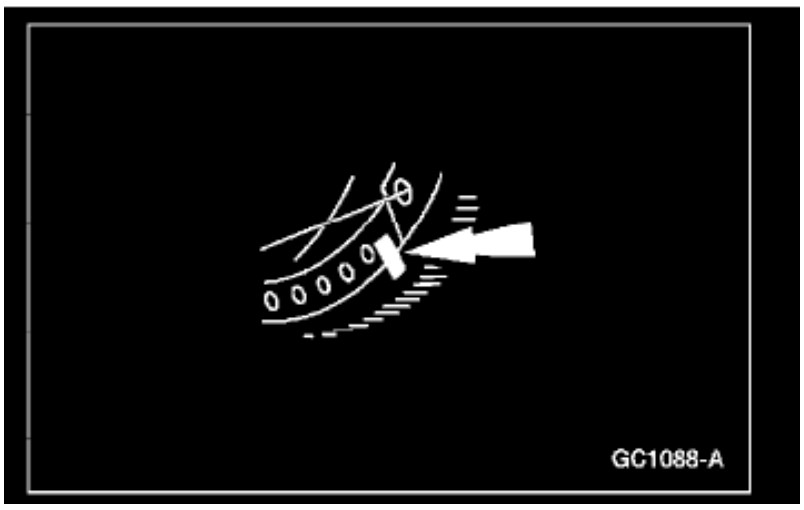


5. Check for wear or rust on the splines. If necessary, clean them with an emery cloth.

Material

Item	Specification
High Temperature 4x4 Front Axle and Wheel Bearing Grease E8TZ-19590-A	WSS-M1C267-A1





Clutch Disc: Service and Repair

Clutch Disc and Pressure Plate

Removal

1. Remove the transmission.

2. CAUTION: If the clutch disc and pressure plate are to be reinstalled, bolts must be removed evenly or permanent damage to the

diaphragm spring will occur, resulting in complete clutch release.

NOTE: If the parts are to be reused, index-mark the clutch pressure plate to the flywheel.

Remove the bolts, clutch pressure plate and the clutch disc.

3. Inspect the transmission input shaft pilot bearing:

^ for misalignment and looseness in the crankshaft (gasoline engine) or flywheel (diesel engine).

^ needle rollers for scoring, discoloration, wear and broken rollers.

^ seal for damage and lubricant leakage. -

Install a new transmission input shaft pilot bearing if any of these conditions are present.

4. NOTE: Use emery cloth to remove minor imperfections in the clutch disc friction surface.

Inspect the clutch disc for: ^

oil and grease saturation.

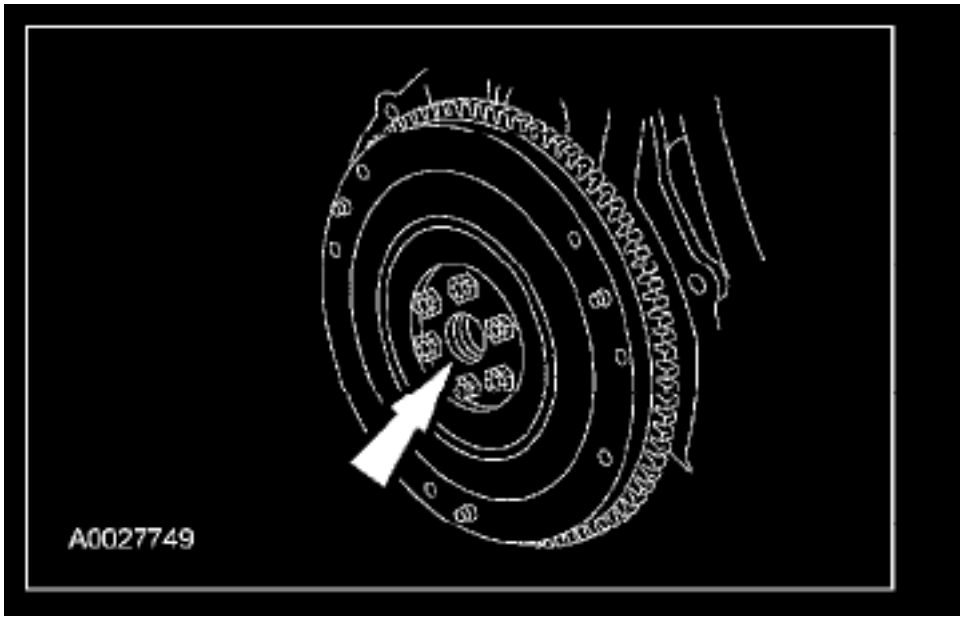
^ worn and loose rivets at the hub.

^ broken springs.

^ wear and rust on the splines. -

Install a new clutch disc if any of these conditions are present.

5. NOTE: If necessary, use a suitable cleaning solution to remove any oil film from the clutch pressure plate friction surface.



Inspect the clutch pressure plate levers for heavy wear associated with binding. Also, inspect for substantial difference in lever wear. Inspect the clutch pressure plate friction surface for scoring, burning, heat checking, distortion, warping and dishing. ^

Install a new clutch pressure plate if any of these conditions are present.

6. NOTE: If necessary, use a suitable cleaning solution to clean the flywheel clutch surface.

Inspect the flywheel for: ^

surface cracks.

^ heat check.

^ glazing.

^ scoring.

^ scratches or grooves. -

For minor damage, finish the flywheel surface with coarse emery cloth or with a fine grade (400 grit) sandpaper. To polish the surface, stroke parallel to the machine lines.

7. Inspect the flywheel or ring gear for worn, chopped or broken teeth.

Installation

1. Lubricate the transmission input shaft pilot bearing with grease.

2. Adjust the clutch pressure plate.

1 Using a suitable press, press downward on the fingers until the adjusting ring moves freely.

2 Rotate the adjusting ring counterclockwise to compress the tension springs. Hold the adjusting ring in this position.

3 Release the pressure on the fingers. The adjusting ring will stay in the reset position.

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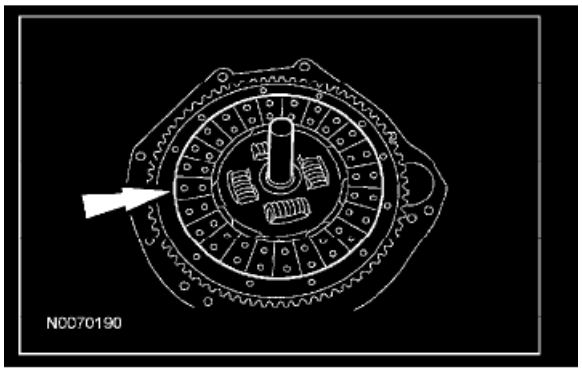
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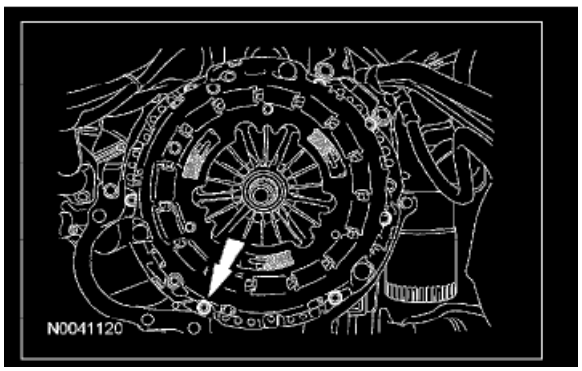
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3. Using a suitable clutch aligner, position the clutch disc on the flywheel.

4. NOTE: If reusing the clutch pressure plate and flywheel, align the marks made during removal.

Using a suitable aligner, align the clutch disc and the clutch pressure plate. Install the bolts and tighten in a star-pattern sequence. ^

Tighten to 27 Nm (20 lb-ft).

5. NOTE: Before securing the transmission to the engine, connect the hydraulic line to the clutch slave cylinder.

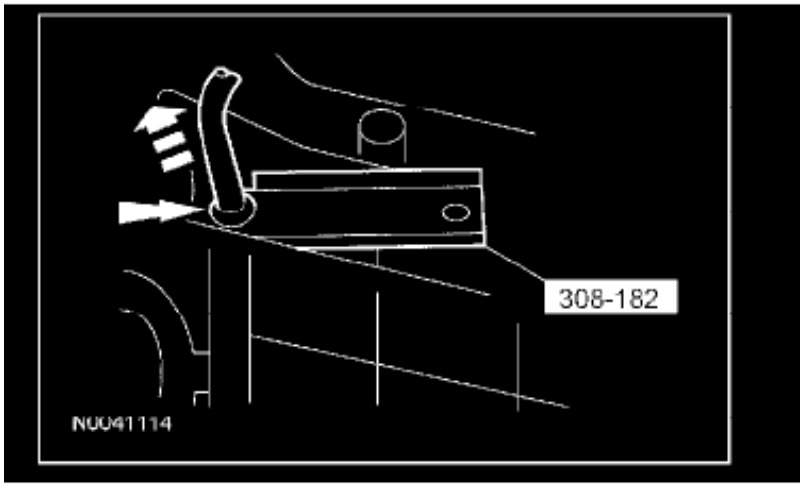
Install the transmission.

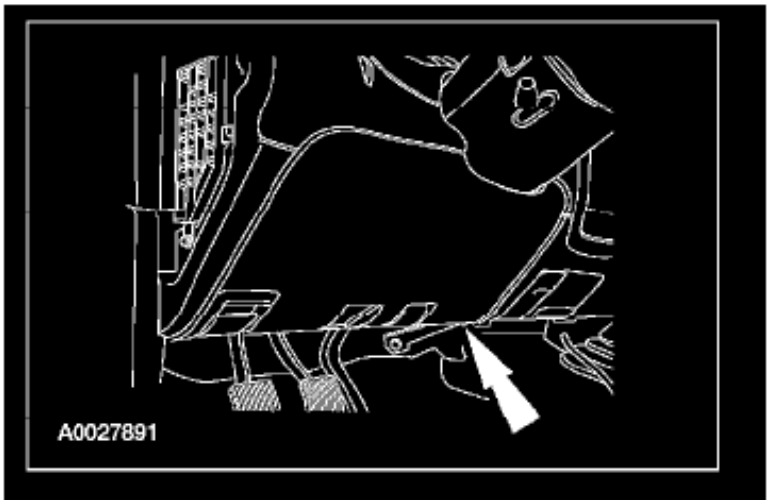
Clutch Fluid: Specifications

Clutch Hydraulic Fluid - Motorcraft High Performance DOT 3 Motor Vehicle Brake Fluid

Special Tool(s)

ST1318-A	Remover, Hydraulic Line Connector 308-182 (T88T-70522-A)





Clutch Master Cylinder: Service and Repair Clutch Master Cylinder and Reservoir

Clutch Master Cylinder and Reservoir

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist.

2. NOTE: Clean the area around the quick disconnect coupling.

Using the special tool, disconnect the hydraulic line from the clutch slave cylinder.

3. Remove the 2 screws and the lower steering column finish panel.

4. Remove the 5 bolts and the lower reinforcement panel.

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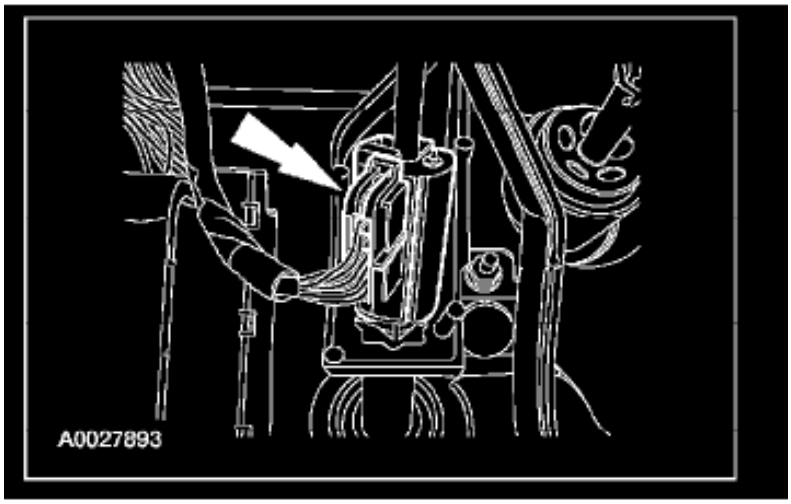
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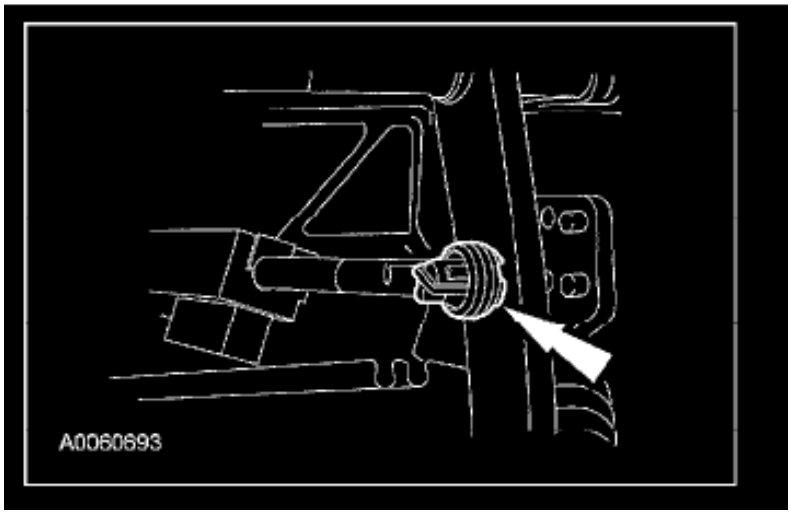
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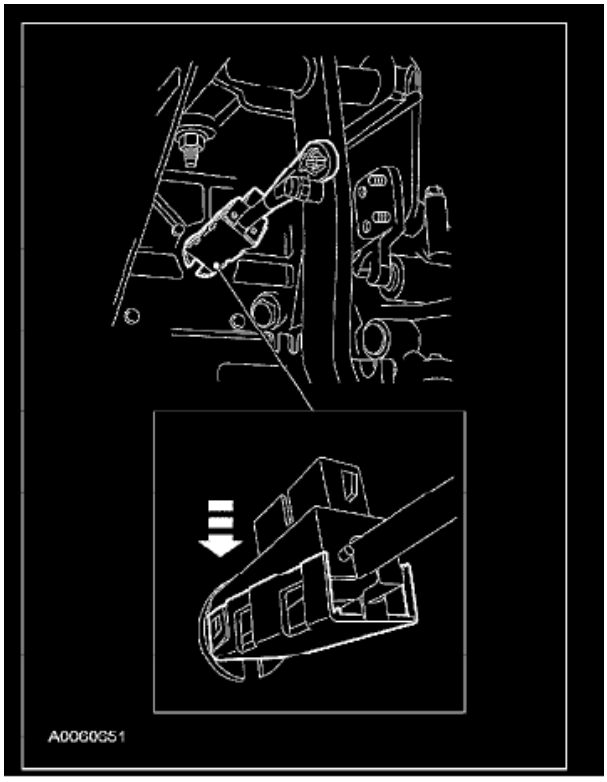
5. Disconnect the clutch pedal position (CPP) switch electrical connector.

6. Disconnect the clutch master cylinder rod from the clutch pedal arm.

7. Remove the CPP switch.

^ Lift the upper cover from the lock tabs and pull the upper cover up.

^ Rotate and remove the CPP switch from the clutch master cylinder rod.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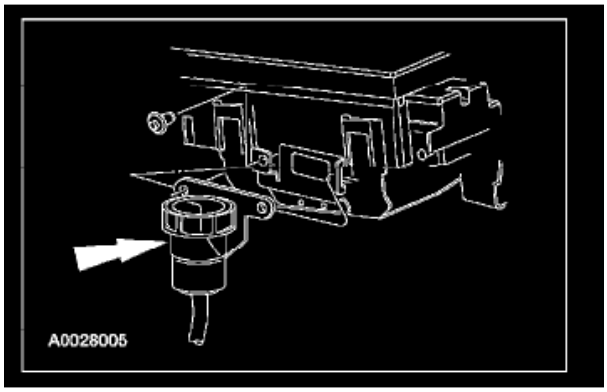
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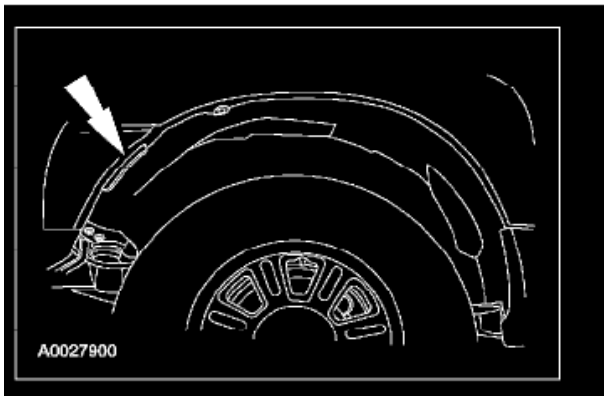
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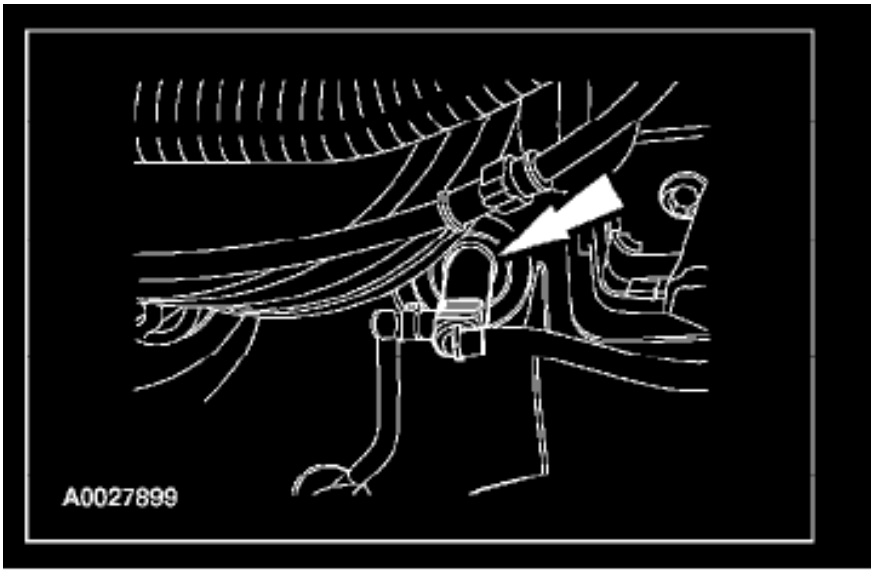
8. Remove the clutch reservoir.

9. Remove the 3 pushpins, 4 bolts, 4 screws and the inner fender splash shield.

10. Unclip the hydraulic line-to-frame retainer.

11. WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical

advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product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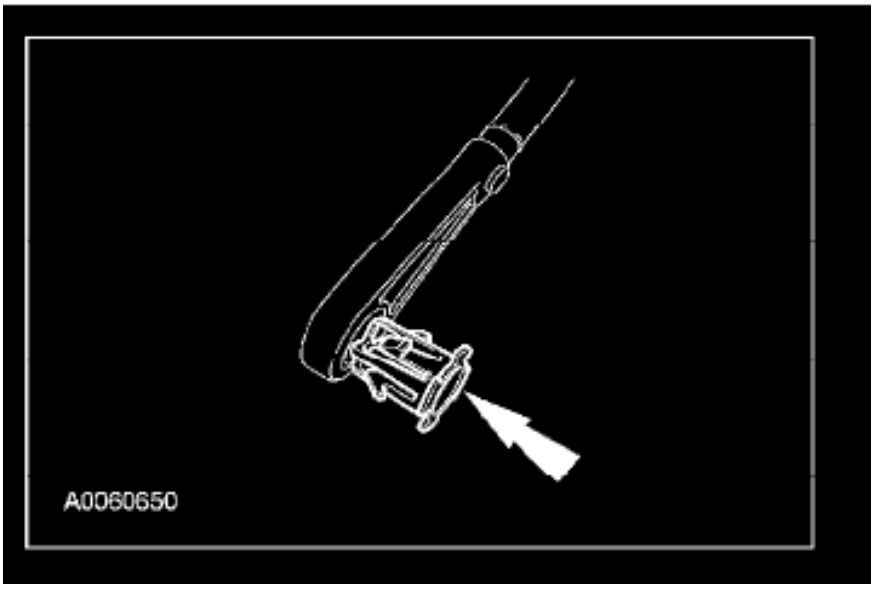
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Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

Unlock and remove the clutch master cylinder assembly. ^

Twist the clutch master cylinder counterclockwise 45 degrees to unlock it from the support bracket.

12. Remove the clutch reservoir, the hydraulic line and the clutch master cylinder as an assembly.

13. WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical

advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

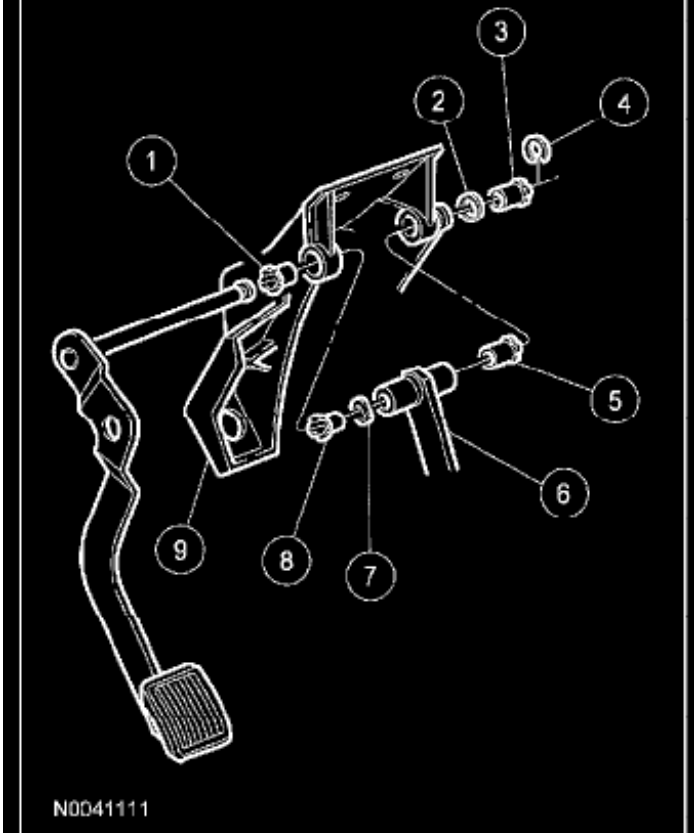
To install, reverse the removal procedure. ^

Install a new push rod retainer.

^ Depress and release the clutch pedal 15 strokes.

Material

Item	Specification
Premium Long Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B



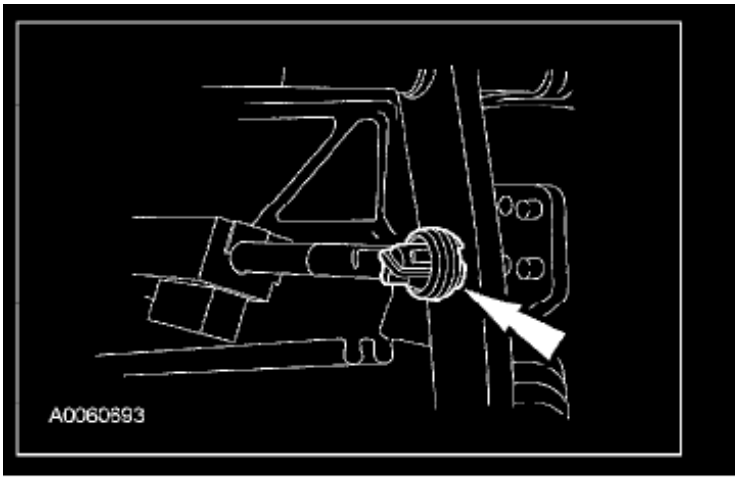
Item	Part Number	Description
1	7508	Clutch shaft bushing
2	353574-S	Washer
3	7508	Clutch shaft bushing
4	97414-S	Retaining ring
5	7508	Brake pedal bushing
6	2455	Brake pedal
7	353574-S	Washer
8	7508	Brake pedal bushing
9	2L252	Clutch and brake pedal support

Clutch Master Cylinder: Service and Repair Clutch Pedal

Clutch Pedal

Removal and Installation

1. Using a screwdriver, disconnect the clutch master cylinder rod from the clutch pedal pin.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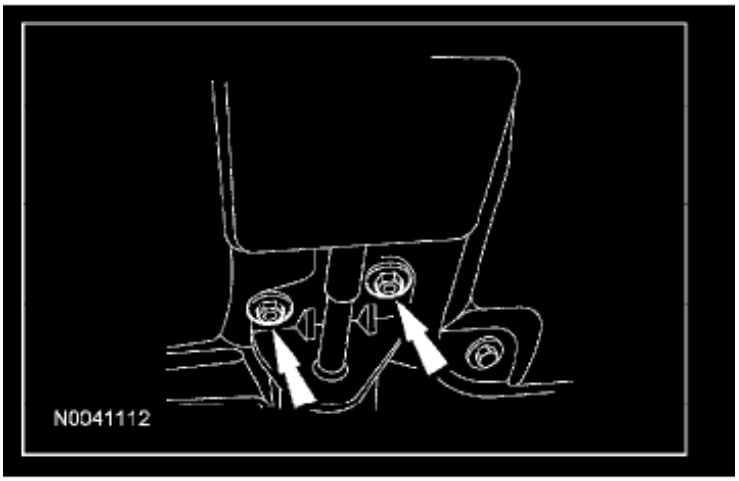
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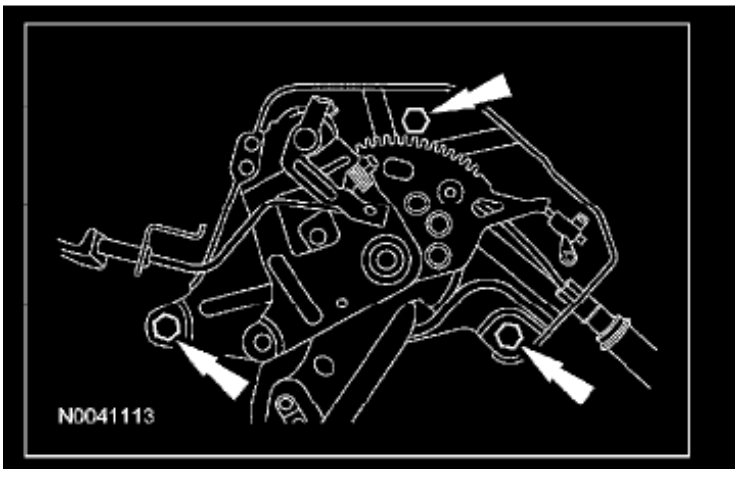
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2. Remove the LH cowl side trim panel. 3. Remove the 3 parking brake release bolts.

^ To install, tighten to 2.5 Nm (22 lb-inch).

4. Remove the parking brake control bolts, then position the parking brake control aside.

^ To install, tighten to 20 Nm (15 lb-ft).

5. Remove the retaining ring, then slide the clutch pedal from the clutch and brake pedal support.
6. To install, reverse the removal procedure.

^ Inspect the bushings for wear or damage, install new bushings as necessary.

^ Lubricate the clutch pedal shaft with grease.

Clutch Slave Cylinder: Customer Interest M/T - Squeaking Noise During Clutch Pedal Operation

TSB 09-25-6

12/28/09

NOISE FROM CLUTCH SLAVE CYLINDER WHEN CLUTCH - ENGAGED/DISENGAGED

FORD: 2004-2009 Ranger

This article supersedes TSB 08-22-8 to update the vehicle model years covered.

ISSUE Some 2004-2009 Ranger vehicles equipped with a manual transmission may exhibit a squeaking noise when engaging or disengaging the clutch. This may be due to the inter[ace between the clutch slave cylinder and clutch fingers. The noise may be duplicated by cycling the clutch with the vehicle standing still and the engine off.

ACTION Follow the Service Procedure steps to correct the condition.

SERVICE PROCEDURE

1. Use a stethoscope to confirm the source of the noise is coming from the clutch slave cylinder located in the transmission bell housing.

a. If the noise is from the clutch slave cylinder, obtain the Dow Corning(R) Molykote(R) G-n Metal Assembly Paste and Clutch Kit and proceed to

Step 2.

b. If the noise is not from the clutch slave cylinder, do not continue with this procedure. Follow normal diagnostics per the Workshop Manual

(WSM).

NOTE

THE USE OF DOW CORNING(R) MOLYKOTE(R) G-N METAL ASSEMBLY PASTE IS A CRITICAL COMPONENT OF THIS PROCEDURE AND MUST BE APPLIED AS INDICATED.

2. A 2.8 oz. (79.3 g) tube of Dow Corning® Molykote(R) G-n Metal Assembly Paste may be obtained from a local source or one of the following

suppliers:

a. Dealers in the United States contact Motion Industries at 1-586-726-6262.

b. Dealers in Canada contact Paisley Products at 1-514-344-0218 extension 226.

3. Remove the transmission. Refer to the WSM, Section 308 for removal and installation procedures.

4. Replace the clutch disc and pressure plate.

5. Replace the clutch slave cylinder. Apply a thin film of Dow Corning® Molykote(R) G-n Metal Assembly Paste to the new clutch slave cylinder

bearing face as well as on each of the clutch fingers of the pressure plate.

NOTE

ONLY 1-2 OUNCES (28-57 g) OF GREASE IS REQUIRED PER VEHICLE.

6. Install the transmission.

NOTE

DOW CORNING® MOLYKOTE(R) G-N METAL ASSEMBLY PASTE MUST BE OBTAINED LOCALLY.

WARRANTY STATUS: Eligible Under Provisions Of New Vehicle Limited Warranty Coverage
IMPORTANT: Warranty coverage limits/policies are not altered by a TSB. Warranty coverage limits are determined by the identified causal part.

OPERATION DESCRIPTION TIME

092506A 2004-2009 Ranger 4X2 3.1 Hrs.

4.0L SOHC: Replace The

NOTE: The information in Technical Service Bulletins is intended for use by trained, professional technicians with the knowledge, tools, and equipment to do the job properly and safely. It informs these technicians of conditions that may occur on some vehicles, or provides information that could assist in proper vehicle service. The procedures should not be performed by "do-it-yourselfers". Do not assume that a condition described affects your car or truck. Contact a Ford, Lincoln, or Mercury dealership to determine whether the Bulletin applies to your vehicle.

Clutch Disc, Pressure Plate, Slave Cylinder And Apply Grease, Includes Diagnosis (Do Not Use With Any Other Labor Operation)

092506A 2004-2009 Ranger 4X4 4.9 Hrs.

4.0L SOHC: Replace The Clutch Disc, Pressure Plate, Slave Cylinder And Apply Grease, Includes Diagnosis (Do Not Use With Any Other Labor Operation)

092506A 2004-2008 Ranger 4X2 3.1 Hrs.

3.0L MFI/FFV: Replace The Clutch Disc, Pressure Plate, Slave Cylinder And Apply Grease, Includes Diagnosis (Do Not Use With Any Other Labor Operation)

092506A 2004-2008 Ranger 4X2 3.3 Hrs.

2.3L: Replace The Clutch Disc, Pressure Plate, Slave Cylinder And Apply Grease, Includes Diagnosis (Do Not Use With Any Other Labor Operation)

092506A 2004-2008 Ranger 4X4 4.4 Hrs.

3.0L MFI/FFV: Replace The Clutch Disc, Pressure Plate, Slave Cylinder And Apply Grease, Includes Diagnosis (Do Not Use With Any Other Labor Operation)

DEALER CODING

CONDITION

BASIC PART NO. CODE

7A508 49

Disclaimer

Clutch Slave Cylinder: All Technical Service Bulletins M/T - Squeaking Noise During Clutch Pedal Operation

TSB 09-25-6

12/28/09

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b. If the noise is not from the clutch slave cylinder, do not continue with this procedure. Follow normal diagnostics per the Workshop Manual

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bearing face as well as on each of the clutch fingers of the pressure plate.

NOTE

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6. Install the transmission.

NOTE

DOW CORNING® MOLYKOTE(R) G-N METAL ASSEMBLY PASTE MUST BE OBTAINED LOCALLY.

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IMPORTANT: Warranty coverage limits/policies are not altered by a TSB. Warranty coverage limits are determined by the identified causal part.

OPERATION DESCRIPTION TIME

092506A 2004-2009 Ranger 4X2 3.1 Hrs.

4.0L SOHC: Replace The

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Clutch Disc, Pressure Plate, Slave Cylinder And Apply Grease, Includes Diagnosis (Do Not Use With Any Other Labor Operation)

092506A 2004-2009 Ranger 4X4 4.9 Hrs.

4.0L SOHC: Replace The Clutch Disc, Pressure Plate, Slave Cylinder And Apply Grease, Includes Diagnosis (Do Not Use With Any Other Labor Operation)

092506A 2004-2008 Ranger 4X2 3.1 Hrs.

3.0L MFI/FFV: Replace The Clutch Disc, Pressure Plate, Slave Cylinder And Apply Grease, Includes Diagnosis (Do Not Use With Any Other Labor Operation)

092506A 2004-2008 Ranger 4X2 3.3 Hrs.

2.3L: Replace The Clutch Disc, Pressure Plate, Slave Cylinder And Apply Grease, Includes Diagnosis (Do Not Use With Any Other Labor Operation)

092506A 2004-2008 Ranger 4X4 4.4 Hrs.

3.0L MFI/FFV: Replace The Clutch Disc, Pressure Plate, Slave Cylinder And Apply Grease, Includes Diagnosis (Do Not Use With Any Other Labor Operation)

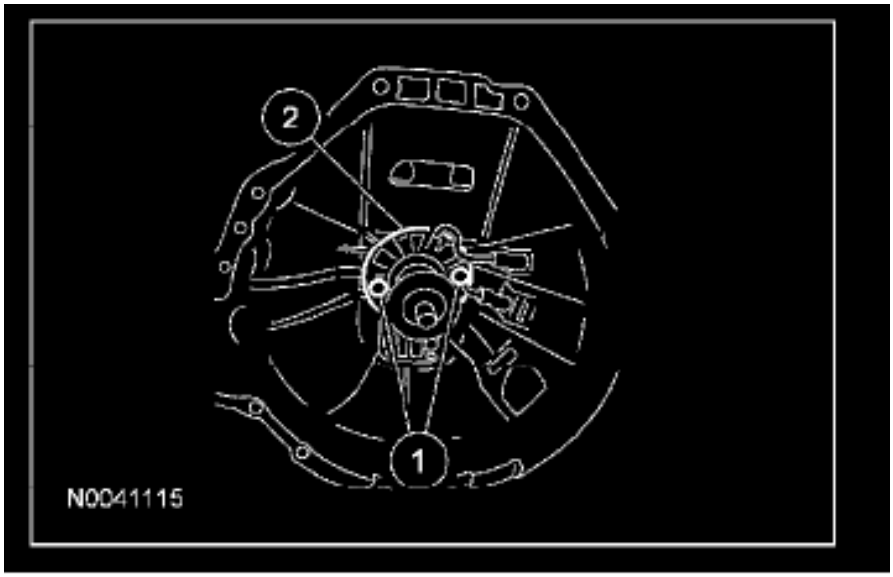
DEALER CODING

CONDITION

BASIC PART NO. CODE

7A508 49

Disclaimer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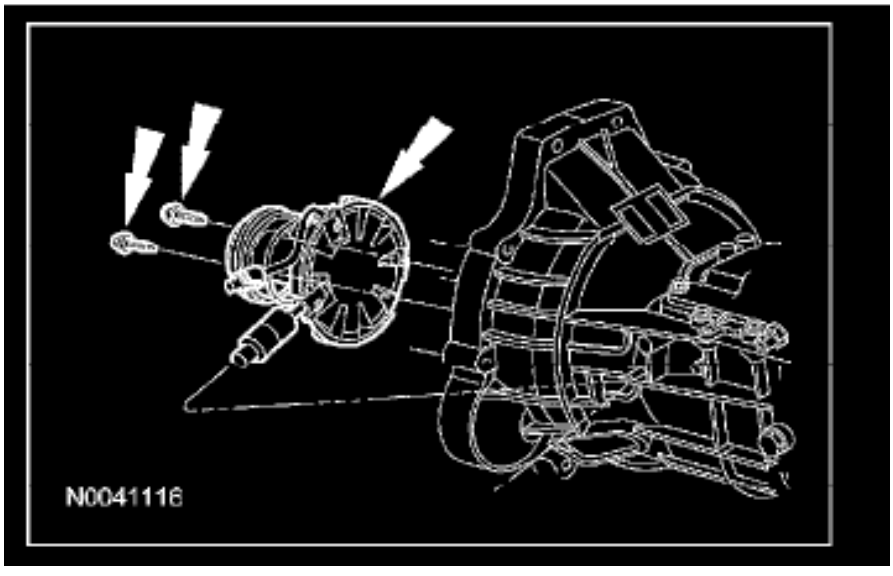
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Clutch Slave Cylinder: Service and Repair

Clutch Slave Cylinder

Removal

1. Remove the transmission.

2. NOTE: Inspect the clutch housing for traces of fluid. If brake fluid is visible, install a new clutch slave cylinder.

Remove the clutch slave cylinder. 1

Remove the 2 clutch slave cylinder bolts.

2 Remove the clutch slave cylinder.

3. Inspect the clutch slave cylinder for the following:

^ Worn or damaged boot.

^ Leaking fluid.

^ Worn or damaged bearing.

4. Inspect the clutch release bearing as follows:

^ Rotate the outer race while applying pressure. If the bearing rotation is rough, install a new clutch slave cylinder.

^ Inspect for wear or damage.

Installation

1. Position the clutch slave cylinder to the transmission and install the 2 bolts.

^ Tighten to 20 Nm (15 lb-ft).

2. NOTE: Before securing the engine to the transmission, connect the hydraulic line to the clutch slave cylinder.

Install the transmission.

3. Depress and release the clutch pedal 5 full strokes.

Hydraulic Hose: Tools and Equipment

Clutch Line Fork

AST tool# 8008

Used for the R and R of the hydraulic clutch line from the internally mounted slave cylinder. This tool is applicable to the following Ford vehicles with manual transmissions: 1989 and later Ford Aerostar, Bronco II, Explorer, F150 and Ranger.

- For R and R of Hydraulic Clutch Lines

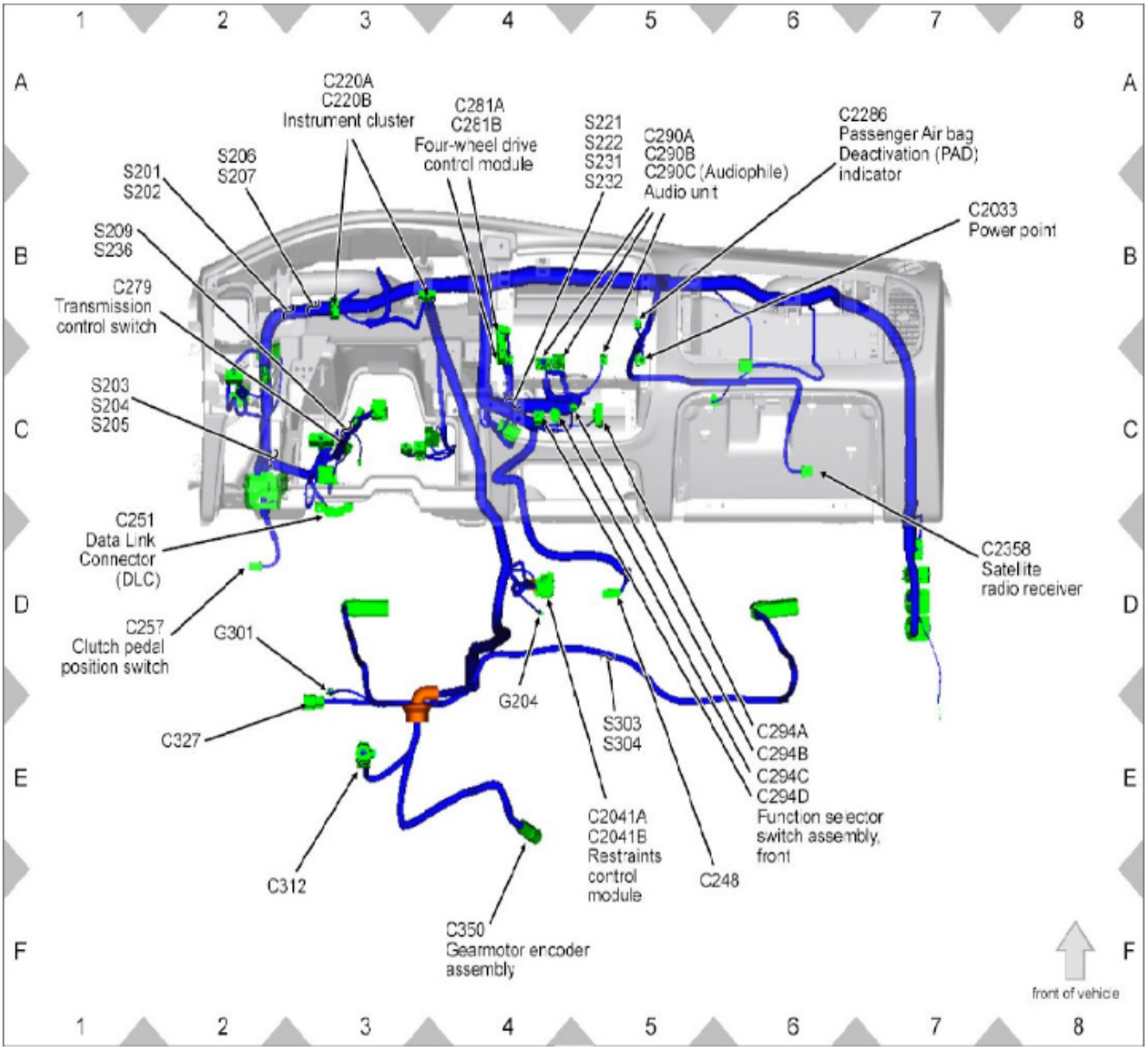
- Applicable to Ford Models with Manual Transmissions

- Steel Construction

- Black-Oxide Finish

Contact AST for pricing.

Assenmacher Specialty Tools 1-800-525-2943


1
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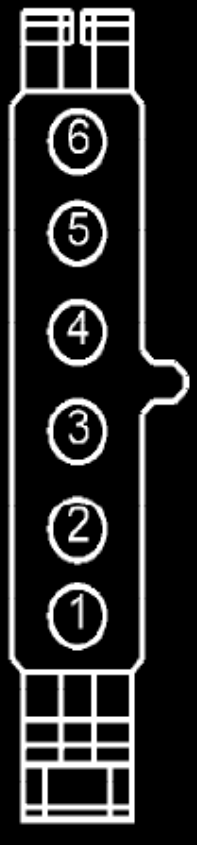
A
B
C
D
E
F
C220A
C220B
Instrument cluster
C281A
C281B
Four-wheel drive control module
S221
S222
S231
S232
C290A
C290B
C290C (Audiophile)
Audio unit
C2286
Passenger Air bag Deactivation (PAD) indicator
C2033
Power point
S201
S202
S206
S207
S209
S236
C279
Transmission control switch
S203
S204
S205
C251
Data Link Connector (DLC)
C257
Clutch pedal position switch
G301
C327
C312
G204
S303
S304
C2041A
C2041B
Restraints control module
C248
C294A
C294B
C294C
C294D
Function selector switch assembly, front
C2358
Satellite radio receiver
C350
Gearmotor encoder assembly
front of vehicle

View 151-12

Connector: C257

Description:	Harness:	Base Part #:
CLUTCH PEDAL POSITION SWITCH	14401	11A152



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE904 (GN-VT)	22	SWITCH - CLUTCH PEDAL POSITION # TOP OF TRAVEL (CPP-TT)	
2	GD174 (BK-WH)	22	GROUND - TUNNEL	
3	CCB15 (BN-GN)	22	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL CLOSED	
4	CCB15 (BN-GN)	22	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL CLOSED	
5	GD174 (BK-WH)	22	GROUND - TUNNEL	
6	CDC36 (GN-BN)	22	SWITCH - START INTERLOCK CLUTCH PEDAL	

C257

Pilot Bearing: Testing and Inspection

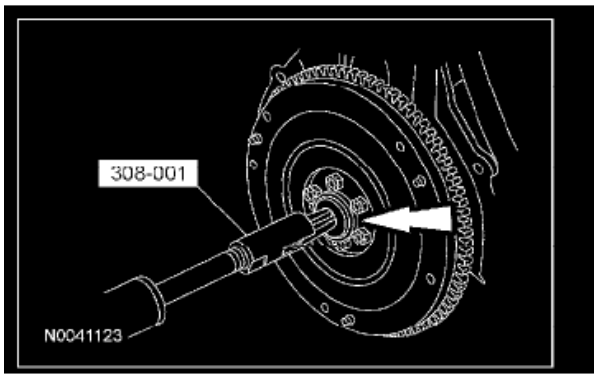
Pilot Bearing Check

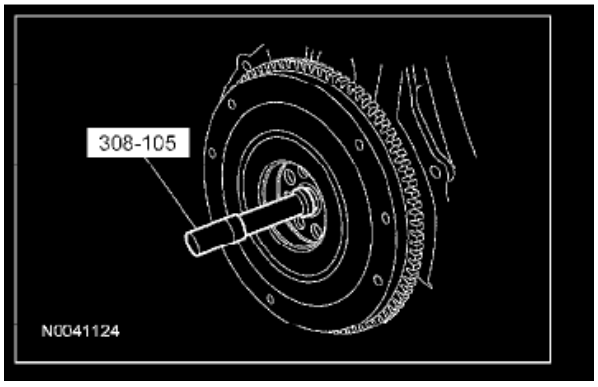
1. CAUTION: The pilot bearing is a sealed bearing and must not be immersed in any type of cleaning fluid.

Inspect the pilot bearing for excessive wear or scoring and install new if necessary.

Special Tool(s)

ST1470-A	Installer, Pilot Bearing 308-105 (T85T-7137-A)
ST1282-A	Remover, Pilot Bearing 308-001 (T58L-101-B)





Pilot Bearing: Service and Repair

Pilot Bearing

Removal

1. Using the special tool, remove the transmission input shaft pilot bearing.

2. Inspect the transmission input shaft pilot bearing for:

^ misalignment and looseness in the flywheel.

^ needle rollers for scoring, worn or broken needle rollers, inadequate grease or discoloration.

^ seal leakage.

Installation

1. NOTE: The transmission input shaft pilot bearing can only be installed with the seal facing the transmission. The transmission input shaft pilot

bearing is pregreased and does not require additional lubrication. A new transmission input shaft pilot bearing must be installed whenever it is removed.

Using a soft-face hammer and the special tool, install the transmission input shaft pilot bearing.

Pressure Plate: Customer Interest M/T - Squeaking Noise During Clutch Pedal Operation

TSB 09-25-6

12/28/09

NOISE FROM CLUTCH SLAVE CYLINDER WHEN CLUTCH - ENGAGED/DISENGAGED

FORD: 2004-2009 Ranger

This article supersedes TSB 08-22-8 to update the vehicle model years covered.

ISSUE Some 2004-2009 Ranger vehicles equipped with a manual transmission may exhibit a squeaking noise when engaging or disengaging the clutch. This may be due to the inter[ace between the clutch slave cylinder and clutch fingers. The noise may be duplicated by cycling the clutch with the vehicle standing still and the engine off.

ACTION Follow the Service Procedure steps to correct the condition.

SERVICE PROCEDURE

1. Use a stethoscope to confirm the source of the noise is coming from the clutch slave cylinder located in the transmission bell housing.

a. If the noise is from the clutch slave cylinder, obtain the Dow Corning(R) Molykote(R) G-n Metal Assembly Paste and Clutch Kit and proceed to

Step 2.

b. If the noise is not from the clutch slave cylinder, do not continue with this procedure. Follow normal diagnostics per the Workshop Manual

(WSM).

NOTE

THE USE OF DOW CORNING(R) MOLYKOTE(R) G-N METAL ASSEMBLY PASTE IS A CRITICAL COMPONENT OF THIS PROCEDURE AND MUST BE APPLIED AS INDICATED.

2. A 2.8 oz. (79.3 g) tube of Dow Corning® Molykote(R) G-n Metal Assembly Paste may be obtained from a local source or one of the following

suppliers:

a. Dealers in the United States contact Motion Industries at 1-586-726-6262.

b. Dealers in Canada contact Paisley Products at 1-514-344-0218 extension 226.

3. Remove the transmission. Refer to the WSM, Section 308 for removal and installation procedures.

4. Replace the clutch disc and pressure plate.

5. Replace the clutch slave cylinder. Apply a thin film of Dow Corning® Molykote(R) G-n Metal Assembly Paste to the new clutch slave cylinder

bearing face as well as on each of the clutch fingers of the pressure plate.

NOTE

ONLY 1-2 OUNCES (28-57 g) OF GREASE IS REQUIRED PER VEHICLE.

6. Install the transmission.

NOTE

DOW CORNING® MOLYKOTE(R) G-N METAL ASSEMBLY PASTE MUST BE OBTAINED LOCALLY.

WARRANTY STATUS: Eligible Under Provisions Of New Vehicle Limited Warranty Coverage
IMPORTANT: Warranty coverage limits/policies are not altered by a TSB. Warranty coverage limits are determined by the identified causal part.

OPERATION DESCRIPTION TIME

092506A 2004-2009 Ranger 4X2 3.1 Hrs.

4.0L SOHC: Replace The

NOTE: The information in Technical Service Bulletins is intended for use by trained, professional technicians with the knowledge, tools, and equipment to do the job properly and safely. It informs these technicians of conditions that may occur on some vehicles, or provides information that could assist in proper vehicle service. The procedures should not be performed by "do-it-yourselfers". Do not assume that a condition described affects your car or truck. Contact a Ford, Lincoln, or Mercury dealership to determine whether the Bulletin applies to your vehicle.

Clutch Disc, Pressure Plate, Slave Cylinder And Apply Grease, Includes Diagnosis (Do Not Use With Any Other Labor Operation)

092506A 2004-2009 Ranger 4X4 4.9 Hrs.

4.0L SOHC: Replace The Clutch Disc, Pressure Plate, Slave Cylinder And Apply Grease, Includes Diagnosis (Do Not Use With Any Other Labor Operation)

092506A 2004-2008 Ranger 4X2 3.1 Hrs.

3.0L MFI/FFV: Replace The Clutch Disc, Pressure Plate, Slave Cylinder And Apply Grease, Includes Diagnosis (Do Not Use With Any Other Labor Operation)

092506A 2004-2008 Ranger 4X2 3.3 Hrs.

2.3L: Replace The Clutch Disc, Pressure Plate, Slave Cylinder And Apply Grease, Includes Diagnosis (Do Not Use With Any Other Labor Operation)

092506A 2004-2008 Ranger 4X4 4.4 Hrs.

3.0L MFI/FFV: Replace The Clutch Disc, Pressure Plate, Slave Cylinder And Apply Grease, Includes Diagnosis (Do Not Use With Any Other Labor Operation)

DEALER CODING

CONDITION

BASIC PART NO. CODE

7A508 49

Disclaimer

Pressure Plate: All Technical Service Bulletins M/T - Squeaking Noise During Clutch Pedal Operation

TSB 09-25-6

12/28/09

NOISE FROM CLUTCH SLAVE CYLINDER WHEN CLUTCH - ENGAGED/DISENGAGED

FORD: 2004-2009 Ranger

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5. Replace the clutch slave cylinder. Apply a thin film of Dow Corning® Molykote(R) G-n Metal Assembly Paste to the new clutch slave cylinder

bearing face as well as on each of the clutch fingers of the pressure plate.

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6. Install the transmission.

NOTE

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IMPORTANT: Warranty coverage limits/policies are not altered by a TSB. Warranty coverage limits are determined by the identified causal part.

OPERATION DESCRIPTION TIME

092506A 2004-2009 Ranger 4X2 3.1 Hrs.

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Clutch Disc, Pressure Plate, Slave Cylinder And Apply Grease, Includes Diagnosis (Do Not Use With Any Other Labor Operation)

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092506A 2004-2008 Ranger 4X2 3.1 Hrs.

3.0L MFI/FFV: Replace The Clutch Disc, Pressure Plate, Slave Cylinder And Apply Grease, Includes Diagnosis (Do Not Use With Any Other Labor Operation)

092506A 2004-2008 Ranger 4X2 3.3 Hrs.

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DEALER CODING

CONDITION

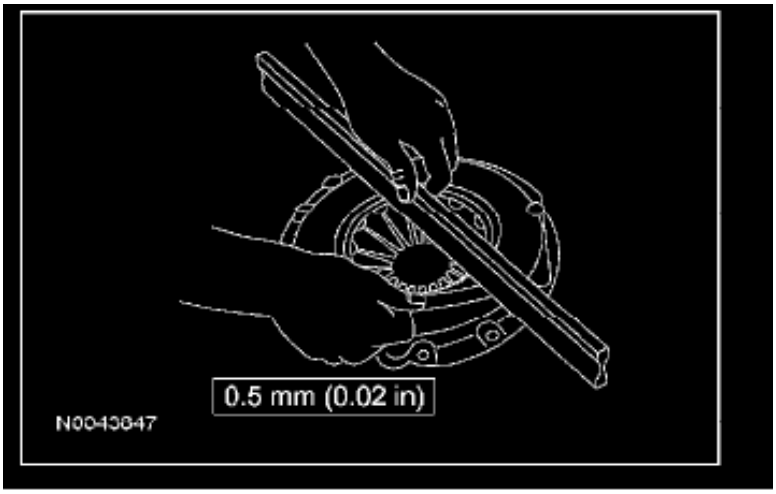
BASIC PART NO. CODE

7A508 49

Disclaimer

Pressure Plate: Specifications

Clutch Pressure Plate Bolts
..... 27 Nm (20 lb-ft)
in a star-pattern sequence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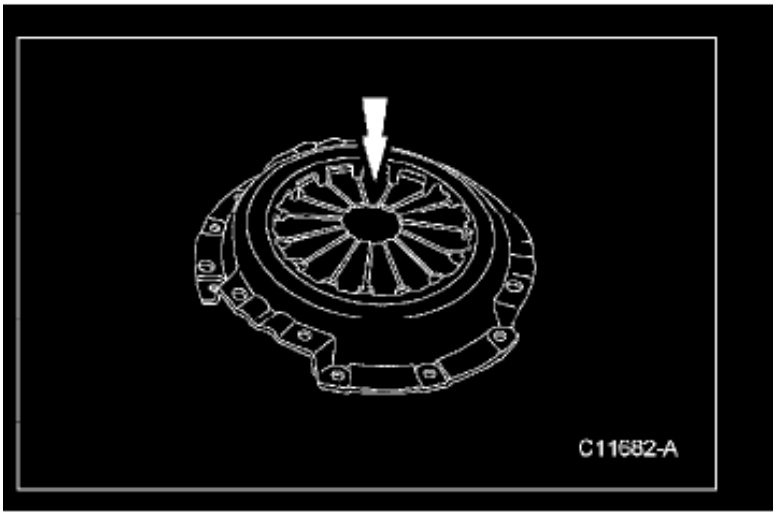
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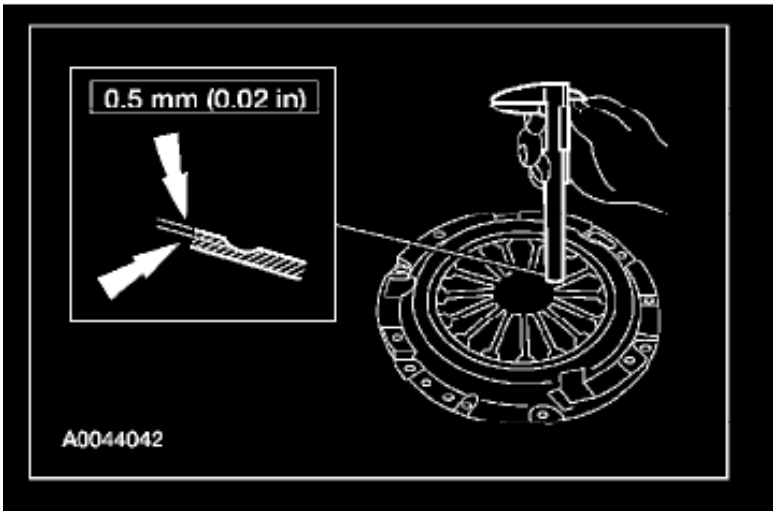
0.5 mm (0.02 in)
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Pressure Plate: Testing and Inspection

Clutch Pressure Plate Check

1. Check the clutch pressure plate surface for scoring, cracks or discoloration. Minor scratches or discoloration should be removed with a fine emery

cloth.

2. Measure the flatness of the clutch pressure plate surface with a straightedge and a feeler gauge.

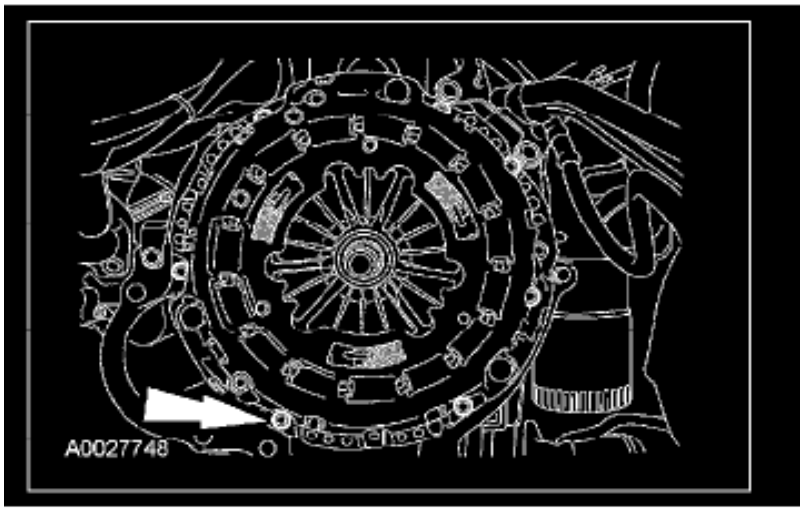
^ If the measurement exceeds the maximum allowance, install a new clutch pressure plate.

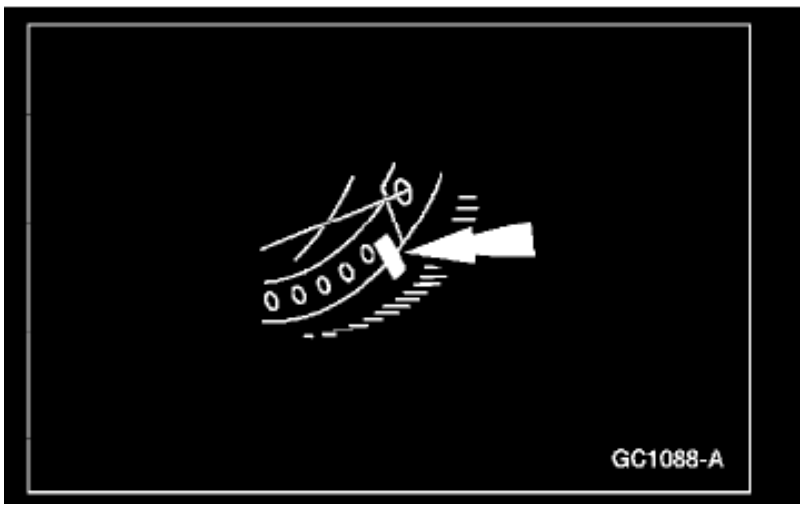
3. Check the diaphragm spring fingers for discoloration, scoring, bent or broken segments and spring ends that are higher or lower than the rest.

4. Measure the wear of the diaphragm spring fingers.

Material

Item	Specification
High Temperature 4x4 Front Axle and Wheel Bearing Grease E8TZ-19590-A	WSS-M1C267-A1





Pressure Plate: Service and Repair

Clutch Disc and Pressure Plate

Removal

1. Remove the transmission.

2. CAUTION: If the clutch disc and pressure plate are to be reinstalled, bolts must be removed evenly or permanent damage to the

diaphragm spring will occur, resulting in complete clutch release.

NOTE: If the parts are to be reused, index-mark the clutch pressure plate to the flywheel.

Remove the bolts, clutch pressure plate and the clutch disc.

3. Inspect the transmission input shaft pilot bearing:

^ for misalignment and looseness in the crankshaft (gasoline engine) or flywheel (diesel engine).

^ needle rollers for scoring, discoloration, wear and broken rollers.

^ seal for damage and lubricant leakage. -

Install a new transmission input shaft pilot bearing if any of these conditions are present.

4. NOTE: Use emery cloth to remove minor imperfections in the clutch disc friction surface.

Inspect the clutch disc for: ^

oil and grease saturation.

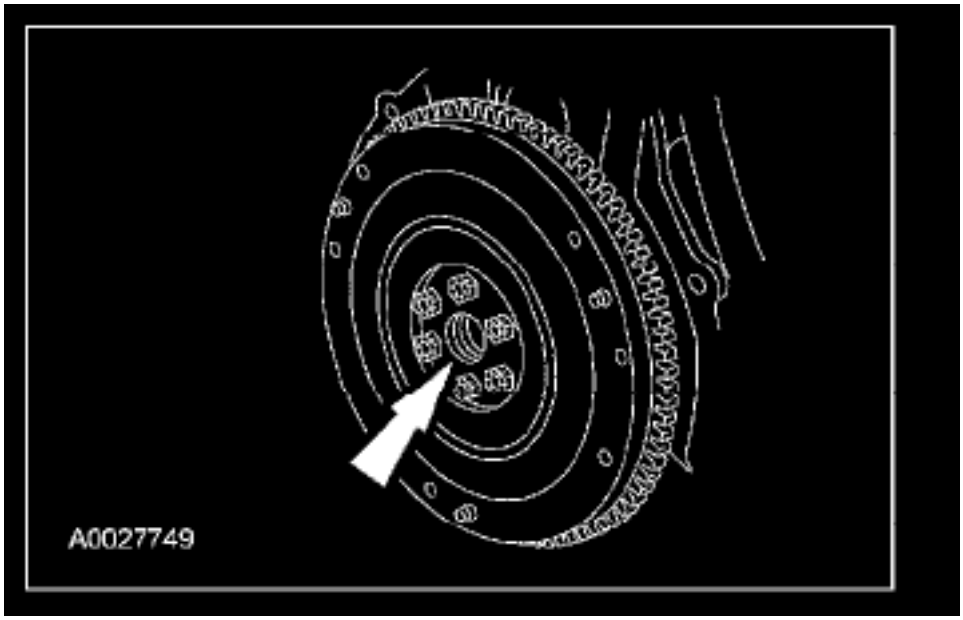
^ worn and loose rivets at the hub.

^ broken springs.

^ wear and rust on the splines. -

Install a new clutch disc if any of these conditions are present.

5. NOTE: If necessary, use a suitable cleaning solution to remove any oil film from the clutch pressure plate friction surface.



Inspect the clutch pressure plate levers for heavy wear associated with binding. Also, inspect for substantial difference in lever wear. Inspect the clutch pressure plate friction surface for scoring, burning, heat checking, distortion, warping and dishing. ^

Install a new clutch pressure plate if any of these conditions are present.

6. NOTE: If necessary, use a suitable cleaning solution to clean the flywheel clutch surface.

Inspect the flywheel for: ^

surface cracks.

^ heat check.

^ glazing.

^ scoring.

^ scratches or grooves. -

For minor damage, finish the flywheel surface with coarse emery cloth or with a fine grade (400 grit) sandpaper. To polish the surface, stroke parallel to the machine lines.

7. Inspect the flywheel or ring gear for worn, chopped or broken teeth.

Installation

1. Lubricate the transmission input shaft pilot bearing with grease.

2. Adjust the clutch pressure plate.

1 Using a suitable press, press downward on the fingers until the adjusting ring moves freely.

2 Rotate the adjusting ring counterclockwise to compress the tension springs. Hold the adjusting ring in this position.

3 Release the pressure on the fingers. The adjusting ring will stay in the reset position.

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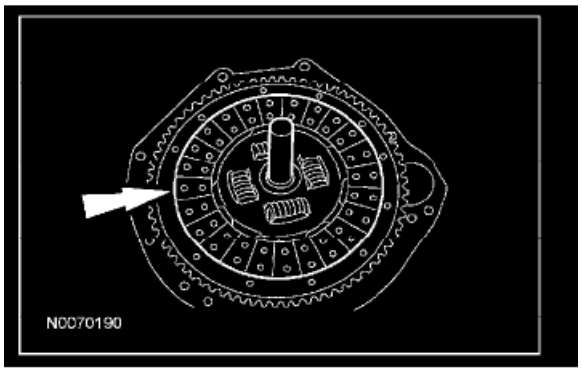
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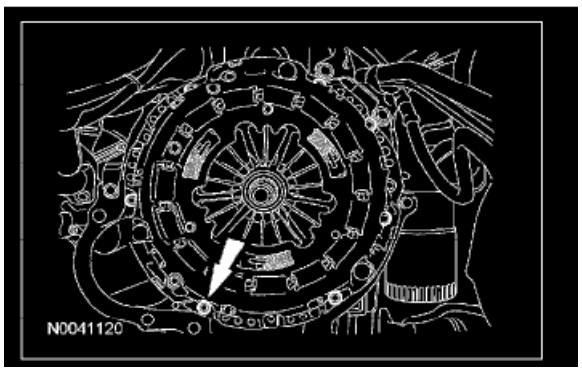
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3. Using a suitable clutch aligner, position the clutch disc on the flywheel.

4. NOTE: If reusing the clutch pressure plate and flywheel, align the marks made during removal.

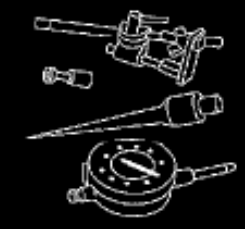
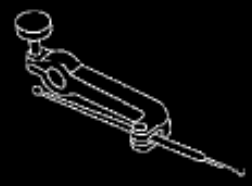
Using a suitable aligner, align the clutch disc and the clutch pressure plate. Install the bolts and tighten in a star-pattern sequence. ^

Tighten to 27 Nm (20 lb-ft).

5. NOTE: Before securing the transmission to the engine, connect the hydraulic line to the clutch slave cylinder.

Install the transmission.

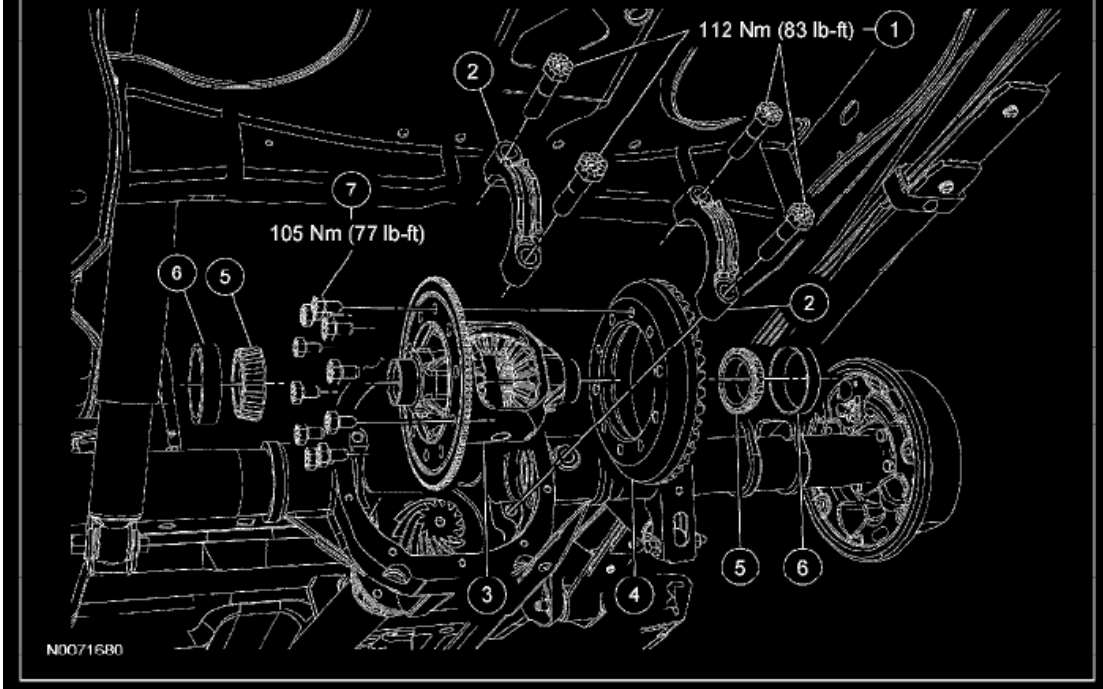
Special Tool(s)

 ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent
 ST1348-A	Gauge, Clutch Housing 308-021 (T75L-4201-A)
ST1485-A	Installer, Differential Shim 205-220 (T85L-4067-AH)
ST1375-A	Installer, Differential Side Bearing 205-009 (T57L-4221-A1)
S11543-A	Step Plate 205-D016 (D80L-630-5) or equivalent
ST2026-A	2-Jaw Puller 205-D072 (D97L-4221-A) or equivalent

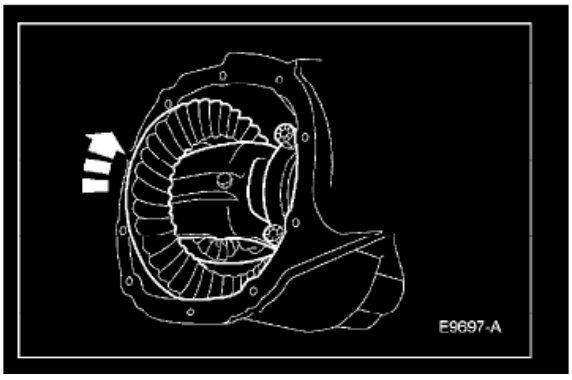
Differential Carrier: Service and Repair Differential Case

Ford 7.5-Inch Ring Gear - Rear Drive Axle/Differential

Differential Case



Item	Part Number	Description
1	—	Bearing cap bolts (part of 4010)
2	—	Bearing caps (part of 4010)
3	4204	Differential case
4	4209	Differential ring gear
5	4221	Differential bearings (2 required)
6	4222	Differential bearing cups (2 required)
7	4216	Differential ring gear bolt (10 required)



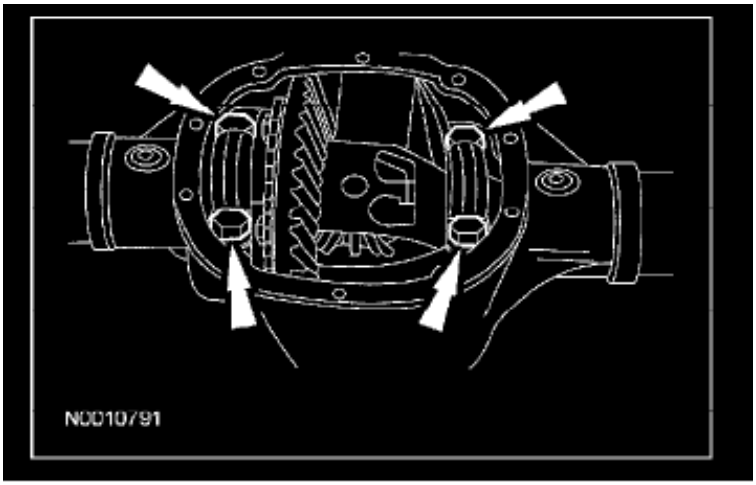
Removal

1. Remove the axle shafts.

2. NOTE: Inspect the removed lubricant for metallic particles which indicate wear or damage.

Wipe the lubricant from the internal working parts and visually inspect the parts for wear or damage.

3. Rotate the differential case to see if there is any roughness which would indicate damaged bearings or gears.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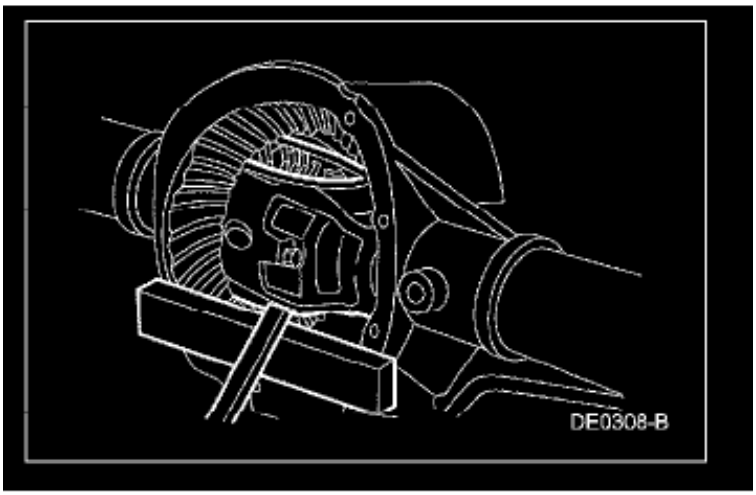
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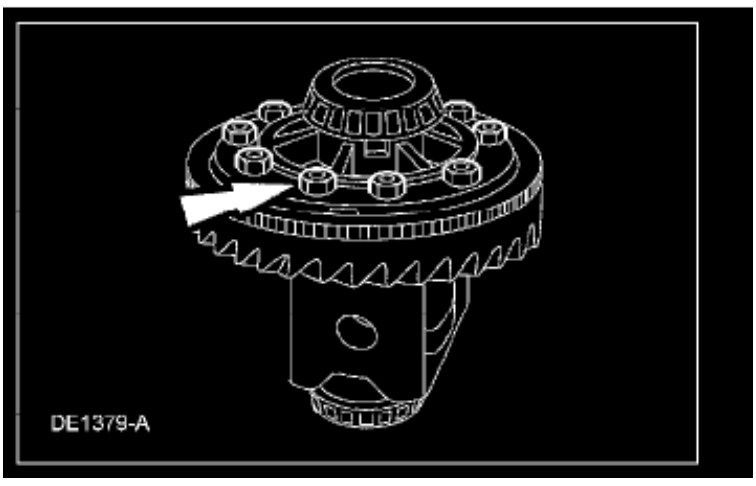

DE1379-A

4. NOTE: Mark the position of the bearing caps, as arrows may not be visible. The bearing caps must be installed in their original locations and

positions.

Remove the 4 bolts and the 2 bearing caps.

5. CAUTION: Place a wood block between the pry bar and the rear axle housing to protect the machined surface from damage.

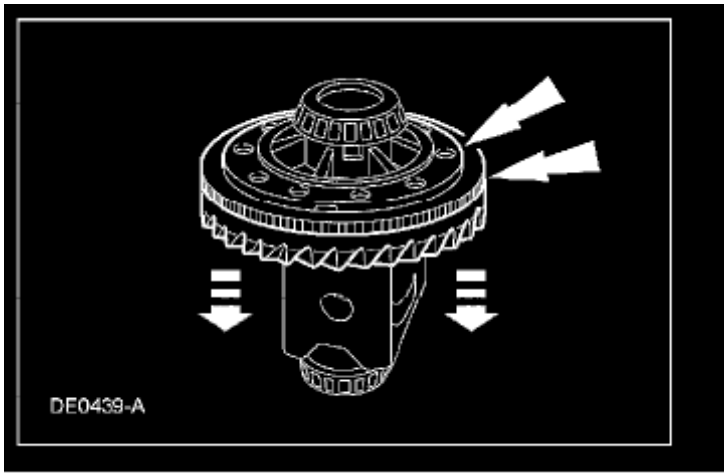
Using a pry bar and wood block, pry the differential case from the rear axle housing.

6. Remove and discard the 10 ring gear bolts.

7. NOTE: Care should be taken not to damage the ring bolt hole threads.

NOTE: The anti-lock speed sensor ring cannot be reused once removed.

Insert a punch in the bolt holes and drive off the ring gear and, if necessary, the anti-lock speed sensor ring.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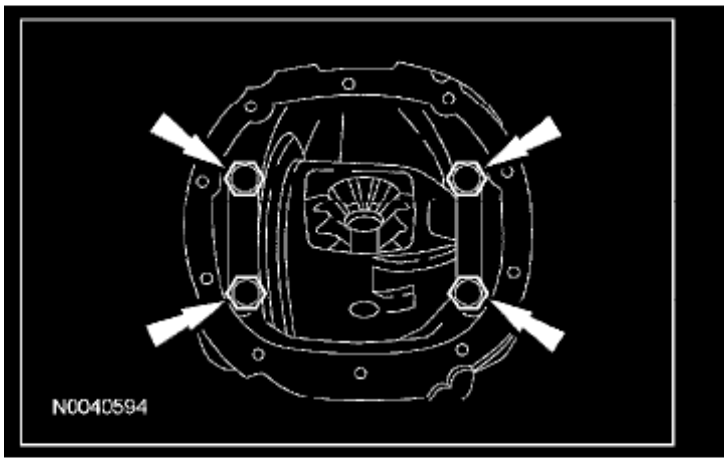
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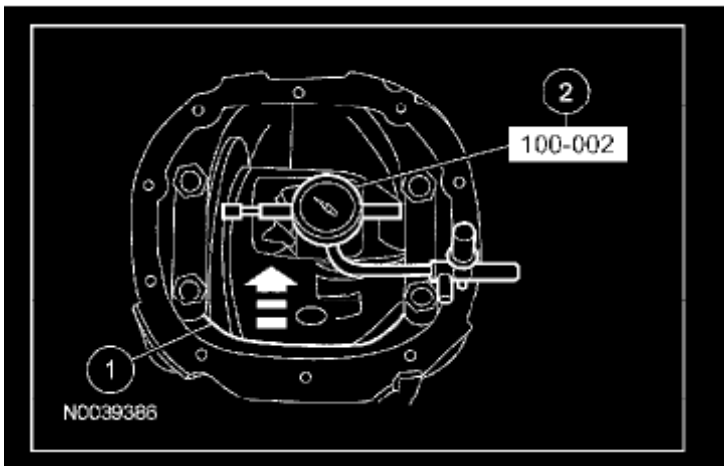

2
100-002
1
N0039386

8. Position the differential case assembly, including the bearing cups and shims, in the rear axle housing. Install the 2 differential bearing caps and

the 4 differential bearing cap bolts. ^

Tighten to 112 Nm (83 lb-ft).

9. Position the special tool.

1 Rotate the differential case to make sure the differential bearings are correctly seated.

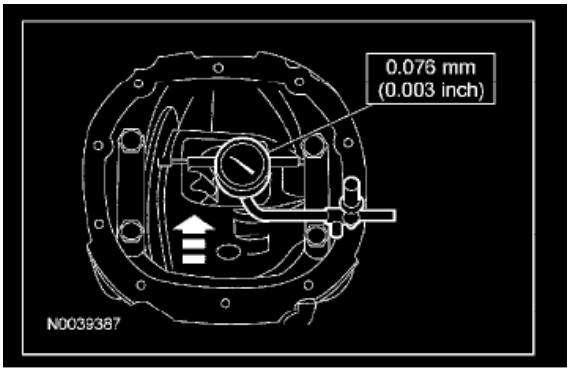
2 Position the special tool.

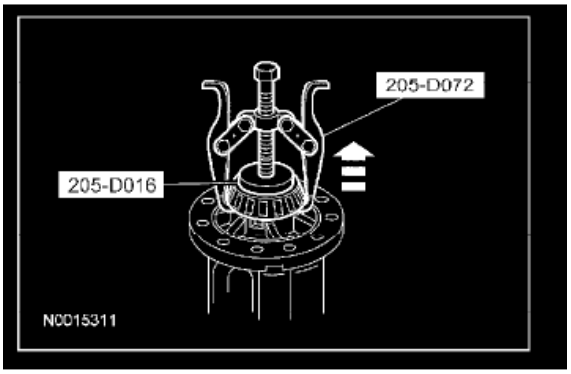
10. Rotate the differential case and measure the differential case runout without the ring gear.

^ If runout is less than the specification, install a new ring gear and pinion.

^ If runout exceeds specification, the ring gear is true and the concern is due to either a damaged differential case or differential bearings.

^ Inspect the differential bearings. If the differential bearings are not damaged, install new differential case and differential bearings.


0.076 mm
(0.003 inch)
N0039387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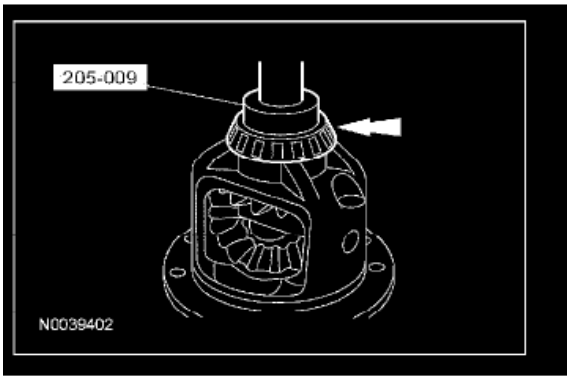
205-D016
N0015311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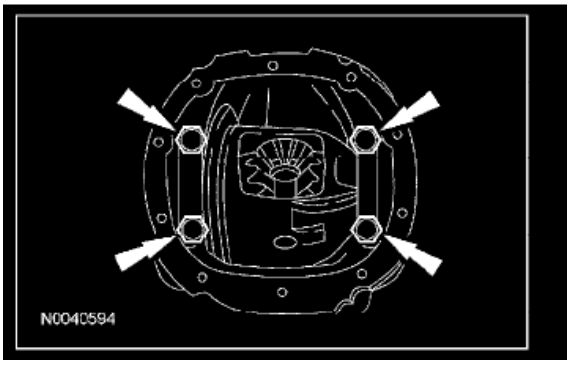
N0039402

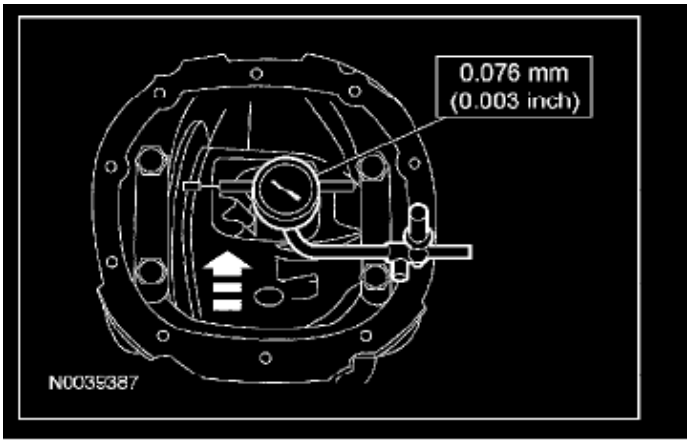

N0040594

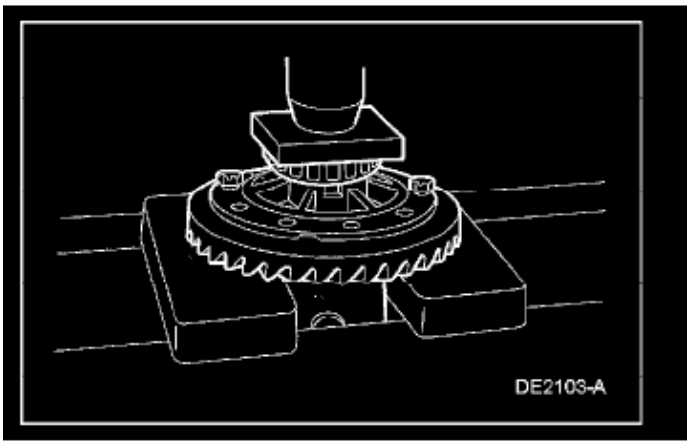
11. Remove the differential case from the rear axle housing. Using the special tools, remove the differential bearings.

12. Using the special tool, install the new differential bearings on the differential case.

13. Position the differential case assembly, including the bearing cups and shims in the rear axle housing.

^ Tighten to 112 Nm (83 lb-ft).


0.076 mm
(0.003 inch)
N0035387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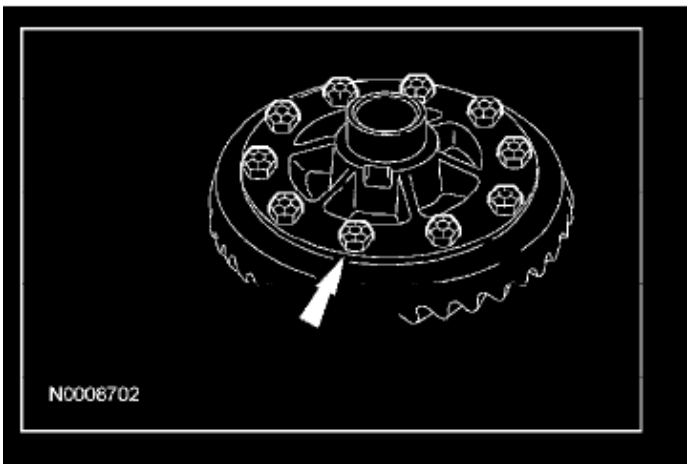

N0008702

14. Measure the differential case runout without the ring gear. Check the case runout again with the new differential bearings.

^ If the runout is now within specification, use the new differential bearings for assembly.

^ If the runout exceeds the specification, install a new differential case.

15. Remove differential case from the rear axle housing.

Installation

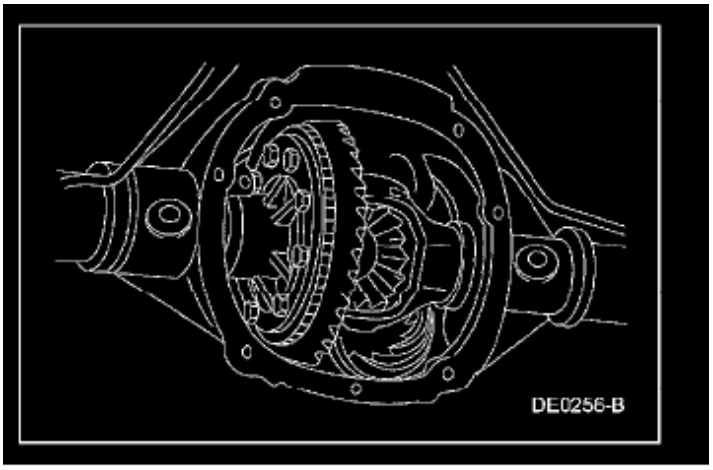
Assembly

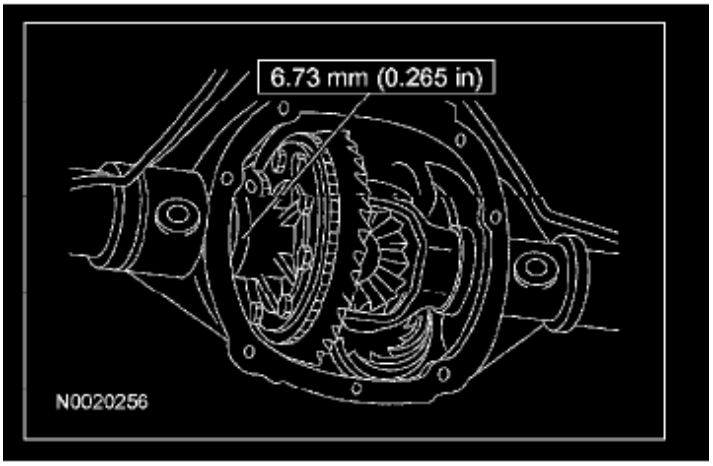
1. Press a new anti-lock speed sensor ring, if removed, and the ring gear on the differential case.

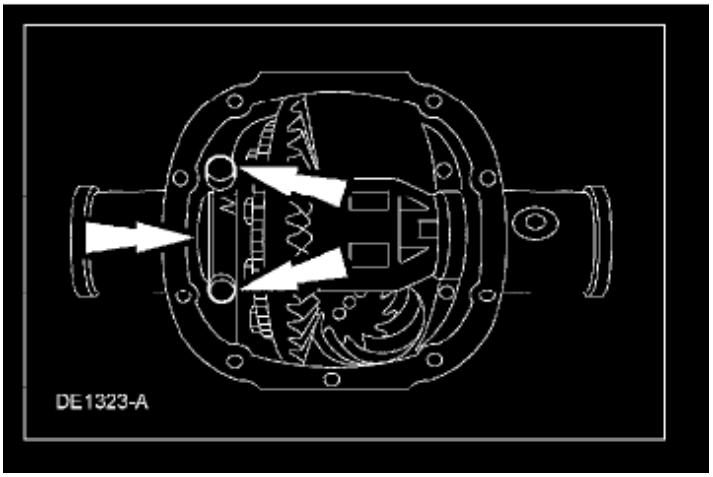
2. Install the 10 new ring gear bolts.

^ Tighten to 105 Nm (77 lb-ft).

3. With pinion depth set and pinion installed, place the differential case in the rear axle housing.


DE0256-B


6.73 mm (0.265 in)
N0020256


DE1323-A

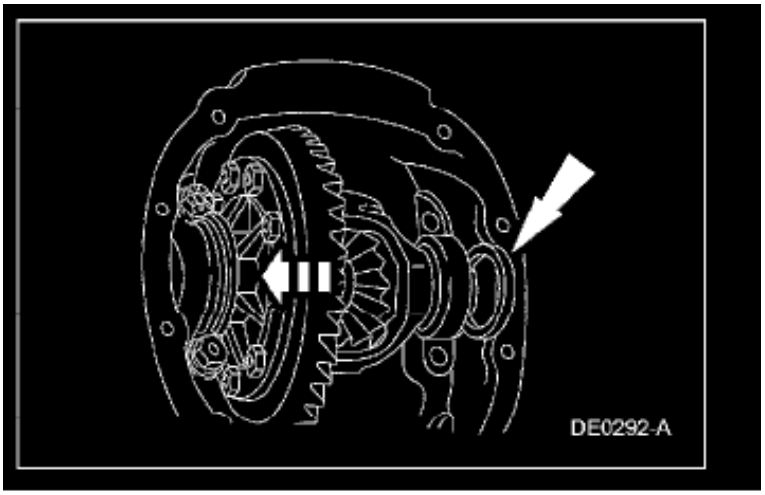
4. Install a nominal shim on the left side.

5. NOTE: Always install the bearing caps in their original locations and positions.

NOTE: Apply pressure toward the left side to make sure the left bearing cup is seated.

Install the left bearing cap and loosely install the 2 bearing cap bolts.

6. Install progressively larger shims on the right side until the largest shim selected can be assembled by hand.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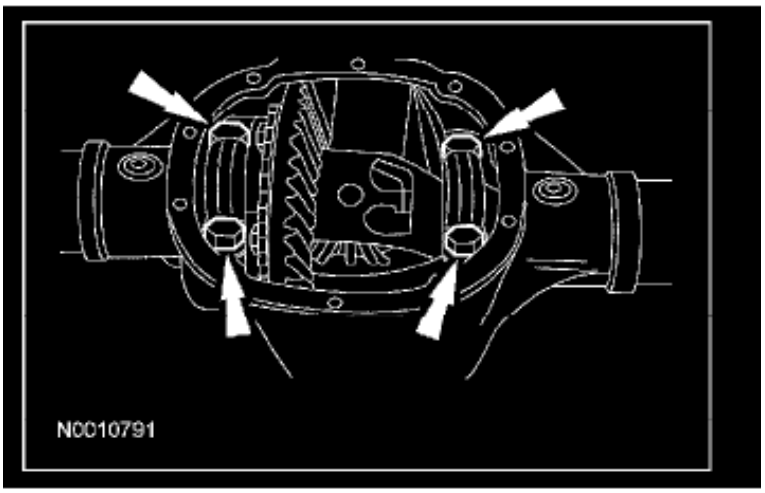
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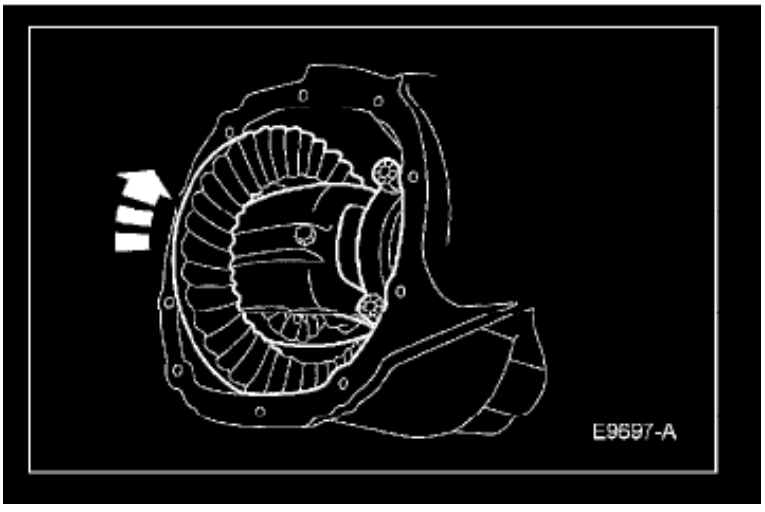

E9697-A

7. Install the right side bearing cap and tighten the 2 left side and 2 right side bolts.

^ Tighten to 112 Nm (83 lb-ft).

8. Rotate the differential case to make sure it rotates freely.

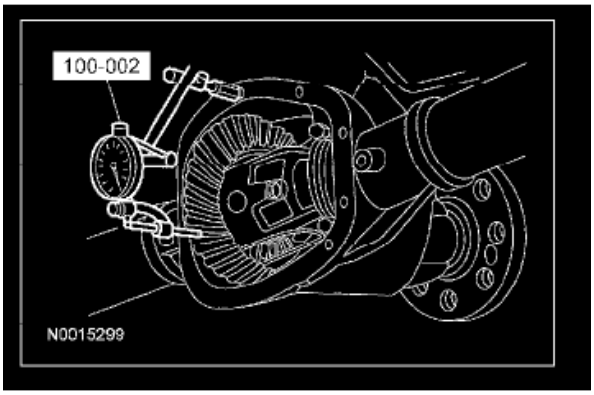
Measuring backlash 9. Using the special tools, measure the ring gear backlash.

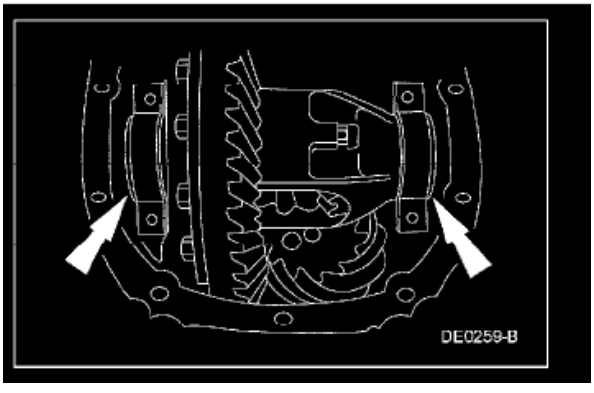
^ If the backlash is within specification, go to Backlash within specification.

^ If a zero backlash condition occurs, go to Zero backlash in this procedure.

^ If the backlash is not within specification, go to Backlash not within specification.

Backlash Change Required		Thickness Change Required	
mm	Inch	mm	Inch
0.025	0.001	0.050	0.002
0.050	0.002	0.050	0.002
0.076	0.003	0.101	0.004
0.101	0.004	0.152	0.006
0.127	0.005	0.152	0.006
0.152	0.006	0.203	0.008
0.177	0.007	0.254	0.010
0.203	0.008	0.254	0.010
0.228	0.009	0.304	0.012
0.254	0.010	0.355	0.014
0.279	0.011	0.355	0.014
0.304	0.012	0.406	0.016
0.330	0.013	0.457	0.018
0.335	0.014	0.457	0.018
0.381	0.015	0.508	0.020





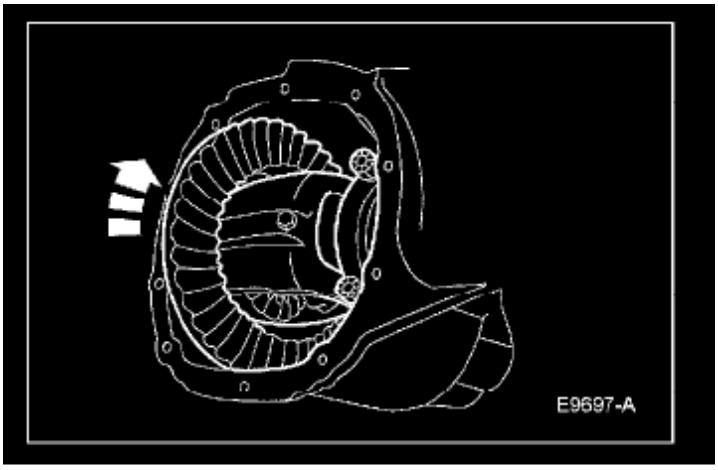
Zero backlash 10. If a zero backlash condition occurs, add 0.51 mm (0.020 inch) to the RH side and subtract 0.51 mm (0.020 inch) from the LH side to allow

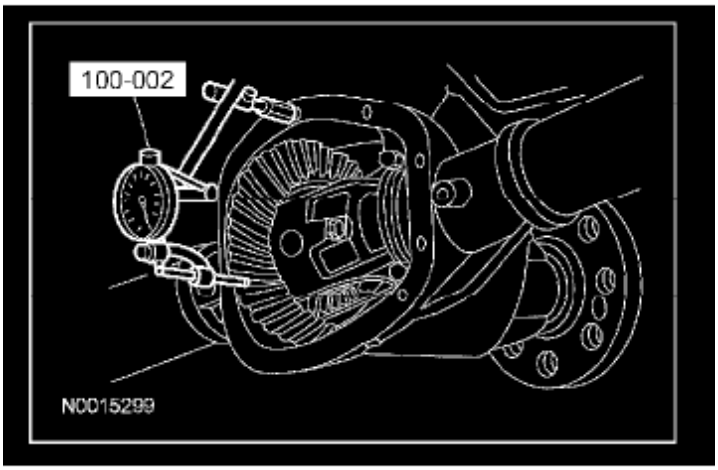
backlash indication. Check the backlash. Repeat Measuring backlash in this procedure.

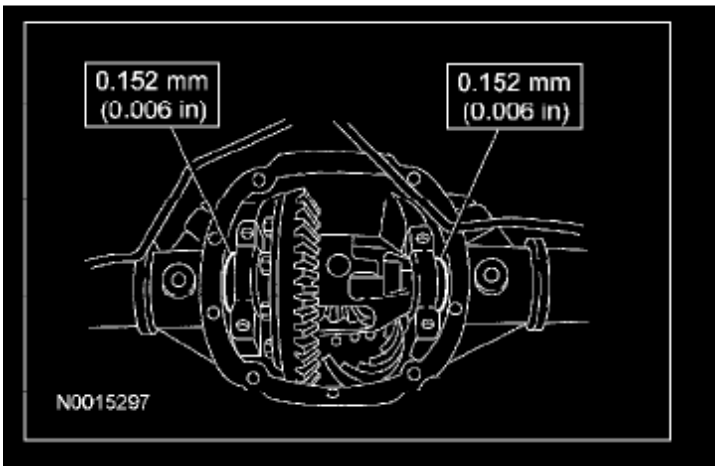
Backlash not within specification 11. To increase or decrease the backlash, remove the bearing caps and install a thicker shim or a thinner shim as shown.

^ If the backlash is not within specification, correct by increasing the thickness of one differential bearing shim and decreasing the thickness of the other differential bearing shim by the same amount.

12. Rotate the differential several times to make sure the differential bearings are correctly seated.


E9697-A


100-002
N0015299


0.152 mm
(0.006 in)
0.152 mm
(0.006 in)
N0015297

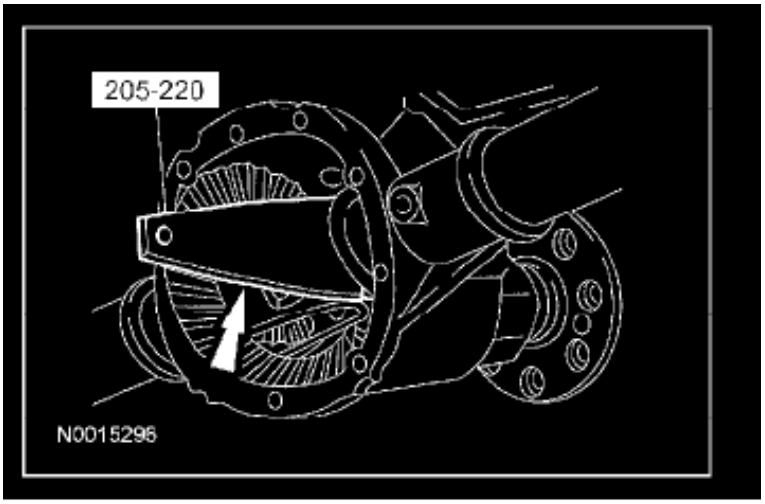
13. Using the special tools, recheck the backlash.

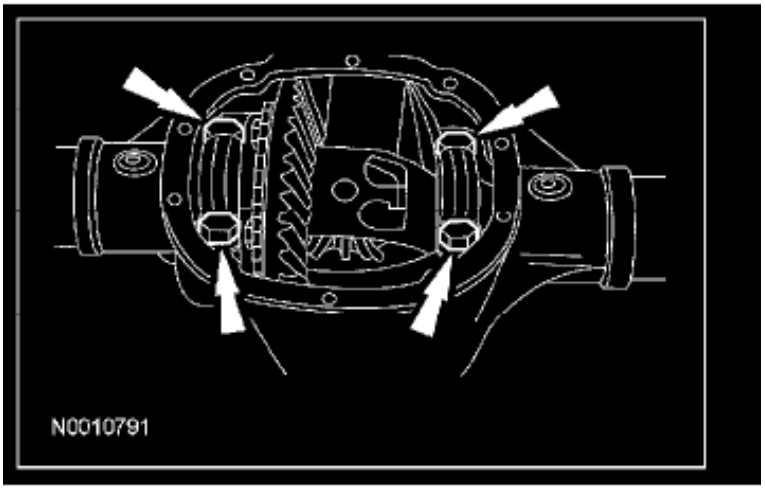
^ If backlash is within the specification, refer to Backlash within specification in this procedure. If backlash is not within the specification, repeat Backlash not within specification in this procedure.

Backlash within specification 14. Remove the 4 bolts and 2 bearing caps.

^ To establish differential bearing preload, increase both left and right shim sizes by the specification shown in the illustration.

15. Using the special tool, fully seat the differential bearing shims.


205-220
N0015296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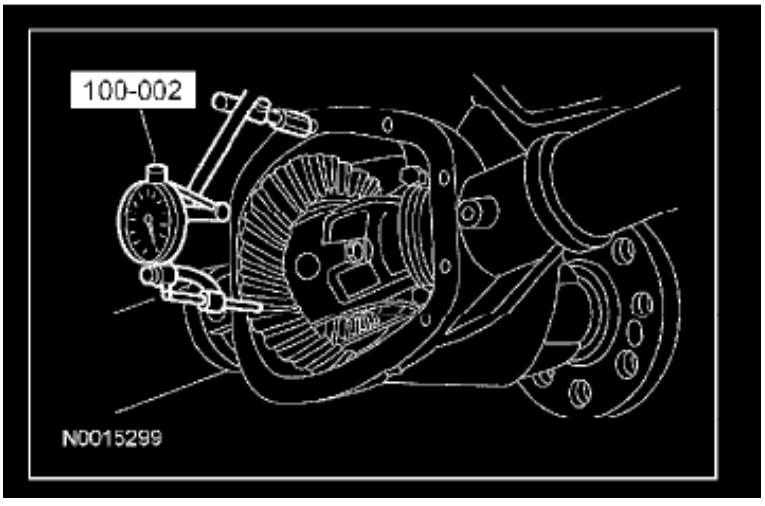

100-002
N0015299

16. Install the 2 bearing caps and 4 bearing cap bolts.

^ Tighten to 112 Nm (83 lb-ft).

17. Using the special tool, recheck the backlash.

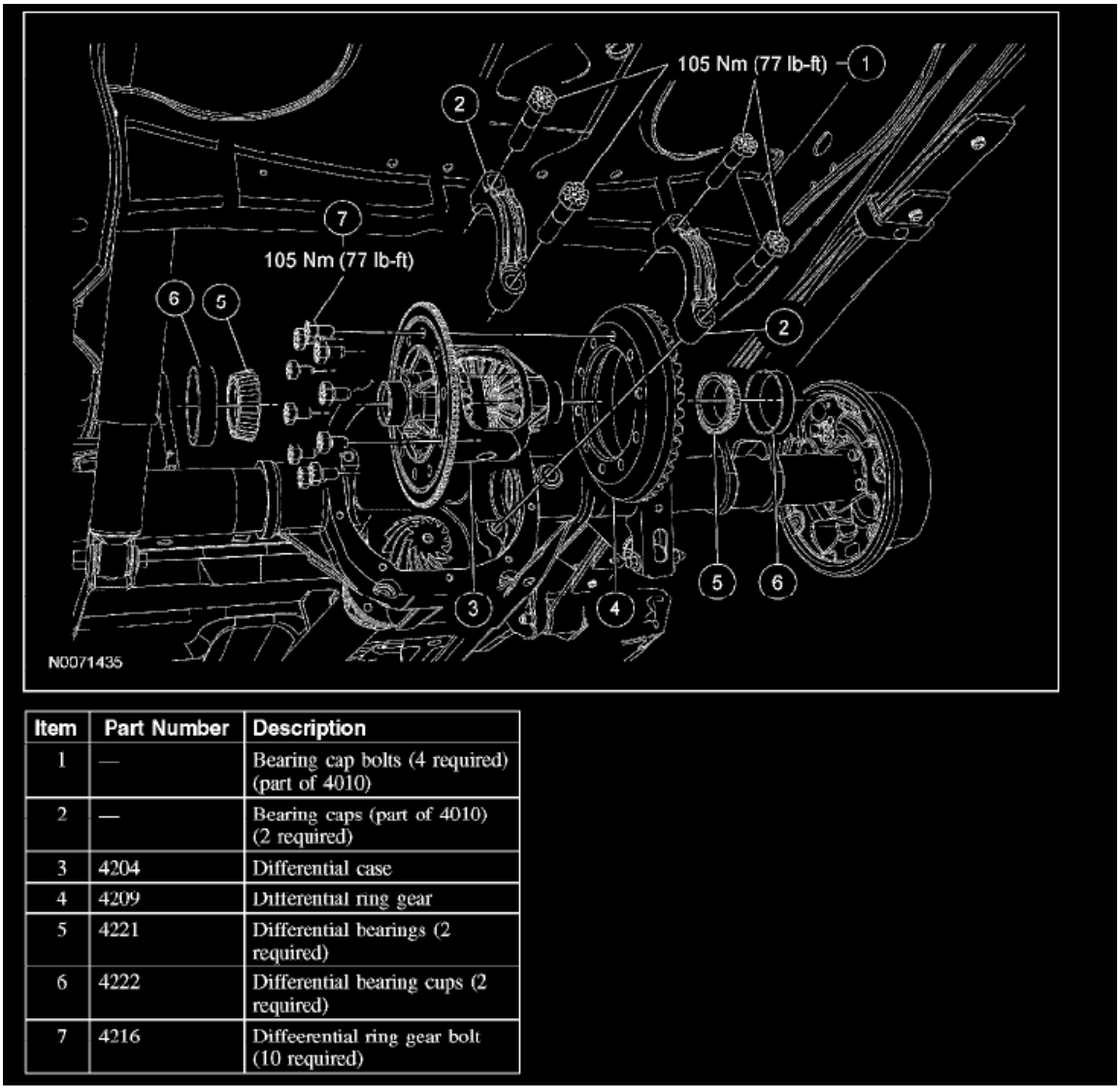
18. Install the axle shafts.

Ford 8.8-Inch Ring Gear - Rear Drive Axle/Differential

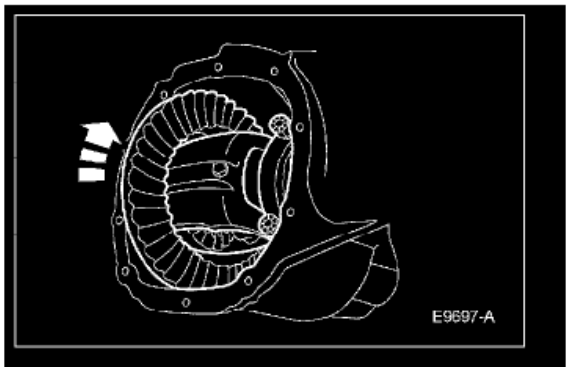
Differential Case

Special Tool(s)

ST1214-A	Dial Indicator With Holding Fixture 100-002 (TOOL-4201-C) or equivalent
ST1348-A	Gauge, Clutch Housing 308-021 (T57L-4201-A)
ST1485-A	Installer, Differential Shim 205-220 (T85L-4067-AH)
ST1375-A	Installer, Differential Side Bearing 205-010 (T57L-4221-A2)
ST1543-A	Step Plate 205-D016 (D80L-630-5) or equivalent
ST2026-A	2-Jaw Puller 205-D072 (D97L-4221-A) or equivalent



Item	Part Number	Description
1	—	Bearing cap bolts (4 required) (part of 4010)
2	—	Bearing caps (part of 4010) (2 required)
3	4204	Differential case
4	4209	Differential ring gear
5	4221	Differential bearings (2 required)
6	4222	Differential bearing cups (2 required)
7	4216	Diffeerential ring gear bolt (10 required)



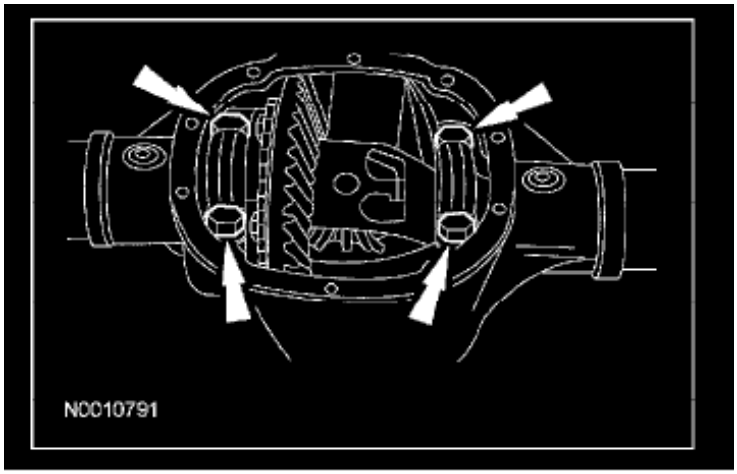
Removal

1. Remove the axle shafts.

2. NOTE: Inspect the removed lubricant for metallic particles which indicate wear or damage.

Wipe the lubricant from the internal working parts and inspect the parts for wear and damage.

3. Rotate the differential assembly to check for roughness indicating bearing/gear damage.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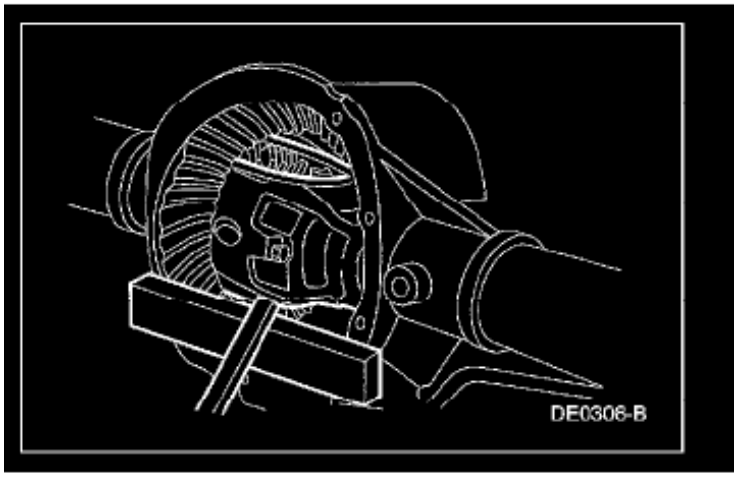
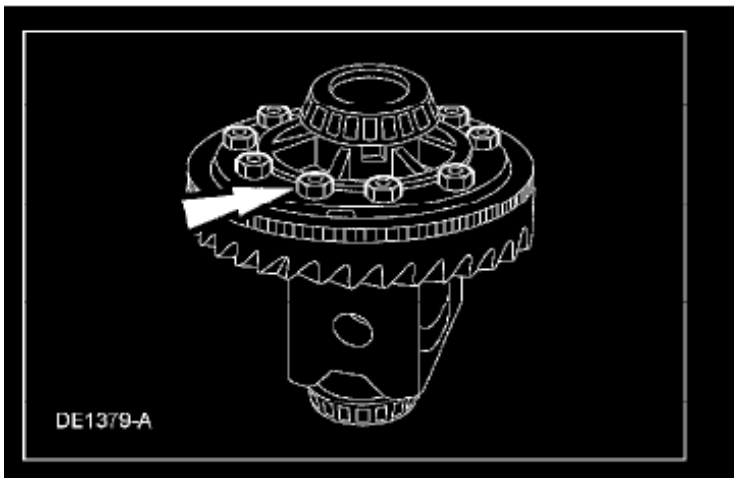

DE0306-B


DE1379-A

4. NOTE: Mark the position of the bearing caps, as the arrows may not be visible. Always install the bearing caps in their original locations and

positions.

Remove the 4 bolts and the 2 bearing caps.

5. CAUTION: Place a wood block between the pry bar and the differential housing to protect the machined surface or damage to the

component may occur.

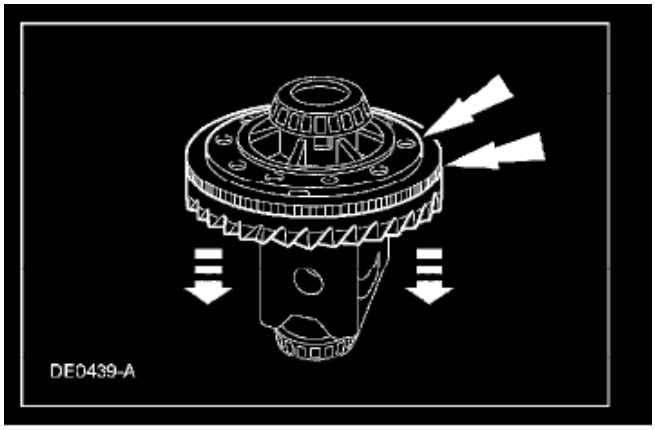
Using a pry bar and a wood block, remove the differential assembly from the differential housing.

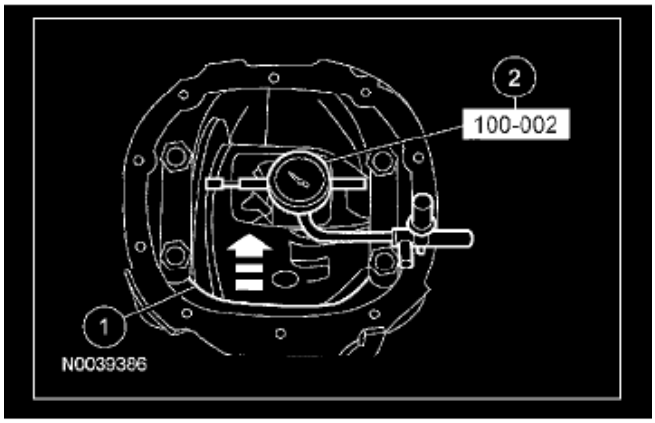
6. Remove and discard the 10 ring gear bolts.

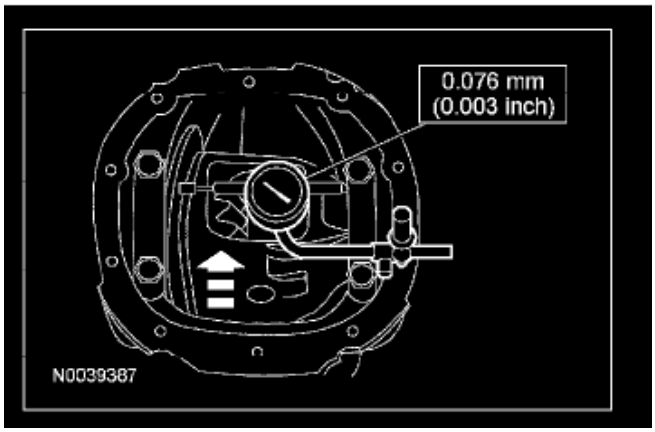
7. NOTE: Do not damage the differential ring gear bolt hole threads.

NOTE: If removing the anti-lock speed sensor ring, discard it, and install a new anti-lock speed sensor ring during installation.

Insert a punch in the bolt holes and drive off the differential ring gear and, if necessary, the anti-lock speed sensor ring.


DE0439-A


2
100-002
1
N0039386


0.076 mm
(0.003 inch)
N0039387

8. Position the differential assembly, including the differential bearing cups and differential bearing shims, in the differential housing. Install the 2

bearing caps and the 4 bolts. ^

Tighten to 112 Nm (83 lb-ft).

9. Position the special tool.

1 Rotate the differential case to verify that the differential bearings have seated correctly.

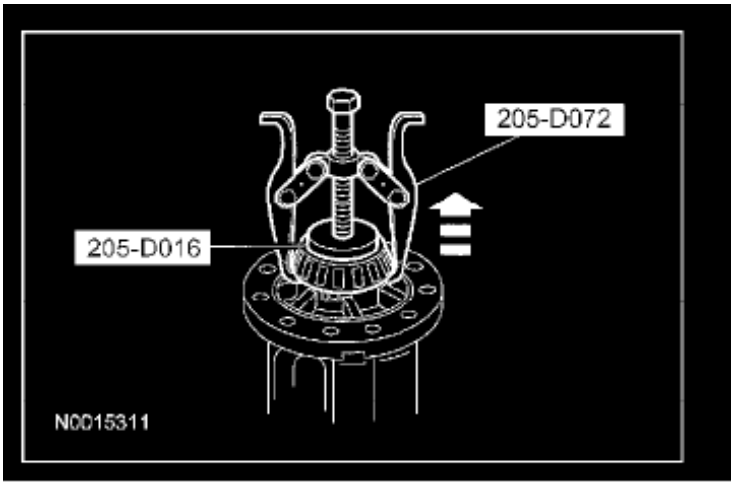
2 Position the special tool.

10. Measure and note the differential case runout.

^ If the runout does not exceed the specification, install a new differential ring gear and pinion.

^ If the runout exceeds the specification, the differential ring gear is true and the concern is due to either differential case/differential bearing damage. Proceed as follows.

11. Remove the 4 bearing cap bolts, the 2 bearing caps and the differential assembly from the axle housing. 12. Using the special tools, remove the differential bearings.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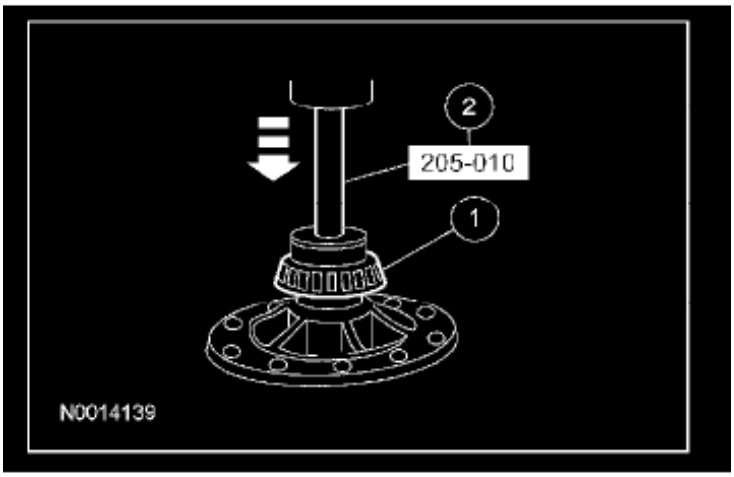
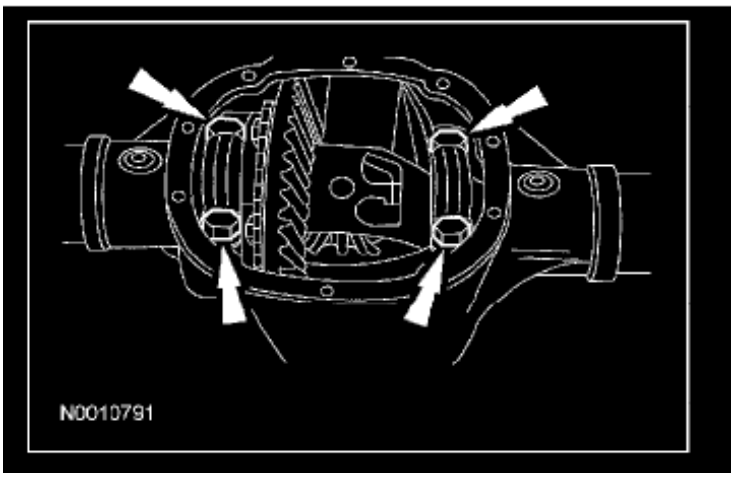
205-D016
N0015311


2
205-010
1
N0014139


N0010791

13. Using the special tool, install the new differential bearings.

1 Position the bearing.

2 Using the special tool, press the bearings on the differential case.

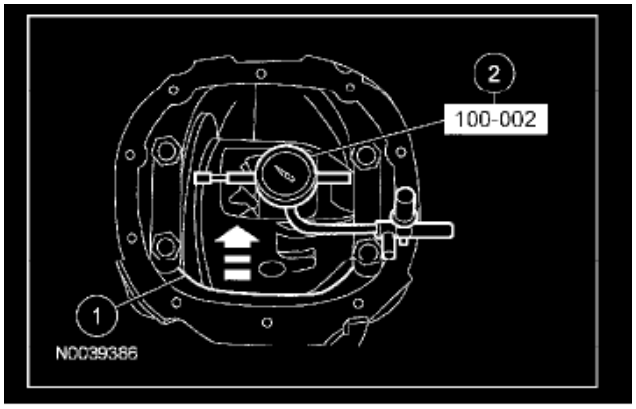
14. Position the differential assembly, including the differential bearing cups and differential bearing shims in the differential housing. Tighten bearing

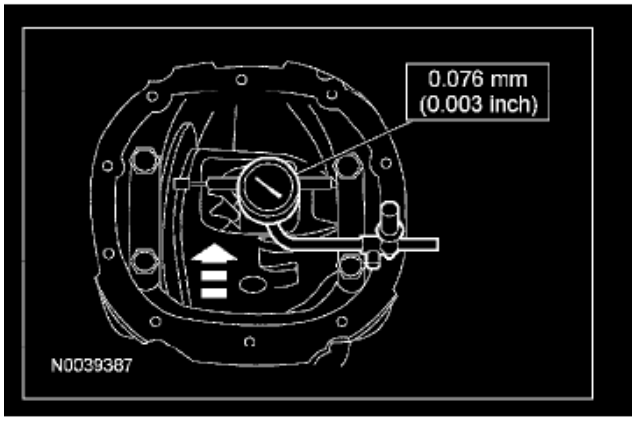
caps to 112 Nm (83 lb-ft).

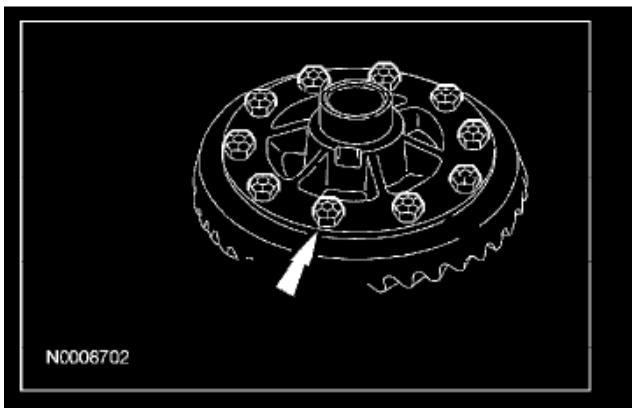
15. Position the special tool.

1 Rotate the differential case to verify that the differential bearings have seated correctly.

2 Position the special tool.


2
100-002
1
N0039386


0.076 mm
(0.003 inch)
N0039387


N0006702

16. Measure the differential case runout.

^ If the runout does not exceed the specification, use the new differential bearings for assembly.

^ If the runout exceeds the specification, install a new differential case.

17. Remove the 4 bearing cap bolts, the 2 bearing caps and the differential assembly from the axle housing.

Installation

Assembly

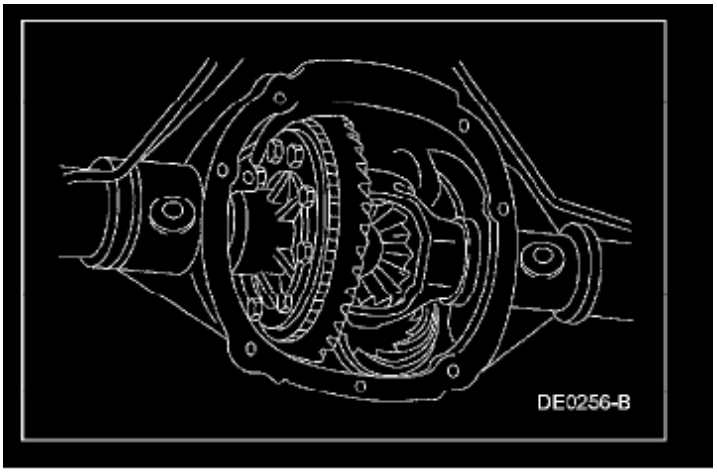
1. Position the differential ring gear, the anti-lock speed sensor ring and the differential case. Align the bolt holes by starting 2 bolts through the holes

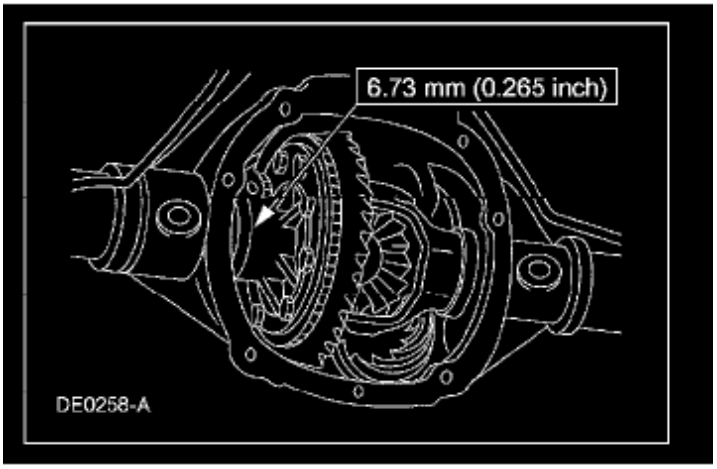
in the differential case and the differential ring gear. Press the new anti-lock speed sensor ring, if removed, and the differential ring gear on the differential case.

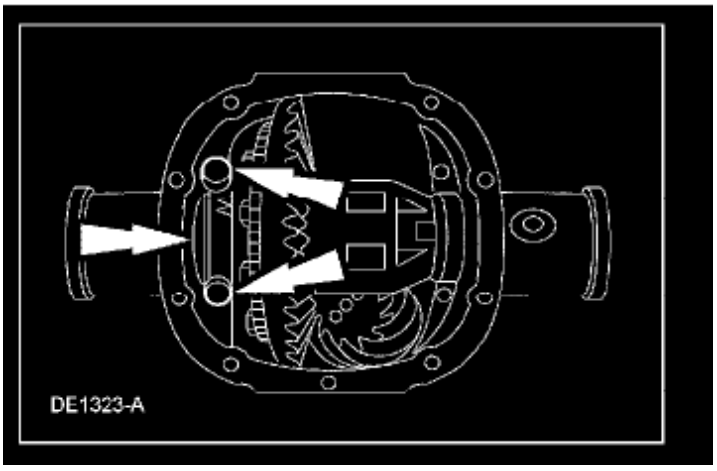
2. Install the 10 new differential ring gear bolts.

^ Tighten to 105 Nm (77 lb-ft).

3. With the pinion depth set and pinion installed, place the differential assembly in the differential housing.


DE0256-B


6.73 mm (0.265 inch)
DE0258-A


DE1323-A

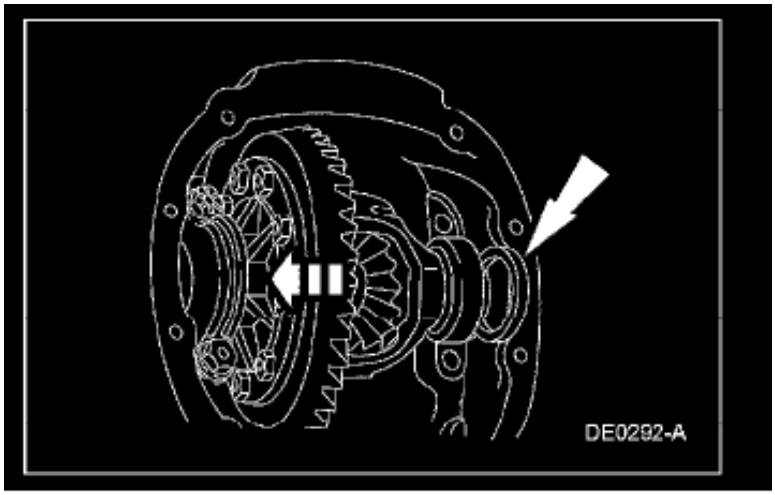
4. Install a differential bearing shim on the left side.

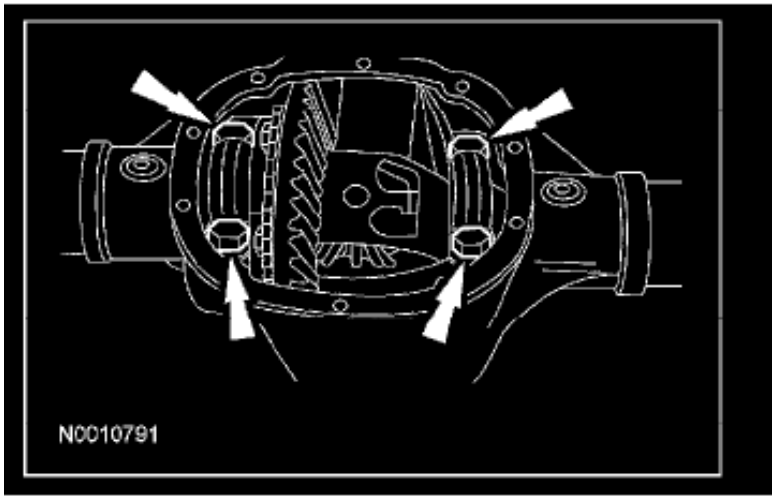
5. NOTE: Always install the bearing caps in their original locations and positions.

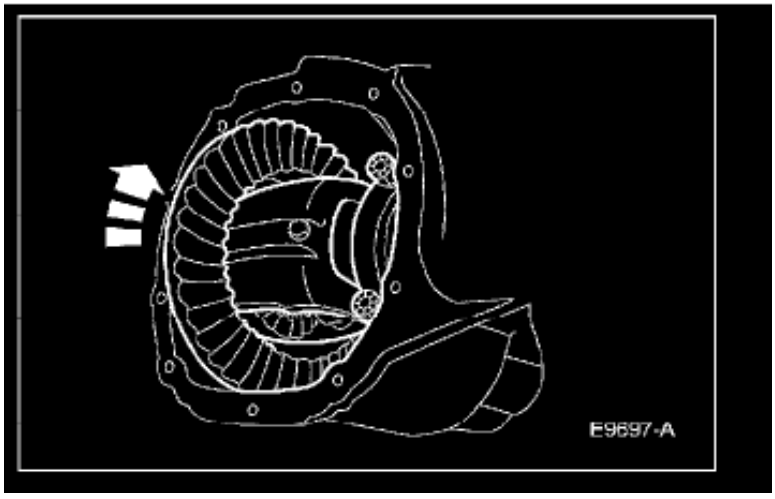
NOTE: Apply pressure toward the left side to make sure the left differential bearing cup seats correctly.

Install the left bearing cap and loosely install the 2 bolts.

6. Install progressively larger differential bearing shims, on the right side until the largest shim selected is installed by hand.


DE0292-A


N0010791


E9697-A

7. Install the right side bearing cap and tighten the 2 left side and 2 right side bolts.

^ Tighten to 112 Nm (83 lb-ft).

8. Rotate the differential case to make sure it turns freely.

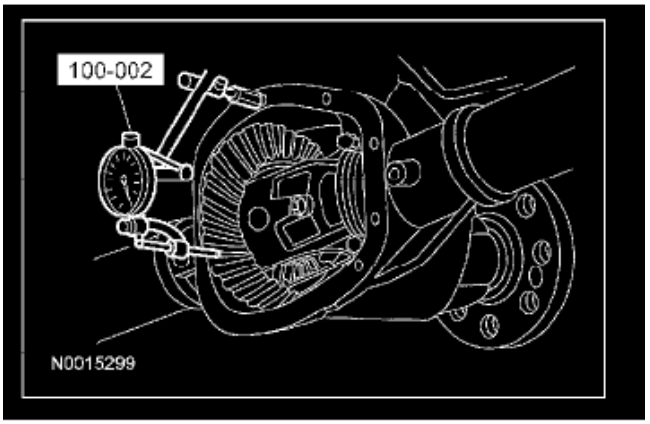
Measuring backlash 9. Using the special tools, measure and note the differential ring gear backlash.

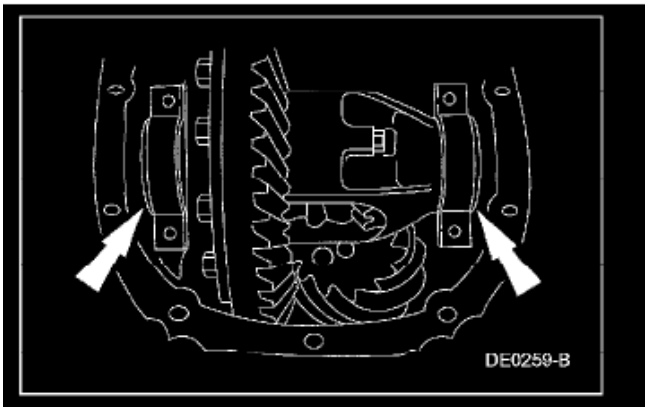
^ If backlash is within the specification, refer to Backlash within specification in this procedure.

^ If a zero backlash condition occurs, refer to Zero backlash in this procedure.

^ If backlash is not within the specification, refer to Backlash not within specification in this procedure.

Backlash Change Required		Thickness Change Required	
mm	Inch	mm	Inch
0.025	0.001	0.050	0.002
0.050	0.002	0.050	0.002
0.076	0.003	0.101	0.004
0.101	0.004	0.152	0.006
0.127	0.005	0.152	0.006
0.152	0.006	0.203	0.008
0.177	0.007	0.254	0.010
0.203	0.008	0.254	0.010
0.228	0.009	0.304	0.012
0.254	0.010	0.355	0.014
0.279	0.011	0.355	0.014
0.304	0.012	0.406	0.016
0.330	0.013	0.457	0.018
0.335	0.014	0.457	0.018
0.381	0.015	0.508	0.020



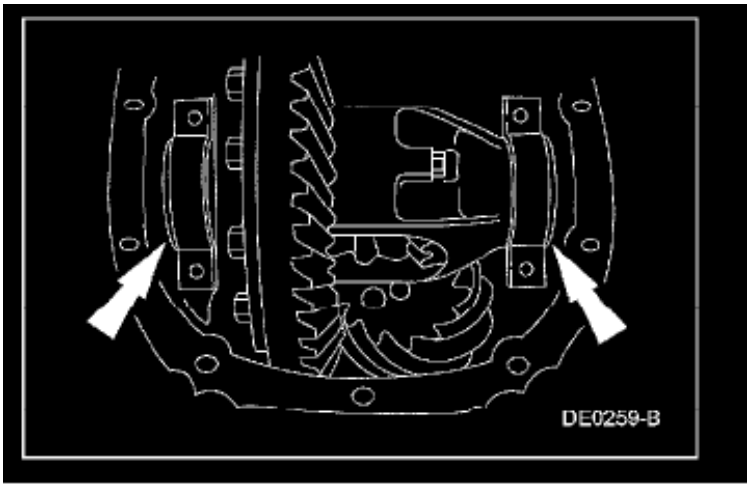


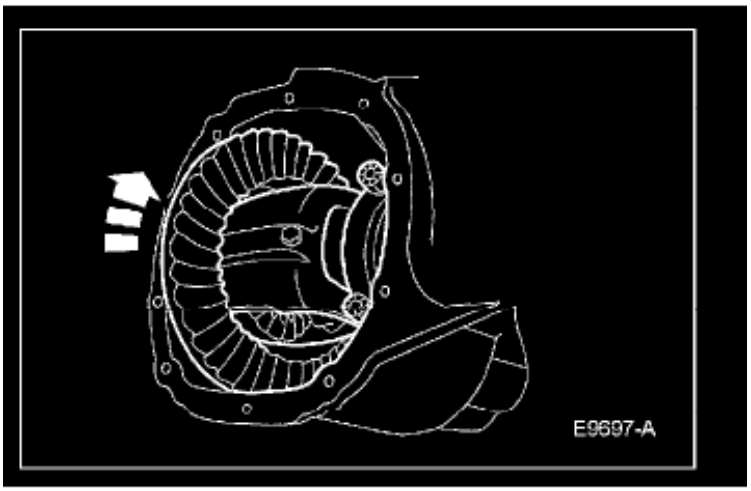
Zero backlash 10. If a zero backlash condition occurs, add 0.51 mm (0.020 inch) to the RH side and subtract 0.51 mm (0.020 inch) from the LH side to allow

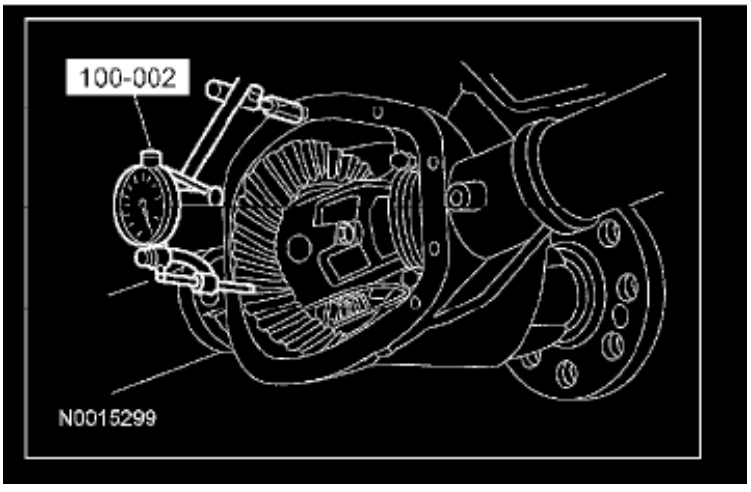
backlash indication. Measure the backlash. Refer to Measuring backlash in this procedure.

Backlash not within specification 11. To increase or decrease backlash, remove the bearing caps and install a thicker shim and a thinner shim accordingly.

^ If backlash is not within the specification, increase the thickness of one differential bearing shim and decrease the thickness of the other differential bearing shim by the same amount.


DE0259-B


E9697-A

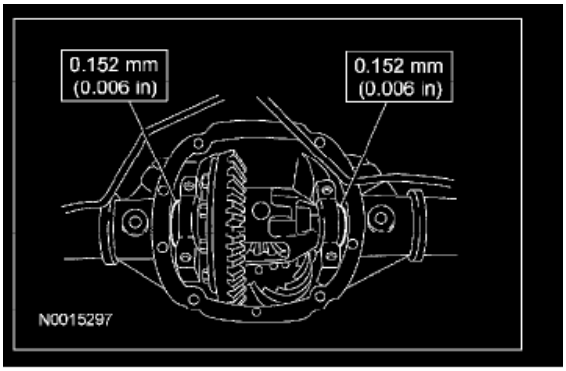

100-002
N0015299

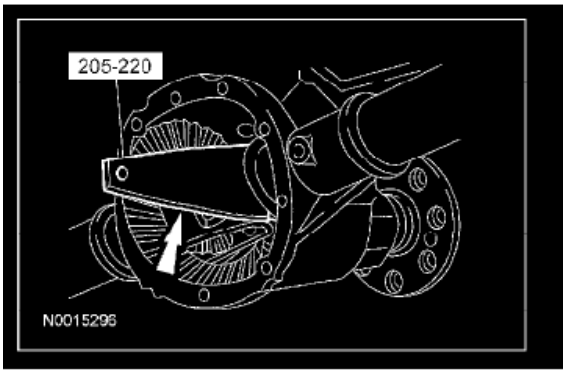
12. Rotate the differential assembly several times to verify that the differential bearings seated correctly.

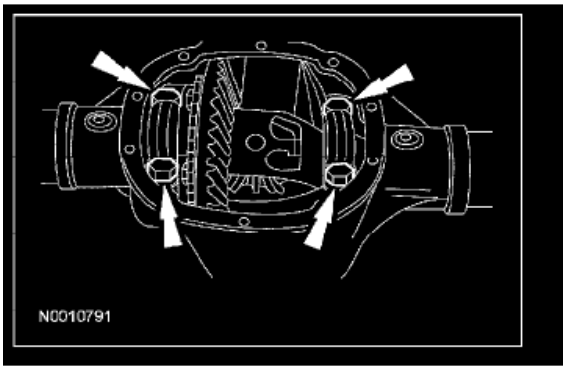
13. Using the special tools, recheck the backlash.

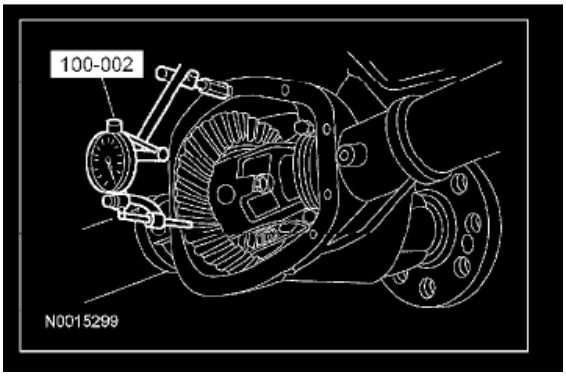
^ If backlash is within the specification, refer to Backlash within specification in this procedure. If backlash is not within the specification, repeat Backlash not within specification in this procedure.

Backlash within specification 14. Remove the 4 bolts and the 2 bearing caps. 15. To establish differential bearing preload, increase both left and right differential bearing shim sizes by the specification shown.


0.152 mm
(0.006 in)
0.152 mm
(0.006 in)
N0015297


205-220
N0015296


N0010791


100-002
N0015299

16. Using the special tool, fully seat the differential bearing shims. Make sure the assembly rotates freely.

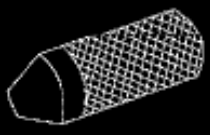
17. Install the 2 bearing caps and 4 bolts.

^ Tighten to 112 Nm (83 lb-ft).

18. Using the special tools, recheck the backlash.

19. Install the axle shafts.

Special Tool(s)

ST1743-A	Adapter for 205-S127 205-105 (T76P-4020-A3)
ST1429-A	Adapter for 205-S127 205-109 (T76P-4020-A9)
ST1431-A	Adapter for 205-S127 205-110 (T76P-4020-A10)
 ST1432-A	Adapter for 205-S127 205-111 (T76P-4020-A11)
ST1743-A	Adapter for 205-S127 205-125 (T78P-4020-A15)
ST1214-A	Dial Indicator Gauge With Bracketry 100-002 (TOOL-4201-C)

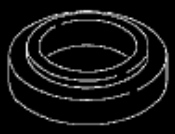
(Continued)

Differential Carrier: Service and Repair Differential Ring and Pinion

Ford 7.5-Inch Ring Gear - Rear Drive Axle/Differential

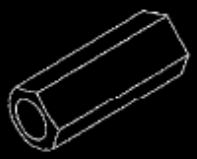
Differential Ring And Pinion

Special Tool(s)

ST1434-A	Gauge Tube 205-D034 (D80T-4020-F49) or equivalent
ST1257-A	Holding Fixture, Drive Pinion Flange 205-126 (T78P-4851-A)
ST1485-A	Installer, Differential Shim 205-220 (T85L-4067-AH)
ST1375-A	Installer, Differential Side Bearing 205-009 (T57L-4221-A1)
 ST1367-A	Installer, Drive Pinion Bearing Cone 205-005 (T53T-4621-C)
ST1678-A 	Installer, Drive Pinion Bearing Cup 205-054 (T71P-4616-A) Installer, Drive Pinion Flange 205-002 (TOOL-4858-E)

(Continued)

Special Tool(s)

ST1325-A	Installer, Drive Pinion Oil Seal 205-208 (T83T-4676-A)
ST1254-A	Plate, Bearing/Oil Seal 205-090 (T75L-1165-B)
 ST1744-A	Protector, Drive Pinion Thread 205-460

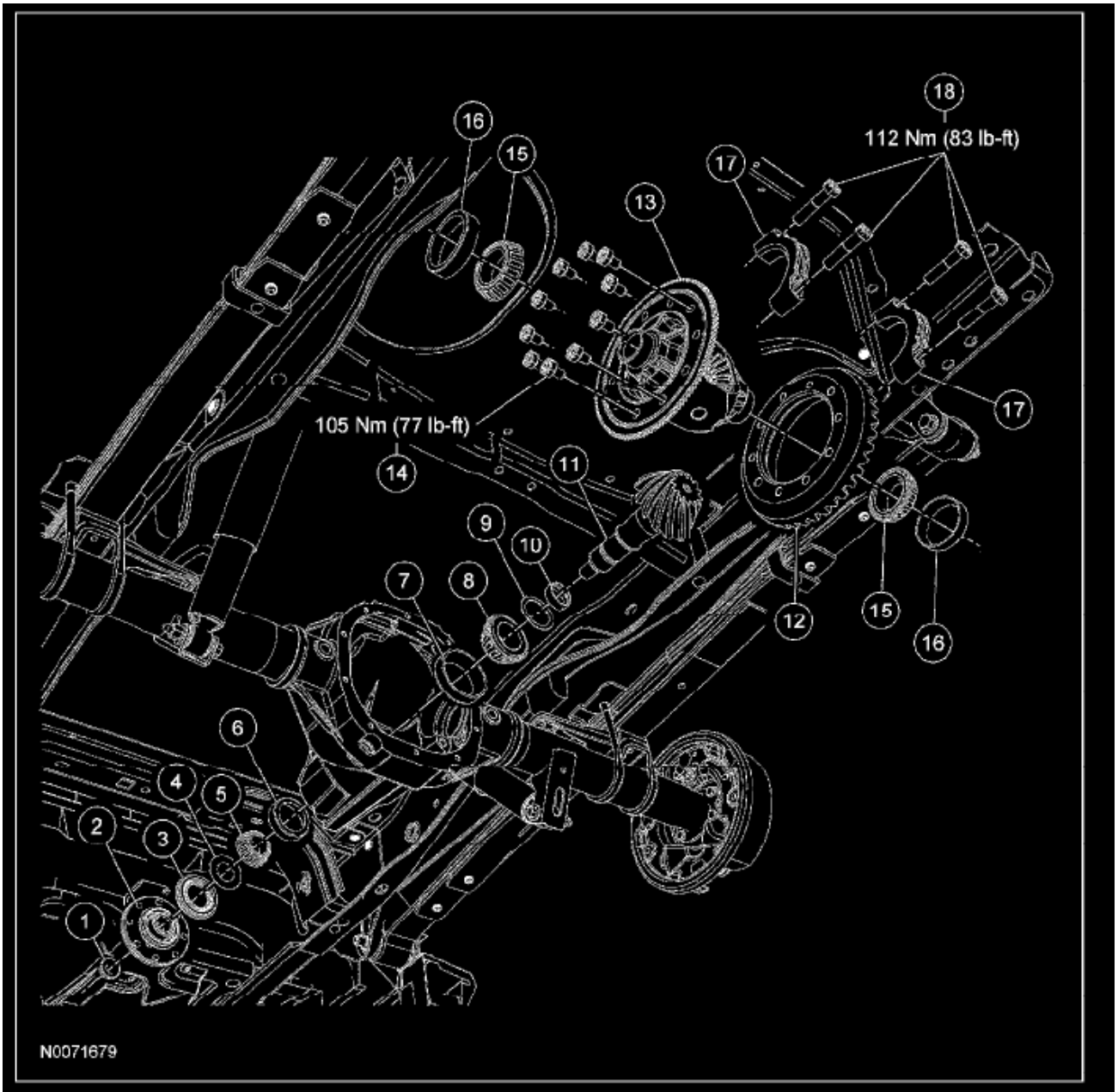
(Continued)

Special Tool(s)

ST1543-A	Step Plate 205-D016 (D80L-630-5) or equivalent
ST2026-A	2-Jaw Puller 205-D072 (D79L-4221-A1) or equivalent

Material

Item	Specification
Motorcraft High Contrast Hypoid Gear Marking Compound XG-14	—



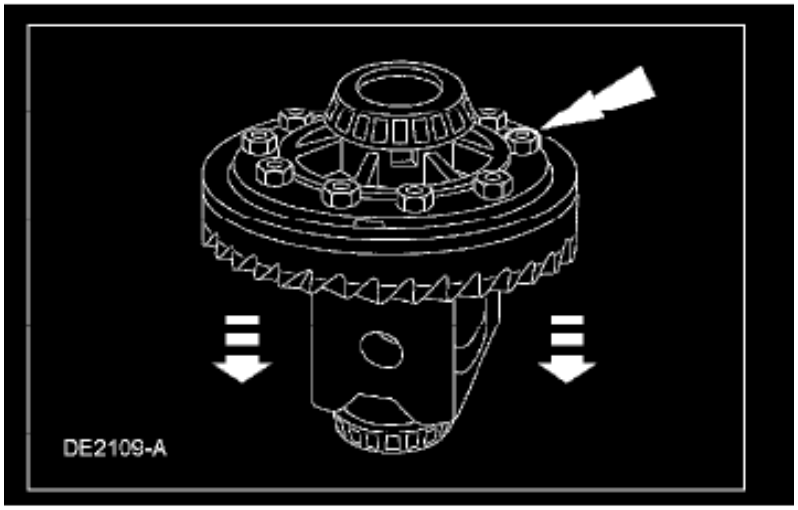
Item	Part Number	Description
1	389546-S	Pinion nut
2	4851	Pinion flange
3	4676	Pinion oil seal
4	4670	Pinion oil slinger
5	4621	Outer pinion bearing
6	4616	Outer pinion bearing cup
7	4628	Inner pinion bearing cup
8	4630	Inner pinion bearing

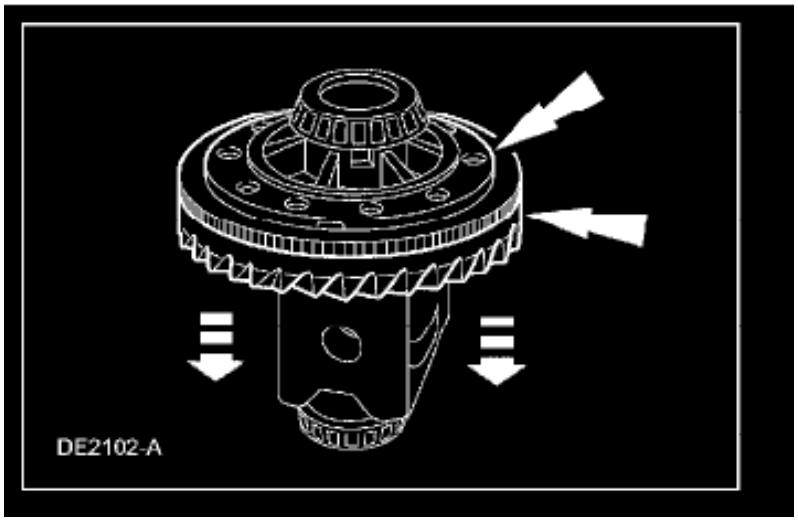
(Continued)

Item	Part Number	Description
9	4663	Pinion bearing adjustment shim
10	4662	Collapsible spacer
11	4209	Drive pinion
12	4209	Ring gear
13	4204	Differential case
14	4216	Differential ring gear bolt (10 required)
15	4221	Differential bearings (2 required)

(Continued)

Item	Part Number	Description
16	4222	Differential bearing cups (2 required)
17	—	Differential bearing caps (part of 4010)
18	—	Differential bearing cap bolts (part of 4010)





Removal

1. Remove the differential carrier. 2. Remove and discard the 10 differential ring gear bolts.

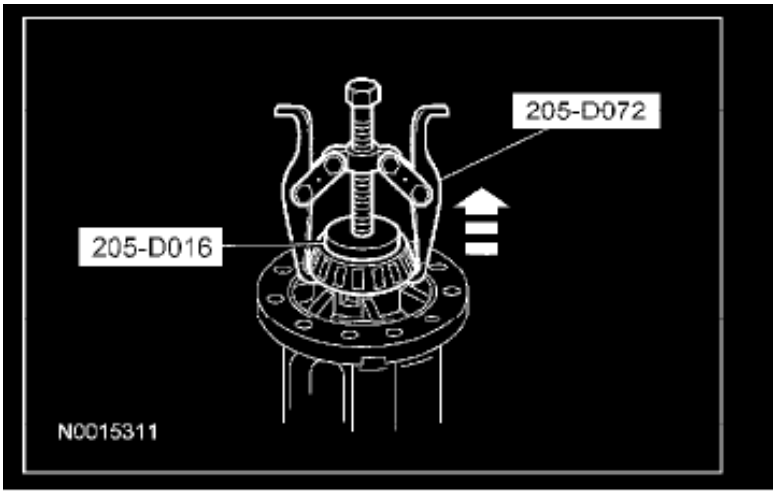
3. NOTE: Do not damage the differential ring gear bolt hole threads.

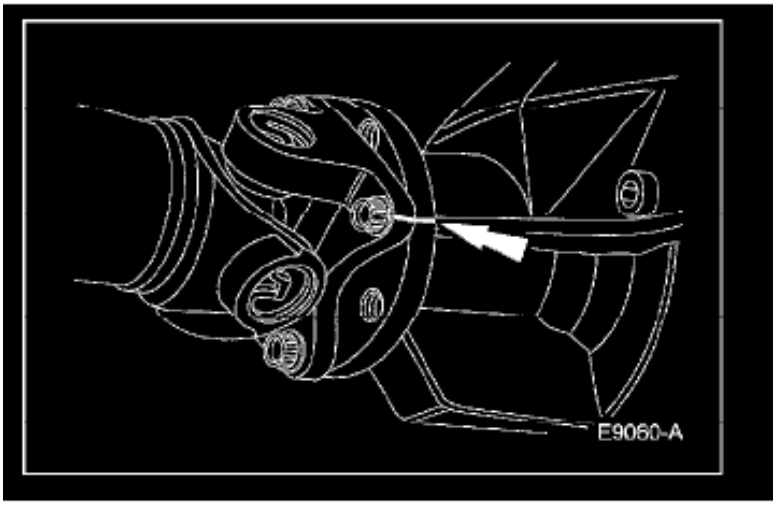
Insert a punch in the differential ring gear bolt holes and drive the differential ring gear off.

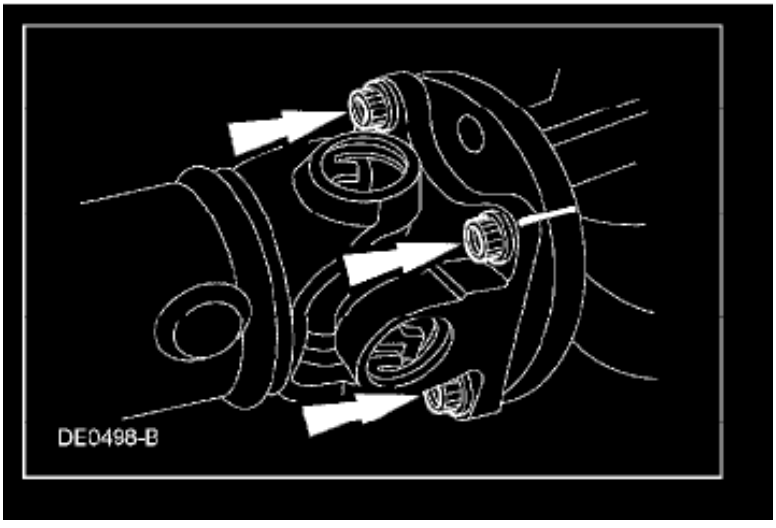
4. NOTE: The speed sensor ring cannot be reused once removed. Remove the speed sensor ring only if damaged.

If necessary, remove the speed sensor ring.

5. Using the special tools, remove the differential bearings.


205-D072
205-D016
N0015311


E9060-A


DE0498-B

6. Index-mark the driveshaft flange and pinion flange for correct alignment during installation.

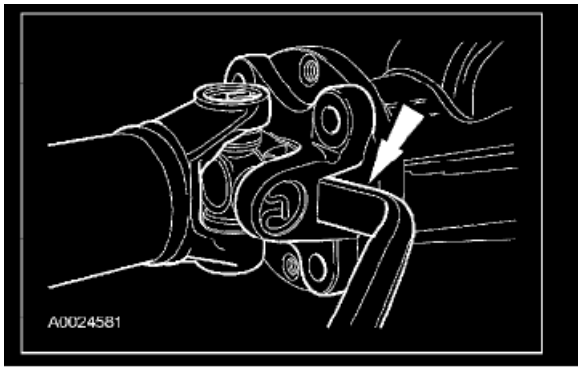
7. Remove the 4 driveshaft flange bolts.

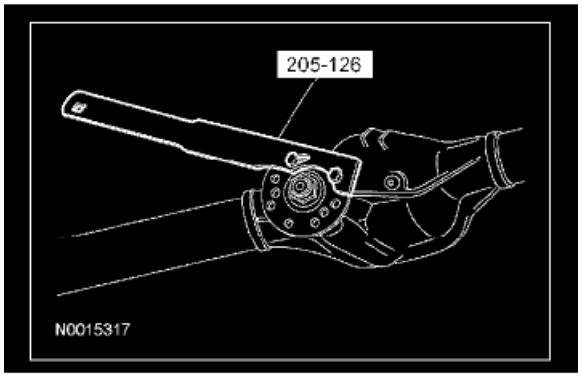
8. CAUTION: The driveshaft centering socket yoke fits tightly on the pinion flange pilot. Never hammer on the driveshaft or any of its

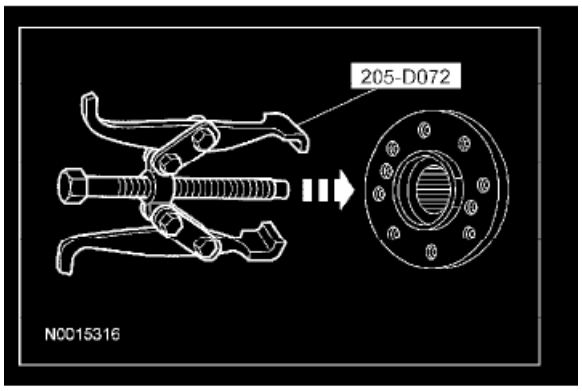
components to disconnect the driveshaft centering socket yoke from the pinion flange or damage to the component may occur. Pry only in the area shown with a suitable tool to disconnect the driveshaft centering socket yoke from the pinion flange or damage to the component may occur.

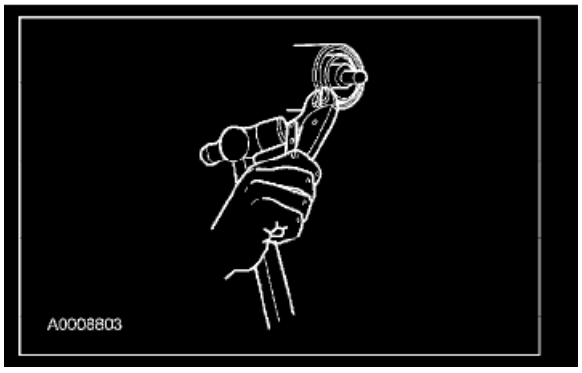
Using a suitable tool as shown, disconnect the driveshaft centering socket yoke from the pinion flange. ^

Using mechanic's wire, position the driveshaft aside.


A0024581


205-126
N0015317


205-D072
N0015316

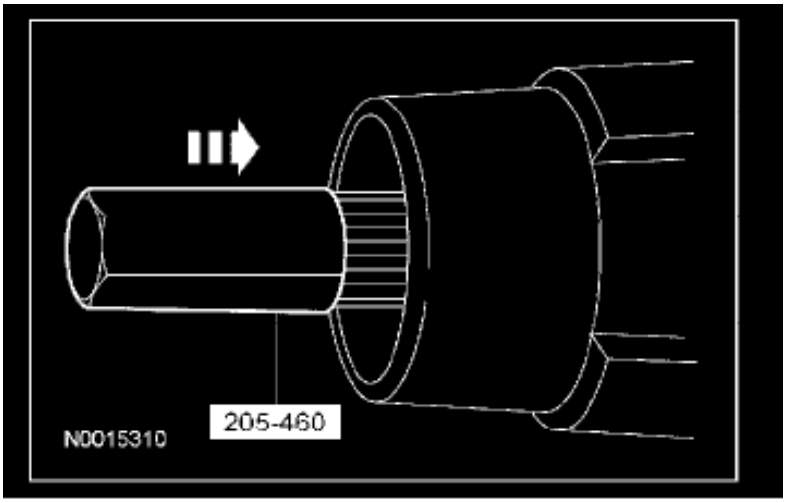

A0008803

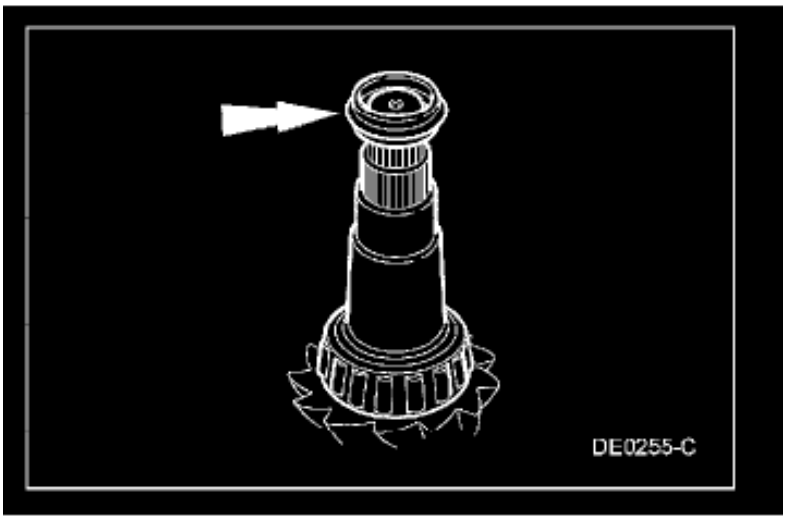
9. Using the special tool to hold the pinion flange, remove and discard the pinion nut.

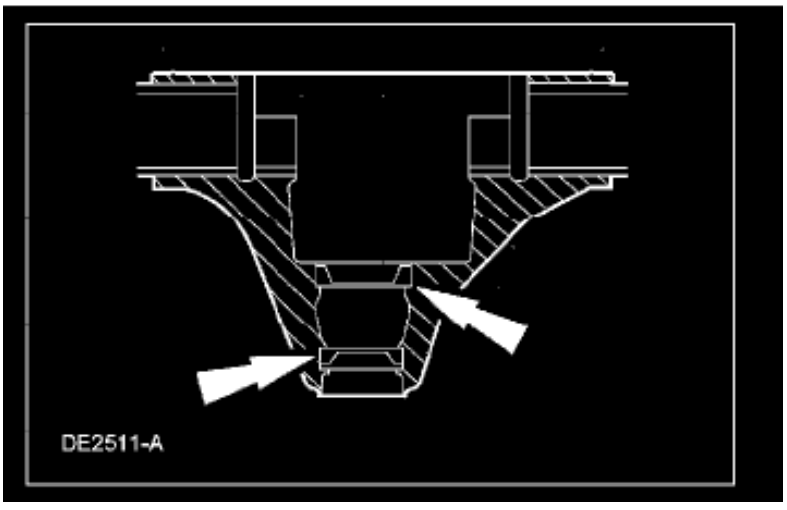
10. Using the special tool, remove the pinion flange.

11. Force up on the metal flange of the drive pinion seal. Install gripping pliers and strike with a hammer until the drive pinion seal is removed.

12. Remove the drive pinion shaft oil slinger and the outer drive pinion bearing.


205-460
N0015310


DE0255-C


DE2511-A

13. Install the special tool. Using a soft-faced hammer, drive the pinion assembly out of the axle housing.

14. Remove and discard the drive pinion collapsible spacer.

15. Using a brass drift, remove the drive pinion bearing cups by tapping alternately on opposite sides of the drive pinion bearing cups.

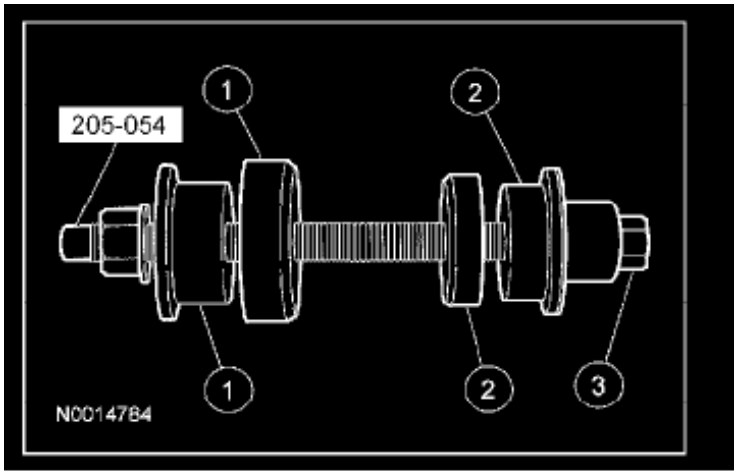
Installation

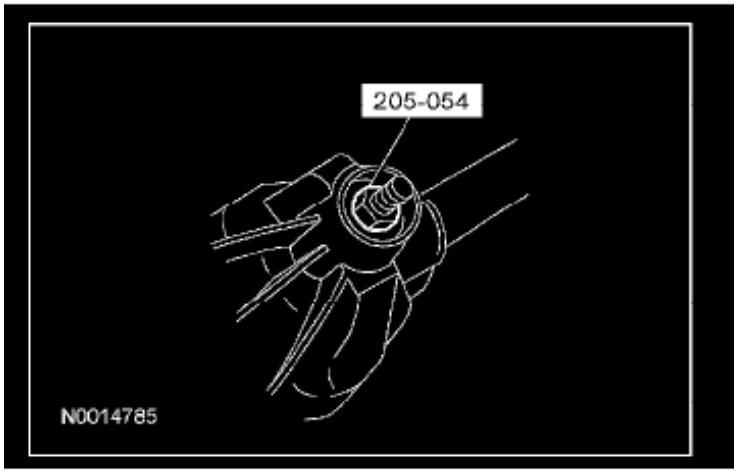
1. Position the special tool and the inner and outer drive pinion bearing cups in their respective bores.

1 After placing the inner and outer drive pinion bearing cups in their bores, place the special tool (inner) on the inner drive pinion bearing cup.

2 Place the special tool (outer) on the outer drive pinion bearing cup.

3 Install the special tool.


205-054
1
2
1
2
3
N0014784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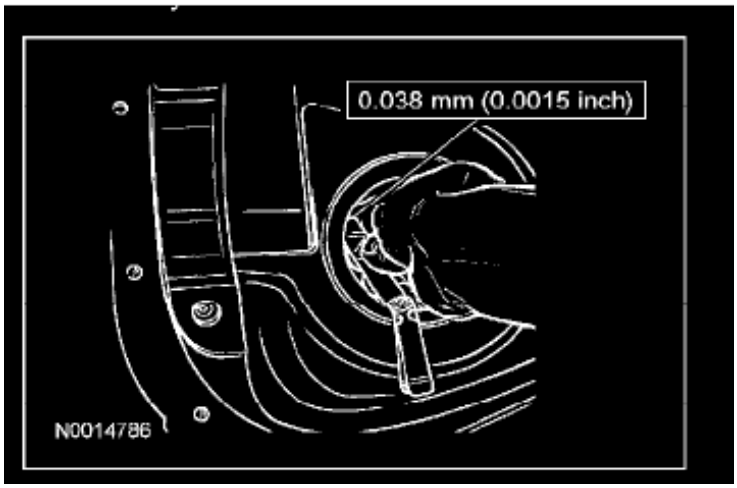
N0014785


0.038 mm (0.0015 inch)
N0014786

2. Tighten the special tool to seat the drive pinion bearing cups into their bores.

3. NOTE: If a feeler gauge can be inserted between a drive pinion bearing cup and the bottom of its bore at any point around the drive pinion

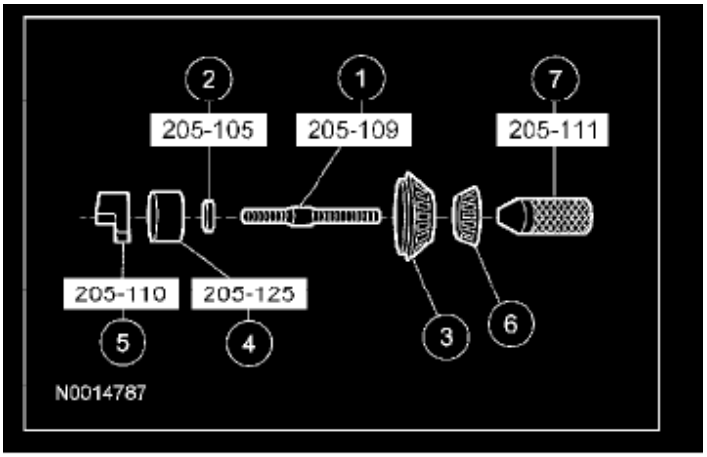
bearing cup, the drive pinion bearing cup is not correctly seated.

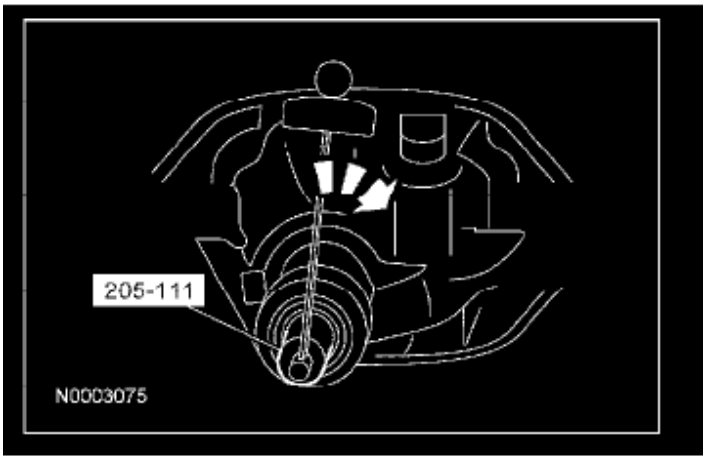
Make sure the drive pinion bearing cups are correctly seated in their bores.

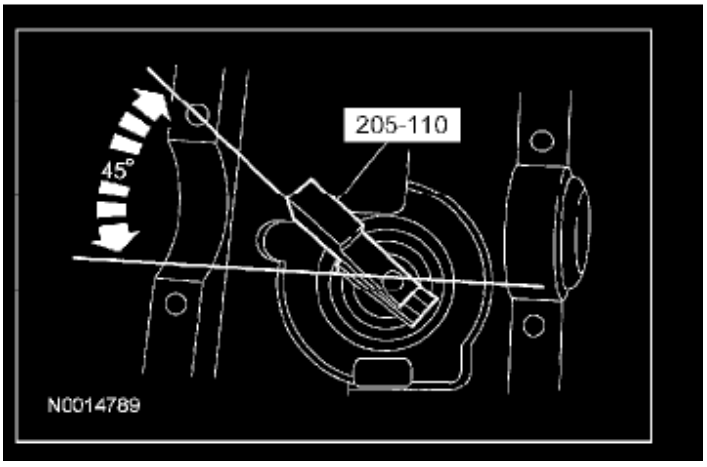
4. NOTE: Install new drive pinion bearings without any additional lubricant since the anti-rust oil provides adequate lubricant without upsetting the

drive pinion bearing preload settings.

Assemble and position the special tools in the sequence shown.


2
1
7
205-105
205-109
205-111
205-110
205-125
5
4
3
6
N0014787


205-111
N0003075


205-110
45°
N0014789

5. NOTE: This step duplicates final drive pinion bearing preload.

Tighten the special tool. ^

Tighten to 2.2 Nm (20 lb-inch).

6. NOTE: The special tool must be offset to obtain an accurate reading.

Rotate the special tool several half-turns to make sure of correct seating of the drive pinion bearings and position the special tool.

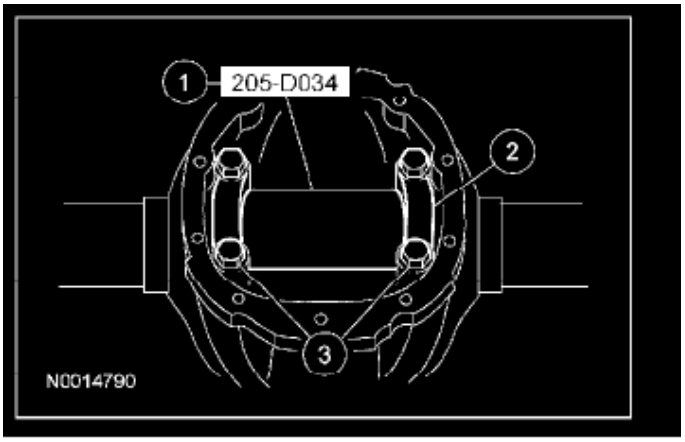
7. Install the special tool.

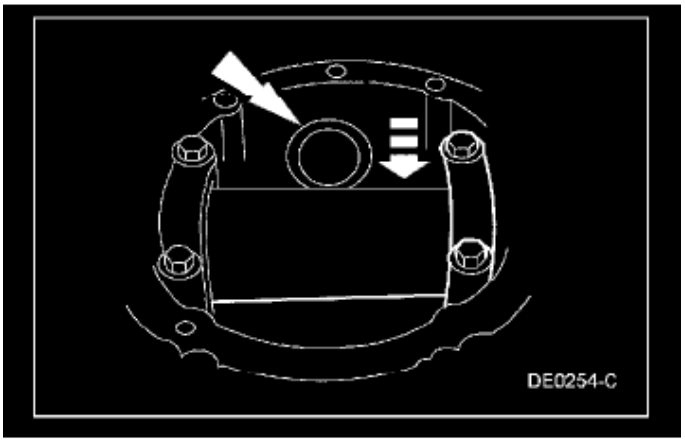
1 Position the special tool.

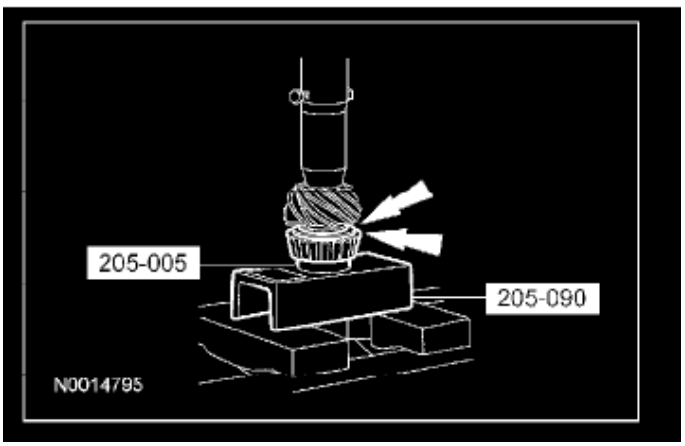
2 Install the differential bearing caps.

3 Install the 4 differential bearing cap bolts. ^

Tighten to 112 Nm (83 lb-ft).


1
205-D034
2
3
N0014790


DE0254-C


205-005
205-090
N0014795

8. NOTE: Drive pinion bearing adjustment shims must be flat and clean.

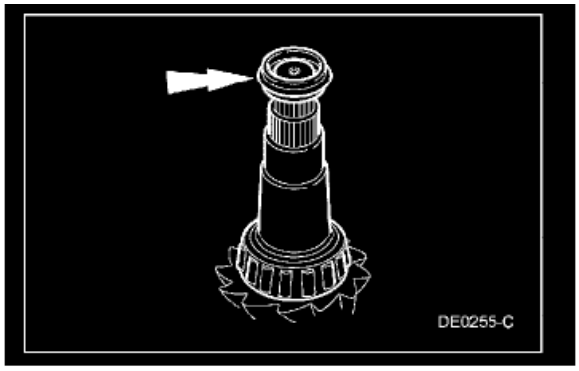
NOTE: A slight drag should be felt for correct drive pinion bearing adjustment shim selection. Do not attempt to force the drive pinion bearing adjustment shim between the gauge block and the gauge tube. This will minimize selection of a drive pinion bearing adjustment shim thicker than required, which results in a deep tooth contact in final assembly of integral axle assemblies.

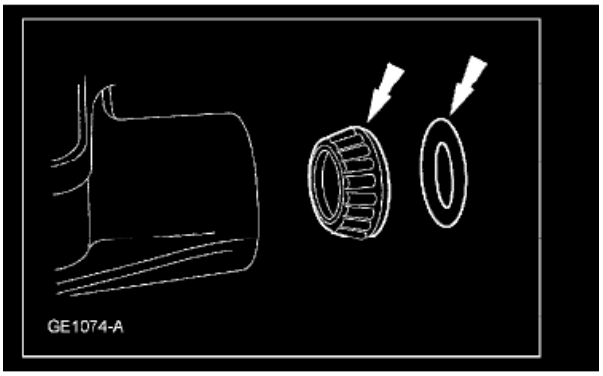
Use a drive pinion bearing adjustment shim as a gauge for drive pinion bearing adjustment shim selection. ^

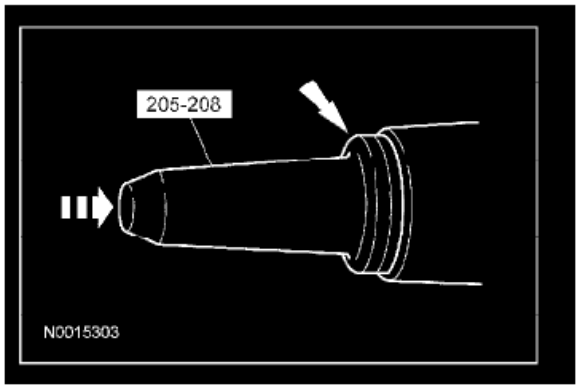
After the correct drive pinion bearing adjustment shim thickness has been determined, remove all of the special tools.

9. Using the special tool, press the inner drive pinion bearing and drive pinion bearing adjustment shim until it is firmly seated on the pinion shaft.

10. Install a new drive pinion collapsible spacer on the pinion shaft against the pinion shaft shoulder.


DE0255-C


GE1074-A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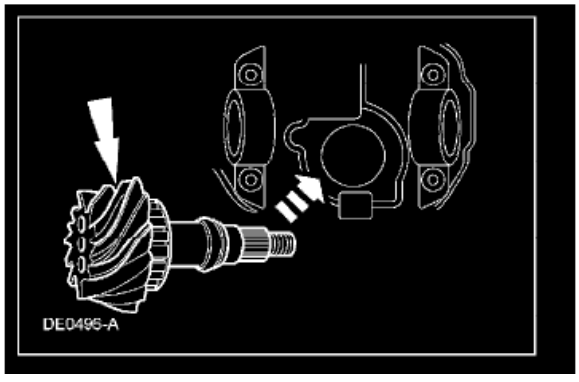
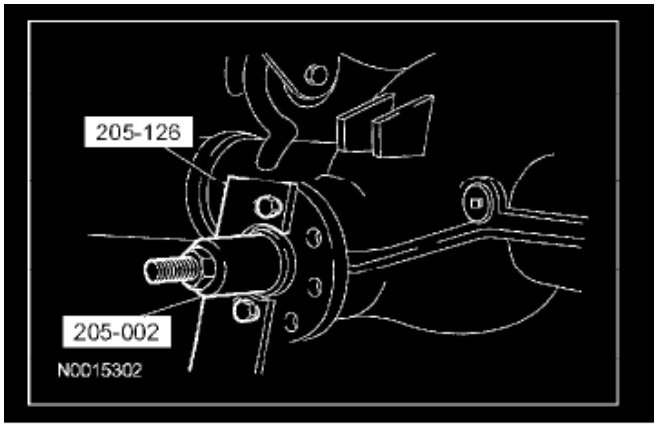
N0015303


DE0496-A

11. Install the outer drive pinion bearing and the drive pinion shaft oil slinger.
12. Using the special tools, install the drive pinion seal.
13. Position the drive pinion assembly into the axle housing.
14. Using the special tools, install the drive pinion flange.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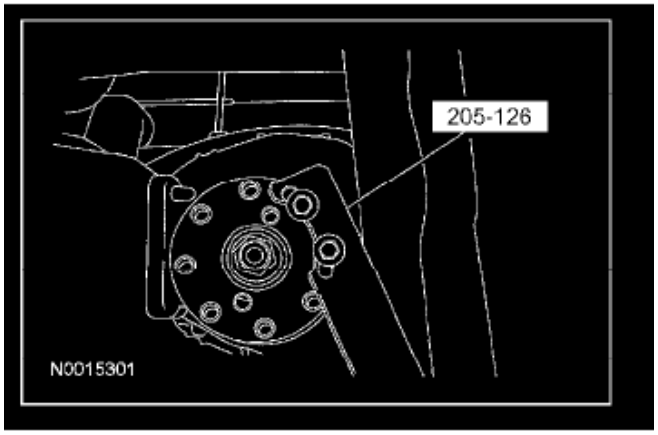
205-002
N0015302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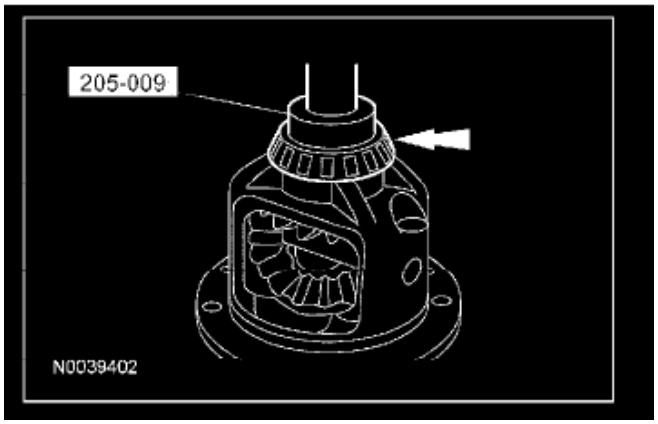

205-009
N0039402

15. CAUTION: Do not, under any circumstance, loosen the drive pinion nut to reduce pinion bearing preload or damage to the component

may occur. If it is necessary to reduce the preload, install a new drive pinion collapsible spacer and drive pinion nut.

NOTE: Remove the special tool while taking rotational pinion bearing preload checks with the Nm (lb-inch) torque wrench.

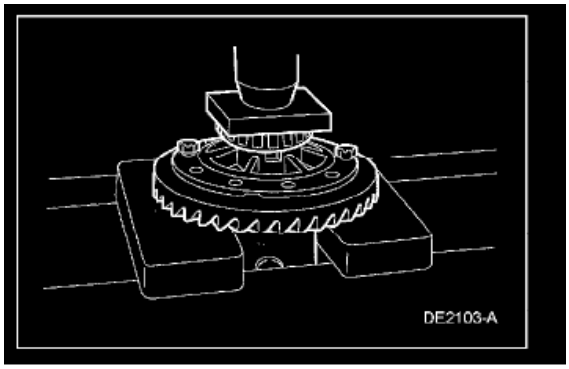
Use the special tool to hold the pinion flange while tightening the pinion nut. ^

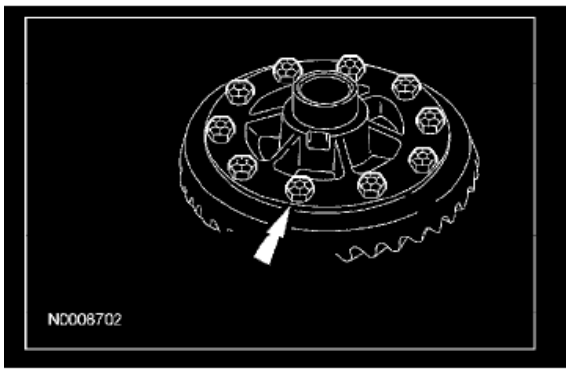
Rotate the pinion occasionally to make sure the differential pinion bearings are seating correctly. Take frequent differential pinion bearing preload checks by rotating the differential pinion with a Nm (lb-inch) torque wrench. Tighten the pinion nut in small increments to avoid excessive pinion bearing preload. Tighten the pinion nut until the drive pinion bearing preload is in specification. -

Tighten to a rotational torque of 1.8-3.3 Nm (16-29 lb-inch).

16. Using the special tool, install the 2 new differential bearings.

17. Press the differential ring gear on the differential assembly.


DE2103-A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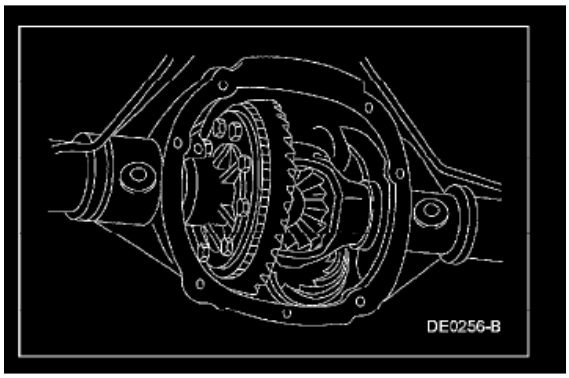
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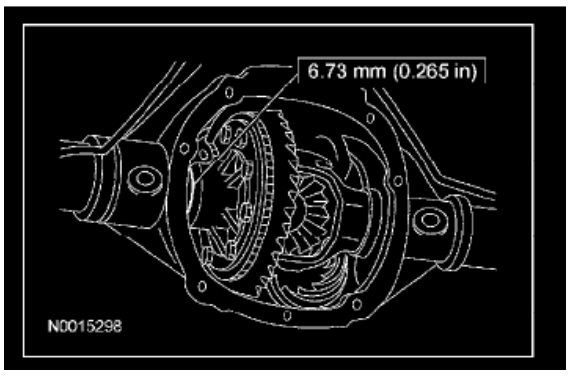
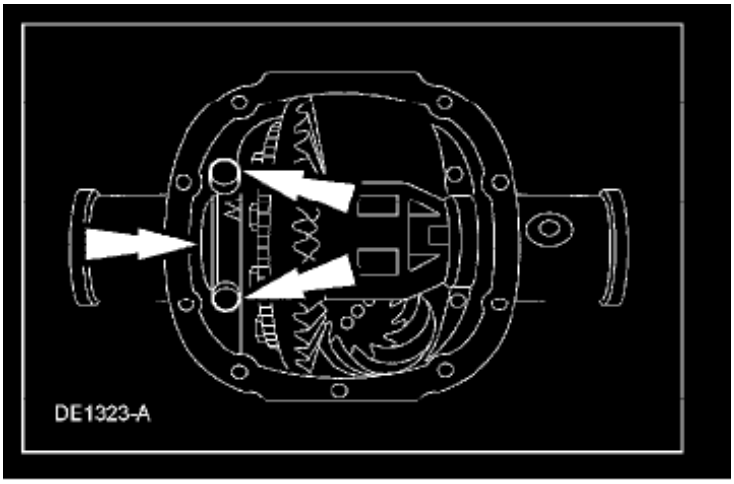

6.73 mm (0.265 in)
N0015298

18. Install the 10 new differential ring gear bolts.

^ Tighten to 105 Nm (77 lb-ft).

19. Position the differential carrier assembly and the new differential bearing cups in the differential housing.

20. Install a differential bearing shim of the shown dimension on the LH side.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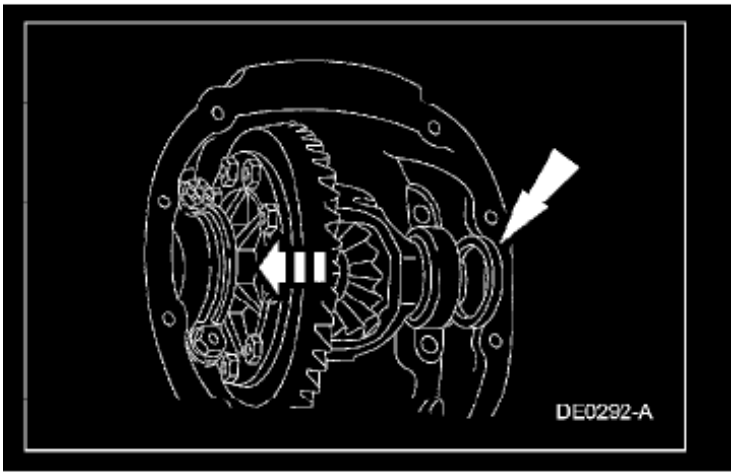
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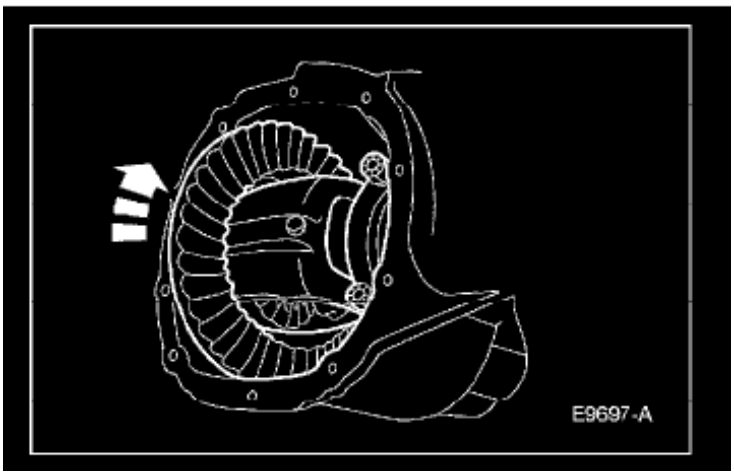

E9697-A

21. NOTE: Always install the bearing caps in their original locations and positions.

NOTE: Apply pressure toward the left side to make sure the LH differential bearing cup seats correctly.

Install the LH bearing cap and loosely install the 2 bolts.

22. Install progressively larger differential bearing shims on the RH side until the largest shim is installed by hand.

23. Install the right side bearing cap and 2 bolts. Tighten the 4 LH and RH bearing cap bolts.

^ Tighten to 112 Nm (83 lb-ft).

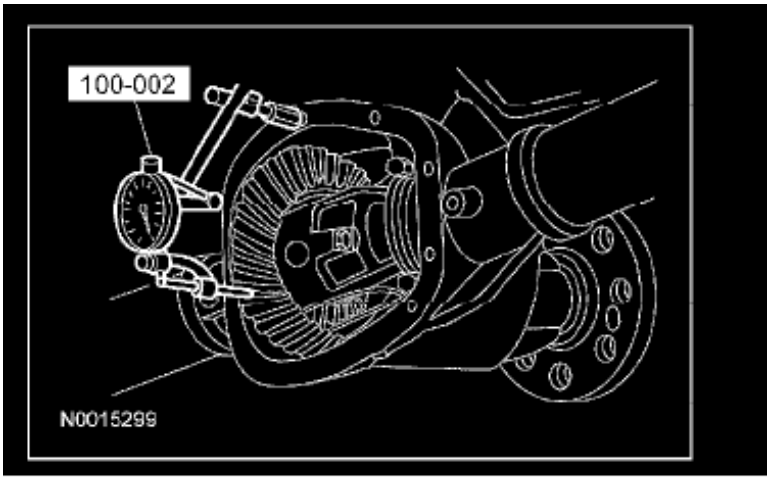
24. Rotate the differential carrier several times to verify the differential bearings have seated correctly.

25. Install the special tools and measure the ring gear backlash.

^ If the backlash is within specification, proceed to Step 28.

^ If a zero backlash condition occurs, proceed to Step 26.

^ If the backlash is not within specification, proceed to Step 27.



Backlash Change Required		Thickness Change Required	
mm	Inch	mm	Inch
0.025	0.001	0.050	0.002
0.050	0.002	0.050	0.002
0.076	0.003	0.101	0.004
0.101	0.004	0.152	0.006
0.127	0.005	0.152	0.006
0.152	0.006	0.203	0.008
0.177	0.007	0.254	0.010
0.203	0.008	0.254	0.010
0.228	0.009	0.304	0.012
0.254	0.010	0.355	0.014
0.279	0.011	0.355	0.014
0.304	0.012	0.406	0.016
0.330	0.013	0.457	0.018

Backlash Change Required		Thickness Change Required	
mm	Inch	mm	Inch
0.335	0.014	0.457	0.018
0.381	0.015	0.508	0.020

26. If a zero backlash condition occurs, add 0.50 mm (0.020 inch) to the RH side shim and subtract 0.50 mm (0.020 inch) from the LH side shim to

allow a backlash indication. Go back to Step 25.

27. To correct for high or low backlash, increase the thickness of one differential bearing shim and decrease the thickness of the other differential

bearing shim by the same amount. Refer to the following tables when adjusting the backlash. When the backlash is within specification, proceed to Step 28.

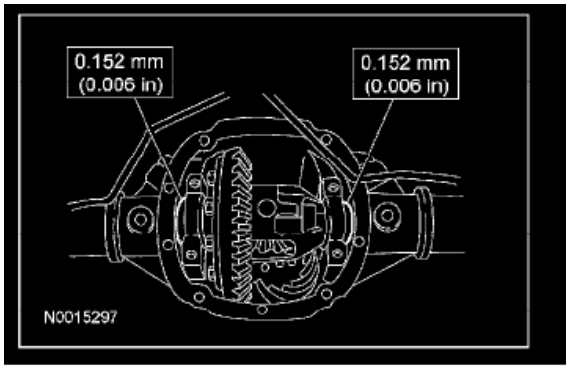
Differential Shim Size Chart 4067

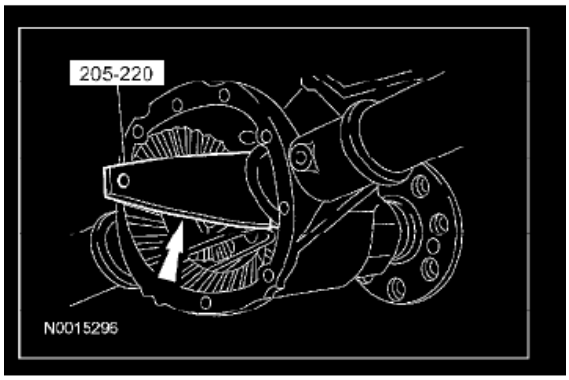
Differential Shim Size Chart 4067

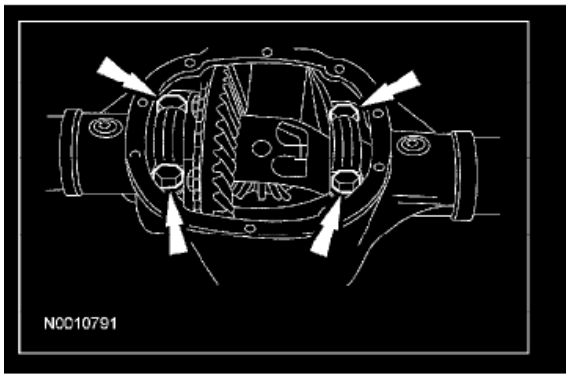
Stripes and Color Code	Dimension A	
	mm	Inch
2 — C-COAL	7.7978-7.8105	0.3070-0.3075
1 — C-COAL	7.7470-7.7597	0.3050-0.3055
5 — BLU	7.6962-7.7089	0.3030-0.3035
4 — BLU	7.6454-7.6581	0.3010-0.3015
3 — BLU	7.5946-7.6073	0.2990-0.2995
2 — BLU	7.5458-7.5565	0.2970-0.2975
5 — PINK	7.4422-7.4549	0.2930-0.2935
4 — PINK	7.3914-7.4041	0.2910-0.2915
3 — PINK	7.3406-7.3533	0.2890-0.2895
2 — PINK	7.2898-7.3025	0.2870-0.2875
1 — PINK	7.2390-7.2517	0.2850-0.2855
5 — GRN	7.1882-7.2009	0.2830-0.2835
4 — GRN	7.1374-7.1501	0.2810-0.2815
3 — GRN	7.0866-7.0993	0.2790-0.2795
2 — GRN	7.0358-7.0485	0.2770-0.2775
1 — GRN	6.9850-7.0485	0.2750-0.2755
5 — WH	6.9342-6.9469	0.2730-0.2735
4 — WH	6.8834-6.8961	0.2710-0.2715
3 — WH	6.8326-6.8453	0.2690-0.2695
2 — WH	6.7818-6.7945	0.2670-0.2675
1 — WH	6.7310-6.7437	0.2650-0.2655
5 — YEL	6.6802-6.6929	0.2630-0.2635
4 — YEL	6.6294-6.6421	0.2610-0.2615
3 — YEL	6.5786-6.5913	0.2590-0.2595
2 — YEL	6.5278-6.5405	0.2570-0.2575
1 — YEL	6.4770-6.4897	0.2550-0.2555
5 — ORNG	6.4262-6.4389	0.2530-0.2535
4 — ORNG	6.3754-6.3881	0.2510-0.2515
3 — ORNG	6.3246-6.3373	0.2490-0.2495
2 — ORNG	6.2738-6.2865	0.2470-0.2475
1 — ORNG	6.2223-6.2357	0.2450-0.2455
2 — RED	6.1722-6.1849	0.2430-0.2435
1 — RED	6.1214-6.1341	0.2410-0.2415

Differential Shim Size Chart 4067

28. Remove the 4 bearing cap bolts and 2 bearing caps. 29. To establish differential bearing preload, increase both LH and RH differential bearing shim size by the thickness shown.


0.152 mm
(0.006 in)
0.152 mm
(0.006 in)
N0015297


205-220
N0015296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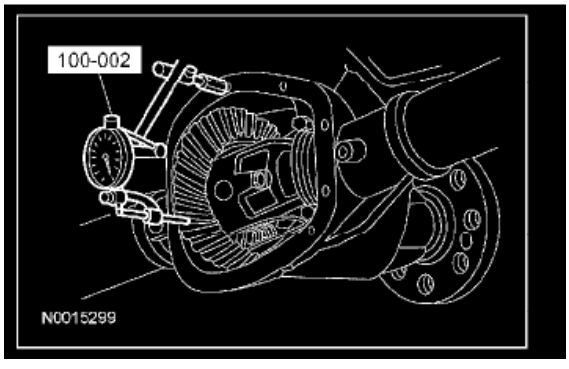
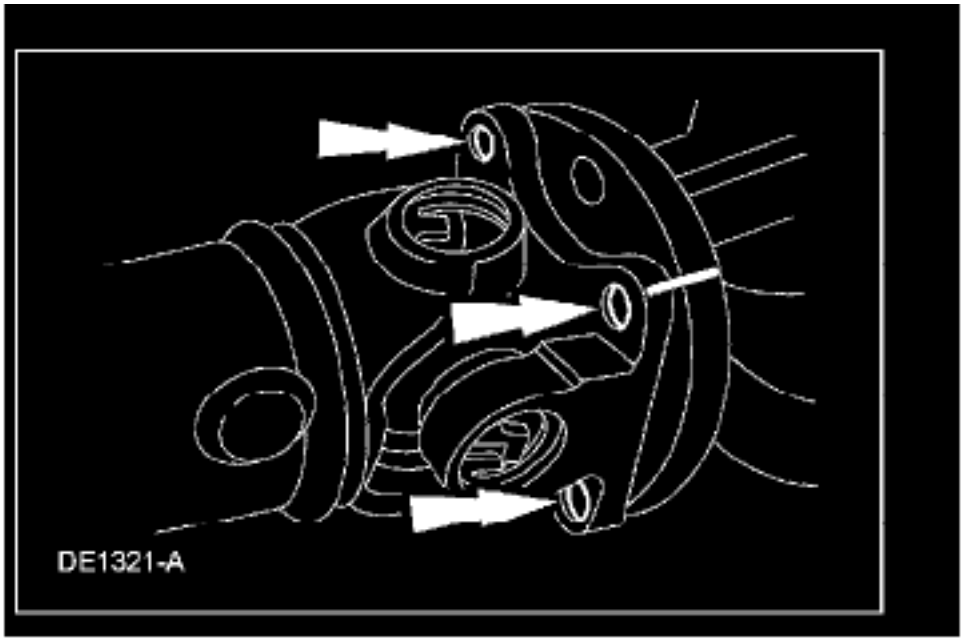

100-002
N0015299

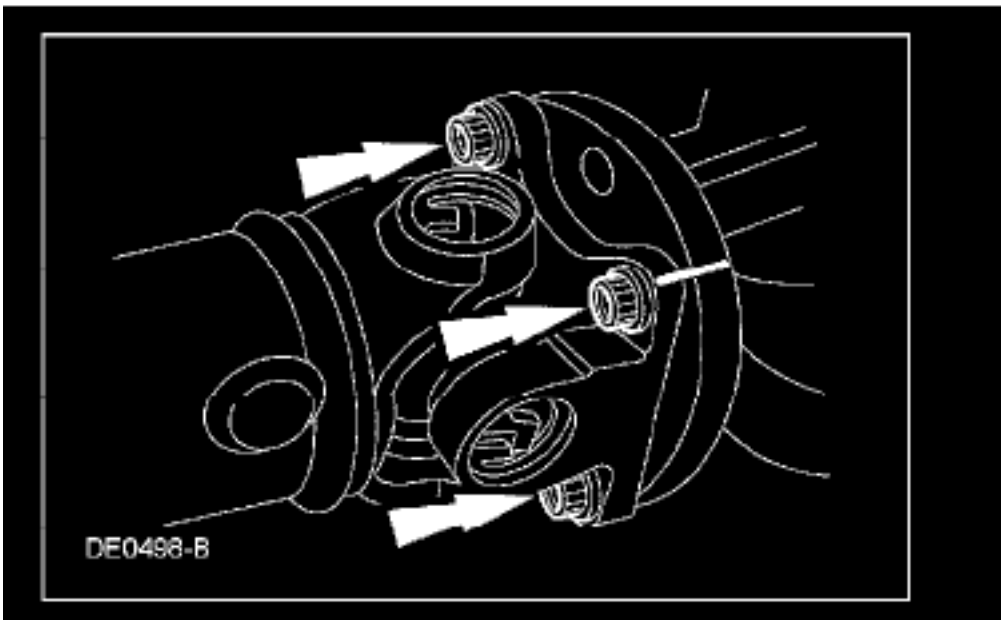
30. Using the special tool, fully seat the differential bearing shims. Make sure the assembly rotates freely.

31. Install the 2 bearing caps and 4 bolts.

^ Tighten to 112 Nm (83 lb-ft).

32. Using the special tools, recheck the ring gear backlash.





33. Apply marking compound and rotate the differential assembly 5 complete revolutions. 34. Verify an acceptable pattern check. 35. Install the axle shafts. 36. Position the driveshaft and align the index marks on the pinion flange.

37. NOTE: The driveshaft centering socket yoke fits tightly on the pinion flange pilot. To make sure that the driveshaft centering socket yoke seats

squarely on the pinion flange, tighten the driveshaft flange bolts evenly in a cross pattern.

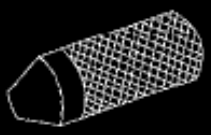
Install the 4 driveshaft flange bolts. ^

Tighten to 112 Nm (83 lb-ft).

Ford 8.8-Inch Ring Gear - Rear Drive Axle/Differential

Differential Ring And Pinion

Special Tool(s)

ST1743-A	Adapter For 205-S127 205-105 (T76P-4020-A3)
ST1429-A	Adapter For 205-S127 205-109 (T76P-4020-A9)
ST1431-A	Adapter For 205-S127 205-110 (T76P-4020-A10)
 ST1432-A	Adapter For 205-S127 205-111 (T76P-4020-A11)
S11743-A	Adapter For 205-S127 205-129 (T79P-4020-A18)
ST1434-A	Adapter For 205-S127 205-130 (T79P-4020-A19)

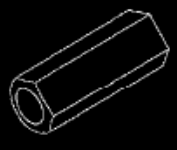
(Continued)

Special Tool(s)

ST1214 A	Dial Indicator Gauge With Bracketry 100-002 (TOOL-4201-C) or equivalent
ST1257-A	Holding Fixture, Drive Pinion Flange 205-126 (T78P-4851-A)
ST1495 A	Installer, Differential Shim 205-220 (T85L-4067-AH)
ST1375-A	Installer, Differential Side Bearing 205-010 (T57L-4221-A2)
ST1367-A	Installer, Drive Pinion Bearing Cone 205-005 (T53T-4621-C)
ST1678-A	Installer, Drive Pinion Bearing Cup 205-024 (T67P-4616-A)
	Installer, Drive Pinion Flange 205-002 (TOOL-4858-E) or equivalent

(Continued)

Special Tool(s)

ST1325-A	Installer, Drive Pinion Oil Seal 205-208 (T83T-4676-A)
ST1254-A	Plate, Bearing Oil Seal 205-090 (T75L-1165-B)
 ST1744-A	Protector, Drive Pinion Thread 205-460 or equivalent
ST1220-A	Remover, Differential Bearing 205-116 (T77F-4220-B1)

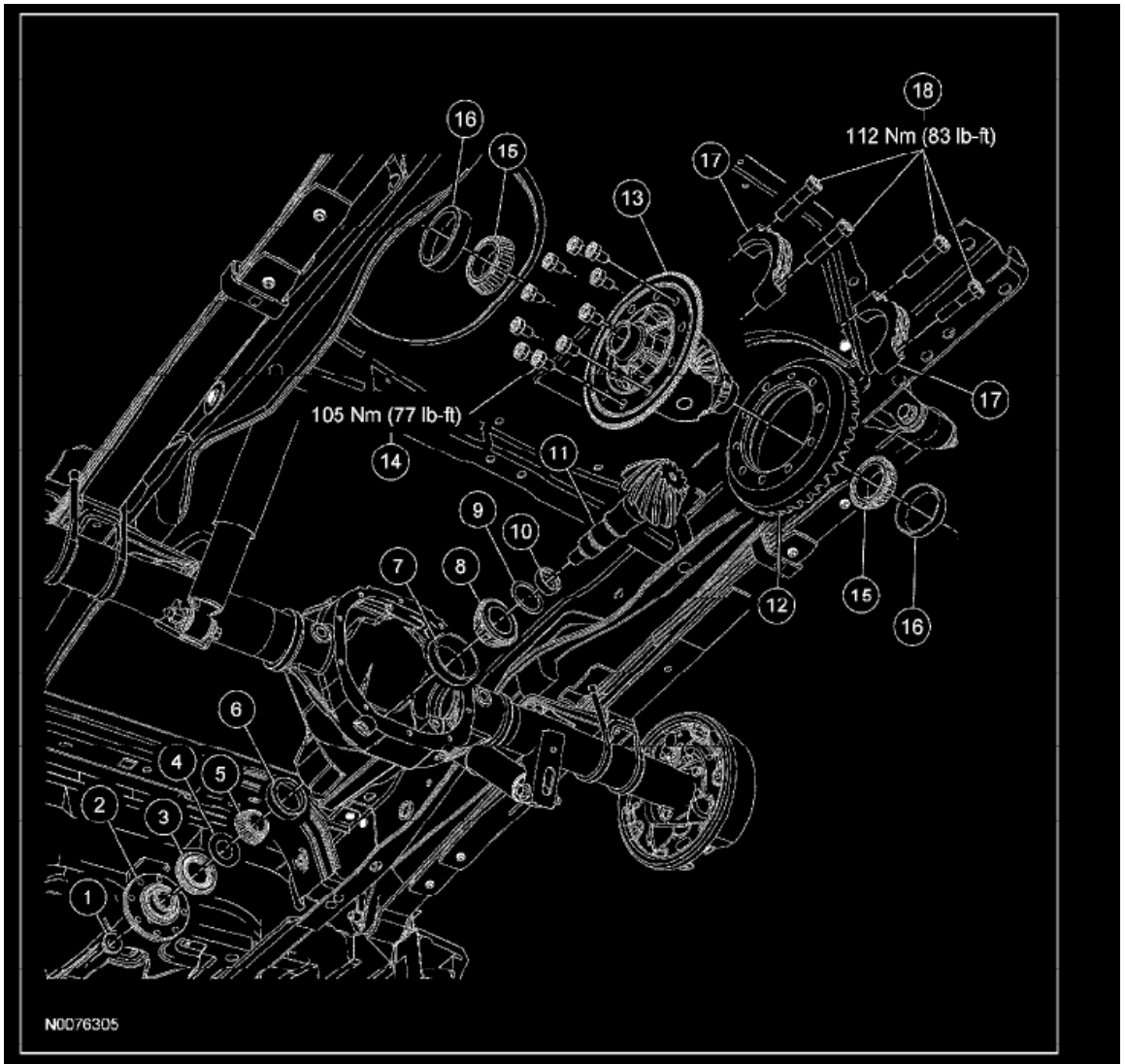
(Continued)

Special Tool(s)

ST1543-A	Step Plate 205-D016 (D80L-630-5) or equivalent
ST2025-A	2-Jaw Puller 205-D072 (D79L-4221-A1) or equivalent

Material

Item	Specification
Motorcraft High Contrast Hypoid Gear Marking Compound XG-14	—



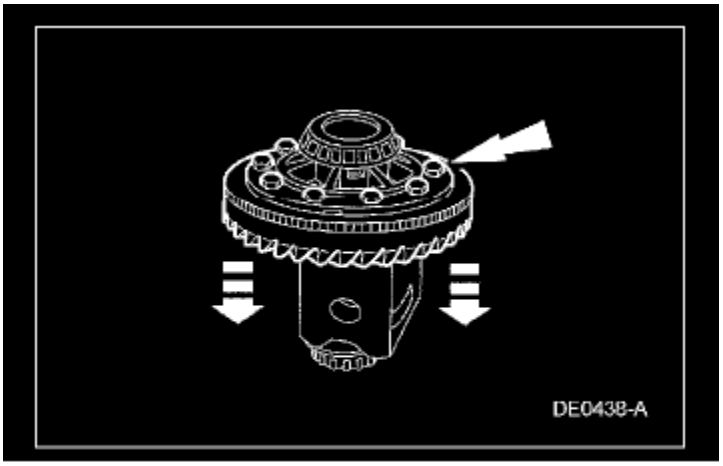
Item	Part Number	Description
1	389546-S	Pinion nut
2	4851	Pinion flange
3	4676	Pinion oil seal
4	4670	Pinion oil slinger
5	4621	Outer pinion bearing
6	4616	Outer pinion bearing cup
7	4628	Inner pinion bearing cup
8	4630	Inner pinion bearing

(Continued)

Item	Part Number	Description
9	4663	Pinion bearing adjustment shim
10	4662	Collapsible spacer
11	4209	Drive pinion
12	4209	Ring gear
13	4204	Differential case
14	4216	Differential ring gear bolt (10 required)
15	4221	Differential bearings (2 required)

(Continued)

Item	Part Number	Description
16	4222	Differential bearing cups (2 required)
17	—	Differential bearing caps (part of 4010)
18	—	Differential bearing cap bolts (part of 4010)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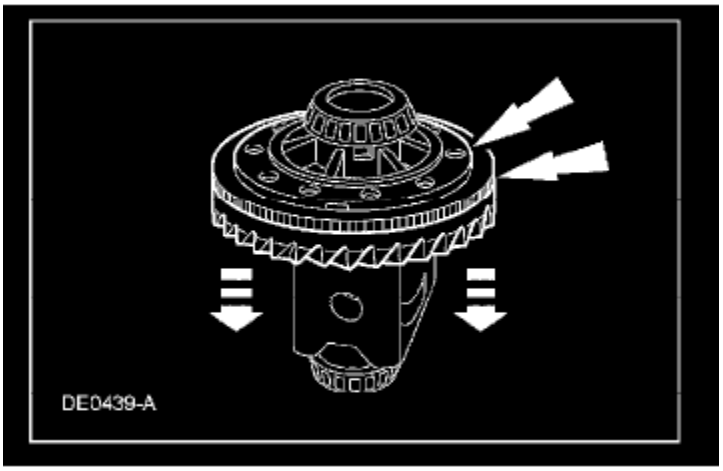
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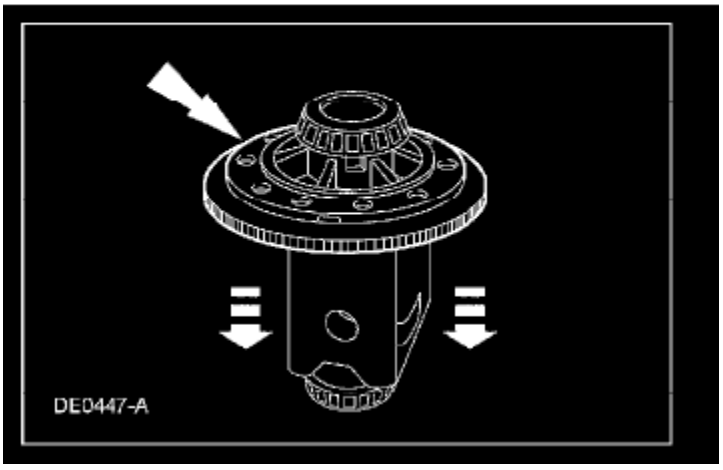

DE0447-A

Removal

1. Remove the differential carrier assembly. 2. Remove and discard the 10 differential ring gear bolts.

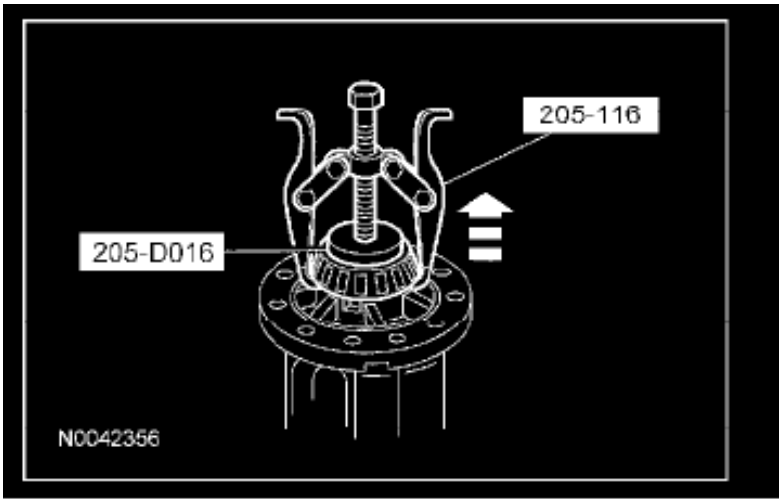
3. NOTE: Care should be taken not to damage the differential ring gear bolt hole threads.

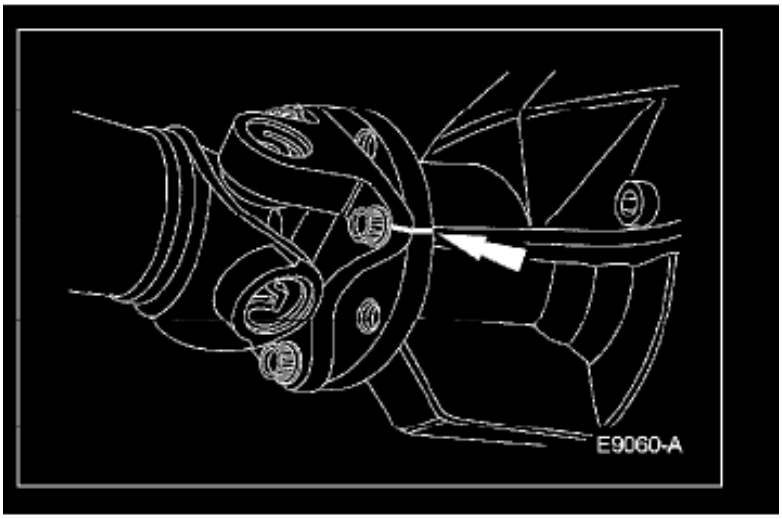
Insert a punch in the differential ring gear bolt holes and drive the differential ring gear off.

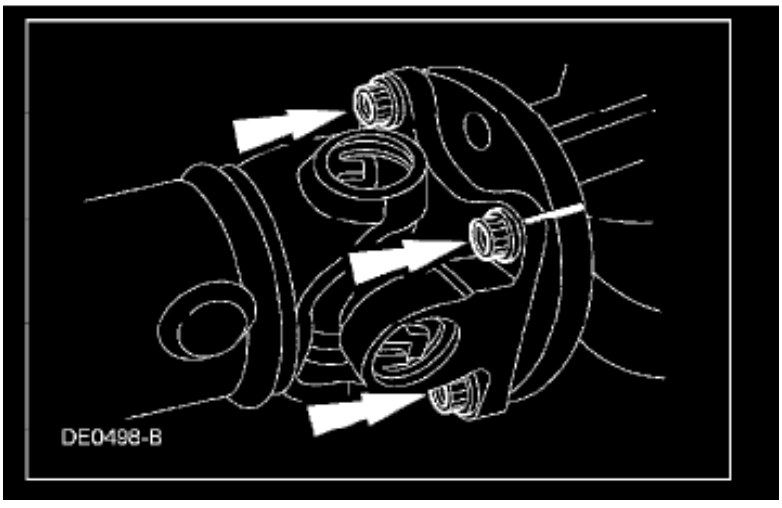
4. NOTE: The anti-lock ring cannot be reused once removed. Remove the anti-lock ring only if damaged.

If necessary, remove the anti-lock ring.

5. Using the special tools, remove the differential bearings.


205-116
205-D016
N0042356


E9060-A


DE0498-B

6. Index-mark the driveshaft flange and pinion flange for correct alignment during installation.

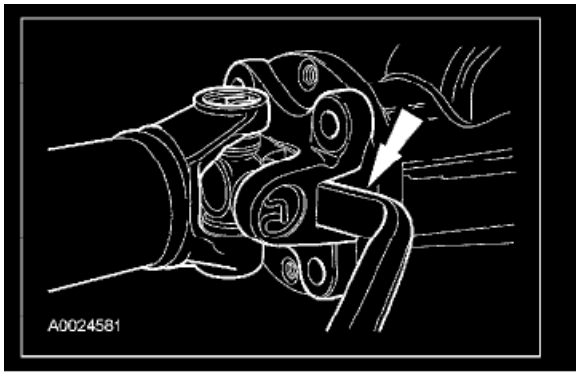
7. Remove the 4 driveshaft flange bolts.

8. CAUTION: The driveshaft centering socket yoke fits tightly on the pinion flange pilot. Never hammer on the driveshaft or any of its

components to disconnect the driveshaft centering socket yoke from the pinion flange. Pry only in the area shown with a suitable tool to disconnect the driveshaft centering socket yoke from the pinion flange or damage to the component may occur.

Using a suitable tool as shown, disconnect the driveshaft centering socket yoke from the pinion flange. ^

Using mechanic's wire, position the driveshaft aside.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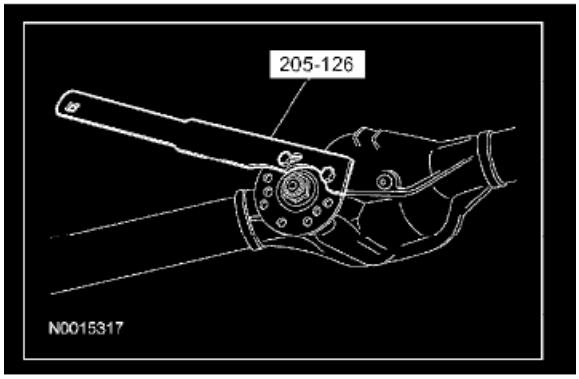
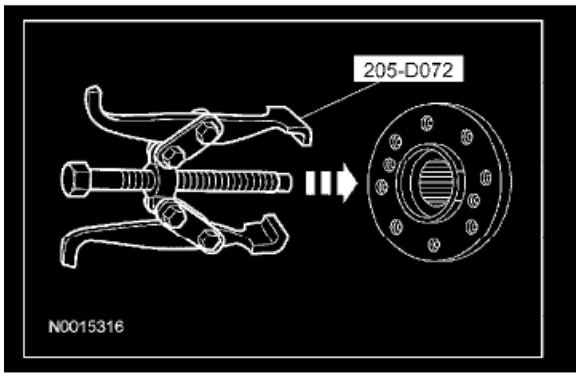

205-126
N0015317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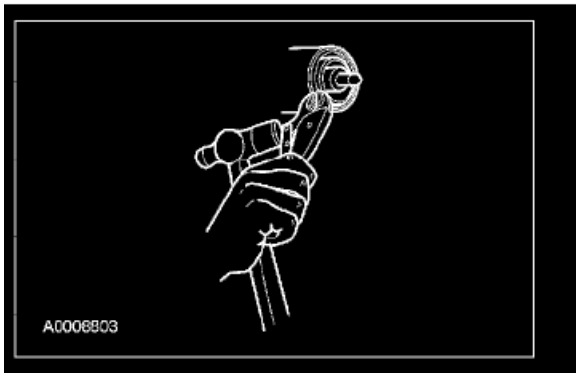
N0015316

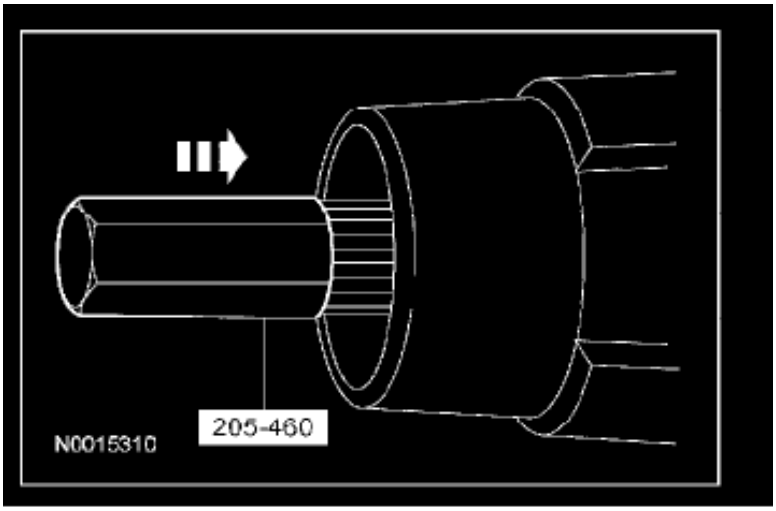

A0006803

9. Using the special tool to hold the pinion flange, remove and discard the pinion nut.

10. Using the special tool, remove the pinion flange.

11. Force up on the metal flange of the drive pinion seal. Install gripping pliers and strike with a hammer until the drive pinion seal is removed.

12. Remove the drive pinion shaft oil slinger and the outer drive pinion bearing.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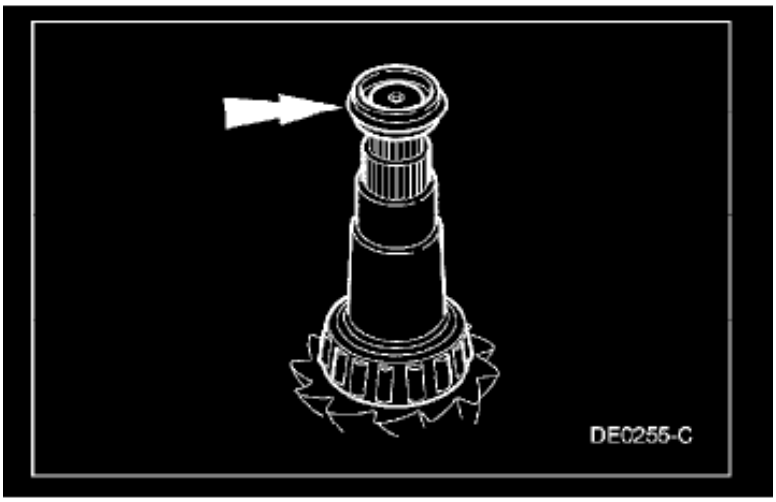
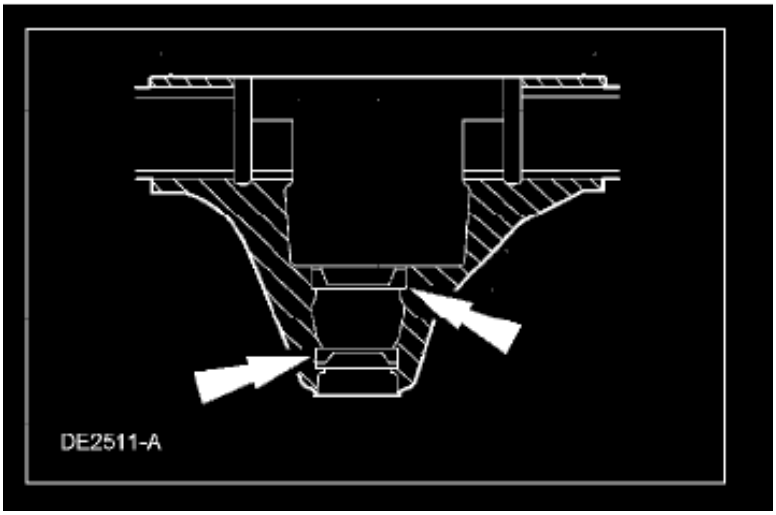
N0015310


DE0255-C


DE2511-A

13. Install the special tool. Using a soft-faced hammer, drive the pinion assembly out of the axle housing.

14. Remove and discard the drive pinion collapsible spacer.

15. Using a brass drift, remove the drive pinion bearing cups by tapping alternately on opposite sides of the drive pinion bearing cups.

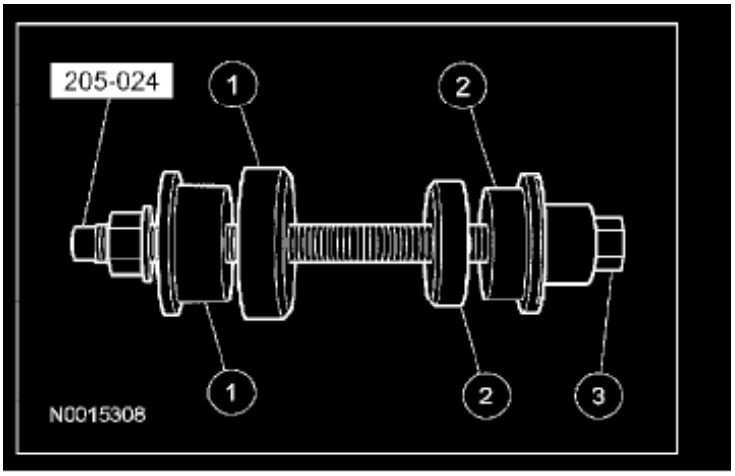
Installation

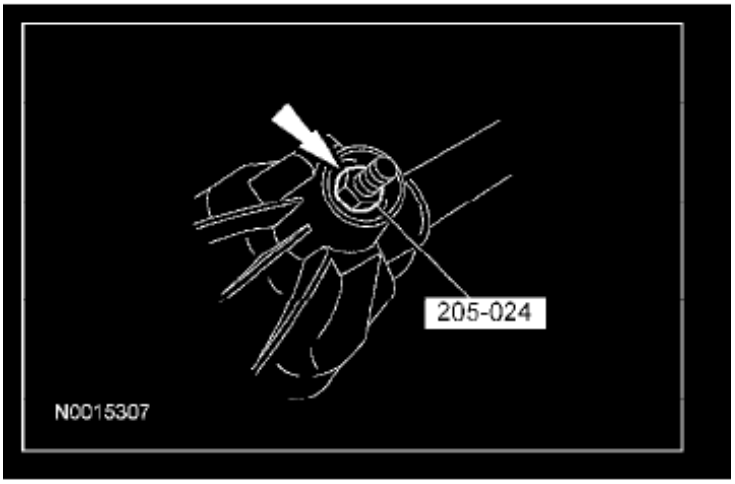
1. Position the special tool and the inner and outer drive pinion bearing cups in their respective bores.

1 After placing the inner and outer drive pinion bearing cups in their bores, place the special tool (inner) on the inner drive pinion bearing cup.

2 Place the special tool (outer) on the outer drive pinion bearing cup.

3 Install the special tool.


205-024
1
2
1
2
3
N0015308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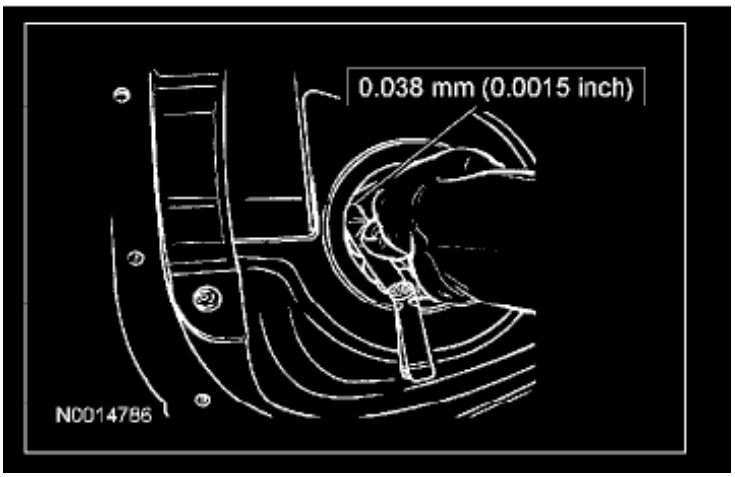
N0015307


0.038 mm (0.0015 inch)
N0014786

2. Tighten the special tool to seat the drive pinion bearing cups into their bores.

3. NOTE: If a feeler gauge can be inserted between a drive pinion bearing cup and the bottom of its bore at any point around the drive pinion

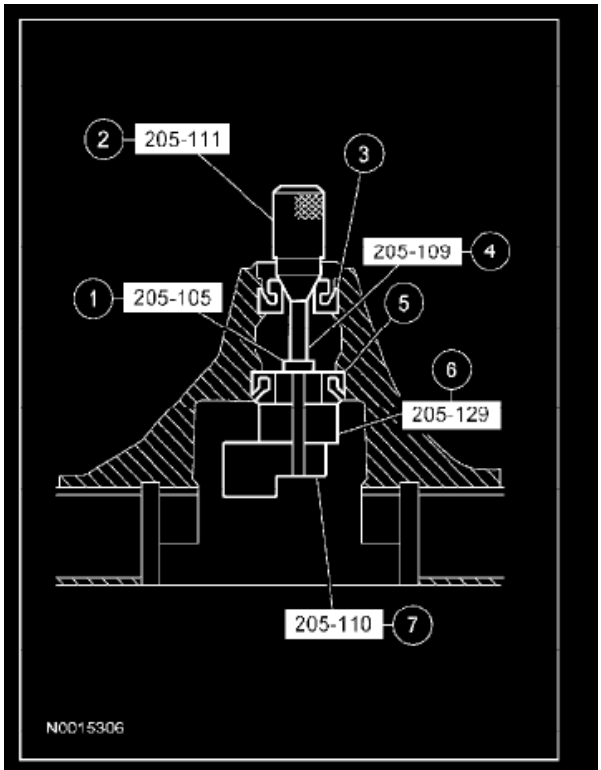
bearing cup, the drive pinion bearing cup is not correctly seated.

Make sure the drive pinion bearing cups are correctly seated in their bores.

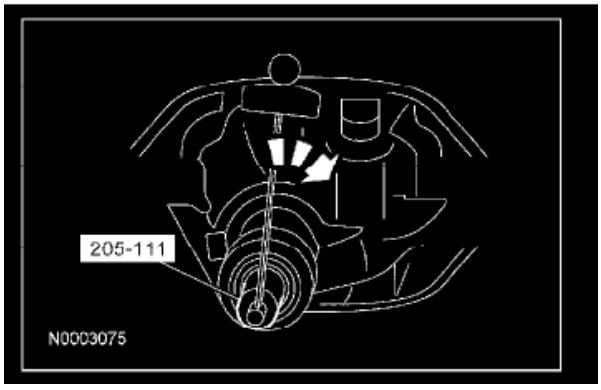
4. NOTE: Install new drive pinion bearings without any additional lubricant since the anti-rust oil provides adequate lubricant without upsetting the

drive pinion bearing preload settings.

Assemble and position the special tools.



Item	Part Number	Description
1	205-105	Adapter for 205-S127 (1.612 in O.D.) (T76P-4020-A3)
2	205-111	Adapter for 205-S127 (T76P-4020-A11)
3	4621	Drive pinion bearing (outer)
4	205-109	Adapter for 205-S127 (T76P-4020-A9)
5	4630	Drive pinion bearing (inner)
6	205-129	Adapter for 105-S127 (1.1884 in thick) (T79P-4020-A18)
7	205-110	Adapter for 205-S127 (1.7 in thick) (T76P-4020-A10)

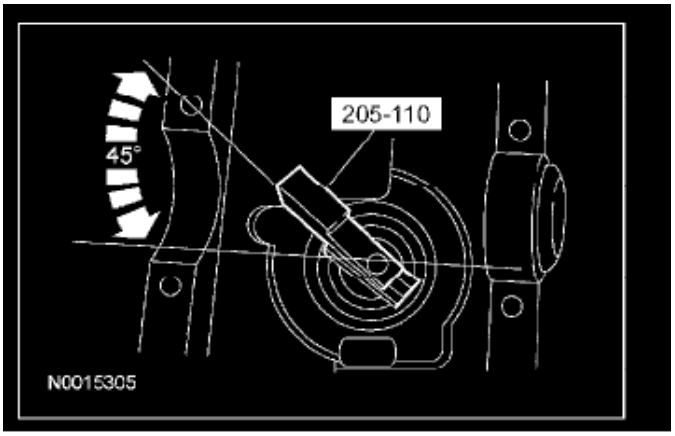


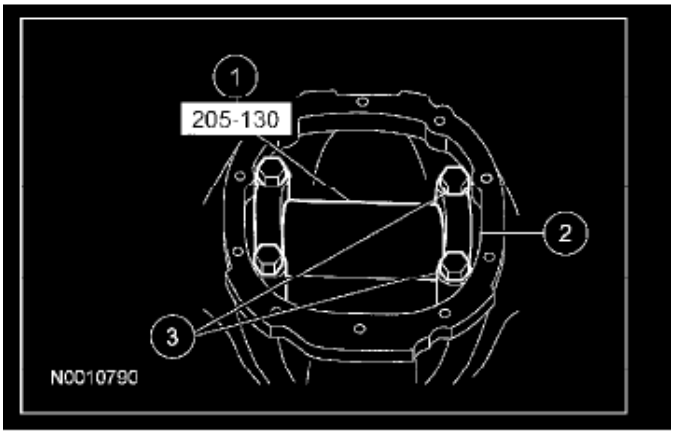
5. NOTE: This step duplicates final drive pinion bearing preload.

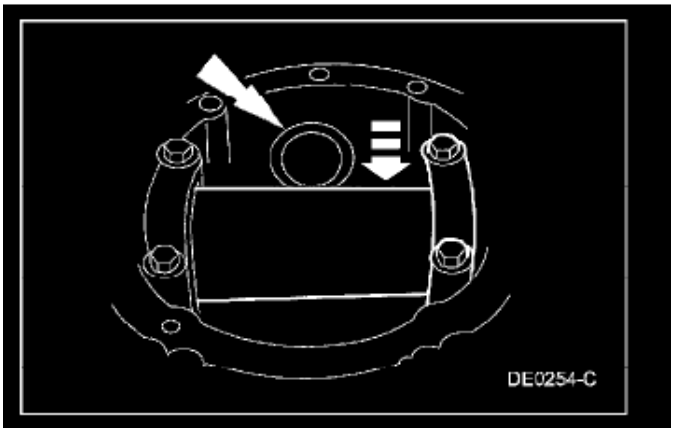
Tighten the special tool. Tighten to 2.2 Nm (20 lb-inch) rotational torque.

6. NOTE: The special tool must be offset to obtain an accurate reading.

Rotate the special tool several half-turns to make sure of correct seating of the drive pinion bearings and position the special tool.


205-110
45°
N0015305


1
205-130
2
3
N0010790


DE0254-C

7. Install the special tool. 1 Position the special tool. 2 Install the 2 differential bearing caps. 3 Install the 4 differential bearing cap bolts. 1 Tighten to

112 Nm (83 lb-ft).

8. NOTE: Drive pinion bearing adjustment shims must be flat and clean.

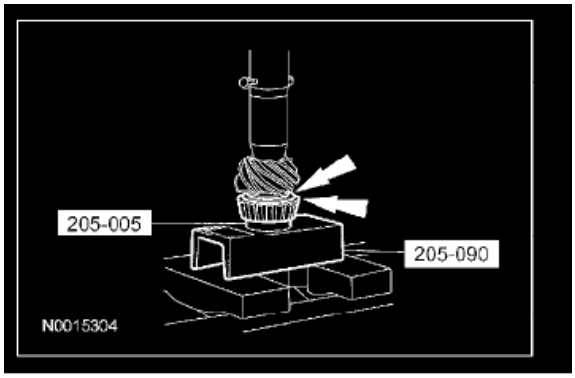
NOTE: A slight drag should be felt for correct drive pinion bearing adjustment shim selection. Do not attempt to force the drive pinion bearing adjustment shim between the gauge block and the gauge tube. This will minimize selection of a drive pinion bearing adjustment shim thicker than required, which results in a deep tooth contact in final assembly of integral axle assemblies.

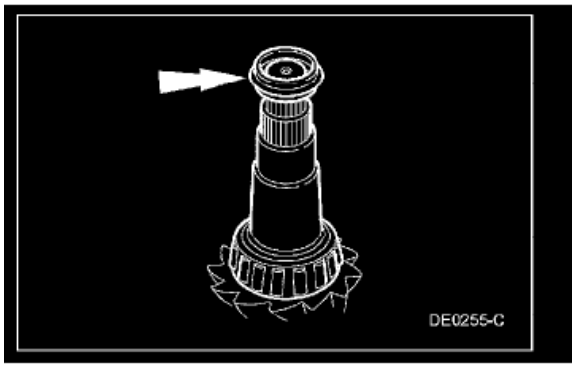
Use a drive pinion bearing adjustment shim as a gauge for drive pinion bearing adjustment shim selection. ^

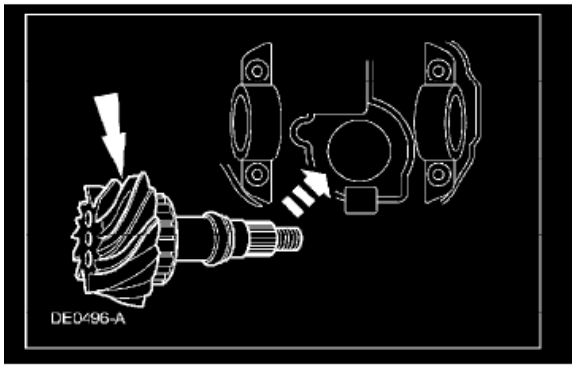
After the correct drive pinion bearing adjustment shim thickness has been determined, remove all of the special tools.

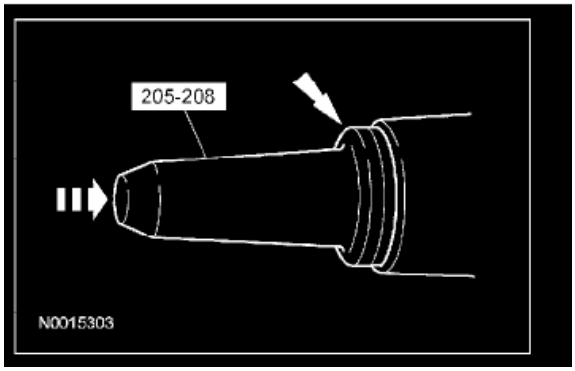
9. Using the special tool and a shop press, drive the inner drive pinion bearing and the selected drive pinion bearing adjustment shim until they are

firmly seated on the pinion shaft.


205-005
205-090
N0015304


DE0255-C


DE0496-A

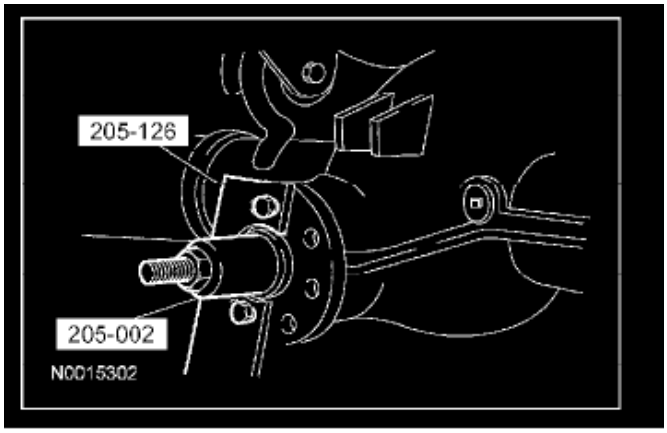

205-208
N0015303

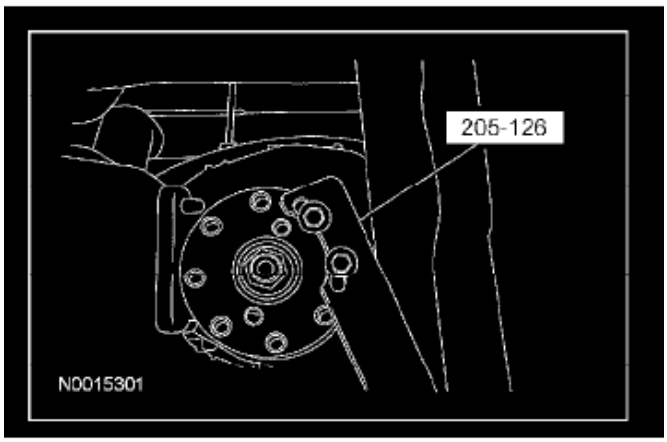
10. Install a new drive pinion collapsible spacer on the pinion shaft against the pinion shaft shoulder.

11. Install the drive pinion assembly into the axle housing.

12. Install the outer drive pinion bearing and the drive pinion shaft oil slinger. 13. Using the special tools, install the drive pinion seal.

14. Using the special tools, install the drive pinion flange.


205-126
205-002
N0015302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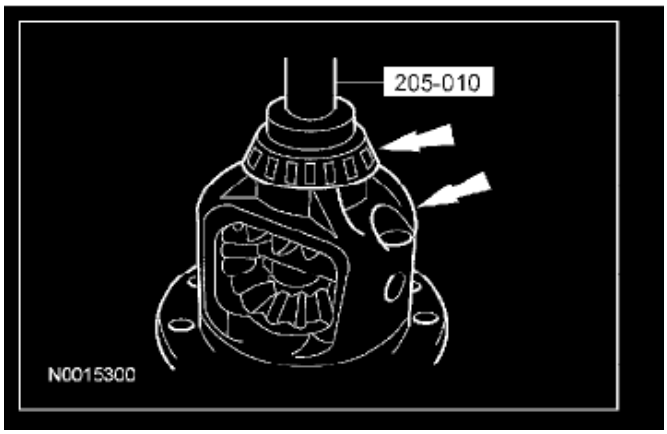

205-010
N0015300

15. CAUTION: Do not, under any circumstance, loosen the drive pinion nut to reduce pinion bearing preload or damage to the component

may occur. If it is necessary to reduce the preload, install a new drive pinion collapsible spacer and drive pinion nut.

NOTE: Remove the special tool while taking rotational pinion bearing preload checks with the Nm (lb-inch) torque wrench.

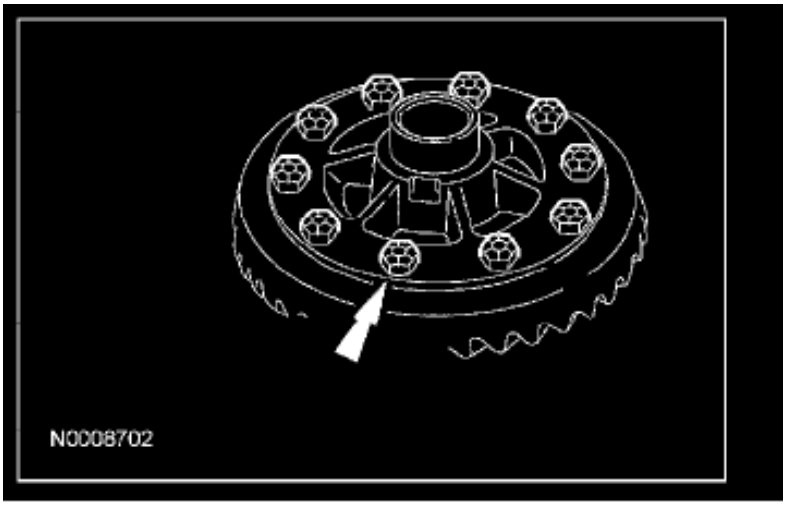
Use the special tool to hold the pinion flange while tightening the pinion nut. ^

Rotate the pinion occasionally to make sure the differential pinion bearings are seating correctly. Take frequent differential pinion bearing preload checks by rotating the differential pinion with a Nm (lb-inch) torque wrench. Tighten the pinion nut in small increments to avoid excessive pinion bearing preload. Tighten the pinion nut until the drive pinion bearing preload is in specification.

16. Using the special tool, install the 2 new differential bearings.

17. Install the 10 new differential ring gear bolts.

^ Tighten to 105 Nm (77 lb-ft).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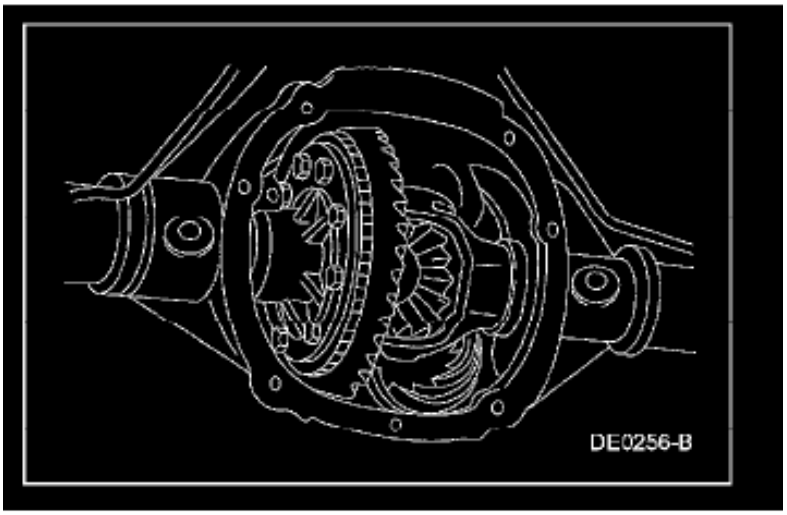
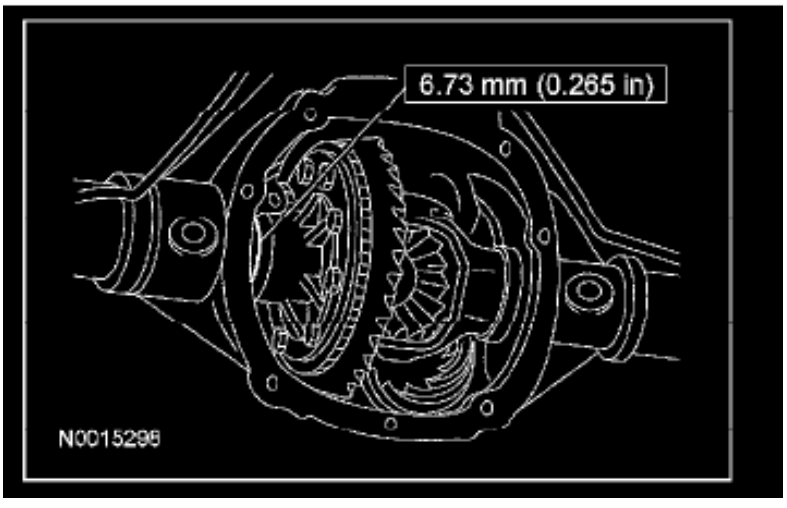

DE0256-B


6.73 mm (0.265 in)
N0015298

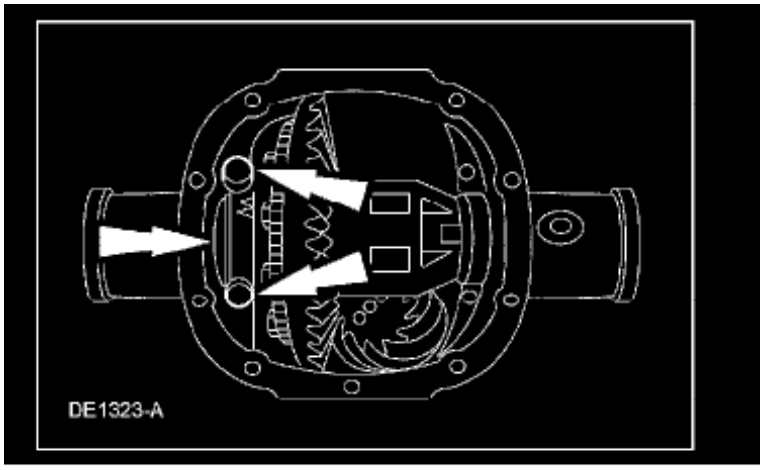
18. Position the differential carrier assembly and the new differential bearing cups in the differential housing.

19. Install a differential bearing shim of the shown dimension on the left side.

20. CAUTION: Always install the bearing caps in their original locations and positions or damage to the component may occur.

NOTE: Apply pressure toward the LH side to make sure the left differential bearing cup seats correctly.

Install the LH bearing cap and loosely install the 2 bolts.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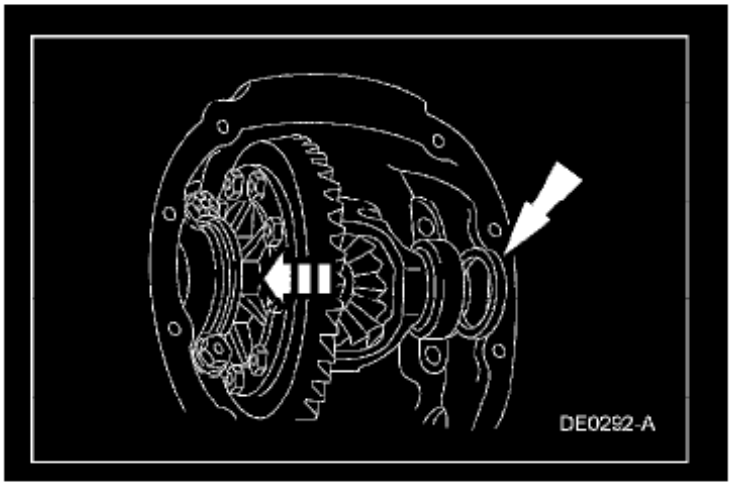
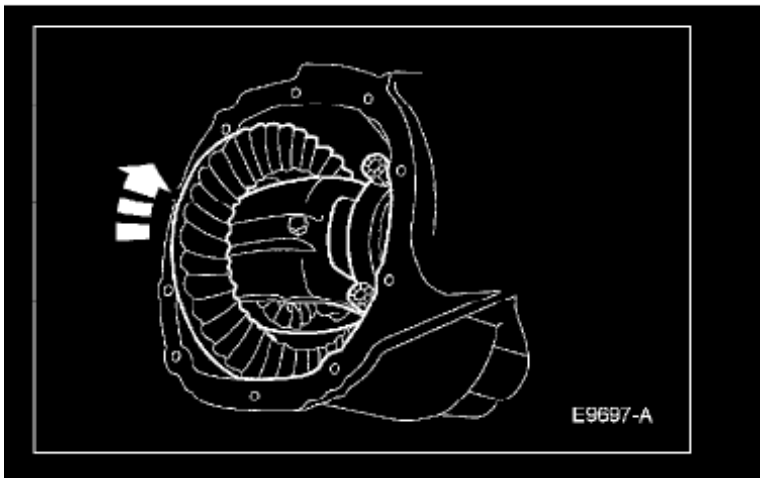

DE0292-A


E9697-A

21. Install progressively larger differential bearing shims on the RH side until the largest shim is installed by hand.

22. Install the right side bearing cap and 2 bolts. Tighten the 4 LH and RH bearing cap bolts.

^ Tighten to 112 Nm (83 lb-ft).

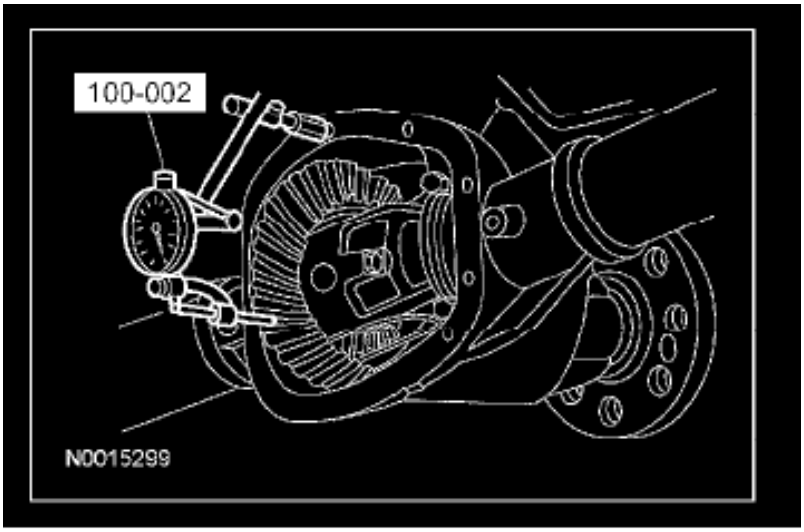
23. Rotate the differential carrier several times to verify the differential bearings have seated correctly.

24. Install the special tools and measure the ring gear backlash.

^ If the backlash is within specification, proceed to Step 27.

^ If a zero backlash condition occurs, proceed to Step 25.

^ If the backlash is not within specification, proceed to Step 26.



Backlash Change Required		Thickness Change Required	
mm	In	mm	In
0.025	0.001	0.050	0.002
0.050	0.002	0.050	0.002
0.076	0.003	0.101	0.004
0.101	0.004	0.152	0.006
0.127	0.005	0.152	0.006
0.152	0.006	0.203	0.008
0.177	0.007	0.254	0.010
0.203	0.008	0.254	0.010
0.228	0.009	0.304	0.012
0.254	0.010	0.355	0.014
0.279	0.011	0.355	0.014
0.304	0.012	0.406	0.016
0.330	0.013	0.457	0.018
0.335	0.014	0.457	0.018
0.381	0.015	0.508	0.020

25. If a zero backlash condition occurs, add 0.50 mm (0.020 inch) to the RH side shim and subtract 0.50 mm (0.020 inch) from the LH side shim to

allow a backlash indication. Go back to Step 24.

26. To correct for high or low backlash, increase the thickness of one differential bearing shim and decrease the thickness of the other differential

bearing shim by the same amount. Refer to the following tables when adjusting the backlash. When the backlash is within specification, proceed to Step 27.

Differential Shim Size Chart 4067

Differential Shim Size Chart 4067

Stripes and Color Code	Dimension A	
	mm	In
2 — C-COAL	7.7978-7.8105	0.3070-0.3075
1 — C-COAL	7.7470-7.7597	0.3050-0.3055
5 — BLU	7.6962-7.7089	0.3030-0.3035
4 — BLU	7.6454-7.6581	0.3010-0.3015
3 — BLU	7.5946-7.6073	0.2990-0.2995
2 — BLU	7.5458-7.5565	0.2970-0.2975
5 — PINK	7.4422-7.4549	0.2930-0.2935
4 — PINK	7.3914-7.4041	0.2910-0.2915
3 — PINK	7.3406-7.3533	0.2890-0.2895
2 — PINK	7.2898-7.3025	0.2870-0.2875
1 — PINK	7.2390-7.2517	0.2850-0.2855
5 — GRN	7.1882-7.2009	0.2830-0.2835

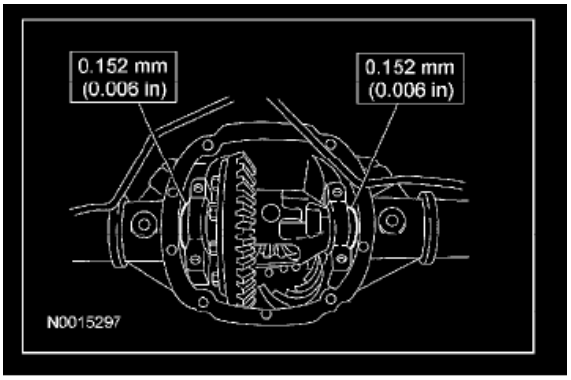
Differential Shim Size Chart 4067 (Continued)

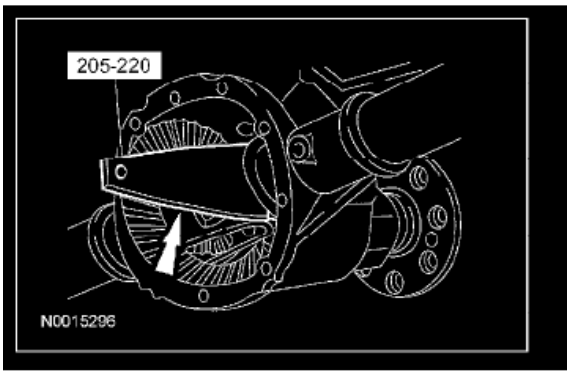
Stripes and Color Code	Dimension A	
	mm	In
4 — GRN	7.1374-7.1501	0.2810-0.2815
3 — GRN	7.0866-7.0993	0.2790-0.2795
2 — GRN	7.0358-7.0485	0.2770-0.2775
1 — GRN	6.9850-7.0485	0.2750-0.2755
5 — WH	6.9342-6.9469	0.2730-0.2735
4 — WH	6.8834-6.8961	0.2710-0.2715
3 — WH	6.8326-6.8453	0.2690-0.2695
2 — WH	6.7818-6.7945	0.2670-0.2675
1 — WH	6.7310-6.7437	0.2650-0.2655
5 — YEL	6.6802-6.6929	0.2630-0.2635
4 — YEL	6.6294-6.6421	0.2610-0.2615
3 — YEL	6.5786-6.5913	0.2590-0.2595
2 — YEL	6.5278-6.5405	0.2570-0.2575
1 — YEL	6.4770-6.4897	0.2550-0.2555
5 — ORNG	6.4262-6.4389	0.2530-0.2535
4 — ORNG	6.3754-6.3881	0.2510-0.2515
3 — ORNG	6.3246-6.3373	0.2490-0.2495
2 — ORNG	6.2738-6.2865	0.2470-0.2475
1 — ORNG	6.2223-6.2357	0.2450-0.2455
2 — RED	6.1722-6.1849	0.2430-0.2435
1 — RED	6.1214-6.1341	0.2410-0.2415

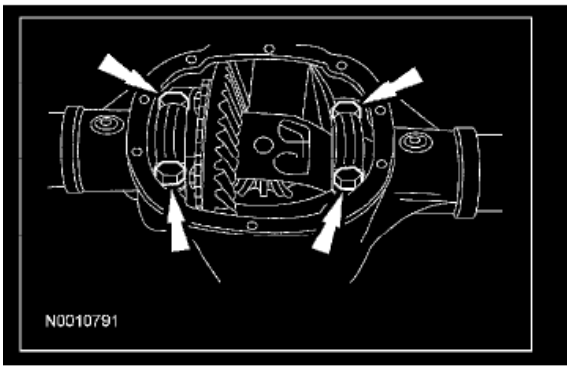
Differential Shim Size Chart 4067 (Part 1)

Differential Shim Size Chart 4067 (Part 2)

27. Remove the 4 bearing cap bolts and 2 bearing caps. 28. To establish differential bearing preload, increase both LH and RH differential bearing shim size by the thickness shown.


0.152 mm
(0.006 in)
0.152 mm
(0.006 in)
N0015297


205-220
N0015296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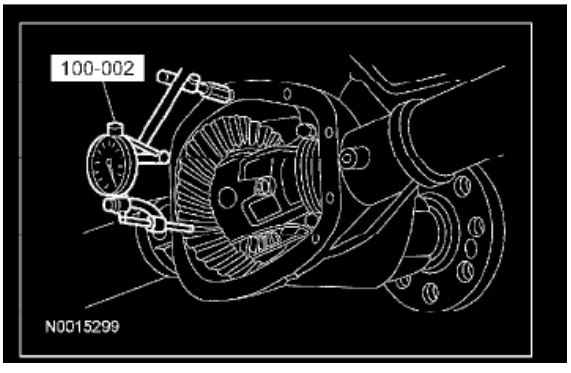
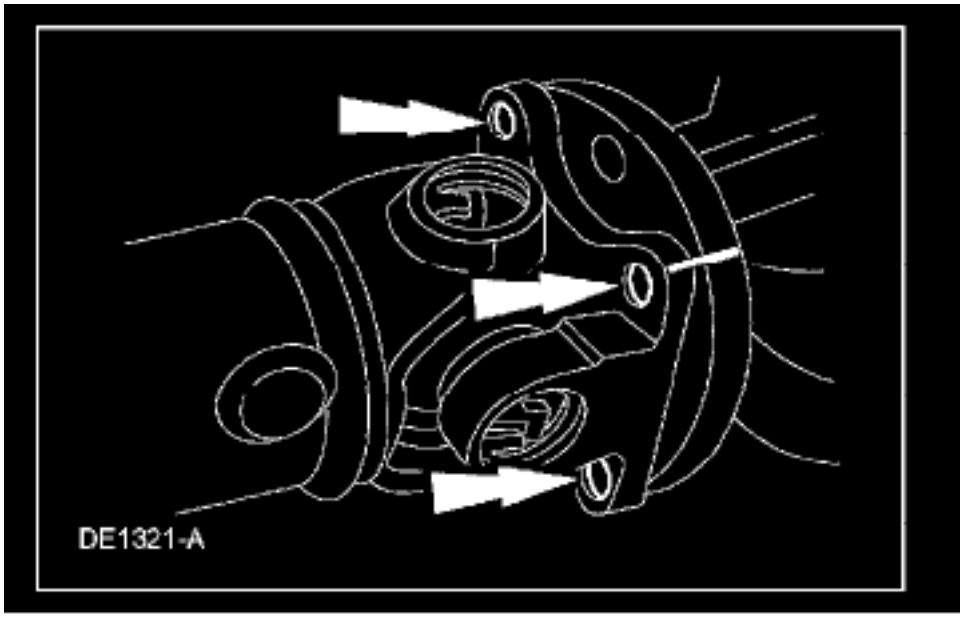

100-002
N0015299

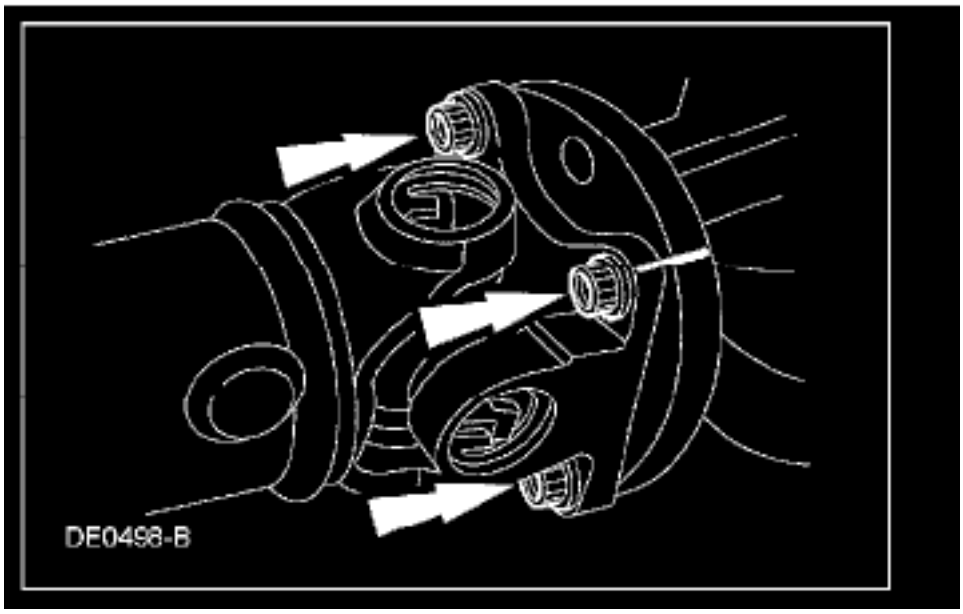
29. Using the special tool, fully seat the differential bearing shims, Make sure the assembly rotates freely.

30. Install the 2 bearing caps and 4 bolts.

^ Tighten to 112 Nm (83 lb-ft).

31. Using the special tool, recheck the ring gear backlash.





32. Apply marking compound and rotate the differential assembly 5 complete revolutions. 33. Check for an acceptable pattern. 34. Install the axle shafts. 35. Position the driveshaft and align the

index marks on the pinion flange.

36. CAUTION: The driveshaft centering socket yoke fits tightly on the pinion flange pilot. To make sure that the driveshaft centering socket

yoke seats squarely on the pinion flange, tighten the driveshaft flange bolts evenly in a cross pattern or damage to the component may occur.

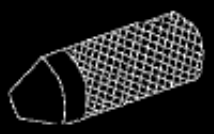
Install the 4 driveshaft flange bolts. ^

Tighten to 103 Nm (76 lb-ft).

Ford 8.8-Inch Ring Gear High Torque - Rear Drive Axle/Differential

Differential Ring And Pinion

Special Tool(s)

ST1743-A	Adapter For 205-S127 205-105 (T76P-4020-A3)
ST1429-A	Adapter For 205-S127 205-109 (T76P-4020-A9)
ST1431-A	Adapter For 205-S127 205-110 (T76P-4020-A10)
 ST1432-A	Adapter For 205-S127 205-111 (T76P-4020-A11)
ST1743-A	Adapter For 205-S127 205-129 (T79P-4020-A18)
ST1434-A	Adapter For 205-S127 205-130 (T79P-4020-A19)

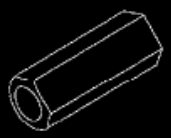
(Continued)

Special Tool(s)

ST1214-A	Dial Indicator Gauge With Bracketry 100-002 (TOOL-4201-C) or equivalent
ST1257-A	Holding Fixture, Drive Pinion Flange 205-126 (T78P-4851-A)
ST1367 A	Installer, Drive Pinion Bearing Cone 205-005 (T53T-4621-C)
ST1678-A	Installer, Drive Pinion Bearing Cup 205-024 (T67P-4616-A)
ST1485-A	Installer, Differential Shim 205-220 (T85L-4067-AH)
ST1375-A	Installer, Differential Side Bearing 205-010 (T57L-4221-A2)
	Installer, Drive Pinion Flange 205-002 (TOOL-4858-E) or equivalent

(Continued)

Special Tool(s)

ST1325-A	Installer, Drive Pinion Oil Seal 205-208 (T83T-4676-A)
ST1254-A	Plate, Bearing Oil Seal 205-090 (T75L-1165-B)
 ST1744-A	Protector, Drive Pinion Thread 205-460 or equivalent
ST1220-A	Remover, Differential Bearing 205-116 (T77F-4220-B1)

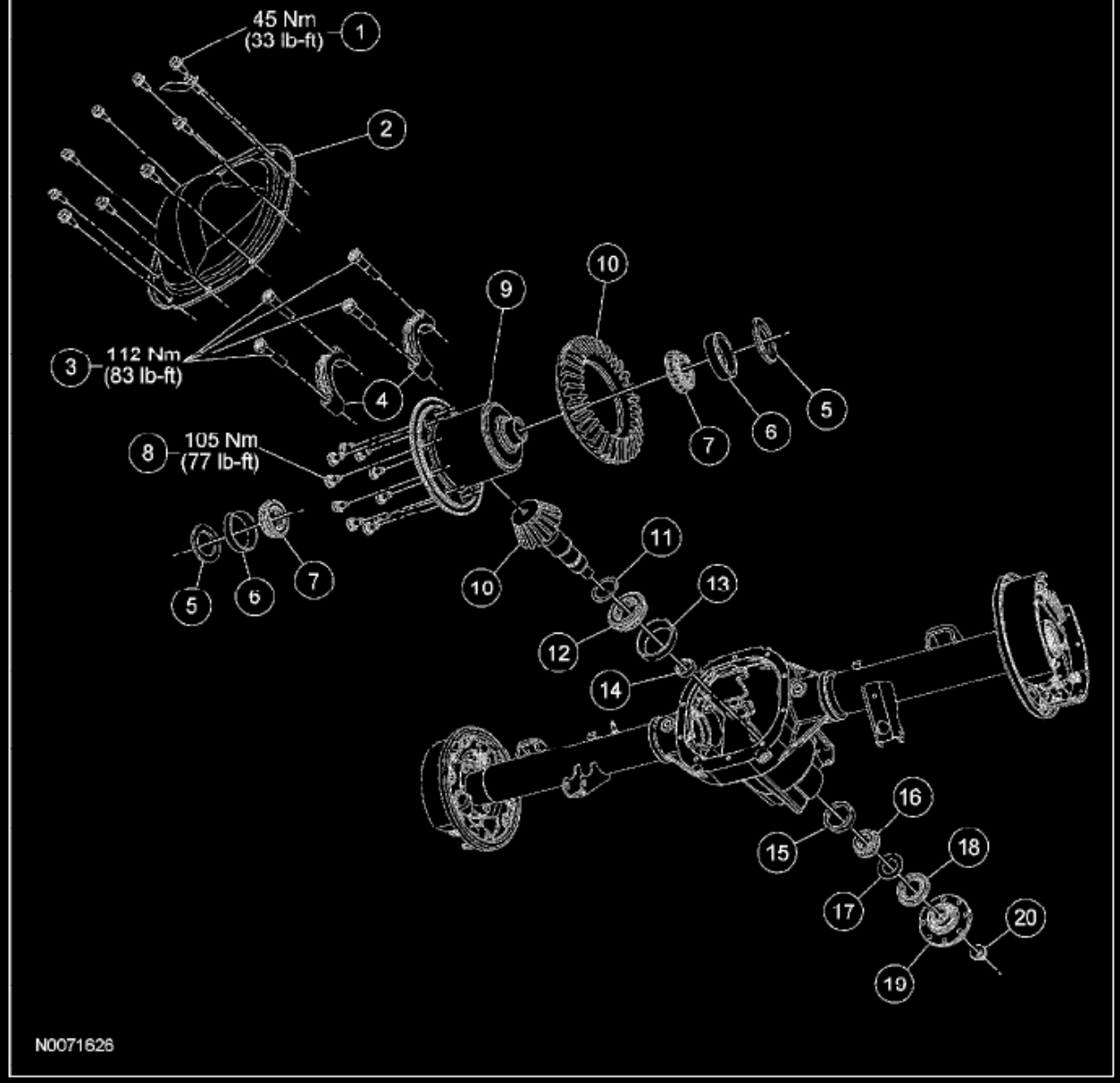
(Continued)

Special Tool(s)

ST1543-A	Step Plate 205-D016 (D80L-630-5) or equivalent
ST2026-A	2-Jaw Puller 205-D072 (D79L-4221-A1) or equivalent

Material

Item	Specification
Additive Friction Modifier XL-3	EST-M2C118-A
Motorcraft SAE 75W-140 High Performance Rear Axle Lubricant XY-75W140-QL	WSL-M2C192-A



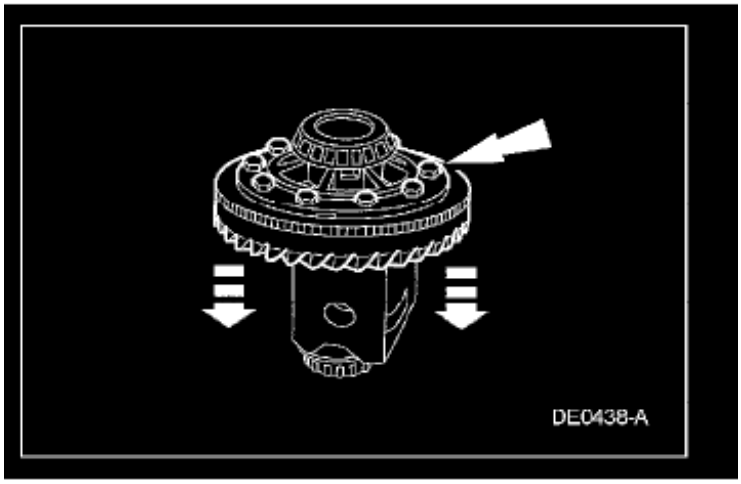
Item	Part Number	Description
1	4346	Differential housing cover bolts (10 required)
2	4033	Differential housing cover
3	—	Differential bearing cap bolts (4 required) (part of 4010)
4	—	Differential bearing caps (2 required) (part of 4010)
5	4067	Differential bearing shims (2 required)
6	4222	Differential bearing cups (2 required)

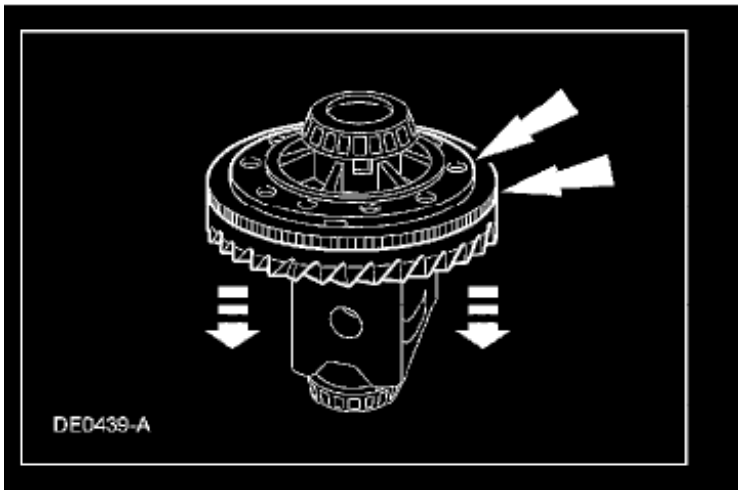
(Continued)

Item	Part Number	Description
7	4221	Differential bearings (2 required)
8	4216	Ring gear bolts (10 required)
9	4204	Differential assembly
10	4209	Ring gear
10	4209	Drive pinion
11	4663	Pinion bearing adjustment shim
12	4628	Inner pinion bearing cup
13	4630	Inner pinion bearing

(Continued)

Item	Part Number	Description
14	4662	Collapsible spacer
15	4616	Outer pinion bearing cup
16	4621	Outer pinion bearing
17	4670	Oil slinger
18	4676	Drive pinion oil seal
19	4851	Drive pinion flange
20	389546 S	Drive pinion nut





Removal

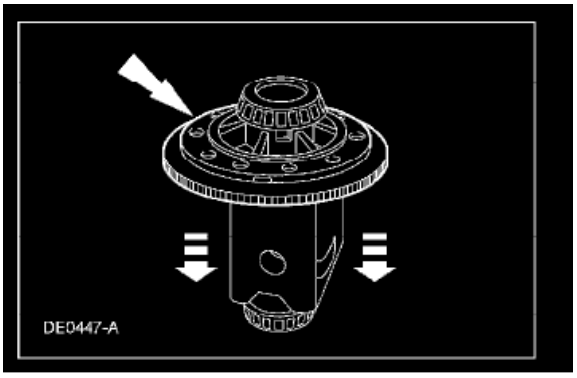
1. Remove the rear driveshaft. 2. Remove the differential carrier. 3. Remove and discard the 10 differential ring gear bolts.

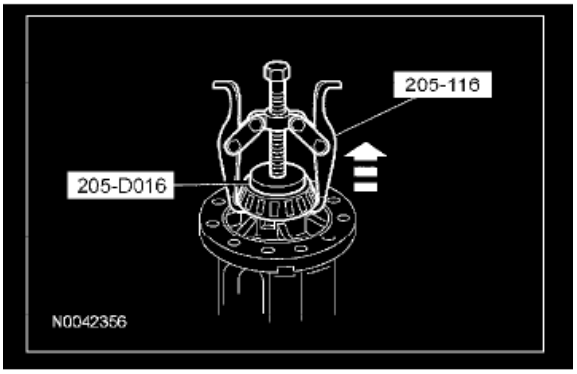
4. NOTE: Care should be taken not to damage the differential ring gear bolt hole threads.

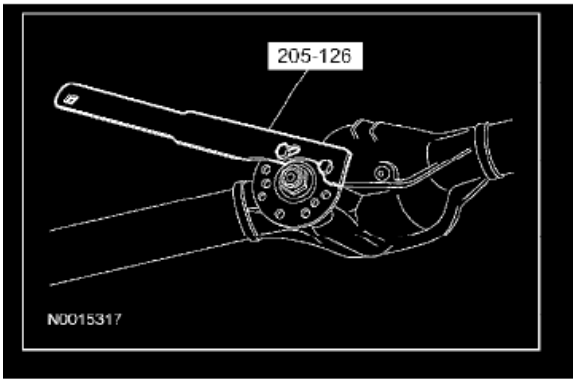
Insert a punch in the differential ring gear bolt holes and drive the differential ring gear off.

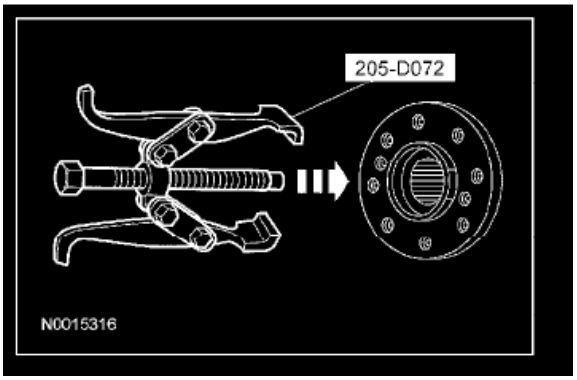
5. NOTE: The anti-lock ring cannot be reused once removed. Remove the anti-lock ring only if damaged.

If necessary, remove the anti-lock ring.


DE0447-A


205-116
205-D016
N0042356


205-126
N0015317

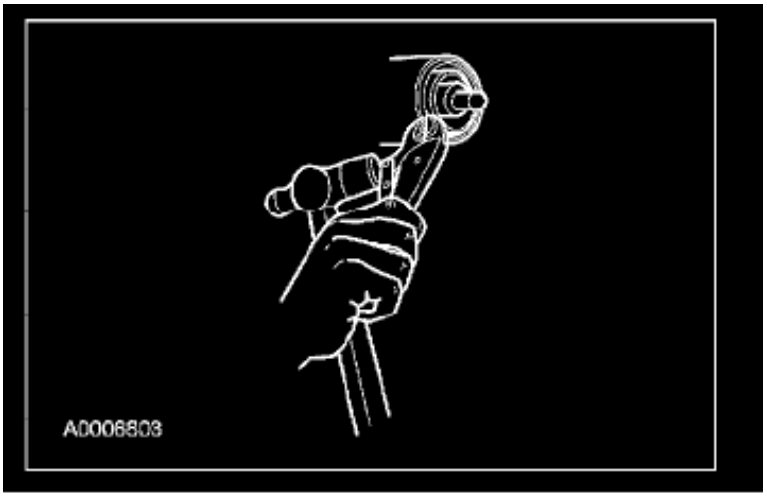

205-D072
N0015316

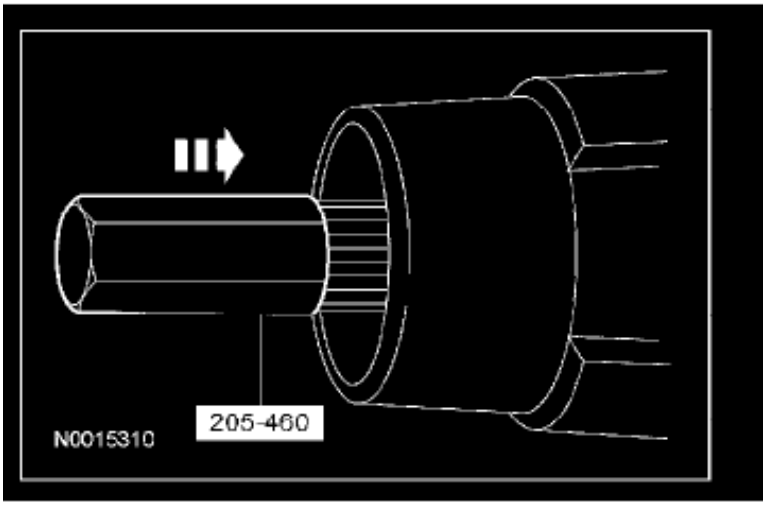
6. Using the special tools, remove the differential bearings.

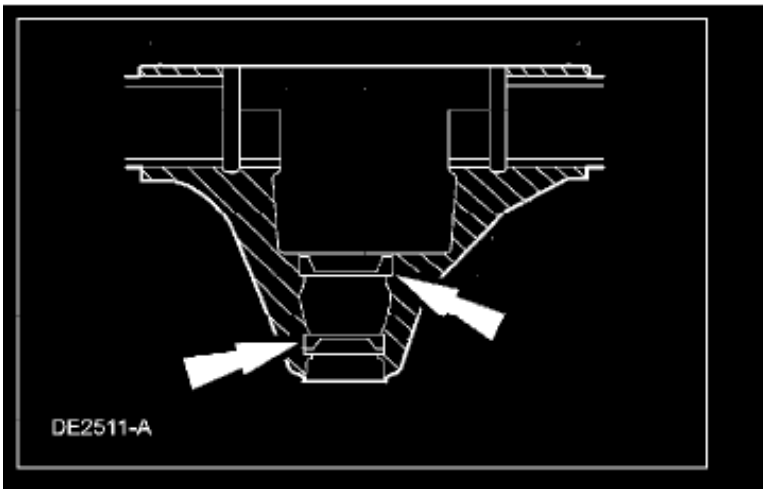
7. Using the special tool to hold the pinion flange, remove and discard the pinion nut.

8. Using the special tool, remove the pinion flange.

9. Force up on the metal flange of the drive pinion seal. Install gripping pliers and strike with a hammer until the drive pinion seal is removed.


A0006803


205-460
N0015310


DE2511-A

10. Remove the drive pinion shaft oil slinger and the outer drive pinion bearing. 11. Install the special tool and using a soft-faced hammer, drive the pinion assembly out of the axle housing.

12. Using a brass drift, remove the 2 drive pinion bearing cups by tapping alternately on opposite sides of the drive pinion bearing cups.

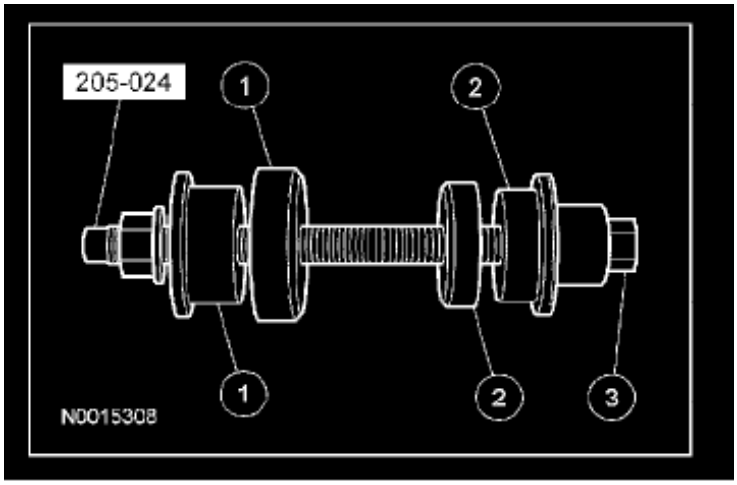
Installation

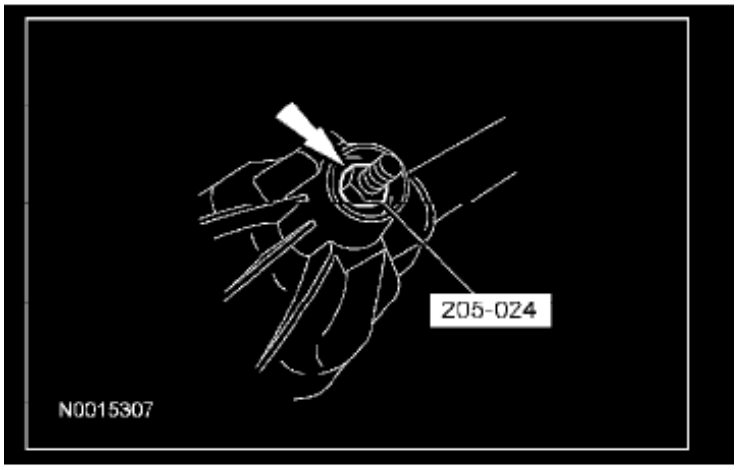
1. Position the special tool and the inner and outer drive pinion bearing cups in their respective bores.

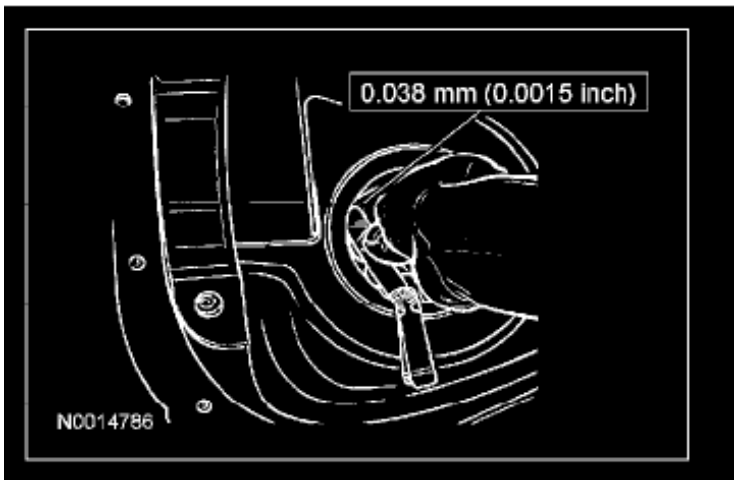
1 After placing the inner and outer drive pinion bearing cups in their bores, place the special tool (inner) on the inner drive pinion bearing cup.

2 Place the special tool (outer) on the outer drive pinion bearing cup.

3 Install the special tool.


205-024
1
2
1
2
3
N0015308


205-024
N0015307


0.038 mm (0.0015 inch)
N0014786

2. Tighten the special tool to seat the 2 drive pinion bearing cups into their bores.

3. NOTE: If a feeler gauge can be inserted between a drive pinion bearing cup and the bottom of its bore at any point around the drive pinion

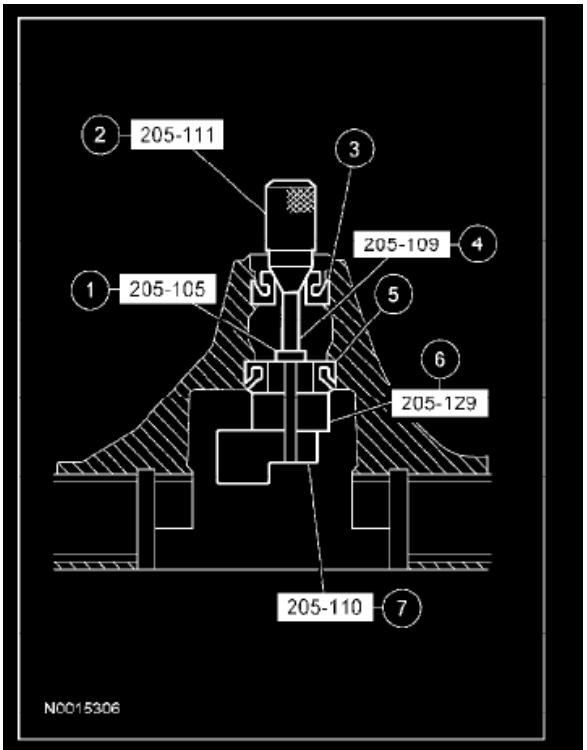
bearing cup, the drive pinion bearing cup is not correctly seated.

Make sure the drive pinion bearing cups are correctly seated in their bores.

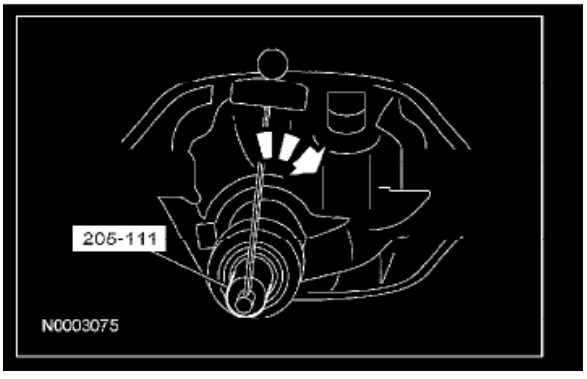
4. NOTE: Install new drive pinion bearings without any additional lubricant since the anti-rust oil provides adequate lubricant without upsetting the

drive pinion bearing preload settings.

Assemble and position the special tools.



Item	Part Number	Description
1	205-105	Adapter for 205-S127 (1.612 in O.D.) (T76P-4020-A3)
2	205-111	Adapter for 205-S127 (T76P-4020-A11)
3	4621	Drive pinion bearing (outer)
4	205-109	Adapter for 205-S127 (T76P-4020-A9)
5	4630	Drive pinion bearing (inner)
6	205-129	Adapter for 105-S127 (1.1884 in thick) (T79P-4020-A18)
7	205-110	Adapter for 205-S127 (1.7 in thick) (T76P-4020-A10)

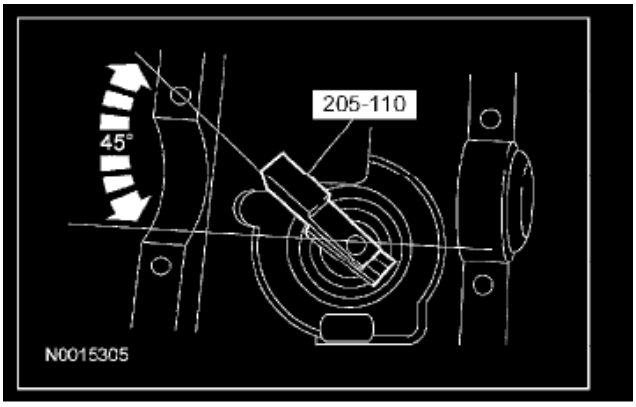


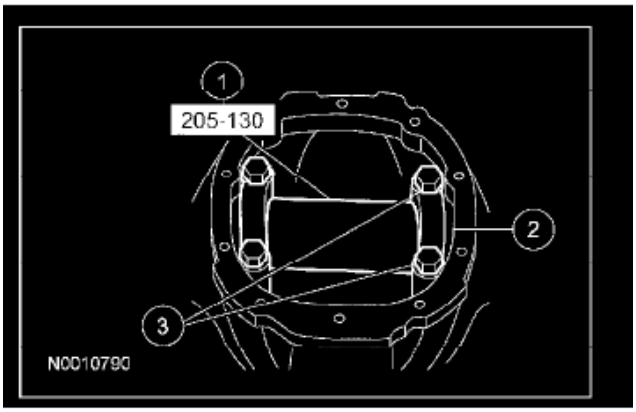
5. NOTE: This step duplicates final drive pinion bearing preload.

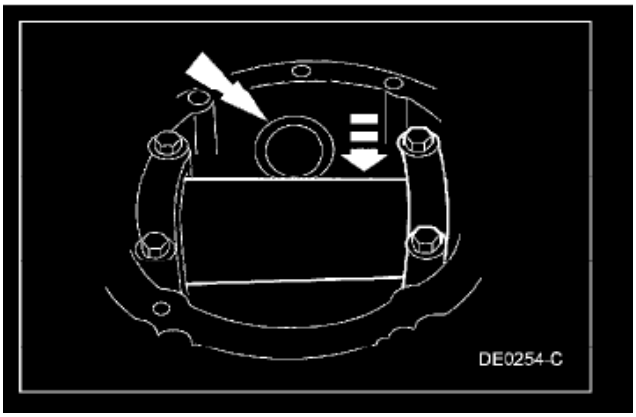
Tighten the special tool. ^

Tighten to 2.2 Nm (20 lb-inch) rotational torque.

6. NOTE: The special tool must be offset to obtain an accurate reading.


205-110
45°
N0015305


1
205-130
2
3
N0010790


DE0254-C

Rotate the special tool several half-turns to make sure of correct seating of the drive pinion bearings and position the special tool.

7. Install the special tool.

1 Position the special tool.

2 Install the 2 differential bearing caps.

3 Install the 4 differential bearing cap bolts. ^

Tighten to 112 Nm (83 lb-ft).

8. NOTE: Drive pinion bearing adjustment shims must be flat and clean.

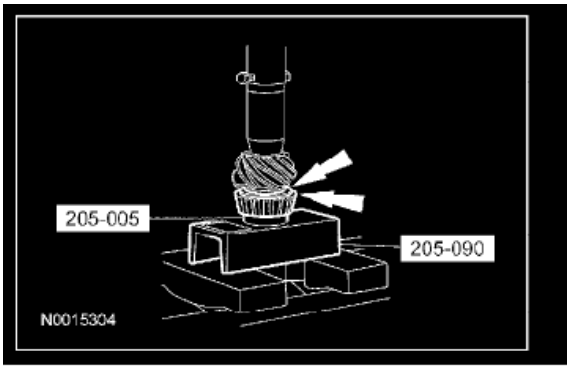
NOTE: A slight drag should be felt for correct drive pinion bearing adjustment shim selection. Do not attempt to force the drive pinion bearing adjustment shim between the gauge block and the gauge tube. This will minimize selection of a drive pinion bearing adjustment shim thicker than required, which results in a deep tooth contact in final assembly of integral axle assemblies.

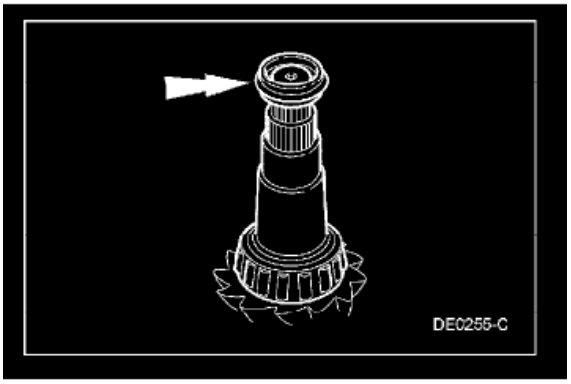
Use a drive pinion bearing adjustment shim as a gauge for drive pinion bearing adjustment shim selection. ^

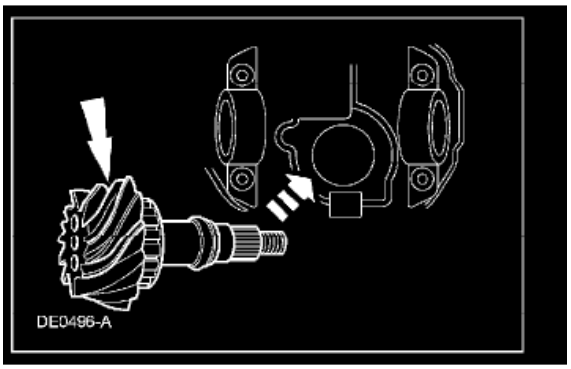
After the correct drive pinion bearing adjustment shim thickness has been determined, remove all of the special tools.

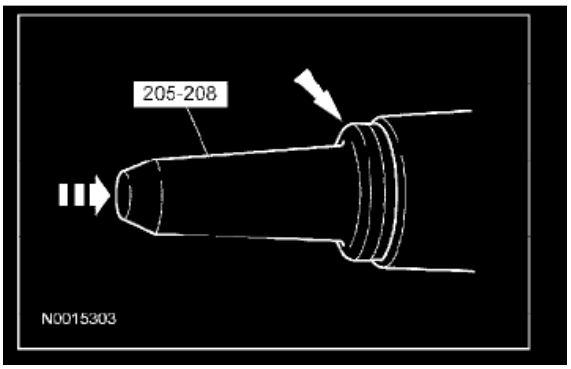
9. Using the special tools and a shop press, drive the inner drive pinion bearing and the selected drive pinion bearing adjustment shim until they are

firmly seated on the pinion shaft.


205-005
205-090
N0015304


DE0255-C

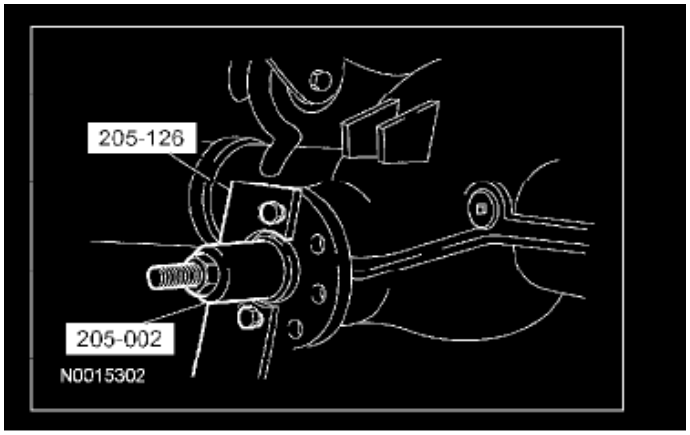

DE0496-A

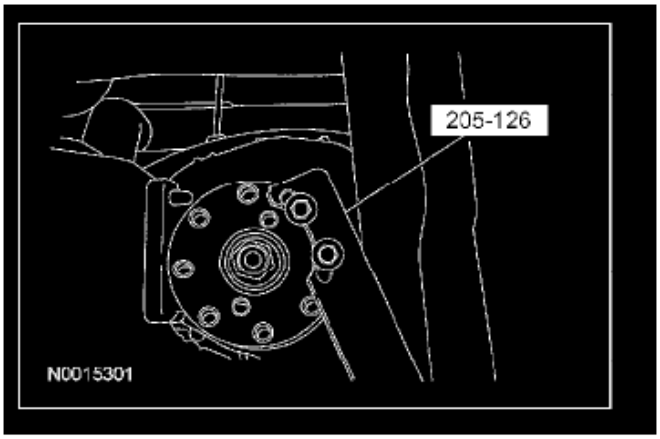

205-208
N0015303

10. Install a new drive pinion collapsible spacer on the pinion shaft against the pinion shaft shoulder.

11. Install the drive pinion assembly into the axle housing.

12. Install the outer drive pinion bearing and the drive pinion shaft oil slinger. 13. Using the special tool, install the drive pinion seal.


205-126
205-002
N0015302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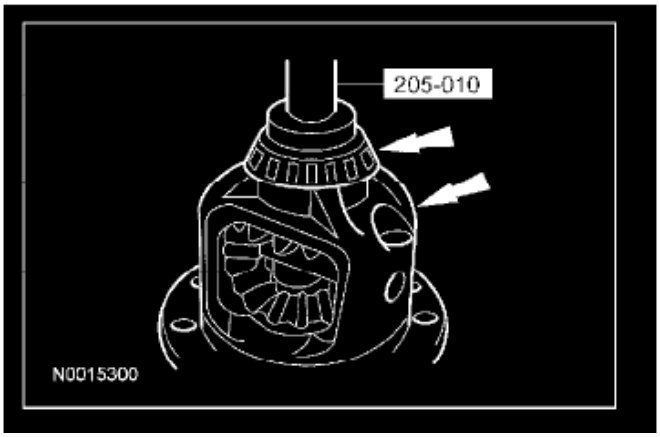
N0015301


205-010
N0015300

14. Using the special tools, install the drive pinion flange.

15. CAUTION: Do not, under any circumstance, loosen the drive pinion nut to reduce pinion bearing preload. If it is necessary to reduce the

preload, install a new drive pinion collapsible spacer and drive pinion nut or damage to the component may occur.

NOTE: Remove the special tool while taking rotational pinion bearing preload checks with the Nm (lb-inch) torque wrench.

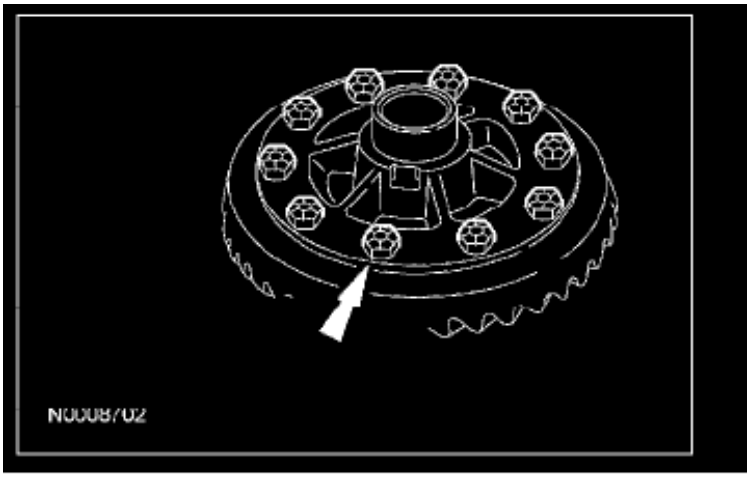
Use the special tool to hold the pinion flange while tightening the pinion nut. ^

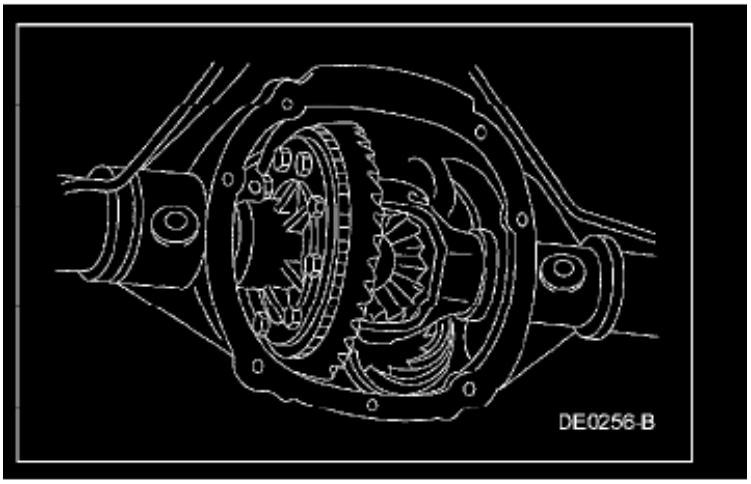
Rotate the pinion occasionally to make sure the differential pinion bearings are seating correctly. Take frequent differential pinion bearing preload checks by rotating the differential pinion with a Nm (lb-inch) torque wrench. Tighten the pinion nut in small increments to avoid excessive pinion bearing preload. Tighten the pinion nut until the drive pinion bearing preload is in specification.

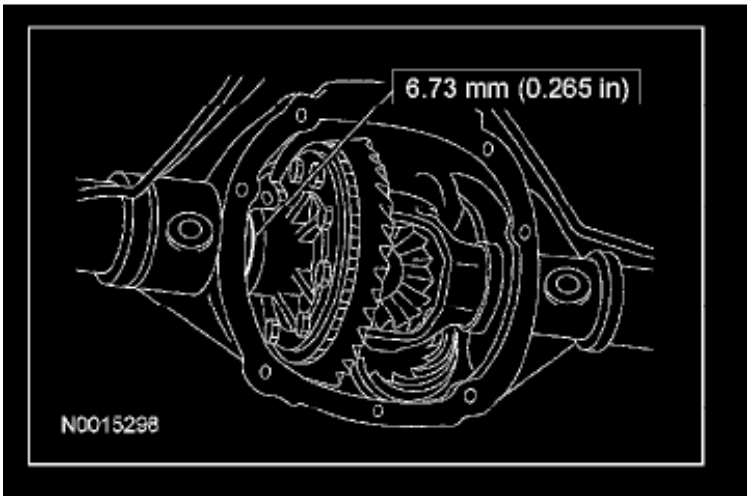
16. Using the special tool, install the 2 new differential bearings.

17. Install the 10 new differential ring gear bolts.

^ Tighten to 112 Nm (83 lb-ft).


N0008702


DE0256-B


6.73 mm (0.265 in)
N0015298

18. Position the differential carrier assembly and the new differential bearing cups in the differential housing.

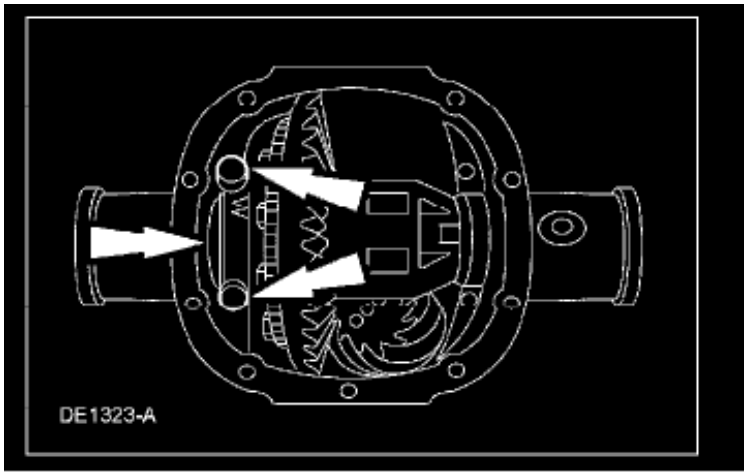
19. NOTE: Differential bearing shims are to be installed with the chamfer facing outboard.

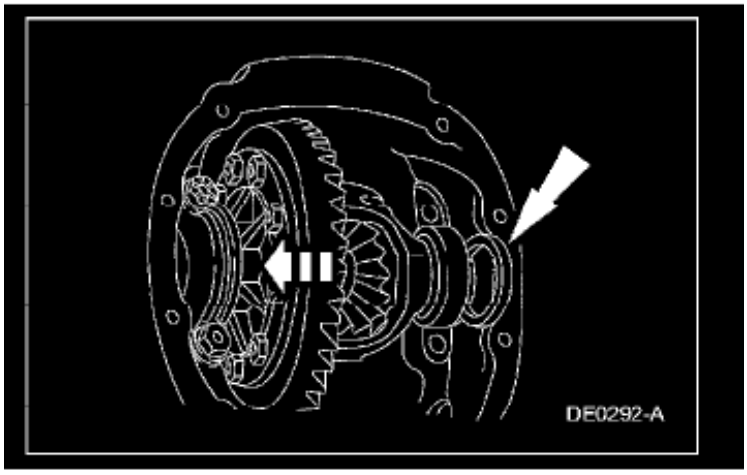
Install a differential bearing shim of the shown dimension on the left side.

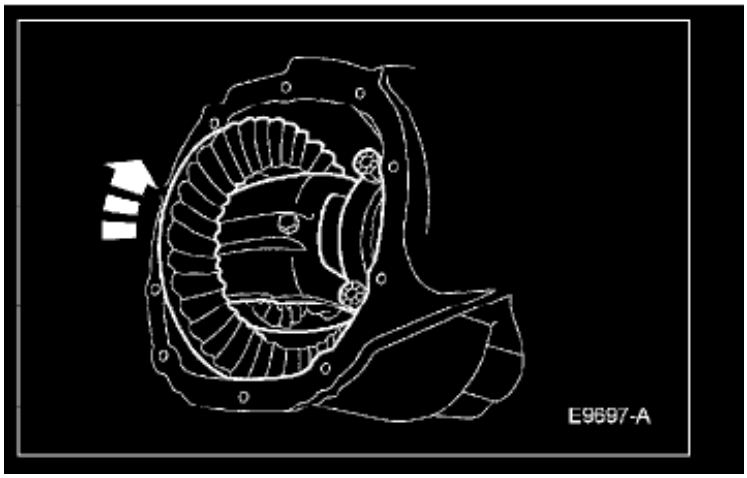
20. NOTE: Always install the bearing caps in their original locations and positions.

NOTE: Apply pressure toward the LH side to make sure the left differential bearing cup seats correctly.

Install the LH bearing cap and loosely install the 2 bolts.


DE1323-A


DE0292-A


E9697-A

21. Install progressively larger differential bearing shims on the RH side until the largest shim is installed by hand.

22. Install the right side bearing cap and 2 bolts. Tighten the LH and RH bearing cap bolts.

^ Tighten to 112 Nm (83 lb-ft).

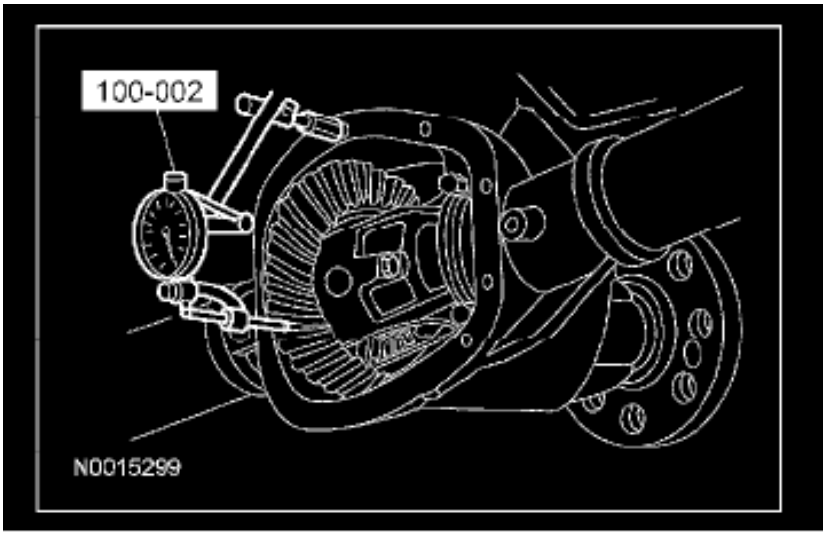
23. Rotate the differential carrier several times to verify the differential bearings have seated correctly.

24. Install the special tools and measure the ring gear backlash.

^ If the backlash is within specification, proceed to Step 27.

^ If a zero backlash condition occurs, proceed to Step 25.

^ If the backlash is not within specification, proceed to Step 26.



Backlash Change Required		Thickness Change Required	
mm	Inch	mm	Inch
0.025	0.001	0.050	0.002
0.050	0.002	0.050	0.002
0.076	0.003	0.101	0.004
0.101	0.004	0.152	0.006
0.127	0.005	0.152	0.006
0.152	0.006	0.203	0.008
0.177	0.007	0.254	0.010
0.203	0.008	0.254	0.010
0.228	0.009	0.304	0.012
0.254	0.010	0.355	0.014
0.279	0.011	0.355	0.014
0.304	0.012	0.406	0.016
0.330	0.013	0.457	0.018
0.335	0.014	0.457	0.018
0.381	0.015	0.508	0.020

25. If a zero backlash condition occurs, add 0.50 mm (0.020 inch) to the RH side shim and subtract 0.50 mm (0.020 inch) from the LH side shim to

allow a backlash indication. Go back to Step 24.

26. To correct for high or low backlash, increase the thickness of one differential bearing shim and decrease the thickness of the other differential

bearing shim by the same amount. Refer to the following tables when adjusting the backlash. When the backlash is within specification, proceed to Step 27.

Differential Shim Size Chart 4067

Differential Shim Size Chart 4067

Stripes and Color Code	Dimension A	
	mm	Inch
2 — C-COAL	7.7978-7.8105	0.3070-0.3075
1 — C-COAL	7.7470-7.7597	0.3050-0.3055
5 — BLU	7.6962-7.7089	0.3030-0.3035
4 — BLU	7.6454-7.6581	0.3010-0.3015
3 — BLU	7.5946-7.6073	0.2990-0.2995
2 BLU	7.5458 7.5565	0.2970 0.2975
5 — PINK	7.4422-7.4549	0.2930-0.2935
4 — PINK	7.3914-7.4041	0.2910-0.2915
3 — PINK	7.3406-7.3533	0.2890-0.2895
2 — PINK	7.2898-7.3025	0.2870-0.2875
1 — PINK	7.2390-7.2517	0.2850-0.2855
5 — GRN	7.1882-7.2009	0.2830-0.2835
4 — GRN	7.1374-7.1501	0.2810-0.2815

Differential Shim Size Chart 4067 (Continued)

Stripes and Color Code	Dimension A	
	mm	Inch
3 — GRN	7.0866-7.0993	0.2790-0.2795
2 — GRN	7.0358-7.0485	0.2770-0.2775
1 — GRN	6.9850-7.0485	0.2750-0.2755
5 — WH	6.9342-6.9469	0.2730-0.2735
4 — WH	6.8834-6.8961	0.2710-0.2715
3 — WH	6.8326-6.8453	0.2690-0.2695
2 — WH	6.7818-6.7945	0.2670-0.2675
1 — WH	6.7310-6.7437	0.2650-0.2655
5 — YEL	6.6802-6.6929	0.2630-0.2635
4 — YEL	6.6294-6.6421	0.2610-0.2615
3 — YEL	6.5786-6.5913	0.2590-0.2595
2 — YEL	6.5278-6.5405	0.2570-0.2575
1 — YEL	6.4770-6.4897	0.2550-0.2555
5 — ORNG	6.4262-6.4389	0.2530-0.2535
4 — ORNG	6.3754 6.3881	0.2510 0.2515
3 — ORNG	6.3246-6.3373	0.2490-0.2495
2 — ORNG	6.2738-6.2865	0.2470-0.2475
1 — ORNG	6.2223-6.2357	0.2450-0.2455
2 — RED	6.1722-6.1849	0.2430-0.2435
1 — RED	6.1214-6.1341	0.2410-0.2415

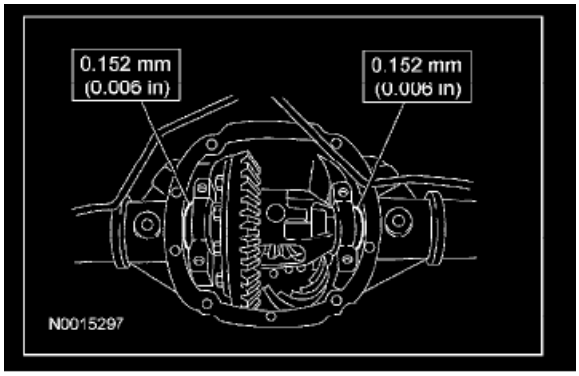
Differential Shim Size Chart 4067 (Part 1)

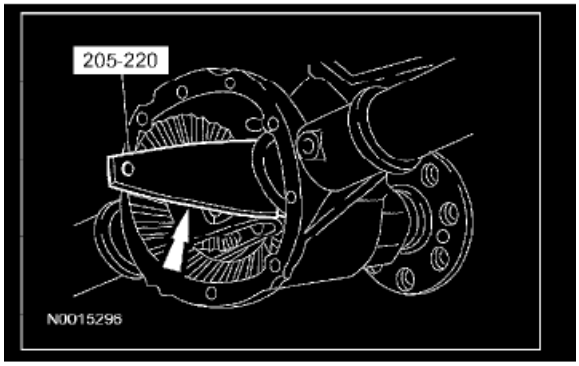
Differential Shim Size Chart 4067 (Part 2)

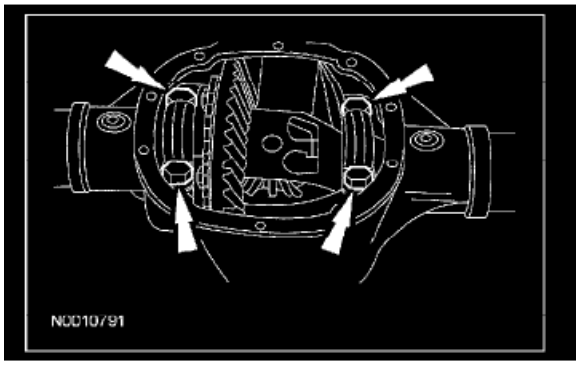
27. Remove the 4 bearing cap bolts and 2 bearing caps.

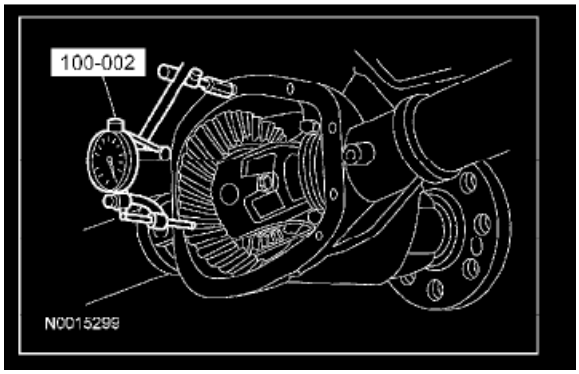
28. NOTE: Differential bearing shims are to be installed with the chamfer facing outboard.

To establish differential bearing preload, increase both LH and RH differential bearing shim size by the thickness shown.


0.152 mm
(0.006 in)
0.152 mm
(0.006 in)
N0015297


205-220
N0015296


N0010791


100-002
N0015299

29. Using the special tool, fully seat the differential bearing shims Make sure the assembly rotates freely.

30. Install the 2 bearing caps and 4 bolts.

^ Tighten to 112 Nm (83 lb-ft).

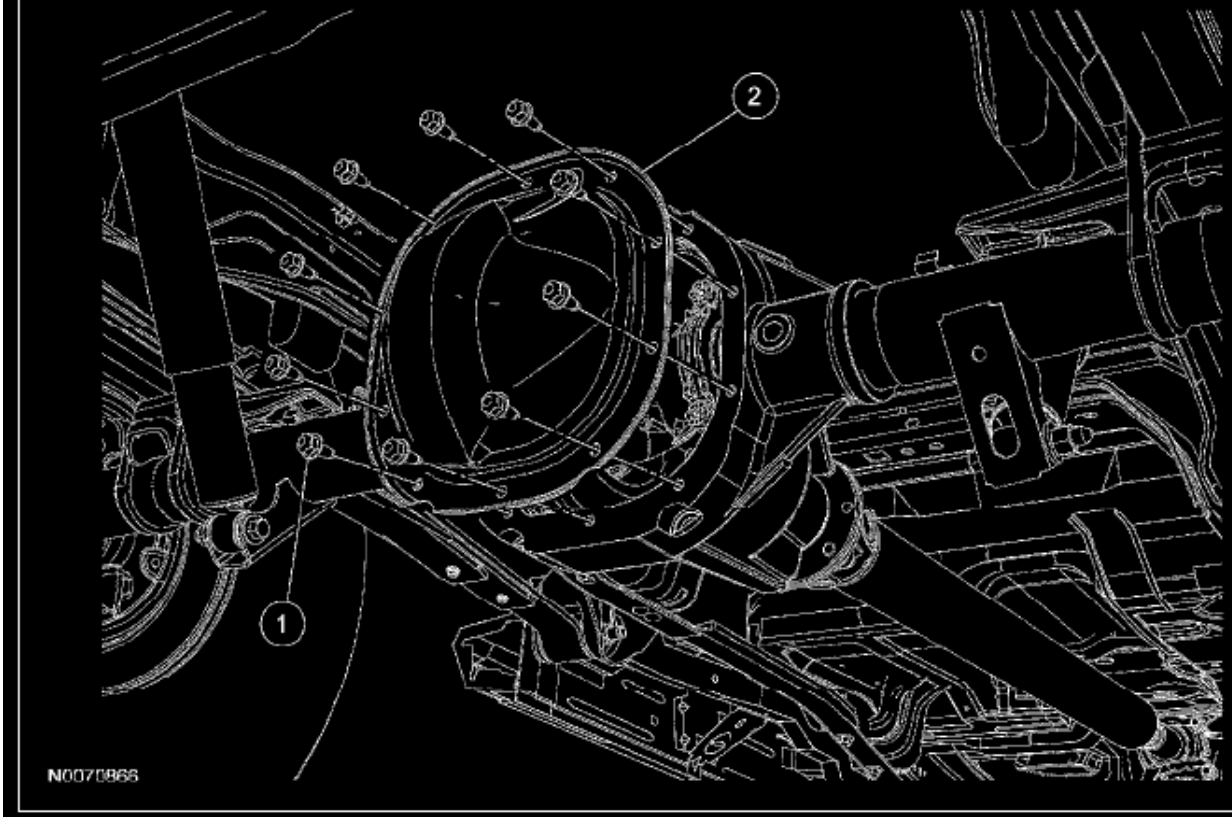
31. Using the special tools, recheck the ring gear backlash.

32. Apply marking compound and rotate the differential assembly 5 complete revolutions.

33. Check for an acceptable pattern. 34. Install the axle shafts. 35. Install the driveshaft.

Material

Item	Specification
Additive Friction Modifier XL-3 (US); CXL-3 (Canada)	EST-M2C118-A
Clear Silicone Rubber TA-32	ESB-M4G92-A
Motorcraft SAE 80W-90 Premium Rear Axle Lubricant XY-80W90-QL (US); CXY-80W90-1L (Canada)	WSP-M2C197-A



Item	Part Number	Description
1	4346	Differential housing cover bolt (10 required)
2	4033	Differential housing cover

Differential Cover: Service and Repair Ford 7.5-Inch Ring Gear - Rear Drive Axle/Differential

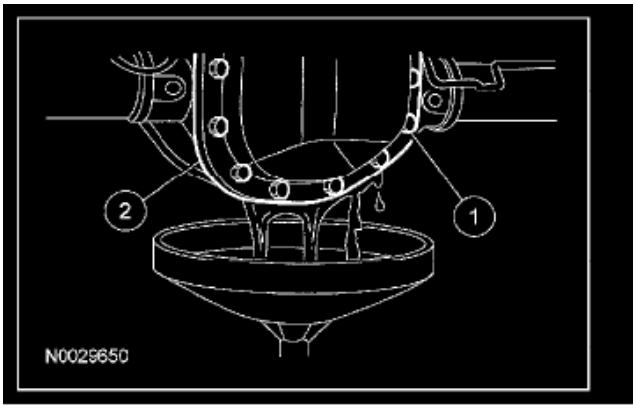
Differential Housing Cover

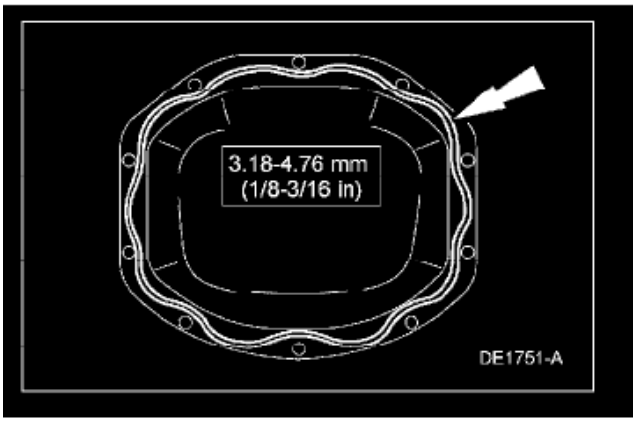
Removal

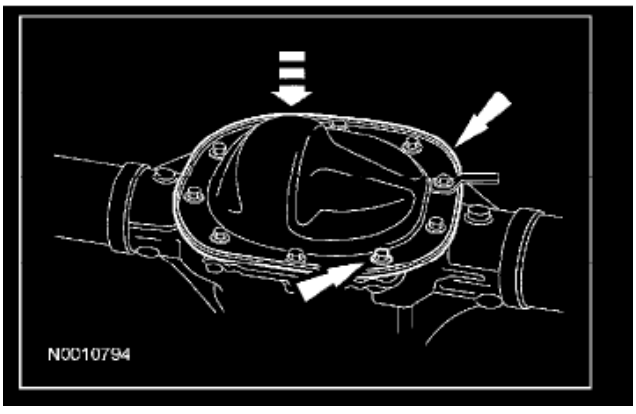
1. With the vehicle in NEUTRAL, position it on a hoist. 2. Remove the differential housing cover.

1 Remove the 10 differential housing cover bolts and drain the lubricant from the rear axle housing.

2 Remove the differential housing cover.


2
1
N0029650


3.18-4.76 mm
(1/8-3/16 in)
DE1751-A


N0010794

Installation

1. CAUTION: Make sure the machined surfaces on the rear axle housing and the differential housing cover are clean and free of oil before

installing the new silicone sealant. The inside of the rear axle must be covered when cleaning the machined surface to prevent contamination or damage to the component may occur.

Clean the gasket mating surface of the rear axle and the differential housing cover.

2. Apply a new continuous bead of sealant of the specified thickness to the differential housing cover.

3. NOTE: The differential housing cover must be installed within 15 minutes of application of the silicone, or new sealant must be applied. If

possible, allow one hour before filling with lubricant to make sure the silicone sealant has correctly cured.

Install the differential housing cover and the 10 bolts. ^

Tighten to 45 Nm (33 lb-ft).

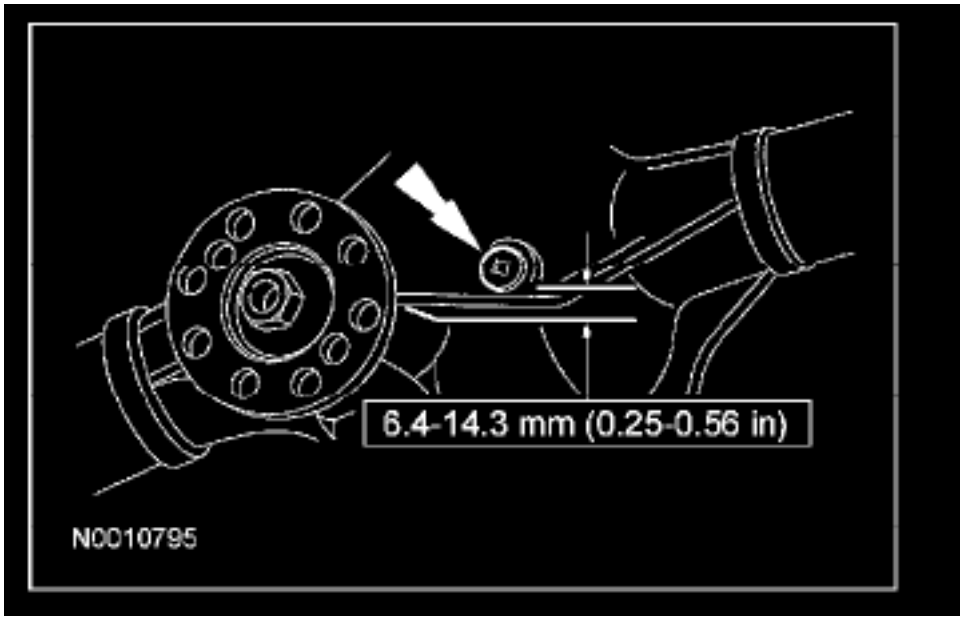
4. NOTE: For Traction-Lok(R) axles, before filling the rear axle with lubricant, first fill the rear axle with 118 ml (4 oz) of additive friction

modifier.

NOTE: Service refill capacities are determined by filling the rear axle with the specified lubricant to the level shown in the illustration.

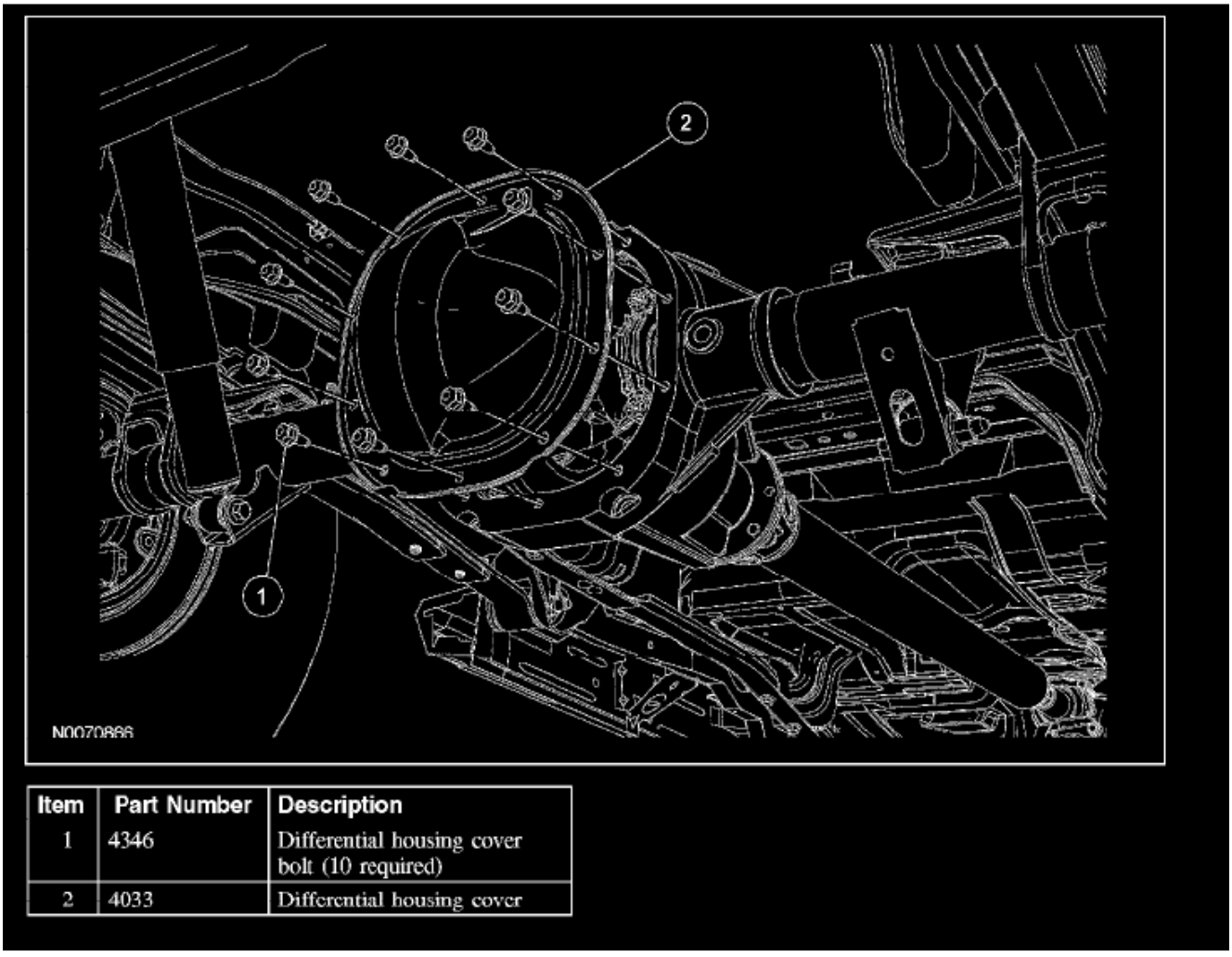
Remove the filler plug and fill the rear axle with 2.4L (5 pt) with the specified lubricant and install the fill plug. ^

Tighten to 52 Nm (38 lb-ft).


6.4-14.3 mm (0.25-0.56 in)
N0010795

Material

Item	Specification
Additive Friction Modifier XL-3 (US); CXL-3 (Canada)	EST-M2C118-A
Clear Silicone Rubber TA-32	ESB-M4G92-A
Motorcraft SAE 80W-90 Premium Rear Axle Lubricant XY-80W90-QL (US); CXY-80W90-1L (Canada)	WSP-M2C197-A



Item	Part Number	Description
1	4346	Differential housing cover bolt (10 required)
2	4033	Differential housing cover

Differential Cover: Service and Repair Ford 8.8-Inch Ring Gear - Rear Drive Axle/Differential

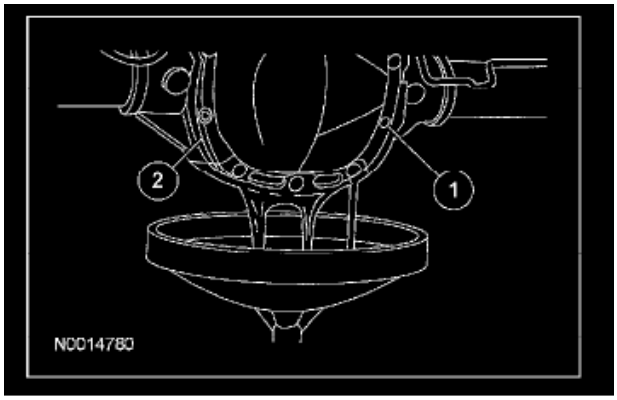
Differential Housing Cover

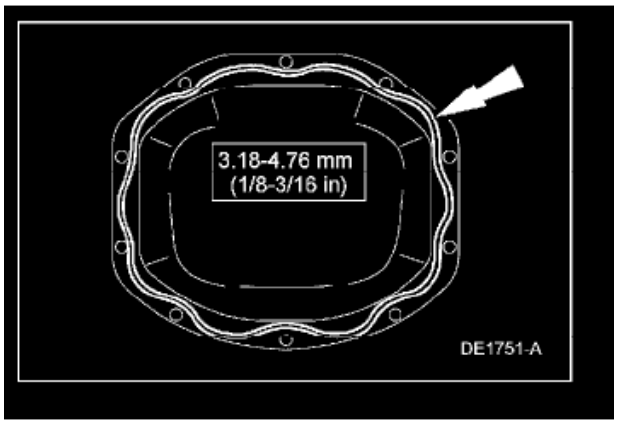
Removal

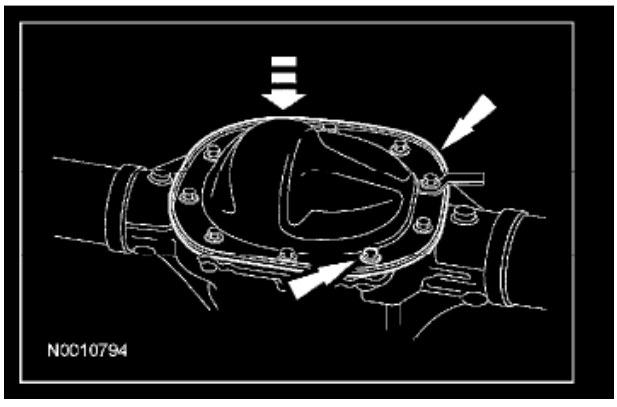
1. With the vehicle in NEUTRAL, position it on a hoist. 2. Remove the differential housing cover.

1 Remove the 10 bolts and drain the lubricant from the differential housing.

2 Remove the differential housing cover.


2
1
N0014780


3.18-4.76 mm
(1/8-3/16 in)
DE1751-A


N0010794

Installation

1. NOTE: The machined surfaces on the differential housing and the differential housing cover must be clean and free of oil before applying the

silicone sealant. Cover the inside of the rear axle prior to cleaning the machined surface to prevent contamination.

Clean the gasket mating surfaces.

2. NOTE: Install the differential housing cover within 15 minutes of applying the silicone, or it will be necessary to apply new sealant.

Apply a continuous bead of silicone sealant to the differential housing cover.

3. NOTE: If possible, allow one hour before filling the axle with lubricant to allow the silicone sealant to cure.

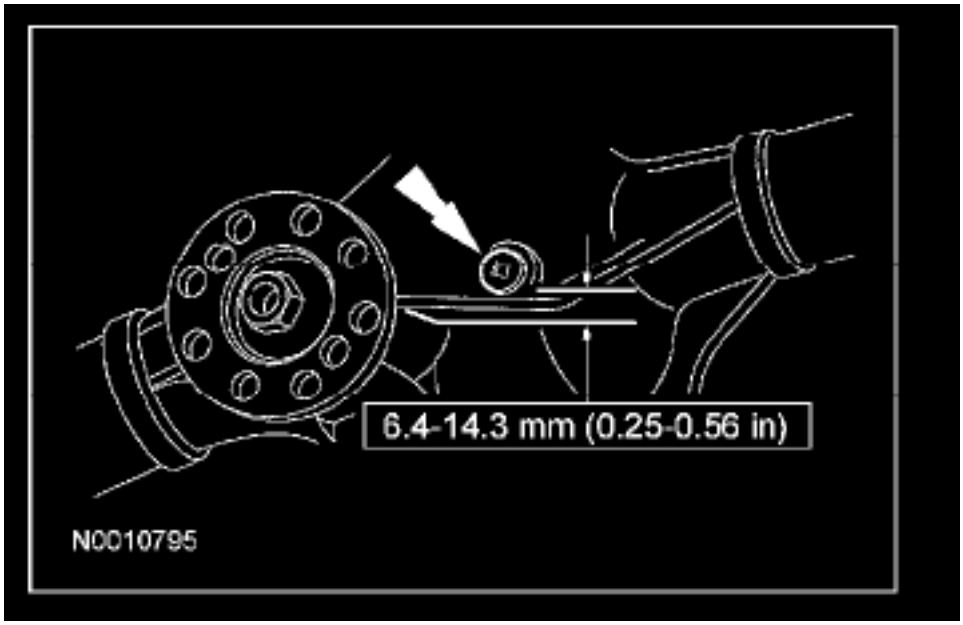
Install the differential housing cover and the 10 bolts. ^

Tighten to 45 Nm (33 lb-ft).

4. NOTE: When filling a Traction-Lok(R) axle with new lubricant, first fill the axle with 118 ml (4 oz) of friction modifier.

NOTE: Service refill capacities are determined by filling the rear axle to the level shown.

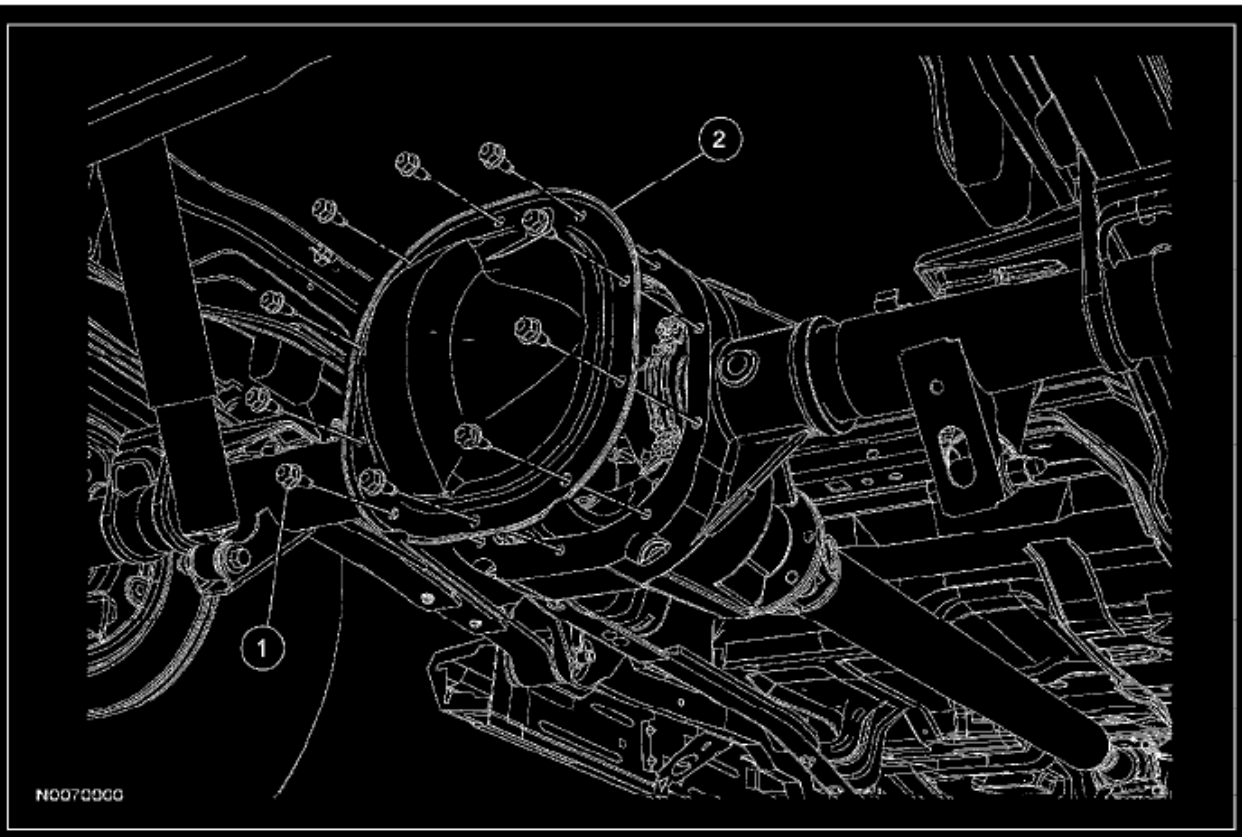
Remove the filler plug, fill the rear axle with approximately 2.4L (5 pt) of rear axle lubricant and install the fill plug.



^ Tighten to 52 Nm (38 lb-ft).

Material

Item	Specification
Additive Friction Modifier XL-3 (US); CXL-3 (Canada)	EST-M2C118-A
Motorcraft SAE 75W-140 Synthetic Rear Axle Lubricant XY-75W140-QL (US); CXY-75W140-1L (Canada)	WSL-M2C192-A
Ultra Silicone Sealant TA-29	WSS-M4G320-A3



Item	Part Number	Description
1	4346	Differential housing cover bolt (10 required)
2	4033	Differential housing cover

Differential Cover: Service and Repair Ford 8.8-Inch Ring Gear High Torque - Rear Drive Axle/Differential

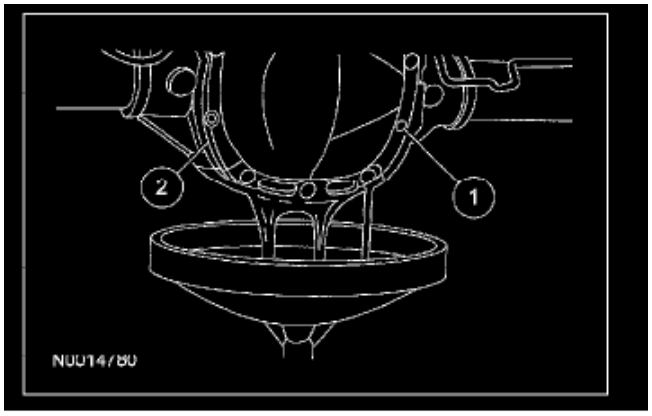
Differential Housing Cover

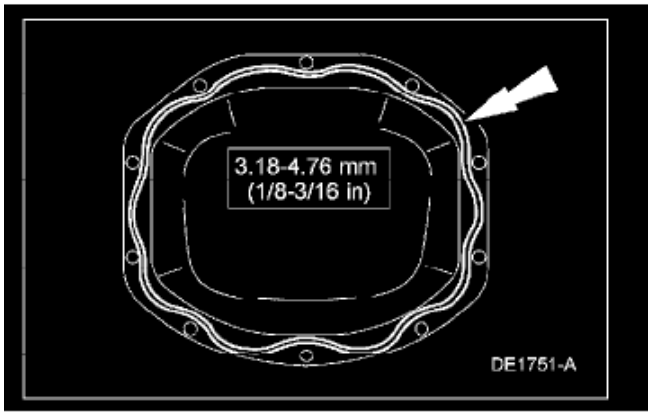
Removal

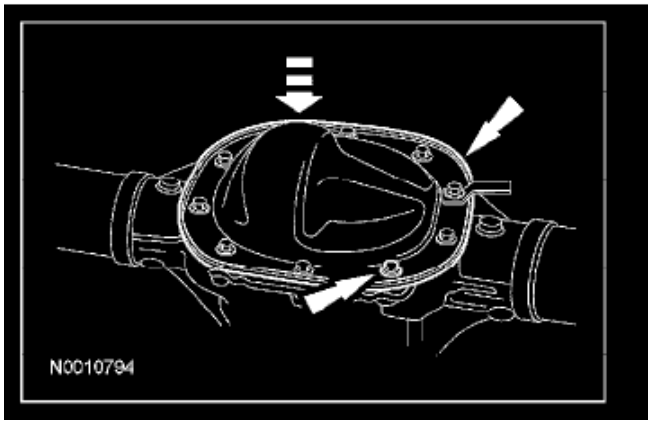
1. With the vehicle in NEUTRAL, position it on a hoist. 2. Remove the differential housing cover.

1 Remove the 10 differential housing cover bolts and drain the lubricant from the rear axle housing.

2 Remove the differential housing cover.


2
1
N0014780


3.18-4.76 mm
(1/8-3/16 in)
DE1751-A


N0010794

Installation

1. NOTE: Make sure the machined surfaces on both the rear axle housing and the differential housing cover are clean and free of oil before

installing the new silicone sealant. The inside of the rear axle must be covered when cleaning the machined surface to prevent contamination.

Clean the gasket mating surface of the rear axle and the differential housing cover.

2. Apply a new continuous bead of sealant to the differential housing cover.

3. NOTE: The differential housing cover must be installed within 15 minutes of application of the silicone, or new sealant must be applied. If

possible, allow one hour before filling with lubricant to make sure the silicone sealant has correctly cured.

Install the differential housing cover and 10 bolts. ^

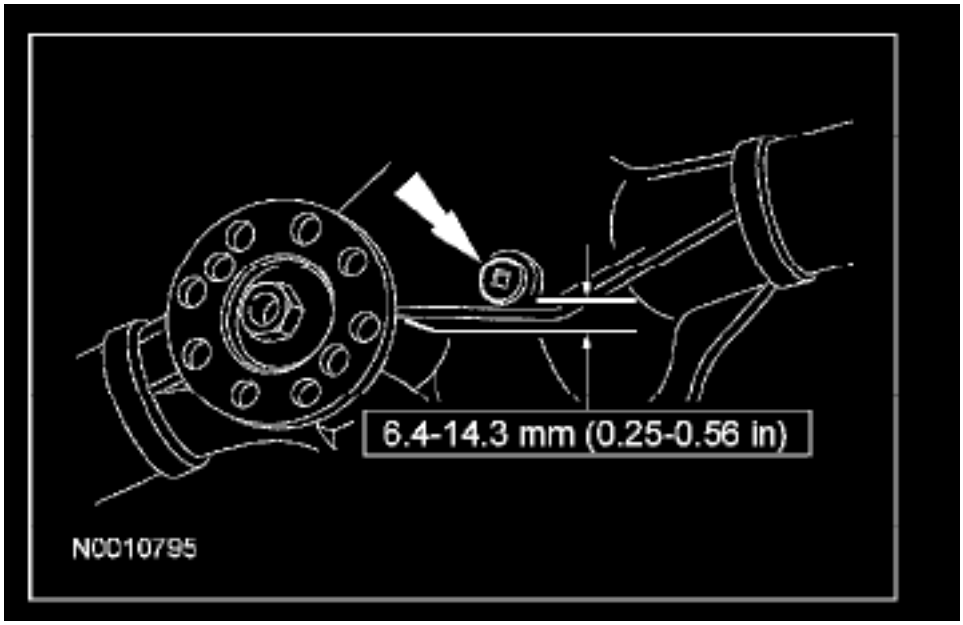
Tighten to 45 Nm (33 lb-ft).

4. NOTE: First fill the rear axle with 118 ml (4 oz) of friction modifier.

NOTE: Service refill capacities are determined by filling the rear axle to the level shown.

Remove the filler plug, fill the rear axle with 2.54L (5.37 pt) of rear axle lubricant and install the filler plug. ^

Tighten to 52 Nm (38 lb-ft).


6.4-14.3 mm (0.25-0.56 in)
N0010795

Fluid - Differential: Capacity Specifications

Differential Oil Capacity

Rear Axle ..... 5.0 - 5.3 Pints (2.4 - 2.5 L)

Note: Traction-Lok axles use 4.75 - 5.0 pints (2.2 - 2.4 L) of rear axle lubricant.

Note: Service refill capacities are determined by filling the rear axle 1/4 inch to 9/16 inch (6 mm to 14 mm) below the bottom of the filler hole.

Note: Add 8 oz. (118 ml) of Additive Friction Modifier XL-3 or equivalent meeting Ford specification EST-M2C118-A for complete refill of Traction-Lok axles.

Fluid - Differential: Fluid Type Specifications

Differential Fluid Type

Rear Axle Ford Part Name ..... Motorcraft SAE 80W-90 Premium Rear Axle Lubricant Ford Part Number ..... XY-80W90-QL Ford Specification WSP-m2C197-A

Special Tool(s)

ST1257-A	Holding Fixture, Drive Pinion Flange 205-126 (T78P-4851-A)
	Installer, Drive Pinion Flange 205-002 (TOOL-4858-E) or equivalent
ST2026 A	2-Jaw Puller 205-D072 (D97L-4221-A) or equivalent

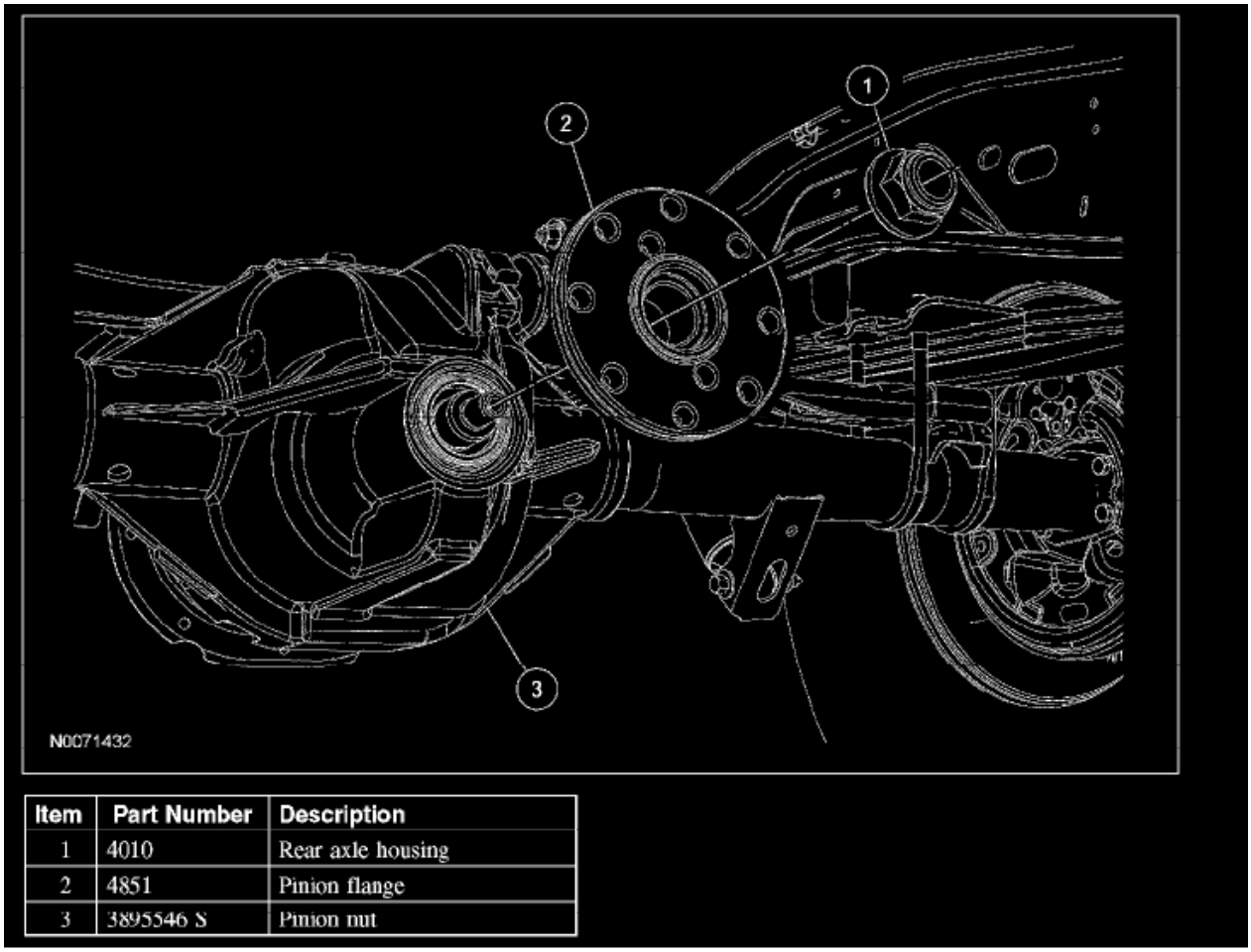
Material

Item	Specification
Motorcraft SAE 80W-90 Premium Rear Axle Lubricant XY-80W90-QL (US); CXY-80W90-1L (Canada); (Model 60/70 axles)	WSP-M2C197-A

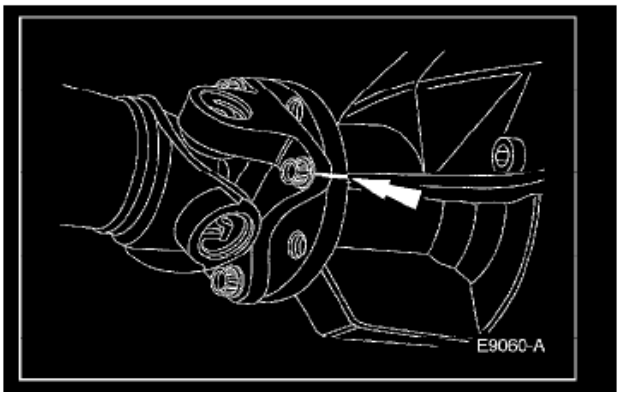
Pinion Flange: Service and Repair Drive Pinion Flange

Ford 7.5-Inch Ring Gear - Rear Drive Axle/Differential

Drive Pinion Flange



Item	Part Number	Description
1	4010	Rear axle housing
2	4851	Pinion flange
3	3895546 S	Pinion nut



Removal

CAUTION: The color on the rear of the drive pinion nut is critical to this repair. Use the same color new drive pinion nut for installation. If a new collapsible spacer is installed, install the nut in the kit or damage to the component may occur.

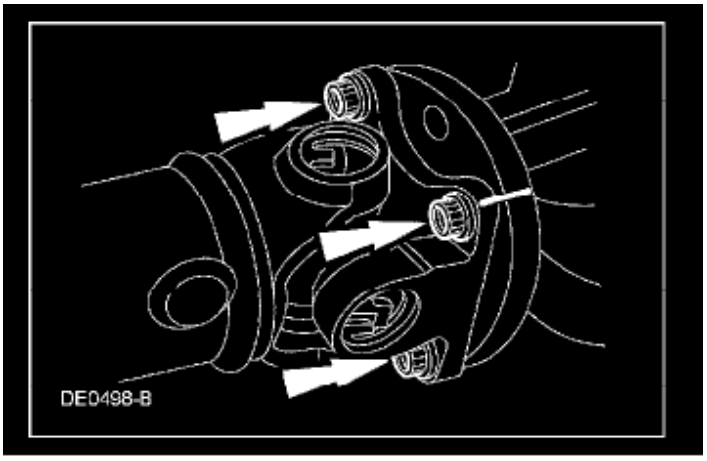
1. With the vehicle in NEUTRAL, position it on a hoist.

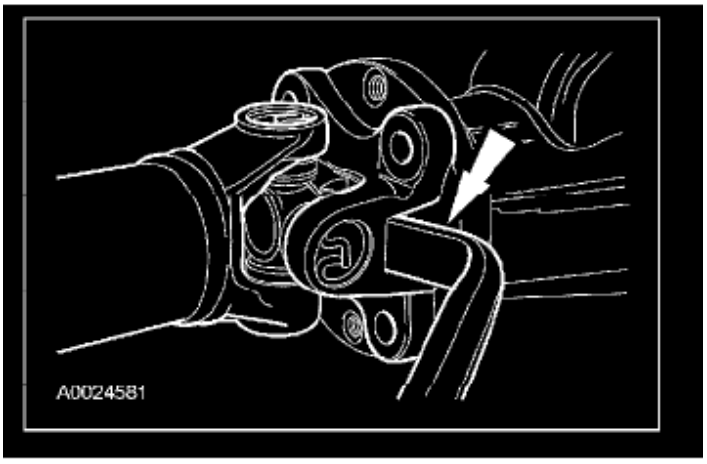
2. NOTE: The rear wheels and brake drums must be removed to prevent brake drag during drive pinion bearing preload adjustment.

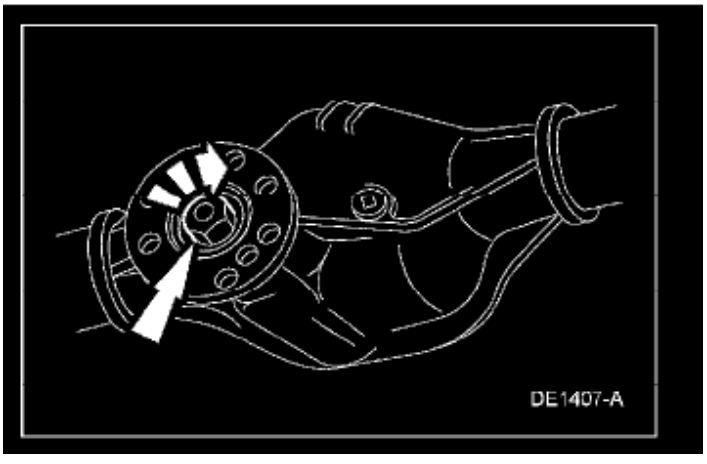
Remove the brake drums.

3. Mark the driveshaft flange and pinion flange for correct alignment during installation.

4. Remove the 4 driveshaft-to-pinion flange bolts.


DE0498-B


A0024581


DE1407-A

5. NOTE: The driveshaft centering socket yoke fits tightly on the rear axle pinion flange pilot. Never hammer on the driveshaft or any of its

components to disconnect the yoke from the flange. Pry only in the area shown with a suitable tool to disconnect the yoke from the flange.

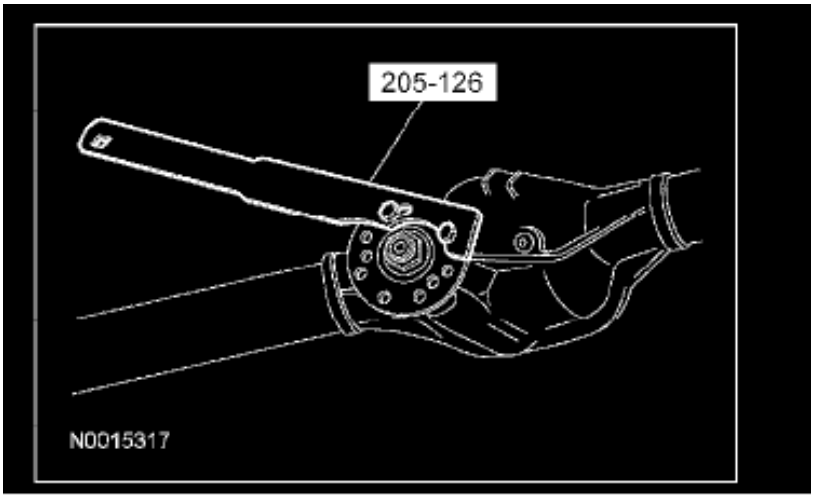
Using a suitable tool as shown, disconnect the driveshaft centering socket yoke from the rear axle pinion flange. ^

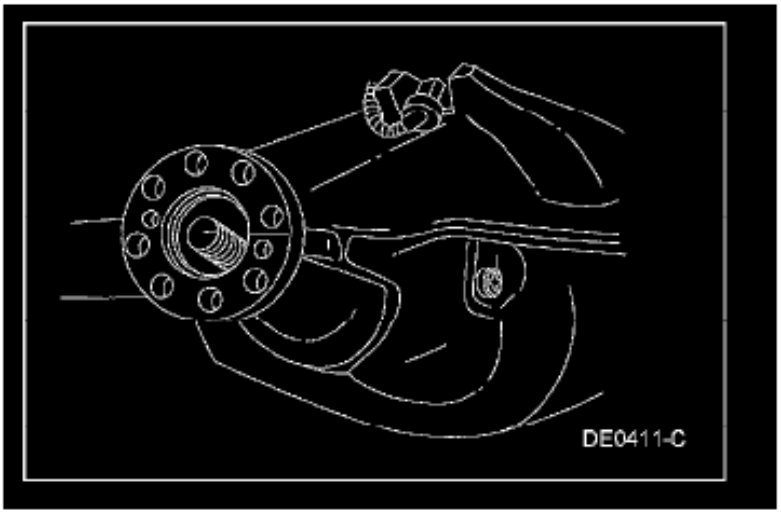
Position the driveshaft aside.

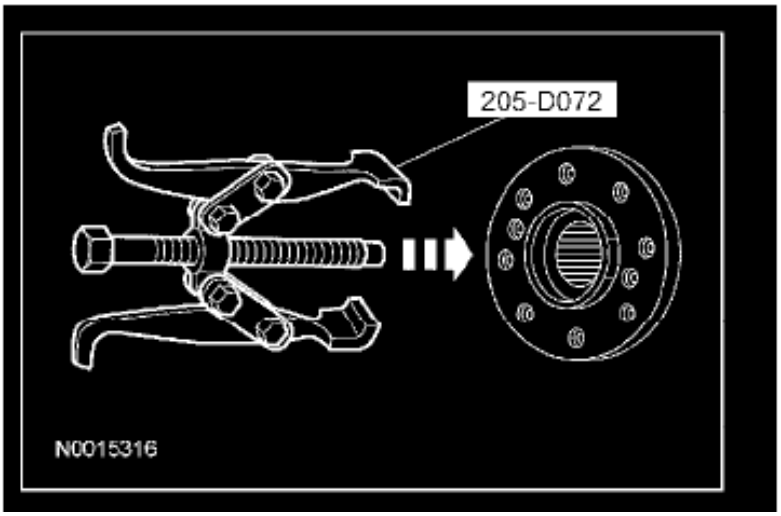
6. Install a Nm (lb-inch) torque wrench on the pinion nut and record the torque required to maintain rotation of the pinion through several

revolutions.

7. Using the special tool, hold the pinion flange and remove and discard the nut.


205-126
N0015317


DE0411-C


205-D072
N0015316

8. Index-mark the pinion flange in relation to the pinion stem to make sure of correct alignment during installation.

9. Using the special tool, remove the pinion flange.

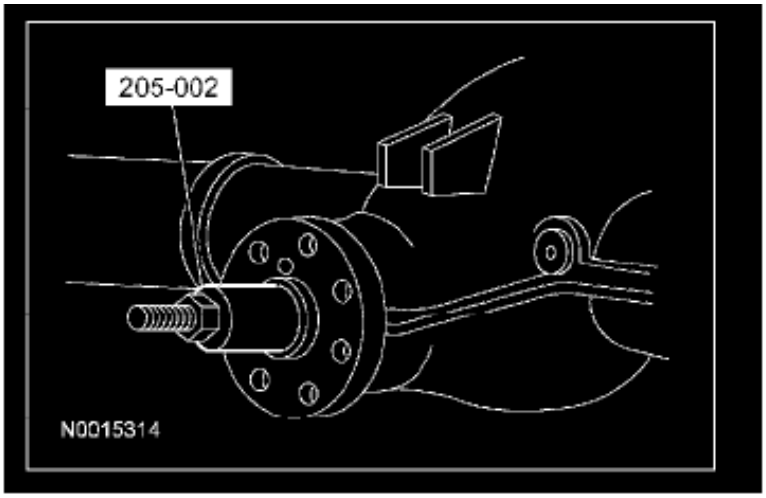
Installation

1. Lubricate the pinion flange splines with lubricant.

2. NOTE: Disregard the scribe marks if a new pinion flange is being installed.

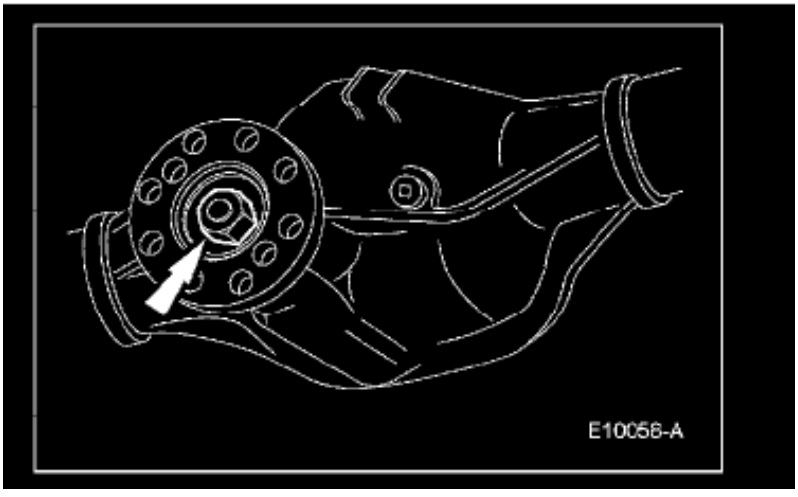
Align the pinion flange with the drive pinion shaft.

3. Install the pinion flange using the special tool.



7.5 In Drive Pinion Nut

Part Number	Color	Application
389546-S100	Orange	Axles built before 7/16/07
4320	Purple	Axles built after 7/16/07
4C121	Purple	Kit with spacer all 7.5



4. CAUTION: Use the same color new drive pinion nut for installation. If a new collapsible spacer must be installed for preload reduction,

install the nut supplied with the new spacer or damage to the component may occur.

Position the new pinion flange nut.

7.5 In Drive Pinion Nut

7.5 In Drive Pinion Nut

5. CAUTION: Under no circumstances is the pinion nut to be backed off to reduce preloads or component damage may occur. If reduced

preload is required, a new drive pinion collapsible spacer and pinion nut kit must be installed.

NOTE: Remove the special tool while taking preload readings with the Nm (lb-inch) torque wrench.

Using the special tool, hold the pinion flange and tighten the pinion nut. ^

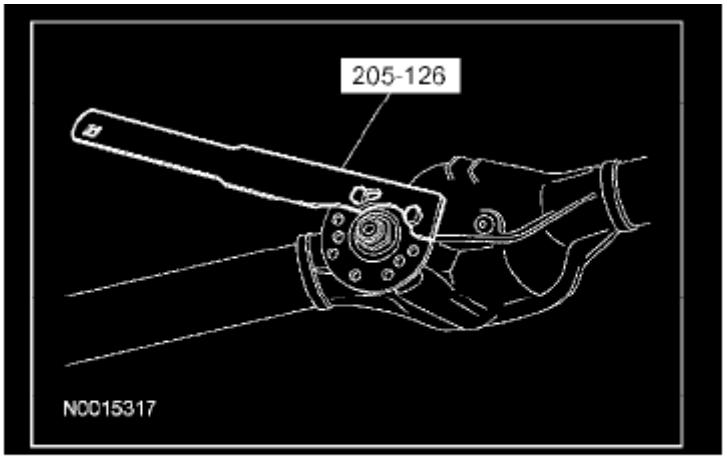
Rotate the pinion occasionally to make sure the cone and roller bearings are seating correctly.

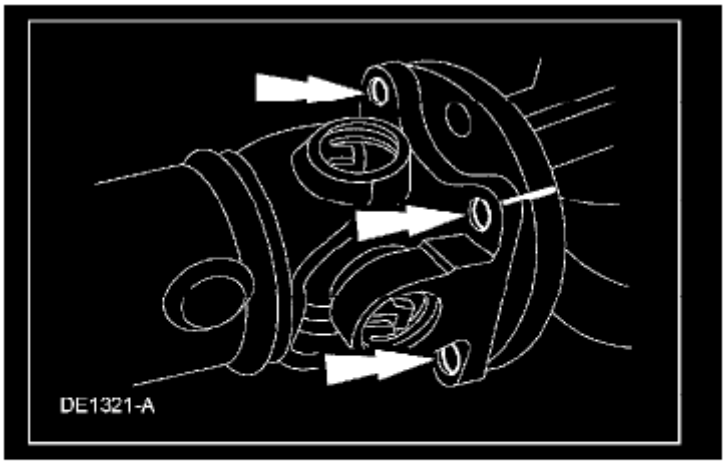
^ Install a Nm (lb-inch) torque wrench on the pinion nut.

^ Rotating the pinion through several revolutions, take frequent cone and roller bearing torque preload readings until the original recorded preload reading is obtained.

^ If the original recorded preload is lower than specification, tighten to the appropriate specification. If the preload is higher than the specification, then tighten the nut to the original reading as recorded.

^ Refer to Torque Specification.


205-126
N0015317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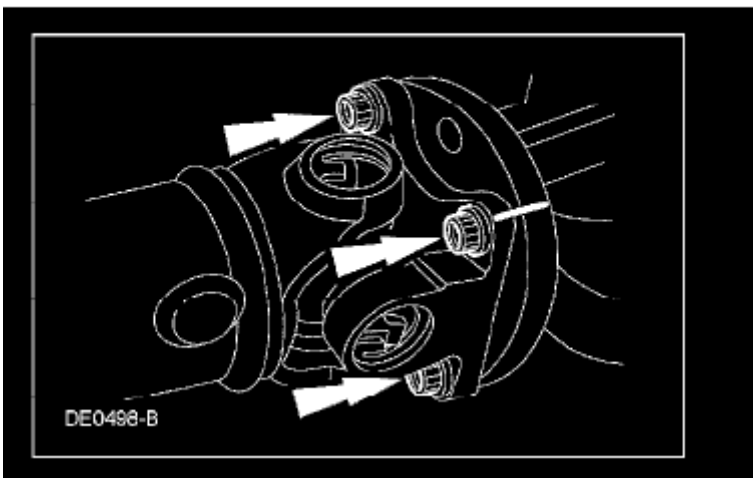

DE0498-B

6. Position the driveshaft and align the marks on the pinion flange.

7. NOTE: The driveshaft centering socket yoke fits tightly on the rear axle pinion flange pilot. To make sure that the yoke seats squarely on the

flange, tighten the bolts evenly in a cross pattern.

Install the 4 driveshaft bolts. ^

Tighten to 112 Nm (83 lb-ft).

8. Install the rear brake drums.

Ford 8.8-Inch Ring Gear - Rear Drive Axle/Differential

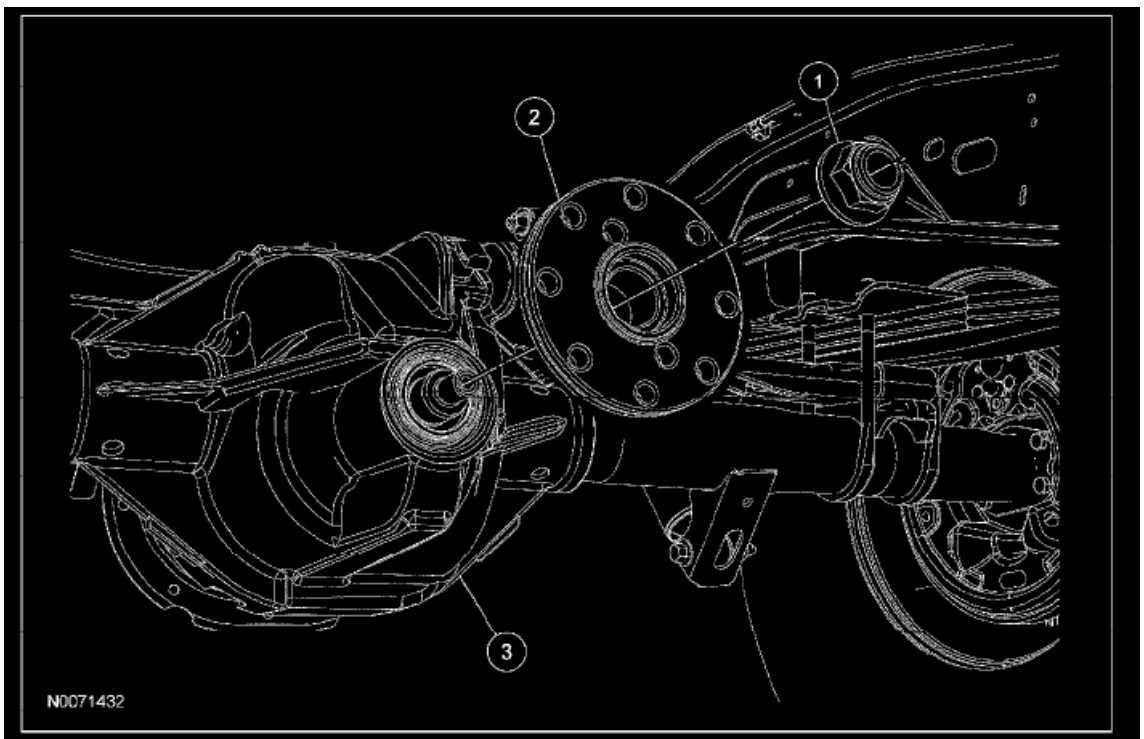
Drive Pinion Flange

Special Tool(s)

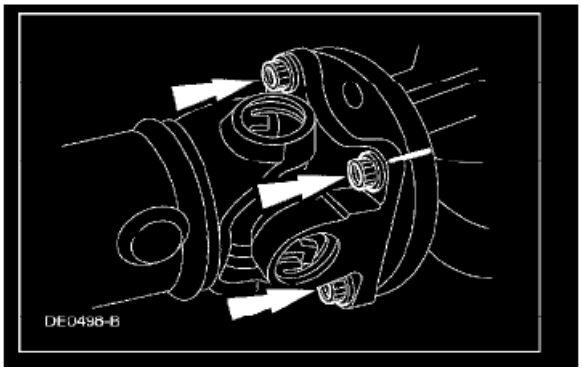
ST1257-A	Holding Fixture, Drive Pinion Flange 205-126 (T78P-4851-A)
	Installer, Drive Pinion Flange 205-002 (TOOL-4858-E) or equivalent
ST2026-A	2-Jaw Puller 205-D072 (D97L-4221-A) or equivalent

Material

Item	Specification
Motorcraft SAE 80W-90 Premium Rear Axle Lubricant XY-80W90-QL (US); CXY-80W90-1L (Canada)	WSP-M2C197-A
Threadlock and Sealer TA-25	WSK-M2G351-A5



Item	Part Number	Description
1	4010	Rear axle housing
2	4851	Pinion flange
3	3895546 S	Pinion nut



Removal

CAUTION: The color on the rear face of the drive pinion nut is critical to this repair. Use the same color new drive pinion nut for installation. If a new collapsible spacer is installed, install the nut in the kit or damage to the component may occur.

1. With the vehicle in NEUTRAL, position it on a hoist.

2. NOTE: The rear wheels and brake drums must be removed to prevent brake drag during drive pinion bearing preload adjustment.

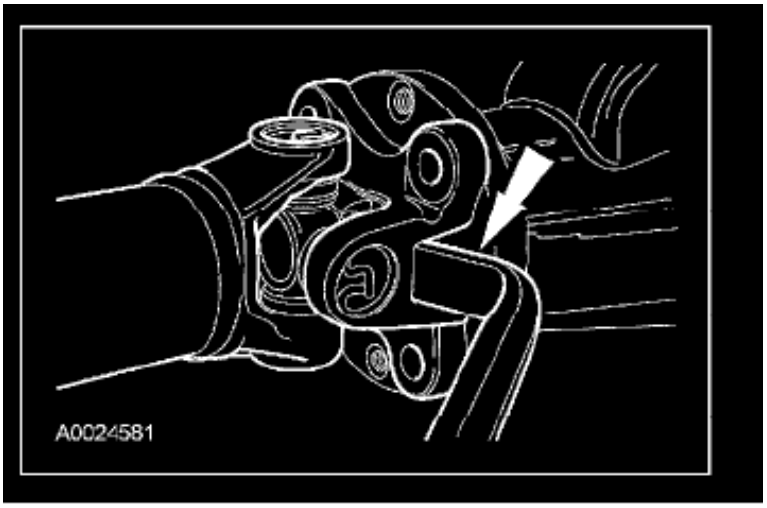
Remove the rear wheel and tire.

3. Remove the rear brake drums.

4. NOTE: Index-mark the driveshaft flange and pinion flange for correct alignment during installation.

Remove the 4 driveshaft-to-pinion flange bolts.

5. CAUTION: The driveshaft flange fits tightly on the rear axle pinion flange pilot. Never hammer on the driveshaft or any of its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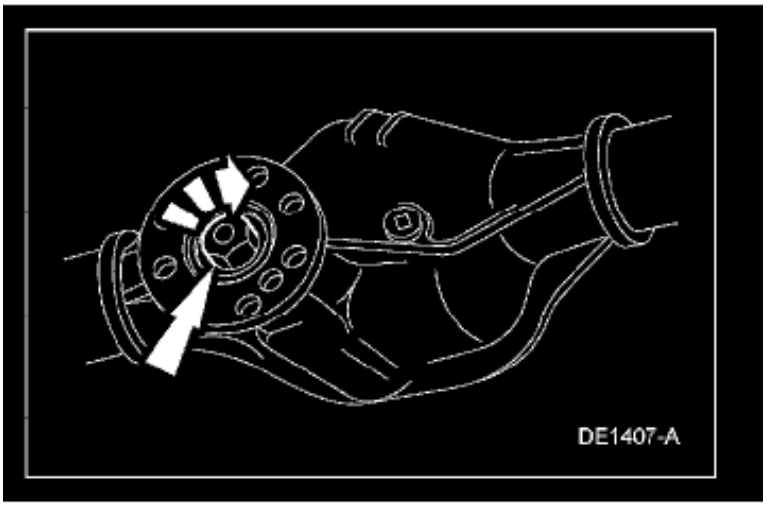
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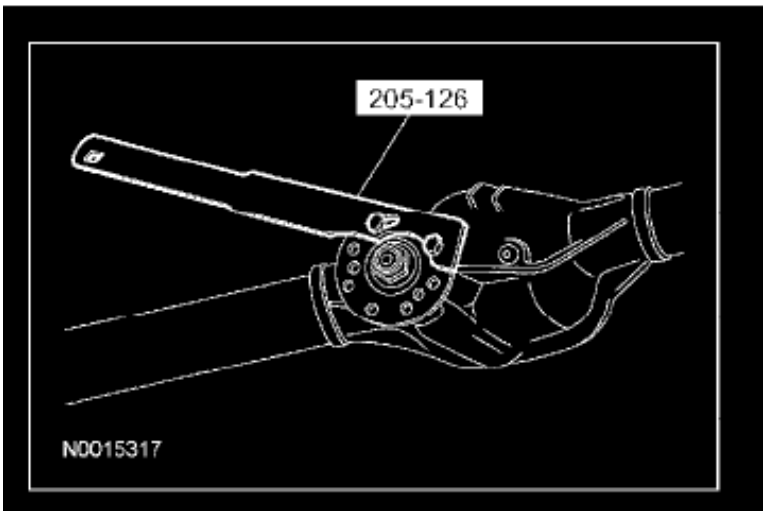
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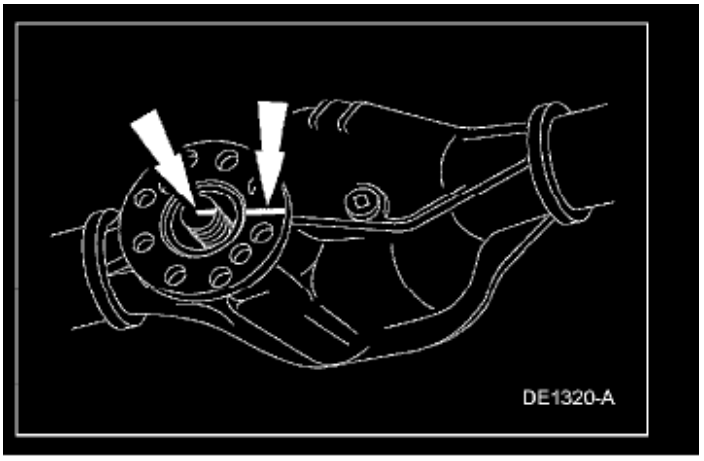
components to disconnect the driveshaft flange from the pinion flange. Pry only in the area shown with a suitable tool to disconnect the driveshaft flange from the pinion flange or damage to the component may occur.

Using a suitable tool as shown, disconnect the driveshaft flange from the rear axle pinion flange.

6. Install a Nm (lb-inch) torque wrench on the nut and record the torque necessary to maintain rotation of the pinion through several revolutions.

7. Using the special tool, hold the pinion flange and remove and discard the nut.

8. Index-mark the pinion flange and the drive pinion stem for correct alignment during installation.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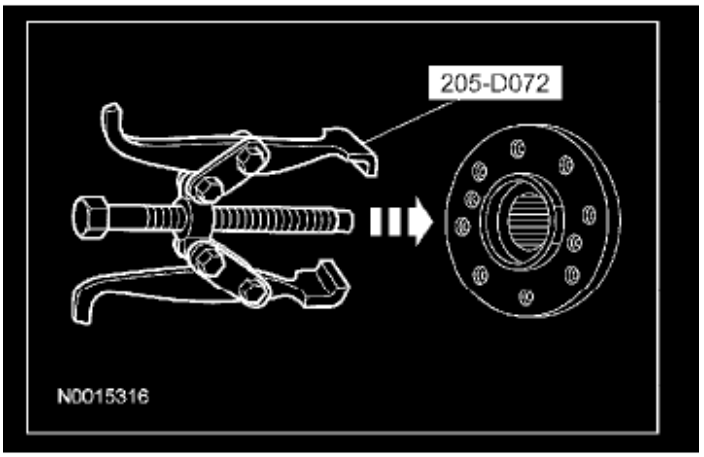
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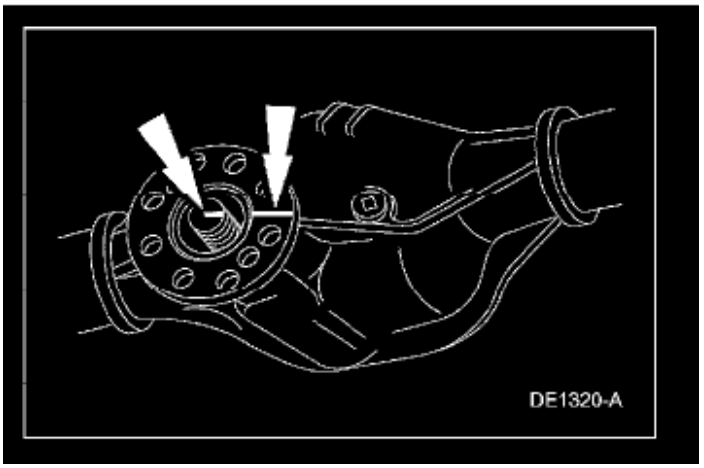

DE1320-A

9. Using the special tool, remove the pinion flange.

Installation

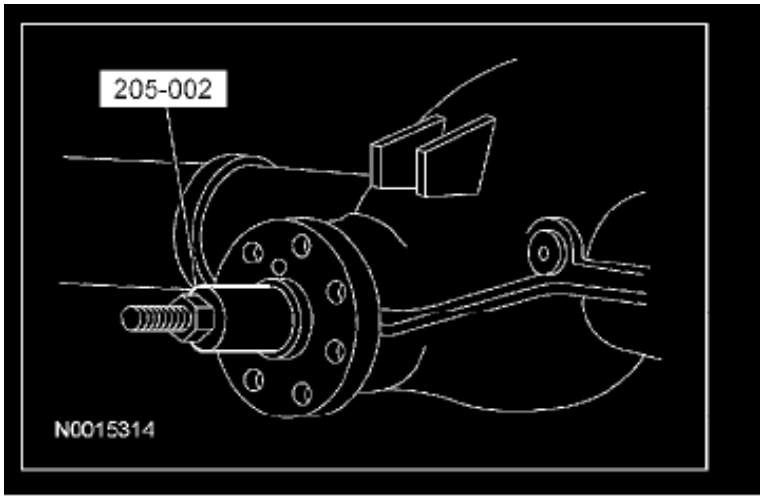
1. Lubricate the pinion flange splines with rear axle lubricant.

2. NOTE: Disregard the scribe marks if a new pinion flange is being installed.

Align the pinion flange with the drive pinion shaft.

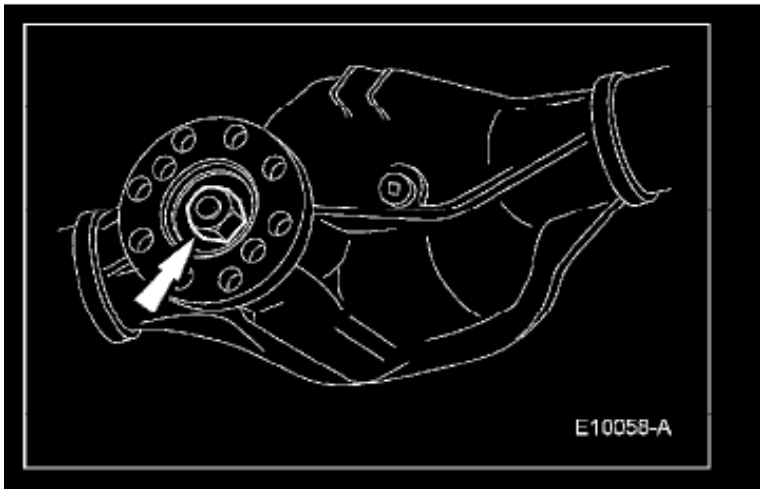
3. NOTE: Disregard the scribe marks if a new pinion flange is being installed.

Using the special tool, install the pinion flange.



8.8 In Drive Pinion Nut

Part Number	Color	Application
389546-S100	Orange	Axles built before 7/16/07
4320	Purple	Axles built after 7/16/07
4C121	Purple	Kit with spacer all 8.8 in



4. CAUTION: Use the same color new drive pinion nut for installation. If a new collapsible spacer must be installed for pinion bearing

preload reduction, install the nut supplied with the new spacer or damage to the component may occur.

Position the new pinion flange nut.

8.8 In Drive Pinion Nut

8.8 In Drive Pinion Nut

5. CAUTION: Do not, under any circumstance, loosen the nut to reduce preload. If it is necessary to reduce preload, install a new

collapsible spacer and nut kit or damage to the component may occur.

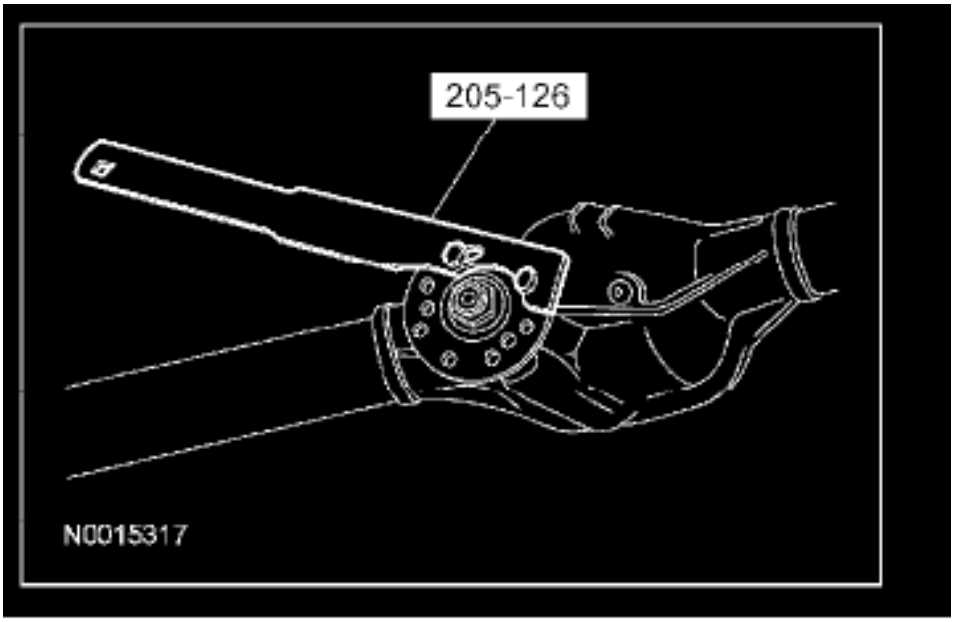
NOTE: Remove the special tool while taking preload readings with the Nm (lb-inch) torque wrench.

Using the special tool to hold the pinion flange, tighten the nut. ^

Rotate the pinion occasionally to make sure the differential pinion bearings seat correctly. Take frequent differential pinion bearing preload readings by rotating the pinion with a Nm (lb-inch) torque wrench.

^ If the preload recorded prior to disassembly is lower than the specification, tighten the nut to specification. If the preload recorded prior to disassembly is higher than the specification, tighten the nut to the original reading as recorded.

^ Refer to Torque Specifications.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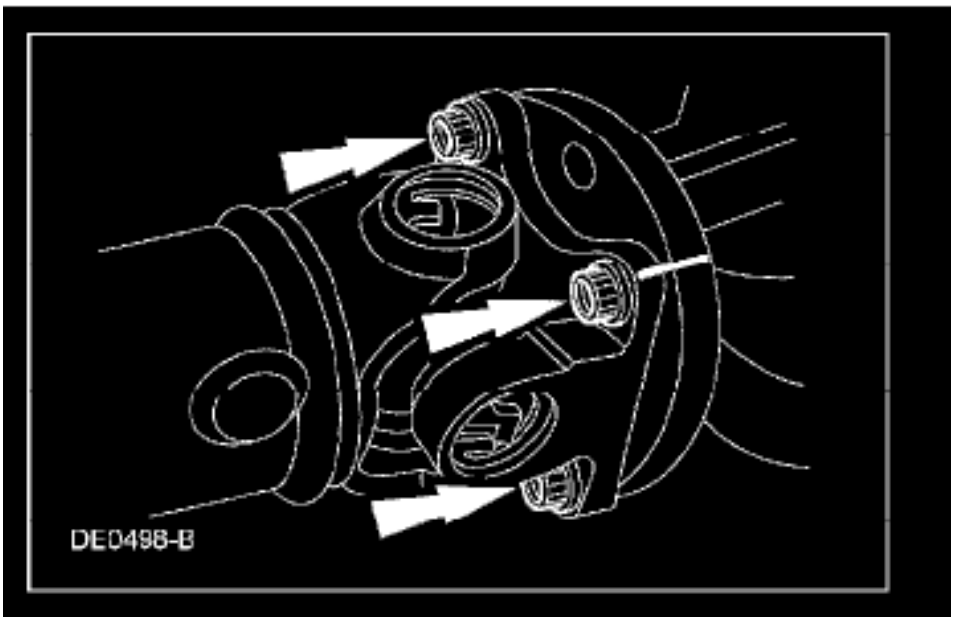

DE0498-B

6. NOTE: Align the index marks.

NOTE: If new bolts to retain the driveshaft to the axle are not available, coat the threads of the original bolts with Threadlock(R).

NOTE: The driveshaft flange fits tightly on the rear axle pinion flange pilot. To make sure that the driveshaft flange seats squarely on the pinion flange, tighten the bolts evenly in a cross pattern.

Position the driveshaft flange on the pinion flange with the index marks aligned, and install the bolts. ^

Tighten to 112 Nm (83 lb-ft).

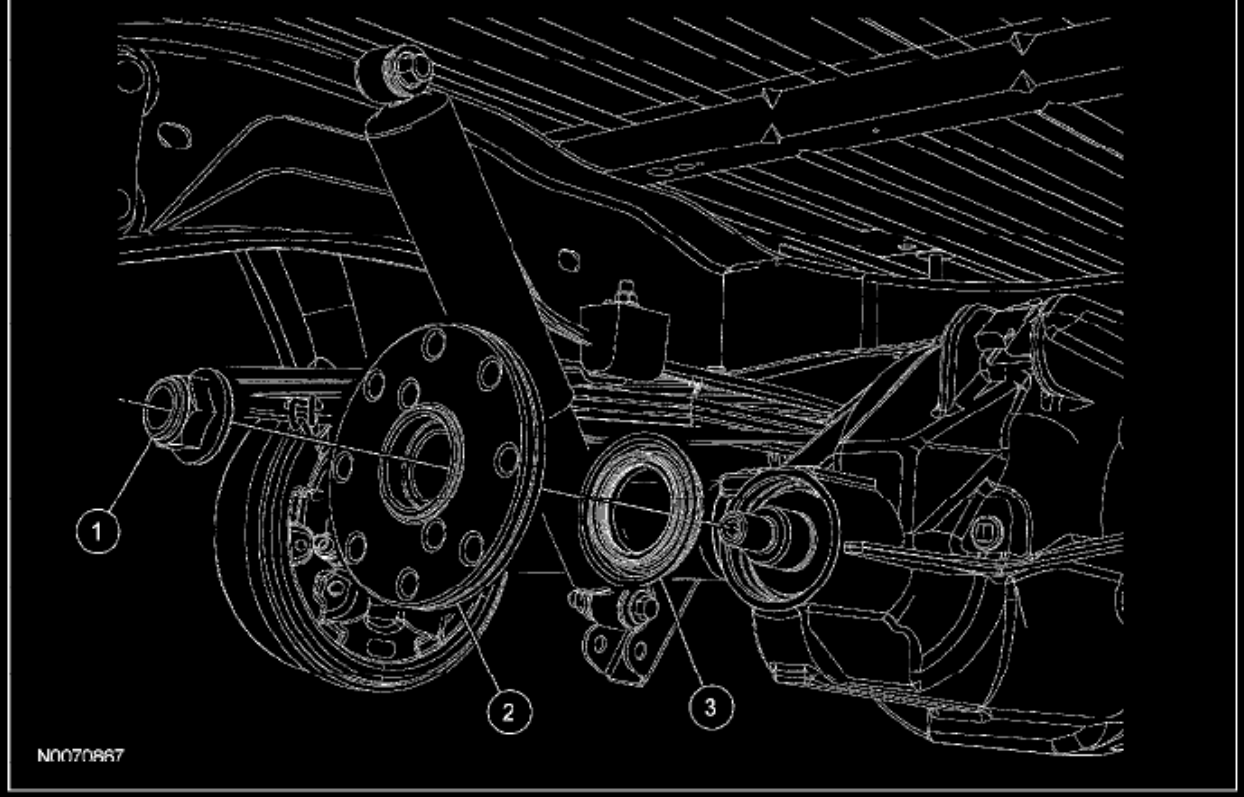
7. Install the brake drums. 8. Install the rear wheel and tire.

Special Tool(s)

ST1325-A	Installer, Drive Pinion Oil Seal 205-208 (T83T-4676-A)

Material

Item	Specification
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B



Item	Part Number	Description
1	389546-S100	Drive pinion nut
2	4851	Drive pinion flange
3	4676	Drive pinion seal

Pinion Flange: Service and Repair Drive Pinion Seal

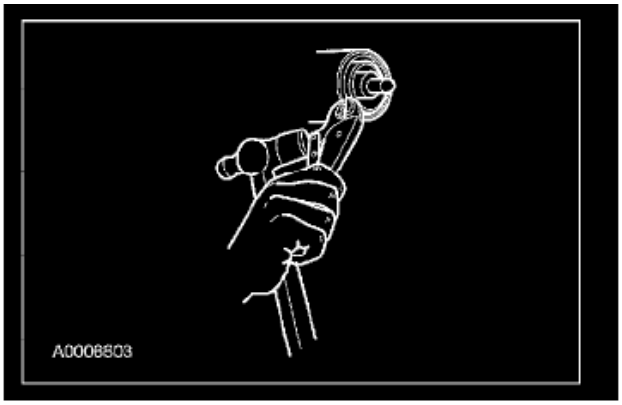
Ford 7.5-Inch Ring Gear - Rear Drive Axle/Differential

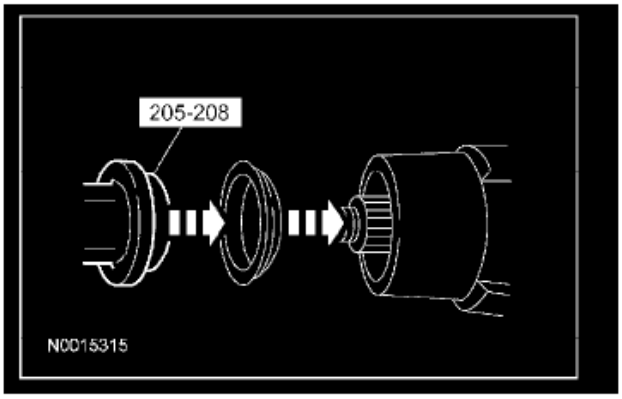
Drive Pinion Seal

Removal

1. Remove the pinion flange. 2. Pry up on the metal flange of the rear axle drive pinion seal. Install gripping pliers and strike with a hammer until the rear axle drive pinion seal is

removed.





Special Tool(s)

ST1325-A	Installer, Driver Pinion Oil Seal 205-208 (T83T-4676-A)

Material

Item	Specification
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B

Installation

1. Lubricate the lips of the new rear axle drive pinion seal with grease.

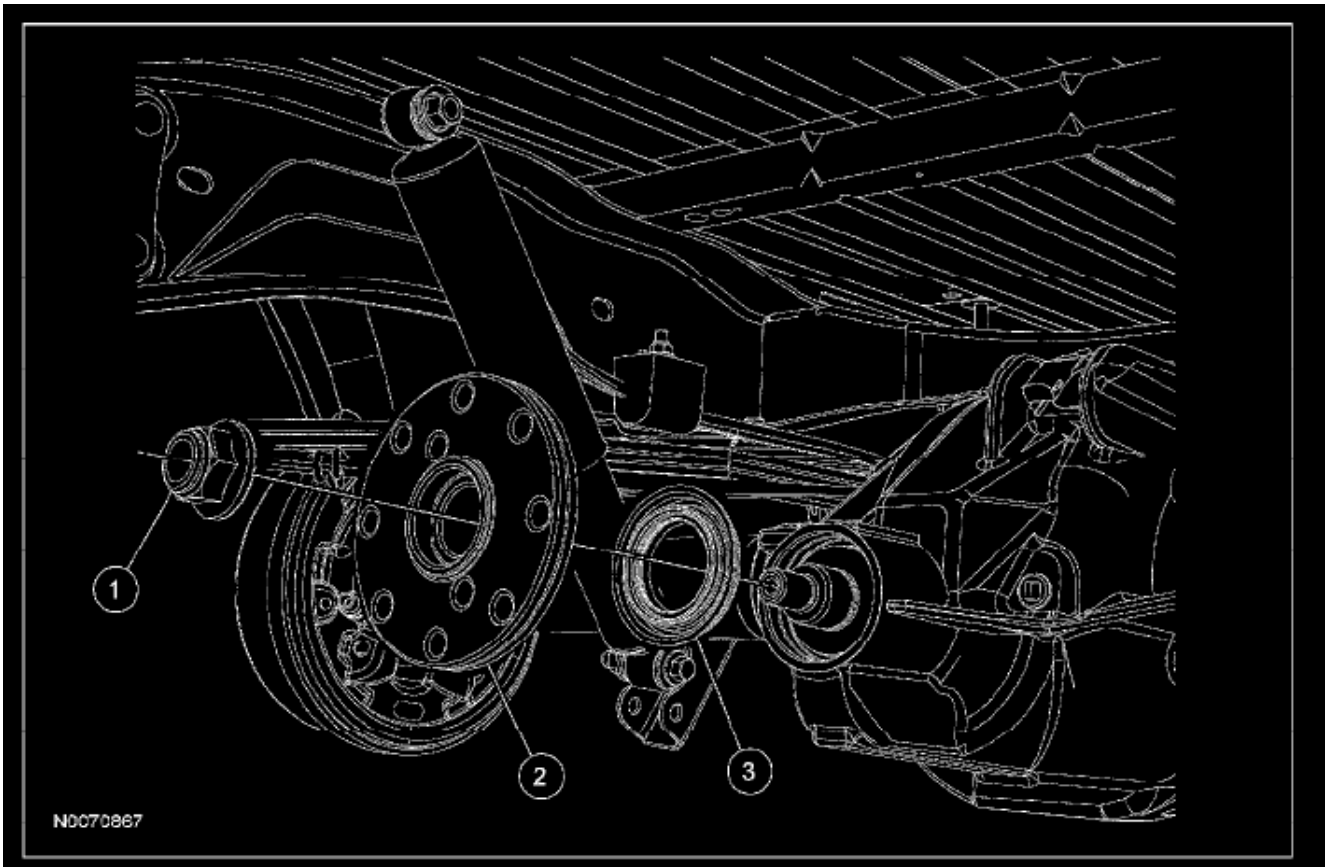
2. NOTE: If the rear axle drive pinion seal becomes misaligned during installation, remove the rear axle drive pinion seal and install a new seal.

Using the special tool, install the rear axle drive pinion seal.

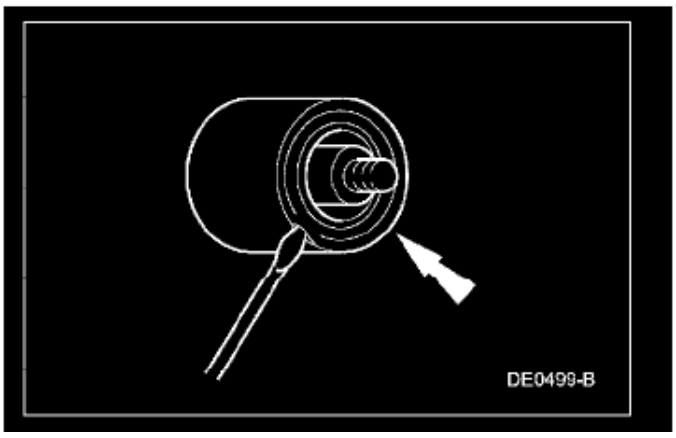
3. Install the pinion flange.

Ford 8.8-Inch Ring Gear - Rear Drive Axle/Differential

Drive Pinion Seal



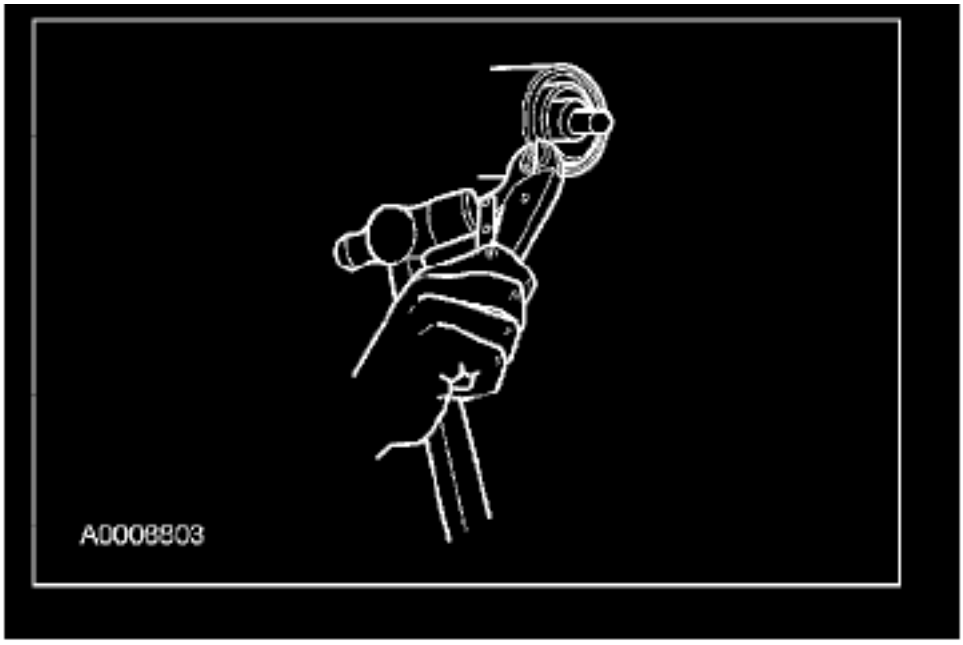
Item	Part Number	Description
1	389546-S100	Pinion nut
2	4851	Pinion flange
3	4676	Drive pinion seal

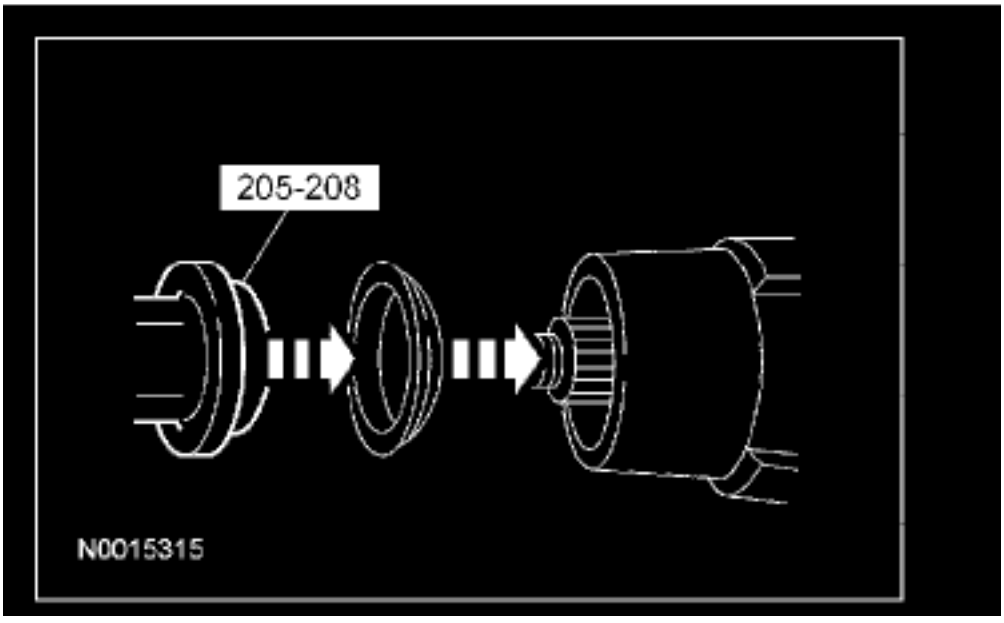


Removal

1. Remove the pinion flange. 2. Using a screwdriver, force the rear axle drive pinion seal metal flange up and strike it with a hammer.

3. Using gripping pliers and a hammer, remove the seal.





Installation

1. Coat the new rear axle drive pinion seal lips with grease.

2. NOTE: If the rear axle drive pinion seal becomes misaligned during installation, remove the seal and install a new seal.

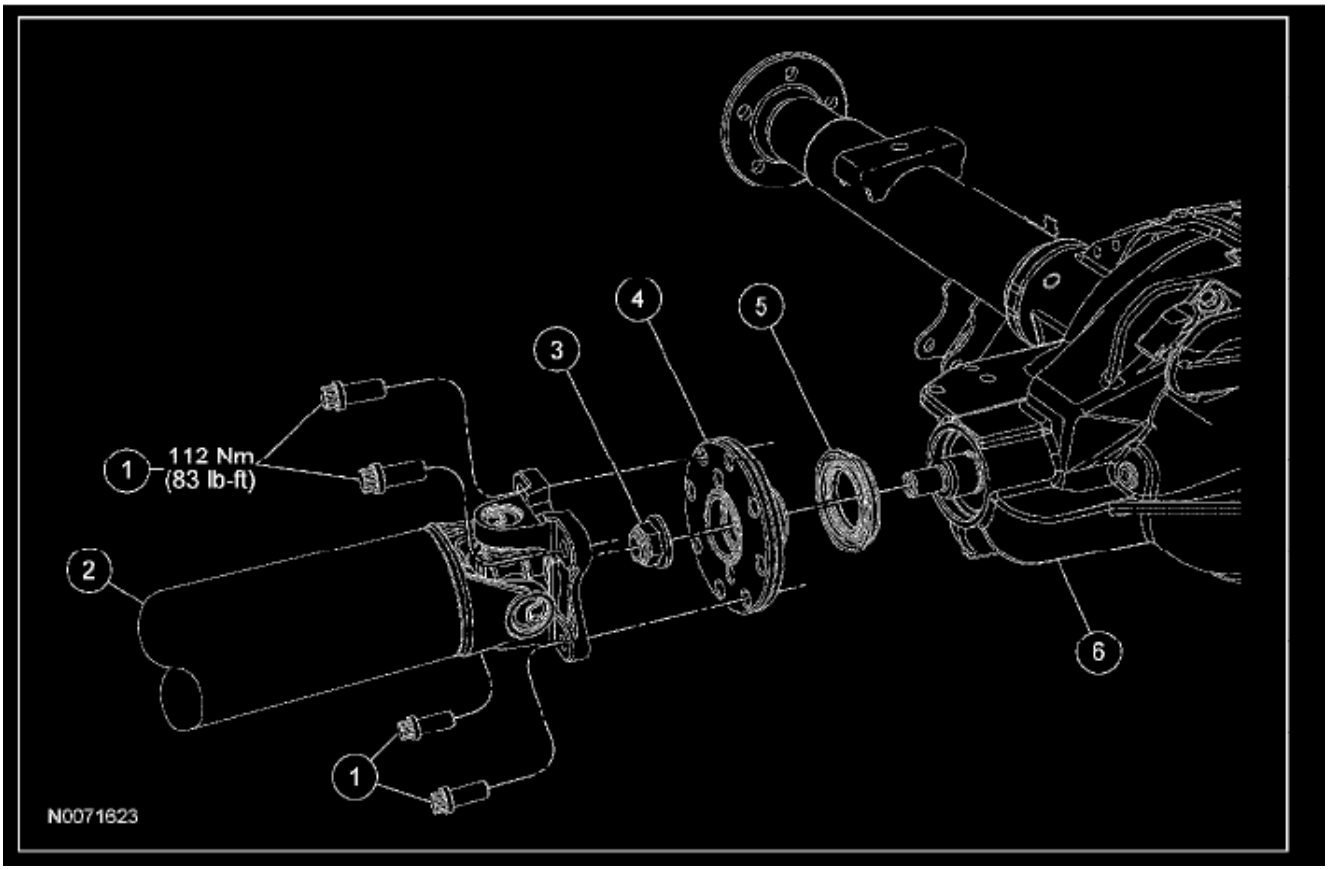
Using the special tool, install the rear axle drive pinion seal.

3. Install the pinion flange.

Special Tool(s)

ST1257-A	Holding Fixture, Drive Pinion Flange 205-126 (T78P-4851-A)
	Installer, Drive Pinion Flange 205-002 (TOOL-4858-E) or equivalent

(Continued)



Pinion Flange: Service and Repair Drive Pinion Flange and Drive Pinion Seal

Drive Pinion Flange and Drive Pinion Seal

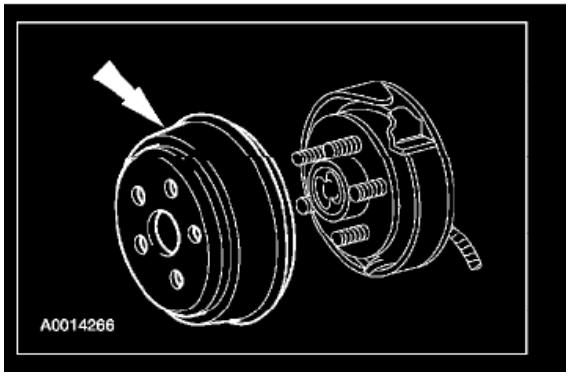
Special Tool(s)

ST1325-A	Installer, Drive Pinion Oil Seal 205-208 (T83T-4676-A)
ST2026-A	2-Jaw Puller 205-D072 (D97L-4221-A) or equivalent

Material

Item	Specification
Motorcraft SAE 75W-140 Synthetic Rear Axle Lubricant XY-75W140-QL (US); CXY-75W140-1L (Canada)	WSL-M2C192-A

Item	Part Number	Description
1	N800594-S	Driveshaft flange-to-pinion flange bolts (4 required)
2	4602	Driveshaft assembly
3	389546-S100	Pinion nut
4	4851	Pinion flange
5	4676	Drive pinion seal
6	4010	Rear drive axle housing



Removal

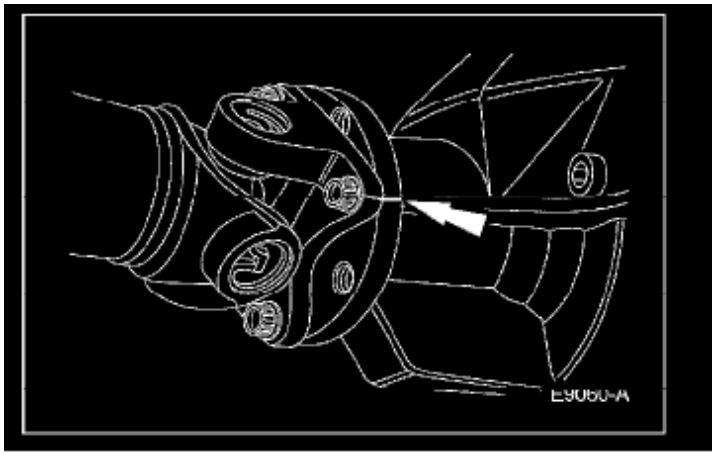
CAUTION: The color on the rear face of the drive pinion nut is critical to this repair. Use the same color new drive pinion nut for installation unless installing a new collapsible spacer or damage to the component may occur.

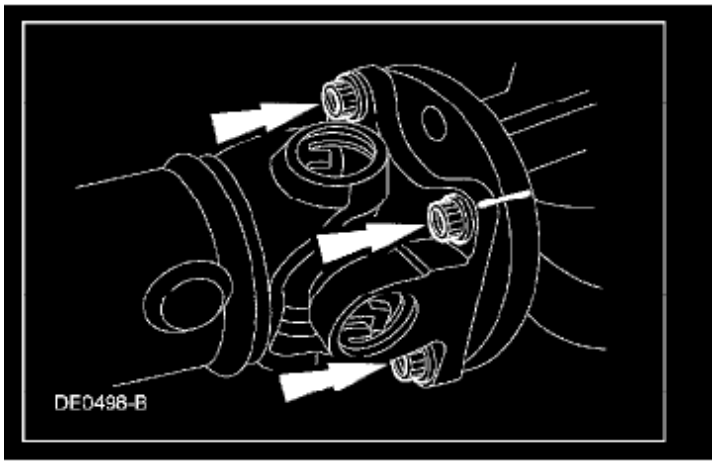
1. With the vehicle in NEUTRAL, position it on a hoist.

2. NOTE: The rear wheels and brake drums must be removed to prevent brake drag during drive pinion bearing preload adjustment.

Remove the wheel and tire.

3. Remove the rear brake drums.

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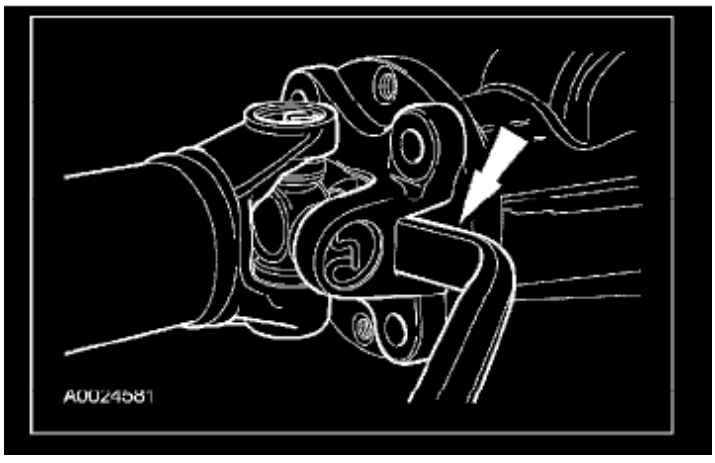
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4. Mark the driveshaft flange and pinion flange for correct alignment during installation.

5. Remove the 4 driveshaft flange-to-pinion flange bolts.

6. CAUTION: The driveshaft centering socket yoke fits tightly on the rear axle pinion flange pilot. Never hammer on the driveshaft or any

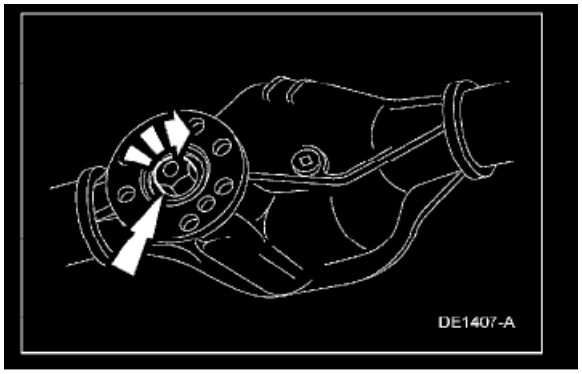
of its components to disconnect the yoke from the flange. Pry only in the area shown with a suitable tool to disconnect the yoke from the flange or damage to the component may occur.

Using a suitable tool as shown, disconnect the driveshaft centering socket yoke from the rear axle pinion flange. ^

Position the driveshaft aside.

7. Install a Nm (lb-inch) torque wrench on the pinion nut and record the torque required to maintain rotation of the pinion through several

revolutions.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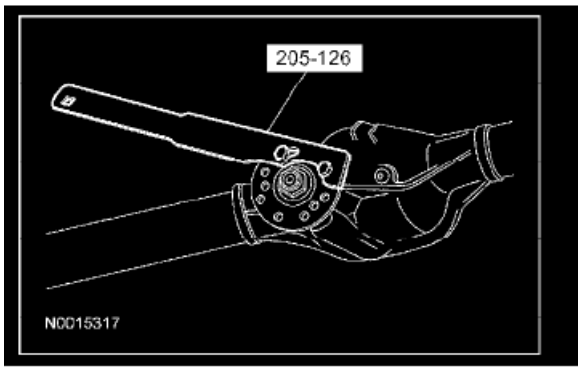
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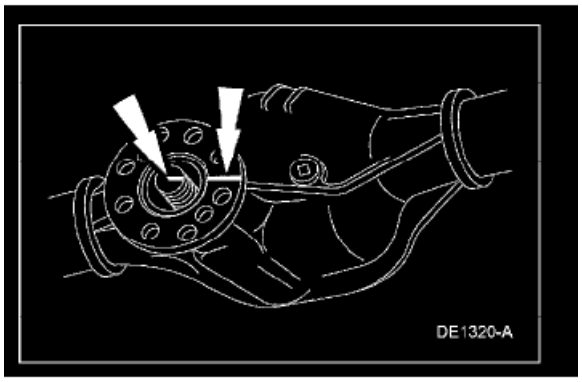
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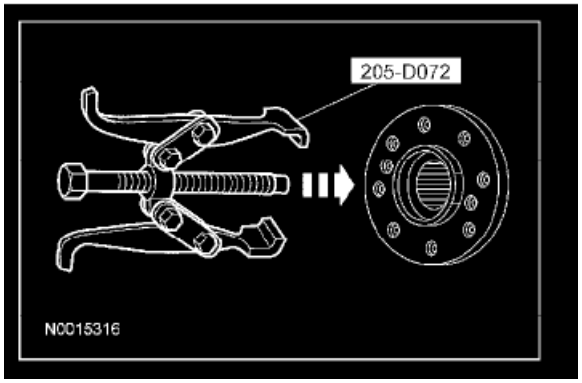
205-D072
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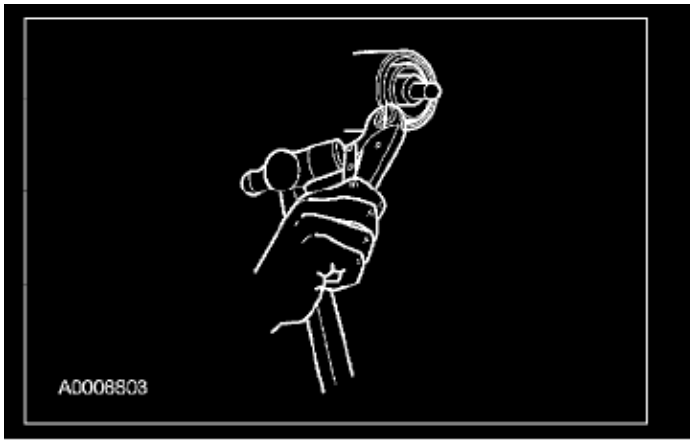
8. Using the special tool, hold the pinion flange and remove and discard the pinion nut.

9. Mark the pinion flange in relation to the drive pinion stem to make sure of correct alignment during installation.

10. Using the special tool, remove the pinion flange.

11. Force up on the metal flange of the rear axle drive pinion seal. Install gripping pliers and strike with a hammer until the rear axle pinion seal is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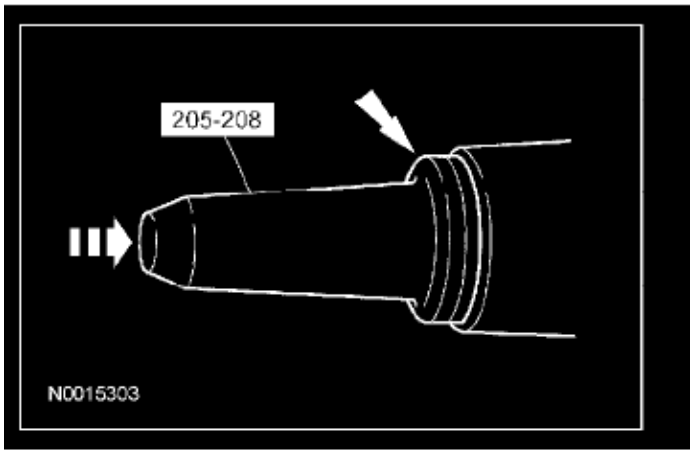
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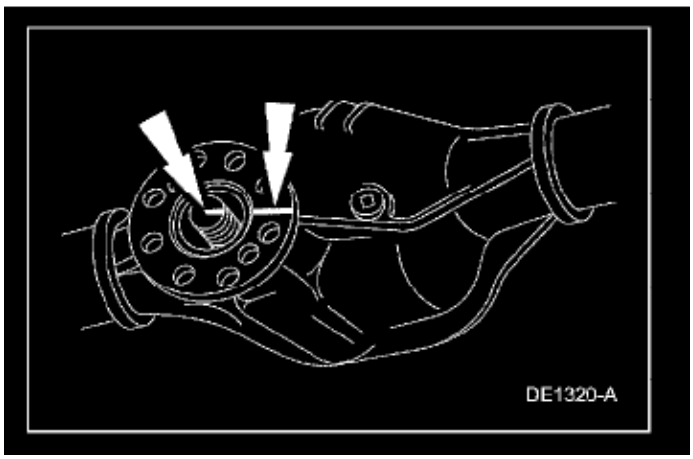
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removed.

Installation

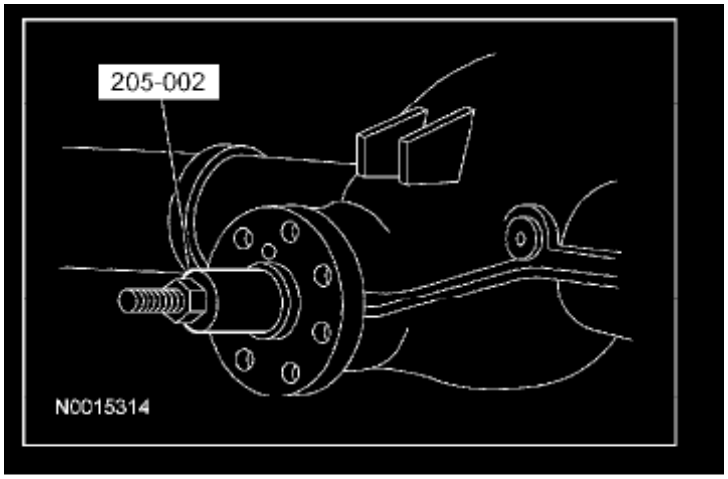
1. Lubricate the new rear axle drive pinion seal with lubricant. 2. Using the special tool, install the rear axle drive pinion seal.

3. Lubricate the pinion flange splines with lubricant.

4. NOTE: Disregard the scribe marks if a new pinion flange is being installed.

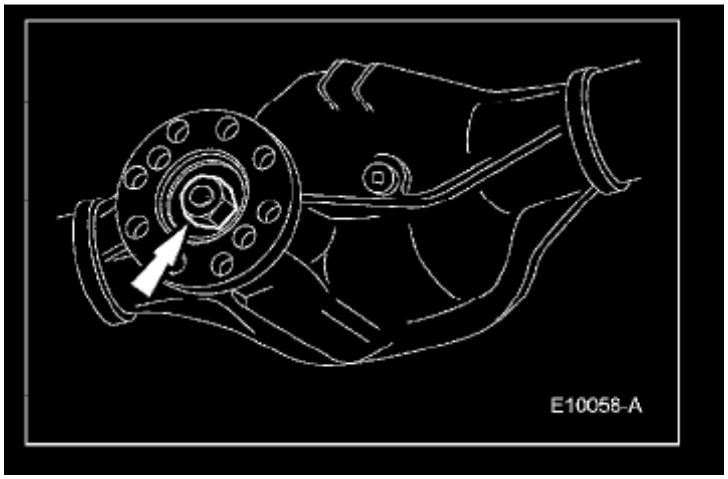
Align the pinion flange with the drive pinion shaft.

5. Install the pinion flange using the special tool.



Drive Pinion Nut

Part Number	Color Description	Application
389546-S100	Orange	Axles built before 7/16/07
4320	Purple	Axles built after 7/16/07
4C121	Purple	Kit with spacer for all 8.8 in axles



6. CAUTION: Install a new pinion nut with the same color as the original if not replacing the collapsible spacer. If a new collapsible spacer

is installed, install the nut in the kit or damage to the component may occur.

Position the new pinion nut.

Drive Pinion Nut

Drive Pinion Nut

7. CAUTION: Under no circumstances is the pinion nut to be backed off to reduce preload. If reduced preload is required, a new

collapsible spacer and pinion nut kit must be installed or damage to the component may occur.

NOTE: Remove the special tool while taking preload readings with the Nm (lb-inch) torque wrench.

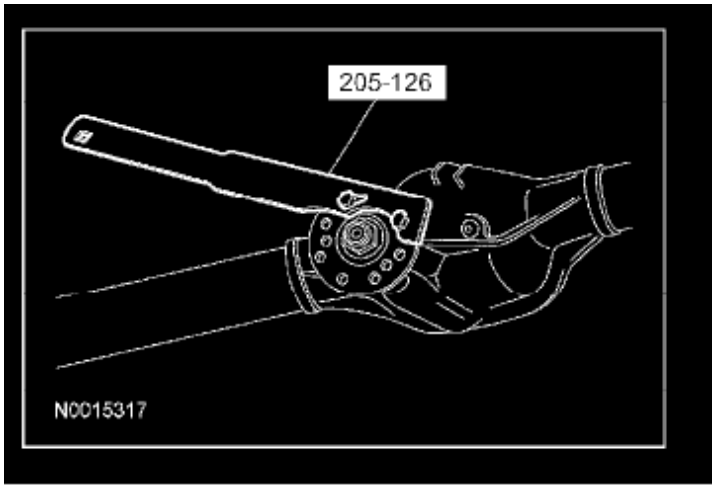
Using the special tool hold the pinion flange, tighten the pinion nut. ^

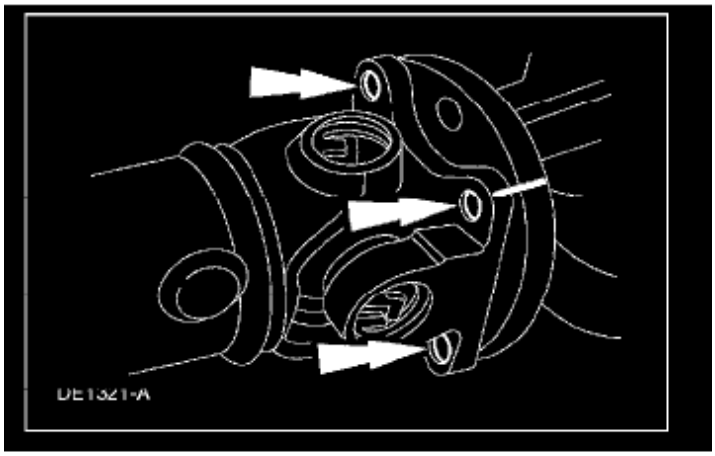
Rotate the pinion occasionally to make sure the cone and roller bearings are seating correctly.

^ Install a Nm (lb-inch) torque wrench on the pinion nut.

^ Rotating the pinion through several revolutions, take frequent cone and roller bearing torque preload readings until the original recorded preload reading is obtained.

^ If the original recorded preload is lower than specifications, tighten to the appropriate specifications for used bearings. If the preload is higher than specification, tighten the nut to the original reading as recorded.


205-126
N0015317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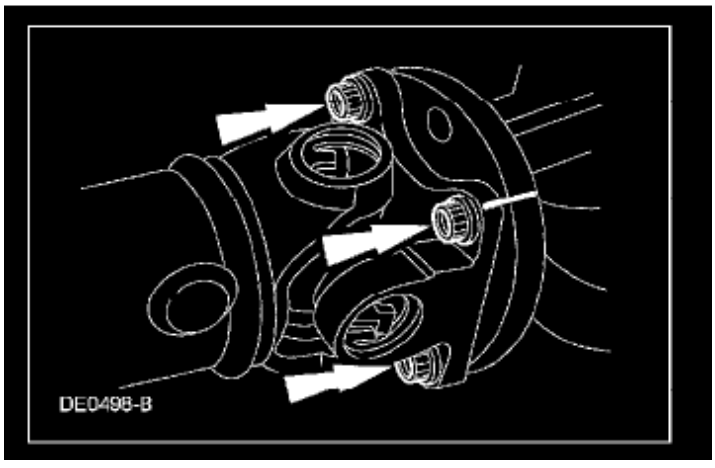

DE0498-B

8. Position the rear driveshaft and align the marks on the pinion flange.

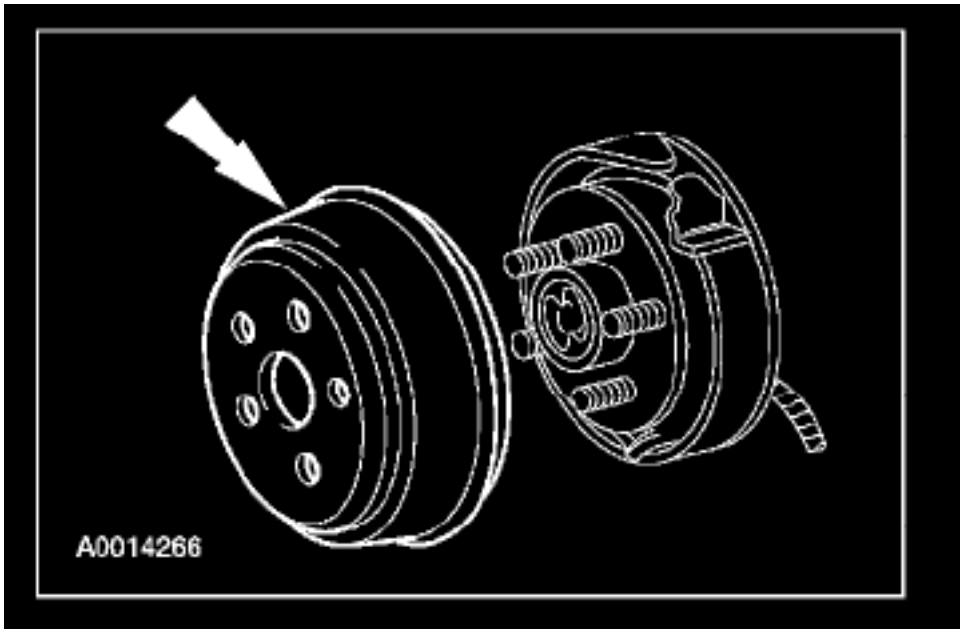
9. NOTE: The driveshaft centering socket yoke fits tightly on the rear axle pinion flange pilot. To make sure that the yoke seats squarely on the

flange, tighten the bolts evenly in a cross pattern.

Install the 4 bolts. ^

Tighten to 112 Nm (83 lb-ft).

10. Install the rear brake drums.



11. Install the wheel and tire.

Special Tool(s)

ST1257-A	Holding Fixture, Drive Pinion Flange 205-126 (T78P-4851-A)
	Installer, Drive Pinion Flange 205-002 (TOOL-4858-E) or equivalent
ST2026 A	2-Jaw Puller 205-D072 (D97L-4221-A) or equivalent

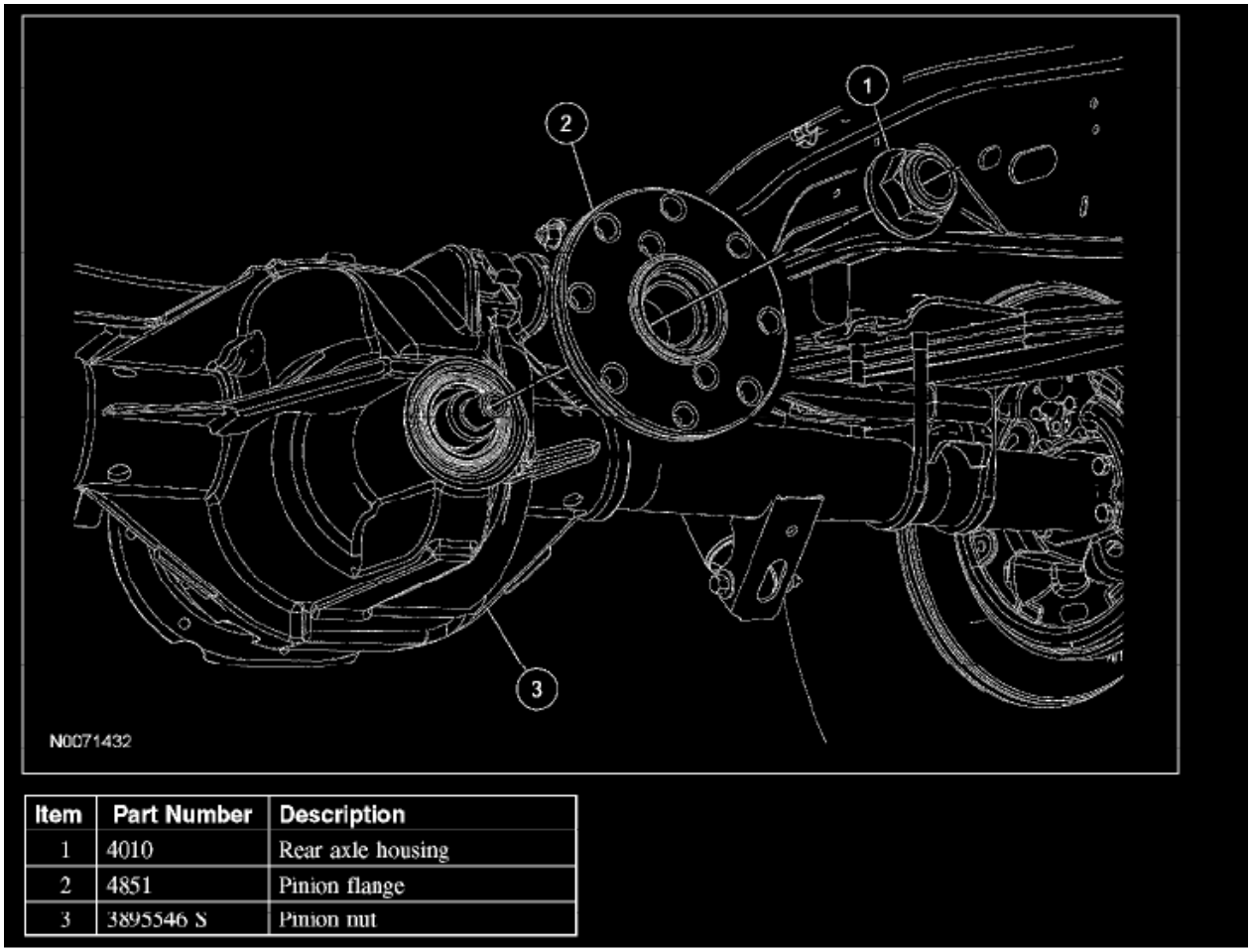
Material

Item	Specification
Motorcraft SAE 80W-90 Premium Rear Axle Lubricant XY-80W90-QL (US); CXY-80W90-1L (Canada); (Model 60/70 axles)	WSP-M2C197-A

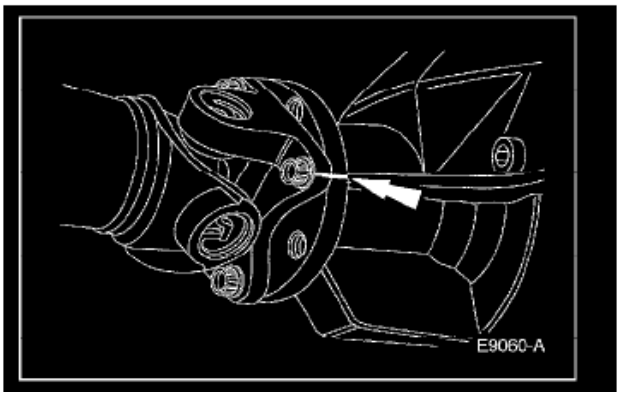
Seals and Gaskets: Service and Repair Drive Pinion Flange

Ford 7.5-Inch Ring Gear - Rear Drive Axle/Differential

Drive Pinion Flange



Item	Part Number	Description
1	4010	Rear axle housing
2	4851	Pinion flange
3	3895546 S	Pinion nut



Removal

CAUTION: The color on the rear of the drive pinion nut is critical to this repair. Use the same color new drive pinion nut for installation. If a new collapsible spacer is installed, install the nut in the kit or damage to the component may occur.

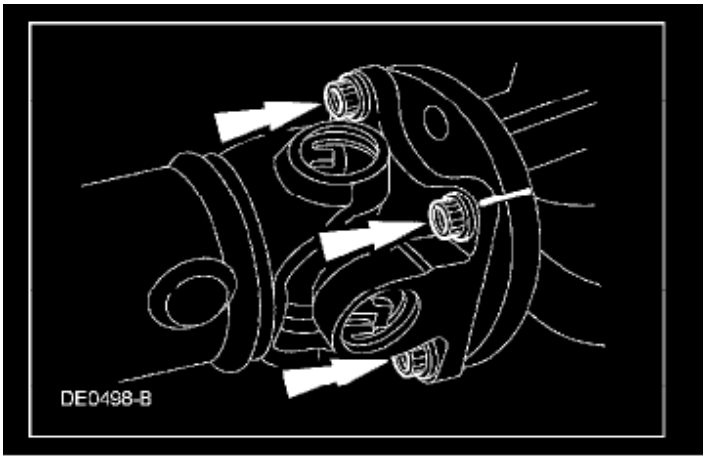
1. With the vehicle in NEUTRAL, position it on a hoist.

2. NOTE: The rear wheels and brake drums must be removed to prevent brake drag during drive pinion bearing preload adjustment.

Remove the brake drums.

3. Mark the driveshaft flange and pinion flange for correct alignment during installation.

4. Remove the 4 driveshaft-to-pinion flange bolts.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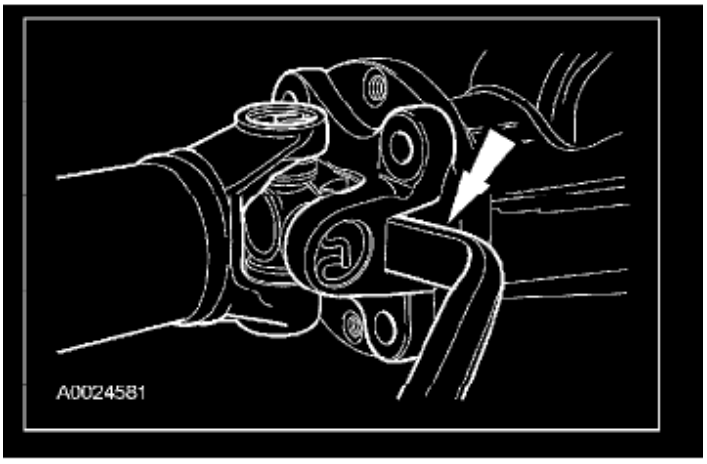
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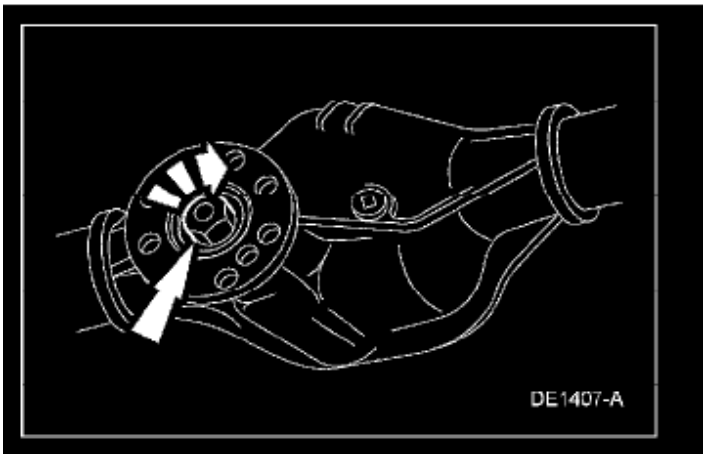

DE1407-A

5. NOTE: The driveshaft centering socket yoke fits tightly on the rear axle pinion flange pilot. Never hammer on the driveshaft or any of its

components to disconnect the yoke from the flange. Pry only in the area shown with a suitable tool to disconnect the yoke from the flange.

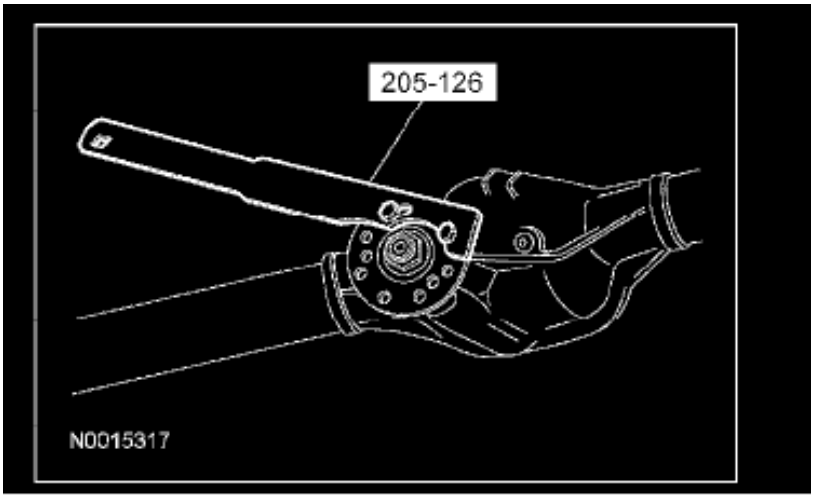
Using a suitable tool as shown, disconnect the driveshaft centering socket yoke from the rear axle pinion flange. ^

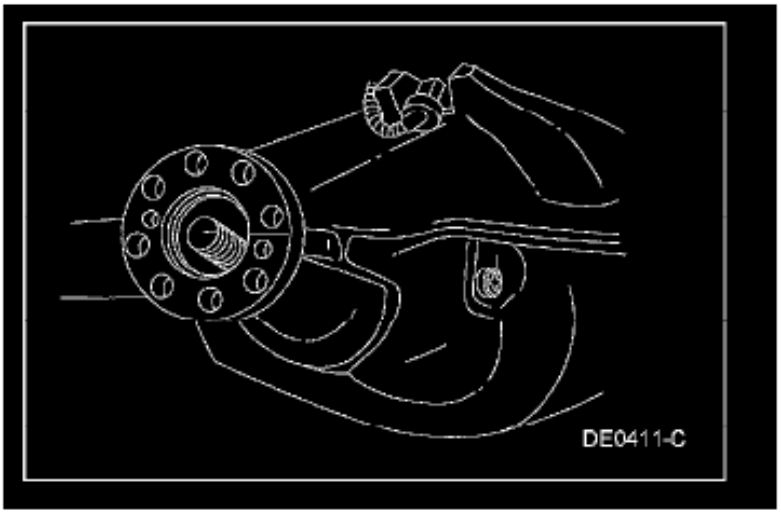
Position the driveshaft aside.

6. Install a Nm (lb-inch) torque wrench on the pinion nut and record the torque required to maintain rotation of the pinion through several

revolutions.

7. Using the special tool, hold the pinion flange and remove and discard the nut.


205-126
N0015317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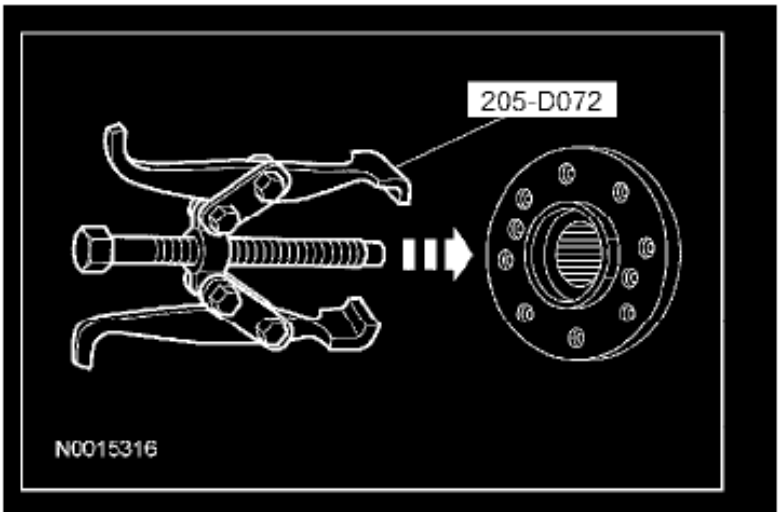

205-D072
N0015316

8. Index-mark the pinion flange in relation to the pinion stem to make sure of correct alignment during installation.

9. Using the special tool, remove the pinion flange.

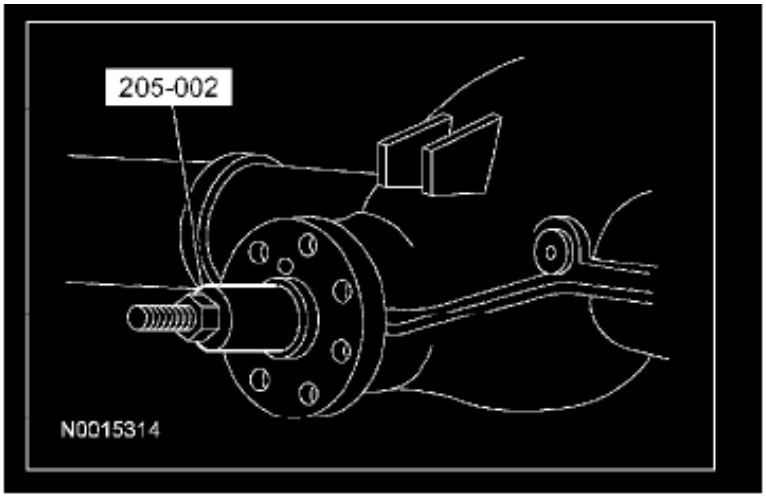
Installation

1. Lubricate the pinion flange splines with lubricant.

2. NOTE: Disregard the scribe marks if a new pinion flange is being installed.

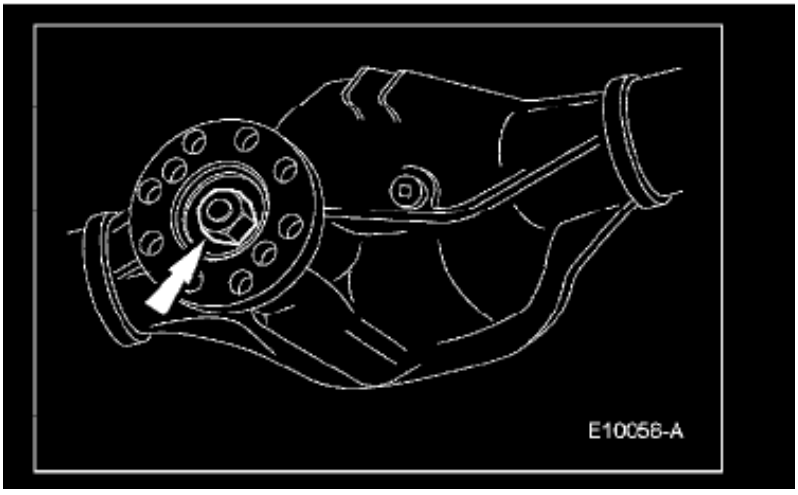
Align the pinion flange with the drive pinion shaft.

3. Install the pinion flange using the special tool.



7.5 In Drive Pinion Nut

Part Number	Color	Application
389546-S100	Orange	Axles built before 7/16/07
4320	Purple	Axles built after 7/16/07
4C121	Purple	Kit with spacer all 7.5



4. CAUTION: Use the same color new drive pinion nut for installation. If a new collapsible spacer must be installed for preload reduction,

install the nut supplied with the new spacer or damage to the component may occur.

Position the new pinion flange nut.

7.5 In Drive Pinion Nut

7.5 In Drive Pinion Nut

5. CAUTION: Under no circumstances is the pinion nut to be backed off to reduce preloads or component damage may occur. If reduced

preload is required, a new drive pinion collapsible spacer and pinion nut kit must be installed.

NOTE: Remove the special tool while taking preload readings with the Nm (lb-inch) torque wrench.

Using the special tool, hold the pinion flange and tighten the pinion nut. ^

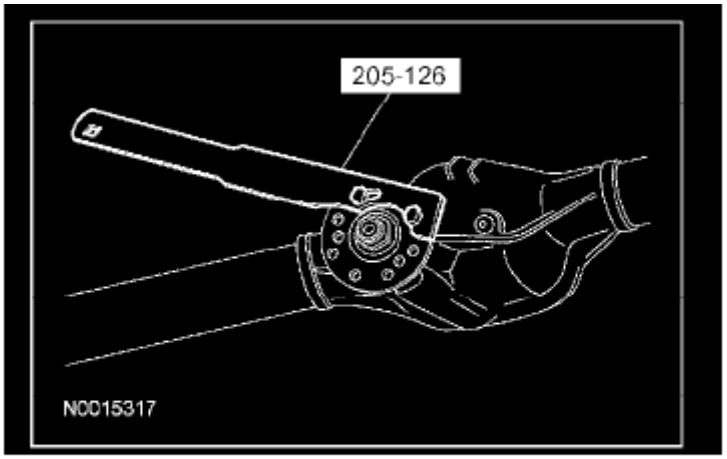
Rotate the pinion occasionally to make sure the cone and roller bearings are seating correctly.

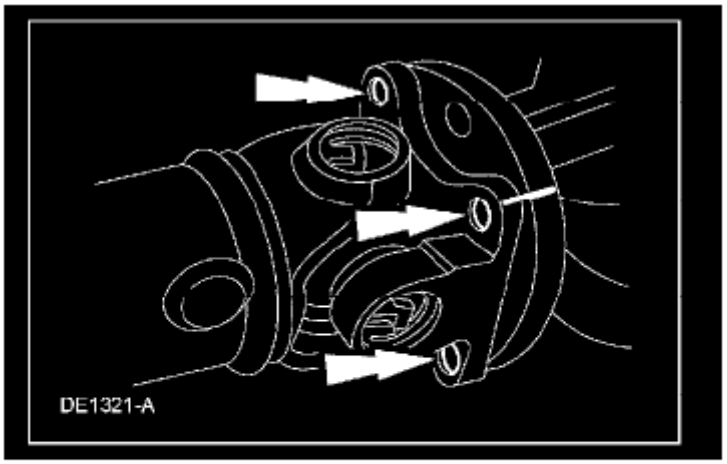
^ Install a Nm (lb-inch) torque wrench on the pinion nut.

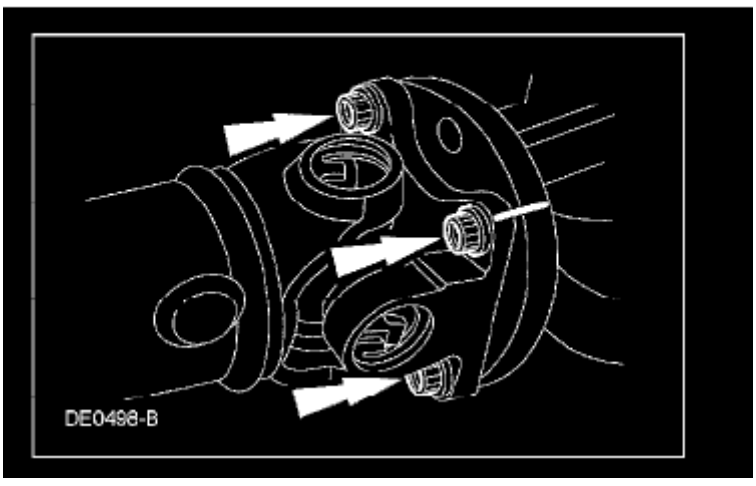
^ Rotating the pinion through several revolutions, take frequent cone and roller bearing torque preload readings until the original recorded preload reading is obtained.

^ If the original recorded preload is lower than specification, tighten to the appropriate specification. If the preload is higher than the specification, then tighten the nut to the original reading as recorded.

^ Refer to Torque Specification.


205-126
N0015317


DE1321-A


DE0498-B

6. Position the driveshaft and align the marks on the pinion flange.

7. NOTE: The driveshaft centering socket yoke fits tightly on the rear axle pinion flange pilot. To make sure that the yoke seats squarely on the

flange, tighten the bolts evenly in a cross pattern.

Install the 4 driveshaft bolts. ^

Tighten to 112 Nm (83 lb-ft).

8. Install the rear brake drums.

Ford 8.8-Inch Ring Gear - Rear Drive Axle/Differential

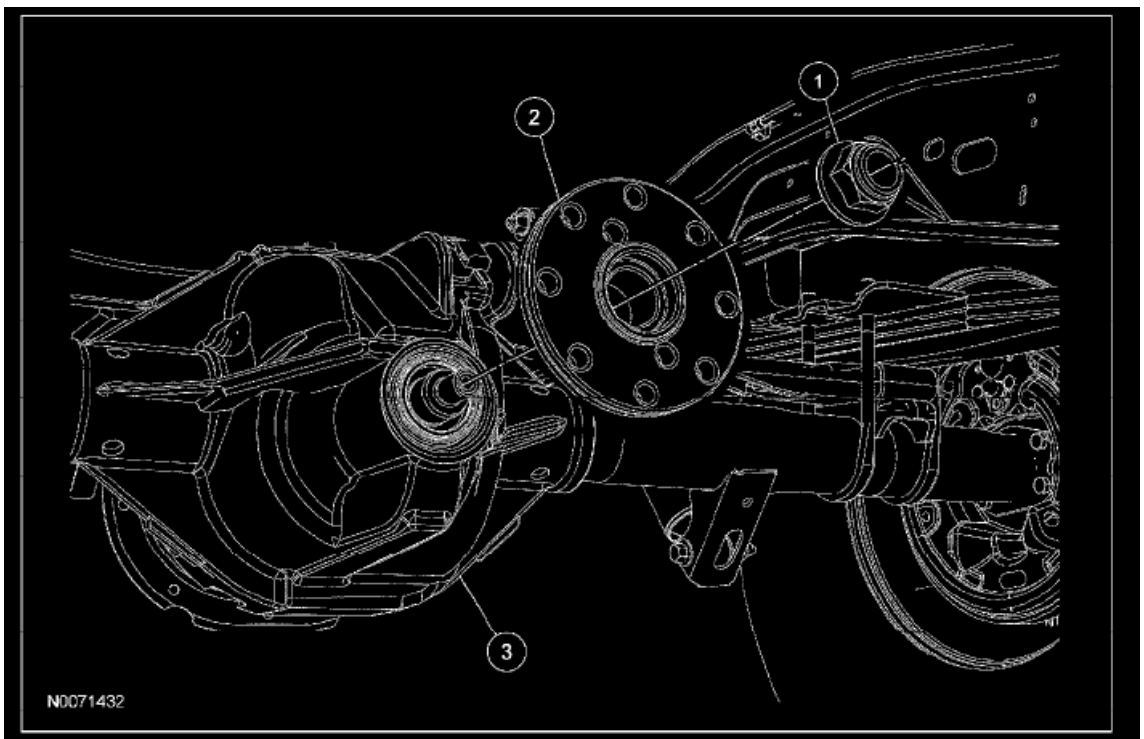
Drive Pinion Flange

Special Tool(s)

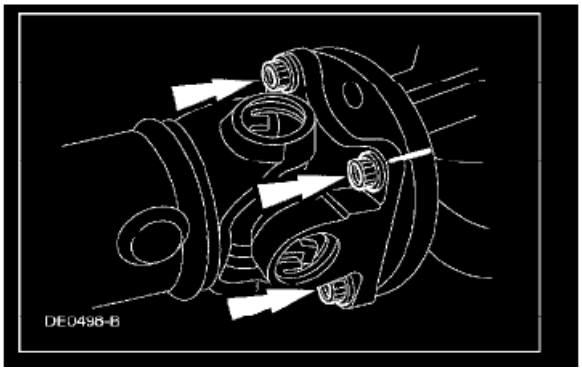
ST1257-A	Holding Fixture, Drive Pinion Flange 205-126 (T78P-4851-A)
	Installer, Drive Pinion Flange 205-002 (TOOL-4858-E) or equivalent
ST2026-A	2-Jaw Puller 205-D072 (D97L-4221-A) or equivalent

Material

Item	Specification
Motorcraft SAE 80W-90 Premium Rear Axle Lubricant XY-80W90-QL (US); CXY-80W90-1L (Canada)	WSP-M2C197-A
Threadlock and Sealer TA-25	WSK-M2G351-A5



Item	Part Number	Description
1	4010	Rear axle housing
2	4851	Pinion flange
3	3895546 S	Pinion nut



Removal

CAUTION: The color on the rear face of the drive pinion nut is critical to this repair. Use the same color new drive pinion nut for installation. If a new collapsible spacer is installed, install the nut in the kit or damage to the component may occur.

1. With the vehicle in NEUTRAL, position it on a hoist.

2. NOTE: The rear wheels and brake drums must be removed to prevent brake drag during drive pinion bearing preload adjustment.

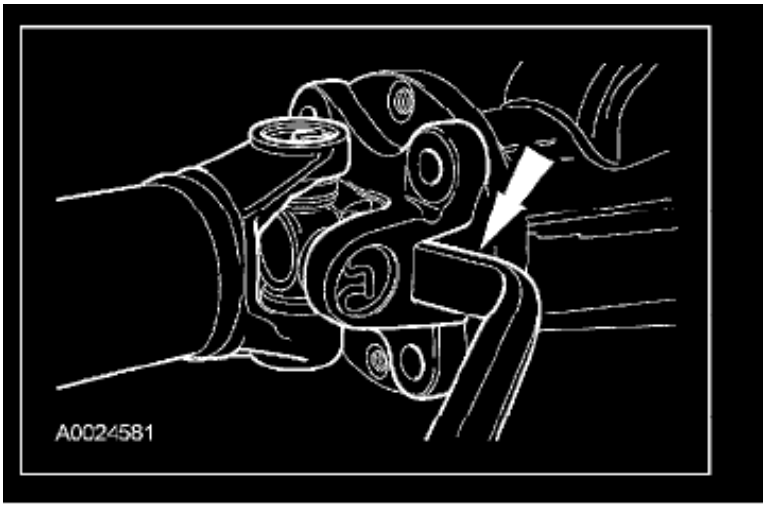
Remove the rear wheel and tire.

3. Remove the rear brake drums.

4. NOTE: Index-mark the driveshaft flange and pinion flange for correct alignment during installation.

Remove the 4 driveshaft-to-pinion flange bolts.

5. CAUTION: The driveshaft flange fits tightly on the rear axle pinion flange pilot. Never hammer on the driveshaft or any of its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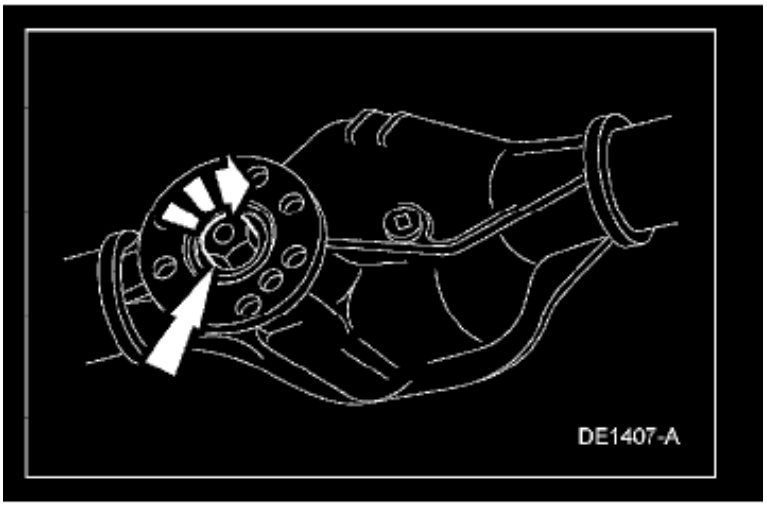
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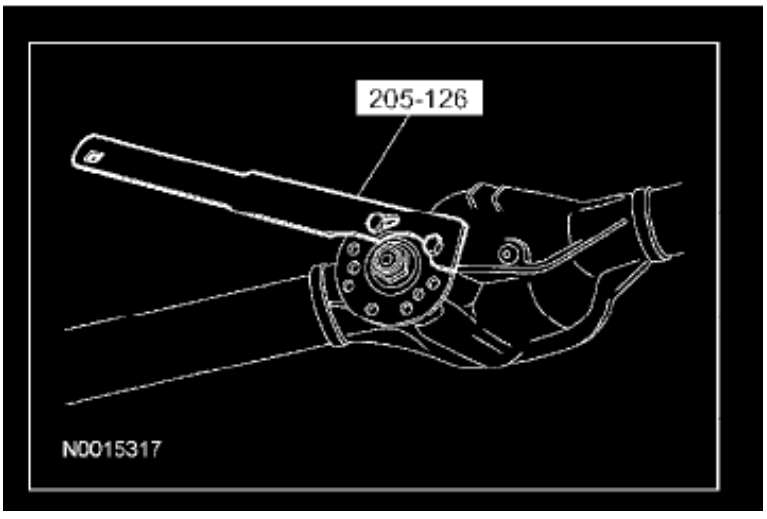

205-126
N0015317

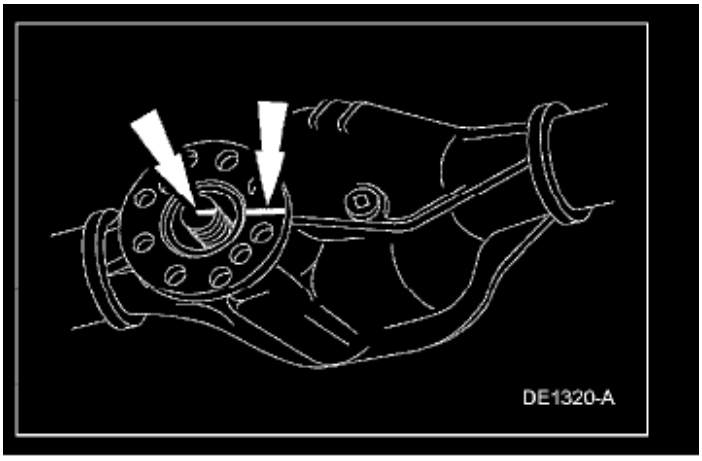
components to disconnect the driveshaft flange from the pinion flange. Pry only in the area shown with a suitable tool to disconnect the driveshaft flange from the pinion flange or damage to the component may occur.

Using a suitable tool as shown, disconnect the driveshaft flange from the rear axle pinion flange.

6. Install a Nm (lb-inch) torque wrench on the nut and record the torque necessary to maintain rotation of the pinion through several revolutions.

7. Using the special tool, hold the pinion flange and remove and discard the nut.

8. Index-mark the pinion flange and the drive pinion stem for correct alignment during installation.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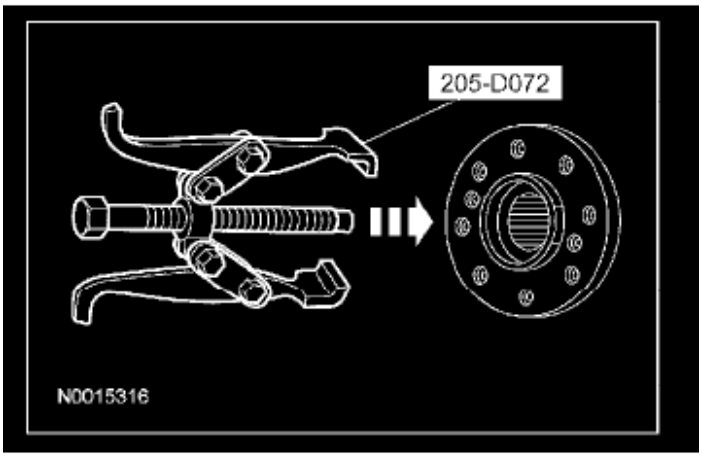
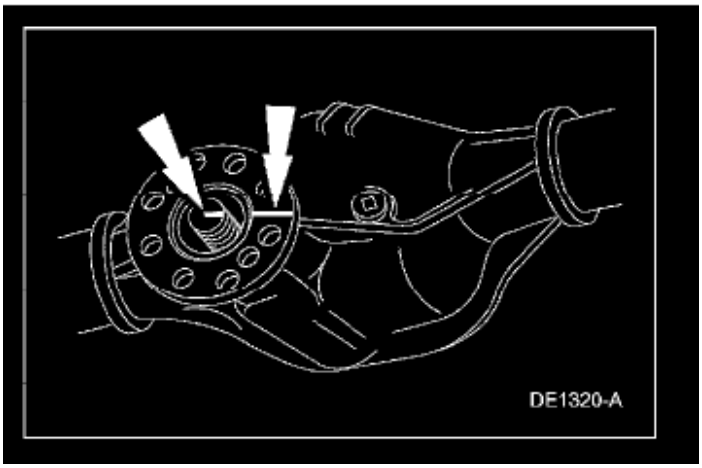

205-D072
N0015316


DE1320-A

9. Using the special tool, remove the pinion flange.

Installation

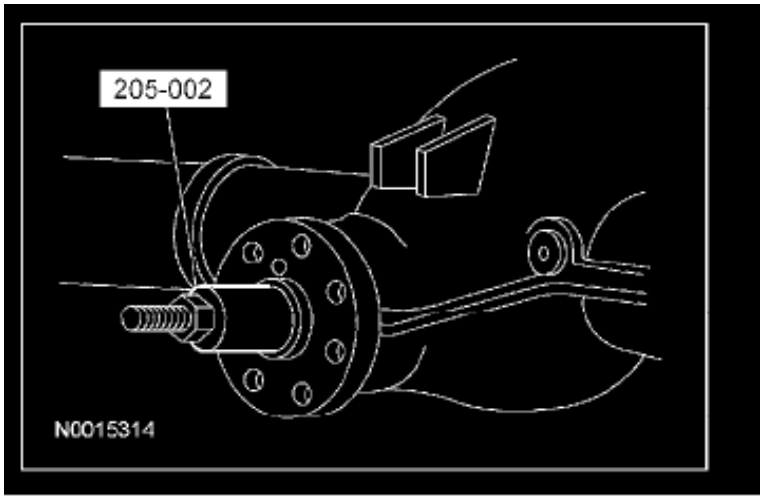
1. Lubricate the pinion flange splines with rear axle lubricant.

2. NOTE: Disregard the scribe marks if a new pinion flange is being installed.

Align the pinion flange with the drive pinion shaft.

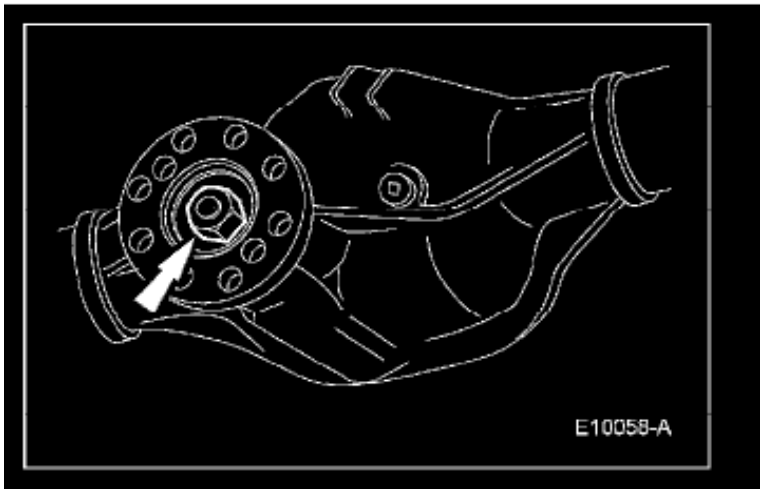
3. NOTE: Disregard the scribe marks if a new pinion flange is being installed.

Using the special tool, install the pinion flange.



8.8 In Drive Pinion Nut

Part Number	Color	Application
389546-S100	Orange	Axles built before 7/16/07
4320	Purple	Axles built after 7/16/07
4C121	Purple	Kit with spacer all 8.8 in



4. CAUTION: Use the same color new drive pinion nut for installation. If a new collapsible spacer must be installed for pinion bearing

preload reduction, install the nut supplied with the new spacer or damage to the component may occur.

Position the new pinion flange nut.

8.8 In Drive Pinion Nut

8.8 In Drive Pinion Nut

5. CAUTION: Do not, under any circumstance, loosen the nut to reduce preload. If it is necessary to reduce preload, install a new

collapsible spacer and nut kit or damage to the component may occur.

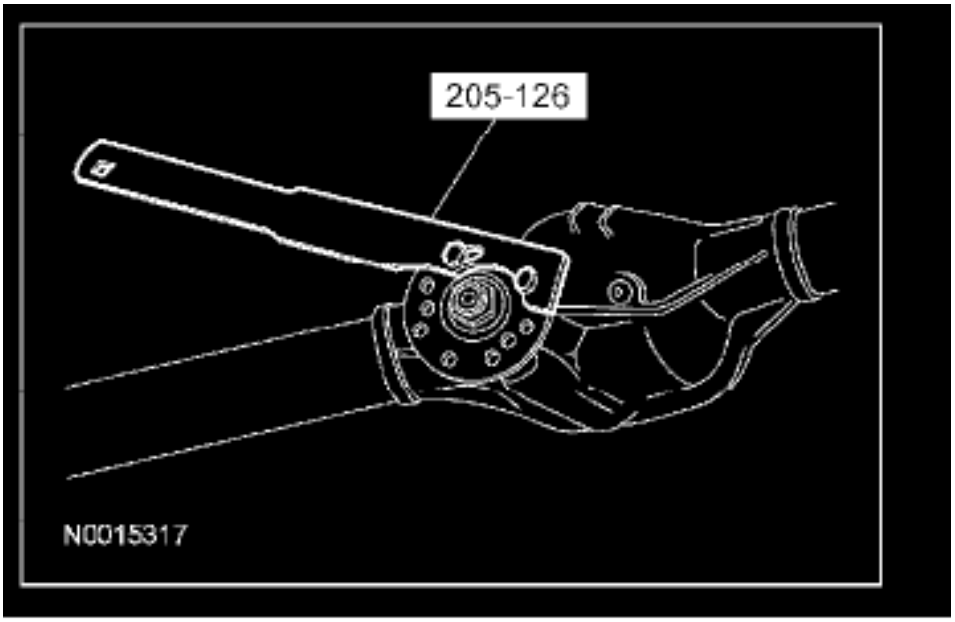
NOTE: Remove the special tool while taking preload readings with the Nm (lb-inch) torque wrench.

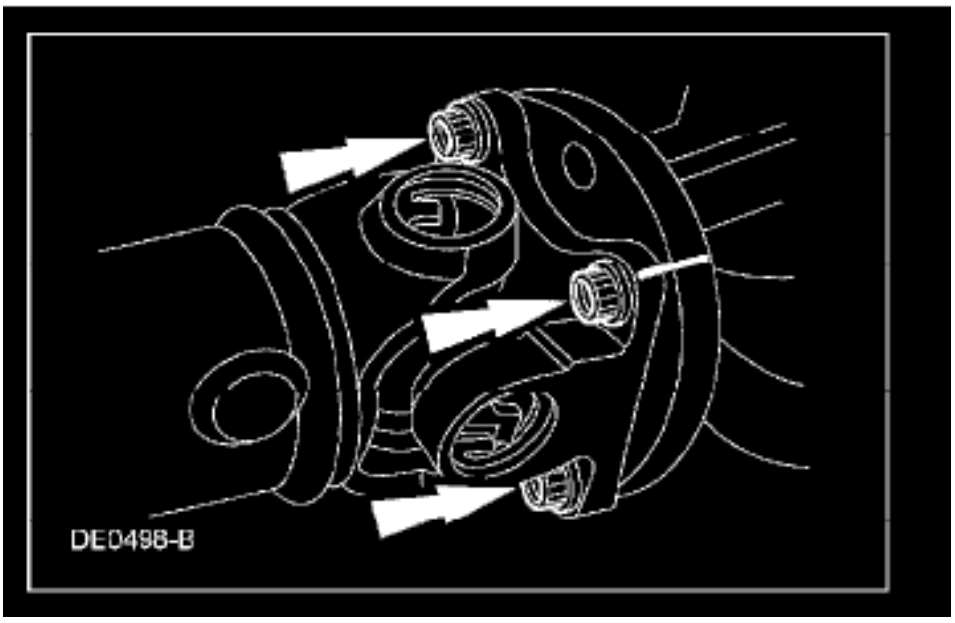
Using the special tool to hold the pinion flange, tighten the nut. ^

Rotate the pinion occasionally to make sure the differential pinion bearings seat correctly. Take frequent differential pinion bearing preload readings by rotating the pinion with a Nm (lb-inch) torque wrench.

^ If the preload recorded prior to disassembly is lower than the specification, tighten the nut to specification. If the preload recorded prior to disassembly is higher than the specification, tighten the nut to the original reading as recorded.

^ Refer to Torque Specifications.


205-126
N0015317


DE0498-B

6. NOTE: Align the index marks.

NOTE: If new bolts to retain the driveshaft to the axle are not available, coat the threads of the original bolts with Threadlock(R).

NOTE: The driveshaft flange fits tightly on the rear axle pinion flange pilot. To make sure that the driveshaft flange seats squarely on the pinion flange, tighten the bolts evenly in a cross pattern.

Position the driveshaft flange on the pinion flange with the index marks aligned, and install the bolts. ^

Tighten to 112 Nm (83 lb-ft).

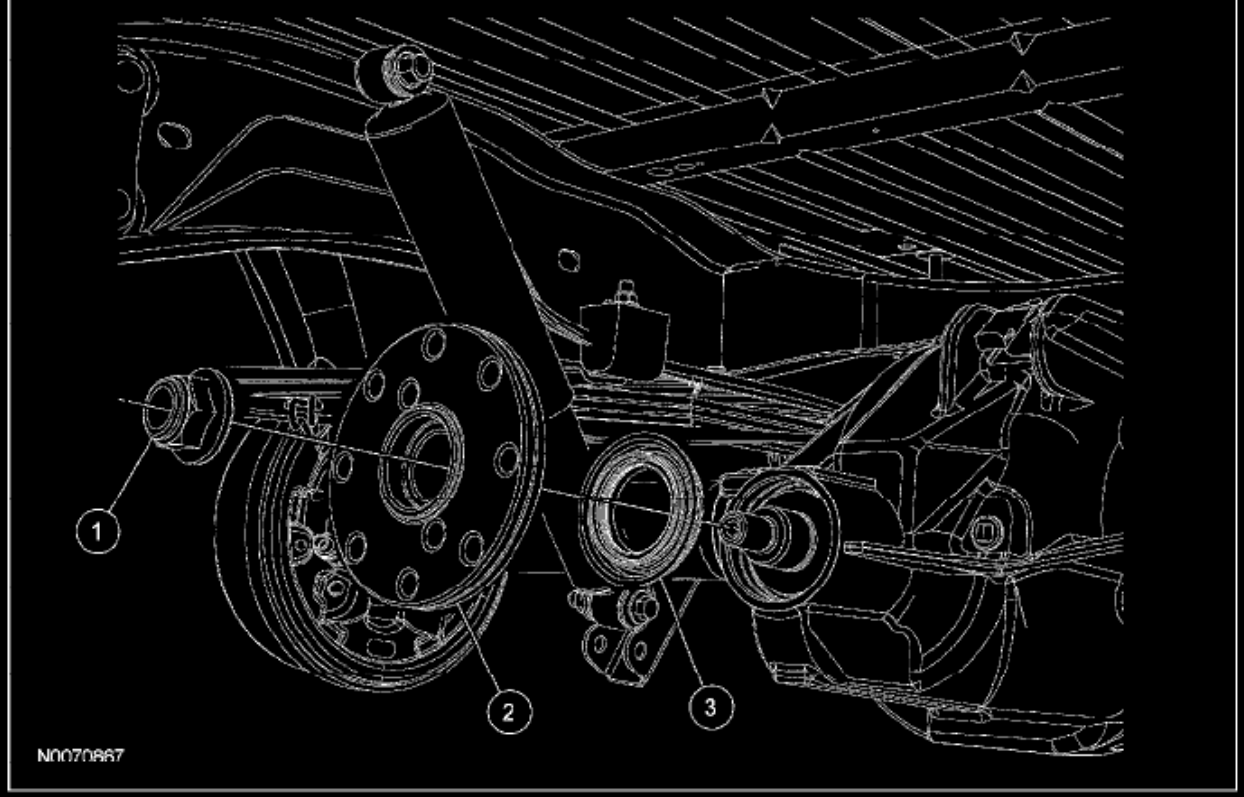
7. Install the brake drums. 8. Install the rear wheel and tire.

Special Tool(s)

ST1325-A	Installer, Drive Pinion Oil Seal 205-208 (T83T-4676-A)

Material

Item	Specification
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B



Item	Part Number	Description
1	389546-S100	Drive pinion nut
2	4851	Drive pinion flange
3	4676	Drive pinion seal

Seals and Gaskets: Service and Repair Drive Pinion Seal

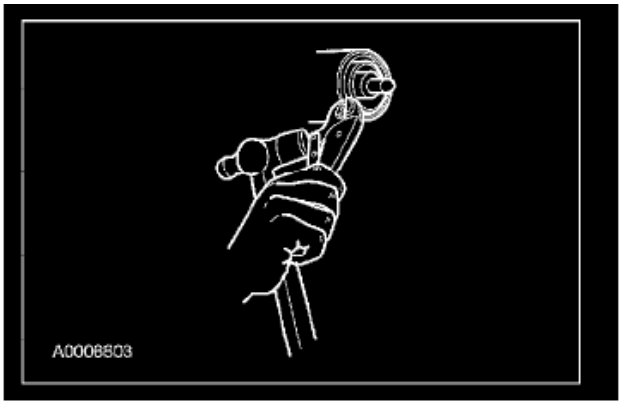
Ford 7.5-Inch Ring Gear - Rear Drive Axle/Differential

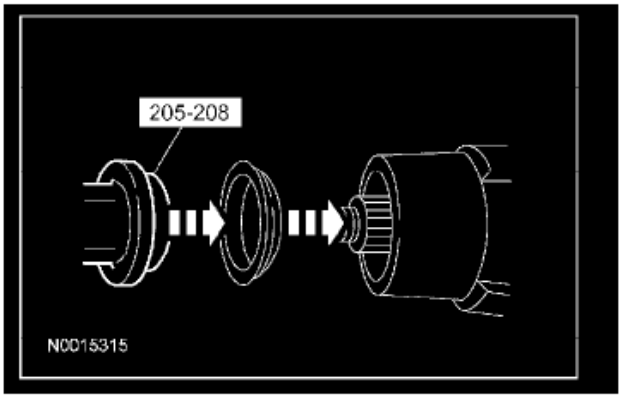
Drive Pinion Seal

Removal

1. Remove the pinion flange. 2. Pry up on the metal flange of the rear axle drive pinion seal. Install gripping pliers and strike with a hammer until the rear axle drive pinion seal is

removed.





Special Tool(s)

ST1325-A	Installer, Driver Pinion Oil Seal 205-208 (T83T-4676-A)

Material

Item	Specification
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B

Installation

1. Lubricate the lips of the new rear axle drive pinion seal with grease.

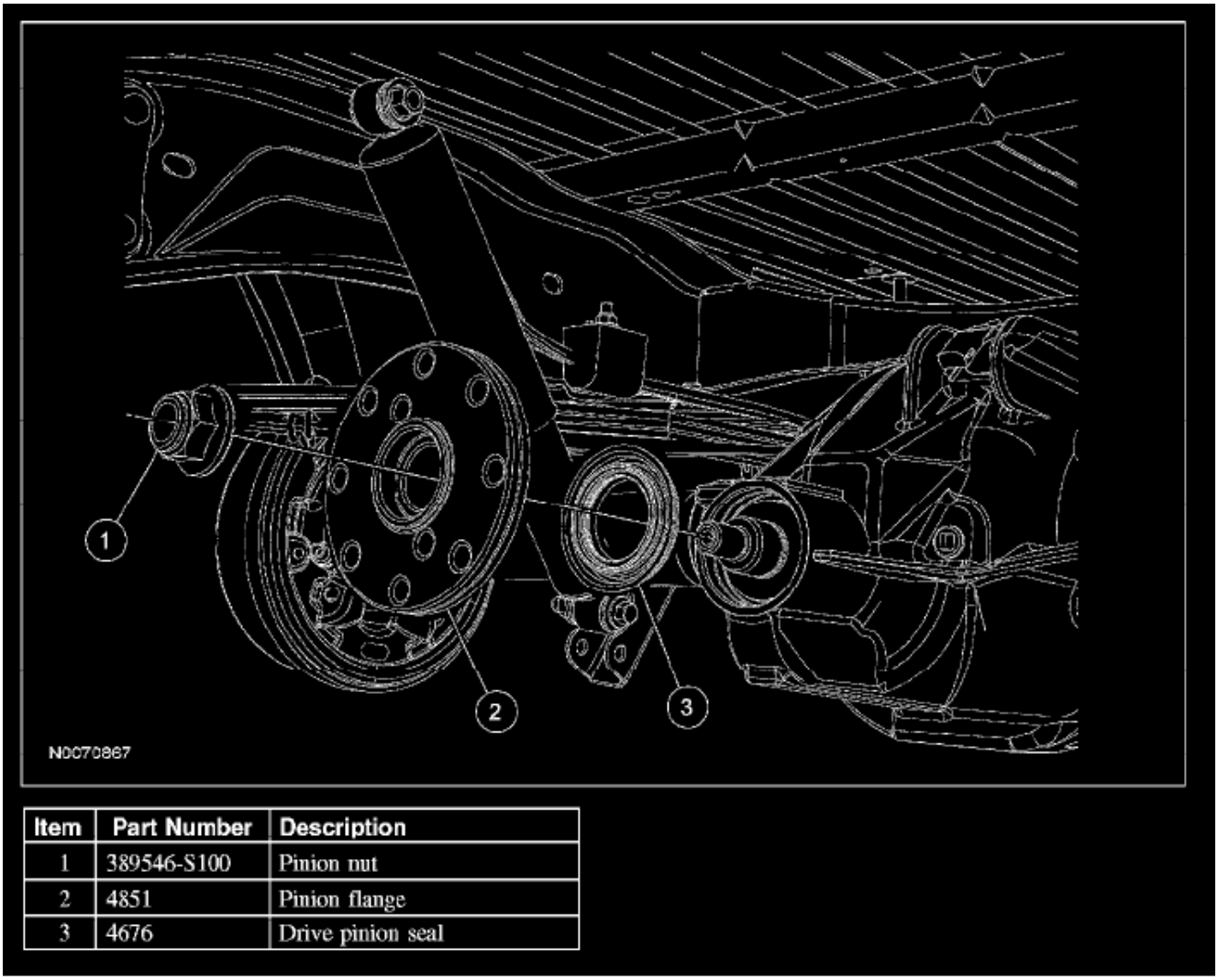
2. NOTE: If the rear axle drive pinion seal becomes misaligned during installation, remove the rear axle drive pinion seal and install a new seal.

Using the special tool, install the rear axle drive pinion seal.

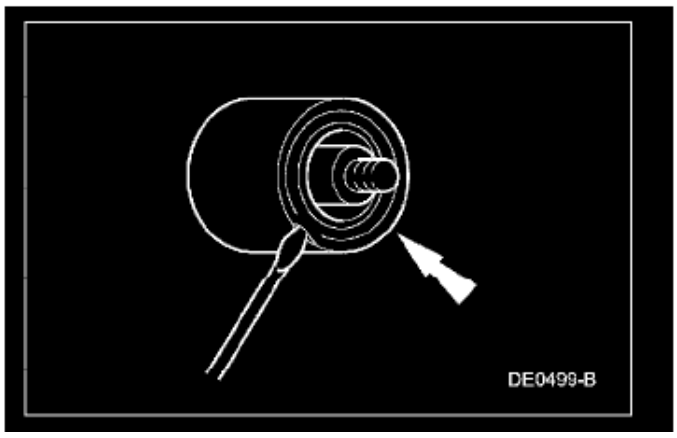
3. Install the pinion flange.

Ford 8.8-Inch Ring Gear - Rear Drive Axle/Differential

Drive Pinion Seal



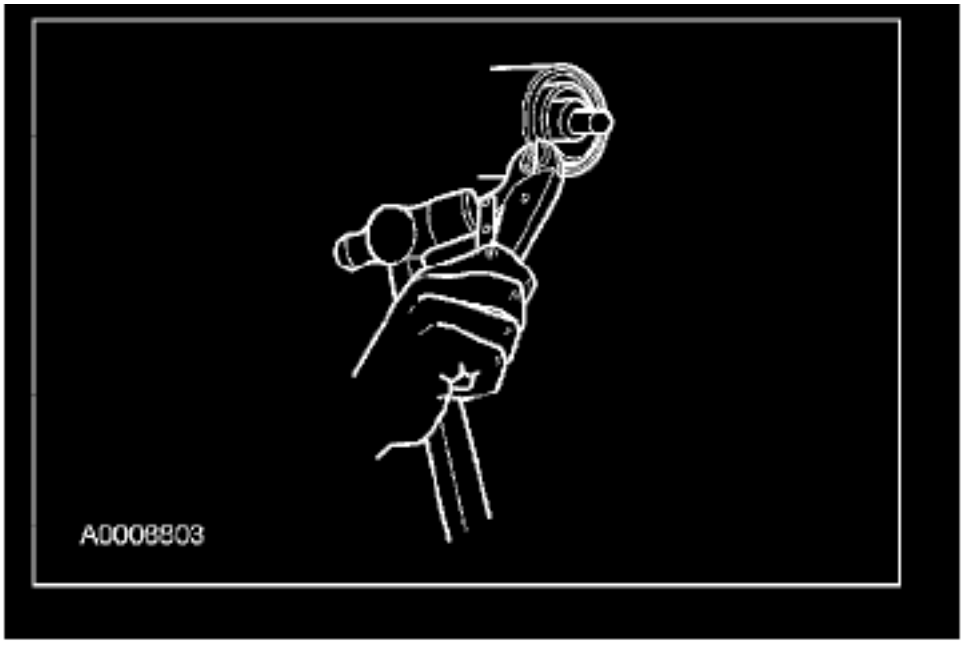
Item	Part Number	Description
1	389546-S100	Pinion nut
2	4851	Pinion flange
3	4676	Drive pinion seal

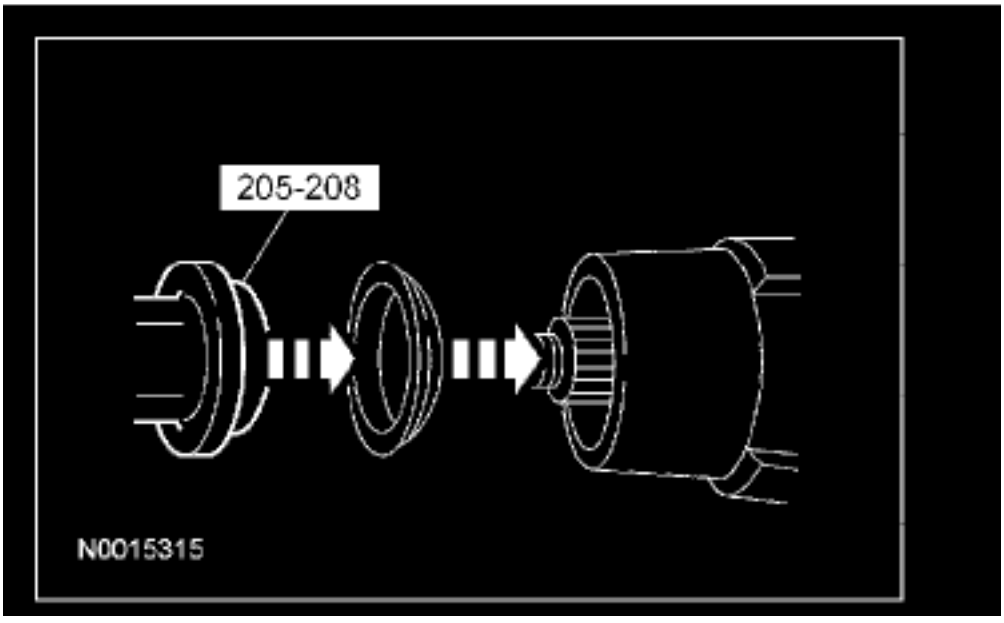


Removal

1. Remove the pinion flange. 2. Using a screwdriver, force the rear axle drive pinion seal metal flange up and strike it with a hammer.

3. Using gripping pliers and a hammer, remove the seal.





Installation

1. Coat the new rear axle drive pinion seal lips with grease.

2. NOTE: If the rear axle drive pinion seal becomes misaligned during installation, remove the seal and install a new seal.

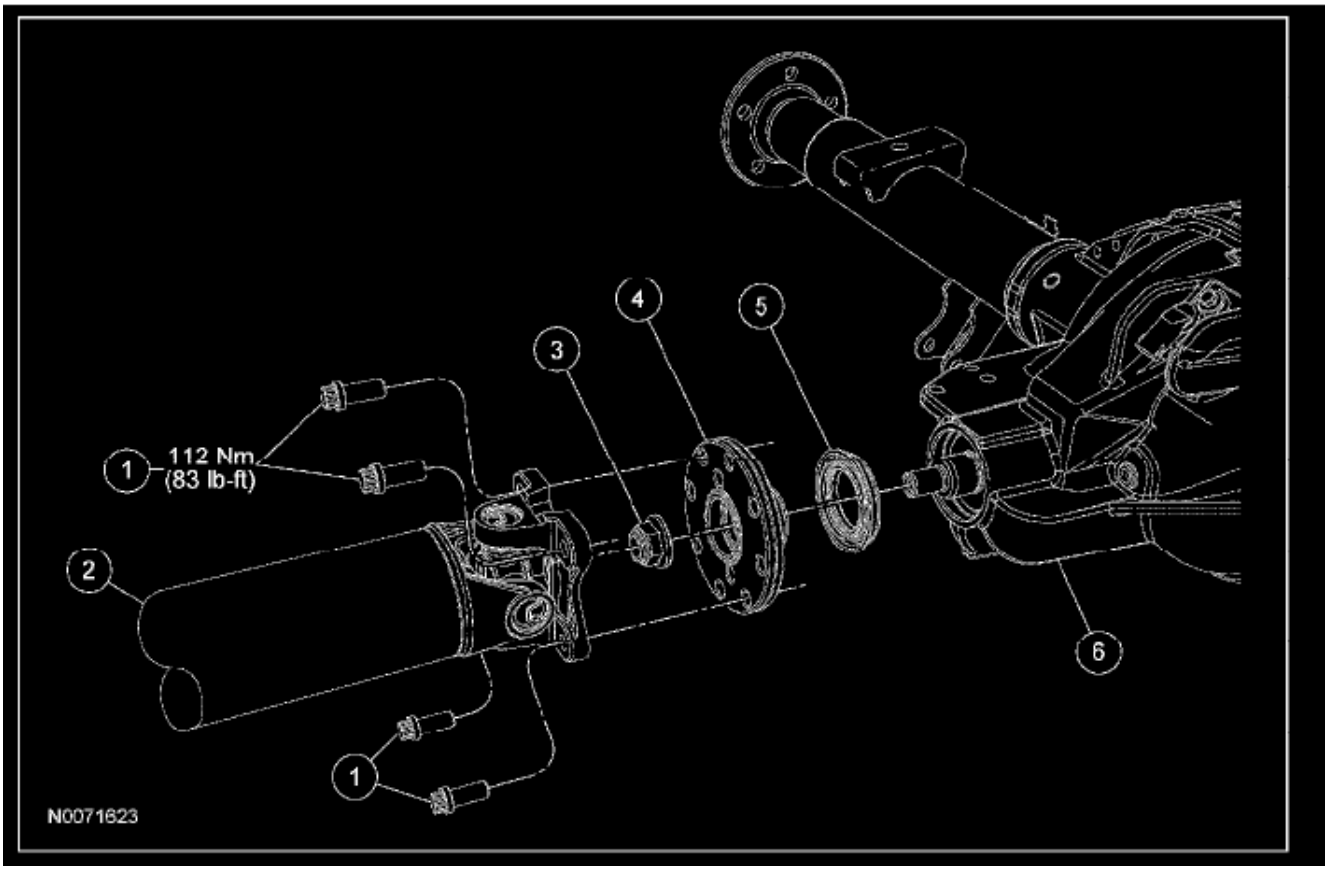
Using the special tool, install the rear axle drive pinion seal.

3. Install the pinion flange.

Special Tool(s)

ST1257-A	Holding Fixture, Drive Pinion Flange 205-126 (T78P-4851-A)
	Installer, Drive Pinion Flange 205-002 (TOOL-4858-E) or equivalent

(Continued)



Seals and Gaskets: Service and Repair Drive Pinion Flange and Drive Pinion Seal

Drive Pinion Flange and Drive Pinion Seal

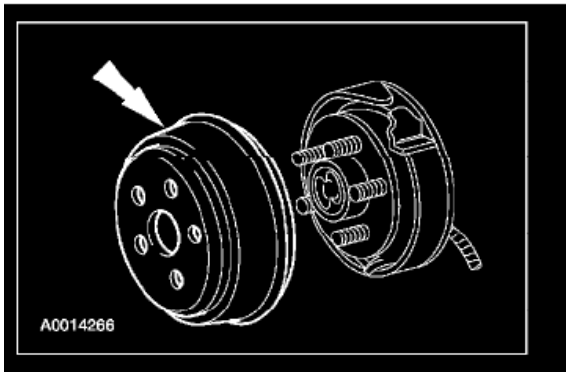
Special Tool(s)

ST1325-A	Installer, Drive Pinion Oil Seal 205-208 (T83T-4676-A)
ST2026-A	2-Jaw Puller 205-D072 (D97L-4221-A) or equivalent

Material

Item	Specification
Motorcraft SAE 75W-140 Synthetic Rear Axle Lubricant XY-75W140-QL (US); CXY-75W140-1L (Canada)	WSL-M2C192-A

Item	Part Number	Description
1	N800594-S	Driveshaft flange-to-pinion flange bolts (4 required)
2	4602	Driveshaft assembly
3	389546-S100	Pinion nut
4	4851	Pinion flange
5	4676	Drive pinion seal
6	4010	Rear drive axle housing



Removal

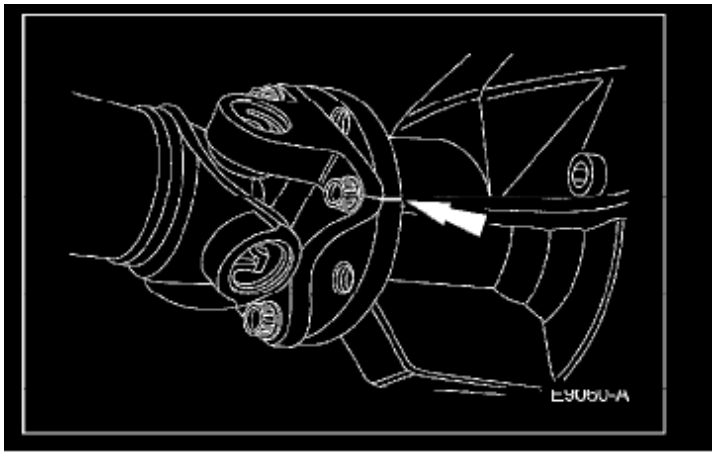
CAUTION: The color on the rear face of the drive pinion nut is critical to this repair. Use the same color new drive pinion nut for installation unless installing a new collapsible spacer or damage to the component may occur.

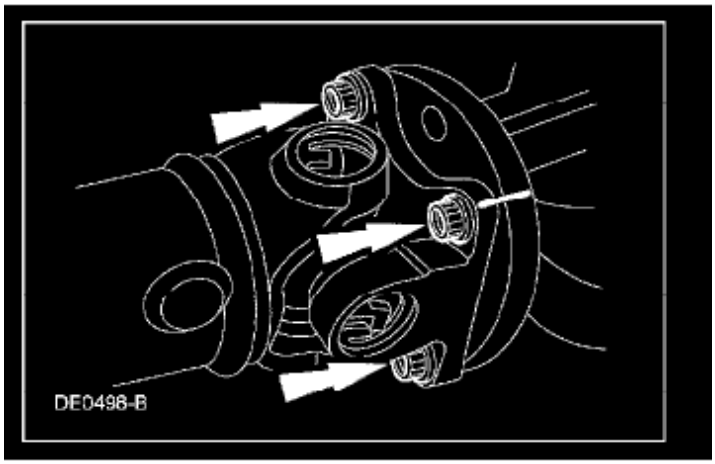
1. With the vehicle in NEUTRAL, position it on a hoist.

2. NOTE: The rear wheels and brake drums must be removed to prevent brake drag during drive pinion bearing preload adjustment.

Remove the wheel and tire.

3. Remove the rear brake drums.

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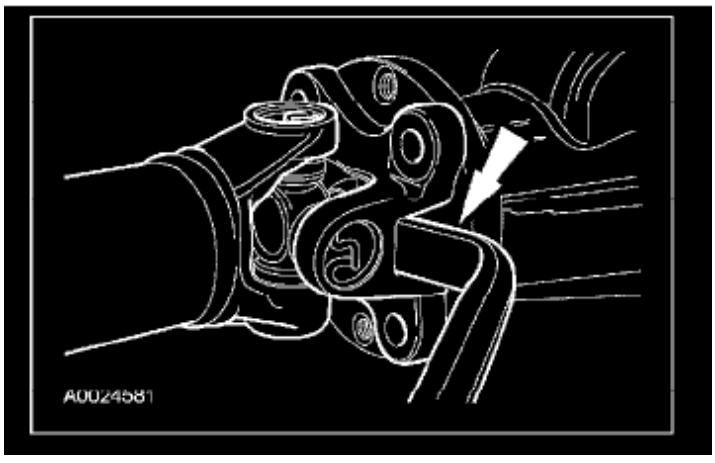

A0024581

4. Mark the driveshaft flange and pinion flange for correct alignment during installation.

5. Remove the 4 driveshaft flange-to-pinion flange bolts.

6. CAUTION: The driveshaft centering socket yoke fits tightly on the rear axle pinion flange pilot. Never hammer on the driveshaft or any

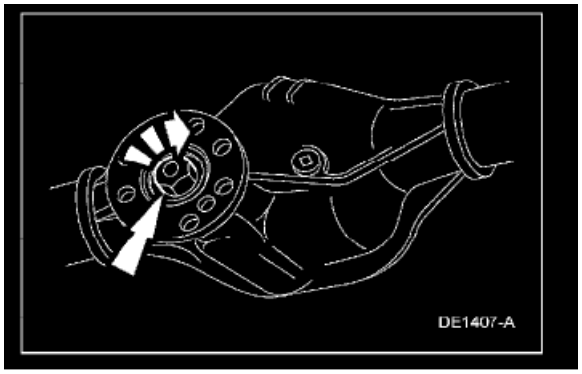
of its components to disconnect the yoke from the flange. Pry only in the area shown with a suitable tool to disconnect the yoke from the flange or damage to the component may occur.

Using a suitable tool as shown, disconnect the driveshaft centering socket yoke from the rear axle pinion flange. ^

Position the driveshaft aside.

7. Install a Nm (lb-inch) torque wrench on the pinion nut and record the torque required to maintain rotation of the pinion through several

revolutions.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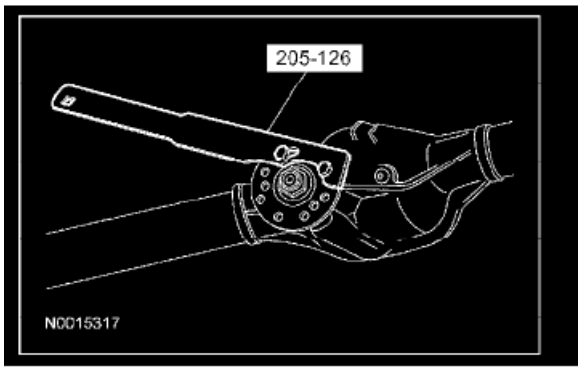
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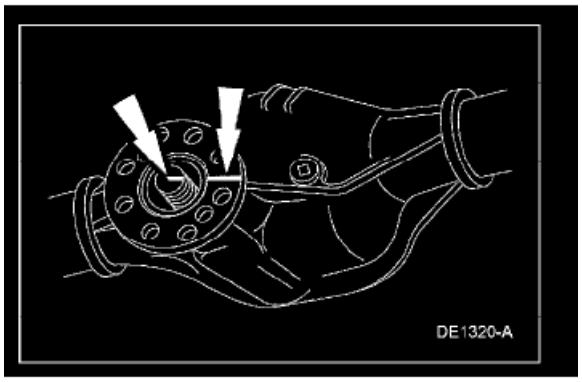
N0015317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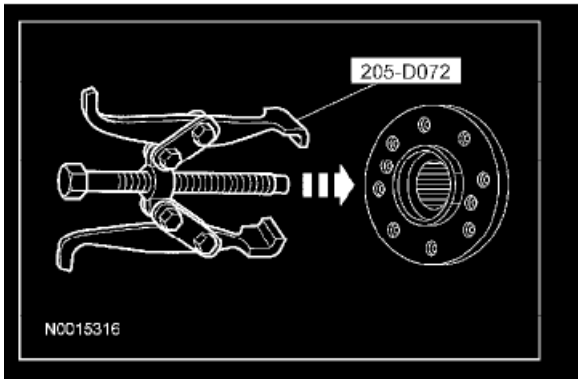
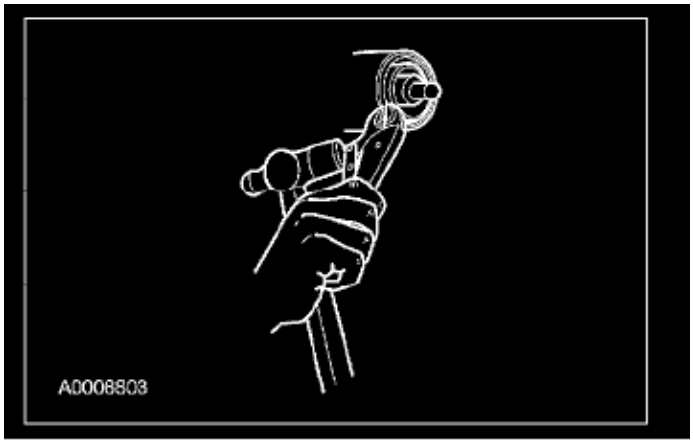

205-D072
N0015316

8. Using the special tool, hold the pinion flange and remove and discard the pinion nut.

9. Mark the pinion flange in relation to the drive pinion stem to make sure of correct alignment during installation.

10. Using the special tool, remove the pinion flange.

11. Force up on the metal flange of the rear axle drive pinion seal. Install gripping pliers and strike with a hammer until the rear axle pinion seal is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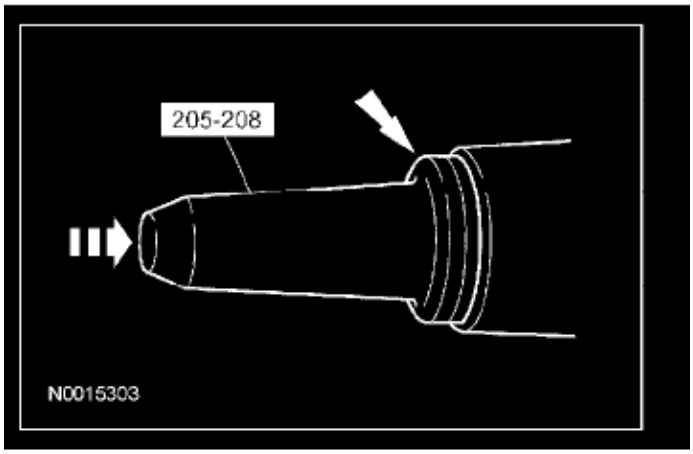
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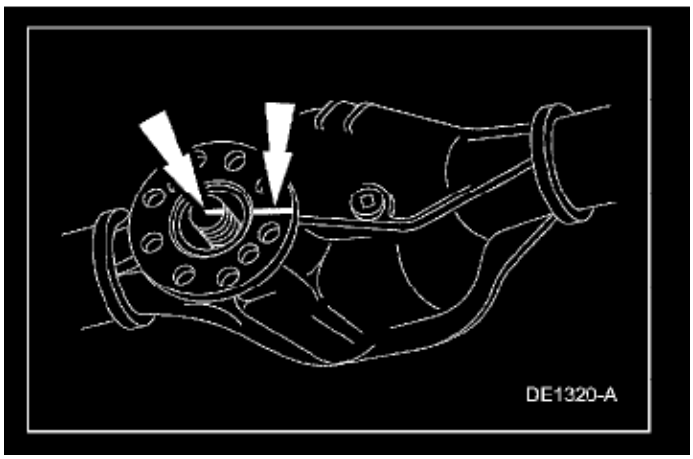

DE1320-A

removed.

Installation

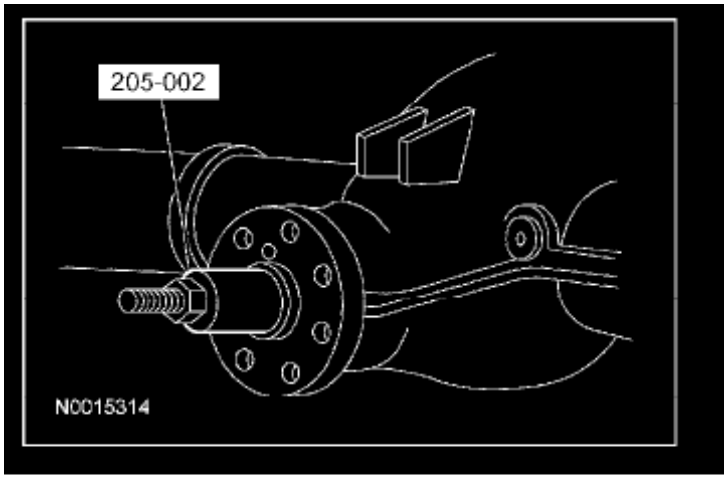
1. Lubricate the new rear axle drive pinion seal with lubricant. 2. Using the special tool, install the rear axle drive pinion seal.

3. Lubricate the pinion flange splines with lubricant.

4. NOTE: Disregard the scribe marks if a new pinion flange is being installed.

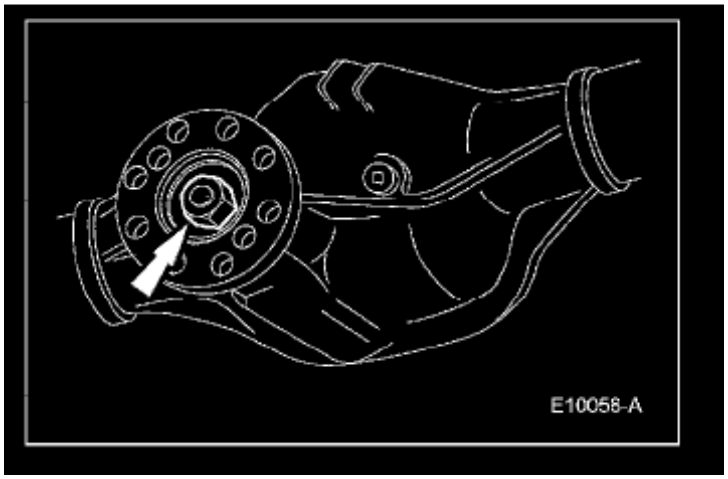
Align the pinion flange with the drive pinion shaft.

5. Install the pinion flange using the special tool.



Drive Pinion Nut

Part Number	Color Description	Application
389546-S100	Orange	Axles built before 7/16/07
4320	Purple	Axles built after 7/16/07
4C121	Purple	Kit with spacer for all 8.8 in axles



6. CAUTION: Install a new pinion nut with the same color as the original if not replacing the collapsible spacer. If a new collapsible spacer

is installed, install the nut in the kit or damage to the component may occur.

Position the new pinion nut.

Drive Pinion Nut

Drive Pinion Nut

7. CAUTION: Under no circumstances is the pinion nut to be backed off to reduce preload. If reduced preload is required, a new

collapsible spacer and pinion nut kit must be installed or damage to the component may occur.

NOTE: Remove the special tool while taking preload readings with the Nm (lb-inch) torque wrench.

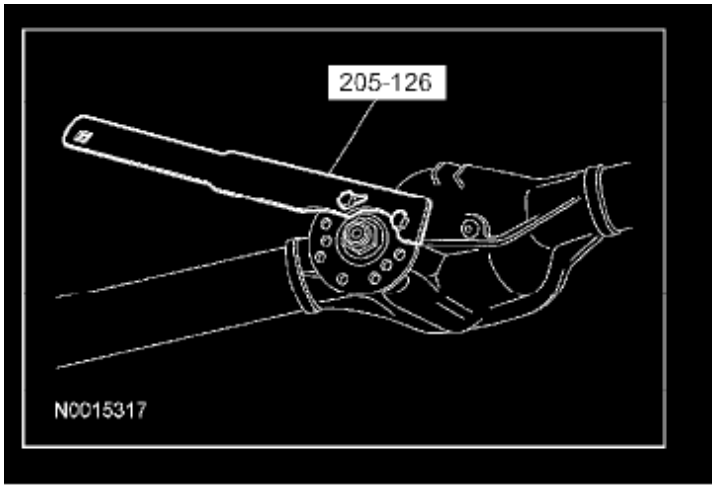
Using the special tool hold the pinion flange, tighten the pinion nut. ^

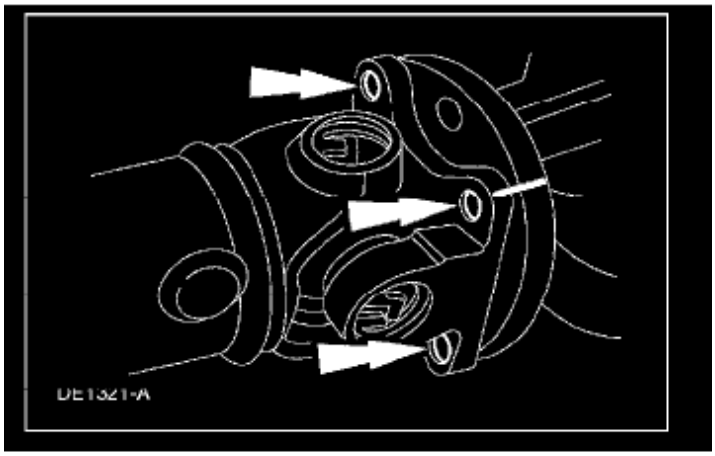
Rotate the pinion occasionally to make sure the cone and roller bearings are seating correctly.

^ Install a Nm (lb-inch) torque wrench on the pinion nut.

^ Rotating the pinion through several revolutions, take frequent cone and roller bearing torque preload readings until the original recorded preload reading is obtained.

^ If the original recorded preload is lower than specifications, tighten to the appropriate specifications for used bearings. If the preload is higher than specification, tighten the nut to the original reading as recorded.


205-126
N0015317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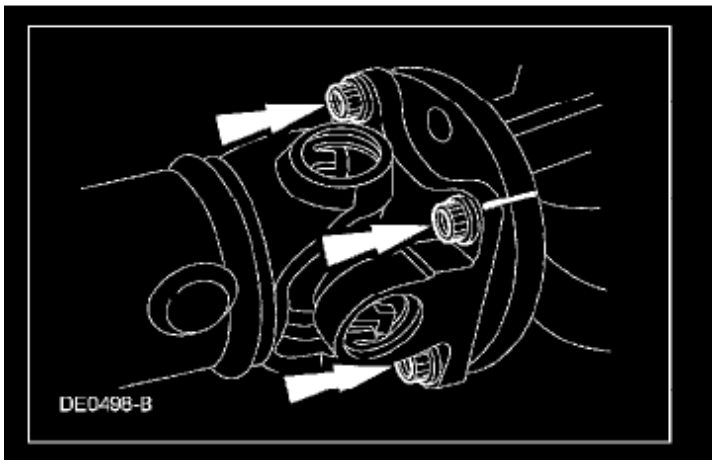

DE0498-B

8. Position the rear driveshaft and align the marks on the pinion flange.

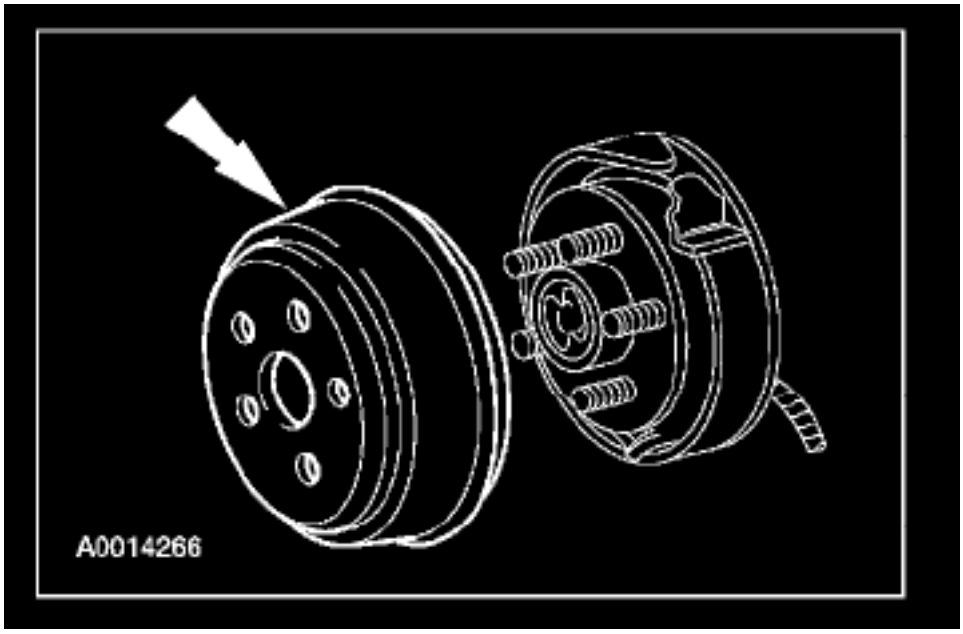
9. NOTE: The driveshaft centering socket yoke fits tightly on the rear axle pinion flange pilot. To make sure that the yoke seats squarely on the

flange, tighten the bolts evenly in a cross pattern.

Install the 4 bolts. ^

Tighten to 112 Nm (83 lb-ft).

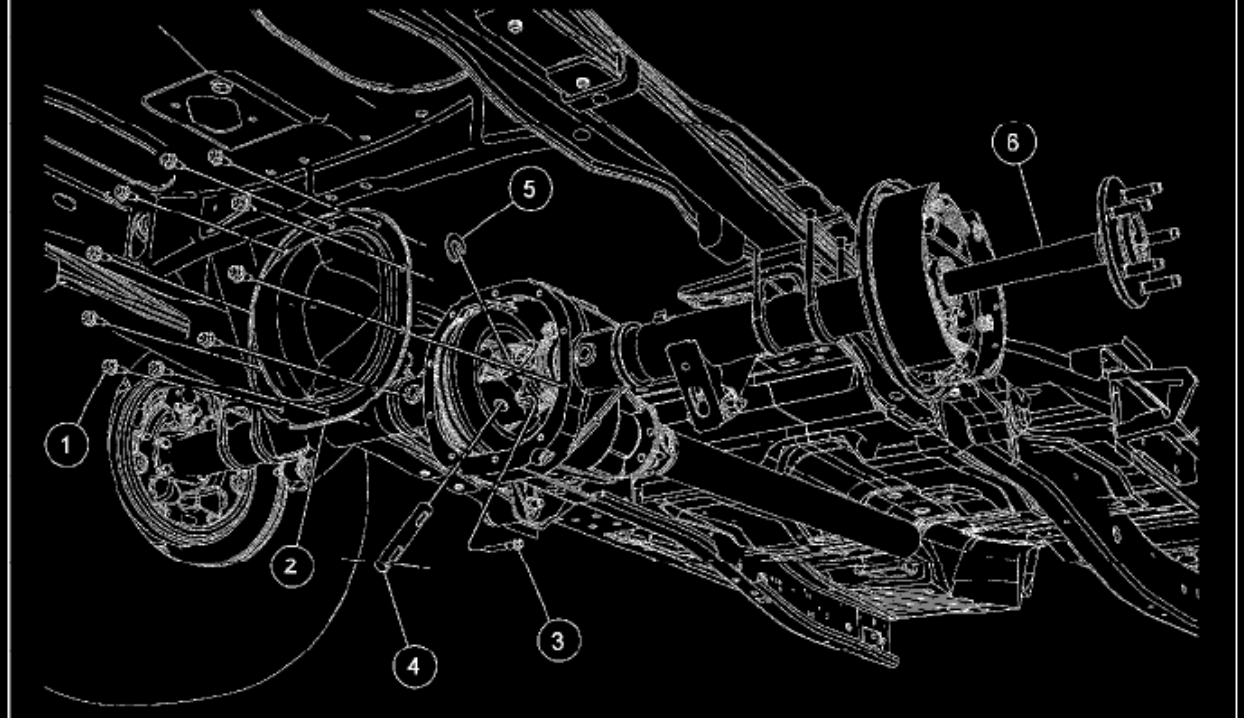
10. Install the rear brake drums.



11. Install the wheel and tire.

Material

Item	Specification
Clear Silicone Rubber TA-32	ESB-M4G92-A
Motorcraft SAE 80W-90 Premium Rear Axle Lubricant XY-80W90-QL (US); CXY-80W90-1L (Canada)	WSP-M2C197-A
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B



Item	Part Number	Description
1	4346	Differential housing cover bolt (10 required)
2	4033	Differential housing cover
3	4241	Differential pinion shaft lock bolt

Item	Part Number	Description
4	4211	Differential pinion shaft
5	4N237	Axle shaft U-washer
6	4234	Axle shaft

(Continued)

Axle Shaft Assembly: Service and Repair Ford 7.5-Inch Ring Gear - Rear Drive Axle/Differential

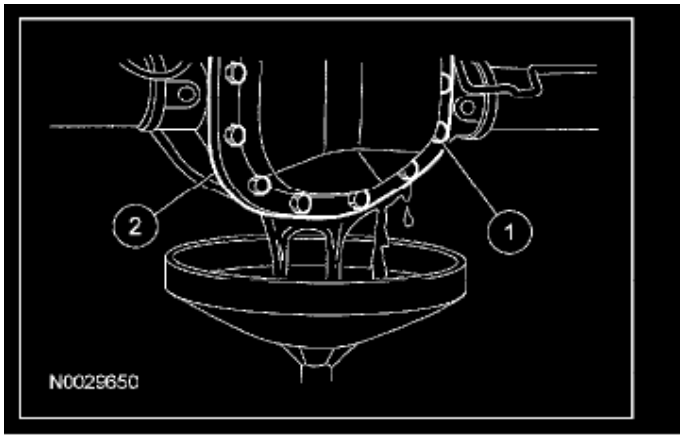
Axle Shaft

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Remove the wheel and tire. 3. Remove the differential housing cover.

1 Remove the 10 differential housing cover bolts and drain the lubricant from the rear axle housing.

2 Remove the differential housing cover.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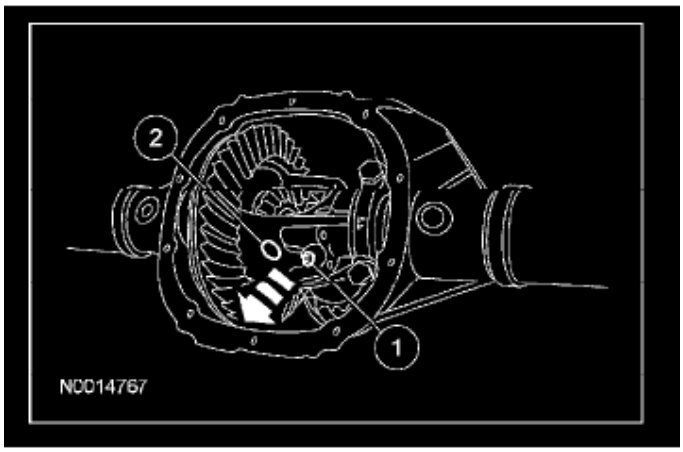
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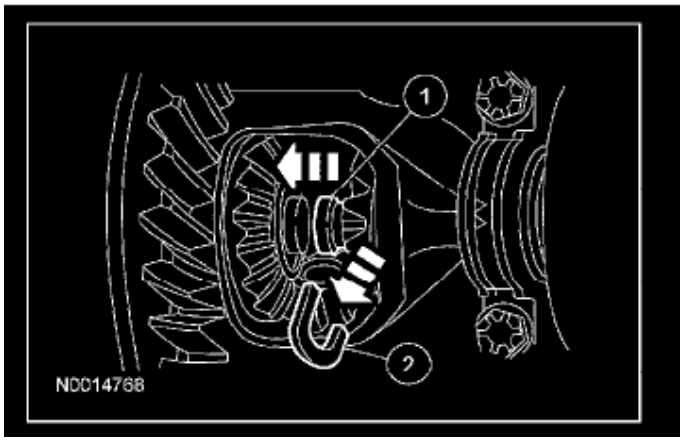

1
2
N0014768

4. Remove the rear brake drums. 5. Remove the differential pinion shaft.

1 Remove and discard the differential pinion shaft lock bolt.

2 Remove the differential pinion shaft.

6. CAUTION: Do not damage the rubber O-rings in the axle shaft grooves.

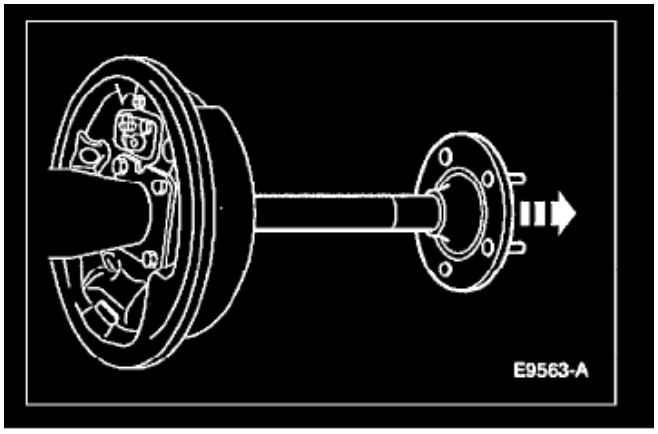
Remove the U-washers. 1

Push the axle shafts inboard.

2 Remove the U-washers.

7. CAUTION: Do not damage the wheel bearing oil seal.

Remove the 2 axle shafts.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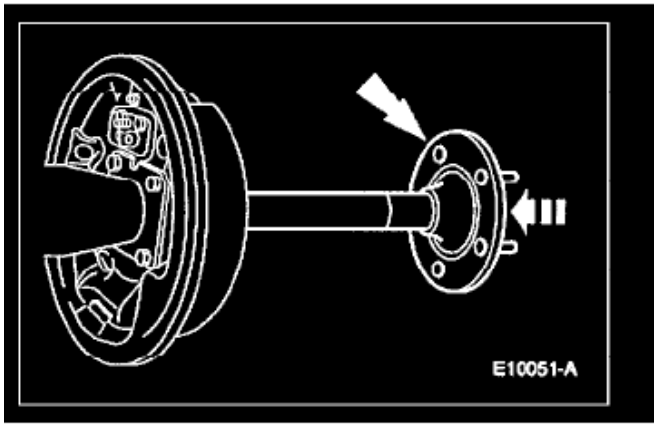
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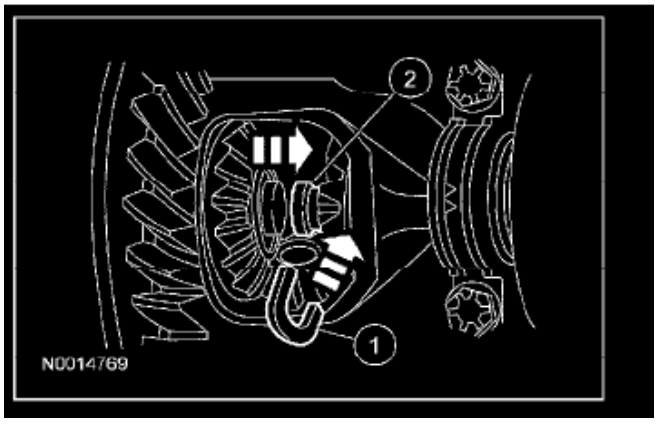

2
1
N0014769

Installation

1. Lubricate the lip of the wheel bearing oil seal with grease.

2. NOTE: Do not damage the wheel bearing oil seal.

Install the 2 axle shafts.

3. NOTE: Do not damage the rubber O-rings in the axle shaft grooves.

Install the U-washers. 1

Position the 2 U-washers on the button end of the axle shafts.

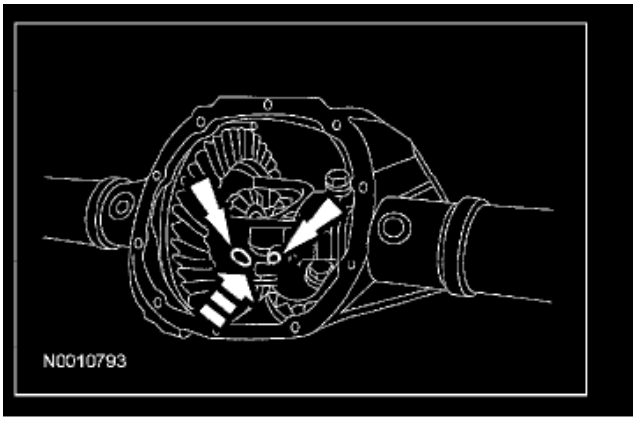
2 Pull the axle shafts outward.

4. Install the differential pinion shaft.

^ Align the hole in the differential pinion shaft with the case lock bolt hole.

^ Install a new differential pinion shaft lock bolt. -

Tighten to 30 Nm (22 lb-ft).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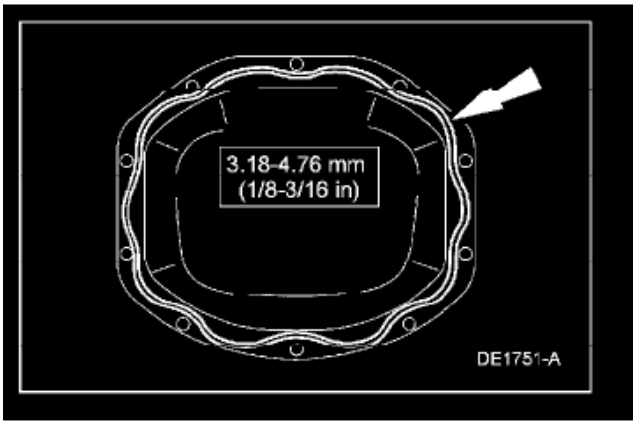
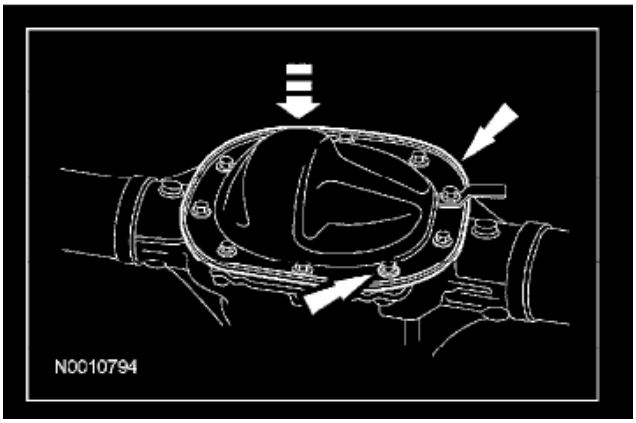

3.18-4.76 mm
(1/8-3/16 in)
DE1751-A


N0010794

5. Install the rear brake drums.

6. NOTE: Make sure the machined surfaces on the rear axle housing and the differential housing cover are clean and free of oil before installing the

new silicone sealant. The inside of the rear axle must be covered when cleaning the machined surface to prevent contamination.

Clean the gasket mating surface of the rear axle and the differential housing cover.

7. Apply a new continuous bead of sealant of the specified thickness to the differential housing cover.

8. NOTE: The differential housing cover must be installed within 15 minutes of application of the silicone, or new sealant must be applied. If

possible, allow one hour before filling with lubricant to make sure the silicone sealant has correctly cured.

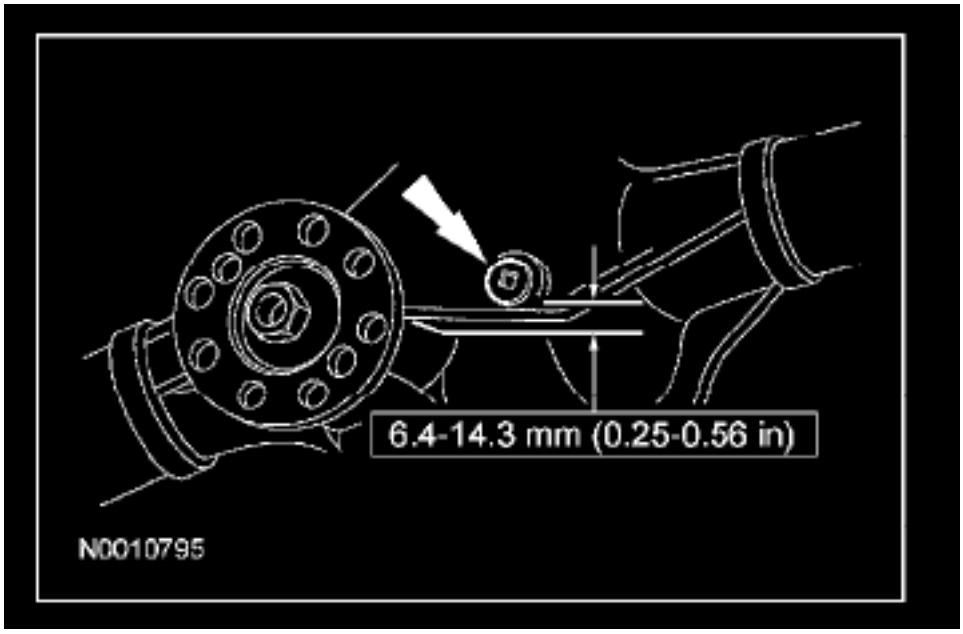
Install the differential housing cover and the 10 bolts. ^

Tighten to 45 Nm (33 lb-ft).

9. NOTE: Service refill capacities are determined by filling the rear axle with the specified lubricant to the level shown in the illustration.

Remove the filler plug and fill the rear axle with 2.4L (5 pt) with the specified lubricant and install the fill plug. ^

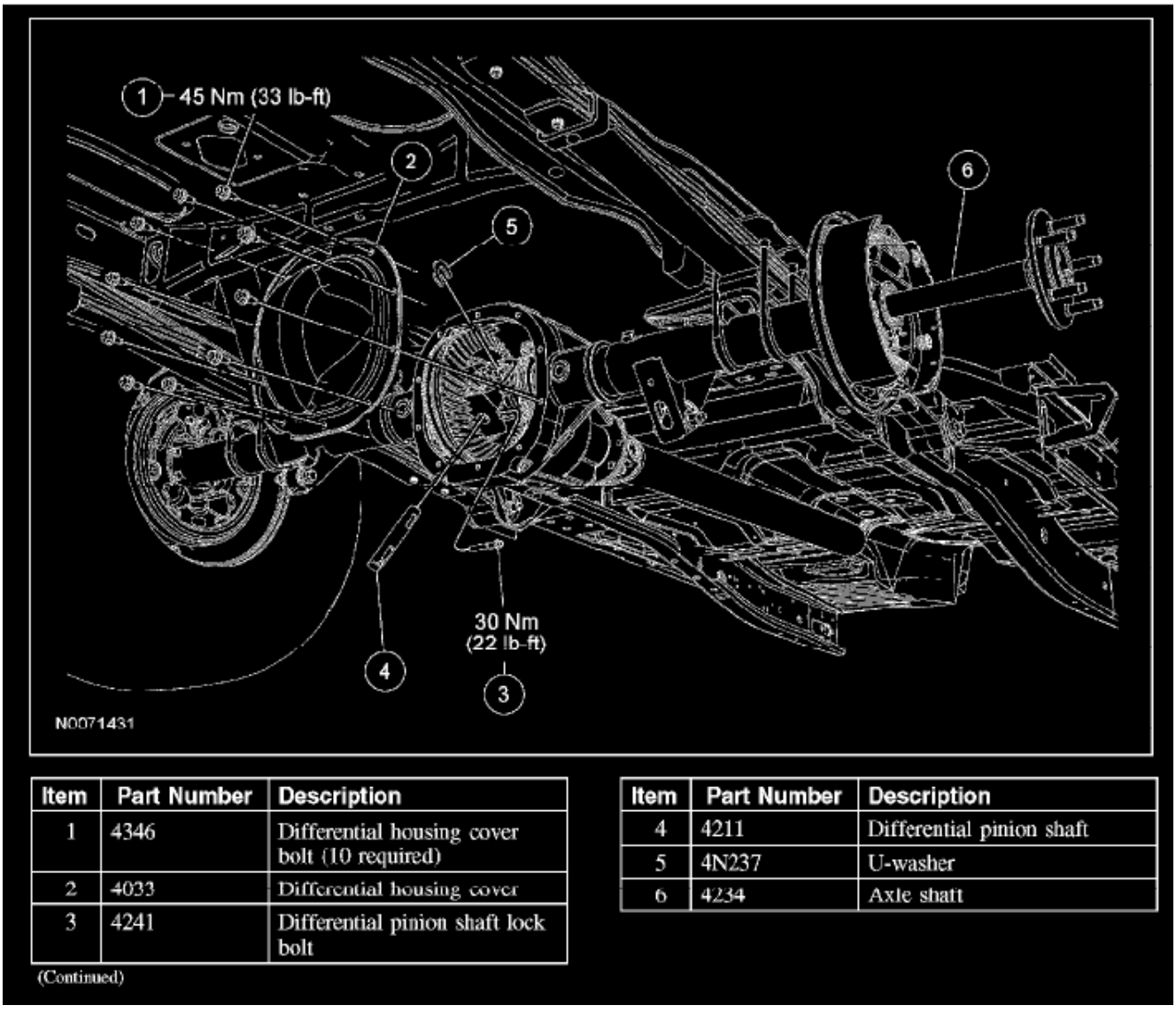
Tighten to 52 Nm (38 lb-ft).



10. Install the wheels and tires.

Material

Item	Specification
Motorcraft SAE 80W-90 Premium Rear Axle Lubricant XY-80W90-QL (US); CXY-80W90-1L (Canada); (Model 60/70 axles)	WSP-M2C197-A
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B
Threadlock and Sealer TA-25	WSK-M2G351-A5



Item	Part Number	Description
1	4346	Differential housing cover bolt (10 required)
2	4033	Differential housing cover
3	4241	Differential pinion shaft lock bolt

Item	Part Number	Description
4	4211	Differential pinion shaft
5	4N237	U-washer
6	4234	Axle shaft

(Continued)

Axle Shaft Assembly: Service and Repair Ford 8.8-Inch Ring Gear - Rear Drive Axle/Differential

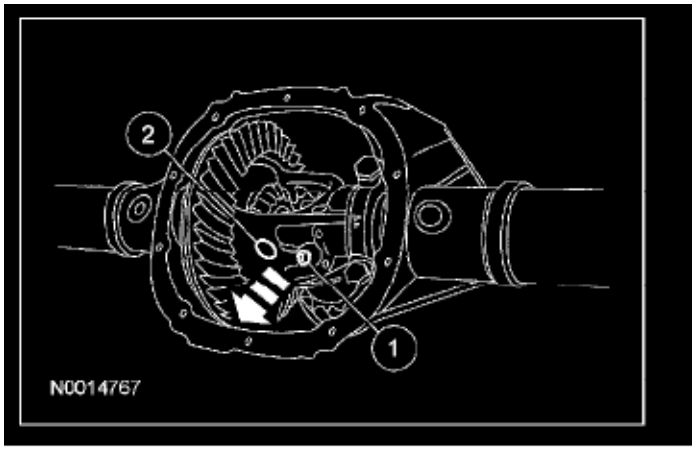
Axle Shaft

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Remove the rear wheel and tire. 3. Remove the brake drum. 4. Remove the differential housing cover and drain the lubricant. 5. Remove the differential pinion shaft.

1 Remove and discard the bolt.

2 Remove the differential pinion shaft.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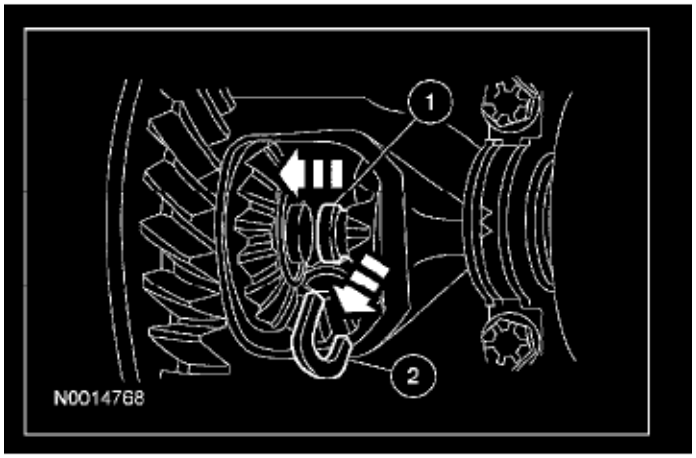
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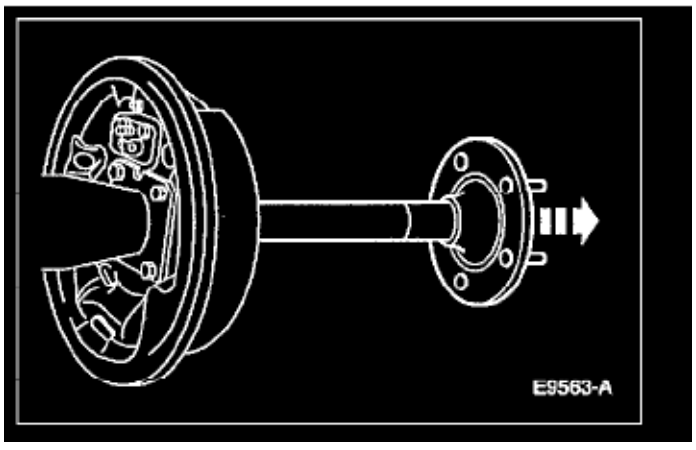
N0014768


E9563-A

6. NOTE: Do not damage the rubber O-ring in the U-washer groove.

Remove the U-washer. 1

Push the axle shaft inboard.

2 Remove the U-washer.

7. NOTE: Do not damage the wheel bearing oil seal.

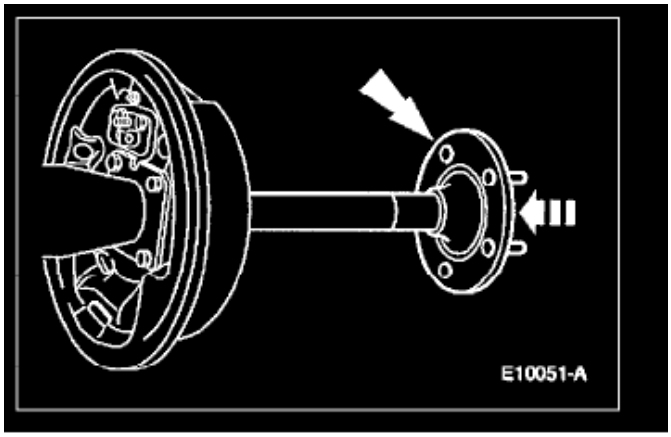
Remove the axle shaft.

Installation

1. Lubricate the lip of the wheel bearing oil seal with grease.

2. NOTE: Do not damage the wheel bearing oil seal.

Install the axle shaft.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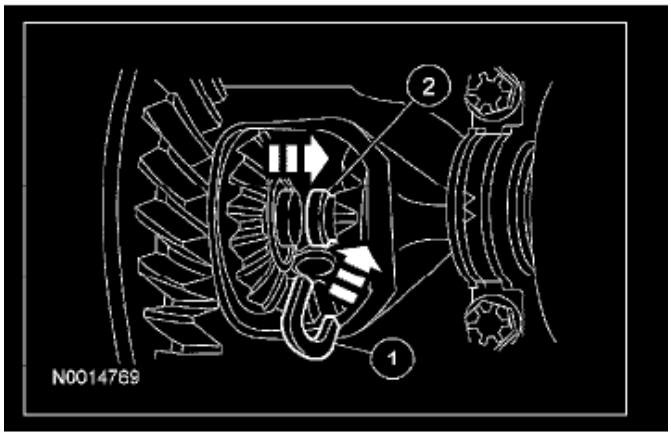
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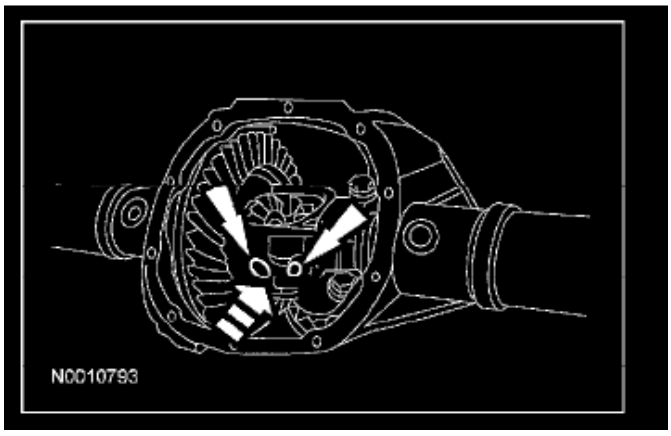
1
N0014769


N0010793

3. NOTE: Do not damage the rubber O-ring in the U-washer groove.

Install the U-washer. 1

Position the U-washer on the button end of the axle shaft.

2 Pull the axle shaft outward.

4. NOTE: If a new bolt is unavailable, coat the bolt threads with Threadlock(R) prior to installation.

Install the differential pinion shaft.

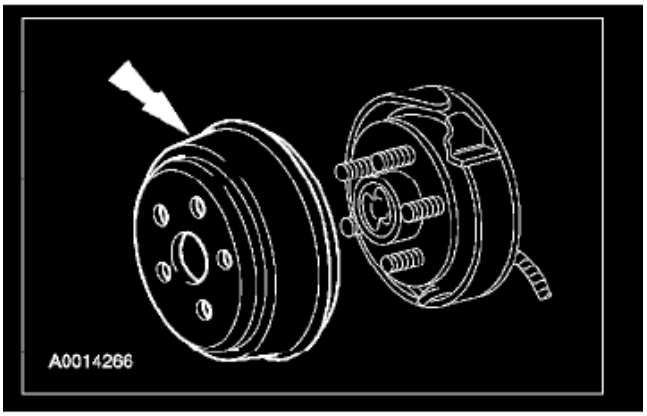
^ Align the bolt hole in the differential pinion shaft with the bolt hole in the case.

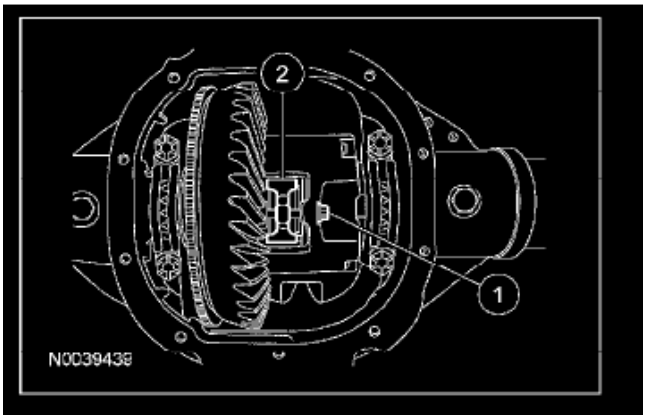
^ Install the new pinion shaft lock bolt. 1 Tighten to 30 Nm (22 lb-ft).

5. Install the brake drum. 6. Install the differential housing cover and fill the differential housing with the specified lubricant. 7. Install the rear wheel and tire.

Material

Item	Specification
Additive Friction Modifier XL-3 (US); CXL-3 (Canada)	EST-M2C118-A
Motorcraft SAE 75W-140 Synthetic Rear Axle Lubricant XY-75W140-QL (US); CXY-75W140-1L (Canada)	WSL-M2C192-A
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B
Ultra Silicone Sealant TA-29	WSS-M4G320-A3





Axle Shaft Assembly: Service and Repair Ford 8.8-Inch Ring Gear High Torque - Rear Drive Axle/Differential

Axle Shaft

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Remove the wheel and tire. 3. Remove the 10 differential housing cover bolts and drain the lubricant from the rear axle housing. 4. Remove the rear brake drums.

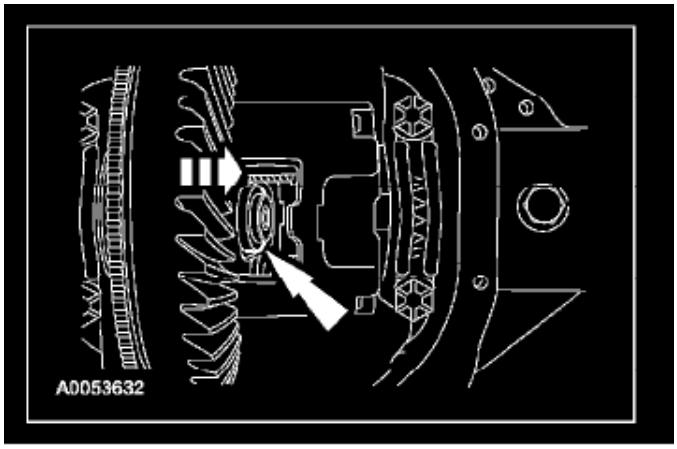
5. Remove the differential thrust plate.

1 Remove and discard the differential thrust plate lock bolt.

2 Remove the differential thrust plate.

6. NOTE: Do not damage the rubber O-rings in the axle shaft grooves.

Push the axle shafts inboard and remove the U-washers.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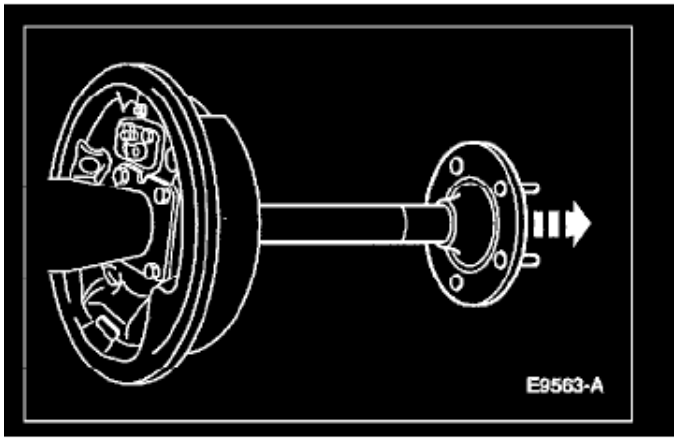
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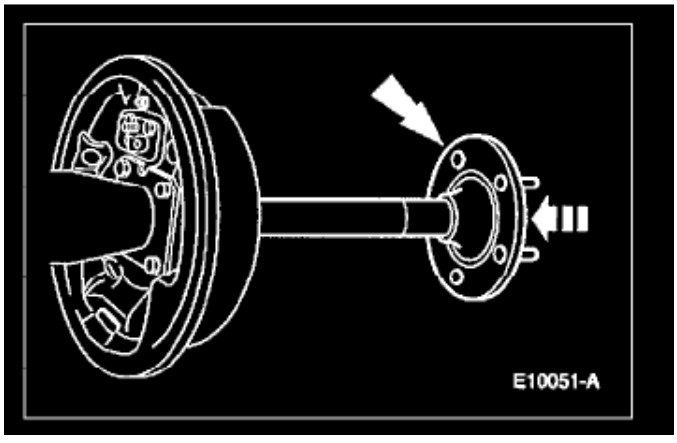

E10051-A

7. NOTE: Do not damage the wheel bearing oil seal.

Remove the 2 axle shafts.

Installation

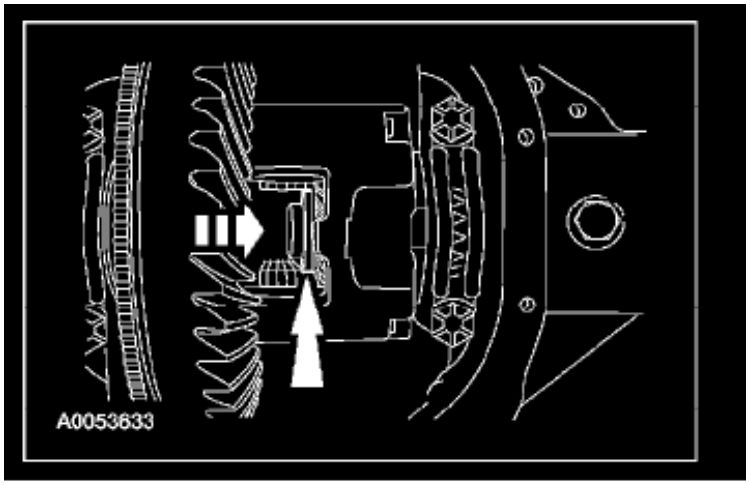
1. Lubricate the lip of the wheel bearing oil seal with grease.

2. NOTE: Do not damage the wheel bearing oil seal.

Install the 2 axle shafts.

3. NOTE: Do not damage the rubber O-rings in the U-washer grooves.

Position the 2 U-washers on the button end of the axle shafts and pull the axle shafts outward.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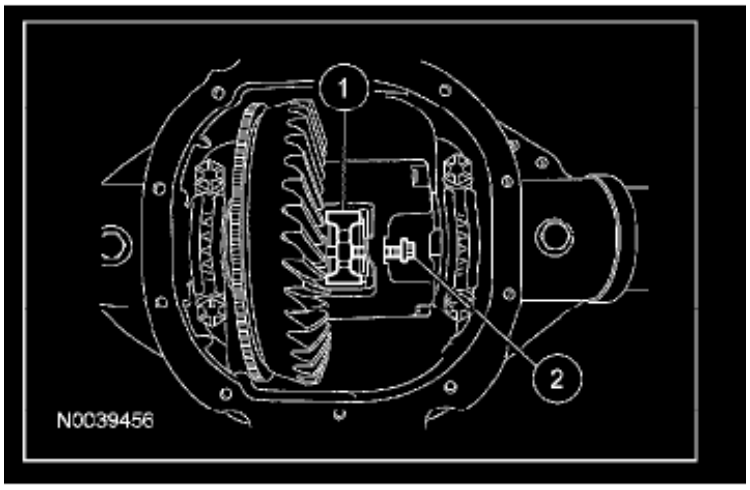
1
2
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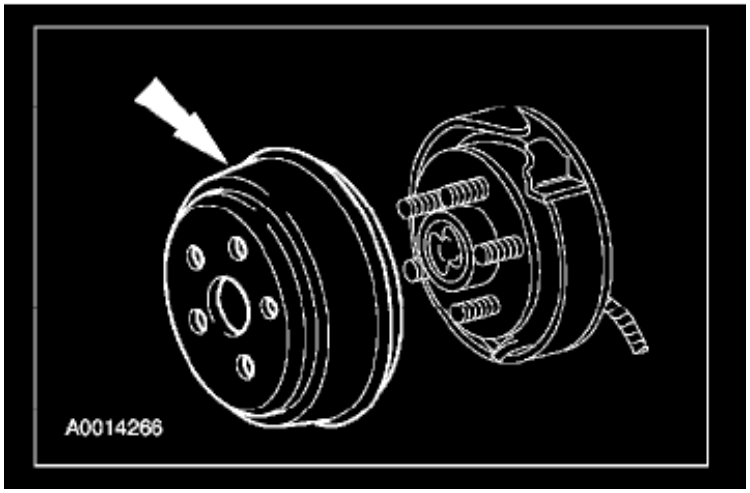

A0014266

4. Install the differential thrust plate.

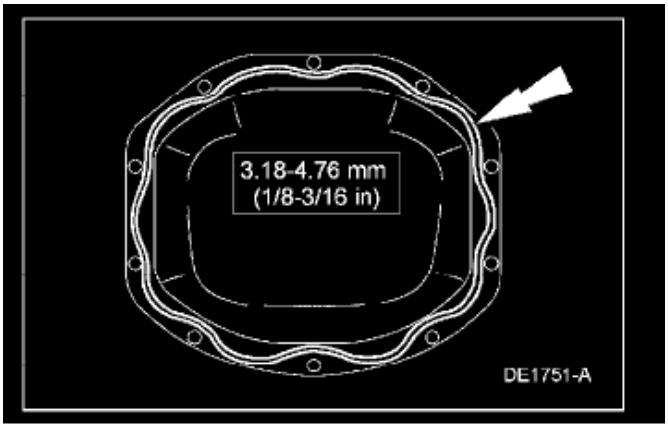
1 Align the hole in the thrust plate shaft with the case lock bolt hole.

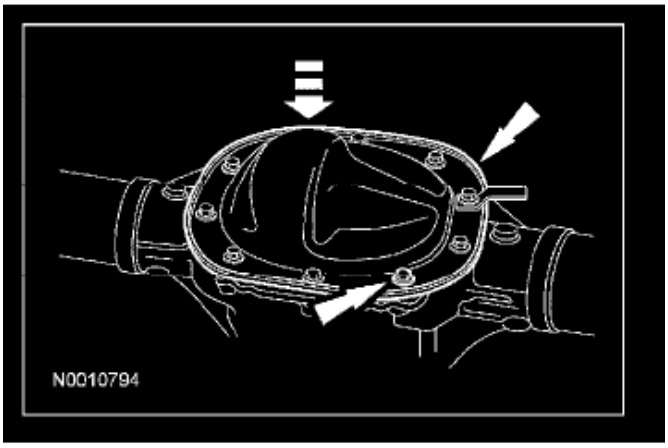
2 Install a new differential pinion shaft lock bolt.

5. Install the rear brake drums.

6. NOTE: Clean the gasket mating surface of the rear axle and the differential housing cover.

Apply a continuous bead of sealant to the differential housing cover.


3.18-4.76 mm
(1/8-3/16 in)
DE1751-A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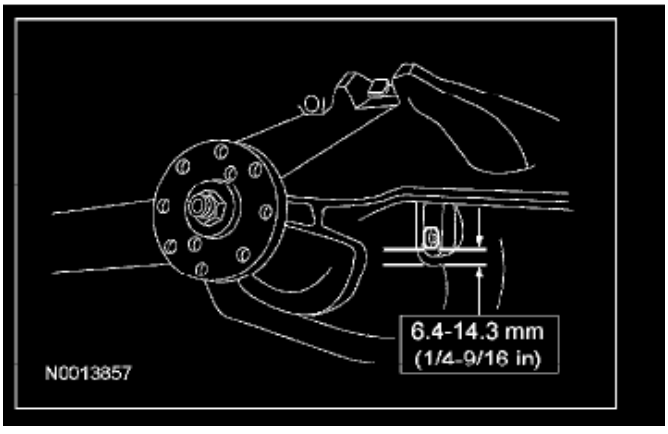

6.4-14.3 mm
(1/4-9/16 in)
N0013857

7. NOTE: The differential housing cover must be installed within 15 minutes of application of the silicone, or new sealant must be applied. If

possible, allow one hour before filling with lubricant to make sure the silicone sealant has correctly cured.

Install the differential housing cover and 10 bolts. ^

Tighten to 45 Nm (33 lb-ft).

8. NOTE: Service refill capacities are determined by filling the axle with the specified lubricant to the specified level below the bottom of the filler

hole.

Remove the plug and fill the axle to the level shown with axle lubricant and install the filler plug. ^

Tighten to 52 Nm (38 lb-ft).

9. Install the tire and wheel.

Special Tool(s)

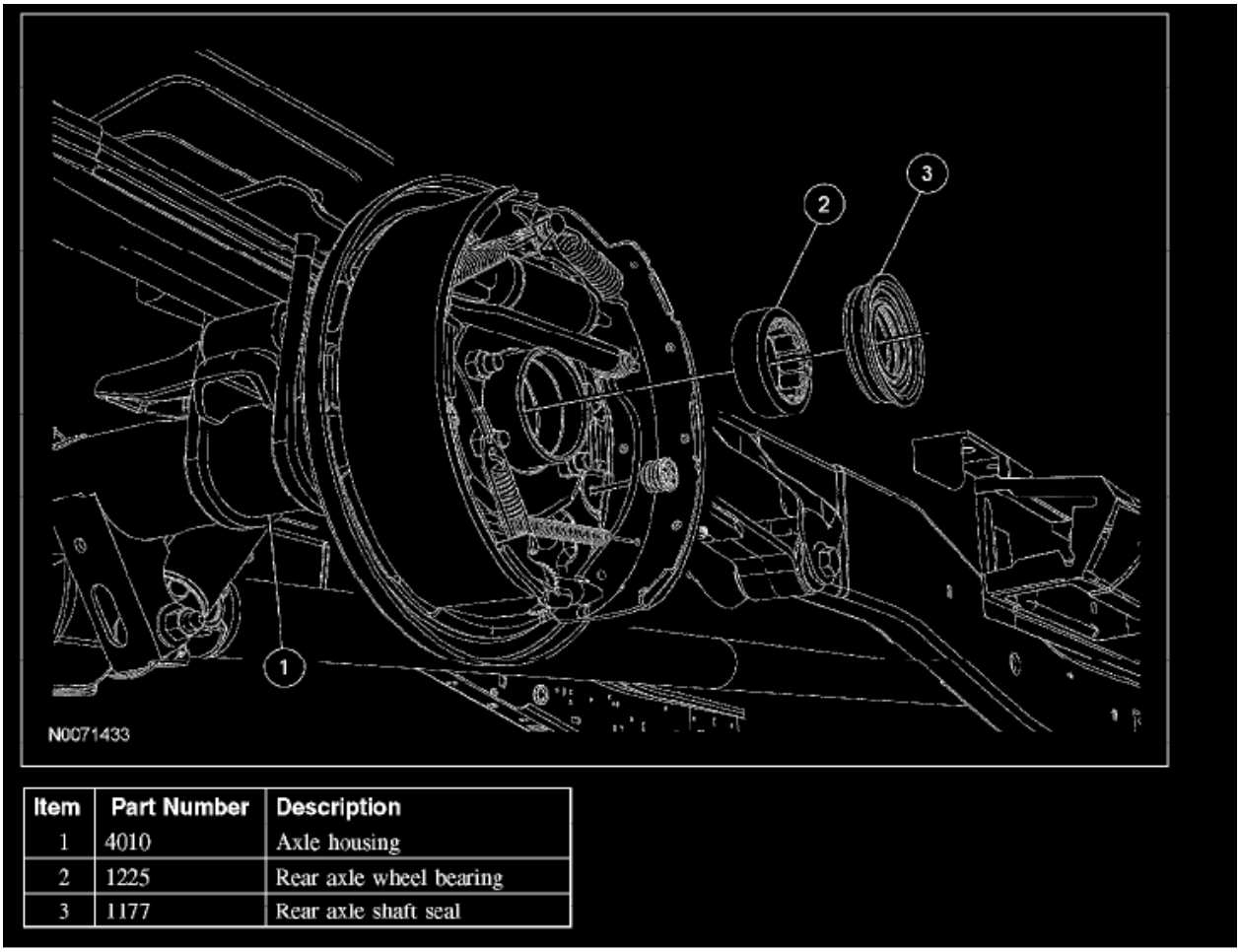
ST1326-A	Adapter for 303-224 (Handle) 205-153 (T80T-4000-W)
ST1541A	Installer, Axle Shaft Bearing 205-124 (T78P-1225-A)
ST2027 A	Installer, Rear Axle Oil Seal 205-390 (T97T-1177-B)
ST1185-A	Slide Hammer 100-001 (T50T-100-A)
ST2035-A	Remover, Axle Bearing 205-219 (T85L-1225-AH)

Material

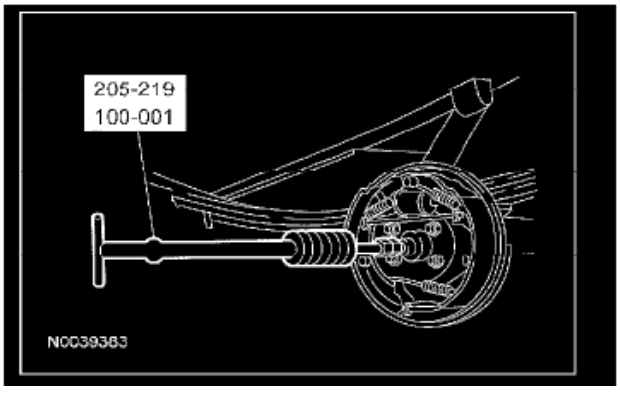
Item	Specification
Motorcraft SAE 80W-90 Premium Rear Axle Lubricant XY-80W90-QL (US); CXY-80W90-1L (Canada)	WSP-M2C197-A
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B

Seals and Gaskets: Service and Repair Ford 7.5-Inch Ring Gear - Rear Drive Axle/Differential

Rear Wheel Bearing and Axle Shaft Seal



Item	Part Number	Description
1	4010	Axle housing
2	1225	Rear axle wheel bearing
3	1177	Rear axle shaft seal



Removal

1. NOTE: If the wheel bearing oil seal is leaking, the axle housing vent may be plugged.

Remove the axle shaft.

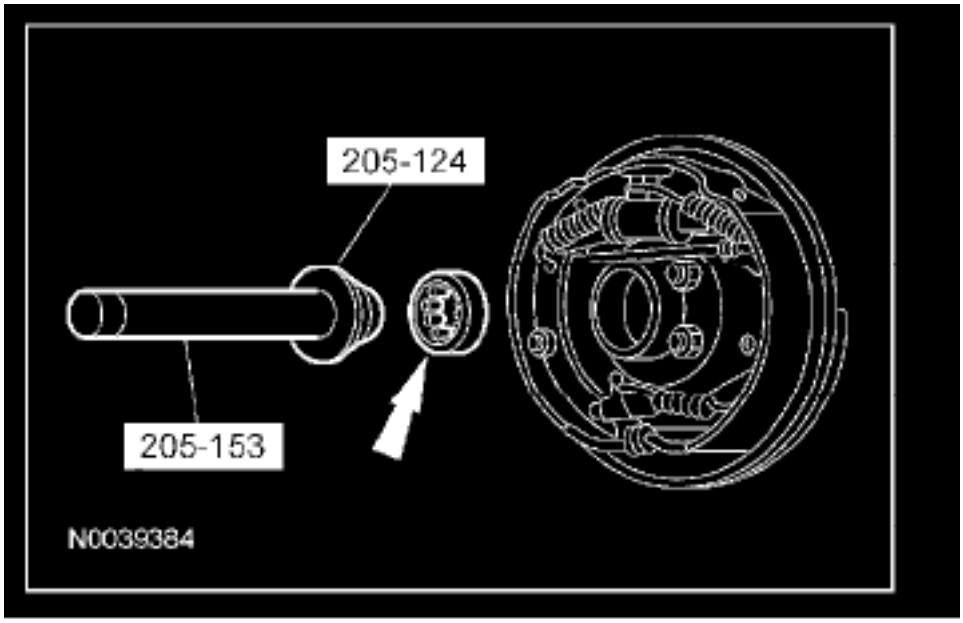
2. NOTE: If only a new seal needs to be installed, use care to avoid damaging the seal bore.

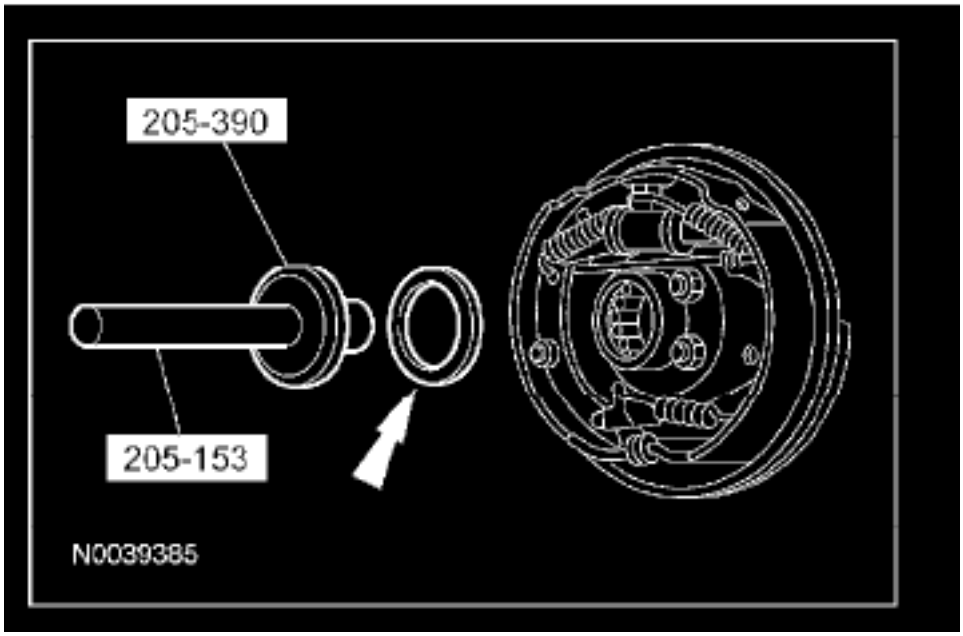
Using a suitable seal remover, remove and discard the axle shaft oil seal.

3. Inspect the rear wheel bearing and axle shaft for wear or damage. 4. If necessary, using the special tools, remove the rear wheel bearing.

Installation

1. Lubricate the new rear wheel bearing with lubricant. 2. Using the special tools, install the rear wheel bearing. 3. Lubricate the lip of the new wheel bearing oil seal with grease.





4. Using the special tools, install the wheel bearing oil seal.

5. Install the axle shaft.

Special Tool(s)

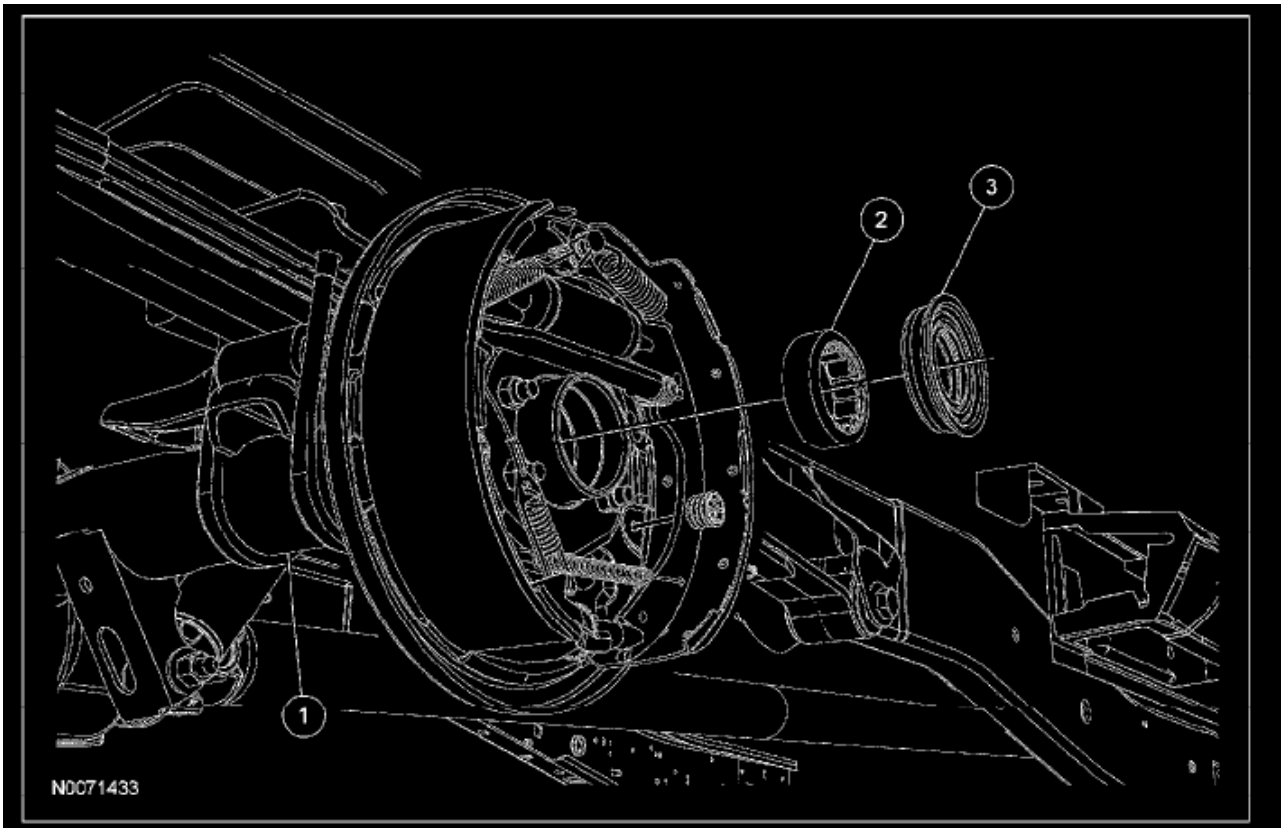
ST1325-A	Adapter For 303-224 (Handle) 205-153 (T80T-4000-W)
ST1185-A	Impact Slide Hammer 100-001 (T50T-100-A)
ST1541A	Installer, Axle Shaft Bearing 205-124 (T78P-1225-A)
ST2027-A	Installer, Rear Axle Oil Seal 205-390 (T97-1177-B)
ST2035-A	Remover, Axle Bearing 205-219 (T85L-1225-AH)

Material

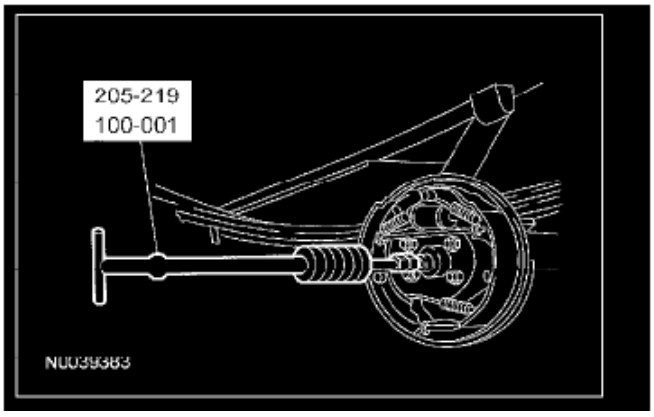
Item	Specification
Motorcraft SAE 80W-90 Premium Rear Axle Lubricant XY-80W90-QL (US); CXY-80W90-1L (Canada)	WSP-M2C197-A
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B

Seals and Gaskets: Service and Repair Ford 8.8-Inch Ring Gear - Rear Drive Axle/Differential

Rear Wheel Bearing and Axle Shaft Seal



Item	Part Number	Description
1	4010	Axle housing
2	1225	Rear axle wheel bearing
3	1177	Rear axle shaft seal



Removal

1. Remove the axle shaft.

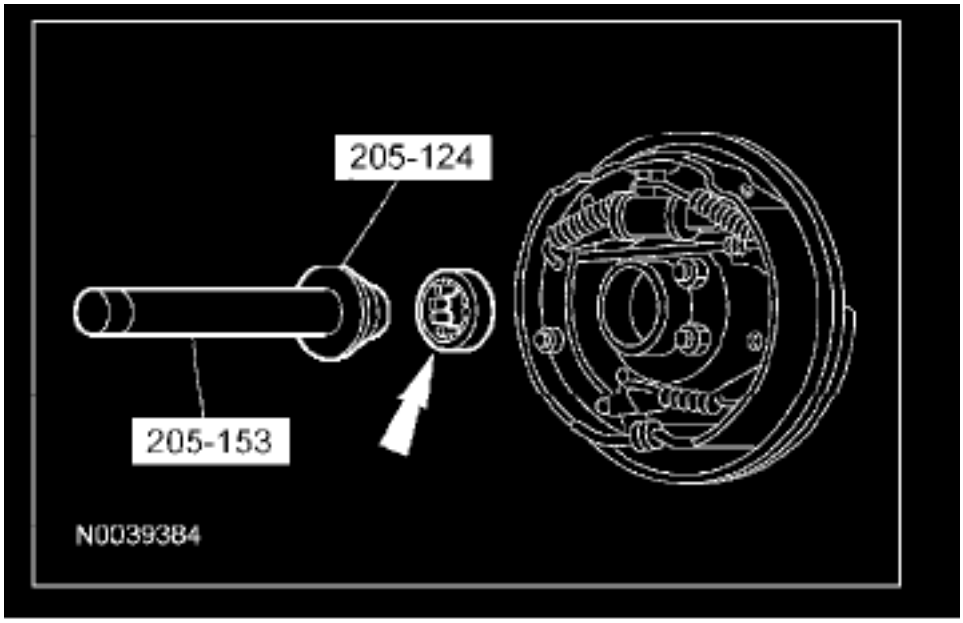
2. NOTE: If only a new seal needs to be installed, use care to avoid damaging the seal bore.

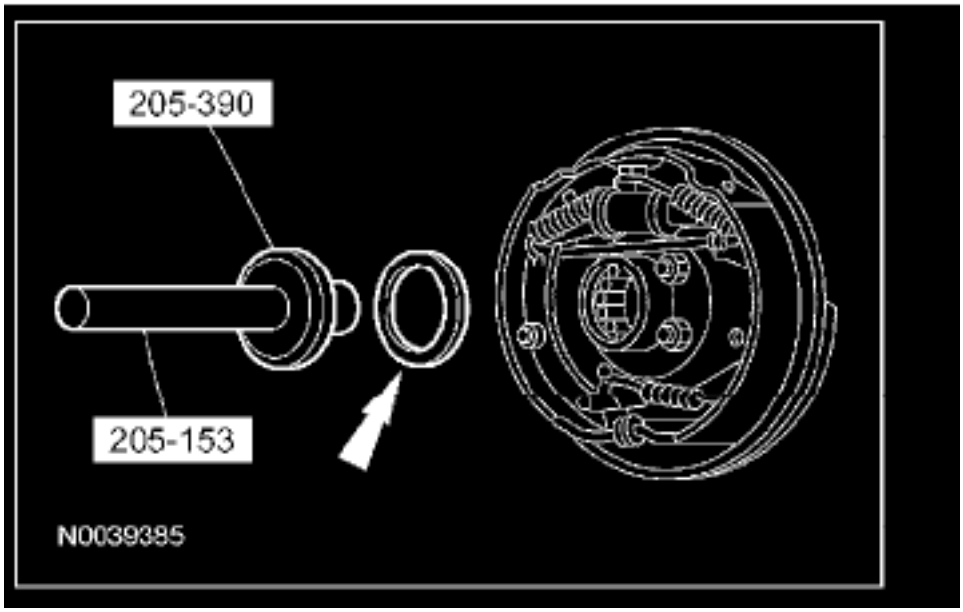
Using a suitable seal remover, remove and discard the axle shaft oil seal.

3. Inspect the rear wheel bearing and axle shaft for wear or damage. 4. If necessary, using the special tools, remove the rear wheel bearing.

Installation

1. Lubricate the new rear wheel bearing with rear axle lubricant.





2. Using the special tools, install the rear wheel bearing. 3. Lubricate the lip of the new wheel bearing oil seal with grease. 4. Using the special tools, install the wheel bearing oil seal.

5. Install the axle shaft.

Special Tool(s)

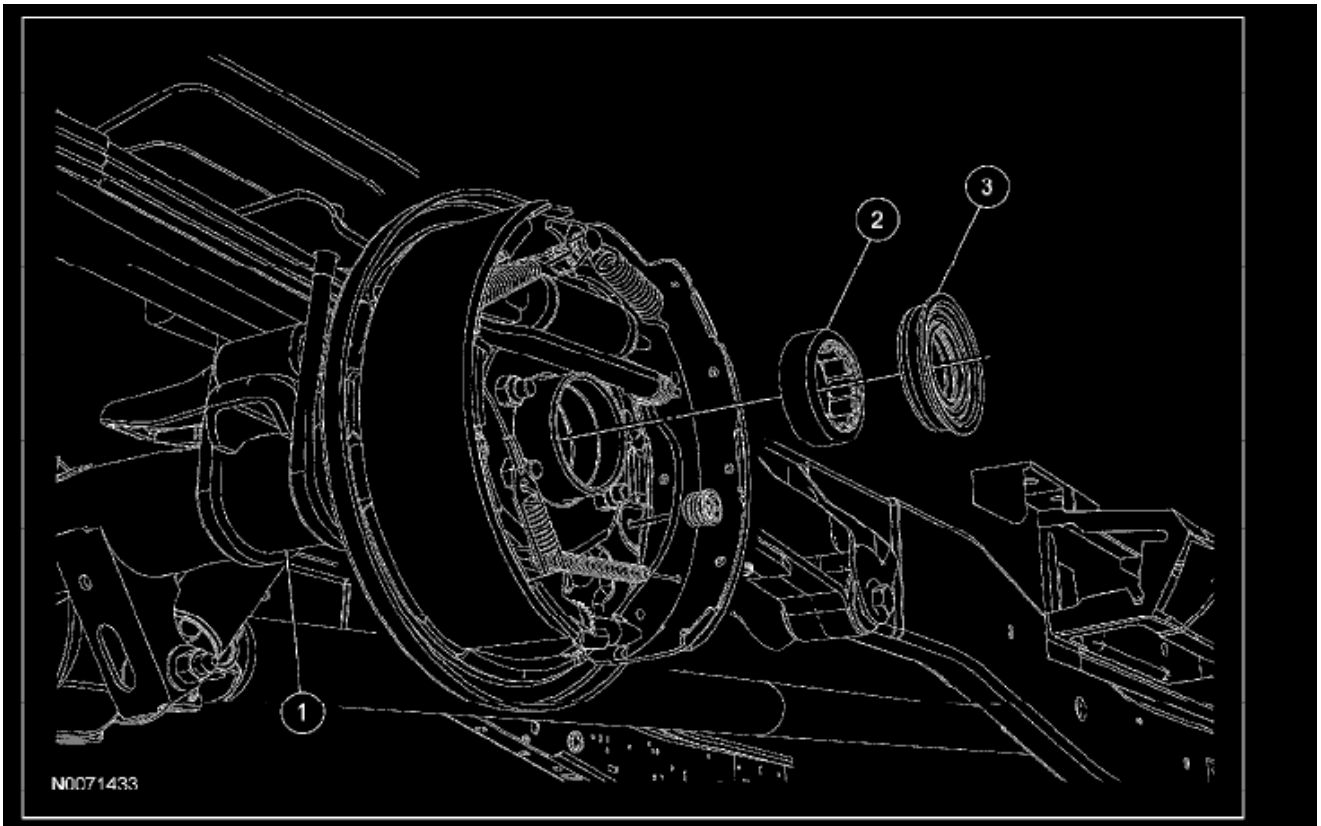
ST1326-A	Adapter For 303-224 (Handle) 205-153 (T80T-4000-W)
ST1322-A	Installer, Axle Bearing 205-194 (T83T-1225-B)
ST1736-A	Installer, Axle Oil Seal 205-190 (T83T-1175-A)
ST1263-A	Remover, Axle Bearing 205-193 (T83T-1225-A)
ST1185-A	Slide Hammer 100-001 (T50T-100-A)

Material

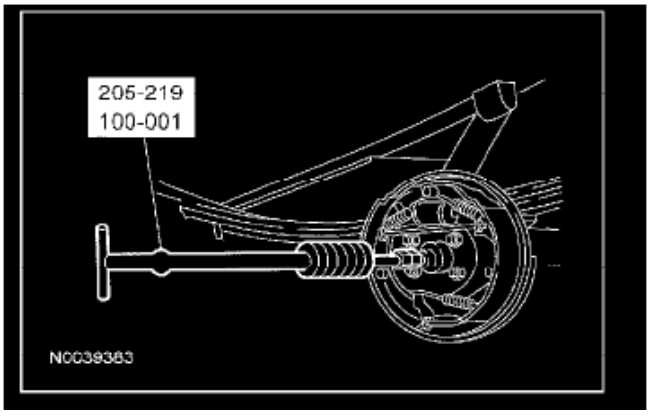
Item	Specification
Additive Friction Modifier XL-3 (US); CXL-3 (Canada)	EST-M2C118-A
Motorcraft SAE 75W-140 Synthetic Rear Axle Lubricant XY-75W140-QL (US); CXY-75W140-1L (Canada)	WSL-M2C192-A
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B

Seals and Gaskets: Service and Repair Ford 8.8-Inch Ring Gear High Torque - Rear Drive Axle/Differential

Rear Wheel Bearing and Axle Shaft Seal



Item	Part Number	Description
1	4010	Axle housing
2	1225	Rear axle wheel bearing
3	1177	Rear axle shaft seal



Removal

1. Remove the axle shaft.

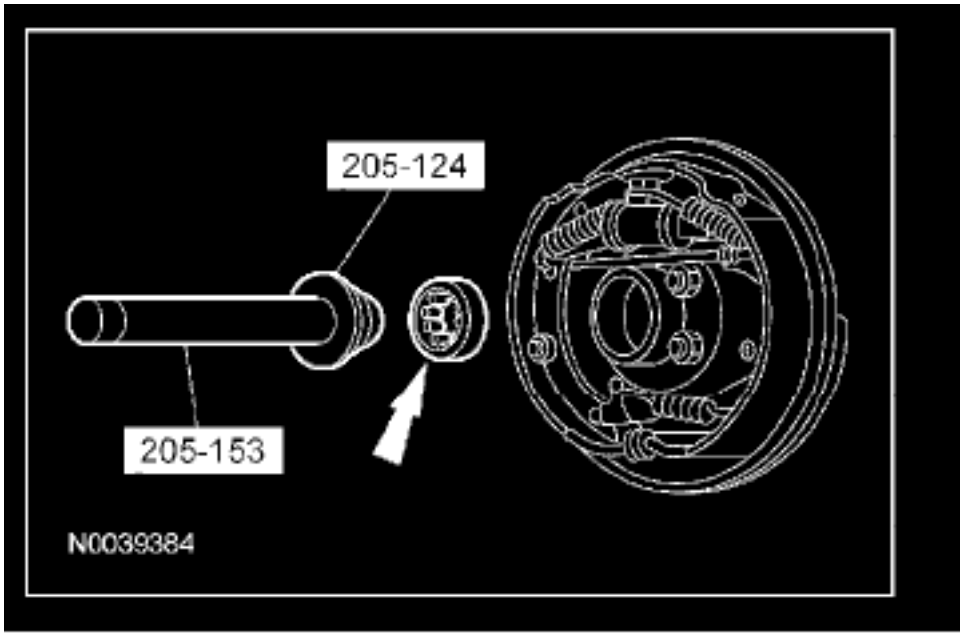
2. NOTE: If only a new seal needs to be installed, use care to avoid damaging the seal bore.

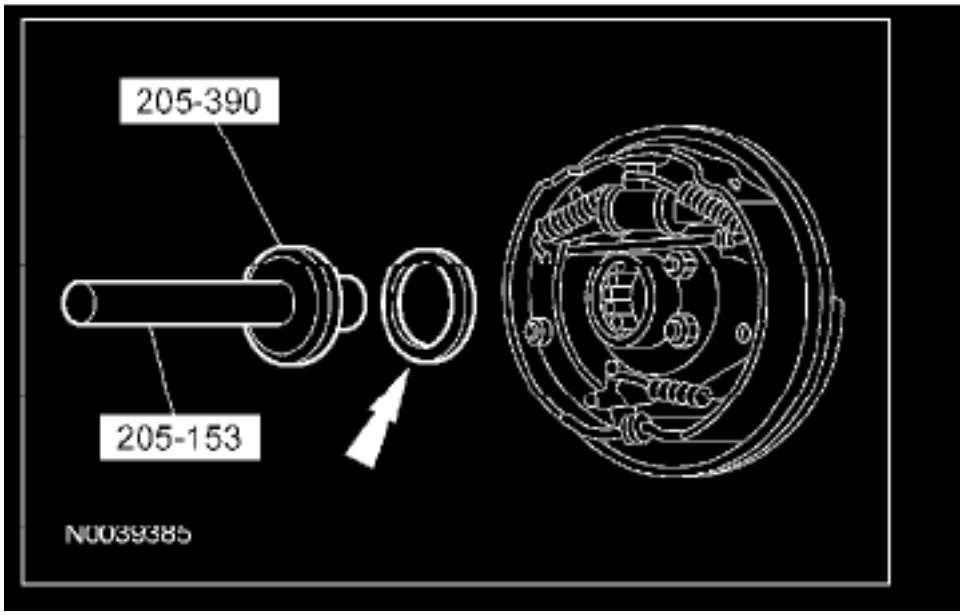
Using a suitable seal remover, remove the axle shaft oil seal. Discard the oil seal.

3. Inspect the rear wheel bearing and axle shaft for wear or damage. 4. If necessary, using the special tools, remove the rear wheel bearing.

Installation

1. Lubricate the new rear wheel bearing with rear axle lubricant. 2. Using the special tools, install the rear wheel bearing.





3. Lubricate the lip of the new wheel bearing oil seal with grease. 4. Using the special tools, install the wheel bearing oil seal.

5. Install the axle shaft.

Special Tool(s)

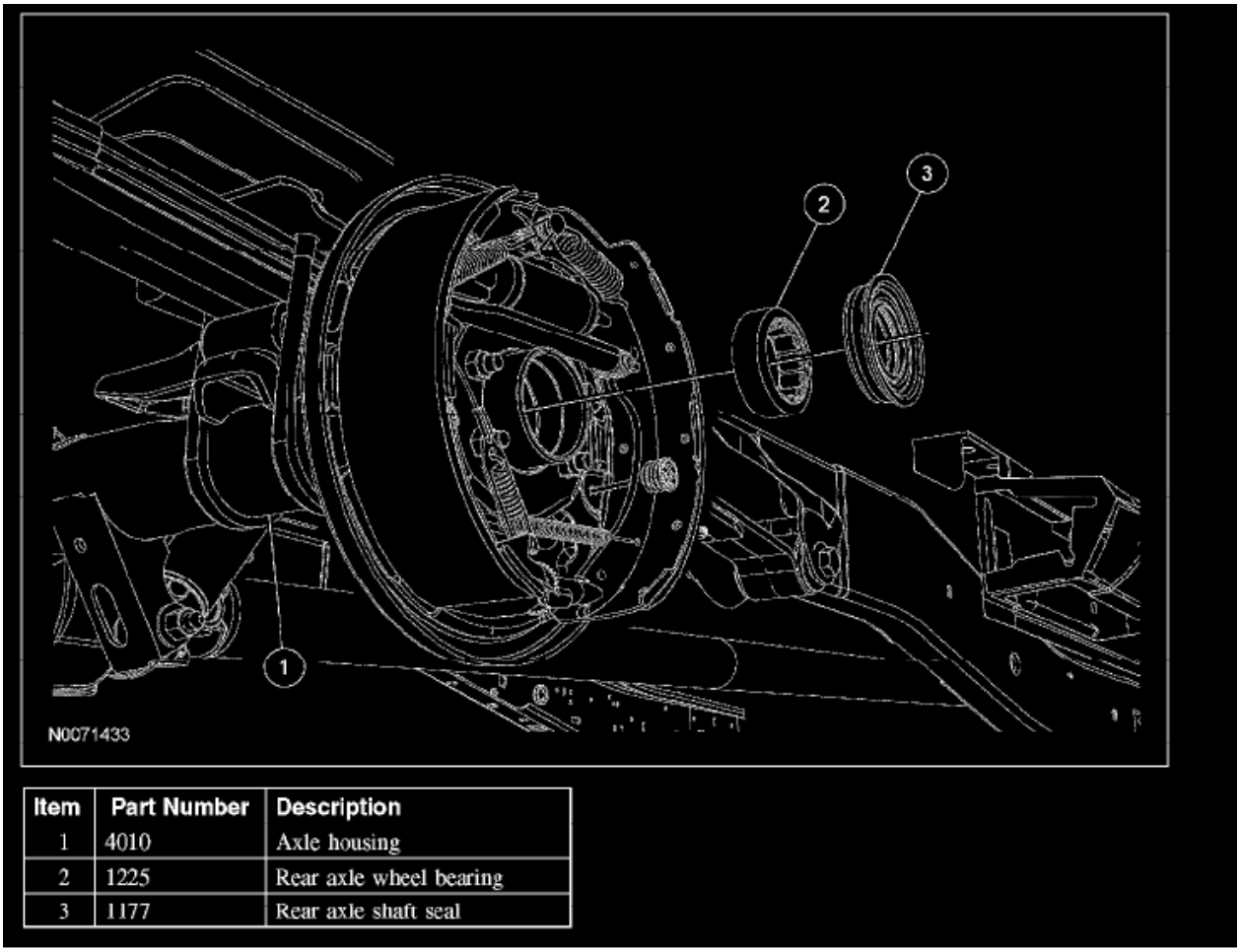
ST1326-A	Adapter for 303-224 (Handle) 205-153 (T80T-4000-W)
ST1541A	Installer, Axle Shaft Bearing 205-124 (T78P-1225-A)
ST2027 A	Installer, Rear Axle Oil Seal 205-390 (T97T-1177-B)
ST1185-A	Slide Hammer 100-001 (T50T-100-A)
ST2035-A	Remover, Axle Bearing 205-219 (T85L-1225-AH)

Material

Item	Specification
Motorcraft SAE 80W-90 Premium Rear Axle Lubricant XY-80W90-QL (US); CXY-80W90-1L (Canada)	WSP-M2C197-A
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B

Wheel Bearing: Service and Repair Ford 7.5-Inch Ring Gear - Rear Drive Axle/Differential

Rear Wheel Bearing and Axle Shaft Seal



Item	Part Number	Description
1	4010	Axle housing
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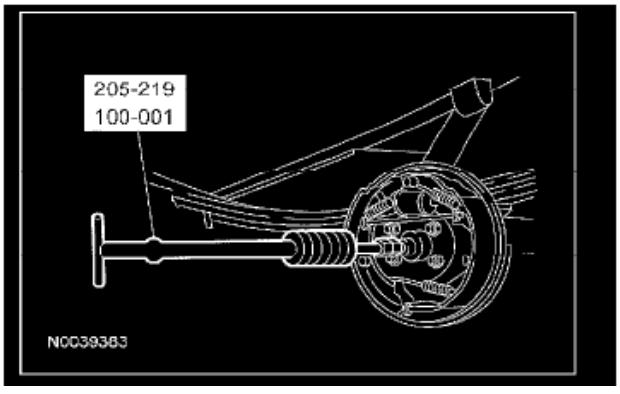
3	1177	Rear axle shaft seal



Removal

1. NOTE: If the wheel bearing oil seal is leaking, the axle housing vent may be plugged.

Remove the axle shaft.

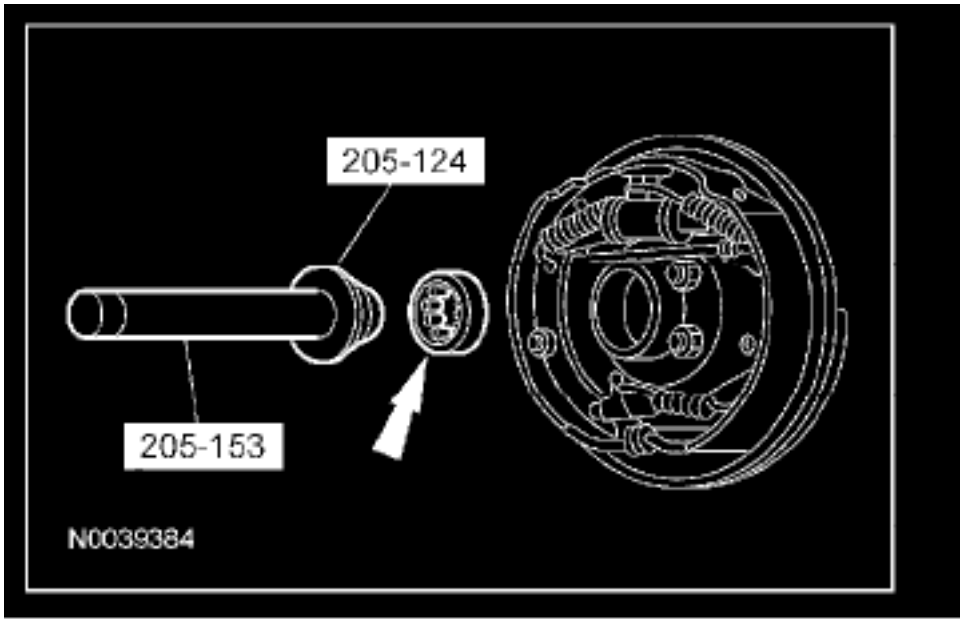
2. NOTE: If only a new seal needs to be installed, use care to avoid damaging the seal bore.

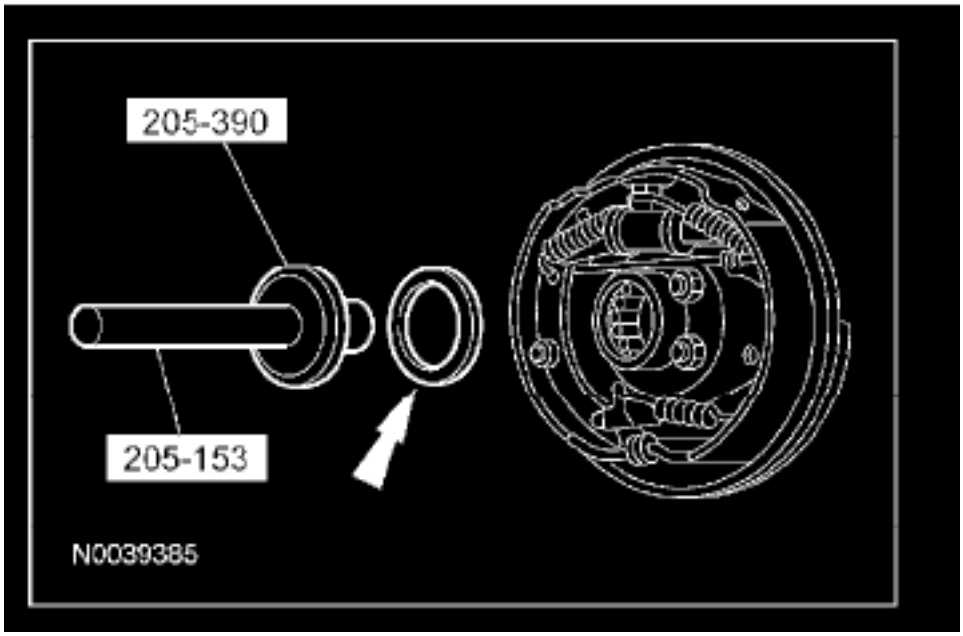
Using a suitable seal remover, remove and discard the axle shaft oil seal.

3. Inspect the rear wheel bearing and axle shaft for wear or damage. 4. If necessary, using the special tools, remove the rear wheel bearing.

Installation

1. Lubricate the new rear wheel bearing with lubricant. 2. Using the special tools, install the rear wheel bearing. 3. Lubricate the lip of the new wheel bearing oil seal with grease.





4. Using the special tools, install the wheel bearing oil seal.

5. Install the axle shaft.

Special Tool(s)

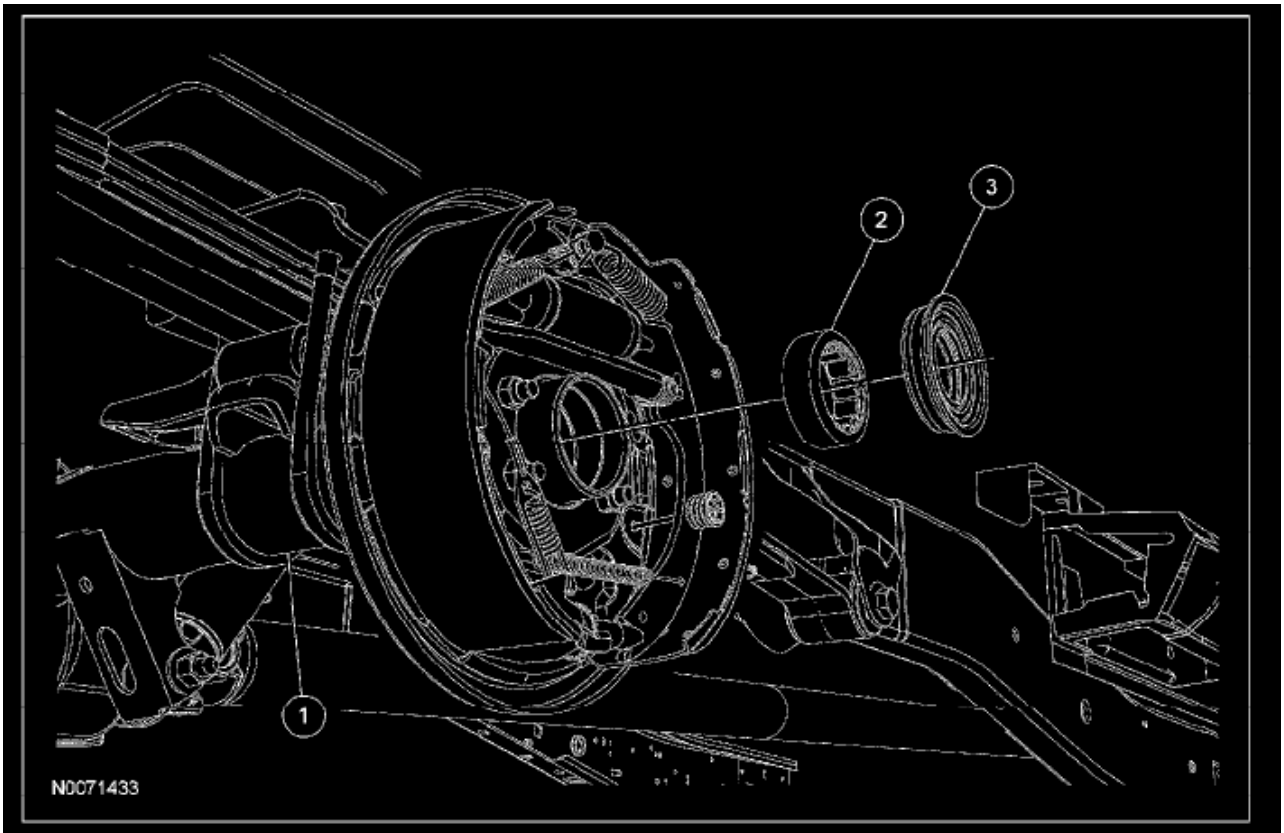
ST1325-A	Adapter For 303-224 (Handle) 205-153 (T80T-4000-W)
ST1185-A	Impact Slide Hammer 100-001 (T50T-100-A)
ST1541A	Installer, Axle Shaft Bearing 205-124 (T78P-1225-A)
ST2027-A	Installer, Rear Axle Oil Seal 205-390 (T97-1177-B)
ST2035-A	Remover, Axle Bearing 205-219 (T85L-1225-AH)

Material

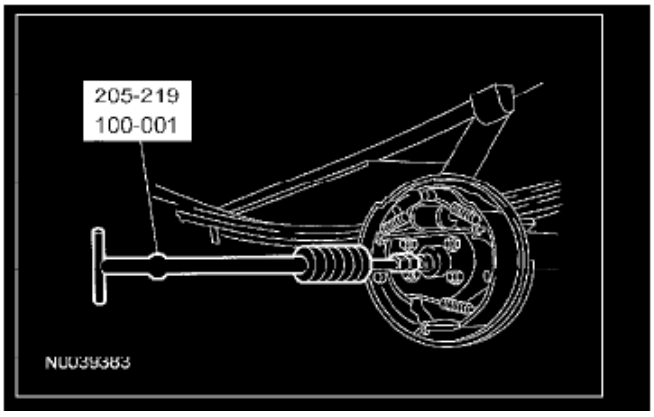
Item	Specification
Motorcraft SAE 80W-90 Premium Rear Axle Lubricant XY-80W90-QL (US); CXY-80W90-1L (Canada)	WSP-M2C197-A
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B

Wheel Bearing: Service and Repair Ford 8.8-Inch Ring Gear - Rear Drive Axle/Differential

Rear Wheel Bearing and Axle Shaft Seal



Item	Part Number	Description
1	4010	Axle housing
2	1225	Rear axle wheel bearing
3	1177	Rear axle shaft seal



Removal

1. Remove the axle shaft.

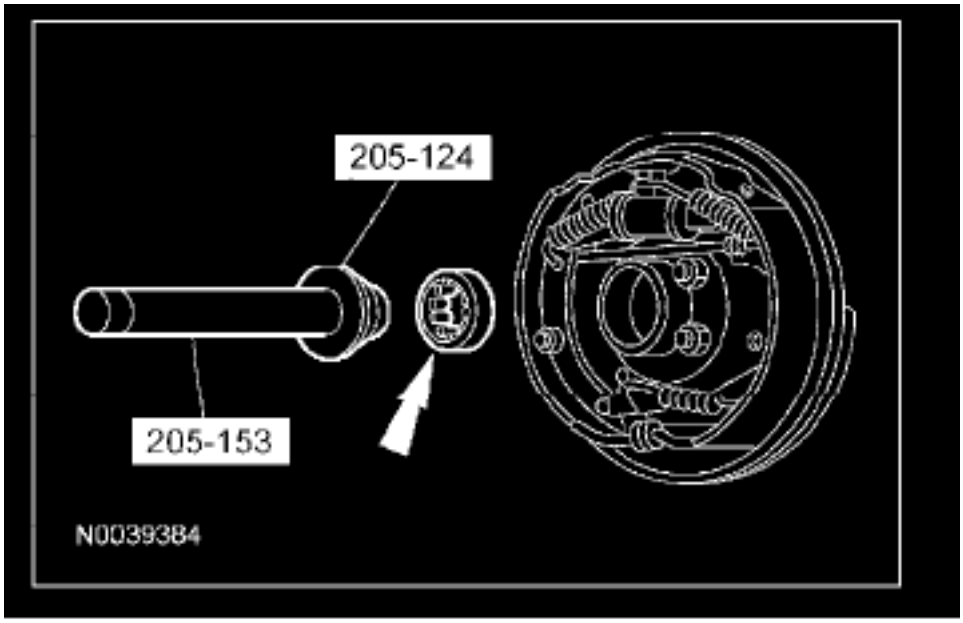
2. NOTE: If only a new seal needs to be installed, use care to avoid damaging the seal bore.

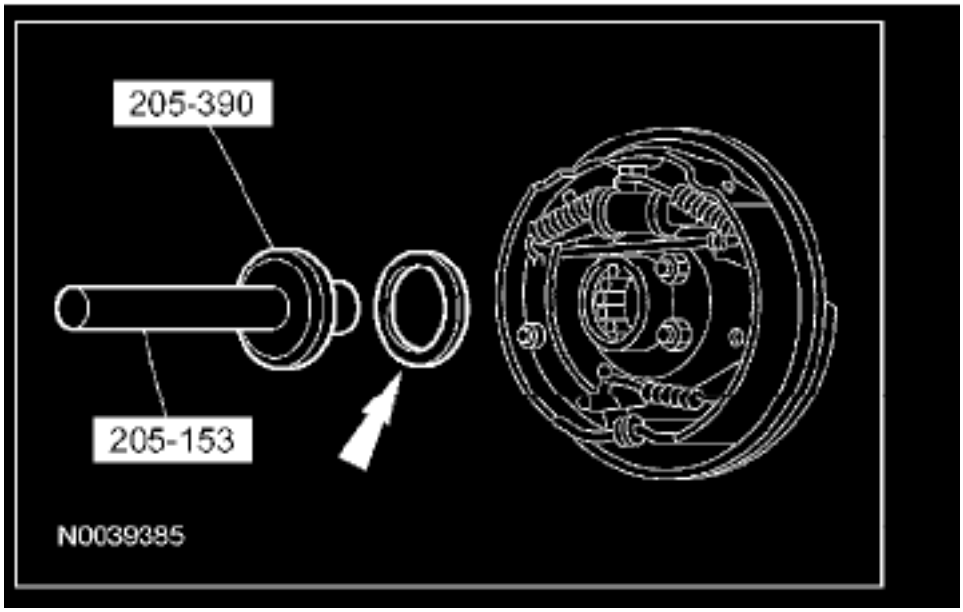
Using a suitable seal remover, remove and discard the axle shaft oil seal.

3. Inspect the rear wheel bearing and axle shaft for wear or damage. 4. If necessary, using the special tools, remove the rear wheel bearing.

Installation

1. Lubricate the new rear wheel bearing with rear axle lubricant.





2. Using the special tools, install the rear wheel bearing. 3. Lubricate the lip of the new wheel bearing oil seal with grease. 4. Using the special tools, install the wheel bearing oil seal.

5. Install the axle shaft.

Special Tool(s)

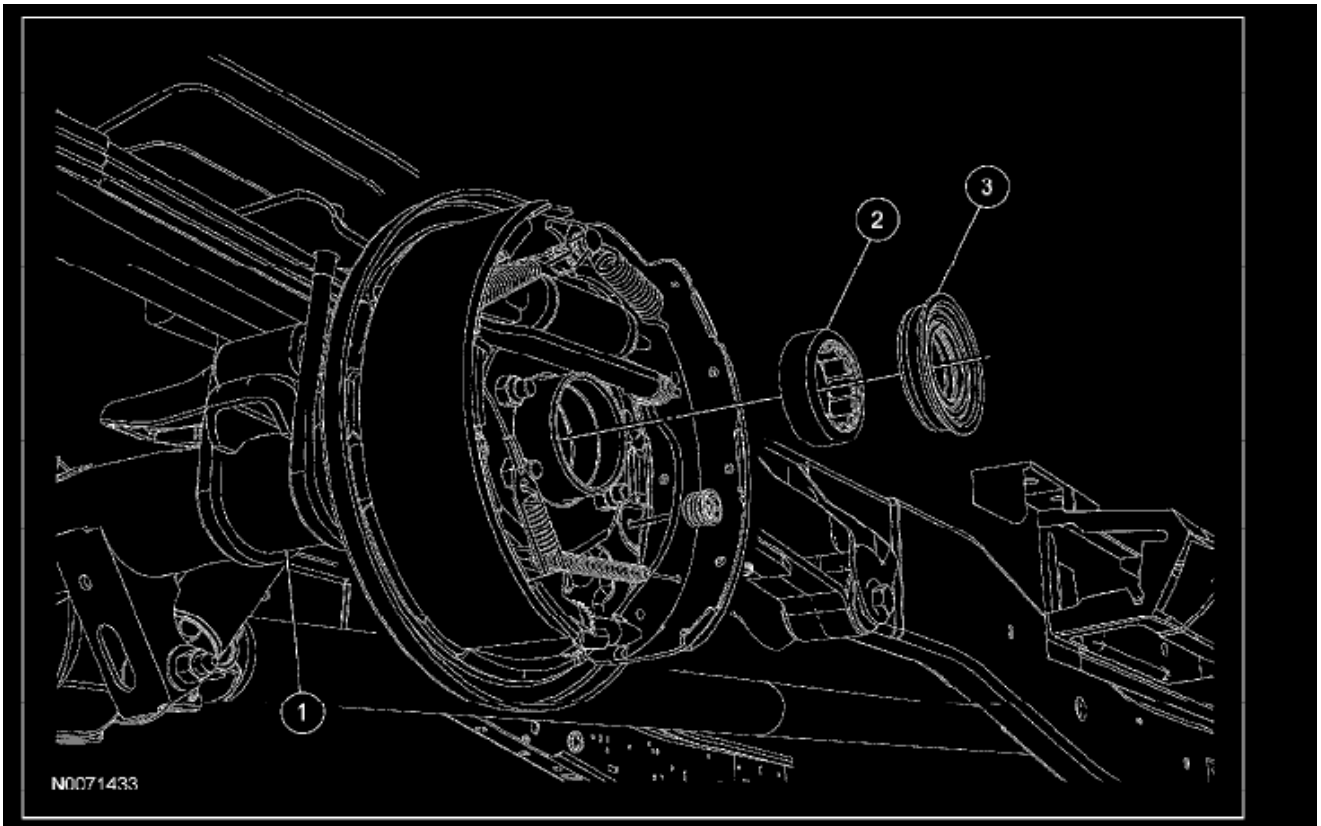
ST1326-A	Adapter For 303-224 (Handle) 205-153 (T80T-4000-W)
ST1322-A	Installer, Axle Bearing 205-194 (T83T-1225-B)
ST1736-A	Installer, Axle Oil Seal 205-190 (T83T-1175-A)
ST1263-A	Remover, Axle Bearing 205-193 (T83T-1225-A)
ST1185-A	Slide Hammer 100-001 (T50T-100-A)

Material

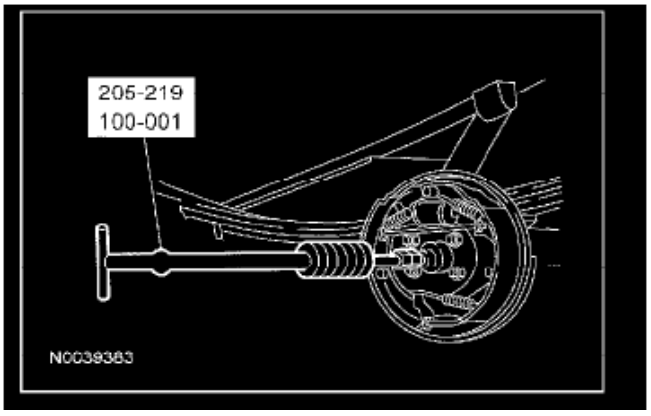
Item	Specification
Additive Friction Modifier XL-3 (US); CXL-3 (Canada)	EST-M2C118-A
Motorcraft SAE 75W-140 Synthetic Rear Axle Lubricant XY-75W140-QL (US); CXY-75W140-1L (Canada)	WSL-M2C192-A
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B

Wheel Bearing: Service and Repair Ford 8.8-Inch Ring Gear High Torque - Rear Drive Axle/Differential

Rear Wheel Bearing and Axle Shaft Seal



Item	Part Number	Description
1	4010	Axle housing
2	1225	Rear axle wheel bearing
3	1177	Rear axle shaft seal



Removal

1. Remove the axle shaft.

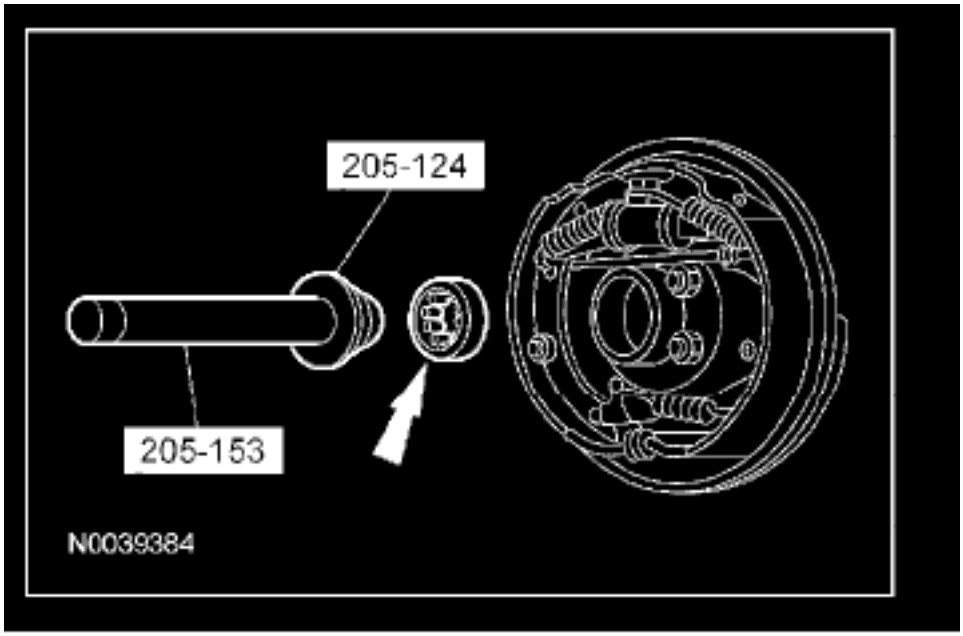
2. NOTE: If only a new seal needs to be installed, use care to avoid damaging the seal bore.

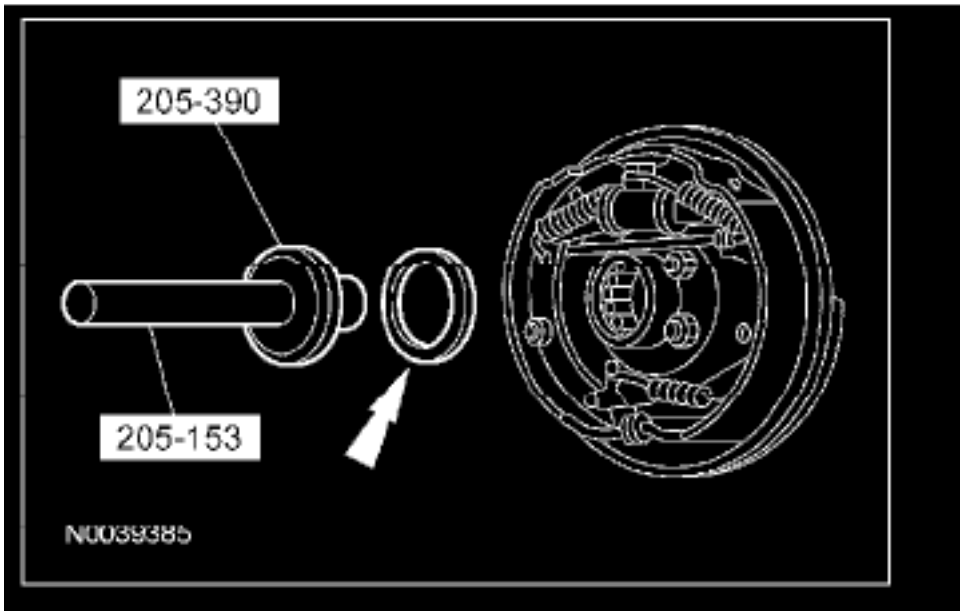
Using a suitable seal remover, remove the axle shaft oil seal. Discard the oil seal.

3. Inspect the rear wheel bearing and axle shaft for wear or damage. 4. If necessary, using the special tools, remove the rear wheel bearing.

Installation

1. Lubricate the new rear wheel bearing with rear axle lubricant. 2. Using the special tools, install the rear wheel bearing.





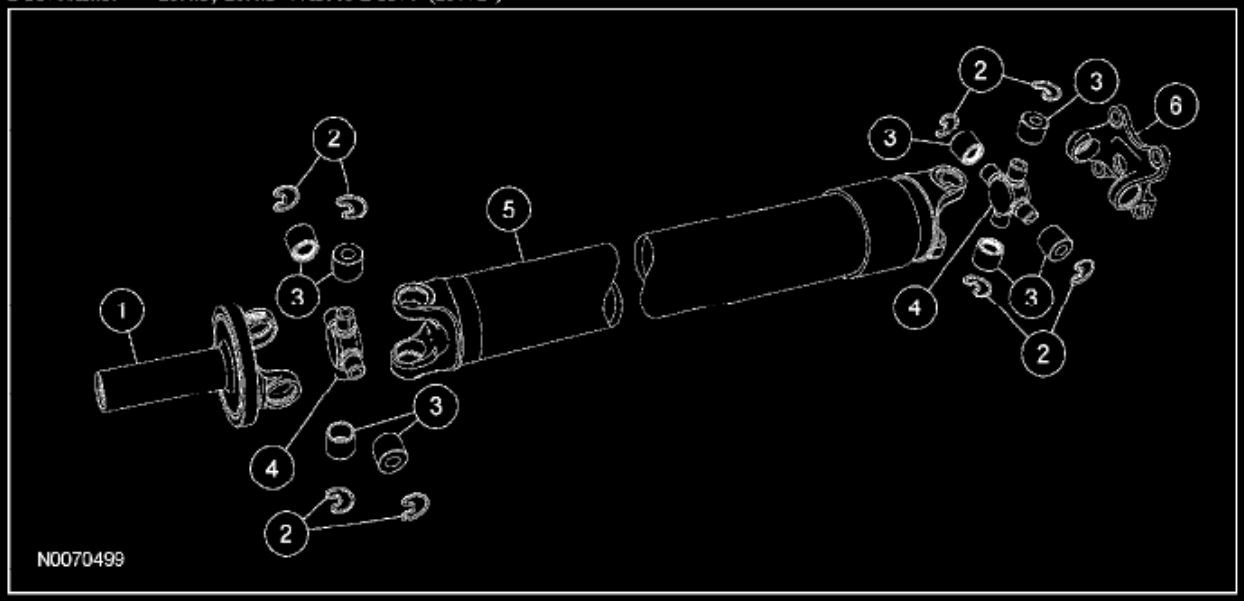
3. Lubricate the lip of the new wheel bearing oil seal with grease. 4. Using the special tools, install the wheel bearing oil seal.

5. Install the axle shaft.

Axle Nut: Specifications

Hub Nut and Washer ..... 250 Nm (184 lb-ft)

Driveshaft — Rear, Rear Wheel Drive (RWD)

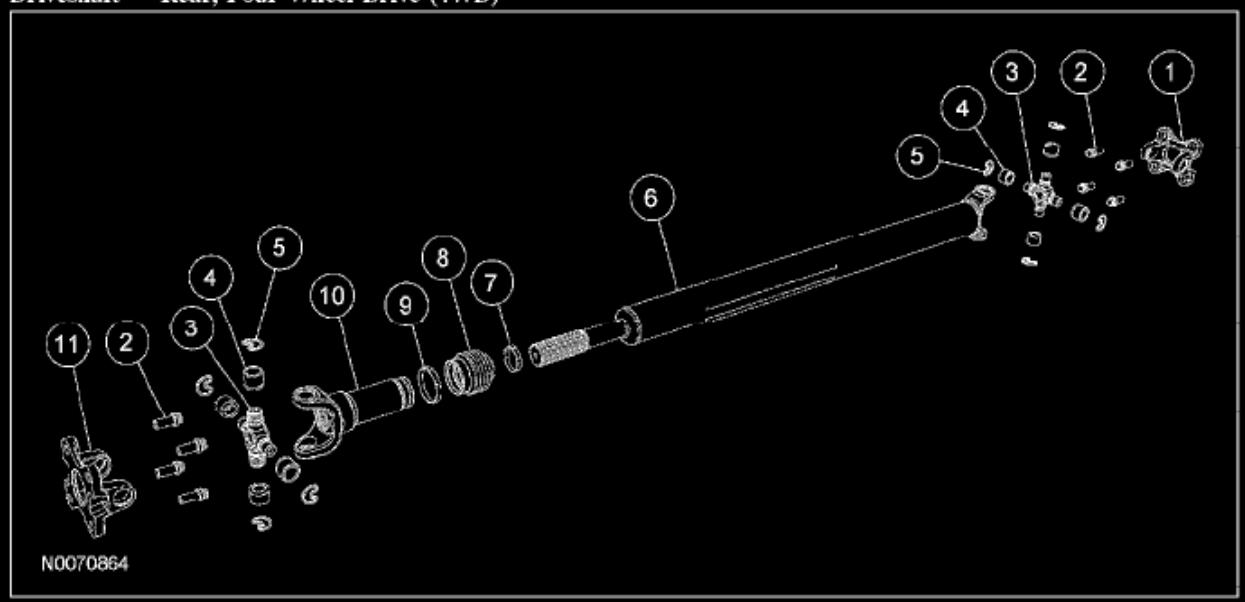


Item	Part Number	Description
1	4841	Driveshaft slip-yoke
2	—	Snap rings (part of 4635)
3	—	Bearings (part of 4635)

Item	Part Number	Description
4	—	Spiders (part of 4635)
5	4602	Driveshaft
6	4782	Flange

(Continued)

Driveshaft — Rear, Four Wheel Drive (4WD)



Drive/Propeller Shaft: Diagrams

Driveshaft - Exploded View

Driveshaft - Rear, Rear Wheel Drive (RWD)

Driveshaft - Rear, Rear Wheel Drive (RWD)

Driveshaft - Rear, Four Wheel Drive (4WD)

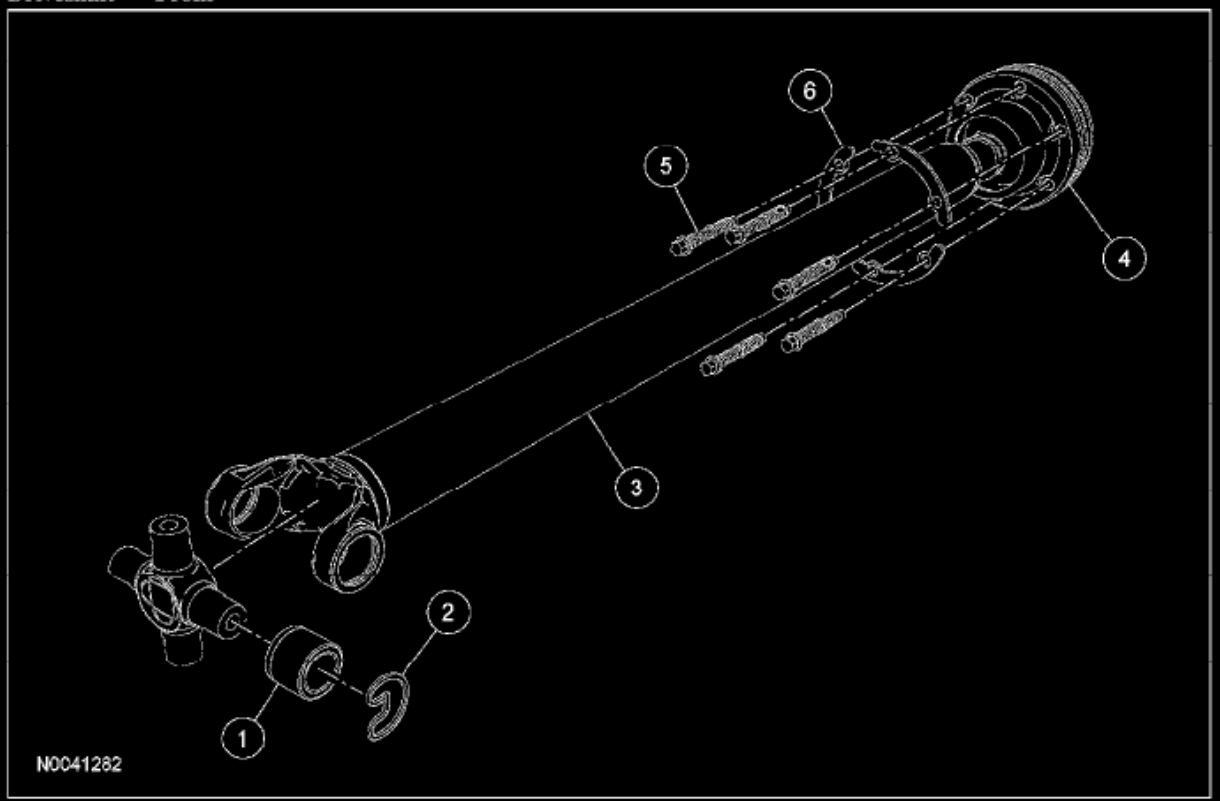
Driveshaft - Rear, Four Wheel Drive (4WD) (Part 1)

Item	Part Number	Description
1	4A378	Rear driveshaft flange
2	N800594-S	Driveshaft flange bolts (8 required)
3	—	Spiders (part of 4635)
4	—	Bearing cups (part of 4635)
5	—	Snap rings (part of 4635) (8 required)
6	4602	Driveshaft

(Continued)

Item	Part Number	Description
7	3B478	Driveshaft slip-yoke boot clamp
8	4421	U-joint slip-yoke boot
9	3B478	Driveshaft slip-yoke boot clamp
10	—	Driveshaft slip-yoke (part of 4602)
11	4A378	Front driveshaft flange

Driveshaft — Front



Item	Part Number	Description
1	4635	U-joint
2	—	Snap ring (part of 4635) (2 required)
3	4A376	Front driveshaft
4	—	Constant velocity (CV) joint (part of 4A376)

(Continued)

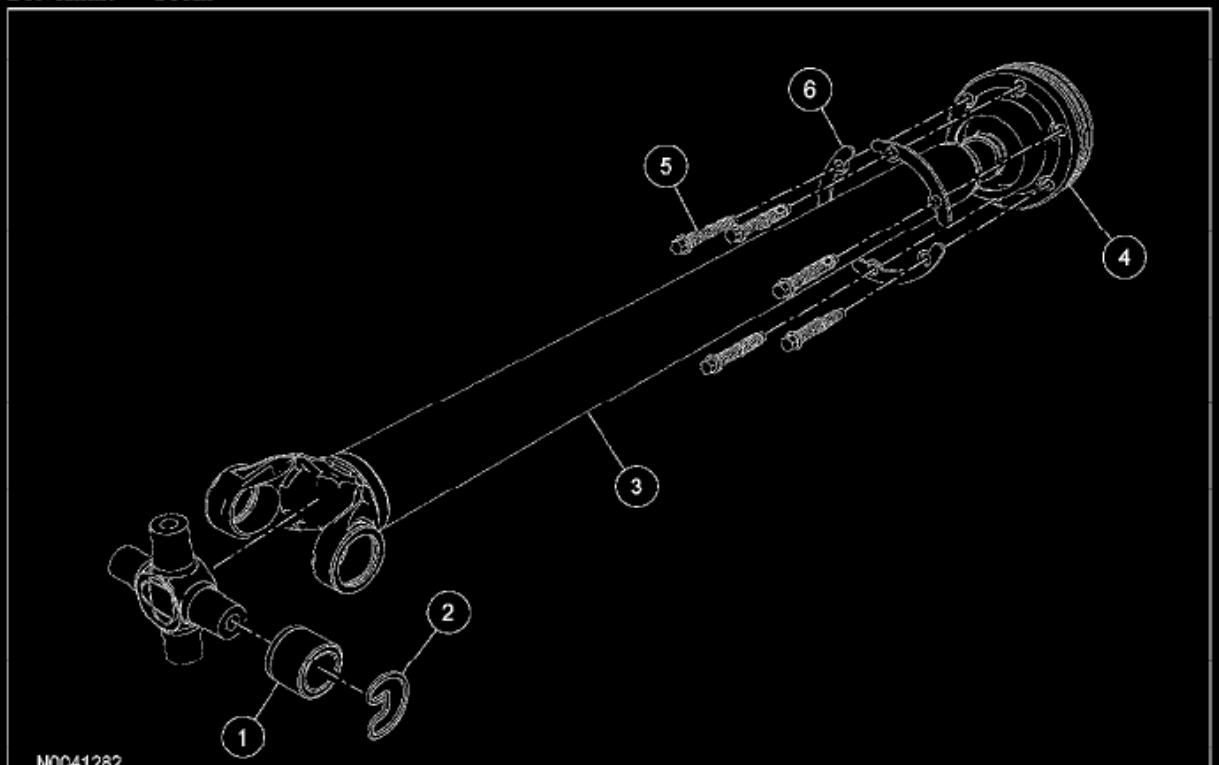
Item	Part Number	Description
5	4B496	CV joint bolt and washer (6 required)
6	—	CV joint retainer (part of 4B496) (3 required)

Driveshaft - Rear, Four Wheel Drive (4WD) (Part 2)

Driveshaft - Front

Driveshaft - Front

Driveshaft — Front



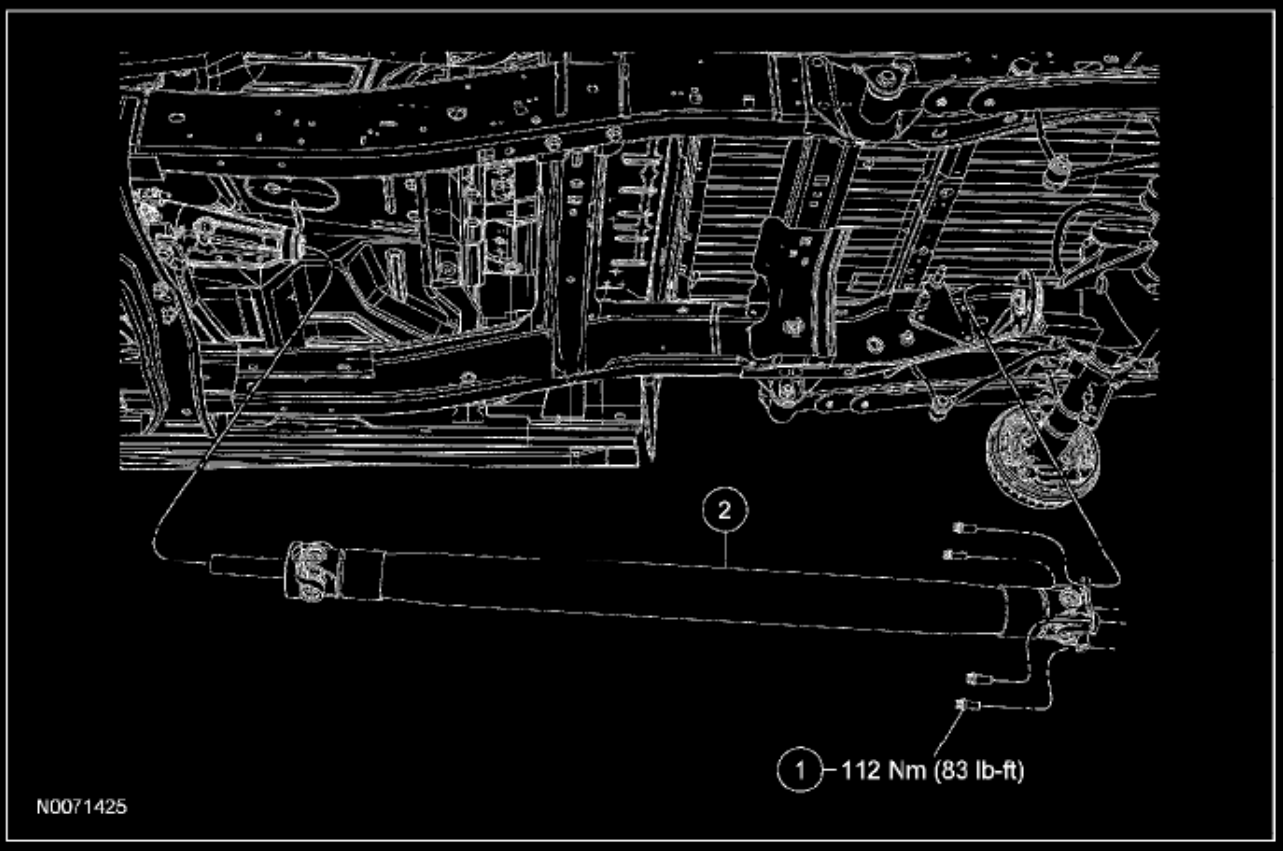
Item	Part Number	Description
1	4635	U-joint
2	—	Snap ring (part of 4635) (2 required)
3	4A376	Front driveshaft
4	—	Constant velocity (CV) joint (part of 4A376)

Item	Part Number	Description
5	4B496	CV joint bolt and washer (6 required)
6	—	CV joint retainer (part of 4B496) (3 required)

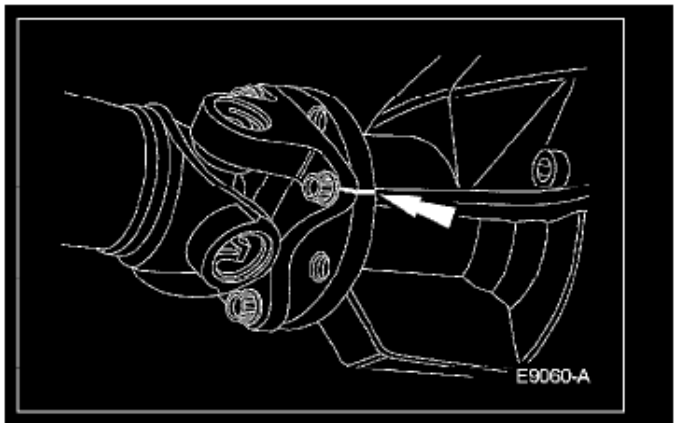
(Continued)

Driveshaft - Front

Driveshaft — Rear Wheel Drive (RWD)



Item	Part Number	Description
1	N800594-S	Bolt-to-flange (4 required)
2	4602	Driveshaft



Drive/Propeller Shaft: Service and Repair

Driveshaft - Rear Wheel Drive (RWD)

Driveshaft - Rear Wheel Drive (RWD)

Removal and Installation

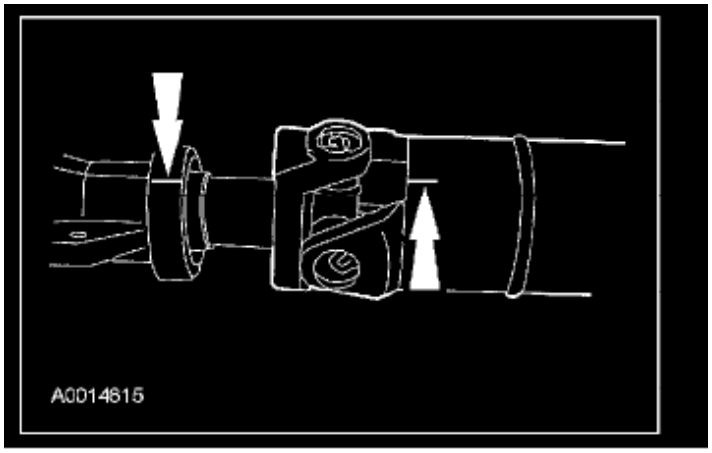
1. With the vehicle in NEUTRAL, position it on a hoist.

2. Index-mark the driveshaft flange to the rear axle pinion flange to maintain driveshaft balance.

3. NOTE: Make sure the index marks on the extension housing and the driveshaft are aligned before separation.

NOTE: After removing the driveshaft, place an index mark on the transmission output shaft that matches the transmission extension housing mark.

Index-mark the driveshaft and the extension housing.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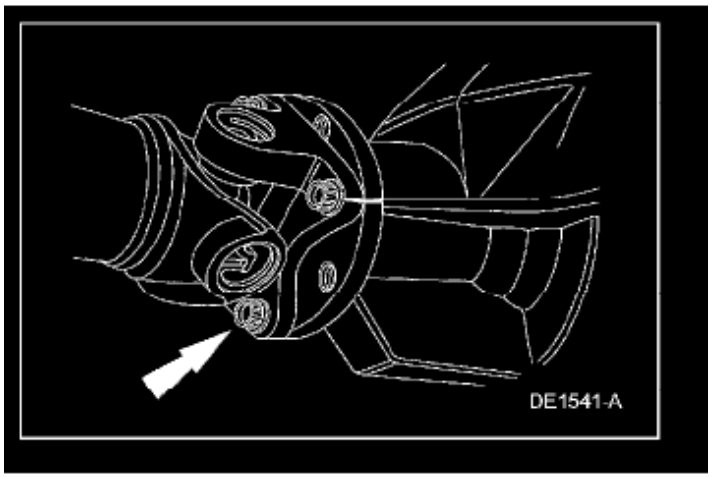
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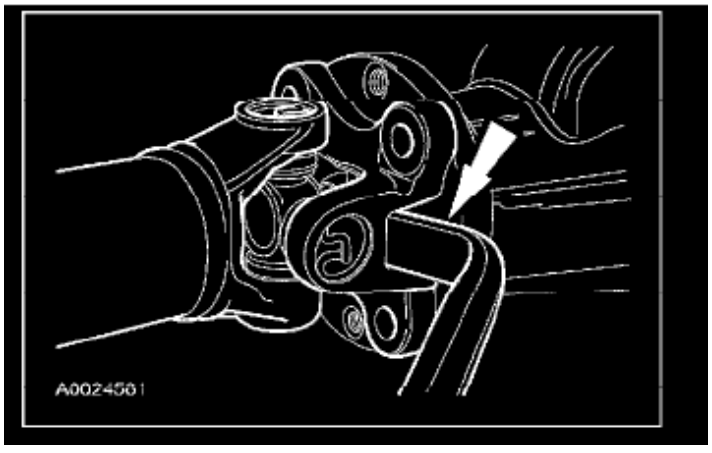
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4. Remove and discard the 4 rear axle flange bolts.

^ Upon installation, install new bolts and tighten to 112 Nm (83 lb-ft).

5. NOTE: The driveshaft flange fits tightly on the rear axle pinion flange pilot. Never hammer on the driveshaft or any of its components to

disconnect the driveshaft flange from the pinion flange. Pry only in the area shown, with a suitable tool, to disconnect the driveshaft flange from the pinion flange.

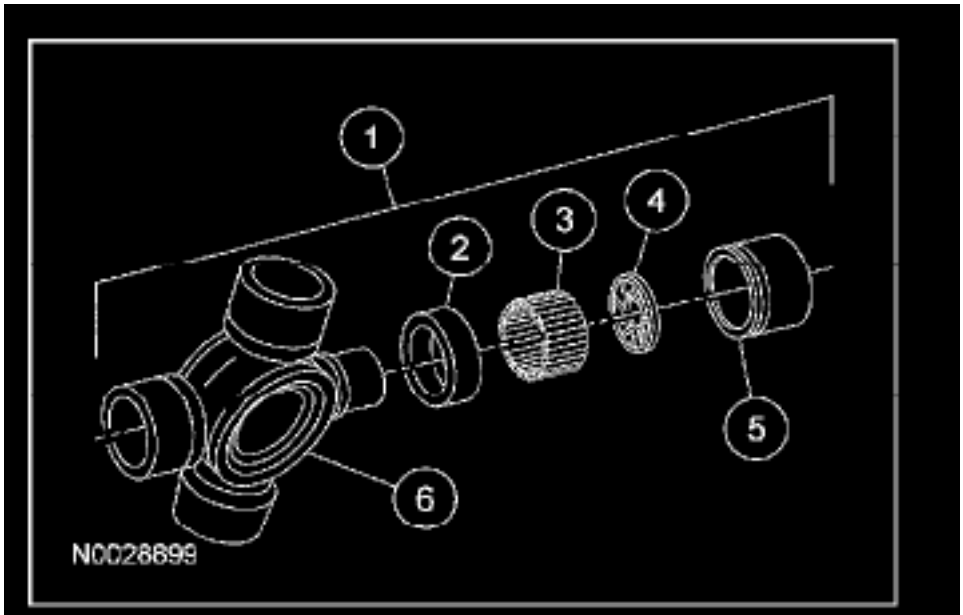
Using a suitable tool, pry only in the area shown. Separate the driveshaft flange from the rear axle pinion flange.

6. Lower the driveshaft and slide it off the output shaft. 7. Plug the extension housing to prevent fluid loss.

8. NOTE: The driveshaft flange fits tightly on the rear axle pinion flange pilot. To make sure that the driveshaft flange seats squarely on the pinion

flange, tighten the bolts evenly in a cross pattern as shown.

To install, reverse the removal procedure.



Item	Part Number	Description
1	4635	U-joint
2	—	Grease seal (part of 4635)
3	—	Needle roller (part of 4635)
4	—	Thrust washer (part of 4635)
5	—	Bearing cup (part of 4635)
6	—	Spider (part of 4635)

Universal Joint: Description and Operation

Universal Joints

The U-joints are: ^

lubed-for-life design and require no lubrication.

^ equipped with nylon thrust washers, located at each base of the bearing cup, which control end play, position the needle bearing and improve grease movement.

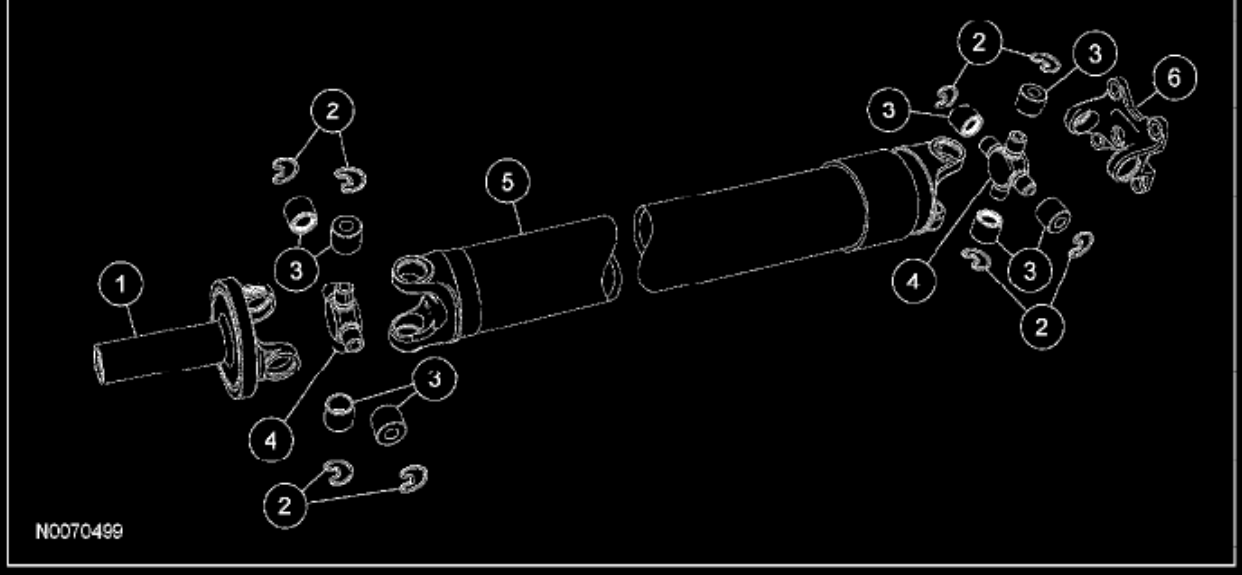
^ retained in the driveshaft yoke by snap rings.

The U-joints and constant velocity (CV) joints allow the driveshaft to rotate smoothly through the changing angles between the transmission output shaft and the driveshaft, plus the changes between the rear axle pinion angle and the driveshaft. The angles are constantly changing as the vehicle goes through jounce and rebound in the normal driving cycle.

Special Tool(s)

ST1172-A	Installer/Remover, C-Frame and Screw 205-086 (T74P-4635-C)

Universal Joint



Item	Part Number	Description
1	4841	Driveshaft slip yoke
2	—	Snap rings (4 required) (part of 4635)
3	—	Bearing cups (part of 4635)
4	—	Spiders (part of 4635)
5	4602	Driveshaft
6	4782	Driveshaft centering socket flange

Universal Joint: Service and Repair Driveshaft Universal Joint - Single Cardan, Slip Yoke

Driveshaft Universal Joint - Single Cardan, Slip Yoke

Universal Joint

Disassembly

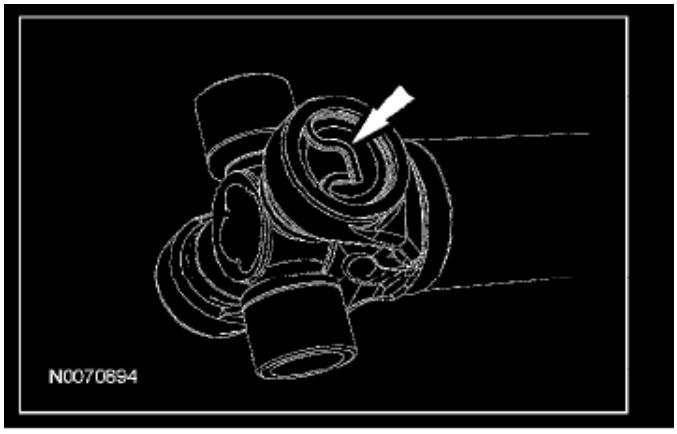
Initial Disassembly

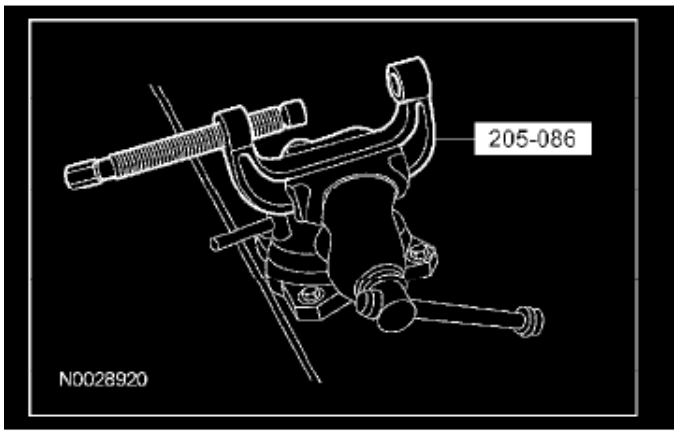
1. CAUTION: Do not, under any circumstance, clamp the shaft in the jaws of a vise or similar holding fixture. Denting or localizing

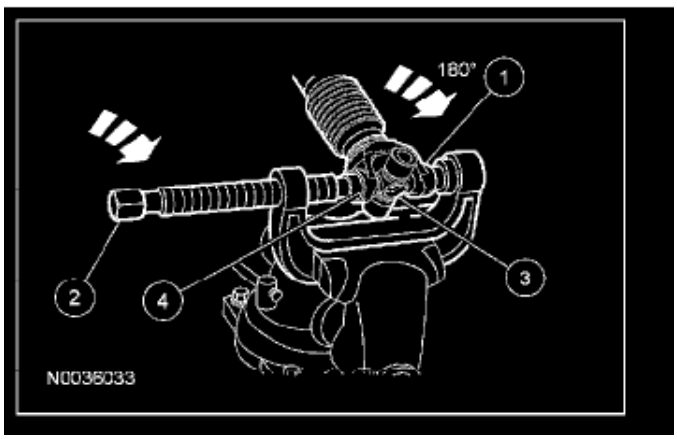
fracture may result, causing shaft failure during vehicle operation.

Place the shaft on a suitable workbench. Do not damage the tube.

2. Remove and discard the 2 snap rings.







3. Clamp the special tool in a vise.

Bearing cup removal

4. NOTE: If necessary, use a pair of pliers to remove a bearing cup that fails to press out all the way.

Remove the bearing cups and the slip-yoke. 1

Position the slip-yoke in the special tool.

2 Press out a bearing cup.

3 Rotate the driveshaft slip-yoke 180 degrees.

4 Press on the spider to remove the remaining bearing cup and the U-joint.

5. Clean the driveshaft slip-yoke.

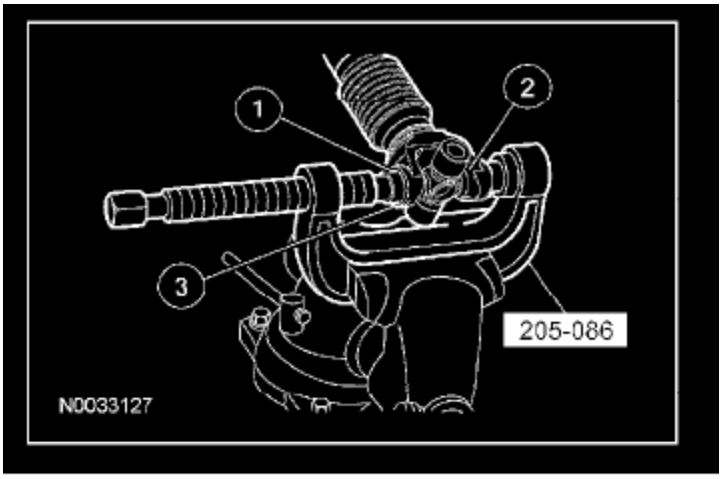
^ Inspect the driveshaft slip-yoke.

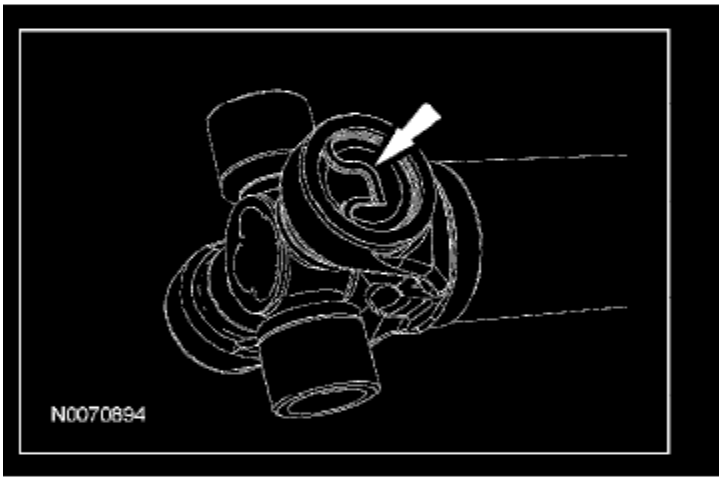
^ Install a new yoke as necessary.

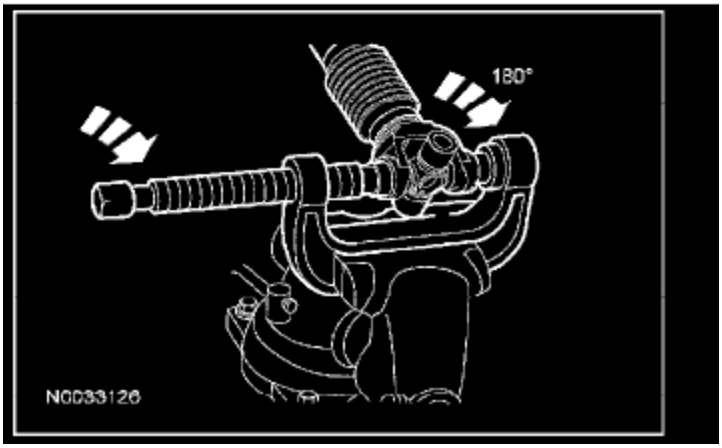
Assembly

Bearing cup installation

1. NOTE: Install the U-joint Kits as complete assemblies only. Do not mix components from other kits.







Install a new spider and bearing cup. 1

Start a new bearing cup in the shaft yoke. ^

Check the needle bearings for correct positioning.

2 Position the new spider in the shaft yoke.

3 Press the bearing cup to just below the snap ring groove.

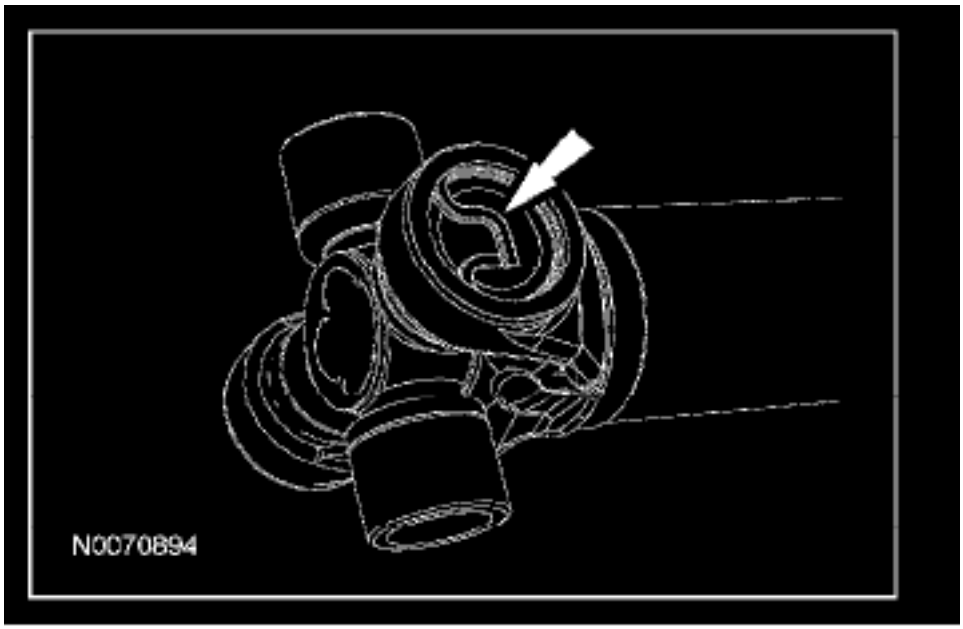
2. NOTE: Use the yellow snap rings supplied in the kit to assemble the U-joint. If difficulty is encountered with the yellow snap rings, install the

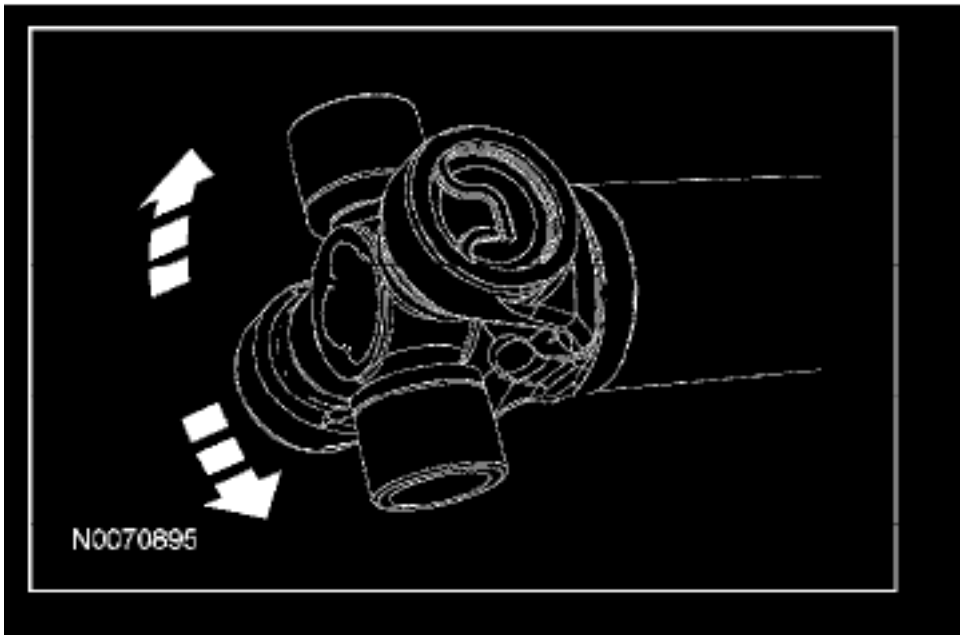
black snap rings.

Remove the shaft from the special tool and install the new snap ring.

Opposite bearing cup installation 3. Repeat bearing cup installation in this procedure to install the new bearing cup and snap ring on the opposite side of the shaft yoke.

4. Remove the shaft from the special tool and install the new snap ring.





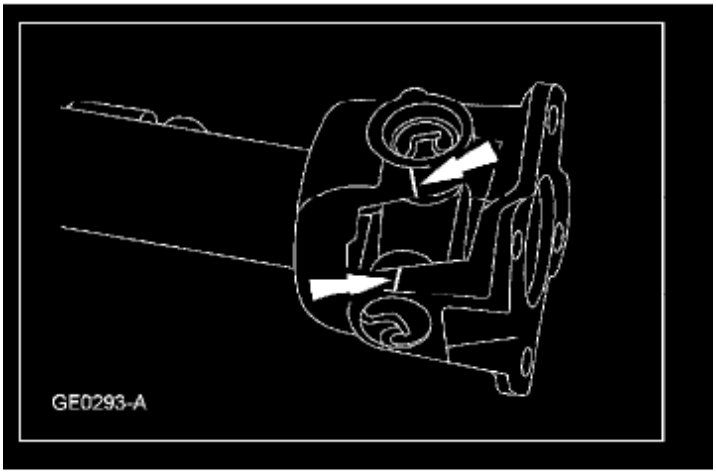
5. CAUTION: Do not strike the bearings.

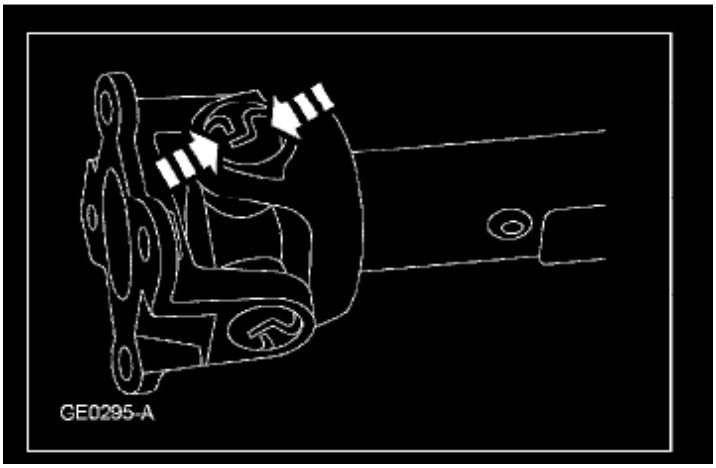
Check the U-joint for freedom of movement. ^

If binding, strike the yoke with a brass or plastic hammer.

Special Tool(s)

ST1172-A	Installer/Remover, C-Frame and Screw 205-086 (T74P-4635-C)





Universal Joint: Service and Repair Driveshaft Universal Joint - Single Cardan, Flange Yoke

Driveshaft Universal Joint - Single Cardan, Flange Yoke

Disassembly

Initial disassembly

1. CAUTION: Do not, under any circumstance, clamp the driveshaft in the jaws of a vise or similar holding fixture. Denting or localizing

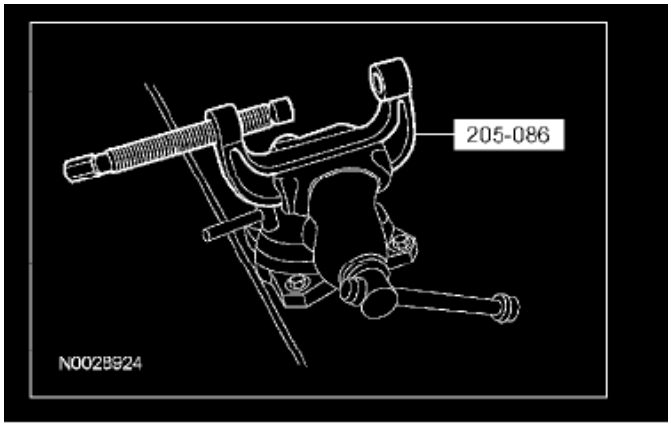
fracture may result, causing driveshaft failure during vehicle operation.

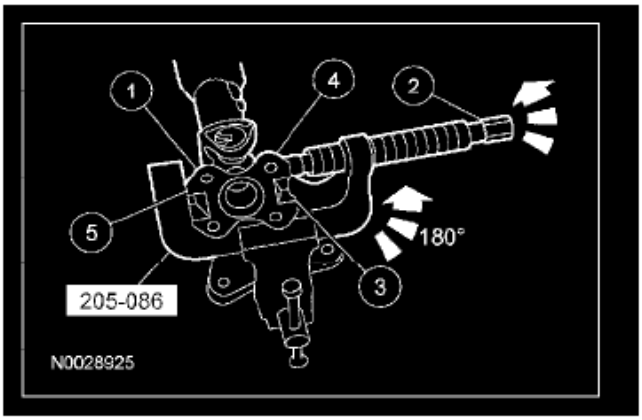
Place the driveshaft on a suitable workbench. Do not damage the tube.

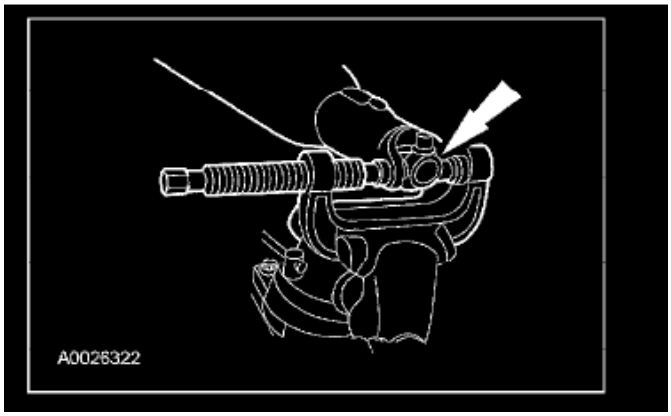
2. Index-mark the driveshaft components.

3. Remove and discard the 4 snap rings.

4. Clamp the special tool in a vise.







Bearing cup removal

5. NOTE: If necessary, use a pair of pliers to remove a bearing cup that fails to press out all the way.

Remove the bearing cups and the flange. 1

Position the flange in the special tool.

2 Press out a bearing cup.

3 Rotate the flange 180 degrees.

4 Press on the spider to remove the remaining bearing cup.

5 Remove the flange.

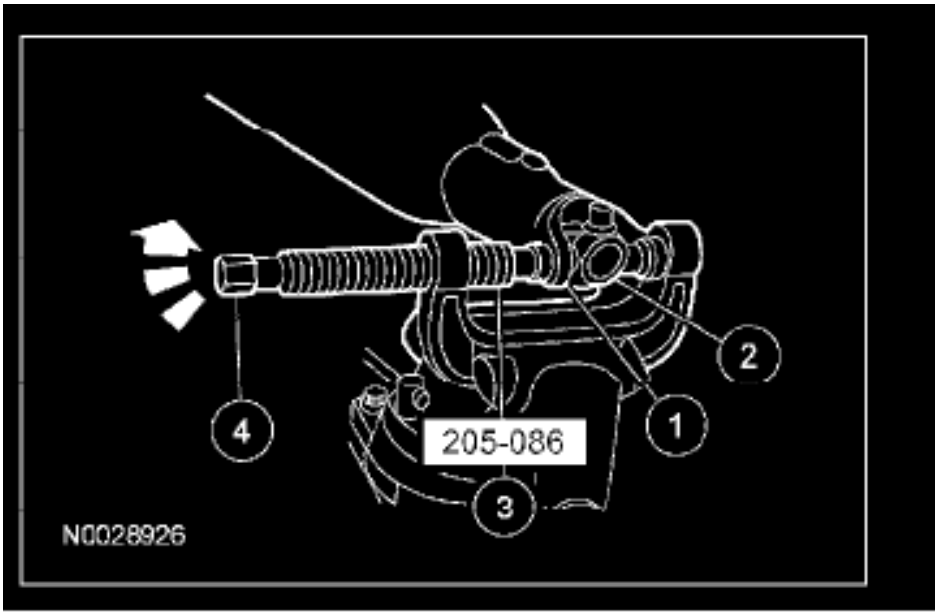
Final disassembly 6. Repeat bearing cup removal in this procedure to remove the remaining bearing cups and the spider from the driveshaft.

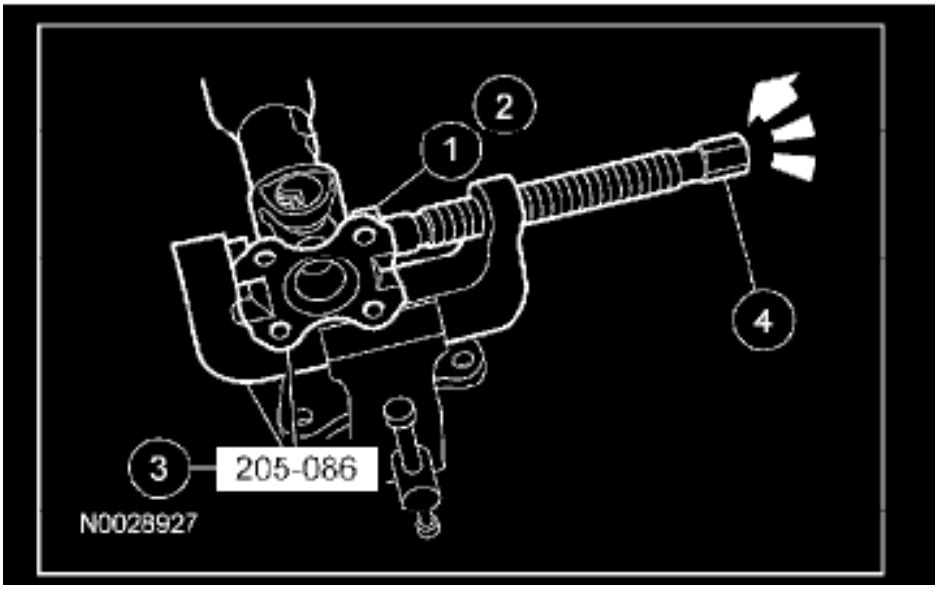
7. Clean the yoke area at the end of the driveshaft.

Assembly

Bearing cup installation

1. NOTE: Install the U-joint Kits as complete assemblies only. Do not mix components from other kits.





Install a new spider and bearing cups. 1

Start a new bearing cup in the driveshaft yoke. ^

Check the needle bearings for correct positioning.

2 Position the new spider in the driveshaft yoke.

3 Position the driveshaft yoke in the special tool.

4 Press the bearing cup to just below the snap ring groove. ^

Repeat to install the new bearing cup on the opposite side of the driveshaft yoke.

Flange installation 2. Inspect the flange. Install a new flange, if necessary. 3. Install the new bearing cups and the flange.

1 Start a new bearing cup in the flange. ^

Check the needle bearings for correct positioning.

2 Position the flange on the spider.

3 Position the assembly in the special tool.

4 Press the bearing cup to just below the snap ring groove. ^

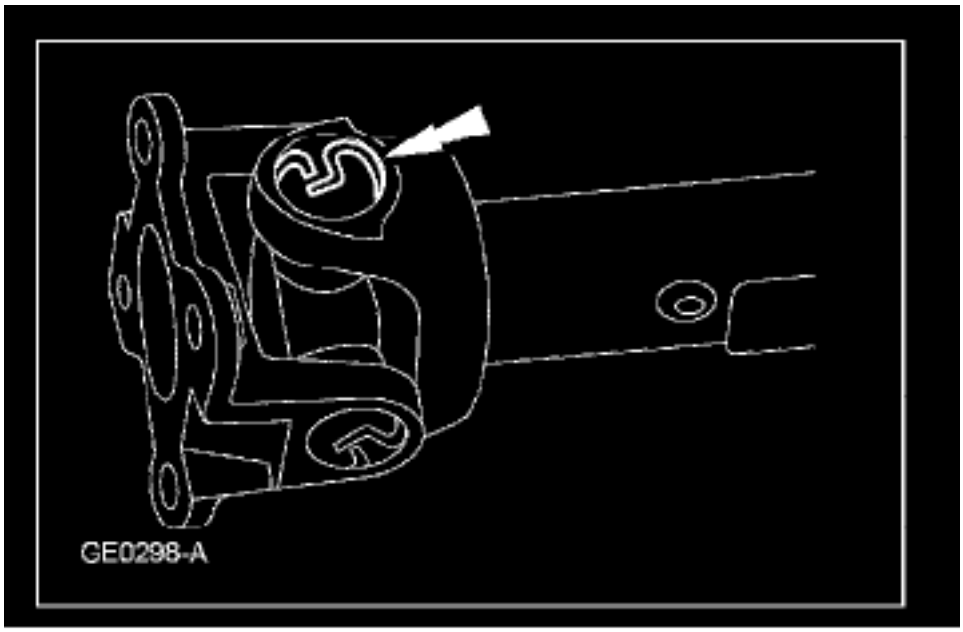
Repeat to install the new bearing cup on the opposite side of the flange.

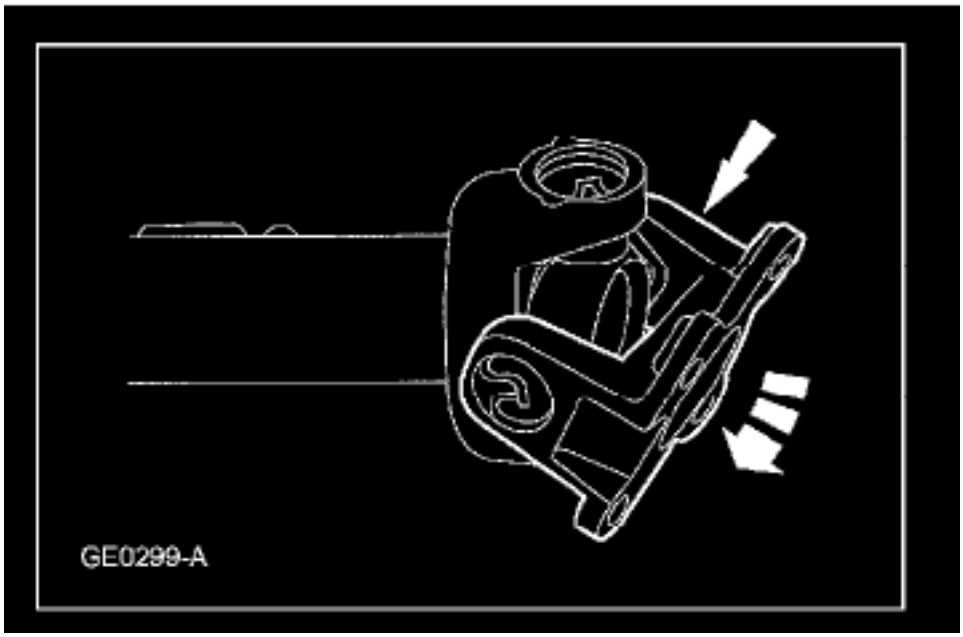
Final assembly

4. NOTE: Use the yellow snap rings supplied in the kit to assemble the U-joint. If difficulty is encountered with the yellow snap rings, install the

black snap rings.

Remove the driveshaft from the special tool, and install the 4 new snap rings.





5. CAUTION: Do not strike the bearings.

Check the U-joint for freedom of movement. ^

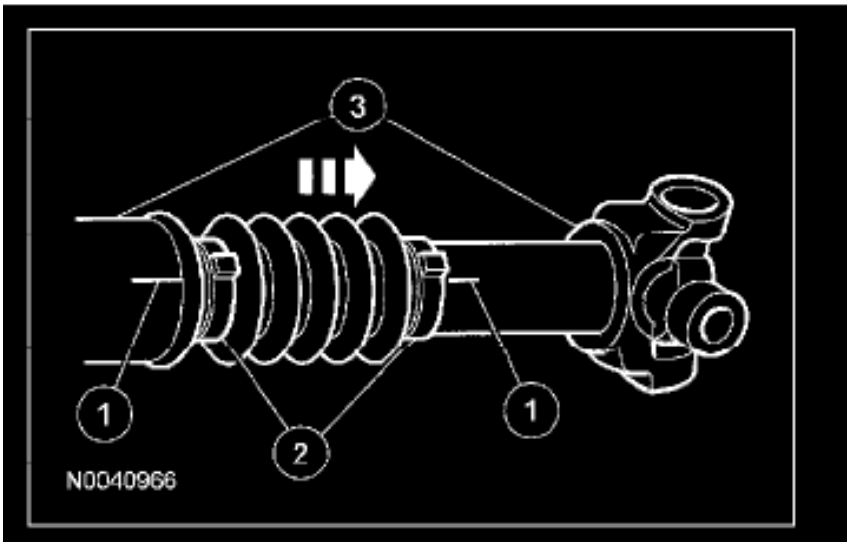
If binding, strike the yoke with a brass or plastic hammer.

Special Tool(s)

ST1173-A	Installer, Keystone Clamp 211-002 (T63P-9171-A)

Material

Item	Specification
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B



Universal Joint: Service and Repair Driveshaft Slip Yoke

Driveshaft Slip Yoke

Disassembly

1. CAUTION: Do not, under any circumstance, clamp the driveshaft in the jaws of a vise or similar holding fixture. Denting or localizing

fracture can result, causing driveshaft failure during vehicle operation.

Place the driveshaft on a suitable workbench. Do not damage the tube.

2. Remove the driveshaft slip-yoke from the driveshaft.

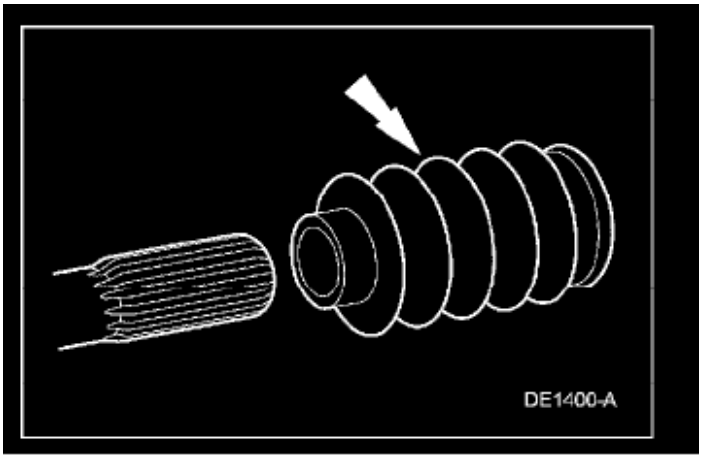
1 Index-mark the driveshaft and driveshaft slip-yoke.

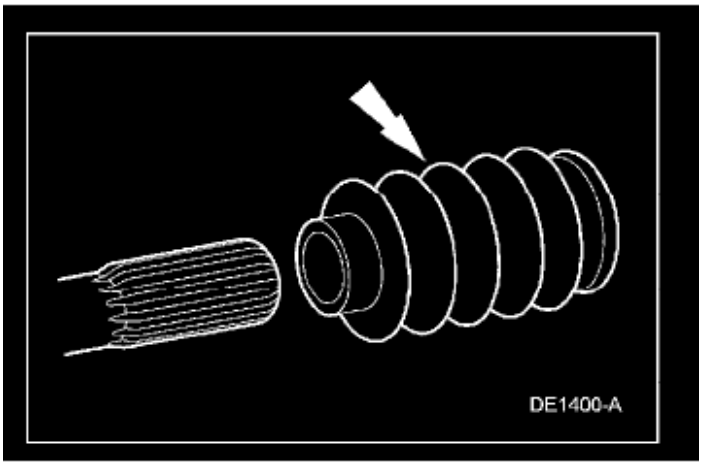
2 Cut and discard the driveshaft slip-yoke boot clamps.

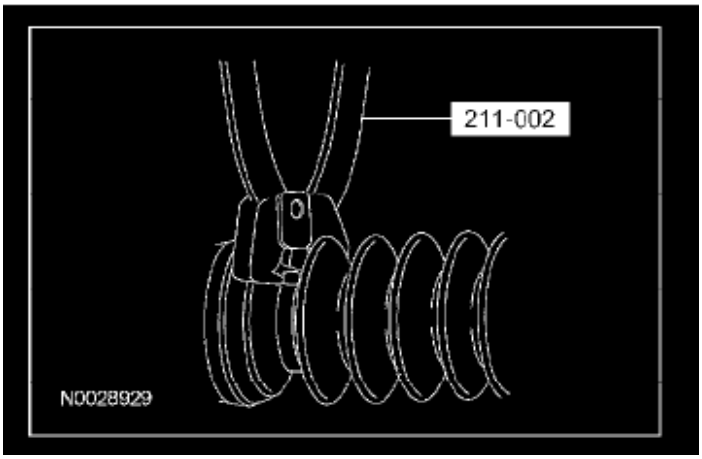
3 Remove the driveshaft slip-yoke from the driveshaft.

3. Remove the slip-yoke boot from the driveshaft.

^ Inspect the boot for damage. Discard the boot as necessary.







4. Inspect the lubricant on the driveshaft splines and in the driveshaft slip-yoke for contamination. If contaminated, inspect the driveshaft splines and

the driveshaft slip-yoke for wear. Install new components as necessary.

Assembly

1. Position the new small driveshaft slip-yoke boot clamp on the driveshaft stub shaft. 2. Slide the small opening end of the slip-yoke boot on the driveshaft stub shaft, as far as it will travel.

3. Using the special tool, crimp the driveshaft slip-yoke boot clamp.

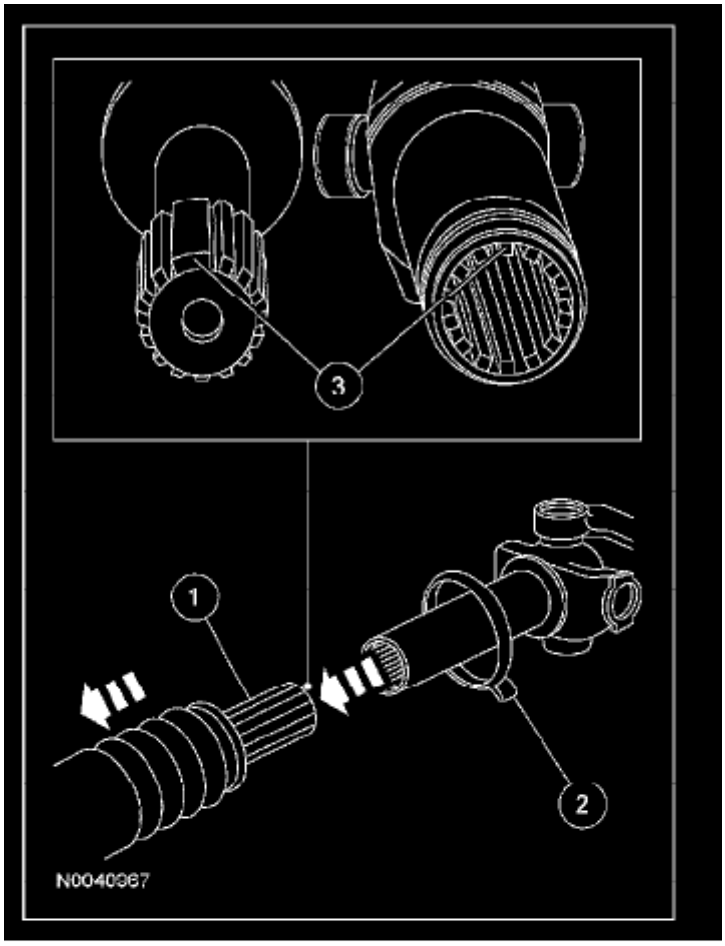
4. Install the driveshaft slip-yoke on the driveshaft.

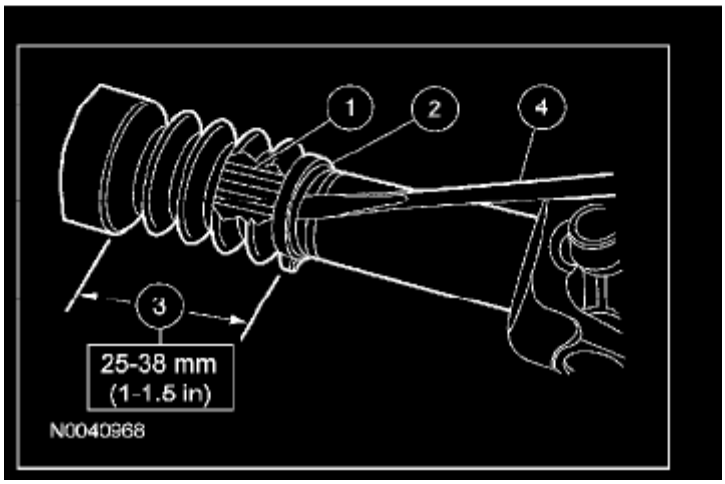
1 Pull the slip-yoke boot toward the driveshaft. Lubricate the driveshaft splines with approximately 10 gm (0.24 oz) of lubricant. ^

Use grease as the lubricant.

2 Position the new large slip-yoke boot clamp.

3 Align the index marks and install the driveshaft slip-yoke on the driveshaft.





5. Set the driveshaft assembled length to specification.

1 Remove any excess grease from the slip-yoke boot and driveshaft slip-yoke surfaces.

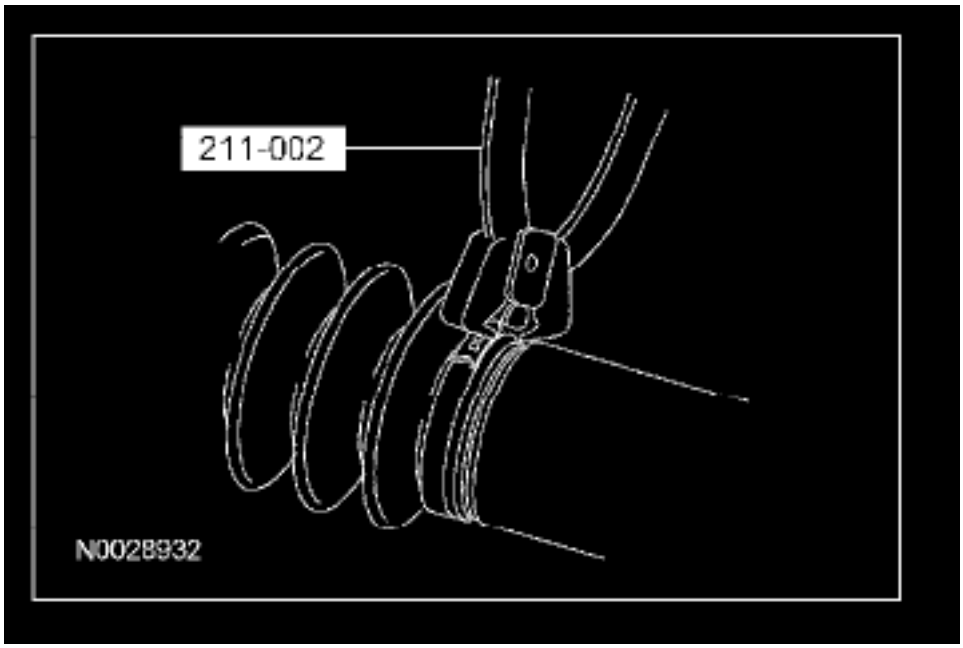
2 Position the slip-yoke boot in the slip-yoke boot groove.

3 Set the driveshaft assembled length to specification. ^

Measure from the stub shaft weld to the end of the driveshaft slip-yoke.

4 Bleed the air from the slip-yoke boot.

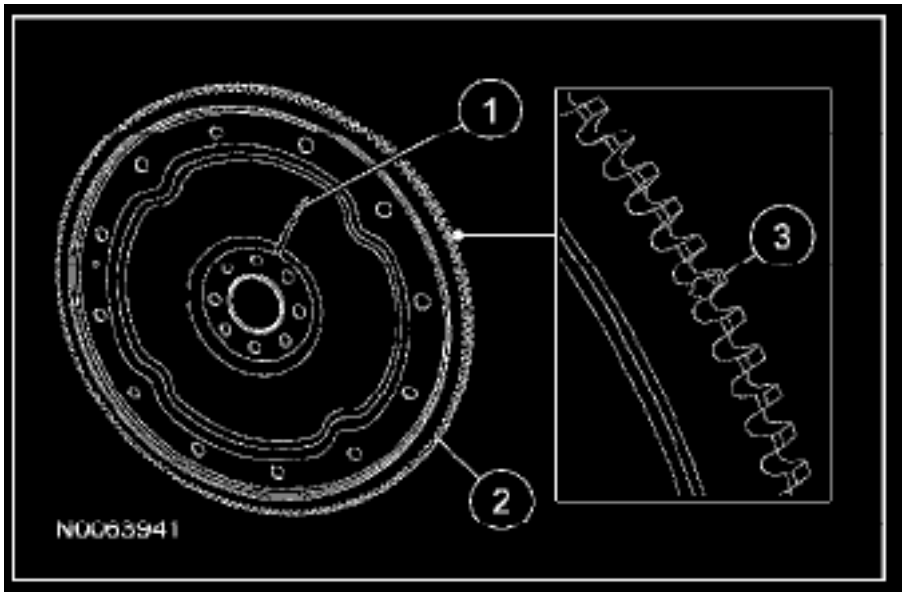
6. Using the special tool, crimp the large driveshaft slip-yoke boot clamp.


211-002
N0028932

Flex Plate: Specifications

Flexplate bolts ..... 80 Nm (59 lb-ft)

Tighten the bolts in a criss-cross pattern



Flex Plate: Testing and Inspection

Flexplate Inspection

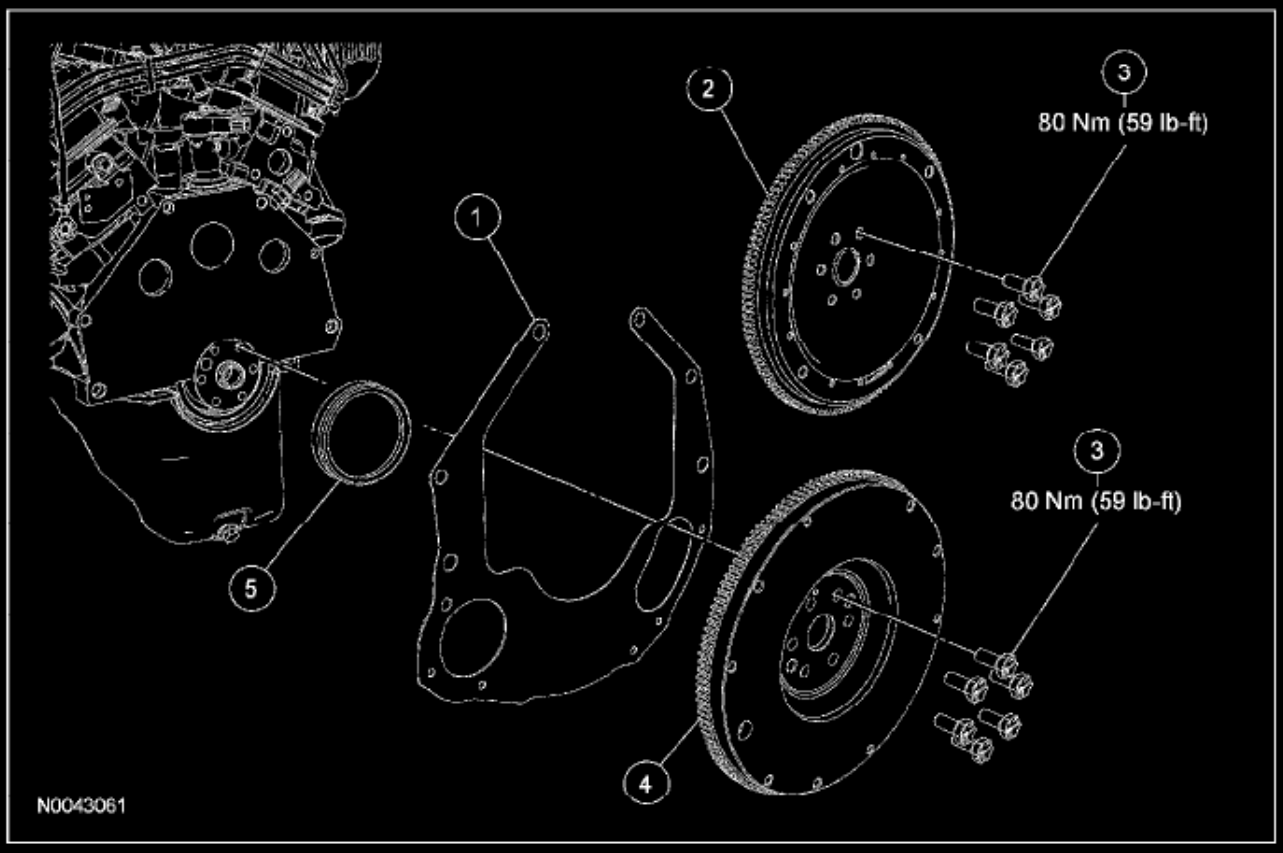
1. Inspect the flexplate for:

1 Any cracks.

2 Worn ring gear teeth.

3 Chipped or cracked ring gear teeth.

Flexplate or Flywheel and Crankshaft Rear Seal — Exploded View



Item	Part Number	Description
1	6A372	Engine-to-transmission spacer plate
2	6375	Flexplate
3	N802012-S	Flexplate/flywheel bolt
4	6375	Flywheel
5	6701	Crankshaft rear seal

Flex Plate: Service and Repair

Flexplate

Flexplate or Flywheel and Crankshaft Rear Seal - Exploded View

Removal

1. Remove the transmission. 2. Remove the bolts and the flexplate.

^ Inspect the flexplate for cracks or other damage. Install a new flexplate if necessary.

Installation

NOTE: Special bolts are used for the installation. Do not use standard bolts.

1. Position the flexplate on the crankshaft and install the bolts.

^ Tighten the bolts in a criss-cross pattern.

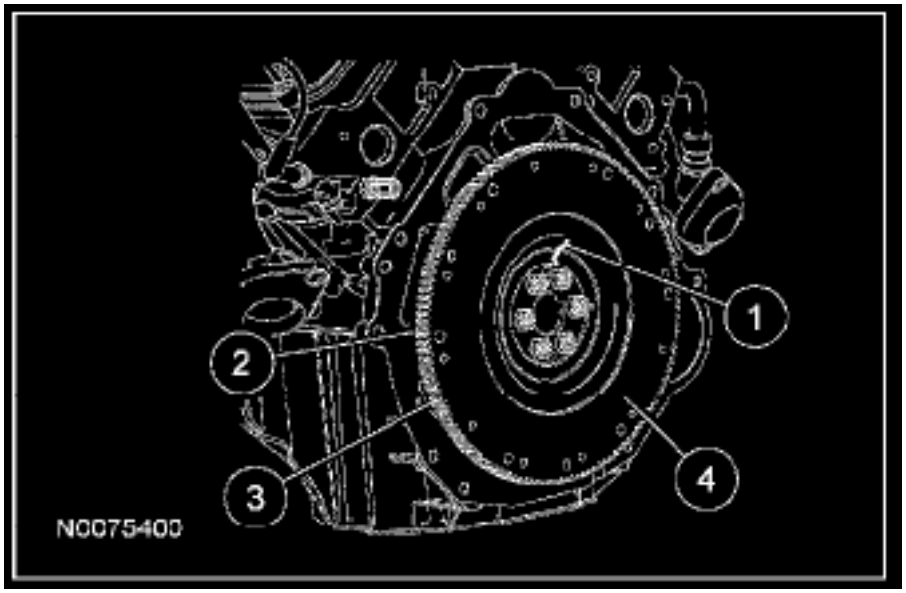
^ Tighten to 80 Nm (59 lb-ft).

2. Install the transmission.

Flywheel: Specifications

Flywheel bolts ..... 80 Nm (59 lb-ft)

Tighten the bolts in a criss-cross pattern



Flywheel: Testing and Inspection Flywheel Inspection

Flywheel Inspection

1. NOTE: The flywheel cannot be resurfaced, it must be replaced.

Inspect the flywheel for: 1

Any cracks.

2 Worn ring gear teeth.

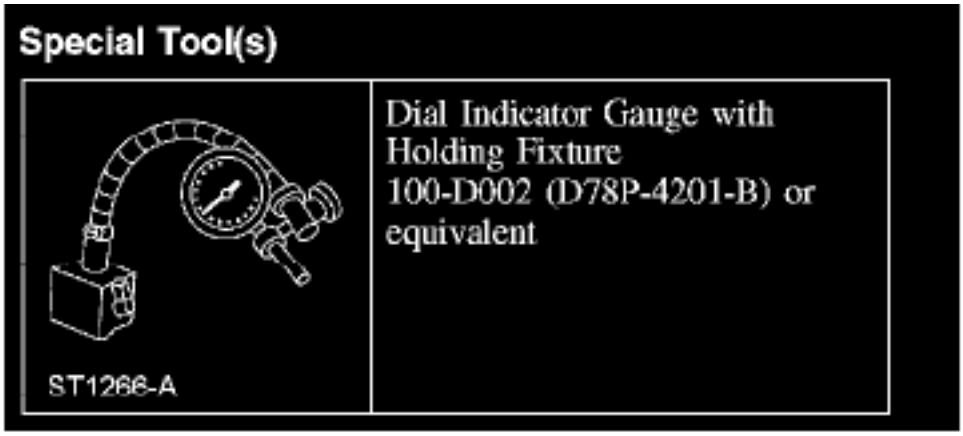
3 Chipped or cracked ring gear teeth.

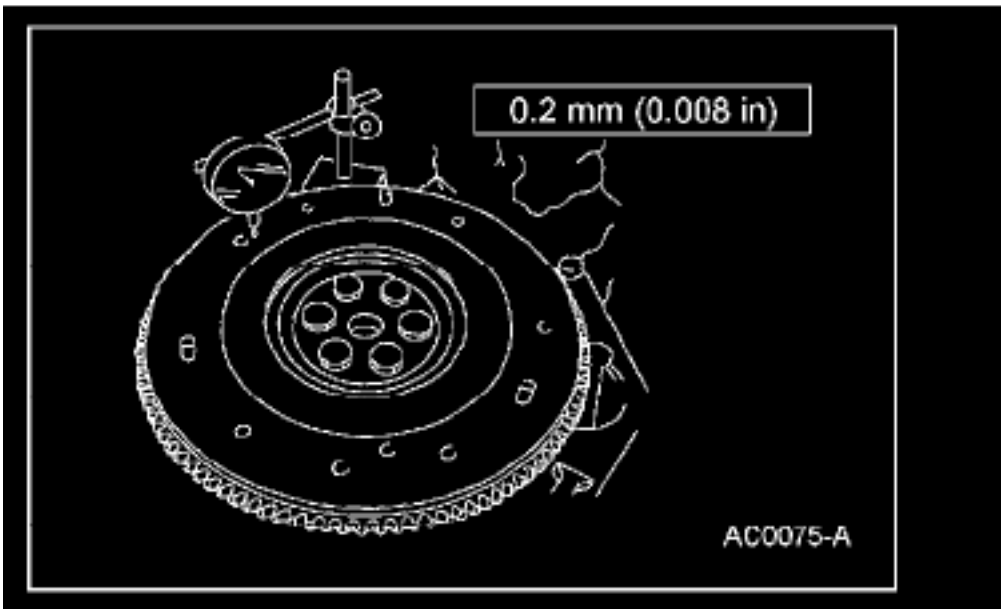
4 Scratches, nicks and discoloration.

Flywheel: Testing and Inspection Flywheel Housing Check

Flywheel Housing Check

1. Check the flywheel surface for scoring, cracks or discoloration. Minor scratches or discoloration should be removed with a fine emery cloth.



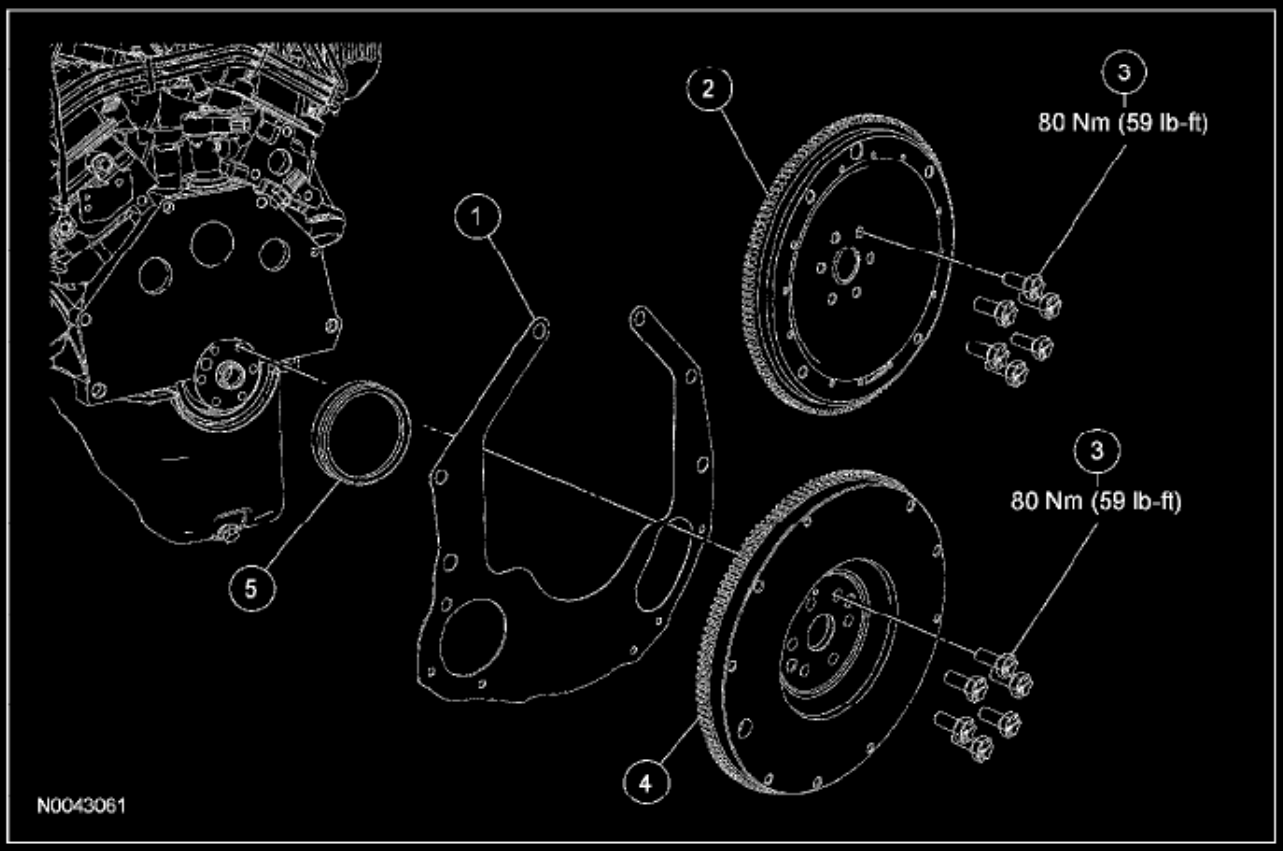


Flywheel: Testing and Inspection Flywheel Runout Check

Flywheel Runout Check

1. Mount the special tool so that the indicator contact point rides on the clutch disc contact surface.
2. Turn the flywheel. If the runout exceeds the maximum allowance, install a new flywheel.

Flexplate or Flywheel and Crankshaft Rear Seal — Exploded View



Item	Part Number	Description
1	6A372	Engine-to-transmission spacer plate
2	6375	Flexplate
3	N802012-S	Flexplate/flywheel bolt
4	6375	Flywheel
5	6701	Crankshaft rear seal

Flywheel: Service and Repair

Flywheel

Flexplate or Flywheel and Crankshaft Rear Seal - Exploded View

Flexplate or Flywheel and Crankshaft Rear Seal - Exploded View

Removal

1. Remove the clutch. 2. Remove the flywheel bolts. 3. Remove the flywheel.

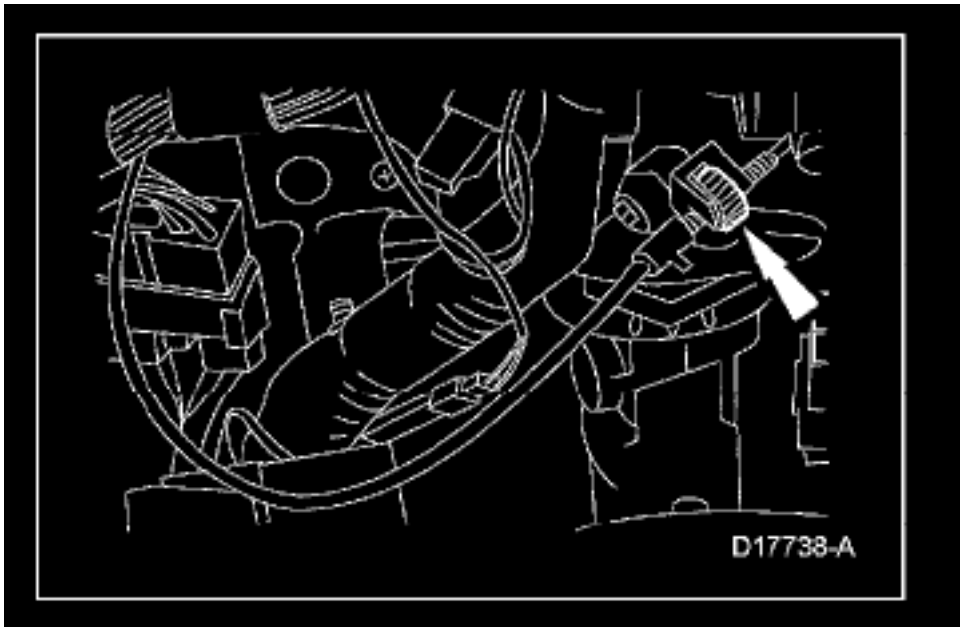
Installation

1. Install the flywheel.

^ Install the 6 bolts. Tighten the bolts in a criss-cross pattern.

^ Tighten to 80 Nm (59 lb-ft).

2. Install the clutch.



Shift Indicator: Adjustments

Selector Lever Indicator Adjustment

1. Remove the upper instrument panel steering column cover. 2. Place the selector lever in the (D) position.

^ Rotate the selector lever clockwise until it bottoms out (1st gear), then rotate 2 detents counterclockwise ((D) position).

3. Hang the 1.4 kg (3 lb) weight on the gearshift lever. 4. Center the pointer in the middle of the (D) position.

^ Rotate the thumb-wheel located on the bottom of the steering column to adjust the pointer.

5. Remove the 1.4 kg (3 lb) weight. 6. Carefully move the selector lever into each detent and compare with the transmission settings.

^ Readjust if necessary.

7. Install the upper instrument panel steering column cover.

Transmission Mode Indicator - A/T: Description and Operation

TRANSMISSION CONTROL INDICATOR LAMP (TCIL)

The TCIL is an output signal from the PCM that controls the lamp on/off function depending on the engagement or disengagement of overdrive.

Fluid - M/T: Capacity Specifications

Manual Transmission

Capacity ..... 2.8 Quarts

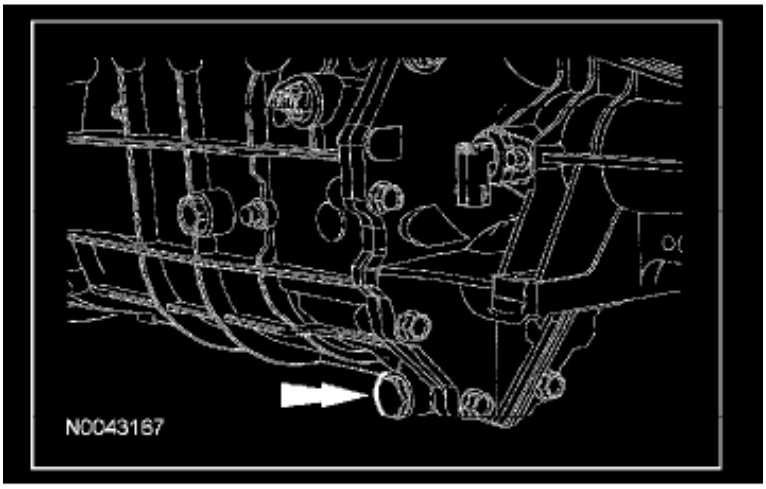
Note: Approximate refill. Service refill capacity is determined by filling the transmission to the bottom of the filler hole with the vehicle on a level surface.

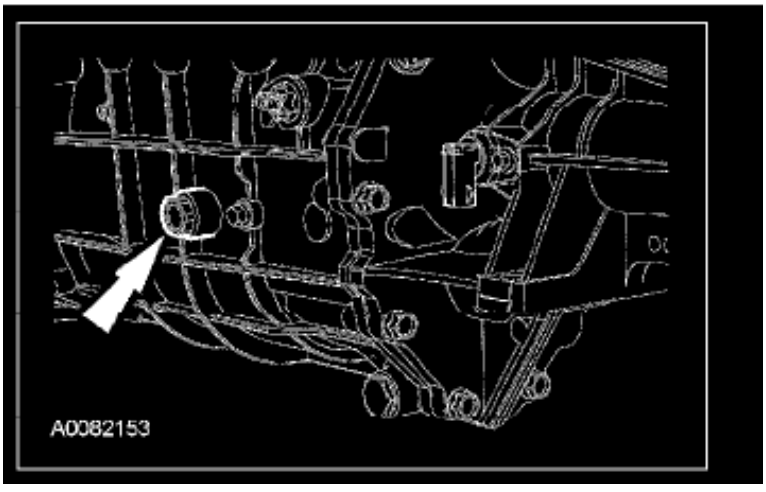
Fluid - M/T: Fluid Type Specifications

Manual Transmission Fluid ..... Mercon V ATF

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V





Fluid - M/T: Service and Repair

Transmission Draining and Filling

1. NOTE: Position a suitable drain pan under the transmission.

Remove the drain plug and drain the transmission.

2. Clean and install the drain plug.

^ Tighten to 48 Nm (35 lb-ft).

3. NOTE: Before removing, clean the area around the filler plug.

Remove the filler plug.

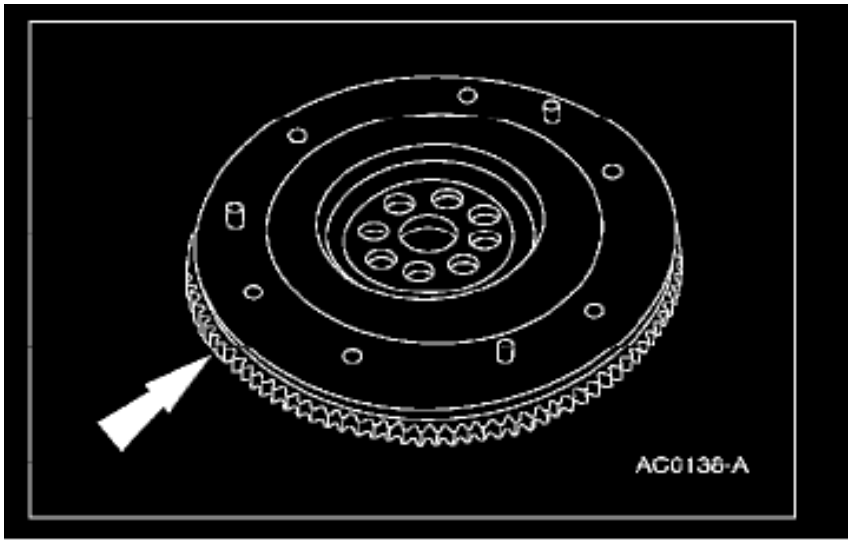
4. NOTE: Fill the transmission with the vehicle on a level surface.

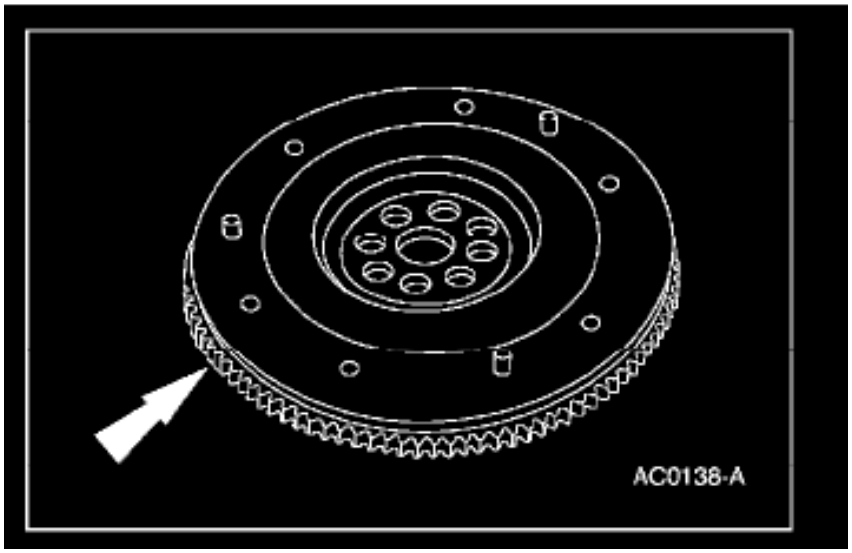
Using a suitable oil suction gun, fill the transmission to the correct level with the specified fluid. The fluid must be just below the fill plug hole. ^

Transmission capacity is 2.6L (2.8 qt).

5. Install the fill plug.

^ Tighten to 48 Nm (35 lb-ft).


AC0138-A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Flywheel Gear: Service and Repair

Flywheel Ring Gear

Removal

WARNING: This procedure should be carried out only by a correctly equipped and experienced acetylene torch operator. Use tongs or wear welding gloves and safety goggles when handling hot components. Failure to follow these instructions may result in serious personal injury.

1. Remove the flywheel.

2. CAUTION: Do not heat the flywheel ring gear beyond 278° C (500° F). Use heat indicating crayons to prevent over heating, over heating

will damage the flywheel.

NOTE: Tap the flywheel ring gear evenly to prevent binding.

Remove the flywheel ring gear from the flywheel. ^

Evenly heat the flywheel ring gear and use a brass drift to drive the flywheel ring gear off the flywheel.

Installation

WARNING: This procedure should be carried out only by a correctly equipped and experienced acetylene torch operator. Use tongs or wear welding gloves and safety goggles when handling hot components. Failure to follow these instructions may result in serious personal injury.

1. CAUTION: Do not heat the flywheel ring gear beyond 278° C (500° F). Use heat indicating crayons to prevent over heating, over heating

will damage the flywheel.

CAUTION: Keep the torch moving to prevent hot spots or damage to the components may occur.

Evenly heat the flywheel ring gear.

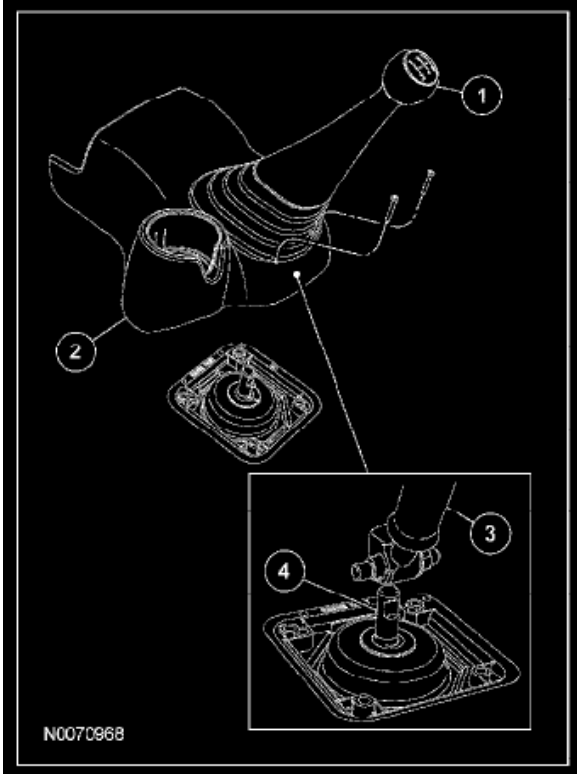
2. Install the flywheel ring gear.

^ The bevel on the flywheel ring gear must face the rear of the flywheel.

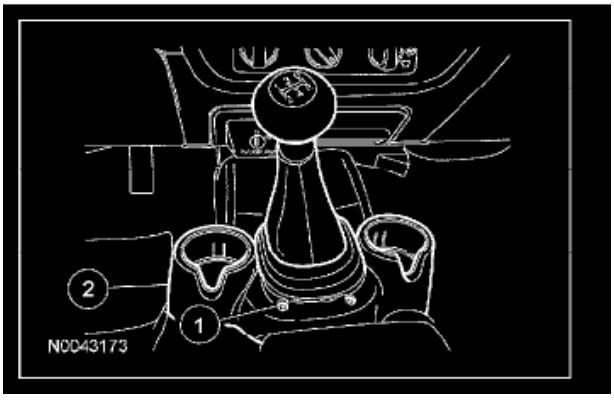
^ Use a brass drift.

3. Install the flywheel.

Gearshift Lever and Boot



Item	Part Number	Description
1	7213	Gearshift knob
2	—	Gearshift lever boot and console
3	7210	Gearshift lever (upper)
4	—	Gearshift lever (lower)



Shifter M/T: Service and Repair

Gearshift Lever and Boot

Gearshift Lever and Boot

Removal and Installation

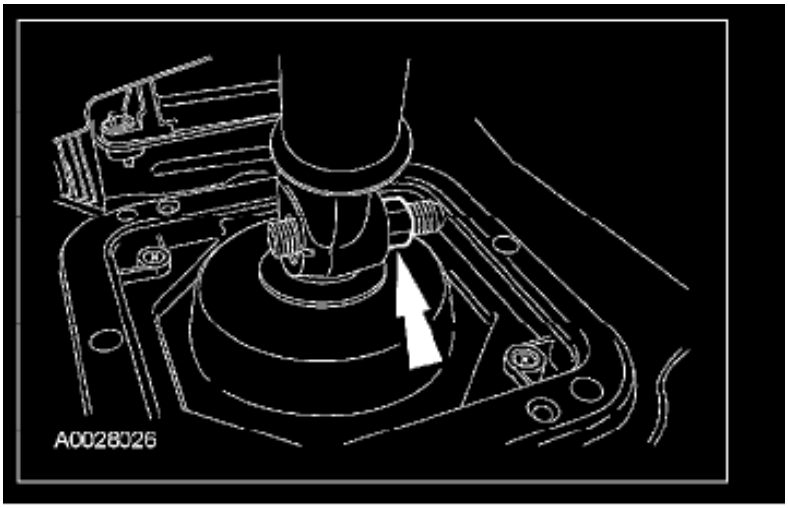
1. Raise the outer gearshift lever boot and console assembly to access the nut and eccentric stud that retains the upper gearshift lever to the lower

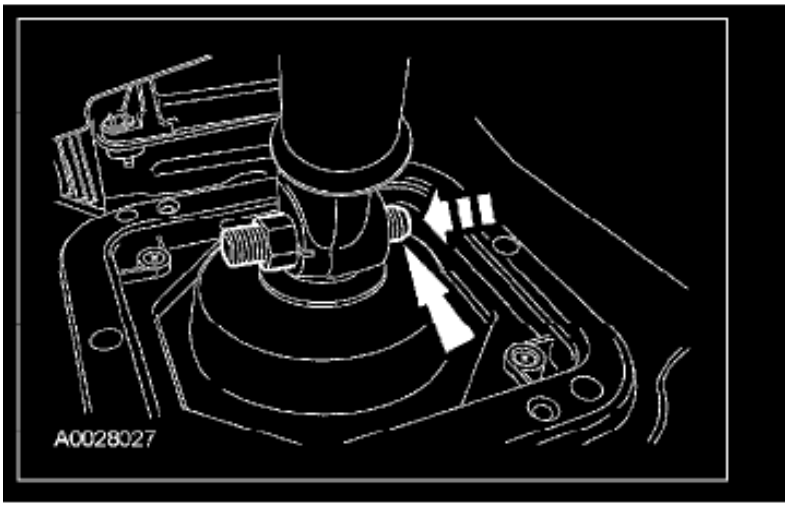
gearshift lever. 1

Remove the 2 screws retaining the console to the floor.

2 Raise the outer gearshift lever boot and console assembly to access the nut and eccentric stud.

2. Remove the nut.


A0028026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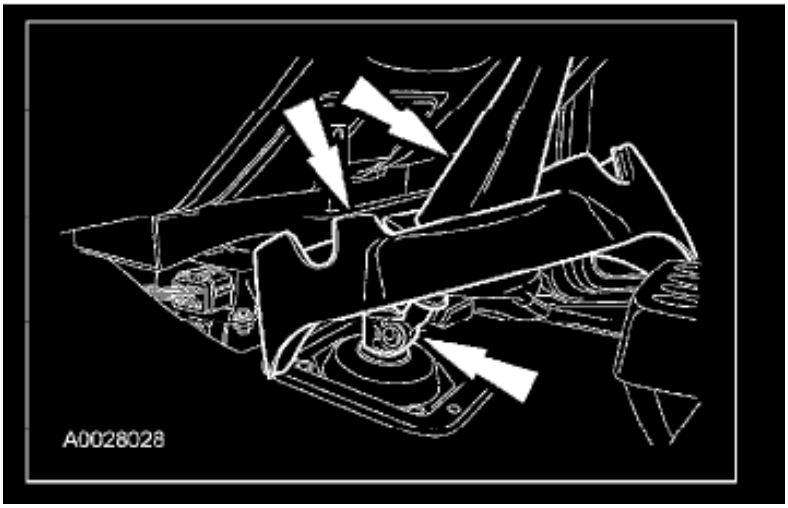
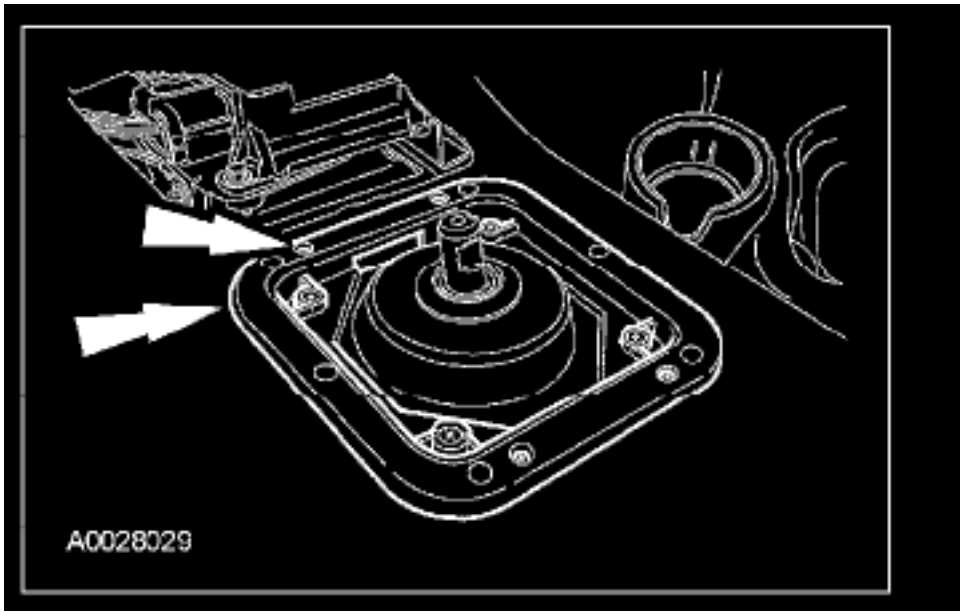

A0028028

3. Install the nut on the LH side of the lever, then tighten the nut to remove the eccentric stud out of the gearshift lever.

4. Remove the upper gearshift lever and the outer gearshift lever boot and console assembly as an assembly.

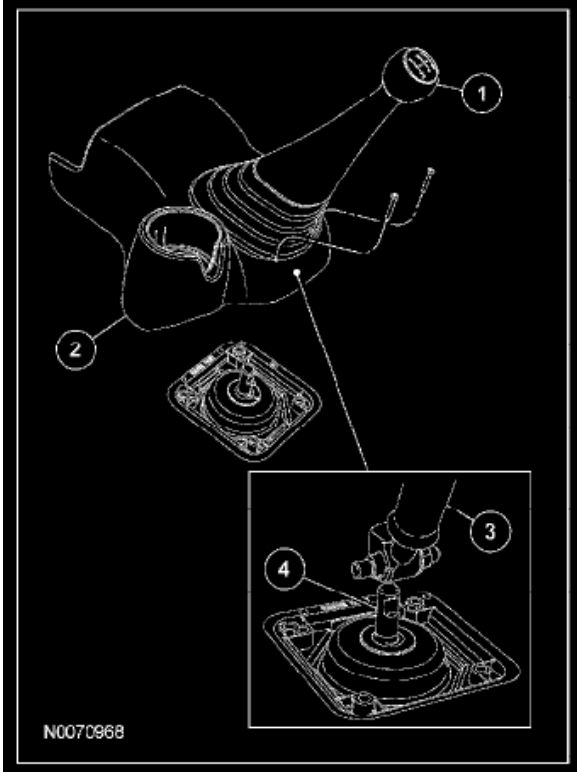
5. NOTE: Note the position of the vehicle identification tags on the top of the inner gearshift lever boot for correct installation.

If necessary, remove the 4 screws and the inner gearshift lever boot.



6. To install, reverse the removal procedure.

Gearshift Lever and Boot



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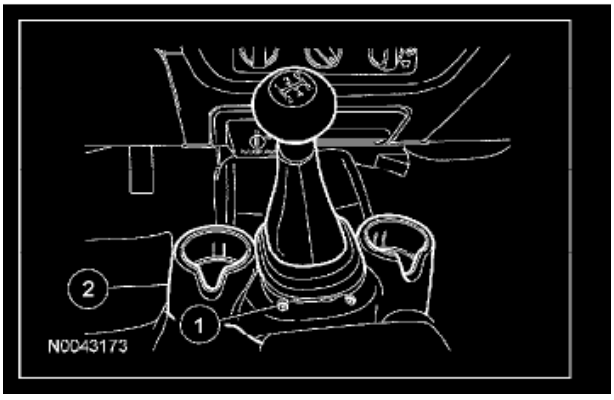


Shift Boot: Service and Repair

Gearshift Lever and Boot

Gearshift Lever and Boot

Removal and Installation

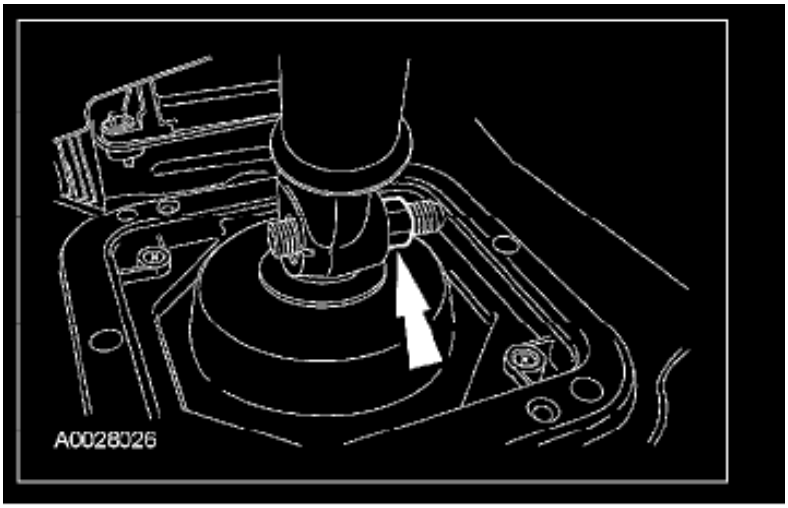
1. Raise the outer gearshift lever boot and console assembly to access the nut and eccentric stud that retains the upper gearshift lever to the lower

gearshift lever. 1

Remove the 2 screws retaining the console to the floor.

2 Raise the outer gearshift lever boot and console assembly to access the nut and eccentric stud.

2. Remove the nut.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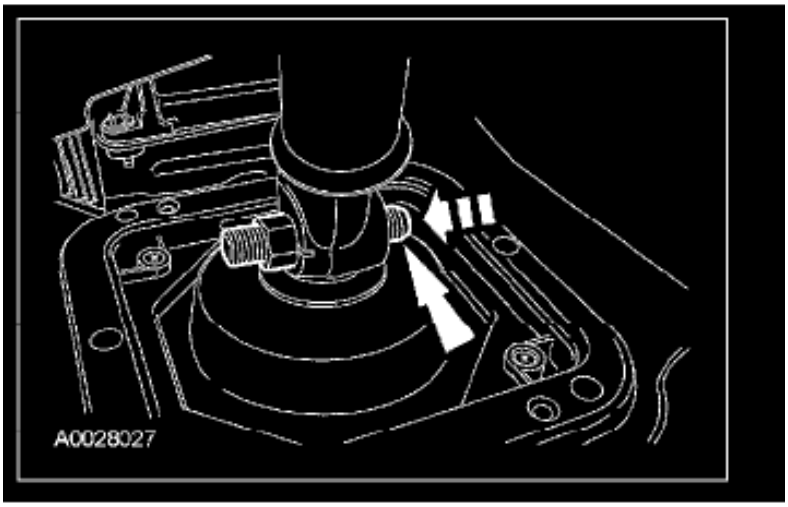
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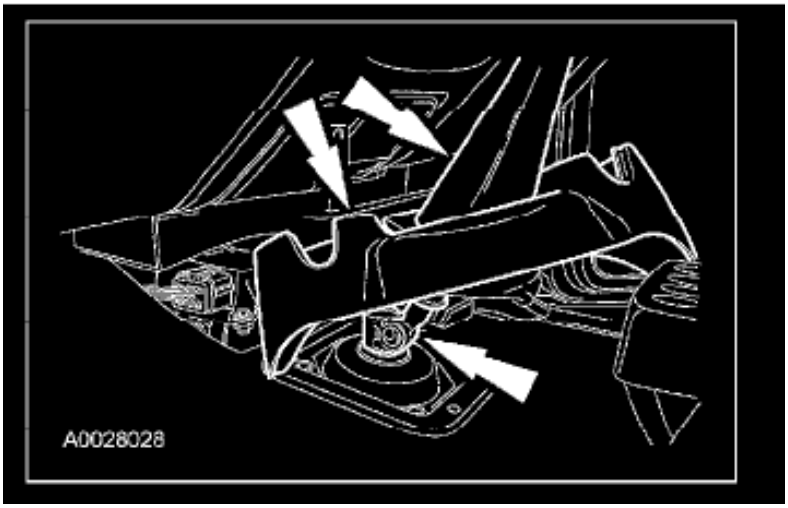
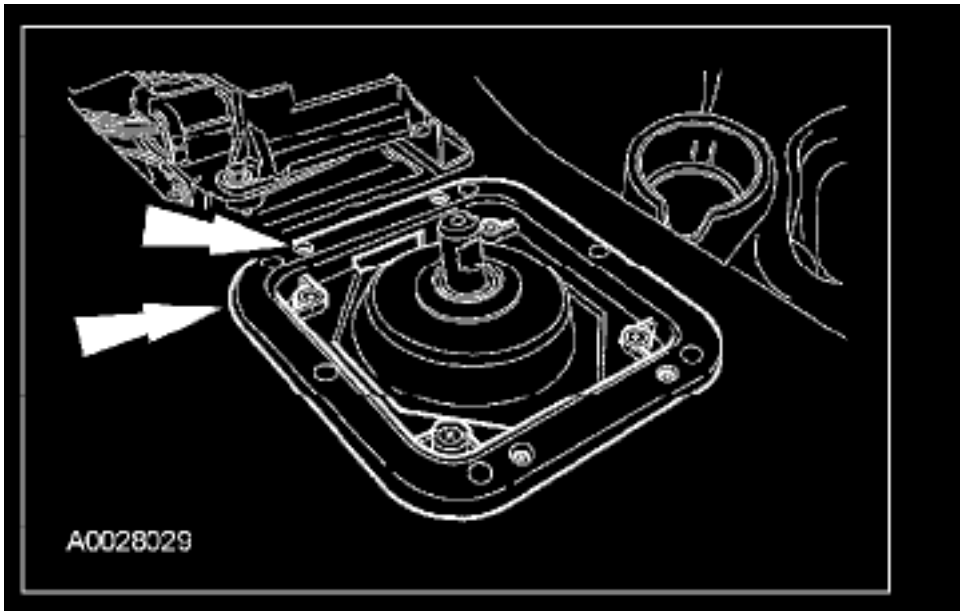

A0028028

3. Install the nut on the LH side of the lever, then tighten the nut to remove the eccentric stud out of the gearshift lever.

4. Remove the upper gearshift lever and the outer gearshift lever boot and console assembly as an assembly.

5. NOTE: Note the position of the vehicle identification tags on the top of the inner gearshift lever boot for correct installation.

If necessary, remove the 4 screws and the inner gearshift lever boot.



6. To install, reverse the removal procedure.

Power Take-Off: Description and Operation

POWER TAKE-OFF (PTO) SWITCH AND CIRCUITS

The PTO circuit is used by the PCM to disable some of the on board diagnostics (OBD) monitors during PTO operation. The PTO switch is normally open. When the PTO unit is activated, the PTO switch is closed and battery voltage is supplied to the PTO input circuit. This indicates to the PCM that an additional load is being applied to the engine. The PTO indicator lamp illuminates when the PTO system is functioning correctly and flashes when the PTO system is damaged.

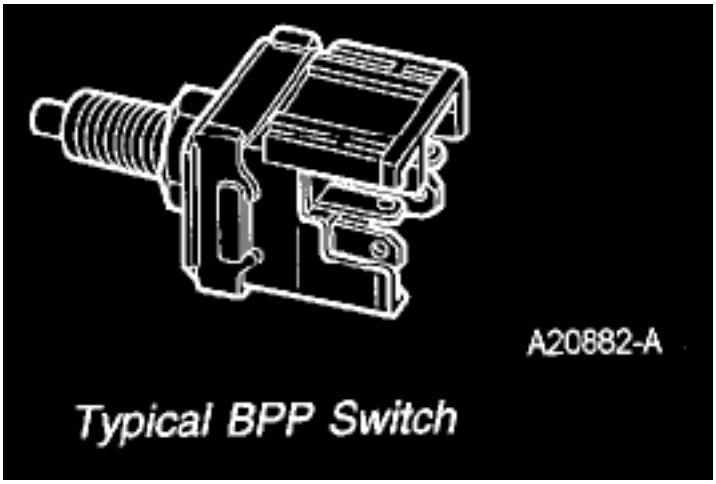
When the PTO unit is activated, the PCM disables some OBD monitors, which may not function reliably during PTO operation. Without the PTO circuit information to the PCM, false DTCs may be set during PTO operation. Prior to an Inspection/Maintenance test, operate the vehicle with the PTO disengaged long enough to successfully complete the OBD Monitors.

PTO Circuits Description

The 3 PTO input circuits are PTO mode, PTO engage, and PTO RPM.

The PTO engage circuit is used when the operator is requesting the PCM to check the needed inputs required to initiate the PTO engagement.

The PTO RPM circuit is used for the operator to request additional engine RPM for PTO operation.



Brake Switch - TCC: Description and Operation

BRAKE PEDAL POSITION (BPP) SWITCH

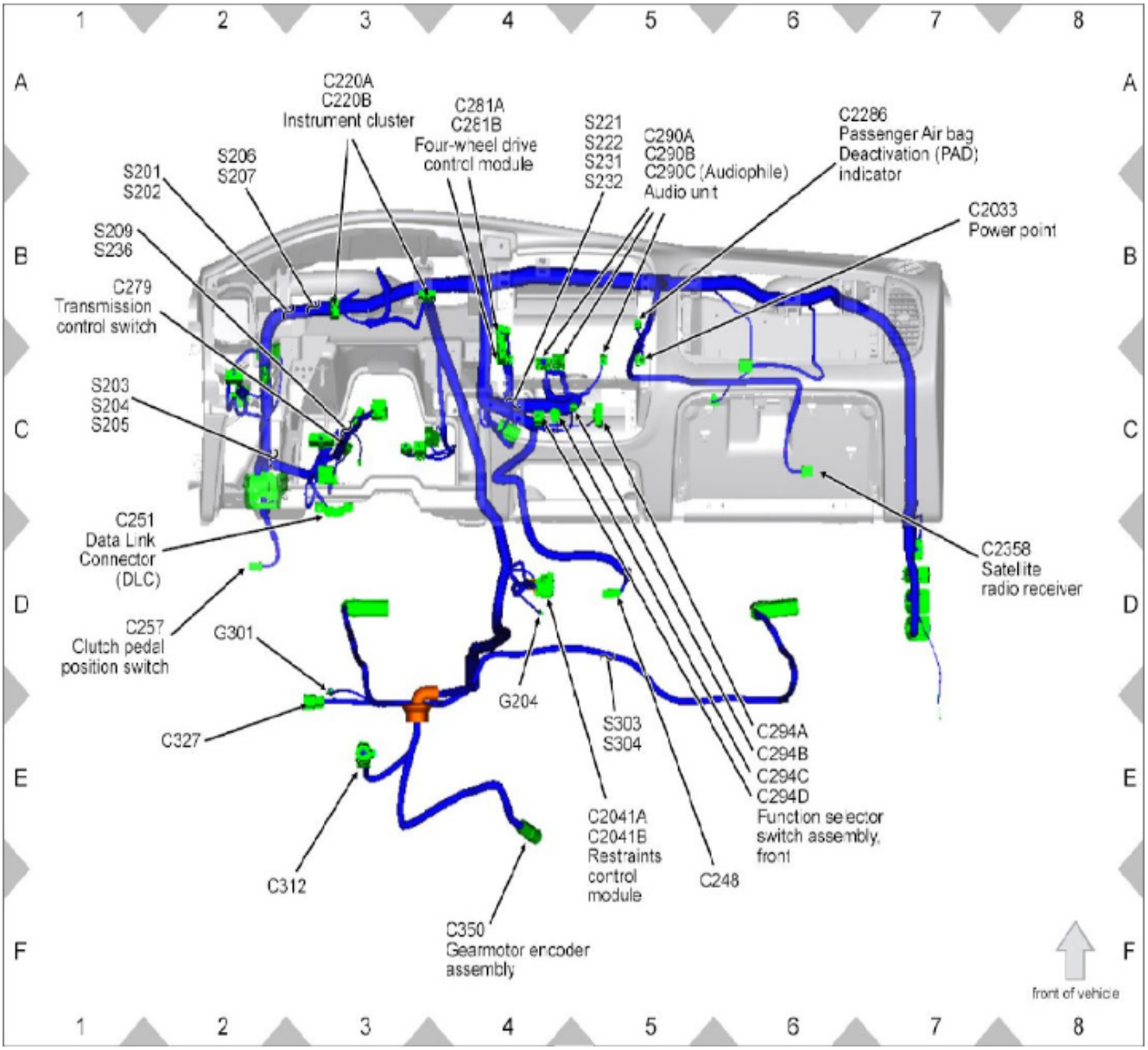
Typical BPP Switch

The BPP switch is sometimes referred to as the stoplamp switch. The BPP switch provides a signal to the PCM indicating that the brakes are applied. The BPP switch is normally open and is mounted on the brake pedal support. Depending on the vehicle application the BPP switch can be hardwired as follows:

- to the PCM supplying battery positive voltage (B+) when the vehicle brake pedal is applied.

- to the antilock brake system (ABS) module, or lighting control module (LCM), the BPP signal is then broadcast over the network to be received by the PCM.

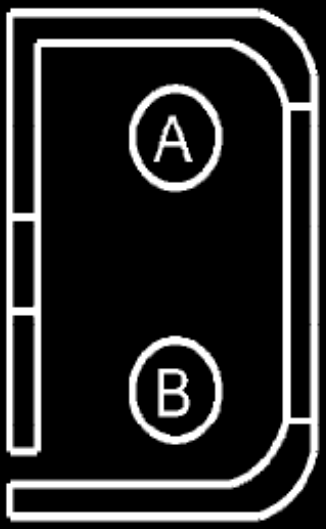
- to the ABS traction control/stability assist module. The ABS module interprets the BPP switch input along with other ABS inputs and generates an output called the driver brake application (DBA) signal. The DBA signal is then sent to the PCM and to other BPP signal users.


C220A
C220B
Instrument cluster
C281A
C281B
Four-wheel drive control module
S221
S222
S231
S232
C290A
C290B
C290C (Audiophile)
Audio unit
C2286
Passenger Air bag Deactivation (PAD) indicator
C2033
Power point
S201
S202
S206
S207
S209
S236
C279
Transmission control switch
S203
S204
S205
C251
Data Link Connector (DLC)
C257
Clutch pedal position switch
G301
C327
C312
G204
S303
S304
C294A
C294B
C294C
C294D
Function selector switch assembly, front
C2041A
C2041B
Restraints control module
C248
C350
Gearmotor encoder assembly
C2358
Satellite radio receiver
front of vehicle

View 151-12

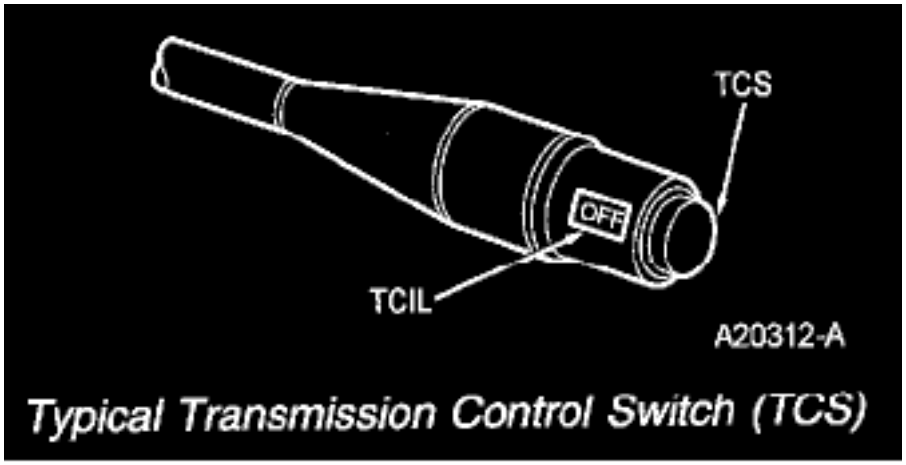
Connector: C279

Description:	Harness:	Base Part #:
TRANSMISSION CONTROL SWITCH	14401	7G550

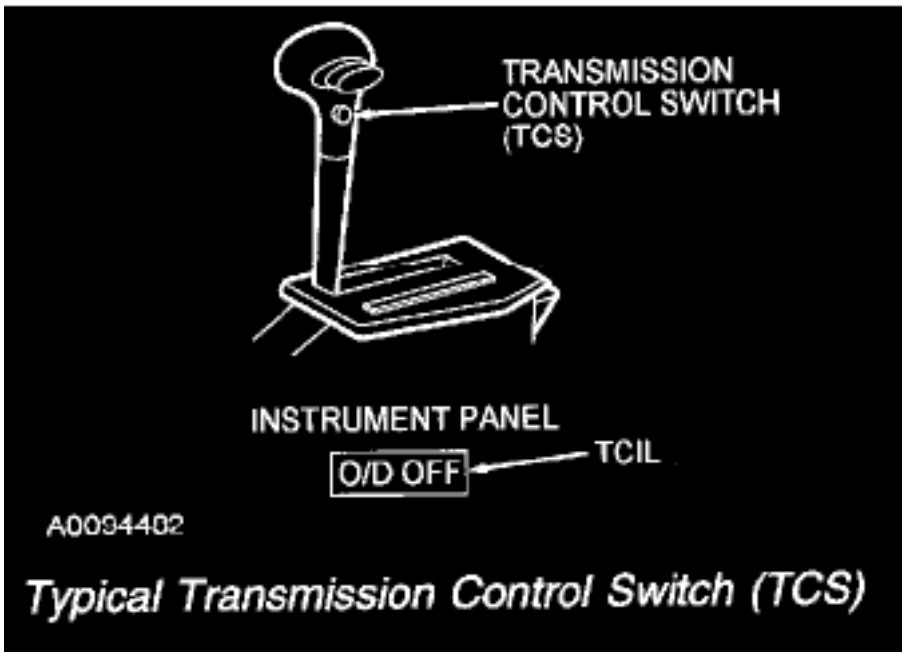


Pin	Circuit	Gauge	Circuit Function	Qualifier
A	CBP20 (YE-VT)	20	FUSE - 20 OR CIRCUIT BREAKER	
B	CE134 (BN-GN)	20	SWITCH - TRANSMISSION CONTROL/OVERDRIVE CANCEL (TCS)	

C279



Typical Transmission Control Switch (TCS)



Typical Transmission Control Switch (TCS)

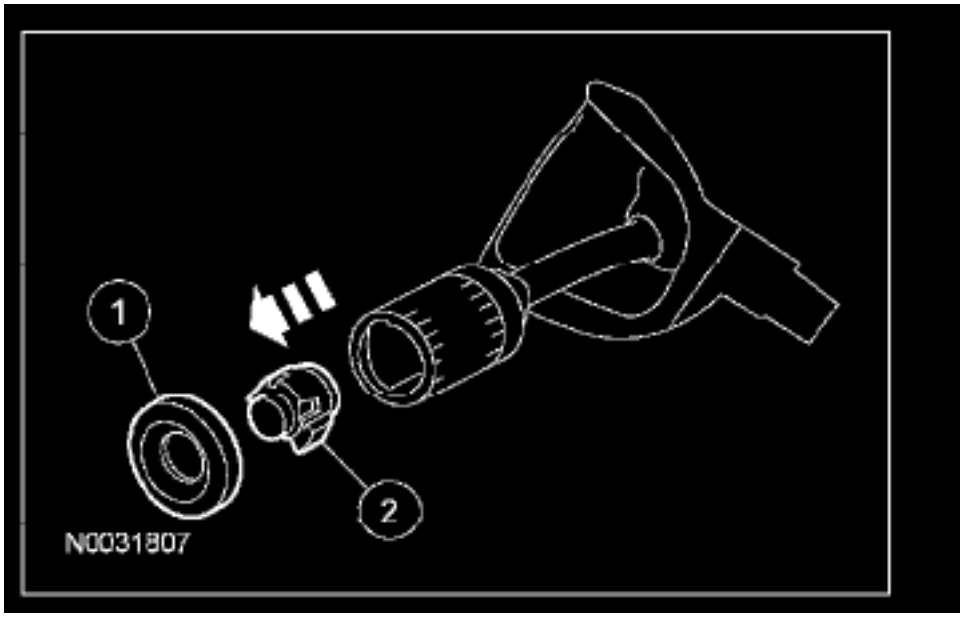
Transmission Mode Switch: Description and Operation

TRANSMISSION CONTROL SWITCH (TCS)

Typical Transmission Control Switch (TCS)

Typical Transmission Control Switch (TCS)

The TCS signals the PCM with VPWR whenever the TCS is pressed. On vehicles with this feature, the transmission control indicator lamp (TCIL) illuminates when the TCS is cycled to disengage overdrive.



Transmission Mode Switch: Service and Repair

Transmission Control (TC) Switch

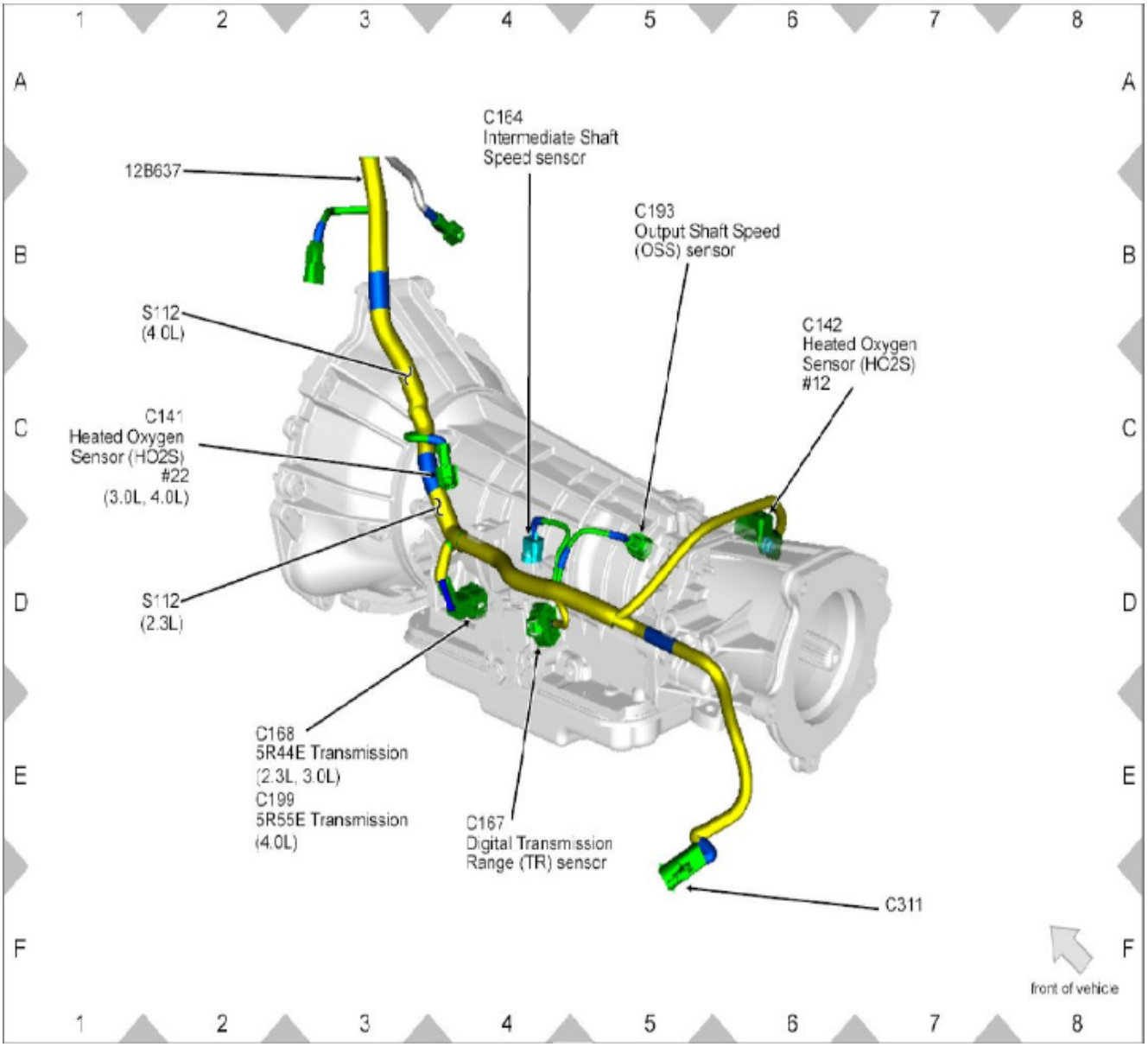
Removal and Installation

1. Remove the transmission control (TC) switch.

1 Remove the TC switch cover.

2 Remove the TC switch.

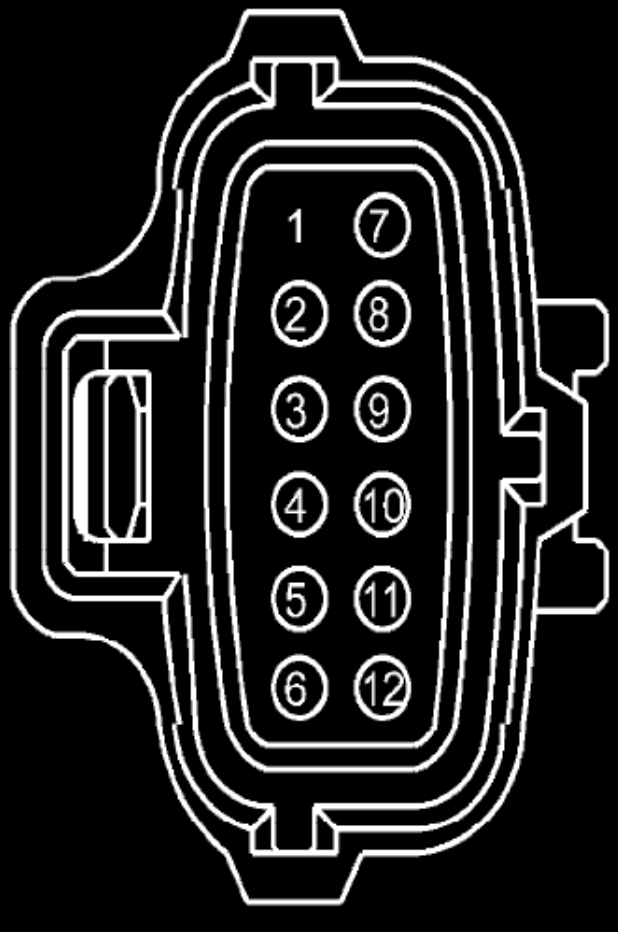
2. To install, reverse the removal procedure.


1
2
3
4
5
6
7
8
A
B
C
D
E
F
C164
Intermediate Shaft
Speed sensor
12B637
C193
Output Shaft Speed
(OSS) sensor
S112
(4.0L)
C142
Heated Oxygen
Sensor (HO2S)
#12
C141
Heated Oxygen
Sensor (HO2S)
#22
(3.0L, 4.0L)
S112
(2.3L)
C168
5R44E Transmission
(2.3L, 3.0L)
C199
5R55E Transmission
(4.0L)
C167
Digital Transmission
Range (TR) sensor
C311
front of vehicle

View 151-10

Connector: C167

Description:	Harness:	Base Part #:
DIGITAL TRANSMISSION RANGE (TR) SENSOR	12B637	7F293



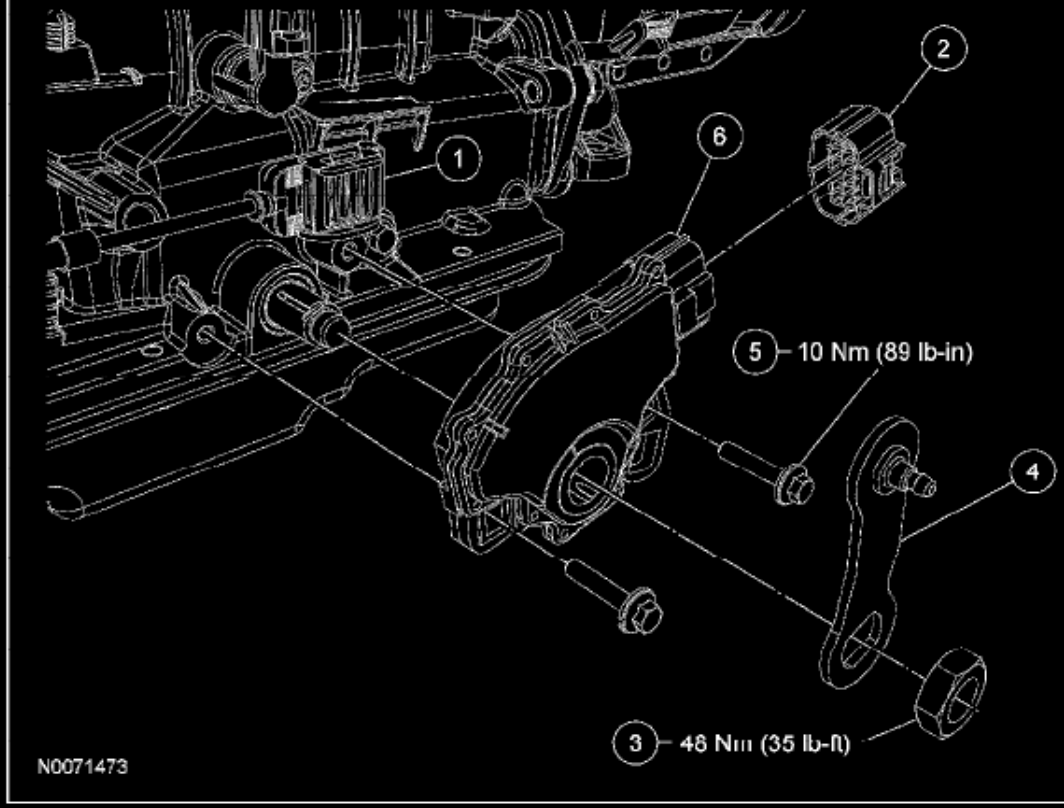
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	RE406 (GY-VT)	18	SIGNAL RETURN	
3	VET28 (GY-VT)	20	TR3A	
4	VET29 (VT-WH)	20	TR1	
5	VET30 (YE)	20	TR2	
6	VET31 (BU-OG)	20	TR4	
7	GD108 (BK-VT)	18	GROUND	4x4
8	CCF20 (GY-VT)	20	NETURAL SENSE	4x4
9	CBP20 (YE-VT)	18	FUSED POWER FEED	
10	CET40 (GN-OG)	20	STARTER CONTROL	
11	CET41 (BN-YE)	18	BACK UP	
12	CBP21 (BU-GY)	20	STARTER TO STARTER INTERRUPT RELAY	

C167

Special Tool(s)

ST1633-A	Alignment Gauge, TR Sensor 307-351 (T97L-70010-A)

Digital Transmission Range (TR) Sensor



Item	Part Number	Description
1	7E395-A	Selector lever cable
2	—	Digital transmission range (TR) sensor electrical connector
3	W701271-S	Manual control lever nut
4	7A256-A	Manual control lever
5	N806933-S	Digital TR sensor screw (2 required)
6	7F293-A	Digital TR sensor

Transmission Position Switch/Sensor: Service and Repair

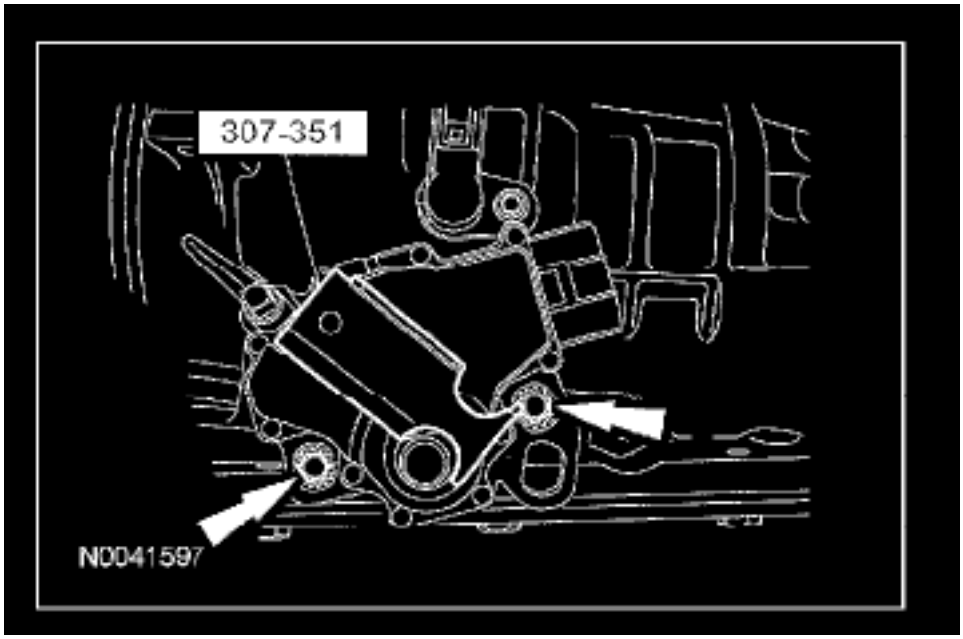
Digital Transmission Range (TR) Sensor

Digital Transmission Range (TR) Sensor

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the selector lever cable from the manual control lever. 3. Disconnect the digital transmission range (TR) sensor electrical connector. 4. Remove the manual control outer lever nut and manual control outer lever. 5. Remove the screws and the digital TR sensor.

Installation



1. CAUTION: The digital transmission range (TR) sensor must fit flush against the boss on the case to prevent damage to the sensor.

Install the digital TR sensor and loosely install the screws.

2. CAUTION: Tightening one screw before tightening the other may cause the sensor to bind or become damaged.

NOTE: The manual lever must be in the NEUTRAL position.

Using the special tool, align the digital TR sensor and tighten screws in an alternating sequence. ^

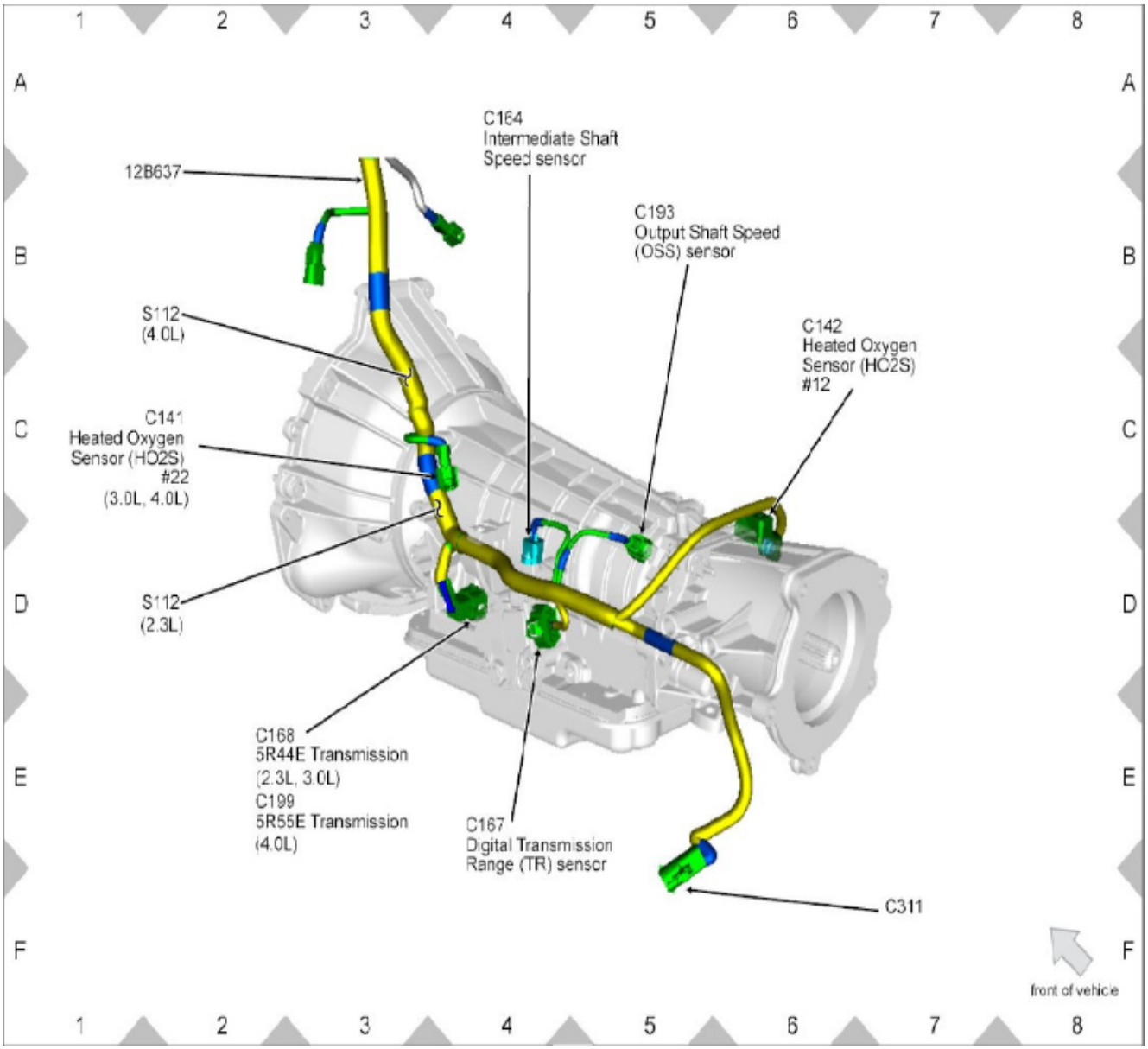
Tighten to 10 Nm (89 lb-inch).

3. Install the manual control outer lever and nut.

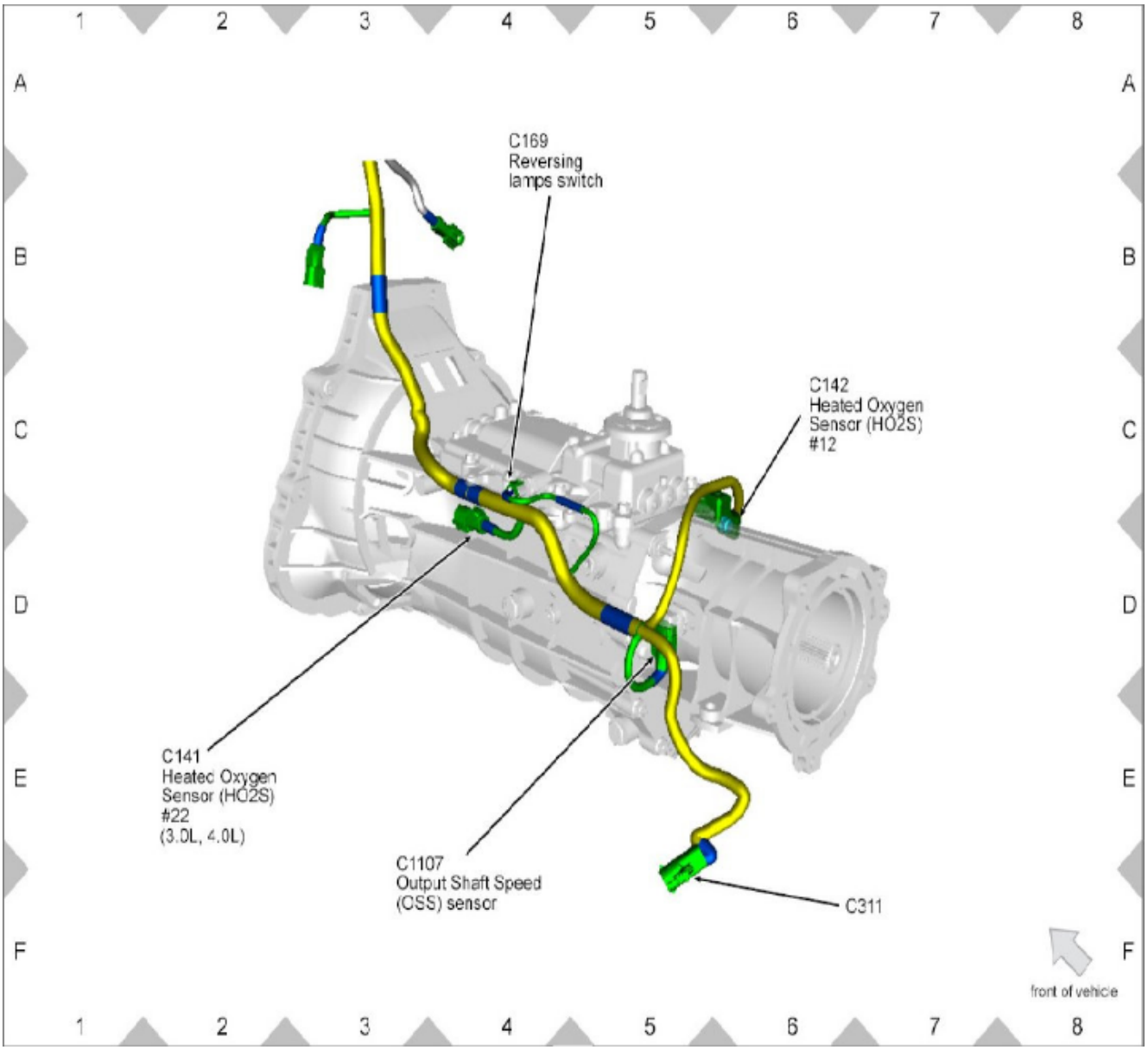
^ Tighten to 48 Nm (35 lb-ft).

4. Connect the digital TR sensor electrical connector. 5. Connect the selector lever cable to the manual control lever. 6. Verify that the selector lever cable is adjusted correctly.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Transmission and Drivetrain > Sensors and Switches - Transmission and Drivetrain > Sensors and Switches - A/T > Transmission Speed Sensor, A/T > Component Information > Locations > Intermediate Shaft Speed Sensor

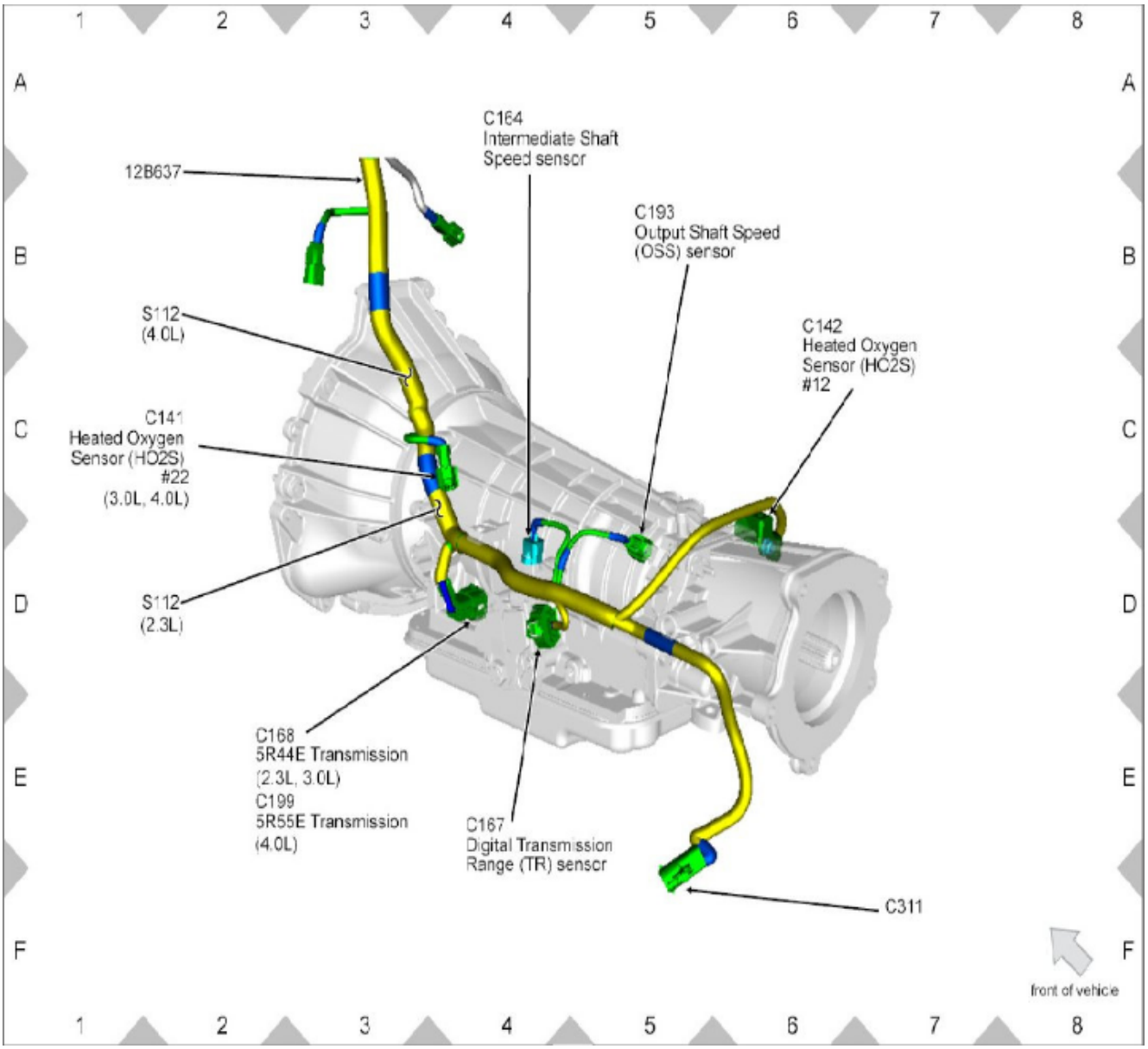


View 151-10

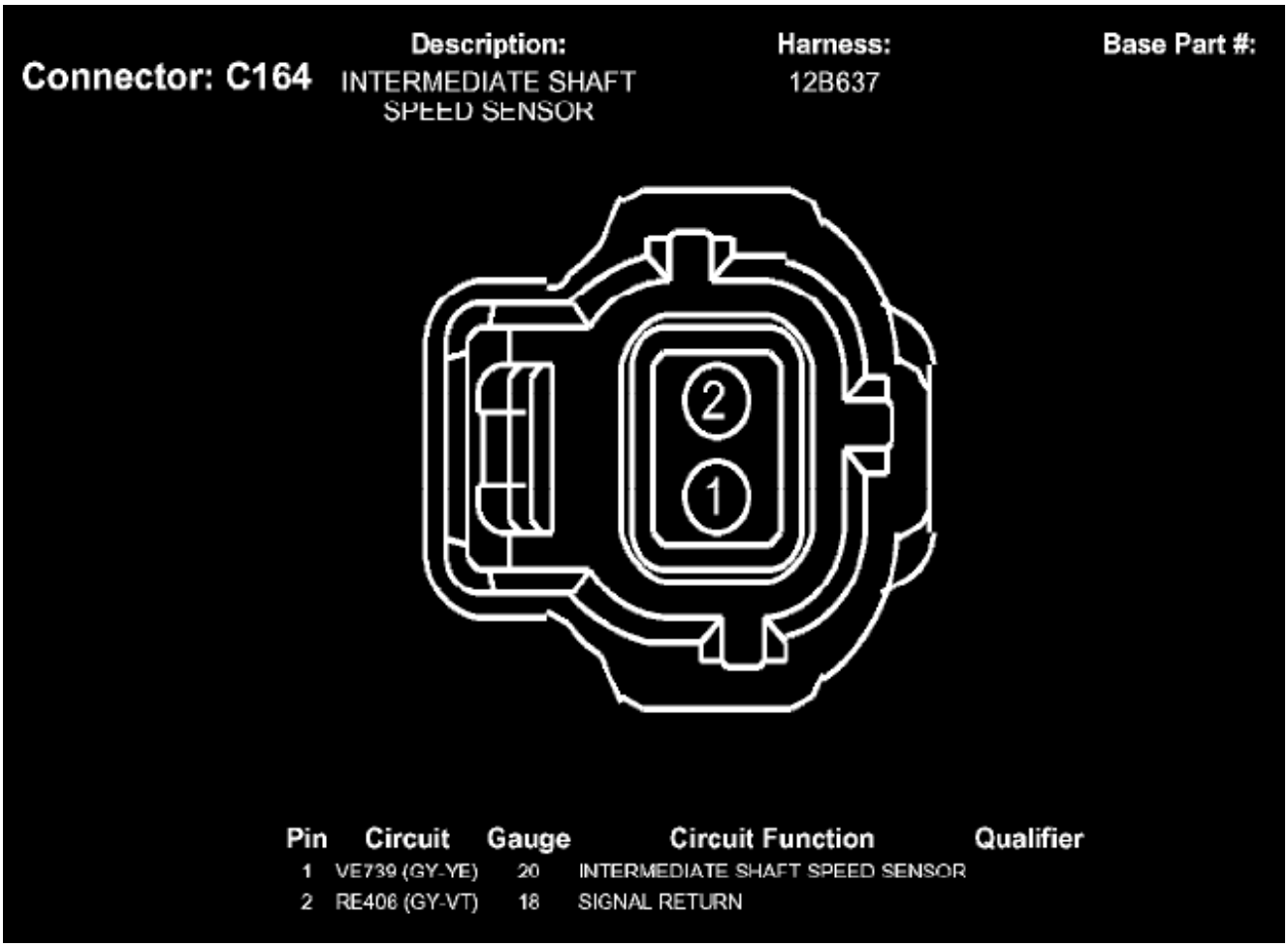


Transmission Speed Sensor: Locations Output Shaft Speed (OSS) Sensor

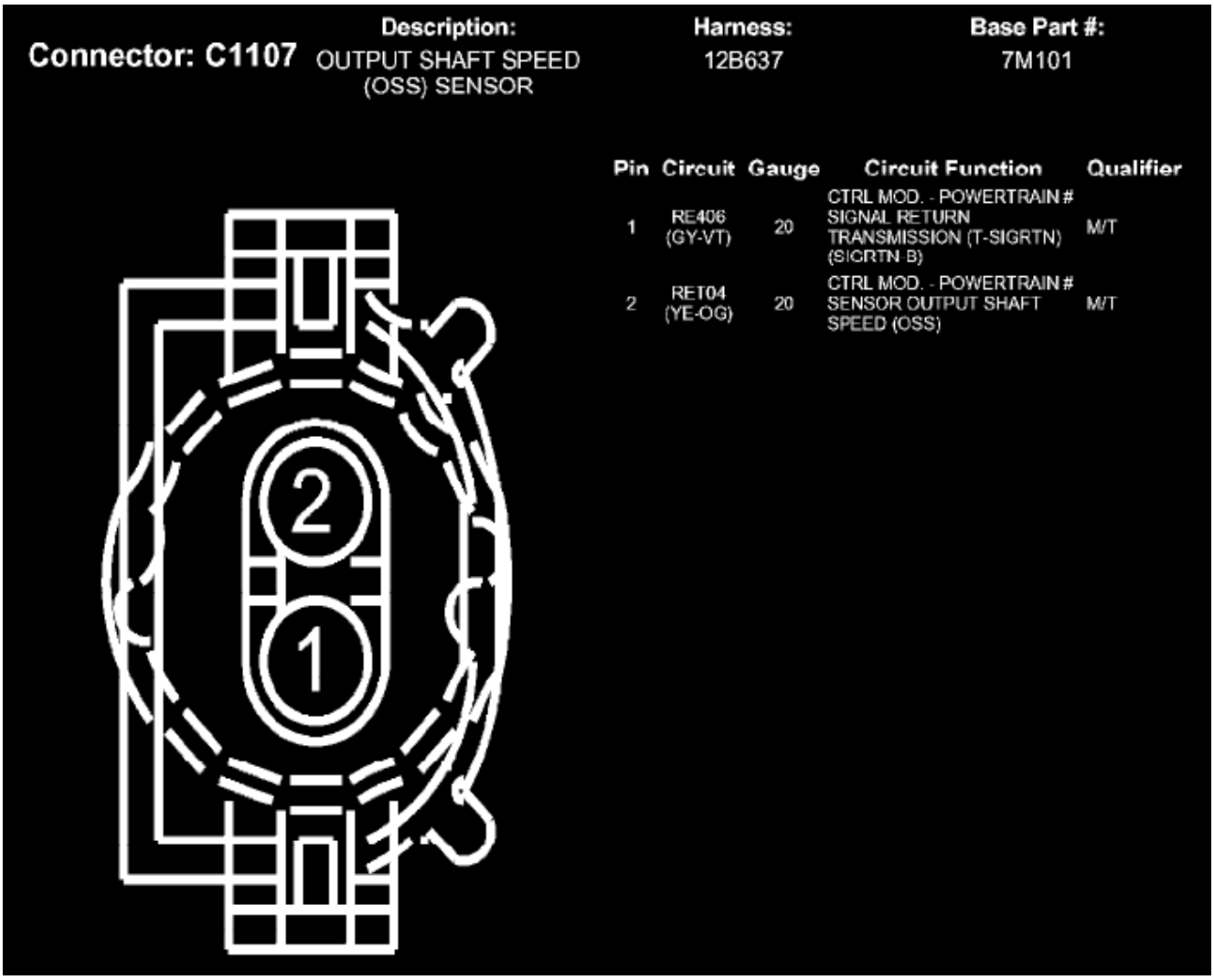
View 151-9


C164
Intermediate Shaft
Speed sensor
12B637
C193
Output Shaft Speed
(OSS) sensor
S112
(4.0L)
C142
Heated Oxygen
Sensor (HO2S)
#12
C141
Heated Oxygen
Sensor (HO2S)
#22
(3.0L, 4.0L)
S112
(2.3L)
C168
5R44E Transmission
(2.3L, 3.0L)
C199
5R55E Transmission
(4.0L)
C167
Digital Transmission
Range (TR) sensor
C311
front of vehicle

View 151-10

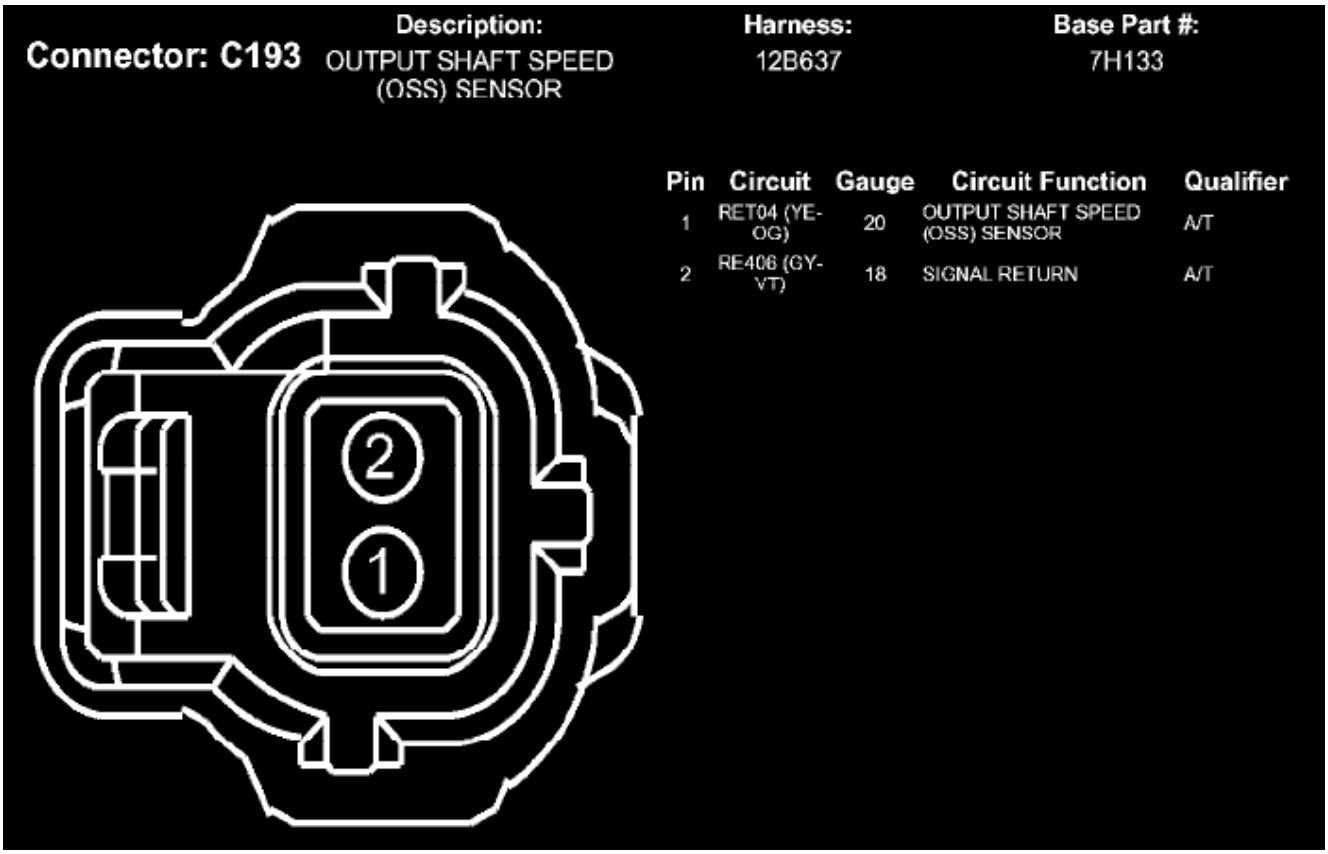

Connector: C164
Description:
INTERMEDIATE SHAFT SPEED SENSOR
Harness:
12B637
Base Part #:
2
1
Pin Circuit Gauge Circuit Function Qualifier
1 VE739 (GY-YE) 20 INTERMEDIATE SHAFT SPEED SENSOR
2 RE406 (GY-VT) 18 SIGNAL RETURN

C164



Transmission Speed Sensor: Diagrams Output Shaft Speed (OSS) Sensor

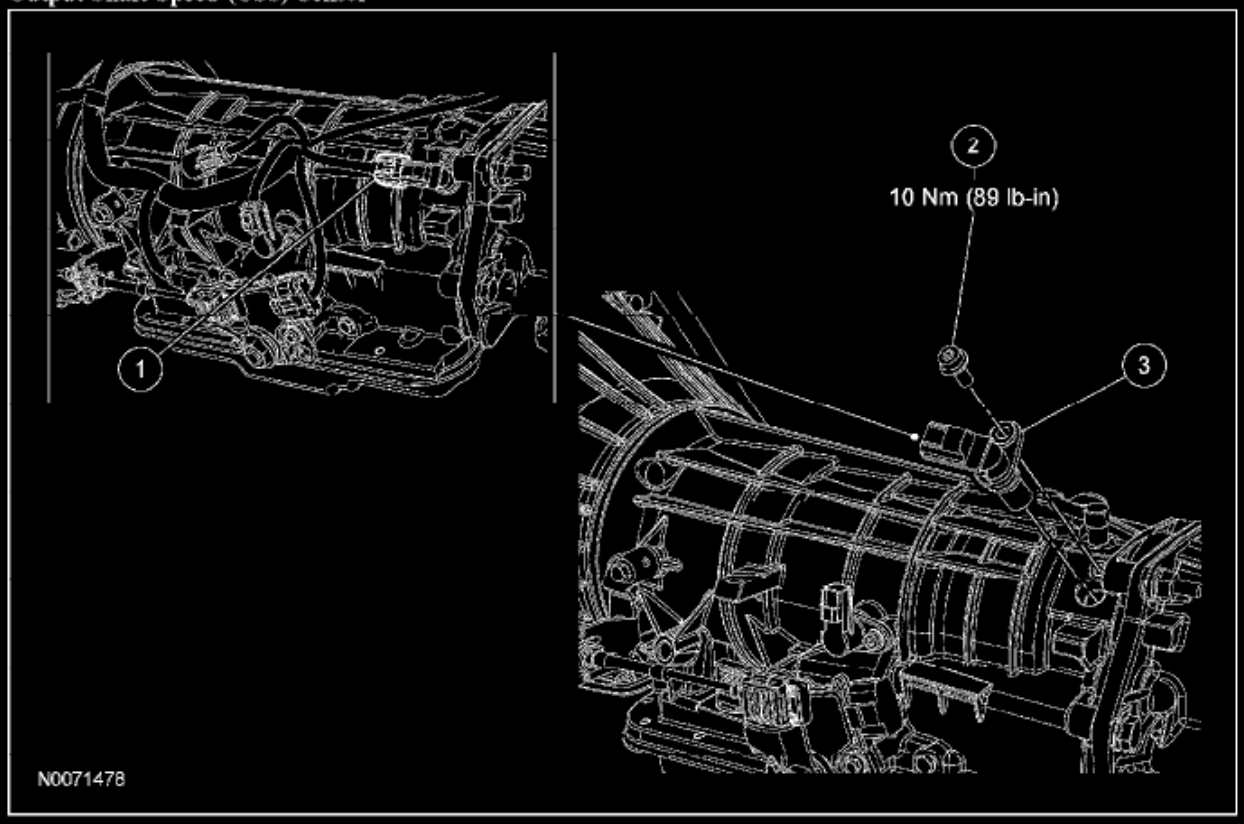
C1107



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RET04 (YE-OG)	20	OUTPUT SHAFT SPEED (OSS) SENSOR	A/T
2	RE406 (GY-VT)	18	SIGNAL RETURN	A/T

C193

Output Shaft Speed (OSS) Sensor



Item	Part Number	Description
1	—	Output shaft speed (OSS) sensor electrical connector
2	W702297-S	OSS sensor screw
3	7H103-B	OSS sensor

Transmission Speed Sensor: Service and Repair Output Shaft Speed (OSS) Sensor

Output Shaft Speed (OSS) Sensor

Output Shaft Speed (OSS) Sensor

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the output shaft speed (OSS) sensor electrical connector. 3. Remove the OSS sensor screw. 4. Remove the OSS sensor from the transmission.

Installation

1. NOTE: Inspect the OSS sensor O-ring for damage. If damaged, install a new O-ring Inspect and lubricate the O-ring with petroleum jelly.

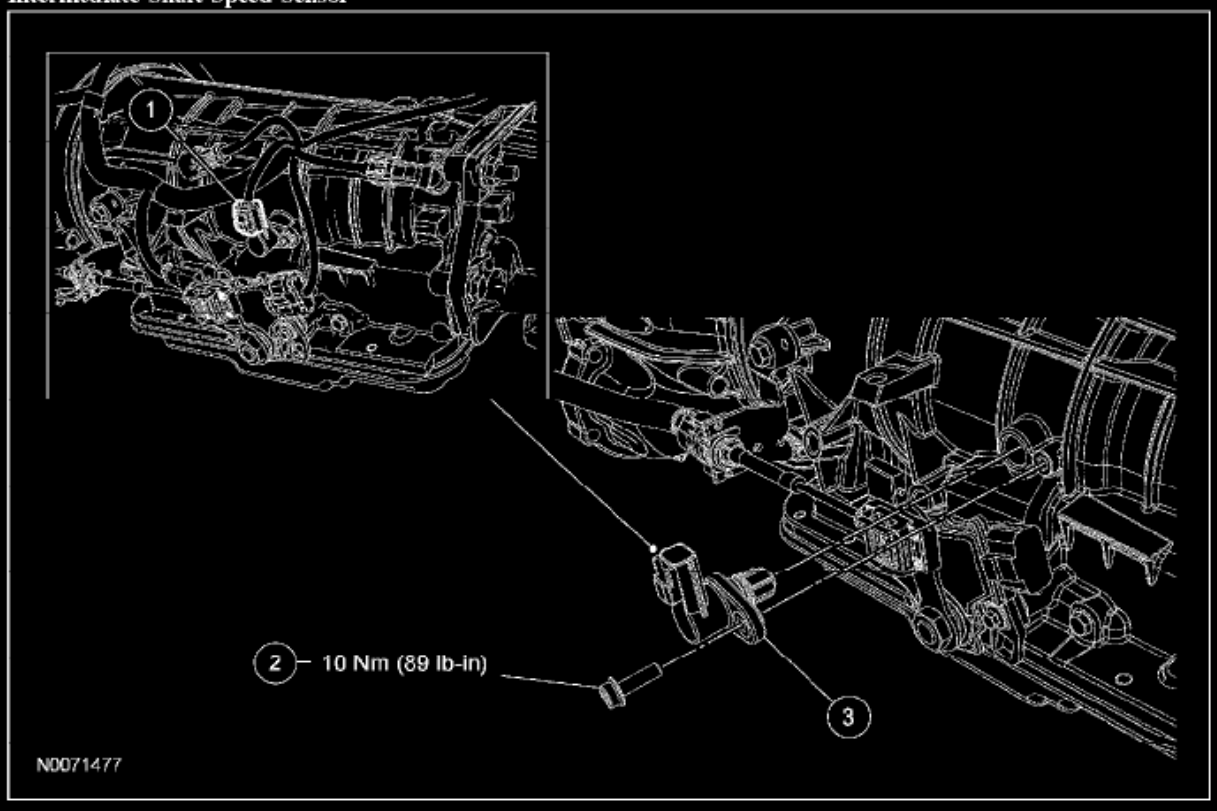
Install the OSS sensor into the transmission.

2. Install the OSS sensor screw.

^ Tighten to 10 Nm (89 lb-inch).

3. Connect the OSS sensor electrical connector.

Intermediate Shaft Speed Sensor



Item	Part Number	Description
1	—	Intermediate shaft speed sensor electrical connector
2	W702769-S	Intermediate shaft speed sensor screw
3	7M183-A	Intermediate shaft speed sensor

Transmission Speed Sensor: Service and Repair Intermediate Shaft Speed Sensor

Intermediate Shaft Speed Sensor

Intermediate Shaft Speed Sensor

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the intermediate shaft speed sensor electrical connector. 3. Remove the intermediate shaft speed sensor screw. 4. Remove the intermediate shaft speed sensor from the transmission.

Installation

1. NOTE: Inspect the intermediate shaft speed sensor O-ring for damage. If damaged, install a new O-ring

Inspect and lubricate the O-ring with petroleum jelly.

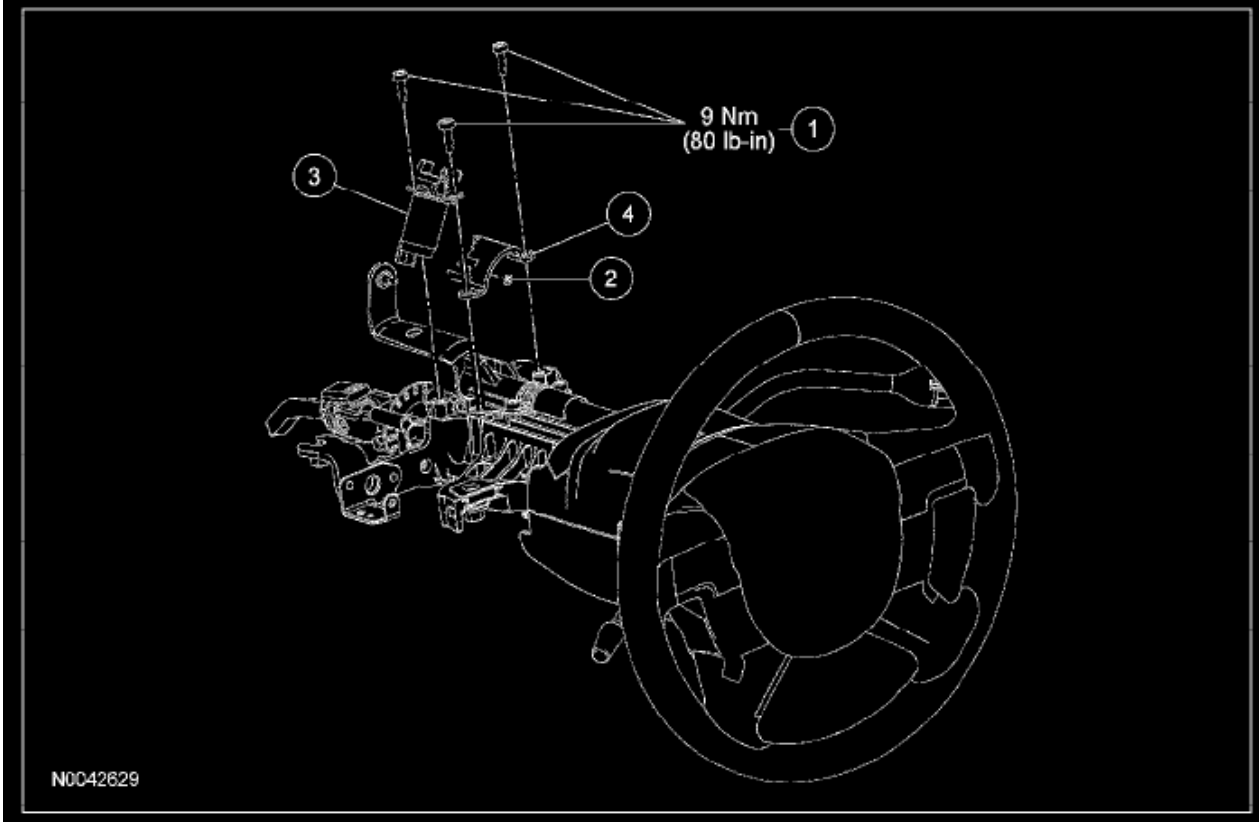
Install the intermediate shaft speed sensor into the transmission.

2. Install the intermediate shaft speed sensor screw.

^ Tighten to 10 Nm (89 lb-inch).

3. Connect the intermediate shaft speed sensor electrical connector. 4. Lower the vehicle.

Brake Shift Interlock Actuator



Item	Part Number	Description
1	N806584-S	Brake shift interlock actuator bolts
2	W623450-S	Brake shift interlock actuator clip
3	3F770-A	Brake shift interlock actuator
4	7A216-A	Insert plate

Shift Interlock Solenoid: Service and Repair

Brake Shift Interlock Actuator

Brake Shift Interlock Actuator

Removal and Installation

1. Remove the steering column assembly. 2. Remove the insert plate and the brake shift interlock actuator bolts.

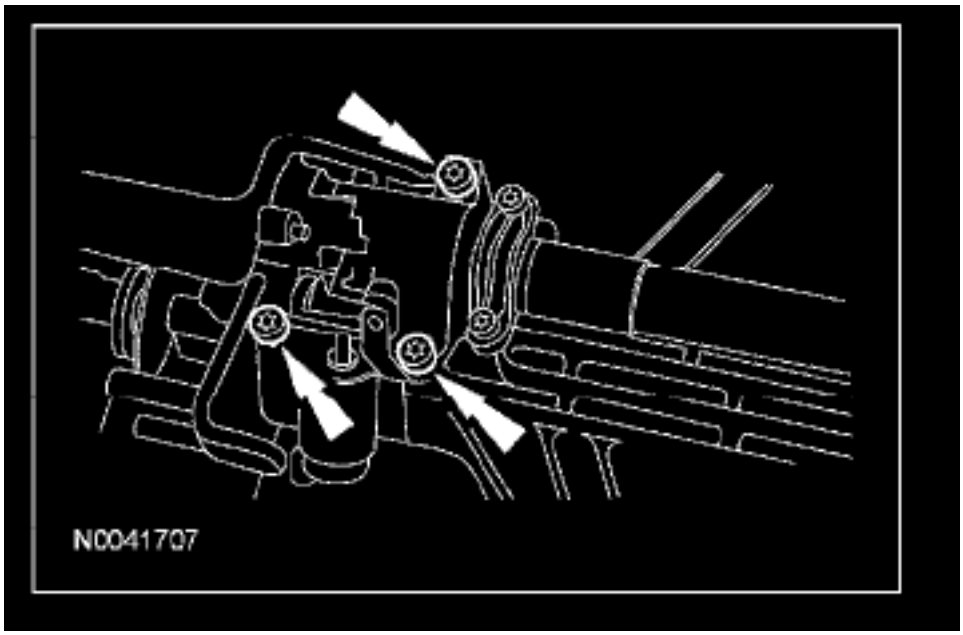
3. NOTE: The brake shift interlock actuator clip is an assembly aid for the assembly plant and does not need to be replaced.

Remove the insert plate from the brake shift interlock actuator. ^

Remove and discard the brake shift interlock actuator clip.

4. To install, reverse the removal procedure.

^ Tighten to 9 Nm (80 lb-inch).


N0041707

Solenoid Operation Chart

Gearshift Selector Position	PCM Commanded Gear	Solenoid States				
		SSA	SSB	SSC	SSD	Engine Braking
P/N	P/N	On	Off	Off	Off	No
R	R	On	Off	Off	Off	No
(D) (Overdrive)	1	On	Off	Off	Off	No
	2[a]	On	Off	On	Off	No
	3	On	On	Off	Off	No
	4	Off	Off	Off	Off	No
	5	Off	Off	On	Off	No
Drive	1	On	Off	Off	Off	No
	2[a]	On	Off	On	Off	No
	3	On	On	Off	On[b]	No
	4	Off	Off	Off	On	Yes
2	3	On	On	Off	On	Yes
1	1	On	Off	Off	On	Yes

a PCM Controlled
b On time calibration dependent

Shift Solenoid: Specifications

Solenoid Operation Chart

Solenoid Operation Chart

Solenoid Operation Chart

Gearshift Selector Position	PCM Commanded Gear	Solenoid States				
		SSA	SSB	SSC	SSD	Engine Braking
P/N	P/N	On	Off	Off	Off	No
R	R	On	Off	Off	Off	No
(D) (Overdrive)	1	On	Off	Off	Off	No
	2[a]	On	Off	On	Off	No
	3	On	On	Off	Off	No
	4	Off	Off	Off	Off	No
	5	Off	Off	On	Off	No
Drive	1	On	Off	Off	Off	No
	2[a]	On	Off	On	Off	No
	3	On	On	Off	On[b]	No
	4	Off	Off	Off	On	Yes
2	3	On	On	Off	On	Yes
1	1	On	Off	Off	On	Yes

a PCM Controlled
b On time calibration dependent

SSA ALWAYS "ON":	Transmission Range Selector Lever Position		
	OD	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	1	3	1

SSA ALWAYS "ON":	Transmission Range Selector Lever Position		
	OD	2	1
2	2	Ratio 1.1	2
3	3	3	3
4	1	3	1
5	2	Ratio 1.1	2

Shift Solenoid: Testing and Inspection

Pinpoint Tests - OSC Equipped Vehicle Anytime an electrical connector or solenoid body is disconnected, inspect the connector for terminal condition, corrosion and contamination. Also inspect the connector seal for damage. Clean, repair or install a new connector as required.

Shift Solenoid Pre-Diagnosis Use the following shift solenoid operation information while carrying out Pinpoint Test A.

Solenoid Operation Chart

Solenoid Operation Chart

Shift Solenoid Failure Mode Chart "Always On" Failed OFF due to PCM and/or vehicle wiring concerns, solenoid electrically, mechanically or hydraulically stuck ON.

SSB ALWAYS "ON":	Transmission Range Selector Lever Position		
	OD	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	3	3	3
2	Ratio 1.1	Ratio 1.1	Ratio 1.1
3	3	3	3
4	3	3	3
5	Ratio 1.1	Ratio 1.1	Ratio 1.1

SSC ALWAYS "ON":	Transmission Range Selector Lever Position		
	OD	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	2	3	1
2	2	Ratio 1.1	2
3	Ratio 1.1	3	3
4	5	3	3
5	5	Ratio 1.1	Ratio 1.1

SSD ALWAYS "ON":	Transmission Range Selector Lever Position		
	OD	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	1	3	1
2	1	3	1
3	3	3	3
4	4	3	3
5	4	3	3

SSA ALWAYS "OFF":	Transmission Range Selector Lever Position		
	OD	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	4	3	3

SSA ALWAYS "OFF":	Transmission Range Selector Lever Position		
	OD	2	1
2	5	Ratio 1.1	Ratio 1.1
3	3	3	3
4	4	3	3
5	5	Ratio 1.1	Ratio 1.1

Shift Solenoid Failure Mode Chart "Always Off" Failed ON due to PCM and/or vehicle wiring concerns, solenoid electrically, mechanically or hydraulically stuck OFF.

SSB ALWAYS "OFF":	Transmission Range Selector Lever Position		
	OD	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	1	3	1
2	2	Ratio 1.1	2
3	1[a] (2[b])	3	1
4	4	3	3
5	5	Ratio 1.1	Ratio 1.1

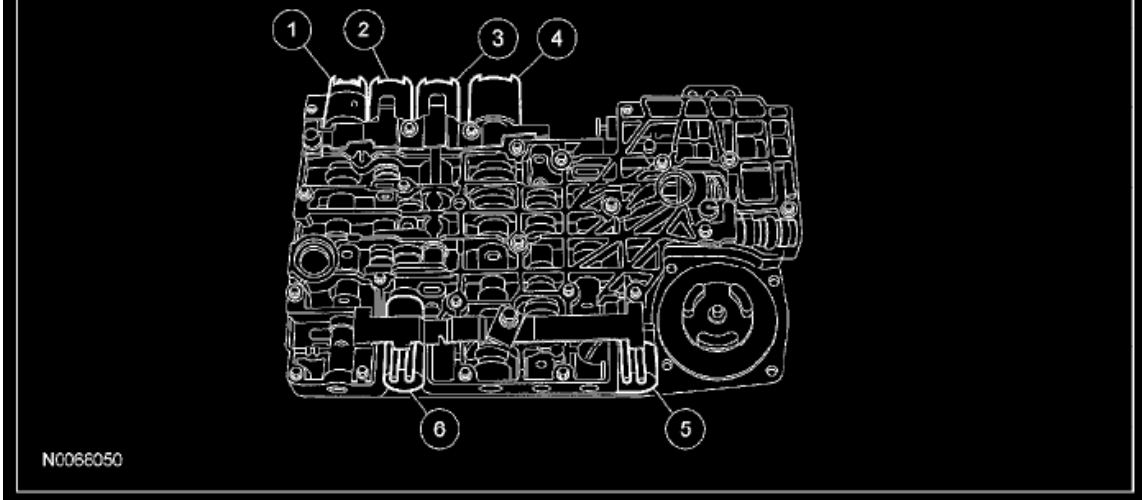
a During Downshift Only
b During Upshift Only

SSC ALWAYS "OFF":	Transmission Range Selector Lever Position		
	OD	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	1	3	1
2	1	3	1
3	3	3	3
4	4	3	3
5	4	3	3

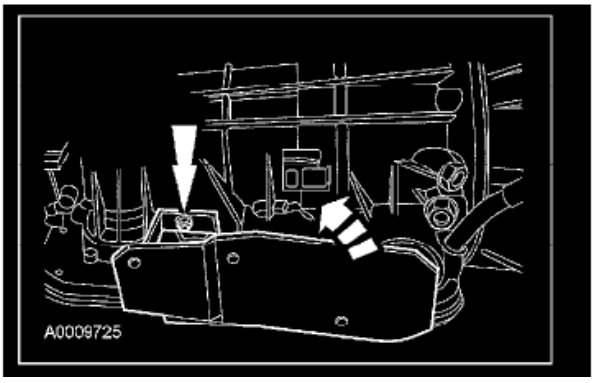
SSD ALWAYS "OFF":	Transmission Range Selector Lever Position		
	OD	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	1	3	1
2	2	Ratio 1.1	2
3	3	3	3
4	4	3	3
5	5	Ratio 1.1	Ratio 1.1

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V



Item	Part Number	Description
1	7F037	Torque converter clutch (TCC)
2	7G484	Shift solenoid (SSD)
3	7G484	Shift solenoid (SSB)
4	7H144	Electronic pressure control (EPC)
5	7G484	Shift solenoid (SSA)
6	7G484	Shift solenoid (SSC)



Shift Solenoid: Service and Repair

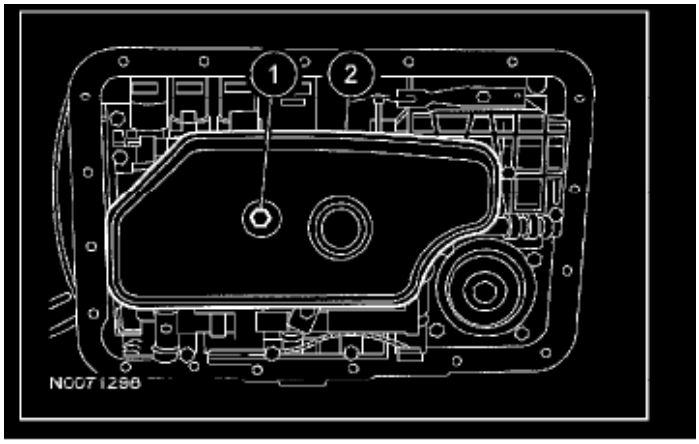
Solenoids - Shift, Torque Converter Clutch, Electronic Pressure Control

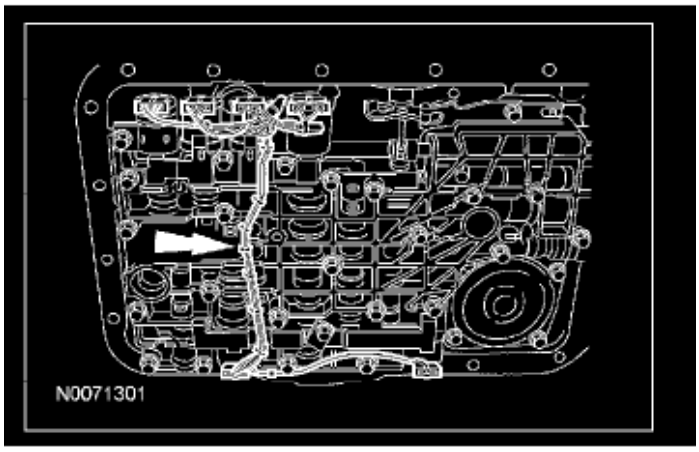
Removal

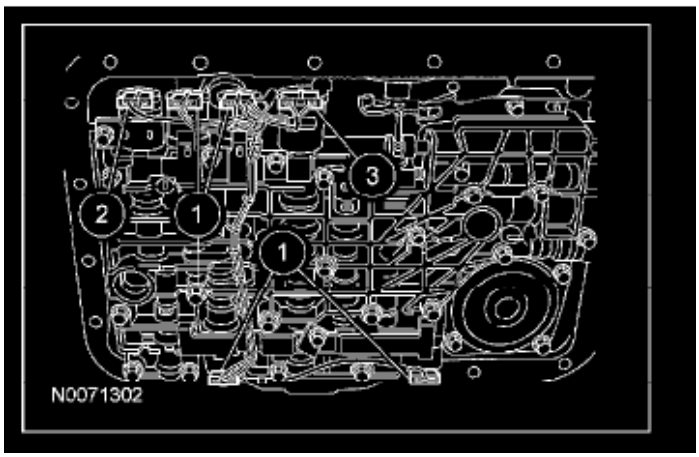
1. With the vehicle in NEUTRAL, position it on a hoist.

2. NOTE: If equipped, the transmission servo heat shield needs to be unclipped from the fluid pan rail and positioned aside for fluid pan removal.

If equipped, loosen the nut and position the heat shield aside.







3. Place a drain pan under the transmission fluid pan. 4. Drain the transmission fluid. 5. Remove the transmission fluid filter.

1 Remove the transmission fluid filter screw.

2 Remove the transmission fluid filter.

6. NOTE: Main control assembly does not need to be removed for solenoid service.

Remove wire loom guide and protector. ^

Carefully lift up on wire loom guide and protector and disengage the retaining pins from the solenoid clamps.

7. Disconnect the appropriate solenoid electrical connector.

1 Disconnect shift solenoids electrical connectors.

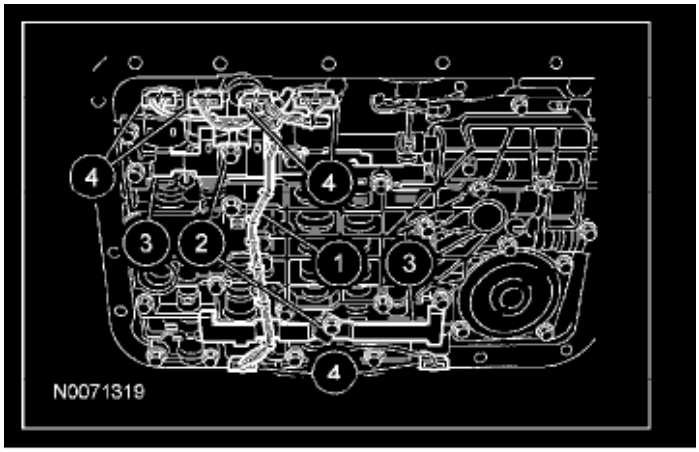
2 Disconnect the torque converter clutch (TCC) solenoid electrical connector.

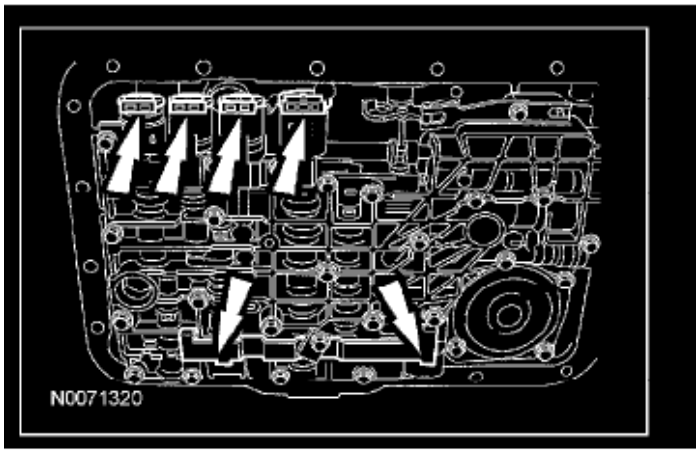
3 Disconnect the electronic pressure control (EPC) solenoid electrical connector.

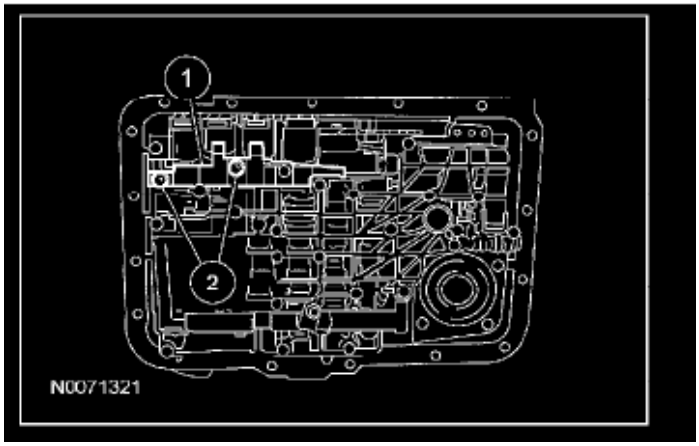
8. CAUTION: The torque converter clutch (TCC) solenoid and converter modulator valve may pop out of its bore. This may damage the

solenoid or converter modulator valve.

CAUTION: Shift solenoid (SSC) may pop out of its bore. This may damage the solenoid.







Remove the shift solenoids. 1

Remove the wire harness.

2 Remove the solenoid clamp screws.

3 Remove the solenoid clamp.

4 Remove the appropriate solenoid(s).

Installation

1. Install the new solenoid(s).

2. NOTE: The solenoid clamp must be installed in the torque converter clutch (TCC) and electronic pressure control (EPC) solenoid grooves, shift

solenoid pockets and the No. 204 plug.

Install the solenoid clamp. 1

Position the solenoid clamp on the main control valve body.

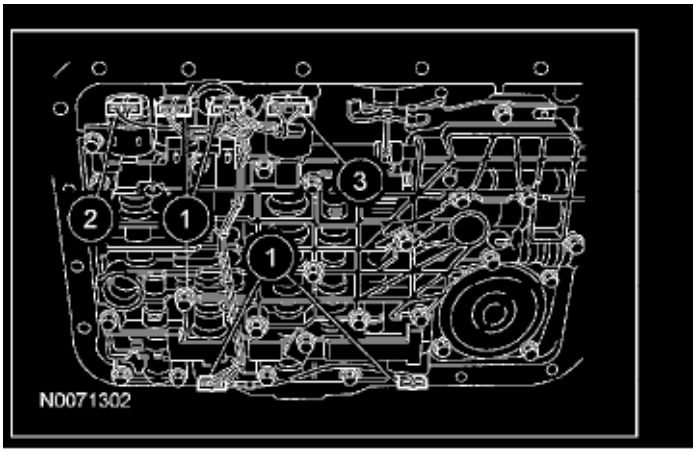
2 Install the solenoid clamp screws.

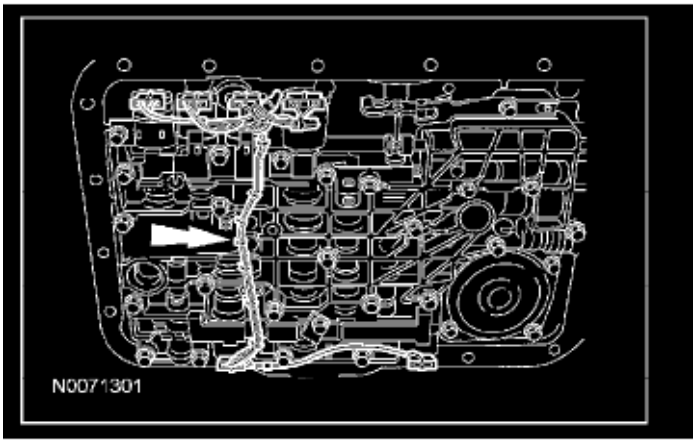
3. Connect the 6 solenoid electrical connectors.

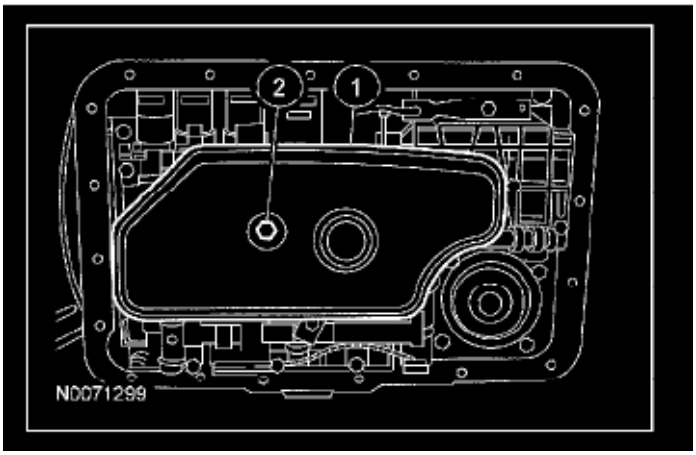
1 Connect shift solenoid SSA, SSB, SSC, SSD electrical connectors.

2 Connect the TCC solenoid electrical connector.

3 Connect the EPC solenoid electrical connector.







4. CAUTION: Excessive pressure may break the retaining pins.

Install the main control valve body wire loom. ^

Align the retaining pins to the holes in the solenoid clamps and gently press in the main control valve body wire loom guide and protector.

5. Install the transmission fluid filter.

1 Install the transmission fluid filter.

2 Install the transmission fluid filter screw. ^

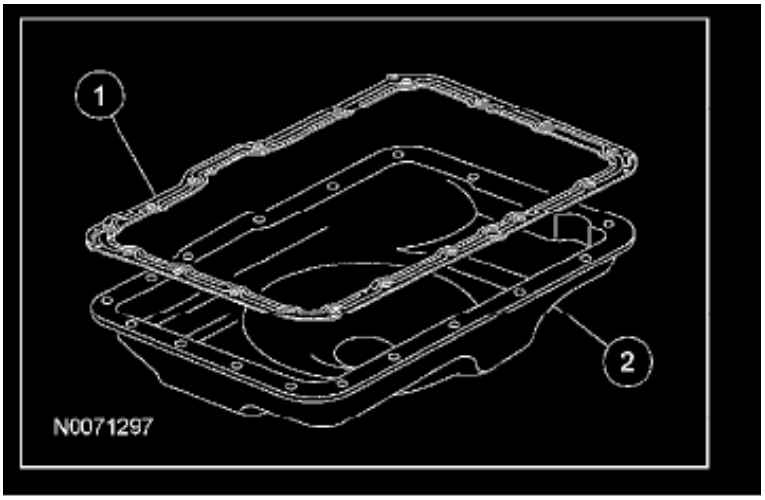
Tighten to 10 Nm (89 lb-inch).

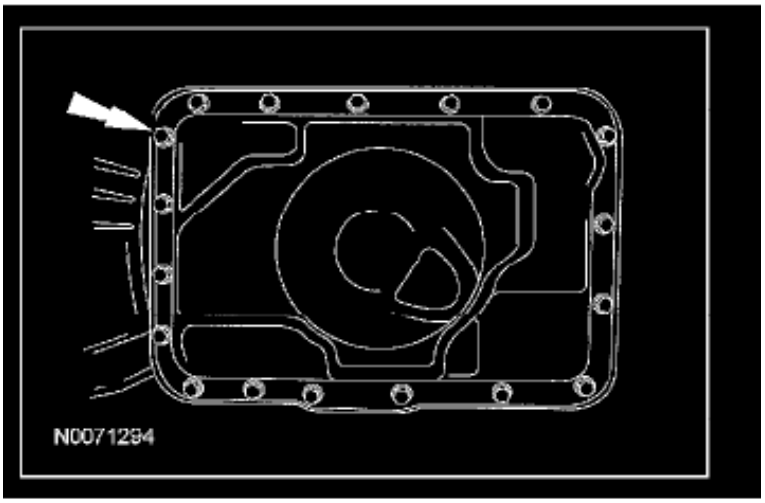
6. NOTE: The transmission fluid pan gasket is reusable. Clean and inspect for damage, if not damaged, the gasket should be reused.

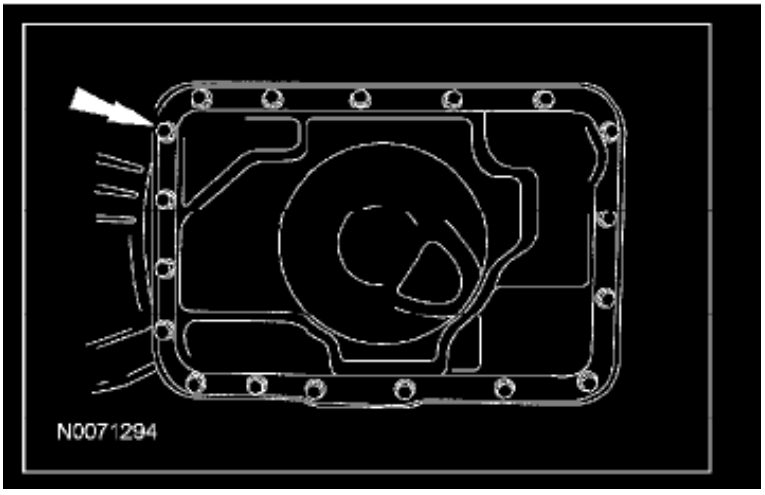
Install the transmission fluid pan. 1

Position the transmission fluid pan gasket on the transmission fluid pan.

2 Align and install the transmission fluid pan.







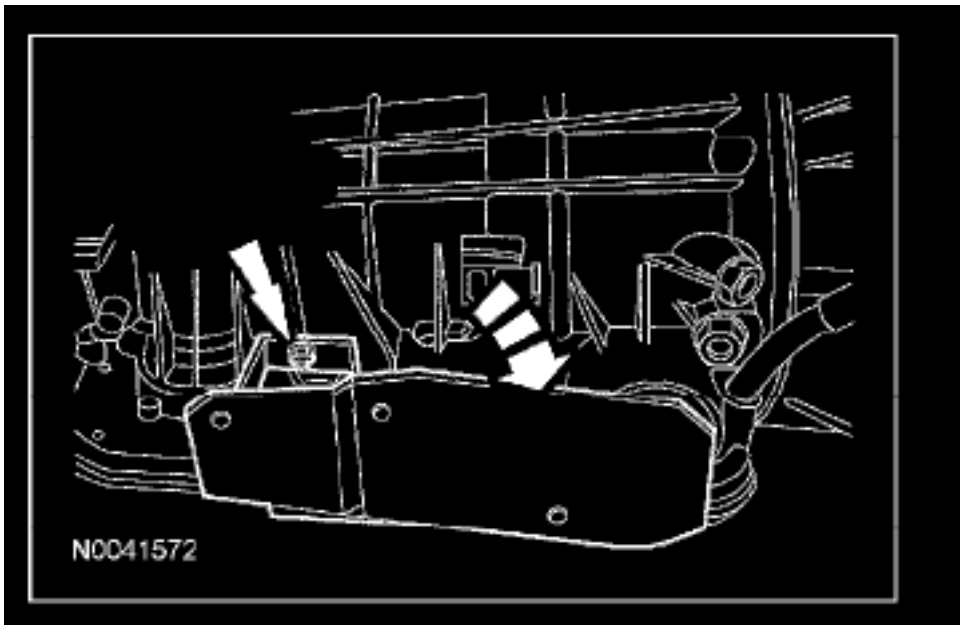
7. Loosely install the transmission fluid pan screws.

8. Tighten the transmission fluid pan screws in a crisscross pattern.

^ Tighten to 10 Nm (89 lb-inch).

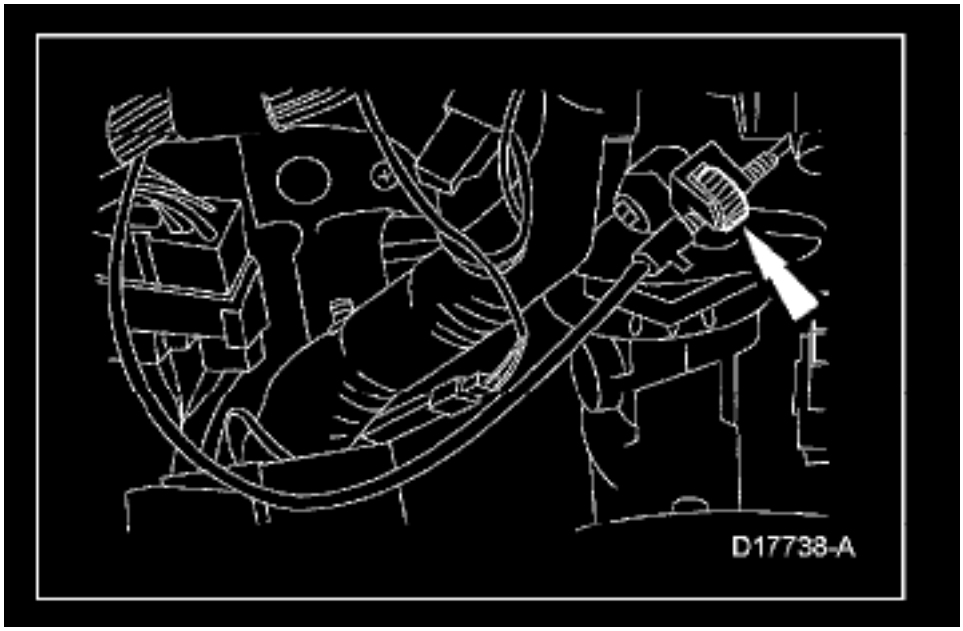
9. If equipped, position the servo heat shield over the servos and clip it to the pan rail.

^ Tighten to 10 Nm (89 lb-inch).



10. NOTE: Start with a minimum of 3.7L (4 qt) clean automatic transmission fluid.

Fill transmission with clean automatic transmission fluid to the correct fluid level.



Shift Indicator: Adjustments

Selector Lever Indicator Adjustment

1. Remove the upper instrument panel steering column cover. 2. Place the selector lever in the (D) position.

^ Rotate the selector lever clockwise until it bottoms out (1st gear), then rotate 2 detents counterclockwise ((D) position).

3. Hang the 1.4 kg (3 lb) weight on the gearshift lever. 4. Center the pointer in the middle of the (D) position.

^ Rotate the thumb-wheel located on the bottom of the steering column to adjust the pointer.

5. Remove the 1.4 kg (3 lb) weight. 6. Carefully move the selector lever into each detent and compare with the transmission settings.

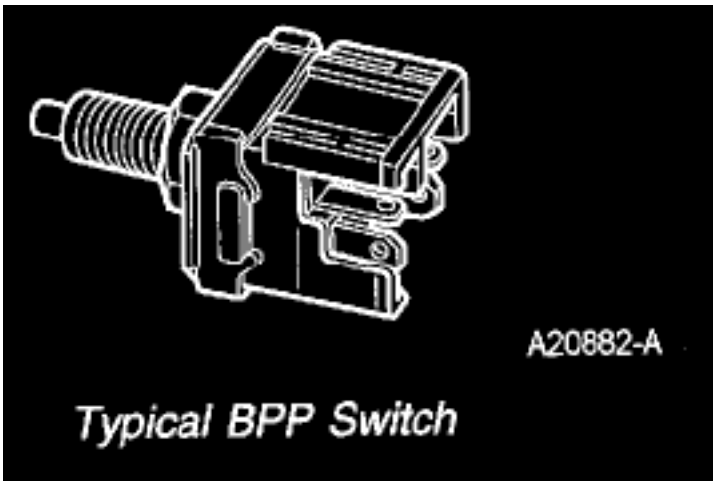
^ Readjust if necessary.

7. Install the upper instrument panel steering column cover.

Transmission Mode Indicator - A/T: Description and Operation

TRANSMISSION CONTROL INDICATOR LAMP (TCIL)

The TCIL is an output signal from the PCM that controls the lamp on/off function depending on the engagement or disengagement of overdrive.



Brake Switch - TCC: Description and Operation

BRAKE PEDAL POSITION (BPP) SWITCH

Typical BPP Switch

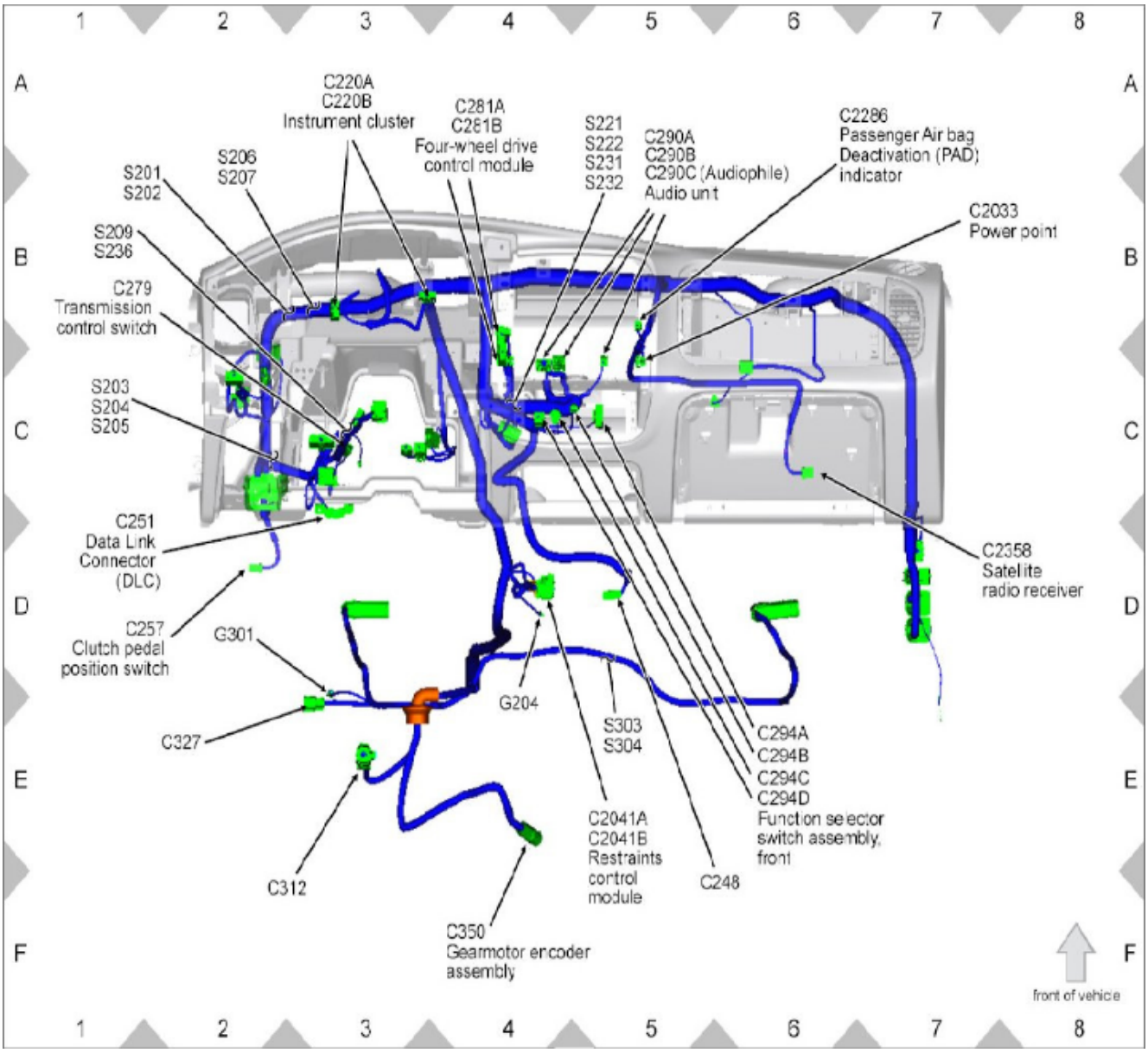
The BPP switch is sometimes referred to as the stoplamp switch. The BPP switch provides a signal to the PCM indicating that the brakes are applied. The BPP switch is normally open and is mounted on the brake pedal support. Depending on the vehicle application the BPP switch can be hardwired as follows:

- to the PCM supplying battery positive voltage (B+) when the vehicle brake pedal is applied.

- to the antilock brake system (ABS) module, or lighting control module (LCM), the BPP signal is then broadcast over the network to be received by the PCM.

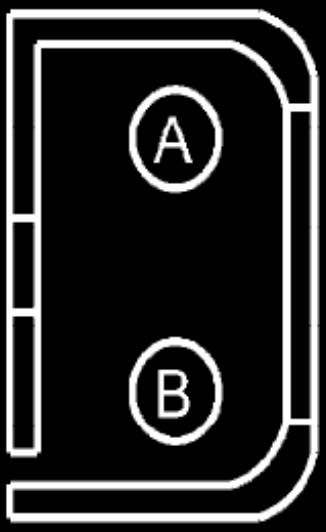
- to the ABS traction control/stability assist module. The ABS module interprets the BPP switch input along with other ABS inputs and generates an output called the driver brake application (DBA) signal. The DBA signal is then sent to the PCM and to other BPP signal users.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Transmission and Drivetrain > Transmission Control Systems > Sensors and Switches - Transmission and Drivetrain > Sensors and Switches - A/T > Transmission Mode Switch, A/T > Component Information > Locations



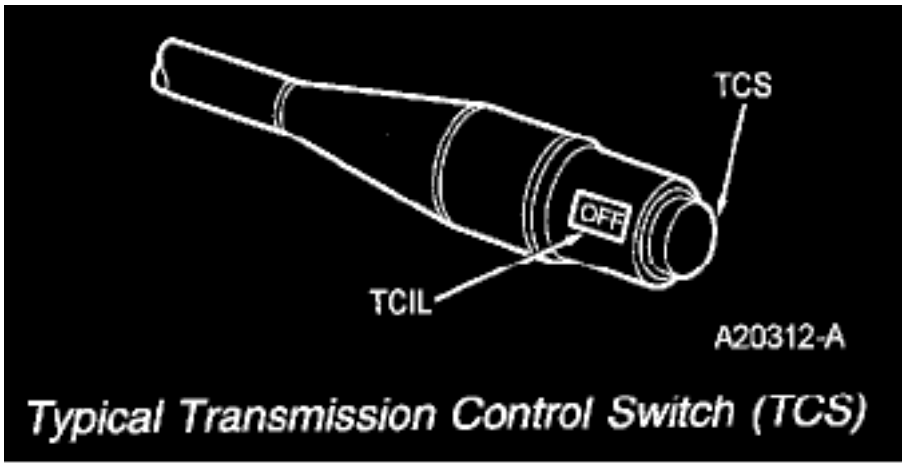
View 151-12

Connector: C279	Description:	Harness:	Base Part #:
	TRANSMISSION CONTROL SWITCH	14401	7G550

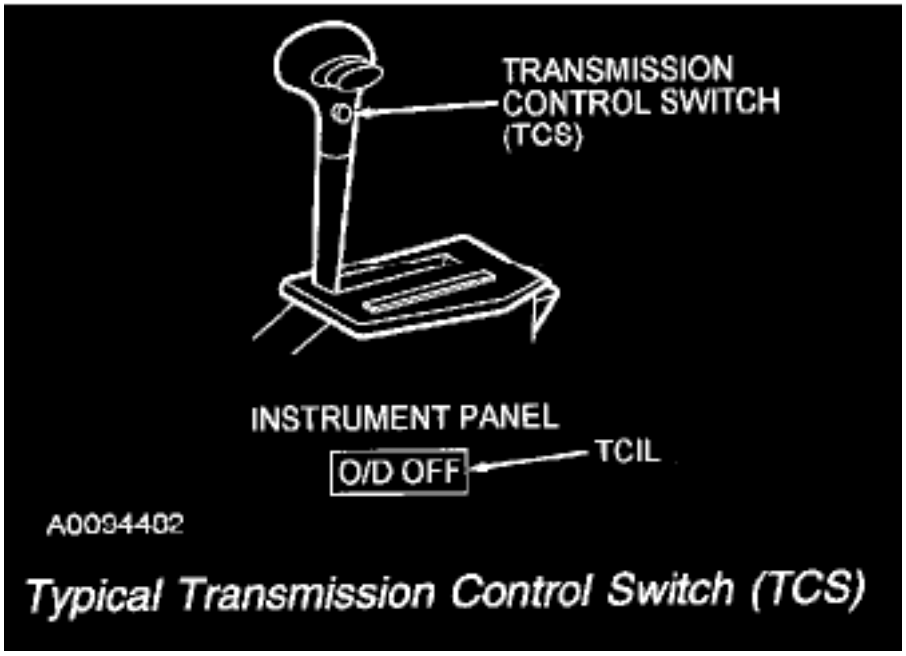


Pin	Circuit	Gauge	Circuit Function	Qualifier
A	CBP20 (YE-VT)	20	FUSE - 20 OR CIRCUIT BREAKER	
B	CE134 (BN-GN)	20	SWITCH - TRANSMISSION CONTROL/OVERDRIVE CANCEL (TCS)	

C279



Typical Transmission Control Switch (TCS)



Typical Transmission Control Switch (TCS)

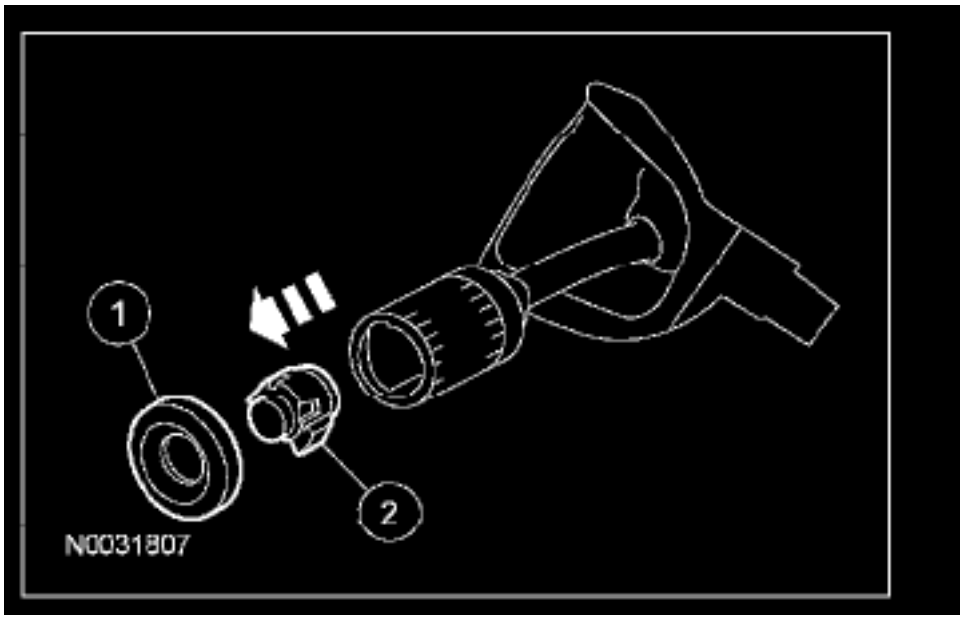
Transmission Mode Switch: Description and Operation

TRANSMISSION CONTROL SWITCH (TCS)

Typical Transmission Control Switch (TCS)

Typical Transmission Control Switch (TCS)

The TCS signals the PCM with VPWR whenever the TCS is pressed. On vehicles with this feature, the transmission control indicator lamp (TCIL) illuminates when the TCS is cycled to disengage overdrive.



Transmission Mode Switch: Service and Repair

Transmission Control (TC) Switch

Removal and Installation

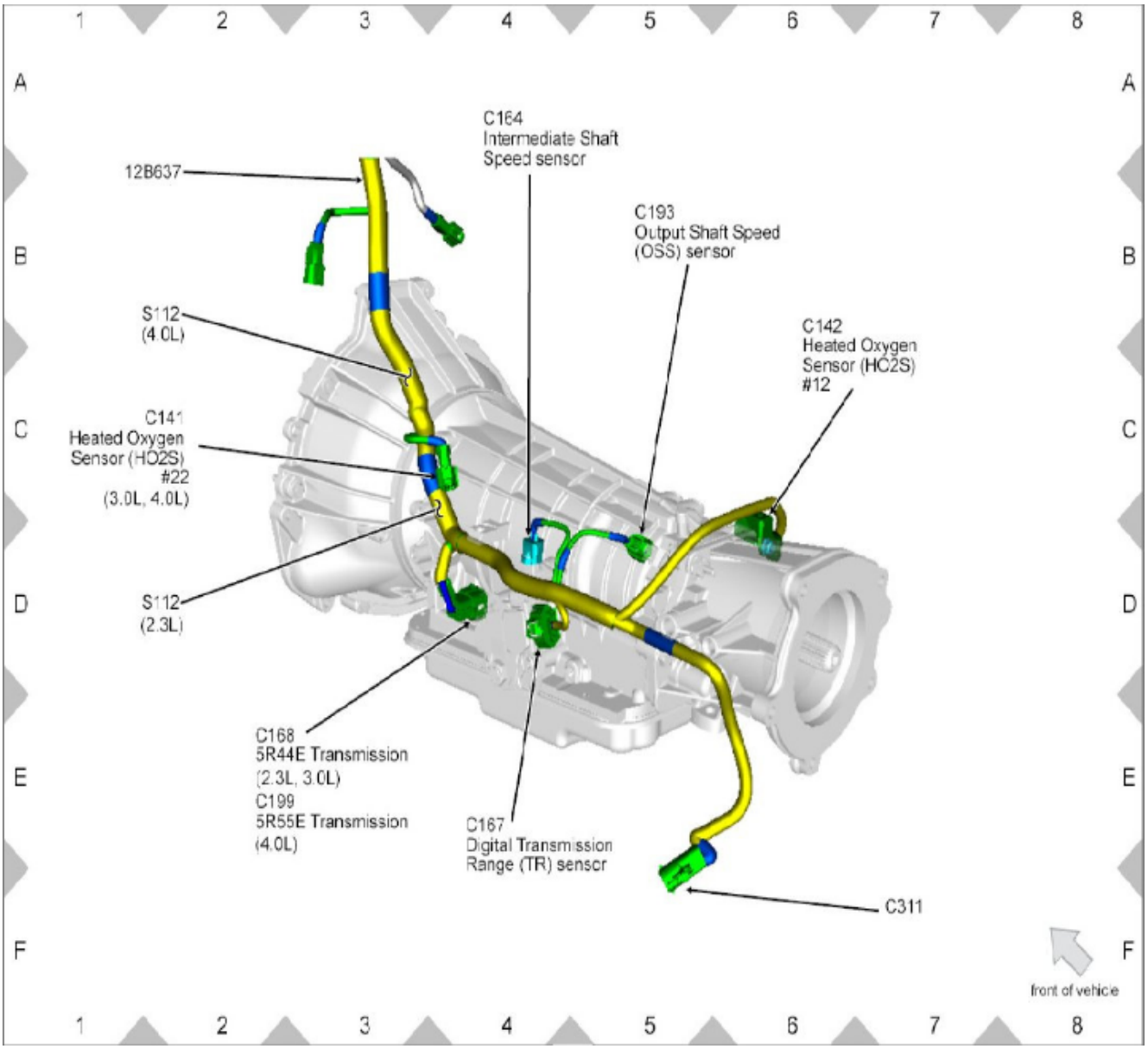
1. Remove the transmission control (TC) switch.

1 Remove the TC switch cover.

2 Remove the TC switch.

2. To install, reverse the removal procedure.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Transmission and Drivetrain > Transmission Control Systems > Sensors and Switches - Transmission and Drivetrain > Sensors and Switches - A/T > Transmission Position Switch/Sensor, A/T > Component Information > Locations



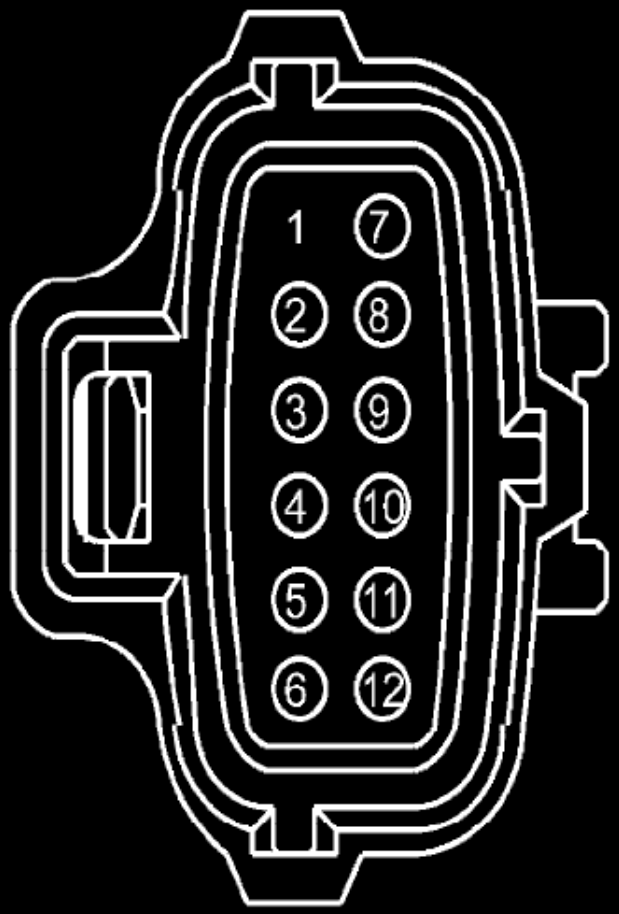
View 151-10

Connector: C167

Description: DIGITAL TRANSMISSION RANGE (TR) SENSOR

Harness: 12B637

Base Part #: 7F293



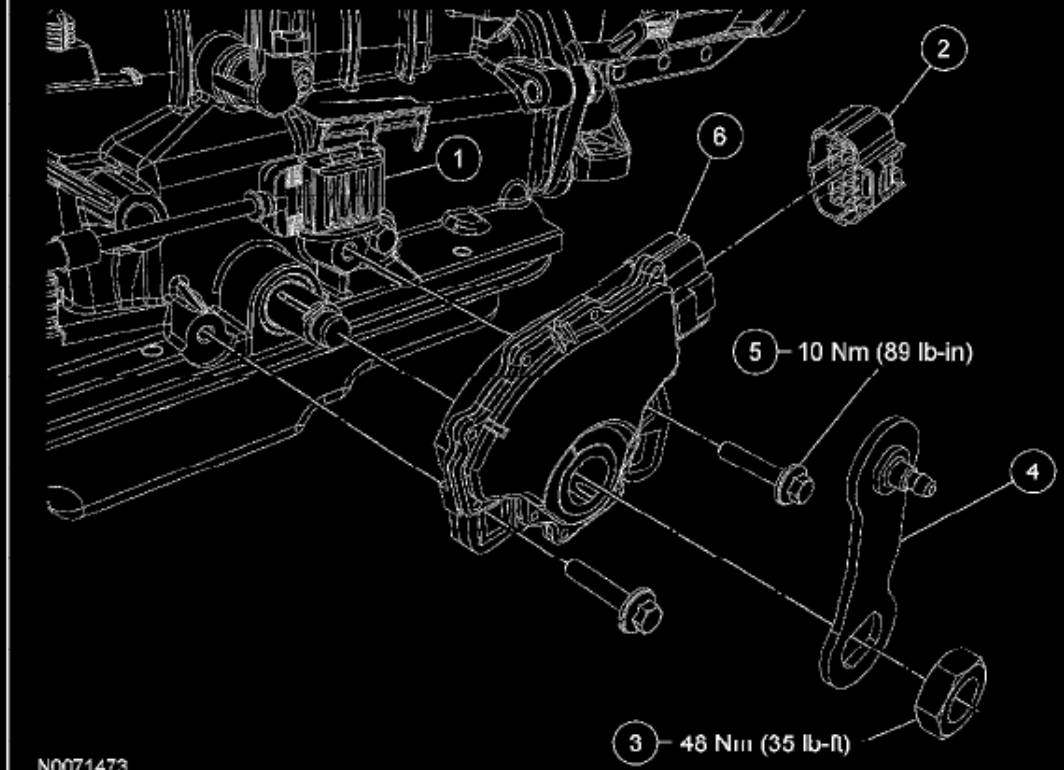
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	RE406 (GY-VT)	18	SIGNAL RETURN	
3	VET28 (GY-VT)	20	TR3A	
4	VET29 (VT-WH)	20	TR1	
5	VET30 (YE)	20	TR2	
6	VET31 (BU-OG)	20	TR4	
7	GD108 (BK-VT)	18	GROUND	4x4
8	CCF20 (GY-VT)	20	NETURAL SENSE	4x4
9	CBP20 (YE-VT)	18	FUSED POWER FEED	
10	CET40 (GN-OG)	20	STARTER CONTROL	
11	CET41 (BN-YE)	18	BACK UP	
12	CBP21 (BU-GY)	20	STARTER TO STARTER INTERRUPT RELAY	

C167

Special Tool(s)

ST1633-A	Alignment Gauge, TR Sensor 307-351 (T97L-70010-A)

Digital Transmission Range (TR) Sensor



Item	Part Number	Description
1	7E395-A	Selector lever cable
2	—	Digital transmission range (TR) sensor electrical connector
3	W701211-S	Manual control lever nut
4	7A256-A	Manual control lever
5	N806933-S	Digital TR sensor screw (2 required)
6	7F293-A	Digital TR sensor

Transmission Position Switch/Sensor: Service and Repair

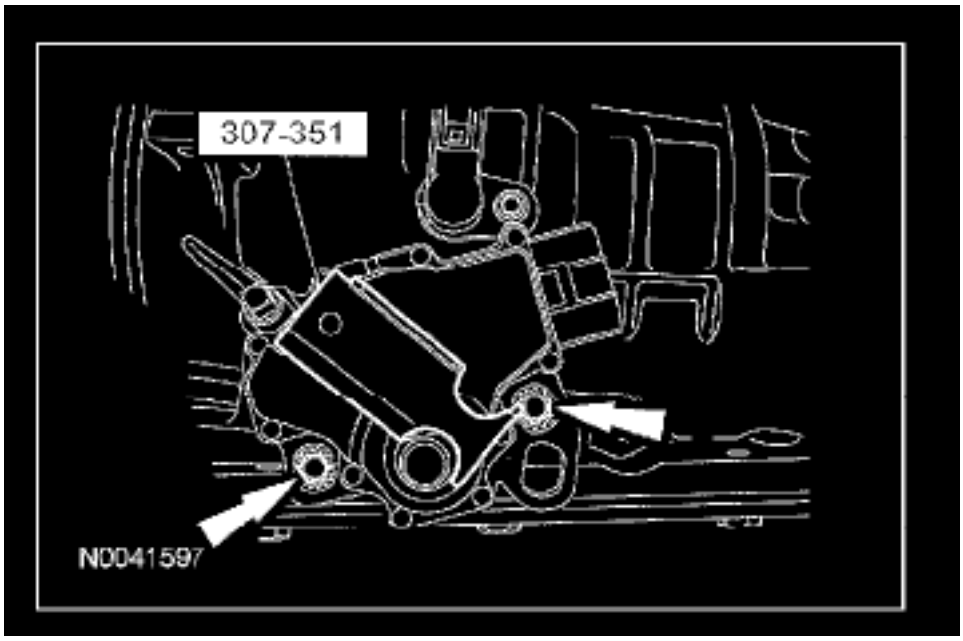
Digital Transmission Range (TR) Sensor

Digital Transmission Range (TR) Sensor

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the selector lever cable from the manual control lever. 3. Disconnect the digital transmission range (TR) sensor electrical connector. 4. Remove the manual control outer lever nut and manual control outer lever. 5. Remove the screws and the digital TR sensor.

Installation



1. CAUTION: The digital transmission range (TR) sensor must fit flush against the boss on the case to prevent damage to the sensor.

Install the digital TR sensor and loosely install the screws.

2. CAUTION: Tightening one screw before tightening the other may cause the sensor to bind or become damaged.

NOTE: The manual lever must be in the NEUTRAL position.

Using the special tool, align the digital TR sensor and tighten screws in an alternating sequence. ^

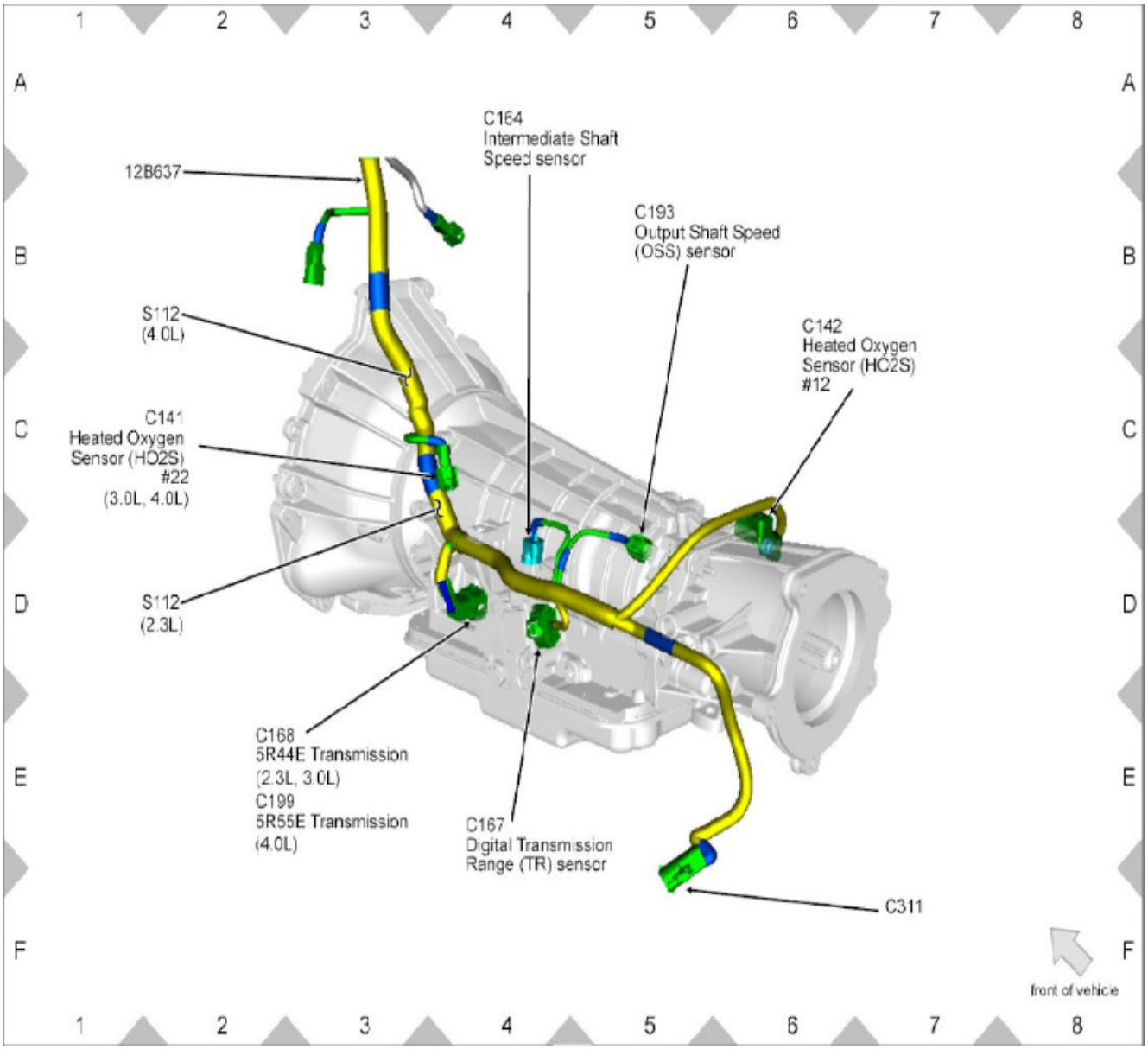
Tighten to 10 Nm (89 lb-inch).

3. Install the manual control outer lever and nut.

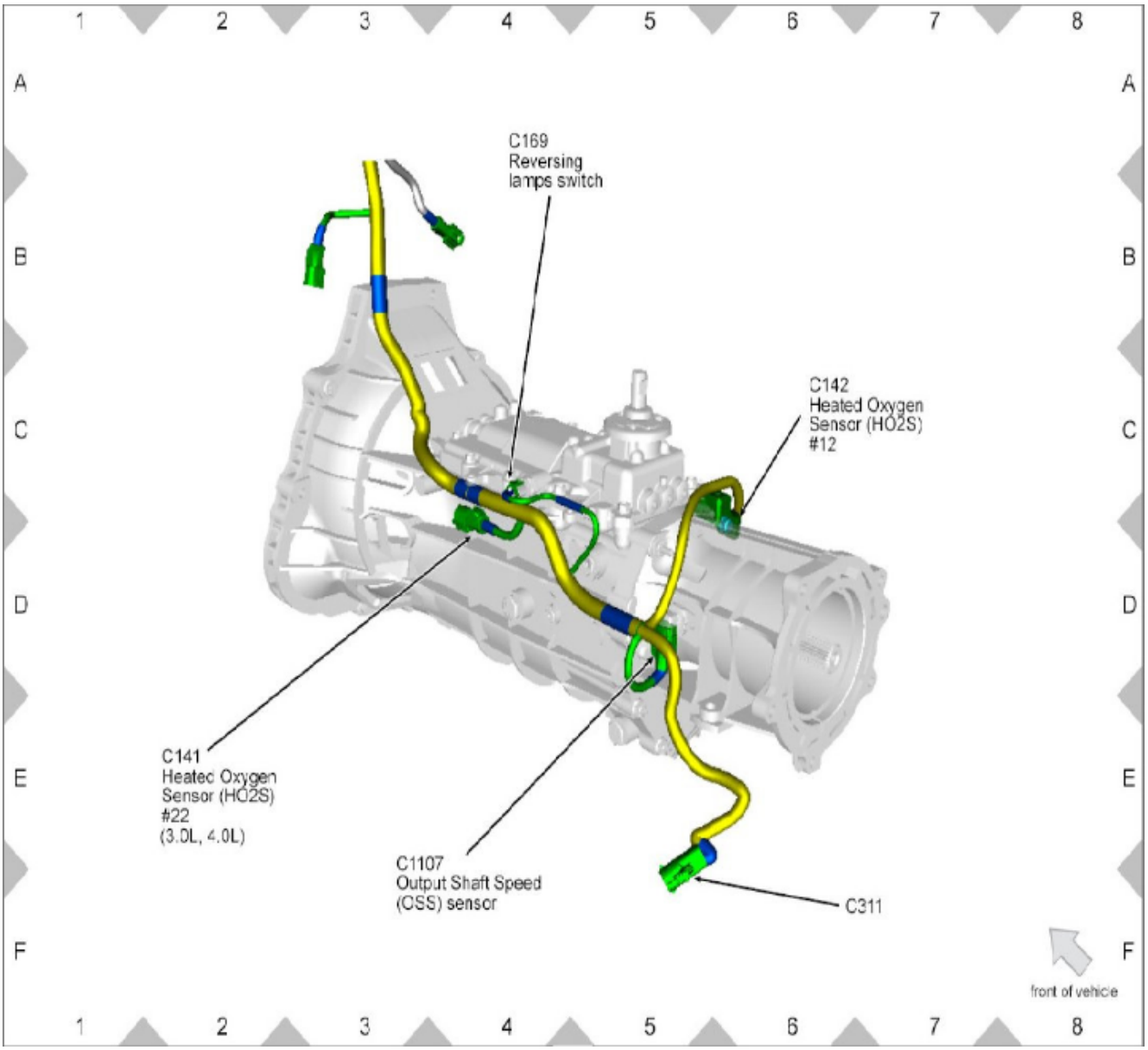
^ Tighten to 48 Nm (35 lb-ft).

4. Connect the digital TR sensor electrical connector. 5. Connect the selector lever cable to the manual control lever. 6. Verify that the selector lever cable is adjusted correctly.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Transmission and Drivetrain > Transmission Control Systems > Sensors and Switches - Transmission and Drivetrain > Sensors and Switches - A/T > Transmission Speed Sensor, A/T > Component Information > Locations > Intermediate Shaft Speed Sensor

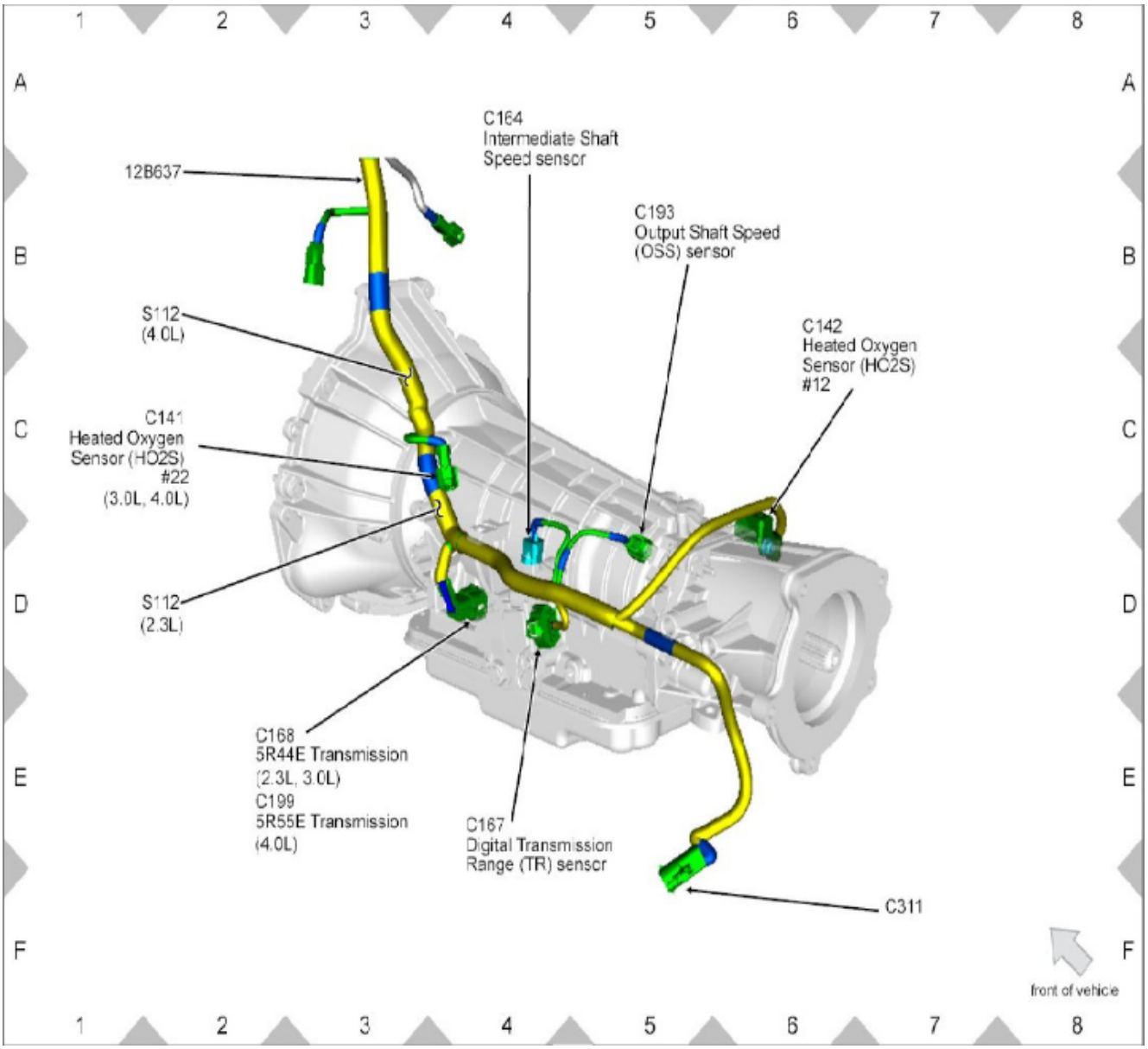


View 151-10

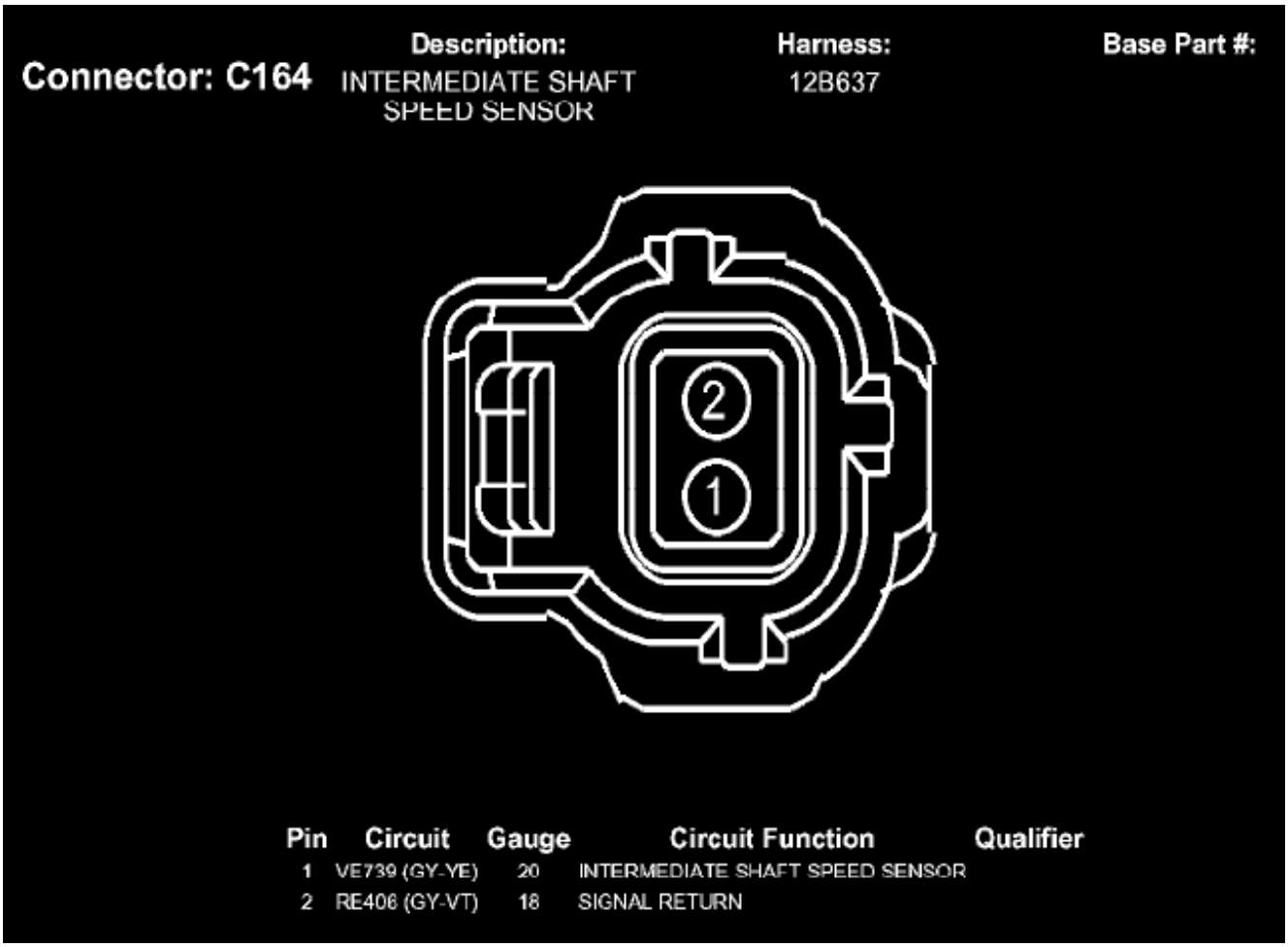


Transmission Speed Sensor: Locations Output Shaft Speed (OSS) Sensor

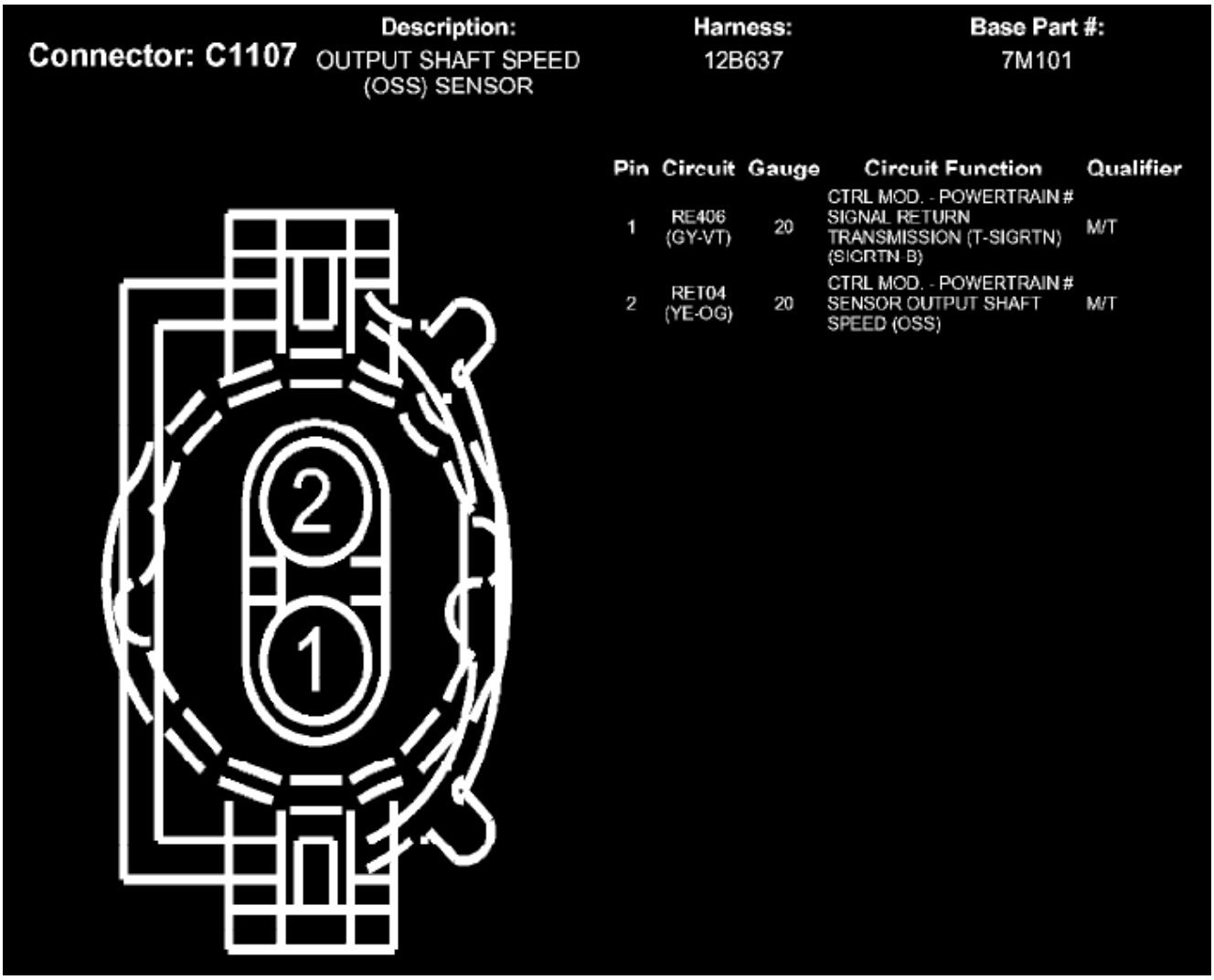
View 151-9


C164
Intermediate Shaft
Speed sensor
12B637
C193
Output Shaft Speed
(OSS) sensor
S112
(4.0L)
C142
Heated Oxygen
Sensor (HO2S)
#12
C141
Heated Oxygen
Sensor (HO2S)
#22
(3.0L, 4.0L)
S112
(2.3L)
C168
5R44E Transmission
(2.3L, 3.0L)
C199
5R55E Transmission
(4.0L)
C167
Digital Transmission
Range (TR) sensor
C311
front of vehicle

View 151-10


Connector: C164
Description:
INTERMEDIATE SHAFT SPEED SENSOR
Harness:
12B637
Base Part #:
2
1
Pin Circuit Gauge Circuit Function Qualifier
1 VE739 (GY-YE) 20 INTERMEDIATE SHAFT SPEED SENSOR
2 RE406 (GY-VT) 18 SIGNAL RETURN

C164

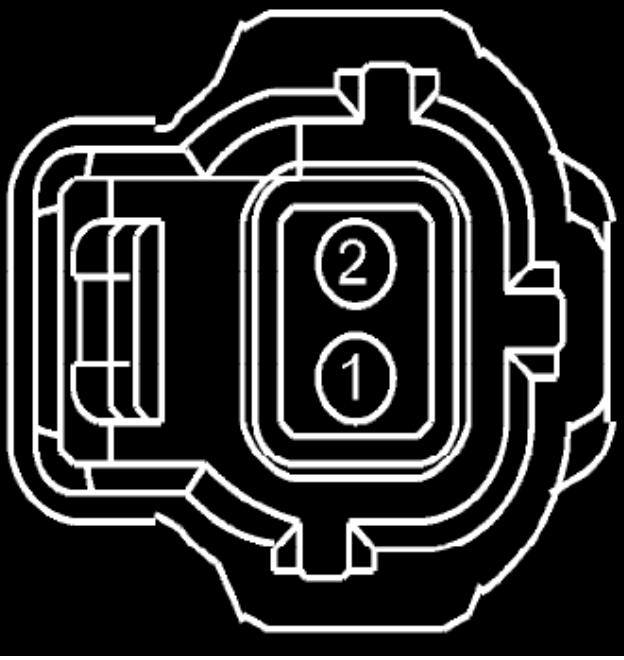


Transmission Speed Sensor: Diagrams Output Shaft Speed (OSS) Sensor

C1107

Connector: C193

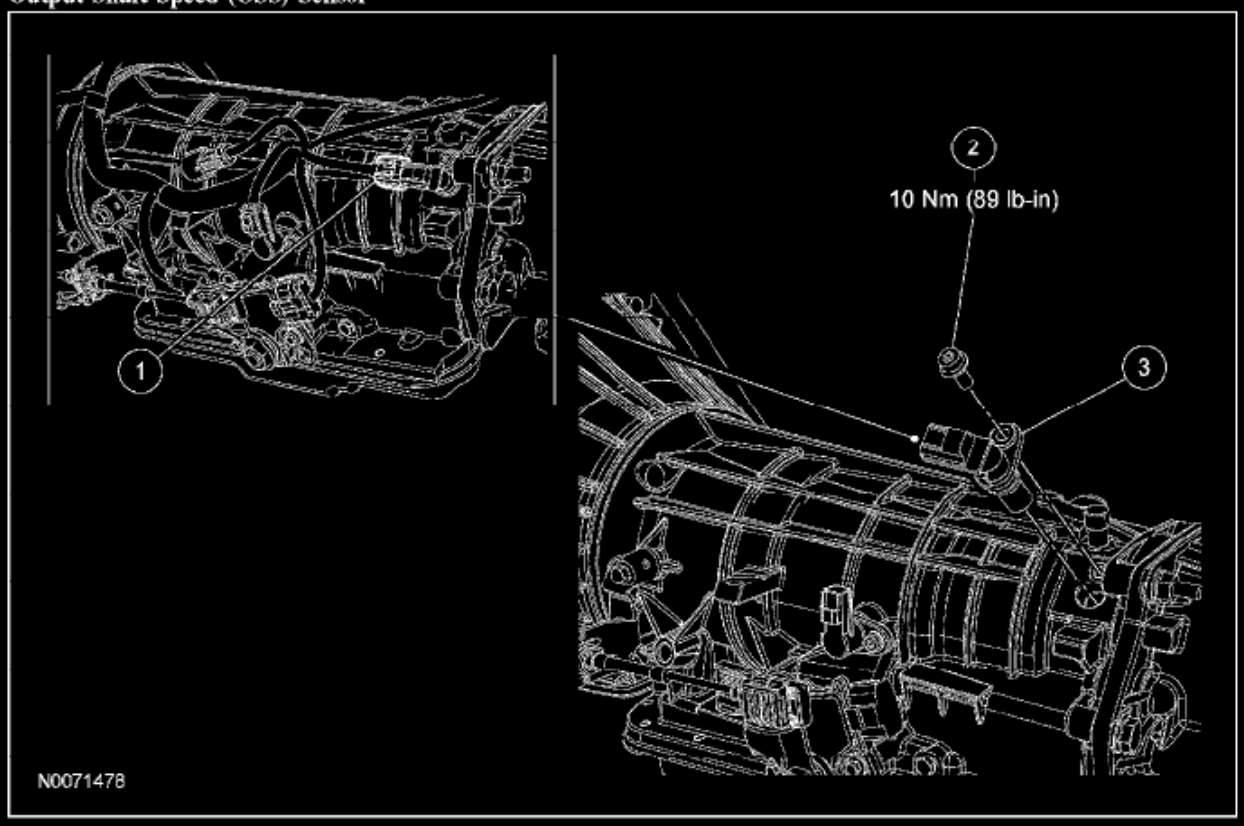
Description:	Harness:	Base Part #:
OUTPUT SHAFT SPEED (OSS) SENSOR	12B637	7H133



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RET04 (YE-OG)	20	OUTPUT SHAFT SPEED (OSS) SENSOR	A/T
2	RE406 (GY-VT)	18	SIGNAL RETURN	A/T

C193

Output Shaft Speed (OSS) Sensor



Item	Part Number	Description
1	—	Output shaft speed (OSS) sensor electrical connector
2	W702297-S	OSS sensor screw
3	7H103-B	OSS sensor

Transmission Speed Sensor: Service and Repair Output Shaft Speed (OSS) Sensor

Output Shaft Speed (OSS) Sensor

Output Shaft Speed (OSS) Sensor

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the output shaft speed (OSS) sensor electrical connector. 3. Remove the OSS sensor screw. 4. Remove the OSS sensor from the transmission.

Installation

1. NOTE: Inspect the OSS sensor O-ring for damage. If damaged, install a new O-ring Inspect and lubricate the O-ring with petroleum jelly.

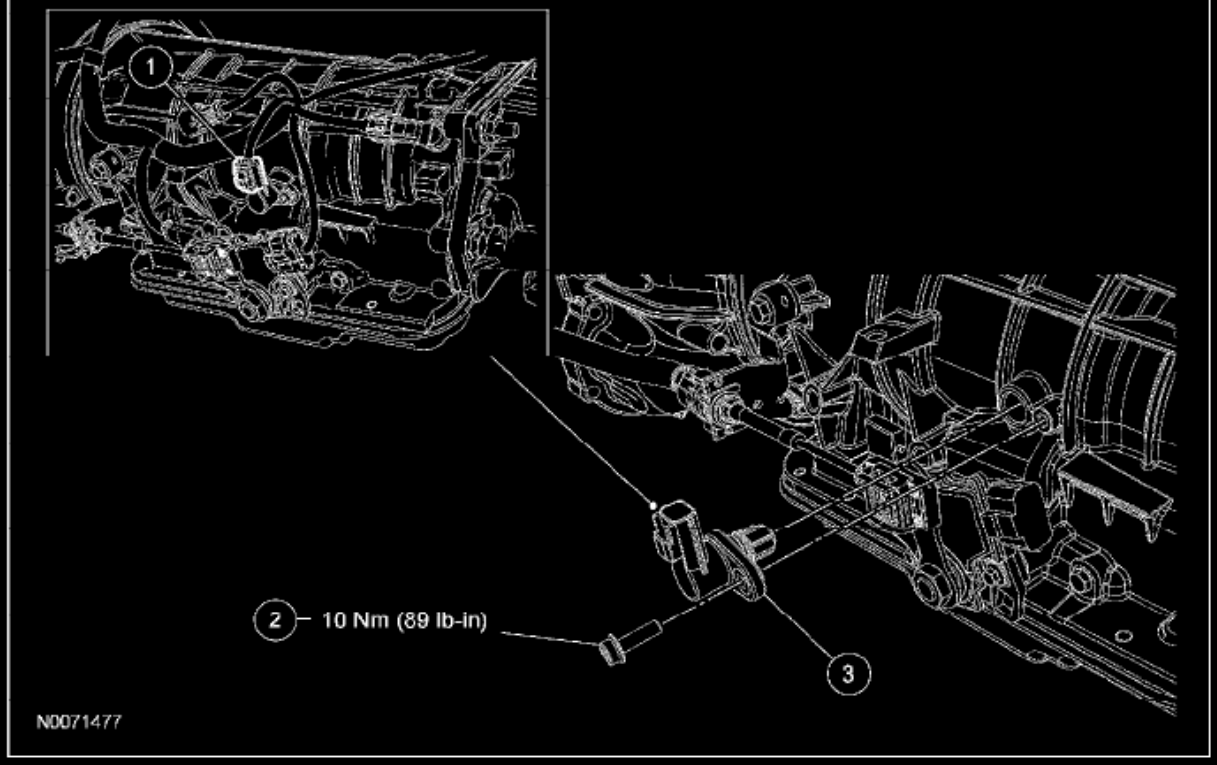
Install the OSS sensor into the transmission.

2. Install the OSS sensor screw.

^ Tighten to 10 Nm (89 lb-inch).

3. Connect the OSS sensor electrical connector.

Intermediate Shaft Speed Sensor



Item	Part Number	Description
1	—	Intermediate shaft speed sensor electrical connector
2	W702769-S	Intermediate shaft speed sensor screw
3	7M183-A	Intermediate shaft speed sensor

Transmission Speed Sensor: Service and Repair Intermediate Shaft Speed Sensor

Intermediate Shaft Speed Sensor

Intermediate Shaft Speed Sensor

Removal

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the intermediate shaft speed sensor electrical connector. 3. Remove the intermediate shaft speed sensor screw. 4. Remove the intermediate shaft speed sensor from the transmission.

Installation

1. NOTE: Inspect the intermediate shaft speed sensor O-ring for damage. If damaged, install a new O-ring

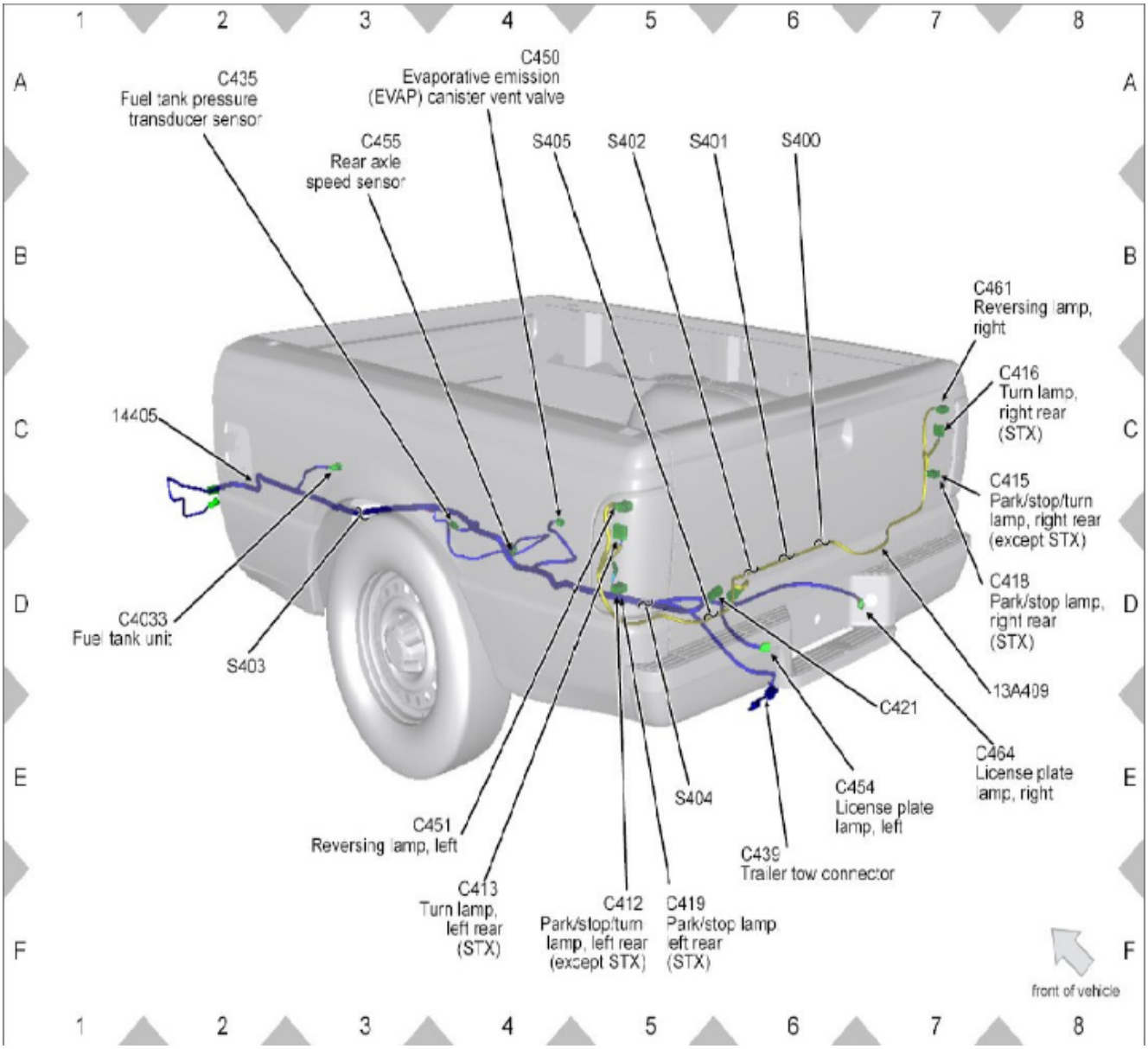
Inspect and lubricate the O-ring with petroleum jelly.

Install the intermediate shaft speed sensor into the transmission.

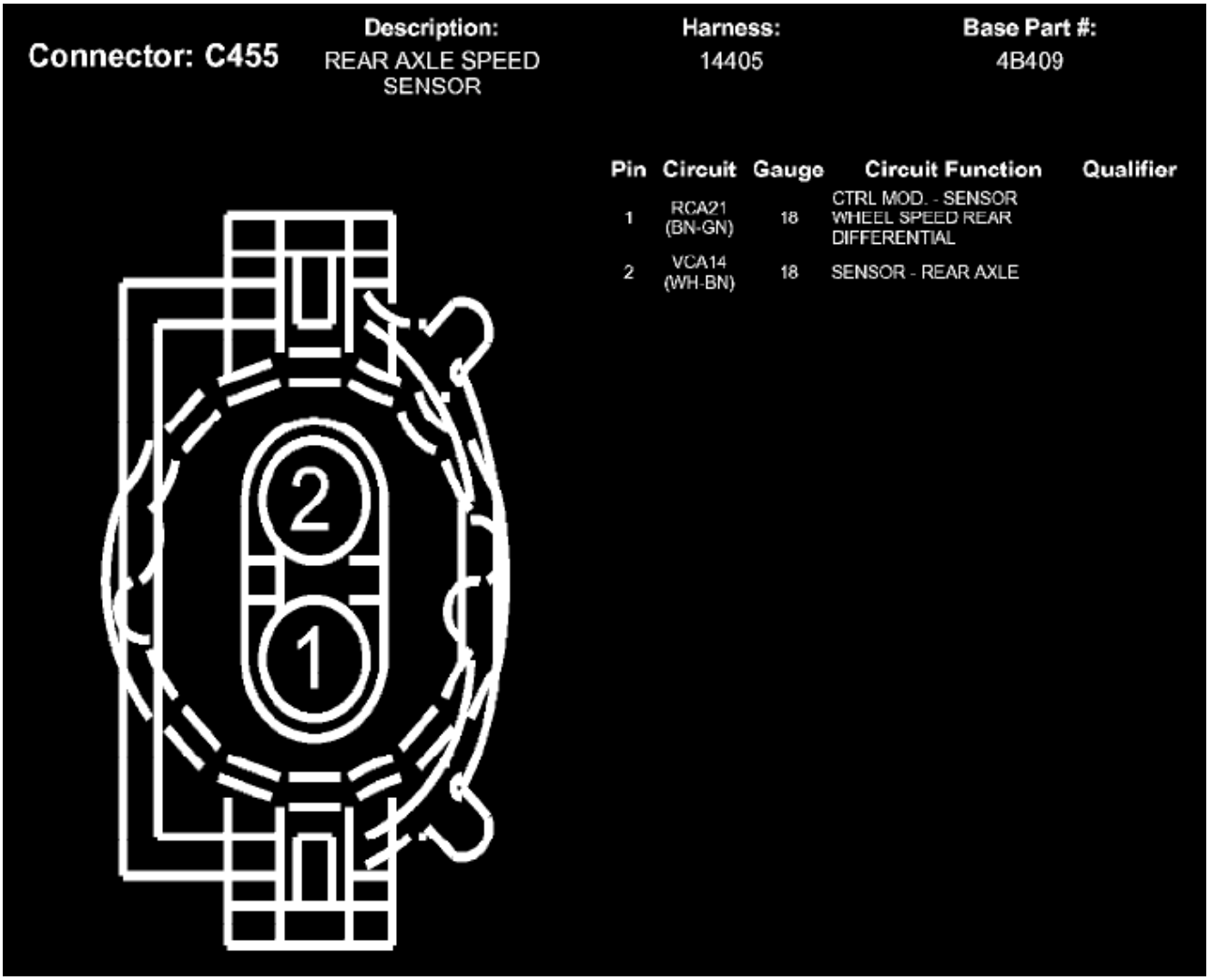
2. Install the intermediate shaft speed sensor screw.

^ Tighten to 10 Nm (89 lb-inch).

3. Connect the intermediate shaft speed sensor electrical connector. 4. Lower the vehicle.

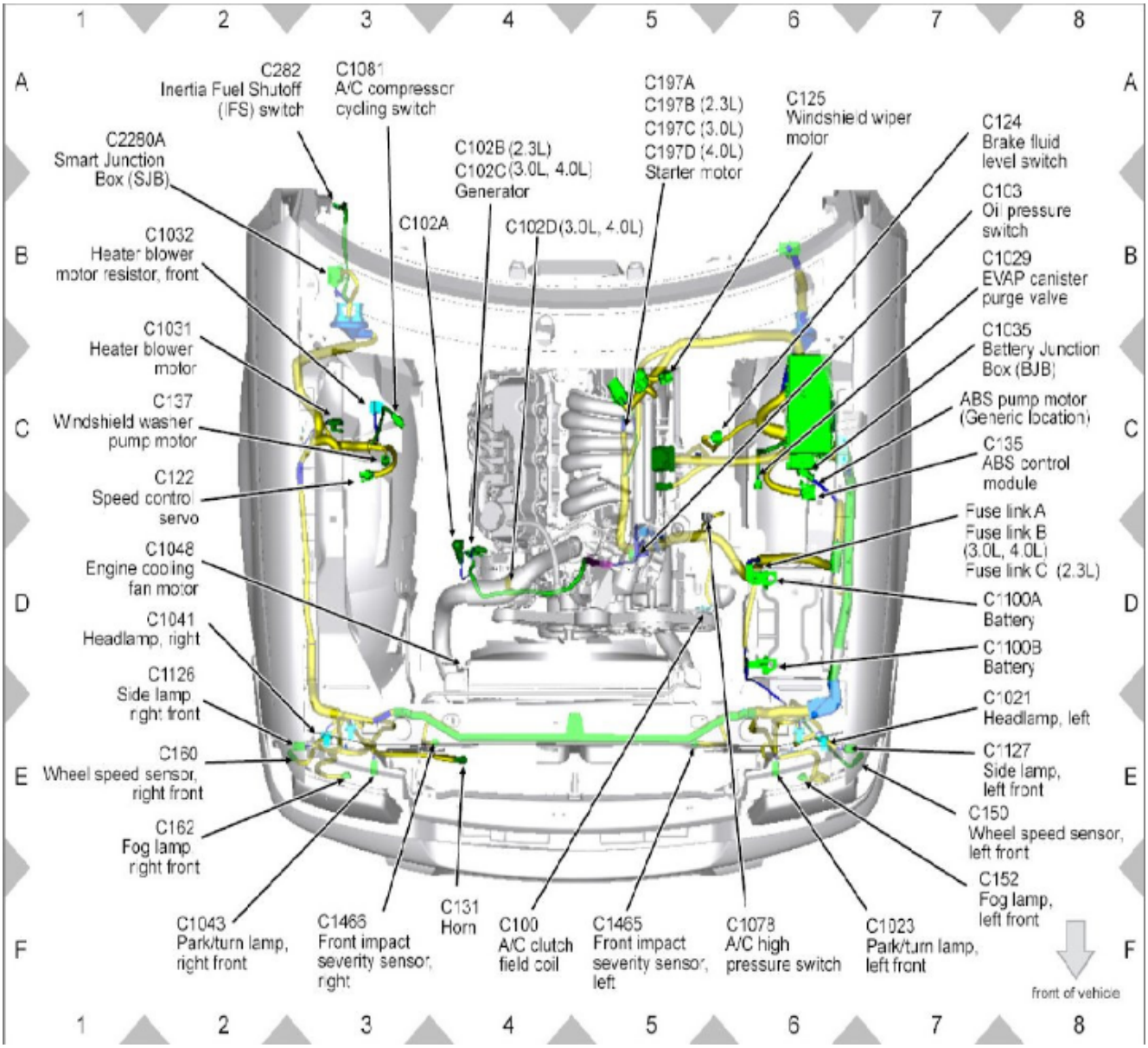

C435
Fuel tank pressure transducer sensor
C450
Evaporative emission (EVAP) canister vent valve
C455
Rear axle speed sensor
S405
S402
S401
S400
C461
Reversing lamp, right
C416
Turn lamp, right rear (STX)
14405
C415
Park/stop/turn lamp, right rear (except STX)
C4033
Fuel tank unit
S403
C418
Park/stop lamp, right rear (STX)
13A409
C421
C464
License plate lamp, right
C454
License plate lamp, left
S404
C451
Reversing lamp, left
C439
Trailer tow connector
C413
Turn lamp, left rear (STX)
C412
Park/stop/turn lamp, left rear (except STX)
C419
Park/stop lamp left rear (STX)
front of vehicle

View 151-27



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RCA21 (BN-GN)	18	CTRL MOD. - SENSOR WHEEL SPEED REAR DIFFERENTIAL	
2	VCA14 (WH-BN)	18	SENSOR - REAR AXLE	

C455


C282
Inertia Fuel Shutoff (IFS) switch
C1081
A/C compressor cycling switch
C2280A
Smart Junction Box (SJB)
C102B (2.3L)
C102C (3.0L, 4.0L)
Generator
C102A
C102D (3.0L, 4.0L)
C197A
C197B (2.3L)
C197C (3.0L)
C197D (4.0L)
Starter motor
C125
Windshield wiper motor
C124
Brake fluid level switch
C103
Oil pressure switch
C1032
Heater blower motor resistor, front
C1029
EVAP canister purge valve
C1031
Heater blower motor
C1035
Battery Junction Box (BJB)
C137
Windshield washer pump motor
ABS pump motor (Generic location)
C135
ABS control module
C122
Speed control servo
Fuse link A
Fuse link B (3.0L, 4.0L)
Fuse link C (2.3L)
C1048
Engine cooling fan motor
C1100A
Battery
C1100B
Battery
C1041
Headlamp, right
C1021
Headlamp, left
C1126
Side lamp right front
C1127
Side lamp, left front
C160
Wheel speed sensor, right front
C150
Wheel speed sensor, left front
C162
Fog lamp right front
C152
Fog lamp, left front
C1043
Park/turn lamp, right front
C1466
Front impact severity sensor, right
C131
Horn
C100
A/C clutch field coil
C1465
Front impact severity sensor, left
C1078
A/C high pressure switch
C1023
Park/turn lamp, left front
front of vehicle

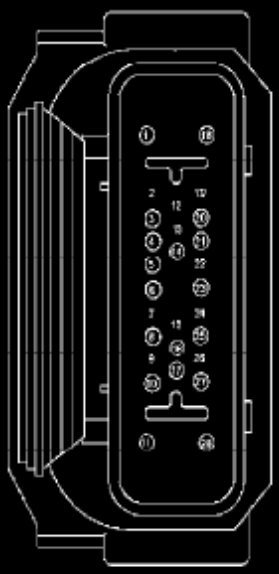
View 151-1

Connector: C135

Description: ABS CONTROL MODULE

Harness: 14290

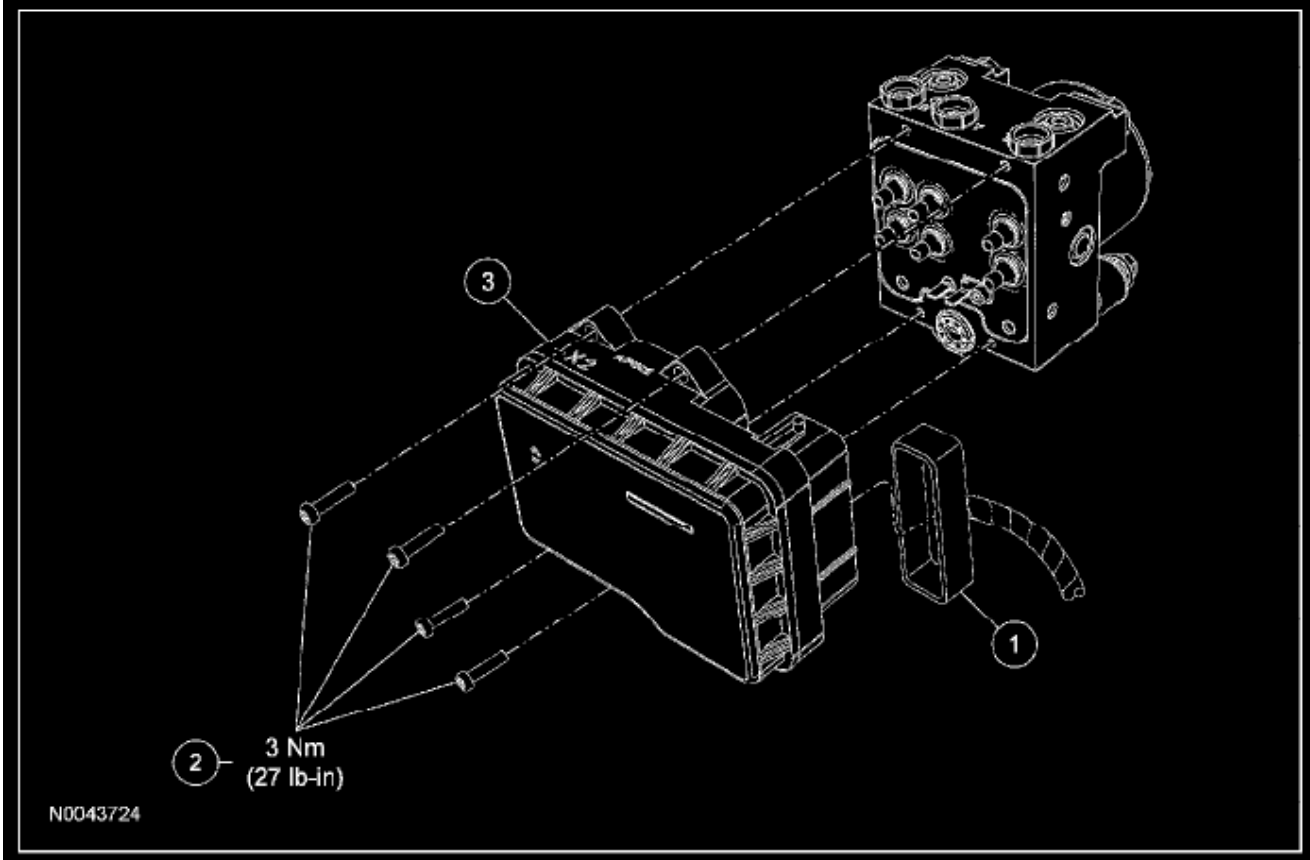
Base Part #: 2C219



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD122 (BK)	14	GROUND - FENDER FRONT LEFT # 3RD STUD	
2	*	*	not used	
3	VCA05 (GY-VT)	20	SENSOR - WHEEL SPEED RIGHT FRONT	
4	RCA19 (VT)	20	CTRL MOD. - SENSOR WHEEL SPEED RIGHT FRONT	
5	VCA03 (VT-WT)	20	SENSOR - WHEEL SPEED LEFT FRONT	
6	RCA17 (YE)	20	CTRL MOD. - SENSOR WHEEL SPEED LEFT FRONT	
7	*	*	not used	
8	CCB15 (BN-GN)	22	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL CLOSED	
9	*	*	not used	
10	CCF23 (GN-VT)	18	CTRL MOD. - POWERTRAIN # FOUR WHEEL DRIVE STATUS	
11	SBB15 (WH-RD)	14	FUSE - 15 OR CIRCUIT BREAKER	
12	*	*	not used	
13	*	*	not used	
14	RCA21 (BN-GN)	20	CTRL MOD. - SENSOR WHEEL SPEED REAR DIFFERENTIAL	
15	*	*	not used	
16	VDB10 (GY)	20	CONNECTOR - DIAGNOSTIC # K LINE ISO 9141	
17	CCA01 (BU-OG)	22	CTRL MOD. - INDICATOR WARNING ABS	
18	GD122 (BK)	14	GROUND - FENDER FRONT LEFT # 3RD STUD	
19	*	*	not used	
20	CBP20 (YE-VT)	20	FUSE - 20 OR CIRCUIT BREAKER	
21	VCA14 (WT-BN)	20	SENSOR - REAR AXLE	
22	*	*	not used	
23	RMC19 (YE-GY)	20	SWITCH - LOW LEVEL BRAKE FLUID (CONTINUITY CHECK)	
24	*	*	not used	
25	CMC19 (GY-VT)	20	SWITCH - LOW LEVEL BRAKE FLUID	
26	*	*	not used	
27	CCA02 (GN-VT)	22	CTRL MOD. - INDICATOR WARNING ELECTRONIC BRAKE DISTRIBUTION	
28	SBB17 (RD)	12	FUSE - 17 OR CIRCUIT BREAKER	

C135

Anti-Lock Brake System (ABS) Module



Item	Part Number	Description
1	—	ABS module electrical connector (part of 14290)
2	—	ABS module bolts (4 required) (part of 2C065)
3	2C065	ABS module

Electronic Brake Control Module: Service and Repair

Anti-Lock Brake System (ABS) Module

Anti-Lock Brake System (ABS) Module

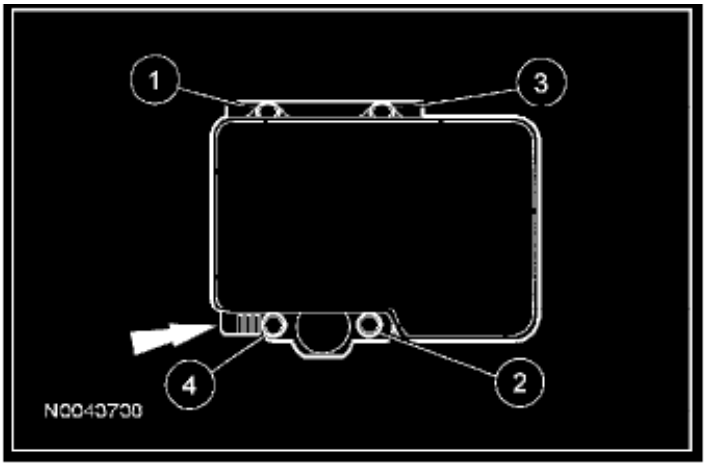
Removal and Installation

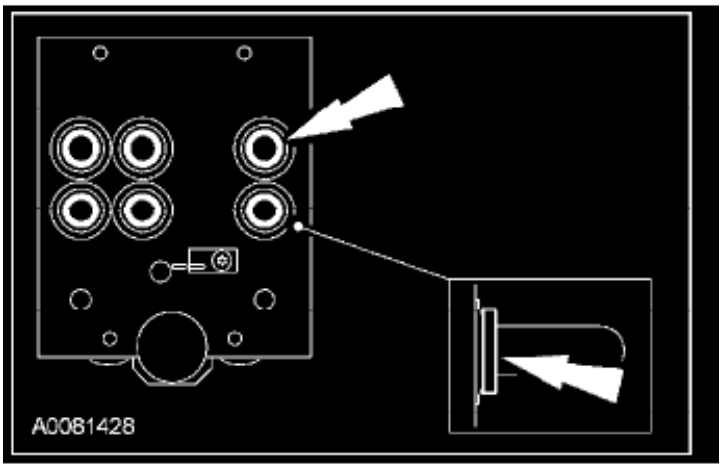
1. Remove the hydraulic control unit (HCU).

2. NOTE: The ABS module bolts must be removed and installed in the sequence shown.

Remove the 4 ABS module bolts in the sequence shown. ^

To install, tighten to 3 Nm (27 lb-inch).


1
3
4
2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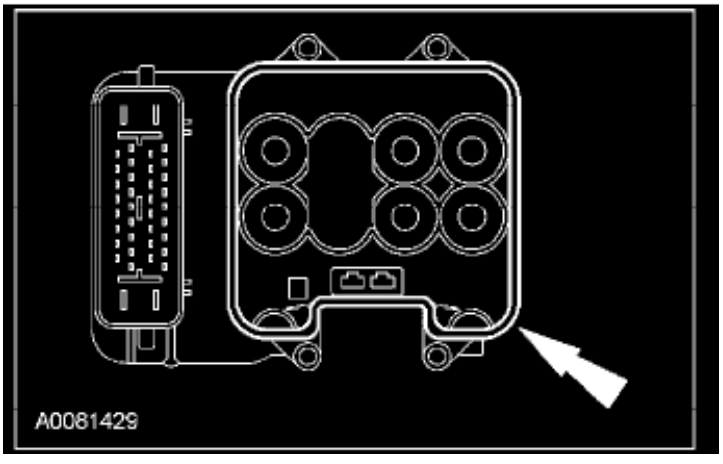

A0081429

3. CAUTION: When the anti-lock brake system (ABS) module is separated from the hydraulic control unit (HCU), the motor terminals and

the valve stems will be exposed. Protect the terminals and the valve stems from damage.

Remove the ABS module from the HCU.

4. Remove and discard the O-ring seals.

5. Remove and discard the ABS module seal.

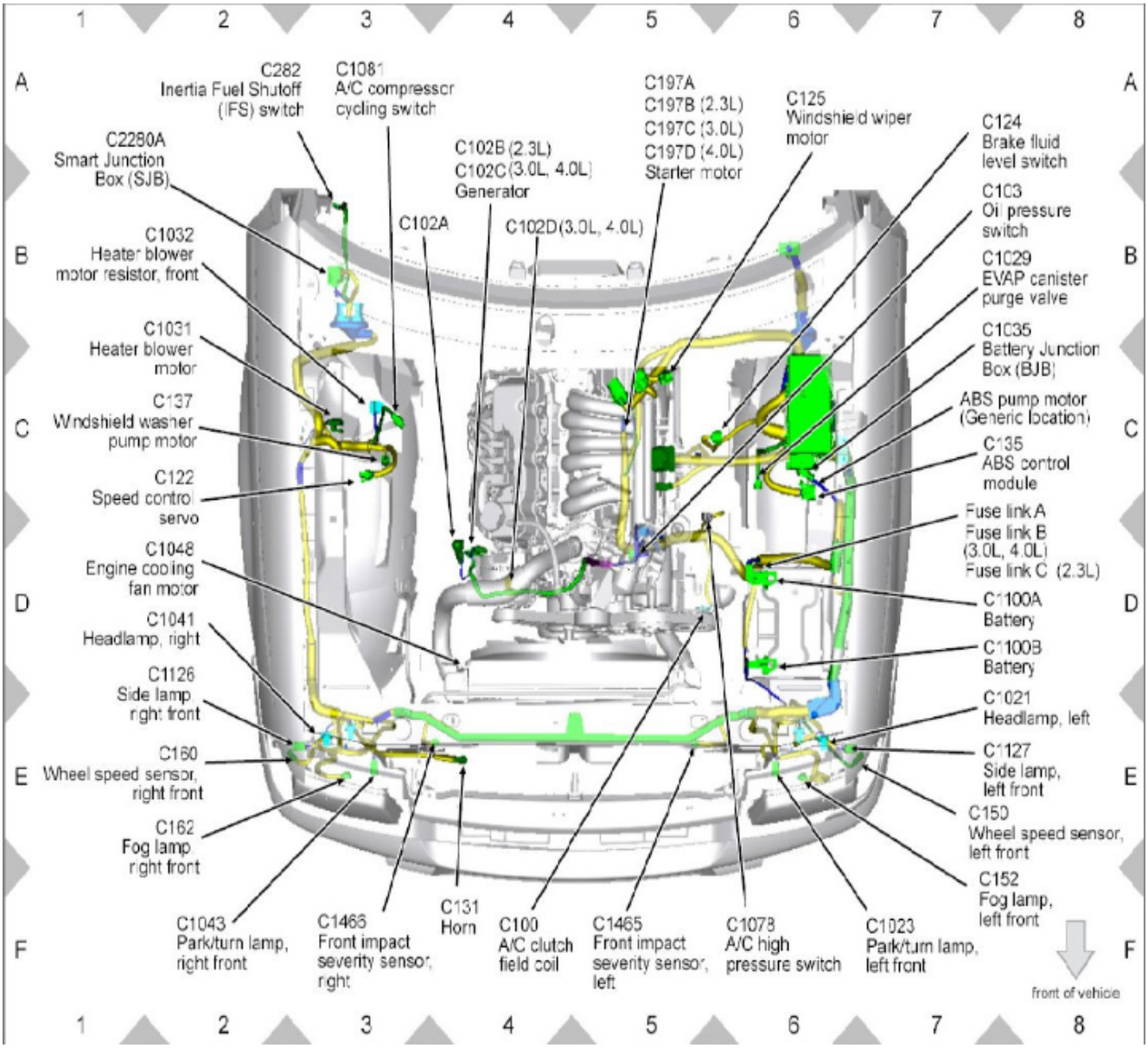
6. CAUTION: All components must be free of dust, oil, fluid and foreign material prior to installation. A new seal kit must be used when

installing the anti-lock brake system (ABS) module. The old seals must be discarded as they may cause a leak between the ABS module and the hydraulic control unit (HCU).

NOTE: The O-ring seals must be installed to the valve flange. Make sure the O-ring seals are not deformed when installed.

NOTE: Clean the groove of the ABS module before installing a new seal.

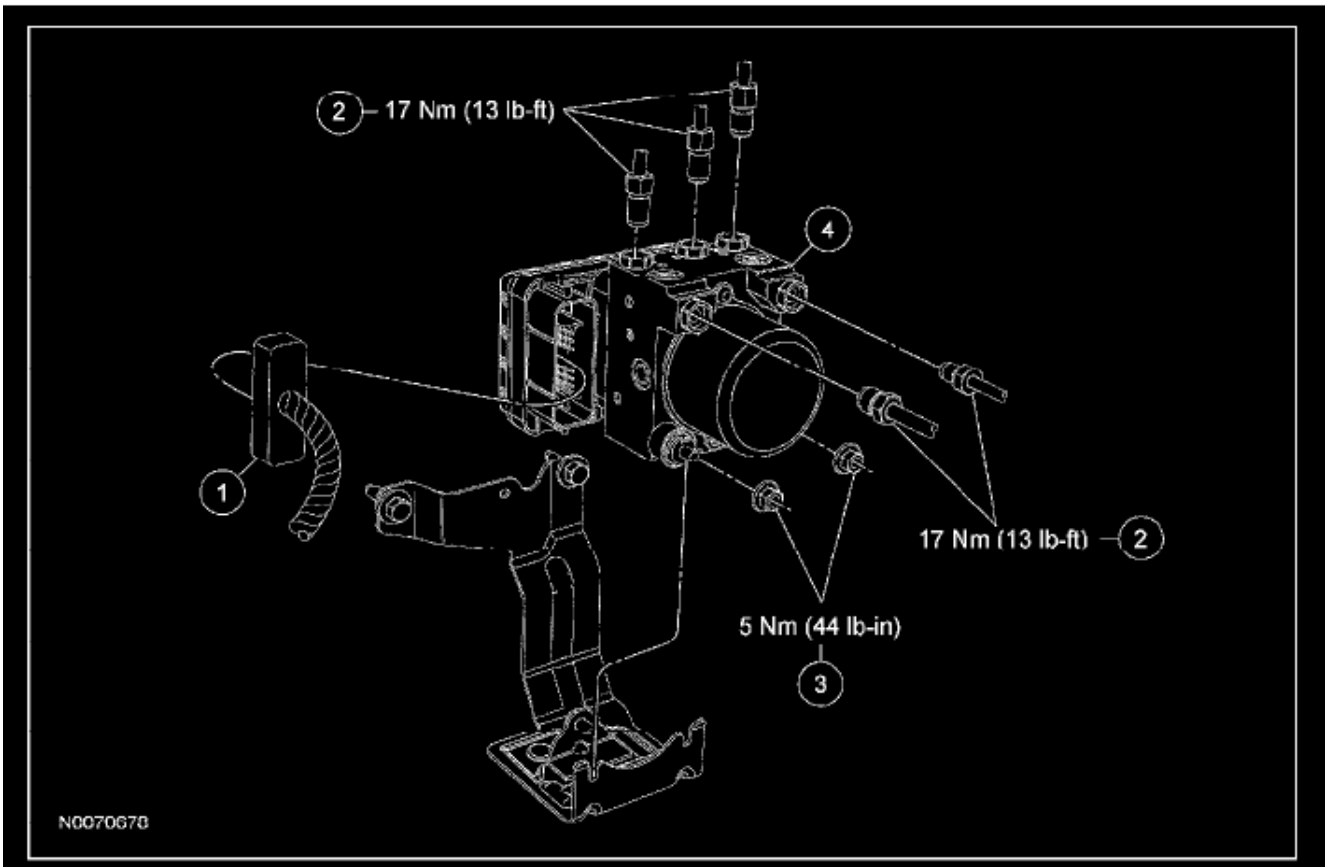
To install, reverse the removal procedure.


C282
Inertia Fuel Shutoff (IFS) switch
C1081
A/C compressor cycling switch
C2280A
Smart Junction Box (SJB)
C102B (2.3L)
C102C (3.0L, 4.0L)
Generator
C102A
C102D (3.0L, 4.0L)
C197A
C197B (2.3L)
C197C (3.0L)
C197D (4.0L)
Starter motor
C125
Windshield wiper motor
C124
Brake fluid level switch
C103
Oil pressure switch
C1032
Heater blower motor resistor, front
C1029
EVAP canister purge valve
C1031
Heater blower motor
C1035
Battery Junction Box (BJB)
C137
Windshield washer pump motor
ABS pump motor (Generic location)
C135
ABS control module
C122
Speed control servo
Fuse link A
Fuse link B (3.0L, 4.0L)
Fuse link C (2.3L)
C1048
Engine cooling fan motor
C1100A
Battery
C1100B
Battery
C1041
Headlamp, right
C1021
Headlamp, left
C1126
Side lamp right front
C1127
Side lamp, left front
C160
Wheel speed sensor, right front
C150
Wheel speed sensor, left front
C162
Fog lamp right front
C152
Fog lamp, left front
C1043
Park/turn lamp, right front
C1466
Front impact severity sensor, right
C131
Horn
C100
A/C clutch field coil
C1465
Front impact severity sensor, left
C1078
A/C high pressure switch
C1023
Park/turn lamp, left front
front of vehicle

View 151-1

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A



Item	Part Number	Description
1	—	ABS module electrical connector (part of 14290)
2	—	Hydraulic control unit (HCU) brake tube fittings (5 required) (part of 2B523)

Item	Part Number	Description
3	2C348	HCU-to-bracket nuts (2 required)
4	2C215	HCU

(Continued)

Hydraulic Control Assembly - Antilock Brakes: Service and Repair

Hydraulic Control Unit (HCU)

Removal and Installation

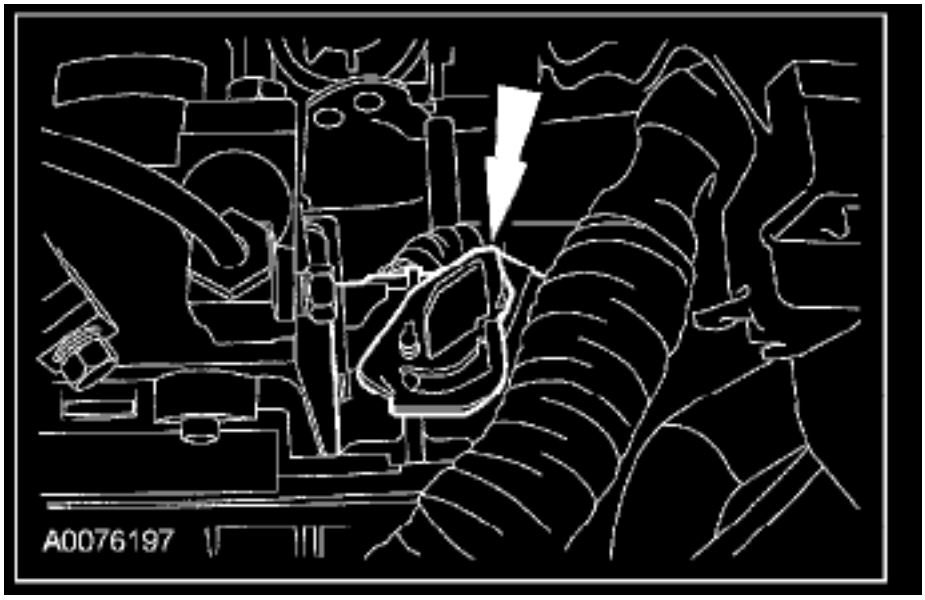
WARNING: Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal

injury.

WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

1. Disconnect the battery ground cable. 2. Disconnect the ABS module electrical connector by rotating the release lever.



3. NOTE: After disconnecting the hydraulic control unit (HCU) brake tube fittings, cap the holes in the HCU to prevent contamination or foreign

material from entering the brake tube ports.

Disconnect the 5 HCU brake tube fittings from the HCU. ^

To install, tighten to 17 Nm (13 lb-ft).

4. Remove the 2 HCU-to-bracket nuts and the HCU assembly.

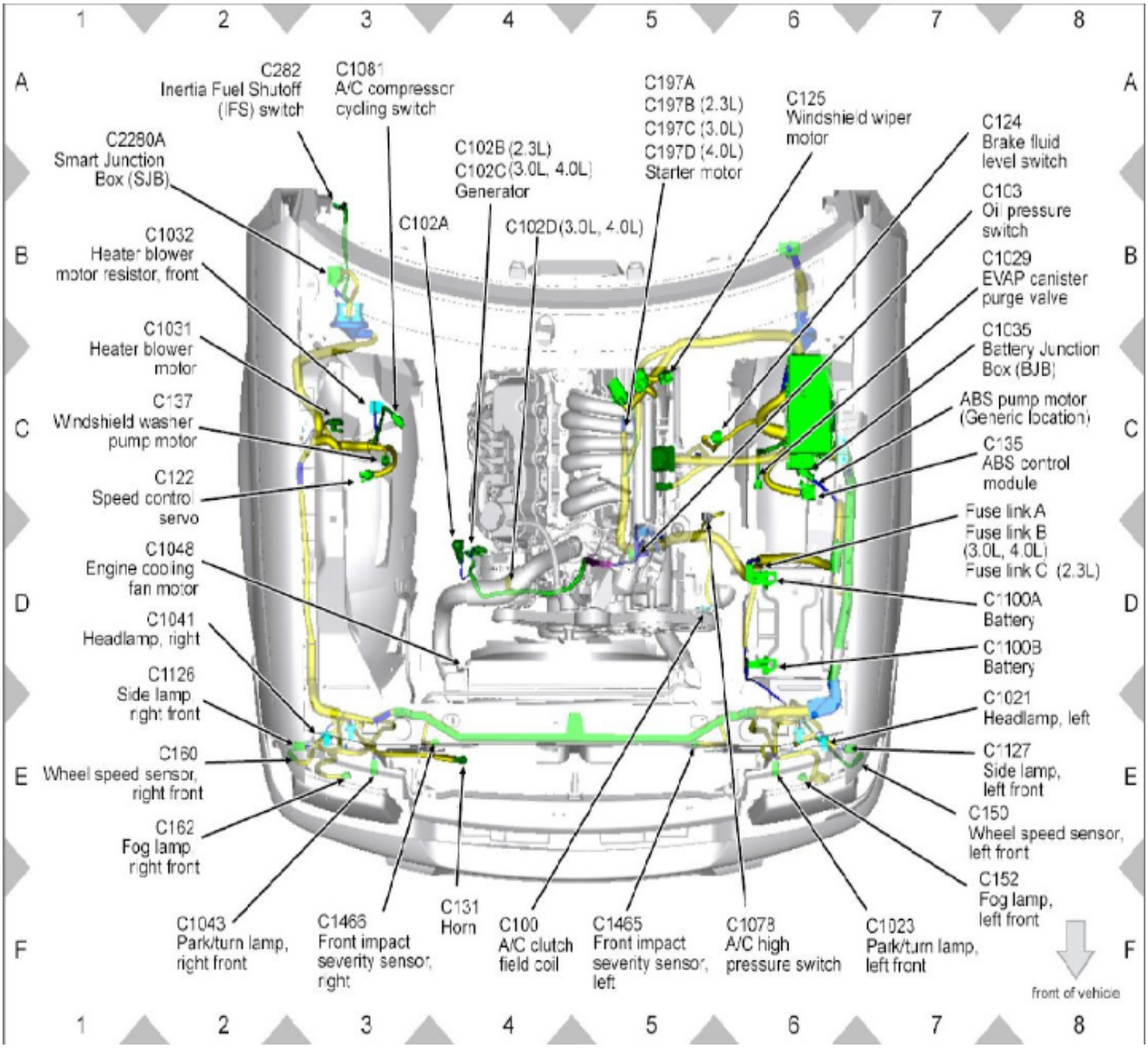
^ To install, tighten to 5 Nm (44 lb-inch).

5. If necessary, remove the 2 HCU bracket-to-frame nuts, the 2 HCU bracket-to-frame bolts and the HCU bracket.

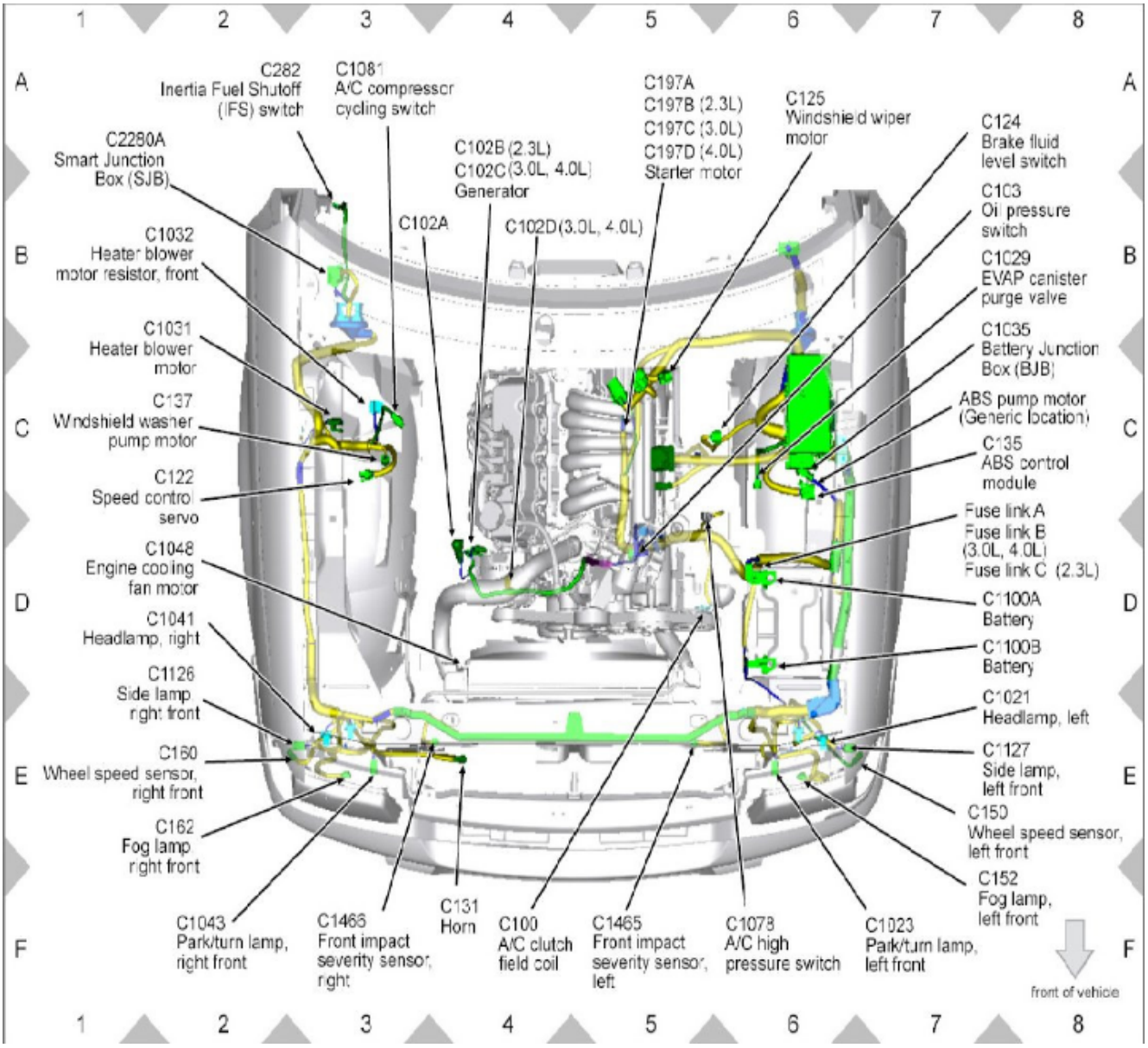
^ To install, tighten to 12 Nm (9 lb-ft).

6. To install, reverse the removal procedure. 7. Bleed the brake system.

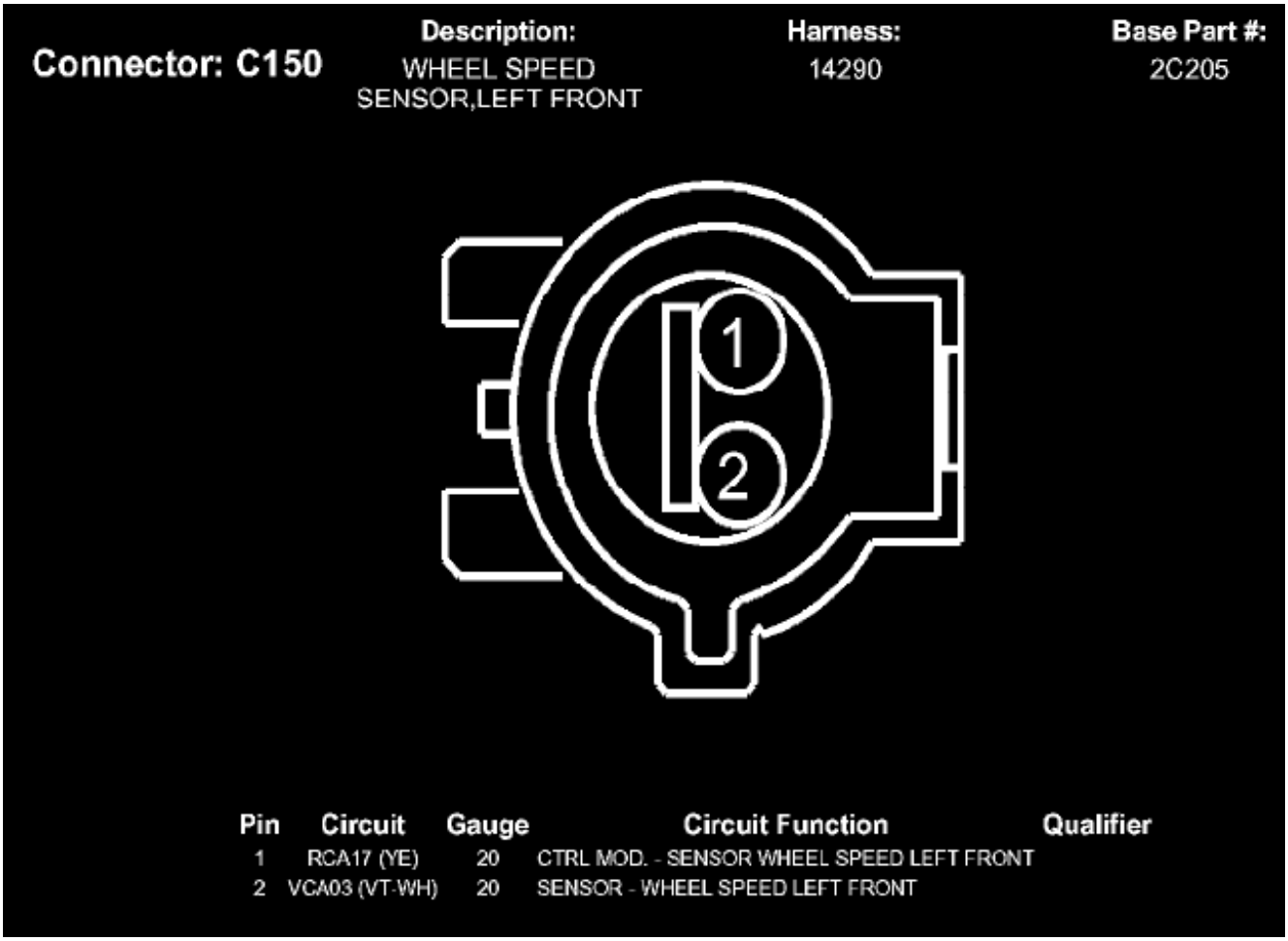
Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Brakes and Traction Control > Antilock Brakes / Traction Control Systems > Wheel Speed Sensor > Component Information > Locations > Wheel Speed Sensor, Right Front



View 151-1

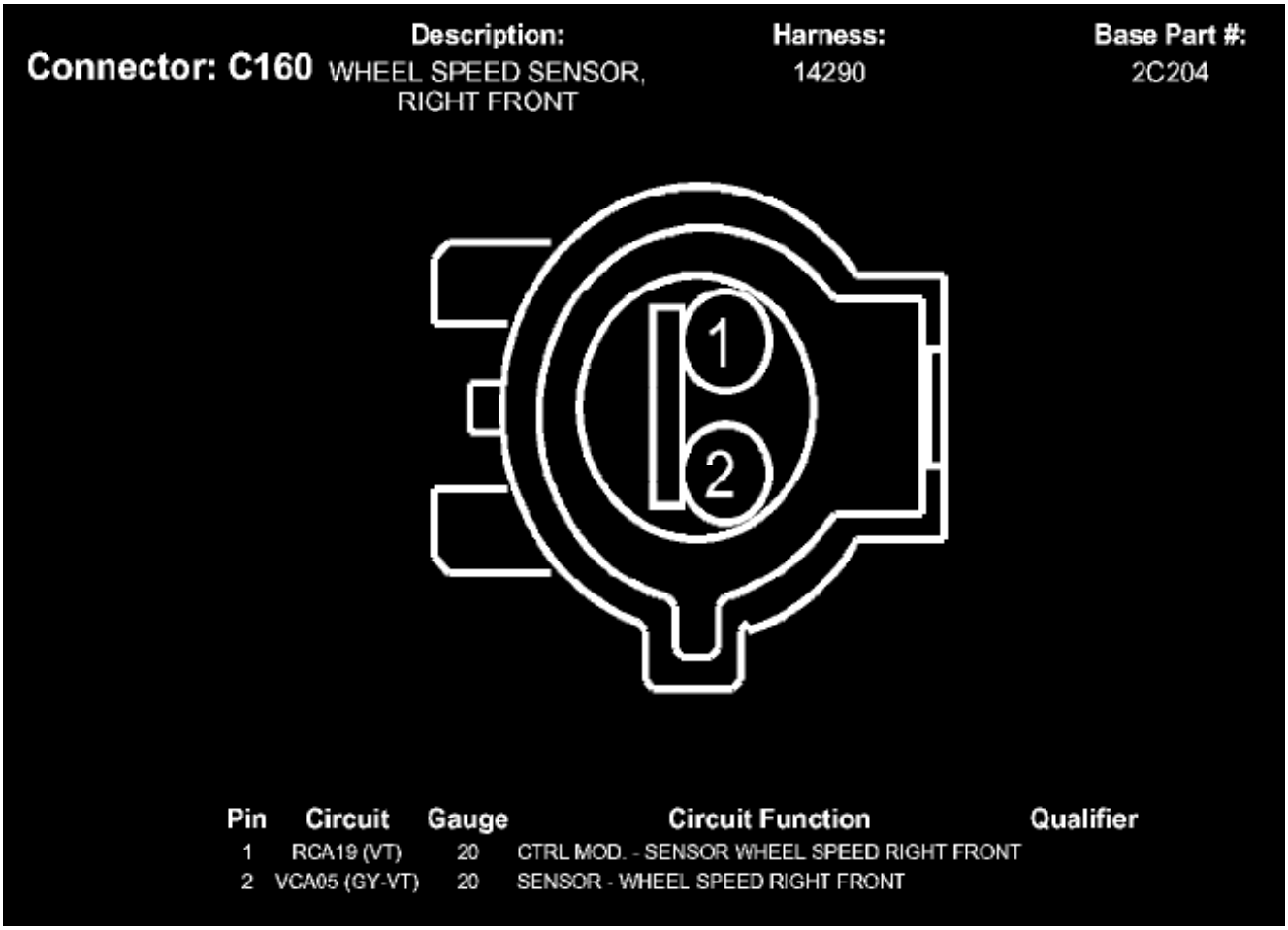

C282
Inertia Fuel Shutoff (IFS) switch
C1081
A/C compressor cycling switch
C2280A
Smart Junction Box (SJB)
C102B (2.3L)
C102C (3.0L, 4.0L)
Generator
C102A
C102D (3.0L, 4.0L)
C197A
C197B (2.3L)
C197C (3.0L)
C197D (4.0L)
Starter motor
C125
Windshield wiper motor
C124
Brake fluid level switch
C103
Oil pressure switch
C1032
Heater blower motor resistor, front
C1029
EVAP canister purge valve
C1031
Heater blower motor
C1035
Battery Junction Box (BJB)
C137
Windshield washer pump motor
ABS pump motor (Generic location)
C135
ABS control module
C122
Speed control servo
Fuse link A
Fuse link B (3.0L, 4.0L)
Fuse link C (2.3L)
C1048
Engine cooling fan motor
C1100A
Battery
C1041
Headlamp, right
C1100B
Battery
C1126
Side lamp, right front
C1021
Headlamp, left
C160
Wheel speed sensor, right front
C1127
Side lamp, left front
C162
Fog lamp, right front
C150
Wheel speed sensor, left front
C152
Fog lamp, left front
C1043
Park/turn lamp, right front
C1466
Front impact severity sensor, right
C131
Horn
C100
A/C clutch field coil
C1465
Front impact severity sensor, left
C1078
A/C high pressure switch
C1023
Park/turn lamp, left front
front of vehicle

View 151-1



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RCA17 (YE)	20	CTRL MOD. - SENSOR WHEEL SPEED LEFT FRONT	
2	VCA03 (VT-WH)	20	SENSOR - WHEEL SPEED LEFT FRONT	

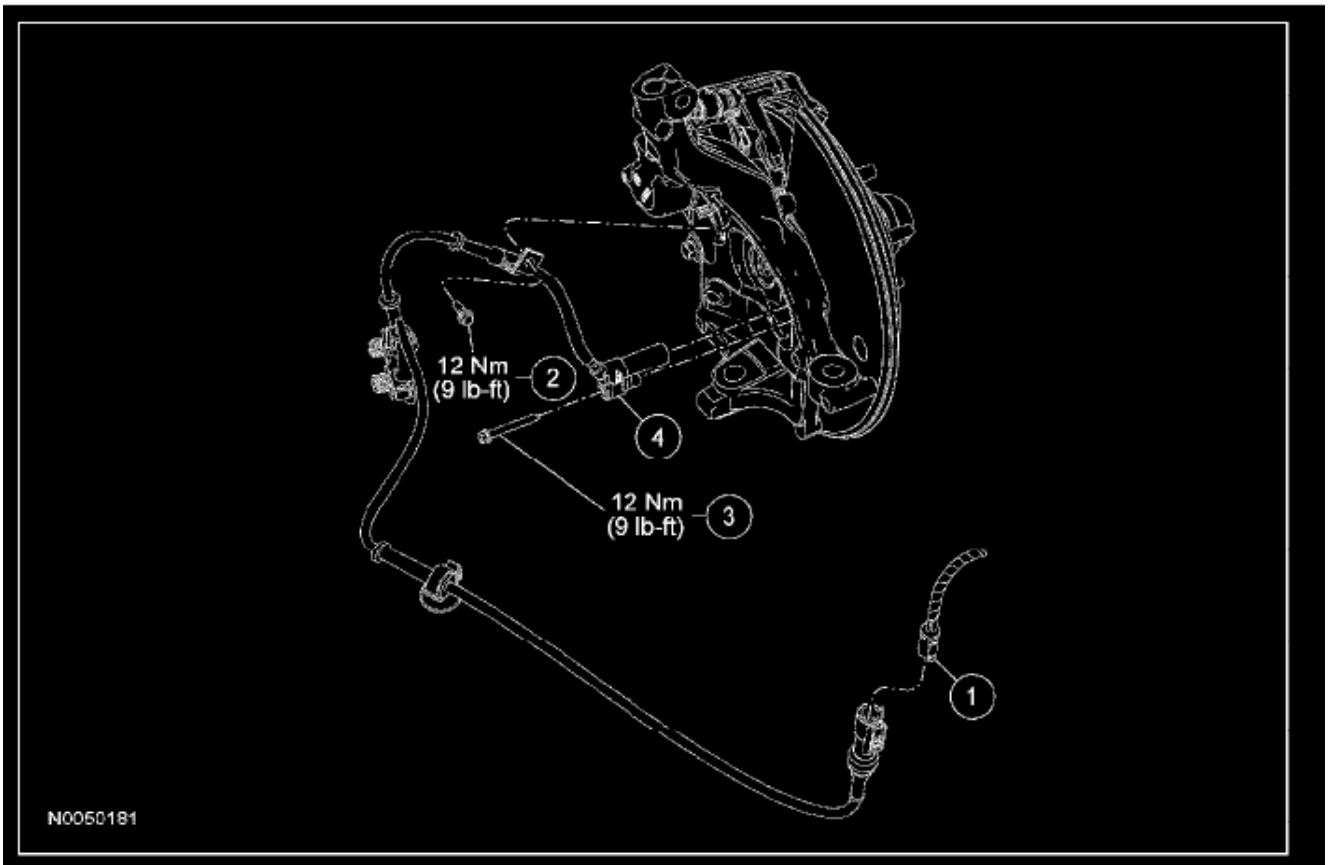
C150


Description:
Connector: C160 WHEEL SPEED SENSOR, RIGHT FRONT
Harness:
14290
Base Part #:
2C204
1
2
Pin Circuit Gauge Circuit Function Qualifier
1 RCA19 (VT) 20 CTRL MOD. - SENSOR WHEEL SPEED RIGHT FRONT
2 VCA05 (GY-VT) 20 SENSOR - WHEEL SPEED RIGHT FRONT

C160

Material

Item	Specification
High Temperature 4x4 Front Axle and Wheel Bearing Grease E8TZ-19590-A	WSS-M1C267-A1



Item	Part Number	Description
1	—	Wheel speed sensor electrical connector (part of 14290)
2	N611171	Wheel speed sensor harness bolt
3	N811177	Wheel speed sensor bolt
4	2C204	Wheel speed sensor

Wheel Speed Sensor: Service and Repair Wheel Speed Sensor - Front

Wheel Speed Sensor - Front, Rear Wheel Drive (RWD)

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the wheel speed sensor electrical connector. 3. Remove the wheel speed sensor harness bolt and unclip the retainers.

^ To install, tighten to 12 Nm (9 lb-ft).

4. Remove the wheel speed sensor bolt and the wheel speed sensor.

^ To install, tighten to 12 Nm (9 lb-ft).

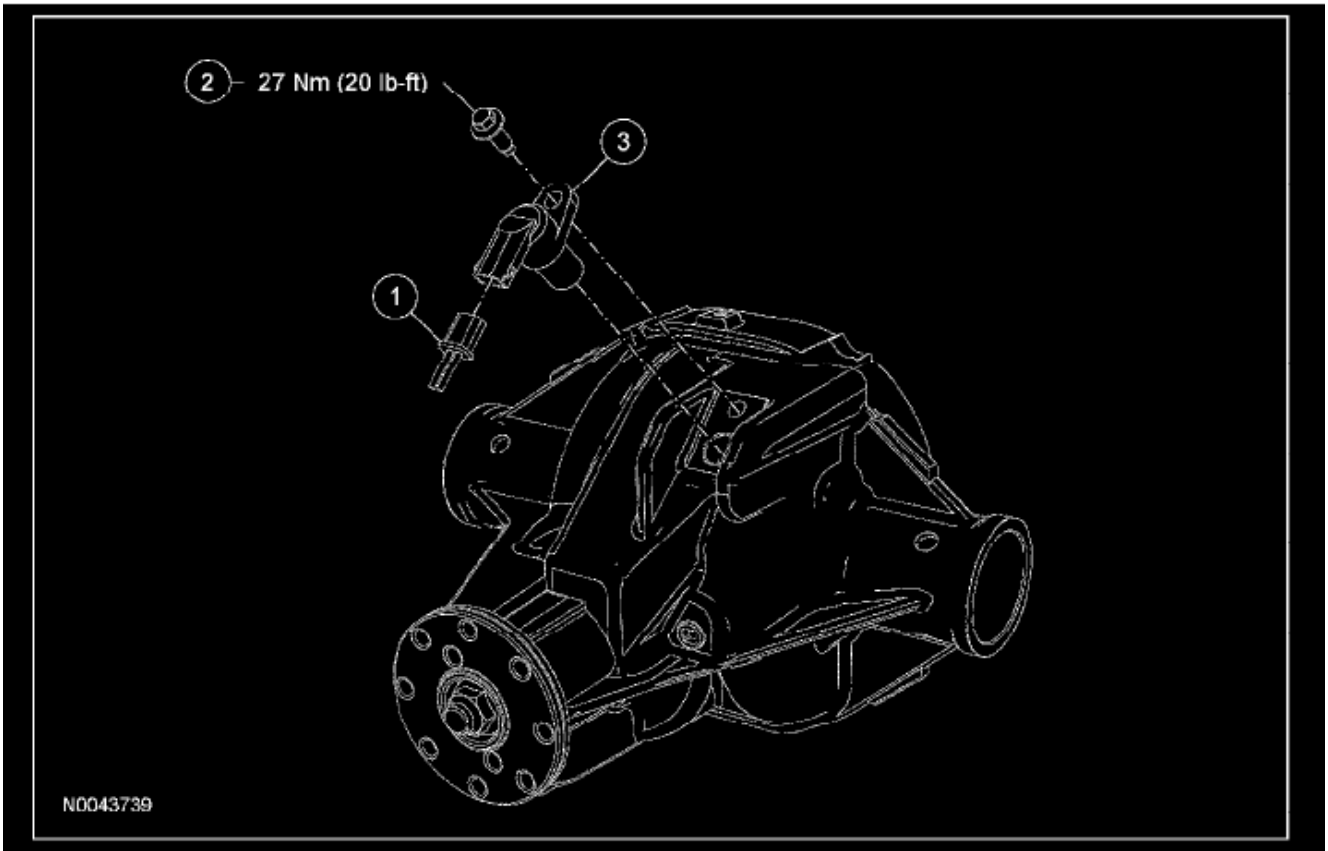
5. NOTE: Plug the sensor cavity and thoroughly clean the sensor mounting surface. Apply a light coating of the specified grease to the mounting

surface.

To install, reverse the removal procedure.

Material

Item	Specification
Motorcraft SAE 75W-140 Synthetic Rear Axle Lubricant XY-75W140-QL (US); CXY-75W140-1L (Canada)	WSL-M2C192-A



Item	Part Number	Description
1	—	Wheel speed sensor electrical connector (part of 14405)
2	391998	Wheel speed sensor bolt
3	9E731	Wheel speed sensor

Wheel Speed Sensor: Service and Repair Wheel Speed Sensor - Rear

Wheel Speed Sensor - Rear

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the wheel speed sensor electrical connector. 3. Remove the wheel speed sensor bolt and the wheel speed sensor.

^ To install, tighten to 27 Nm (20 lb-ft).

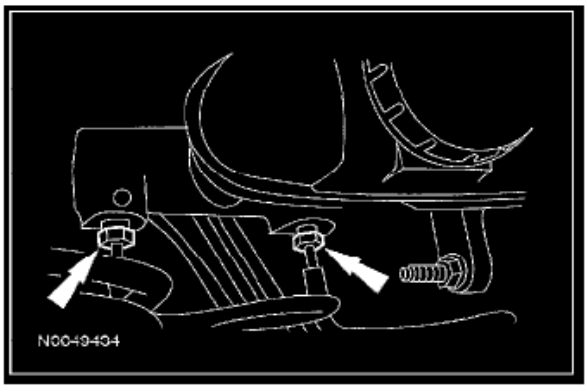
4. NOTE: Plug the sensor cavity and thoroughly clean the sensor mounting surface.

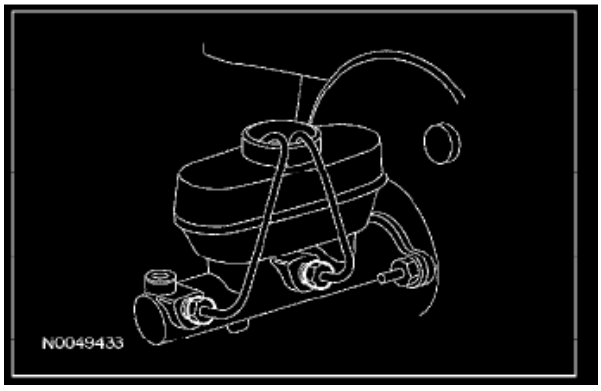
NOTE: Inspect the anti-lock brake sensor O-ring seal for damage; lightly lubricate the O-ring seal with the specified lubricant.

To install, reverse the removal procedure.

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A





Brake Bleeding: Service and Repair Component Bleeding

Component Bleeding

Master Cylinder Priming

WARNING: Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.

WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

WARNING: Do not allow the brake master cylinder to run dry during the bleeding operation. Master cylinder may be damaged if operated without fluid, resulting in degraded braking performance. Failure to follow this instruction may result in serious personal injury.

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

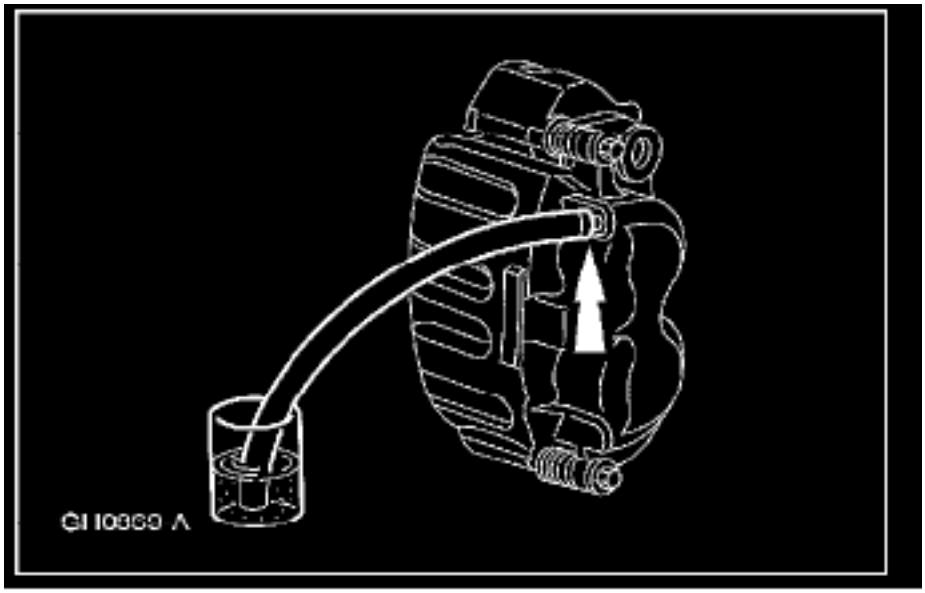
NOTE: When the brake master cylinder has been installed new or the system has been emptied or partially emptied, it must be primed to prevent air from entering the system.

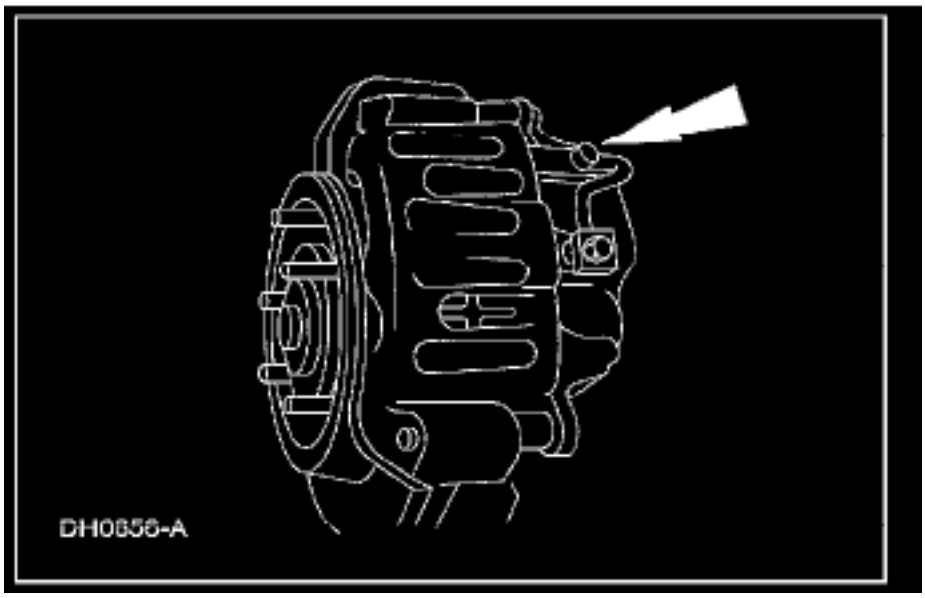
1. Disconnect the brake outlet tubes from the master cylinder.

2. Install short brake tubes with the ends submerged in the brake master cylinder reservoir and fill the brake master cylinder reservoir with clean,

specified brake fluid.

3. Have an assistant pump the brake pedal until clear fluid flows from both brake tubes, without air bubbles.





4. Remove the short brake tubes and install the brake outlet tubes. 5. Bleed each brake tube at the brake master cylinder as follows:

1 Have an assistant pump the brake pedal at least 2 times and then hold firm pressure on the brake pedal.

2 Loosen the rearmost brake tube fitting until a stream of brake fluid comes out. While the assistant maintains pressure on the brake pedal, tighten the brake tube fitting.

3 Repeat this operation until clear, bubble-free fluid comes out.

4 Refill the brake master cylinder reservoir as necessary. Repeat the bleeding operation at the front brake tube.

5 Tighten the master cylinder brake tube fittings to 18 Nm (13 lb-ft).

6. Bleed the brake system.

Brake caliper

WARNING: Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.

WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

WARNING: Do not allow the brake master cylinder to run dry during the bleeding operation. Master cylinder may be damaged if operated without fluid, resulting in degraded braking performance. Failure to follow this instruction may result in serious personal injury.

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

NOTE: It is not necessary to do a complete brake system bleed if only the brake caliper was disconnected or installed new.

1. Remove the bleeder screw cap and place a box-end wrench on the disc brake caliper bleeder screw. Attach a rubber drain hose to the disc brake

caliper bleeder screw and submerge the free end of the hose in a container partially filled with clean, specified brake fluid.

2. Have an assistant pump the brake pedal at least 2 times and then hold firm pressure on the brake pedal. 3. Loosen the disc brake caliper bleeder screw until a stream of brake fluid comes out. While the assistant maintains pressure on the brake pedal,

tighten the disc brake caliper bleeder screw. ^

Repeat until clear, bubble-free fluid comes out.

^ Refill the brake master cylinder reservoir as necessary.

4. Tighten the brake caliper bleeder screw to 15 Nm (11 lb-ft), remove the rubber hose and install the bleeder screw cap.

5. Apply brakes several times to verify correct brake operation.

Wheel Cylinder

WARNING: Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.

WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

WARNING: Do not allow the brake master cylinder to run dry during the bleeding operation. Master cylinder may be damaged if operated without fluid, resulting in degraded braking performance. Failure to follow this instruction may result in serious personal injury.

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

NOTE: It is not necessary to do a complete brake system bleed if only the wheel cylinder was disconnected or installed new.

1. Remove the bleeder screw cap and place a box-end wrench on the wheel cylinder bleeder screw. Attach a rubber drain hose to the disc brake

caliper bleeder screw and submerge the free end of the hose in a container partially filled with clean, specified brake fluid.

2. Have an assistant pump the brake pedal at least 2 times and then hold firm pressure on the brake pedal. 3. Loosen the wheel cylinder bleeder screw until a stream of brake fluid comes out. While the assistant maintains pressure on the brake pedal, tighten

the bleeder screw. ^

Repeat until clear, bubble-free fluid comes out.

^ Refill the brake master cylinder reservoir as necessary.

4. Tighten the wheel cylinder bleeder screw to 8 Nm (71 lb-inch), remove the rubber hose and install the bleeder screw cap. 5. Apply brakes several times to verify correct brake operation.

Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A

Brake Bleeding: Service and Repair Brake System Bleeding

Brake System Bleeding

ABS Hydraulic Control Unit (HCU) Bleeding

WARNING: Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.

WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

WARNING: Do not allow the brake master cylinder to run dry during the bleeding operation. Master cylinder may be damaged if operated without fluid, resulting in degraded braking performance. Failure to follow this instruction may result in serious personal injury.

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

NOTE: When any part of the hydraulic system has been disconnected for repair or installation of new components, air can get into the system and cause spongy brake pedal action. This requires bleeding of the hydraulic system, including the hydraulic control unit (HCU) after it has been correctly connected.

NOTE: If the HCU or any component upstream of the HCU is installed new, carry out the brake system bleed procedure first without the scan tool, followed by the brake system bleed procedure using the scan tool.

NOTE: This procedure is only required when a new HCU is installed.

1. Connect the scan tool and follow the ABS bleed instructions. 2. Follow the manual bleeding or pressure bleeding procedure steps to bleed the system.

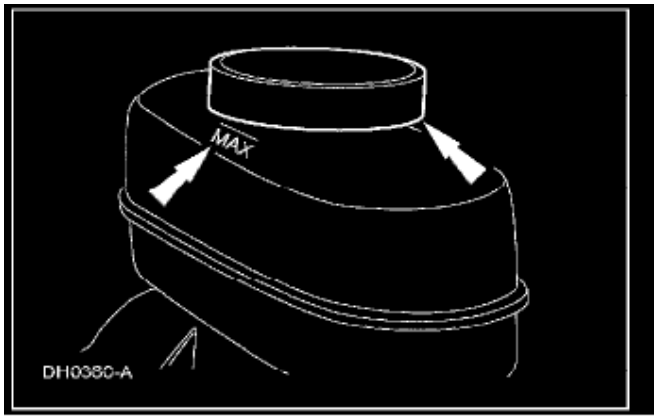
Manual Bleeding Method

WARNING: Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.

WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

WARNING: Do not allow the brake master cylinder to run dry during the bleeding operation. Master cylinder may be damaged if operated without fluid, resulting in degraded braking performance. Failure to follow this instruction may result in serious personal injury.

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.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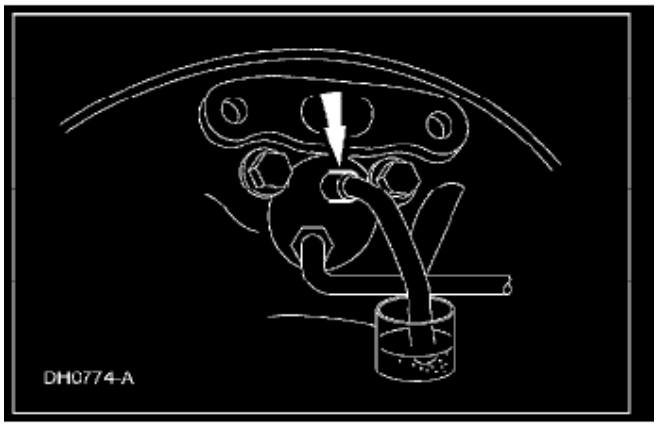
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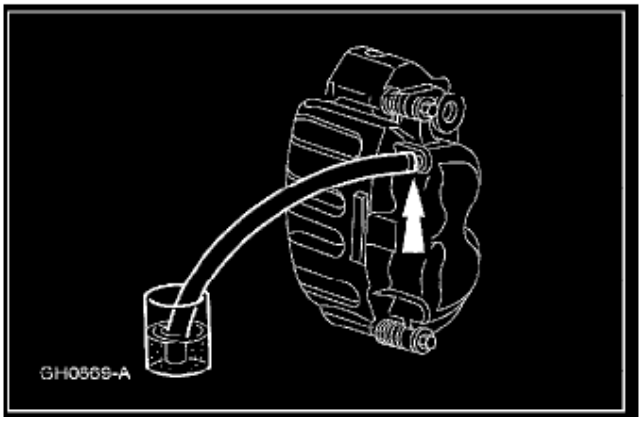
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NOTE: When any part of the hydraulic system has been disconnected for repair or installation of new components, air can get into the system and cause spongy brake pedal action. This requires bleeding of the hydraulic system, including the HCU after it has been correctly connected.

1. Clean all the dirt from around the brake fluid reservoir cap and remove the cap. Fill the brake master cylinder reservoir with clean, specified brake

fluid.

2. Remove the RR wheel cylinder bleeder screw cap and place a box-end wrench on the bleeder screw. Attach a rubber drain hose to the RR wheel

cylinder bleeder screw and submerge the free end of the hose in a container partially filled with clean, specified brake fluid.

3. Have an assistant pump and then hold firm pressure on the brake pedal. 4. Loosen the RR wheel cylinder bleeder screw until a stream of brake fluid comes out. While an assistant maintains pressure on the brake pedal,

tighten the RR wheel cylinder bleeder screw. ^

Repeat until clear, bubble-free fluid comes out.

^ Refill the brake master cylinder reservoir as necessary.

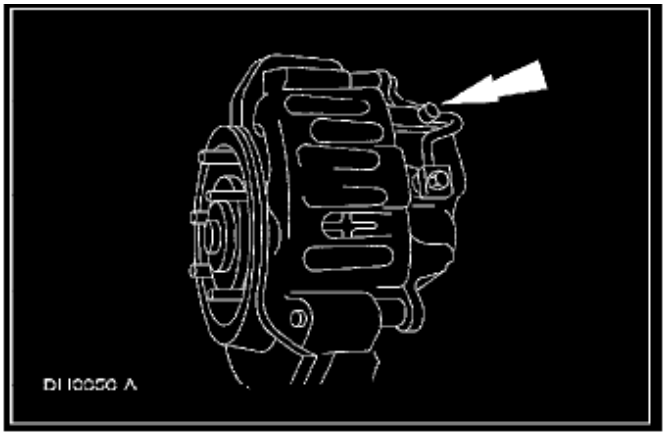
5. Tighten the RR wheel cylinder bleeder screw to 8 Nm (71 lb-inch), remove the rubber hose and install the bleeder screw cap. 6. Repeat Steps 2-5 for the LR wheel cylinder bleeder screw. 7. Remove the RF brake caliper bleeder cap and place a box-end wrench on the bleeder screw. Attach a rubber drain hose to the RF brake caliper

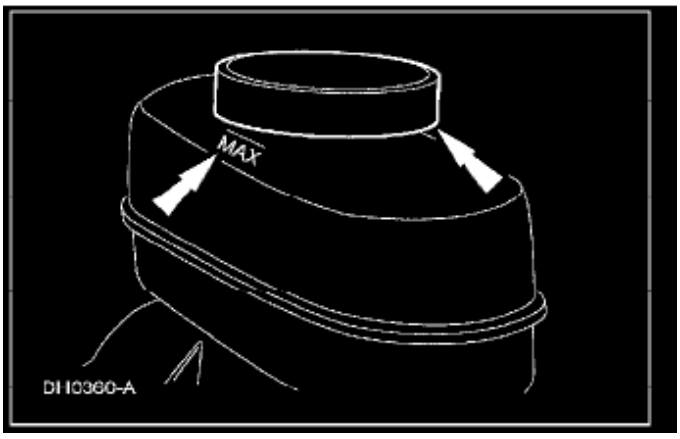
bleeder screw and submerge the free end of the hose in a container partially filled with clean, specified brake fluid.

8. Have an assistant pump and then hold firm pressure on the brake pedal. 9. Loosen the RF brake caliper bleeder screw until a stream of brake fluid comes out. While the assistant maintains pressure on the brake pedal,

tighten the RF brake caliper bleeder screw. ^

Repeat until clear, bubble-free fluid comes out.

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^ Refill the brake master cylinder reservoir as necessary.

10. Tighten the RF brake caliper bleeder screw to 15 Nm (11 lb-ft), remove the rubber hose and install the bleeder screw cap.

11. Repeat Steps 7 through 10 for the LF brake caliper bleeder screw. 12. Apply brakes several times to verify correct brake operation.

Pressure Bleeding Method

WARNING: Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.

WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

WARNING: Do not allow the brake master cylinder to run dry during the bleeding operation. Master cylinder may be damaged if operated without fluid, resulting in degraded braking performance. Failure to follow this instruction may result in serious personal injury.

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

NOTE: When any part of the hydraulic system has been disconnected for repair or installation of new components, air can get into the system and cause spongy brake pedal action. This requires bleeding of the hydraulic system, including the hydraulic control unit (HCU) after it has been correctly connected.

1. Clean all dirt from and remove the brake master cylinder filler cap and fill the brake master cylinder reservoir with clean, specified brake fluid.

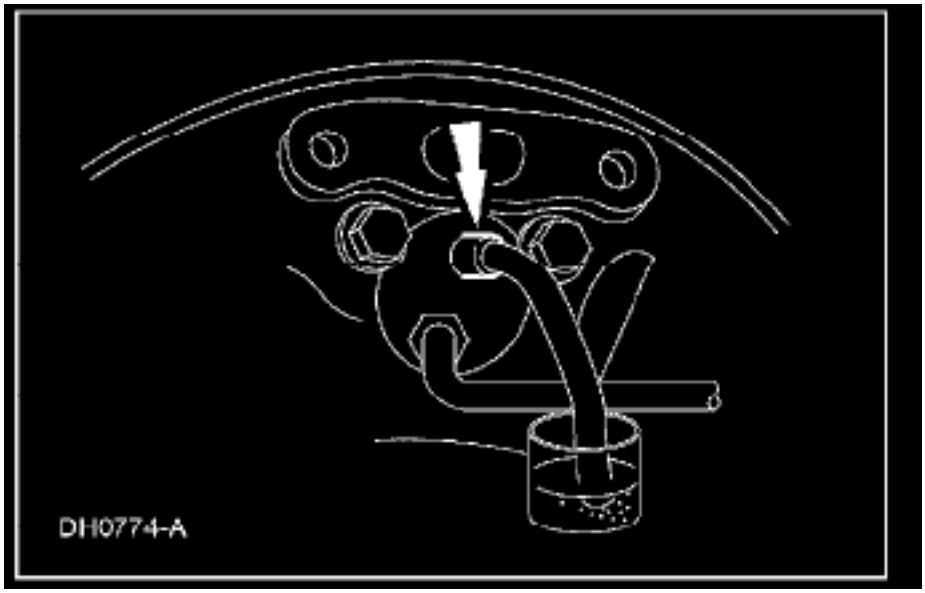
2. NOTE: Master cylinder pressure bleeder adapter tools are available from various manufacturers of pressure bleeding equipment. Follow the

instructions of the manufacturer when installing the adapter.

Install the bleeder adapter to the brake master cylinder reservoir, and attach the bleeder tank hose to the fitting on the adapter.

3. NOTE: Bleed the longest line first. Make sure the bleeder tank contains enough specified brake fluid to complete the bleeding operation.

Remove the RR wheel cylinder bleeder screw cap and place a box-end wrench on the bleeder screw. Attach a rubber drain hose to the RR wheel cylinder bleeder screw and submerge the free end of the hose in a container partially filled with clean, specified brake fluid.



4. Open the valve on the bleeder tank. 5. Loosen the RR wheel cylinder bleeder screw. Leave open until clear, bubble-free brake fluid flows, then tighten the RR wheel cylinder bleeder

screw to 8 Nm (71 lb-inch) and remove the rubber hose.

6. Continue bleeding the rest of the system, going in order from the LR wheel cylinder bleeder screw to the RF disc brake caliper bleeder screw,

ending with the LF disc brake caliper bleeder screw. ^

Tighten the brake caliper bleeder screws to 15 Nm (11 lb-ft).

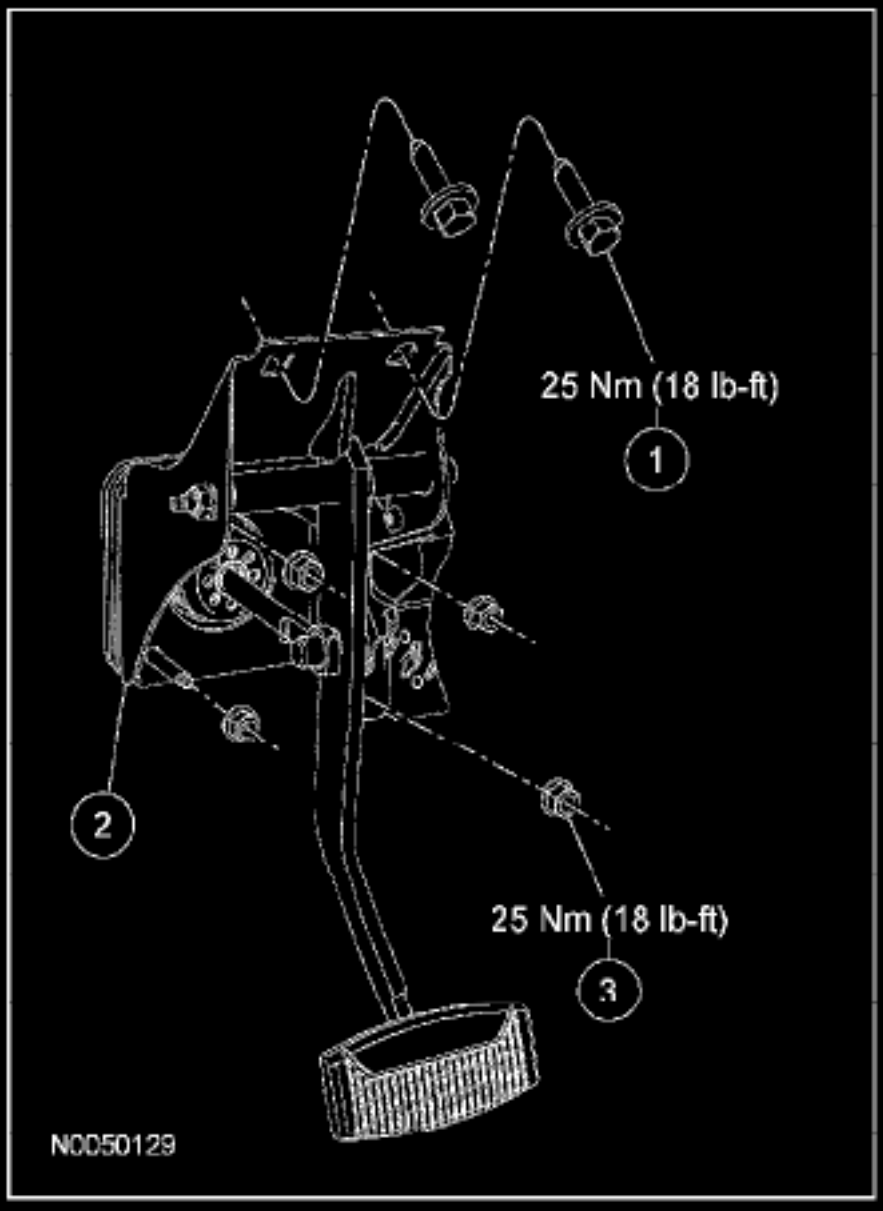
7. Close the bleeder tank valve. Remove the tank hose from the adapter and remove the adapter. Fill the reservoir with clean, specified brake fluid

and install the reservoir cap.

8. Apply brakes several times to verify correct brake operation.

Brake Pedal and Bracket

NOTE: Automatic transmission shown, manual transmission similar.



Item	Part Number	Description
1	N806738	Brake pedal bracket bolt (2 required)
2	2450	Brake pedal and bracket
3	N620481	Brake pedal bracket nut (4 required)

Brake Pedal Assy: Service and Repair

Brake Pedal and Bracket

NOTE: Automatic transmission shown, manual transmission similar.

Brake Pedal And Bracket

Removal and Installation

All vehicles

1. CAUTION: Do not service the brake pedal or brake booster without first removing the stoplamp switch and speed control deactivator

switch. These switches must be removed with the brake pedal in the at-rest position. Switch plungers must be compressed for the switch to rotate in the bracket. Attempting to remove the switch when the plunger is extended (during pedal apply) will result in damage to the switch.

Remove the stoplamp switch.

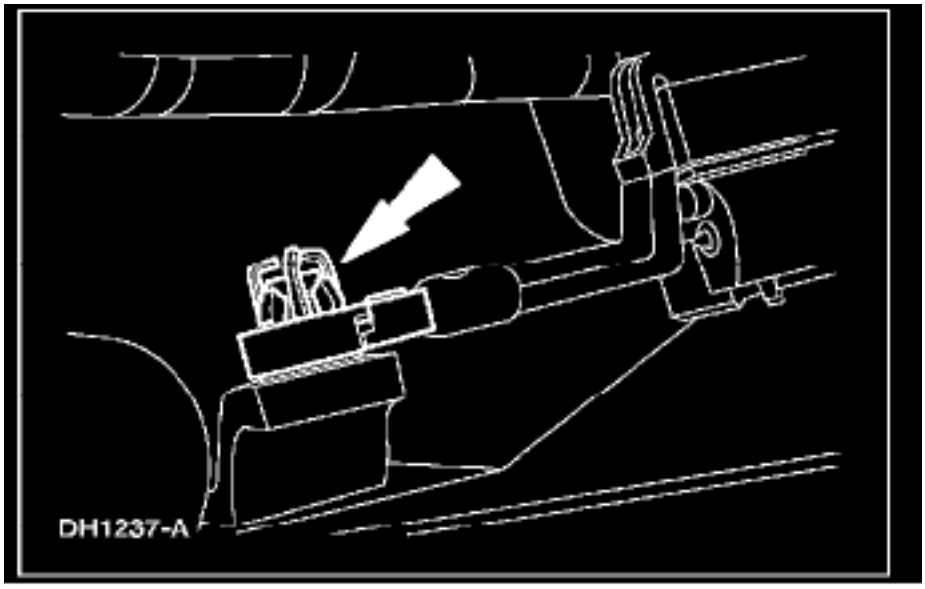
2. If equipped, remove the speed control deactivator switch.

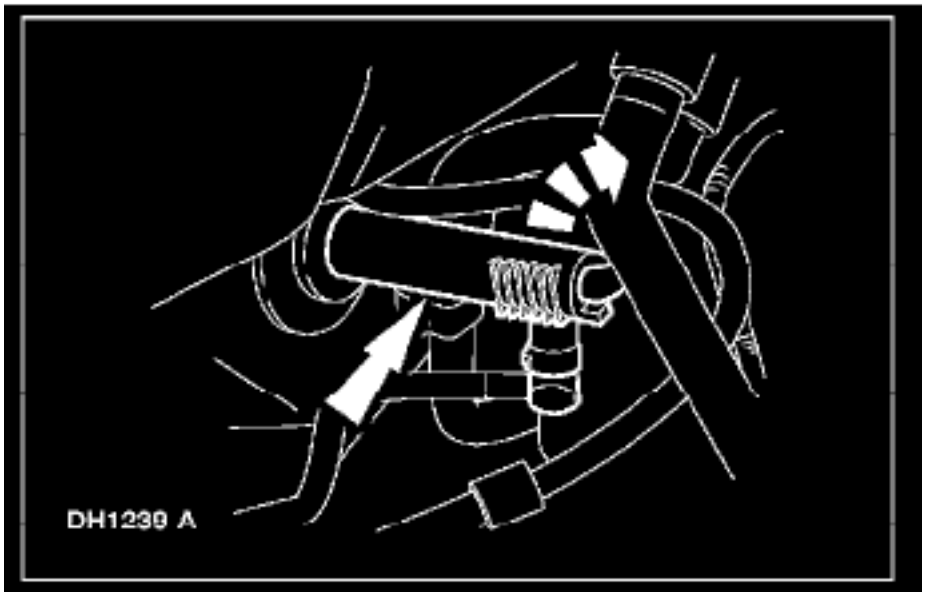
Manual transmission

3. Disconnect the clutch pedal position (CPP) switch.

4. NOTE: The clutch pedal master cylinder push rod retaining clip is not reusable.

Disconnect the clutch pedal master cylinder push rod.





5. Remove the clutch master cylinder from the brake and clutch pedal bracket by rotating it 45 degrees clockwise.

All vehicles

6. Remove the bulkhead sound insulator. 7. Remove the 2 brake pedal bracket bolts.

^ To install, tighten to 25 Nm (18 lb-ft).

8. CAUTION: Support the brake master cylinder and power brake booster in the engine compartment or damage to components may

occur.

Remove the 4 brake pedal bracket nuts and remove the brake pedal and bracket. ^

To install, tighten to 25 Nm (18 lb-ft).

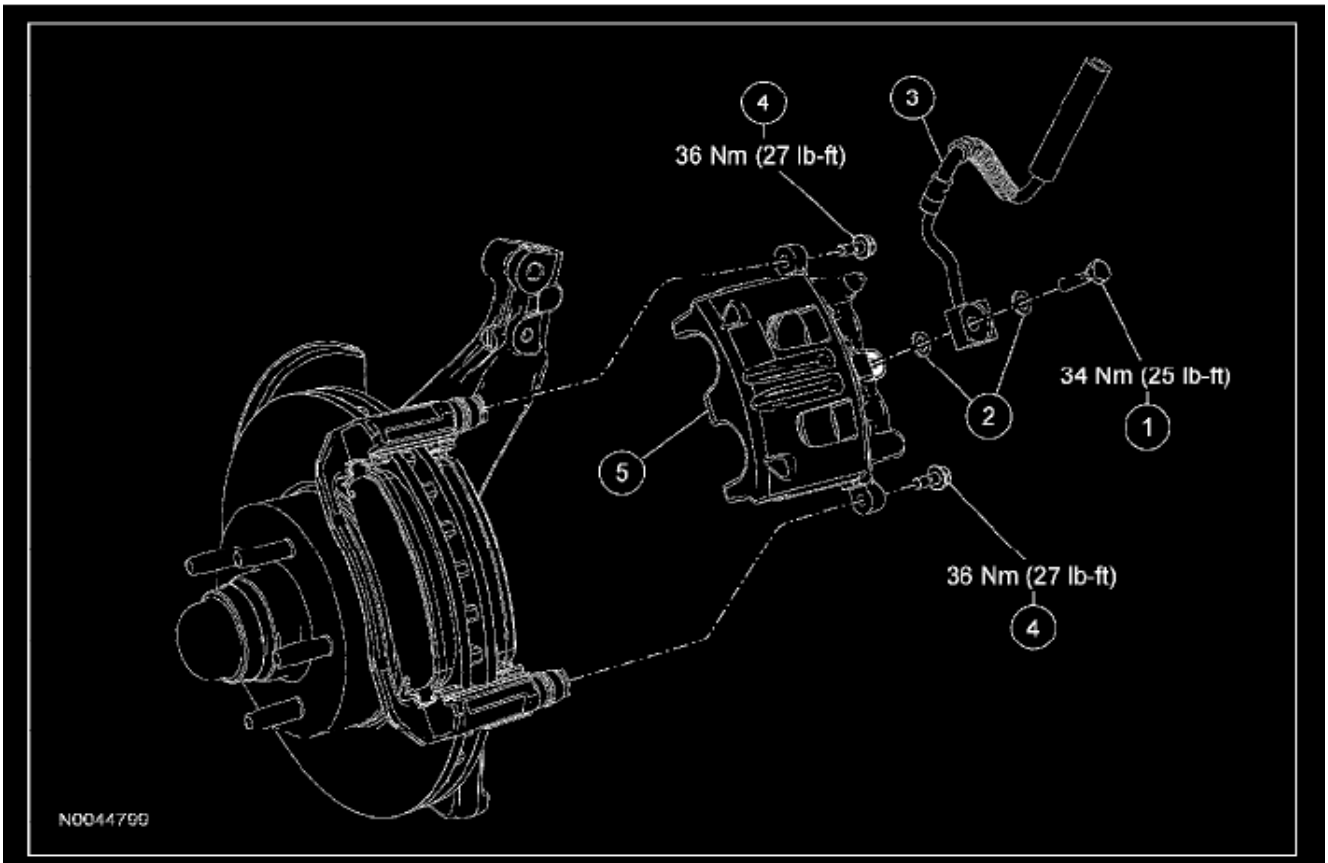
9. CAUTION: Do not press, pull or otherwise move the brake pedal while installing the stoplamp switch or the speed control deactivator

switch. These switches must be installed with the booster push rod attached to the brake pedal and with the brake pedal in the at-rest position. Installing these switches with the brake pedal in any other position will result in incorrect adjustment and may damage the switches.

To install, reverse the removal procedure.

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A



Item	Part Number	Description
1	N808236	Brake caliper flow bolt
2	2149	Copper washers (2 required)
3	2078	Front brake hose

Item	Part Number	Description
4	2B296	Brake caliper pin bolts (2 required)
5	2B120	Brake caliper

(Continued)

Brake Caliper: Service and Repair Caliper Removal and Installation, Front

Brake Caliper

Removal

WARNING: Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.

WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

1. Remove the wheel and tire. 2. Remove the brake caliper flow bolt and position the brake hose aside.

^ Discard the 2 copper washers.

^ Plug the brake hose.

3. CAUTION: Do not pry in the caliper sight hole to retract the pistons as this can damage the pistons and boots.

Remove the 2 brake caliper guide pin bolts and the brake caliper. ^

If leaks or damaged boots are found, install a new disc brake caliper.

Installation

1. CAUTION: Tighten the bottom caliper bolt before tightening the top caliper bolt or damage to guide pins may occur.

CAUTION: Make sure the caliper pin boots are correctly seated to prevent damage to the guide pins.

Position the brake caliper and install the 2 brake caliper guide pin bolts. ^

Tighten to 36 Nm (27 lb-ft).

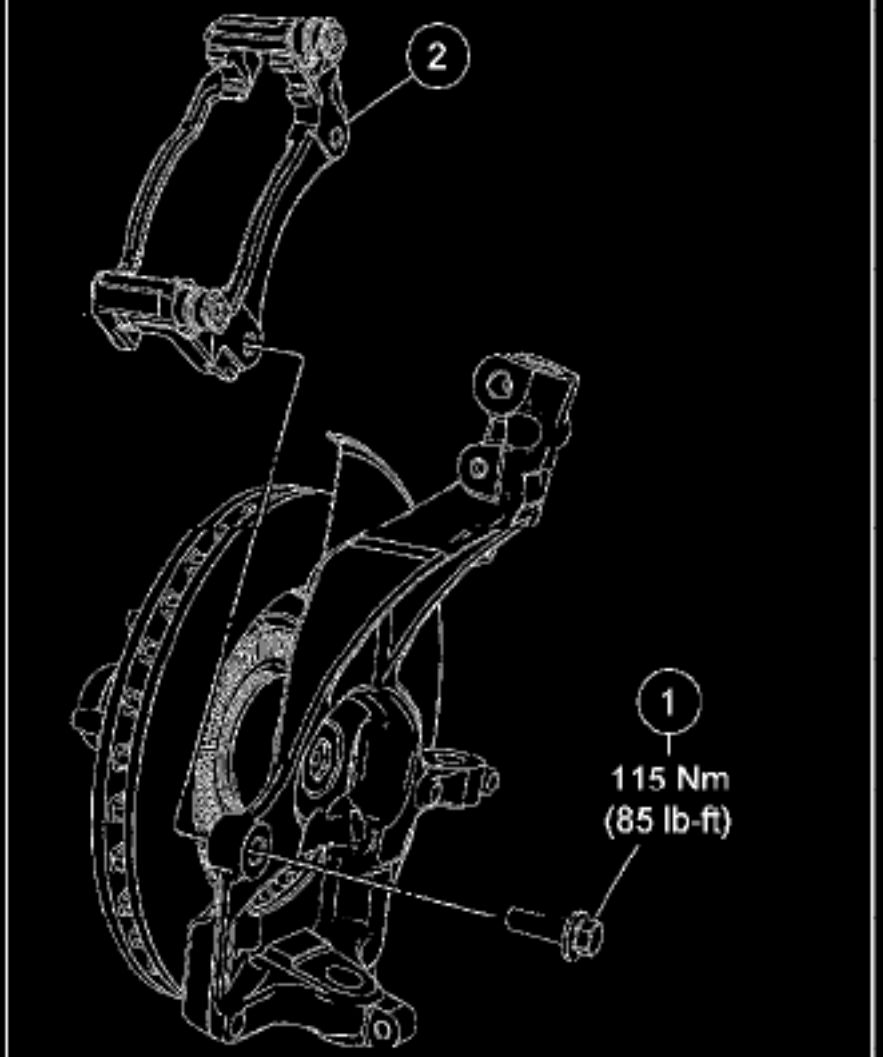
2. Using 2 new copper washers, position the brake hose and install the brake caliper flow bolt.

^ Tighten to 34 Nm (25 lb-ft).

3. Bleed the brake caliper. 4. Install the wheel and tire. 5. Test the brake system for normal operation. 6. Apply the brakes several times to verify correct brake operation.

Brake Caliper Anchor Plate

NOTE: Rear wheel drive (RWD) shown, four wheel drive (4WD) similar.



Item	Part Number	Description
1	W710701	Brake caliper anchor plate bolt (2 required)
2	2C396	Brake caliper anchor plate

Brake Caliper: Service and Repair Brake Caliper Anchor Plate, Front

Brake Caliper Anchor Plate

NOTE: Rear wheel drive (RWD) shown, four wheel drive (4WD) similar.

Removal and Installation

1. Remove the wheel and tire. 2. Remove the 2 brake caliper guide pin bolts and position the caliper aside.

^ To install, tighten to 36 Nm (27 lb-ft).

^ Support the caliper using mechanic's wire.

3. Remove the brake pads and the brake pad clips. 4. Remove the 2 brake caliper anchor plate bolts and the brake caliper anchor plate.

^ To install, tighten to 115 Nm (85 lb-ft).

5. To install, reverse the removal procedure.

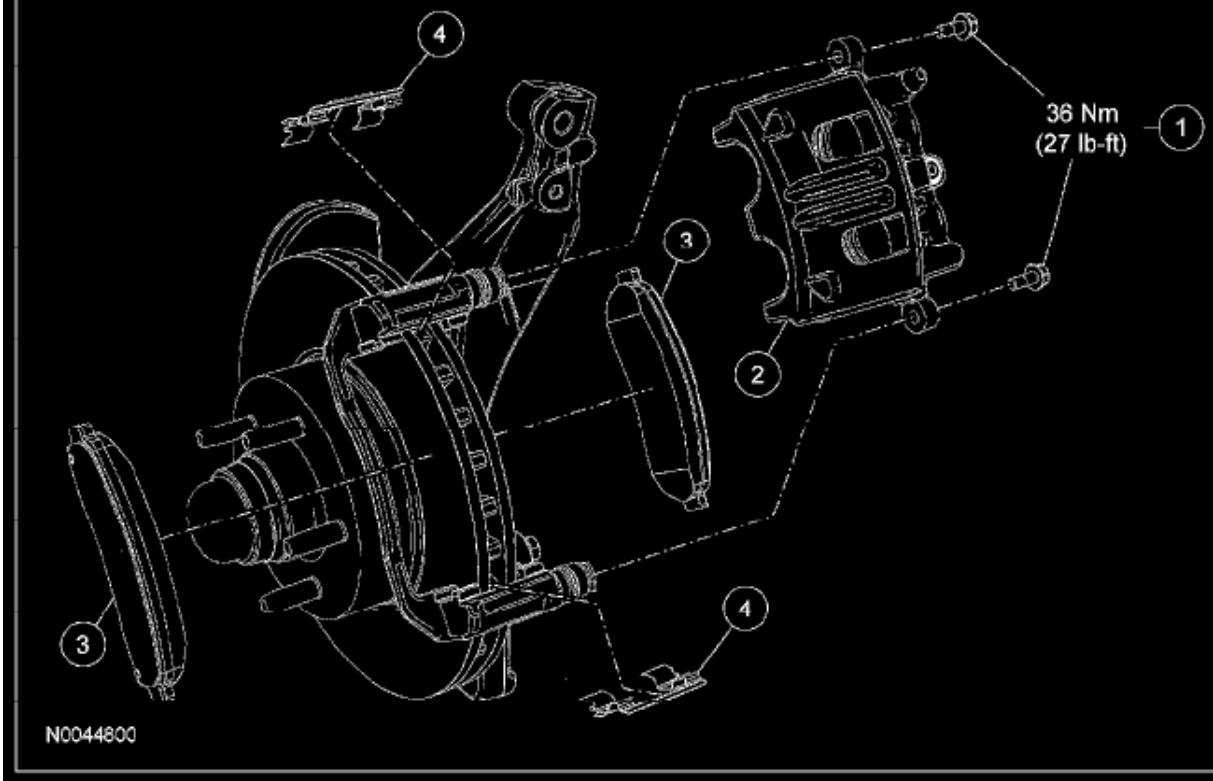
Brake Pad: Specifications

Maximum brake pad taper wear (in any direction) ..... 3.0 mm (0.118 in) Minimum brake pad thickness .... 3.0 mm (0.118 in)

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A

NOTE: Rear wheel drive (RWD) shown, four wheel drive (4WD) similar.



Item	Part Number	Description
1	2B296	Brake caliper guide pin bolts (2 required)
2	2B120	Brake caliper

Item	Part Number	Description
3	2001	Brake pads (2 required)
4	—	Brake pad clips (2 required) (part of 2001)

(Continued)

Brake Pad: Service and Repair

Brake Pads

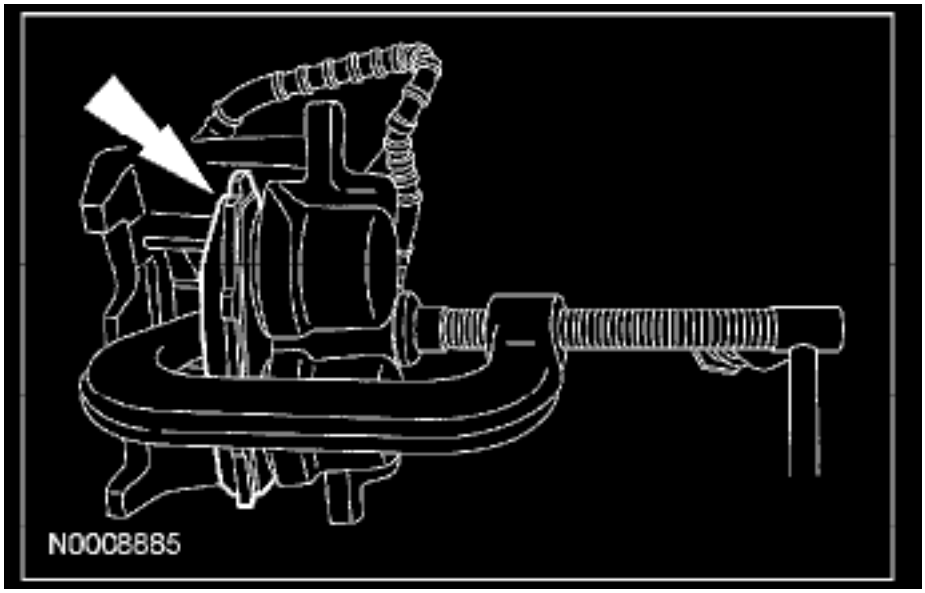
Removal

WARNING: Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.

WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

WARNING: Always install new brake shoes or pads at both ends of an axle to reduce the possibility of brakes pulling vehicle to one side. Failure to follow this instruction may result in uneven braking and serious personal injury.

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.



1. Check the brake fluid level in the brake master cylinder reservoir.

^ If required, remove the fluid until the brake master cylinder reservoir is half full.

2. Remove the wheel and tire.

3. CAUTION: Do not pry in the caliper sight hole to retract the pistons, as this may damage the pistons and boots.

CAUTION: Do not allow the brake caliper to hang from the brake hose or damage to the hose may occur.

Remove the 2 brake caliper guide pin bolts and position the caliper aside. ^

Support the caliper using mechanic's wire.

4. NOTE: Do not remove the anchor pins unless installing new pins.

Inspect the anchor plate guide pins. They should slide in and out of the anchor plates with no binding. Check the boots for cracks or tears. If the pins do not slide easily or the boots are cracked or torn, install new boots and pins. Lubricate the pins using the specified silicone brake caliper grease.

5. Inspect the brake pads for wear and contamination. 6. Inspect the brake disc. Machine or install a new front brake disc as necessary.

Installation

1. CAUTION: Do not allow grease, oil brake fluid or other contaminants to contact the pad lining material, or damage to components may

occur. Do not install contaminated pads.

NOTE: If installing new brake pads, install all new hardware as supplied with the brake pad kit.

Install the 2 new brake pad clips and the 2 brake pads.

2. CAUTION: Protect the piston and boots when pushing the caliper piston into the caliper piston bores or damage to components may

occur.

If installing new brake pads, using a C-clamp and a worn brake pad, compress the disc brake caliper pistons into the caliper.

3. CAUTION: Tighten the bottom caliper bolt before tightening the top caliper bolt or damage to guide pins may occur.

CAUTION: Make sure the caliper pin boots are correctly seated to prevent damage to the guide pins.

Position the brake caliper and install the 2 caliper guide pin bolts. ^

Tighten to 36 Nm (27 lb-ft).

4. Install the wheel and tire. 5. Fill the brake master cylinder reservoir with clean, specified brake fluid. 6. Apply the brakes several times to verify correct brake operation.

Brake Rotor/Disc: Specifications

Minimum brake disc thickness ..... 24.50 mm (0.964 in) Minimum brake disc thickness to machine ..... 25.10 mm (0.988 in)

Material

Item	Specification
High Temperature Nickel Anti-Seize Lubricant XL-2 (US); CXG-2-B (Canada)	ESE-M12A4-A
Metal Brake Parts Cleaner PM-4-A or PM-4-B (US); CPM-4 (Canada)	—

Brake Rotor/Disc: Procedures

Brake Disc Machining

NOTE: Do not use a bench lathe to machine the brake discs.

NOTE: Read the entire operating manual and/or view the video shipped with the lathe before installing, operating or repairing the lathe.

NOTE: If the thickness of the brake disc is less than the minimum thickness to machine specification, install a new brake disc. This will make sure that the brake disc will be above minimum thickness after machining.

NOTE: Do not machine new brake discs.

NOTE: Lateral runout and disc thickness variation measurements are not required because correct adjustment of the on-vehicle brake lathe will make sure that these dimensions are within specifications.

1. NOTE: It is not necessary to disconnect the brake tube from the brake caliper.

Position the brake caliper and brake caliper anchor bracket aside.

2. For vehicles with a 2-piece brake disc and hub assembly:

1 Mark the brake disc and the wheel stud for correct indexing during re-assembly.

2 Remove the brake disc from the hub.

3 CAUTION: Do not use an abrasive sanding disc since it will remove paint or other protective finishes from the wheel or metal from the mounting surfaces, adversely affecting corrosion protection and brake disc lateral runout.

Remove corrosion from the wheel mounting surface, both disc mounting surfaces and hub mounting surface.

4 Align the match marks and install the brake disc on the hub.

3. Machine the brake disc using an on-vehicle brake lathe.

1 Install the hub adapter and silencer belt if necessary.

2 Install the cutting lathe.

3 If the lathe is not self adjusting, adjust the lathe oscillation using a dial indicator. Total indicated reading (TIR) target is 0.000 mm (0.000 inch), maximum is 0.08 mm (0.003 inch).

4 Center the cutting head, adjust the cutting bits and install the chip deflector.

5 NOTE: The depth of cut should be between 0.10 and 0.20 mm (0.004 and 0.008 inch). Lighter cuts will cause the bit to heat up and wear faster. Heavier cuts will cause poor brake disc surface finish.

Machine the brake disc.

6 Remove the lathe and, if installed, the silencer belt.

7 Remove the hub adapter.

4. Remove the metal shavings. 5. For vehicles with a 2-piece brake disc and hub assembly:

1 Remove the brake disc from the hub.

2 Remove metal shavings from the hub, the brake disc mounting surfaces and from the ABS sensors.

3 Apply anti-seize lubricant to the hub mounting surface to prevent corrosion.

4 Align the match marks and install the brake disc on the hub.

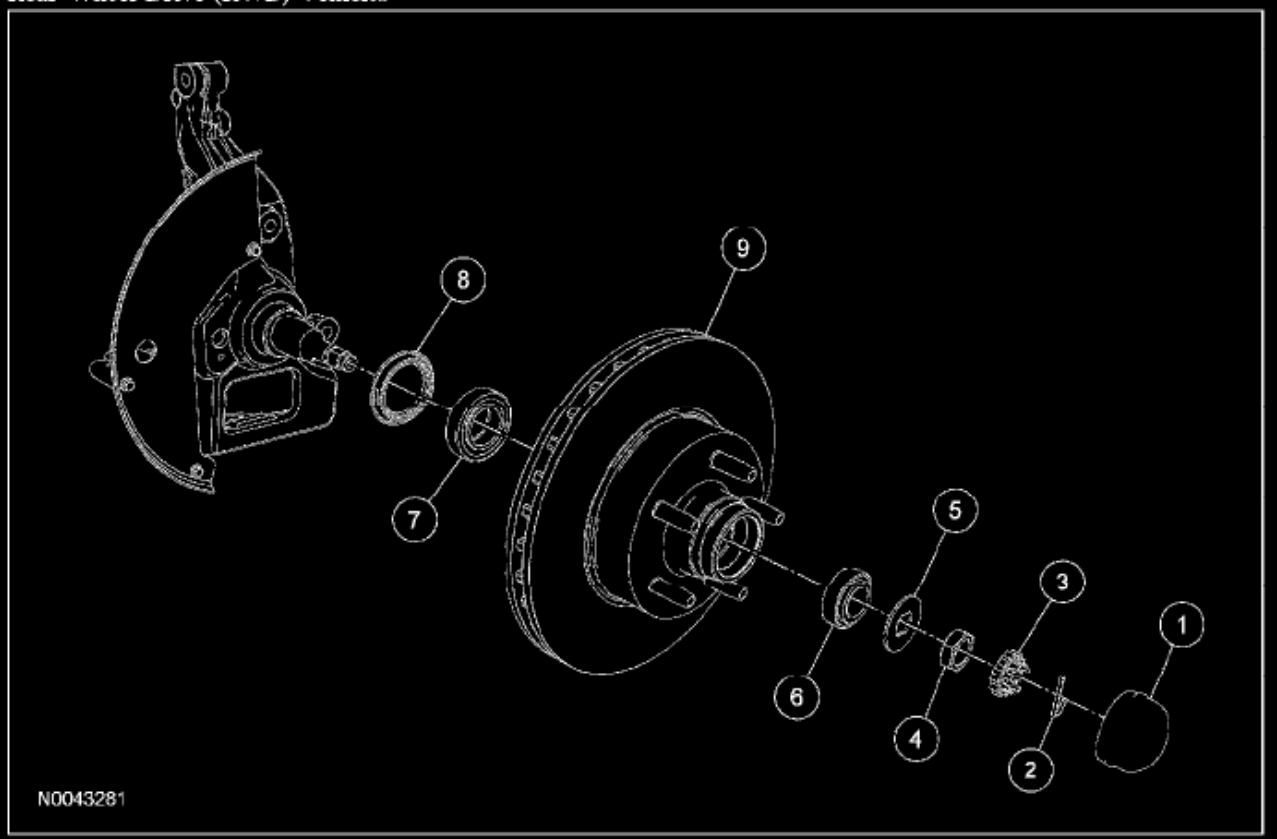
6. NOTE: It is not required to install new brake pads if friction material properties are within guidelines.

Install the brake caliper and brake caliper anchor bracket.

Material

Item	Specification
High Temperature Nickel Anti-Seize Lubricant XL-2 (US); CXG-2-B (Canada)	ESE-M12A4-A
Metal Brake Parts Cleaner PM-4-A or PM-4-B (US); CPM-4 (Canada)	—
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B

Rear Wheel Drive (RWD) Vehicles



Item	Part Number	Description
1	1131	Hub grease cap
2	N642569	Cotter pin
3	390622	Hub spindle nut retainer
4	374504	Hub spindle nut

(Continued)

Item	Part Number	Description
5	1195	Outer wheel bearing retaining washer
6	1216	Outer wheel bearing
7	1216	Inner wheel bearing
8	1190	Grease seal
9	1104	Brake disc and hub assembly

Brake Rotor/Disc: Removal and Replacement

Disc Removal and Installation, Front

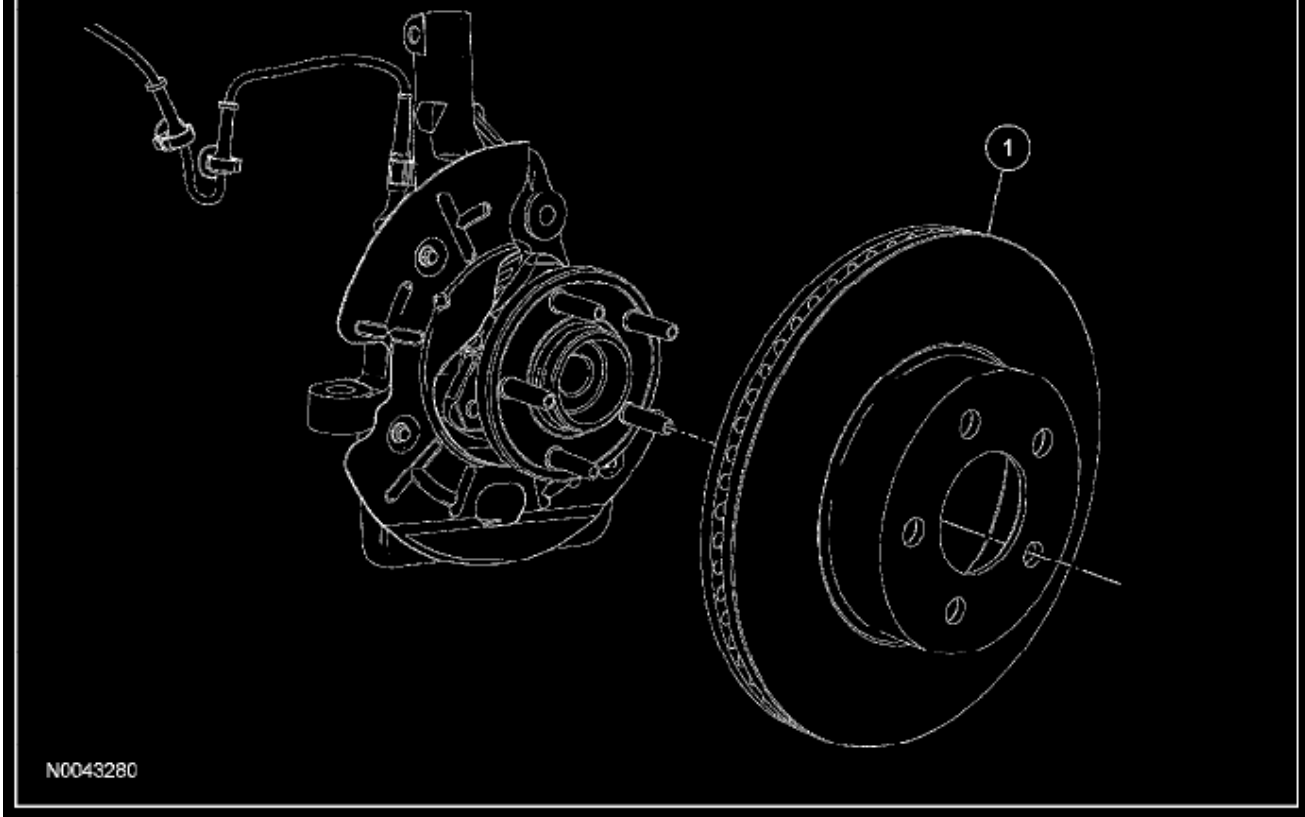
Brake Disc

Rear Wheel Drive (RWD) Vehicles

Rear Wheel Drive (RWD) Vehicles

Four Wheel Drive (4WD) Vehicles

Four Wheel Drive (4WD) Vehicles



Item	Part Number	Description
1	1125	Brake disc

Four Wheel Drive (4WD) Vehicles

Removal

All vehicles

1. Remove the front disc brake caliper anchor plate.

Four wheel drive (4WD) vehicles

2. Remove the brake disc.

Rear wheel drive (RWD) vehicles

3. Remove the hub grease cap. 4. Remove the cotter pin. 5. Remove the hub spindle nut retainer. 6. Remove the hub spindle nut. 7. Remove the outer wheel bearing retaining washer. 8. Remove the outer wheel bearing. 9. Remove the brake disc and hub.

10. NOTE: The wheel hub grease seal is a one-time-use part. When it is removed, a new wheel hub grease seal must be installed.

Remove the wheel hub grease seal.

11. Remove the inner wheel bearing.

Installation

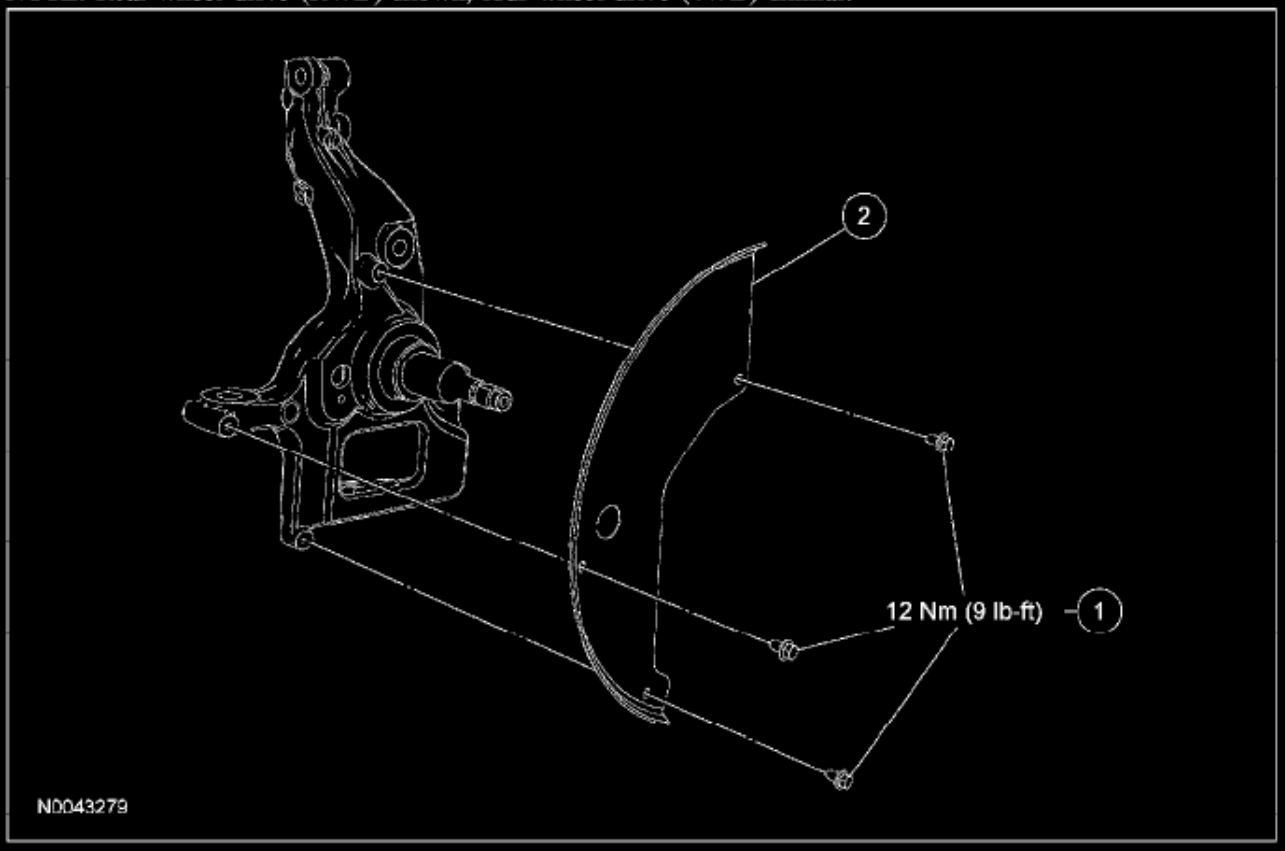
4WD vehicles

1. Install the brake disc.

^ Clean the wheel hub mating surface with brake parts cleaner and apply anti-seize lubricant to the mating surface.

Brake Disc Shield

NOTE: Rear wheel drive (RWD) shown, four wheel drive (4WD) similar.



Item	Part Number	Description
1	N611171	Brake disc shield bolts (3 required)
2	2K004 LH/ 2K005 RH	Brake disc shield

RWD vehicles

2. Clean the inner and outer wheel bearings, the brake disc and hub race with metal brake parts cleaner. Inspect for damage or wear. 3. Lubricate the inner and outer wheel bearings, the brake disc and hub race with premium long-life grease. 4. Install the inner wheel bearing into the brake disc hub. 5. Install a new wheel hub grease seal. 6. Position the brake disc and hub onto the spindle. 7. Install the outer wheel bearing, outer wheel bearing retaining washer and the hub spindle nut. 8. Tighten the spindle nut while rotating the brake disc and hub.

^ Tighten to 29 Nm (21 lb-ft).

9. Loosen the spindle nut 175 degrees.

10. Tighten the spindle nut while rotating the brake disc and hub.

^ Tighten to 2 Nm (18 lb-inch).

11. Install the hub spindle nut retainer, the cotter pin and the hub grease cap.

All vehicles

12. Install the front disc brake caliper anchor plate. 13. Install the wheel and tire. 14. Apply the brakes several times to verify correct brake operation.

Shield Removal and Installation, Front

Brake Disc Shield

NOTE: Rear wheel drive (RWD) shown, four wheel drive (4WD) similar.

Brake Disc Shield

Removal and Installation

1. Remove the brake disc. 2. Remove the 3 brake disc shield bolts and the brake disc shield.

^ To install, tighten to 12 Nm (9 lb-ft).

3. To install, reverse the removal procedure.

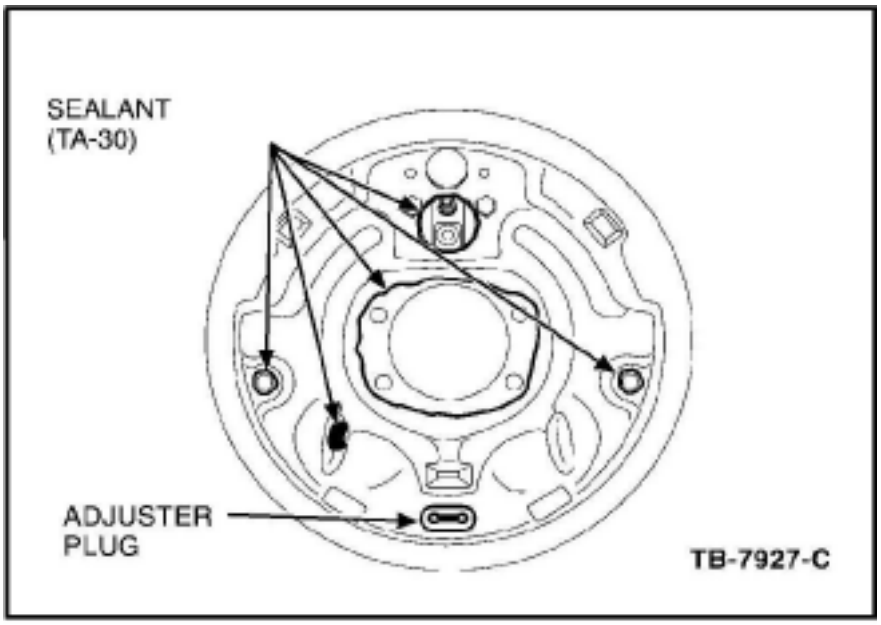


Figure 1

Backing Plate: Customer Interest Brakes - Rear Brake Grab On First Applications

TSB 09-13-12

07/13/09

GRABBING CONDITION FROM REAR DRUM BRAKES

FORD: 2002-2009 Ranger

This article supersedes TSB 8-6-7 to update the vehicle model years.

ISSUE Some 2002-2009 Ranger vehicles may exhibit a grabbing condition from the rear brakes during the first few brake applications. The condition only occurs after the vehicle has been parked for several hours.

ACTION Follow the Service Procedure steps to correct the condition.

SERVICE PROCEDURE

To service, reduce/minimize moisture intrusion into the rear drum brake assemblies by applying Motorcraft® Silicone Gasket and Sealant to the brake backing plate.

1. Place vehicle on hoist and remove the rear wheels.

2. Remove the rear brake drums and replace the rear linings. Refer to Workshop Manual (WSM), Section 206-02.

WARNING

Do not breathe dust or use compressed air to blow dust from storage containers or friction components. Remove dust using government-approved techniques. Friction component dust may

be a cancer and lung disease hazard. Exposure to potentially hazardous components may occur if dusts are created during repair of friction components, such as brake pads and clutch discs. Exposure may also cause irritation to skin, eyes and respiratory tract, and may cause allergic reactions and/or may lead to other chronic health effects. If irritation persists, seek medical attention or advice. Failure to follow these instructions may result in serious personal injury.

3. Inspect the rear brake assemblies for damaged, missing and/or improperly seated adjuster plug or parking brake cable.

4. Inspect and clean the lining contact area of the brake drum; machine if necessary.

5. Install the rear brake drums and adjust the lining to drum clearance per WSM, Section 206-02.

6. Thoroughly clean the backside of the rear drum brake backing plate to promote proper adhesion of sealant.

7. Apply Motorcraft(R) Silicone Gasket and Sealant to the backside of the rear drum brake backing plate at the following interface areas (Figure 1):

^ Axle Flange

^ Wheel Cylinder

PART NUMBER	PART NAME
3L5Z-2200-CA	Brake Shoes 9" (2003-2009)
3L5Z-2200-DA	Brake Shoes 10" (2003-2009)
2U2Z-2V200-MARM	Brake Shoes 9" (2002)
F77Z-2200-BA	Brake Shoes 10" (2002)
TA-30	Motorcraft® Silicone Gasket And Sealant

NOTE: The information in Technical Service Bulletins is intended for use by trained, professional technicians with the knowledge, tools, and equipment to do the job properly and safely. It informs these technicians of conditions that may occur on some vehicles, or provides information that could assist in proper vehicle service. The procedures should not be performed by "do-it-yourselfers". Do not assume that a condition described affects your car or truck. Contact a Ford, Lincoln, or Mercury dealership to determine whether the Bulletin applies to your vehicle.

^ Parking Brake Cable

^ Hold Down Pins

NOTE

AVOID GETTING SEALANT ON THE BRAKE BLEED SCREW AND BRAKE TUBE NUT.

8. Install the rear wheels and torque lug nuts per WSM, Section 204-04.

WARRANTY STATUS: Eligible Under Provisions Of New Vehicle Limited Warranty Coverage
IMPORTANT: Warranty coverage limits/policies are not altered by a TSB. Warranty coverage limits are determined by the identified causal part.

OPERATION DESCRIPTION TIME

091312A 2002-2009 Ranger: 2.4 Hrs.

Replace Rear Brake Linings, Seal Backing Plate And Includes Time To Machine Brake Drums If Necessary (Do Not Use With Any Other Labor Operations)

DEALER CODING

CONDITION

BASIC PART NO. CODE

2200 69

Disclaimer

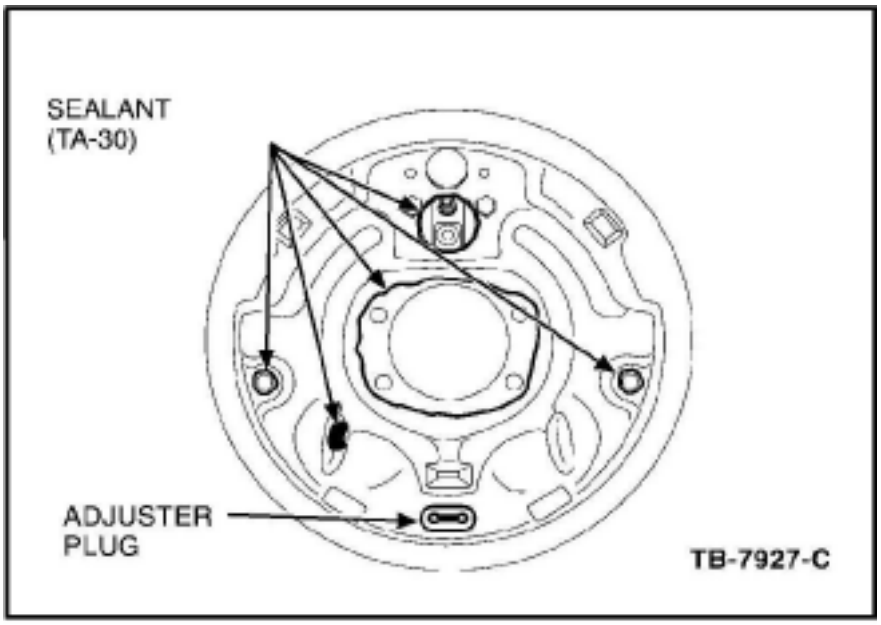


Figure 1

Backing Plate: All Technical Service Bulletins Brakes - Rear Brake Grab On First Applications

TSB 09-13-12

07/13/09

GRABBING CONDITION FROM REAR DRUM BRAKES

FORD: 2002-2009 Ranger

This article supersedes TSB 8-6-7 to update the vehicle model years.

ISSUE Some 2002-2009 Ranger vehicles may exhibit a grabbing condition from the rear brakes during the first few brake applications. The condition only occurs after the vehicle has been parked for several hours.

ACTION Follow the Service Procedure steps to correct the condition.

SERVICE PROCEDURE

To service, reduce/minimize moisture intrusion into the rear drum brake assemblies by applying Motorcraft® Silicone Gasket and Sealant to the brake backing plate.

1. Place vehicle on hoist and remove the rear wheels.

2. Remove the rear brake drums and replace the rear linings. Refer to Workshop Manual (WSM), Section 206-02.

WARNING

Do not breathe dust or use compressed air to blow dust from storage containers or friction components. Remove dust using government-approved techniques. Friction component dust may

be a cancer and lung disease hazard. Exposure to potentially hazardous components may occur if dusts are created during repair of friction components, such as brake pads and clutch discs. Exposure may also cause irritation to skin, eyes and respiratory tract, and may cause allergic reactions and/or may lead to other chronic health effects. If irritation persists, seek medical attention or advice. Failure to follow these instructions may result in serious personal injury.

3. Inspect the rear brake assemblies for damaged, missing and/or improperly seated adjuster plug or parking brake cable.

4. Inspect and clean the lining contact area of the brake drum; machine if necessary.

5. Install the rear brake drums and adjust the lining to drum clearance per WSM, Section 206-02.

6. Thoroughly clean the backside of the rear drum brake backing plate to promote proper adhesion of sealant.

7. Apply Motorcraft(R) Silicone Gasket and Sealant to the backside of the rear drum brake backing plate at the following interface areas (Figure 1):

^ Axle Flange

^ Wheel Cylinder

PART NUMBER	PART NAME
3L5Z-2200-CA	Brake Shoes 9" (2003-2009)
3L5Z-2200-DA	Brake Shoes 10" (2003-2009)
2U2Z-2V200-MARM	Brake Shoes 9" (2002)
F77Z-2200-BA	Brake Shoes 10" (2002)
TA-30	Motorcraft® Silicone Gasket And Sealant

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^ Parking Brake Cable

^ Hold Down Pins

NOTE

AVOID GETTING SEALANT ON THE BRAKE BLEED SCREW AND BRAKE TUBE NUT.

8. Install the rear wheels and torque lug nuts per WSM, Section 204-04.

WARRANTY STATUS: Eligible Under Provisions Of New Vehicle Limited Warranty Coverage
IMPORTANT: Warranty coverage limits/policies are not altered by a TSB. Warranty coverage limits are determined by the identified causal part.

OPERATION DESCRIPTION TIME

091312A 2002-2009 Ranger: 2.4 Hrs.

Replace Rear Brake Linings, Seal Backing Plate And Includes Time To Machine Brake Drums If Necessary (Do Not Use With Any Other Labor Operations)

DEALER CODING

CONDITION

BASIC PART NO. CODE

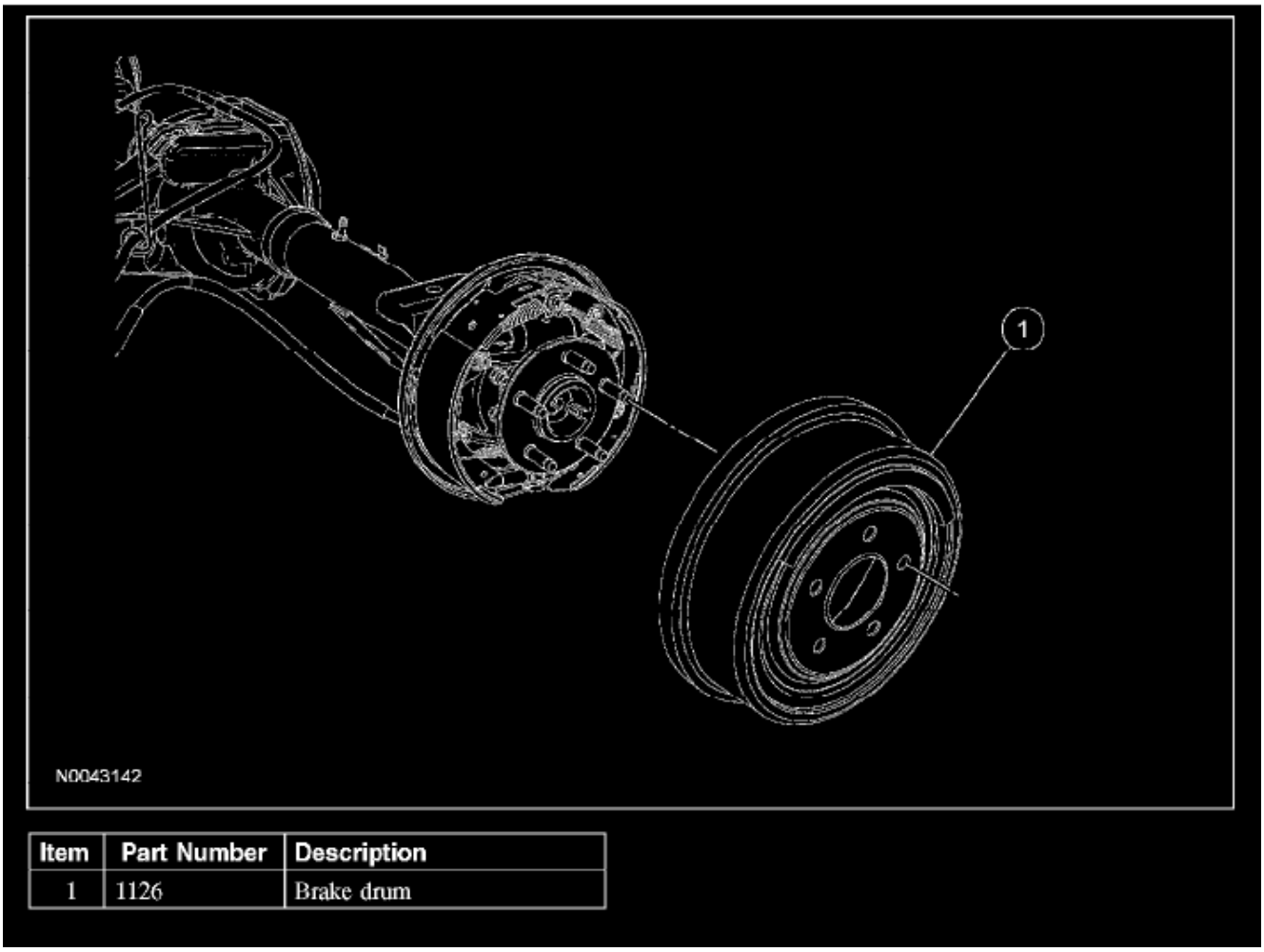
2200 69

Disclaimer

Brake Drum: Specifications

Maximum brake drum inside diameter ..... Molded into the brake drum

Special Tool(s)	
ST1131-A	Brake/Clutch/Service Vacuum 164-R3622 or equivalent
ST1342-A	Brake Drum Micrometer 104-00046 or equivalent



Item	Part Number	Description
1	1126	Brake drum

Brake Drum: Service and Repair

Brake Drum

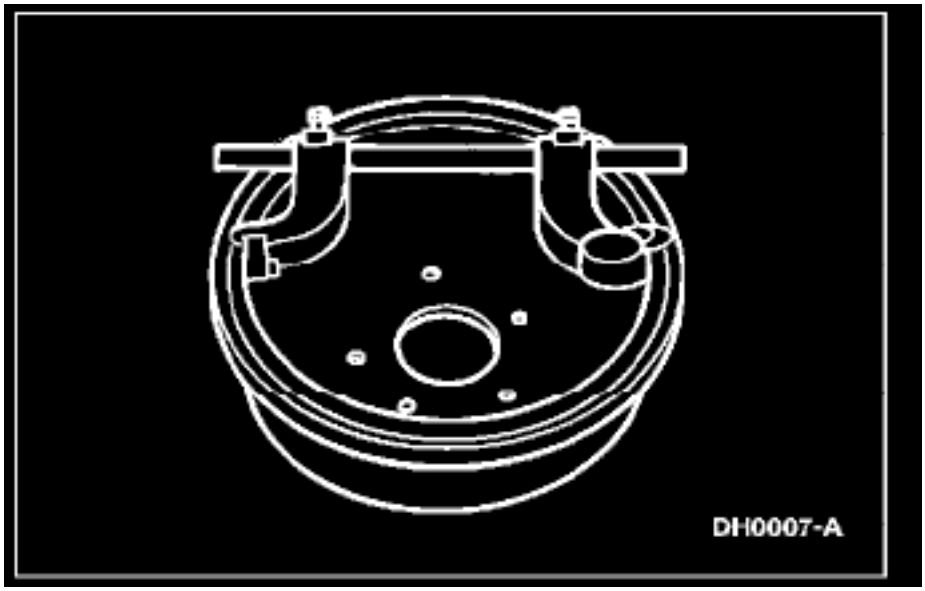
Removal and Installation

WARNING: Make sure the occupant classification sensor (OCS) shield(s) is present, not damaged and correctly installed. The OCS system shield(s) helps prevent damage to the OCS weight sensor bolt electrical connectors. Failure to follow these instructions may result in incorrect operation of the OCS system, which increases the risk of serious personal injury or death in a crash.

WARNING: Always install new brake shoes or pads at both ends of an axle to reduce the possibility of brakes pulling vehicle to one side. Failure to follow this instruction may result in uneven braking and serious personal injury.

NOTE: Make sure that the parking brake control is fully released.

1. Remove the wheel and tire.



2. CAUTION: Use of a brake drum puller or a torch is not recommended. Brake drum distortion may result.

NOTE: If the brake drum is rusted to the axle shaft pilot diameter, tap the center of the brake drum between the wheel studs.

Remove the brake drum.

3. Using the Brake Drum Micrometer, measure the brake drum inside diameter.

^ Install a new brake drum if the maximum inside diameter exceeds the specification molded on the brake drum.

4. To install, reverse the removal procedure.

^ Adjust the rear brakes.

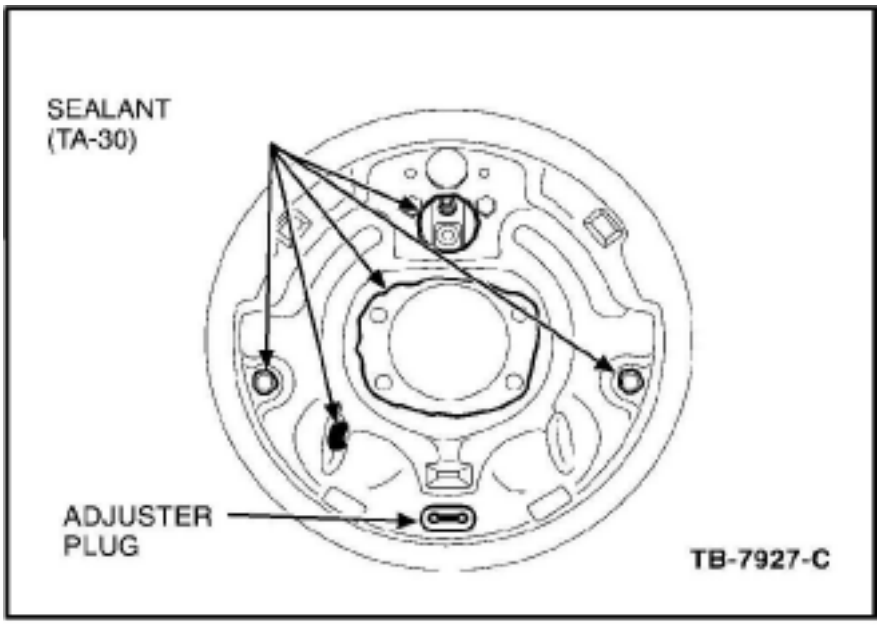


Figure 1

Brake Shoe: Customer Interest Brakes - Rear Brake Grab On First Applications

TSB 09-13-12

07/13/09

GRABBING CONDITION FROM REAR DRUM BRAKES

FORD: 2002-2009 Ranger

This article supersedes TSB 8-6-7 to update the vehicle model years.

ISSUE Some 2002-2009 Ranger vehicles may exhibit a grabbing condition from the rear brakes during the first few brake applications. The condition only occurs after the vehicle has been parked for several hours.

ACTION Follow the Service Procedure steps to correct the condition.

SERVICE PROCEDURE

To service, reduce/minimize moisture intrusion into the rear drum brake assemblies by applying Motorcraft® Silicone Gasket and Sealant to the brake backing plate.

1. Place vehicle on hoist and remove the rear wheels.

2. Remove the rear brake drums and replace the rear linings. Refer to Workshop Manual (WSM), Section 206-02.

WARNING

Do not breathe dust or use compressed air to blow dust from storage containers or friction components. Remove dust using government-approved techniques. Friction component dust may

be a cancer and lung disease hazard. Exposure to potentially hazardous components may occur if dusts are created during repair of friction components, such as brake pads and clutch discs. Exposure may also cause irritation to skin, eyes and respiratory tract, and may cause allergic reactions and/or may lead to other chronic health effects. If irritation persists, seek medical attention or advice. Failure to follow these instructions may result in serious personal injury.

3. Inspect the rear brake assemblies for damaged, missing and/or improperly seated adjuster plug or parking brake cable.

4. Inspect and clean the lining contact area of the brake drum; machine if necessary.

5. Install the rear brake drums and adjust the lining to drum clearance per WSM, Section 206-02.

6. Thoroughly clean the backside of the rear drum brake backing plate to promote proper adhesion of sealant.

7. Apply Motorcraft(R) Silicone Gasket and Sealant to the backside of the rear drum brake backing plate at the following interface areas (Figure 1):

^ Axle Flange

^ Wheel Cylinder

PART NUMBER	PART NAME
3L5Z-2200-CA	Brake Shoes 9" (2003-2009)
3L5Z-2200-DA	Brake Shoes 10" (2003-2009)
2U2Z-2V200-MARM	Brake Shoes 9" (2002)
F77Z-2200-BA	Brake Shoes 10" (2002)
TA-30	Motorcraft® Silicone Gasket And Sealant

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^ Parking Brake Cable

^ Hold Down Pins

NOTE

AVOID GETTING SEALANT ON THE BRAKE BLEED SCREW AND BRAKE TUBE NUT.

8. Install the rear wheels and torque lug nuts per WSM, Section 204-04.

WARRANTY STATUS: Eligible Under Provisions Of New Vehicle Limited Warranty Coverage
IMPORTANT: Warranty coverage limits/policies are not altered by a TSB. Warranty coverage limits are determined by the identified causal part.

OPERATION DESCRIPTION TIME

091312A 2002-2009 Ranger: 2.4 Hrs.

Replace Rear Brake Linings, Seal Backing Plate And Includes Time To Machine Brake Drums If Necessary (Do Not Use With Any Other Labor Operations)

DEALER CODING

CONDITION

BASIC PART NO. CODE

2200 69

Disclaimer

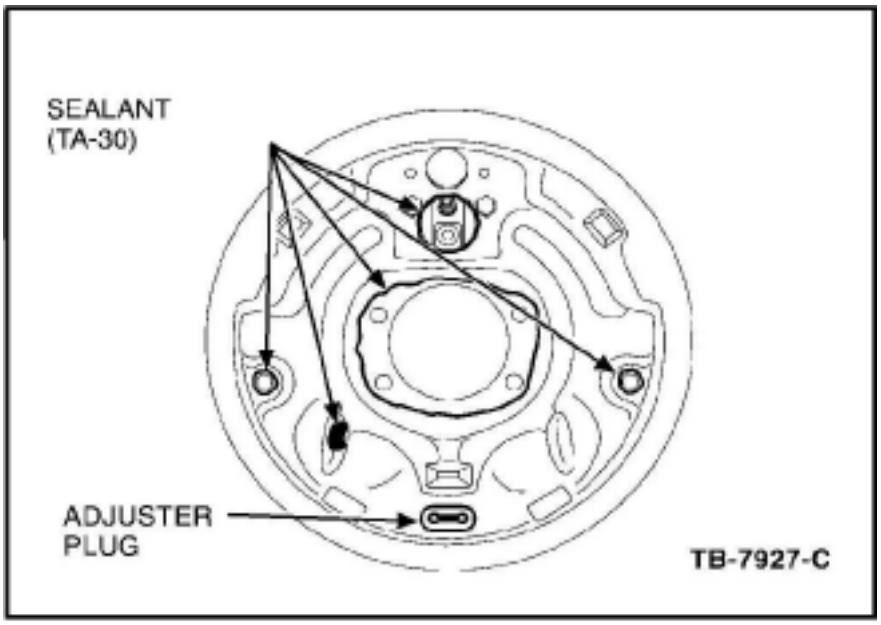

Figure 1

Brake Shoe: All Technical Service Bulletins Brakes - Rear Brake Grab On First Applications

TSB 09-13-12

07/13/09

GRABBING CONDITION FROM REAR DRUM BRAKES

FORD: 2002-2009 Ranger

This article supersedes TSB 8-6-7 to update the vehicle model years.

ISSUE Some 2002-2009 Ranger vehicles may exhibit a grabbing condition from the rear brakes during the first few brake applications. The condition only occurs after the vehicle has been parked for several hours.

ACTION Follow the Service Procedure steps to correct the condition.

SERVICE PROCEDURE

To service, reduce/minimize moisture intrusion into the rear drum brake assemblies by applying Motorcraft® Silicone Gasket and Sealant to the brake backing plate.

1. Place vehicle on hoist and remove the rear wheels.

2. Remove the rear brake drums and replace the rear linings. Refer to Workshop Manual (WSM), Section 206-02.

WARNING

Do not breathe dust or use compressed air to blow dust from storage containers or friction components. Remove dust using government-approved techniques. Friction component dust may

be a cancer and lung disease hazard. Exposure to potentially hazardous components may occur if dusts are created during repair of friction components, such as brake pads and clutch discs. Exposure may also cause irritation to skin, eyes and respiratory tract, and may cause allergic reactions and/or may lead to other chronic health effects. If irritation persists, seek medical attention or advice. Failure to follow these instructions may result in serious personal injury.

3. Inspect the rear brake assemblies for damaged, missing and/or improperly seated adjuster plug or parking brake cable.

4. Inspect and clean the lining contact area of the brake drum; machine if necessary.

5. Install the rear brake drums and adjust the lining to drum clearance per WSM, Section 206-02.

6. Thoroughly clean the backside of the rear drum brake backing plate to promote proper adhesion of sealant.

7. Apply Motorcraft(R) Silicone Gasket and Sealant to the backside of the rear drum brake backing plate at the following interface areas (Figure 1):

^ Axle Flange

^ Wheel Cylinder

PART NUMBER	PART NAME
3L5Z-2200-CA	Brake Shoes 9" (2003-2009)
3L5Z-2200-DA	Brake Shoes 10" (2003-2009)
2U2Z-2V200-MARM	Brake Shoes 9" (2002)
F77Z-2200-BA	Brake Shoes 10" (2002)
TA-30	Motorcraft® Silicone Gasket And Sealant

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^ Parking Brake Cable

^ Hold Down Pins

NOTE

AVOID GETTING SEALANT ON THE BRAKE BLEED SCREW AND BRAKE TUBE NUT.

8. Install the rear wheels and torque lug nuts per WSM, Section 204-04.

WARRANTY STATUS: Eligible Under Provisions Of New Vehicle Limited Warranty Coverage
IMPORTANT: Warranty coverage limits/policies are not altered by a TSB. Warranty coverage limits are determined by the identified causal part.

OPERATION DESCRIPTION TIME

091312A 2002-2009 Ranger: 2.4 Hrs.

Replace Rear Brake Linings, Seal Backing Plate And Includes Time To Machine Brake Drums If Necessary (Do Not Use With Any Other Labor Operations)

DEALER CODING

CONDITION

BASIC PART NO. CODE

2200 69

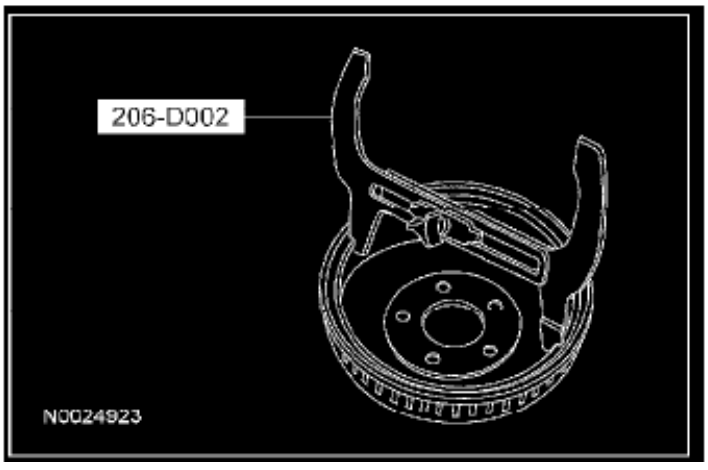
Disclaimer

Brake Shoe: Specifications

Minimum brake shoe thickness ..... 0.8 mm (0.03 in)

Special Tool(s)

ST1468-A	Brake Adjusting Gauge 206-D002 (D81L-1103-A) or equivalent
ST1467-A	Brake Adjustment Tool 206-D003 (D81L-1103-C) or equivalent
ST1131-A	Brake/Clutch/Service Vacuum 164-R3622 or equivalent



Brake Shoe: Adjustments

Brake Shoe Adjustment

Brake Drums Removed

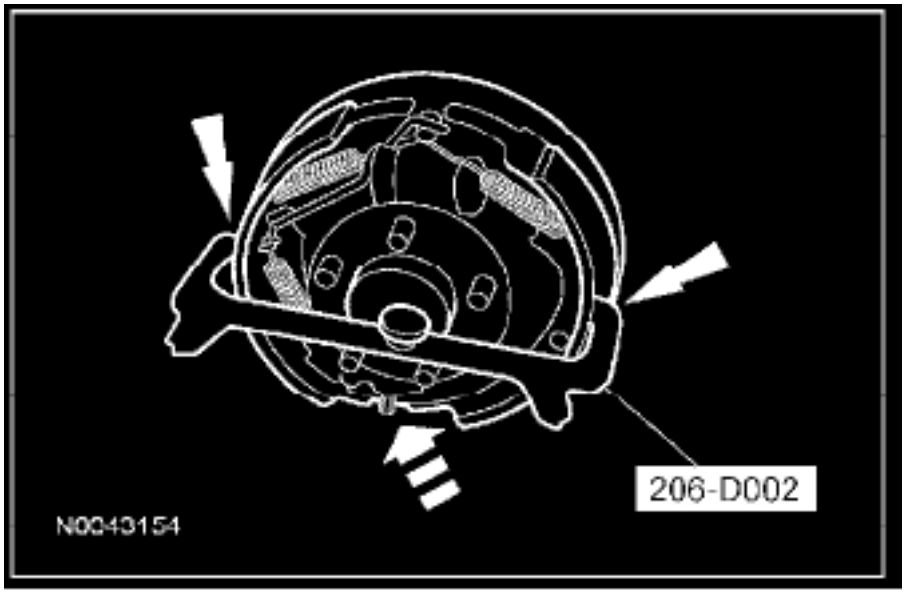
WARNING: Make sure the occupant classification sensor (OCS) shield(s) is present, not damaged and correctly installed. The OCS system shield(s) helps prevent damage to the OCS weight sensor bolt electrical connectors. Failure to follow these instructions may result in incorrect operation of the OCS system, which increases the risk of serious personal injury or death in a crash.

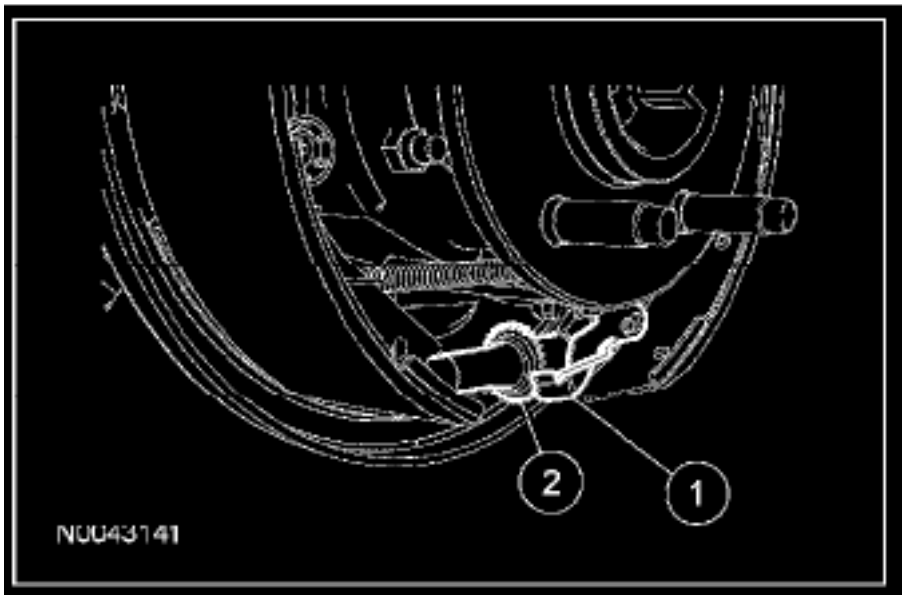
NOTE: After adjusting the rear brake shoes and linings, check the parking brake for correct operation. Make sure the parking brake cable equalizer operates freely.

1. Using the special tool or equivalent, measure the brake drum inside diameter.

2. Adjust the rear brake shoes and linings.

^ Rotate the brake adjusting screw until the brake shoes and linings touch the tool.





Brake Drums Installed

1. With the vehicle in NEUTRAL, position it on a hoist. 2. At the back of the brake backing plate, remove the brake adjusting hole cover. 3. Rotate the brake shoe adjusting screw.

1 Move the brake shoe adjusting lever off the brake shoe adjusting screw.

2 Using the special tool or equivalent, turn the adjusting screw until the brake drum begins to drag. Then loosen the brake adjusting screw until the brake drum rotates freely.

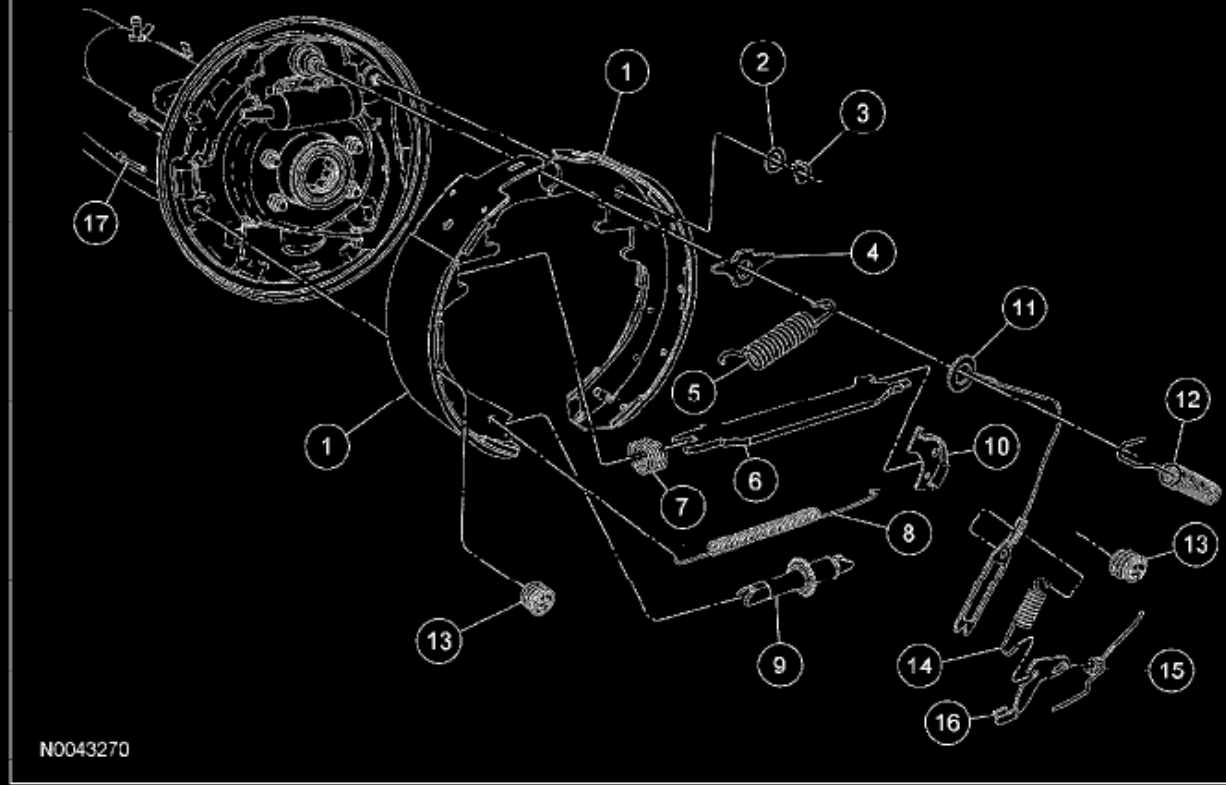
4. Install a new brake backing plate adjusting hole cover.

Special Tool(s)

ST1131-A	Brake/Clutch/Service Vacuum 164-R3622 or equivalent

Material

Item	Specification
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A



Item	Part Number	Description
1	2200	Brake shoes and linings (2 required)
2	—	Washer (part of 2A637 RH/ 2A638 LH)

(Continued)

Item	Part Number	Description
3	—	Parking brake lever pin retainer (part of 2A637 RH/ 2A638 LH)

(Continued)

Brake Shoe: Service and Repair

Brake Shoes

Item	Part Number	Description
4	—	Brake shoe guide plate (part of 2C077)
5	—	Primary brake shoe retracting spring (part of 2296)
6	—	Parking brake strut (part of 2C077)
7	—	Parking brake strut spring (part of 2C077)
8	—	Brake shoe adjusting screw spring (part of 2296)
9	2041	Brake shoe adjusting screw
10	—	Cable guide (part of 2A176 RH/ 2A177 LH)
11	—	Brake shoe adjusting lever cable (part of 2A176 RH/ 2A177 LH)
12	—	Secondary brake shoe retracting spring (part of 2296)
13	—	Brake shoe hold-down spring (part of 2296)
14	—	Brake shoe adjusting lever cable spring (part of 2A176 RH/ 2A177 LH)
15	—	Adjusting lever return spring (part of 2A176 RH/ 2A177 LH)
16	—	Brake shoe adjusting lever (part of 2A176 RH/ 2A177 LH)
17	—	Brake shoe hold-down spring pin (part of 2296)

Removal

WARNING: DANGER, do not breathe dust or use compressed air to blow dust from storage containers or friction components. Use a low pressure/wet cleaning method, such as a solvent based brake and clutch cleaner to remove all adherent dust. Friction component dust may be a cancer and lung disease hazard. Exposure to potentially hazardous components may occur if dusts are created during repair of friction components, such as brake pads and clutch discs. Exposure may also cause irritation to skin, eyes and respiratory tract, and may cause allergic reactions and/or may lead to other chronic health effects. If irritation persists, seek medical attention or advice. Failure to follow these instructions may result in serious personal injury.

WARNING: Always install new brake shoes or pads at both ends of an axle to reduce the possibility of brakes pulling vehicle to one side. Failure to follow this instruction may result in uneven braking and serious personal injury.

NOTE: Make sure that the parking brake control is fully released.

1. Remove the brake drum. 2. Inspect the rear brake assembly.

^ Inspect the wheel cylinder for excessive leakage that can contaminate brake system parts and install a new wheel cylinder as necessary.

^ Inspect the brake shoes and linings for contamination and install new shoes and linings as necessary.

^ Inspect the brake shoes and linings for minimum thickness, above the backing plate or rivets and install new as necessary.

^ Inspect the springs for heat discoloration and install new as necessary.

^ Inspect the adjusting lever contact with the brake adjuster screw.

3. NOTE: To aid installation, note the locations of the short and long brake shoe retracting springs.

Remove the brake shoe retracting springs.

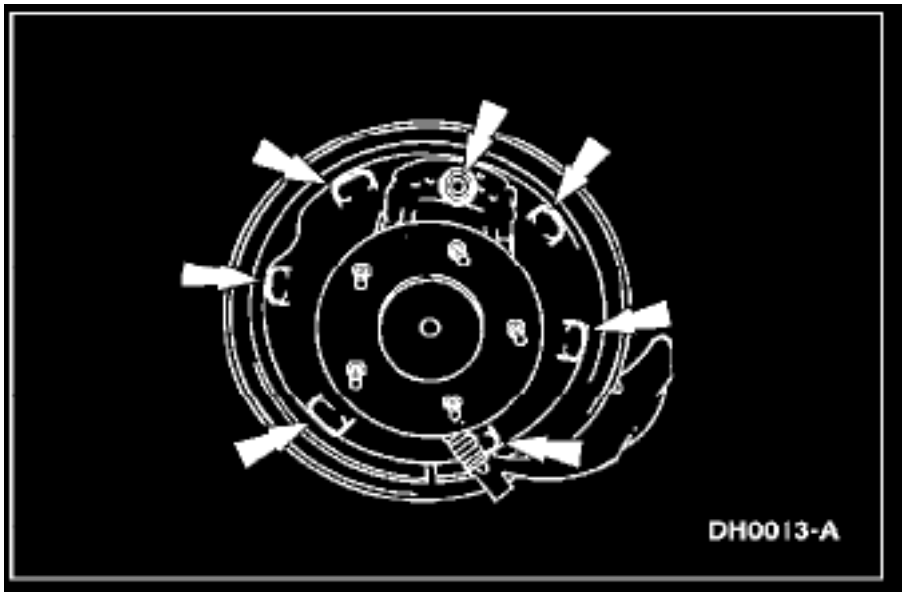
4. Remove the adjusting screw assembly in the following sequence.

1 Disconnect the brake shoe adjusting lever cable from the brake shoe adjusting lever.

2 Remove the brake shoe adjusting lever cable.

3 Remove the cable guide.

4 Remove the adjusting lever return spring and the brake shoe adjusting lever.



5 Remove the brake shoe adjusting screw spring.

6 Remove the brake adjuster screw assembly.

5. Remove the brake shoe anchor pin guide plate and the parking brake strut. 6. Remove the hold-down springs and the rear brake shoes and linings.

^ Remove the brake shoe hold-down spring pins.

7. Pull back the parking brake cable spring and disconnect the parking brake lever.

Installation

1. Compress the parking brake cable spring and attach the parking brake lever. 2. Clean and lubricate the brake backing plate using silicone brake caliper grease or an equivalent silicone.

3. Install the rear brake shoes and linings in the following sequence.

1 Position the rear brake shoes and linings.

2 Position the parking brake lever.

3 Install the brake shoe hold-down spring pins and the brake shoe hold-down springs.

4. Install the parking brake strut in the following sequence.

1 Install the parking brake link spring on the parking brake strut.

2 Install the parking brake strut.

3 Install the brake shoe anchor pin guide plate.

5. Install the short brake shoe retracting spring in the following sequence.

1 Place the brake shoe adjusting lever cable over the anchor pin, with crimped side in.

2 Install the short brake shoe retracting spring.

6. NOTE: Make sure the brake shoe adjusting lever cable is positioned in the cable guide groove.

Install the long brake shoe retracting spring in the following sequence. 1

Install the cable guide.

2 Position the brake shoe adjusting lever cable in the cable guide groove.

3 Install the long brake shoe retracting spring.

7. NOTE: To prevent incorrect installation, the socket end of each brake adjuster screw is stamped R or L.

Assemble the brake adjuster screw assembly in the following sequence. 1

Apply silicone brake caliper grease to the threads on the brake adjuster screw.

2 Install the brake adjuster screw into the brake shoe adjusting screw nut to the end of the threads, and then loosen one-half turn.

3 Install the brake shoe adjusting screw socket on the brake shoe adjusting screw nut.

8. Install the brake adjuster screw assembly in the following sequence.

1 Position the brake adjuster screw assembly.

2 Install the brake shoe adjusting screw spring.

3 Position the brake shoe adjusting lever cable.

4 Position the adjusting lever return spring and the brake shoe adjusting lever.

5 Hook the brake shoe adjusting lever cable to the brake shoe adjusting lever.

9. Test the operation of the automatic self-adjuster.

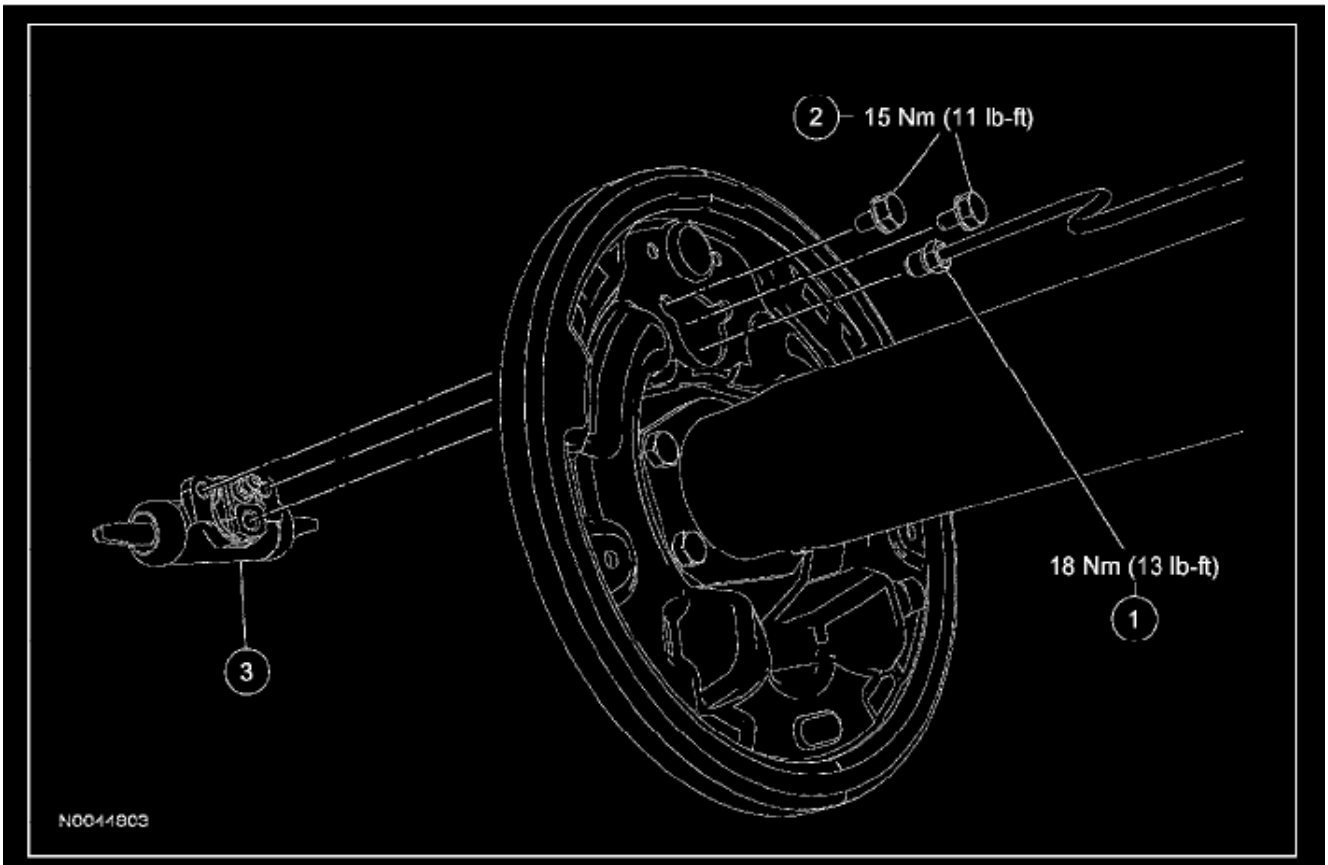
^ Pull the brake shoe adjusting lever cable and check that the brake shoe adjusting lever rotates the brake shoe adjuster assembly.

^ Release the brake shoe adjusting lever cable and check that the brake shoe adjusting lever advances to the next notch on the brake shoe adjusting screw nut.

10. Adjust the brakes. 11. Install the brake drum.

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A



Item	Part Number	Description
1	—	Brake tube-to-wheel cylinder fitting (part of 2268 LH/ 2267 RH)
2	—	Wheel cylinder bolts (2 required) (part of 2261)
3	2261	Wheel cylinder

Wheel Cylinder: Removal and Replacement

Wheel Cylinder

Removal and Installation

WARNING: Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal

injury.

WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

1. Remove the brake shoes and linings. 2. Disconnect the brake tube-to-wheel cylinder fitting.

^ To install, tighten to 18 Nm (13 lb-ft).

3. Remove the 2 wheel cylinder bolts and the wheel cylinder.

^ To install, tighten to 15 Nm (11 lb-ft).

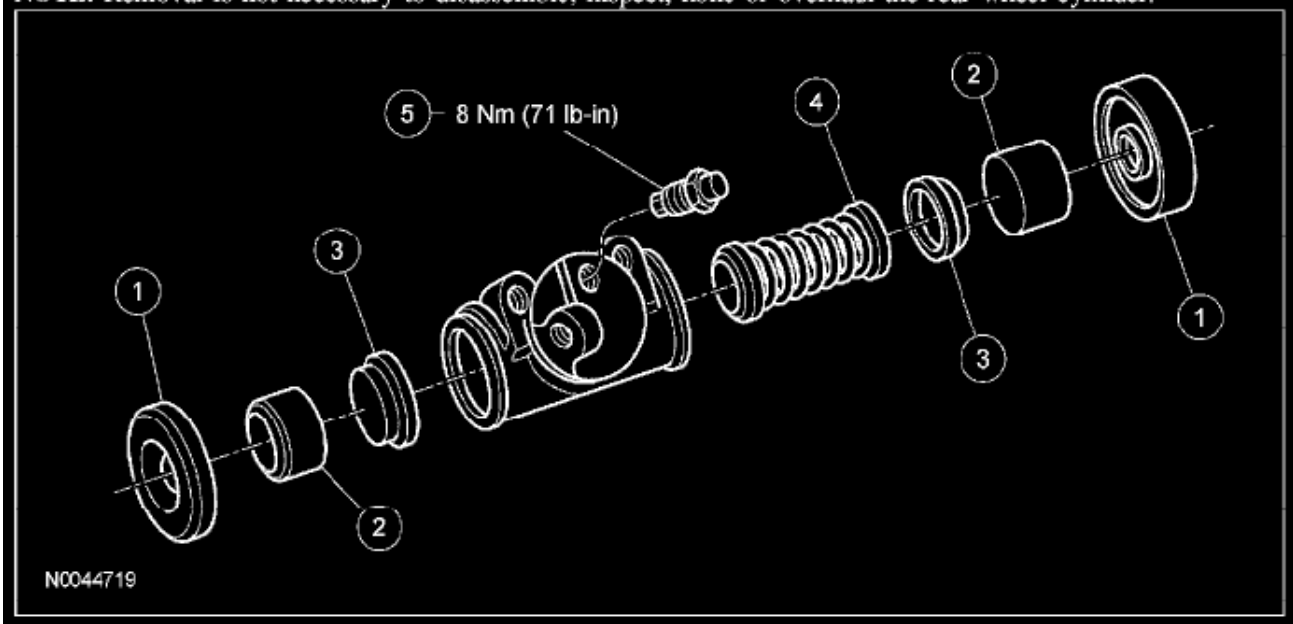
4. To install, reverse the removal procedure.

^ Bleed the brake system.

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A

NOTE: Removal is not necessary to disassemble, inspect, hone or overhaul the rear wheel cylinder.



Item	Part Number	Description
1	—	Wheel cylinder boots (part of 2261)
2	—	Wheel cylinder pistons (part of 2261)
3	—	Wheel cylinder cups (part of 2261)

Item	Part Number	Description
4	—	Wheel cylinder expander (part of 2261)
5	—	Wheel cylinder bleeder screw (part of 2261)

(Continued)

Wheel Cylinder: Overhaul

Wheel Cylinder

NOTE: Removal is not necessary to disassemble, inspect, hone or overhaul the rear wheel cylinder.

Disassembly and Assembly

WARNING: Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.

WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

1. Remove the wheel cylinder boots. 2. Remove the wheel cylinder pistons. 3. Remove the wheel cylinder cups. 4. Remove the wheel cylinder expander. 5. Remove the wheel cylinder bleeder screw from the rear wheel cylinder.

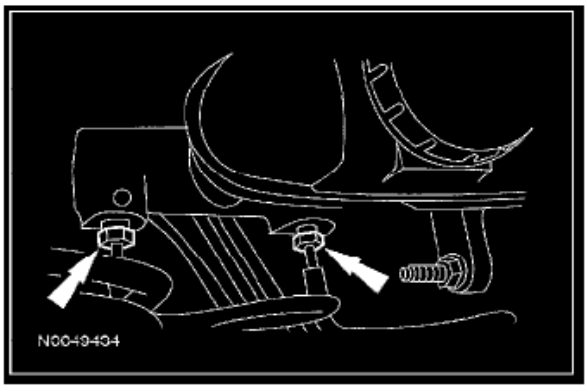
^ To install, tighten to 8 Nm (71 lb-inch).

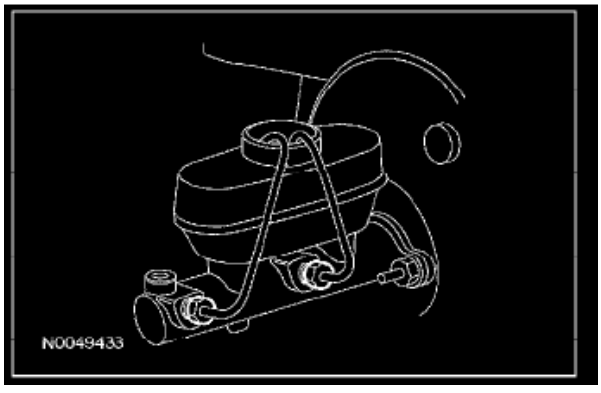
6. NOTE: Coat all the wheel cylinder parts with brake fluid.

To install, reverse the removal procedure.

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A





Brake Bleeding: Service and Repair Component Bleeding

Component Bleeding

Master Cylinder Priming

WARNING: Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.

WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

WARNING: Do not allow the brake master cylinder to run dry during the bleeding operation. Master cylinder may be damaged if operated without fluid, resulting in degraded braking performance. Failure to follow this instruction may result in serious personal injury.

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

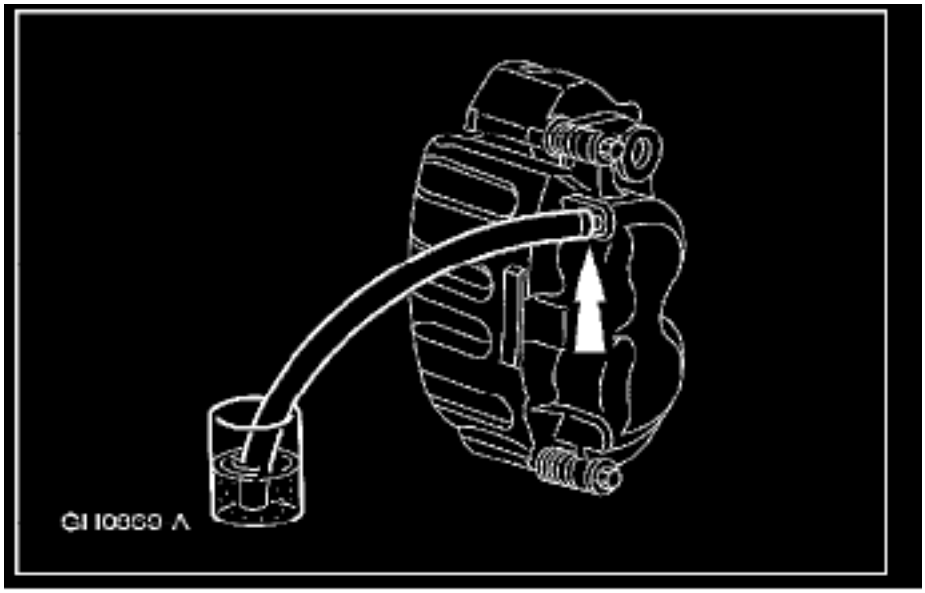
NOTE: When the brake master cylinder has been installed new or the system has been emptied or partially emptied, it must be primed to prevent air from entering the system.

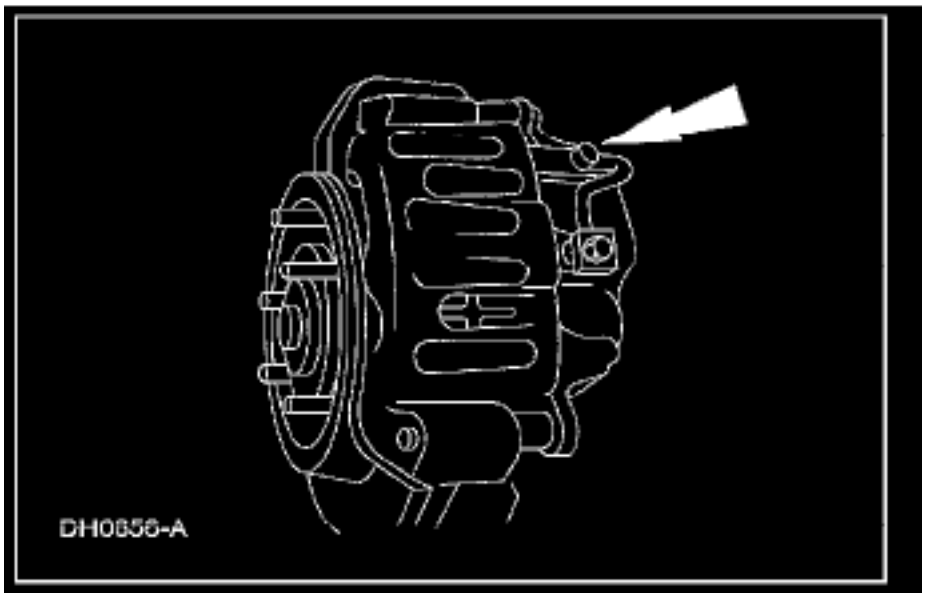
1. Disconnect the brake outlet tubes from the master cylinder.

2. Install short brake tubes with the ends submerged in the brake master cylinder reservoir and fill the brake master cylinder reservoir with clean,

specified brake fluid.

3. Have an assistant pump the brake pedal until clear fluid flows from both brake tubes, without air bubbles.





4. Remove the short brake tubes and install the brake outlet tubes. 5. Bleed each brake tube at the brake master cylinder as follows:

1 Have an assistant pump the brake pedal at least 2 times and then hold firm pressure on the brake pedal.

2 Loosen the rearmost brake tube fitting until a stream of brake fluid comes out. While the assistant maintains pressure on the brake pedal, tighten the brake tube fitting.

3 Repeat this operation until clear, bubble-free fluid comes out.

4 Refill the brake master cylinder reservoir as necessary. Repeat the bleeding operation at the front brake tube.

5 Tighten the master cylinder brake tube fittings to 18 Nm (13 lb-ft).

6. Bleed the brake system.

Brake caliper

WARNING: Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.

WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

WARNING: Do not allow the brake master cylinder to run dry during the bleeding operation. Master cylinder may be damaged if operated without fluid, resulting in degraded braking performance. Failure to follow this instruction may result in serious personal injury.

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

NOTE: It is not necessary to do a complete brake system bleed if only the brake caliper was disconnected or installed new.

1. Remove the bleeder screw cap and place a box-end wrench on the disc brake caliper bleeder screw. Attach a rubber drain hose to the disc brake

caliper bleeder screw and submerge the free end of the hose in a container partially filled with clean, specified brake fluid.

2. Have an assistant pump the brake pedal at least 2 times and then hold firm pressure on the brake pedal. 3. Loosen the disc brake caliper bleeder screw until a stream of brake fluid comes out. While the assistant maintains pressure on the brake pedal,

tighten the disc brake caliper bleeder screw. ^

Repeat until clear, bubble-free fluid comes out.

^ Refill the brake master cylinder reservoir as necessary.

4. Tighten the brake caliper bleeder screw to 15 Nm (11 lb-ft), remove the rubber hose and install the bleeder screw cap.

5. Apply brakes several times to verify correct brake operation.

Wheel Cylinder

WARNING: Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.

WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

WARNING: Do not allow the brake master cylinder to run dry during the bleeding operation. Master cylinder may be damaged if operated without fluid, resulting in degraded braking performance. Failure to follow this instruction may result in serious personal injury.

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

NOTE: It is not necessary to do a complete brake system bleed if only the wheel cylinder was disconnected or installed new.

1. Remove the bleeder screw cap and place a box-end wrench on the wheel cylinder bleeder screw. Attach a rubber drain hose to the disc brake

caliper bleeder screw and submerge the free end of the hose in a container partially filled with clean, specified brake fluid.

2. Have an assistant pump the brake pedal at least 2 times and then hold firm pressure on the brake pedal. 3. Loosen the wheel cylinder bleeder screw until a stream of brake fluid comes out. While the assistant maintains pressure on the brake pedal, tighten

the bleeder screw. ^

Repeat until clear, bubble-free fluid comes out.

^ Refill the brake master cylinder reservoir as necessary.

4. Tighten the wheel cylinder bleeder screw to 8 Nm (71 lb-inch), remove the rubber hose and install the bleeder screw cap. 5. Apply brakes several times to verify correct brake operation.

Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A

Brake Bleeding: Service and Repair Brake System Bleeding

Brake System Bleeding

ABS Hydraulic Control Unit (HCU) Bleeding

WARNING: Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.

WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

WARNING: Do not allow the brake master cylinder to run dry during the bleeding operation. Master cylinder may be damaged if operated without fluid, resulting in degraded braking performance. Failure to follow this instruction may result in serious personal injury.

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

NOTE: When any part of the hydraulic system has been disconnected for repair or installation of new components, air can get into the system and cause spongy brake pedal action. This requires bleeding of the hydraulic system, including the hydraulic control unit (HCU) after it has been correctly connected.

NOTE: If the HCU or any component upstream of the HCU is installed new, carry out the brake system bleed procedure first without the scan tool, followed by the brake system bleed procedure using the scan tool.

NOTE: This procedure is only required when a new HCU is installed.

1. Connect the scan tool and follow the ABS bleed instructions. 2. Follow the manual bleeding or pressure bleeding procedure steps to bleed the system.

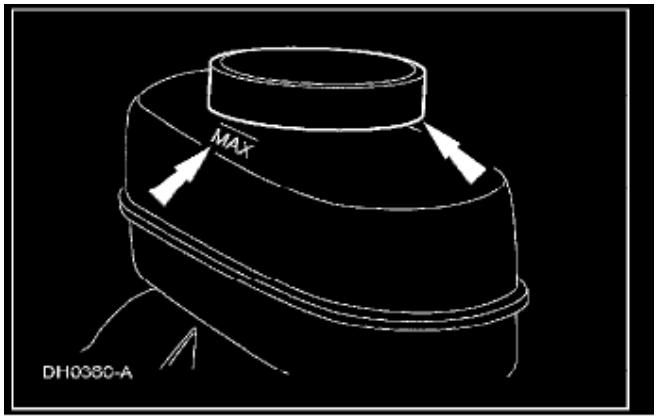
Manual Bleeding Method

WARNING: Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.

WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

WARNING: Do not allow the brake master cylinder to run dry during the bleeding operation. Master cylinder may be damaged if operated without fluid, resulting in degraded braking performance. Failure to follow this instruction may result in serious personal injury.

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.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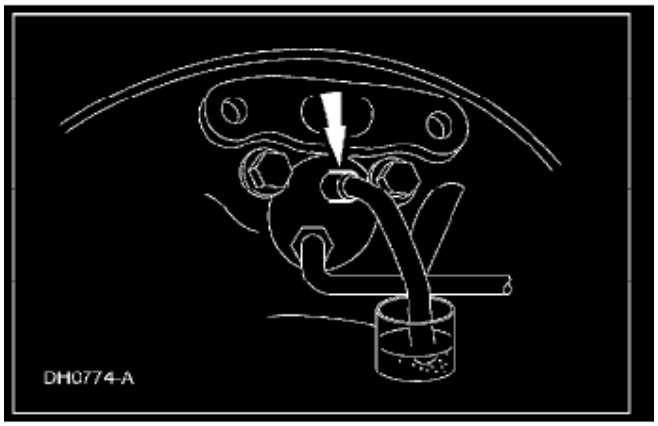
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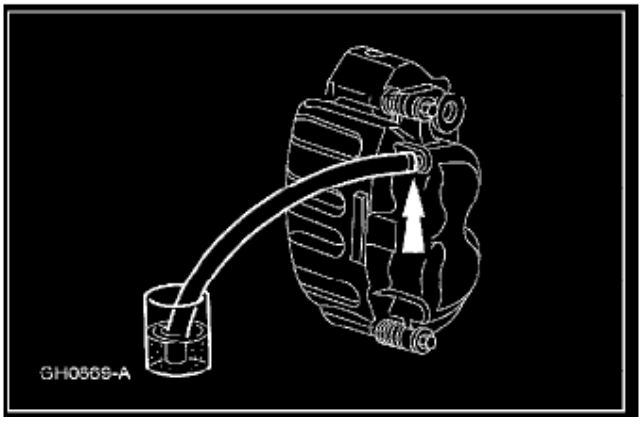
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NOTE: When any part of the hydraulic system has been disconnected for repair or installation of new components, air can get into the system and cause spongy brake pedal action. This requires bleeding of the hydraulic system, including the HCU after it has been correctly connected.

1. Clean all the dirt from around the brake fluid reservoir cap and remove the cap. Fill the brake master cylinder reservoir with clean, specified brake

fluid.

2. Remove the RR wheel cylinder bleeder screw cap and place a box-end wrench on the bleeder screw. Attach a rubber drain hose to the RR wheel

cylinder bleeder screw and submerge the free end of the hose in a container partially filled with clean, specified brake fluid.

3. Have an assistant pump and then hold firm pressure on the brake pedal. 4. Loosen the RR wheel cylinder bleeder screw until a stream of brake fluid comes out. While an assistant maintains pressure on the brake pedal,

tighten the RR wheel cylinder bleeder screw. ^

Repeat until clear, bubble-free fluid comes out.

^ Refill the brake master cylinder reservoir as necessary.

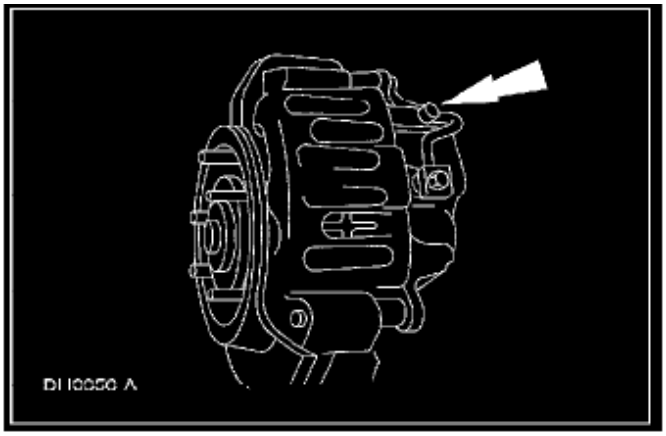
5. Tighten the RR wheel cylinder bleeder screw to 8 Nm (71 lb-inch), remove the rubber hose and install the bleeder screw cap. 6. Repeat Steps 2-5 for the LR wheel cylinder bleeder screw. 7. Remove the RF brake caliper bleeder cap and place a box-end wrench on the bleeder screw. Attach a rubber drain hose to the RF brake caliper

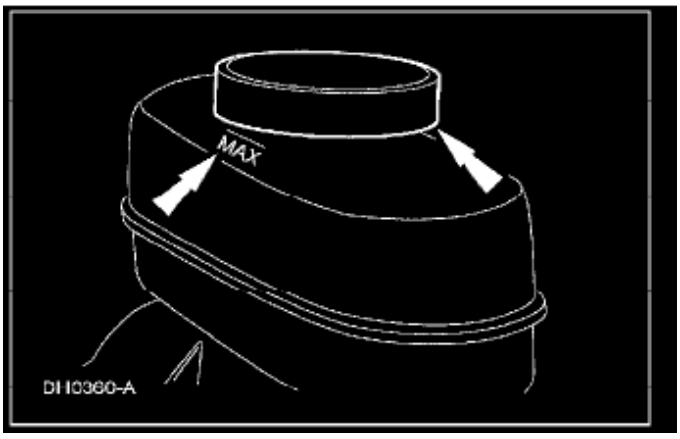
bleeder screw and submerge the free end of the hose in a container partially filled with clean, specified brake fluid.

8. Have an assistant pump and then hold firm pressure on the brake pedal. 9. Loosen the RF brake caliper bleeder screw until a stream of brake fluid comes out. While the assistant maintains pressure on the brake pedal,

tighten the RF brake caliper bleeder screw. ^

Repeat until clear, bubble-free fluid comes out.

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^ Refill the brake master cylinder reservoir as necessary.

10. Tighten the RF brake caliper bleeder screw to 15 Nm (11 lb-ft), remove the rubber hose and install the bleeder screw cap.

11. Repeat Steps 7 through 10 for the LF brake caliper bleeder screw. 12. Apply brakes several times to verify correct brake operation.

Pressure Bleeding Method

WARNING: Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.

WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

WARNING: Do not allow the brake master cylinder to run dry during the bleeding operation. Master cylinder may be damaged if operated without fluid, resulting in degraded braking performance. Failure to follow this instruction may result in serious personal injury.

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

NOTE: When any part of the hydraulic system has been disconnected for repair or installation of new components, air can get into the system and cause spongy brake pedal action. This requires bleeding of the hydraulic system, including the hydraulic control unit (HCU) after it has been correctly connected.

1. Clean all dirt from and remove the brake master cylinder filler cap and fill the brake master cylinder reservoir with clean, specified brake fluid.

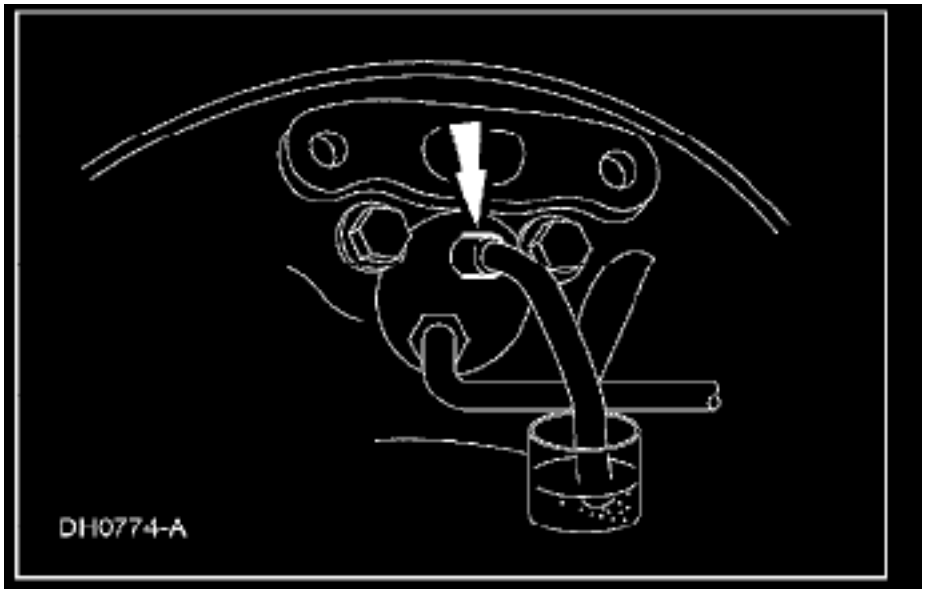
2. NOTE: Master cylinder pressure bleeder adapter tools are available from various manufacturers of pressure bleeding equipment. Follow the

instructions of the manufacturer when installing the adapter.

Install the bleeder adapter to the brake master cylinder reservoir, and attach the bleeder tank hose to the fitting on the adapter.

3. NOTE: Bleed the longest line first. Make sure the bleeder tank contains enough specified brake fluid to complete the bleeding operation.

Remove the RR wheel cylinder bleeder screw cap and place a box-end wrench on the bleeder screw. Attach a rubber drain hose to the RR wheel cylinder bleeder screw and submerge the free end of the hose in a container partially filled with clean, specified brake fluid.



4. Open the valve on the bleeder tank. 5. Loosen the RR wheel cylinder bleeder screw. Leave open until clear, bubble-free brake fluid flows, then tighten the RR wheel cylinder bleeder

screw to 8 Nm (71 lb-inch) and remove the rubber hose.

6. Continue bleeding the rest of the system, going in order from the LR wheel cylinder bleeder screw to the RF disc brake caliper bleeder screw,

ending with the LF disc brake caliper bleeder screw. ^

Tighten the brake caliper bleeder screws to 15 Nm (11 lb-ft).

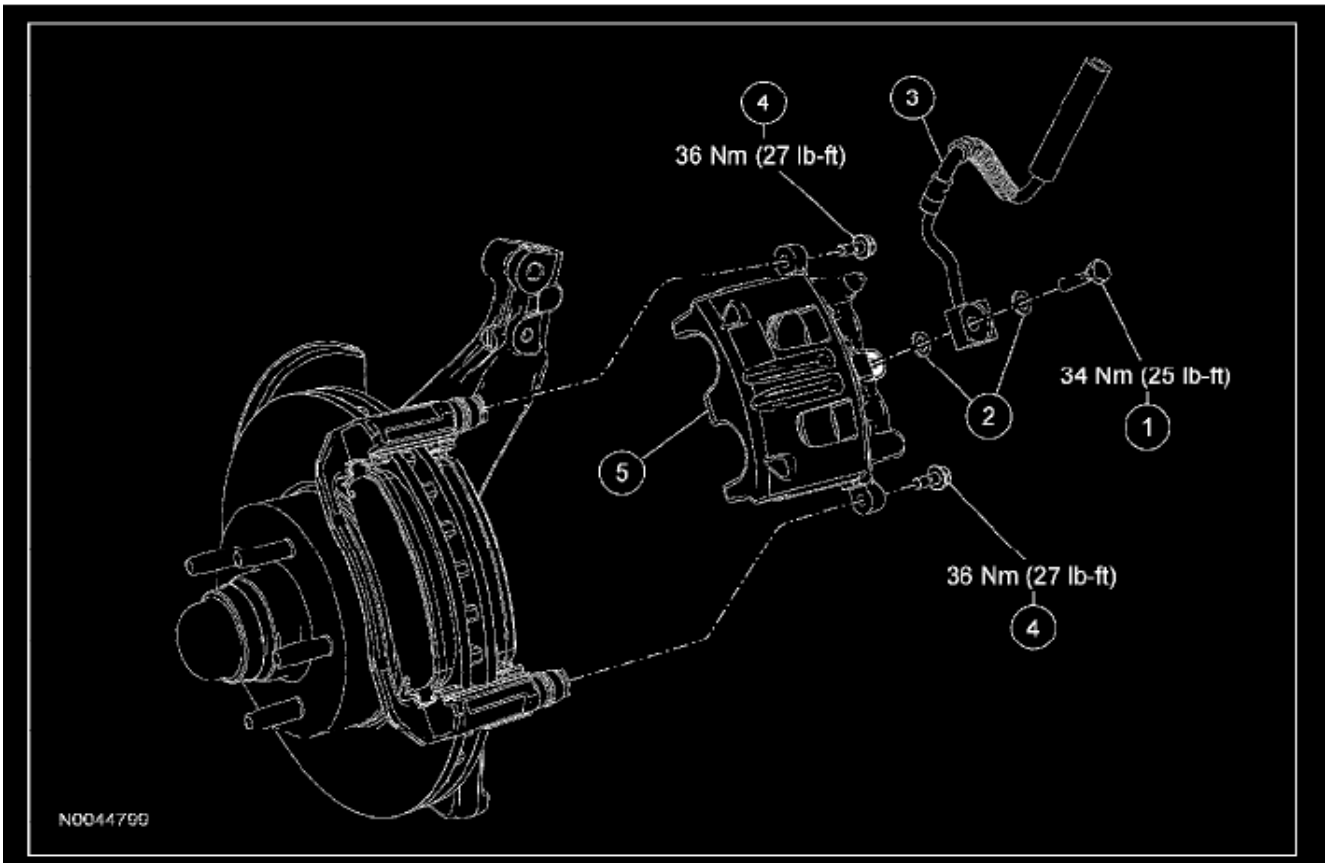
7. Close the bleeder tank valve. Remove the tank hose from the adapter and remove the adapter. Fill the reservoir with clean, specified brake fluid

and install the reservoir cap.

8. Apply brakes several times to verify correct brake operation.

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A



Item	Part Number	Description
1	N808236	Brake caliper flow bolt
2	2149	Copper washers (2 required)
3	2078	Front brake hose

Item	Part Number	Description
4	2B296	Brake caliper pin bolts (2 required)
5	2B120	Brake caliper

(Continued)

Brake Caliper: Service and Repair Caliper Removal and Installation, Front

Brake Caliper

Removal

WARNING: Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.

WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

1. Remove the wheel and tire. 2. Remove the brake caliper flow bolt and position the brake hose aside.

^ Discard the 2 copper washers.

^ Plug the brake hose.

3. CAUTION: Do not pry in the caliper sight hole to retract the pistons as this can damage the pistons and boots.

Remove the 2 brake caliper guide pin bolts and the brake caliper. ^

If leaks or damaged boots are found, install a new disc brake caliper.

Installation

1. CAUTION: Tighten the bottom caliper bolt before tightening the top caliper bolt or damage to guide pins may occur.

CAUTION: Make sure the caliper pin boots are correctly seated to prevent damage to the guide pins.

Position the brake caliper and install the 2 brake caliper guide pin bolts. ^

Tighten to 36 Nm (27 lb-ft).

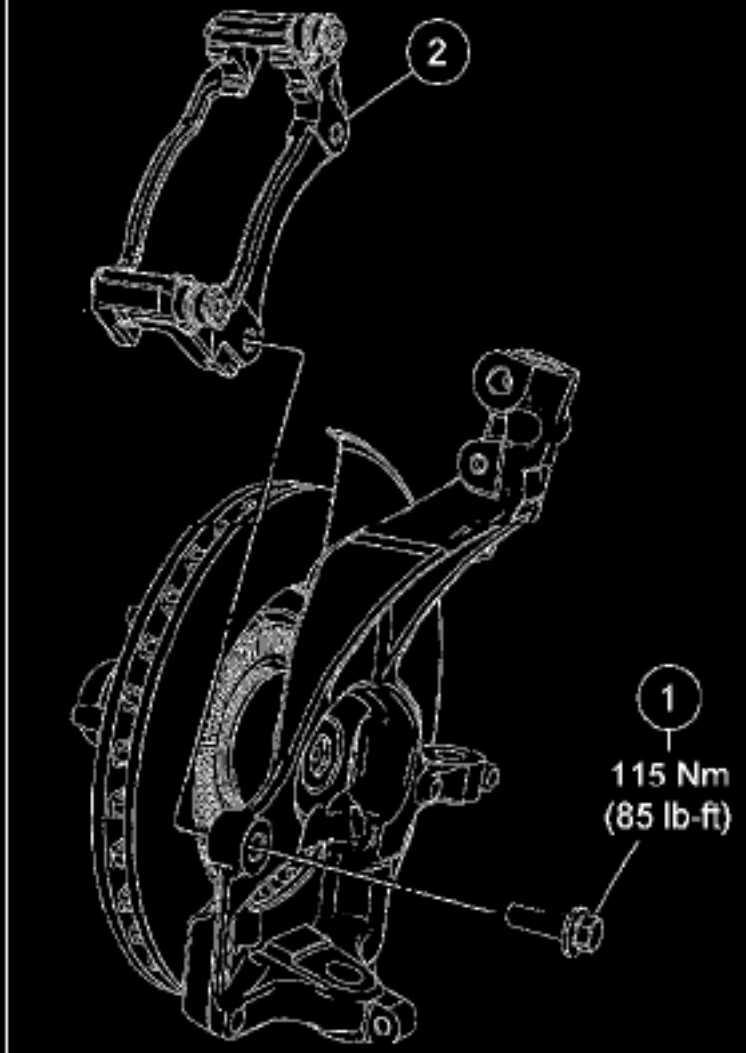
2. Using 2 new copper washers, position the brake hose and install the brake caliper flow bolt.

^ Tighten to 34 Nm (25 lb-ft).

3. Bleed the brake caliper. 4. Install the wheel and tire. 5. Test the brake system for normal operation. 6. Apply the brakes several times to verify correct brake operation.

Brake Caliper Anchor Plate

NOTE: Rear wheel drive (RWD) shown, four wheel drive (4WD) similar.



Item	Part Number	Description
1	W710701	Brake caliper anchor plate bolt (2 required)
2	2C396	Brake caliper anchor plate

Brake Caliper: Service and Repair Brake Caliper Anchor Plate, Front

Brake Caliper Anchor Plate

NOTE: Rear wheel drive (RWD) shown, four wheel drive (4WD) similar.

Removal and Installation

1. Remove the wheel and tire. 2. Remove the 2 brake caliper guide pin bolts and position the caliper aside.

^ To install, tighten to 36 Nm (27 lb-ft).

^ Support the caliper using mechanic's wire.

3. Remove the brake pads and the brake pad clips. 4. Remove the 2 brake caliper anchor plate bolts and the brake caliper anchor plate.

^ To install, tighten to 115 Nm (85 lb-ft).

5. To install, reverse the removal procedure.

Brake Fluid: Specifications

Brake Fluid Type

Ford Part Name

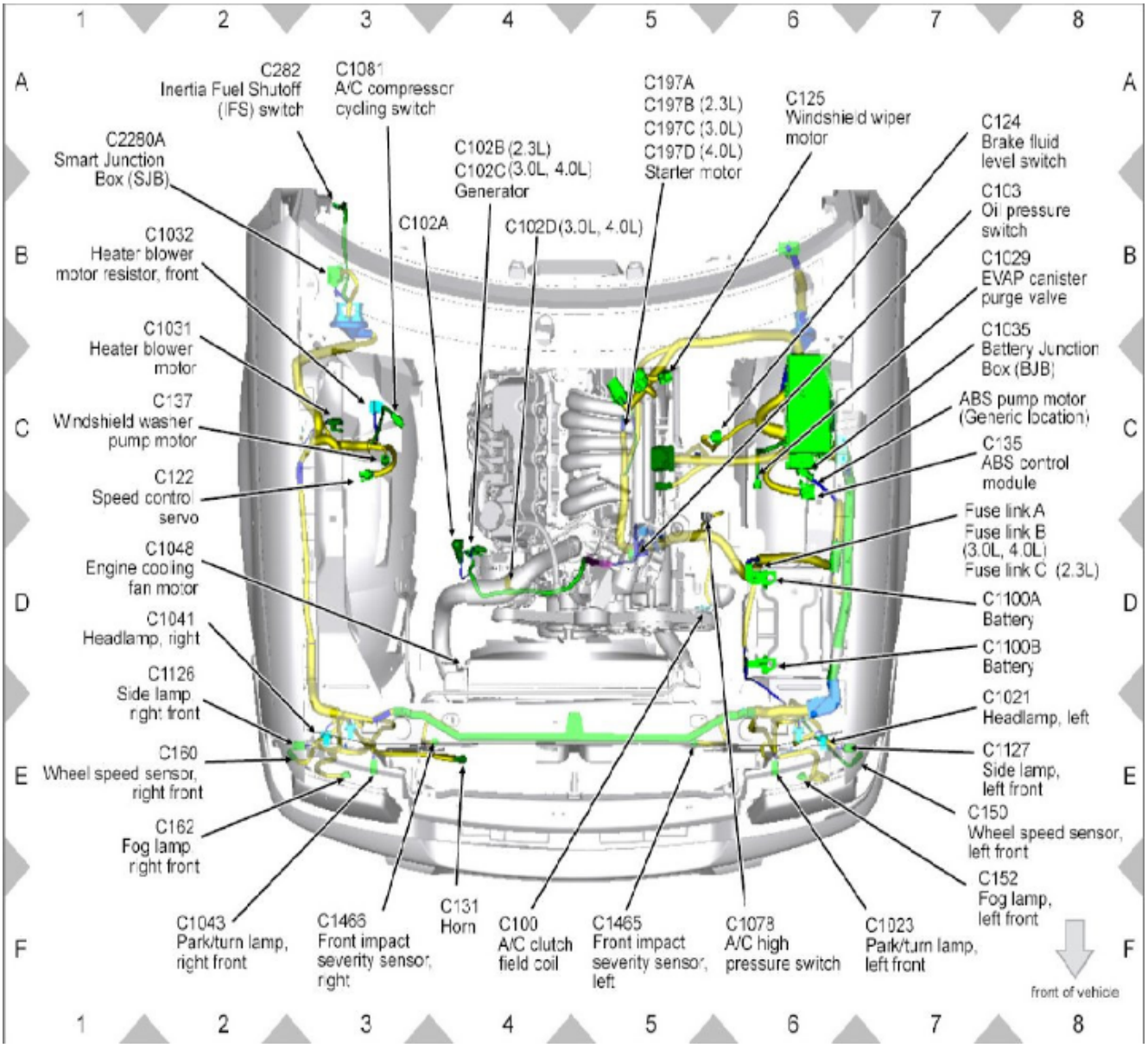
- Motorcraft High Performance DOT 3 Motor Vehicle Brake Fluid

Ford Part Number

- PM-1 or PM-1-C

Ford Specifications

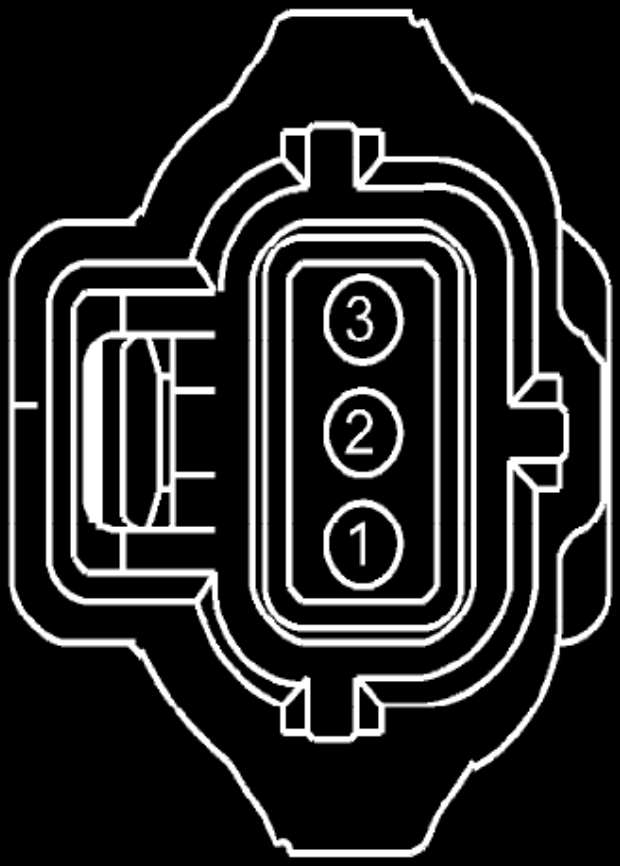
- ESA-M6C25-A or WSS-M6C62-A


C282
Inertia Fuel Shutoff (IFS) switch
C1081
A/C compressor cycling switch
C2280A
Smart Junction Box (SJB)
C102B (2.3L)
C102C (3.0L, 4.0L)
Generator
C102A
C102D (3.0L, 4.0L)
C197A
C197B (2.3L)
C197C (3.0L)
C197D (4.0L)
Starter motor
C125
Windshield wiper motor
C124
Brake fluid level switch
C103
Oil pressure switch
C1032
Heater blower motor resistor, front
C1029
EVAP canister purge valve
C1031
Heater blower motor
C1035
Battery Junction Box (BJB)
C137
Windshield washer pump motor
ABS pump motor (Generic location)
C135
ABS control module
C122
Speed control servo
Fuse link A
Fuse link B (3.0L, 4.0L)
Fuse link C (2.3L)
C1048
Engine cooling fan motor
C1100A
Battery
C1041
Headlamp, right
C1100B
Battery
C1126
Side lamp, right front
C1021
Headlamp, left
C160
Wheel speed sensor, right front
C1127
Side lamp, left front
C162
Fog lamp, right front
C150
Wheel speed sensor, left front
C152
Fog lamp, left front
C1043
Park/turn lamp, right front
C1466
Front impact severity sensor, right
C131
Horn
C100
A/C clutch field coil
C1465
Front impact severity sensor, left
C1078
A/C high pressure switch
C1023
Park/turn lamp, left front
front of vehicle

View 151-1

Connector: C124

Description:	Harness:	Base Part #:
BRAKE FLUID LEVEL SWITCH	14290	2L414

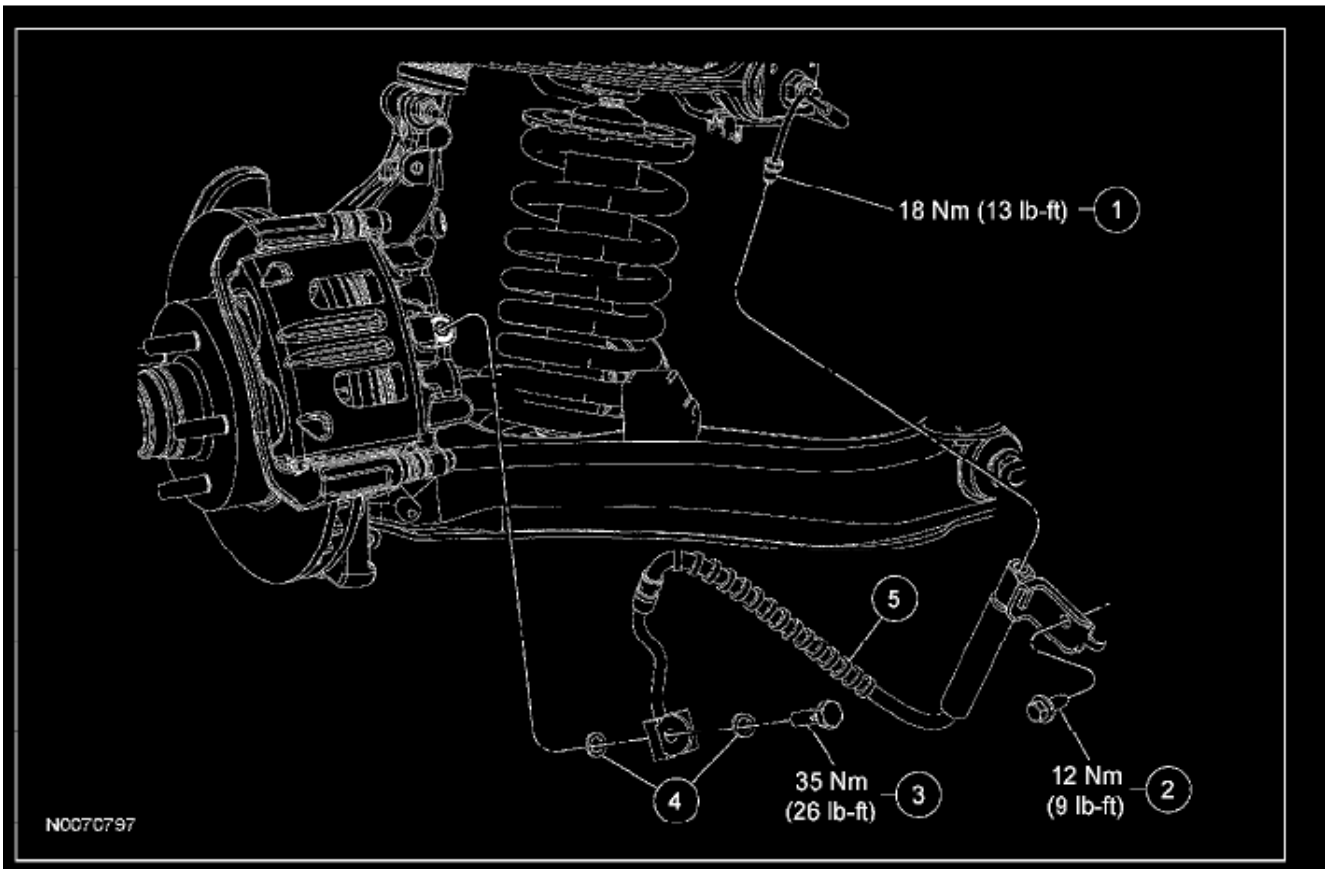


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD121 (BK-YE)	20	GROUND - FENDER FRONT LEFT # 2ND STUD	
2	GMC19 (GY-VT)	20	SWITCH - LOW LEVEL BRAKE FLUID	
3	RMC19 (YE-GY)	20	SWITCH - LOW LEVEL BRAKE FLUID (CONTINUITY CHECK)	

C124

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A



Item	Part Number	Description
1	—	Brake tube fitting (part of 2263 RH/ 2264 LH)
2	W712215	Brake flexible hose bracket bolt

Item	Part Number	Description
3	385116	Brake caliper flow bolt
4	2149	Copper washers (2 required)
5	2282	Brake flexible hose

(Continued)

Brake Hose/Line: Service and Repair

Brake Flexible Hose

Removal and Installation

WARNING: Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.

WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

1. Remove the wheel and tire. 2. Disconnect the brake tube fitting from the brake flexible hose.

^ To install, tighten to 18 Nm (13 lb-ft).

3. Remove the brake caliper flow bolt and discard the 2 copper washers.

^ To install, tighten to 34 Nm (25 lb-ft).

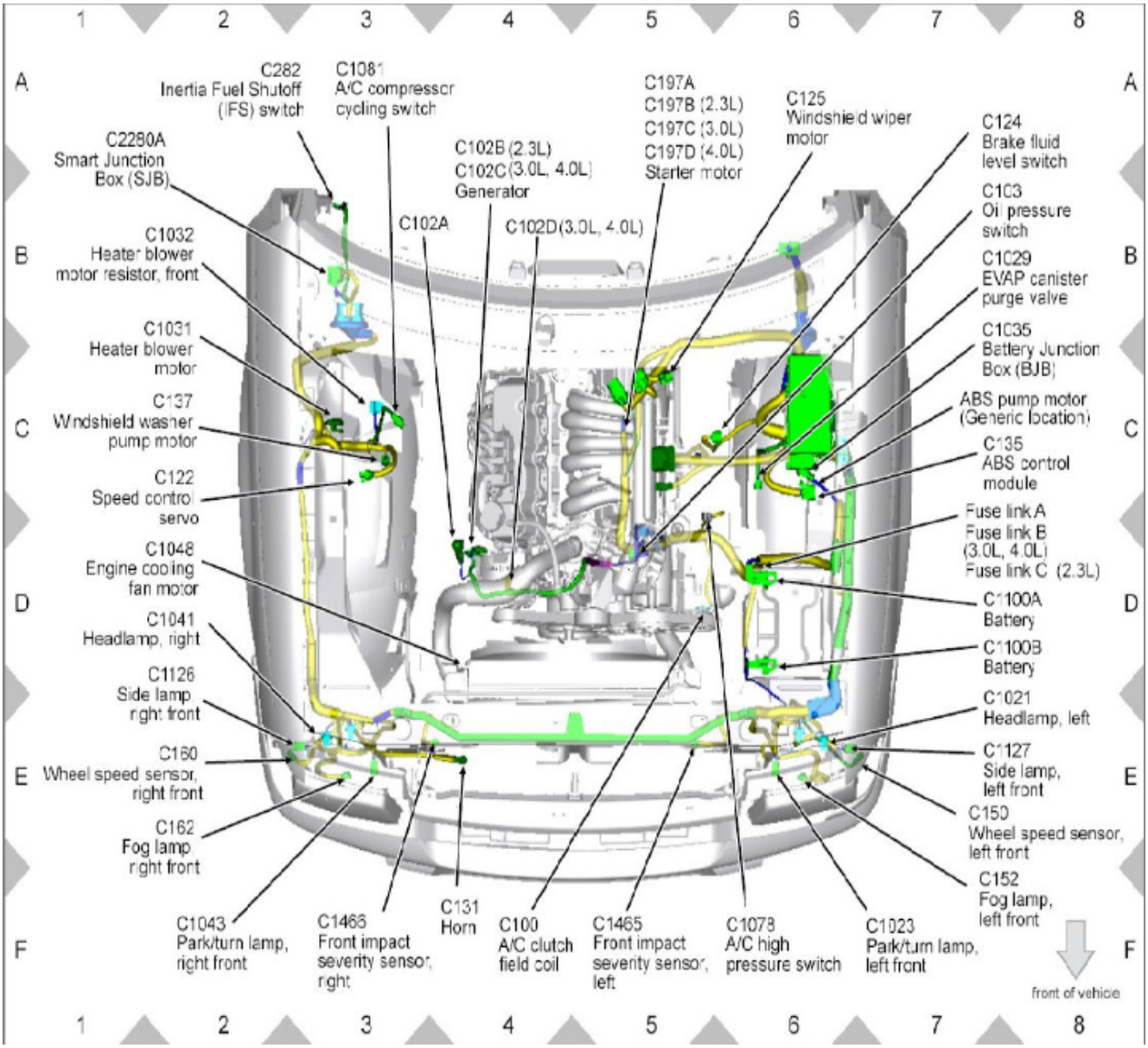
^ Use new copper washers.

4. Remove the brake flexible hose bracket bolt and the brake flexible hose.

^ To install, tighten to 12 Nm (9 lb-ft).

5. To install, reverse the removal procedure.

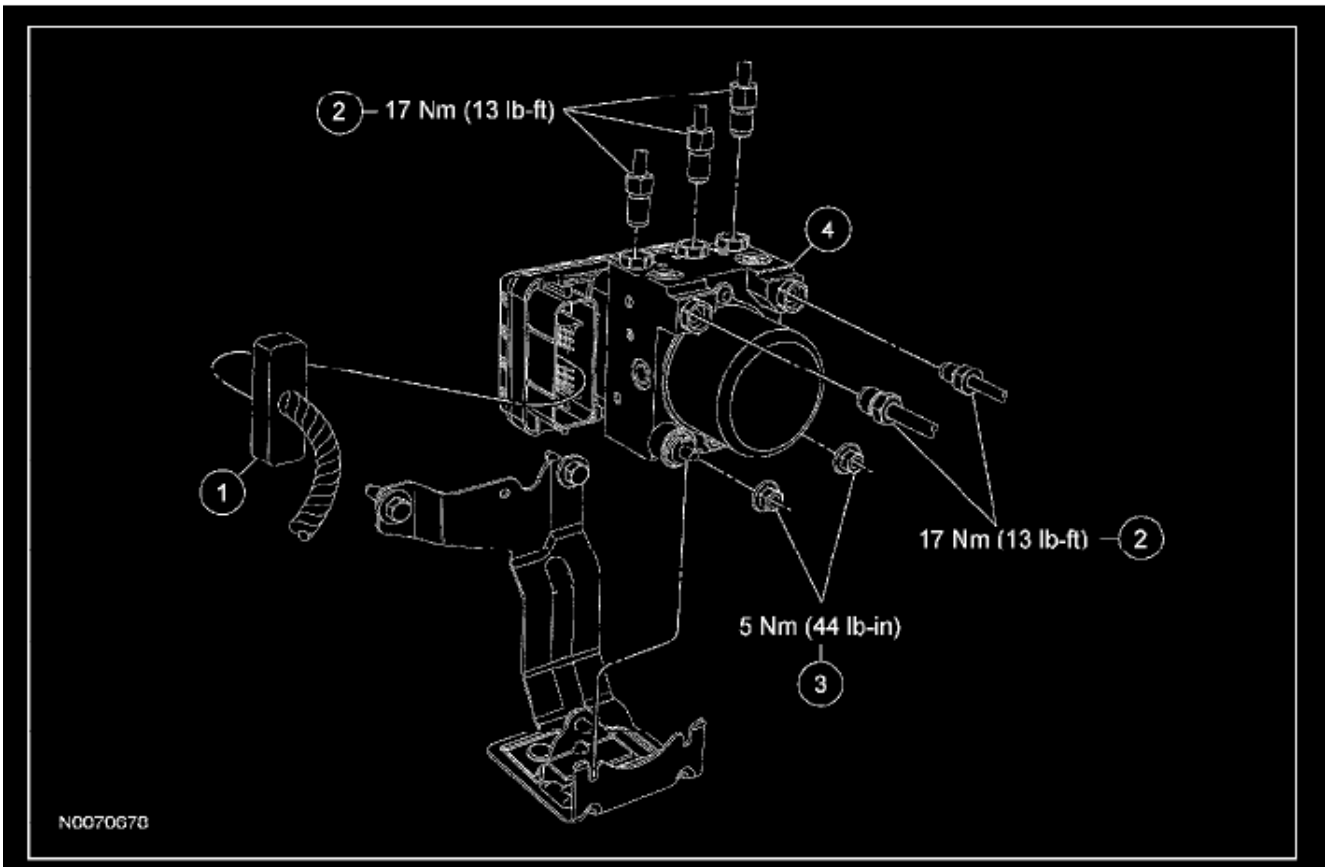
^ Bleed the brake caliper.


C282
Inertia Fuel Shutoff (IFS) switch
C1081
A/C compressor cycling switch
C2280A
Smart Junction Box (SJB)
C1032
Heater blower motor resistor, front
C1031
Heater blower motor
C137
Windshield washer pump motor
C122
Speed control servo
C1048
Engine cooling fan motor
C1041
Headlamp, right
C1126
Side lamp, right front
C160
Wheel speed sensor, right front
C162
Fog lamp, right front
C1043
Park/turn lamp, right front
C1466
Front impact severity sensor, right
C131
Horn
C102A
C102B (2.3L)
C102C (3.0L, 4.0L)
Generator
C102D (3.0L, 4.0L)
C197A
C197B (2.3L)
C197C (3.0L)
C197D (4.0L)
Starter motor
C100
A/C clutch field coil
C1465
Front impact severity sensor, left
C1078
A/C high pressure switch
C125
Windshield wiper motor
C1023
Park/turn lamp, left front
C124
Brake fluid level switch
C103
Oil pressure switch
C1029
EVAP canister purge valve
C1035
Battery Junction Box (BJB)
ABS pump motor (Generic location)
C135
ABS control module
Fuse link A
Fuse link B (3.0L, 4.0L)
Fuse link C (2.3L)
C1100A
Battery
C1100B
Battery
C1021
Headlamp, left
C1127
Side lamp, left front
C150
Wheel speed sensor, left front
C152
Fog lamp, left front
front of vehicle
A
B
C
D
E
F
1
2
3
4
5
6
7
8

View 151-1

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A



Item	Part Number	Description
1	—	ABS module electrical connector (part of 14290)
2	—	Hydraulic control unit (HCU) brake tube fittings (5 required) (part of 2B523)

Item	Part Number	Description
3	2C348	HCU-to-bracket nuts (2 required)
4	2C215	HCU

(Continued)

Hydraulic Control Assembly - Antilock Brakes: Service and Repair

Hydraulic Control Unit (HCU)

Removal and Installation

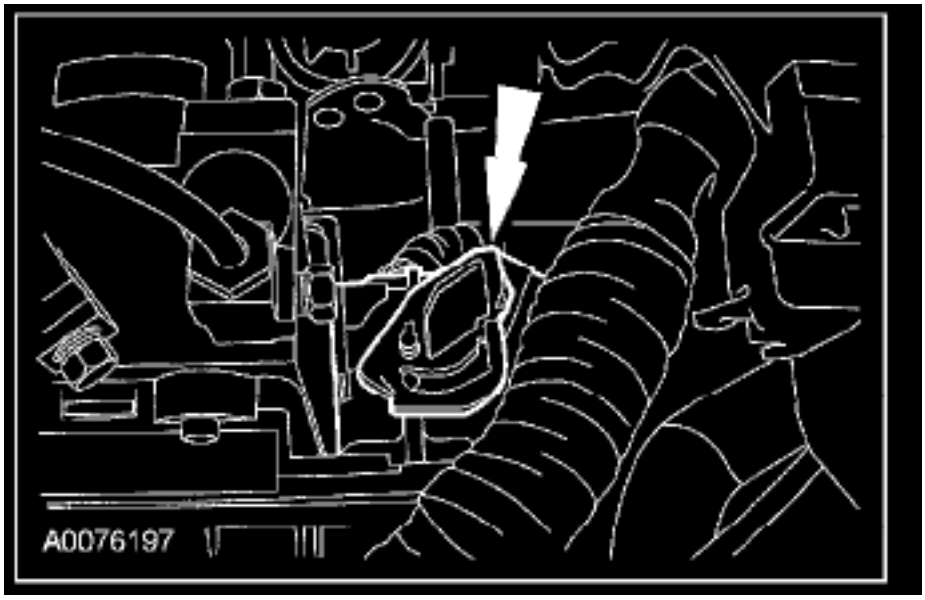
WARNING: Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal

injury.

WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

1. Disconnect the battery ground cable. 2. Disconnect the ABS module electrical connector by rotating the release lever.



3. NOTE: After disconnecting the hydraulic control unit (HCU) brake tube fittings, cap the holes in the HCU to prevent contamination or foreign

material from entering the brake tube ports.

Disconnect the 5 HCU brake tube fittings from the HCU. ^

To install, tighten to 17 Nm (13 lb-ft).

4. Remove the 2 HCU-to-bracket nuts and the HCU assembly.

^ To install, tighten to 5 Nm (44 lb-inch).

5. If necessary, remove the 2 HCU bracket-to-frame nuts, the 2 HCU bracket-to-frame bolts and the HCU bracket.

^ To install, tighten to 12 Nm (9 lb-ft).

6. To install, reverse the removal procedure. 7. Bleed the brake system.

Brake Master Cylinder: Testing and Inspection Brake Master Cylinder - Bypass Condition

Brake Master Cylinder - Bypass Condition

1. Disconnect the brake tubes from the master cylinder. 2. Plug the outlet ports of the master cylinder. 3. Apply the brakes. If brake pedal height cannot be maintained, the brake master cylinder has an internal leak and a new brake master cylinder must

be installed.

Brake Master Cylinder: Testing and Inspection Brake Master Cylinder - Compensator Port

Brake Master Cylinder - Compensator Port

The purpose of the compensator ports in the brake master cylinder is to: ^

supply additional brake fluid from the brake master cylinder reservoir needed by the brake system due to brake lining wear.

^ allow brake fluid to return to the brake master cylinder reservoir when the brakes are released. The returning brake fluid creates a slight turbulence in the brake master cylinder reservoir. This is a normal condition and indicates that the compensator ports are not clogged.

Clogged compensator ports may cause the brakes to hang up or not fully release. If clogged compensator ports are suspected, proceed as follows: 1. With the vehicle in NEUTRAL, position it on a hoist. Refer to Maintenance/Service and Repair. 2. With the brakes released, attempt to rotate each wheel and check for any brake drag.

^ If an excessive amount of brake drag exists at all 4 wheels, continue with the test.

^ If an excessive amount of brake drag exists at only one wheel, it indicates a possible seized brake caliper, brake wheel cylinder or parking brake component. Repair or install new components as necessary.

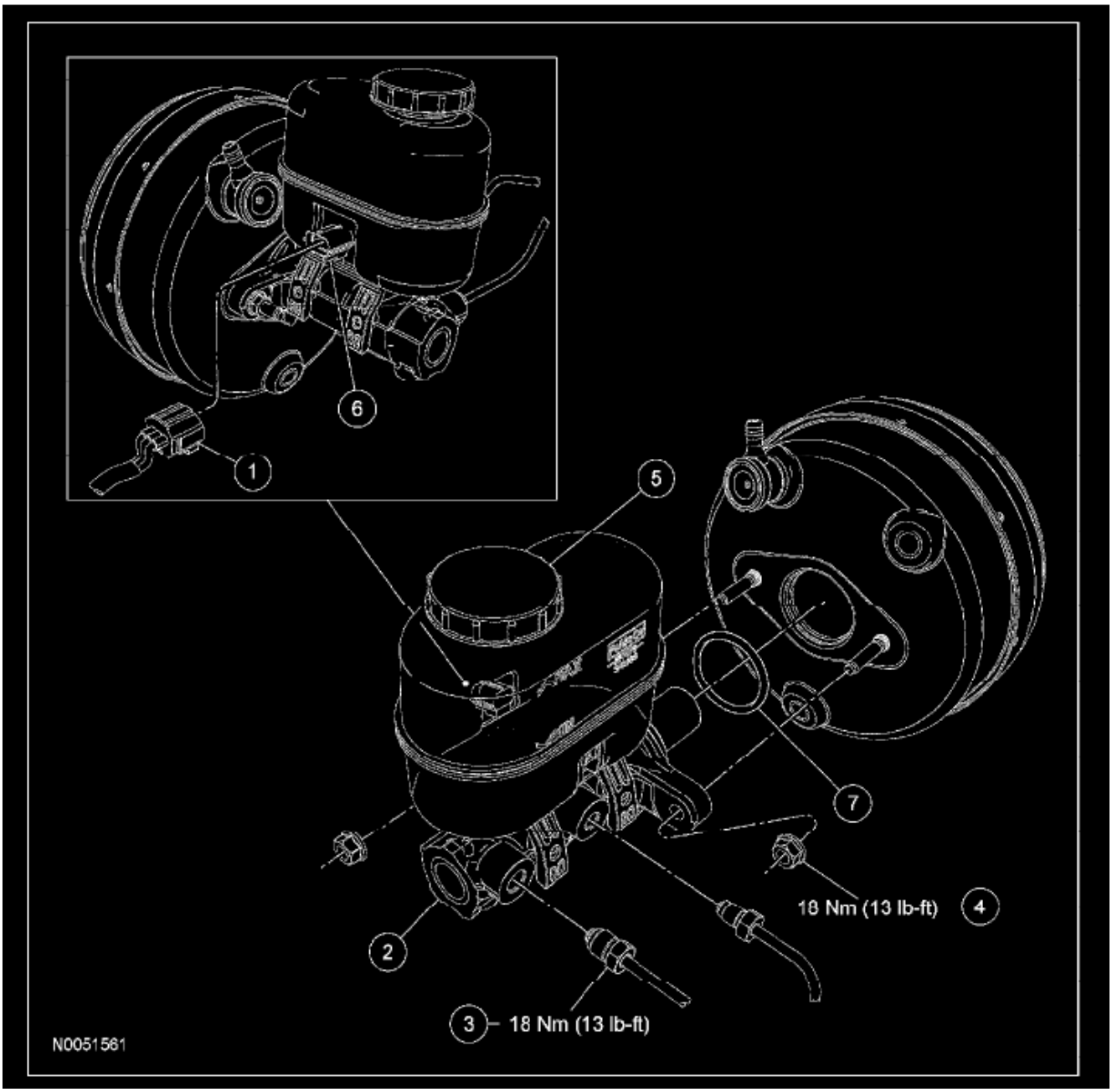
3. Check the brake stoplamp switch and the brake pedal free play to verify that the brake pedal is not partially applied. 4. Loosen the brake master cylinder nuts and position the brake master cylinder away from the brake booster. 5. With the brakes released, attempt to rotate each wheel and check for any brake drag.

^ If the brake drag is no longer present, install a new brake booster.

^ If the brake drag is still present, install a new master cylinder.

Material

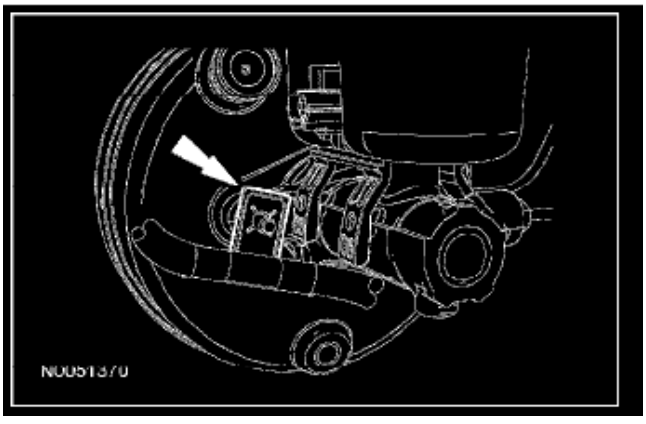
Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A



Brake Master Cylinder: Service and Repair

Brake Master Cylinder

Item	Part Number	Description
1	—	Brake master cylinder fluid level switch electrical connector (part of 14300)
2	2004	Brake master cylinder and reservoir assembly
3	—	Brake tube fitting (part of 2234)
4	W520112	Brake master cylinder nut (2 required)
5	2162	Brake master cylinder reservoir cap
6	2L414	Brake fluid level sensor
7	2152	Brake master cylinder-to-brake booster O-ring



Removal and Installation

WARNING: Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.

WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

1. Disconnect the brake fluid level warning switch electrical connector.

2. CAUTION: The vacuum must be relieved in the brake booster before the master cylinder is removed. Failure to relieve the vacuum will

result in the O-ring being drawn into the brake booster.

NOTE: If the O-ring is drawn into the brake booster and cannot be recovered, a new brake booster must be installed.

Remove the check valve from the brake booster to relieve the vacuum.

3. Disconnect the wiring retainer clip from the brake booster stud.

4. Disconnect the 2 brake tube fittings.

^ Plug the tubes and the brake master cylinder ports.

^ To install, tighten to 18 Nm (13 lb-ft).

5. Remove the 2 brake master cylinder nuts and the brake master cylinder.

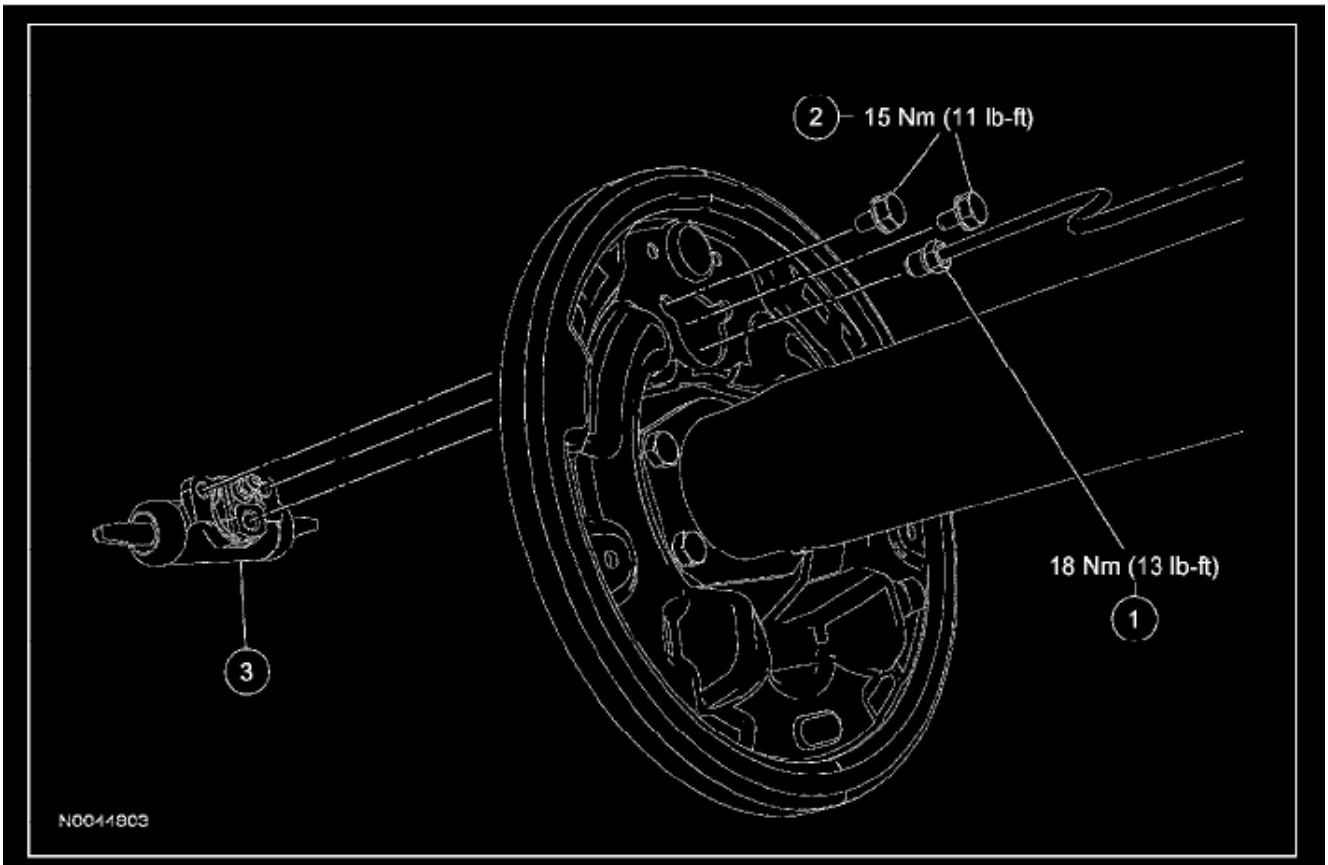
^ To install, tighten to 18 Nm (13 lb-ft).

6. To install, reverse the removal procedure.

^ Bleed the master cylinder before installation.

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A



Item	Part Number	Description
1	—	Brake tube-to-wheel cylinder fitting (part of 2268 LH/ 2267 RH)
2	—	Wheel cylinder bolts (2 required) (part of 2261)
3	2261	Wheel cylinder

Wheel Cylinder: Removal and Replacement

Wheel Cylinder

Removal and Installation

WARNING: Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal

injury.

WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

1. Remove the brake shoes and linings. 2. Disconnect the brake tube-to-wheel cylinder fitting.

^ To install, tighten to 18 Nm (13 lb-ft).

3. Remove the 2 wheel cylinder bolts and the wheel cylinder.

^ To install, tighten to 15 Nm (11 lb-ft).

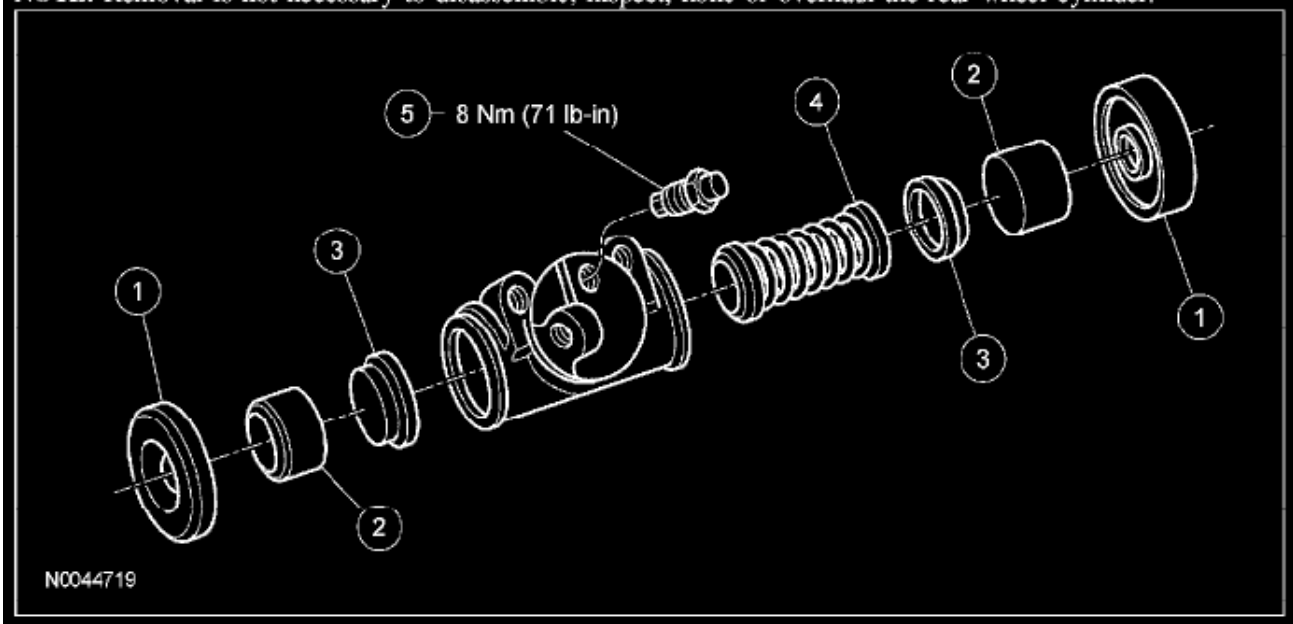
4. To install, reverse the removal procedure.

^ Bleed the brake system.

Material

Item	Specification
High Performance DOT 3 Motor Vehicle Brake Fluid PM-1-C (US); CPM-1-C (Canada)	WSS-M6C62-A

NOTE: Removal is not necessary to disassemble, inspect, hone or overhaul the rear wheel cylinder.



Item	Part Number	Description
1	—	Wheel cylinder boots (part of 2261)
2	—	Wheel cylinder pistons (part of 2261)
3	—	Wheel cylinder cups (part of 2261)

Item	Part Number	Description
4	—	Wheel cylinder expander (part of 2261)
5	—	Wheel cylinder bleeder screw (part of 2261)

(Continued)

Wheel Cylinder: Overhaul

Wheel Cylinder

NOTE: Removal is not necessary to disassemble, inspect, hone or overhaul the rear wheel cylinder.

Disassembly and Assembly

WARNING: Do not use any fluid other than clean brake fluid meeting manufacturer's specification. Additionally, do not use brake fluid that has been previously drained. Following these instructions will help prevent system contamination, brake component damage and the risk of serious personal injury.

WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. In the USA or Canada on Ford/Motorcraft products call: 1-800-959-3673. For additional information, consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

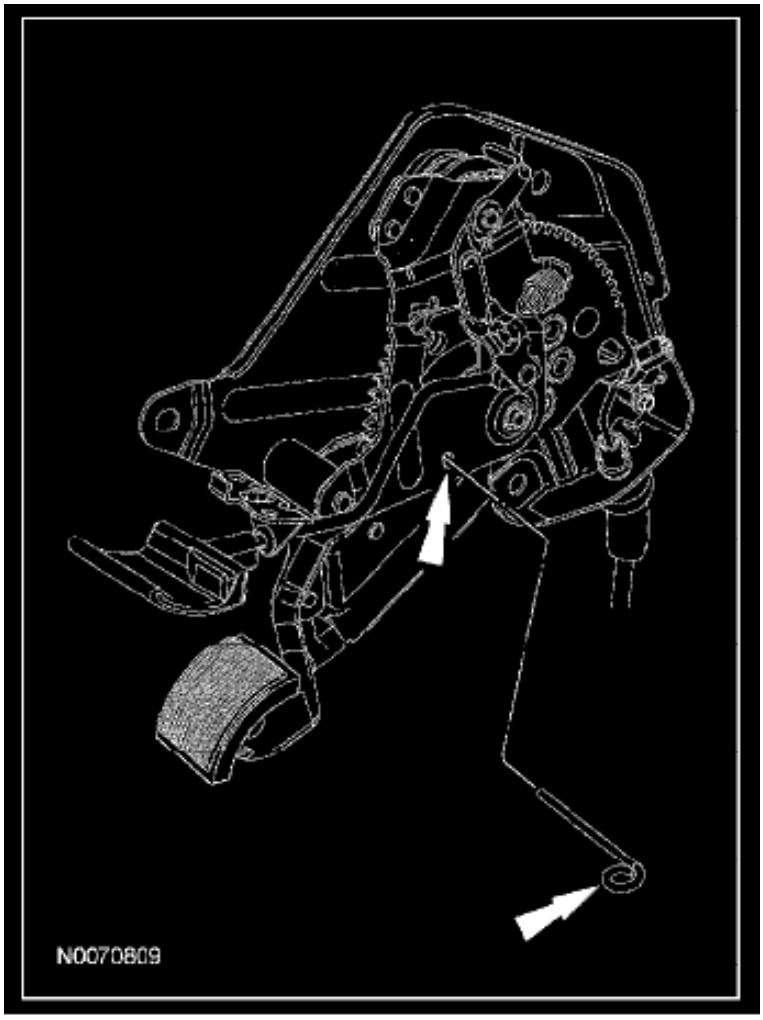
CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

1. Remove the wheel cylinder boots. 2. Remove the wheel cylinder pistons. 3. Remove the wheel cylinder cups. 4. Remove the wheel cylinder expander. 5. Remove the wheel cylinder bleeder screw from the rear wheel cylinder.

^ To install, tighten to 8 Nm (71 lb-inch).

6. NOTE: Coat all the wheel cylinder parts with brake fluid.

To install, reverse the removal procedure.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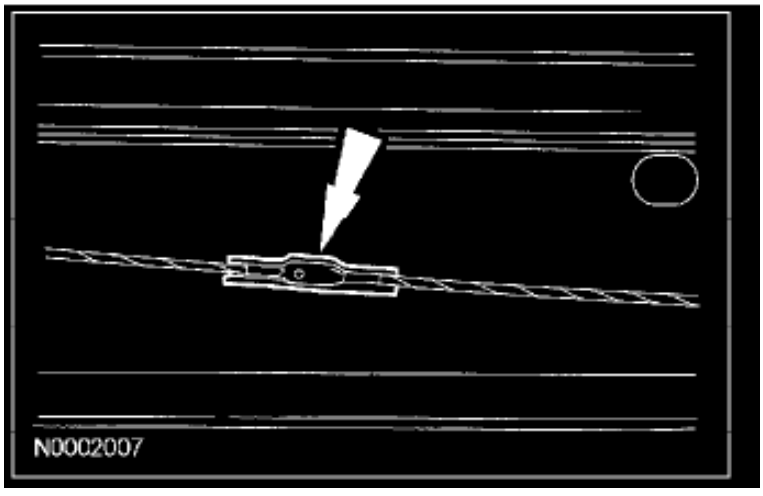

N0002007

Parking Brake Cable: Procedures

Parking Brake Cable Tension Release

1. Remove the LH cowl side trim panel. 2. With the help of an assistant, release the parking brake cable tension by pulling down on the intermediate cable at the cable-to-cable connector clip

until the parking brake control sector rotates to its stop and a 4 mm (0.15 inch) x 150 mm (5.9 inch) retainer pin can be inserted.

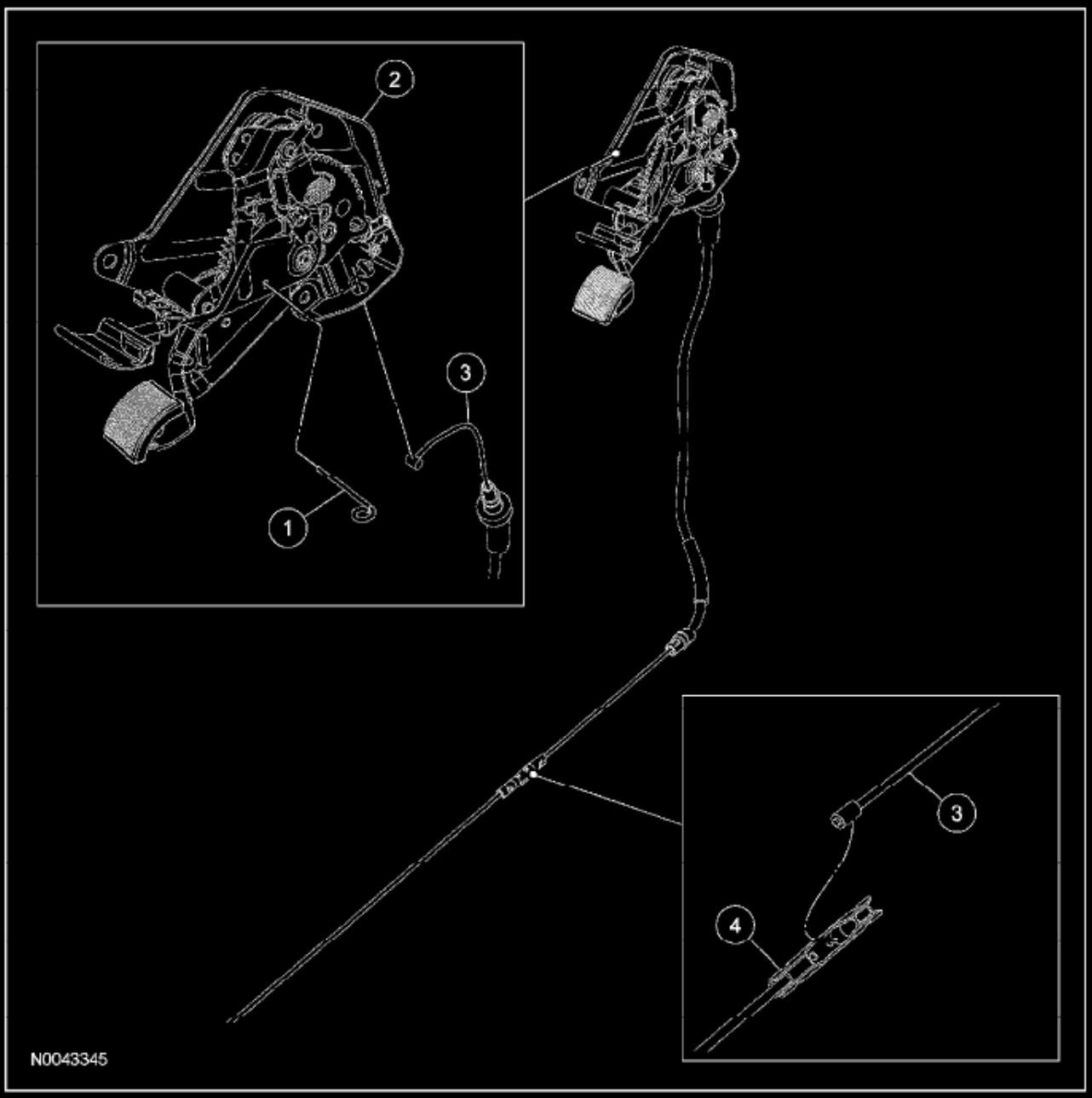
3. NOTE: Make sure the cable-to-cable connector clip is connected to the front and rear cable before removing the brake control retaining pin, and

the cable tension is reloaded slowly.

Disconnect the cable-to-cable connector clip.

4. To reload the tension on the parking brake cable, follow the release procedure in reverse.

Parking Brake Cable — Front



Item	Part Number	Description
1	—	Retaining pin (part of 2780)
2	2780	Parking brake control
3	2853	Front parking brake cable
4	2A793	Intermediate cable

Parking Brake Cable: Removal and Replacement

Parking Brake Cable - Front

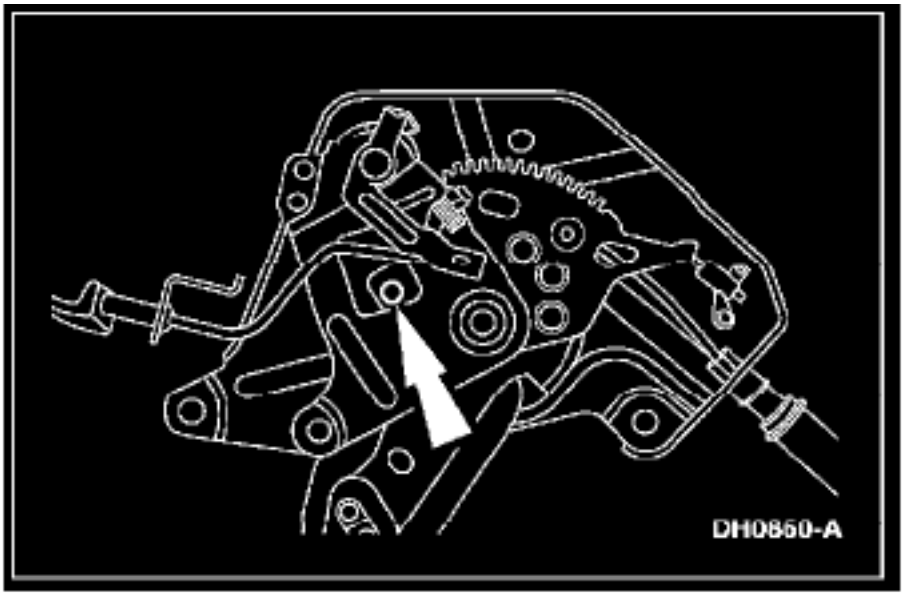
Parking Brake Cable - Front

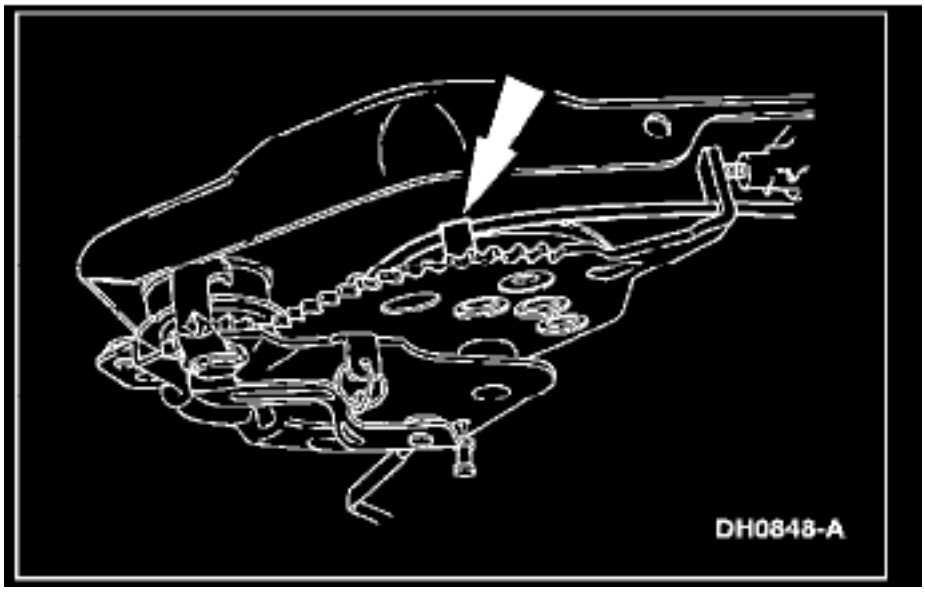
Parking Brake Cable - Front

Removal and Installation

1. NOTE: Make sure the parking brake control is fully released.

Release the parking brake cable tension.





2. Remove the LH fender splash shield. 3. Disconnect the front parking brake cable from the parking brake intermediate cable at the cable union. 4. Compress the clip and separate the front parking brake cable and conduit from the frame bracket. 5. Disconnect the front parking brake cable from the parking brake control.

6. Compress the clip and disconnect the front parking brake cable from the parking brake control.

^ Remove the front parking brake cable.

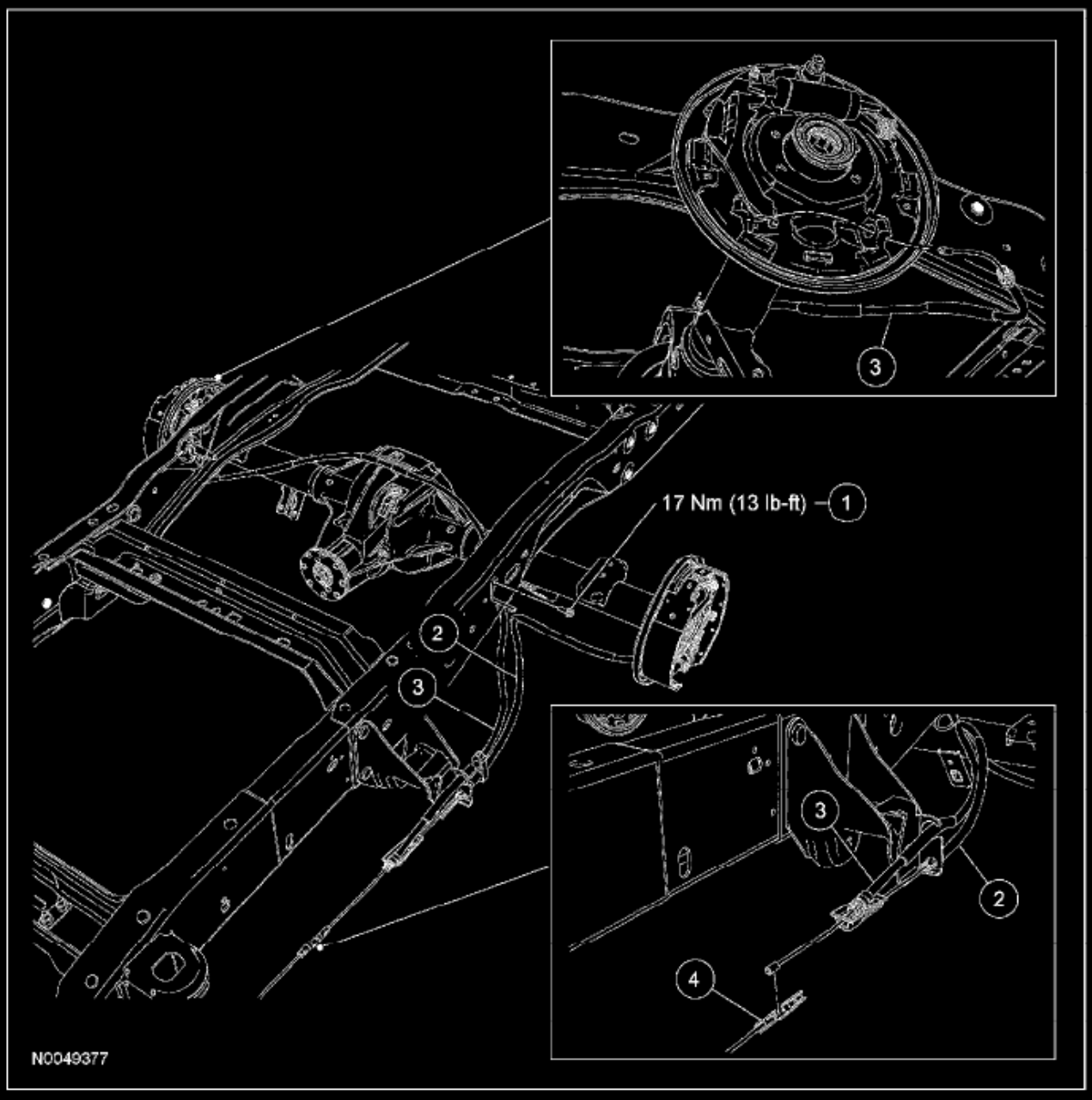
7. To install, reverse the removal procedure.

^ Make sure the front cable is routed through the loop on the spool.

Parking Brake Cable - Rear

Parking Brake Cable - Rear

Parking Brake Cable — Rear



Item	Part Number	Description
1	W712215	Parking brake cable wireform bracket bolt
2	2A635	LH rear parking brake cable
3	2A635	RH rear parking brake cable
4	2A793	Intermediate parking brake cable

Parking Brake Cable - Rear

Removal and Installation

1. NOTE: Make sure the parking brake control is fully released.

Release the parking brake cable tension.

2. Remove the brake shoes. 3. Disconnect the RH rear parking brake cable from the intermediate cable at the cable union. 4. Compress the retainer and separate the RH rear parking brake cable from the LH rear parking brake cable at the equalizer. 5. Remove the parking brake cable wireform bracket bolt.

^ To install, tighten to 17 Nm (13 lb-ft).

6. Separate the LH rear parking brake cable from the frame bracket.

^ Remove the equalizer.

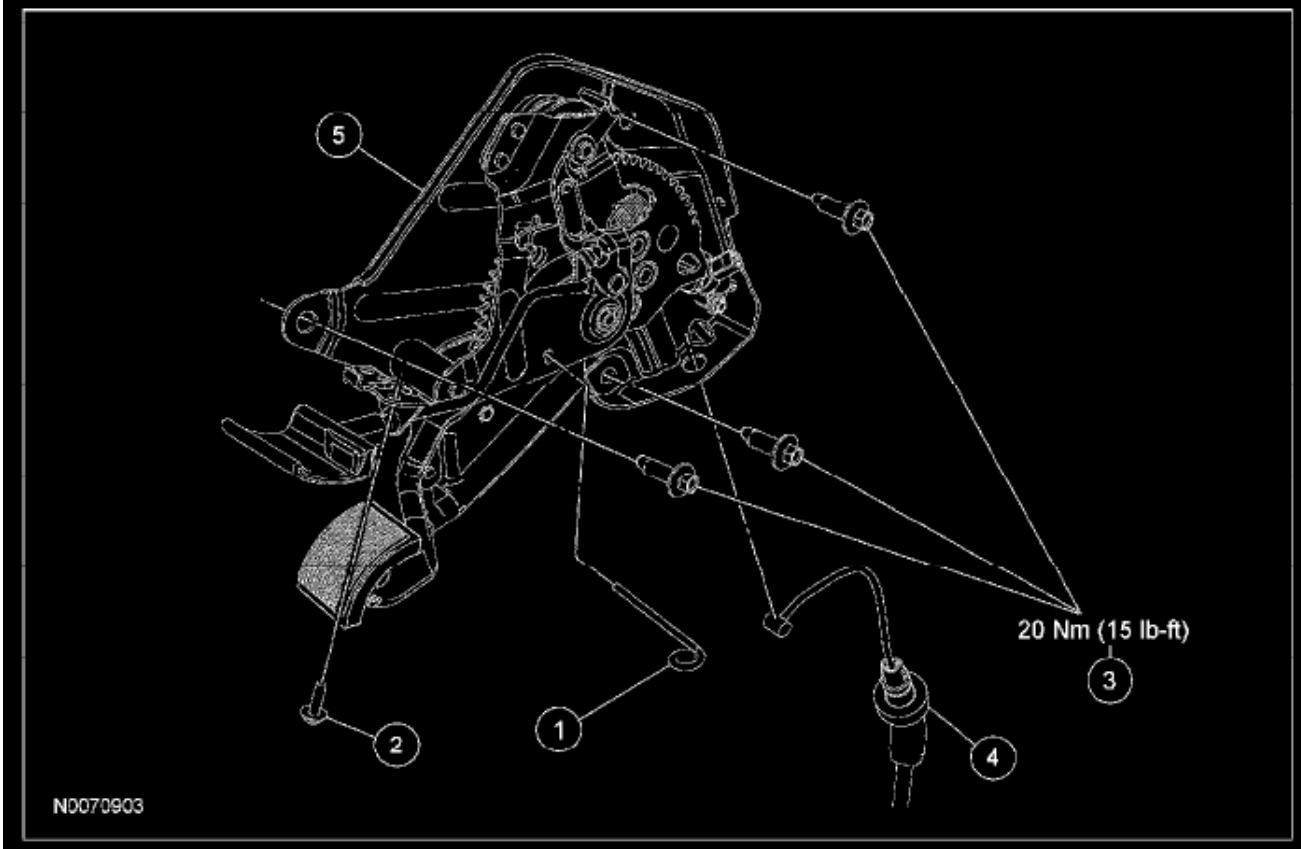
^ Compress the parking brake cable clip.

^ Separate the LH rear parking brake cable from the frame bracket.

7. Separate the RH rear parking brake cable from the RH hydraulic brake tube clips. 8. Unclip the RH rear parking brake cable from the brake tube clip on top of the rear axle housing. 9. Disconnect the parking brake cables from the parking brake levers.

10. Compress the clips and disconnect the rear parking brake cables from the backing plates. 11. To install, reverse the removal procedure.

Parking Brake Control



Item	Part Number	Description
1	—	Retaining pin (part of 2780)
2	W707628	Parking brake release handle bolt (2 required)
3	W704522	Parking brake control bolts (3 required)
4	2853	Front parking brake cable
5	2780	Parking brake control

Parking Brake Control: Service and Repair

Parking Brake Control

Parking Brake Control

Removal and Installation

1. NOTE: Make sure the parking brake control is fully released.

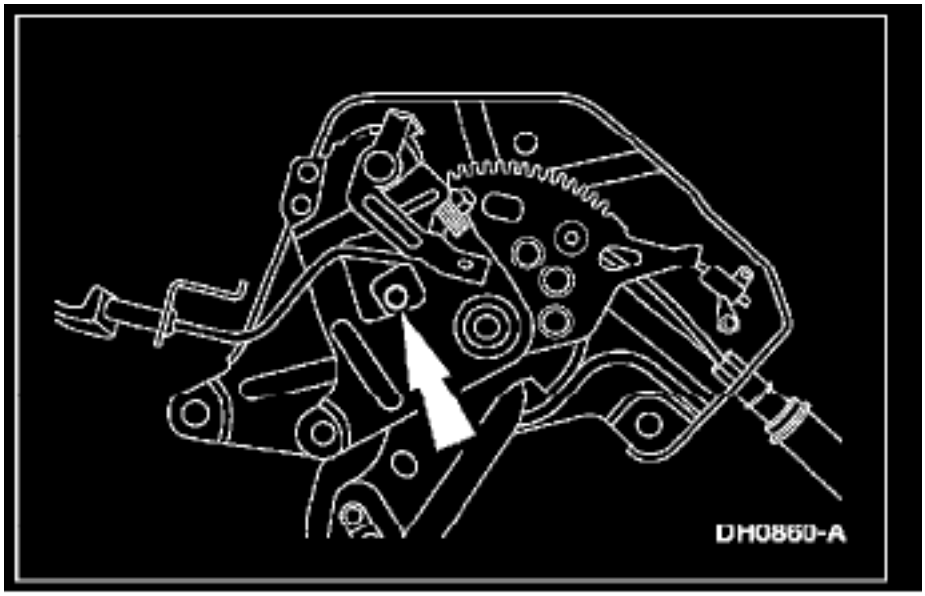
Release the parking brake cable tension.

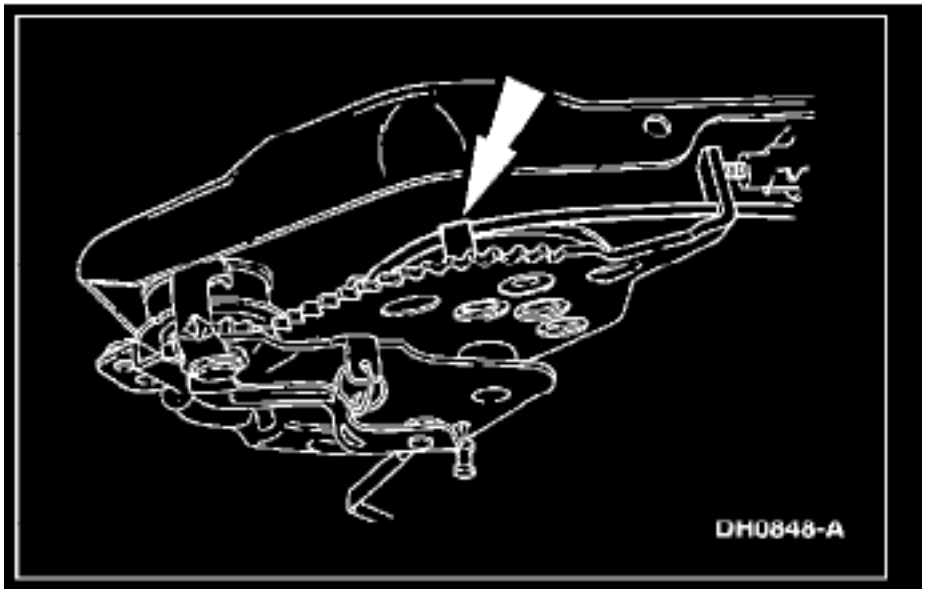
2. Disconnect the front parking brake cable from the parking brake intermediate cable at the cable union. 3. Compress the clip and separate the front parking brake cable from the frame bracket. 4.

Remove the 2 parking brake release handle bolts. 5. Disconnect the parking brake signal switch electrical connector. 6. Remove the 3 parking brake control bolts.

^ To install, tighten to 20 Nm (15 lb-ft).

7. Disconnect the front parking brake cable from the parking brake control.





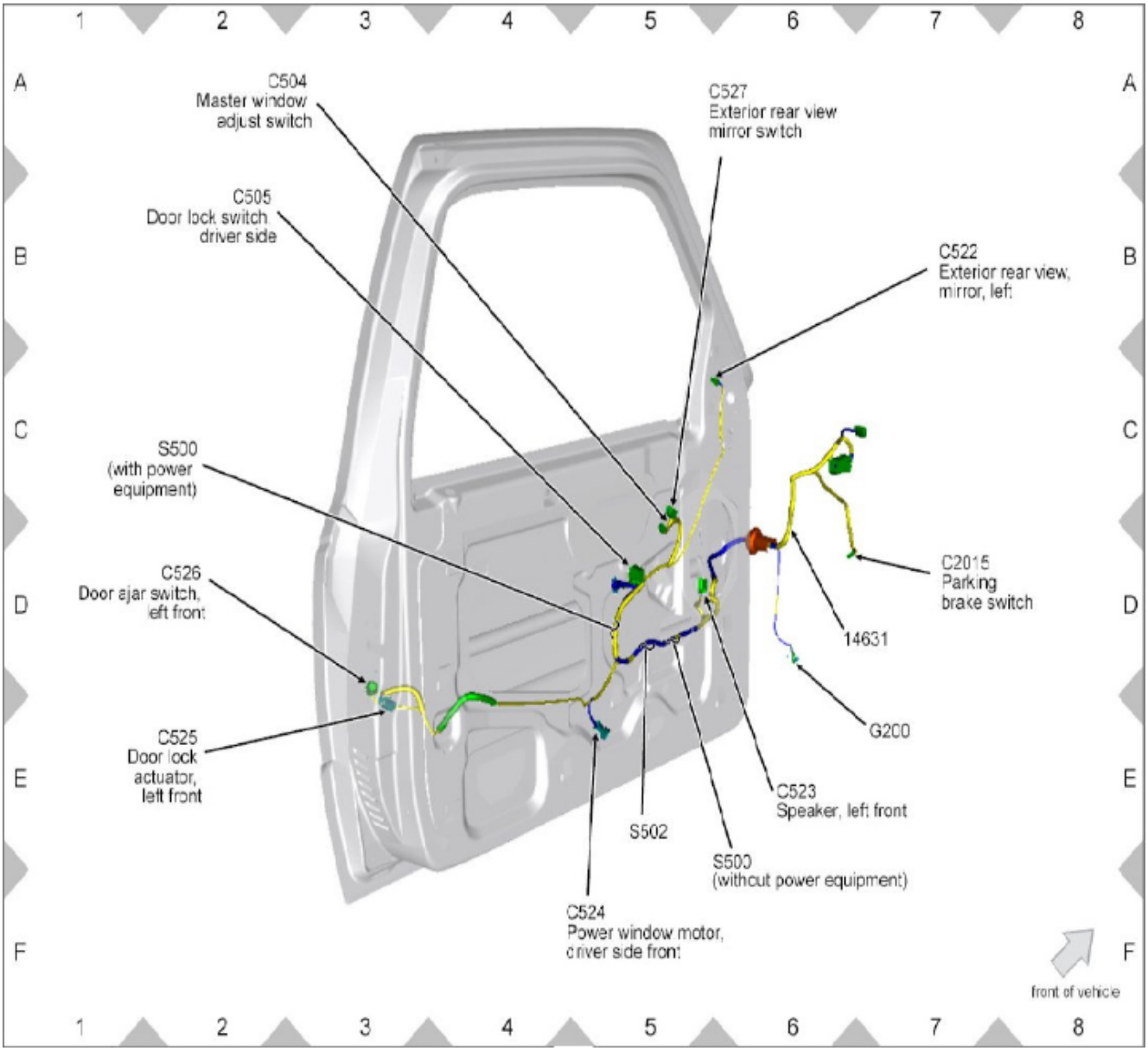
8. Compress the clip and disconnect the front parking brake cable from the control bracket.

^ Remove the parking brake control.

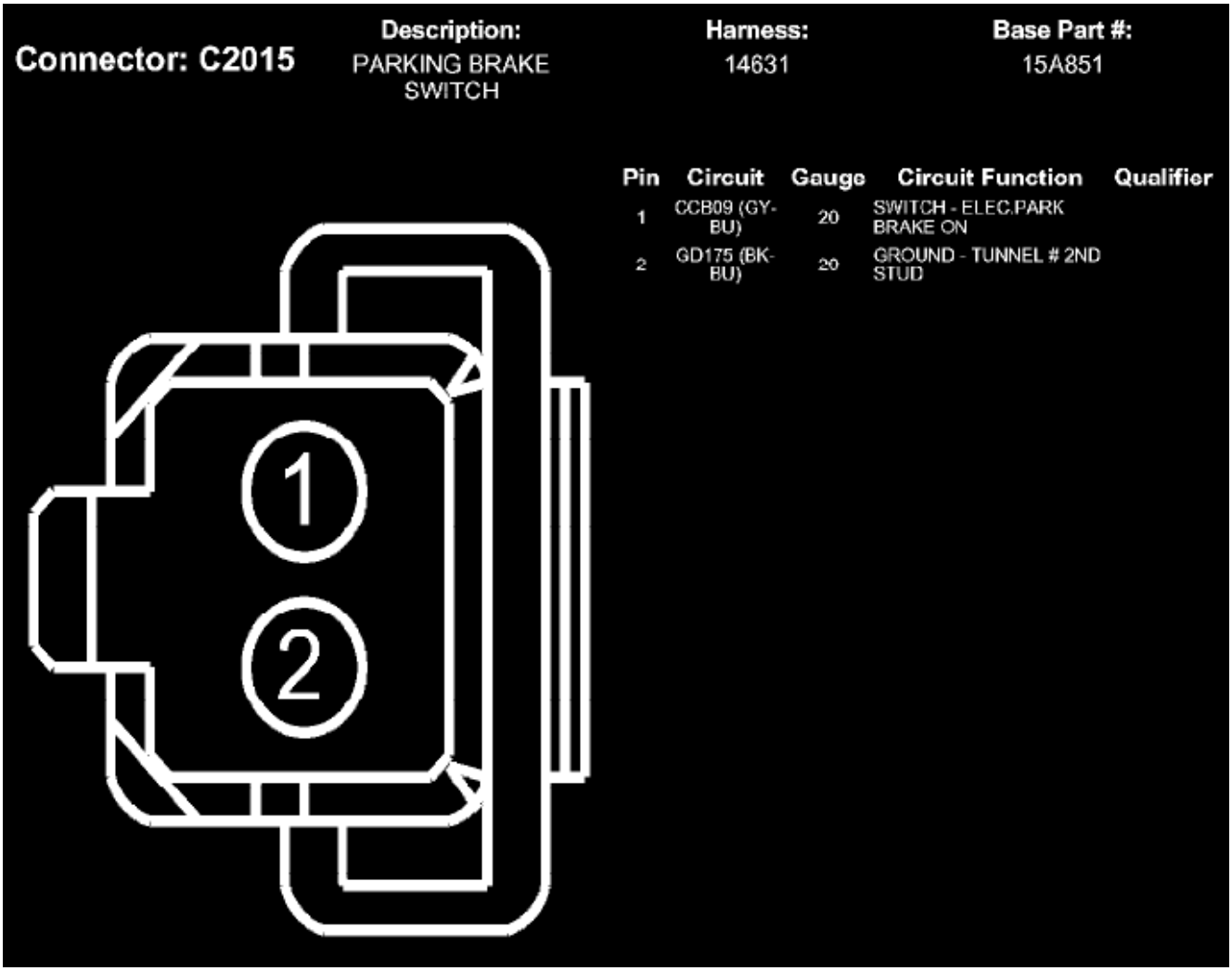
9. To install, reverse the removal procedure.

^ Make sure that the front cable is routed through the loop on the spool.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Brakes and Traction Control > Parking Brake System > Parking Brake Warning Switch > Component Information > Locations



View 151-20


Connector: C2015
Description:
PARKING BRAKE SWITCH
Harness:
14631
Base Part #:
15A851
Pin
Circuit
Gauge
Circuit Function
Qualifier
1
CCB09 (GY-BU)
20
SWITCH - ELEC.PARK BRAKE ON
2
GD175 (BK-BU)
20
GROUND - TUNNEL # 2ND STUD
1
2

C2015

Torque Specifications

Description	Nm	lb-ft
Brake booster nuts	25	18

Vacuum Brake Booster: Specifications

Torque Specifications

Vacuum Brake Booster: Description and Operation

Brake Booster

The power brake actuation system consists of the following components: ^

Brake booster assembly

^ Brake booster vacuum fitting

Pedal pressure is amplified by the brake booster. The brake booster uses engine vacuum from the intake manifold. The low pressure in the intake manifold is applied to a rubber diaphragm on the vacuum side of the brake booster chamber, which then pulls the piston rod in when the brakes are applied to supply a power assist. The piston rod is connected to the brake pedal.

Vacuum Brake Booster: Testing and Inspection

Brake Booster

1. Disconnect the check valve from the brake booster. 2. Apply the parking brake, start the engine and place the transmission in NEUTRAL. 3. Verify that manifold vacuum is available at the check valve with the engine at idle speed and the transmission in NEUTRAL.

^ If manifold vacuum is available, stop the engine, connect the check valve and continue with Step 5.

^ If manifold vacuum is not available, continue with Step 4.

4. Disconnect the check valve from the vacuum hose and verify that manifold vacuum is available at the hose with the engine at idle speed and the

transmission in NEUTRAL. ^

If manifold vacuum is available, stop the engine, install a new check valve and continue with Step 5.

^ If manifold vacuum is not available, stop the engine, connect the vacuum hose to the check valve and refer to Engine to diagnose the no vacuum condition.

5. Apply the brake pedal several times to exhaust all vacuum from the system. 6. Apply the brake pedal and hold it in the applied position. Start the engine and verify that the brake pedal moves downward after the engine starts.

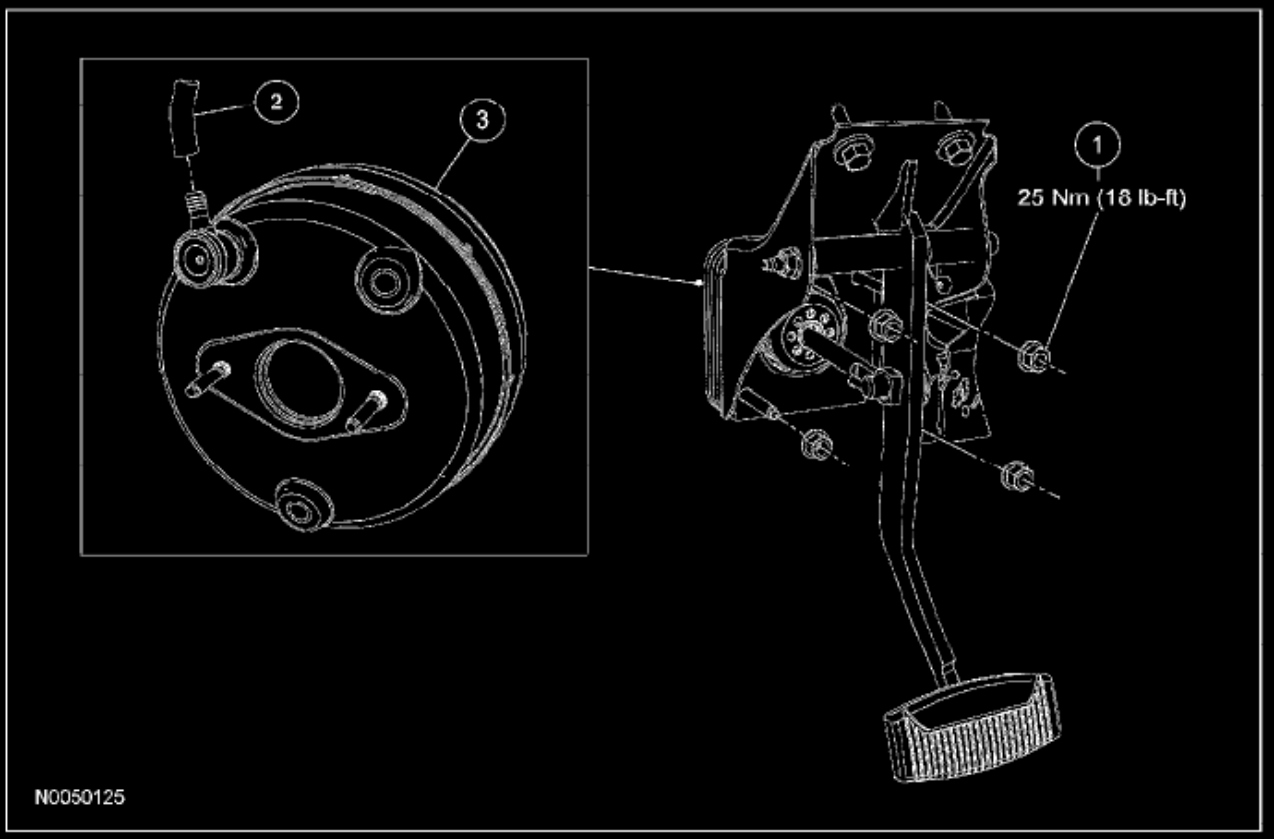
^ If the brake pedal moves, the brake booster is operating correctly

^ If the brake pedal does not move, install a new brake booster.

7. Operate the engine a minimum of 10 seconds at fast idle. Stop the engine, and let the vehicle stand for 10 minutes. Then apply the brake pedal with

approximately 89 N (20 lb) of force. The brake pedal feel should be the same as that noted with the engine operating. If the brake pedal feels hard (no power assist), install a new brake booster check valve and retest. If the brake pedal feels spongy, bleed the hydraulic system to remove air.

Brake Booster



Item	Part Number	Description
1	N620481	Brake booster nut (4 required)
2	9C482	Vacuum hose (4.0L)
2	9C490	Vacuum hose (2.3L and 3.0L)
3	2002	Brake booster kit

Vacuum Brake Booster: Service and Repair

Brake Booster

Brake Booster

Removal and Installation

1. Remove the brake master cylinder. 2. Disconnect the vacuum hose from the brake booster check valve.

3. CAUTION: Do not service the brake pedal or brake booster without first removing the stoplamp switch and speed control deactivator

switch. These switches must be removed with the brake pedal in the at-rest position. Switch plungers must be compressed for the switch to rotate in the bracket. Attempting to remove the switch when the plunger is extended (during pedal apply) will result in damage to the switch.

Remove the stoplamp switch.

4. Remove the speed control deactivator switch. 5. Disconnect the brake booster push rod from the brake pedal and bracket. 6. Remove the bulkhead sound insulator. 7. Remove the 4 brake booster nuts and the brake booster.

^ To install, tighten to 25 Nm (18 lb-ft).

8. CAUTION: Do not press, pull or otherwise move the brake pedal while installing the stoplamp switch or the speed control deactivator

switch. These switches must be installed with the booster push rod attached to the brake pedal and with the brake pedal in the at-rest position. Installing these switches with the brake pedal in any other position will result in incorrect adjustment and may damage the switches.

To install, reverse the removal procedure.

Vacuum Brake Booster Check Valve: Testing and Inspection

Brake Booster Check Valve

The function of the brake booster check valve is to allow manifold vacuum to enter the brake booster and prevent the escape of vacuum in case manifold vacuum is lost during sustained full throttle operation. 1. Disconnect the vacuum booster hose from the check valve. 2. Apply the parking brake, start the engine and place the transmission in NEUTRAL. 3. Verify that manifold vacuum is available at the check valve end of the vacuum hose with the engine at idle speed and the transmission in

NEUTRAL. ^

If manifold vacuum is available, stop the engine, connect the vacuum hose to the check valve and continue this test.

^ If manifold vacuum is not available, stop the engine, connect the vacuum hose to the check valve and refer to Engine to diagnose the no vacuum condition.

4. Connect the vacuum hose to the check valve and run the engine for at least 10 seconds. 5. Operate the brake pedal to check for power assist.

^ If power assist is present, continue with this test.

^ If power assist is not present, refer to Brake Booster Component Test.

6. NOTE: Do not remove the brake booster check valve from the brake booster in this step.

Stop the engine and disconnect the vacuum booster hose from the brake booster check valve.

7. Apply the brake and verify that there is enough vacuum retained in the brake booster for at least one power-assisted brake application.

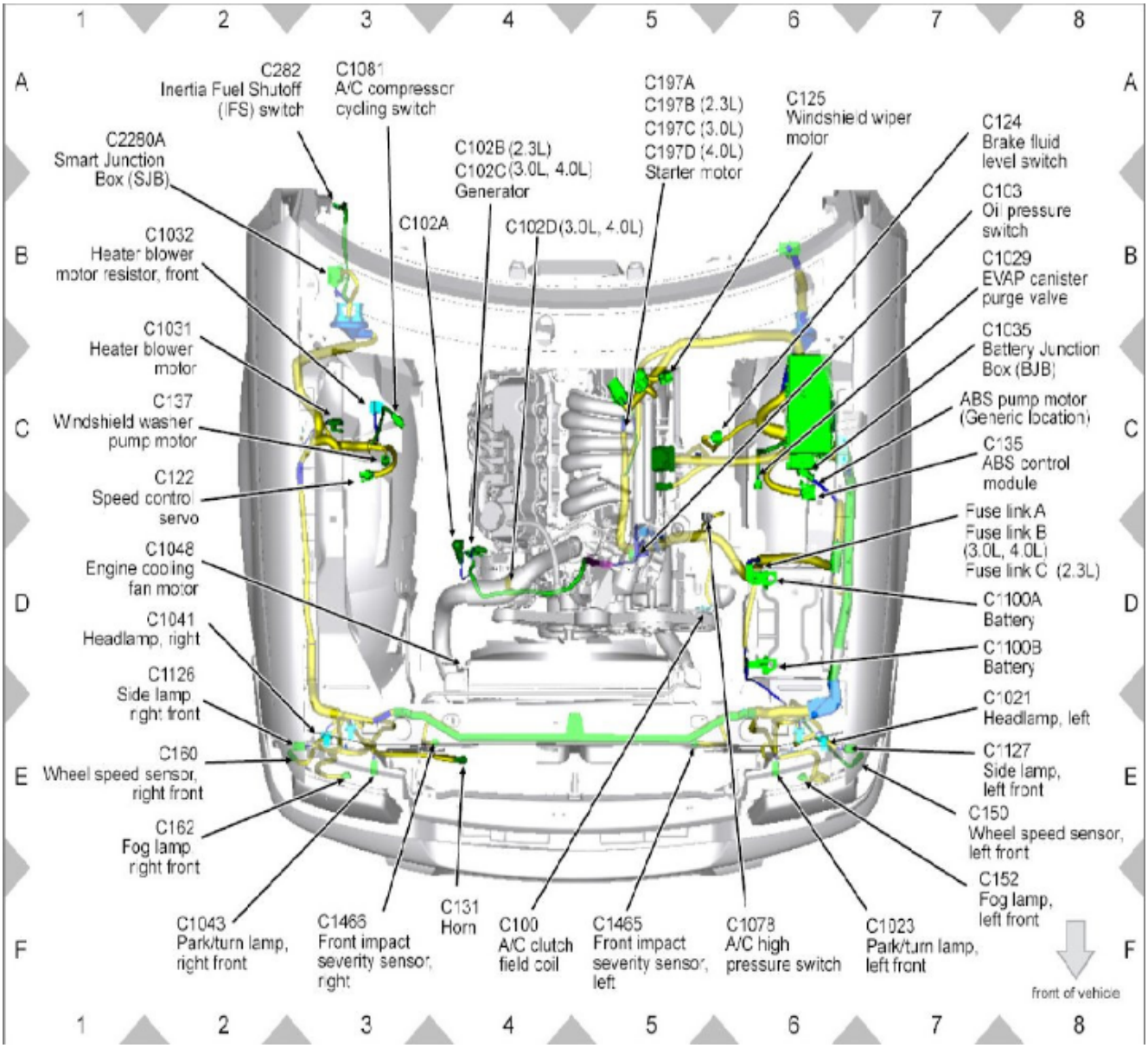
^ If there is enough vacuum for at least one power-assisted brake application, the check valve is functioning correctly.

^ If there is not enough vacuum for at least on one power-assisted brake application, continue with this test.

8. Inspect the brake booster for any signs of damage that may cause a leak.

^ If any damage is found, install a new brake booster and repeat this test.

^ If no damage is found, install a new check valve.


C282
Inertia Fuel Shutoff (IFS) switch
C1081
A/C compressor cycling switch
C2280A
Smart Junction Box (SJB)
C102B (2.3L)
C102C (3.0L, 4.0L)
Generator
C102A
C102D (3.0L, 4.0L)
C197A
C197B (2.3L)
C197C (3.0L)
C197D (4.0L)
Starter motor
C125
Windshield wiper motor
C124
Brake fluid level switch
C103
Oil pressure switch
C1032
Heater blower motor resistor, front
C1029
EVAP canister purge valve
C1031
Heater blower motor
C1035
Battery Junction Box (BJB)
C137
Windshield washer pump motor
ABS pump motor (Generic location)
C122
Speed control servo
C135
ABS control module
C1048
Engine cooling fan motor
Fuse link A
Fuse link B (3.0L, 4.0L)
Fuse link C (2.3L)
C1041
Headlamp, right
C1100A
Battery
C1100B
Battery
C1126
Side lamp, right front
C1021
Headlamp, left
C160
Wheel speed sensor, right front
C1127
Side lamp, left front
C162
Fog lamp, right front
C150
Wheel speed sensor, left front
C152
Fog lamp, left front
C1043
Park/turn lamp, right front
C1466
Front impact severity sensor, right
C131
Horn
C100
A/C clutch field coil
C1465
Front impact severity sensor, left
C1078
A/C high pressure switch
C1023
Park/turn lamp, left front
front of vehicle

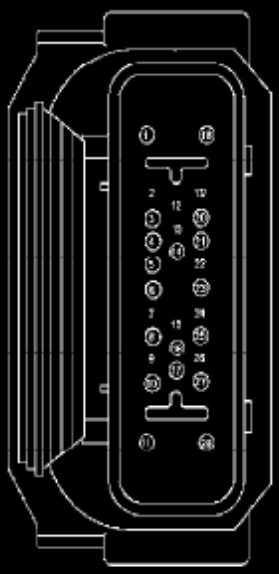
View 151-1

Connector: C135

Description: ABS CONTROL MODULE

Harness: 14290

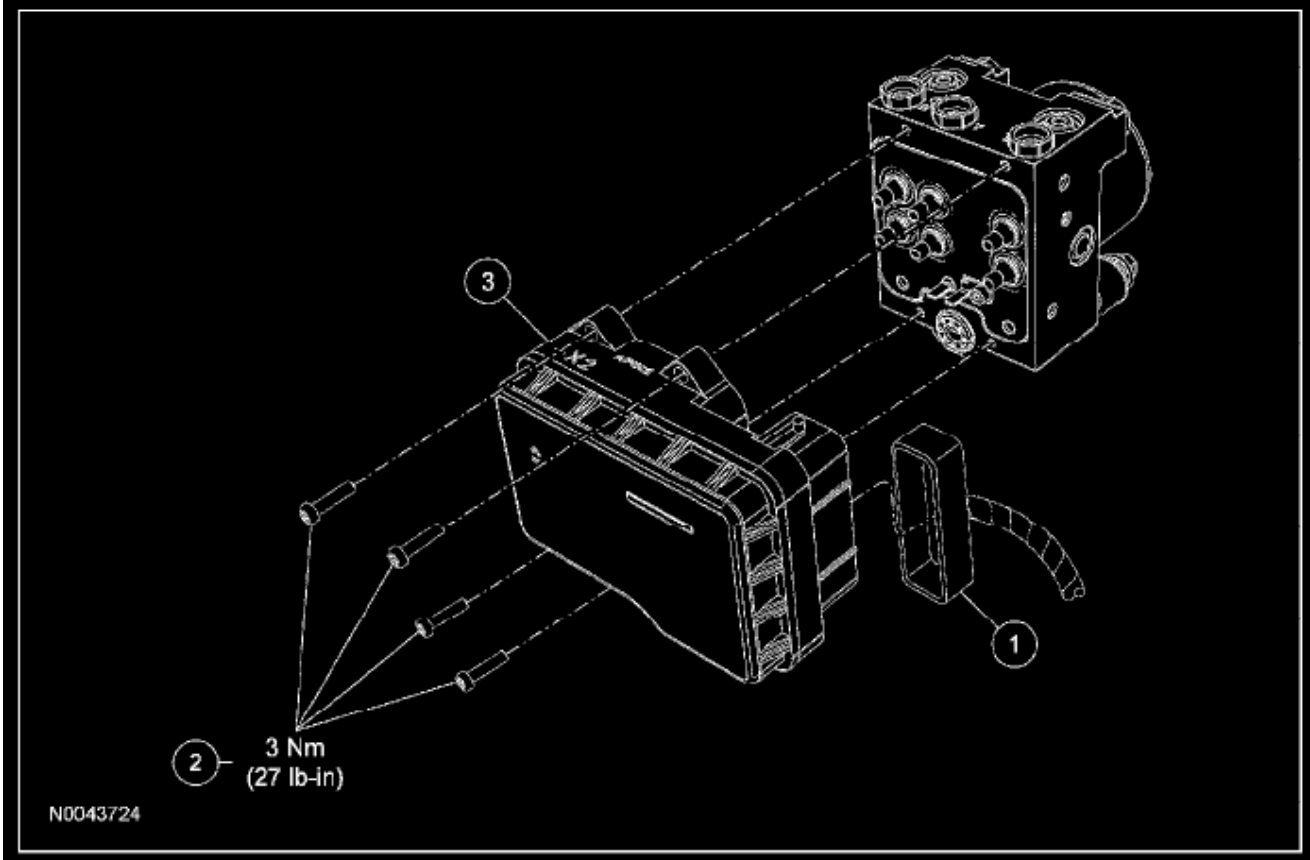
Base Part #: 2C219



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD122 (BK)	14	GROUND - FENDER FRONT LEFT # 3RD STUD	
2	*	*	not used	
3	VCA05 (GY-VT)	20	SENSOR - WHEEL SPEED RIGHT FRONT	
4	RCA19 (VT)	20	CTRL MOD. - SENSOR WHEEL SPEED RIGHT FRONT	
5	VCA03 (VT-WT)	20	SENSOR - WHEEL SPEED LEFT FRONT	
6	RCA17 (YE)	20	CTRL MOD. - SENSOR WHEEL SPEED LEFT FRONT	
7	*	*	not used	
8	CCB15 (BN-GN)	22	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL CLOSED	
9	*	*	not used	
10	CCF23 (GN-VT)	18	CTRL MOD. - POWERTRAIN # FOUR WHEEL DRIVE STATUS	
11	SBB15 (WH-RD)	14	FUSE - 15 OR CIRCUIT BREAKER	
12	*	*	not used	
13	*	*	not used	
14	RCA21 (BN-GN)	20	CTRL MOD. - SENSOR WHEEL SPEED REAR DIFFERENTIAL	
15	*	*	not used	
16	VDB10 (GY)	20	CONNECTOR - DIAGNOSTIC # K LINE ISO 9141	
17	CCA01 (BU-OG)	22	CTRL MOD. - INDICATOR WARNING ABS	
18	GD122 (BK)	14	GROUND - FENDER FRONT LEFT # 3RD STUD	
19	*	*	not used	
20	CBP20 (YE-VT)	20	FUSE - 20 OR CIRCUIT BREAKER	
21	VCA14 (WT-BN)	20	SENSOR - REAR AXLE	
22	*	*	not used	
23	RMC19 (YE-GY)	20	SWITCH - LOW LEVEL BRAKE FLUID (CONTINUITY CHECK)	
24	*	*	not used	
25	CMC19 (GY-VT)	20	SWITCH - LOW LEVEL BRAKE FLUID	
26	*	*	not used	
27	CCA02 (GN-VT)	22	CTRL MOD. - INDICATOR WARNING ELECTRONIC BRAKE DISTRIBUTION	
28	SBB17 (RD)	12	FUSE - 17 OR CIRCUIT BREAKER	

C135

Anti-Lock Brake System (ABS) Module



Item	Part Number	Description
1	—	ABS module electrical connector (part of 14290)
2	—	ABS module bolts (4 required) (part of 2C065)
3	2C065	ABS module

Electronic Brake Control Module: Service and Repair

Anti-Lock Brake System (ABS) Module

Anti-Lock Brake System (ABS) Module

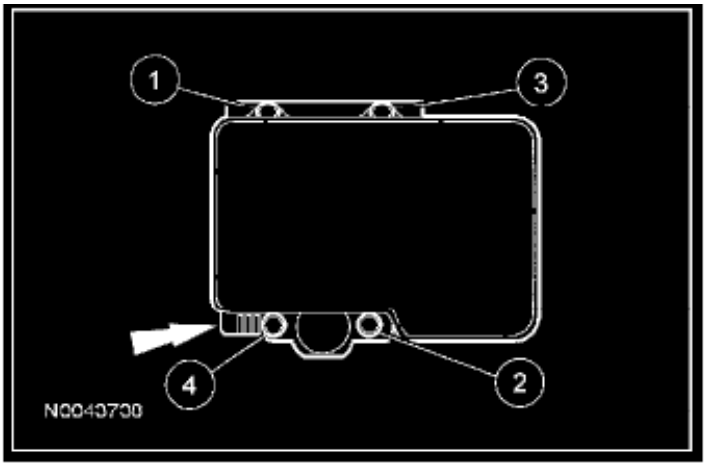
Removal and Installation

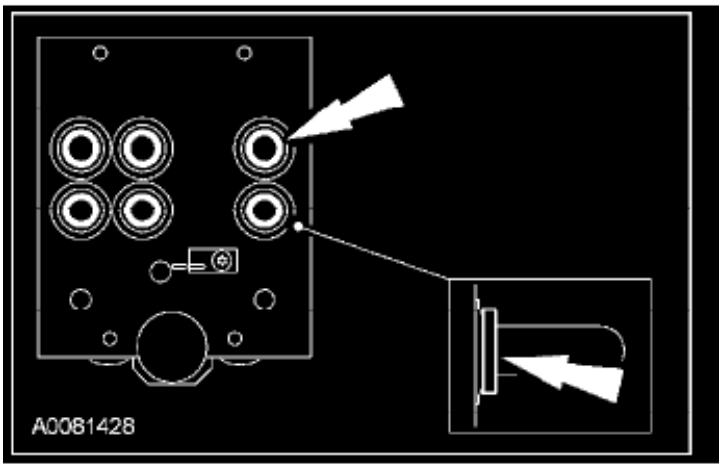
1. Remove the hydraulic control unit (HCU).

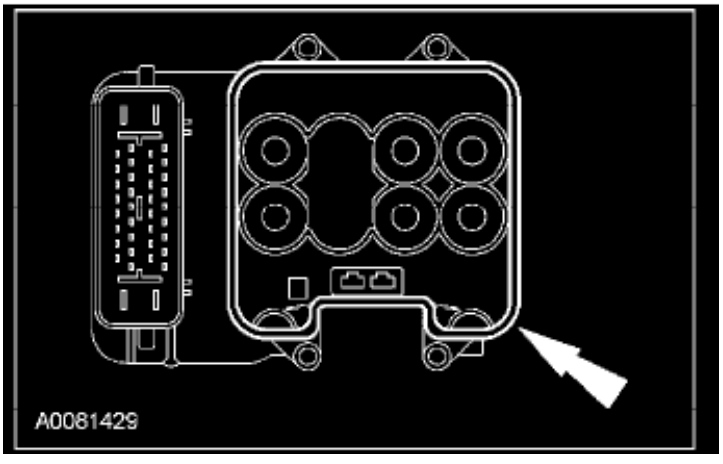
2. NOTE: The ABS module bolts must be removed and installed in the sequence shown.

Remove the 4 ABS module bolts in the sequence shown. ^

To install, tighten to 3 Nm (27 lb-inch).


1
3
4
2


A0081428


A0081429

3. CAUTION: When the anti-lock brake system (ABS) module is separated from the hydraulic control unit (HCU), the motor terminals and

the valve stems will be exposed. Protect the terminals and the valve stems from damage.

Remove the ABS module from the HCU.

4. Remove and discard the O-ring seals.

5. Remove and discard the ABS module seal.

6. CAUTION: All components must be free of dust, oil, fluid and foreign material prior to installation. A new seal kit must be used when

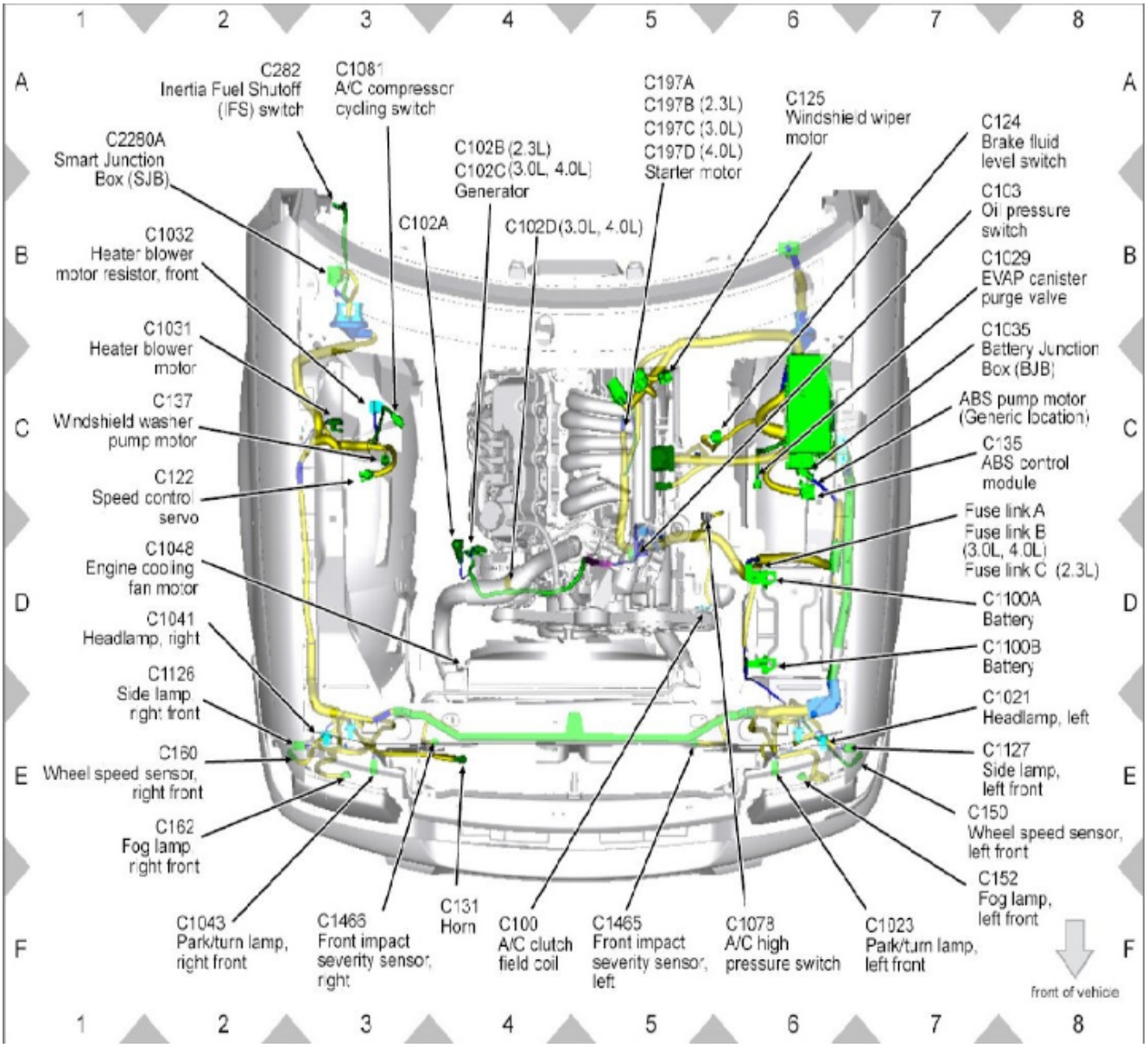
installing the anti-lock brake system (ABS) module. The old seals must be discarded as they may cause a leak between the ABS module and the hydraulic control unit (HCU).

NOTE: The O-ring seals must be installed to the valve flange. Make sure the O-ring seals are not deformed when installed.

NOTE: Clean the groove of the ABS module before installing a new seal.

To install, reverse the removal procedure.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Brakes and Traction Control > Sensors and Switches - Brakes and Traction Control > Brake Fluid Level Sensor/Switch > Component Information > Locations



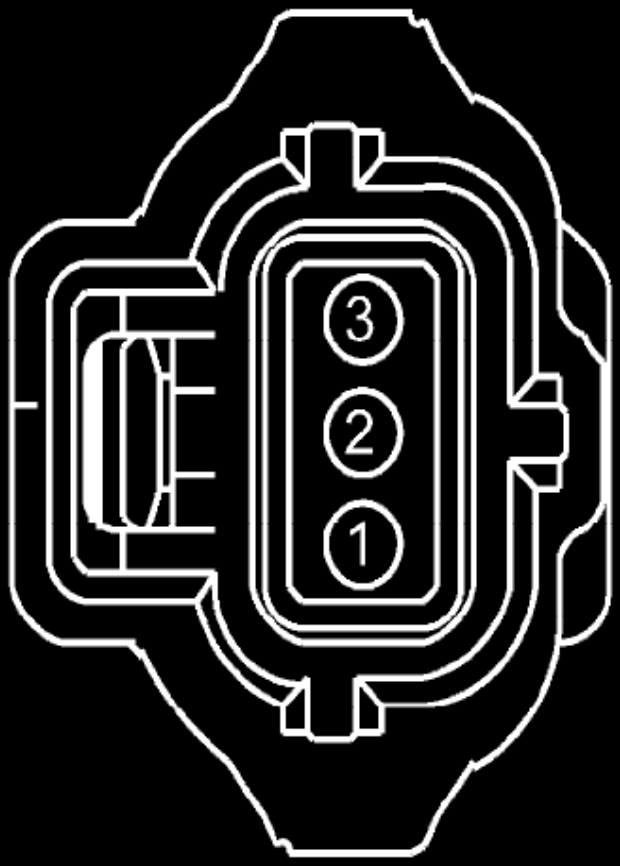
View 151-1

Connector: C124

Description: BRAKE FLUID LEVEL SWITCH

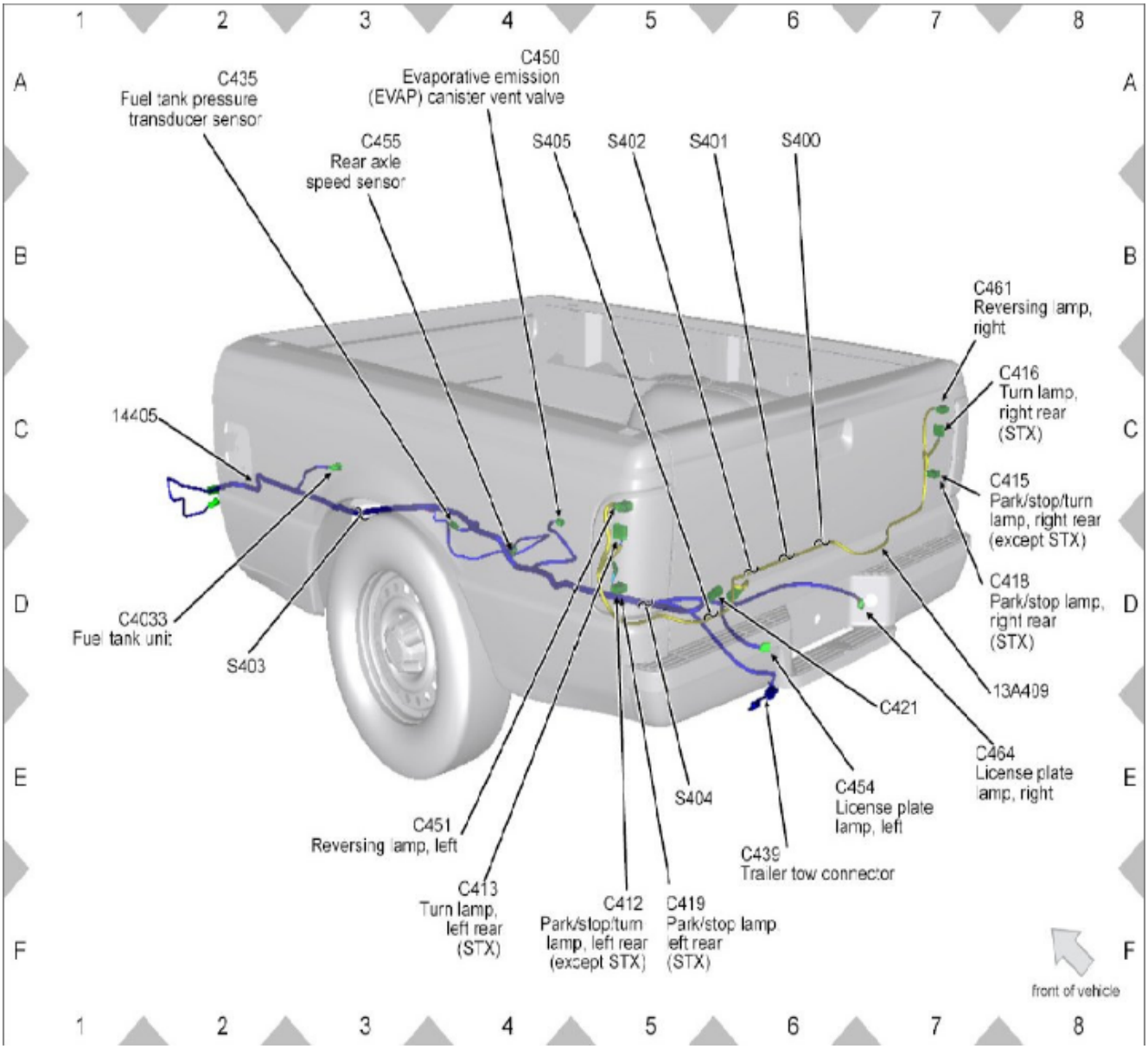
Harness: 14290

Base Part #: 2L414



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD121 (BK-YE)	20	GROUND - FENDER FRONT LEFT # 2ND STUD	
2	GMC19 (GY-VT)	20	SWITCH - LOW LEVEL BRAKE FLUID	
3	RMC19 (YE-GY)	20	SWITCH - LOW LEVEL BRAKE FLUID (CONTINUITY CHECK)	

C124


C435
Fuel tank pressure transducer sensor
C450
Evaporative emission (EVAP) canister vent valve
C455
Rear axle speed sensor
S405
S402
S401
S400
C461
Reversing lamp, right
C416
Turn lamp, right rear (STX)
14405
C415
Park/stop/turn lamp, right rear (except STX)
C4033
Fuel tank unit
S403
C418
Park/stop lamp, right rear (STX)
13A409
C421
C464
License plate lamp, right
C454
License plate lamp, left
S404
C451
Reversing lamp, left
C439
Trailer tow connector
C413
Turn lamp, left rear (STX)
C412
Park/stop/turn lamp, left rear (except STX)
C419
Park/stop lamp left rear (STX)
front of vehicle

View 151-27

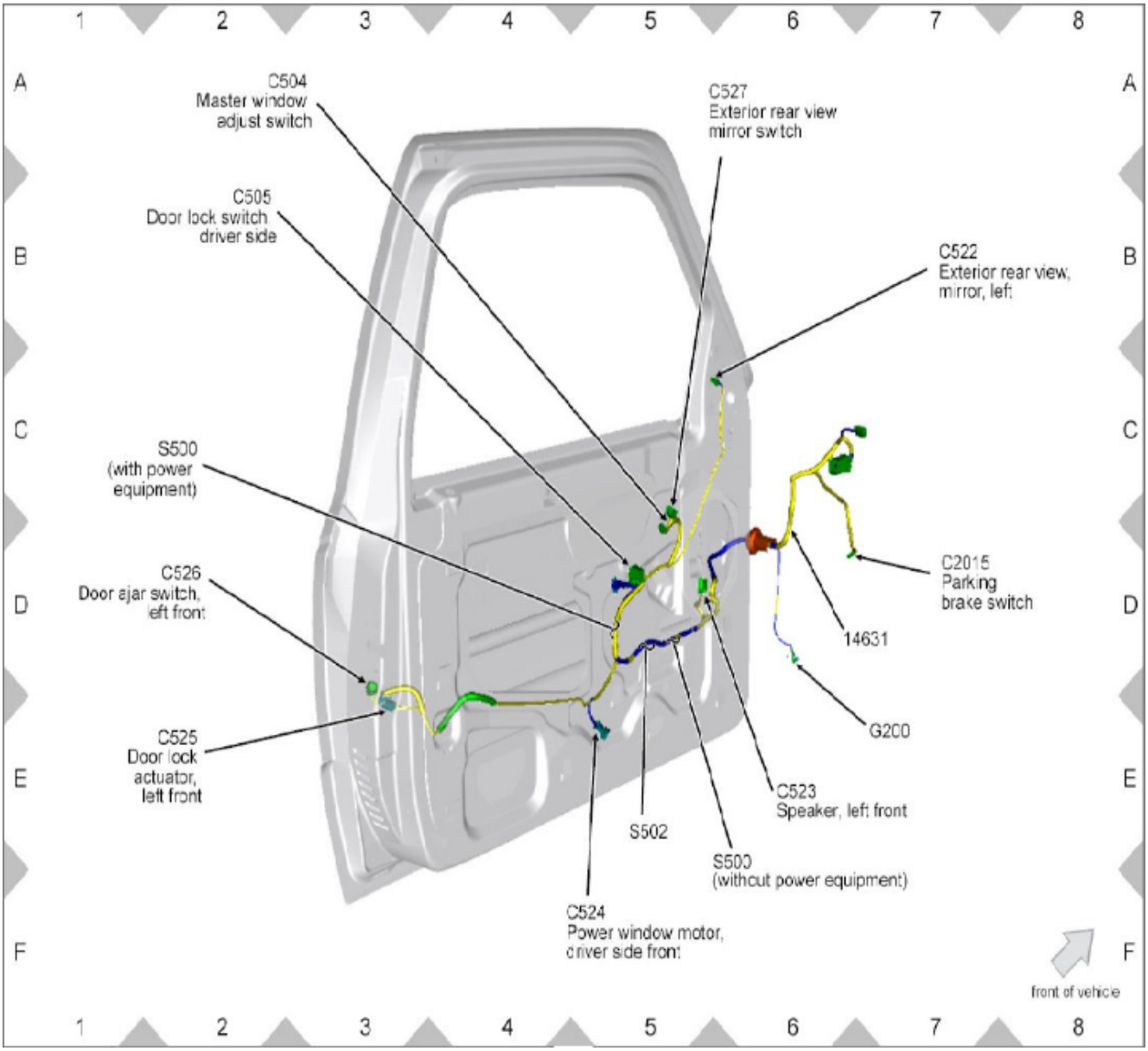
Connector: C455

Description:	Harness:	Base Part #:
REAR AXLE SPEED SENSOR	14405	4B409

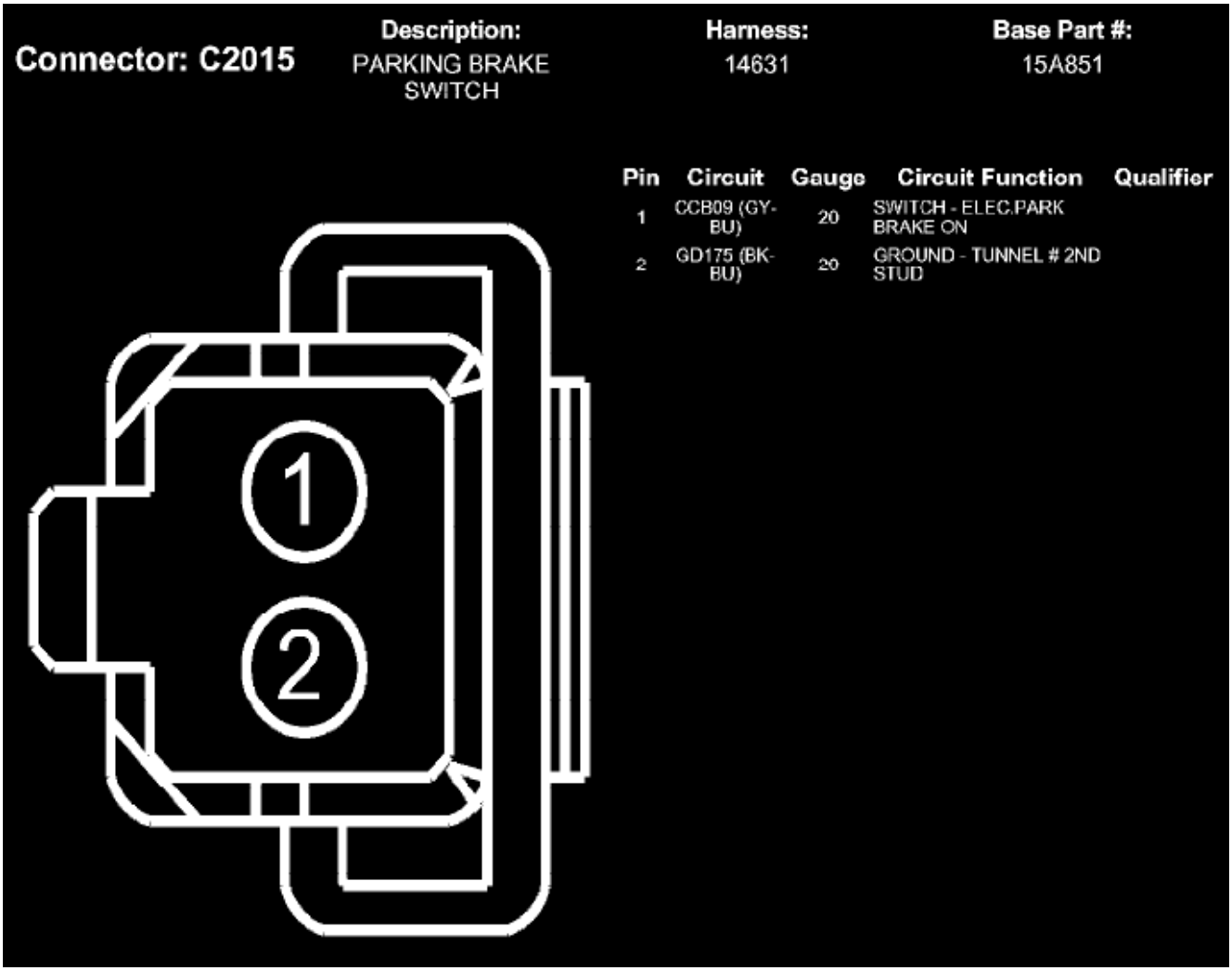
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RCA21 (BN-GN)	18	CTRL MOD. - SENSOR WHEEL SPEED REAR DIFFERENTIAL	
2	VCA14 (WH-BN)	18	SENSOR - REAR AXLE	

C455

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Brakes and Traction Control > Sensors and Switches - Brakes and Traction Control > Parking Brake Warning Switch > Component Information > Locations

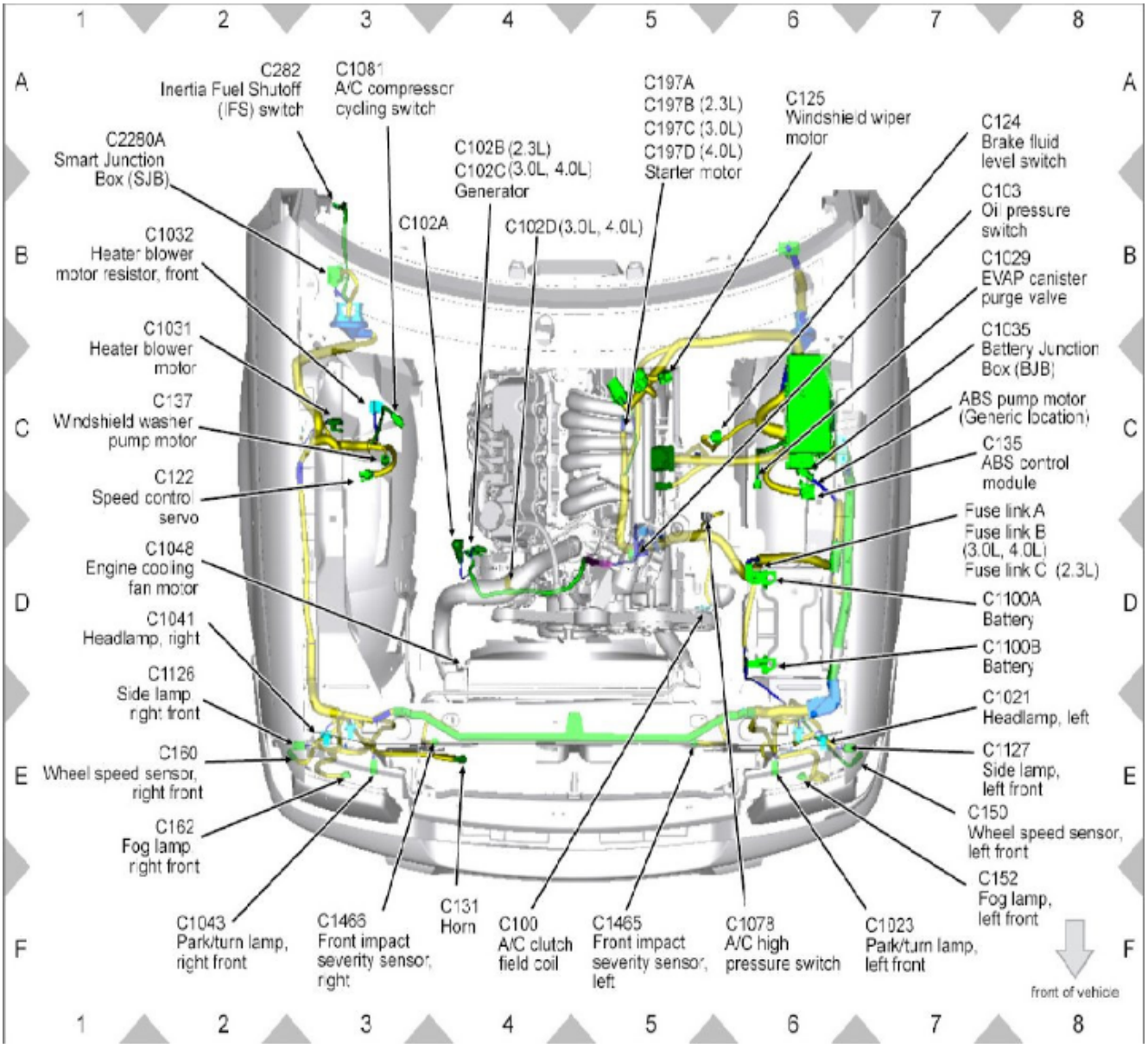


View 151-20

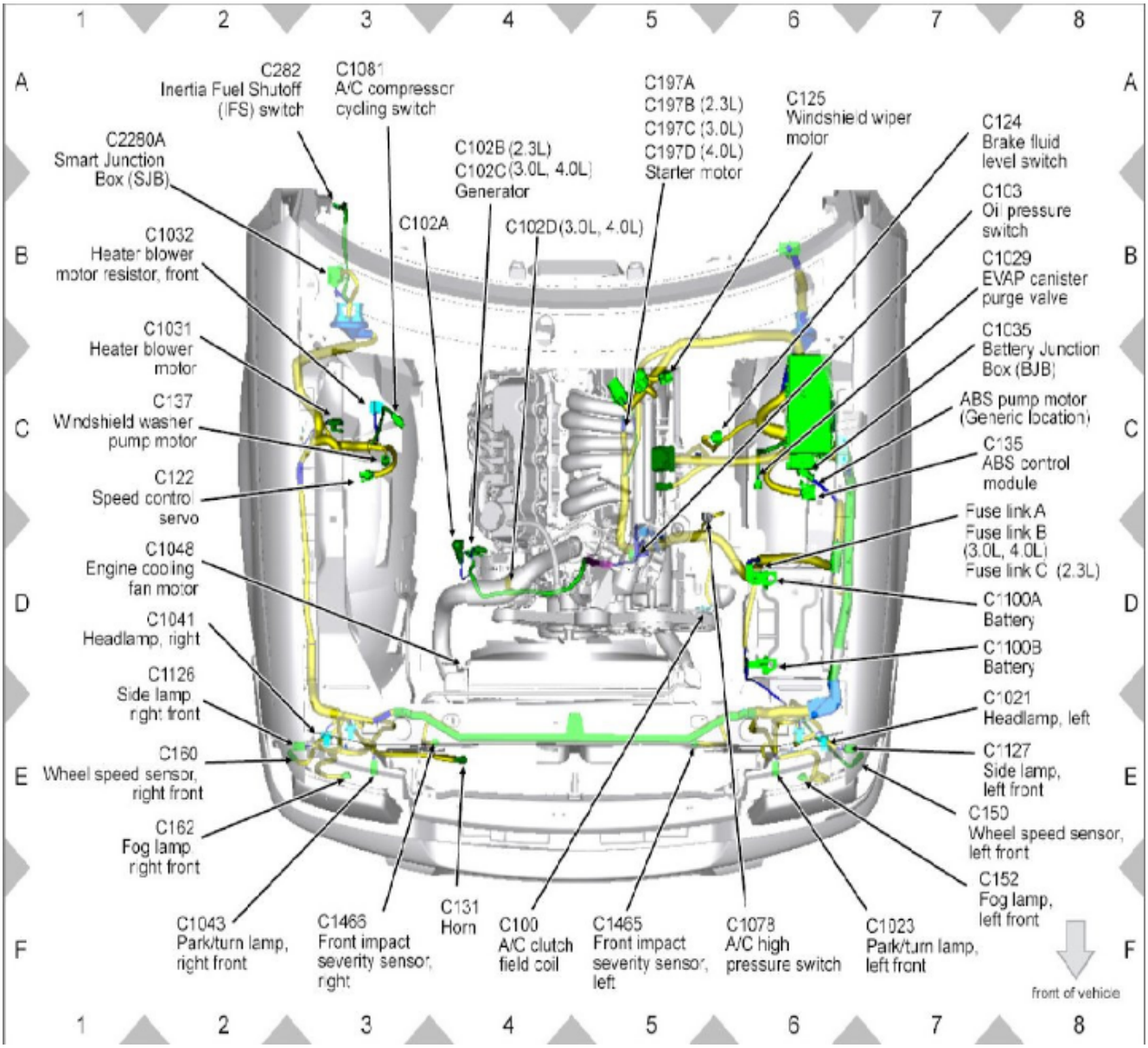

Connector: C2015
Description:
PARKING BRAKE SWITCH
Harness:
14631
Base Part #:
15A851
Pin
Circuit
Gauge
Circuit Function
Qualifier
1
CCB09 (GY-BU)
20
SWITCH - ELEC.PARK BRAKE ON
2
GD175 (BK-BU)
20
GROUND - TUNNEL # 2ND STUD
1
2

C2015

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Brakes and Traction Control > Sensors and Switches - Brakes and Traction Control > Wheel Speed Sensor > Component Information > Locations > Wheel Speed Sensor, Right Front



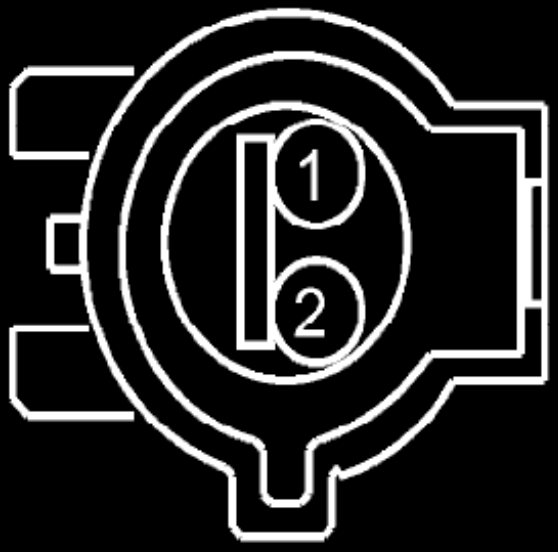
View 151-1


C282
Inertia Fuel Shutoff (IFS) switch
C1081
A/C compressor cycling switch
C2280A
Smart Junction Box (SJB)
C102B (2.3L)
C102C (3.0L, 4.0L)
Generator
C102A
C102D (3.0L, 4.0L)
C197A
C197B (2.3L)
C197C (3.0L)
C197D (4.0L)
Starter motor
C125
Windshield wiper motor
C124
Brake fluid level switch
C103
Oil pressure switch
C1032
Heater blower motor resistor, front
C1029
EVAP canister purge valve
C1031
Heater blower motor
C1035
Battery Junction Box (BJB)
C137
Windshield washer pump motor
ABS pump motor (Generic location)
C135
ABS control module
C122
Speed control servo
Fuse link A
Fuse link B (3.0L, 4.0L)
Fuse link C (2.3L)
C1048
Engine cooling fan motor
C1100A
Battery
C1041
Headlamp, right
C1100B
Battery
C1126
Side lamp, right front
C1021
Headlamp, left
C160
Wheel speed sensor, right front
C1127
Side lamp, left front
C162
Fog lamp, right front
C150
Wheel speed sensor, left front
C152
Fog lamp, left front
C1043
Park/turn lamp, right front
C1466
Front impact severity sensor, right
C131
Horn
C100
A/C clutch field coil
C1465
Front impact severity sensor, left
C1078
A/C high pressure switch
C1023
Park/turn lamp, left front
front of vehicle

View 151-1

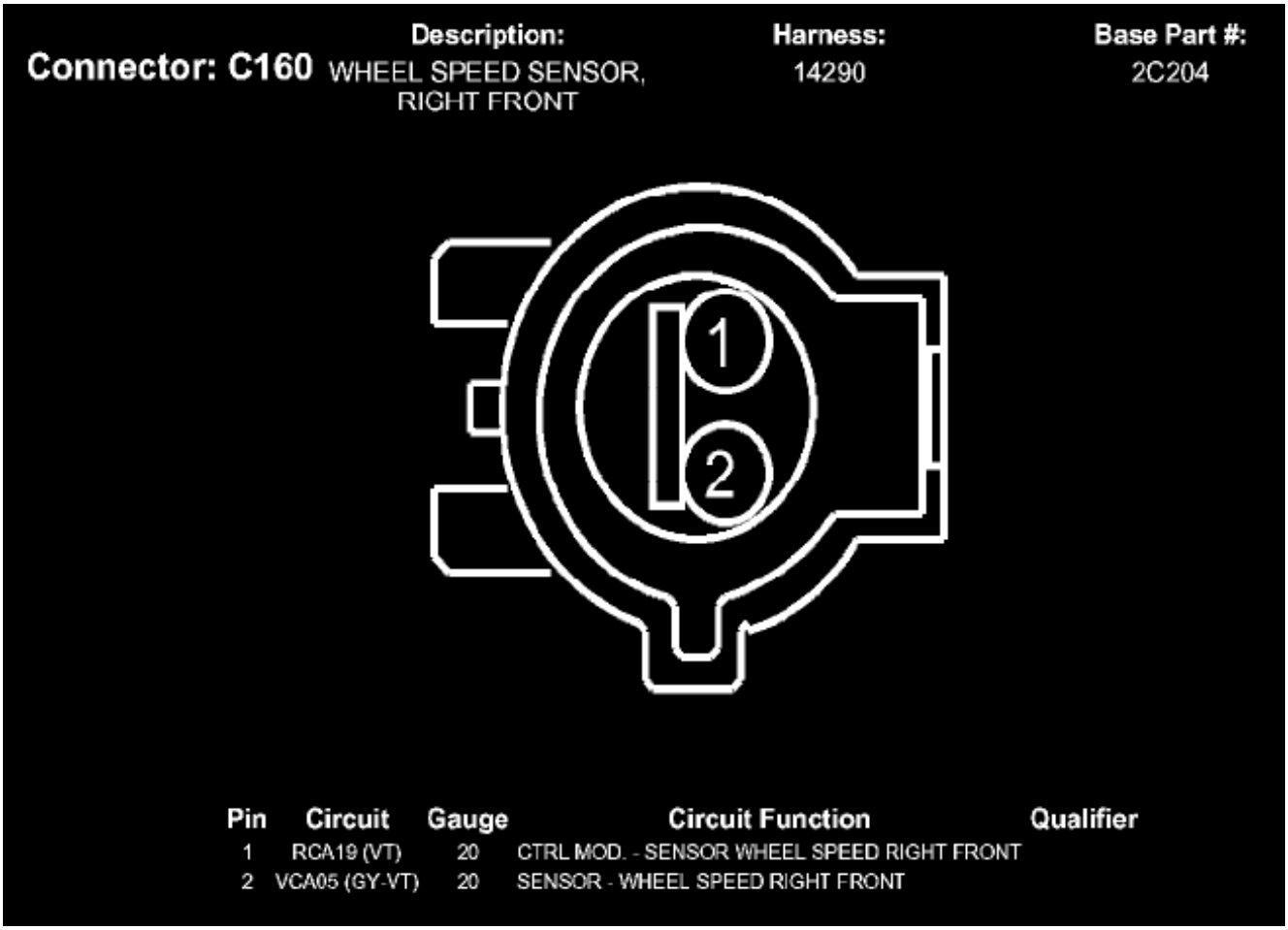
Connector: C150

Description:	Harness:	Base Part #:
WHEEL SPEED SENSOR,LEFT FRONT	14290	2C205



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	RCA17 (YE)	20	CTRL MOD. - SENSOR WHEEL SPEED LEFT FRONT	
2	VCA03 (VT-WH)	20	SENSOR - WHEEL SPEED LEFT FRONT	

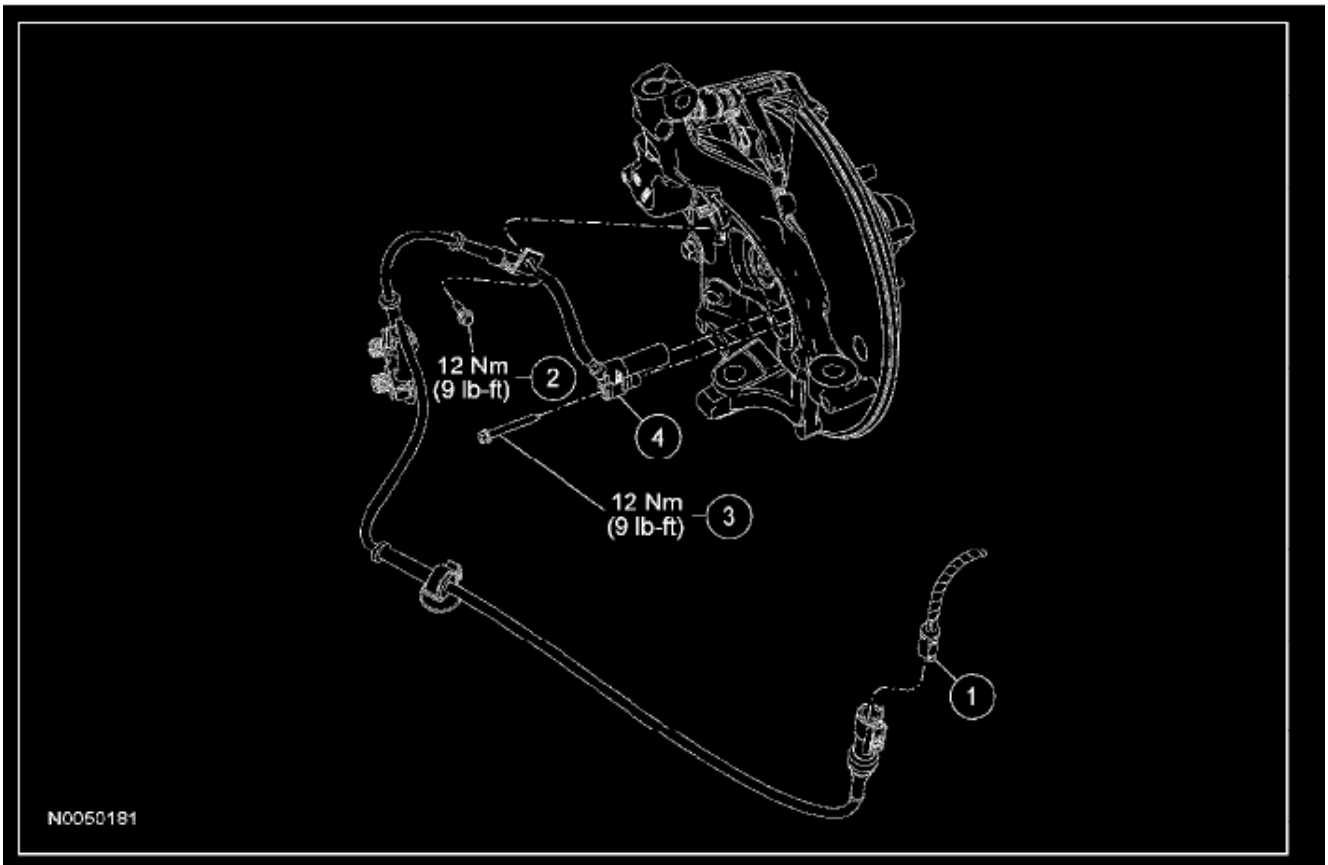
C150


Connector: C160
Description:
WHEEL SPEED SENSOR, RIGHT FRONT
Harness:
14290
Base Part #:
2C204
1
2
Pin Circuit Gauge Circuit Function Qualifier
1 RCA19 (VT) 20 CTRL MOD. - SENSOR WHEEL SPEED RIGHT FRONT
2 VCA05 (GY-VT) 20 SENSOR - WHEEL SPEED RIGHT FRONT

C160

Material

Item	Specification
High Temperature 4x4 Front Axle and Wheel Bearing Grease E8TZ-19590-A	WSS-M1C267-A1



Item	Part Number	Description
1	—	Wheel speed sensor electrical connector (part of 14290)
2	N611171	Wheel speed sensor harness bolt
3	N811177	Wheel speed sensor bolt
4	2C204	Wheel speed sensor

Wheel Speed Sensor: Service and Repair Wheel Speed Sensor - Front

Wheel Speed Sensor - Front, Rear Wheel Drive (RWD)

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the wheel speed sensor electrical connector. 3. Remove the wheel speed sensor harness bolt and unclip the retainers.

^ To install, tighten to 12 Nm (9 lb-ft).

4. Remove the wheel speed sensor bolt and the wheel speed sensor.

^ To install, tighten to 12 Nm (9 lb-ft).

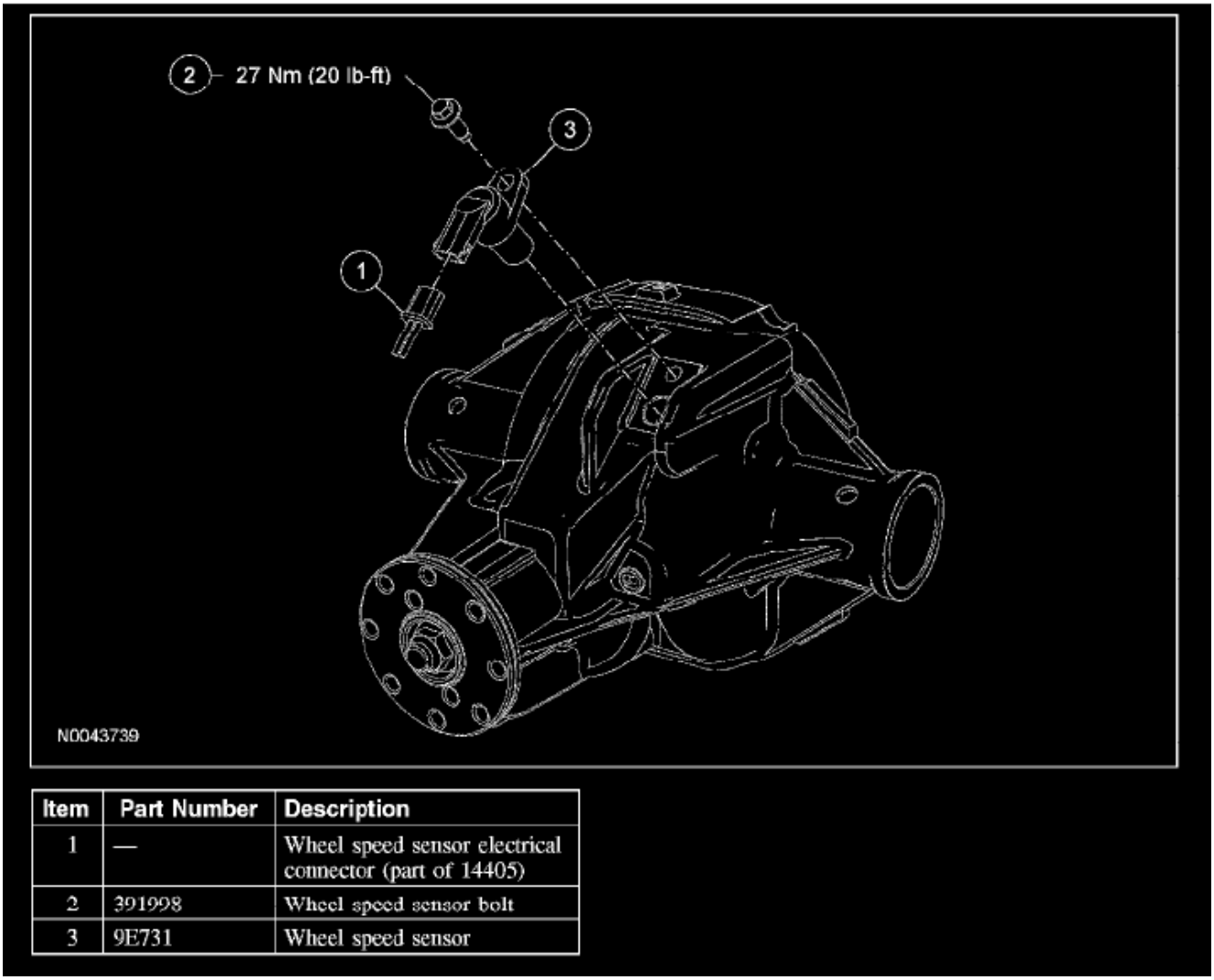
5. NOTE: Plug the sensor cavity and thoroughly clean the sensor mounting surface. Apply a light coating of the specified grease to the mounting

surface.

To install, reverse the removal procedure.

Material

Item	Specification
Motorcraft SAE 75W-140 Synthetic Rear Axle Lubricant XY-75W140-QL (US); CXY-75W140-1L (Canada)	WSL-M2C192-A



Item	Part Number	Description
1	—	Wheel speed sensor electrical connector (part of 14405)
2	391998	Wheel speed sensor bolt
3	9E731	Wheel speed sensor

Wheel Speed Sensor: Service and Repair Wheel Speed Sensor - Rear

Wheel Speed Sensor - Rear

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the wheel speed sensor electrical connector. 3. Remove the wheel speed sensor bolt and the wheel speed sensor.

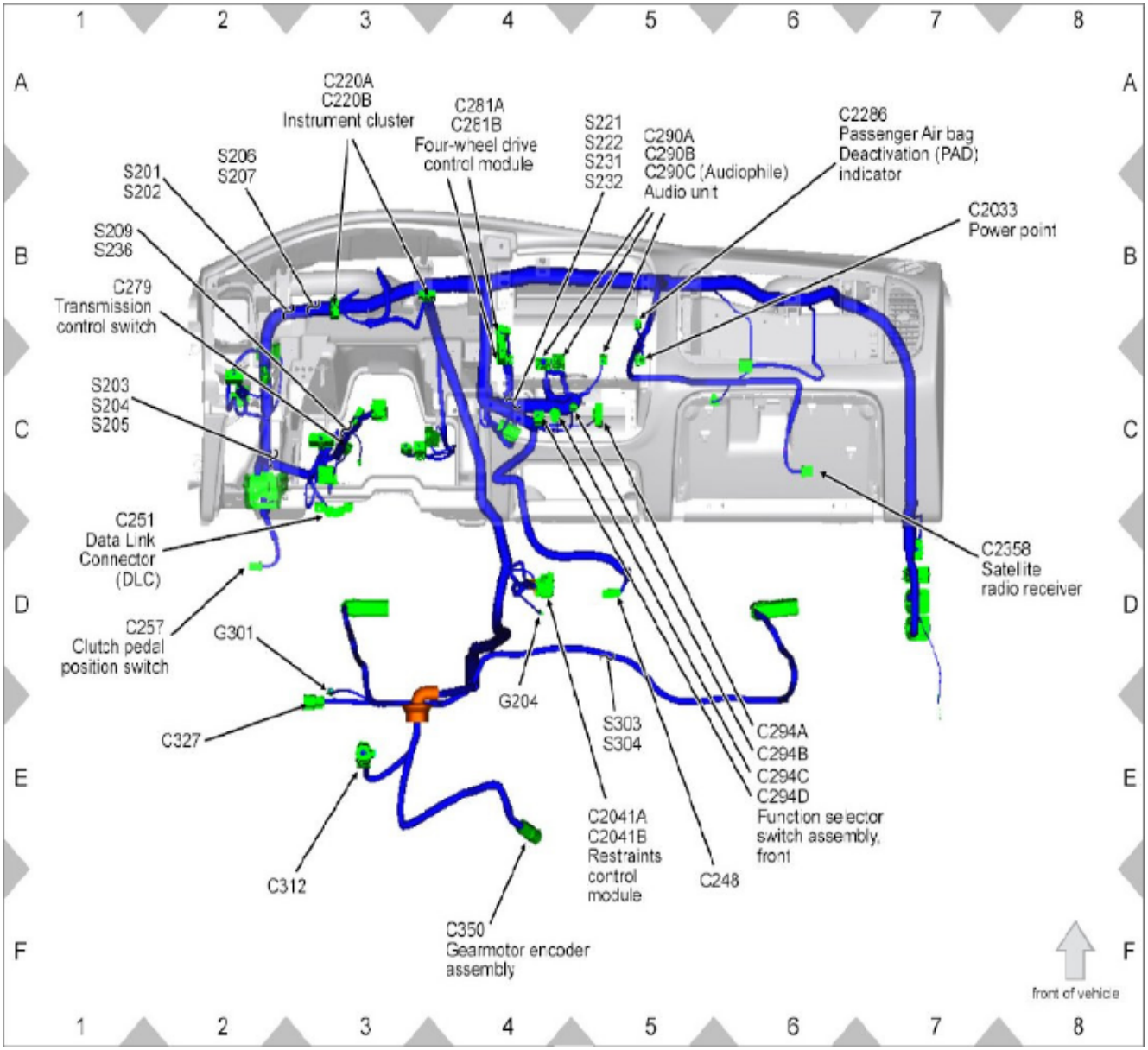
^ To install, tighten to 27 Nm (20 lb-ft).

4. NOTE: Plug the sensor cavity and thoroughly clean the sensor mounting surface.

NOTE: Inspect the anti-lock brake sensor O-ring seal for damage; lightly lubricate the O-ring seal with the specified lubricant.

To install, reverse the removal procedure.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Starting and Charging > Sensors and Switches - Starting and Charging > Clutch Switch > Component Information > Locations



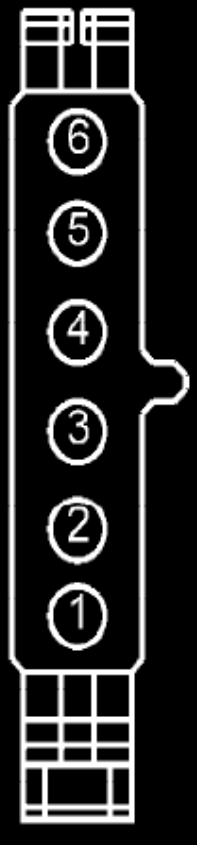
View 151-12

Connector: C257

Description: CLUTCH PEDAL POSITION SWITCH

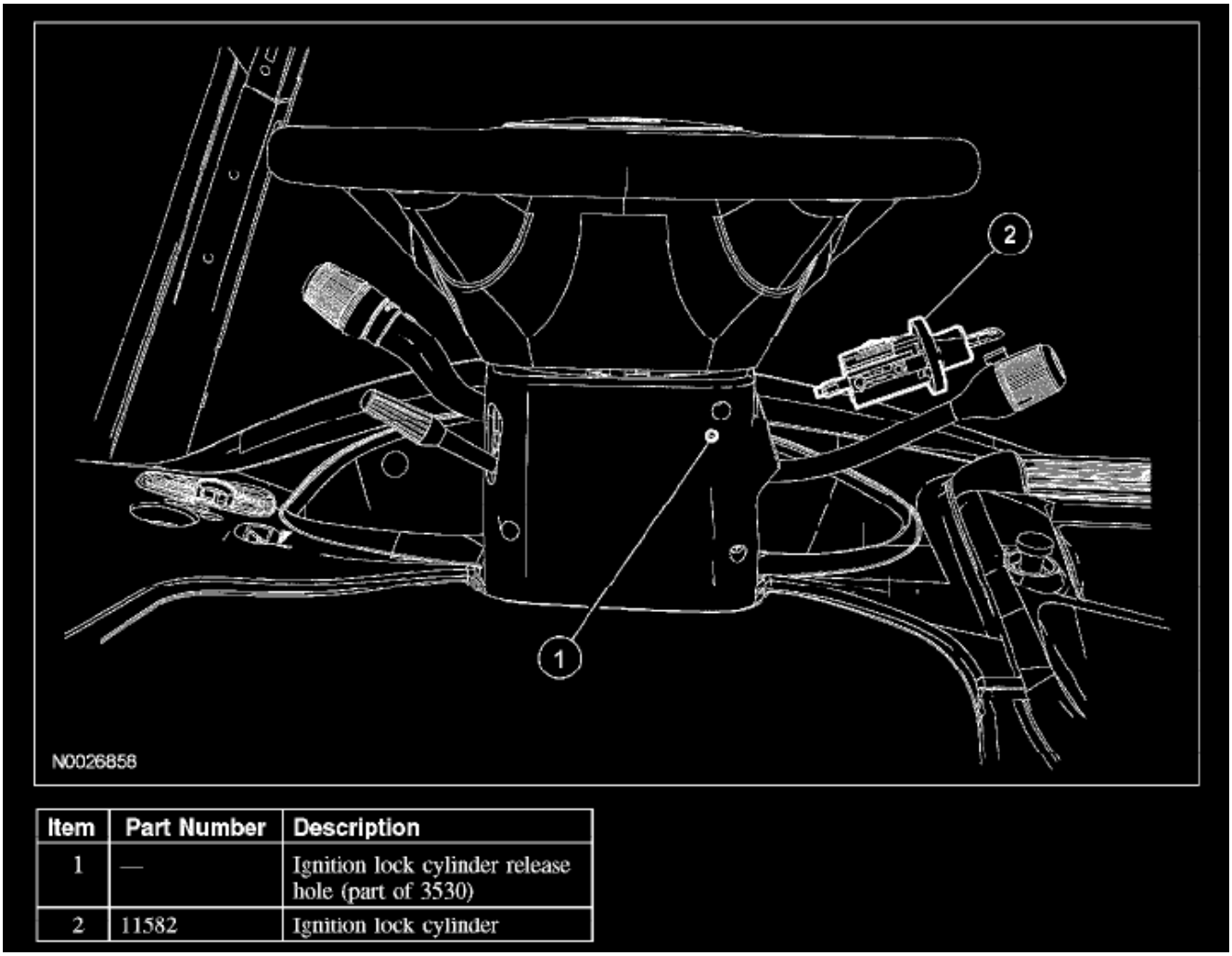
Harness: 14401

Base Part #: 11A152



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE904 (GN-VT)	22	SWITCH - CLUTCH PEDAL POSITION # TOP OF TRAVEL (CPP-TT)	
2	GD174 (BK-WH)	22	GROUND - TUNNEL	
3	CCB15 (BN-GN)	22	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL CLOSED	
4	CCB15 (BN-GN)	22	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL CLOSED	
5	GD174 (BK-WH)	22	GROUND - TUNNEL	
6	CDC36 (GN-BN)	22	SWITCH - START INTERLOCK CLUTCH PEDAL	

C257



Item	Part Number	Description
1	—	Ignition lock cylinder release hole (part of 3530)
2	11582	Ignition lock cylinder

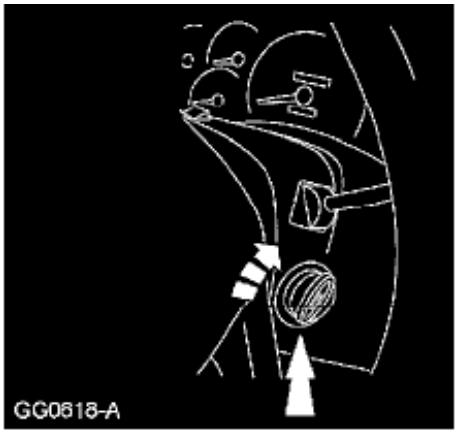
Ignition Switch Lock Cylinder: Service and Repair Ignition Lock Cylinder - Functional

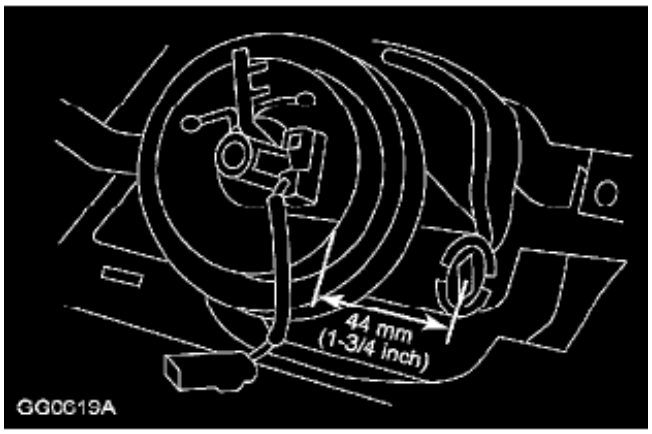
IGNITION LOCK CYLINDER - FUNCTIONAL

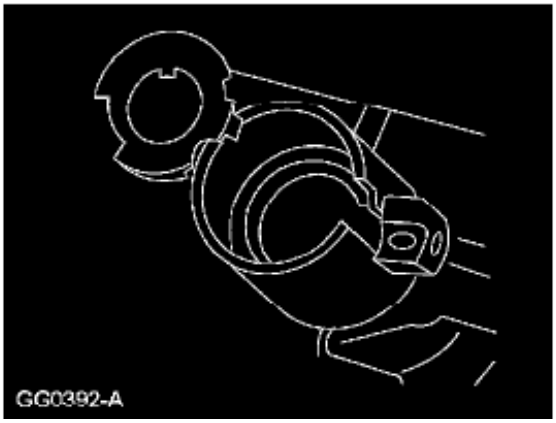
Removal and Installation

1. Disconnect the battery ground cable. 2. Insert the ignition key and turn to the RUN position. 3. Press the ignition lock cylinder release pin and remove the ignition lock cylinder. 4. To install, reverse the removal procedure.

- Verify ignition lock cylinder operation.







Ignition Switch Lock Cylinder: Service and Repair Ignition Lock Cylinder - Non Functional

IGNITION LOCK CYLINDER - NON FUNCTIONAL

Removal and Installation

1. NOTE: Make sure the front wheels are in the straight-ahead position.

Remove the steering wheel assembly.

2. Twist off the cap from the ignition lock cylinder.

3. NOTE: The lock cylinder is repaired by discarding the inoperative lock cylinder and building a new lock cylinder using the appropriate lock

repair package (F85Z-11582-AA). The lock repair package includes a detailed instruction sheet to build the new lock cylinder to the current key code of the vehicle.

Remove the ignition lock cylinder. -

Use a 1/8-inch diameter drill bit to drill out the lock cylinder retaining pin.

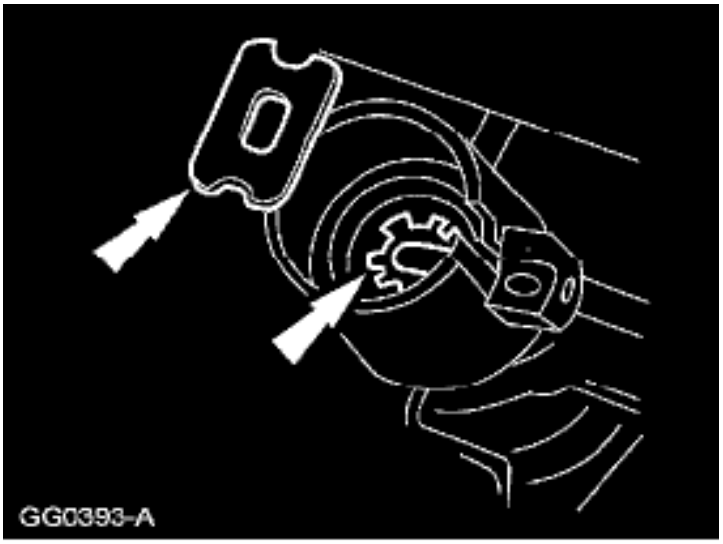
- Use a 3/8-inch drill bit to drill down the middle of the ignition lock key slot until the ignition lock cylinder breaks loose.

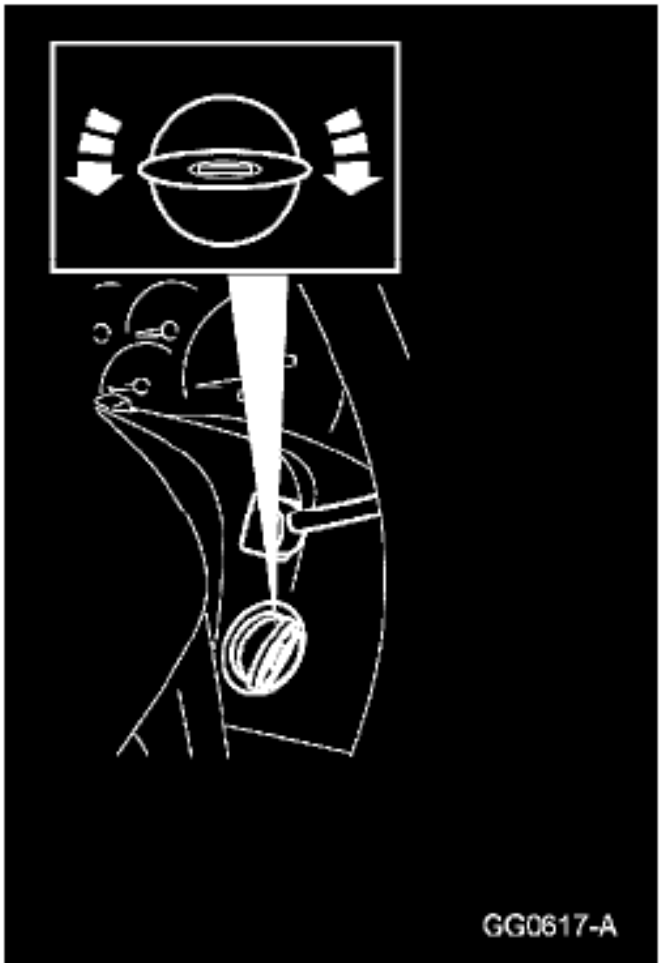
- Remove and discard the ignition lock cylinder and clean the drill shavings from the steering column.

4. Remove the bearing retainer.

5. Remove the bearing and gear.

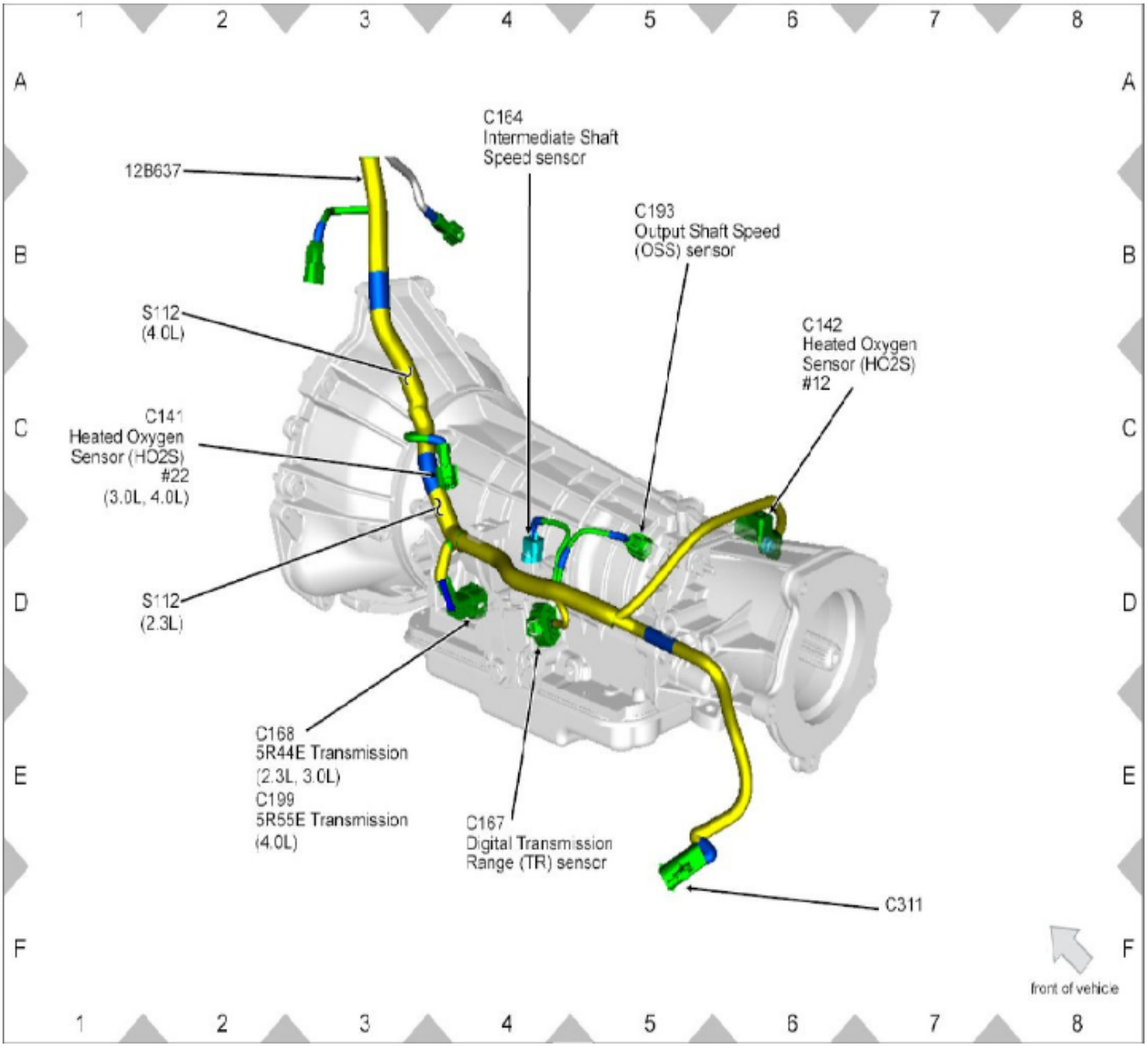
- Thoroughly clean all drill shavings from the steering column and inspect it for damage.





6. To install, reverse the removal procedure.

- Install a new ignition lock cylinder.
- Verify ignition lock cylinder operation.


C164
Intermediate Shaft Speed sensor
12B637
C193
Output Shaft Speed (OSS) sensor
S112
(4.0L)
C142
Heated Oxygen Sensor (HC2S) #12
C141
Heated Oxygen Sensor (HO2S) #22
(3.0L, 4.0L)
S112
(2.3L)
C168
5R44E Transmission
(2.3L, 3.0L)
C199
5R55E Transmission
(4.0L)
C167
Digital Transmission Range (TR) sensor
C311
front of vehicle

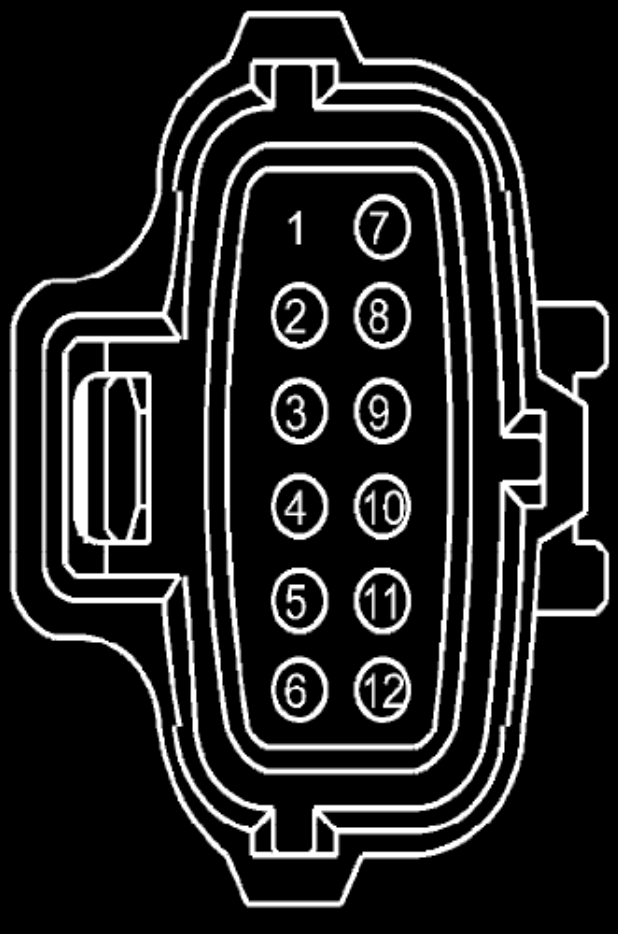
View 151-10

Connector: C167

Description: DIGITAL TRANSMISSION RANGE (TR) SENSOR

Harness: 12B637

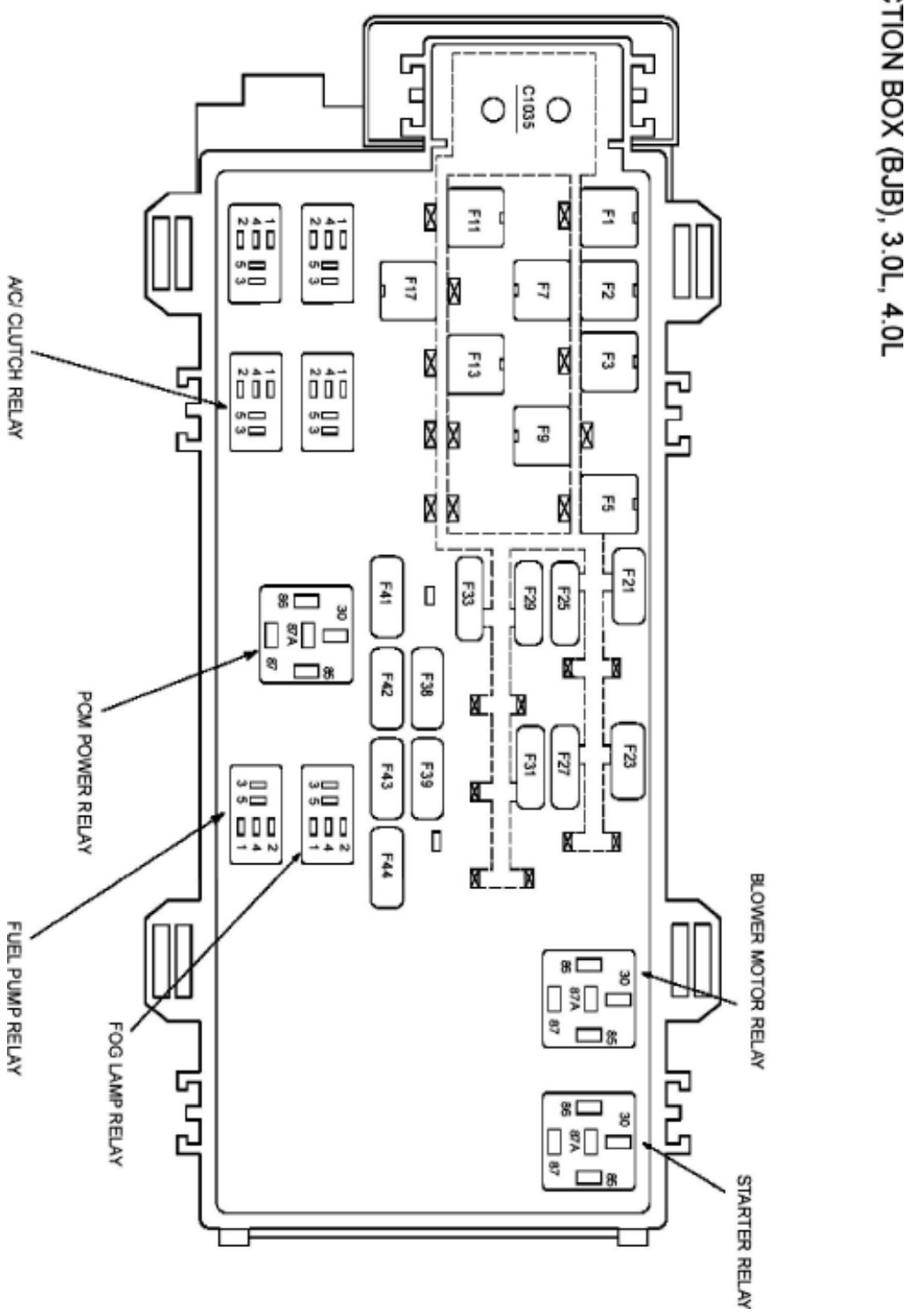
Base Part #: 7F293



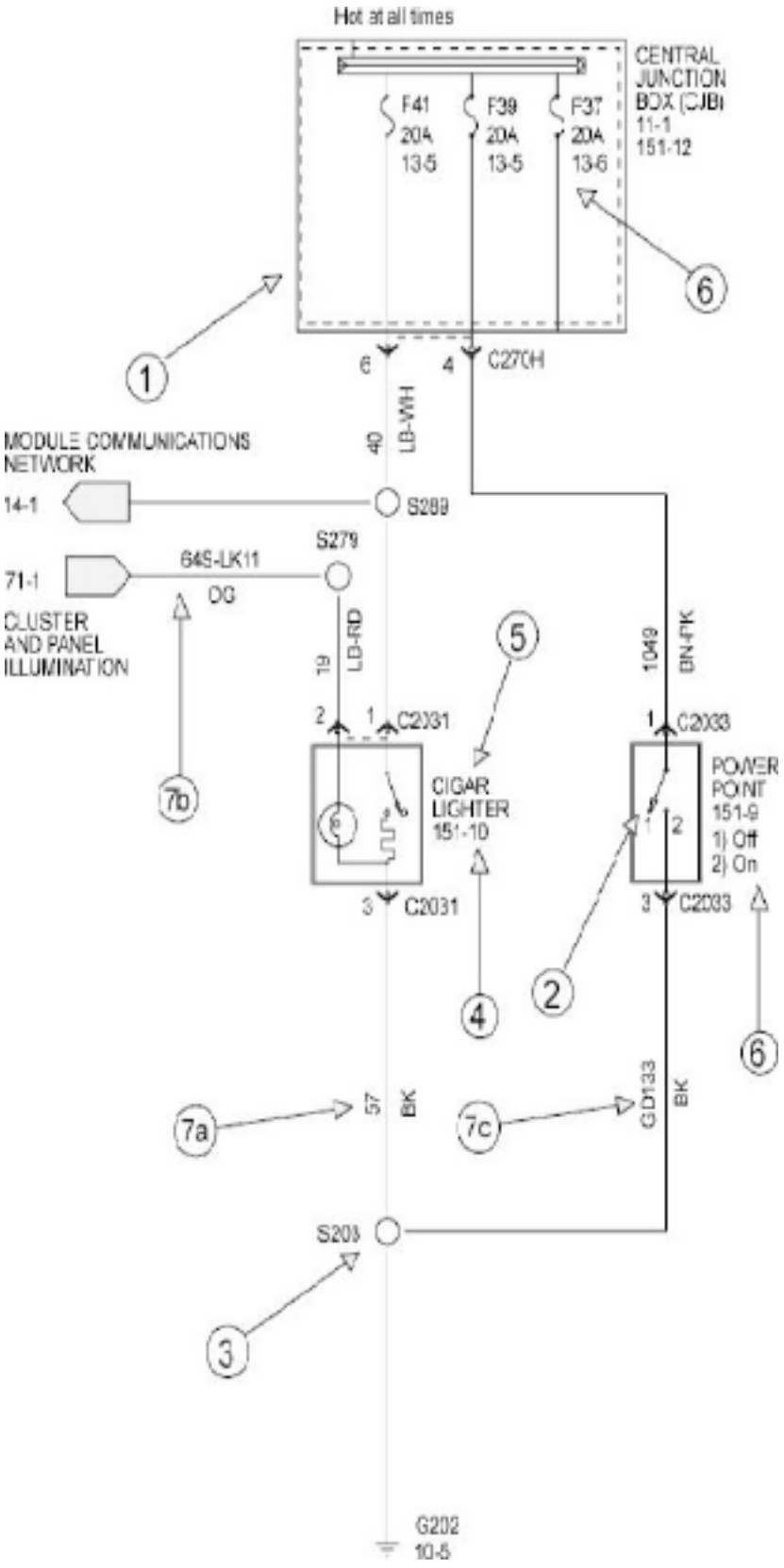
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	RE406 (GY-VT)	18	SIGNAL RETURN	
3	VET28 (GY-VT)	20	TR3A	
4	VET29 (VT-WH)	20	TR1	
5	VET30 (YE)	20	TR2	
6	VET31 (BU-OG)	20	TR4	
7	GD108 (BK-VT)	18	GROUND	4x4
8	CCF20 (GY-VT)	20	NETURAL SENSE	4x4
9	CBP20 (YE-VT)	18	FUSED POWER FEED	
10	CET40 (GN-OG)	20	STARTER CONTROL	
11	CET41 (BN-YE)	18	BACK UP	
12	CBP21 (BU-GY)	20	STARTER TO STARTER INTERRUPT RELAY	

C167

BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L



Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Starting and Charging > Relays and Modules - Starting and Charging > Starter Relay > Component Information > Diagrams > Diagram Information and Instructions



Starter Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

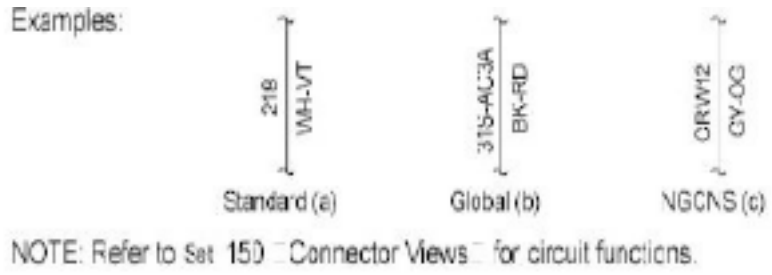
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

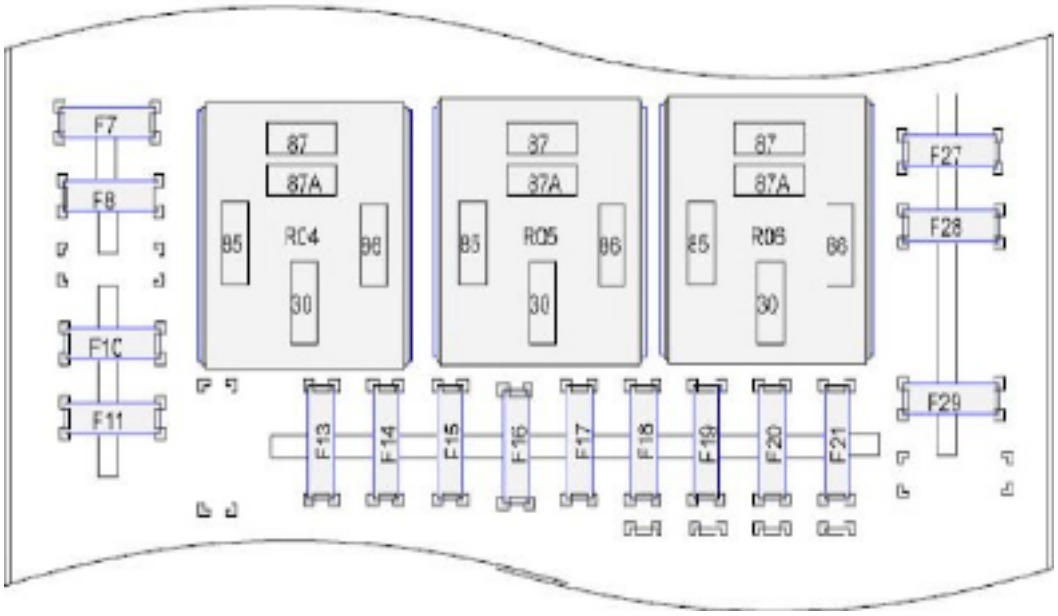
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

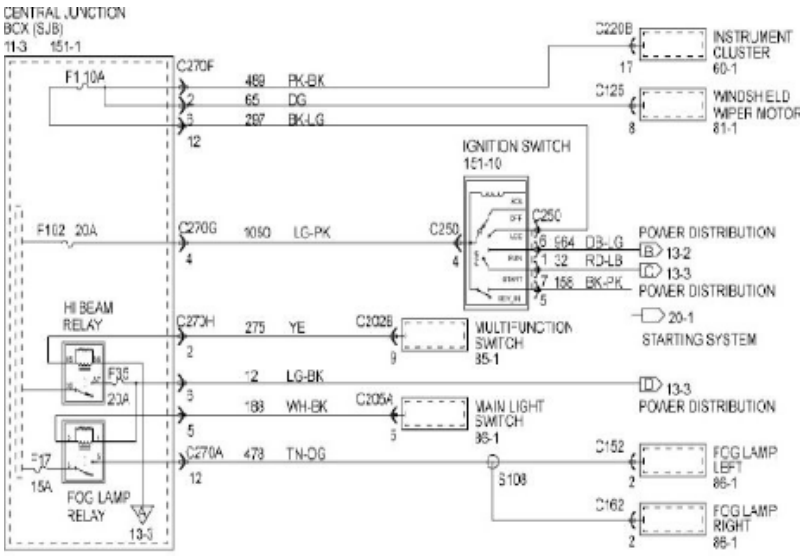
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

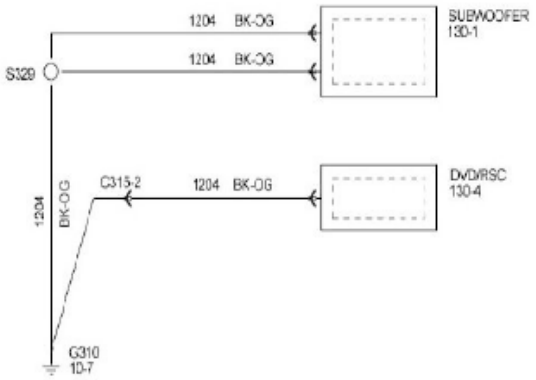
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

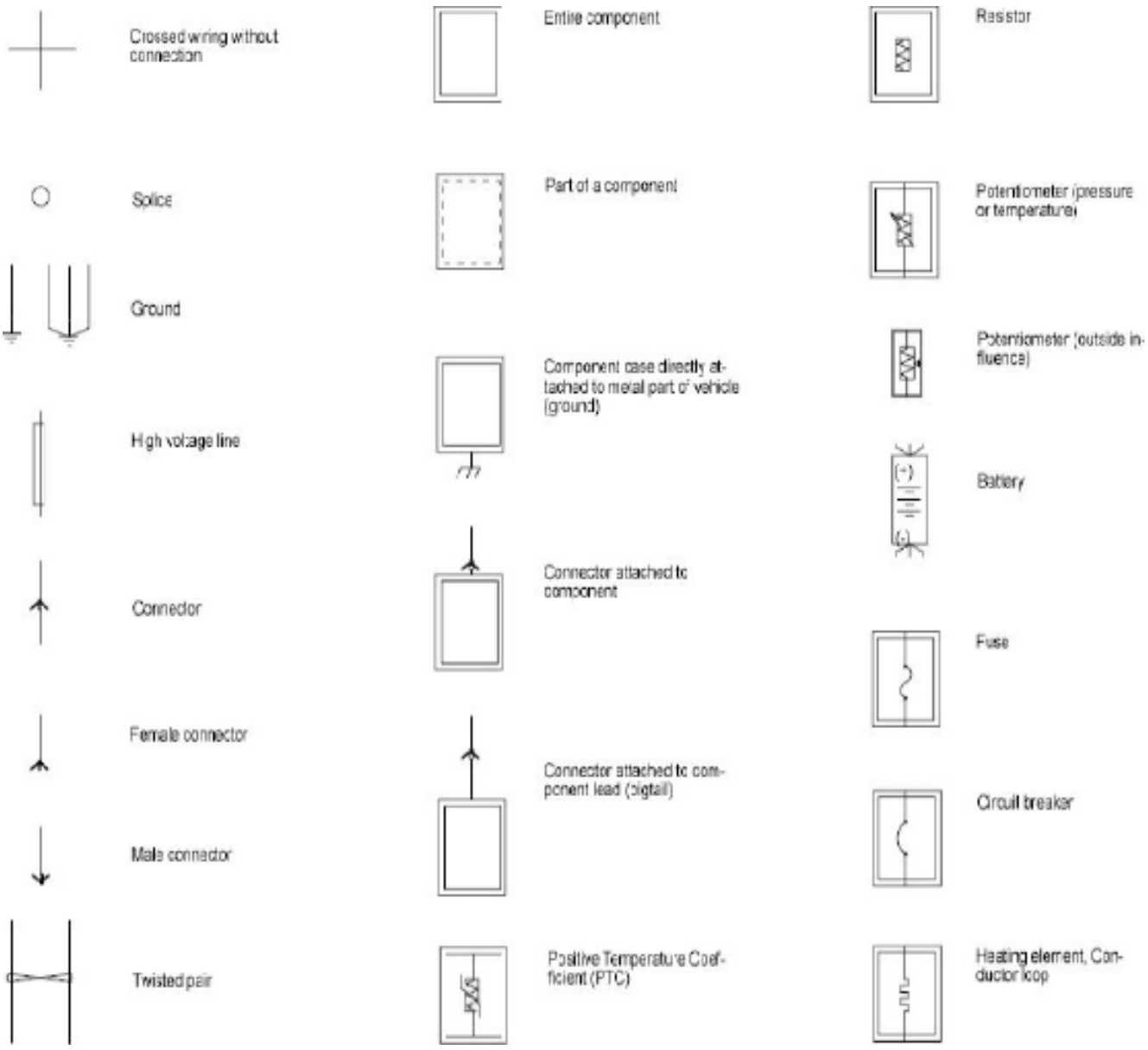
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

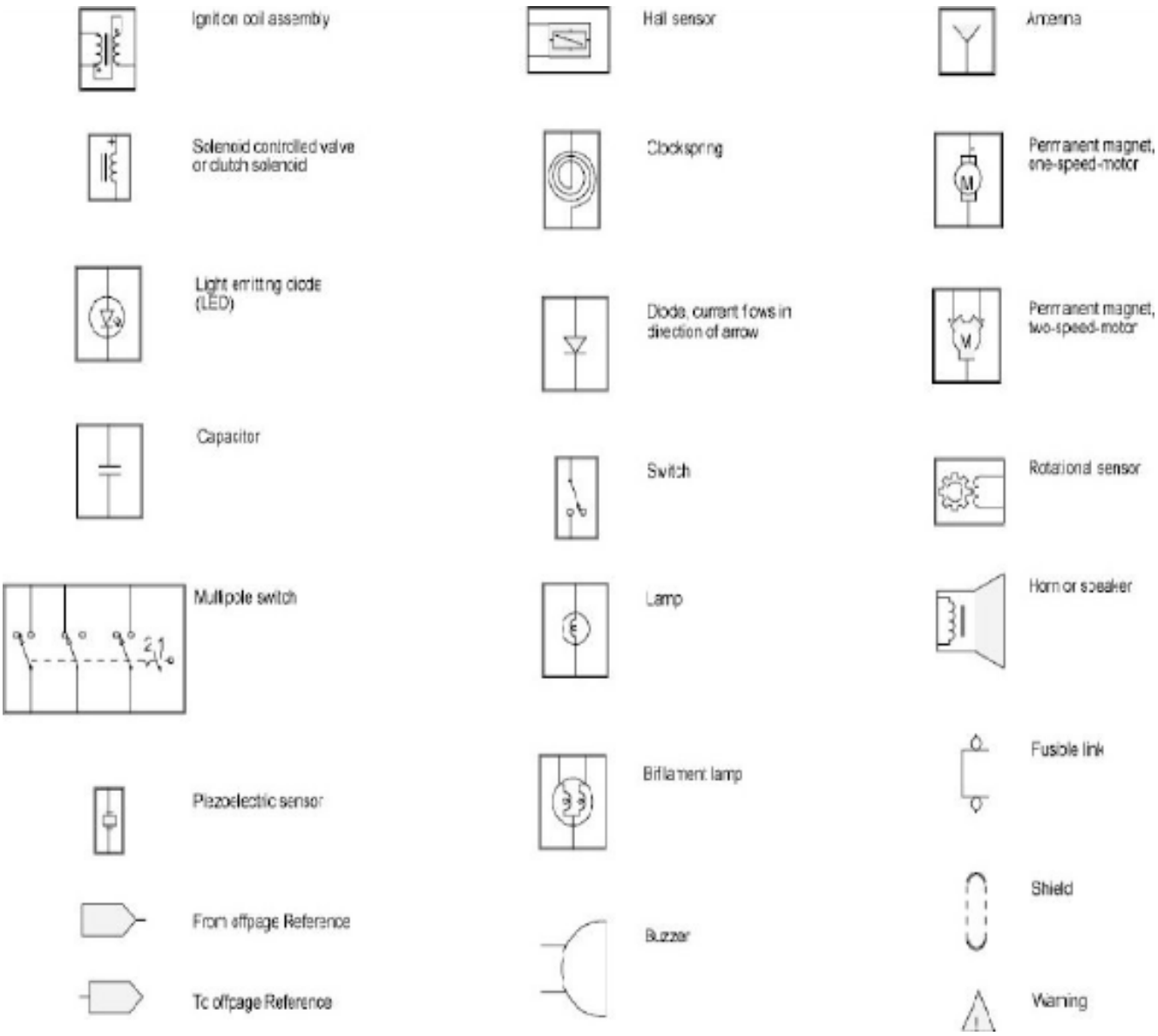
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

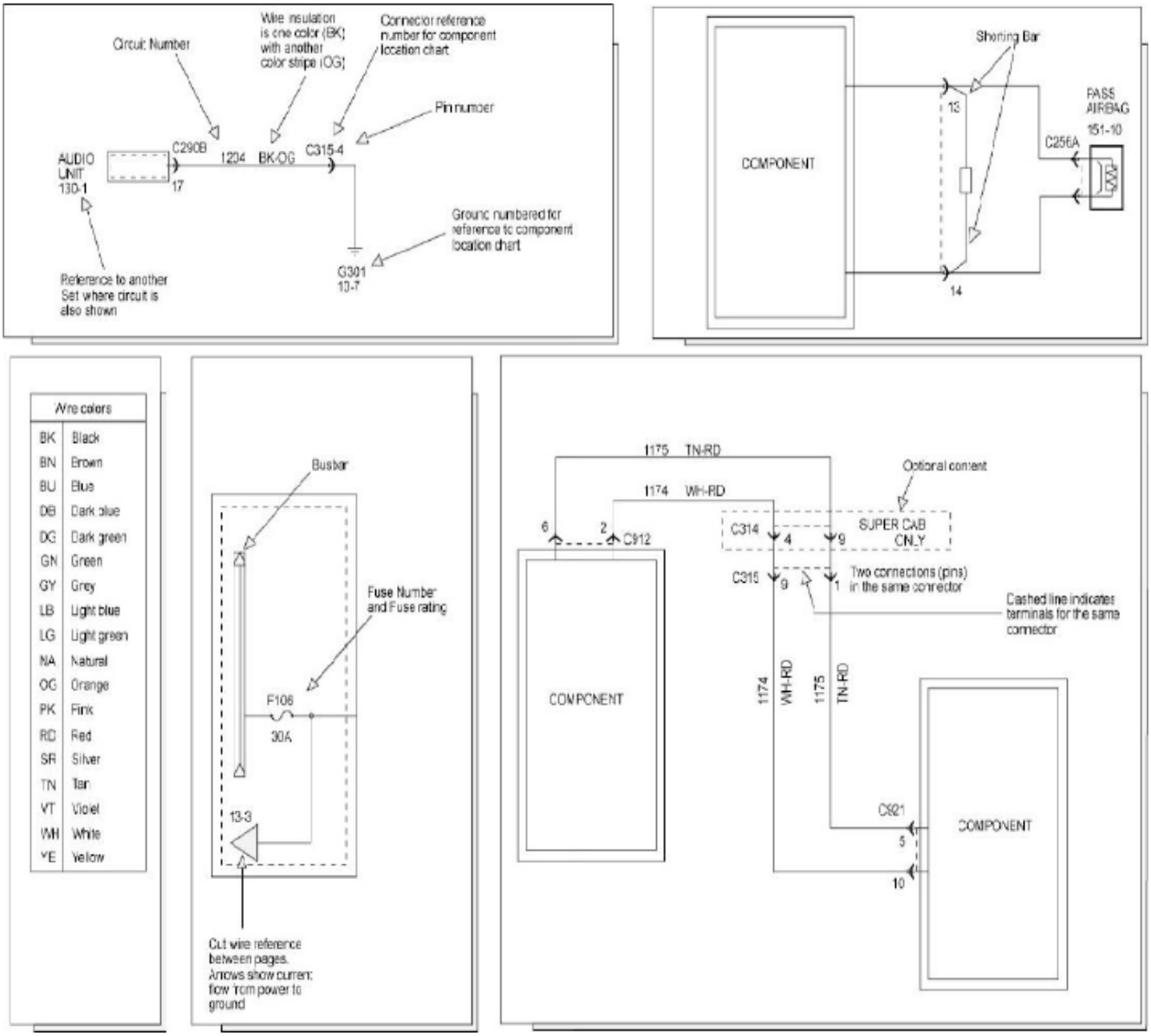
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

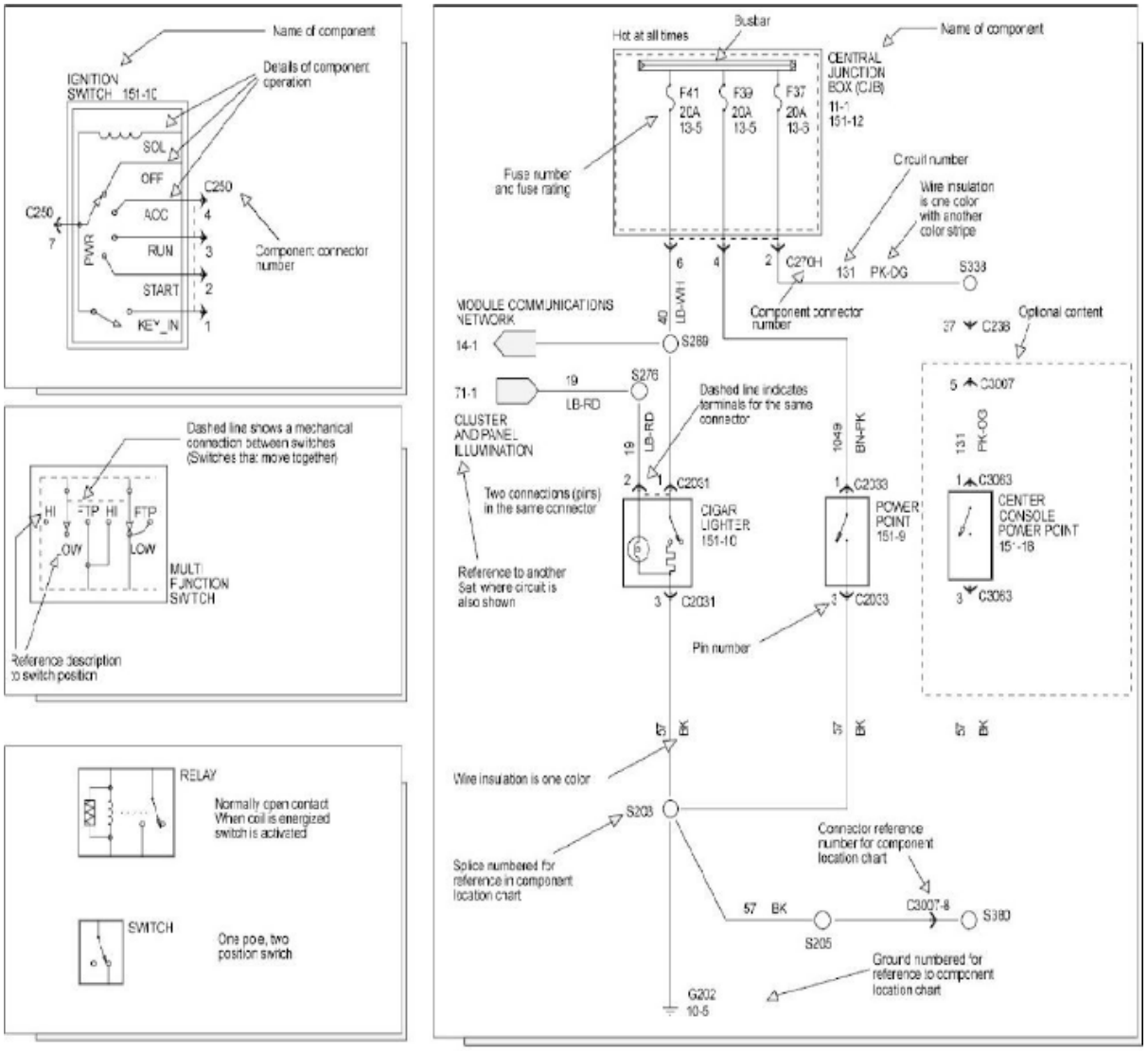
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

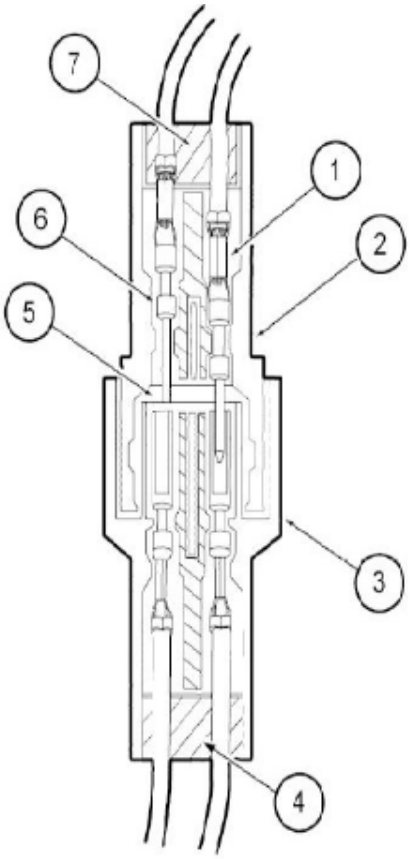


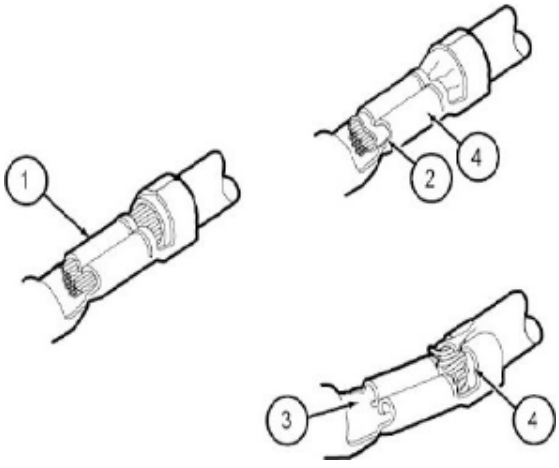
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Starter Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

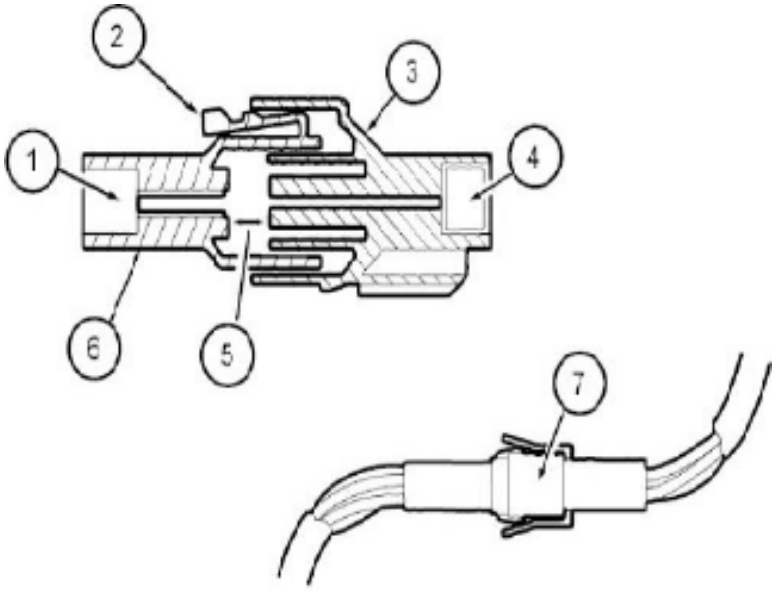
5 = Intermittent contact

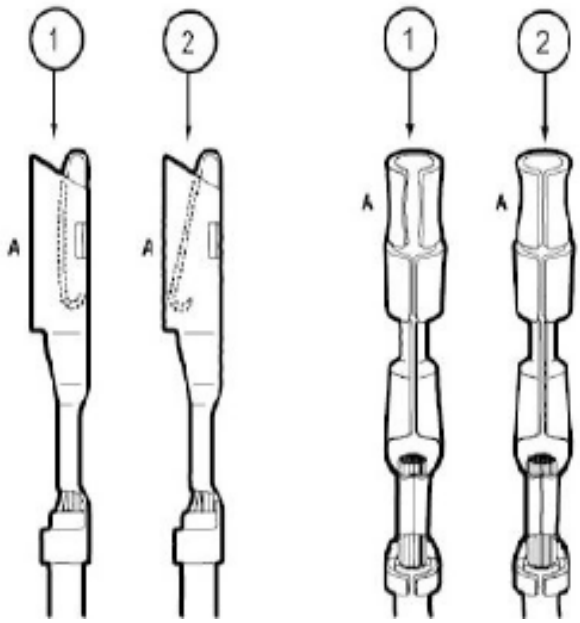
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

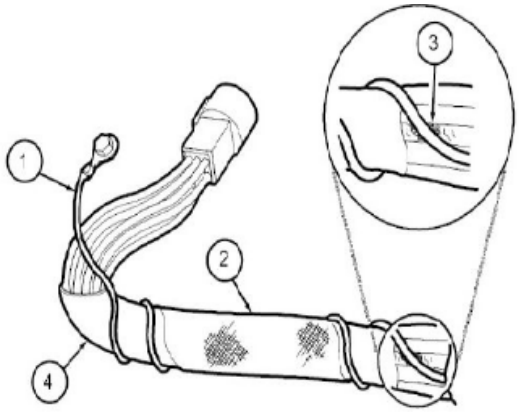
Deformed (enlarged) female terminals

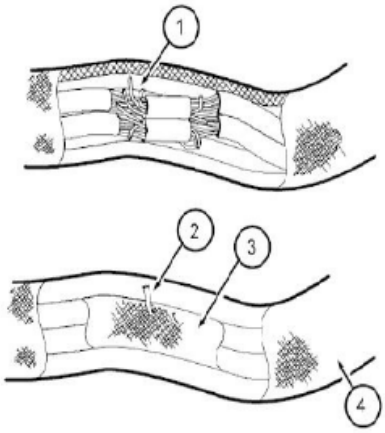
1 = Enlarged

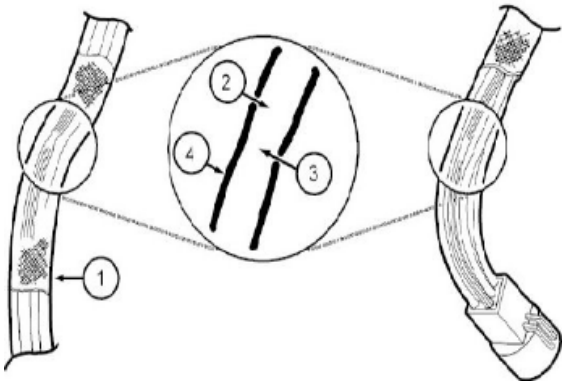
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

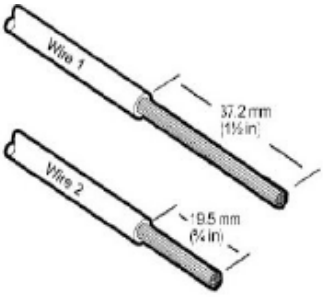
Splice covered 2

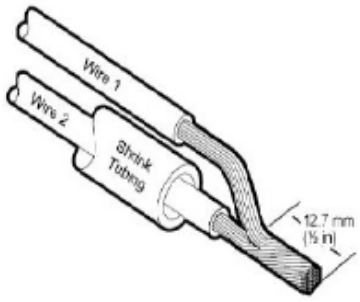
= Wire strand

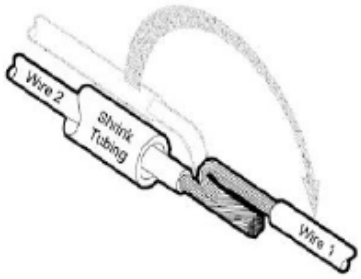
3 = Splice tape

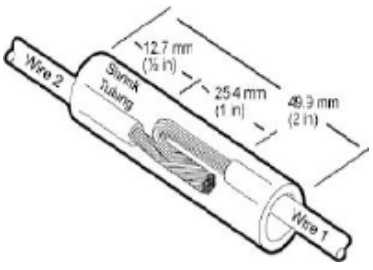
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

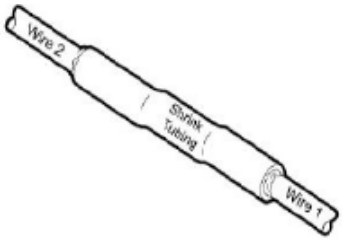
NOTE: -

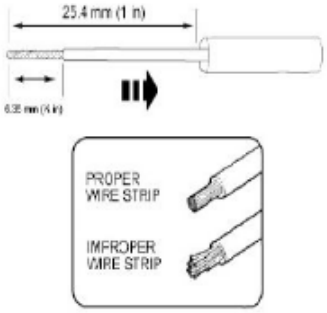
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

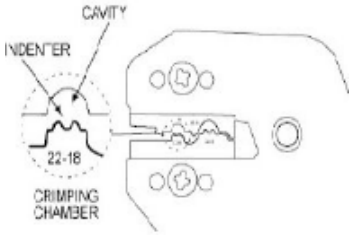
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

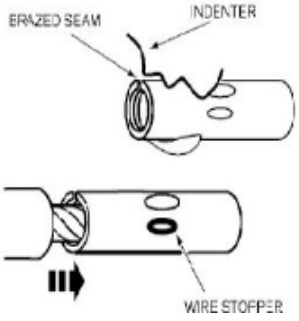
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
6.35 mm (¼ in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

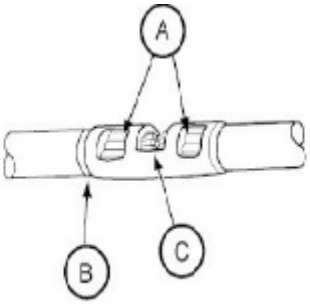
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

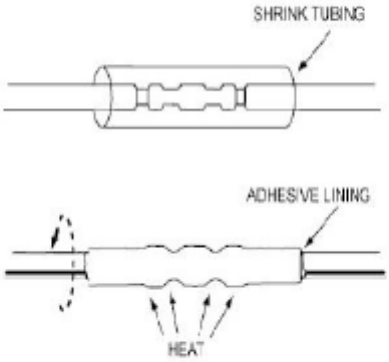
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4 strip, cut 9 strands	* 1/4 strip, cut 2 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip, fold 3x dia.
	16-14	* 1/4 strip, cut 7 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip fold 2x dia	1 strip, fold 3x dia.	1 1/4 strip, fold 4x dia.	Not Recommended
	12-10	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip fold 3x cia.	1 1/4 strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Figtail only

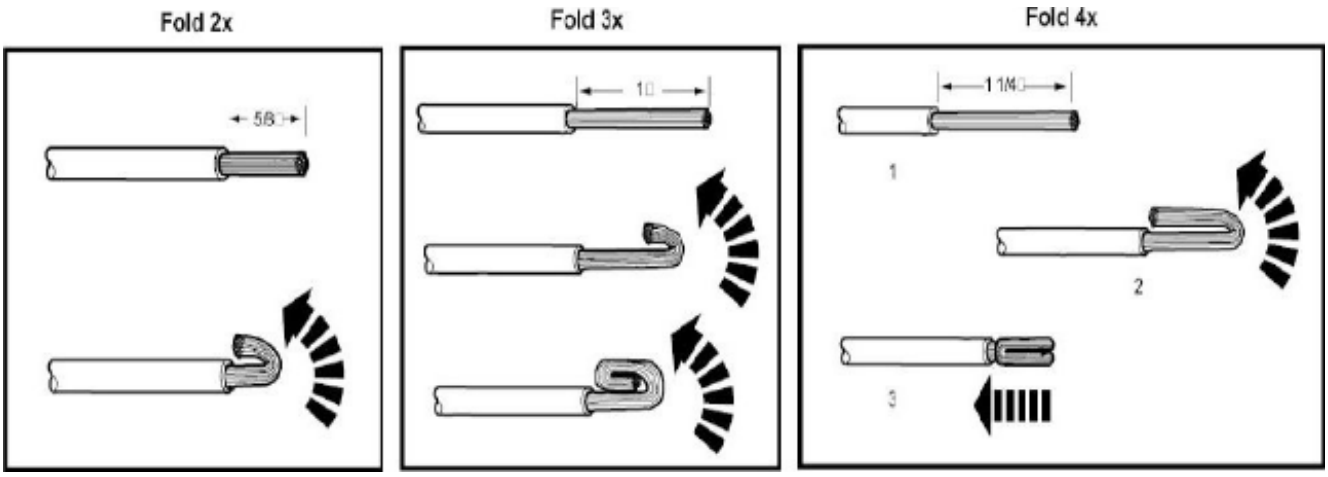
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Starter Relay: Description and Operation

The starter relay:

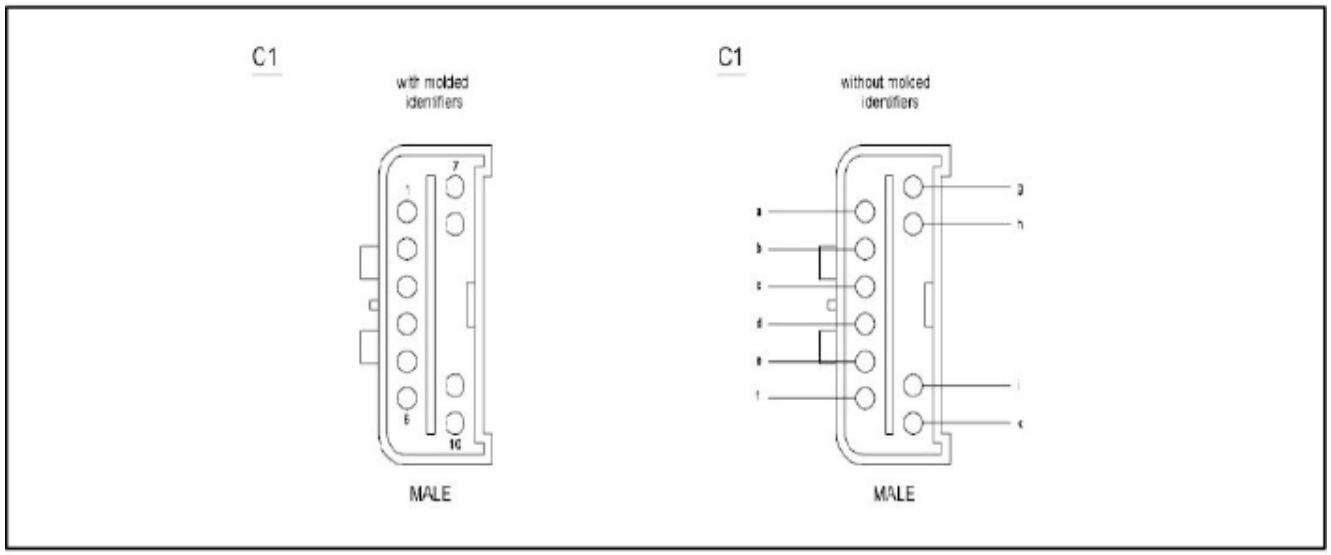
^ Is a mini ISO relay. A. switches power to the starter solenoid to engage the starter motor when it is provided a ground throigh the PCM.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



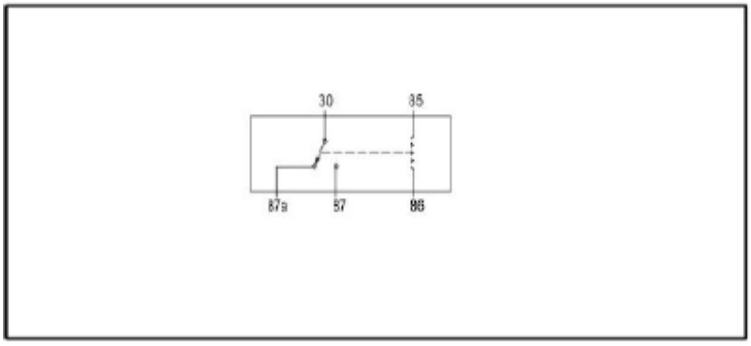
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

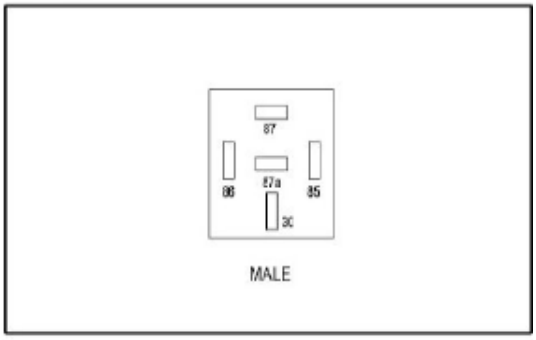
Starter Relay: Testing and Inspection

Relay □ Mini ISO

Schematic



Terminals



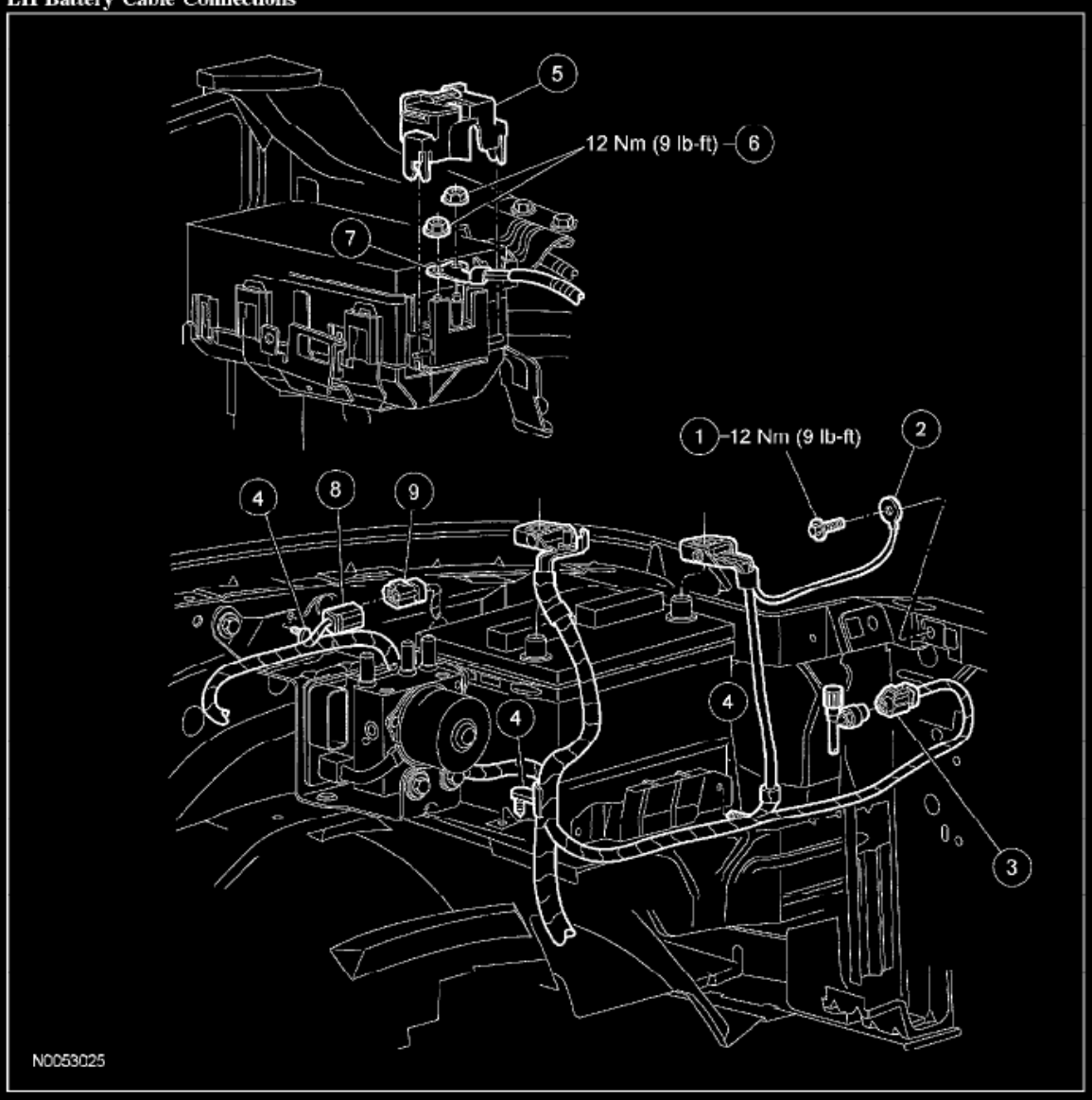
Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	45 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

LH Battery Cable Connections



Item	Part Number	Description
1	W705661-S437M	Battery cable body ground terminal bolt
2	—	Battery cable body ground terminal
3	—	A/C cut-off switch connector (if equipped)

(Continued)

Item	Part Number	Description
4	—	Battery cable locators (3 required)
5	14A003	Battery junction box (BJB) cover
6	W706199-S437M	BJB terminal nuts (2 required)

(Continued)

Item	Part Number	Description
7	—	BJB terminal
8	—	Connector (to 14290)
9	—	Connector (part of 14290)

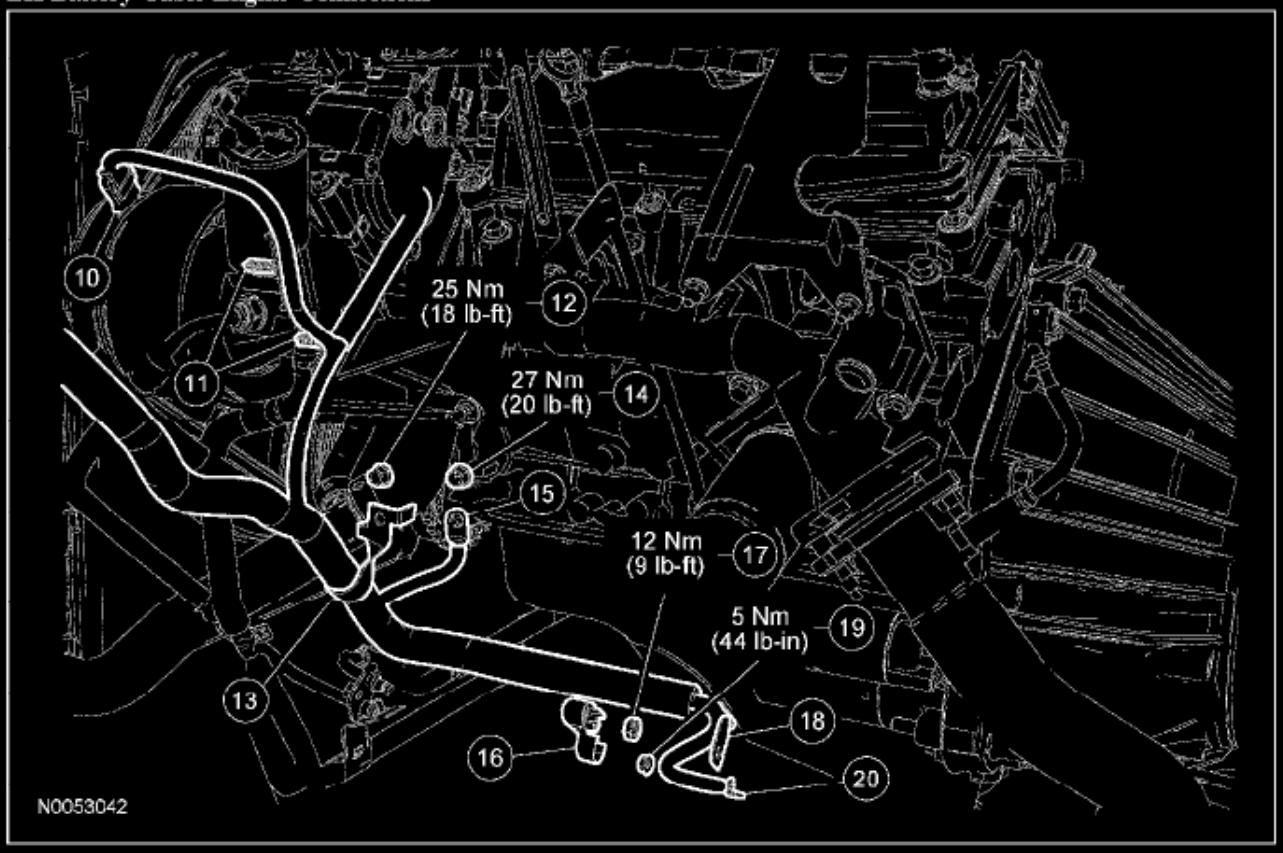
Battery Cable: Service and Repair

BATTERY CABLES

LH Battery Cable Connections (Part 1)

LH Battery Cable Connections (Part 2)

LH Battery Cable Engine Connections



Item	Part Number	Description
10	—	A/C compressor electrical connector
11	—	Battery cable locator (2 required)
12	W520112-S440	Battery cable engine bracket nut
13	—	Battery cable engine bracket
14	N802001-S437	Battery cable engine ground terminal nut
15	—	Battery cable engine ground terminal

(Continued)

Item	Part Number	Description
16	11N087	Starter solenoid terminal cover
17	W706414-S413	Battery cable starter solenoid terminal nut
18	—	Battery cable starter solenoid terminal
19	N805320-S100	Battery cable starter solenoid wire terminal nut
20	—	Battery cable starter solenoid wire terminal

LH Battery Cable Engine Connections

Battery Cable Generator Connections

Item	Part Number	Description
21	—	Battery cable locator
22	—	Generator electrical connectors (2 required)
23	W705790-S901	Battery cable generator B+ terminal nut
24	—	Battery cable generator B+ terminal
25	14A280	Battery cable

Battery Cable Generator Connections

Removal and Installation

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the battery. 3. Remove the bolt and position the battery cable body ground terminal aside.

- To install, tighten to 12 Nm (9 lb-ft).

4. If equipped, disconnect the A/C cut-off switch connector. 5. Release the 3 battery cable locators from the battery tray and fender. 6. Remove the battery junction box (BJB) cover, remove the 2 nuts and position the BJB terminal aside.

- To install, tighten to 12 Nm (9 lb-ft).

7. Disconnect the battery cable connector on the fender well. 8. If equipped, disconnect the A/C compressor electrical connector. 9. Remove the 2 battery cable locators from the A/C compressor.

10. Remove the nut and position the battery cable engine bracket aside.

- To install, tighten to 25 Nm (18 lb-ft).

11. Remove the nut and position the battery cable engine ground terminal aside

- To install, tighten to 27 Nm (20 lb-ft).

12. Remove the starter solenoid terminal cover. 13. Remove the nut and position the battery cable starter solenoid terminal aside.

- To install, tighten to 12 Nm (9 lb-ft).

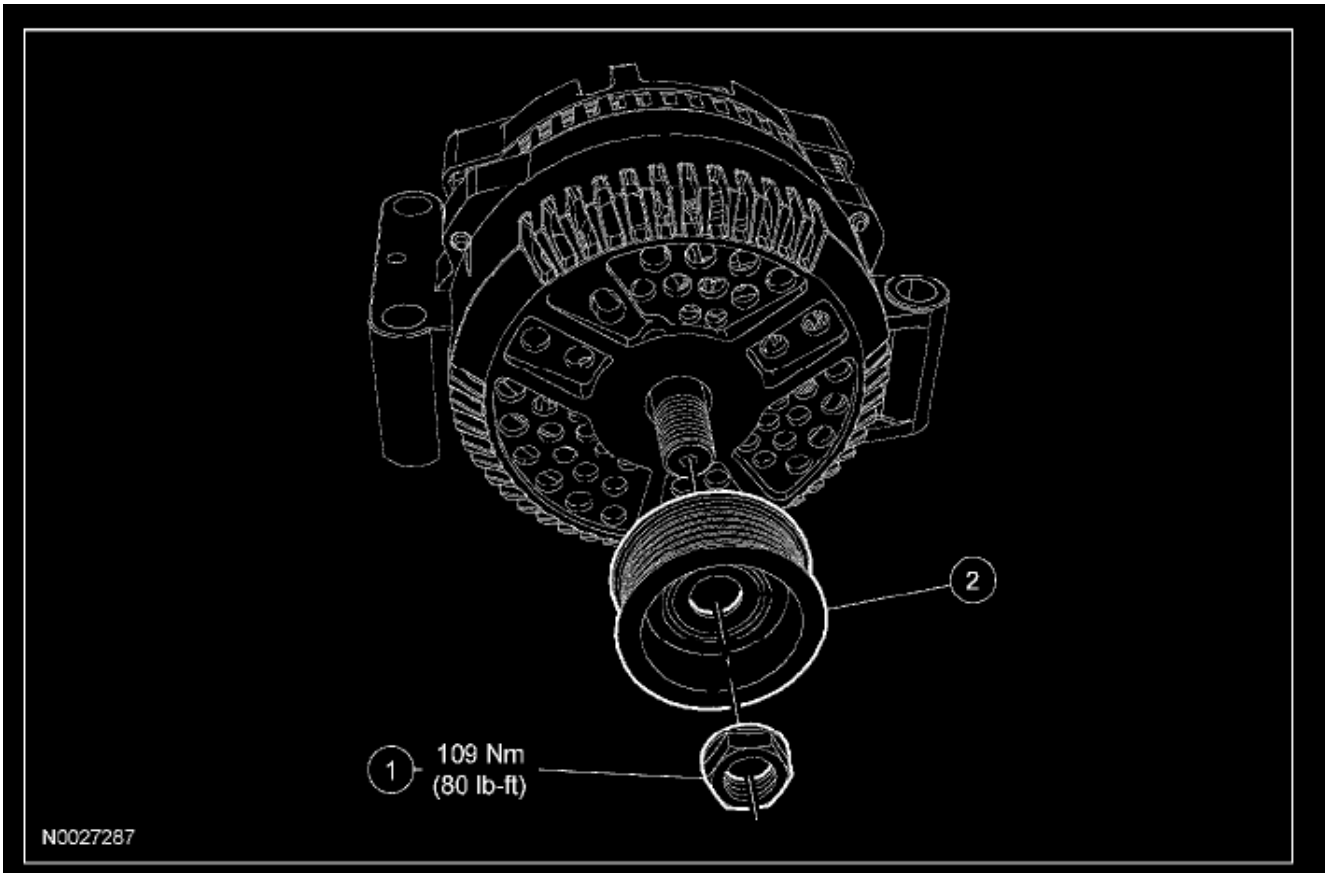
14. Remove the nut and position the battery cable starter solenoid wire terminal aside.

- To install, tighten to 5 Nm (44 lb-in).

15. Release the battery cable locator from the generator bracket. 16. Disconnect the 2 generator electrical connectors. 17. Position the generator B+ protective cover aside, remove the nut and position the battery cable generator B+ terminal aside.

- To install, tighten to 8 Nm (71 lb-in).

18. Remove the battery cable. 19. To install, reverse the removal procedure.



Item	Part Number	Description
1	—	Generator pulley nut (part of 10346)
2	10344	Generator pulley

Alternator Pulley: Service and Repair

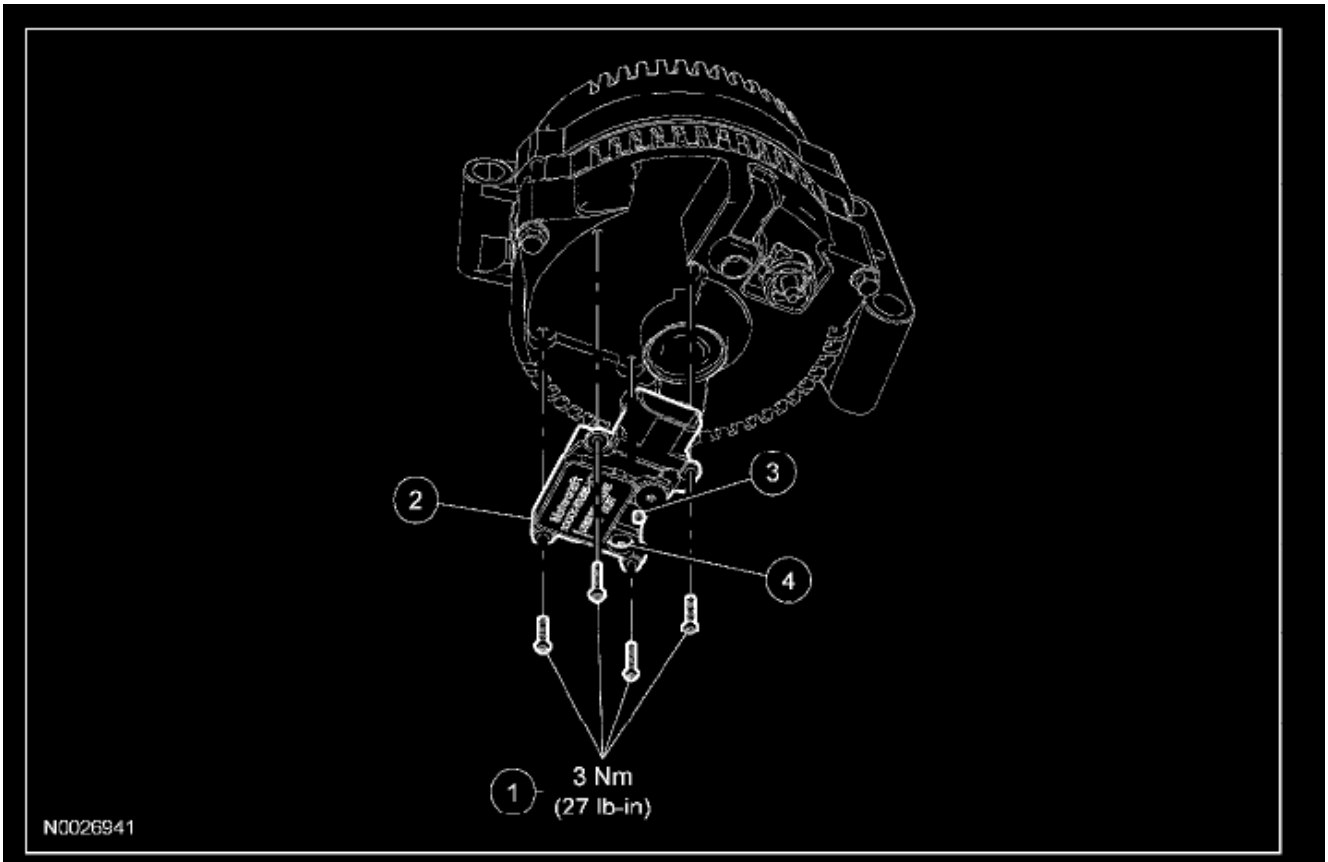
GENERATOR PULLEY

Removal and Installation

1. Remove the generator. 2. Remove the nut and the generator pulley.

- To install, tighten to 109 Nm (80 lb-ft).

3. To install, reverse the removal procedure.



Item	Part Number	Description
1	—	Generator voltage regulator screws (4 required) (includes the generator brush and terminal holder)
2	—	Generator voltage regulator (includes the generator brush and terminal holder)
3	—	Generator brush holding wire insertion hole
4	—	Generator test terminal

Voltage Regulator: Service and Repair

VOLTAGE REGULATOR

Removal and Installation

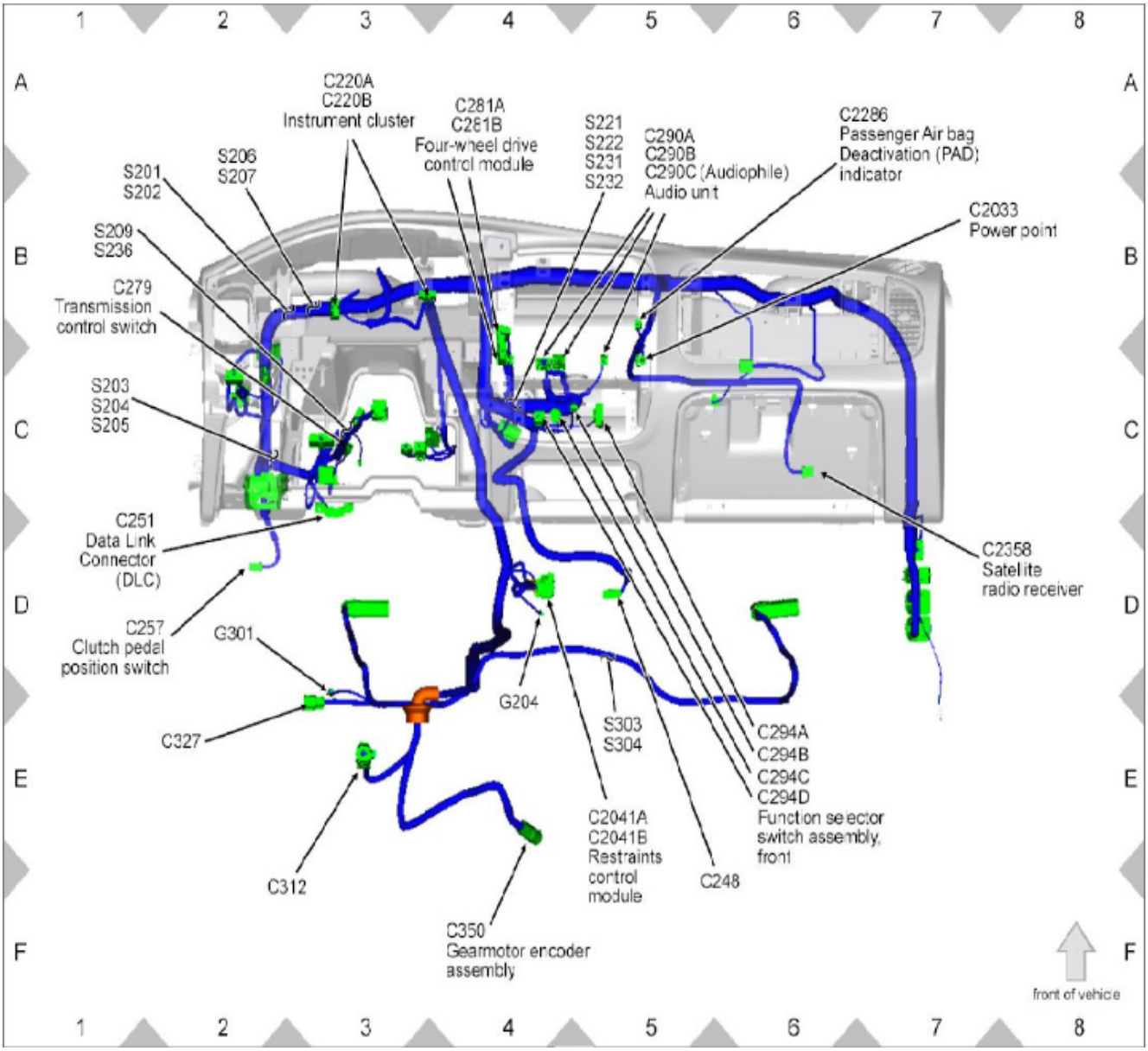
1. Remove the generator. 2. Remove the 4 screws and the generator voltage regulator (includes the generator brush and terminal holder).

- To install, tighten to 3 Nm (27 lb-in).

3. NOTE: When installing the voltage regulator (including the generator brush and terminal holder) assembly, it is necessary to insert a wire

(preferably plastic) into the generator brush holding wire insertion hole in order to hold the generator brushes while the voltage regulator assembly (including the generator brush and terminal holder) is being assembled to the generator. Make certain to remove the wire before the vehicle is started or the generator will not operate.

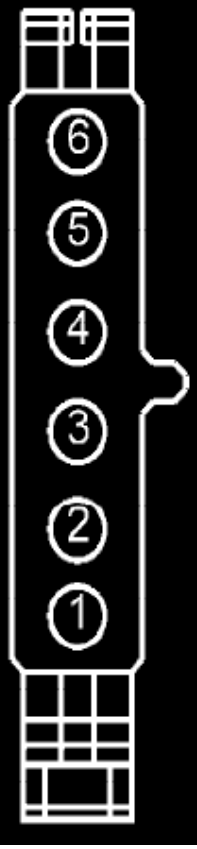
To install, reverse the removal procedure.


1
2
3
4
5
6
7
8
A
B
C
D
E
F
C220A
C220B
Instrument cluster
C281A
C281B
Four-wheel drive
control module
S221
S222
S231
S232
C290A
C290B
C290C (Audiophile)
Audio unit
C2286
Passenger Air bag
Deactivation (PAD)
indicator
C2033
Power point
S206
S207
S201
S202
S209
S236
C279
Transmission
control switch
S203
S204
S205
C251
Data Link
Connector
(DLC)
C257
Clutch pedal
position switch
G301
C327
C312
G204
S303
S304
C294A
C294B
C294C
C294D
Function selector
switch assembly,
front
C2041A
C2041B
Restraints
control
module
C248
C350
Gearmotor encoder
assembly
C2358
Satellite
radio receiver
front of vehicle

View 151-12

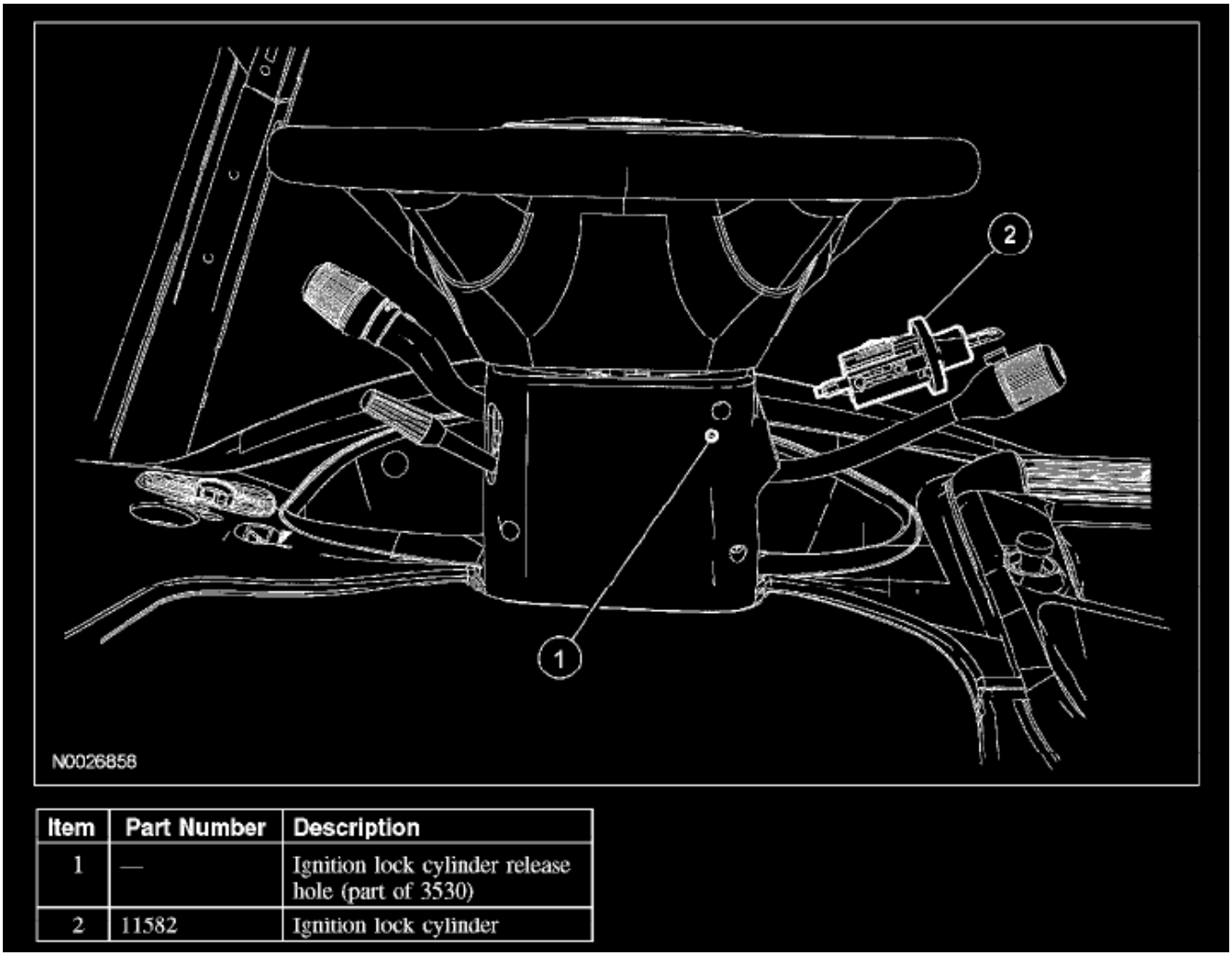
Connector: C257

Description:	Harness:	Base Part #:
CLUTCH PEDAL POSITION SWITCH	14401	11A152



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE904 (GN-VT)	22	SWITCH - CLUTCH PEDAL POSITION # TOP OF TRAVEL (CPP-TT)	
2	GD174 (BK-WH)	22	GROUND - TUNNEL	
3	CCB15 (BN-GN)	22	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL CLOSED	
4	CCB15 (BN-GN)	22	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL CLOSED	
5	GD174 (BK-WH)	22	GROUND - TUNNEL	
6	CDC36 (GN-BN)	22	SWITCH - START INTERLOCK CLUTCH PEDAL	

C257



Item	Part Number	Description
1	—	Ignition lock cylinder release hole (part of 3530)
2	11582	Ignition lock cylinder

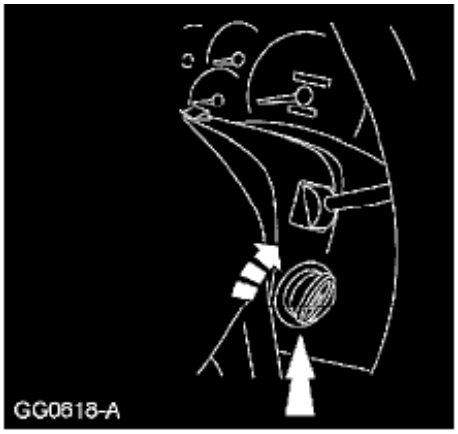
Ignition Switch Lock Cylinder: Service and Repair Ignition Lock Cylinder - Functional

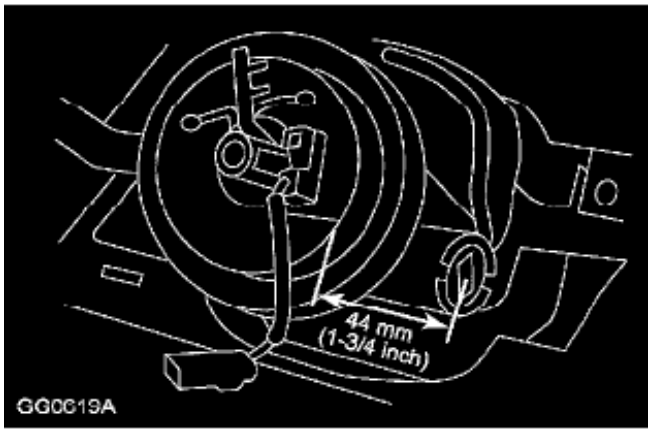
IGNITION LOCK CYLINDER - FUNCTIONAL

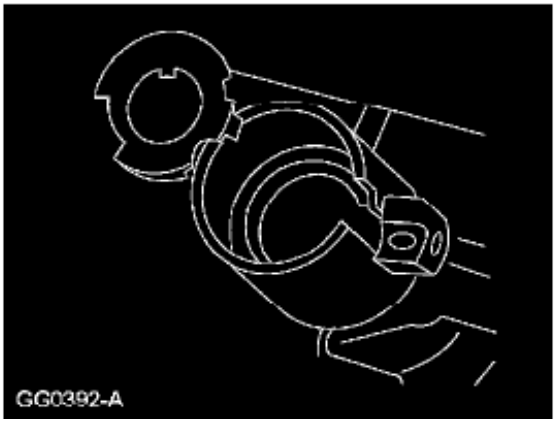
Removal and Installation

1. Disconnect the battery ground cable. 2. Insert the ignition key and turn to the RUN position. 3. Press the ignition lock cylinder release pin and remove the ignition lock cylinder. 4. To install, reverse the removal procedure.

- Verify ignition lock cylinder operation.


GG0618-A


44 mm
(1-3/4 inch)
GG0619A


GG0392-A

Ignition Switch Lock Cylinder: Service and Repair Ignition Lock Cylinder - Non Functional

IGNITION LOCK CYLINDER - NON FUNCTIONAL

Removal and Installation

1. NOTE: Make sure the front wheels are in the straight-ahead position.

Remove the steering wheel assembly.

2. Twist off the cap from the ignition lock cylinder.

3. NOTE: The lock cylinder is repaired by discarding the inoperative lock cylinder and building a new lock cylinder using the appropriate lock

repair package (F85Z-11582-AA). The lock repair package includes a detailed instruction sheet to build the new lock cylinder to the current key code of the vehicle.

Remove the ignition lock cylinder. -

Use a 1/8-inch diameter drill bit to drill out the lock cylinder retaining pin.

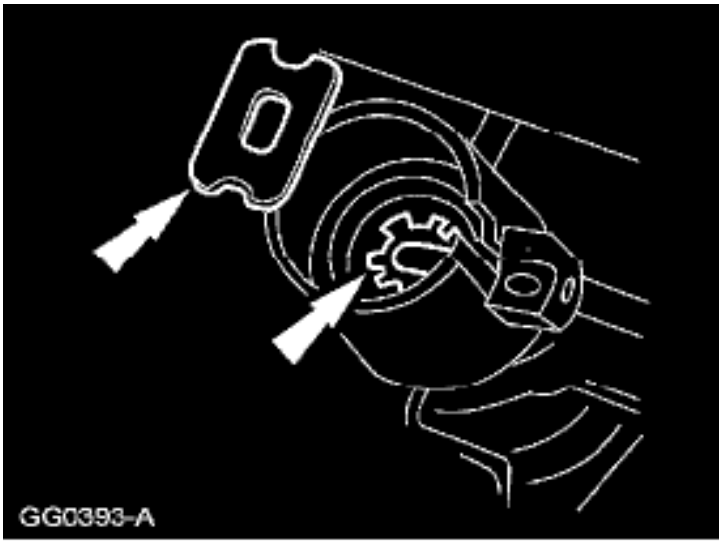
- Use a 3/8-inch drill bit to drill down the middle of the ignition lock key slot until the ignition lock cylinder breaks loose.

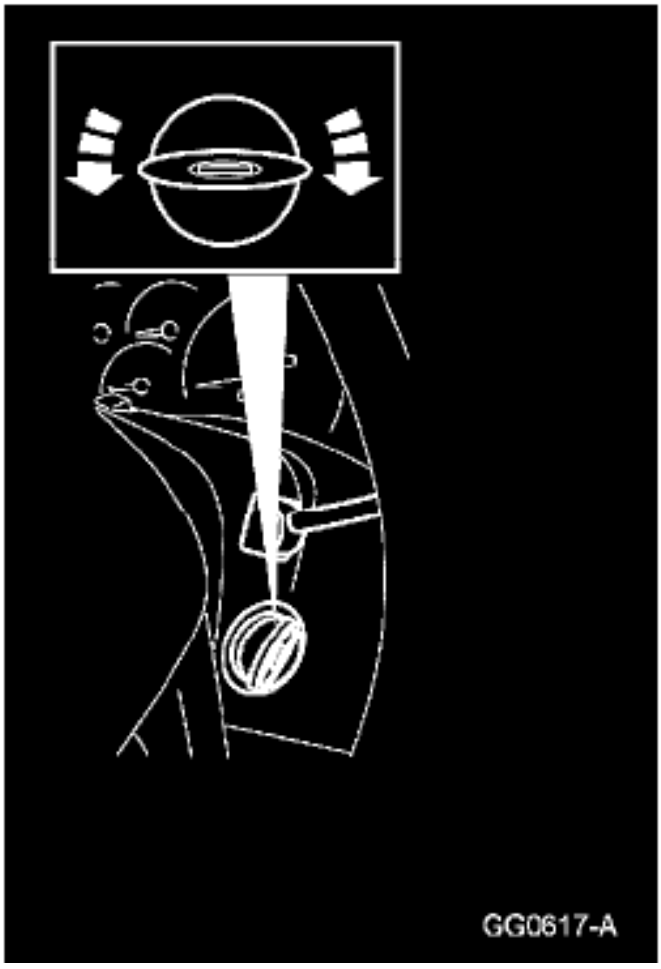
- Remove and discard the ignition lock cylinder and clean the drill shavings from the steering column.

4. Remove the bearing retainer.

5. Remove the bearing and gear.

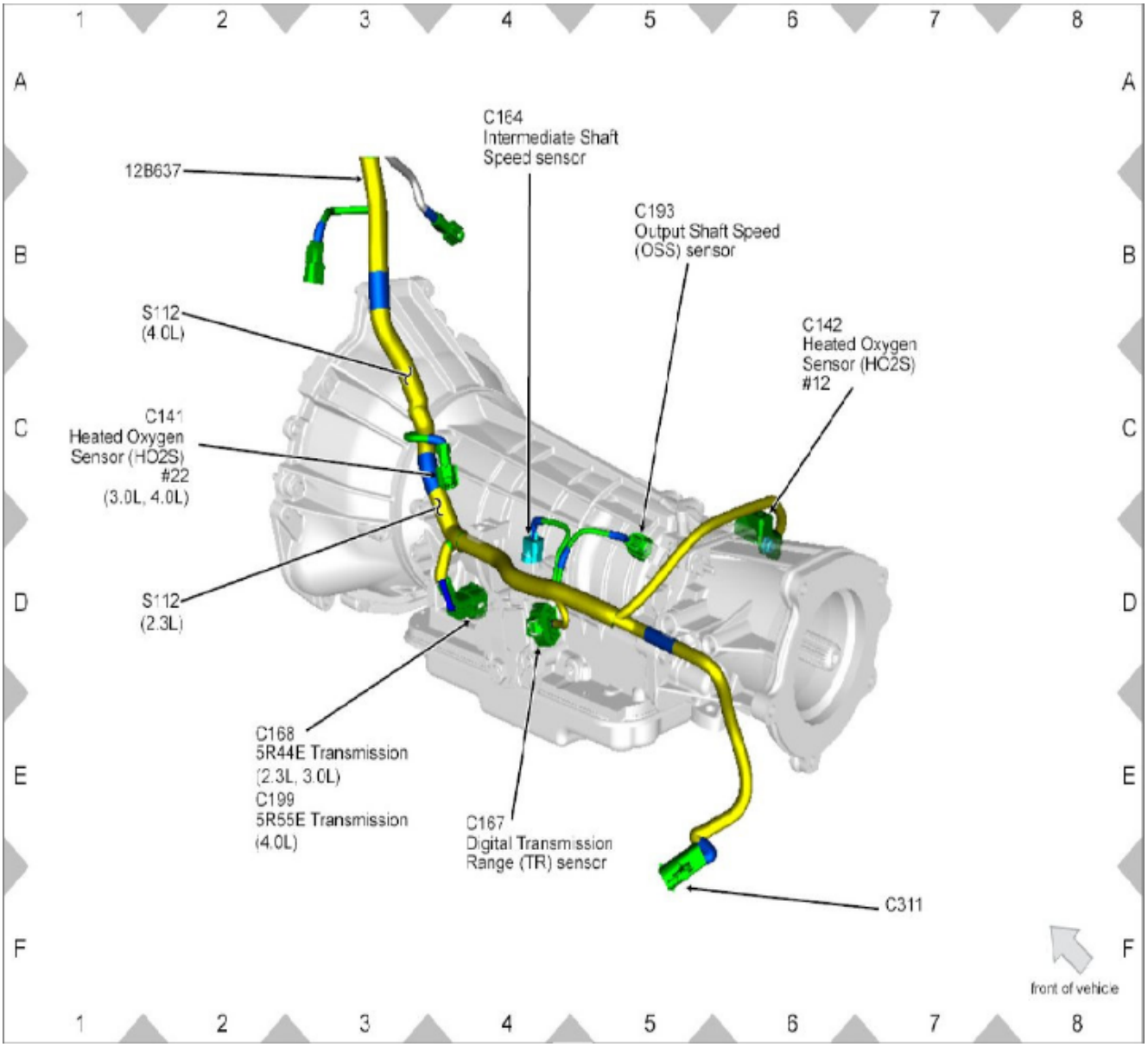
- Thoroughly clean all drill shavings from the steering column and inspect it for damage.


GG0393-A


GG0617-A

6. To install, reverse the removal procedure.

- Install a new ignition lock cylinder.
- Verify ignition lock cylinder operation.


1
2
3
4
5
6
7
8
A
B
C
D
E
F
C164
Intermediate Shaft
Speed sensor
12B637
C193
Output Shaft Speed
(OSS) sensor
S112
(4.0L)
C142
Heated Oxygen
Sensor (HO2S)
#12
C141
Heated Oxygen
Sensor (HO2S)
#22
(3.0L, 4.0L)
S112
(2.3L)
C168
5R44E Transmission
(2.3L, 3.0L)
C199
5R55E Transmission
(4.0L)
C167
Digital Transmission
Range (TR) sensor
C311
front of vehicle

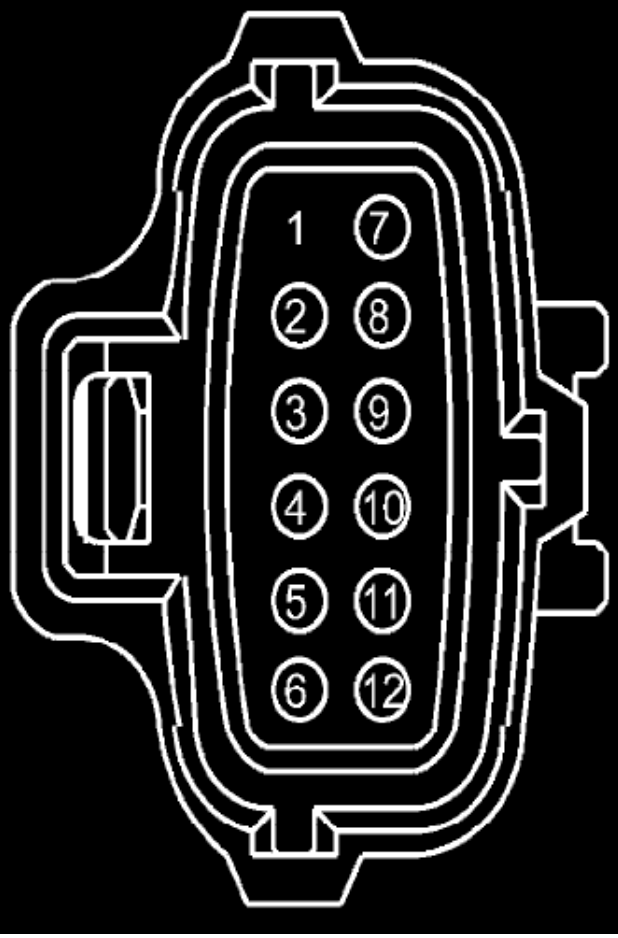
View 151-10

Connector: C167

Description: DIGITAL TRANSMISSION RANGE (TR) SENSOR

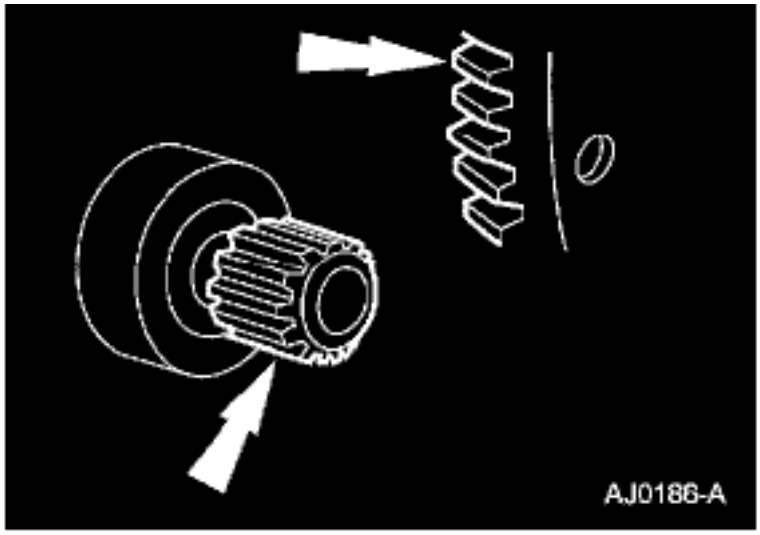
Harness: 12B637

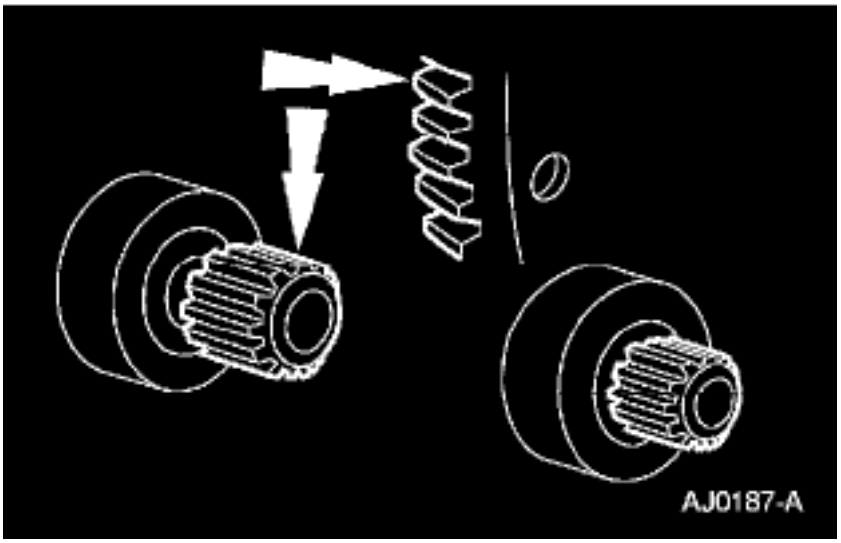
Base Part #: 7F293



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	RE406 (GY-VT)	18	SIGNAL RETURN	
3	VET28 (GY-VT)	20	TR3A	
4	VET29 (VT-WH)	20	TR1	
5	VET30 (YE)	20	TR2	
6	VET31 (BU-OG)	20	TR4	
7	GD108 (BK-VT)	18	GROUND	4x4
8	CCF20 (GY-VT)	20	NETURAL SENSE	4x4
9	CBP20 (YE-VT)	18	FUSED POWER FEED	
10	CET40 (GN-OG)	20	STARTER CONTROL	
11	CET41 (BN-YE)	18	BACK UP	
12	CBP21 (BU-GY)	20	STARTER TO STARTER INTERRUPT RELAY	

C167





Starter Drive/Bendix: Testing and Inspection

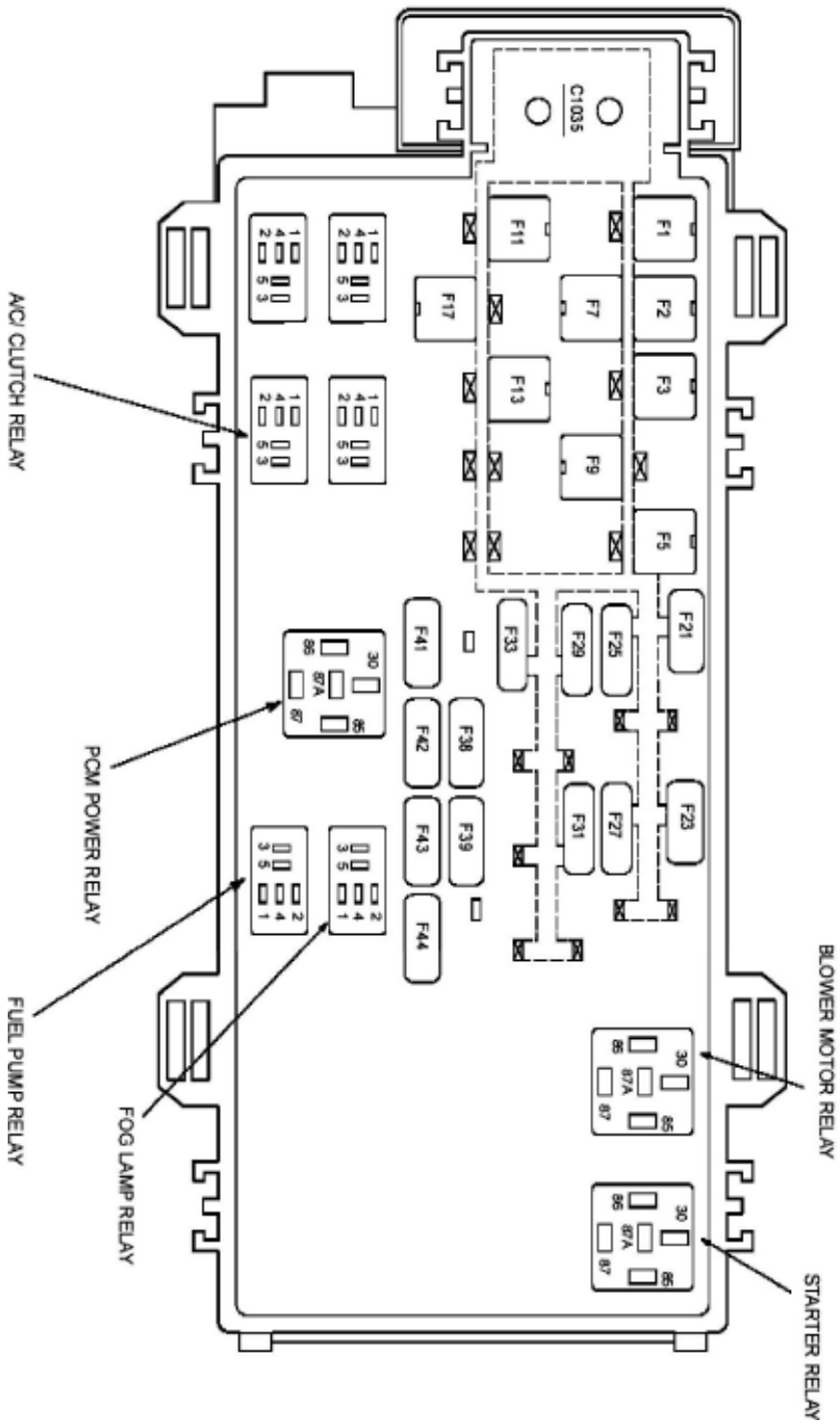
STARTER MOTOR DRIVE GEAR AND FLYWHEEL RING GEAR INSPECTION

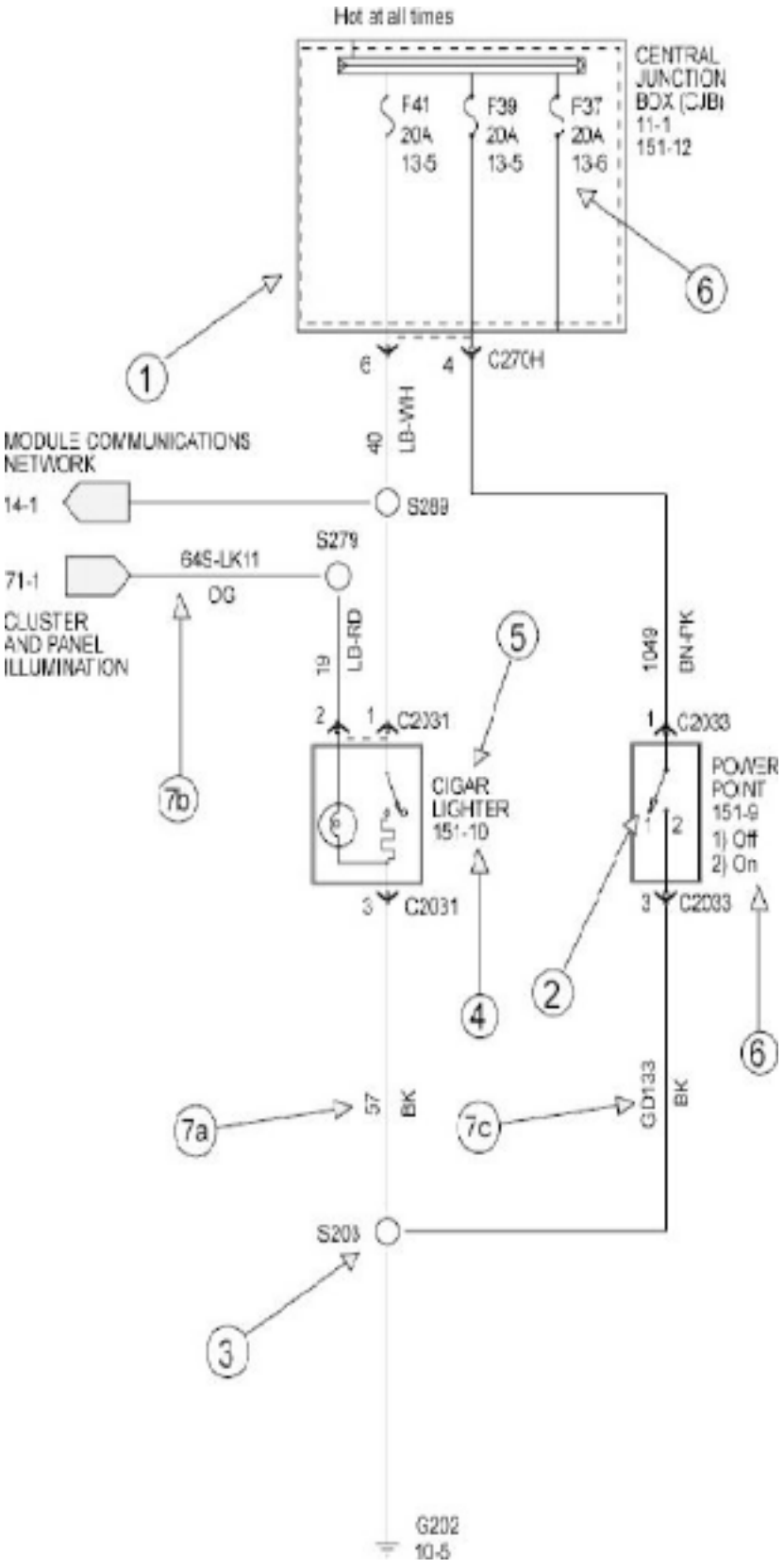
1. Remove the starter motor. 2. Check the wear patterns on the starter drive gear and the flywheel ring gear. If the wear pattern is normal, install the starter motor.

3. If the starter drive gear and the flywheel ring gear are not fully meshing and both of the gears are scored or damaged, install a new starter motor.

If necessary, install a new flywheel.

BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L




Hot at all times
CENTRAL JUNCTION BOX (CJB)
11-1
151-12
F41 20A 13-5
F39 20A 13-5
F37 20A 13-6
C270H
MODULE COMMUNICATIONS NETWORK
14-1
S289
S279
71-1
CLUSTER AND PANEL ILLUMINATION
64S-LK11 DG
LB-RD
LB-WH
BN-PK
C2031
C2033
CIGAR LIGHTER
151-10
POWER POINT
151-9
1) Off
2) On
BK
GD133
S203
G202
10-5

Starter Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

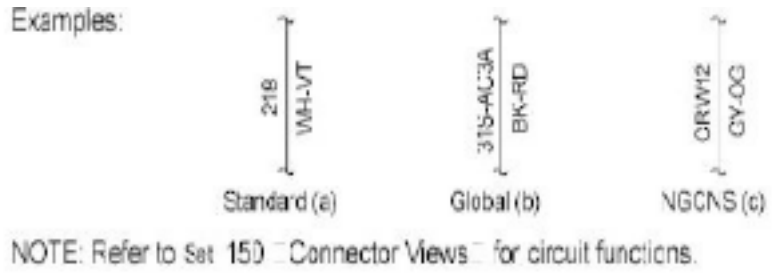
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

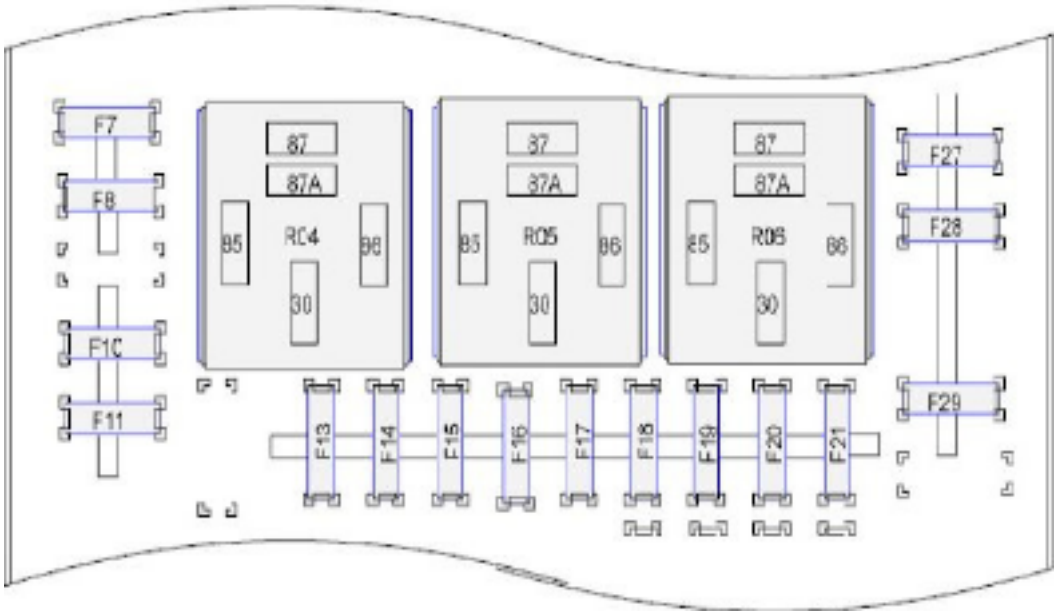
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

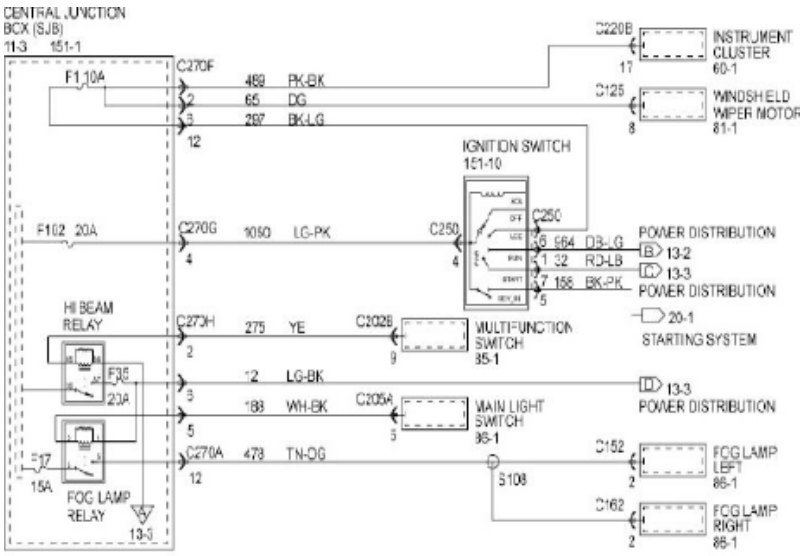
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

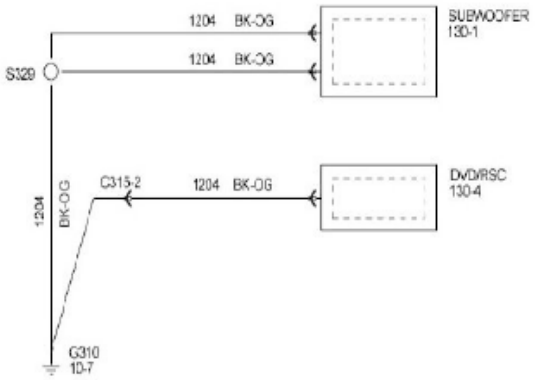
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

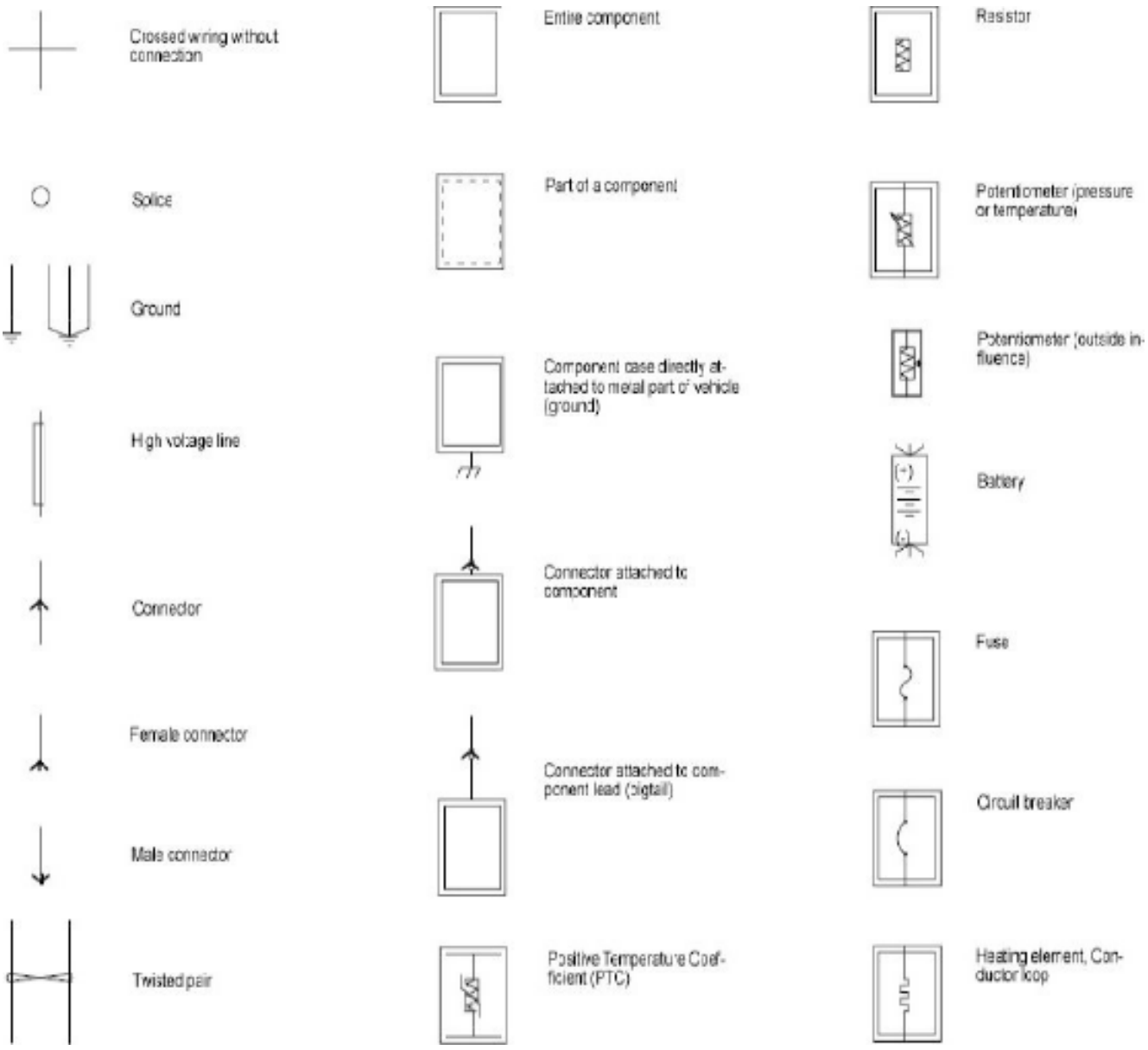
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

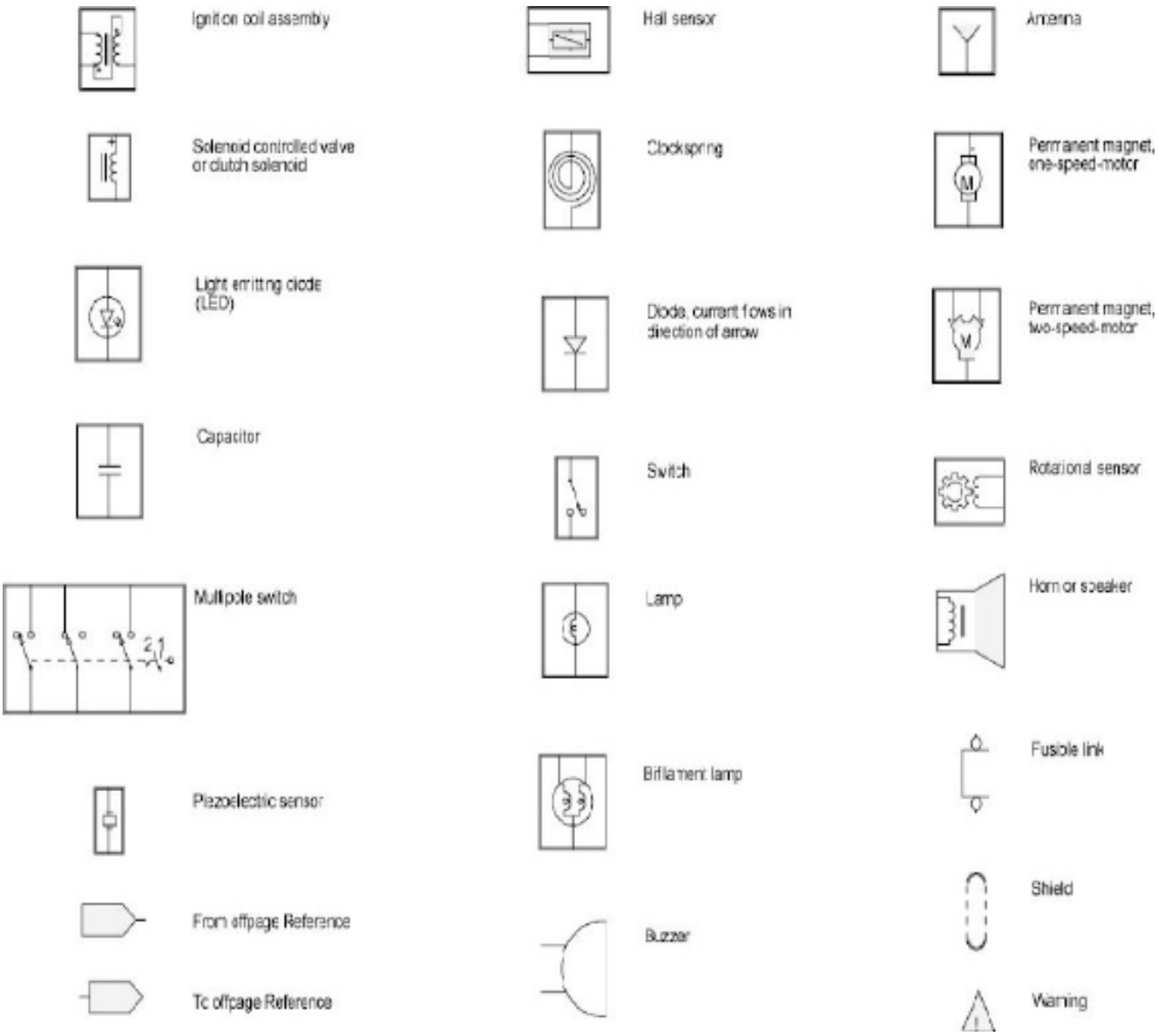
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

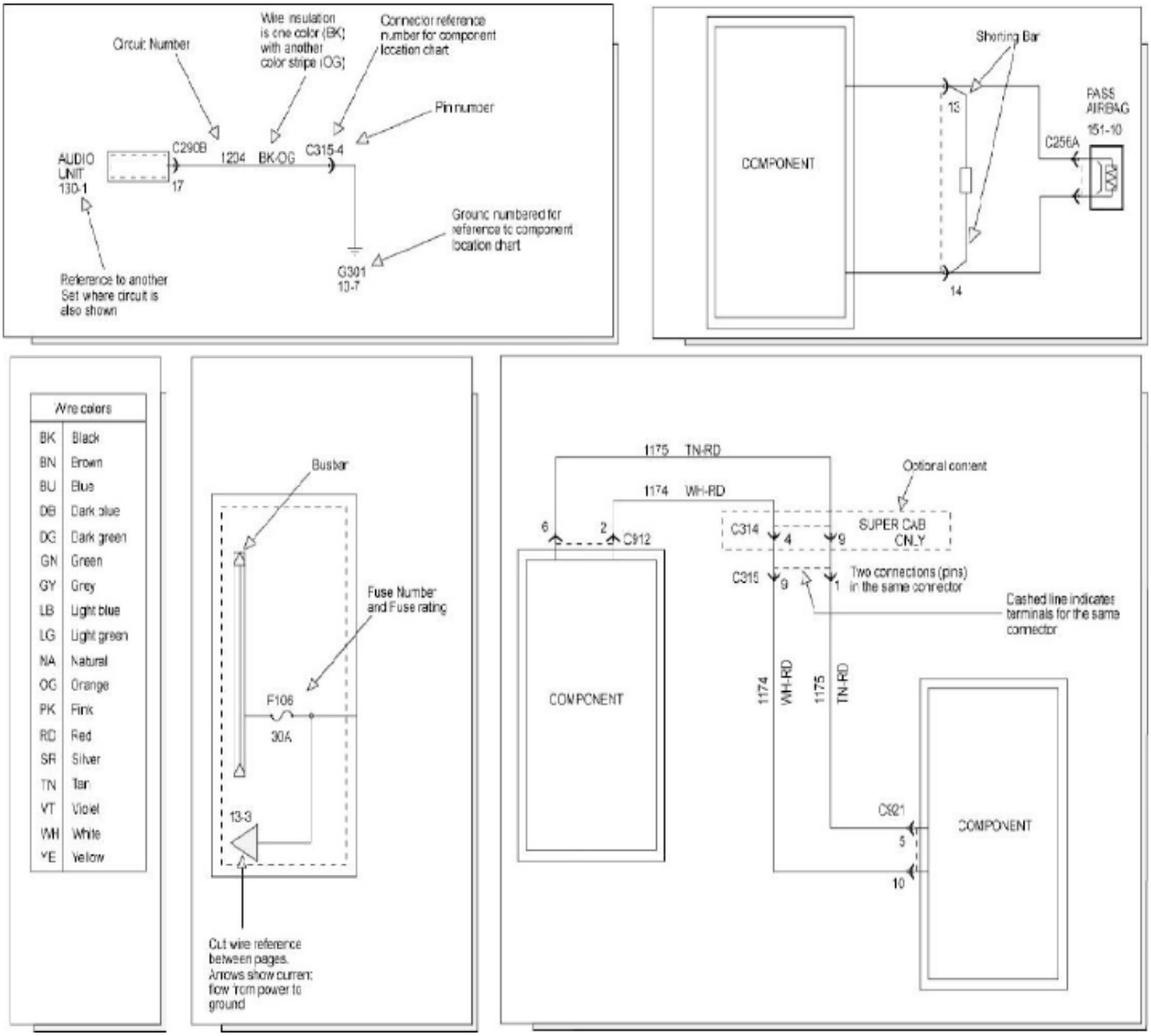
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

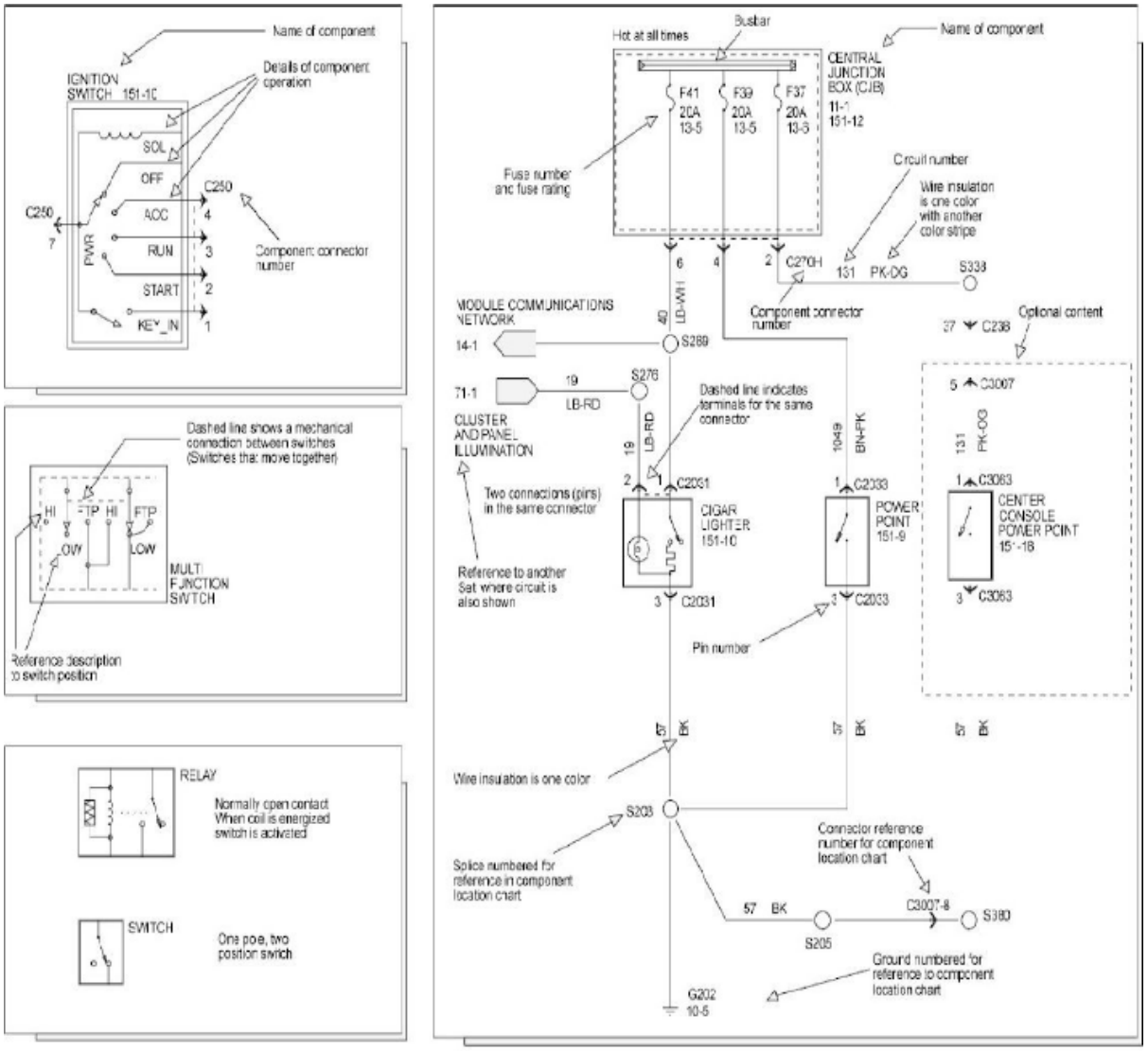
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

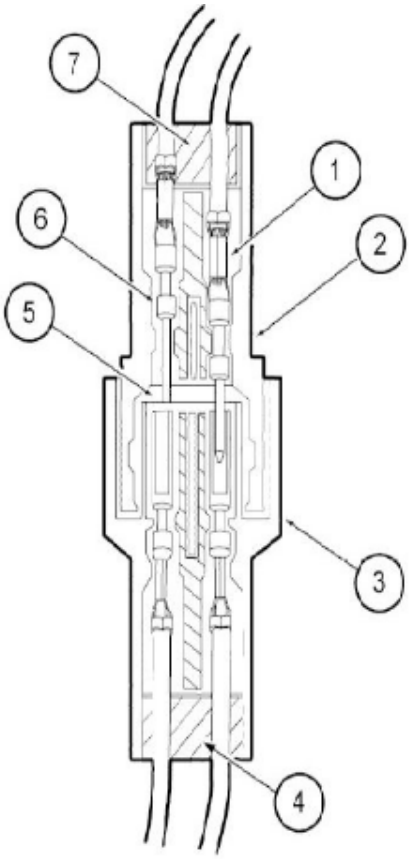


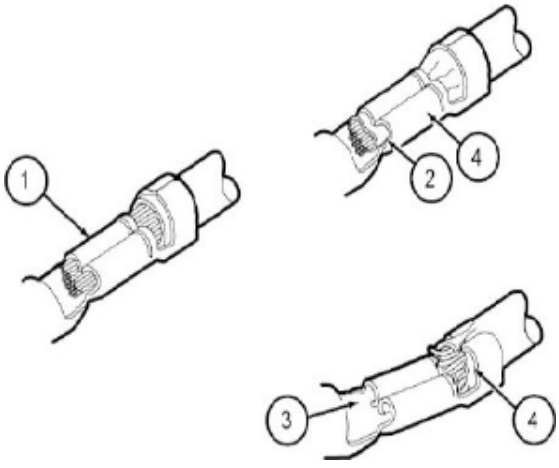
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Starter Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

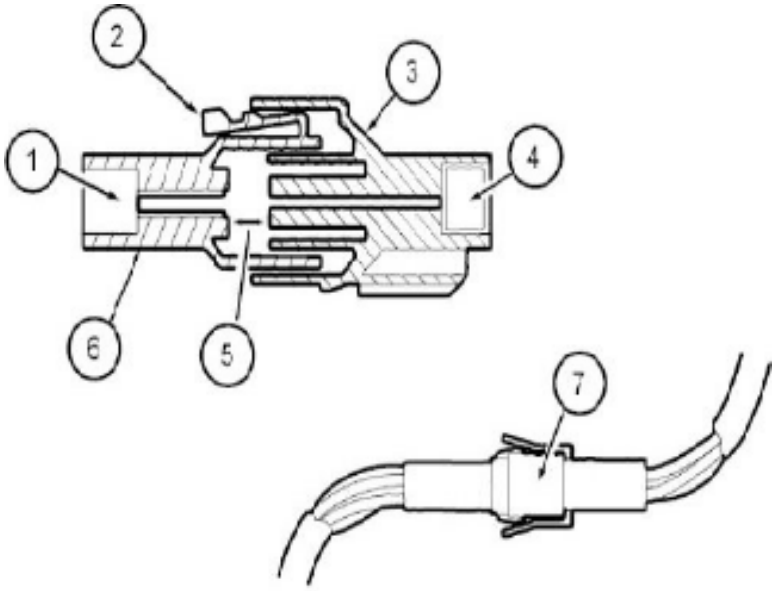
5 = Intermittent contact

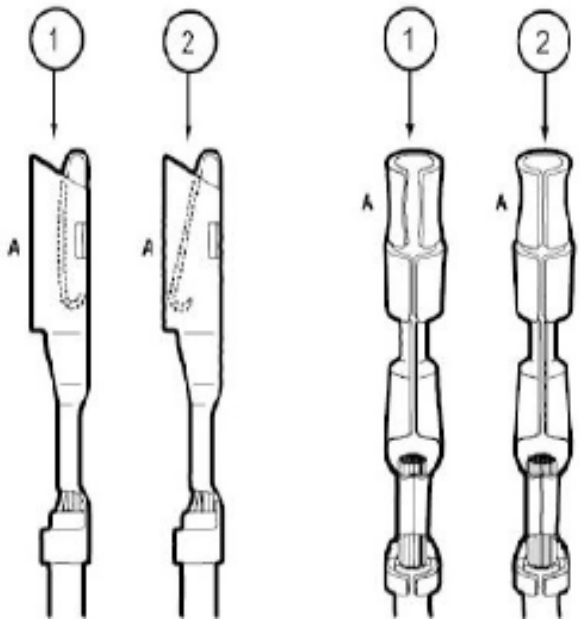
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

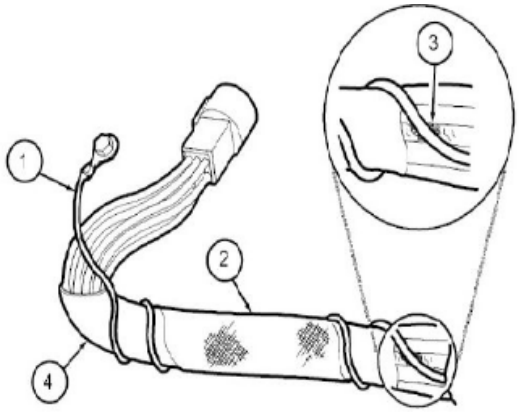
Deformed (enlarged) female terminals

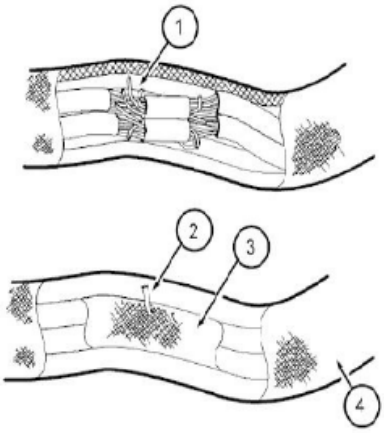
1 = Enlarged

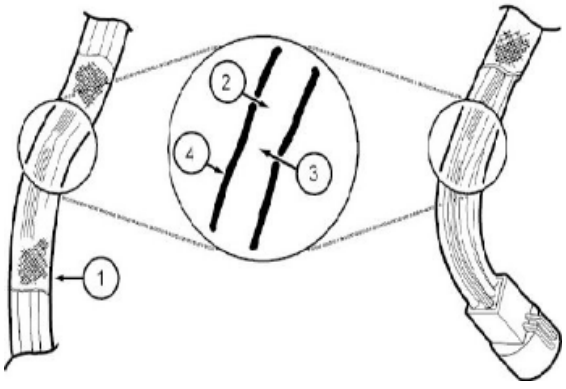
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

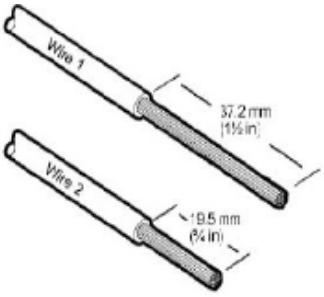
Splice covered 2

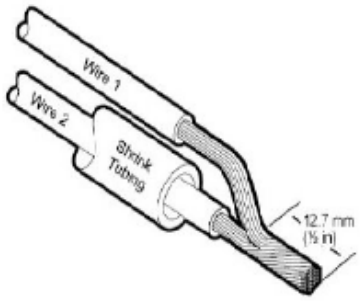
= Wire strand

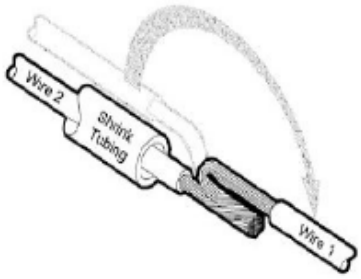
3 = Splice tape

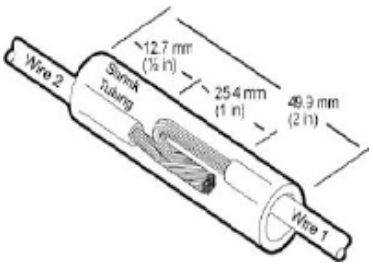
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

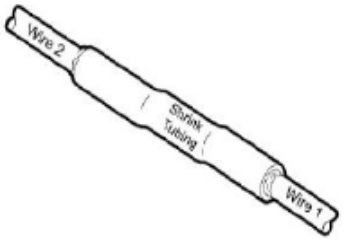
NOTE: -

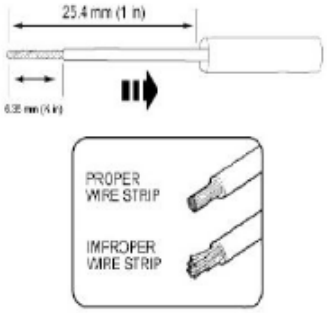
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

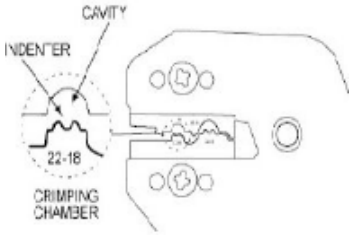
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

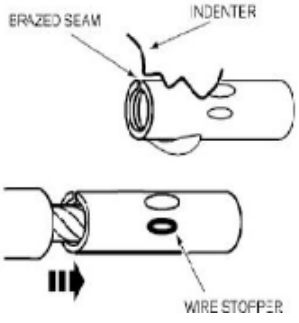
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

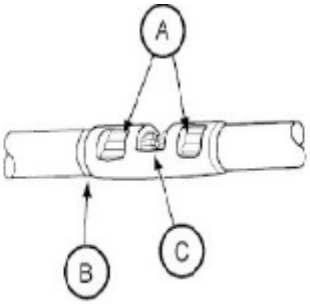
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

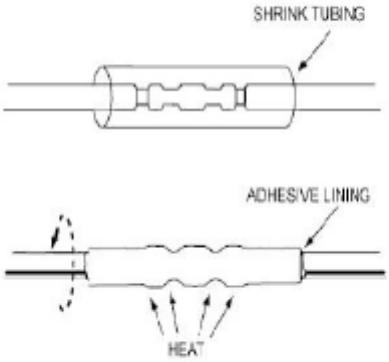
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4 strip, cut 9 strands	* 1/4 strip, cut 2 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip, fold 3x dia.
	16-14	* 1/4 strip, cut 7 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip fold 2x dia	1 strip, fold 3x dia.	1 1/4 strip, fold 4x dia.	Not Recommended
	12-10	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip fold 3x cia.	1 1/4 strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Figtail only

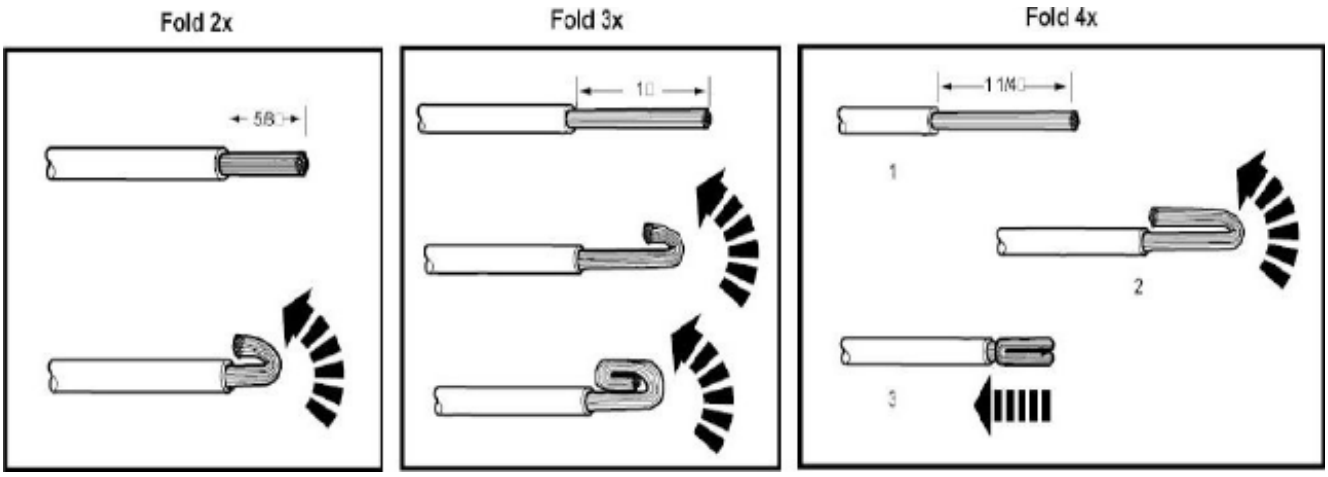
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Starter Relay: Description and Operation

The starter relay:

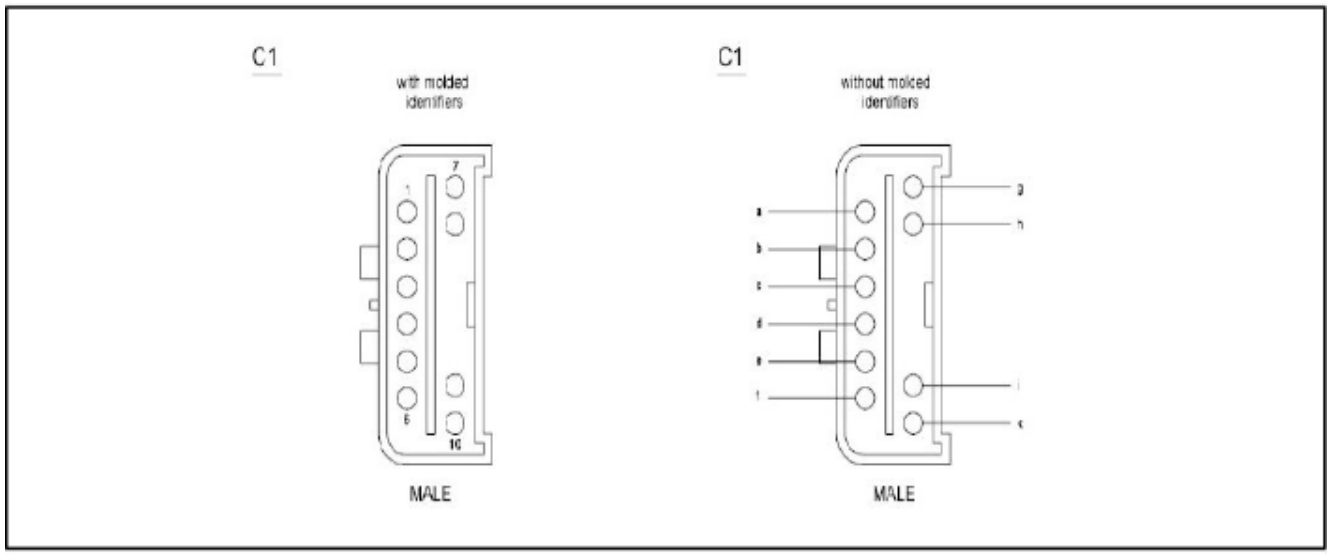
^ Is a mini ISO relay. A. switches power to the starter solenoid to engage the starter motor when it is provided a ground throigh the PCM.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



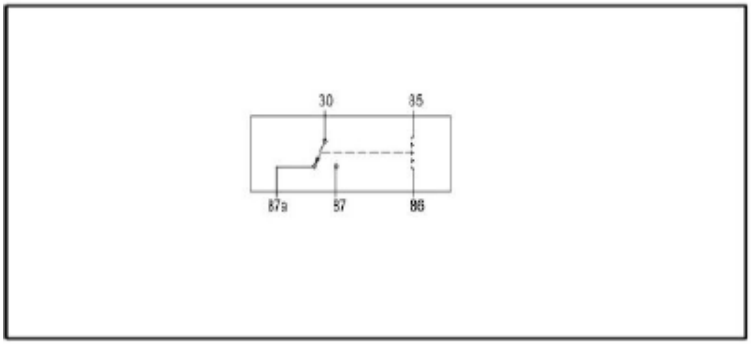
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

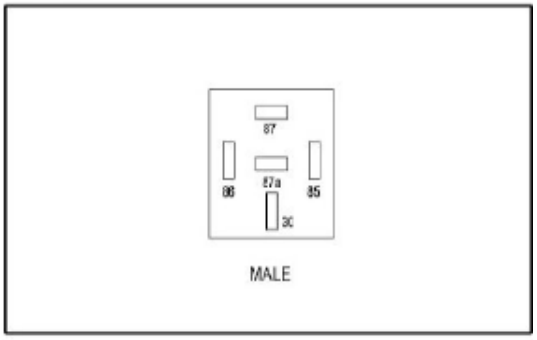
Starter Relay: Testing and Inspection

Relay □ Mini ISO

Schematic



Terminals

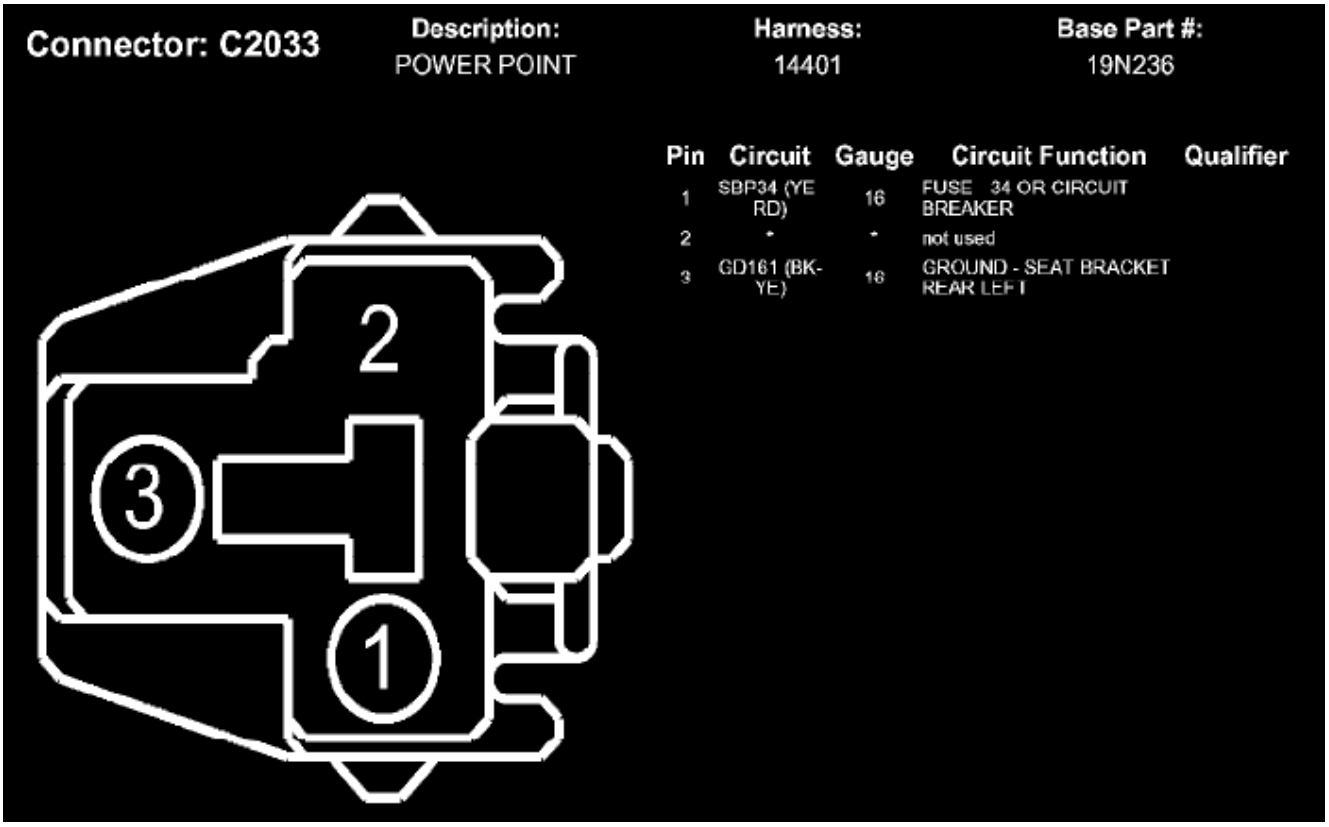


Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

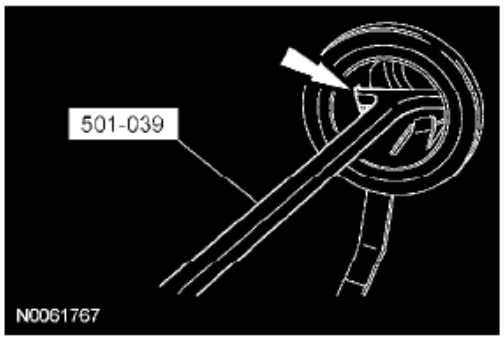


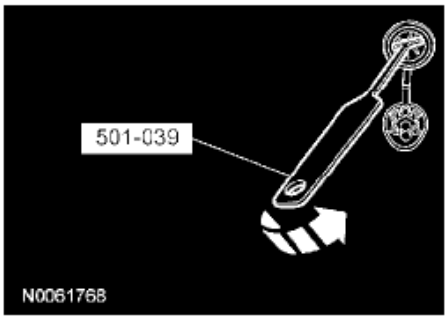
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	SBP34 (YE RD)	16	FUSE 34 OR CIRCUIT BREAKER	
2	*	*	not used	
3	GD161 (BK-YE)	16	GROUND - SEAT BRACKET REAR LEFT	

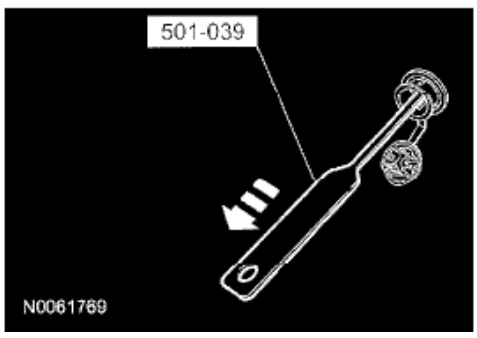
C2033

Special Tool(s)

ST3024-A	Remover, Power Point Socket 501-039 or equivalent







Auxiliary Power Outlet: Service and Repair

POWER POINT

Special Tool(s)

Special Tool(s)

Removal

NOTE: Power point cover may differ depending on location.

1. Open the power point cover. 2. Install the special tool in one of the power point socket slots.

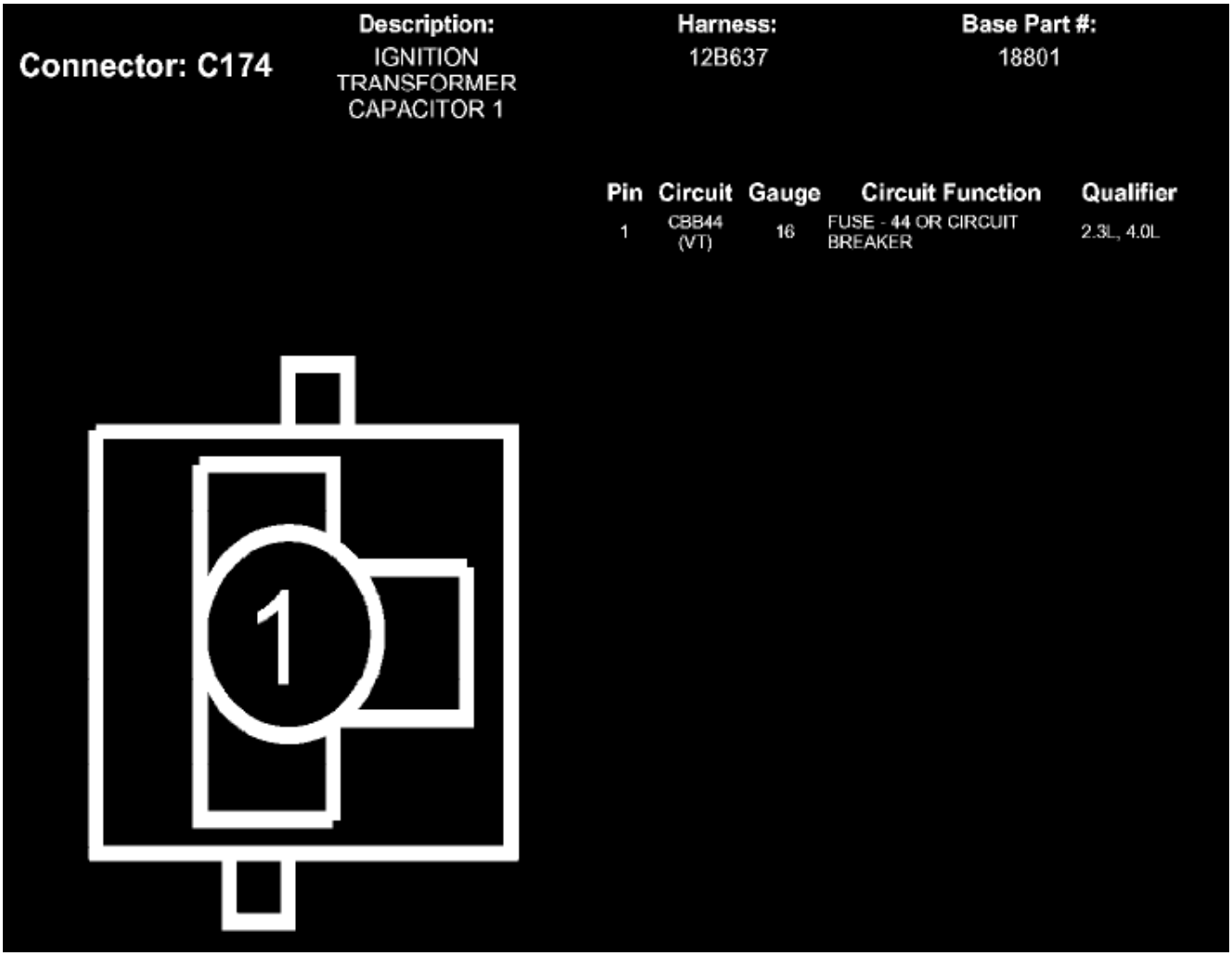
3. Position the special tool so that it engages in the adjacent slot.

4. Using the special tool, pull the power point socket out of the retainer.

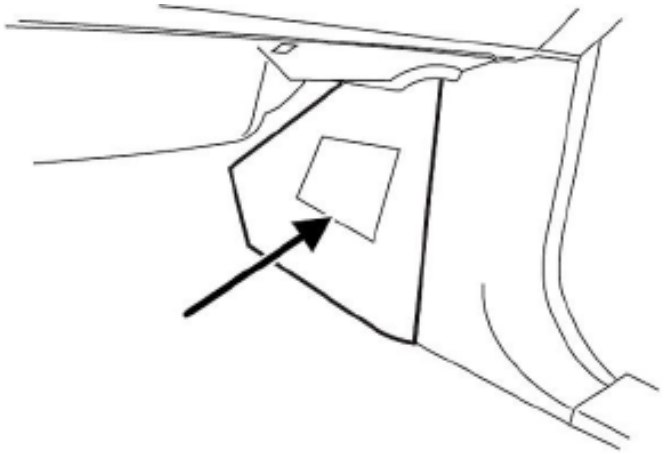
5. Disconnect the electrical connector.

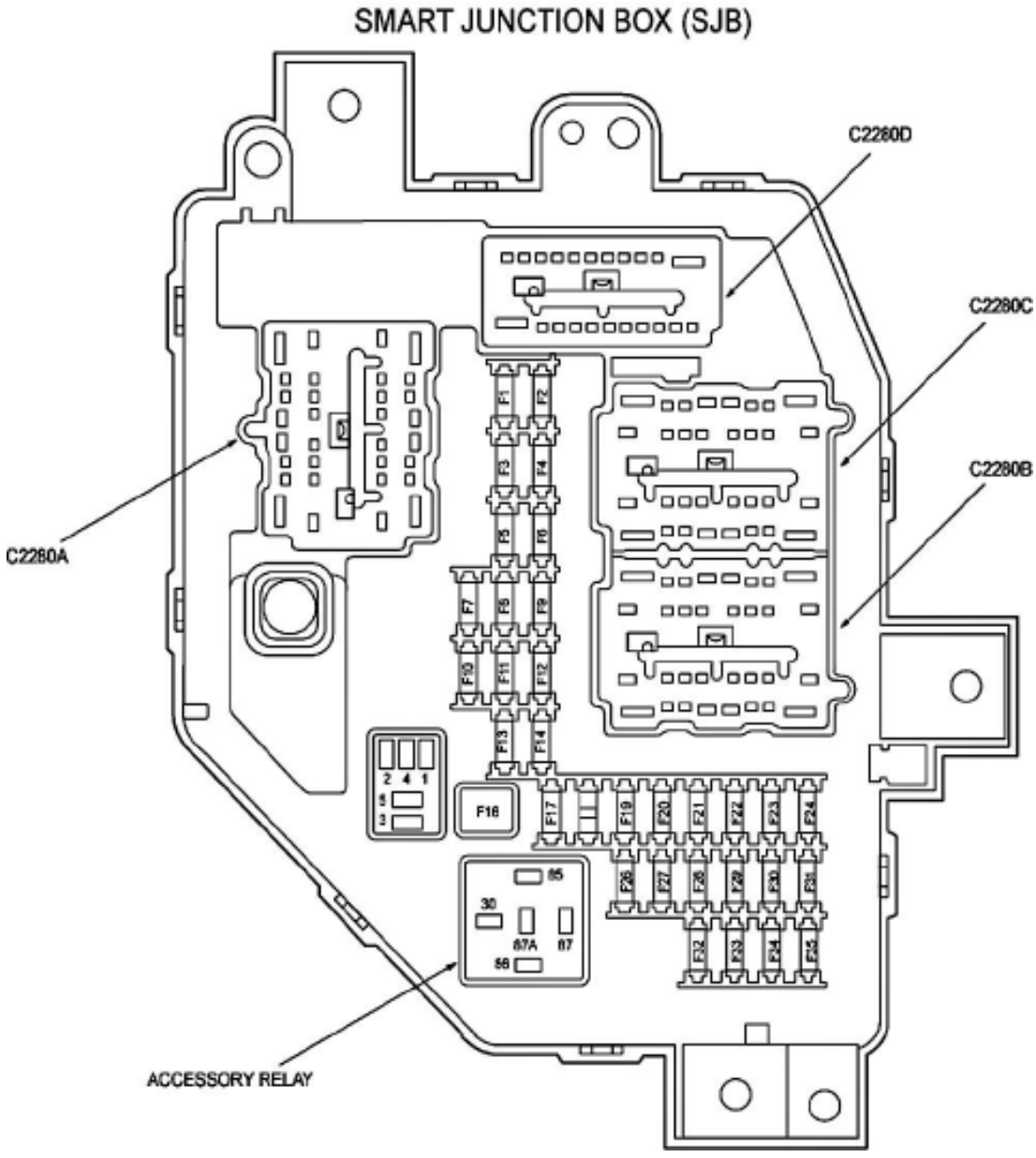
Installation

1. Connect the electrical connector. 2. Slide the power point socket into the retainer.


Connector: C174
Description:
IGNITION TRANSFORMER CAPACITOR 1
Harness:
12B637
Base Part #:
18801
Pin
Circuit
Gauge
Circuit Function
Qualifier
1
CBB44 (VT)
16
FUSE - 44 OR CIRCUIT BREAKER
2.3L, 4.0L
1

C174

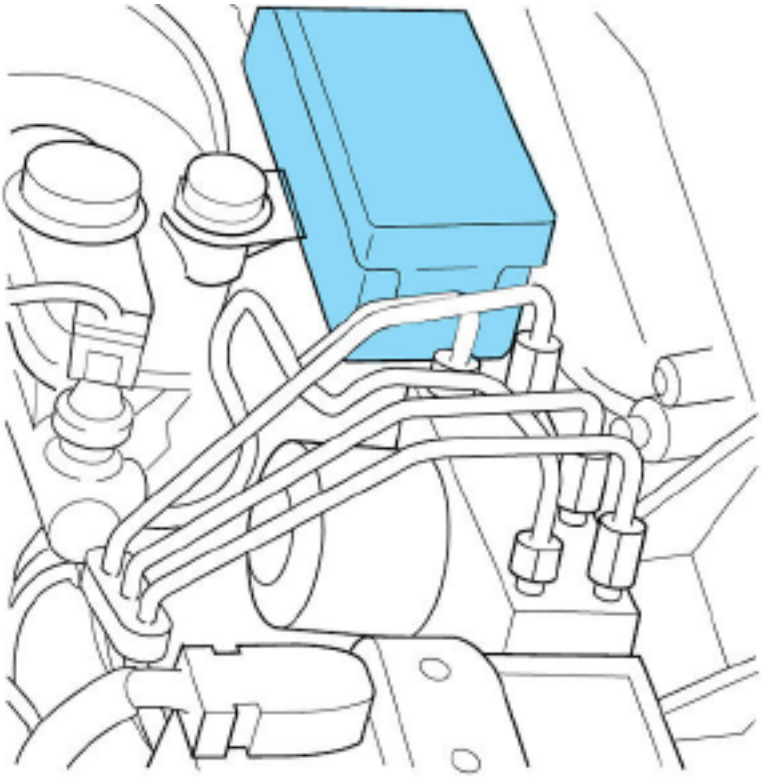



SMART JUNCTION BOX (SJB)
C2280D
C2280C
C2280B
C2280A
F1
F2
F3
F4
F5
F6
F7
F8
F9
F10
F11
F12
F13
F14
F16
F17
F19
F20
F21
F22
F23
F24
F26
F27
F28
F29
F30
F31
F32
F33
F34
F35
2 4 1
3
30
85
87A
87
86
ACCESSORY RELAY

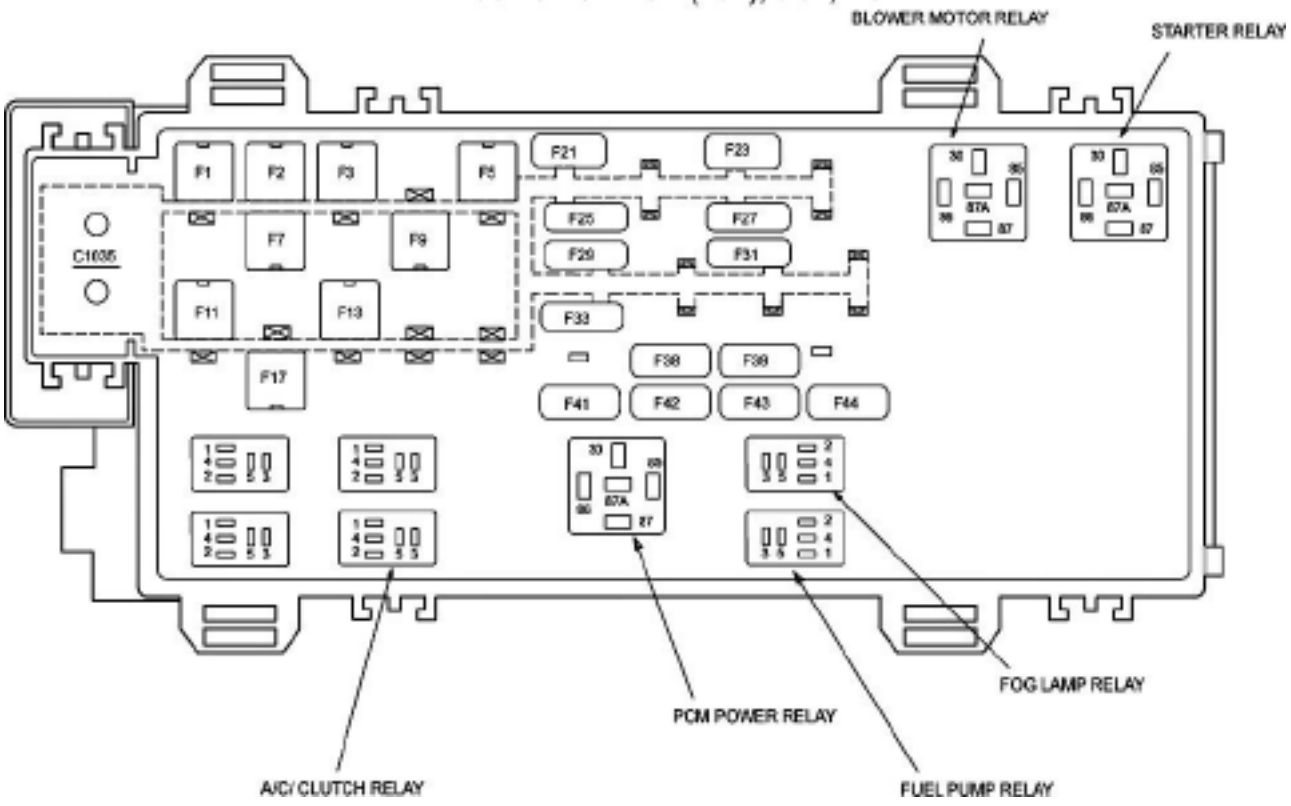
Fuse: Locations Smart Junction Box

FUSE	AMPS	Circuits Protected
F1	5A	Illumination dimmer
F2	10A	Trailer tow connector - Park
F3	10A	Headlamp, right (Low beam lamp feed)
F4	10A	Headlamp, left (Low beam lamp feed)
F5	5A	Windshield wiper module
F6	10A	Audio unit, Door lock switch illumination
F7	5A	Not Used
F8	10A	Restraints Control Module (RCM), Occupant Classification System Module (OCSM), Passenger Air bag Deactivation (PAD) Indicator
F9	5A	Instrument Cluster (IC), Air bag indicator
F10	10A	4X4 control module, Instrument Cluster (IC)
F11	10A	Smart Junction Box (SJB), logic power
F12	15A	Subwoofer amplifier with audiophile, Satellite radio receiver
F13	15A	Interior lamp relay, Horn relay
F14	15A	High beam lamp feed to High beam indicator, Headlamp, right, Headlamp, left
F16	30A	Accessory relay (Power windows)
F17	15A	Indicator flasher relay
F18	-	Not Used

FUSE	AMPS	Circuits Protected
F19	20A	Brake pedal position switch (Stoplamps)
F20	10A	Transmission control switch, Digital Transmission Range (TR) sensor, Speed control servo, Anti-lock Brake System (ABS) module, Indicator flasher relay, Reversing lamps switch, Speed control On/Off switch, Speed control Set/Resume switch
F21	5A	Digital Transmission Range (TR) sensor, Starter relay, Powertrain Control Module (PCM)
F22	5A	Audio unit
F23	30A	Main light switch, Multifunction switch
F24	20A	Audio unit
F26	2A	Deactivator switch
F27	10A	Blend door actuator, Climate control assembly
F28	15A	4X4 control module
F29	20A	Cigar lighter, front, Data Link Connector (DLC)
F30	5A	Exterior rear view mirror switch
F31	20A	Park lamp relay
F32	5A	Brake pedal position switch (logic power), Brake shift interlock
F33	5A	Instrument Cluster (IC), Neutral tow indicator
F34	20A	Power point
F35	15A	Door lock/unlock relay, Driver door unlock relay



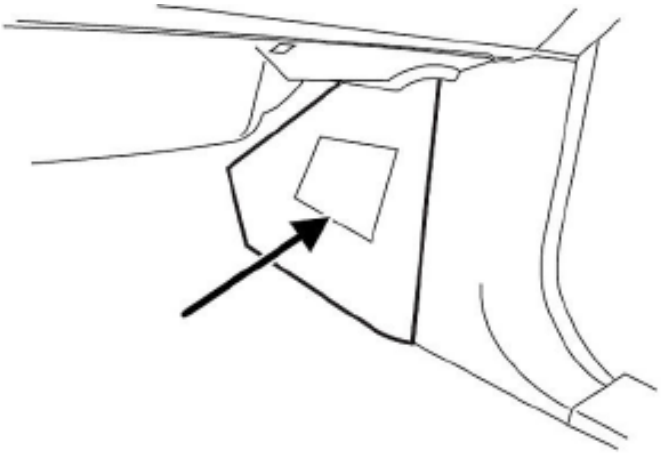
BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L

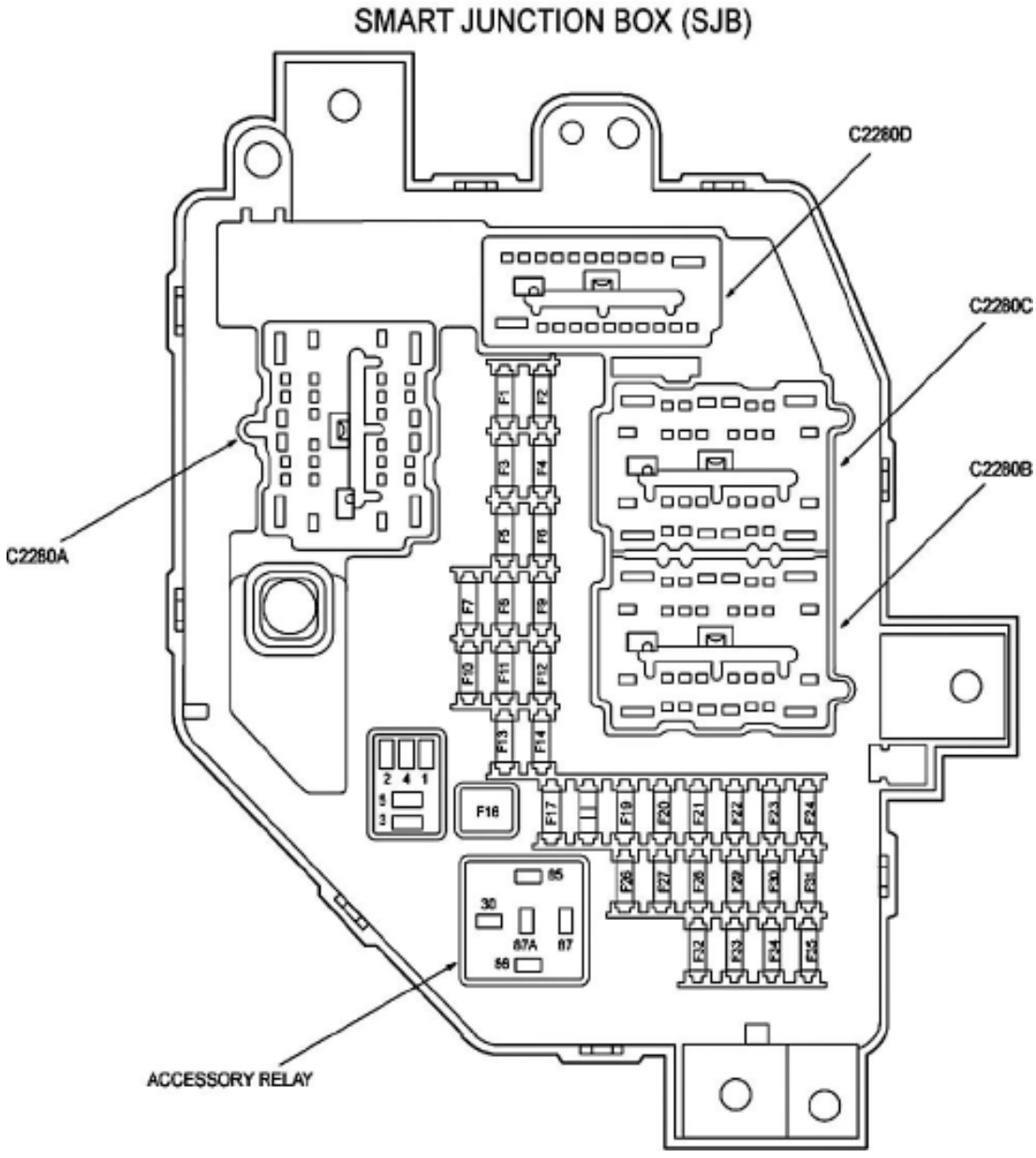


Fuse: Locations Battery Junction Box

FUSE	AMPS	Circuits Protected
F1	40A	Smart Junction Box (SJB)
F2	-	Not Used
F3	40A	Smart Junction Box (SJB)
F4	-	Not Used
F5	50A	Smart Junction Box (SJB)
F6	-	Not Used
F7	30A	Starter Relay
F8	-	Not Used
F9	40A	Ignition Switch
F10	-	Not Used
F11	30A	PCM power relay
F12	-	Not Used
F13	30A	Blower motor relay
F14	-	Not Used
F15	-	Not Used
F16	-	Not Used
F17	40A	Anti-lock Brake System (ABS) module
F18	-	Not Used
F19	-	Not Used
F20	-	Not Used
F21	10A	Powertrain Control Module (PCM), Evaporative emission (EVAP) canister vent valve
F22	-	Not Used
F23	30A	Fuel Pump Relay, Fuel injectors
F24	-	Not Used

FUSE	AMPS	Circuits Protected
F25	10A	A/C clutch relay
F26	-	Not Used
F27	20A	4X4 control module
F28	-	Not Used
F29	30A	Windshield wipers/washer
F30	-	Not Used
F31	15A	Fog lamp relay
F32	-	Not Used
F33	30A	Anti-lock Brake System (ABS) module
F34	-	Not Used
F35	-	Not Used
F36	-	Not Used
F37	-	Not Used
F38	7.5A	Trailer tow connector - Right turn
F39	15A	Powertrain Control Module (PCM)
F40	-	Not Used
F41	10A	*5R44E Transmission **5R55E Transmission
F42	7.5A	Trailer tow connector - Left turn
F43	20A	EVAP canister purge valve, Heated Positive Crankcase Ventilation (PCV) valve, Idle Air Control (IAC) valve, Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor, Heated Oxygen Sensor (HO2S) #11, Heated Oxygen Sensor (HO2S) #12, Heated Oxygen Sensor (HO2S) #21, Heated Oxygen Sensor (HO2S) #22, EGR vacuum regulator solenoid valve, A/C relay coil
F44	15A	Ignition coil, *Ignition transformer capacitor 1

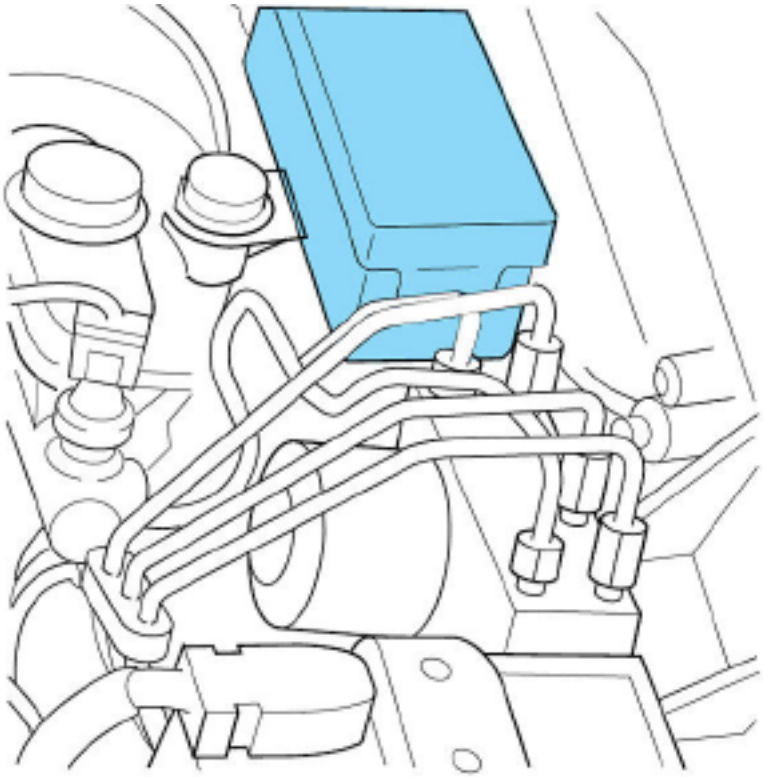



SMART JUNCTION BOX (SJB)
C2280D
C2280C
C2280B
C2280A
F1
F2
F3
F4
F5
F6
F7
F8
F9
F10
F11
F12
F13
F14
F16
F17
F19
F20
F21
F22
F23
F24
F26
F27
F28
F29
F30
F31
F32
F33
F34
F35
2 4 1
3
30
85
87A
87
86
ACCESSORY RELAY

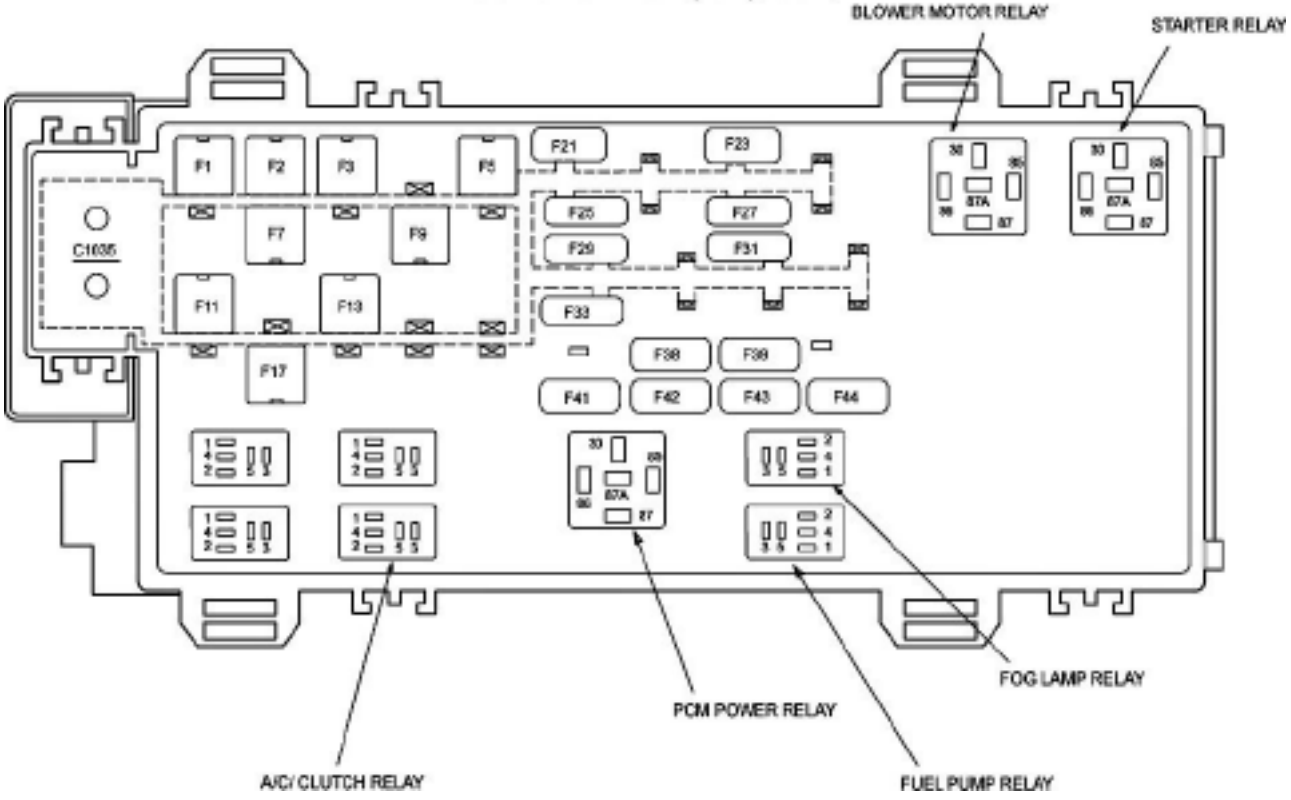
Fuse: Application and ID Smart Junction Box

FUSE	AMPS	Circuits Protected
F1	5A	Illumination dimmer
F2	10A	Trailer tow connector - Park
F3	10A	Headlamp, right (Low beam lamp feed)
F4	10A	Headlamp, left (Low beam lamp feed)
F5	5A	Windshield wiper module
F6	10A	Audio unit, Door lock switch illumination
F7	5A	Not Used
F8	10A	Restraints Control Module (RCM), Occupant Classification System Module (OCSM), Passenger Air bag Deactivation (PAD) Indicator
F9	5A	Instrument Cluster (IC), Air bag indicator
F10	10A	4X4 control module, Instrument Cluster (IC)
F11	10A	Smart Junction Box (SJB), logic power
F12	15A	Subwoofer amplifier with audiophile, Satellite radio receiver
F13	15A	Interior lamp relay, Horn relay
F14	15A	High beam lamp feed to High beam indicator, Headlamp, right, Headlamp, left
F16	30A	Accessory relay (Power windows)
F17	15A	Indicator flasher relay
F18	-	Not Used

FUSE	AMPS	Circuits Protected
F19	20A	Brake pedal position switch (Stoplamps)
F20	10A	Transmission control switch, Digital Transmission Range (TR) sensor, Speed control servo, Anti-lock Brake System (ABS) module, Indicator flasher relay, Reversing lamps switch, Speed control On/Off switch, Speed control Set/Resume switch
F21	5A	Digital Transmission Range (TR) sensor, Starter relay, Powertrain Control Module (PCM)
F22	5A	Audio unit
F23	30A	Main light switch, Multifunction switch
F24	20A	Audio unit
F26	2A	Deactivator switch
F27	10A	Blend door actuator, Climate control assembly
F28	15A	4X4 control module
F29	20A	Cigar lighter, front, Data Link Connector (DLC)
F30	5A	Exterior rear view mirror switch
F31	20A	Park lamp relay
F32	5A	Brake pedal position switch (logic power), Brake shift interlock
F33	5A	Instrument Cluster (IC), Neutral tow indicator
F34	20A	Power point
F35	15A	Door lock/unlock relay, Driver door unlock relay



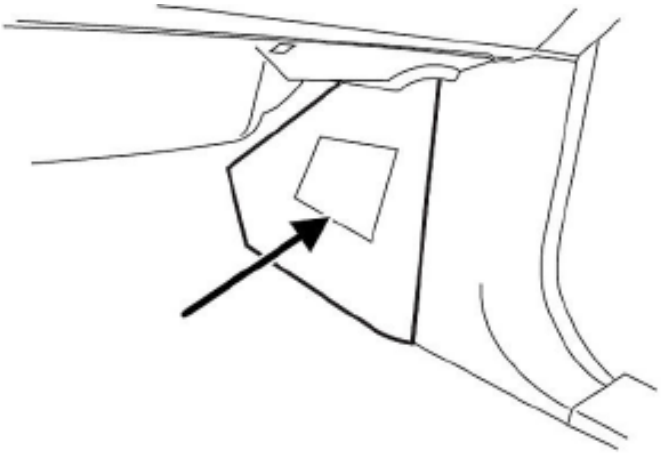
BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L

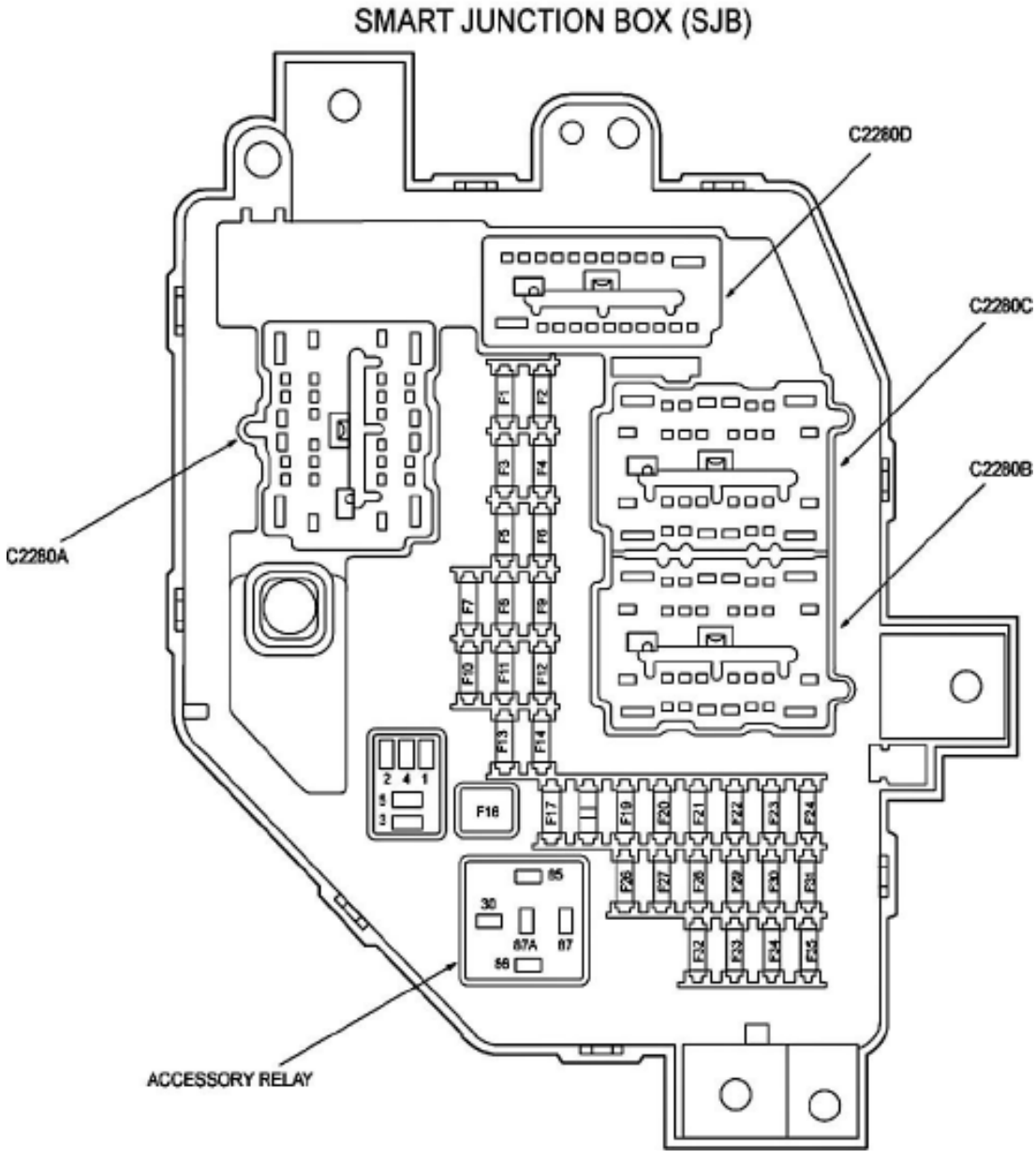


Fuse: Application and ID Battery Junction Box

FUSE	AMPS	Circuits Protected
F1	40A	Smart Junction Box (SJB)
F2	-	Not Used
F3	40A	Smart Junction Box (SJB)
F4	-	Not Used
F5	50A	Smart Junction Box (SJB)
F6	-	Not Used
F7	30A	Starter Relay
F8	-	Not Used
F9	40A	Ignition Switch
F10	-	Not Used
F11	30A	PCM power relay
F12	-	Not Used
F13	30A	Blower motor relay
F14	-	Not Used
F15	-	Not Used
F16	-	Not Used
F17	40A	Anti-lock Brake System (ABS) module
F18	-	Not Used
F19	-	Not Used
F20	-	Not Used
F21	10A	Powertrain Control Module (PCM), Evaporative emission (EVAP) canister vent valve
F22	-	Not Used
F23	30A	Fuel Pump Relay, Fuel injectors
F24	-	Not Used

FUSE	AMPS	Circuits Protected
F25	10A	A/C clutch relay
F26	-	Not Used
F27	20A	4X4 control module
F28	-	Not Used
F29	30A	Windshield wipers/washer
F30	-	Not Used
F31	15A	Fog lamp relay
F32	-	Not Used
F33	30A	Anti-lock Brake System (ABS) module
F34	-	Not Used
F35	-	Not Used
F36	-	Not Used
F37	-	Not Used
F38	7.5A	Trailer tow connector - Right turn
F39	15A	Powertrain Control Module (PCM)
F40	-	Not Used
F41	10A	*5R44E Transmission **5R55E Transmission
F42	7.5A	Trailer tow connector - Left turn
F43	20A	EVAP canister purge valve, Heated Positive Crankcase Ventilation (PCV) valve, Idle Air Control (IAC) valve, Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor, Heated Oxygen Sensor (HO2S) #11, Heated Oxygen Sensor (HO2S) #12, Heated Oxygen Sensor (HO2S) #21, Heated Oxygen Sensor (HO2S) #22, EGR vacuum regulator solenoid valve, A/C relay coil
F44	15A	Ignition coil, *Ignition transformer capacitor 1

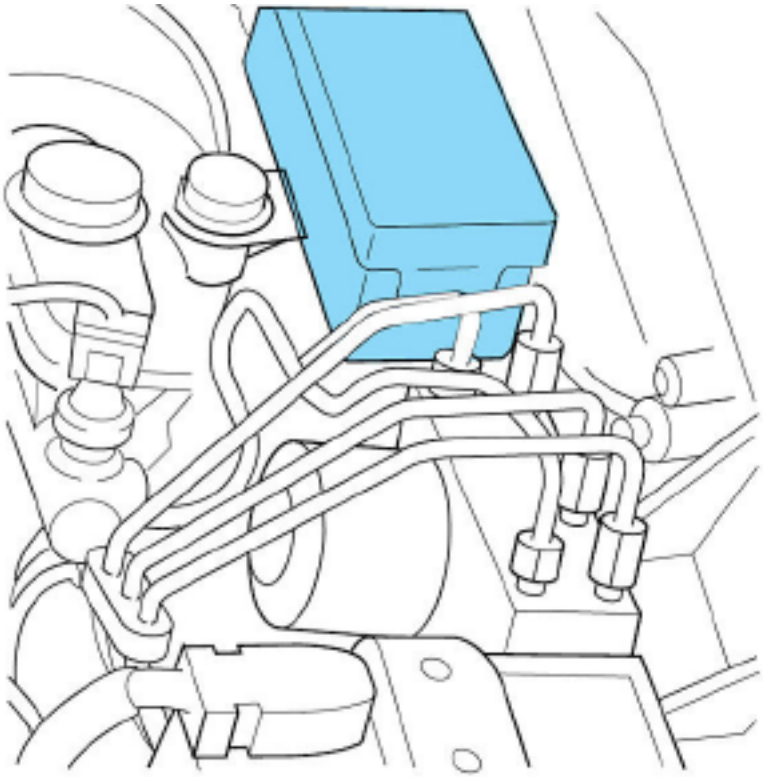


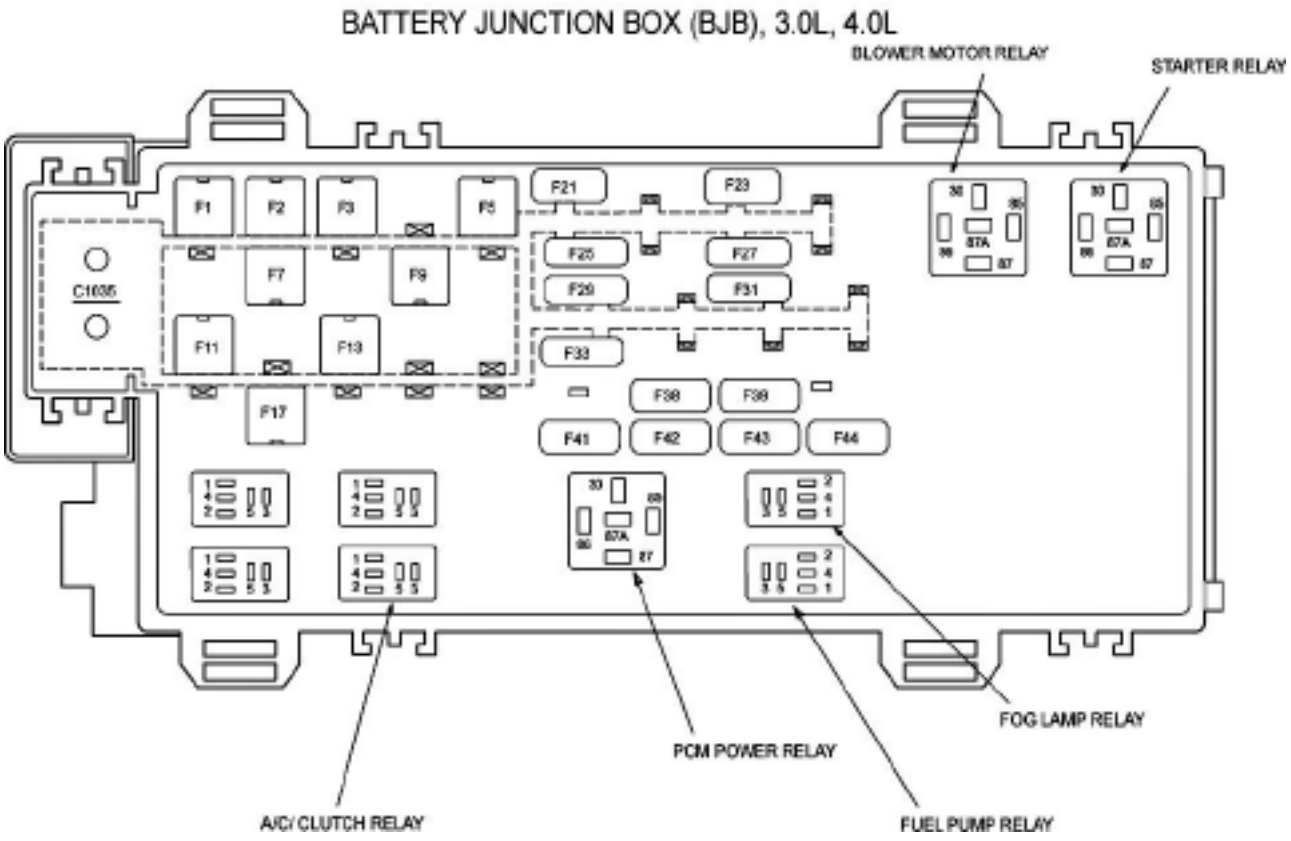

SMART JUNCTION BOX (SJB)
C2280D
C2280C
C2280B
C2280A
F1
F2
F3
F4
F5
F6
F7
F8
F9
F10
F11
F12
F13
F14
F16
F17
F19
F20
F21
F22
F23
F24
F26
F27
F28
F29
F30
F31
F32
F33
F34
F35
2 4 1
3
30
85
87A
87
86
ACCESSORY RELAY

Fuse Block: Locations Smart Junction Box

FUSE	AMPS	Circuits Protected
F1	5A	Illumination dimmer
F2	10A	Trailer tow connector - Park
F3	10A	Headlamp, right (Low beam lamp feed)
F4	10A	Headlamp, left (Low beam lamp feed)
F5	5A	Windshield wiper module
F6	10A	Audio unit, Door lock switch illumination
F7	5A	Not Used
F8	10A	Restraints Control Module (RCM), Occupant Classification System Module (OCSM), Passenger Air bag Deactivation (PAD) Indicator
F9	5A	Instrument Cluster (IC), Air bag indicator
F10	10A	4X4 control module, Instrument Cluster (IC)
F11	10A	Smart Junction Box (SJB), logic power
F12	15A	Subwoofer amplifier with audiophile, Satellite radio receiver
F13	15A	Interior lamp relay, Horn relay
F14	15A	High beam lamp feed to High beam indicator, Headlamp, right, Headlamp, left
F16	30A	Accessory relay (Power windows)
F17	15A	Indicator flasher relay
F18	-	Not Used

FUSE	AMPS	Circuits Protected
F19	20A	Brake pedal position switch (Stoplamps)
F20	10A	Transmission control switch, Digital Transmission Range (TR) sensor, Speed control servo, Anti-lock Brake System (ABS) module, Indicator flasher relay, Reversing lamps switch, Speed control On/Off switch, Speed control Set/Resume switch
F21	5A	Digital Transmission Range (TR) sensor, Starter relay, Powertrain Control Module (PCM)
F22	5A	Audio unit
F23	30A	Main light switch, Multifunction switch
F24	20A	Audio unit
F26	2A	Deactivator switch
F27	10A	Blend door actuator, Climate control assembly
F28	15A	4X4 control module
F29	20A	Cigar lighter, front, Data Link Connector (DLC)
F30	5A	Exterior rear view mirror switch
F31	20A	Park lamp relay
F32	5A	Brake pedal position switch (logic power), Brake shift interlock
F33	5A	Instrument Cluster (IC), Neutral tow indicator
F34	20A	Power point
F35	15A	Door lock/unlock relay, Driver door unlock relay

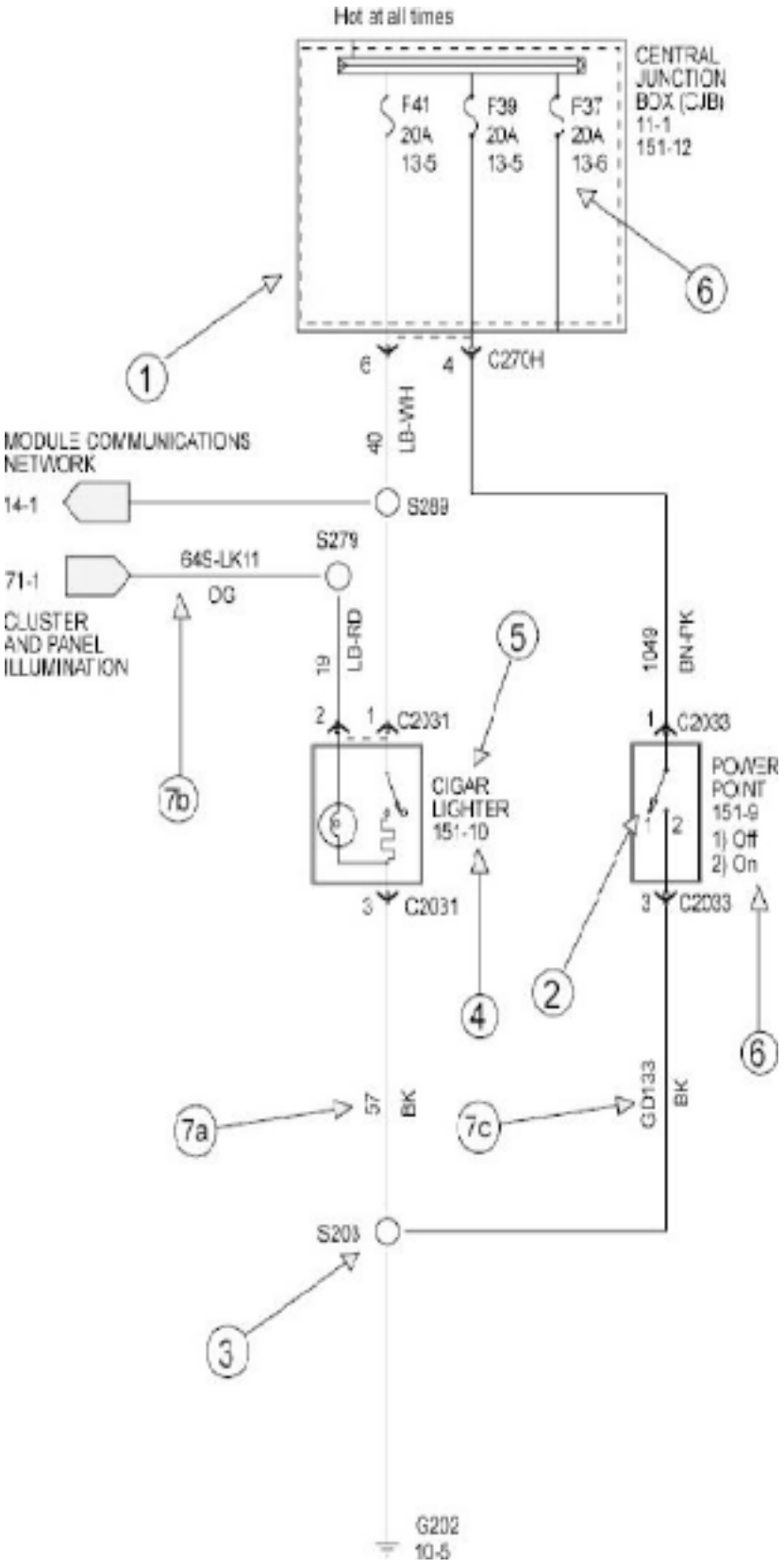



BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L
BLOWER MOTOR RELAY
STARTER RELAY
F1
F2
F3
F5
F21
F23
F7
F9
F25
F27
C1035
F29
F31
F11
F13
F33
F17
F38
F39
F41
F42
F43
F44
FOG LAMP RELAY
PCM POWER RELAY
A/C CLUTCH RELAY
FUEL PUMP RELAY

Fuse Block: Locations Battery Junction Box

FUSE	AMPS	Circuits Protected
F1	40A	Smart Junction Box (SJB)
F2	-	Not Used
F3	40A	Smart Junction Box (SJB)
F4	-	Not Used
F5	50A	Smart Junction Box (SJB)
F6	-	Not Used
F7	30A	Starter Relay
F8	-	Not Used
F9	40A	Ignition Switch
F10	-	Not Used
F11	30A	PCM power relay
F12	-	Not Used
F13	30A	Blower motor relay
F14	-	Not Used
F15	-	Not Used
F16	-	Not Used
F17	40A	Anti-lock Brake System (ABS) module
F18	-	Not Used
F19	-	Not Used
F20	-	Not Used
F21	10A	Powertrain Control Module (PCM), Evaporative emission (EVAP) canister vent valve
F22	-	Not Used
F23	30A	Fuel Pump Relay, Fuel injectors
F24	-	Not Used

FUSE	AMPS	Circuits Protected
F25	10A	A/C clutch relay
F26	-	Not Used
F27	20A	4X4 control module
F28	-	Not Used
F29	30A	Windshield wipers/washer
F30	-	Not Used
F31	15A	Fog lamp relay
F32	-	Not Used
F33	30A	Anti-lock Brake System (ABS) module
F34	-	Not Used
F35	-	Not Used
F36	-	Not Used
F37	-	Not Used
F38	7.5A	Trailer tow connector - Right turn
F39	15A	Powertrain Control Module (PCM)
F40	-	Not Used
F41	10A	*5R44E Transmission **5R55E Transmission
F42	7.5A	Trailer tow connector - Left turn
F43	20A	EVAP canister purge valve, Heated Positive Crankcase Ventilation (PCV) valve, Idle Air Control (IAC) valve, Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor, Heated Oxygen Sensor (HO2S) #11, Heated Oxygen Sensor (HO2S) #12, Heated Oxygen Sensor (HO2S) #21, Heated Oxygen Sensor (HO2S) #22, EGR vacuum regulator solenoid valve, A/C relay coil
F44	15A	Ignition coil, *Ignition transformer capacitor 1


Hot at all times
CENTRAL JUNCTION BOX (CJB)
11-1
151-12
F41
20A
13-5
F39
20A
13-5
F37
20A
13-6
C270H
6
4
40
LB-WH
MODULE COMMUNICATIONS NETWORK
14-1
S289
S279
64S-LK11
71-1
DG
CLUSTER AND PANEL ILLUMINATION
19
LB-RD
2
1
C2031
CIGAR LIGHTER
151-10
3
C2031
1049
BN-PK
1
C2033
POWER POINT
151-9
1) Off
2) On
3
C2033
57
BK
GD133
BK
S203
G202
10-5
1
2
3
4
5
6
7a
7b
7c

Fuse Block: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

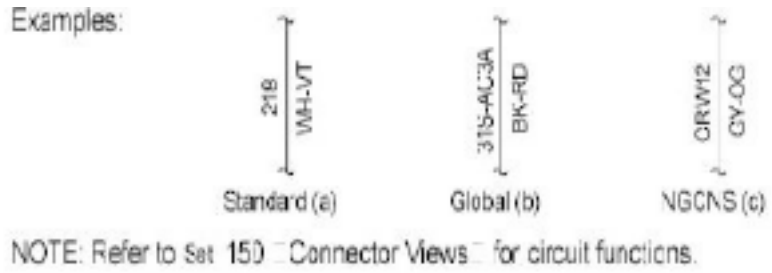
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

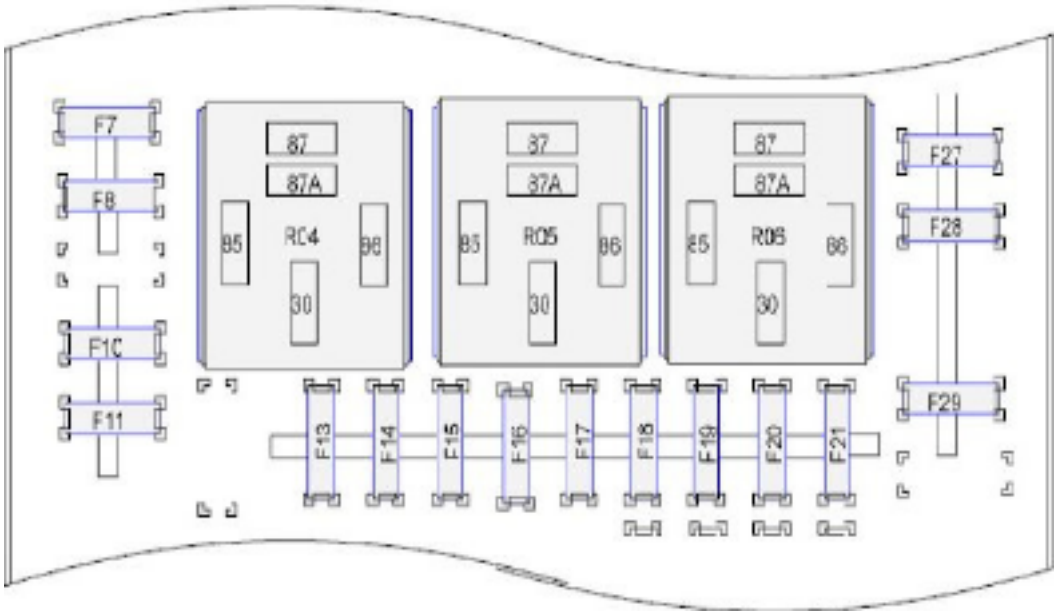
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

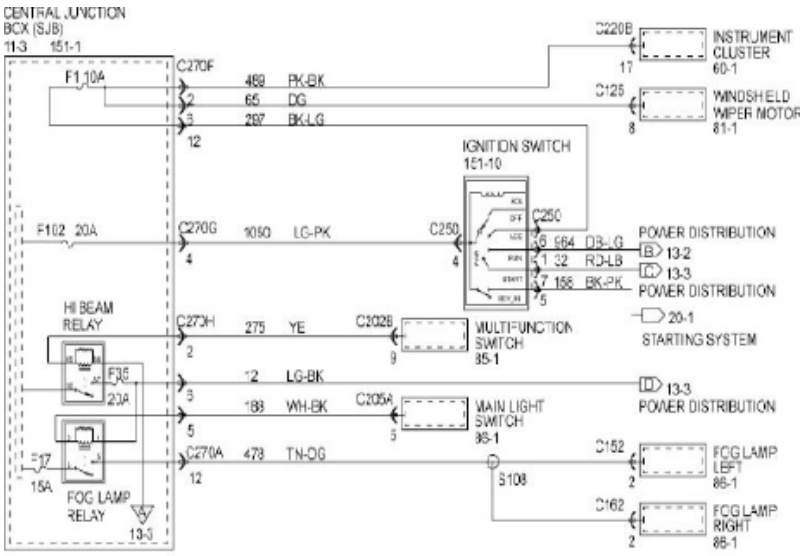
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

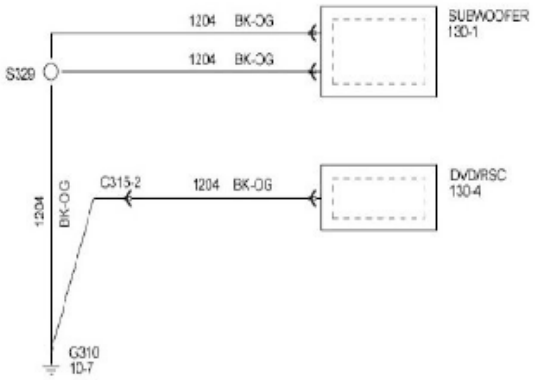
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

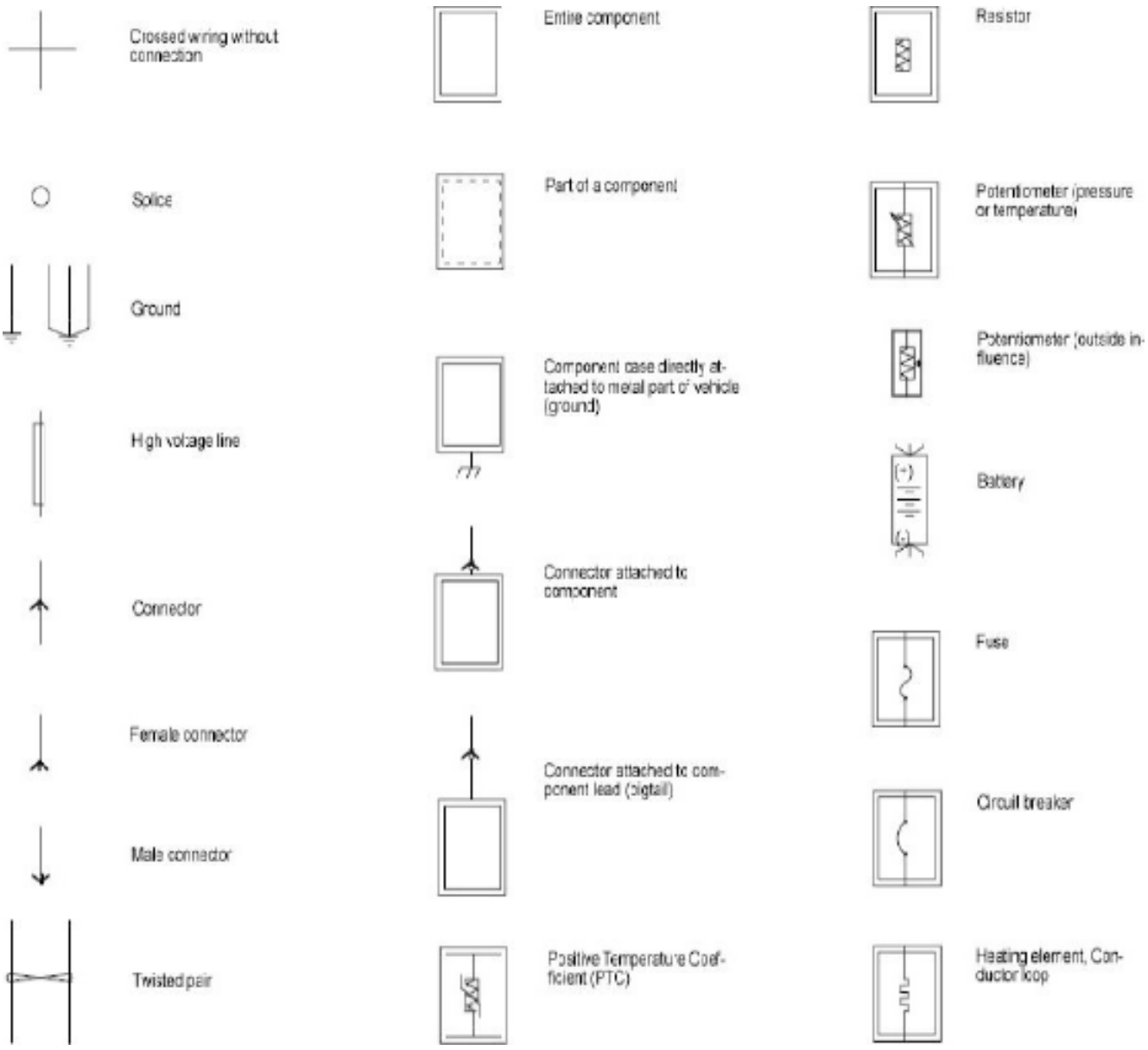
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

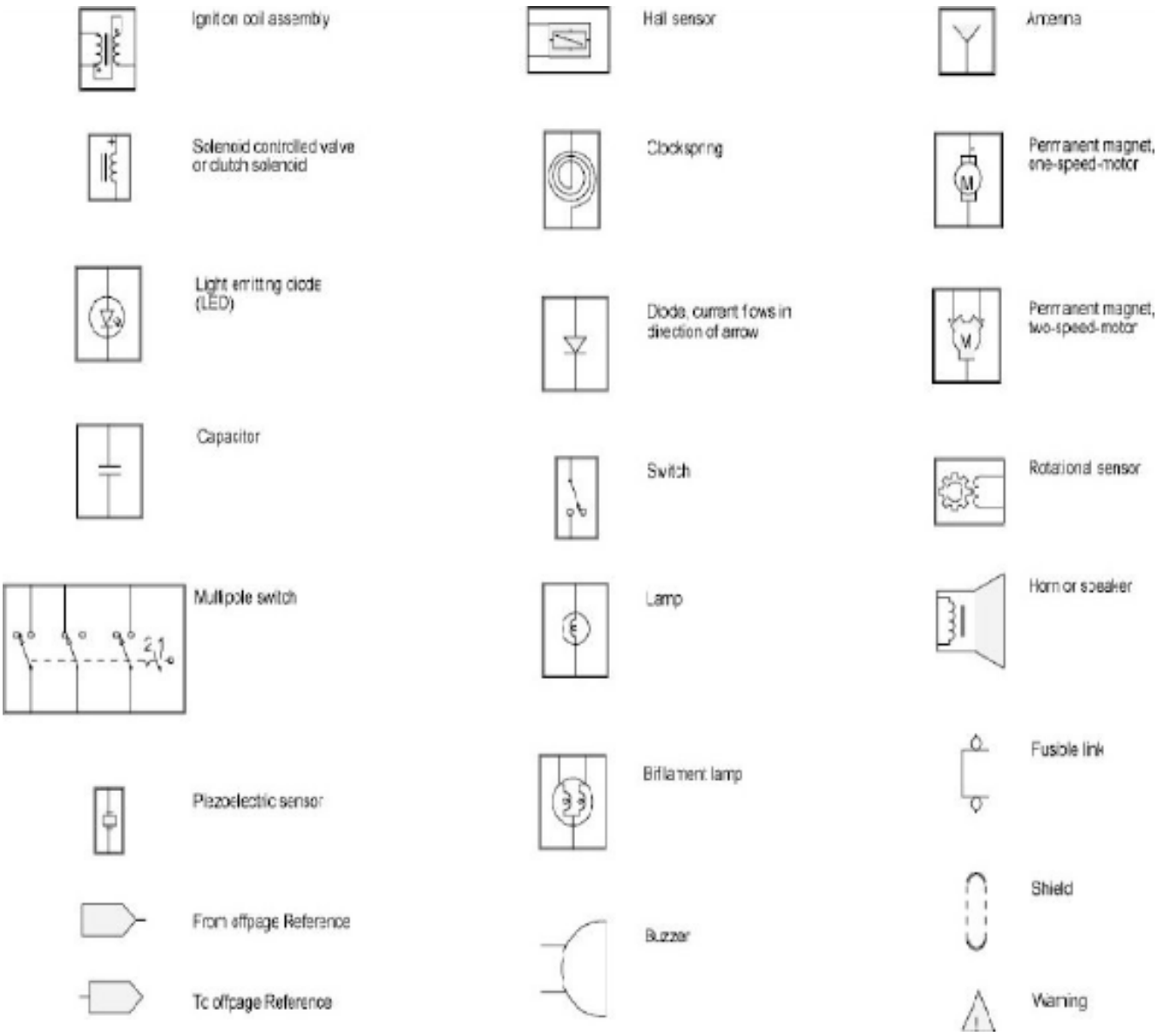
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

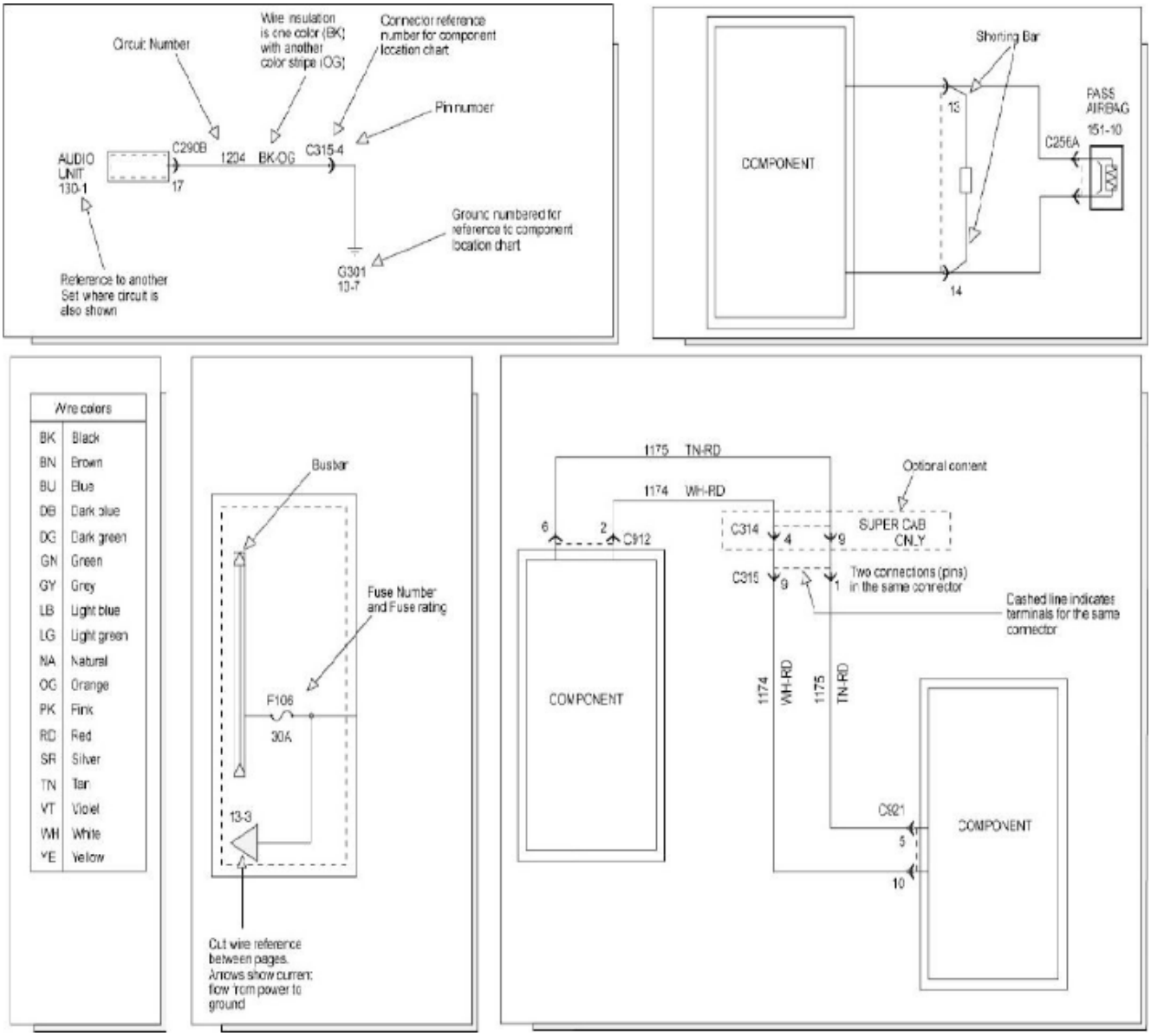
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

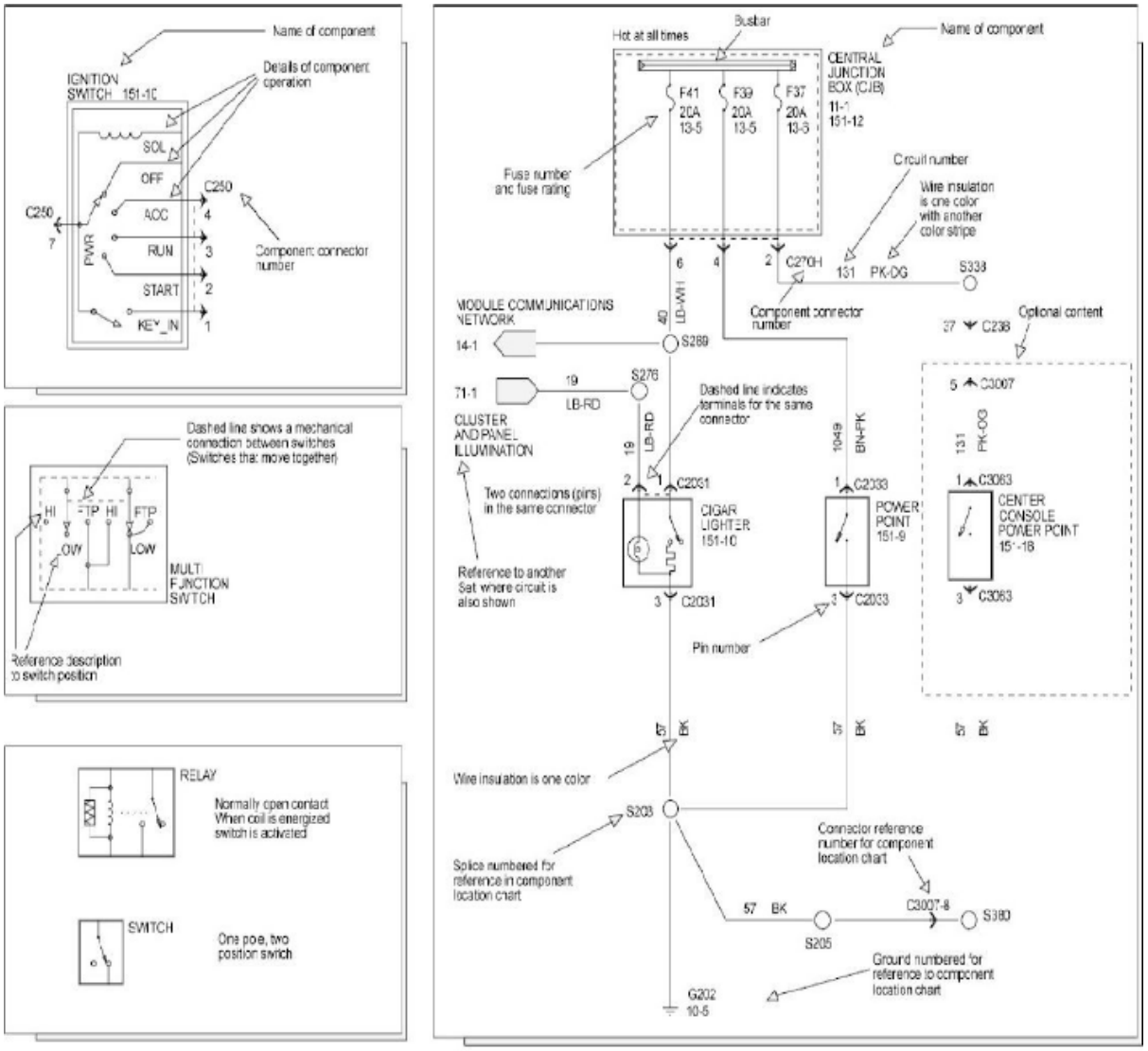
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

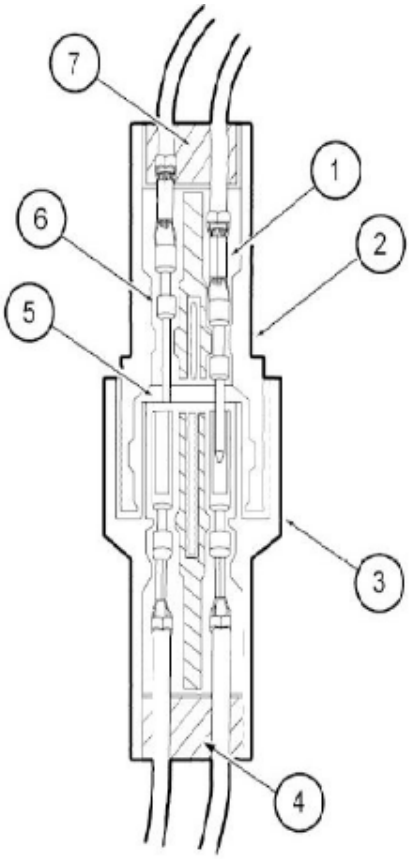


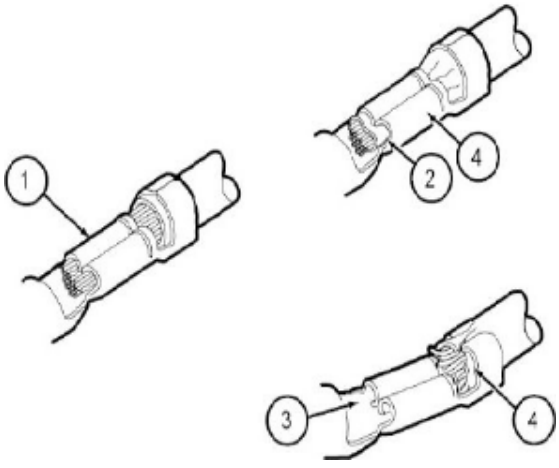
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Fuse Block: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

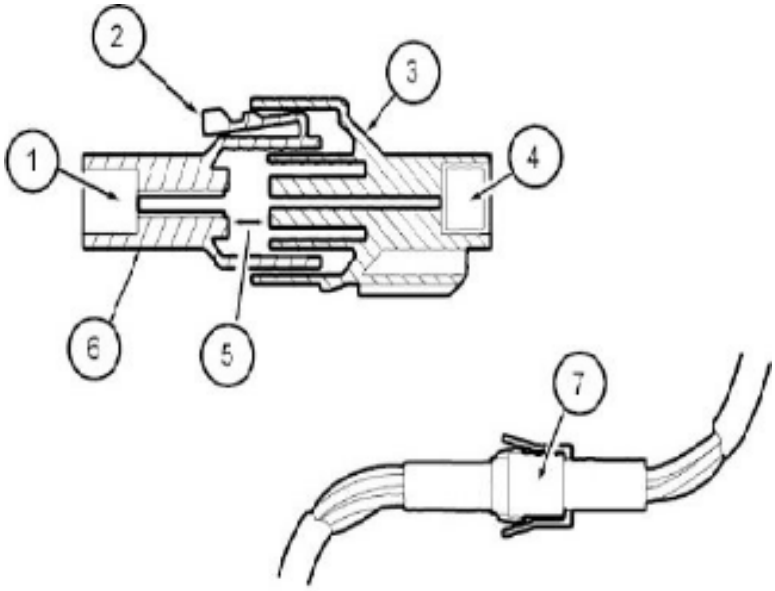
5 = Intermittent contact

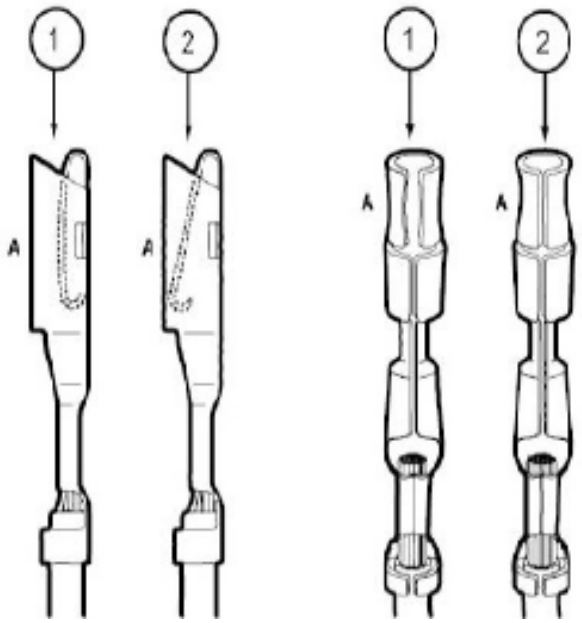
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

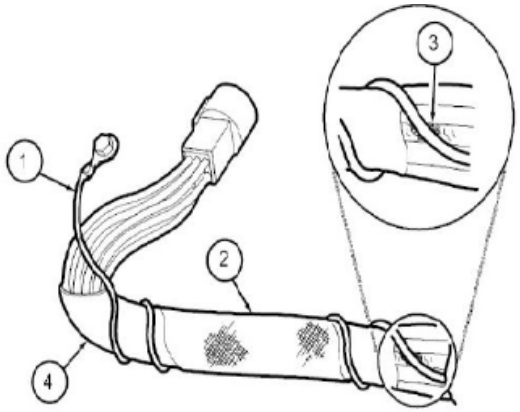
Deformed (enlarged) female terminals

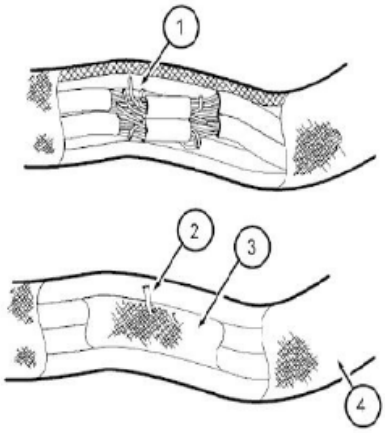
1 = Enlarged

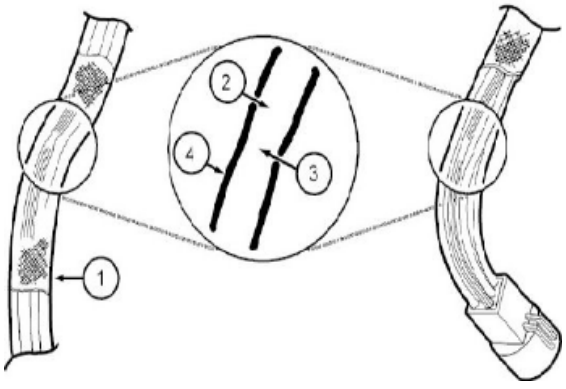
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

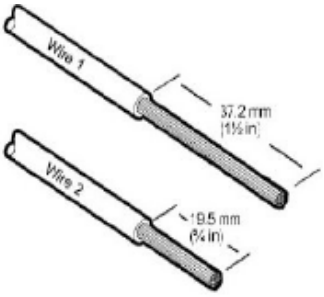
Splice covered 2

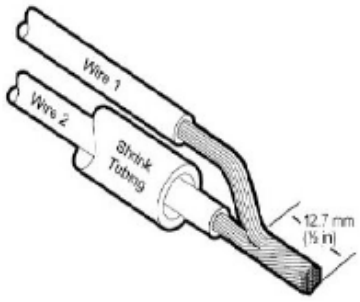
= Wire strand

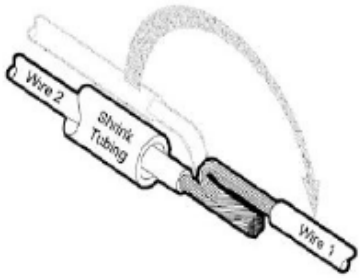
3 = Splice tape

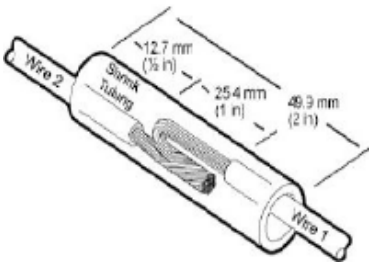
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

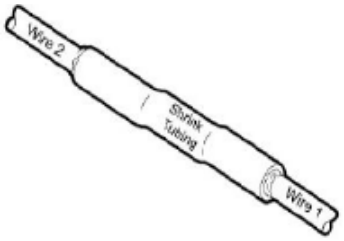
NOTE: -

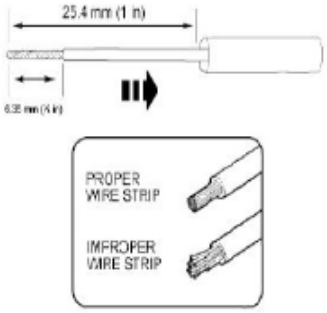
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

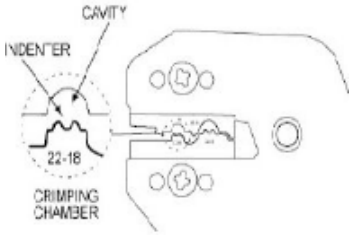
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

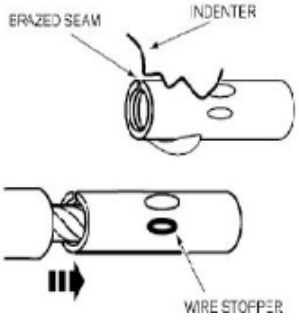
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

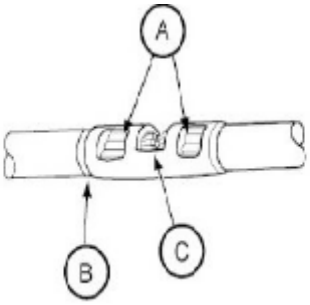
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

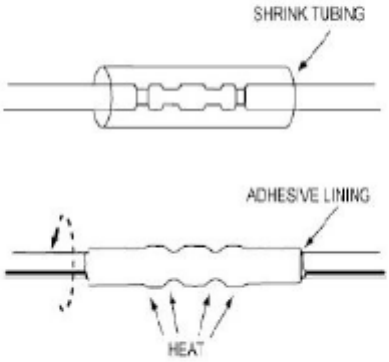
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4□ strip, cut 9 strands	* 1/4□ strip, cut 2 strands	1/4□ strip, no fold	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip, fold 2x dia.	1□ strip, fold 3x dia.
	16-14	* 1/4□ strip, cut 7 strands	1/4□ strip, no fold	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip fold 2x dia	1□ strip, fold 3x dia.	1 1/4□ strip, fold 4x dia.	Not Recommended
	12-10	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip, fold 2x dia.	1□ strip fold 3x cia.	1 1/4□ strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Figtail only

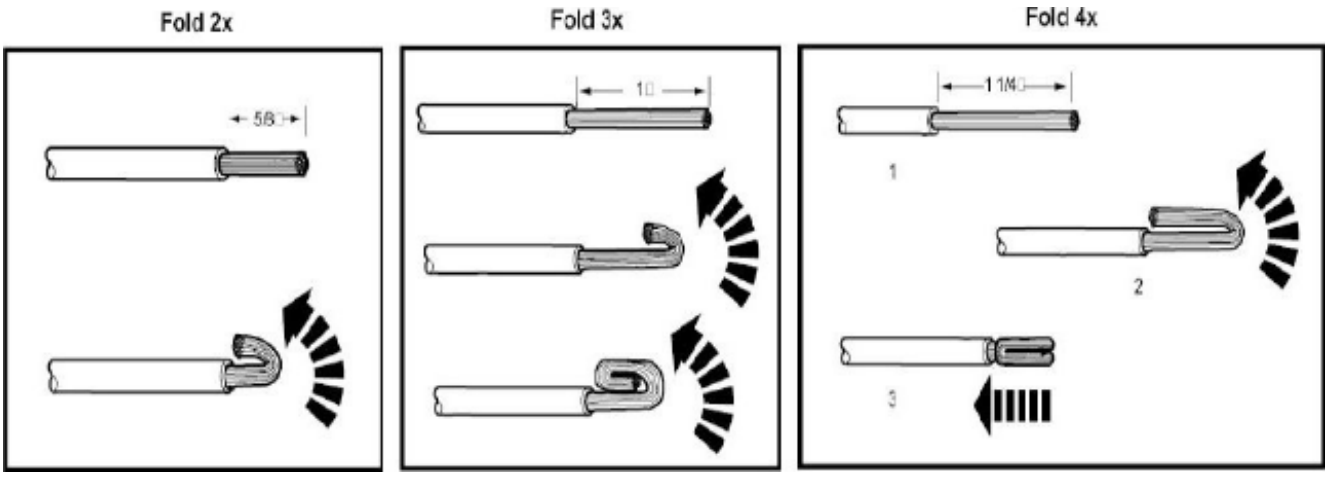
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

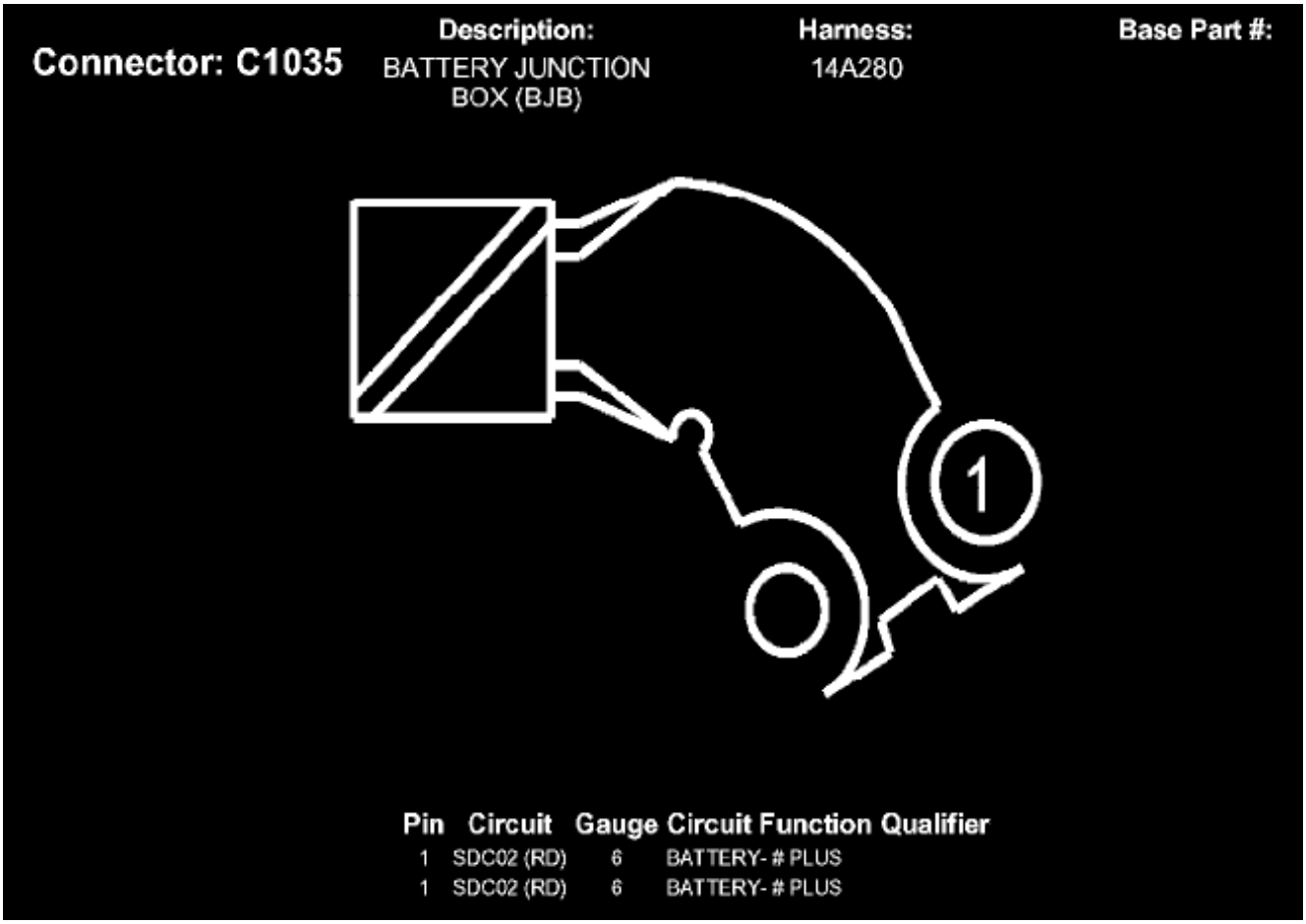
11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

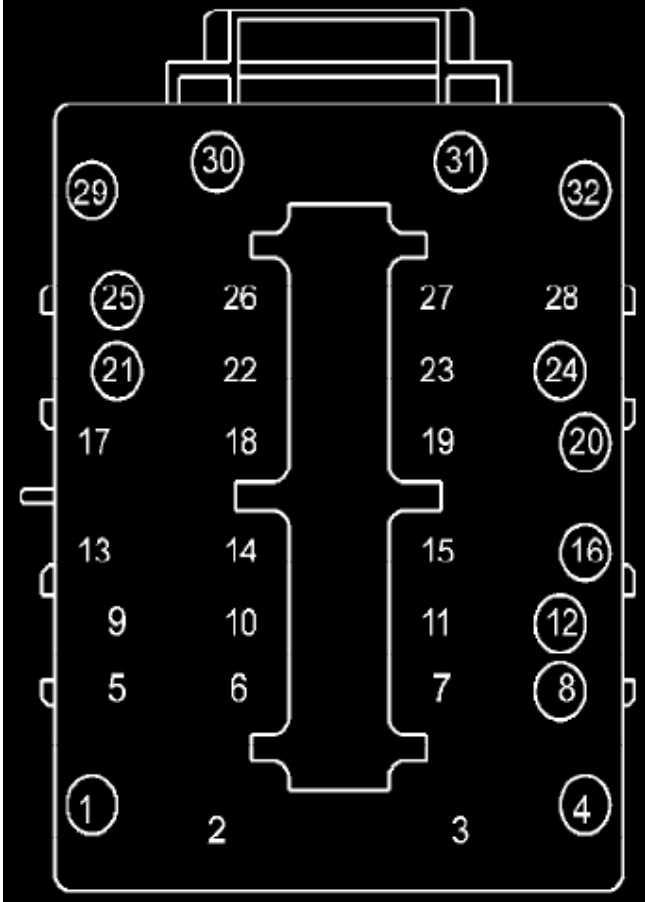


Fuse Block: Connector Views

C1035

Connector: C2280A

Description:	Harness:	Base Part #:
SMART JUNCTION BOX (SJB)	14290	14B476

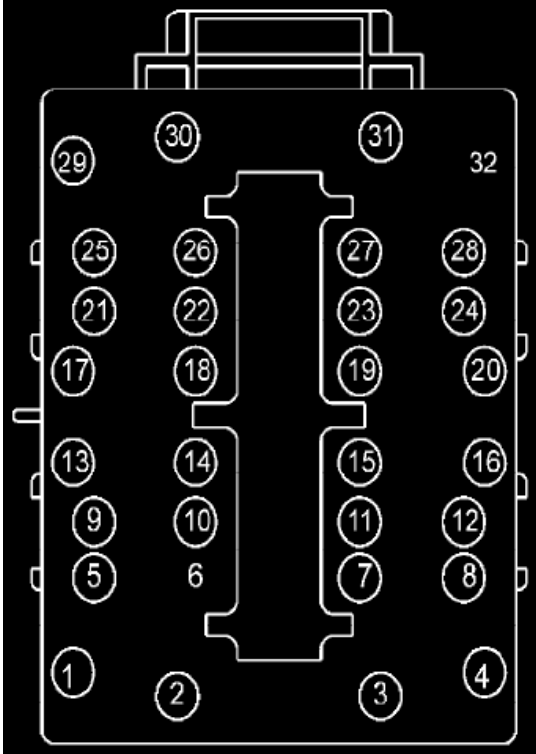


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	SBB01 (RD)	12	FUSE - 1 OR CIRCUIT BREAKER	
2	*	*	not used	
3	*	*	not used	
4	CBP05 (YE)	20	FUSE - 5 OR CIRCUIT BREAKER	
5	*	*	not used	
6	*	*	not used	
7	*	*	not used	
8	CES03 (VT-WH)	20	CTRL MOD - POWERTRAIN # SPEED CONTROL INDICATOR (SCIL)	
9	*	*	not used	
10	*	*	not used	
11	*	*	not used	
12	CLS34 (GY)	18	SWITCH - PARK LAMPS	
13	*	*	not used	
14	*	*	not used	
15	*	*	not used	
16	CBP04 (VT)	18	FUSE - 4 OR CIRCUIT BREAKER	
17	*	*	not used	
18	*	*	not used	
19	*	*	not used	
20	CBP03 (GY)	18	FUSE - 3 OR CIRCUIT BREAKER	
21	SBR14 (BN-RD)	18	FUSE - 14 OR CIRCUIT BREAKER	
22	*	*	not used	
23	*	*	not used	
24	CE517 (BU-GN)	20	DIODE - RELAY POWERTRAIN CONTROL MODULE	
25	CBP14 (VT-OG)	16	FUSE - 14 OR CIRCUIT BREAKER	
26	*	*	not used	
27	*	*	not used	
28	*	*	not used	
29	SBB03 (BU-RD)	12	FUSE - 3 OR CIRCUIT BREAKER	
30	CRH02 (BU-WH)	18	SWITCH - HORN	
31	CBP21 (BU-GY)	22	FUSE - 21 OR CIRCUIT BREAKER	
32	SBB05 (GY-RD)	10	FUSE - 5 OR CIRCUIT BREAKER	

C2280A

Connector: C2280B

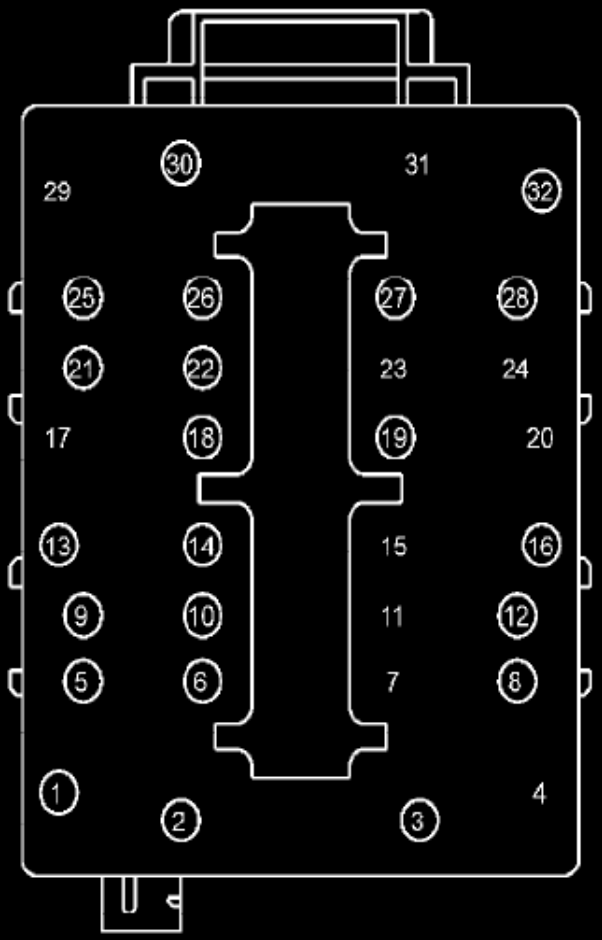
Description:	Harness:	Base Part #:
SMART JUNCTION BOX (SJB)	14401	14B476



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	SBP23 (WH-RD)	14	FUSE - 23 OR CIRCUIT BREAKER	
2	SBP24 (VT-RD)	16	FUSE - 24 OR CIRCUIT BREAKER	
3	SBP34 (YE-RD)	16	FUSE - 34 OR CIRCUIT BREAKER	
4	SBP23 (WH-RD)	14	FUSE - 23 OR CIRCUIT BREAKER	
5	CBP10 (YE-OG)	20	FUSE - 10 OR CIRCUIT BREAKER	
6	*	*	not used	
7	SBP28 (GN-RD)	18	FUSE - 28 OR CIRCUIT BREAKER	
8	SBP30 (BN-RD)	22	FUSE - 30 OR CIRCUIT BREAKER	
9	CPL19 (WH-VT)	20	RELAY - DOOR LOCK # ALL LOCK	
10	CPL18 (GY-VT)	20	RELAY - DOOR LOCK # ALL UNLOCK	
11	CDC35 (BU-WH)	14	SWITCH - IGNITION # START	
12	SBP33 (RD)	20	FUSE - 33 OR CIRCUIT BREAKER	
13	CPL11 (GY-BN)	20	CTRL MOD. - DOOR LOCK # ALL LOCK	
14	GD161 (BK-YE)	18	GROUND - SEAT BRACKET REAR LEFT	
15	CBP20 (YE-VT)	18	FUSE - 20 OR CIRCUIT BREAKER	
16	SBP29 (GY-RD)	18	FUSE - 29 OR CIRCUIT BREAKER	
17	CDC32 (BN-YE)	12	SWITCH - IGNITION # RUN	
18	CBP27 (GN-BN)	22	FUSE - 27 OR CIRCUIT BREAKER	
19	CBP20 (YE-VT)	18	FUSE - 20 OR CIRCUIT BREAKER	
20	SBP29 (GY-RD)	16	FUSE - 29 OR CIRCUIT BREAKER	
21	CBP27 (GN-BN)	22	FUSE - 27 OR CIRCUIT BREAKER	
22	CBP26 (BU-WH)	20	FUSE - 26 OR CIRCUIT BREAKER	
23	CBP20 (YE-VT)	18	FUSE - 20 OR CIRCUIT BREAKER	
24	CBP22 (GN-OG)	20	FUSE - 22 OR CIRCUIT BREAKER	
25	CLF27 (GN-BN)	14	SWITCH - FLASH TO PASS	
26	SBP17 (RD)	18	FUSE - 17 OR CIRCUIT BREAKER	
27	CBP20 (YE-VT)	20	FUSE - 20 OR CIRCUIT BREAKER	
28	SBP32 (VT-RD)	22	FUSE - 32 OR CIRCUIT BREAKER	
29	CDC34 (WH-OG)	12	SWITCH - IGNITION # RUN; START	
30	SBP12 (GN-RD)	16	FUSE - 12 OR CIRCUIT BREAKER	Audiophile sound system
30	SBP12 (GN-RD)	20	FUSE - 12 OR CIRCUIT BREAKER	without Audiophile and satellite radio
31	SBP19 (BU-RD)	16	FUSE - 19 OR CIRCUIT BREAKER	
32	*	*	not used	

C2280B (Part 1)

Connector: C2280C | **Description:** SMART JUNCTION BOX (SJB) | **Harness:** 14401 | **Base Part #:** 14B476

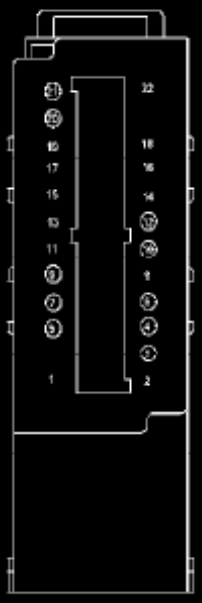


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD174 (BK-WH)	18	GROUND - TUNNEL	
2	CPL12 (VT-OG)	20	CTRL MOD. - DOOR LOCK # DOUBLE LOCK ALL LOCK	
3	CLS34 (GY)	16	SWITCH - PARK LAMPS	
4	*	*	not used	
5	CPL42 (GY-YE)	22	SWITCH - TRIM DOOR LOCK (DRIVER) # LOCK	
6	CPL26 (GN-VT)	20	SWITCH - LATCH DRIVER # AJAR	
7	*	*	not used	
8	CLN28 (GN-BU)	18	SWITCH - DOME LAMP	
9	CPL43 (VT-GY)	22	SWITCH - TRIM DOOR LOCK (DRIVER) # UNLOCK	
10	CPL42 (GY-YE)	22	SWITCH - TRIM DOOR LOCK (DRIVER) # LOCK	
11	*	*	not used	
12	CPL51 (BU-GN)	20	CTRL MOD. - DOOR LOCK # DRIVER UNLOCK	
13	CPW14 (VT-WH)	14	SWITCH - POWER WINDOW DRIVER # PASSENGER LOCK OUT (ENABLE)	
14	CPL43 (VT-GY)	22	SWITCH - TRIM DOOR LOCK (DRIVER) # UNLOCK	
15	*	*	not used	
16	CPW30 (GY-YE)	14	RELAY - POWER WINDOW	
17	*	*	not used	
18	CBP08 (GY-YE)	20	FUSE - 8 OR CIRCUIT BREAKER	
19	CE517 (BU-GN)	20	DIODE - RELAY POWERTRAIN CONTROL MODULE	
20	*	*	not used	
21	CLF29 (BN)	22	CTRL MOD. - FOG LAMPS FRONT (LEFT)	
22	CBP08 (GY-YE)	20	FUSE - 8 OR CIRCUIT BREAKER	
23	*	*	not used	
24	*	*	not used	
25	CAT17 (BN)	16	RELAY - TRAILER TOW PARK LAMPS (COLOR TO SAE 1239)	
26	CBP01 (BU)	22	FUSE - 1 OR CIRCUIT BREAKER	
27	CBP06 (WH-BU)	20	FUSE - 6 OR CIRCUIT BREAKER	
28	CBP09 (VT-GY)	20	FUSE - 9 OR CIRCUIT BREAKER	
29	*	*	not used	
30	CLF16 (BU-WH)	16	SWITCH - BEAM LOW	
31	*	*	not used	
32	CDC33 (VT-GN)	12	SWITCH - IGNITION # RUN: ACCESSORY	

C2280B (Part 2)

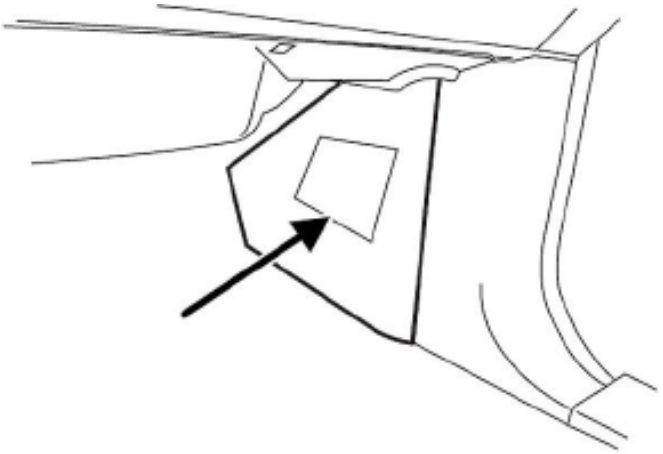
C2280C

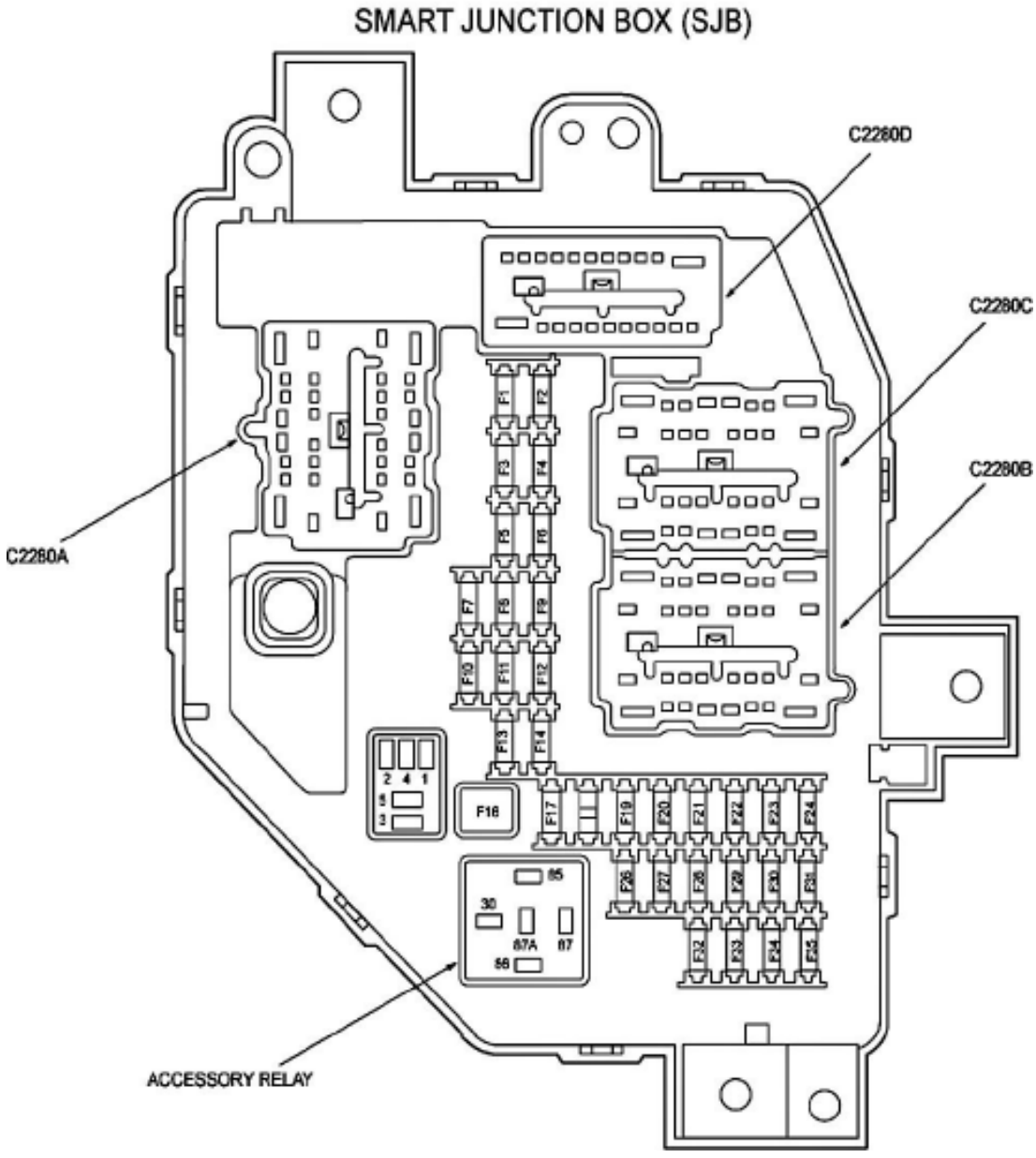
Connector: C2280D	Description:	Harness:	Base Part #:
	SMART JUNCTION BOX (SJB)	14401	14B476



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	*	*	not used	
3	CPL31 (WH)	20	SWITCH - LATCH PASSENGER # AJAR	
4	CPL36 (GN)	20	SWITCH - LATCH REAR DRIVER SIDE # AJAR (INCL.SLIDING DOOR)	
5	CLS30 (VT-WH)	18	RELAY - PARK LAMP	
6	CPL39 (YE)	20	SWITCH - LATCH REAR PASSENGER SIDE # AJAR (INCL.SLIDING DOOR)	
7	CCB15 (BN-GN)	22	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL CLOSED	
8	*	*	not used	
9	CLF21 (GY-VT)	18	SWITCH - FOG LAMPS FRONT	
10	CLN27 (WH-BN)	18	CTRL MOD. - DIMMER INSTRUMENT	
11	*	*	not used	
12	SRH01 (YE-RD)	20	RELAY - HORN	
13	*	*	not used	
14	*	*	not used	
15	*	*	not used	
16	*	*	not used	
17	*	*	not used	
18	*	*	not used	
19	*	*	not used	
20	VDB04 (WH-BU)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED HIGH	
21	VDB05 (WH)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED LOW	
22	*	*	not used	

C2280D

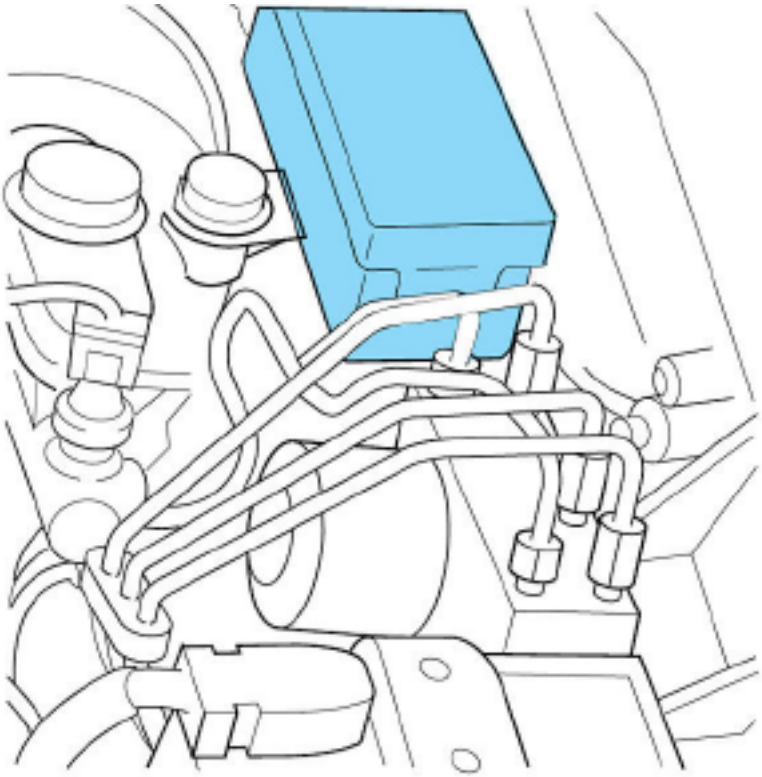



SMART JUNCTION BOX (SJB)
C2280D
C2280C
C2280B
C2280A
F1
F2
F3
F4
F5
F6
F7
F8
F9
F10
F11
F12
F13
F14
F16
F17
F19
F20
F21
F22
F23
F24
F26
F27
F28
F29
F30
F31
F32
F33
F34
F35
2 4 1
3
85
30
87A
87
86
ACCESSORY RELAY

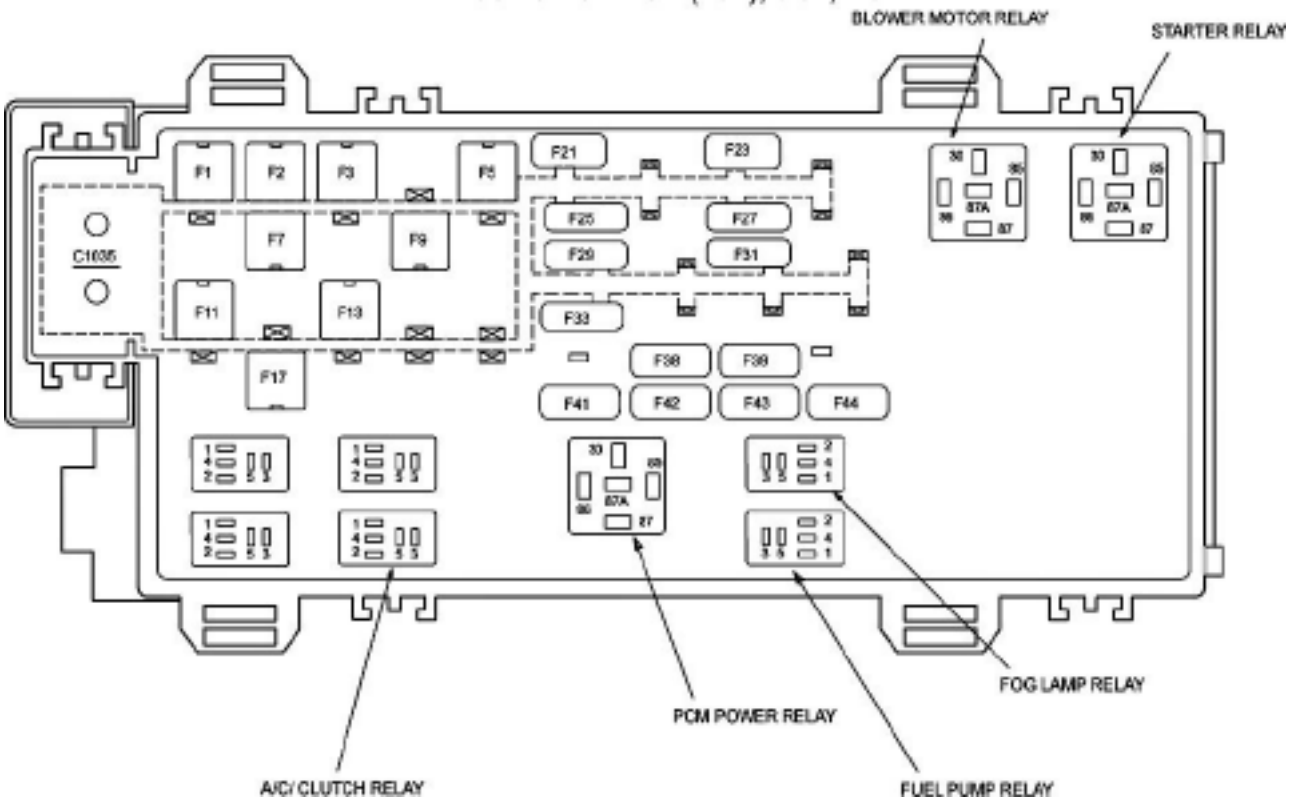
Fuse Block: Application and ID Smart Junction Box

FUSE	AMPS	Circuits Protected
F1	5A	Illumination dimmer
F2	10A	Trailer tow connector - Park
F3	10A	Headlamp, right (Low beam lamp feed)
F4	10A	Headlamp, left (Low beam lamp feed)
F5	5A	Windshield wiper module
F6	10A	Audio unit, Door lock switch illumination
F7	5A	Not Used
F8	10A	Restraints Control Module (RCM), Occupant Classification System Module (OCSM), Passenger Air bag Deactivation (PAD) Indicator
F9	5A	Instrument Cluster (IC), Air bag indicator
F10	10A	4X4 control module, Instrument Cluster (IC)
F11	10A	Smart Junction Box (SJB), logic power
F12	15A	Subwoofer amplifier with audiophile, Satellite radio receiver
F13	15A	Interior lamp relay, Horn relay
F14	15A	High beam lamp feed to High beam indicator, Headlamp, right, Headlamp, left
F16	30A	Accessory relay (Power windows)
F17	15A	Indicator flasher relay
F18	-	Not Used

FUSE	AMPS	Circuits Protected
F19	20A	Brake pedal position switch (Stoplamps)
F20	10A	Transmission control switch, Digital Transmission Range (TR) sensor, Speed control servo, Anti-lock Brake System (ABS) module, Indicator flasher relay, Reversing lamps switch, Speed control On/Off switch, Speed control Set/Resume switch
F21	5A	Digital Transmission Range (TR) sensor, Starter relay, Powertrain Control Module (PCM)
F22	5A	Audio unit
F23	30A	Main light switch, Multifunction switch
F24	20A	Audio unit
F26	2A	Deactivator switch
F27	10A	Blend door actuator, Climate control assembly
F28	15A	4X4 control module
F29	20A	Cigar lighter, front, Data Link Connector (DLC)
F30	5A	Exterior rear view mirror switch
F31	20A	Park lamp relay
F32	5A	Brake pedal position switch (logic power), Brake shift interlock
F33	5A	Instrument Cluster (IC), Neutral tow indicator
F34	20A	Power point
F35	15A	Door lock/unlock relay, Driver door unlock relay



BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L



Fuse Block: Application and ID Battery Junction Box

FUSE	AMPS	Circuits Protected
F1	40A	Smart Junction Box (SJB)
F2	-	Not Used
F3	40A	Smart Junction Box (SJB)
F4	-	Not Used
F5	50A	Smart Junction Box (SJB)
F6	-	Not Used
F7	30A	Starter Relay
F8	-	Not Used
F9	40A	Ignition Switch
F10	-	Not Used
F11	30A	PCM power relay
F12	-	Not Used
F13	30A	Blower motor relay
F14	-	Not Used
F15	-	Not Used
F16	-	Not Used
F17	40A	Anti-lock Brake System (ABS) module
F18	-	Not Used
F19	-	Not Used
F20	-	Not Used
F21	10A	Powertrain Control Module (PCM), Evaporative emission (EVAP) canister vent valve
F22	-	Not Used
F23	30A	Fuel Pump Relay, Fuel injectors
F24	-	Not Used

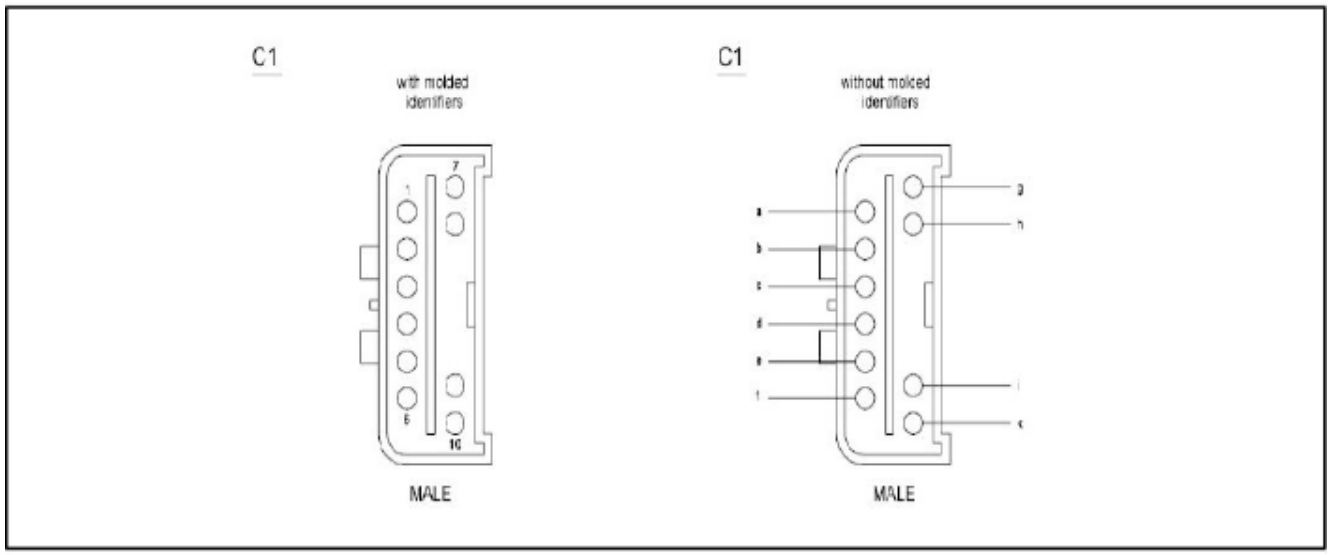
FUSE	AMPS	Circuits Protected
F25	10A	A/C clutch relay
F26	-	Not Used
F27	20A	4X4 control module
F28	-	Not Used
F29	30A	Windshield wipers/washer
F30	-	Not Used
F31	15A	Fog lamp relay
F32	-	Not Used
F33	30A	Anti-lock Brake System (ABS) module
F34	-	Not Used
F35	-	Not Used
F36	-	Not Used
F37	-	Not Used
F38	7.5A	Trailer tow connector - Right turn
F39	15A	Powertrain Control Module (PCM)
F40	-	Not Used
F41	10A	*5R44E Transmission **5R55E Transmission
F42	7.5A	Trailer tow connector - Left turn
F43	20A	EVAP canister purge valve, Heated Positive Crankcase Ventilation (PCV) valve, Idle Air Control (IAC) valve, Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor, Heated Oxygen Sensor (HO2S) #11, Heated Oxygen Sensor (HO2S) #12, Heated Oxygen Sensor (HO2S) #21, Heated Oxygen Sensor (HO2S) #22, EGR vacuum regulator solenoid valve, A/C relay coil
F44	15A	Ignition coil, *Ignition transformer capacitor 1

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



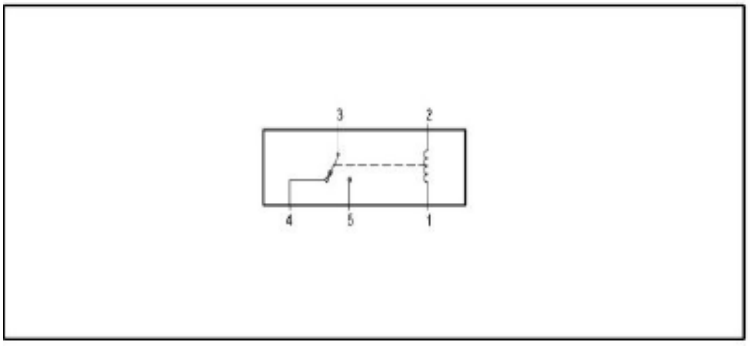
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

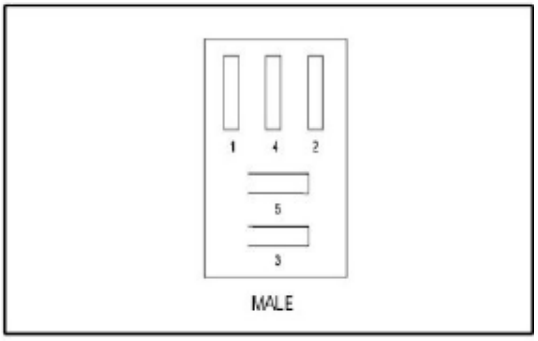
Micro ISO Relay: Testing and Inspection

Relay □ Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63□102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil □ Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

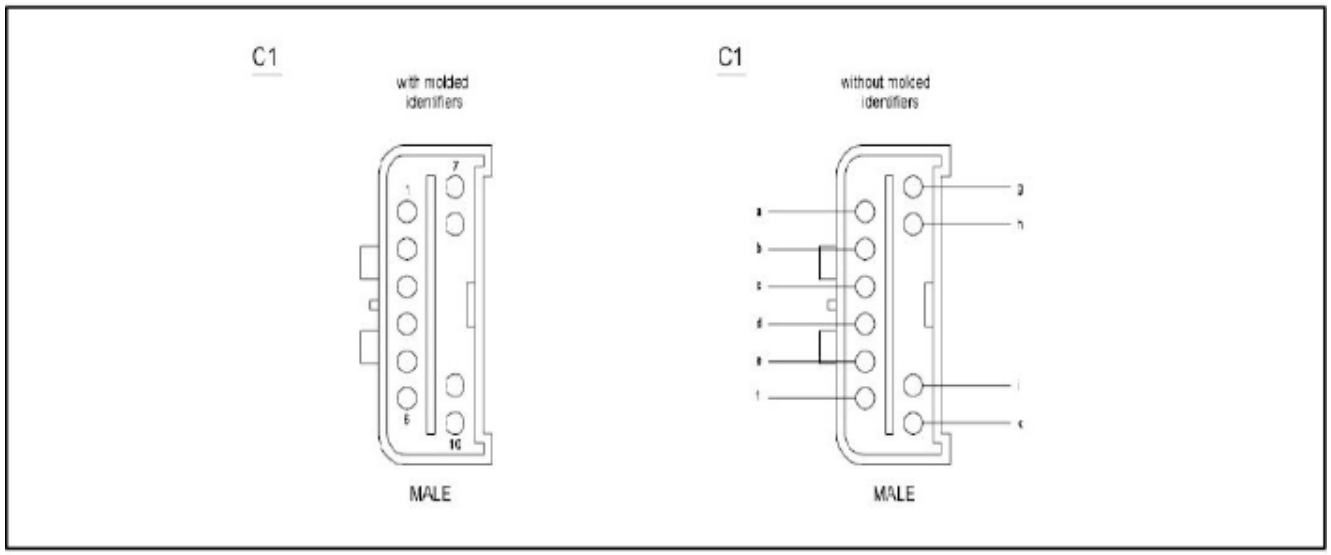
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



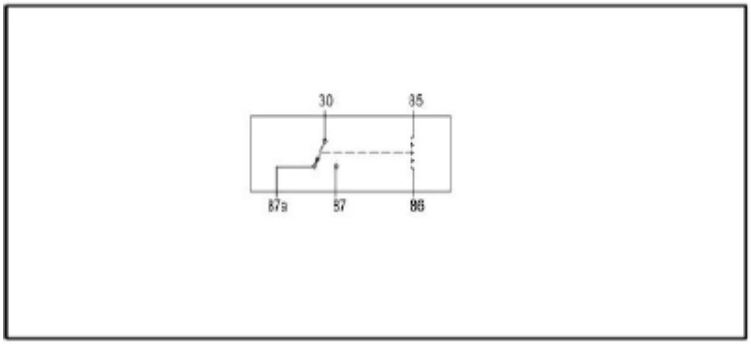
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

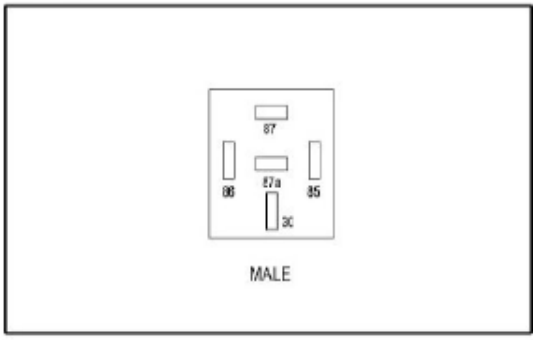
Mini ISO Relay: Testing and Inspection

Relay □ Mini ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 □ 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

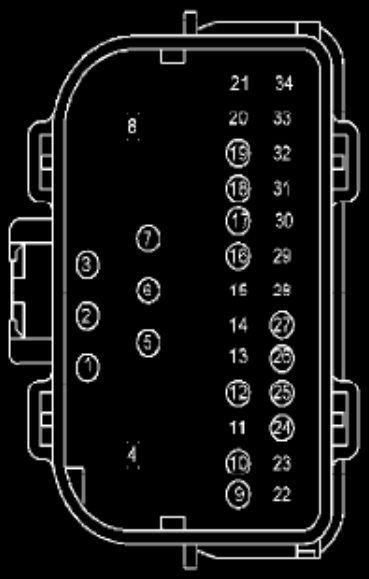
Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

Inline: C110

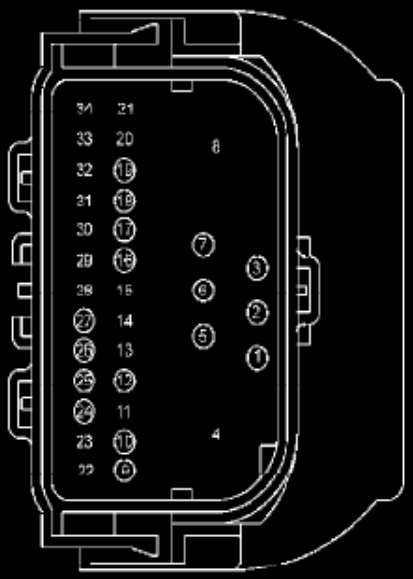
Description: Inline

Base Part #:

MALE
Harness: 14290



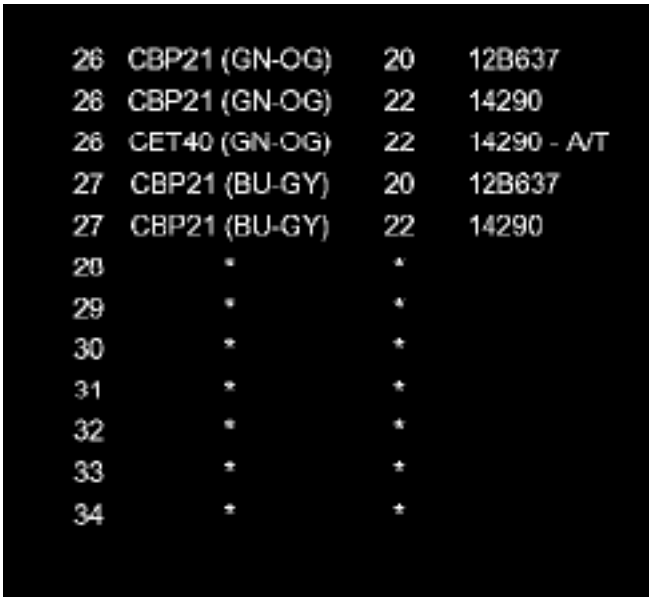
FEMALE
Harness: 12B637



Pin	Circuit	Gauge	Qualifier
1	CE132 (BN-YE)	18	
2	CDB08 (BN)	20	12B637
2	CDB08 (BN)	22	14290
3	CET34 (BN-GN)	20	
4	*	*	
5	CF904 (GN-VT)	22	
6	CDC36 (GN-BN)	22	
7	VH101 (WH-VT)	20	
8	*	*	
9	VE225 (YE-OG)	20	12B637
9	VE225 (YE-OG)	22	14290
10	CH302 (WH-BN)	20	12B637
10	CH302 (WH-BN)	22	14290
11	*	*	
12	CH425 (GN-BU)	20	
13	*	*	
14	*	*	
15	*	*	
16	SBB21 (GY-RD)	20	
17	VDB04 (WH-BU)	20	
18	VDB05 (WH)	20	
19	CCB15 (BN-GN)	20	
20	*	*	
21	*	*	
22	*	*	
23	*	*	
24	CBP20 (YE-VT)	18	
25	CCP20 (GY-VT)	22	
26	CBP21 (BU-GY)	20	12B637 - M/T
26	CBP21 (BU-GY)	22	14290

Multiple Junction Connector: Diagrams C110

C110 (Part 1)



26	CBP21 (GN-OG)	20	12B637
26	CBP21 (GN-OG)	22	14290
26	CET40 (GN-OG)	22	14290 - A/T
27	CBP21 (BU-GY)	20	12B637
27	CBP21 (BU-GY)	22	14290
28	*	*	
29	*	*	
30	*	*	
31	*	*	
32	*	*	
33	*	*	
34	*	*	

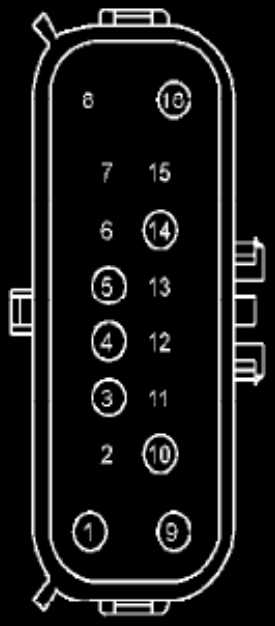
C110 (Part 2)

Inline: C133

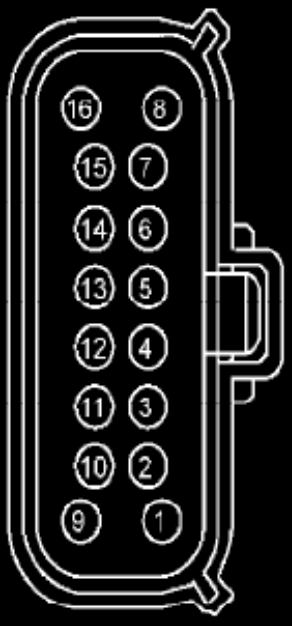
Description:
Inline

Base Part #:

MALE
Harness: 12B637



FEMALE
Harness: 14290



Pin	Circuit	Gauge	Qualifier
1	CBB44 (VT)	16	
2	*	*	
3	CBB39 (VT-WH)	18	
4	VMC05 (VT-OG)	20	
5	CMC24 (GY)	16	12B637 - 3.0L
5	CMC24 (GY)	22	14290 - 3.0L
6	*	*	
7	*	*	
8	*	*	
9	VE518 (BN-WH)	14	14290
9	VE518 (BN-WH)	16	12B637 - 3.0L
10	CBB41 (BU)	18	
11	*	*	
12	*	*	14290
12	GD108 (BK-VT)	16	12B637
13	*	*	
14	CDC12 (YE)	20	12B637
14	CDC12 (YE)	22	14290
15	*	*	
16	CBB43 (GY)	16	

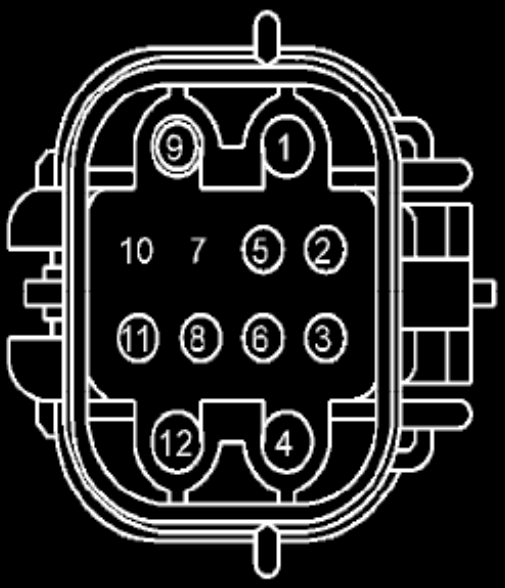
C133

Inline: C139

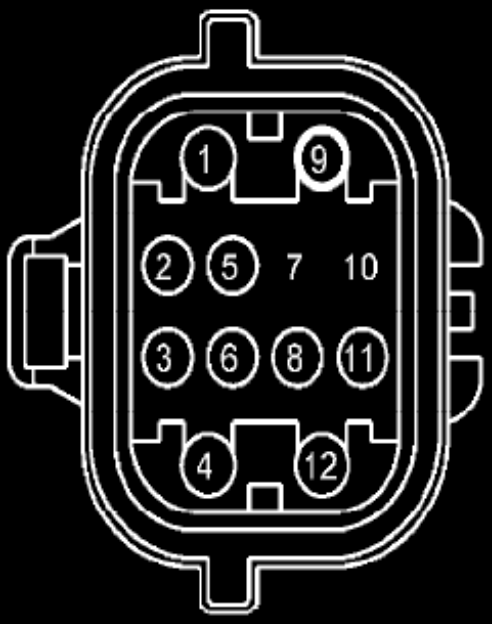
Description:
Inline

Base Part #:

MALE
Harness: 14290



FEMALE
Harness: 14A280



Pin	Circuit	Gauge	Qualifier
1	*	*	
2	CH423 (YE)	20	
3	GD121 (BK-GY)	20	14A280
3	GD121 (BK-YE)	20	14290
4	*	*	
5	CH443 (GN-OG)	20	14A280
5	CH443 (GN-OG)	22	14290
6	CH401 (VT-WH)	20	
7	*	*	
8	CMC24 (GY)	16	14A280 - 2.3L/4.0L
8	CMC24 (GY)	22	14290 - 2.3L/4.0L
9	CDC25 (BN-GN)	12	
10	*	*	
11	VDC42 (GN)	22	14290
11	VDC42 (GY)	20	14A280
12	*	*	

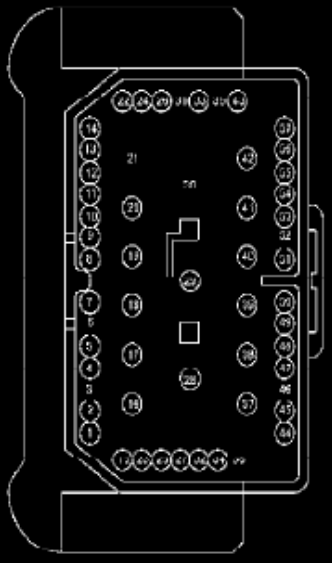
C139

Inline: C144

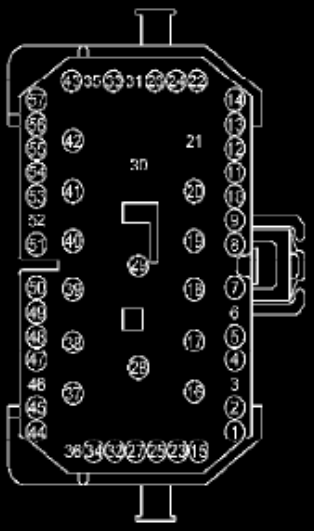
Description:
Inline

Base Part #:

MALE
Harness: 14401



FEMALE
Harness: 14290



Pin	Circuit	Gauge	Qualifier
1	CBP20 (YE-VT)	18	14401
1	CBP20 (YE-VT)	20	14290
2	VES10 (WH)	20	
3	*	*	
4	SBR14 (BN-RD)	18	14290
4	SBR14 (BN-RD)	20	14401
5	CCF20 (GY-VT)	20	14401
5	CCF20 (GY-VT)	22	14290
6	*	*	
7	CDC36 (GN-BN)	22	
8	CLS41 (GY-YE)	18	
9	CLS39 (VT-WH)	18	
10	CLS36 (YE)	18	
11	CLS35 (VT)	18	
12	CLS41 (GY-YE)	18	
13	CLS39 (VT-WH)	18	
14	CCB15 (BN-GN)	20	14290
14	CCB15 (BN-GN)	22	14401
15	CDB08 (BN)	22	
16	CBP20 (YE-VT)	18	
17	CAT06 (YE)	16	
17	CAT09 (YE)	16	
18	SBB27 (BU-RD)	16	
19	CAT09 (GN)	16	
20	CH435 (VT-GY)	22	
21	*	*	
22	VCA14 (WH-BN)	20	
23	VR214 (WH-BU)	20	
24	RCA21 (BN-GN)	20	
25	RR130 (GN-BU)	20	

Multiple Junction Connector: Diagrams C144

C144 (Part 1)

26	VDC42 (GN)	22	
27	VR213 (VT-GN)	20	
28	SBB09 (RD)	12	
29	GD121 (BK-YE)	10	
30	*	*	
31	*	*	
32	RR129 (YE-GY)	20	
33	CLF29 (BN)	20	14290
33	CLF29 (BN)	22	14401
34	CMC24 (GY)	22	
35	*	*	
36	*	*	
37	CET34 (BN-GN)	20	
38	CE904 (GN-VT)	22	
39	CRW19 (BU-OG)	20	
40	CRW18 (VT-WH)	20	
41	CH443 (GN-OG)	22	
42	CRW15 (BN-WH)	20	
43	CRW17 (GN-VT)	20	
44	CRW07 (GY-BN)	20	
45	VDB10 (GY)	20	14290
45	VDB10 (GY)	22	14401
46	*	*	
47	VDB04 (WH-BU)	20	
48	VDB05 (WH)	20	
49	GD174 (BK-WH)	20	
50	CES09 (VT-OG)	20	
51	CBP20 (YE-VT)	20	
52	*	*	
53	RES08 (GN-BN)	20	
54	CCB15 (BN-GN)	22	
55	CCA02 (GN-VT)	22	
56	CCA01 (BU-OG)	22	
57	CCF23 (GN-VT)	18	14290
57	CCF23 (GN-VT)	22	14401

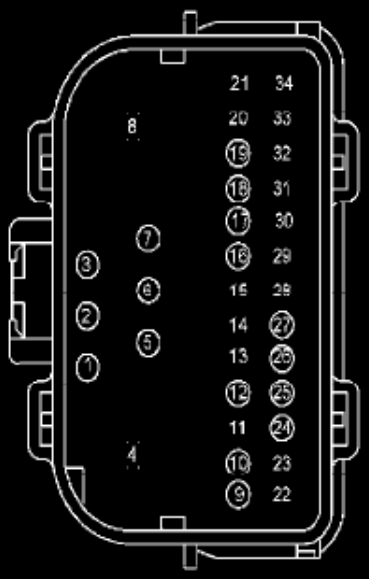
C144 (Part 2)

Inline: C110

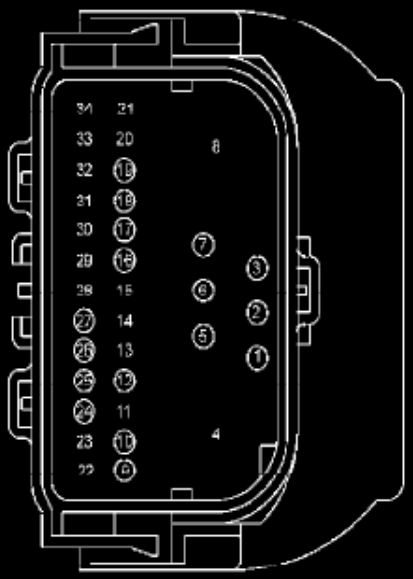
Description:
Inline

Base Part #:

MALE
Harness: 14290



FEMALE
Harness: 12B637



Pin	Circuit	Gauge	Qualifier
1	CE132 (BN-YE)	18	
2	CDB08 (BN)	20	12B637
2	CDB08 (BN)	22	14290
3	CET34 (BN-GN)	20	
4	*	*	
5	CF904 (GN-VT)	22	
6	CDC36 (GN-BN)	22	
7	VH101 (WH-VT)	20	
8	*	*	
9	VE225 (YE-OG)	20	12B637
9	VE225 (YE-OG)	22	14290
10	CH302 (WH-BN)	20	12B637
10	CH302 (WH-BN)	22	14290
11	*	*	
12	CH425 (GN-BU)	20	
13	*	*	
14	*	*	
15	*	*	
16	SBB21 (GY-RD)	20	
17	VDB04 (WH-BU)	20	
18	VDB05 (WH)	20	
19	CCB15 (BN-GN)	20	
20	*	*	
21	*	*	
22	*	*	
23	*	*	
24	CBP20 (YE-VT)	18	
25	CCP20 (GY-VT)	22	
26	CBP21 (BU-GY)	20	12B637 - M/T
26	CBP21 (BU-GY)	22	14290

Multiple Junction Connector: Diagrams

C110 (Part 1)

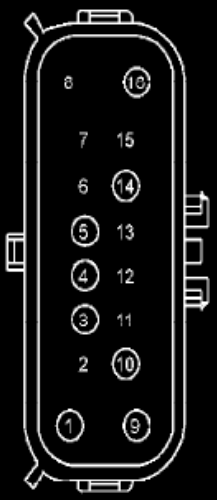
26	CBP21 (GN-OG)	20	12B637
26	CBP21 (GN-OG)	22	14290
26	CET40 (GN-OG)	22	14290 - A/T
27	CBP21 (BU-GY)	20	12B637
27	CBP21 (BU-GY)	22	14290
28	*	*	
29	*	*	
30	*	*	
31	*	*	
32	*	*	
33	*	*	
34	*	*	

Inline: C133

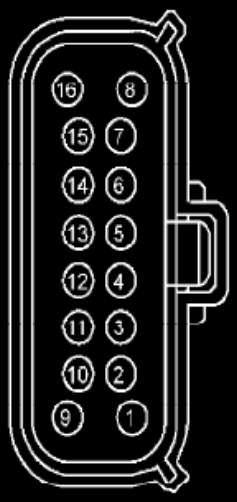
Description:
Inline

Base Part #:

MALE
Harness: 12B637



FEMALE
Harness: 14290



Pin	Circuit	Gauge	Qualifier
1	CBB44 (VT)	16	
2	*	*	
3	CBB39 (VT-WH)	18	
4	VMC05 (VT-OG)	20	
5	CMC24 (GY)	16	12B637 - 3.0L
5	CMC24 (GY)	22	14290 - 3.0L
6	*	*	
7	*	*	
8	*	*	
9	VE518 (BN-WH)	14	14290
9	VE518 (BN-WH)	16	12B637 - 3.0L
10	CBB41 (BU)	18	
11	*	*	
12	*	*	14290
12	GD108 (BK-VT)	16	12B637
13	*	*	
14	CDC12 (YE)	20	12B637
14	CDC12 (YE)	22	14290
15	*	*	
16	CBB43 (GY)	16	

C110 (Part 2)

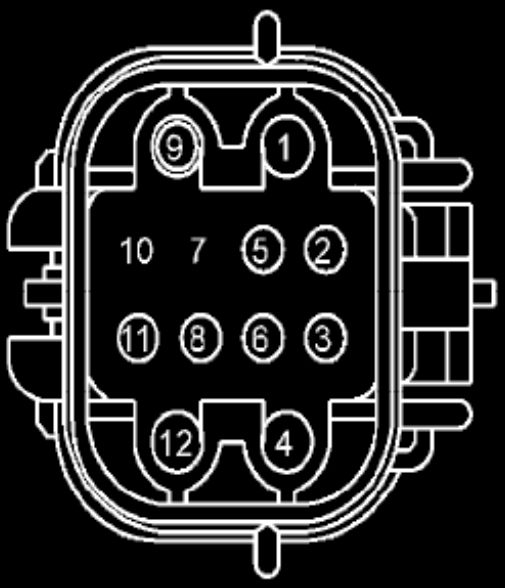
C133

Inline: C139

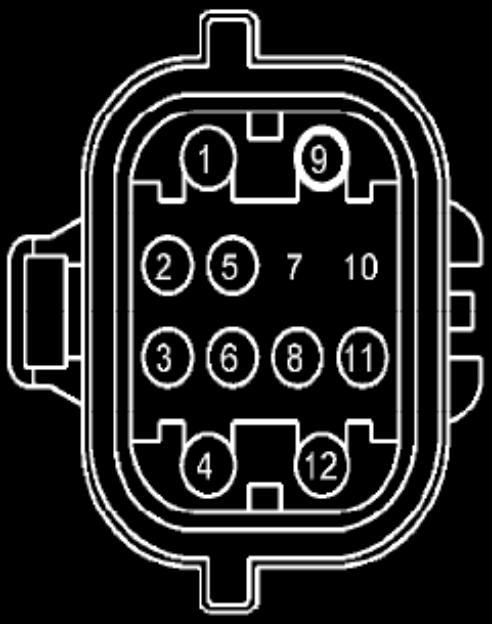
Description:
Inline

Base Part #:

MALE
Harness: 14290



FEMALE
Harness: 14A280



Pin	Circuit	Gauge	Qualifier
1	*	*	
2	CH423 (YE)	20	
3	GD121 (BK-GY)	20	14A280
3	GD121 (BK-YE)	20	14290
4	*	*	
5	CH443 (GN-OG)	20	14A280
5	CH443 (GN-OG)	22	14290
6	CH401 (VT-WH)	20	
7	*	*	
8	CMC24 (GY)	16	14A280 - 2.3L/4.0L
8	CMC24 (GY)	22	14290 - 2.3L/4.0L
9	CDC25 (BN-GN)	12	
10	*	*	
11	VDC42 (GN)	22	14290
11	VDC42 (GY)	20	14A280
12	*	*	

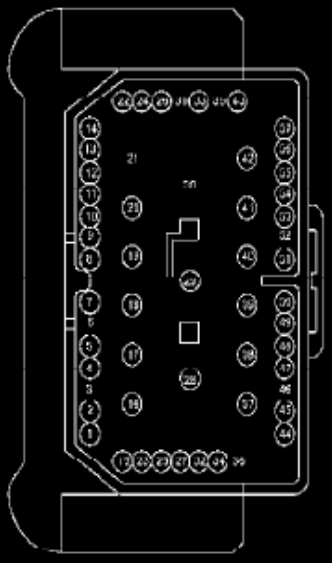
C139

Inline: C144

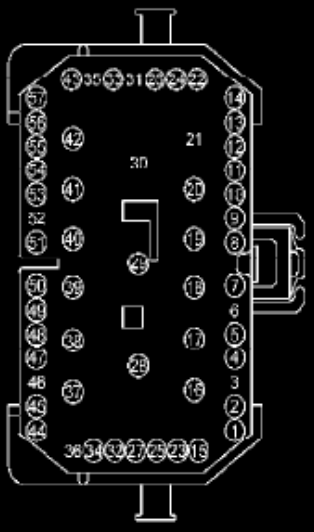
Description:
Inline

Base Part #:

MALE
Harness: 14401



FEMALE
Harness: 14290



Pin	Circuit	Gauge	Qualifier
1	CBP20 (YE-VT)	18	14401
1	CBP20 (YE-VT)	20	14290
2	VES10 (WH)	20	
3	*	*	
4	SBR14 (BN-RD)	18	14290
4	SBR14 (BN-RD)	20	14401
5	CCF20 (GY-VT)	20	14401
5	CCF20 (GY-VT)	22	14290
6	*	*	
7	CDC36 (GN-BN)	22	
8	CLS41 (GY-YE)	18	
9	CLS39 (VT-WH)	18	
10	CLS36 (YE)	18	
11	CLS35 (VT)	18	
12	CLS41 (GY-YE)	18	
13	CLS39 (VT-WH)	18	
14	CCB15 (BN-GN)	20	14290
14	CCB15 (BN-GN)	22	14401
15	CDB08 (BN)	22	
16	CBP20 (YE-VT)	18	
17	CAT06 (YE)	16	
17	CAT09 (YE)	16	
18	SBB27 (BU-RD)	16	
19	CAT09 (GN)	16	
20	CH435 (VT-GY)	22	
21	*	*	
22	VCA14 (WH-BN)	20	
23	VR214 (WH-BU)	20	
24	RCA21 (BN-GN)	20	
25	RR130 (GN-BU)	20	

C144 (Part 1)

26	VDC42 (GN)	22	
27	VR213 (VT-GN)	20	
28	SBB09 (RD)	12	
29	GD121 (BK-YE)	10	
30	*	*	
31	*	*	
32	RR129 (YE-GY)	20	
33	CLF29 (BN)	20	14290
33	CLF29 (BN)	22	14401
34	CMC24 (GY)	22	
35	*	*	
36	*	*	
37	CET34 (BN-GN)	20	
38	CE904 (GN-VT)	22	
39	CRW19 (BU-OG)	20	
40	CRW18 (VT-WH)	20	
41	CH443 (GN-OG)	22	
42	CRW15 (BN-WH)	20	
43	CRW17 (GN-VT)	20	
44	CRW07 (GY-BN)	20	
45	VDB10 (GY)	20	14290
45	VDB10 (GY)	22	14401
46	*	*	
47	VDB04 (WH-BU)	20	
48	VDB05 (WH)	20	
49	GD174 (BK-WH)	20	
50	CES09 (VT-OG)	20	
51	CBP20 (YE-VT)	20	
52	*	*	
53	RES08 (GN-BN)	20	
54	CCB15 (BN-GN)	22	
55	CCA02 (GN-VT)	22	
56	CCA01 (BU-OG)	22	
57	CCF23 (GN-VT)	18	14290
57	CCF23 (GN-VT)	22	14401

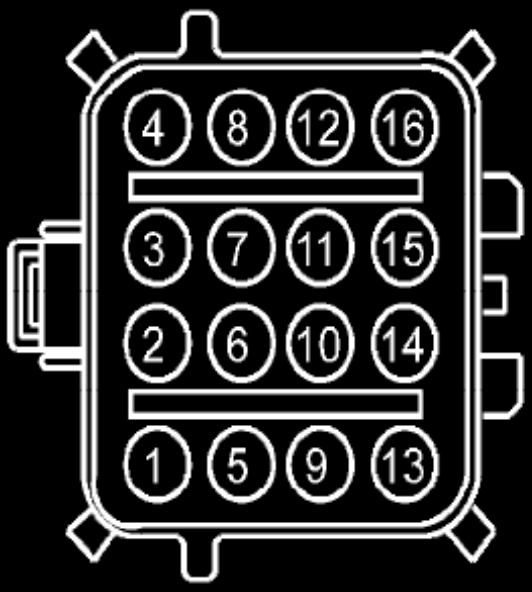
C144 (Part 2)

Inline: C210

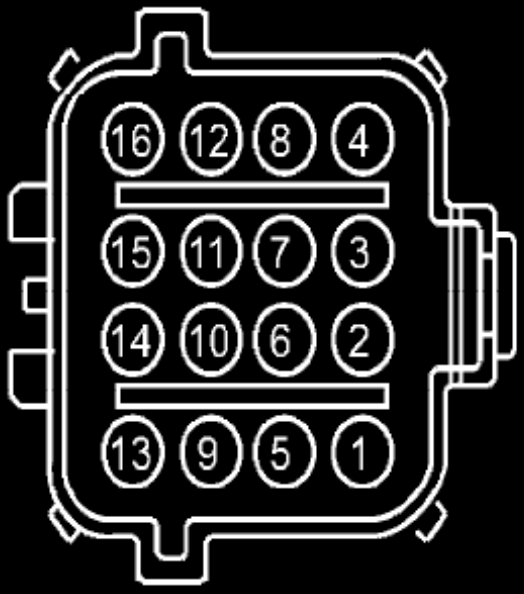
Description:
Inline

Base Part #:

MALE
Harness: 14631

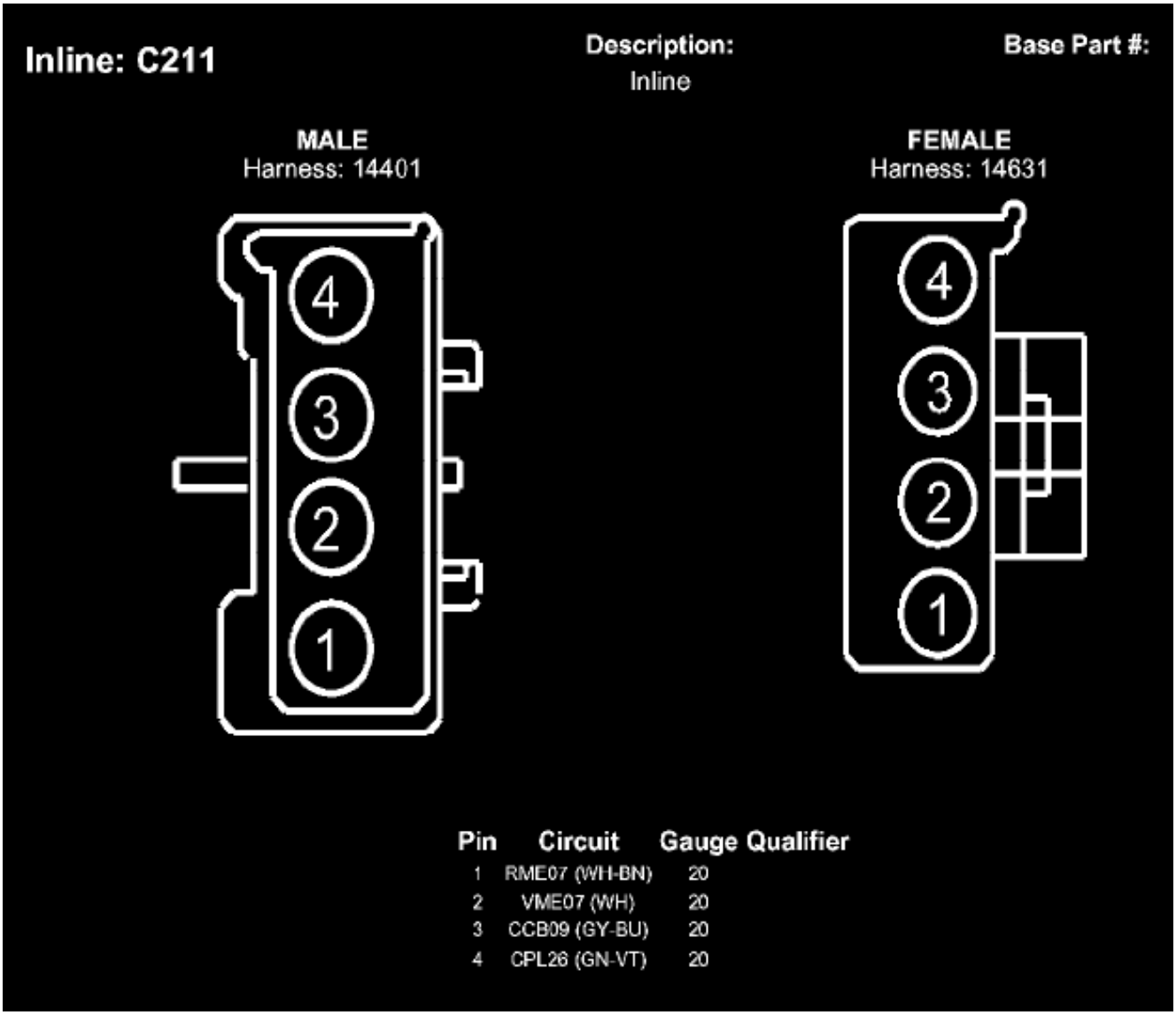


FEMALE
Harness: 14401



Pin	Circuit	Gauge	Qualifier
1	SBP30 (BN-RD)	22	
2	CPL51 (BU-GN)	18	14631
2	CPL51 (BU-GN)	22	14401
3	CPW12 (GN-OG)	14	
4	*	*	
5	CPL42 (GY-YE)	20	14631
5	CPL42 (GY-YE)	22	14401
6	CPL43 (VT-GY)	20	14631
6	CPL43 (VT-GY)	22	14401
7	CPW30 (GY-YE)	14	
8	CPL11 (GY-BN)	18	
9	*	*	
10	CBP06 (WH-BU)	20	14631
10	CBP06 (WH-BU)	20	14401
11	CPW13 (BN-YE)	14	
12	*	*	
13	CPM15 (VT-OG)	22	
14	CPM17 (BU-GN)	22	
15	*	*	
16	CPM23 (GY)	22	

C210


Inline: C211
Description:
Inline
Base Part #:
MALE
Harness: 14401
FEMALE
Harness: 14631
4
3
2
1
4
3
2
1
Pin Circuit Gauge Qualifier
1 RME07 (WH-BN) 20
2 VME07 (WH) 20
3 CCB09 (GY-BU) 20
4 CPL26 (GN-VT) 20

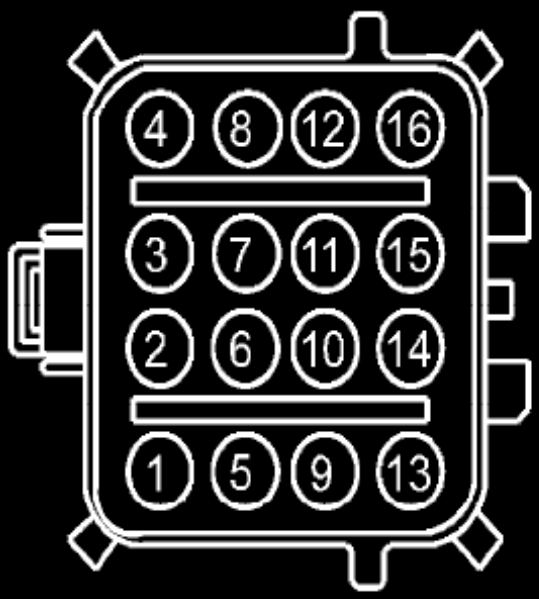
C211

Inline: C213

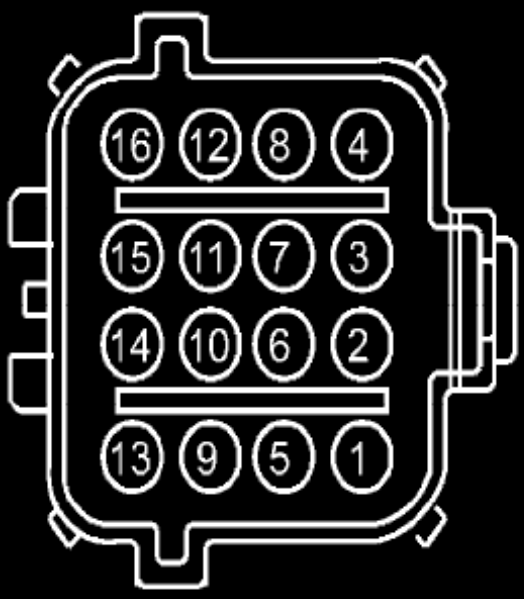
Description:
Inline

Base Part #:

MALE
Harness: 14401



FEMALE
Harness: 14630



Pin	Circuit	Gauge	Qualifier
1	CPW13 (BN-YE)	14	
2	CPM17 (BU-GN)	22	
3	CPL18 (GY-VT)	20	
4	*	*	
5	CPW12 (GN-OG)	14	
6	CPL43 (VT-GY)	20	14630
6	CPL43 (VT-GY)	22	14401
7	RME10 (WH-OG)	20	
8	VME10 (WH-VT)	20	
9	CPM23 (GY)	22	
10	CPL42 (GY-YE)	20	14630
10	CPL42 (GY-YE)	22	14401
11	CPM15 (VT-OG)	22	
12	CPW14 (VT-WH)	14	
13	CBP06 (WH-BU)	20	
14	CPL19 (WH-VT)	20	
15	CPL31 (WH)	20	
16	GD161 (BK-YE)	20	14630
16	GD161 (BK-YE)	22	14401

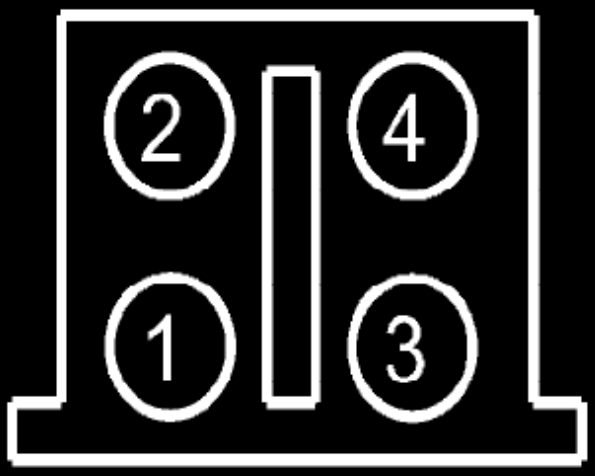
C213

Inline: C237

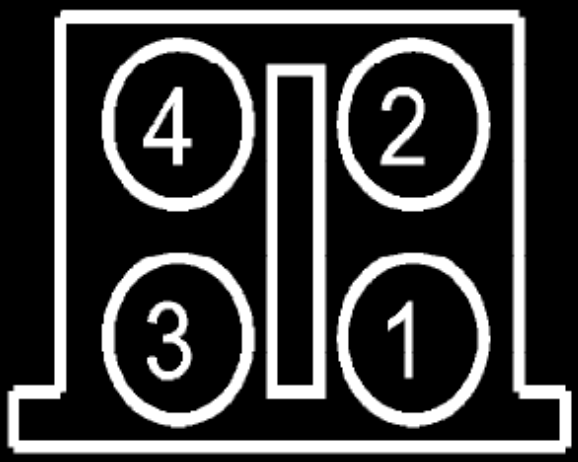
Description:
Inline

Base Part #:

MALE
Harness: 14290



FEMALE
Harness: 14401



Pin	Circuit	Gauge	Qualifier
1	CH428 (GN-WH)	14	14290
1	CH428 (GN-WH)	16	14401
2	CH429 (GY-BN)	14	14290
2	CH429 (GY-BN)	16	14401
3	CE911 (VT-WH)	14	
4	CH430 (VT-OG)	10	

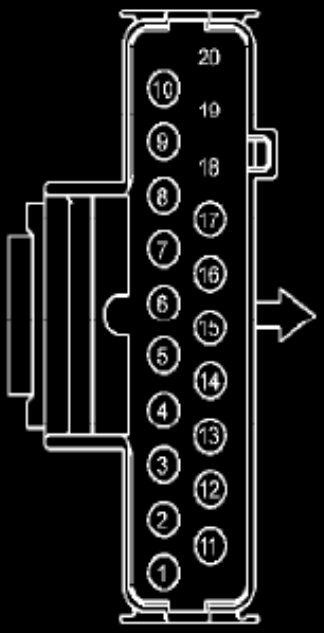
C237

Inline: C238

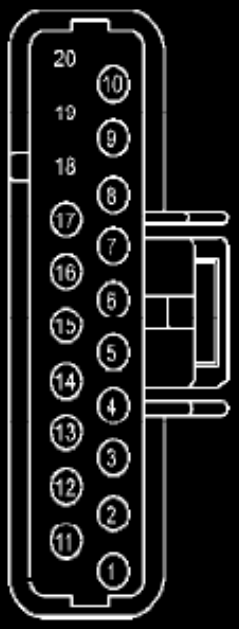
Description:
Inline

Base Part #:

MALE
Harness: 14A320



FEMALE
Harness: 14401



Pin	Circuit	Gauge Qualifier
1	CRW15 (BN-WH)	20
2	CRW07 (GY-BN)	20
3	GD161 (BK-YE)	18
4	CLS39 (VT-WH)	22
5	CLF18 (BU-WH)	16
6	CLS24 (BN-WH)	16
7	CLS32 (BN-YE)	18
8	CLS42 (VT-BN)	18
9	CCB08 (VT-WH)	16
10	SBP23 (WH-RD)	14
11	CLF27 (GN-BN)	14
12	CRW18 (VT-WH)	20
13	CRW19 (BU-OG)	20
14	CRW17 (GN-VT)	20
15	CLS35 (VT)	18
16	CLS41 (GY-YE)	22
17	CLS36 (YE)	18
18	*	*
19	*	*
20	*	*

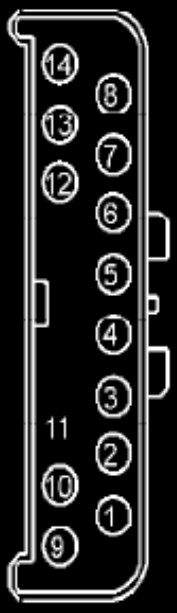
C238

Inline: C248

Description:
Inline

Base Part #:

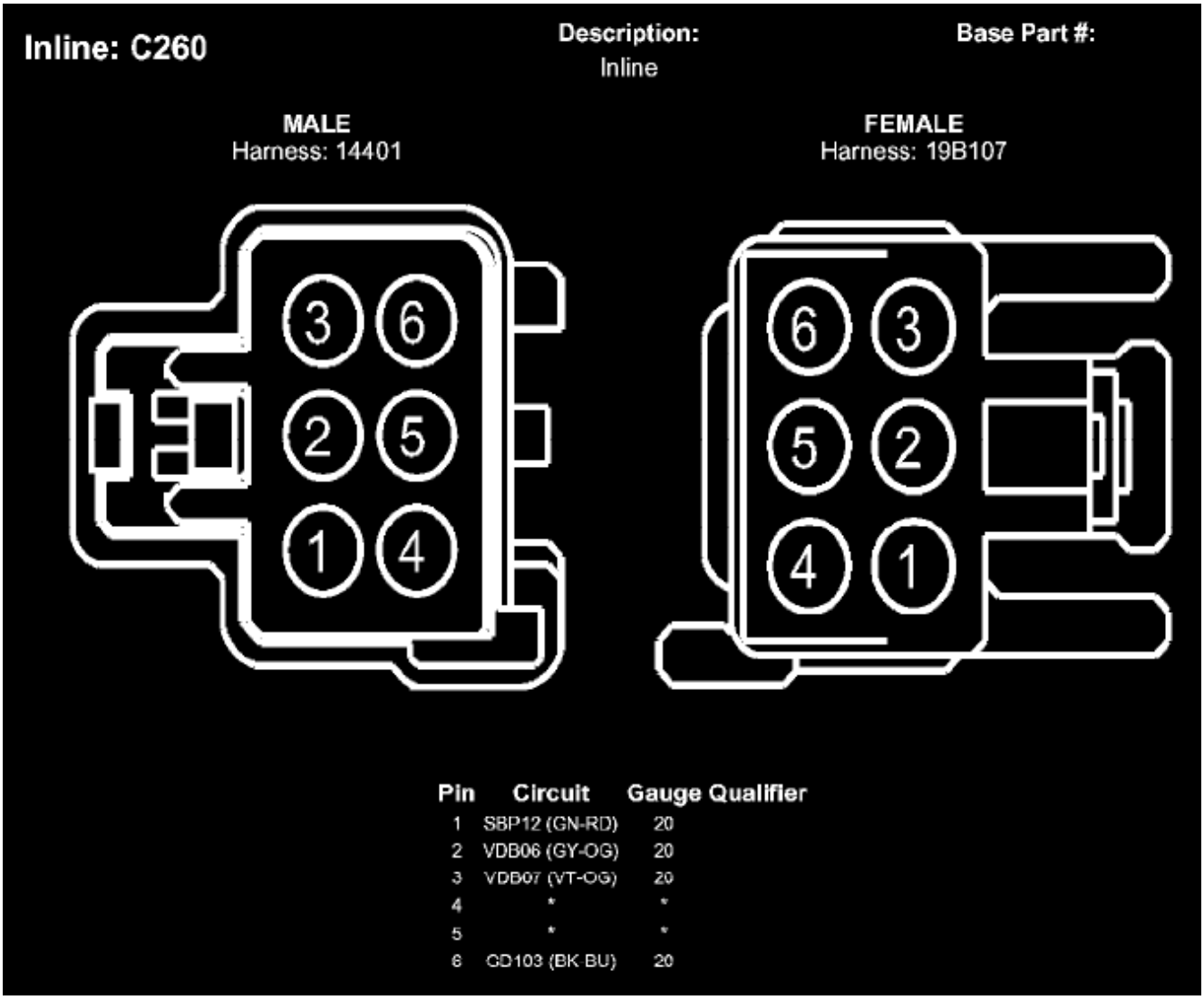
MALE
Harness: 19A170



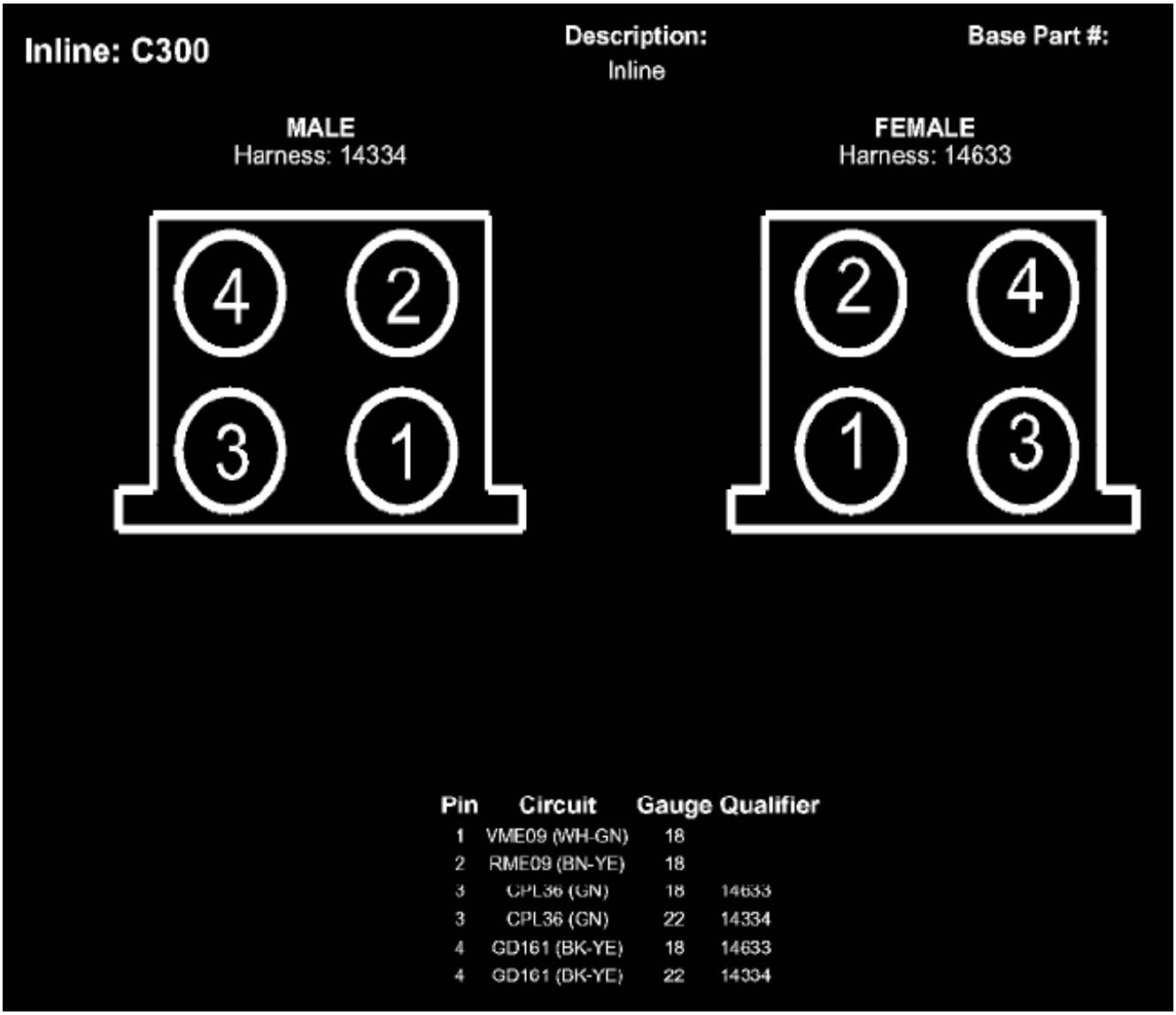
FEMALE
Harness: 14401

Pin	Circuit	Gauge	Qualifier
1	GD103 (BK-BU)	16	
2	VME46 (BU-GN)	22	w/ audio input jack
3	RME46 (WH-GN)	22	w/ audio input jack
4	RME22 (GN-WH)	22	
5	VME22 (VT-GN)	22	
6	VME45 (BU)	22	w/ audio input jack
7	RME45 (YE-GN)	22	w/ audio input jack
8	SBP12 (GN-RD)	16	
9	GD103 (BK-BU)	16	
10	DME22 (-)	18	
11	*	*	
12	SME23 (VT-RD)	22	
13	DME45 (-)	18	w/ audio input jack
14	SBP12 (GN-RD)	16	

C248


Inline: C260
Description:
Inline
Base Part #:
MALE
Harness: 14401
FEMALE
Harness: 19B107
3 6
2 5
1 4
6 3
5 2
4 1
Pin Circuit Gauge Qualifier
1 SBP12 (GN-RD) 20
2 VDB06 (GY-OG) 20
3 VDB07 (VT-OG) 20
4 * *
5 * *
6 GD103 (BK BU) 20

C260



Pin	Circuit	Gauge	Qualifier
1	VME09 (WH-GN)	18	
2	RME09 (BN-YE)	18	
3	CPL36 (GN)	18	14633
3	CPL36 (GN)	22	14334
4	GD161 (BK-YE)	18	14633
4	GD161 (BK-YE)	22	14334

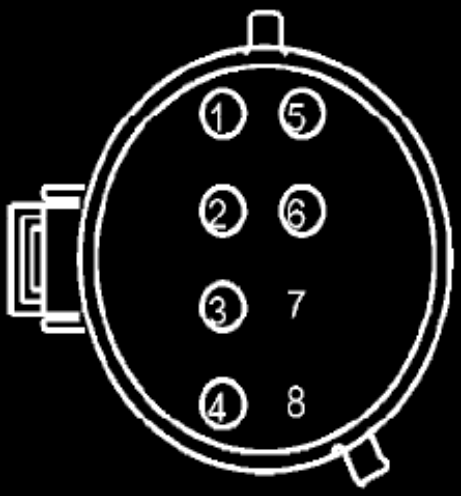
C300

Inline: C311

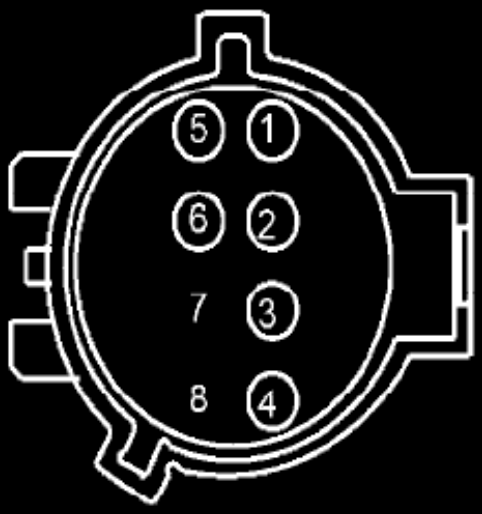
Description:
Inline

Base Part #:

MALE
Harness: 12B637



FEMALE
Harness: 14405



Pin	Circuit	Gauge	Qualifier
1	RE407 (YE-VT)	20	
2	CET41 (BN-YE)	18	
3	CE114 (GN-BU)	18	
3	CE114 (GN-BU)	20	
4	LE424 (YE-GN)	20	
5	SBB21 (GY-RD)	18	
6	VE922 (VT-GN)	20	
7	*	*	
8	*	*	

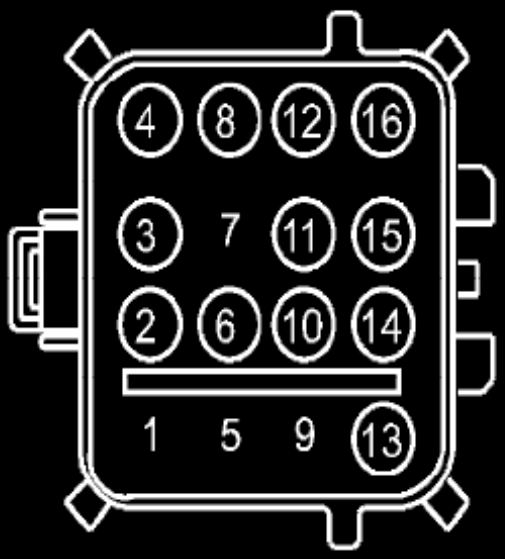
C311

Inline: C312

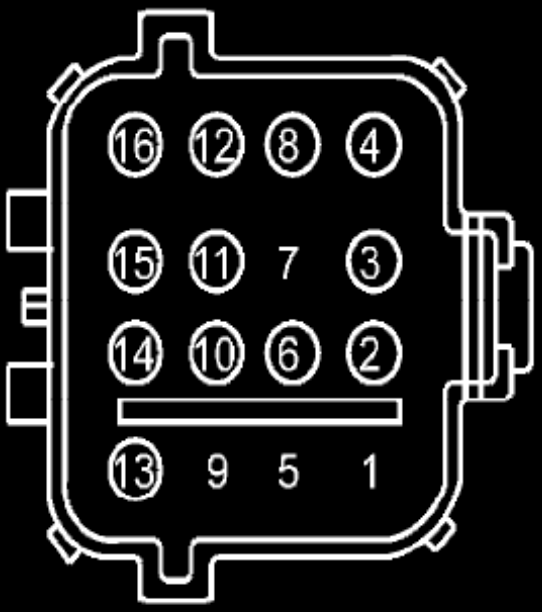
Description:
Inline

Base Part #:

MALE
Harness: 14405



FEMALE
Harness: 14401



Pin	Circuit	Gauge	Qualifier
1	*	*	
1	CLS41 (GY-YE)	18	
2	CLS36 (YE)	18	
3	CLS35 (VT)	18	
4	CAT09 (GN)	16	
5	*	*	
5	CLS39 (VT-WH)	18	
6	CAT06 (YE)	16	
7	*	*	
8	CE911 (VT-WH)	14	
9	*	*	
9	CCB08 (VT-WH)	18	
10	VMC11 (YE-VT)	20	
11	GD174 (BK-WH)	20	
12	CAT17 (BN)	16	14401
12	CAT17 (BN-WH)	16	14405
13	RCA21 (BN-GN)	18	
13	RCA21 (BN-GN)	20	
14	VCA14 (WH-BN)	18	
14	VCA14 (WH-BN)	20	
15	CLS34 (GY)	16	
15	CLS34 (GY)	18	
16	GD121 (BK-YE)	16	14405
16	GD121 (BK-YE)	18	14401

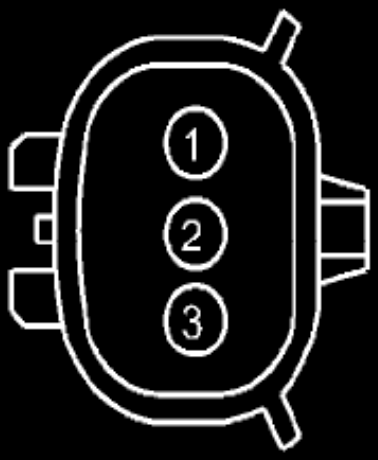
C312

Inline: C315

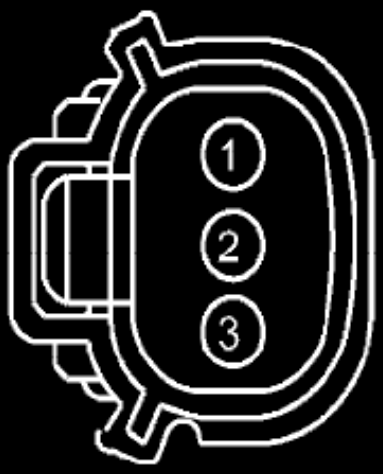
Description:
Inline

Base Part #:

MALE
Harness: 14632

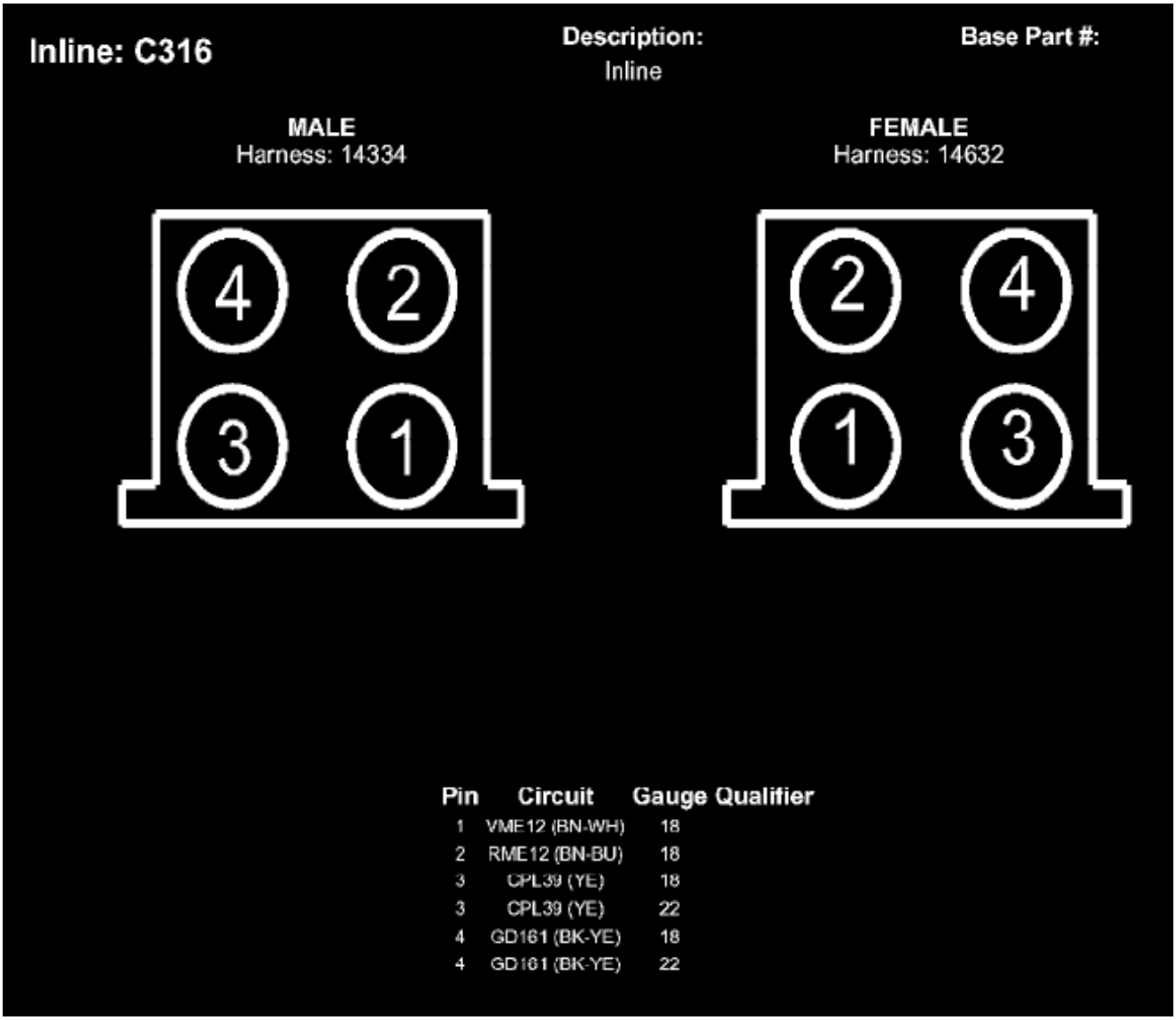


FEMALE
Harness: 14334



Pin	Circuit	Gauge Qualifier
1	LR142 (YE-BN)	18
1	LR142 (YE-BN)	20
2	RR142 (GN)	18
2	RR142 (GN)	20
3	VR210 (BU-BN)	18
3	VR210 (BU-BN)	20

C315



Pin	Circuit	Gauge Qualifier
1	VME12 (BN-WH)	18
2	RME12 (BN-BU)	18
3	CPL39 (YE)	18
3	CPL39 (YE)	22
4	GD161 (BK-YE)	18
4	GD161 (BK-YE)	22

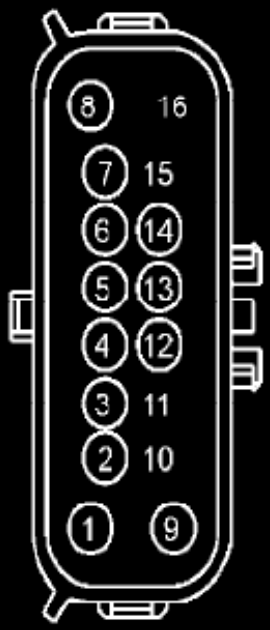
C316

Inline: C327

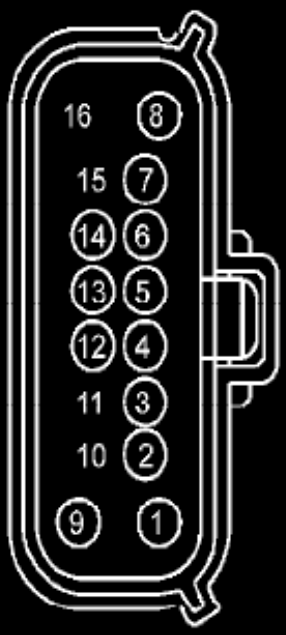
Description:
Inline

Base Part #:

MALE
Harness: 13A724/14334



FEMALE
Harness: 14401



Pin	Circuit	Gauge	Qualifier
1	RR142 (GN)	20	
2	GD161 (BK-YE)	18	
3	CPL39 (YE)	20	14401
3	CPL39 (YE)	22	14334
4	VME09 (WH-GN)	18	13A724/14334
4	VME09 (WH-GN)	20	14401
5	RME09 (BN-YE)	18	13A724/14334
5	RME09 (BN-YE)	20	
6	VME12 (BN-WH)	18	13A724/14334
6	VME12 (BN-WH)	20	14401
7	RME12 (BN-BU)	18	13A724/14334
7	RME12 (BN-BU)	20	14401
8	CPL36 (GN)	20	14401
8	CPL36 (GN)	22	14334
9	VR210 (BU-BN)	20	
10	*	*	
11	*	*	
12	CCR08 (VT-WH)	16	
13	LR142 (YE-BU)	20	
14	CLN28 (GN-BU)	18	
15	*	*	
16	*	*	

C327

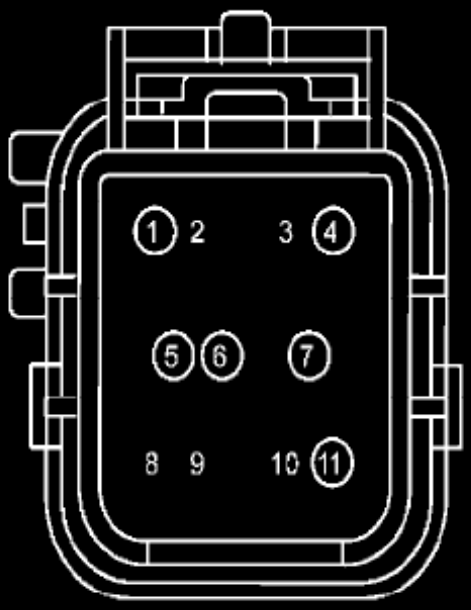
Inline: C328

Description:
Inline

Base Part #:

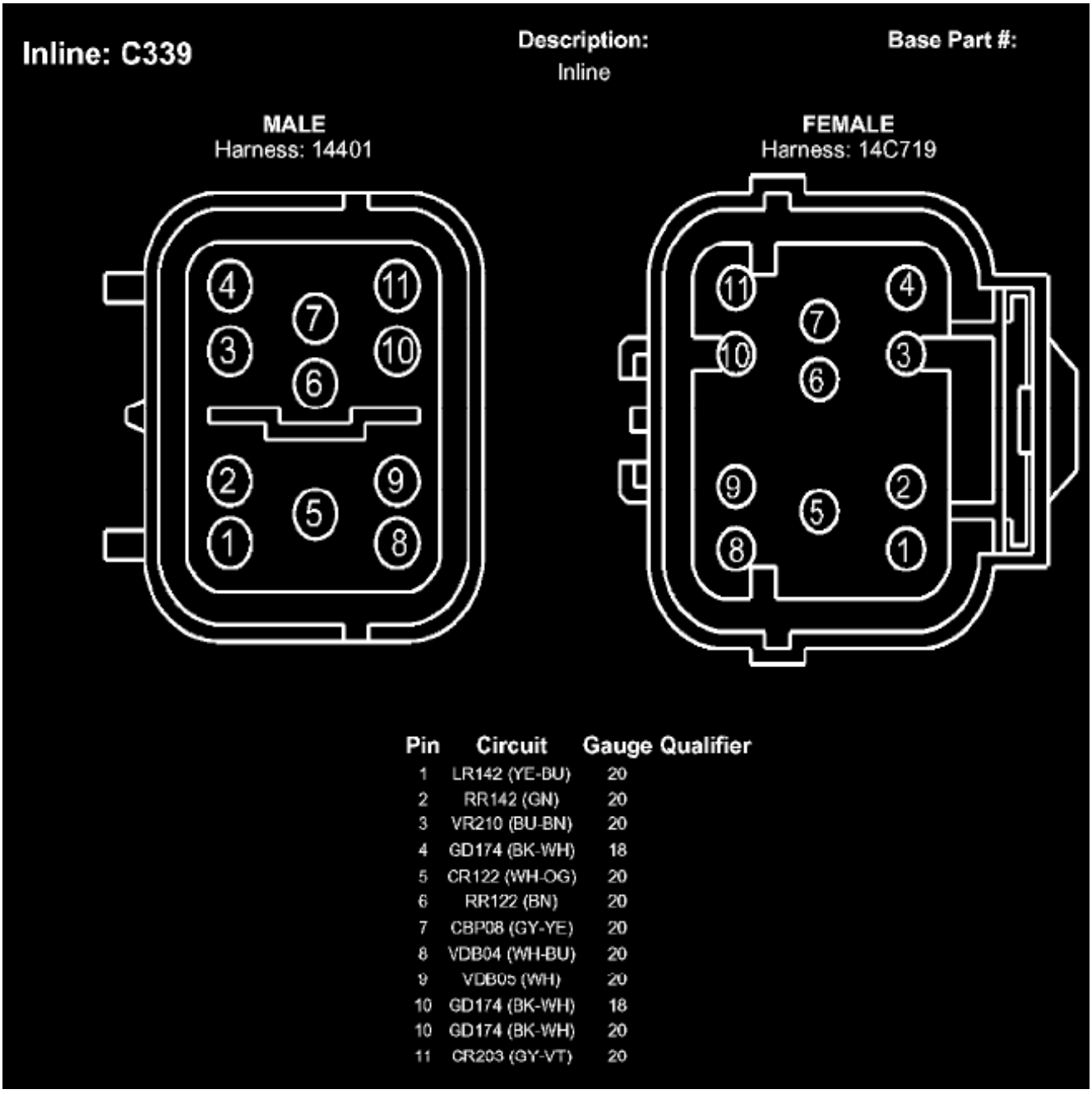
MALE
Harness: 14401

FEMALE
Harness: 2027933



Pin	Circuit	Gauge Qualifier
1	VR215 (OG)	20
1	VR215 (YE-VT)	20
2	*	*
3	*	*
4	GD174 (BK-WH)	20
4	GD174 (OG)	20
5	RR120 (BN-GN)	20
5	RR120 (RD-WH)	20
6	CR120 (BU-OG)	20
6	CR120 (RD-WH)	20
7	CR201 (BN-LB)	20
7	CR201 (GN-BU)	20
8	*	*
9	*	*
10	*	*
11	GD174 (BK-LB)	20
11	GD174 (BK-WH)	20

C328



Pin	Circuit	Gauge Qualifier
1	LR142 (YE-BU)	20
2	RR142 (GN)	20
3	VR210 (BU-BN)	20
4	GD174 (BK-WH)	18
5	CR122 (WH-OG)	20
6	RR122 (BN)	20
7	CBP08 (GY-YE)	20
8	VDB04 (WH-BU)	20
9	VDB05 (WH)	20
10	GD174 (BK-WH)	18
10	GD174 (BK-WH)	20
11	CR203 (GY-VT)	20

C339

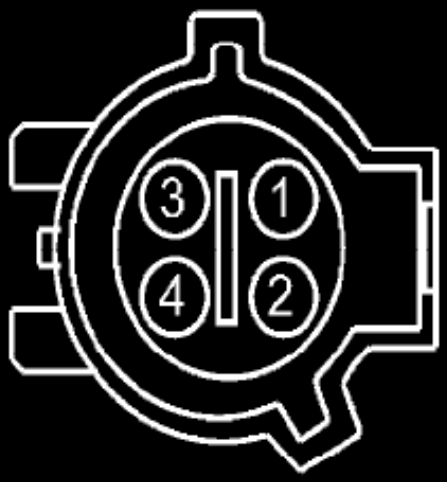
Inline: C340

Description:
Inline

Base Part #:

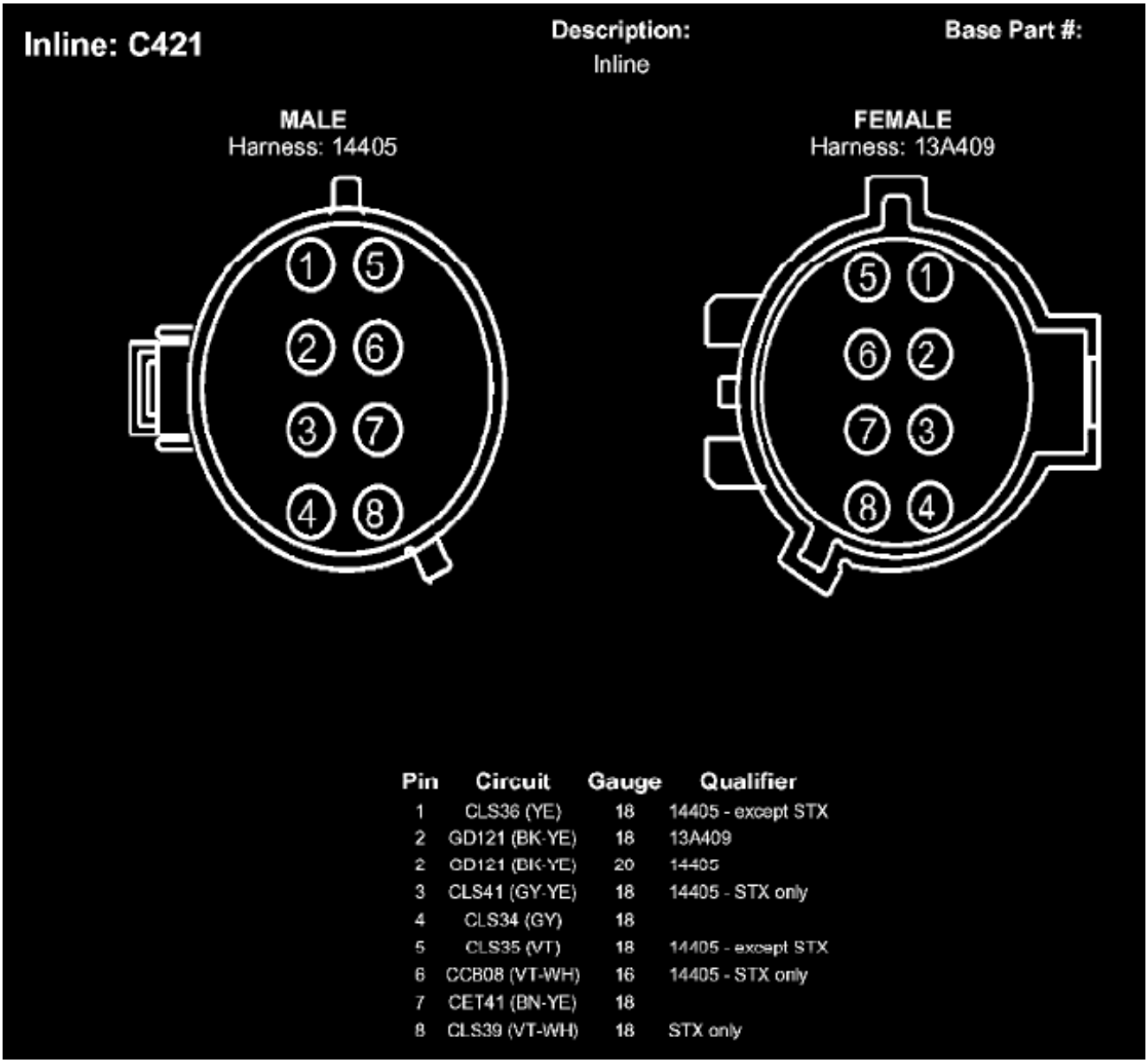
MALE
Harness: 14C719

FEMALE
Harness: 2027934



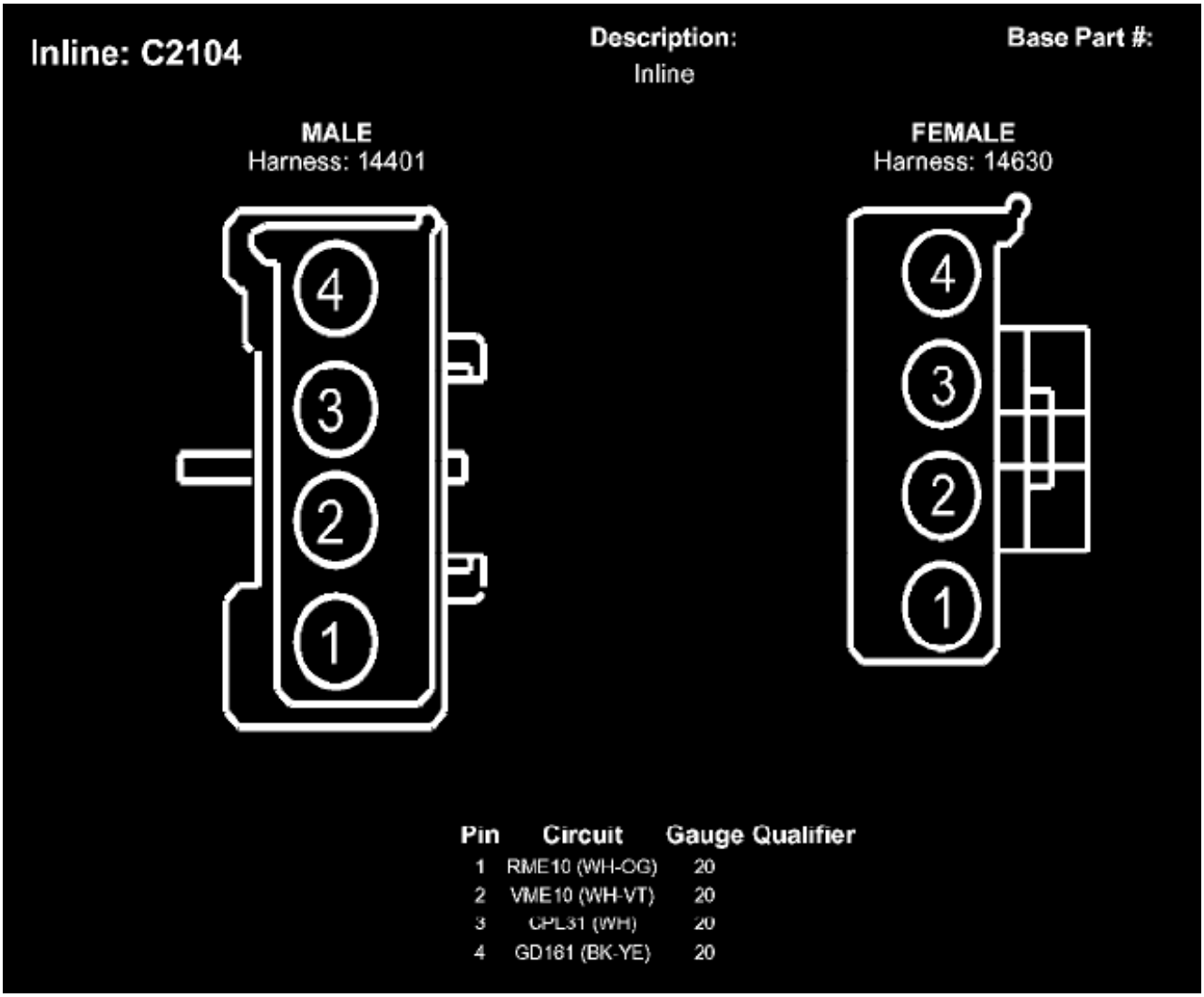
Pin	Circuit	Gauge Qualifier
1	CR122 (RD-WH)	20
1	CR122 (WH-OG)	20
2	CR203 (GY-VT)	20
2	CR203 (RD-BK)	20
3	RR122 (BN)	20
3	RR122 (RD-WH)	20
4	GD174 (BK-LB)	20
4	GD174 (BK-WH)	20

C340

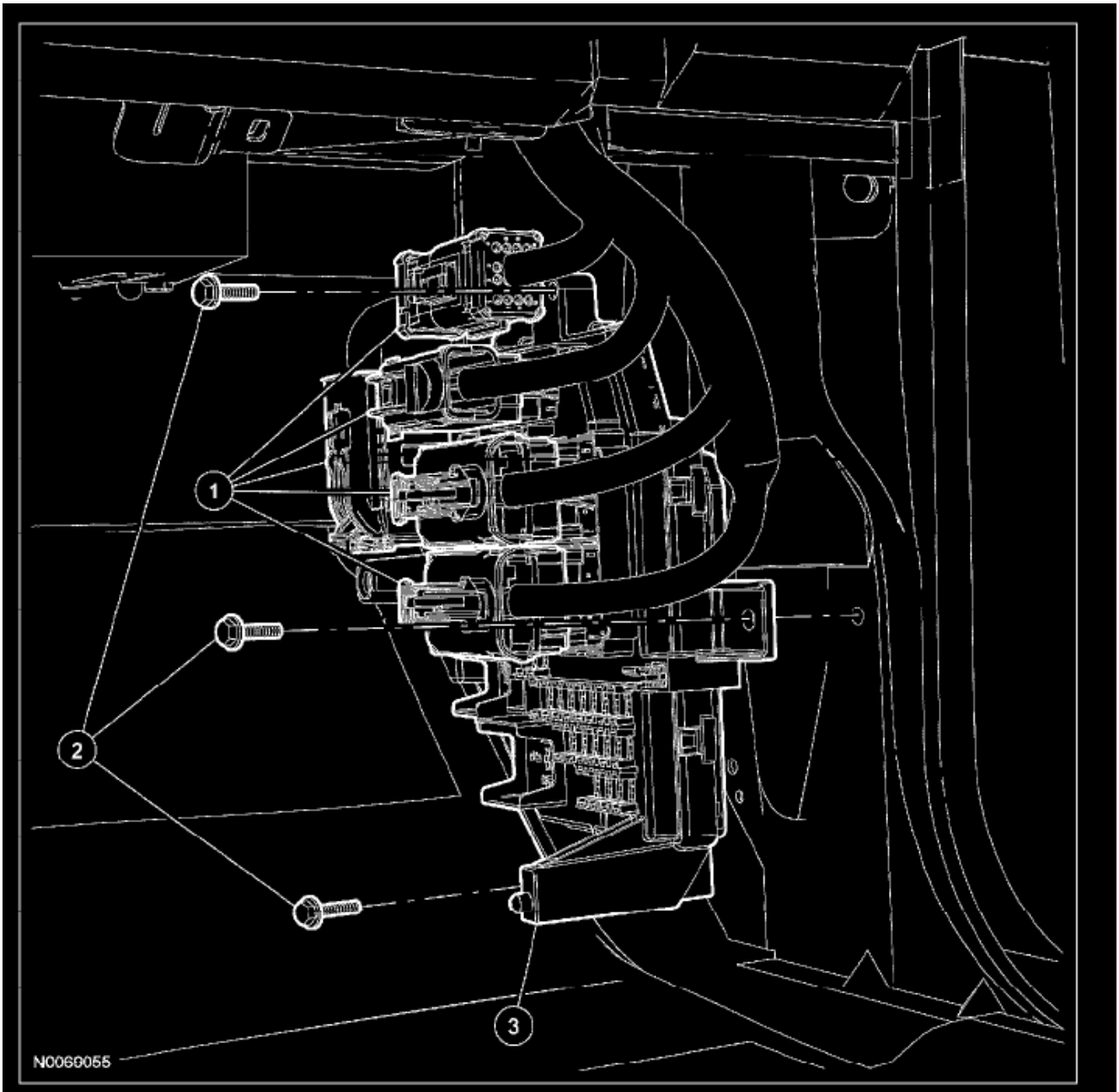


Pin	Circuit	Gauge	Qualifier
1	CLS36 (YE)	18	14405 - except STX
2	GD121 (BK-YE)	18	13A409
2	GD121 (BK-YE)	20	14405
3	CLS41 (GY-YE)	18	14405 - STX only
4	CLS34 (GY)	18	
5	CLS35 (VT)	18	14405 - except STX
6	CCB08 (VT-WH)	16	14405 - STX only
7	CET41 (BN-YE)	18	
8	CLS39 (VT-WH)	18	STX only

C421


Inline: C2104
Description:
Inline
Base Part #:
MALE
Harness: 14401
FEMALE
Harness: 14630
4
3
2
1
4
3
2
1
Pin Circuit Gauge Qualifier
1 RME10 (WH-OG) 20
2 VME10 (WH-VT) 20
3 CPL31 (WH) 20
4 GD161 (BK-YE) 20

C2104



Item	Part Number	Description
1	—	Smart junction box (SJB) electrical connectors (part of 14401)
2	—	SJB screws (3 required)
3	15604	SJB

Power Distribution Module: Service and Repair

SMART JUNCTION BOX (SJB)

Removal

CAUTION: Electronic modules are sensitive to static electrical charges. If exposed to these charges, damage may result.

NOTE: -

Prior to the replacement of the module, it is necessary to upload the module configuration information into the appropriate scan tool. This information must be downloaded into the new module after installation.

- The tire pressure monitoring system (TPMS) functionality is integral to the smart junction box (SJB).

- The steps included in the SJB removal and installation procedure are critical to restoring the vehicle security and tire pressure monitoring systems to normal operation. A new SJB is delivered in a manufacturing mode with 7 pre-set DTCs related to the TPMS. To clear the DTCs, successful configuration of the SJB must occur, followed by successful TPMS sensor training, and a successful self-test, including clearing of the DTCs. The DTCs are as follows:

- B106D (Tire Pressure Monitor System [TPMS] Initiators Not Configured)

- B2477 (Module Configuration Failure)

- B2868 (Left Front Tire Pressure Sensor Fault)

- B2869 (Right Front Tire Pressure Sensor Fault)

- 2870 (Right Rear Tire Pressure Sensor Fault)

- B2871 (Left Rear Tire Pressure Sensor Fault)

- C2780 (ECU in Manufacturer Sub-State)

1. NOTE: This step is necessary only if the SJB is being replaced.

Upload the module configuration information from the SJB.

2. Remove the RH lower cowl trim panel. 3. Disconnect the electrical connectors. 4. Remove the 3 screws and the SJB.

Installation

NOTE: When a new SJB is installed, all customer RKE transmitters may be required to be present in order to program the RKE transmitters to the new SJB.

1. Install the SJB.

- Install the 3 screws.

- Connect the electrical connectors.

2. NOTE: If the SJB was not replaced, this is the last step that is necessary.

Install the RH lower cowl trim panel.

3. NOTE:

- When successful, this step provides the calibration necessary for the SJB operation and clears DTCs B106D and B2477. The clearing of these DTCs indicates the calibration data has been successfully downloaded to the new SJB.

- When successful, this step also programs the remote transmitters into the new SJB. In the event the remote transmitters do not program to the new SJB, all of the remote transmitters will need to be present. Refer to Locks, Remote Keyless Entry Transmitter Programming. This action will program the remote transmitters into the new SJB. See: Accessories and Optional Equipment/Antitheft and Alarm Systems/Keyless Entry/Keyless Entry Transmitter/Testing and Inspection

Download the SJB configuration information from the scan tool into the new SJB.

4. NOTE: When successful, this step clears DTCs B2868, B2869, B2870 and B2871. The clearing of these DTCs indicates the SJB has recognized

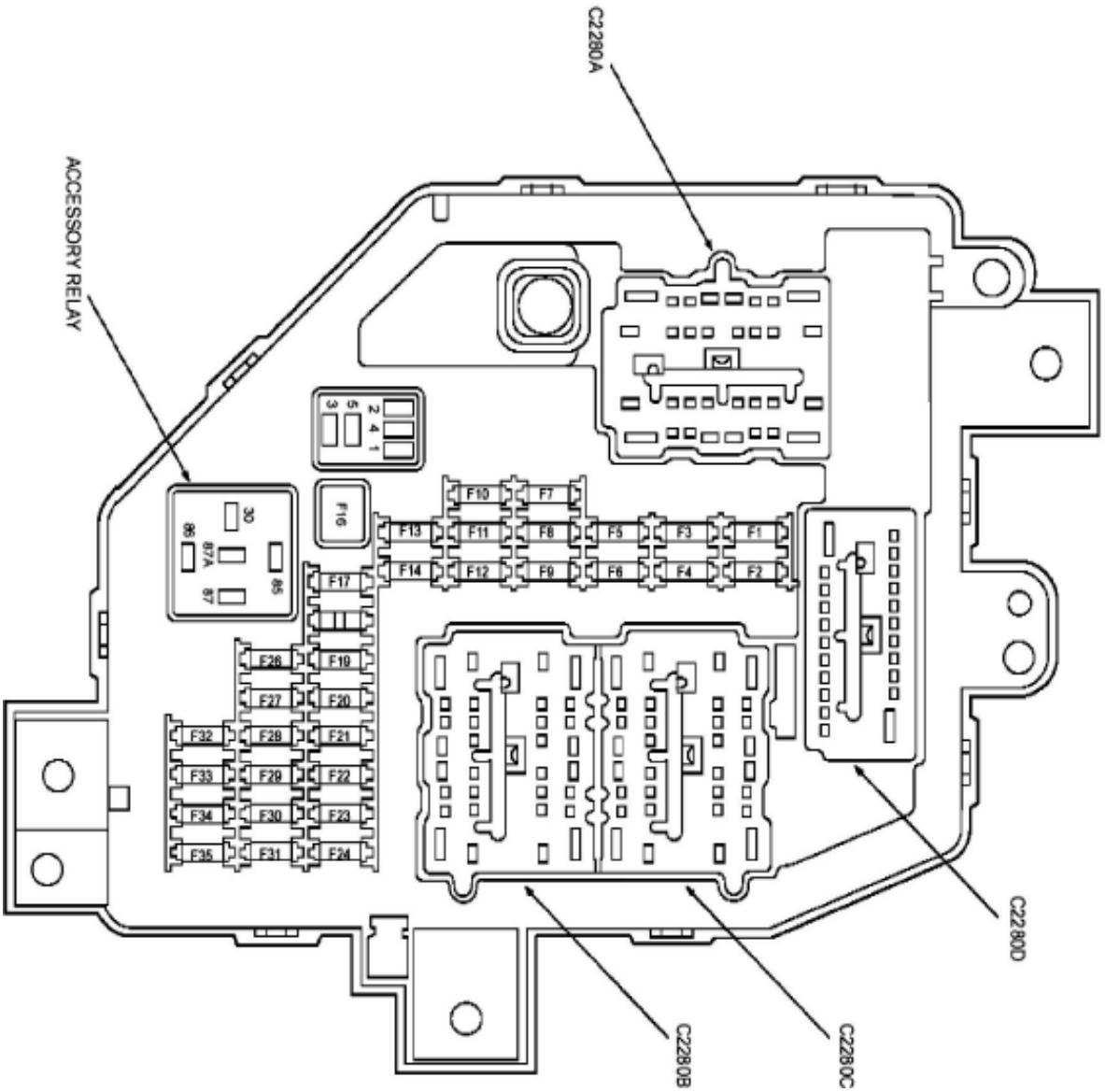
the tire pressure sensors during the training procedure.

Train the tire pressure sensors.

5. NOTE: DTC C2780 will not clear if any other DTCs are present in the SJB. When successful, this step will clear the DTC C2780.

Carry out the SJB on-demand self-test by clearing DTCs, and then retrieving DTCs to confirm all DTCs have been cleared.

SMART JUNCTION BOX (SJB)

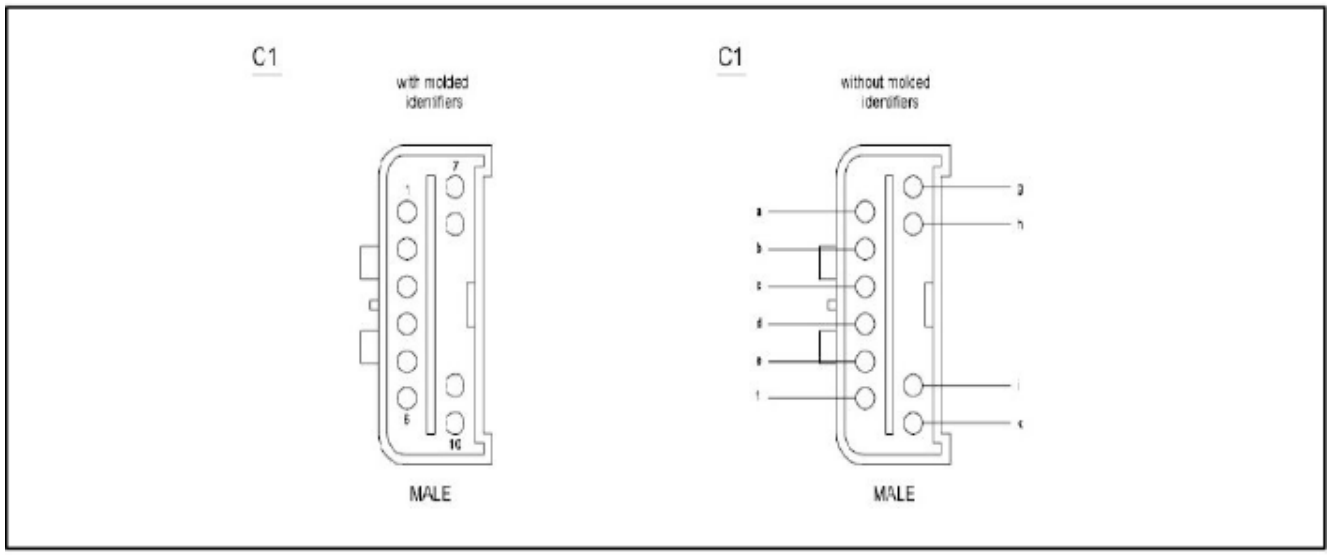


Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



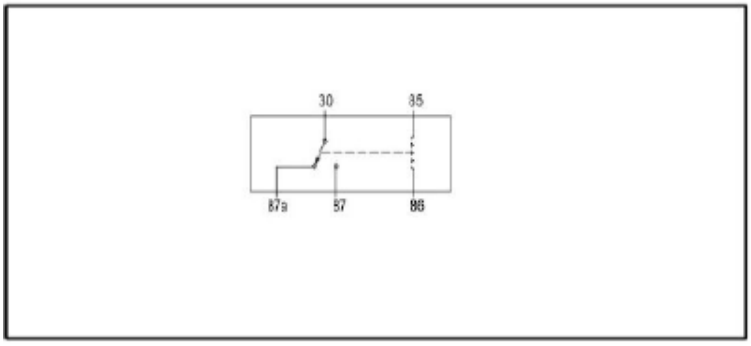
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

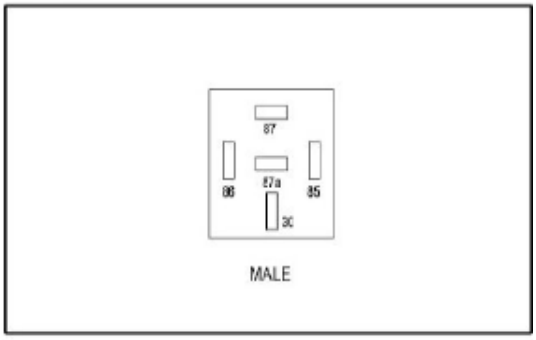
Power Distribution Relay: Testing and Inspection

Relay □ Mini ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 □ 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

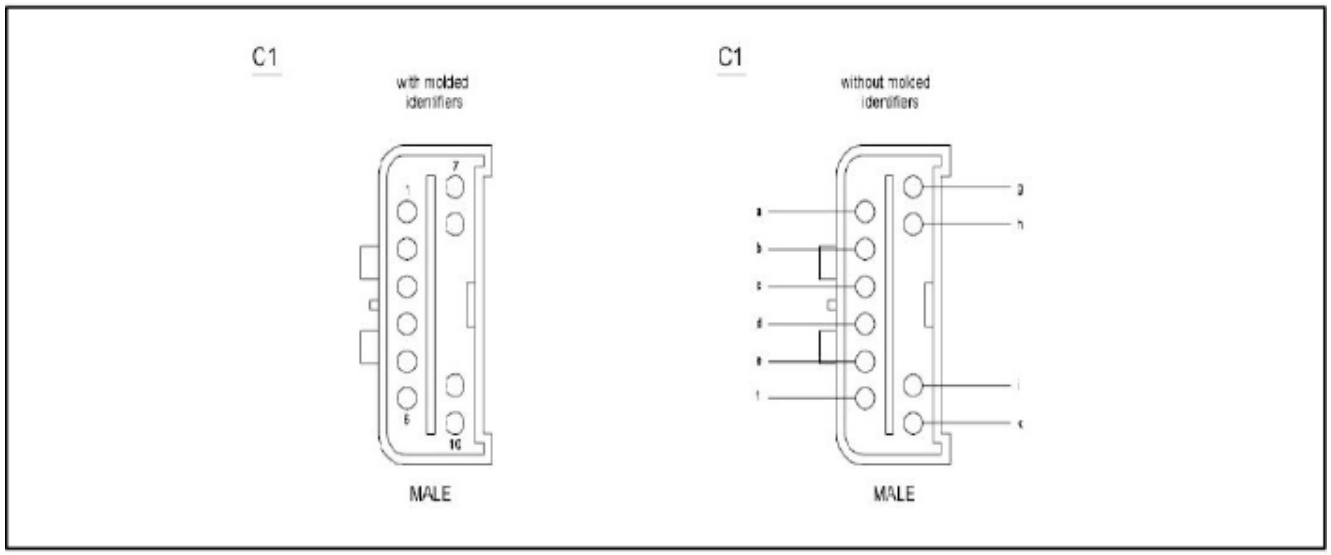
Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



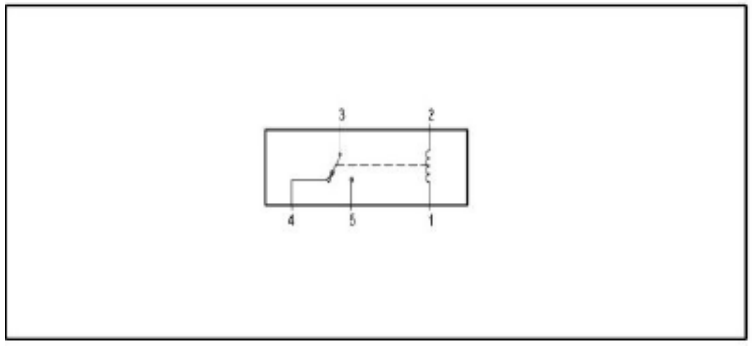
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

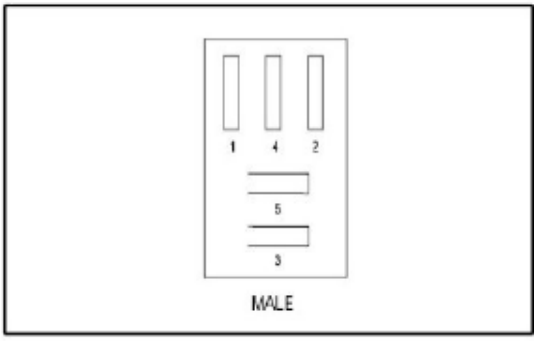
Micro ISO Relay: Testing and Inspection

Relay □ Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63□102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil □ Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

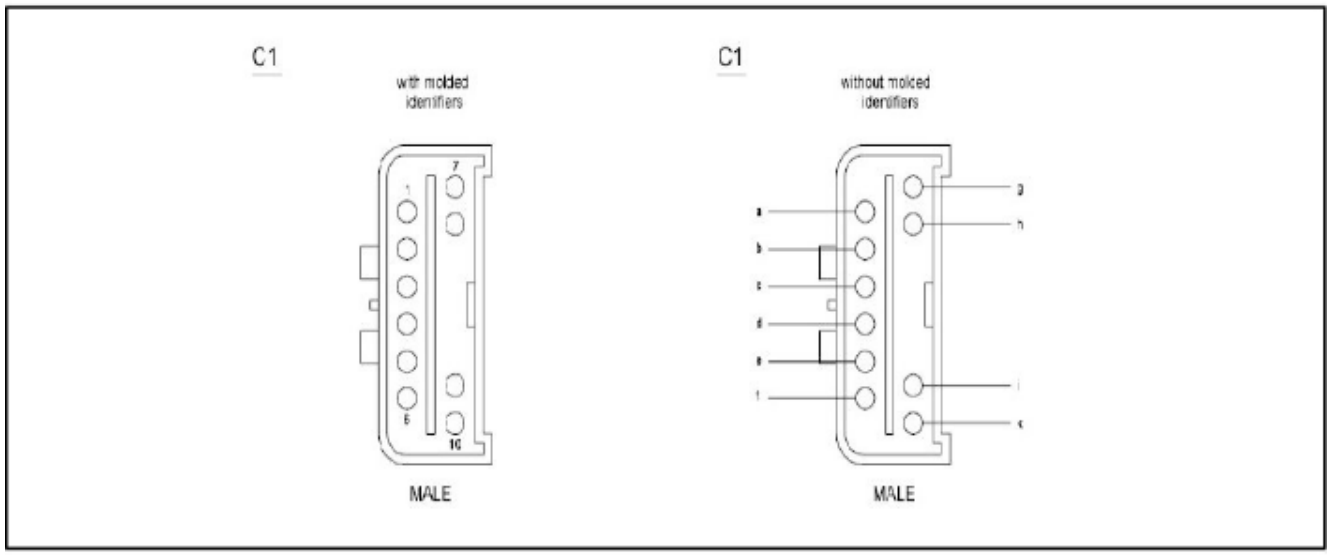
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



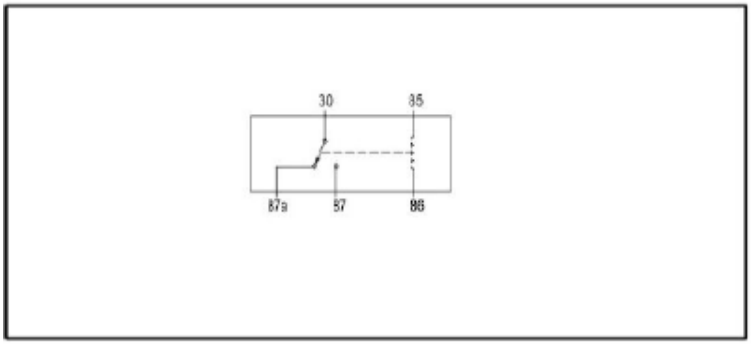
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

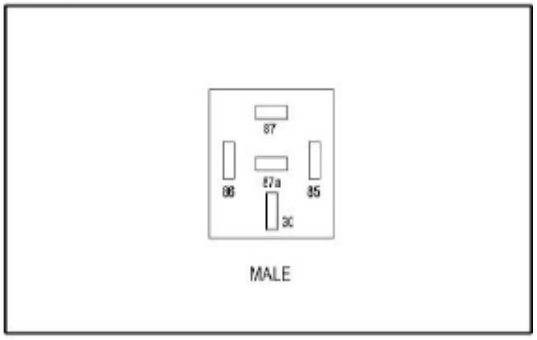
Mini ISO Relay: Testing and Inspection

Relay □ Mini ISO

Schematic



Terminals

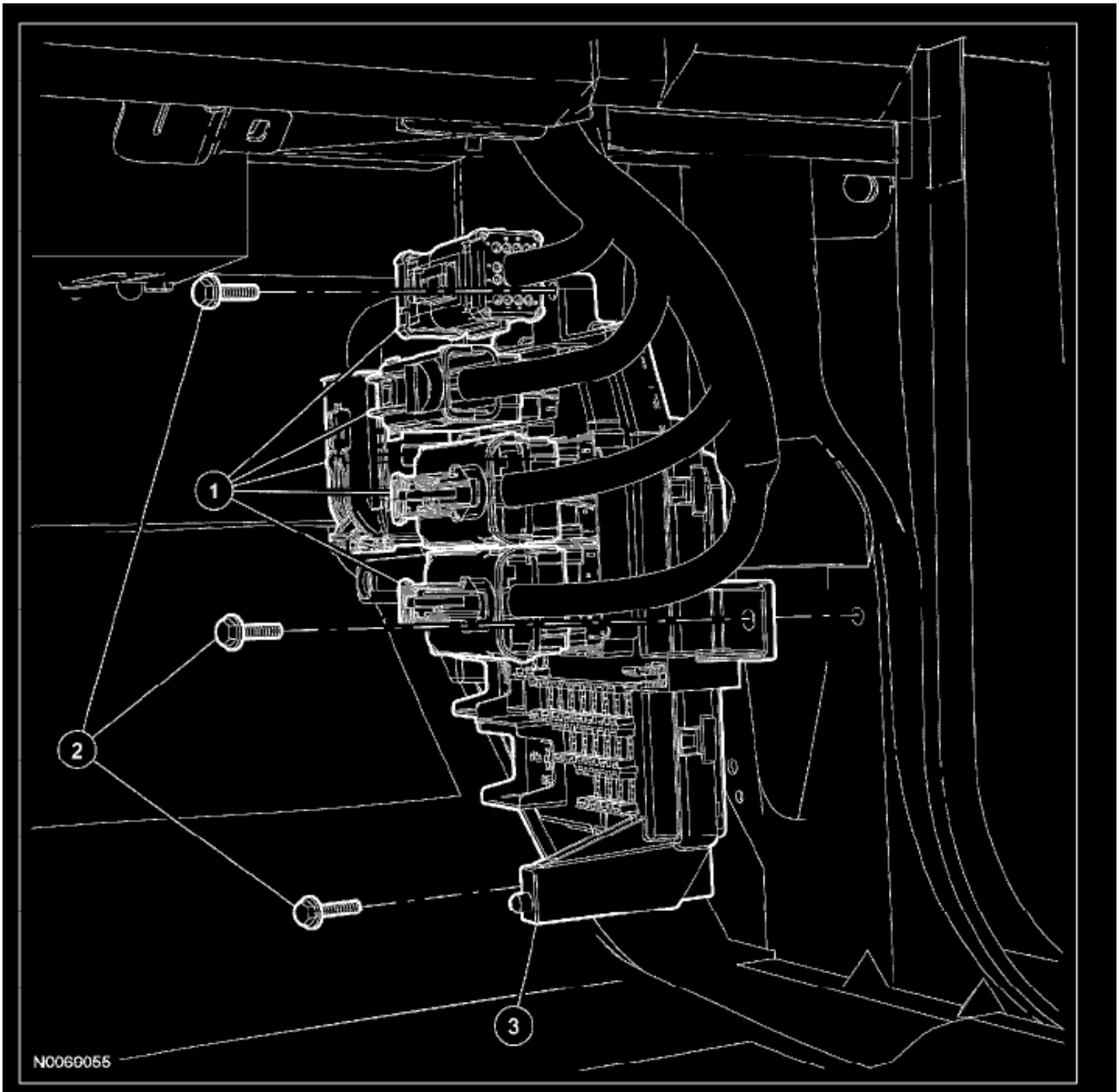


Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.



Item	Part Number	Description
1	—	Smart junction box (SJB) electrical connectors (part of 14401)
2	—	SJB screws (3 required)
3	15604	SJB

Power Distribution Module: Service and Repair

SMART JUNCTION BOX (SJB)

Removal

CAUTION: Electronic modules are sensitive to static electrical charges. If exposed to these charges, damage may result.

NOTE: -

Prior to the replacement of the module, it is necessary to upload the module configuration information into the appropriate scan tool. This information must be downloaded into the new module after installation.

- The tire pressure monitoring system (TPMS) functionality is integral to the smart junction box (SJB).

- The steps included in the SJB removal and installation procedure are critical to restoring the vehicle security and tire pressure monitoring systems to normal operation. A new SJB is delivered in a manufacturing mode with 7 pre-set DTCs related to the TPMS. To clear the DTCs, successful configuration of the SJB must occur, followed by successful TPMS sensor training, and a successful self-test, including clearing of the DTCs. The DTCs are as follows:

- B106D (Tire Pressure Monitor System [TPMS] Initiators Not Configured)

- B2477 (Module Configuration Failure)

- B2868 (Left Front Tire Pressure Sensor Fault)

- B2869 (Right Front Tire Pressure Sensor Fault)

- 2870 (Right Rear Tire Pressure Sensor Fault)

- B2871 (Left Rear Tire Pressure Sensor Fault)

- C2780 (ECU in Manufacturer Sub-State)

1. NOTE: This step is necessary only if the SJB is being replaced.

Upload the module configuration information from the SJB.

2. Remove the RH lower cowl trim panel. 3. Disconnect the electrical connectors. 4. Remove the 3 screws and the SJB.

Installation

NOTE: When a new SJB is installed, all customer RKE transmitters may be required to be present in order to program the RKE transmitters to the new SJB.

1. Install the SJB.

- Install the 3 screws.

- Connect the electrical connectors.

2. NOTE: If the SJB was not replaced, this is the last step that is necessary.

Install the RH lower cowl trim panel.

3. NOTE:

- When successful, this step provides the calibration necessary for the SJB operation and clears DTCs B106D and B2477. The clearing of these DTCs indicates the calibration data has been successfully downloaded to the new SJB.

- When successful, this step also programs the remote transmitters into the new SJB. In the event the remote transmitters do not program to the new SJB, all of the remote transmitters will need to be present. Refer to Locks, Remote Keyless Entry Transmitter Programming. This action will program the remote transmitters into the new SJB. See: Accessories and Optional Equipment/Antitheft and Alarm Systems/Keyless Entry/Keyless Entry Transmitter/Testing and Inspection

Download the SJB configuration information from the scan tool into the new SJB.

4. NOTE: When successful, this step clears DTCs B2868, B2869, B2870 and B2871. The clearing of these DTCs indicates the SJB has recognized

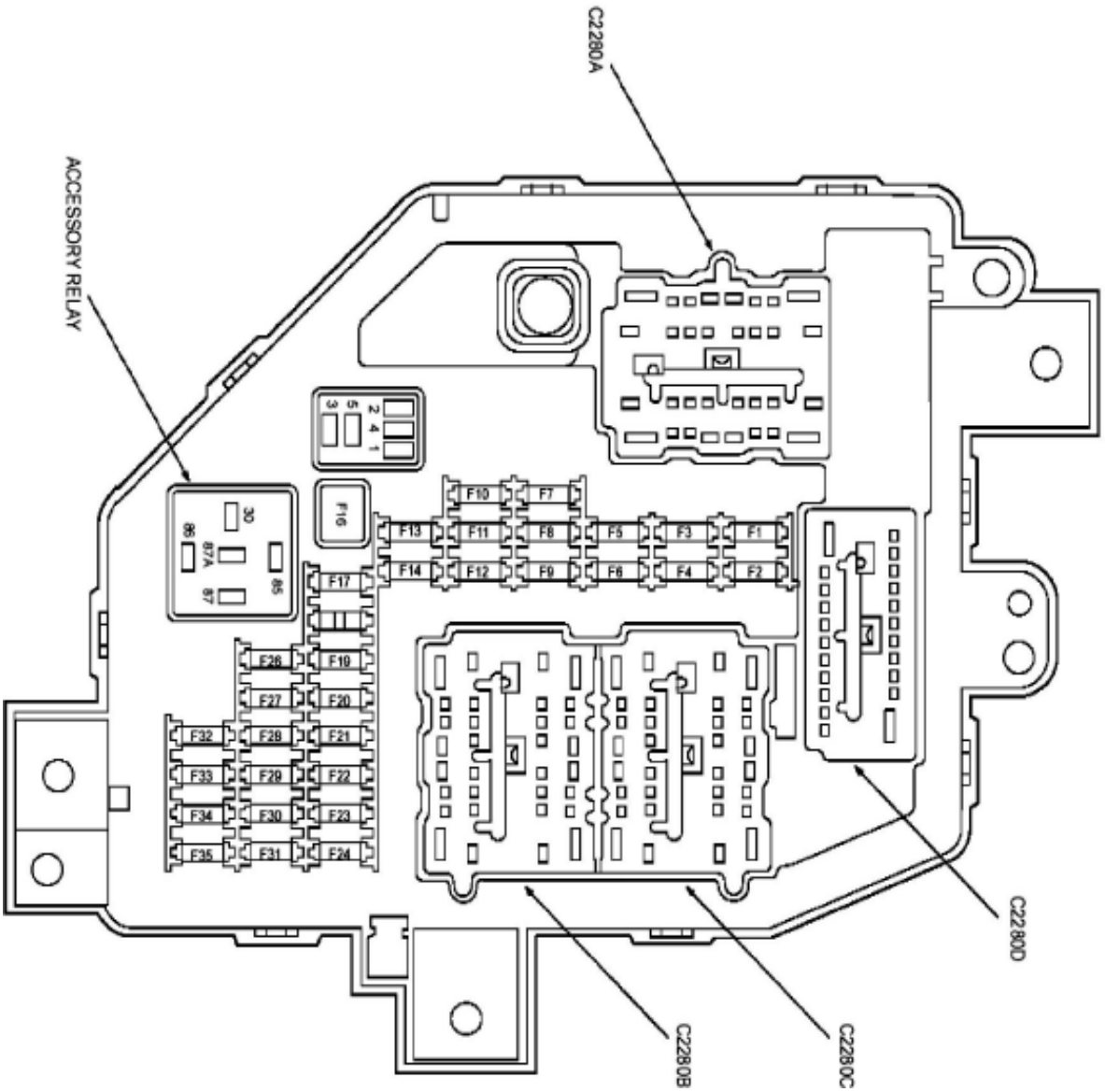
the tire pressure sensors during the training procedure.

Train the tire pressure sensors.

5. NOTE: DTC C2780 will not clear if any other DTCs are present in the SJB. When successful, this step will clear the DTC C2780.

Carry out the SJB on-demand self-test by clearing DTCs, and then retrieving DTCs to confirm all DTCs have been cleared.

SMART JUNCTION BOX (SJB)

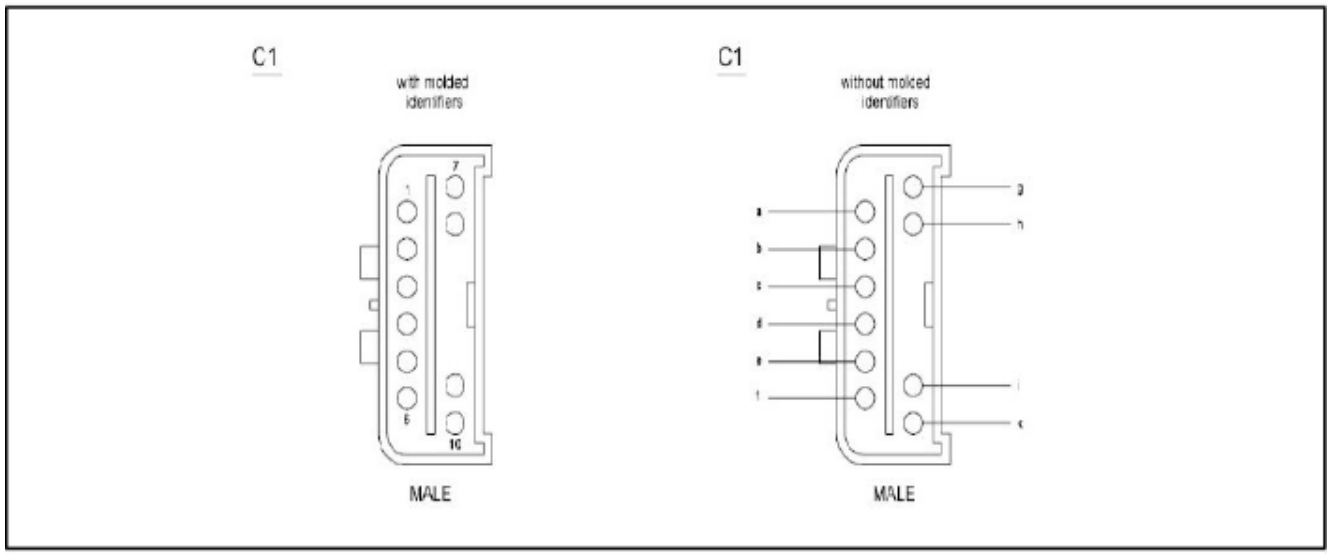


Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



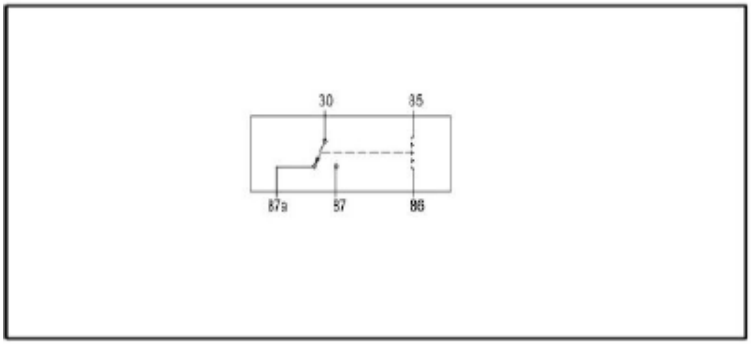
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

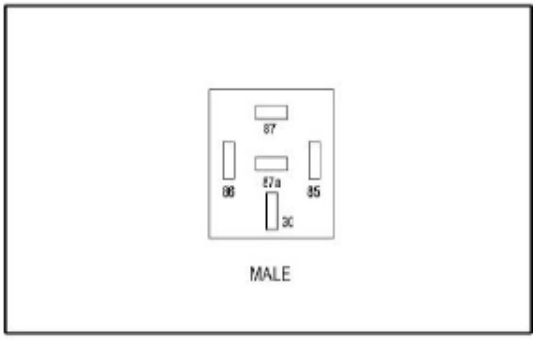
Power Distribution Relay: Testing and Inspection

Relay □ Mini ISO

Schematic



Terminals



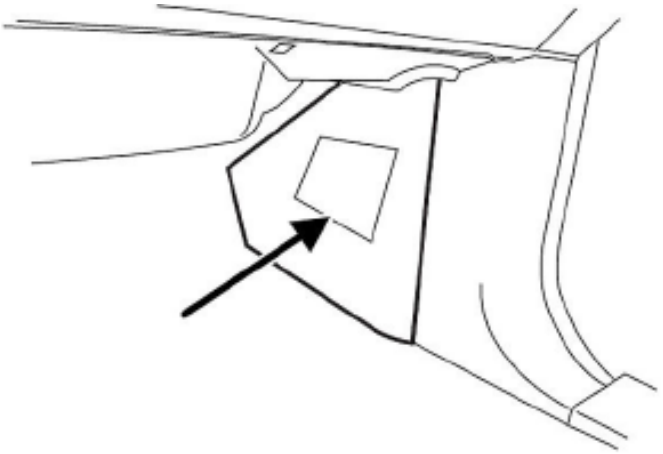
Component testing procedure (no voltage applied)

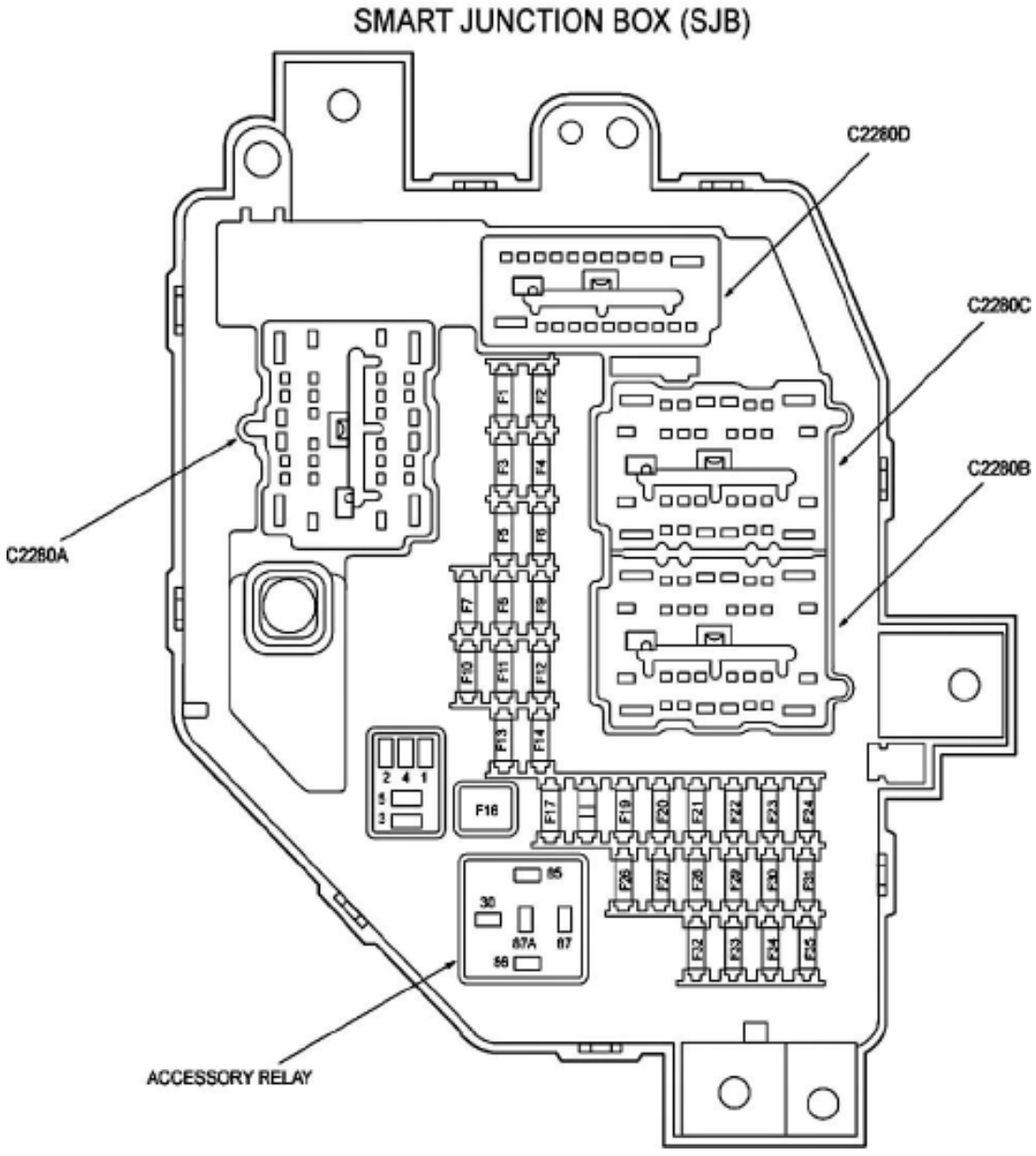
Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Starting and Charging > Power and Ground Distribution > Relays and Modules - Power and Ground Distribution > Relay Box > Component Information > Locations > Smart Junction Box

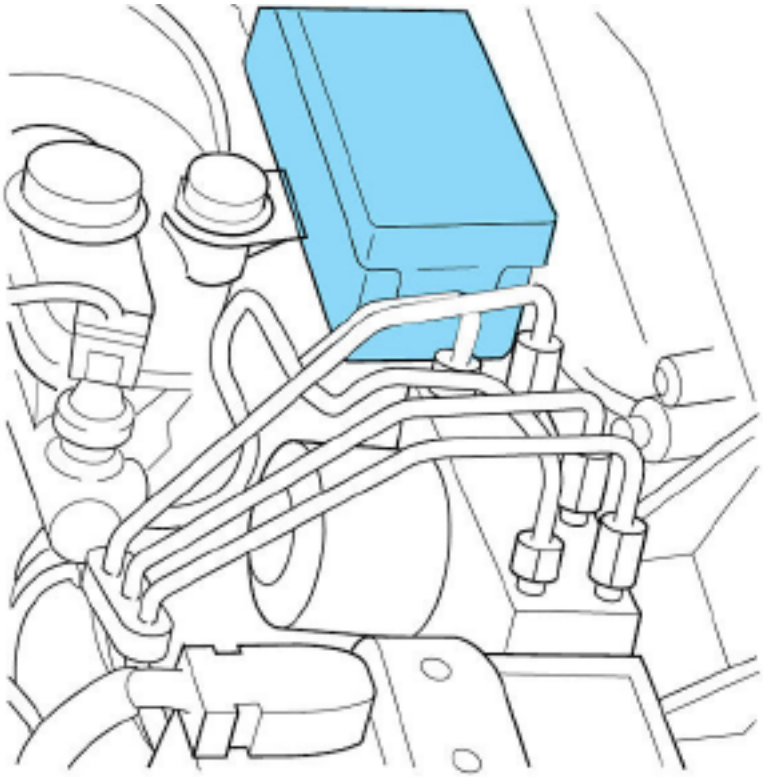




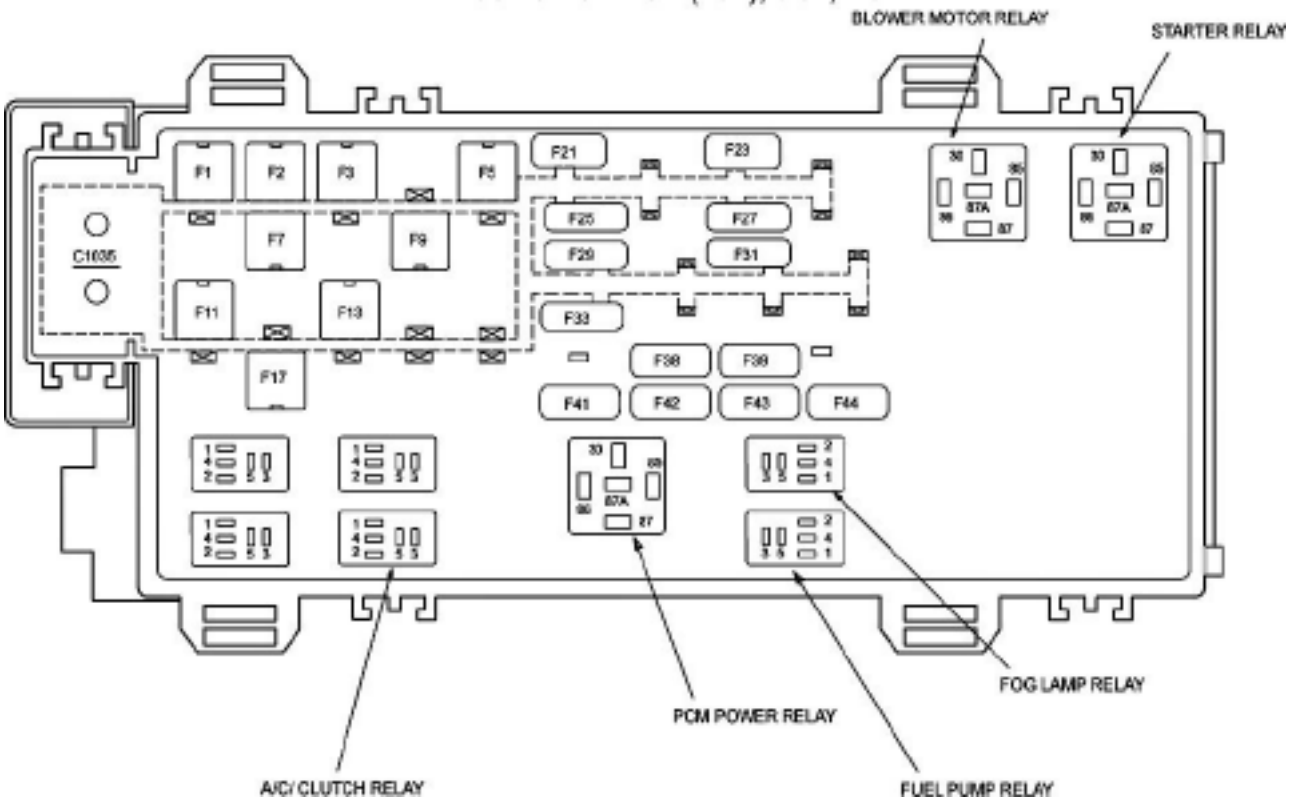
Relay Box: Locations Smart Junction Box

FUSE	AMPS	Circuits Protected
F1	5A	Illumination dimmer
F2	10A	Trailer tow connector - Park
F3	10A	Headlamp, right (Low beam lamp feed)
F4	10A	Headlamp, left (Low beam lamp feed)
F5	5A	Windshield wiper module
F6	10A	Audio unit, Door lock switch illumination
F7	5A	Not Used
F8	10A	Restraints Control Module (RCM), Occupant Classification System Module (OCSM), Passenger Air bag Deactivation (PAD) Indicator
F9	5A	Instrument Cluster (IC), Air bag indicator
F10	10A	4X4 control module, Instrument Cluster (IC)
F11	10A	Smart Junction Box (SJB), logic power
F12	15A	Subwoofer amplifier with audiophile, Satellite radio receiver
F13	15A	Interior lamp relay, Horn relay
F14	15A	High beam lamp feed to High beam indicator, Headlamp, right, Headlamp, left
F16	30A	Accessory relay (Power windows)
F17	15A	Indicator flasher relay
F18	-	Not Used

FUSE	AMPS	Circuits Protected
F19	20A	Brake pedal position switch (Stoplamps)
F20	10A	Transmission control switch, Digital Transmission Range (TR) sensor, Speed control servo, Anti-lock Brake System (ABS) module, Indicator flasher relay, Reversing lamps switch, Speed control On/Off switch, Speed control Set/Resume switch
F21	5A	Digital Transmission Range (TR) sensor, Starter relay, Powertrain Control Module (PCM)
F22	5A	Audio unit
F23	30A	Main light switch, Multifunction switch
F24	20A	Audio unit
F26	2A	Deactivator switch
F27	10A	Blend door actuator, Climate control assembly
F28	15A	4X4 control module
F29	20A	Cigar lighter, front, Data Link Connector (DLC)
F30	5A	Exterior rear view mirror switch
F31	20A	Park lamp relay
F32	5A	Brake pedal position switch (logic power), Brake shift interlock
F33	5A	Instrument Cluster (IC), Neutral tow indicator
F34	20A	Power point
F35	15A	Door lock/unlock relay, Driver door unlock relay



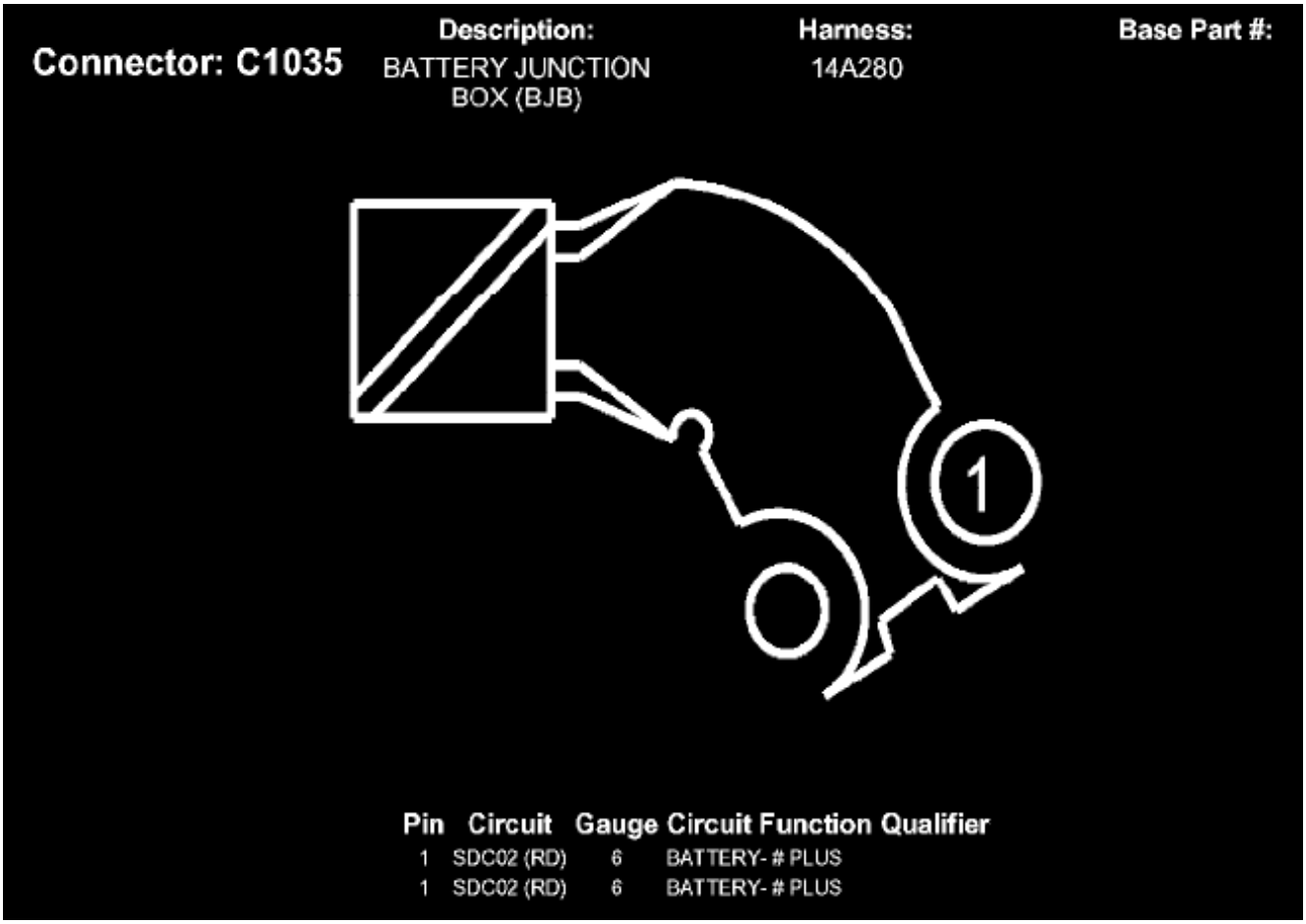
BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L



Relay Box: Locations Battery Junction Box

FUSE	AMPS	Circuits Protected
F1	40A	Smart Junction Box (SJB)
F2	-	Not Used
F3	40A	Smart Junction Box (SJB)
F4	-	Not Used
F5	50A	Smart Junction Box (SJB)
F6	-	Not Used
F7	30A	Starter Relay
F8	-	Not Used
F9	40A	Ignition Switch
F10	-	Not Used
F11	30A	PCM power relay
F12	-	Not Used
F13	30A	Blower motor relay
F14	-	Not Used
F15	-	Not Used
F16	-	Not Used
F17	40A	Anti-lock Brake System (ABS) module
F18	-	Not Used
F19	-	Not Used
F20	-	Not Used
F21	10A	Powertrain Control Module (PCM), Evaporative emission (EVAP) canister vent valve
F22	-	Not Used
F23	30A	Fuel Pump Relay, Fuel injectors
F24	-	Not Used

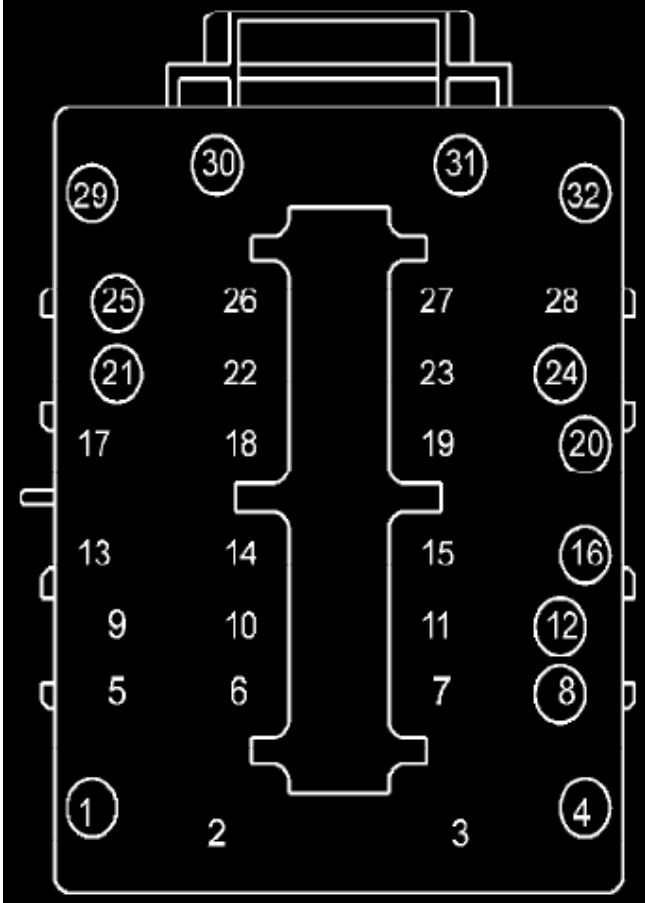
FUSE	AMPS	Circuits Protected
F25	10A	A/C clutch relay
F26	-	Not Used
F27	20A	4X4 control module
F28	-	Not Used
F29	30A	Windshield wipers/washer
F30	-	Not Used
F31	15A	Fog lamp relay
F32	-	Not Used
F33	30A	Anti-lock Brake System (ABS) module
F34	-	Not Used
F35	-	Not Used
F36	-	Not Used
F37	-	Not Used
F38	7.5A	Trailer tow connector - Right turn
F39	15A	Powertrain Control Module (PCM)
F40	-	Not Used
F41	10A	*5R44E Transmission **5R55E Transmission
F42	7.5A	Trailer tow connector - Left turn
F43	20A	EVAP canister purge valve, Heated Positive Crankcase Ventilation (PCV) valve, Idle Air Control (IAC) valve, Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor, Heated Oxygen Sensor (HO2S) #11, Heated Oxygen Sensor (HO2S) #12, Heated Oxygen Sensor (HO2S) #21, Heated Oxygen Sensor (HO2S) #22, EGR vacuum regulator solenoid valve, A/C relay coil
F44	15A	Ignition coil, *Ignition transformer capacitor 1


Connector: C1035
Description:
BATTERY JUNCTION BOX (BJB)
Harness:
14A280
Base Part #:
1
Pin Circuit Gauge Circuit Function Qualifier
1 SDC02 (RD) 6 BATTERY- # PLUS
1 SDC02 (RD) 6 BATTERY- # PLUS

C1035

Connector: C2280A

Description:	Harness:	Base Part #:
SMART JUNCTION BOX (SJB)	14290	14B476

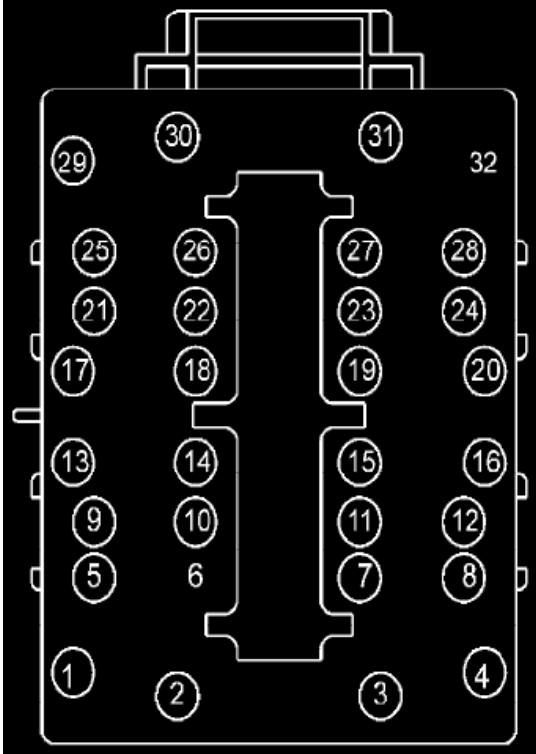


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	SBB01 (RD)	12	FUSE - 1 OR CIRCUIT BREAKER	
2	*	*	not used	
3	*	*	not used	
4	CBP05 (YE)	20	FUSE - 5 OR CIRCUIT BREAKER	
5	*	*	not used	
6	*	*	not used	
7	*	*	not used	
8	CES03 (VT-WH)	20	CTRL MOD - POWERTRAIN # SPEED CONTROL INDICATOR (SCIL)	
9	*	*	not used	
10	*	*	not used	
11	*	*	not used	
12	CLS34 (GY)	18	SWITCH - PARK LAMPS	
13	*	*	not used	
14	*	*	not used	
15	*	*	not used	
16	CBP04 (VT)	18	FUSE - 4 OR CIRCUIT BREAKER	
17	*	*	not used	
18	*	*	not used	
19	*	*	not used	
20	CBP03 (GY)	18	FUSE - 3 OR CIRCUIT BREAKER	
21	SBR14 (BN-RD)	18	FUSE - 14 OR CIRCUIT BREAKER	
22	*	*	not used	
23	*	*	not used	
24	CE517 (BU-GN)	20	DIODE - RELAY POWERTRAIN CONTROL MODULE	
25	CBP14 (VT-OG)	16	FUSE - 14 OR CIRCUIT BREAKER	
26	*	*	not used	
27	*	*	not used	
28	*	*	not used	
29	SBB03 (BU-RD)	12	FUSE - 3 OR CIRCUIT BREAKER	
30	CRH02 (BU-WH)	18	SWITCH - HORN	
31	CBP21 (BU-GY)	22	FUSE - 21 OR CIRCUIT BREAKER	
32	SBB05 (GY-RD)	10	FUSE - 5 OR CIRCUIT BREAKER	

Relay Box: Diagrams Smart Junction Box (SJB)

C2280A

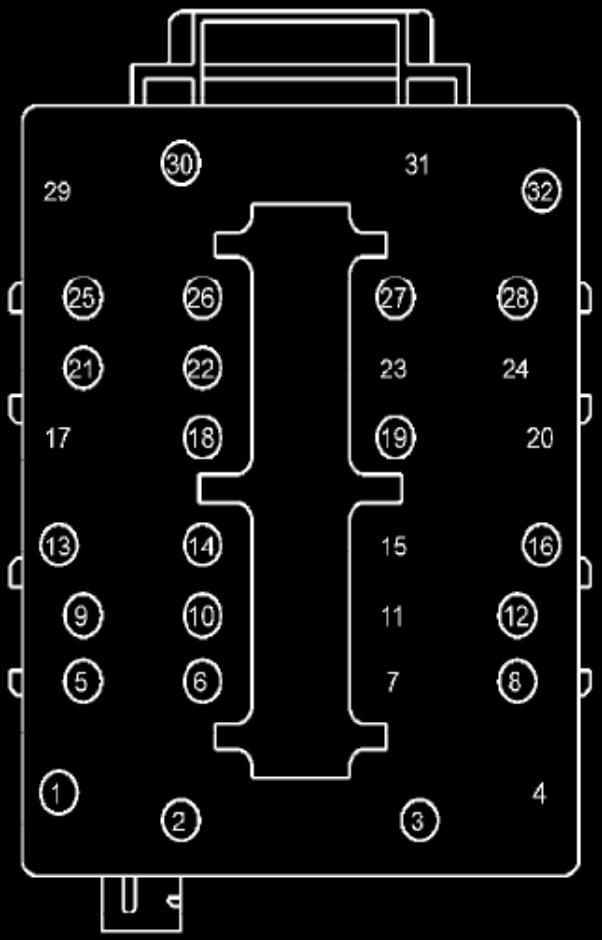
Connector: C2280B | **Description:** SMART JUNCTION BOX (SJB) | **Harness:** 14401 | **Base Part #:** 14B476



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	SBP23 (WH-RD)	14	FUSE - 23 OR CIRCUIT BREAKER	
2	SBP24 (VT-RD)	16	FUSE - 24 OR CIRCUIT BREAKER	
3	SBP34 (YE-RD)	16	FUSE - 34 OR CIRCUIT BREAKER	
4	SBP23 (WH-RD)	14	FUSE - 23 OR CIRCUIT BREAKER	
5	CBP10 (YE-OG)	20	FUSE - 10 OR CIRCUIT BREAKER	
6	*	*	not used	
7	SBP28 (GN-RD)	18	FUSE - 28 OR CIRCUIT BREAKER	
8	SBP30 (BN-RD)	22	FUSE - 30 OR CIRCUIT BREAKER	
9	CPL19 (WH-VT)	20	RELAY - DOOR LOCK # ALL LOCK	
10	CPL18 (GY-VT)	20	RELAY - DOOR LOCK # ALL UNLOCK	
11	CDC35 (BU-WH)	14	SWITCH - IGNITION # START	
12	SBP33 (RD)	20	FUSE - 33 OR CIRCUIT BREAKER	
13	CPL11 (GY-BN)	20	CTRL MOD. - DOOR LOCK # ALL LOCK	
14	GD161 (BK-YE)	18	GROUND - SEAT BRACKET REAR LEFT	
15	CBP20 (YE-VT)	18	FUSE - 20 OR CIRCUIT BREAKER	
16	SBP29 (GY-RD)	18	FUSE - 29 OR CIRCUIT BREAKER	
17	CDC32 (BN-YE)	12	SWITCH - IGNITION # RUN	
18	CBP27 (GN-BN)	22	FUSE - 27 OR CIRCUIT BREAKER	
19	CBP20 (YE-VT)	18	FUSE - 20 OR CIRCUIT BREAKER	
20	SBP29 (GY-RD)	16	FUSE - 29 OR CIRCUIT BREAKER	
21	CBP27 (GN-BN)	22	FUSE - 27 OR CIRCUIT BREAKER	
22	CBP26 (BU-WH)	20	FUSE - 26 OR CIRCUIT BREAKER	
23	CBP20 (YE-VT)	18	FUSE - 20 OR CIRCUIT BREAKER	
24	CBP22 (GN-OG)	20	FUSE - 22 OR CIRCUIT BREAKER	
25	CLF27 (GN-BN)	14	SWITCH - FLASH TO PASS	
26	SBP17 (RD)	18	FUSE - 17 OR CIRCUIT BREAKER	
27	CBP20 (YE-VT)	20	FUSE - 20 OR CIRCUIT BREAKER	
28	SBP32 (VT-RD)	22	FUSE - 32 OR CIRCUIT BREAKER	
29	CDC34 (WH-OG)	12	SWITCH - IGNITION # RUN; START	
30	SBP12 (GN-RD)	16	FUSE - 12 OR CIRCUIT BREAKER	Audiophile sound system
30	SBP12 (GN-RD)	20	FUSE - 12 OR CIRCUIT BREAKER	without Audiophile and satellite radio
31	SBP19 (BU-RD)	16	FUSE - 19 OR CIRCUIT BREAKER	
32	*	*	not used	

C2280B (Part 1)

Connector: C2280C | **Description:** SMART JUNCTION BOX (SJB) | **Harness:** 14401 | **Base Part #:** 14B476

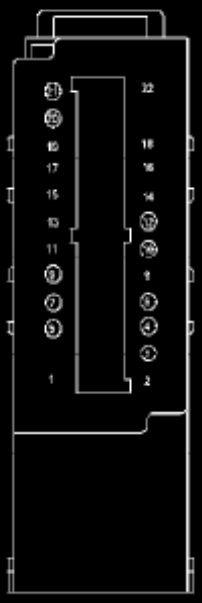


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD174 (BK-WH)	18	GROUND - TUNNEL	
2	CPL12 (VT-OG)	20	CTRL MOD. - DOOR LOCK # DOUBLE LOCK ALL LOCK	
3	CLS34 (GY)	16	SWITCH - PARK LAMPS	
4	*	*	not used	
5	CPL42 (GY-YE)	22	SWITCH - TRIM DOOR LOCK (DRIVER) # LOCK	
6	CPL26 (GN-VT)	20	SWITCH - LATCH DRIVER # AJAR	
7	*	*	not used	
8	CLN28 (GN-BU)	18	SWITCH - DOME LAMP	
9	CPL43 (VT-GY)	22	SWITCH - TRIM DOOR LOCK (DRIVER) # UNLOCK	
10	CPL42 (GY-YE)	22	SWITCH - TRIM DOOR LOCK (DRIVER) # LOCK	
11	*	*	not used	
12	CPL51 (BU-GN)	20	CTRL MOD. - DOOR LOCK # DRIVER UNLOCK	
13	CPW14 (VT-WH)	14	SWITCH - POWER WINDOW DRIVER # PASSENGER LOCK OUT (ENABLE)	
14	CPL43 (VT-GY)	22	SWITCH - TRIM DOOR LOCK (DRIVER) # UNLOCK	
15	*	*	not used	
16	CPW30 (GY-YE)	14	RELAY - POWER WINDOW	
17	*	*	not used	
18	CBP08 (GY-YE)	20	FUSE - 8 OR CIRCUIT BREAKER	
19	CE517 (BU-GN)	20	DIODE - RELAY POWERTRAIN CONTROL MODULE	
20	*	*	not used	
21	CLF29 (BN)	22	CTRL MOD. - FOG LAMPS FRONT (LEFT)	
22	CBP08 (GY-YE)	20	FUSE - 8 OR CIRCUIT BREAKER	
23	*	*	not used	
24	*	*	not used	
25	CAT17 (BN)	16	RELAY - TRAILER TOW PARK LAMPS (COLOR TO SAE 1239)	
26	CBP01 (BU)	22	FUSE - 1 OR CIRCUIT BREAKER	
27	CBP06 (WH-BU)	20	FUSE - 6 OR CIRCUIT BREAKER	
28	CBP09 (VT-GY)	20	FUSE - 9 OR CIRCUIT BREAKER	
29	*	*	not used	
30	CLF16 (BU-WH)	16	SWITCH - BEAM LOW	
31	*	*	not used	
32	CDC33 (VT-GN)	12	SWITCH - IGNITION # RUN: ACCESSORY	

C2280B (Part 2)

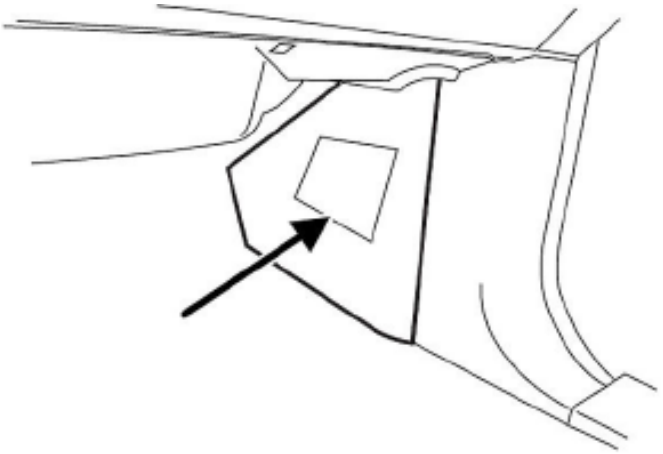
C2280C

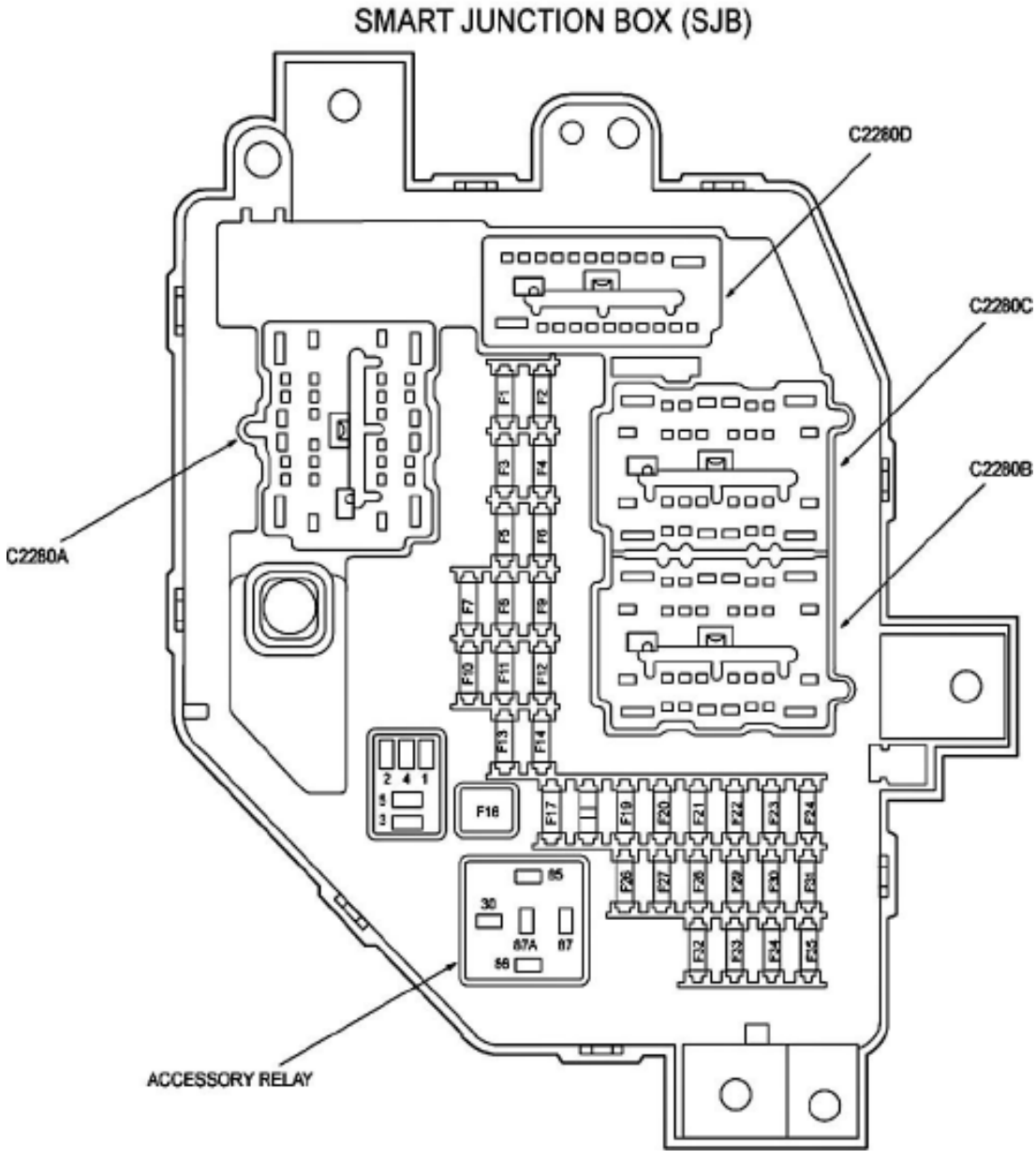
Connector: C2280D	Description:	Harness:	Base Part #:
	SMART JUNCTION BOX (SJB)	14401	14B476



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	*	*	not used	
3	CPL31 (WH)	20	SWITCH - LATCH PASSENGER # AJAR	
4	CPL36 (GN)	20	SWITCH - LATCH REAR DRIVER SIDE # AJAR (INCL.SLIDING DOOR)	
5	CLS30 (VT-WH)	18	RELAY - PARK LAMP	
6	CPL39 (YE)	20	SWITCH - LATCH REAR PASSENGER SIDE # AJAR (INCL.SLIDING DOOR)	
7	CCB15 (BN-GN)	22	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL CLOSED	
8	*	*	not used	
9	CLF21 (GY-VT)	18	SWITCH - FOG LAMPS FRONT	
10	CLN27 (WH-BN)	18	CTRL MOD. - DIMMER INSTRUMENT	
11	*	*	not used	
12	SRH01 (YE-RD)	20	RELAY - HORN	
13	*	*	not used	
14	*	*	not used	
15	*	*	not used	
16	*	*	not used	
17	*	*	not used	
18	*	*	not used	
19	*	*	not used	
20	VDB04 (WH-BU)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED HIGH	
21	VDB05 (WH)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED LOW	
22	*	*	not used	

C2280D

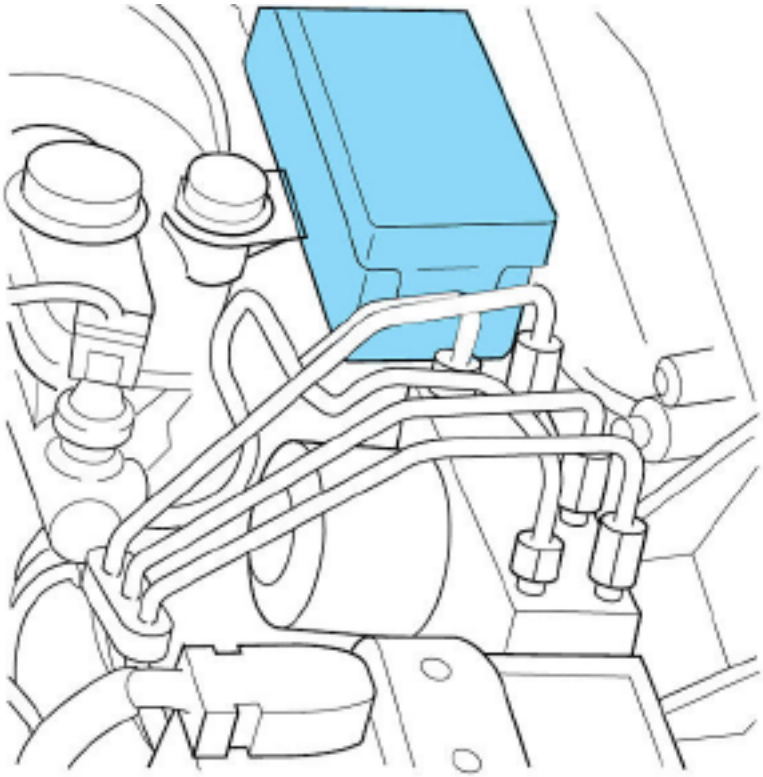



SMART JUNCTION BOX (SJB)
C2280D
C2280C
C2280B
C2280A
F1
F2
F3
F4
F5
F6
F7
F8
F9
F10
F11
F12
F13
F14
F16
F17
F19
F20
F21
F22
F23
F24
F26
F27
F28
F29
F30
F31
F32
F33
F34
F35
2 4 1
5
3
30
85
87A
87
86
ACCESSORY RELAY

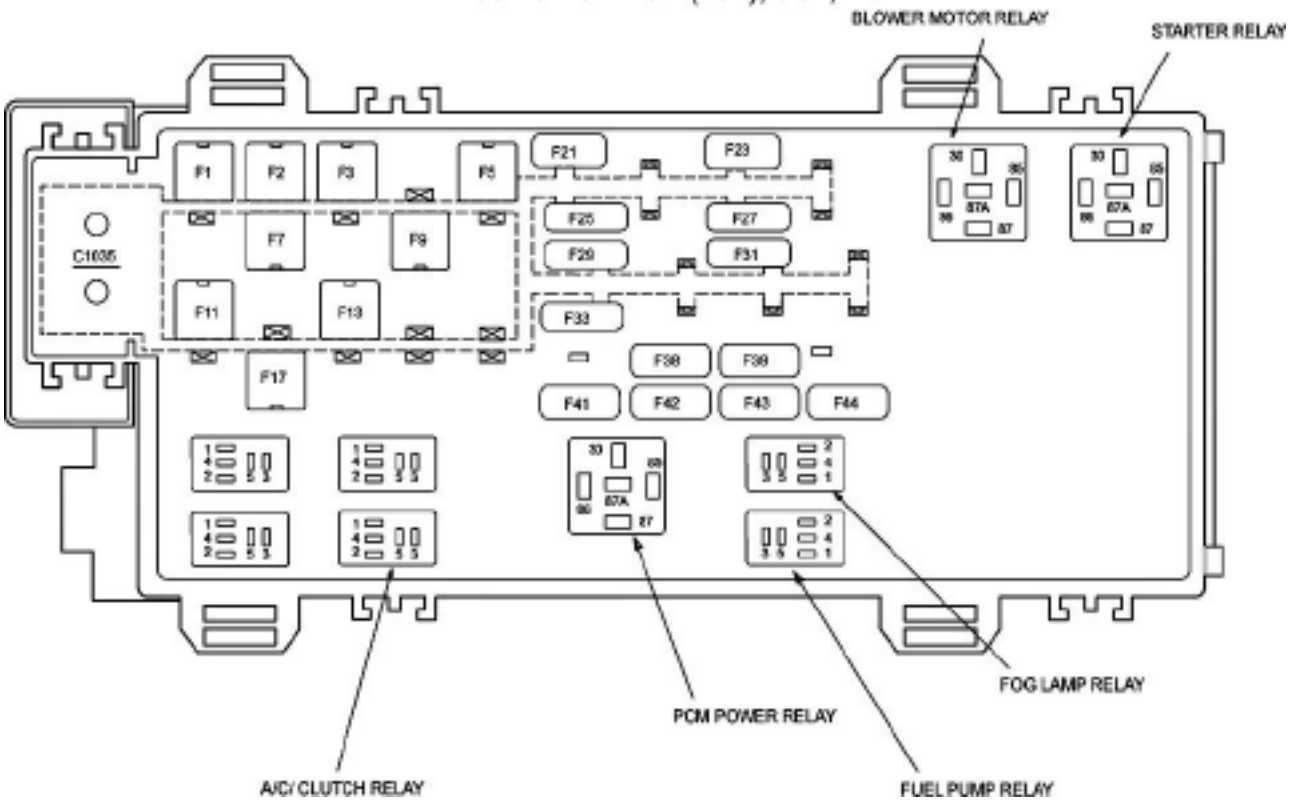
Relay Box: Application and ID Smart Junction Box

FUSE	AMPS	Circuits Protected
F1	5A	Illumination dimmer
F2	10A	Trailer tow connector - Park
F3	10A	Headlamp, right (Low beam lamp feed)
F4	10A	Headlamp, left (Low beam lamp feed)
F5	5A	Windshield wiper module
F6	10A	Audio unit, Door lock switch illumination
F7	5A	Not Used
F8	10A	Restraints Control Module (RCM), Occupant Classification System Module (OCSM), Passenger Air bag Deactivation (PAD) Indicator
F9	5A	Instrument Cluster (IC), Air bag indicator
F10	10A	4X4 control module, Instrument Cluster (IC)
F11	10A	Smart Junction Box (SJB), logic power
F12	15A	Subwoofer amplifier with audiophile, Satellite radio receiver
F13	15A	Interior lamp relay, Horn relay
F14	15A	High beam lamp feed to High beam indicator, Headlamp, right, Headlamp, left
F16	30A	Accessory relay (Power windows)
F17	15A	Indicator flasher relay
F18	-	Not Used

FUSE	AMPS	Circuits Protected
F19	20A	Brake pedal position switch (Stoplamps)
F20	10A	Transmission control switch, Digital Transmission Range (TR) sensor, Speed control servo, Anti-lock Brake System (ABS) module, Indicator flasher relay, Reversing lamps switch, Speed control On/Off switch, Speed control Set/Resume switch
F21	5A	Digital Transmission Range (TR) sensor, Starter relay, Powertrain Control Module (PCM)
F22	5A	Audio unit
F23	30A	Main light switch, Multifunction switch
F24	20A	Audio unit
F26	2A	Deactivator switch
F27	10A	Blend door actuator, Climate control assembly
F28	15A	4X4 control module
F29	20A	Cigar lighter, front, Data Link Connector (DLC)
F30	5A	Exterior rear view mirror switch
F31	20A	Park lamp relay
F32	5A	Brake pedal position switch (logic power), Brake shift interlock
F33	5A	Instrument Cluster (IC), Neutral tow indicator
F34	20A	Power point
F35	15A	Door lock/unlock relay, Driver door unlock relay



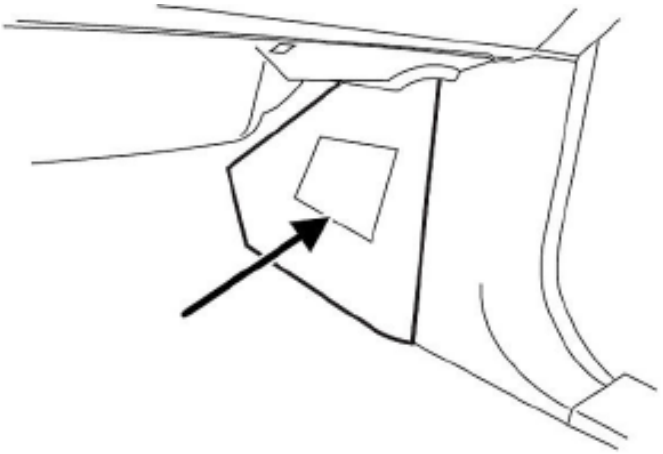
BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L

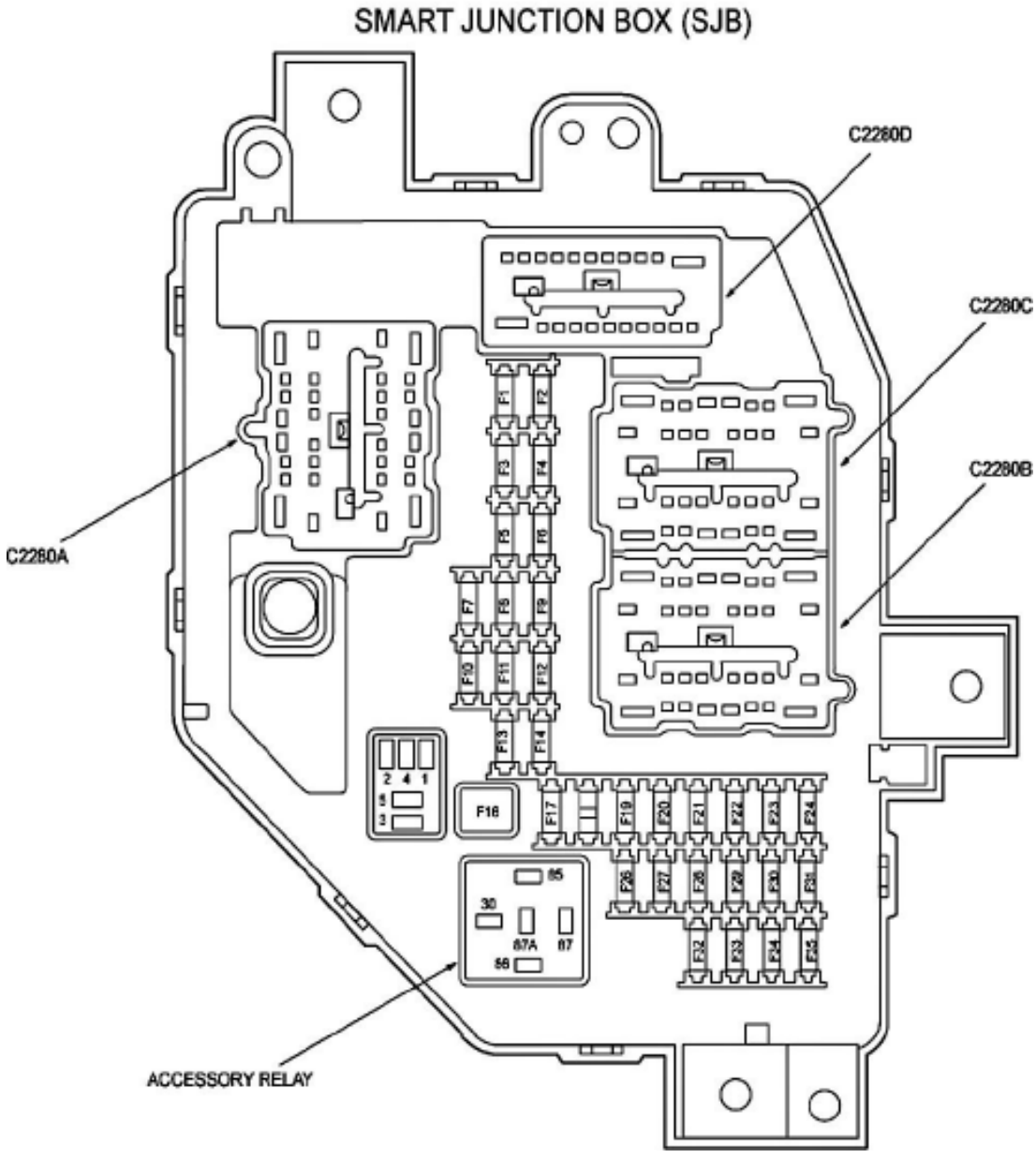


Relay Box: Application and ID Battery Junction Box

FUSE	AMPS	Circuits Protected
F1	40A	Smart Junction Box (SJB)
F2	-	Not Used
F3	40A	Smart Junction Box (SJB)
F4	-	Not Used
F5	50A	Smart Junction Box (SJB)
F6	-	Not Used
F7	30A	Starter Relay
F8	-	Not Used
F9	40A	Ignition Switch
F10	-	Not Used
F11	30A	PCM power relay
F12	-	Not Used
F13	30A	Blower motor relay
F14	-	Not Used
F15	-	Not Used
F16	-	Not Used
F17	40A	Anti-lock Brake System (ABS) module
F18	-	Not Used
F19	-	Not Used
F20	-	Not Used
F21	10A	Powertrain Control Module (PCM), Evaporative emission (EVAP) canister vent valve
F22	-	Not Used
F23	30A	Fuel Pump Relay, Fuel injectors
F24	-	Not Used

FUSE	AMPS	Circuits Protected
F25	10A	A/C clutch relay
F26	-	Not Used
F27	20A	4X4 control module
F28	-	Not Used
F29	30A	Windshield wipers/washer
F30	-	Not Used
F31	15A	Fog lamp relay
F32	-	Not Used
F33	30A	Anti-lock Brake System (ABS) module
F34	-	Not Used
F35	-	Not Used
F36	-	Not Used
F37	-	Not Used
F38	7.5A	Trailer tow connector - Right turn
F39	15A	Powertrain Control Module (PCM)
F40	-	Not Used
F41	10A	*5R44E Transmission **5R55E Transmission
F42	7.5A	Trailer tow connector - Left turn
F43	20A	EVAP canister purge valve, Heated Positive Crankcase Ventilation (PCV) valve, Idle Air Control (IAC) valve, Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor, Heated Oxygen Sensor (HO2S) #11, Heated Oxygen Sensor (HO2S) #12, Heated Oxygen Sensor (HO2S) #21, Heated Oxygen Sensor (HO2S) #22, EGR vacuum regulator solenoid valve, A/C relay coil
F44	15A	Ignition coil, *Ignition transformer capacitor 1




SMART JUNCTION BOX (SJB)
C2280D
C2280C
C2280B
C2280A
F1
F2
F3
F4
F5
F6
F7
F8
F9
F10
F11
F12
F13
F14
F16
F17
F19
F20
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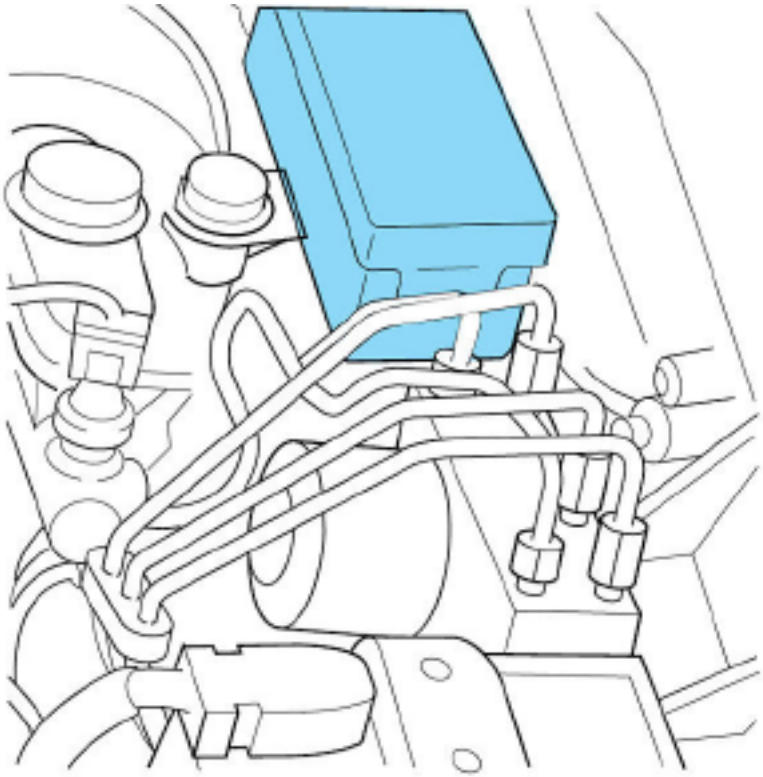
F24
F26
F27
F28
F29
F30
F31
F32
F33
F34
F35
2 4 1
3
30
85
87A
87
86
ACCESSORY RELAY

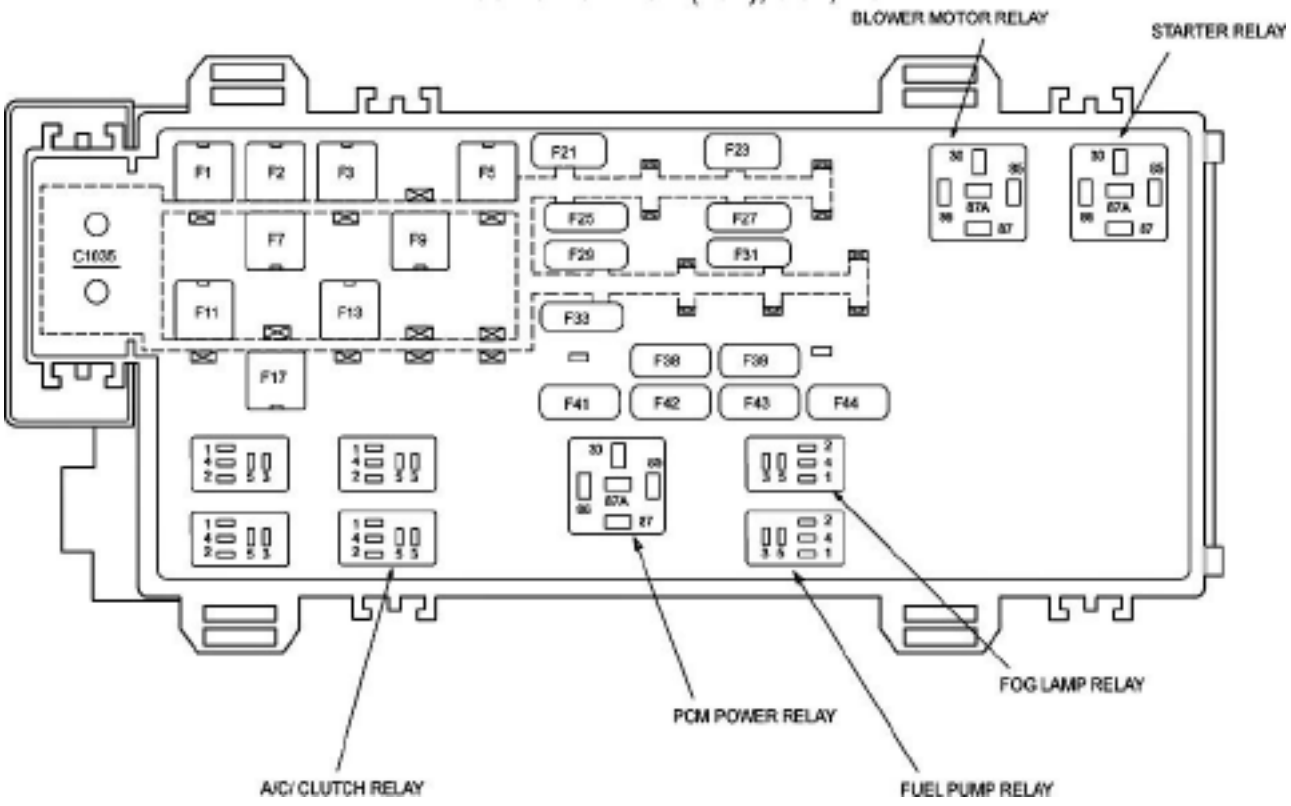
Relay Box: Locations Smart Junction Box

FUSE	AMPS	Circuits Protected
F1	5A	Illumination dimmer
F2	10A	Trailer tow connector - Park
F3	10A	Headlamp, right (Low beam lamp feed)
F4	10A	Headlamp, left (Low beam lamp feed)
F5	5A	Windshield wiper module
F6	10A	Audio unit, Door lock switch illumination
F7	5A	Not Used
F8	10A	Restraints Control Module (RCM), Occupant Classification System Module (OCSM), Passenger Air bag Deactivation (PAD) Indicator
F9	5A	Instrument Cluster (IC), Air bag indicator
F10	10A	4X4 control module, Instrument Cluster (IC)
F11	10A	Smart Junction Box (SJB), logic power
F12	15A	Subwoofer amplifier with audiophile, Satellite radio receiver
F13	15A	Interior lamp relay, Horn relay
F14	15A	High beam lamp feed to High beam indicator, Headlamp, right, Headlamp, left
F16	30A	Accessory relay (Power windows)
F17	15A	Indicator flasher relay
F18	-	Not Used

FUSE	AMPS	Circuits Protected
F19	20A	Brake pedal position switch (Stoplamps)
F20	10A	Transmission control switch, Digital Transmission Range (TR) sensor, Speed control servo, Anti-lock Brake System (ABS) module, Indicator flasher relay, Reversing lamps switch, Speed control On/Off switch, Speed control Set/Resume switch
F21	5A	Digital Transmission Range (TR) sensor, Starter relay, Powertrain Control Module (PCM)
F22	5A	Audio unit
F23	30A	Main light switch, Multifunction switch
F24	20A	Audio unit
F26	2A	Deactivator switch
F27	10A	Blend door actuator, Climate control assembly
F28	15A	4X4 control module
F29	20A	Cigar lighter, front, Data Link Connector (DLC)
F30	5A	Exterior rear view mirror switch
F31	20A	Park lamp relay
F32	5A	Brake pedal position switch (logic power), Brake shift interlock
F33	5A	Instrument Cluster (IC), Neutral tow indicator
F34	20A	Power point
F35	15A	Door lock/unlock relay, Driver door unlock relay



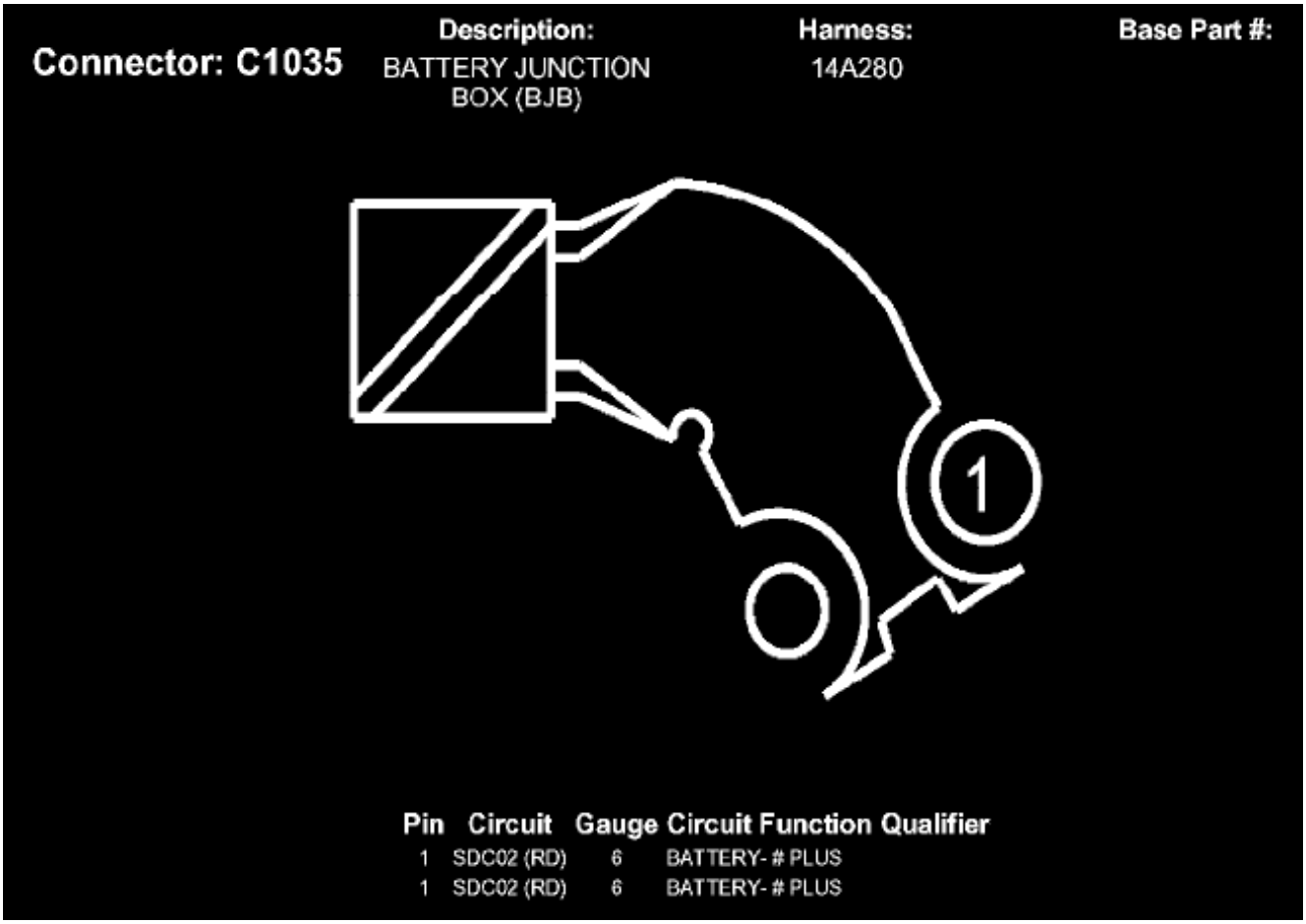
BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L



Relay Box: Locations Battery Junction Box

FUSE	AMPS	Circuits Protected
F1	40A	Smart Junction Box (SJB)
F2	-	Not Used
F3	40A	Smart Junction Box (SJB)
F4	-	Not Used
F5	50A	Smart Junction Box (SJB)
F6	-	Not Used
F7	30A	Starter Relay
F8	-	Not Used
F9	40A	Ignition Switch
F10	-	Not Used
F11	30A	PCM power relay
F12	-	Not Used
F13	30A	Blower motor relay
F14	-	Not Used
F15	-	Not Used
F16	-	Not Used
F17	40A	Anti-lock Brake System (ABS) module
F18	-	Not Used
F19	-	Not Used
F20	-	Not Used
F21	10A	Powertrain Control Module (PCM), Evaporative emission (EVAP) canister vent valve
F22	-	Not Used
F23	30A	Fuel Pump Relay, Fuel injectors
F24	-	Not Used

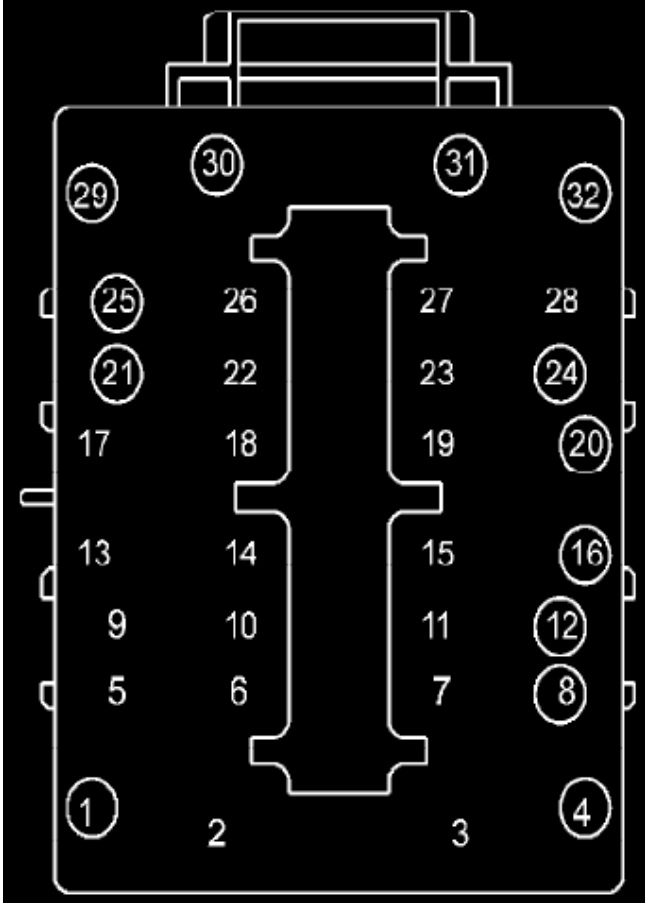
FUSE	AMPS	Circuits Protected
F25	10A	A/C clutch relay
F26	-	Not Used
F27	20A	4X4 control module
F28	-	Not Used
F29	30A	Windshield wipers/washer
F30	-	Not Used
F31	15A	Fog lamp relay
F32	-	Not Used
F33	30A	Anti-lock Brake System (ABS) module
F34	-	Not Used
F35	-	Not Used
F36	-	Not Used
F37	-	Not Used
F38	7.5A	Trailer tow connector - Right turn
F39	15A	Powertrain Control Module (PCM)
F40	-	Not Used
F41	10A	*5R44E Transmission **5R55E Transmission
F42	7.5A	Trailer tow connector - Left turn
F43	20A	EVAP canister purge valve, Heated Positive Crankcase Ventilation (PCV) valve, Idle Air Control (IAC) valve, Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor, Heated Oxygen Sensor (HO2S) #11, Heated Oxygen Sensor (HO2S) #12, Heated Oxygen Sensor (HO2S) #21, Heated Oxygen Sensor (HO2S) #22, EGR vacuum regulator solenoid valve, A/C relay coil
F44	15A	Ignition coil, *Ignition transformer capacitor 1


Connector: C1035
Description:
BATTERY JUNCTION BOX (BJB)
Harness:
14A280
Base Part #:
1
Pin Circuit Gauge Circuit Function Qualifier
1 SDC02 (RD) 6 BATTERY- # PLUS
1 SDC02 (RD) 6 BATTERY- # PLUS

C1035

Connector: C2280A

Description:	Harness:	Base Part #:
SMART JUNCTION BOX (SJB)	14290	14B476

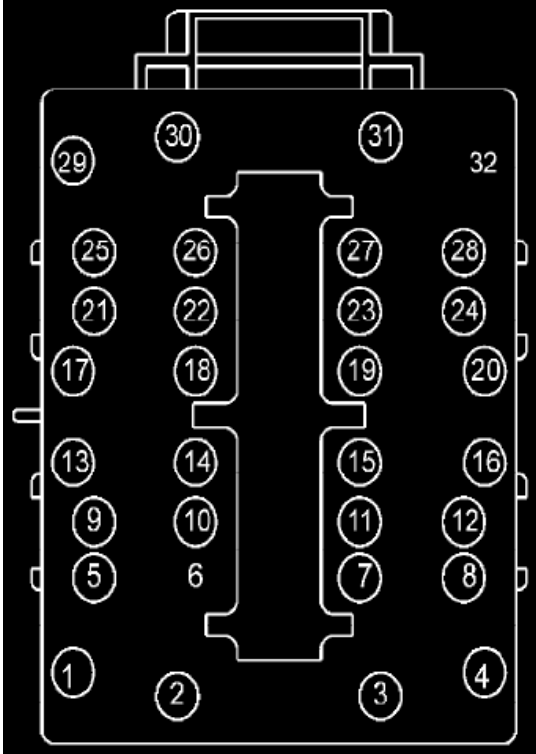


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	SBB01 (RD)	12	FUSE - 1 OR CIRCUIT BREAKER	
2	*	*	not used	
3	*	*	not used	
4	CBP05 (YE)	20	FUSE - 5 OR CIRCUIT BREAKER	
5	*	*	not used	
6	*	*	not used	
7	*	*	not used	
8	CES03 (VT-WH)	20	CTRL MOD - POWERTRAIN # SPEED CONTROL INDICATOR (SCIL)	
9	*	*	not used	
10	*	*	not used	
11	*	*	not used	
12	CLS34 (GY)	18	SWITCH - PARK LAMPS	
13	*	*	not used	
14	*	*	not used	
15	*	*	not used	
16	CBP04 (VT)	18	FUSE - 4 OR CIRCUIT BREAKER	
17	*	*	not used	
18	*	*	not used	
19	*	*	not used	
20	CBP03 (GY)	18	FUSE - 3 OR CIRCUIT BREAKER	
21	SBR14 (BN-RD)	18	FUSE - 14 OR CIRCUIT BREAKER	
22	*	*	not used	
23	*	*	not used	
24	CE517 (BU-GN)	20	DIODE - RELAY POWERTRAIN CONTROL MODULE	
25	CBP14 (VT-OG)	16	FUSE - 14 OR CIRCUIT BREAKER	
26	*	*	not used	
27	*	*	not used	
28	*	*	not used	
29	SBB03 (BU-RD)	12	FUSE - 3 OR CIRCUIT BREAKER	
30	CRH02 (BU-WH)	18	SWITCH - HORN	
31	CBP21 (BU-GY)	22	FUSE - 21 OR CIRCUIT BREAKER	
32	SBB05 (GY-RD)	10	FUSE - 5 OR CIRCUIT BREAKER	

Relay Box: Diagrams Smart Junction Box (SJB)

C2280A

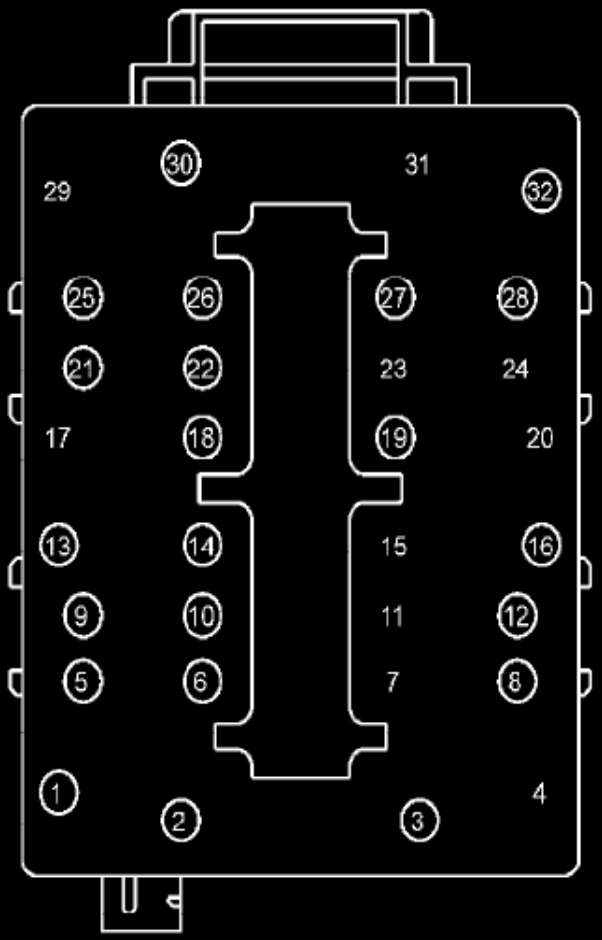
Connector: C2280B | **Description:** SMART JUNCTION BOX (SJB) | **Harness:** 14401 | **Base Part #:** 14B476



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	SBP23 (WH-RD)	14	FUSE - 23 OR CIRCUIT BREAKER	
2	SBP24 (VT-RD)	16	FUSE - 24 OR CIRCUIT BREAKER	
3	SBP34 (YE-RD)	16	FUSE - 34 OR CIRCUIT BREAKER	
4	SBP23 (WH-RD)	14	FUSE - 23 OR CIRCUIT BREAKER	
5	CBP10 (YE-OG)	20	FUSE - 10 OR CIRCUIT BREAKER	
6	*	*	not used	
7	SBP28 (GN-RD)	18	FUSE - 28 OR CIRCUIT BREAKER	
8	SBP30 (BN-RD)	22	FUSE - 30 OR CIRCUIT BREAKER	
9	CPL19 (WH-VT)	20	RELAY - DOOR LOCK # ALL LOCK	
10	CPL18 (GY-VT)	20	RELAY - DOOR LOCK # ALL UNLOCK	
11	CDC35 (BU-WH)	14	SWITCH - IGNITION # START	
12	SBP33 (RD)	20	FUSE - 33 OR CIRCUIT BREAKER	
13	CPL11 (GY-BN)	20	CTRL MOD. - DOOR LOCK # ALL LOCK	
14	GD161 (BK-YE)	18	GROUND - SEAT BRACKET REAR LEFT	
15	CBP20 (YE-VT)	18	FUSE - 20 OR CIRCUIT BREAKER	
16	SBP29 (GY-RD)	18	FUSE - 29 OR CIRCUIT BREAKER	
17	CDC32 (BN-YE)	12	SWITCH - IGNITION # RUN	
18	CBP27 (GN-BN)	22	FUSE - 27 OR CIRCUIT BREAKER	
19	CBP20 (YE-VT)	18	FUSE - 20 OR CIRCUIT BREAKER	
20	SBP29 (GY-RD)	16	FUSE - 29 OR CIRCUIT BREAKER	
21	CBP27 (GN-BN)	22	FUSE - 27 OR CIRCUIT BREAKER	
22	CBP26 (BU-WH)	20	FUSE - 26 OR CIRCUIT BREAKER	
23	CBP20 (YE-VT)	18	FUSE - 20 OR CIRCUIT BREAKER	
24	CBP22 (GN-OG)	20	FUSE - 22 OR CIRCUIT BREAKER	
25	CLF27 (GN-BN)	14	SWITCH - FLASH TO PASS	
26	SBP17 (RD)	18	FUSE - 17 OR CIRCUIT BREAKER	
27	CBP20 (YE-VT)	20	FUSE - 20 OR CIRCUIT BREAKER	
28	SBP32 (VT-RD)	22	FUSE - 32 OR CIRCUIT BREAKER	
29	CDC34 (WH-OG)	12	SWITCH - IGNITION # RUN; START	
30	SBP12 (GN-RD)	16	FUSE - 12 OR CIRCUIT BREAKER	Audiophile sound system
30	SBP12 (GN-RD)	20	FUSE - 12 OR CIRCUIT BREAKER	without Audiophile and satellite radio
31	SBP19 (BU-RD)	16	FUSE - 19 OR CIRCUIT BREAKER	
32	*	*	not used	

C2280B (Part 1)

Connector: C2280C | **Description:** SMART JUNCTION BOX (SJB) | **Harness:** 14401 | **Base Part #:** 14B476

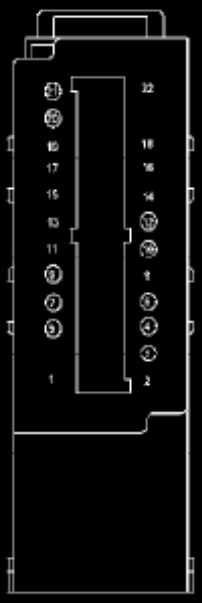


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD174 (BK-WH)	18	GROUND - TUNNEL	
2	CPL12 (VT-OG)	20	CTRL MOD. - DOOR LOCK # DOUBLE LOCK ALL LOCK	
3	CLS34 (GY)	16	SWITCH - PARK LAMPS	
4	*	*	not used	
5	CPL42 (GY-YE)	22	SWITCH - TRIM DOOR LOCK (DRIVER) # LOCK	
6	CPL26 (GN-VT)	20	SWITCH - LATCH DRIVER # AJAR	
7	*	*	not used	
8	CLN28 (GN-BU)	18	SWITCH - DOME LAMP	
9	CPL43 (VT-GY)	22	SWITCH - TRIM DOOR LOCK (DRIVER) # UNLOCK	
10	CPL42 (GY-YE)	22	SWITCH - TRIM DOOR LOCK (DRIVER) # LOCK	
11	*	*	not used	
12	CPL51 (BU-GN)	20	CTRL MOD. - DOOR LOCK # DRIVER UNLOCK	
13	CPW14 (VT-WH)	14	SWITCH - POWER WINDOW DRIVER # PASSENGER LOCK OUT (ENABLE)	
14	CPL43 (VT-GY)	22	SWITCH - TRIM DOOR LOCK (DRIVER) # UNLOCK	
15	*	*	not used	
16	CPW30 (GY-YE)	14	RELAY - POWER WINDOW	
17	*	*	not used	
18	CBP08 (GY-YE)	20	FUSE - 8 OR CIRCUIT BREAKER	
19	CE517 (BU-GN)	20	DIODE - RELAY POWERTRAIN CONTROL MODULE	
20	*	*	not used	
21	CLF29 (BN)	22	CTRL MOD. - FOG LAMPS FRONT (LEFT)	
22	CBP08 (GY-YE)	20	FUSE - 8 OR CIRCUIT BREAKER	
23	*	*	not used	
24	*	*	not used	
25	CAT17 (BN)	16	RELAY - TRAILER TOW PARK LAMPS (COLOR TO SAE 1239)	
26	CBP01 (BU)	22	FUSE - 1 OR CIRCUIT BREAKER	
27	CBP06 (WH-BU)	20	FUSE - 6 OR CIRCUIT BREAKER	
28	CBP09 (VT-GY)	20	FUSE - 9 OR CIRCUIT BREAKER	
29	*	*	not used	
30	CLF16 (BU-WH)	16	SWITCH - BEAM LOW	
31	*	*	not used	
32	CDC33 (VT-GN)	12	SWITCH - IGNITION # RUN: ACCESSORY	

C2280B (Part 2)

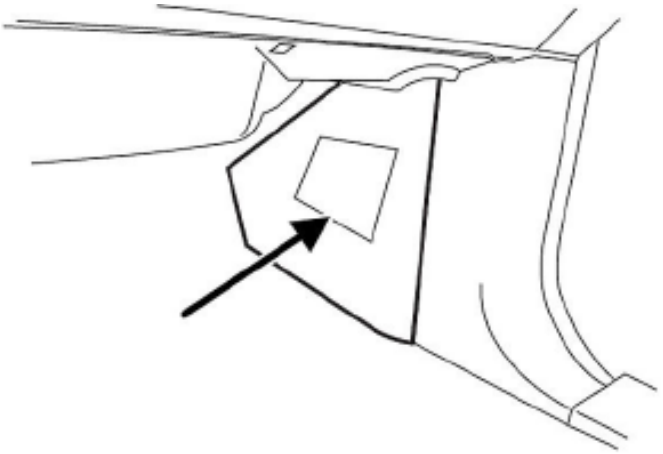
C2280C

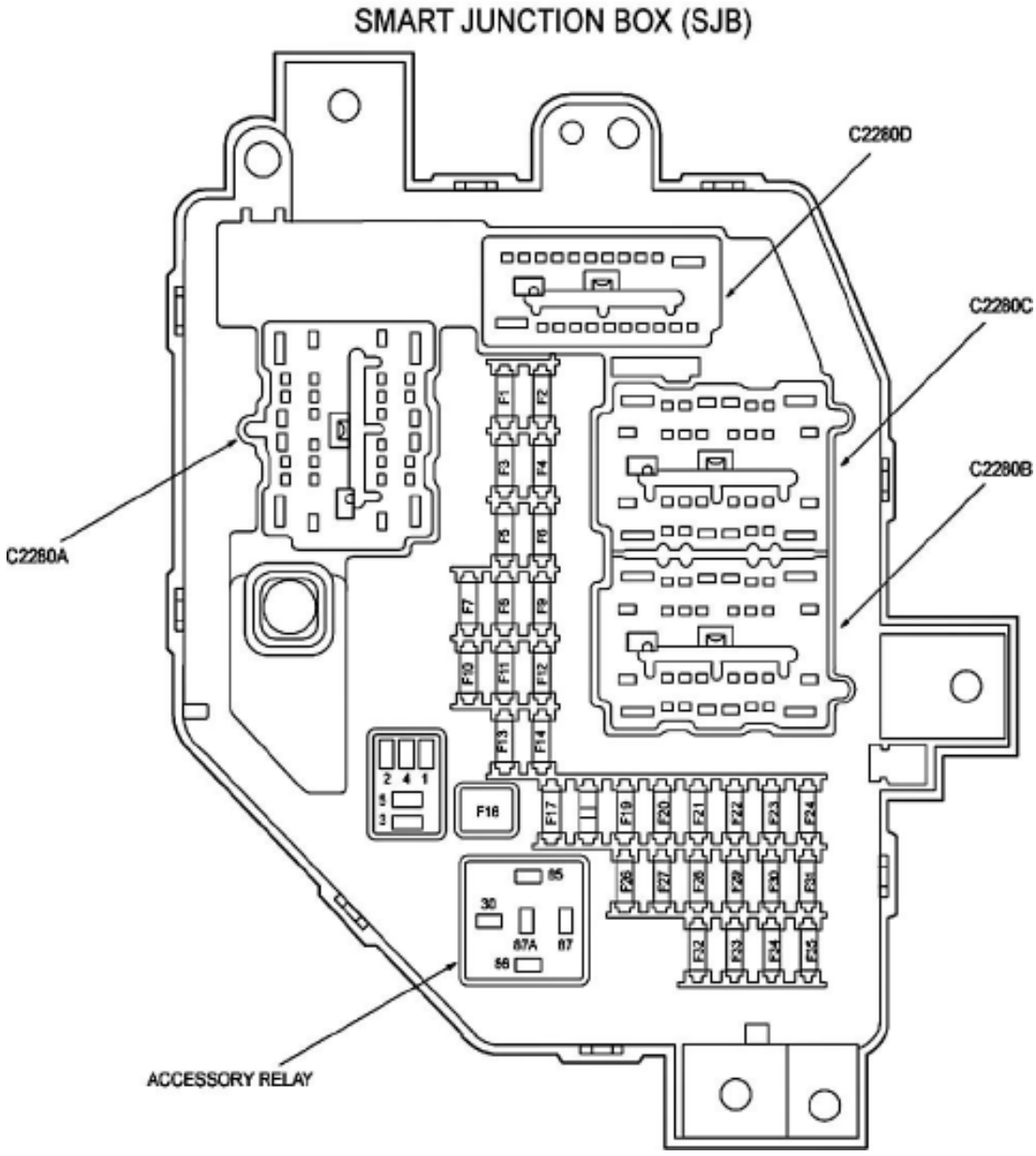
Connector: C2280D	Description:	Harness:	Base Part #:
	SMART JUNCTION BOX (SJB)	14401	14B476



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	*	*	not used	
3	CPL31 (WH)	20	SWITCH - LATCH PASSENGER # AJAR	
4	CPL36 (GN)	20	SWITCH - LATCH REAR DRIVER SIDE # AJAR (INCL.SLIDING DOOR)	
5	CLS30 (VT-WH)	18	RELAY - PARK LAMP	
6	CPL39 (YE)	20	SWITCH - LATCH REAR PASSENGER SIDE # AJAR (INCL.SLIDING DOOR)	
7	CCB15 (BN-GN)	22	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL CLOSED	
8	*	*	not used	
9	CLF21 (GY-VT)	18	SWITCH - FOG LAMPS FRONT	
10	CLN27 (WH-BN)	18	CTRL MOD. - DIMMER INSTRUMENT	
11	*	*	not used	
12	SRH01 (YE-RD)	20	RELAY - HORN	
13	*	*	not used	
14	*	*	not used	
15	*	*	not used	
16	*	*	not used	
17	*	*	not used	
18	*	*	not used	
19	*	*	not used	
20	VDB04 (WH-BU)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED HIGH	
21	VDB05 (WH)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED LOW	
22	*	*	not used	

C2280D

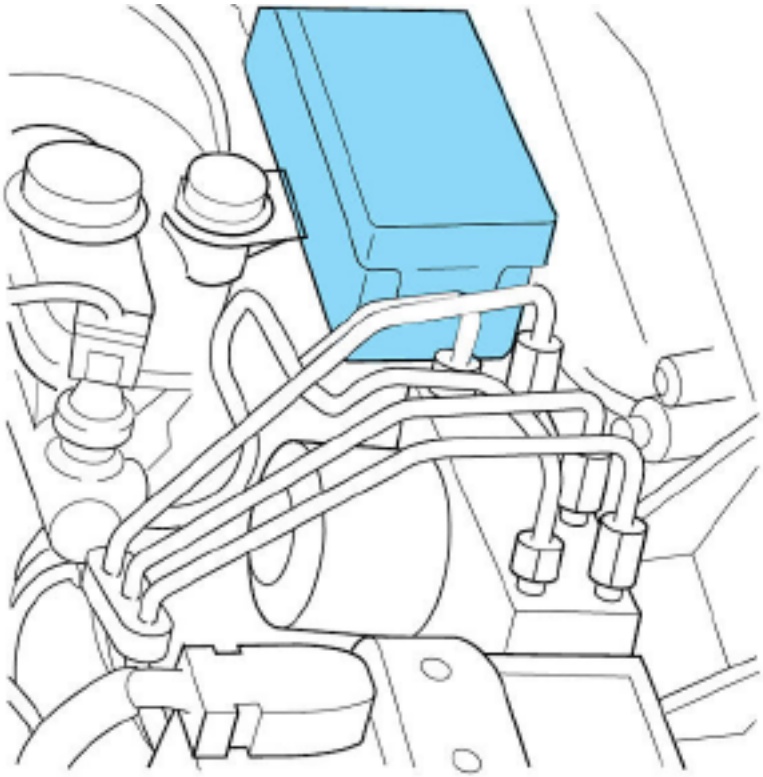



SMART JUNCTION BOX (SJB)
C2280D
C2280C
C2280B
C2280A
F1
F2
F3
F4
F5
F6
F7
F8
F9
F10
F11
F12
F13
F14
F16
F17
F19
F20
F21
F22
F23
F24
F26
F27
F28
F29
F30
F31
F32
F33
F34
F35
2 4 1
3
30
85
87A
87
86
ACCESSORY RELAY

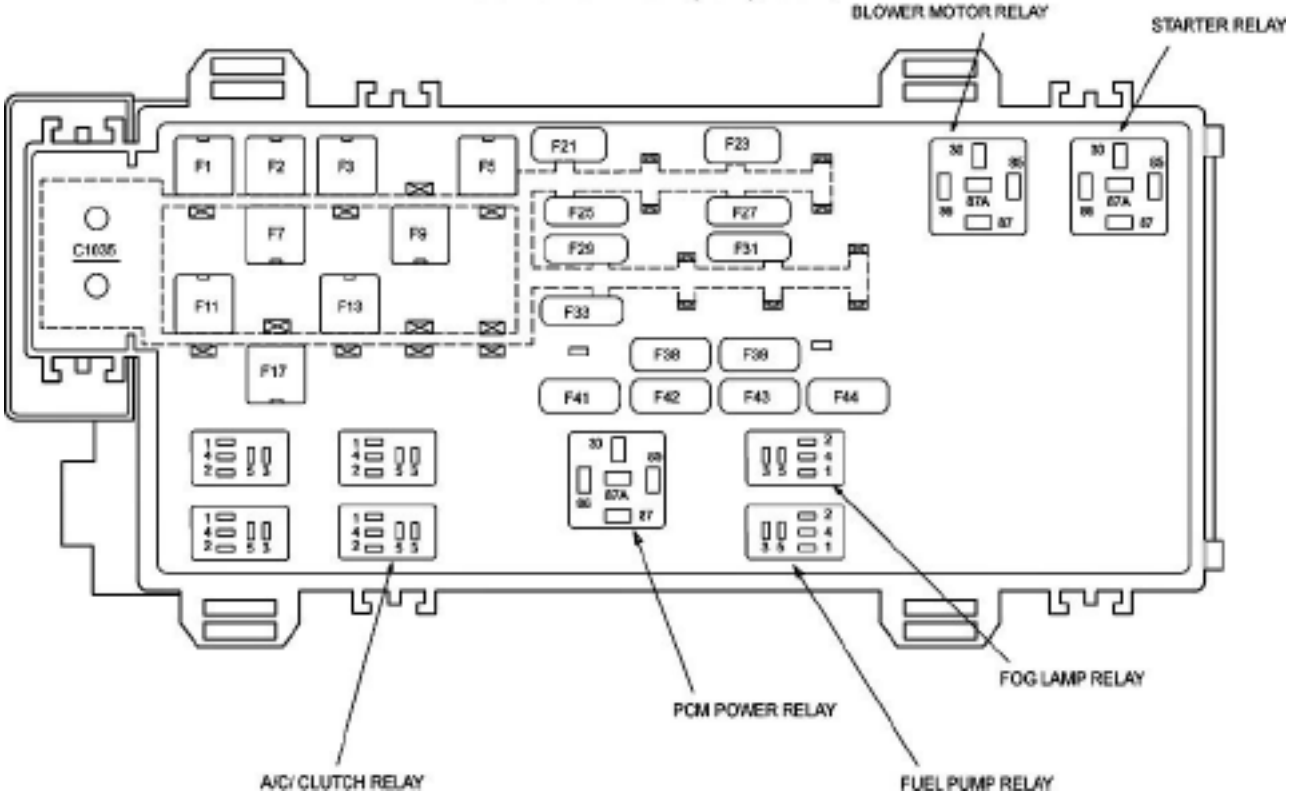
Relay Box: Application and ID Smart Junction Box

FUSE	AMPS	Circuits Protected
F1	5A	Illumination dimmer
F2	10A	Trailer tow connector - Park
F3	10A	Headlamp, right (Low beam lamp feed)
F4	10A	Headlamp, left (Low beam lamp feed)
F5	5A	Windshield wiper module
F6	10A	Audio unit, Door lock switch illumination
F7	5A	Not Used
F8	10A	Restraints Control Module (RCM), Occupant Classification System Module (OCSM), Passenger Air bag Deactivation (PAD) Indicator
F9	5A	Instrument Cluster (IC), Air bag indicator
F10	10A	4X4 control module, Instrument Cluster (IC)
F11	10A	Smart Junction Box (SJB), logic power
F12	15A	Subwoofer amplifier with audiophile, Satellite radio receiver
F13	15A	Interior lamp relay, Horn relay
F14	15A	High beam lamp feed to High beam indicator, Headlamp, right, Headlamp, left
F16	30A	Accessory relay (Power windows)
F17	15A	Indicator flasher relay
F18	-	Not Used

FUSE	AMPS	Circuits Protected
F19	20A	Brake pedal position switch (Stoplamps)
F20	10A	Transmission control switch, Digital Transmission Range (TR) sensor, Speed control servo, Anti-lock Brake System (ABS) module, Indicator flasher relay, Reversing lamps switch, Speed control On/Off switch, Speed control Set/Resume switch
F21	5A	Digital Transmission Range (TR) sensor, Starter relay, Powertrain Control Module (PCM)
F22	5A	Audio unit
F23	30A	Main light switch, Multifunction switch
F24	20A	Audio unit
F26	2A	Deactivator switch
F27	10A	Blend door actuator, Climate control assembly
F28	15A	4X4 control module
F29	20A	Cigar lighter, front, Data Link Connector (DLC)
F30	5A	Exterior rear view mirror switch
F31	20A	Park lamp relay
F32	5A	Brake pedal position switch (logic power), Brake shift interlock
F33	5A	Instrument Cluster (IC), Neutral tow indicator
F34	20A	Power point
F35	15A	Door lock/unlock relay, Driver door unlock relay



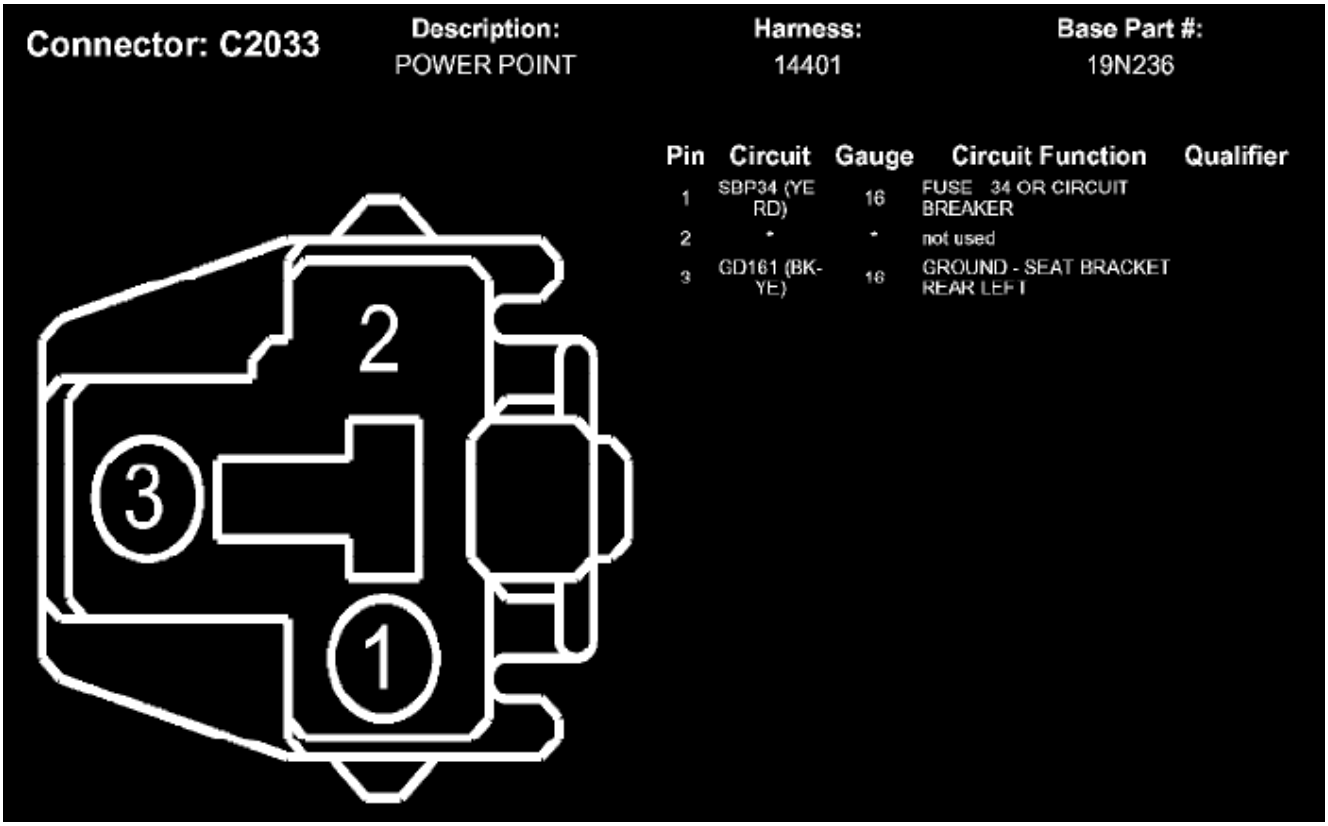
BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L



Relay Box: Application and ID Battery Junction Box

FUSE	AMPS	Circuits Protected
F1	40A	Smart Junction Box (SJB)
F2	-	Not Used
F3	40A	Smart Junction Box (SJB)
F4	-	Not Used
F5	50A	Smart Junction Box (SJB)
F6	-	Not Used
F7	30A	Starter Relay
F8	-	Not Used
F9	40A	Ignition Switch
F10	-	Not Used
F11	30A	PCM power relay
F12	-	Not Used
F13	30A	Blower motor relay
F14	-	Not Used
F15	-	Not Used
F16	-	Not Used
F17	40A	Anti-lock Brake System (ABS) module
F18	-	Not Used
F19	-	Not Used
F20	-	Not Used
F21	10A	Powertrain Control Module (PCM), Evaporative emission (EVAP) canister vent valve
F22	-	Not Used
F23	30A	Fuel Pump Relay, Fuel injectors
F24	-	Not Used

FUSE	AMPS	Circuits Protected
F25	10A	A/C clutch relay
F26	-	Not Used
F27	20A	4X4 control module
F28	-	Not Used
F29	30A	Windshield wipers/washer
F30	-	Not Used
F31	15A	Fog lamp relay
F32	-	Not Used
F33	30A	Anti-lock Brake System (ABS) module
F34	-	Not Used
F35	-	Not Used
F36	-	Not Used
F37	-	Not Used
F38	7.5A	Trailer tow connector - Right turn
F39	15A	Powertrain Control Module (PCM)
F40	-	Not Used
F41	10A	*5R44E Transmission **5R55E Transmission
F42	7.5A	Trailer tow connector - Left turn
F43	20A	EVAP canister purge valve, Heated Positive Crankcase Ventilation (PCV) valve, Idle Air Control (IAC) valve, Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor, Heated Oxygen Sensor (HO2S) #11, Heated Oxygen Sensor (HO2S) #12, Heated Oxygen Sensor (HO2S) #21, Heated Oxygen Sensor (HO2S) #22, EGR vacuum regulator solenoid valve, A/C relay coil
F44	15A	Ignition coil, *Ignition transformer capacitor 1

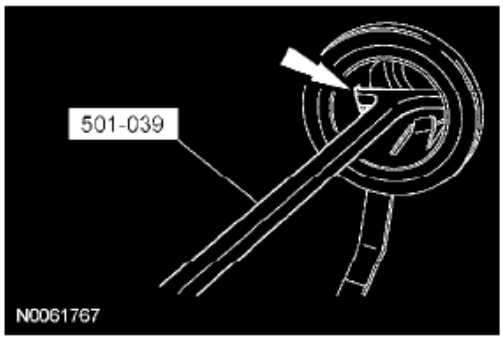


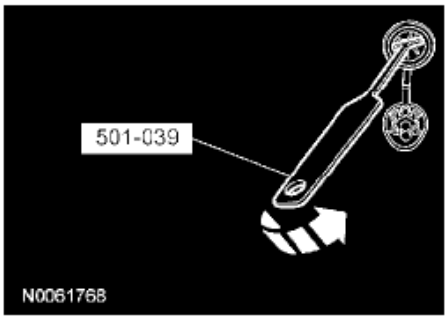
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	SBP34 (YE RD)	16	FUSE 34 OR CIRCUIT BREAKER	
2	*	*	not used	
3	GD161 (BK-YE)	16	GROUND - SEAT BRACKET REAR LEFT	

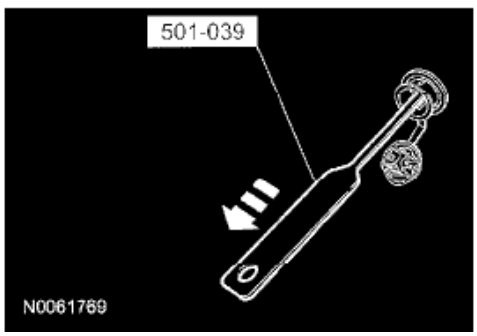
C2033

Special Tool(s)

ST3024-A	Remover, Power Point Socket 501-039 or equivalent







Auxiliary Power Outlet: Service and Repair

POWER POINT

Special Tool(s)

Special Tool(s)

Removal

NOTE: Power point cover may differ depending on location.

1. Open the power point cover. 2. Install the special tool in one of the power point socket slots.

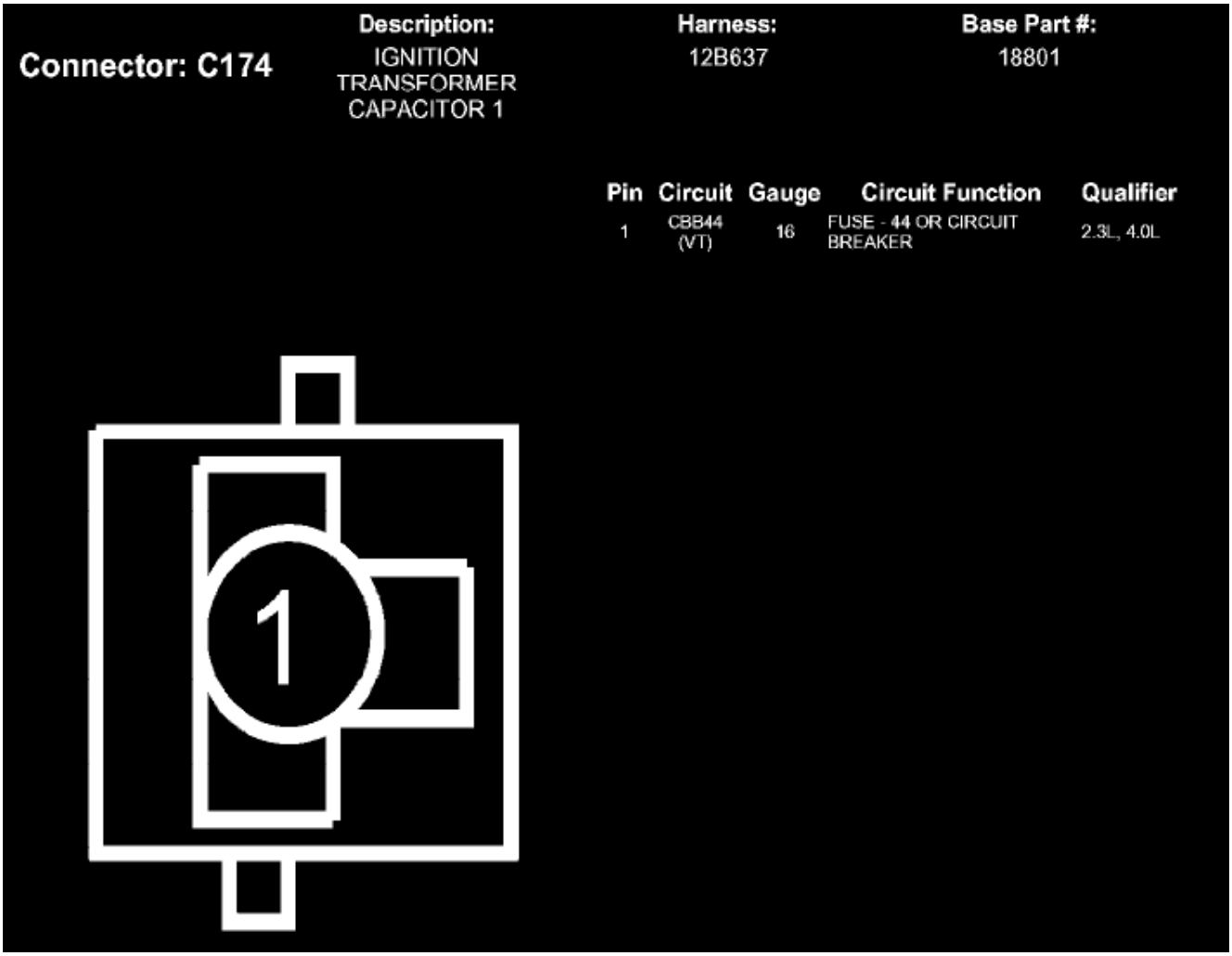
3. Position the special tool so that it engages in the adjacent slot.

4. Using the special tool, pull the power point socket out of the retainer.

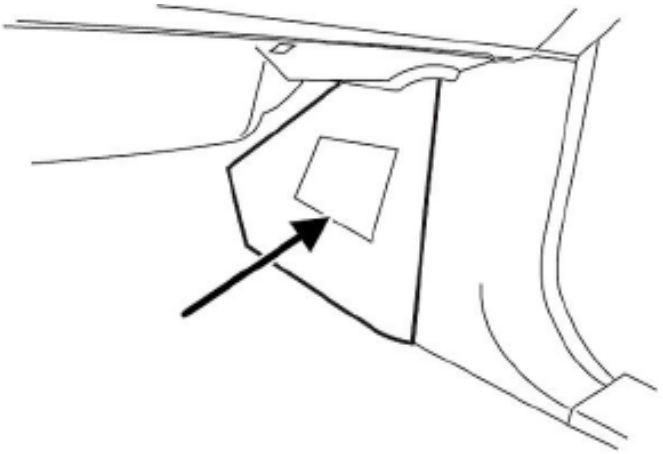
5. Disconnect the electrical connector.

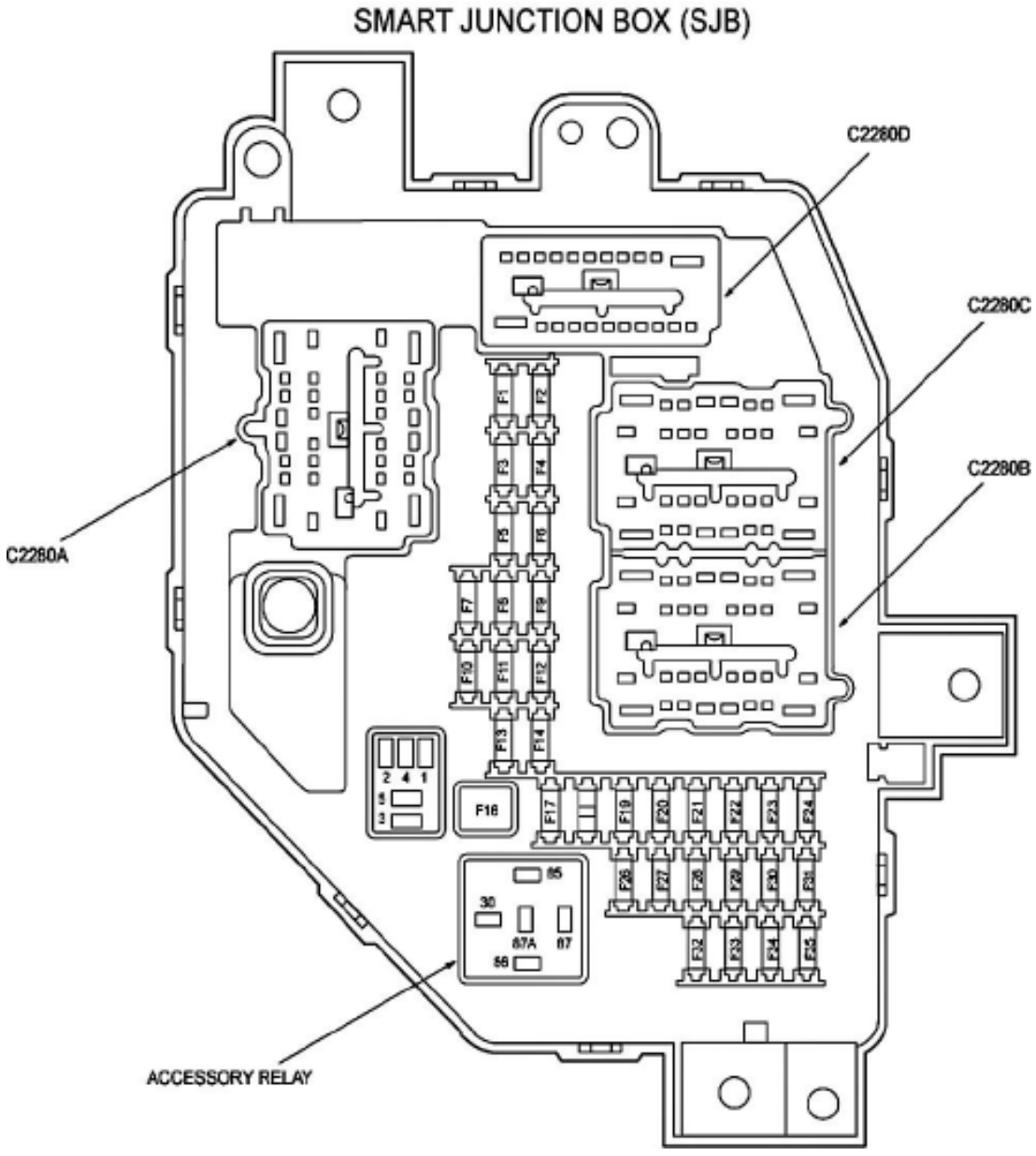
Installation

1. Connect the electrical connector. 2. Slide the power point socket into the retainer.


Connector: C174
Description:
IGNITION TRANSFORMER CAPACITOR 1
Harness:
12B637
Base Part #:
18801
Pin
Circuit
Gauge
Circuit Function
Qualifier
1
CBB44 (VT)
16
FUSE - 44 OR CIRCUIT BREAKER
2.3L, 4.0L
1

C174

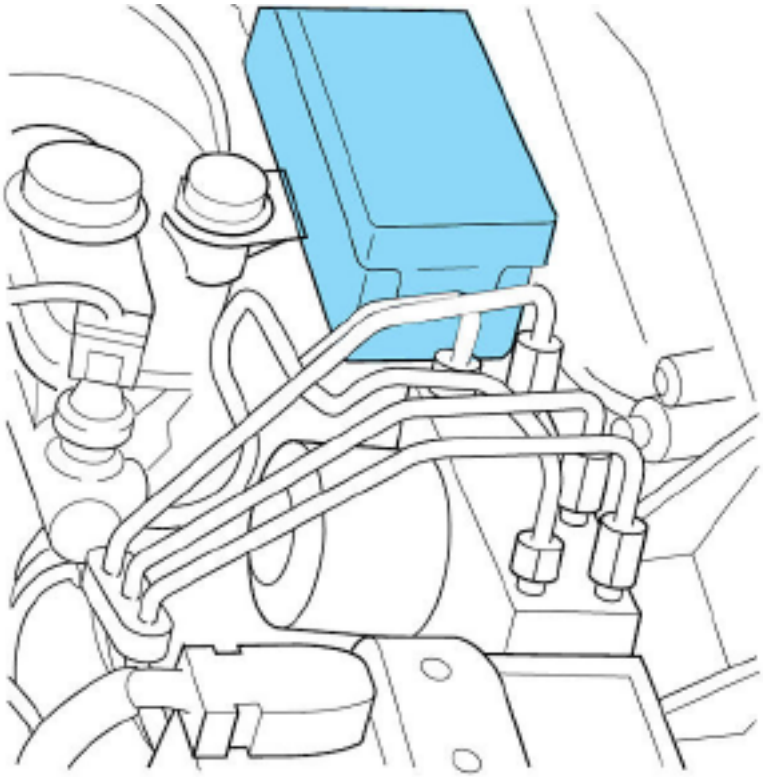



SMART JUNCTION BOX (SJB)
C2280D
C2280C
C2280B
C2280A
F1
F2
F3
F4
F5
F6
F7
F8
F9
F10
F11
F12
F13
F14
F16
F17
F19
F20
F21
F22
F23
F24
F26
F27
F28
F29
F30
F31
F32
F33
F34
F35
2 4 1
3
30
85
87A
87
86
ACCESSORY RELAY

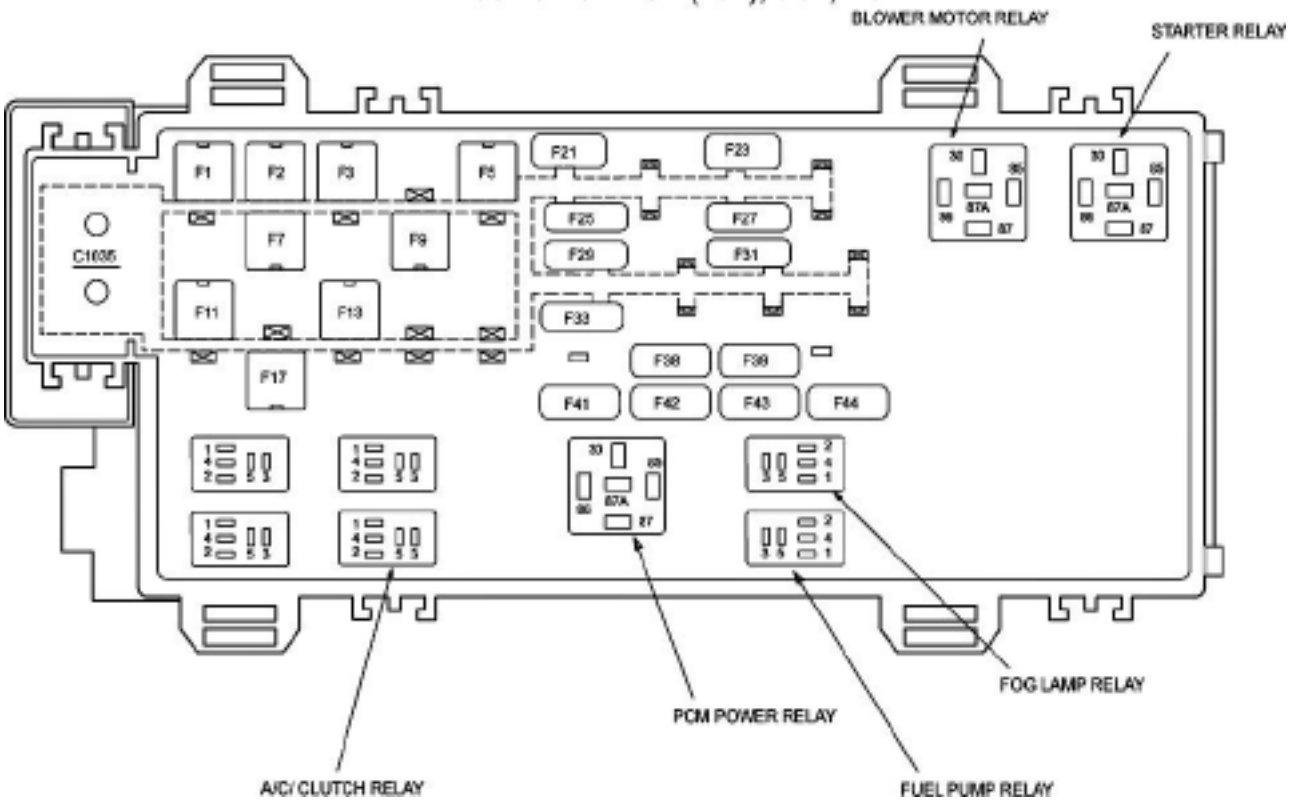
Fuse: Locations Smart Junction Box

FUSE	AMPS	Circuits Protected
F1	5A	Illumination dimmer
F2	10A	Trailer tow connector - Park
F3	10A	Headlamp, right (Low beam lamp feed)
F4	10A	Headlamp, left (Low beam lamp feed)
F5	5A	Windshield wiper module
F6	10A	Audio unit, Door lock switch illumination
F7	5A	Not Used
F8	10A	Restraints Control Module (RCM), Occupant Classification System Module (OCSM), Passenger Air bag Deactivation (PAD) Indicator
F9	5A	Instrument Cluster (IC), Air bag indicator
F10	10A	4X4 control module, Instrument Cluster (IC)
F11	10A	Smart Junction Box (SJB), logic power
F12	15A	Subwoofer amplifier with audiophile, Satellite radio receiver
F13	15A	Interior lamp relay, Horn relay
F14	15A	High beam lamp feed to High beam indicator, Headlamp, right, Headlamp, left
F16	30A	Accessory relay (Power windows)
F17	15A	Indicator flasher relay
F18	-	Not Used

FUSE	AMPS	Circuits Protected
F19	20A	Brake pedal position switch (Stoplamps)
F20	10A	Transmission control switch, Digital Transmission Range (TR) sensor, Speed control servo, Anti-lock Brake System (ABS) module, Indicator flasher relay, Reversing lamps switch, Speed control On/Off switch, Speed control Set/Resume switch
F21	5A	Digital Transmission Range (TR) sensor, Starter relay, Powertrain Control Module (PCM)
F22	5A	Audio unit
F23	30A	Main light switch, Multifunction switch
F24	20A	Audio unit
F26	2A	Deactivator switch
F27	10A	Blend door actuator, Climate control assembly
F28	15A	4X4 control module
F29	20A	Cigar lighter, front, Data Link Connector (DLC)
F30	5A	Exterior rear view mirror switch
F31	20A	Park lamp relay
F32	5A	Brake pedal position switch (logic power), Brake shift interlock
F33	5A	Instrument Cluster (IC), Neutral tow indicator
F34	20A	Power point
F35	15A	Door lock/unlock relay, Driver door unlock relay



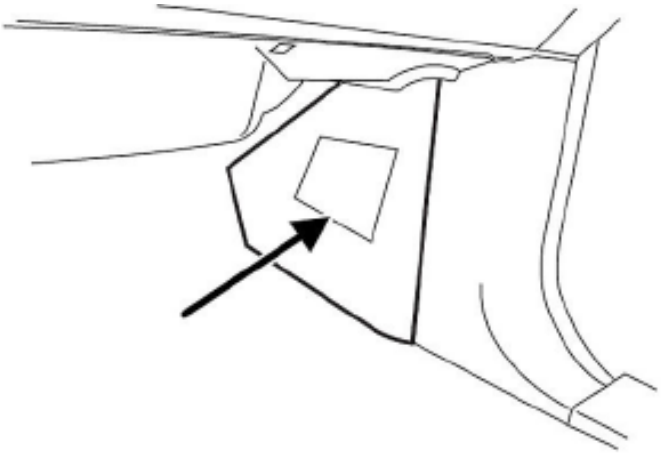
BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L

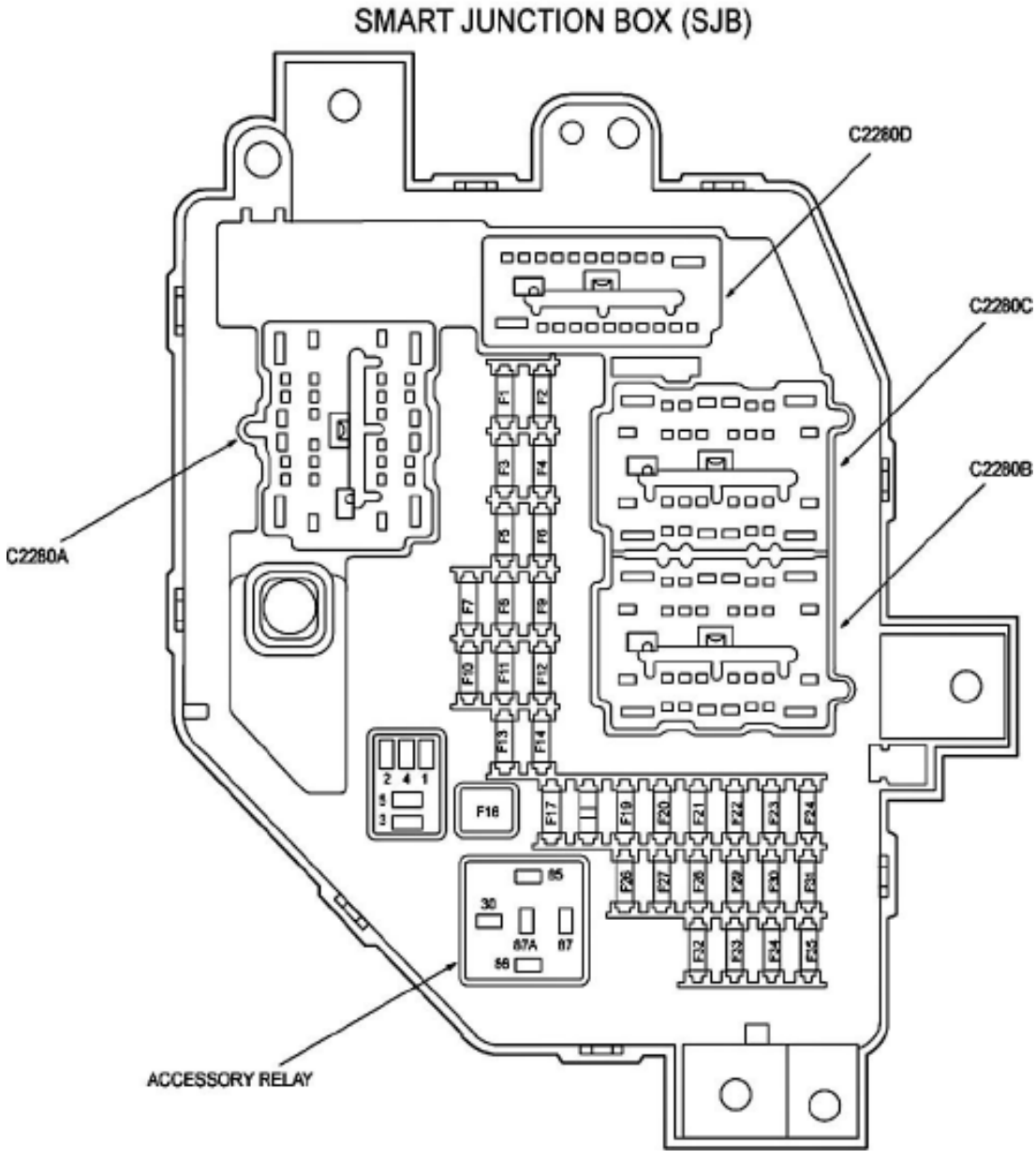


Fuse: Locations Battery Junction Box

FUSE	AMPS	Circuits Protected
F1	40A	Smart Junction Box (SJB)
F2	-	Not Used
F3	40A	Smart Junction Box (SJB)
F4	-	Not Used
F5	50A	Smart Junction Box (SJB)
F6	-	Not Used
F7	30A	Starter Relay
F8	-	Not Used
F9	40A	Ignition Switch
F10	-	Not Used
F11	30A	PCM power relay
F12	-	Not Used
F13	30A	Blower motor relay
F14	-	Not Used
F15	-	Not Used
F16	-	Not Used
F17	40A	Anti-lock Brake System (ABS) module
F18	-	Not Used
F19	-	Not Used
F20	-	Not Used
F21	10A	Powertrain Control Module (PCM), Evaporative emission (EVAP) canister vent valve
F22	-	Not Used
F23	30A	Fuel Pump Relay, Fuel injectors
F24	-	Not Used

FUSE	AMPS	Circuits Protected
F25	10A	A/C clutch relay
F26	-	Not Used
F27	20A	4X4 control module
F28	-	Not Used
F29	30A	Windshield wipers/washer
F30	-	Not Used
F31	15A	Fog lamp relay
F32	-	Not Used
F33	30A	Anti-lock Brake System (ABS) module
F34	-	Not Used
F35	-	Not Used
F36	-	Not Used
F37	-	Not Used
F38	7.5A	Trailer tow connector - Right turn
F39	15A	Powertrain Control Module (PCM)
F40	-	Not Used
F41	10A	*5R44E Transmission **5R55E Transmission
F42	7.5A	Trailer tow connector - Left turn
F43	20A	EVAP canister purge valve, Heated Positive Crankcase Ventilation (PCV) valve, Idle Air Control (IAC) valve, Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor, Heated Oxygen Sensor (HO2S) #11, Heated Oxygen Sensor (HO2S) #12, Heated Oxygen Sensor (HO2S) #21, Heated Oxygen Sensor (HO2S) #22, EGR vacuum regulator solenoid valve, A/C relay coil
F44	15A	Ignition coil, *Ignition transformer capacitor 1

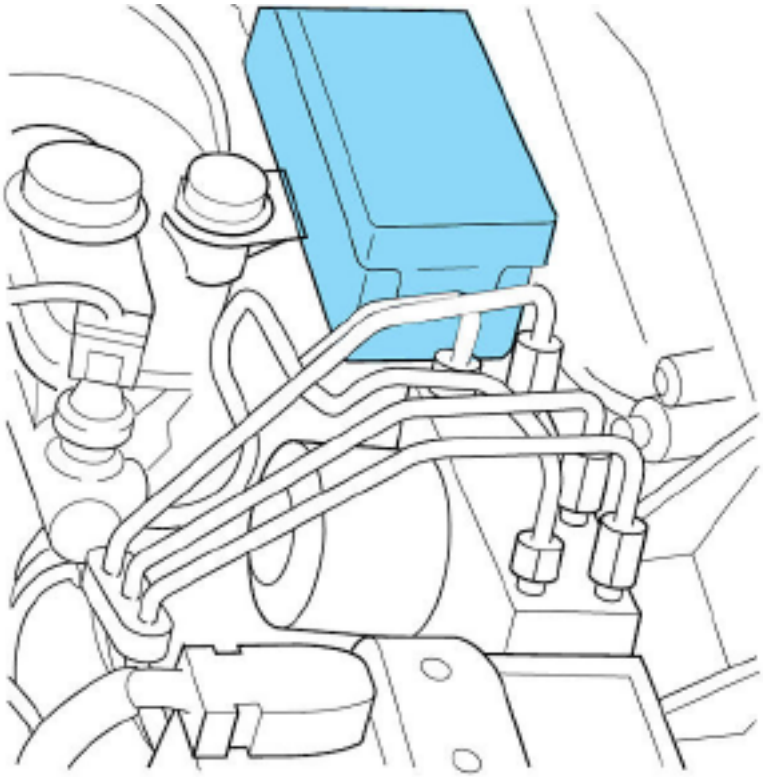



SMART JUNCTION BOX (SJB)
C2280D
C2280C
C2280B
C2280A
F1
F2
F3
F4
F5
F6
F7
F8
F9
F10
F11
F12
F13
F14
F16
F17
F19
F20
F21
F22
F23
F24
F26
F27
F28
F29
F30
F31
F32
F33
F34
F35
2 4 1
3
30
85
87A
87
86
ACCESSORY RELAY

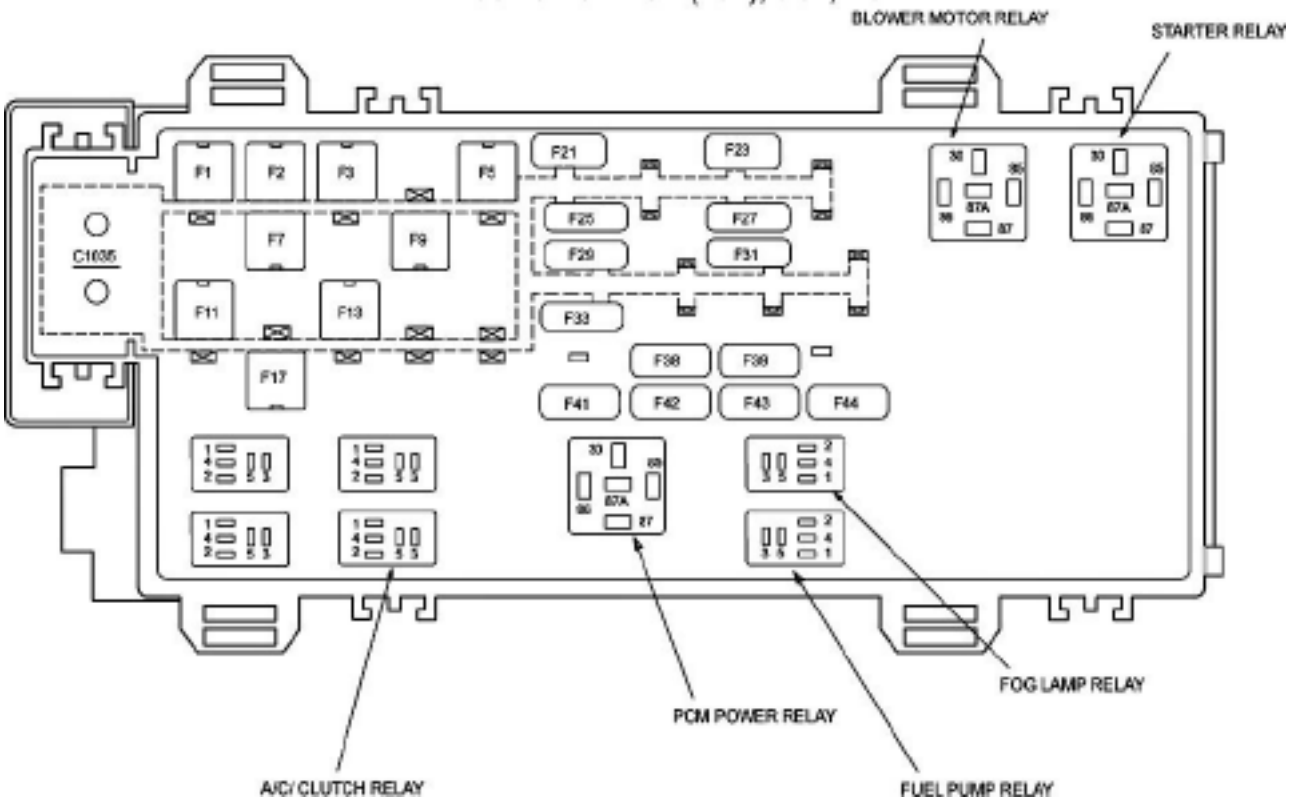
Fuse: Application and ID Smart Junction Box

FUSE	AMPS	Circuits Protected
F1	5A	Illumination dimmer
F2	10A	Trailer tow connector - Park
F3	10A	Headlamp, right (Low beam lamp feed)
F4	10A	Headlamp, left (Low beam lamp feed)
F5	5A	Windshield wiper module
F6	10A	Audio unit, Door lock switch illumination
F7	5A	Not Used
F8	10A	Restraints Control Module (RCM), Occupant Classification System Module (OCSM), Passenger Air bag Deactivation (PAD) Indicator
F9	5A	Instrument Cluster (IC), Air bag indicator
F10	10A	4X4 control module, Instrument Cluster (IC)
F11	10A	Smart Junction Box (SJB), logic power
F12	15A	Subwoofer amplifier with audiophile, Satellite radio receiver
F13	15A	Interior lamp relay, Horn relay
F14	15A	High beam lamp feed to High beam indicator, Headlamp, right, Headlamp, left
F16	30A	Accessory relay (Power windows)
F17	15A	Indicator flasher relay
F18	-	Not Used

FUSE	AMPS	Circuits Protected
F19	20A	Brake pedal position switch (Stoplamps)
F20	10A	Transmission control switch, Digital Transmission Range (TR) sensor, Speed control servo, Anti-lock Brake System (ABS) module, Indicator flasher relay, Reversing lamps switch, Speed control On/Off switch, Speed control Set/Resume switch
F21	5A	Digital Transmission Range (TR) sensor, Starter relay, Powertrain Control Module (PCM)
F22	5A	Audio unit
F23	30A	Main light switch, Multifunction switch
F24	20A	Audio unit
F26	2A	Deactivator switch
F27	10A	Blend door actuator, Climate control assembly
F28	15A	4X4 control module
F29	20A	Cigar lighter, front, Data Link Connector (DLC)
F30	5A	Exterior rear view mirror switch
F31	20A	Park lamp relay
F32	5A	Brake pedal position switch (logic power), Brake shift interlock
F33	5A	Instrument Cluster (IC), Neutral tow indicator
F34	20A	Power point
F35	15A	Door lock/unlock relay, Driver door unlock relay



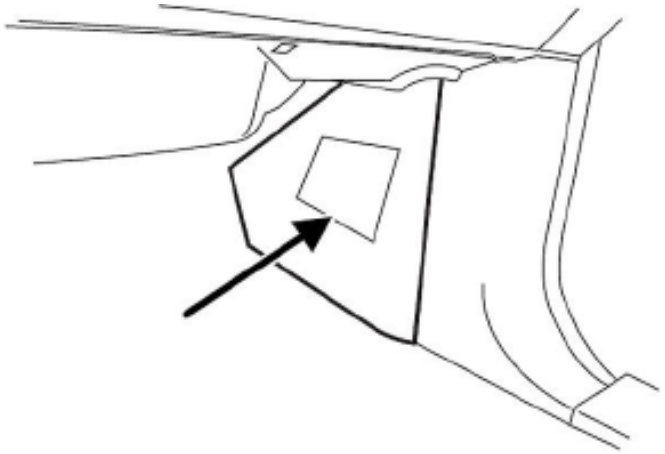
BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L

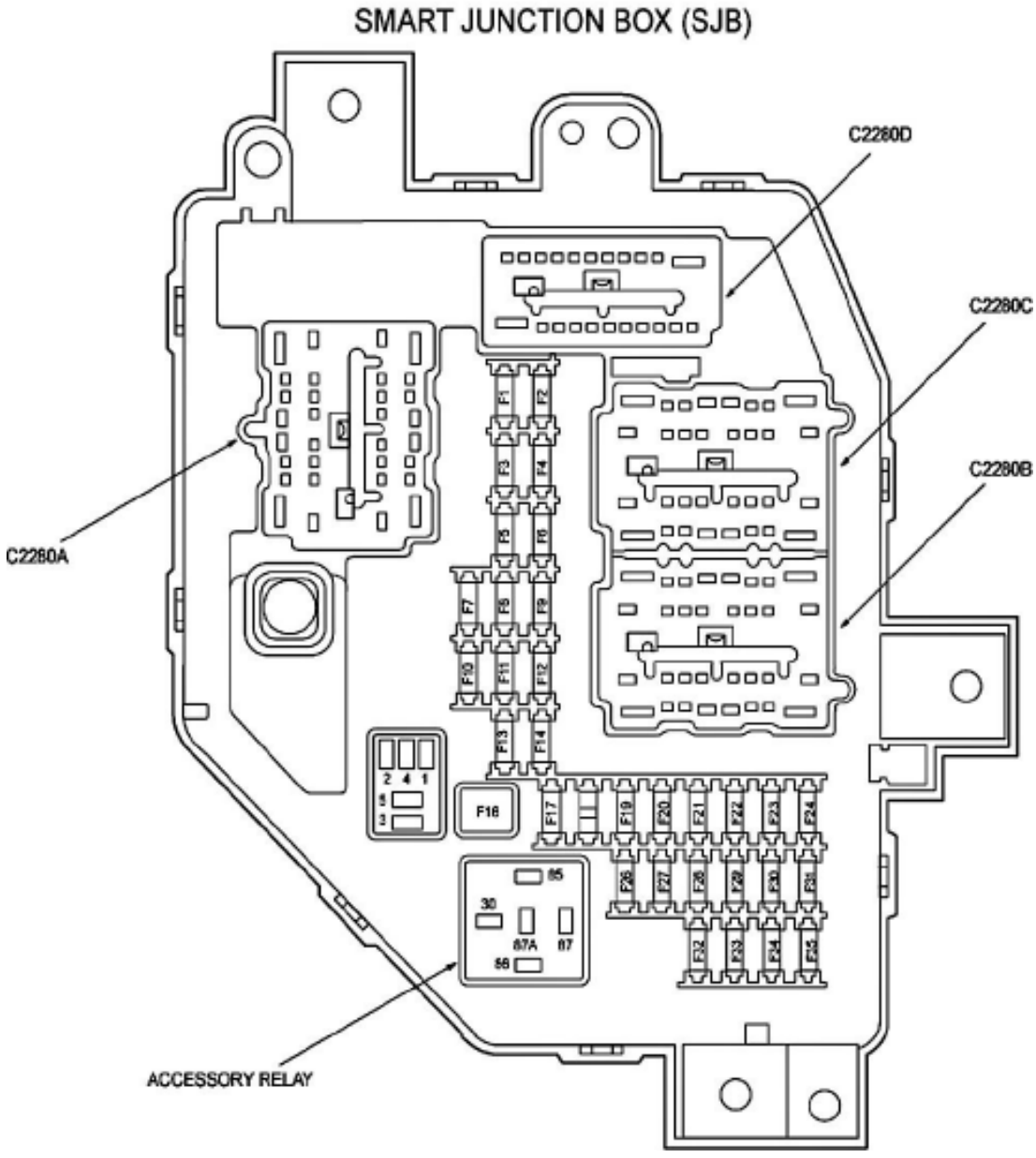


Fuse: Application and ID Battery Junction Box

FUSE	AMPS	Circuits Protected
F1	40A	Smart Junction Box (SJB)
F2	-	Not Used
F3	40A	Smart Junction Box (SJB)
F4	-	Not Used
F5	50A	Smart Junction Box (SJB)
F6	-	Not Used
F7	30A	Starter Relay
F8	-	Not Used
F9	40A	Ignition Switch
F10	-	Not Used
F11	30A	PCM power relay
F12	-	Not Used
F13	30A	Blower motor relay
F14	-	Not Used
F15	-	Not Used
F16	-	Not Used
F17	40A	Anti-lock Brake System (ABS) module
F18	-	Not Used
F19	-	Not Used
F20	-	Not Used
F21	10A	Powertrain Control Module (PCM), Evaporative emission (EVAP) canister vent valve
F22	-	Not Used
F23	30A	Fuel Pump Relay, Fuel injectors
F24	-	Not Used

FUSE	AMPS	Circuits Protected
F25	10A	A/C clutch relay
F26	-	Not Used
F27	20A	4X4 control module
F28	-	Not Used
F29	30A	Windshield wipers/washer
F30	-	Not Used
F31	15A	Fog lamp relay
F32	-	Not Used
F33	30A	Anti-lock Brake System (ABS) module
F34	-	Not Used
F35	-	Not Used
F36	-	Not Used
F37	-	Not Used
F38	7.5A	Trailer tow connector - Right turn
F39	15A	Powertrain Control Module (PCM)
F40	-	Not Used
F41	10A	*5R44E Transmission **5R55E Transmission
F42	7.5A	Trailer tow connector - Left turn
F43	20A	EVAP canister purge valve, Heated Positive Crankcase Ventilation (PCV) valve, Idle Air Control (IAC) valve, Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor, Heated Oxygen Sensor (HO2S) #11, Heated Oxygen Sensor (HO2S) #12, Heated Oxygen Sensor (HO2S) #21, Heated Oxygen Sensor (HO2S) #22, EGR vacuum regulator solenoid valve, A/C relay coil
F44	15A	Ignition coil, *Ignition transformer capacitor 1

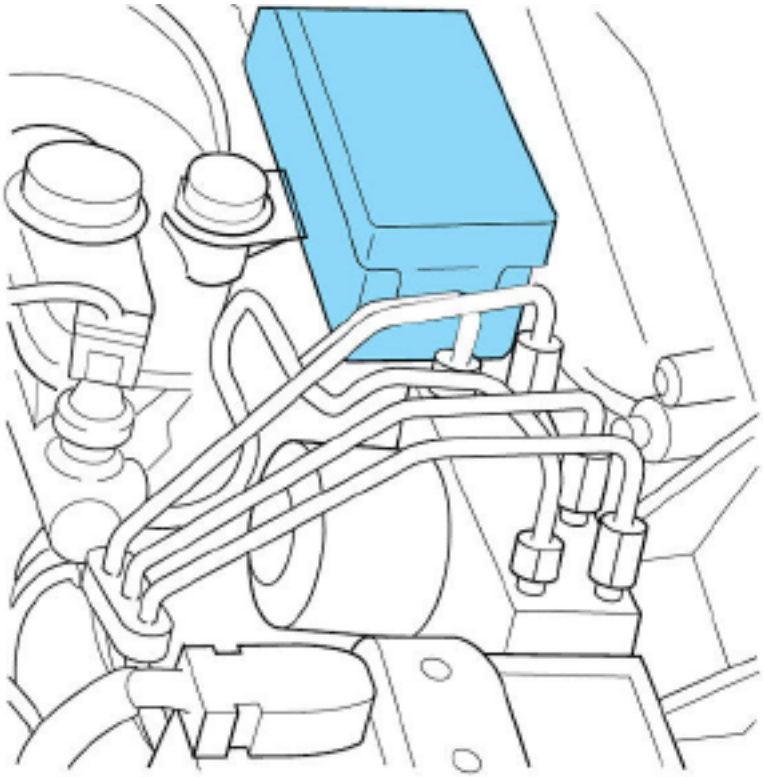



SMART JUNCTION BOX (SJB)
C2280D
C2280C
C2280B
C2280A
F1
F2
F3
F4
F5
F6
F7
F8
F9
F10
F11
F12
F13
F14
F16
F17
F19
F20
F21
F22
F23
F24
F26
F27
F28
F29
F30
F31
F32
F33
F34
F35
2 4 1
5
3
85
30
87A
87
86
ACCESSORY RELAY

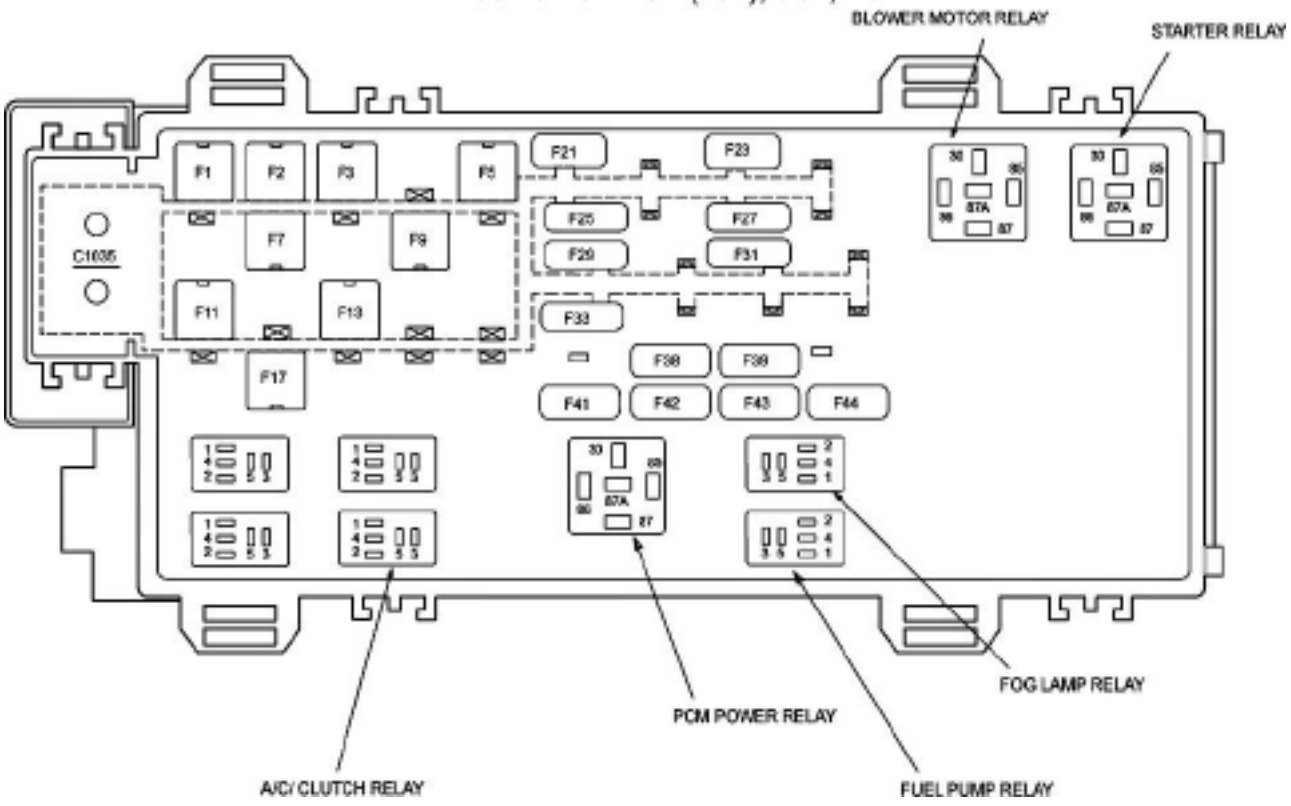
Fuse Block: Locations Smart Junction Box

FUSE	AMPS	Circuits Protected
F1	5A	Illumination dimmer
F2	10A	Trailer tow connector - Park
F3	10A	Headlamp, right (Low beam lamp feed)
F4	10A	Headlamp, left (Low beam lamp feed)
F5	5A	Windshield wiper module
F6	10A	Audio unit, Door lock switch illumination
F7	5A	Not Used
F8	10A	Restraints Control Module (RCM), Occupant Classification System Module (OCSM), Passenger Air bag Deactivation (PAD) Indicator
F9	5A	Instrument Cluster (IC), Air bag indicator
F10	10A	4X4 control module, Instrument Cluster (IC)
F11	10A	Smart Junction Box (SJB), logic power
F12	15A	Subwoofer amplifier with audiophile, Satellite radio receiver
F13	15A	Interior lamp relay, Horn relay
F14	15A	High beam lamp feed to High beam indicator, Headlamp, right, Headlamp, left
F16	30A	Accessory relay (Power windows)
F17	15A	Indicator flasher relay
F18	-	Not Used

FUSE	AMPS	Circuits Protected
F19	20A	Brake pedal position switch (Stoplamps)
F20	10A	Transmission control switch, Digital Transmission Range (TR) sensor, Speed control servo, Anti-lock Brake System (ABS) module, Indicator flasher relay, Reversing lamps switch, Speed control On/Off switch, Speed control Set/Resume switch
F21	5A	Digital Transmission Range (TR) sensor, Starter relay, Powertrain Control Module (PCM)
F22	5A	Audio unit
F23	30A	Main light switch, Multifunction switch
F24	20A	Audio unit
F26	2A	Deactivator switch
F27	10A	Blend door actuator, Climate control assembly
F28	15A	4X4 control module
F29	20A	Cigar lighter, front, Data Link Connector (DLC)
F30	5A	Exterior rear view mirror switch
F31	20A	Park lamp relay
F32	5A	Brake pedal position switch (logic power), Brake shift interlock
F33	5A	Instrument Cluster (IC), Neutral tow indicator
F34	20A	Power point
F35	15A	Door lock/unlock relay, Driver door unlock relay



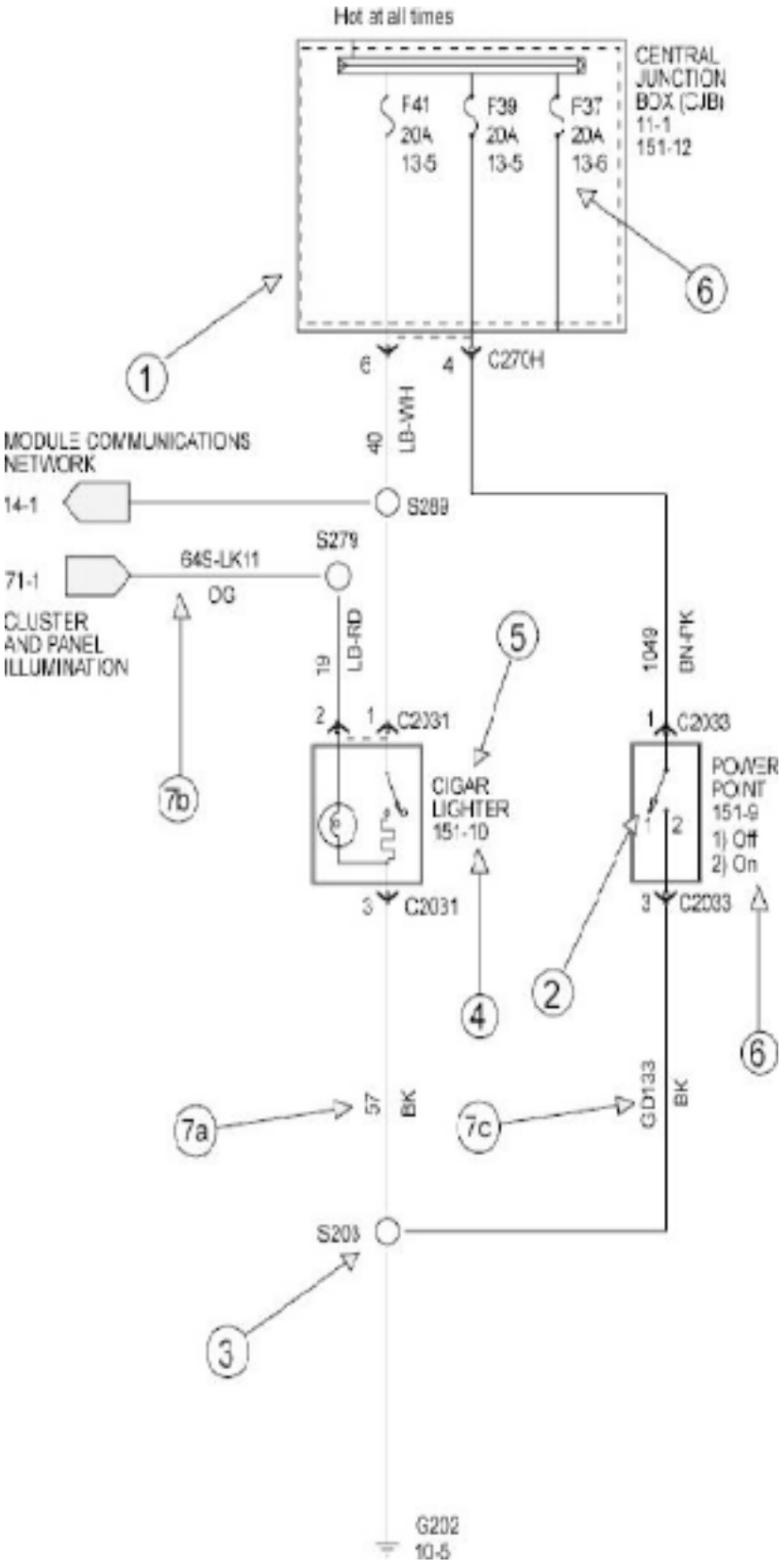
BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L



Fuse Block: Locations Battery Junction Box

FUSE	AMPS	Circuits Protected
F1	40A	Smart Junction Box (SJB)
F2	-	Not Used
F3	40A	Smart Junction Box (SJB)
F4	-	Not Used
F5	50A	Smart Junction Box (SJB)
F6	-	Not Used
F7	30A	Starter Relay
F8	-	Not Used
F9	40A	Ignition Switch
F10	-	Not Used
F11	30A	PCM power relay
F12	-	Not Used
F13	30A	Blower motor relay
F14	-	Not Used
F15	-	Not Used
F16	-	Not Used
F17	40A	Anti-lock Brake System (ABS) module
F18	-	Not Used
F19	-	Not Used
F20	-	Not Used
F21	10A	Powertrain Control Module (PCM), Evaporative emission (EVAP) canister vent valve
F22	-	Not Used
F23	30A	Fuel Pump Relay, Fuel injectors
F24	-	Not Used

FUSE	AMPS	Circuits Protected
F25	10A	A/C clutch relay
F26	-	Not Used
F27	20A	4X4 control module
F28	-	Not Used
F29	30A	Windshield wipers/washer
F30	-	Not Used
F31	15A	Fog lamp relay
F32	-	Not Used
F33	30A	Anti-lock Brake System (ABS) module
F34	-	Not Used
F35	-	Not Used
F36	-	Not Used
F37	-	Not Used
F38	7.5A	Trailer tow connector - Right turn
F39	15A	Powertrain Control Module (PCM)
F40	-	Not Used
F41	10A	*5R44E Transmission **5R55E Transmission
F42	7.5A	Trailer tow connector - Left turn
F43	20A	EVAP canister purge valve, Heated Positive Crankcase Ventilation (PCV) valve, Idle Air Control (IAC) valve, Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor, Heated Oxygen Sensor (HO2S) #11, Heated Oxygen Sensor (HO2S) #12, Heated Oxygen Sensor (HO2S) #21, Heated Oxygen Sensor (HO2S) #22, EGR vacuum regulator solenoid valve, A/C relay coil
F44	15A	Ignition coil, *Ignition transformer capacitor 1


Hot at all times
CENTRAL JUNCTION BOX (CJB)
11-1
151-12
F41
20A
13-5
F39
20A
13-5
F37
20A
13-6
C270H
6
4
40
LB-WH
MODULE COMMUNICATIONS NETWORK
14-1
S289
S279
64S-LK11
71-1
DG
CLUSTER AND PANEL ILLUMINATION
19
LB-RD
2
1
C2031
CIGAR LIGHTER
151-10
3
C2031
1049
BN-PK
1
C2033
POWER POINT
151-9
1) Off
2) On
3
C2033
57
BK
GD133
BK
S203
G202
10-5
1
2
3
4
5
6
7a
7b
7c

Fuse Block: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

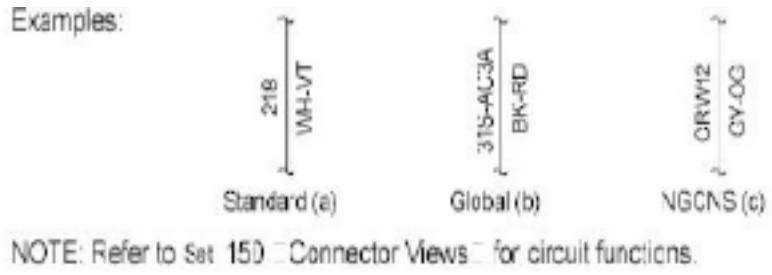
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

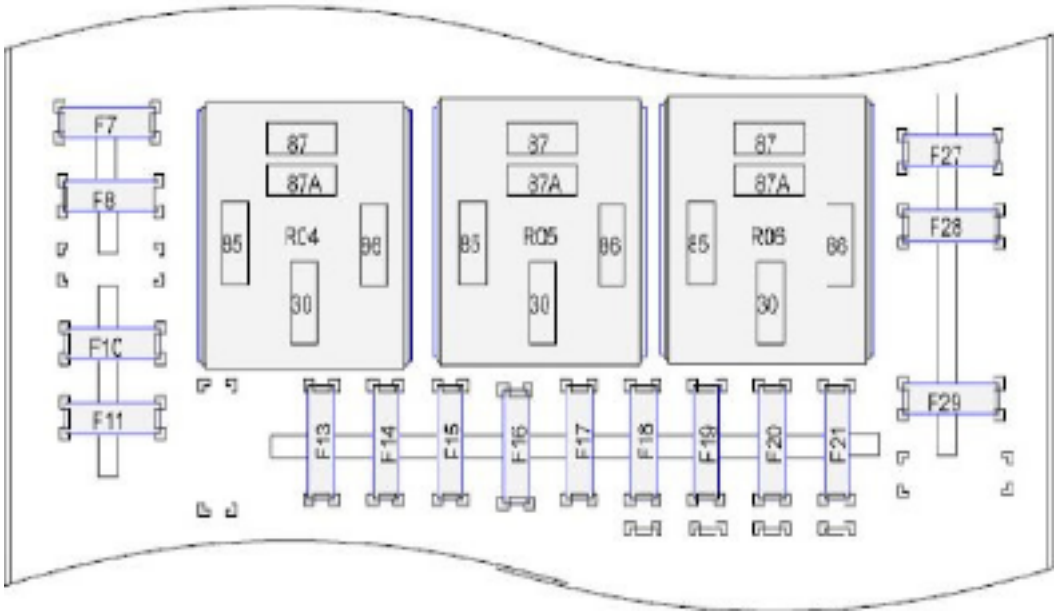
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

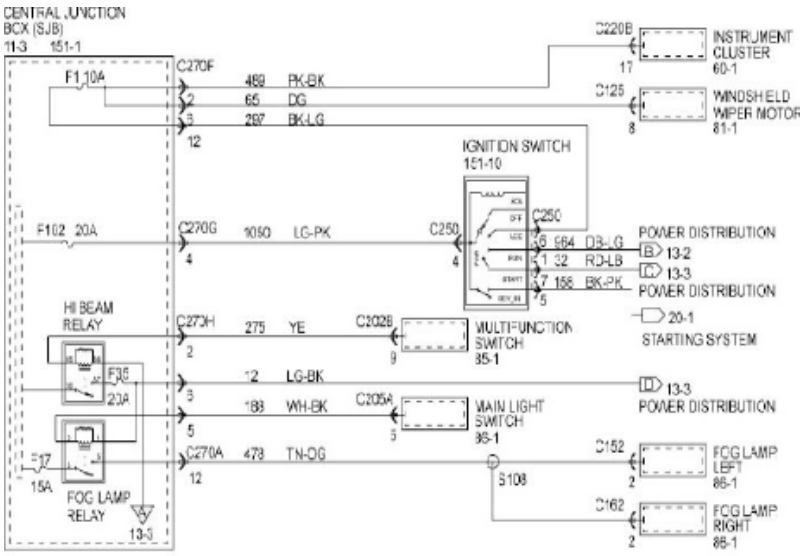
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

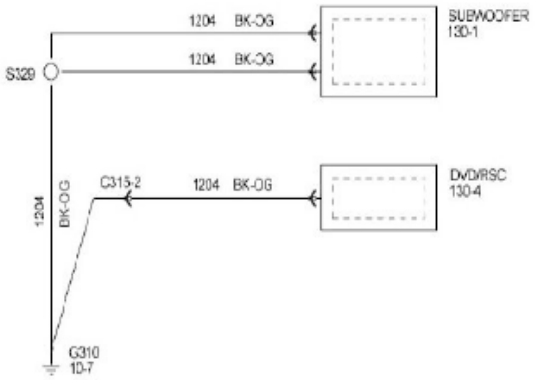
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

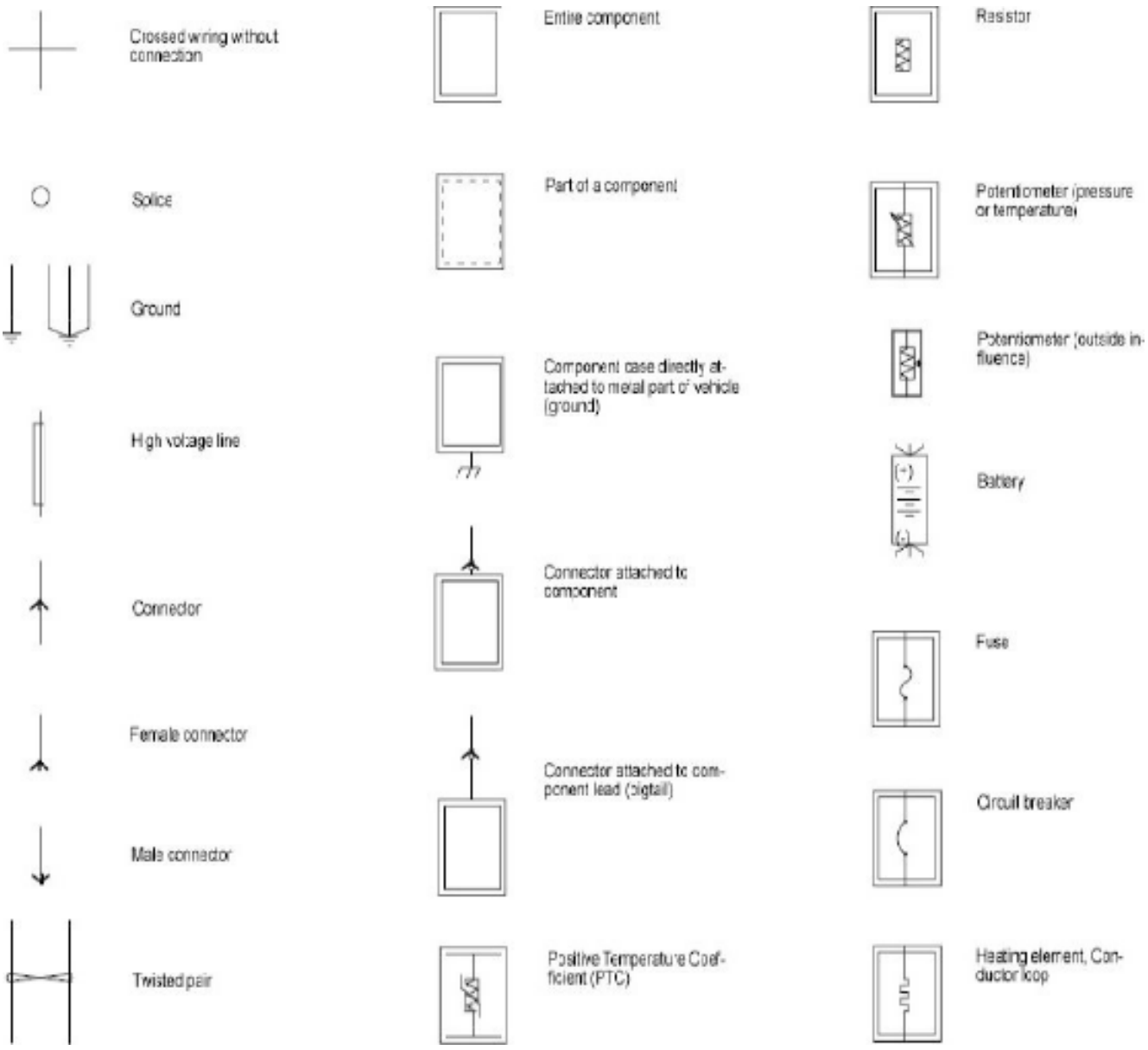
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

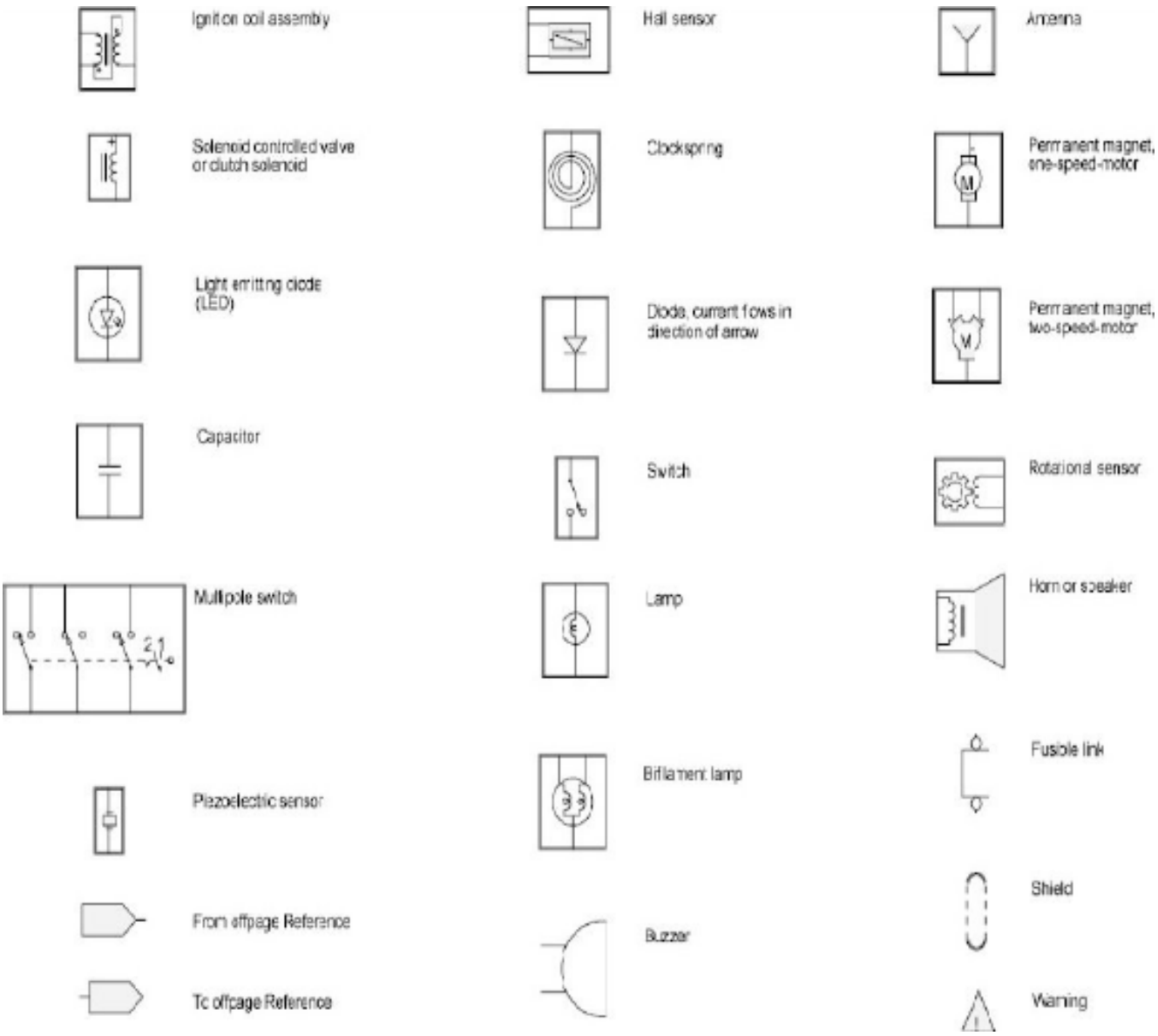
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

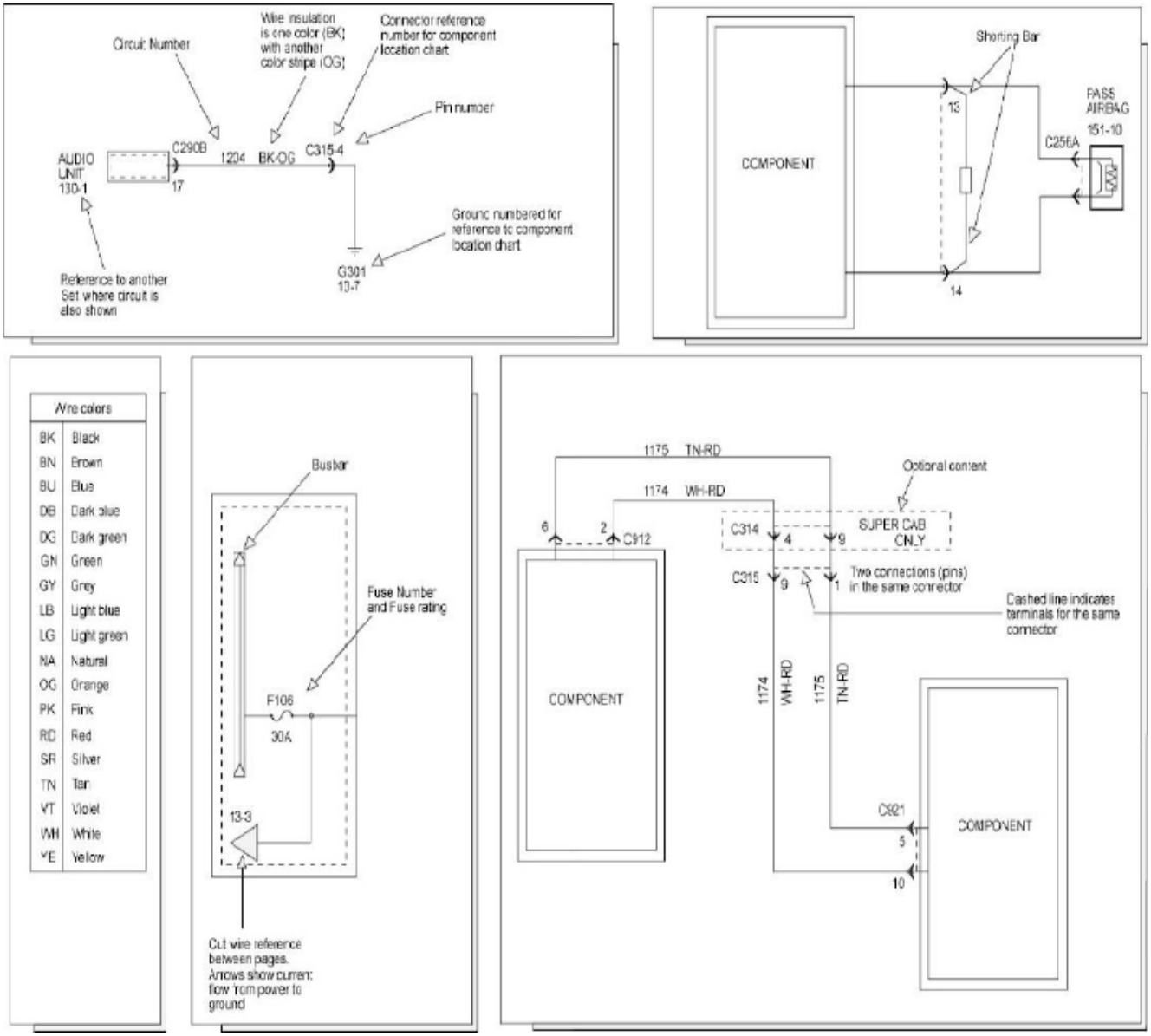
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

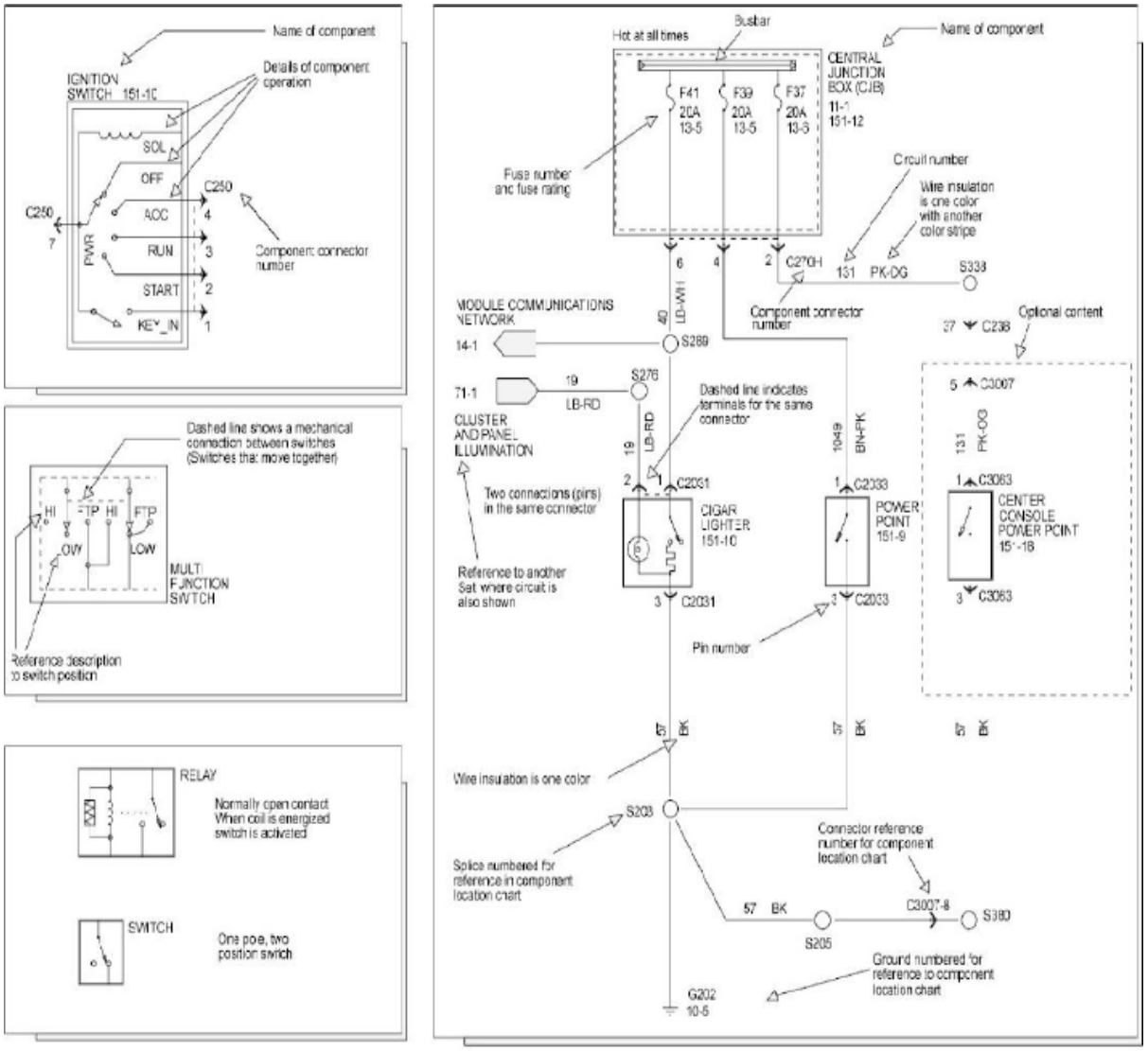
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

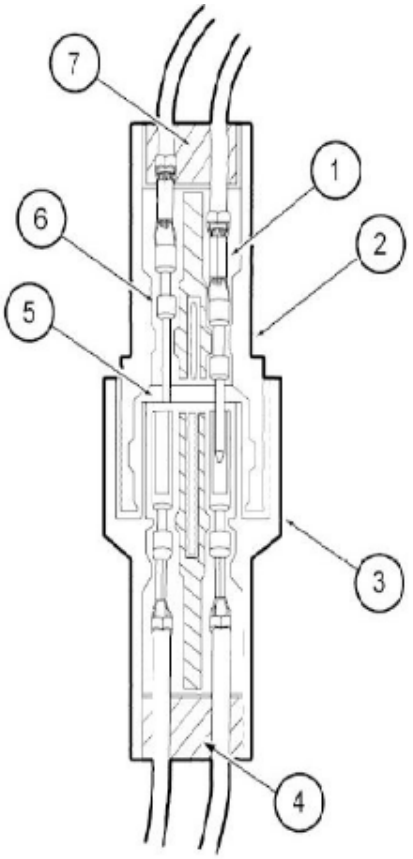


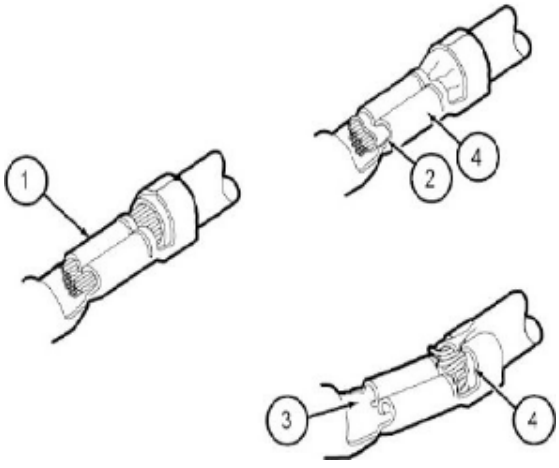
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Fuse Block: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

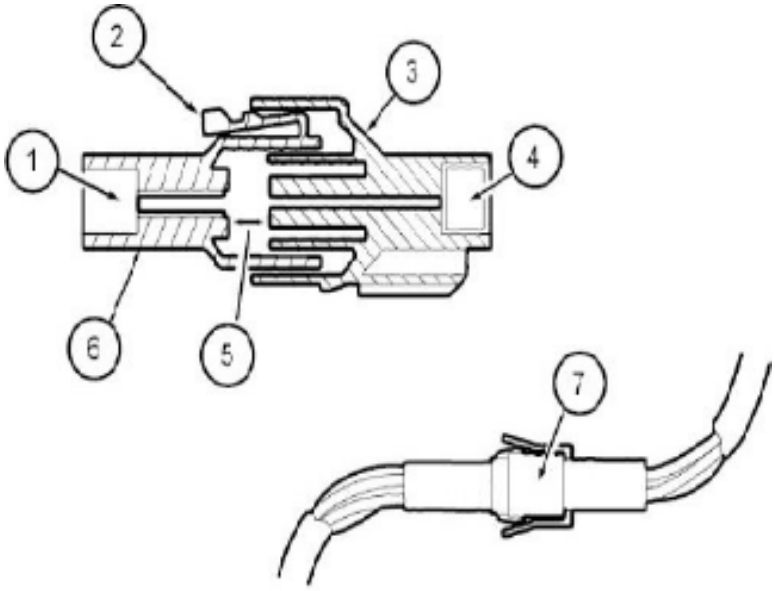
5 = Intermittent contact

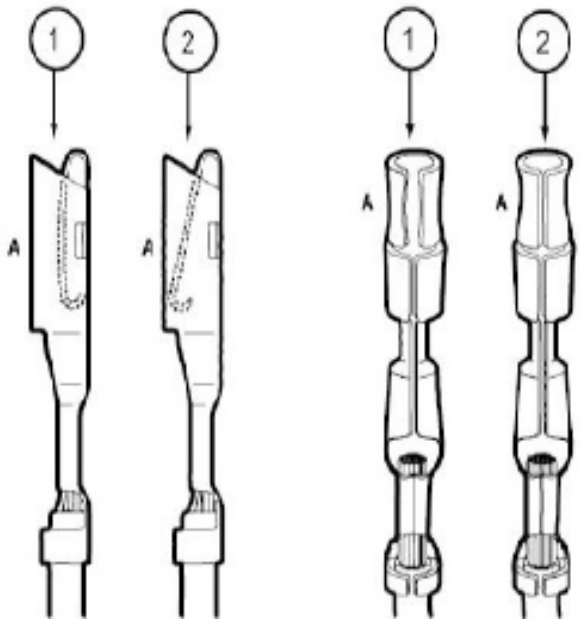
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

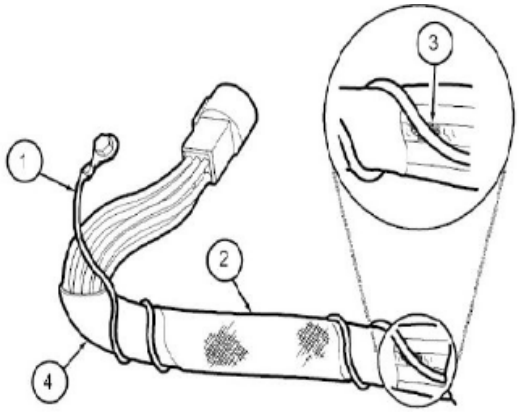
Deformed (enlarged) female terminals

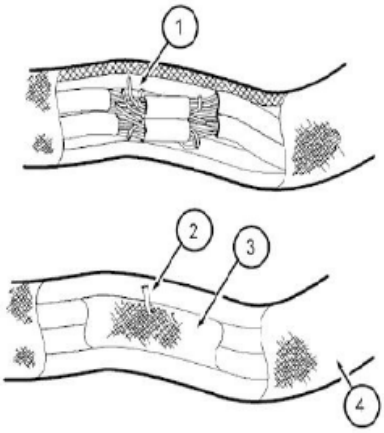
1 = Enlarged

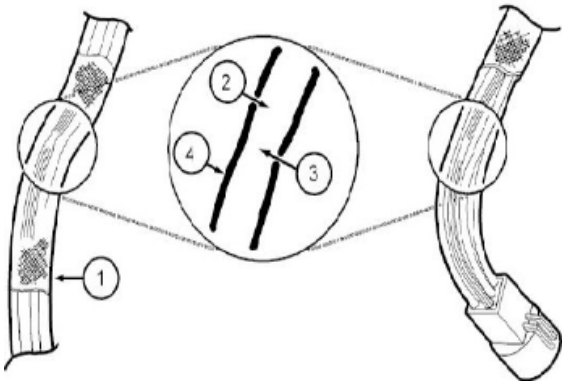
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

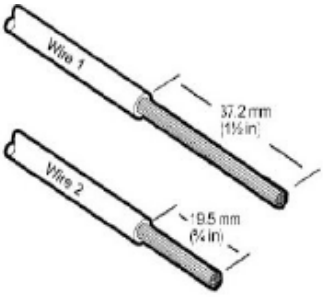
Splice covered 2

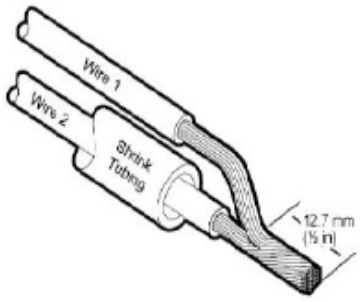
= Wire strand

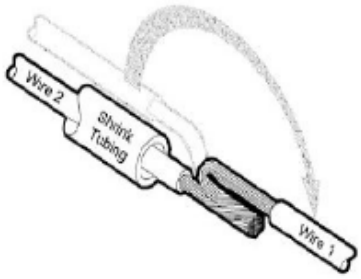
3 = Splice tape

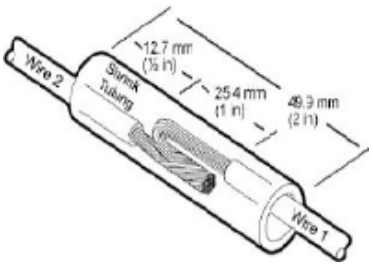
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

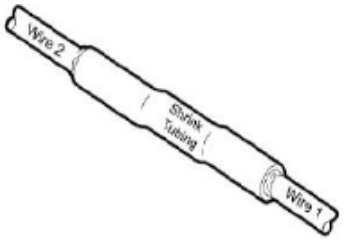
NOTE: -

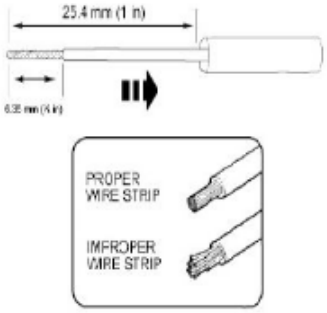
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

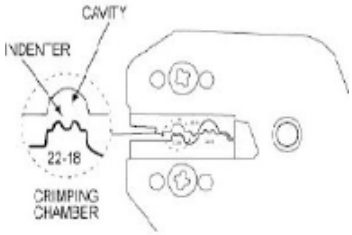
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

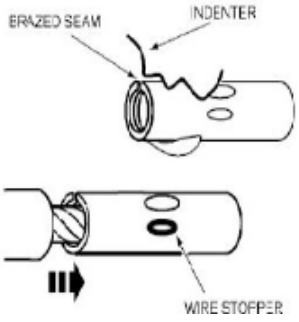
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
6.35 mm (¼ in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

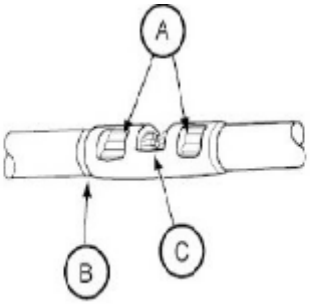
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

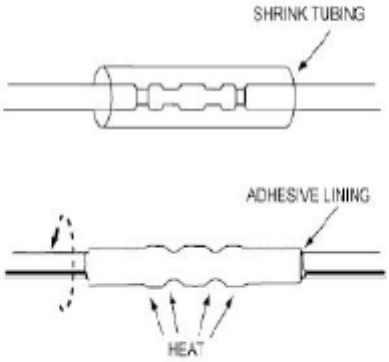
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4□ strip, cut 9 strands	* 1/4□ strip, cut 2 strands	1/4□ strip, no fold	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip, fold 2x dia.	1□ strip, fold 3x dia.
	16-14	* 1/4□ strip, cut 7 strands	1/4□ strip, no fold	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip fold 2x dia	1□ strip, fold 3x dia.	1 1/4□ strip, fold 4x dia.	Not Recommended
	12-10	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip, fold 2x dia.	1□ strip fold 3x cia.	1 1/4□ strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Figtail only

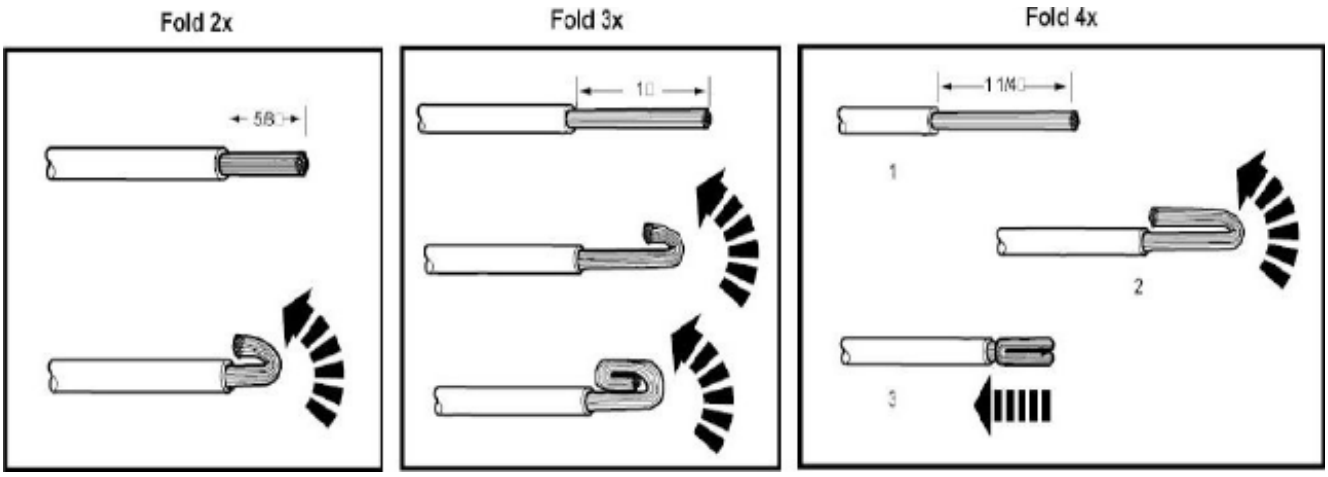
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

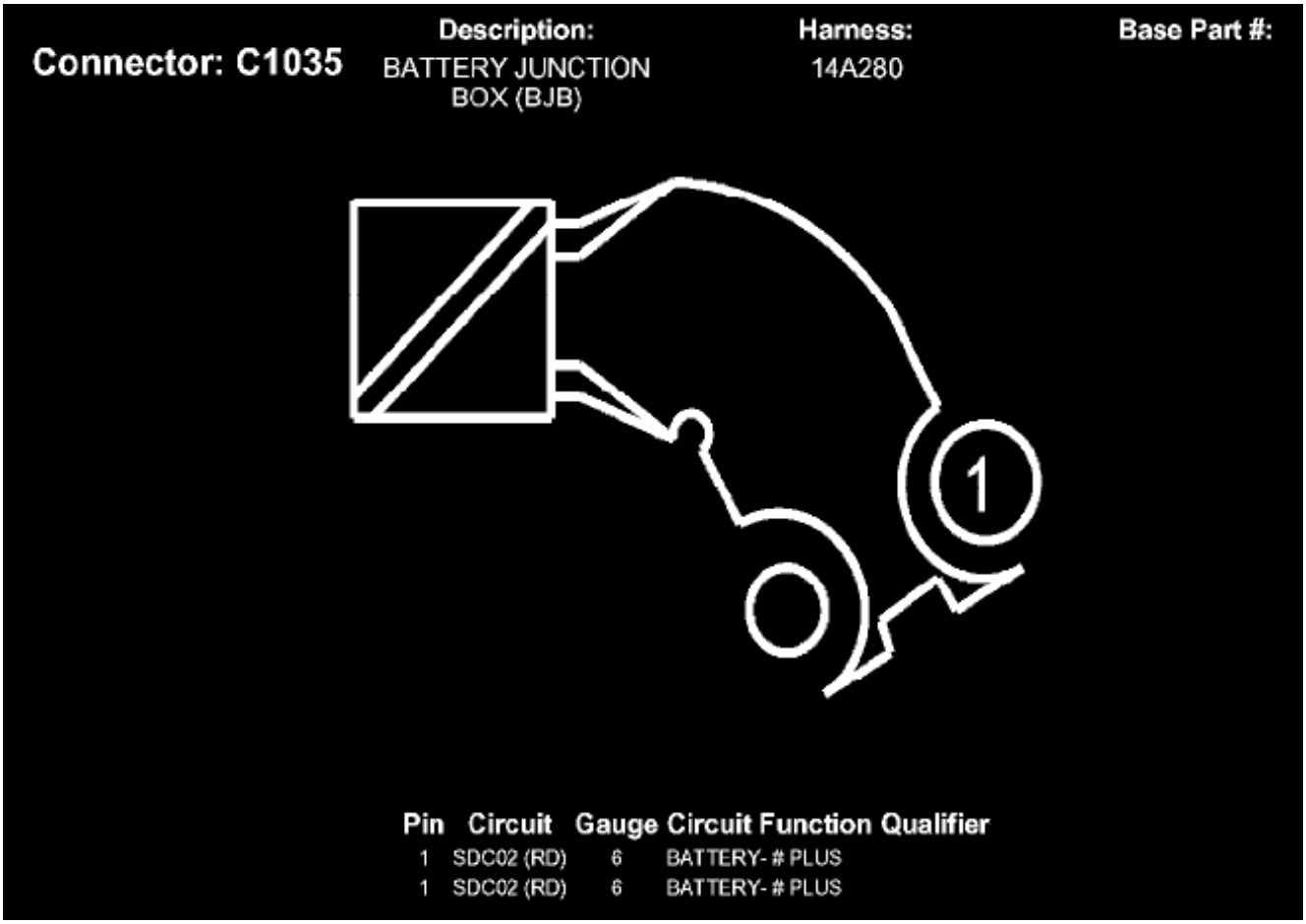
11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

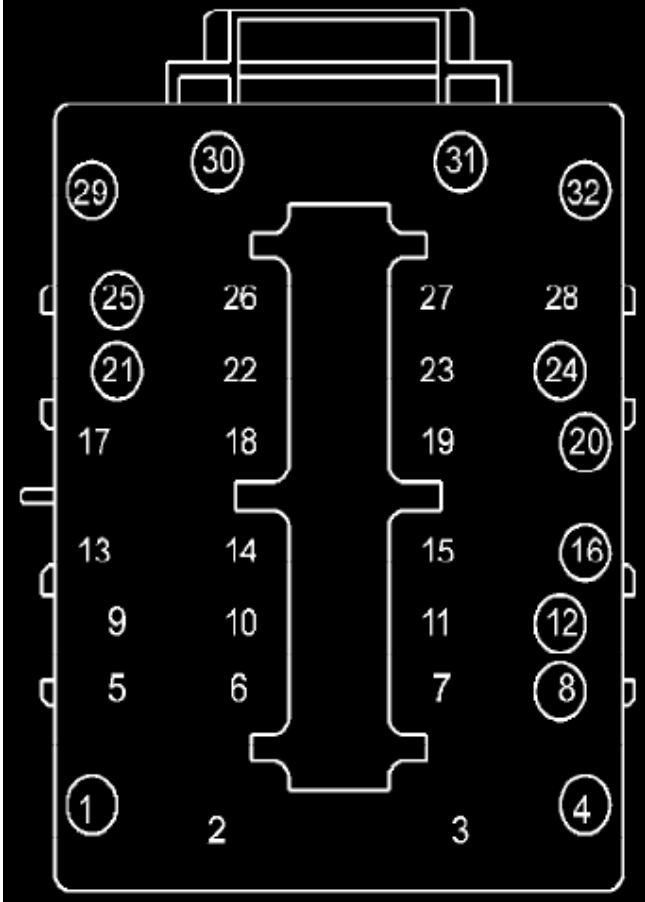


Fuse Block: Connector Views

C1035

Connector: C2280A

Description:	Harness:	Base Part #:
SMART JUNCTION BOX (SJB)	14290	14B476

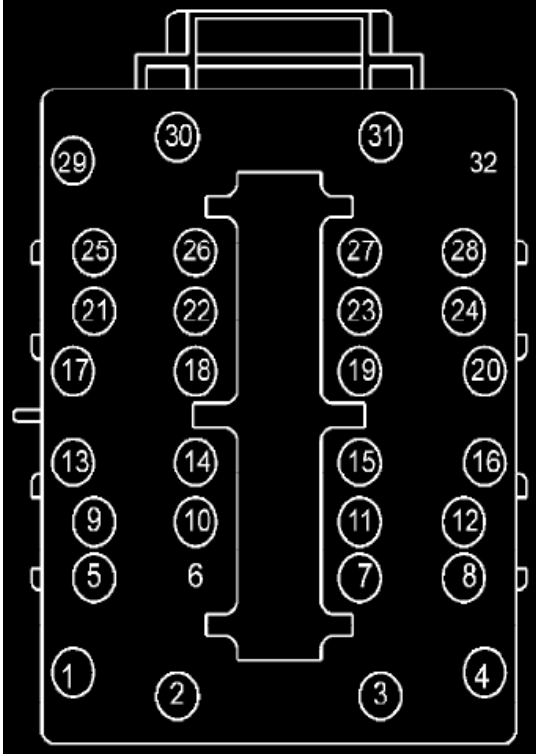


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	SBB01 (RD)	12	FUSE - 1 OR CIRCUIT BREAKER	
2	*	*	not used	
3	*	*	not used	
4	CBP05 (YE)	20	FUSE - 5 OR CIRCUIT BREAKER	
5	*	*	not used	
6	*	*	not used	
7	*	*	not used	
8	CES03 (VT-WH)	20	CTRL MOD - POWERTRAIN # SPEED CONTROL INDICATOR (SCIL)	
9	*	*	not used	
10	*	*	not used	
11	*	*	not used	
12	CLS34 (GY)	18	SWITCH - PARK LAMPS	
13	*	*	not used	
14	*	*	not used	
15	*	*	not used	
16	CBP04 (VT)	18	FUSE - 4 OR CIRCUIT BREAKER	
17	*	*	not used	
18	*	*	not used	
19	*	*	not used	
20	CBP03 (GY)	18	FUSE - 3 OR CIRCUIT BREAKER	
21	SBR14 (BN-RD)	18	FUSE - 14 OR CIRCUIT BREAKER	
22	*	*	not used	
23	*	*	not used	
24	CE517 (BU-GN)	20	DIODE - RELAY POWERTRAIN CONTROL MODULE	
25	CBP14 (VT-OG)	16	FUSE - 14 OR CIRCUIT BREAKER	
26	*	*	not used	
27	*	*	not used	
28	*	*	not used	
29	SBB03 (BU-RD)	12	FUSE - 3 OR CIRCUIT BREAKER	
30	CRH02 (BU-WH)	18	SWITCH - HORN	
31	CBP21 (BU-GY)	22	FUSE - 21 OR CIRCUIT BREAKER	
32	SBB05 (GY-RD)	10	FUSE - 5 OR CIRCUIT BREAKER	

C2280A

Connector: C2280B

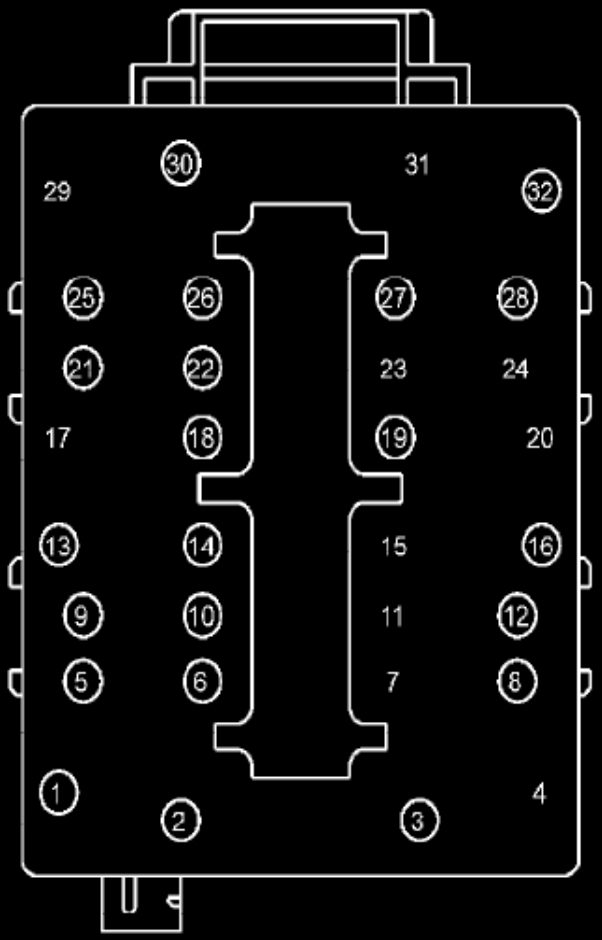
Description:	Harness:	Base Part #:
SMART JUNCTION BOX (SJB)	14401	14B476



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	SBP23 (WH-RD)	14	FUSE - 23 OR CIRCUIT BREAKER	
2	SBP24 (VT-RD)	16	FUSE - 24 OR CIRCUIT BREAKER	
3	SBP34 (YE-RD)	16	FUSE - 34 OR CIRCUIT BREAKER	
4	SBP23 (WH-RD)	14	FUSE - 23 OR CIRCUIT BREAKER	
5	CBP10 (YE-OG)	20	FUSE - 10 OR CIRCUIT BREAKER	
6	*	*	not used	
7	SBP28 (GN-RD)	18	FUSE - 28 OR CIRCUIT BREAKER	
8	SBP30 (BN-RD)	22	FUSE - 30 OR CIRCUIT BREAKER	
9	CPL19 (WH-VT)	20	RELAY - DOOR LOCK # ALL LOCK	
10	CPL18 (GY-VT)	20	RELAY - DOOR LOCK # ALL UNLOCK	
11	CDC35 (BU-WH)	14	SWITCH - IGNITION # START	
12	SBP33 (RD)	20	FUSE - 33 OR CIRCUIT BREAKER	
13	CPL11 (GY-BN)	20	CTRL MOD. - DOOR LOCK # ALL LOCK	
14	GD161 (BK-YE)	18	GROUND - SEAT BRACKET REAR LEFT	
15	CBP20 (YE-VT)	18	FUSE - 20 OR CIRCUIT BREAKER	
16	SBP29 (GY-RD)	18	FUSE - 29 OR CIRCUIT BREAKER	
17	CDC32 (BN-YE)	12	SWITCH - IGNITION # RUN	
18	CBP27 (GN-BN)	22	FUSE - 27 OR CIRCUIT BREAKER	
19	CBP20 (YE-VT)	18	FUSE - 20 OR CIRCUIT BREAKER	
20	SBP29 (GY-RD)	16	FUSE - 29 OR CIRCUIT BREAKER	
21	CBP27 (GN-BN)	22	FUSE - 27 OR CIRCUIT BREAKER	
22	CBP26 (BU-WH)	20	FUSE - 26 OR CIRCUIT BREAKER	
23	CBP20 (YE-VT)	18	FUSE - 20 OR CIRCUIT BREAKER	
24	CBP22 (GN-OG)	20	FUSE - 22 OR CIRCUIT BREAKER	
25	CLF27 (GN-BN)	14	SWITCH - FLASH TO PASS	
26	SBP17 (RD)	18	FUSE - 17 OR CIRCUIT BREAKER	
27	CBP20 (YE-VT)	20	FUSE - 20 OR CIRCUIT BREAKER	
28	SBP32 (VT-RD)	22	FUSE - 32 OR CIRCUIT BREAKER	
29	CDC34 (WH-OG)	12	SWITCH - IGNITION # RUN; START	
30	SBP12 (GN-RD)	16	FUSE - 12 OR CIRCUIT BREAKER	Audiophile sound system
30	SBP12 (GN-RD)	20	FUSE - 12 OR CIRCUIT BREAKER	without Audiophile and satellite radio
31	SBP19 (BU-RD)	16	FUSE - 19 OR CIRCUIT BREAKER	
32	*	*	not used	

C2280B (Part 1)

Connector: C2280C | **Description:** SMART JUNCTION BOX (SJB) | **Harness:** 14401 | **Base Part #:** 14B476

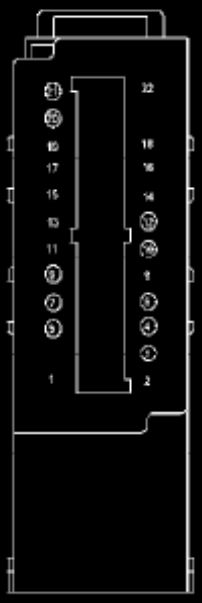


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD174 (BK-WH)	18	GROUND - TUNNEL	
2	CPL12 (VT-OG)	20	CTRL MOD. - DOOR LOCK # DOUBLE LOCK ALL LOCK	
3	CLS34 (GY)	16	SWITCH - PARK LAMPS	
4	*	*	not used	
5	CPL42 (GY-YE)	22	SWITCH - TRIM DOOR LOCK (DRIVER) # LOCK	
6	CPL26 (GN-VT)	20	SWITCH - LATCH DRIVER # AJAR	
7	*	*	not used	
8	CLN28 (GN-BU)	18	SWITCH - DOME LAMP	
9	CPL43 (VT-GY)	22	SWITCH - TRIM DOOR LOCK (DRIVER) # UNLOCK	
10	CPL42 (GY-YE)	22	SWITCH - TRIM DOOR LOCK (DRIVER) # LOCK	
11	*	*	not used	
12	CPL51 (BU-GN)	20	CTRL MOD. - DOOR LOCK # DRIVER UNLOCK	
13	CPW14 (VT-WH)	14	SWITCH - POWER WINDOW DRIVER # PASSENGER LOCK OUT (ENABLE)	
14	CPL43 (VT-GY)	22	SWITCH - TRIM DOOR LOCK (DRIVER) # UNLOCK	
15	*	*	not used	
16	CPW30 (GY-YE)	14	RELAY - POWER WINDOW	
17	*	*	not used	
18	CBP08 (GY-YE)	20	FUSE - 8 OR CIRCUIT BREAKER	
19	CE517 (BU-GN)	20	DIODE - RELAY POWERTRAIN CONTROL MODULE	
20	*	*	not used	
21	CLF29 (BN)	22	CTRL MOD. - FOG LAMPS FRONT (LEFT)	
22	CBP08 (GY-YE)	20	FUSE - 8 OR CIRCUIT BREAKER	
23	*	*	not used	
24	*	*	not used	
25	CAT17 (BN)	16	RELAY - TRAILER TOW PARK LAMPS (COLOR TO SAE 1239)	
26	CBP01 (BU)	22	FUSE - 1 OR CIRCUIT BREAKER	
27	CBP06 (WH-BU)	20	FUSE - 6 OR CIRCUIT BREAKER	
28	CBP09 (VT-GY)	20	FUSE - 9 OR CIRCUIT BREAKER	
29	*	*	not used	
30	CLF16 (BU-WH)	16	SWITCH - BEAM LOW	
31	*	*	not used	
32	CDC33 (VT-GN)	12	SWITCH - IGNITION # RUN: ACCESSORY	

C2280B (Part 2)

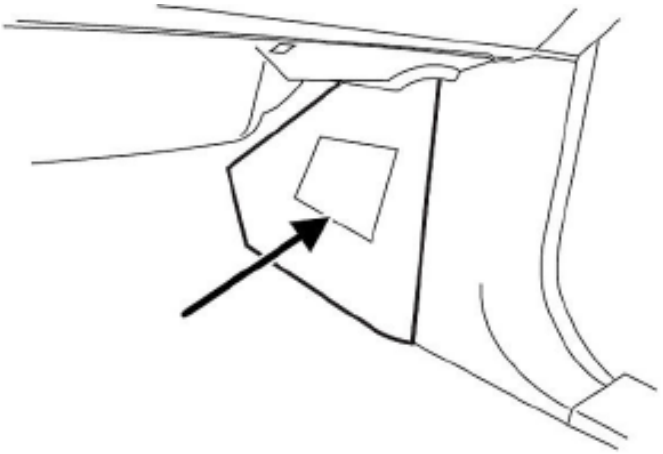
C2280C

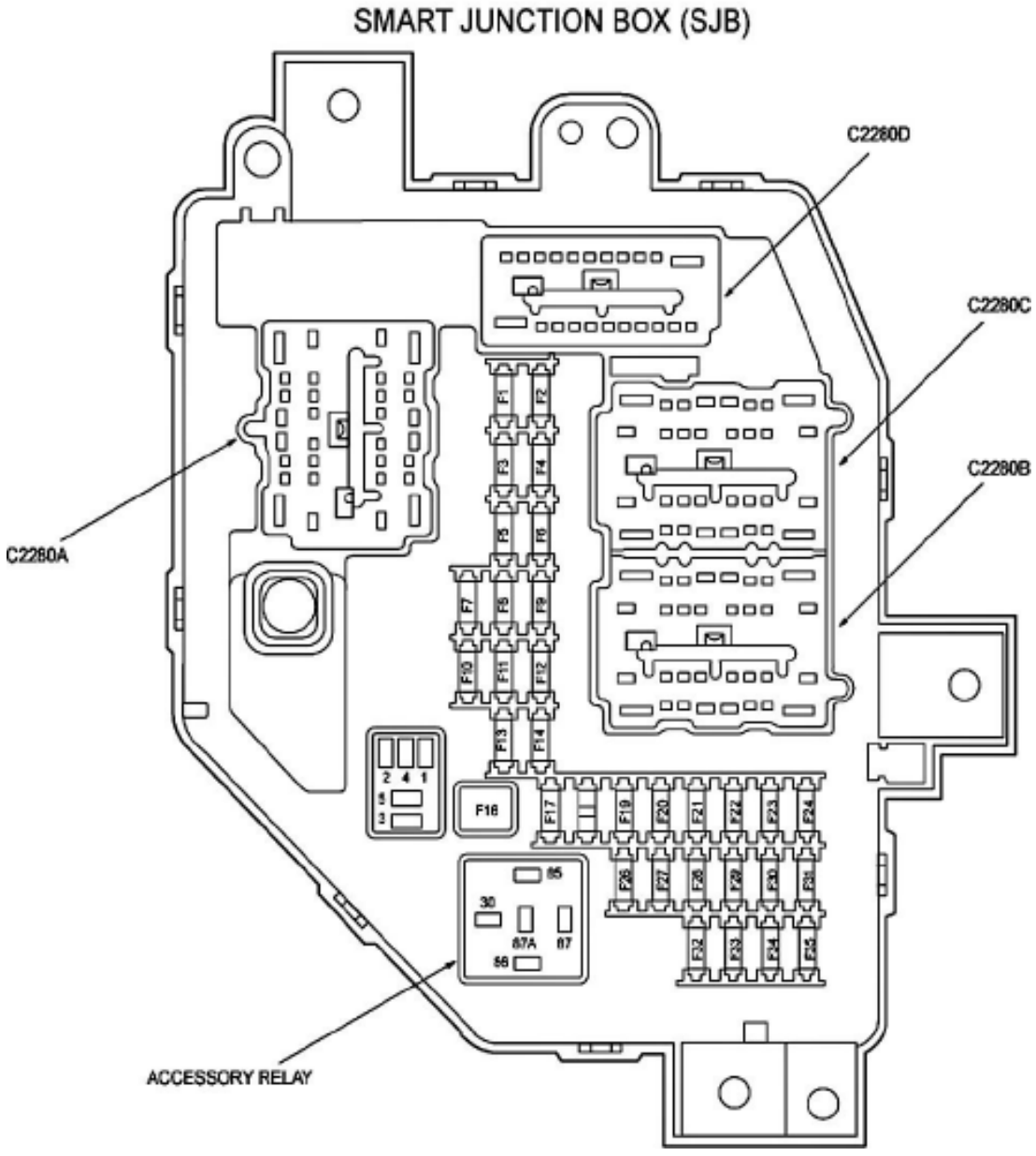
Connector: C2280D	Description:	Harness:	Base Part #:
	SMART JUNCTION BOX (SJB)	14401	14B476



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	*	*	not used	
3	CPL31 (WH)	20	SWITCH - LATCH PASSENGER # AJAR	
4	CPL36 (GN)	20	SWITCH - LATCH REAR DRIVER SIDE # AJAR (INCL.SLIDING DOOR)	
5	CLS30 (VT-WH)	18	RELAY - PARK LAMP	
6	CPL39 (YE)	20	SWITCH - LATCH REAR PASSENGER SIDE # AJAR (INCL.SLIDING DOOR)	
7	CCB15 (BN-GN)	22	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL CLOSED	
8	*	*	not used	
9	CLF21 (GY-VT)	18	SWITCH - FOG LAMPS FRONT	
10	CLN27 (WH-BN)	18	CTRL MOD. - DIMMER INSTRUMENT	
11	*	*	not used	
12	SRH01 (YE-RD)	20	RELAY - HORN	
13	*	*	not used	
14	*	*	not used	
15	*	*	not used	
16	*	*	not used	
17	*	*	not used	
18	*	*	not used	
19	*	*	not used	
20	VDB04 (WH-BU)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED HIGH	
21	VDB05 (WH)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED LOW	
22	*	*	not used	

C2280D

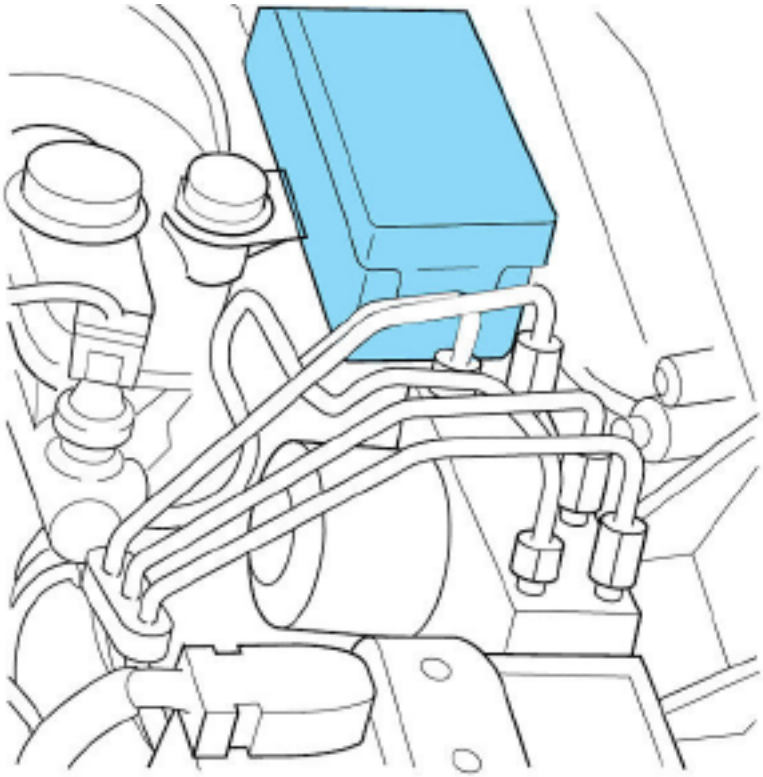



SMART JUNCTION BOX (SJB)
C2280D
C2280C
C2280B
C2280A
F1
F2
F3
F4
F5
F6
F7
F8
F9
F10
F11
F12
F13
F14
F16
F17
F19
F20
F21
F22
F23
F24
F26
F27
F28
F29
F30
F31
F32
F33
F34
F35
2 4 1
3
85
30
87A
87
86
ACCESSORY RELAY

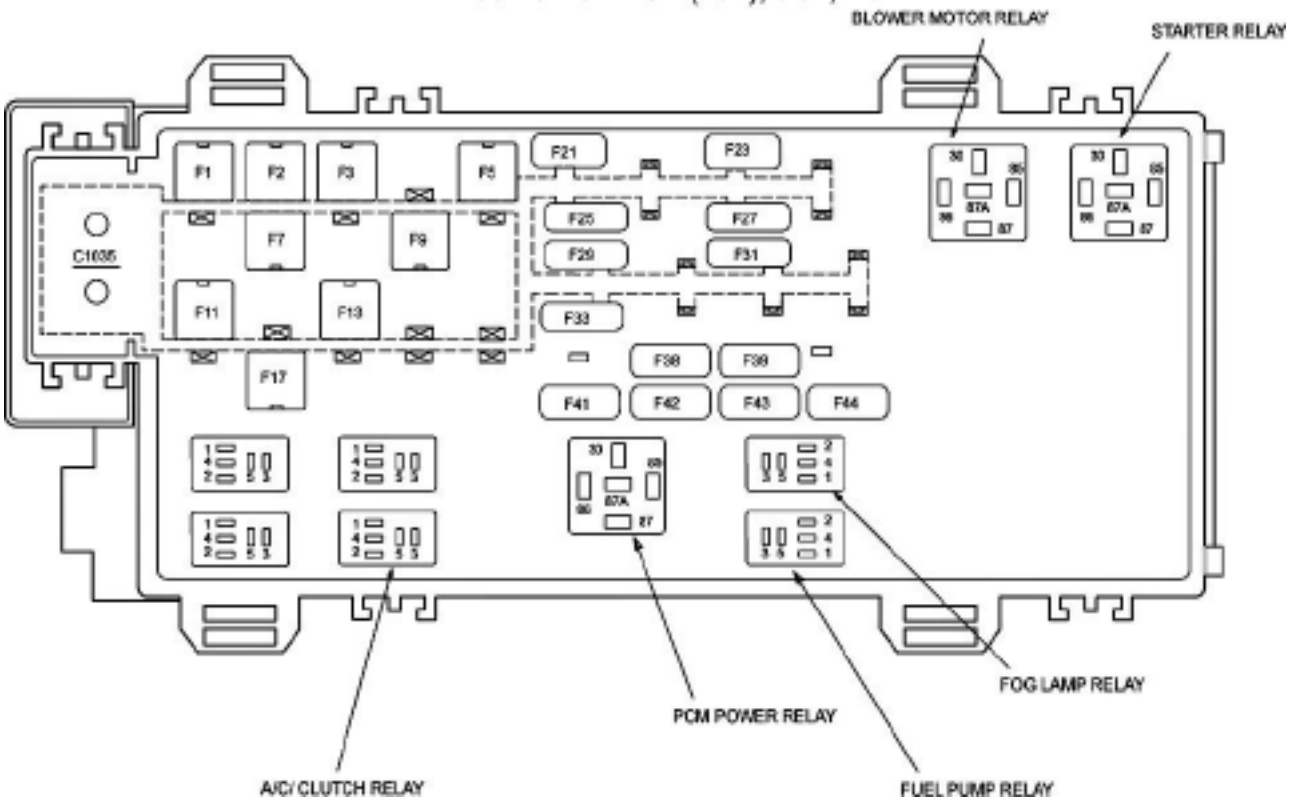
Fuse Block: Application and ID Smart Junction Box

FUSE	AMPS	Circuits Protected
F1	5A	Illumination dimmer
F2	10A	Trailer tow connector - Park
F3	10A	Headlamp, right (Low beam lamp feed)
F4	10A	Headlamp, left (Low beam lamp feed)
F5	5A	Windshield wiper module
F6	10A	Audio unit, Door lock switch illumination
F7	5A	Not Used
F8	10A	Restraints Control Module (RCM), Occupant Classification System Module (OCSM), Passenger Air bag Deactivation (PAD) Indicator
F9	5A	Instrument Cluster (IC), Air bag indicator
F10	10A	4X4 control module, Instrument Cluster (IC)
F11	10A	Smart Junction Box (SJB), logic power
F12	15A	Subwoofer amplifier with audiophile, Satellite radio receiver
F13	15A	Interior lamp relay, Horn relay
F14	15A	High beam lamp feed to High beam indicator, Headlamp, right, Headlamp, left
F16	30A	Accessory relay (Power windows)
F17	15A	Indicator flasher relay
F18	-	Not Used

FUSE	AMPS	Circuits Protected
F19	20A	Brake pedal position switch (Stoplamps)
F20	10A	Transmission control switch, Digital Transmission Range (TR) sensor, Speed control servo, Anti-lock Brake System (ABS) module, Indicator flasher relay, Reversing lamps switch, Speed control On/Off switch, Speed control Set/Resume switch
F21	5A	Digital Transmission Range (TR) sensor, Starter relay, Powertrain Control Module (PCM)
F22	5A	Audio unit
F23	30A	Main light switch, Multifunction switch
F24	20A	Audio unit
F26	2A	Deactivator switch
F27	10A	Blend door actuator, Climate control assembly
F28	15A	4X4 control module
F29	20A	Cigar lighter, front, Data Link Connector (DLC)
F30	5A	Exterior rear view mirror switch
F31	20A	Park lamp relay
F32	5A	Brake pedal position switch (logic power), Brake shift interlock
F33	5A	Instrument Cluster (IC), Neutral tow indicator
F34	20A	Power point
F35	15A	Door lock/unlock relay, Driver door unlock relay



BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L



Fuse Block: Application and ID Battery Junction Box

FUSE	AMPS	Circuits Protected
F1	40A	Smart Junction Box (SJB)
F2	-	Not Used
F3	40A	Smart Junction Box (SJB)
F4	-	Not Used
F5	50A	Smart Junction Box (SJB)
F6	-	Not Used
F7	30A	Starter Relay
F8	-	Not Used
F9	40A	Ignition Switch
F10	-	Not Used
F11	30A	PCM power relay
F12	-	Not Used
F13	30A	Blower motor relay
F14	-	Not Used
F15	-	Not Used
F16	-	Not Used
F17	40A	Anti-lock Brake System (ABS) module
F18	-	Not Used
F19	-	Not Used
F20	-	Not Used
F21	10A	Powertrain Control Module (PCM), Evaporative emission (EVAP) canister vent valve
F22	-	Not Used
F23	30A	Fuel Pump Relay, Fuel injectors
F24	-	Not Used

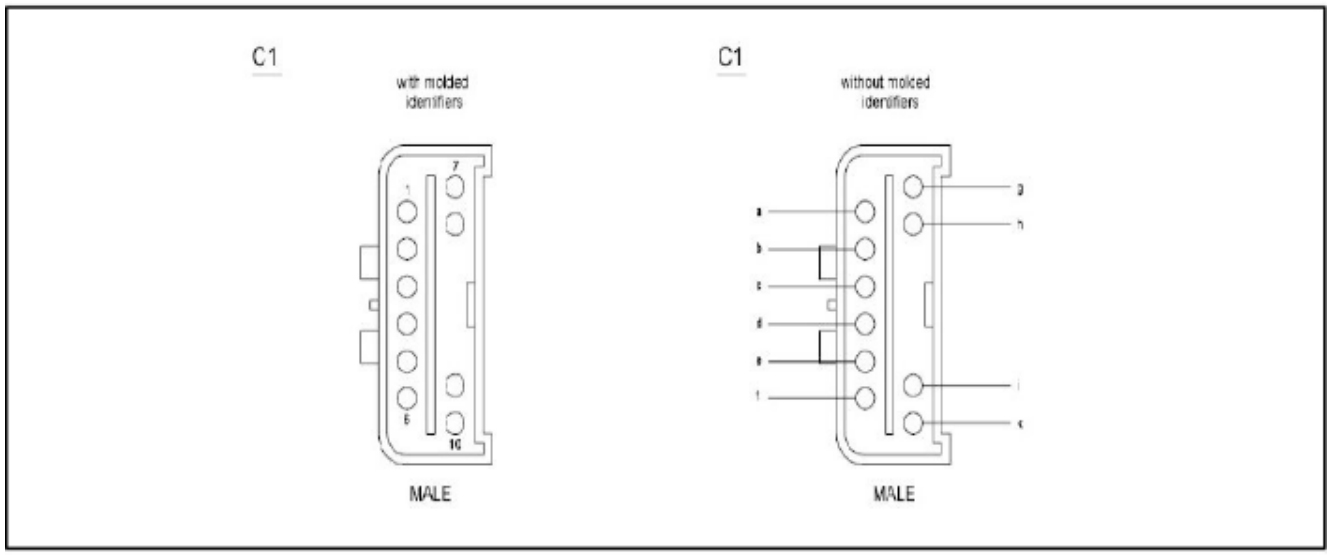
FUSE	AMPS	Circuits Protected
F25	10A	A/C clutch relay
F26	-	Not Used
F27	20A	4X4 control module
F28	-	Not Used
F29	30A	Windshield wipers/washer
F30	-	Not Used
F31	15A	Fog lamp relay
F32	-	Not Used
F33	30A	Anti-lock Brake System (ABS) module
F34	-	Not Used
F35	-	Not Used
F36	-	Not Used
F37	-	Not Used
F38	7.5A	Trailer tow connector - Right turn
F39	15A	Powertrain Control Module (PCM)
F40	-	Not Used
F41	10A	*5R44E Transmission **5R55E Transmission
F42	7.5A	Trailer tow connector - Left turn
F43	20A	EVAP canister purge valve, Heated Positive Crankcase Ventilation (PCV) valve, Idle Air Control (IAC) valve, Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor, Heated Oxygen Sensor (HO2S) #11, Heated Oxygen Sensor (HO2S) #12, Heated Oxygen Sensor (HO2S) #21, Heated Oxygen Sensor (HO2S) #22, EGR vacuum regulator solenoid valve, A/C relay coil
F44	15A	Ignition coil, *Ignition transformer capacitor 1

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



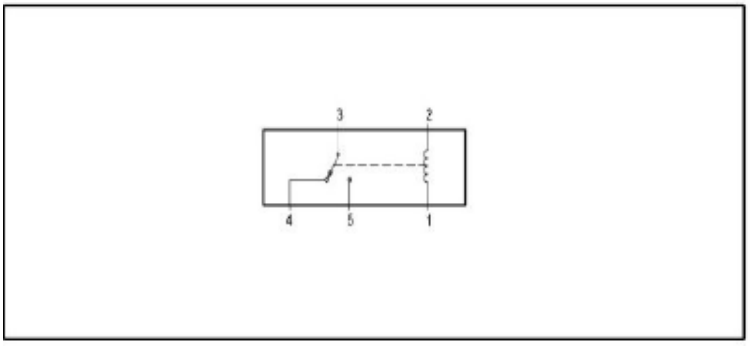
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

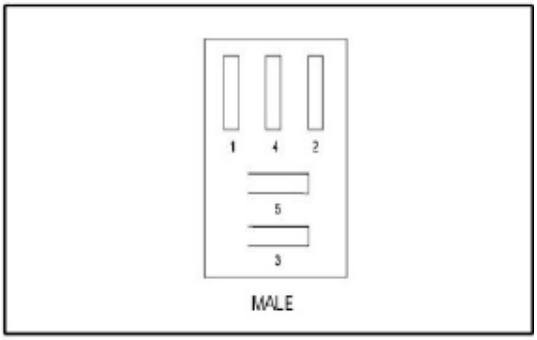
Micro ISO Relay: Testing and Inspection

Relay □ Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63□102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil □ Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

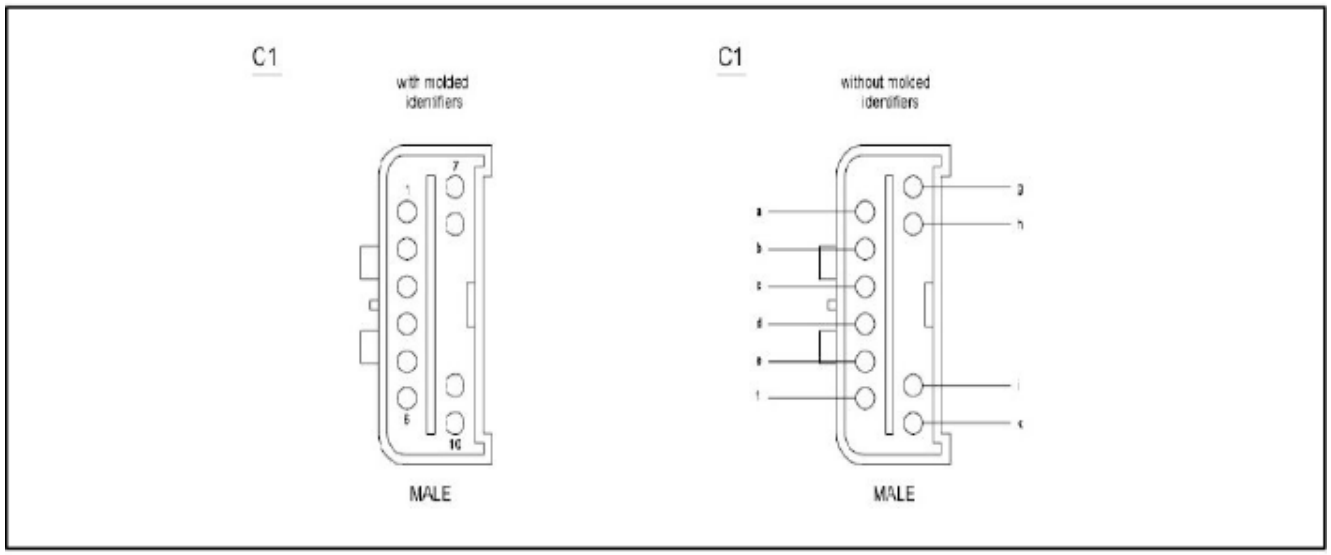
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



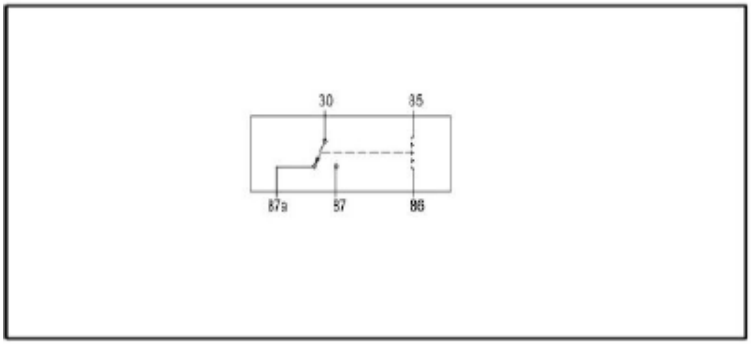
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

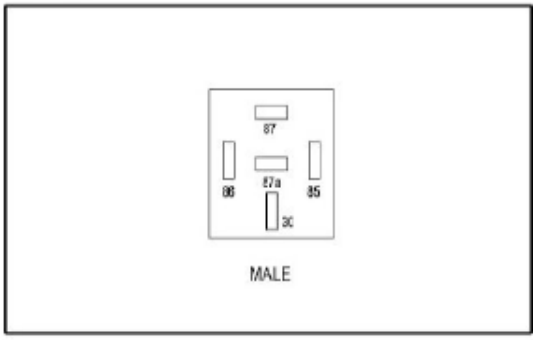
Mini ISO Relay: Testing and Inspection

Relay □ Mini ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

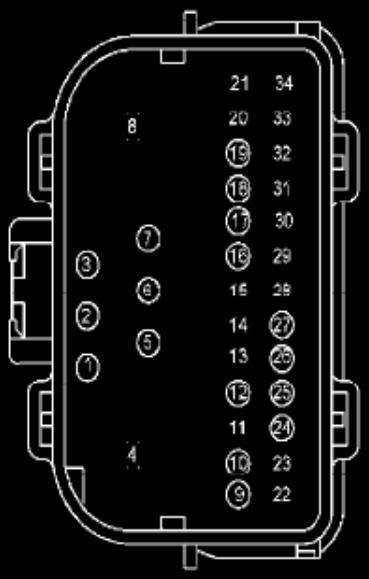
Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

Inline: C110

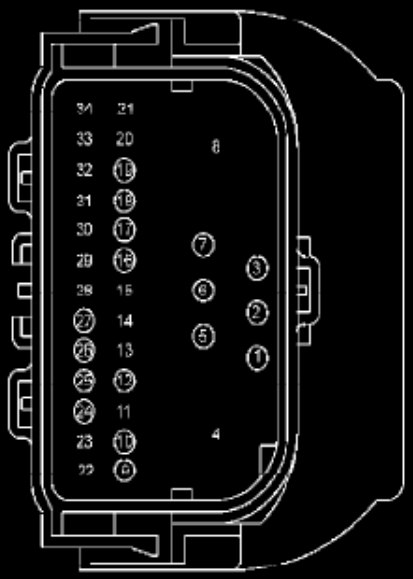
Description:
Inline

Base Part #:

MALE
Harness: 14290



FEMALE
Harness: 12B637



Pin	Circuit	Gauge	Qualifier
1	CE132 (BN-YE)	18	
2	CDB08 (BN)	20	12B637
2	CDB08 (BN)	22	14290
3	CET34 (BN-GN)	20	
4	*	*	
5	CF904 (GN-VT)	22	
6	CDC36 (GN-BN)	22	
7	VH101 (WH-VT)	20	
8	*	*	
9	VE225 (YE-OG)	20	12B637
9	VE225 (YE-OG)	22	14290
10	CH302 (WH-BN)	20	12B637
10	CH302 (WH-BN)	22	14290
11	*	*	
12	CH425 (GN-BU)	20	
13	*	*	
14	*	*	
15	*	*	
16	SBB21 (GY-RD)	20	
17	VDB04 (WH-BU)	20	
18	VDB05 (WH)	20	
19	CCB15 (BN-GN)	20	
20	*	*	
21	*	*	
22	*	*	
23	*	*	
24	CBP20 (YE-VT)	18	
25	CCP20 (GY-VT)	22	
26	CBP21 (BU-GY)	20	12B637 - M/T
26	CBP21 (BU-GY)	22	14290

Multiple Junction Connector: Diagrams C110

C110 (Part 1)

26	CBP21 (GN-OG)	20	12B637
26	CBP21 (GN-OG)	22	14290
26	CET40 (GN-OG)	22	14290 - A/T
27	CBP21 (BU-GY)	20	12B637
27	CBP21 (BU-GY)	22	14290
28	*	*	
29	*	*	
30	*	*	
31	*	*	
32	*	*	
33	*	*	
34	*	*	

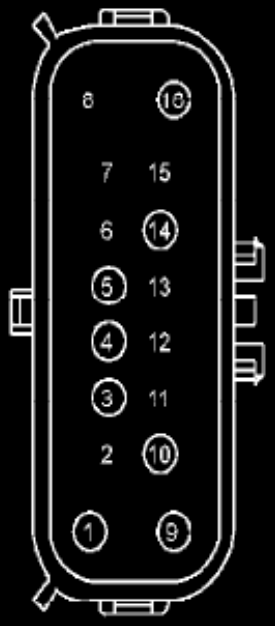
C110 (Part 2)

Inline: C133

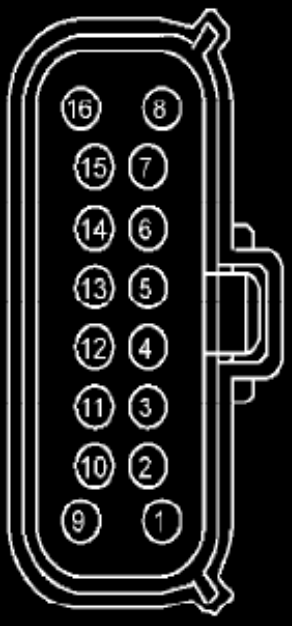
Description:
Inline

Base Part #:

MALE
Harness: 12B637



FEMALE
Harness: 14290



Pin	Circuit	Gauge	Qualifier
1	CBB44 (VT)	16	
2	*	*	
3	CBB39 (VT-WH)	18	
4	VMC05 (VT-OG)	20	
5	CMC24 (GY)	16	12B637 - 3.0L
5	CMC24 (GY)	22	14290 - 3.0L
6	*	*	
7	*	*	
8	*	*	
9	VE518 (BN-WH)	14	14290
9	VE518 (BN-WH)	16	12B637 - 3.0L
10	CBB41 (BU)	18	
11	*	*	
12	*	*	14290
12	GD108 (BK-VT)	16	12B637
13	*	*	
14	CDC12 (YE)	20	12B637
14	CDC12 (YE)	22	14290
15	*	*	
16	CBB43 (GY)	16	

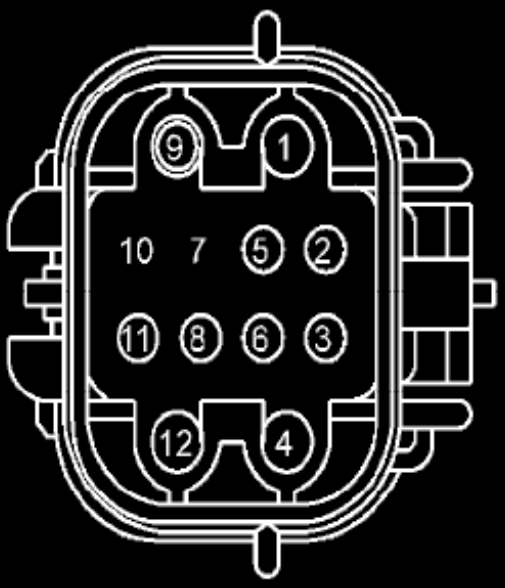
C133

Inline: C139

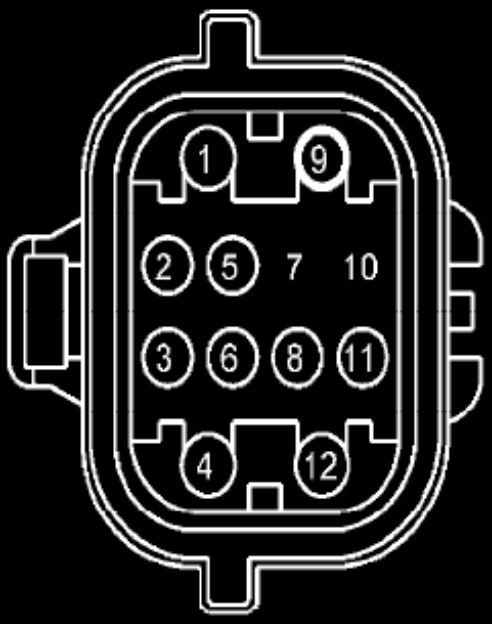
Description:
Inline

Base Part #:

MALE
Harness: 14290



FEMALE
Harness: 14A280



Pin	Circuit	Gauge	Qualifier
1	*	*	
2	CH423 (YE)	20	
3	GD121 (BK-GY)	20	14A280
3	GD121 (BK-YE)	20	14290
4	*	*	
5	CH443 (GN-OG)	20	14A280
5	CH443 (GN-OG)	22	14290
6	CH401 (VT-WH)	20	
7	*	*	
8	CMC24 (GY)	16	14A280 - 2.3L/4.0L
8	CMC24 (GY)	22	14290 - 2.3L/4.0L
9	CDC25 (BN-GN)	12	
10	*	*	
11	VDC42 (GN)	22	14290
11	VDC42 (GY)	20	14A280
12	*	*	

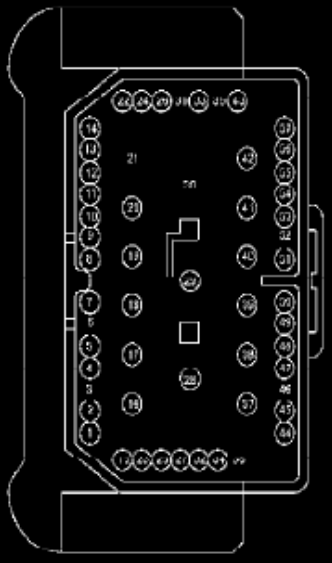
C139

Inline: C144

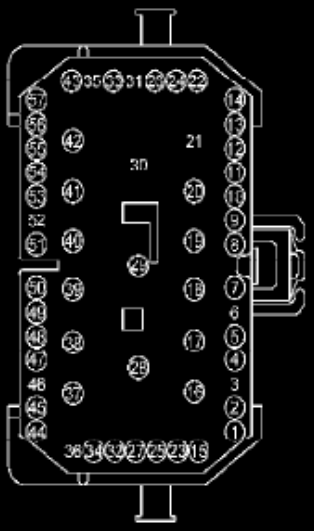
Description:
Inline

Base Part #:

MALE
Harness: 14401



FEMALE
Harness: 14290



Pin	Circuit	Gauge	Qualifier
1	CBP20 (YE-VT)	18	14401
1	CBP20 (YE-VT)	20	14290
2	VES10 (WH)	20	
3	*	*	
4	SBR14 (BN-RD)	18	14290
4	SBR14 (BN-RD)	20	14401
5	CCF20 (GY-VT)	20	14401
5	CCF20 (GY-VT)	22	14290
6	*	*	
7	CDC36 (GN-BN)	22	
8	CLS41 (GY-YE)	18	
9	CLS39 (VT-WH)	18	
10	CLS36 (YE)	18	
11	CLS35 (VT)	18	
12	CLS41 (GY-YE)	18	
13	CLS39 (VT-WH)	18	
14	CCB15 (BN-GN)	20	14290
14	CCB15 (BN-GN)	22	14401
15	CDB08 (BN)	22	
16	CBP20 (YE-VT)	18	
17	CAT06 (YE)	16	
17	CAT09 (YE)	16	
18	SBB27 (BU-RD)	16	
19	CAT09 (GN)	16	
20	GH435 (VT-GY)	22	
21	*	*	
22	VCA14 (WH-BN)	20	
23	VR214 (WH-BU)	20	
24	RCA21 (BN-GN)	20	
25	RR130 (GN-BU)	20	

Multiple Junction Connector: Diagrams C144

C144 (Part 1)

26	VDC42 (GN)	22	
27	VR213 (VT-GN)	20	
28	SBB09 (RD)	12	
29	GD121 (BK-YE)	10	
30	*	*	
31	*	*	
32	RR129 (YE-GY)	20	
33	CLF29 (BN)	20	14290
33	CLF29 (BN)	22	14401
34	CMC24 (GY)	22	
35	*	*	
36	*	*	
37	CET34 (BN-GN)	20	
38	CE904 (GN-VT)	22	
39	CRW19 (BU-OG)	20	
40	CRW18 (VT-WH)	20	
41	CH443 (GN-OG)	22	
42	CRW15 (BN-WH)	20	
43	CRW17 (GN-VT)	20	
44	CRW07 (GY-BN)	20	
45	VDB10 (GY)	20	14290
45	VDB10 (GY)	22	14401
46	*	*	
47	VDB04 (WH-BU)	20	
48	VDB05 (WH)	20	
49	GD174 (BK-WH)	20	
50	CES09 (VT-OG)	20	
51	CBP20 (YE-VT)	20	
52	*	*	
53	RES08 (GN-BN)	20	
54	CCB15 (BN-GN)	22	
55	CCA02 (GN-VT)	22	
56	CCA01 (BU-OG)	22	
57	CCF23 (GN-VT)	18	14290
57	CCF23 (GN-VT)	22	14401

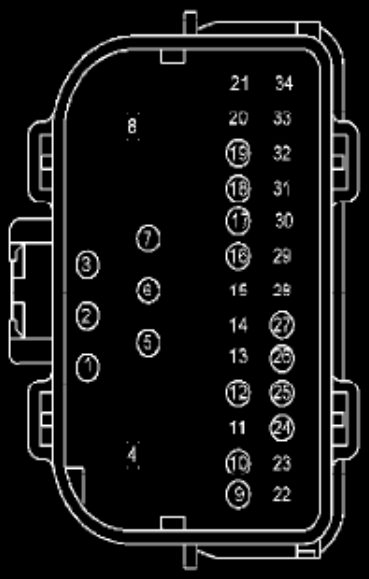
C144 (Part 2)

Inline: C110

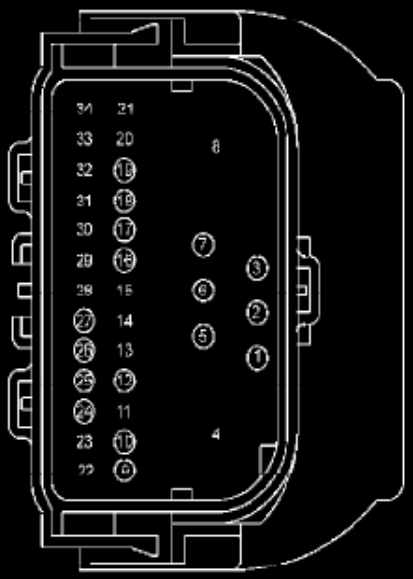
Description:
Inline

Base Part #:

MALE
Harness: 14290



FEMALE
Harness: 12B637



Pin	Circuit	Gauge	Qualifier
1	CE132 (BN-YE)	18	
2	CDB08 (BN)	20	12B637
2	CDB08 (BN)	22	14290
3	CET34 (BN-GN)	20	
4	*	*	
5	CF904 (GN-VT)	22	
6	CDC36 (GN-BN)	22	
7	VH101 (WH-VT)	20	
8	*	*	
9	VE225 (YE-OG)	20	12B637
9	VE225 (YE-OG)	22	14290
10	CH302 (WH-BN)	20	12B637
10	CH302 (WH-BN)	22	14290
11	*	*	
12	CH425 (GN-BU)	20	
13	*	*	
14	*	*	
15	*	*	
16	SBB21 (GY-RD)	20	
17	VDB04 (WH-BU)	20	
18	VDB05 (WH)	20	
19	CCB15 (BN-GN)	20	
20	*	*	
21	*	*	
22	*	*	
23	*	*	
24	CBP20 (YE-VT)	18	
25	CCP20 (GY-VT)	22	
26	CBP21 (BU-GY)	20	12B637 - M/T
26	CBP21 (BU-GY)	22	14290

Multiple Junction Connector: Diagrams

C110 (Part 1)

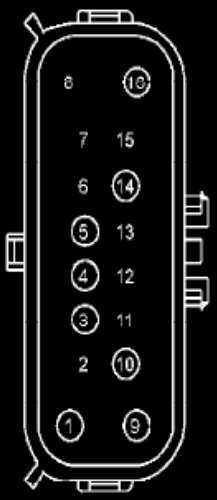
26	CBP21 (GN-OG)	20	12B637
26	CBP21 (GN-OG)	22	14290
26	CET40 (GN-OG)	22	14290 - A/T
27	CBP21 (BU-GY)	20	12B637
27	CBP21 (BU-GY)	22	14290
28	*	*	
29	*	*	
30	*	*	
31	*	*	
32	*	*	
33	*	*	
34	*	*	

Inline: C133

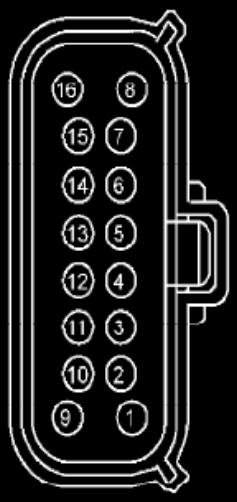
Description:
Inline

Base Part #:

MALE
Harness: 12B637



FEMALE
Harness: 14290



Pin	Circuit	Gauge	Qualifier
1	CBB44 (VT)	16	
2	*	*	
3	CBB39 (VT-WH)	18	
4	VMC05 (VT-OG)	20	
5	CMC24 (GY)	16	12B637 - 3.0L
5	CMC24 (GY)	22	14290 - 3.0L
6	*	*	
7	*	*	
8	*	*	
9	VE518 (BN-WH)	14	14290
9	VE518 (BN-WH)	16	12B637 - 3.0L
10	CBB41 (BU)	18	
11	*	*	
12	*	*	14290
12	GD108 (BK-VT)	16	12B637
13	*	*	
14	CDC12 (YE)	20	12B637
14	CDC12 (YE)	22	14290
15	*	*	
16	CBB43 (GY)	16	

C110 (Part 2)

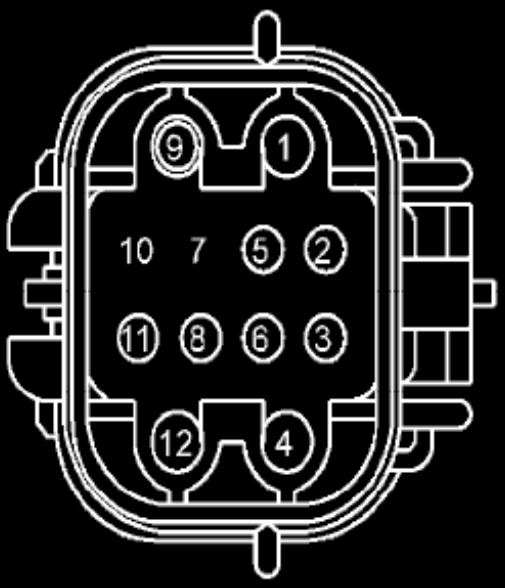
C133

Inline: C139

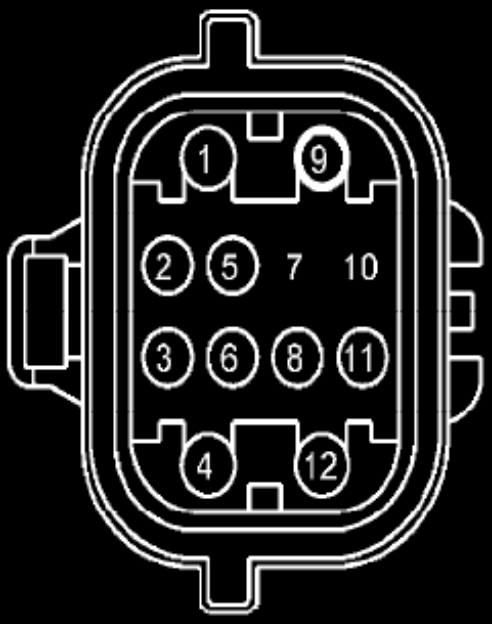
Description:
Inline

Base Part #:

MALE
Harness: 14290



FEMALE
Harness: 14A280



Pin	Circuit	Gauge	Qualifier
1	*	*	
2	CH423 (YE)	20	
3	GD121 (BK-GY)	20	14A280
3	GD121 (BK-YE)	20	14290
4	*	*	
5	CH443 (GN-OG)	20	14A280
5	CH443 (GN-OG)	22	14290
6	CH401 (VT-WH)	20	
7	*	*	
8	CMC24 (GY)	16	14A280 - 2.3L/4.0L
8	CMC24 (GY)	22	14290 - 2.3L/4.0L
9	CDC25 (BN-GN)	12	
10	*	*	
11	VDC42 (GN)	22	14290
11	VDC42 (GY)	20	14A280
12	*	*	

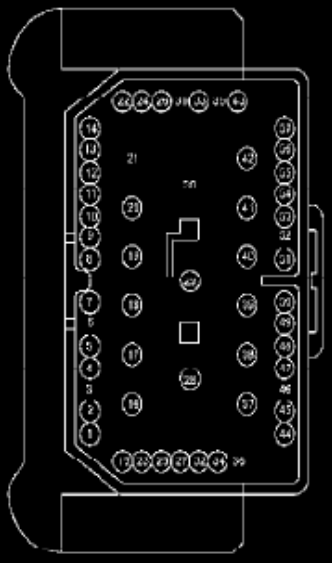
C139

Inline: C144

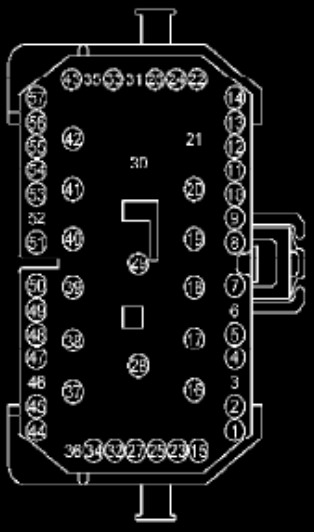
Description:
Inline

Base Part #:

MALE
Harness: 14401



FEMALE
Harness: 14290



Pin	Circuit	Gauge	Qualifier
1	CBP20 (YE-VT)	18	14401
1	CBP20 (YE-VT)	20	14290
2	VES10 (WH)	20	
3	*	*	
4	SBR14 (BN-RD)	18	14290
4	SBR14 (BN-RD)	20	14401
5	CCF20 (GY-VT)	20	14401
5	CCF20 (GY-VT)	22	14290
6	*	*	
7	CDC36 (GN-BN)	22	
8	CLS41 (GY-YE)	18	
9	CLS39 (VT-WH)	18	
10	CLS36 (YE)	18	
11	CLS35 (VT)	18	
12	CLS41 (GY-YE)	18	
13	CLS39 (VT-WH)	18	
14	CCB15 (BN-GN)	20	14290
14	CCB15 (BN-GN)	22	14401
15	CDB08 (BN)	22	
16	CBP20 (YE-VT)	18	
17	CAT06 (YE)	16	
17	CAT09 (YE)	16	
18	SBB27 (BU-RD)	16	
19	CAT09 (GN)	16	
20	CH435 (VT-GY)	22	
21	*	*	
22	VCA14 (WH-BN)	20	
23	VR214 (WH-BU)	20	
24	RCA21 (BN-GN)	20	
25	RR130 (GN-BU)	20	

C144 (Part 1)

26	VDC42 (GN)	22	
27	VR213 (VT-GN)	20	
28	SBB09 (RD)	12	
29	GD121 (BK-YE)	10	
30	*	*	
31	*	*	
32	RR129 (YE-GY)	20	
33	CLF29 (BN)	20	14290
33	CLF29 (BN)	22	14401
34	CMC24 (GY)	22	
35	*	*	
36	*	*	
37	CET34 (BN-GN)	20	
38	CE904 (GN-VT)	22	
39	CRW19 (BU-OG)	20	
40	CRW18 (VT-WH)	20	
41	CH443 (GN-OG)	22	
42	CRW15 (BN-WH)	20	
43	CRW17 (GN-VT)	20	
44	CRW07 (GY-BN)	20	
45	VDB10 (GY)	20	14290
45	VDB10 (GY)	22	14401
46	*	*	
47	VDB04 (WH-BU)	20	
48	VDB05 (WH)	20	
49	GD174 (BK-WH)	20	
50	CES09 (VT-OG)	20	
51	CBP20 (YE-VT)	20	
52	*	*	
53	RES08 (GN-BN)	20	
54	CCB15 (BN-GN)	22	
55	CCA02 (GN-VT)	22	
56	CCA01 (BU-OG)	22	
57	CCF23 (GN-VT)	18	14290
57	CCF23 (GN-VT)	22	14401

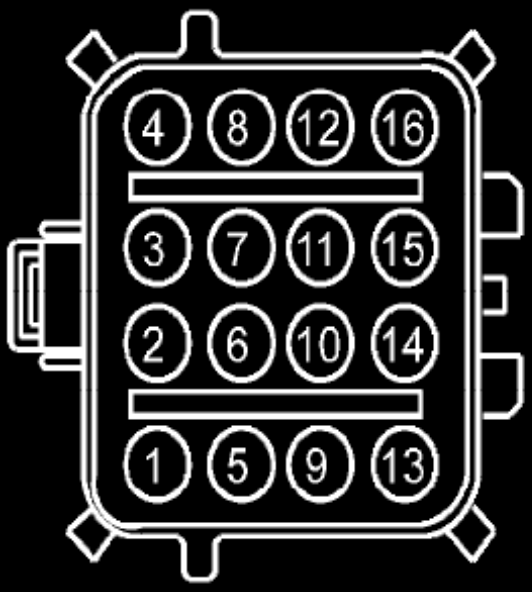
C144 (Part 2)

Inline: C210

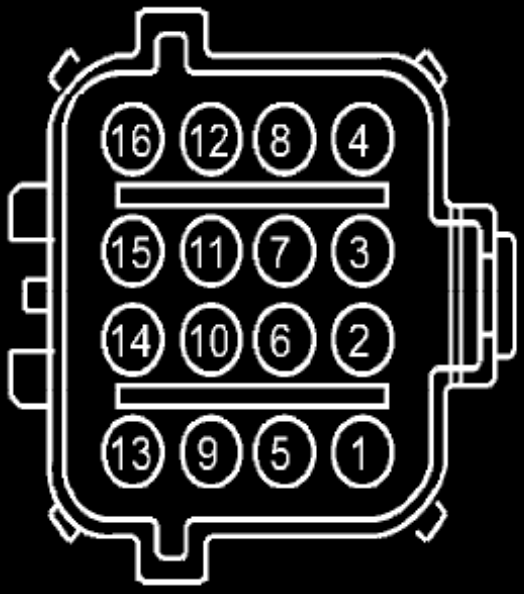
Description:
Inline

Base Part #:

MALE
Harness: 14631

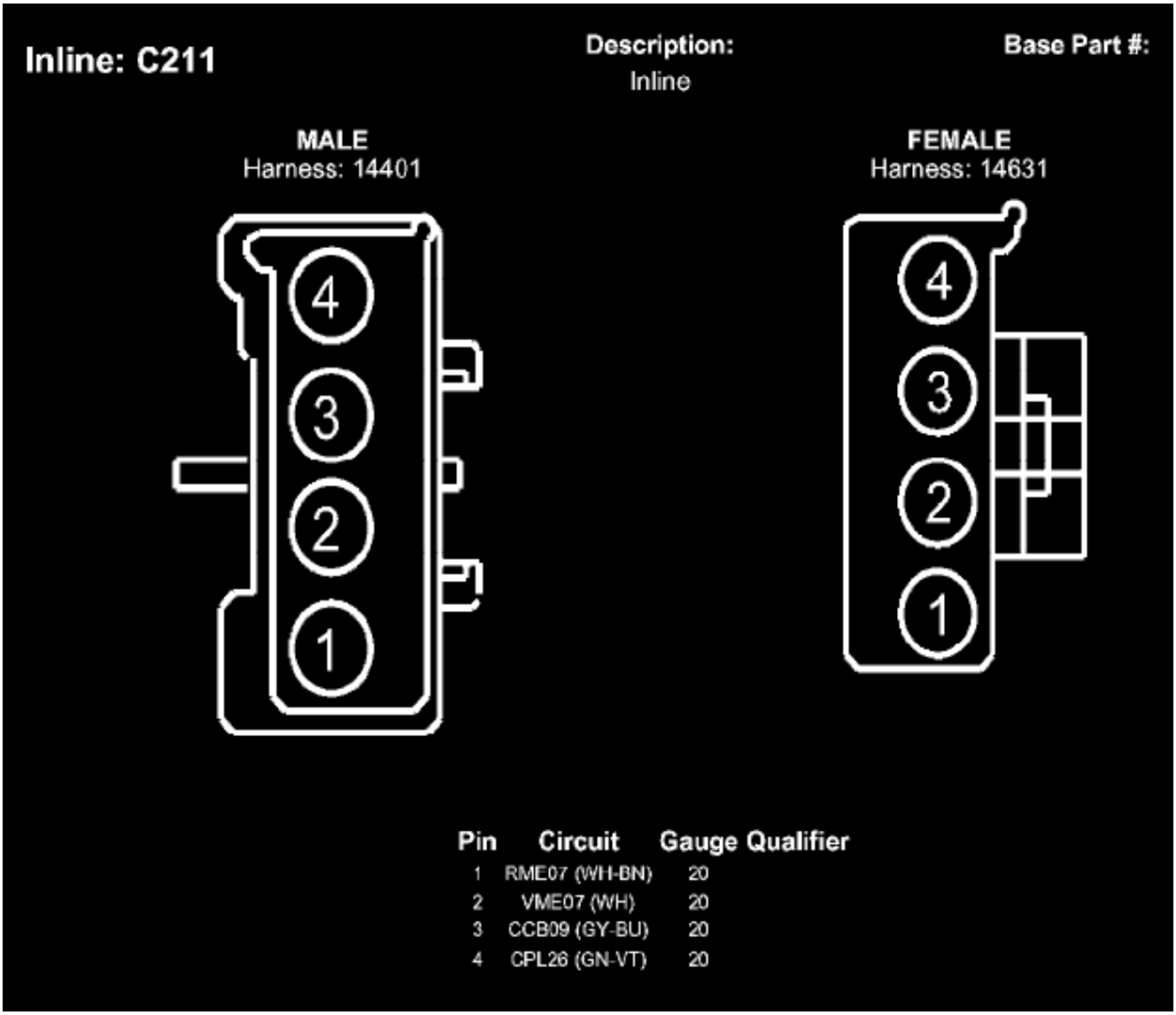


FEMALE
Harness: 14401



Pin	Circuit	Gauge	Qualifier
1	SBP30 (BN-RD)	22	
2	CPL51 (BU-GN)	18	14631
2	CPL51 (BU-GN)	22	14401
3	CPW12 (GN-OG)	14	
4	*	*	
5	CPL42 (GY-YE)	20	14631
5	CPL42 (GY-YE)	22	14401
6	CPL43 (VT-GY)	20	14631
6	CPL43 (VT-GY)	22	14401
7	CPW30 (GY-YE)	14	
8	CPL11 (GY-BN)	18	
9	*	*	
10	CBP06 (WH-BU)	20	14631
10	CBP06 (WH-BU)	20	14401
11	CPW13 (BN-YE)	14	
12	*	*	
13	CPM15 (VT-OG)	22	
14	CPM17 (BU-GN)	22	
15	*	*	
16	CPM23 (GY)	22	

C210


Inline: C211
Description:
Inline
Base Part #:
MALE
Harness: 14401
FEMALE
Harness: 14631
4
3
2
1
4
3
2
1
Pin Circuit Gauge Qualifier
1 RME07 (WH-BN) 20
2 VME07 (WH) 20
3 CCB09 (GY-BU) 20
4 CPL26 (GN-VT) 20

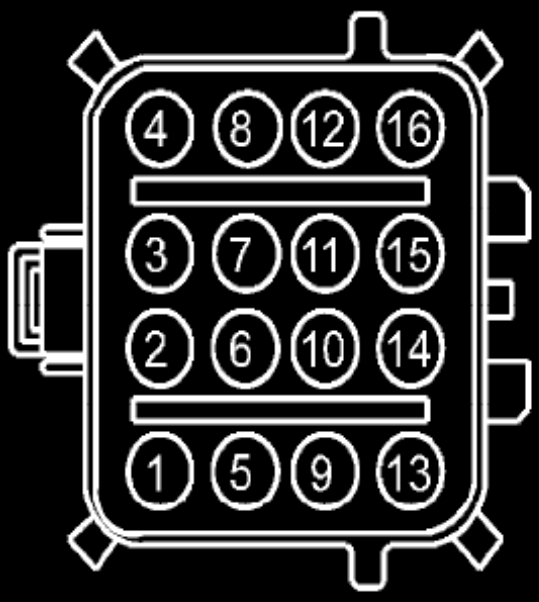
C211

Inline: C213

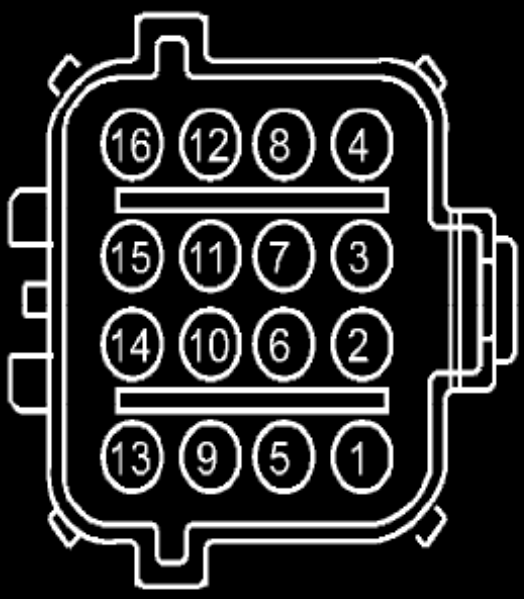
Description:
Inline

Base Part #:

MALE
Harness: 14401



FEMALE
Harness: 14630



Pin	Circuit	Gauge	Qualifier
1	CPW13 (BN-YE)	14	
2	CPM17 (BU-GN)	22	
3	CPL18 (GY-VT)	20	
4	*	*	
5	CPW12 (GN-OG)	14	
6	CPL43 (VT-GY)	20	14630
6	CPL43 (VT-GY)	22	14401
7	RME10 (WH-OG)	20	
8	VME10 (WH-VT)	20	
9	CPM23 (GY)	22	
10	CPL42 (GY-YE)	20	14630
10	CPL42 (GY-YE)	22	14401
11	CPM15 (VT-OG)	22	
12	CPW14 (VT-WH)	14	
13	CBP06 (WH-BU)	20	
14	CPL19 (WH-VT)	20	
15	CPL31 (WH)	20	
16	GD161 (BK-YE)	20	14630
16	GD161 (BK-YE)	22	14401

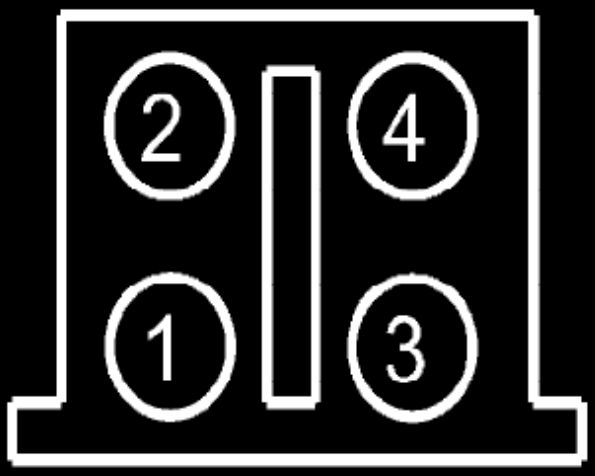
C213

Inline: C237

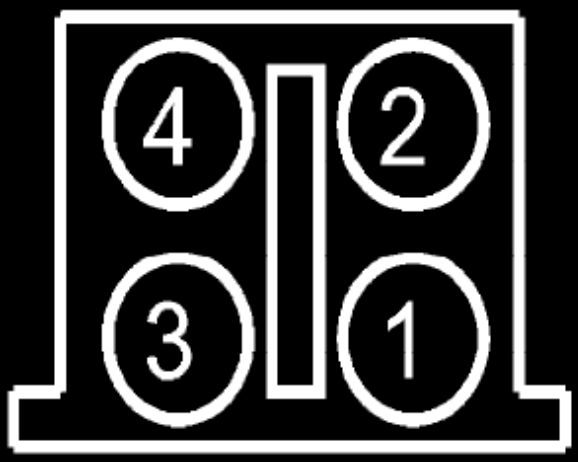
Description:
Inline

Base Part #:

MALE
Harness: 14290



FEMALE
Harness: 14401



Pin	Circuit	Gauge	Qualifier
1	CH428 (GN-WH)	14	14290
1	CH428 (GN-WH)	16	14401
2	CH429 (GY-BN)	14	14290
2	CH429 (GY-BN)	16	14401
3	CE911 (VT-WH)	14	
4	CH430 (VT-OG)	10	

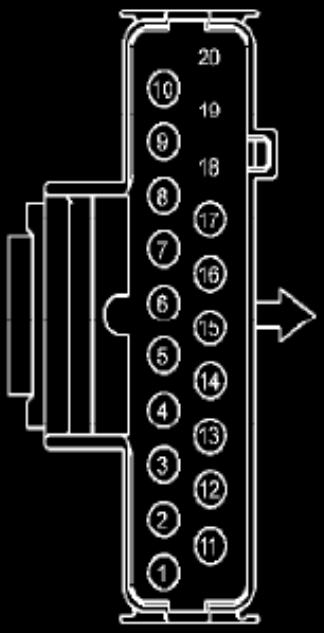
C237

Inline: C238

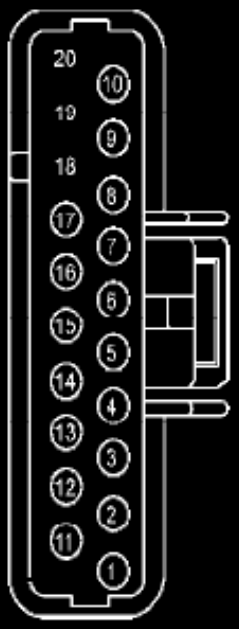
Description:
Inline

Base Part #:

MALE
Harness: 14A320



FEMALE
Harness: 14401



Pin	Circuit	Gauge Qualifier
1	CRW15 (BN-WH)	20
2	CRW07 (GY-BN)	20
3	GD161 (BK-YE)	18
4	CLS39 (VT-WH)	22
5	CLF18 (BU-WH)	16
6	CLS24 (BN-WH)	16
7	CLS32 (BN-YE)	18
8	CLS42 (VT-BN)	18
9	CCB08 (VT-WH)	16
10	SBP23 (WH-RD)	14
11	CLF27 (GN-BN)	14
12	CRW18 (VT-WH)	20
13	CRW19 (BU-OG)	20
14	CRW17 (GN-VT)	20
15	CLS35 (VT)	18
16	CLS41 (GY-YE)	22
17	CLS36 (YE)	18
18	*	*
19	*	*
20	*	*

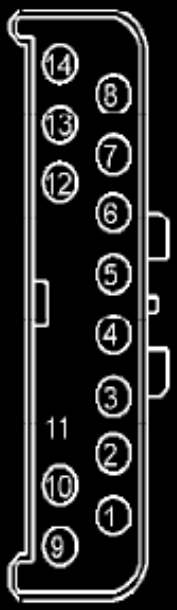
C238

Inline: C248

Description:
Inline

Base Part #:

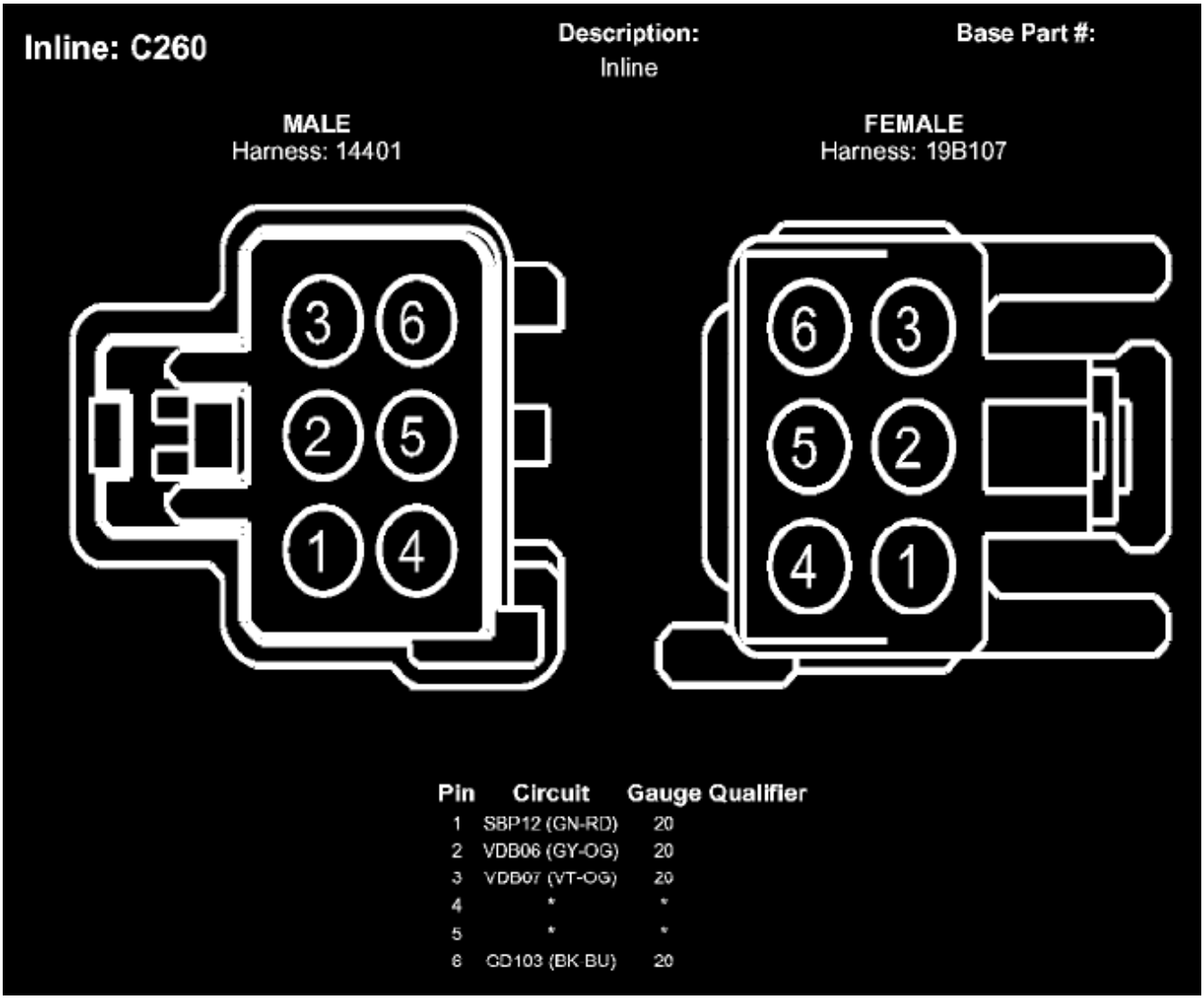
MALE
Harness: 19A170



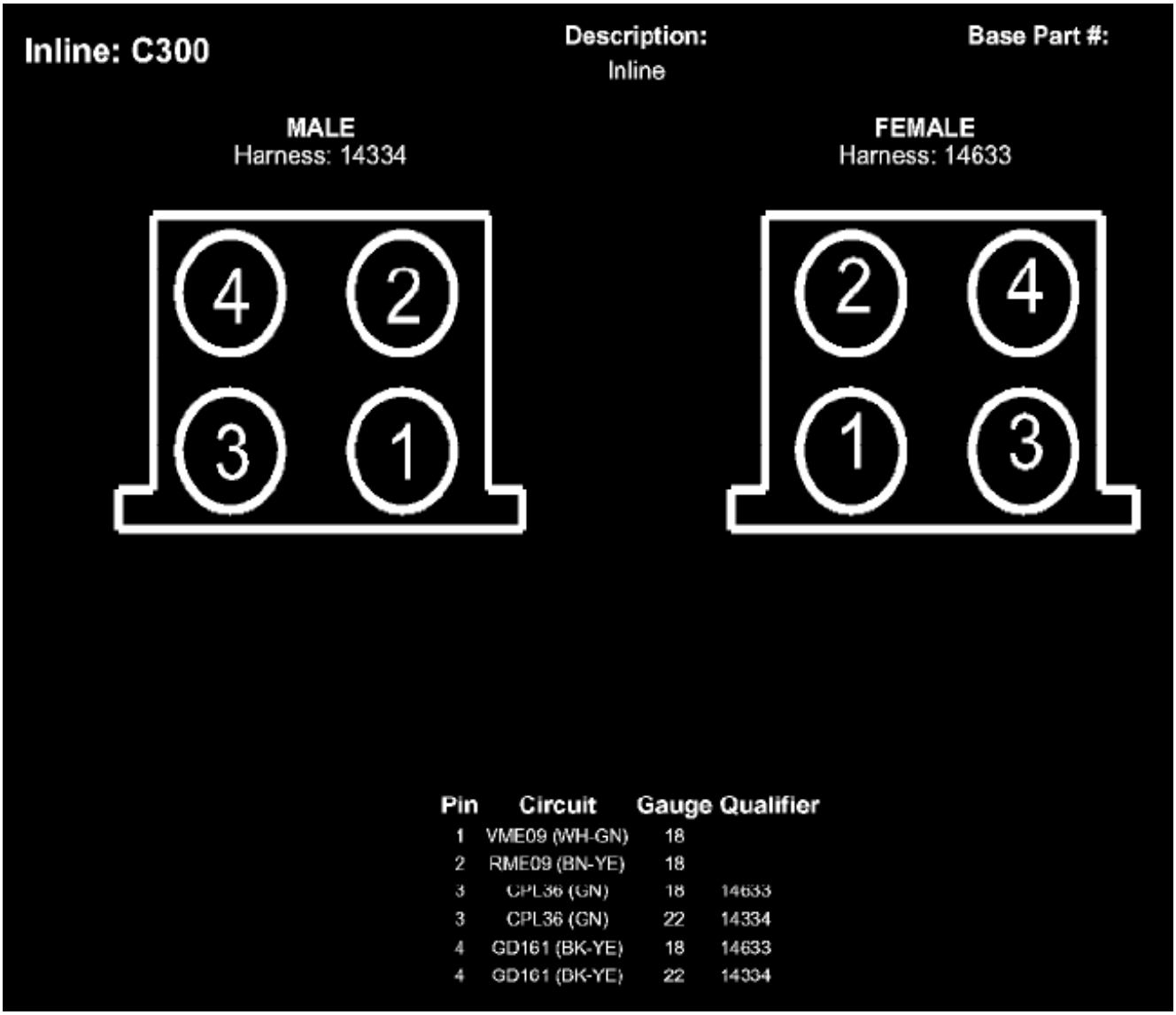
FEMALE
Harness: 14401

Pin	Circuit	Gauge	Qualifier
1	GD103 (BK-BU)	16	
2	VME46 (BU-GN)	22	w/ audio input jack
3	RME46 (WH-GN)	22	w/ audio input jack
4	RME22 (GN-WH)	22	
5	VME22 (VT-GN)	22	
6	VME45 (BU)	22	w/ audio input jack
7	RME45 (YE-GN)	22	w/ audio input jack
8	SBP12 (GN-RD)	16	
9	GD103 (BK-BU)	16	
10	DME22 (-)	18	
11	*	*	
12	SME23 (VT-RD)	22	
13	DME45 (-)	18	w/ audio input jack
14	SBP12 (GN-RD)	16	

C248


Inline: C260
Description:
Inline
Base Part #:
MALE
Harness: 14401
FEMALE
Harness: 19B107
3 6
2 5
1 4
6 3
5 2
4 1
Pin Circuit Gauge Qualifier
1 SBP12 (GN-RD) 20
2 VDB06 (GY-OG) 20
3 VDB07 (VT-OG) 20
4 * *
5 * *
6 GD103 (BK BU) 20

C260



Pin	Circuit	Gauge	Qualifier
1	VME09 (WH-GN)	18	
2	RME09 (BN-YE)	18	
3	CPL36 (GN)	18	14633
3	CPL36 (GN)	22	14334
4	GD161 (BK-YE)	18	14633
4	GD161 (BK-YE)	22	14334

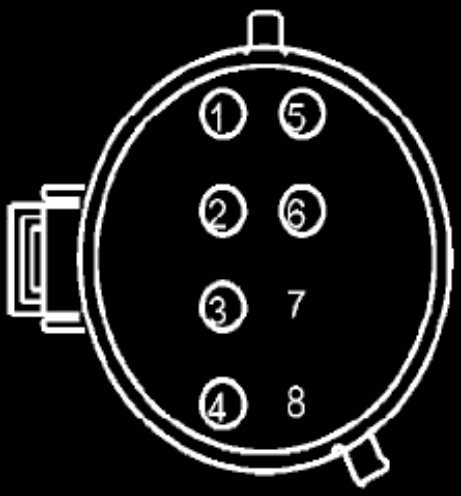
C300

Inline: C311

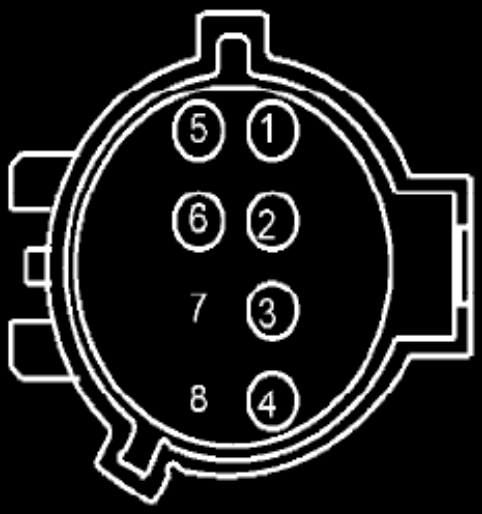
Description:
Inline

Base Part #:

MALE
Harness: 12B637



FEMALE
Harness: 14405



Pin	Circuit	Gauge	Qualifier
1	RE407 (YE-VT)	20	
2	CET41 (BN-YE)	18	
3	CE114 (GN-BU)	18	
3	CE114 (GN-BU)	20	
4	LE424 (YE-GN)	20	
5	SBB21 (GY-RD)	18	
6	VE922 (VT-GN)	20	
7	*	*	
8	*	*	

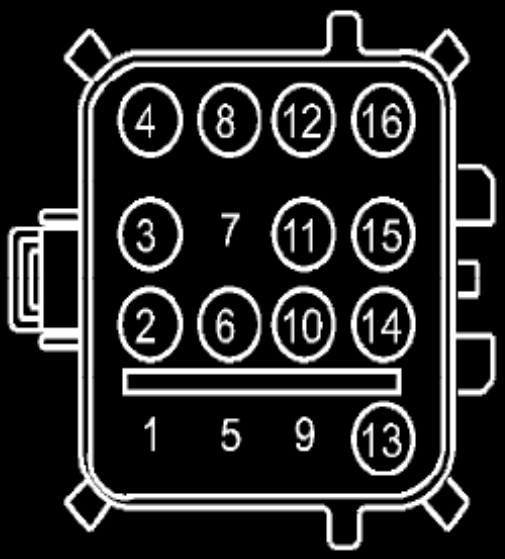
C311

Inline: C312

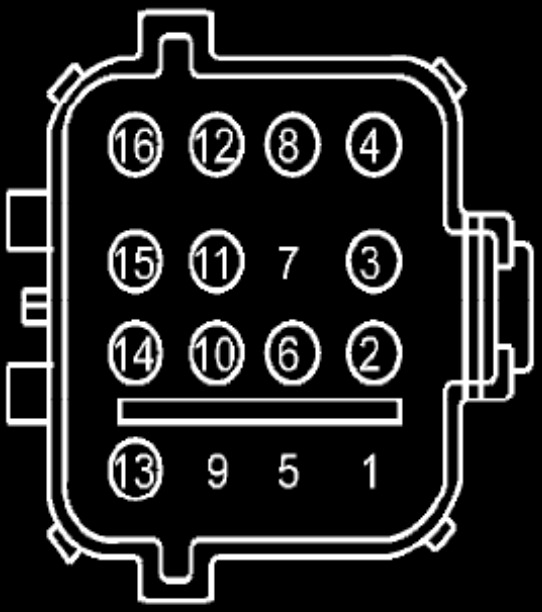
Description:
Inline

Base Part #:

MALE
Harness: 14405



FEMALE
Harness: 14401



Pin	Circuit	Gauge	Qualifier
1	*	*	
1	CLS41 (GY-YE)	18	
2	CLS36 (YE)	18	
3	CLS35 (VT)	18	
4	CAT09 (GN)	16	
5	*	*	
5	CLS39 (VT-WH)	18	
6	CAT06 (YE)	16	
7	*	*	
8	CE911 (VT-WH)	14	
9	*	*	
9	CCB08 (VT-WH)	18	
10	VMC11 (YE-VT)	20	
11	GD174 (BK-WH)	20	
12	CAT17 (BN)	16	14401
12	CAT17 (BN-WH)	16	14405
13	RCA21 (BN-GN)	18	
13	RCA21 (BN-GN)	20	
14	VCA14 (WH-BN)	18	
14	VCA14 (WH-BN)	20	
15	CLS34 (GY)	16	
15	CLS34 (GY)	18	
16	GD121 (BK-YE)	16	14405
16	GD121 (BK-YE)	18	14401

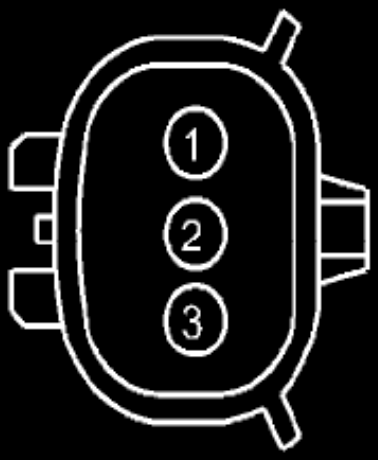
C312

Inline: C315

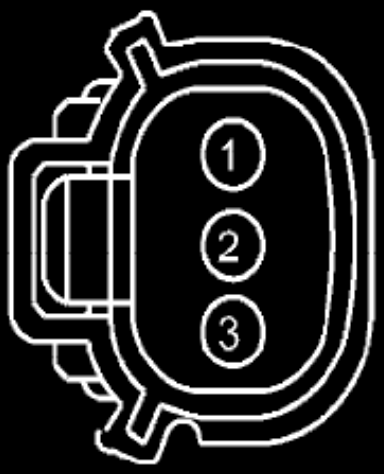
Description:
Inline

Base Part #:

MALE
Harness: 14632

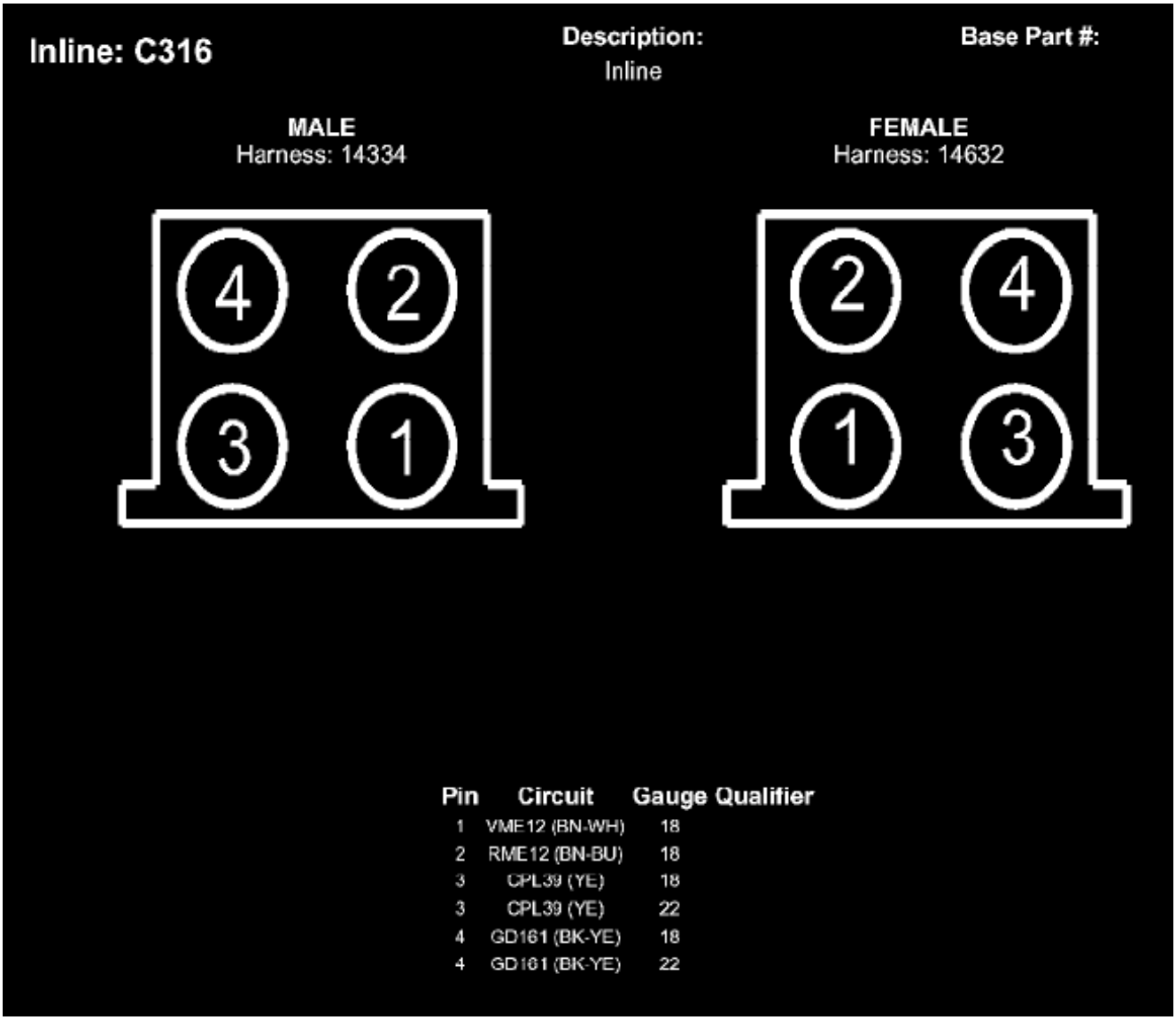


FEMALE
Harness: 14334



Pin	Circuit	Gauge Qualifier
1	LR142 (YE-BN)	18
1	LR142 (YE-BN)	20
2	RR142 (GN)	18
2	RR142 (GN)	20
3	VR210 (BU-BN)	18
3	VR210 (BU-BN)	20

C315



Pin	Circuit	Gauge Qualifier
1	VME12 (BN-WH)	18
2	RME12 (BN-BU)	18
3	CPL39 (YE)	18
3	CPL39 (YE)	22
4	GD161 (BK-YE)	18
4	GD161 (BK-YE)	22

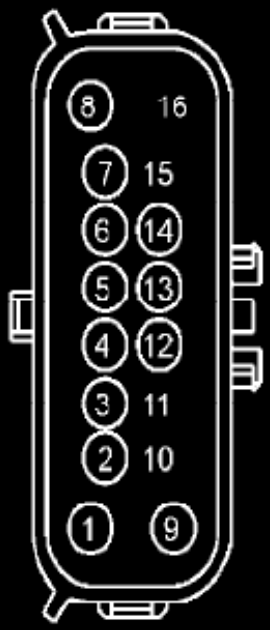
C316

Inline: C327

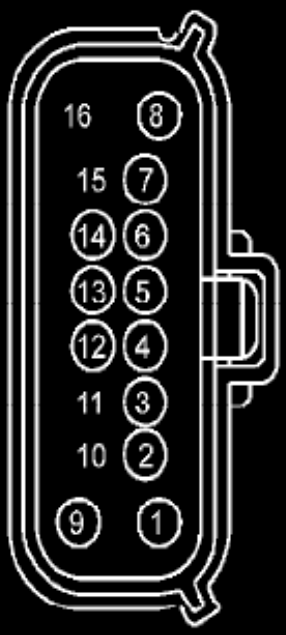
Description:
Inline

Base Part #:

MALE
Harness: 13A724/14334



FEMALE
Harness: 14401



Pin	Circuit	Gauge	Qualifier
1	RR142 (GN)	20	
2	GD161 (BK-YE)	18	
3	CPL39 (YE)	20	14401
3	CPL39 (YE)	22	14334
4	VME09 (WH-GN)	18	13A724/14334
4	VME09 (WH-GN)	20	14401
5	RME09 (BN-YE)	18	13A724/14334
5	RME09 (BN-YE)	20	
6	VME12 (BN-WH)	18	13A724/14334
6	VME12 (BN-WH)	20	14401
7	RME12 (BN-BU)	18	13A724/14334
7	RME12 (BN-BU)	20	14401
8	CPL36 (GN)	20	14401
8	CPL36 (GN)	22	14334
9	VR210 (BU-BN)	20	
10	*	*	
11	*	*	
12	CCR08 (VT-WH)	16	
13	LR142 (YE-BU)	20	
14	CLN28 (GN-BU)	18	
15	*	*	
16	*	*	

C327

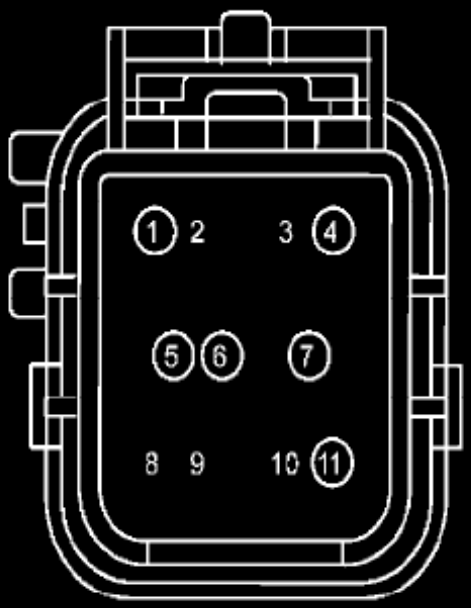
Inline: C328

Description:
Inline

Base Part #:

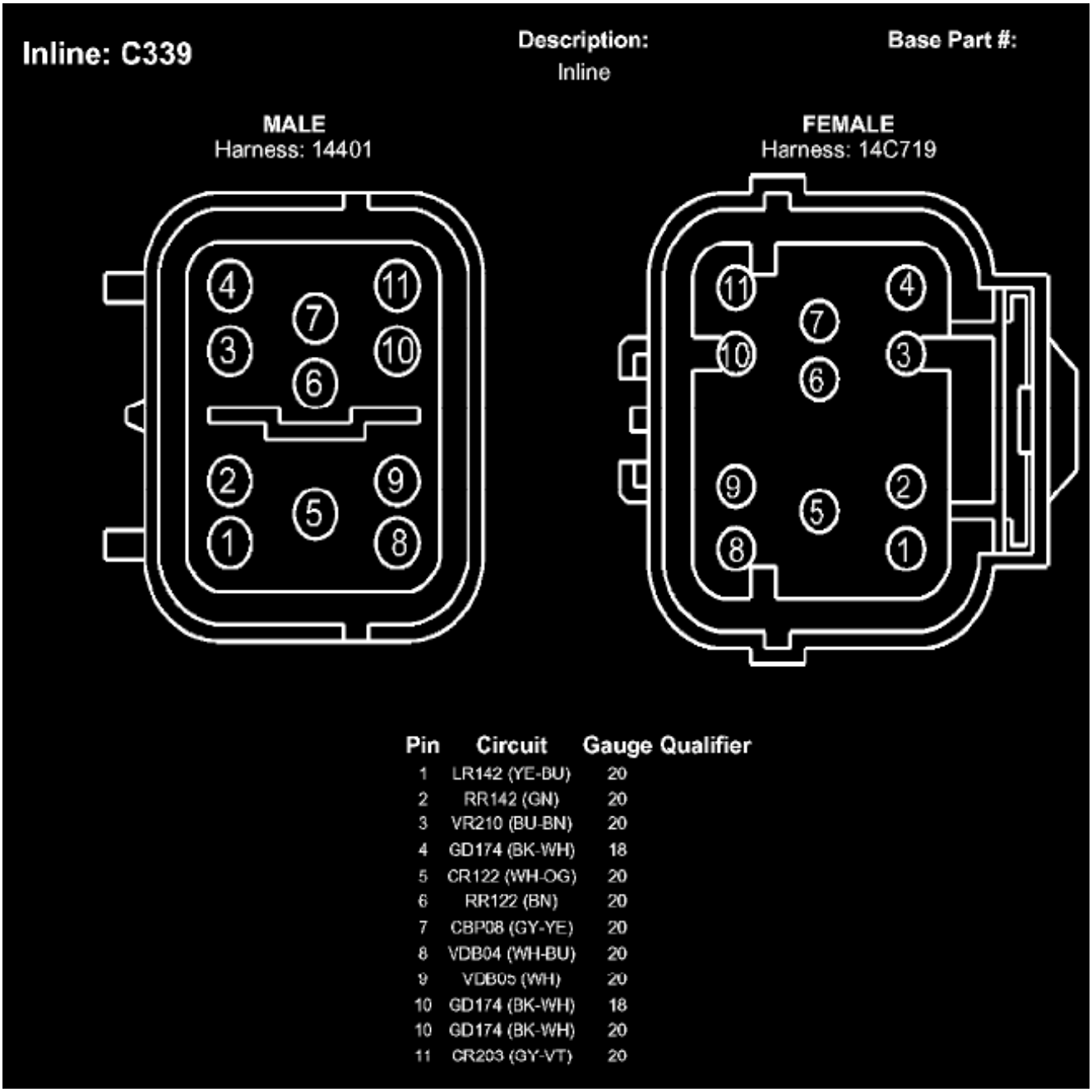
MALE
Harness: 14401

FEMALE
Harness: 2027933



Pin	Circuit	Gauge Qualifier
1	VR215 (OG)	20
1	VR215 (YE-VT)	20
2	*	*
3	*	*
4	GD174 (BK-WH)	20
4	GD174 (OG)	20
5	RR120 (BN-GN)	20
5	RR120 (RD-WH)	20
6	CR120 (BU-OG)	20
6	CR120 (RD-WH)	20
7	CR201 (BN-LB)	20
7	CR201 (GN-BU)	20
8	*	*
9	*	*
10	*	*
11	GD174 (BK-LB)	20
11	GD174 (BK-WH)	20

C328



Pin	Circuit	Gauge Qualifier
1	LR142 (YE-BU)	20
2	RR142 (GN)	20
3	VR210 (BU-BN)	20
4	GD174 (BK-WH)	18
5	CR122 (WH-OG)	20
6	RR122 (BN)	20
7	CBP08 (GY-YE)	20
8	VDB04 (WH-BU)	20
9	VDB05 (WH)	20
10	GD174 (BK-WH)	18
10	GD174 (BK-WH)	20
11	CR203 (GY-VT)	20

C339

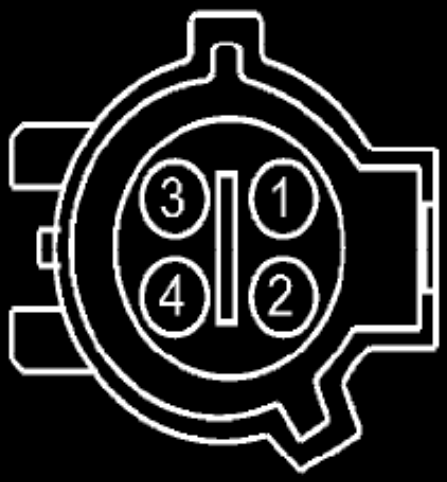
Inline: C340

Description:
Inline

Base Part #:

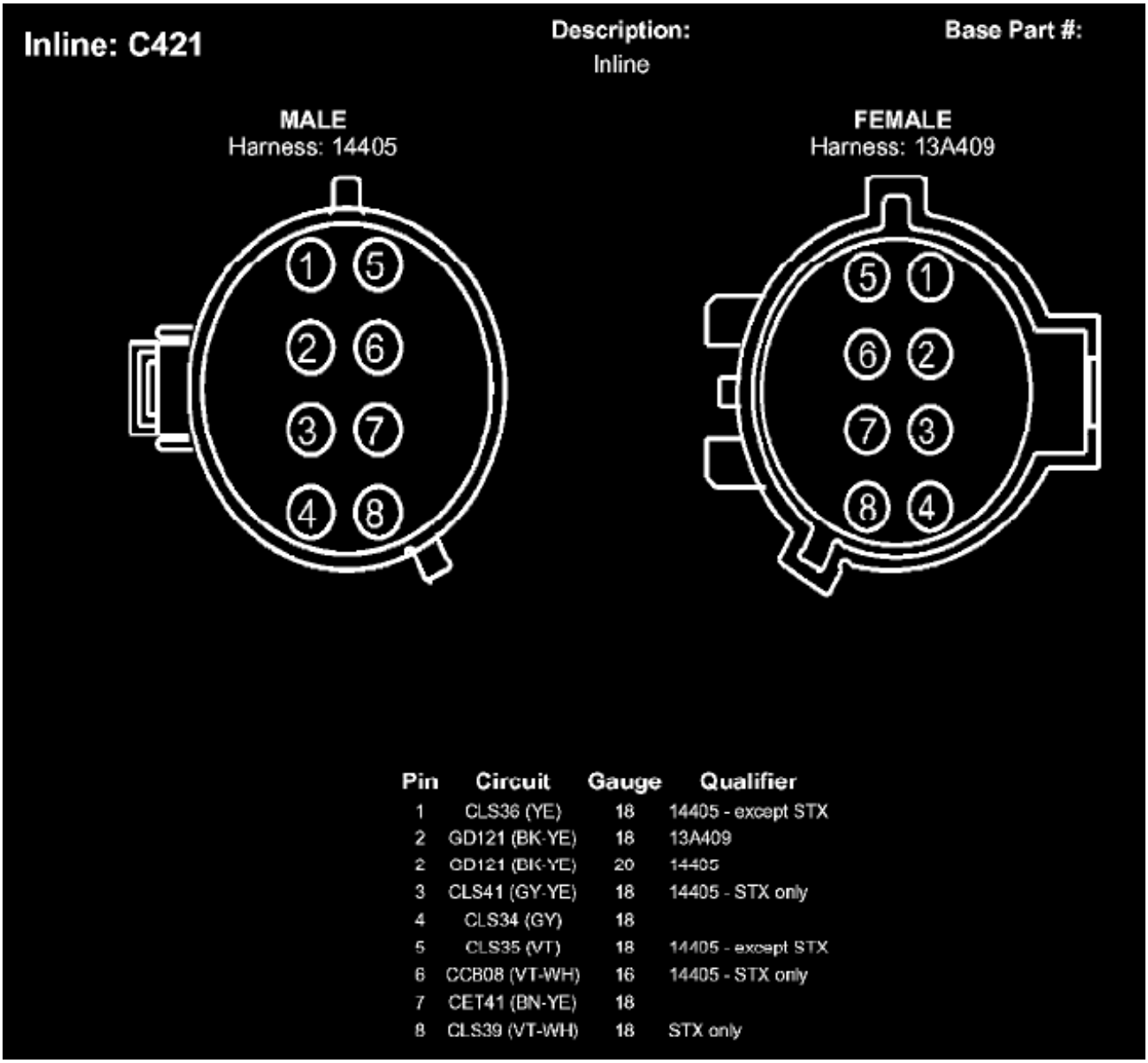
MALE
Harness: 14C719

FEMALE
Harness: 2027934



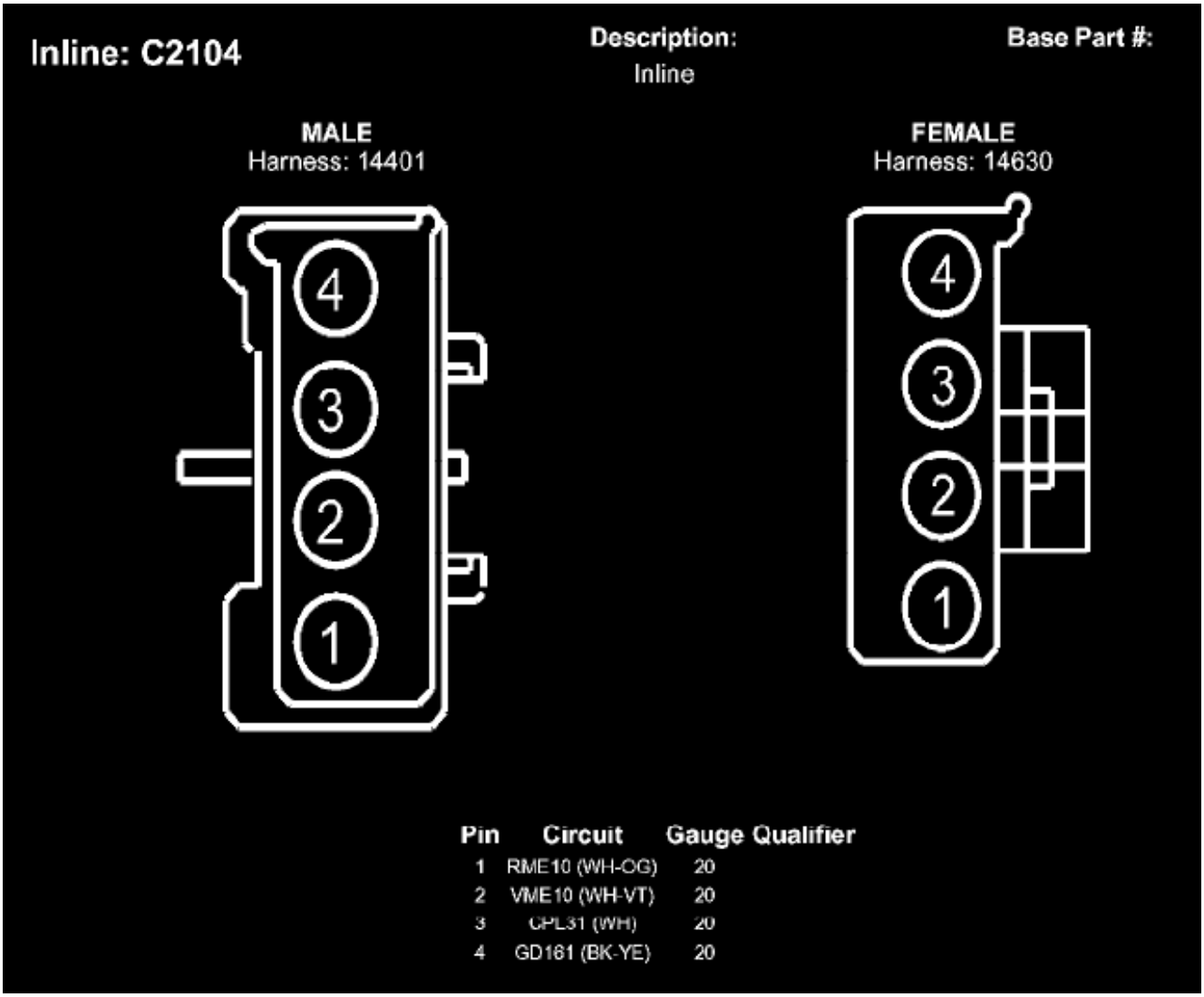
Pin	Circuit	Gauge Qualifier
1	CR122 (RD-WH)	20
1	CR122 (WH-OG)	20
2	CR203 (GY-VT)	20
2	CR203 (RD-BK)	20
3	RR122 (BN)	20
3	RR122 (RD-WH)	20
4	GD174 (BK-LB)	20
4	GD174 (BK-WH)	20

C340

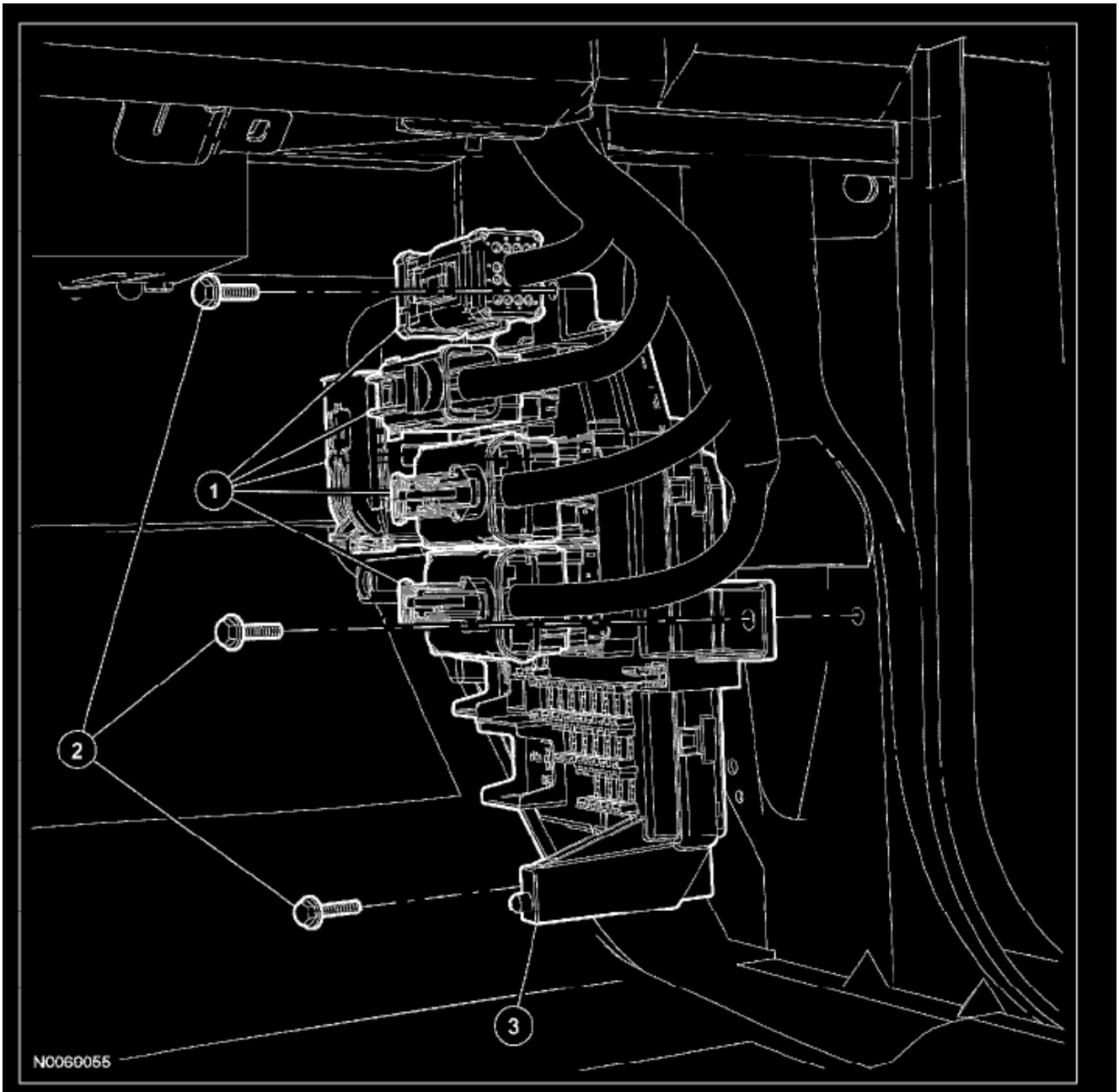


Pin	Circuit	Gauge	Qualifier
1	CLS36 (YE)	18	14405 - except STX
2	GD121 (BK-YE)	18	13A409
2	GD121 (BK-YE)	20	14405
3	CLS41 (GY-YE)	18	14405 - STX only
4	CLS34 (GY)	18	
5	CLS35 (VT)	18	14405 - except STX
6	CCB08 (VT-WH)	16	14405 - STX only
7	CET41 (BN-YE)	18	
8	CLS39 (VT-WH)	18	STX only

C421


Inline: C2104
Description:
Inline
Base Part #:
MALE
Harness: 14401
FEMALE
Harness: 14630
4
3
2
1
4
3
2
1
Pin Circuit Gauge Qualifier
1 RME10 (WH-OG) 20
2 VME10 (WH-VT) 20
3 CPL31 (WH) 20
4 GD161 (BK-YE) 20

C2104



Item	Part Number	Description
1	—	Smart junction box (SJB) electrical connectors (part of 14401)
2	—	SJB screws (3 required)
3	15604	SJB

Power Distribution Module: Service and Repair

SMART JUNCTION BOX (SJB)

Removal

CAUTION: Electronic modules are sensitive to static electrical charges. If exposed to these charges, damage may result.

NOTE: -

Prior to the replacement of the module, it is necessary to upload the module configuration information into the appropriate scan tool. This information must be downloaded into the new module after installation.

- The tire pressure monitoring system (TPMS) functionality is integral to the smart junction box (SJB).

- The steps included in the SJB removal and installation procedure are critical to restoring the vehicle security and tire pressure monitoring systems to normal operation. A new SJB is delivered in a manufacturing mode with 7 pre-set DTCs related to the TPMS. To clear the DTCs, successful configuration of the SJB must occur, followed by successful TPMS sensor training, and a successful self-test, including clearing of the DTCs. The DTCs are as follows:

- B106D (Tire Pressure Monitor System [TPMS] Initiators Not Configured)

- B2477 (Module Configuration Failure)

- B2868 (Left Front Tire Pressure Sensor Fault)

- B2869 (Right Front Tire Pressure Sensor Fault)

- 2870 (Right Rear Tire Pressure Sensor Fault)

- B2871 (Left Rear Tire Pressure Sensor Fault)

- C2780 (ECU in Manufacturer Sub-State)

1. NOTE: This step is necessary only if the SJB is being replaced.

Upload the module configuration information from the SJB.

2. Remove the RH lower cowl trim panel. 3. Disconnect the electrical connectors. 4. Remove the 3 screws and the SJB.

Installation

NOTE: When a new SJB is installed, all customer RKE transmitters may be required to be present in order to program the RKE transmitters to the new SJB.

1. Install the SJB.

- Install the 3 screws.

- Connect the electrical connectors.

2. NOTE: If the SJB was not replaced, this is the last step that is necessary.

Install the RH lower cowl trim panel.

3. NOTE:

- When successful, this step provides the calibration necessary for the SJB operation and clears DTCs B106D and B2477. The clearing of these DTCs indicates the calibration data has been successfully downloaded to the new SJB.

- When successful, this step also programs the remote transmitters into the new SJB. In the event the remote transmitters do not program to the new SJB, all of the remote transmitters will need to be present. Refer to Locks, Remote Keyless Entry Transmitter Programming. This action will program the remote transmitters into the new SJB. See: Accessories and Optional Equipment/Antitheft and Alarm Systems/Keyless Entry/Keyless Entry Transmitter/Testing and Inspection

Download the SJB configuration information from the scan tool into the new SJB.

4. NOTE: When successful, this step clears DTCs B2868, B2869, B2870 and B2871. The clearing of these DTCs indicates the SJB has recognized

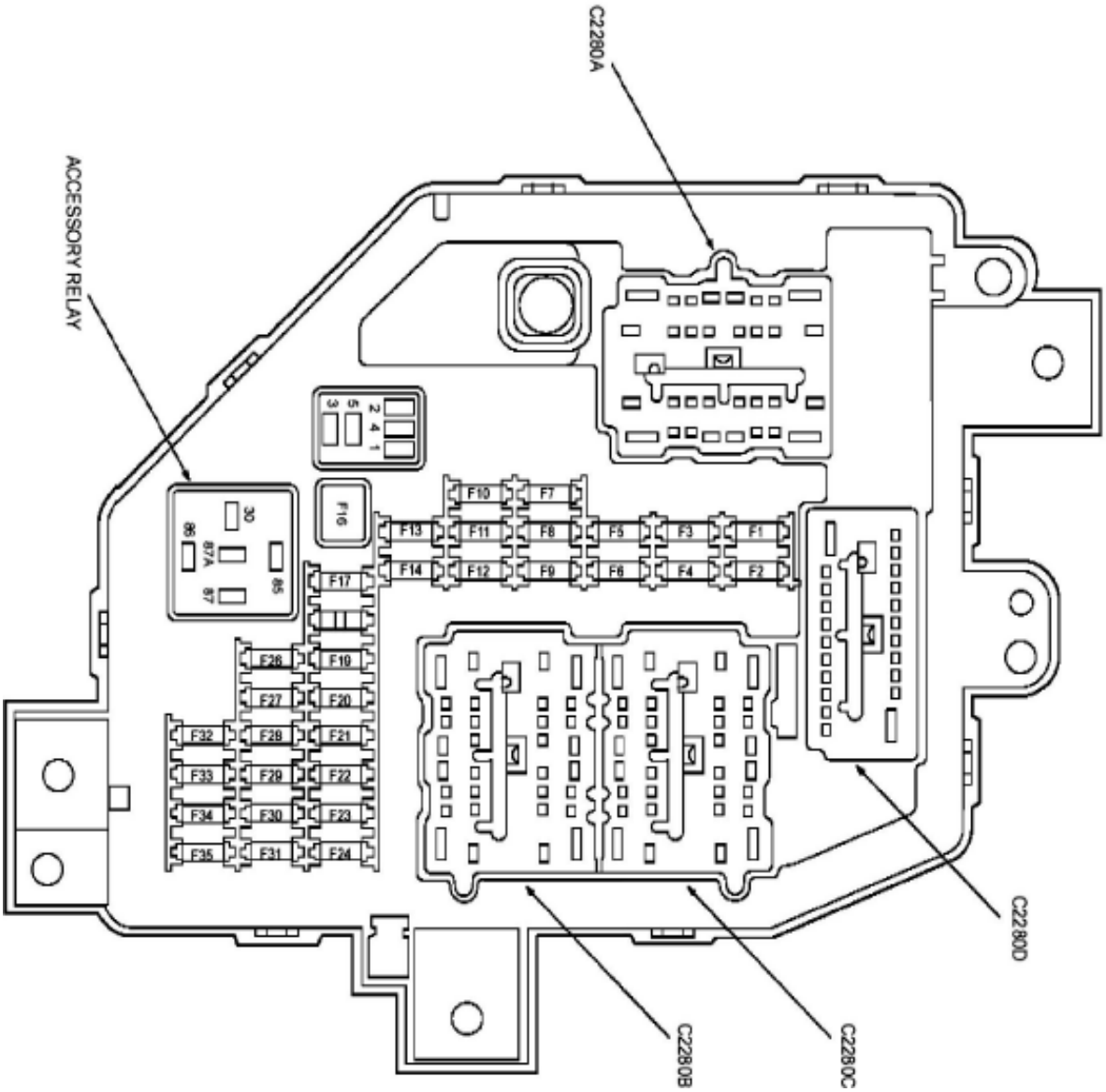
the tire pressure sensors during the training procedure.

Train the tire pressure sensors.

5. NOTE: DTC C2780 will not clear if any other DTCs are present in the SJB. When successful, this step will clear the DTC C2780.

Carry out the SJB on-demand self-test by clearing DTCs, and then retrieving DTCs to confirm all DTCs have been cleared.

SMART JUNCTION BOX (SJB)

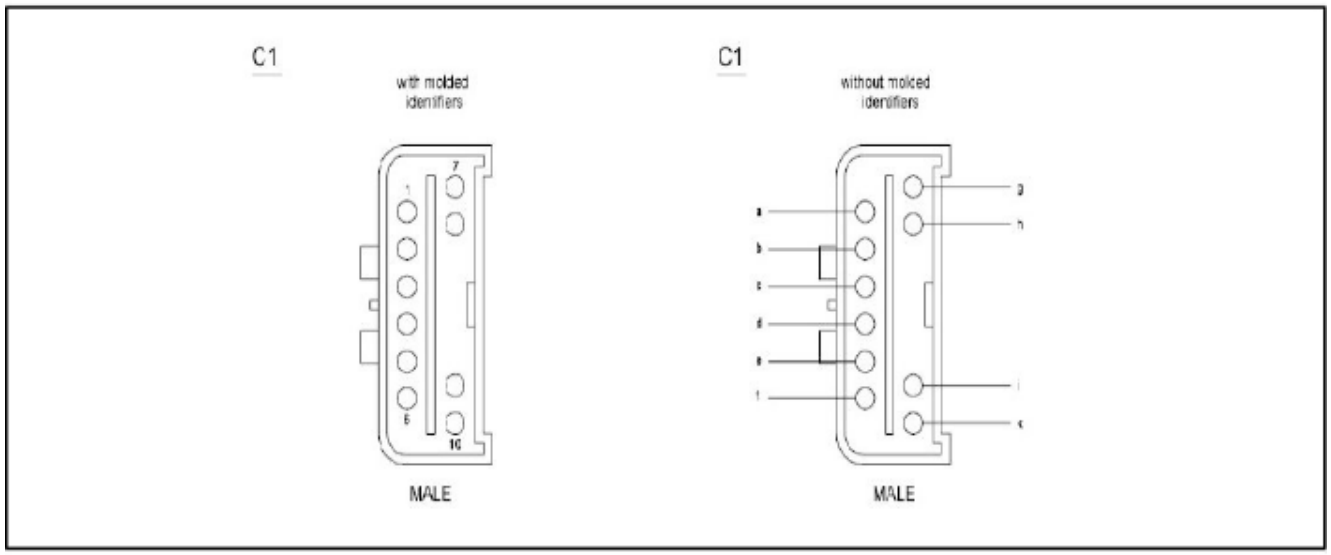


Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



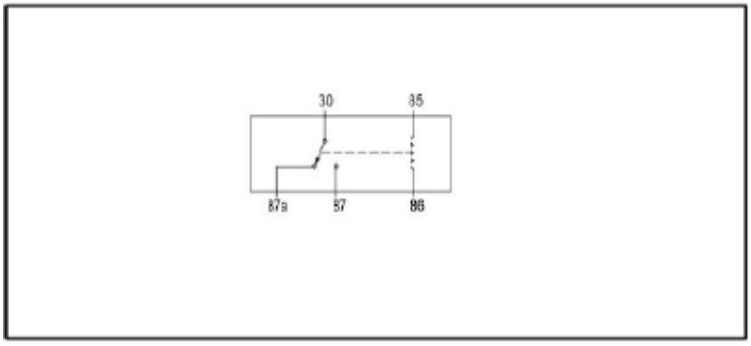
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

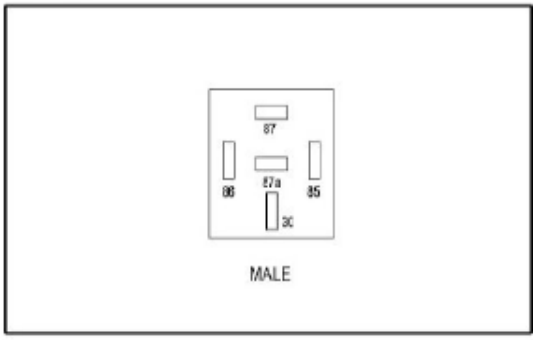
Power Distribution Relay: Testing and Inspection

Relay □ Mini ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

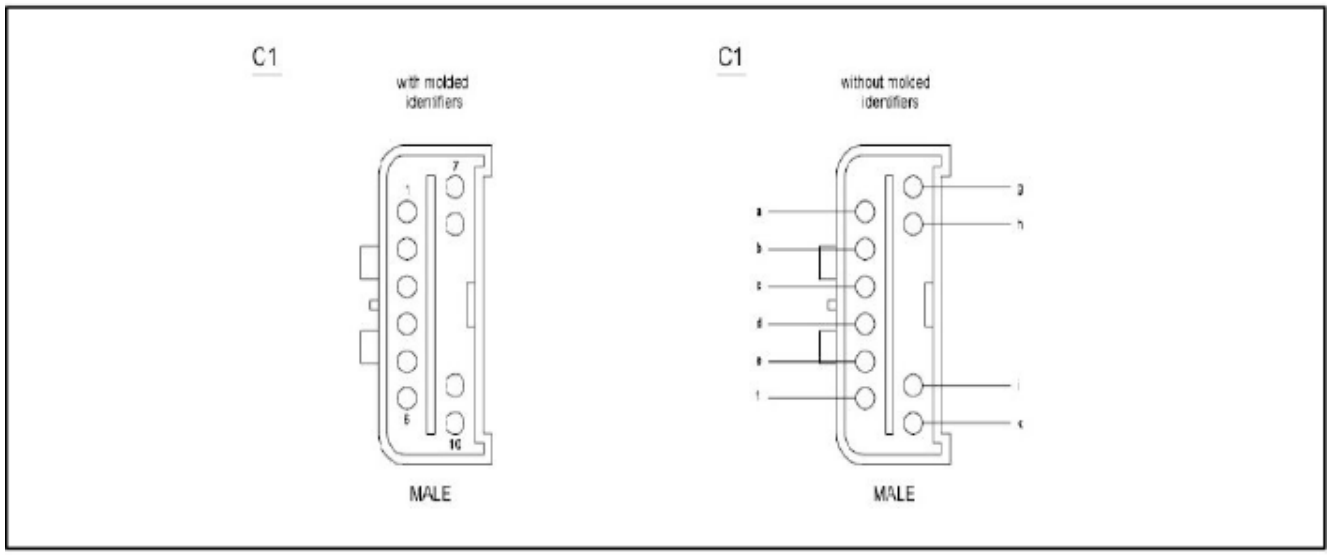
Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



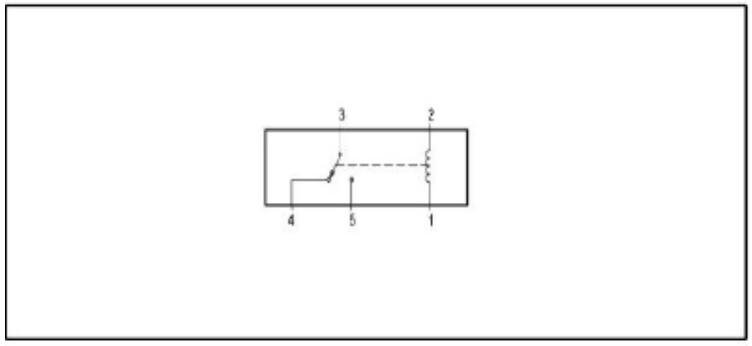
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

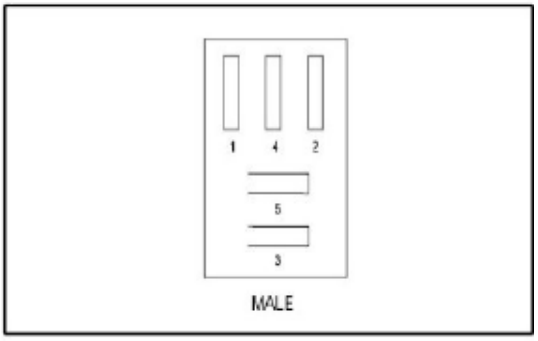
Micro ISO Relay: Testing and Inspection

Relay □ Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63□102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil □ Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

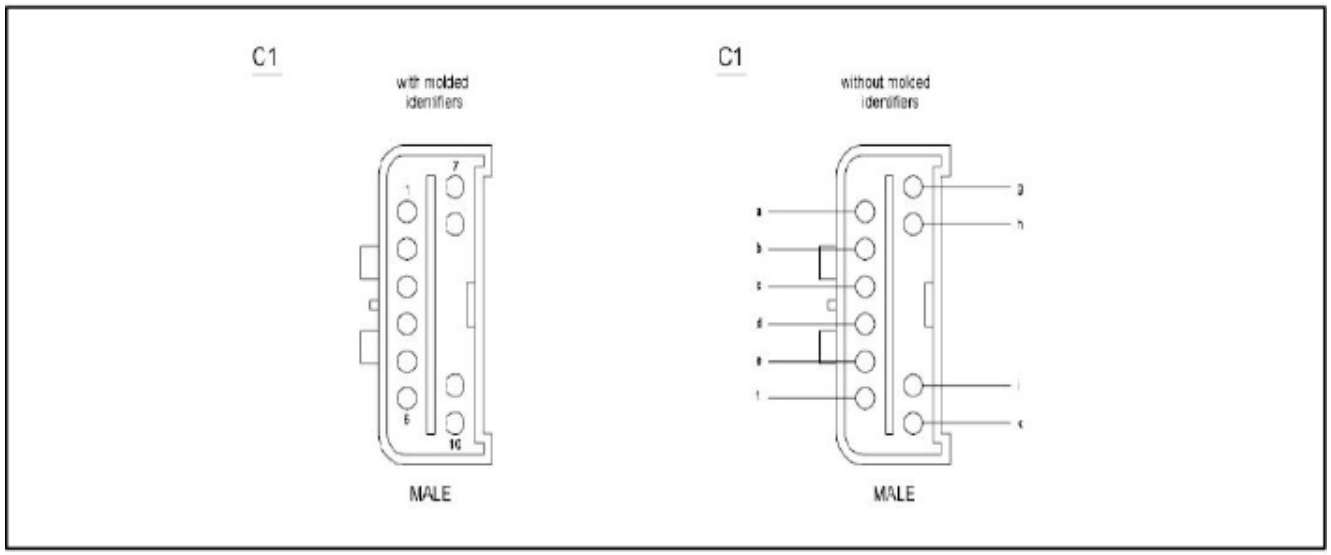
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



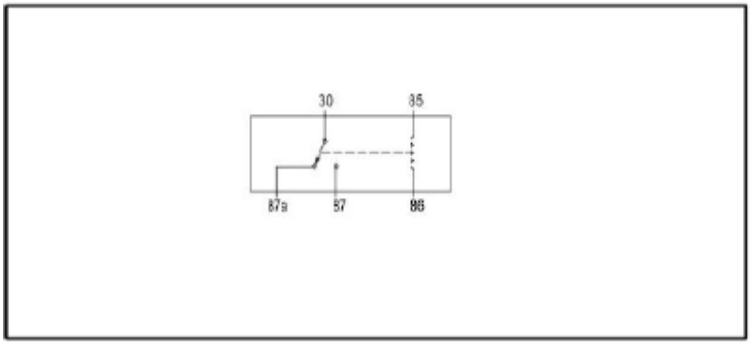
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

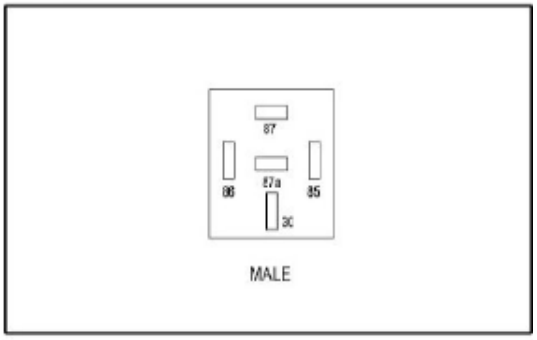
Mini ISO Relay: Testing and Inspection

Relay □ Mini ISO

Schematic



Terminals

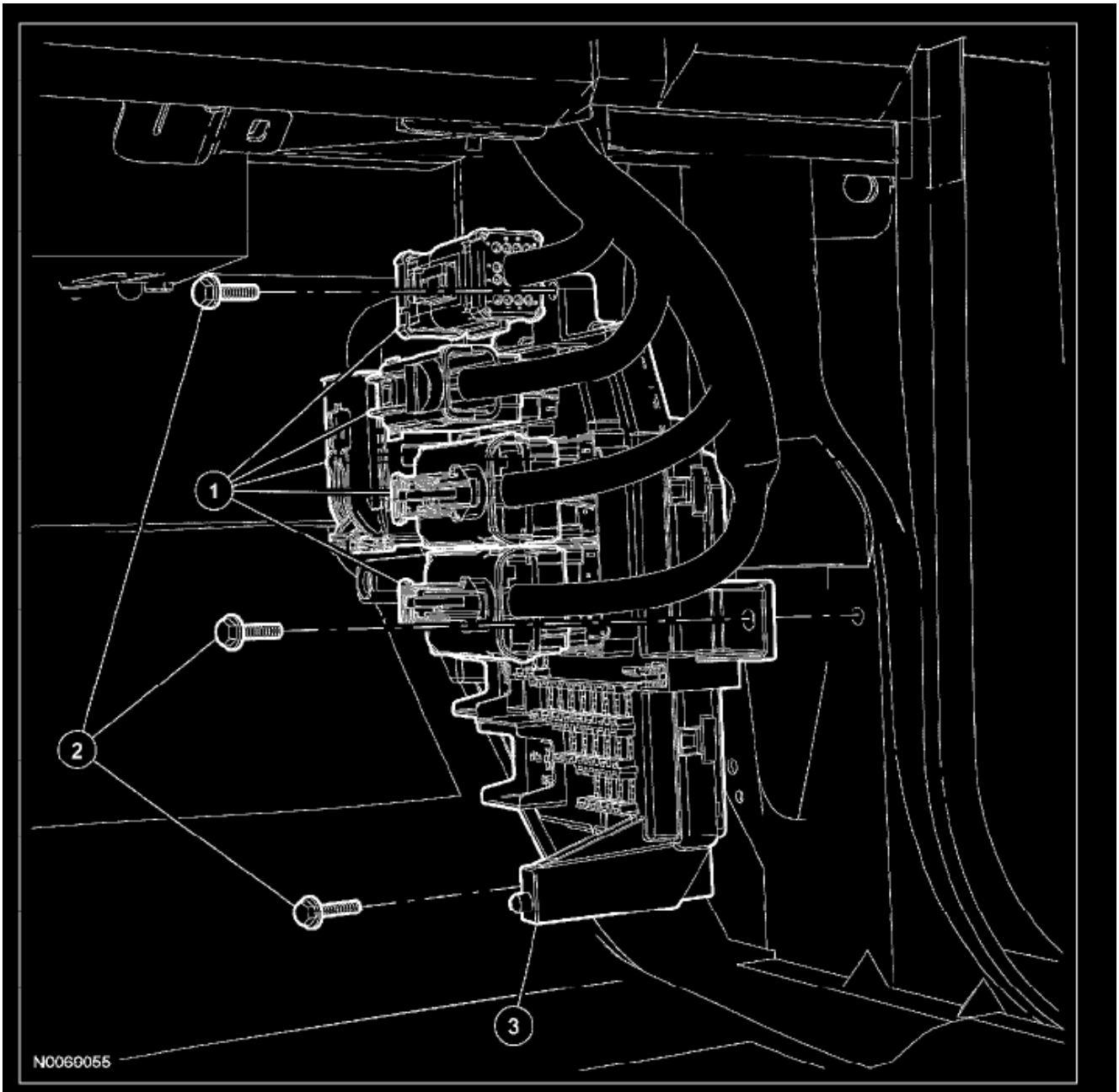


Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.



Item	Part Number	Description
1	—	Smart junction box (SJB) electrical connectors (part of 14401)
2	—	SJB screws (3 required)
3	15604	SJB

Power Distribution Module: Service and Repair

SMART JUNCTION BOX (SJB)

Removal

CAUTION: Electronic modules are sensitive to static electrical charges. If exposed to these charges, damage may result.

NOTE: -

Prior to the replacement of the module, it is necessary to upload the module configuration information into the appropriate scan tool. This information must be downloaded into the new module after installation.

- The tire pressure monitoring system (TPMS) functionality is integral to the smart junction box (SJB).

- The steps included in the SJB removal and installation procedure are critical to restoring the vehicle security and tire pressure monitoring systems to normal operation. A new SJB is delivered in a manufacturing mode with 7 pre-set DTCs related to the TPMS. To clear the DTCs, successful configuration of the SJB must occur, followed by successful TPMS sensor training, and a successful self-test, including clearing of the DTCs. The DTCs are as follows:

- B106D (Tire Pressure Monitor System [TPMS] Initiators Not Configured)

- B2477 (Module Configuration Failure)

- B2868 (Left Front Tire Pressure Sensor Fault)

- B2869 (Right Front Tire Pressure Sensor Fault)

- 2870 (Right Rear Tire Pressure Sensor Fault)

- B2871 (Left Rear Tire Pressure Sensor Fault)

- C2780 (ECU in Manufacturer Sub-State)

1. NOTE: This step is necessary only if the SJB is being replaced.

Upload the module configuration information from the SJB.

2. Remove the RH lower cowl trim panel. 3. Disconnect the electrical connectors. 4. Remove the 3 screws and the SJB.

Installation

NOTE: When a new SJB is installed, all customer RKE transmitters may be required to be present in order to program the RKE transmitters to the new SJB.

1. Install the SJB.

- Install the 3 screws.

- Connect the electrical connectors.

2. NOTE: If the SJB was not replaced, this is the last step that is necessary.

Install the RH lower cowl trim panel.

3. NOTE:

- When successful, this step provides the calibration necessary for the SJB operation and clears DTCs B106D and B2477. The clearing of these DTCs indicates the calibration data has been successfully downloaded to the new SJB.

- When successful, this step also programs the remote transmitters into the new SJB. In the event the remote transmitters do not program to the new SJB, all of the remote transmitters will need to be present. Refer to Locks, Remote Keyless Entry Transmitter Programming. This action will program the remote transmitters into the new SJB. See: Accessories and Optional Equipment/Antitheft and Alarm Systems/Keyless Entry/Keyless Entry Transmitter/Testing and Inspection

Download the SJB configuration information from the scan tool into the new SJB.

4. NOTE: When successful, this step clears DTCs B2868, B2869, B2870 and B2871. The clearing of these DTCs indicates the SJB has recognized

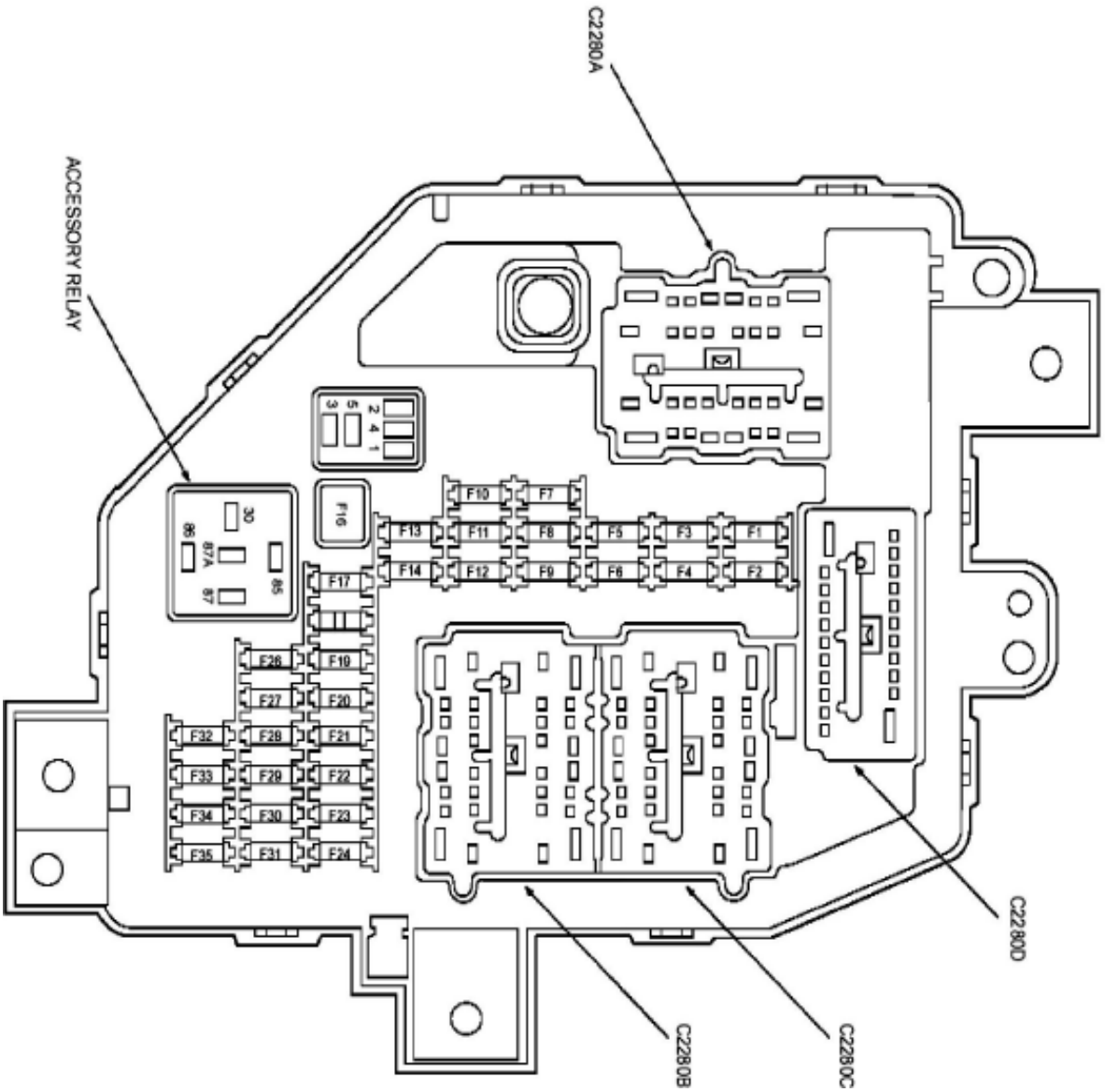
the tire pressure sensors during the training procedure.

Train the tire pressure sensors.

5. NOTE: DTC C2780 will not clear if any other DTCs are present in the SJB. When successful, this step will clear the DTC C2780.

Carry out the SJB on-demand self-test by clearing DTCs, and then retrieving DTCs to confirm all DTCs have been cleared.

SMART JUNCTION BOX (SJB)

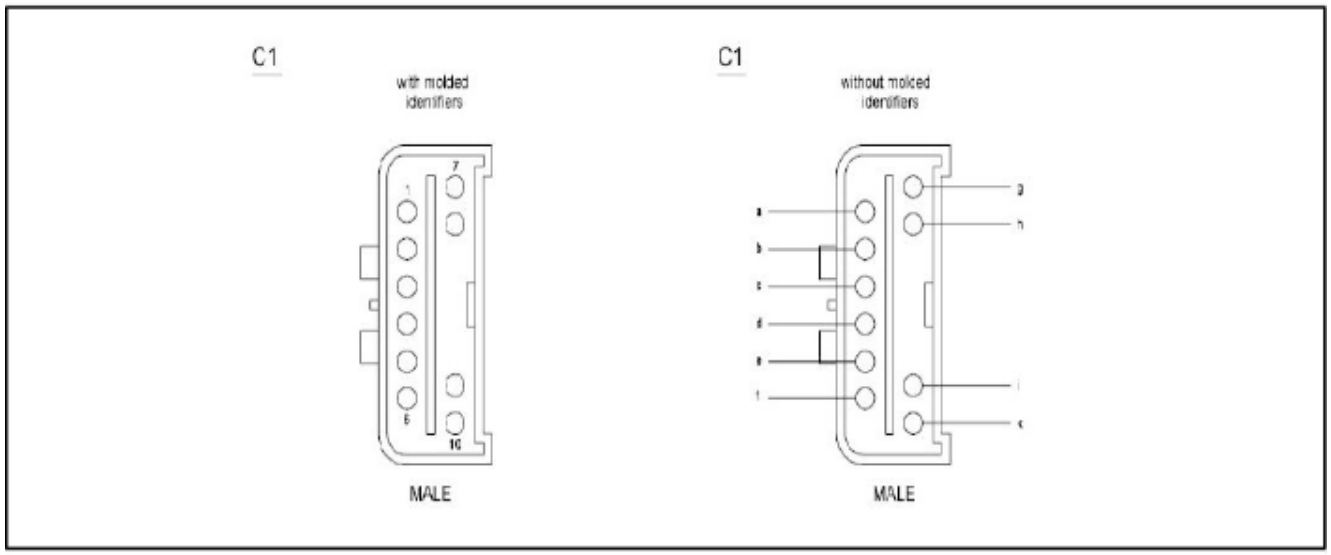


Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



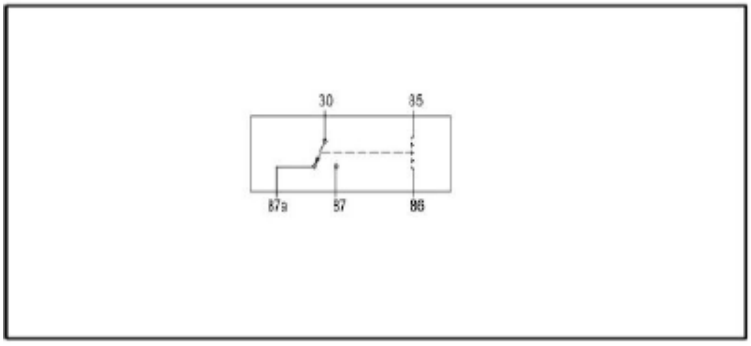
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

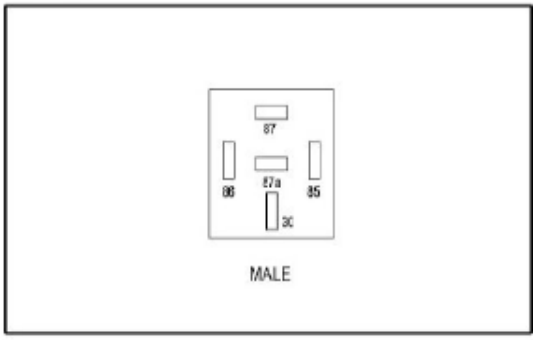
Power Distribution Relay: Testing and Inspection

Relay □ Mini ISO

Schematic



Terminals



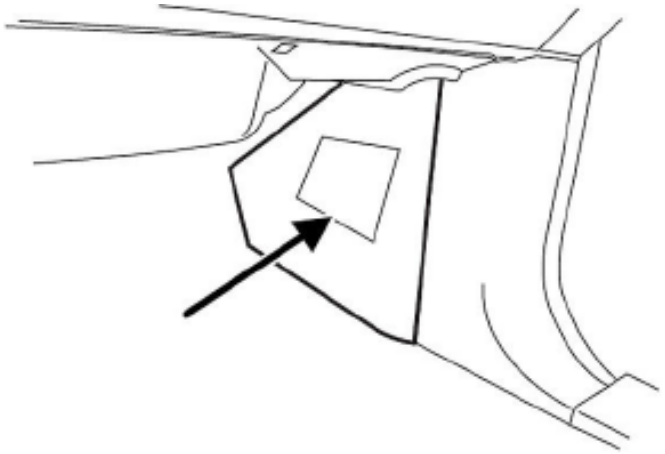
Component testing procedure (no voltage applied)

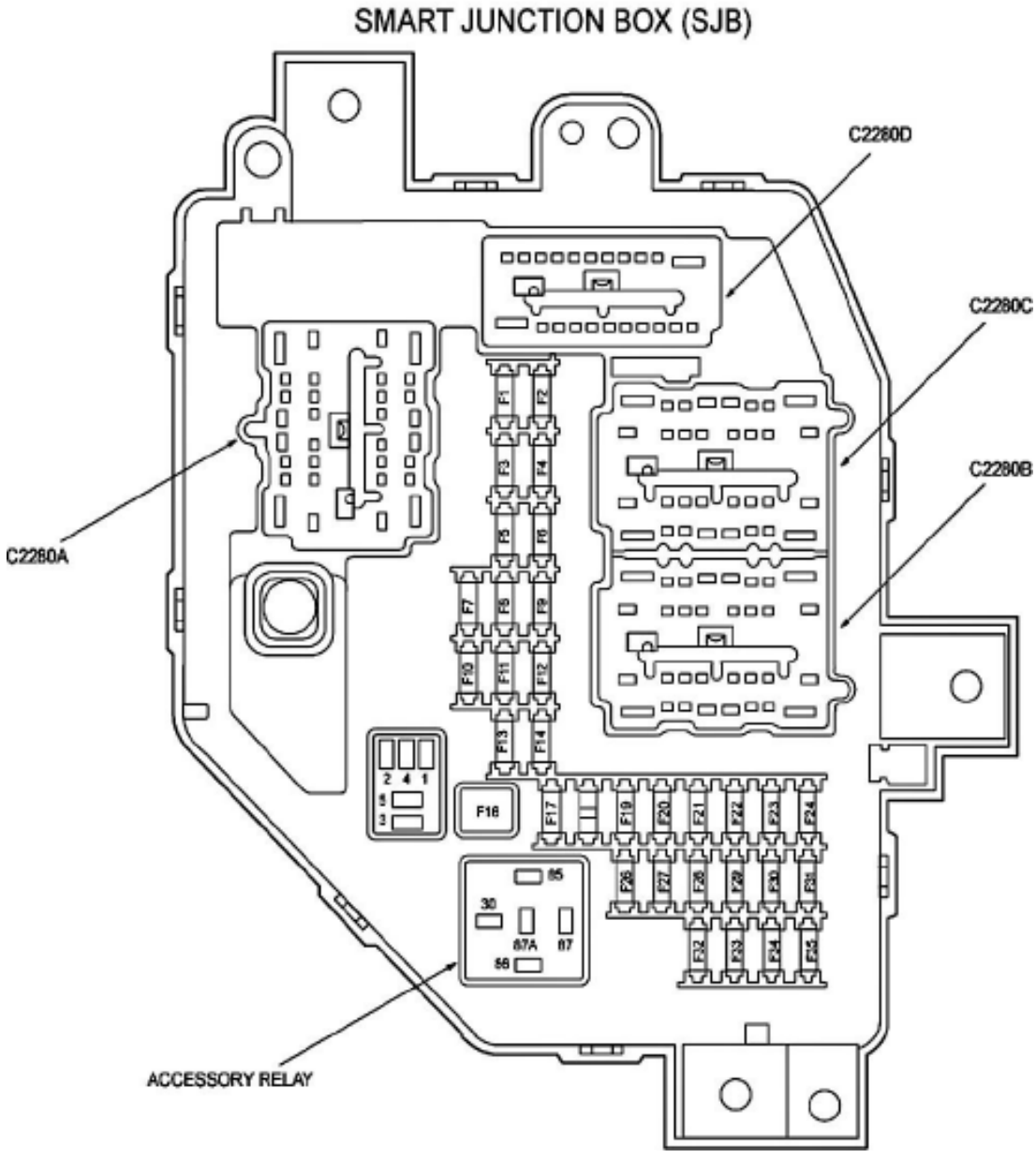
Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Power and Ground Distribution > Relays and Modules - Power and Ground Distribution > Relay Box > Component Information > Locations > Smart Junction Box

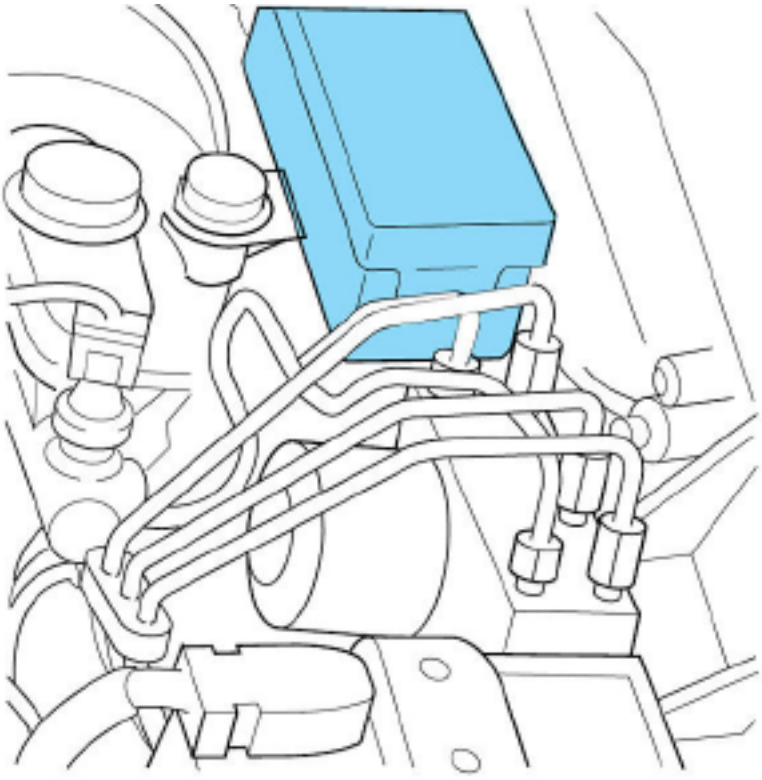




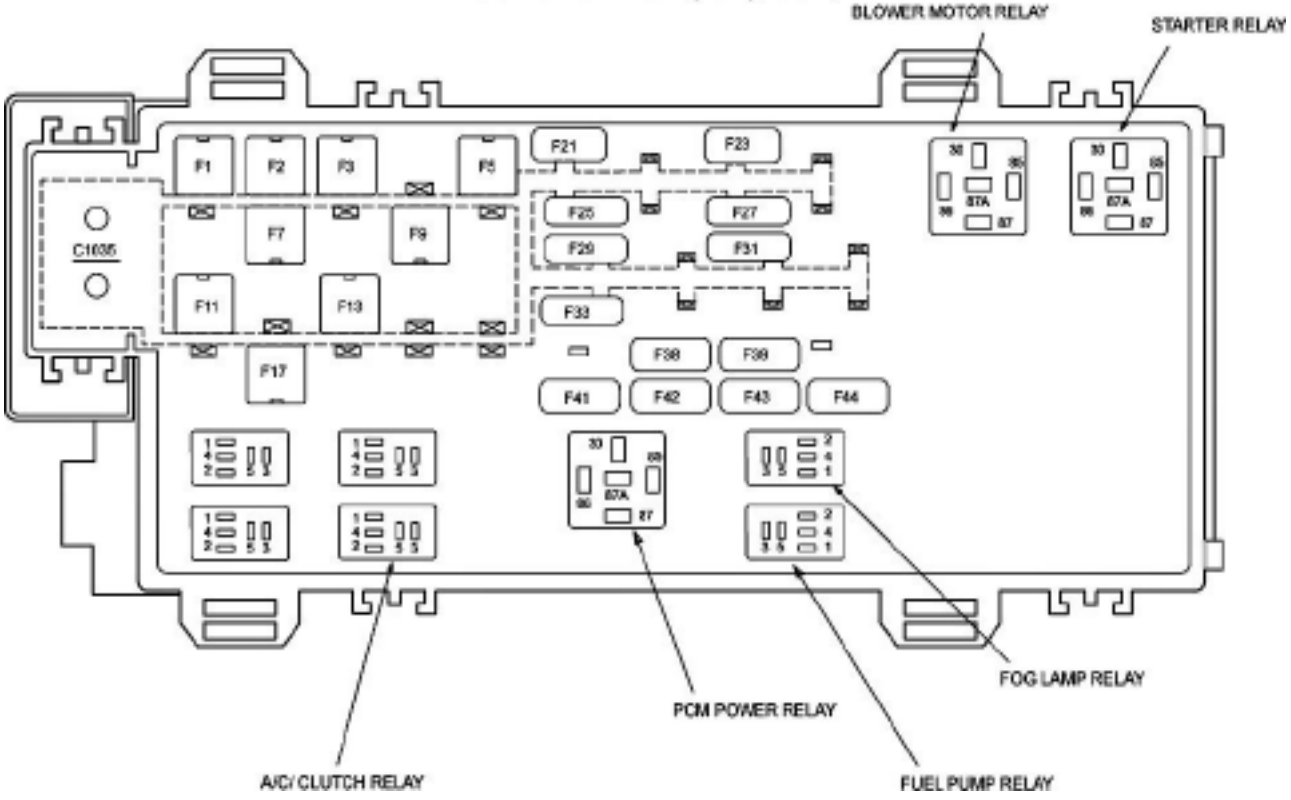
Relay Box: Locations Smart Junction Box

FUSE	AMPS	Circuits Protected
F1	5A	Illumination dimmer
F2	10A	Trailer tow connector - Park
F3	10A	Headlamp, right (Low beam lamp feed)
F4	10A	Headlamp, left (Low beam lamp feed)
F5	5A	Windshield wiper module
F6	10A	Audio unit, Door lock switch illumination
F7	5A	Not Used
F8	10A	Restraints Control Module (RCM), Occupant Classification System Module (OCSM), Passenger Air bag Deactivation (PAD) Indicator
F9	5A	Instrument Cluster (IC), Air bag indicator
F10	10A	4X4 control module, Instrument Cluster (IC)
F11	10A	Smart Junction Box (SJB), logic power
F12	15A	Subwoofer amplifier with audiophile, Satellite radio receiver
F13	15A	Interior lamp relay, Horn relay
F14	15A	High beam lamp feed to High beam indicator, Headlamp, right, Headlamp, left
F16	30A	Accessory relay (Power windows)
F17	15A	Indicator flasher relay
F18	-	Not Used

FUSE	AMPS	Circuits Protected
F19	20A	Brake pedal position switch (Stoplamps)
F20	10A	Transmission control switch, Digital Transmission Range (TR) sensor, Speed control servo, Anti-lock Brake System (ABS) module, Indicator flasher relay, Reversing lamps switch, Speed control On/Off switch, Speed control Set/Resume switch
F21	5A	Digital Transmission Range (TR) sensor, Starter relay, Powertrain Control Module (PCM)
F22	5A	Audio unit
F23	30A	Main light switch, Multifunction switch
F24	20A	Audio unit
F26	2A	Deactivator switch
F27	10A	Blend door actuator, Climate control assembly
F28	15A	4X4 control module
F29	20A	Cigar lighter, front, Data Link Connector (DLC)
F30	5A	Exterior rear view mirror switch
F31	20A	Park lamp relay
F32	5A	Brake pedal position switch (logic power), Brake shift interlock
F33	5A	Instrument Cluster (IC), Neutral tow indicator
F34	20A	Power point
F35	15A	Door lock/unlock relay, Driver door unlock relay



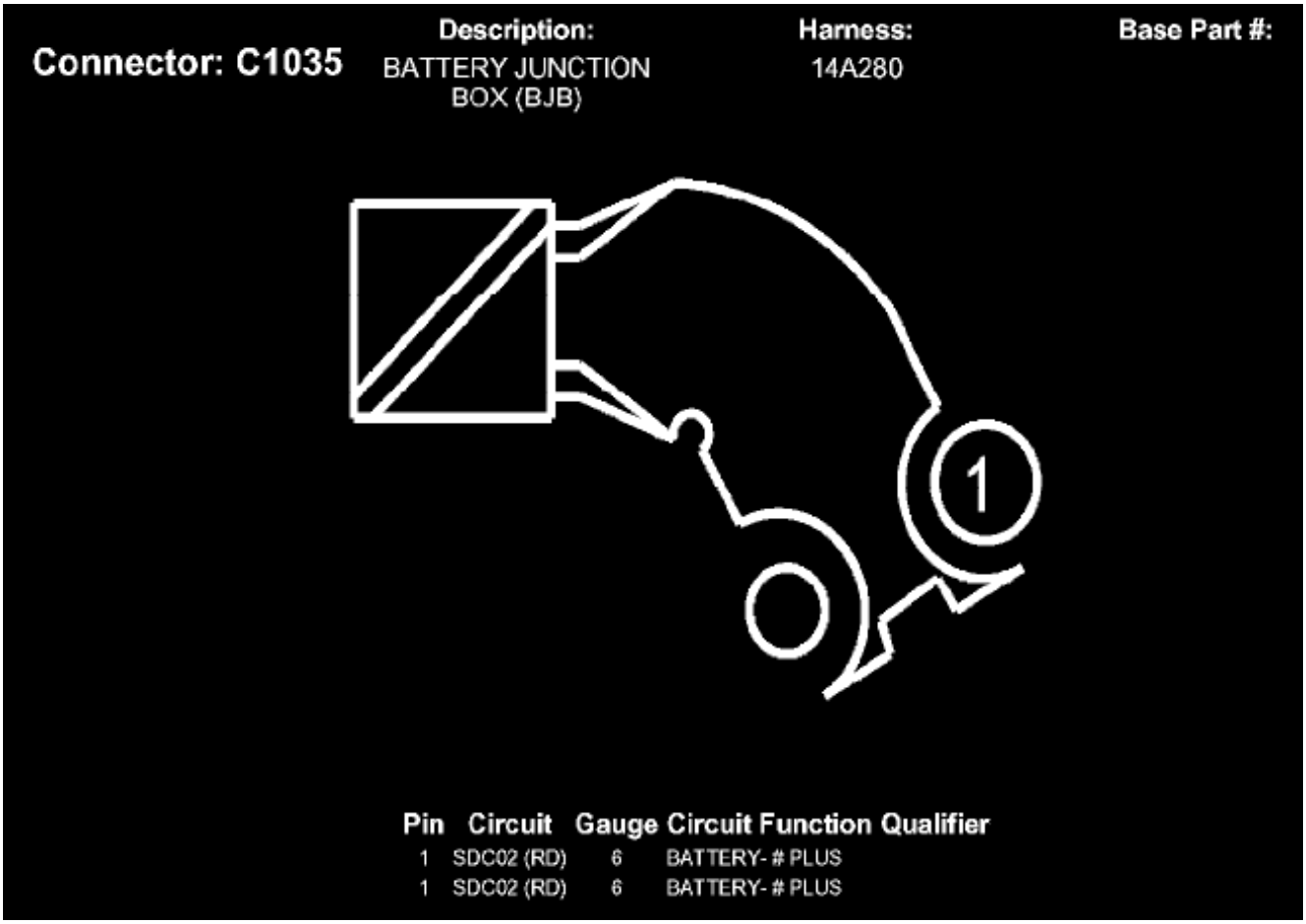
BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L



Relay Box: Locations Battery Junction Box

FUSE	AMPS	Circuits Protected
F1	40A	Smart Junction Box (SJB)
F2	-	Not Used
F3	40A	Smart Junction Box (SJB)
F4	-	Not Used
F5	50A	Smart Junction Box (SJB)
F6	-	Not Used
F7	30A	Starter Relay
F8	-	Not Used
F9	40A	Ignition Switch
F10	-	Not Used
F11	30A	PCM power relay
F12	-	Not Used
F13	30A	Blower motor relay
F14	-	Not Used
F15	-	Not Used
F16	-	Not Used
F17	40A	Anti-lock Brake System (ABS) module
F18	-	Not Used
F19	-	Not Used
F20	-	Not Used
F21	10A	Powertrain Control Module (PCM), Evaporative emission (EVAP) canister vent valve
F22	-	Not Used
F23	30A	Fuel Pump Relay, Fuel injectors
F24	-	Not Used

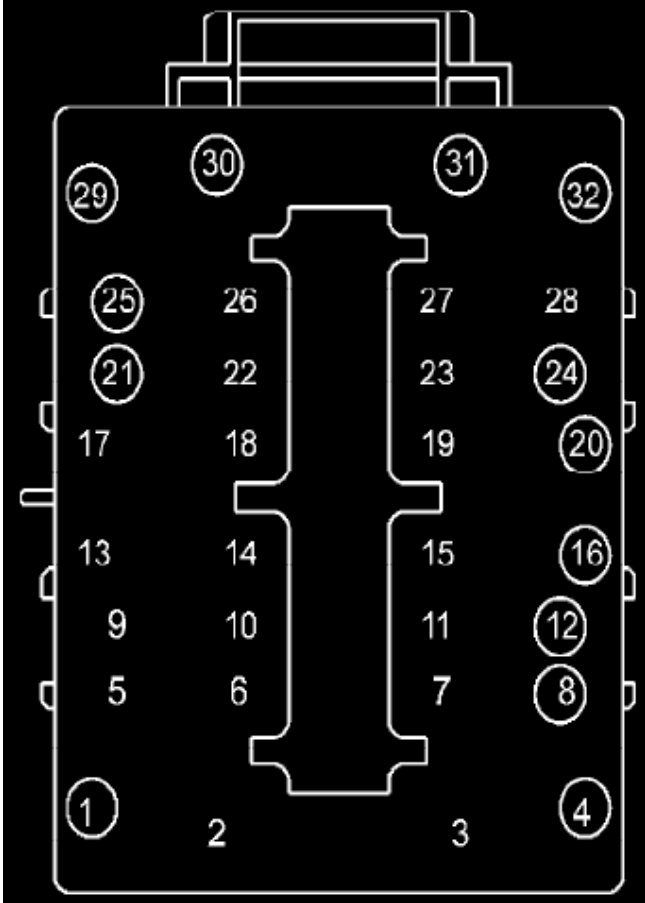
FUSE	AMPS	Circuits Protected
F25	10A	A/C clutch relay
F26	-	Not Used
F27	20A	4X4 control module
F28	-	Not Used
F29	30A	Windshield wipers/washer
F30	-	Not Used
F31	15A	Fog lamp relay
F32	-	Not Used
F33	30A	Anti-lock Brake System (ABS) module
F34	-	Not Used
F35	-	Not Used
F36	-	Not Used
F37	-	Not Used
F38	7.5A	Trailer tow connector - Right turn
F39	15A	Powertrain Control Module (PCM)
F40	-	Not Used
F41	10A	*5R44E Transmission **5R55E Transmission
F42	7.5A	Trailer tow connector - Left turn
F43	20A	EVAP canister purge valve, Heated Positive Crankcase Ventilation (PCV) valve, Idle Air Control (IAC) valve, Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor, Heated Oxygen Sensor (HO2S) #11, Heated Oxygen Sensor (HO2S) #12, Heated Oxygen Sensor (HO2S) #21, Heated Oxygen Sensor (HO2S) #22, EGR vacuum regulator solenoid valve, A/C relay coil
F44	15A	Ignition coil, *Ignition transformer capacitor 1


Connector: C1035
Description:
BATTERY JUNCTION BOX (BJB)
Harness:
14A280
Base Part #:
1
Pin Circuit Gauge Circuit Function Qualifier
1 SDC02 (RD) 6 BATTERY- # PLUS
1 SDC02 (RD) 6 BATTERY- # PLUS

C1035

Connector: C2280A

Description:	Harness:	Base Part #:
SMART JUNCTION BOX (SJB)	14290	14B476

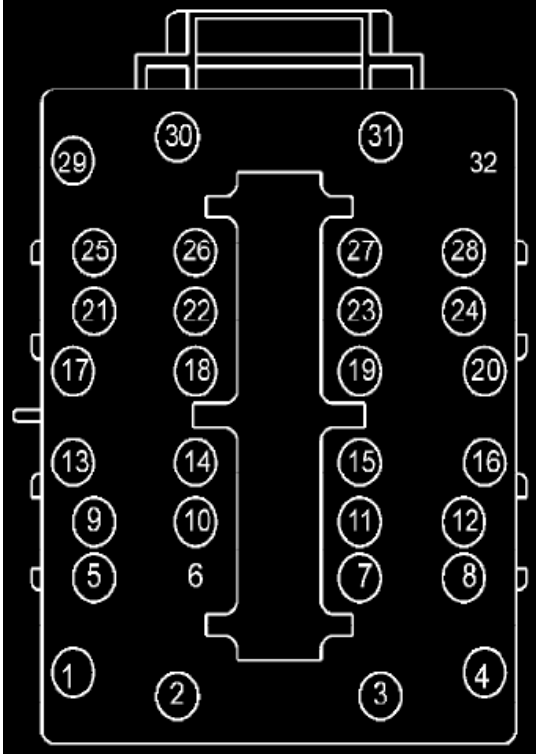


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	SBB01 (RD)	12	FUSE - 1 OR CIRCUIT BREAKER	
2	*	*	not used	
3	*	*	not used	
4	CBP05 (YE)	20	FUSE - 5 OR CIRCUIT BREAKER	
5	*	*	not used	
6	*	*	not used	
7	*	*	not used	
8	CES03 (VT-WH)	20	CTRL MOD - POWERTRAIN # SPEED CONTROL INDICATOR (SCIL)	
9	*	*	not used	
10	*	*	not used	
11	*	*	not used	
12	CLS34 (GY)	18	SWITCH - PARK LAMPS	
13	*	*	not used	
14	*	*	not used	
15	*	*	not used	
16	CBP04 (VT)	18	FUSE - 4 OR CIRCUIT BREAKER	
17	*	*	not used	
18	*	*	not used	
19	*	*	not used	
20	CBP03 (GY)	18	FUSE - 3 OR CIRCUIT BREAKER	
21	SBR14 (BN-RD)	18	FUSE - 14 OR CIRCUIT BREAKER	
22	*	*	not used	
23	*	*	not used	
24	CE517 (BU-GN)	20	DIODE - RELAY POWERTRAIN CONTROL MODULE	
25	CBP14 (VT-OG)	16	FUSE - 14 OR CIRCUIT BREAKER	
26	*	*	not used	
27	*	*	not used	
28	*	*	not used	
29	SBB03 (BU-RD)	12	FUSE - 3 OR CIRCUIT BREAKER	
30	CRH02 (BU-WH)	18	SWITCH - HORN	
31	CBP21 (BU-GY)	22	FUSE - 21 OR CIRCUIT BREAKER	
32	SBB05 (GY-RD)	10	FUSE - 5 OR CIRCUIT BREAKER	

Relay Box: Diagrams Smart Junction Box (SJB)

C2280A

Connector: C2280B | **Description:** SMART JUNCTION BOX (SJB) | **Harness:** 14401 | **Base Part #:** 14B476



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	SBP23 (WH-RD)	14	FUSE - 23 OR CIRCUIT BREAKER	
2	SBP24 (VT-RD)	16	FUSE - 24 OR CIRCUIT BREAKER	
3	SBP34 (YE-RD)	16	FUSE - 34 OR CIRCUIT BREAKER	
4	SBP23 (WH-RD)	14	FUSE - 23 OR CIRCUIT BREAKER	
5	CBP10 (YE-OG)	20	FUSE - 10 OR CIRCUIT BREAKER	
6	*	*	not used	
7	SBP28 (GN-RD)	18	FUSE - 28 OR CIRCUIT BREAKER	
8	SBP30 (BN-RD)	22	FUSE - 30 OR CIRCUIT BREAKER	
9	CPL19 (WH-VT)	20	RELAY - DOOR LOCK # ALL LOCK	
10	CPL18 (GY-VT)	20	RELAY - DOOR LOCK # ALL UNLOCK	
11	CDC35 (BU-WH)	14	SWITCH - IGNITION # START	
12	SBP33 (RD)	20	FUSE - 33 OR CIRCUIT BREAKER	
13	CPL11 (GY-BN)	20	CTRL MOD. - DOOR LOCK # ALL LOCK	
14	GD161 (BK-YE)	18	GROUND - SEAT BRACKET REAR LEFT	
15	CBP20 (YE-VT)	18	FUSE - 20 OR CIRCUIT BREAKER	
16	SBP29 (GY-RD)	18	FUSE - 29 OR CIRCUIT BREAKER	
17	CDC32 (BN-YE)	12	SWITCH - IGNITION # RUN	
18	CBP27 (GN-BN)	22	FUSE - 27 OR CIRCUIT BREAKER	
19	CBP20 (YE-VT)	18	FUSE - 20 OR CIRCUIT BREAKER	
20	SBP29 (GY-RD)	16	FUSE - 29 OR CIRCUIT BREAKER	
21	CBP27 (GN-BN)	22	FUSE - 27 OR CIRCUIT BREAKER	
22	CBP26 (BU-WH)	20	FUSE - 26 OR CIRCUIT BREAKER	
23	CBP20 (YE-VT)	18	FUSE - 20 OR CIRCUIT BREAKER	
24	CBP22 (GN-OG)	20	FUSE - 22 OR CIRCUIT BREAKER	
25	CLF27 (GN-BN)	14	SWITCH - FLASH TO PASS	
26	SBP17 (RD)	18	FUSE - 17 OR CIRCUIT BREAKER	
27	CBP20 (YE-VT)	20	FUSE - 20 OR CIRCUIT BREAKER	
28	SBP32 (VT-RD)	22	FUSE - 32 OR CIRCUIT BREAKER	
29	CDC34 (WH-OG)	12	SWITCH - IGNITION # RUN; START	
30	SBP12 (GN-RD)	16	FUSE - 12 OR CIRCUIT BREAKER	Audiophile sound system
30	SBP12 (GN-RD)	20	FUSE - 12 OR CIRCUIT BREAKER	without Audiophile and satellite radio
31	SBP19 (BU-RD)	16	FUSE - 19 OR CIRCUIT BREAKER	
32	*	*	not used	

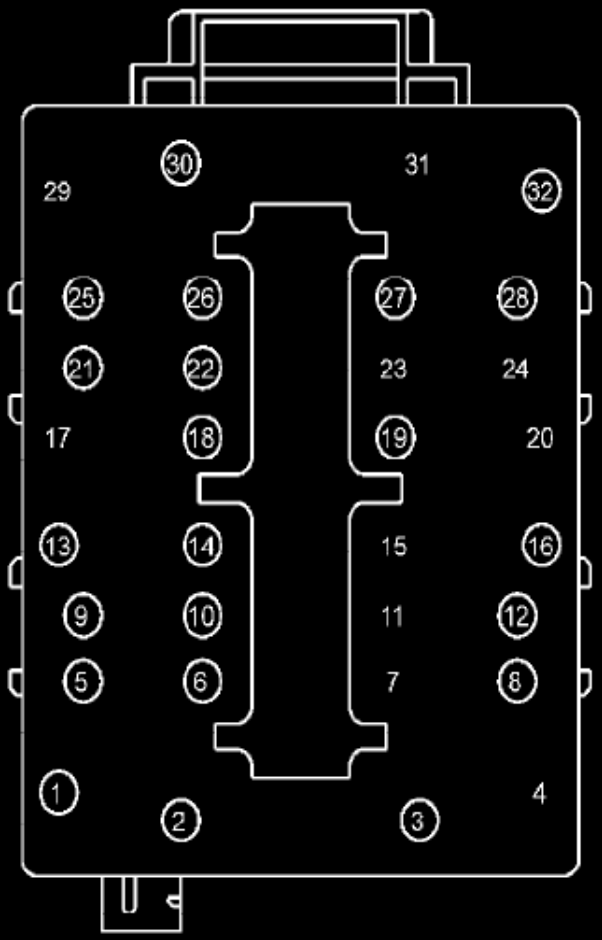
C2280B (Part 1)

Connector: C2280C

Description: SMART JUNCTION BOX (SJB)

Harness: 14401

Base Part #: 14B476



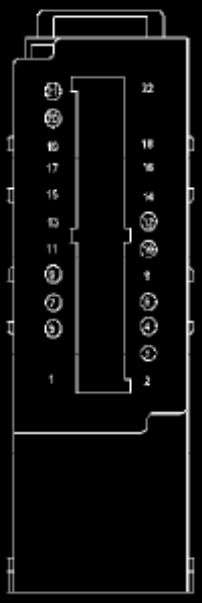
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD174 (BK-WH)	18	GROUND - TUNNEL	
2	CPL12 (VT-OG)	20	CTRL MOD. - DOOR LOCK # DOUBLE LOCK ALL LOCK	
3	CLS34 (GY)	16	SWITCH - PARK LAMPS	
4	*	*	not used	
5	CPL42 (GY-YE)	22	SWITCH - TRIM DOOR LOCK (DRIVER) # LOCK	
6	CPL26 (GN-VT)	20	SWITCH - LATCH DRIVER # AJAR	
7	*	*	not used	
8	CLN28 (GN-BU)	18	SWITCH - DOME LAMP	
9	CPL43 (VT-GY)	22	SWITCH - TRIM DOOR LOCK (DRIVER) # UNLOCK	
10	CPL42 (GY-YE)	22	SWITCH - TRIM DOOR LOCK (DRIVER) # LOCK	
11	*	*	not used	
12	CPL51 (BU-GN)	20	CTRL MOD. - DOOR LOCK # DRIVER UNLOCK	
13	CPW14 (VT-WH)	14	SWITCH - POWER WINDOW DRIVER # PASSENGER LOCK OUT (ENABLE)	
14	CPL43 (VT-GY)	22	SWITCH - TRIM DOOR LOCK (DRIVER) # UNLOCK	
15	*	*	not used	
16	CPW30 (GY-YE)	14	RELAY - POWER WINDOW	
17	*	*	not used	
18	CBP08 (GY-YE)	20	FUSE - 8 OR CIRCUIT BREAKER	
19	CE517 (BU-GN)	20	DIODE - RELAY POWERTRAIN CONTROL MODULE	
20	*	*	not used	
21	CLF29 (BN)	22	CTRL MOD. - FOG LAMPS FRONT (LEFT)	
22	CBP08 (GY-YE)	20	FUSE - 8 OR CIRCUIT BREAKER	
23	*	*	not used	
24	*	*	not used	
25	CAT17 (BN)	16	RELAY - TRAILER TOW PARK LAMPS (COLOR TO SAE 1239)	
26	CBP01 (BU)	22	FUSE - 1 OR CIRCUIT BREAKER	
27	CBP06 (WH-BU)	20	FUSE - 6 OR CIRCUIT BREAKER	
28	CBP09 (VT-GY)	20	FUSE - 9 OR CIRCUIT BREAKER	
29	*	*	not used	
30	CLF16 (BU-WH)	16	SWITCH - BEAM LOW	
31	*	*	not used	
32	CDC33 (VT-GN)	12	SWITCH - IGNITION # RUN: ACCESSORY	

C2280B (Part 2)

C2280C

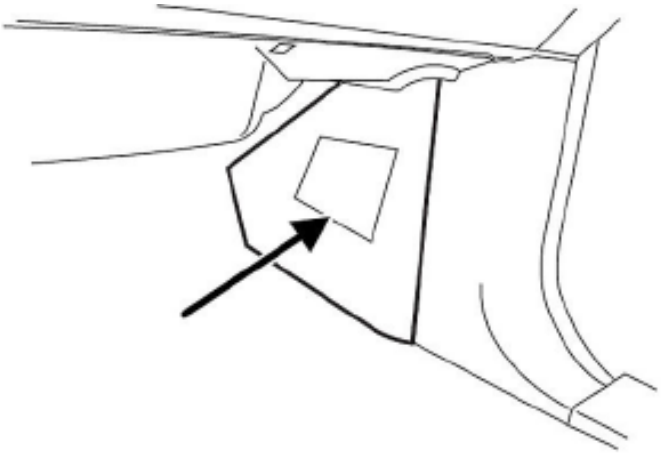
Connector: C2280D

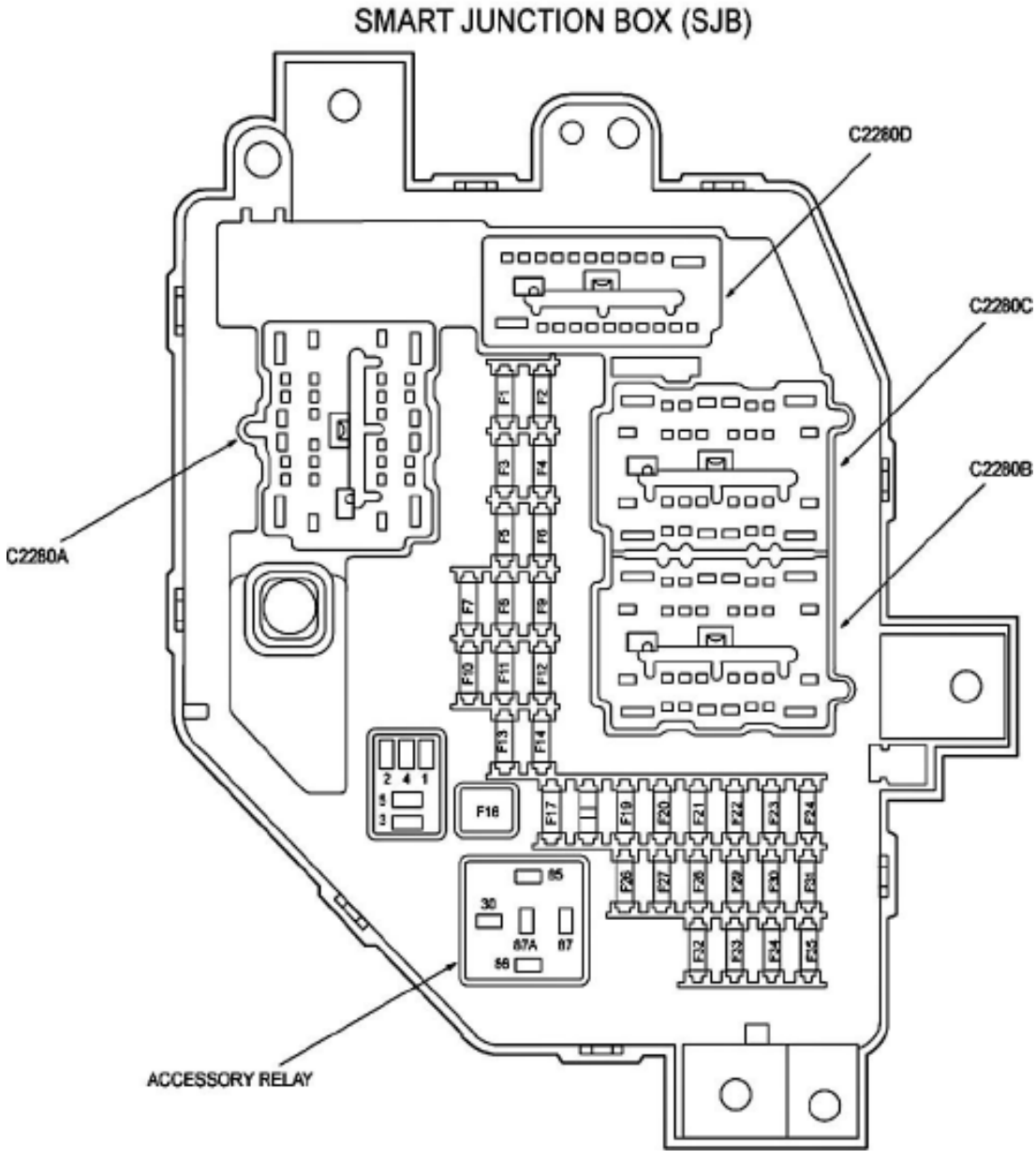
Description:	Harness:	Base Part #:
SMART JUNCTION BOX (SJB)	14401	14B476



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	*	*	not used	
3	CPL31 (WH)	20	SWITCH - LATCH PASSENGER # AJAR	
4	CPL36 (GN)	20	SWITCH - LATCH REAR DRIVER SIDE # AJAR (INCL.SLIDING DOOR)	
5	CLS30 (VT-WH)	18	RELAY - PARK LAMP	
6	CPL39 (YE)	20	SWITCH - LATCH REAR PASSENGER SIDE # AJAR (INCL.SLIDING DOOR)	
7	CCB15 (BN-GN)	22	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL CLOSED	
8	*	*	not used	
9	CLF21 (GY-VT)	18	SWITCH - FOG LAMPS FRONT	
10	CLN27 (WH-BN)	18	CTRL MOD. - DIMMER INSTRUMENT	
11	*	*	not used	
12	SRH01 (YE-RD)	20	RELAY - HORN	
13	*	*	not used	
14	*	*	not used	
15	*	*	not used	
16	*	*	not used	
17	*	*	not used	
18	*	*	not used	
19	*	*	not used	
20	VDB04 (WH-BU)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED HIGH	
21	VDB05 (WH)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED LOW	
22	*	*	not used	

C2280D




SMART JUNCTION BOX (SJB)
C2280D
C2280C
C2280B
C2280A
F1
F2
F3
F4
F5
F6
F7
F8
F9
F10
F11
F12
F13
F14
F16
F17
F19
F20
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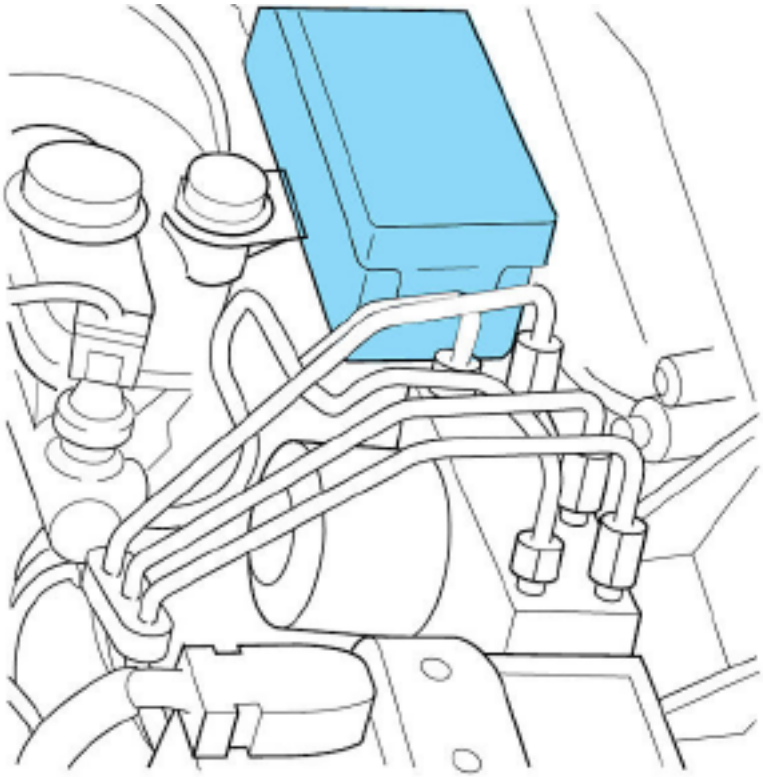
F23
F24
F26
F27
F28
F29
F30
F31
F32
F33
F34
F35
2 4 1
5
3
30
85
87A
87
86
ACCESSORY RELAY

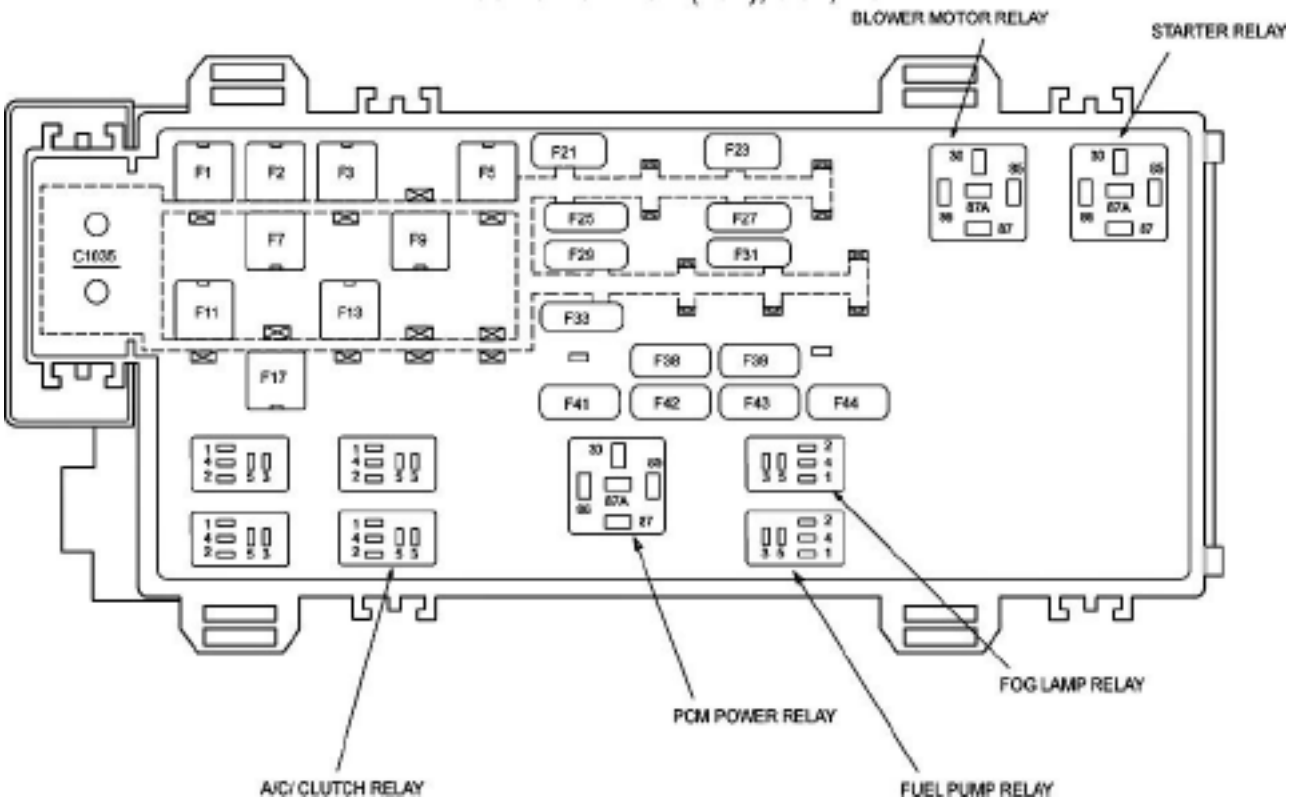
Relay Box: Application and ID Smart Junction Box

FUSE	AMPS	Circuits Protected
F1	5A	Illumination dimmer
F2	10A	Trailer tow connector - Park
F3	10A	Headlamp, right (Low beam lamp feed)
F4	10A	Headlamp, left (Low beam lamp feed)
F5	5A	Windshield wiper module
F6	10A	Audio unit, Door lock switch illumination
F7	5A	Not Used
F8	10A	Restraints Control Module (RCM), Occupant Classification System Module (OCSM), Passenger Air bag Deactivation (PAD) Indicator
F9	5A	Instrument Cluster (IC), Air bag indicator
F10	10A	4X4 control module, Instrument Cluster (IC)
F11	10A	Smart Junction Box (SJB), logic power
F12	15A	Subwoofer amplifier with audiophile, Satellite radio receiver
F13	15A	Interior lamp relay, Horn relay
F14	15A	High beam lamp feed to High beam indicator, Headlamp, right, Headlamp, left
F16	30A	Accessory relay (Power windows)
F17	15A	Indicator flasher relay
F18	-	Not Used

FUSE	AMPS	Circuits Protected
F19	20A	Brake pedal position switch (Stoplamps)
F20	10A	Transmission control switch, Digital Transmission Range (TR) sensor, Speed control servo, Anti-lock Brake System (ABS) module, Indicator flasher relay, Reversing lamps switch, Speed control On/Off switch, Speed control Set/Resume switch
F21	5A	Digital Transmission Range (TR) sensor, Starter relay, Powertrain Control Module (PCM)
F22	5A	Audio unit
F23	30A	Main light switch, Multifunction switch
F24	20A	Audio unit
F26	2A	Deactivator switch
F27	10A	Blend door actuator, Climate control assembly
F28	15A	4X4 control module
F29	20A	Cigar lighter, front, Data Link Connector (DLC)
F30	5A	Exterior rear view mirror switch
F31	20A	Park lamp relay
F32	5A	Brake pedal position switch (logic power), Brake shift interlock
F33	5A	Instrument Cluster (IC), Neutral tow indicator
F34	20A	Power point
F35	15A	Door lock/unlock relay, Driver door unlock relay



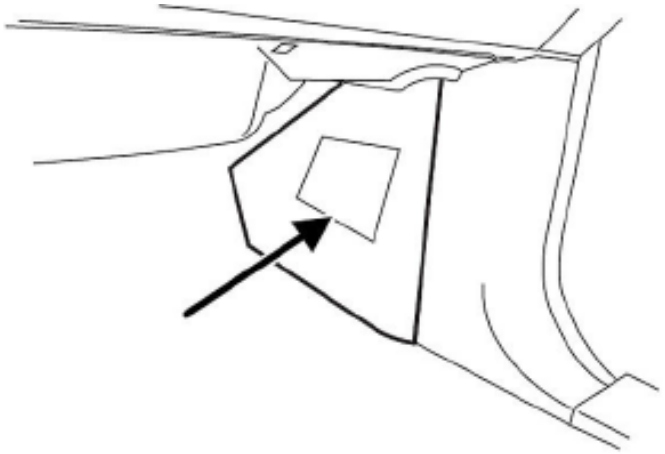
BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L

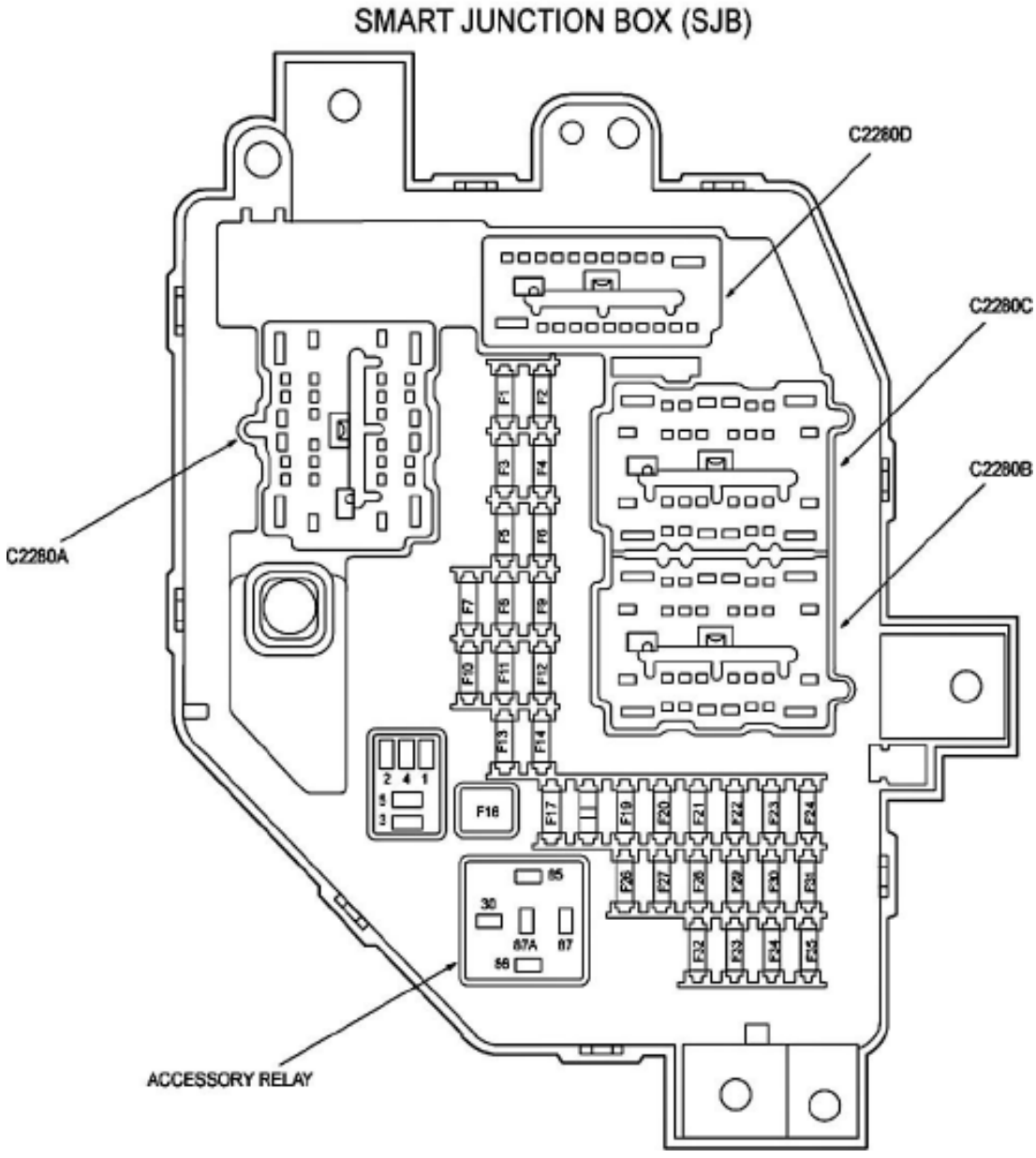


Relay Box: Application and ID Battery Junction Box

FUSE	AMPS	Circuits Protected
F1	40A	Smart Junction Box (SJB)
F2	-	Not Used
F3	40A	Smart Junction Box (SJB)
F4	-	Not Used
F5	50A	Smart Junction Box (SJB)
F6	-	Not Used
F7	30A	Starter Relay
F8	-	Not Used
F9	40A	Ignition Switch
F10	-	Not Used
F11	30A	PCM power relay
F12	-	Not Used
F13	30A	Blower motor relay
F14	-	Not Used
F15	-	Not Used
F16	-	Not Used
F17	40A	Anti-lock Brake System (ABS) module
F18	-	Not Used
F19	-	Not Used
F20	-	Not Used
F21	10A	Powertrain Control Module (PCM), Evaporative emission (EVAP) canister vent valve
F22	-	Not Used
F23	30A	Fuel Pump Relay, Fuel injectors
F24	-	Not Used

FUSE	AMPS	Circuits Protected
F25	10A	A/C clutch relay
F26	-	Not Used
F27	20A	4X4 control module
F28	-	Not Used
F29	30A	Windshield wipers/washer
F30	-	Not Used
F31	15A	Fog lamp relay
F32	-	Not Used
F33	30A	Anti-lock Brake System (ABS) module
F34	-	Not Used
F35	-	Not Used
F36	-	Not Used
F37	-	Not Used
F38	7.5A	Trailer tow connector - Right turn
F39	15A	Powertrain Control Module (PCM)
F40	-	Not Used
F41	10A	*5R44E Transmission **5R55E Transmission
F42	7.5A	Trailer tow connector - Left turn
F43	20A	EVAP canister purge valve, Heated Positive Crankcase Ventilation (PCV) valve, Idle Air Control (IAC) valve, Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor, Heated Oxygen Sensor (HO2S) #11, Heated Oxygen Sensor (HO2S) #12, Heated Oxygen Sensor (HO2S) #21, Heated Oxygen Sensor (HO2S) #22, EGR vacuum regulator solenoid valve, A/C relay coil
F44	15A	Ignition coil, *Ignition transformer capacitor 1




SMART JUNCTION BOX (SJB)
C2280D
C2280C
C2280B
C2280A
F1
F2
F3
F4
F5
F6
F7
F8
F9
F10
F11
F12
F13
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F19
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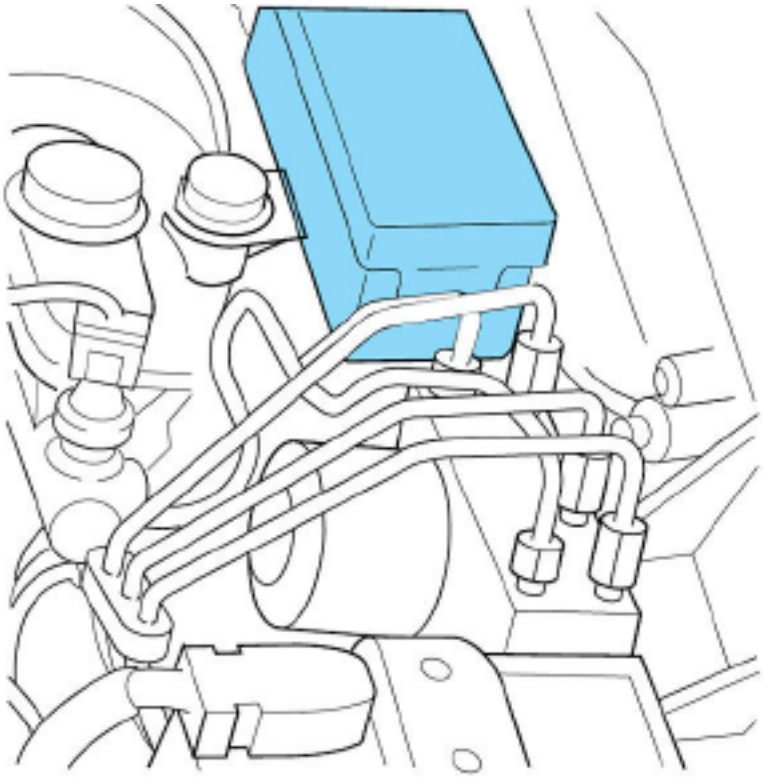
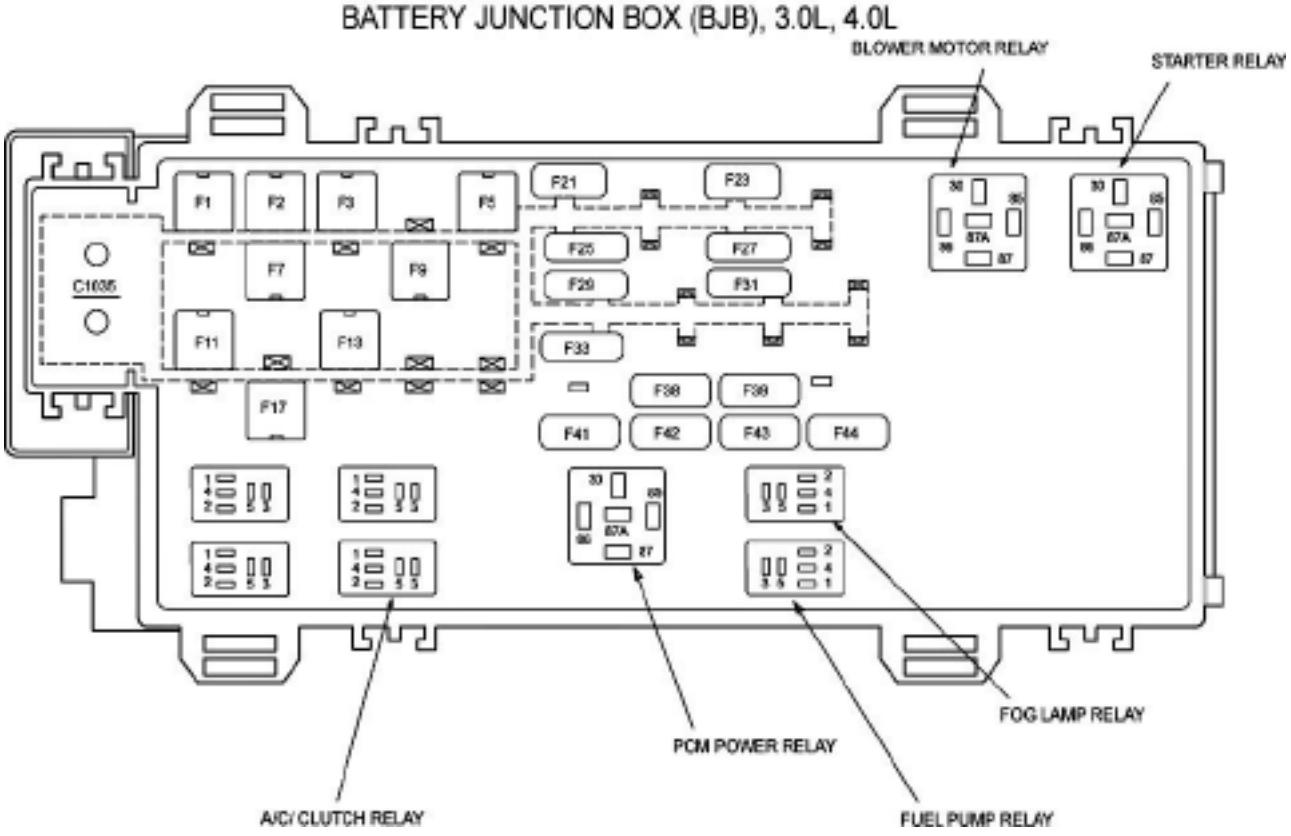
F28
F29
F30
F31
F32
F33
F34
F35
2 4 1
3
30
85
87A
87
86
ACCESSORY RELAY

Relay Box: Locations Smart Junction Box

FUSE	AMPS	Circuits Protected
F1	5A	Illumination dimmer
F2	10A	Trailer tow connector - Park
F3	10A	Headlamp, right (Low beam lamp feed)
F4	10A	Headlamp, left (Low beam lamp feed)
F5	5A	Windshield wiper module
F6	10A	Audio unit, Door lock switch illumination
F7	5A	Not Used
F8	10A	Restraints Control Module (RCM), Occupant Classification System Module (OCSM), Passenger Air bag Deactivation (PAD) Indicator
F9	5A	Instrument Cluster (IC), Air bag indicator
F10	10A	4X4 control module, Instrument Cluster (IC)
F11	10A	Smart Junction Box (SJB), logic power
F12	15A	Subwoofer amplifier with audiophile, Satellite radio receiver
F13	15A	Interior lamp relay, Horn relay
F14	15A	High beam lamp feed to High beam indicator, Headlamp, right, Headlamp, left
F16	30A	Accessory relay (Power windows)
F17	15A	Indicator flasher relay
F18	-	Not Used

FUSE	AMPS	Circuits Protected
F19	20A	Brake pedal position switch (Stoplamps)
F20	10A	Transmission control switch, Digital Transmission Range (TR) sensor, Speed control servo, Anti-lock Brake System (ABS) module, Indicator flasher relay, Reversing lamps switch, Speed control On/Off switch, Speed control Set/Resume switch
F21	5A	Digital Transmission Range (TR) sensor, Starter relay, Powertrain Control Module (PCM)
F22	5A	Audio unit
F23	30A	Main light switch, Multifunction switch
F24	20A	Audio unit
F26	2A	Deactivator switch
F27	10A	Blend door actuator, Climate control assembly
F28	15A	4X4 control module
F29	20A	Cigar lighter, front, Data Link Connector (DLC)
F30	5A	Exterior rear view mirror switch
F31	20A	Park lamp relay
F32	5A	Brake pedal position switch (logic power), Brake shift interlock
F33	5A	Instrument Cluster (IC), Neutral tow indicator
F34	20A	Power point
F35	15A	Door lock/unlock relay, Driver door unlock relay

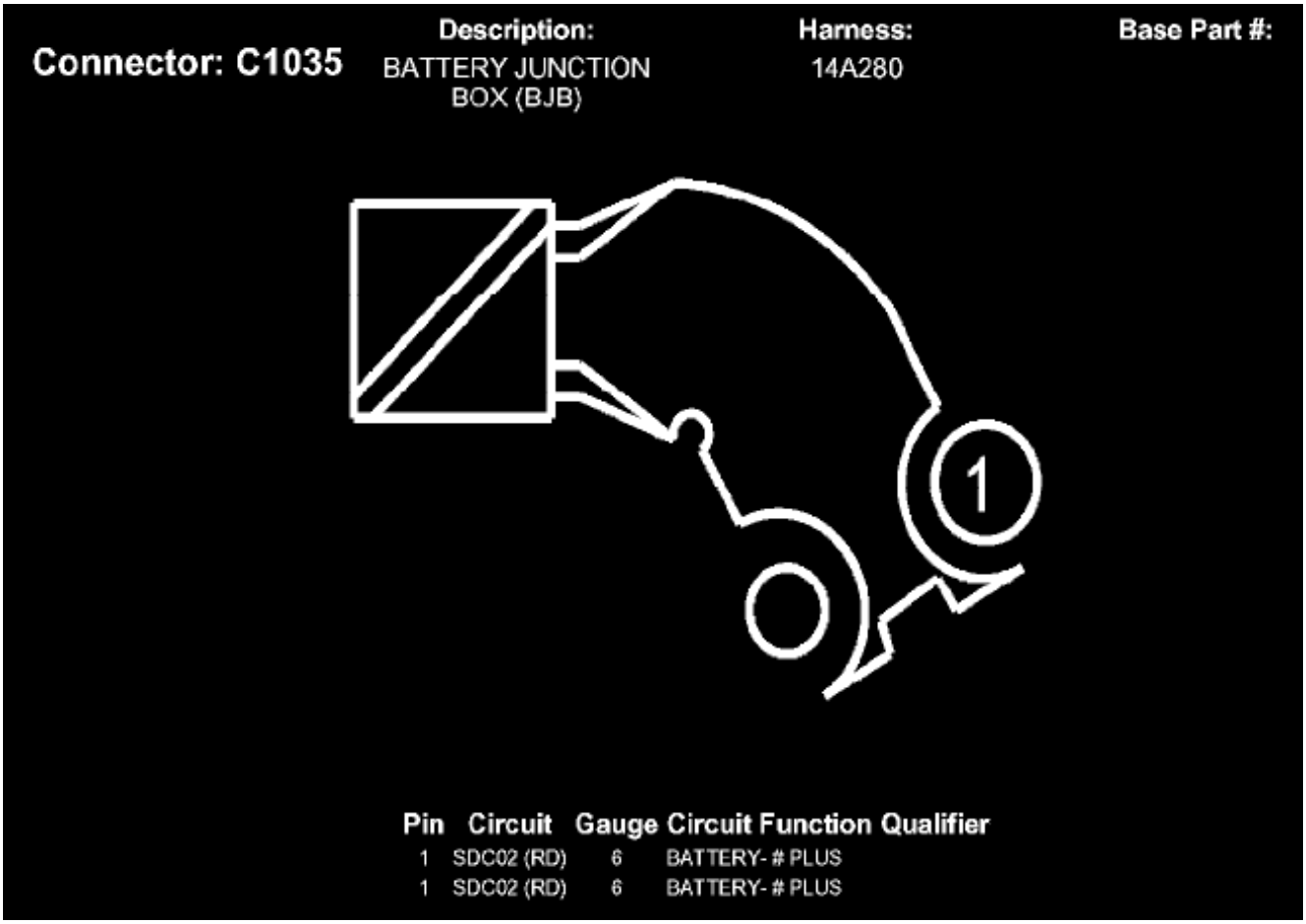



BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L
BLOWER MOTOR RELAY
STARTER RELAY
F1
F2
F3
F5
F21
F23
F7
F9
F25
F27
F29
F31
C1035
F11
F13
F33
F17
F38
F39
F41
F42
F43
F44
FOG LAMP RELAY
PCM POWER RELAY
A/C CLUTCH RELAY
FUEL PUMP RELAY

Relay Box: Locations Battery Junction Box

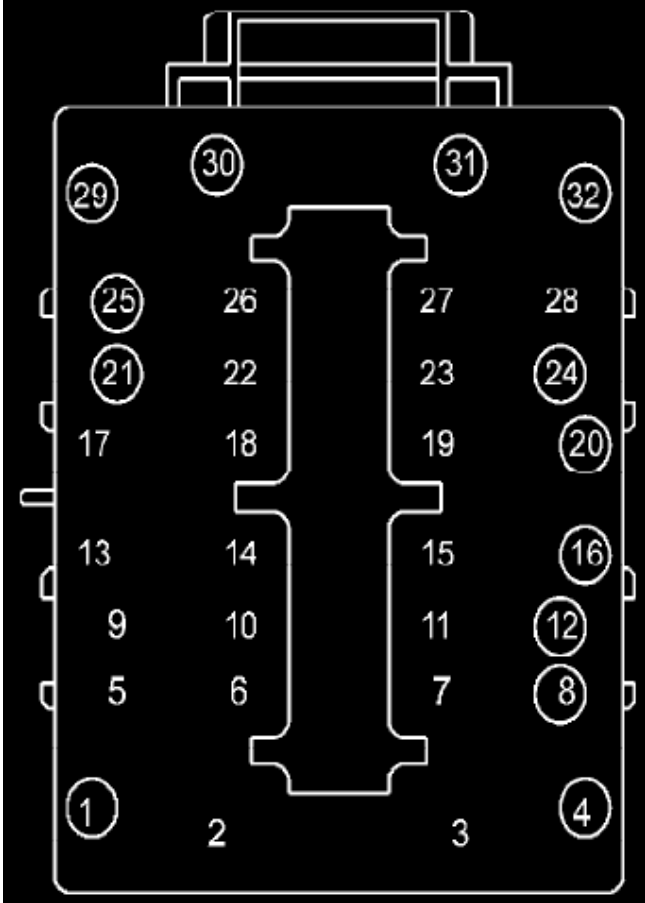
FUSE	AMPS	Circuits Protected
F1	40A	Smart Junction Box (SJB)
F2	-	Not Used
F3	40A	Smart Junction Box (SJB)
F4	-	Not Used
F5	50A	Smart Junction Box (SJB)
F6	-	Not Used
F7	30A	Starter Relay
F8	-	Not Used
F9	40A	Ignition Switch
F10	-	Not Used
F11	30A	PCM power relay
F12	-	Not Used
F13	30A	Blower motor relay
F14	-	Not Used
F15	-	Not Used
F16	-	Not Used
F17	40A	Anti-lock Brake System (ABS) module
F18	-	Not Used
F19	-	Not Used
F20	-	Not Used
F21	10A	Powertrain Control Module (PCM), Evaporative emission (EVAP) canister vent valve
F22	-	Not Used
F23	30A	Fuel Pump Relay, Fuel injectors
F24	-	Not Used

FUSE	AMPS	Circuits Protected
F25	10A	A/C clutch relay
F26	-	Not Used
F27	20A	4X4 control module
F28	-	Not Used
F29	30A	Windshield wipers/washer
F30	-	Not Used
F31	15A	Fog lamp relay
F32	-	Not Used
F33	30A	Anti-lock Brake System (ABS) module
F34	-	Not Used
F35	-	Not Used
F36	-	Not Used
F37	-	Not Used
F38	7.5A	Trailer tow connector - Right turn
F39	15A	Powertrain Control Module (PCM)
F40	-	Not Used
F41	10A	*5R44E Transmission **5R55E Transmission
F42	7.5A	Trailer tow connector - Left turn
F43	20A	EVAP canister purge valve, Heated Positive Crankcase Ventilation (PCV) valve, Idle Air Control (IAC) valve, Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor, Heated Oxygen Sensor (HO2S) #11, Heated Oxygen Sensor (HO2S) #12, Heated Oxygen Sensor (HO2S) #21, Heated Oxygen Sensor (HO2S) #22, EGR vacuum regulator solenoid valve, A/C relay coil
F44	15A	Ignition coil, *Ignition transformer capacitor 1


Connector: C1035
Description:
BATTERY JUNCTION BOX (BJB)
Harness:
14A280
Base Part #:
1
Pin Circuit Gauge Circuit Function Qualifier
1 SDC02 (RD) 6 BATTERY- # PLUS
1 SDC02 (RD) 6 BATTERY- # PLUS

C1035

Connector: C2280A | **Description:** SMART JUNCTION BOX (SJB) | **Harness:** 14290 | **Base Part #:** 14B476



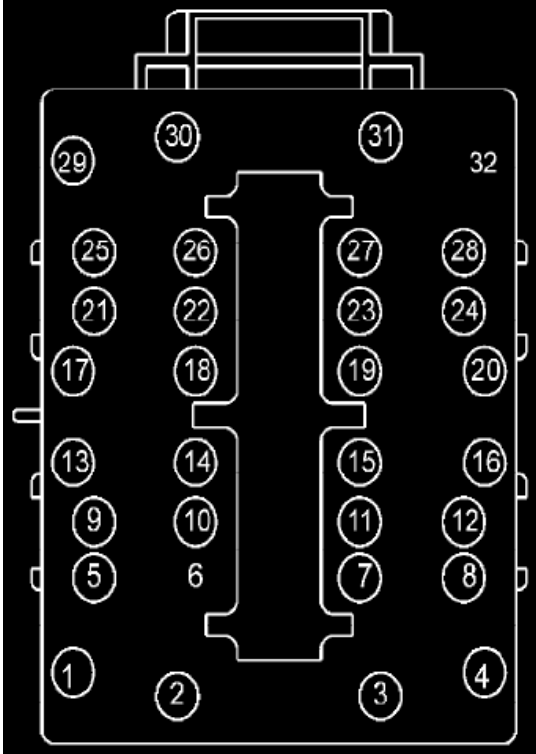
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	SBB01 (RD)	12	FUSE - 1 OR CIRCUIT BREAKER	
2	*	*	not used	
3	*	*	not used	
4	CBP05 (YE)	20	FUSE - 5 OR CIRCUIT BREAKER	
5	*	*	not used	
6	*	*	not used	
7	*	*	not used	
8	CES03 (VT-WH)	20	CTRL MOD - POWERTRAIN # SPEED CONTROL INDICATOR (SCIL)	
9	*	*	not used	
10	*	*	not used	
11	*	*	not used	
12	CLS34 (GY)	18	SWITCH - PARK LAMPS	
13	*	*	not used	
14	*	*	not used	
15	*	*	not used	
16	CBP04 (VT)	18	FUSE - 4 OR CIRCUIT BREAKER	
17	*	*	not used	
18	*	*	not used	
19	*	*	not used	
20	CBP03 (GY)	18	FUSE - 3 OR CIRCUIT BREAKER	
21	SBR14 (BN-RD)	18	FUSE - 14 OR CIRCUIT BREAKER	
22	*	*	not used	
23	*	*	not used	
24	CE517 (BU-GN)	20	DIODE - RELAY POWERTRAIN CONTROL MODULE	
25	CBP14 (VT-OG)	16	FUSE - 14 OR CIRCUIT BREAKER	
26	*	*	not used	
27	*	*	not used	
28	*	*	not used	
29	SBB03 (BU-RD)	12	FUSE - 3 OR CIRCUIT BREAKER	
30	CRH02 (BU-WH)	18	SWITCH - HORN	
31	CBP21 (BU-GY)	22	FUSE - 21 OR CIRCUIT BREAKER	
32	SBB05 (GY-RD)	10	FUSE - 5 OR CIRCUIT BREAKER	

Relay Box: Diagrams Smart Junction Box (SJB)

C2280A

Connector: C2280B

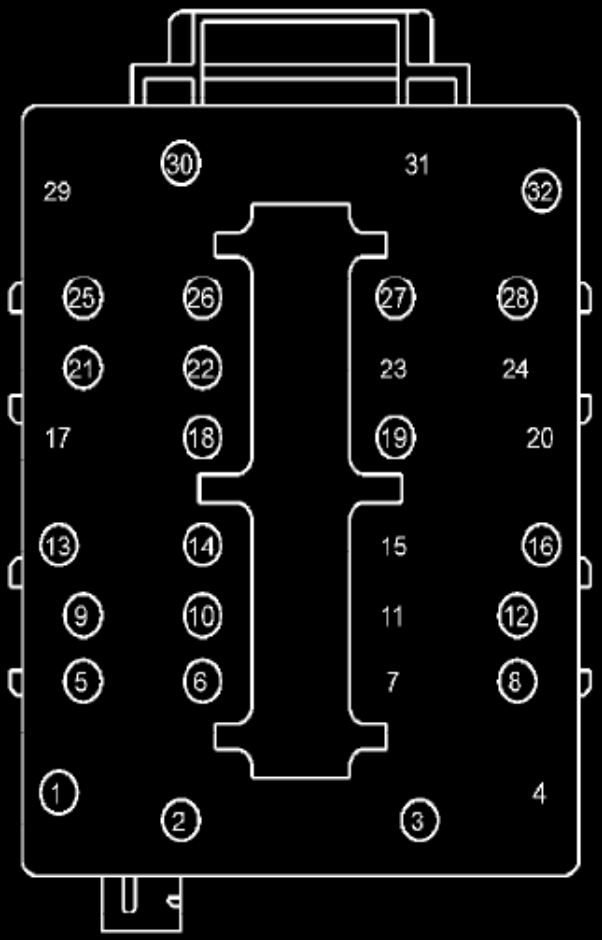
Description:	Harness:	Base Part #:
SMART JUNCTION BOX (SJB)	14401	14B476



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	SBP23 (WH-RD)	14	FUSE - 23 OR CIRCUIT BREAKER	
2	SBP24 (VT-RD)	16	FUSE - 24 OR CIRCUIT BREAKER	
3	SBP34 (YE-RD)	16	FUSE - 34 OR CIRCUIT BREAKER	
4	SBP23 (WH-RD)	14	FUSE - 23 OR CIRCUIT BREAKER	
5	CBP10 (YE-OG)	20	FUSE - 10 OR CIRCUIT BREAKER	
6	*	*	not used	
7	SBP28 (GN-RD)	18	FUSE - 28 OR CIRCUIT BREAKER	
8	SBP30 (BN-RD)	22	FUSE - 30 OR CIRCUIT BREAKER	
9	CPL19 (WH-VT)	20	RELAY - DOOR LOCK # ALL LOCK	
10	CPL18 (GY-VT)	20	RELAY - DOOR LOCK # ALL UNLOCK	
11	CDC35 (BU-WH)	14	SWITCH - IGNITION # START	
12	SBP33 (RD)	20	FUSE - 33 OR CIRCUIT BREAKER	
13	CPL11 (GY-BN)	20	CTRL MOD. - DOOR LOCK # ALL LOCK	
14	GD161 (BK-YE)	18	GROUND - SEAT BRACKET REAR LEFT	
15	CBP20 (YE-VT)	18	FUSE - 20 OR CIRCUIT BREAKER	
16	SBP29 (GY-RD)	18	FUSE - 29 OR CIRCUIT BREAKER	
17	CDC32 (BN-YE)	12	SWITCH - IGNITION # RUN	
18	CBP27 (GN-BN)	22	FUSE - 27 OR CIRCUIT BREAKER	
19	CBP20 (YE-VT)	18	FUSE - 20 OR CIRCUIT BREAKER	
20	SBP29 (GY-RD)	16	FUSE - 29 OR CIRCUIT BREAKER	
21	CBP27 (GN-BN)	22	FUSE - 27 OR CIRCUIT BREAKER	
22	CBP26 (BU-WH)	20	FUSE - 26 OR CIRCUIT BREAKER	
23	CBP20 (YE-VT)	18	FUSE - 20 OR CIRCUIT BREAKER	
24	CBP22 (GN-OG)	20	FUSE - 22 OR CIRCUIT BREAKER	
25	CLF27 (GN-BN)	14	SWITCH - FLASH TO PASS	
26	SBP17 (RD)	18	FUSE - 17 OR CIRCUIT BREAKER	
27	CBP20 (YE-VT)	20	FUSE - 20 OR CIRCUIT BREAKER	
28	SBP32 (VT-RD)	22	FUSE - 32 OR CIRCUIT BREAKER	
29	CDC34 (WH-OG)	12	SWITCH - IGNITION # RUN; START	
30	SBP12 (GN-RD)	16	FUSE - 12 OR CIRCUIT BREAKER	Audiophile sound system
30	SBP12 (GN-RD)	20	FUSE - 12 OR CIRCUIT BREAKER	without Audiophile and satellite radio
31	SBP19 (BU-RD)	16	FUSE - 19 OR CIRCUIT BREAKER	
32	*	*	not used	

C2280B (Part 1)

Connector: C2280C | **Description:** SMART JUNCTION BOX (SJB) | **Harness:** 14401 | **Base Part #:** 14B476

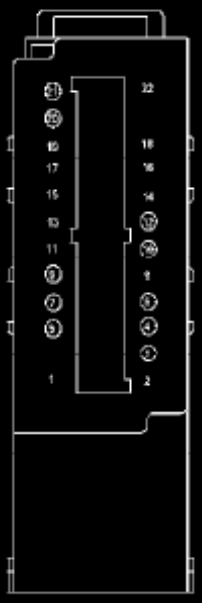


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD174 (BK-WH)	18	GROUND - TUNNEL	
2	CPL12 (VT-OG)	20	CTRL MOD. - DOOR LOCK # DOUBLE LOCK ALL LOCK	
3	CLS34 (GY)	16	SWITCH - PARK LAMPS	
4	*	*	not used	
5	CPL42 (GY-YE)	22	SWITCH - TRIM DOOR LOCK (DRIVER) # LOCK	
6	CPL26 (GN-VT)	20	SWITCH - LATCH DRIVER # AJAR	
7	*	*	not used	
8	CLN28 (GN-BU)	18	SWITCH - DOME LAMP	
9	CPL43 (VT-GY)	22	SWITCH - TRIM DOOR LOCK (DRIVER) # UNLOCK	
10	CPL42 (GY-YE)	22	SWITCH - TRIM DOOR LOCK (DRIVER) # LOCK	
11	*	*	not used	
12	CPL51 (BU-GN)	20	CTRL MOD. - DOOR LOCK # DRIVER UNLOCK	
13	CPW14 (VT-WH)	14	SWITCH - POWER WINDOW DRIVER # PASSENGER LOCK OUT (ENABLE)	
14	CPL43 (VT-GY)	22	SWITCH - TRIM DOOR LOCK (DRIVER) # UNLOCK	
15	*	*	not used	
16	CPW30 (GY-YE)	14	RELAY - POWER WINDOW	
17	*	*	not used	
18	CBP08 (GY-YE)	20	FUSE - 8 OR CIRCUIT BREAKER	
19	CE517 (BU-GN)	20	DIODE - RELAY POWERTRAIN CONTROL MODULE	
20	*	*	not used	
21	CLF29 (BN)	22	CTRL MOD. - FOG LAMPS FRONT (LEFT)	
22	CBP08 (GY-YE)	20	FUSE - 8 OR CIRCUIT BREAKER	
23	*	*	not used	
24	*	*	not used	
25	CAT17 (BN)	16	RELAY - TRAILER TOW PARK LAMPS (COLOR TO SAE 1239)	
26	CBP01 (BU)	22	FUSE - 1 OR CIRCUIT BREAKER	
27	CBP06 (WH-BU)	20	FUSE - 6 OR CIRCUIT BREAKER	
28	CBP09 (VT-GY)	20	FUSE - 9 OR CIRCUIT BREAKER	
29	*	*	not used	
30	CLF16 (BU-WH)	16	SWITCH - BEAM LOW	
31	*	*	not used	
32	CDC33 (VT-GN)	12	SWITCH - IGNITION # RUN: ACCESSORY	

C2280B (Part 2)

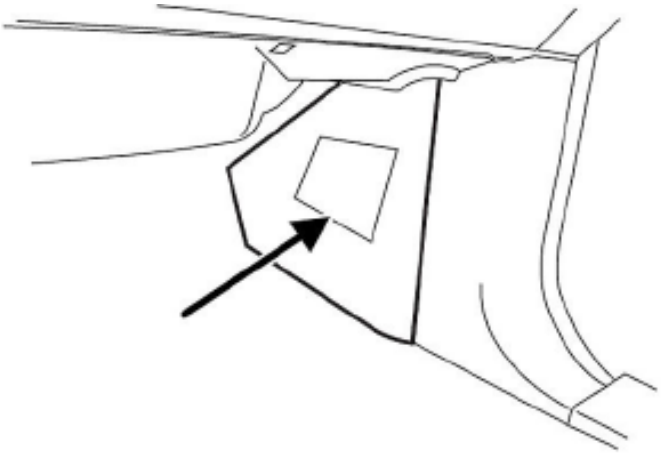
C2280C

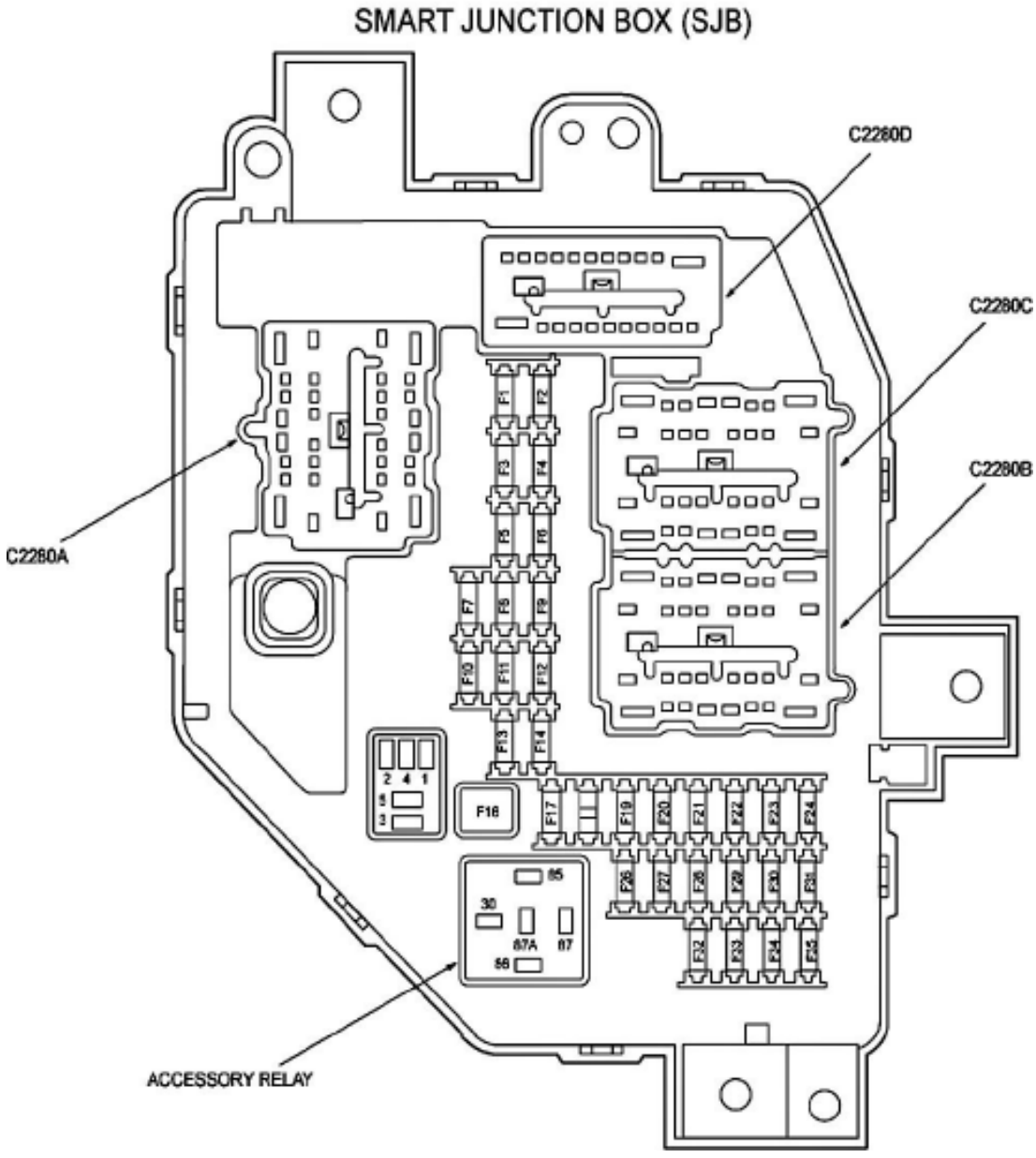
Connector: C2280D	Description:	Harness:	Base Part #:
	SMART JUNCTION BOX (SJB)	14401	14B476



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	*	*	not used	
3	CPL31 (WH)	20	SWITCH - LATCH PASSENGER # AJAR	
4	CPL36 (GN)	20	SWITCH - LATCH REAR DRIVER SIDE # AJAR (INCL.SLIDING DOOR)	
5	CLS30 (VT-WH)	18	RELAY - PARK LAMP	
6	CPL39 (YE)	20	SWITCH - LATCH REAR PASSENGER SIDE # AJAR (INCL.SLIDING DOOR)	
7	CCB15 (BN-GN)	22	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL CLOSED	
8	*	*	not used	
9	CLF21 (GY-VT)	18	SWITCH - FOG LAMPS FRONT	
10	CLN27 (WH-BN)	18	CTRL MOD. - DIMMER INSTRUMENT	
11	*	*	not used	
12	SRH01 (YE-RD)	20	RELAY - HORN	
13	*	*	not used	
14	*	*	not used	
15	*	*	not used	
16	*	*	not used	
17	*	*	not used	
18	*	*	not used	
19	*	*	not used	
20	VDB04 (WH-BU)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED HIGH	
21	VDB05 (WH)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED LOW	
22	*	*	not used	

C2280D

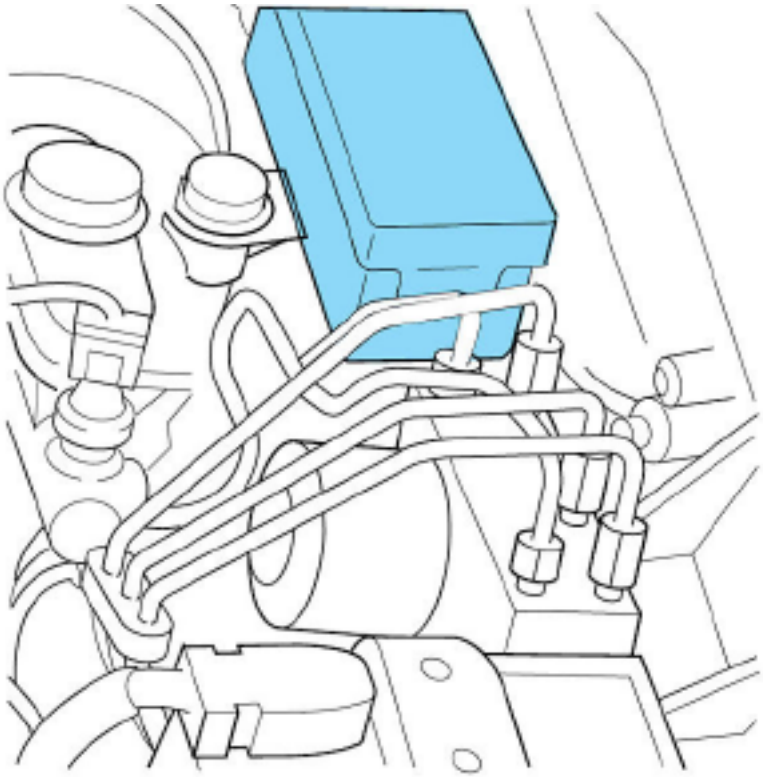



SMART JUNCTION BOX (SJB)
C2280D
C2280C
C2280B
C2280A
F1
F2
F3
F4
F5
F6
F7
F8
F9
F10
F11
F12
F13
F14
F16
F17
F19
F20
F21
F22
F23
F24
F26
F27
F28
F29
F30
F31
F32
F33
F34
F35
2 4 1
3
30
85
87A
87
86
ACCESSORY RELAY

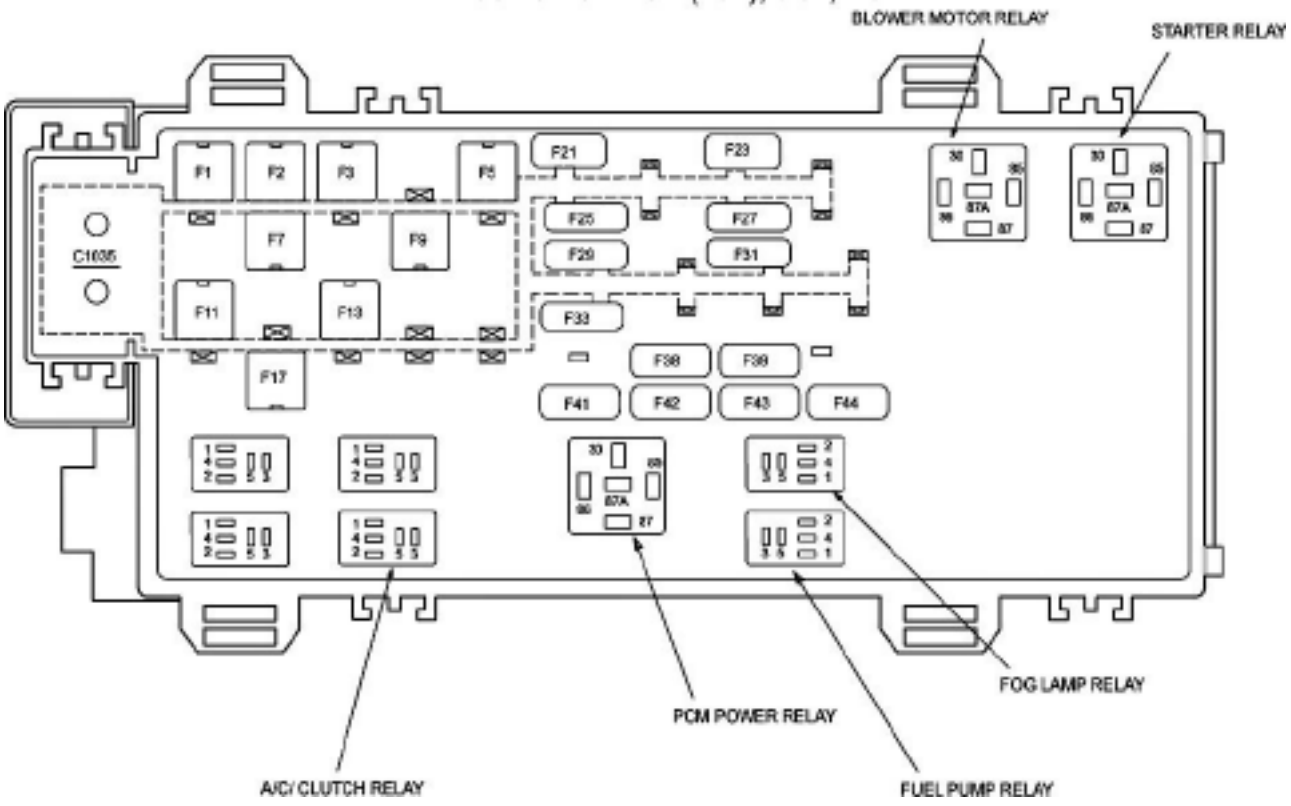
Relay Box: Application and ID Smart Junction Box

FUSE	AMPS	Circuits Protected
F1	5A	Illumination dimmer
F2	10A	Trailer tow connector - Park
F3	10A	Headlamp, right (Low beam lamp feed)
F4	10A	Headlamp, left (Low beam lamp feed)
F5	5A	Windshield wiper module
F6	10A	Audio unit, Door lock switch illumination
F7	5A	Not Used
F8	10A	Restraints Control Module (RCM), Occupant Classification System Module (OCSM), Passenger Air bag Deactivation (PAD) Indicator
F9	5A	Instrument Cluster (IC), Air bag indicator
F10	10A	4X4 control module, Instrument Cluster (IC)
F11	10A	Smart Junction Box (SJB), logic power
F12	15A	Subwoofer amplifier with audiophile, Satellite radio receiver
F13	15A	Interior lamp relay, Horn relay
F14	15A	High beam lamp feed to High beam indicator, Headlamp, right, Headlamp, left
F16	30A	Accessory relay (Power windows)
F17	15A	Indicator flasher relay
F18	-	Not Used

FUSE	AMPS	Circuits Protected
F19	20A	Brake pedal position switch (Stoplamps)
F20	10A	Transmission control switch, Digital Transmission Range (TR) sensor, Speed control servo, Anti-lock Brake System (ABS) module, Indicator flasher relay, Reversing lamps switch, Speed control On/Off switch, Speed control Set/Resume switch
F21	5A	Digital Transmission Range (TR) sensor, Starter relay, Powertrain Control Module (PCM)
F22	5A	Audio unit
F23	30A	Main light switch, Multifunction switch
F24	20A	Audio unit
F26	2A	Deactivator switch
F27	10A	Blend door actuator, Climate control assembly
F28	15A	4X4 control module
F29	20A	Cigar lighter, front, Data Link Connector (DLC)
F30	5A	Exterior rear view mirror switch
F31	20A	Park lamp relay
F32	5A	Brake pedal position switch (logic power), Brake shift interlock
F33	5A	Instrument Cluster (IC), Neutral tow indicator
F34	20A	Power point
F35	15A	Door lock/unlock relay, Driver door unlock relay



BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L



Relay Box: Application and ID Battery Junction Box

FUSE	AMPS	Circuits Protected
F1	40A	Smart Junction Box (SJB)
F2	-	Not Used
F3	40A	Smart Junction Box (SJB)
F4	-	Not Used
F5	50A	Smart Junction Box (SJB)
F6	-	Not Used
F7	30A	Starter Relay
F8	-	Not Used
F9	40A	Ignition Switch
F10	-	Not Used
F11	30A	PCM power relay
F12	-	Not Used
F13	30A	Blower motor relay
F14	-	Not Used
F15	-	Not Used
F16	-	Not Used
F17	40A	Anti-lock Brake System (ABS) module
F18	-	Not Used
F19	-	Not Used
F20	-	Not Used
F21	10A	Powertrain Control Module (PCM), Evaporative emission (EVAP) canister vent valve
F22	-	Not Used
F23	30A	Fuel Pump Relay, Fuel injectors
F24	-	Not Used

FUSE	AMPS	Circuits Protected
F25	10A	A/C clutch relay
F26	-	Not Used
F27	20A	4X4 control module
F28	-	Not Used
F29	30A	Windshield wipers/washer
F30	-	Not Used
F31	15A	Fog lamp relay
F32	-	Not Used
F33	30A	Anti-lock Brake System (ABS) module
F34	-	Not Used
F35	-	Not Used
F36	-	Not Used
F37	-	Not Used
F38	7.5A	Trailer tow connector - Right turn
F39	15A	Powertrain Control Module (PCM)
F40	-	Not Used
F41	10A	*5R44E Transmission **5R55E Transmission
F42	7.5A	Trailer tow connector - Left turn
F43	20A	EVAP canister purge valve, Heated Positive Crankcase Ventilation (PCV) valve, Idle Air Control (IAC) valve, Mass Air Flow/Intake Air Temperature (MAF/IAT) sensor, Heated Oxygen Sensor (HO2S) #11, Heated Oxygen Sensor (HO2S) #12, Heated Oxygen Sensor (HO2S) #21, Heated Oxygen Sensor (HO2S) #22, EGR vacuum regulator solenoid valve, A/C relay coil
F44	15A	Ignition coil, *Ignition transformer capacitor 1

Alignment Specifications

Item	LH	RH	Total/Split
Front — Rear Wheel Drive (RWD) with Coil Spring Suspension			
Camber	-0.5° ± 0.75°	-0.5° ± 0.75°	0.0° ± 0.75°
Caster	3.0° ± 1.0°	3.4° ± 1.0°	-0.4° ± 0.75°
Toe @ curb ride height (Positive value is toe-in, negative value is toe-out)	—	—	0.06° ± 0.25°
Front — Rear Wheel Drive (RWD) with Torsion Bar Suspension			
Camber	0.0° ± 0.7°	0.0° ± 0.7°	0.0° ± 0.75°
Caster	2.8° ± 1.0°	3.5° ± 1.0°	-0.7° ± 0.75°
Toe @ curb ride height (Positive value is toe-in, negative value is toe-out)	—	—	0.12° ± 0.25°
Front — Four Wheel Drive (4WD)			
Camber	0.0° ± 0.7°	0.0° ± 0.7°	0.0° ± 0.75°
Caster	2.8° ± 1.0°	3.5° ± 1.0°	-0.7° ± 0.75°
Toe @ curb ride height (Positive value is toe-in, negative value is toe-out)	—	—	0.12° ± 0.25°

Alignment: Specifications Alignment Specifications

Alignment Specifications

General Specifications

Item	Specification
Ball Joint Deflection	
Lower ball joint	0-0.8 mm (0-0.032 in)
Upper ball joint	0-0.2 mm (0-0.008 in)
Dogtracking	
Maximum (Centerline of front tires compared to centerline of rear tires)	30 mm (1.2 in)
Front Ride Height	
Four wheel drive (4WD) and rear wheel drive (RWD) torsion bar — if new parts are installed	105 mm (4.13 in) ± 12 mm (0.47 in)
4WD and RWD torsion bar — new vehicles with less than 805 km (500 mi)	105 mm (4.13 in) ± 12 mm (0.47 in)
4WD and RWD torsion bar — vehicles with more than 805 km (500 mi)	93 mm (3.66 in) ± 12 mm (0.47 in)
FX4 — if new parts are installed	113 mm (4.52 in) + 12 mm (0.47 in)
FX4 — new vehicles with less than 805 km (500 mi)	113 mm (4.52 in) ± 12 mm (0.47 in)
FX4 — vehicles with more than 805 km (500 mi)	101 mm (4.08 in) ± 12 mm (0.47 in)

Alignment: Specifications General Specifications

General Specifications

General Specifications (Continued)

Item	Specification
Max ride height, side-to-side variance	12 mm (0.47 in)
RWD coil spring — if new parts are installed	102 mm (4.08 in) + 12 mm (0.47 in)
RWD coil spring — vehicles with more than 805 km (500 mi)	102 mm (4.08 in) ± 12 mm (0.47 in)
Rear Ride Height	
4WD, FX4 and RWD torsion bar regular cab base suspension — if new parts are installed	185 mm (7.28 in) - 207 mm (8.15 in)
4WD, FX4 and RWD torsion bar regular cab base suspension — new vehicles with less than 805 km (500 mi)	185 mm (7.28 in) - 207 mm (8.15 in)
4WD, FX4 and RWD torsion bar regular cab base suspension — vehicles with more than 805 km (500 mi)	175 mm (6.89 in) - 197 mm (7.76 in)
4WD, FX4 and RWD torsion bar SuperCab base suspension — if new parts are installed	166 mm (6.54 in) - 185 mm (7.28 in)

General Specifications (Continued)

Item	Specification
4WD, FX4 and RWD torsion bar SuperCab base suspension — new vehicles with less than 805 km (500 mi)	166 mm (6.54 in) - 185 mm (7.28 in)
4WD, FX4 and RWD torsion bar SuperCab base suspension — vehicles with more than 805 km (500 mi)	156 mm (6.14 in) - 175 mm (6.89 in)
4WD, FX4 and RWD torsion bar SuperCab payload package — if new parts are installed	185 mm (7.28 in) - 207 mm (8.15 in)
4WD, FX4 and RWD torsion bar SuperCab payload package — new vehicles with less than 805 km (500 mi)	185 mm (7.28 in) - 207 mm (8.15 in)
4WD, FX4 and RWD torsion bar SuperCab payload package — vehicles with more than 805 km (500 mi)	175 mm (6.89 in) - 197 mm (7.76 in)
RWD, regular cab and SuperCab, coil spring base suspension — if new parts are installed	188 mm (7.40 in) - 210 mm (8.27 in)
RWD, regular cab and SuperCab, coil spring base suspension — new vehicles with less than 805 km (500 mi)	188 mm (7.40 in) - 210 mm (8.27 in)

General Specifications (Continued)

Item	Specification
RWD, regular cab and SuperCab, coil spring base suspension — vehicles with more than 805 km (500 mi)	178 mm (7.20 in) - 200 mm (7.87 in)
RWD, regular cab and SuperCab, coil spring payload package — if new parts are installed	208 mm (8.19 in) - 232 mm (9.13 in)
RWD, regular cab and SuperCab, coil spring payload package — new vehicles with less than 805 km (500 mi)	208 mm (8.19 in) - 232 mm (9.13 in)
RWD, regular cab and SuperCab, coil spring payload package — vehicles with more than 805 km (500 mi)	198 mm (7.80 in) - 222 mm (8.74 in)
Vehicle Lean (Side-to-Side Differences)	
Front and rear	13 mm (0.5 in)
Wheel Track	
Wheel track	30.6 mm (1.22 in)

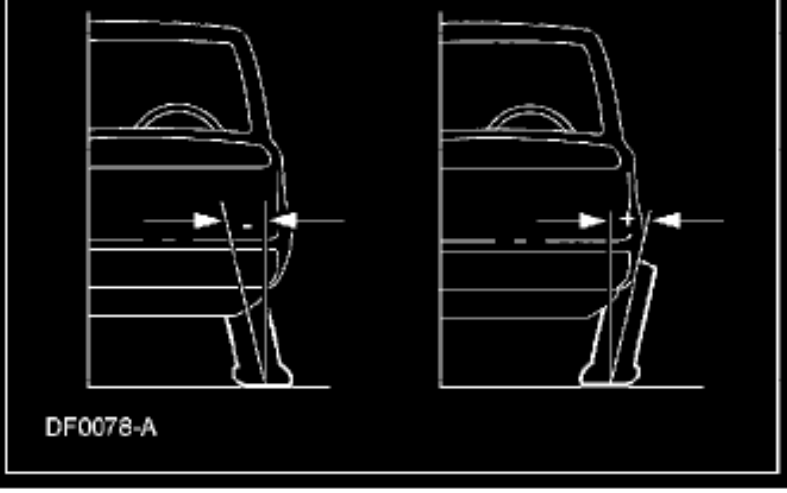
Torque Specifications

Description	Nm	lb-ft
Tie-rod jam nuts	80	59
U-bolt nuts	115	85
Upper arm-to-frame nuts	133	98

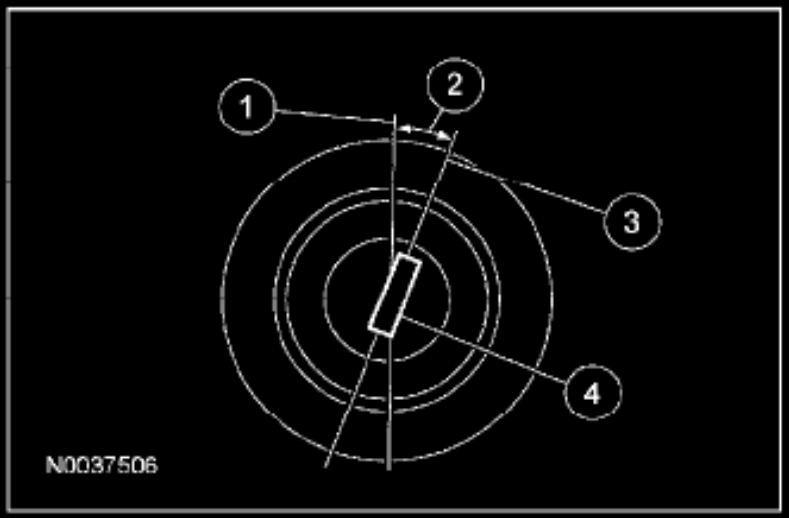
Alignment: Specifications Torque Specifications

Torque Specifications

Negative and Positive Camber



Caster



Item	Part Number	Description
1	—	True vertical
2	—	Positive caster angle
3	—	Ball joint center line
4	—	Pivot center line

Alignment: Description and Operation

Wheel Alignment Angles

Front caster and camber are adjusted by replacing the upper arm alignment set shims with washers, this allows for adjustment of the arm in the frame slot. Front toe is adjusted by the use of the inner tie rods.

Camber

Negative and Positive Camber

Camber is the vertical tilt of the wheel when viewed from the front. Camber can be positive or negative and has a direct effect on tire wear.

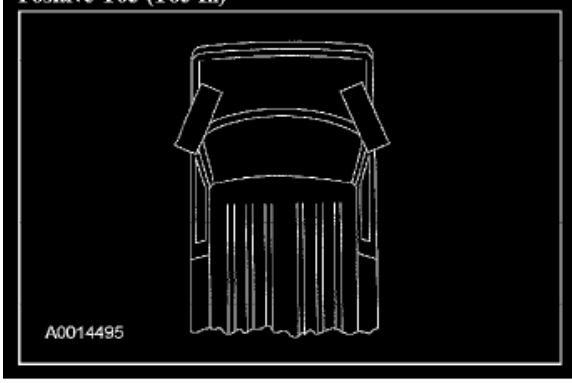
Caster

Caster

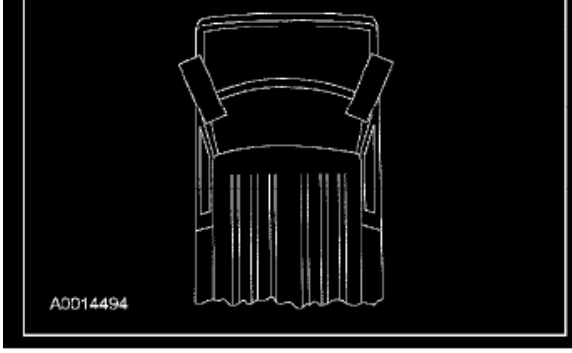
Caster is the deviation from vertical of an imaginary line drawn through the ball joints when viewed from the side. The caster specifications will give the vehicle the best directional stability characteristics when loaded and driven. The caster setting is not related to tire wear.

Toe

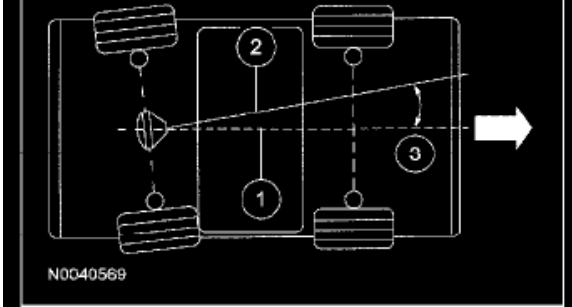
Positive Toe (Toe In)



Negative Toe (Toe Out)



Incorrect Thrust Angle (Dogtracking)



Item	Part Number	Description
1	—	Vertical centerline
2	—	Axle centerline
3	—	Thrust angle

Positive Toe (Toe In)

Negative Toe (Toe Out)

The vehicle toe setting: ^

affects tire wear and directional stability.

^ must be checked after adding aftermarket equipment, such as a snowplow.

Incorrect Thrust Angle (Dogtracking)

Incorrect Thrust Angle (Dogtracking)

Incorrect thrust angle (dogtracking) is the condition in which the rear axle is not square to the chassis. Heavily crowned roads can give the illusion of dogtracking.

Wander

Wander is the tendency of the vehicle to require frequent, random left and right steering wheel corrections to maintain a straight path down a level road.

Shimmy

Shimmy, as observed by the driver, is large, consistent, rotational oscillations of the steering wheel resulting from large, side-to-side (lateral) tire/wheel movements.

Shimmy is usually experienced near 64 km/h (40 mph), and can begin or be amplified when the tire contacts pot holes or irregularities in the road surface.

Nibble

Sometimes confused with shimmy, nibble is a condition resulting from tire interaction with various road surfaces and observed by the driver as small rotational oscillations of the steering wheel.

Poor Returnability/Sticky Steering

Poor returnability and sticky steering is used to described the poor return of the steering wheel to center after a turn or the steering correction is completed.

Drift/Pull

Pull is a tugging sensation, felt by the hands on the steering wheel, that must be overcome to keep the vehicle going straight.

Drift describes what a vehicle with this condition does with hands off the steering wheel. ^

A vehicle-related drift/pull, on a flat road, will cause a consistent deviation from the straight-ahead path and require constant steering input in the opposite direction to counteract the effect.

^ Drift/pull may be induced by conditions external to the vehicle (i.e., wind, road camber).

Poor Groove Feel

Poor groove feel is characterized by little or no buildup of turning effort felt in the steering wheel as the wheel is rocked slowly left and right within very small turns around center or straight-ahead (under 20 degrees of steering wheel turn). Efforts may be said to be "flat on center". ^

Under 20 degrees of turn, most of the turning effort that builds up comes from the mesh of gear teeth in the steering gear. In this range, the steering wheel is not yet turned enough to feel the effort from the self-aligning forces at the road wheel or tire patch.

^ In the diagnosis of a concern, it is important to understand the difference between wander and poor groove feel.

Adjustment	Front of Upper Arm	Rear of Upper Arm
Increase caster	Out	In
Decrease caster	In	Out
Increase camber	Out	Out
Decrease camber	In	In
Increase caster and camber simultaneously	Out	—
Decrease caster and camber simultaneously	In	—

Alignment: Service and Repair Camber and Caster Adjustment

Camber and Caster Adjustment

1. NOTE: The upper arm-to-frame mounting bolts have set shims that must be replaced with washers (W-705040S900) to allow for adjustment of

the arm in the frame slot.

Index-mark the upper arm-to-frame bolts, then remove and discard the upper arm-to-frame nuts and set shims.

2. Align the index marks and install the new washers and new nuts.

^ Tighten the nuts until snug.

3. Using alignment equipment and the manufacturer's instructions, measure the caster and camber.

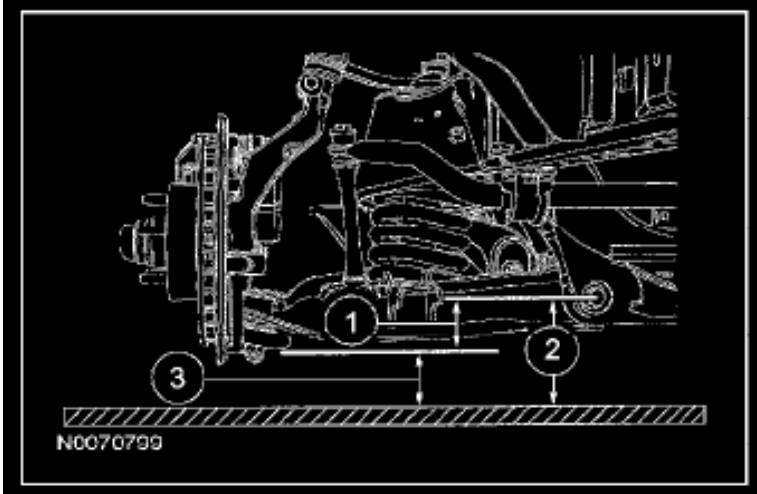
4. NOTE: The vehicle should be supported by the lower arms to ease movement of the upper arm in the slot.

To adjust the caster and camber refer to the following chart. ^

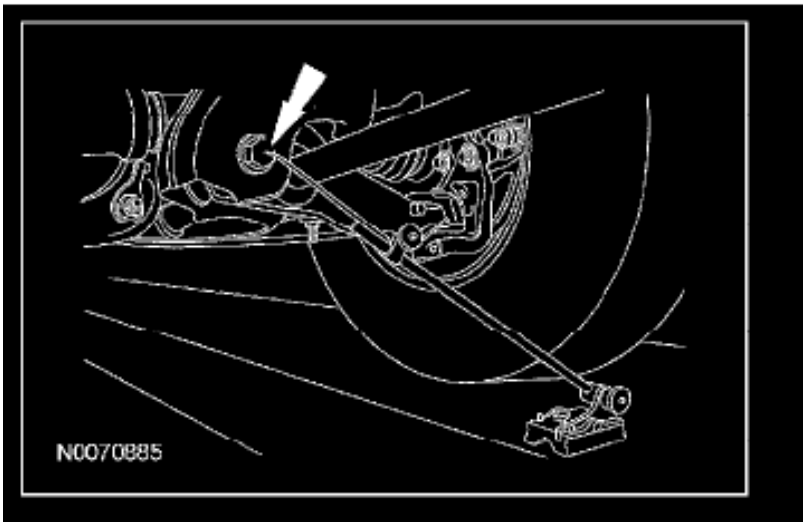
When making adjustments that require moving both the front and the rear of the upper arm, move both ends of the arm equally.

5. Tighten the upper arm-to-frame nuts to 133 Nm (98 lb-ft). 6. Recheck the caster and camber settings and adjust as necessary. 7. Check and, if necessary, adjust the front toe.

Front Ride Height Measurement



Item	Part Number	Description
1	—	Ride height = A - B
2	—	Measurement A
3	—	Measurement B



Alignment: Service and Repair Ride Height Measurement

Ride Height Measurement

Front Ride Height Measurement

Front Ride Height Measurement

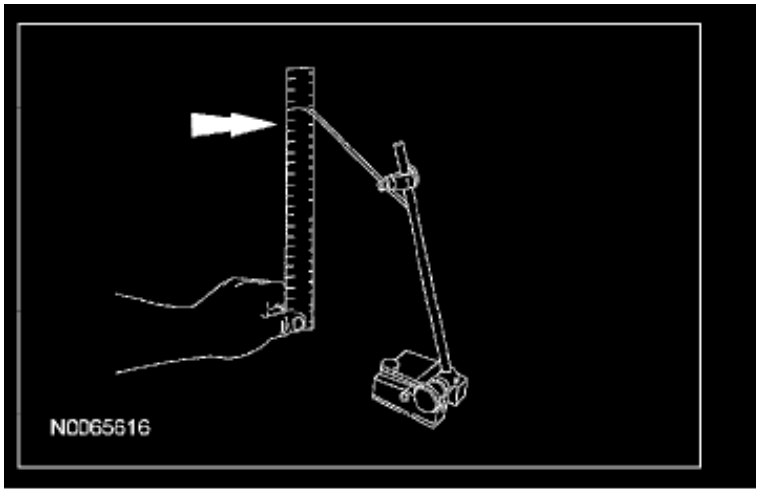
NOTE: Make sure that the vehicle is positioned on a flat, level surface and the tires are inflated to the correct pressure. Vehicle should have a full tank of fuel.

1. Position a suitable surface gauge (such as Starrett 57D Surface Gauge), on a flat, level surface and adjust the gauge's arm until the scriber point is

located in the center of the lower arm rearward bolt. ^

Lock the surface gauge in this position.

2. With the surface gauge positioned on a flat, level surface, record the measurement of the surface gauge position (measurement A).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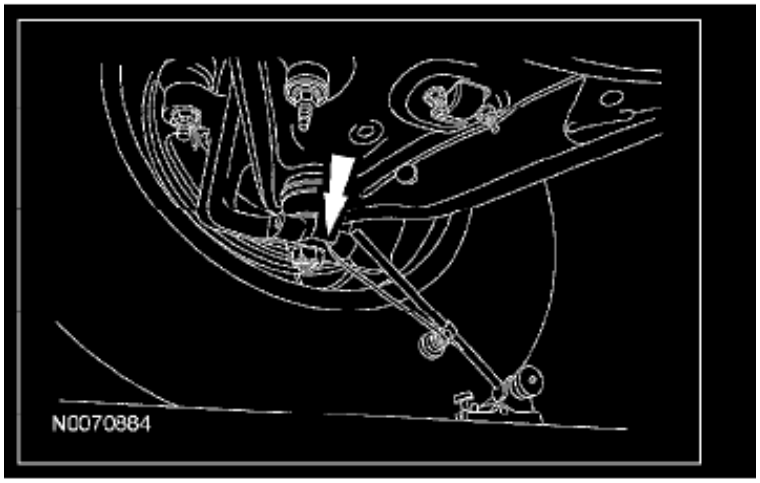
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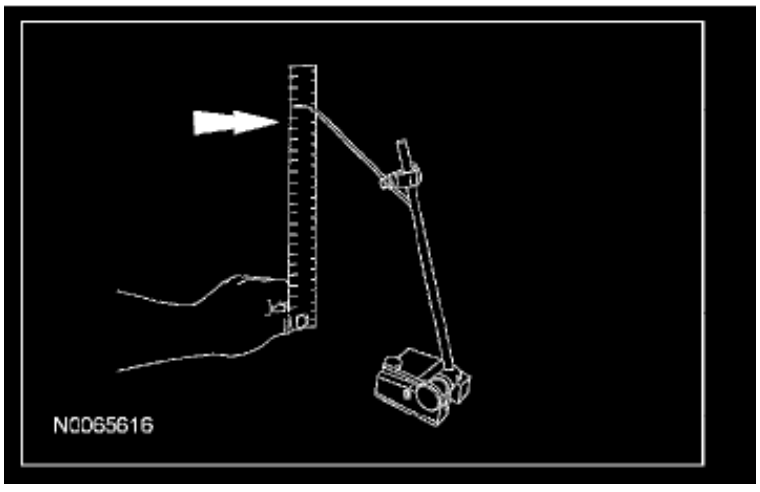

N0065616

3. Position the surface gauge on the same flat, level surface as used in Step 1, adjust the gauge's arm until the scriber point is located on the wheel

knuckle lowest point, behind the lower ball joint nut. ^

Lock the surface gauge in this position.

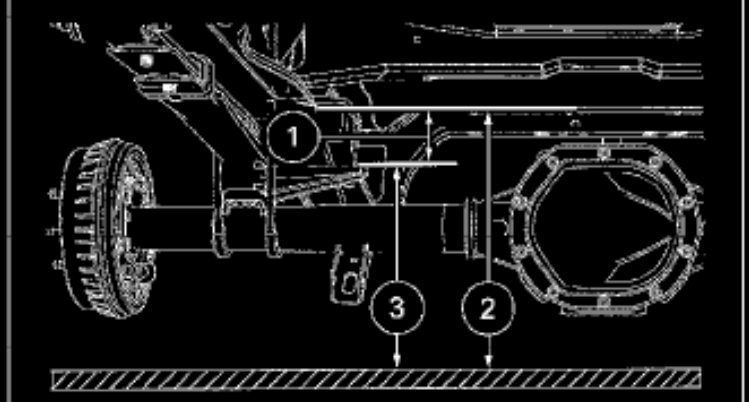
4. With the surface gauge positioned on a flat, level surface, record the measurement of the surface gauge position (measurement B).

5. Subtract measurement B from measurement A to obtain the front ride height.

^ Refer to Specifications.

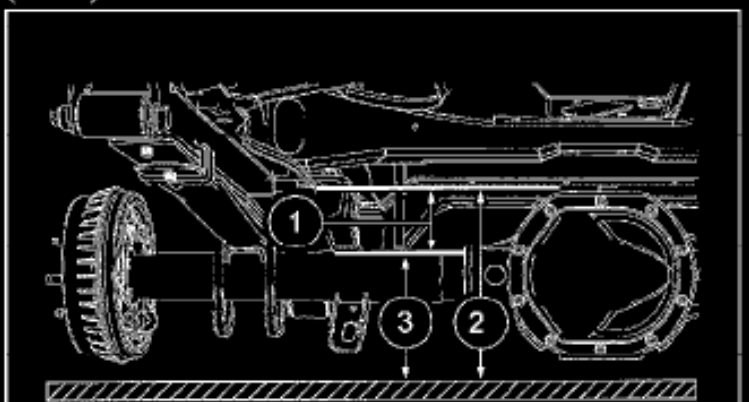
Rear Ride Height Measurement

Ride Height Measurement — Four Wheel Drive (4WD)



Item	Part Number	Description
1		Ride height = A - B
2	—	Measurement point A
3	—	Measurement point B

Ride Height Measurement — Rear Wheel Drive (RWD)



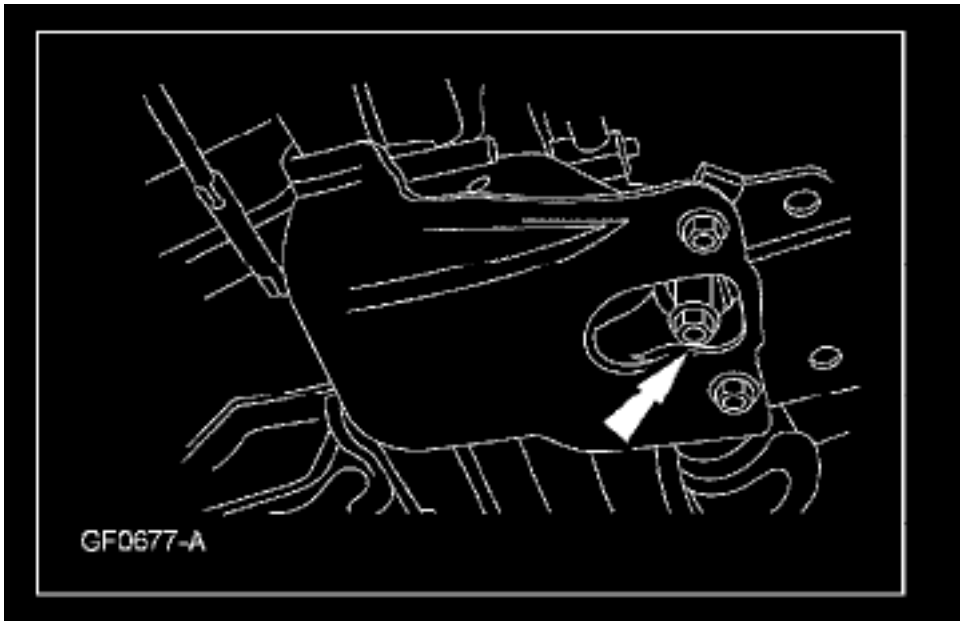
Item	Part Number	Description
1	—	Ride height = A - B
2	—	Measurement point A
3		Measurement point B

Ride Height Measurement - Four Wheel Drive (4WD)

Ride Height Measurement - Rear Wheel Drive (RWD)

NOTE: Make sure that the vehicle is positioned on a flat, level surface and the tires are inflated to the correct pressure. Vehicle should have a full tank of fuel.

1. To obtain rear ride height, measure the distance between points A and B. For additional information, refer to Specifications.



Alignment: Service and Repair Suspension Design Height Setting

Suspension Design Height Setting

NOTE: Make sure the vehicle is on a flat, level surface, such as a drive-on hoist.

1. Jounce the vehicle's front and rear suspension to normalize the vehicle static ride height. 2. Measure the ride height.

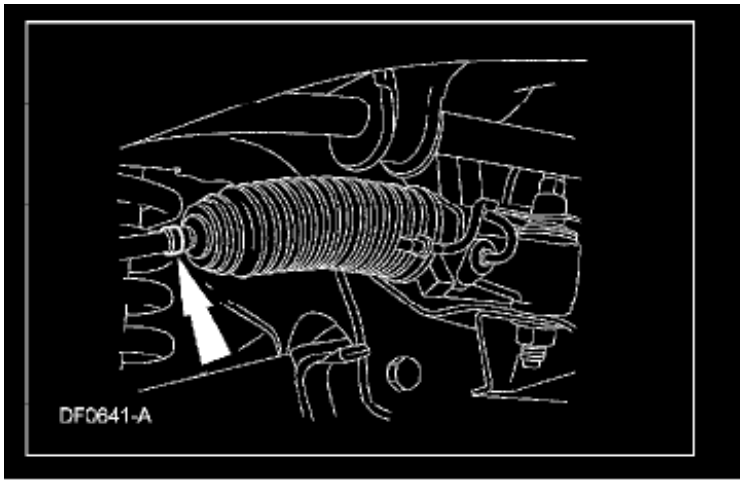
3. NOTE: The torsion bar adjusting bolt is coated with a thread locking compound that wears off after disassembly. If the torsion bar system is ever

disassembled or if the torsion bar adjusting bolt is ever removed, use a new torsion bar adjusting bolt when assembling.

Adjust the ride height as follows: ^

To increase the ride height, tighten the torsion bar adjusting bolt.

^ To decrease the ride height, loosen the torsion bar adjusting bolt.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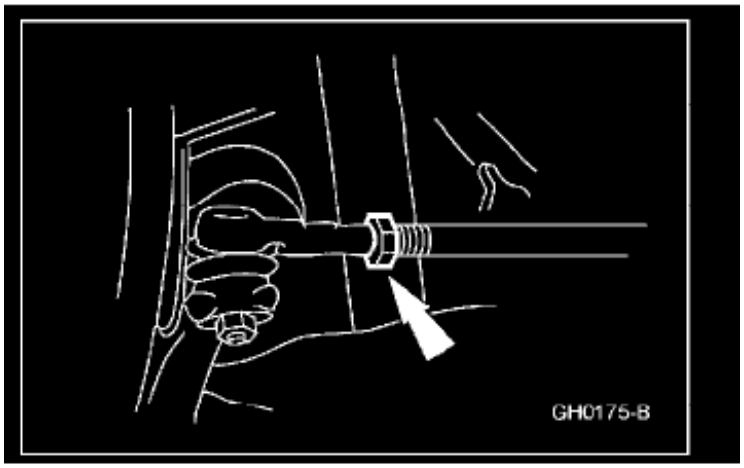
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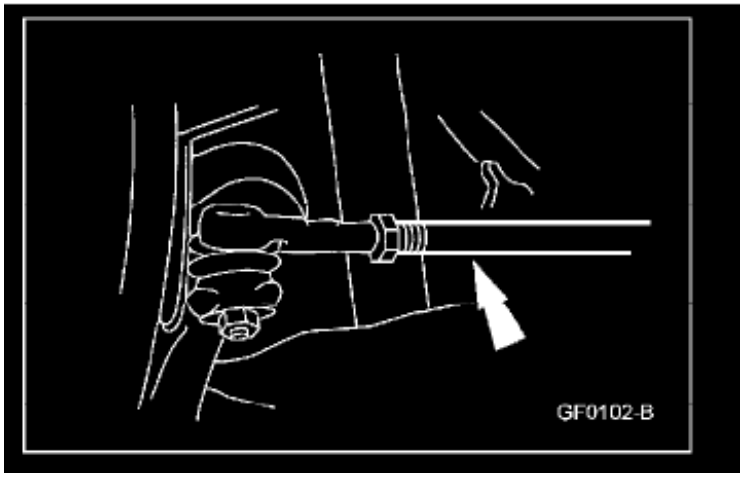

GF0102-B

Alignment: Service and Repair Toe Adjustment

Toe Adjustment

1. Start the engine and center the steering wheel. 2. Turn the engine OFF and, using a suitable holding device, lock the steering wheel in the straight ahead position. 3. Using alignment equipment and the manufacturer's instructions, measure the toe. 4. Remove the steering gear bellows clamps.

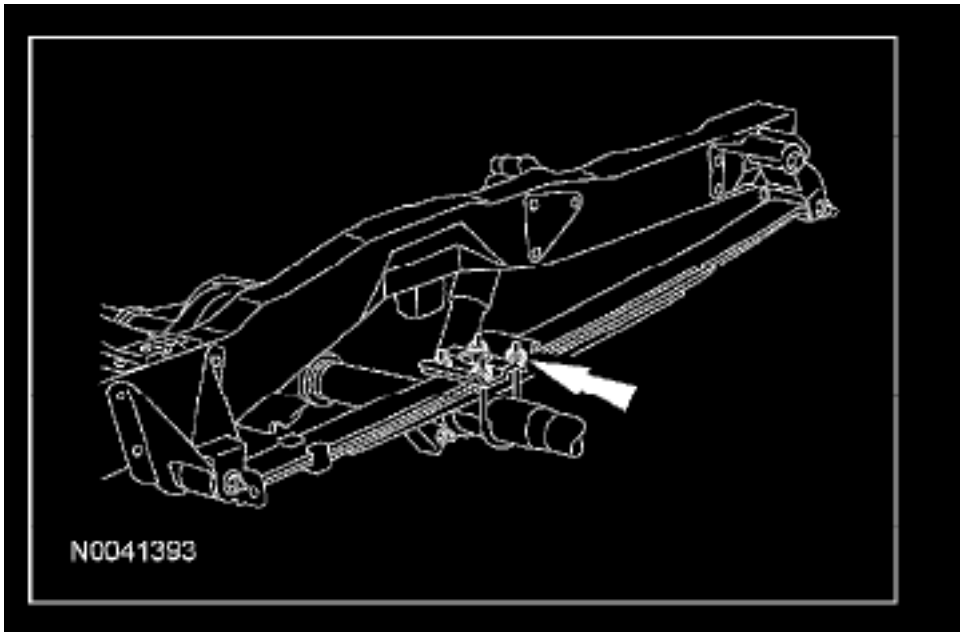
5. Loosen the tie-rod jam nuts.

6. CAUTION: Do not allow the steering gear bellows to twist when the front wheel spindle tie rod is rotated or damage to the bellows may

occur.

Rotate the inner tie rods until the toe setting is within specifications.

7. Tighten the tie-rod jam nuts to 80 Nm (59 lb-ft). 8. Install the steering gear bellows clamps. 9. Recheck the toe settings and adjust as necessary.



Alignment: Service and Repair Lean Correction - Rear

Lean Correction - Rear

NOTE: A side-to-side lean may be adjusted by 6 mm (0.25 inch). This is accomplished by placing a shim (D7TZ-5742-A) between the rear spring and the axle on the low side of the vehicle.

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Using a suitable jack, support the rear axle. 3. Remove and discard the 4 U-bolt nuts and U-bolts.

^ Remove the spring plate.

^ To install, tighten to 115 Nm (85 lb-ft).

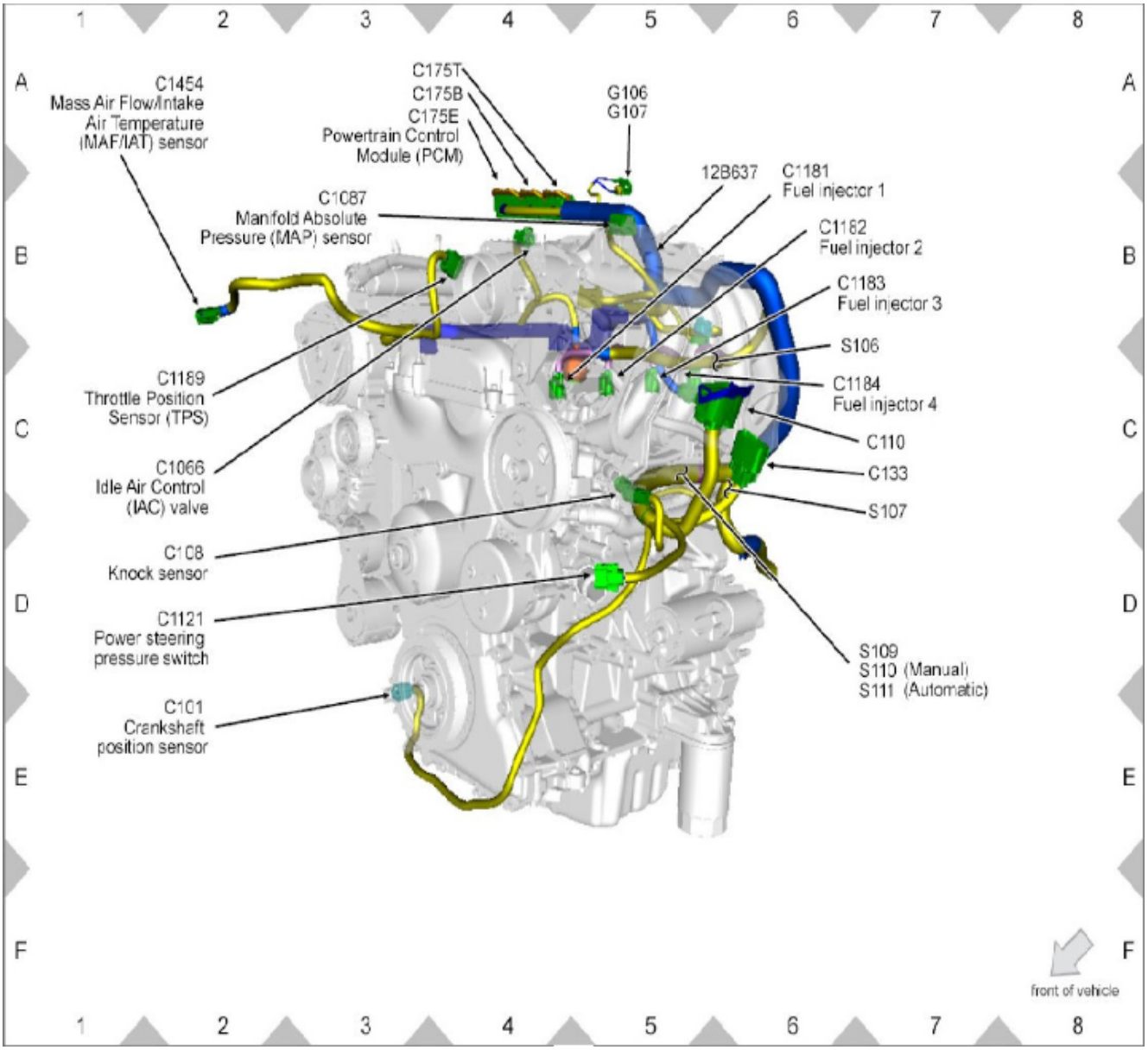
4. Using the jack, lower the rear axle approximately 13 mm (0.51 inch).

5. NOTE: Make sure that the spring locator bolt is centered in the spacer hole.

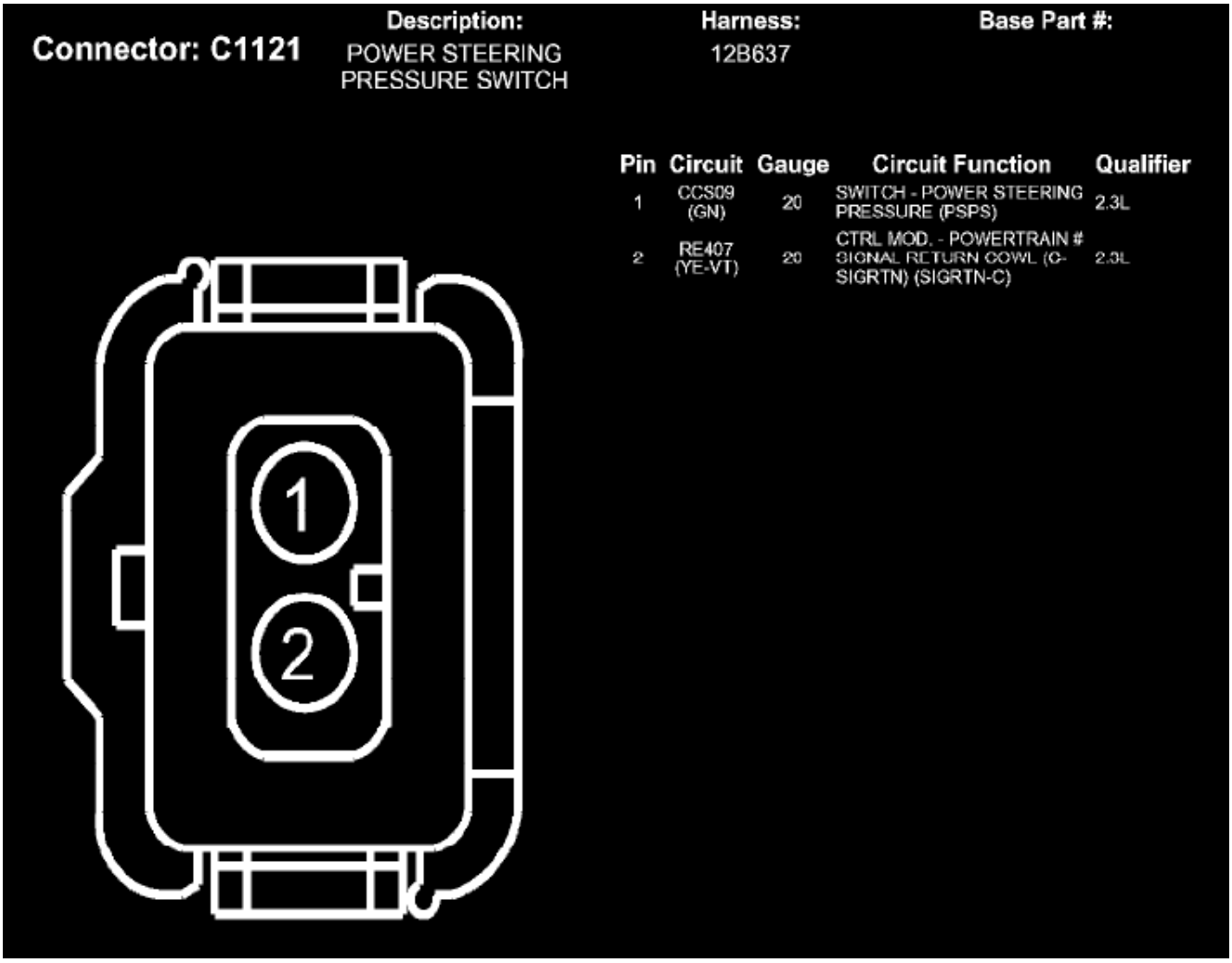
NOTE: On vehicles equipped with a spring spacer block, place the shim between the rear spring and the axle spacer.

Install the spacer (D7TZ-5742-A) between the spring and the axle.

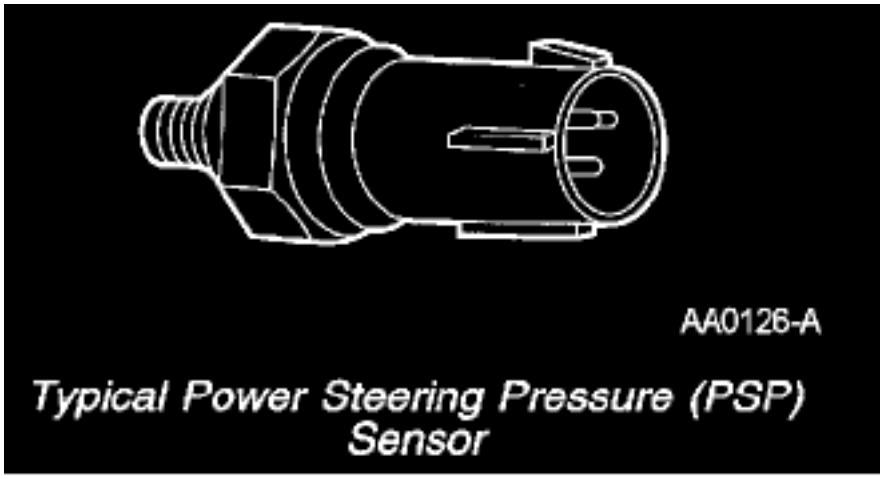
Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Steering and Suspension > Sensors and Switches - Steering and Suspension > Sensors and Switches - Steering > Power Steering Pressure Switch > Component Information > Locations



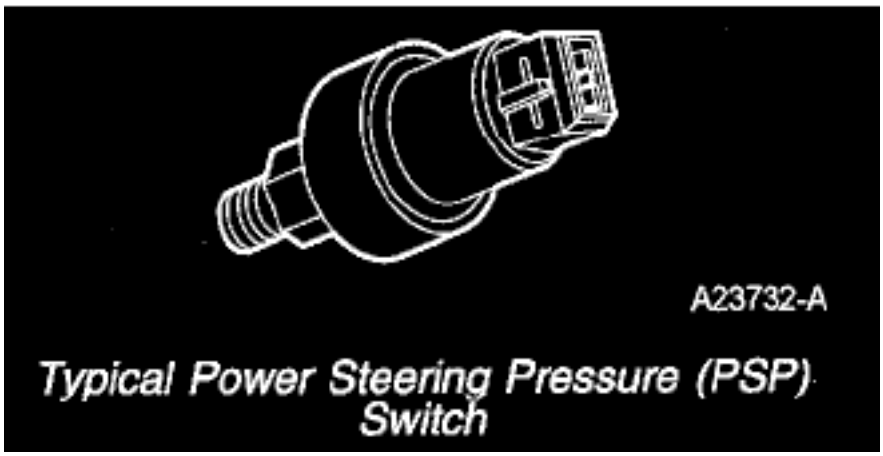
View 151-3


Connector: C1121
Description:
POWER STEERING PRESSURE SWITCH
Harness:
12B637
Base Part #:
Pin Circuit Gauge Circuit Function Qualifier
1 CCS09 (GN) 20 SWITCH - POWER STEERING PRESSURE (PSPS) 2.3L
2 RE407 (YE-VT) 20 CTRL MOD. - POWERTRAIN # SIGNAL RETURN COWL (C-SIGRTN) (SIGRTN-C) 2.3L
1
2

C1121



Typical Power Steering Pressure (PSP) Sensor



Typical Power Steering Pressure (PSP) Switch

Power Steering Pressure Switch: Description and Operation

Power Steering Pressure (PSP) Sensor

Typical Power Steering Pressure (PSP) Sensor

The PSP sensor monitors the hydraulic pressure within the power steering system. The PSP sensor voltage input to the PCM changes as the hydraulic pressure changes. The PCM uses the input signal from the PSP sensor to compensate for additional loads on the engine by adjusting the

idle RPM and preventing engine stall during parking maneuvers. Also, the PSP sensor signals the PCM to adjust the transmission electronic pressure control (EPC) pressure during increased engine load, for example, during parking maneuvers.

Power Steering Pressure (PSP) Switch

Typical Power Steering Pressure (PSP) Switch

The PSP switch monitors the hydraulic pressure within the power steering system. The PSP switch is a normally closed switch that opens as the hydraulic pressure increases. The PCM provides a low current voltage on the PSP circuit. When the PSP switch is closed, this voltage is pulled low through the SIG RTN circuit. The PCM uses the input signal from the PSP switch to compensate for additional loads on the engine by adjusting the idle RPM and preventing engine stall during parking maneuvers. Also, the PSP switch signals the PCM to adjust the transmission electronic pressure control (EPC) pressure during increased engine load, for example during parking maneuvers.

Special Tool(s)

ST2941-A	Activation Tool, Tire Pressure Monitor 204-363
ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Tire Pressure Sensor: Testing and Inspection Tire Pressure Monitoring System (TPMS) Sensor Training

Tire Pressure Monitoring System (TPMS) Sensor Training

NOTE: If the vehicle has been stationary for more than 30 minutes, the sensors will go into a "sleep mode" to conserve battery power. It will be necessary to wake them up so they will transmit the latest tire pressure information to the smart junction box (SJB). For additional information, refer to Tire Pressure Monitoring System (TPMS) Sensor Activation.

NOTE: The tire pressure sensor training procedure must be done on a single vehicle, in an area without radio frequency noise and at least 1 m (3 ft) away from other vehicles equipped with tire pressure monitoring system (TPMS). Radio frequency noise is generated by electrical motors and appliance operation, cellular telephones, remote transmitters, power inverters and portable entertainment equipment.

NOTE: If a sensor does not respond to the activation tool, attempt to activate the same sensor with the activation tool. If the sensor still does not respond, move the vehicle to rotate the wheels at least 1/4 of a turn and attempt to activate the same sensor again.

NOTE: The SJB has a 2-minute time limit between sensor responses. If the SJB does not recognize any 1 of the 4 tire pressure sensors during this time limit, the horn will sound twice and the message center (if equipped) will display TIRE NOT TRAINED REPEAT and the entire procedure must be repeated.

1. NOTE: For vehicles with different front and rear tire pressures (such as the E-Series and certain F-Series), the tire pressure sensors must be

trained following a tire rotation. Failure to train the sensors will cause the TPMS indicator to illuminate. For vehicles with the same tire pressure for front and rear tires, tire rotation will not affect the system.

Turn the ignition switch to the OFF position, then press and release the brake pedal.

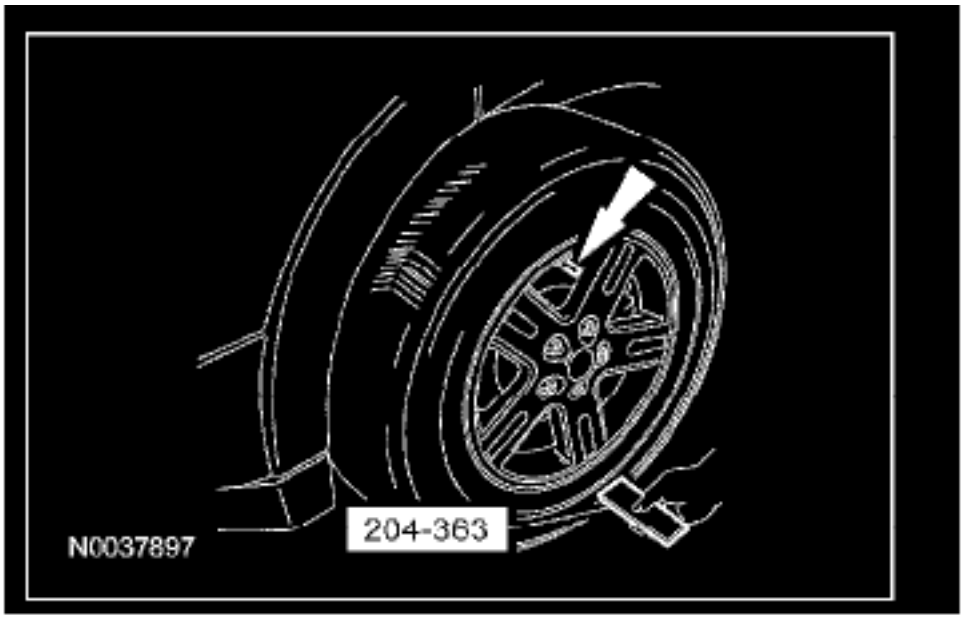
2. Cycle the ignition switch from the OFF position to the RUN position 3 times, ending in the RUN position. 3. Press and release the brake pedal. 4. Turn the ignition switch to the OFF position. 5. Turn the ignition switch from the OFF position to the RUN position 3 times, ending in the RUN position.

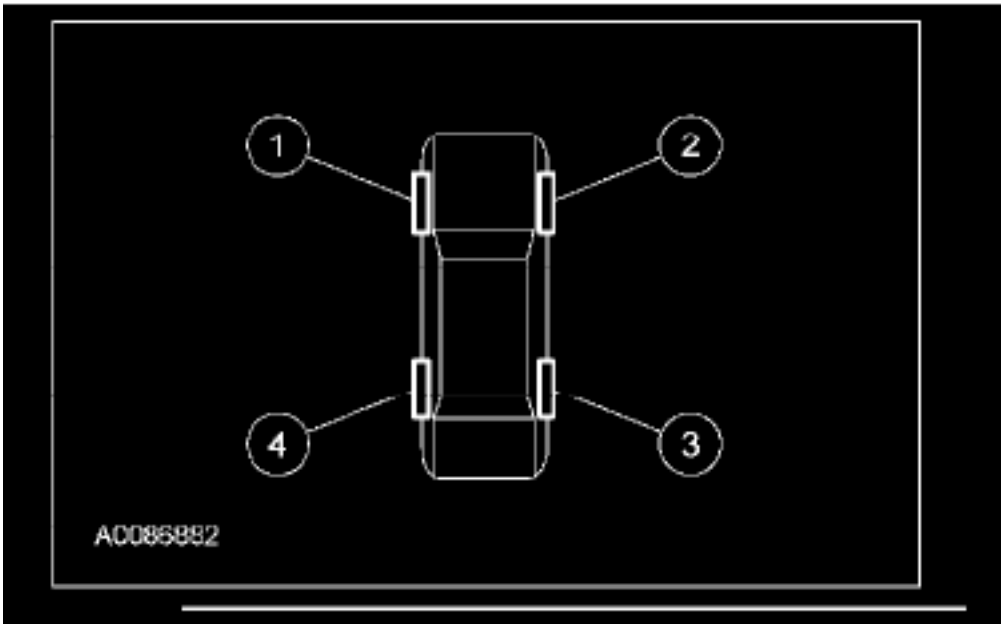
^ The horn will sound once and the TPMS indicator will flash if the training mode has been entered successfully. If equipped, the message center will display TRAIN LF TIRE.

6. NOTE: It may take up to 6 seconds to activate a tire pressure sensor. During this time, the activation tool must remain in place 180 degrees from

the valve stem.

Place the activation tool on the LF tire sidewall opposite (180 degrees) from the valve stem. Press and release the test button on the special tool. The horn will sound briefly to indicate that the tire pressure sensor has been recognized by the SJB.





7. Within 2 minutes of the horn sounding, place the activation tool on the RF tire sidewall opposite (180 degrees) from the valve stem and press and

release the test button to train the RF tire pressure sensor.

8. NOTE: Do not wait more than 2 minutes between training each sensor or the SJB will time out and the entire procedure must be repeated.

Repeat Step 7 for the RR and LR tires. ^

The procedure is completed after the last tire has been trained. When the training procedure is complete, the message center (if equipped) will display TIRE TRAINING COMPLETE.

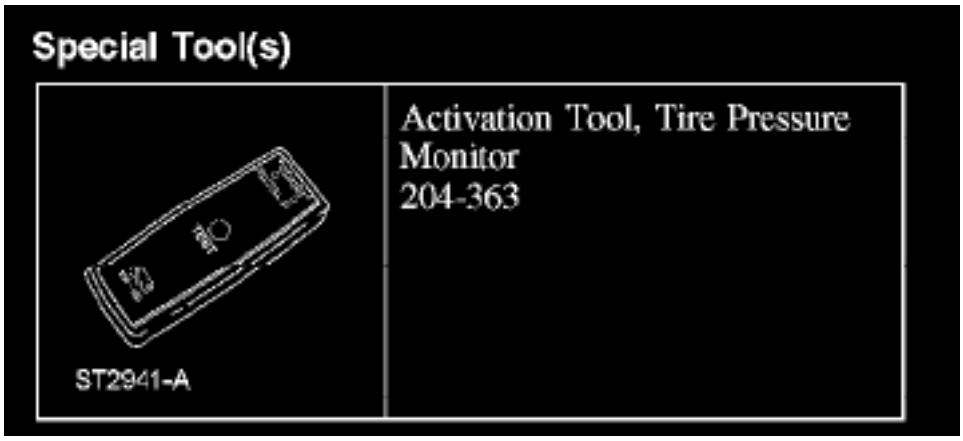
^ For vehicles not equipped with a message center, successful completion of the training procedure will be verified by turning the ignition switch to the OFF position without the horn sounding. If the horn sounds twice when the switch is turned to the OFF position, the training procedure was not successful.

9. Using the scan tool, locate the updated TPMS sensor IDs trained to the SJB and document them on the applicable warranty claim.

10. NOTE: This step is required to clear DTC C2780, cause the SJB to exit the manufacturing mode and to make sure there are no other concerns

with a newly programmed SJB.

If the sensors are being trained due to the installation of a new SJB, clear any DTCs and perform the SJB on-demand self test.



Tire Pressure Sensor: Testing and Inspection Tire Pressure Monitoring System (TPMS) Sensor Activation

Tire Pressure Monitoring System (TPMS) Sensor Activation

NOTE: The tire pressure sensors will go into a 14 sleep mode" after 30 minutes of inactivity to conserve battery power. The sensors do not transmit information while in sleep mode, it will be necessary to wake them up so they will transmit the latest tire pressure information.

1. Turn the ignition switch to the ON position. 2. Position the tire pressure monitor activation tool against the LF tire sidewall 180 degrees from the tire valve stem.

3. NOTE: The activation tool will provide feedback in the form of a flashing green light and a beep sound for each successful response from a tire

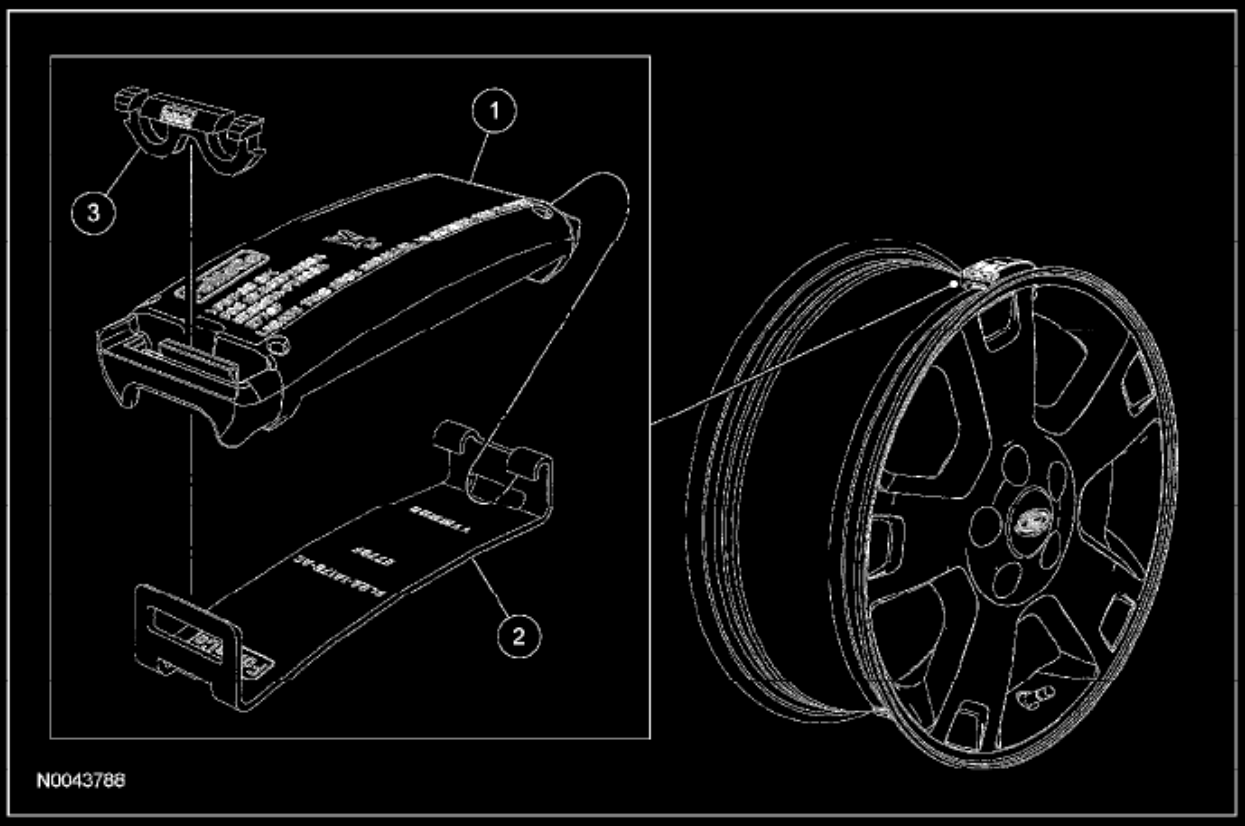
pressure sensor.

Press the test button on the activation tool to activate the sensor, activate the sensor at least 2 times.

4. Repeat Steps 2 and 3 for the remaining tires. 5. If the tire pressure monitoring system (TPMS) indicator remains illuminated after adjusting and activating each sensor, refer to the Symptom Chart

in Diagnosis and Testing.

Tire Pressure Monitoring System (TPMS) Sensor



Item	Part Number	Description
1	1A150/1A189	Tire pressure sensor/sensor kit
2	1A175	Sensor cradle

(Continued)

Item	Part Number	Description
3	14C202	Locking clip (also part of 1A189)

Tire Pressure Sensor: Service and Repair Tire Pressure Monitoring System (TPMS) Sensor

Tire Pressure Monitoring System (TPMS) Sensor

Tire Pressure Monitoring System (TPMS) Sensor

Disassembly

WARNING: The tire pressure monitoring system (TPMS) sensor battery may release hazardous chemicals if exposed to extreme mechanical damage. If these chemicals contact the skin or eyes, flush immediately with water for a minimum of 15 minutes and get prompt medical attention. If any part of the battery is swallowed, contact a physician immediately. When disposing of TPMS sensors, follow the correct procedures for hazardous material disposal. Failure to follow these instructions may result in serious personal injury.

NOTE: Tire pressure sensors are equipped with Lithium-ion batteries and must be disposed of accordingly.

NOTE: Tire pressure sensors are manufactured in multiple colors based on their application. When installing a new sensor, make sure the color of the sensor being installed matches the color of the sensor that was removed. The different colored sensors are not interchangeable.

NOTE: The sensor can be removed and installed without removing the strap or the cradle.

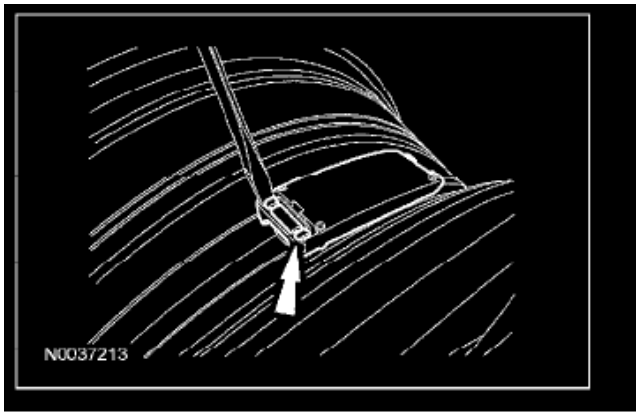
1. CAUTION: The sensor, cradle and strap may be damaged by incorrect tire mounting or dismounting. Dismount the tire only as

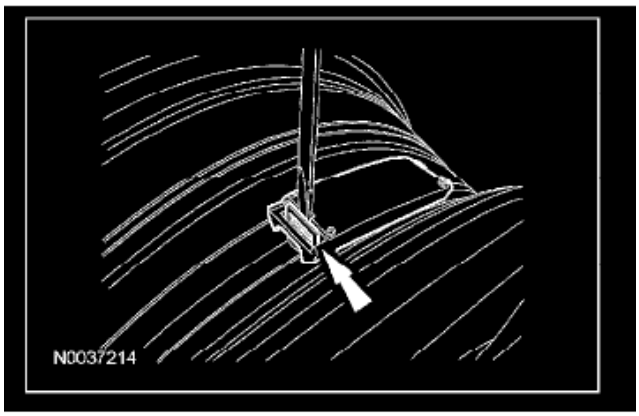
instructed.

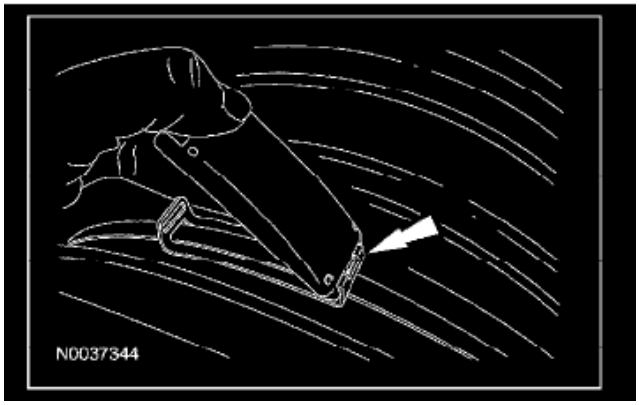
Remove the tire from the wheel.

2. CAUTION: Do not use a large screwdriver. Apply minimum force during removal or damage to the sensor locking clip may occur.

Using a pocket screwdriver or similar tool, remove the sensor locking clip.







3. CAUTION: Do not use a large screwdriver. Apply minimum force during removal or damage to the sensor may occur.

Using a pocket screwdriver or similar tool, detach the sensor from the cradle.

4. Remove the sensor.

Assembly

1. CAUTION: Damage to the sensor may occur if excessive force is applied during sensor installation.

NOTE: Make sure the sensor is fully seated into the cradle. The sensor will make a "click" noise when correctly seated.

Position the sensor into the cradle by inserting the hinge end of the sensor into the hook end of the cradle and pushing the opposite end of the sensor down onto the cradle.

2. NOTE: The locking clip can only be fully seated when installed in the correct orientation. If the sensor locking clip cannot be fully inserted, then

the sensor may not be fully seated on the cradle or the locking clip may be inserted backward.

Insert a new locking clip into the sensor.

3. CAUTION: The sensor, cradle and strap may be damaged by incorrect tire mounting or dismounting. Mount the tire only as instructed.

Install the tire onto the wheel.

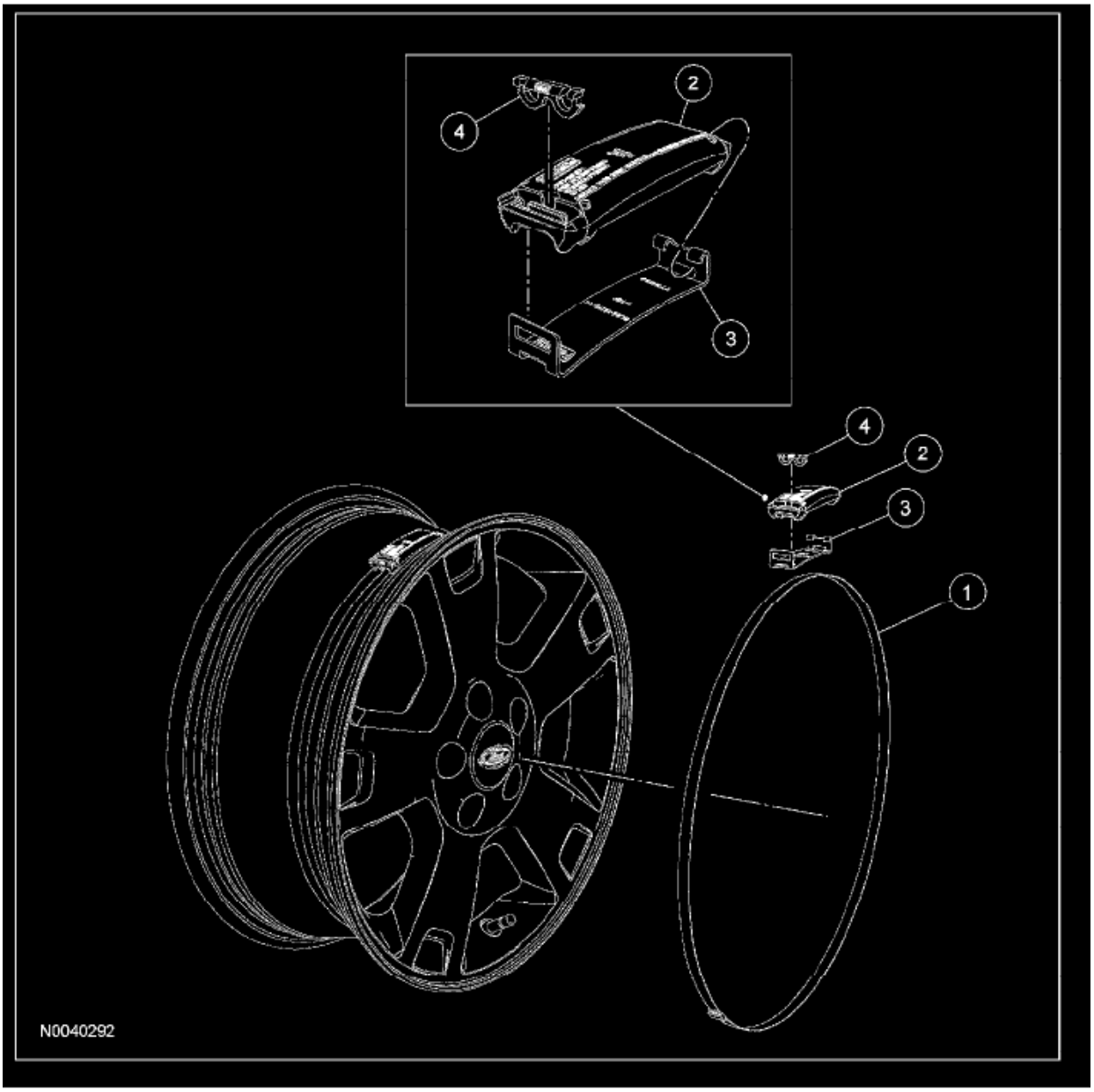
4. NOTE: A new tire pressure sensor is shipped in an off mode (or battery saver mode) and must be turned on before it can be trained. To turn the

sensor on, install it on a wheel, mount the tire and inflate the tire to the recommended inflation pressure. Wait at least 2 minutes, then continue with the sensor training procedure.

Train the tire pressure sensor(s).

Material

Item	Specification
Wheel and Tire Cleaner ZC-27-A or B	—

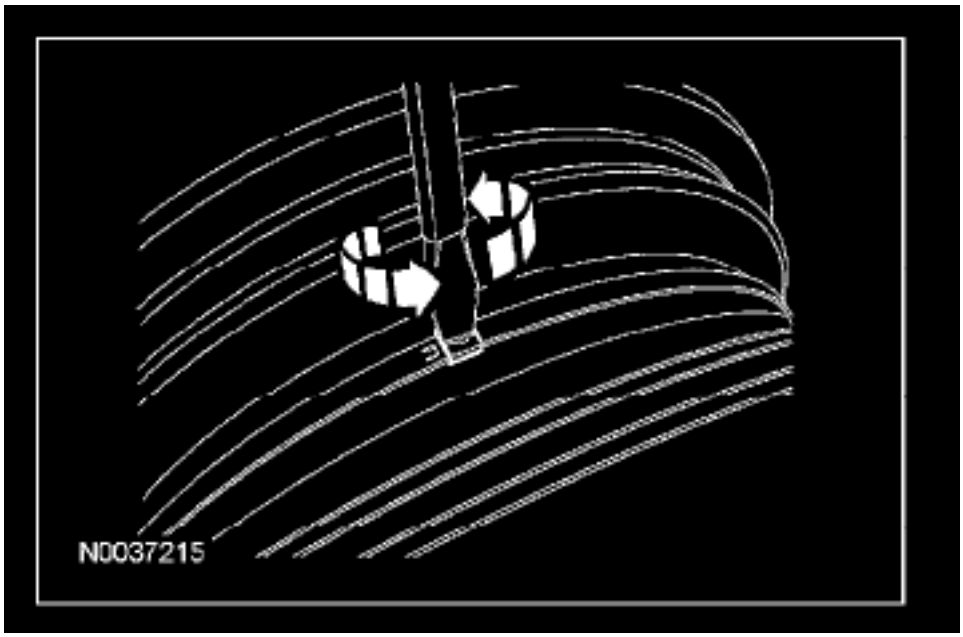


Item	Part Number	Description
1	1A177/1A193	Strap/strap kit
2	1A150/1A189	Tire pressure sensor/sensor kit
3	1A175	Sensor cradle (also part of 1A193)
4	14C202	Locking clip (also part of 1A189)

Tire Pressure Sensor: Service and Repair Tire Pressure Monitoring System (TPMS) Strap and Cradle

Tire Pressure Monitoring System (TPMS) Strap and Cradle

Disassembly



WARNING: The tire pressure monitoring system (TPMS) sensor battery may release hazardous chemicals if exposed to extreme mechanical damage. If these chemicals contact the skin or eyes, flush immediately with water for a minimum of 15 minutes and get prompt medical attention. If any part of the battery is swallowed, contact a physician immediately. When disposing of TPMS sensors, follow the correct procedures for hazardous material disposal. Failure to follow these instructions may result in serious personal injury.

NOTE: Tire pressure sensors are equipped with Lithium-ion batteries and must be disposed of accordingly.

NOTE: Tire pressure sensors are manufactured in multiple colors based on their application. When installing a new sensor, make sure the color of the sensor being installed matches the color of the sensor that was removed. The different colored sensors are not interchangeable.

NOTE: The sensor is available separately, the cradle and strap are available as a strap kit. There are several different strap kits available based on wheel diameter but all strap kits share the same base part number.

1. Remove the tire pressure monitoring system (TPMS) sensor.

2. WARNING: Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.

WARNING: Wear protective gloves when handling components or parts that have pointed or sharp edges. Failure to follow this instruction may result in serious personal injury.

Remove a factory installed strap in the following sequence: 1

Locate the strap buckle and secure the strap to the wheel using duct tape or a similar item, on both sides of the buckle approximately 25 mm (0.98 inch) from the buckle.

2 Using a large screwdriver and a twisting motion, unbuckle the strap.

3 Discard the strap.

3. To remove a dealer installed strap, turn the worm gear screw until the strap is fully released from the worm gear.

^ Discard the strap.

4. NOTE: To aid assembly, mark the location of the cradle prior to disassembly.

Using a screwdriver, or similar tool, remove the cradle by inserting the screwdriver under the cradle and prying up.

Assembly

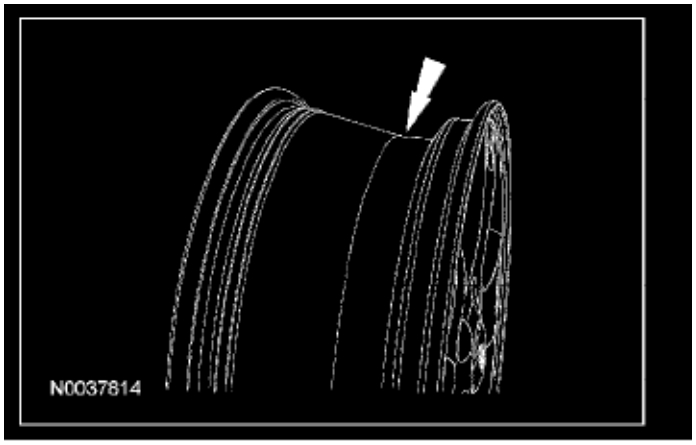
1. NOTE: Make sure the sensor is fully seated into the new cradle. The sensor will make a "click" noise when fully seated.

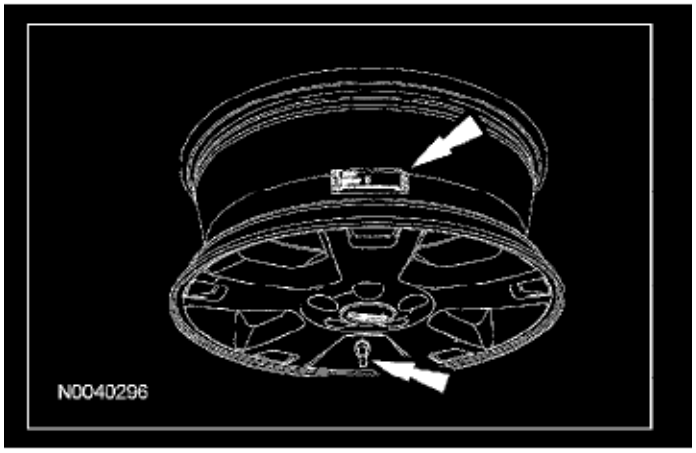
Position the sensor into the new cradle by inserting the hinge end of the sensor into the hook end of the cradle and pushing the opposite end of the sensor down onto the cradle.

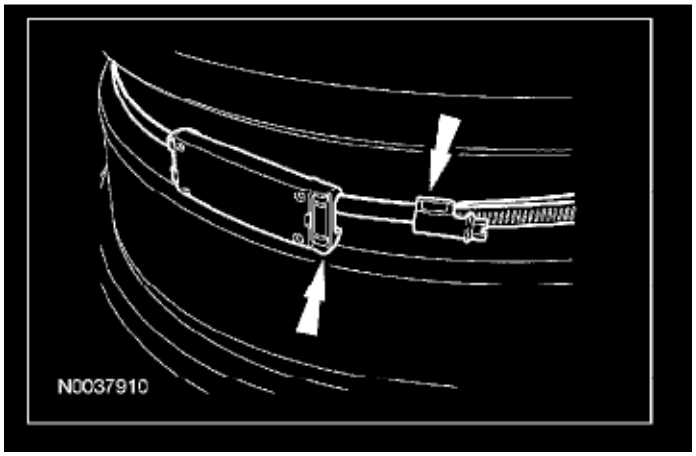
2. CAUTION: Metal scrapers may damage the wheel. Use only plastic or non-metallic scrapers to remove the cradle adhesive strip residue.

NOTE: The sensor and cradle must be installed in the drop well of the wheel, 180 degrees from the valve stem.

Clean the area where the sensor and cradle are to be installed.







3. NOTE: The sensor and cradle must be positioned with the hinge side of the sensor on the RH side when viewed from the curb side (beauty side)

of the wheel.

NOTE: The sensor has raised markings indicating how to position the sensor.

Remove the adhesive tape liner from the cradle and position the sensor and cradle into the wheel drop well 180 degrees from the valve stem.

4. Install the tapered end of the strap through the opening of the cradle on the hinge side of the sensor. This will position the worm gear on the

locking clip side of the sensor.

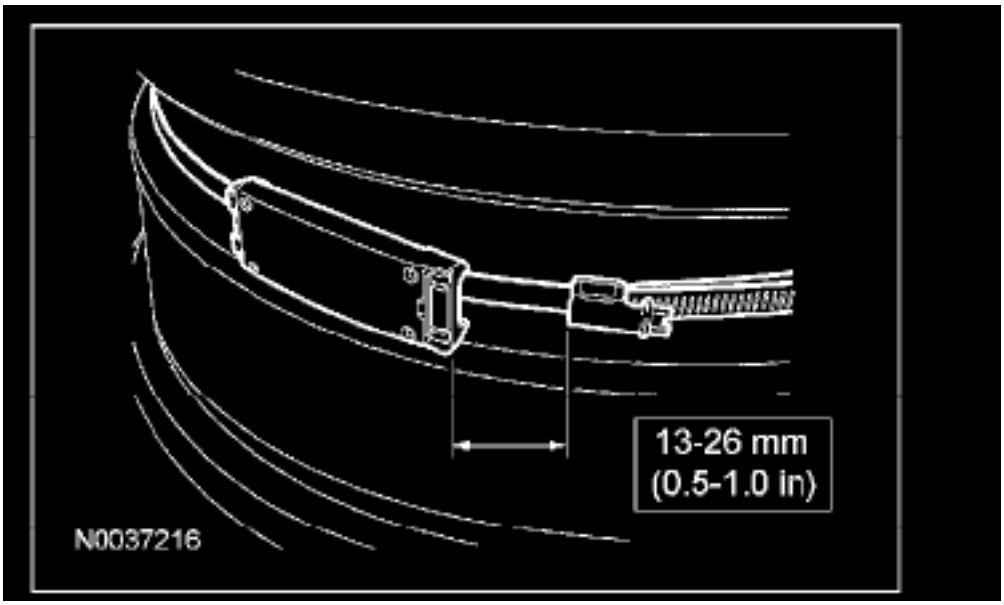
5. CAUTION: Steel wheels have a "high spot" along their circumference. Make sure the strap and sensor are mounted at the lowest spot

possible to avoid damaging the sensor during wheel and tire disassembly and assembly.

NOTE: Keep the strap parallel with the wheel flange while tightening the worm gear.

Position the worm gear 13-26 mm (0.5-1.0 inch) away from the sensor and tighten the worm gear.
^

Tighten to 3 Nm (27 lb-inch).



6. CAUTION: The sensor, cradle and strap may be damaged by incorrect tire mounting or dismounting. Mount the tire only as instructed.

Install the tire onto the wheel.

7. NOTE: A new tire pressure sensor is shipped in an off mode (or battery saver mode) and must be turned on before it can be trained. To turn the

sensor on, install it on a wheel, mount the tire and inflate the tire to the recommended inflation pressure. Wait at least 2 minutes, then continue with the sensor training procedure.

Train the tire pressure sensor(s).

Special Tool(s)

ST2670-A	Evacuation Cap, Power Steering 211-265 or equivalent
ST1178-A	Vacuum Pump Kit 416-D002 (D95L-7559-A) or equivalent

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V

Power Steering Bleeding: Service and Repair

Power Steering System Purging

CAUTION: If the air is not purged from the power steering system correctly, premature power steering pump failure may result. The condition may occur on pre-delivery vehicles with evidence of aerated fluid or on vehicles that have had steering component repairs.

1. NOTE: A whine heard from the power steering pump can be caused by air in the system. The power steering purge procedure must be carried out

prior to any component repair for which power steering noise complaints are accompanied by evidence of aerated fluid.

Remove the power steering pump reservoir cap. Check the fluid.

2. Raise the front wheels off the floor. 3. Tightly insert the stopper of the vacuum pump into the reservoir. 4. Start the engine. 5. Install the vacuum pump, apply vacuum and maintain the maximum vacuum of 68-85 kPa (20-25 in-Hg). 6. If equipped with Hydro-Boost(R), apply the brake pedal twice.

7. CAUTION: Do not hold the steering wheel against the stops for an extended amount of time. Damage to the power steering pump may

occur.

Cycle the steering wheel fully from stop-to-stop 10 times.

8. Stop the engine. 9. Release the vacuum and remove the vacuum pump.

10. NOTE: Do not overfill the reservoir.

Fill the reservoir. ^

Use approved transmission fluid.

11. Start the engine. 12. Install the vacuum pump. Apply and maintain the maximum vacuum of 68-85 kPa (20-25 in-Hg).

13. CAUTION: Do not hold the steering wheel against the stops for an extended amount of time. Damage to the power steering pump may

occur.

Cycle the steering wheel fully from stop-to-stop 10 times.

14. Stop the engine, release the vacuum and remove the vacuum pump.

15. NOTE: Do not overfill the reservoir.

Fill the reservoir as needed and install the reservoir cap.

16. Visually inspect the power steering system for leaks.

17. NOTE: Do not overfill the reservoir.

Fill the reservoir as needed and visually inspect the power steering system for leaks.

18. Install the reservoir cap.

Power Steering Fluid: Specifications

Transfer Case Fluid Type

Ford Part Number ..... Motorcraft MERCON V ATF Ford Part Number XT-5-QM
Ford Specification ..... MERCON V

Power Steering Fluid: Testing and Inspection

Power Steering Fluid Leak Test

NOTE: This test should only be carried out if a leak in the system has not been detected during a thorough visual inspection. Refer to Inspection and Verification.

1. Check the power steering fluid level. If necessary, add the specified power steering fluid. 2. Remove the power steering pump reservoir cap and tightly install the evacuation cap to the power steering pump reservoir. 3. Install the hose from the fill adapter manifold tee to the evacuation cap on the power steering pump reservoir. 4. Install the vacuum pump to the evacuation cap. 5. Using the vacuum pump, apply 68-85 kPa (20-25 in-Hg) of vacuum to the power steering system. 6. Observe the vacuum gauge for 30 seconds. If the vacuum gauge reading drops more than 3 kPa (0.88 in-Hg) a leak is present. 7. Remove the vacuum pump.

8. CAUTION: Do not hold the steering wheel at the stops for an extended amount of time. Damage to the power steering pump may occur.

Start the engine. With the engine at idle, raise the power steering fluid temperature to 74-80° C (165-176° F) by rotating the steering wheel fully to the left and right several times.

9. Visually inspect the system for leaks. If a leak is evident, repair as necessary. If a leak is not evident, add the specified UV fluorescent tracer dye

to the power steering fluid. Use 14.78 ml (1/2 oz) of dye solution for every 1.89L (2 qt) of power steering fluid.

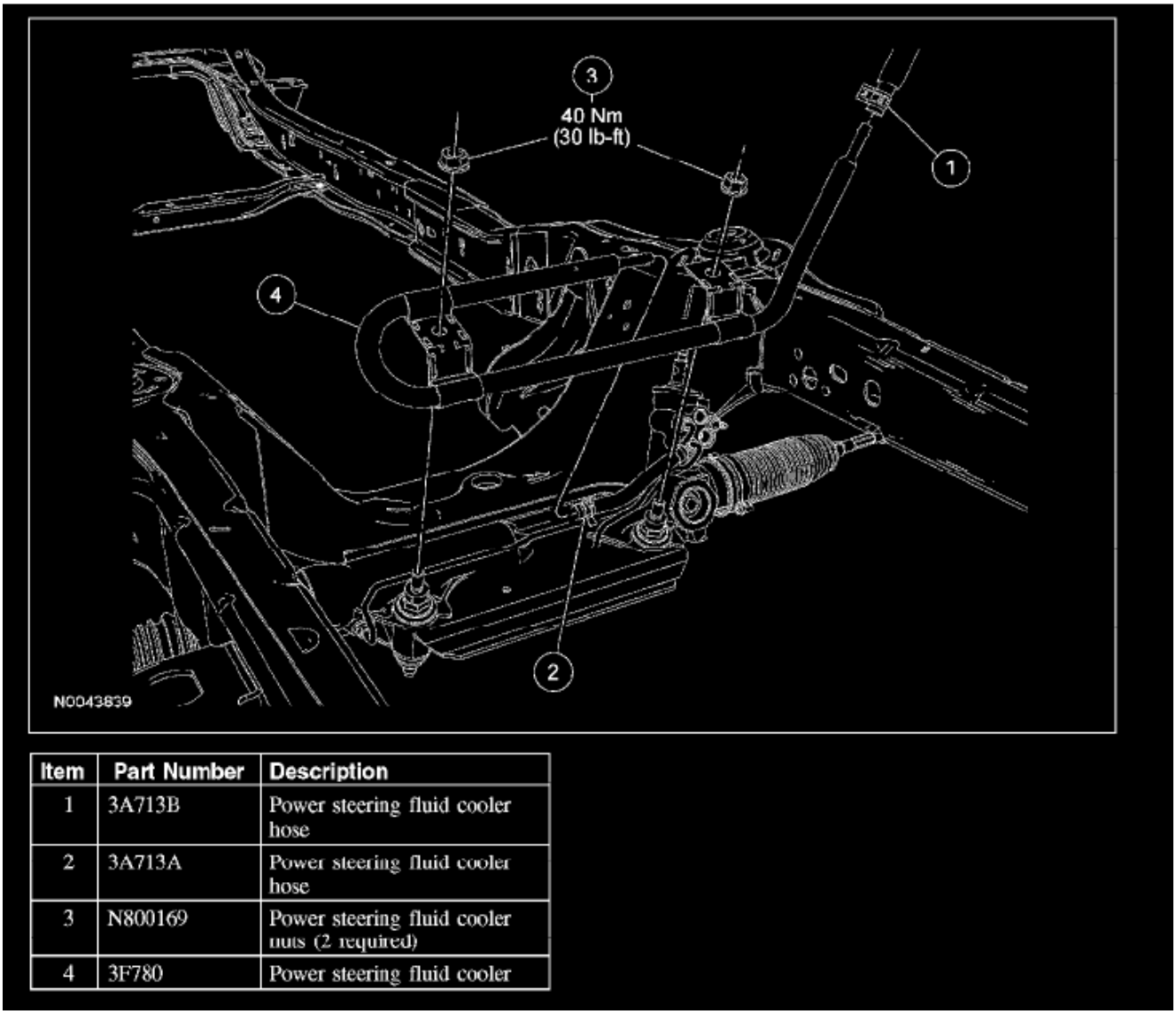
10. CAUTION: Do not hold the steering wheel at the stops for an extended amount of time. Damage to the power steering pump may occur.

Start the engine. With the engine at idle, raise the power steering fluid temperature to 74-80° C (165-176° F) by rotating the steering wheel fully to the left and right several times.

11. Using the special tool (UV lamp), inspect the system for traces of UV dye. Repair as necessary.

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V



Item	Part Number	Description
1	3A713B	Power steering fluid cooler hose
2	3A713A	Power steering fluid cooler hose
3	N800169	Power steering fluid cooler nuts (2 required)
4	3F780	Power steering fluid cooler

Power Steering Fluid Cooler: Service and Repair

Power Steering Fluid Cooler

Removal and Installation

CAUTION: While repairing the power steering system, care should be taken to prevent the entry of foreign material or failure of the power steering components may result.

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Remove the 2 power steering fluid cooler nuts.

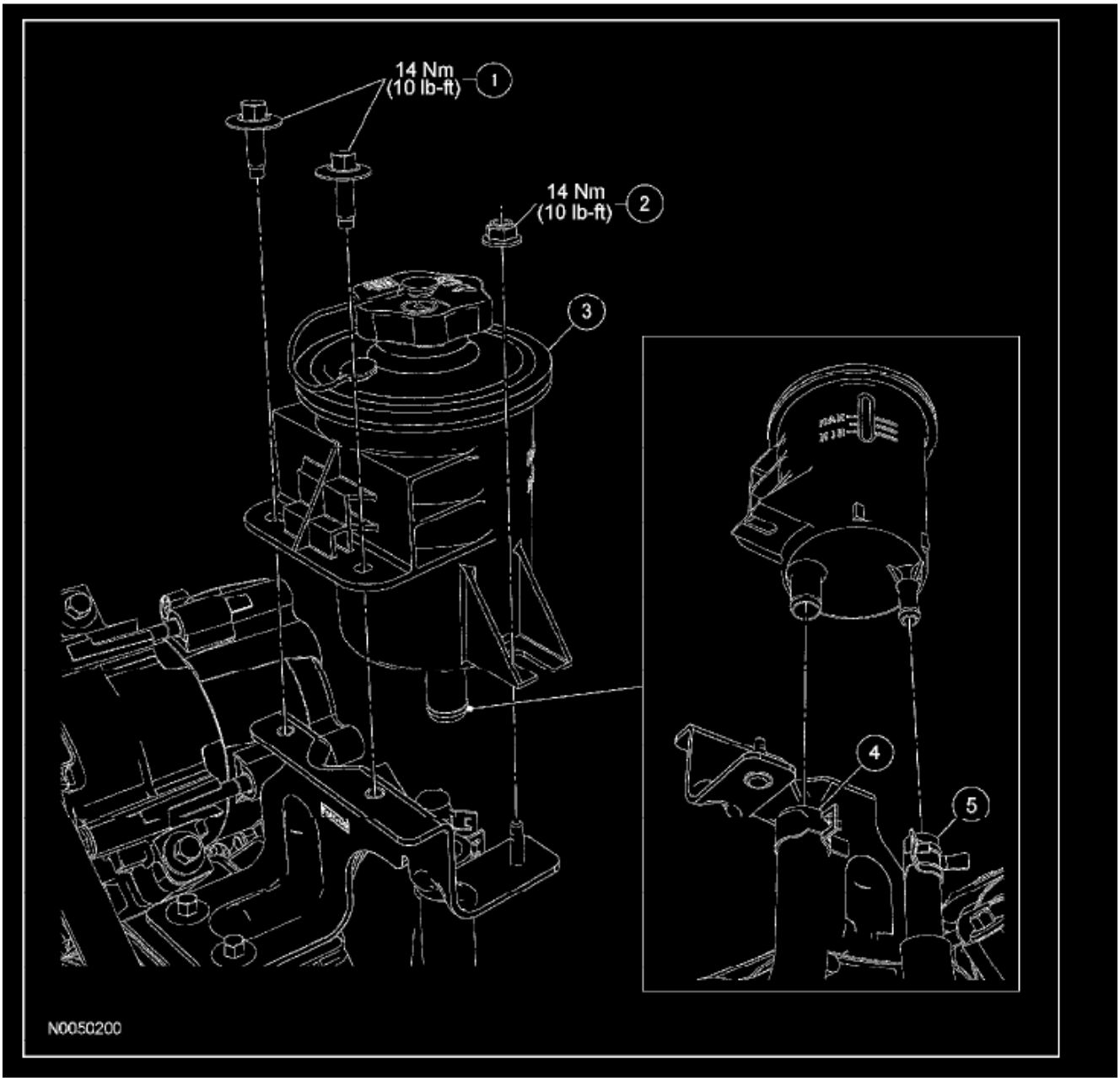
^ To install, tighten to 40 Nm (30 lb-ft).

3. Compress the clamps and disconnect the 2 power steering fluid cooler hoses. 4. To install, reverse the removal procedure.

^ Fill the power steering system.

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US); CXT-5-LM12 (Canada)	MERCON® V



Power Steering Fluid Reservoir: Service and Repair

Power Steering Fluid Reservoir - 3.0L

Item	Part Number	Description
1	W503923	Power steering fluid reservoir bolts (2 required)
2	W520101	Power steering fluid reservoir nut
3	3R700	Power steering fluid reservoir
4	CS7617	Power steering pump supply hose
5	3F731	Return hose

Removal and Installation

CAUTION: While repairing the power steering system, care should be taken to prevent the entry of foreign material or failure of the power steering components may result.

1. CAUTION: Do not allow power steering fluid to contact the engine accessory drive belt or the belt may be damaged.

Using a suitable suction device, remove the power steering fluid from the reservoir.

2. Compress the clamp and disconnect the return hose. 3. Compress the clamp and disconnect the power steering pump supply hose. 4. Remove the power steering fluid reservoir nut.

^ To install, tighten to 14 Nm (10 lb-ft).

5. Remove the 2 bolts and the power steering fluid reservoir.

^ To install, tighten to 14 Nm (10 lb-ft).

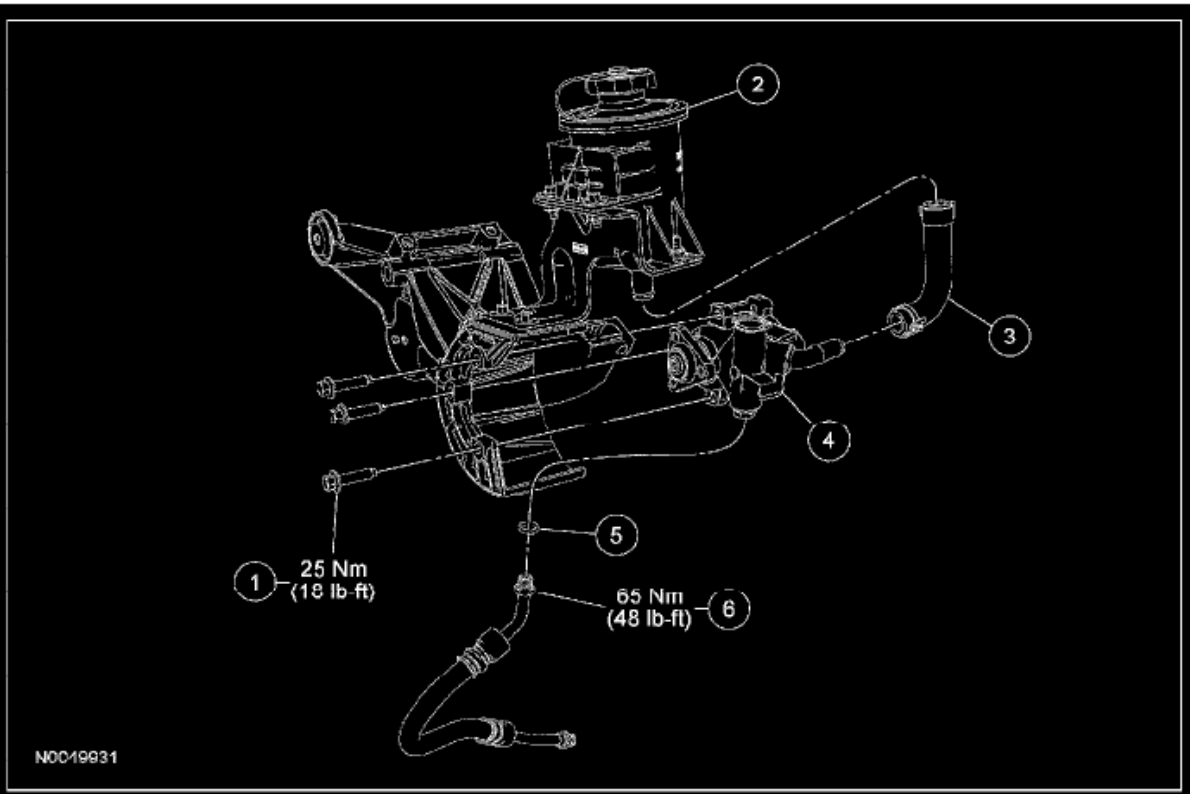
6. To install, reverse the removal procedure. 7. Fill the power steering system.

Special Tool(s)

ST1444-A	Installer Set, Teflon® Seal 211-D027 (D90P-3517-A) or equivalent

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM (or XT-5-QMC) (US), CXT-5-LM12 (Canada)	MERCON® V



Item	Part Number	Description
1	N605784	Power steering pump bolt (3 required)
2	3R700	Power steering fluid reservoir

(Continued)

Item	Part Number	Description
3	CS7617	Power steering pump supply hose
4	3A674	Power steering pump

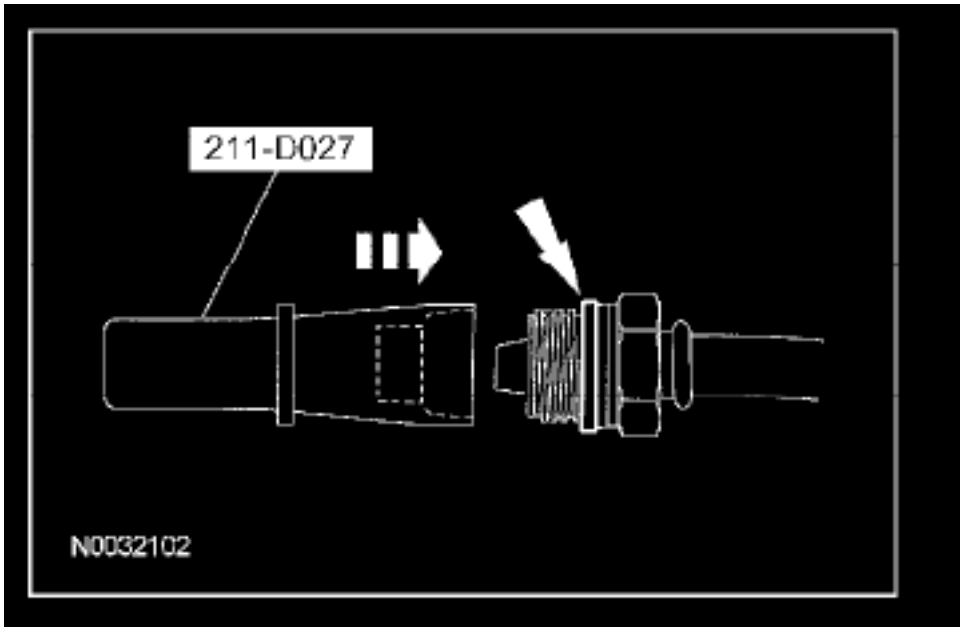
(Continued)

Item	Part Number	Description
5	N803257	Teflon® seal
6	3A719	Pressure line-to-pump fitting

Power Steering Pump: Service and Repair Power Steering Pump

Power Steering Pump - 3.0L

Removal and Installation



CAUTION: While repairing the power steering system, care should be taken to prevent the entry of foreign material or failure of the power steering components may result.

1. CAUTION: Do not allow power steering fluid to contact the engine accessory drive belt or the belt may be damaged.

Using a suitable suction device, remove the power steering fluid from the reservoir.

2. Remove the power steering pump pulley. 3. Disconnect the pressure line-to-pump fitting.

^ Remove and discard the Teflon(R) seal.

^ To install, tighten to 65 Nm (48 lb-ft).

4. Compress the clamp and disconnect the power steering pump supply hose. 5. Remove the 3 bolts and the power steering pump.

^ To install, tighten to 25 Nm (18 lb-ft).

6. CAUTION: A new Teflon(R) seal must be installed any time the pressure line fitting is disconnected from the power steering pump or a

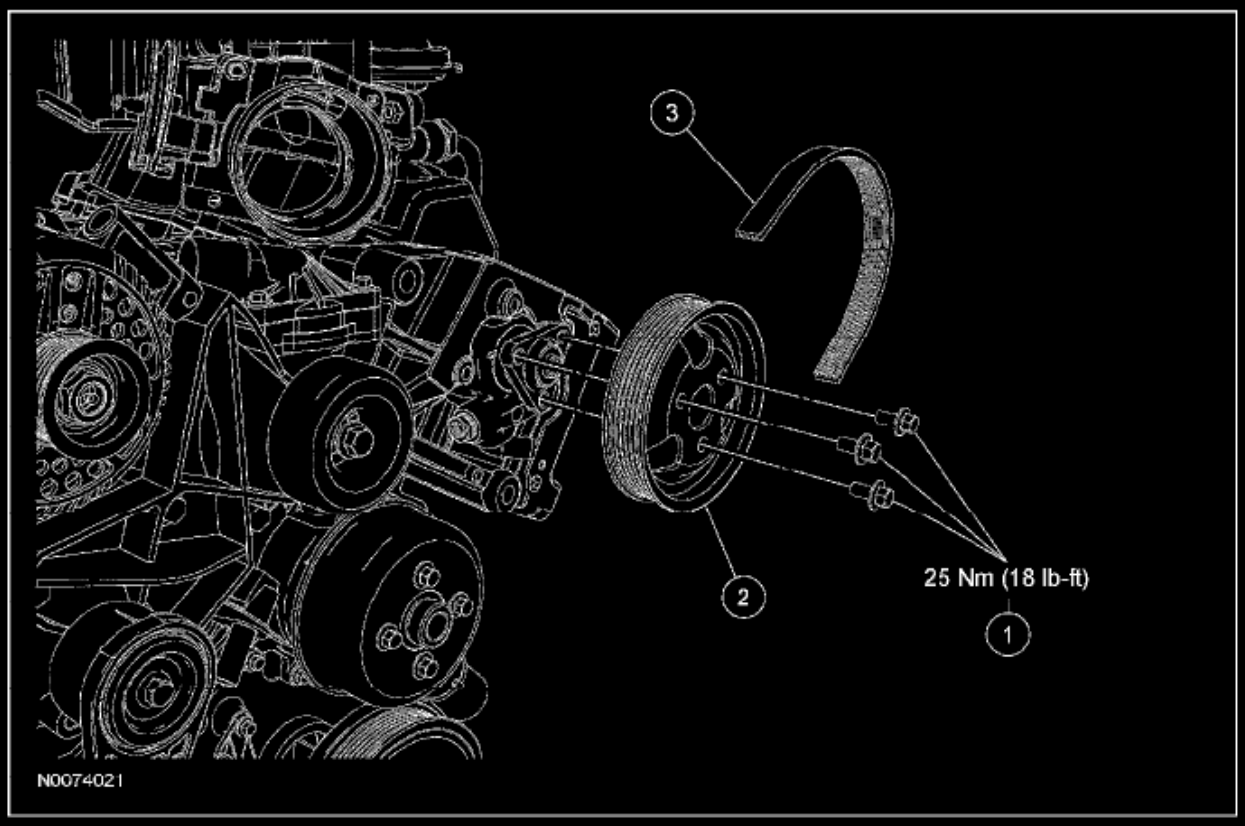
fluid leak may occur.

To install, reverse the removal procedure. ^

Using the special tool, install a new Teflon(R) seal on the pressure line-to-pump fitting.

^ Fill the power steering system.

Power Steering Pump Pulley — 3.0L, 4.0L



Item	Part Number	Description
1	N605784	Power steering pump pulley bolts (3 required)
2	3A733	Power steering pump pulley
3	8620	Accessory drive belt

Power Steering Pump: Service and Repair Power Steering Pump Pulley

Power Steering Pump Pulley - (3.0L), 4.0L

Power Steering Pump Pulley - 3.0L, 4.0L

Removal and Installation

1. NOTE: 4.0L engine shown, 3.0L engine similar.

Loosen the power steering pump pulley bolts.

2. NOTE: For additional information on accessory drive belt routing, refer to Drive Belts, Mounts, Brackets and Accessories.

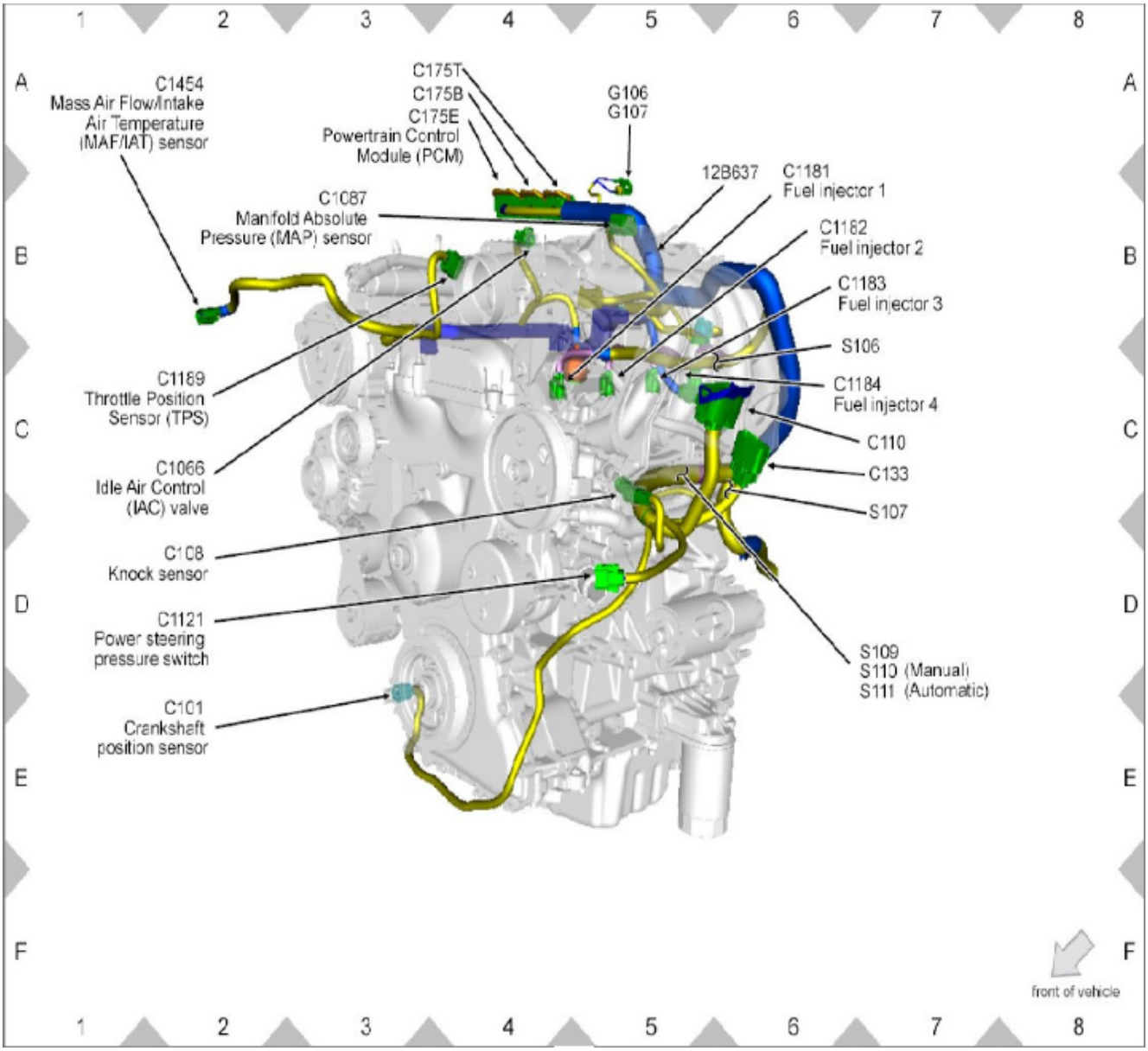
Rotate the accessory drive belt tensioner counterclockwise and position the accessory drive belt aside.

3. Remove the 3 bolts and the power steering pump pulley.

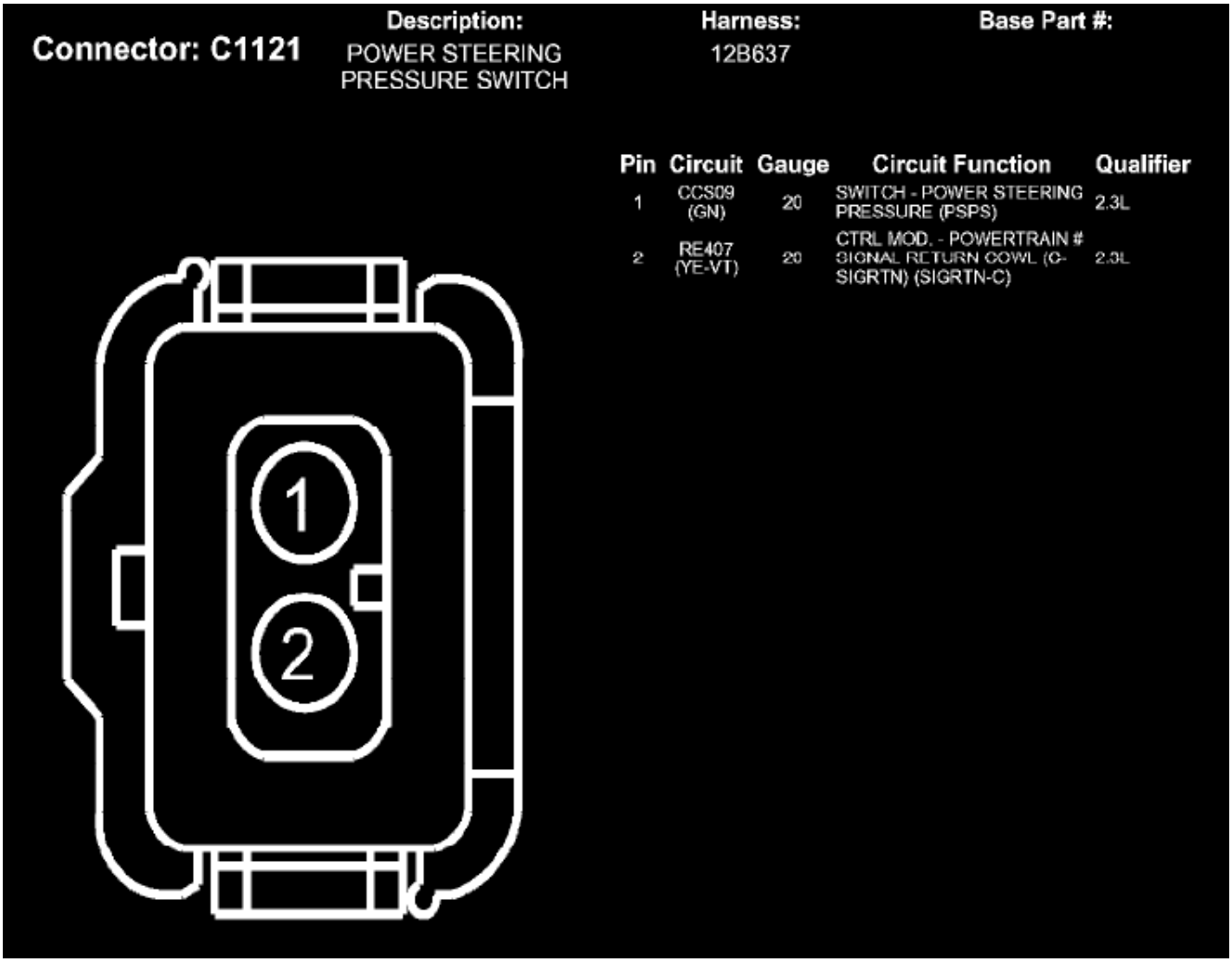
^ To install, tighten to 25 Nm (18 lb-ft).

4. To install, reverse the removal procedure.

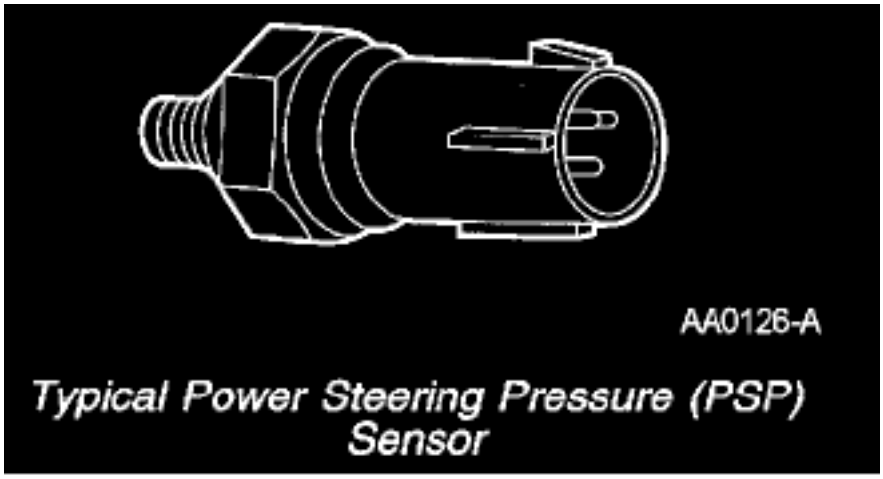
Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Steering and Suspension > Steering > Sensors and Switches - Steering > Power Steering Pressure Switch > Component Information > Locations



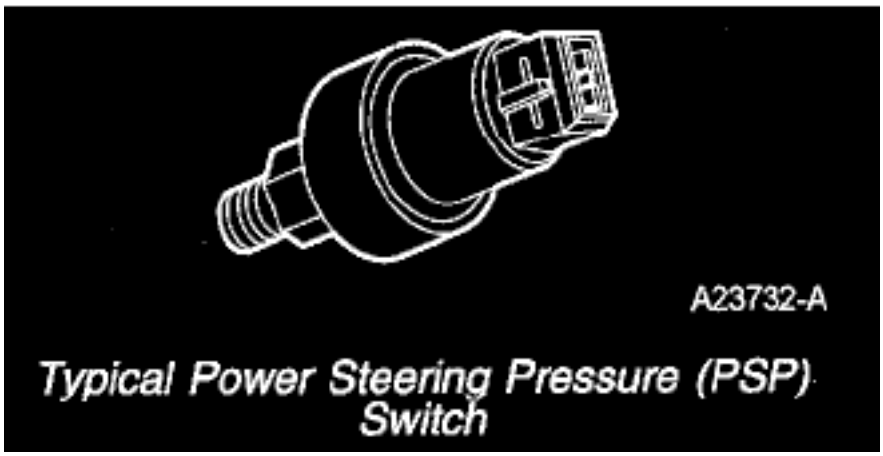
View 151-3


Connector: C1121
Description:
POWER STEERING PRESSURE SWITCH
Harness:
12B637
Base Part #:
Pin Circuit Gauge Circuit Function Qualifier
1 CCS09 (GN) 20 SWITCH - POWER STEERING PRESSURE (PSPS) 2.3L
2 RE407 (YE-VT) 20 CTRL MOD. - POWERTRAIN # SIGNAL RETURN COWL (C-SIGRTN) (SIGRTN-C) 2.3L
1
2

C1121



Typical Power Steering Pressure (PSP) Sensor



Typical Power Steering Pressure (PSP) Switch

Power Steering Pressure Switch: Description and Operation

Power Steering Pressure (PSP) Sensor

Typical Power Steering Pressure (PSP) Sensor

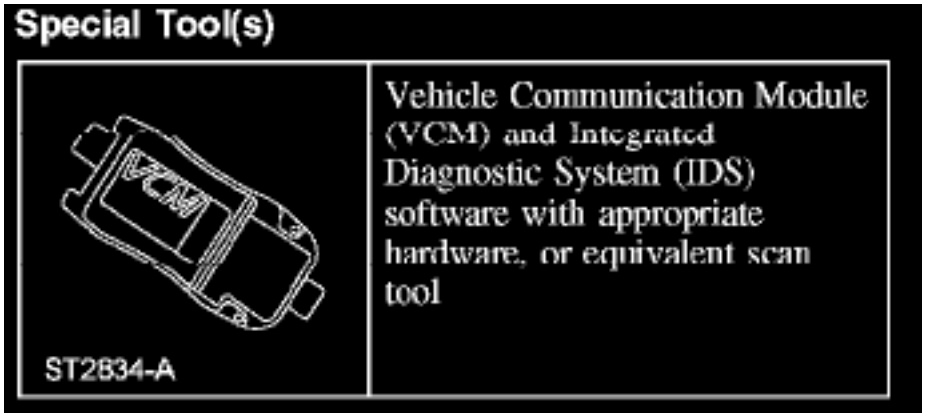
The PSP sensor monitors the hydraulic pressure within the power steering system. The PSP sensor voltage input to the PCM changes as the hydraulic pressure changes. The PCM uses the input signal from the PSP sensor to compensate for additional loads on the engine by adjusting the

idle RPM and preventing engine stall during parking maneuvers. Also, the PSP sensor signals the PCM to adjust the transmission electronic pressure control (EPC) pressure during increased engine load, for example, during parking maneuvers.

Power Steering Pressure (PSP) Switch

Typical Power Steering Pressure (PSP) Switch

The PSP switch monitors the hydraulic pressure within the power steering system. The PSP switch is a normally closed switch that opens as the hydraulic pressure increases. The PCM provides a low current voltage on the PSP circuit. When the PSP switch is closed, this voltage is pulled low through the SIG RTN circuit. The PCM uses the input signal from the PSP switch to compensate for additional loads on the engine by adjusting the idle RPM and preventing engine stall during parking maneuvers. Also, the PSP switch signals the PCM to adjust the transmission electronic pressure control (EPC) pressure during increased engine load, for example during parking maneuvers.



Air Bag(s) Arming and Disarming: Service and Repair Supplemental Restraint System (SRS) Depowering and Repowering

SUPPLEMENTAL RESTRAINT SYSTEM (SRS) DEPOWERING AND REPOWERING

Special Tool(s)

Special Tool(s)

Depowering Procedure

WARNING:

- Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.

- To reduce the risk of accidental deployment, do not use any memory saver devices. Failure to follow this instruction may result in serious personal injury or death.

NOTE:

- The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate an SRS fault.

- The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1. Turn all vehicle accessories OFF. 2. Turn the ignition switch to OFF. 3. At the smart junction box (SJB), located below the RH side of the instrument panel, remove the RH lower cowl trim panel and remove the

restraints control module (RCM) fuse 8 (10A) from the SJB.

4. Turn the ignition ON and visually monitor the air bag warning indicator for at least 30 seconds. The air bag warning indicator will remain lit

continuously (no flashing) if the correct RCM fuse has been removed. If the air bag warning indicator does not remain lit continuously, remove the correct RCM fuse before proceeding.

5. Turn the ignition OFF.

6. WARNING: Always deplete the backup power supply before repairing or installing any new front or side air bag supplemental restraint

system (SRS) component and before servicing, removing, installing, adjusting or striking components near the front or side impact sensors or the restraints control module (RCM). Nearby components include doors, instrument panel, console, door latches, strikers, seats and hood latches.

Refer to the Description and Operation portion of Air Bag Systems for location of the RCM and impact sensor(s).

To deplete the backup power supply energy, disconnect the battery ground cable and wait at least 1 minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Failure to follow these instructions may result in serious personal injury or death in the event of an accidental deployment.

Disconnect the battery ground cable and wait at least one minute.

Repowering Procedure

1. Turn the ignition switch from OFF to ON. 2. Install the RCM fuse 8 (10A) to the SJB and install the RH lower cowl trim panel.

3. WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is

connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

Connect the battery ground cable.

4. Prove out the SRS as follows:

Turn the ignition key from ON to OFF. Wait 10 seconds, then turn the key back to ON and visually monitor the air bag warning indicator with the air bag modules installed. The air bag warning

indicator will light continuously for approximately 6 seconds and then turn off. If an air bag SRS fault is present, the air bag warning indicator will: -

fail to light.

- remain lit continuously.

- flash at a 5Hz rate (RCM not configured).

The air bag warning indicator may not illuminate until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON position. This is the time required for the RCM to complete the testing of the SRS. If the air bag warning indicator is inoperative and a SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag warning indicator and any SRS fault discovered must be diagnosed and repaired.

Clear all continuous RCM and occupant classification system module (OCSM) DTCs using a scan tool.

Special Tool(s)

ST2621-A	Diagnostic Tool, Restraint System (2 required) 418-F395
ST2512-A	Diagnostic Tool, Restraint System 418-F403
ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Air Bag(s) Arming and Disarming: Service and Repair Supplemental Restraint System (SRS) Deactivation and Reactivation

SUPPLEMENTAL RESTRAINT SYSTEM (SRS) DEACTIVATION AND REACTIVATION

Special Tool(s)

Deactivation Procedure

WARNING:

- Always carry or place a live air bag module with the air bag and deployment door/trim cover/tear seam pointed away from the body. Do not set a live air bag module down with the deployment door/trim cover/tear seam face down. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

- Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which

increases the risk of serious personal injury or death.

- To reduce the risk of accidental deployment, do not use any memory saver devices. Failure to follow this instruction may result in serious personal injury or death.

NOTE:

- The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

- No restraint system diagnostic tools are available for the safety belt buckle pretensioners. If the ignition switch is set to RUN or START with either the driver or passenger safety belt buckle pretensioner electrical connector disconnected, the DTCs for an open circuit fault will be active.

- The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1. Turn all vehicle accessories OFF. 2. Turn the ignition switch to OFF. 3. At the smart junction box (SJB), located below the RH side of the instrument panel, remove the restraints control module (RCM) fuse 8 (10A)

from the SJB.

4. Turn the ignition ON and visually monitor the air bag warning indicator for at least 30 seconds. The air bag warning indicator will remain lit

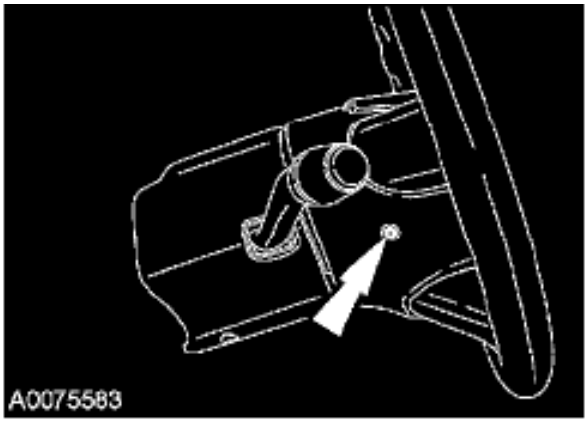
continuously (no flashing) if the correct RCM fuse has been removed. If the air bag warning indicator does not remain lit continuously, remove the correct RCM fuse before proceeding.

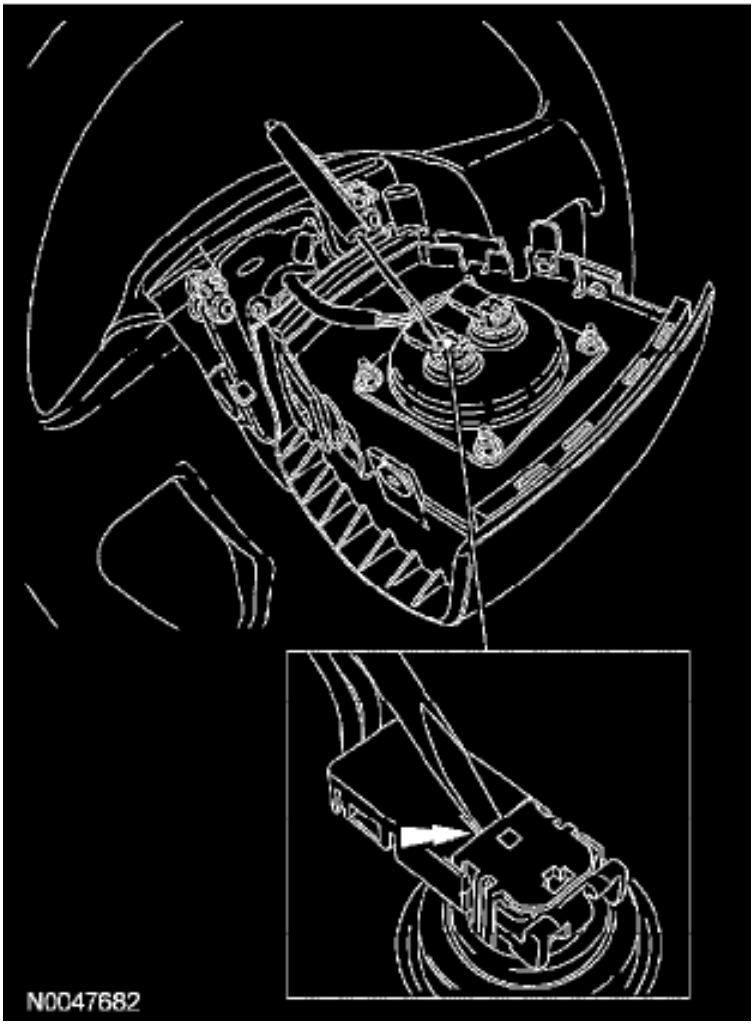
5. Turn the ignition OFF.

6. WARNING: Always deplete the backup power supply before repairing or installing any new front or side air bag supplemental restraint

system (SRS) component and before servicing, removing, installing, adjusting or striking components near the front or side impact sensors or the restraints control module (RCM). Nearby components include doors, instrument panel, console, door latches, strikers, seats and hood latches.

Refer to the Description and Operation portion of Air Bag Systems for location of the RCM and impact sensor(s).





To deplete the backup power supply energy, disconnect the battery ground cable and wait at least 1 minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Failure to follow these instructions may result in serious personal injury or death in the event of an accidental deployment.

Disconnect the battery ground cable and wait at least 1 minute.

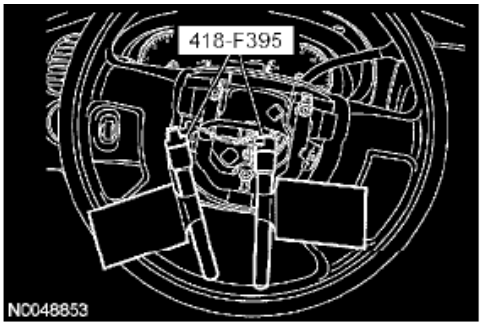
7. Remove the 2 driver air bag module bolts (1 shown).

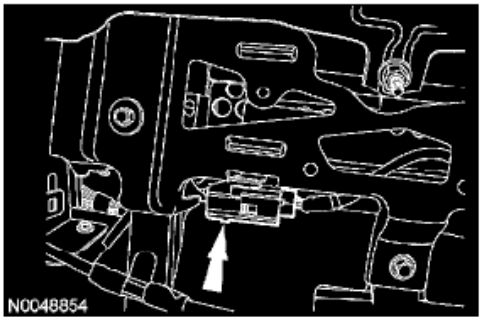
8. CAUTION: Do not pull the driver air bag module electrical connectors out by the locking buttons. Damage to the locking buttons may

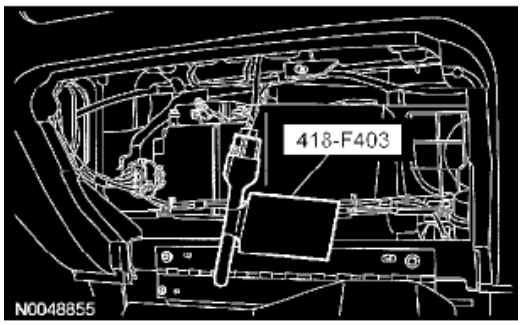
occur.

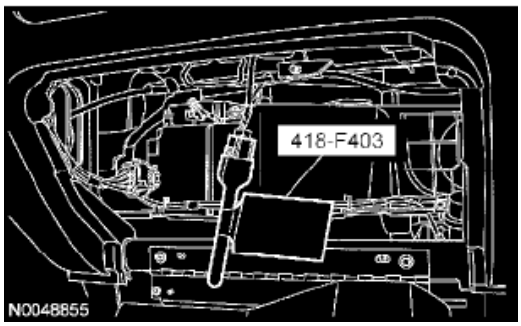
Using a small screwdriver as shown, lift up and release the locking buttons on the driver air bag module electrical connectors. With the locking buttons released, remove the electrical connectors and the driver air bag module.

9. Attach the restraint system diagnostic tools to the clockspring electrical connectors at the top of the steering column.









10. Open the glove compartment door fully to access the passenger air bag electrical connector.
11. Release the tab and disconnect the passenger air bag module electrical connector.

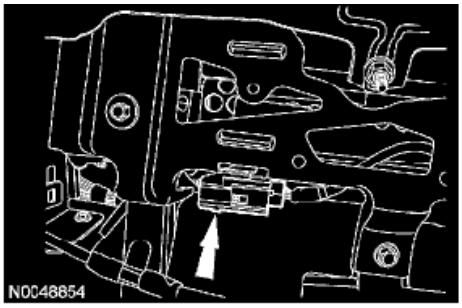
12. Attach the restraint system diagnostic tool to the vehicle harness side of the passenger air bag module electrical connector.

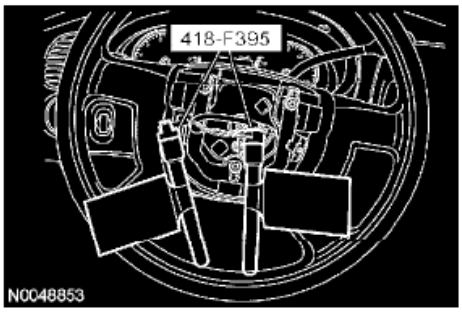
13. Install the RCM fuse 8 (10A) to the SJB. 14. Connect the battery ground cable.

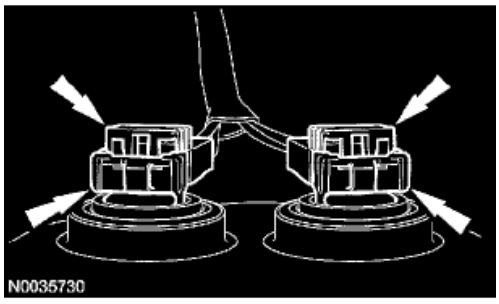
Reactivation Procedure

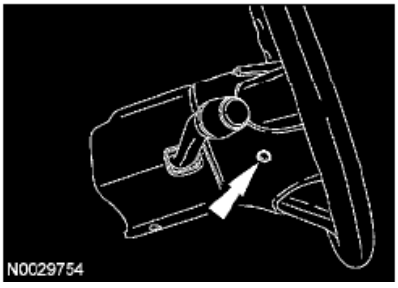
1. Remove the RCM fuse 8 (10A) from the SJB. 2. Disconnect the battery ground cable and wait at least one minute. 3. Remove the restraint system diagnostic tool from the vehicle harness side of the passenger air bag module electrical connector.

4. Connect the passenger air bag module electrical connector.









5. Close the glove compartment door. 6. Remove the restraint system diagnostic tools from the clockspring electrical connectors at the top of the steering column.

7. CAUTION:

- Do not install the driver air bag module electrical connectors by the locking buttons. Damage to the locking buttons may occur.

- The driver air bag module electrical connector locking buttons must be in the released position when the connector is being installed or connector damage may occur.

- The driver air bag module electrical connectors are unique and cannot be reversed when connected to the driver air bag module. Match the electrical connector key to the keyway in the driver air bag module. Do not force the electrical connectors into the driver air bag module. Damage to the connector or component may occur.

With the locking buttons released, install the driver air bag module electrical connectors fully into the driver air bag module and seat the locking buttons.

8. Install the 2 driver air bag module bolts (1 shown).

- Tighten to 6 Nm (53 lb-in).

9. WARNING: Remove restraint system diagnostic tools from the vehicle prior to road testing. If tools are not removed, the supplemental

restraint system (SRS) device may not deploy in a crash. Failure to follow this instruction may result in serious personal injury or death

in a crash and possibly violate vehicle safety standards.

Make sure all restraint system diagnostic tool(s) that may have been installed during the repair have been removed from the vehicle and all SRS components are connected.

10. Turn the ignition from OFF to ON. 11. Install the restraint system control module fuse 8 (10A) to the SJB.

12. WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is

connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

Connect the battery ground cable.

13. Prove out the SRS as follows:

Turn the ignition key from ON to OFF. Wait 10 seconds, then turn the key back to ON and visually monitor the air bag warning indicator with the air bag modules installed. The air bag warning indicator will light continuously for approximately 6 seconds and then turn off. If an air bag SRS fault is present, the air bag warning indicator will: -

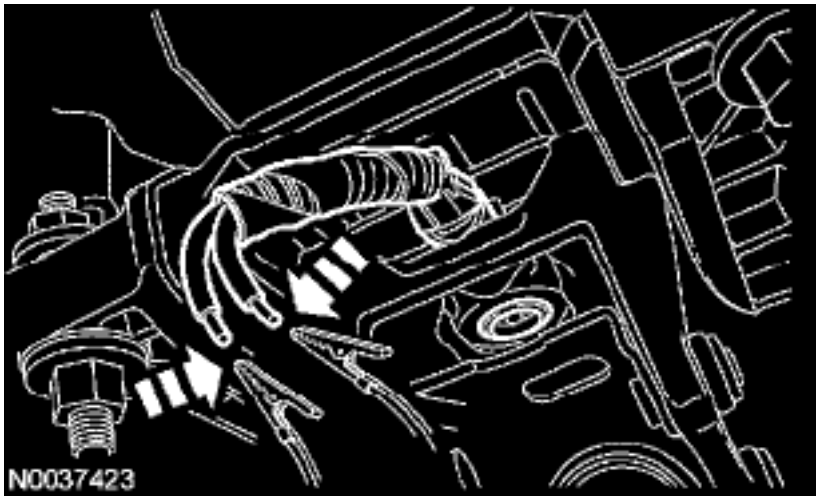
fail to light.

- remain lit continuously.

- flash at a 5Hz rate (RCM not configured).

The air bag warning indicator may not illuminate until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON position. This is the time required for the RCM to complete the testing of the SRS. If the air bag warning indicator is inoperative and a SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag warning indicator and any SRS fault discovered must be diagnosed and repaired.

Clear all continuous RCM and occupant classification system module (OCSM) DTCs using a scan tool.



Adaptive Collapsible Steering Column: Service and Repair

DEPLOYABLE STEERING COLUMN - IN-VEHICLE DEPLOYMENT

WARNING: Deploy all supplemental restraint system (SRS) devices (air bags, pretensioners, load limiters, etc.) outdoors with all personnel at least 9.14 meters (30 feet) away to make sure of personal safety. Due to the loud report which occurs when an SRS device is deployed, hearing protection is required. Failure to follow these instructions may result in serious personal injury.

1. Depower the SRS.

2. NOTE: It may be necessary to lower or remove the deployable steering column from the instrument panel to access the deployable steering

column electrical connector.

Access the deployable steering column electrical connector.

3. NOTE: If the deployable steering column does not have a hard-wired pigtail, it will be necessary to cut the wires and connector(s) from the

vehicle wire harness and reconnect to the deployable steering column.

Cut each of the deployable steering column wires, leaving at least 4 inches to work with.

4. Remove any sheathing (if present) and strip the insulation from the ends of the cut wires. 5. Make a jumper harness to deploy the deployable steering column.

- Obtain 2 wires (20 gauge minimum) at least 9.14 m (30 ft) long and strip both ends of each wire.

- At one end of the jumper harness, connect the wires together.

6. Using the end of the jumper harness that the wires are not connected together, attach each wire of the jumper harness to each wire of the

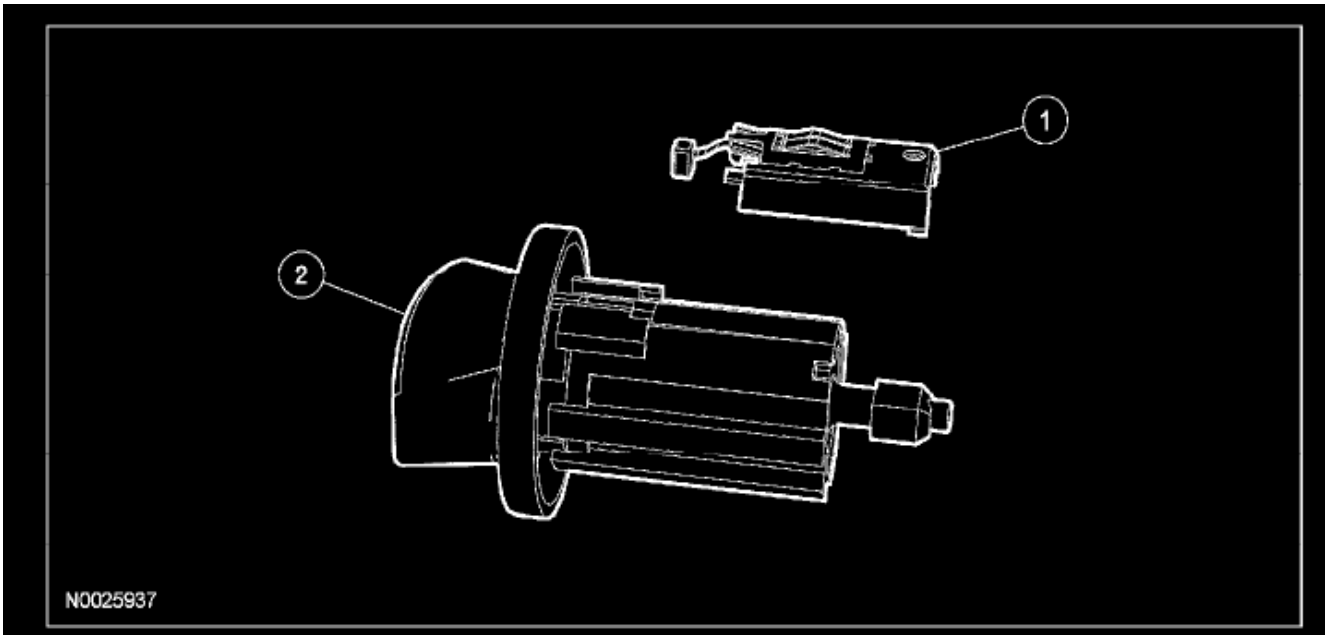
deployable steering column. Use tape or other insulating material to make sure that the leads do not make contact with each other.

7. Remain at least 9.14 m (30 ft) away from the deployable steering column. 8. From the end of the jumper harness that is not connected to the deployable steering column, disconnect the 2 wires of the jumper harness from

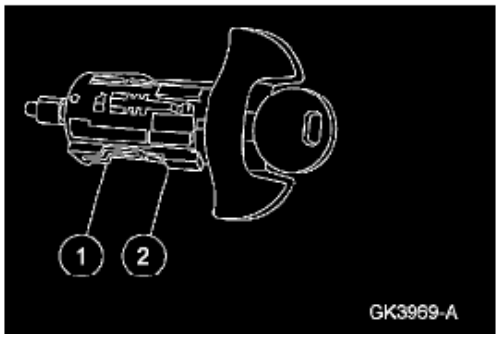
each other.

9. Deploy the deployable steering column by touching the ends of the 2 wires of the jumper harness to the terminals of a 12-volt battery.

10. To allow for cooling, wait at least 10 minutes before approaching the deployed steering column. 11. Dispose of the deployed steering column in the same manner as any other part to be scrapped.



Item	Part Number	Description
1	11A127	Key-in-ignition warning switch
2	11582	Ignition lock cylinder



Key Reminder Switch: Service and Repair

KEY-IN-IGNITION WARNING SWITCH

Removal and Installation

1. Remove the ignition lock cylinder. 2. Remove the key-in-ignition warning switch.

1 Pry the clip downward.

2 Release the key-in-ignition warning switch from the rear of the ignition lock cylinder.

3. To install, reverse the removal procedure.

Steering Gear: Testing and Inspection Steering Gear Valve Test

Steering Gear Valve Test

1. With the vehicle in motion, place the transmission in NEUTRAL and turn the engine OFF.

^ If the vehicle does not pull with the engine OFF, repair or install a new steering gear.

2. If the vehicle pulls with the engine OFF, switch the right side front wheel to the left side of the vehicle and the left side front wheel to the right side

of the vehicle.

3. If the vehicle pulls to the opposite side, switch the front wheels with the rear wheels keeping them on the same side of the vehicle. 4. If the vehicle pull direction does not change, check the front suspension components, wheel alignment and frame alignment.

Steering Gear: Testing and Inspection Steering Gear Grunt/Shudder Test

Steering Gear Grunt/Shudder Test

1. Start and run the vehicle to operating temperature. 2. Set engine idle speed to 1,200 rpm.

3. CAUTION: Do not hold the steering wheel against the stops for an extended amount of time. Damage to the power steering pump may

occur.

Rotate the steering wheel to the RH stop, then turn the steering wheel 90 degrees back from that position. Slowly turn the steering wheel back and forth approximately 1/12 of a full turn.

4. Turn the steering wheel another 90 degrees. Slowly turn the steering wheel back and forth approximately 1/12 of a full turn. 5. Repeat the test with the power steering fluid at different temperatures. 6. If a light grunt is heard or a low (50-200 Hz) shudder is present, this is a normal steering system condition. 7. If a loud grunt is heard, or a strong shudder is felt, purge the power steering system. If a loud grunt or strong shudder still exists, check the power

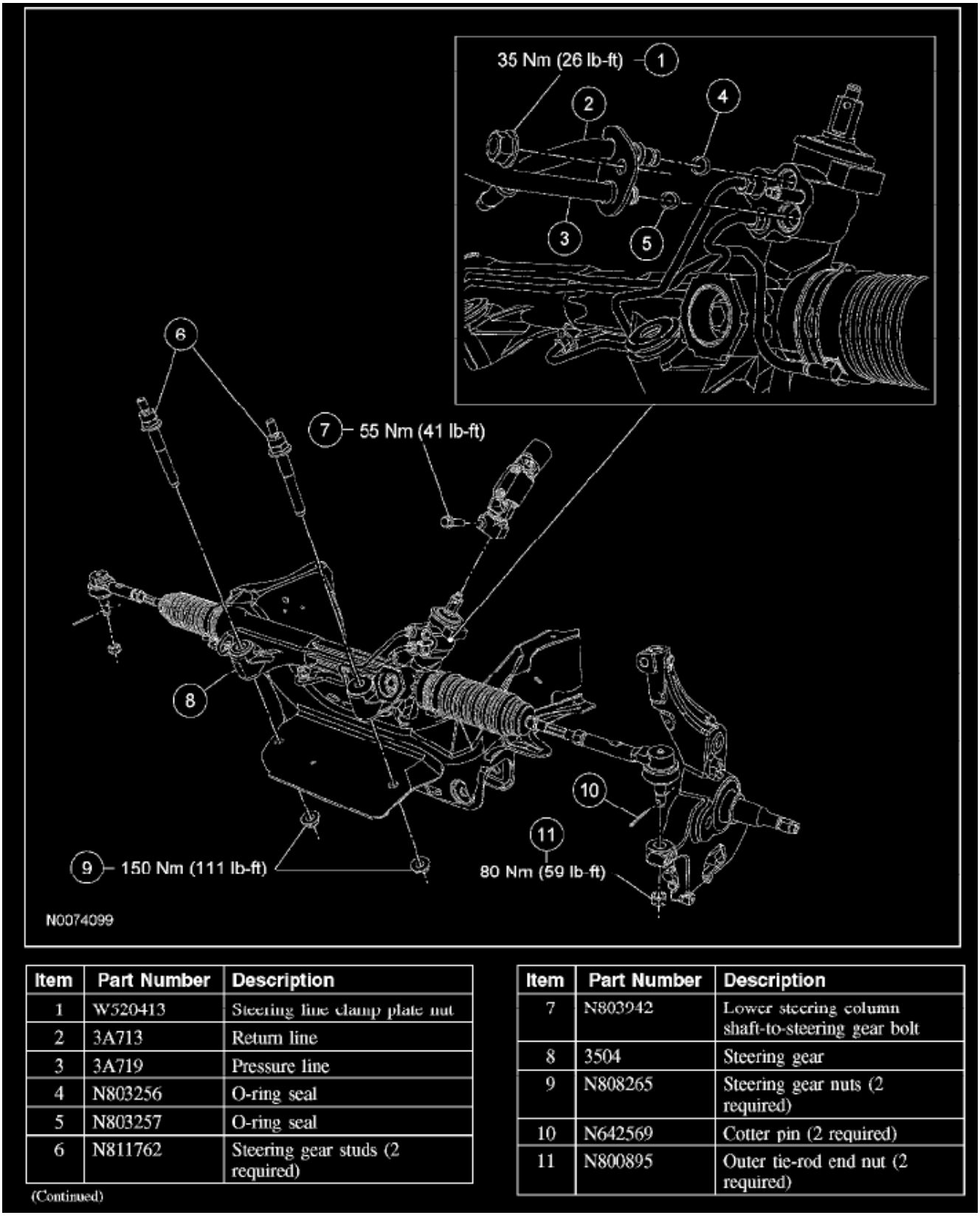
steering lines/hoses for restrictions or damage and repair as necessary. If the lines/hoses are OK, install a new steering gear.

Special Tool(s)

Remover, Tie-Rod End
211-001 (TOOL-3290-D) or equivalent

Steering Gear: Service and Repair

Steering Gear - Rear Wheel Drive (RWD)



Item	Part Number	Description
1	W520413	Steering line clamp plate nut
2	3A713	Return line
3	3A719	Pressure line
4	N803256	O-ring seal
5	N803257	O-ring seal
6	N811762	Steering gear studs (2 required)

(Continued)

Item	Part Number	Description
7	N803942	Lower steering column shaft-to-steering gear bolt
8	3504	Steering gear
9	N808265	Steering gear nuts (2 required)
10	N642569	Cotter pin (2 required)
11	N800895	Outer tie-rod end nut (2 required)

Removal and Installation

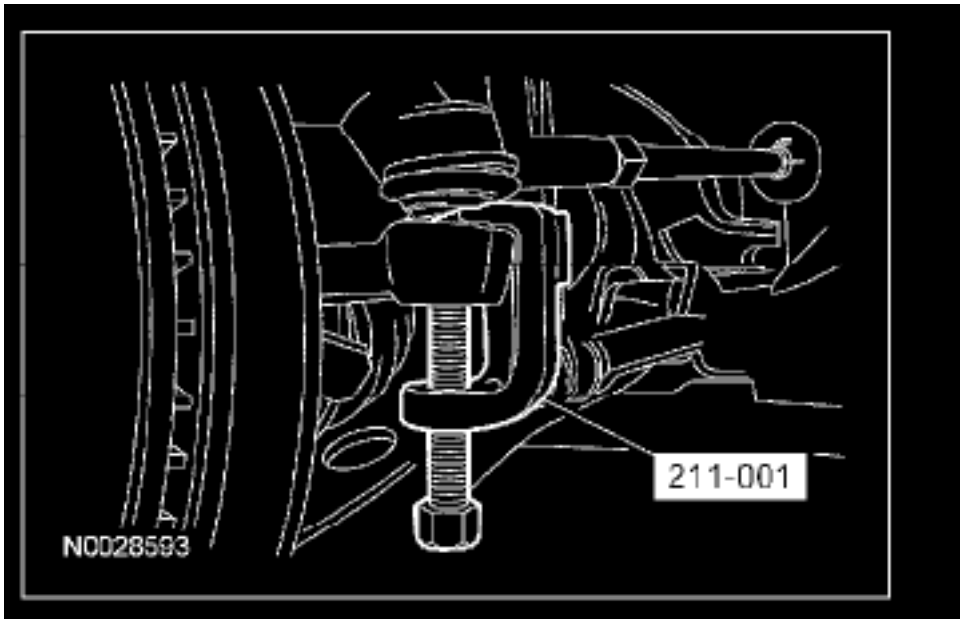
All vehicles

CAUTION: When repairing the power steering system, care should be taken to prevent the entry of foreign material or failure of the power steering components may result.

1. Remove the front wheels and tires. 2. Place the steering wheel in the straight-ahead position and remove the ignition key.

Rotate the steering wheel until the steering column locks into position.

(3.0L) and 4.0L) engines



3. Remove the power steering fluid cooler.

All vehicles

4. Remove the outer tie-rod end cotter pins and nuts.

^ Discard the cotter pins.

^ To install, tighten to 80 Nm (59 lb-ft).

5. CAUTION: Do not damage the tie-rod boot when installing the special tool.

NOTE: Remove the adapter from the ball end of the special tool. Apply a small amount of grease to the tie-rod end stud and the ball of the special tool.

Using special tool, separate the outer tie-rod ends from the wheel spindles.

6. CAUTION: Do not allow the steering column to rotate while the steering column shaft is disconnected from the steering gear or damage

to the clockspring may result. If there is evidence that the steering column has rotated, the clockspring must be removed and recentered.

Remove the lower steering column shaft-to- steering gear bolt and disconnect the lower steering column shaft from the gear. ^

Discard the bolt.

^ To install, tighten to 55 Nm (41 lb-ft).

7. Remove the steering line clamp plate nut and disconnect the pressure and return lines.

^ Discard the O-ring seals.

^ To install, tighten to 35 Nm (26 lb-ft).

8. Plug or cap the return line, pressure line and the steering gear ports to prevent the entry of dirt.

9. CAUTION: Hold the tops of the steering gear studs to avoid damaging the steering gear fluid transfer tubes.

Remove the 2 steering gear nuts and the 2 steering gear studs. ^

To install, tighten to 150 Nm (111 lb-ft).

10. Remove the steering gear. 11. If necessary, remove the outer tie-rod ends.

12. CAUTION: New O-ring seals must be installed any time the power steering lines are disconnected from the steering gear or a fluid leak

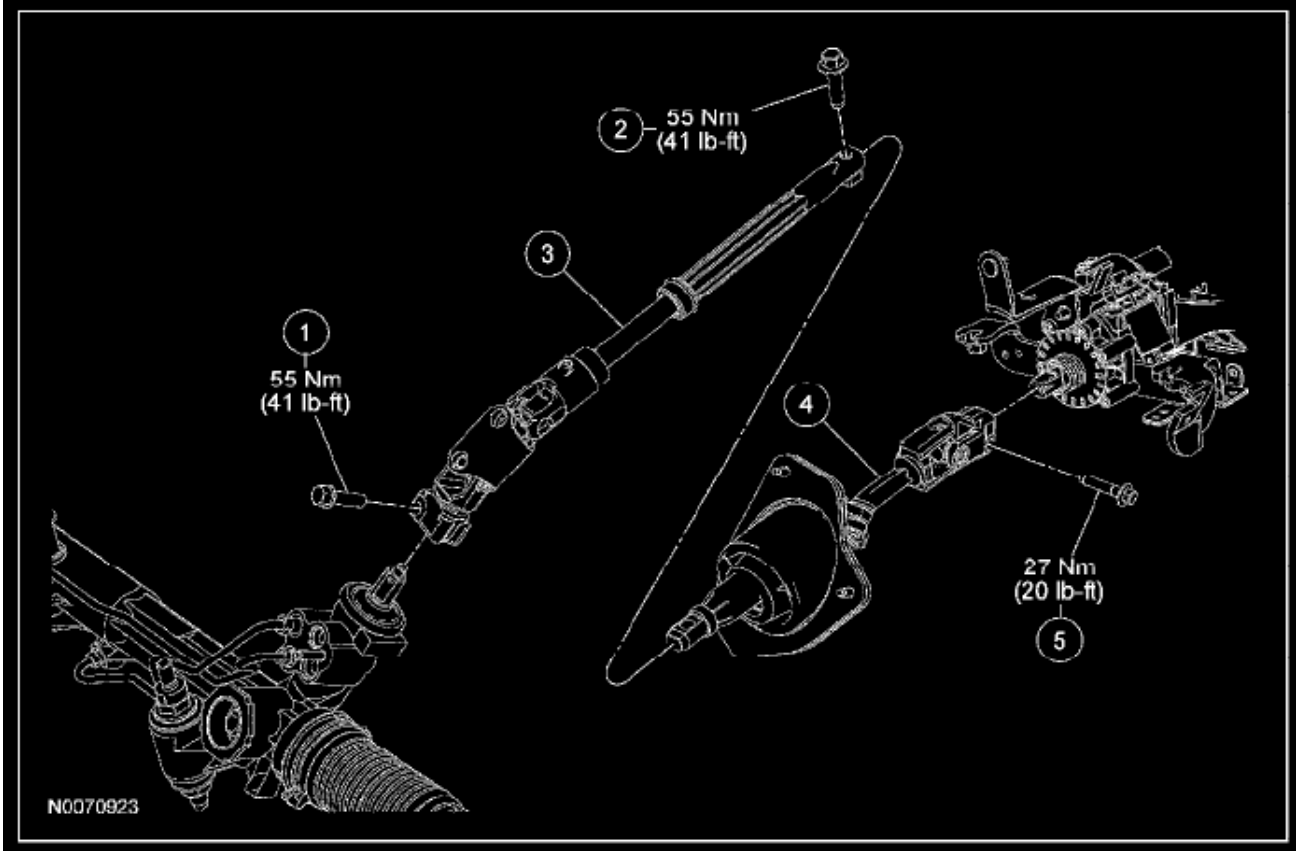
may occur.

To install, reverse the removal procedure. ^

Install new power steering line O-ring seals.

13. Fill the power steering system. 14. Check and, if necessary, adjust the front toe.

Steering Column Shaft



Item	Part Number	Description
1	N801614	Lower steering column shaft-to-steering gear bolt
2	N801614	Lower steering column shaft-to-upper steering column shaft bolt
3	3C662	Lower steering column shaft
4	3E751	Upper steering column shaft
5	N808684	Upper steering column shaft-to-steering column bolt

Steering Shaft: Service and Repair

Steering Column Shaft

Steering Column Shaft

Removal and Installation

Upper and lower shaft

1. With the vehicle in NEUTRAL, position it on a hoist.

2. CAUTION: Do not allow the steering column to rotate while the steering column shaft is disconnected or damage to the clockspring may

result. If there is evidence that the shaft has rotated, the clockspring must be removed and recentered.

Remove and discard the lower steering column shaft-to-upper steering column shaft bolt. ^

Collapse the lower steering column shaft.

^ To install, tighten to 55 Nm (41 lb-ft).

3. Remove the upper steering column shaft-to- steering column bolt and remove the upper steering column shaft.

^ Discard the bolt.

^ To install, tighten to 27 Nm (20 lb-ft).

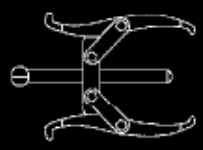
Lower shaft 4. Remove the lower steering column shaft-to-steering gear bolt and remove the lower steering column shaft.

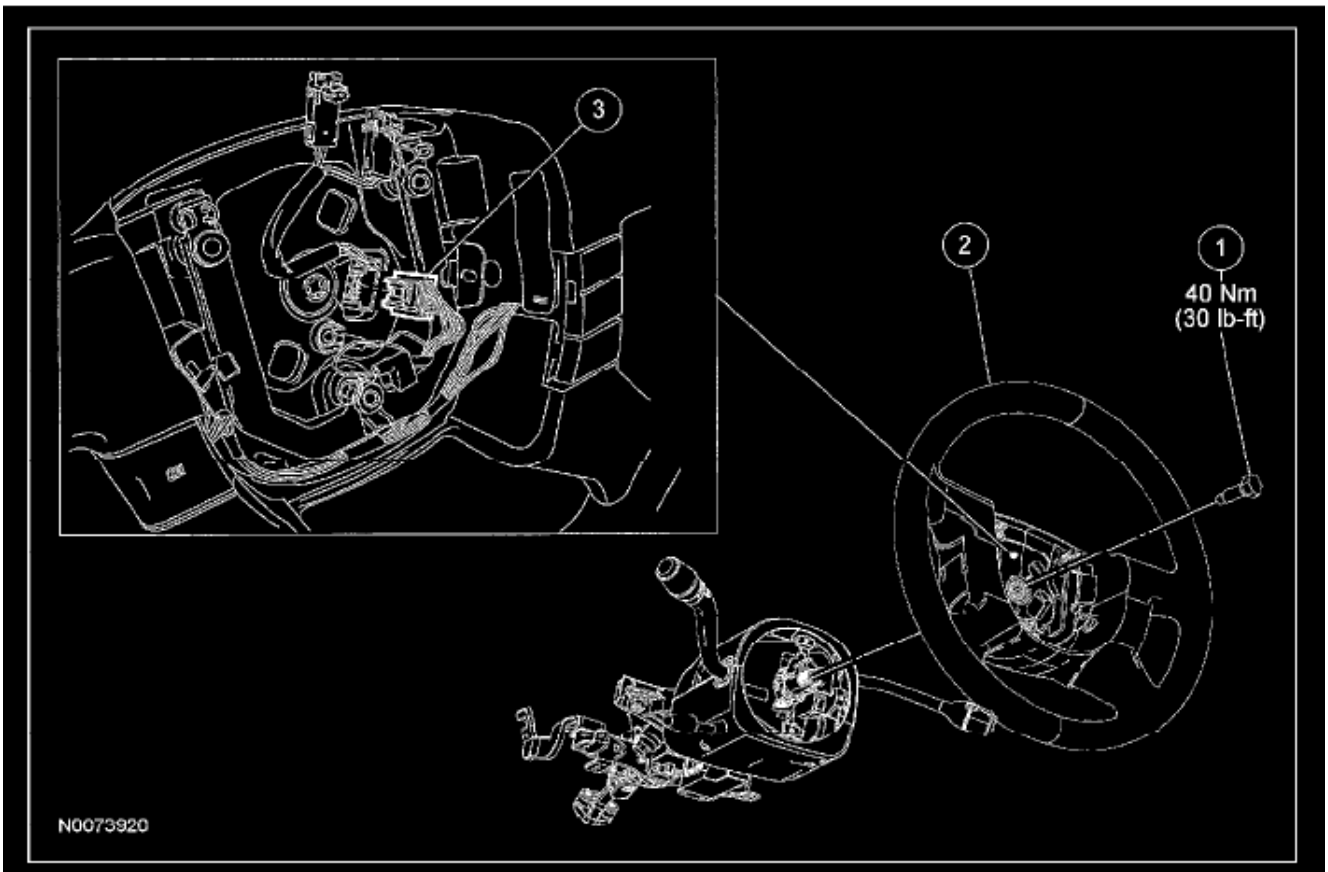
^ Discard the bolt.

^ To install, tighten to 55 Nm (41 lb-ft).

Upper and lower shaft 5. To install, reverse the removal procedure.

Special Tool(s)

 ST1321-A	Remover, Differential Bearing 205-116 (T77F-4220-B1)



Item	Part Number	Description
1	N807493	Steering wheel bolt
2	3600	Steering wheel
3	—	Steering wheel switches electrical connector (part of 3600)

Steering Wheel: Service and Repair

Steering Wheel

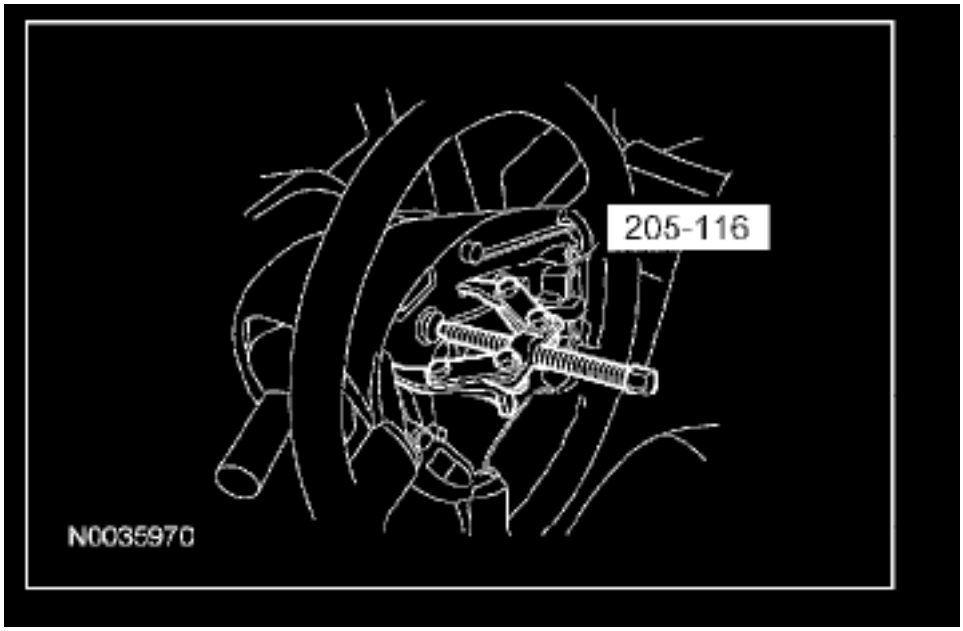
Removal and Installation

1. Turn the steering wheel to the straight-ahead position and turn the ignition switch to the OFF position. 2. Remove the driver air bag module. 3. Loosen the steering wheel bolt.

^ To install, tighten to 40 Nm (30 lb-ft).

4. CAUTION: Removing the steering wheel without using a puller may damage the column bearings.

Using the special tool, remove the steering wheel.



5. Remove and discard the steering wheel bolt. 6. Disconnect the steering wheel switches electrical connector from the clockspring. 7. Remove the steering wheel.

^ Route the wires from the clockspring through the steering wheel.

8. NOTE: A new steering wheel bolt must be installed.

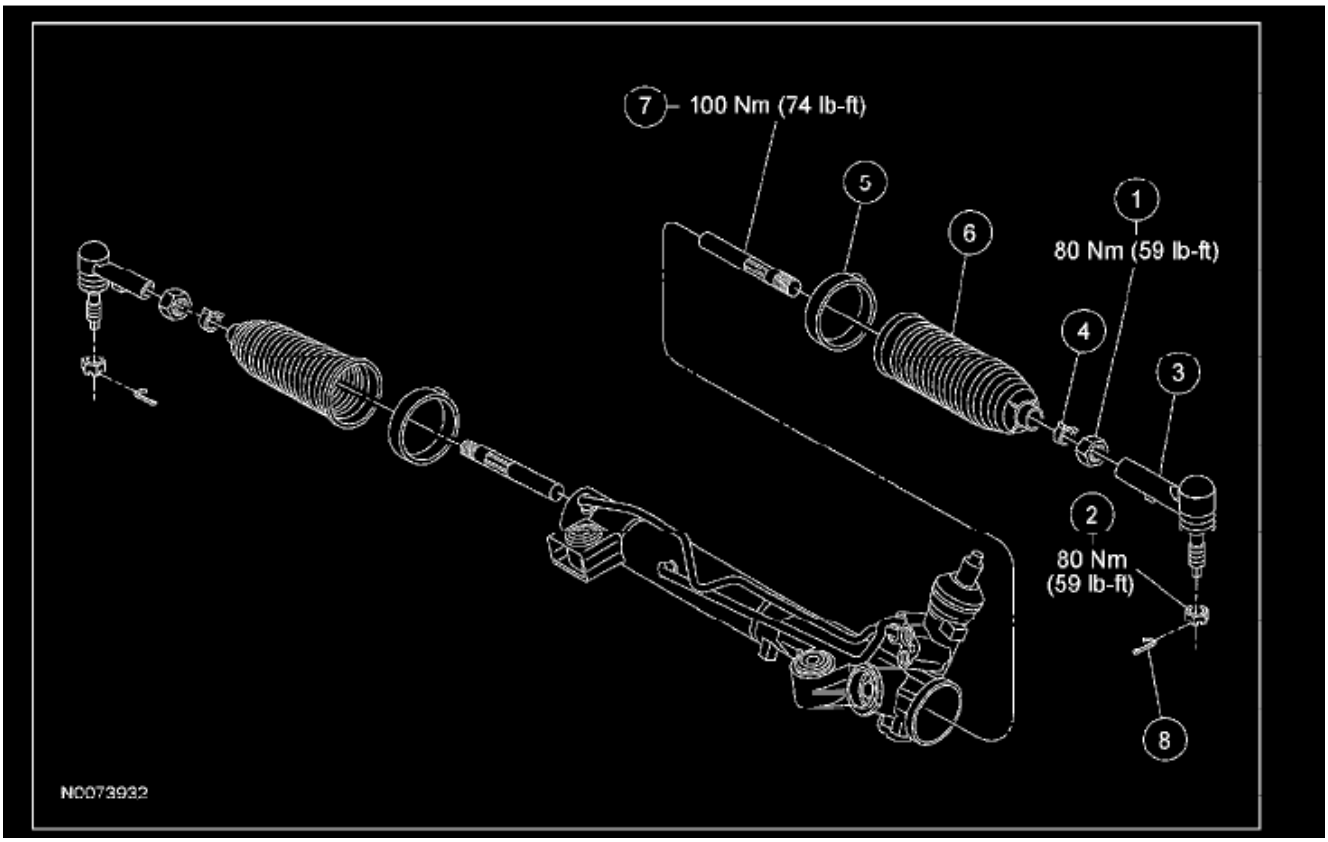
To install, reverse the removal procedure.

Special Tool(s)

ST1427-A	Inner Tie-Rod Socket Tool 211-D029 or equivalent
ST1408-A	Tie-Rod End Separator 211-105 (T85M-3395-A) or equivalent

Material

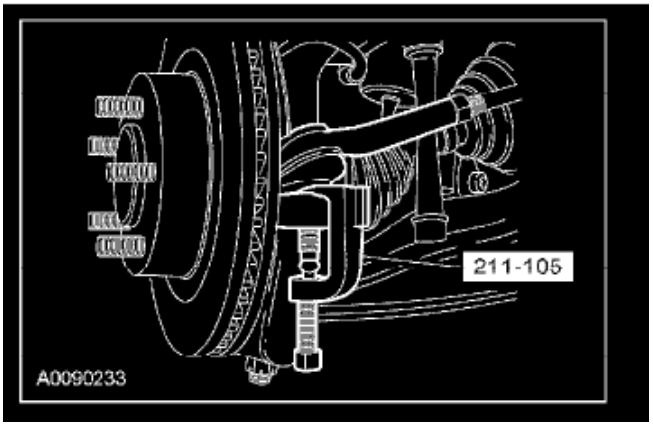
Item	Specification
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B



Tie Rod: Service and Repair

Inner Tie Rod

Item	Part Number	Description
1	N803637	Tie-rod jam nut (part of 3280) (2 required)
2	N800895	Outer tie-rod end nut (2 required)
3	3290	Outer tie-rod end (2 required)
4	3K745	Outer bellows boot clamp (2 required)
5	3C650A	Inner bellows boot clamp (2 required)
6	3K661	Steering gear bellows boot (2 required)
7	3280	Inner tie rod (2 required)
8	N642569	Cotter pin (2 required)



Removal and Installation

CAUTION: The boots and clamps are designed to provide an airtight seal and protect the internal components of the steering gear. If the seal is not airtight, the vacuum generated during turning may draw water and foreign material into the gear and damage internal components. Zip ties do not produce an airtight seal and must not be used.

CAUTION: The inner ball joint grease is not compatible with water. Water and foreign material trapped in the grease may damage the joint.

CAUTION: If present, the orientation of the vent tubes must be noted so the boots and vent tubes may be installed in their original locations. Incorrect venting may lead to internal component damage.

Coil spring suspension vehicles

1. Remove the wheel and tire. 2. Loosen the tie-rod jam nuts.

^ To install, tighten to 80 Nm (59 lb-ft).

3. Remove the outer tie-rod end cotter pin and nut.

^ Discard the cotter pin.

^ To install, tighten to 80 Nm (59 lb-ft).

4. CAUTION: Do not damage the tie-rod end boot when installing the special tool.

Using the special tool, disconnect the outer tie-rod end.

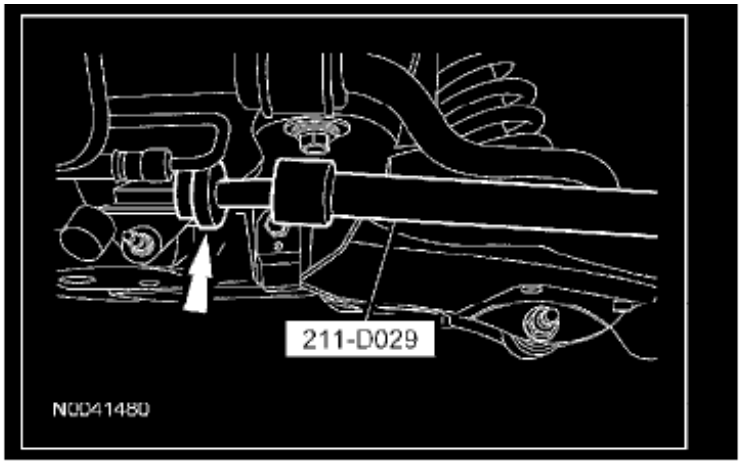
5. NOTE: Count and record the number of times the outer tie-rod end turns for assembly reference.

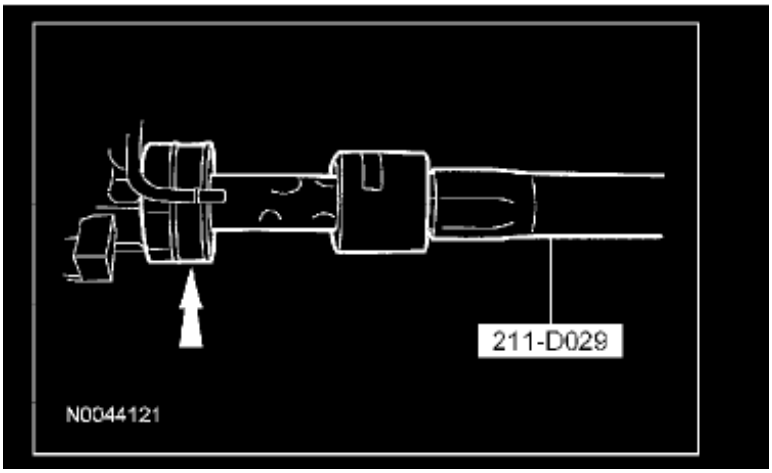
Remove the outer tie-rod end.

6. Remove the tie-rod jam nut.

7. NOTE: If repairing the RH side, it will be necessary to pull back the LH inner bellows boot to hold the steering gear.

Remove the inner and outer bellows boot clamps.


211-D029
N0041480


211-D029
N0044121

8. Remove the bellows boot.

9. CAUTION: Place the steering gear at the center position. Use a 21 mm (0.82 inch) crowfoot on the flat of the rack gear to resist rotation

and to prevent damage during removal and installation of the inner tie rod.

NOTE: The help of an assistant may be needed for removal of the RH inner tie rod.

Using the special tool, remove the inner tie rod. ^

To install, tighten to 100 Nm (74 lb-ft).

Torsion bar suspension vehicles 10. Loosen the tie-rod jam nut.

^ To install, tighten to 80 Nm (59 lb-ft).

11. Remove the steering gear.

12. NOTE: Count and record the number of times the outer tie-rod end turns for assembly reference.

Remove the outer tie-rod end and jam nut.

13. NOTE: If repairing the RH side, it will be necessary to pull back the LH inner bellows boot to hold the steering gear.

Remove the inner and outer bellows boot clamps.

14. CAUTION: Place the steering gear at the center position. Use a 21 mm (0.82 inch) crowfoot on the flat of the rack gear to resist rotation

and to prevent damage during removal and installation of the inner tie rod.

NOTE: The help of an assistant may be needed for removal of the RH inner tie rod.

Using the special tool, remove the inner tie rod. ^

To install, tighten to 100 Nm (74 lb-ft).

All vehicles

15. CAUTION: Thoroughly remove any dirt or foreign material that is present. This material is extremely harmful to the steering gear.

Thoroughly clean and inspect all the parts to be reused. Install new parts as necessary.

16. Check that the bellows boot seal is positioned correctly over the steering gear housing bead at the large inside diameter (ID) and is in the inner

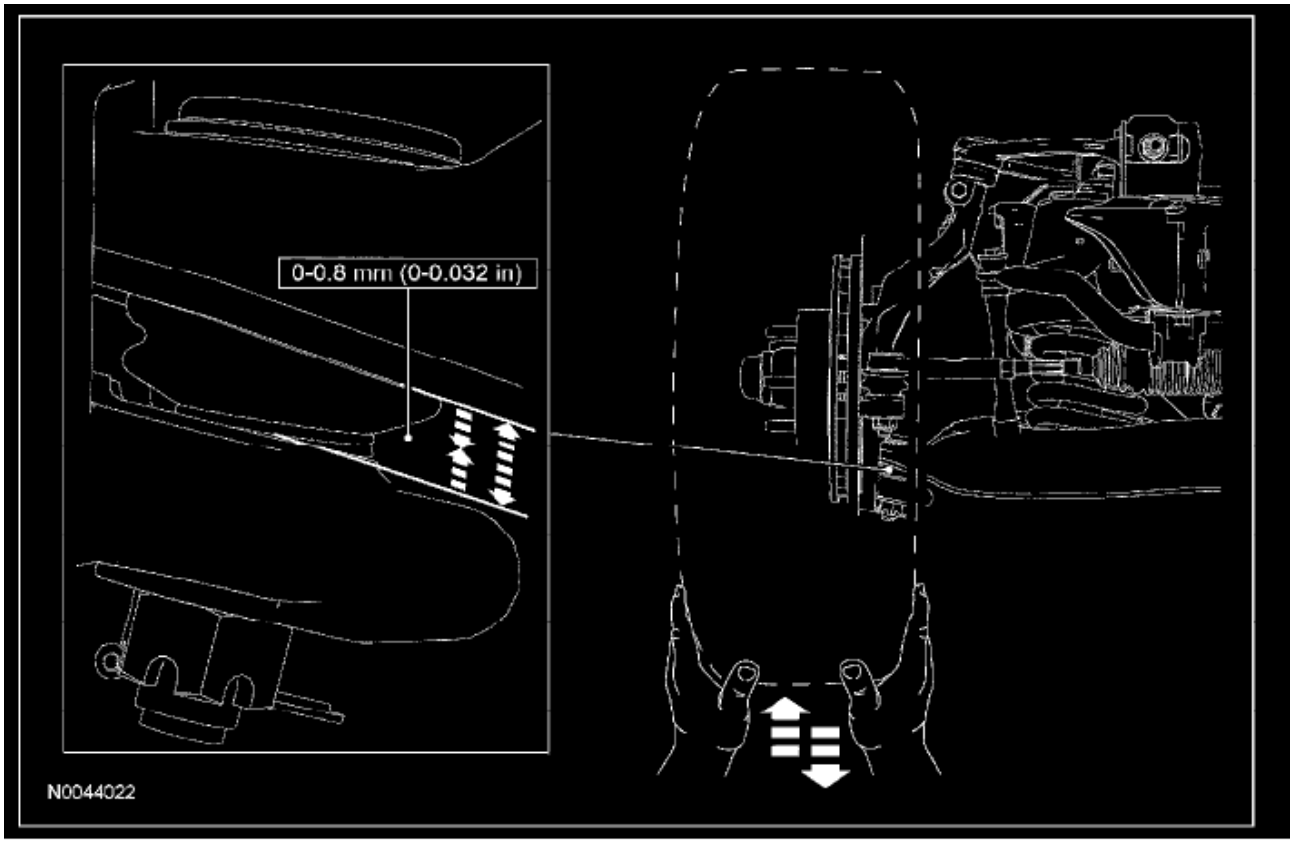
tie-rod groove at the small ID. ^

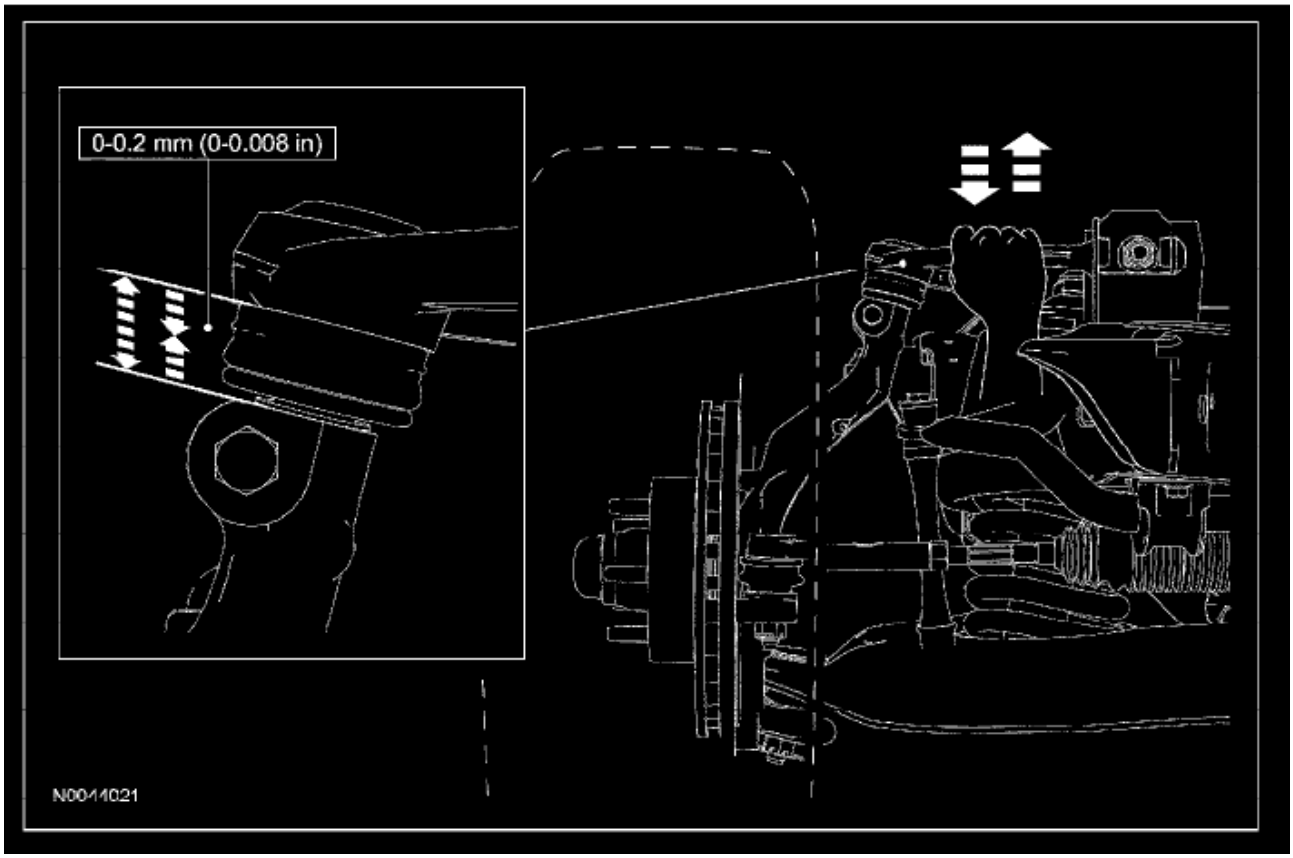
Check that the bellows boot seal is not twisted and the breather tube is securely inserted into the breather nipple at both bellows boots.

17. NOTE: Lubricate the inner tie rod inside groove with steering gear grease where the bellows boot is clamped.

To install, reverse the removal procedure.

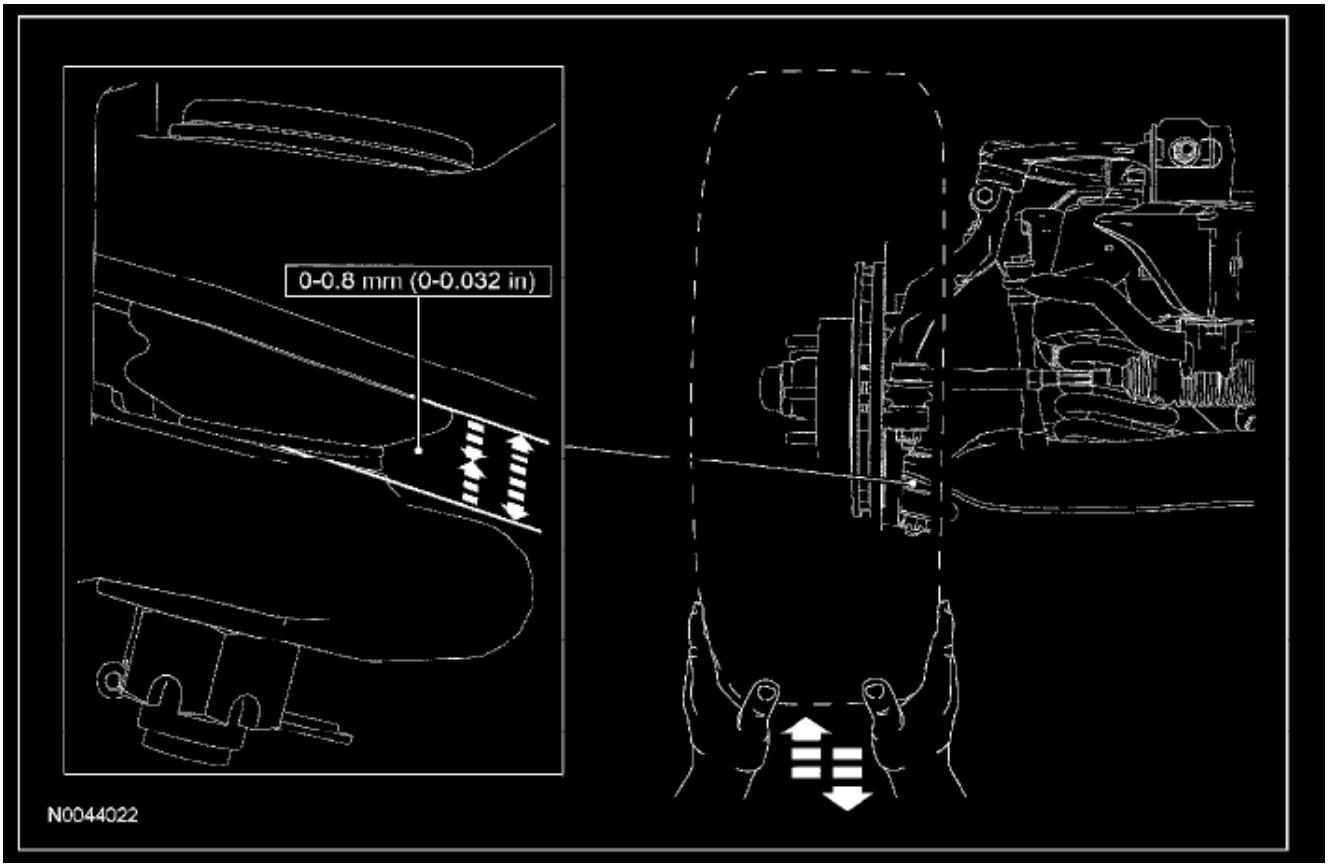
18. Check and if necessary adjust the front toe.


0-0.8 mm (0-0.032 in)
N0044022


0-0.2 mm (0-0.008 in)
N0044021

Ball Joint: Specifications

Ball Joint Wear Limits



Ball Joint: Testing and Inspection

Ball Joint Inspection

1. Prior to inspecting the ball joints for wear, inspect the wheel bearings. 2. Raise and support the vehicle by the frame or by the axle beams. 3. Inspect the ball joint and ball joint boot for damage.

^ If the ball joint or ball joint boot is damaged, install a new ball joint.

NOTE: Carry out Steps 4-6 to inspect the lower ball joint. Carry out Steps 7-9 to inspect the upper ball joint.

4. CAUTION: Do not use any tools or equipment to move the wheel and tire assembly or suspension components while checking for relative

movement. Suspension damage may occur. The use of tools or equipment will also create relative movement that may not exist when using hand force. Relative movement must be measured using hand force only.

Inspect the ball joint for relative movement by alternately pulling downward and pushing upward on the wheel and tire assembly by hand. Note any relative movement between the wheel knuckle and lower arm at the lower ball joint. ^

If relative movement is not felt or seen, the ball joint is OK. Do not install a new ball joint.

^ If relative movement is found, continue with Step 5.

5. NOTE: In order to obtain an accurate measurement, the dial indicator should be aligned as close as possible with the vertical axis (center line) of

the ball joint.

To measure ball joint deflection, attach a suitable dial indicator with a flexible arm between the lower arm and the wheel knuckle or ball joint stud.

6. Measure the ball joint deflection while an assistant pushes up and pulls down on the wheel and tire assembly by hand.

^ If the deflection exceeds the specification, a new lower ball joint must be installed.

^ If the deflection meets the specification, continue with the procedure.

7. CAUTION: Do not use any tools or equipment to move the wheel and tire or suspension components while checking for relative

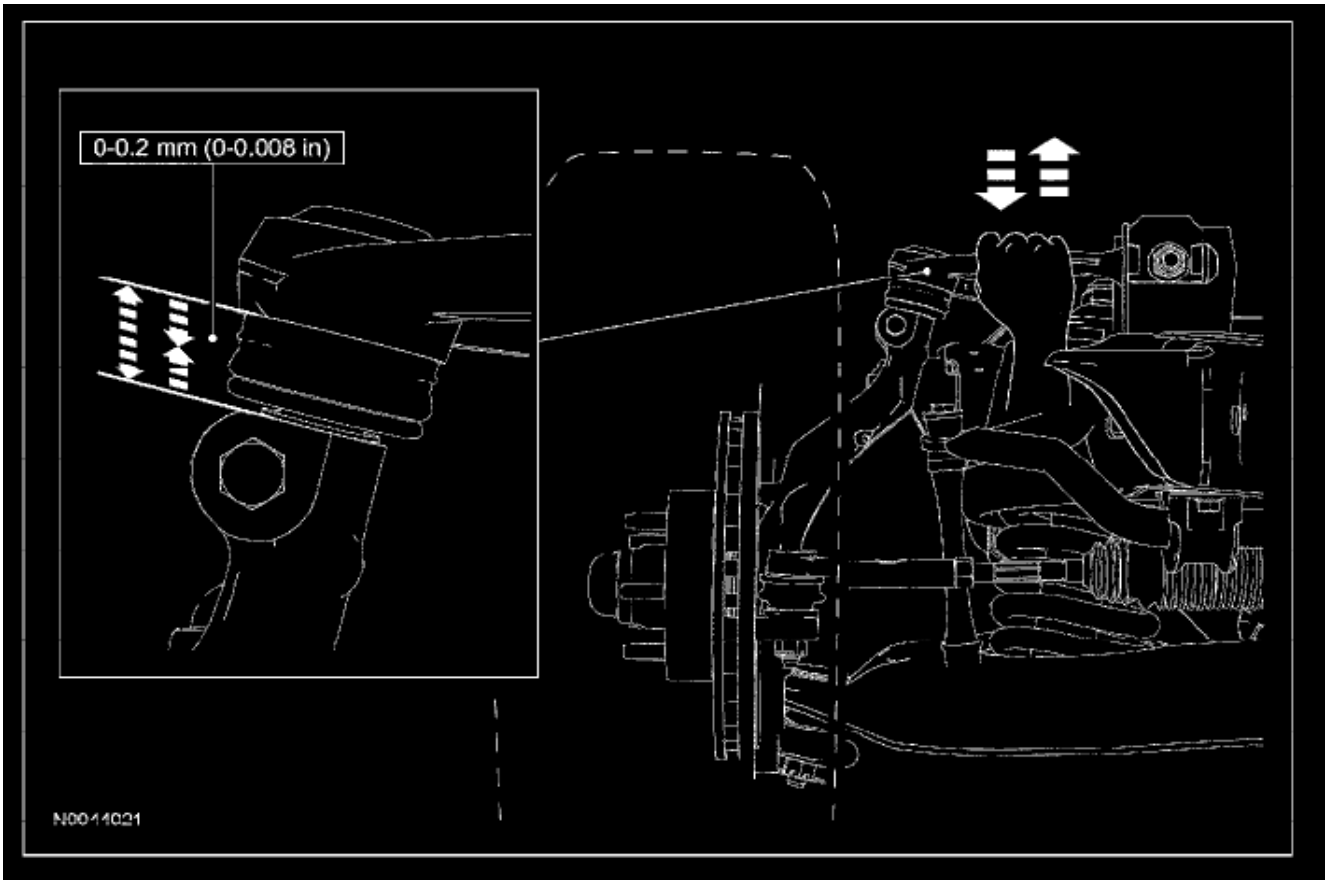
movement. Suspension damage may occur. The use of tools or equipment will also create relative movement that may not exist when using hand force. Relative movement must be measured using hand force only.

Inspect the ball joint for relative movement by alternately pulling downward and pushing upward on the upper arm by hand. Note any relative movement between the wheel knuckle and upper arm at the upper ball joint. ^

If relative movement is not felt or seen, the ball joint is OK. Do not install a new ball joint.

^ If relative movement is found, continue with Step 8.

8. NOTE: In order to obtain an accurate measurement, the dial indicator should be aligned as close as possible with the center line of the ball joint.



To measure ball joint deflection, attach a suitable dial indicator with a flexible arm between the upper arm and the wheel knuckle or ball joint stud.

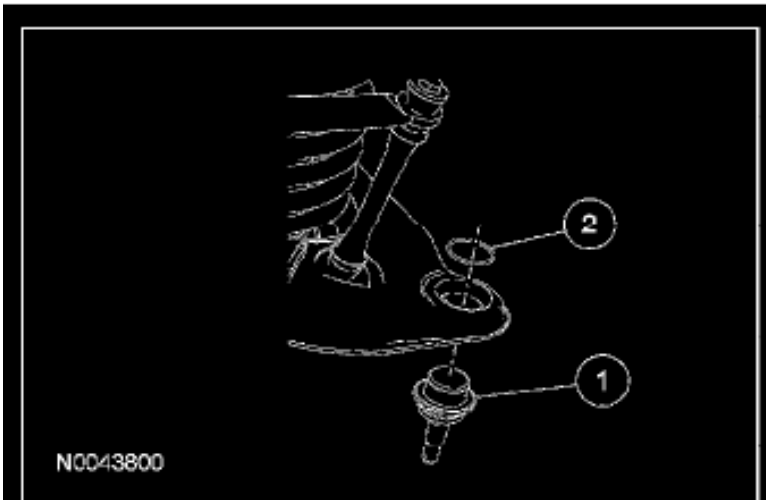
9. Measure the ball joint deflection while an assistant pushes upward then pulls down on the upper arm by hand.

^ If the deflection exceeds the specification, a new upper ball joint must be installed.

^ If the deflection meets the specification, no further action is required.

Special Tool(s)

ST1172-A	Installer/Remover, C-Frame and Screw 205-086
ST1855-A	Remover, Ball Joint 204-182
ST2929-A	Installer/Remover, Ball Joint 204-355



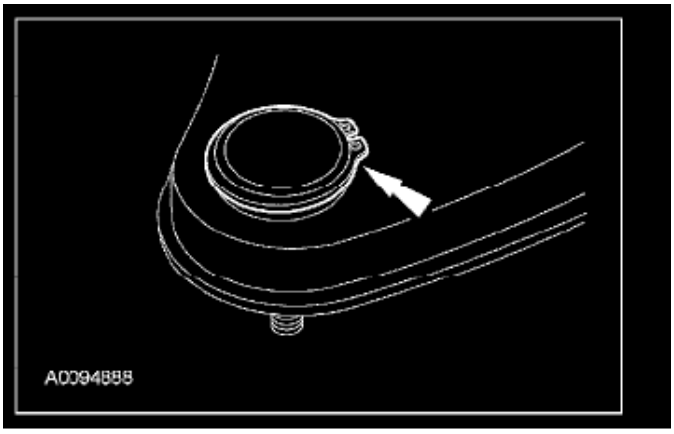
Item	Part Number	Description
1	3050	Lower ball joint
2	—	Lower ball joint snap ring (part of 3050 kit)

Ball Joint: Service and Repair

Ball Joint - Lower

Removal

1. Remove the wheel spindle. 2. Remove and discard the lower ball joint snap ring.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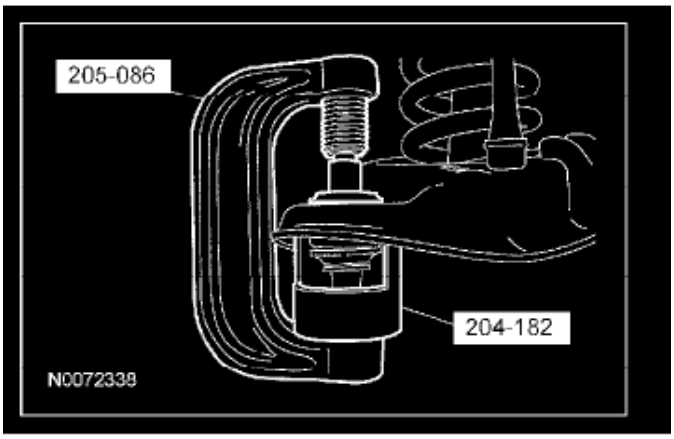
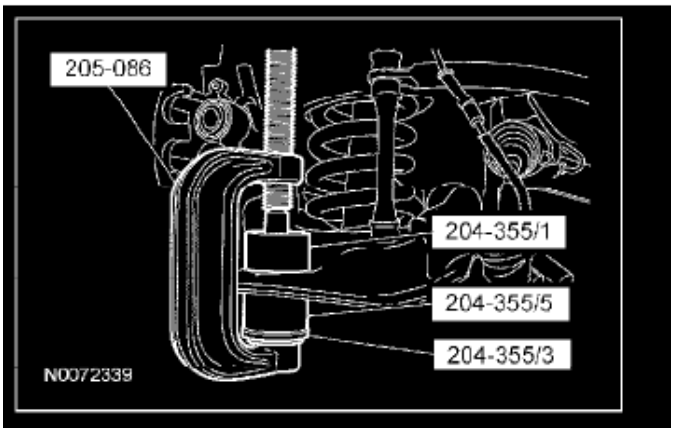

205-086
204-182
N0072338


205-086
204-355/1
204-355/5
204-355/3
N0072339

3. Using the special tools, remove the lower ball joint.

Installation

1. CAUTION: Do not damage the lower ball joint boot when installing the special tool.

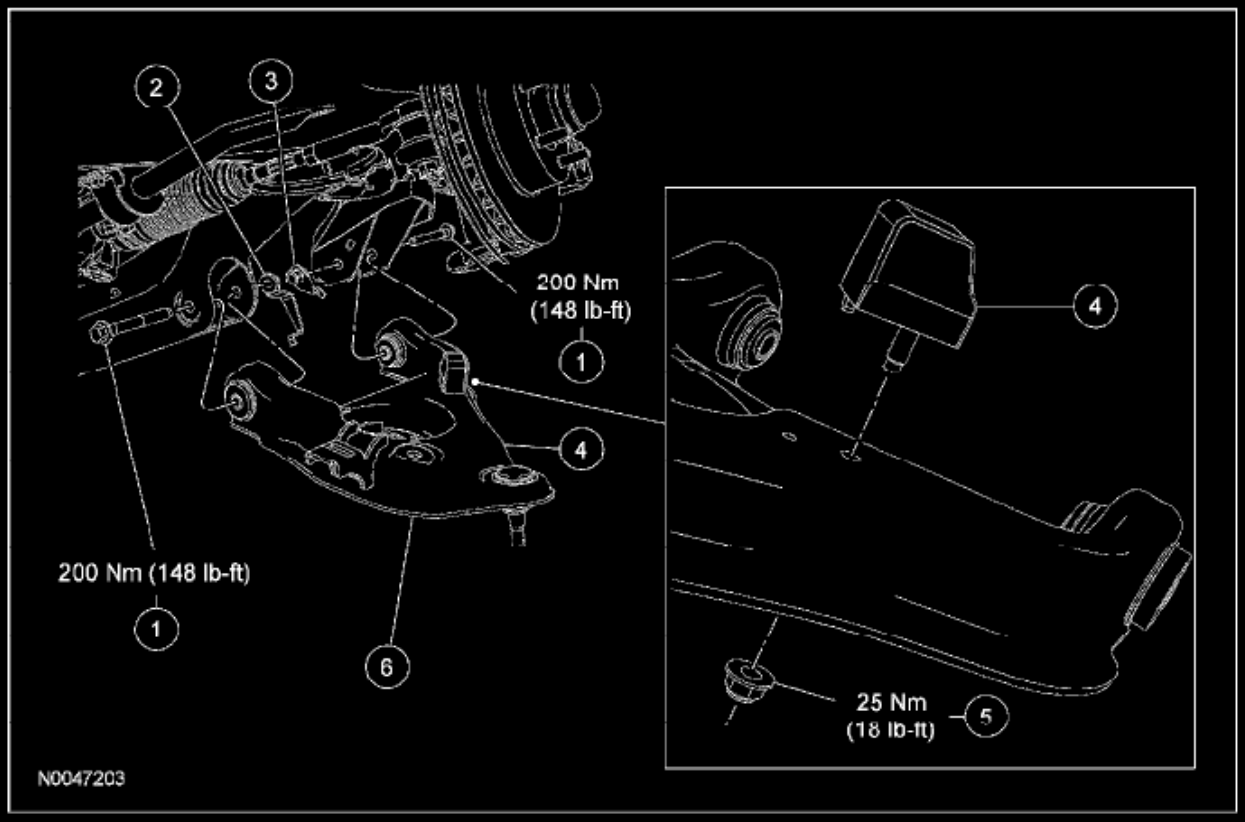
NOTE: Clean and inspect the lower arm ball joint bore for damage before installing a new ball joint.

NOTE: Make sure the new lower ball joint snap ring is fully seated.

Using the special tools, install the lower ball joint.

2. Install the wheel spindle.

Lower Arm — Coil Spring Suspension



Item	Part Number	Description
1	N808264	Lower arm bolt (2 required)
2	N811577	Lower arm forward flag nut
3	N808166	Lower arm rearward flag nut
4	3020	Jounce bumper
5	W520113	Jounce bumper nut
6	3042 RH/ 3051 LH	Lower arm

Control Arm: Service and Repair Lower Arm - Coil Spring Suspension

Lower Arm - Coil Spring Suspension

Lower Arm - Coil Spring Suspension

Removal and Installation

CAUTION: Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part number or an equivalent part if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

1. Remove the spring. 2. Remove and discard the 2 lower arm bolts, flag nuts and the lower control arm.

^ To install, tighten to 200 Nm (148 lb-ft).

3. If necessary, replace the jounce bumper and jounce bumper nut.

^ To install, tighten to 25 Nm (18 lb-ft).

4. To install, reverse the removal procedure.

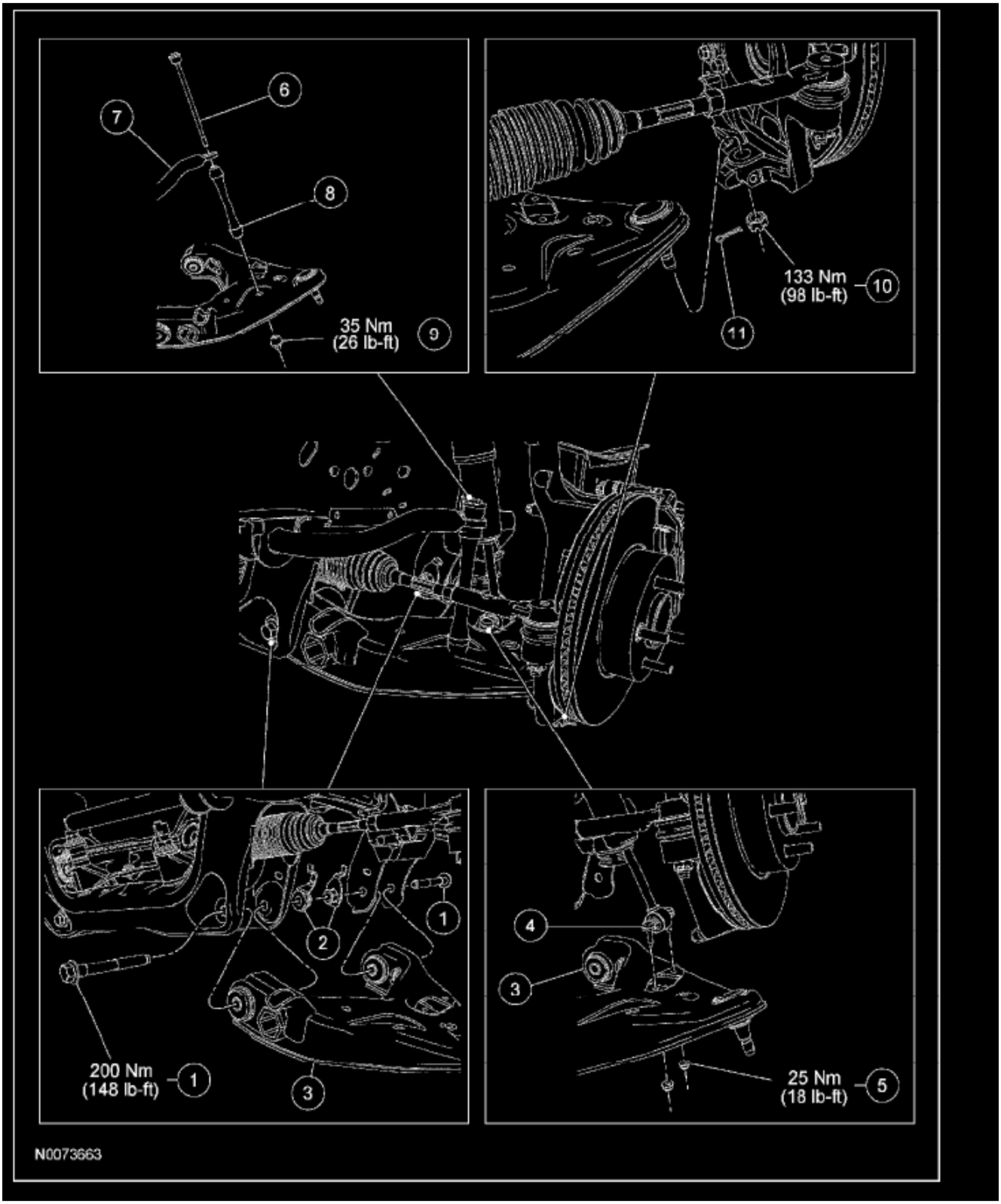
^ Check and, if necessary, align the front end.

Special Tool(s)

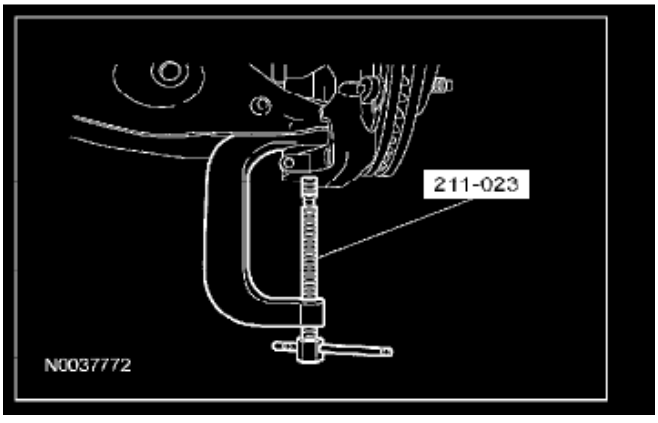
ST1494-A	Installer/Remover C-Frame and Screw 211-023 (T74P-3044-A1)

Control Arm: Service and Repair Lower Arm - Torsion Bar Suspension

Lower Arm - Torsion Bar Suspension


6
7
8
35 Nm
(26 lb-ft)
9
133 Nm
(98 lb-ft)
10
11
1
2
3
200 Nm
(148 lb-ft)
1
4
3
25 Nm
(18 lb-ft)
5
N0073663

Item	Part Number	Description
1	N808264	Lower arm bolts (2 required)
2	N808166	Lower arm flag nut, rearward
2	N811577	Lower arm flag nut, forward
3	3042 RH/ 3051 LH	Lower arm
4	18198	Shock absorber
5	W520102	Shock absorber lower nut (2 required)
6	5495	Stabilizer bar link stud and grommet (part of 5K483)
7	5482	Stabilizer bar
8	5K483	Stabilizer bar link assembly
9	5C491	Stabilizer bar link nut and grommet (part of 5K483)
10	N808039	Lower ball joint nut
11	W525287	Lower ball joint cotter pin



Removal

CAUTION: Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part number or an equivalent part if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

1. Remove the torsion bar. 2. Remove the wheel and tire. 3. Remove and discard the stabilizer bar link nut and grommet. 4. Remove the stabilizer link stud and grommet and the stabilizer link assembly. 5. Remove and discard the 2 lower shock nuts. 6. Remove and discard the lower ball joint cotter pin and nut.

7. CAUTION: Do not use a hammer to separate the ball joint from the wheel spindle/knuckle or damage to the wheel spindle/knuckle will

result.

CAUTION: Do not damage the ball joint boot while installing the special tool.

Using the special tool, separate the ball joint from the wheel spindle/knuckle.

8. Remove the lower arm bolts and nuts, and remove the front suspension lower arm.

^ Discard the 2 bolts and 2 nuts.

Installation

1. NOTE: Do not tighten the bolts at this time.

Position the lower arm and loosely install the 2 lower arm bolts and the 2 lower arm nuts.

2. Position the ball joint and install the ball joint nut.

^ Tighten to 133 Nm (98 lb-ft).

3. CAUTION: Install the new cotter pin into the lower ball joint from outboard to inboard with the fingers bent together at a right angle.

Failure to do so will result in damage to the wheel and tire assembly.

Install a new lower ball joint cotter pin.

4. Install the 2 shock absorber lower nuts.

^ Tighten to 25 Nm (18 lb-ft).

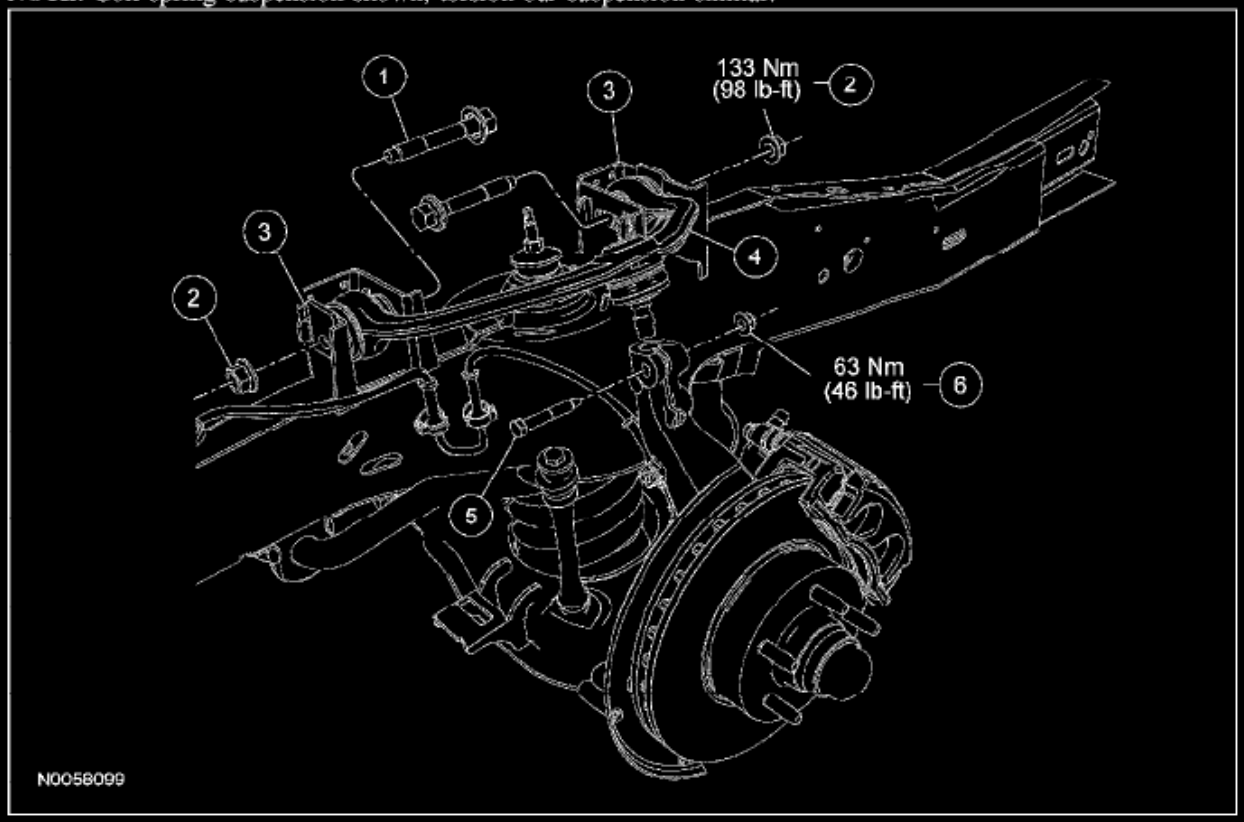
5. Install the stabilizer link stud and grommet and the stabilizer link assembly.

^ Tighten the stabilizer link nut to 35 Nm (26 lb-ft).

6. Install the wheel and tire. 7. With the weight of the vehicle on the wheel and tire, tighten the 2 lower arm nuts to 200 Nm (148 lb-ft).

Upper Arm

NOTE: Coil spring suspension shown, torsion bar suspension similar.



Item	Part Number	Description
1	W709831	Upper arm flag bolt (2 required)
2	N805480	Upper arm nuts (2 required)
3	3C203	Upper arm alignment set shims (2 required)

Item	Part Number	Description
4	3084 RH/ 3085 LH	Upper arm
5	N808474	Upper ball joint pinch bolt
6	W520113	Upper ball joint nut

(Continued)

Control Arm: Service and Repair Upper Arm

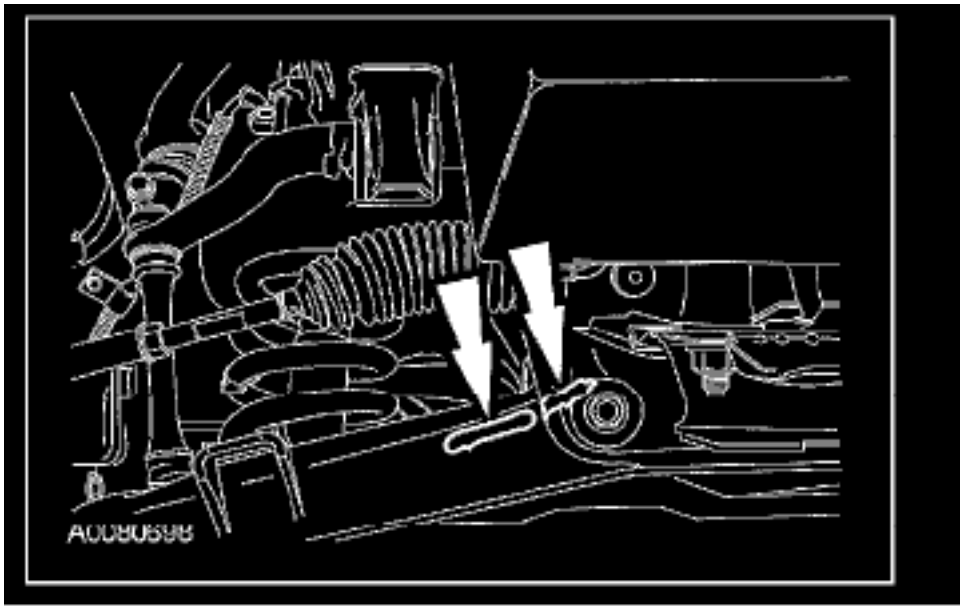
Upper Arm

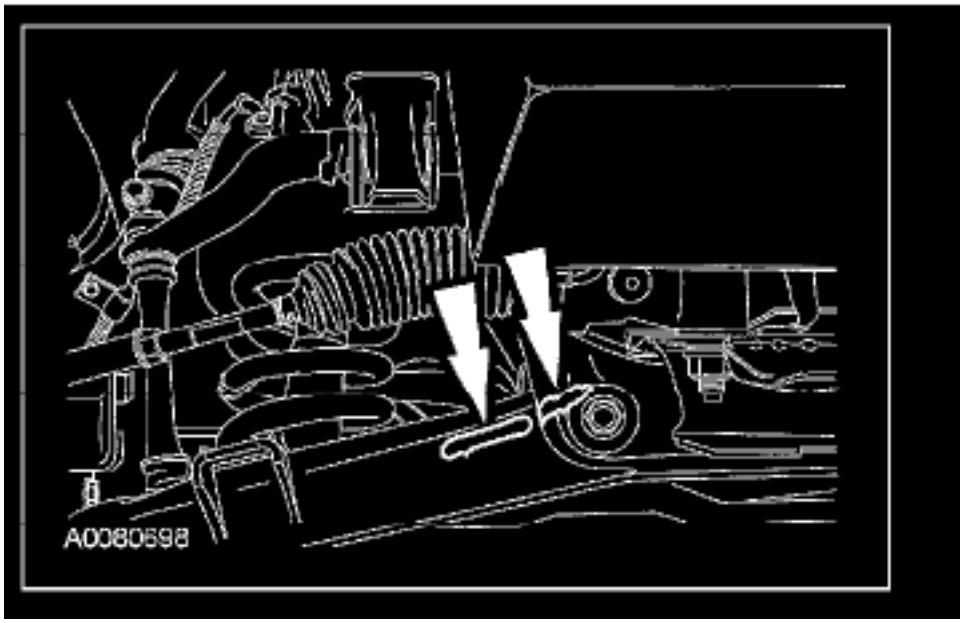
Upper Arm

Removal

CAUTION: Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part number or an equivalent part if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

1. Index-mark the lower arm to the frame with the vehicle in a static ground position (curb height).





2. Remove the wheel and tire. 3. Use a suitable jack to support the lower arm.

4. CAUTION: To avoid possible damage to the wheel spindle/knuckle, secure the wheel spindle/knuckle to keep it from tilting before

removing the pinch bolt and nut.

Remove and discard the upper ball joint nut and pinch bolt, and separate the ball joint from the wheel spindle/knuckle.

5. Remove and discard the 2 upper arm nuts, flag bolts and set shims.

^ Remove the upper arm.

Installation

1. NOTE: Do not tighten the nuts at this time.

NOTE: Make sure that the set shims are installed in their original positions.

Position the upper arm and loosely install the 2 upper arm flag bolts, set shims and nuts.

2. Install the upper ball joint and ball joint nut.

^ Tighten to 63 Nm (46 lb-ft).

3. Position a suitable jack under the front suspension lower arm and raise the suspension until the index marks on the lower arm and the frame are

aligned (curb height).

4. CAUTION: Make sure the upper arm bolts are held in place when tightening the nuts. Failure to do so may result in incorrect torque.

Tighten the upper arm nuts to 133 Nm (98 lb-ft).

5. Install the wheel and tire. 6. Check and, if necessary, align the front end.

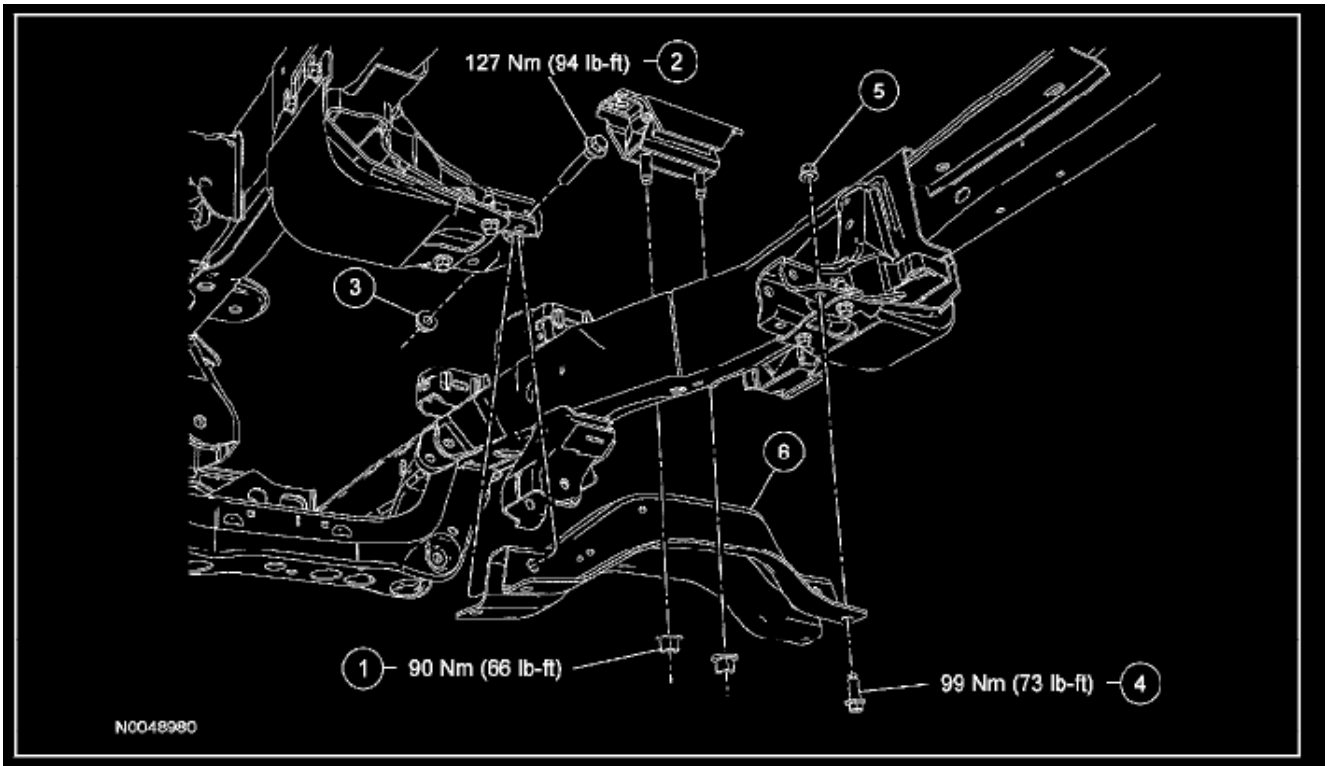
Torque Specifications

Description	Nm	lb-ft
Body mount bolt	80	59
Front End Sheet Metal (FESM) mount bolt	55	41
FESM mount nut	55	41
Horizontal transmission support bolts	127	94
Rear body mount nut	40	30
Transmission mount nuts	90	66
Vertical transmission support bolts	99	73

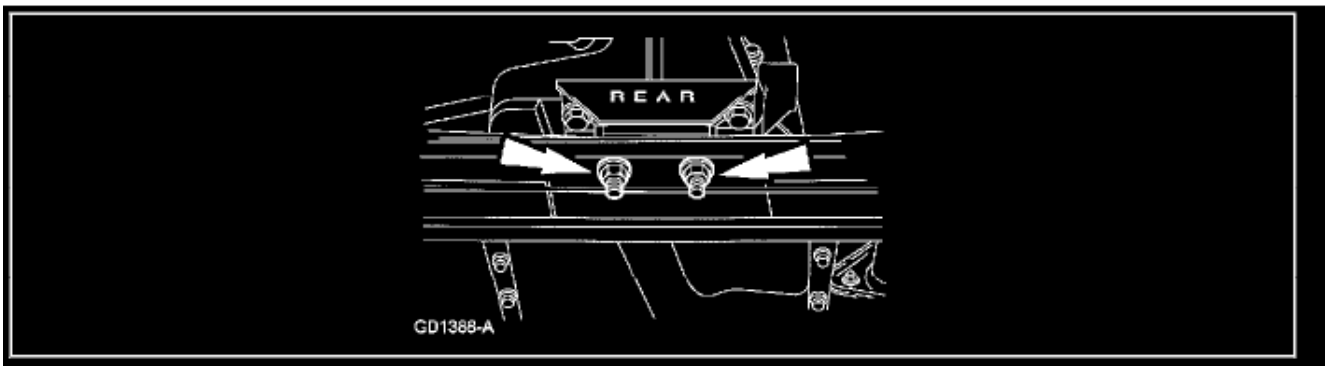
Cross-Member: Specifications

SPECIFICATIONS

Torque Specifications



Item	Part Number	Description
1	N621945	Transmission mount nut (2 required)
2	N802594	Transmission crossmember bolt (2 required)
3	N620482	Transmission crossmember nut (2 required)
4	—	Transmission crossmember bolt (4 required)
5	—	Transmission crossmember nut (4 required)
6	6A023	Transmission crossmember



Cross-Member: Service and Repair

TRANSMISSION SUPPORT CROSSMEMBER

Transmission Support Crossmember

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Remove the 2 transmission mount nuts from the transmission support crossmember. Discard the nuts.

- To install, tighten to 90 Nm (66 lb-ft).

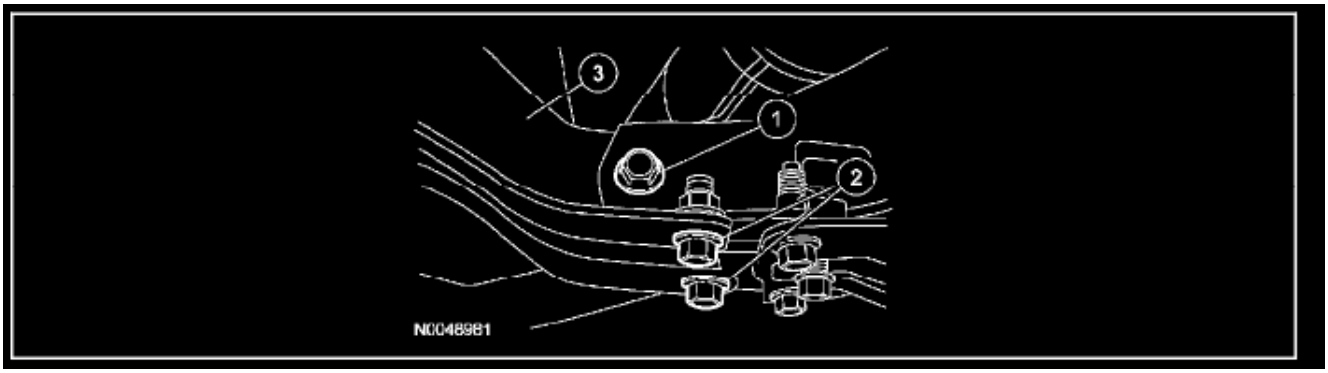
3. NOTE: Do not allow the transmission to hang freely.

Support the transmission with a suitable jack.

4. NOTE: Four-Wheel Drive (4WD) transmission support crossmember shown, Rear Wheel Drive (RWD) transmission support crossmember

similar.

Remove the transmission support crossmember. 1. Remove the 2 horizontal transmission support crossmember bolts and nuts (1 each side).



- To install, tighten to 127 Nm (94 lb-ft).

2. Remove the 4 vertical transmission support bolts and nuts (2 each side).

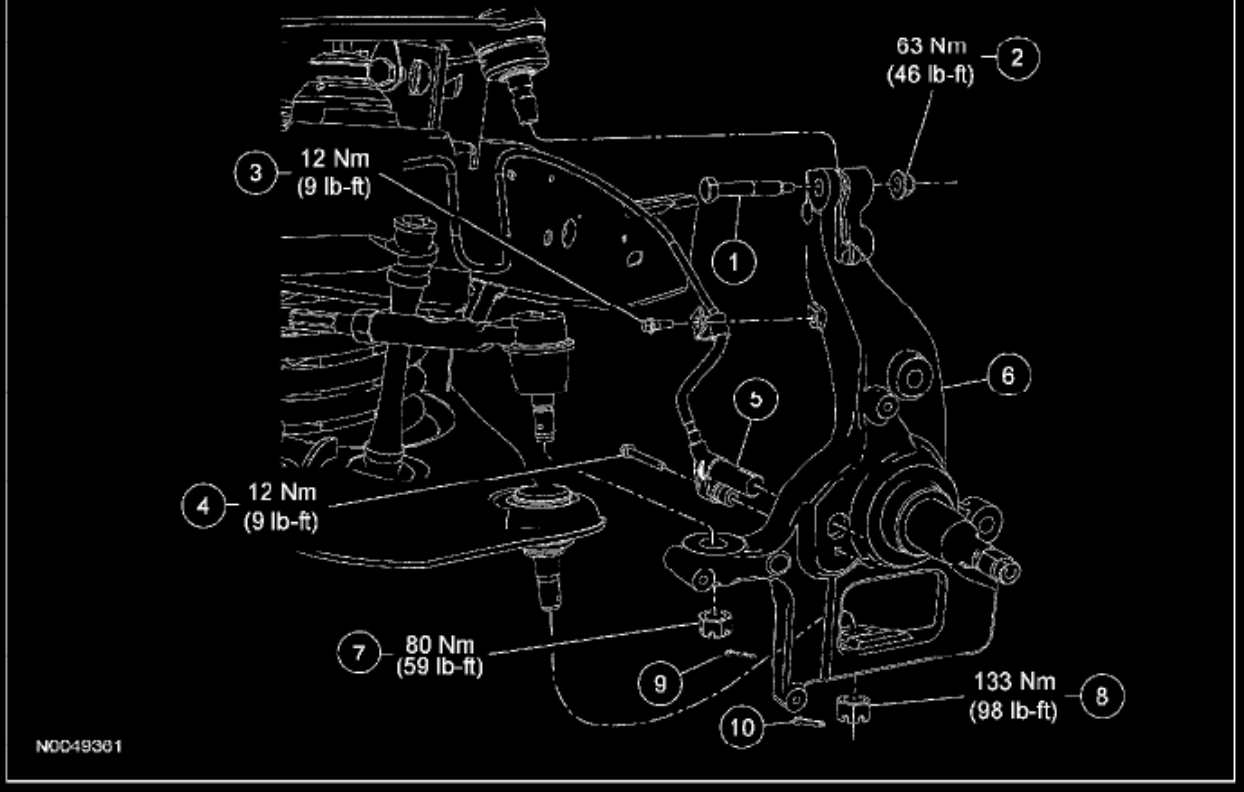
- To install, tighten to 99 Nm (73 lb-ft).

3. Remove the transmission support crossmember.

5. To install, reverse the removal procedure.

Special Tool(s)

ST1494-A	C-Frame and Screw 211-023 (T74P-3044-A1)



Item	Part Number	Description
1	N808474	Upper ball joint pinch bolt
2	W520113	Upper ball joint nut
3	N611171	Wheel speed sensor harness bolt
4	N811177	Wheel speed sensor bolt
5	5C204	Wheel speed sensor

Item	Part Number	Description
6	3105 RH/ 3106 LH	Wheel spindle
7	N800895	Outer tie-rod end nut
8	N808039	Lower ball joint nut
9	W525287	Cotter pin
10	W525287	Cotter pin

(Continued)

Spindle: Service and Repair

Wheel Spindle

Removal and Installation

CAUTION: Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part number or an equivalent part if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

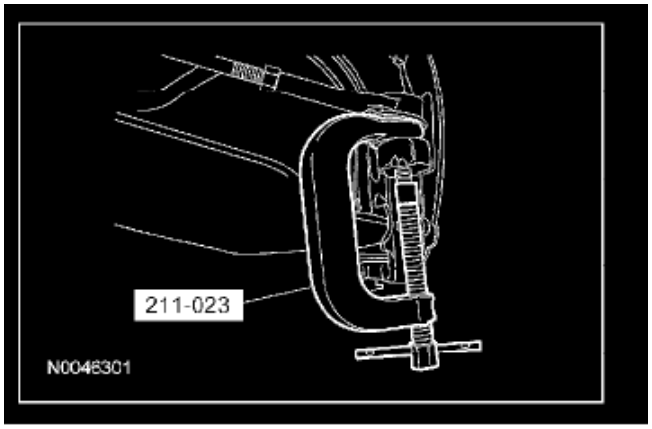
1. Remove the brake disc shield. 2. Remove and discard the wheel speed sensor harness bolt.

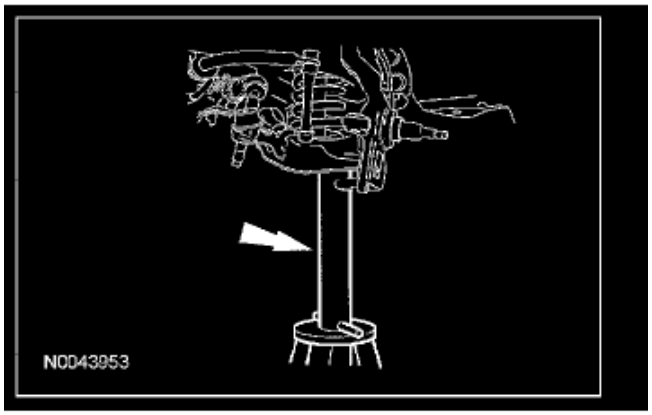
^ To install, tighten to 12 Nm (9 lb-ft).

3. Remove and discard the wheel speed sensor bolt and disconnect the wheel speed sensor from the wheel spindle.

^ To install, tighten to 12 Nm (9 lb-ft).

4. Remove and discard the outer tie-rod end nut.


211-023
N0046301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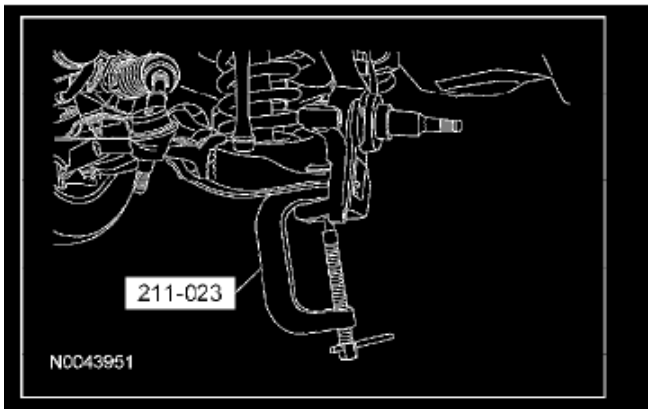

211-023
N0043951

^ To install, tighten to 80 Nm (59 lb-ft).

5. CAUTION: Do not use a hammer to separate the tie-rod end from the wheel spindle or damage to the wheel spindle will result.

CAUTION: Do not damage the tie-rod end boot when installing the special tool.

Using the special tool, separate the outer tie-rod end from the wheel spindle.

6. Use a suitable jack to support the front suspension lower arm.

7. Remove and discard the upper ball joint nut and pinch bolt.

^ Disconnect the upper ball joint from the wheel spindle.

^ To install, tighten to 63 Nm (46 lb-ft).

8. Remove and discard the lower ball joint cotter pin and nut.

^ To install, tighten to 133 Nm (98 lb-ft).

9. CAUTION: Do not use a hammer to separate the ball joint from the wheel spindle or damage to the wheel spindle will result.

CAUTION: Do not damage the ball joint boot while installing the special tool.

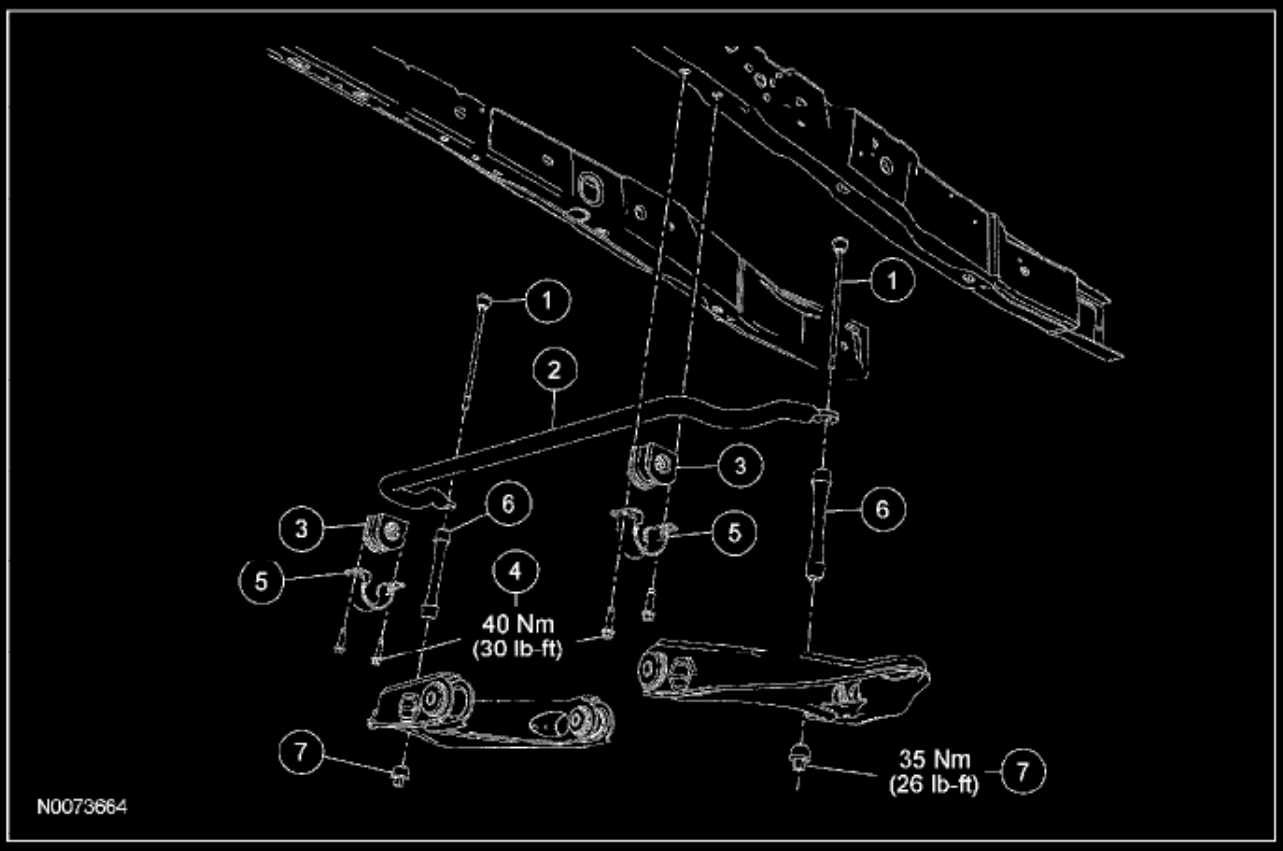
Using the special tool, separate the lower ball joint from the wheel spindle and remove the front wheel spindle.

10. CAUTION: Always install the cotter pins into the nuts from the outboard to inboard, with the ringers bent together at a right angle.

Failure to do so will result in damage to the wheel and tire assembly.

To install, reverse the removal procedure.

Stabilizer Bar and Link



Item	Part Number	Description
1	5495	Stabilizer link studs and grommets (part of 5K483) (2 required)
2	5482	Stabilizer bar
3	5484	Stabilizer bar bushings (2 required)
4	N811848	Stabilizer bar bracket bolt (4 required)
5	5486	Stabilizer bar brackets (2 required)
6	5K483	Stabilizer bar link assemblies (2 required)
7	5C491	Stabilizer bar link nuts and grommets (part of 5K483) (2 required)

Stabilizer Link: Service and Repair

Stabilizer Bar and Link

Stabilizer Bar and Link

Removal and Installation

CAUTION: Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part number or an equivalent part if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Remove and discard the front stabilizer bar link nuts and grommets.

^ To install, tighten to 35 Nm (26 lb-ft).

3. Remove the front stabilizer bar link studs and the front stabilizer bar links. 4. Remove the 4 stabilizer bar bracket bolts, stabilizer bar, brackets and bushings.

^ Discard the stabilizer bar bracket bolts.

^ To install, tighten to 40 Nm (30 lb-ft).

5. NOTE: Inspect and clean the mating surfaces and the internal threads. Make sure all mating surfaces are free of foreign material and remove any

thread locking compound from the internal threads.

NOTE: In the event the stabilizer bar bracket bolts cannot be installed in the frame, remove the weld nut and replace with a flag nut (N807634-S441).

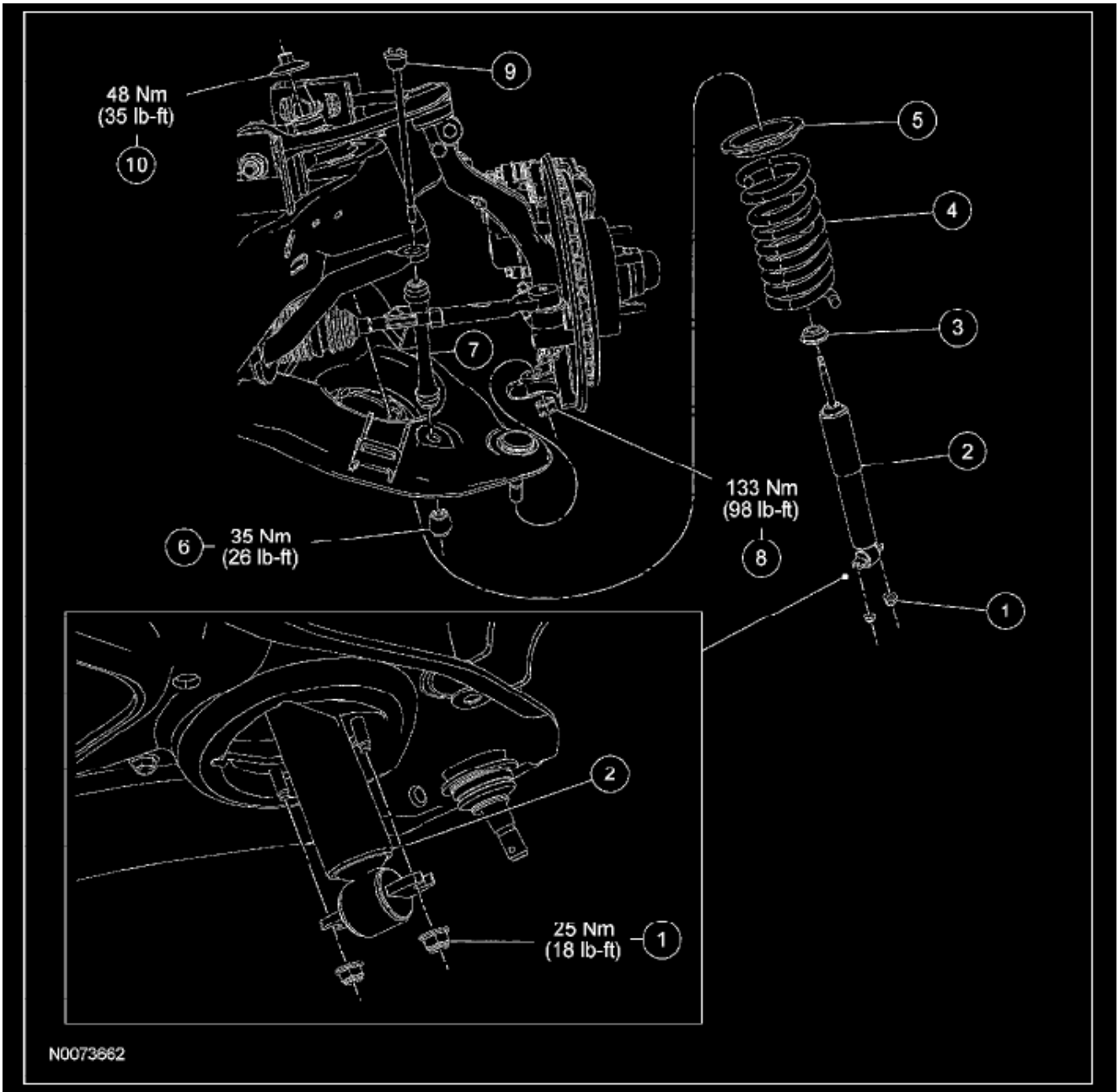
To install, reverse the removal procedure.

Special Tool(s)

ST1494-A	C-Frame and Screw Assembly 211-023 (T74P-3044-A1)
ST1352-A	Coil Spring Compressor 204-D001 (D78P-5310-A) or Equivalent

Suspension Spring (Coil / Leaf): Service and Repair Front

Spring



Item	Part Number	Description
1	W520102	Lower shock nut (2 required)
2	18124	Shock absorber
3	18198	Shock absorber insulator
4	5310	Coil spring
5	5415	Coil spring insulator
6	5K483	Stabilizer bar link assembly

Item	Part Number	Description
7	5C491	Stabilizer bar link and grommet
8	N808039	Lower ball joint nut
9	5495	Stabilizer bar link stud and grommet
10	18B025	Shock absorber rod nut

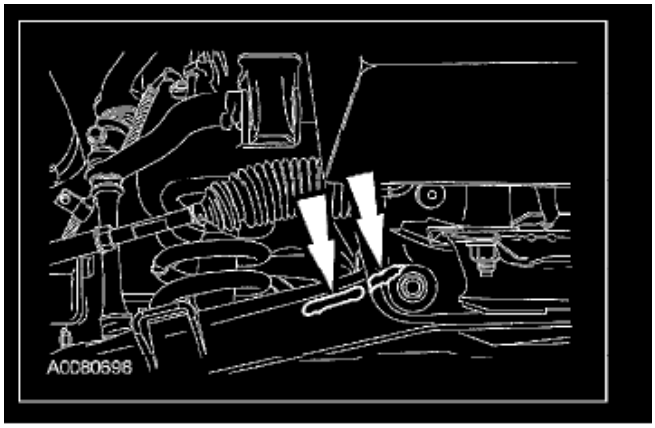
(Continued)

Removal

WARNING: Do not apply heat or flame to the shock absorber or strut tube. The shock absorber and strut tube are gas pressurized and could explode if heated. Failure to follow this instruction may result in serious personal injury.

WARNING: Keep all body parts clear of shock absorbers or strut rods. Shock absorbers or struts can extend unassisted. Failure to follow this instruction may result in serious personal injury.

CAUTION: Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part number or an equivalent part if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.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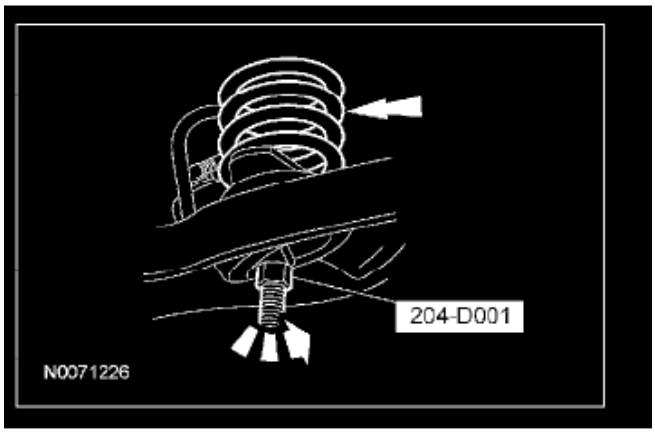
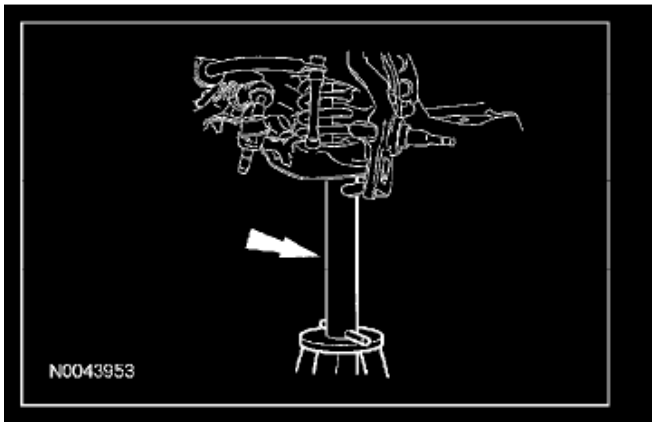

204-D001
N0071226


N0043953

1. Index-mark the lower arm to the frame with the vehicle in a static ground position (curb height).

2. Remove the wheel and tire.

3. CAUTION: Do not allow the shaft to turn while removing the nut. Hold the flats on the shock rod using a suitable wrench or damage to

the shock can result.

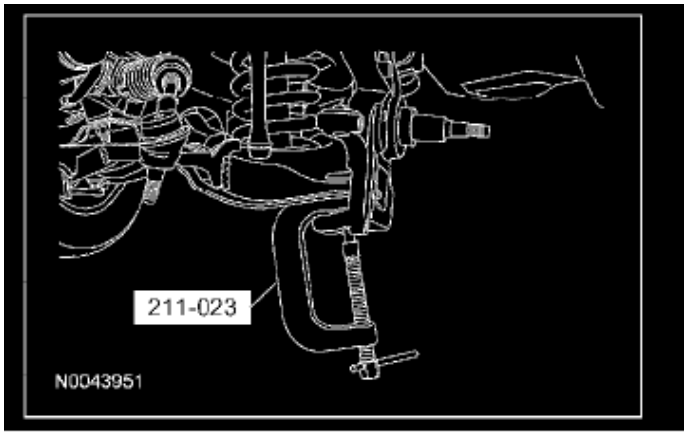
Remove and discard the shock absorber rod nut and washer assembly.

4. Remove and discard the 2 shock absorber lower nuts, and remove the shock absorber. 5. Remove the stabilizer bar link nut and grommet, then remove the link assembly. 6. Using the special tool, compress the coil spring.

7. Remove and discard the lower ball joint nut. 8. Using a suitable jack, support the lower arm.

9. CAUTION: Do not damage the ball joint boot when installing the special tool.

Using the special tool, separate the lower ball joint from the wheel spindle.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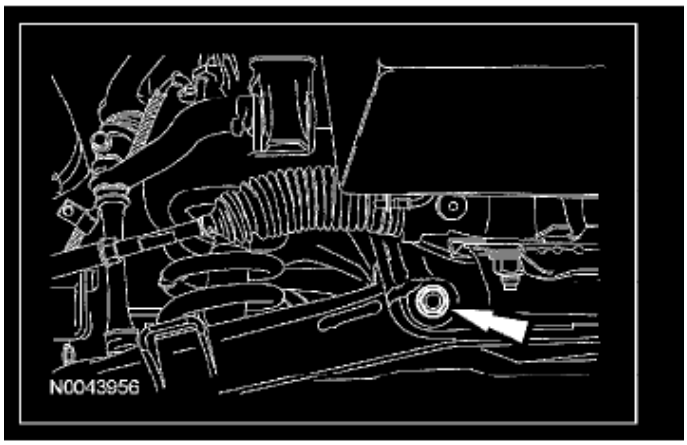
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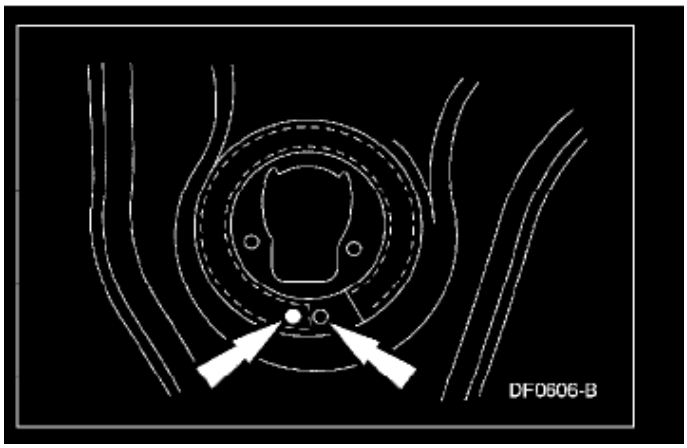
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10. Carefully remove the jack from under the lower arm. 11. Loosen the lower arm bolts and allow the lower arm to swing down.

12. Position the wheel spindle aside and remove the coil spring.

Installation

1. NOTE: The end of the coil spring must cover the first hole and should not be visible in the second hole of the lower arm.

Install the coil spring in the lower arm.

2. Using a suitable jack, support the lower arm.

3. CAUTION: Always install the cotter pin into the lower ball joint nut from outboard to inboard. Failure to do so will result in damage to

the wheel and tire assembly.

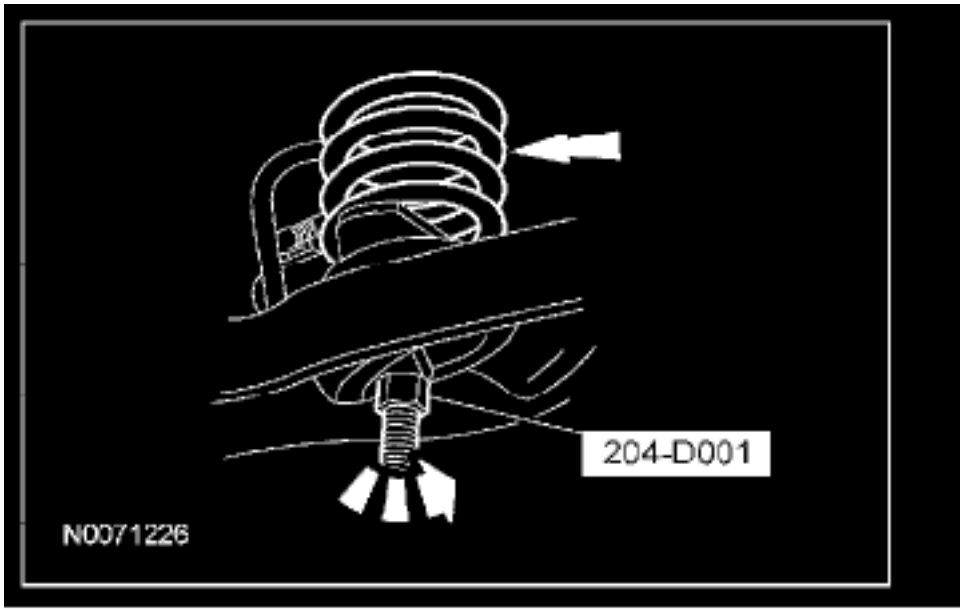
Position the lower ball joint and install a new nut. ^

Tighten to 133 Nm (98 lb-ft).

^ Install a new cotter pin.

4. Remove the jack from under the lower control arm. 5. Install the stabilizer bar link assembly in the following sequence.

1 Install the stabilizer bar link stud and grommet.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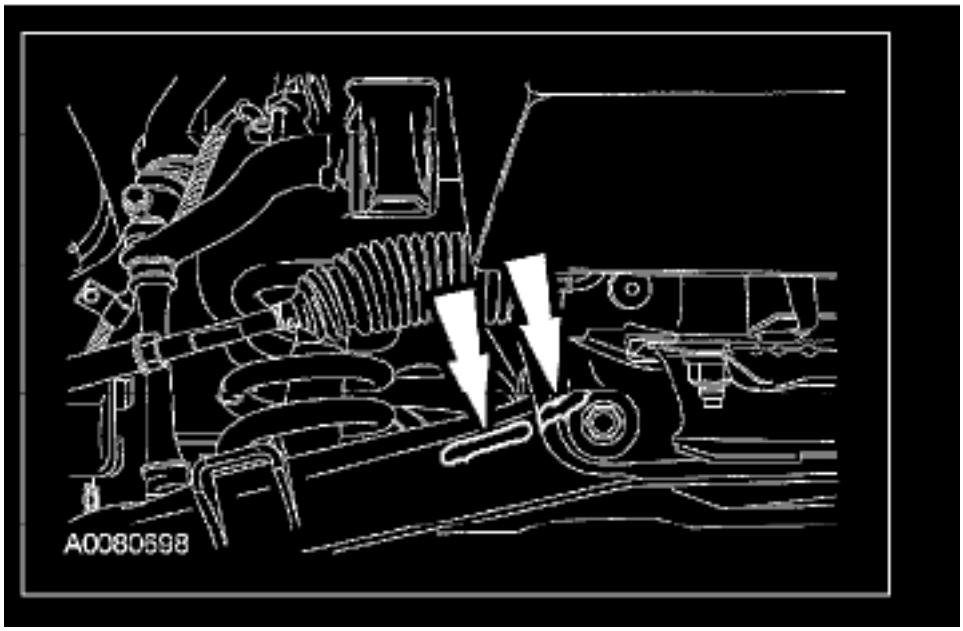
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2 Install a new stabilizer bar link nut and grommet. ^

Tighten to 35 Nm (26 lb-ft).

6. Remove the special tool.

7. Position the shock absorber and install 2 new shock absorber lower nuts.

^ Tighten to 25 Nm (18 lb-ft)

8. Install a new shock absorber rod nut and washer.

^ Tighten to 48 Nm (35 lb-ft).

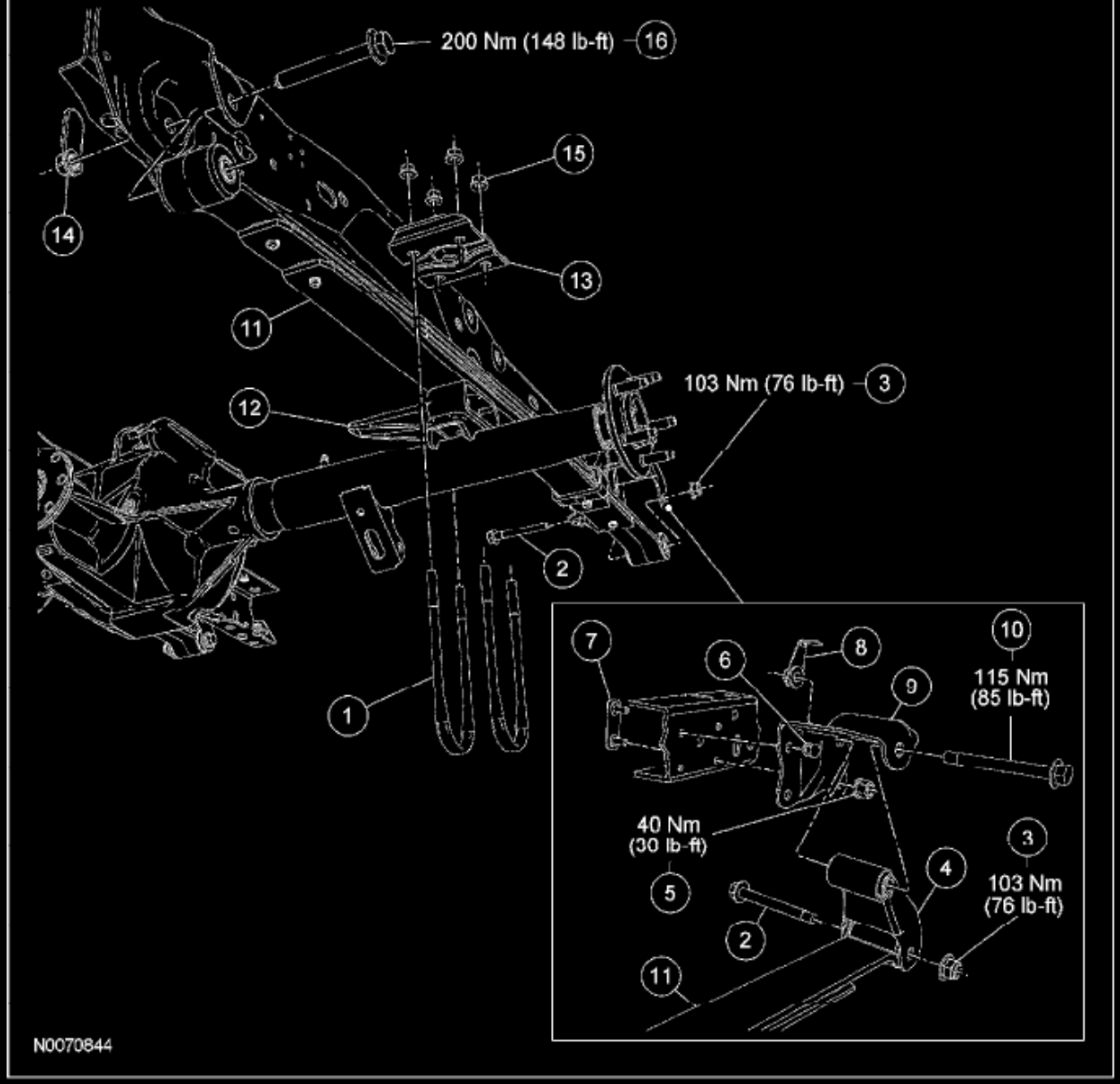
9. Position a suitable jack under the lower arm and raise the suspension until the index marks on the lower arm and the frame are aligned (curb

height). ^

Tighten to 200 Nm (148 lb-ft).

10. Remove the jack from under the lower control arm.

Spring



Item	Part Number	Description
1	W708550	U-bolt (2 required) (coil spring suspension)
1	5705	U-bolt (2 required) (Torsion® axle)
2	N807280	Spring shackle-to-spring bolt
3	W520115	Spring shackle-to-spring nut
4	5776	Spring shackle

(Continued)

Item	Part Number	Description
5	W520113	Frame bracket nut (2 required)
6	N647096	Frame bracket rivet (2 required)
7	N807216	Frame bracket bolt and retainer assembly

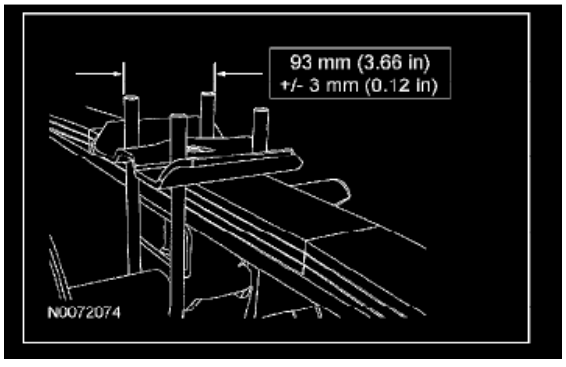
(Continued)

Suspension Spring (Coil / Leaf): Service and Repair Rear

Spring

Spring (Part 1)

Item	Part Number	Description
8	N806368	Spring shackle-to-frame bracket flag nut
9	5775	Frame bracket
10	N807280	Spring shackle-to-frame bracket bolt
11	5560	Leaf spring
12	5598	Rear spring spacer (torsion bar suspension only)
13	5798	Spring plate
14	W707573	Spring-to-frame bracket flag nut
15	N620483	U bolt nut (4 required) (standard axle)
15	W520115	U-bolt nut (Torsion® axle)
16	W707202	Spring-to-frame bracket bolt



Spring (Part 2)

Removal and Installation

CAUTION: Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part numbers or equivalent parts if replacement is necessary. Do not use replacement parts of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Using a suitable jack, support the rear axle. 3. Remove and discard the lower shock absorber bolt and nut.

^ To install, tighten to 80 Nm (59 lb-ft).

4. NOTE: When installing new U-bolts, the distance between the U-bolts should be 93 mm (3.66 inch) ± 3 mm (0.12 inch). This is important for

providing the correct U-bolt clamp load and retention of parts.

Remove and discard the 4 rear U-bolt nuts. ^

Remove the U-bolts and the spring plate.

^ To install, tighten Torsion(R) axle U-bolt nuts in 4 stages. -

Stage 1: Tighten in a cross pattern to 25 Nm (18 lb-ft).

- Stage 2: Tighten in a cross pattern to 50 Nm (37 lb-ft).

- Stage 3: Tighten in a cross pattern to 75 Nm (55 lb-ft).

- Stage 4: Tighten in a cross pattern to 103 Nm (76 lb-ft).

^ To install, tighten standard axle U-bolt nuts in 4 stages. -

Stage 1: Tighten in a cross pattern to 30 Nm (22 lb-ft).

- Stage 2: Tighten in a cross pattern to 60 Nm (44 lb-ft).

- Stage 3: Tighten in a cross pattern to 90 Nm (66 lb-ft).

- Stage 4: Tighten in a cross pattern to 115 Nm (85 lb-ft).

5. If equipped carefully lower the rear axle and remove the rear spring spacer.

6. Remove and discard the spring-to-frame bracket bolt and flagnut.

^ To install, tighten to 200 Nm (148 lb-ft).

7. Remove and discard the spring shackle-to-spring bolt and nut and remove the spring.

^ To install, tighten to 103 Nm (76 lb-ft).

8. If necessary, remove the spring shackle.

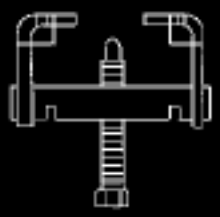
^ Remove and discard the spring shackle-to-frame bracket bolt and flagnut.

^ Remove the shackle.

^ To install, tighten to 115 Nm (85 lb-ft).

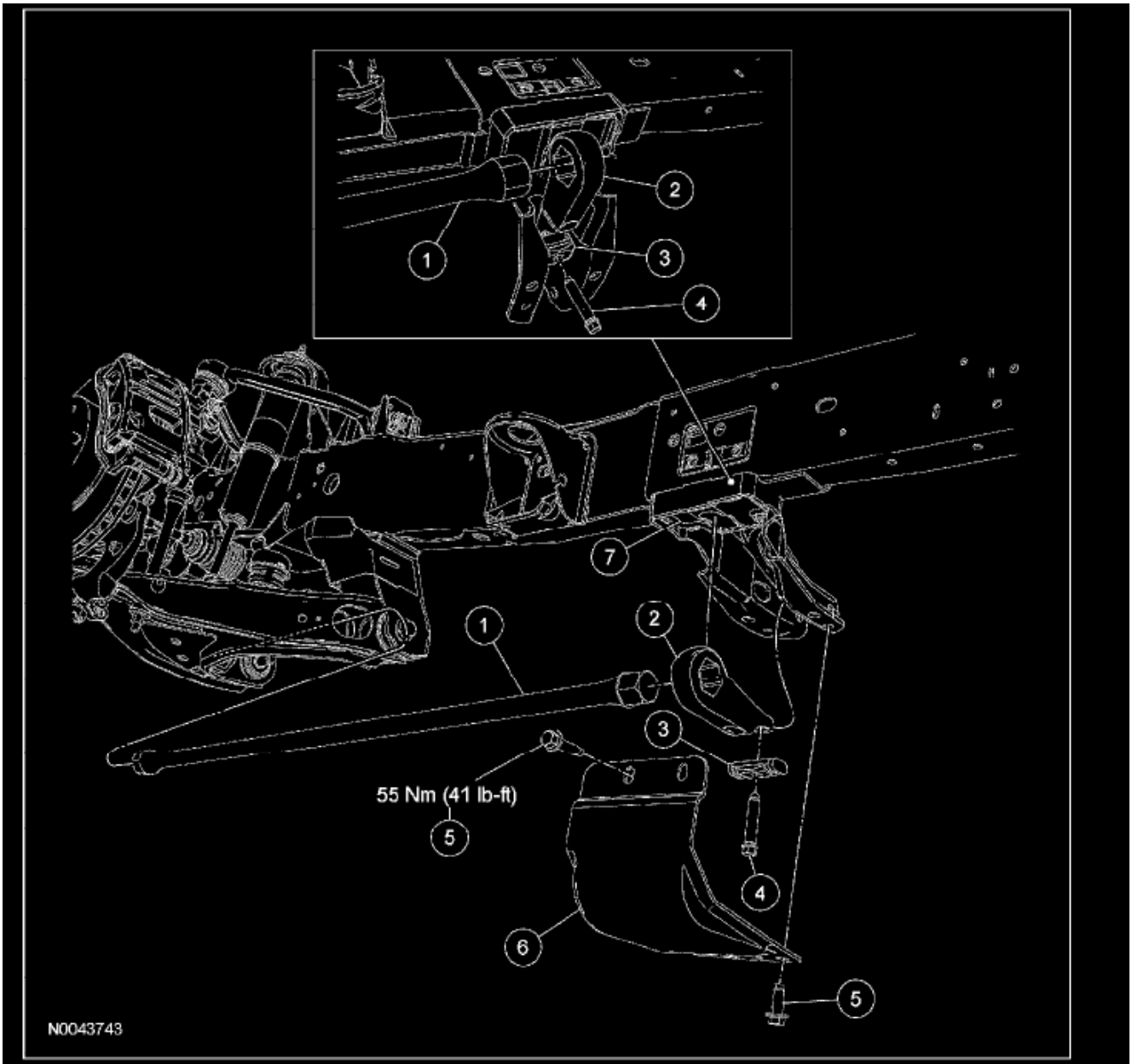
9. To install, reverse the removal procedure.

Special Tool(s)

ST2036-A	Adapter for 204-185 (Spacer) 204-204
 ST1355-A	Remover/Installer, Torsion Bar 204-185

Torsion Bar: Service and Repair

Torsion Bar



Item	Part Number	Description
1	5B327 RH/ 5B326 LH	Torsion bar
2	5B328	Torsion bar adjuster
3	5B329	Torsion bar support nut
4	N811015	Torsion bar adjuster bolt

Item	Part Number	Description
5	N811848	Torsion bar cover plate bolts (4 required)
6	5D050 RH/ 5D051 LH	Torsion bar cover plate
7	5B335	Torsion bar insulator plate

(Continued)

Removal

CAUTION: Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be

installed with the same part number or an equivalent part if replacement is necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

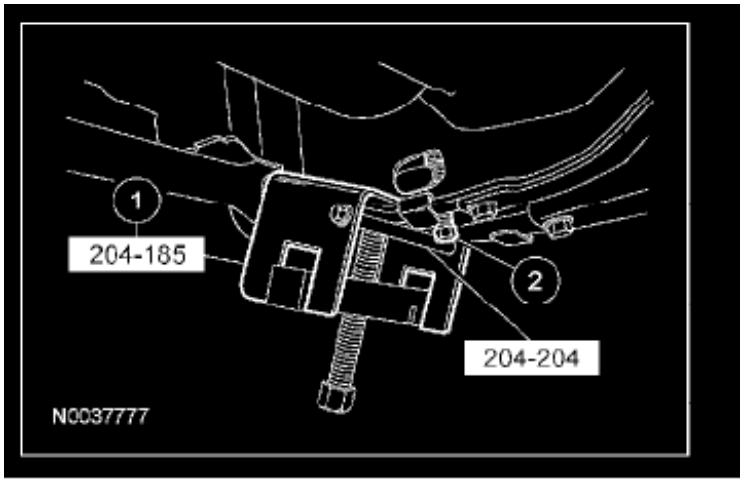
1. With the vehicle in NEUTRAL, position it on a hoist. 2. Remove the torsion bar cover plate bolts and the torsion bar cover plate.

^ To install, tighten to 55 Nm (41 lb-ft).

3. NOTE: Before relieving the torsion bar tension, measure and record the measurement of the torsion bar adjustment bolt. This measurement will

be used as the preset depth for the new torsion bar adjustment bolt during installation.

Make preliminary adjustment references.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204-185
2
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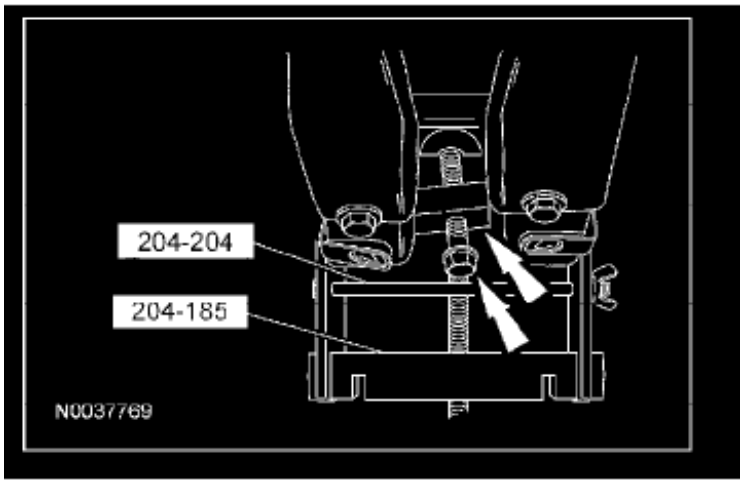
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204-185
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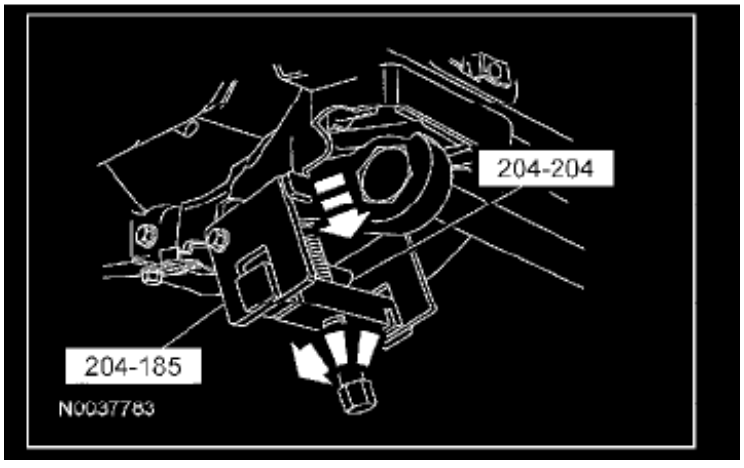
204-204
204-185
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4. Relieve the torsion bar tension.

1 Position the special tool and adapters.

2 Tighten the special tool until the torsion bar adjuster lifts off the adjustment bolt.

5. CAUTION: The torsion bar adjustment bolt is coated with dry adhesive and must be replaced if it is backed off or removed. Failure to

do so may cause the adjustment bolt to loosen during operation and cause a loss of vehicle alignment.

Remove and discard the torsion bar adjustment bolt and support nut.

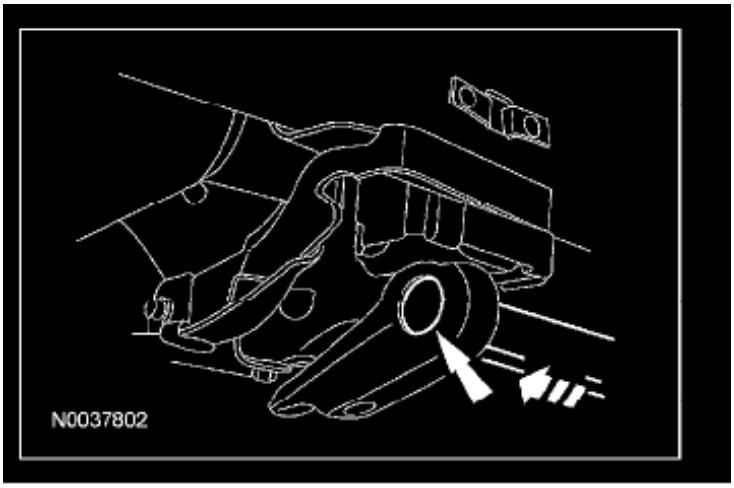
6. Loosen the special tool until the tension is removed from the torsion bar.

7. Remove the torsion bar in the following sequence.

1 Mark the torsion bar and the adjuster for correct installation.

2 Remove the torsion bar insulator plate.

3 Grasp the torsion bar and pull it free from the lower arm.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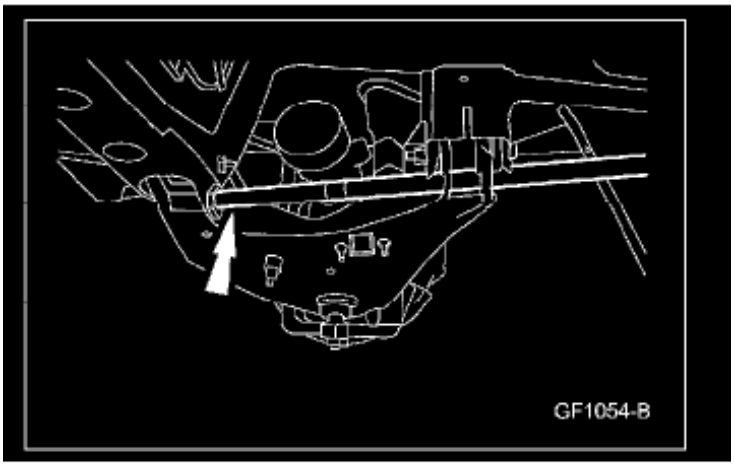
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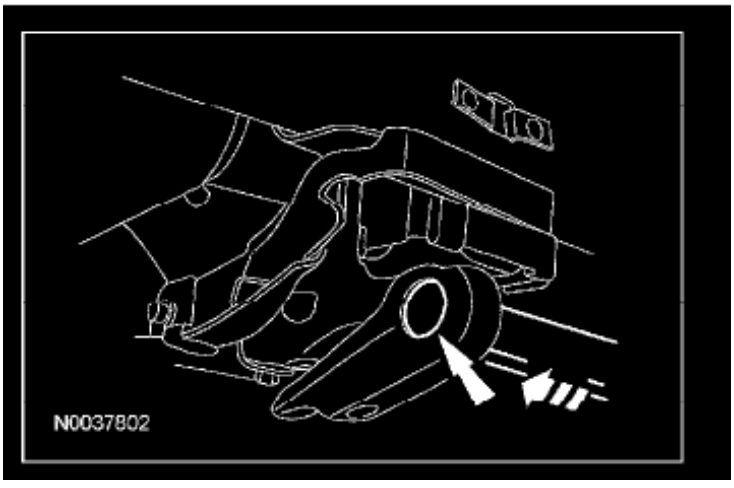

N0037802

Installation

1. Position the torsion bar into lower arm.

2. Install the torsion bar adjuster in the following sequence.

1 Align the marks on the torsion bar and the torsion bar adjuster, then install the torsion bar adjuster.

2 Position the torsion bar insulator plate.

3. CAUTION: The torsion bar adjustment bolt is coated with dry adhesive and must be replaced if it is backed off or removed. Failure to

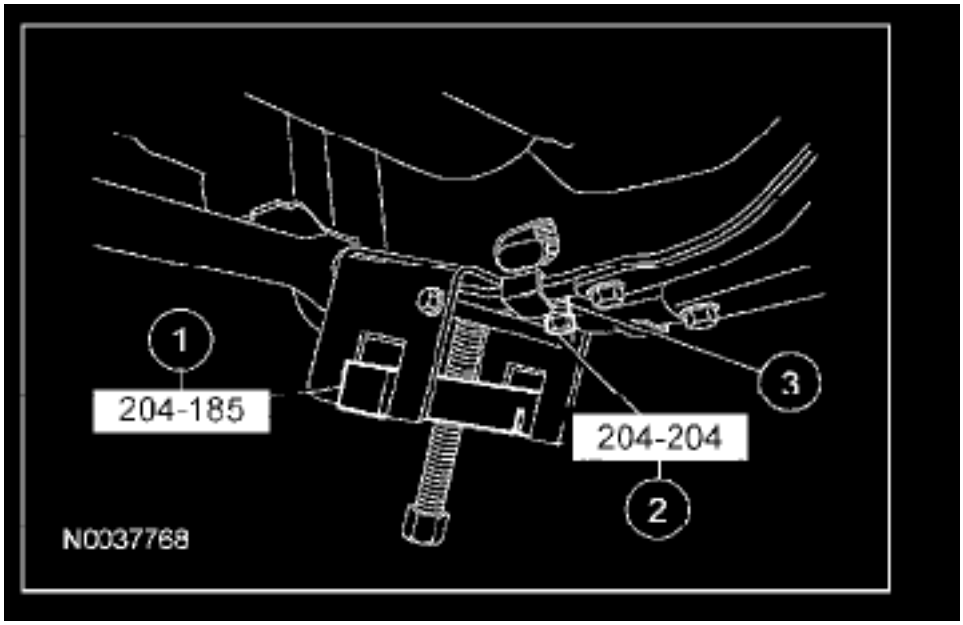
do so may cause the adjustment bolt to loosen during operation and cause a loss of vehicle alignment.

Preload the torsion bar in the following sequence. 1

Install the special tool and the adapters.

2 Tighten the special tool until the new adjustment bolt and nut can be installed.

3 Turn the adjustment bolt until the preliminary adjustment measurement (recorded length of the old adjustment bolt) is reached.



4. Remove the special tool. 5. Install the torsion bar cover plate and 4 retaining bolts.

^ Tighten to 55 Nm (41 lb-ft).

6. Adjust the ride height. 7. Check and if necessary, align the front end.

Special Tool(s)

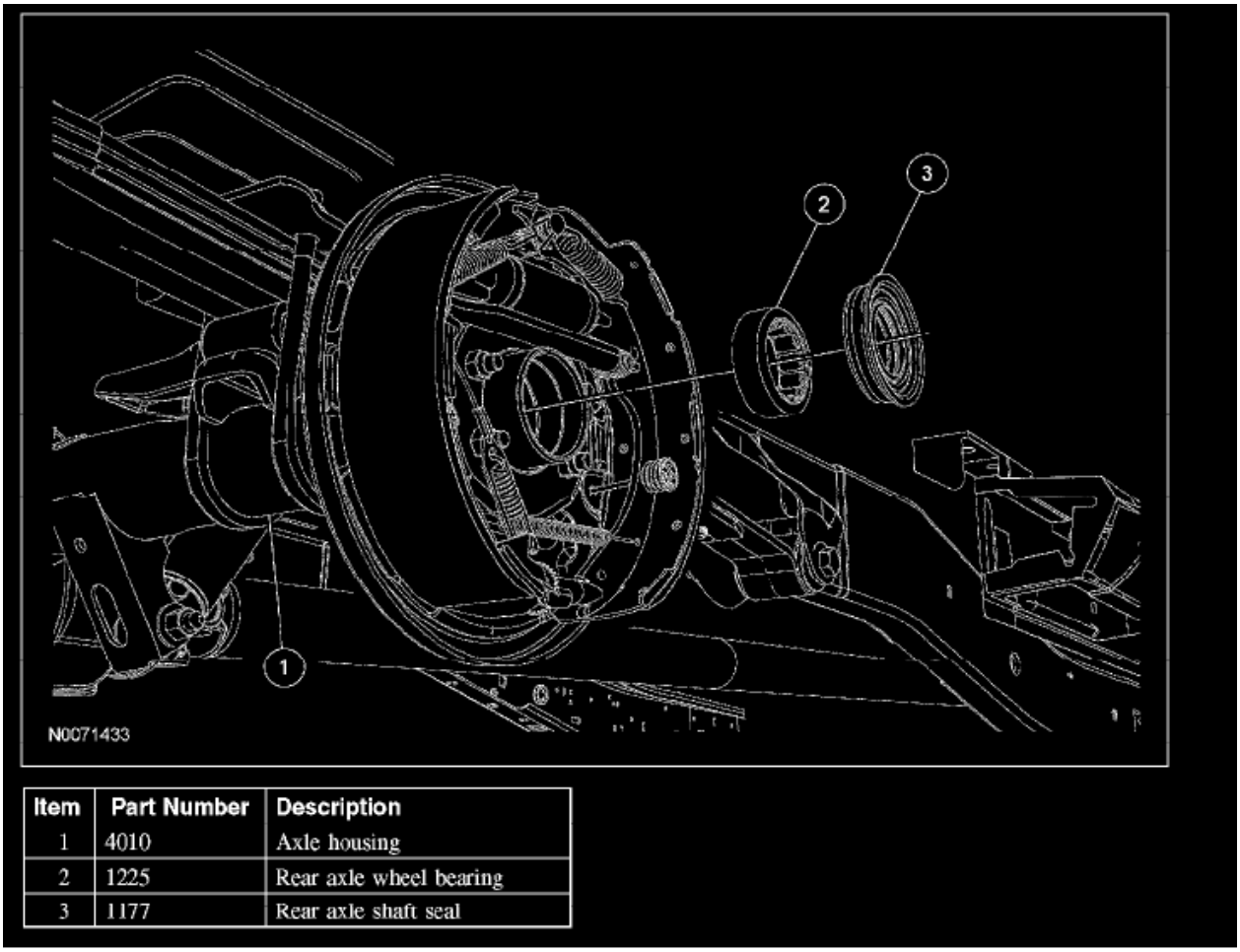
ST1326-A	Adapter for 303-224 (Handle) 205-153 (T80T-4000-W)
ST1541A	Installer, Axle Shaft Bearing 205-124 (T78P-1225-A)
ST2027 A	Installer, Rear Axle Oil Seal 205-390 (T97T-1177-B)
ST1185-A	Slide Hammer 100-001 (T50T-100-A)
ST2035-A	Remover, Axle Bearing 205-219 (T85L-1225-AH)

Material

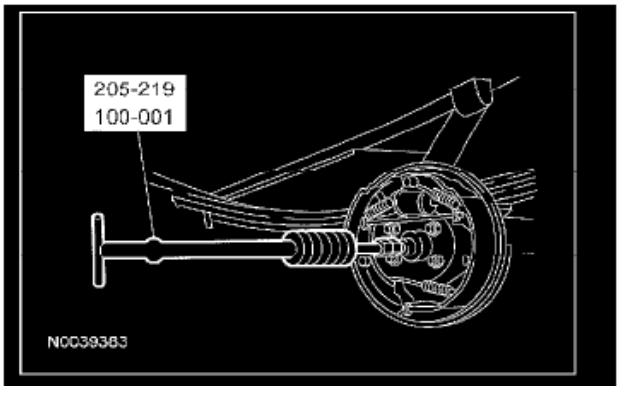
Item	Specification
Motorcraft SAE 80W-90 Premium Rear Axle Lubricant XY-80W90-QL (US); CXY-80W90-1L (Canada)	WSP-M2C197-A
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B

Wheel Bearing: Service and Repair Ford 7.5-Inch Ring Gear - Rear Drive Axle/Differential

Rear Wheel Bearing and Axle Shaft Seal



Item	Part Number	Description
1	4010	Axle housing
2	1225	Rear axle wheel bearing
3	1177	Rear axle shaft seal



Removal

1. NOTE: If the wheel bearing oil seal is leaking, the axle housing vent may be plugged.

Remove the axle shaft.

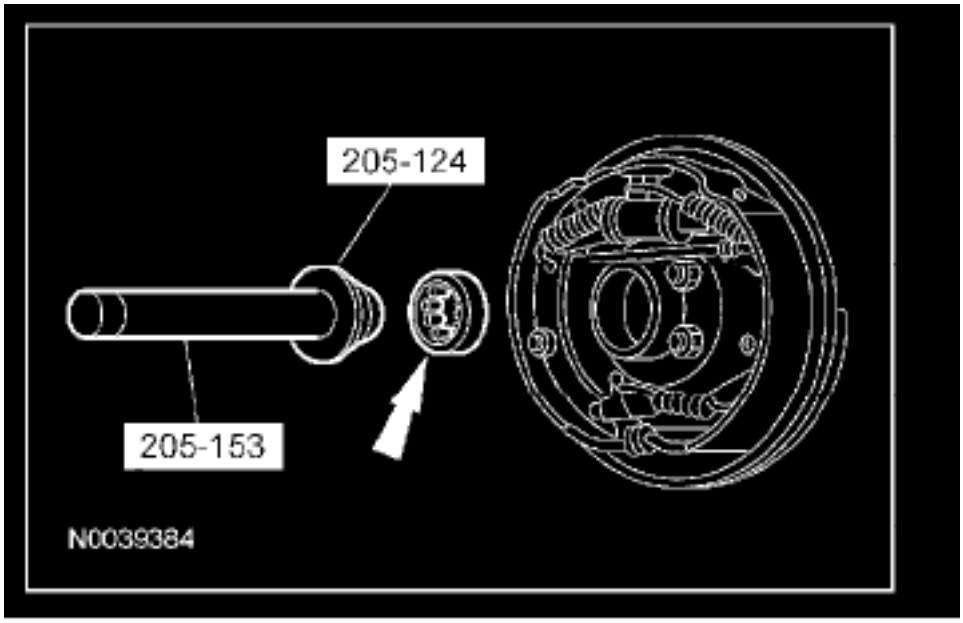
2. NOTE: If only a new seal needs to be installed, use care to avoid damaging the seal bore.

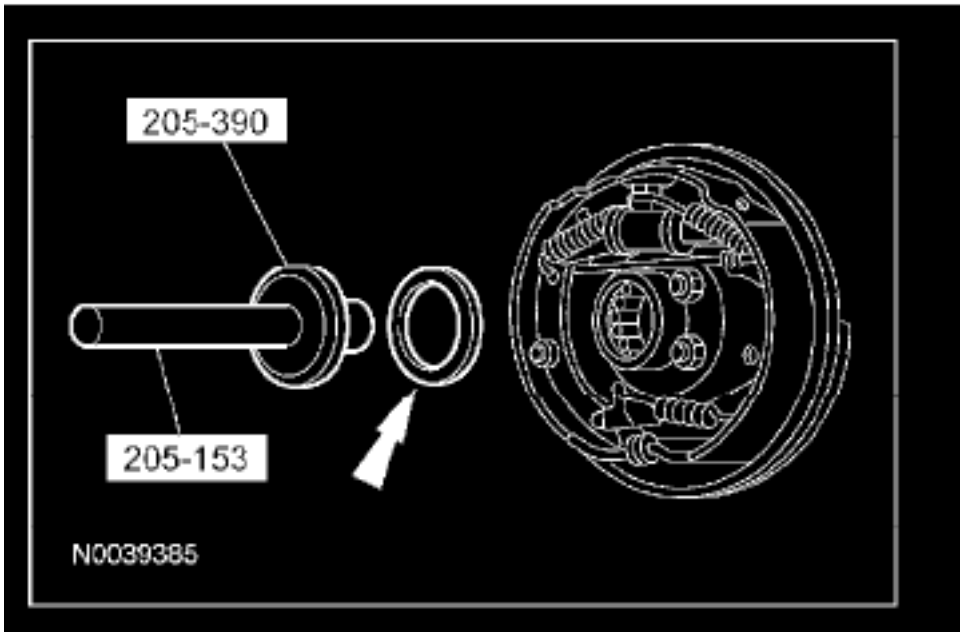
Using a suitable seal remover, remove and discard the axle shaft oil seal.

3. Inspect the rear wheel bearing and axle shaft for wear or damage. 4. If necessary, using the special tools, remove the rear wheel bearing.

Installation

1. Lubricate the new rear wheel bearing with lubricant. 2. Using the special tools, install the rear wheel bearing. 3. Lubricate the lip of the new wheel bearing oil seal with grease.





4. Using the special tools, install the wheel bearing oil seal.

5. Install the axle shaft.

Special Tool(s)

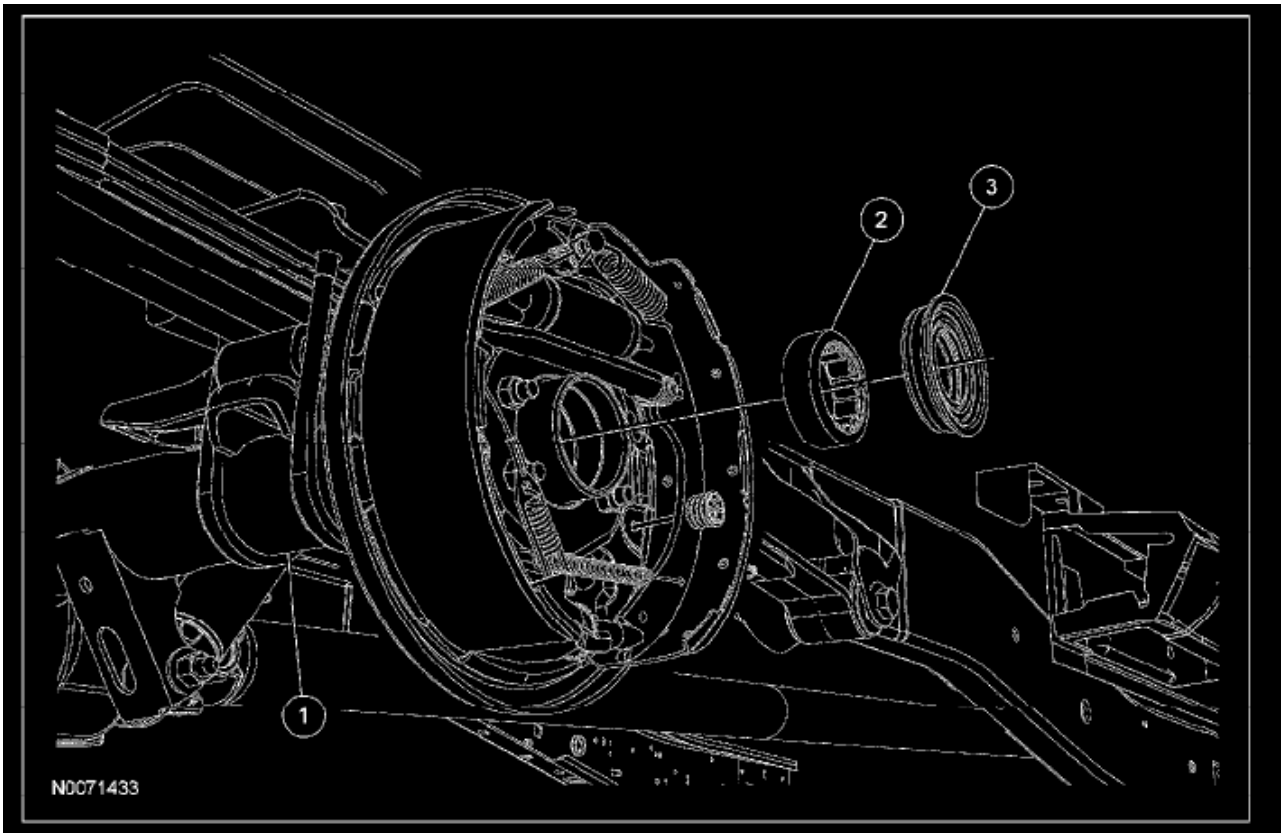
ST1325-A	Adapter For 303-224 (Handle) 205-153 (T80T-4000-W)
ST1185-A	Impact Slide Hammer 100-001 (T50T-100-A)
ST1541A	Installer, Axle Shaft Bearing 205-124 (T78P-1225-A)
ST2027-A	Installer, Rear Axle Oil Seal 205-390 (T97-1177-B)
ST2035-A	Remover, Axle Bearing 205-219 (T85L-1225-AH)

Material

Item	Specification
Motorcraft SAE 80W-90 Premium Rear Axle Lubricant XY-80W90-QL (US); CXY-80W90-1L (Canada)	WSP-M2C197-A
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B

Wheel Bearing: Service and Repair Ford 8.8-Inch Ring Gear - Rear Drive Axle/Differential

Rear Wheel Bearing and Axle Shaft Seal



Item	Part Number	Description
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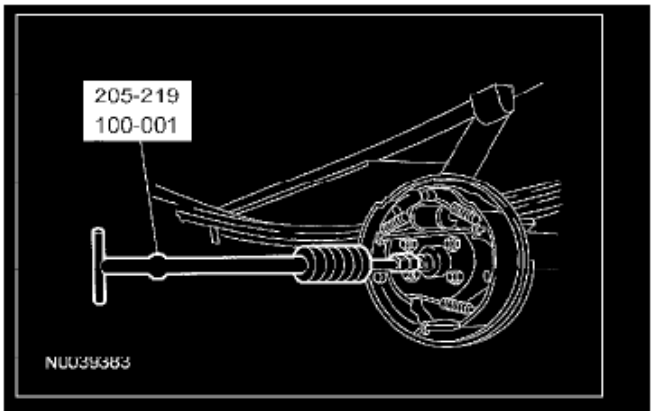


Removal

1. Remove the axle shaft.

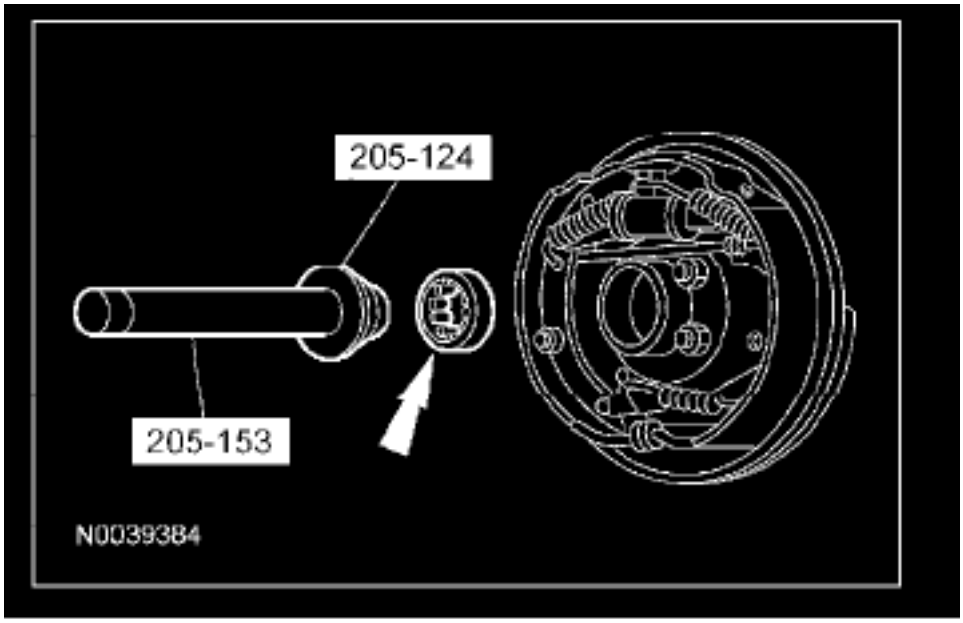
2. NOTE: If only a new seal needs to be installed, use care to avoid damaging the seal bore.

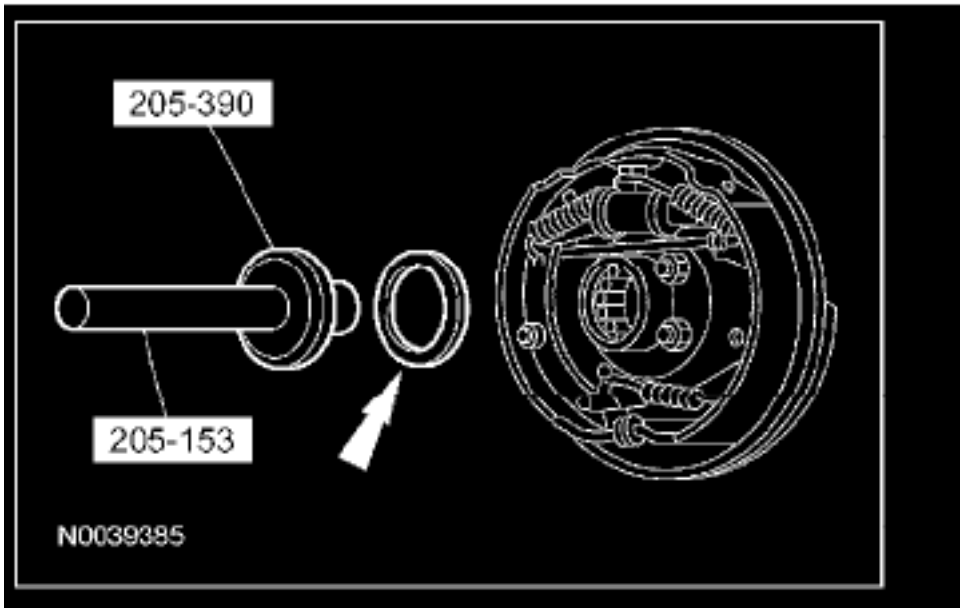
Using a suitable seal remover, remove and discard the axle shaft oil seal.

3. Inspect the rear wheel bearing and axle shaft for wear or damage. 4. If necessary, using the special tools, remove the rear wheel bearing.

Installation

1. Lubricate the new rear wheel bearing with rear axle lubricant.





2. Using the special tools, install the rear wheel bearing. 3. Lubricate the lip of the new wheel bearing oil seal with grease. 4. Using the special tools, install the wheel bearing oil seal.

5. Install the axle shaft.

Special Tool(s)

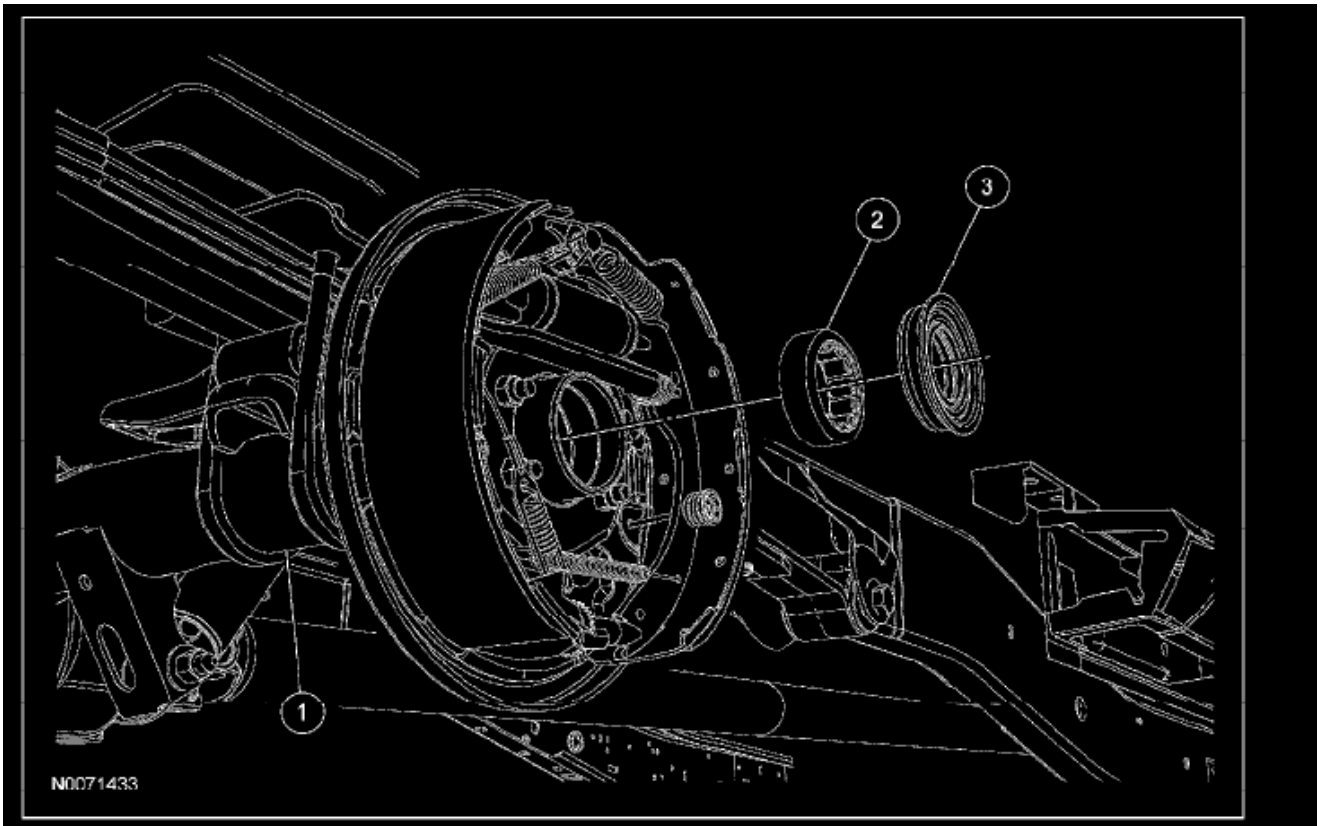
ST1326-A	Adapter For 303-224 (Handle) 205-153 (T80T-4000-W)
ST1322-A	Installer, Axle Bearing 205-194 (T83T-1225-B)
ST1736-A	Installer, Axle Oil Seal 205-190 (T83T-1175-A)
ST1263-A	Remover, Axle Bearing 205-193 (T83T-1225-A)
ST1185-A	Slide Hammer 100-001 (T50T-100-A)

Material

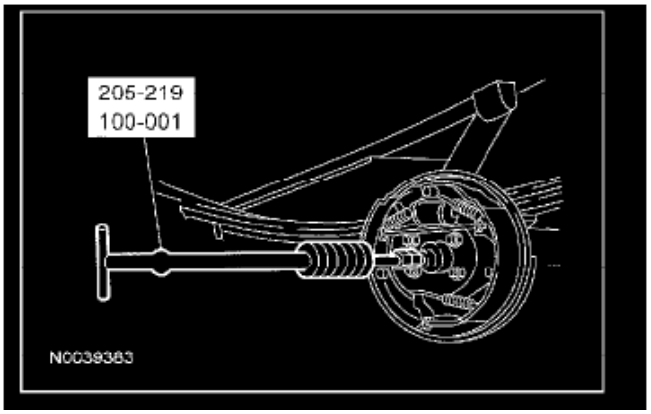
Item	Specification
Additive Friction Modifier XL-3 (US); CXL-3 (Canada)	EST-M2C118-A
Motorcraft SAE 75W-140 Synthetic Rear Axle Lubricant XY-75W140-QL (US); CXY-75W140-1L (Canada)	WSL-M2C192-A
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B

Wheel Bearing: Service and Repair Ford 8.8-Inch Ring Gear High Torque - Rear Drive Axle/Differential

Rear Wheel Bearing and Axle Shaft Seal



Item	Part Number	Description
1	4010	Axle housing
2	1225	Rear axle wheel bearing
3	1177	Rear axle shaft seal



Removal

1. Remove the axle shaft.

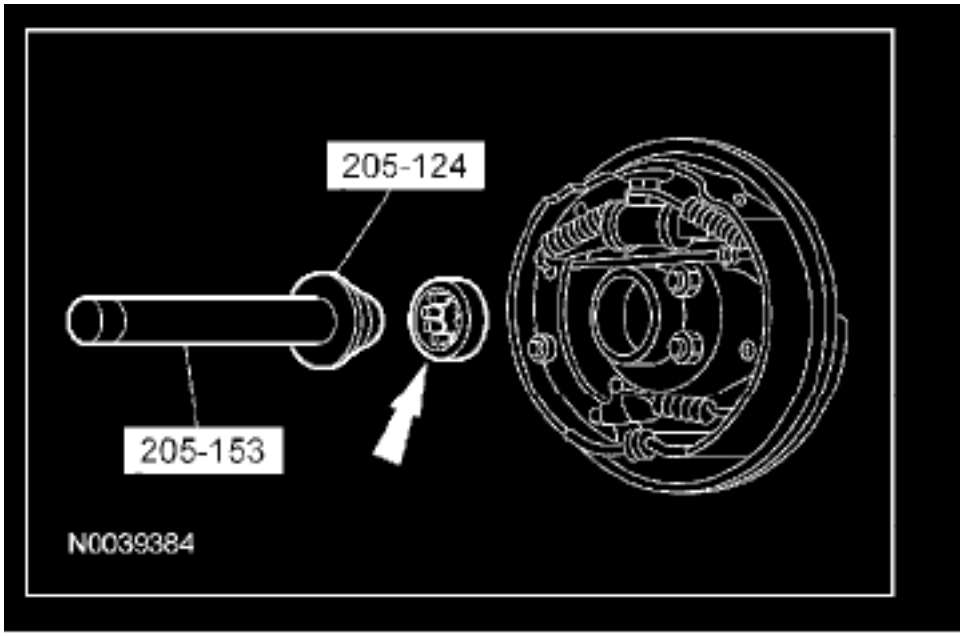
2. NOTE: If only a new seal needs to be installed, use care to avoid damaging the seal bore.

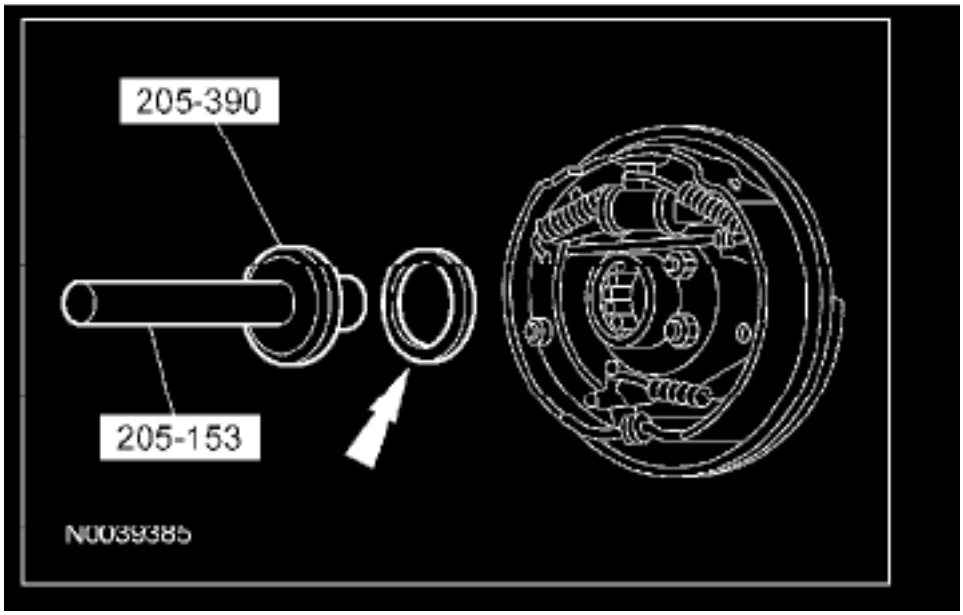
Using a suitable seal remover, remove the axle shaft oil seal. Discard the oil seal.

3. Inspect the rear wheel bearing and axle shaft for wear or damage. 4. If necessary, using the special tools, remove the rear wheel bearing.

Installation

1. Lubricate the new rear wheel bearing with rear axle lubricant. 2. Using the special tools, install the rear wheel bearing.





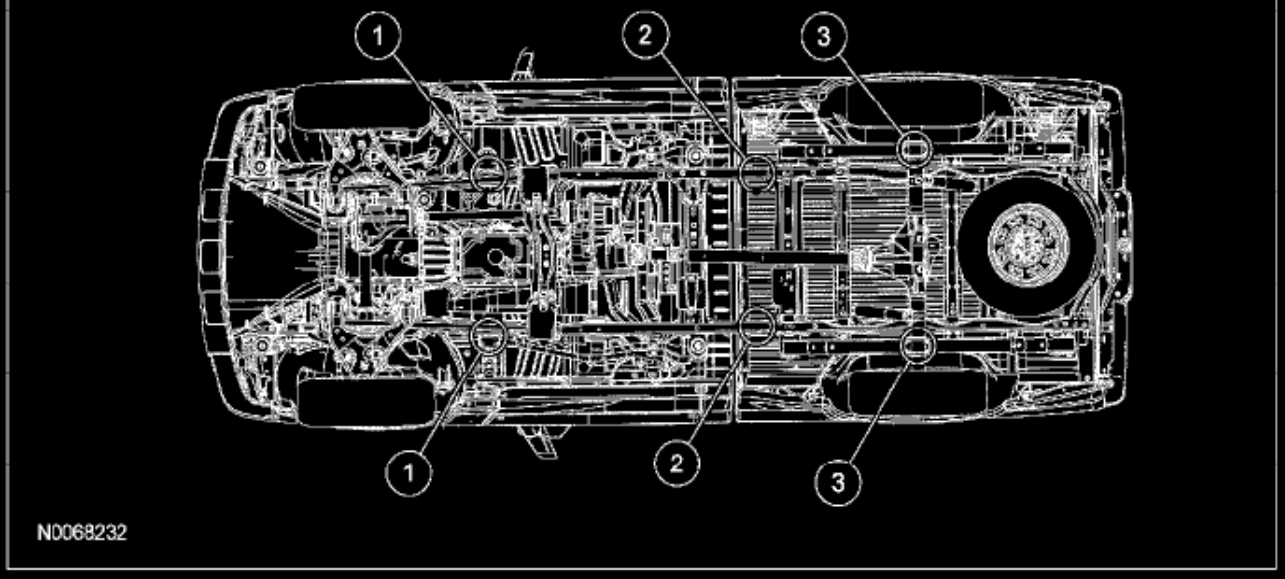
3. Lubricate the lip of the new wheel bearing oil seal with grease. 4. Using the special tools, install the wheel bearing oil seal.

5. Install the axle shaft.

Axle Nut: Specifications

Hub Nut and Washer ..... 250 Nm (184 lb-ft)

Jacking and Lifting Locations — Four Wheel Drive (4WD)



Item	Description
1	Front jacking and lifting locations
2	Rear lifting locations
3	Rear jacking locations

Vehicle Lifting: Description and Operation

JACKING AND LIFTING

WARNING:

- Block all wheels, set the parking brake and firmly apply the service brake to reduce the risk of vehicle movement during this procedure. Failure to follow these instructions may result in serious personal injury.

- Only raise the vehicle when positioned on a hard, level surface. Attempting to raise the vehicle on an uneven or soft surface may result in vehicle slipping or falling from the jack or jackstand. Failure to follow this instruction may result in serious personal injury.

- Never get underneath a vehicle that is supported only by a jack. The jack could unintentionally lower. Always support vehicle with floor stands. Failure to follow these instructions may result in serious personal injury.

CAUTION:

- The jack provided with the vehicle is intended to be used in an emergency for changing a deflated tire. To avoid damage to the vehicle, never use the jack to hoist the vehicle for any other purpose.

- Do not attempt to use jack pressure on either the front bumper or the rear bumper of any vehicle. Damage to bumper covers will occur.

- To prevent possible damage to the underbody, do not drive the vehicle onto the drive-on lift without first checking for possible interference.

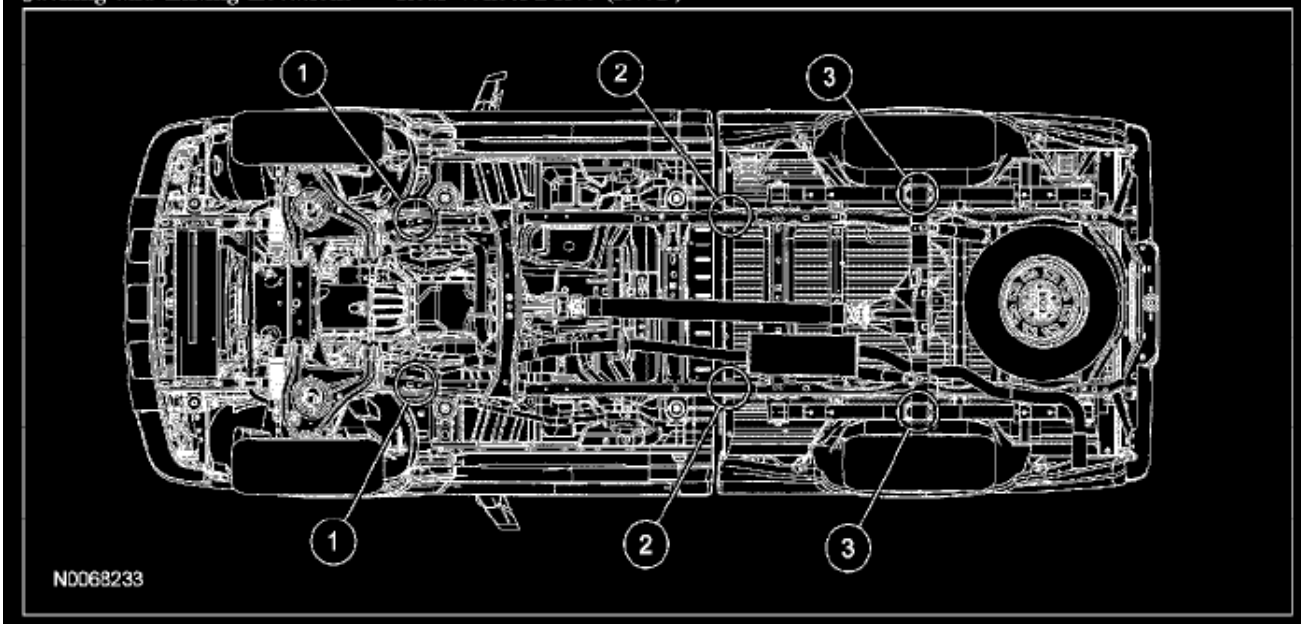
- Make sure the jack has an adequate lifting capacity for the vehicle being lifted, or damage to the vehicle may occur.

- When raising a vehicle on a twin-post hoist, use care when positioning the vehicle so that the hoisting forks do not interfere with the suspension components, mounting brackets or stabilizer mounting brackets, if so equipped. In addition, use care in hoist positioning to avoid possible damage to the axle carrier or rear cover.

- Damage to the suspension, exhaust or steering linkage components may occur if care is not exercised when positioning the hoist adapters prior to lifting the vehicle.

Jacking and Lifting Locations - Four Wheel Drive (4WD)

Jacking and Lifting Locations — Rear Wheel Drive (RWD)



Item	Description
1	Front jacking and lifting locations
2	Rear lifting locations
3	Rear jacking locations

Jacking and Lifting Locations - Rear Wheel Drive (RWD)

Special Tool(s)

ST2941-A	Activation Tool, Tire Pressure Monitor 204-363
ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Tire Pressure Sensor: Testing and Inspection Tire Pressure Monitoring System (TPMS) Sensor Training

Tire Pressure Monitoring System (TPMS) Sensor Training

NOTE: If the vehicle has been stationary for more than 30 minutes, the sensors will go into a "sleep mode" to conserve battery power. It will be necessary to wake them up so they will transmit the latest tire pressure information to the smart junction box (SJB). For additional information, refer to Tire Pressure Monitoring System (TPMS) Sensor Activation.

NOTE: The tire pressure sensor training procedure must be done on a single vehicle, in an area without radio frequency noise and at least 1 m (3 ft) away from other vehicles equipped with tire pressure monitoring system (TPMS). Radio frequency noise is generated by electrical motors and appliance operation, cellular telephones, remote transmitters, power inverters and portable entertainment equipment.

NOTE: If a sensor does not respond to the activation tool, attempt to activate the same sensor with the activation tool. If the sensor still does not respond, move the vehicle to rotate the wheels at least 1/4 of a turn and attempt to activate the same sensor again.

NOTE: The SJB has a 2-minute time limit between sensor responses. If the SJB does not recognize any 1 of the 4 tire pressure sensors during this time limit, the horn will sound twice and the message center (if equipped) will display TIRE NOT TRAINED REPEAT and the entire procedure must be repeated.

1. NOTE: For vehicles with different front and rear tire pressures (such as the E-Series and certain F-Series), the tire pressure sensors must be

trained following a tire rotation. Failure to train the sensors will cause the TPMS indicator to illuminate. For vehicles with the same tire pressure for front and rear tires, tire rotation will not affect the system.

Turn the ignition switch to the OFF position, then press and release the brake pedal.

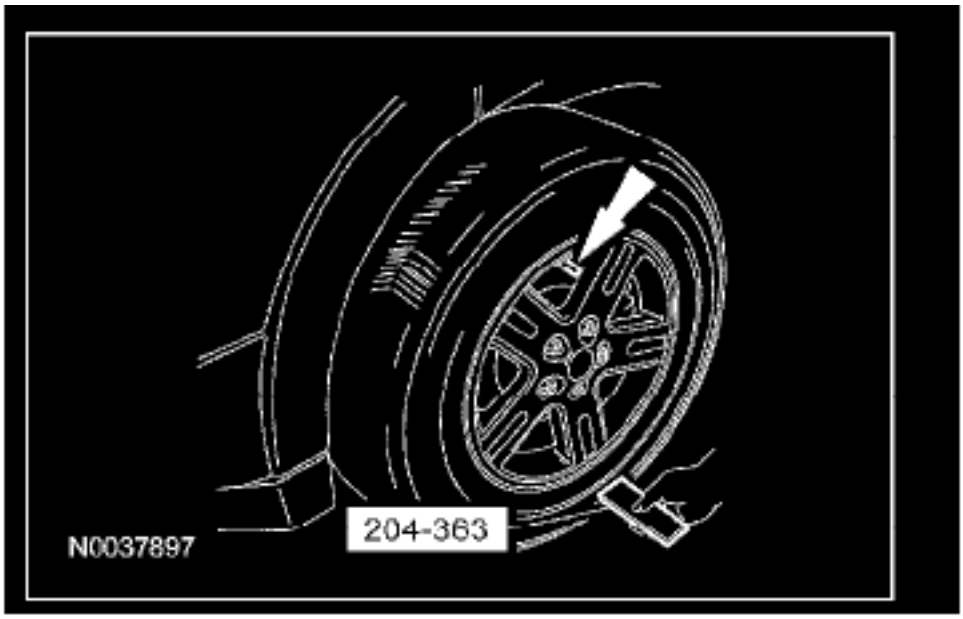
2. Cycle the ignition switch from the OFF position to the RUN position 3 times, ending in the RUN position. 3. Press and release the brake pedal. 4. Turn the ignition switch to the OFF position. 5. Turn the ignition switch from the OFF position to the RUN position 3 times, ending in the RUN position.

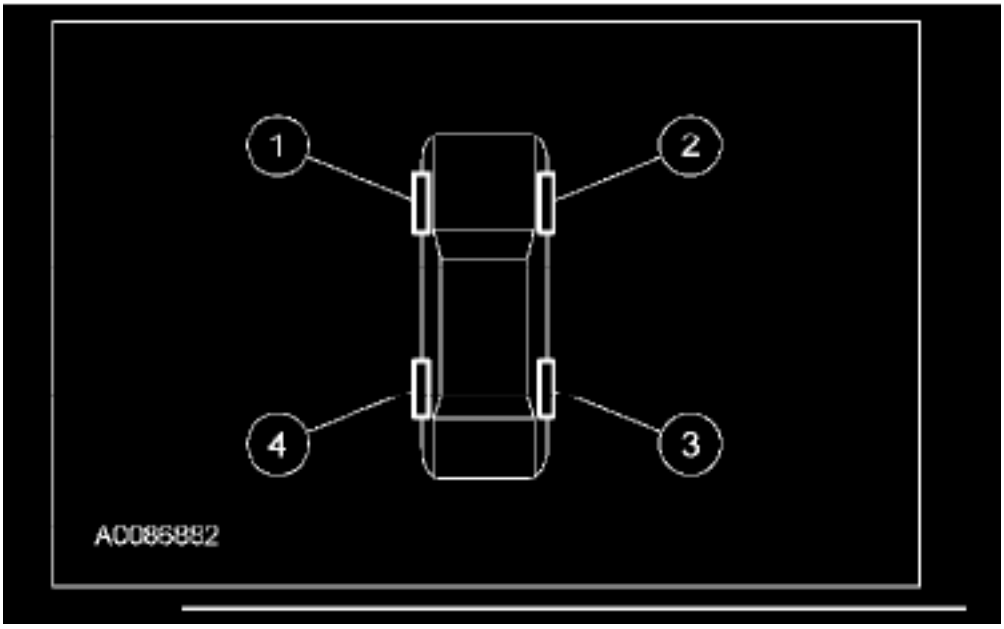
^ The horn will sound once and the TPMS indicator will flash if the training mode has been entered successfully. If equipped, the message center will display TRAIN LF TIRE.

6. NOTE: It may take up to 6 seconds to activate a tire pressure sensor. During this time, the activation tool must remain in place 180 degrees from

the valve stem.

Place the activation tool on the LF tire sidewall opposite (180 degrees) from the valve stem. Press and release the test button on the special tool. The horn will sound briefly to indicate that the tire pressure sensor has been recognized by the SJB.





7. Within 2 minutes of the horn sounding, place the activation tool on the RF tire sidewall opposite (180 degrees) from the valve stem and press and

release the test button to train the RF tire pressure sensor.

8. NOTE: Do not wait more than 2 minutes between training each sensor or the SJB will time out and the entire procedure must be repeated.

Repeat Step 7 for the RR and LR tires. ^

The procedure is completed after the last tire has been trained. When the training procedure is complete, the message center (if equipped) will display TIRE TRAINING COMPLETE.

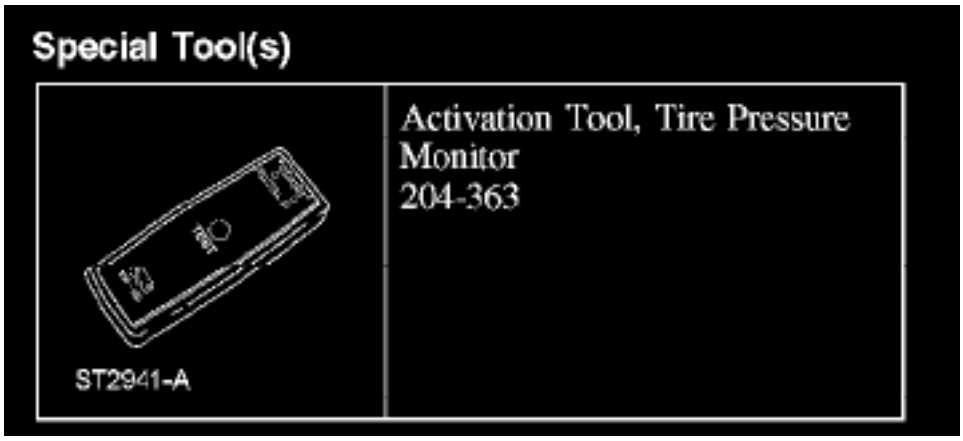
^ For vehicles not equipped with a message center, successful completion of the training procedure will be verified by turning the ignition switch to the OFF position without the horn sounding. If the horn sounds twice when the switch is turned to the OFF position, the training procedure was not successful.

9. Using the scan tool, locate the updated TPMS sensor IDs trained to the SJB and document them on the applicable warranty claim.

10. NOTE: This step is required to clear DTC C2780, cause the SJB to exit the manufacturing mode and to make sure there are no other concerns

with a newly programmed SJB.

If the sensors are being trained due to the installation of a new SJB, clear any DTCs and perform the SJB on-demand self test.



Tire Pressure Sensor: Testing and Inspection Tire Pressure Monitoring System (TPMS) Sensor Activation

Tire Pressure Monitoring System (TPMS) Sensor Activation

NOTE: The tire pressure sensors will go into a 14 sleep mode" after 30 minutes of inactivity to conserve battery power. The sensors do not transmit information while in sleep mode, it will be necessary to wake them up so they will transmit the latest tire pressure information.

1. Turn the ignition switch to the ON position. 2. Position the tire pressure monitor activation tool against the LF tire sidewall 180 degrees from the tire valve stem.

3. NOTE: The activation tool will provide feedback in the form of a flashing green light and a beep sound for each successful response from a tire

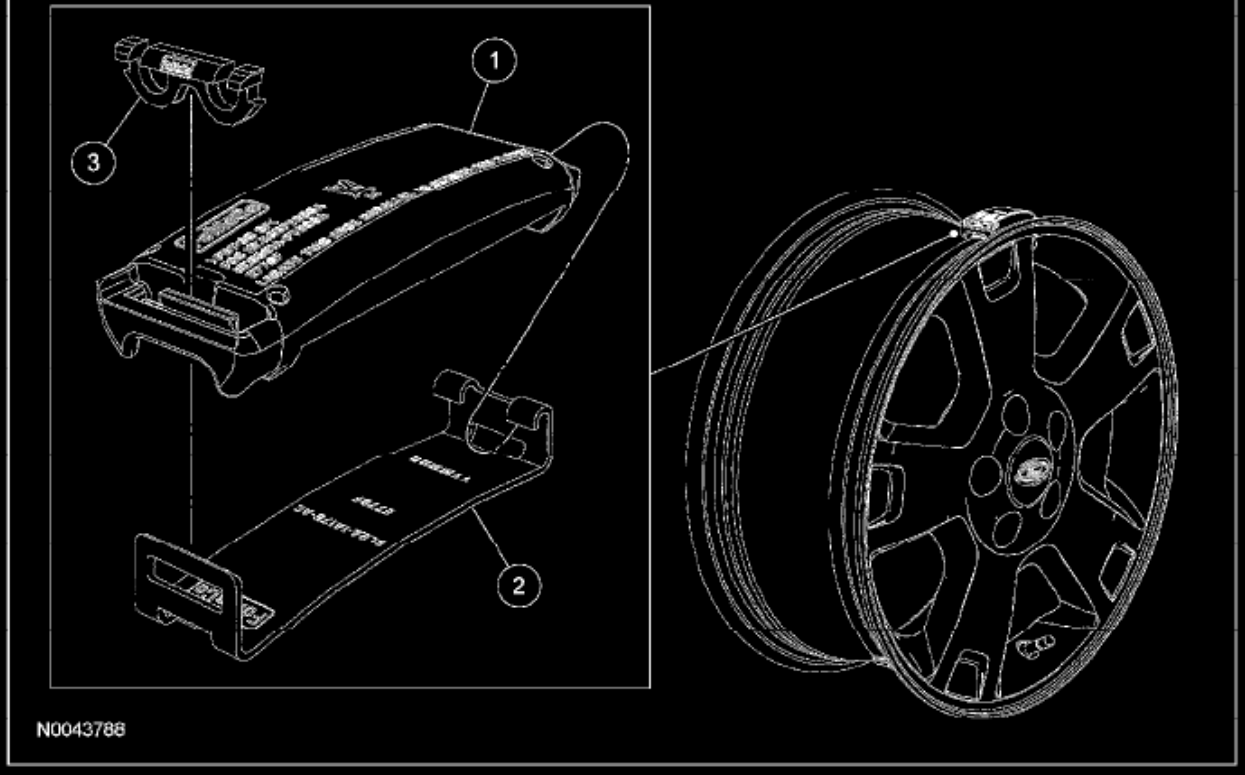
pressure sensor.

Press the test button on the activation tool to activate the sensor, activate the sensor at least 2 times.

4. Repeat Steps 2 and 3 for the remaining tires. 5. If the tire pressure monitoring system (TPMS) indicator remains illuminated after adjusting and activating each sensor, refer to the Symptom Chart

in Diagnosis and Testing.

Tire Pressure Monitoring System (TPMS) Sensor



Item	Part Number	Description
1	1A150/1A189	Tire pressure sensor/sensor kit
2	1A175	Sensor cradle

(Continued)

Item	Part Number	Description
3	14C202	Locking clip (also part of 1A189)

Tire Pressure Sensor: Service and Repair Tire Pressure Monitoring System (TPMS) Sensor

Tire Pressure Monitoring System (TPMS) Sensor

Tire Pressure Monitoring System (TPMS) Sensor

Disassembly

WARNING: The tire pressure monitoring system (TPMS) sensor battery may release hazardous chemicals if exposed to extreme mechanical damage. If these chemicals contact the skin or eyes, flush immediately with water for a minimum of 15 minutes and get prompt medical attention. If any part of the battery is swallowed, contact a physician immediately. When disposing of TPMS sensors, follow the correct procedures for hazardous material disposal. Failure to follow these instructions may result in serious personal injury.

NOTE: Tire pressure sensors are equipped with Lithium-ion batteries and must be disposed of accordingly.

NOTE: Tire pressure sensors are manufactured in multiple colors based on their application. When installing a new sensor, make sure the color of the sensor being installed matches the color of the sensor that was removed. The different colored sensors are not interchangeable.

NOTE: The sensor can be removed and installed without removing the strap or the cradle.

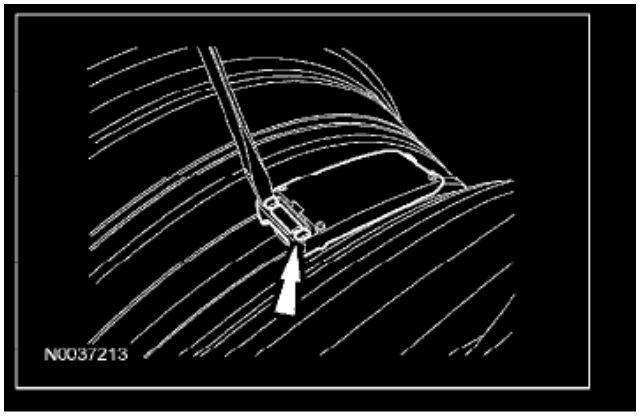
1. CAUTION: The sensor, cradle and strap may be damaged by incorrect tire mounting or dismounting. Dismount the tire only as

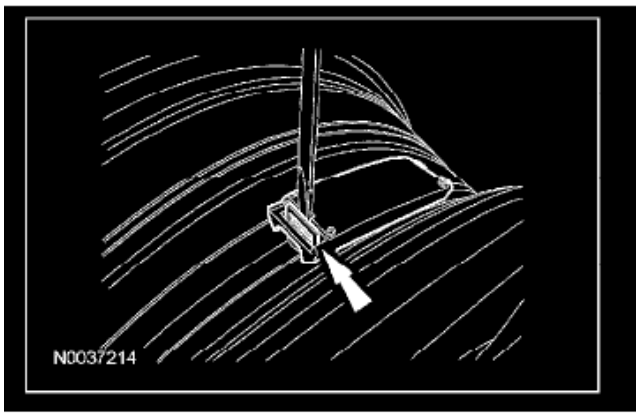
instructed.

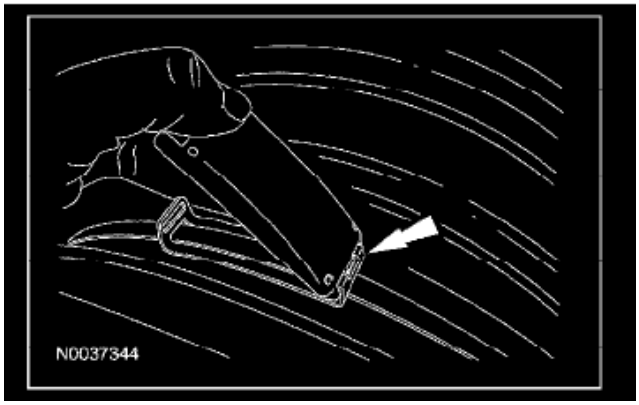
Remove the tire from the wheel.

2. CAUTION: Do not use a large screwdriver. Apply minimum force during removal or damage to the sensor locking clip may occur.

Using a pocket screwdriver or similar tool, remove the sensor locking clip.







3. CAUTION: Do not use a large screwdriver. Apply minimum force during removal or damage to the sensor may occur.

Using a pocket screwdriver or similar tool, detach the sensor from the cradle.

4. Remove the sensor.

Assembly

1. CAUTION: Damage to the sensor may occur if excessive force is applied during sensor installation.

NOTE: Make sure the sensor is fully seated into the cradle. The sensor will make a "click" noise when correctly seated.

Position the sensor into the cradle by inserting the hinge end of the sensor into the hook end of the cradle and pushing the opposite end of the sensor down onto the cradle.

2. NOTE: The locking clip can only be fully seated when installed in the correct orientation. If the sensor locking clip cannot be fully inserted, then

the sensor may not be fully seated on the cradle or the locking clip may be inserted backward.

Insert a new locking clip into the sensor.

3. CAUTION: The sensor, cradle and strap may be damaged by incorrect tire mounting or dismounting. Mount the tire only as instructed.

Install the tire onto the wheel.

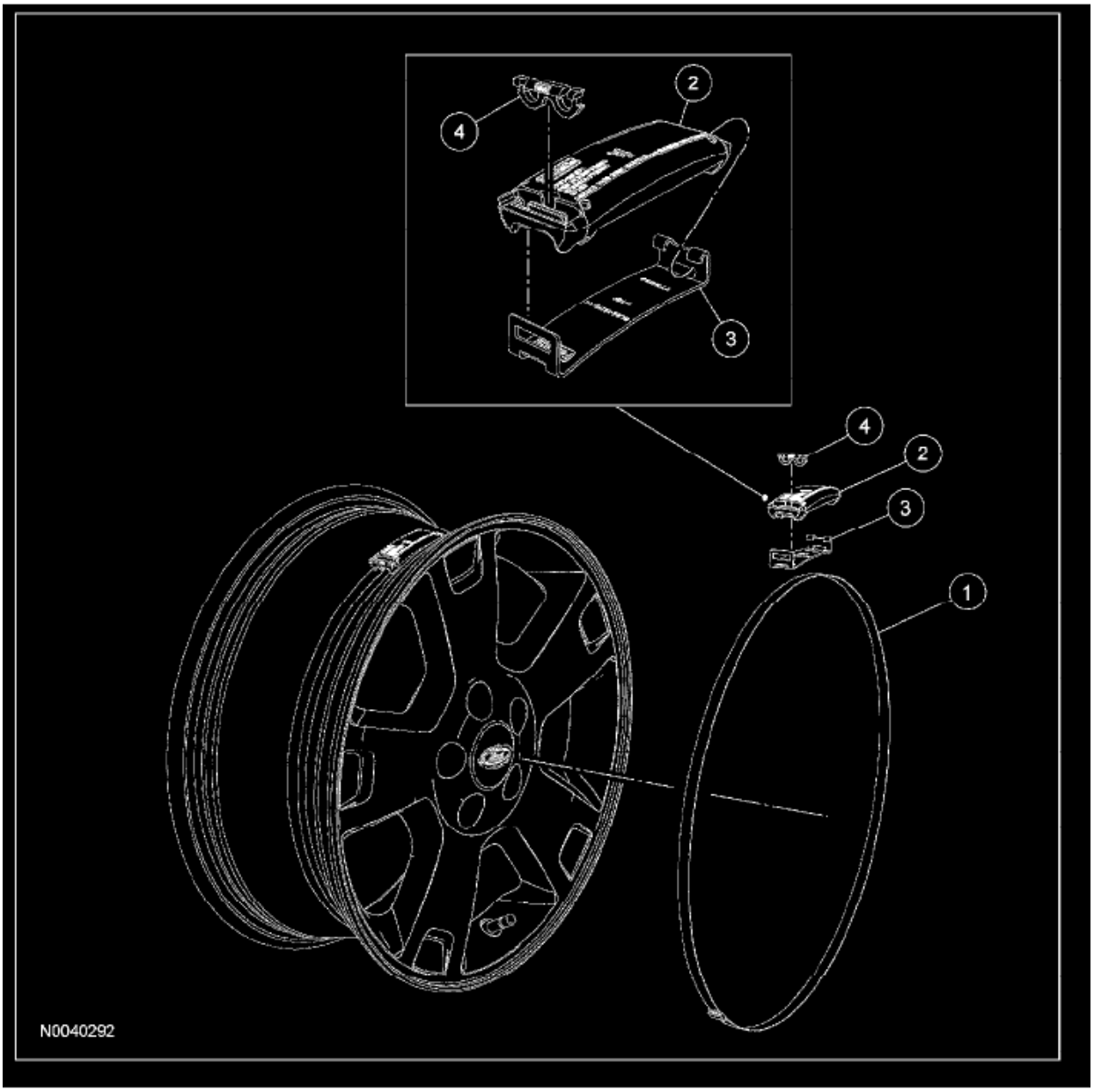
4. NOTE: A new tire pressure sensor is shipped in an off mode (or battery saver mode) and must be turned on before it can be trained. To turn the

sensor on, install it on a wheel, mount the tire and inflate the tire to the recommended inflation pressure. Wait at least 2 minutes, then continue with the sensor training procedure.

Train the tire pressure sensor(s).

Material

Item	Specification
Wheel and Tire Cleaner ZC-27-A or B	—

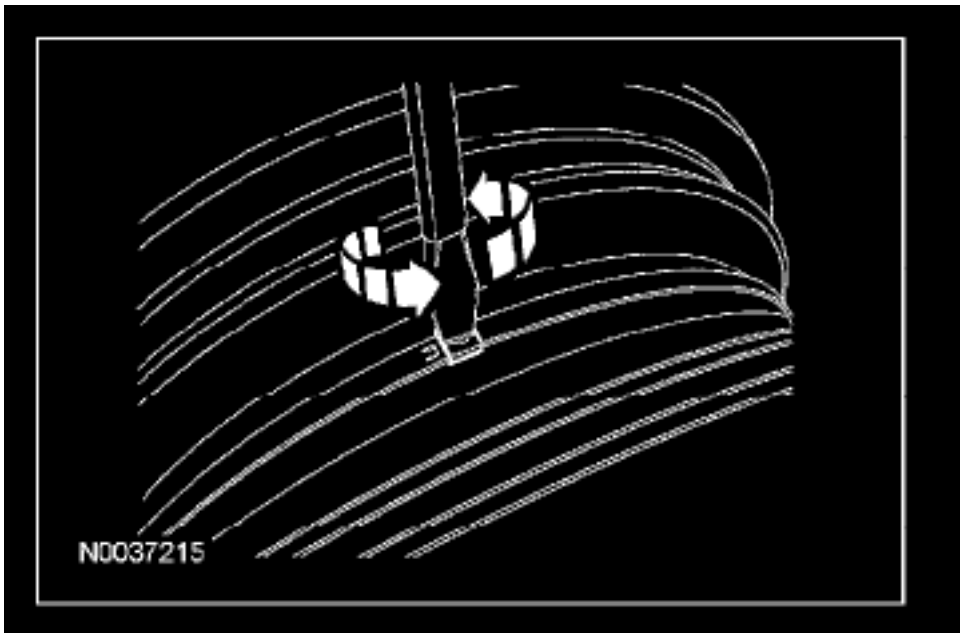


Item	Part Number	Description
1	1A177/1A193	Strap/strap kit
2	1A150/1A189	Tire pressure sensor/sensor kit
3	1A175	Sensor cradle (also part of 1A193)
4	14C202	Locking clip (also part of 1A189)

Tire Pressure Sensor: Service and Repair Tire Pressure Monitoring System (TPMS) Strap and Cradle

Tire Pressure Monitoring System (TPMS) Strap and Cradle

Disassembly



WARNING: The tire pressure monitoring system (TPMS) sensor battery may release hazardous chemicals if exposed to extreme mechanical damage. If these chemicals contact the skin or eyes, flush immediately with water for a minimum of 15 minutes and get prompt medical attention. If any part of the battery is swallowed, contact a physician immediately. When disposing of TPMS sensors, follow the correct procedures for hazardous material disposal. Failure to follow these instructions may result in serious personal injury.

NOTE: Tire pressure sensors are equipped with Lithium-ion batteries and must be disposed of accordingly.

NOTE: Tire pressure sensors are manufactured in multiple colors based on their application. When installing a new sensor, make sure the color of the sensor being installed matches the color of the sensor that was removed. The different colored sensors are not interchangeable.

NOTE: The sensor is available separately, the cradle and strap are available as a strap kit. There are several different strap kits available based on wheel diameter but all strap kits share the same base part number.

1. Remove the tire pressure monitoring system (TPMS) sensor.

2. WARNING: Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.

WARNING: Wear protective gloves when handling components or parts that have pointed or sharp edges. Failure to follow this instruction may result in serious personal injury.

Remove a factory installed strap in the following sequence: 1

Locate the strap buckle and secure the strap to the wheel using duct tape or a similar item, on both sides of the buckle approximately 25 mm (0.98 inch) from the buckle.

2 Using a large screwdriver and a twisting motion, unbuckle the strap.

3 Discard the strap.

3. To remove a dealer installed strap, turn the worm gear screw until the strap is fully released from the worm gear.

^ Discard the strap.

4. NOTE: To aid assembly, mark the location of the cradle prior to disassembly.

Using a screwdriver, or similar tool, remove the cradle by inserting the screwdriver under the cradle and prying up.

Assembly

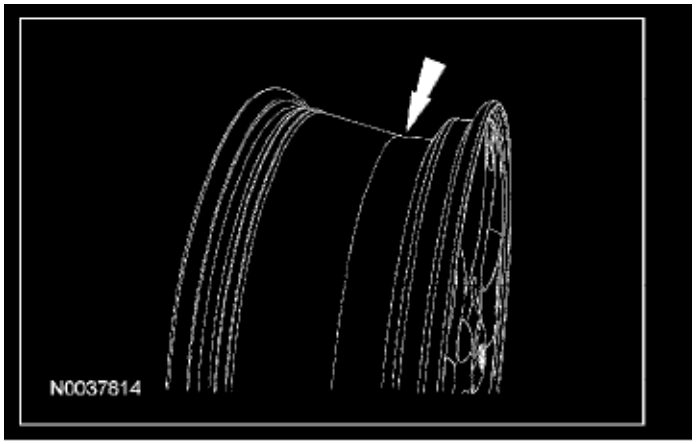
1. NOTE: Make sure the sensor is fully seated into the new cradle. The sensor will make a "click" noise when fully seated.

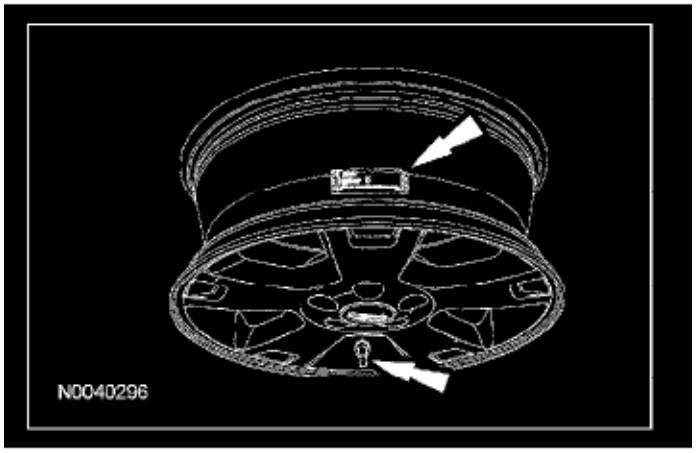
Position the sensor into the new cradle by inserting the hinge end of the sensor into the hook end of the cradle and pushing the opposite end of the sensor down onto the cradle.

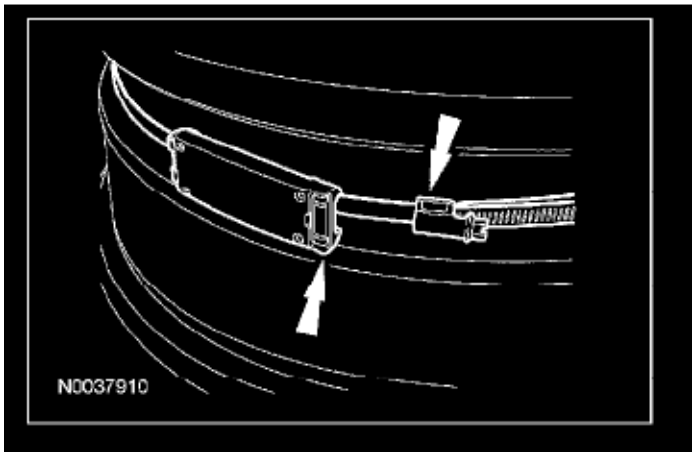
2. CAUTION: Metal scrapers may damage the wheel. Use only plastic or non-metallic scrapers to remove the cradle adhesive strip residue.

NOTE: The sensor and cradle must be installed in the drop well of the wheel, 180 degrees from the valve stem.

Clean the area where the sensor and cradle are to be installed.







3. NOTE: The sensor and cradle must be positioned with the hinge side of the sensor on the RH side when viewed from the curb side (beauty side)

of the wheel.

NOTE: The sensor has raised markings indicating how to position the sensor.

Remove the adhesive tape liner from the cradle and position the sensor and cradle into the wheel drop well 180 degrees from the valve stem.

4. Install the tapered end of the strap through the opening of the cradle on the hinge side of the sensor. This will position the worm gear on the

locking clip side of the sensor.

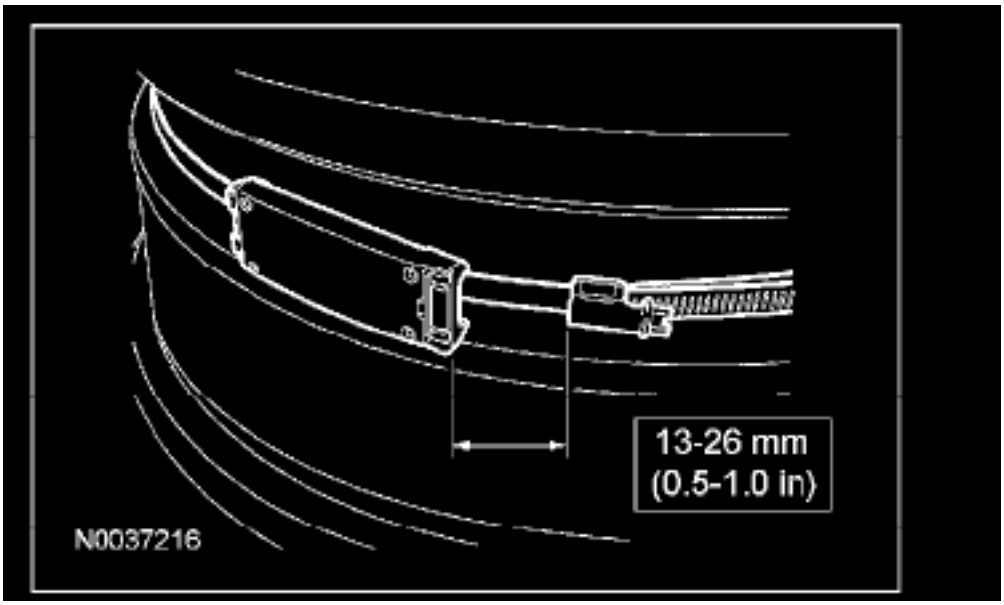
5. CAUTION: Steel wheels have a "high spot" along their circumference. Make sure the strap and sensor are mounted at the lowest spot

possible to avoid damaging the sensor during wheel and tire disassembly and assembly.

NOTE: Keep the strap parallel with the wheel flange while tightening the worm gear.

Position the worm gear 13-26 mm (0.5-1.0 inch) away from the sensor and tighten the worm gear.
^

Tighten to 3 Nm (27 lb-inch).



6. CAUTION: The sensor, cradle and strap may be damaged by incorrect tire mounting or dismounting. Mount the tire only as instructed.

Install the tire onto the wheel.

7. NOTE: A new tire pressure sensor is shipped in an off mode (or battery saver mode) and must be turned on before it can be trained. To turn the

sensor on, install it on a wheel, mount the tire and inflate the tire to the recommended inflation pressure. Wait at least 2 minutes, then continue with the sensor training procedure.

Train the tire pressure sensor(s).

Low Tire Pressure Indicator: Testing and Inspection

Tire Pressure Monitoring System (TPMS) Indicator and Message Center Messages

The TPMS indicator and vehicle message center (if equipped) sometimes displays faults that cannot be resolved by the customer. Treat these messages as TPMS faults that must be serviced.

Tire Pressure Monitoring System (TPMS) Indicator Illuminates Continuously

NOTE: If the spare tire is in use, the damaged road tire must be repaired and installed on the vehicle to restore complete TPMS functionality before carrying out any diagnosis.

NOTE: For vehicles with different front and rear tire pressures (such as E-Series and certain F-Series), the tire pressure sensors must be trained following a tire rotation. Failure to train the sensors will cause the TPMS indicator to illuminate.

For vehicles with the same tire pressures for front and rear tires, tire rotation will not affect the system.

1. The TPMS indicator remains on continuously for the following condition:

^ Low Tire Pressure - The TPMS indicator is illuminated solid and the message center displays LOW TIRE PRESSURE (if equipped). This is displayed when any of the tire pressures are low. When this condition exists, the tire pressure must be adjusted to the recommended cold pressure as indicated on the vehicle certification label.

2. NOTE: The TPMS sensors do not transmit when the vehicle is stationary. If the vehicle has been stationary for more than 30 minutes, it will be

necessary to wake up the sensors so they will transmit the latest tire pressure information to the SJB.

If the vehicle has been stationary for more than 30 minutes, refer to Tire Pressure Monitoring System (TPMS) Sensor Activation procedure.

Tire Pressure Monitoring System (TPMS) Indicator Flashes

The TPMS indicator flashes for 70 seconds and then remains ON solid when the ignition key is turned to the ON position for the following conditions: 1. Tire Pressure Sensor Fault - If equipped, the message center will display TIRE SENSOR FAULT when a tire pressure sensor is malfunctioning.

GO to Symptom Chart. See: Testing and Inspection/Symptom Related Diagnostic Procedures

2. No communication with the SJB (TPMS is integral to the SJB) - The TPMS indicator is illuminated when the instrument cluster has received no

signals from the SJB for more than 5 seconds. If equipped, the message center displays TIRE MONITOR FAULT. GO to Symptom Chart. See: Testing and Inspection/Symptom Related Diagnostic Procedures

3. Tire Pressure Monitor Fault - If equipped, the message center will display TIRE MONITOR FAULT when the tire pressure monitoring system is

malfunctioning or communication with the instrument cluster has been lost. GO to Symptom Chart. See: Testing and Inspection/Symptom Related Diagnostic Procedures

Special Tool(s)

ST2941-A	Activation Tool, Tire Pressure Monitor 204-363
ST2634-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Tire Pressure Sensor: Testing and Inspection Tire Pressure Monitoring System (TPMS) Sensor Training

Tire Pressure Monitoring System (TPMS) Sensor Training

NOTE: If the vehicle has been stationary for more than 30 minutes, the sensors will go into a "sleep mode" to conserve battery power. It will be necessary to wake them up so they will transmit the latest tire pressure information to the smart junction box (SJB). For additional information, refer to Tire Pressure Monitoring System (TPMS) Sensor Activation.

NOTE: The tire pressure sensor training procedure must be done on a single vehicle, in an area without radio frequency noise and at least 1 m (3 ft) away from other vehicles equipped with tire pressure monitoring system (TPMS). Radio frequency noise is generated by electrical motors and appliance operation, cellular telephones, remote transmitters, power inverters and portable entertainment equipment.

NOTE: If a sensor does not respond to the activation tool, attempt to activate the same sensor with the activation tool. If the sensor still does not respond, move the vehicle to rotate the wheels at least 1/4 of a turn and attempt to activate the same sensor again.

NOTE: The SJB has a 2-minute time limit between sensor responses. If the SJB does not recognize any 1 of the 4 tire pressure sensors during this time limit, the horn will sound twice and the message center (if equipped) will display TIRE NOT TRAINED REPEAT and the entire procedure must be repeated.

1. NOTE: For vehicles with different front and rear tire pressures (such as the E-Series and certain F-Series), the tire pressure sensors must be

trained following a tire rotation. Failure to train the sensors will cause the TPMS indicator to illuminate. For vehicles with the same tire pressure for front and rear tires, tire rotation will not affect the system.

Turn the ignition switch to the OFF position, then press and release the brake pedal.

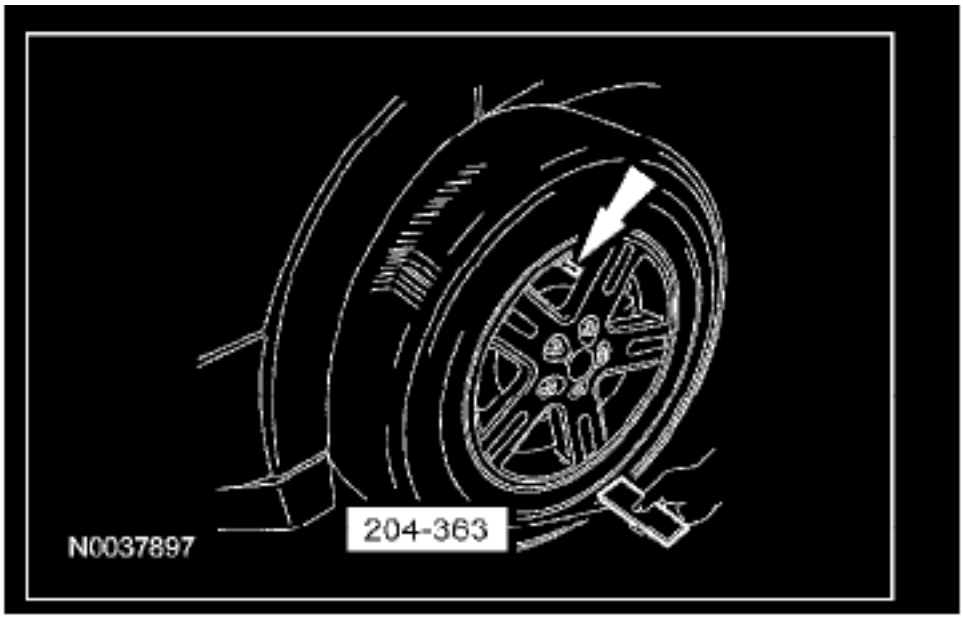
2. Cycle the ignition switch from the OFF position to the RUN position 3 times, ending in the RUN position. 3. Press and release the brake pedal. 4. Turn the ignition switch to the OFF position. 5. Turn the ignition switch from the OFF position to the RUN position 3 times, ending in the RUN position.

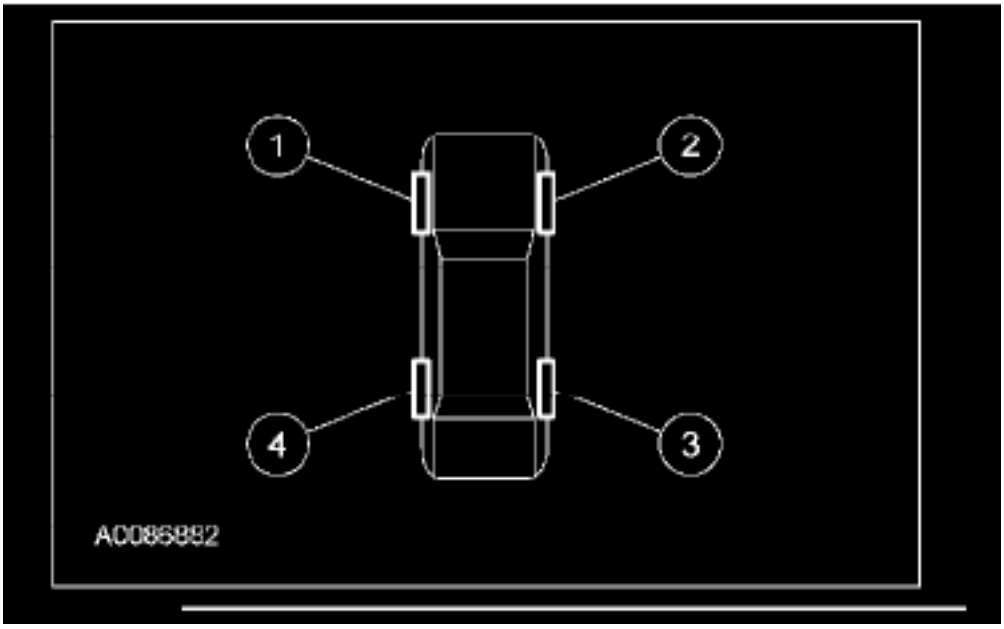
^ The horn will sound once and the TPMS indicator will flash if the training mode has been entered successfully. If equipped, the message center will display TRAIN LF TIRE.

6. NOTE: It may take up to 6 seconds to activate a tire pressure sensor. During this time, the activation tool must remain in place 180 degrees from

the valve stem.

Place the activation tool on the LF tire sidewall opposite (180 degrees) from the valve stem. Press and release the test button on the special tool. The horn will sound briefly to indicate that the tire pressure sensor has been recognized by the SJB.





7. Within 2 minutes of the horn sounding, place the activation tool on the RF tire sidewall opposite (180 degrees) from the valve stem and press and

release the test button to train the RF tire pressure sensor.

8. NOTE: Do not wait more than 2 minutes between training each sensor or the SJB will time out and the entire procedure must be repeated.

Repeat Step 7 for the RR and LR tires. ^

The procedure is completed after the last tire has been trained. When the training procedure is complete, the message center (if equipped) will display TIRE TRAINING COMPLETE.

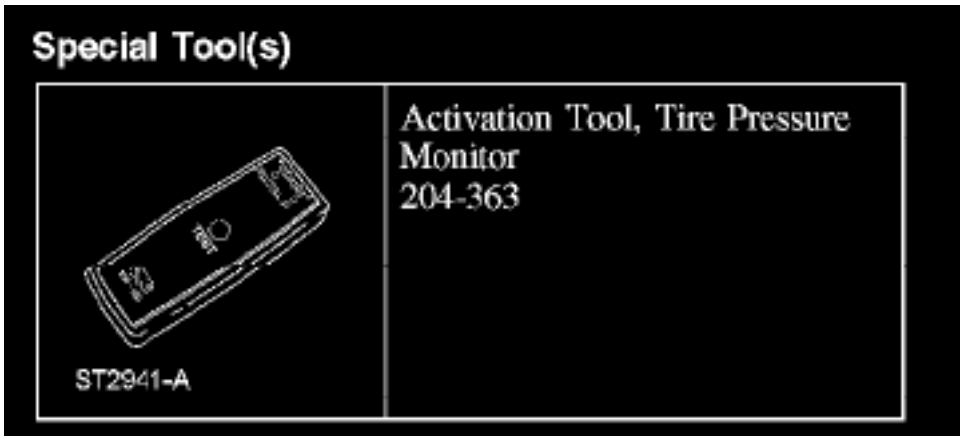
^ For vehicles not equipped with a message center, successful completion of the training procedure will be verified by turning the ignition switch to the OFF position without the horn sounding. If the horn sounds twice when the switch is turned to the OFF position, the training procedure was not successful.

9. Using the scan tool, locate the updated TPMS sensor IDs trained to the SJB and document them on the applicable warranty claim.

10. NOTE: This step is required to clear DTC C2780, cause the SJB to exit the manufacturing mode and to make sure there are no other concerns

with a newly programmed SJB.

If the sensors are being trained due to the installation of a new SJB, clear any DTCs and perform the SJB on-demand self test.



Tire Pressure Sensor: Testing and Inspection Tire Pressure Monitoring System (TPMS) Sensor Activation

Tire Pressure Monitoring System (TPMS) Sensor Activation

NOTE: The tire pressure sensors will go into a 14 sleep mode" after 30 minutes of inactivity to conserve battery power. The sensors do not transmit information while in sleep mode, it will be necessary to wake them up so they will transmit the latest tire pressure information.

1. Turn the ignition switch to the ON position. 2. Position the tire pressure monitor activation tool against the LF tire sidewall 180 degrees from the tire valve stem.

3. NOTE: The activation tool will provide feedback in the form of a flashing green light and a beep sound for each successful response from a tire

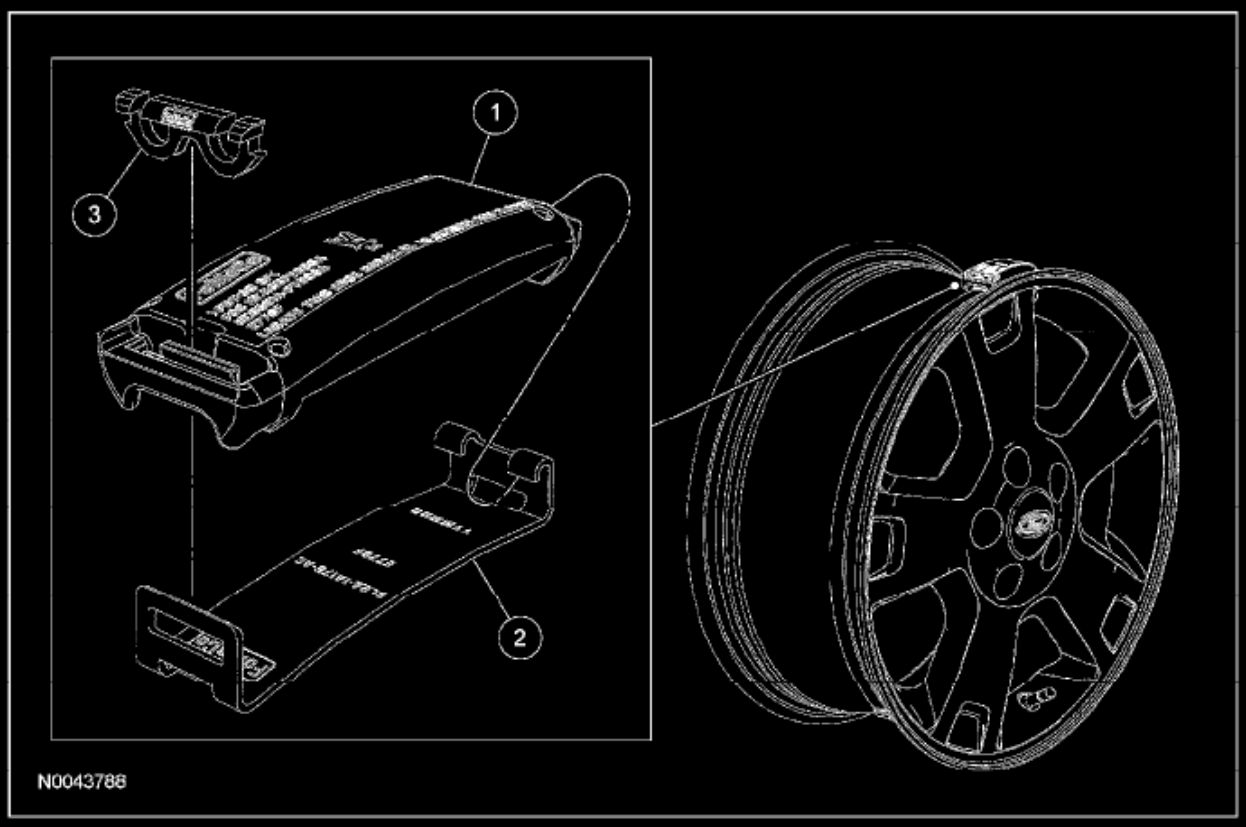
pressure sensor.

Press the test button on the activation tool to activate the sensor, activate the sensor at least 2 times.

4. Repeat Steps 2 and 3 for the remaining tires. 5. If the tire pressure monitoring system (TPMS) indicator remains illuminated after adjusting and activating each sensor, refer to the Symptom Chart

in Diagnosis and Testing.

Tire Pressure Monitoring System (TPMS) Sensor



Item	Part Number	Description
1	1A150/1A189	Tire pressure sensor/sensor kit
2	1A175	Sensor cradle

Item	Part Number	Description
3	14C202	Locking clip (also part of 1A189)

(Continued)

Tire Pressure Sensor: Service and Repair Tire Pressure Monitoring System (TPMS) Sensor

Tire Pressure Monitoring System (TPMS) Sensor

Tire Pressure Monitoring System (TPMS) Sensor

Disassembly

WARNING: The tire pressure monitoring system (TPMS) sensor battery may release hazardous chemicals if exposed to extreme mechanical damage. If these chemicals contact the skin or eyes, flush immediately with water for a minimum of 15 minutes and get prompt medical attention. If any part of the battery is swallowed, contact a physician immediately. When disposing of TPMS sensors, follow the correct procedures for hazardous material disposal. Failure to follow these instructions may result in serious personal injury.

NOTE: Tire pressure sensors are equipped with Lithium-ion batteries and must be disposed of accordingly.

NOTE: Tire pressure sensors are manufactured in multiple colors based on their application. When installing a new sensor, make sure the color of the sensor being installed matches the color of the sensor that was removed. The different colored sensors are not interchangeable.

NOTE: The sensor can be removed and installed without removing the strap or the cradle.

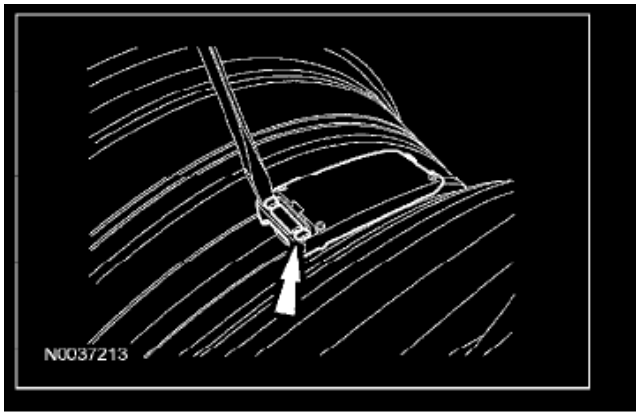
1. CAUTION: The sensor, cradle and strap may be damaged by incorrect tire mounting or dismounting. Dismount the tire only as

instructed.

Remove the tire from the wheel.

2. CAUTION: Do not use a large screwdriver. Apply minimum force during removal or damage to the sensor locking clip may occur.

Using a pocket screwdriver or similar tool, remove the sensor locking clip.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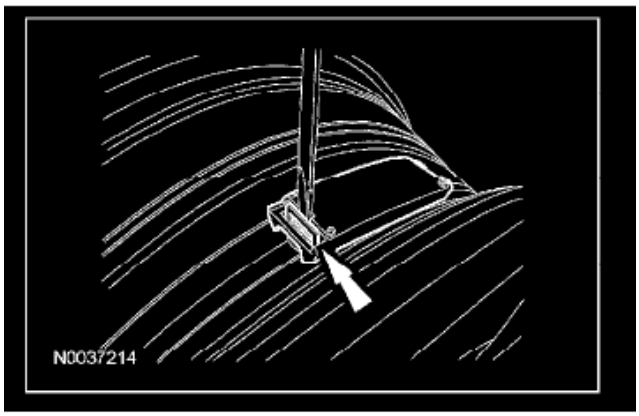
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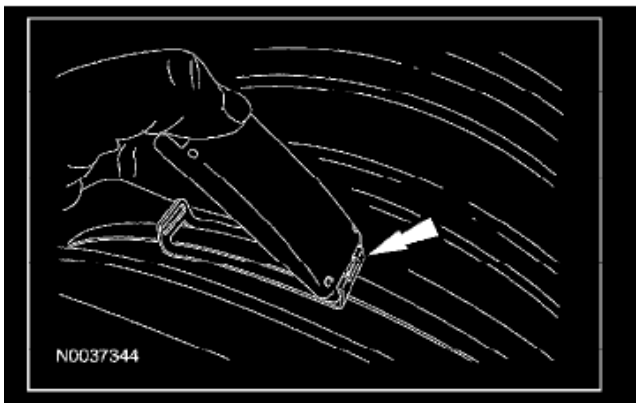

N0037344

3. CAUTION: Do not use a large screwdriver. Apply minimum force during removal or damage to the sensor may occur.

Using a pocket screwdriver or similar tool, detach the sensor from the cradle.

4. Remove the sensor.

Assembly

1. CAUTION: Damage to the sensor may occur if excessive force is applied during sensor installation.

NOTE: Make sure the sensor is fully seated into the cradle. The sensor will make a "click" noise when correctly seated.

Position the sensor into the cradle by inserting the hinge end of the sensor into the hook end of the cradle and pushing the opposite end of the sensor down onto the cradle.

2. NOTE: The locking clip can only be fully seated when installed in the correct orientation. If the sensor locking clip cannot be fully inserted, then

the sensor may not be fully seated on the cradle or the locking clip may be inserted backward.

Insert a new locking clip into the sensor.

3. CAUTION: The sensor, cradle and strap may be damaged by incorrect tire mounting or dismounting. Mount the tire only as instructed.

Install the tire onto the wheel.

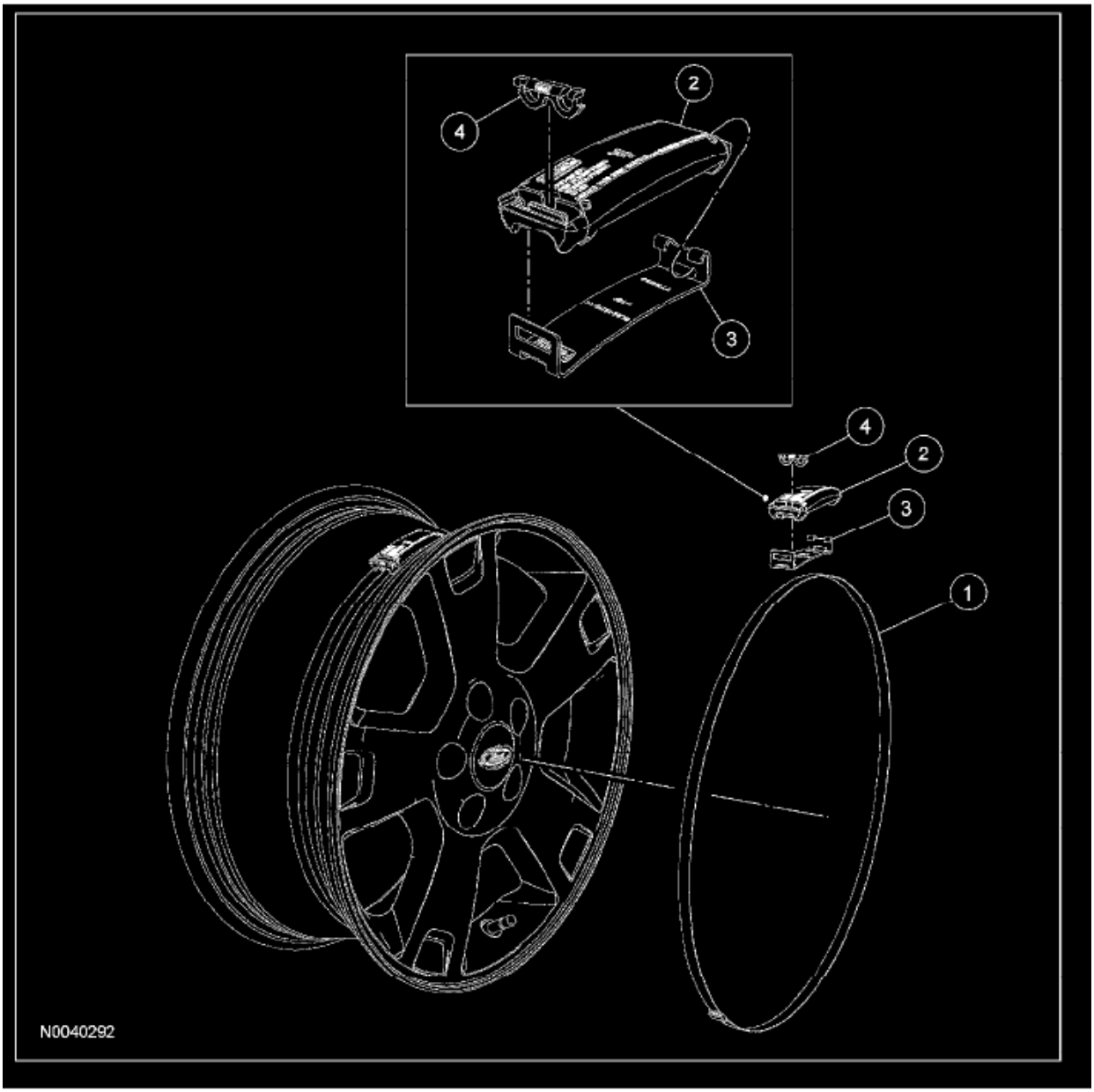
4. NOTE: A new tire pressure sensor is shipped in an off mode (or battery saver mode) and must be turned on before it can be trained. To turn the

sensor on, install it on a wheel, mount the tire and inflate the tire to the recommended inflation pressure. Wait at least 2 minutes, then continue with the sensor training procedure.

Train the tire pressure sensor(s).

Material

Item	Specification
Wheel and Tire Cleaner ZC-27-A or B	—

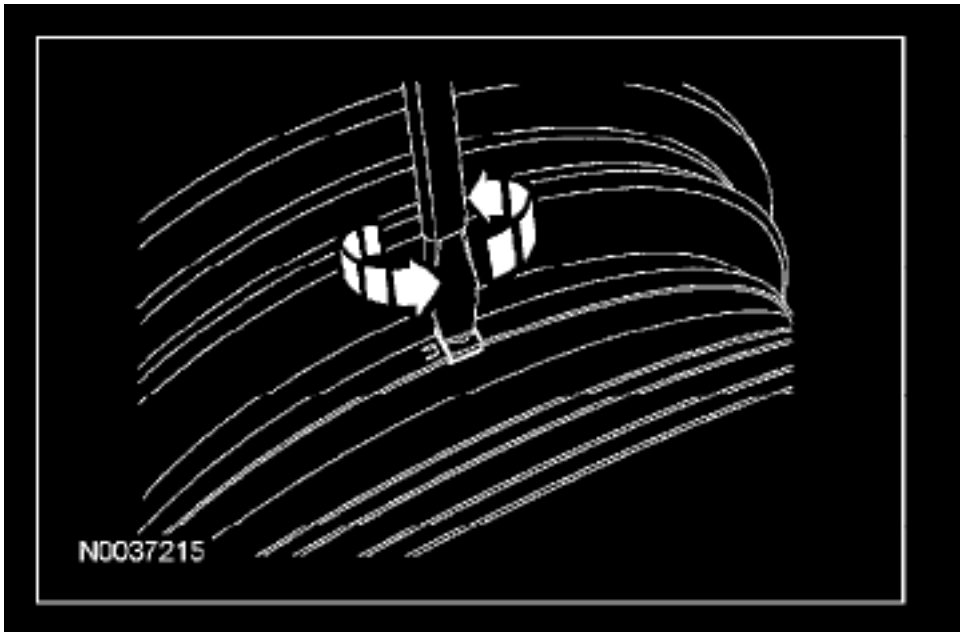


Item	Part Number	Description
1	1A177/1A193	Strap/strap kit
2	1A150/1A189	Tire pressure sensor/sensor kit
3	1A175	Sensor cradle (also part of 1A193)
4	14C202	Locking clip (also part of 1A189)

Tire Pressure Sensor: Service and Repair Tire Pressure Monitoring System (TPMS) Strap and Cradle

Tire Pressure Monitoring System (TPMS) Strap and Cradle

Disassembly



WARNING: The tire pressure monitoring system (TPMS) sensor battery may release hazardous chemicals if exposed to extreme mechanical damage. If these chemicals contact the skin or eyes, flush immediately with water for a minimum of 15 minutes and get prompt medical attention. If any part of the battery is swallowed, contact a physician immediately. When disposing of TPMS sensors, follow the correct procedures for hazardous material disposal. Failure to follow these instructions may result in serious personal injury.

NOTE: Tire pressure sensors are equipped with Lithium-ion batteries and must be disposed of accordingly.

NOTE: Tire pressure sensors are manufactured in multiple colors based on their application. When installing a new sensor, make sure the color of the sensor being installed matches the color of the sensor that was removed. The different colored sensors are not interchangeable.

NOTE: The sensor is available separately, the cradle and strap are available as a strap kit. There are several different strap kits available based on wheel diameter but all strap kits share the same base part number.

1. Remove the tire pressure monitoring system (TPMS) sensor.

2. WARNING: Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.

WARNING: Wear protective gloves when handling components or parts that have pointed or sharp edges. Failure to follow this instruction may result in serious personal injury.

Remove a factory installed strap in the following sequence: 1

Locate the strap buckle and secure the strap to the wheel using duct tape or a similar item, on both sides of the buckle approximately 25 mm (0.98 inch) from the buckle.

2 Using a large screwdriver and a twisting motion, unbuckle the strap.

3 Discard the strap.

3. To remove a dealer installed strap, turn the worm gear screw until the strap is fully released from the worm gear.

^ Discard the strap.

4. NOTE: To aid assembly, mark the location of the cradle prior to disassembly.

Using a screwdriver, or similar tool, remove the cradle by inserting the screwdriver under the cradle and prying up.

Assembly

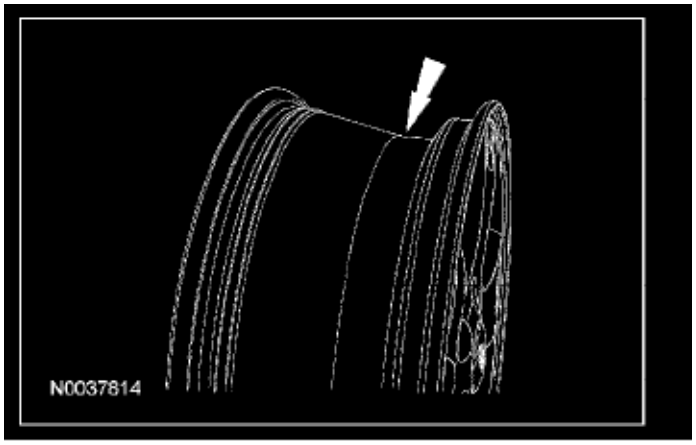
1. NOTE: Make sure the sensor is fully seated into the new cradle. The sensor will make a "click" noise when fully seated.

Position the sensor into the new cradle by inserting the hinge end of the sensor into the hook end of the cradle and pushing the opposite end of the sensor down onto the cradle.

2. CAUTION: Metal scrapers may damage the wheel. Use only plastic or non-metallic scrapers to remove the cradle adhesive strip residue.

NOTE: The sensor and cradle must be installed in the drop well of the wheel, 180 degrees from the valve stem.

Clean the area where the sensor and cradle are to be installed.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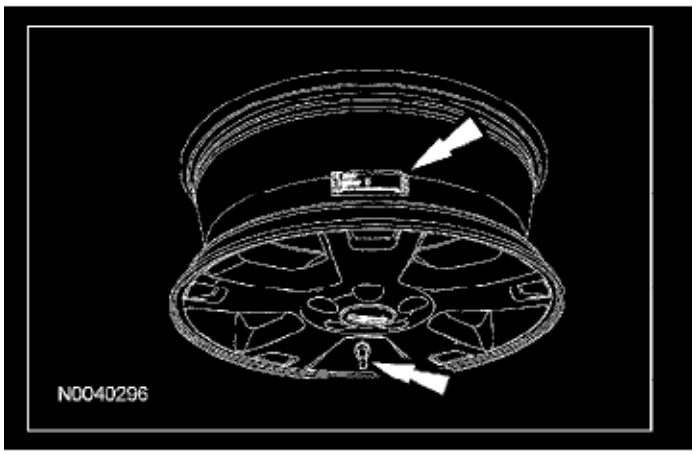
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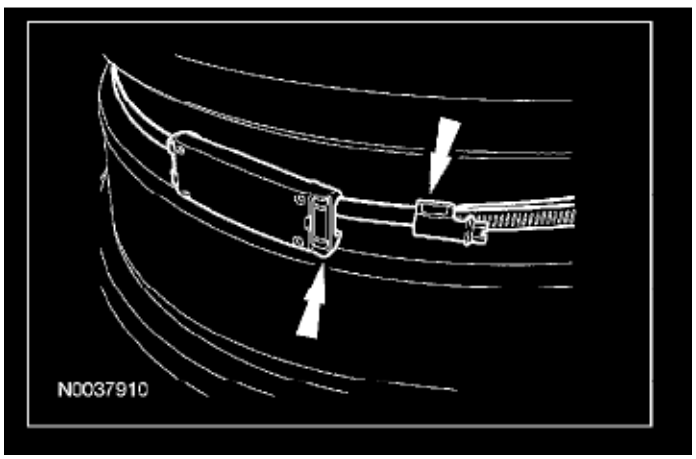

N0037910

3. NOTE: The sensor and cradle must be positioned with the hinge side of the sensor on the RH side when viewed from the curb side (beauty side)

of the wheel.

NOTE: The sensor has raised markings indicating how to position the sensor.

Remove the adhesive tape liner from the cradle and position the sensor and cradle into the wheel drop well 180 degrees from the valve stem.

4. Install the tapered end of the strap through the opening of the cradle on the hinge side of the sensor. This will position the worm gear on the

locking clip side of the sensor.

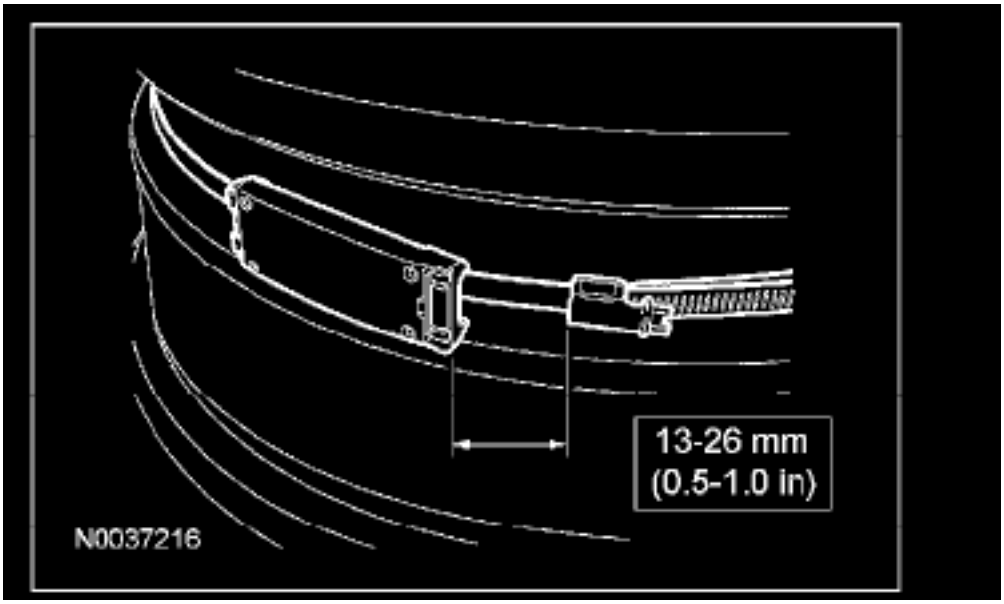
5. CAUTION: Steel wheels have a "high spot" along their circumference. Make sure the strap and sensor are mounted at the lowest spot

possible to avoid damaging the sensor during wheel and tire disassembly and assembly.

NOTE: Keep the strap parallel with the wheel flange while tightening the worm gear.

Position the worm gear 13-26 mm (0.5-1.0 inch) away from the sensor and tighten the worm gear.
^

Tighten to 3 Nm (27 lb-inch).



6. CAUTION: The sensor, cradle and strap may be damaged by incorrect tire mounting or dismounting. Mount the tire only as instructed.

Install the tire onto the wheel.

7. NOTE: A new tire pressure sensor is shipped in an off mode (or battery saver mode) and must be turned on before it can be trained. To turn the

sensor on, install it on a wheel, mount the tire and inflate the tire to the recommended inflation pressure. Wait at least 2 minutes, then continue with the sensor training procedure.

Train the tire pressure sensor(s).

Special Tool(s)

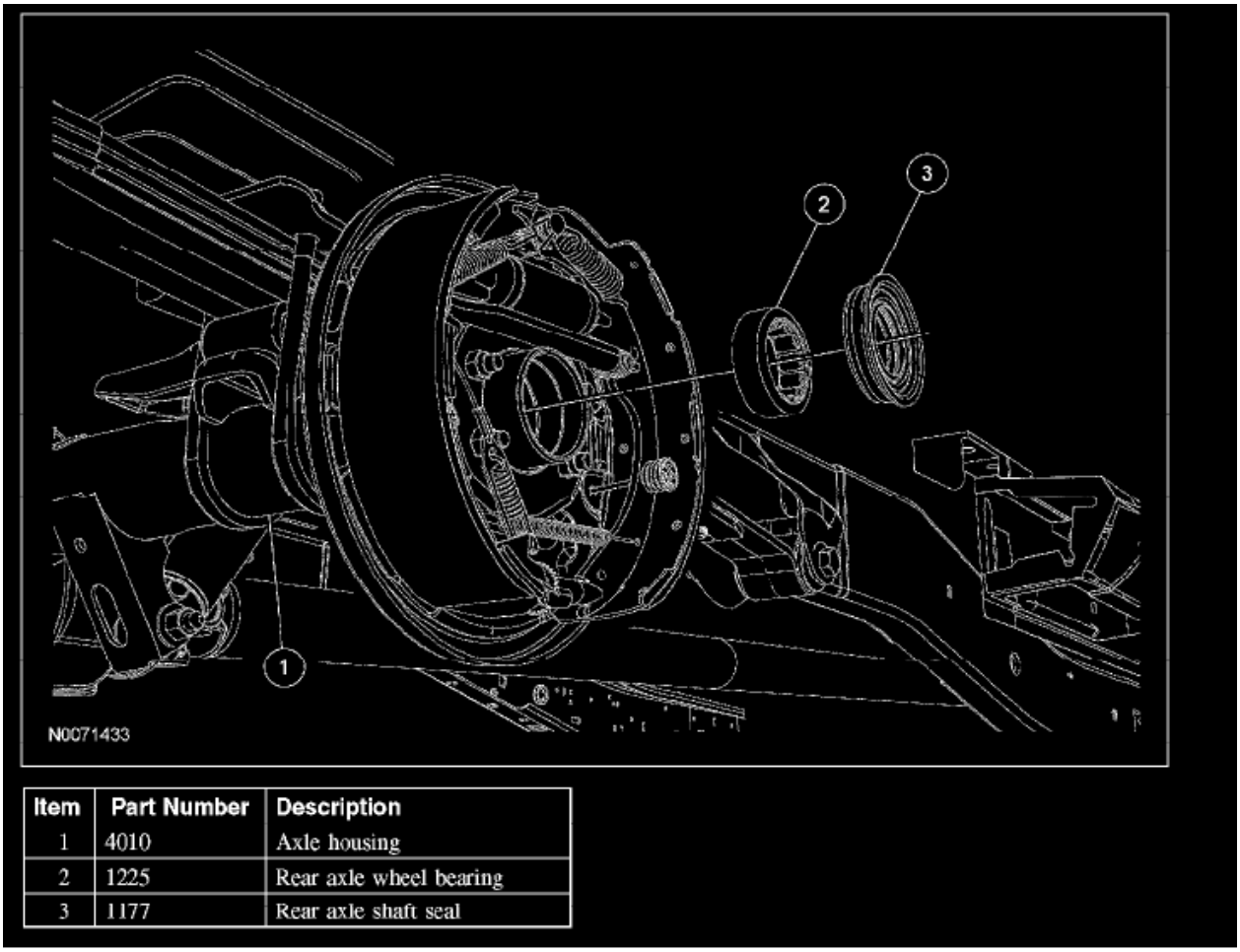
ST1326-A	Adapter for 303-224 (Handle) 205-153 (T80T-4000-W)
ST1541A	Installer, Axle Shaft Bearing 205-124 (T78P-1225-A)
ST2027 A	Installer, Rear Axle Oil Seal 205-390 (T97T-1177-B)
ST1185-A	Slide Hammer 100-001 (T50T-100-A)
ST2035-A	Remover, Axle Bearing 205-219 (T85L-1225-AH)

Material

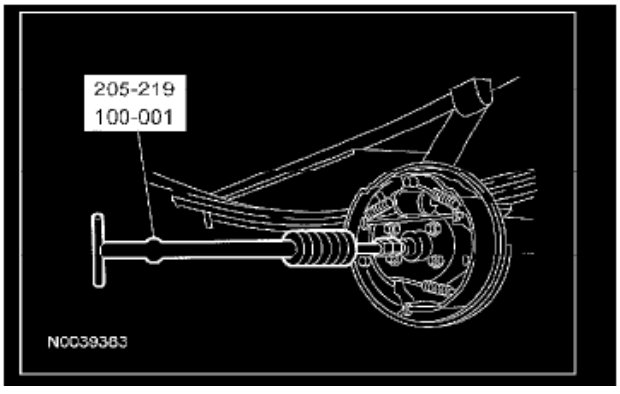
Item	Specification
Motorcraft SAE 80W-90 Premium Rear Axle Lubricant XY-80W90-QL (US); CXY-80W90-1L (Canada)	WSP-M2C197-A
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B

Wheel Bearing: Service and Repair Ford 7.5-Inch Ring Gear - Rear Drive Axle/Differential

Rear Wheel Bearing and Axle Shaft Seal



Item	Part Number	Description
1	4010	Axle housing
2	1225	Rear axle wheel bearing
3	1177	Rear axle shaft seal



Removal

1. NOTE: If the wheel bearing oil seal is leaking, the axle housing vent may be plugged.

Remove the axle shaft.

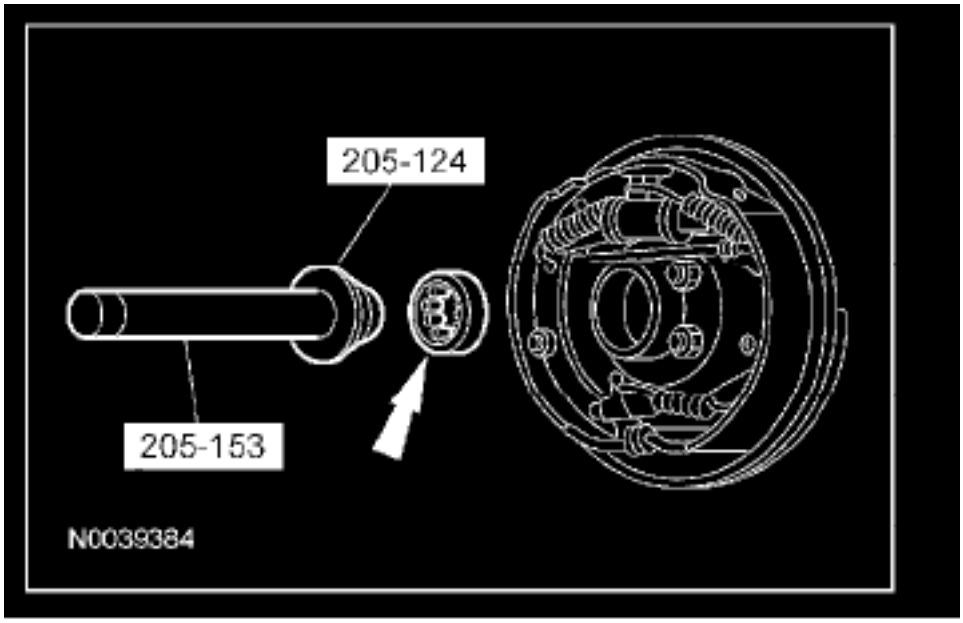
2. NOTE: If only a new seal needs to be installed, use care to avoid damaging the seal bore.

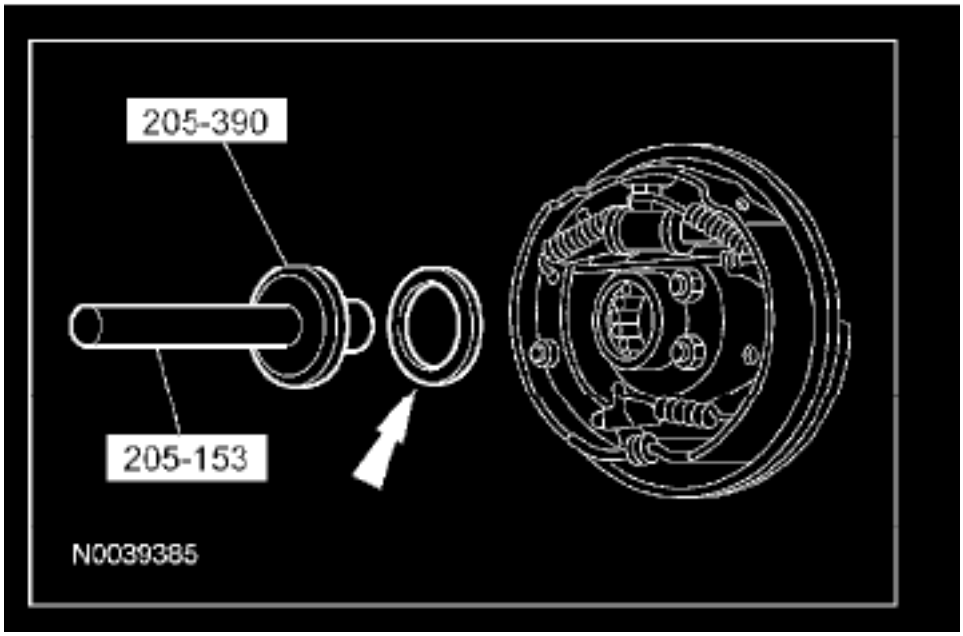
Using a suitable seal remover, remove and discard the axle shaft oil seal.

3. Inspect the rear wheel bearing and axle shaft for wear or damage. 4. If necessary, using the special tools, remove the rear wheel bearing.

Installation

1. Lubricate the new rear wheel bearing with lubricant. 2. Using the special tools, install the rear wheel bearing. 3. Lubricate the lip of the new wheel bearing oil seal with grease.





4. Using the special tools, install the wheel bearing oil seal.

5. Install the axle shaft.

Special Tool(s)

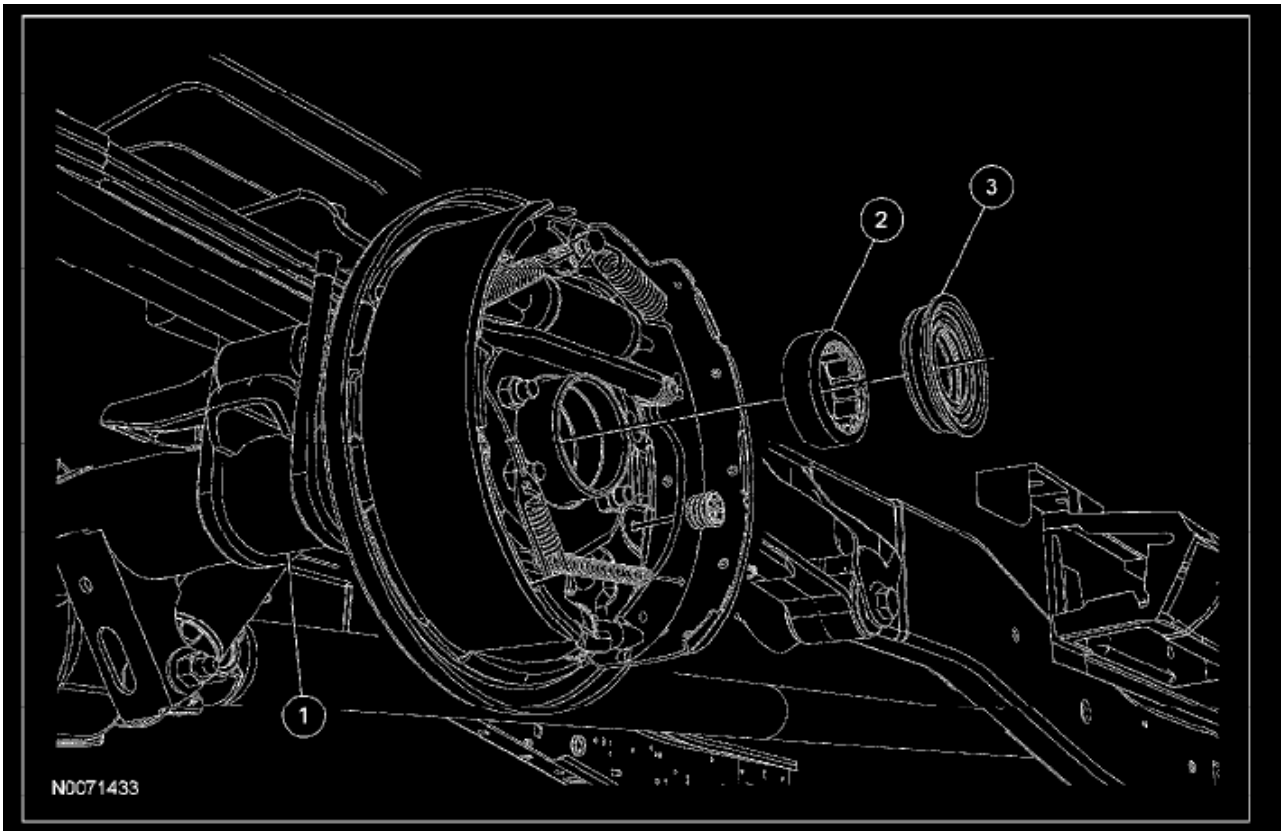
ST1325-A	Adapter For 303-224 (Handle) 205-153 (T80T-4000-W)
ST1185-A	Impact Slide Hammer 100-001 (T50T-100-A)
ST1541A	Installer, Axle Shaft Bearing 205-124 (T78P-1225-A)
ST2027-A	Installer, Rear Axle Oil Seal 205-390 (T97-1177-B)
ST2035-A	Remover, Axle Bearing 205-219 (T85L-1225-AH)

Material

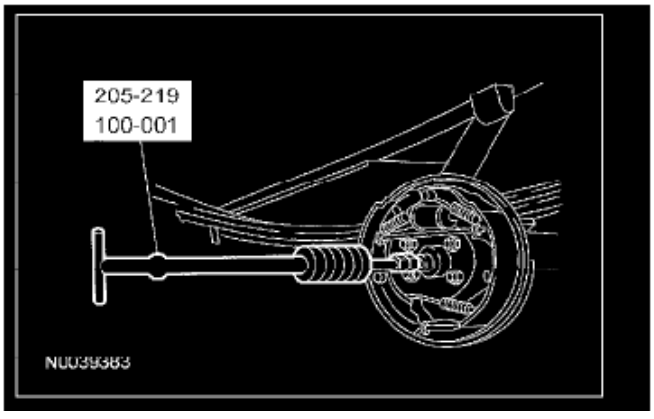
Item	Specification
Motorcraft SAE 80W-90 Premium Rear Axle Lubricant XY-80W90-QL (US); CXY-80W90-1L (Canada)	WSP-M2C197-A
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B

Wheel Bearing: Service and Repair Ford 8.8-Inch Ring Gear - Rear Drive Axle/Differential

Rear Wheel Bearing and Axle Shaft Seal



Item	Part Number	Description
1	4010	Axle housing
2	1225	Rear axle wheel bearing
3	1177	Rear axle shaft seal



Removal

1. Remove the axle shaft.

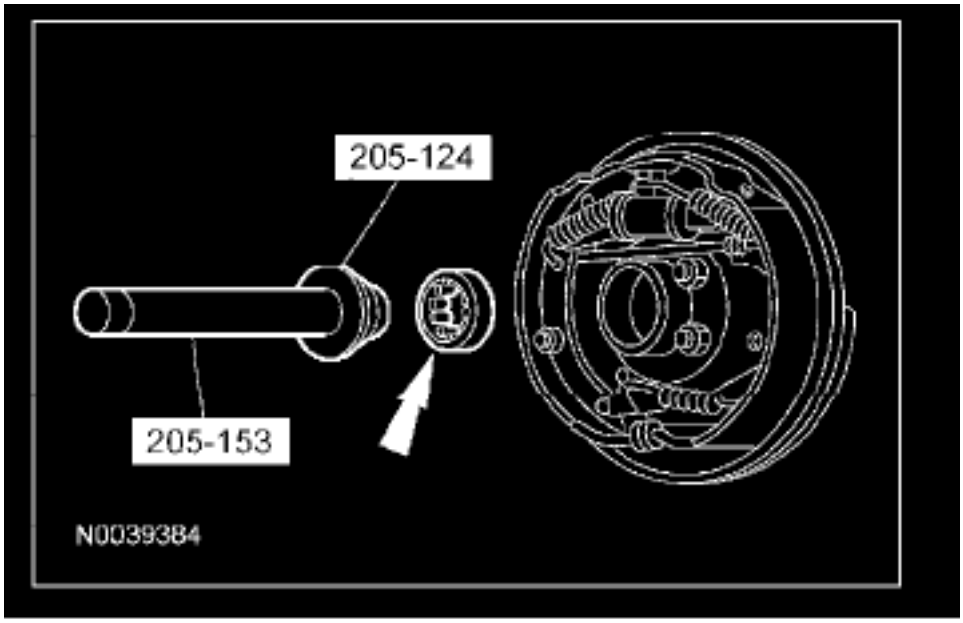
2. NOTE: If only a new seal needs to be installed, use care to avoid damaging the seal bore.

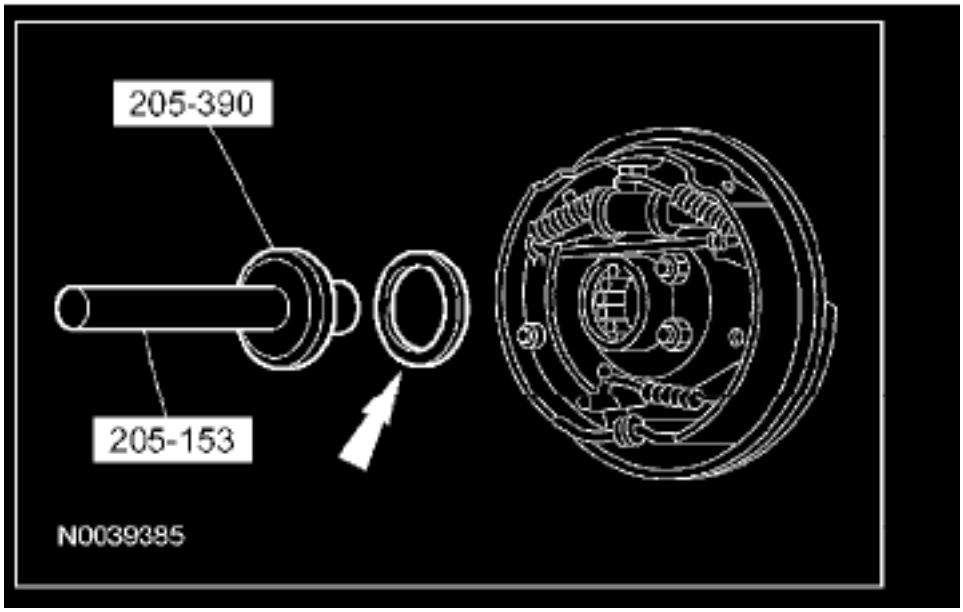
Using a suitable seal remover, remove and discard the axle shaft oil seal.

3. Inspect the rear wheel bearing and axle shaft for wear or damage. 4. If necessary, using the special tools, remove the rear wheel bearing.

Installation

1. Lubricate the new rear wheel bearing with rear axle lubricant.





2. Using the special tools, install the rear wheel bearing. 3. Lubricate the lip of the new wheel bearing oil seal with grease. 4. Using the special tools, install the wheel bearing oil seal.

5. Install the axle shaft.

Special Tool(s)

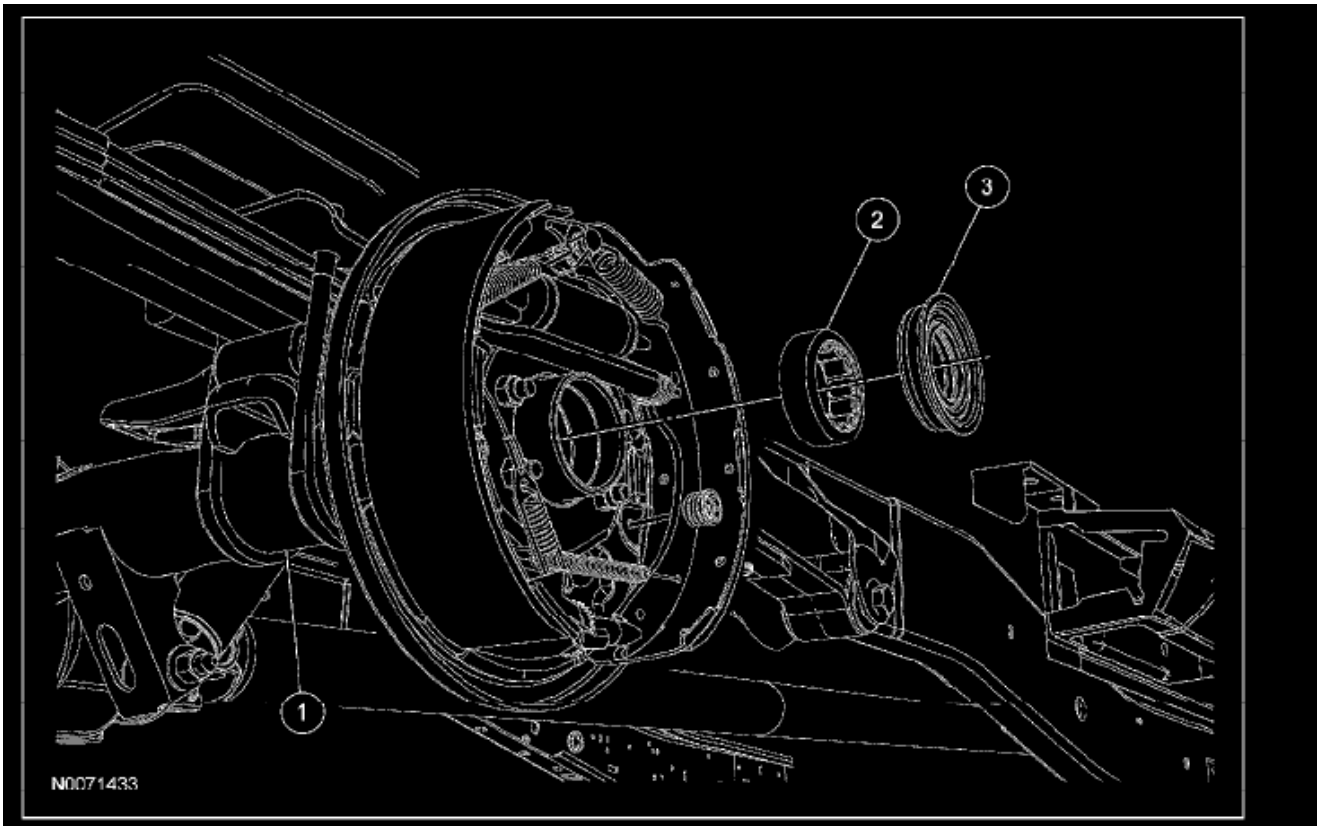
ST1326-A	Adapter For 303-224 (Handle) 205-153 (T80T-4000-W)
ST1322-A	Installer, Axle Bearing 205-194 (T83T-1225-B)
ST1736-A	Installer, Axle Oil Seal 205-190 (T83T-1175-A)
ST1263-A	Remover, Axle Bearing 205-193 (T83T-1225-A)
ST1185-A	Slide Hammer 100-001 (T50T-100-A)

Material

Item	Specification
Additive Friction Modifier XL-3 (US); CXL-3 (Canada)	EST-M2C118-A
Motorcraft SAE 75W-140 Synthetic Rear Axle Lubricant XY-75W140-QL (US); CXY-75W140-1L (Canada)	WSL-M2C192-A
Premium Long-Life Grease XG-1-C or XG-1-K (US); CXG-1-C (Canada)	ESA-M1C75-B

Wheel Bearing: Service and Repair Ford 8.8-Inch Ring Gear High Torque - Rear Drive Axle/Differential

Rear Wheel Bearing and Axle Shaft Seal



Item	Part Number	Description
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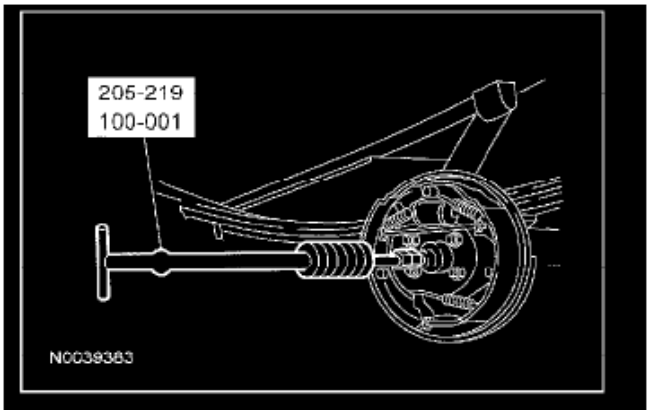


Removal

1. Remove the axle shaft.

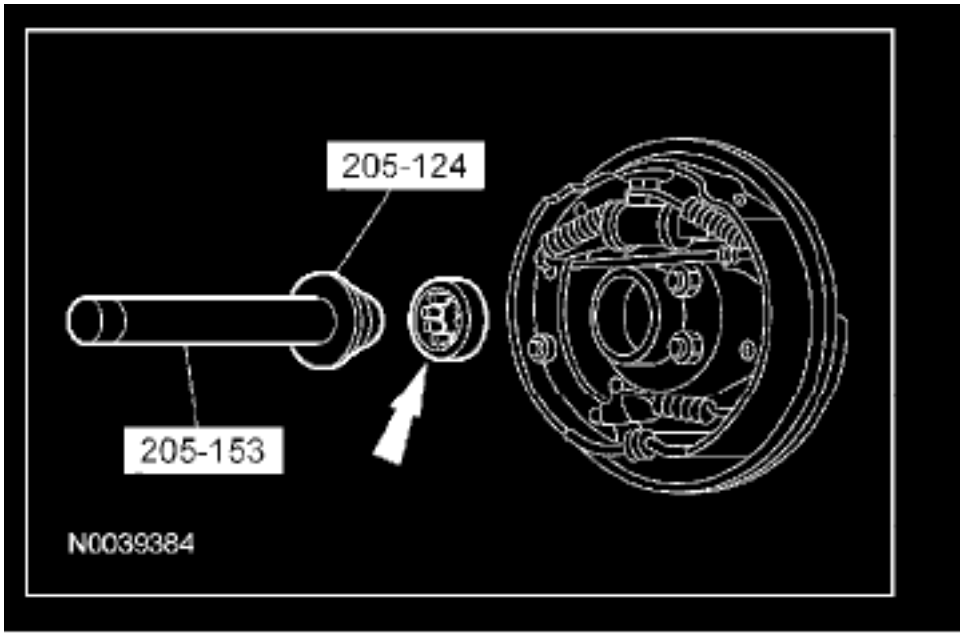
2. NOTE: If only a new seal needs to be installed, use care to avoid damaging the seal bore.

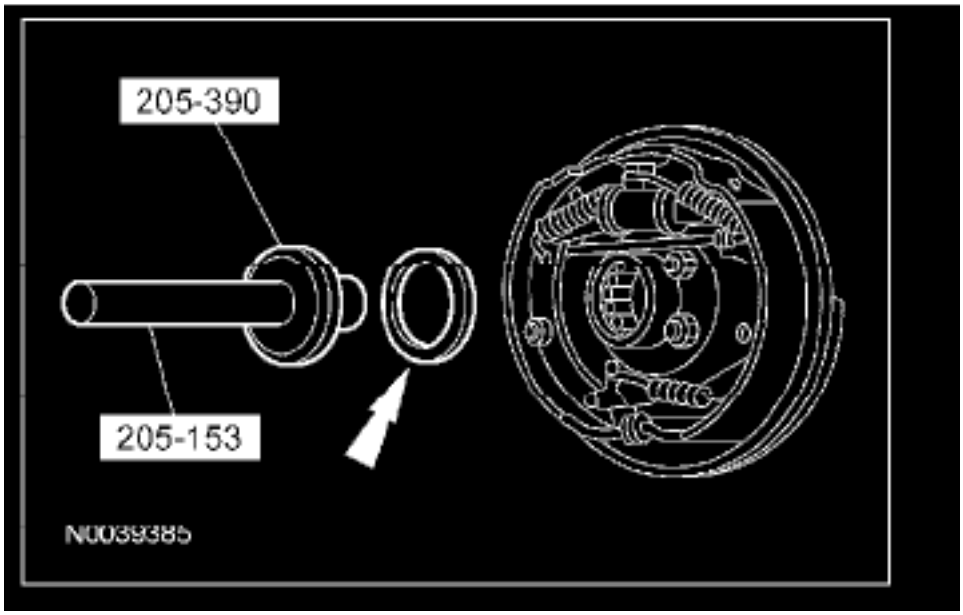
Using a suitable seal remover, remove the axle shaft oil seal. Discard the oil seal.

3. Inspect the rear wheel bearing and axle shaft for wear or damage. 4. If necessary, using the special tools, remove the rear wheel bearing.

Installation

1. Lubricate the new rear wheel bearing with rear axle lubricant. 2. Using the special tools, install the rear wheel bearing.



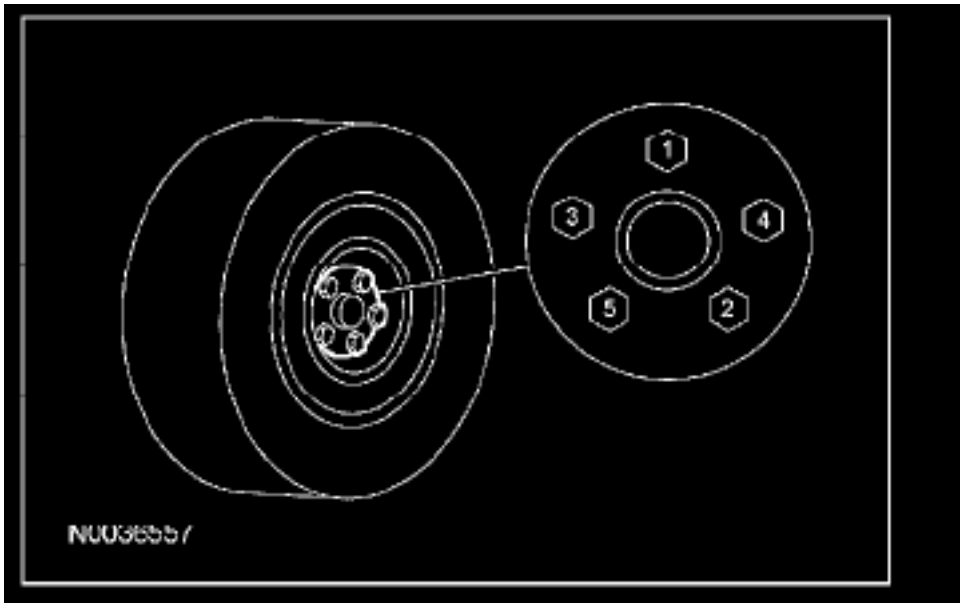


3. Lubricate the lip of the new wheel bearing oil seal with grease. 4. Using the special tools, install the wheel bearing oil seal.

5. Install the axle shaft.

Axle Nut: Specifications

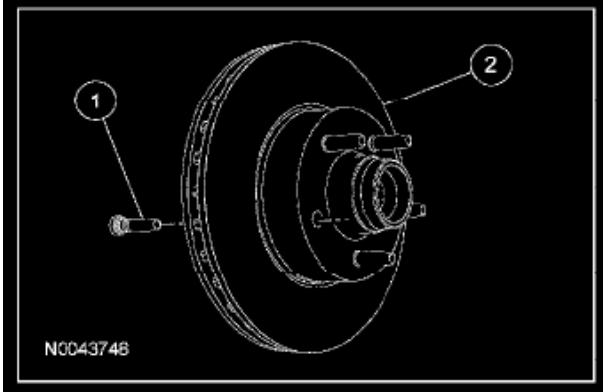
Hub Nut and Washer ..... 250 Nm (184 lb-ft)



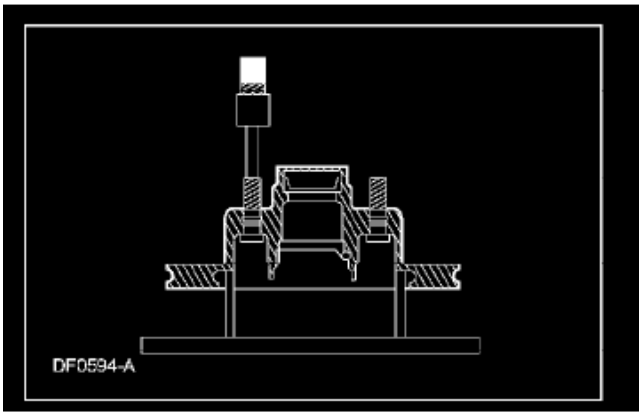
Wheel Fastener: Specifications

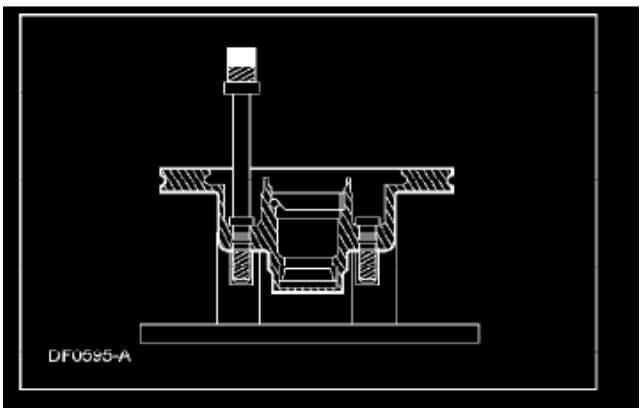
Wheel Nuts ..... 135 Nm (100 lb-ft)

Wheel Studs



Item	Part Number	Description
1	1107	Wheel stud (5 required)
2	1102	Brake disc and hub





Wheel Fastener: Service and Repair Front

Wheel Studs

Wheel Studs

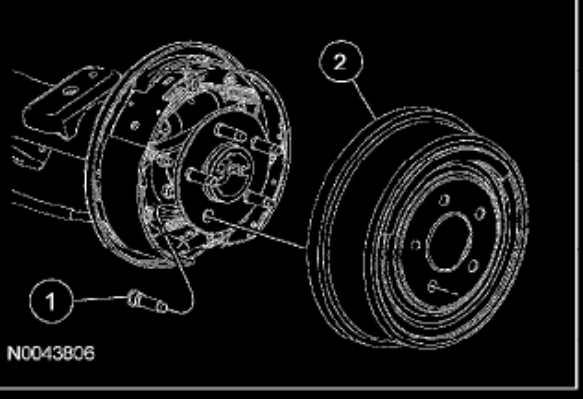
Removal and Installation

1. Remove the brake disc. 2. Using a suitable press, remove the wheel stud from the brake disc.

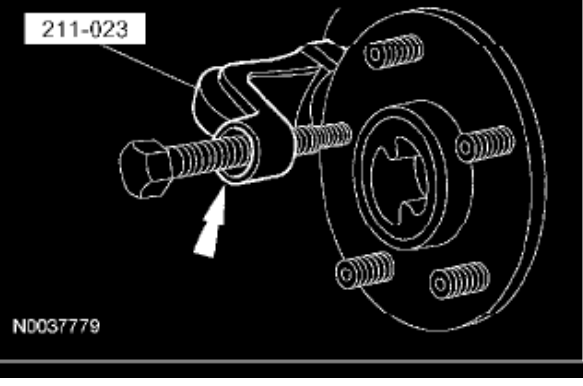
3. To install, reverse the removal procedure.

Special Tool(s)

ST1494-A	C-Frame and Clamp Assembly 211-023 (T74P-3044-A1)



Item	Part Number	Description
1	W707287	Wheel stud
2	1126	Rear brake drum



Wheel Fastener: Service and Repair Rear

Wheel Studs

Removal

CAUTION: Suspension fasteners are critical parts because they affect performance of vital components and systems and their failure may result in major service expense. New parts must be installed with the same part numbers or equivalent parts if replacement is necessary. Do not use replacement parts of lesser quality or substitute design. Torque values must be used as specified during reassembly to make sure of correct retention of these parts.

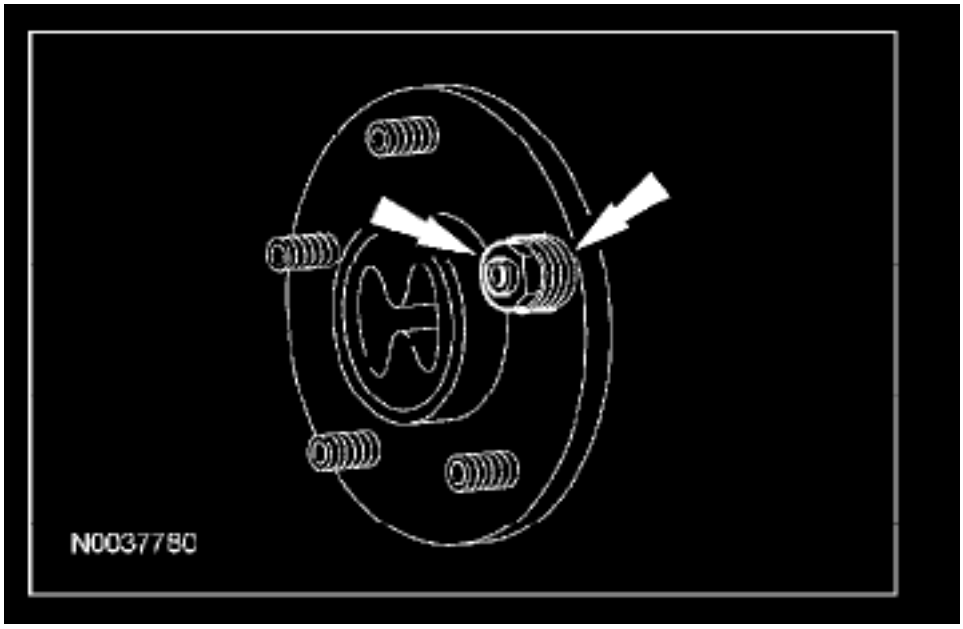
CAUTION: Never use a hammer to remove the wheel stud or damage to the axle flange, wheel bearing or hub may occur.

1. Remove the rear brake drum. 2. Using the special tool, press the wheel stud from its seat and discard.

Installation

CAUTION: Never use air tools to install wheel studs. The serrations may be stripped from the stud.

1. Insert a new wheel stud in the axle flange, making sure the serrations are aligned with those made by the original wheel stud.



2. Seat the new wheel stud in the axle flange.

^ Place 4 flat washers over the outside end of the wheel stud.

^ Thread a standard wheel nut with the flat side against the washers.

^ Tighten the wheel nut until the wheel stud head seats against the back side of the flange.

3. Remove the wheel nut and flat washers. 4. Install the rear brake drum.

Accumulator HVAC: Description and Operation

SUCTION ACCUMULATOR

NOTE: Installation of a new suction accumulator is not required when repairing the air conditioning system, except when there is physical evidence of contamination from a failed A/C compressor or damage to the suction accumulator.

After entering the inlet of the suction accumulator, heavier oil-laden refrigerant contacts an internally mounted dome (which serves as an umbrella) and drips down onto the bottom of the canister.

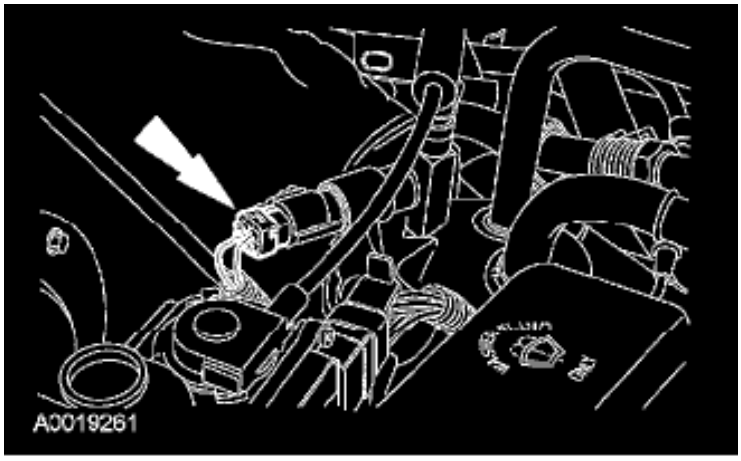
- A small diameter oil bleed hole, in the bottom of the vapor return tube, allows the accumulated heavier liquid refrigerant and oil mixture to re-enter the compressor suction line at a controlled rate.

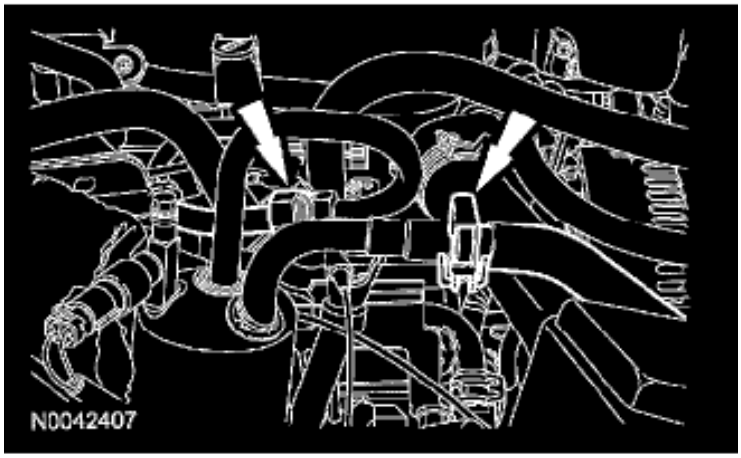
- As the heavier mixture passes through the small diameter liquid bleed hole, it has a second chance to vaporize and recirculate through the A/C compressor without causing compressor damage due to slugging.

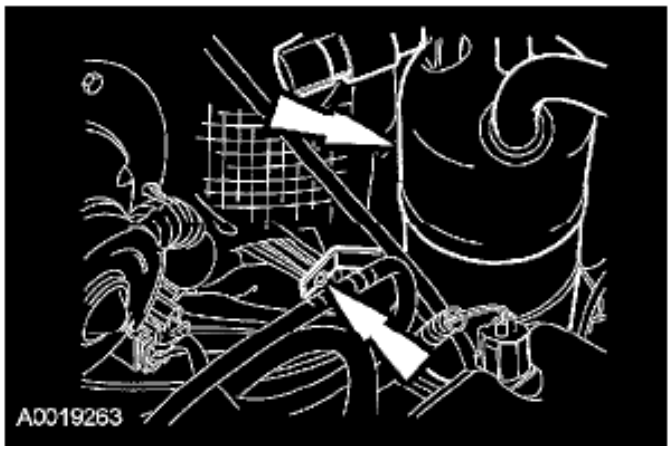
- A fine mesh screened filter fits tightly around the bottom of the vapor return tube to filter out refrigerant system contaminant particles.

- A desiccant bag is mounted inside the canister to absorb any moisture which may be in the refrigerant system.

- A fitting located on the side of the suction accumulator is used to mount a serviceable low-pressure A/C charge port valve.


A0019261


N0042407


A0019263

Accumulator HVAC: Service and Repair

SUCTION ACCUMULATOR

Removal and Installation

NOTE: Installation of a new suction accumulator is not required when repairing the air conditioning system, except when there is physical evidence of contamination from a failed A/C compressor or damage to the suction accumulator.

1. Recover the refrigerant. 2. Disconnect the A/C cycling switch electrical connector.

3. CAUTION: Use a back-up wrench to prevent damage to the tubes.

Disconnect the suction accumulator inlet and outlet fittings. -

Discard the O-ring seals.

- To install, tighten the inlet fitting to 39 Nm (29 lb-ft)

4. Remove the suction accumulator bracket screws and the suction accumulator.

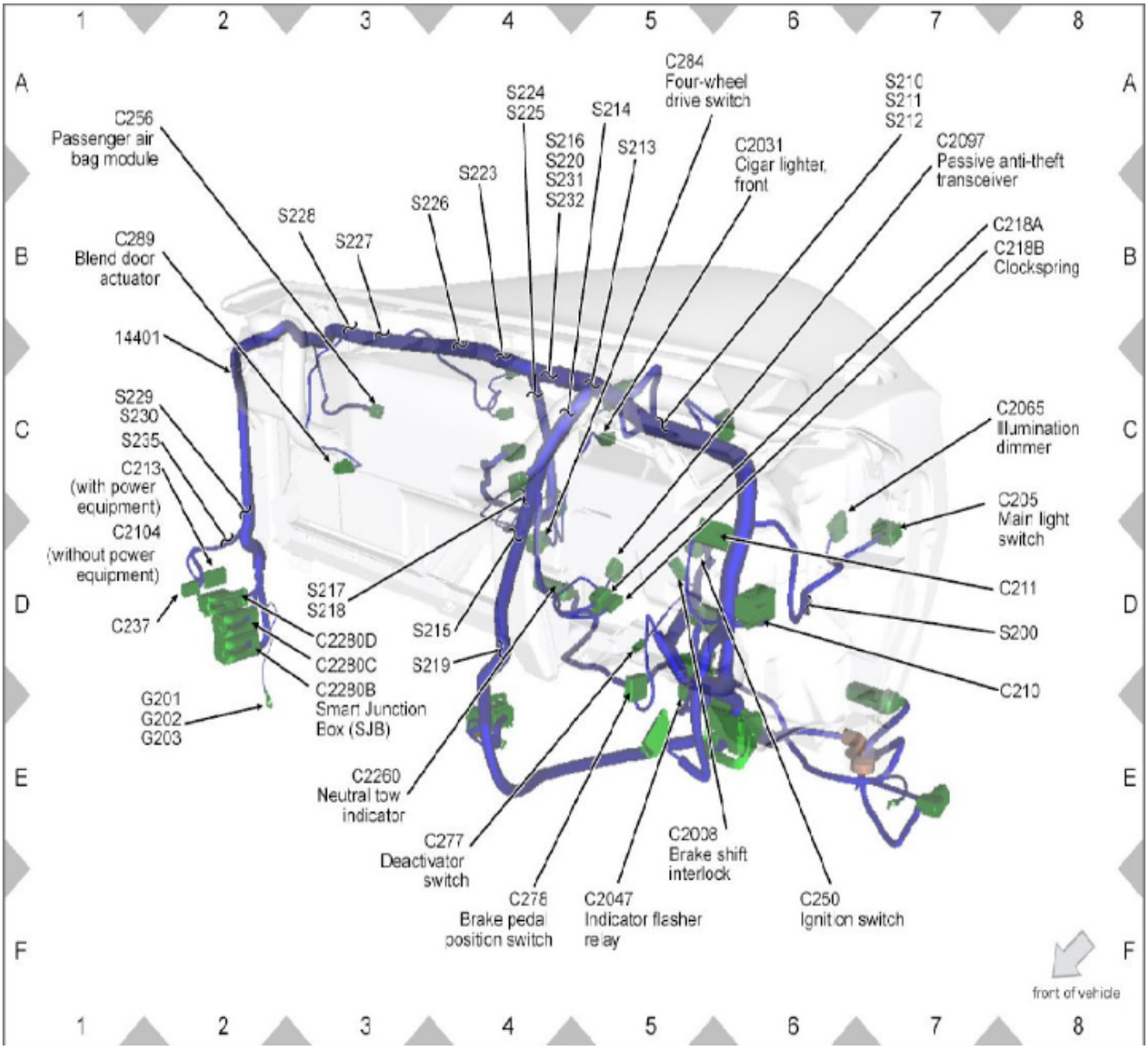
5. To install, reverse the removal procedure.

- Install new O-ring seals.

- Lubricate the refrigerant system with the correct amount of clean PAG oil or equivalent.

6. Evacuate, leak test and charge the refrigerant system.

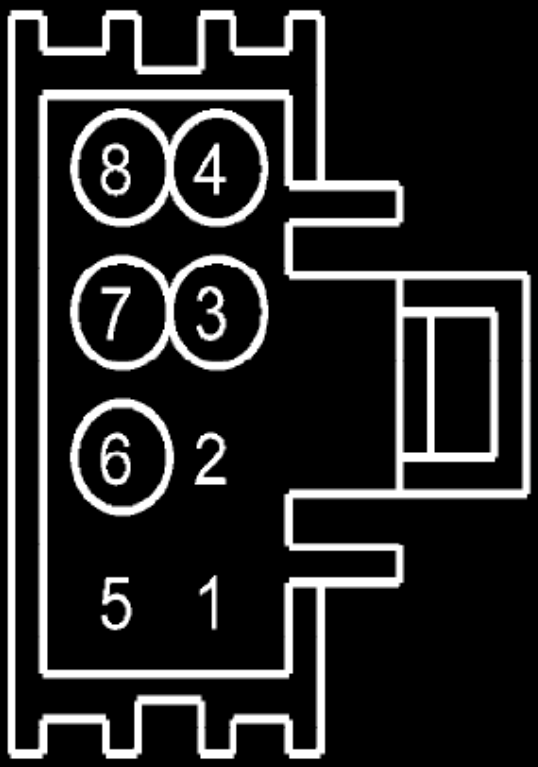
Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Heating and Air Conditioning > Air Door, HVAC > Air Door Actuator / Motor, HVAC > Component Information > Locations



View 151-11

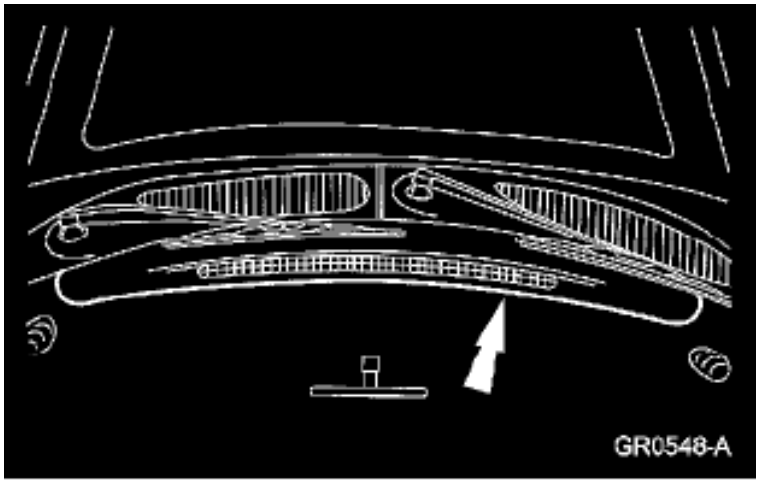
Connector: C289

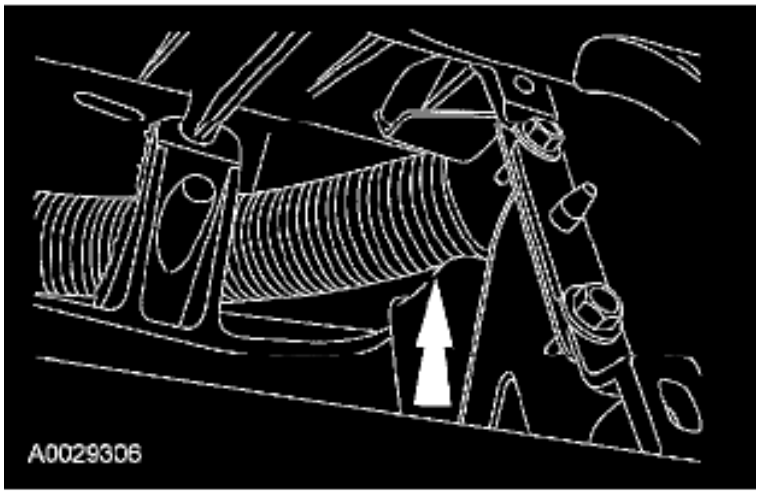
Description:	Harness:	Base Part #:
BLEND DOOR ACTUATOR	14401	19E616

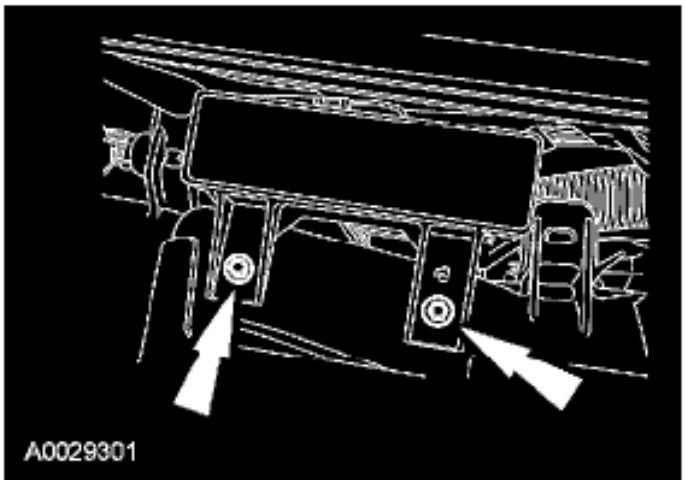


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	*	*	not used	
3	VI1450 (BN-WH)	22	SWITCH - DOOR TEMPERATURE CONTROL	
4	RH449 (GY-OG)	22	SWITCH - DOOR TEMPERATURE	
5	*	*	not used	
6	CH449 (BU-OG)	22	SWITCH - DOOR TEMPERATURE	
7	CBP27 (GN-BN)	22	FUSE - 27 OR CIRCUIT BREAKER	
8	GD161 (BK-YE)	22	GROUND - SEAT BRACKET REAR LEFT	

C289


GR0548-A


A0029306


A0029301

Air Door Actuator / Motor: Service and Repair Temperature Blend Door Actuator

TEMPERATURE BLEND DOOR ACTUATOR

Removal and Installation

All vehicles

1. Remove the passenger air bag module. 2. Remove the defroster opening grill.

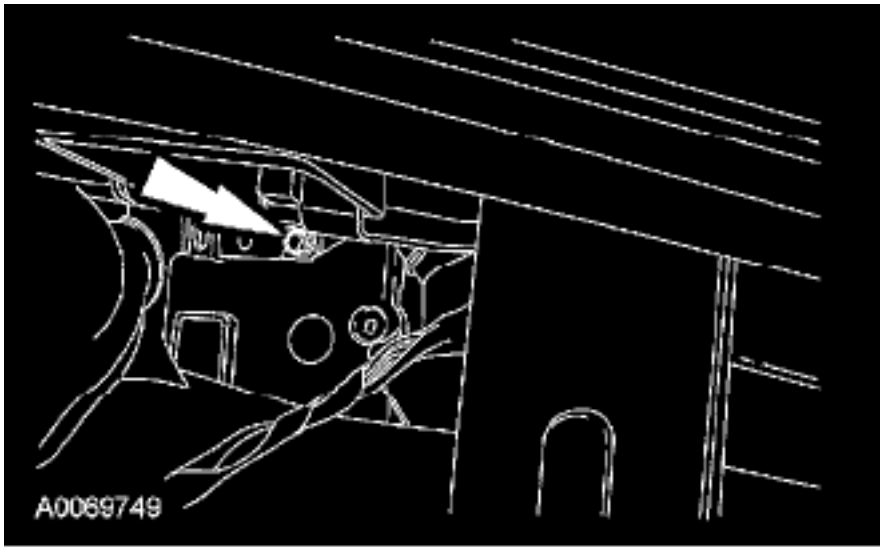
3. Detach and position the RH demister hose aside.

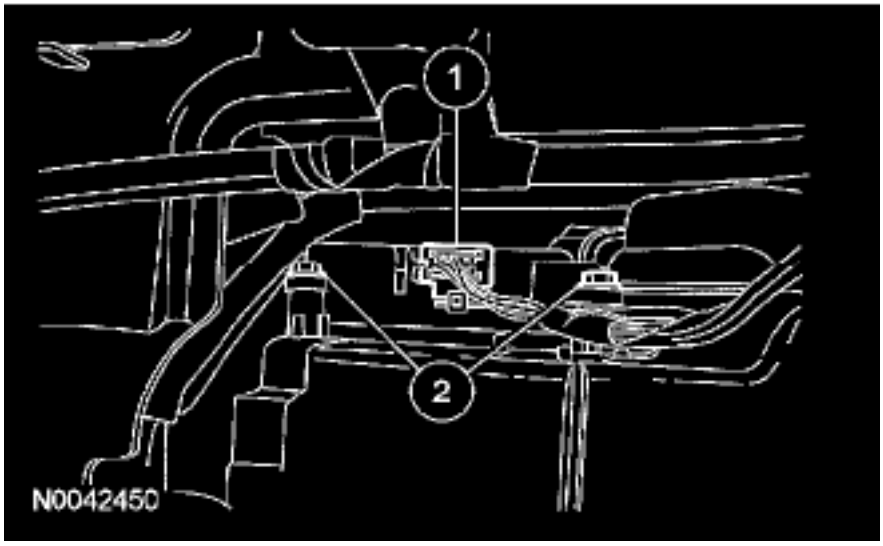
Vehicles with anti-theft/keyless entry

4. Remove the screws and position the anti-theft/keyless entry module aside.

All vehicles

5. Working through the opening near the RH defroster nozzle, remove the screw.



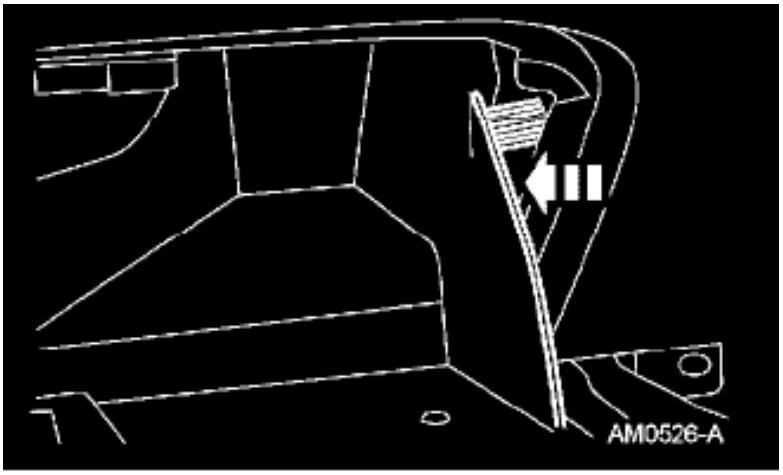


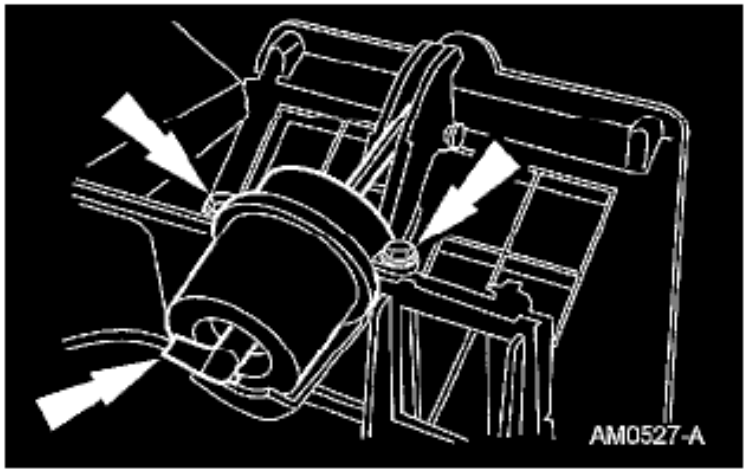
6. Remove the temperature blend door actuator.

1 Disconnect the electrical connector.

2 Remove the screws and the temperature blend door actuator.

7. To install, reverse the removal procedure.


AM0526-A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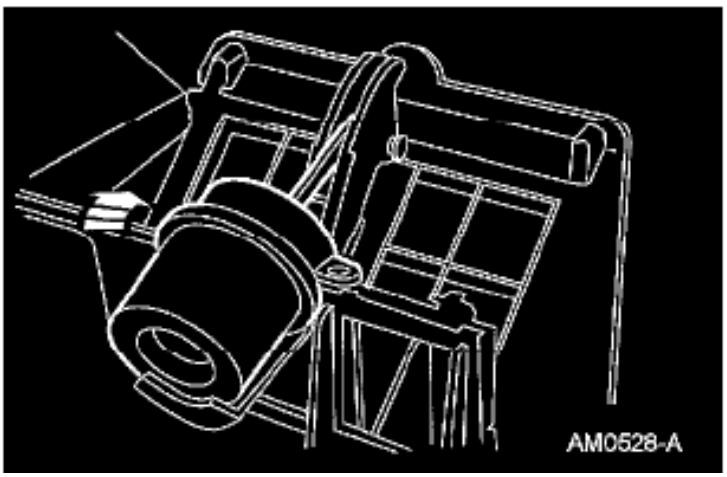

AM0528-A

Air Door Actuator / Motor: Service and Repair Vacuum Control Motor - Air Inlet Door

VACUUM CONTROL MOTOR - AIR INLET DOOR

Removal and Installation

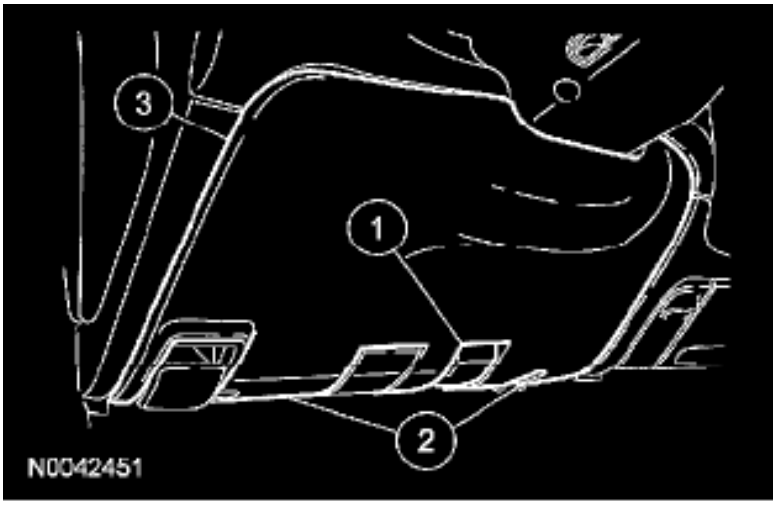
1. Release the stops and lower the glove compartment door.

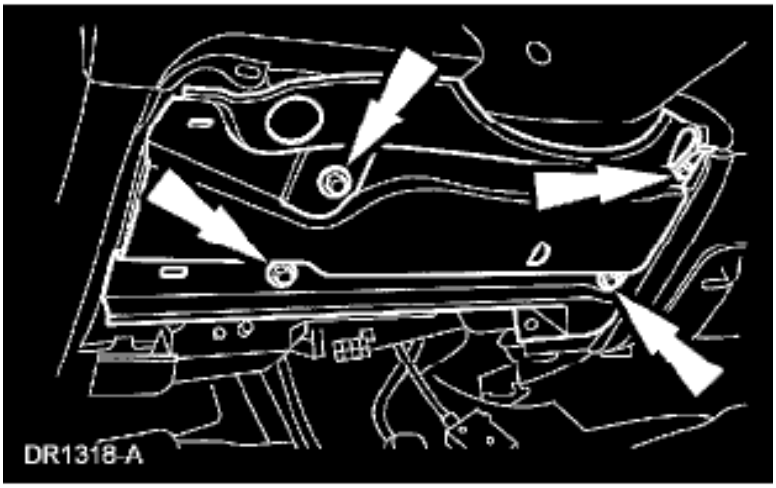
2. Remove the screws and disconnect the vacuum hose.

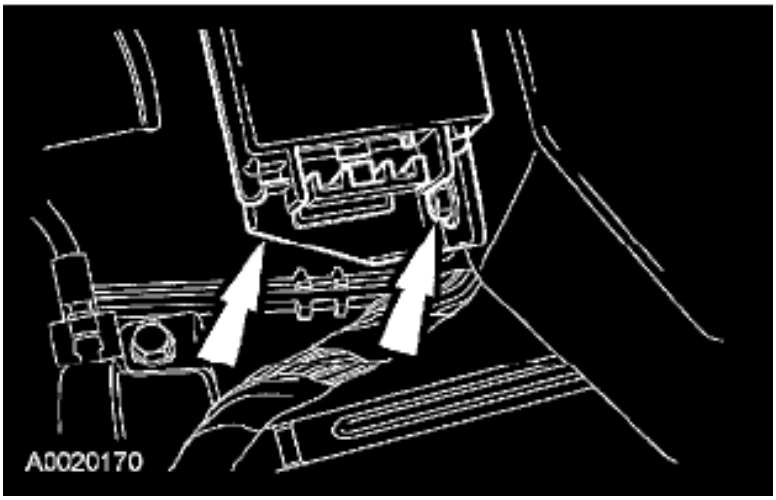
3. CAUTION: Do not attempt to bend any part of the lever. It is brittle and will break.

Rotate the vacuum control motor, disengage the lever and remove the vacuum control motor.

4. To install, reverse the removal procedure.


3
1
2
N0042451


DR1318-A


A0020170

Air Door Actuator / Motor: Service and Repair Vacuum Control Motor - Panel Defrost Door

VACUUM CONTROL MOTOR - PANEL DEFROST DOOR

Removal and Installation

1. Disconnect the battery ground cable. 2. Remove the lower steering column cover.

1 Remove the screws and detach the hood release handle.

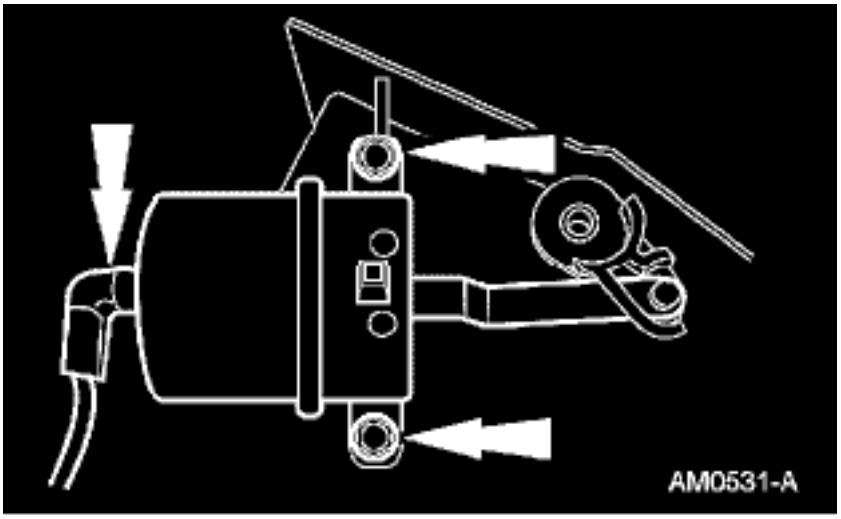
2 Remove the 2 screws.

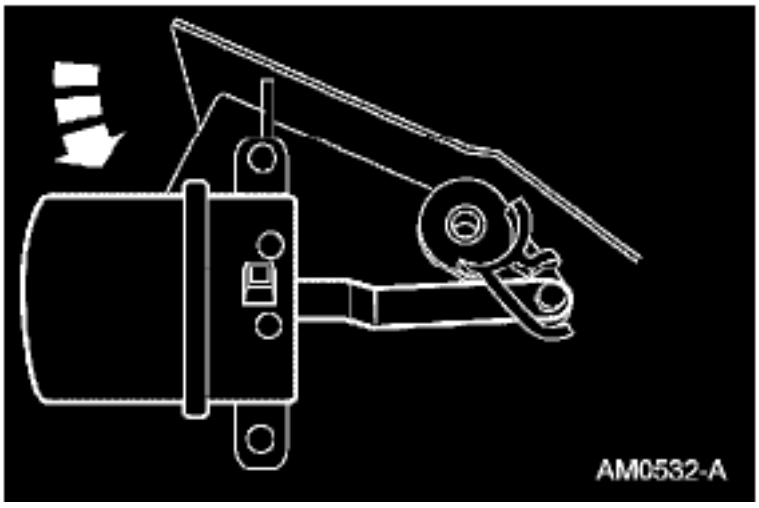
3 Remove the lower steering column cover.

3. Remove the bolts and the lower steering column cover reinforcement.

4. Remove the 2 screws and detach the relay panel.

5. Remove the screws and disconnect the vacuum connector.

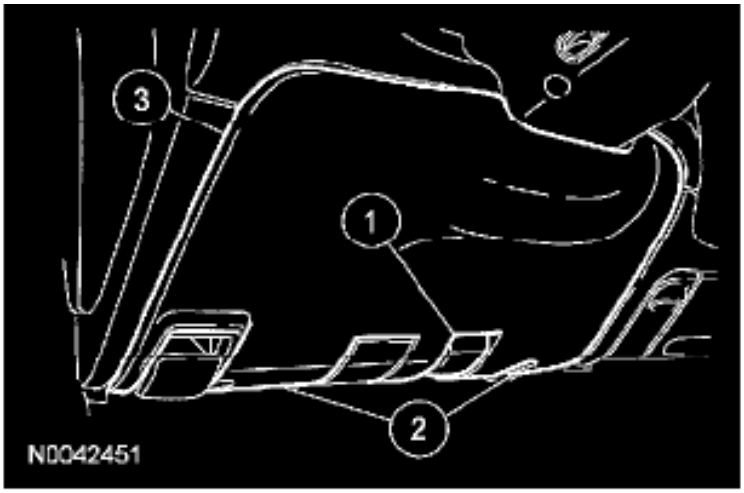


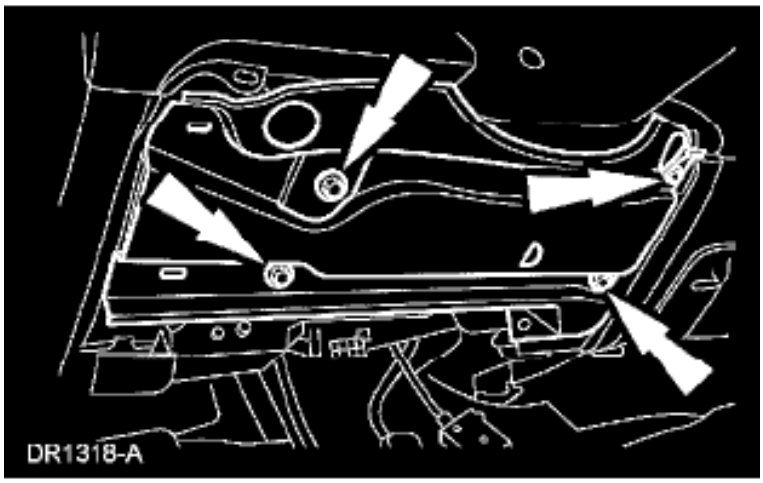


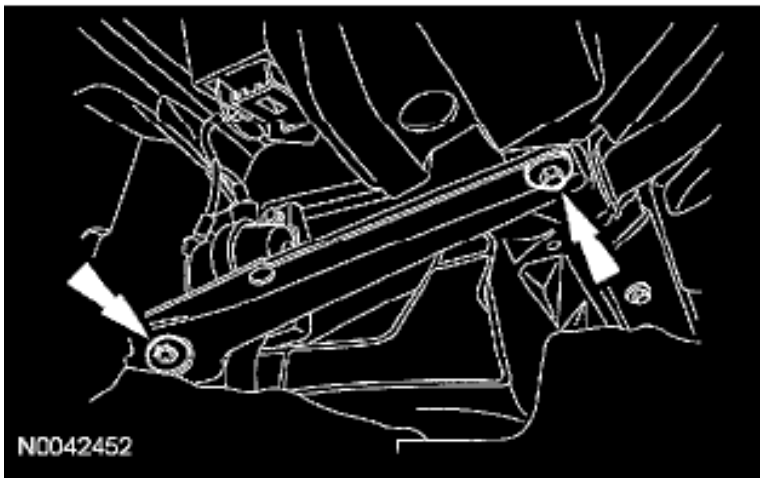
6. CAUTION: Do not attempt to bend any part of the lever. It is brittle and will break.

Rotate the vacuum control motor until it clears the retaining arm and remove the vacuum control motor.

7. To install, reverse the removal procedure.


3
1
2
N0042451


DR1318-A


N0042452

Air Door Actuator / Motor: Service and Repair Vacuum Control Motor - Panel/Floor Door

VACUUM CONTROL MOTOR - PANEL/FLOOR DOOR

Removal and Installation

1. Remove the lower steering column cover.

1 Remove the screws and detach the hood release handle.

2 Remove the 2 screws.

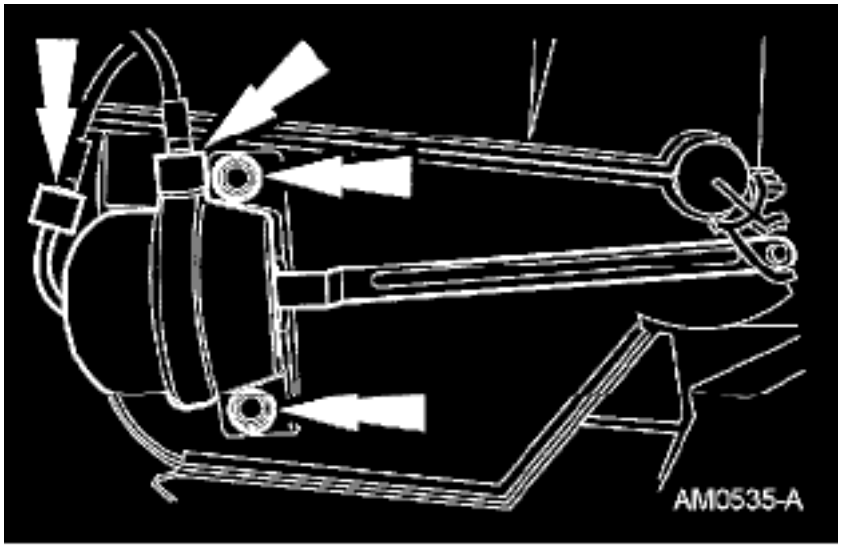
3 Remove the lower steering column cover.

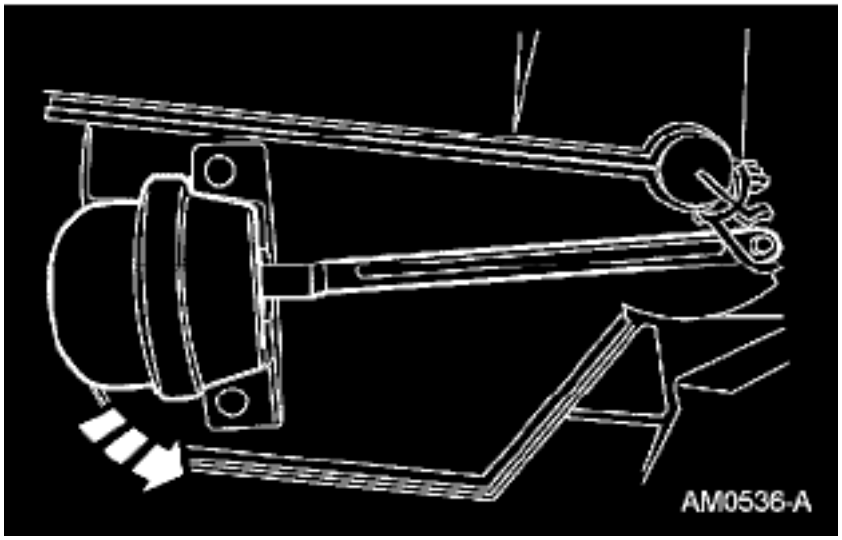
2. Remove the bolts and the lower steering column cover reinforcement.

3. Remove the 2 bolts and the instrument panel support brace.

- To install, tighten to 9 Nm (80 lb-in).

4. Remove the screws and disconnect the vacuum hose.

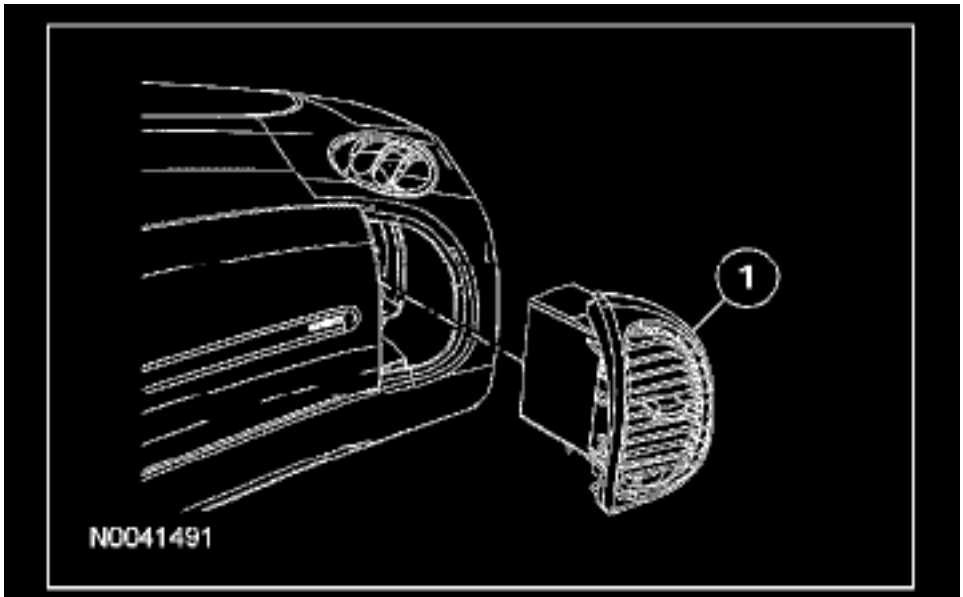




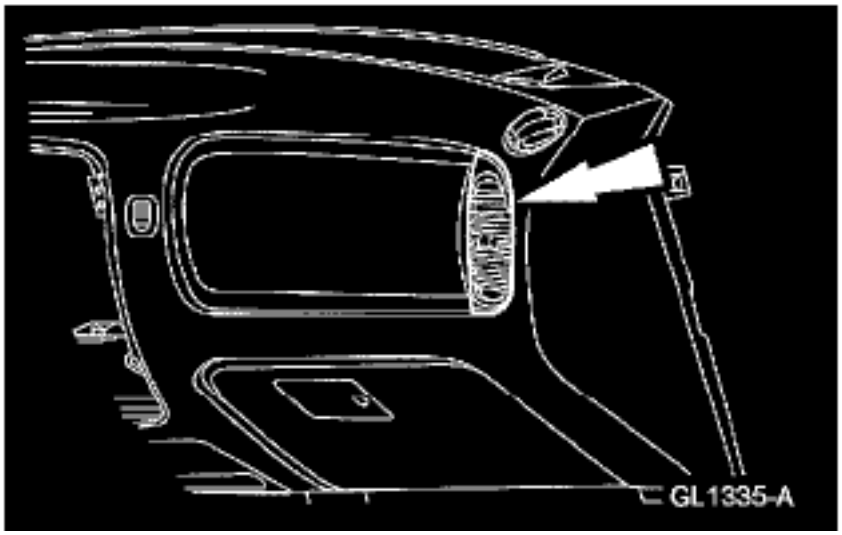
5. CAUTION: Do not attempt to bend any part of the lever. It is brittle and will break.

Rotate the vacuum control motor until it clears the retaining arm and remove the vacuum control motor.

6. To install, reverse the removal procedure.



Item	Part Number	Description
1	19893	Passenger side register



Air Register: Service and Repair Register - Passenger Side

REGISTER - PASSENGER SIDE

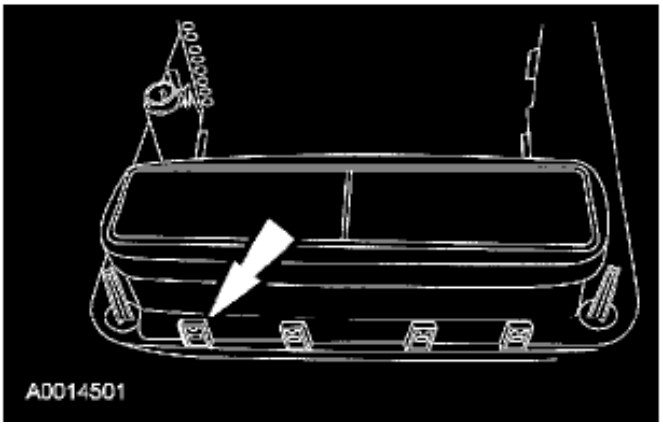
Removal and Installation

1. Lift the edge of the passenger side register to expose the retainers.

2. Release the retainers and remove the passenger side register. 3. To install, reverse the removal procedure.

Special Tool(s)

ST1445-A	Remover, Audio Unit 415-001 (T87P-19061-A)



Air Register: Service and Repair Register - Center

REGISTER - CENTER

Special Tool(s)

Special Tool(s)

Removal and Installation

1. Using the special tools, remove the audio unit.

- Disconnect the antenna cable and electrical connectors.

2. Remove the center instrument panel finish panel.

1 Remove the 2 screws.

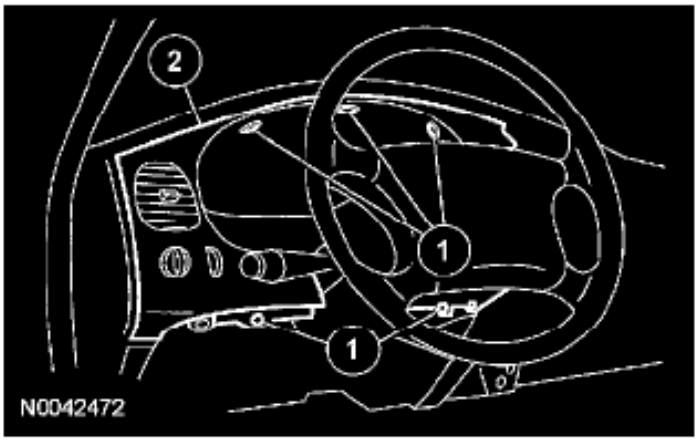
2 Disengage the spring clips and remove the instrument panel finish panel.

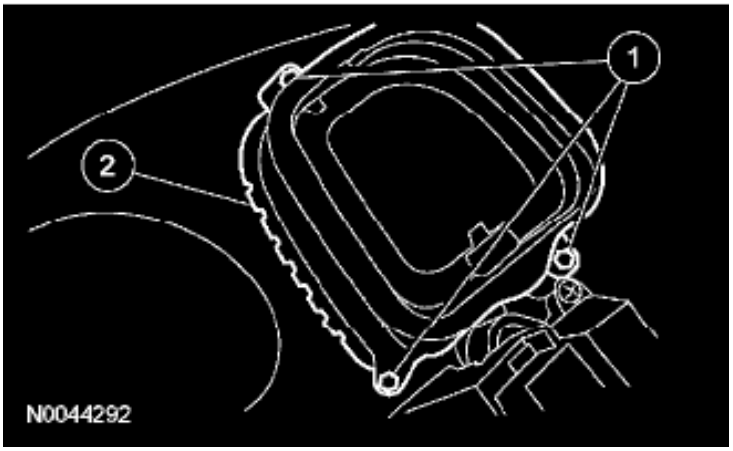
- Disconnect the electrical connectors.

3. Release the 8 clips and remove the center registers.

4. To install, reverse the removal procedure.

2
1
N0042471


2
1
1
N0042472


1
2
N0044292

Air Register: Service and Repair Register - Driver Side

REGISTER - DRIVER SIDE

Removal and Installation

1. Remove the audio unit. 2. Remove the center instrument panel finish panel.

1 Remove the 2 screws.

2 Remove the center instrument panel finish panel.

- Disconnect the electrical connectors.

3. Remove the instrument cluster finish panel.

1 Remove the 5 screws.

2 Remove the instrument cluster finish panel.

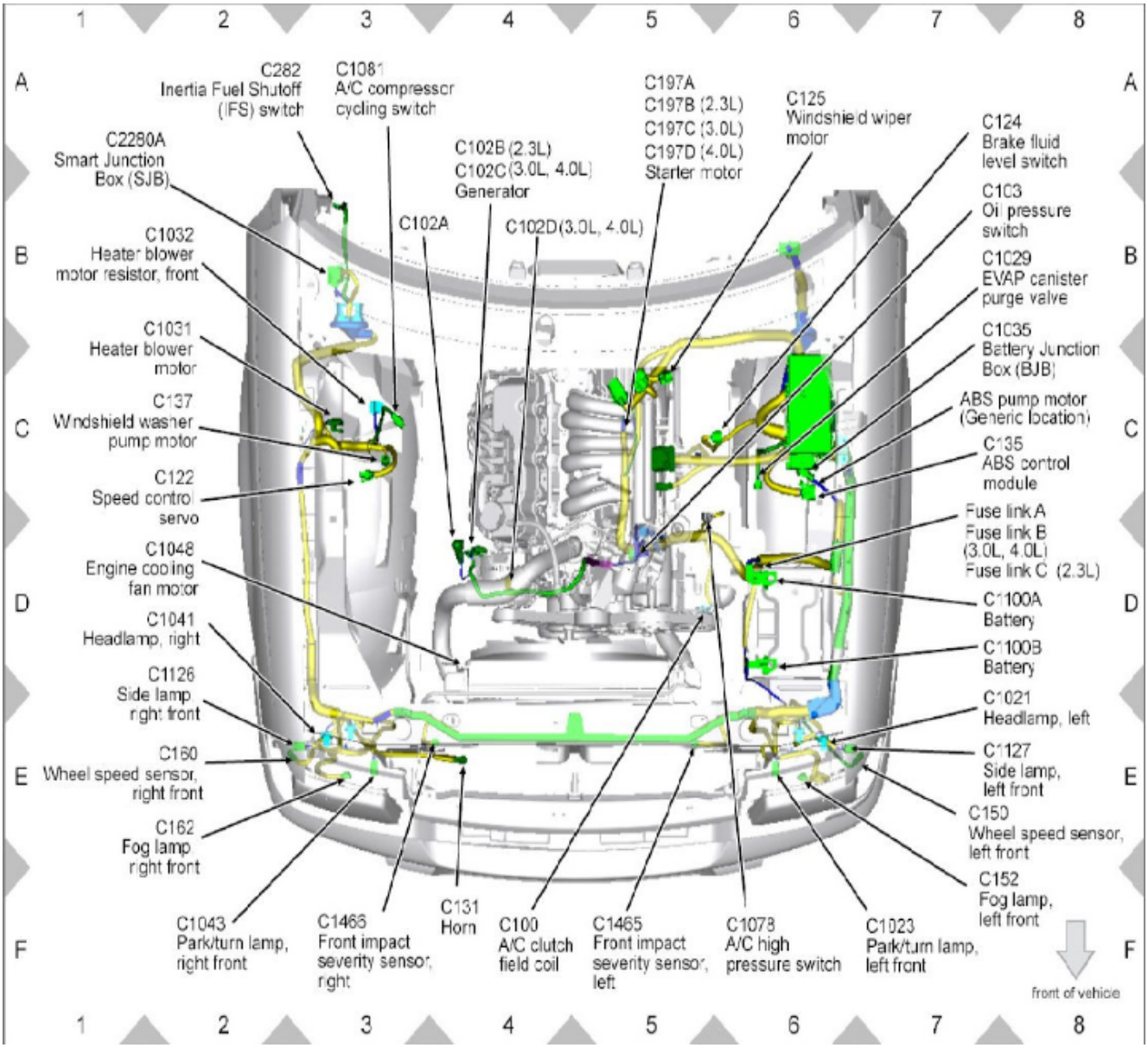
- Disconnect the electrical connectors.

4. Remove the LH instrument panel register.

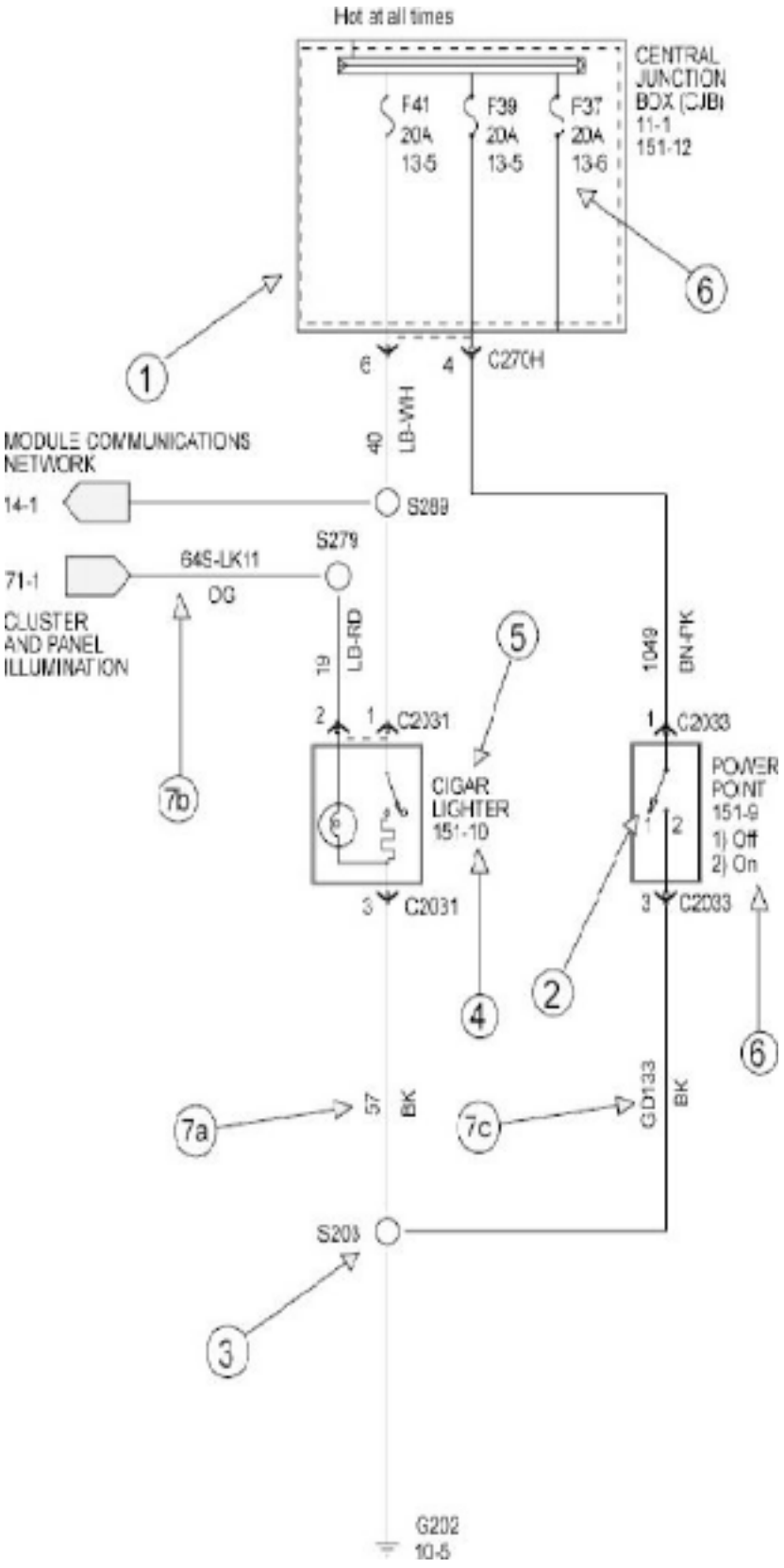
1 Remove the 3 screws.

2 Remove the driver side register.

5. To install, reverse the removal procedure.


C282
Inertia Fuel Shutoff (IFS) switch
C1081
A/C compressor cycling switch
C2280A
Smart Junction Box (SJB)
C102B (2.3L)
C102C (3.0L, 4.0L)
Generator
C102A
C102D (3.0L, 4.0L)
C197A
C197B (2.3L)
C197C (3.0L)
C197D (4.0L)
Starter motor
C125
Windshield wiper motor
C124
Brake fluid level switch
C1032
Heater blower motor resistor, front
C103
Oil pressure switch
C1029
EVAP canister purge valve
C1031
Heater blower motor
C1035
Battery Junction Box (BJB)
C137
Windshield washer pump motor
ABS pump motor (Generic location)
C135
ABS control module
C122
Speed control servo
Fuse link A
Fuse link B (3.0L, 4.0L)
Fuse link C (2.3L)
C1048
Engine cooling fan motor
C100A
Battery
C1041
Headlamp, right
C100B
Battery
C1126
Side lamp right front
C1021
Headlamp, left
C160
Wheel speed sensor, right front
C1127
Side lamp, left front
C150
Wheel speed sensor, left front
C162
Fog lamp right front
C152
Fog lamp, left front
C1043
Park/turn lamp, right front
C1465
Front impact severity sensor, right
C131
Horn
C100
A/C clutch field coil
C1465
Front impact severity sensor, left
C1078
A/C high pressure switch
C1023
Park/turn lamp, left front
front of vehicle
1
2
3
4
5
6
7
8
A
B
C
D
E
F

View 151-1


Hot at all times
CENTRAL JUNCTION BOX (CJB)
11-1
151-12
F41
20A
13-5
F39
20A
13-5
F37
20A
13-6
C270H
40
LB-WH
MODULE COMMUNICATIONS NETWORK
14-1
S289
S279
64S-LK11
71-1
DG
CLUSTER AND PANEL ILLUMINATION
19
LB-RD
C2031
CIGAR LIGHTER
151-10
1049
BN-PK
C2033
POWER POINT
151-9
1) Off
2) On
57
BK
GD133
BK
S203
G202
10-5

Blower Motor: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

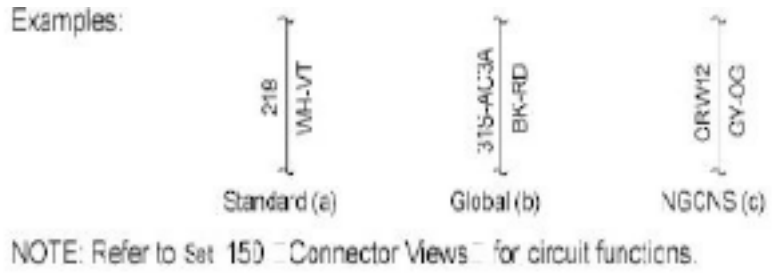
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

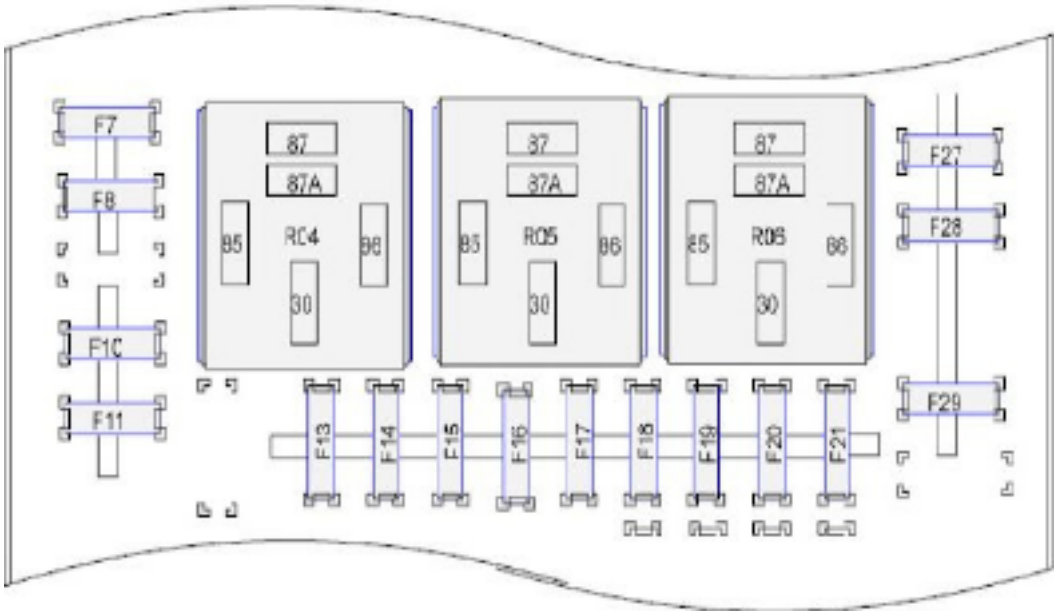
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

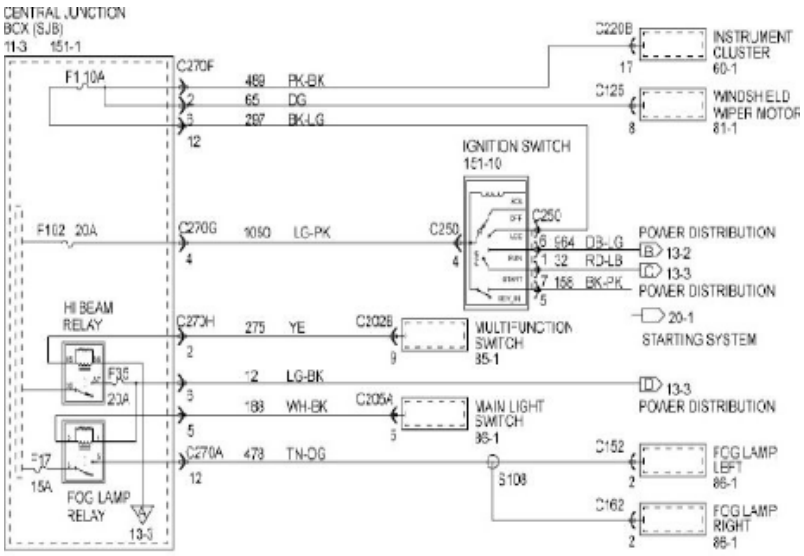
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

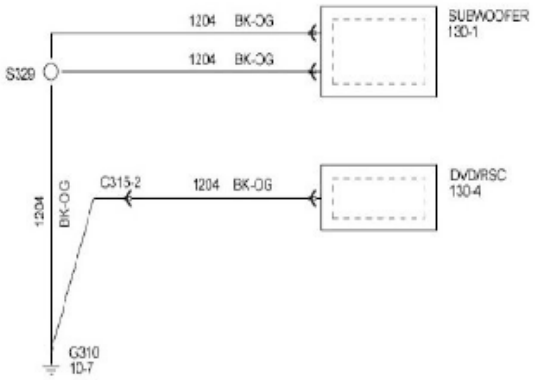
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

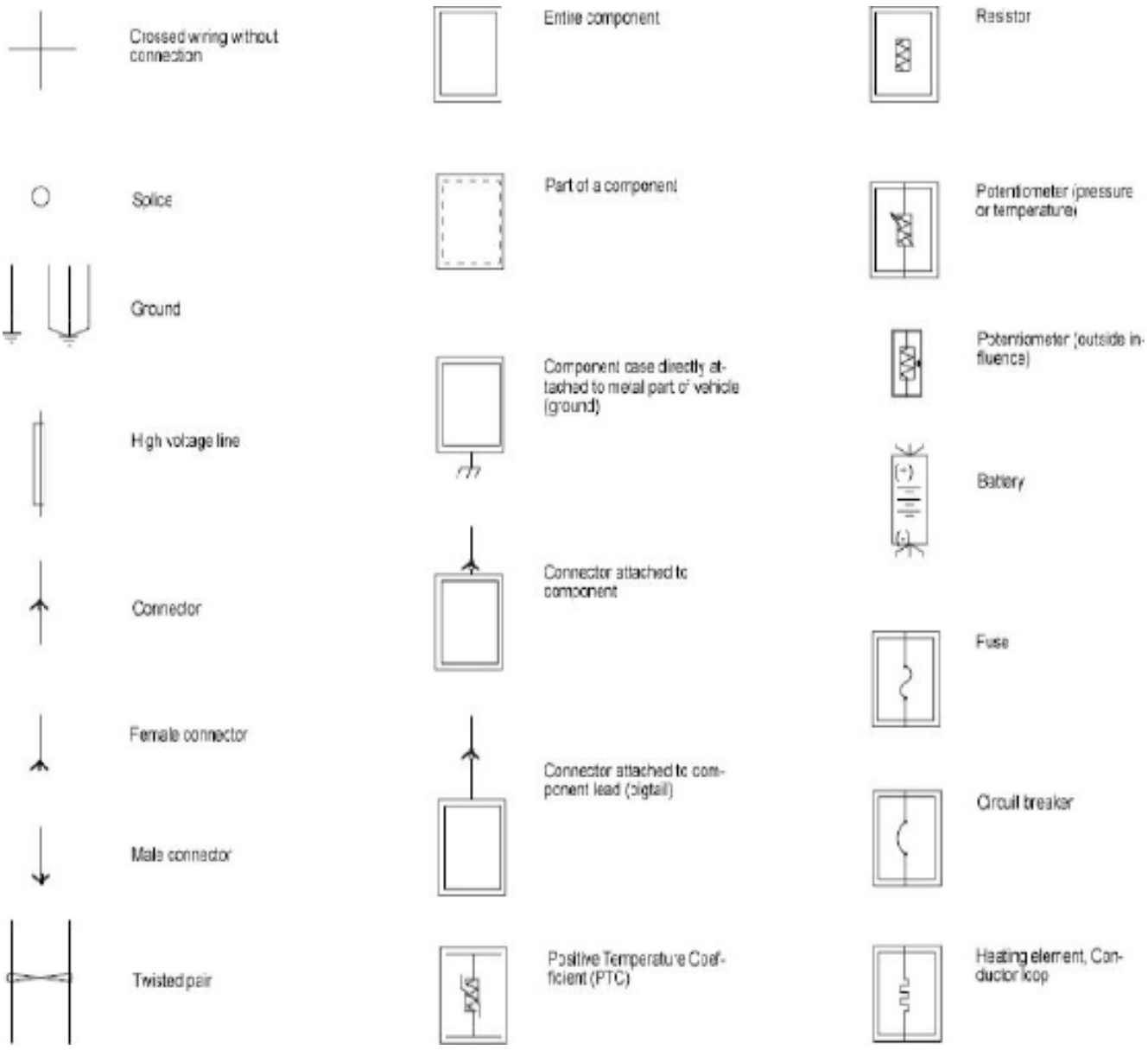
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

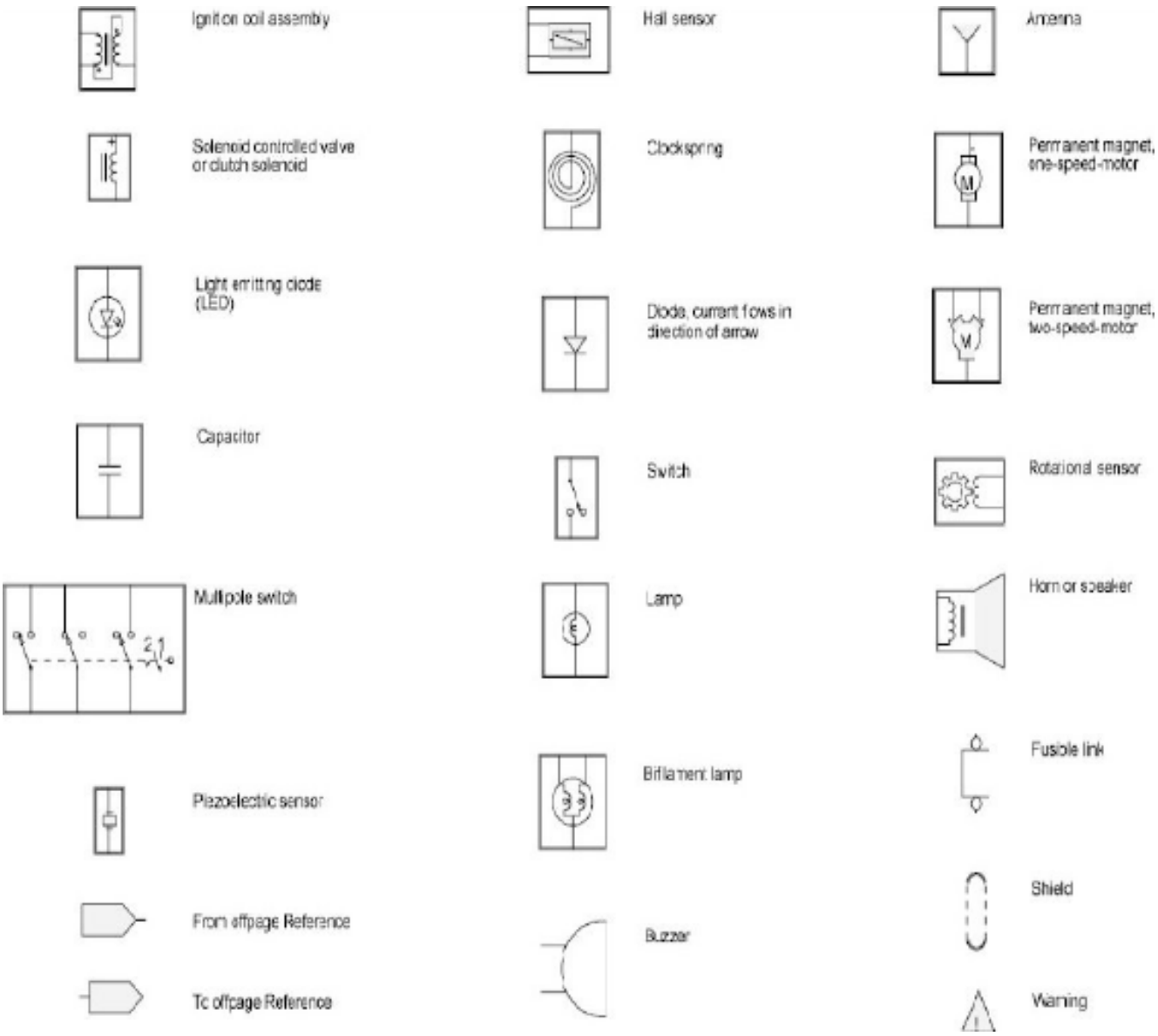
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

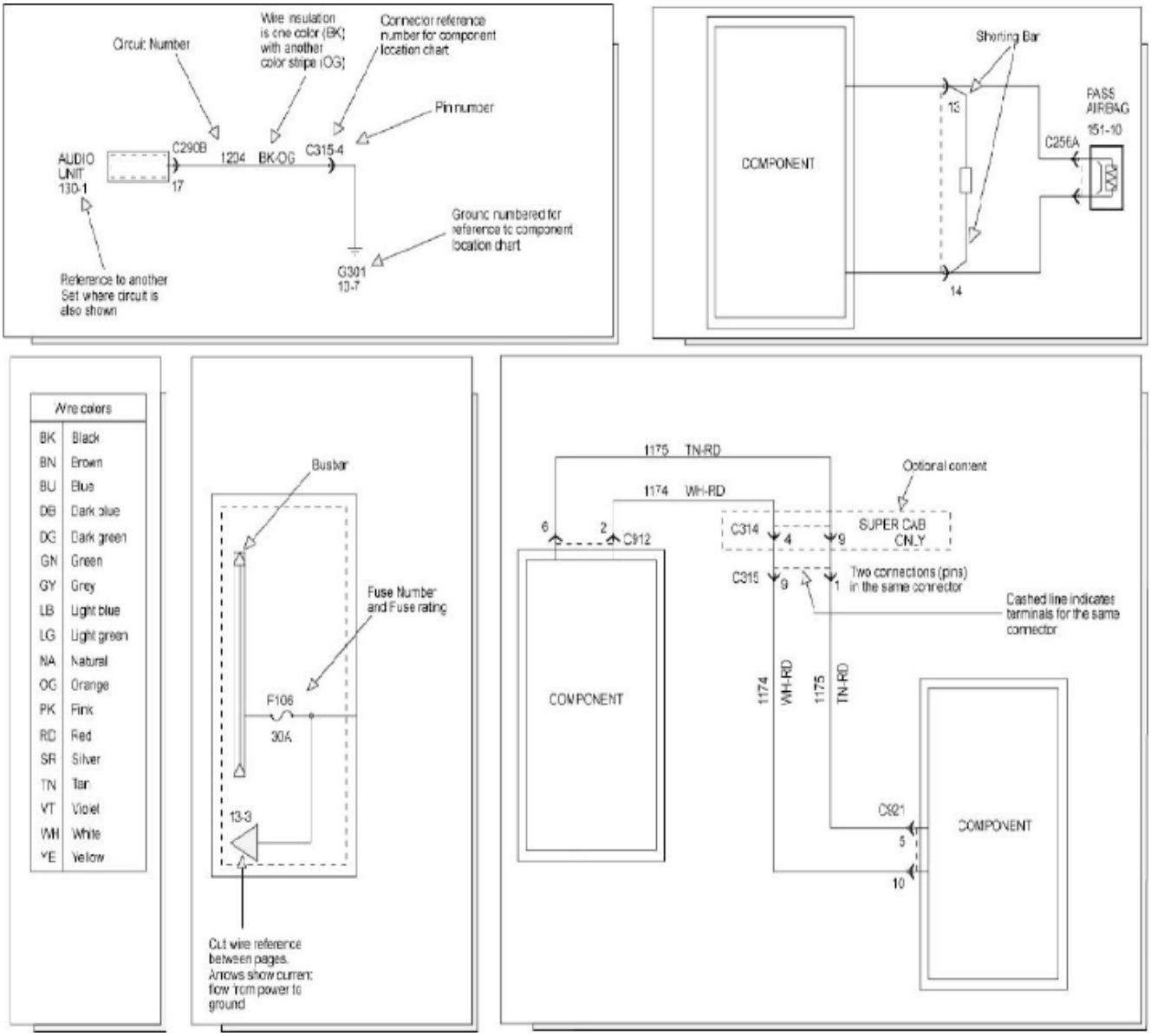
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

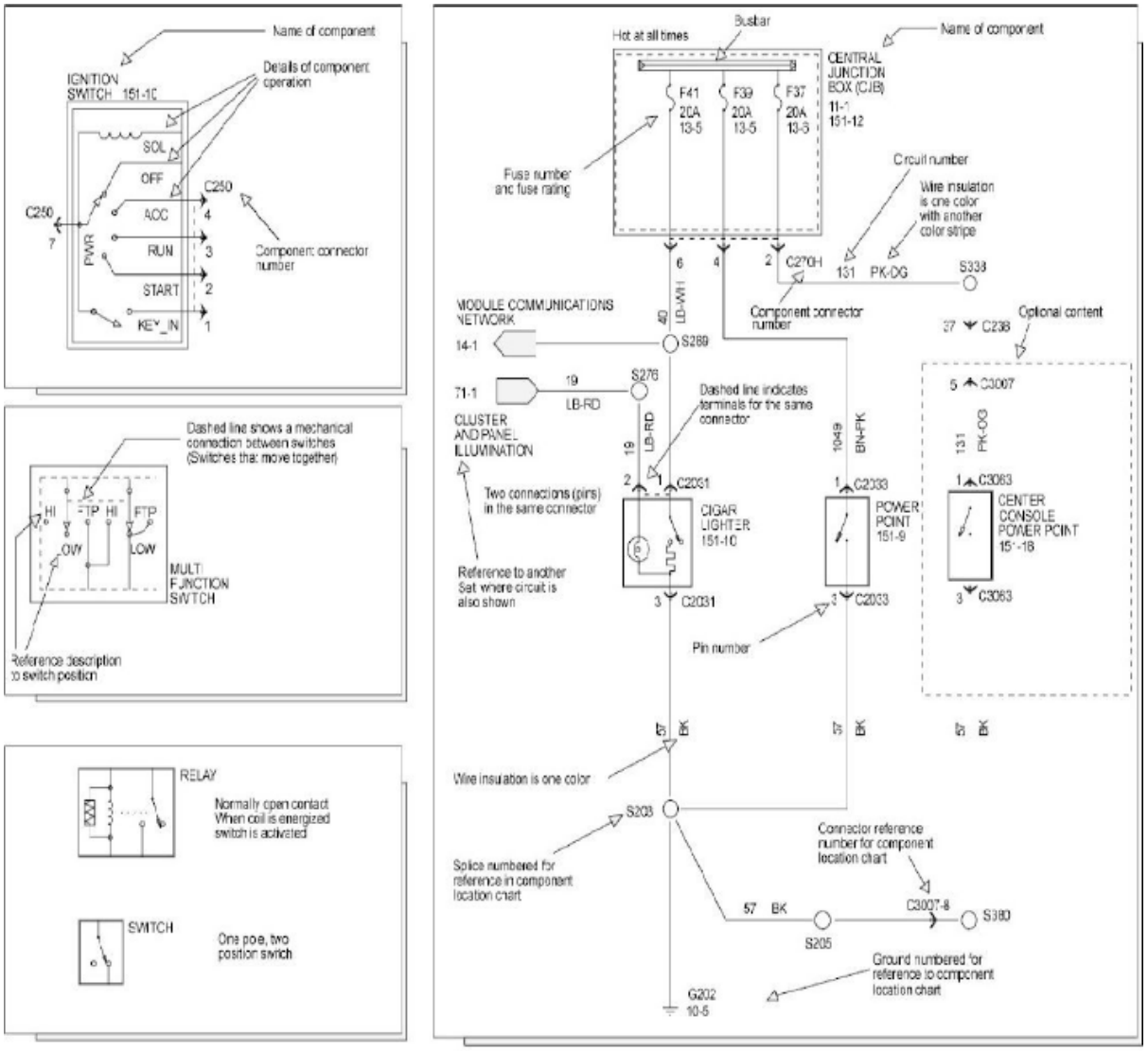
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

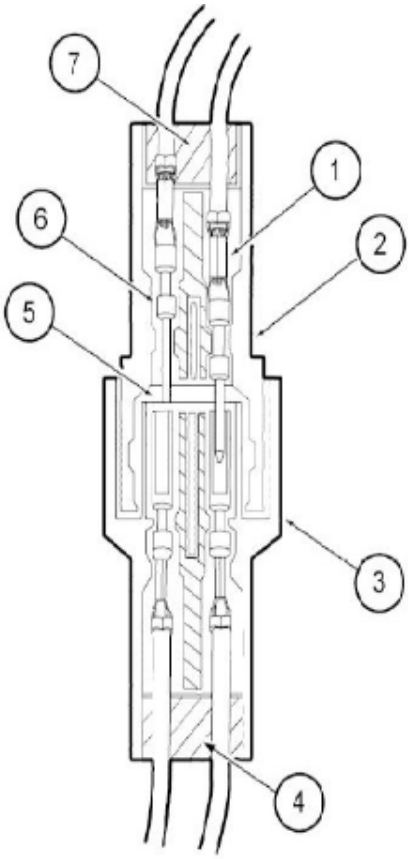


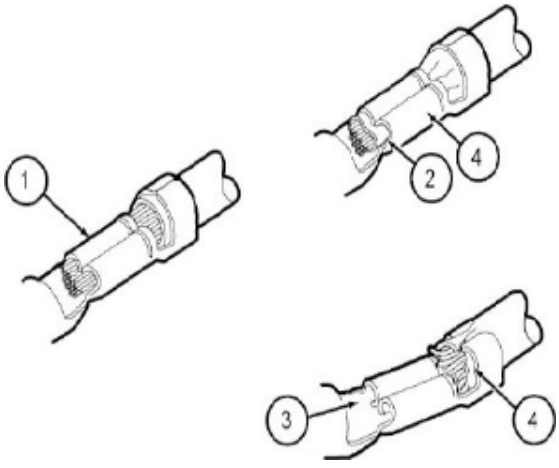
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Blower Motor: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

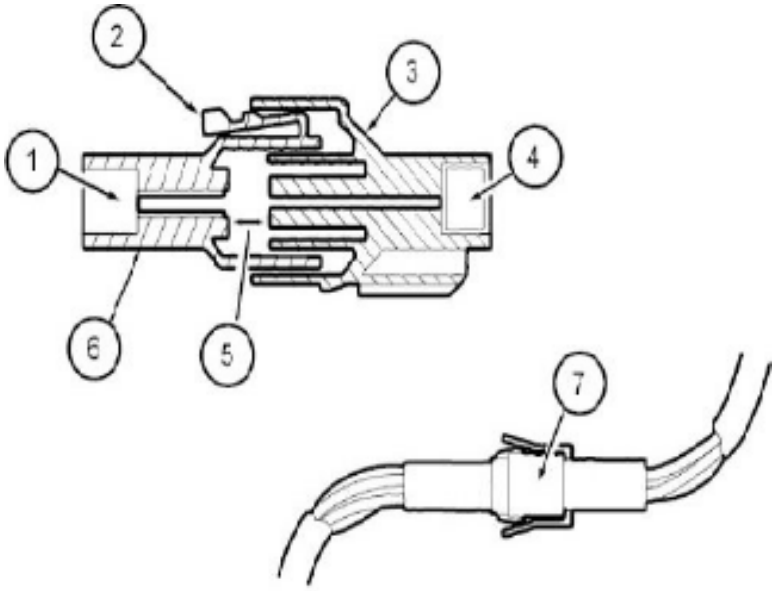
5 = Intermittent contact

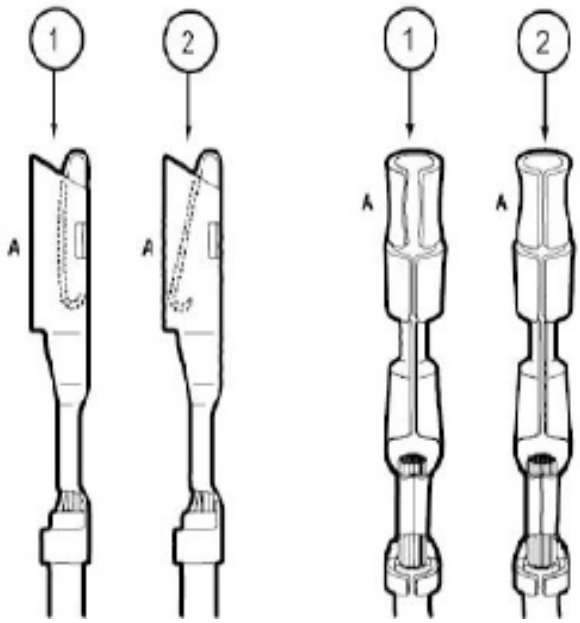
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

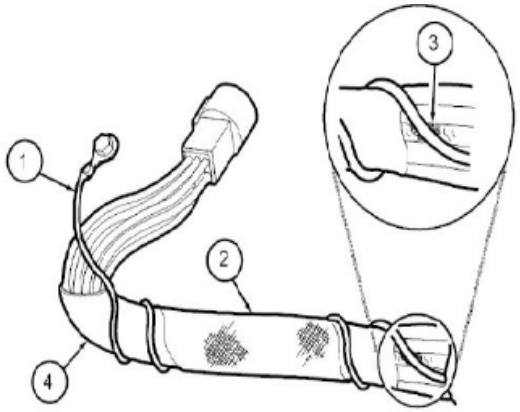
Deformed (enlarged) female terminals

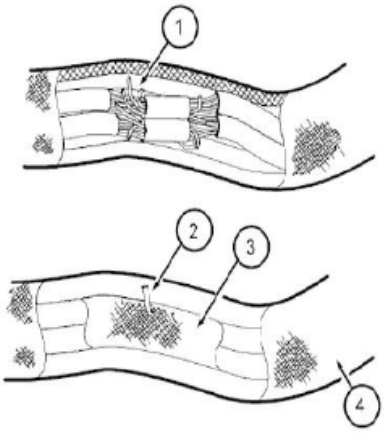
1 = Enlarged

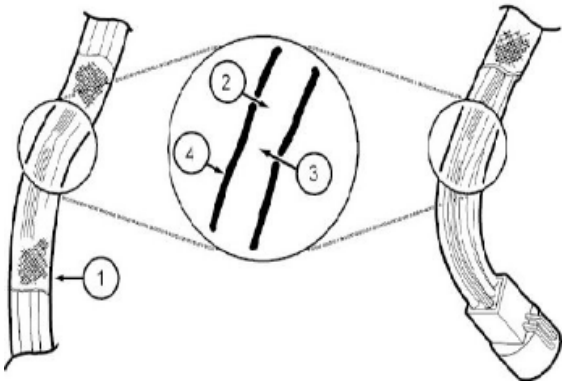
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

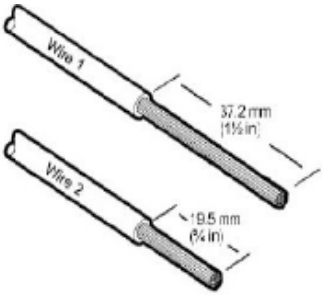
Splice covered 2

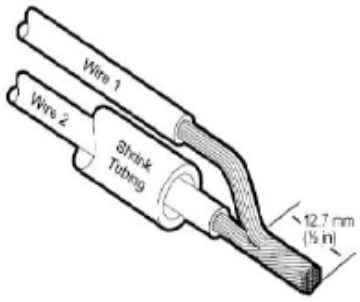
= Wire strand

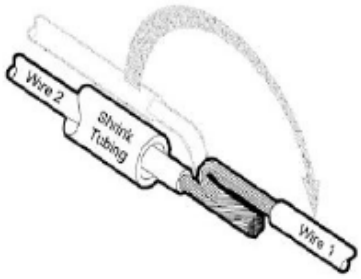
3 = Splice tape

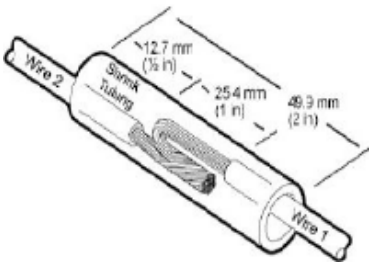
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

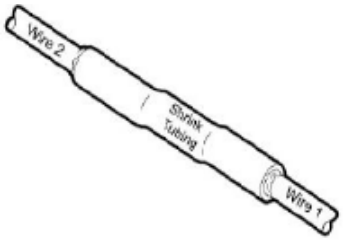
NOTE: -

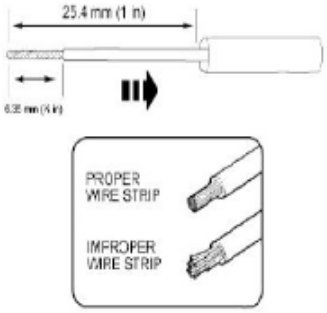
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

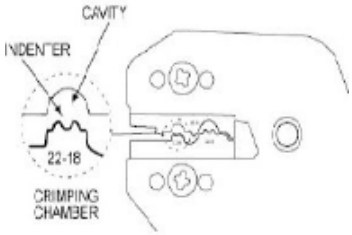
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

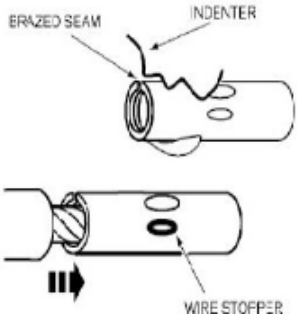
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
6.35 mm (¼ in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

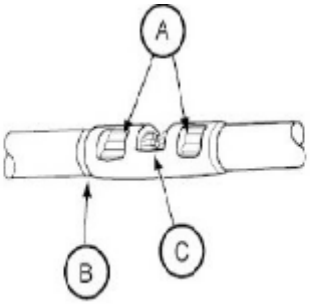
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

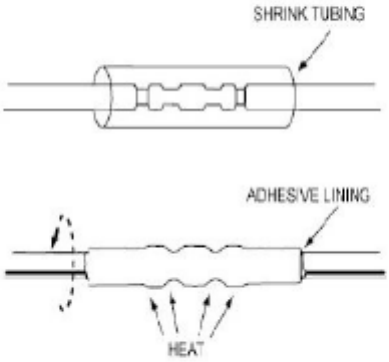
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4 strip, cut 9 strands	* 1/4 strip, cut 2 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip, fold 3x dia.
	16-14	* 1/4 strip, cut 7 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip fold 2x dia	1 strip, fold 3x dia.	1 1/4 strip, fold 4x dia.	Not Recommended
	12-10	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip fold 3x cia.	1 1/4 strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Figtail only

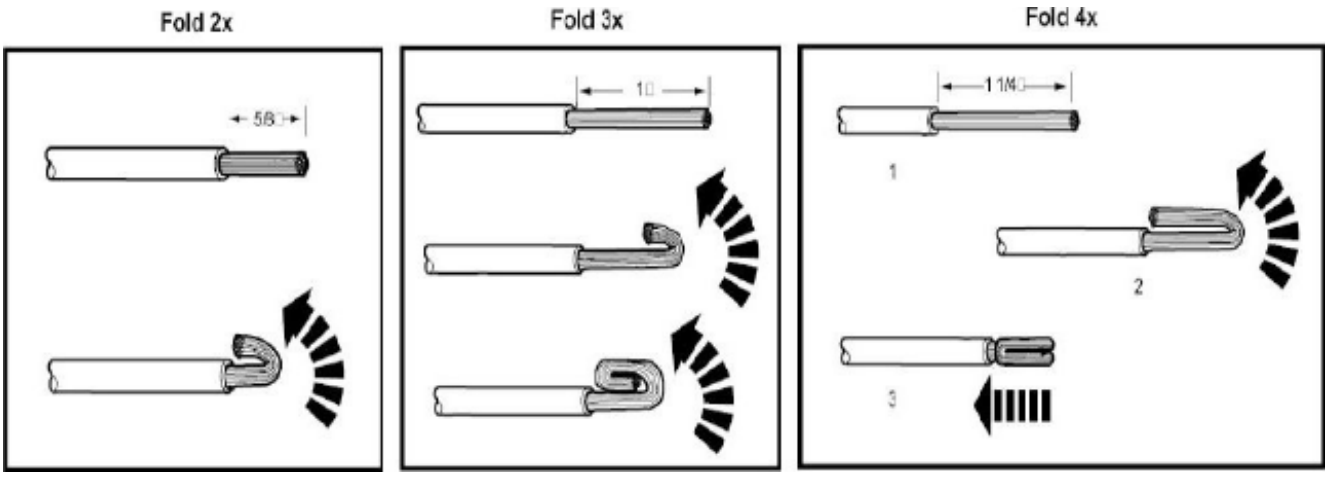
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

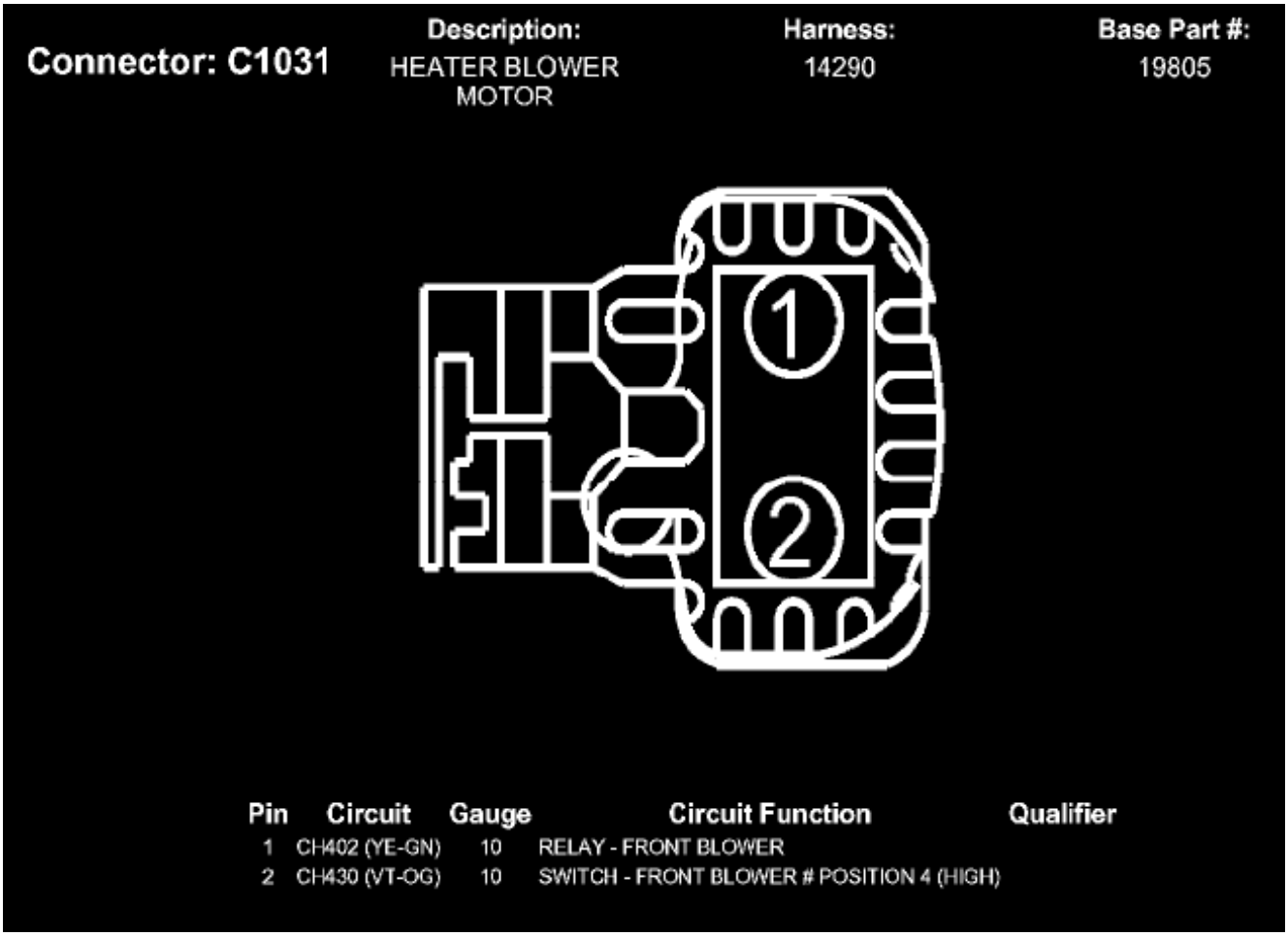
11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

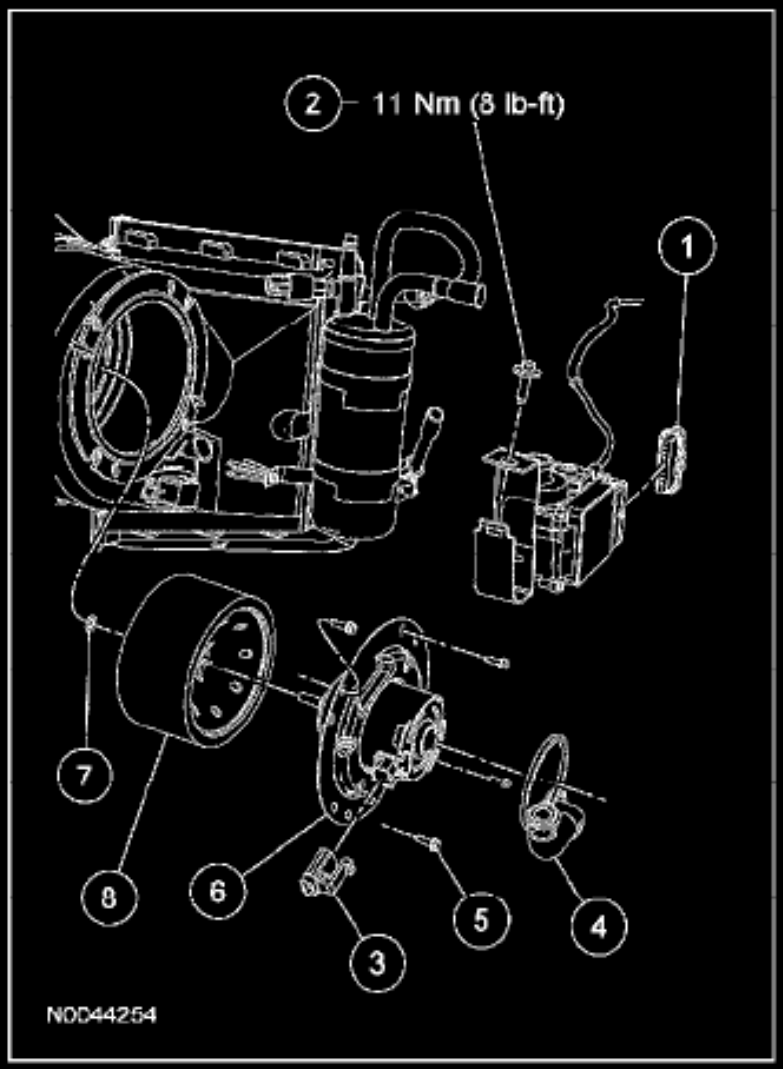
12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.


Connector: C1031
Description:
HEATER BLOWER MOTOR
Harness:
14290
Base Part #:
19805
1
2
Pin Circuit Gauge Circuit Function Qualifier
1 CH402 (YE-GN) 10 RELAY - FRONT BLOWER
2 CH430 (VT-OG) 10 SWITCH - FRONT BLOWER # POSITION 4 (HIGH)

C1031



Item	Part Number	Description
1	—	Speed control actuator electrical connector (part of 14290)
2	—	Speed control actuator bolt
3	—	Blower motor electrical connector (part of 14290)
4	19A786	Blower motor vent tube
5	W701696	Blower motor screw (4 required)
6	19805	Blower motor
7	18A287	Blower motor wheel clip
8	19834	Blower motor wheel

Blower Motor: Service and Repair

BLOWER MOTOR

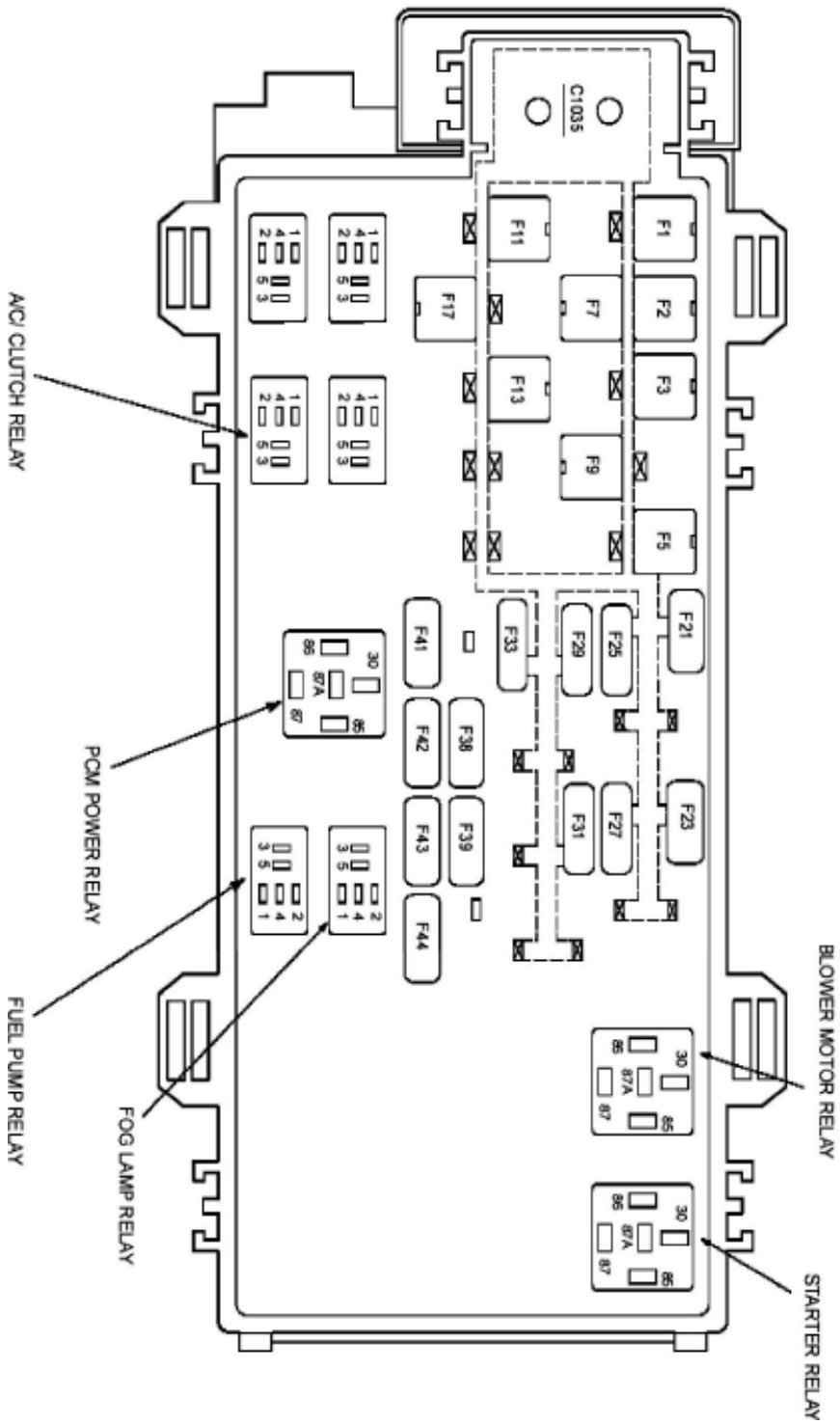
Removal and Installation

1. Disconnect the speed control actuator electrical connector. 2. Remove the speed control actuator bolt and position the speed control actuator aside.

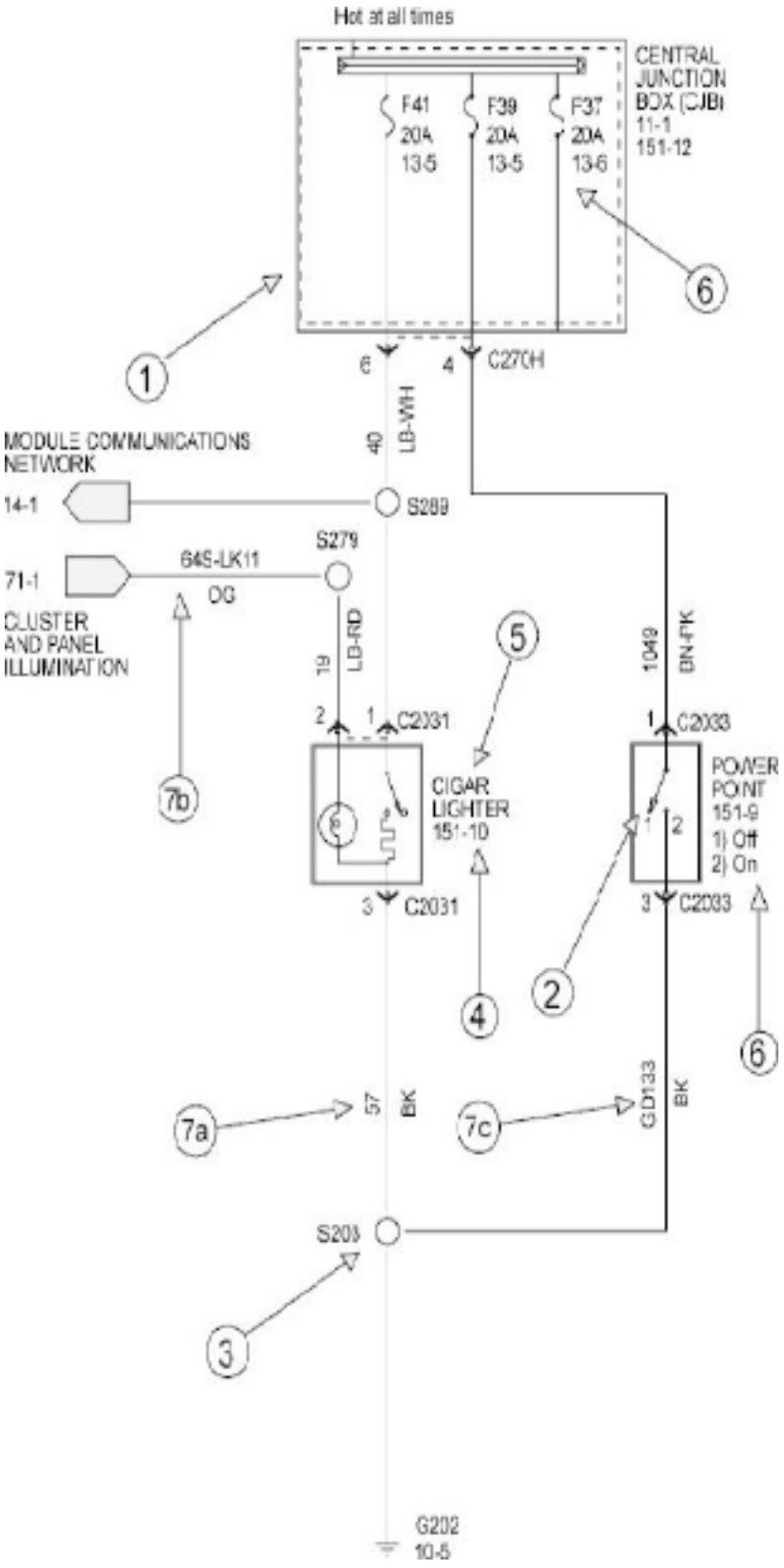
- To install, tighten to 11 Nm (8 lb-ft).

3. Disconnect the blower motor electrical connector. 4. Remove the blower motor vent tube. 5. Remove the 4 blower motor screws and the blower motor. 6. Remove the blower motor wheel clip. 7. Remove the blower motor wheel. 8. To install, reverse the removal procedure.

BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L



Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Heating and Air Conditioning > Blower Motor Relay > Component Information > Diagrams > Diagram Information and Instructions



Blower Motor Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

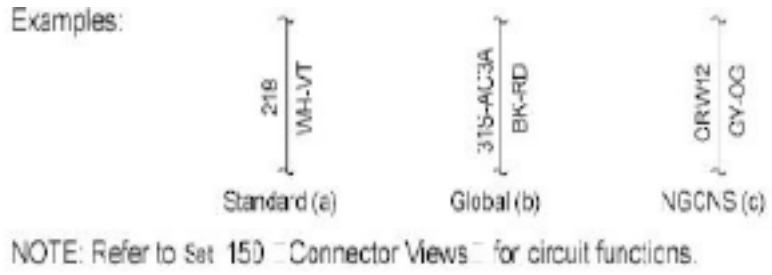
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

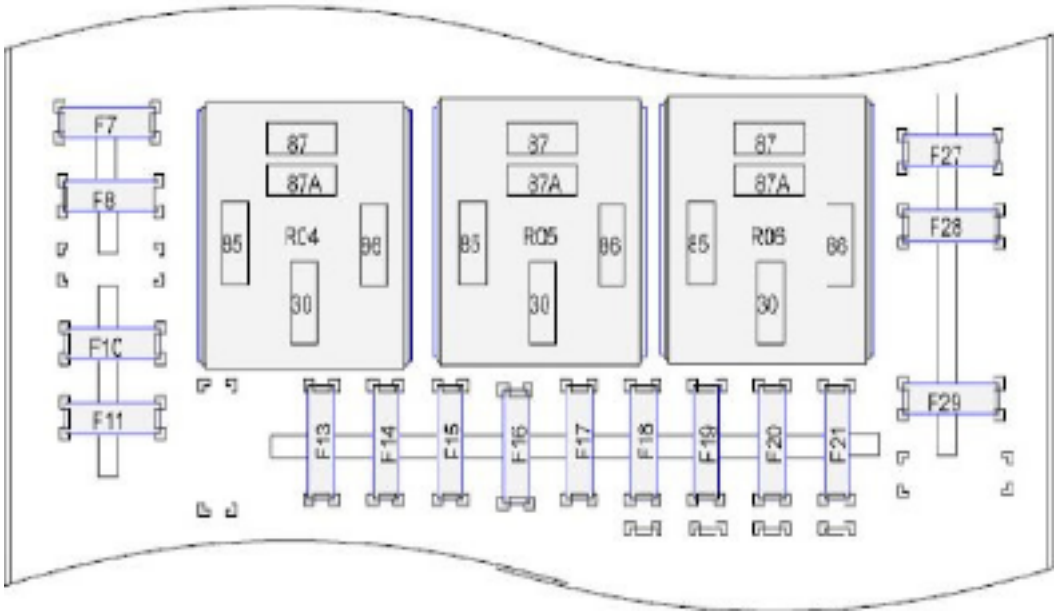
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

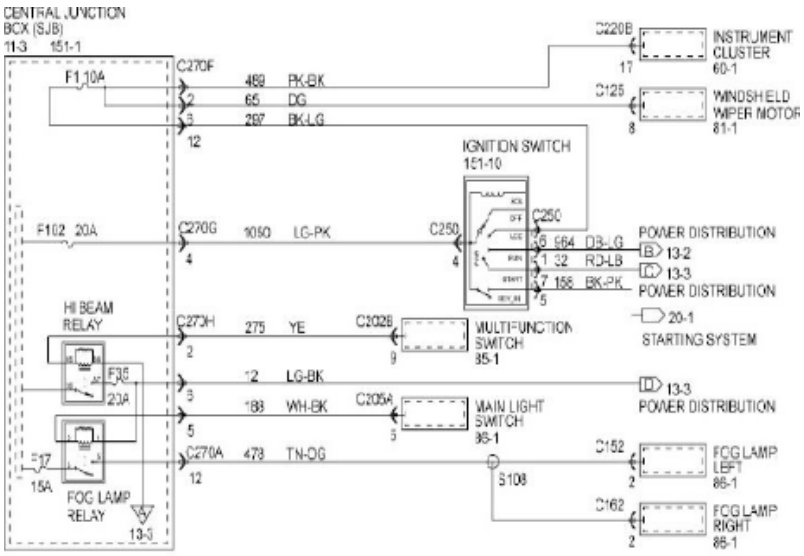
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

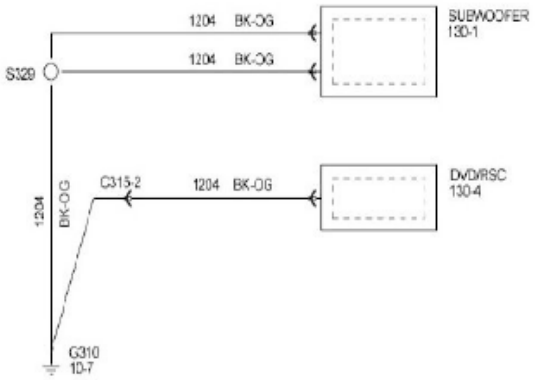
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

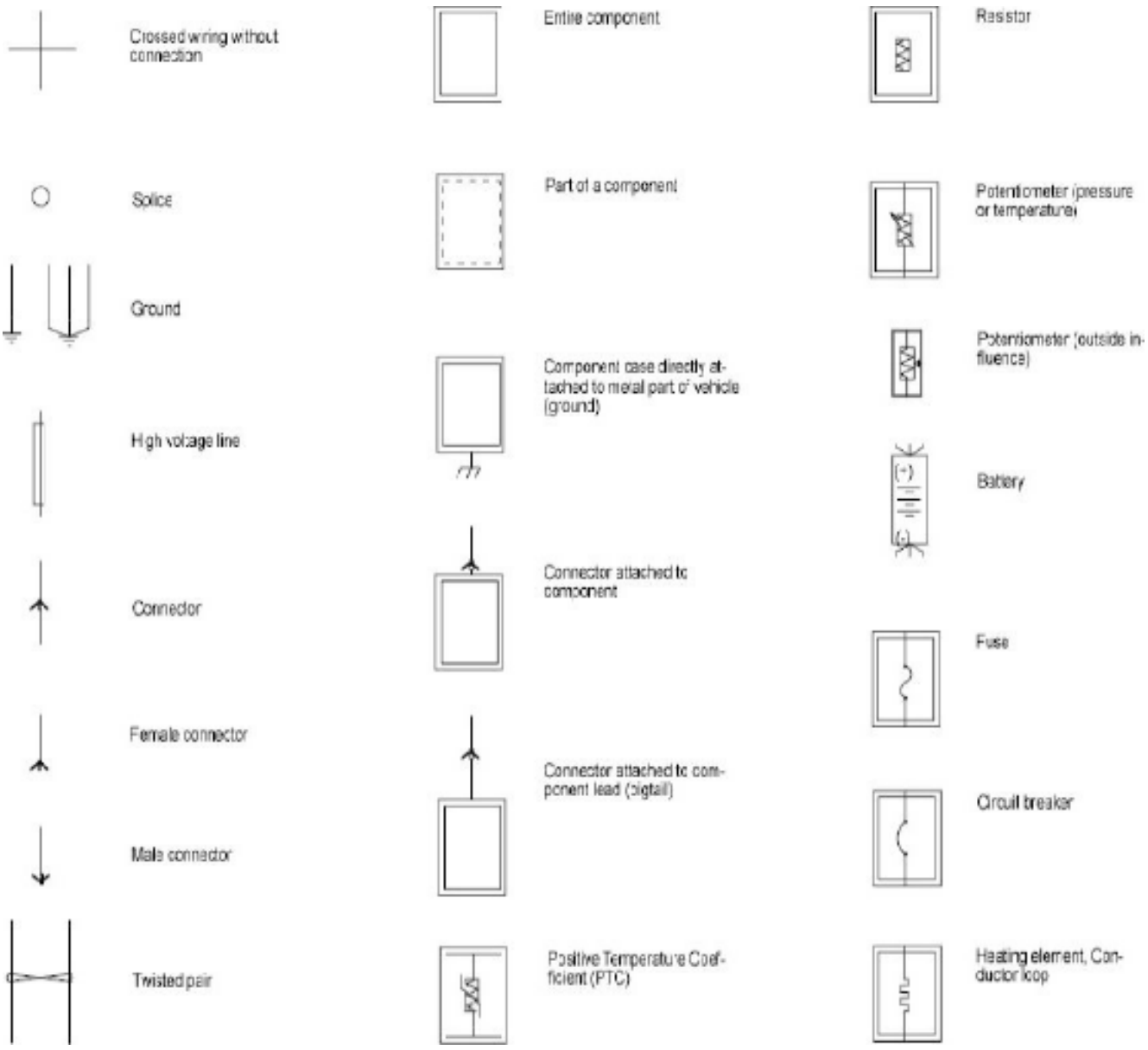
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

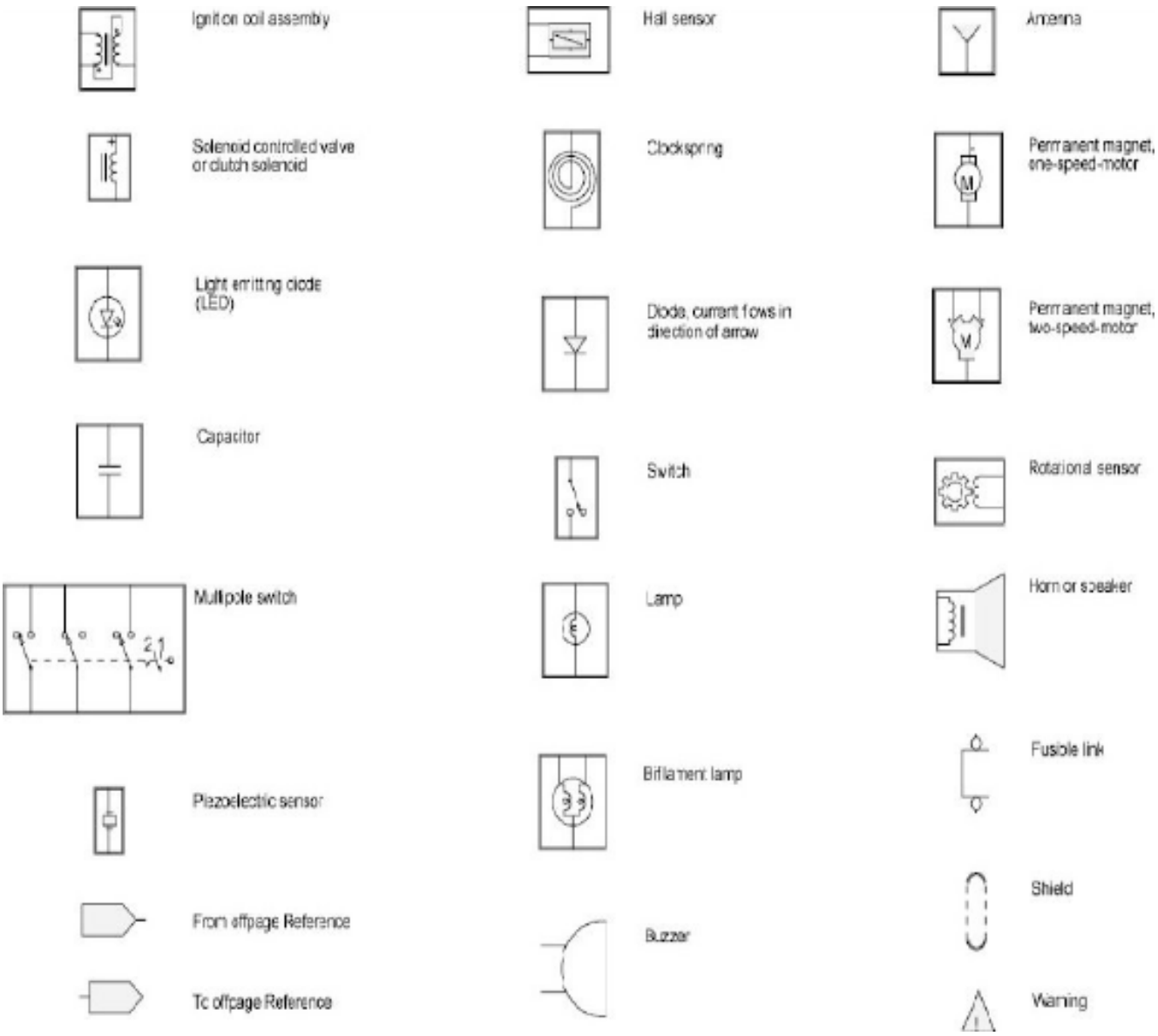
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

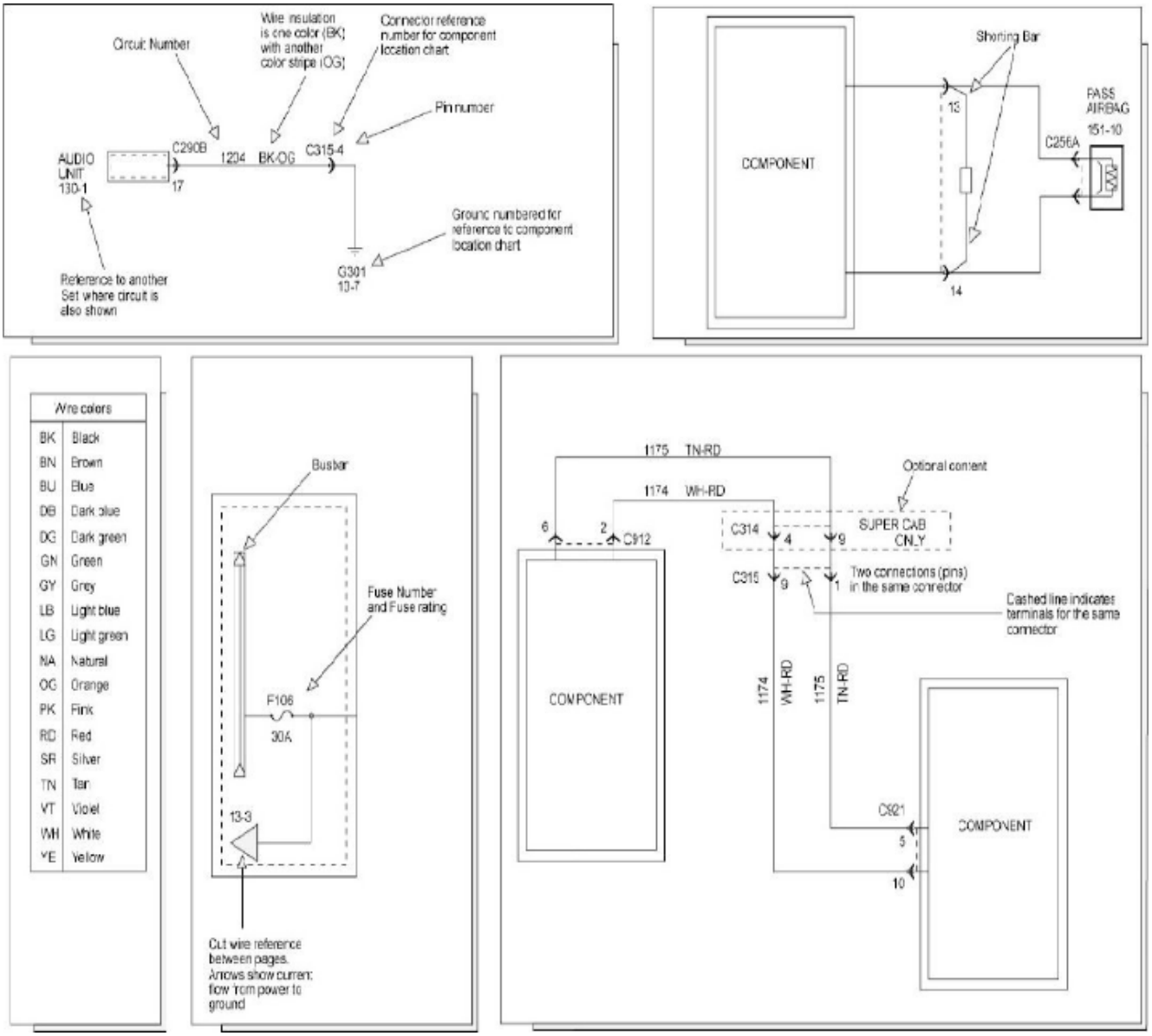
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

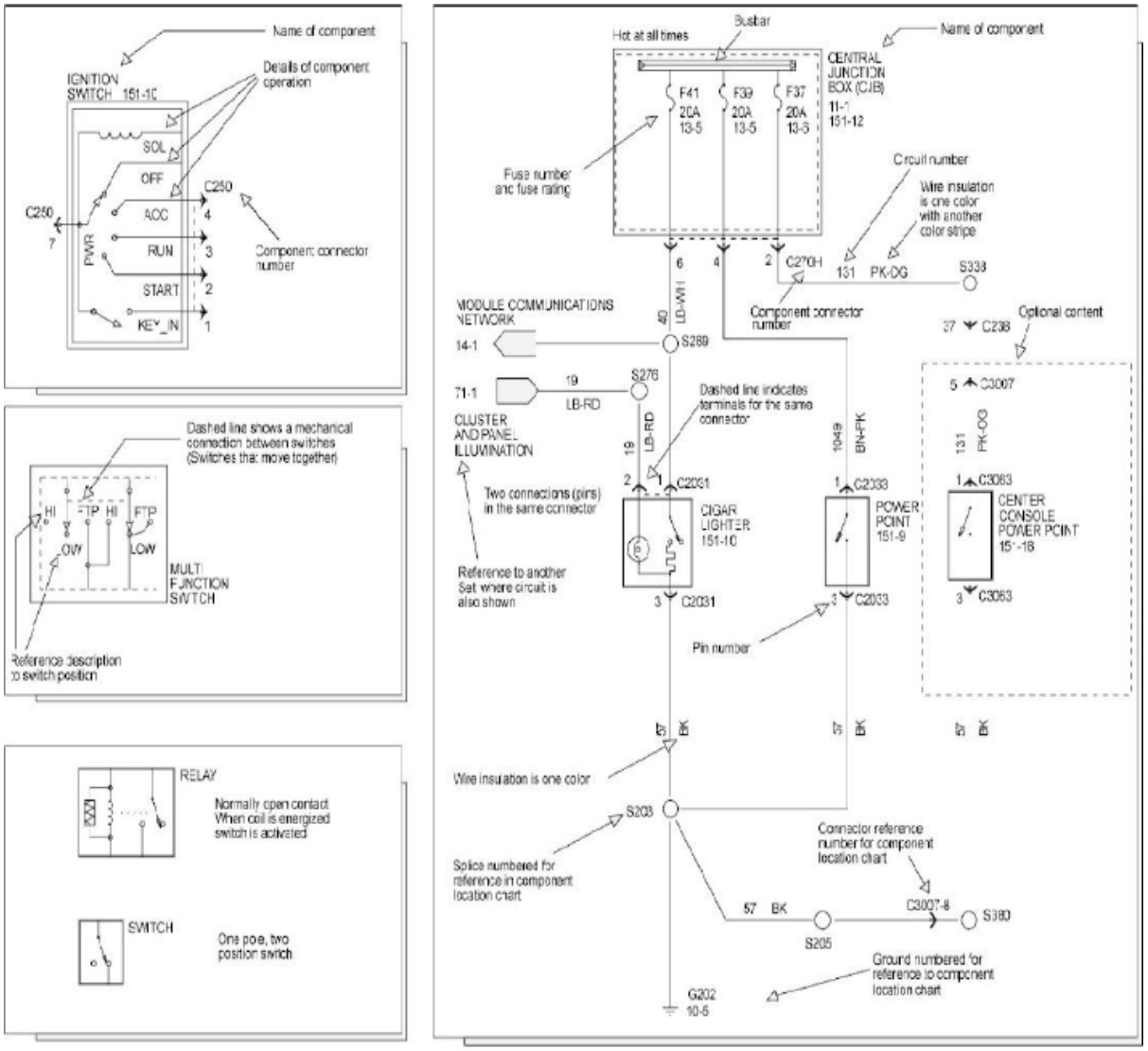
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

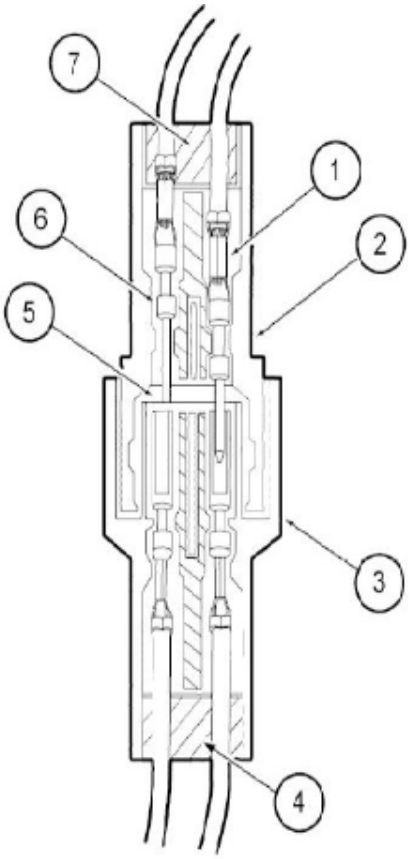


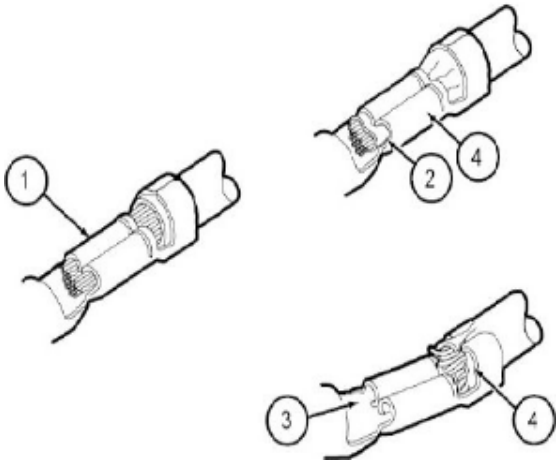
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Blower Motor Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

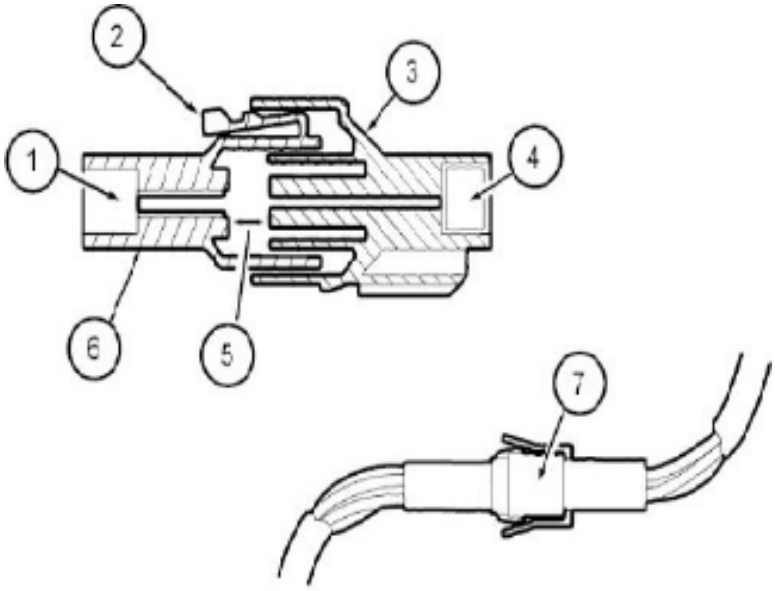
5 = Intermittent contact

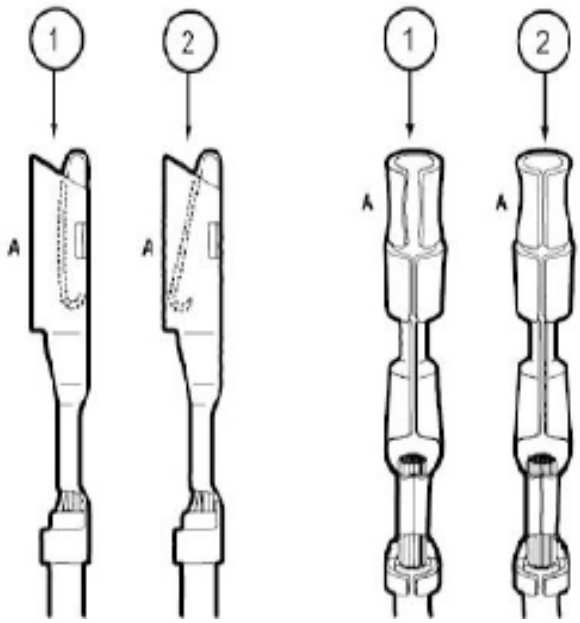
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

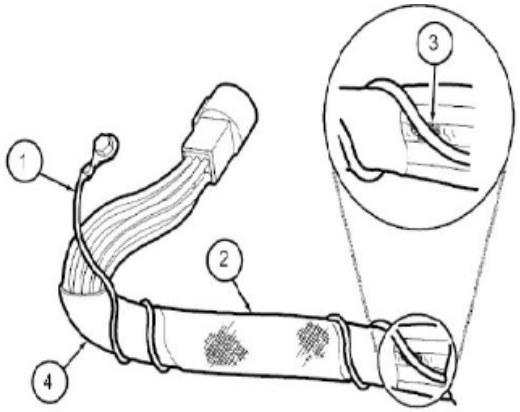
Deformed (enlarged) female terminals

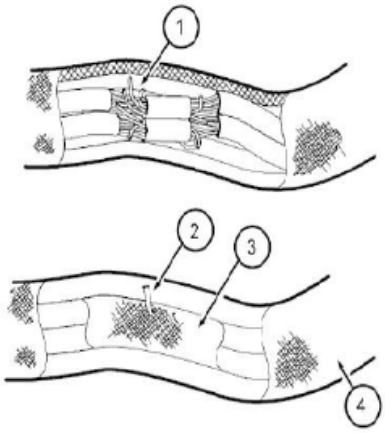
1 = Enlarged

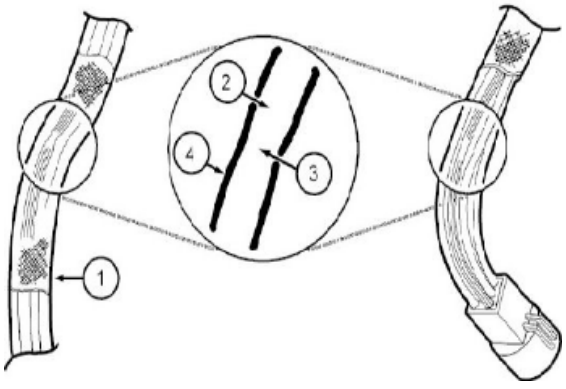
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

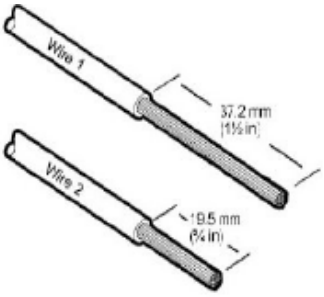
Splice covered 2

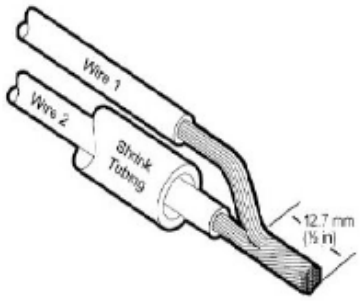
= Wire strand

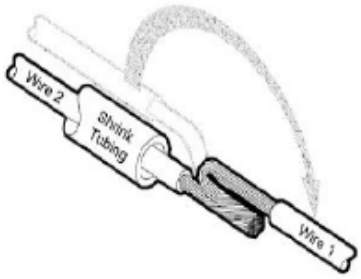
3 = Splice tape

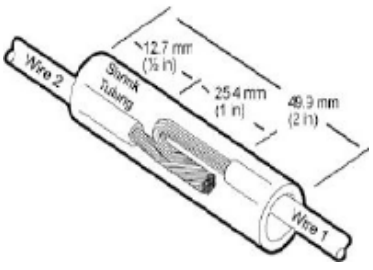
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.9 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

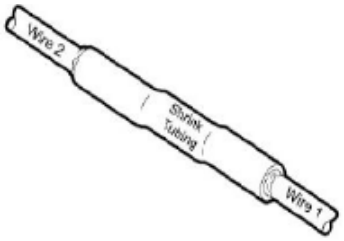
NOTE: -

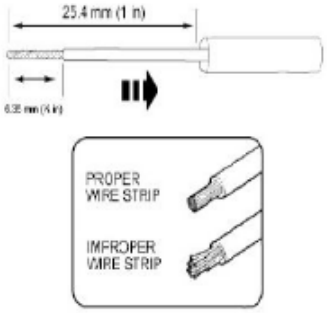
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

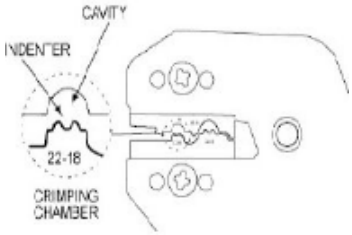
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

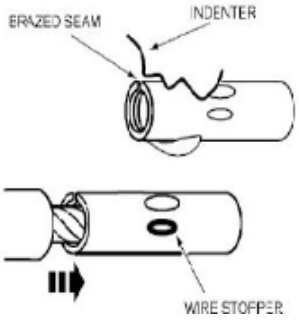
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

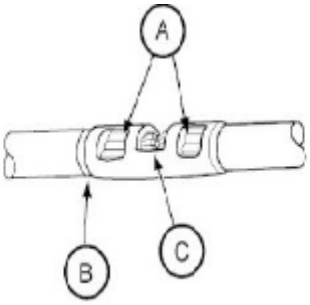
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

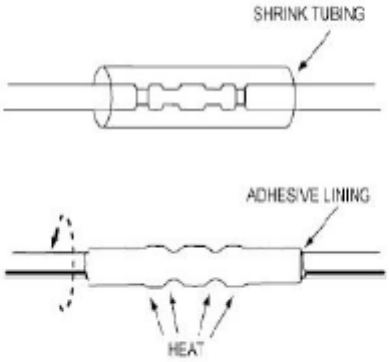
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4 strip, cut 9 strands	* 1/4 strip, cut 2 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip, fold 3x dia.
	16-14	* 1/4 strip, cut 7 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip fold 2x dia	1 strip, fold 3x dia.	1 1/4 strip, fold 4x dia.	Not Recommended
	12-10	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip fold 3x cia.	1 1/4 strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Figtail only

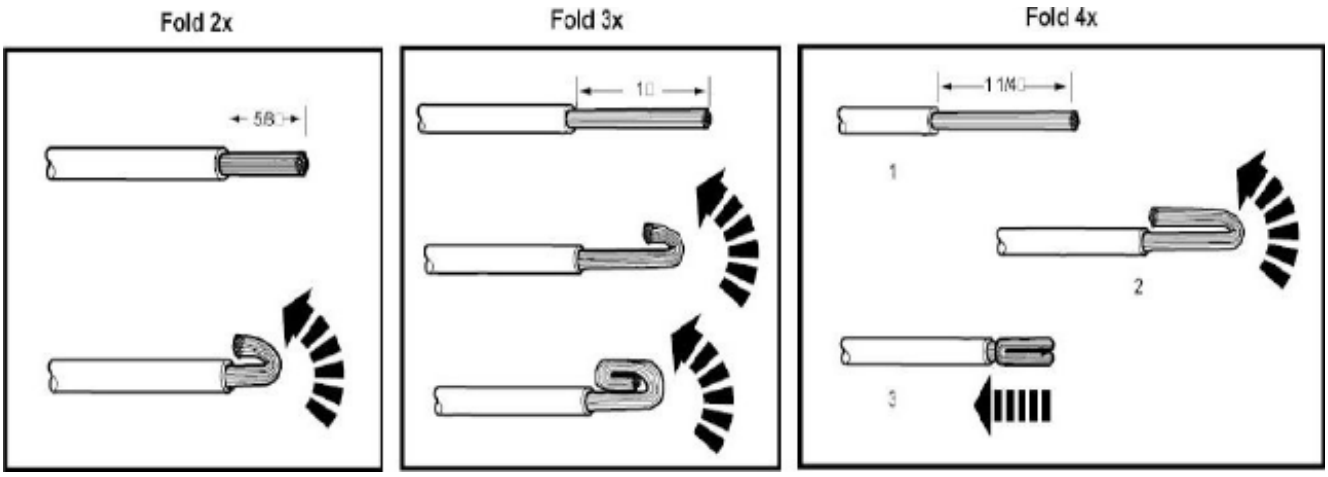
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



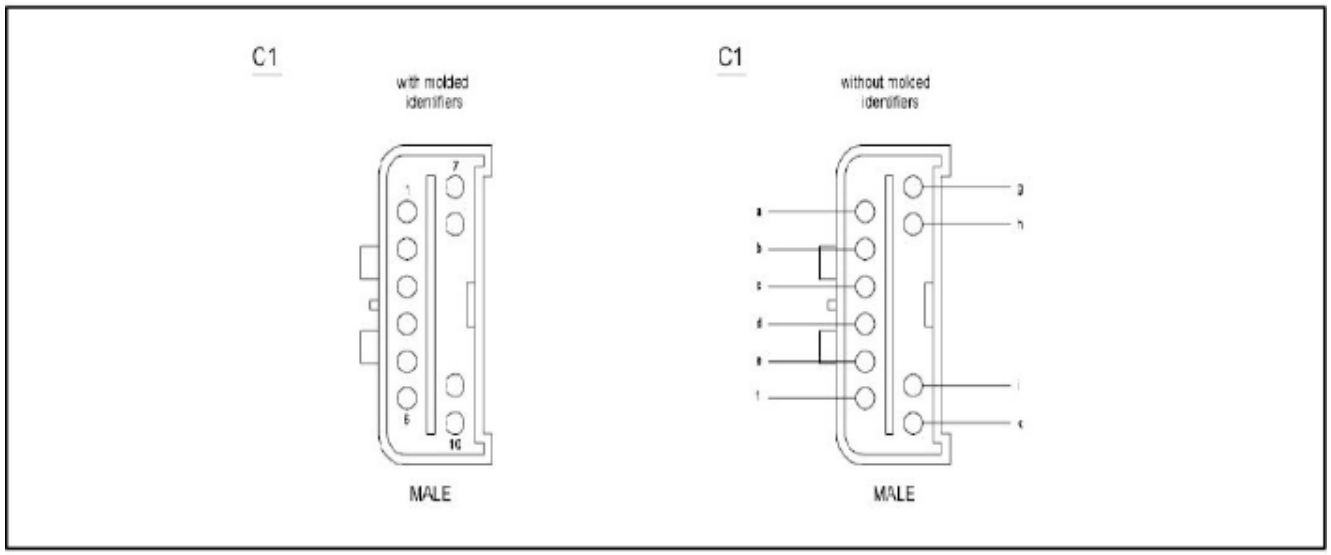
The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



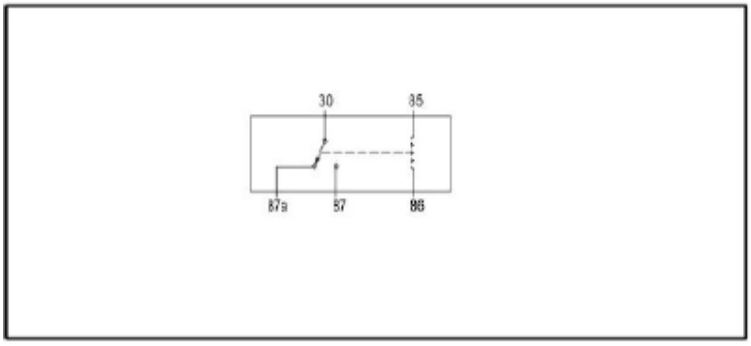
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

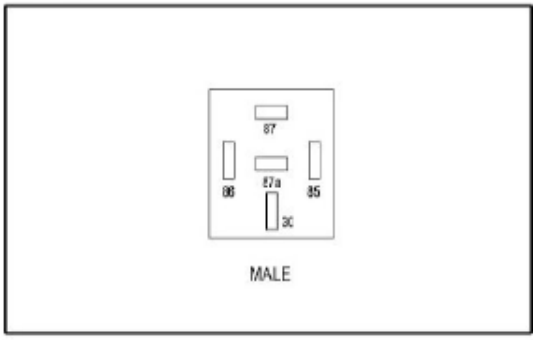
Blower Motor Relay: Testing and Inspection Mini ISO Relay

Relay □ Mini ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	45 □ 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

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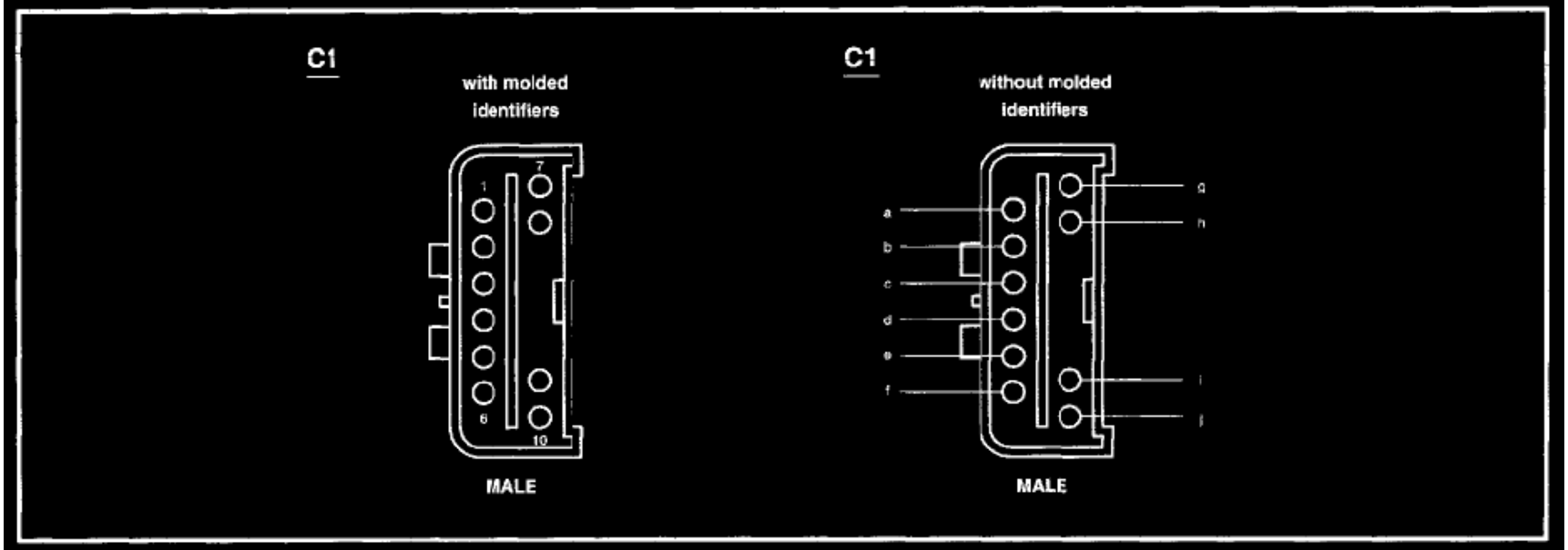
Testing information for each component includes a schematic, a view of the terminal locations and step–by–step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



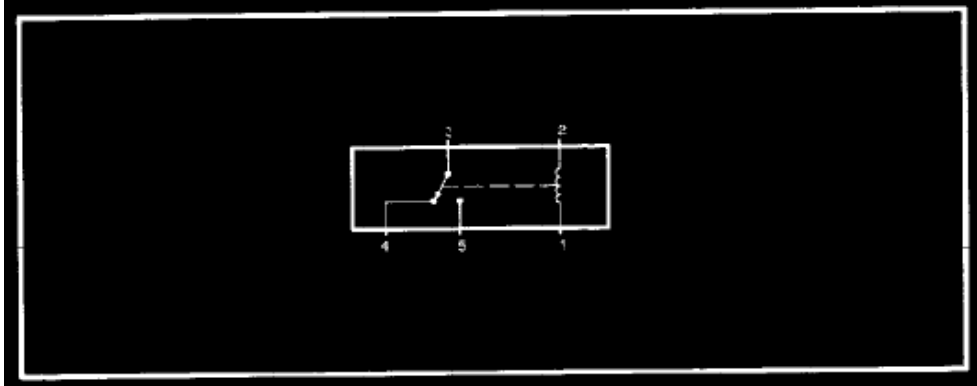
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

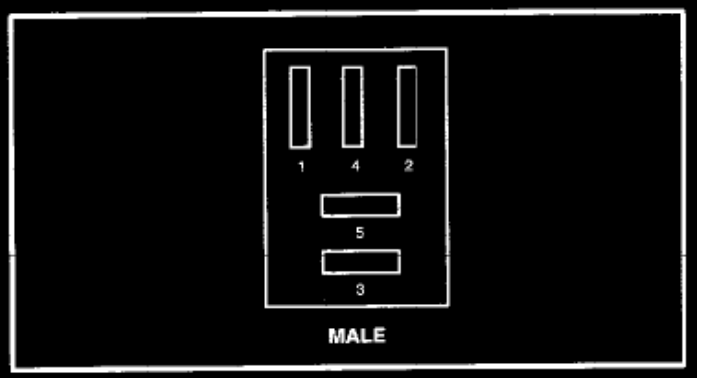
Blower Motor Relay: Testing and Inspection Micro ISO Relay

Relay – Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63–102Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil – Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

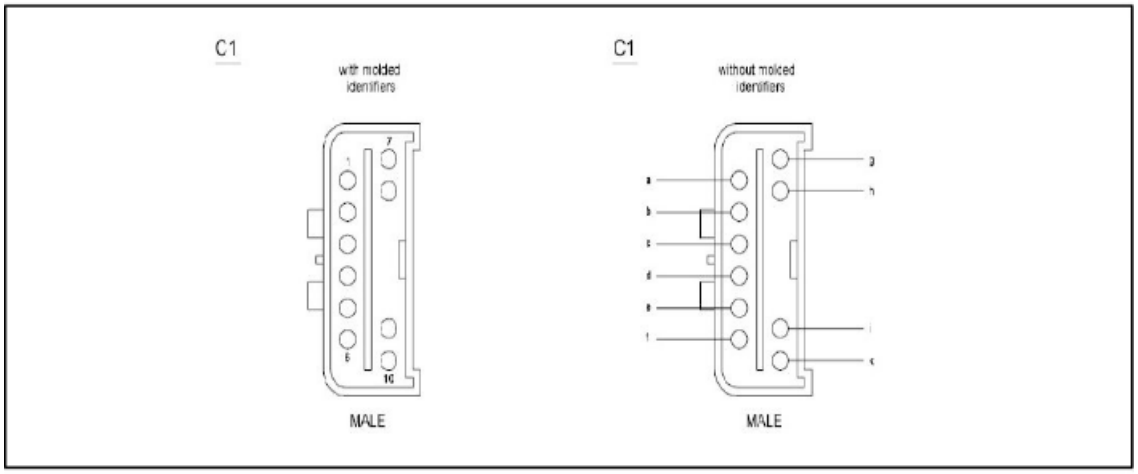
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step□by□step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals

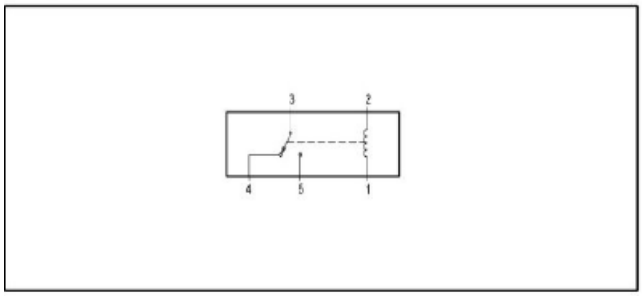


The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column □Circuit to test□. If you wish to test the complete component, perform all tests.

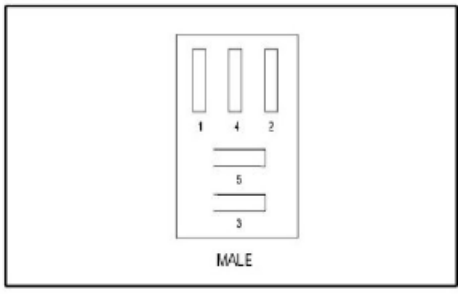
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Relay □ Micro ISO

Schematic



Terminals

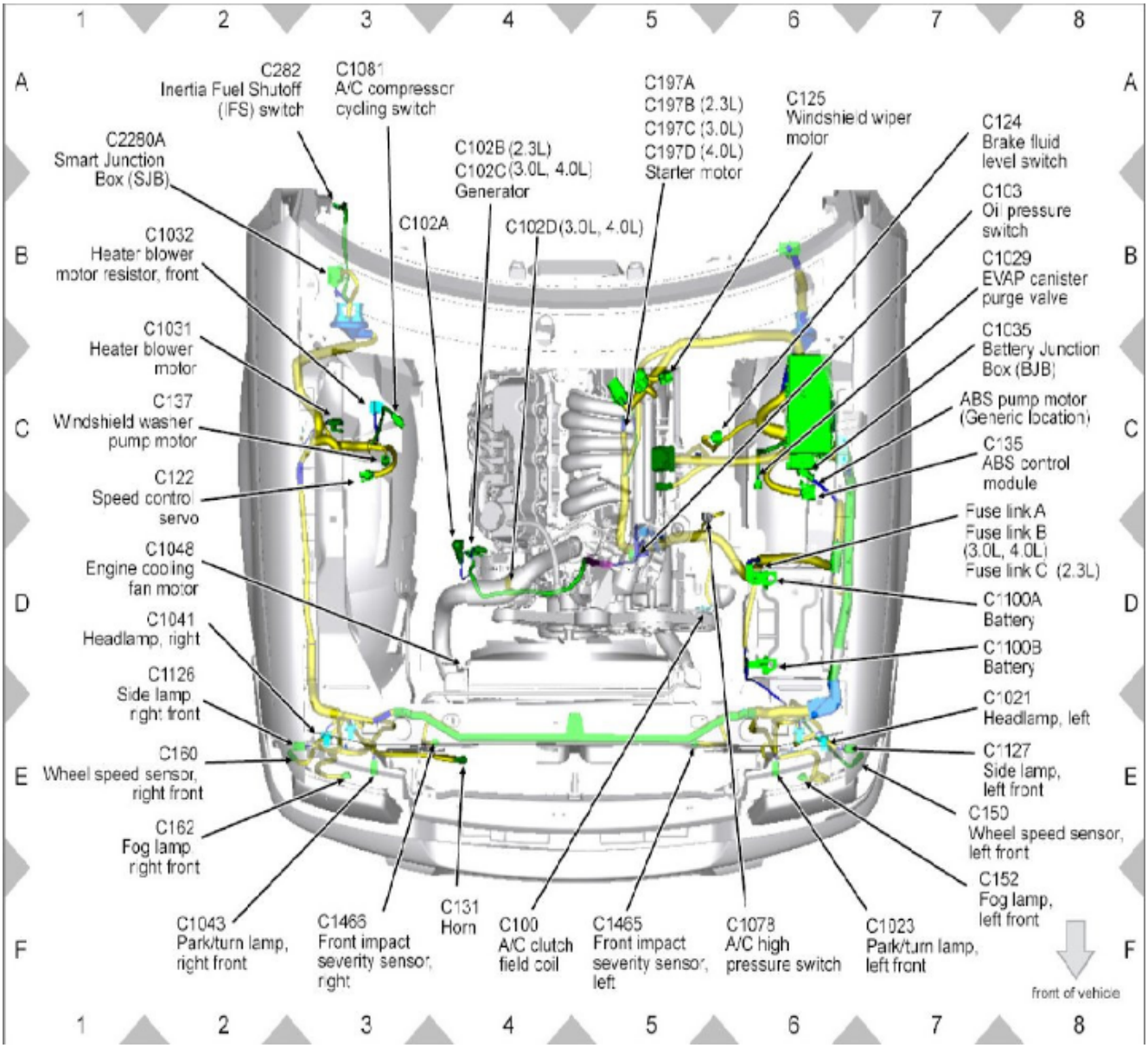


Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63□102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil □ Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

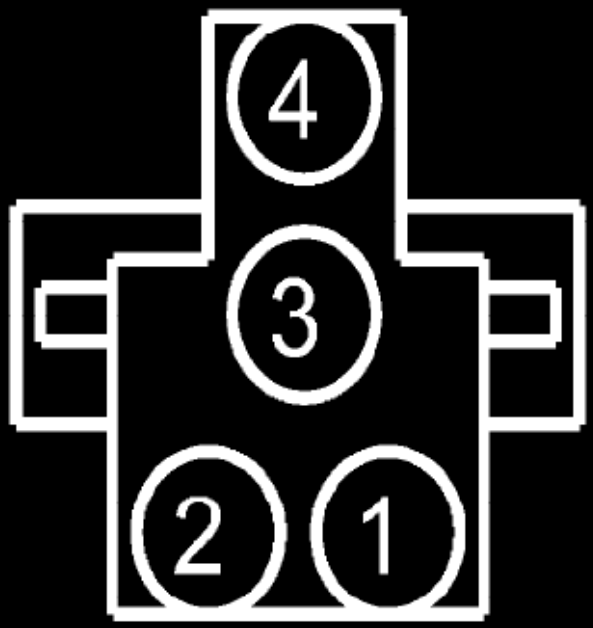
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.


C282
Inertia Fuel Shutoff (IFS) switch
C1081
A/C compressor cycling switch
C2280A
Smart Junction Box (SJB)
C102B (2.3L)
C102C (3.0L, 4.0L)
Generator
C102A
C102D (3.0L, 4.0L)
C197A
C197B (2.3L)
C197C (3.0L)
C197D (4.0L)
Starter motor
C125
Windshield wiper motor
C124
Brake fluid level switch
C1032
Heater blower motor resistor, front
C103
Oil pressure switch
C1029
EVAP canister purge valve
C1031
Heater blower motor
C1035
Battery Junction Box (BJB)
C137
Windshield washer pump motor
ABS pump motor (Generic location)
C135
ABS control module
C122
Speed control servo
Fuse link A
Fuse link B (3.0L, 4.0L)
Fuse link C (2.3L)
C1048
Engine cooling fan motor
C100A
Battery
C1041
Headlamp, right
C100B
Battery
C1126
Side lamp right front
C1021
Headlamp, left
C160
Wheel speed sensor, right front
C1127
Side lamp, left front
C150
Wheel speed sensor, left front
C162
Fog lamp right front
C152
Fog lamp, left front
C1043
Park/turn lamp, right front
C1466
Front impact severity sensor, right
C131
Horn
C100
A/C clutch field coil
C1465
Front impact severity sensor, left
C1078
A/C high pressure switch
C1023
Park/turn lamp, left front
front of vehicle

View 151-1

Connector: C1032

Description:	Harness:	Base Part #:
HEATER BLOWER MOTOR RESISTOR, FRONT	14290	19A706



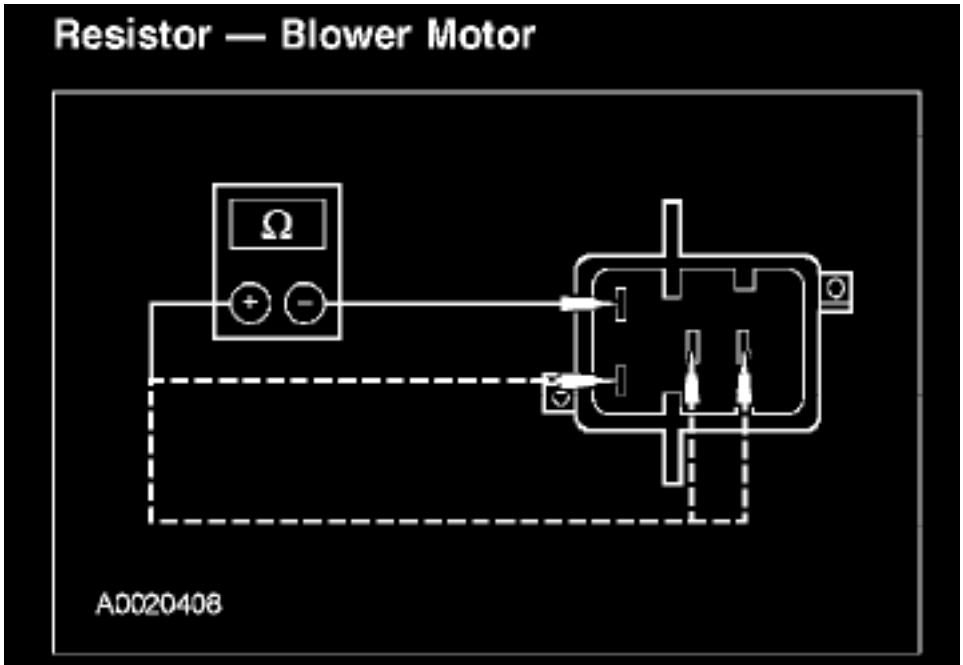
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CH430 (VT-OG)	12	SWITCH - FRONT BLOWER # POSITION 4 (HIGH)	
2	CH429 (GY-BN)	14	SWITCH - FRONT BLOWER # POSITION 3 (MEDIUM HIGH)	
3	GD123 (BK-GY)	14	GROUND - FENDER FRONT RIGHT	
4	CH428 (GN-WH)	14	SWITCH - FRONT BLOWER # POSITION 2 (MEDIUM LOW)	

C1032

Blower Motor Resistor: Description and Operation

BLOWER MOTOR RESISTOR

The blower motor resistor has 3 resistor elements mounted on the resistor board to provide 4 blower motor speeds. Depending on the blower motor switch position, series resistance is added or bypassed in the blower motor circuit to decrease or increase blower motor speed. The blower motor resistor has an overheating device (thermal limiter) that opens the resistor coil when the temperature reaches approximately 184°C (363°F), interrupting the blower motor operation in all speeds except high. The thermal limiter cannot be reset and is not serviceable.



Blower Motor Resistor Pins	Resistance
4 and 2	3,750 milliohms
4 and 1	1,050 milliohms
4 and 3	250 milliohms

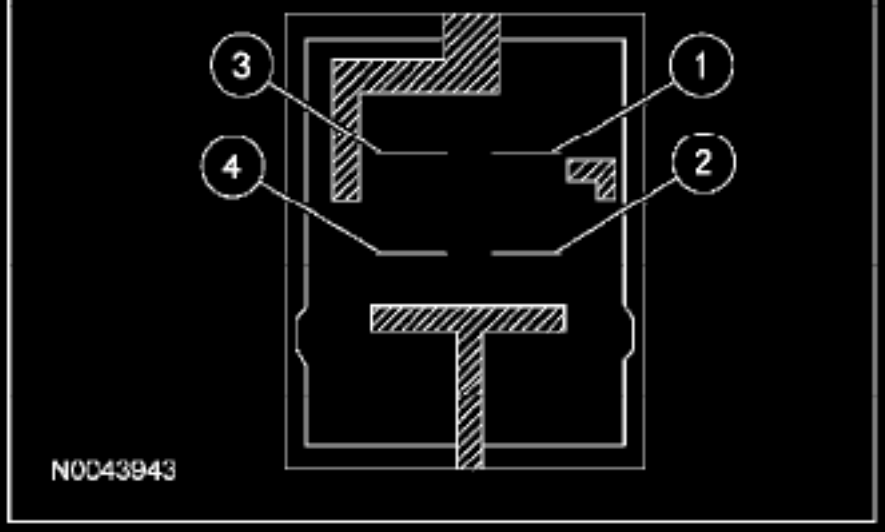
Resistor - Blower Motor

Blower Motor Switch: Description and Operation

BLOWER MOTOR SWITCH

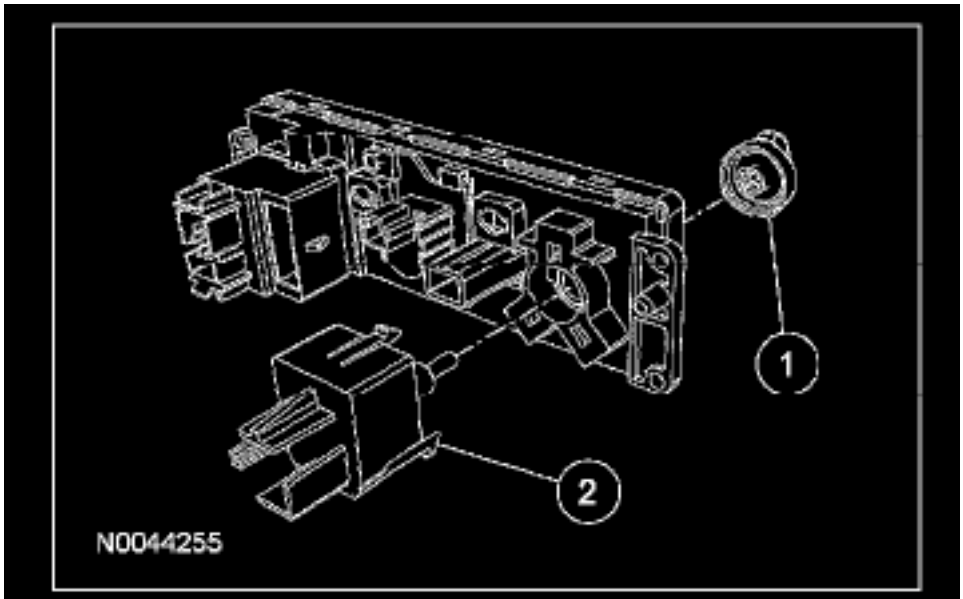
The blower motor switch controls blower motor speed by adding or by passing resistors in the heater blower motor switch resistor.

Switch — Blower Motor

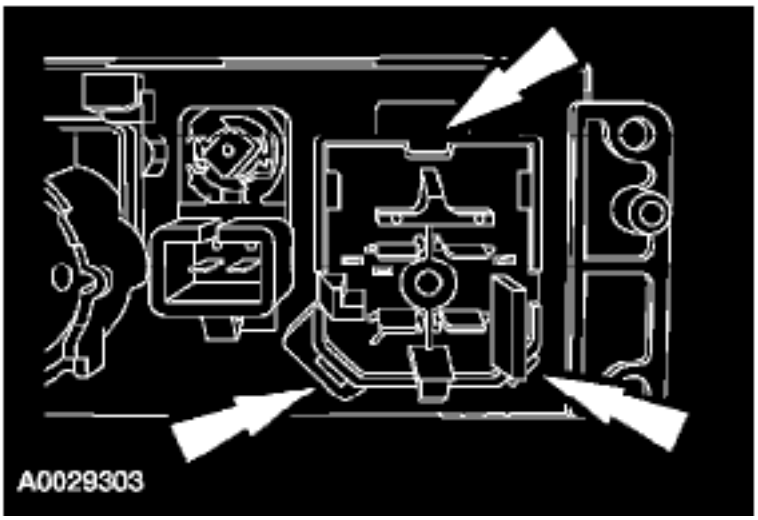


Switch Position	Continuity Between Pins
LOW	none
MED LOW	2 and 3
MED HIGH	2, 3 and 4
HIGH	1, 3 and 4

Switch - Blower Motor



Item	Part Number	Description
1	18519	Blower motor switch knob
2	19986	Blower motor switch



Blower Motor Switch: Service and Repair

BLOWER MOTOR SWITCH

Removal and Installation

1. Remove the climate control assembly. 2. Gently pull and remove the blower motor switch knob.
3. Release the 3 clips and remove the blower motor switch.

4. To install, reverse the removal procedure.

Cabin Air Filter: Service and Repair

Air Distribution

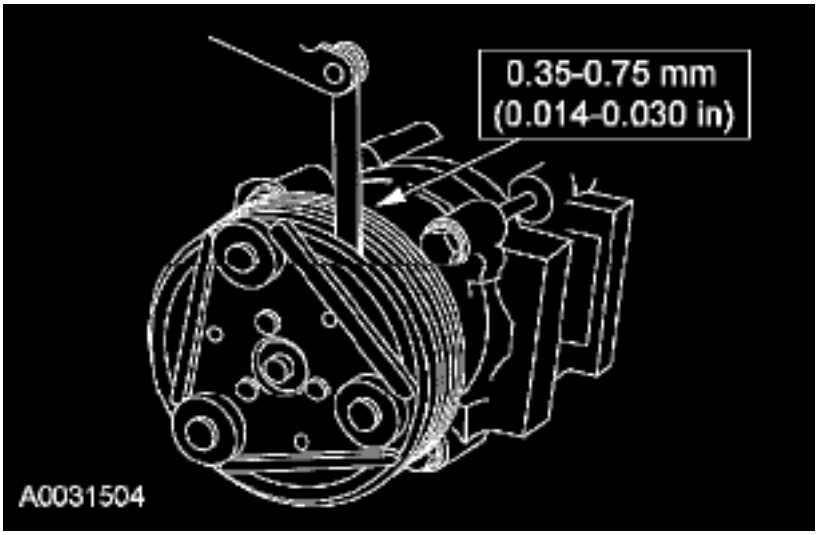
Note: The air distribution system of this vehicle CANNOT be equipped with a cabin air filter.

Compressor Clutch: Specifications

Item.....Specification

Magnetic Clutch

Air Gap Clearance.....0.35-0.75 mm (0.014-0.030 in)



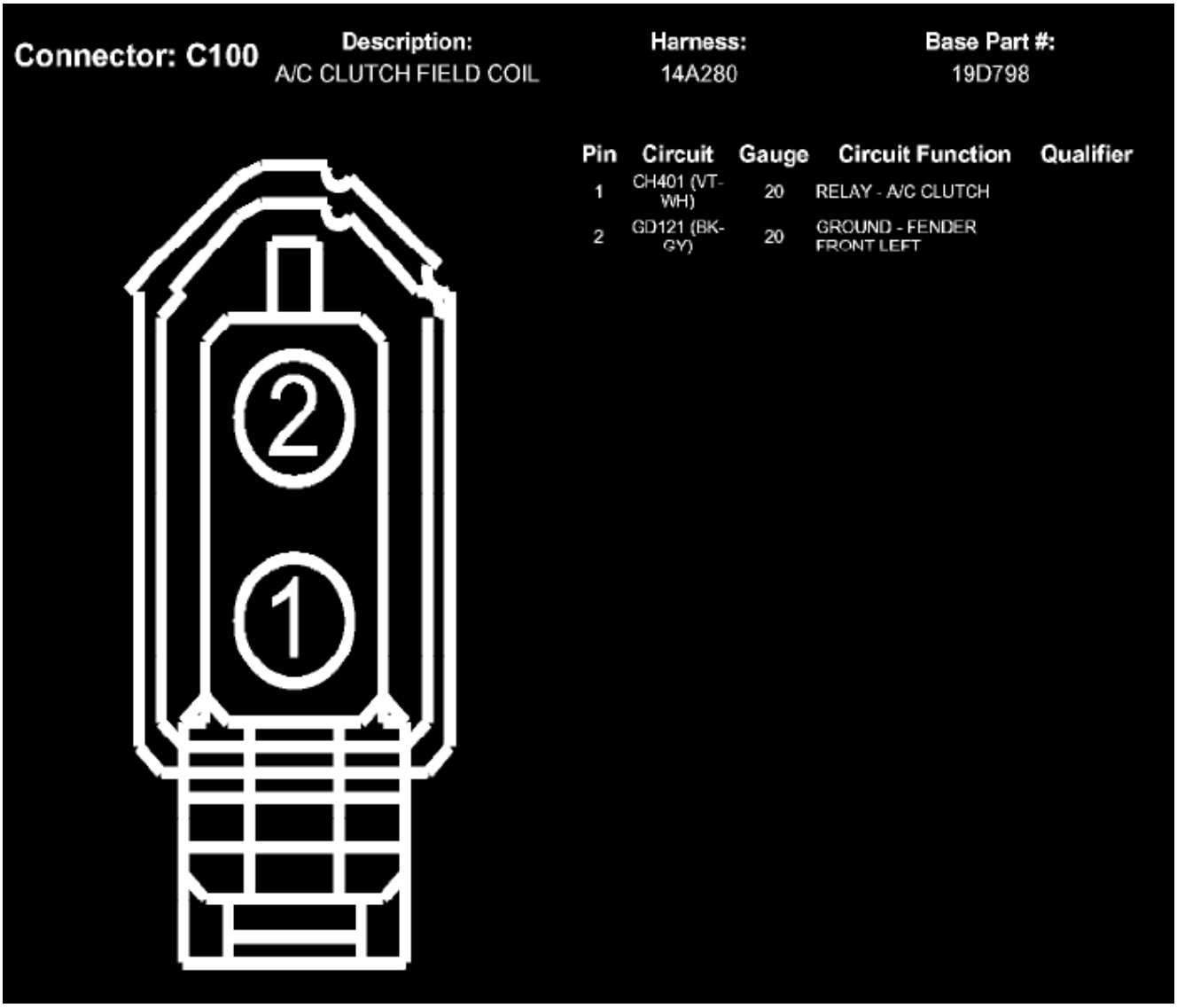
Compressor Clutch: Adjustments

AIR CONDITIONING (A/C) CLUTCH AIR GAP ADJUSTMENT

1. Check the A/C clutch air gap at 3 equally-spaced places between the A/C clutch disc and hub and the A/C clutch pulley.

2. Remove the A/C clutch disc and hub. Add or remove spacers between the A/C clutch disc and hub and the compressor shaft until clearance is

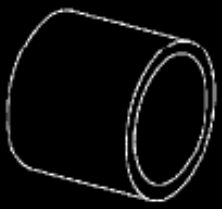
within specification.



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CH401 (VT-WH)	20	RELAY - A/C CLUTCH	
2	GD121 (BK-GY)	20	GROUND - FENDER FRONT LEFT	

C100

Special Tool(s)

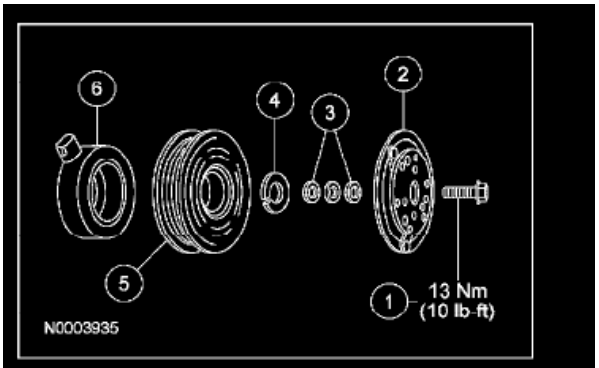
ST2382-A	Remover, Compressor Pulley 412-001 (T71P-19703-B)
ST1232-A	Installer, A/C Compressor Coil 412-065 (T89P-19623-EH)
ST1766-A	Wrench (vehicles with leaf spring A/C clutch) 205-036 (T70P-4067-A)
ST1235-A	Holding Fixture, Compressor Clutch (vehicles with 3-eye A/C clutch) 412-098 (T94P-19703-AH)
ST1234-A	Installer, A/C Compressor Field Coil 412-078 (T91L-19623-CH)
 ST1233-A	Remover, A/C Compressor Field Coil 412-067 (T89P-19623-FH)

Compressor Clutch Coil: Service and Repair

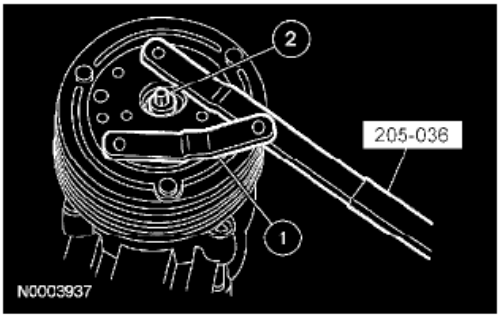
CLUTCH AND CLUTCH FIELD COIL

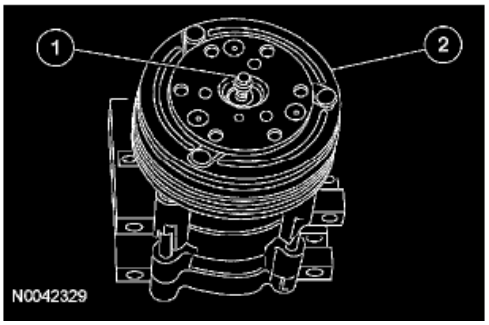
Special Tool(s)

Special Tool(s)



Item	Part Number	Description
1	N805332	A/C clutch disc and hub bolt
2	19D786	A/C clutch disc and hub
3	19D648	A/C clutch disc and hub spacer
4	N805338	A/C compressor pulley snap ring
5	19D784	A/C compressor pulley
6	19D798	A/C clutch field coil





Removal

All vehicles 1. Remove the A/C compressor.

Vehicles with leaf spring A/C clutch 2. Remove the A/C clutch disc and hub retaining bolt.

1 Hold the A/C clutch disc and hub with the special tool.

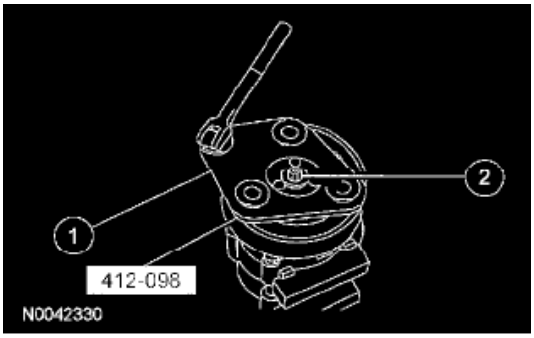
2 Remove the bolt.

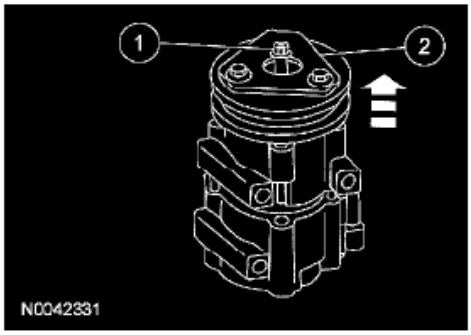
3. Remove the A/C clutch disc and hub and the A/C clutch hub spacer.

1 Thread an 8 x 1.25 mm bolt into the A/C clutch disc and hub to force it from the compressor shaft.

2 Lift the A/C clutch disc and hub and the spacer from the compressor shaft.

Vehicles with 3-eye A/C clutch


1
2
412-098
N0042330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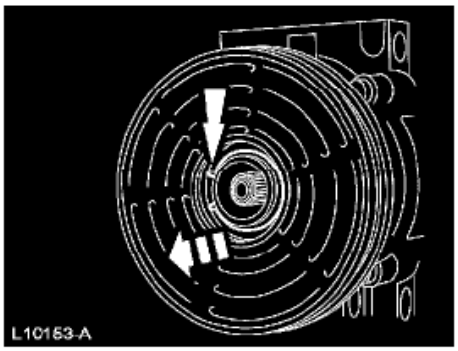
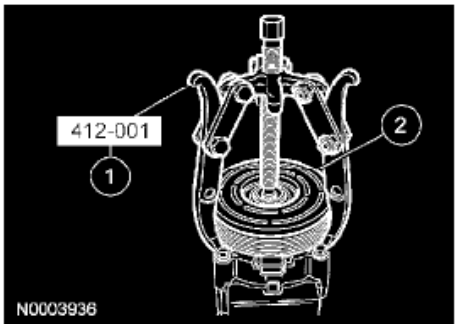
N0042331


L10153-A


412-001
1
2
N0003936

4. Remove the A/C clutch disc and hub retaining bolt.

1 Hold the A/C clutch disc and hub with the special tool.

2 Remove the bolt.

5. Remove the A/C clutch disc and hub and the A/C clutch hub spacer.

1 Thread an 8 x 1.25 mm bolt into the A/C clutch disc and hub to force it from the compressor shaft.

2 Lift the A/C clutch disc and hub and the A/C clutch hub spacer from the compressor shaft.

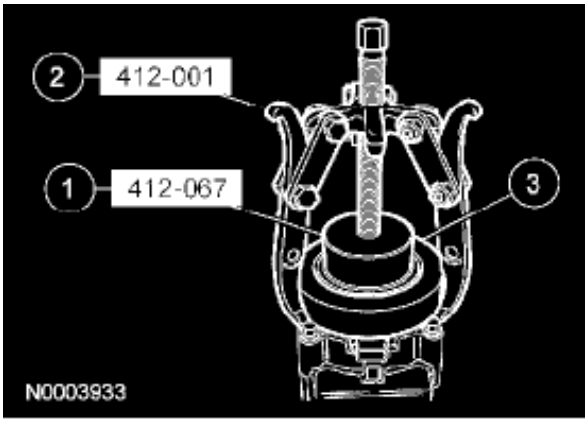
All vehicles 6. Remove the A/C clutch pulley snap ring.

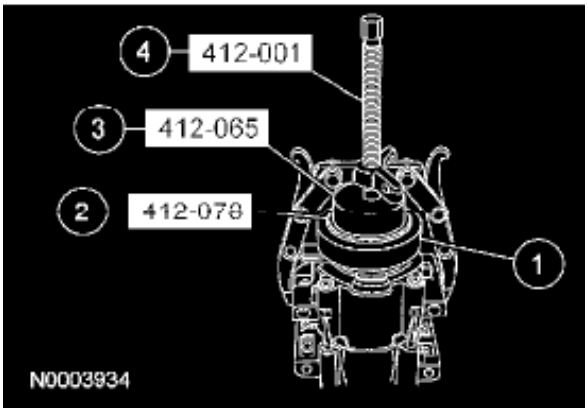
7. Remove the A/C clutch pulley.

1 Install the special tool.

2 Remove the A/C clutch pulley.

8. CAUTION: Do not use air tools. The A/C compressor clutch field coil can be easily damaged.


2
412-001
1
412-067
3
N0003933


4
412-001
3
412-065
2
412-078
1
N0003934

Remove the A/C compressor clutch field coil. 1

Install the special tool on the nose opening of the A/C compressor.

2 Install the special tool.

3 Remove the A/C compressor clutch field coil.

Installation

All vehicles

1. NOTE: If installing a new A/C compressor, the A/C clutch components should be reused unless obvious signs of damage are found. If excessive

grooving is found, a new A/C clutch disc and hub and A/C compressor pulley must be installed together. Otherwise, each component can be installed individually where needed.

Visually inspect the A/C clutch disc and hub, A/C compressor pulley and A/C clutch field coil for damage. -

Inspect for physical damage, including cracked or melted components or discoloration due to excessive heat.

- Inspect for excessive wear, including grooving in the A/C clutch disc and hub or A/C compressor pulley that is more than fingernail depth.

- Inspect for roughness in the A/C compressor pulley bearing.

2. Clean the A/C compressor clutch field coil and bearing mounting surfaces.

3. CAUTION: Do not use air tools. The A/C compressor clutch field coil can be easily damaged.

Install the A/C compressor clutch field coil. 1

Place the A/C compressor clutch field coil on the A/C compressor with the A/C compressor clutch field coil electrical connector correctly positioned.

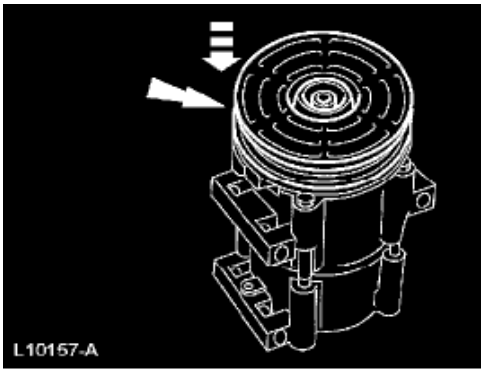
2 Place the special tool on the A/C clutch field coil.

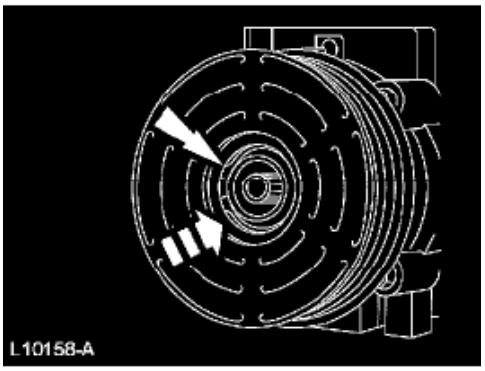
3 Place the special tool on the special tool.

4 Use the special tool to install the A/C compressor clutch field coil until bottomed completely against the A/C compressor.

4. NOTE: The A/C clutch pulley is a tight fit on the A/C compressor head; it must be correctly aligned during installation.

Install the A/C clutch pulley.


L10157-A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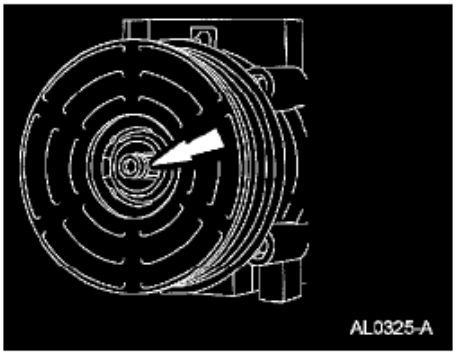
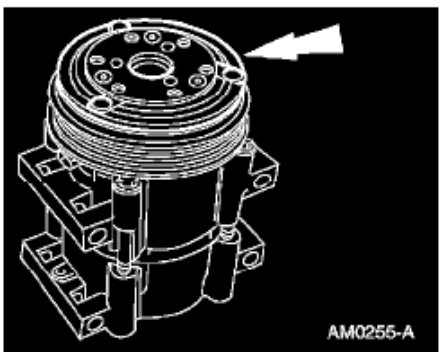

AL0325-A


AM0255-A

5. Install the A/C clutch pulley snap ring with the bevel side out.

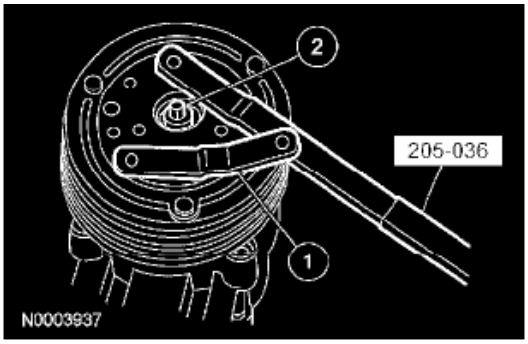
6. Place one nominal thickness A/C clutch hub spacer inside the clutch hub spline opening.

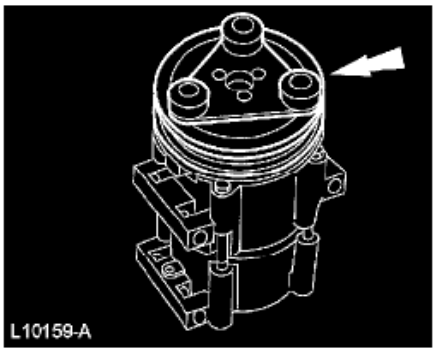
Vehicles with leaf spring A/C clutch 7. Install the A/C clutch disc and hub.

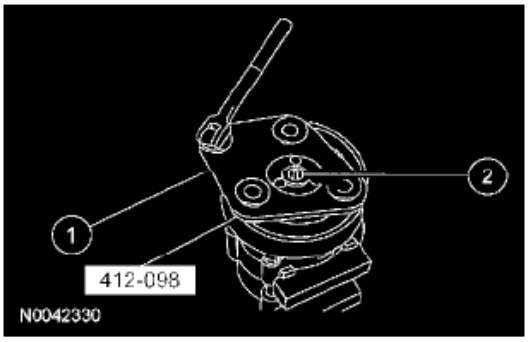
8. Install the A/C clutch disc and hub bolt.

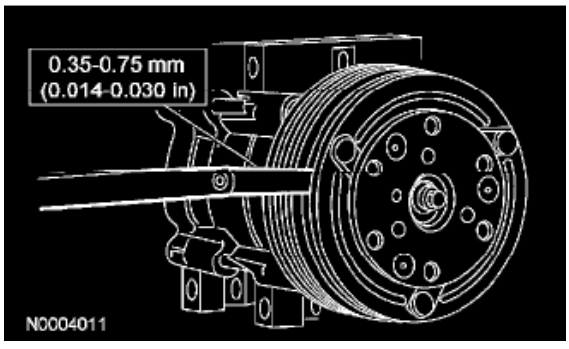
1 Hold the A/C clutch disc and hub with the special tool.

2 Install and tighten the A/C clutch disc and hub bolt to 13 Nm (10 lb-ft).


2
205-036
1
N0003937


L10159-A


2
1
412-098
N0042330


0.35-0.75 mm
(0.014-0.030 in)
N0004011

Vehicles with 3-eye A/C clutch 9. Install the A/C clutch disc and hub.

10. Install the A/C clutch disc and hub bolt.

1 Hold the A/C clutch disc and hub with the special tool.

2 Install and tighten the A/C clutch disc and hub bolt to 13 Nm (10 lb-ft).

All vehicles 11. Measure and adjust the clutch air gap by removing or adding A/C clutch hub spacers.

12. Install the A/C compressor.

Special Tool(s)

ST1766-A	Wrench (vehicles with leaf spring A/C clutch) 205-036 (T70P-4067-A)
ST1235-A	Holding Fixture, Compressor Clutch (vehicles with 3-eye A/C clutch) 412-098 (T94P-19703-AH)
ST1230-A	Protector, A/C Compressor Shaft Oil Seal 412-094 (T94P-19623-F)
ST1229-A	Remover, A/C Compressor Shaft Oil Seal 412-059 (T89P-19623-BH)
ST1228-A	Installer, A/C Compressor Shaft Oil Seal 412-058 (T89P-19623-AH)
ST1231-A	Remover, A/C Compressor Snap Ring 412-063 (T89P-19623-DH)
ST1219-A	Remover, O-Ring Seal 100-010 (T71P-19703-C)

Compressor Shaft Seal: Service and Repair

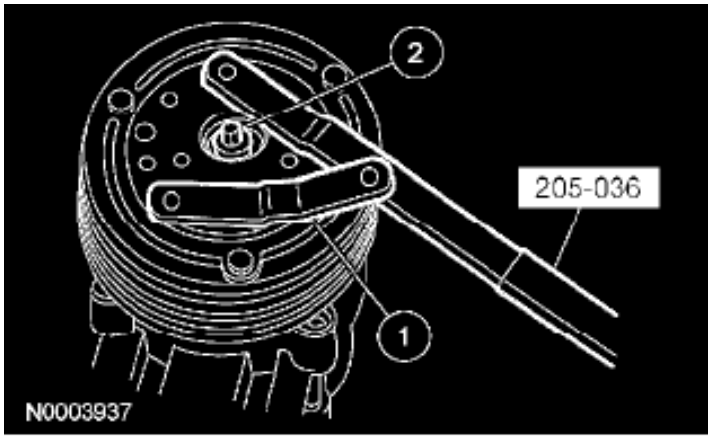
AIR CONDITIONING (A/C) COMPRESSOR SHAFT SEAL

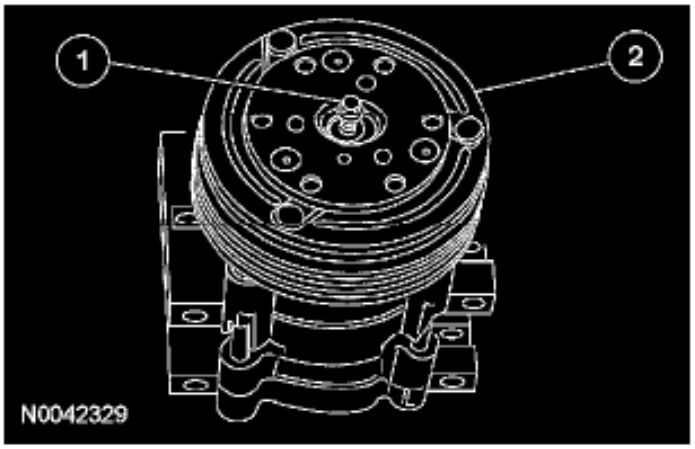
Special Tool(s)

Special Tool(s)

Removal

All vehicles


2
205-036
1
N0003937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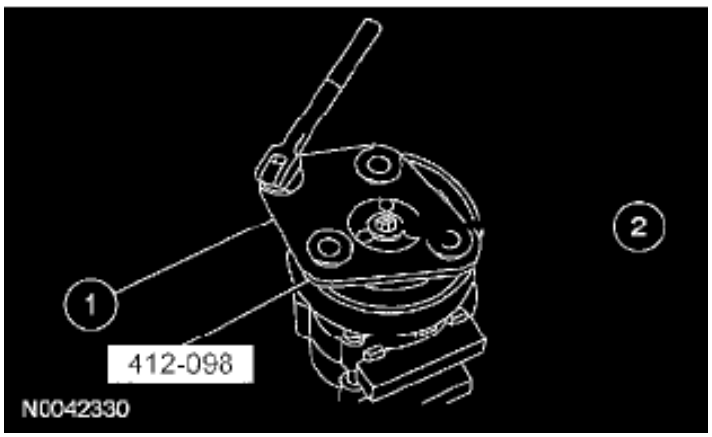

2
1
412-098
N0042330

1. Remove the A/C compressor (19703).

Vehicles with leaf spring A/C clutch 2. Remove the A/C clutch disc and hub retaining bolt.

1 Hold the A/C clutch disc and hub with the special tool.

2 Remove the bolt.

3. Remove the A/C clutch disc and hub and the A/C clutch hub spacer.

1 Thread an 8 x 1.25 mm bolt into the A/C clutch disc and hub to force it from the compressor shaft.

2 Lift the A/C clutch disc and hub and the spacer from the compressor shaft.

Vehicles with 3-eye A/C clutch 4. Remove the A/C clutch disc and hub retaining bolt.

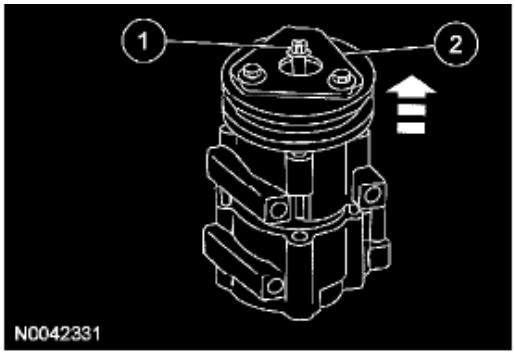
1 Hold the A/C clutch disc and hub with the special tool.

2 Remove the bolt.

5. Remove the A/C clutch disc and hub and the A/C clutch hub spacer.

1 Thread an 8 x 1.25 mm bolt into the A/C clutch disc and hub to force it from the compressor shaft.

2 Lift the A/C clutch disc and hub and the A/C clutch hub spacer from the compressor shaft.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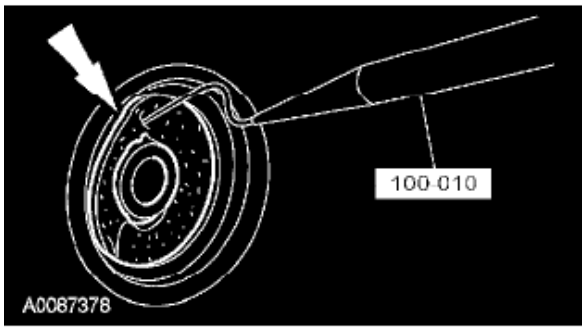
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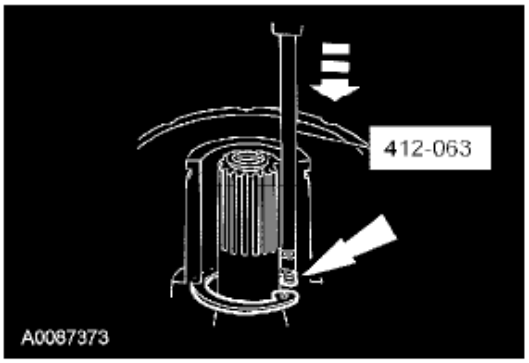
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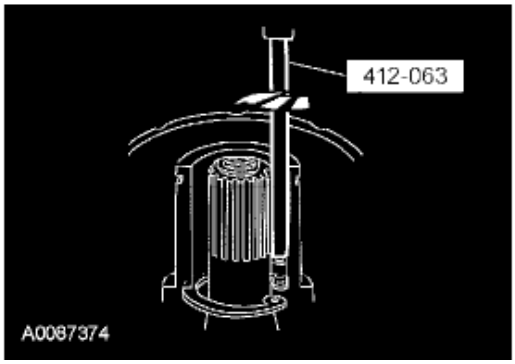
A0087373

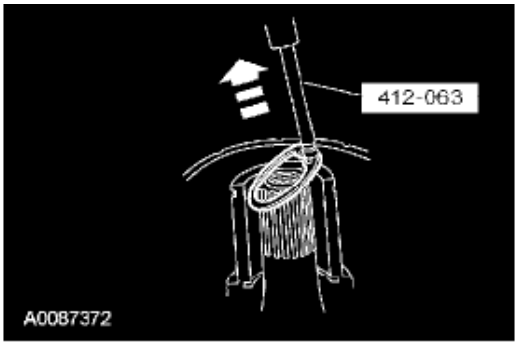

412-063
A0087374

All vehicles 6. Remove the shaft seal felt from the nose of the A/C compressor with the special tool.

7. Clean the compressor nose area. 8. Insert the tip of the special tool into one of the snap ring eyes.

9. Rotate the special tool to position the tool tip and the snap ring eye closest to the A/C compressor shaft.

10. Pull the special tool up quickly while keeping the tool shaft against the side of the nose opening and remove the snap ring.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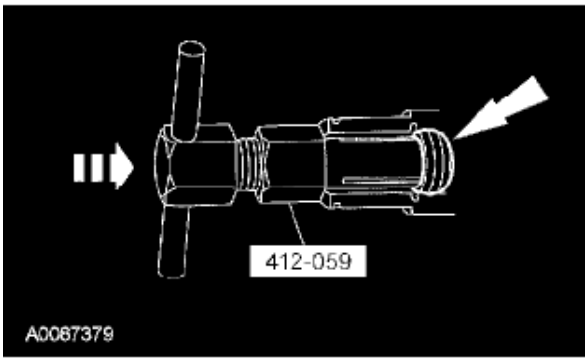
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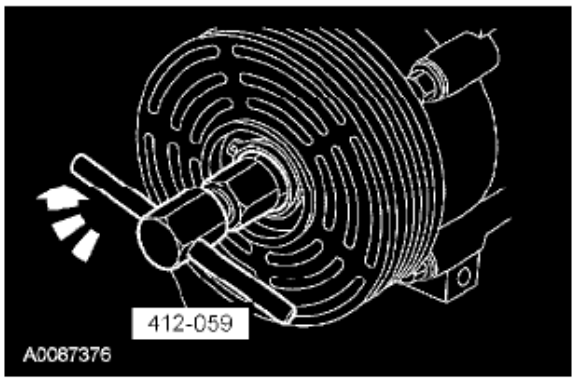
A0087379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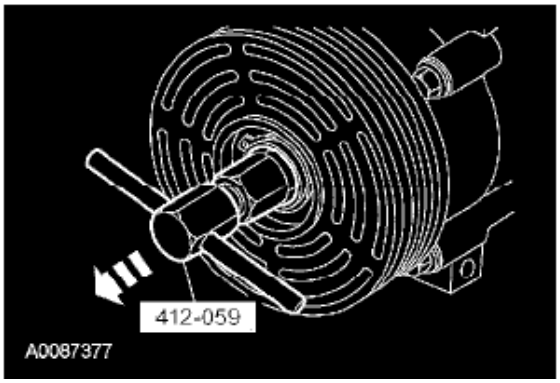

412-059
A0087377

11. Engage the special tool into the inside diameter of the shaft seal.

12. Turn the tool handle clockwise to expand the tool tip inside of the shaft seal.

13. Pull the seal from the A/C compressor.

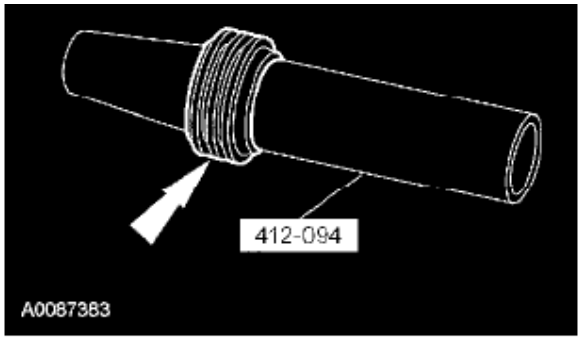
Installation

All vehicles

1. CAUTION: To prevent refrigerant system contamination, do not allow dirt or other foreign materials to enter the A/C compressor.

Clean the A/C compressor nose area.

2. Place the shaft seal on the special tool. Lubricate the shaft seal and the special tool with mineral oil or equivalent.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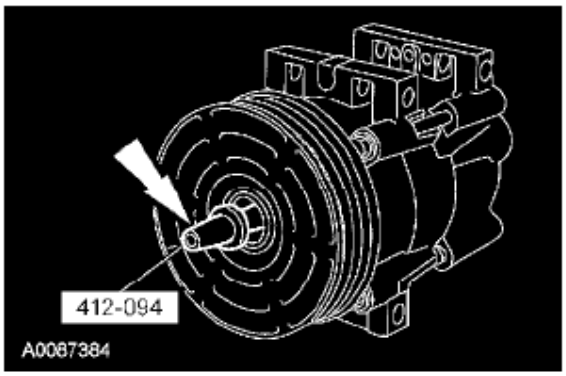
A0087383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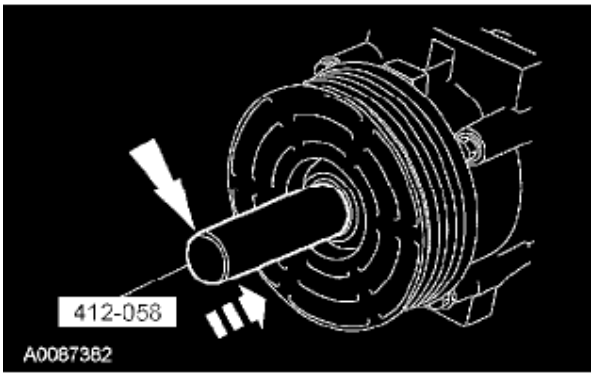
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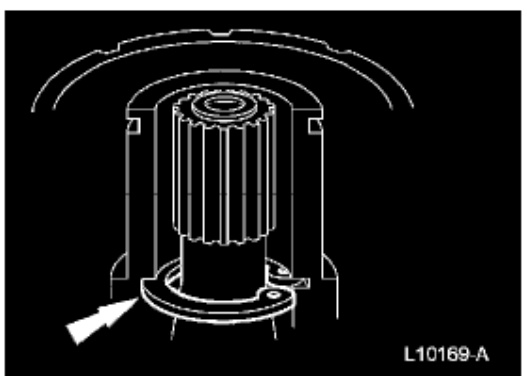

L10169-A

3. Position the shaft seal and the special tool over the A/C compressor shaft.

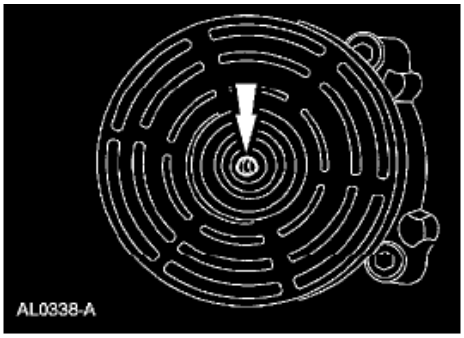
4. Push the shaft seal onto the A/C compressor shaft with the special tool until seated.

5. Install the shaft seal snap ring.

6. Carry out the A/C Compressor-External Leak Test. See: Testing and Inspection/Component Tests and General Diagnostics/A/C Compressor -

External Leak Test

7. Install the shaft seal felt.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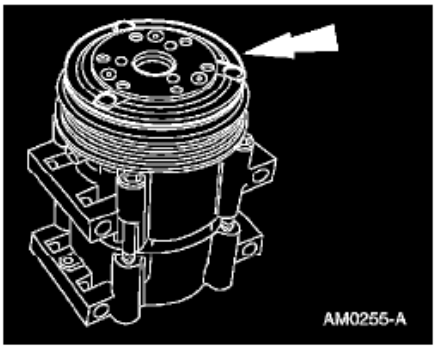
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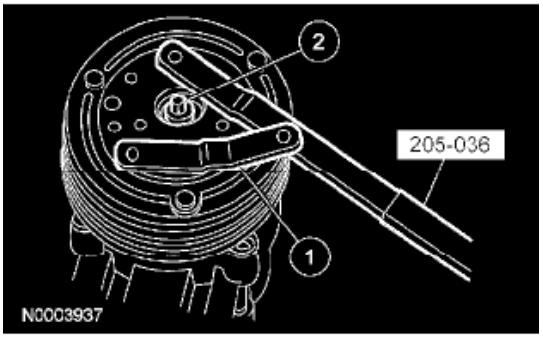
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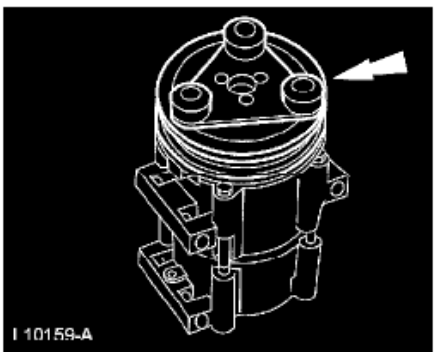
205-036
1
N0003937


I 10159-A

Vehicles with leaf spring A/C clutch 8. Install the A/C clutch disc and hub.

9. Install the A/C clutch disc and hub retaining bolt.

1 Hold the A/C clutch disc and hub with the special tool.

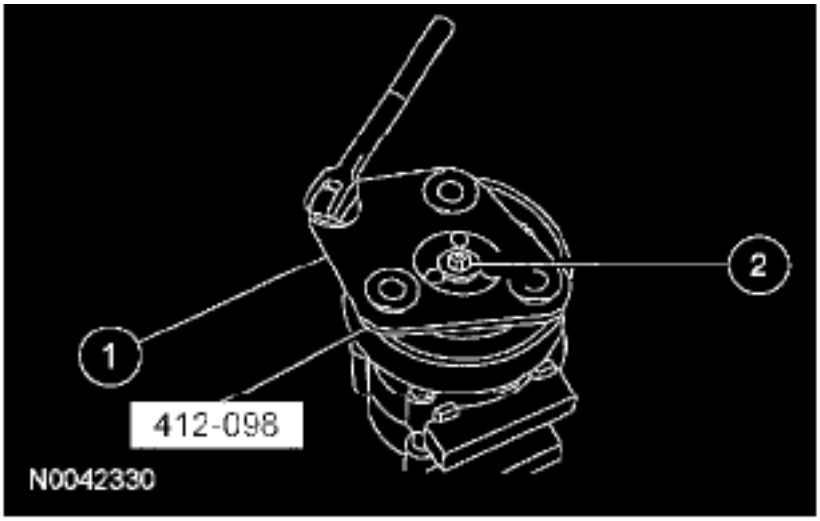
2 Install and tighten the A/C clutch disc and hub bolt to 13 Nm (10 lb-ft).

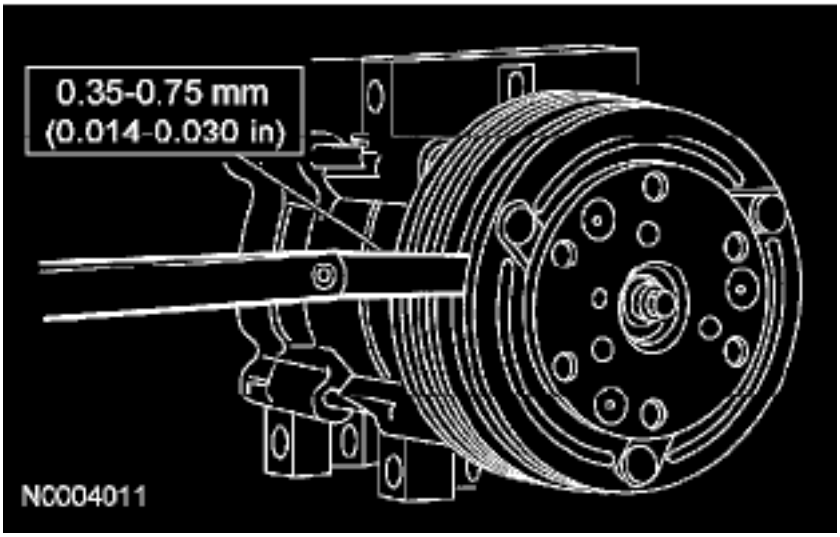
Vehicles with 3-eye A/C clutch 10. Install the A/C clutch disc and hub.

11. Install the A/C clutch disc and hub bolt.

1 Hold the A/C clutch disc and hub with the special tool.

2 Install and tighten the A/C clutch disc and hub bolt to 13 Nm (10 lb-ft).

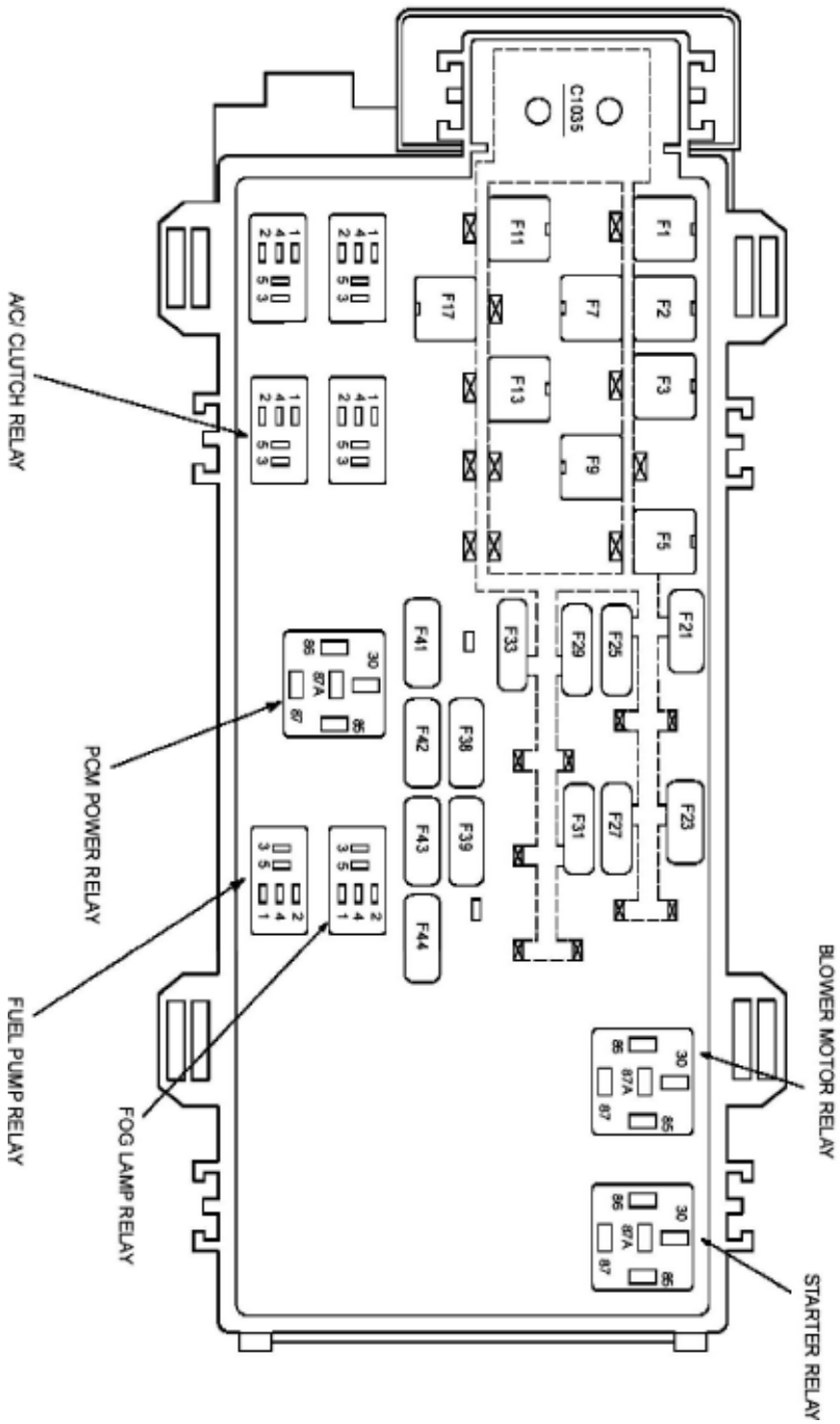


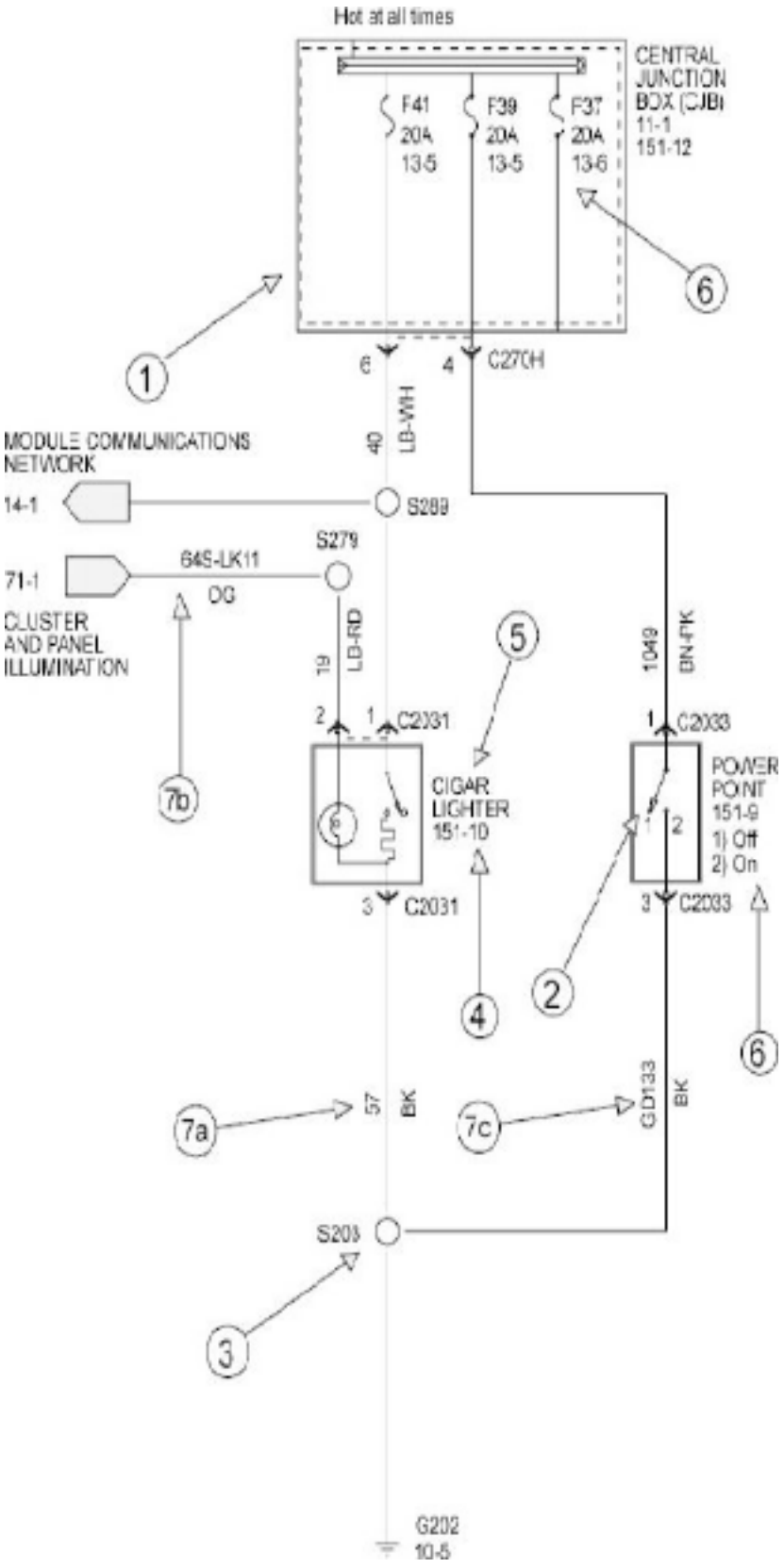


All vehicles 12. Measure and adjust the clutch air gap by removing or adding A/C clutch hub spacers.

13. Install the A/C compressor.

BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L




Hot at all times
CENTRAL JUNCTION BOX (CJB)
11-1
151-12
F41
20A
13-5
F39
20A
13-5
F37
20A
13-6
6
1
6
4
C270H
40
LB-WH
MODULE COMMUNICATIONS NETWORK
14-1
S289
S279
64S-LK11
71-1
DG
CLUSTER AND PANEL ILLUMINATION
19
LB-RD
5
1049
BN-PK
2
1
C2031
1
C2033
7b
CIGAR LIGHTER
151-10
POWER POINT
151-9
1) Off
2) On
3
C2031
3
C2033
4
2
6
7a
57
BK
7c
GD133
BK
S203
3
G202
10-5

Compressor Clutch Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

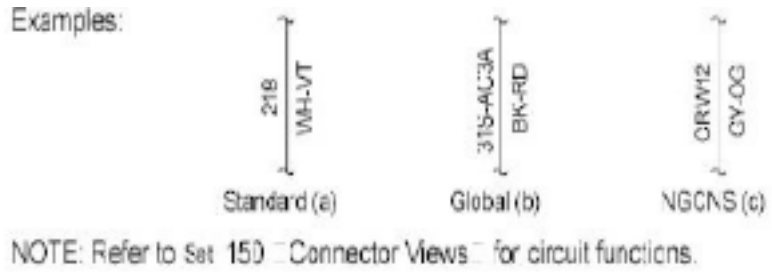
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

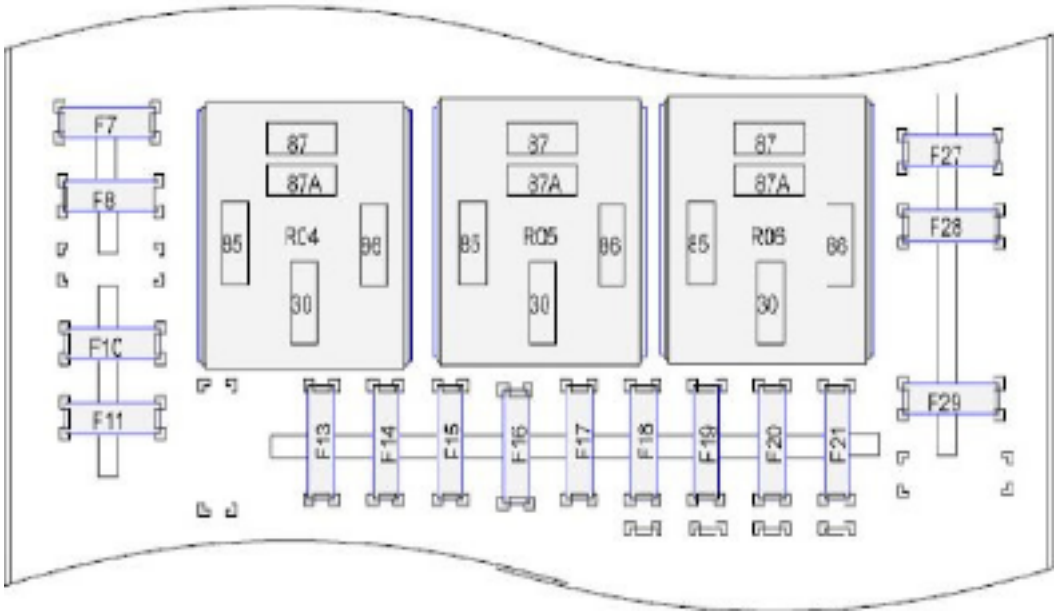
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

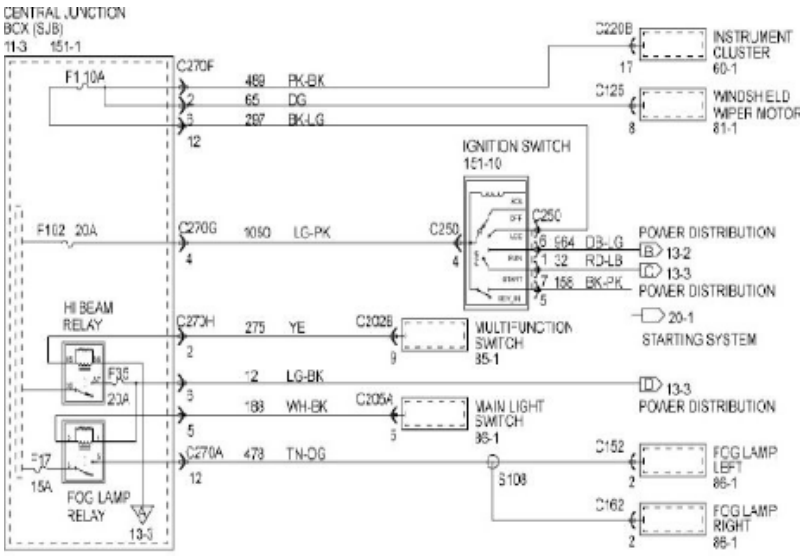
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

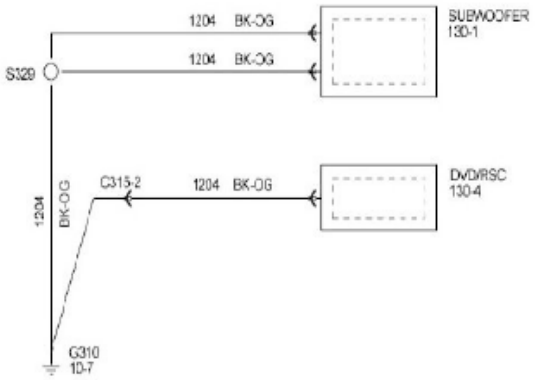
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

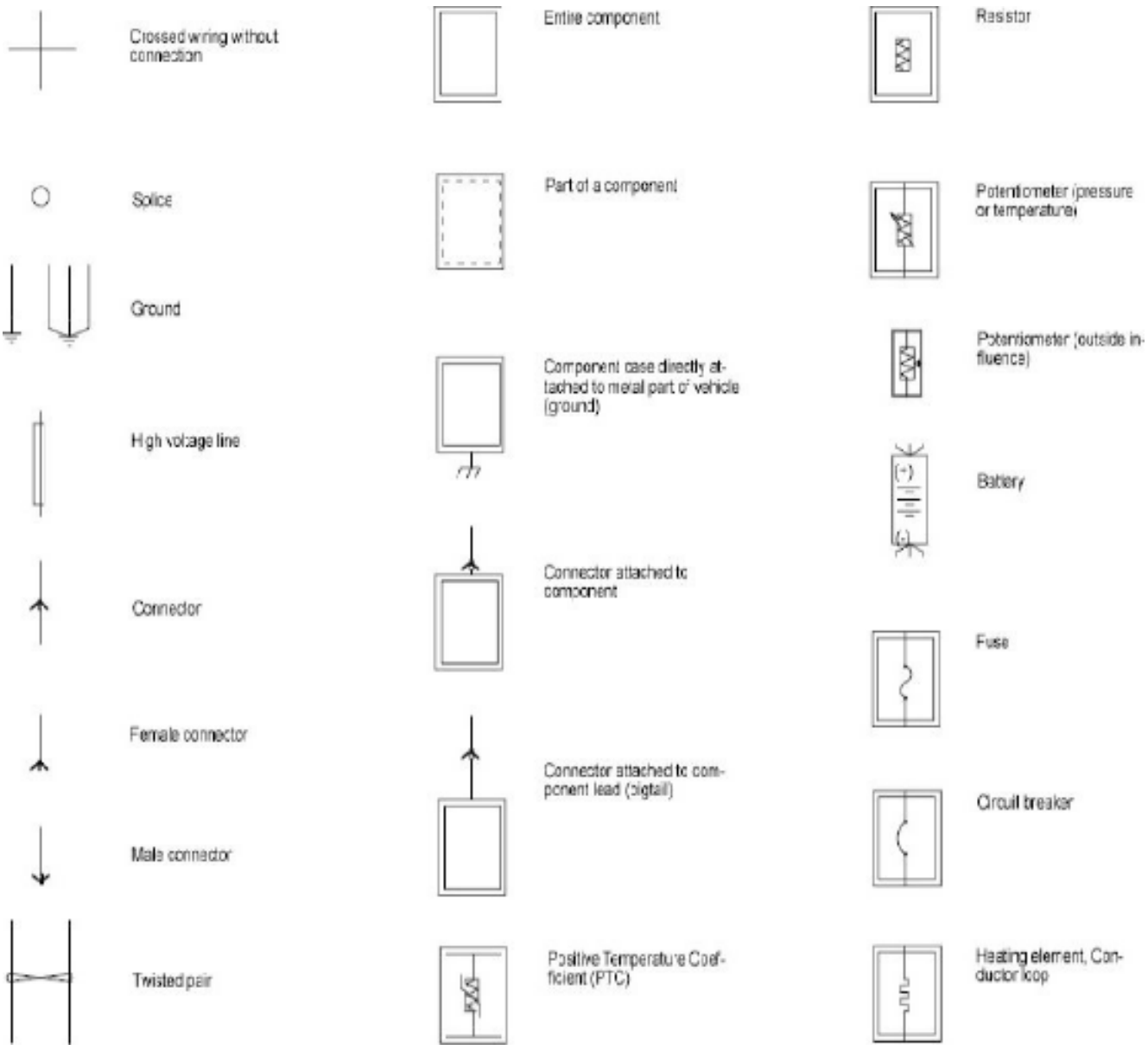
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

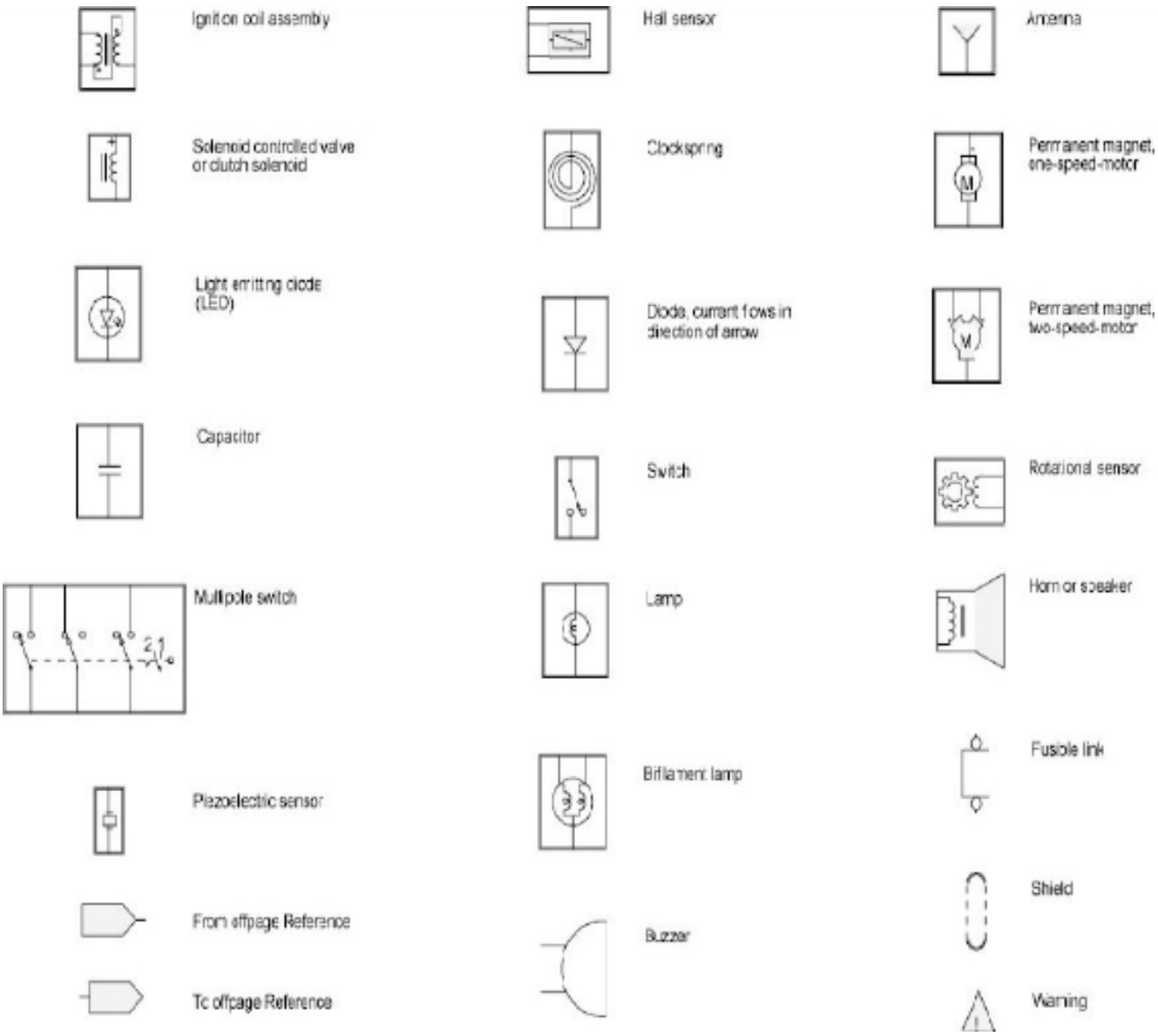
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

Symbols (Part 1)



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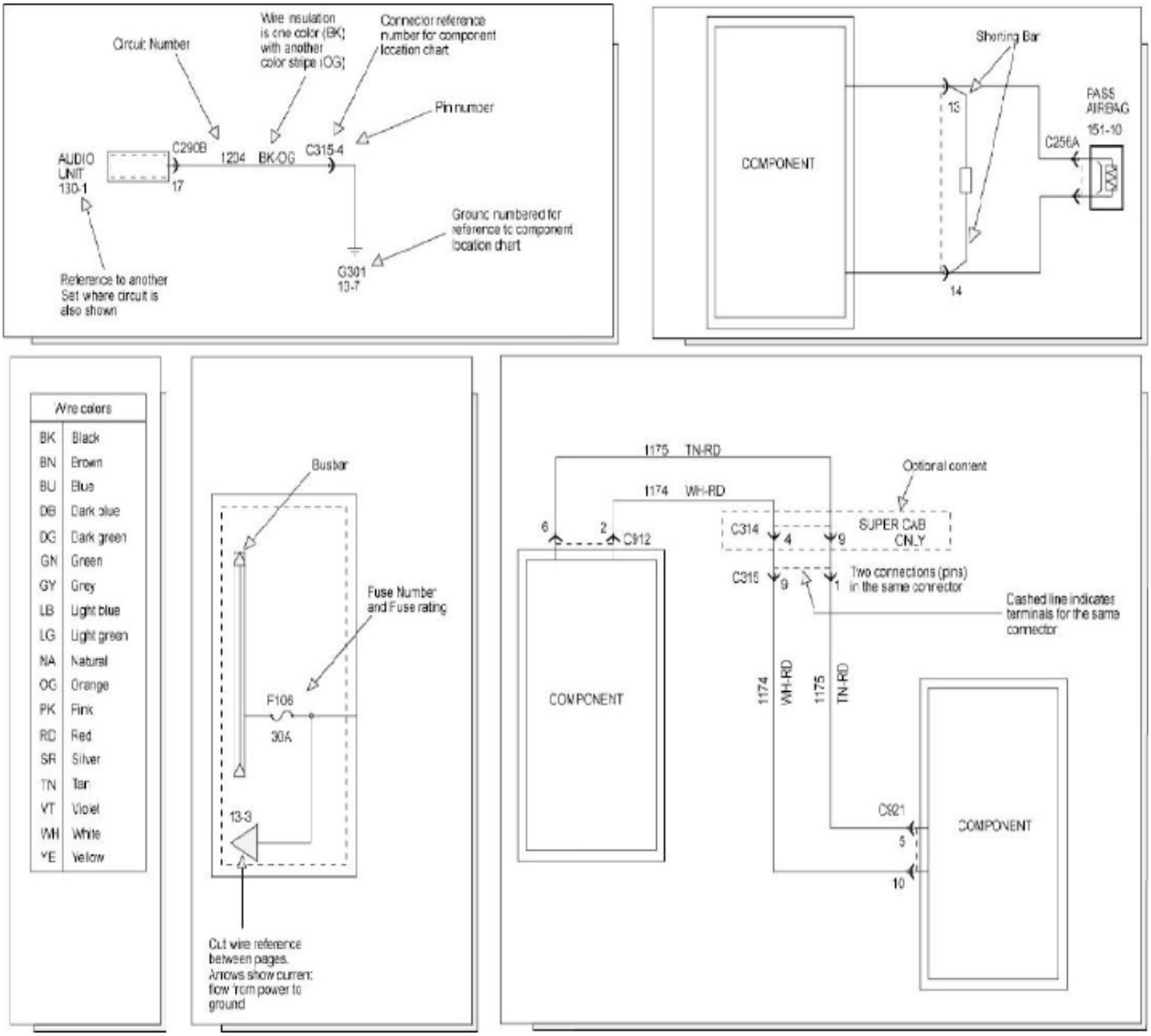

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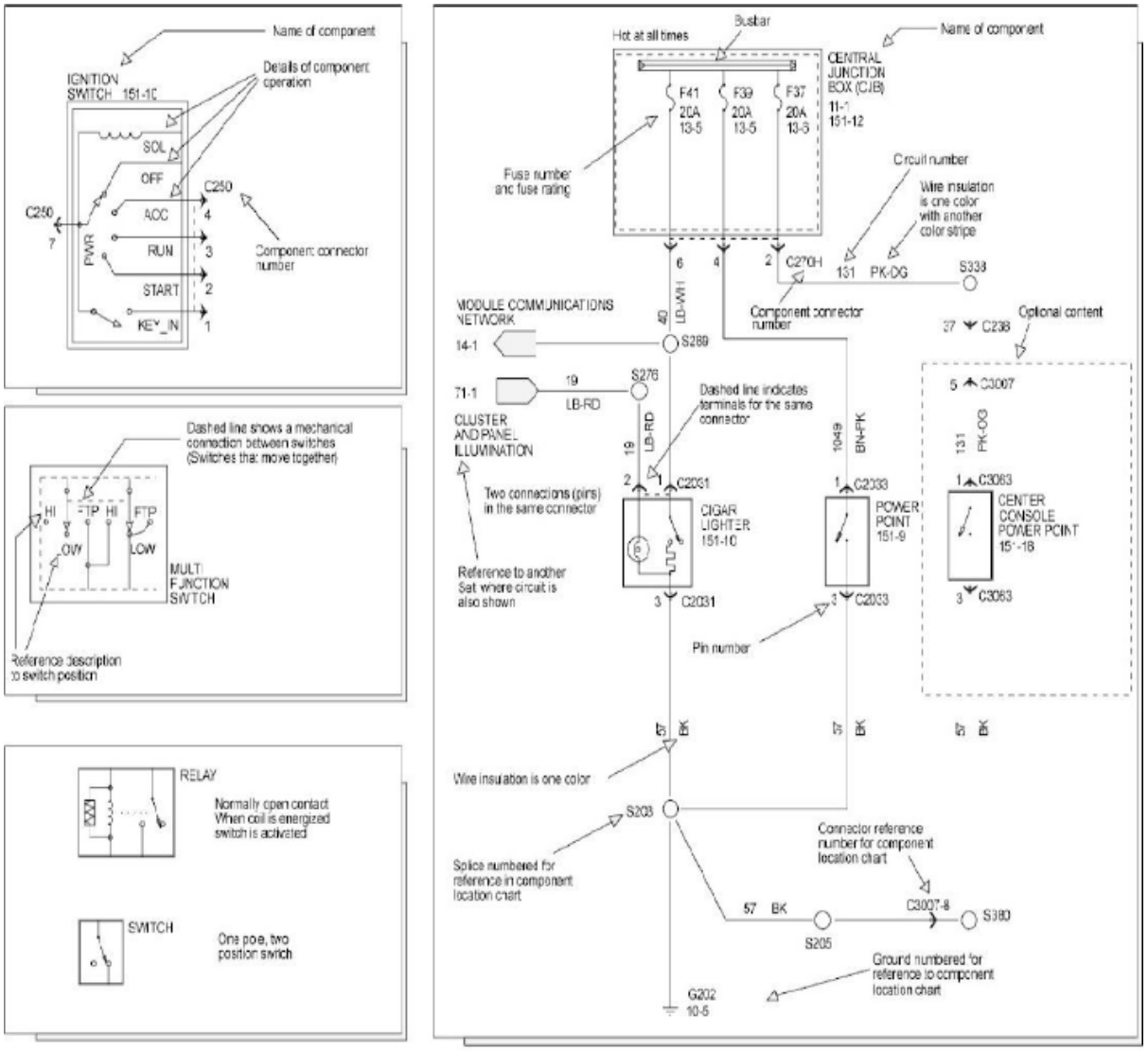
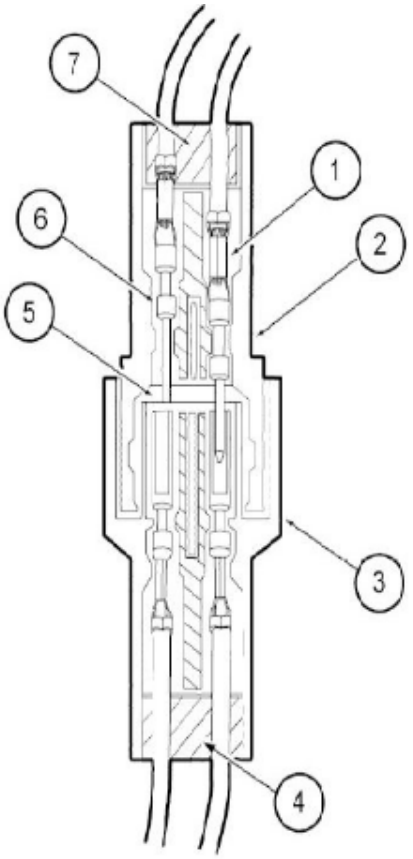


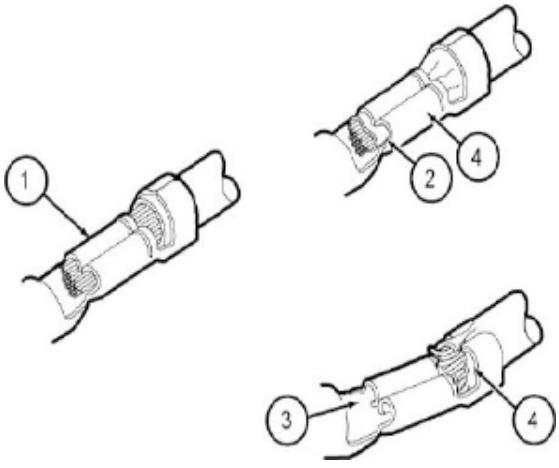
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Compressor Clutch Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

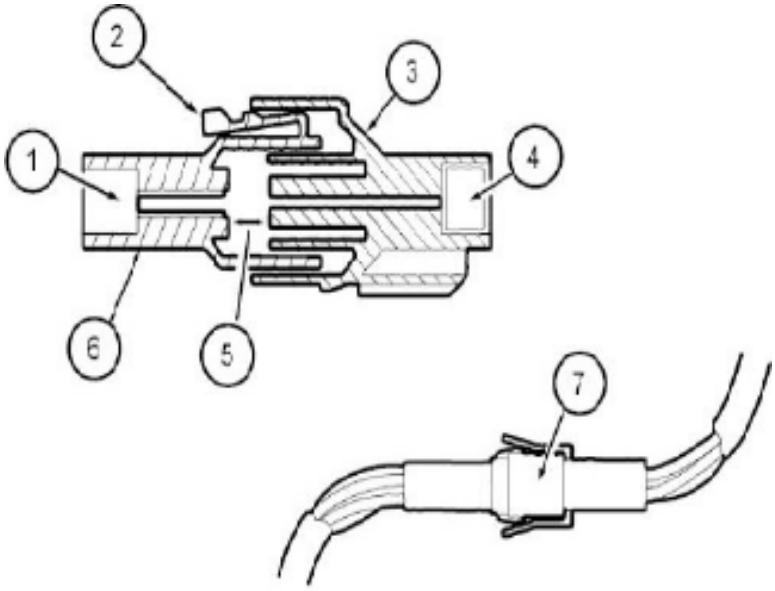
5 = Intermittent contact

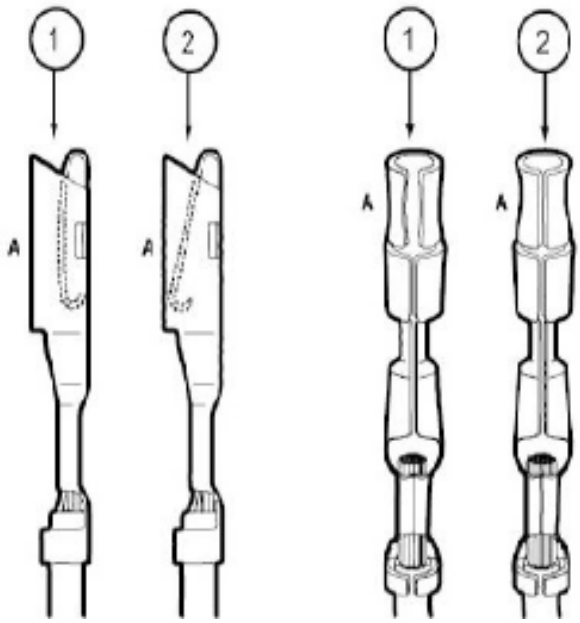
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

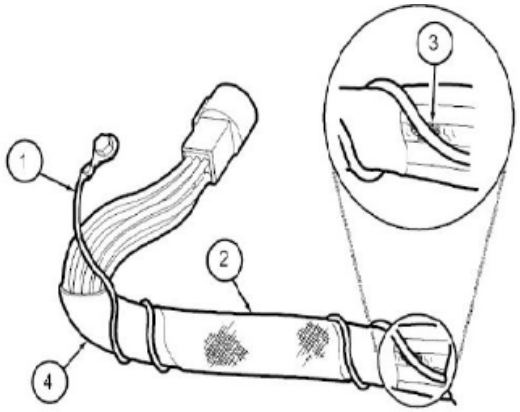
Deformed (enlarged) female terminals

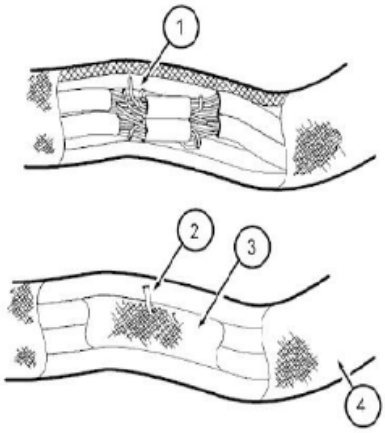
1 = Enlarged

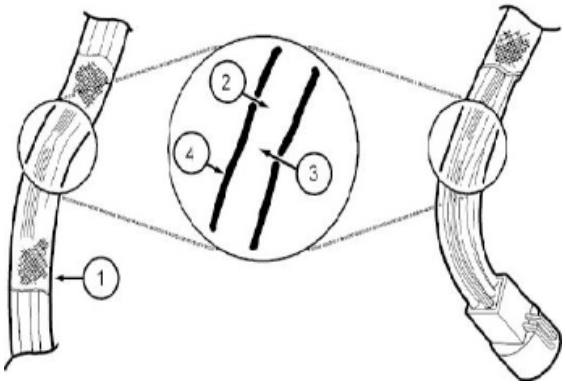
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

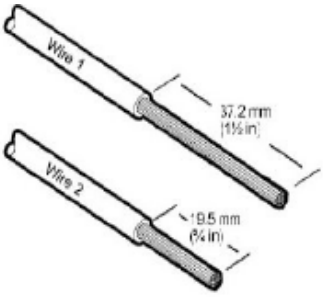
Splice covered 2

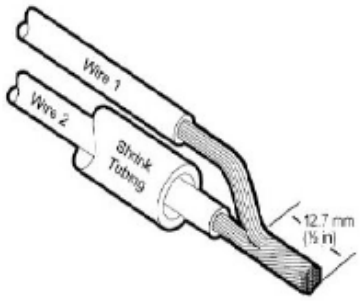
= Wire strand

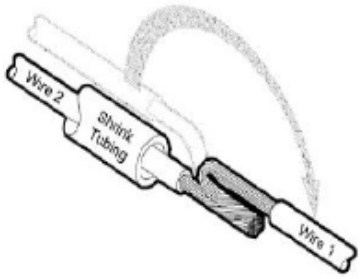
3 = Splice tape

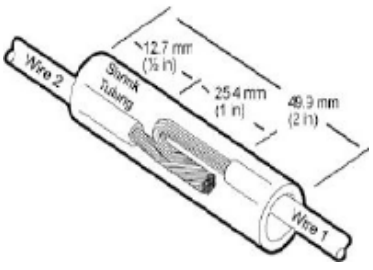
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

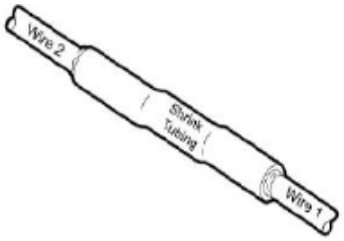
NOTE: -

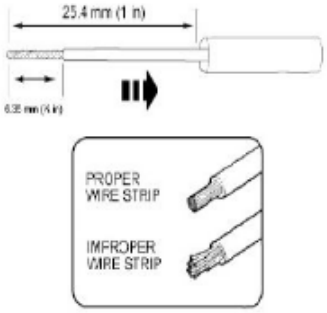
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

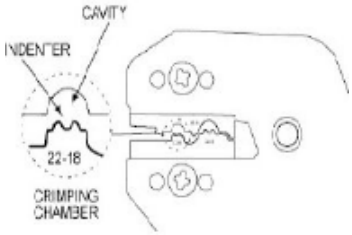
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

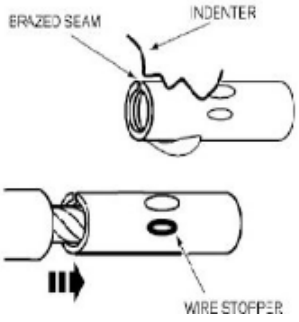
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

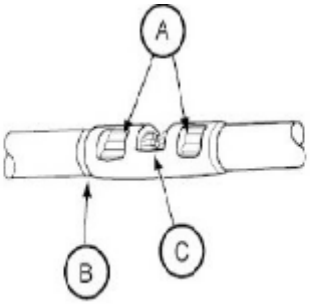
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

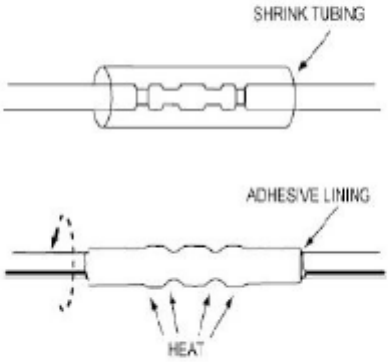
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4 strip, cut 9 strands	* 1/4 strip, cut 2 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip, fold 3x dia.
	16-14	* 1/4 strip, cut 7 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip fold 2x dia	1 strip, fold 3x dia.	1 1/4 strip, fold 4x dia.	Not Recommended
	12-10	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip fold 3x cia.	1 1/4 strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Figtail only

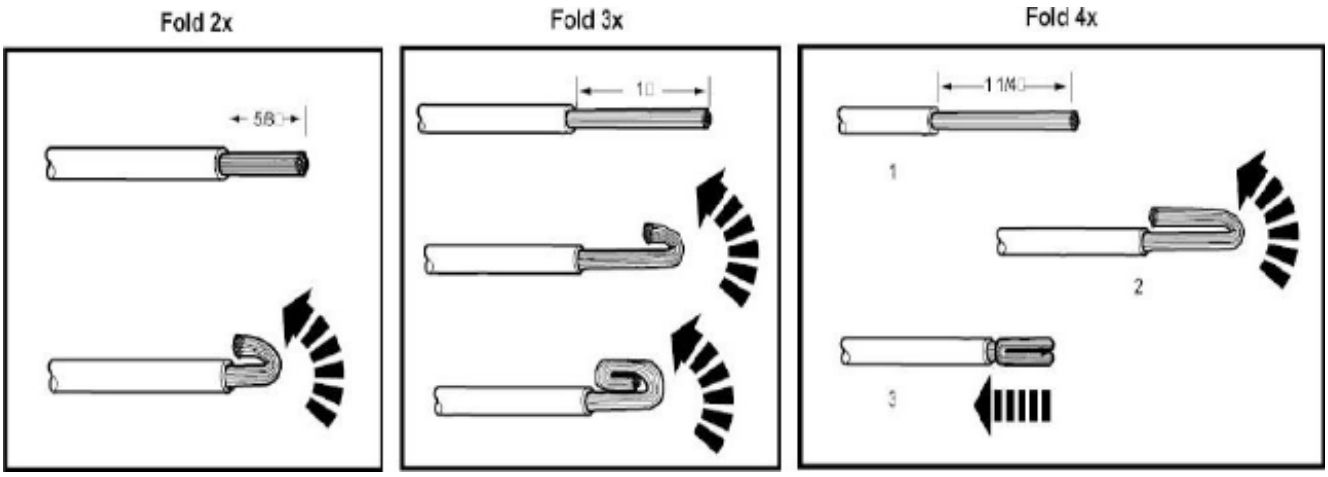
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Compressor Clutch Relay: Description and Operation

AIR CONDITIONING (A/C) CLUTCH RELAY (A/CCR)

NOTE: The PCM PIDs WAC and wide open throttle air conditioning cutoff fault (WACF) are used to monitor the A/CCR output.

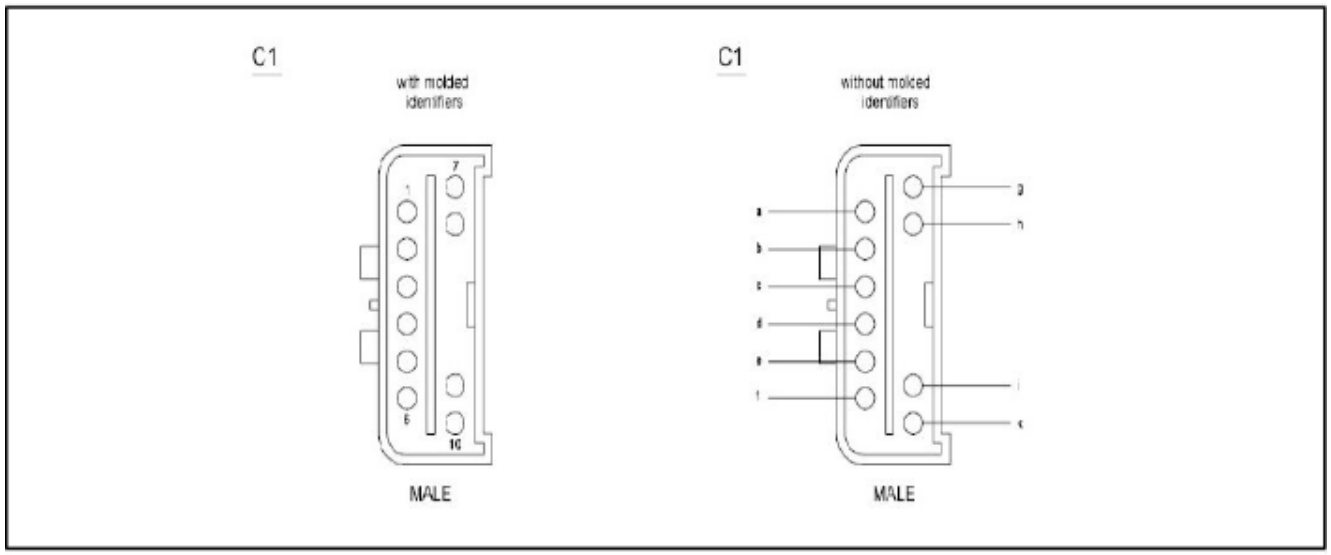
The A/CCR is wired normally open. There is no direct electrical connection between the A/C switch or electronic automatic temperature control (EATC) module and the A/C clutch. The PCM receives a signal indicating that A/C is requested. For some applications, this message is sent through the communications network. When A/C is requested, the PCM checks other A/C related inputs that are available, such as A/C pressure switch and A/C cycling switch. If these inputs indicate A/C operation is OK, and the engine conditions are OK (coolant temperature, engine RPM, throttle position), the PCM grounds the A/CCR output, closing the relay contacts and sending voltage to the A/CCR.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



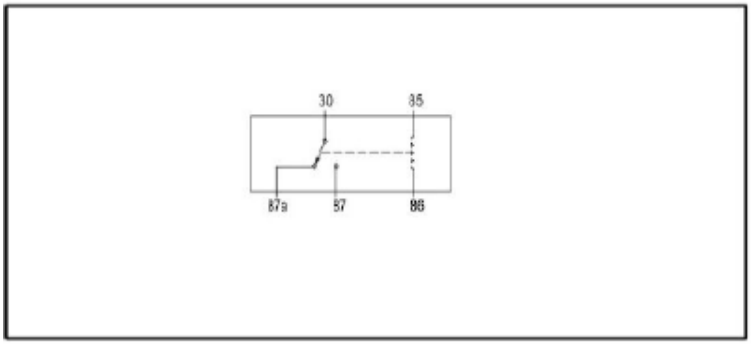
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

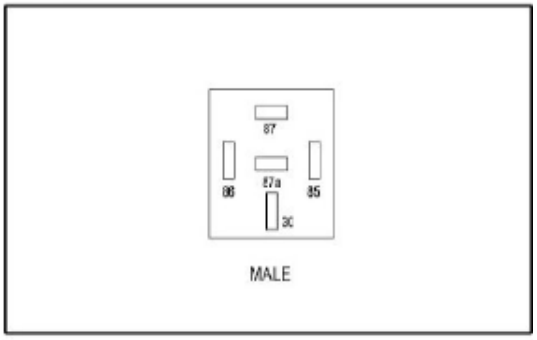
Compressor Clutch Relay: Testing and Inspection Mini ISO Relay

Relay □ Mini ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	45 □ 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

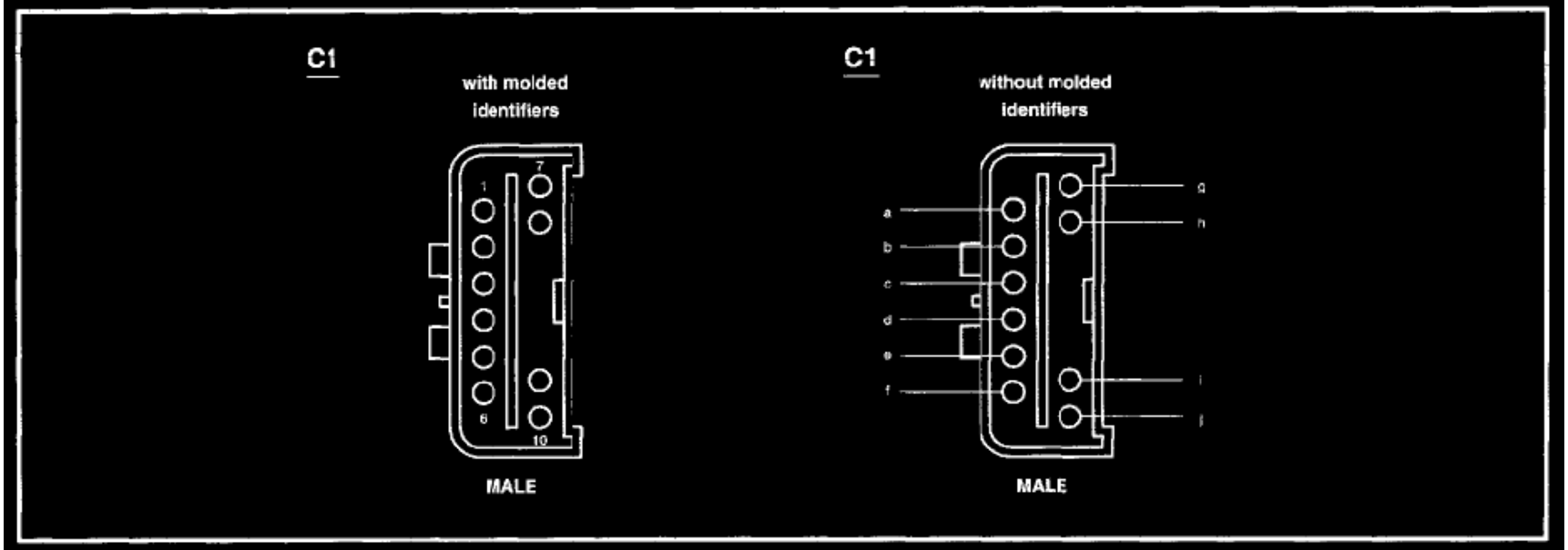
Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step–by–step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



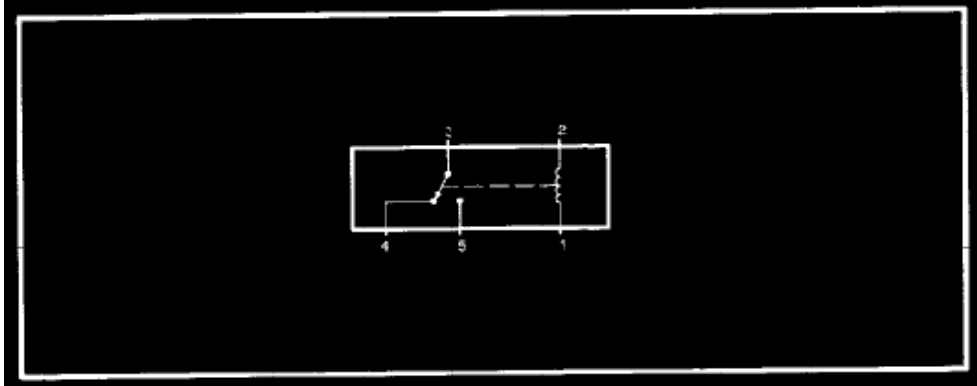
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

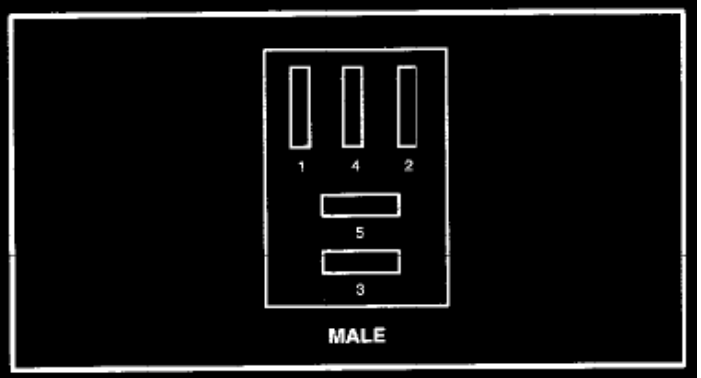
Compressor Clutch Relay: Testing and Inspection Micro ISO Relay

Relay – Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63–102Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil – Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

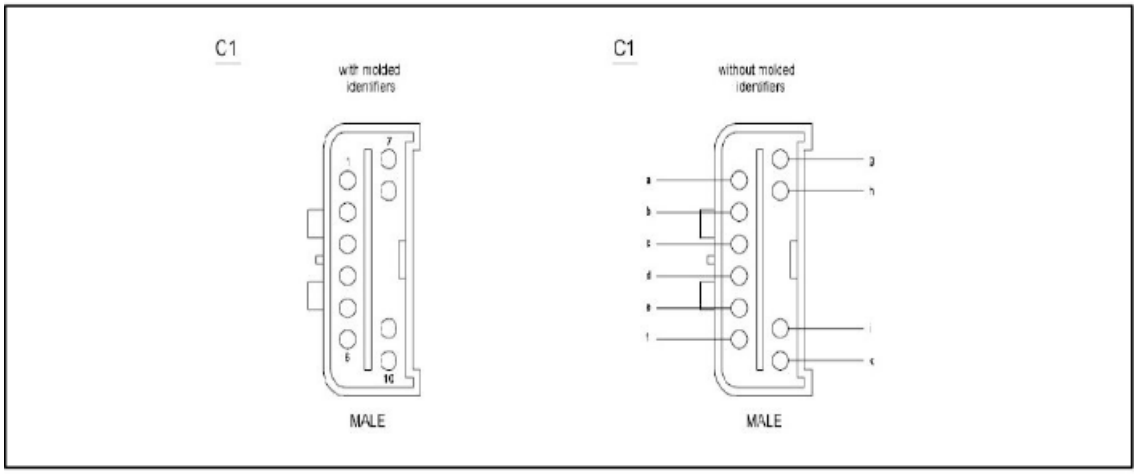
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step□by□step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals

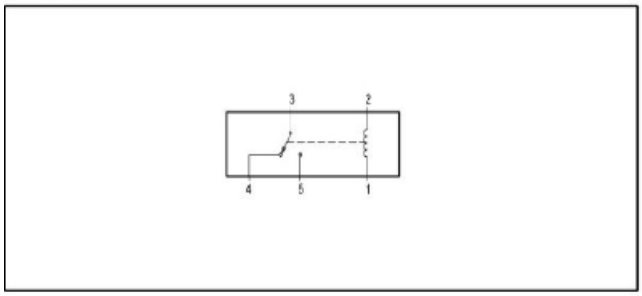


The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column □Circuit to test□. If you wish to test the complete component, perform all tests.

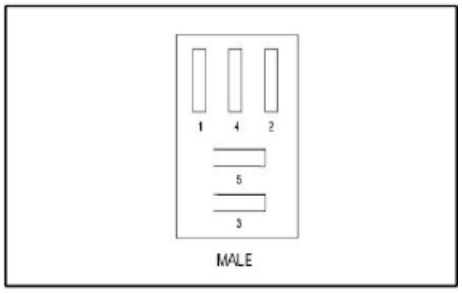
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Relay □ Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63□102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil □ Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Condenser HVAC: Description and Operation

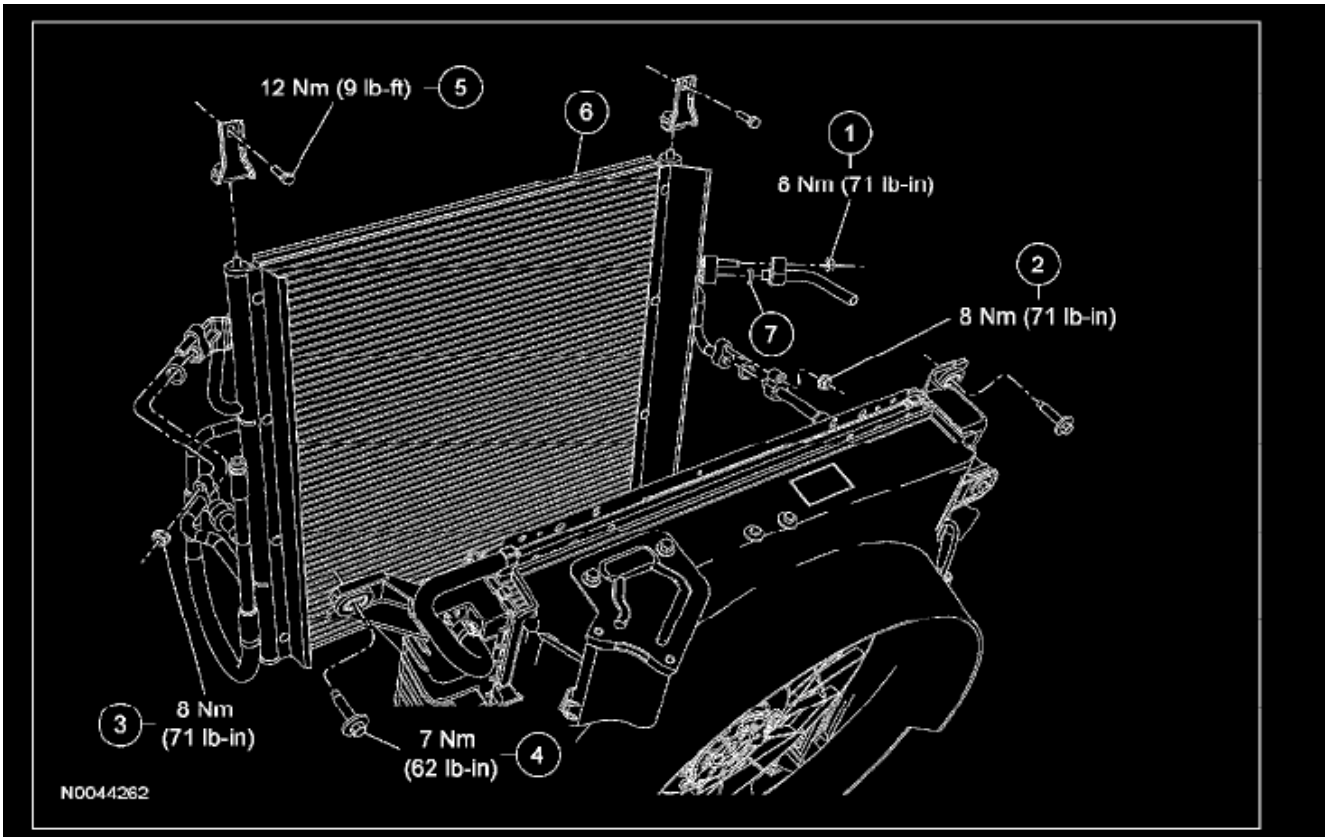
CONDENSER CORE

NOTE: Replacement of the suction accumulator is not required when repairing the air conditioning system except when there is physical evidence of system contamination from a failed A/C compressor or damage to the suction accumulator.

The condenser core has the following characteristics:

- It is an aluminum fin and tube design heat exchanger located in front of vehicle radiator.

- It cools compressed refrigerant gas by allowing air to pass over fins and tubes to extract heat and by condensing gas to liquid refrigerant as it is cooled.



Item	Part Number	Description
1	W520413	Condenser outlet fitting nut
2	W520413	Compressor-to-condenser line fitting nut
3	W520413	Condenser inlet fitting nut
4	N811605	Radiator bolt (2 required)

Item	Part Number	Description
5	19B594	Condenser bolt (2 required)
6	19712	Condenser core
7	19E889	O-ring seal (3 required, 2.3L) (2 required 3.0L or 4.0L)

(Continued)

Condenser HVAC: Service and Repair

CONDENSER CORE

Removal and Installation

NOTE:

- If a condenser core leak is suspected, the condenser core must be leak-tested before it is removed from the vehicle.

- Installation of a new suction accumulator is not required when repairing the air conditioning system, except when there is physical evidence of system contamination from a failed A/C compressor or damage to the suction accumulator.

All vehicles

1. Recover the refrigerant.

2.3L and 4.0L vehicles

2. Remove the air cleaner outlet tube.

2.3L vehicles

3. Remove the compressor-to-condenser line fitting nut and disconnect the fitting.

- Discard the O-ring seal.

- To install, tighten to 8 Nm (71 lb-in).

All vehicles

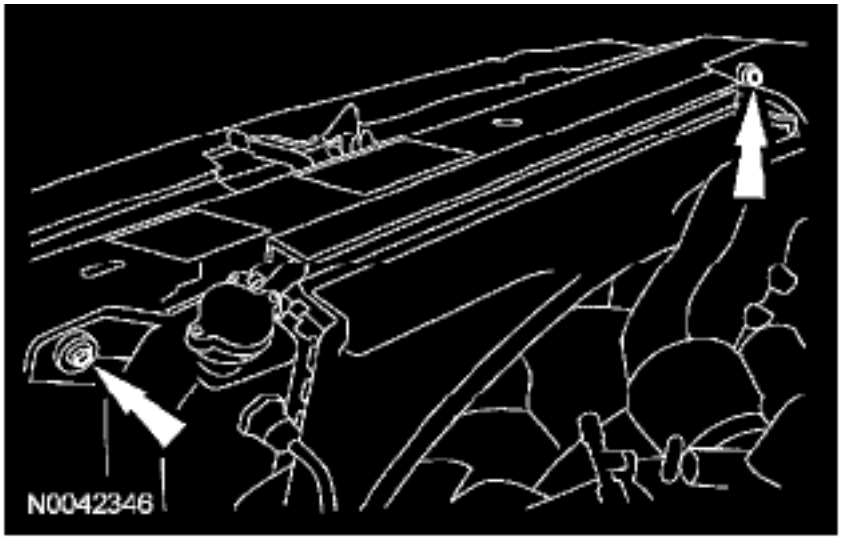
4. Remove the condenser outlet fitting nut and disconnect the fitting.

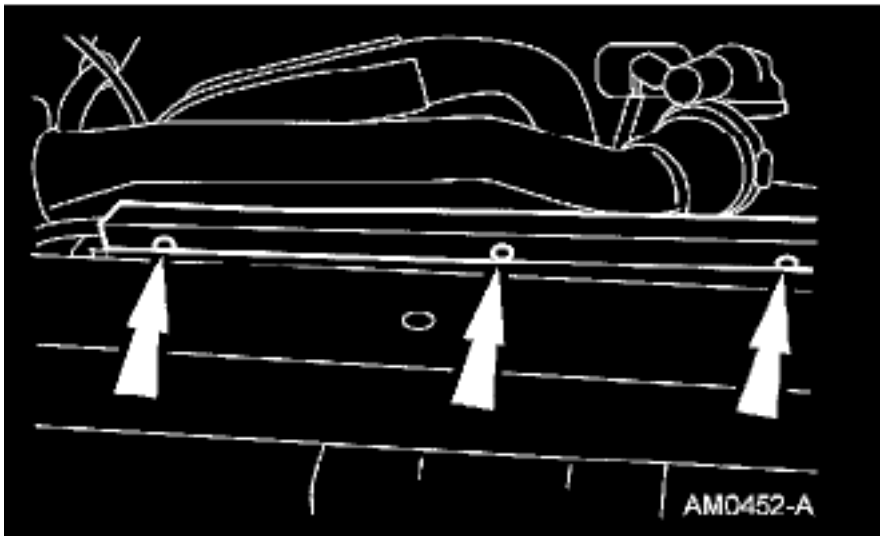
- Discard the O-ring seal.

- To install, tighten to 8 Nm (71 lb-in).

5. Remove the condenser inlet fitting nut and disconnect the fitting.

- Discard the O-ring seal.





- To install, tighten to 8 Nm (71 lb-in).

6. Remove the 2 radiator bolts and tilt the radiator rearward.

- To install, tighten to 7 Nm (62 lb-in).

7. Remove the pin-type retainers and remove the top seal.

8. NOTE: It may be necessary to remove the radiator from the mounting saddles to provide clearance for the condenser core removal.

Remove the 2 condenser core bolts and the condenser core. -

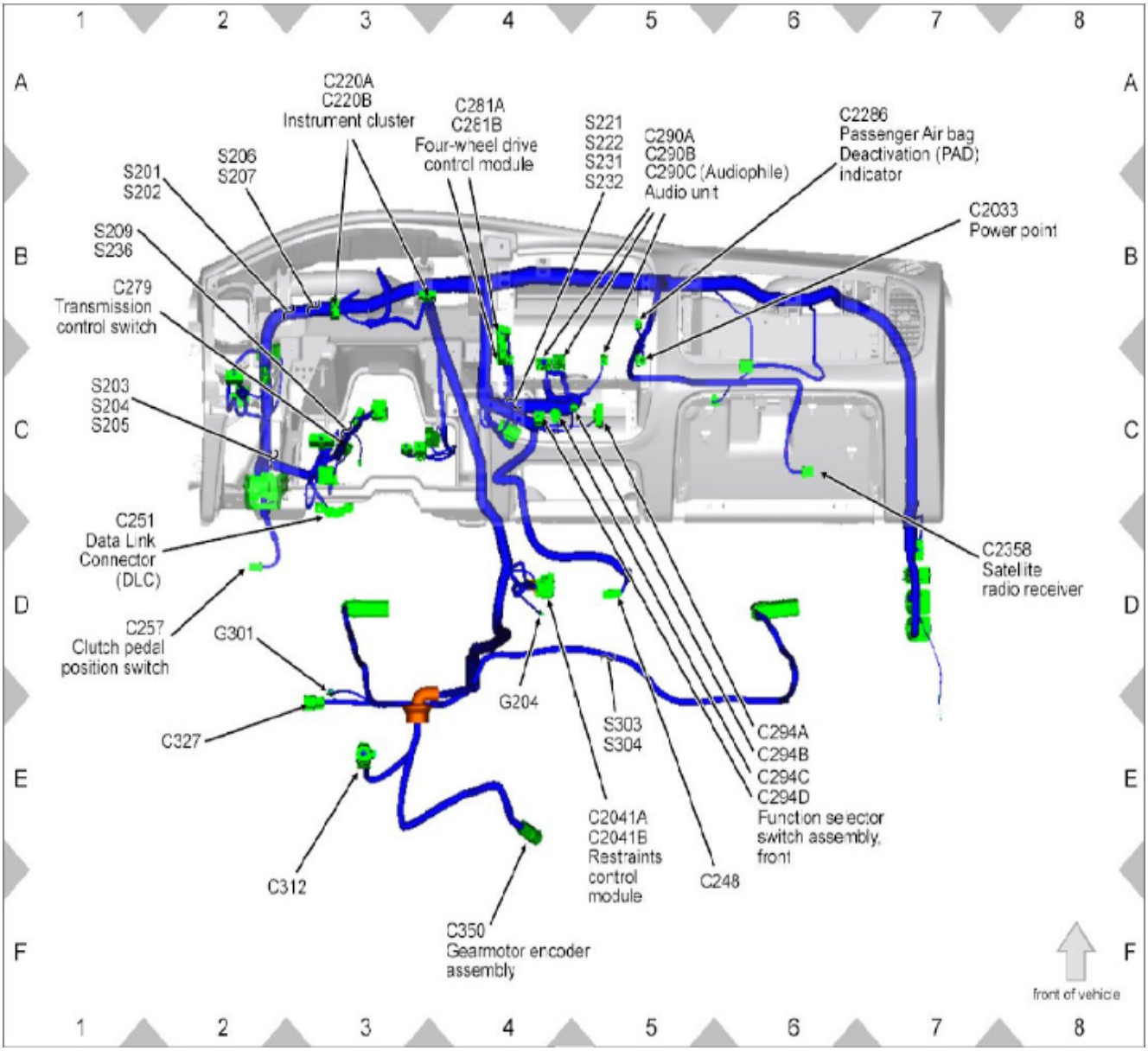
To install, tighten to 12 Nm (9 lb-ft).

9. To install, reverse the removal procedure.

- Install new O-ring seals.

- Lubricate the refrigerant system with the correct amount of clean PAG oil.

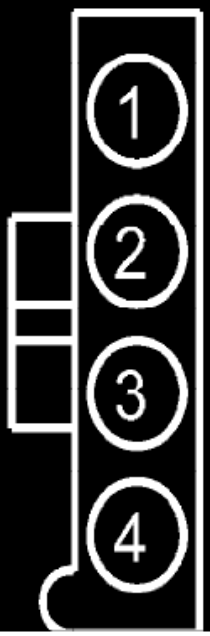
10. Evacuate, leak test and charge the refrigerant system.


1
2
3
4
5
6
7
8
A
B
C
D
E
F
C220A
C220B
Instrument cluster
C281A
C281B
Four-wheel drive
control module
S221
S222
S231
S232
C290A
C290B
C290C (Audiophile)
Audio unit
C2286
Passenger Air bag
Deactivation (PAD)
indicator
C2033
Power point
S206
S207
S201
S202
S209
S236
C279
Transmission
control switch
S203
S204
S205
C251
Data Link
Connector
(DLC)
C257
Clutch pedal
position switch
G301
C327
C312
G204
S303
S304
C294A
C294B
C294C
C294D
Function selector
switch assembly,
front
C2041A
C2041B
Restraints
control
module
C248
C350
Gearmotor encoder
assembly
C2358
Satellite
radio receiver
front of vehicle

View 151-12

Connector: C294A

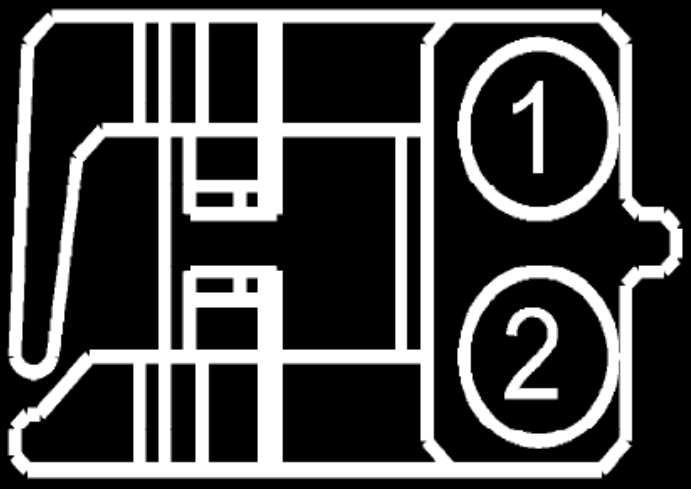
Description:	Harness:	Base Part #:
FUNCTION SELECTOR SWITCH ASSEMBLY, FRONT	14401	19B888



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBP27 (GN-BN)	22	FUSE - 27 OR CIRCUIT BREAKER	
2	CH443 (GN-OG)	22	SWITCH - CLIMATE MODE # DEFROST MODES	
3	CBP27 (GN-BN)	22	FUSE - 27 OR CIRCUIT BREAKER	
4	CH435 (VT-GY)	22	SWITCH - CLIMATE MODE # BLOWER	

Connector: C294B

Description:	Harness:	Base Part #:
FUNCTION SELECTOR SWITCH ASSEMBLY, FRONT	14401	19B888



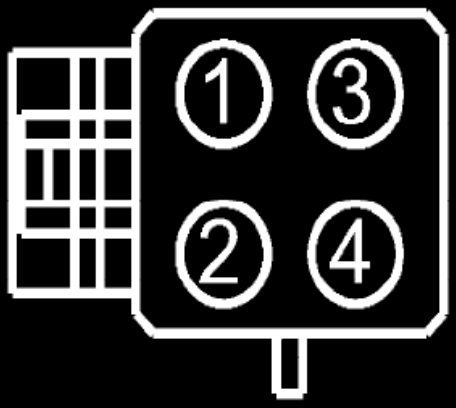
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VLN16 (BU-WH)	22	DIMMER - IP/SWITCH ILLUMINATION	
2	GD161 (BK-YE)	22	GROUND - SEAT BRACKET REAR LEFT	

Control Assembly: Diagrams

C294A

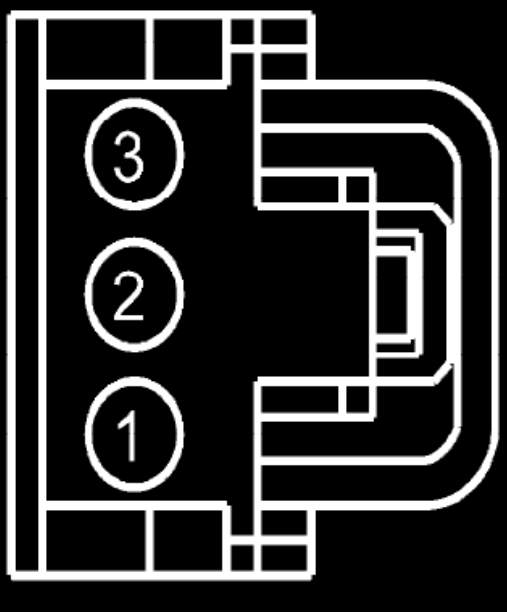
C294B

Connector: C294C	Description:	Harness:	Base Part #:
	FUNCTION SELECTOR SWITCH ASSEMBLY, FRONT	14401	19B888



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD121 (BK-YE)	10	GROUND - FENDER FRONT LEFT # 2ND STUD	
2	CH430 (VT-OG)	10	SWITCH - FRONT BLOWER # POSITION 4 (HIGH)	
3	CH429 (GY-RN)	16	SWITCH - FRONT BLOWER # POSITION 3 (MEDIUM HIGH)	
4	CH428 (GN-WH)	16	SWITCH - FRONT BLOWER # POSITION 2 (MEDIUM LOW)	

Connector: C294D	Description:	Harness:	Base Part #:
	FUNCTION SELECTOR SWITCH ASSEMBLY, FRONT	14401	19B888



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CH449 (BU-OG)	22	SWITCH - DOOR TEMPERATURE	
2	VH450 (BN-WH)	22	SWITCH - DOOR TEMPERATURE CONTROL	
3	RH449 (GY-OG)	22	SWITCH - DOOR TEMPERATURE	

C294C

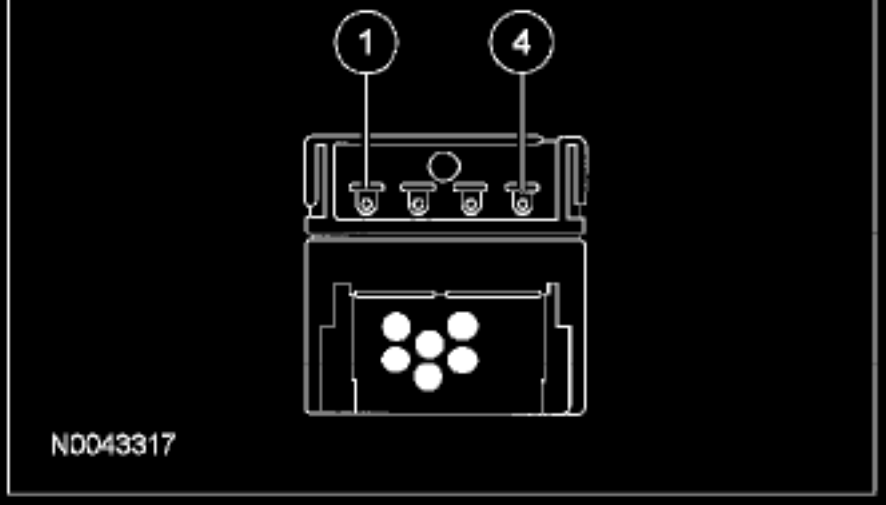
C294D

Control Assembly: Description and Operation

FUNCTION SELECTOR SWITCH

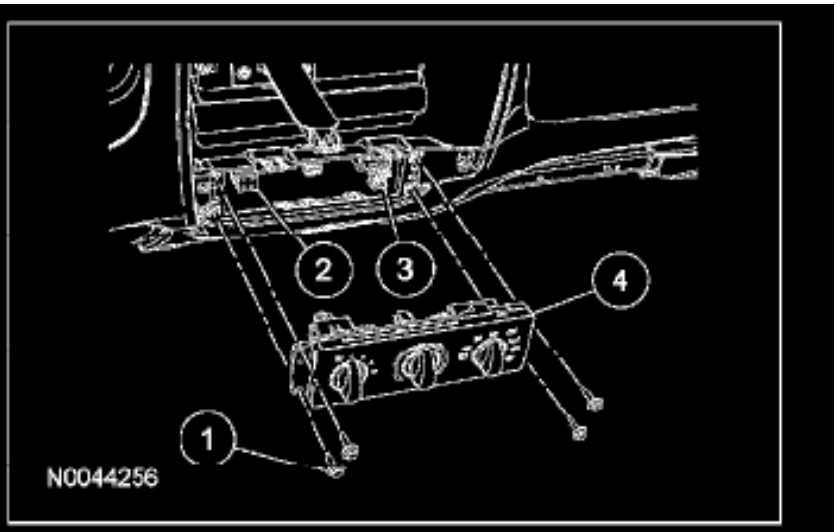
The function selector switch combines a vacuum selector valve with 2 electrical switches to supply battery voltage (B+) to the A/C clutch circuit and the blower motor speed control circuit.

Switch — Function Selector

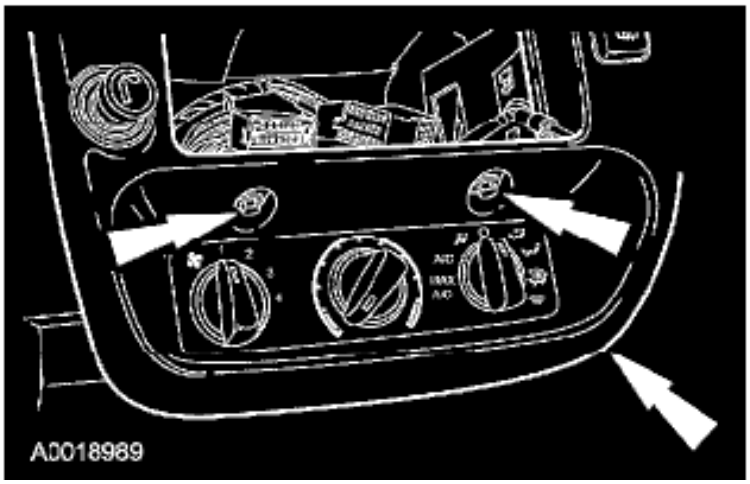


Switch Position	Continuity Between Pins
OFF	none
ANY EXCEPT OFF	3 and 4
A/C, MAX A/C, DEFROST and FLOOR/DEFROST	1 and 2

Switch - Function Selector



Item	Part Number	Description
1	—	Climate control assembly screw (4 required)
2	—	Climate control assembly electrical connector (part of 14401)
3	—	Climate control assembly vacuum connector (part of 19D699)
4	18549	Climate control assembly



Control Assembly: Service and Repair Climate Control Assembly

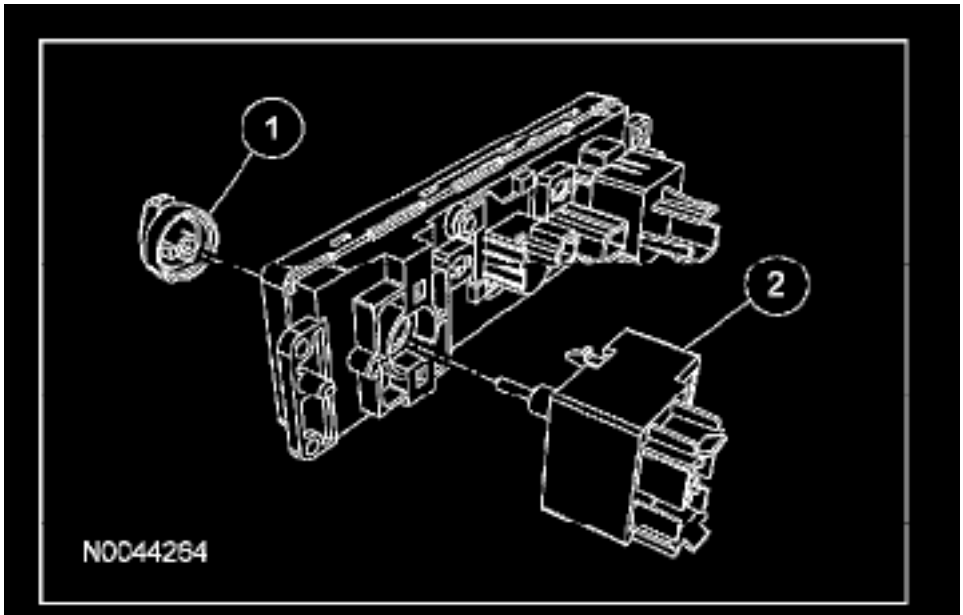
CLIMATE CONTROL ASSEMBLY

Removal and Installation

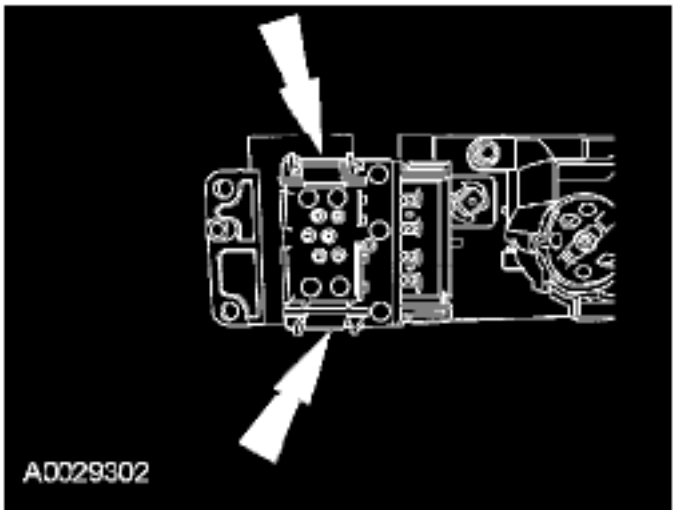
1. Remove the audio unit. 2. Remove the 2 screws and the instrument panel center finish panel.

- Disconnect the electrical connector.

3. Remove the 4 climate control assembly screws. 4. Disconnect the climate control assembly electrical connectors and vacuum connector. 5. Remove the climate control assembly. 6. To install, reverse the removal procedure.



Item	Part Number	Description
1	18519	Function selector switch knob
2	19B888	Function selector switch



Control Assembly: Service and Repair Function Selector Switch

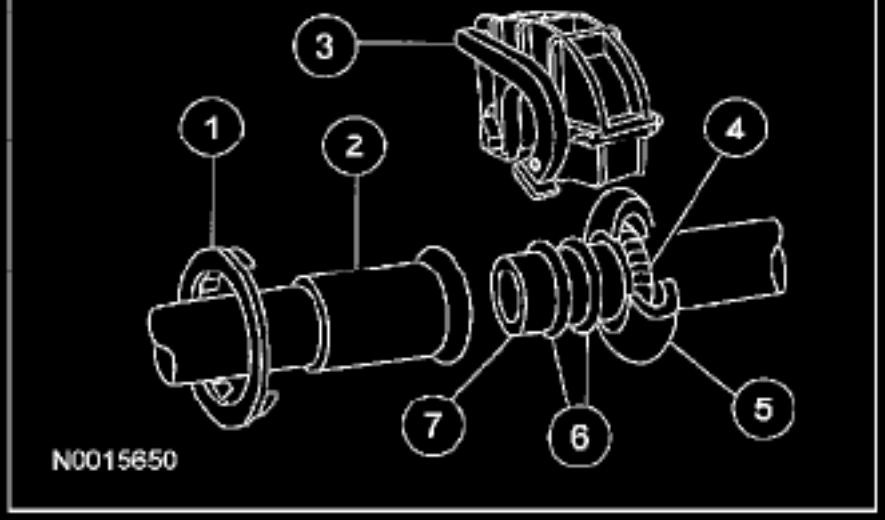
FUNCTION SELECTOR SWITCH

Removal and Installation

1. Remove the climate control assembly. 2. Gently pull and remove the function selector switch knob. 3. Release the clips and remove the function selector switch.

4. To install, reverse the removal procedure.

Spring Lock Coupling



Item	Part Number	Description
1	—	Plastic indicator ring
2	—	Female fitting
3	19E746	A/C tube lock coupling clip
4	19E576	A/C tube lock coupling spring
5	—	Cage
6	19E889	O-ring seals (3 required)
7	—	Male fitting

Coupler HVAC: Description and Operation

Spring Lock Coupling

Spring Lock Coupling

When disconnecting or connecting spring lock couplings, observe the following. -

When the coupling is connected together, the flared end of the female fitting slips behind the garter spring inside the cage of the male fitting.

- The garter spring and cage then prevent the flared end of the female fitting from pulling out of the cage.

- Three O-ring seals are used to seal between the 2 halves of the couplings.

- Use only the O-ring seals listed in the Ford Master Parts Catalog for the spring lock coupling.

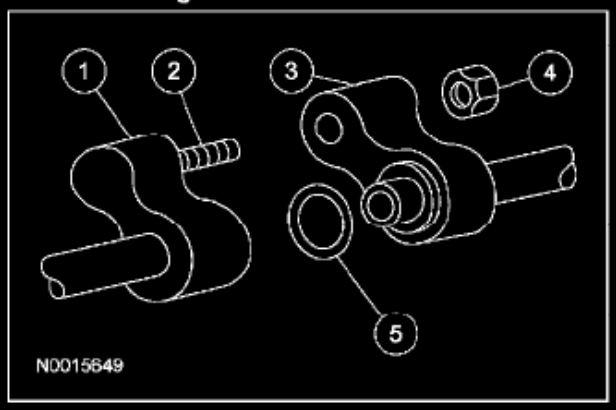
- A plastic indicator ring is used to indicate, during vehicle assembly, that the coupling is connected. Once the coupling is connected, the indicator ring is no longer necessary but will remain captive by the coupling near the cage opening.

- The indicator ring may also be used during service operations to indicate connection of the coupling.

- An A/C tube lock coupling clip is used to secure the coupling and is required.

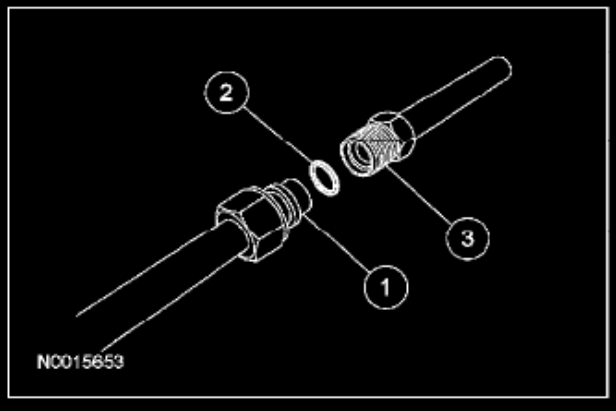
Peanut Fitting

Peanut Fitting



Item	Part Number	Description
1	—	Female block
2	W701890-S426	Stud (part of female block)
3	—	Male block
4	W520413-S301	Nut
5	19E889	O-ring seal

Tube-O Fitting



Item	Part Number	Description
1	—	Male fitting
2	19E889	O-ring seal
3	—	Female fitting

Peanut Fitting

When disconnecting or connecting peanut fittings, observe the following. -

The male and female blocks of the peanut fitting are retained with a nut.

- Support the female fitting with a wrench to prevent twisting of the tubes.

- An O-ring seal is installed around the tube on the male block.

- When correctly assembled, the male and female fittings should be flush.

- Use only the O-ring seal listed in the Ford Master Parts Catalog.

Tube-O Fitting

Tube-O Fitting

When disconnecting or connecting tube-O fittings, observe the following. -

The male and female portions of the fitting are retained with a nut.

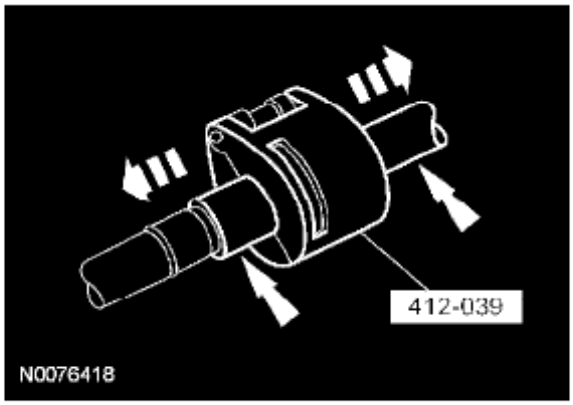
- Support the female fitting with a wrench to prevent twisting of the tubes when disconnecting.

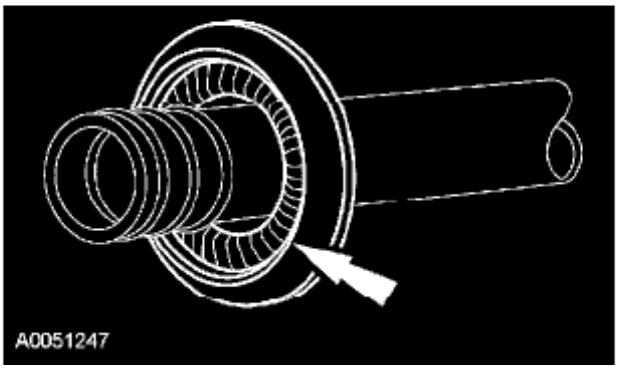
- An O-ring seal is installed around the tube on the male side of the fitting.

- Use only the O-ring seal listed in the Ford Master Parts Catalog.

Special Tool(s)

Remover, Refrigerant Coupling Spring
412-039 (T84L-19623-B)





Coupler HVAC: Service and Repair Spring Lock Coupling

SPRING LOCK COUPLING

Special Tool(s)

Special Tool(s)

Disconnect

1. Remove the spring lock coupling clip, if equipped.

2. CAUTION: Do not use metal tools to remove the O-ring seals. They may cause axial scratches across the O-ring seal grooves, resulting in

refrigerant leaks.

Push the Refrigerant Coupling Spring Remover into the cage opening to release the female fitting from the spring lock coupling spring and pull the fitting apart. -

Remove the O-ring seals using a non-metallic tool.

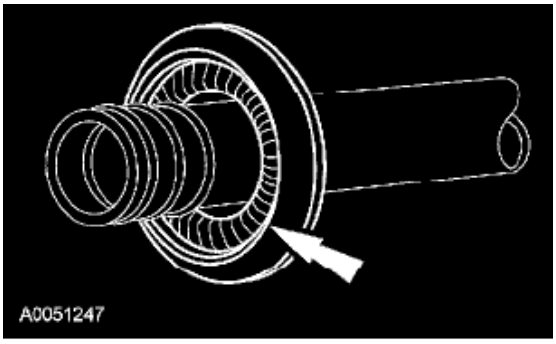
3. CAUTION: Do not use a screwdriver or similar tool to remove the air conditioning (A/C) tube lock coupling spring; this may cause axial

scratches across the O-ring seal grooves resulting in refrigerant leaks.

Remove the spring lock coupling spring with a small hooked wire.

Connect

1. Install the spring lock coupling spring.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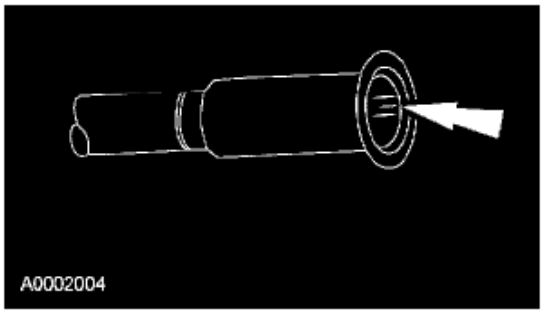
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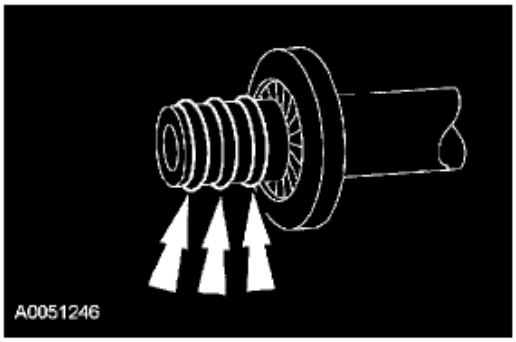
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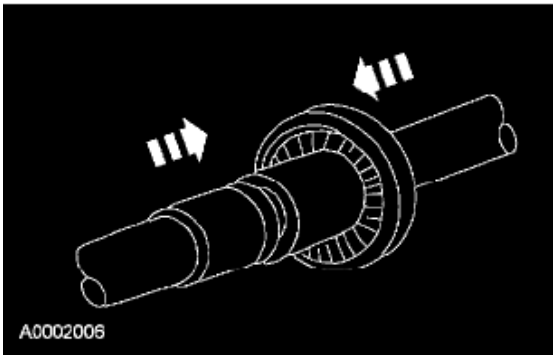

A0002006

2. Lubricate the inside of the coupling with PAG oil.

3. CAUTION: Use only the new O-ring seals. The use of any O-ring seals other than those specified in the Ford Master Parts Catalog may

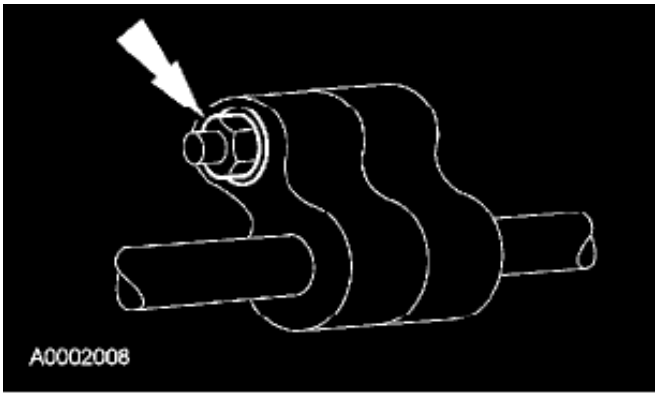
result in intermittent leakage during vehicle operation.

Install the O-ring seals.

4. Connect the spring lock coupling fittings with a twisting motion until the spring lock coupling spring snaps over the flared end of the female

fitting.

5. Install the spring lock coupling clip.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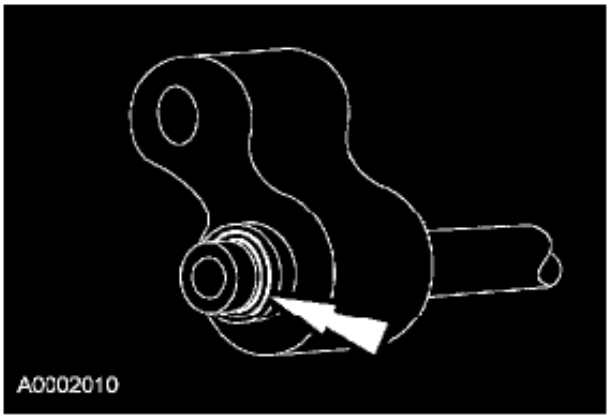
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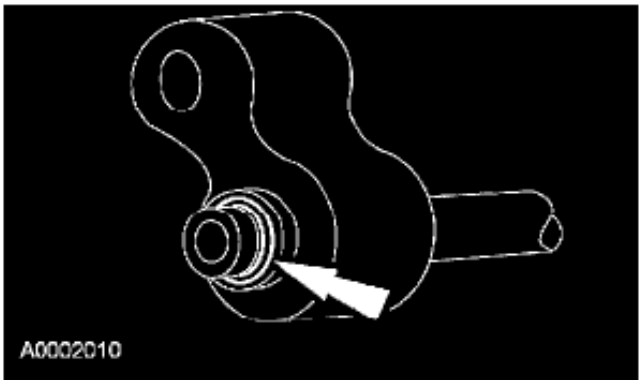

A0002010

Coupler HVAC: Service and Repair Air Conditioning Line (Peanut) Fitting

AIR CONDITIONING LINE (PEANUT) FITTING

Disconnect

1. CAUTION: Support the female fitting with a wrench to prevent the tubes from twisting.

Remove the nut and separate the 2 halves of the peanut fitting.

2. CAUTION: Do not use metal tools to remove the O-ring seal. They can cause axial scratches across the O-ring seal groove, resulting in

refrigerant leaks.

Remove the O-ring seal with a non-metallic tool.

Connect

1. Clean all dirt or foreign material from the fittings.

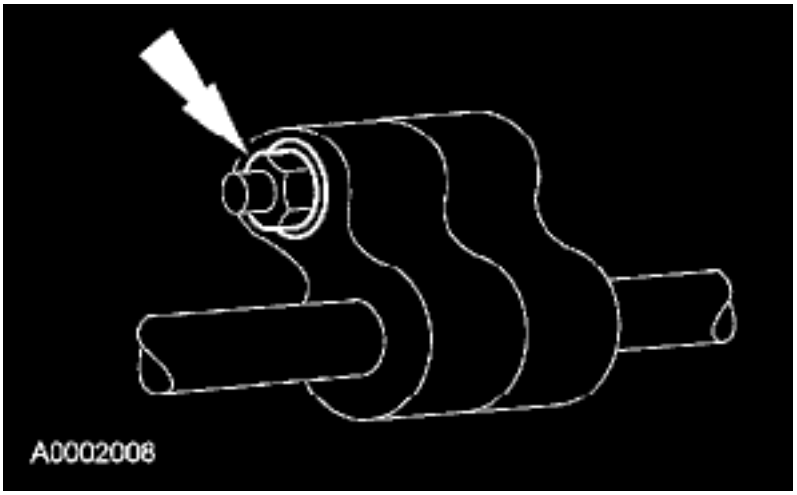
2. CAUTION: Use only the new O-ring seals. The use of any O-ring seals other than those specified in the Ford Master Parts Catalog may

result in intermittent leakage during vehicle operation.

Install the O-ring seal.

3. NOTE: When correctly assembled, the male and female fittings should be flush.

Assemble the male and female fittings together.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Evaporator Core: Description and Operation

EVAPORATOR CORE

NOTE:

- The evaporator core is not separately serviceable. It is serviced only with the evaporator core housing assembly.

- Installation of a new suction accumulator is not required when repairing the air conditioning system except when there is physical evidence of system contamination from a failed A/C compressor or damage to the suction accumulator.

The evaporator core is the plate/fin type.

- A mixture of refrigerant and oil enters the bottom of the evaporator core through the evaporator core inlet tube and then moves out of the evaporator core through the evaporator core outlet tube.

- All airflow from the blower motor passes through the evaporator core and, during A/C operation, is cooled and dehumidified.

- The evaporator core is located in the evaporator core housing at the RH rear of the engine compartment.

Evaporator Core: Testing and Inspection

EVAPORATOR/CONDENSER CORE - ON-VEHICLE LEAK TEST

1. Discharge and recover the refrigerant. Refer to Air Conditioning (A/C) System Recovery, Evacuation and Charging. 2. Disconnect the suspect evaporator core or condenser core from the A/C system. 3. Clean the manifold fittings. 4. Connect the appropriate test fittings from the A/C Fittings Set to the condenser or evaporator core tube connections.

5. NOTE: The automatic shut-off valves on some gauge set hoses do not open when connected to the test fittings. If available, use hoses without

shut-off valves. If hoses with shut-off valves are used, make sure the valve opens when attached to the test fittings or install an adapter that will activate the valve. The test is not valid if the shut-off valve does not open.

Connect the red and blue hoses from the R-134a Manifold Gauge Set to the test fittings on the evaporator core or condenser core. Connect the yellow hose to a known good vacuum pump.

6. Open both gauge set valves and start the vacuum pump. Allow the vacuum pump to operate for a minimum of 45 minutes after the gauge set

low-pressure gauge indicates 101 kPa (30 in-Hg). The 45-minute evacuation is necessary to remove any refrigerant from oil left in the evaporator core or condenser core. If the refrigerant is not completely removed from the oil, outgassing will degrade the vacuum and appear as a refrigerant leak.

7. If the low-pressure gauge reading will not drop to 101 kPa (30 in-Hg) when the valves on the gauge and manifold set are open and the vacuum

pump is operating, close the gauge set valves and observe the low pressure gauge. If the pressure rises rapidly to zero, a large leak is indicated. Recheck the test fitting connections and gauge set connections before installing a new evaporator core or condenser core.

8. After evacuating for 45 minutes, close the gauge set valves and stop the vacuum pump. Observe the low-pressure gauge; it should remain at the

101 kPa (30 in-Hg) mark. -

If the low-pressure gauge reading rises 34 or more kPa (10 or more in-Hg) of vacuum from the 101 kPa (30 in-Hg) position in 10 minutes, a leak is indicated.

- If a very small leak is suspected, wait 30 minutes and observe the vacuum gauge.

- If a small amount of vacuum is lost, operate the vacuum pump with gauge valves open for an additional 30 minutes to remove any remaining refrigerant from the oil in the evaporator core or condenser core. Then recheck for loss of vacuum.

- If a very small leak is suspected, allow the system to sit overnight with vacuum applied and check for vacuum loss.

9. If the evaporator core or condenser core does leak, as verified by the above procedure, install a new evaporator core or condenser core.

Evaporator Core: Service and Repair

EVAPORATOR CORE

Removal and Installation

NOTE:

- The evaporator core is not separately serviceable, it is serviced only with the evaporator core housing assembly.

- Replacement of the suction accumulator is not required when repairing the refrigerant system except when there is physical evidence of system contamination from a failed A/C compressor or damage to the suction accumulator.

- If an evaporator core leak is suspected, the evaporator core must be leak tested before it is removed from the vehicle.

1. Remove the evaporator core housing. 2. Transfer the components from the old evaporator core housing to the new evaporator core housing. 3. Install the evaporator core housing.

A/C EVAPORATOR TEMPERATURE (ACET) SENSOR VOLTAGE AND RESISTANCE

°C	°F	Volts	Resistance (K ohms)
100	212	0.47	2.08
90	194	0.61	2.80
80	176	0.80	3.84
70	158	1.05	5.34
60	140	1.37	7.55
50	122	1.77	10.93
40	104	2.23	16.11
30	86	2.74	24.25
20	68	3.26	37.34
10	50	3.73	58.99
0	32	4.14	95.85
-10	14	4.45	160.31
-20	-4	4.66	276.96

Evaporator Temperature Sensor / Switch: Description and Operation

AIR CONDITIONING EVAPORATOR TEMPERATURE (ACET) SENSOR

A/C Evaporator Temperature (ACET) Sensor Voltage And Resistance

The ACET sensor measures the evaporator air discharge temperature. The ACET sensor is a thermistor device in which resistance changes with temperature. The electrical resistance of a thermistor decreases as the temperature increases, and the resistance increases as the temperature decreases. The PCM sources a low current 5 volts on the ACET circuit. With SIG RTN also connected to the ACET sensor, the varying resistance changes the voltage drop across the sensor terminals. As A/C evaporator air temperature changes, the varying resistance of the ACET sensor changes the voltage the PCM detects.

The ACET sensor is used to more accurately control A/C clutch cycling, improve defrost/demist performance, and reduce A/C clutch cycling.

NOTE: These values can vary 15% due to sensor and VREF variations. Voltage values were calculated for VREF equals 5.0 volts.

Expansion Block/Orifice Tube: Description and Operation

A/C EVAPORATOR CORE ORIFICE

NOTE: A new A/C evaporator core orifice should be installed whenever a new A/C compressor is installed.

The A/C evaporator core orifice has the following characteristics:

- It is located in the evaporator core inlet tube

- It has filter screens located on the inlet and outlet ends of the tube body

- The inlet filter screen acts as a strainer for the liquid refrigerant flowing through the A/C evaporator core orifice

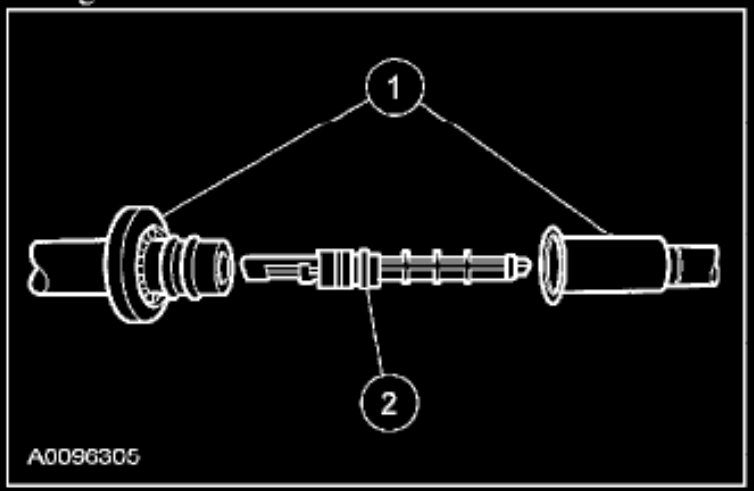
- O-ring seals on the A/C evaporator core orifice prevent the high-pressure liquid refrigerant from bypassing the A/C evaporator core orifice

- The A/C evaporator core orifice assembly cannot be adjusted or serviced. It must be installed as a unit

Special Tool(s)

ST1223-A	Remover, Broken Orifice 412-035 (T83L-19990-B)
ST1224-A	Remover/Installer, Fixed Orifice 412-034 (T38L-19990-A)

NOTE: Installation of a new suction accumulator is not required when repairing the air conditioning system, except when there is physical evidence of contamination from a failed A/C compressor or damage to the suction accumulator.



Item	Part Number	Description
1	—	Evaporator inlet fitting (part of 19835)
2	19D990	Evaporator core orifice

Expansion Block/Orifice Tube: Service and Repair

EVAPORATOR CORE ORIFICE

Special Tool(s)

Special Tool(s)

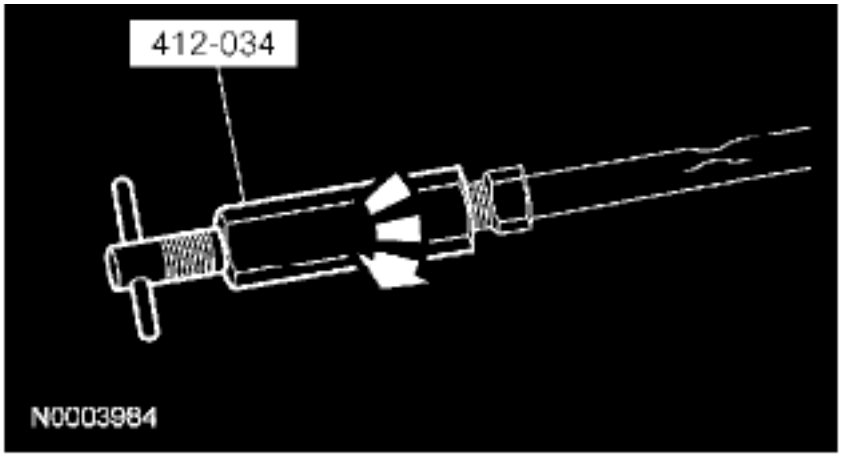
Removal

1. Recover the refrigerant. 2. Disconnect the evaporator inlet fitting.

- Discard the O-ring seals.

3. Inspect the evaporator core orifice for damage before attempting to remove it from the evaporator core inlet line. 4. If the evaporator core orifice is intact, engage the special tool. Hold the T-handle stationary while rotating the tool body to remove the evaporator

core orifice.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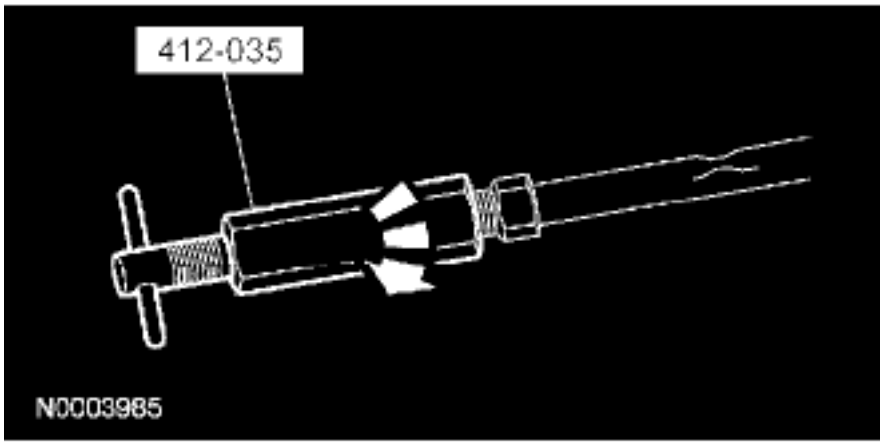
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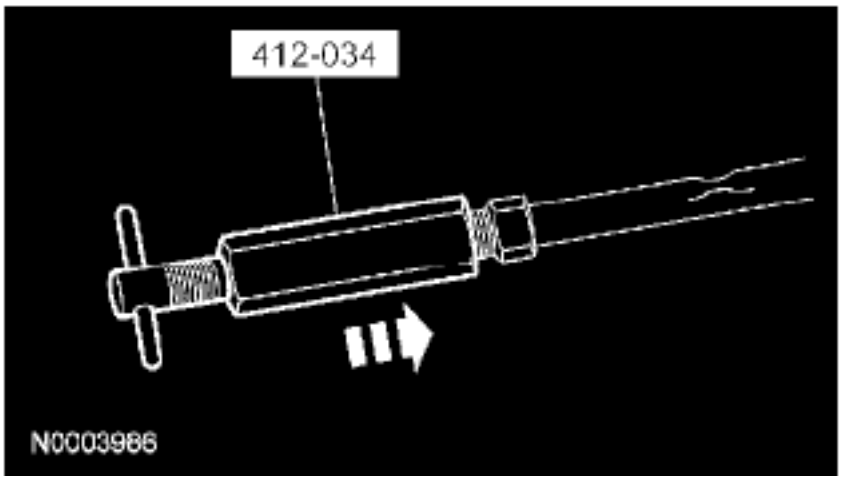

412-034
N0003986

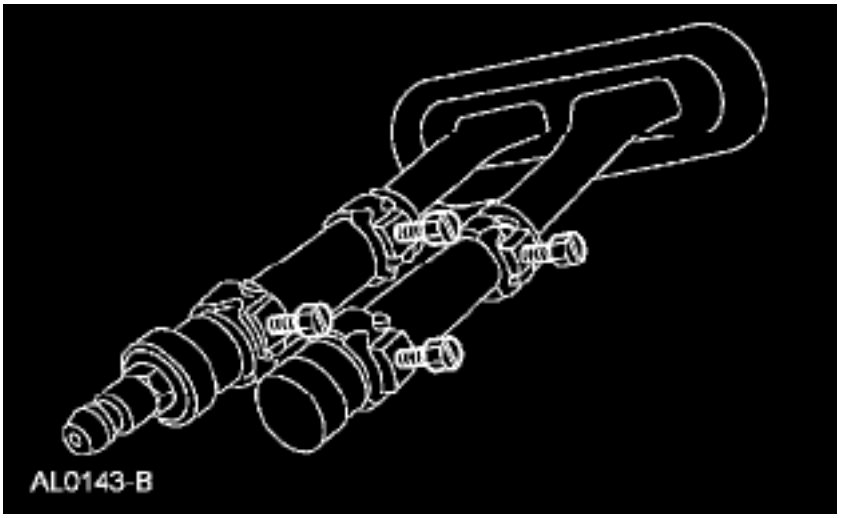
5. If the evaporator core orifice is broken, screw the end of the special tool into the broken orifice. Hold the T-handle stationary while rotating the

tool body to remove the evaporator core orifice.

Installation

1. Lubricate the evaporator core orifice O-ring seals with clean PAG oil and install the evaporator core orifice using the special tool.

2. Install new O-ring seals and connect the evaporator inlet fitting. 3. Evacuate, leak test and charge the refrigerant system.



Heater Core: Testing and Inspection

HEATER CORE

1. NOTE: Testing of returned heater cores reveals that a large percentage of heater cores are good and did not require the installation of a new

heater core. If a heater core leak is suspected, the heater core must be tested by following the plugged heater core component test before the heater core pressure test. Carry out a system inspection by checking the heater system thoroughly as follows:

Inspect for evidence of coolant leakage at the heater hose-to-heater core attachments. A coolant leak in the heater hose could follow the heater core tube to the heater core and appear as a leak in the heater core.

2. NOTE: Spring-type clamps are installed as original equipment. Installation and overtightening of non-specified clamps can cause leakage at the

heater hose connection and damage the heater core.

Check the integrity of the heater hose clamps.

Heater Core - Plugged

WARNING: Before disconnecting any heater water hoses, shut OFF the engine and wait until engine is fully cool. Failure to comply with this warning may result in serious injury or burns from hot liquid escaping from the engine cooling system.

1. Check to see that the engine coolant is at the correct level. 2. Start the engine and turn on the heater. 3. When the engine coolant reaches operating temperature, feel the heater core inlet and outlet hoses to see if they are hot. 4. If the outlet only is not hot:

- the heater core may have an air pocket.

- the heater core may be plugged.

5. If the inlet only is not hot, the thermostat may not be working correctly.

Heater Core - Pressure Test

Use the Pressure Test Kit to carry out the pressure test.

1. NOTE: Due to space limitations, a bench test may be necessary for pressure testing.

Drain the coolant from the cooling system.

2. Disconnect the heater hoses from the heater core. 3. Install a short piece of heater hose, approximately 101 mm (4 in) long on each heater core tube. 4. Fill the heater core and heater hoses with water and install plug BT-7422-B and adapter BT-7422-A from the Pressure Test Kit. Secure the heater

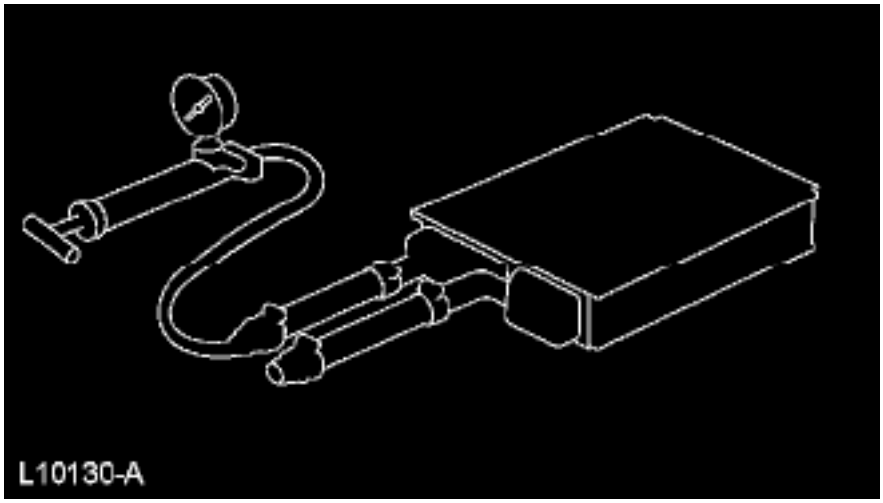
hoses, plug and adapter with hose clamps.

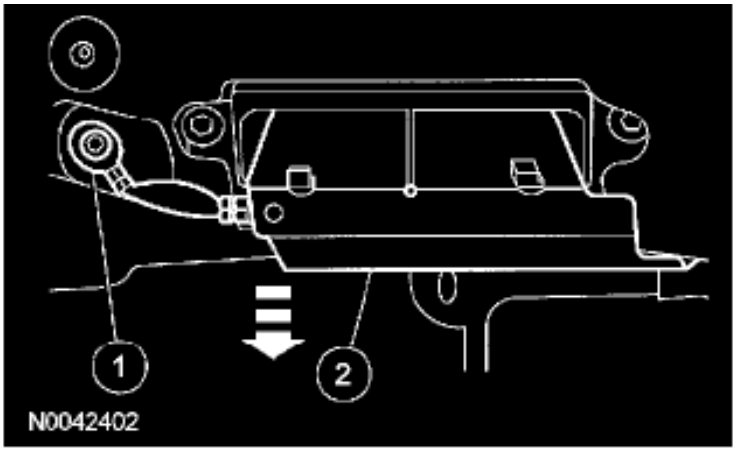
5. Attach the pump and gauge assembly from the Pressure Test Kit to the adapter. 6. Close the bleed valve at the base of the gauge. Pump 138 kPa (20 psi) of air pressure into the heater core. 7. Observe the pressure gauge for a minimum of 3 minutes. 8. If the pressure drops, check the heater hose connections to the core tubes for leaks. If the heater hoses do not leak, remove the heater core from the

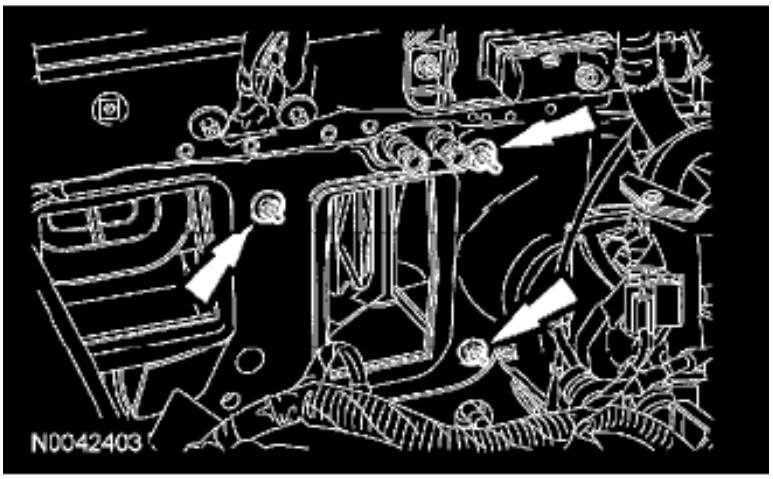
vehicle and carry out the bench test.

Heater Core - Bench Test

1. Remove the heater core from the vehicle. 2. Drain all of the coolant from the heater core. 3. Connect the 101 mm (4 in) test heater hoses with plug and adapter to the core tubes. Then connect the Pressure Test Kit to the adapter. 4. Apply 138 kPa (20 psi) of air pressure to the heater core. Submerge the heater core in water. 5. If a leak is observed, install a new heater core.


L10130-A


1
2
N0042402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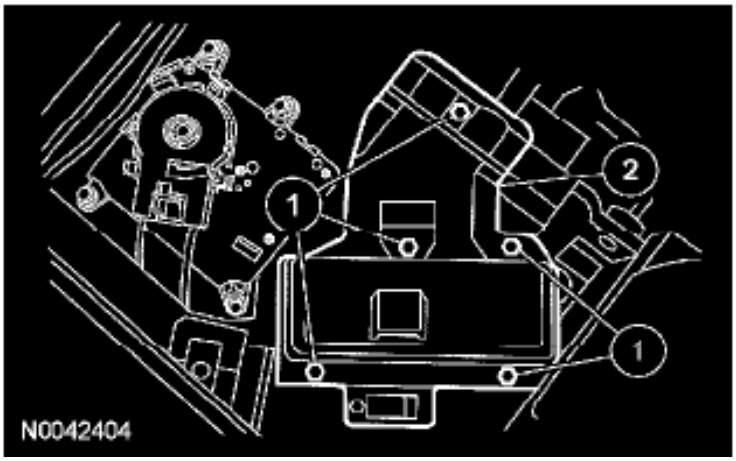

1
2
1
N0042404

Heater Core: Service and Repair

HEATER CORE

Removal and Installation

1. NOTE: If a heater core leak is suspected, the heater core must be leak tested before it is removed from the vehicle.

Remove the evaporator core housing.

2. Remove the instrument panel. 3. Remove the PCM. 4. Remove the PCM heat sink.

1 Remove the ground strap screw.

2 Remove the heat sink.

5. Remove the 4 nuts from the engine side of the dash panel. Position the plenum chamber on the vehicle floor.

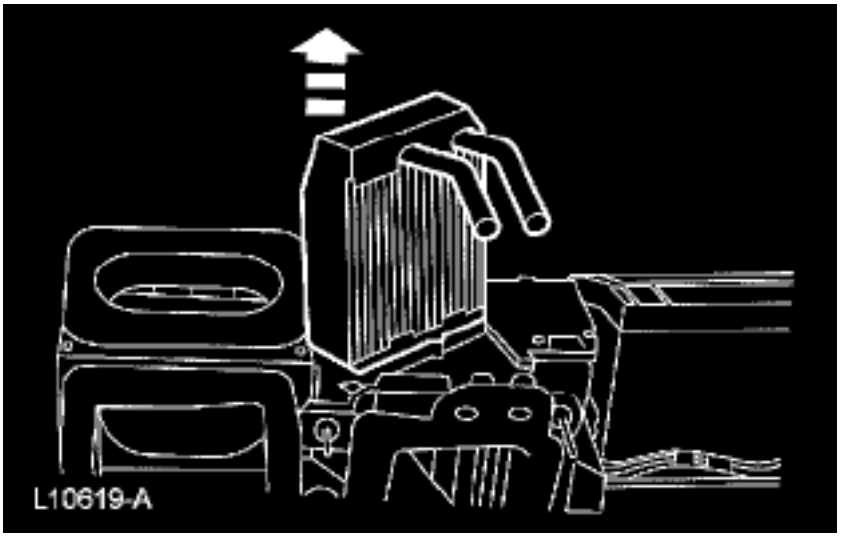
- To install, tighten to 4 Nm (35 lb-in).

6. Remove the heater core cover.

1 Remove the screws.

2 Remove the heater core cover.

7. Remove the heater core.



8. To install, reverse the removal procedure.

- During installation, be sure to install a new oval foam seal around the heater core inlet and outlet tubes.

High Pressure Safety Valve HVAC: Description and Operation

A/C PRESSURE RELIEF VALVE

NOTE: If the A/C compressor is operating within limits and the A/C pressure relief valve is venting, or if the A/C pressure relief valve is leaking around the threads, replace the A/C pressure relief valve and O-ring. If the A/C pressure relief valve still vents after it is replaced, diagnose the refrigerant system for a restriction.

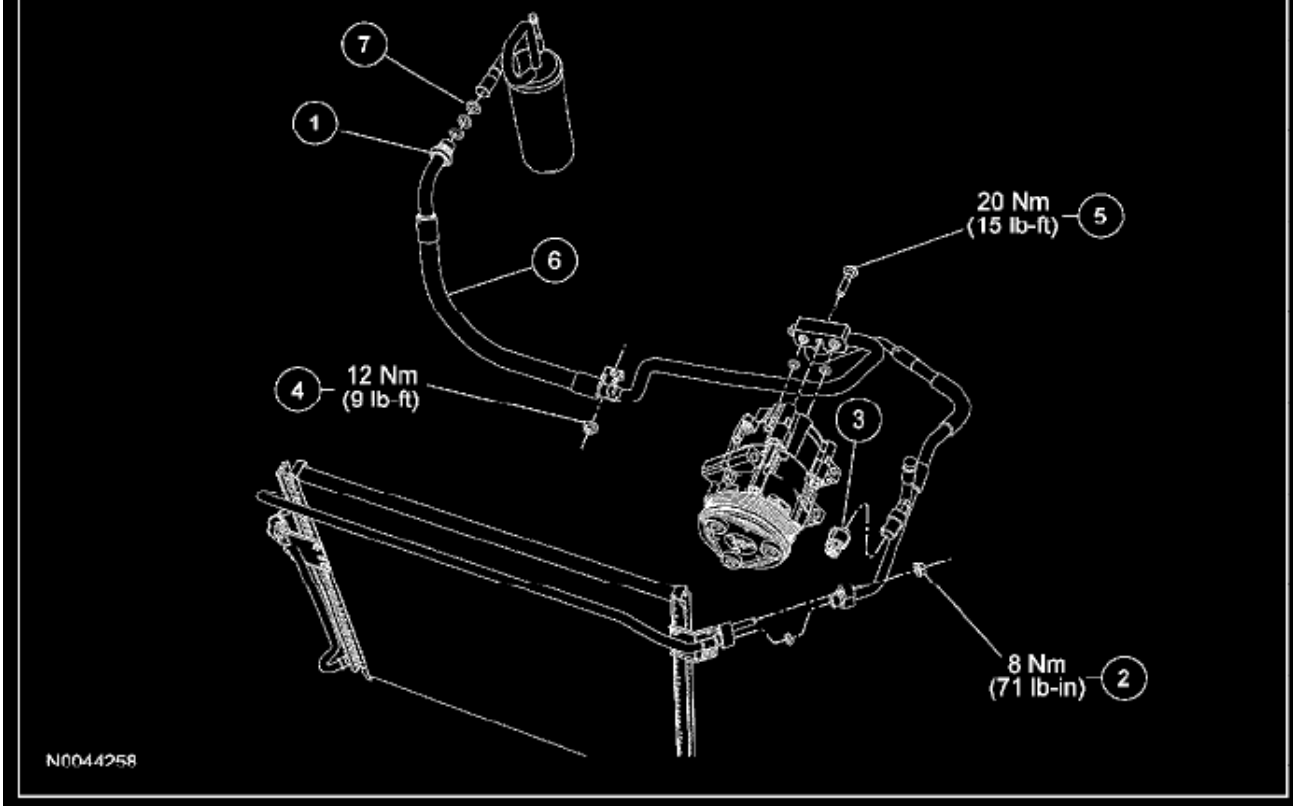
An A/C pressure relief valve is incorporated in the compressor manifold and tube assembly to:

- relieve unusually high refrigerant system discharge pressure buildups. For specifications regarding operating pressure(s), refer to Heating and Air Conditioning.

- prevent damage to the A/C compressor and other system components.

- avoid total refrigerant loss by closing after the excessive pressure has been relieved.

The A/C pressure relief valve is a separate component and can be replaced separately from the A/C compressor manifold and tube assembly. It is necessary to recover the refrigerant before removing the A/C pressure relief valve.



Item	Part Number	Description
1	—	Suction accumulator outlet fitting (part of 19D850)
2	W520413	Condenser inlet fitting nut
3	—	Pressure cutoff switch electrical connector (part of 14A280)
4	N621940	Compressor manifold and tube assembly bracket nut
5	W704692	A/C compressor manifold bolt
6	19D850	Compressor manifold and tube assembly
7	19E889	O-ring seal (6 required)

Hose/Line HVAC: Service and Repair Compressor Manifold and Tube Assembly

COMPRESSOR MANIFOLD AND TUBE ASSEMBLY

Removal and Installation

NOTE: Installation of a new suction accumulator is not required when repairing the air conditioning system, except when there is physical evidence of system contamination from a failed A/C compressor or damage to the suction accumulator.

1. Recover the refrigerant. 2. Disconnect the suction accumulator outlet fitting.

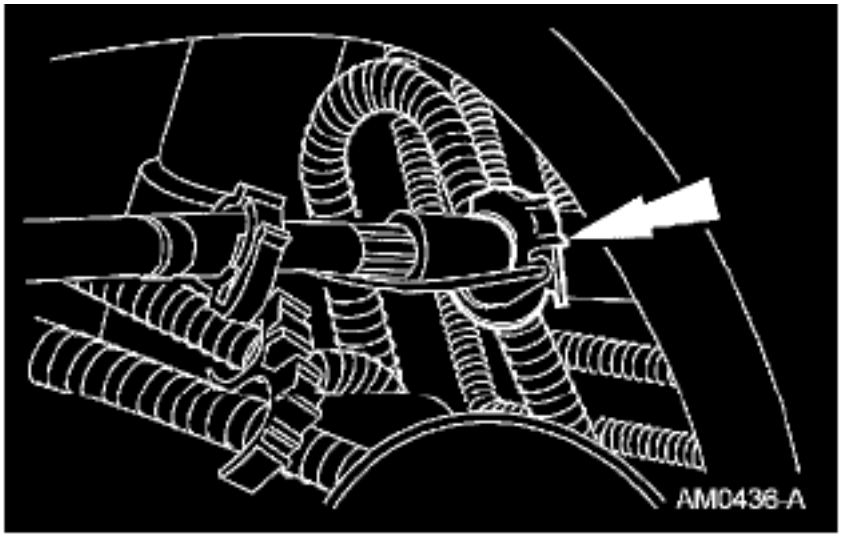
- Discard the O-ring seals.

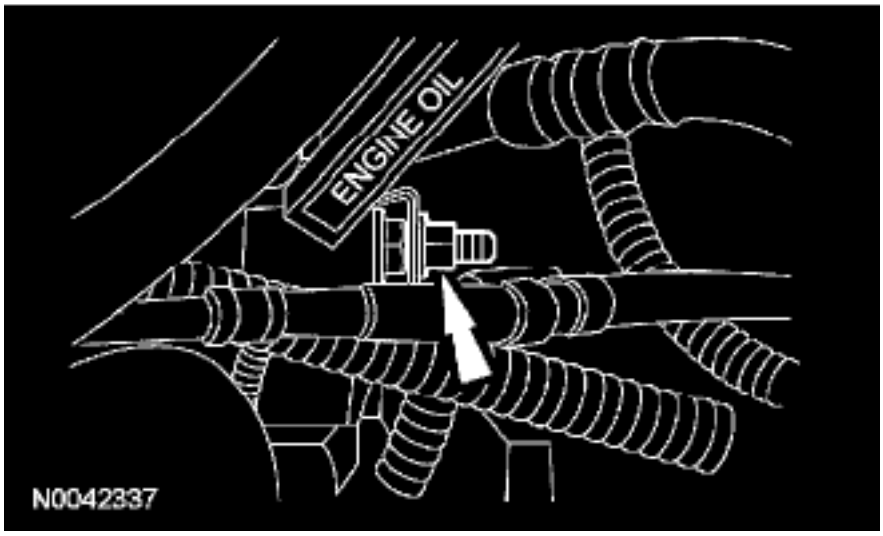
3. Remove the condenser inlet fitting nut and disconnect the fitting.

- Discard the O-ring seal.

- To install, tighten to 8 Nm (71 lb-in).

4. Disconnect the pressure cutoff switch electrical connector. 5. Disconnect the fuel line spring lock coupling.





6. Remove the nut and position the bracket aside.

- To install, tighten to 12 Nm (9 lb-ft).

7. Remove the compressor manifold and tube assembly bracket nut.

- To install, tighten to 12 Nm (9 lb-ft).

8. Loosen the A/C compressor manifold bolt and remove the compressor manifold and tube assembly.

- Discard the O-ring seals.

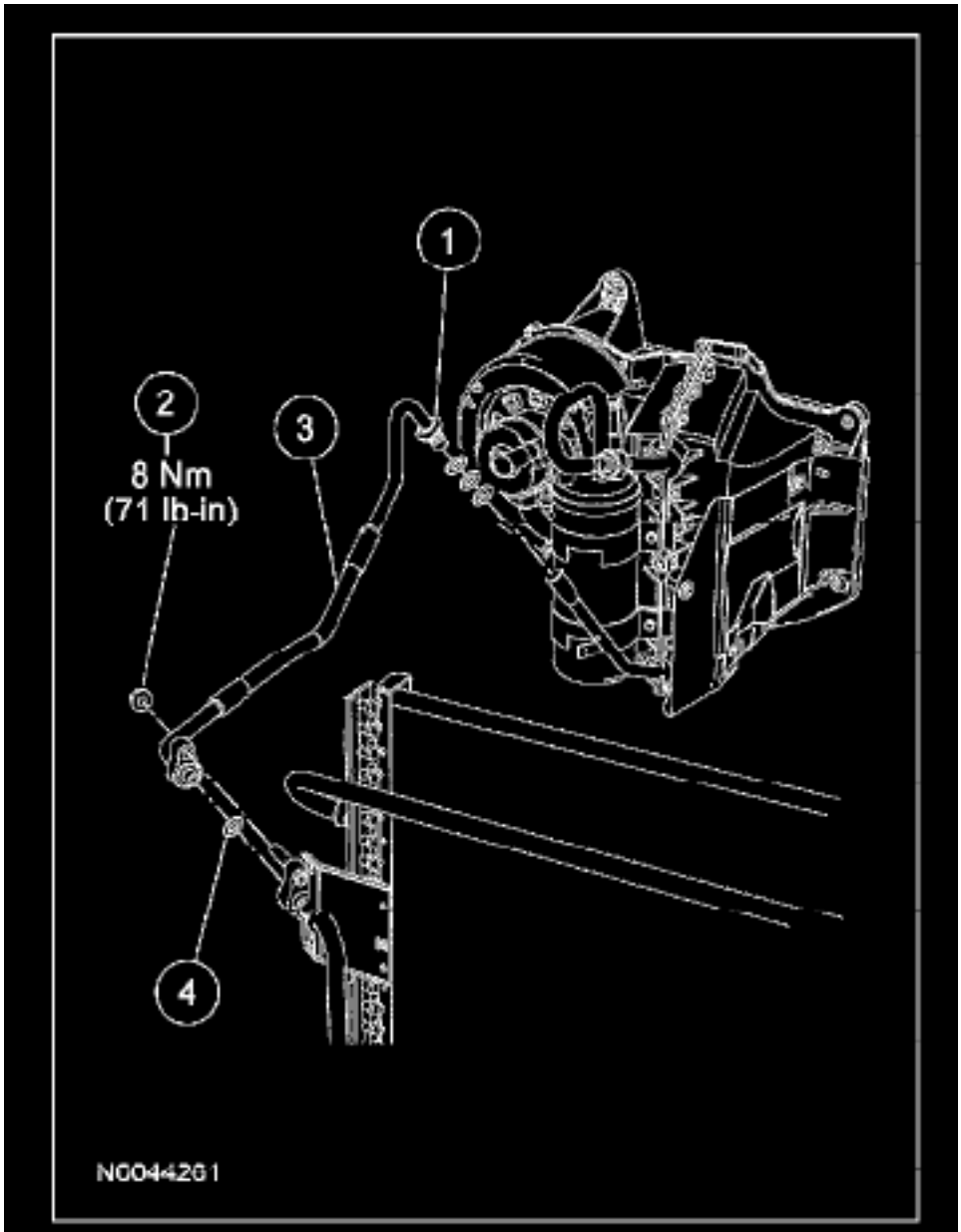
- To install, tighten to 20 Nm (15 lb-ft).

9. To install, reverse the removal procedure.

- Install new O-ring seals.

- Lubricate the refrigerant system with the correct amount of clean PAG oil.

10. Evacuate, leak test and charge the refrigerant system.



Item	Part Number	Description
1	—	Evaporator inlet fitting (part of 19835)
2	W520413	Condenser outlet fitting nut
3	19835	Condenser-to-evaporator line
4	19F889	O-ring seal (4 required)

Hose/Line HVAC: Service and Repair Condenser to Evaporator Line

CONDENSER TO EVAPORATOR LINE

Removal and Installation

NOTE: Installation of a new suction accumulator is not required when repairing the air conditioning system, except when there is physical evidence of system contamination from a failed A/C compressor or damage to the suction accumulator.

1. Recover the refrigerant. 2. Disconnect the evaporator inlet fitting.

- Discard the O-ring seals.

3. Remove the condenser outlet fitting nut and disconnect the fitting.

- Discard the O-ring seal.

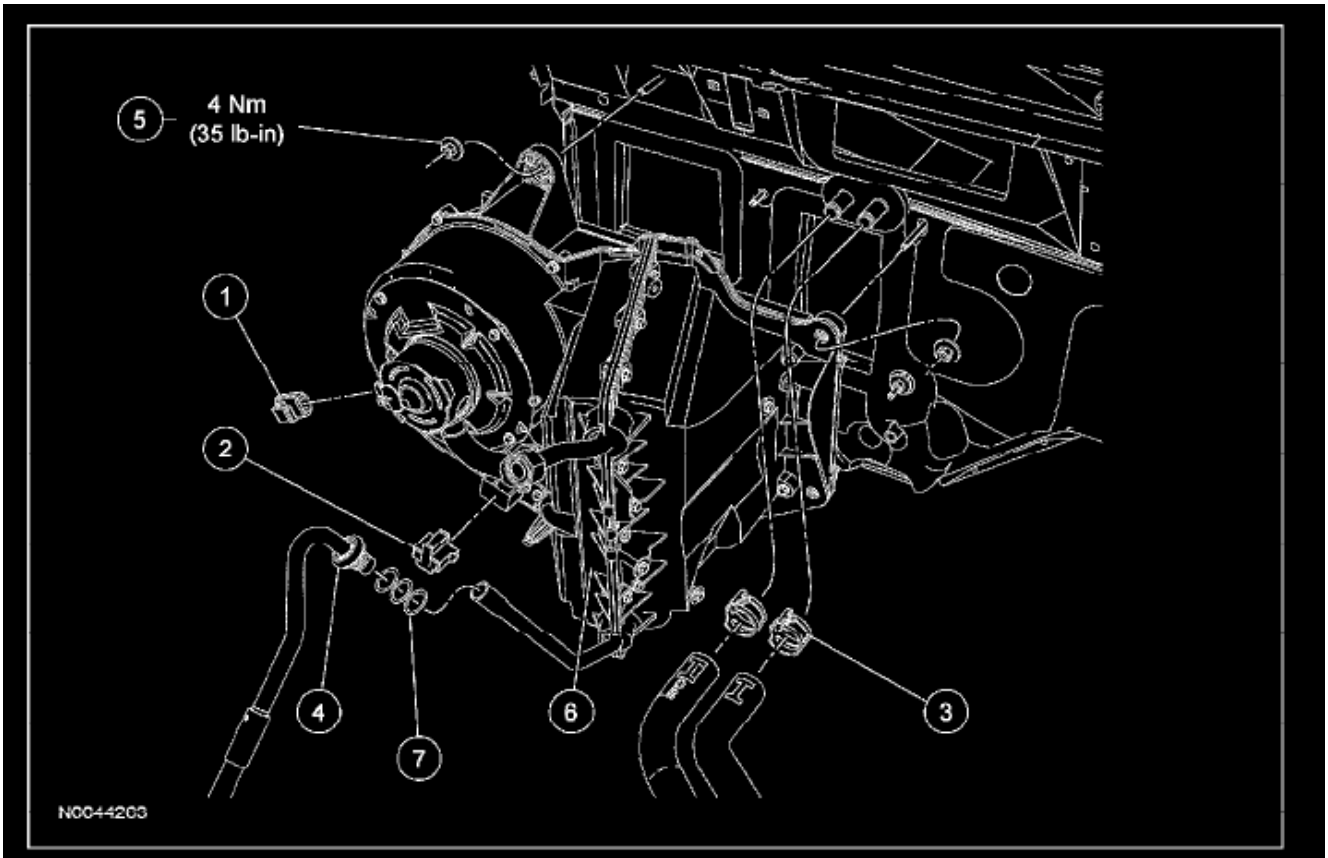
- To install, tighten to 8 Nm (71 lb-in).

4. To install, reverse the removal procedure.

- Install new O-ring seals.

- Lubricate the refrigerant system with the correct amount of clean PAG oil.

5. Evacuate, leak test and charge the refrigerant system.



Item	Part Number	Description
1	14290	Blower motor electrical connector
2	14290	Blower motor resistor electrical connector
3	8287	Heater hose clamp (2 required)

(Continued)

Item	Part Number	Description
4	—	Evaporator inlet line fitting (part of 19835)
5	N808823	Evaporator core housing nut (2 required)
6	19850	Evaporator core housing
7	19E889	O-ring seal (3 required)

Housing Assembly HVAC: Service and Repair Evaporator Core Housing

EVAPORATOR CORE HOUSING

Removal and Installation

NOTE:

- The evaporator core is not separately serviceable, it is serviced only with the evaporator core housing assembly.

- If an evaporator core leak is suspected, the evaporator core must be leak tested before it is removed from the vehicle.

- Installation of a new suction accumulator is not required when repairing the refrigerant system except when there is physical evidence of system contamination from a failed A/C compressor or damage to the suction accumulator.

All vehicles

1. Drain the cooling system. 2. Recover the refrigerant. 3. Remove the air cleaner outlet pipe. 4. Remove the suction accumulator.

Vehicles with 2.3L engine

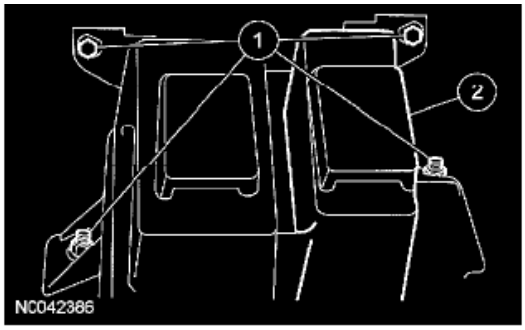
5. Remove the A/C compressor. 6. Remove the engine oil indicator and tube.

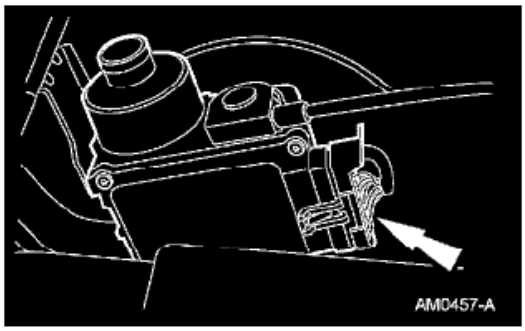
Vehicles with 3.0L and 4.0L engines

7. Position the coolant reservoir and windshield washer reservoir aside.

1 Remove the 2 screws and 2 nuts.

2 Position the reservoirs aside.


1
2
NC042386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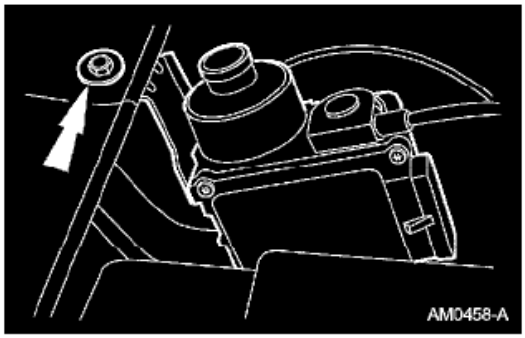
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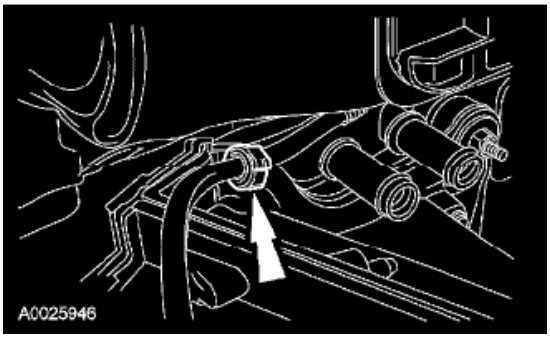

A0025946

Vehicles with speed control

8. Disconnect the speed control actuator electrical connector.

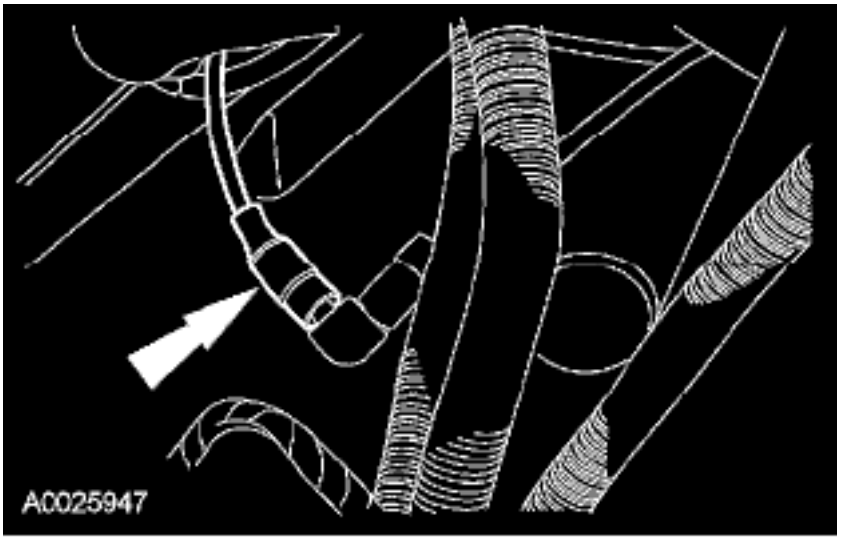
9. Remove the speed control actuator bolt and position the actuator aside.

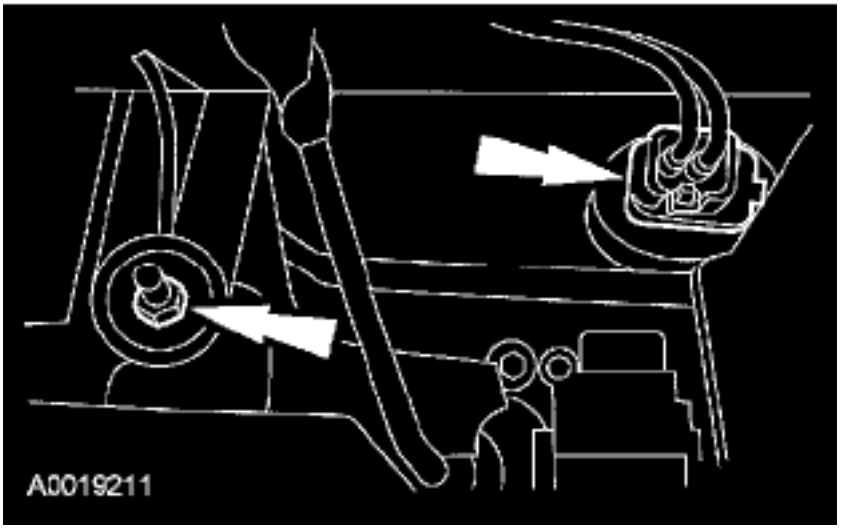
- Detach the speed control cable from the evaporator core housing.

All vehicles

10. Disconnect the blower motor electrical connector. 11. Disconnect the blower motor resistor electrical connector. 12. Release the 2 heater hose clamps and disconnect the heater hoses from the heater core. 13. Detach the pin-type retainer and position the windshield washer hose aside.

14. Disconnect and detach the heater control valve vacuum hose.





15. NOTE: 2.3L engine shown, others are similar.

Disconnect the vacuum supply hose near the evaporator core housing.

16. Disconnect the evaporator inlet fitting.

- Discard the O-ring seals.

17. NOTE: The following step is carried out at the lower passenger side dash panel, inside the passenger compartment.

Disconnect the vacuum hose connector and remove the nut.

Vehicles with 4.0L engine

18. If equipped, remove the wheel splash guard. 19. Remove the RH fender splash shield. 20. Remove the 2 evaporator core housing nuts.

- To install, tighten to 4 Nm (35 lb-in).

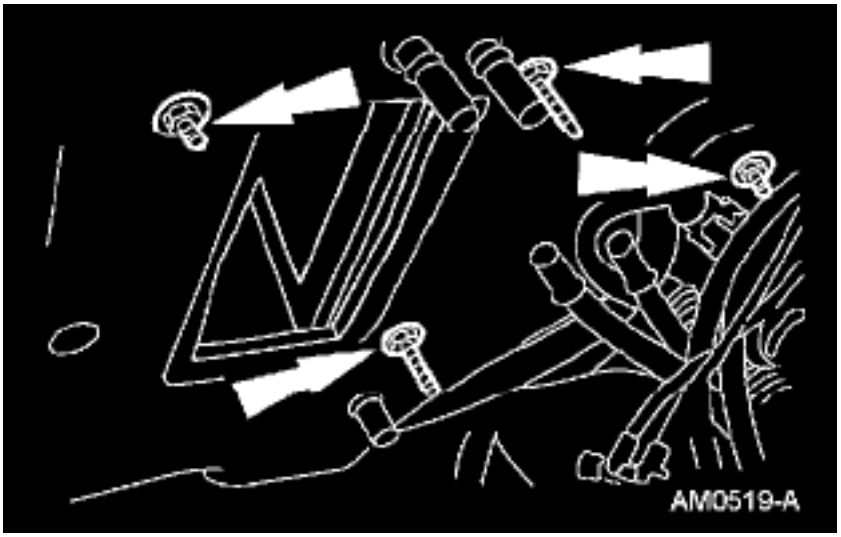
21. Remove the evaporator core housing. 22. To install, reverse the removal procedure.

- Lubricate the refrigerant system with the correct amount of clean PAG oil or equivalent.

- Install new O-ring seals.

- Lubricate the coolant hoses with plain water only, if needed.

23. Evacuate, leak test and charge the refrigerant system.



Housing Assembly HVAC: Service and Repair Plenum Chamber

PLENUM CHAMBER

Removal and Installation

1. Remove the instrument panel. 2. Remove the evaporator core housing. 3. Remove the 3 plenum chamber nuts and the plenum chamber.

- To install, tighten to 4 Nm (35 lb-in).

4. To install, reverse the removal procedure.

Refrigerant: Capacity Specifications

R-134a Refrigerant YN-19 (US); CYN-16-P or CYN-16-R (Canada).....
WSH-M17B19-A (Specification) - 0.94 kg (33 oz) (Fill Capacity)

Refrigerant: Fluid Type Specifications

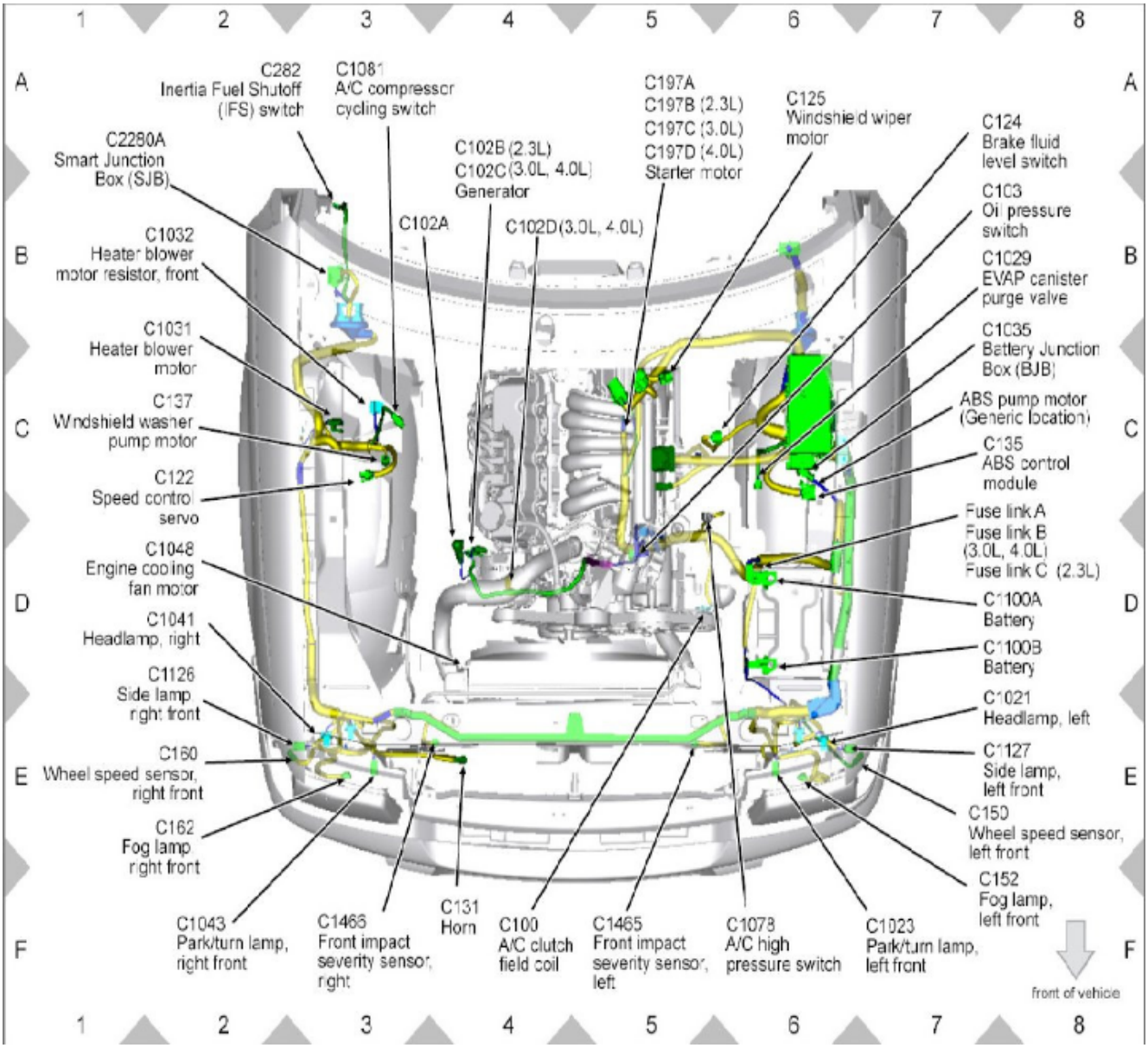
R-134a Refrigerant YN-19 (US); CYN-16-P or CYN-16-R (Canada).....
WSH-M17B19-A (Specification) - 0.94 kg (33 oz) (Fill Capacity)

Refrigerant Oil: Capacity Specifications

PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D.....
WSH-M1C231-B (Specification) - 266 ml (9 fl oz) (Fill Capacity)

Refrigerant Oil: Fluid Type Specifications

PAG Refrigerant Compressor Oil (R-134a Systems) YN-12-D.....
WSH-M1C231-B (Specification) - 266 ml (9 fl oz) (Fill Capacity)


C282
Inertia Fuel Shutoff (IFS) switch
C1081
A/C compressor cycling switch
C2280A
Smart Junction Box (SJB)
C102B (2.3L)
C102C (3.0L, 4.0L)
Generator
C102A
C102D (3.0L, 4.0L)
C197A
C197B (2.3L)
C197C (3.0L)
C197D (4.0L)
Starter motor
C125
Windshield wiper motor
C124
Brake fluid level switch
C103
Oil pressure switch
C1032
Heater blower motor resistor, front
C1029
EVAP canister purge valve
C1031
Heater blower motor
C1035
Battery Junction Box (BJB)
C137
Windshield washer pump motor
ABS pump motor (Generic location)
C135
ABS control module
C122
Speed control servo
Fuse link A
Fuse link B (3.0L, 4.0L)
Fuse link C (2.3L)
C1048
Engine cooling fan motor
C1100A
Battery
C1041
Headlamp, right
C1100B
Battery
C1126
Side lamp, right front
C1021
Headlamp, left
C160
Wheel speed sensor, right front
C1127
Side lamp, left front
C162
Fog lamp, right front
C150
Wheel speed sensor, left front
C152
Fog lamp, left front
C1043
Park/turn lamp, right front
C1466
Front impact severity sensor, right
C131
Horn
C100
A/C clutch field coil
C1465
Front impact severity sensor, left
C1078
A/C high pressure switch
C1023
Park/turn lamp, left front
front of vehicle

View 151-1

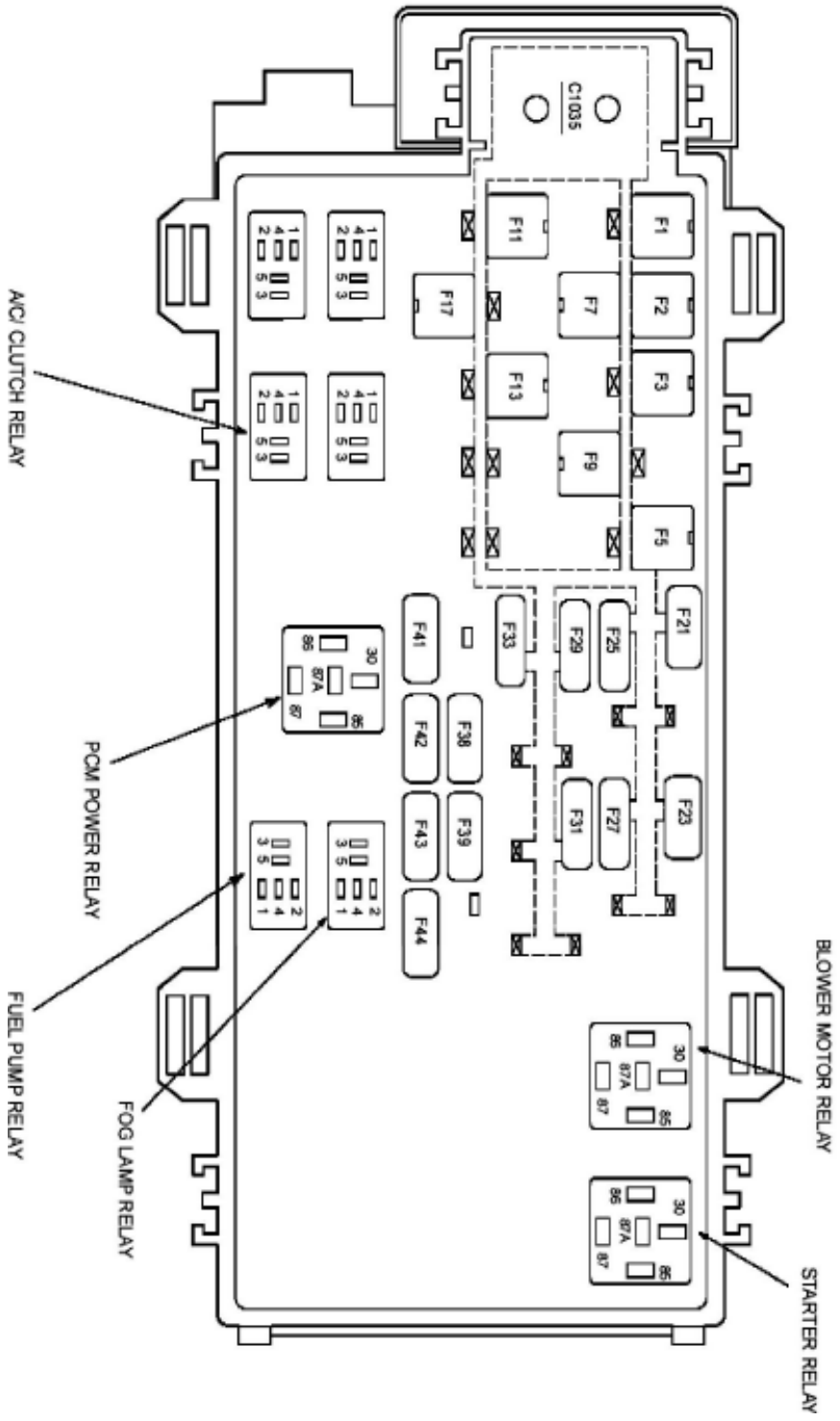
Connector: C1078

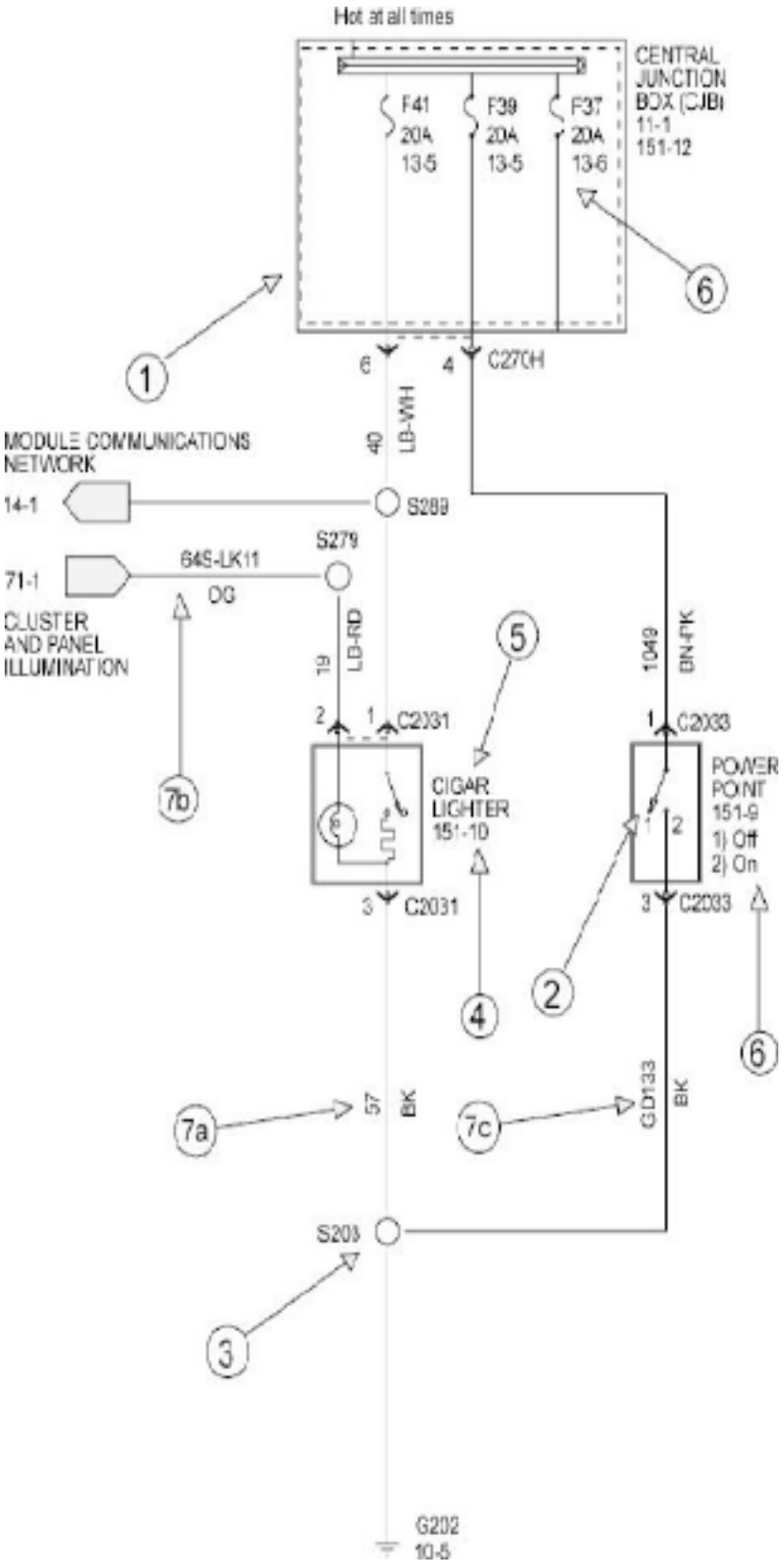
Description:	Harness:	Base Part #:
A/C HIGH PRESSURE SWITCH	14A280	19D594

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CH443 (GN-OG)	20	SWITCH - CLIMATE MODE # DEFROST MODES	
2	*	*	not used	
3	CH423 (YE)	20	SWITCH - A/C LOW PRESSURE CYCLING (ACLPCS)	
4	*	*	not used	

C1078

BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L




Hot at all times
CENTRAL JUNCTION BOX (CJB)
11-1
151-12
F41
20A
13-5
F39
20A
13-5
F37
20A
13-6
C270H
40
LB-WH
MODULE COMMUNICATIONS NETWORK
14-1
S289
S279
64S-LK11
71-1
DG
CLUSTER AND PANEL ILLUMINATION
19
LB-RD
C2031
CIGAR LIGHTER
151-10
C2031
1049
BN-PK
C2033
POWER POINT
151-9
1) Off
2) On
C2033
57
BK
GD133
BK
S203
G202
10-5
1
2
3
4
5
6
7a
7b
7c

Blower Motor Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

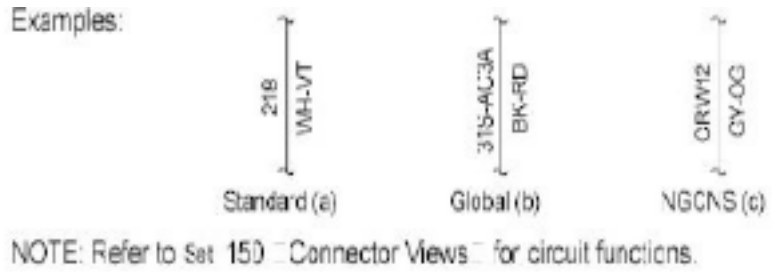
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

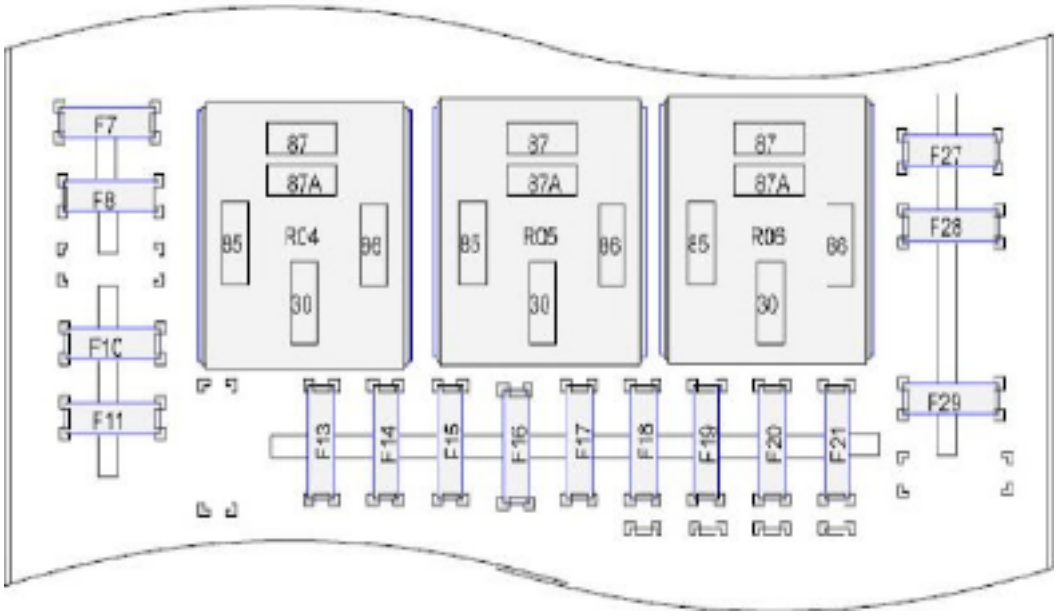
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

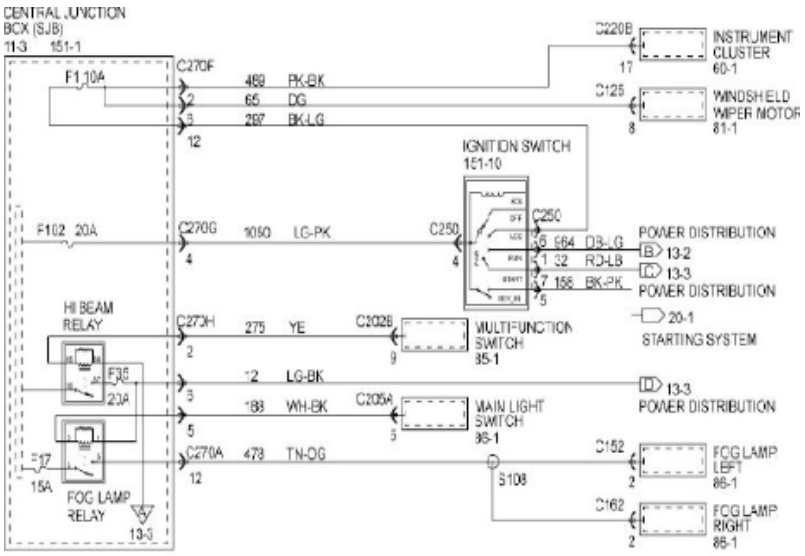
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

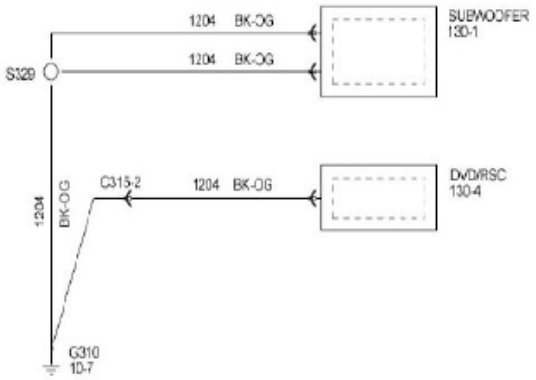
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

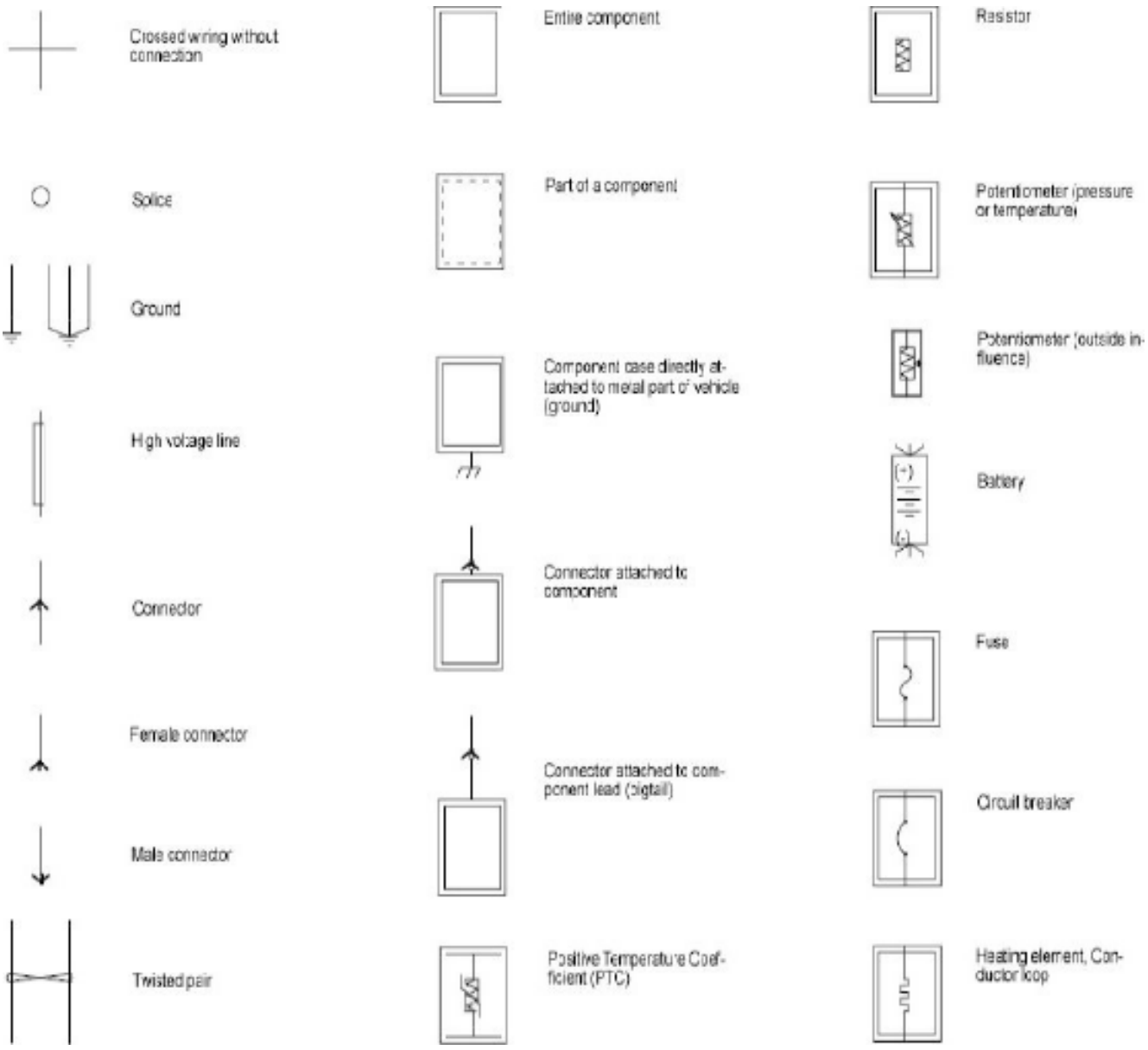
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

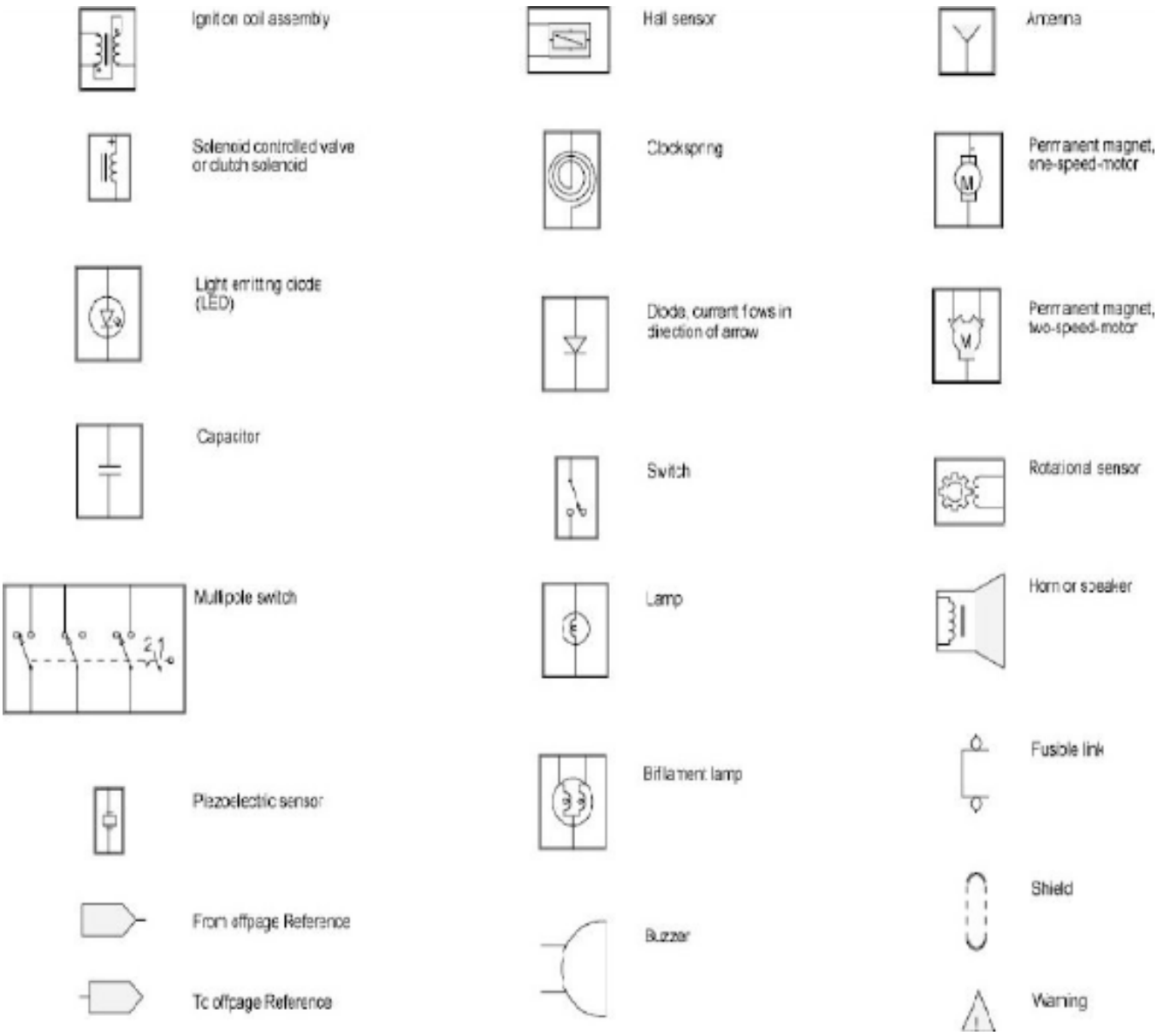
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

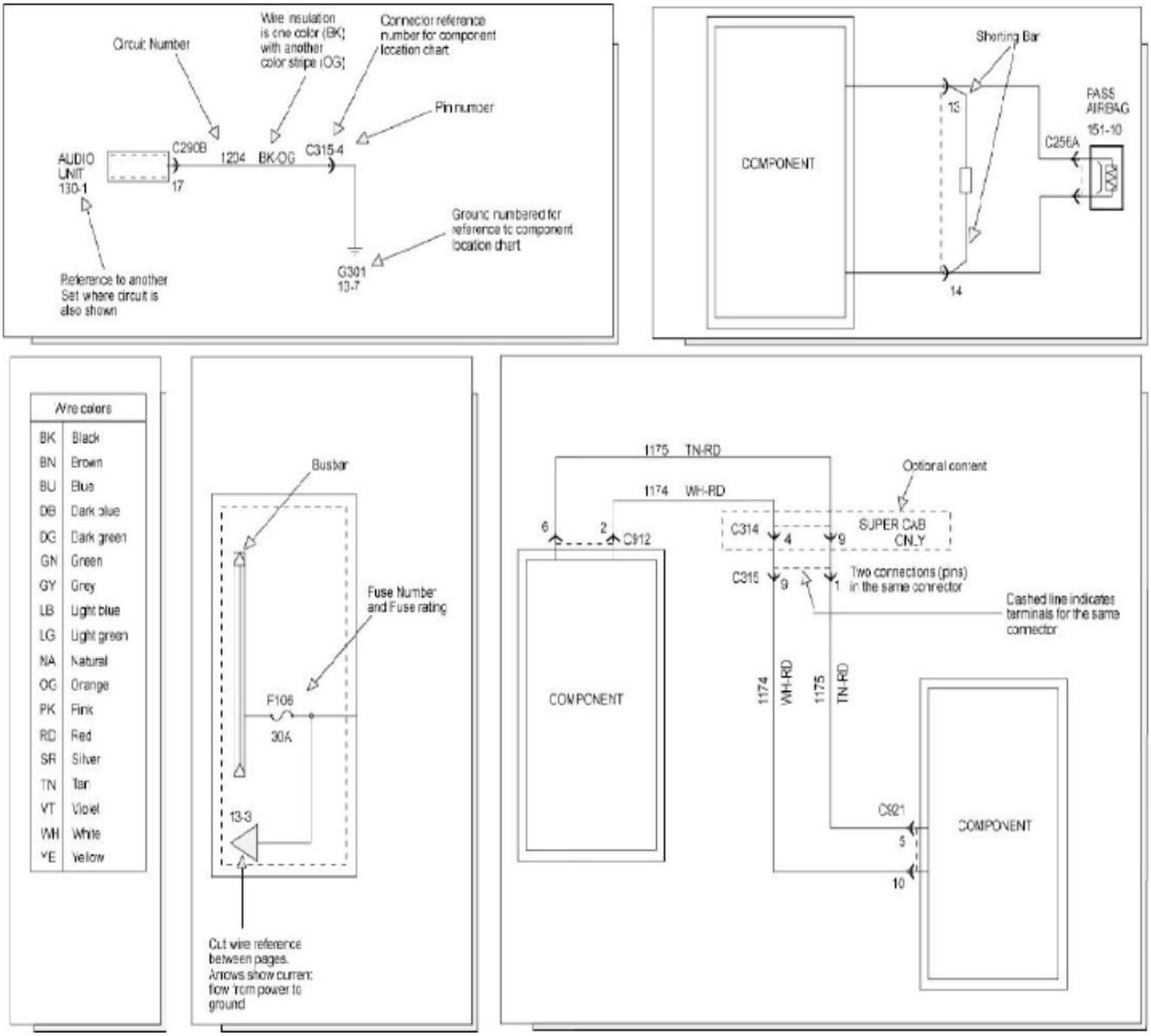
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

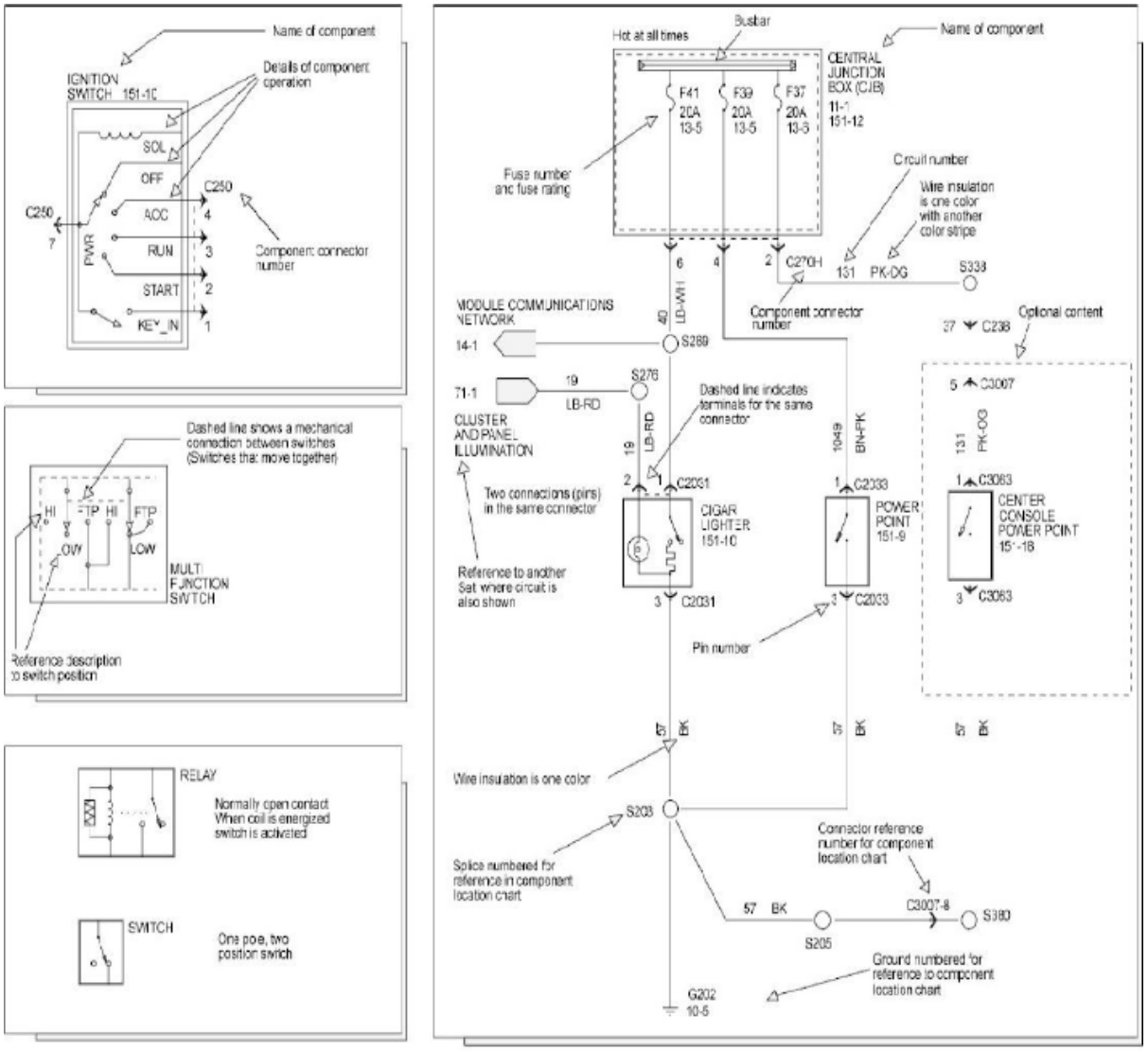
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

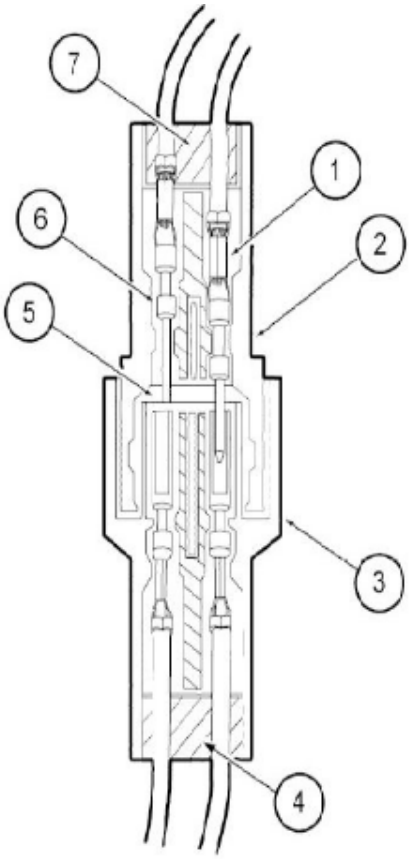


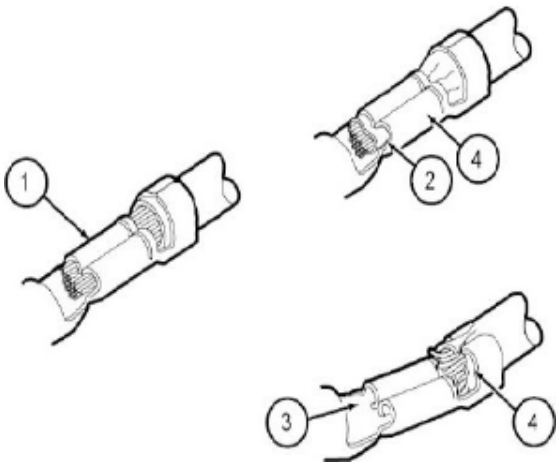
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Blower Motor Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

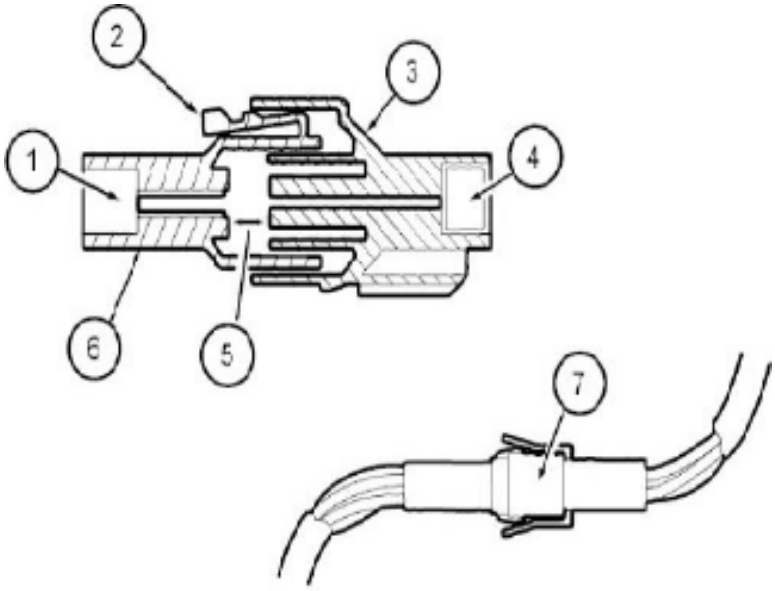
5 = Intermittent contact

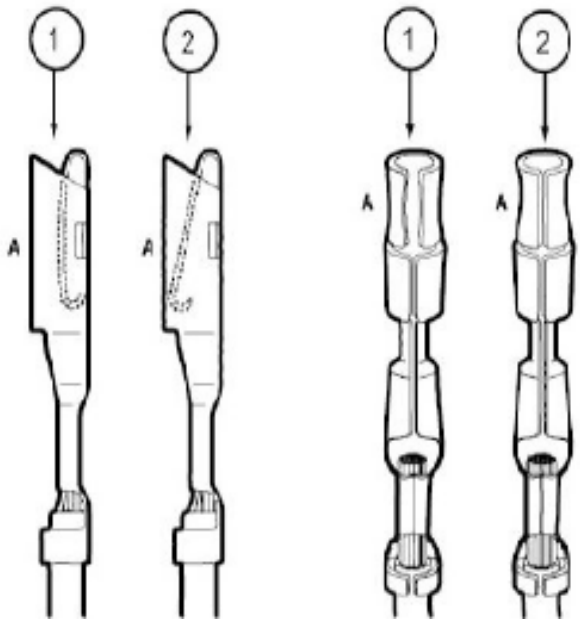
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

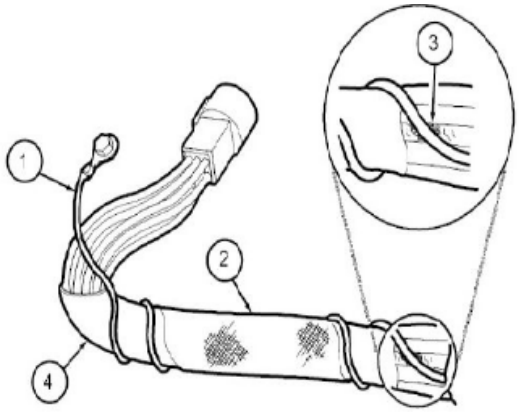
Deformed (enlarged) female terminals

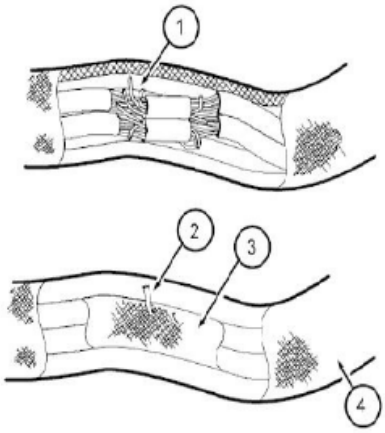
1 = Enlarged

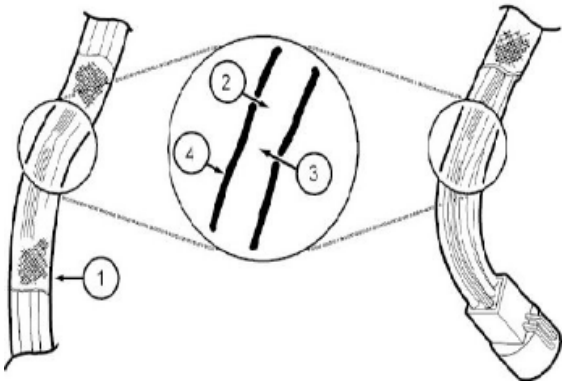
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

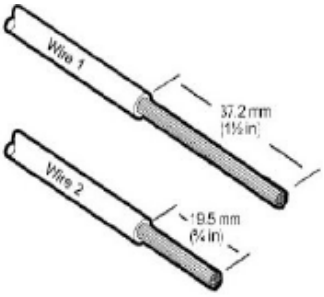
Splice covered 2

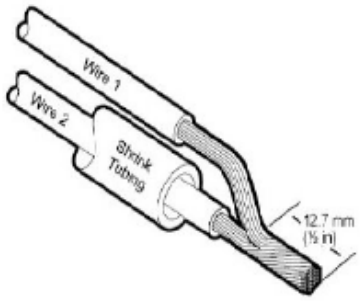
= Wire strand

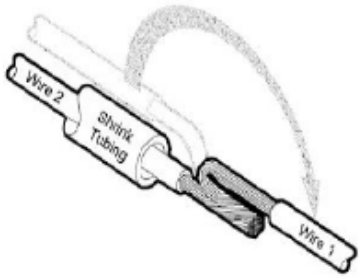
3 = Splice tape

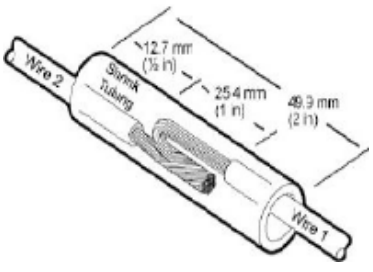
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.9 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

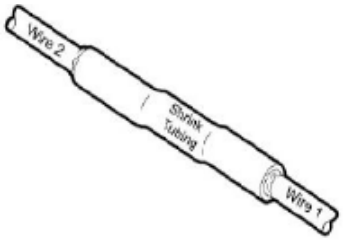
NOTE: -

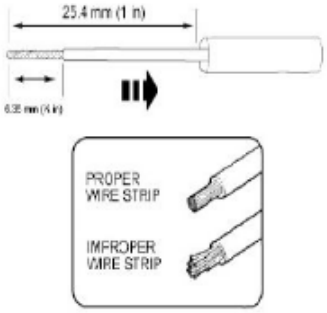
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

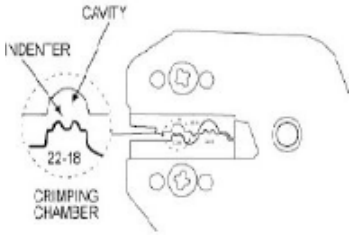
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

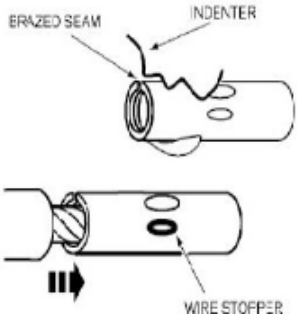
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

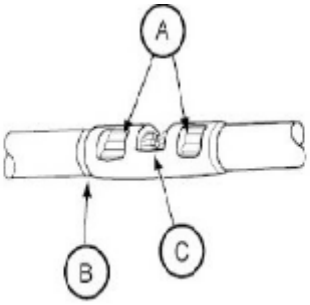
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

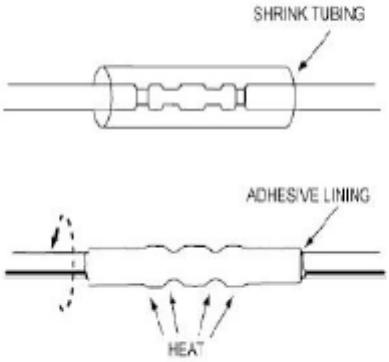
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4 strip, cut 9 strands	* 1/4 strip, cut 2 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip, fold 3x dia.
	16-14	* 1/4 strip, cut 7 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip fold 2x dia	1 strip, fold 3x dia.	1 1/4 strip, fold 4x dia.	Not Recommended
	12-10	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip fold 3x dia.	1 1/4 strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Pigtail only

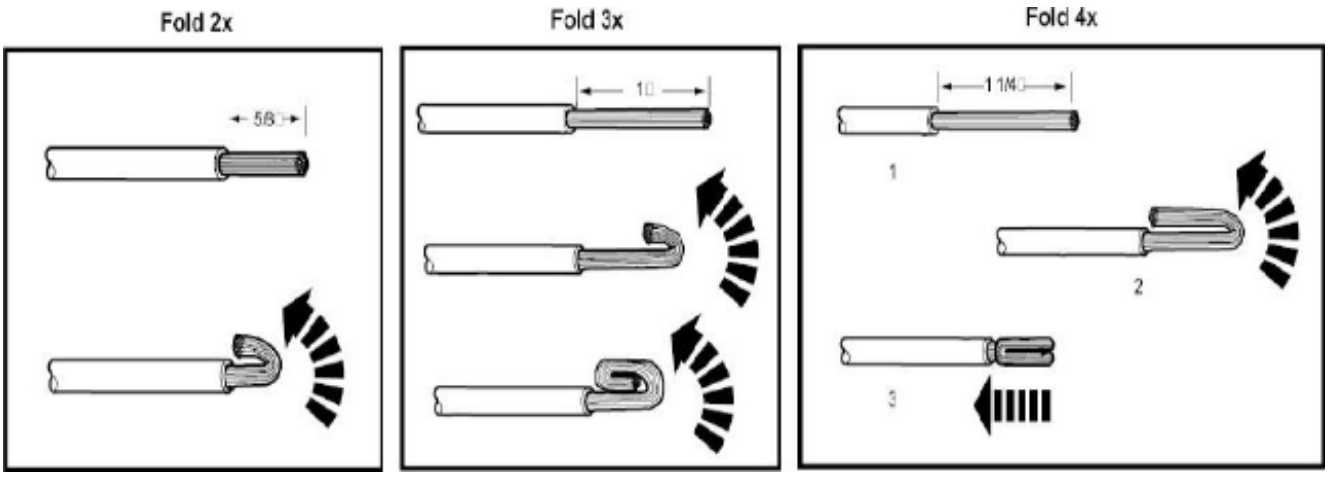
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



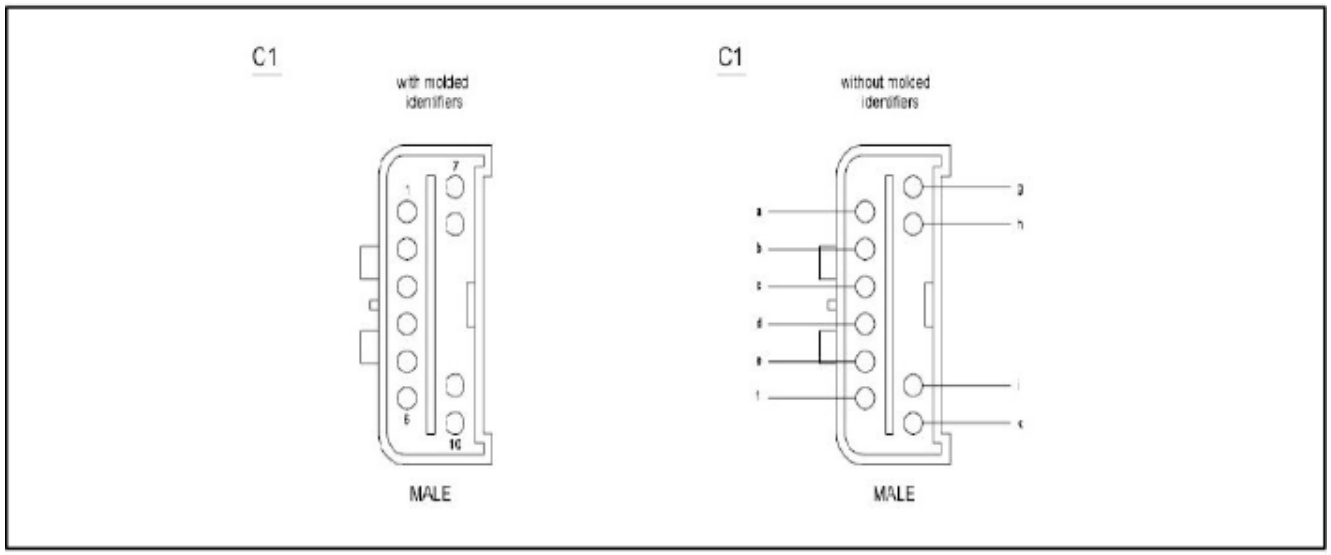
The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step by step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



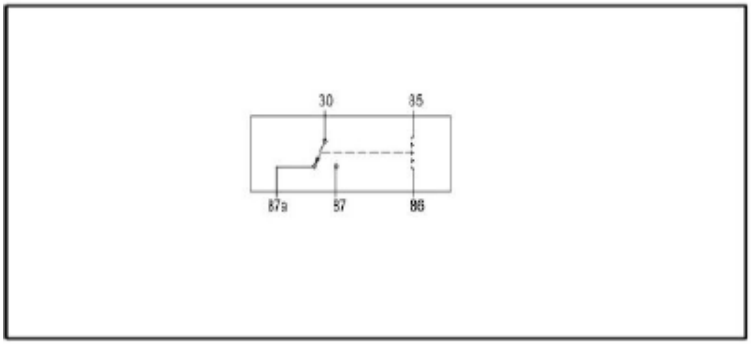
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

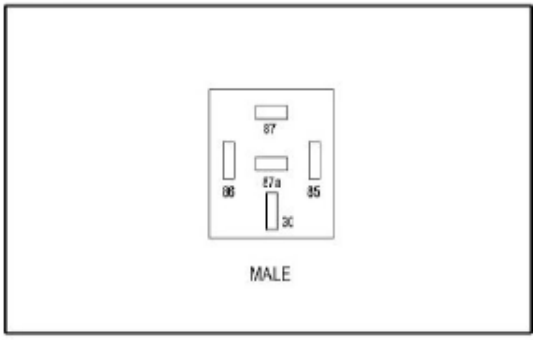
Blower Motor Relay: Testing and Inspection Mini ISO Relay

Relay □ Mini ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	45 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

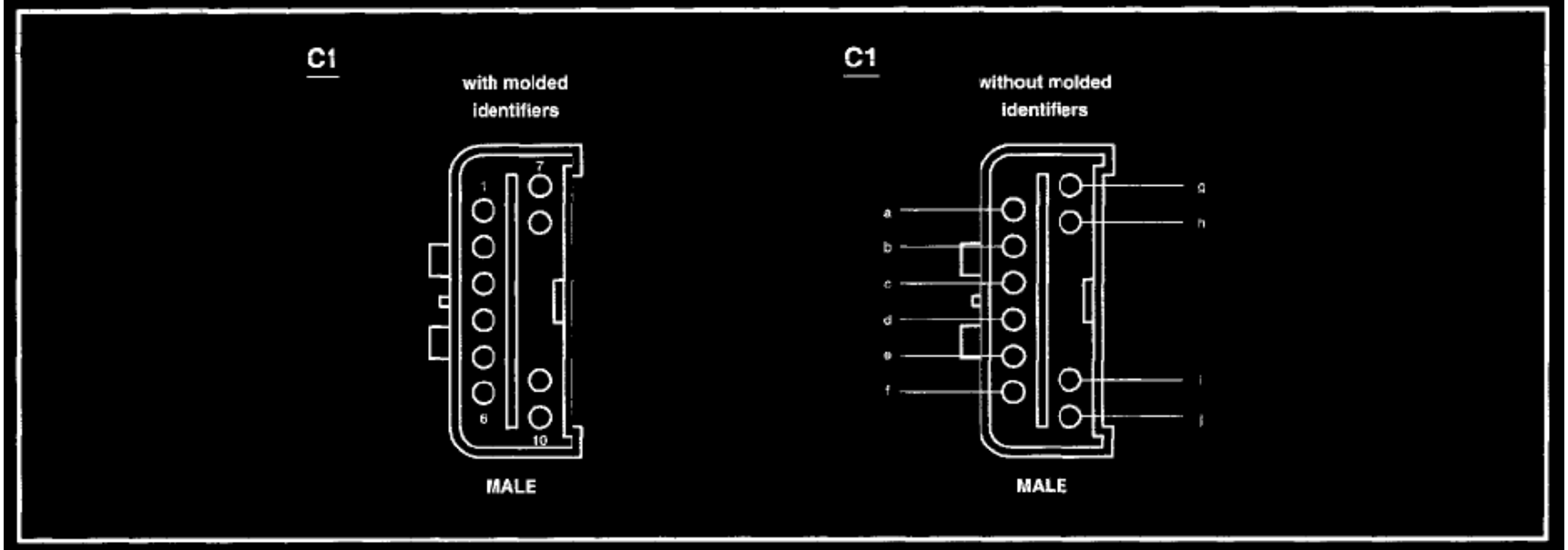
Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step–by–step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



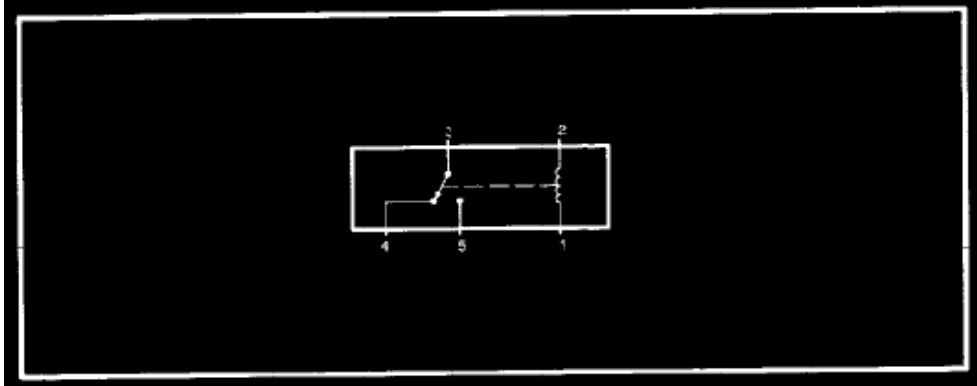
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

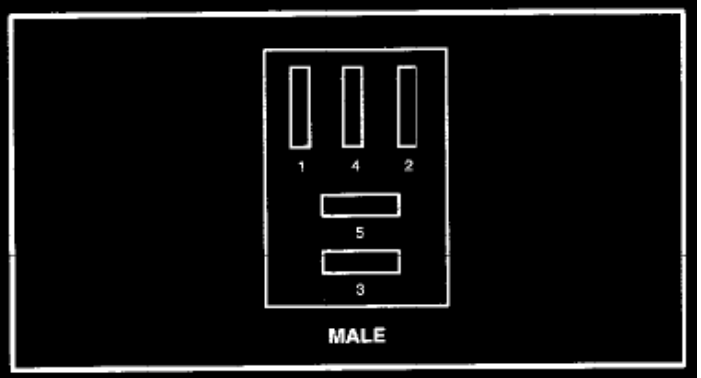
Blower Motor Relay: Testing and Inspection Micro ISO Relay

Relay – Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63–102Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil – Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

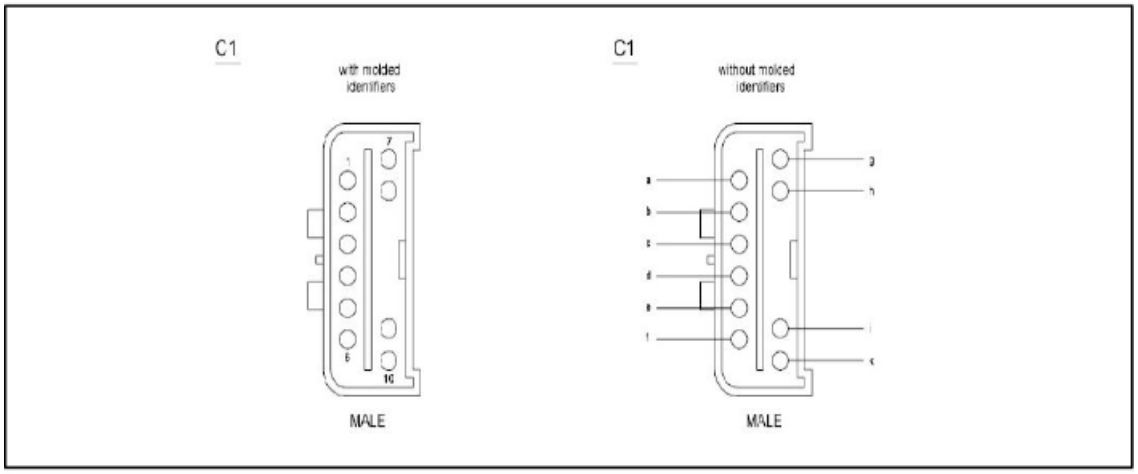
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step□by□step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals

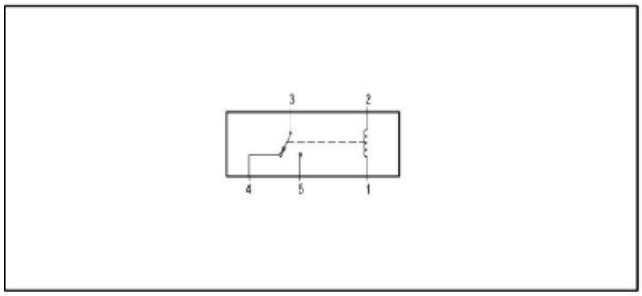


The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column □Circuit to test□. If you wish to test the complete component, perform all tests.

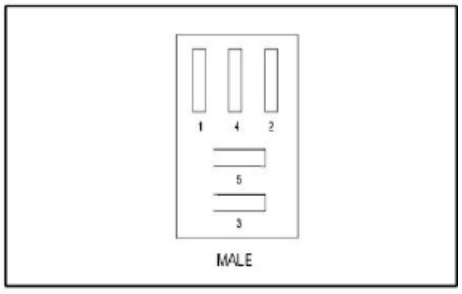
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Relay □ Micro ISO

Schematic



Terminals

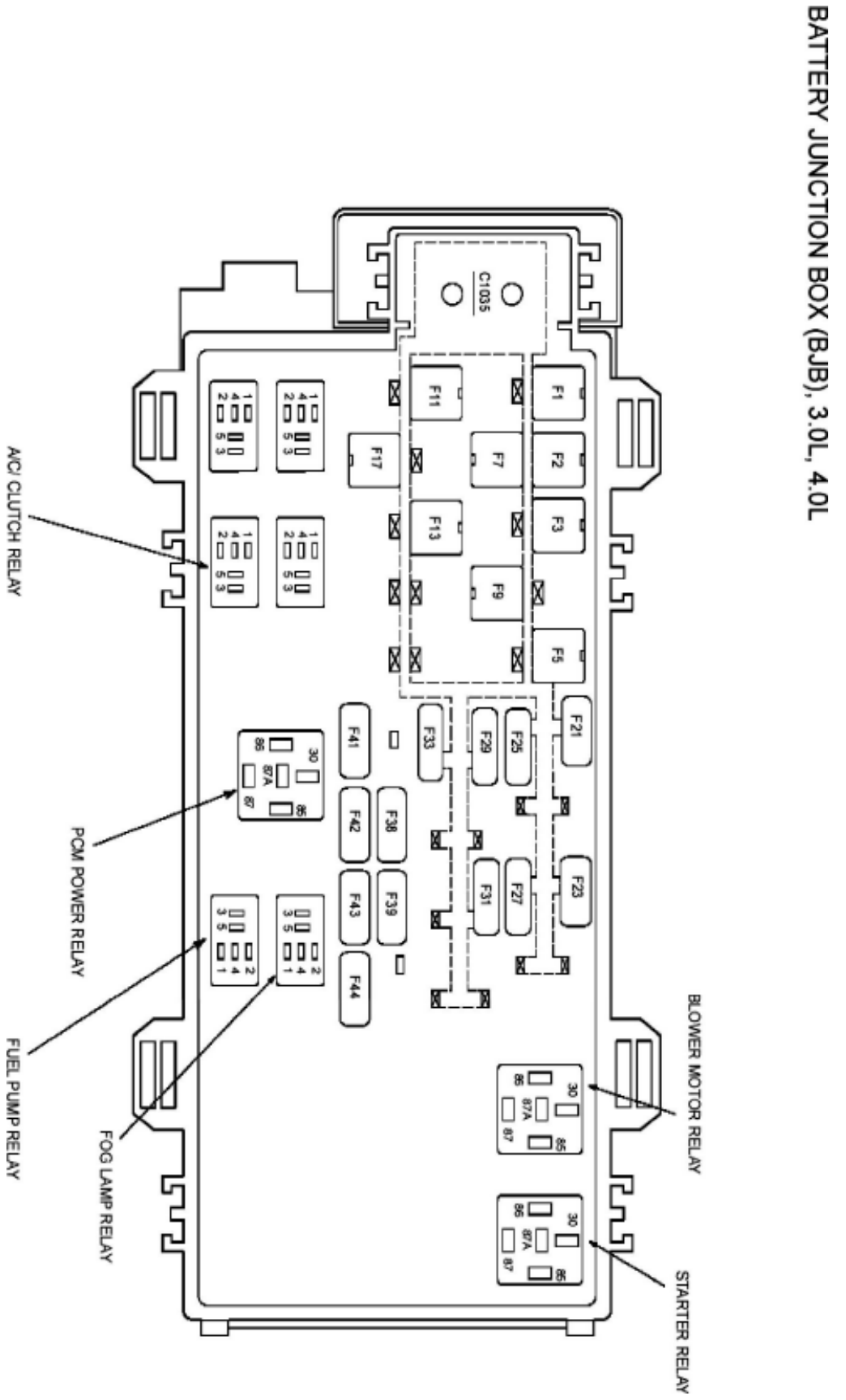


Component testing procedure (no voltage applied)

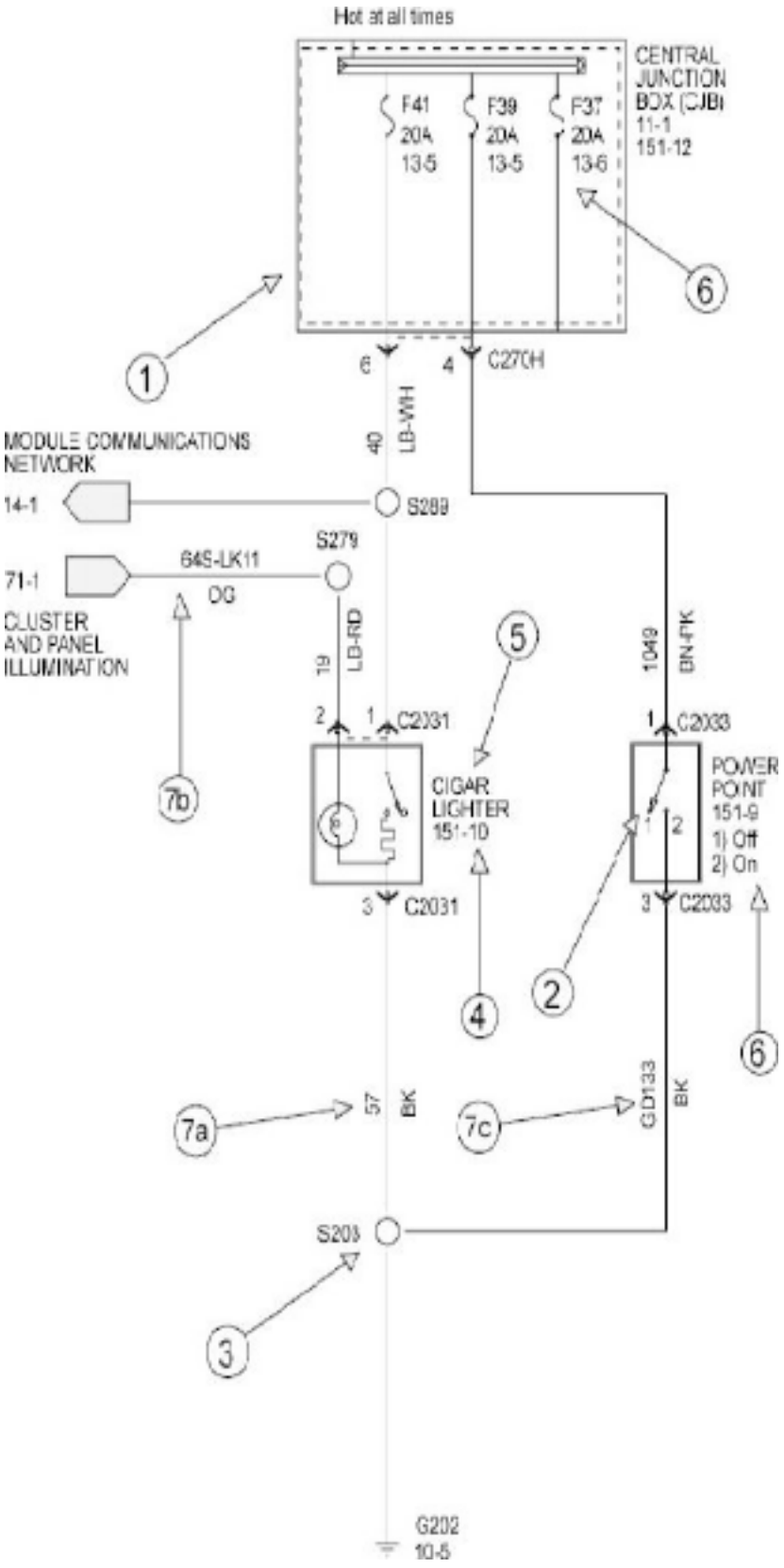
Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63□102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil □ Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.


BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L
C1035
F1
F2
F3
F5
F7
F9
F11
F13
F17
F21
F23
F25
F27
F29
F31
F33
F38
F39
F41
F42
F43
F44
A/C CLUTCH RELAY
PCM POWER RELAY
FUEL PUMP RELAY
FOG LAMP RELAY
BLOWER MOTOR RELAY
STARTER RELAY

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Heating and Air Conditioning > Relays and Modules - HVAC > Compressor Clutch Relay > Component Information > Diagrams > Diagram Information and Instructions



Compressor Clutch Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

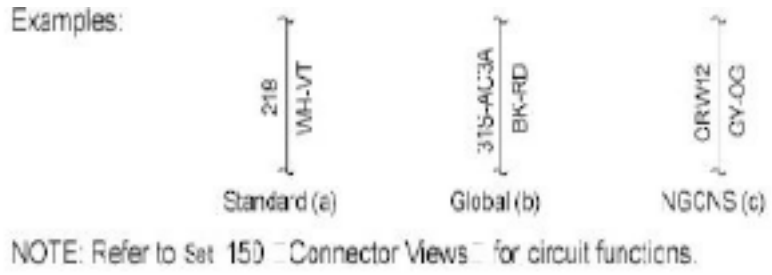
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

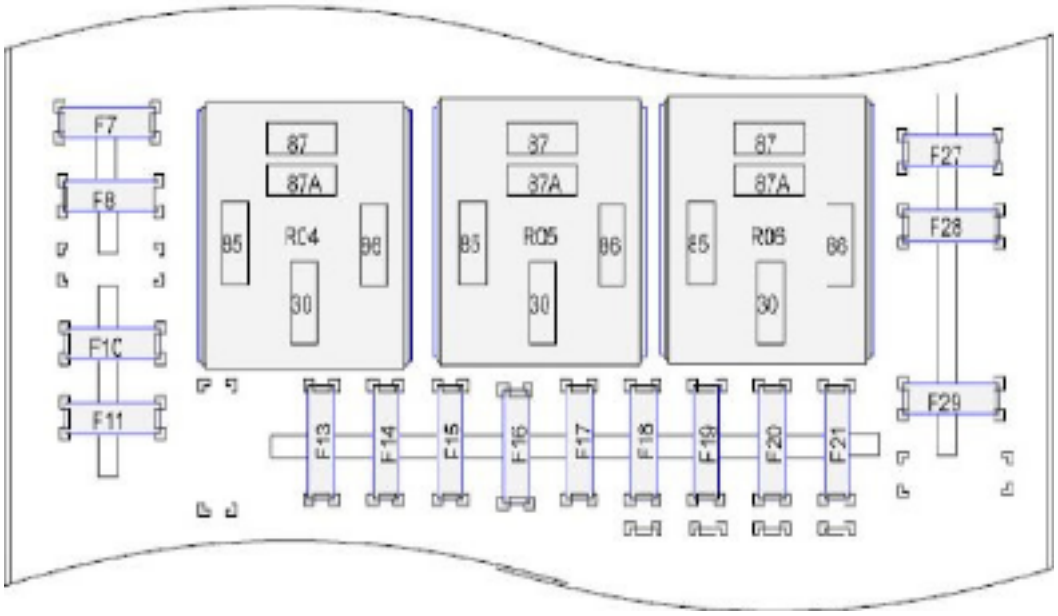
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

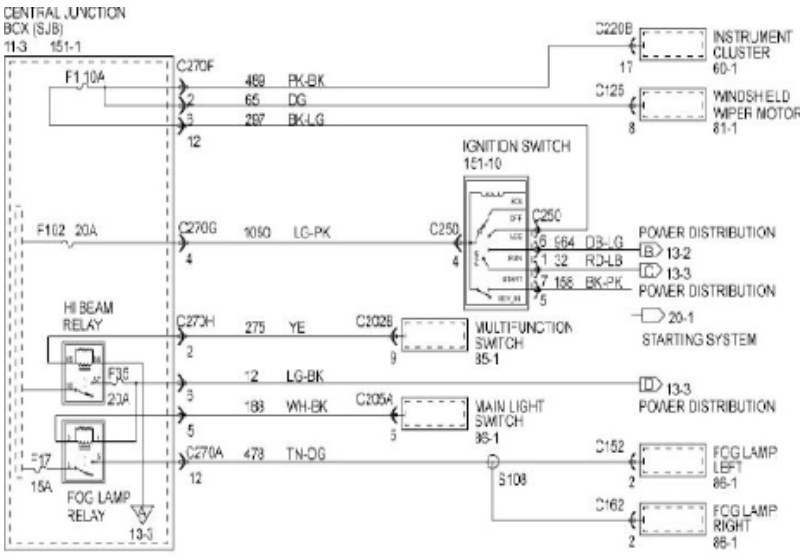
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

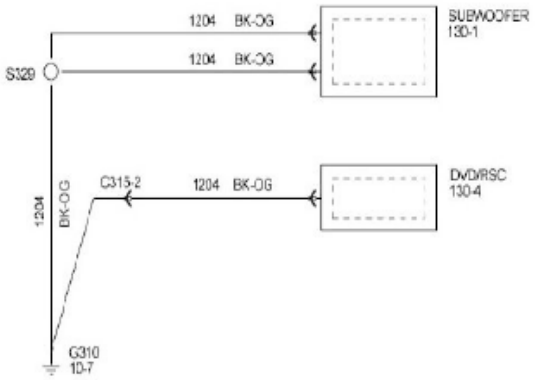
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

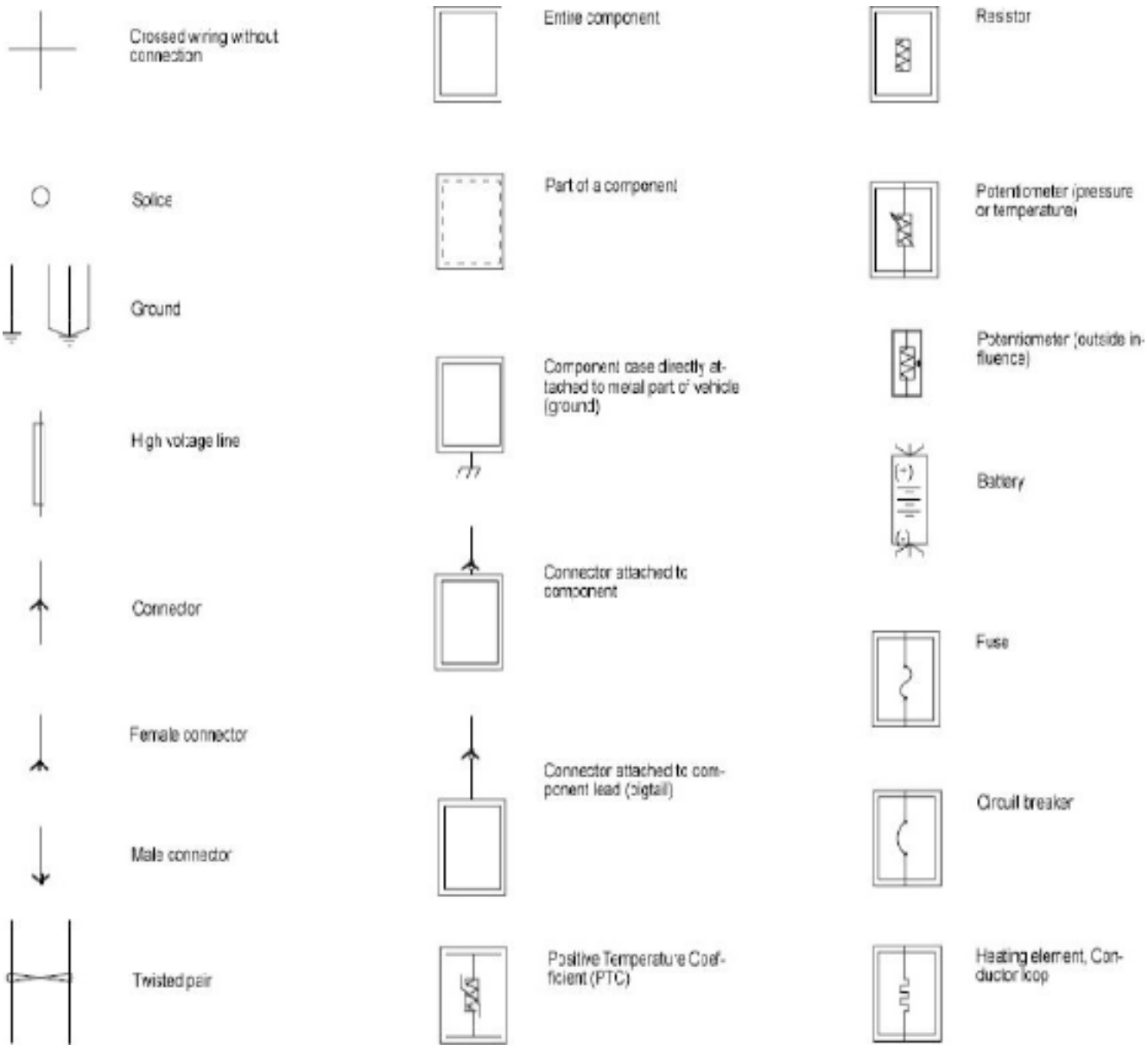
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

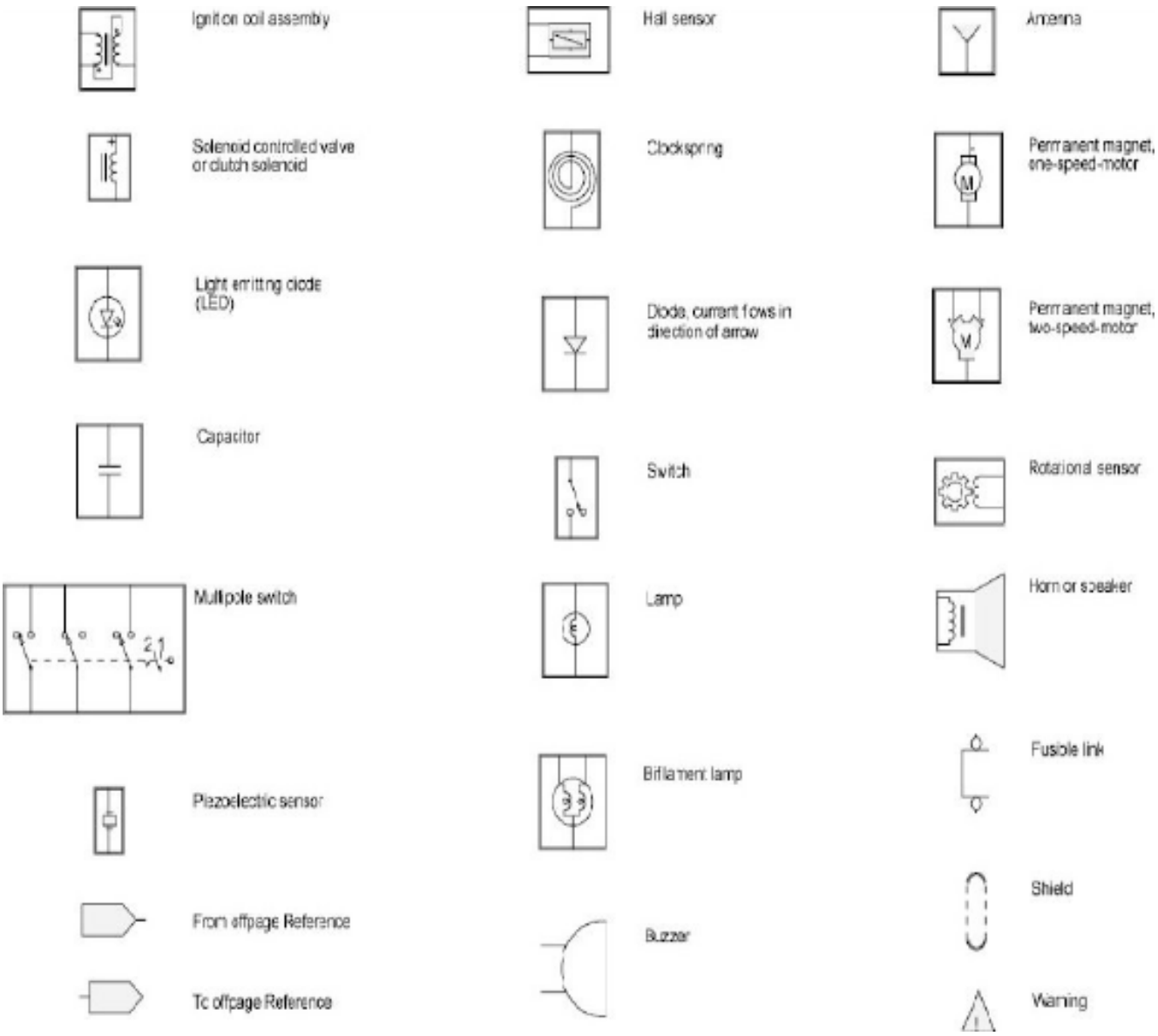
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

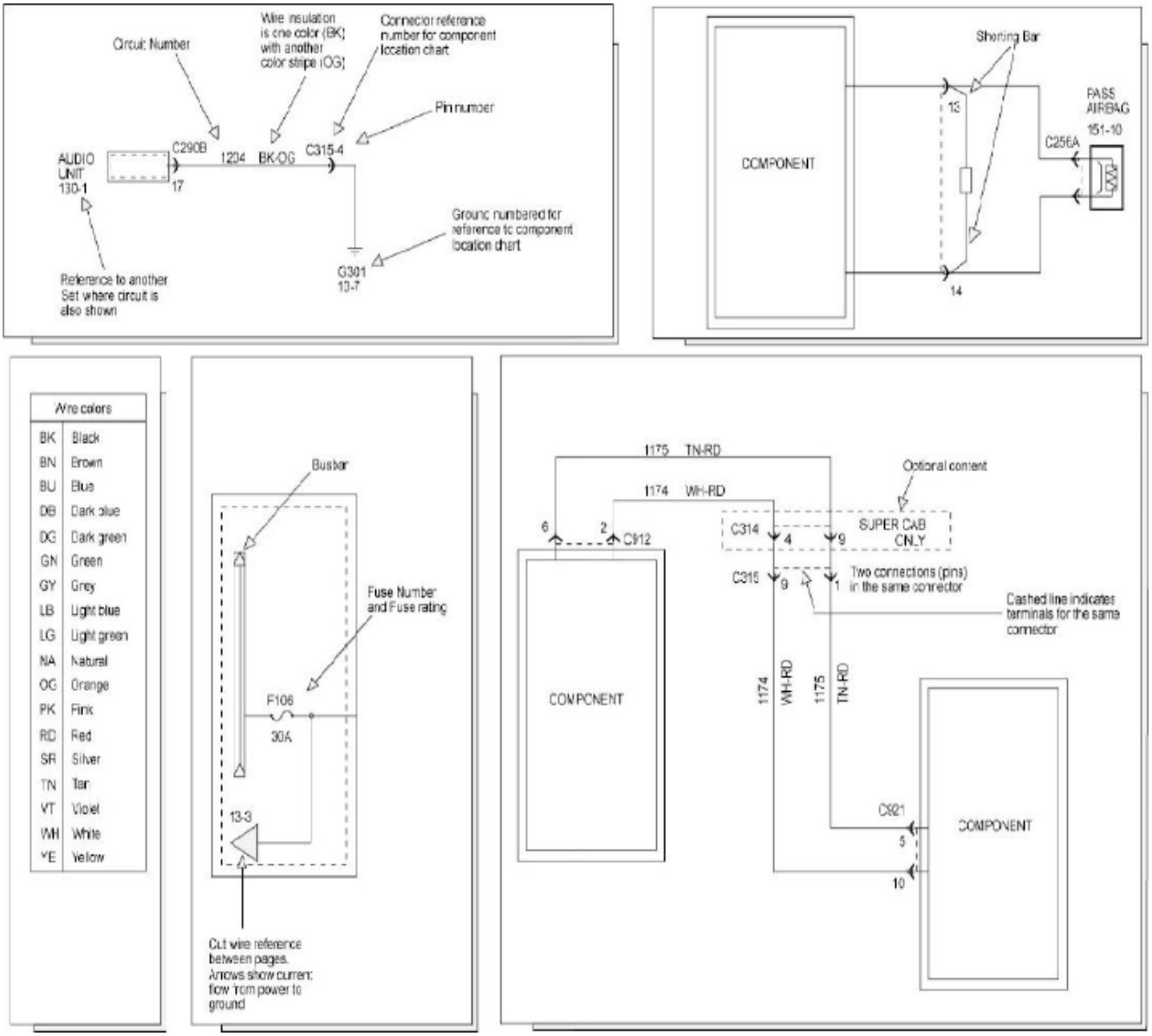
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

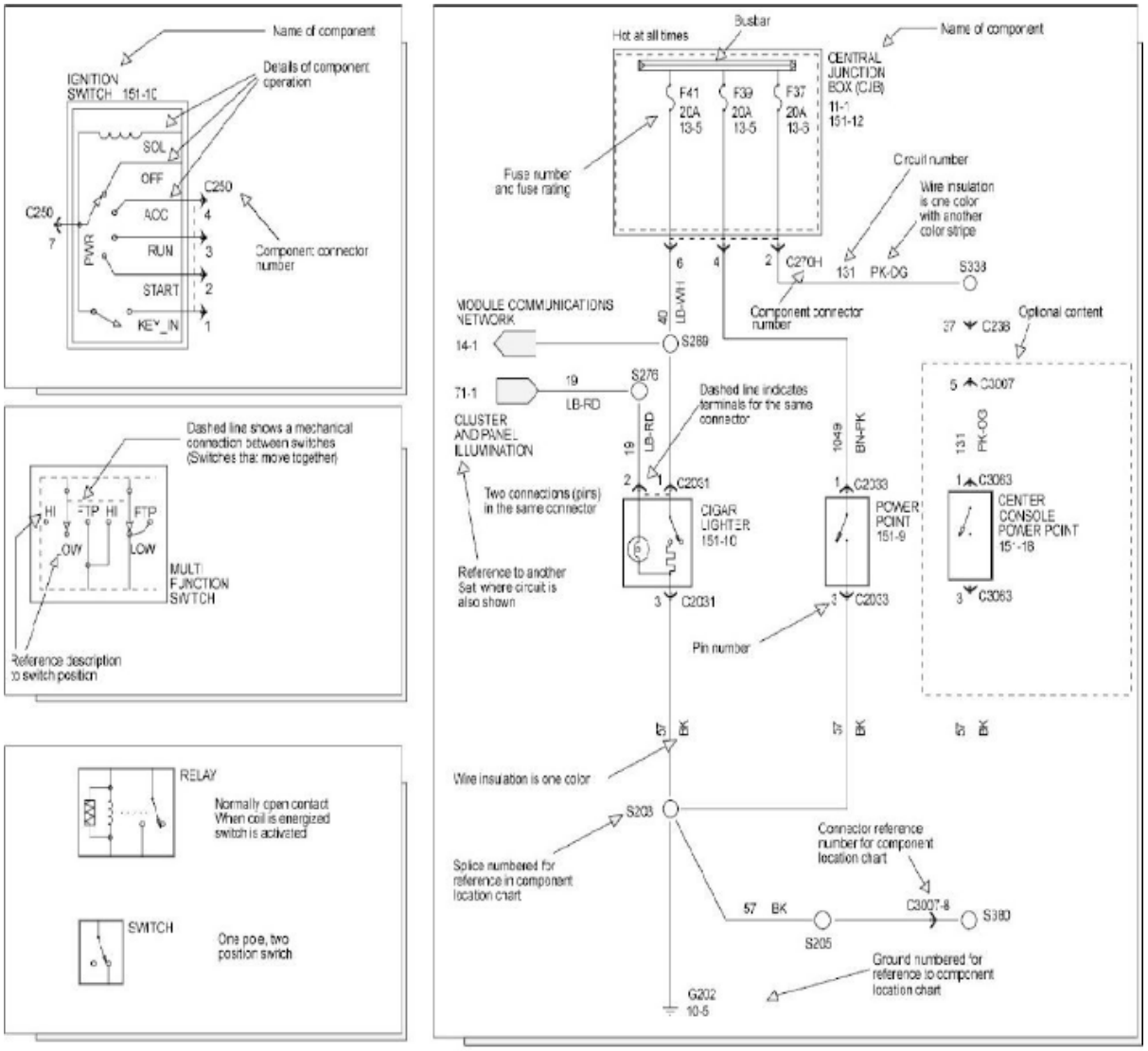
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

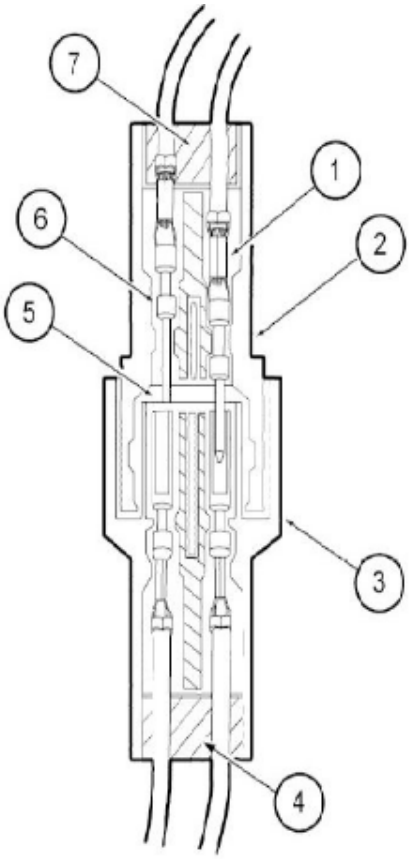


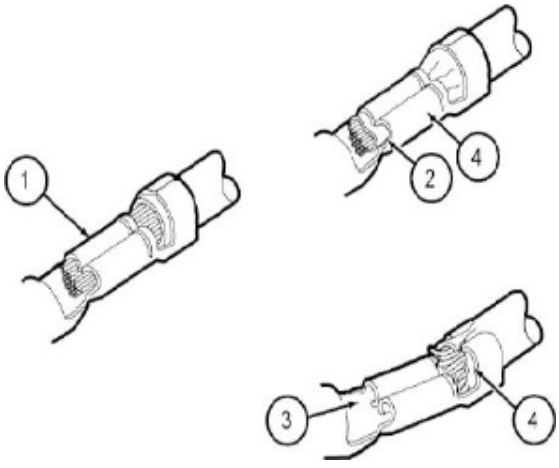
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Compressor Clutch Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

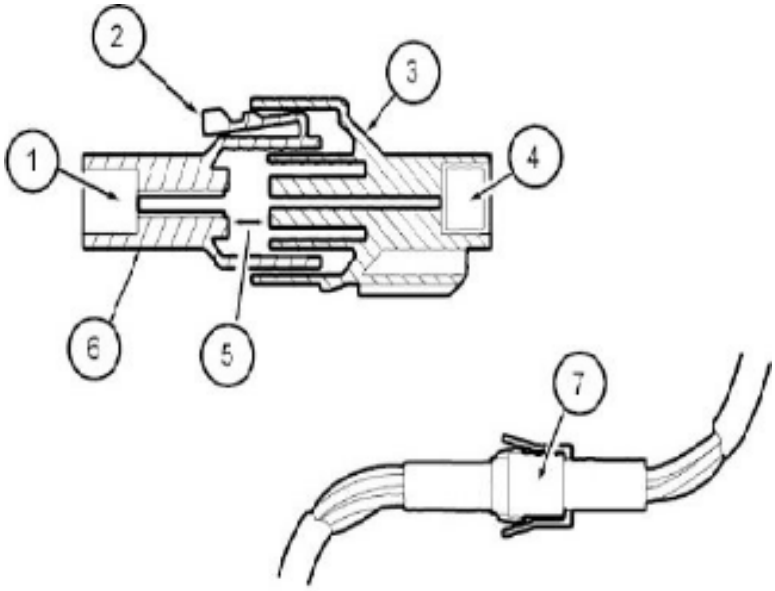
5 = Intermittent contact

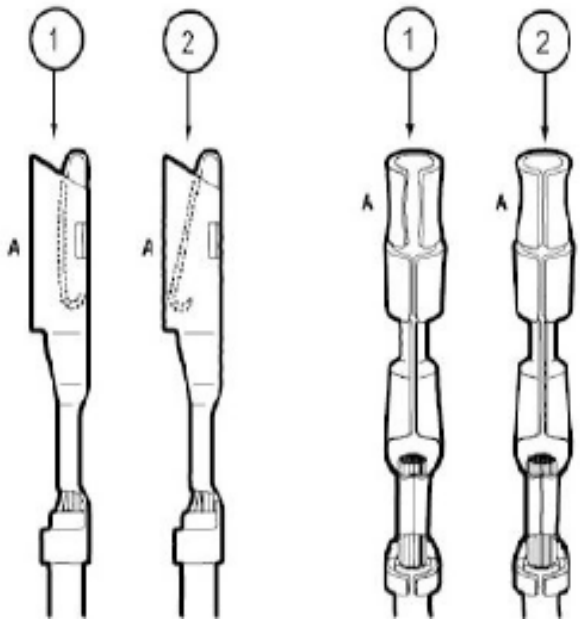
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

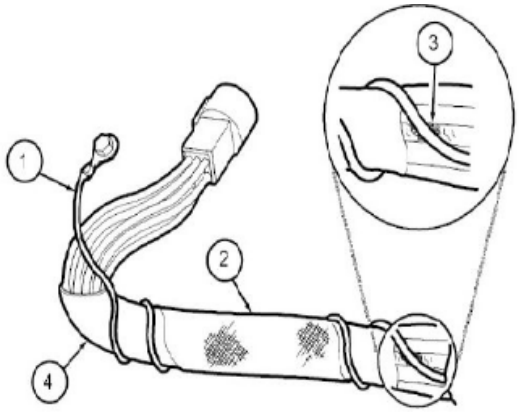
Deformed (enlarged) female terminals

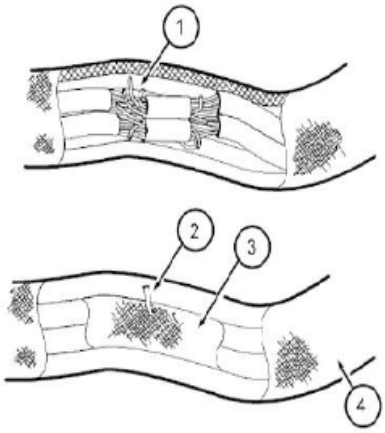
1 = Enlarged

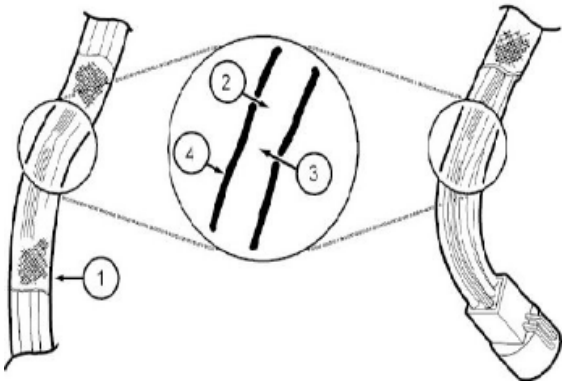
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

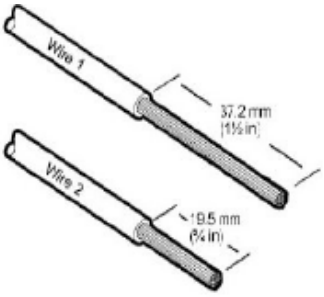
Splice covered 2

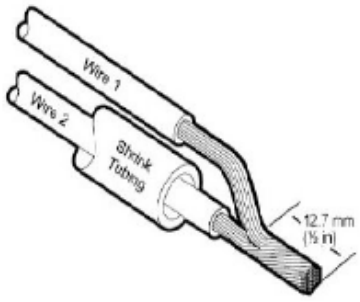
= Wire strand

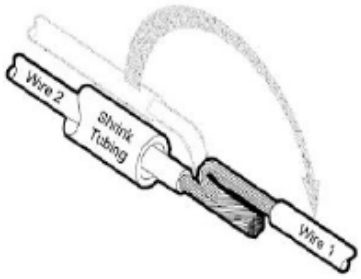
3 = Splice tape

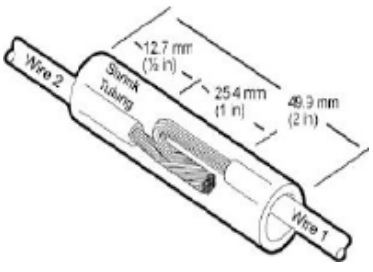
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

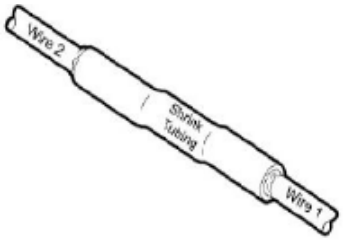
NOTE: -

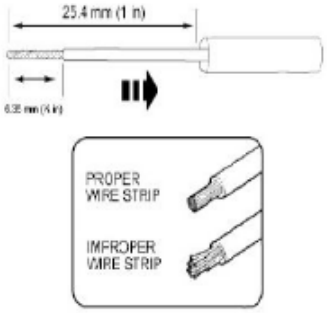
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

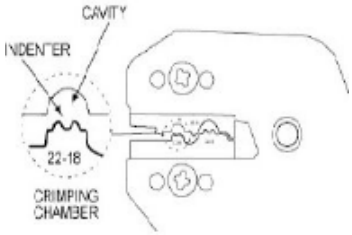
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

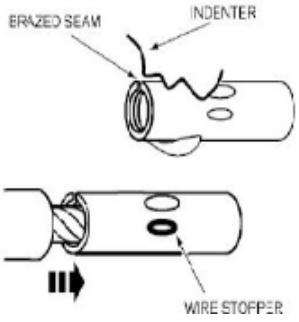
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
6.35 mm (¼ in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

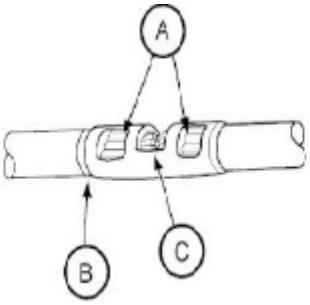
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

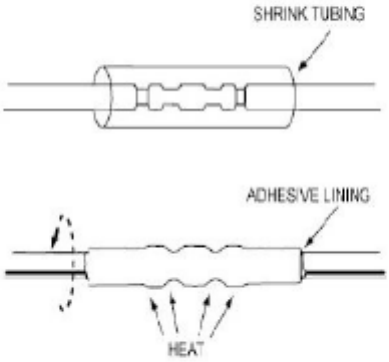
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4 strip, cut 9 strands	* 1/4 strip, cut 2 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip, fold 3x dia.
	16-14	* 1/4 strip, cut 7 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip fold 2x dia	1 strip, fold 3x dia.	1 1/4 strip, fold 4x dia.	Not Recommended
	12-10	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip fold 3x dia.	1 1/4 strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Pigtail only

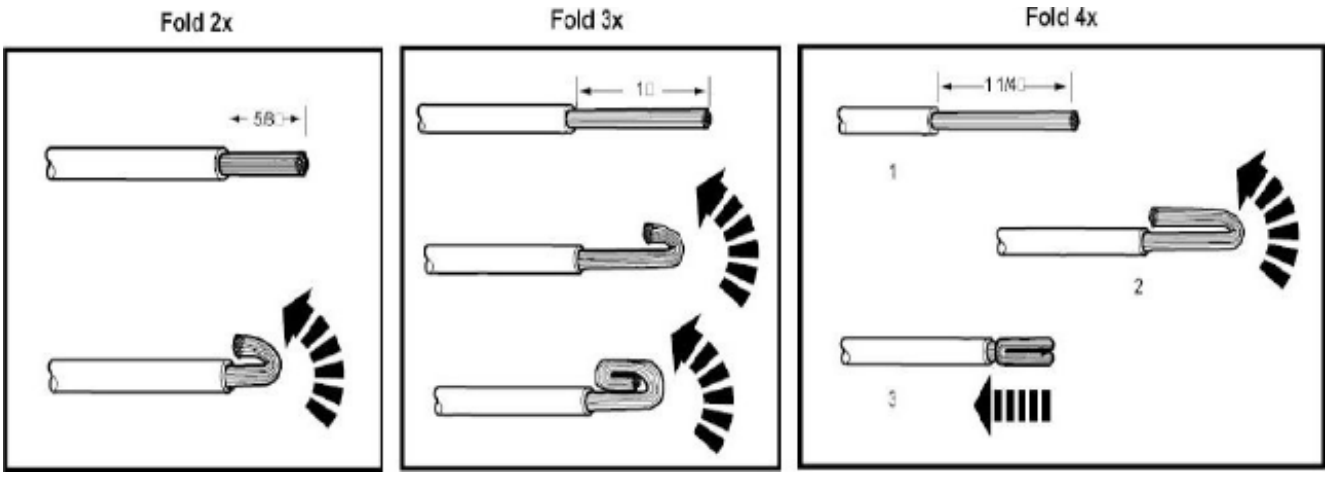
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Compressor Clutch Relay: Description and Operation

AIR CONDITIONING (A/C) CLUTCH RELAY (A/CCR)

NOTE: The PCM PIDs WAC and wide open throttle air conditioning cutoff fault (WACF) are used to monitor the A/CCR output.

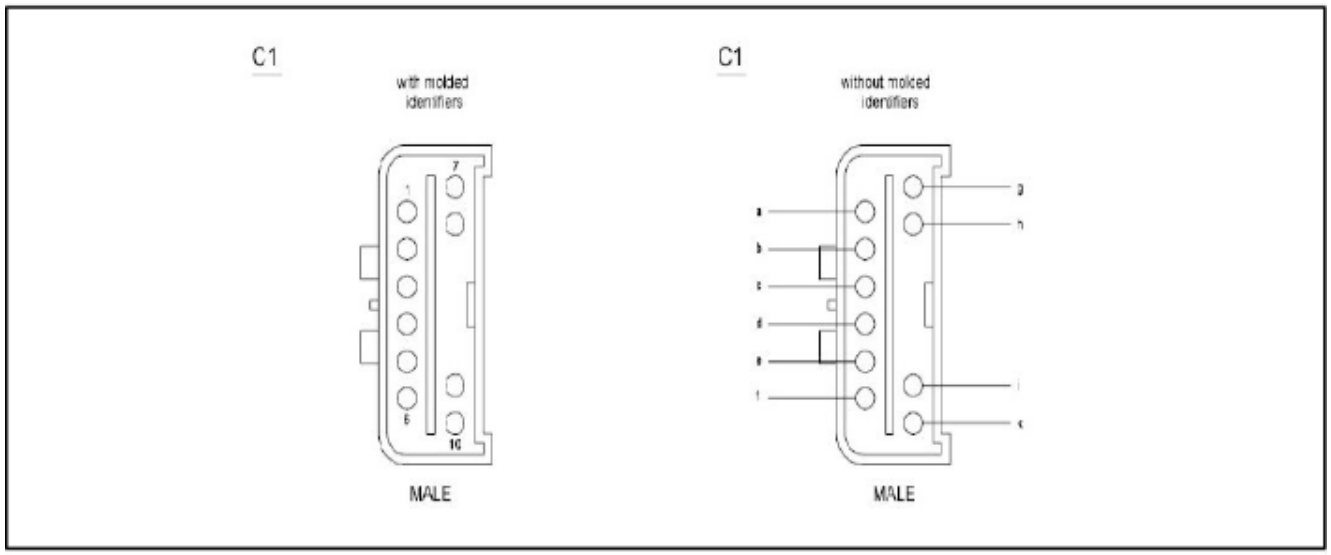
The A/CCR is wired normally open. There is no direct electrical connection between the A/C switch or electronic automatic temperature control (EATC) module and the A/C clutch. The PCM receives a signal indicating that A/C is requested. For some applications, this message is sent through the communications network. When A/C is requested, the PCM checks other A/C related inputs that are available, such as A/C pressure switch and A/C cycling switch. If these inputs indicate A/C operation is OK, and the engine conditions are OK (coolant temperature, engine RPM, throttle position), the PCM grounds the A/CCR output, closing the relay contacts and sending voltage to the A/CCR.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



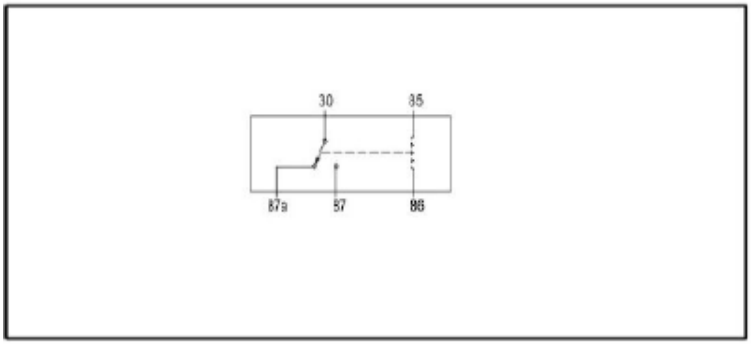
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

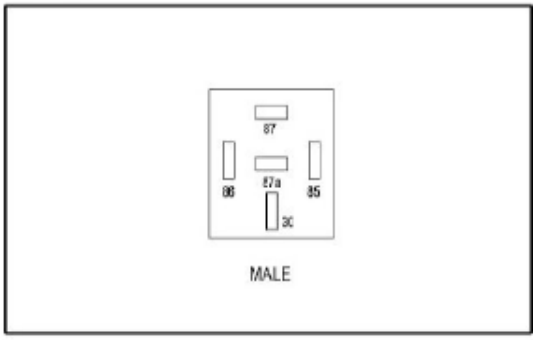
Compressor Clutch Relay: Testing and Inspection Mini ISO Relay

Relay □ Mini ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	45 □ 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

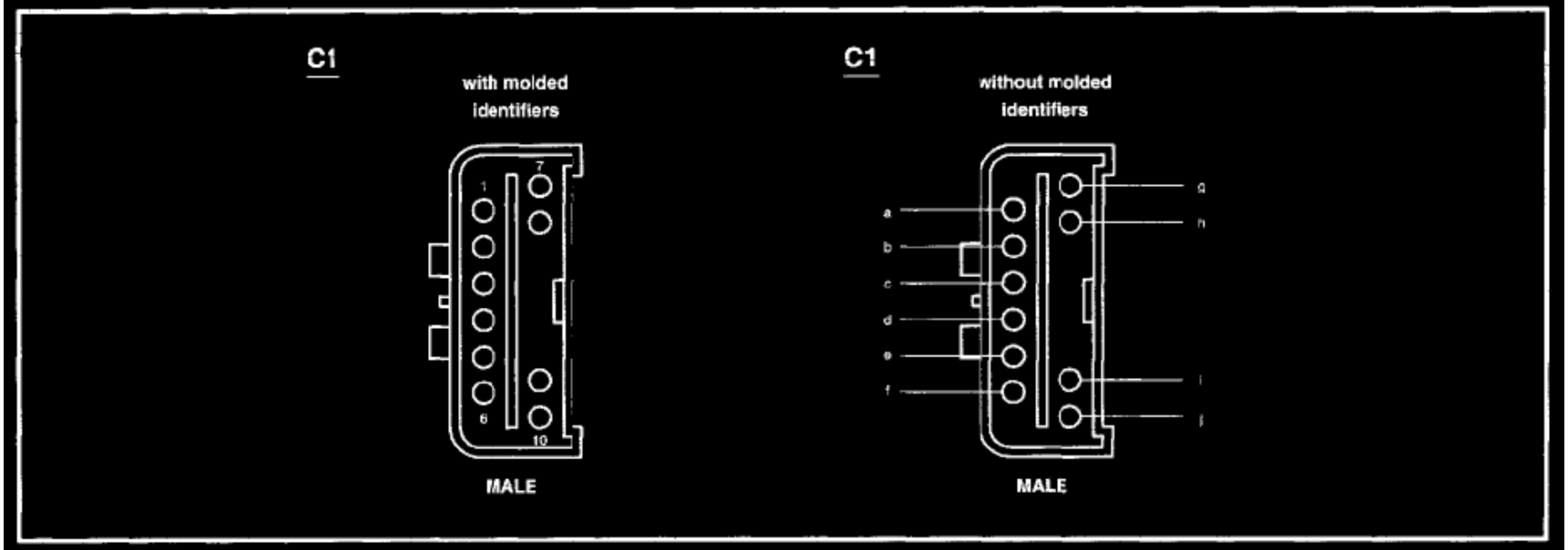
Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step–by–step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



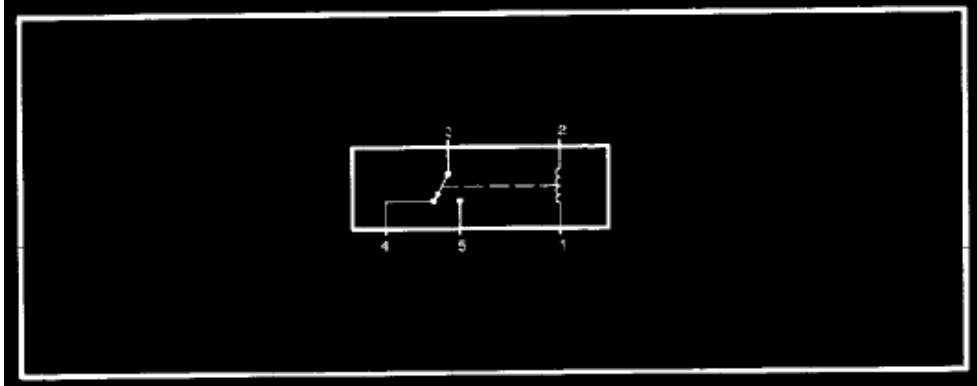
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

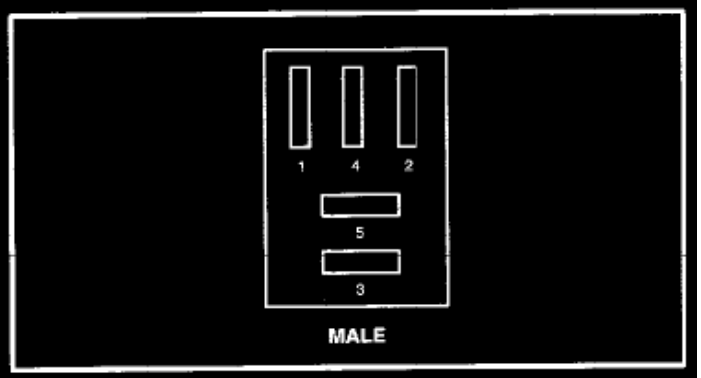
Compressor Clutch Relay: Testing and Inspection Micro ISO Relay

Relay – Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63–102Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil – Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

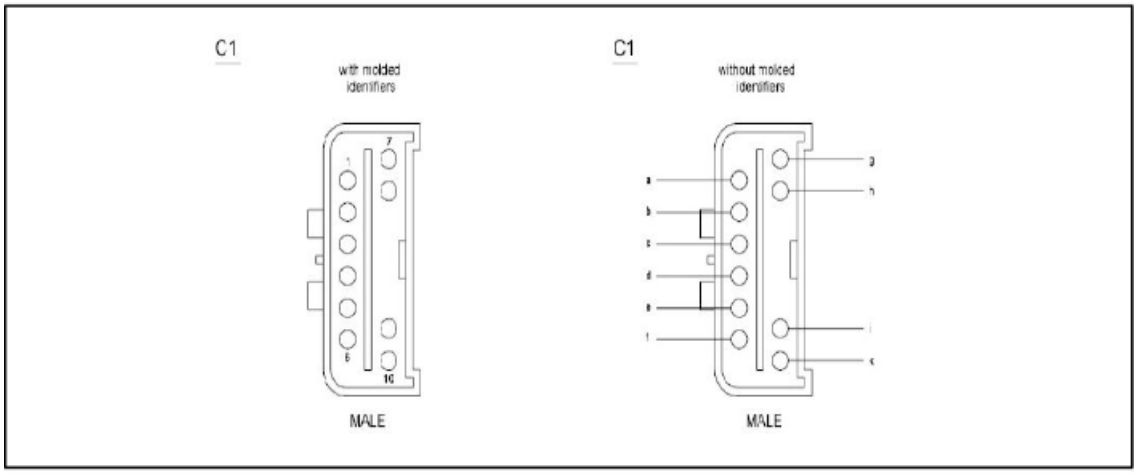
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals

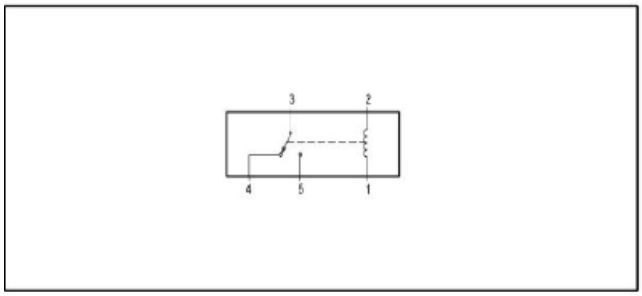


The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

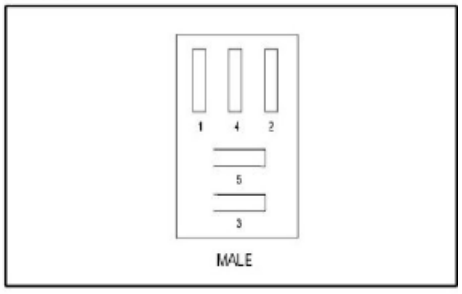
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Relay - Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63-102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil - Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

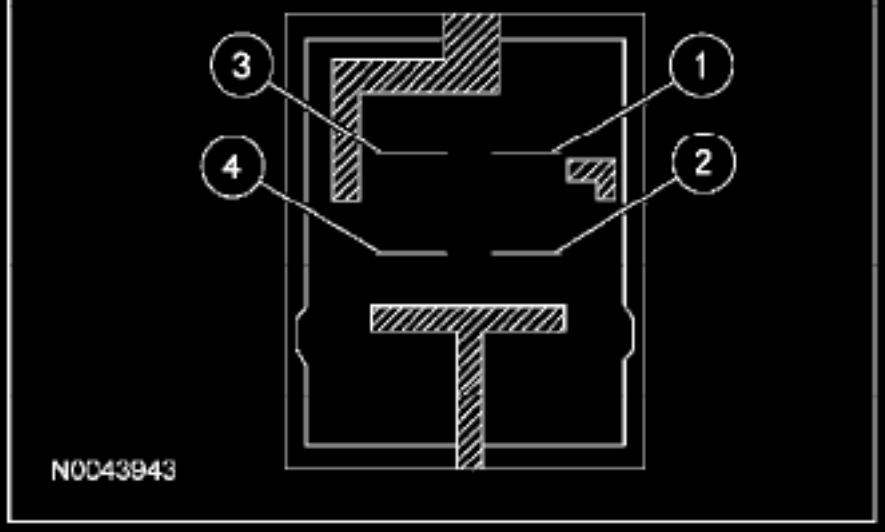
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Blower Motor Switch: Description and Operation

BLOWER MOTOR SWITCH

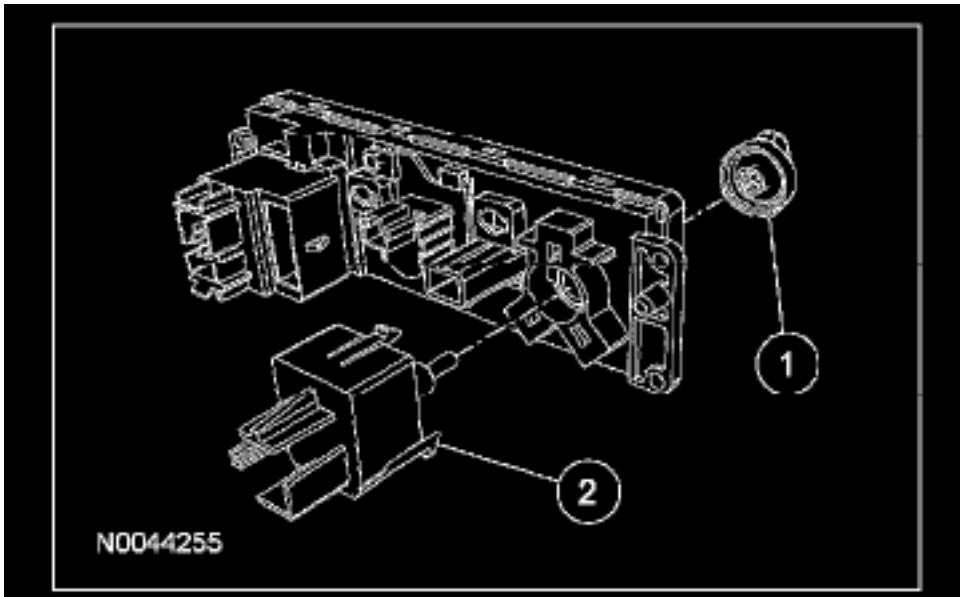
The blower motor switch controls blower motor speed by adding or by passing resistors in the heater blower motor switch resistor.

Switch — Blower Motor

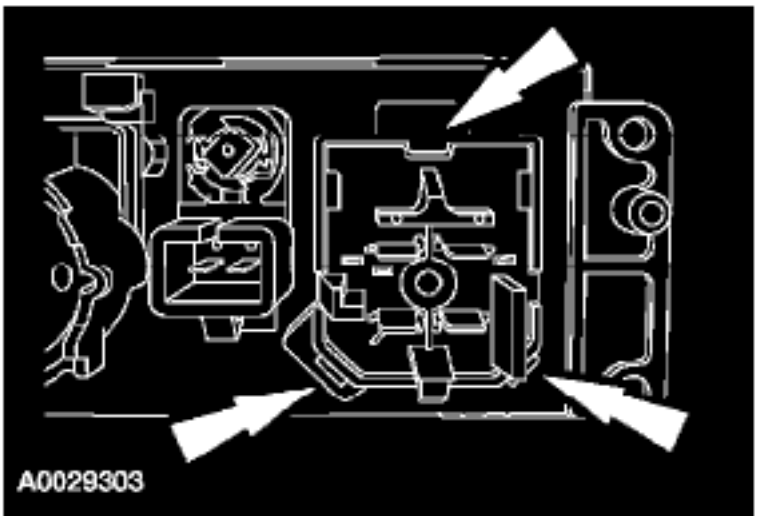


Switch Position	Continuity Between Pins
LOW	none
MED LOW	2 and 3
MED HIGH	2, 3 and 4
HIGH	1, 3 and 4

Switch - Blower Motor



Item	Part Number	Description
1	18519	Blower motor switch knob
2	19986	Blower motor switch



Blower Motor Switch: Service and Repair

BLOWER MOTOR SWITCH

Removal and Installation

1. Remove the climate control assembly. 2. Gently pull and remove the blower motor switch knob.
3. Release the 3 clips and remove the blower motor switch.

4. To install, reverse the removal procedure.

A/C EVAPORATOR TEMPERATURE (ACET) SENSOR VOLTAGE AND RESISTANCE

°C	°F	Volts	Resistance (K ohms)
100	212	0.47	2.08
90	194	0.61	2.80
80	176	0.80	3.84
70	158	1.05	5.34
60	140	1.37	7.55
50	122	1.77	10.93
40	104	2.23	16.11
30	86	2.74	24.25
20	68	3.26	37.34
10	50	3.73	58.99
0	32	4.14	95.85
-10	14	4.45	160.31
-20	-4	4.66	276.96

Evaporator Temperature Sensor / Switch: Description and Operation

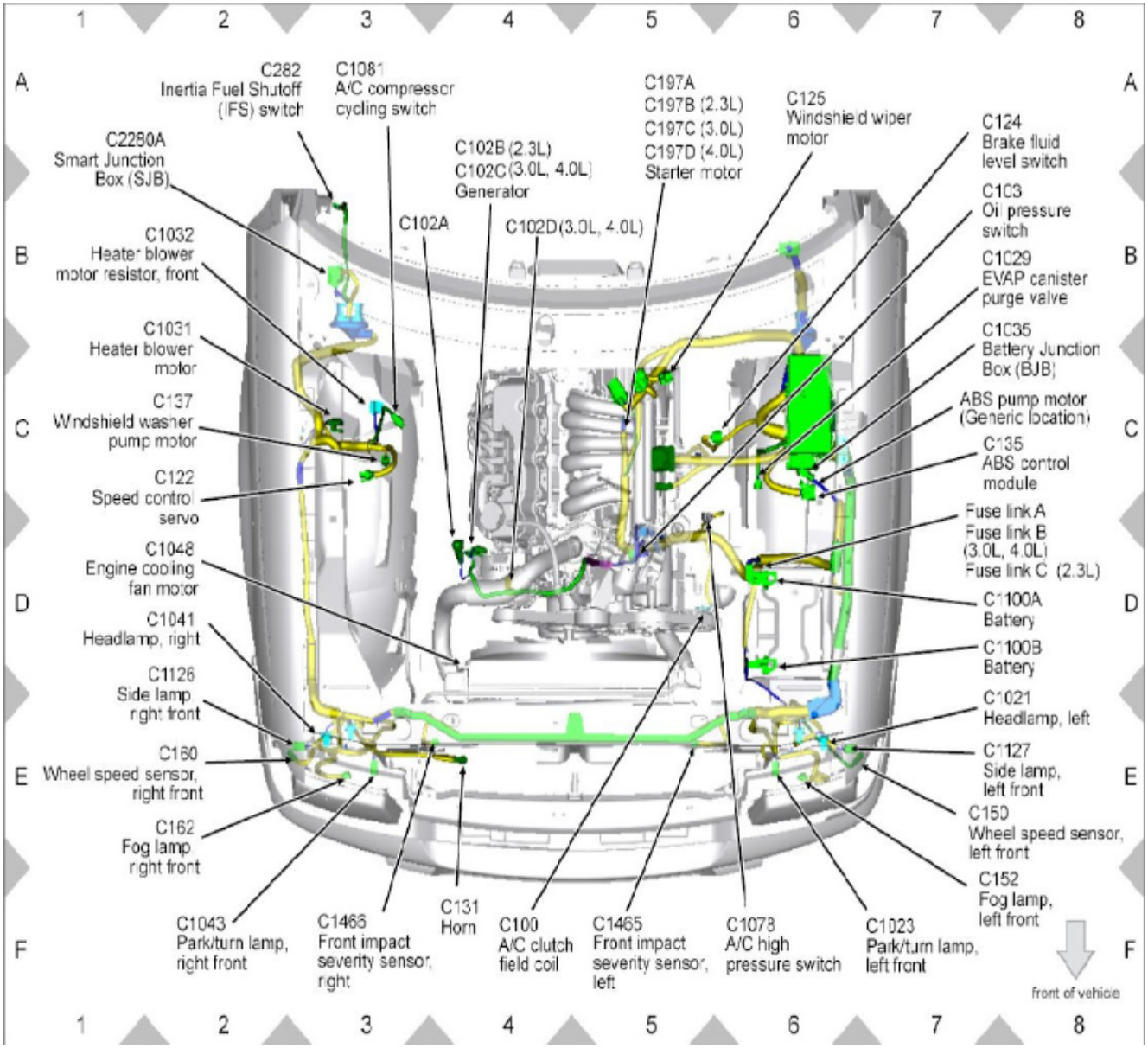
AIR CONDITIONING EVAPORATOR TEMPERATURE (ACET) SENSOR

A/C Evaporator Temperature (ACET) Sensor Voltage And Resistance

The ACET sensor measures the evaporator air discharge temperature. The ACET sensor is a thermistor device in which resistance changes with temperature. The electrical resistance of a thermistor decreases as the temperature increases, and the resistance increases as the temperature decreases. The PCM sources a low current 5 volts on the ACET circuit. With SIG RTN also connected to the ACET sensor, the varying resistance changes the voltage drop across the sensor terminals. As A/C evaporator air temperature changes, the varying resistance of the ACET sensor changes the voltage the PCM detects.

The ACET sensor is used to more accurately control A/C clutch cycling, improve defrost/demist performance, and reduce A/C clutch cycling.

NOTE: These values can vary 15% due to sensor and VREF variations. Voltage values were calculated for VREF equals 5.0 volts.


C282
Inertia Fuel Shutoff (IFS) switch
C1081
A/C compressor cycling switch
C2280A
Smart Junction Box (SJB)
C102B (2.3L)
C102C (3.0L, 4.0L)
Generator
C102A
C102D (3.0L, 4.0L)
C197A
C197B (2.3L)
C197C (3.0L)
C197D (4.0L)
Starter motor
C125
Windshield wiper motor
C124
Brake fluid level switch
C103
Oil pressure switch
C1032
Heater blower motor resistor, front
C1029
EVAP canister purge valve
C1031
Heater blower motor
C1035
Battery Junction Box (BJB)
C137
Windshield washer pump motor
ABS pump motor (Generic location)
C135
ABS control module
C122
Speed control servo
Fuse link A
Fuse link B (3.0L, 4.0L)
Fuse link C (2.3L)
C1048
Engine cooling fan motor
C1100A
Battery
C1100B
Battery
C1041
Headlamp, right
C1021
Headlamp, left
C1126
Side lamp, right front
C1127
Side lamp, left front
C160
Wheel speed sensor, right front
C150
Wheel speed sensor, left front
C162
Fog lamp, right front
C152
Fog lamp, left front
C1043
Park/turn lamp, right front
C1466
Front impact severity sensor, right
C131
Horn
C100
A/C clutch field coil
C1465
Front impact severity sensor, left
C1078
A/C high pressure switch
C1023
Park/turn lamp, left front
front of vehicle

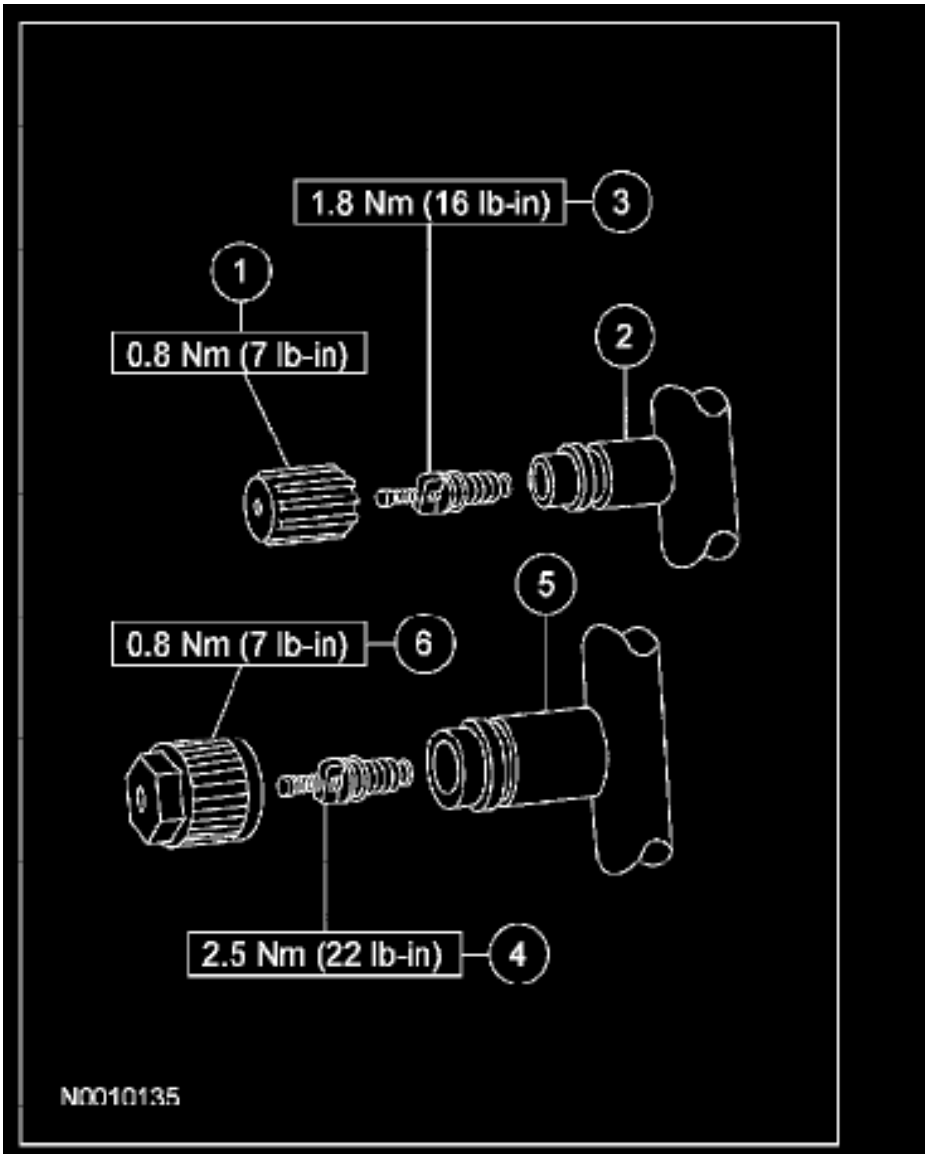
View 151-1

Connector: C1078

Description:	Harness:	Base Part #:
A/C HIGH PRESSURE SWITCH	14A280	19D594

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CH443 (GN-OG)	20	SWITCH - CLIMATE MODE # DEFROST MODES	
2	*	*	not used	
3	CH423 (YE)	20	SWITCH - A/C LOW PRESSURE CYCLING (ACLPCS)	
4	*	*	not used	

C1078



Item	Part Number	Description
1	19D702	A/C charging valve cap
2	—	Low-pressure service gauge port valve
3	19D701	Low-pressure Schrader-type valve
4	19D701	High-pressure Schrader-type valve
5	—	High-pressure service gauge port valve
6	19D702	A/C charging valve cap

Service Port HVAC: Description and Operation

SERVICE GAUGE PORT VALVES

The high-pressure service gauge port valve is located on the compressor-to-condenser discharge line.

The low-pressure service gauge port valve is located on the suction accumulator.

The fitting is an integral part of the refrigeration line or component.

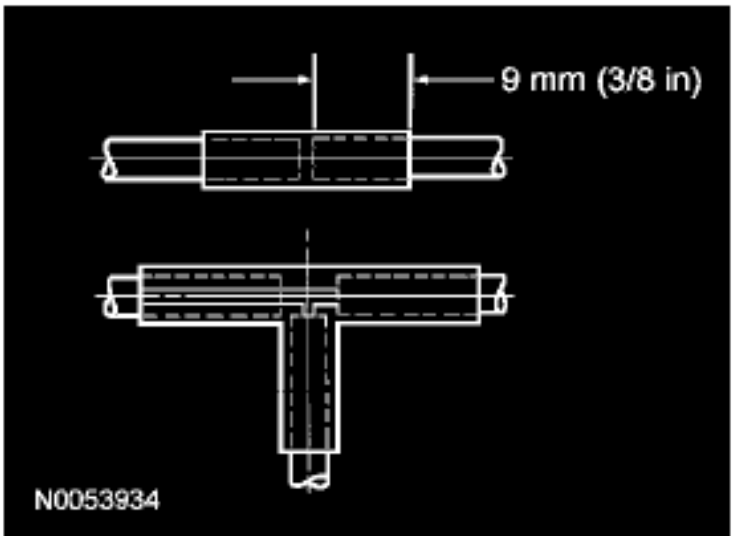
- Special couplings are required for both the high-side and low-side service gauge ports.

- A very small amount of leakage will always be detectable around the Schrader-type valve with the service gauge port valve cap removed, and is considered normal. A new Schrader-type valve core can be installed if the seal leaks excessively.

- The service gauge port valve caps are used as primary seals in the refrigerant system to prevent leakage through the Schrader-type valves from reaching the atmosphere. Always install and tighten the A/C service gauge port valve caps to the correct torque after they are removed.

Special Tool(s)

ST1176-A	Vacuum Pump Kit 416-D002 (D95L-7559-A) or equivalent



Vacuum Harness HVAC: Service and Repair

VACUUM HOSE REPAIR - MINI-TUBE

Special Tool(s)

Special Tool(s)

1. Measure the length of the damaged area of the mini-tube vacuum hose. 2. Cut a piece of standard 1/8-inch inner diameter vacuum hose approximately 25 mm (1 in) longer than the damaged area of the mini-tube vacuum

hose.

3. Cut off the mini-tube vacuum hose on each side of the damaged area.

4. WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical

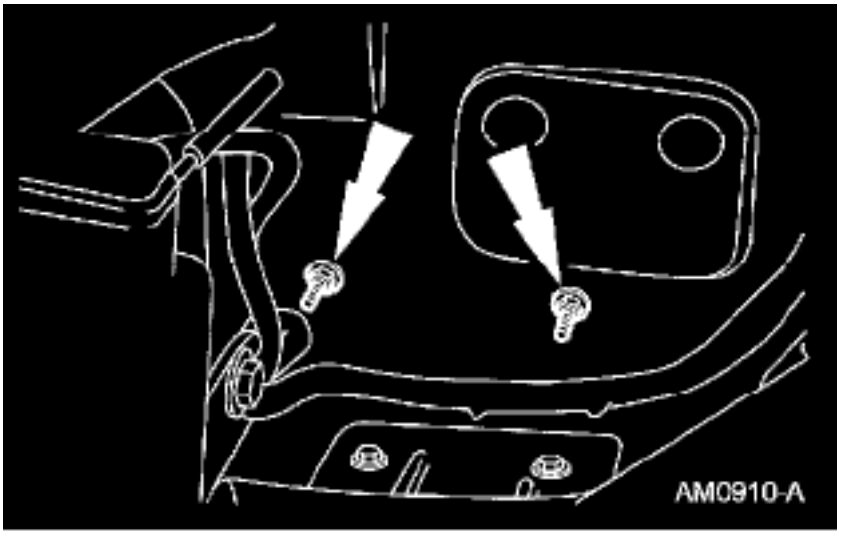
advice. Consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

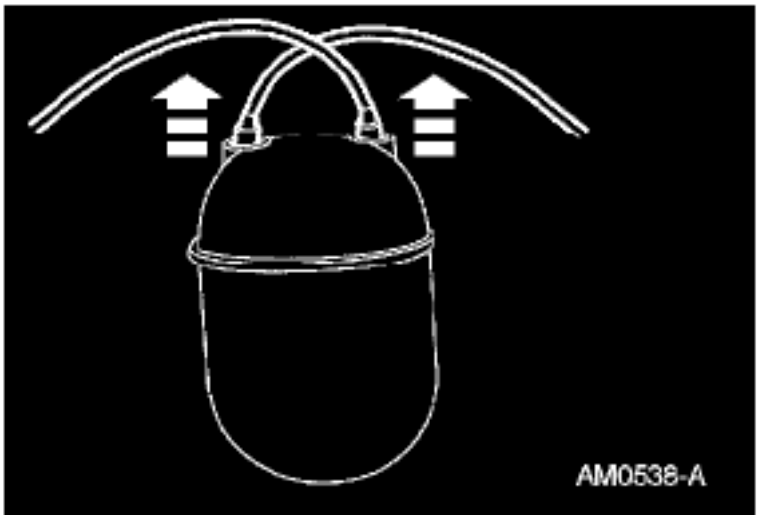
Dip the mini-tube hose ends in commercially available paint thinner containing methyl ethyl ketone (MEK). This solvent will seal the mini-tube in the vacuum hose.

5. Insert the ends of the mini-tube vacuum hose approximately 9 mm (3/8 in) into the ends of the standard 1/8-inch repair vacuum hose section.

6. Shake the repair joint after assembly to make sure the solvent is dispersed and the vacuum line is not plugged. 7. Test the system for a vacuum leak in the repair area.

- Use the vacuum pump or equivalent.





Vacuum Reservoir HVAC: Service and Repair

VACUUM RESERVOIR

Removal and Installation

1. Remove the engine air cleaner. 2. Remove the RH front fender splash shield. 3. Remove the nuts and the vacuum reservoir tank and bracket.

4. Disconnect the vacuum connectors.

5. To install, reverse the removal procedure.

Repairs and Inspections Required After a Collision: Service and Repair Inspection and Repair After A Supplemental Restraint System (SRS) Deployment

INSPECTION AND REPAIR AFTER A SUPPLEMENTAL RESTRAINT SYSTEM (SRS) DEPLOYMENT

WARNING: Remove restraint system diagnostic tools from the vehicle prior to road testing. If tools are not removed, the supplemental restraint system (SRS) device may not deploy in a crash. Failure to follow this instruction may result in serious personal injury or death in a crash and possibly violate vehicle safety standards.

NOTE:

- After diagnosing or repairing a supplemental restraint system (SRS), the restraint system diagnostic tools (if required) must be removed before operating the vehicle over the road.

- Deployable devices (such as air bag modules, pretensioners) may deploy alone or in various combinations depending on the impact event.

- Always refer to the appropriate Vehicle System procedures prior to carrying out vehicle repairs affecting the SRS and safety belt system.

- The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

All vehicles

1. NOTE: Refer to the correct removal and installation procedure for all SRS components being installed.

When any deployable device or combination of devices are deployed and/or the restraints control module (RCM) has the DTC B1231 (Event Threshold Exceeded) in memory, the repair of the vehicle's SRS is to include the removal of all deployed devices and the installation of new deployable devices, the removal and installation of new impact sensors, and the removal and installation of a new RCM. DTCs must cleared from all required modules after repairs are carried out.

Vehicles with occupant classification sensor (OCS) system

2. NOTE: After installation of new occupant classification sensor (OCS) system components carry out the OCS System Reset procedure as

instructed in the Vehicle System. Refer to the appropriate Vehicle System for OCS system removal and installation procedure.

When a vehicle has been involved in a collision and the occupant classification system module (OCSM) has DTC B1231 stored in memory, the repair of the OCS system is to include the following procedures for the specified system: -

For rail type OCS system, inspect the passenger side floorpan for damage and repair as necessary. Install new OCS rails.

- For weight sensor bolt type OCS system, inspect the passenger side floorpan for damage and repair as necessary. Install a new seat track with OCS weight sensor bolts.

- NOTE: Most bladder type OCSM do not store a DTC B1231 in memory after deployment. The DTC B1231 is stored only by the RCM.

For bladder type OCS system, inspect for damage and repair as necessary. If installation of an OCS system component is required, an OCS system service kit must be installed.

All vehicles

3. When any damage to the impact sensor mounting points or mounting hardware has occurred, repair or install new mounting points and mounting

hardware as needed.

4. When the driver air bag module has deployed, a new clockspring must be installed. 5. New driver and/or front passenger safety belt systems (including retractors, buckles and height adjusters) must be installed if the vehicle is

involved in a collision that results in deployment of the driver and/or front passenger safety belt pretensioners.

6. Inspect the entire vehicle for damage, including the following components:

- Steering column (deployable column if equipped)

- Instrument panel knee bolsters and mounting points

- Instrument panel braces and brackets

- Instrument panel and mounting points

- Seats and seat mounting points

- Safety belts, safety belt buckles and safety belt retractors.

- SRS wiring, wiring harnesses and connectors

7. After carrying out the review and inspection of the entire vehicle for damage, repair or install new components as needed.

Repairs and Inspections Required After a Collision: Service and Repair Safety Belt Procedure After A Collision

SAFETY BELT PROCEDURE AFTER A COLLISION

WARNING: After any crash, all of the following safety belt assemblies and attaching hardware must be inspected by an authorized dealer to verify correct function:

- Retractors

- Buckles

- Belt tension sensor (BTS) (if equipped)

- Front safety belt buckle support assemblies (slide bar) (if equipped)

- Safety belt shoulder belt height adjusters (if equipped)

- Child safety seat tether bracket assemblies

- Automatic locking retractor (ALR) feature for child safety seats (passenger seating positions only)

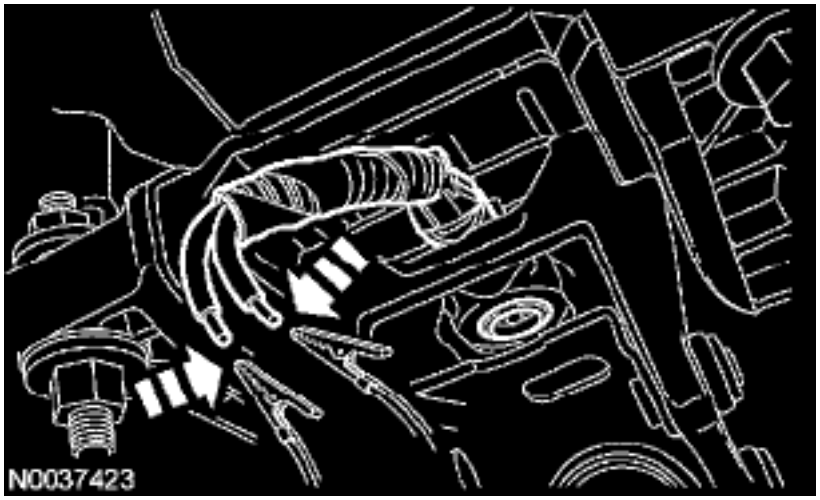
If any safety belt assembly is damaged, does not operate correctly or does not pass all of the Functional Tests in the Diagnosis and Testing portion, a new safety belt assembly must be installed. If any safety belt assembly attaching areas are damaged or distorted, the sheet metal must be restored to its original structural integrity and new safety belt assembly and attaching hardware must be installed. Failure to install new safety belt assemblies and attaching hardware may increase the risk of serious personal injury or death in a crash.

After any crash that results in deployment of the driver and/or front outboard passenger safety belt pretensioners, new driver and/or front outboard passenger safety belt systems (including retractors, buckles and height adjusters) must be installed. Failure to install new safety belt systems increases the risk of serious personal injury or death in a crash.

1. Before installing a new safety belt assembly, the safety belt attaching areas must be inspected for damage and distortion. If the attaching points are

damaged and distorted, the sheet metal must be worked back to its original shape and structural integrity.

2. Install the new safety belt(s). Carry out Functional Test. See: Seat Belt Systems/Testing and Inspection/Component Tests and General Diagnostics



Adaptive Collapsible Steering Column: Service and Repair

DEPLOYABLE STEERING COLUMN - IN-VEHICLE DEPLOYMENT

WARNING: Deploy all supplemental restraint system (SRS) devices (air bags, pretensioners, load limiters, etc.) outdoors with all personnel at least 9.14 meters (30 feet) away to make sure of personal safety. Due to the loud report which occurs when an SRS device is deployed, hearing protection is required. Failure to follow these instructions may result in serious personal injury.

1. Depower the SRS.

2. NOTE: It may be necessary to lower or remove the deployable steering column from the instrument panel to access the deployable steering

column electrical connector.

Access the deployable steering column electrical connector.

3. NOTE: If the deployable steering column does not have a hard-wired pigtail, it will be necessary to cut the wires and connector(s) from the

vehicle wire harness and reconnect to the deployable steering column.

Cut each of the deployable steering column wires, leaving at least 4 inches to work with.

4. Remove any sheathing (if present) and strip the insulation from the ends of the cut wires. 5. Make a jumper harness to deploy the deployable steering column.

- Obtain 2 wires (20 gauge minimum) at least 9.14 m (30 ft) long and strip both ends of each wire.

- At one end of the jumper harness, connect the wires together.

6. Using the end of the jumper harness that the wires are not connected together, attach each wire of the jumper harness to each wire of the

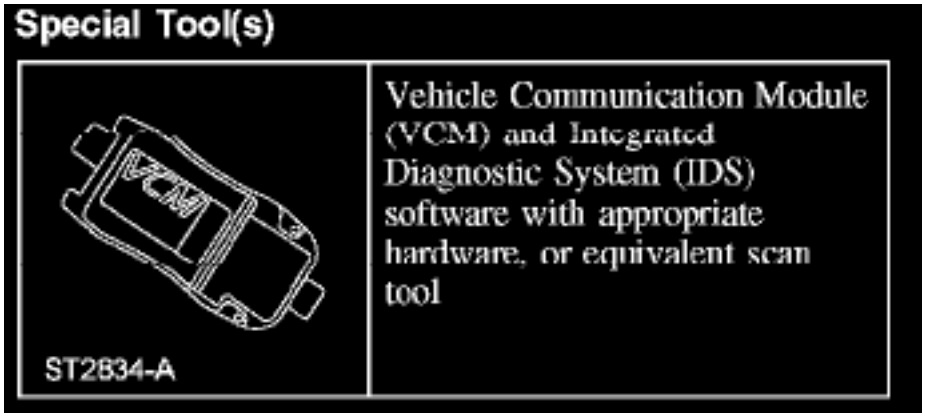
deployable steering column. Use tape or other insulating material to make sure that the leads do not make contact with each other.

7. Remain at least 9.14 m (30 ft) away from the deployable steering column. 8. From the end of the jumper harness that is not connected to the deployable steering column, disconnect the 2 wires of the jumper harness from

each other.

9. Deploy the deployable steering column by touching the ends of the 2 wires of the jumper harness to the terminals of a 12-volt battery.

10. To allow for cooling, wait at least 10 minutes before approaching the deployed steering column. 11. Dispose of the deployed steering column in the same manner as any other part to be scrapped.



Air Bag(s) Arming and Disarming: Service and Repair Supplemental Restraint System (SRS) Depowering and Repowering

SUPPLEMENTAL RESTRAINT SYSTEM (SRS) DEPOWERING AND REPOWERING

Special Tool(s)

Special Tool(s)

Depowering Procedure

WARNING:

- Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.

- To reduce the risk of accidental deployment, do not use any memory saver devices. Failure to follow this instruction may result in serious personal injury or death.

NOTE:

- The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate an SRS fault.

- The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1. Turn all vehicle accessories OFF. 2. Turn the ignition switch to OFF. 3. At the smart junction box (SJB), located below the RH side of the instrument panel, remove the RH lower cowl trim panel and remove the

restraints control module (RCM) fuse 8 (10A) from the SJB.

4. Turn the ignition ON and visually monitor the air bag warning indicator for at least 30 seconds. The air bag warning indicator will remain lit

continuously (no flashing) if the correct RCM fuse has been removed. If the air bag warning indicator does not remain lit continuously, remove the correct RCM fuse before proceeding.

5. Turn the ignition OFF.

6. WARNING: Always deplete the backup power supply before repairing or installing any new front or side air bag supplemental restraint

system (SRS) component and before servicing, removing, installing, adjusting or striking components near the front or side impact sensors or the restraints control module (RCM). Nearby components include doors, instrument panel, console, door latches, strikers, seats and hood latches.

Refer to the Description and Operation portion of Air Bag Systems for location of the RCM and impact sensor(s).

To deplete the backup power supply energy, disconnect the battery ground cable and wait at least 1 minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Failure to follow these instructions may result in serious personal injury or death in the event of an accidental deployment.

Disconnect the battery ground cable and wait at least one minute.

Repowering Procedure

1. Turn the ignition switch from OFF to ON. 2. Install the RCM fuse 8 (10A) to the SJB and install the RH lower cowl trim panel.

3. WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is

connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

Connect the battery ground cable.

4. Prove out the SRS as follows:

Turn the ignition key from ON to OFF. Wait 10 seconds, then turn the key back to ON and visually monitor the air bag warning indicator with the air bag modules installed. The air bag warning indicator will light continuously for approximately 6 seconds and then turn off. If an air bag SRS fault is present, the air bag warning indicator will: -

fail to light.

- remain lit continuously.

- flash at a 5Hz rate (RCM not configured).

The air bag warning indicator may not illuminate until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON position. This is the time required for the RCM to complete the testing of the SRS. If the air bag warning indicator is inoperative and a SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag warning indicator and any SRS fault discovered must be diagnosed and repaired.

Clear all continuous RCM and occupant classification system module (OCSM) DTCs using a scan tool.

Special Tool(s)

ST2621-A	Diagnostic Tool, Restraint System (2 required) 418-F395
ST2512-A	Diagnostic Tool, Restraint System 418-F403
ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Air Bag(s) Arming and Disarming: Service and Repair Supplemental Restraint System (SRS) Deactivation and Reactivation

SUPPLEMENTAL RESTRAINT SYSTEM (SRS) DEACTIVATION AND REACTIVATION

Special Tool(s)

Deactivation Procedure

WARNING:

- Always carry or place a live air bag module with the air bag and deployment door/trim cover/tear seam pointed away from the body. Do not set a live air bag module down with the deployment door/trim cover/tear seam face down. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

- Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.

- To reduce the risk of accidental deployment, do not use any memory saver devices. Failure to follow this instruction may result in serious personal injury or death.

NOTE:

- The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

- No restraint system diagnostic tools are available for the safety belt buckle pretensioners. If the ignition switch is set to RUN or START with either the driver or passenger safety belt buckle pretensioner electrical connector disconnected, the DTCs for an open circuit fault will be active.

- The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1. Turn all vehicle accessories OFF. 2. Turn the ignition switch to OFF. 3. At the smart junction box (SJB), located below the RH side of the instrument panel, remove the restraints control module (RCM) fuse 8 (10A)

from the SJB.

4. Turn the ignition ON and visually monitor the air bag warning indicator for at least 30 seconds. The air bag warning indicator will remain lit

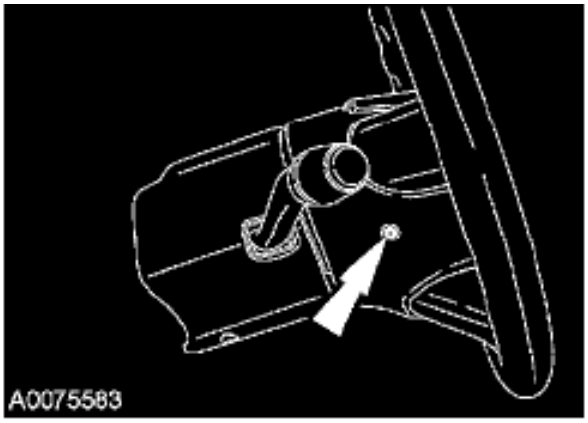
continuously (no flashing) if the correct RCM fuse has been removed. If the air bag warning indicator does not remain lit continuously, remove the correct RCM fuse before proceeding.

5. Turn the ignition OFF.

6. WARNING: Always deplete the backup power supply before repairing or installing any new front or side air bag supplemental restraint

system (SRS) component and before servicing, removing, installing, adjusting or striking components near the front or side impact sensors or the restraints control module (RCM). Nearby components include doors, instrument panel, console, door latches, strikers, seats and hood latches.

Refer to the Description and Operation portion of Air Bag Systems for location of the RCM and impact sensor(s).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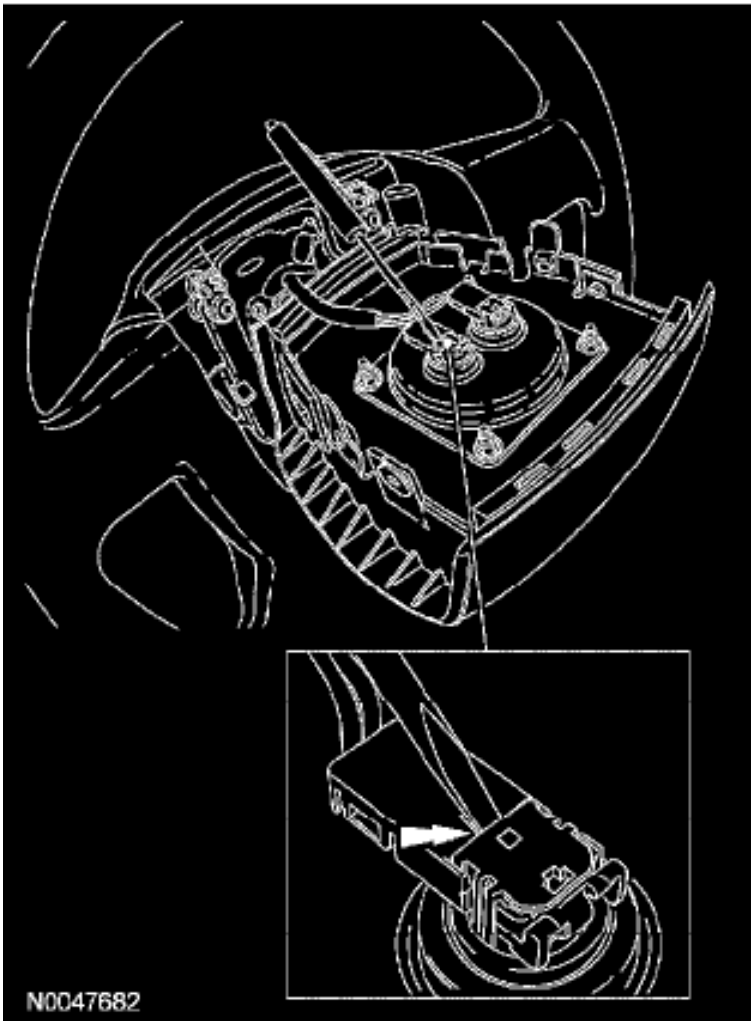

N0047682

To deplete the backup power supply energy, disconnect the battery ground cable and wait at least 1 minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Failure to follow these instructions may result in serious personal injury or death in the event of an accidental deployment.

Disconnect the battery ground cable and wait at least 1 minute.

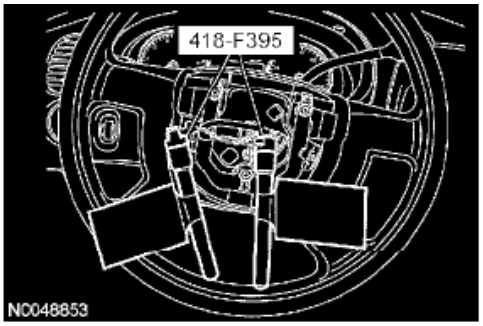
7. Remove the 2 driver air bag module bolts (1 shown).

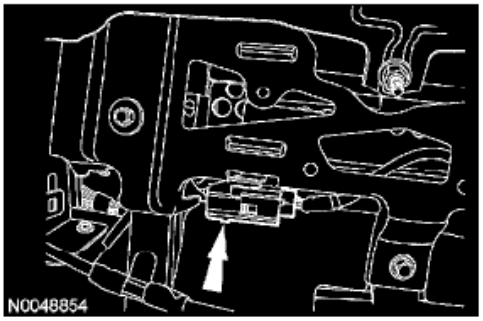
8. CAUTION: Do not pull the driver air bag module electrical connectors out by the locking buttons. Damage to the locking buttons may

occur.

Using a small screwdriver as shown, lift up and release the locking buttons on the driver air bag module electrical connectors. With the locking buttons released, remove the electrical connectors and the driver air bag module.

9. Attach the restraint system diagnostic tools to the clockspring electrical connectors at the top of the steering column.


418-F395
N0048853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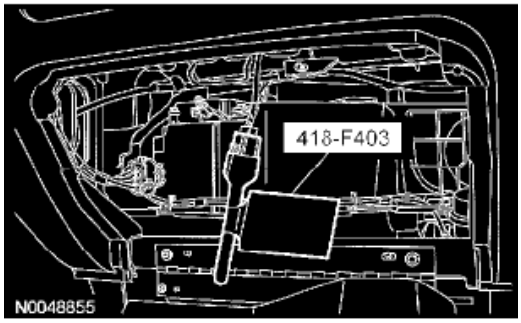
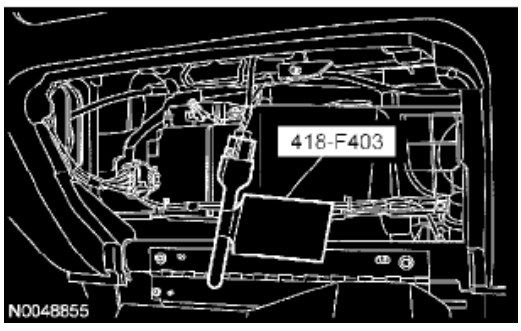

418-F403
N0048855


418-F403
N0048855

10. Open the glove compartment door fully to access the passenger air bag electrical connector.
11. Release the tab and disconnect the passenger air bag module electrical connector.

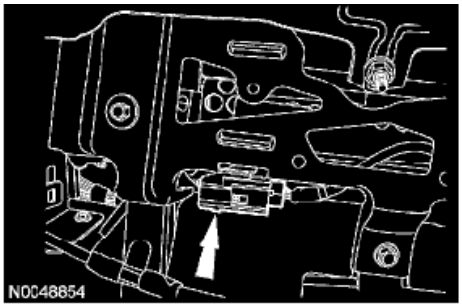
12. Attach the restraint system diagnostic tool to the vehicle harness side of the passenger air bag module electrical connector.

13. Install the RCM fuse 8 (10A) to the SJB. 14. Connect the battery ground cable.

Reactivation Procedure

1. Remove the RCM fuse 8 (10A) from the SJB. 2. Disconnect the battery ground cable and wait at least one minute. 3. Remove the restraint system diagnostic tool from the vehicle harness side of the passenger air bag module electrical connector.

4. Connect the passenger air bag module electrical connector.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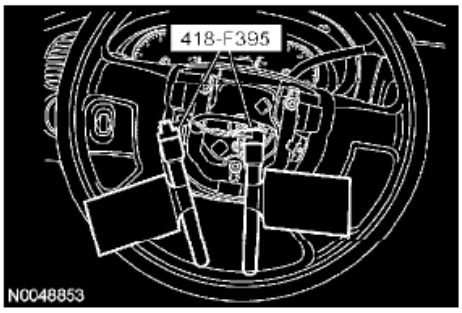
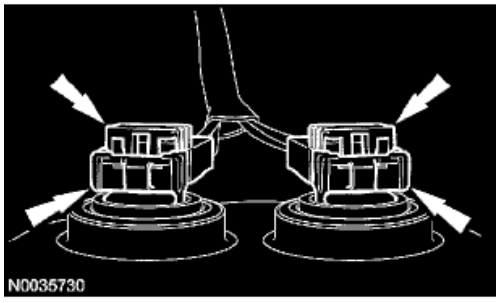

418-F395
N0048853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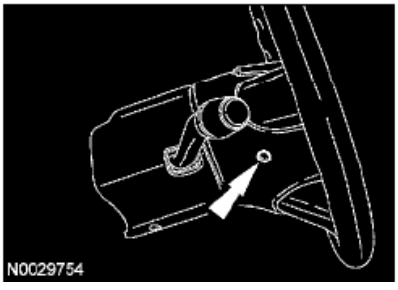

N0029754

5. Close the glove compartment door. 6. Remove the restraint system diagnostic tools from the clockspring electrical connectors at the top of the steering column.

7. CAUTION:

- Do not install the driver air bag module electrical connectors by the locking buttons. Damage to the locking buttons may occur.

- The driver air bag module electrical connector locking buttons must be in the released position when the connector is being installed or connector damage may occur.

- The driver air bag module electrical connectors are unique and cannot be reversed when connected to the driver air bag module. Match the electrical connector key to the keyway in the driver air bag module. Do not force the electrical connectors into the driver air bag module. Damage to the connector or component may occur.

With the locking buttons released, install the driver air bag module electrical connectors fully into the driver air bag module and seat the locking buttons.

8. Install the 2 driver air bag module bolts (1 shown).

- Tighten to 6 Nm (53 lb-in).

9. WARNING: Remove restraint system diagnostic tools from the vehicle prior to road testing. If tools are not removed, the supplemental

restraint system (SRS) device may not deploy in a crash. Failure to follow this instruction may result in serious personal injury or death

in a crash and possibly violate vehicle safety standards.

Make sure all restraint system diagnostic tool(s) that may have been installed during the repair have been removed from the vehicle and all SRS components are connected.

10. Turn the ignition from OFF to ON. 11. Install the restraint system control module fuse 8 (10A) to the SJB.

12. WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is

connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

Connect the battery ground cable.

13. Prove out the SRS as follows:

Turn the ignition key from ON to OFF. Wait 10 seconds, then turn the key back to ON and visually monitor the air bag warning indicator with the air bag modules installed. The air bag warning indicator will light continuously for approximately 6 seconds and then turn off. If an air bag SRS fault is present, the air bag warning indicator will: -

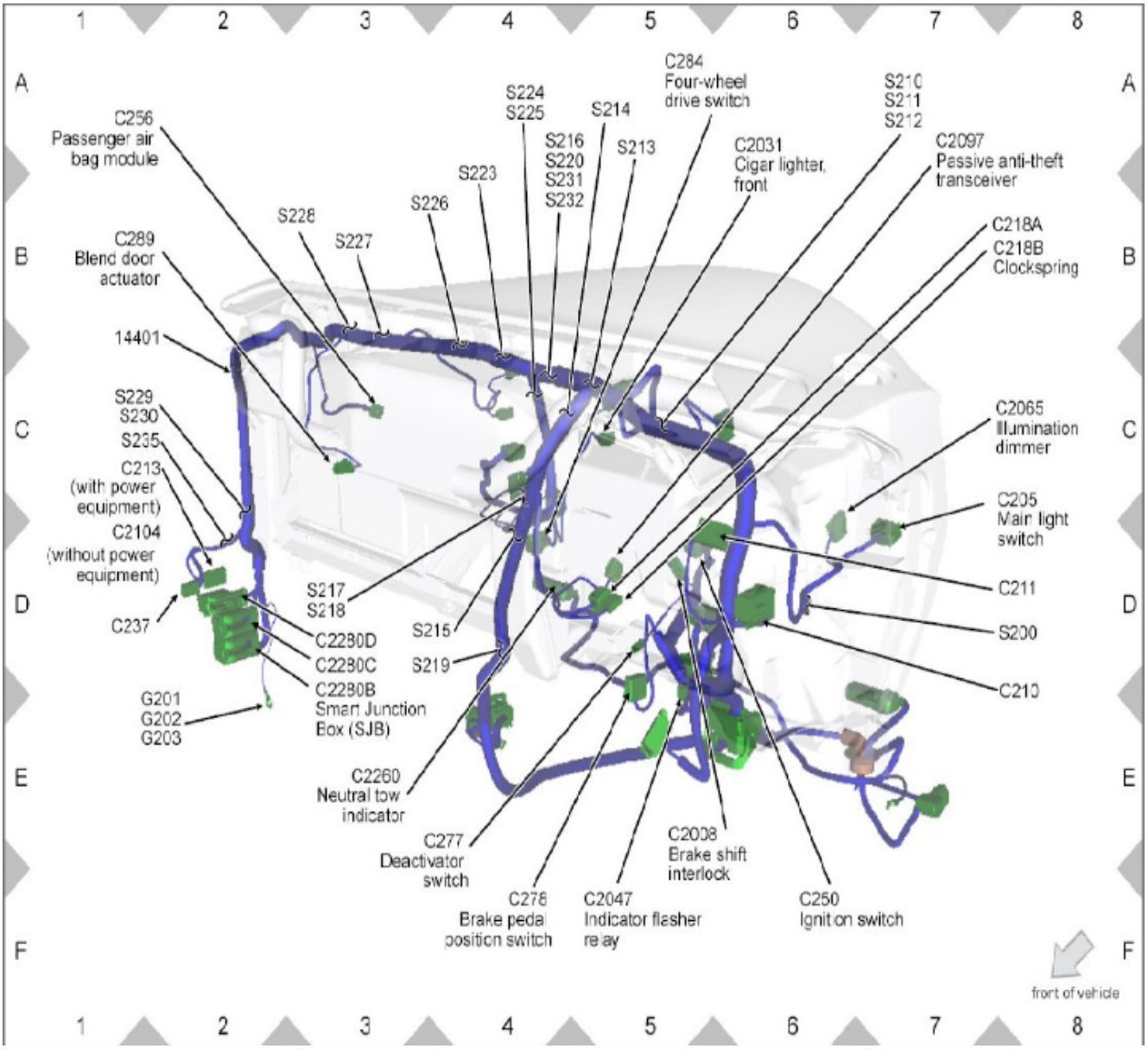
fail to light.

- remain lit continuously.

- flash at a 5Hz rate (RCM not configured).

The air bag warning indicator may not illuminate until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON position. This is the time required for the RCM to complete the testing of the SRS. If the air bag warning indicator is inoperative and a SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag warning indicator and any SRS fault discovered must be diagnosed and repaired.

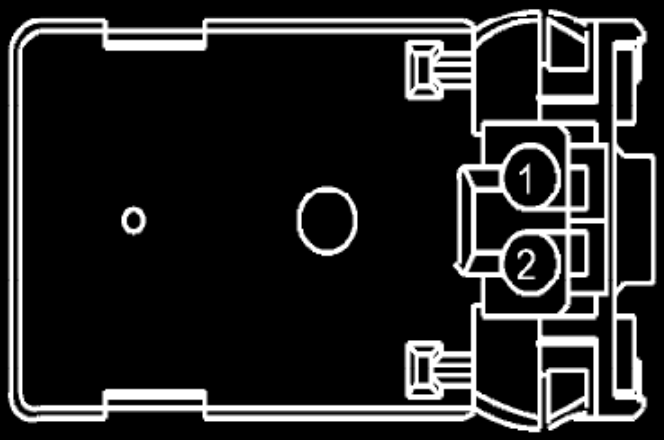
Clear all continuous RCM and occupant classification system module (OCSM) DTCs using a scan tool.


1
2
3
4
5
6
7
8
A
B
C
D
E
F
C256
Passenger air bag module
C289
Blend door actuator
14401
S229
S230
S235
C213
(with power equipment)
C2104
(without power equipment)
C237
G201
G202
G203
S228
S227
S226
S223
S224
S225
S216
S220
S231
S232
S214
S213
C284
Four-wheel drive switch
C2031
Cigar lighter, front
S210
S211
S212
C2097
Passive anti-theft transceiver
C218A
C218B
Clockspring
C2065
Illumination dimmer
C205
Main light switch
C211
S200
C210
S217
S218
S215
S219
C2280D
C2280C
C2280B
Smart Junction Box (SJB)
C2260
Neutral tow indicator
C277
Deactivator switch
C276
Brake pedal position switch
C2047
Indicator flasher relay
C2008
Brake shift interlock
C250
Ignition switch
front of vehicle

View 151-11

Connector: C216A

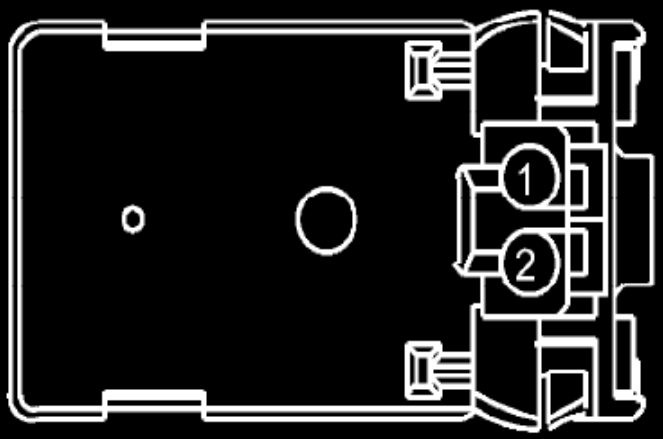
Description:	Harness:	Base Part #:
DRIVER AIR BAG UNIT	14401	78043B13



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	614 (GY-OG)	20	CTRL MOD. - AIR BAG DRIVER 2	
2	615 (GY-WH)	20	CTRL MOD. - AIR BAG DRIVER 2	

Connector: C216B

Description:	Harness:	Base Part #:
DRIVER AIR BAG UNIT	14401	78043B13

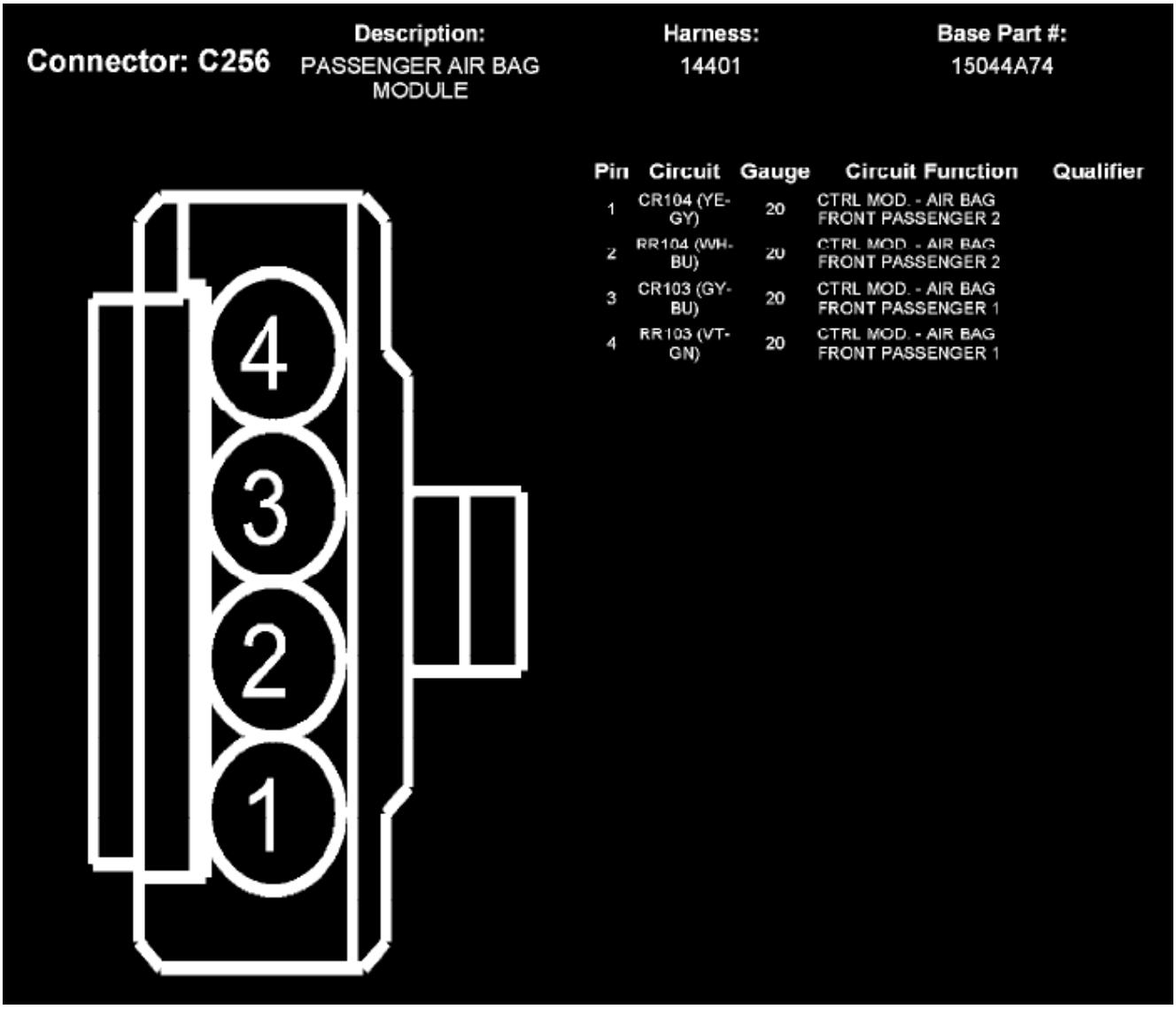


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	1516 (YE-WH)	20	CTRL MOD. - AIR BAG DRIVER 1	
2	1517 (RD-OG)	20	CTRL MOD. - AIR BAG DRIVER 1	

Air Bag: Diagrams Driver Air Bag Unit

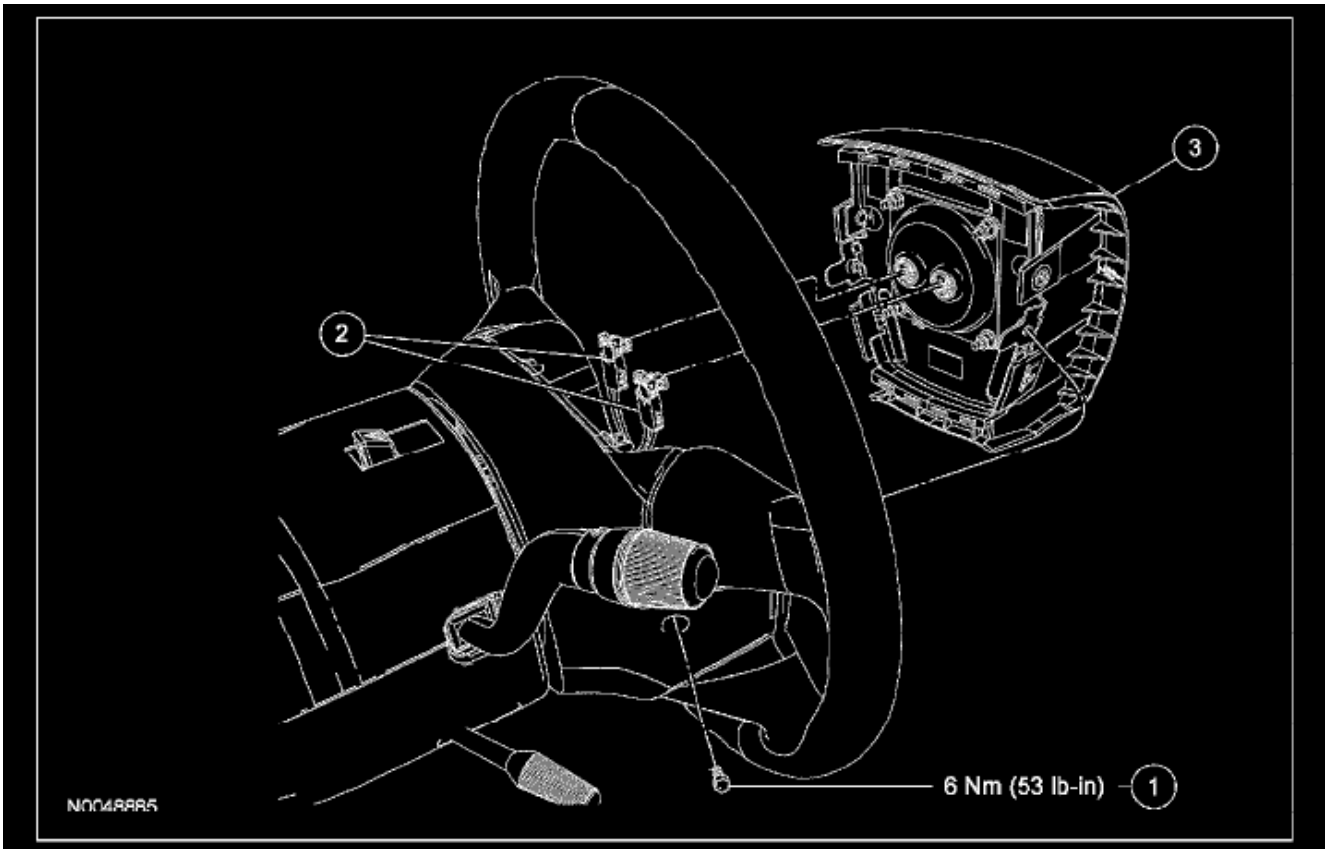
C216A

C216B



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CR104 (YE-GY)	20	CTRL MOD. - AIR BAG FRONT PASSENGER 2	
2	RR104 (WH-BU)	20	CTRL MOD. - AIR BAG FRONT PASSENGER 2	
3	CR103 (GY-BU)	20	CTRL MOD. - AIR BAG FRONT PASSENGER 1	
4	RR103 (VT-GN)	20	CTRL MOD. - AIR BAG FRONT PASSENGER 1	

C256



Item	Part Number	Description
1	W710888	Driver air bag module bolt (2 required)
2	—	Driver air bag module electrical connectors (part of 14A664)
3	043B13	Driver air bag module

Air Bag: Service and Repair Driver Air Bag Module

DRIVER AIR BAG MODULE

Removal

WARNING: -

Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.

- Always carry or place a live air bag module with the air bag and deployment door/trim cover/tear seam pointed away from the body. Do not set a live air bag module down with the deployment door/trim cover/tear seam face down. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

- Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which

increases the risk of serious personal injury or death.

NOTE: -

The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

- The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

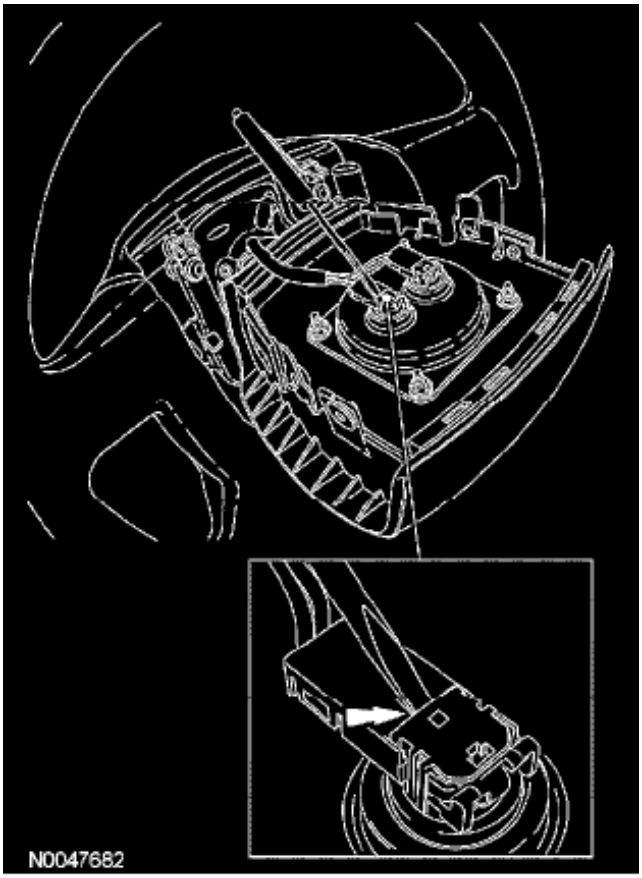
- Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and carry out the diagnostic procedure again.

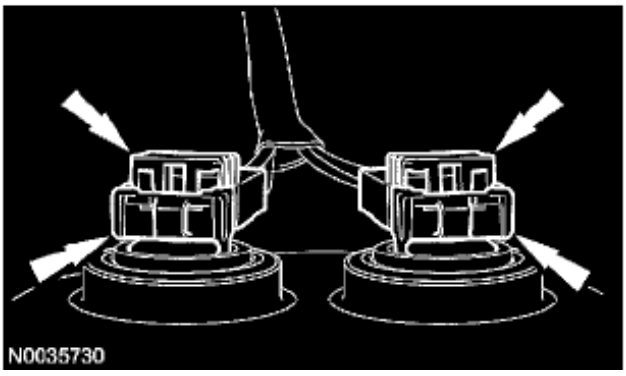
1. Depower the SRS. 2. Remove the 2 driver air bag module bolts.

3. CAUTION: Do not pull the driver air bag module electrical connectors out by the locking buttons. Damage to the locking buttons may

occur.

Using a small screwdriver as shown, lift up and release the locking buttons on the driver air bag module electrical connectors. With the locking


N0047682


N0035730

buttons released, remove the electrical connectors and the driver air bag module.

Installation

1. CAUTION:

- Do not install the driver air bag module electrical connectors by the locking buttons. Damage to the locking buttons may occur.

- The driver air bag module electrical connector locking buttons must be in the released position when the connector is being installed or connector damage may occur.

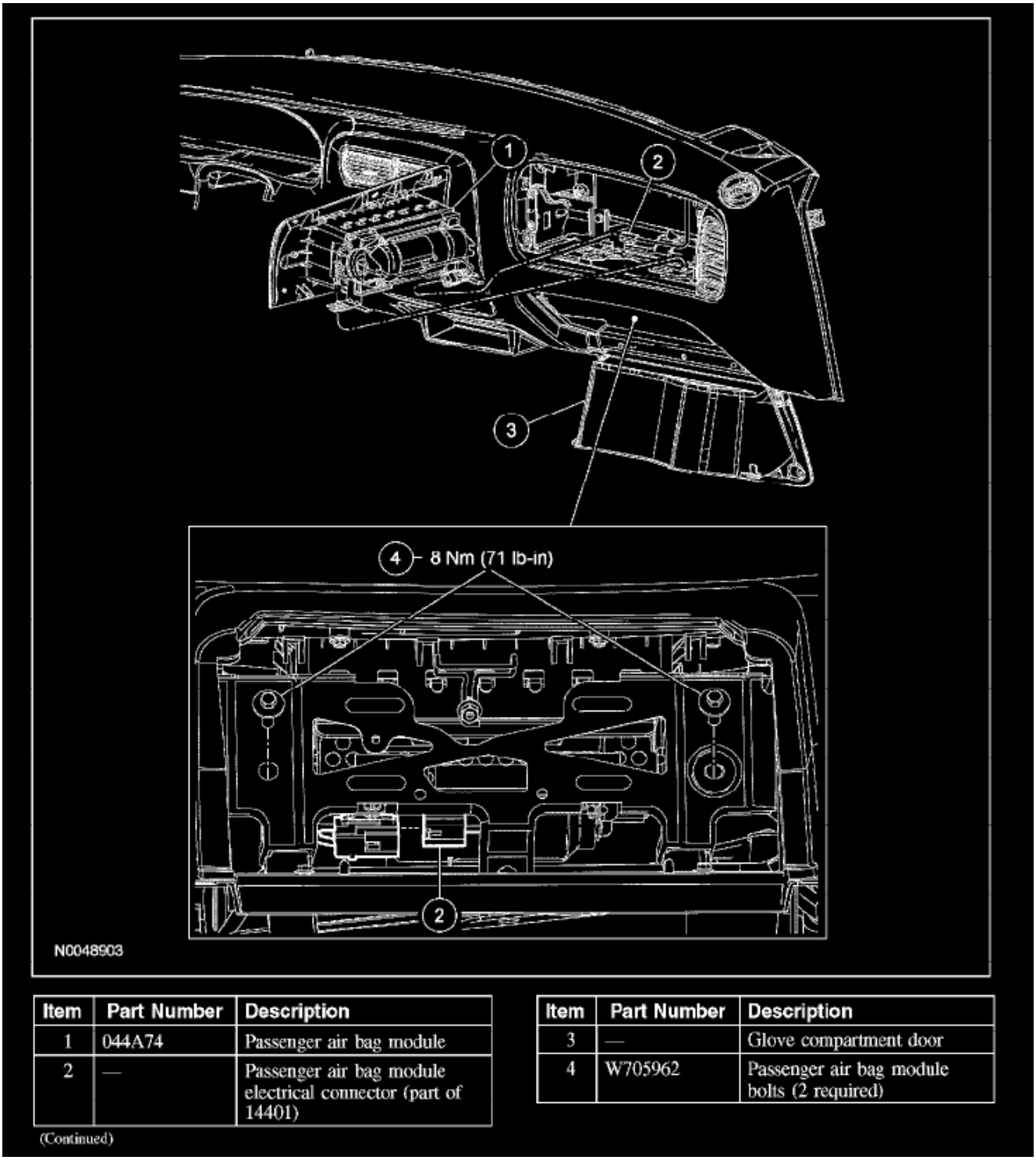
- The driver air bag module electrical connectors are unique and cannot be reversed when connected to the driver air bag module. Match the electrical connector key to the keyway in the driver air bag module. Do not force the electrical connectors into the driver air bag module. Damage to the connector or component may occur.

With the locking buttons released, install the driver air bag module electrical connectors fully into the driver air bag module and seat the locking buttons.

2. Install the 2 driver air bag module bolts.

- Tighten to 6 Nm (53 lb-in).

3. Repower the SRS.



Item	Part Number	Description
1	044A74	Passenger air bag module
2	—	Passenger air bag module electrical connector (part of 14401)

Item	Part Number	Description
3	—	Glove compartment door
4	W705962	Passenger air bag module bolts (2 required)

(Continued)

Air Bag: Service and Repair Passenger Air Bag Module

PASSENGER AIR BAG MODULE

Removal

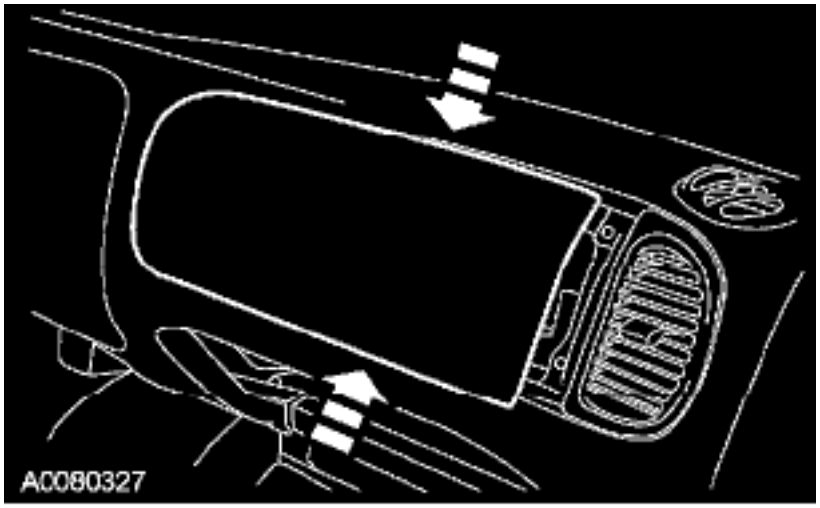
WARNING: -

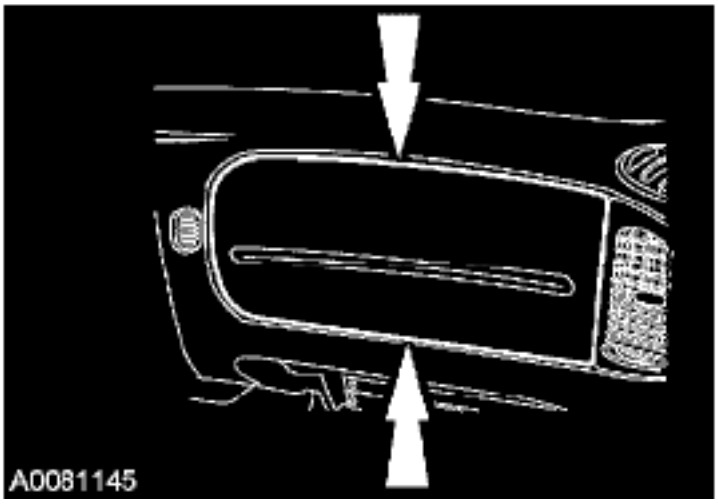
Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.

- Always carry or place a live air bag module with the air bag and deployment door/trim cover/tear seam pointed away from the body. Do not set a live air bag module down with the deployment door/trim cover/tear seam face down. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

- Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.

- Do not repaint air bag modules with discolored or damaged trim covers or deployment doors; new air bag modules must be installed. Failure to follow this instruction may result in the air bag deploying incorrectly, which increases the risk of serious personal injury or





death in a crash.

NOTE: -

The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

- The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

- Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and carry out the diagnostic procedure again.

1. Depower the SRS. 2. Open and lower the glove compartment door. 3. Disconnect the passenger air bag module electrical connector. 4. Remove the 2 passenger air bag module bolts.

5. CAUTION: Do not handle the passenger air bag module by grabbing the edges of the deployment doors. Damage to the air bag module

may occur.

Placing one hand in the glove compartment, push the passenger air bag module out and remove it. -

If necessary, push down on the top and up on the bottom of the deployment door while pushing out on the passenger air bag module, releasing the clips from the instrument panel and remove the passenger air bag module.

Installation

1. CAUTION: Do not handle the passenger air bag module by grabbing the edges of the deployment doors. Damage to the air bag module

may occur.

Position the passenger air bag module into the instrument panel. -

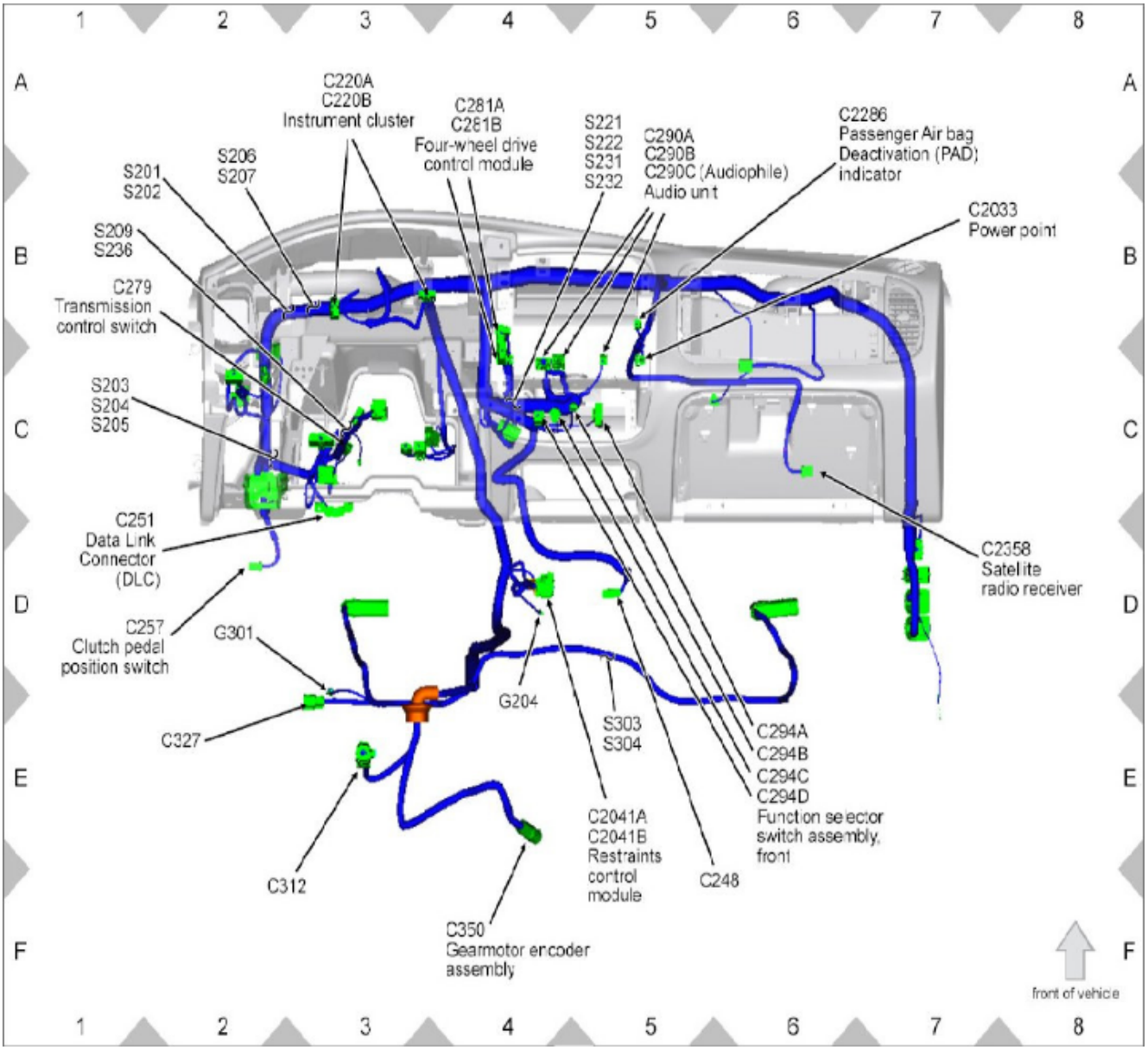
Angle the top of the passenger air bag module into the instrument panel first so that the deployment door upper clips engage to the instrument panel. Push up and in at the top and down and in at the bottom of the deployment door to seat all the clips to the instrument panel.

2. Align the passenger air bag module and install the 2 bolts.

- Tighten to 8 Nm (71 lb-in).

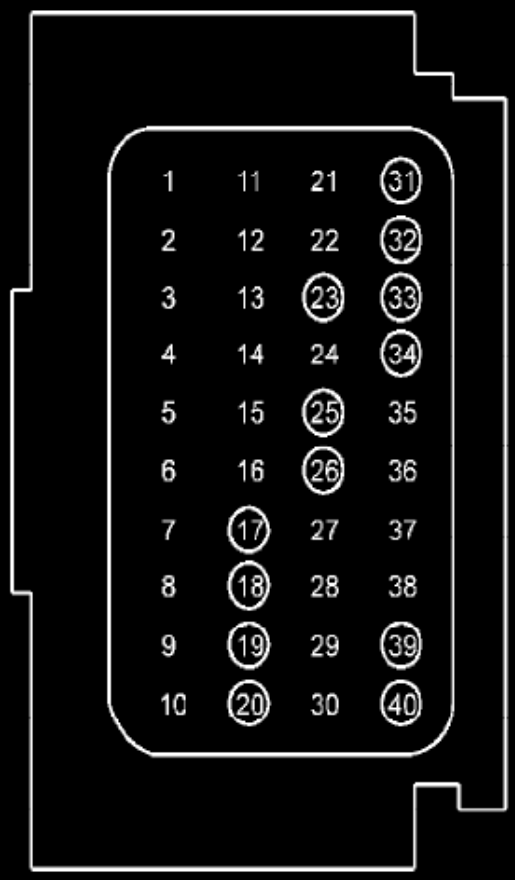
3. Connect the passenger air bag module electrical connector. 4. Close the glove compartment door. 5. Repower the SRS.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Restraint Systems > Air Bag Systems > Air Bag Control Module > Component Information > Locations



View 151-12

Connector: C2041A — **Description:** RESTRAINTS CONTROL MODULE — **Harness:** 14401 — **Base Part #:** 14B321



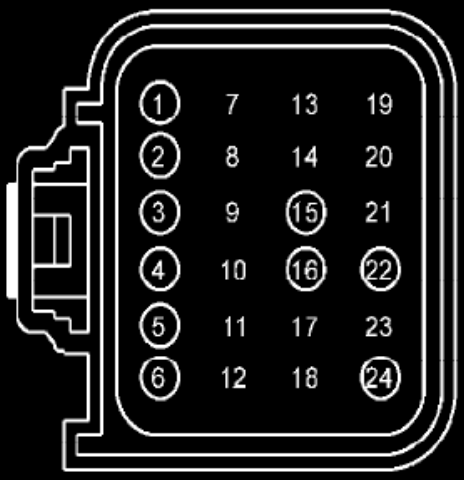
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	*	*	not used	
3	*	*	not used	
4	*	*	not used	
5	*	*	not used	
6	*	*	not used	
7	*	*	not used	
8	*	*	not used	
9	*	*	not used	
10	*	*	not used	
11	*	*	not used	
12	*	*	not used	
13	*	*	not used	
14	*	*	not used	
15	*	*	not used	
16	*	*	not used	
17	VDB05 (WH)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED LOW	
18	VDB04 (WH-BU)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED HIGH	
19	VR213 (VT-GN)	20	SENSOR - IMPACT FRONT 1ST OR LEFT	
20	RR129 (YE-GY)	20	CTRL MOD. - SENSOR IMPACT FRONT 1ST OR LEFT	
21	*	*	not used	
22	*	*	not used	
23	VR215 (YE-VT)	20	SENSOR - SEAT TRACK POSITION DRIVER	
24	*	*	not used	
25	CR201 (GN-BU)	20	SENSOR - SEAT BELT BUCKLE (SEAT BELT REMINDER) FRONT DRIVER SIDE	
26	CR203 (GY-VT)	20	SENSOR - SEAT BELT BUCKLE (SEAT BELT REMINDER) FRONT PASSENGER OUTBOARD	
27	*	*	not used	
28	*	*	not used	
29	*	*	not used	
30	*	*	not used	
31	CR120 (BU-OG)	20	CTRL MOD. - SEAT BELT PRETENSIONER FRONT DRIVER SIDE	
32	RR120 (BN-GN)	20	CTRL MOD. - SEAT BELT PRETENSIONER FRONT DRIVER SIDE	
33	RR122 (BN)	20	CTRL MOD. - SEAT BELT PRETENSIONER FRONT PASSENGER OUTBOARD	
34	CR122 (WH-OG)	20	CTRL MOD. - SEAT BELT PRETENSIONER FRONT PASSENGER OUTBOARD	
35	*	*	not used	
36	*	*	not used	
37	*	*	not used	

Air Bag Control Module: Diagrams

C2041A (Part 1)

38	*	*	not used
39	VR214 (WH-BU)	20	SENSOR - IMPACT FRONT 2ND OR RIGHT
40	RR130 (GN-BU)	20	CTRL MOD. - SENSOR IMPACT FRONT 2ND OR RIGHT

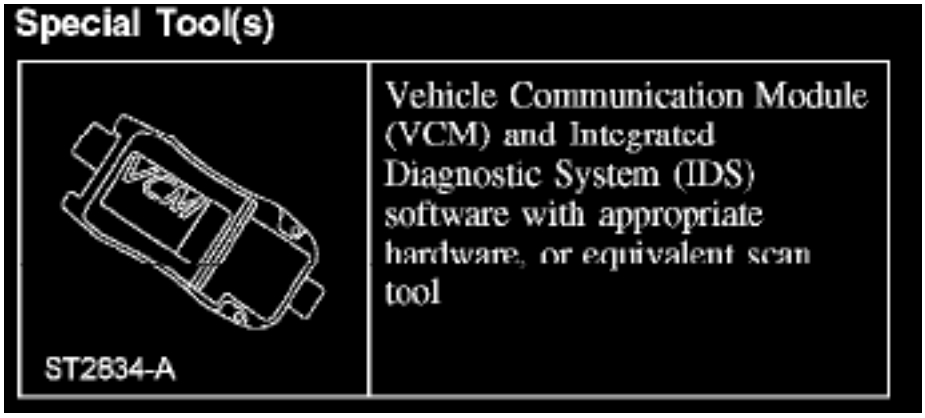
Connector: C2041B **Description:** RESTRAINTS CONTROL MODULE **Harness:** 14401 **Base Part #:** 14B321



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CR103 (GY-BU)	20	CTRL MOD. - AIR BAG FRONT PASSENGER 1	
2	RR103 (VT-GN)	20	CTRL MOD. - AIR BAG FRONT PASSENGER 1	
3	RR101 (YE-GN)	20	CTRL MOD. - AIR BAG DRIVER 1	
4	CR101 (VT-BN)	20	CTRL MOD. - AIR BAG DRIVER 1	
5	CR104 (YE-GY)	20	CTRL MOD. - AIR BAG FRONT PASSENGER 2	
6	RR104 (WH-BU)	20	CTRL MOD. - AIR BAG FRONT PASSENGER 2	
7	*	*	not used	
8	*	*	not used	
9	*	*	not used	
10	*	*	not used	
11	*	*	not used	
12	*	*	not used	
13	*	*	not used	
14	*	*	not used	
15	RR102 (WH)	20	CTRL MOD. - AIR BAG DRIVER 2	
16	CR102 (BU)	20	CTRL MOD. - AIR BAG DRIVER 2	
17	*	*	not used	
18	*	*	not used	
19	*	*	not used	
20	*	*	not used	
21	*	*	not used	
22	CR114 (YE-OG)	20	CTRL MOD. - INDICATOR AIR BAG	
23	*	*	not used	
24	CBP08 (GY-YE)	20	FUSE - 8 OR CIRCUIT BREAKER	

C2041A (Part 2)

C2041B



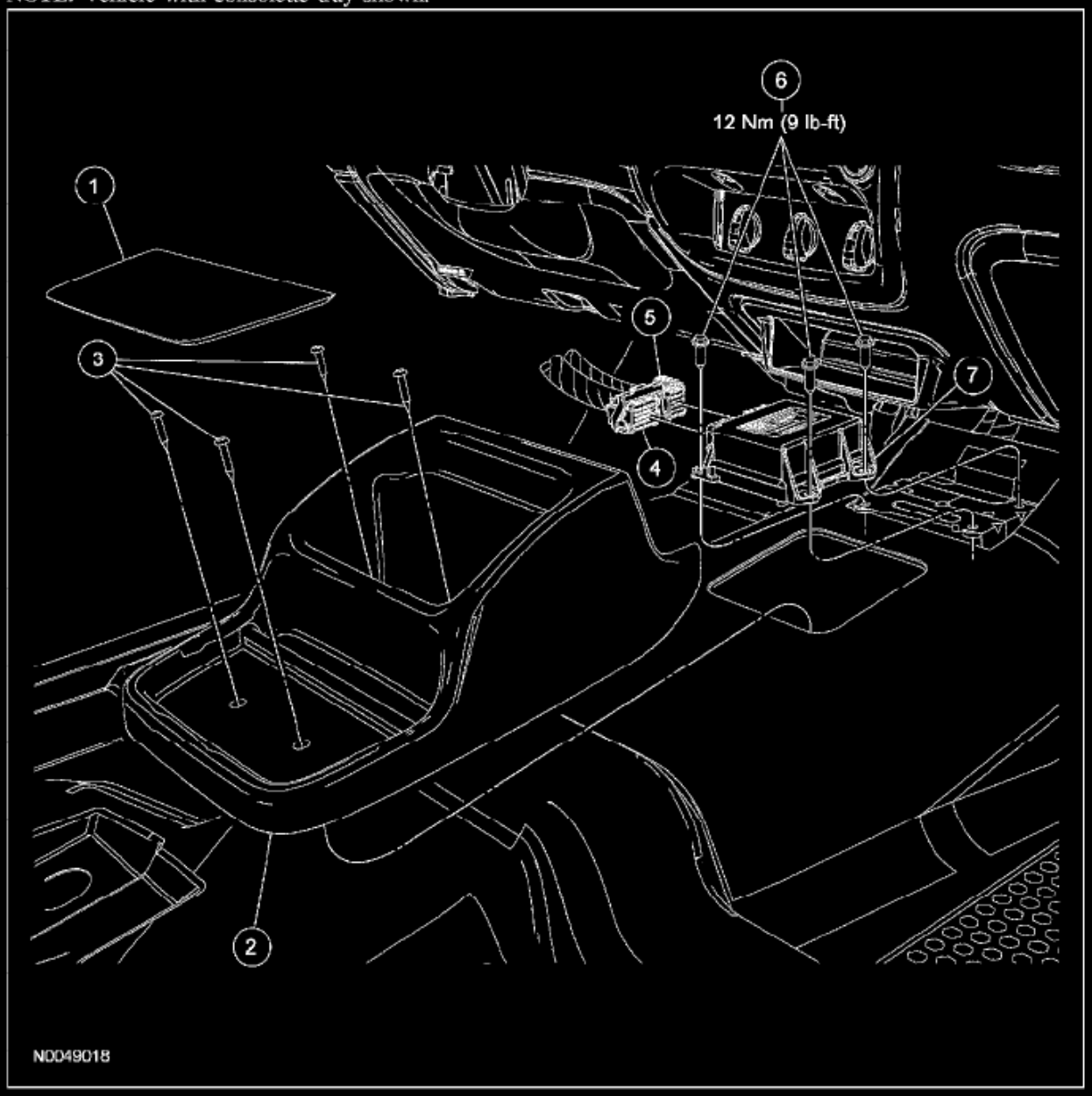
Air Bag Control Module: Service and Repair

RESTRAINTS CONTROL MODULE (RCM)

Special Tool(s)

Special Tool(s)

NOTE: Vehicle with consolette tray shown.



Item	Part Number	Description
1	—	Consolette tray mat (part of 045A36)
2	045A36	Consolette tray
3	—	Consolette tray screws (4 required) (part of 045A36)
4	—	Restraints control module (RCM) large electrical connector (part of 14401)

Item	Part Number	Description
5	—	RCM small electrical connector (part of 14401)
6	W701963	RCM bolts (3 required)
7	14B321	RCM

(Continued)

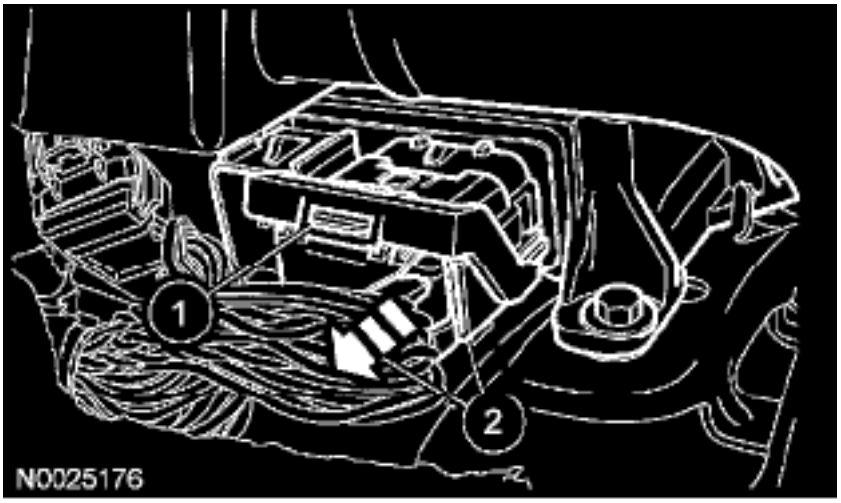
Removal

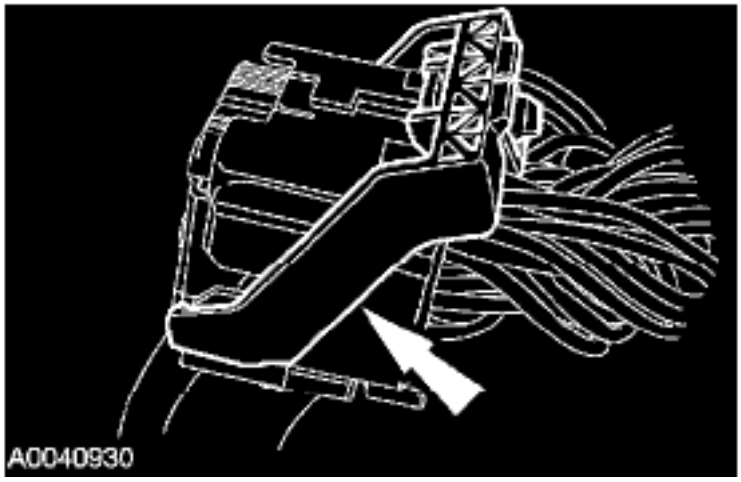
WARNING: If a vehicle has been in a crash, inspect the restraints control module (RCM) and the impact sensor (if equipped) mounting areas for deformation. If damaged, restore the mounting areas to the original production configuration. A new RCM and sensors must be installed whether or not the air bags have deployed. Failure to follow these instructions may result in serious personal injury or death in a crash.

CAUTION: -

When installing a new restraints control module (RCM), it is necessary to carry out programmable module installation (PMI). System failure may occur if PMI is not carried out.

- Electronic modules are sensitive to static electrical charges. If exposed to these charges, damage may result.


1
2
N0025176


A0040930

NOTE: -

The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

- The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

- Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and carry out the diagnostic procedure again.

All vehicles 1. Carry out the steps necessary to prepare for programmable module installation (PMI). 2. Depower the SRS.

Vehicles with high-series floor console 3. Remove the floor console.

Vehicles with a consolette 4. Remove the consolette tray mat. 5. Remove the 4 screws and remove the consolette tray.

All vehicles 6. Disconnect the small RCM electrical connector. 7. Disconnect the large RCM electrical connector.

1 Pinch the thumb tab and pivot the connector position assurance lever all the way back until it stops.

2 Pull out and disconnect the RCM electrical connector.

8. Remove the 3 bolts and the RCM.

Installation

All vehicles

1. WARNING: Always tighten the fasteners of the restraints control module (RCM) and impact sensor (if equipped) to the specified torque.

Failure to do so may result in incorrect restraint system operation, which increases the risk of personal injury or death in a crash.

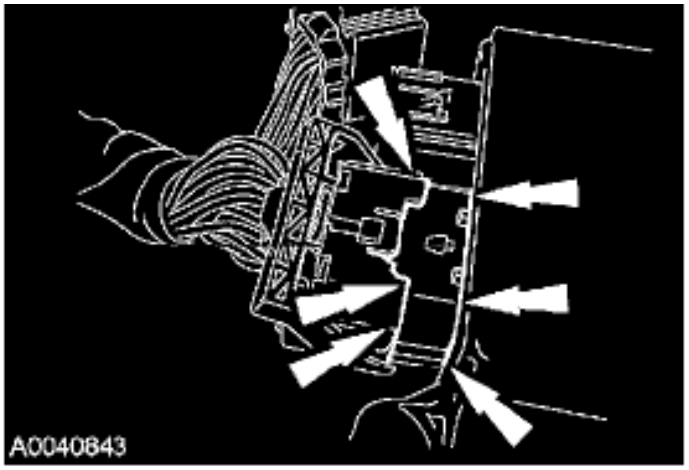
Install the RCM and the 3 bolts. -

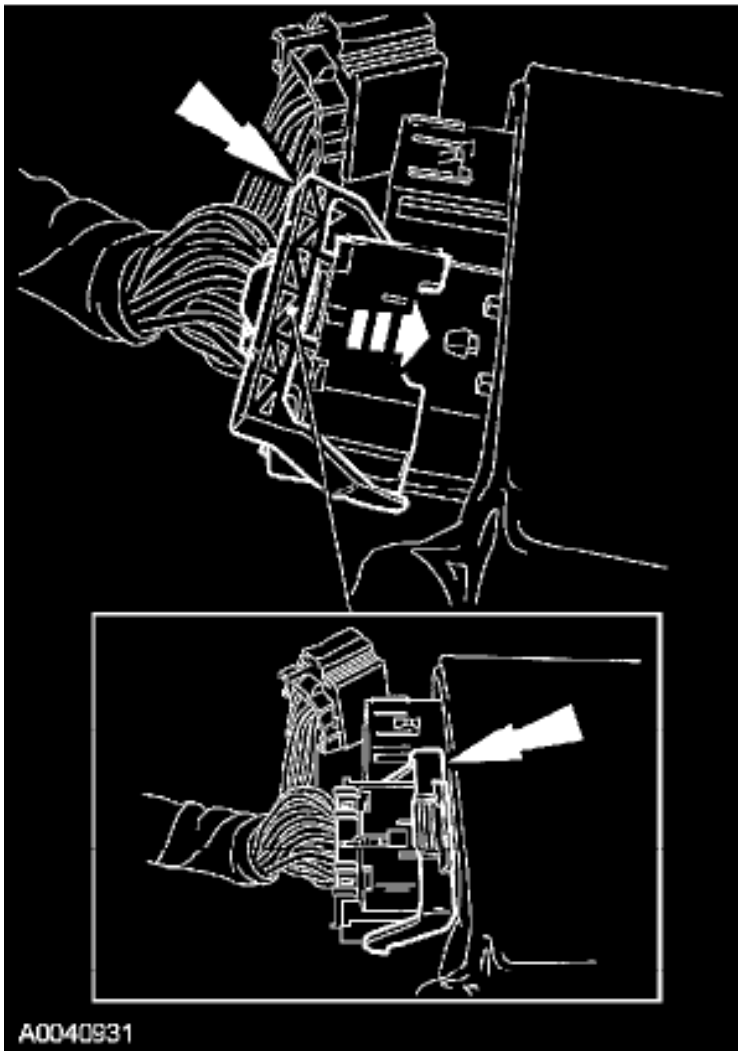
To install, tighten to 12 Nm (9 lb-ft).

2. Make sure the large RCM connector position assurance lever is in the full release position before attempting to connect the connector.

3. CAUTION: Putting the large restraints control module (RCM) electrical wiring connector into the RCM on an angle can cause bad

electrical connections and damage components.


A0040843


A0040931

NOTE: The RCM has been removed for clarity.

Position the large RCM electrical connector into the RCM.

-

CAUTION: Do not push the connector to the point where the lever pivots and seats itself. Light pressure is needed to get the connector into position on the restraints control module (RCM), before using the lever to fully seat the connector. Damage to the connector or component may occur.

With the large RCM electrical connector uniformly aligned to the RCM, lightly push in until a subtle audible click is heard and slight resistance is felt.

4. Connect the large RCM electrical connector.

- Using the connector position assurance lever, pivot it toward the RCM, drawing the connector into the RCM. -

Make sure the thumb tab is engaged to the retainer on the RCM and locked in place.

5. Connect the small RCM electrical connector.

Vehicles with a consolette 6. Install the consolette tray and the 4 screws. 7. Install the consolette tray mat.

Vehicles with high-series floor console 8. Install the floor console.

All vehicles 9. Repower the SRS. Do not prove out the SRS at this time.

10. When installing a new RCM, carry out the steps necessary to complete PMI.

11. Prove out the supplemental restraint system (SRS) as follows:

Turn the ignition switch from ON to OFF. Wait 10 seconds, then turn the ignition switch back to ON and visually monitor the air bag indicator with the air bag modules installed. The air bag indicator will light continuously for approximately 6 seconds and then turn OFF. If an air bag SRS fault is present, the air bag indicator will: -

fail to light.

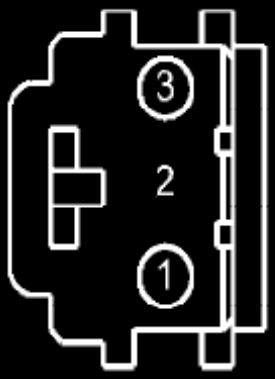
- remain lit continuously.

- flash at a 5 Hz rate (RCM not configured).

The air bag indicator might not light until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON position. This is the time required for the RCM to complete the testing of the SRS. If the air bag indicator is inoperative and a SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag indicator and any SRS fault discovered must be diagnosed and repaired.

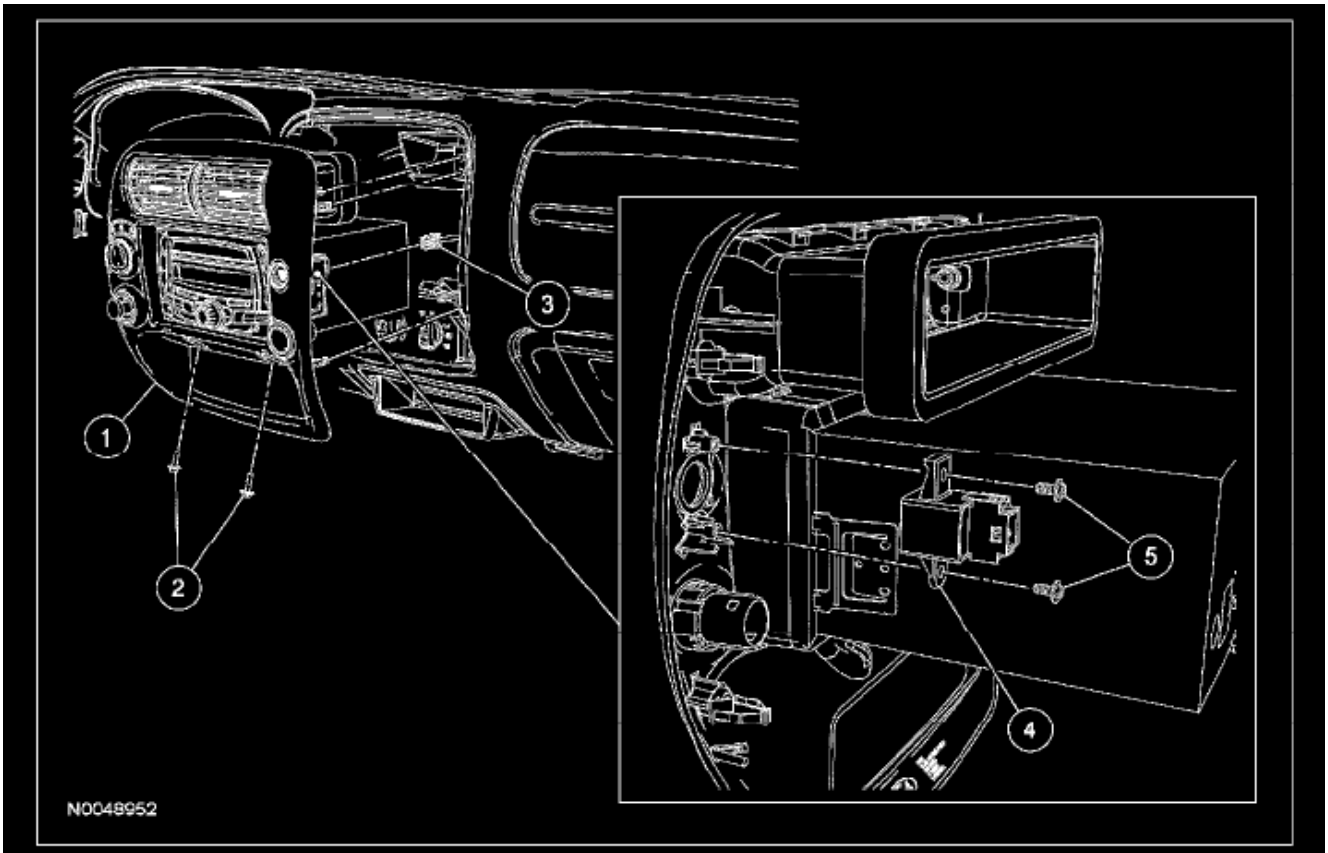
Clear all continuous DTCs from the RCM and occupant classification system module (OCSM) using a scan tool.

Connector: C2286	Description:	Harness:	Base Part #:
	PASSENGER AIR BAG DEACTIVATION (PAD) INDICATOR	14401	



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBP08 (GY-YE)	20	FUSE - 8 OR CIRCUIT BREAKER	
2	*	*	not used	
3	CR114 (YE-OG)	20	CTRL MOD. - INDICATOR AIR BAG	

C2286



Item	Part Number	Description
1	04302	Instrument panel (I/P) center finish panel
2	W707628	I/P center finish panel screws (2 required)
3	—	Passenger air bag deactivation (PAD) indicator electrical connector (part of 14401)
4	0A936A	PAD indicator
5	W505942	PAD indicator screws (2 required)

Air Bag Deactivation Indicator: Service and Repair

PASSENGER AIR BAG DEACTIVATION (PAD) INDICATOR

Removal and Installation

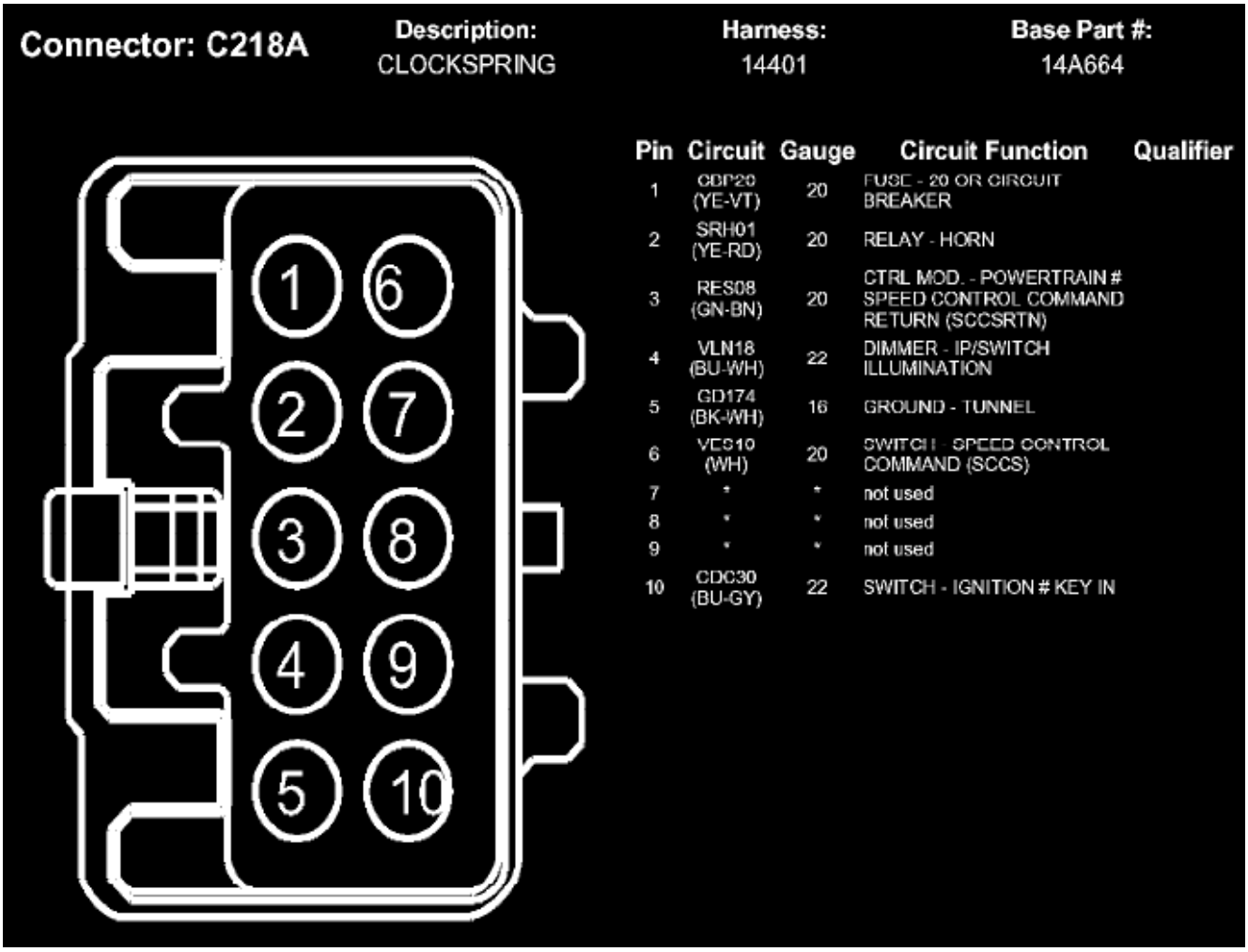
NOTE:

- The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

- Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and carry out the diagnostic procedure again.

- The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1. Depower the SRS. 2. Remove the 2 instrument panel (I/P) center finish panel screws. 3. Pull out to detach the 4 retaining clips and partially remove the I/P center trim panel. 4. Disconnect the passenger air bag deactivation (PAD) indicator electrical connector. 5. Remove the 2 screws from the PAD indicator and remove it from the I/P center finish panel. 6. To install, reverse the removal procedure. 7. Repower the SRS.



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CDP20 (YE-VT)	20	FUSE - 20 OR CIRCUIT BREAKER	
2	SRH01 (YE-RD)	20	RELAY - HORN	
3	RES08 (GN-BN)	20	CTRL MOD. - POWERTRAIN # SPEED CONTROL COMMAND RETURN (SCCSRTN)	
4	VLN18 (BU-WH)	22	DIMMER - IP/SWITCH ILLUMINATION	
5	GD174 (BK-WH)	16	GROUND - TUNNEL	
6	VCS10 (WH)	20	SWITCH - SPEED CONTROL COMMAND (SCCS)	
7	*	*	not used	
8	*	*	not used	
9	*	*	not used	
10	CDC30 (BU-GY)	22	SWITCH - IGNITION # KEY IN	

Clockspring Assembly / Spiral Cable: Diagrams

C218A

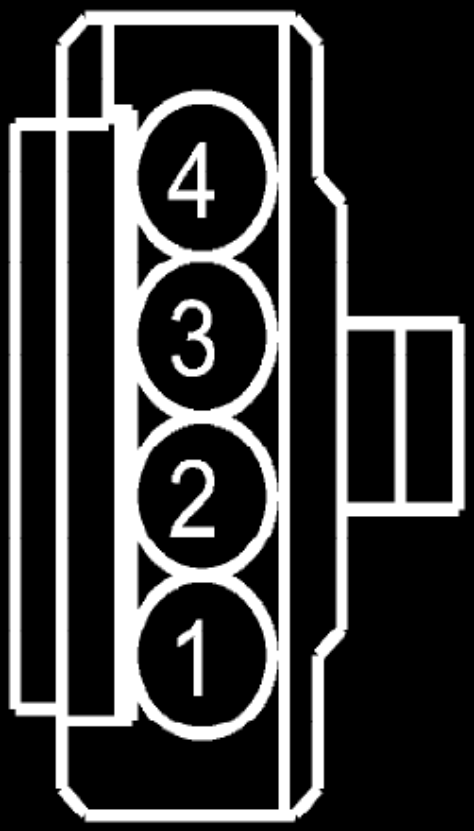
Connector: C218B

Description: CLOCKSPRING

Harness: 14401

Base Part #: 14A664

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CR101 (VT BN)	20	CTRL MOD. AIR BAG DRIVER 1	
2	RR101 (YE-GN)	20	CTRL MOD. - AIR BAG DRIVER 1	
3	CR102 (BU)	20	CTRL MOD. - AIR BAG DRIVER 2	
4	RR102 (WH)	20	CTRL MOD. - AIR BAG DRIVER 2	



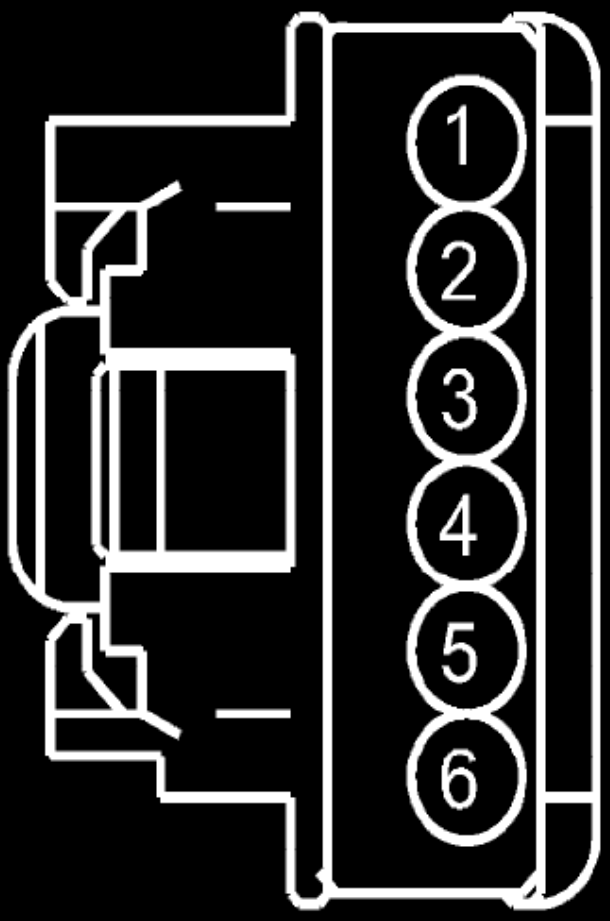
C218B

Connector: C218C

Description: CLOCKSPRING

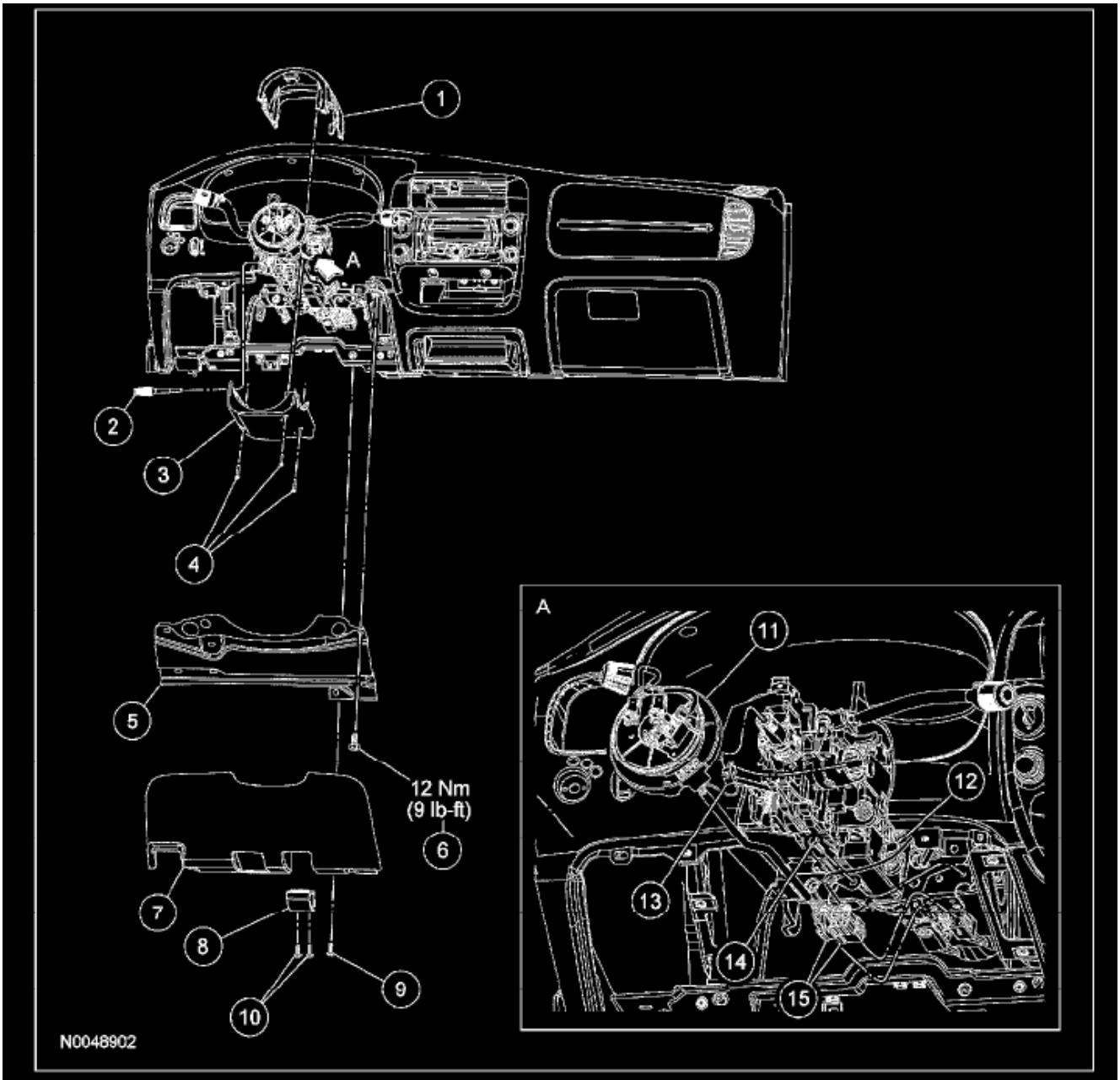
Harness: 17889

Base Part #: 14A664



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	57 (BK)	22	GROUND - TUNNEL	
2	235 (RD-BK)	22	DIMMER - IP/SWITCH ILLUMINATION	
3	151 (LB-BK)	22	SWITCH - SPEED CONTROL COMMAND (SCCS)	
4	848 (DG-OG)	22	CTRL MOD. - POWERTRAIN # SPEED CONTROL COMMAND RETURN (SCCSRTN)	
5	6 (YE-LG)	22	RELAY - HORN	
6	CBP20 (YE-VT)	22	FUSE - 20 OR CIRCUIT BREAKER	

C218C



Item	Part Number	Description
1	3530	Upper steering column shroud
2	3F609	Tilt wheel handle and shank
3	3530	Lower steering column shroud
4	—	Lower steering column shroud screws (3 required)

(Continued)

Item	Part Number	Description
5	017A28	Lower steering column opening finish panel reinforcement
6	N807316	Lower steering column opening finish panel reinforcement bolt (4 required)

(Continued)

Clockspring Assembly / Spiral Cable: Service and Repair

CLOCKSPRING

Part 1

Item	Part Number	Description
7	04459	Lower steering column opening finish panel
8	16916	Hood release handle
9	—	Lower steering column opening finish panel screw (2 required)
10		Hood release handle screws (2 required)
11	14A664	Clockspring
12	—	Clockspring wiring harness retainer (part of 14A664)
13	—	Key-in-ignition warning indicator switch (part of 14A664)
14	N805375	Harness ground wire bolt
15	—	Clockspring electrical connectors (2 required) (part of 14A664)

Part 2

Removal

WARNING: -

Always carry or place a live air bag module with the air bag and deployment door/trim cover/tear seam pointed away from the body. Do not set a live air bag module down with the deployment door/trim cover/tear seam face down. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

- Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.

- Do not repaint air bag modules with discolored or damaged trim covers or deployment doors; new air bag modules must be installed. Failure to follow this instruction may result in the air bag deploying incorrectly, which increases the risk of serious personal injury or death in a crash.

NOTE: -

The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a

supplemental restraint system (SRS) fault.

- The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

- A repair is made by installing a new part only. If the new part does not correct the condition, install the original part and perform the diagnostic procedure again.

1. Remove the driver air bag module.

2. NOTE: Make sure the wheels are in the straight-ahead position.

Remove the steering wheel.

3. Remove the ignition lock cylinder. 4. Remove the 2 screws and position the hood release handle aside. 5. Remove the 2 screws from the lower steering column opening finish panel. Then pull out to release the retaining clips and remove the lower

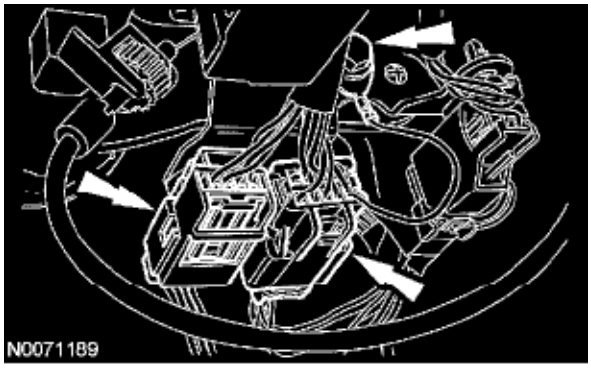
steering column opening finish panel.

6. Remove the 5 bolts and lower steering column opening finish panel reinforcement. 7. If equipped, remove the tilt wheel handle and shank. 8. Remove the 3 screws and lower steering column shroud. 9. Position the upper steering column shroud up enough to access the clockspring retaining clips.

10. Detach the clockspring wire harness from the wiring retainer. 11. Disconnect the clockspring electrical connectors.

- Disconnect the harness ground wire.

- Release the pin-type retainers and disconnect the clockspring electrical connectors.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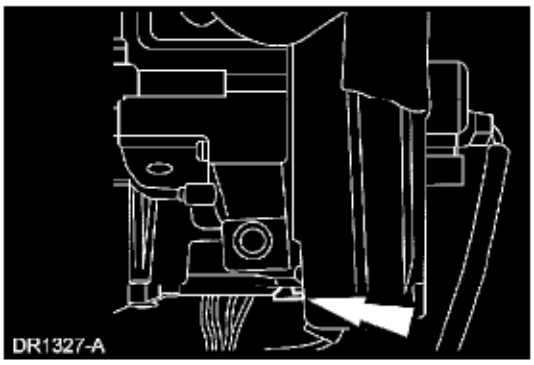
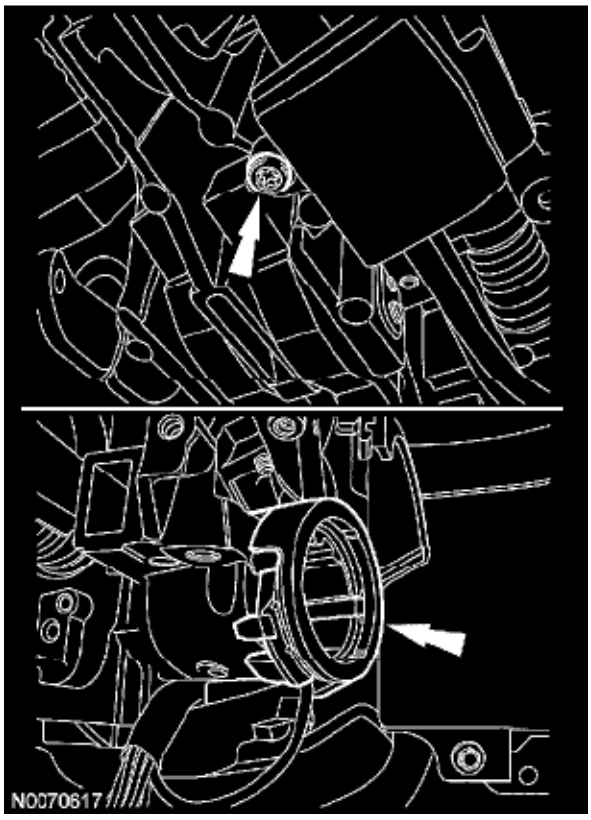

DR1327-A


N0070617

12. Release the lower clockspring retaining clip.

13. Remove the screw, the passive anti-theft system (PATS) antenna and the key-in-ignition warning indicator switch from the lock cylinder housing.

14. Release the remaining 2 clockspring retaining clips and remove the clockspring.

Installation

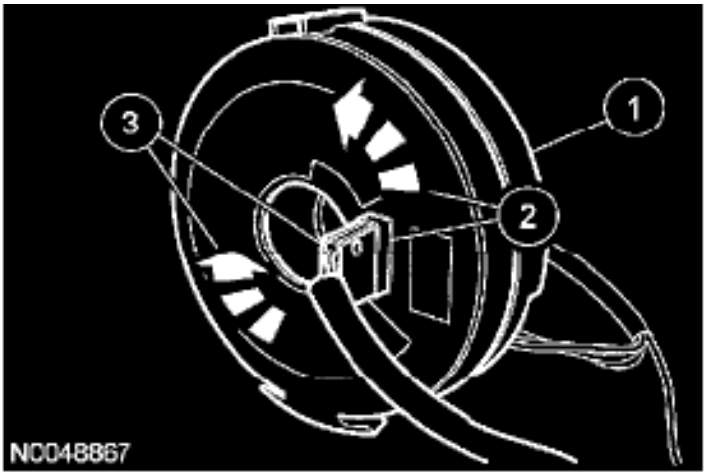
Vehicles receiving a new clockspring

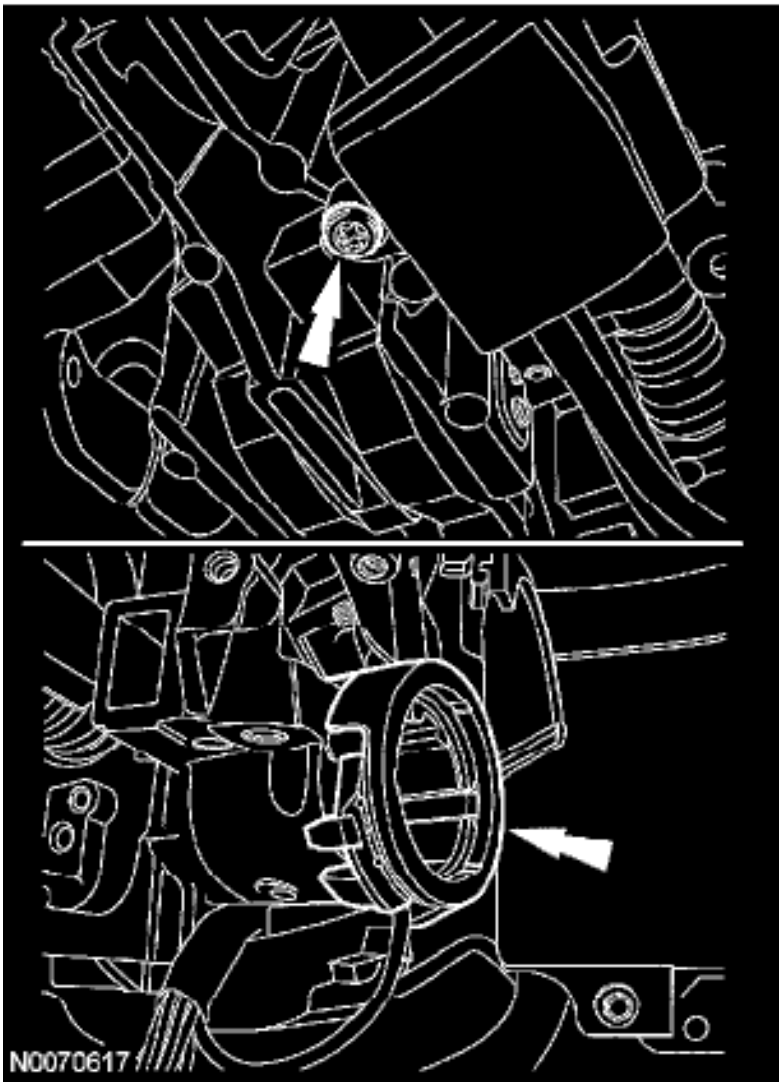
1. NOTE: A new clockspring is packaged in a centralized position and fixed in position with a key.

Remove the key from the clockspring, holding the rotor in its centralized position. -

Do not allow the clockspring rotor to turn.

Vehicles needing clockspring recentering


3
1
2
N0048867


N0070617

2. WARNING: If the clockspring is not correctly centralized, it may fail prematurely. If in doubt, repeat the centralizing procedure.

Failure to follow these instructions may increase the risk of serious personal injury or death in a crash.

NOTE: -

Make sure the wheels are in the straight-ahead position.

- If a clockspring has rotated out of center, follow through with this step.

- Similar clockspring shown.

Centralize the clockspring.

1 Hold the clockspring outer housing stationary.

2 CAUTION: Overturning will destroy the clockspring. The internal ribbon wire acts as the stop and can be broken from its internal connection.

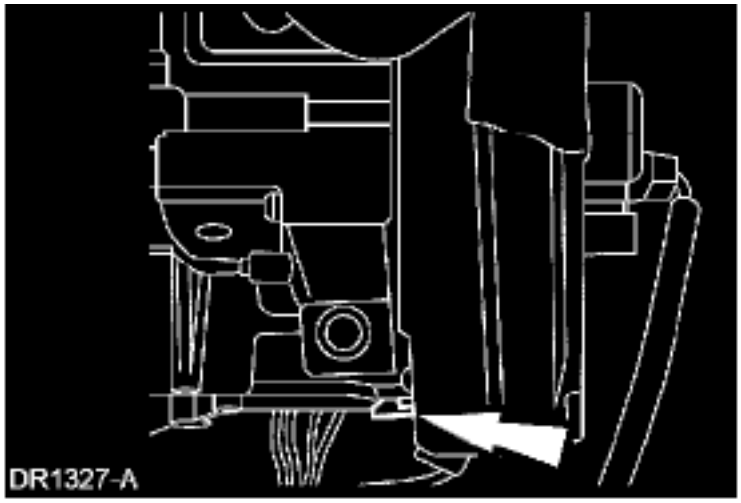
While holding the clockspring locking tab in the released position, turn the rotor counterclockwise, carefully feeling for the ribbon wire to run out of length and a slight resistance to be felt. Stop turning at this point.

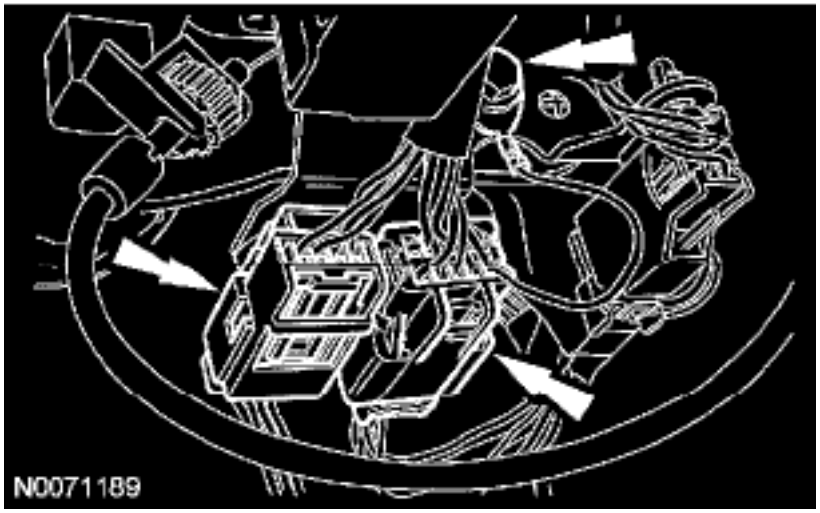
3 While holding the clockspring locking tab in the released position, turn the clockspring clockwise approximately 2.25 turns. This is the center point of the clockspring. -

Do not allow the rotor to turn from this position.

All vehicles 3. Install the PATS antenna and the key-in-ignition warning indicator switch to the lock cylinder housing.

4. NOTE: Slight clockspring rotor turning is allowed for steering column alignment.





Install the clockspring onto the steering column. -

With the flats of the clockspring aligned to the flats of the steering column, slide the clockspring onto the steering column.

- Engage the upper and side retaining tabs.

5. Engage the lower clockspring retaining clip.

6. Install the clockspring electrical connectors.

- Install the ground wire.

- Connect the electrical connectors. Install the pin-type retainers and electrical connectors to the bracket.

7. Attach the clockspring wire harness to the wiring retainer. 8. Reposition the upper steering column shroud. 9. Position the lower steering column shroud and install the 3 screws.

10. Install the tilt wheel handle and shank. 11. Position the steering column opening finish panel reinforcement and install the 4 bolts.

- Tighten to 12 Nm (9 lb-ft).

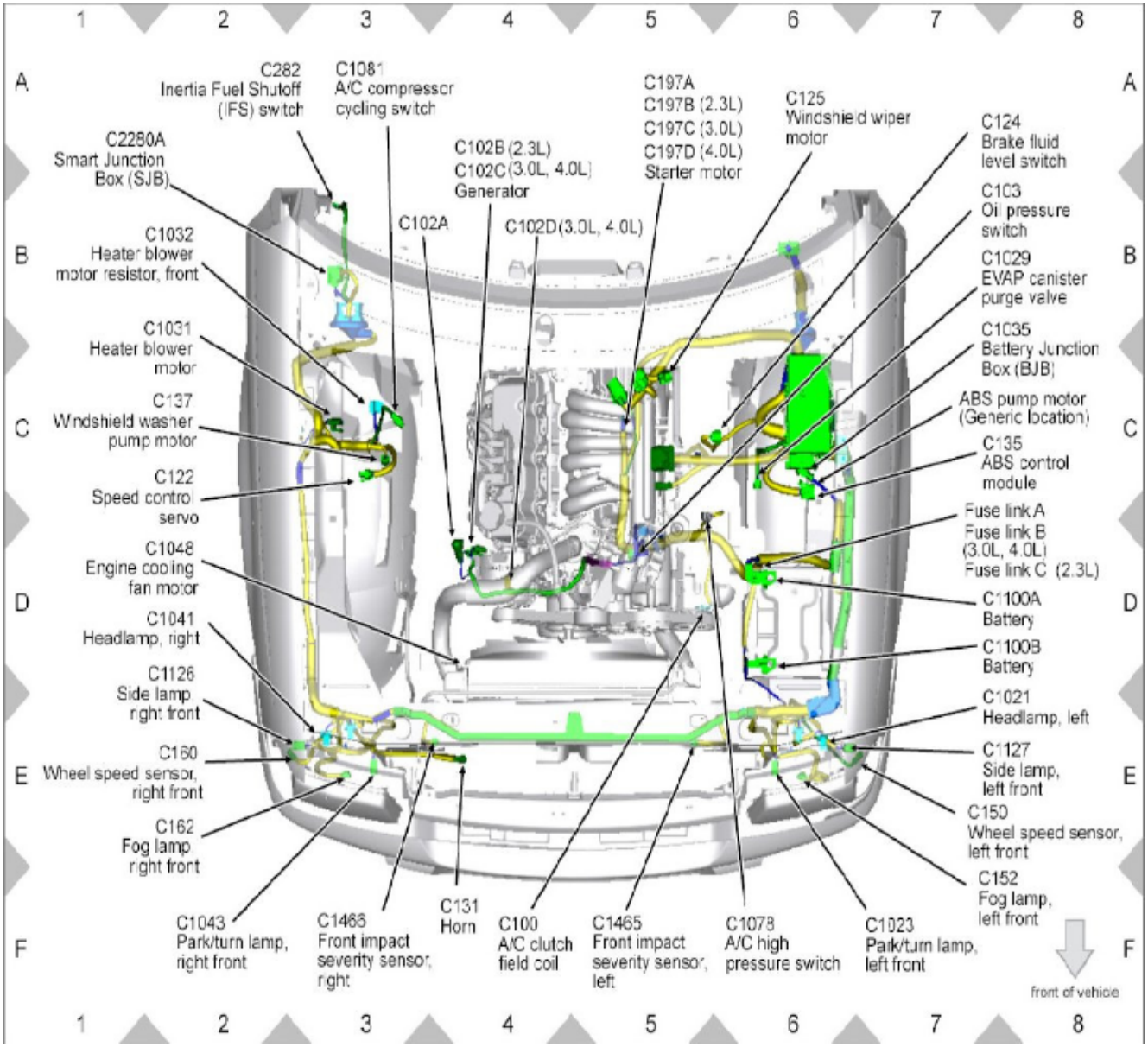
12. Align the lower steering column opening finish panel and push in, seating the retaining clips. Then install the 2 screws. 13. Position the hood release handle. Install the 2 screws. 14. Install the ignition lock cylinder.

15. NOTE: Make sure the wheels are in the straight-ahead position.

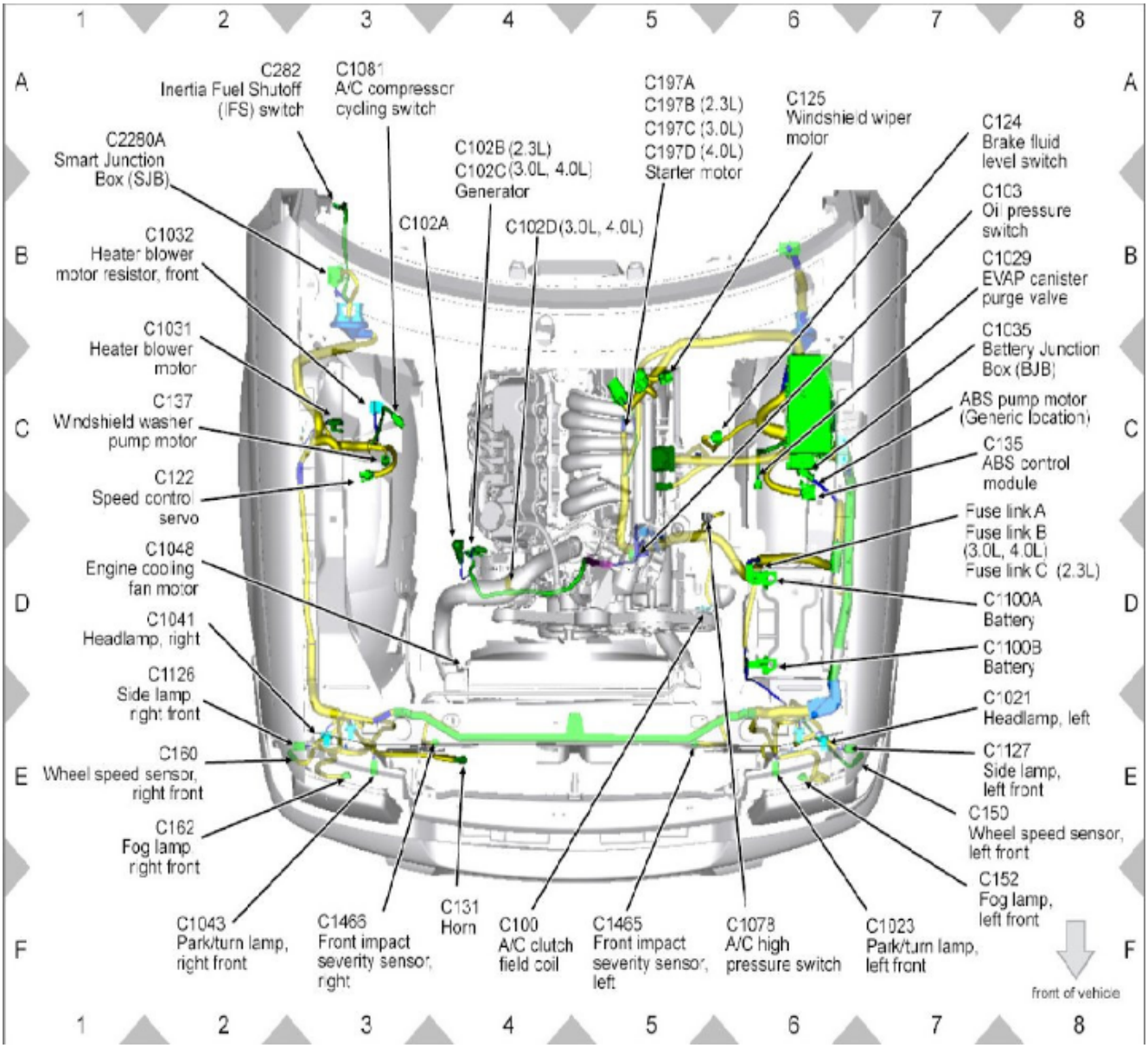
Install the steering wheel.

16. Install the driver air bag module.

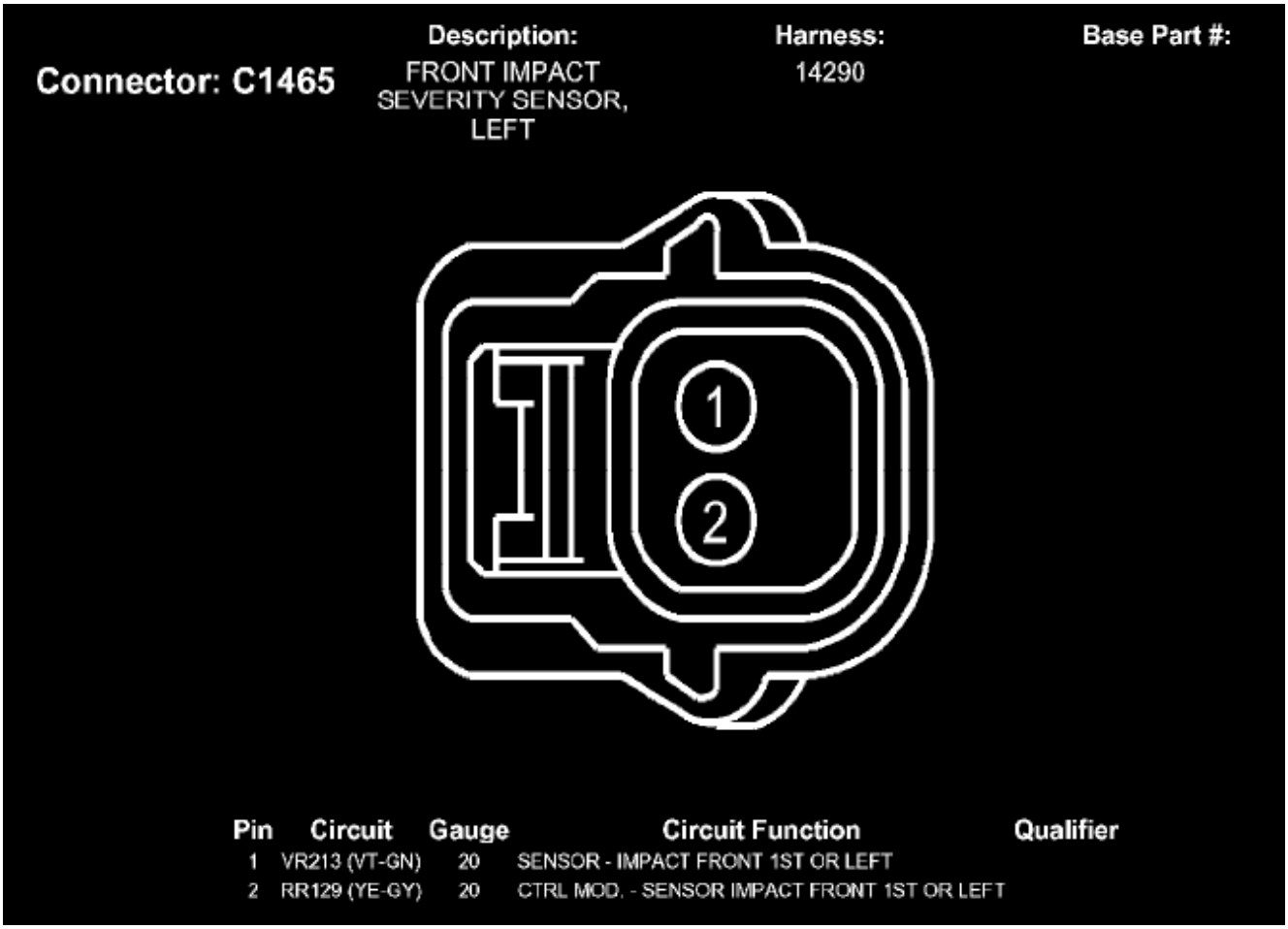
Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Restraint Systems > Air Bag Systems > Impact Sensor > Component Information > Locations > Front Impact Severity Sensor, Left



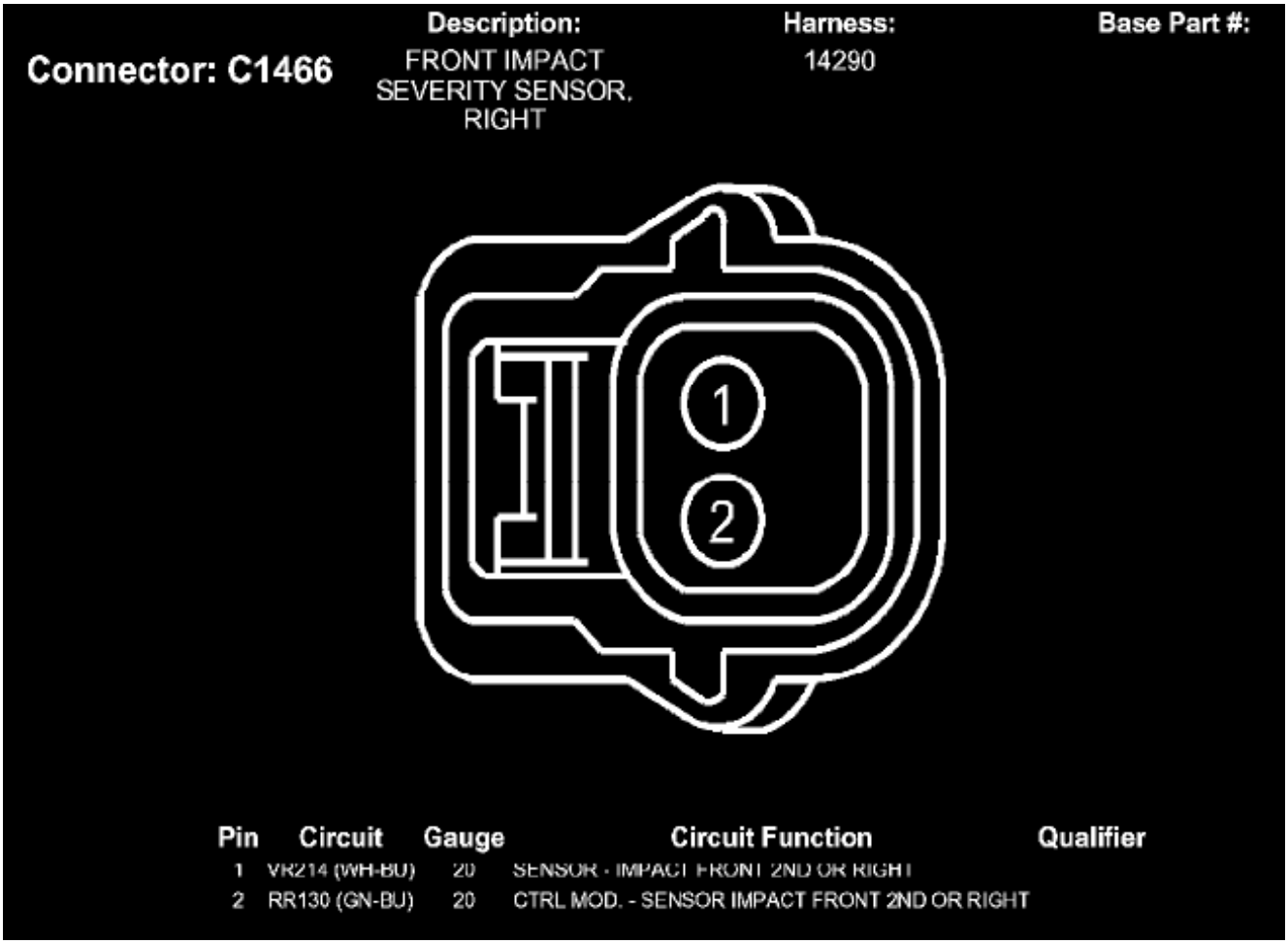
View 151-1


C282
Inertia Fuel Shutoff (IFS) switch
C1081
A/C compressor cycling switch
C2280A
Smart Junction Box (SJB)
C102B (2.3L)
C102C (3.0L, 4.0L)
Generator
C102A
C102D (3.0L, 4.0L)
C197A
C197B (2.3L)
C197C (3.0L)
C197D (4.0L)
Starter motor
C125
Windshield wiper motor
C124
Brake fluid level switch
C103
Oil pressure switch
C1032
Heater blower motor resistor, front
C1029
EVAP canister purge valve
C1031
Heater blower motor
C1035
Battery Junction Box (BJB)
C137
Windshield washer pump motor
ABS pump motor (Generic location)
C135
ABS control module
C122
Speed control servo
Fuse link A
Fuse link B (3.0L, 4.0L)
Fuse link C (2.3L)
C1048
Engine cooling fan motor
C1100A
Battery
C1041
Headlamp, right
C1100B
Battery
C1126
Side lamp, right front
C1021
Headlamp, left
C160
Wheel speed sensor, right front
C1127
Side lamp, left front
C162
Fog lamp, right front
C150
Wheel speed sensor, left front
C152
Fog lamp, left front
C1043
Park/turn lamp, right front
C1466
Front impact severity sensor, right
C131
Horn
C100
A/C clutch field coil
C1465
Front impact severity sensor, left
C1078
A/C high pressure switch
C1023
Park/turn lamp, left front
front of vehicle
A
B
C
D
E
F
1
2
3
4
5
6
7
8

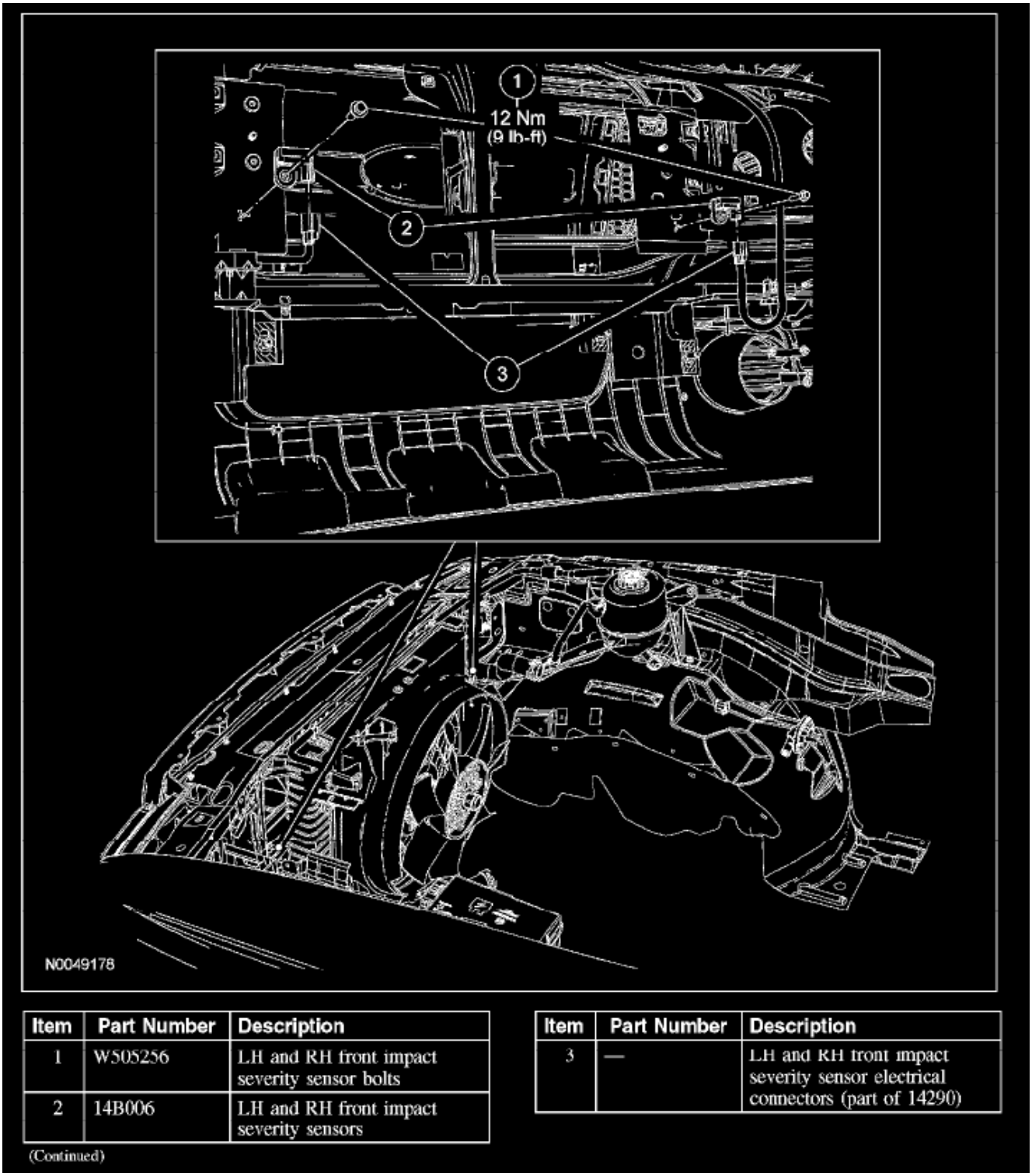
View 151-1


Connector: C1465
Description:
FRONT IMPACT SEVERITY SENSOR, LEFT
Harness:
14290
Base Part #:
1
2
Pin Circuit Gauge Circuit Function Qualifier
1 VR213 (VT-GN) 20 SENSOR - IMPACT FRONT 1ST OR LEFT
2 RR129 (YE-GY) 20 CTRL MOD. - SENSOR IMPACT FRONT 1ST OR LEFT

C1465


Connector: C1466
Description:
FRONT IMPACT SEVERITY SENSOR, RIGHT
Harness:
14290
Base Part #:
1
2
Pin Circuit Gauge Circuit Function Qualifier
1 VR214 (WH-BU) 20 SENSOR - IMPACT FRONT 2ND OR RIGHT
2 RR130 (GN-BU) 20 CTRL MOD. - SENSOR IMPACT FRONT 2ND OR RIGHT

C1466



Item	Part Number	Description
1	W505256	LH and RH front impact severity sensor bolts
2	14B006	LH and RH front impact severity sensors

Item	Part Number	Description
3	—	LH and RH front impact severity sensor electrical connectors (part of 14290)

(Continued)

Impact Sensor: Service and Repair

FRONT IMPACT SEVERITY SENSOR

Removal and Installation

WARNING:

- If a vehicle has been in a crash, inspect the restraints control module (RCM) and the impact sensor (if equipped) mounting areas for deformation. If damaged, restore the mounting areas to the original production configuration. A new RCM and sensors must be installed whether or not the air bags have deployed. Failure to follow these instructions may result in serious personal injury or death in a crash.

- Always tighten the fasteners of the restraints control module (RCM) and impact sensor (if equipped) to the specified torque. Failure to do so may result in incorrect restraint system operation, which increases the risk of personal injury or death in a crash.

NOTE:

- The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

- The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

- Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and carry out the diagnostic procedure again.

All vehicles

1. Depower the SRS.

Vehicles equipped with 2.3L and A/C

2. For the RH front impact severity sensor, remove the air cleaner and air cleaner outlet pipe.

All vehicles

3. NOTE:

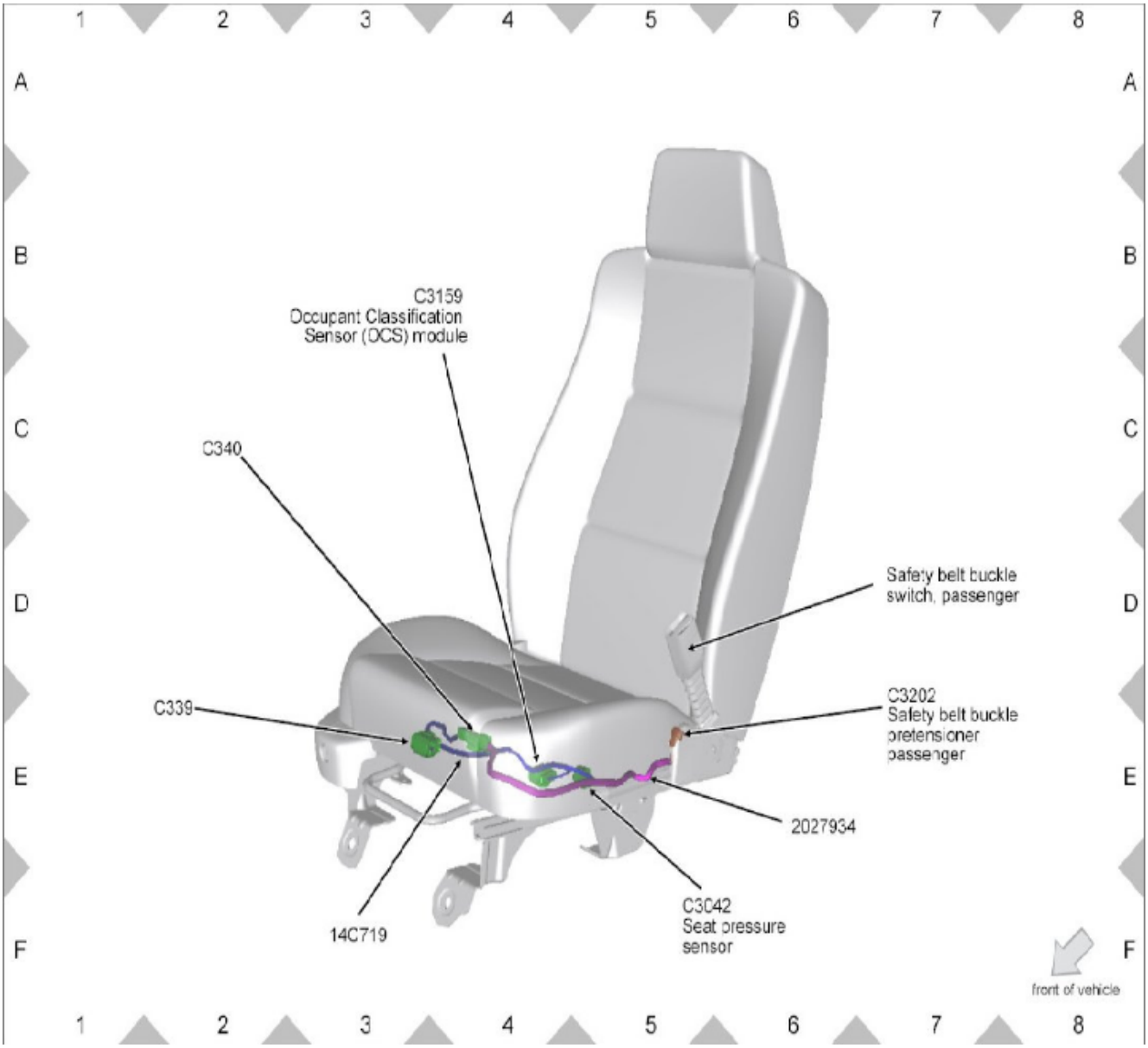
- Make sure the radiator support and front impact severity sensor mating surfaces are clean and free of foreign material.

- Note position of locator tab on sensor bracket for installation.

Remove the front impact severity sensor bolt. -

To install, tighten to 12 Nm (9 lb-ft).

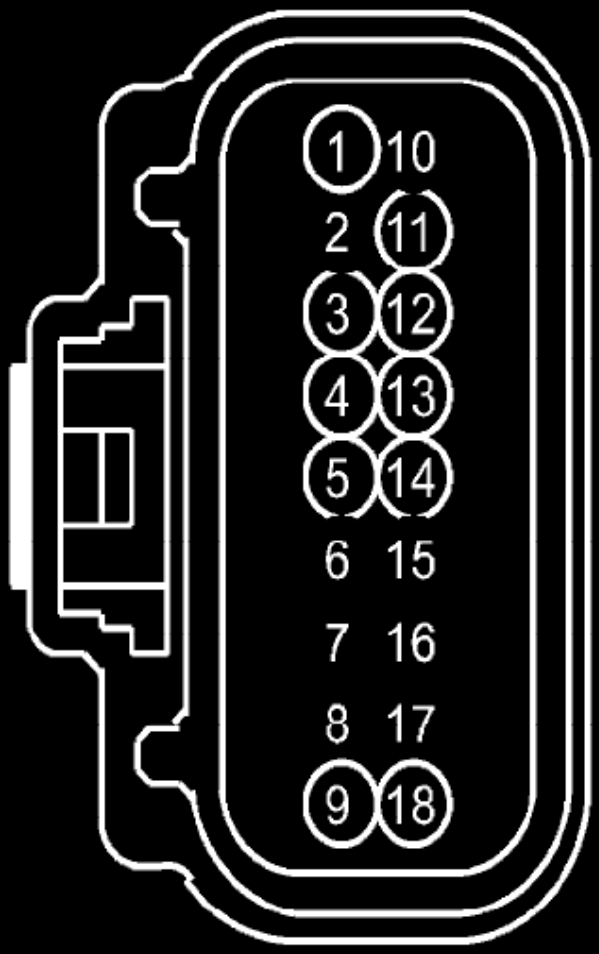
4. Disconnect the front impact severity sensor electrical connector and remove the sensor. 5. To install, reverse the removal procedure. 6. Repower the SRS.


C3159
Occupant Classification Sensor (OCS) module
C340
C339
14C719
Safety belt buckle switch, passenger
C3202
Safety belt buckle pretensioner passenger
2027934
C3042
Seat pressure sensor
front of vehicle

View 151-19

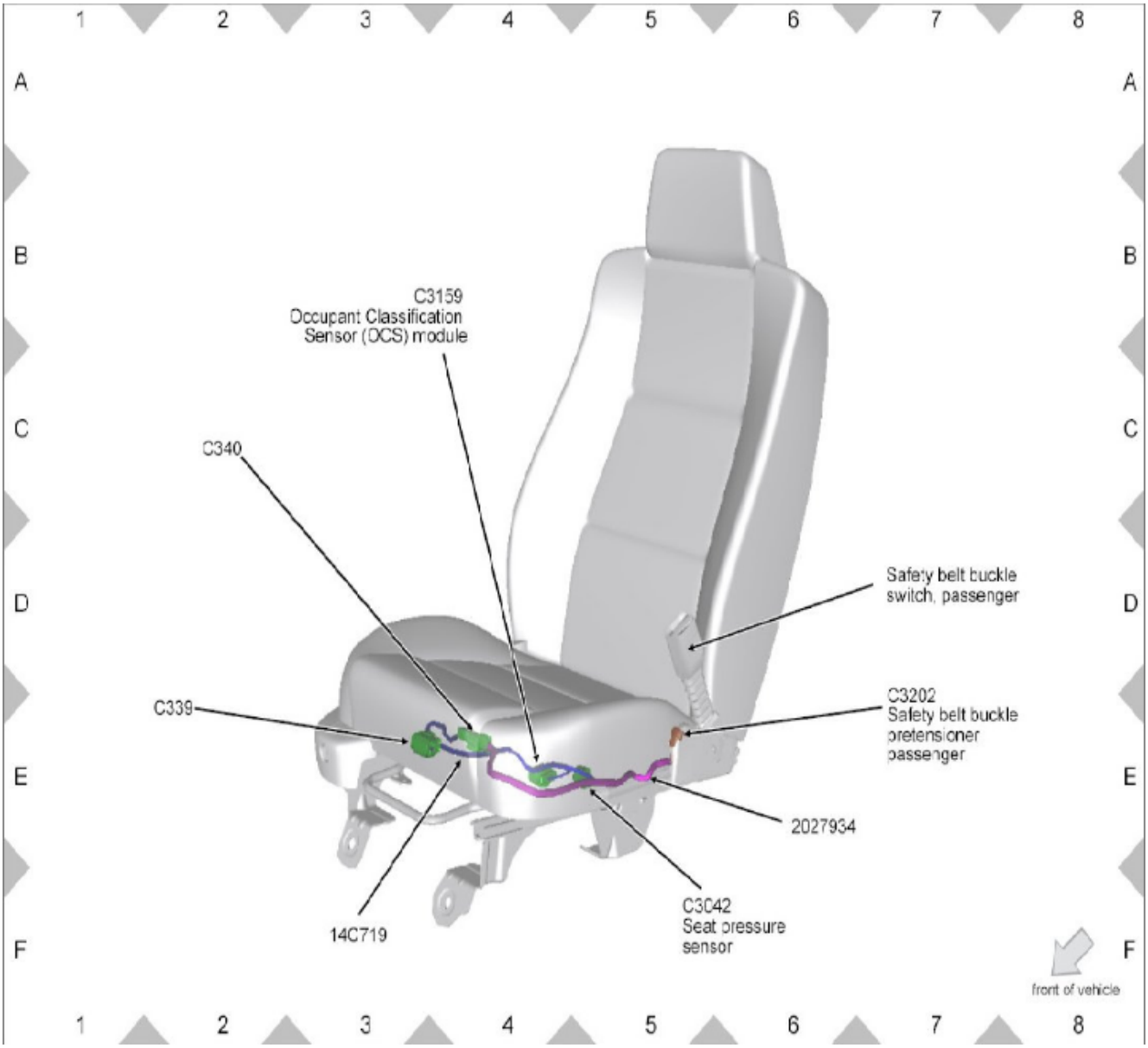
Connector: C3159

Description:	Harness:	Base Part #:
OCCUPANT CLASSIFICATIONSENSOR (OCS) MODULE	14C719	



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBP08 (GY-YE)	20	FUSE - 8 OR CIRCUIT BREAKER	
2	*	*	not used	
3	CR152 (GY-YE)	22	CTRL MOD. - SENSOR OCCUPANT CLASSIFICATION PRESSURE	
4	VR223 (BU-WH)	22	SENSOR - OCCUPANT CLASSIFICATION PRESSURE	
5	RR152 (YE-VT)	22	CTRL MOD. - SENSOR OCCUPANT CLASSIFICATION PRESSURE	
6	*	*	not used	
7	*	*	not used	
8	*	*	not used	
9	VDB05 (WH)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED LOW	
10	*	*	not used	
11	LR142 (YE-BU)	20	CTRL MOD. - SENSOR SEAT BELT TENSION FRONT PASSENGER OUTBOARD	
12	VR210 (BU-BN)	20	SENSOR - SEAT BELT TENSION FRONT PASSENGER OUTBOARD	
13	RR142 (GN)	20	CTRL MOD. - SENSOR SEAT BELT TENSION FRONT PASSENGER OUTBOARD	
14	CD174 (BK-WH)	18	GROUND - TUNNEL	
15	*	*	not used	
16	*	*	not used	
17	*	*	not used	
18	VDB04 (WH-BU)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED HIGH	

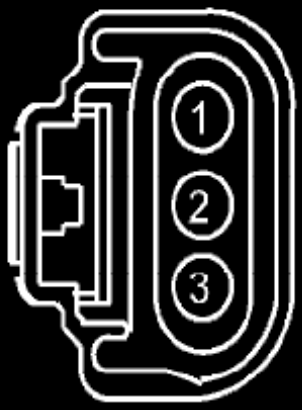
C3159


C3159
Occupant Classification Sensor (OCS) module
C340
C339
14C719
Safety belt buckle switch, passenger
C3202
Safety belt buckle pretensioner passenger
2027934
C3042
Seat pressure sensor
front of vehicle

View 151-19

Connector: C3042

Description:	Harness:	Base Part #:
SEAT PRESSURE SENSOR	14C719	



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CR152 (GY-YE)	22	CTRL MOD. - SENSOR OCCUPANT CLASSIFICATION PRESSURE	
2	VR223 (BU-WH)	22	SENSOR - OCCUPANT CLASSIFICATION PRESSURE	
3	RR152 (YE-VT)	22	CTRL MOD. - SENSOR OCCUPANT CLASSIFICATION PRESSURE	

C3042

Seat Occupant Sensor: Description and Operation

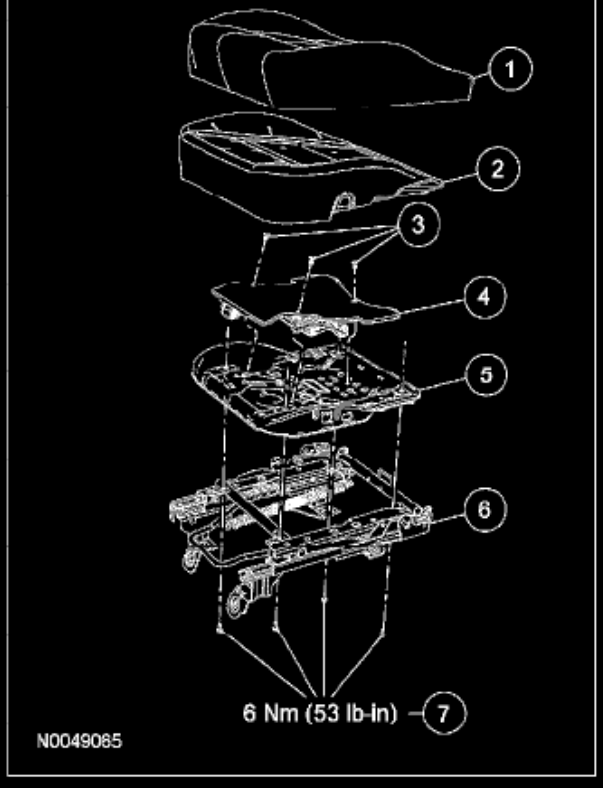
OCCUPANT CLASSIFICATION SENSOR (OCS) SYSTEM

The OCS system is standard equipment on all front outboard passenger seats.

Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Seat with a Production Occupant Classification Sensor



Item	Part Number	Description
1	62900	Seat cushion trim cover
2		Seat cushion foam pad
3	—	Pin-type retainers
4	—	Occupant classification sensor (OCS) system (bladder, hose with pressure sensor, occupant classification system module [OCSM] and seat wiring harness)
5	63101	Seat cushion frame
6	—	Seat track assembly
7		Seat track-to-cushion frame bolts

Seat Occupant Sensor: Service and Repair

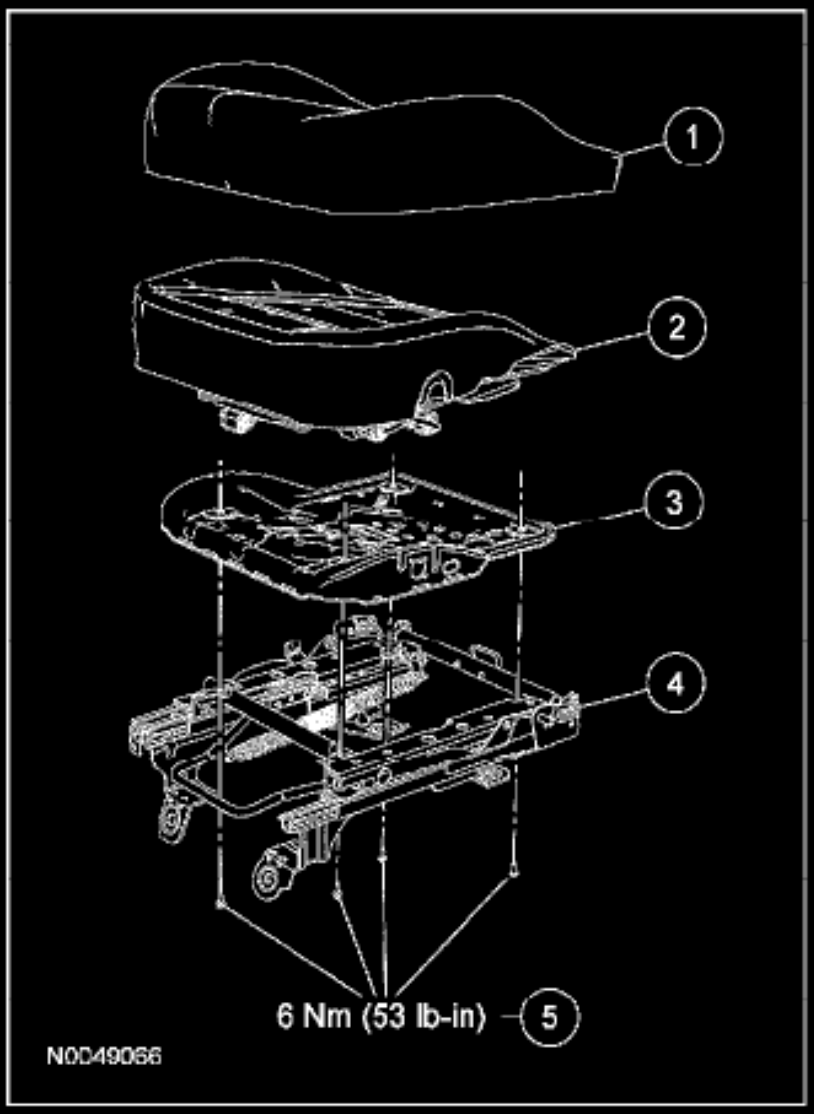
OCCUPANT CLASSIFICATION SENSOR

Special Tool(s)

Special Tool(s)

Seat With A Production Occupant Classification Sensor

Seat with a Service Kit Occupant Classification Sensor



Item	Part Number	Description
1	62900	Seat cushion trim cover
2	603B02	Occupant classification sensor (OCS) system service kit (foam pad, bladder, hose with pressure sensor, OCSM and wiring harness)
3	63101	Seat cushion frame
4	—	Seat track assembly
5	—	Seat track-to-cushion frame bolts

Seat With A Service Kit Occupant Classification Sensor

Removal

WARNING: -

Never probe the electrical connectors on safety belt buckle/retractor pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors, which increases the risk of serious personal injury or death.

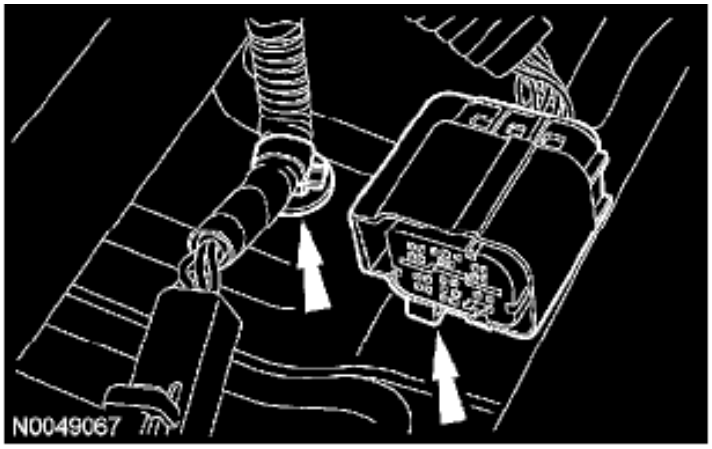
- Install a new occupant classification sensor (OCS) system service kit as a complete assembly. Never install only part of the kit components. Failure to follow this instruction may result in incorrect operation of the OCS system and increases the risk of serious personal injury or death in a crash.

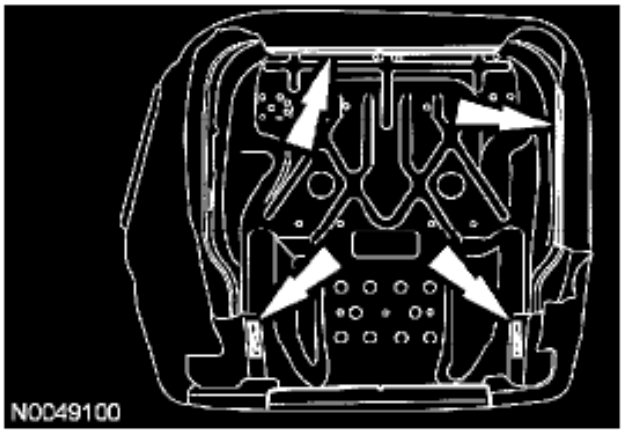
- Make sure the front passenger seat repair is complete, the seat and all attached components (head restraint, seat side shield, etc.) are correctly assembled, and the seat is correctly installed to the vehicle before carrying out the System Reset. Failure to follow these instructions may result in incorrect operation of the occupant classification sensor (OCS) system and increases the risk of serious personal injury or death in a crash.

CAUTION: To prevent system failure, it is necessary to carry out the occupant classification sensor (OCS) system reset when a front passenger seat cushion is disassembled, a new trim cover installed or an OCS system service kit is installed. A scan tool is used to carry out the OCS system reset command.

NOTE: -

Occupant classification sensor (OCS) system components (seat cushion foam pad, bladder with pressure sensor and occupant classification system module [OCSM]) are calibrated to each other and are serviced as an assembly. The OCS system components are not to be installed separately. If a


N0049067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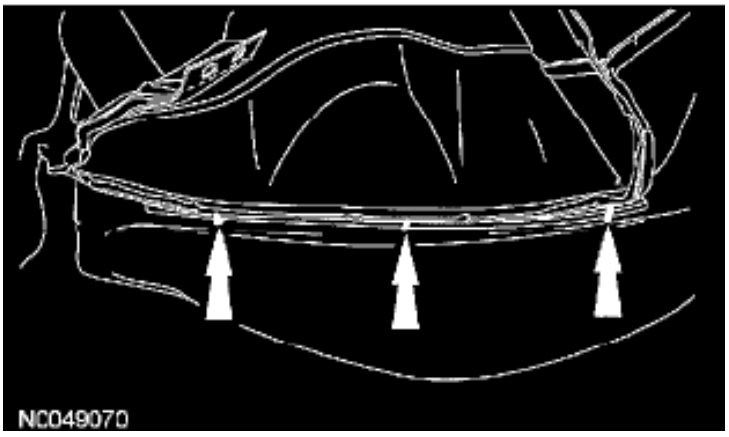

N0049070

new OCS system, OCS system component or seat cushion foam pad are needed, a new OCS system service kit (seat cushion foam pad, bladder with pressure sensor, OCSM and seat wiring harness) must be installed as an assembly.

- The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

- The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

- Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and perform the diagnostic procedure again.

1. Remove the passenger seat. 2. Remove the seat backrest.

3. NOTE: Note position of wire routing for installation.

Release the seat wiring harness retainer clip and detach the seat wiring harness connector from the seat cushion frame.

4. Release the cushion trim cover rear J-clip. 5. Remove the 4 seat track-to-cushion frame bolts and the seat track assembly. 6. Release the remaining cushion trim cover J-clips.

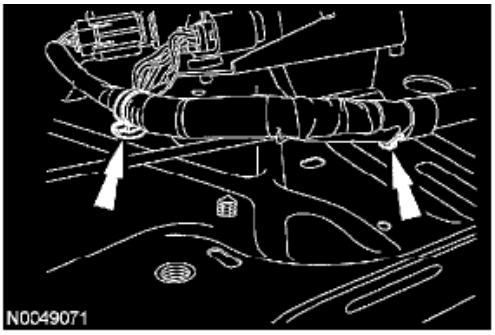
7. CAUTION: An occupant classification sensor (OCS) system service kit will have the OCS system bladder attached to the seat cushion

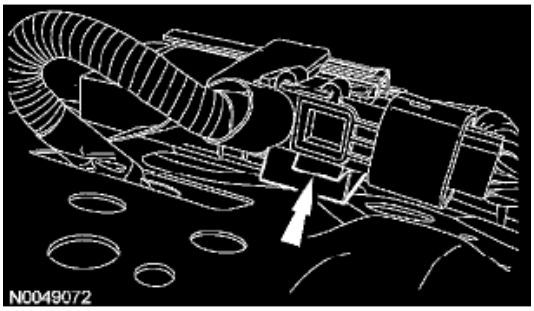
foam pad. Do not separate the OCS system bladder from the seat cushion foam pad. Failure to do so can result in component failure.

Remove the hog rings and the cushion trim cover from the seat cushion foam pad.

8. NOTE: Note position of wire routing for installation.

Release the 2 seat wiring harness routing clips from the cushion frame.


N0049071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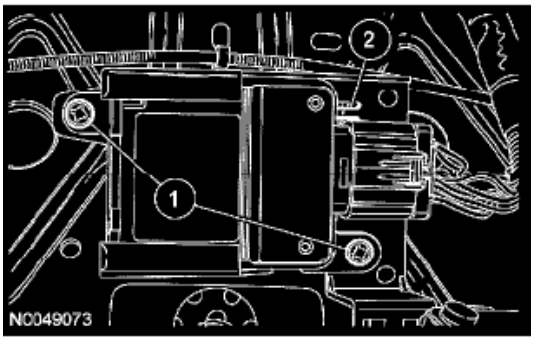
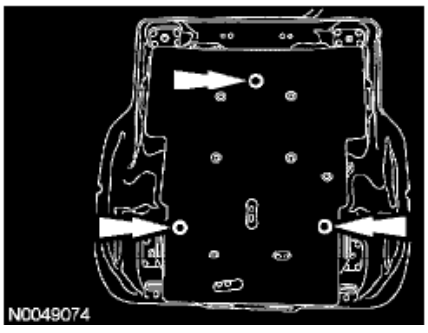

2
1
N0049073


N0049074

9. Release the pressure sensor bracket retainer and slide the pressure sensor off the bracket.

10. Remove the OCSM.

1 Remove the 2 screws from the OCSM.

2 Release the OCSM bracket retainer and slide the OCSM off the bracket.

11. CAUTION: A production occupant classification sensor (OCS) system bladder is shown. An OCS system service kit will have the OCS

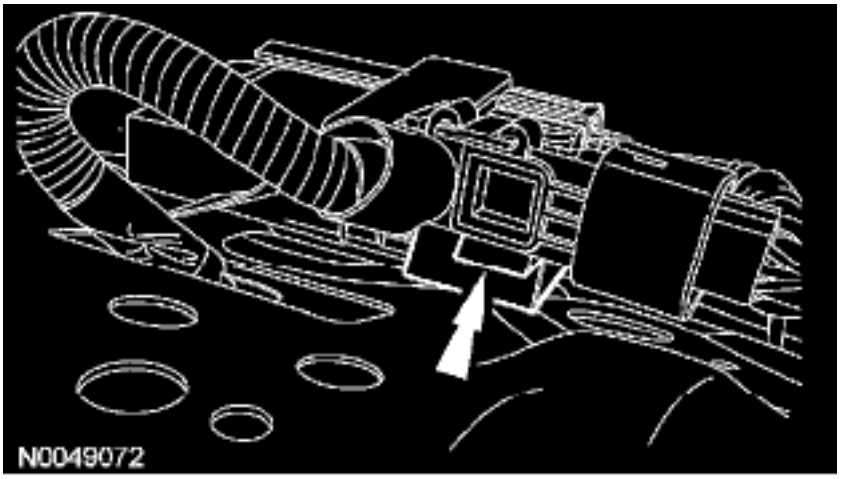
system bladder attached to the seat cushion foam pad. Do not separate the OCS system bladder from the seat cushion foam pad. Failure to do so can result in component failure.

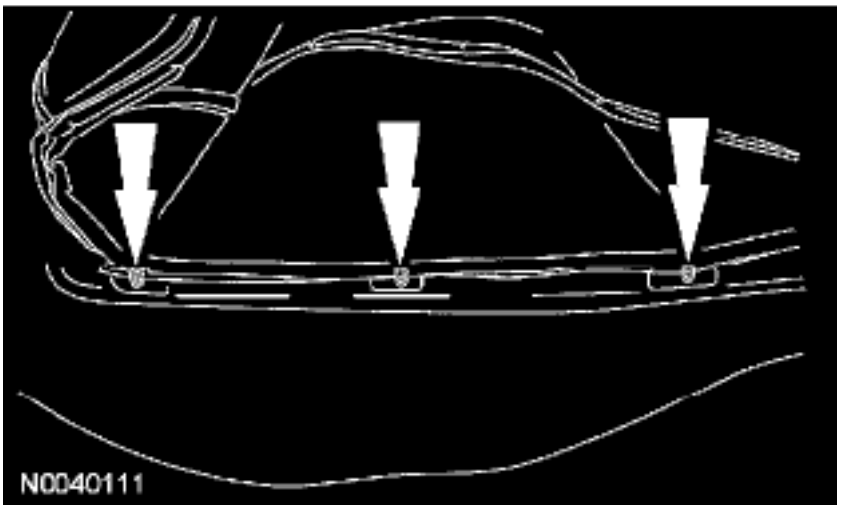
Release the 3 OCS system bladder pin-type retainers from the seat cushion frame.

12. NOTE: Note position of wire routing for installation.

Route the OCS system bladder hose and pressure sensor, OCSM and seat wiring harness out through the seat cushion pan opening.

Installation





1. WARNING: Install a new occupant classification sensor (OCS) system service kit as a complete assembly. Never install only part of the

kit components. Failure to follow this instruction may result in incorrect operation of the OCS system and increases the risk of serious personal injury or death in a crash.

CAUTION: -

Inspect the occupant classification sensor (OCS) system assembly, seat cushion frame and support assembly for any foreign objects before installing the OCS system assembly to the seat cushion frame. If any foreign objects are found, remove them. Failure to follow these instructions may result in incorrect OCS system operation or failure.

- Failure to route the seat occupant sensor components through the correct seat cushion support opening can cause component failure.

- While positioning the seat cushion pan and occupant classification sensor (OCS) assembly, be careful not to damage any of the components. Failure to do so may result in component failure.

NOTE: If the original equipment OCS system is not being installed, install a OCS system service kit using all parts in the kit.

Position the OCS system to the seat cushion frame. -

Route the OCS system bladder hose and pressure sensor, OCSM and seat wiring harness through the seat cushion pan opening.

2. CAUTION: An occupant classification sensor (OCS) system service kit will have the OCS bladder attached to the seat cushion foam pad.

Do not separate the OCS system bladder from the seat cushion foam pad. Failure to do so may result in component failure.

Install the 3 OCS system bladder pin-type retainers to the seat cushion frame.

3. Install the OCSM.

- Slide the OCSM back on the OCSM bracket until it is fully seated and locked in past the OCSM bracket retainer.

- Install the 2 screws in the OCSM.

4. Slide the pressure sensor on the bracket until it is fully seated and locked past the bracket retainer.

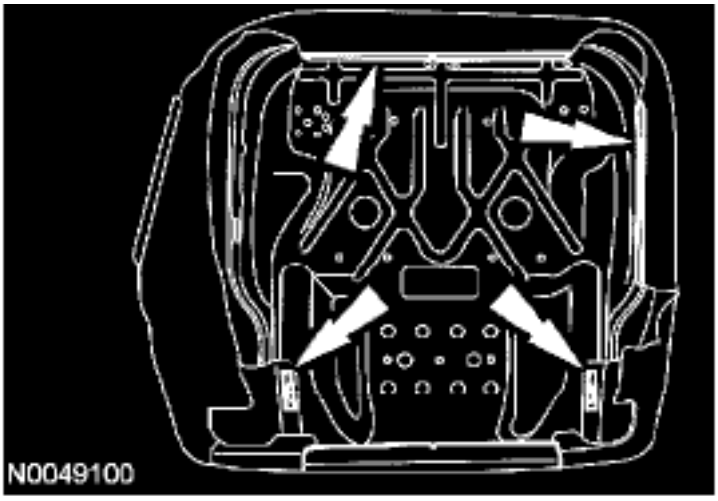
5. Install the 2 seat wiring harness routing clips to the seat cushion frame.

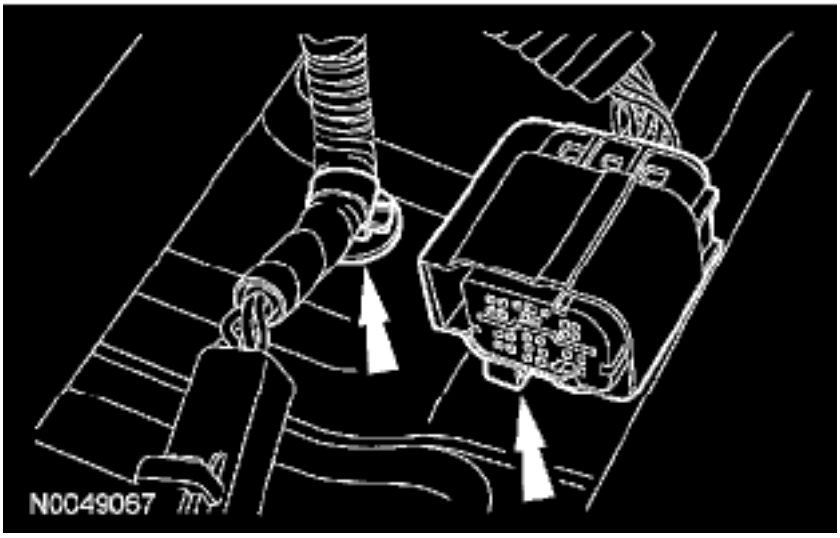
6. CAUTION: Inspect the seat cushion pad and seat cushion trim cover for any foreign objects, before installing the seat cushion trim cover

to the seat cushion pad. If any foreign objects are found, remove them. Failure to follow these instructions may result in incorrect operation of the occupant classification sensor (OCS) system and may cause system failure.

Position the cushion trim cover to the foam pad and install the hog rings.

7. Install the foam pad and cushion trim cover to the cushion frame and fasten the J-clips.





8. Install the seat track assembly and 4 bolts.

- Tighten to 6 Nm (53 lb-in).

9. Attach the seat cushion trim cover rear J-clip.

10. Install the seat wiring harness retainer clip and attach the seat wiring harness connector to the seat cushion frame.

11. Install the front seat backrest. 12. Install the passenger seat into the vehicle. 13. Repower the SRS. Do not prove out the SRS at this time.

14. WARNING:

- Install a new occupant classification sensor (OCS) system service kit as a complete assembly. Never install only part of the kit components. Failure to follow this instruction may result in incorrect operation of the OCS system and increases the risk of serious personal injury or death in a crash.

- Make sure the front passenger seat repair is complete, the seat and all attached components (head restraint, seat side shield, etc.) are correctly assembled, and the seat is correctly installed to the vehicle before carrying out the System Reset. Failure to follow these instructions may result in incorrect operation of the occupant classification sensor (OCS) system and increases the risk of serious personal injury or death in a crash.

CAUTION: -

To prevent system failure, it is necessary to carry out the occupant classification sensor (OCS) system reset of the OCS system when a front passenger seat cushion is disassembled, a new trim cover installed or an OCS system service kit is installed. A scan tool is used to carry out the OCS system reset command.

- To prevent system failure, the following precautions must be taken before carrying out the occupant classification sensor (OCS) system reset: -

Make sure the voltage to the occupant classification system module (OCSM) is above 8.0 volts and less than 18.0 volts.

- Make sure the OCS system is not at a temperature below 6°C (42°F) or above 36°C (97°F) when initiating the OCS system reset process. If the vehicle has been exposed to extreme cold or hot temperatures, the vehicle must be exposed and kept at a temperature within the limits, 6°C to 36°C (42°F to 97°F) for a minimum of 30 minutes.

- Make sure nothing is present on the passenger seat before carrying out the OCS system reset and nothing is placed on the seat during the process.

- Make sure a minimum 8-second time period has passed after cycling the ignition switch ON before the carrying out the OCS system reset process.

NOTE: If the first attempt to carry out the OCS system reset is unsuccessful, a second attempt must be made. If the second attempt is unsuccessful, a new OCS system service kit must be installed.

Carry out the OCS system reset active command.

15. Cycle the ignition switch from ON to OFF.

16. NOTE: The ignition switch must be cycled after the OCS system reset.

Cycle the ignition switch from OFF to ON.

17. Prove out the SRS as follows:

Turn the ignition key from ON to OFF. Wait 10 seconds, then turn the key back to ON and visually monitor the air bag indicator with the air bag modules installed. The air bag indicator will light continuously for approximately 6 seconds and then turn off. If an air bag SRS fault is present, the air bag indicator will: -

fail to light.

- remain lit continuously.

- flash at a 5 Hz rate (RCM not configured).

The air bag warning indicator may not illuminate until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON position. This is the time required for the RCM to complete the testing of the SRS. If the air bag warning indicator is inoperative and a SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag warning indicator and any SRS fault discovered must be diagnosed and repaired.

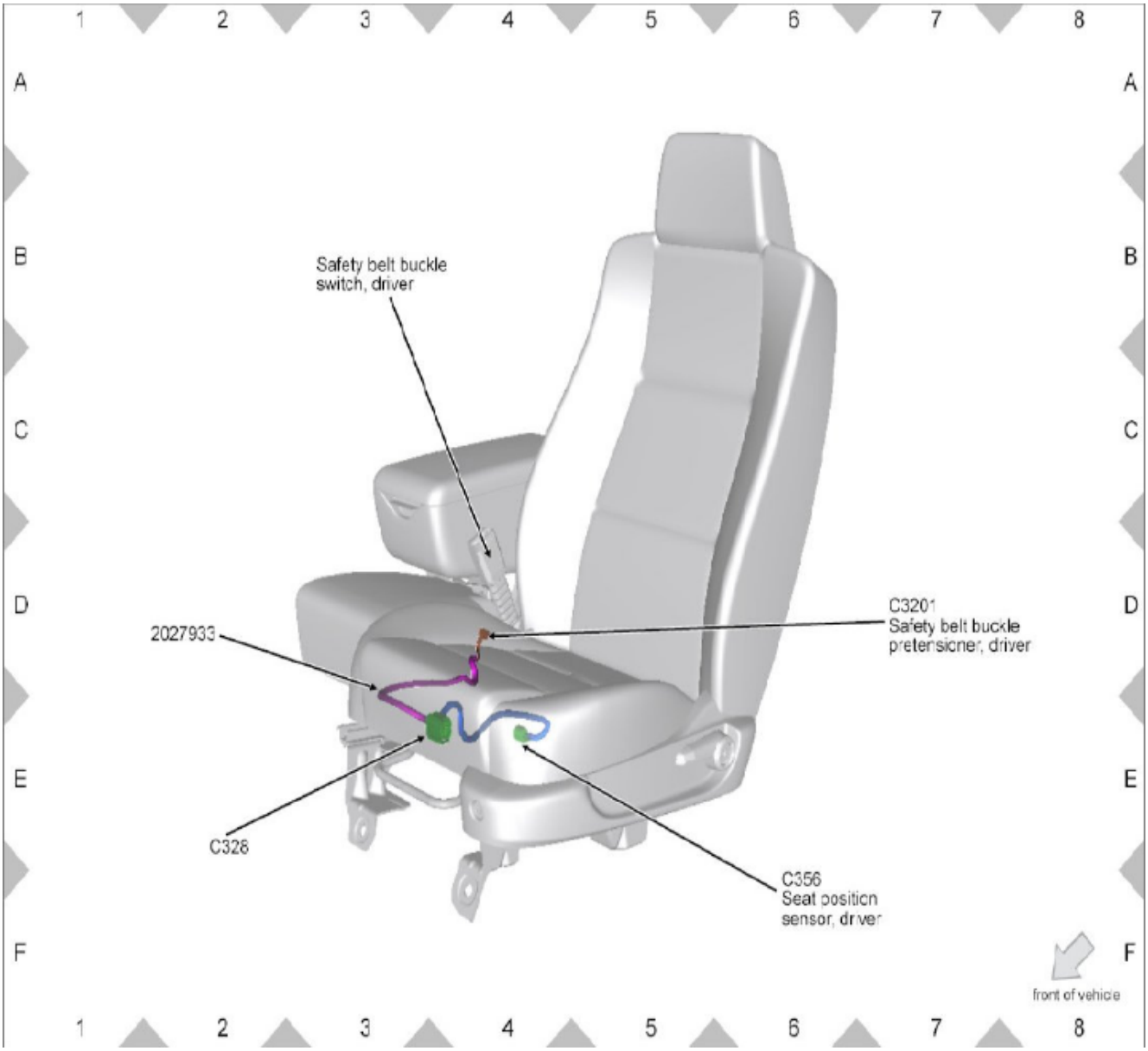
Clear all continuous RCM and OCSM DTCs using a scan tool.

18. NOTE: A prepaid return postcard is provided with a new OCS system service kit. The serial number for the new part and the vehicle

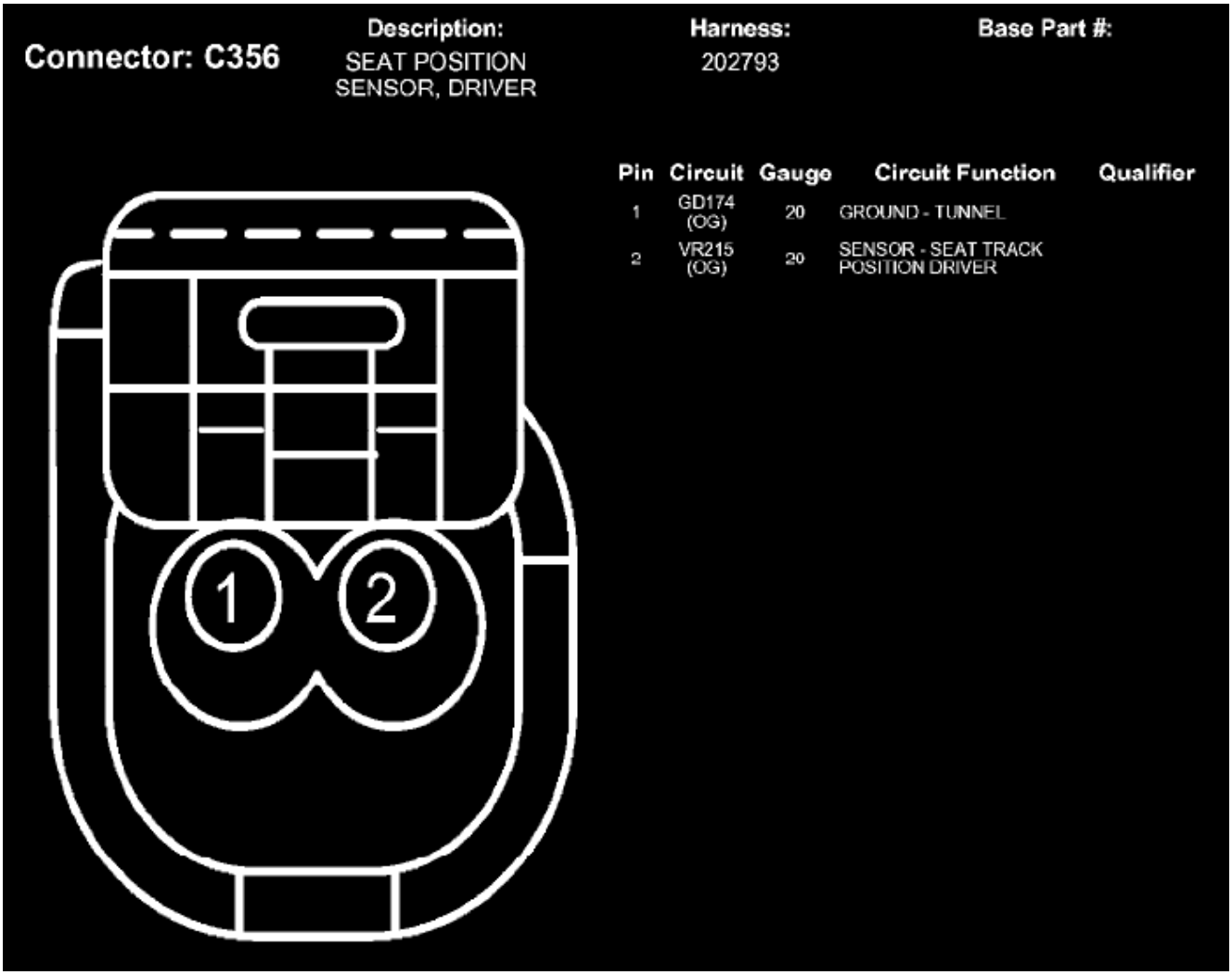
identification number (VIN) must be recorded and sent to Ford Motor Company.

If a new OCS system was installed, fill out the necessary information on the OCS system traceability card and return it along with the complete inoperative OCS system to Ford Motor Company. -

When returning the inoperative OCS system include: seat cushion foam pad, bladder, OCSM, pressure sensor (transducer), hose, electrical connectors and wire harness (service part OCS system only).

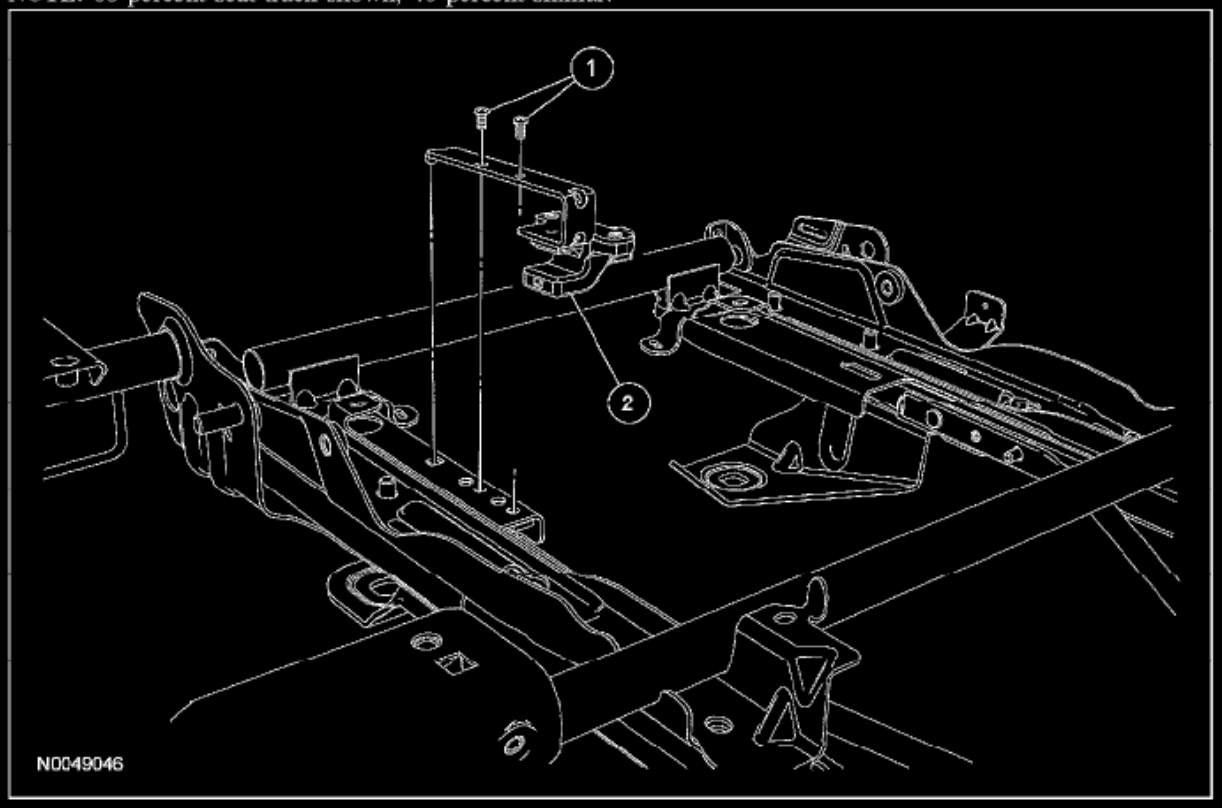

Safety belt buckle switch, driver
2027933
C3201
Safety belt buckle pretensioner, driver
C328
C356
Seat position sensor, driver
front of vehicle

View 151-18


Connector: C356
Description:
SEAT POSITION SENSOR, DRIVER
Harness:
202793
Base Part #:
Pin Circuit Gauge Circuit Function Qualifier
1 GD174 (OG) 20 GROUND - TUNNEL
2 VR215 (OG) 20 SENSOR - SEAT TRACK POSITION DRIVER
1
2

C356

NOTE: 60 percent seat track shown, 40 percent similar.



Item	Part Number	Description
1	—	Seat position sensor and bracket screws
2	14B416	Seat position sensor and bracket

Seat Position Sensor: Service and Repair

SEAT POSITION SENSOR

Removal and Installation

WARNING: Always tighten the seat position sensor retaining bolt to specified torque. Failure to do so may result in incorrect restraint system operation, which increases the risk of personal injury or death in a crash.

NOTE:

- The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a SRS fault.

- The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

- Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and carry out the diagnostic procedure again.

1. Depower the SRS. 2. Remove the driver seat. 3. Remove the seat track.

4. NOTE: Note the position of the seat position sensor locator tab for installation.

Remove the 2 screws and the seat position sensor and bracket.

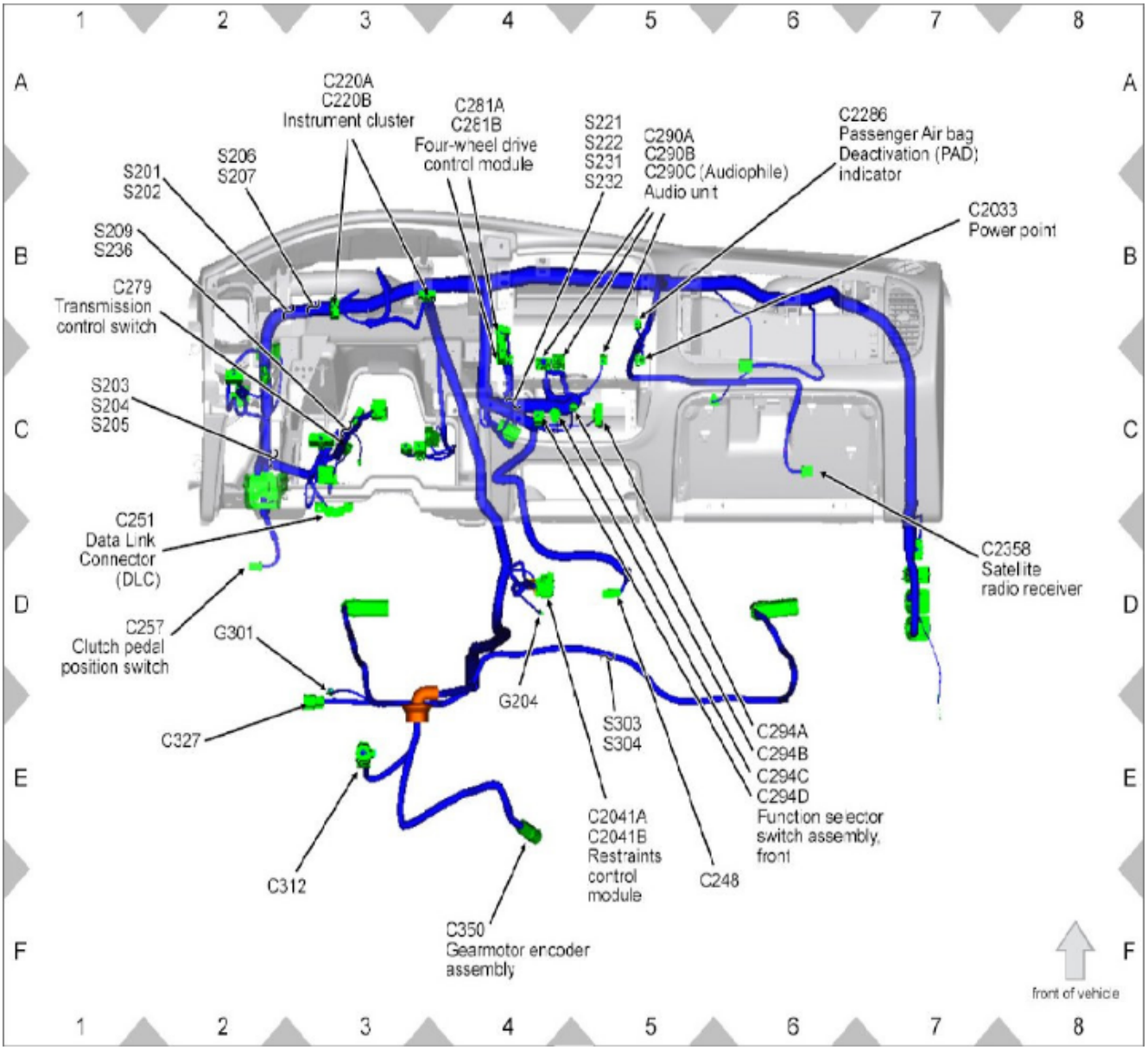
5. To install, reverse the removal procedure. 6. Repower the SRS.

Child Seat: Description and Operation

ATTACHING SAFETY SEATS WITH TETHER STRAPS

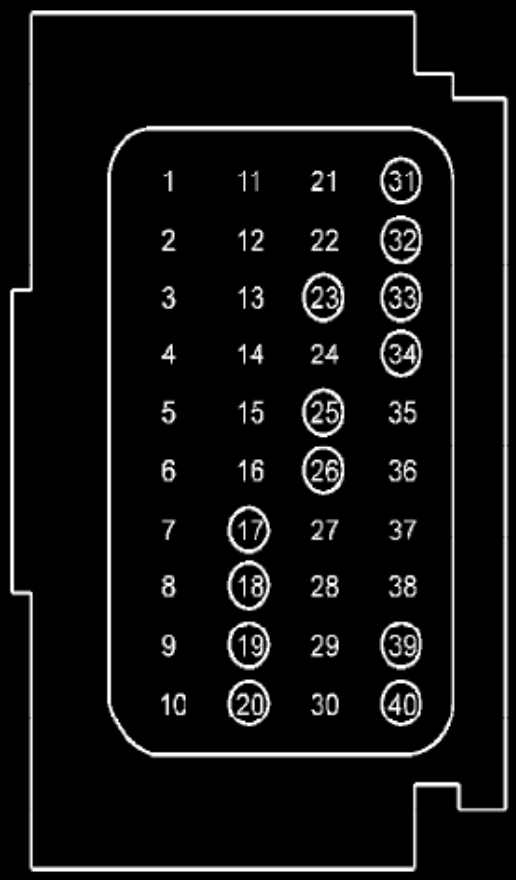
Some manufacturers make child safety seats that include a tether strap that goes over the back of the vehicle seat and attaches to an anchoring point. Other manufacturers offer the tether strap as an accessory. Contact the manufacturer of the child safety seat for information about ordering a tether strap.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Restraint Systems > Relays and Modules - Restraint Systems > Air Bag Control Module > Component Information > Locations



View 151-12

Connector: C2041A | **Description:** RESTRAINTS CONTROL MODULE | **Harness:** 14401 | **Base Part #:** 14B321



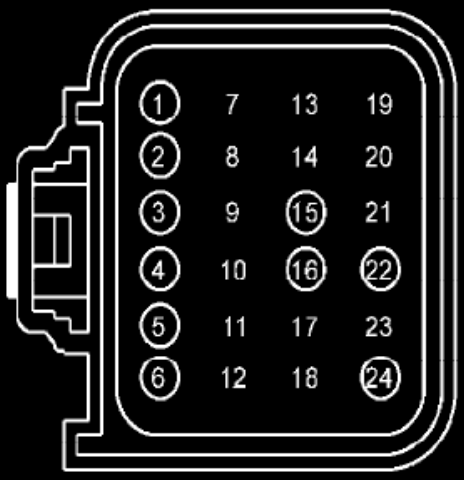
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	*	*	not used	
3	*	*	not used	
4	*	*	not used	
5	*	*	not used	
6	*	*	not used	
7	*	*	not used	
8	*	*	not used	
9	*	*	not used	
10	*	*	not used	
11	*	*	not used	
12	*	*	not used	
13	*	*	not used	
14	*	*	not used	
15	*	*	not used	
16	*	*	not used	
17	VDB05 (WH)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED LOW	
18	VDB04 (WH-BU)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED HIGH	
19	VR213 (VT-GN)	20	SENSOR - IMPACT FRONT 1ST OR LEFT	
20	RR129 (YE-GY)	20	CTRL MOD. - SENSOR IMPACT FRONT 1ST OR LEFT	
21	*	*	not used	
22	*	*	not used	
23	VR215 (YE-VT)	20	SENSOR - SEAT TRACK POSITION DRIVER	
24	*	*	not used	
25	CR201 (GN-BU)	20	SENSOR - SEAT BELT BUCKLE (SEAT BELT REMINDER) FRONT DRIVER SIDE	
26	CR203 (GY-VT)	20	SENSOR - SEAT BELT BUCKLE (SEAT BELT REMINDER) FRONT PASSENGER OUTBOARD	
27	*	*	not used	
28	*	*	not used	
29	*	*	not used	
30	*	*	not used	
31	CR120 (BU-OG)	20	CTRL MOD. - SEAT BELT PRETENSIONER FRONT DRIVER SIDE	
32	RR120 (BN-GN)	20	CTRL MOD. - SEAT BELT PRETENSIONER FRONT DRIVER SIDE	
33	RR122 (BN)	20	CTRL MOD. - SEAT BELT PRETENSIONER FRONT PASSENGER OUTBOARD	
34	CR122 (WH-OG)	20	CTRL MOD. - SEAT BELT PRETENSIONER FRONT PASSENGER OUTBOARD	
35	*	*	not used	
36	*	*	not used	
37	*	*	not used	

Air Bag Control Module: Diagrams

C2041A (Part 1)

38	*	*	not used
39	VR214 (WH-BU)	20	SENSOR - IMPACT FRONT 2ND OR RIGHT
40	RR130 (GN-BU)	20	CTRL MOD. - SENSOR IMPACT FRONT 2ND OR RIGHT

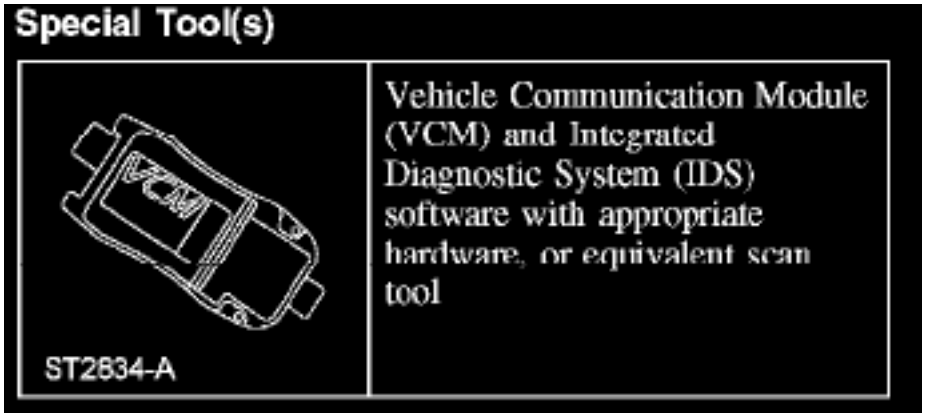
Connector: C2041B | **Description:** RESTRAINTS CONTROL MODULE | **Harness:** 14401 | **Base Part #:** 14B321



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CR103 (GY-BU)	20	CTRL MOD. - AIR BAG FRONT PASSENGER 1	
2	RR103 (VT-GN)	20	CTRL MOD. - AIR BAG FRONT PASSENGER 1	
3	RR101 (YE-GN)	20	CTRL MOD. - AIR BAG DRIVER 1	
4	CR101 (VT-BN)	20	CTRL MOD. - AIR BAG DRIVER 1	
5	CR104 (YE-GY)	20	CTRL MOD. - AIR BAG FRONT PASSENGER 2	
6	RR104 (WH-BU)	20	CTRL MOD. - AIR BAG FRONT PASSENGER 2	
7	*	*	not used	
8	*	*	not used	
9	*	*	not used	
10	*	*	not used	
11	*	*	not used	
12	*	*	not used	
13	*	*	not used	
14	*	*	not used	
15	RR102 (WH)	20	CTRL MOD. - AIR BAG DRIVER 2	
16	CR102 (BU)	20	CTRL MOD. - AIR BAG DRIVER 2	
17	*	*	not used	
18	*	*	not used	
19	*	*	not used	
20	*	*	not used	
21	*	*	not used	
22	CR114 (YE-OG)	20	CTRL MOD. - INDICATOR AIR BAG	
23	*	*	not used	
24	CBP08 (GY-YE)	20	FUSE - 8 OR CIRCUIT BREAKER	

C2041A (Part 2)

C2041B



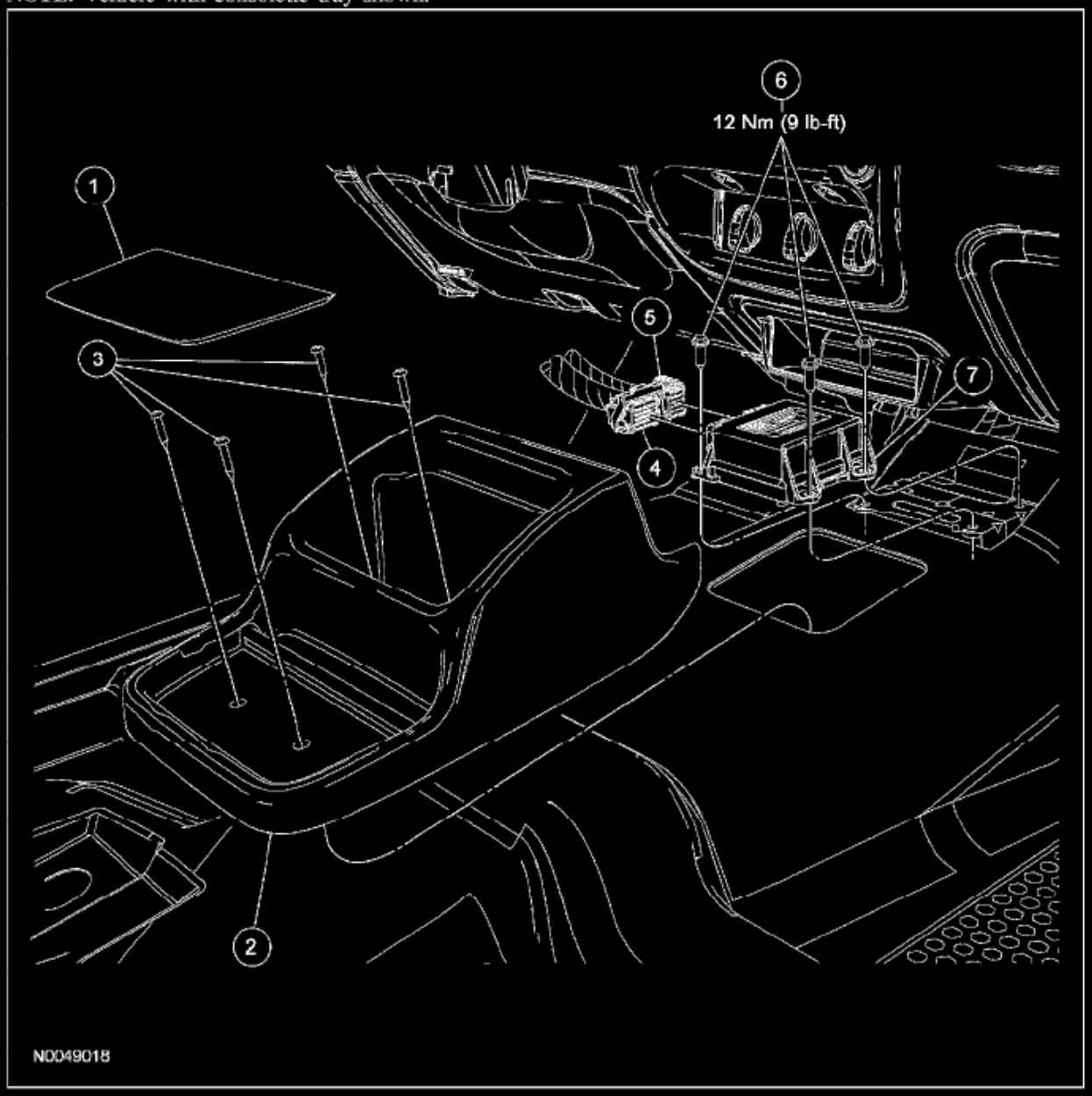
Air Bag Control Module: Service and Repair

RESTRAINTS CONTROL MODULE (RCM)

Special Tool(s)

Special Tool(s)

NOTE: Vehicle with consolette tray shown.



Item	Part Number	Description
1	—	Consolette tray mat (part of 045A36)
2	045A36	Consolette tray
3	—	Consolette tray screws (4 required) (part of 045A36)
4	—	Restraints control module (RCM) large electrical connector (part of 14401)

Item	Part Number	Description
5	—	RCM small electrical connector (part of 14401)
6	W701963	RCM bolts (3 required)
7	14B321	RCM

(Continued)

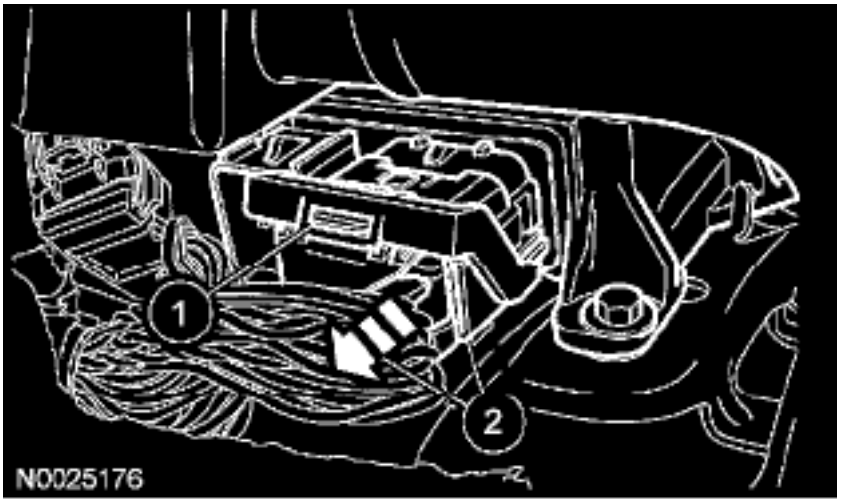
Removal

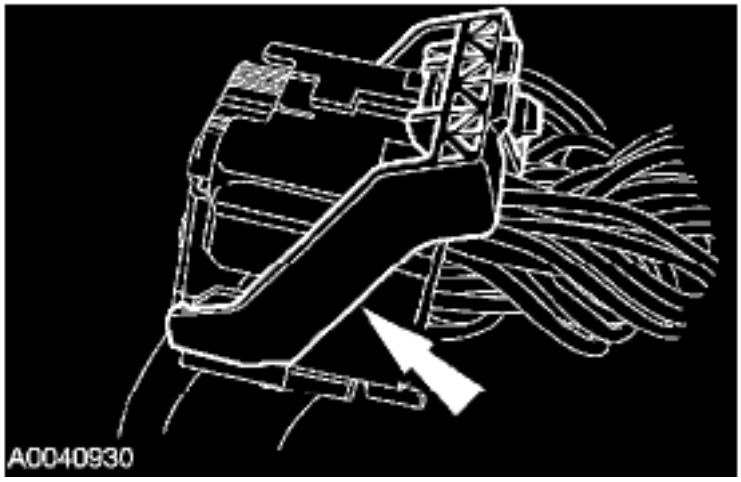
WARNING: If a vehicle has been in a crash, inspect the restraints control module (RCM) and the impact sensor (if equipped) mounting areas for deformation. If damaged, restore the mounting areas to the original production configuration. A new RCM and sensors must be installed whether or not the air bags have deployed. Failure to follow these instructions may result in serious personal injury or death in a crash.

CAUTION: -

When installing a new restraints control module (RCM), it is necessary to carry out programmable module installation (PMI). System failure may occur if PMI is not carried out.

- Electronic modules are sensitive to static electrical charges. If exposed to these charges, damage may result.


1
2
N0025176


A0040930

NOTE: -

The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

- The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

- Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and carry out the diagnostic procedure again.

All vehicles 1. Carry out the steps necessary to prepare for programmable module installation (PMI). 2. Depower the SRS.

Vehicles with high-series floor console 3. Remove the floor console.

Vehicles with a consolette 4. Remove the consolette tray mat. 5. Remove the 4 screws and remove the consolette tray.

All vehicles 6. Disconnect the small RCM electrical connector. 7. Disconnect the large RCM electrical connector.

1 Pinch the thumb tab and pivot the connector position assurance lever all the way back until it stops.

2 Pull out and disconnect the RCM electrical connector.

8. Remove the 3 bolts and the RCM.

Installation

All vehicles

1. WARNING: Always tighten the fasteners of the restraints control module (RCM) and impact sensor (if equipped) to the specified torque.

Failure to do so may result in incorrect restraint system operation, which increases the risk of personal injury or death in a crash.

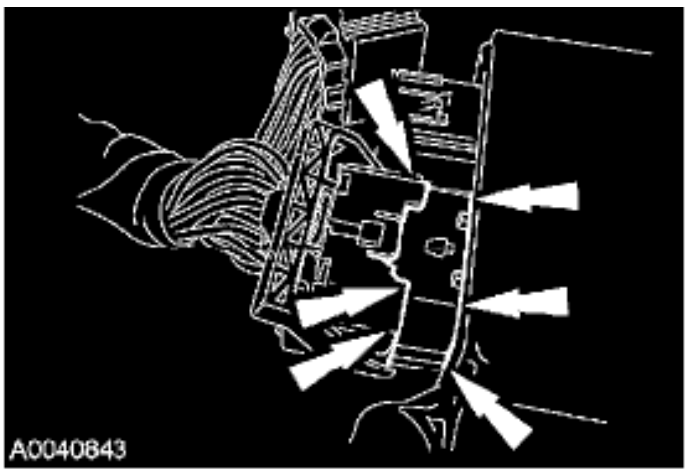
Install the RCM and the 3 bolts. -

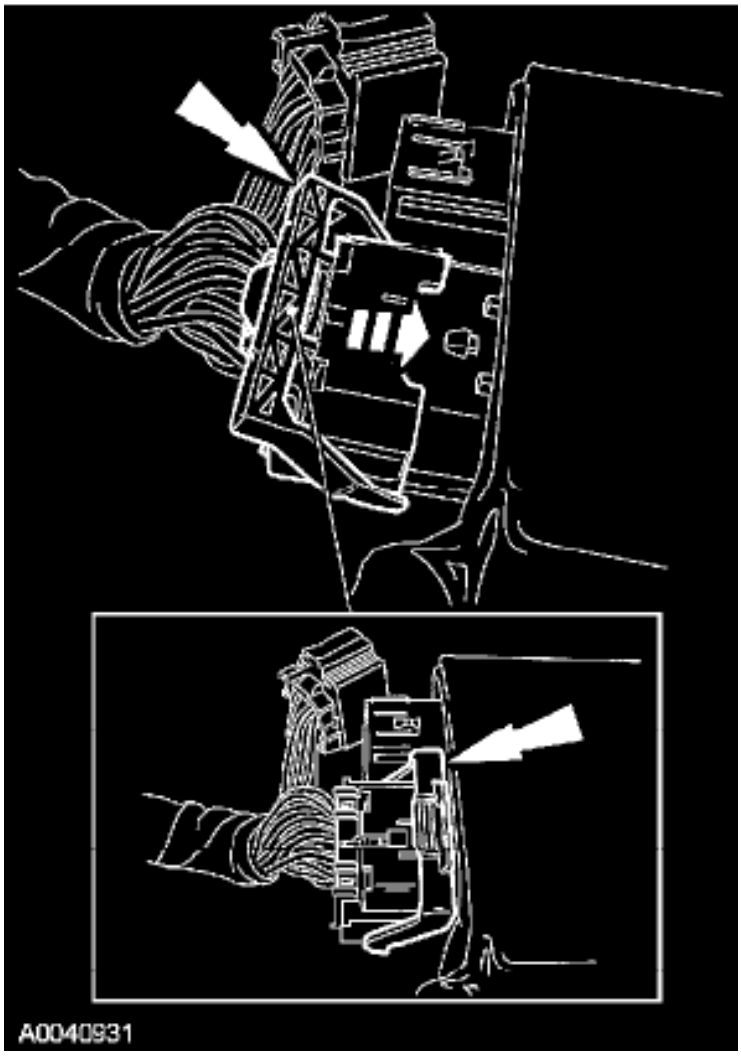
To install, tighten to 12 Nm (9 lb-ft).

2. Make sure the large RCM connector position assurance lever is in the full release position before attempting to connect the connector.

3. CAUTION: Putting the large restraints control module (RCM) electrical wiring connector into the RCM on an angle can cause bad

electrical connections and damage components.


A0040843


A0040931

NOTE: The RCM has been removed for clarity.

Position the large RCM electrical connector into the RCM.

-

CAUTION: Do not push the connector to the point where the lever pivots and seats itself. Light pressure is needed to get the connector into position on the restraints control module (RCM), before using the lever to fully seat the connector. Damage to the connector or component may occur.

With the large RCM electrical connector uniformly aligned to the RCM, lightly push in until a subtle audible click is heard and slight resistance is felt.

4. Connect the large RCM electrical connector.

- Using the connector position assurance lever, pivot it toward the RCM, drawing the connector into the RCM. -

Make sure the thumb tab is engaged to the retainer on the RCM and locked in place.

5. Connect the small RCM electrical connector.

Vehicles with a consolette 6. Install the consolette tray and the 4 screws. 7. Install the consolette tray mat.

Vehicles with high-series floor console 8. Install the floor console.

All vehicles 9. Repower the SRS. Do not prove out the SRS at this time.

10. When installing a new RCM, carry out the steps necessary to complete PMI.

11. Prove out the supplemental restraint system (SRS) as follows:

Turn the ignition switch from ON to OFF. Wait 10 seconds, then turn the ignition switch back to ON and visually monitor the air bag indicator with the air bag modules installed. The air bag indicator will light continuously for approximately 6 seconds and then turn OFF. If an air bag SRS fault is present, the air bag indicator will: -

fail to light.

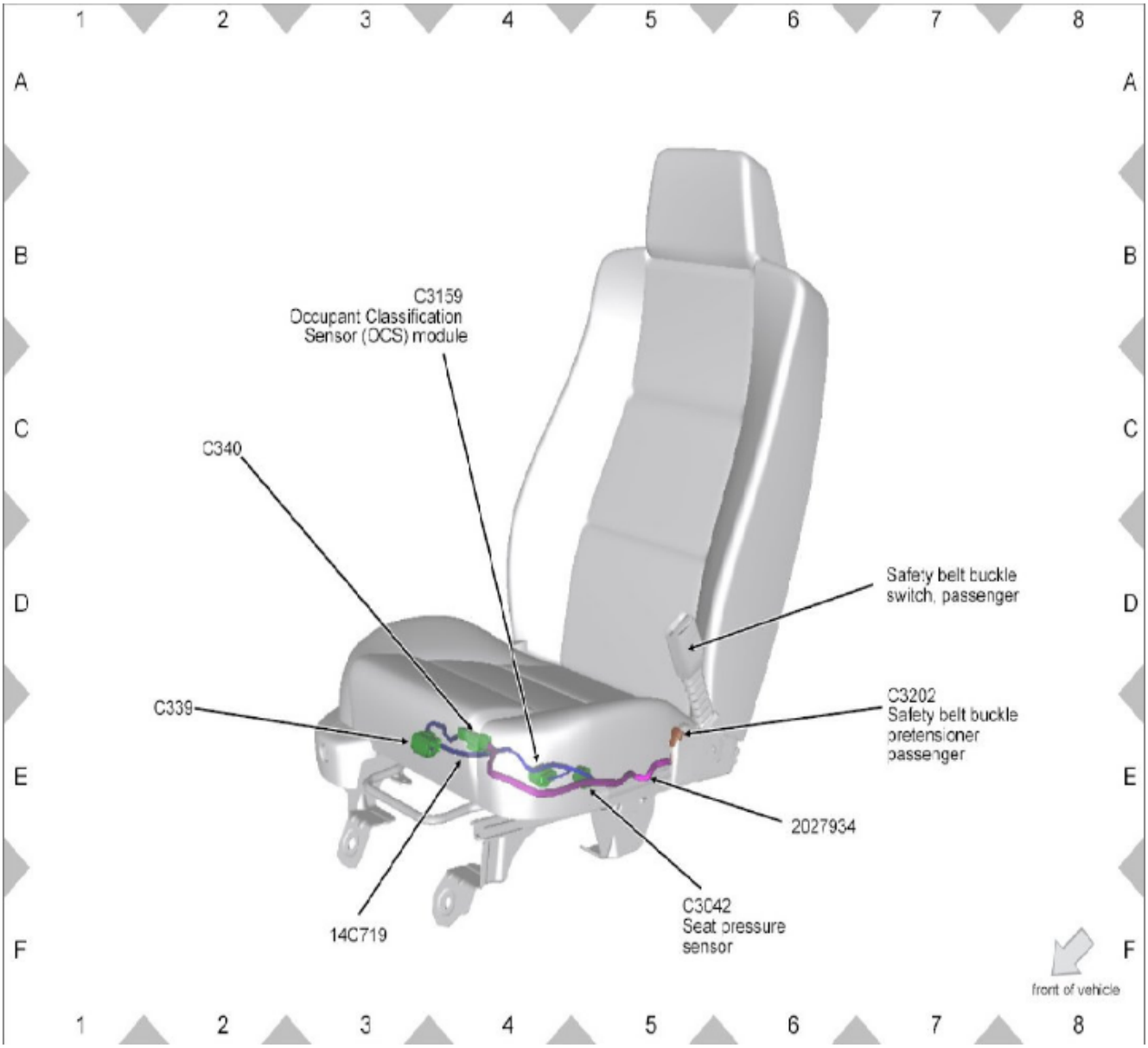
- remain lit continuously.

- flash at a 5 Hz rate (RCM not configured).

The air bag indicator might not light until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON position. This is the time required for the RCM to complete the testing of the SRS. If the air bag indicator is inoperative and a SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag indicator and any SRS fault discovered must be diagnosed and repaired.

Clear all continuous DTCs from the RCM and occupant classification system module (OCSM) using a scan tool.

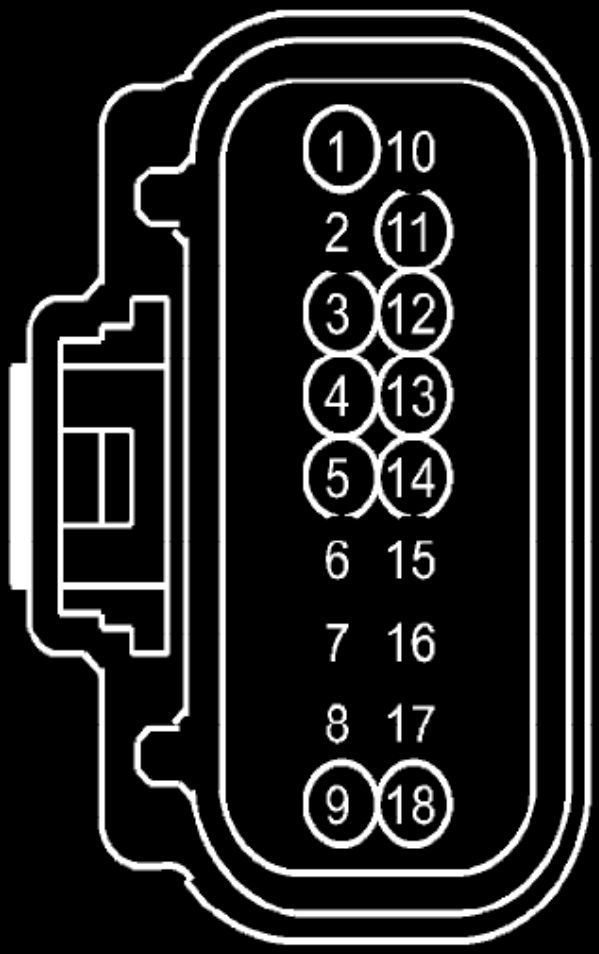
Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Restraint Systems > Relays and Modules - Restraint Systems > Seat Occupant Classification Module - Air Bag > Component Information > Locations



View 151-19

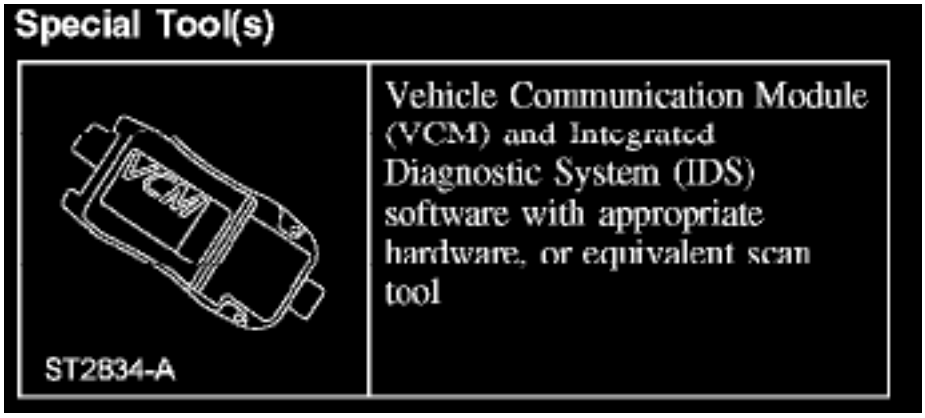
Connector: C3159

Description:	Harness:	Base Part #:
OCCUPANT CLASSIFICATIONSENSOR (OCS) MODULE	14C719	



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBP08 (GY-YE)	20	FUSE - 8 OR CIRCUIT BREAKER	
2	*	*	not used	
3	CR152 (GY-YE)	22	CTRL MOD. - SENSOR OCCUPANT CLASSIFICATION PRESSURE	
4	VR223 (BU-WH)	22	SENSOR - OCCUPANT CLASSIFICATION PRESSURE	
5	RR152 (YE-VT)	22	CTRL MOD. - SENSOR OCCUPANT CLASSIFICATION PRESSURE	
6	*	*	not used	
7	*	*	not used	
8	*	*	not used	
9	VDB05 (WH)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED LOW	
10	*	*	not used	
11	LR142 (YE-BU)	20	CTRL MOD. - SENSOR SEAT BELT TENSION FRONT PASSENGER OUTBOARD	
12	VR210 (BU-BN)	20	SENSOR - SEAT BELT TENSION FRONT PASSENGER OUTBOARD	
13	RR142 (GN)	20	CTRL MOD. - SENSOR SEAT BELT TENSION FRONT PASSENGER OUTBOARD	
14	CD174 (BK-WH)	18	GROUND - TUNNEL	
15	*	*	not used	
16	*	*	not used	
17	*	*	not used	
18	VDB04 (WH-BU)	20	CONNECTOR - DIAGNOSTIC # CAN BUS HIGH SPEED HIGH	

C3159



Air Bag(s) Arming and Disarming: Service and Repair Supplemental Restraint System (SRS) Depowering and Repowering

SUPPLEMENTAL RESTRAINT SYSTEM (SRS) DEPOWERING AND REPOWERING

Special Tool(s)

Special Tool(s)

Depowering Procedure

WARNING:

- Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.

- To reduce the risk of accidental deployment, do not use any memory saver devices. Failure to follow this instruction may result in serious personal injury or death.

NOTE:

- The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate an SRS fault.

- The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1. Turn all vehicle accessories OFF. 2. Turn the ignition switch to OFF. 3. At the smart junction box (SJB), located below the RH side of the instrument panel, remove the RH lower cowl trim panel and remove the

restraints control module (RCM) fuse 8 (10A) from the SJB.

4. Turn the ignition ON and visually monitor the air bag warning indicator for at least 30 seconds. The air bag warning indicator will remain lit

continuously (no flashing) if the correct RCM fuse has been removed. If the air bag warning indicator does not remain lit continuously, remove the correct RCM fuse before proceeding.

5. Turn the ignition OFF.

6. WARNING: Always deplete the backup power supply before repairing or installing any new front or side air bag supplemental restraint

system (SRS) component and before servicing, removing, installing, adjusting or striking components near the front or side impact sensors or the restraints control module (RCM). Nearby components include doors, instrument panel, console, door latches, strikers, seats and hood latches.

Refer to the Description and Operation portion of Air Bag Systems for location of the RCM and impact sensor(s).

To deplete the backup power supply energy, disconnect the battery ground cable and wait at least 1 minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Failure to follow these instructions may result in serious personal injury or death in the event of an accidental deployment.

Disconnect the battery ground cable and wait at least one minute.

Repowering Procedure

1. Turn the ignition switch from OFF to ON. 2. Install the RCM fuse 8 (10A) to the SJB and install the RH lower cowl trim panel.

3. WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is

connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

Connect the battery ground cable.

4. Prove out the SRS as follows:

Turn the ignition key from ON to OFF. Wait 10 seconds, then turn the key back to ON and visually monitor the air bag warning indicator with the air bag modules installed. The air bag warning indicator will light continuously for approximately 6 seconds and then turn off. If an air bag SRS fault is present, the air bag warning indicator will: -

fail to light.

- remain lit continuously.

- flash at a 5Hz rate (RCM not configured).

The air bag warning indicator may not illuminate until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON position. This is the time required for the RCM to complete the testing of the SRS. If the air bag warning indicator is inoperative and a SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag warning indicator and any SRS fault discovered must be diagnosed and repaired.

Clear all continuous RCM and occupant classification system module (OCSM) DTCs using a scan tool.

Special Tool(s)

ST2621-A	Diagnostic Tool, Restraint System (2 required) 418-F395
ST2512-A	Diagnostic Tool, Restraint System 418-F403
ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Air Bag(s) Arming and Disarming: Service and Repair Supplemental Restraint System (SRS) Deactivation and Reactivation

SUPPLEMENTAL RESTRAINT SYSTEM (SRS) DEACTIVATION AND REACTIVATION

Special Tool(s)

Deactivation Procedure

WARNING:

- Always carry or place a live air bag module with the air bag and deployment door/trim cover/tear seam pointed away from the body. Do not set a live air bag module down with the deployment door/trim cover/tear seam face down. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

- Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.

- To reduce the risk of accidental deployment, do not use any memory saver devices. Failure to follow this instruction may result in serious personal injury or death.

NOTE:

- The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

- No restraint system diagnostic tools are available for the safety belt buckle pretensioners. If the ignition switch is set to RUN or START with either the driver or passenger safety belt buckle pretensioner electrical connector disconnected, the DTCs for an open circuit fault will be active.

- The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1. Turn all vehicle accessories OFF. 2. Turn the ignition switch to OFF. 3. At the smart junction box (SJB), located below the RH side of the instrument panel, remove the restraints control module (RCM) fuse 8 (10A)

from the SJB.

4. Turn the ignition ON and visually monitor the air bag warning indicator for at least 30 seconds. The air bag warning indicator will remain lit

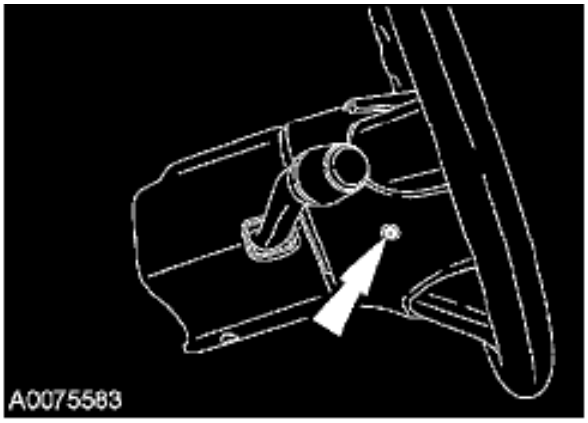
continuously (no flashing) if the correct RCM fuse has been removed. If the air bag warning indicator does not remain lit continuously, remove the correct RCM fuse before proceeding.

5. Turn the ignition OFF.

6. WARNING: Always deplete the backup power supply before repairing or installing any new front or side air bag supplemental restraint

system (SRS) component and before servicing, removing, installing, adjusting or striking components near the front or side impact sensors or the restraints control module (RCM). Nearby components include doors, instrument panel, console, door latches, strikers, seats and hood latches.

Refer to the Description and Operation portion of Air Bag Systems for location of the RCM and impact sensor(s).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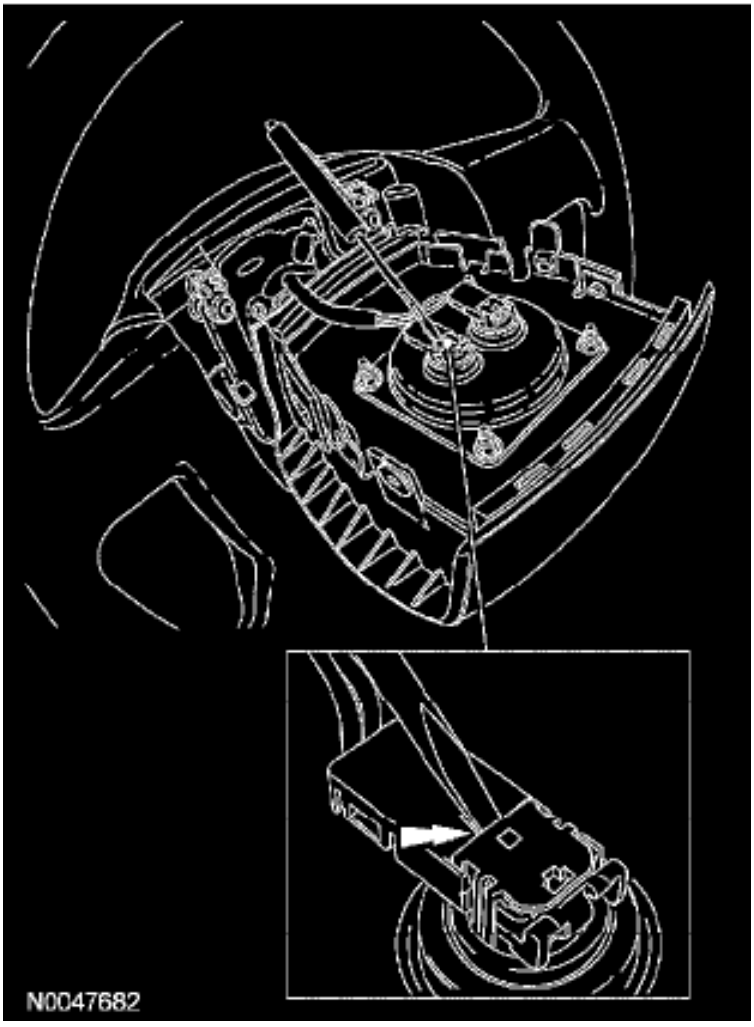

N0047682

To deplete the backup power supply energy, disconnect the battery ground cable and wait at least 1 minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Failure to follow these instructions may result in serious personal injury or death in the event of an accidental deployment.

Disconnect the battery ground cable and wait at least 1 minute.

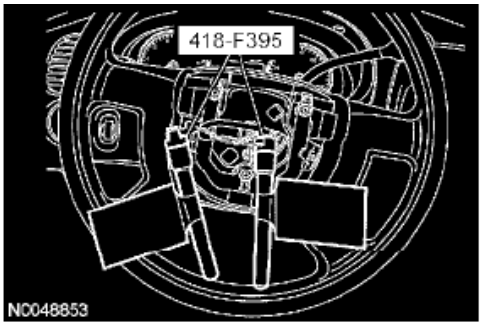
7. Remove the 2 driver air bag module bolts (1 shown).

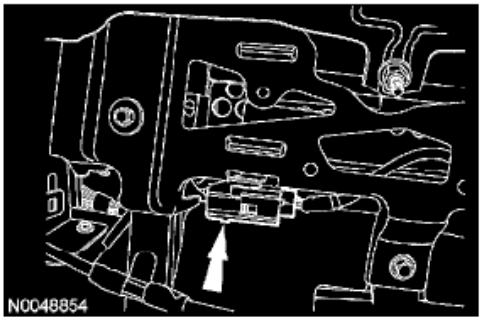
8. CAUTION: Do not pull the driver air bag module electrical connectors out by the locking buttons. Damage to the locking buttons may

occur.

Using a small screwdriver as shown, lift up and release the locking buttons on the driver air bag module electrical connectors. With the locking buttons released, remove the electrical connectors and the driver air bag module.

9. Attach the restraint system diagnostic tools to the clockspring electrical connectors at the top of the steering column.


418-F395
N0048853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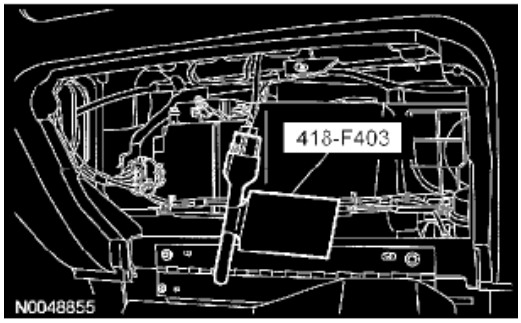
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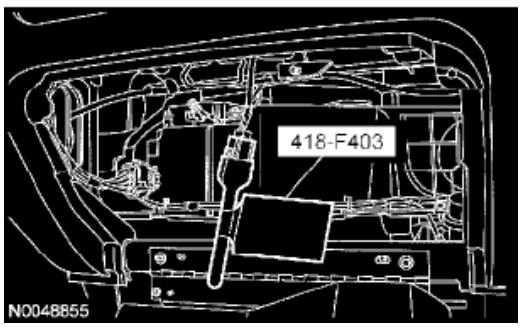
N0048855


418-F403
N0048855

10. Open the glove compartment door fully to access the passenger air bag electrical connector.
11. Release the tab and disconnect the passenger air bag module electrical connector.

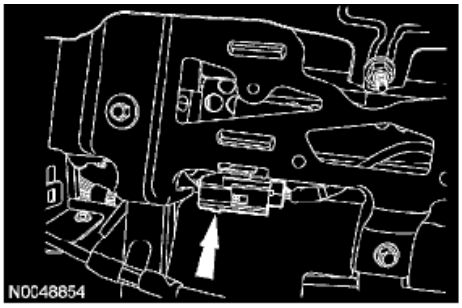
12. Attach the restraint system diagnostic tool to the vehicle harness side of the passenger air bag module electrical connector.

13. Install the RCM fuse 8 (10A) to the SJB. 14. Connect the battery ground cable.

Reactivation Procedure

1. Remove the RCM fuse 8 (10A) from the SJB. 2. Disconnect the battery ground cable and wait at least one minute. 3. Remove the restraint system diagnostic tool from the vehicle harness side of the passenger air bag module electrical connector.

4. Connect the passenger air bag module electrical connector.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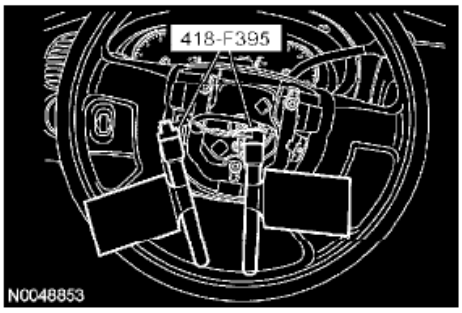
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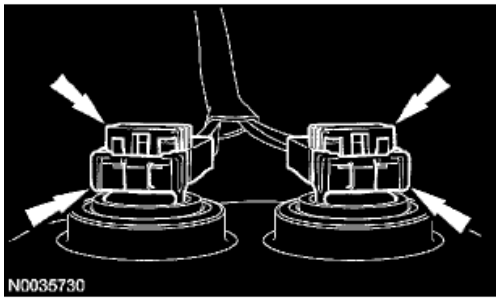
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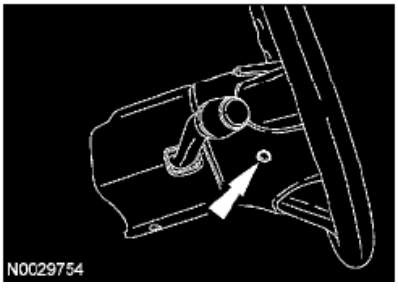
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5. Close the glove compartment door. 6. Remove the restraint system diagnostic tools from the clockspring electrical connectors at the top of the steering column.

7. CAUTION:

- Do not install the driver air bag module electrical connectors by the locking buttons. Damage to the locking buttons may occur.

- The driver air bag module electrical connector locking buttons must be in the released position when the connector is being installed or connector damage may occur.

- The driver air bag module electrical connectors are unique and cannot be reversed when connected to the driver air bag module. Match the electrical connector key to the keyway in the driver air bag module. Do not force the electrical connectors into the driver air bag module. Damage to the connector or component may occur.

With the locking buttons released, install the driver air bag module electrical connectors fully into the driver air bag module and seat the locking buttons.

8. Install the 2 driver air bag module bolts (1 shown).

- Tighten to 6 Nm (53 lb-in).

9. WARNING: Remove restraint system diagnostic tools from the vehicle prior to road testing. If tools are not removed, the supplemental

restraint system (SRS) device may not deploy in a crash. Failure to follow this instruction may result in serious personal injury or death

in a crash and possibly violate vehicle safety standards.

Make sure all restraint system diagnostic tool(s) that may have been installed during the repair have been removed from the vehicle and all SRS components are connected.

10. Turn the ignition from OFF to ON. 11. Install the restraint system control module fuse 8 (10A) to the SJB.

12. WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is

connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

Connect the battery ground cable.

13. Prove out the SRS as follows:

Turn the ignition key from ON to OFF. Wait 10 seconds, then turn the key back to ON and visually monitor the air bag warning indicator with the air bag modules installed. The air bag warning indicator will light continuously for approximately 6 seconds and then turn off. If an air bag SRS fault is present, the air bag warning indicator will: -

fail to light.

- remain lit continuously.

- flash at a 5Hz rate (RCM not configured).

The air bag warning indicator may not illuminate until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON position. This is the time required for the RCM to complete the testing of the SRS. If the air bag warning indicator is inoperative and a SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag warning indicator and any SRS fault discovered must be diagnosed and repaired.

Clear all continuous RCM and occupant classification system module (OCSM) DTCs using a scan tool.

Child Seat Tether Attachment: Description and Operation

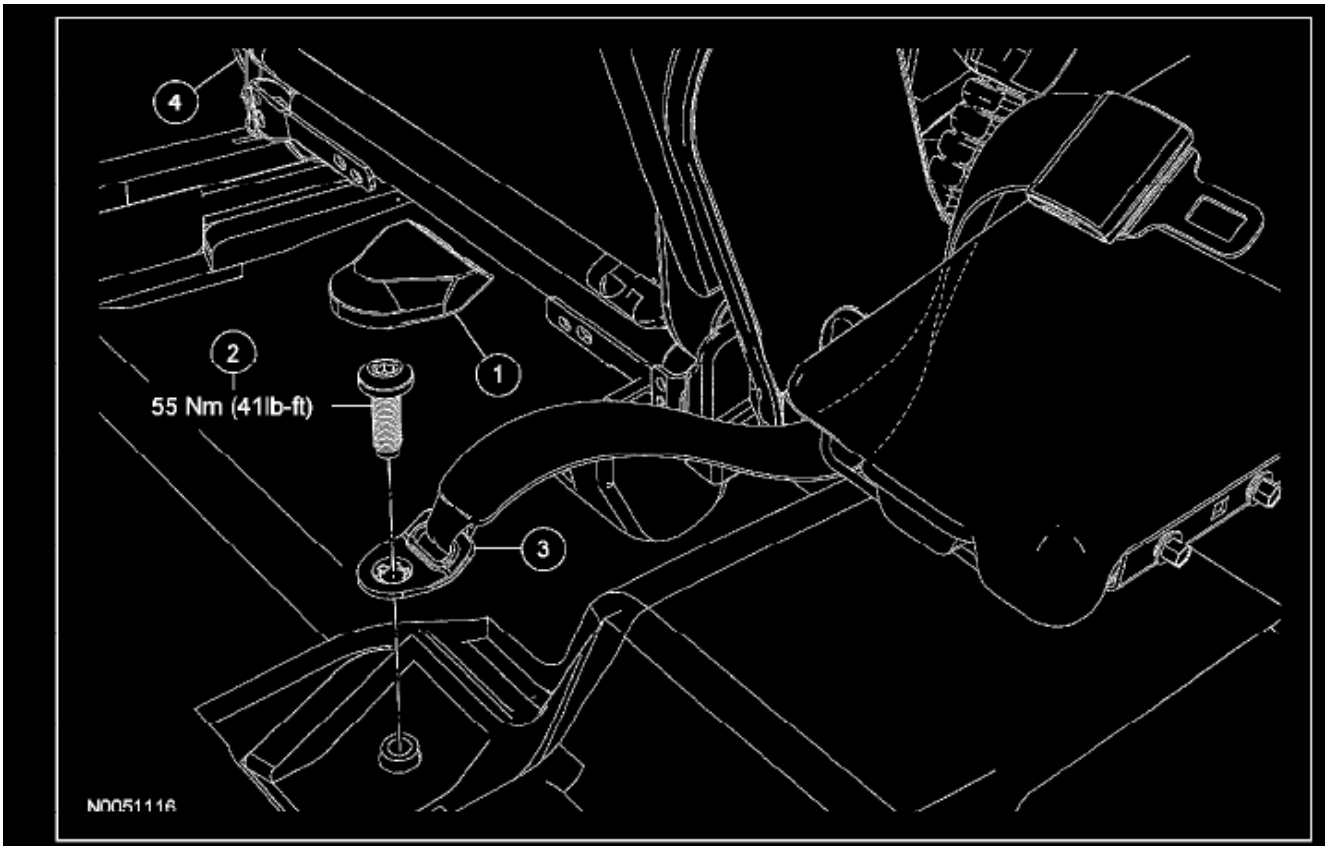
CHILD SAFETY SEAT TETHER ANCHOR

Child safety seat tether anchors have been provided in the vehicle at the passenger and center (60/40 bench only) positions. They are located directly beneath the seat back cushion attached to the frame. To use these anchors, refer to the Owner's Literature. Any child safety seat tether anchor in use during a collision must be inspected and a new seat frame installed if damaged.

Seat Belt: Description and Operation

SAFETY BELT, LAP/SHOULDER

While the vehicle is in motion, the combination lap and shoulder belt adjusts to the occupant's movement. However, if the vehicle brakes hard, corners hard or if the vehicle receives an impact of 8 km/h (5 mph) or more, the lap and shoulder belt locks and helps reduce the occupant's forward movement.



Item	Part Number	Description
1	611B32	Front center safety belt bolt cover (SuperCab only)
2	—	Front center safety belt bolt (part of 611B60)
3	611B60	Front center safety belt
4	—	Driver seat

Seat Belt: Service and Repair Safety Belt - Front, Center

SAFETY BELT - FRONT, CENTER

Removal and Replacement

WARNING: After any crash, all of the following safety belt assemblies and attaching hardware must be inspected by an authorized dealer to verify correct function:

- Retractors

- Buckles

- Belt tension sensor (BTS) (if equipped)

- Front safety belt buckle support assemblies (slide bar) (if equipped)

- Safety belt shoulder belt height adjusters (if equipped)

- Child safety seat tether bracket assemblies

- Automatic locking retractor (ALR) feature for child safety seats (passenger seating positions only)

If any safety belt assembly is damaged, does not operate correctly or does not pass all of the Functional Tests in the Diagnosis and Testing portion, a new safety belt assembly must be installed. If any safety belt assembly attaching areas are damaged or distorted, the sheet metal must be restored to its original structural integrity and new safety belt assembly and attaching hardware must be installed. Failure to install new safety belt assemblies and attaching hardware may increase the risk of serious personal injury or death in a crash.

After any crash that results in deployment of the driver and/or front outboard passenger safety belt pretensioners, new driver and/or front outboard passenger safety belt systems (including retractors, buckles and height adjusters) must be installed. Failure to install new safety belt systems increases the risk of serious personal injury or death in a crash.

1. Position the front seats to allow access to the front center safety belt bolt. 2. For SuperCab, remove the front center safety belt bolt cover. 3. Remove the front center safety belt bolt.

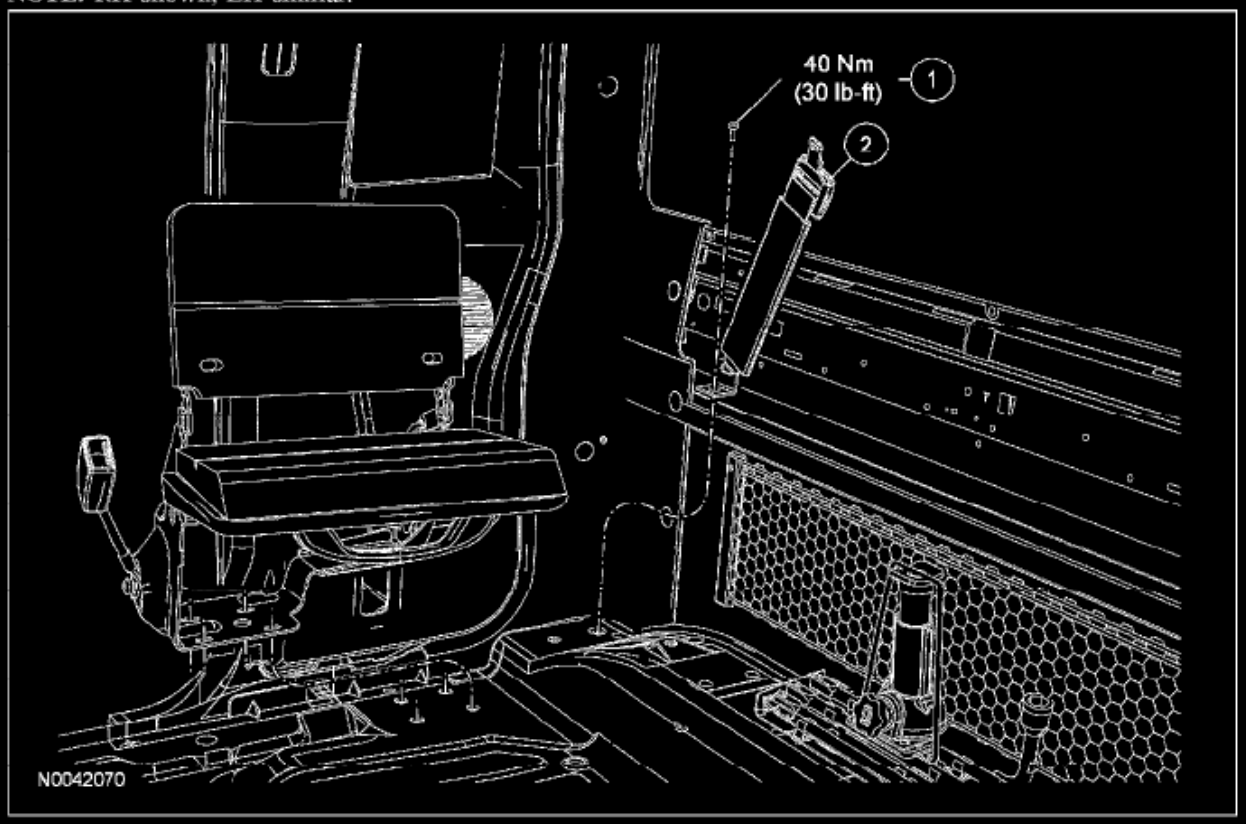
- To install, tighten to 55 Nm (41 lb-ft)

4. NOTE: The SuperCab and regular cab safety belts route differently. Note safety belt position for correct installation.

Route the front center safety belt through the seat cushion trim cover and remove.

5. To install, reverse the removal procedure. 6. Check the active restraint system for correct operation.

NOTE: RH shown, LH similar.



Item	Part Number	Description
1	—	Safety belt bolt (part of 613B84)
2	613B84	Safety belt

Seat Belt: Service and Repair Safety Belt - Rear, 2-Door, Supercab

SAFETY BELT - REAR, 2-DOOR, SUPERCAB

Removal and Installation

WARNING: After any crash, all of the following safety belt assemblies and attaching hardware must be inspected by an authorized dealer to verify correct function:

- Retractors

- Buckles

- Belt tension sensor (BTS) (if equipped)

- Front safety belt buckle support assemblies (slide bar) (if equipped)

- Safety belt shoulder belt height adjusters (if equipped)

- Child safety seat tether bracket assemblies

- Automatic locking retractor (ALR) feature for child safety seats (passenger seating positions only)

If any safety belt assembly is damaged, does not operate correctly or does not pass all of the Functional Tests in the Diagnosis and Testing portion, a new safety belt assembly must be installed. If any safety belt assembly attaching areas are damaged or distorted, the sheet metal must be restored to its original structural integrity and new safety belt assembly and attaching hardware must be installed. Failure to install new safety belt assemblies and attaching hardware may increase the risk of serious personal injury or death in a crash.

After any crash that results in deployment of the driver and/or front outboard passenger safety belt pretensioners, new driver and/or front outboard passenger safety belt systems (including retractors, buckles and height adjusters) must be installed. Failure to install new safety belt systems increases the risk of serious personal injury or death in a crash.

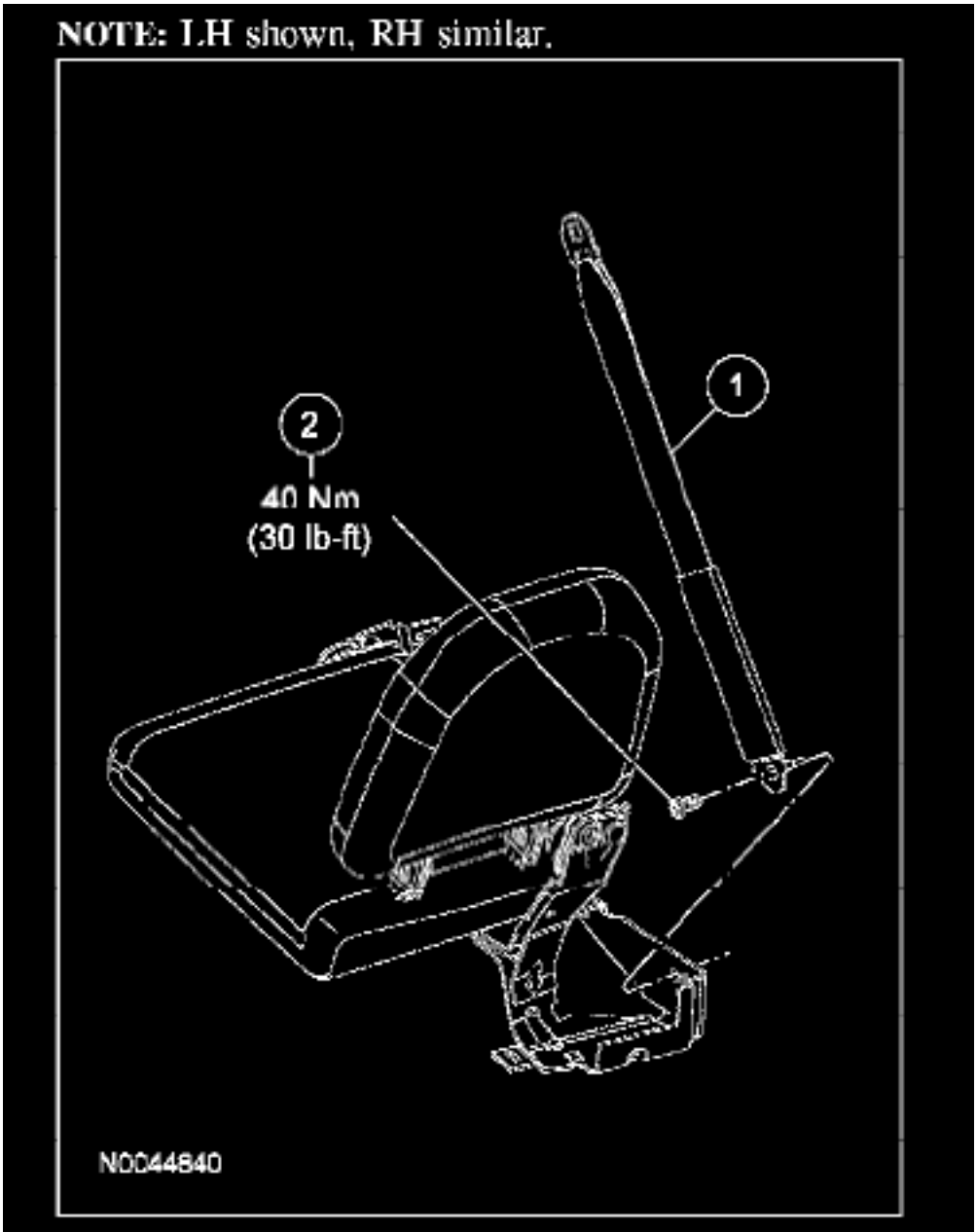
NOTE: Seat is removed for clarity.

1. Remove the bolt and safety belt.

- To install, tighten to 40 Nm (30 lb-ft).

2. To install, reverse the removal procedure.

3. Check the active restraint system for correct operation.



Item	Part Number	Description
1	611B68	Safety belt
2		Safety belt bolt

Seat Belt: Service and Repair Safety Belt - Rear, 4-Door, Supercab

SAFETY BELT - REAR, 4-DOOR, SUPERCAB

Removal and Installation

WARNING: After any crash, all of the following safety belt assemblies and attaching hardware must be inspected by an authorized dealer to verify correct function:

- Retractors

- Buckles

- Belt tension sensor (BTS) (if equipped)

- Front safety belt buckle support assemblies (slide bar) (if equipped)

- Safety belt shoulder belt height adjusters (if equipped)

- Child safety seat tether bracket assemblies

- Automatic locking retractor (ALR) feature for child safety seats (passenger seating positions only)

If any safety belt assembly is damaged, does not operate correctly or does not pass all of the Functional Tests in the Diagnosis and Testing portion, a new safety belt assembly must be installed. If any safety belt assembly attaching areas are damaged or distorted, the sheet metal must be restored to its original structural integrity and new safety belt assembly and attaching hardware must be installed. Failure to install new safety belt assemblies and attaching hardware may increase the risk of serious personal injury or death in a crash.

After any crash that results in deployment of the driver and/or front outboard passenger safety belt pretensioners, new driver and/or front outboard passenger safety belt systems (including retractors, buckles and height adjusters) must be installed. Failure to install new safety belt systems increases the risk of serious personal injury or death in a crash.

1. Remove the affected rear seat. 2. Remove the bolt and safety belt.

- To install, tighten to 40 Nm (30 lb-ft).

3. To install, reverse the removal procedure. 4. Check the active restraint system for correct operation.

Seat Belt Buckle: Description and Operation

SAFETY BELT BUCKLE AND PRETENSIONER

The driver and front outboard passenger safety belt buckle and pretensioner are secured to the front seat assembly on the seat track. This allows the front safety belt buckle end to move with the front seat. The belt and buckle assembly pretensioner is a pyrotechnic device that removes excess webbing from the safety belt system.

The belt and buckle assembly pretensioner uses the same crash sensor system as the air bag supplemental restraint system (SRS). When the belt and buckle assembly pretensioner deploys, the buckle moves downward, pulling excess webbing from the lap and shoulder safety belts.

If the safety belt buckle and pretensioner assembly is deployed, a new assembly must be installed.

For safety belt buckle pretensioner diagnostic information, refer to Air Bag Systems.

For safety belt buckle pretensioner disposal information, refer to Air Bag Systems.

Seat Belt Buckle: Testing and Inspection

FUNCTIONAL TEST - BUCKLE AND TONGUE

The safety belt buckle and tongue assembly must operate freely during the latching and unlatching function. Fasten the safety belt by inserting the tongue (male portion) into the buckle (female portion).

1. Verify the following during the latching sequence:

- Tongue insertion is not hindered by excessive effort.

- A "click" is heard when the buckle latches the tongue.

2. Verify the system integrity by forcefully pulling on the belt webbing. 3. Unlatch the belt by fully depressing the buckle release button, and allowing the belt to release and retract. 4. Verify the following during the unlatching process:

- Push-button depression does not require excessive effort.

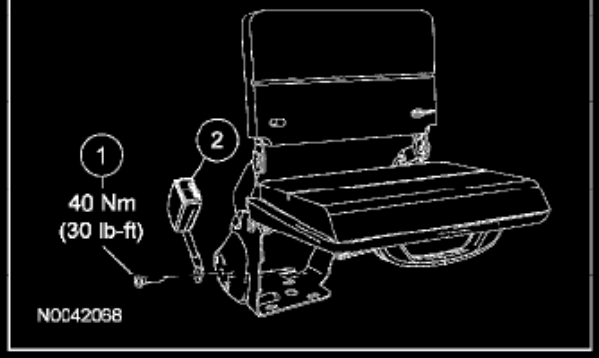
- Tongue can be removed easily from the buckle.

- Repeat the above steps 3 times.

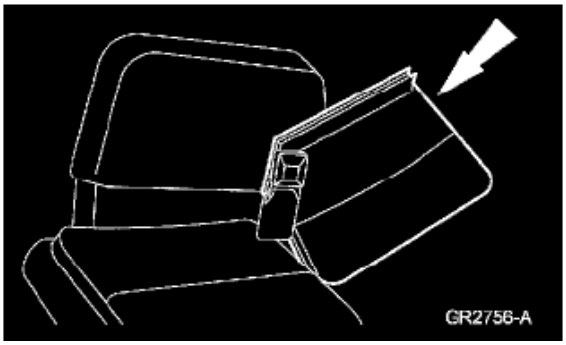
5. If the inspection reveals an obvious concern(s) that can be readily identified, service as required. Do not attempt to carry out any repair on the

buckle and tongue assembly. If a concern exists with either component, a new safety belt buckle and safety belt retractor assembly must be installed.

NOTE: RH shown, LH similar.



Item	Part Number	Description
1	—	Safety belt buckle bolt (part of 613B84)
2	613B84	Safety belt buckle



Seat Belt Buckle: Service and Repair Safety Belt Buckle - Rear, 2-Door, Supercab

SAFETY BELT BUCKLE - REAR, 2-DOOR, SUPERCAB

Removal and Installation

WARNING: After any crash, all of the following safety belt assemblies and attaching hardware must be inspected by an authorized dealer to verify correct function:

- Retractors

- Buckles

- Belt tension sensor (BTS) (if equipped)

- Front safety belt buckle support assemblies (slide bar) (if equipped)

- Safety belt shoulder belt height adjusters (if equipped)

- Child safety seat tether bracket assemblies

- Automatic locking retractor (ALR) feature for child safety seats (passenger seating positions only)

If any safety belt assembly is damaged, does not operate correctly or does not pass all of the Functional Tests in the Diagnosis and Testing portion, a new safety belt assembly must be installed. If any safety belt assembly attaching areas are damaged or distorted, the sheet metal must be restored to its original structural integrity and new safety belt assembly and attaching hardware must be installed. Failure to install new safety belt assemblies and attaching hardware may increase the risk of serious personal injury or death in a crash.

After any crash that results in deployment of the driver and/or front outboard passenger safety belt pretensioners, new driver and/or front outboard passenger safety belt systems (including retractors, buckles and height adjusters) must be installed. Failure to install new safety belt systems increases the risk of serious personal injury or death in a crash.

1. Remove the center facing rear seat. 2. Unhook the trim cover retainer. 3. Reposition the seat back trim cover.

4. Remove the seat back trim cover.

- Drill out the rivets.

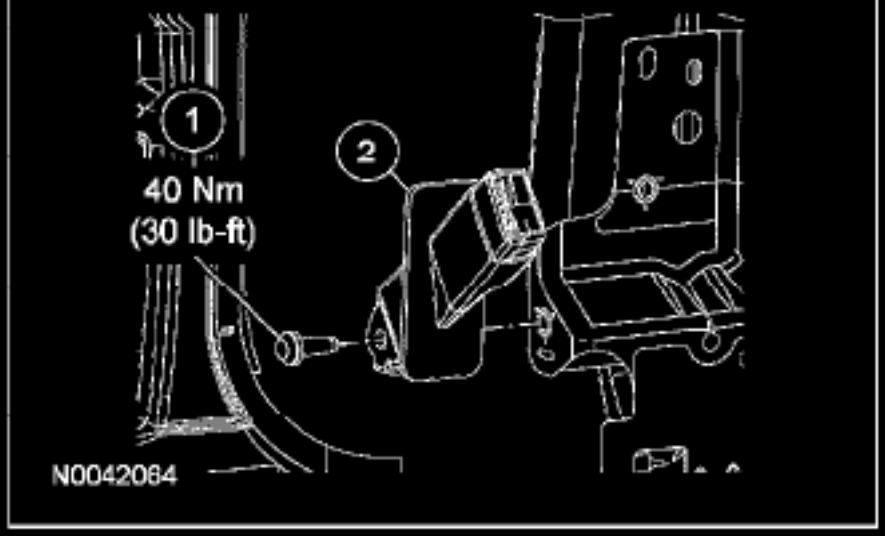
- Remove the seat back trim cover.

5. Remove the bolt and safety belt buckle.

- To install, tighten to 40 Nm (30 lb-ft).

6. To install, reverse the removal procedure. 7. Install the center facing rear seat. 8. Check the active restraint system for correct operation.

NOTE: LH shown, RH similar.



Item	Part Number	Description
1	—	Safety belt buckle bolt
2	60044 RH/ 60045 LH	Safety belt buckle

Seat Belt Buckle: Service and Repair Safety Belt Buckle - Rear, 4-Door, Supercab

SAFETY BELT BUCKLE - REAR, 4-DOOR, SUPERCAB

Removal and Installation

WARNING: After any crash, all of the following safety belt assemblies and attaching hardware must be inspected by an authorized dealer to verify correct function:

- Retractors

- Buckles

- Belt tension sensor (BTS) (if equipped)

- Front safety belt buckle support assemblies (slide bar) (if equipped)

- Safety belt shoulder belt height adjusters (if equipped)

- Child safety seat tether bracket assemblies

- Automatic locking retractor (ALR) feature for child safety seats (passenger seating positions only)

If any safety belt assembly is damaged, does not operate correctly or does not pass all of the Functional Tests in the Diagnosis and Testing portion, a new safety belt assembly must be

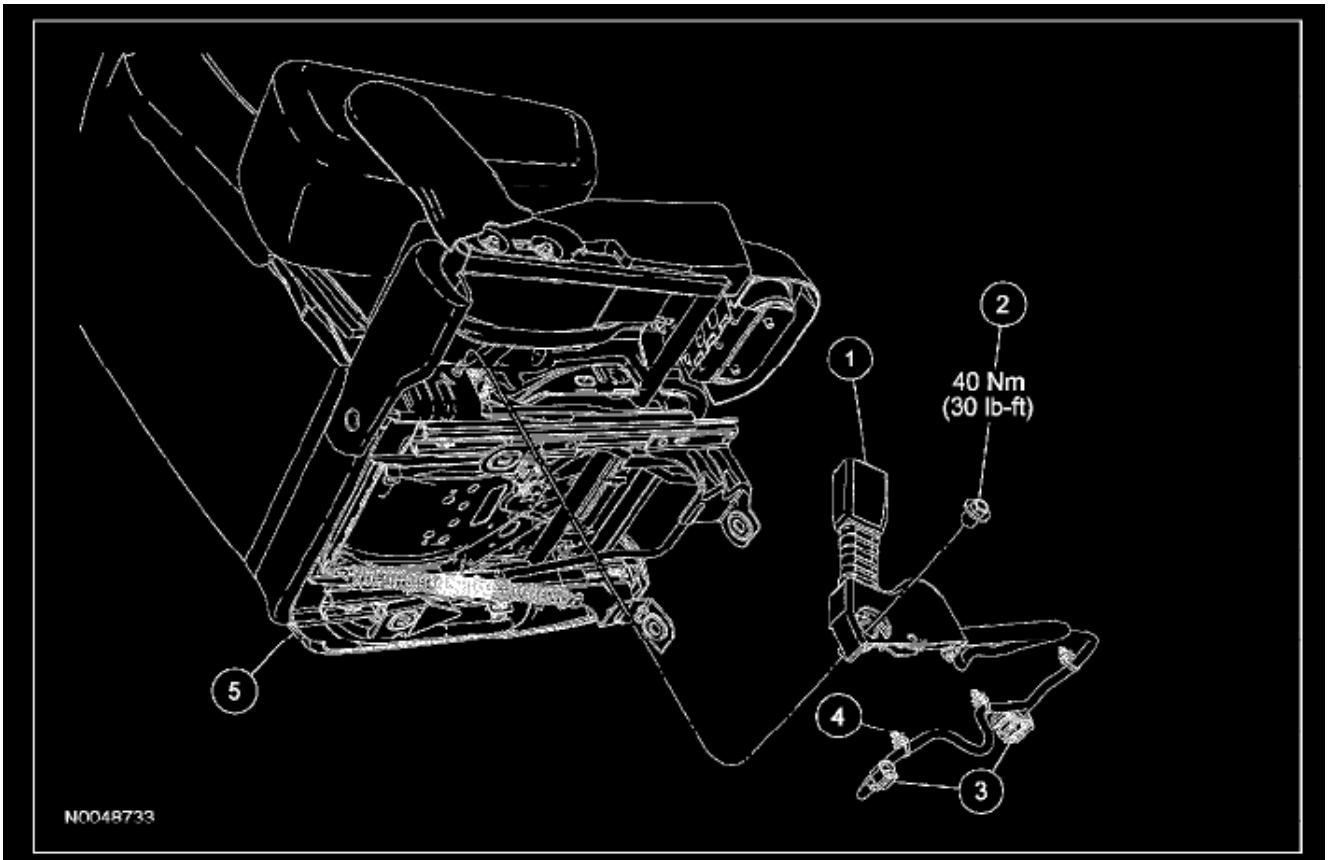
installed. If any safety belt assembly attaching areas are damaged or distorted, the sheet metal must be restored to its original structural integrity and new safety belt assembly and attaching hardware must be installed. Failure to install new safety belt assemblies and attaching hardware may increase the risk of serious personal injury or death in a crash.

After any crash that results in deployment of the driver and/or front outboard passenger safety belt pretensioners, new driver and/or front outboard passenger safety belt systems (including retractors, buckles and height adjusters) must be installed. Failure to install new safety belt systems increases the risk of serious personal injury or death in a crash.

1. Remove the rear door trim panel. 2. Remove the bolt and safety belt buckle.

- To install, tighten to 40 Nm (30 lb-ft).

3. To install, reverse the removal procedure. 4. Check the active restraint system for correct operation.



Item	Part Number	Description
1	61203	Safety belt buckle and pretensioner
2	000A25	Safety belt buckle and pretensioner nut
3	—	Electrical connectors (part of 61203)
4	—	Pin-type retainer (3 required)
5	—	Driver seat

Seat Belt Buckle: Service and Repair Safety Belt Buckle and Pretensioner - 60 Percent

SAFETY BELT BUCKLE AND PRETENSIONER - 60 PERCENT

Removal and Installation

WARNING:

- Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.

- After any crash, all of the following safety belt assemblies and attaching hardware must be inspected by an authorized dealer to verify correct function: -

Retractors

- Buckles

- Belt tension sensor (BTS) (if equipped)

- Front safety belt buckle support assemblies (slide bar) (if equipped)

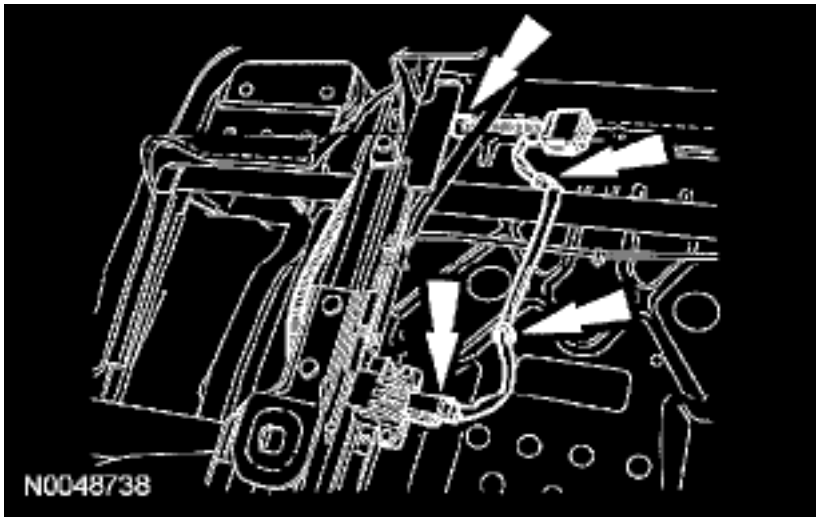
- Safety belt shoulder belt height adjusters (if equipped)

- Child safety seat tether bracket assemblies

- Automatic locking retractor (ALR) feature for child safety seats (passenger seating positions only)

If any safety belt assembly is damaged, does not operate correctly or does not pass all of the Functional Tests in the Diagnosis and Testing portion, a new safety belt assembly must be installed. If any safety belt assembly attaching areas are damaged or distorted, the sheet metal must be restored to its original structural integrity and new safety belt assembly and attaching hardware must be installed. Failure to install new safety belt assemblies and attaching hardware may increase the risk of serious personal injury or death in a crash.

After any crash that results in deployment of the driver and/or front outboard passenger safety belt pretensioners, new driver and/or front outboard passenger safety belt systems (including retractors, buckles and height adjusters) must be installed. Failure to install new safety belt systems increases the risk of serious personal injury or death in a crash.



- Never probe the electrical connectors on safety belt buckle/retractor pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors, which increases the risk of serious personal injury or death.

CAUTION: It is necessary to carry out the occupant classification sensor (OCS) system reset when a front passenger seat cushion is disassembled, a new trim cover is installed or an OCS system service kit is installed. A scan tool is used to carry out the OCS system reset command. Failure to follow this instruction may result in system failure and the incorrect operation of the OCS system.

NOTE:

- The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

- The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

- Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and carry out the diagnostic procedure again.

1. Depower the SRS. 2. Remove the 60 percent bench seat.

3. NOTE: Note the routing of the seat wiring harness for installation.

Detach the wiring harness from the cushion. -

Disconnect the SRS seat position sensor electrical connector.

- Detach the wiring harness and electrical connector pin-type retainers.

- Route out the wiring harness.

4. Remove the nut and safety belt buckle pretensioner.

- To install, tighten to 40 Nm (30 lb-ft).

5. To install, reverse the removal procedure. 6. Install the 60 percent bench seat.

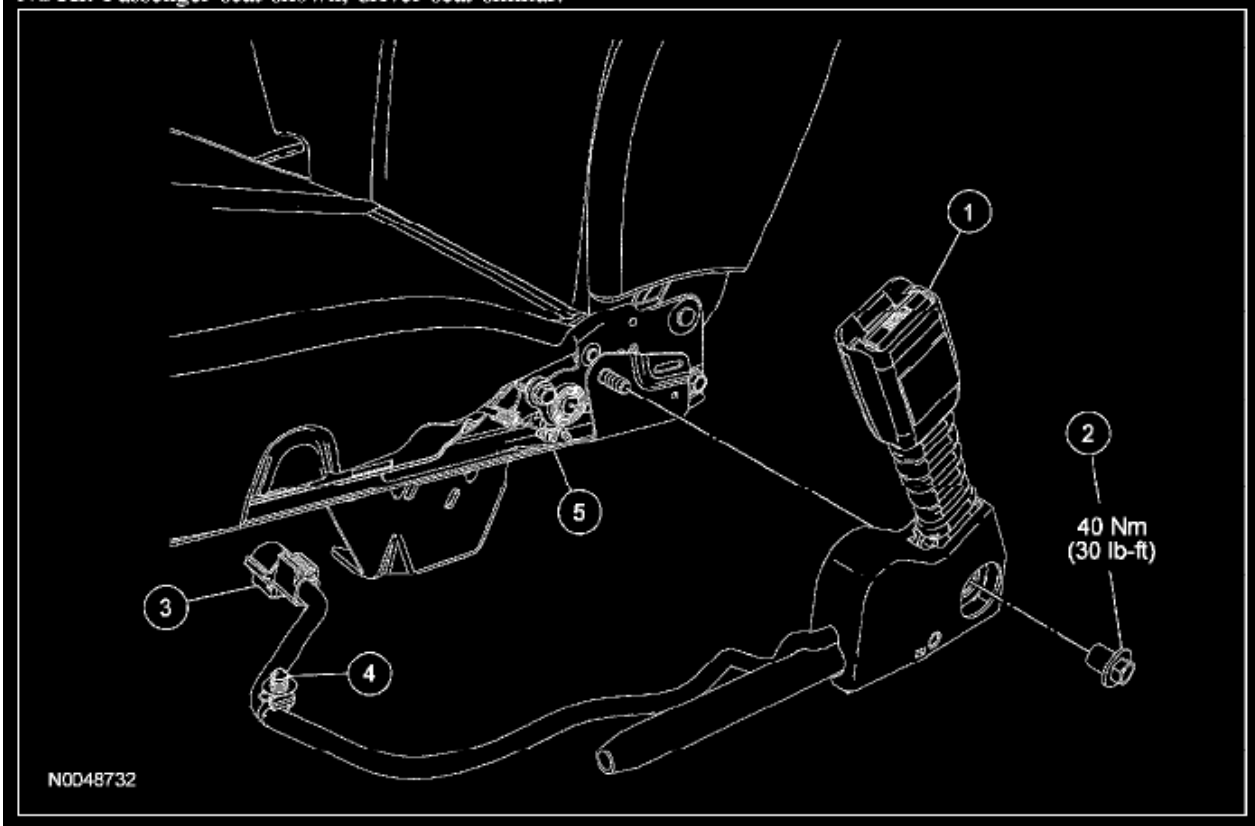
- Make sure the safety belts and buckles are accessible to the occupants after installation.

7. Repower the SRS. 8. Check the active restraint system for correct operation.

Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

NOTE: Passenger seat shown, driver seat similar.



Item	Part Number	Description
1	61202	Safety belt buckle and pretensioner
2	000A25	Safety belt buckle and pretensioner nut
3	—	Electrical connector (part of 61202)
4	—	Pin-type retainer
5	—	Front passenger seat

Seat Belt Buckle: Service and Repair Safety Belt Buckle and Pretensioner - 40 Percent

SAFETY BELT BUCKLE AND PRETENSIONER - 40 PERCENT

Special Tool(s)

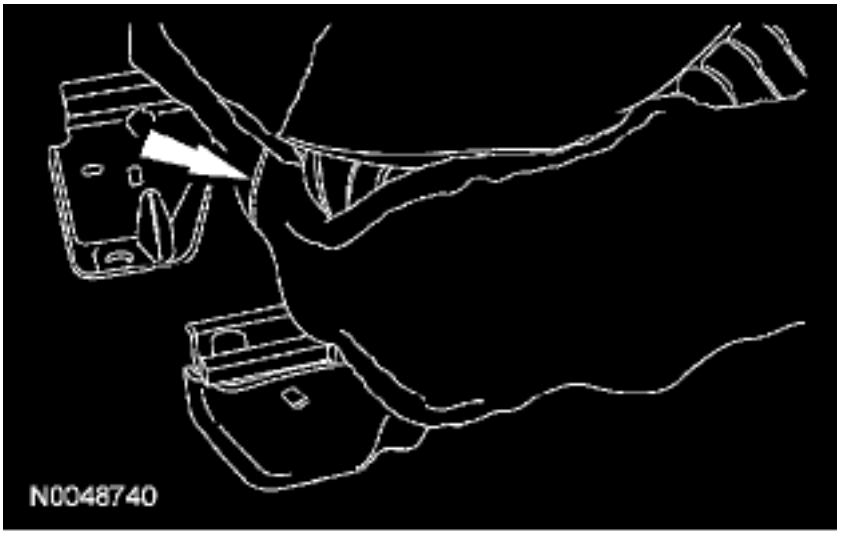
Special Tool(s)

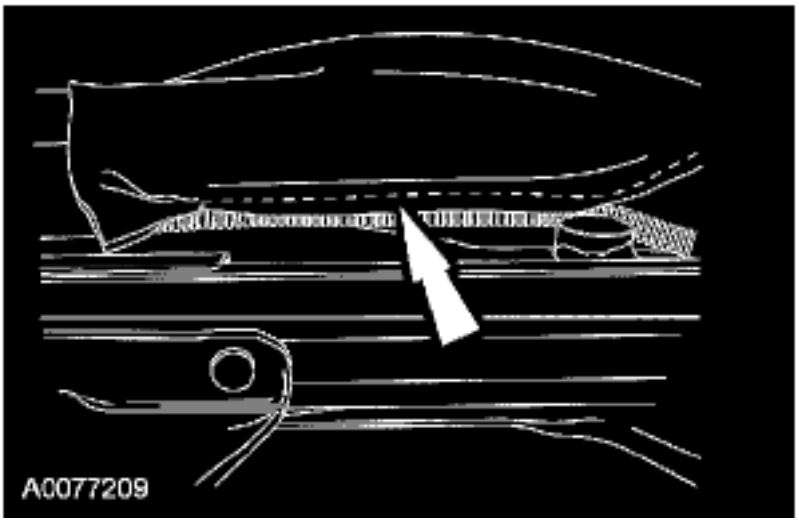
Removal and Installation

WARNING:

- Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.

- After any crash, all of the following safety belt assemblies and attaching hardware must be inspected by an authorized dealer to verify





correct function: -

Retractors

- Buckles

- Belt tension sensor (BTS) (if equipped)

- Front safety belt buckle support assemblies (slide bar) (if equipped)

- Safety belt shoulder belt height adjusters (if equipped)

- Child safety seat tether bracket assemblies

- Automatic locking retractor (ALR) feature for child safety seats (passenger seating positions only)

If any safety belt assembly is damaged, does not operate correctly or does not pass all of the Functional Tests in the Diagnosis and Testing portion, a new safety belt assembly must be installed. If any safety belt assembly attaching areas are damaged or distorted, the sheet metal must be restored to its original structural integrity and new safety belt assembly and attaching hardware must be installed. Failure to install new safety belt assemblies and attaching hardware may increase the risk of serious personal injury or death in a crash.

After any crash that results in deployment of the driver and/or front outboard passenger safety belt pretensioners, new driver and/or front outboard passenger safety belt systems (including retractors, buckles and height adjusters) must be installed. Failure to install new safety belt systems increases the risk of serious personal injury or death in a crash.

- Never probe the electrical connectors on safety belt buckle/retractor pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors, which increases the risk of serious personal injury or death.

CAUTION: It is necessary to carry out the occupant classification sensor (OCS) system reset of the OCS system when a front passenger seat cushion is disassembled, a new trim cover installed or an OCS system service kit is installed. A scan tool is used to trigger the command to carry out the OCS system reset.

NOTE:

- The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

- The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

All seats

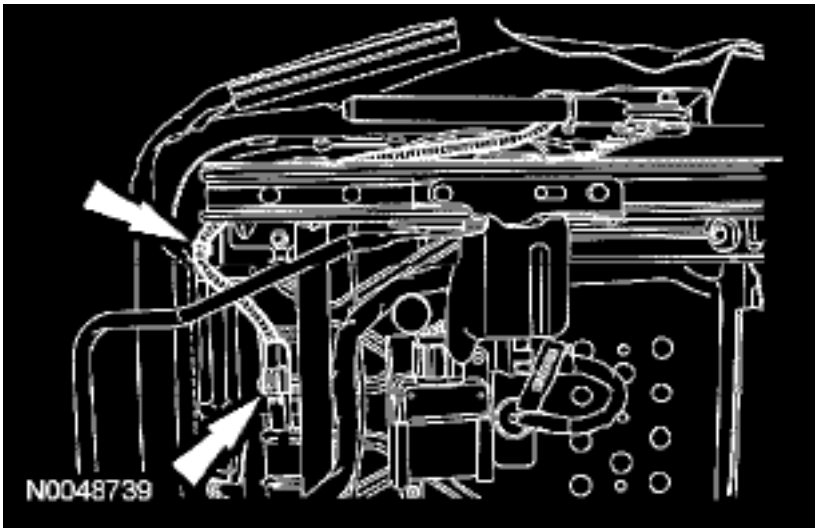
1. Remove the front seat. 2. Release the inboard side rear hook-and-loop strip.

3. Release the inboard side bottom J-clip for access to the safety belt buckle pretensioner.

4. NOTE: Note the routing of the wire harness through the seat for installation.

Detach the pin-type retainers and safety belt buckle pretensioner wire harness from the seat cushion pan. -

For driver seat, disconnect the seat position electrical connector.



- For passenger seat, disconnect the safety belt buckle pretensioner electrical connector.

5. Remove the nut, safety belt buckle pretensioner and wire harness.

- To install, tighten to 40 Nm (30 lb-ft).

6. To install, reverse the removal procedure.

- Make sure the safety belts and buckles are accessible to the occupants after installation.

7. Install the front seat and repower the SRS. If a passenger seat has been serviced, do not prove out the SRS at this time.

Passenger seat

8. WARNING: Make sure the front passenger seat repair is complete, the seat and all attached components (head restraint, seat side shield,

etc.) are correctly assembled, and the seat is correctly installed to the vehicle before carrying out the System Reset. Failure to follow these instructions may result in incorrect operation of the occupant classification sensor (OCS) system and increases the risk of serious personal injury or death in a crash.

CAUTION: -

The following precautions must be taken before carrying out the occupant classification sensor (OCS) system reset: -

Make sure the OCS system components are connected and no faults are present.

- Make sure the voltage to the occupant classification system module (OCSM) is above 8.0 volt and less than 18.0 volts.

- Make sure the OCS system is not at a temperature below 6°C (42°F) or above 36°C (97°F) when initiating the OCS system reset process. If the vehicle has been exposed to extreme cold or hot temperatures, the vehicle must be exposed and kept at a temperature within the limits, 6°C to 36°C (42°C to 97°C) for a minimum of 30 minutes.

- Make sure nothing is present on the passenger seat before carrying out the OCS system reset and nothing is placed on the seat during the process.

- Make sure a minimum 4-second time period has passed after cycling the ignition switch ON before the carrying out the OCS system reset process.

NOTE: If the first attempt to carry out the occupant classification sensor (OCS) system reset is unsuccessful, a second attempt must be made. If the second attempt is unsuccessful, a new OCS system service kit must be installed.

Carry out the OCS system reset active command.

All seats

9. NOTE: The ignition switch must be cycled after the OCS system reset.

Prove out the SRS as follows: Turn the ignition key from ON to OFF. Wait 10 seconds, then turn the key back to ON and visually monitor the air bag warning indicator with the air bag modules installed. The air bag warning indicator will light continuously for approximately 6 seconds and then turn OFF. If an air bag SRS fault is present, the air bag warning indicator will: -

fail to light.

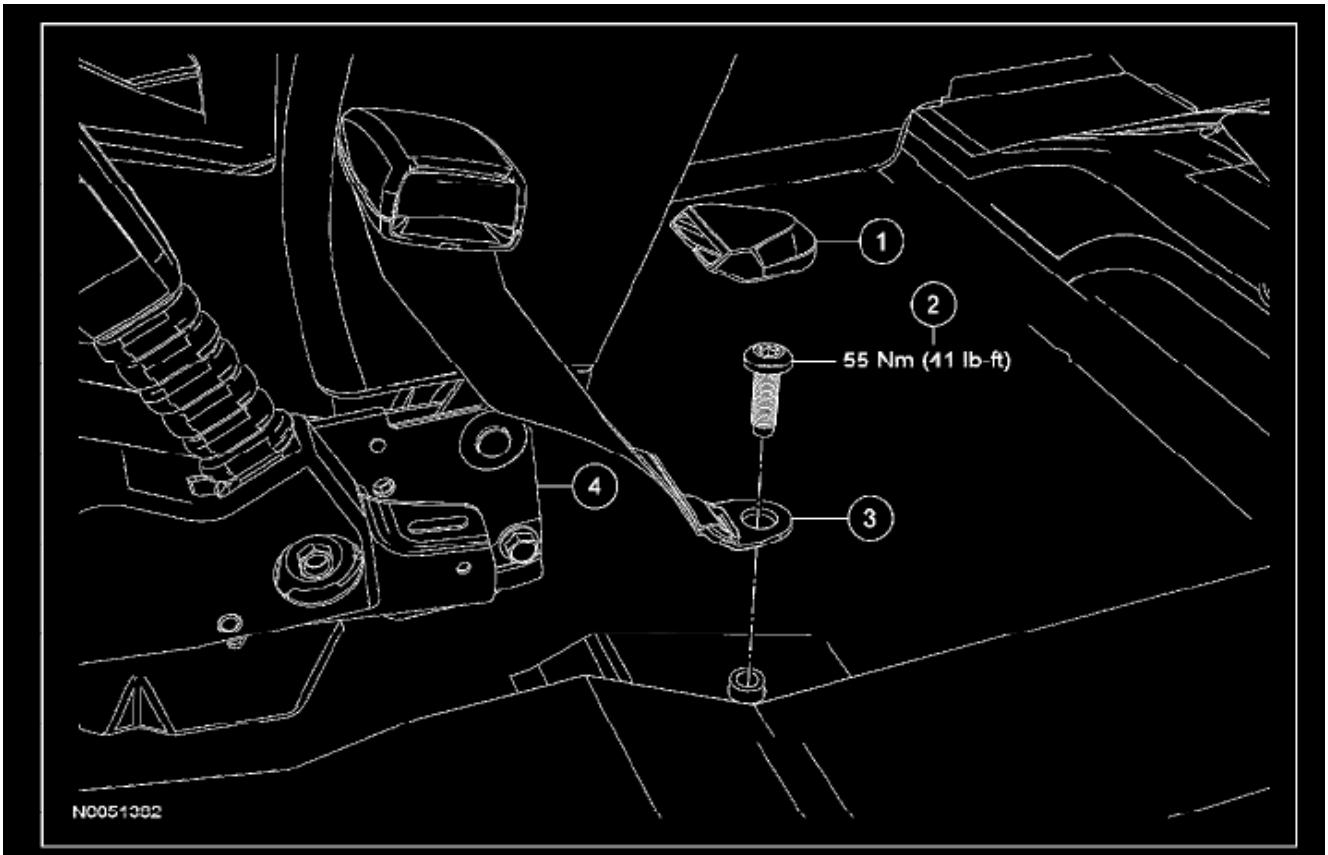
- remain lit continuously.

- flash at a 5 Hz rate (RCM not configured).

The air bag warning indicator might not light until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON position. This is the time required for the RCM to complete the testing of the SRS. If the air bag warning indicator is inoperative and a SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag warning indicator and any SRS fault discovered must be diagnosed and repaired.

Clear all RCM and occupant classification system module (OCSM) DTCs using a scan tool.

10. Check the active restraint system for correct operation.



Item	Part Number	Description
1	611B32	Front center safety belt buckle bolt cover (SuperCab only)
2	—	Front center safety belt buckle bolt (part of 611B60)
3	611B60	Front center safety belt buckle
4	—	Front passenger seat

Seat Belt Buckle: Service and Repair Safety Belt Buckle - Front, Center

SAFETY BELT BUCKLE - FRONT, CENTER

Removal and Replacement

WARNING: After any crash, all of the following safety belt assemblies and attaching hardware must be inspected by an authorized dealer to verify correct function:

- Retractors

- Buckles

- Belt tension sensor (BTS) (if equipped)

- Front safety belt buckle support assemblies (slide bar) (if equipped)

- Safety belt shoulder belt height adjusters (if equipped)

- Child safety seat tether bracket assemblies

- Automatic locking retractor (ALR) feature for child safety seats (passenger seating positions only)

If any safety belt assembly is damaged, does not operate correctly or does not pass all of the Functional Tests in the Diagnosis and Testing portion, a new safety belt assembly must be installed. If any safety belt assembly attaching areas are damaged or distorted, the sheet metal must be restored to its original structural integrity and new safety belt assembly and attaching hardware must be installed. Failure to install new safety belt assemblies and attaching hardware may increase the risk of serious personal injury or death in a crash.

After any crash that results in deployment of the driver and/or front outboard passenger safety belt pretensioners, new driver and/or front outboard passenger safety belt systems (including retractors, buckles and height adjusters) must be installed. Failure to install new safety belt systems increases the risk of serious personal injury or death in a crash.

1. Position the front seats to allow access to the front center safety belt buckle bolt.

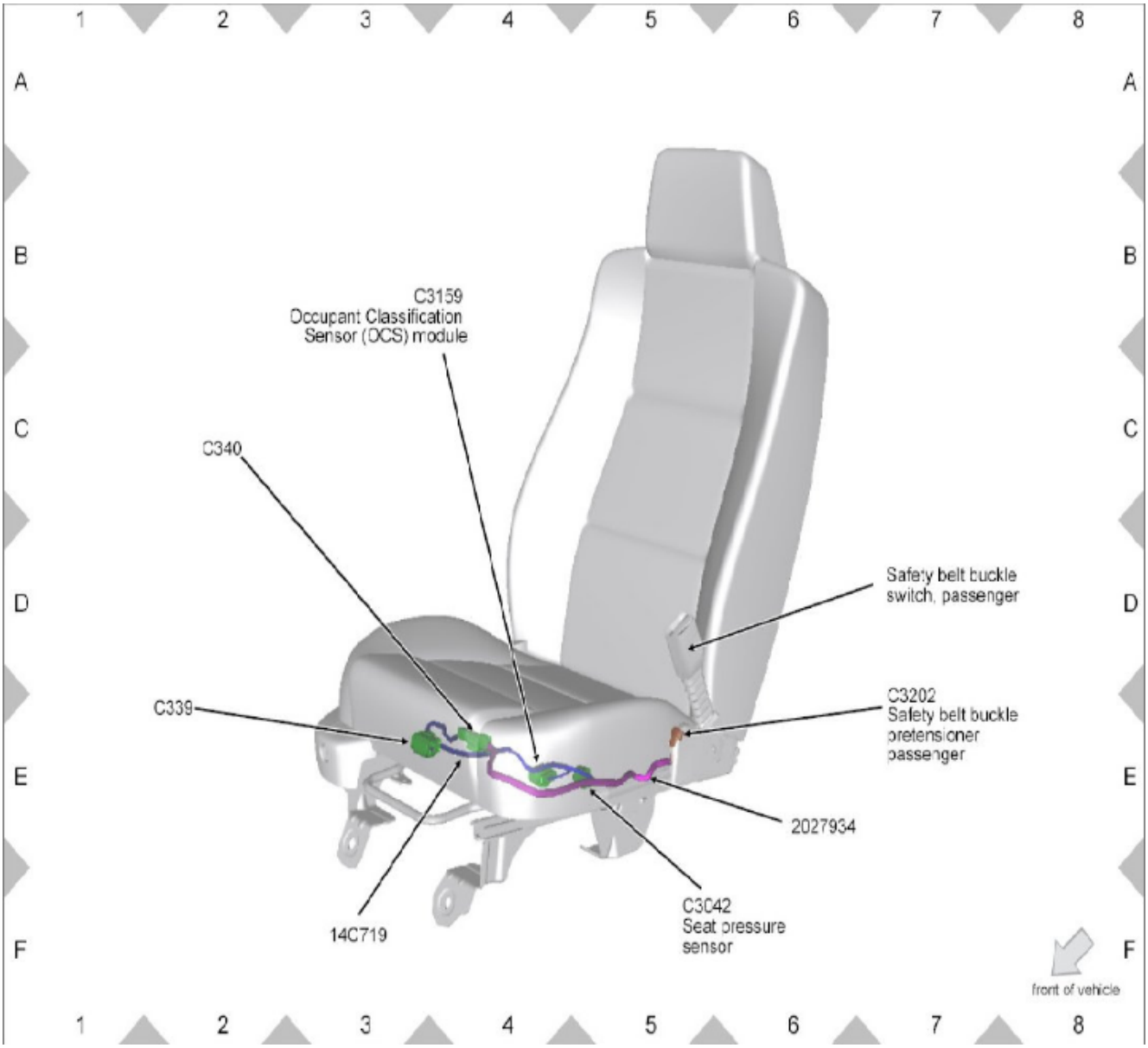
2. For SuperCab, remove the front center safety belt buckle bolt cover. 3. Remove the front center safety belt buckle bolt.

- To install, tighten to 55 Nm (41 lb-ft).

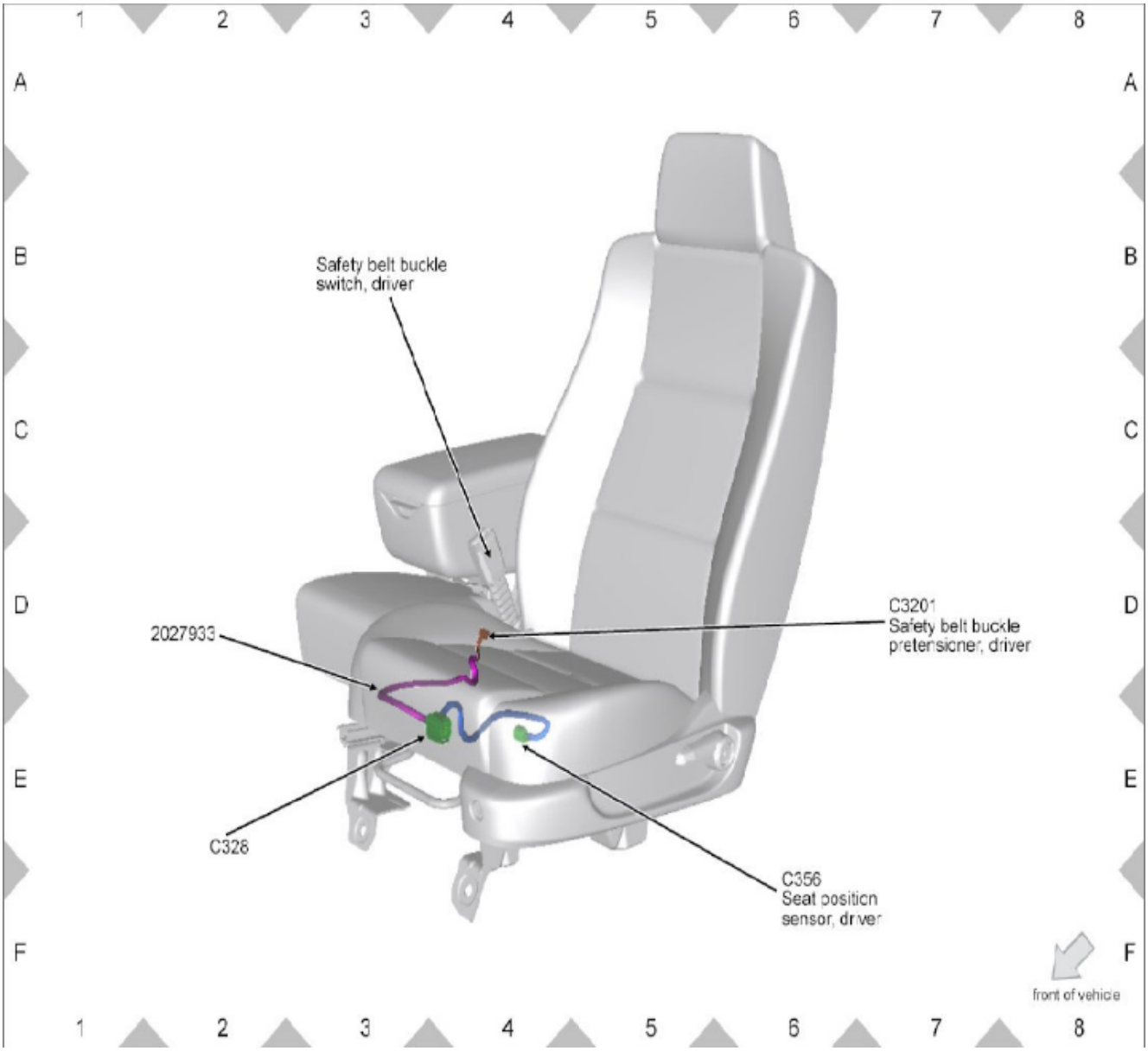
4. NOTE: The SuperCab and regular cab safety belts route differently. Note safety belt buckle position for correct installation.

Route the front center safety belt buckle through the locating strap on the side of the seat cushion and remove.

5. To install, reverse the removal procedure. 6. Check the active restraint system for correct operation.


C3159
Occupant Classification Sensor (OCS) module
C340
Safety belt buckle switch, passenger
C339
C3202
Safety belt buckle pretensioner passenger
2027934
C3042
Seat pressure sensor
14C719
front of vehicle

View 151-19

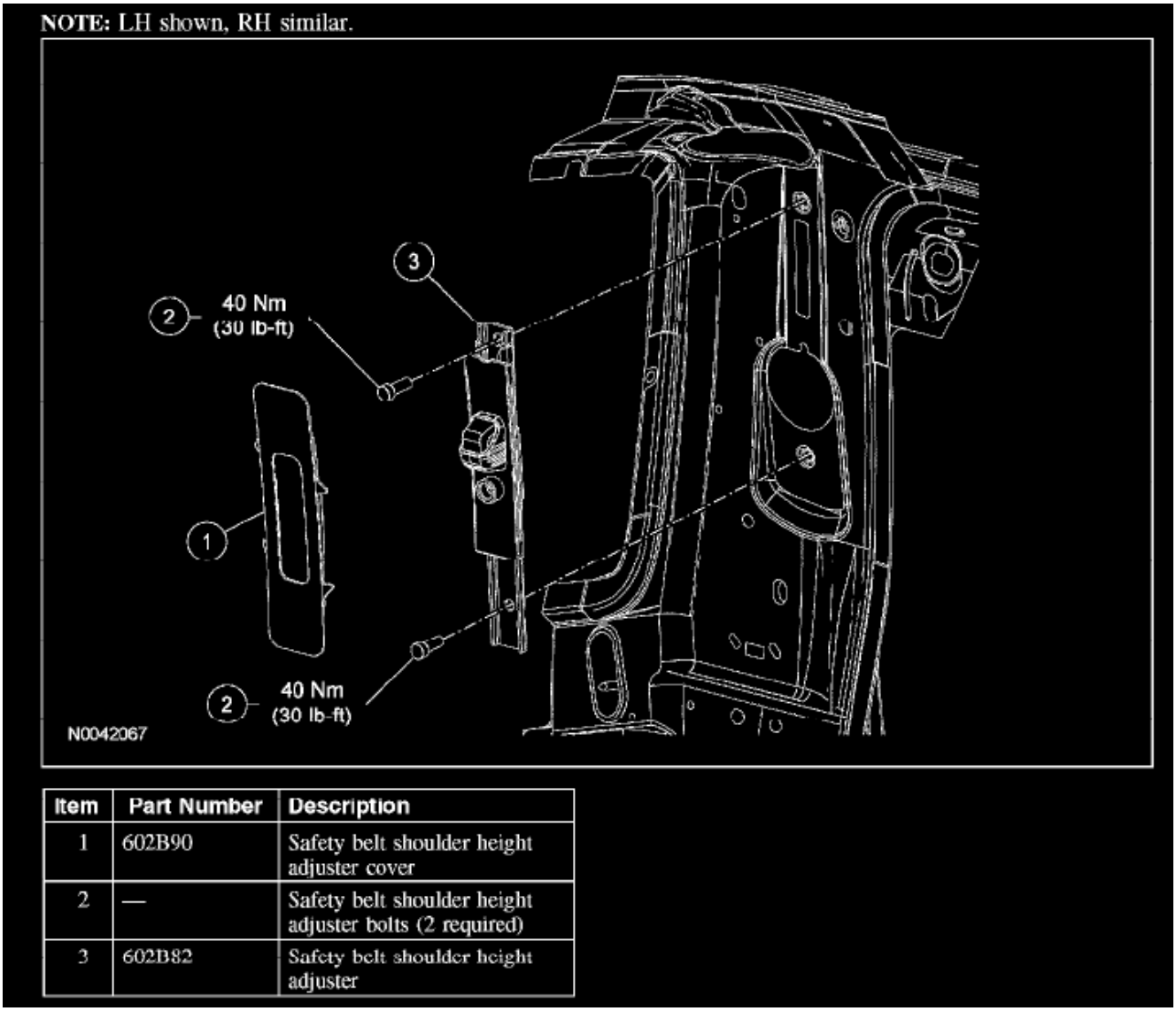

Safety belt buckle switch, driver
2027933
C3201
Safety belt buckle pretensioner, driver
C328
C356
Seat position sensor, driver
front of vehicle

View 151-18

Seat Belt Extension: Description and Operation

SAFETY BELT EXTENSION ASSEMBLY

In certain cases, the safety belt may be too short even when it is fully extended. About 20 cm (8 in) can be added to the belt length by using a safety belt extension. Safety belt extensions are available at no cost from any Ford or Mercury dealership parts department. Safety belt extensions are only available with black webbing and the extender must be from the same manufacturer as the belt system to which it is attached.



Item	Part Number	Description
1	602B90	Safety belt shoulder height adjuster cover
2	—	Safety belt shoulder height adjuster bolts (2 required)
3	602B82	Safety belt shoulder height adjuster

Seat Belt Height Adjuster: Service and Repair Safety Belt Shoulder Height Adjuster

SAFETY BELT SHOULDER HEIGHT ADJUSTER

Removal and Installation

WARNING: After any crash, all of the following safety belt assemblies and attaching hardware must be inspected by an authorized dealer to verify correct function:

- Retractors

- Buckles

- Belt tension sensor (BTS) (if equipped)

- Front safety belt buckle support assemblies (slide bar) (if equipped)

- Safety belt shoulder belt height adjusters (if equipped)

- Child safety seat tether bracket assemblies

- Automatic locking retractor (ALR) feature for child safety seats (passenger seating positions only)

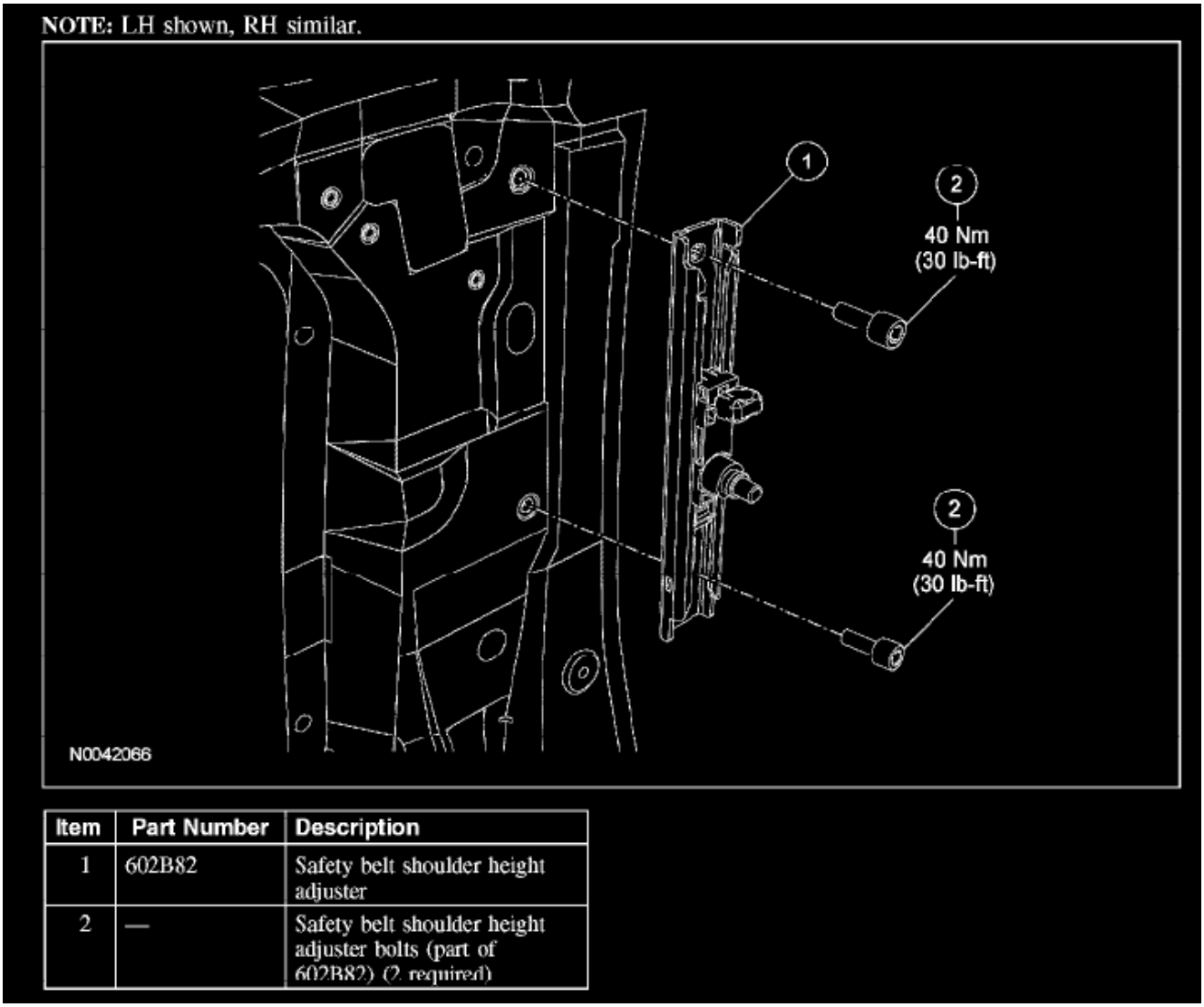
If any safety belt assembly is damaged, does not operate correctly or does not pass all of the Functional Tests in the Diagnosis and Testing portion, a new safety belt assembly must be installed. If any safety belt assembly attaching areas are damaged or distorted, the sheet metal must be restored to its original structural integrity and new safety belt assembly and attaching hardware must be installed. Failure to install new safety belt assemblies and attaching hardware may increase the risk of serious personal injury or death in a crash.

After any crash that results in deployment of the driver and/or front outboard passenger safety belt pretensioners, new driver and/or front outboard passenger safety belt systems (including retractors, buckles and height adjusters) must be installed. Failure to install new safety belt systems increases the risk of serious personal injury or death in a crash.

1. Remove the quarter trim panel. 2. Remove the safety belt shoulder height adjuster cover. 3. Remove the 2 bolts and safety belt shoulder height adjuster.

- To install, tighten to 40 Nm (30 lb-ft).

4. To install, reverse the removal procedure. 5. Check the active restraint system for correct operation.



Item	Part Number	Description
1	602B82	Safety belt shoulder height adjuster
2	—	Safety belt shoulder height adjuster bolts (part of 602B82) (2 required)

Seat Belt Height Adjuster: Service and Repair Safety Belt Shoulder Height Adjuster - 4-Door, Supercab

SAFETY BELT SHOULDER HEIGHT ADJUSTER - 4-DOOR, SUPERCAB

Removal and Installation

WARNING: After any crash, all of the following safety belt assemblies and attaching hardware must be inspected by an authorized dealer to verify correct function:

- Retractors

- Buckles

- Belt tension sensor (BTS) (if equipped)

- Front safety belt buckle support assemblies (slide bar) (if equipped)

- Safety belt shoulder belt height adjusters (if equipped)

- Child safety seat tether bracket assemblies

- Automatic locking retractor (ALR) feature for child safety seats (passenger seating positions only)

If any safety belt assembly is damaged, does not operate correctly or does not pass all of the Functional Tests in the Diagnosis and Testing portion, a new safety belt assembly must be installed. If any safety belt assembly attaching areas are damaged or distorted, the sheet metal must be restored to its original structural integrity and new safety belt assembly and attaching hardware must be installed. Failure to install new safety belt assemblies and attaching hardware may increase the risk of serious personal injury or death in a crash.

After any crash that results in deployment of the driver and/or front outboard passenger safety belt pretensioners, new driver and/or front outboard passenger safety belt systems (including retractors, buckles and height adjusters) must be installed. Failure to install new safety belt systems increases the risk of serious personal injury or death in a crash.

1. Remove the rear door trim panel. 2. Remove the 2 bolts and safety belt shoulder height adjuster.

- To install, tighten to 40 Nm (30 lb-ft).

3. To install, reverse the removal procedure. 4. Check the active restraint system for correct operation.

If...	Then...
The driver's and front passenger's safety belts are buckled before the ignition switch is turned to the ON position or less than 1-2 minutes have elapsed since the ignition switch has been turned ON...	The Belt-Minder® feature will not activate.
The driver's or front passenger's safety belt is not buckled when the vehicle has reached at least 5 km/h (3 mph) and 1-2 minutes have elapsed since the ignition switch has been turned to ON...	The Belt-Minder® feature is activated — the safety belt warning indicator illuminates and the warning chime sounds for 6 seconds every 30 seconds, repeating for approximately 5 minutes or until the safety belts are buckled.
The driver's or front passenger's safety belt becomes unbuckled for approximately one minute while the vehicle is traveling at least 5 km/h (3 mph) and more than 1-2 minutes have elapsed since the ignition switch has been turned to ON...	The Belt-Minder® feature is activated — the safety belt warning indicator illuminates and the warning chime sounds for 6 seconds every 30 seconds, repeating for approximately 5 minutes or until the safety belts are buckled.

Seat Belt Reminder Buzzer: Description and Operation

Safety Belt Warning Indicator and Chime

The safety belt warning indicator and chime remind the driver to fasten their safety belt. The following conditions will take place: -

If the driver's safety belt is not buckled before the ignition is turned to the ON position, the chime will turn on for 4-8 seconds and the indicator will illuminate for 1-2 minutes.

- If the driver's safety belt is buckled while the indicator is on and the chime is sounding, both the indicator and chime will turn off.

- If the driver's safety belt is buckled before the ignition is turned to the ON position, neither the indicator nor the chime will be active.

Belt-Minder(R)

The Belt-Minder(R) feature is a supplemental warning to the safety belt warning function. The feature provides additional reminders by intermittently sounding a chime and illuminating the safety belt warning indicator in the instrument cluster when the driver's and front passenger's safety belt is unbuckled.

The Belt-Minder(R) feature uses information from the front passenger sensing system to determine if a front seat passenger is present and therefore potentially in need of a warning. To avoid activating the Belt-Minder(R) feature for objects placed in the front passenger seat, warnings will only be given to large front seat occupants as determined by the front passenger sensing system.

Both the driver's and passenger's safety belt usages are monitored and either may activate the Belt-Minder(R) feature. The warnings are the same for the driver and front passenger. If the Belt-Minder(R) warnings have expired (warnings for approximately 5 minutes) for one occupant (driver or front passenger), the other occupant can still activate the Belt-Minder(R) feature.

The Belt-Minder(R) feature uses information from the OCS system on the front passenger seat to determine if a front seat passenger is present and therefore potentially in need of a warning. The warning is activated if the OCS system senses weight exceeding a programmed set point.

The driver and front passenger Belt-Minder(R) feature is deactivated/activated independently. When deactivating/activating the Belt-Minder(R) for a seat, do not buckle the safety belts on the other seat, or the process will be terminated. To deactivate/activate the Belt-Minder(R) feature, refer to Instrument Panel, Gauges and Warning Indicators or the Owner's Literature.

If...	Then...
The driver's and front passenger's safety belts are buckled before the ignition switch is turned to the ON position or less than 1-2 minutes have elapsed since the ignition switch has been turned ON...	The Belt-Minder® feature will not activate.
The driver's or front passenger's safety belt is not buckled when the vehicle has reached at least 5 km/h (3 mph) and 1-2 minutes have elapsed since the ignition switch has been turned to ON...	The Belt-Minder® feature is activated — the safety belt warning indicator illuminates and the warning chime sounds for 6 seconds every 30 seconds, repeating for approximately 5 minutes or until the safety belts are buckled.
The driver's or front passenger's safety belt becomes unbuckled for approximately one minute while the vehicle is traveling at least 5 km/h (3 mph) and more than 1-2 minutes have elapsed since the ignition switch has been turned to ON...	The Belt-Minder® feature is activated — the safety belt warning indicator illuminates and the warning chime sounds for 6 seconds every 30 seconds, repeating for approximately 5 minutes or until the safety belts are buckled.

Seat Belt Reminder Lamp: Description and Operation

Safety Belt Warning Indicator and Chime

The safety belt warning indicator and chime remind the driver to fasten their safety belt. The following conditions will take place: -

If the driver's safety belt is not buckled before the ignition is turned to the ON position, the chime will turn on for 4-8 seconds and the indicator will illuminate for 1-2 minutes.

- If the driver's safety belt is buckled while the indicator is on and the chime is sounding, both the indicator and chime will turn off.

- If the driver's safety belt is buckled before the ignition is turned to the ON position, neither the indicator nor the chime will be active.

Belt-Minder(R)

The Belt-Minder(R) feature is a supplemental warning to the safety belt warning function. The feature provides additional reminders by intermittently sounding a chime and illuminating the safety belt warning indicator in the instrument cluster when the driver's and front passenger's safety belt is unbuckled.

The Belt-Minder(R) feature uses information from the front passenger sensing system to determine if a front seat passenger is present and therefore potentially in need of a warning. To avoid activating the Belt-Minder(R) feature for objects placed in the front passenger seat, warnings will only be given to large front seat occupants as determined by the front passenger sensing system.

Both the driver's and passenger's safety belt usages are monitored and either may activate the Belt-Minder(R) feature. The warnings are the same for the driver and front passenger. If the Belt-Minder(R) warnings have expired (warnings for approximately 5 minutes) for one occupant (driver or front passenger), the other occupant can still activate the Belt-Minder(R) feature.

The Belt-Minder(R) feature uses information from the OCS system on the front passenger seat to determine if a front seat passenger is present and therefore potentially in need of a warning. The warning is activated if the OCS system senses weight exceeding a programmed set point.

The driver and front passenger Belt-Minder(R) feature is deactivated/activated independently. When deactivating/activating the Belt-Minder(R) for a seat, do not buckle the safety belts on the other seat, or the process will be terminated. To deactivate/activate the Belt-Minder(R) feature, refer to Instrument Panel, Gauges and Warning Indicators or the Owner's Literature.

Seat Belt Retractor: Description and Operation

Dual Locking Mode Retractors

WARNING: After any crash, all of the following safety belt assemblies and attaching hardware must be inspected by an authorized dealer to verify correct function: -

Retractors

- Buckles

- Belt tension sensor (BTS) (if equipped)

- Front safety belt buckle support assemblies (slide bar) (if equipped)

- Safety belt shoulder belt height adjusters (if equipped)

- Child safety seat tether bracket assemblies

- Automatic locking retractor (ALR) feature for child safety seats (passenger seating positions only)

If any safety belt assembly is damaged, does not operate correctly or does not pass all of the Functional Tests in the Diagnosis and Testing portion, a new safety belt assembly must be installed. If any safety belt assembly attaching areas are damaged or distorted, the sheet metal must be restored to its original structural integrity and new safety belt assembly and attaching hardware must be installed. Failure to install new safety belt assemblies and attaching hardware may increase the risk of serious personal injury or death in a crash.

After any crash that results in deployment of the driver and/or front outboard passenger safety belt pretensioners, new driver and/or front outboard passenger safety belt systems (including retractors, buckles and height adjusters) must be installed. Failure to install new safety belt systems increases the risk of serious personal injury or death in a crash.

NOTE: When installing a new dual locking mode retractor, the retractor should be checked to make sure it is not in the automatic locking retractor (ALR) mode after installation in the STOWED position.

All outboard continuous-loop, 3-point retractor systems, except the driver position, are equipped with the dual locking mode system.

The emergency locking retractor (ELR) mode will allow the occupant freedom of movement, locking only on hard braking, hard cornering or an impact of approximately 8 km/h (5 mph). The ELR mode helps to reduce the forward movement of the driver and passengers. The ELR mode is continuously in operation at all seating positions.

The ALR portion of this system does not allow the occupant freedom of movement. The ALR mode is used when locking a child seat in an outboard seating position or when a tight belt fit is desired. The ALR mode is automatically engaged when the webbing is fully extracted from the retractor and then allowed to retract. As the webbing is retracted back onto the spool, an audible clicking sound is made indicating the retractor is in ALR mode and the webbing will not pull back out of the retractor. To disengage the ALR mode, let the webbing retract back onto the spool. The ALR mode is disengaged when the webbing is free to move out and back into the retractor.

The automatic locking mode must be used when installing a child safety seat in the front or rear passenger seating positions where dual locking mode retractors are provided.

Four-door, Supercab

The outboard safety belt for the front seat is a continuous-loop 3-point system. The combination lap and shoulder (continuous-loop) uses a common sliding tongue and retractor. The front seat safety

belt retractor and the front seat shoulder safety belt height adjuster are both located in the rear door.

The rear seat has a safety belt bolted to the rear seat frame. The rear safety belt buckle is located in the rear door.

The shoulder harness retractor is designed to let the webbing move freely in or out at all times, except during vehicle hard braking, hard cornering or an impact of 8 km/h (5 mph) or more, when it is automatically locked by a mechanically actuated inertia sensor.

The front safety belt retractors can also lock by jerking on the belt.

Energy Management Retractor

This vehicle has a safety belt system with an energy management feature at the front seating positions to help further reduce the risk of injury in the event of a head-on collision.

This safety belt system has a retractor assembly that is designed to pay out webbing in a controlled manner. This feature is designed to help reduce the belt force acting on an occupant's chest.

Seat Belt Retractor: Testing and Inspection

FUNCTIONAL TEST - RETRACTOR

The safety belt retractor assembly must be freely operational for extraction and retraction of the safety belt webbing between full extension and in-vehicle stowed positions.

1. Extract and retract the safety belt between the full extension and stowed positions. 2. Verify the retractor operates without excessive effort or binding. 3. Install a new safety belt retractor and buckle if no obvious concerns are noticed and the complaint has been verified.

Functional Test - Automatic Locking Retractor

WARNING: After any crash, all of the following safety belt assemblies and attaching hardware must be inspected by an authorized dealer to verify correct function: -

Retractors

- Buckles

- Belt tension sensor (BTS) (if equipped)

- Front safety belt buckle support assemblies (slide bar) (if equipped)

- Safety belt shoulder belt height adjusters (if equipped)

- Child safety seat tether bracket assembly

- Automatic locking retractor (ALR) feature for child safety seats (passenger seating positions only)

If any safety belt assembly is damaged, does not operate correctly or does not pass all of the Functional Tests in the Diagnosis and Testing portion, a new safety belt assembly must be installed. If any safety belt assembly attaching areas are damaged or distorted, the sheet metal must be restored to its original structural integrity and new safety belt assembly and attaching hardware must be installed. Failure to install new safety belt assemblies and attaching hardware may increase the risk of serious personal injury or death in a crash.

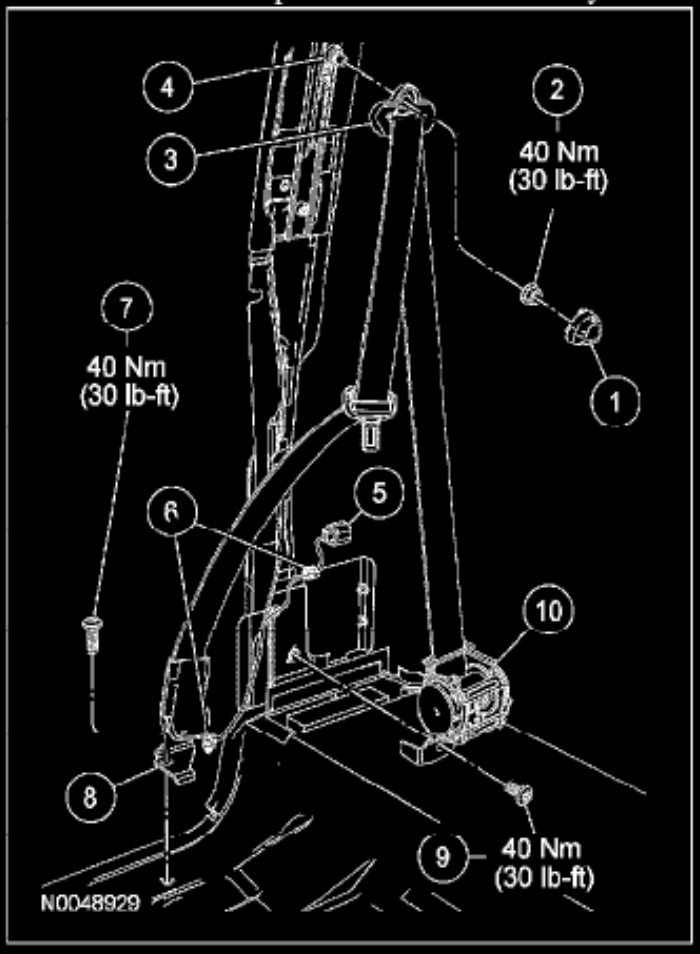
After any crash that results in deployment of the driver and/or front outboard passenger safety belt pretensioners, new driver and/or front outboard passenger safety belt systems (including retractors, buckles and height adjusters) must be installed. Failure to install new safety belt systems increases the risk of serious personal injury or death in a crash.

1. Position the seat back into the full up position. 2. Position the height adjuster (if equipped) in the full down or up position. 3. Latch the seat belt buckle and tongue assembly. 4. Pull the shoulder belt out until the automatic locking retractor (ALR) feature is activated. 5. Release the shoulder belt and allow it to retract until it stops. 6. Pull on the shoulder belt to check that the belt has remained in the ALR mode. If the belt is not locked, install a new safety belt assembly. 7. Unlatch the safety belt tongue from the buckle and allow the safety belt to retract to its stowed position. 8. Pull the shoulder belt to verify the retractor assembly has converted automatically out of the ALR mode. If the shoulder belt remains locked in the

stowed position, install a new safety belt retractor assembly.

NOTE: Passenger side shown, driver side similar.

NOTE: Interior trim panel removed for clarity.



Item	Part Number	Description
1	602B90	D-ring nut cover
2	N806773	D-ring nut
3	—	D-ring (part of 611B08)
4	602B82	Safety belt height adjuster
5	—	Electrical connector (part of 611B08)
6	—	Pin-type retainers
7	—	Safety belt retractor anchor bolt (part of 611B08)
8	—	Safety belt retractor anchor (part of 611B08)
9	—	Safety belt retractor bolt (part of 611B08)
10	611B08	Safety belt retractor

Seat Belt Retractor: Service and Repair Safety Belt Retractor - Front

SAFETY BELT RETRACTOR - FRONT

Removal and Installation

WARNING: After any crash, all of the following safety belt assemblies and attaching hardware must be inspected by an authorized dealer to verify correct function:

- Retractors

- Buckles

- Belt tension sensor (BTS) (if equipped)

- Front safety belt buckle support assemblies (slide bar) (if equipped)

- Safety belt shoulder belt height adjusters (if equipped)

- Child safety seat tether bracket assemblies

- Automatic locking retractor (ALR) feature for child safety seats (passenger seating positions only)

If any safety belt assembly is damaged, does not operate correctly or does not pass all of the Functional Tests in the Diagnosis and Testing portion, a new safety belt assembly must be installed. If any safety belt assembly attaching areas are damaged or distorted, the sheet metal must be restored to its original structural integrity and new safety belt assembly and attaching hardware must be installed. Failure to install new safety belt assemblies and attaching hardware may increase the risk of serious personal injury or death in a crash.

After any crash that results in deployment of the driver and/or front outboard passenger safety belt pretensioners, new driver and/or front outboard passenger safety belt systems (including retractors, buckles and height adjusters) must be installed. Failure to install new safety belt systems increases the risk of serious personal injury or death in a crash.

NOTE:

- The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

- The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

- Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and carry out the diagnostic procedure again.

All safety belt retractors

1. NOTE: If the D-ring cover is damaged or does not remain attached, install a new D-ring cover.

Remove the D-ring cover.

2. Remove the nut and D-ring.

- To install, tighten to 40 Nm (30 lb-ft).

3. Remove the cover and bolt and position aside the safety belt anchor.

- To install, tighten to 40 Nm (30 lb-ft).

Passenger safety belt retractor

4. Depower the SRS.

5. NOTE: Note safety belt routing for installation.

Remove the quarter trim panel and disconnect the belt tension sensor electrical connector. -

Release the wiring harness pin-type retainers.

- Route out the safety belt webbing.

All safety belt retractors

6. Remove the quarter trim panel. 7. Remove the bolt and safety belt retractor.

- To install tighten to, 40 Nm (30 lb-ft).

8. To install, reverse the removal procedure.

Passenger safety belt retractor

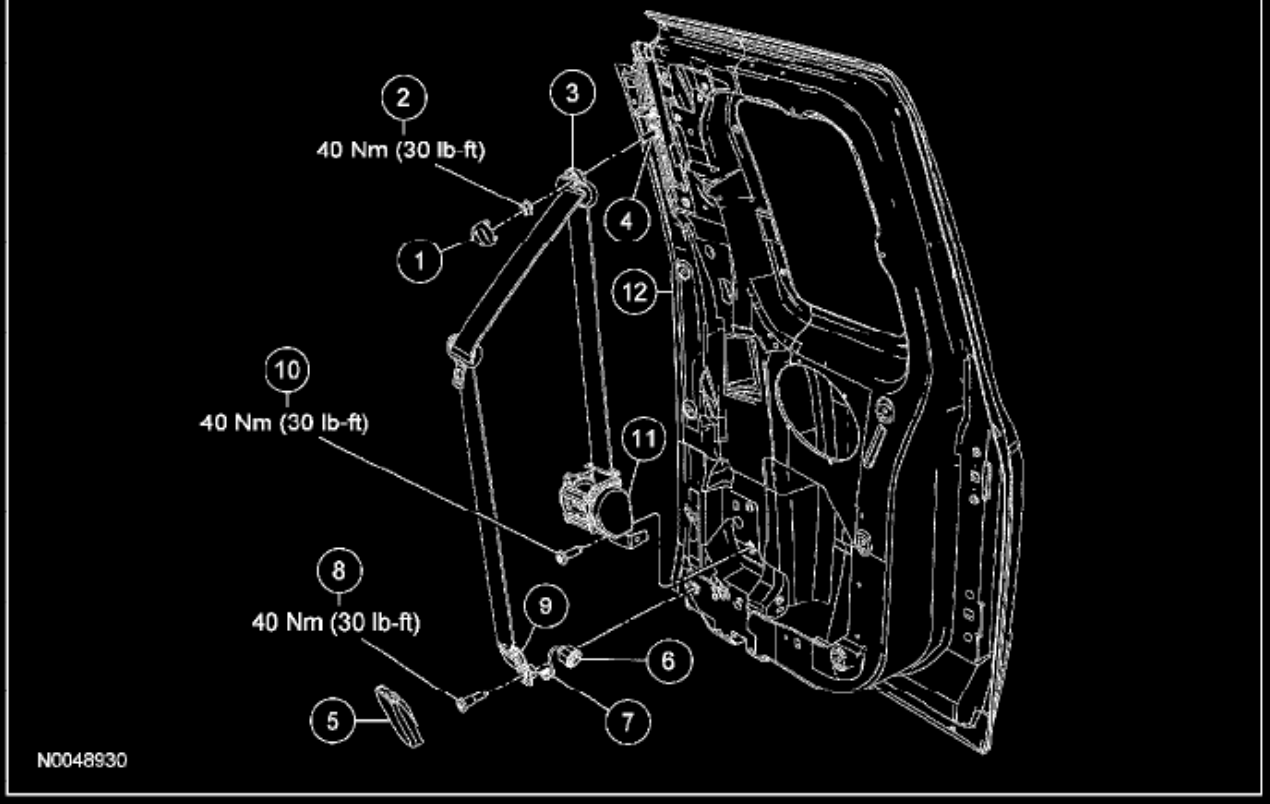
9. Repower the SRS.

All safety belt retractors

10. Check the active restraint system for correct operation.

NOTE: Passenger side shown, driver side similar.

NOTE: Rear door interior trim panel removed for clarity.



Item	Part Number	Description
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3	—	D-ring (part of 611B08)
4	602B82	Safety belt height adjuster
5	—	Safety belt retractor anchor bolt cover (part of 611B08)
6	—	Electrical connector (part of 611B08)
7	—	Pin-type retainer
8	—	Safety belt retractor anchor bolt (part of 611B08)
9	—	Safety belt retractor anchor (part of 611B08)
10	—	Safety belt retractor bolt (part of 611B08)
11	611B08	Safety belt retractor
12	—	Rear passenger door

Seat Belt Retractor: Service and Repair Safety Belt Retractor - Front, 4-Door, Supercab

SAFETY BELT RETRACTOR - FRONT, 4-DOOR, SUPERCAB

Removal and Installation

WARNING: After any crash, all of the following safety belt assemblies and attaching hardware must be inspected by an authorized dealer to verify correct function:

- Retractors

- Buckles

- Belt tension sensor (BTS) (if equipped)

- Front safety belt buckle support assemblies (slide bar) (if equipped)

- Safety belt shoulder belt height adjusters (if equipped)

- Child safety seat tether bracket assemblies

- Automatic locking retractor (ALR) feature for child safety seats (passenger seating positions only)

If any safety belt assembly is damaged, does not operate correctly or does not pass all of the Functional Tests in the Diagnosis and Testing portion, a new safety belt assembly must be installed. If any safety belt assembly attaching areas are damaged or distorted, the sheet metal must be restored to its original structural integrity and new safety belt assembly and attaching hardware must be installed. Failure to install new safety belt assemblies and attaching hardware may increase the risk of serious personal injury or death in a crash.

After any crash that results in deployment of the driver and/or front outboard passenger safety belt pretensioners, new driver and/or front outboard passenger safety belt systems (including retractors, buckles and height adjusters) must be installed. Failure to install new safety belt systems increases the risk of serious personal injury or death in a crash.

NOTE:

- The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

- The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

- Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and carry out the diagnostic procedure again.

All safety belt retractors

1. NOTE: If the D-ring cover is damaged or does not remain attached, install a new D-ring cover.

Remove the D-ring cover.

2. Remove the nut and D-ring.

- To install, tighten to 40 Nm (30 lb-ft).

3. Remove the cover and bolt and position aside the safety belt anchor.

- To install, tighten to 40 Nm (30 lb-ft).

Passenger safety belt retractor

4. Depower the SRS.

5. NOTE: Note safety belt routing for installation.

Remove the rear door trim panel and disconnect the belt tension sensor electrical connector. -

Release the wiring harness pin-type retainer.

- Route out the safety belt webbing.

All safety belt retractors

6. Remove the rear door trim panel. 7. Remove the bolt and safety belt retractor.

- To install, tighten to 40 Nm (30 lb-ft).

8. To install, reverse the removal procedure.

Passenger safety belt retractor

9. Repower the SRS.

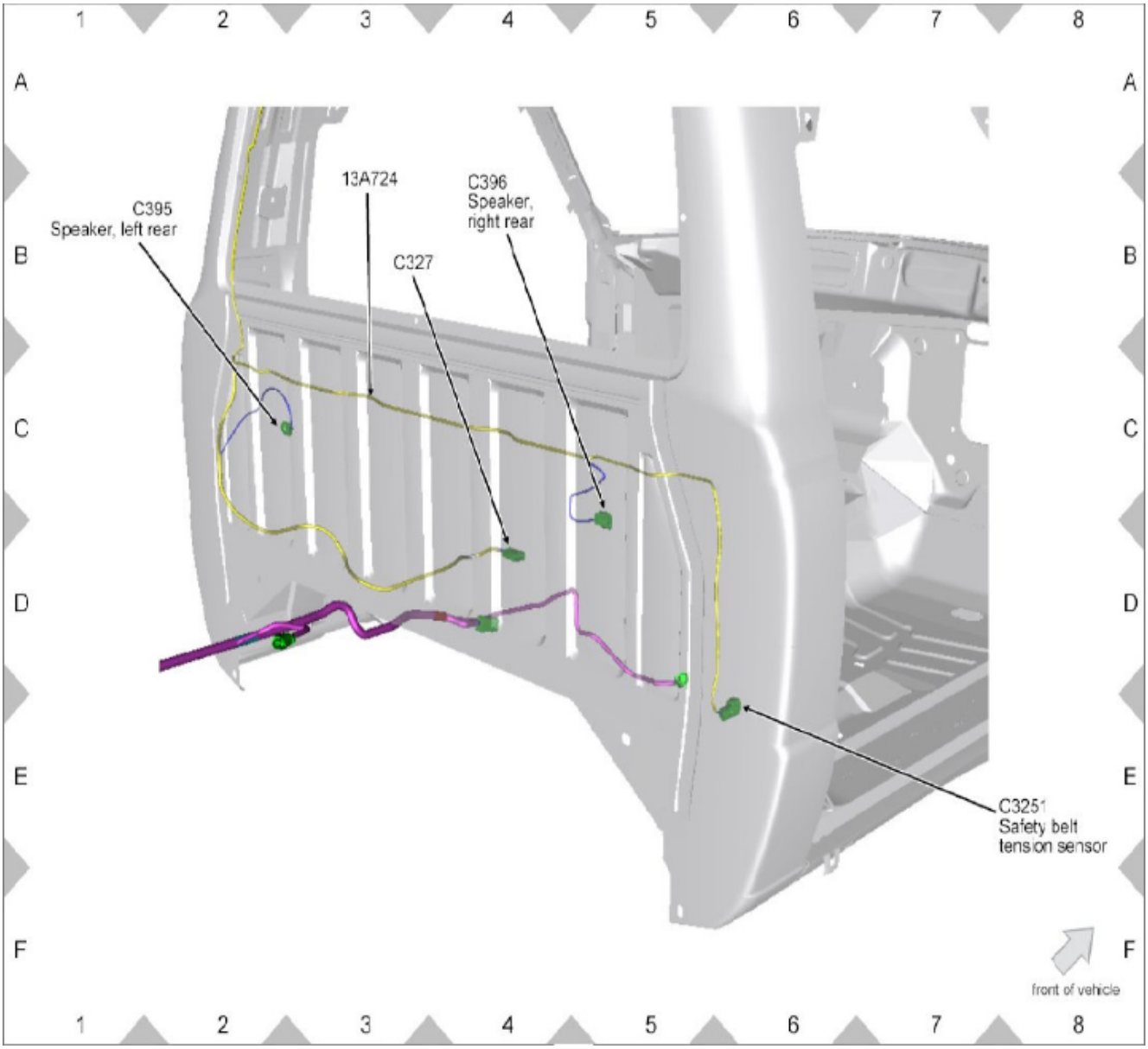
All safety belt retractors

10. Check the active restraint system for correct operation.

Seat Belt Tension Sensor: Description and Operation

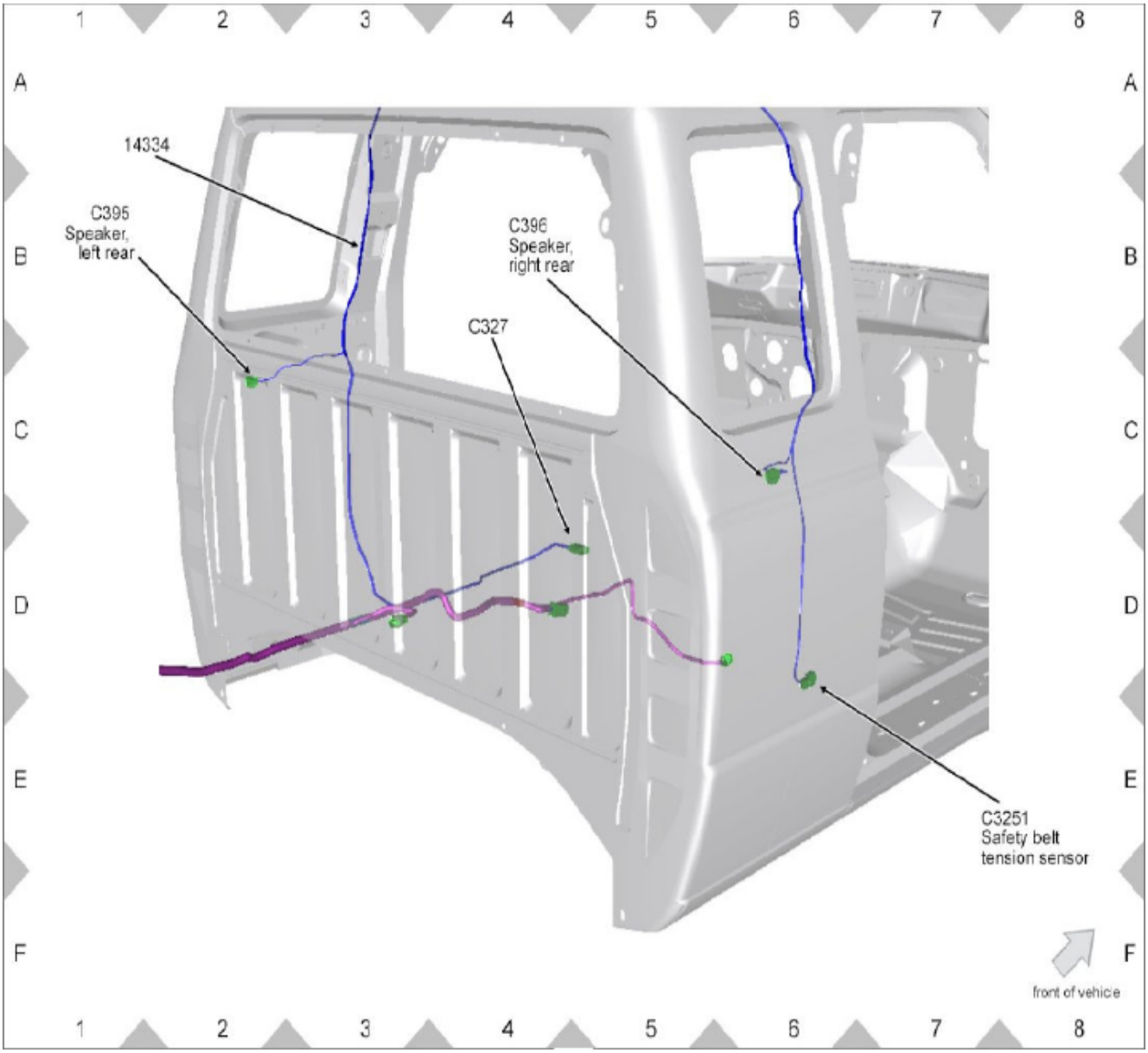
BELT TENSION SENSOR (BTS)

The safety belt tension sensor (BTS) is part of the passenger front safety belt and retractor assembly and is not serviced separately. The safety BTS is located at the safety belt anchor point and is used in conjunction with the occupant classification sensor (OCS) system. For information on diagnosing the BTS and OCS or servicing the OCS system, refer to the appropriate procedure in Air Bag Systems.

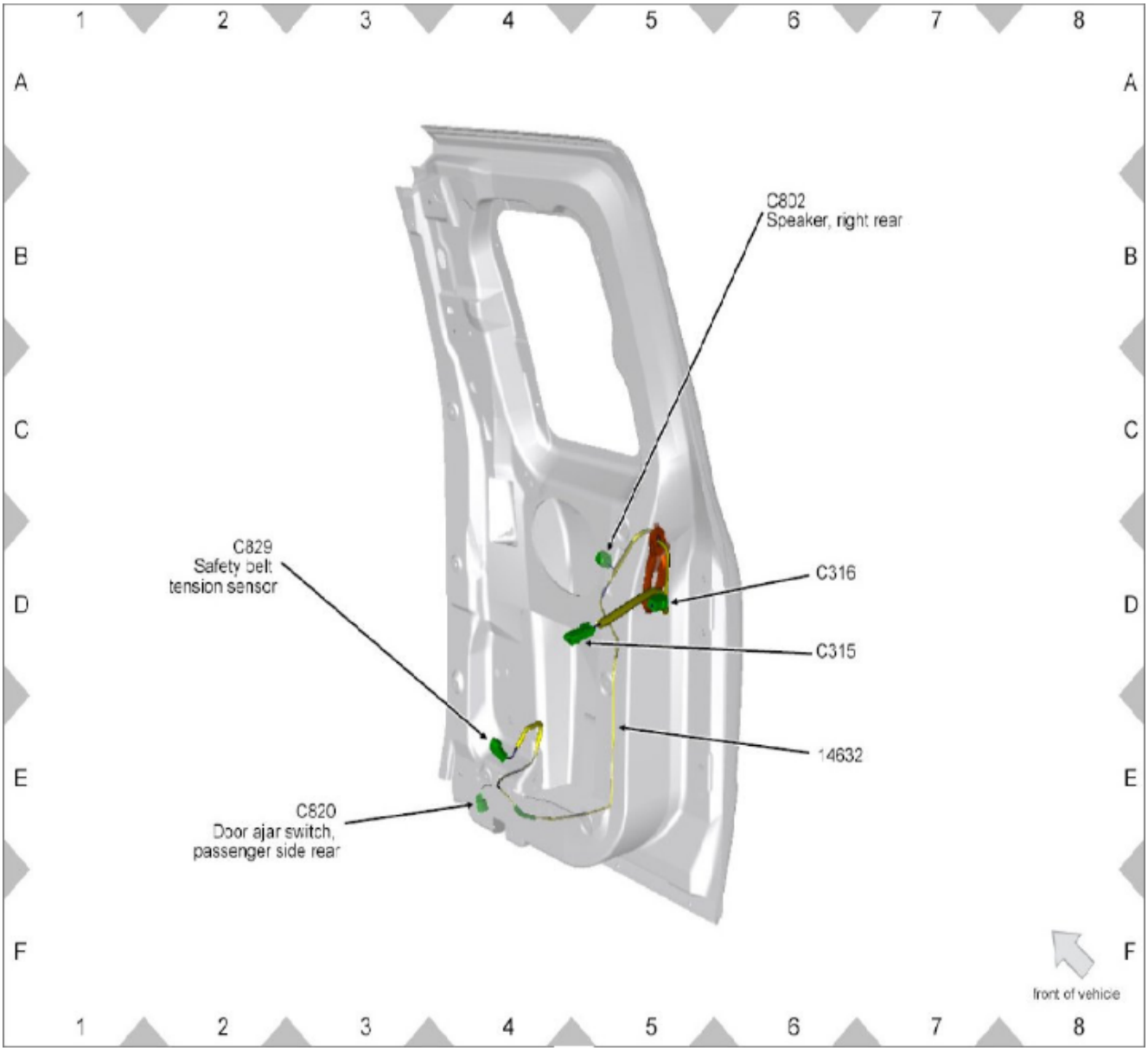


Seat Belt Tensioner: Locations

View 151-15


14334
C395
Speaker,
left rear
C396
Speaker,
right rear
C327
C3251
Safety belt
tension sensor
front of vehicle

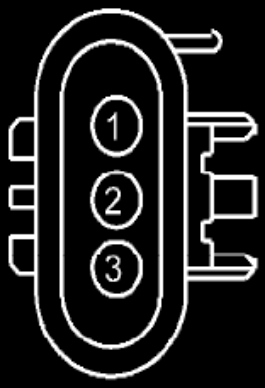
View 151-16


C802
Speaker, right rear
C829
Safety belt tension sensor
C316
C315
14632
C820
Door ajar switch, passenger side rear
front of vehicle

View 151-23

Connector: C829

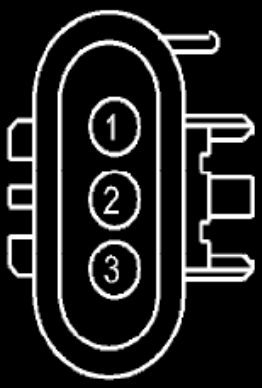
Description:	Harness:	Base Part #:
SAFETY BELT TENSION SENSOR	14632	



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	LR142 (YE-BU)	18	CTRL MOD. - SENSOR SEAT BELT TENSION FRONT PASSENGER OUTBOARD	
2	RR142 (GN)	18	CTRL MOD. - SENSOR SEAT BELT TENSION FRONT PASSENGER OUTBOARD	
3	VR210 (BU-BN)	18	SENSOR - SEAT BELT TENSION FRONT PASSENGER OUTBOARD	

Connector: C3251

Description:	Harness:	Base Part #:
SAFETY BELT TENSION SENSOR	13A724/14334	

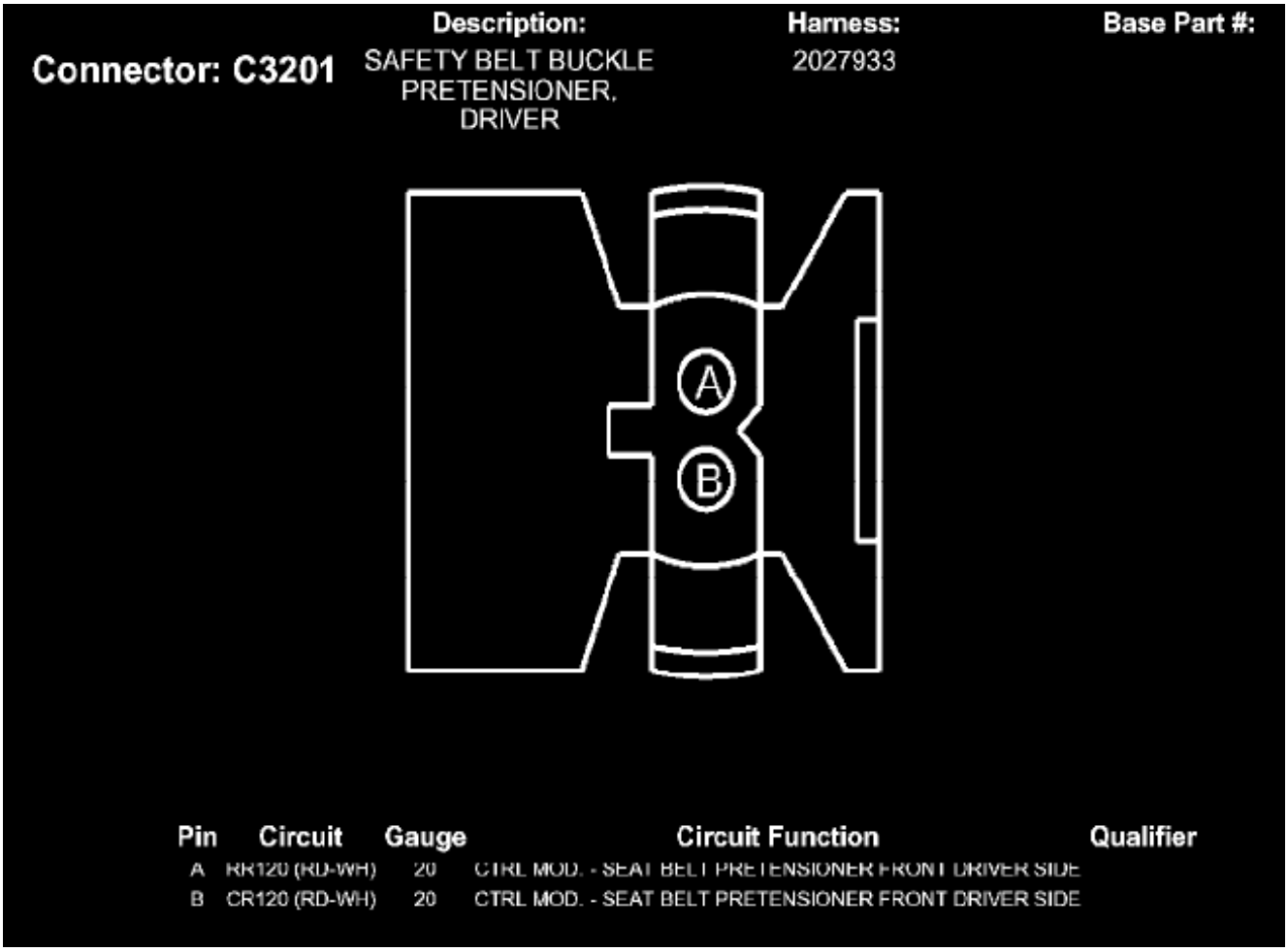


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	LR142 (YE-BU)	20	CTRL MOD. - SENSOR SEAT BELT TENSION FRONT PASSENGER OUTBOARD	
2	RR142 (GN)	20	CTRL MOD. - SENSOR SEAT BELT TENSION FRONT PASSENGER OUTBOARD	
3	VR210 (BU-BN)	20	SENSOR - SEAT BELT TENSION FRONT PASSENGER OUTBOARD	

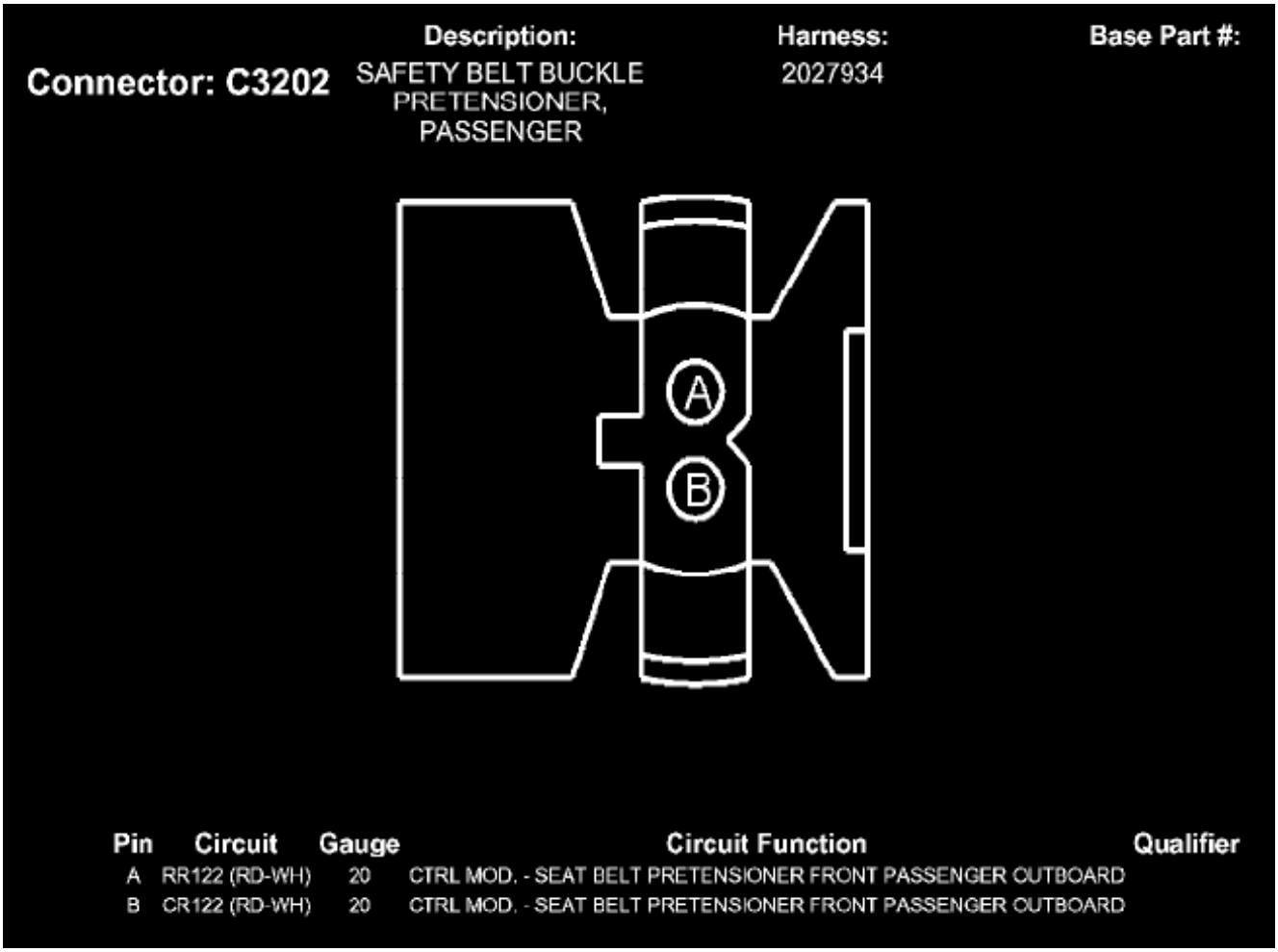
Seat Belt Tensioner: Diagrams Safety Belt Tension Sensor

C829

C3251


Description:
Harness:
Base Part #:
Connector: C3201
SAFETY BELT BUCKLE PRETENSIONER, DRIVER
2027933
A
B
Pin
Circuit
Gauge
Circuit Function
Qualifier
A RR120 (RD-WH) 20 CTRL MOD. - SEAT BELT PRETENSIONER FRONT DRIVER SIDE
B CR120 (RD-WH) 20 CTRL MOD. - SEAT BELT PRETENSIONER FRONT DRIVER SIDE

C3201


Connector: C3202
Description:
SAFETY BELT BUCKLE PRETENSIONER, PASSENGER
Harness:
2027934
Base Part #:
A
B
Pin Circuit Gauge Circuit Function Qualifier
A RR122 (RD-WH) 20 CTRL MOD. - SEAT BELT PRETENSIONER FRONT PASSENGER OUTBOARD
B CR122 (RD-WH) 20 CTRL MOD. - SEAT BELT PRETENSIONER FRONT PASSENGER OUTBOARD

C3202

Seat Belt Tensioner: Description and Operation

SAFETY BELT BUCKLE AND PRETENSIONER

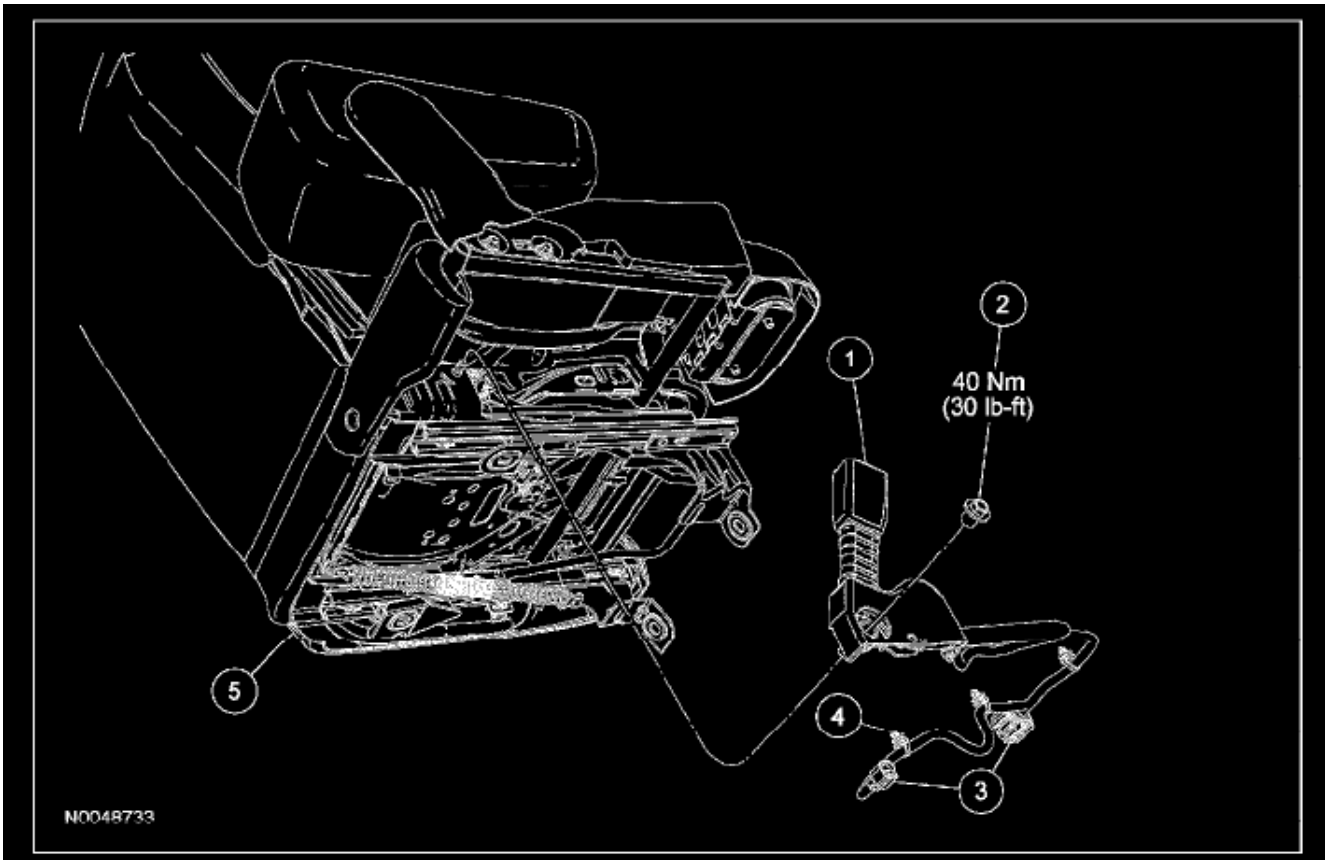
The driver and front outboard passenger safety belt buckle and pretensioner are secured to the front seat assembly on the seat track. This allows the front safety belt buckle end to move with the front seat. The belt and buckle assembly pretensioner is a pyrotechnic device that removes excess webbing from the safety belt system.

The belt and buckle assembly pretensioner uses the same crash sensor system as the air bag supplemental restraint system (SRS). When the belt and buckle assembly pretensioner deploys, the buckle moves downward, pulling excess webbing from the lap and shoulder safety belts.

If the safety belt buckle and pretensioner assembly is deployed, a new assembly must be installed.

For safety belt buckle pretensioner diagnostic information, refer to Air Bag Systems.

For safety belt buckle pretensioner disposal information, refer to Air Bag Systems.



Item	Part Number	Description
1	61203	Safety belt buckle and pretensioner
2	000A25	Safety belt buckle and pretensioner nut
3	—	Electrical connectors (part of 61203)
4	—	Pin-type retainer (3 required)
5	—	Driver seat

Seat Belt Tensioner: Service and Repair Safety Belt Buckle and Pretensioner - 60 Percent

SAFETY BELT BUCKLE AND PRETENSIONER - 60 PERCENT

Removal and Installation

WARNING:

- Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.

- After any crash, all of the following safety belt assemblies and attaching hardware must be inspected by an authorized dealer to verify correct function: -

Retractors

- Buckles

- Belt tension sensor (BTS) (if equipped)

- Front safety belt buckle support assemblies (slide bar) (if equipped)

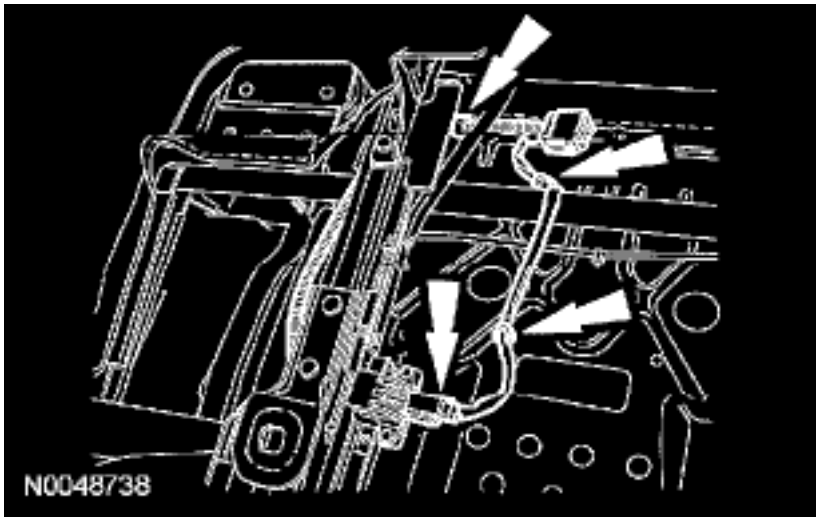
- Safety belt shoulder belt height adjusters (if equipped)

- Child safety seat tether bracket assemblies

- Automatic locking retractor (ALR) feature for child safety seats (passenger seating positions only)

If any safety belt assembly is damaged, does not operate correctly or does not pass all of the Functional Tests in the Diagnosis and Testing portion, a new safety belt assembly must be installed. If any safety belt assembly attaching areas are damaged or distorted, the sheet metal must be restored to its original structural integrity and new safety belt assembly and attaching hardware must be installed. Failure to install new safety belt assemblies and attaching hardware may increase the risk of serious personal injury or death in a crash.

After any crash that results in deployment of the driver and/or front outboard passenger safety belt pretensioners, new driver and/or front outboard passenger safety belt systems (including retractors, buckles and height adjusters) must be installed. Failure to install new safety belt systems increases the risk of serious personal injury or death in a crash.



- Never probe the electrical connectors on safety belt buckle/retractor pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors, which increases the risk of serious personal injury or death.

CAUTION: It is necessary to carry out the occupant classification sensor (OCS) system reset when a front passenger seat cushion is disassembled, a new trim cover is installed or an OCS system service kit is installed. A scan tool is used to carry out the OCS system reset command. Failure to follow this instruction may result in system failure and the incorrect operation of the OCS system.

NOTE:

- The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

- The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

- Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and carry out the diagnostic procedure again.

1. Depower the SRS. 2. Remove the 60 percent bench seat.

3. NOTE: Note the routing of the seat wiring harness for installation.

Detach the wiring harness from the cushion. -

Disconnect the SRS seat position sensor electrical connector.

- Detach the wiring harness and electrical connector pin-type retainers.

- Route out the wiring harness.

4. Remove the nut and safety belt buckle pretensioner.

- To install, tighten to 40 Nm (30 lb-ft).

5. To install, reverse the removal procedure. 6. Install the 60 percent bench seat.

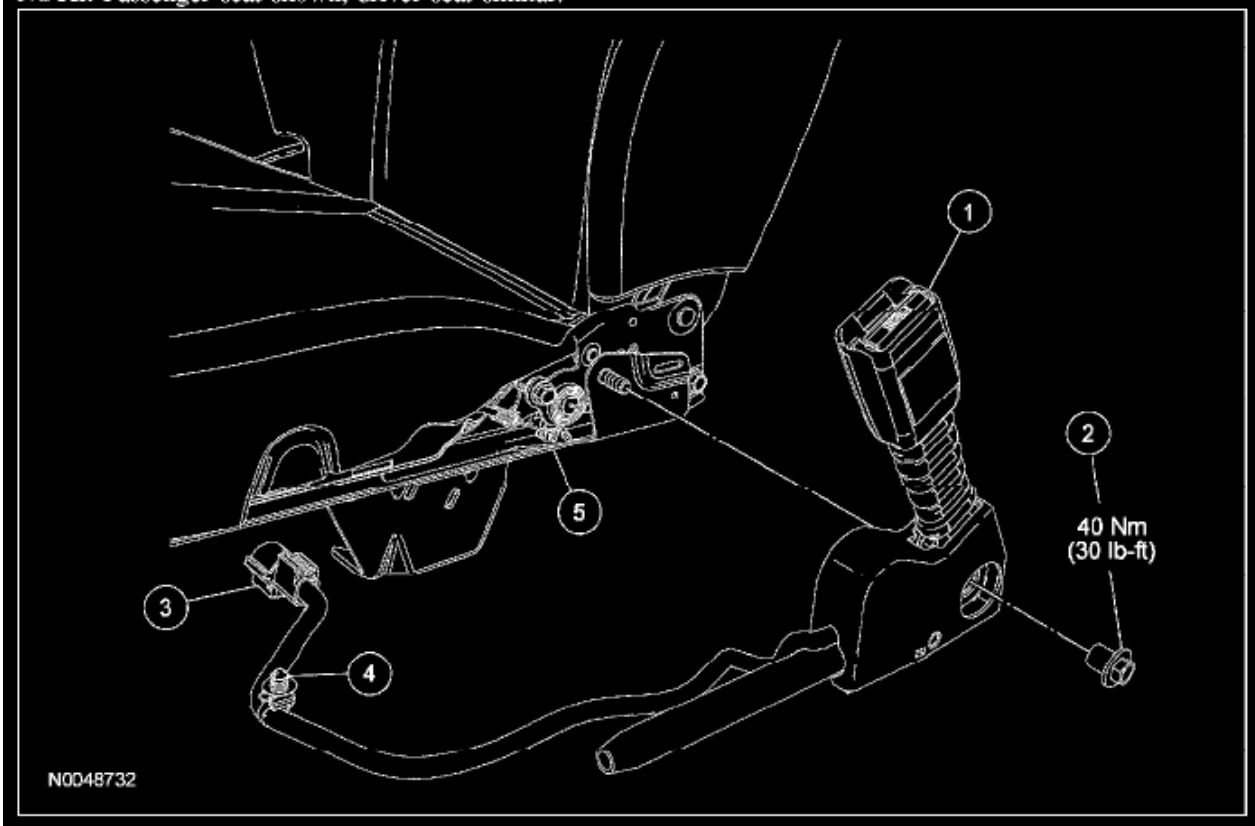
- Make sure the safety belts and buckles are accessible to the occupants after installation.

7. Repower the SRS. 8. Check the active restraint system for correct operation.

Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

NOTE: Passenger seat shown, driver seat similar.



Item	Part Number	Description
1	61202	Safety belt buckle and pretensioner
2	000A25	Safety belt buckle and pretensioner nut
3	—	Electrical connector (part of 61202)
4	—	Pin-type retainer
5	—	Front passenger seat

Seat Belt Tensioner: Service and Repair Safety Belt Buckle and Pretensioner - 40 Percent

SAFETY BELT BUCKLE AND PRETENSIONER - 40 PERCENT

Special Tool(s)

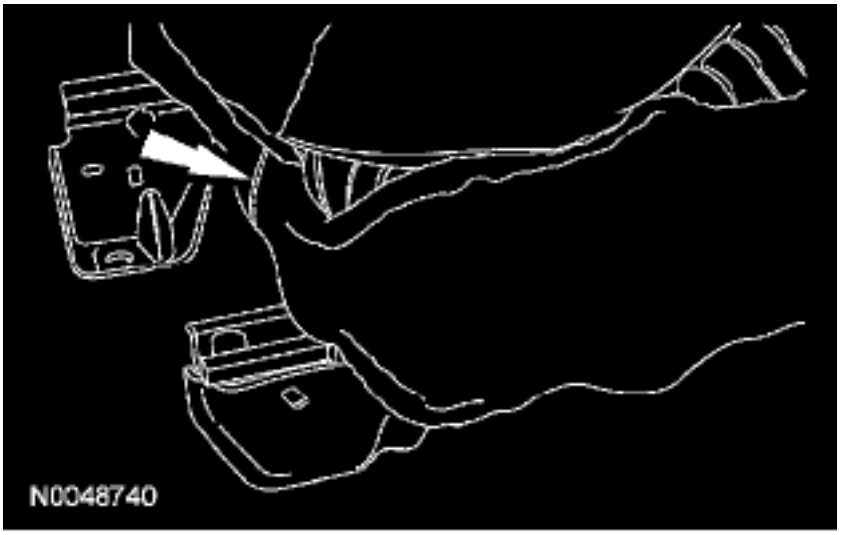
Special Tool(s)

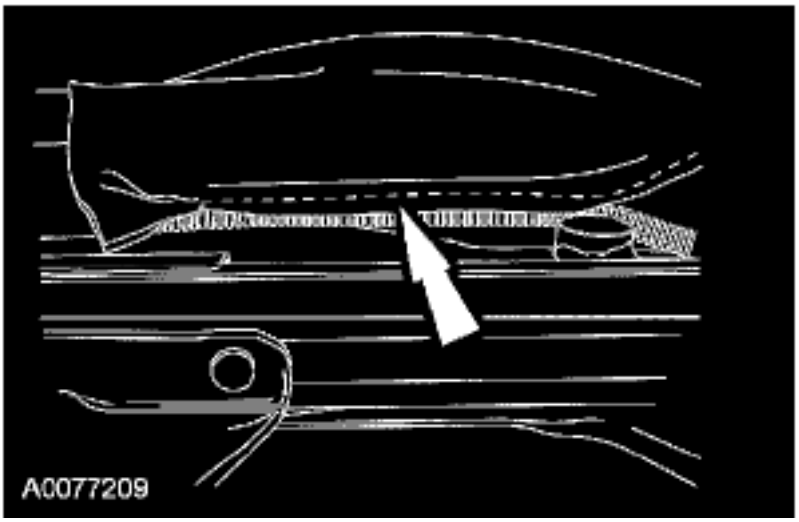
Removal and Installation

WARNING:

- Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.

- After any crash, all of the following safety belt assemblies and attaching hardware must be inspected by an authorized dealer to verify





correct function: -

Retractors

- Buckles

- Belt tension sensor (BTS) (if equipped)

- Front safety belt buckle support assemblies (slide bar) (if equipped)

- Safety belt shoulder belt height adjusters (if equipped)

- Child safety seat tether bracket assemblies

- Automatic locking retractor (ALR) feature for child safety seats (passenger seating positions only)

If any safety belt assembly is damaged, does not operate correctly or does not pass all of the Functional Tests in the Diagnosis and Testing portion, a new safety belt assembly must be installed. If any safety belt assembly attaching areas are damaged or distorted, the sheet metal must be restored to its original structural integrity and new safety belt assembly and attaching hardware must be installed. Failure to install new safety belt assemblies and attaching hardware may increase the risk of serious personal injury or death in a crash.

After any crash that results in deployment of the driver and/or front outboard passenger safety belt pretensioners, new driver and/or front outboard passenger safety belt systems (including retractors, buckles and height adjusters) must be installed. Failure to install new safety belt systems increases the risk of serious personal injury or death in a crash.

- Never probe the electrical connectors on safety belt buckle/retractor pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors, which increases the risk of serious personal injury or death.

CAUTION: It is necessary to carry out the occupant classification sensor (OCS) system reset of the OCS system when a front passenger seat cushion is disassembled, a new trim cover installed or an OCS system service kit is installed. A scan tool is used to trigger the command to carry out the OCS system reset.

NOTE:

- The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

- The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

All seats

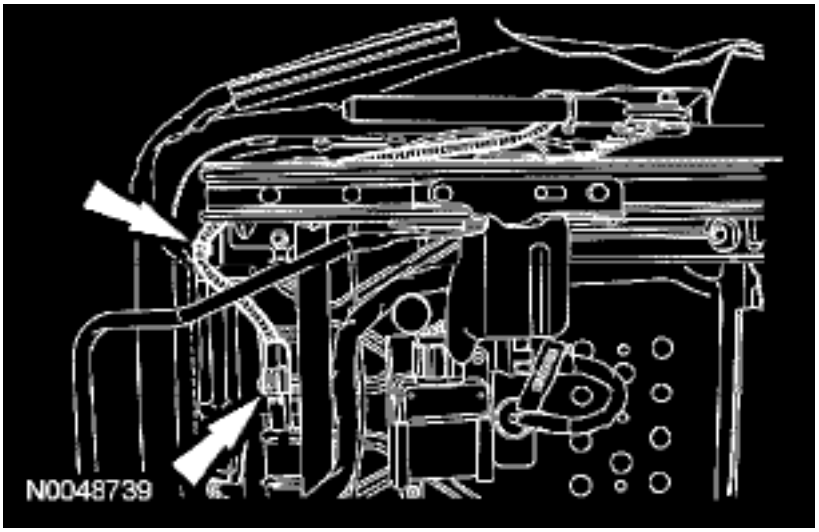
1. Remove the front seat. 2. Release the inboard side rear hook-and-loop strip.

3. Release the inboard side bottom J-clip for access to the safety belt buckle pretensioner.

4. NOTE: Note the routing of the wire harness through the seat for installation.

Detach the pin-type retainers and safety belt buckle pretensioner wire harness from the seat cushion pan. -

For driver seat, disconnect the seat position electrical connector.



- For passenger seat, disconnect the safety belt buckle pretensioner electrical connector.

5. Remove the nut, safety belt buckle pretensioner and wire harness.

- To install, tighten to 40 Nm (30 lb-ft).

6. To install, reverse the removal procedure.

- Make sure the safety belts and buckles are accessible to the occupants after installation.

7. Install the front seat and repower the SRS. If a passenger seat has been serviced, do not prove out the SRS at this time.

Passenger seat

8. WARNING: Make sure the front passenger seat repair is complete, the seat and all attached components (head restraint, seat side shield,

etc.) are correctly assembled, and the seat is correctly installed to the vehicle before carrying out the System Reset. Failure to follow these instructions may result in incorrect operation of the occupant classification sensor (OCS) system and increases the risk of serious personal injury or death in a crash.

CAUTION: -

The following precautions must be taken before carrying out the occupant classification sensor (OCS) system reset: -

Make sure the OCS system components are connected and no faults are present.

- Make sure the voltage to the occupant classification system module (OCSM) is above 8.0 volt and less than 18.0 volts.

- Make sure the OCS system is not at a temperature below 6°C (42°F) or above 36°C (97°F) when initiating the OCS system reset process. If the vehicle has been exposed to extreme cold or hot temperatures, the vehicle must be exposed and kept at a temperature within the limits, 6°C to 36°C (42°C to 97°C) for a minimum of 30 minutes.

- Make sure nothing is present on the passenger seat before carrying out the OCS system reset and nothing is placed on the seat during the process.

- Make sure a minimum 4-second time period has passed after cycling the ignition switch ON before the carrying out the OCS system reset process.

NOTE: If the first attempt to carry out the occupant classification sensor (OCS) system reset is unsuccessful, a second attempt must be made. If the second attempt is unsuccessful, a new OCS system service kit must be installed.

Carry out the OCS system reset active command.

All seats

9. NOTE: The ignition switch must be cycled after the OCS system reset.

Prove out the SRS as follows: Turn the ignition key from ON to OFF. Wait 10 seconds, then turn the key back to ON and visually monitor the air bag warning indicator with the air bag modules installed. The air bag warning indicator will light continuously for approximately 6 seconds and then turn OFF. If an air bag SRS fault is present, the air bag warning indicator will: -

fail to light.

- remain lit continuously.

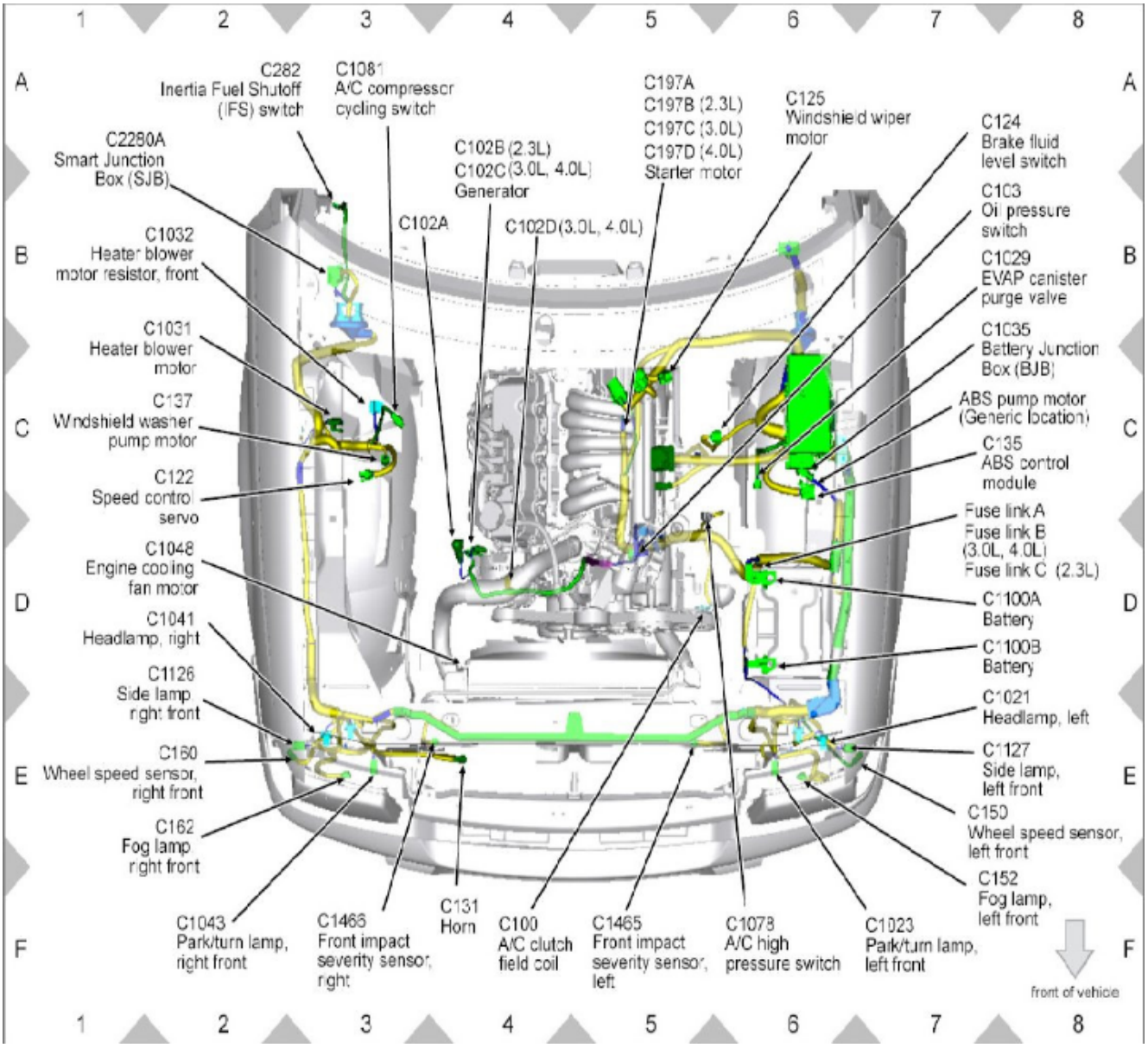
- flash at a 5 Hz rate (RCM not configured).

The air bag warning indicator might not light until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON position. This is the time required for the RCM to complete the testing of the SRS. If the air bag warning indicator is inoperative and a SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag warning indicator and any SRS fault discovered must be diagnosed and repaired.

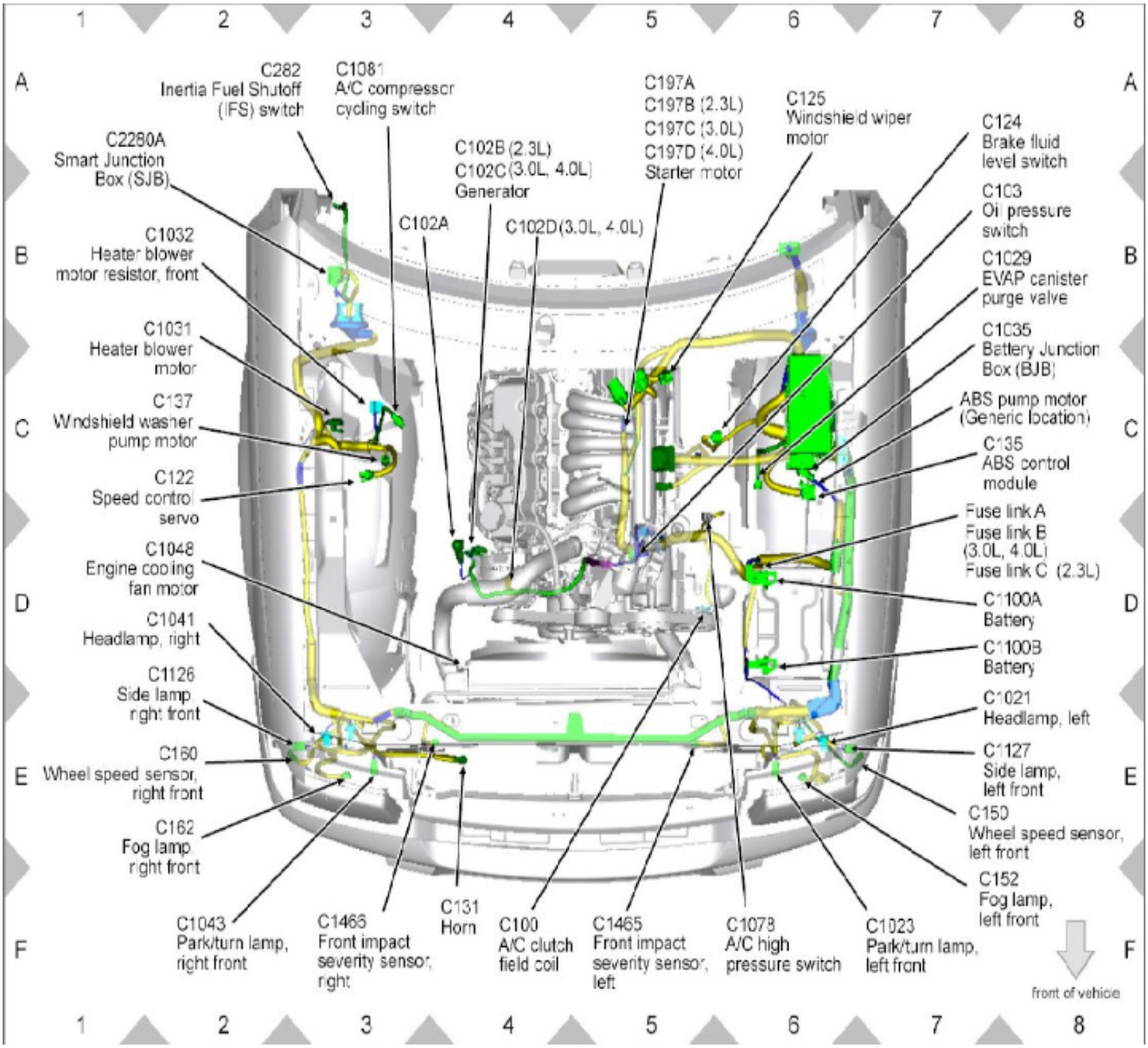
Clear all RCM and occupant classification system module (OCSM) DTCs using a scan tool.

10. Check the active restraint system for correct operation.

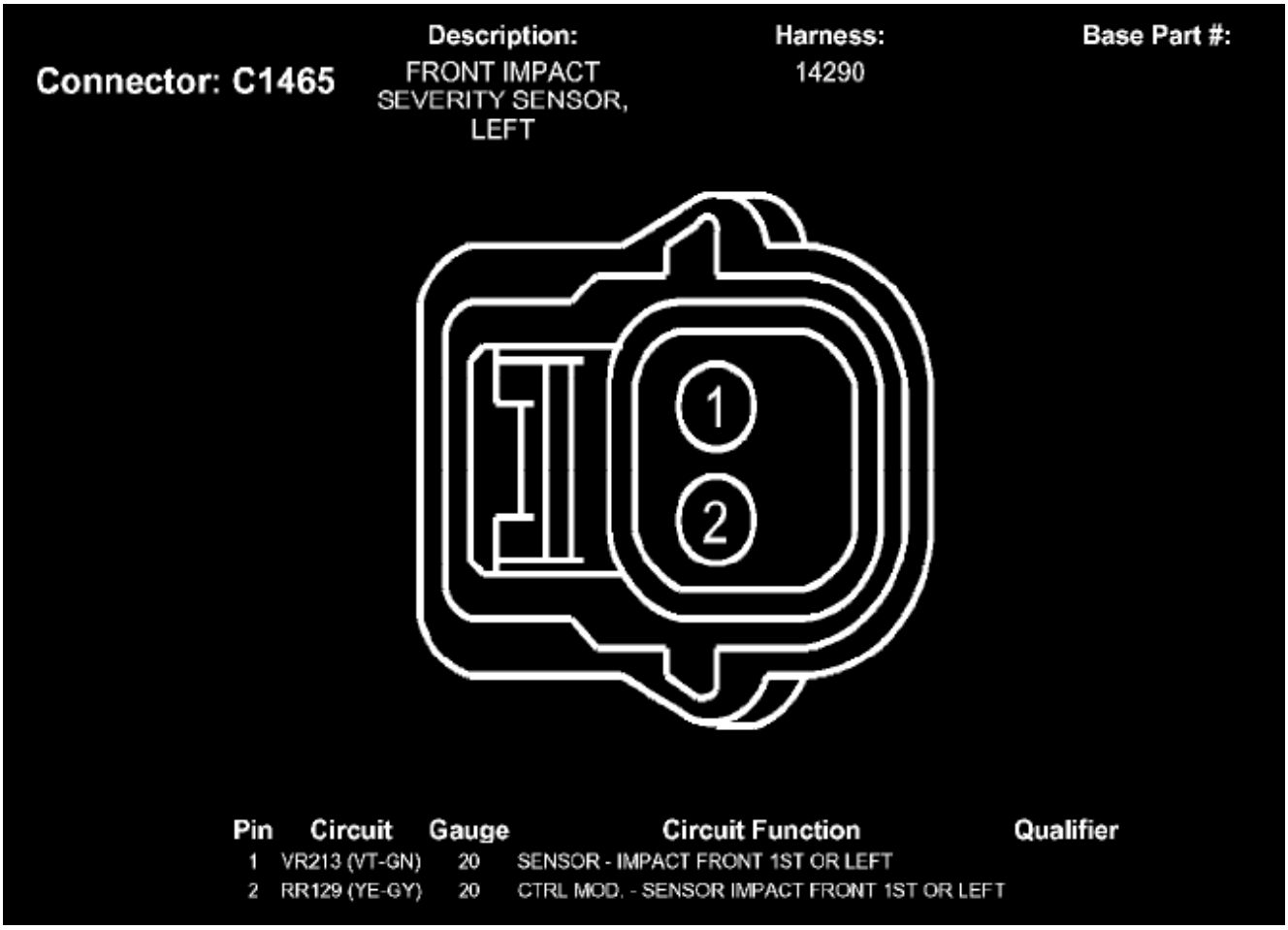
Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Restraint Systems > Sensors and Switches - Restraint Systems > Impact Sensor > Component Information > Locations > Front Impact Severity Sensor, Left



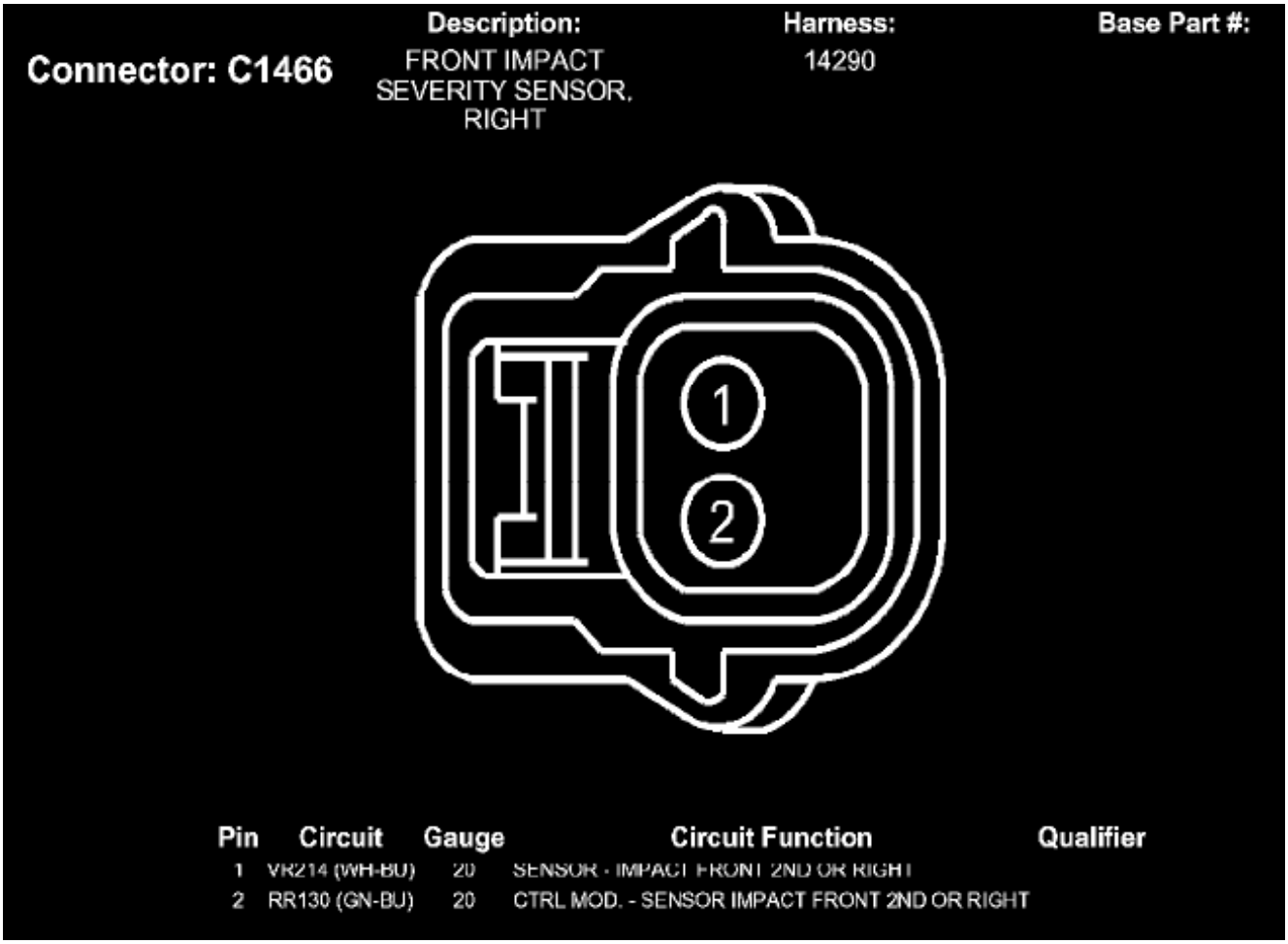
View 151-1


C282
Inertia Fuel Shutoff (IFS) switch
C1081
A/C compressor cycling switch
C2280A
Smart Junction Box (SJB)
C102B (2.3L)
C102C (3.0L, 4.0L)
Generator
C102A
C102D (3.0L, 4.0L)
C197A
C197B (2.3L)
C197C (3.0L)
C197D (4.0L)
Starter motor
C125
Windshield wiper motor
C124
Brake fluid level switch
C103
Oil pressure switch
C1032
Heater blower motor resistor, front
C1029
EVAP canister purge valve
C1031
Heater blower motor
C1035
Battery Junction Box (BJB)
C137
Windshield washer pump motor
ABS pump motor (Generic location)
C135
ABS control module
C122
Speed control servo
Fuse link A
Fuse link B (3.0L, 4.0L)
Fuse link C (2.3L)
C1048
Engine cooling fan motor
C1100A
Battery
C1041
Headlamp, right
C1100B
Battery
C1126
Side lamp, right front
C1021
Headlamp, left
C160
Wheel speed sensor, right front
C1127
Side lamp, left front
C162
Fog lamp, right front
C150
Wheel speed sensor, left front
C152
Fog lamp, left front
C1043
Park/turn lamp, right front
C1466
Front impact severity sensor, right
C131
Horn
C100
A/C clutch field coil
C1465
Front impact severity sensor, left
C1078
A/C high pressure switch
C1023
Park/turn lamp, left front
front of vehicle

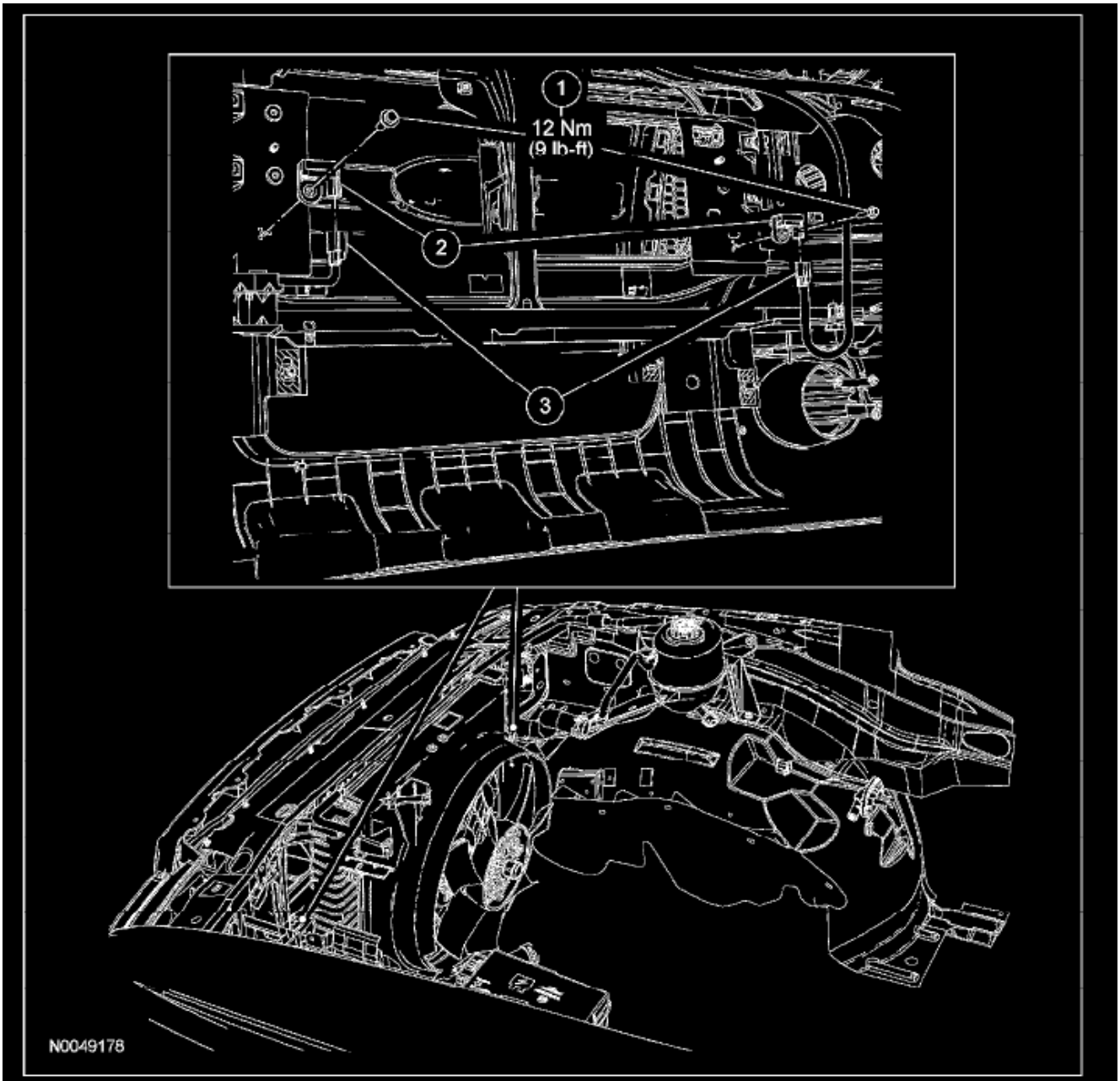
View 151-1


Connector: C1465
Description:
FRONT IMPACT SEVERITY SENSOR, LEFT
Harness:
14290
Base Part #:
1
2
Pin Circuit Gauge Circuit Function Qualifier
1 VR213 (VT-GN) 20 SENSOR - IMPACT FRONT 1ST OR LEFT
2 RR129 (YE-GY) 20 CTRL MOD. - SENSOR IMPACT FRONT 1ST OR LEFT

C1465


Connector: C1466
Description:
FRONT IMPACT SEVERITY SENSOR, RIGHT
Harness:
14290
Base Part #:
1
2
Pin Circuit Gauge Circuit Function Qualifier
1 VR214 (WH-BU) 20 SENSOR - IMPACT FRONT 2ND OR RIGHT
2 RR130 (GN-BU) 20 CTRL MOD. - SENSOR IMPACT FRONT 2ND OR RIGHT

C1466



Item	Part Number	Description
1	W505256	LH and RH front impact severity sensor bolts
2	14B006	LH and RH front impact severity sensors

Item	Part Number	Description
3	—	LH and RH front impact severity sensor electrical connectors (part of 14290)

(Continued)

Impact Sensor: Service and Repair

FRONT IMPACT SEVERITY SENSOR

Removal and Installation

WARNING:

- If a vehicle has been in a crash, inspect the restraints control module (RCM) and the impact sensor (if equipped) mounting areas for deformation. If damaged, restore the mounting areas to the original production configuration. A new RCM and sensors must be installed whether or not the air bags have deployed. Failure to follow these instructions may result in serious personal injury or death in a crash.

- Always tighten the fasteners of the restraints control module (RCM) and impact sensor (if equipped) to the specified torque. Failure to do so may result in incorrect restraint system operation, which increases the risk of personal injury or death in a crash.

NOTE:

- The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

- The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

- Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and carry out the diagnostic procedure again.

All vehicles

1. Depower the SRS.

Vehicles equipped with 2.3L and A/C

2. For the RH front impact severity sensor, remove the air cleaner and air cleaner outlet pipe.

All vehicles

3. NOTE:

- Make sure the radiator support and front impact severity sensor mating surfaces are clean and free of foreign material.

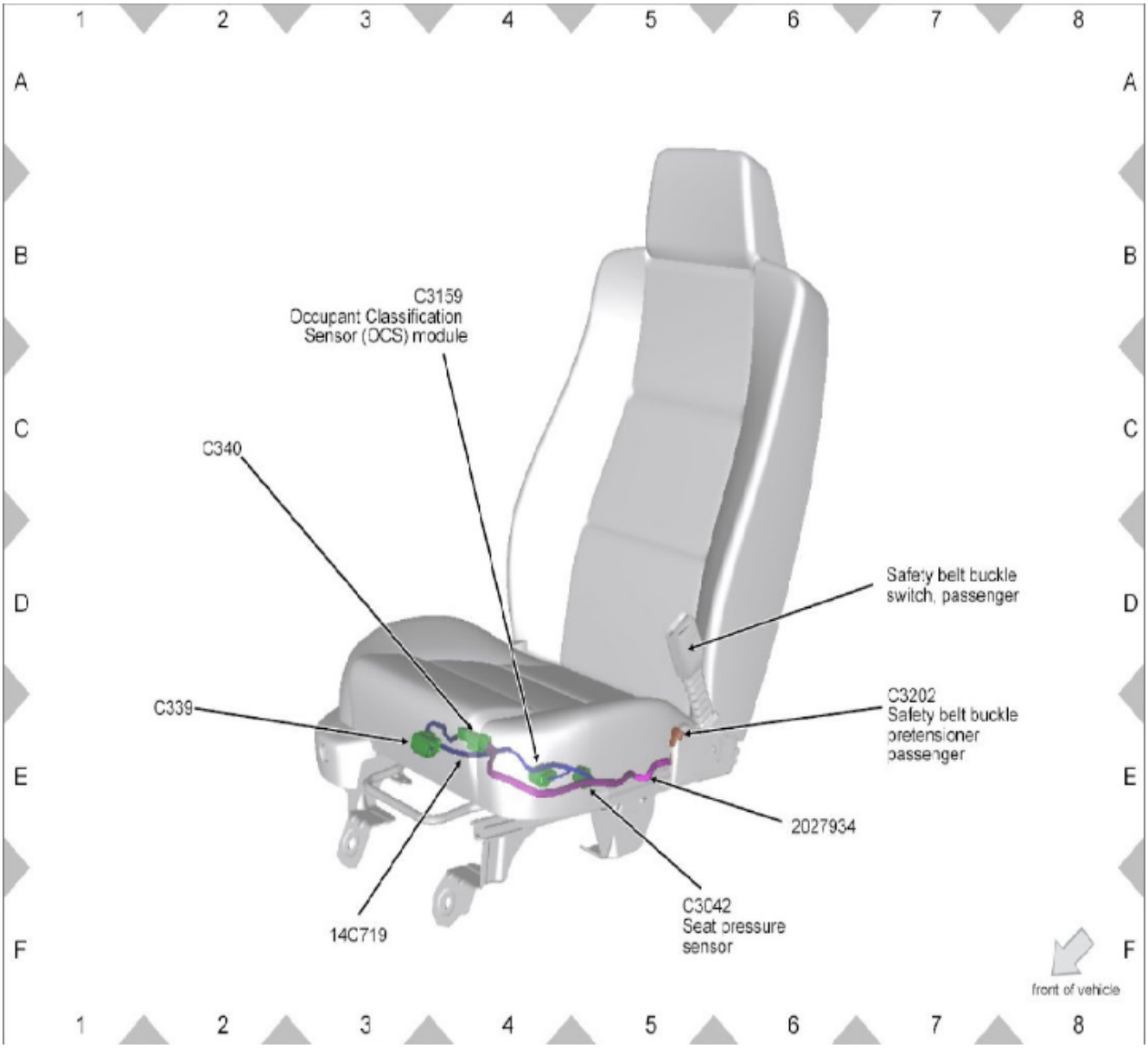
- Note position of locator tab on sensor bracket for installation.

Remove the front impact severity sensor bolt. -

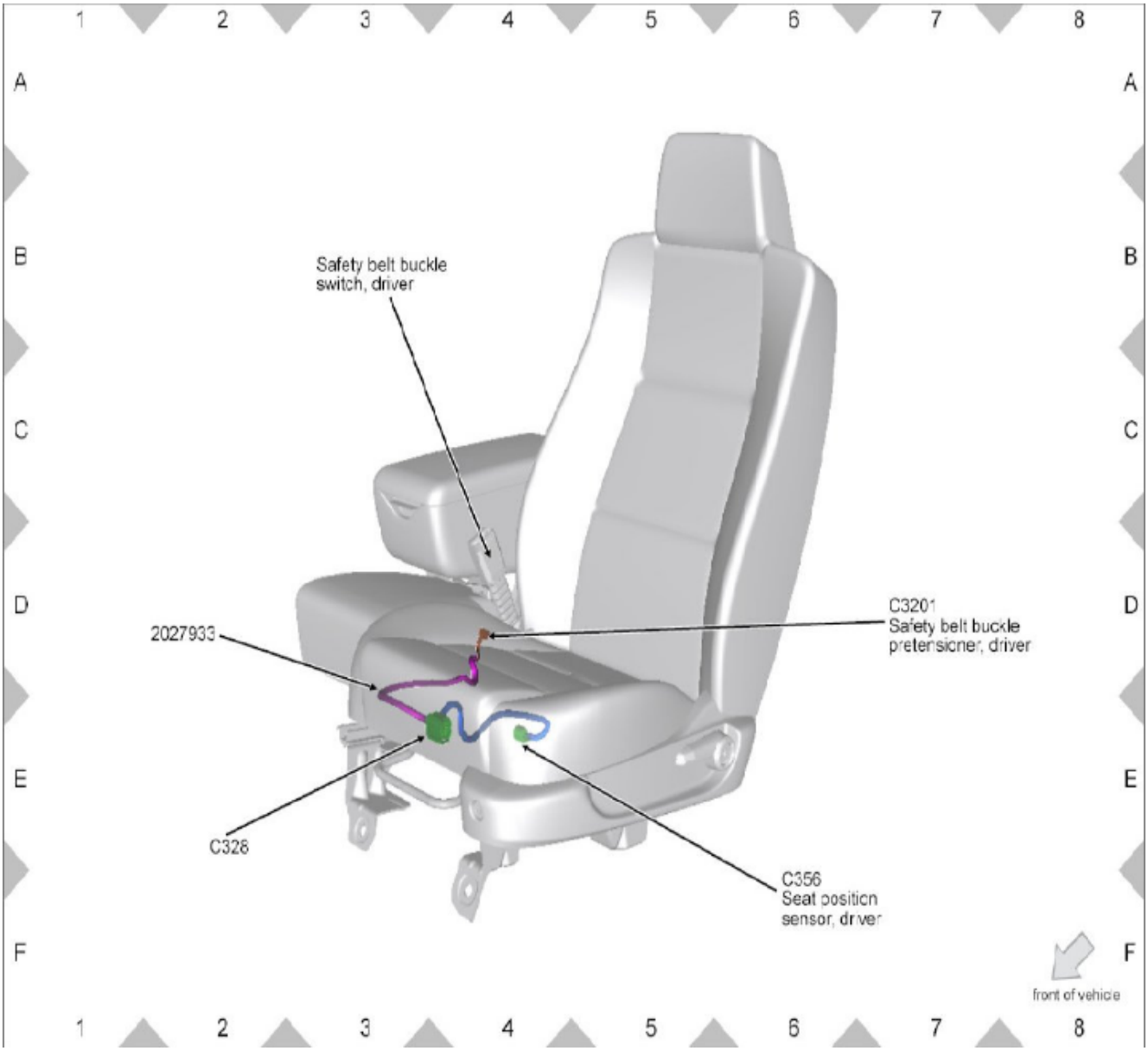
To install, tighten to 12 Nm (9 lb-ft).

4. Disconnect the front impact severity sensor electrical connector and remove the sensor. 5. To install, reverse the removal procedure. 6. Repower the SRS.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Restraint Systems > Sensors and Switches - Restraint Systems > Seat Belt Buckle Switch > Component Information > Locations > Safety Belt Buckle Switch, Passenger



View 151-19

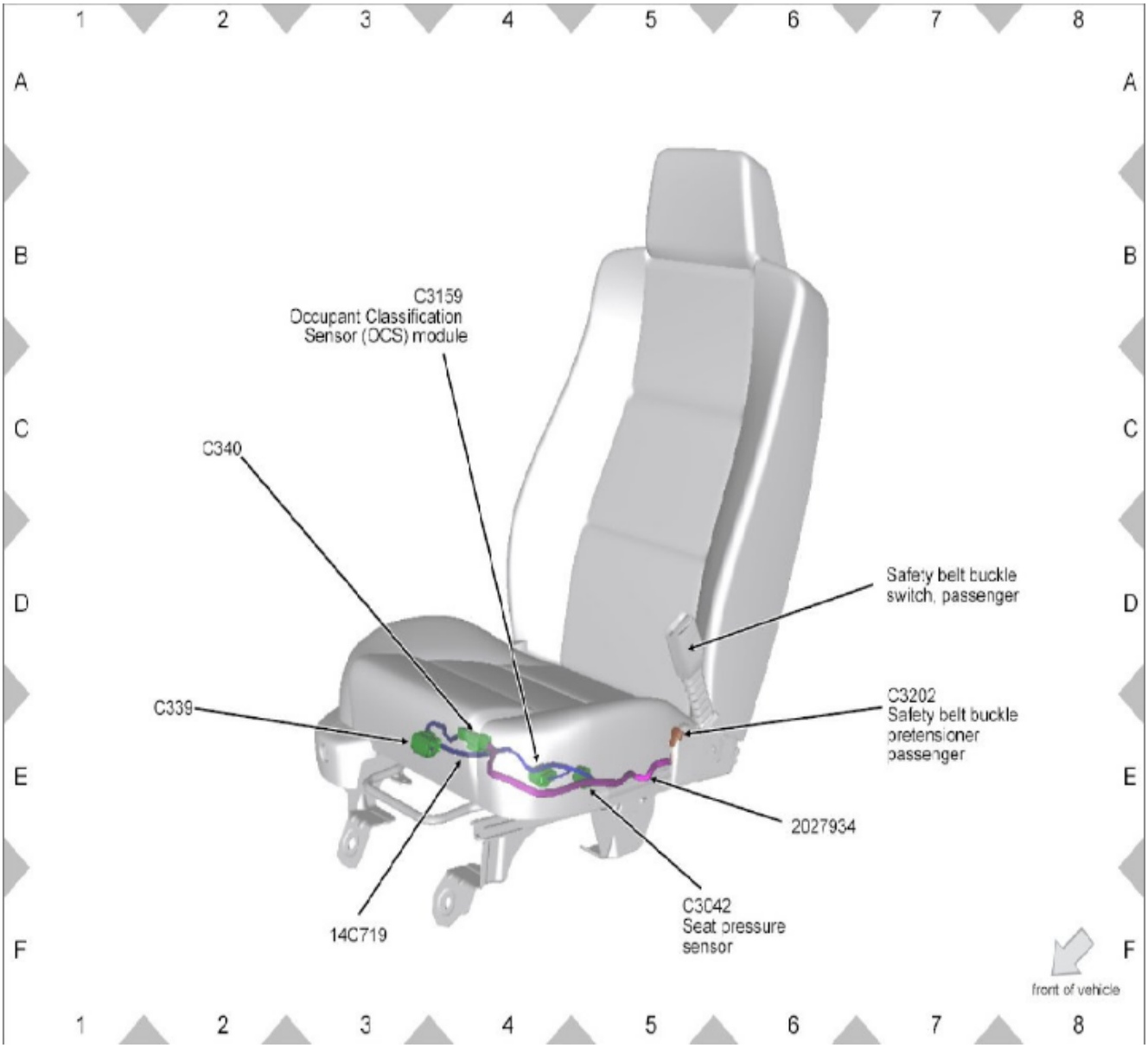

Safety belt buckle switch, driver
2027933
C3201
Safety belt buckle pretensioner, driver
C328
C356
Seat position sensor, driver
front of vehicle

View 151-18

Seat Belt Tension Sensor: Description and Operation

BELT TENSION SENSOR (BTS)

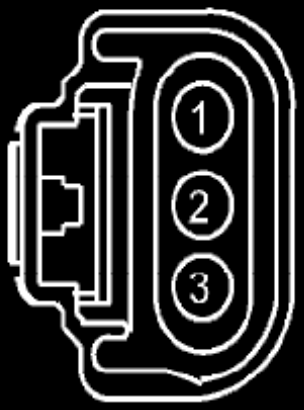
The safety belt tension sensor (BTS) is part of the passenger front safety belt and retractor assembly and is not serviced separately. The safety BTS is located at the safety belt anchor point and is used in conjunction with the occupant classification sensor (OCS) system. For information on diagnosing the BTS and OCS or servicing the OCS system, refer to the appropriate procedure in Air Bag Systems.


C3159
Occupant Classification Sensor (OCS) module
C340
Safety belt buckle switch, passenger
C339
C3202
Safety belt buckle pretensioner passenger
2027934
C3042
Seat pressure sensor
14C719
front of vehicle

View 151-19

Connector: C3042

Description:	Harness:	Base Part #:
SEAT PRESSURE SENSOR	14C719	



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CR152 (GY-YE)	22	CTRL MOD. - SENSOR OCCUPANT CLASSIFICATION PRESSURE	
2	VR223 (BU-WH)	22	SENSOR - OCCUPANT CLASSIFICATION PRESSURE	
3	RR152 (YE-VT)	22	CTRL MOD. - SENSOR OCCUPANT CLASSIFICATION PRESSURE	

C3042

Seat Occupant Sensor: Description and Operation

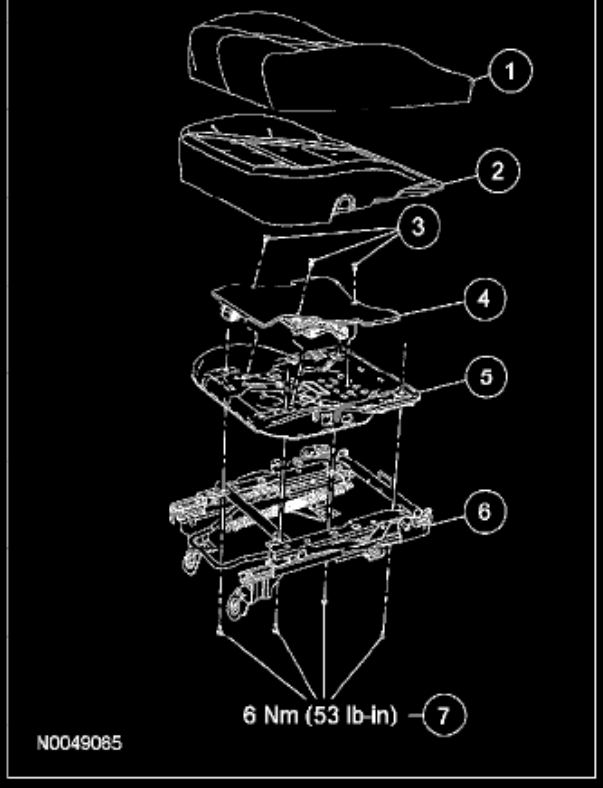
OCCUPANT CLASSIFICATION SENSOR (OCS) SYSTEM

The OCS system is standard equipment on all front outboard passenger seats.

Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Seat with a Production Occupant Classification Sensor



Item	Part Number	Description
1	62900	Seat cushion trim cover
2		Seat cushion foam pad
3	—	Pin-type retainers
4	—	Occupant classification sensor (OCS) system (bladder, hose with pressure sensor, occupant classification system module [OCSM] and seat wiring harness)
5	63101	Seat cushion frame
6	—	Seat track assembly
7		Seat track-to-cushion frame bolts

Seat Occupant Sensor: Service and Repair

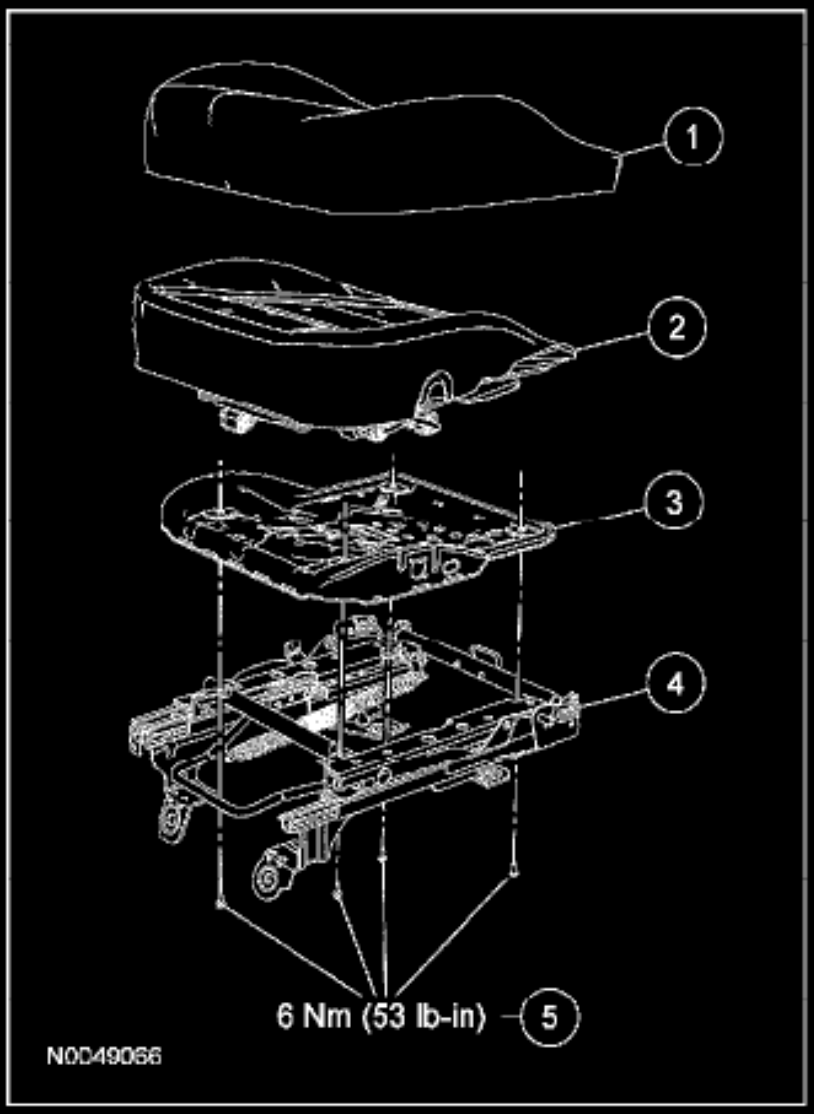
OCCUPANT CLASSIFICATION SENSOR

Special Tool(s)

Special Tool(s)

Seat With A Production Occupant Classification Sensor

Seat with a Service Kit Occupant Classification Sensor



Item	Part Number	Description
1	62900	Seat cushion trim cover
2	603B02	Occupant classification sensor (OCS) system service kit (foam pad, bladder, hose with pressure sensor, OCSM and wiring harness)
3	63101	Seat cushion frame
4	—	Seat track assembly
5	—	Seat track-to-cushion frame bolts

Seat With A Service Kit Occupant Classification Sensor

Removal

WARNING: -

Never probe the electrical connectors on safety belt buckle/retractor pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors, which increases the risk of serious personal injury or death.

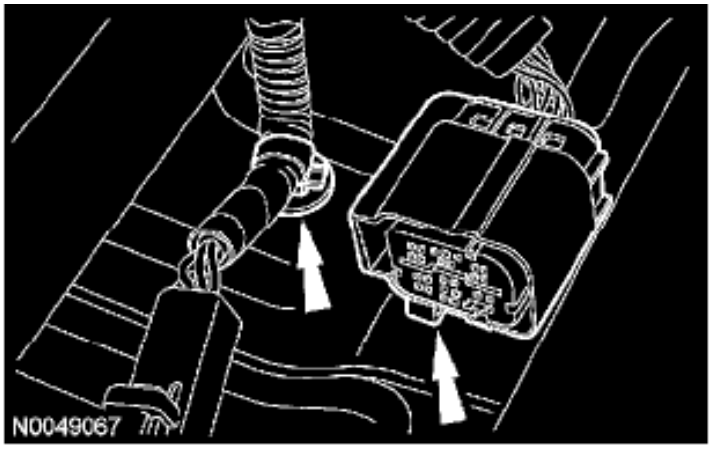
- Install a new occupant classification sensor (OCS) system service kit as a complete assembly. Never install only part of the kit components. Failure to follow this instruction may result in incorrect operation of the OCS system and increases the risk of serious personal injury or death in a crash.

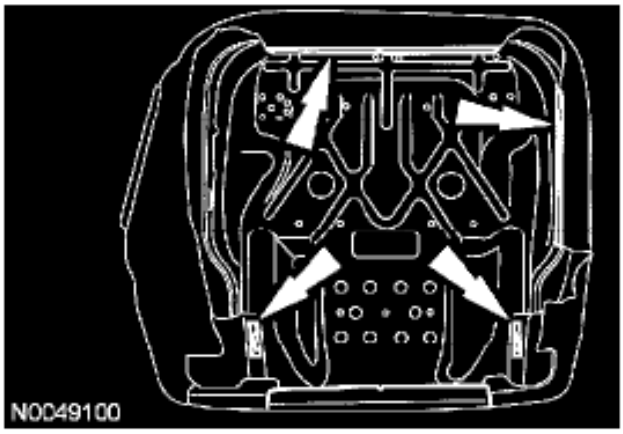
- Make sure the front passenger seat repair is complete, the seat and all attached components (head restraint, seat side shield, etc.) are correctly assembled, and the seat is correctly installed to the vehicle before carrying out the System Reset. Failure to follow these instructions may result in incorrect operation of the occupant classification sensor (OCS) system and increases the risk of serious personal injury or death in a crash.

CAUTION: To prevent system failure, it is necessary to carry out the occupant classification sensor (OCS) system reset when a front passenger seat cushion is disassembled, a new trim cover installed or an OCS system service kit is installed. A scan tool is used to carry out the OCS system reset command.

NOTE: -

Occupant classification sensor (OCS) system components (seat cushion foam pad, bladder with pressure sensor and occupant classification system module [OCSM]) are calibrated to each other and are serviced as an assembly. The OCS system components are not to be installed separately. If a


N0049067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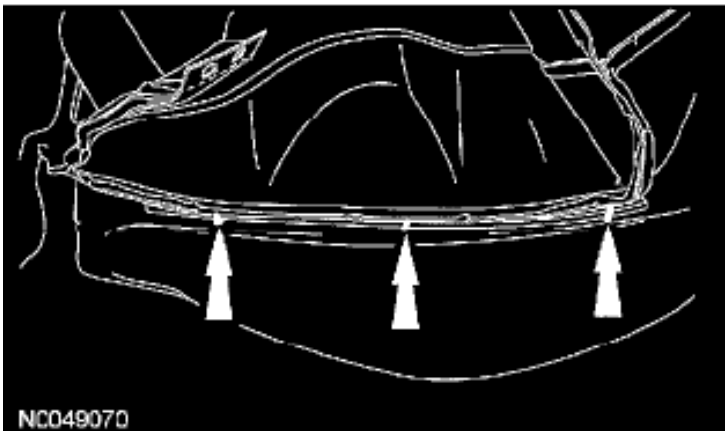

N0049070

new OCS system, OCS system component or seat cushion foam pad are needed, a new OCS system service kit (seat cushion foam pad, bladder with pressure sensor, OCSM and seat wiring harness) must be installed as an assembly.

- The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

- The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

- Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and perform the diagnostic procedure again.

1. Remove the passenger seat. 2. Remove the seat backrest.

3. NOTE: Note position of wire routing for installation.

Release the seat wiring harness retainer clip and detach the seat wiring harness connector from the seat cushion frame.

4. Release the cushion trim cover rear J-clip. 5. Remove the 4 seat track-to-cushion frame bolts and the seat track assembly. 6. Release the remaining cushion trim cover J-clips.

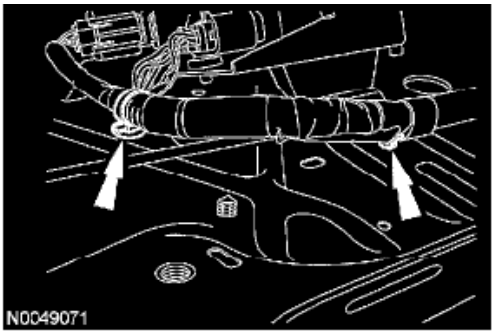
7. CAUTION: An occupant classification sensor (OCS) system service kit will have the OCS system bladder attached to the seat cushion

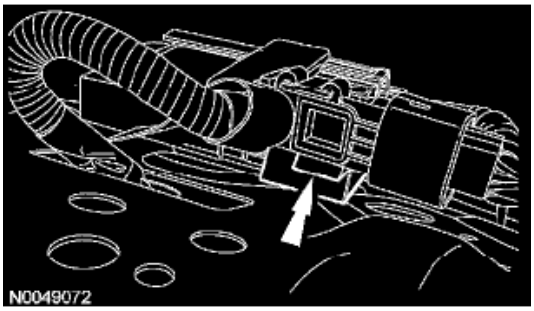
foam pad. Do not separate the OCS system bladder from the seat cushion foam pad. Failure to do so can result in component failure.

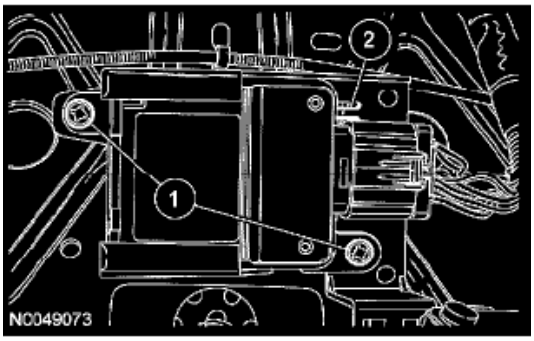
Remove the hog rings and the cushion trim cover from the seat cushion foam pad.

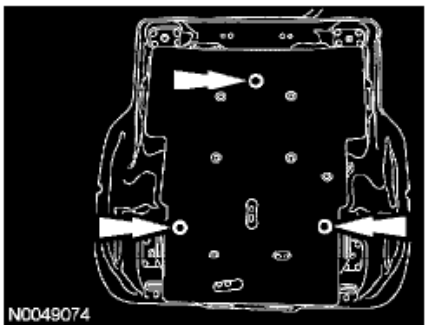
8. NOTE: Note position of wire routing for installation.

Release the 2 seat wiring harness routing clips from the cushion frame.


N0049071


N0049072


1
2
N0049073


N0049074

9. Release the pressure sensor bracket retainer and slide the pressure sensor off the bracket.

10. Remove the OCSM.

1 Remove the 2 screws from the OCSM.

2 Release the OCSM bracket retainer and slide the OCSM off the bracket.

11. CAUTION: A production occupant classification sensor (OCS) system bladder is shown. An OCS system service kit will have the OCS

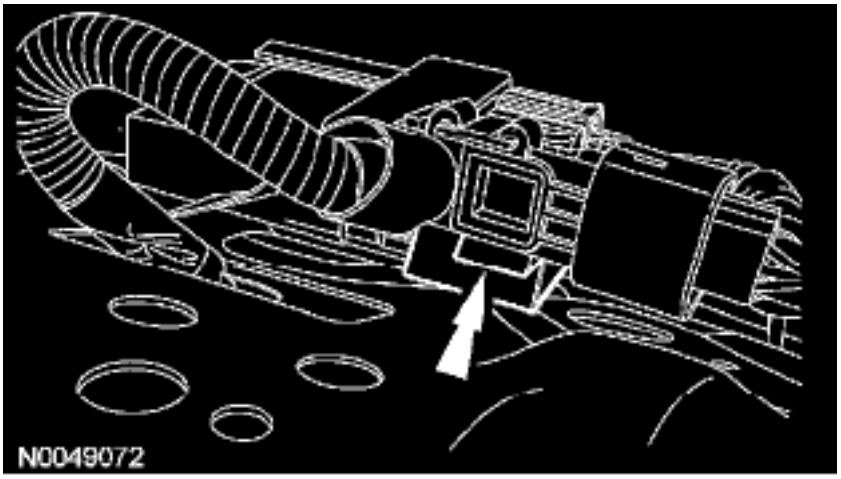
system bladder attached to the seat cushion foam pad. Do not separate the OCS system bladder from the seat cushion foam pad. Failure to do so can result in component failure.

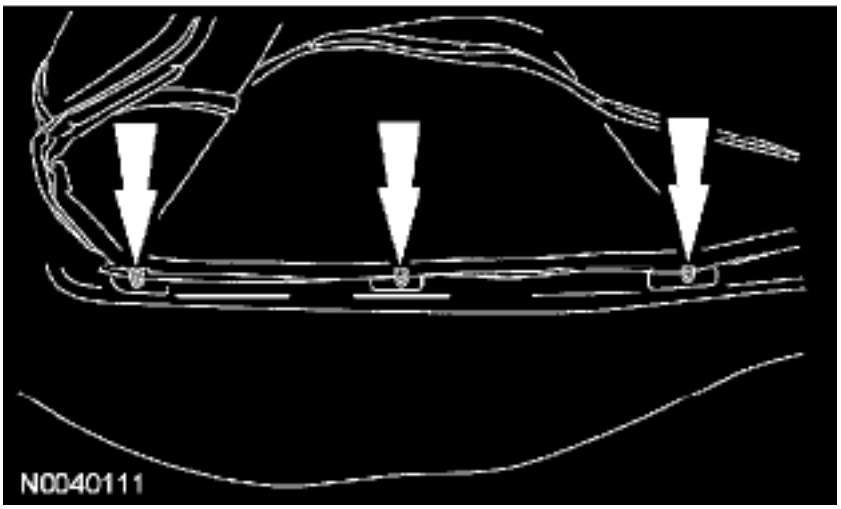
Release the 3 OCS system bladder pin-type retainers from the seat cushion frame.

12. NOTE: Note position of wire routing for installation.

Route the OCS system bladder hose and pressure sensor, OCSM and seat wiring harness out through the seat cushion pan opening.

Installation





1. WARNING: Install a new occupant classification sensor (OCS) system service kit as a complete assembly. Never install only part of the

kit components. Failure to follow this instruction may result in incorrect operation of the OCS system and increases the risk of serious personal injury or death in a crash.

CAUTION: -

Inspect the occupant classification sensor (OCS) system assembly, seat cushion frame and support assembly for any foreign objects before installing the OCS system assembly to the seat cushion frame. If any foreign objects are found, remove them. Failure to follow these instructions may result in incorrect OCS system operation or failure.

- Failure to route the seat occupant sensor components through the correct seat cushion support opening can cause component failure.

- While positioning the seat cushion pan and occupant classification sensor (OCS) assembly, be careful not to damage any of the components. Failure to do so may result in component failure.

NOTE: If the original equipment OCS system is not being installed, install a OCS system service kit using all parts in the kit.

Position the OCS system to the seat cushion frame. -

Route the OCS system bladder hose and pressure sensor, OCSM and seat wiring harness through the seat cushion pan opening.

2. CAUTION: An occupant classification sensor (OCS) system service kit will have the OCS bladder attached to the seat cushion foam pad.

Do not separate the OCS system bladder from the seat cushion foam pad. Failure to do so may result in component failure.

Install the 3 OCS system bladder pin-type retainers to the seat cushion frame.

3. Install the OCSM.

- Slide the OCSM back on the OCSM bracket until it is fully seated and locked in past the OCSM bracket retainer.

- Install the 2 screws in the OCSM.

4. Slide the pressure sensor on the bracket until it is fully seated and locked past the bracket retainer.

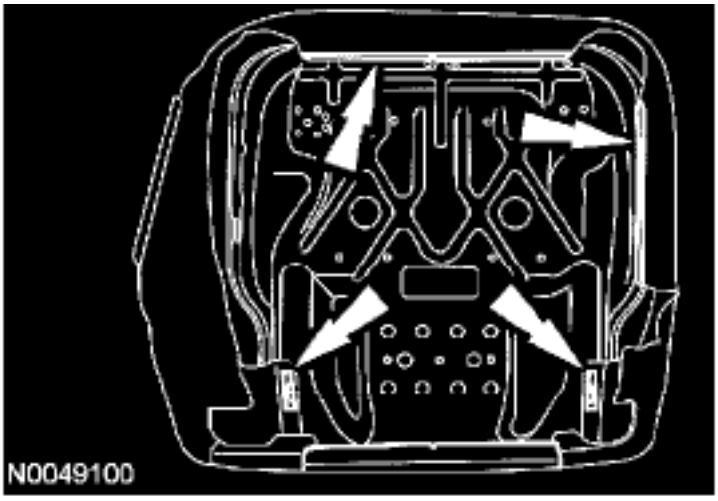
5. Install the 2 seat wiring harness routing clips to the seat cushion frame.

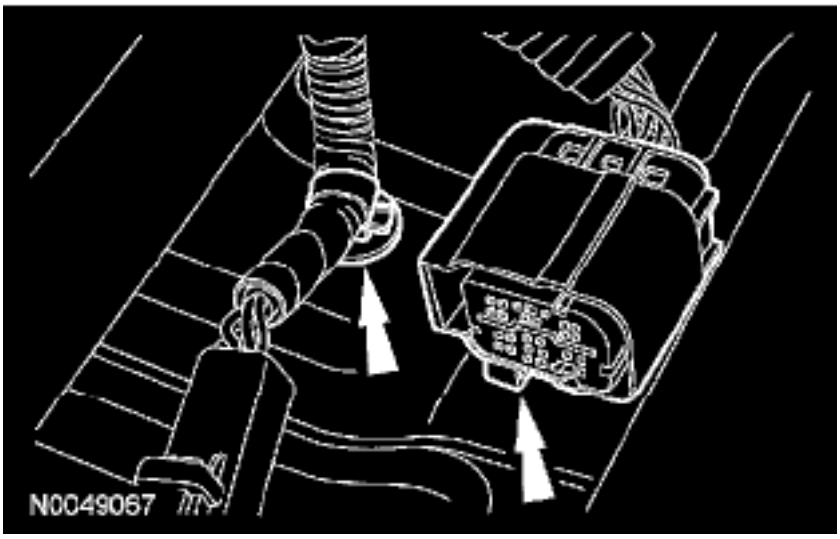
6. CAUTION: Inspect the seat cushion pad and seat cushion trim cover for any foreign objects, before installing the seat cushion trim cover

to the seat cushion pad. If any foreign objects are found, remove them. Failure to follow these instructions may result in incorrect operation of the occupant classification sensor (OCS) system and may cause system failure.

Position the cushion trim cover to the foam pad and install the hog rings.

7. Install the foam pad and cushion trim cover to the cushion frame and fasten the J-clips.





8. Install the seat track assembly and 4 bolts.

- Tighten to 6 Nm (53 lb-in).

9. Attach the seat cushion trim cover rear J-clip.

10. Install the seat wiring harness retainer clip and attach the seat wiring harness connector to the seat cushion frame.

11. Install the front seat backrest. 12. Install the passenger seat into the vehicle. 13. Repower the SRS. Do not prove out the SRS at this time.

14. WARNING:

- Install a new occupant classification sensor (OCS) system service kit as a complete assembly. Never install only part of the kit components. Failure to follow this instruction may result in incorrect operation of the OCS system and increases the risk of serious personal injury or death in a crash.

- Make sure the front passenger seat repair is complete, the seat and all attached components (head restraint, seat side shield, etc.) are correctly assembled, and the seat is correctly installed to the vehicle before carrying out the System Reset. Failure to follow these instructions may result in incorrect operation of the occupant classification sensor (OCS) system and increases the risk of serious personal injury or death in a crash.

CAUTION: -

To prevent system failure, it is necessary to carry out the occupant classification sensor (OCS) system reset of the OCS system when a front passenger seat cushion is disassembled, a new trim cover installed or an OCS system service kit is installed. A scan tool is used to carry out the OCS system reset command.

- To prevent system failure, the following precautions must be taken before carrying out the occupant classification sensor (OCS) system reset: -

Make sure the voltage to the occupant classification system module (OCSM) is above 8.0 volts and less than 18.0 volts.

- Make sure the OCS system is not at a temperature below 6°C (42°F) or above 36°C (97°F) when initiating the OCS system reset process. If the vehicle has been exposed to extreme cold or hot temperatures, the vehicle must be exposed and kept at a temperature within the limits, 6°C to 36°C (42°F to 97°F) for a minimum of 30 minutes.

- Make sure nothing is present on the passenger seat before carrying out the OCS system reset and nothing is placed on the seat during the process.

- Make sure a minimum 8-second time period has passed after cycling the ignition switch ON before the carrying out the OCS system reset process.

NOTE: If the first attempt to carry out the OCS system reset is unsuccessful, a second attempt must be made. If the second attempt is unsuccessful, a new OCS system service kit must be installed.

Carry out the OCS system reset active command.

15. Cycle the ignition switch from ON to OFF.

16. NOTE: The ignition switch must be cycled after the OCS system reset.

Cycle the ignition switch from OFF to ON.

17. Prove out the SRS as follows:

Turn the ignition key from ON to OFF. Wait 10 seconds, then turn the key back to ON and visually monitor the air bag indicator with the air bag modules installed. The air bag indicator will light continuously for approximately 6 seconds and then turn off. If an air bag SRS fault is present, the air bag indicator will: -

fail to light.

- remain lit continuously.

- flash at a 5 Hz rate (RCM not configured).

The air bag warning indicator may not illuminate until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON position. This is the time required for the RCM to complete the testing of the SRS. If the air bag warning indicator is inoperative and a SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag warning indicator and any SRS fault discovered must be diagnosed and repaired.

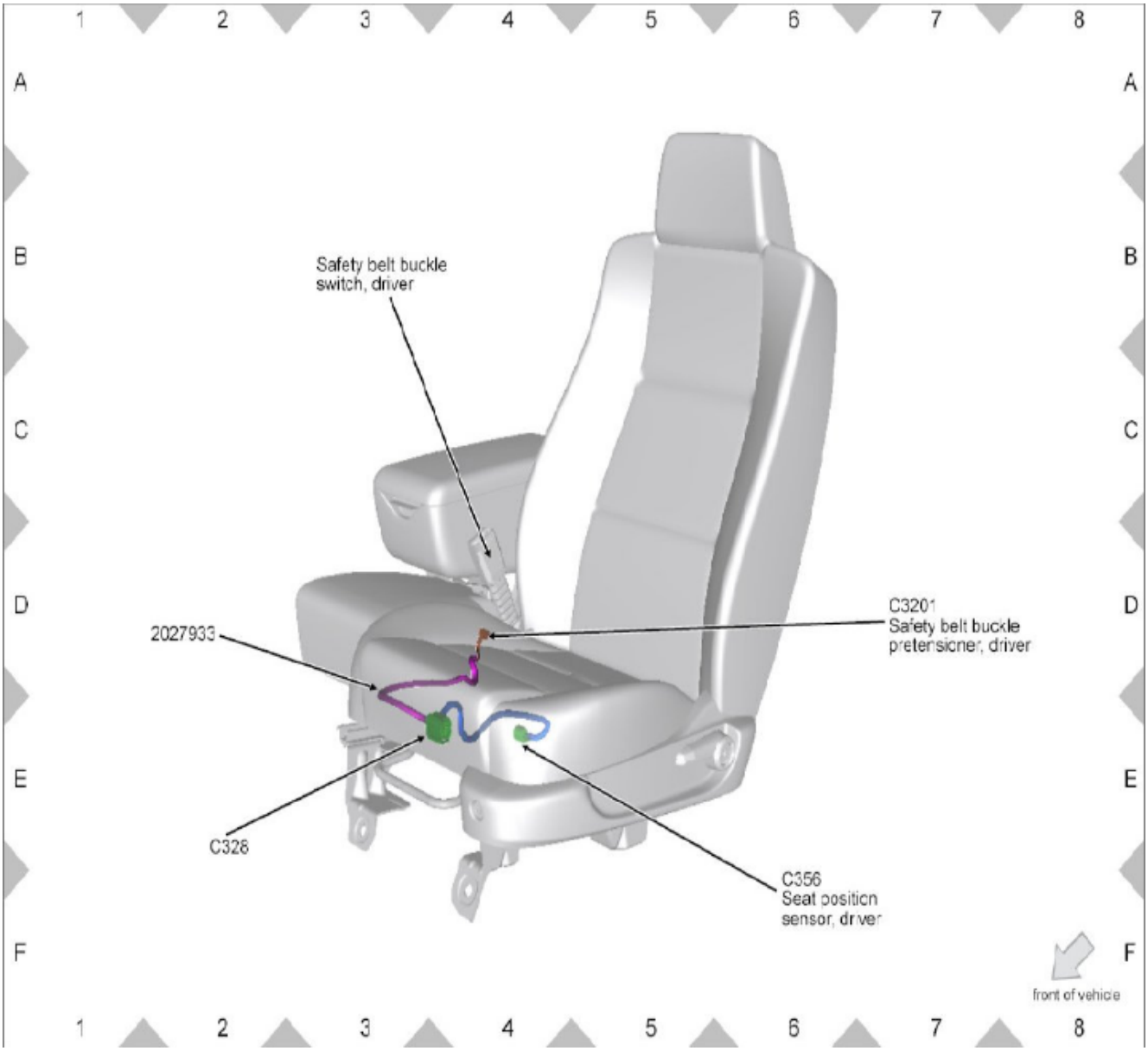
Clear all continuous RCM and OCSM DTCs using a scan tool.

18. NOTE: A prepaid return postcard is provided with a new OCS system service kit. The serial number for the new part and the vehicle

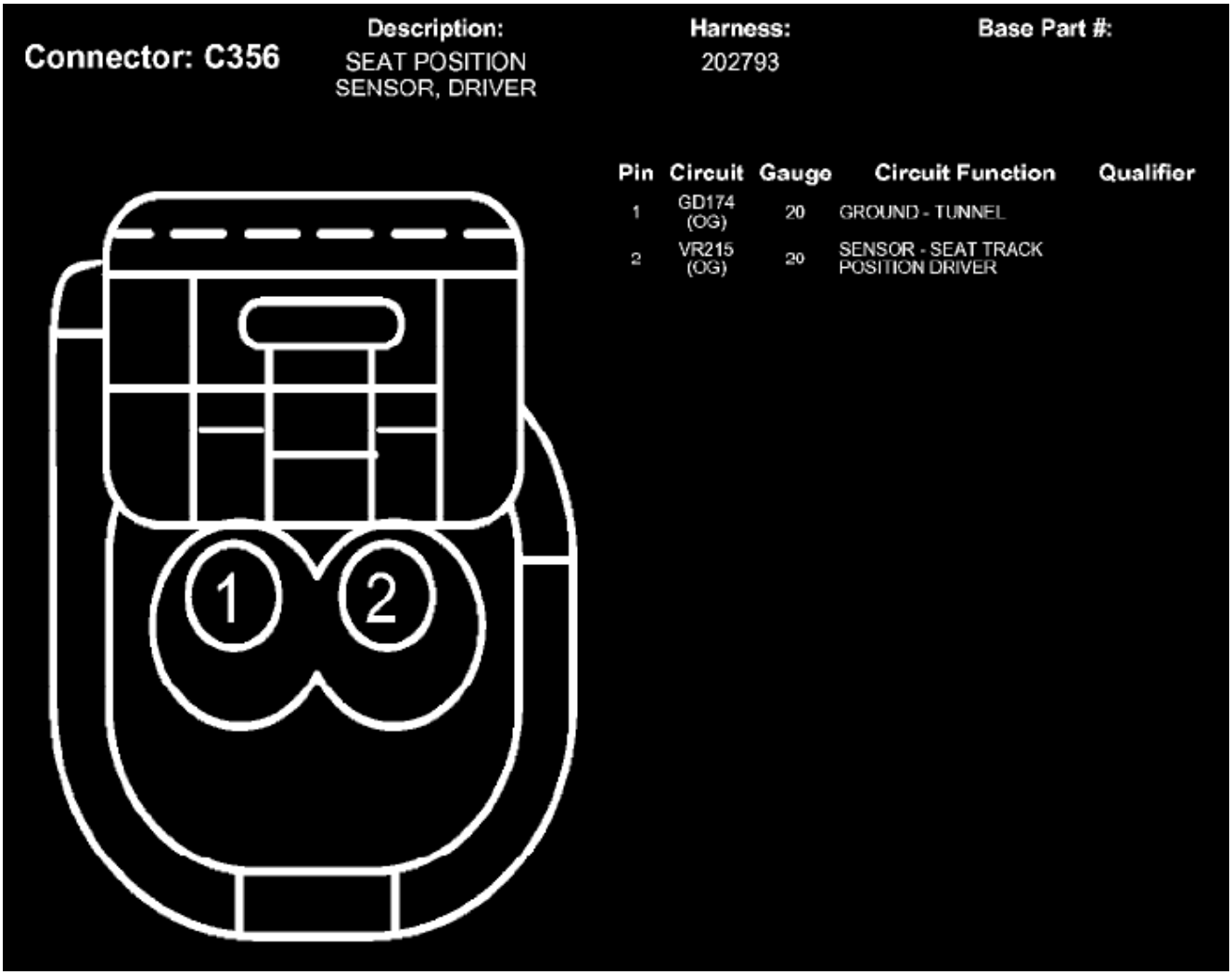
identification number (VIN) must be recorded and sent to Ford Motor Company.

If a new OCS system was installed, fill out the necessary information on the OCS system traceability card and return it along with the complete inoperative OCS system to Ford Motor Company. -

When returning the inoperative OCS system include: seat cushion foam pad, bladder, OCSM, pressure sensor (transducer), hose, electrical connectors and wire harness (service part OCS system only).

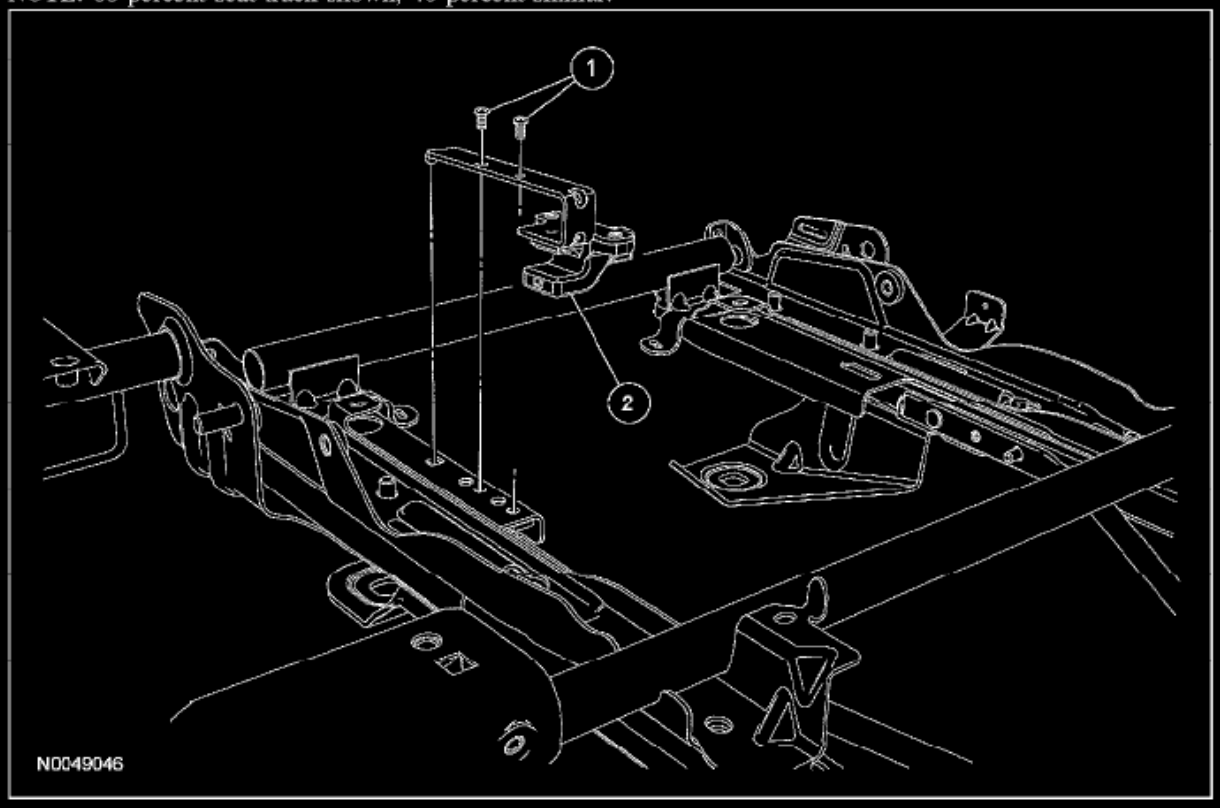

Safety belt buckle switch, driver
2027933
C3201
Safety belt buckle pretensioner, driver
C328
C356
Seat position sensor, driver
front of vehicle

View 151-18


Connector: C356
Description:
SEAT POSITION SENSOR, DRIVER
Harness:
202793
Base Part #:
Pin Circuit Gauge Circuit Function Qualifier
1 GD174 (OG) 20 GROUND - TUNNEL
2 VR215 (OG) 20 SENSOR - SEAT TRACK POSITION DRIVER
1
2

C356

NOTE: 60 percent seat track shown, 40 percent similar.



Item	Part Number	Description
1	—	Seat position sensor and bracket screws
2	14B416	Seat position sensor and bracket

Seat Position Sensor: Service and Repair

SEAT POSITION SENSOR

Removal and Installation

WARNING: Always tighten the seat position sensor retaining bolt to specified torque. Failure to do so may result in incorrect restraint system operation, which increases the risk of personal injury or death in a crash.

NOTE:

- The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a SRS fault.

- The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

- Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and carry out the diagnostic procedure again.

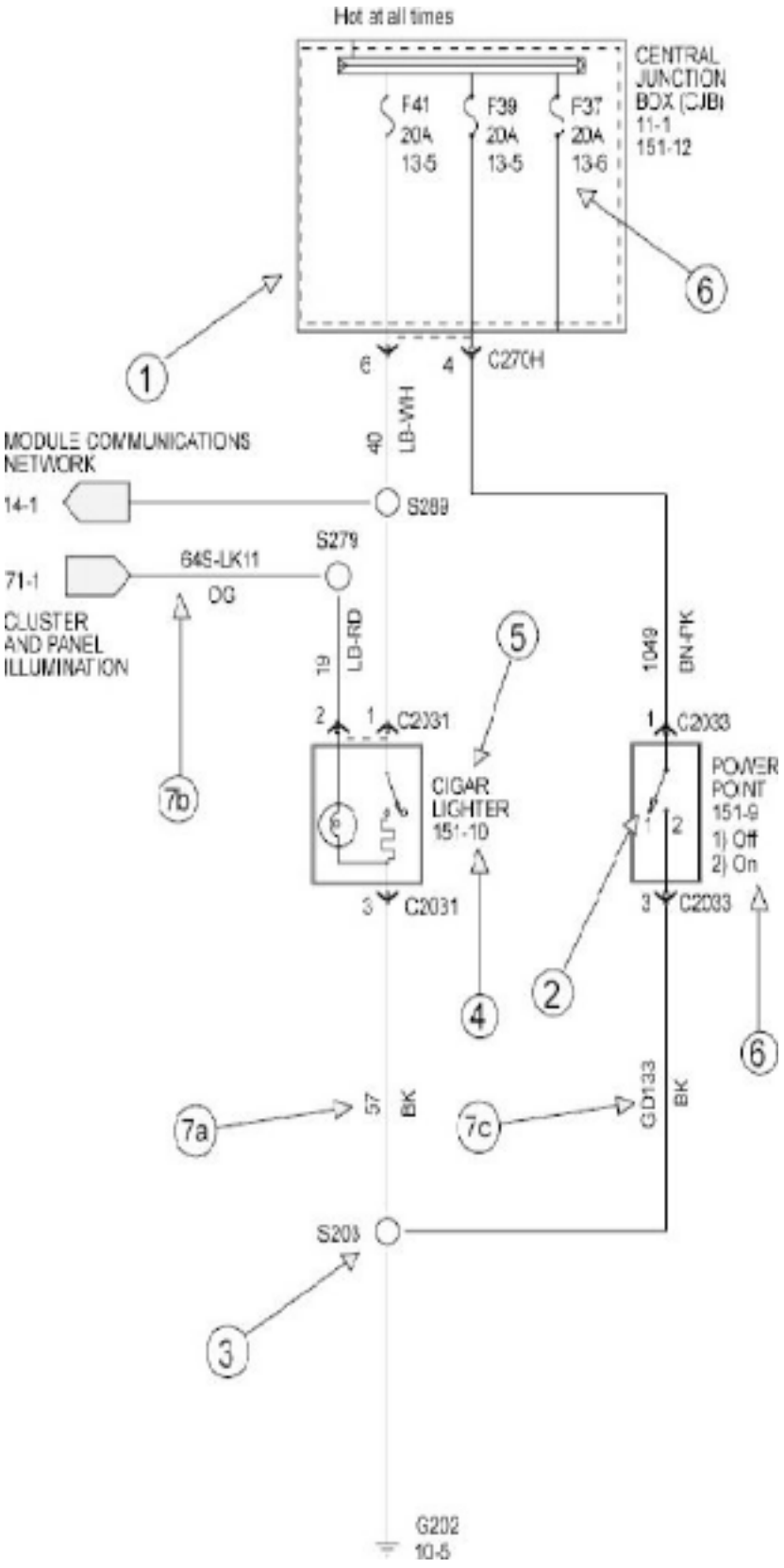
1. Depower the SRS. 2. Remove the driver seat. 3. Remove the seat track.

4. NOTE: Note the position of the seat position sensor locator tab for installation.

Remove the 2 screws and the seat position sensor and bracket.

5. To install, reverse the removal procedure. 6. Repower the SRS.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Accessories and Optional Equipment > Accessory Delay Module > Accessory Delay Relay > Component Information > Diagrams > Diagram Information and Instructions



Accessory Delay Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

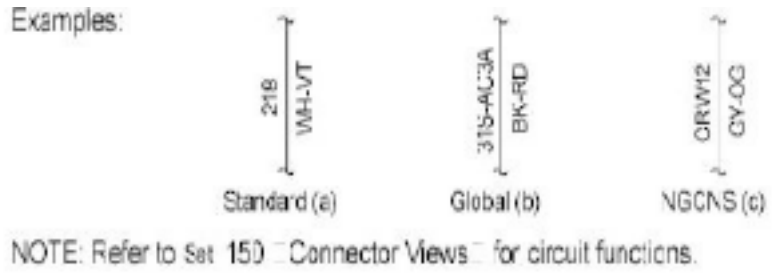
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

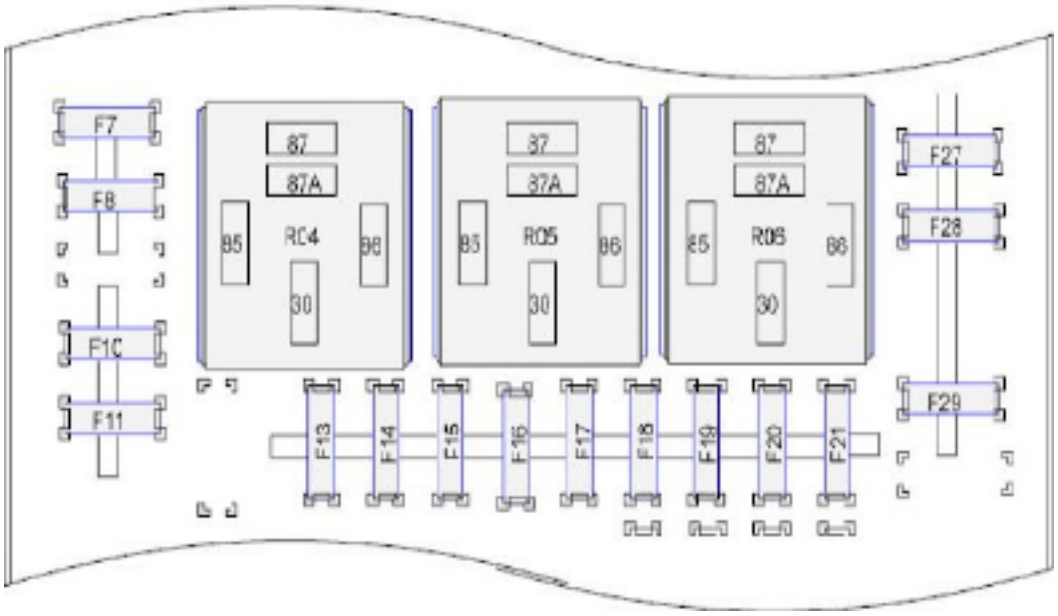
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

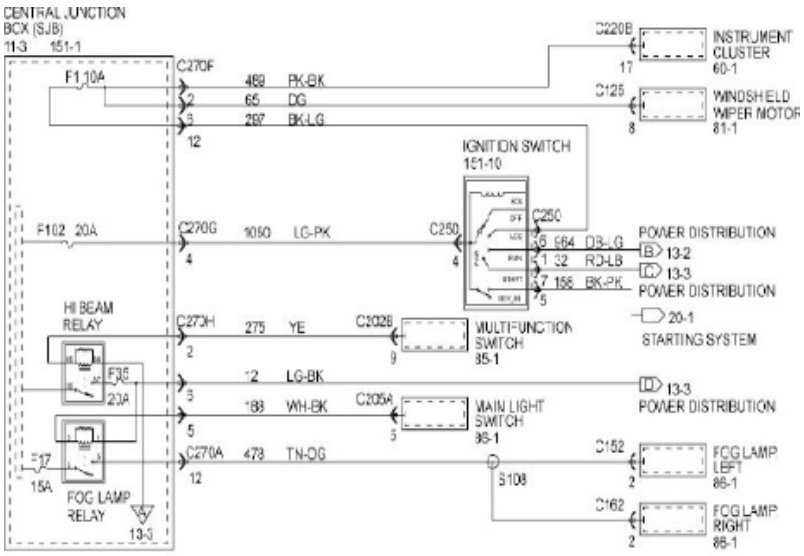
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

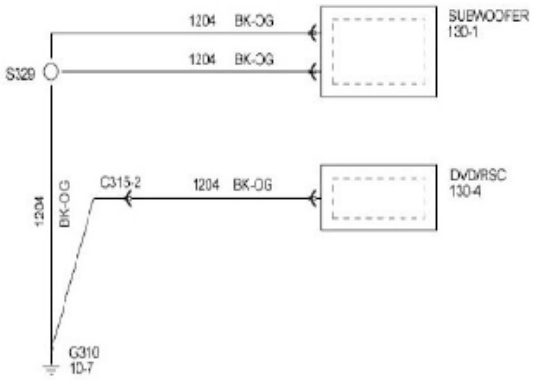
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

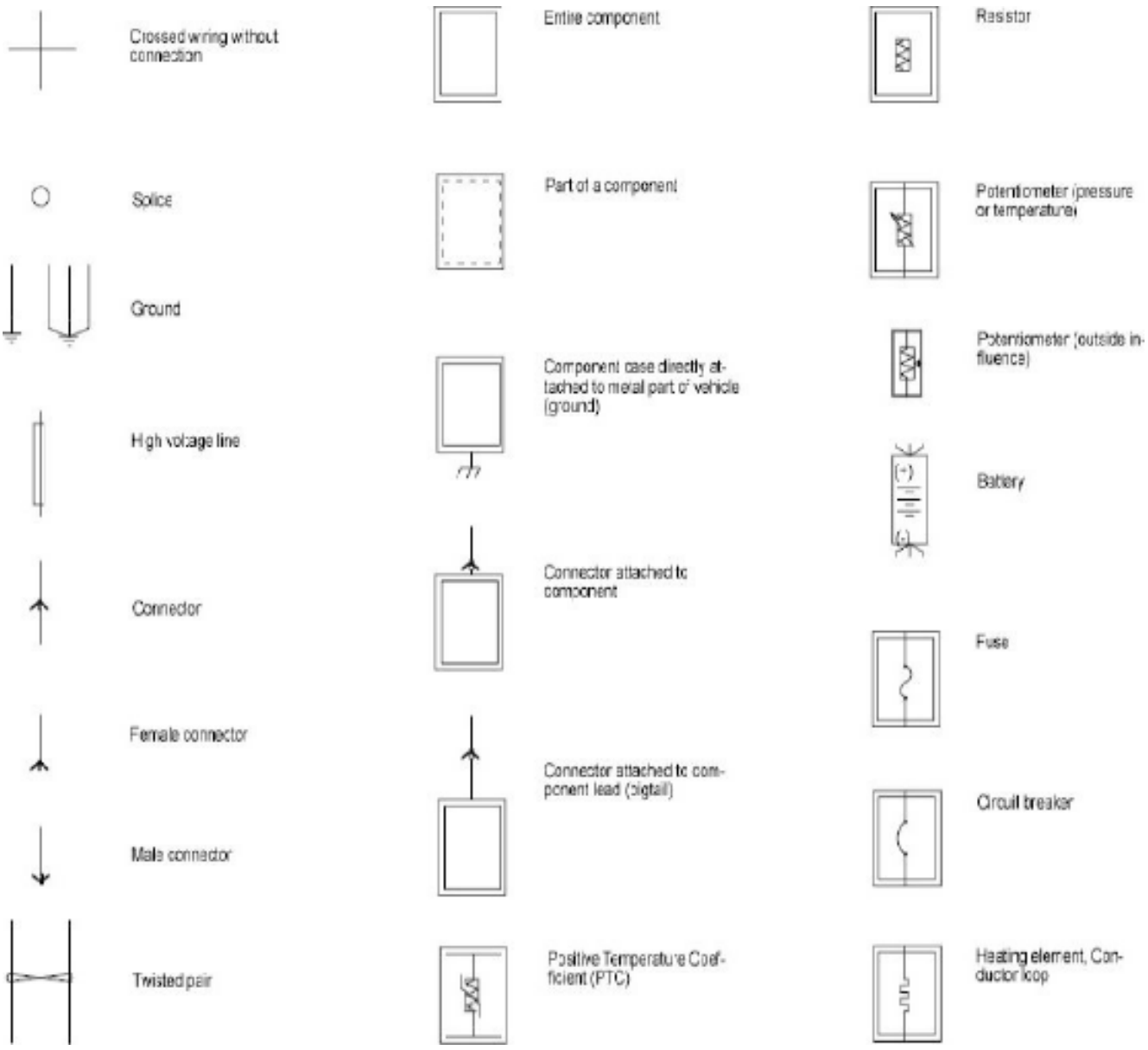
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

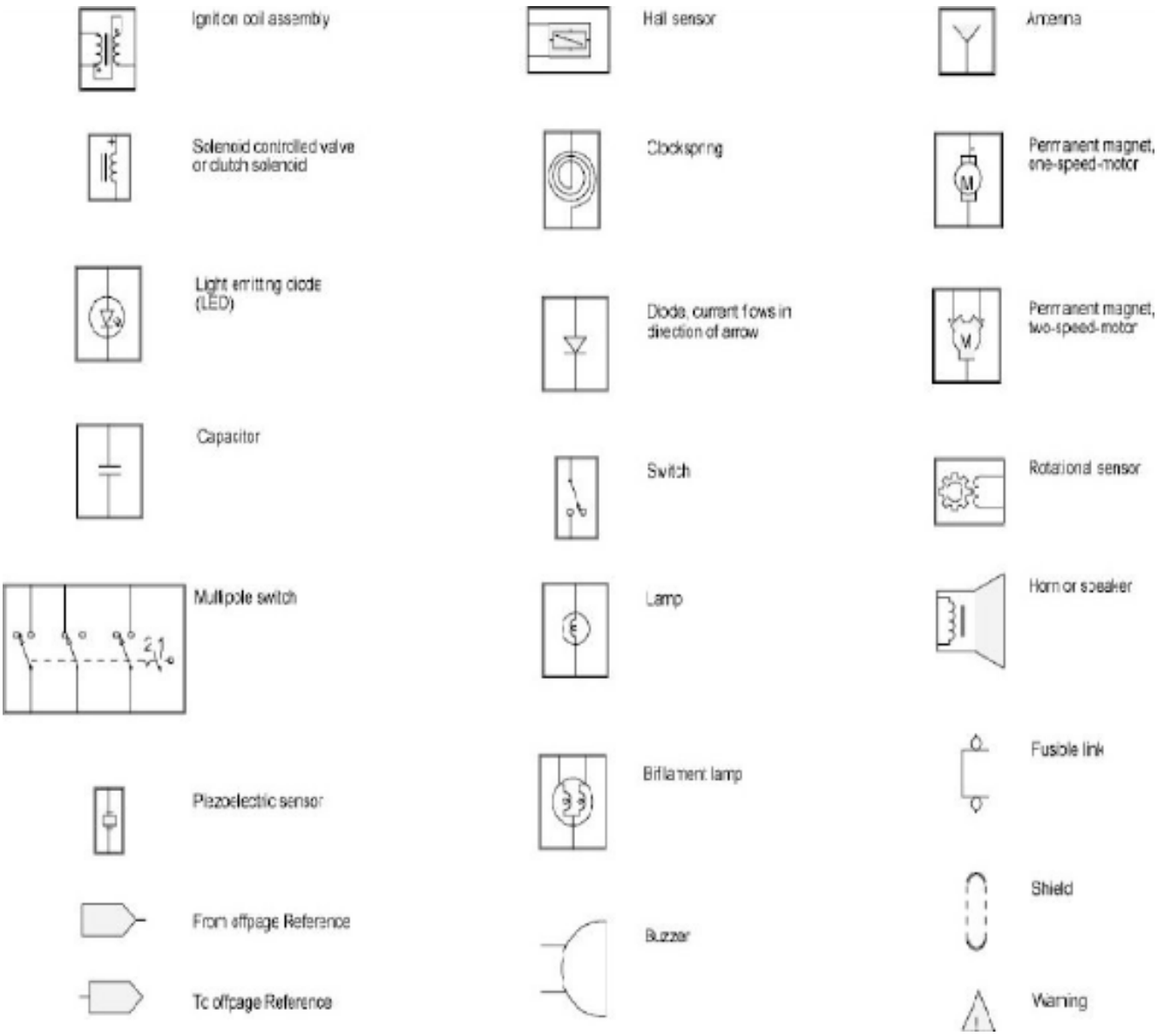
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

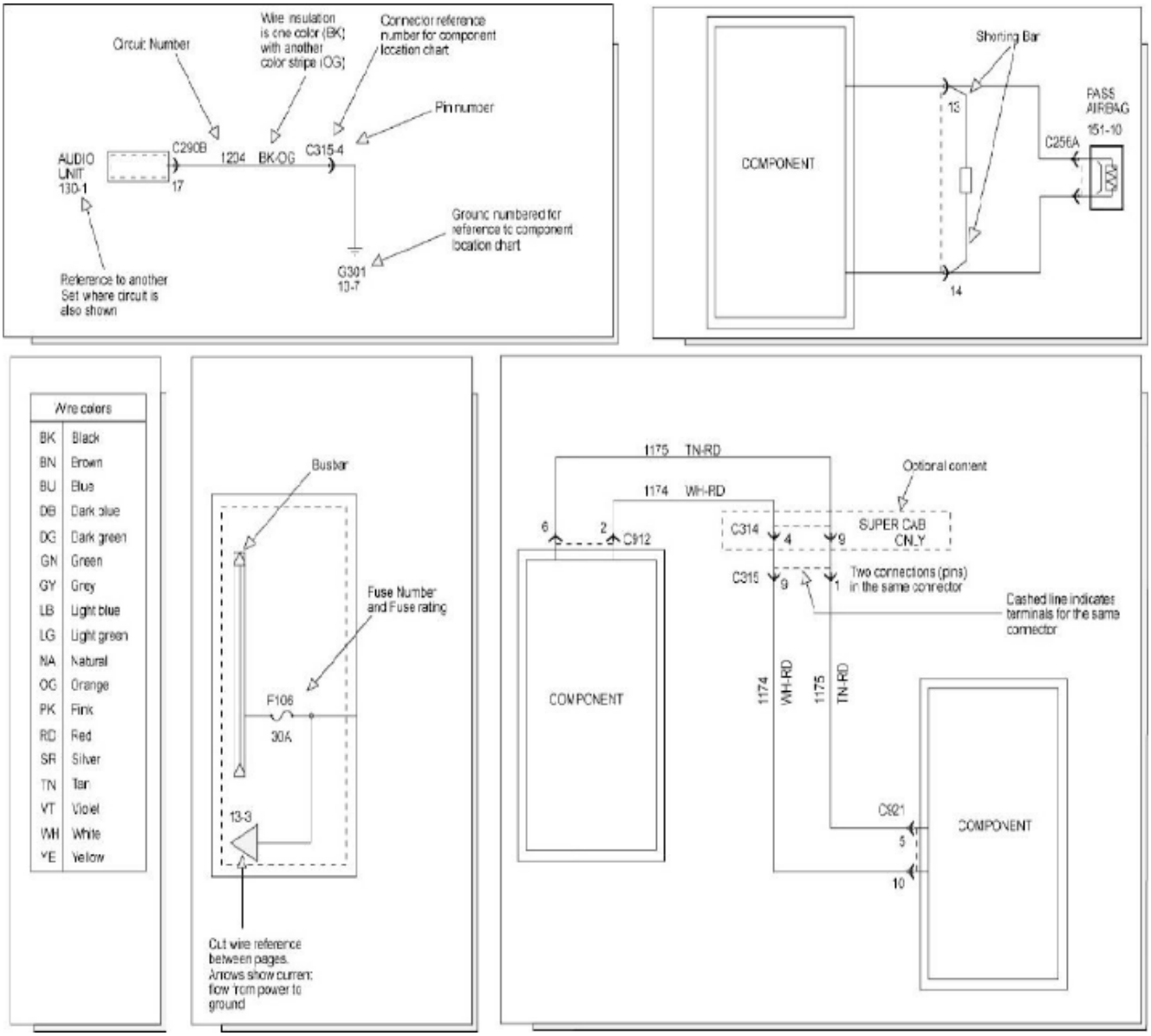
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

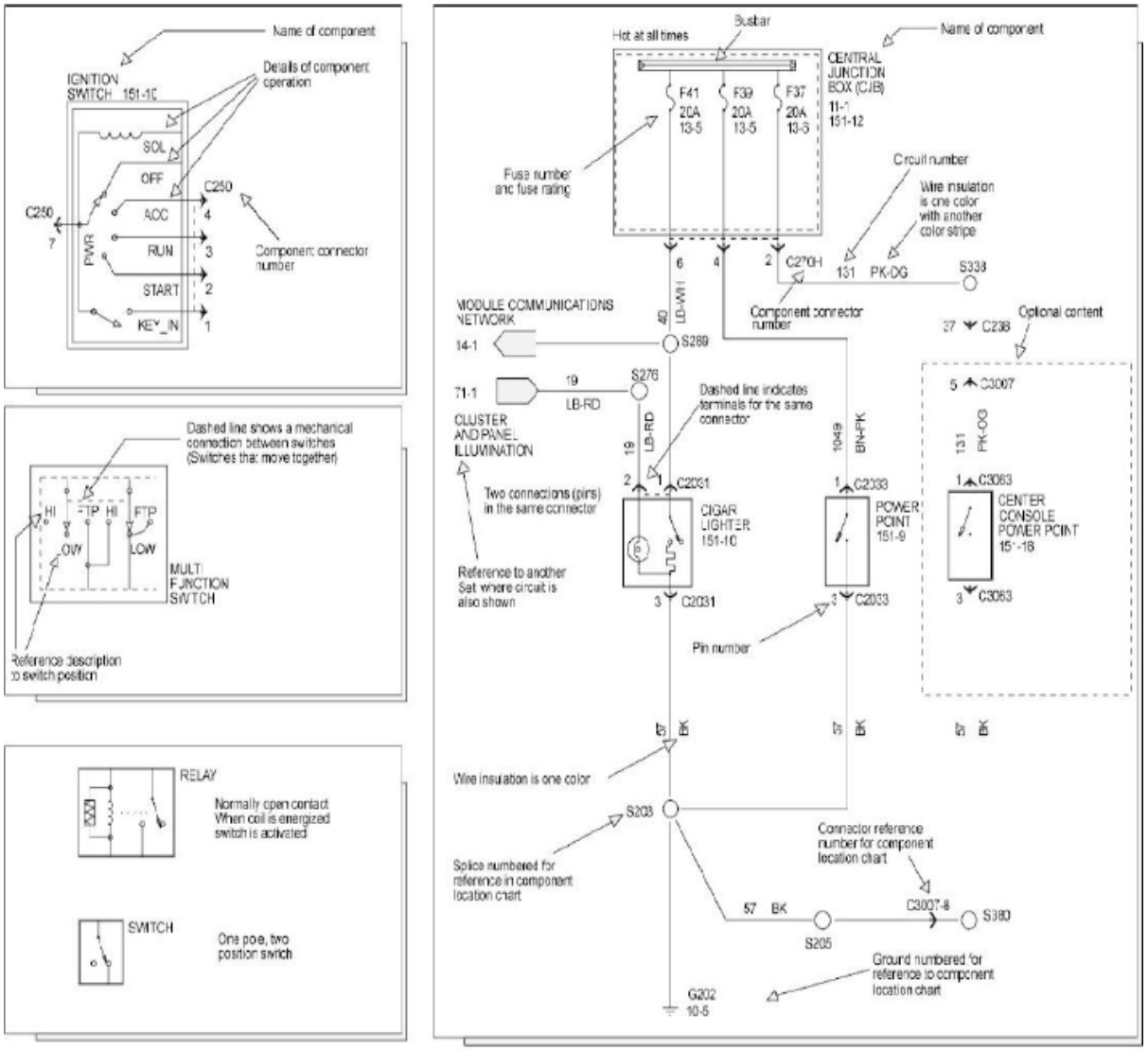
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

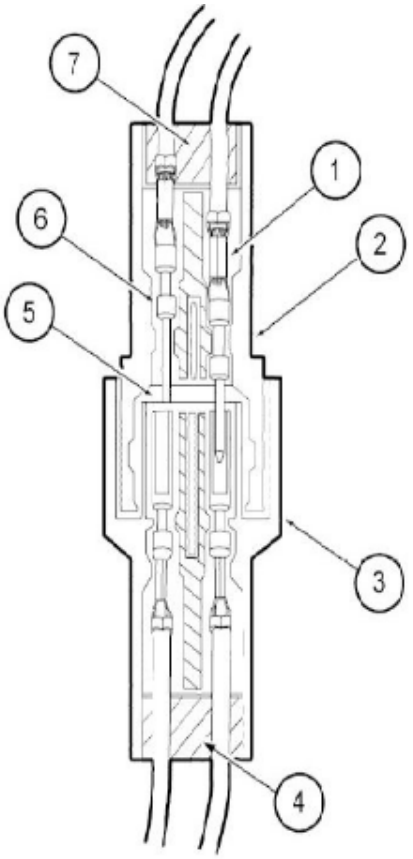


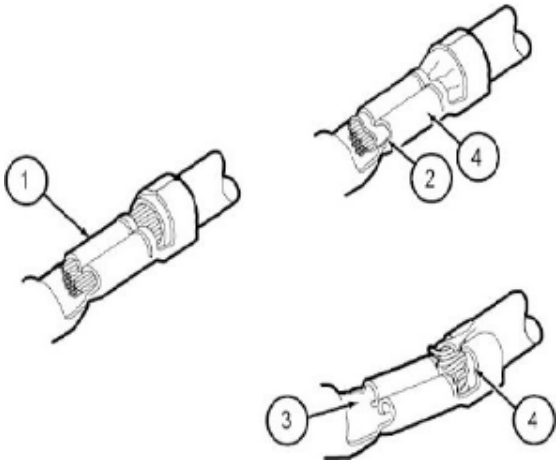
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Accessory Delay Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

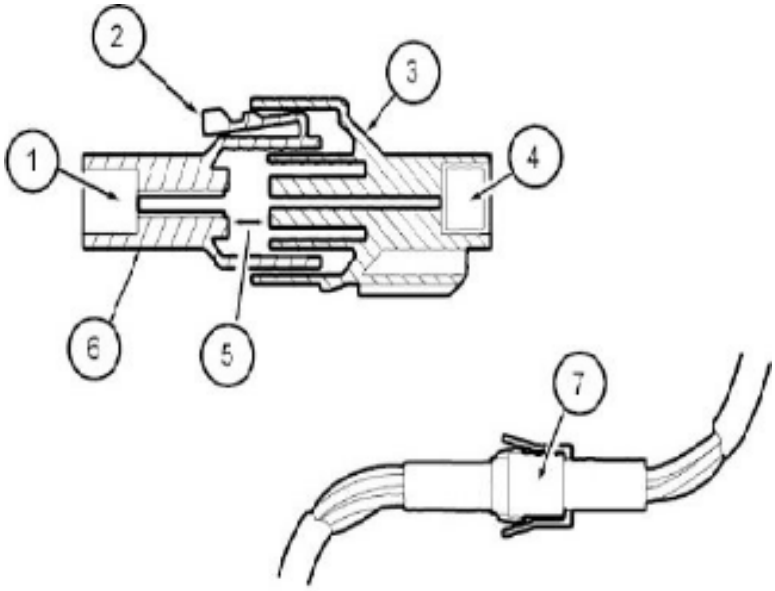
5 = Intermittent contact

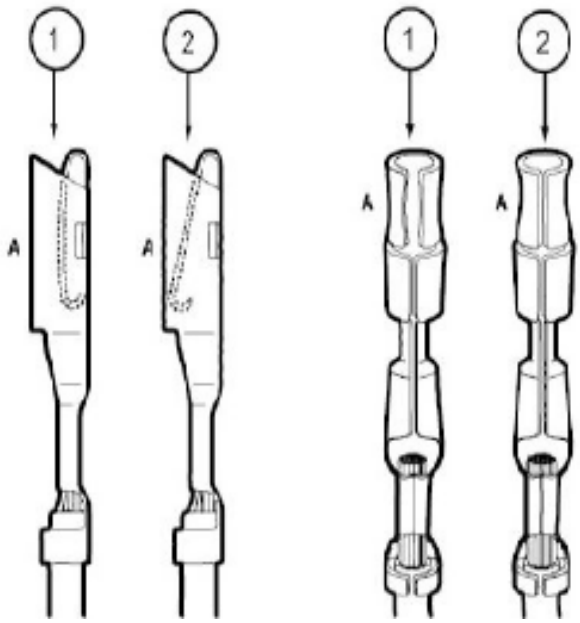
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

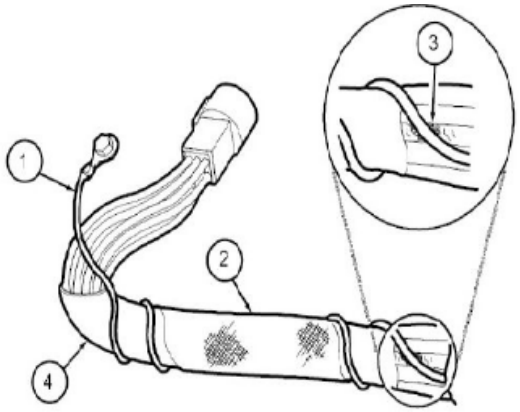
Deformed (enlarged) female terminals

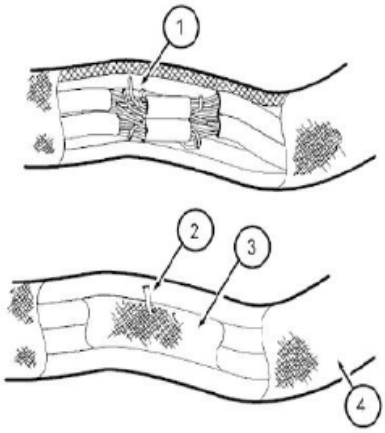
1 = Enlarged

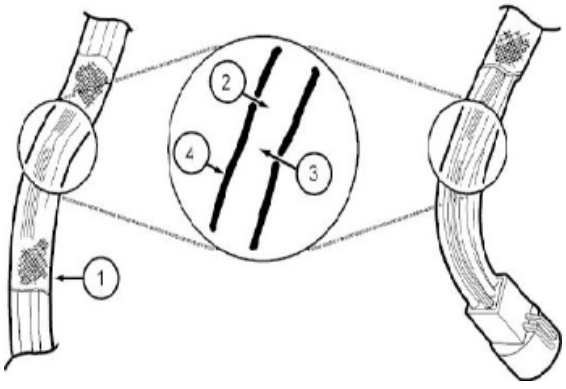
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

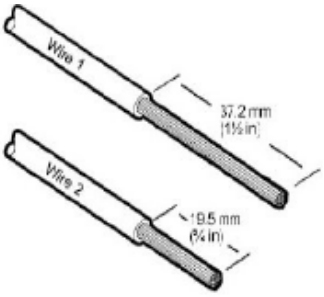
Splice covered 2

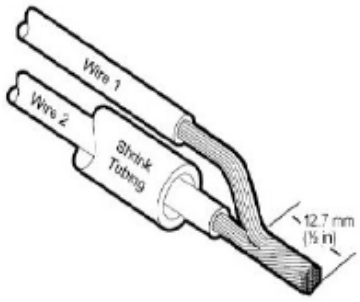
= Wire strand

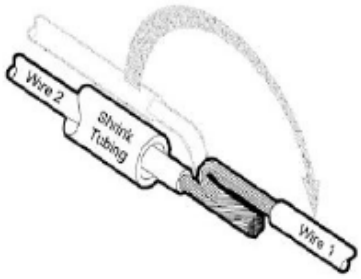
3 = Splice tape

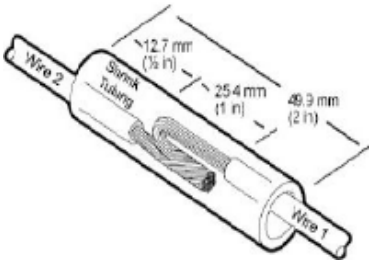
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

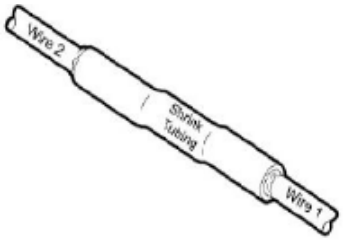
NOTE: -

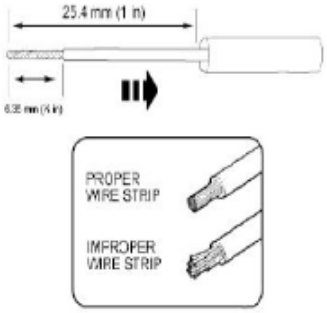
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

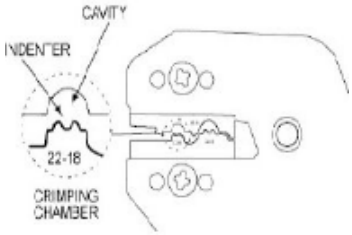
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

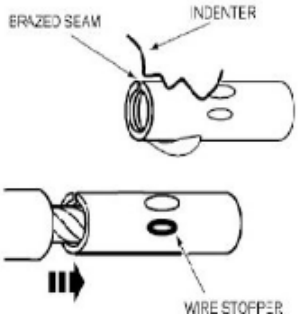
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
6.35 mm (¼ in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

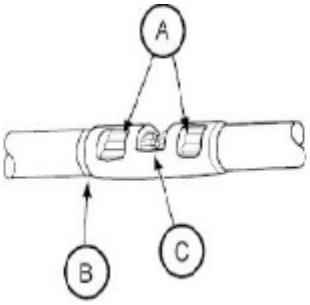
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

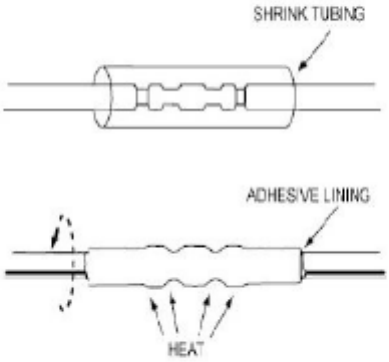
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4□ strip, cut 9 strands	* 1/4□ strip, cut 2 strands	1/4□ strip, no fold	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip, fold 2x dia.	1□ strip, fold 3x dia.
	16-14	* 1/4□ strip, cut 7 strands	1/4□ strip, no fold	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip fold 2x dia	1□ strip, fold 3x dia.	1 1/4□ strip, fold 4x dia.	Not Recommended
	12-10	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip, fold 2x dia.	1□ strip fold 3x dia.	1 1/4□ strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Pigtail only

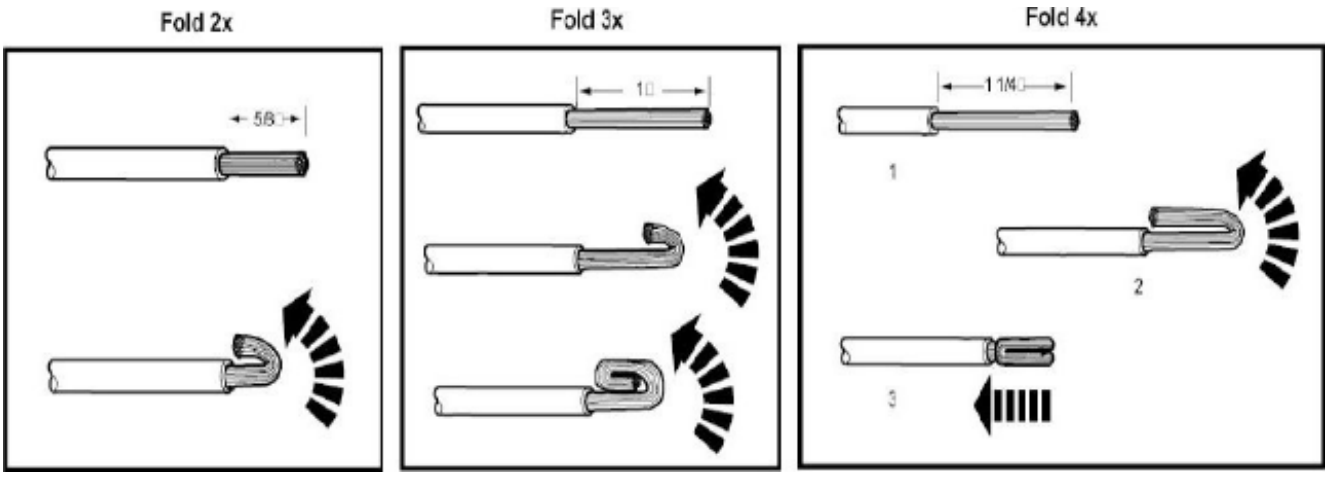
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



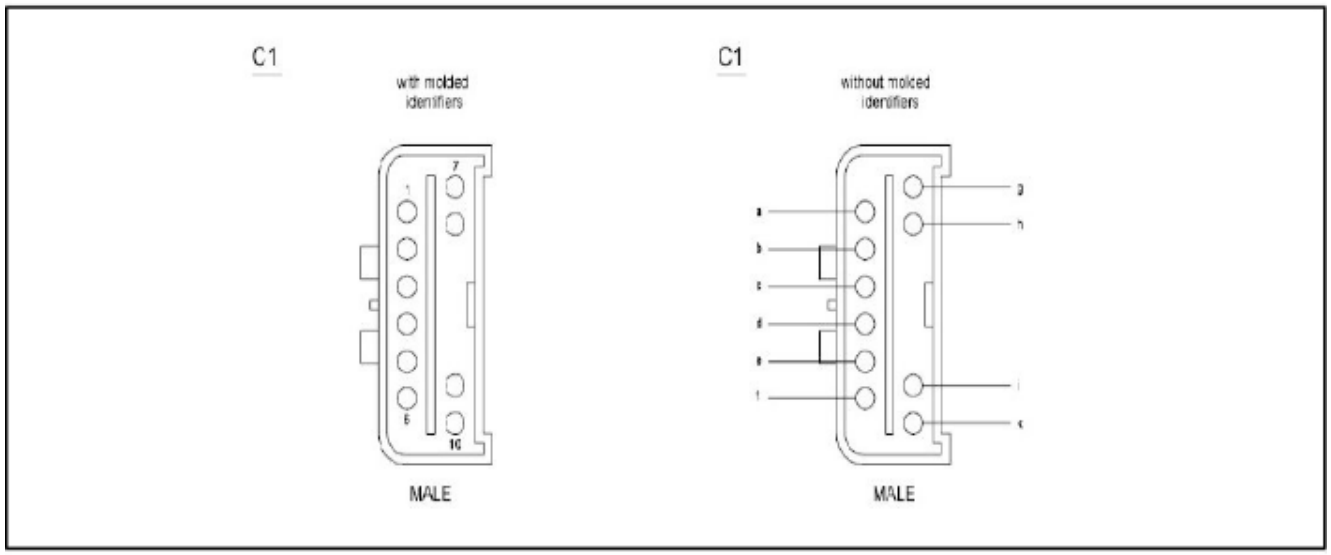
The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step by step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



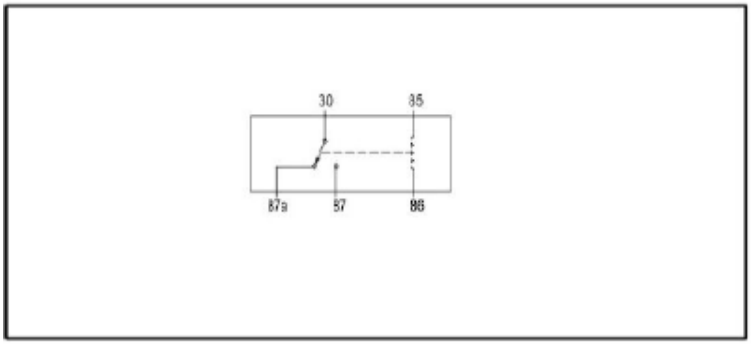
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

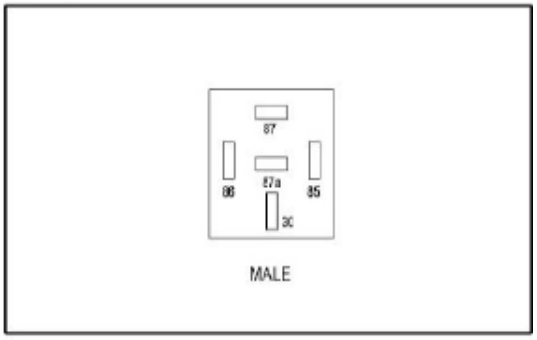
Accessory Delay Relay: Testing and Inspection Mini ISO Relay

Relay □ Mini ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 □ 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

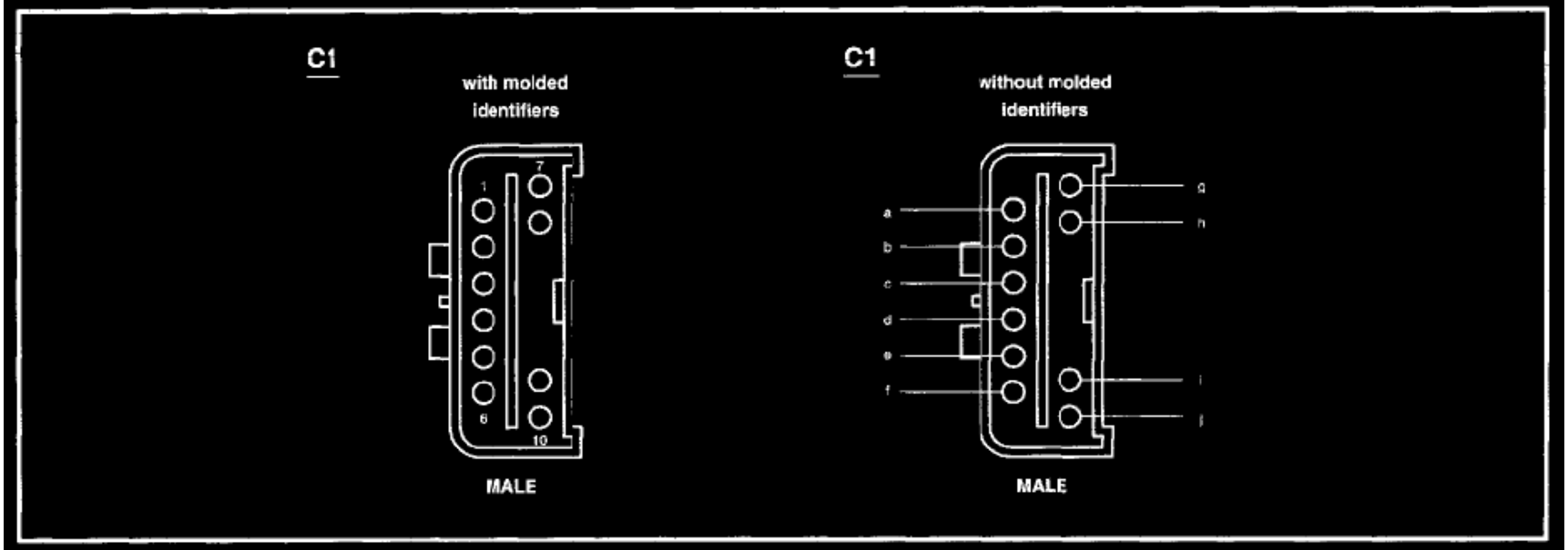
Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step–by–step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



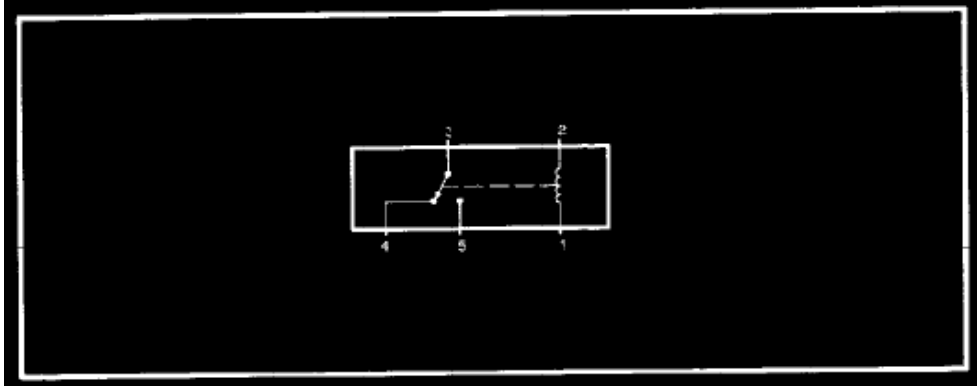
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

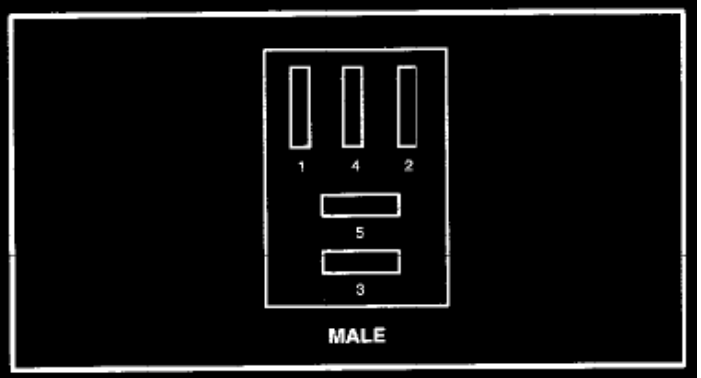
Accessory Delay Relay: Testing and Inspection Micro ISO Relay

Relay – Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63–102Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil – Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

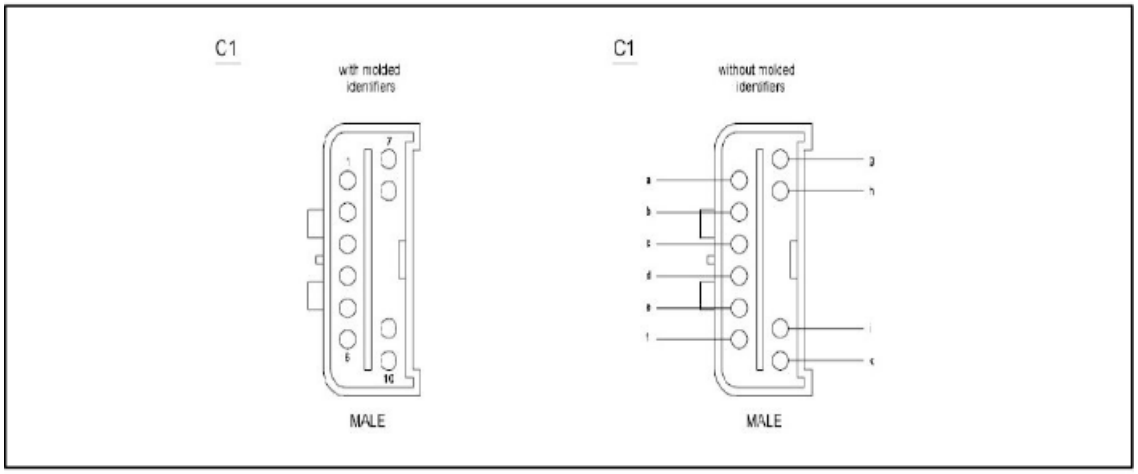
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals

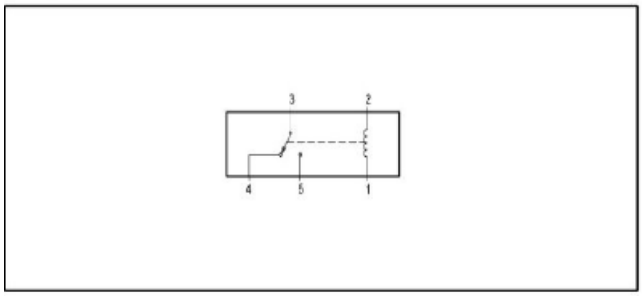


The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

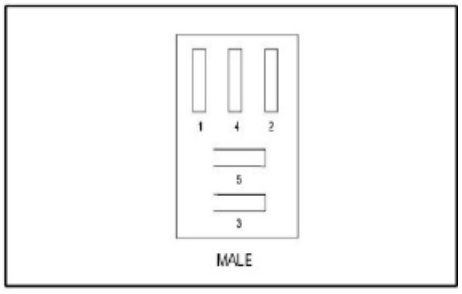
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Relay - Micro ISO

Schematic



Terminals

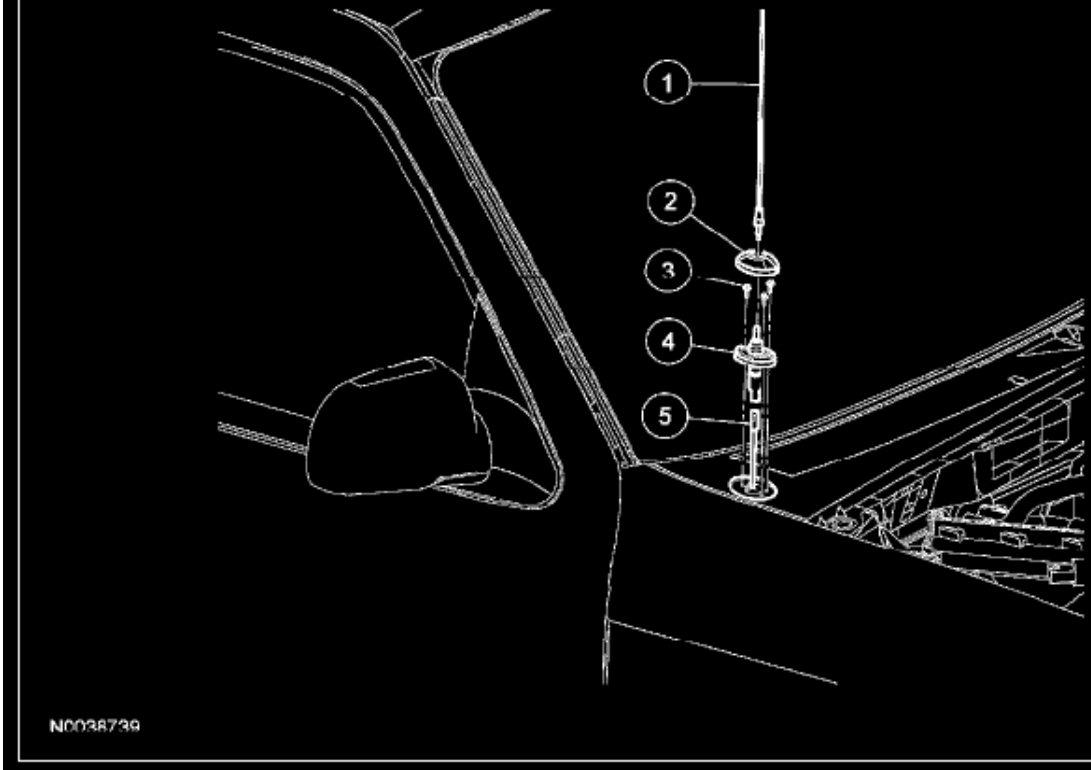


Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63-102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil - Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.



Item	Part Number	Description
1	18813	Antenna mast
2	18A927	Antenna base cover
3	—	Antenna base screws (3 required)
4	19A182	Antenna base
5	—	Antenna cable connector (part of 18812)

Antenna: Service and Repair Antenna

ANTENNA

Removal and Installation

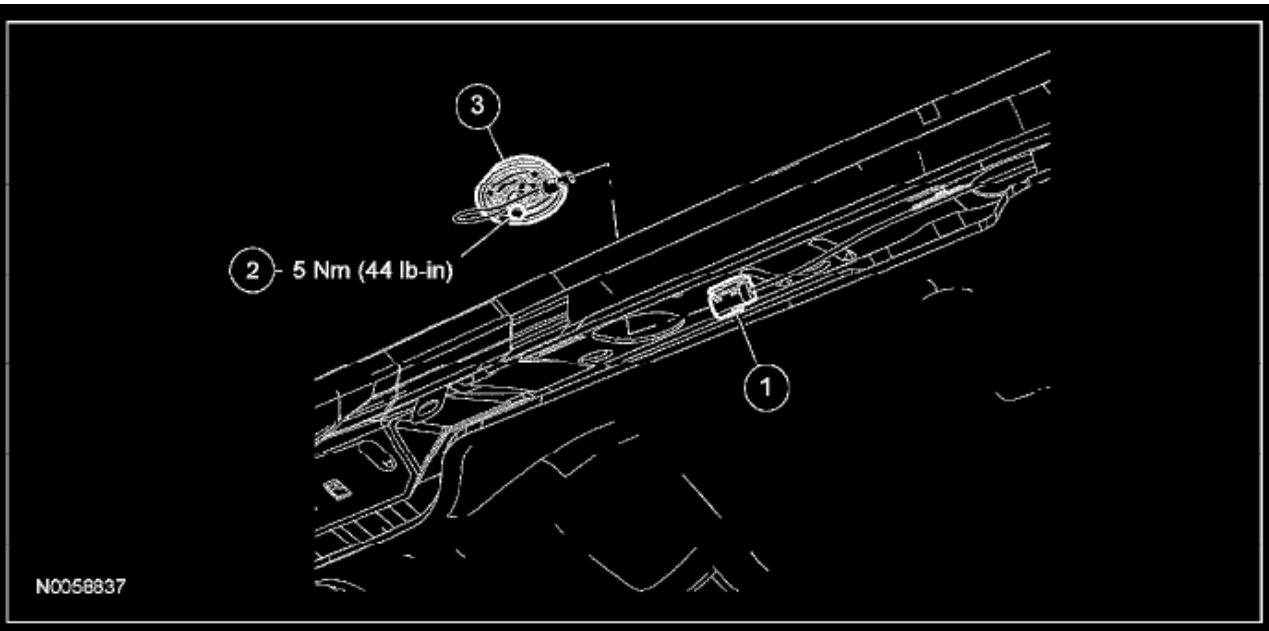
1. Remove the antenna mast. 2. Remove the antenna base cover by prying it from the base.

3. NOTE: Be careful not to allow the antenna cable to fall back into the fender.

Remove the 3 screws and the antenna base. -

Disconnect the antenna cable connector.

4. To install, reverse the removal procedure.



Item	Part Number	Description
1	—	Satellite radio antenna electrical connector (part of 19A397)
2	—	Satellite radio antenna bolt (part of 18C964)
3	18C964	Satellite radio antenna

Antenna: Service and Repair Antenna - Satellite Radio

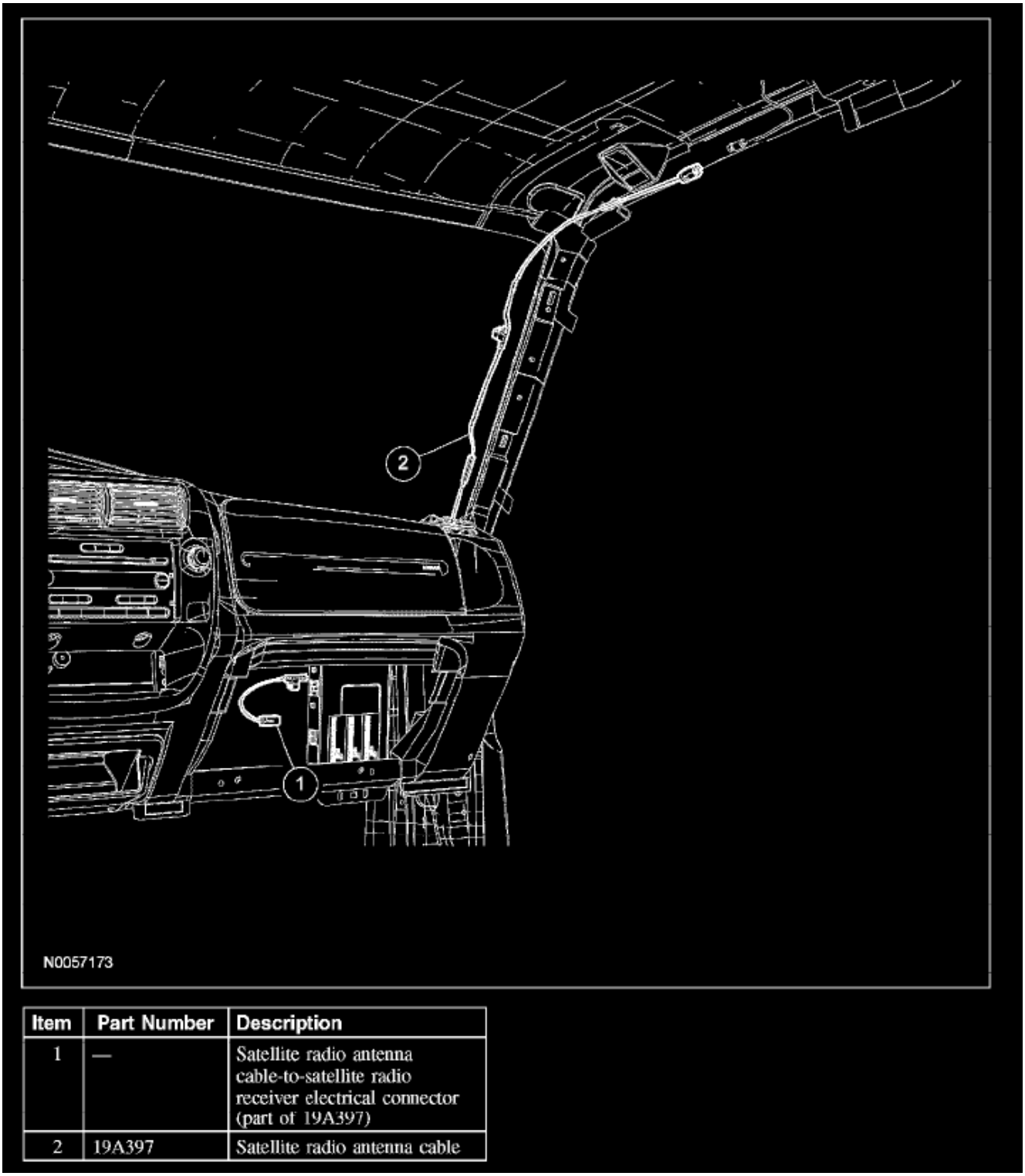
ANTENNA - SATELLITE RADIO

Removal and Installation

1. Remove the RH A-pillar trim panel. 2. Remove the RH visor. 3. Lower the headliner to access the satellite antenna. 4. Disconnect the satellite radio antenna electrical connector. 5. Loosen the bolt and remove the satellite radio antenna.

- To install, tighten to 5 Nm (44 lb-in).

6. To install, reverse the removal procedure.



Item	Part Number	Description
1	—	Satellite radio antenna cable-to-satellite radio receiver electrical connector (part of 19A397)
2	19A397	Satellite radio antenna cable

Antenna: Service and Repair Antenna Cable - Satellite Radio

ANTENNA CABLE - SATELLITE RADIO

Removal and Installation

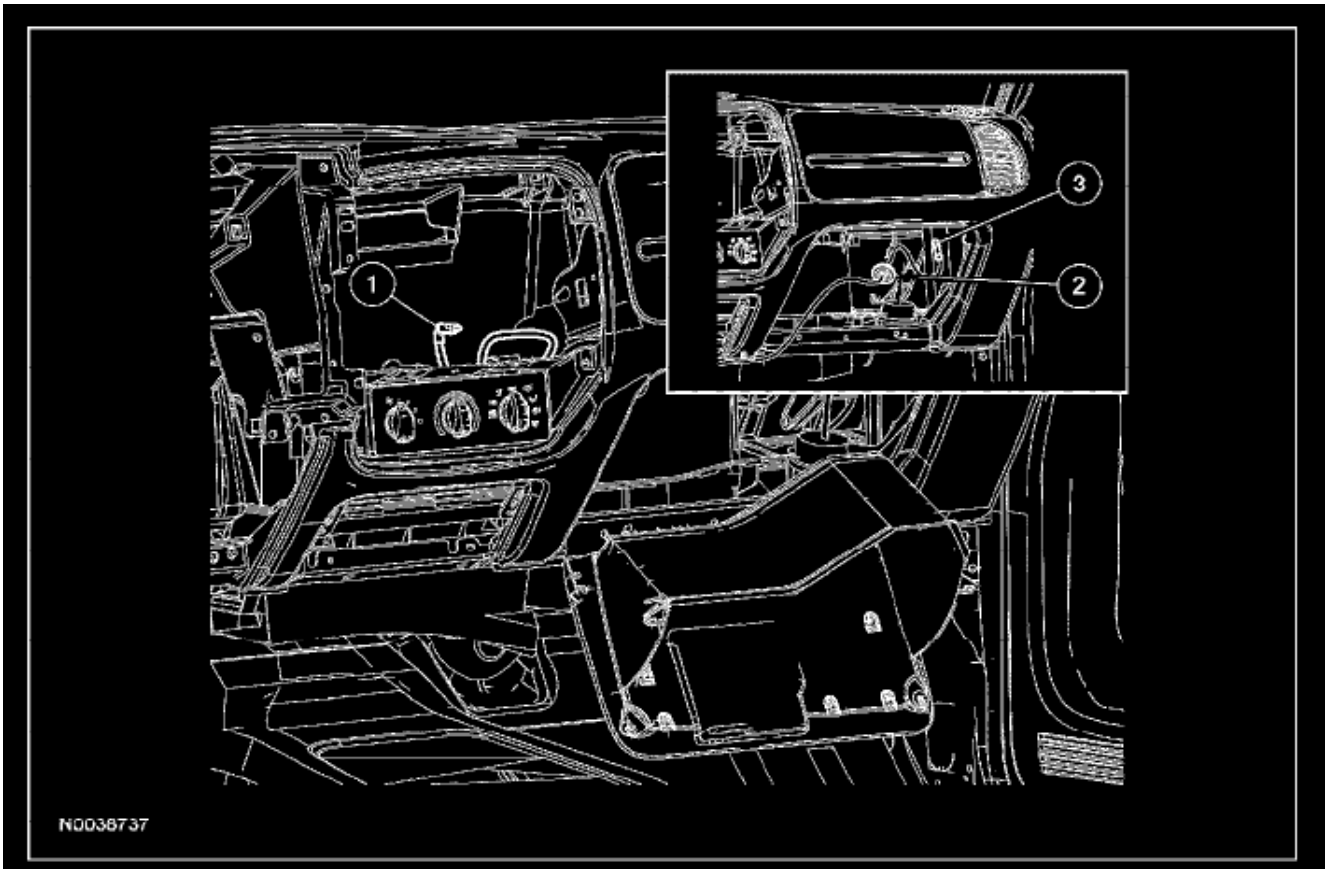
1. Remove the satellite radio antenna. 2. Press the tabs and lower the glove compartment completely. 3. Disconnect the satellite radio antenna cable-to-satellite radio receiver electrical connector.

4. NOTE: For ease of installation, the new satellite radio antenna should be tied to the existing cable and pulled through the side of the instrument

panel.

Remove the satellite radio antenna cable.

5. To install, reverse the removal procedure.



Item	Part Number	Description
1	18812	Antenna cable
2	—	Antenna cable grommet (part of 18812)
3	—	Antenna cable-to-antenna connector (part of 18812)

Antenna: Service and Repair Antenna Cable

ANTENNA CABLE

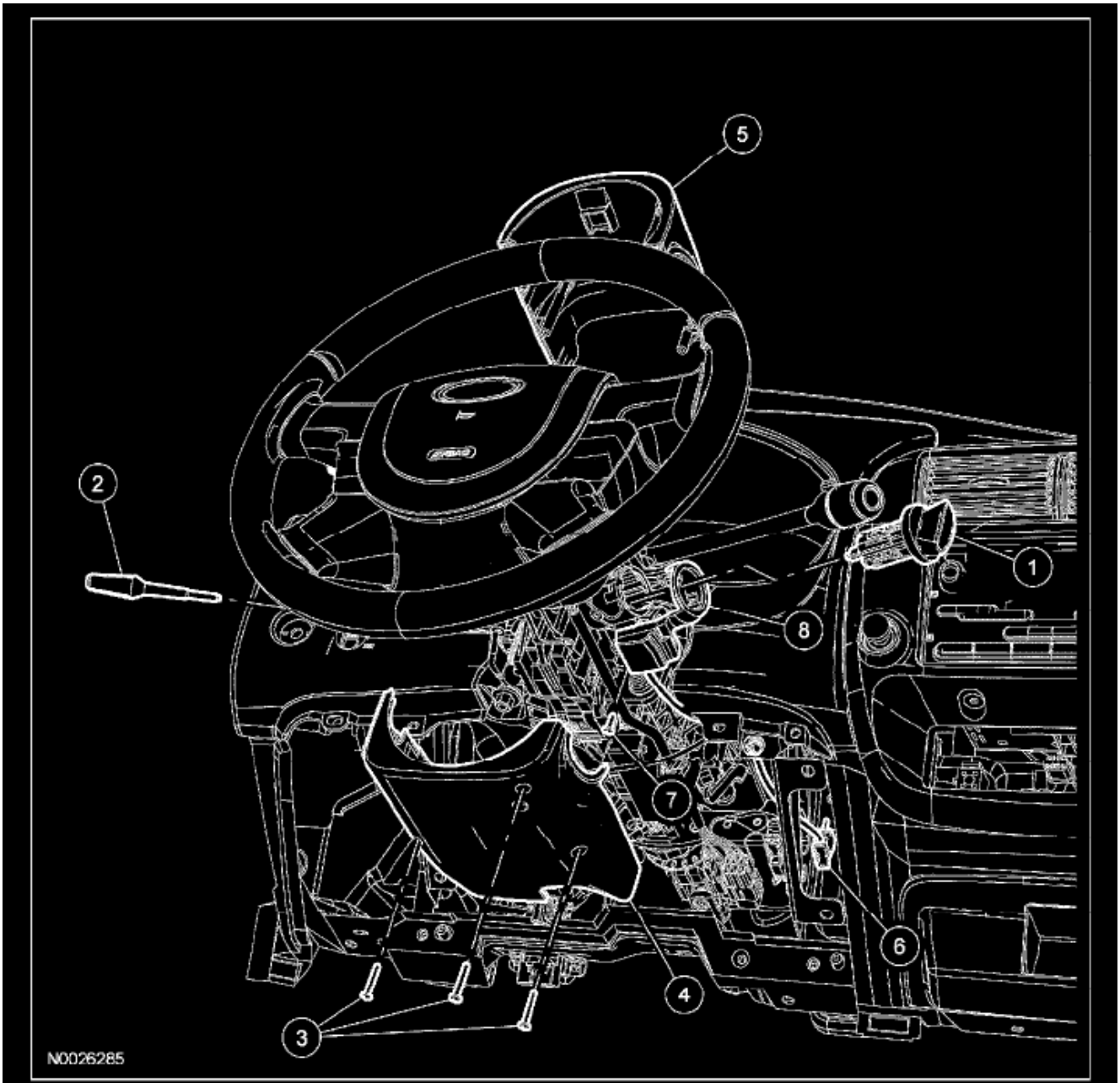
Removal and Installation

1. Remove the antenna. 2. Remove the audio unit. 3. Release the tabs and lower the glove compartment door to the full-open position. 4. Remove the antenna cable.

1 Pull the rubber grommet from the sheet metal.

2 Remove the antenna cable through the glove compartment door opening.

5. To install, reverse the removal procedure.



Item	Part Number	Description
1	11582	Ignition lock cylinder
2	—	Tilt column handle
3	391727-S424	Steering column shroud screws (3 required)
4	3K512	Lower steering column shroud

Item	Part Number	Description
5	3530	Upper steering column shroud
6	—	PATS transceiver electrical connector (part of 14401)
7	W710836-S424	PATS transceiver screw
8	15607	PATS transceiver

(Continued)

Alarm System Transmitter: Service and Repair

PASSIVE ANTI-THEFT SYSTEM (PATS) TRANSCEIVER

Removal and Installation

1. With the ignition lock cylinder in the ON position, press the ignition lock cylinder release button with a suitable tool and pull the ignition lock

cylinder out of the steering column.

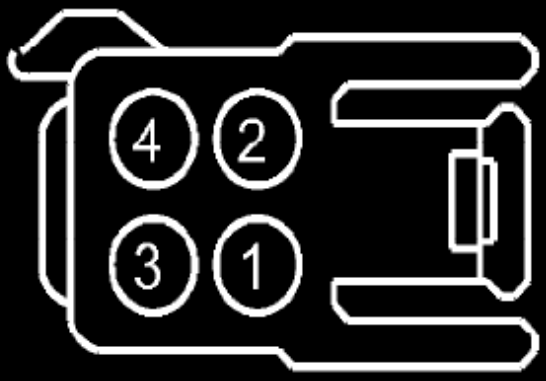
2. Remove the steering column opening panel cover and reinforcement. 3. Remove the tilt column handle. 4. Remove the 3 screws and the upper and lower steering column shrouds. 5. Disconnect the electrical connector. 6. Open the 2 clockspring wiring harness guides. 7. Remove the screw and the PATS transceiver.

8. NOTE: Replacement of the PATS transceiver does not require the PATS keys to be programmed into the IC again.

To install, reverse the removal procedure.

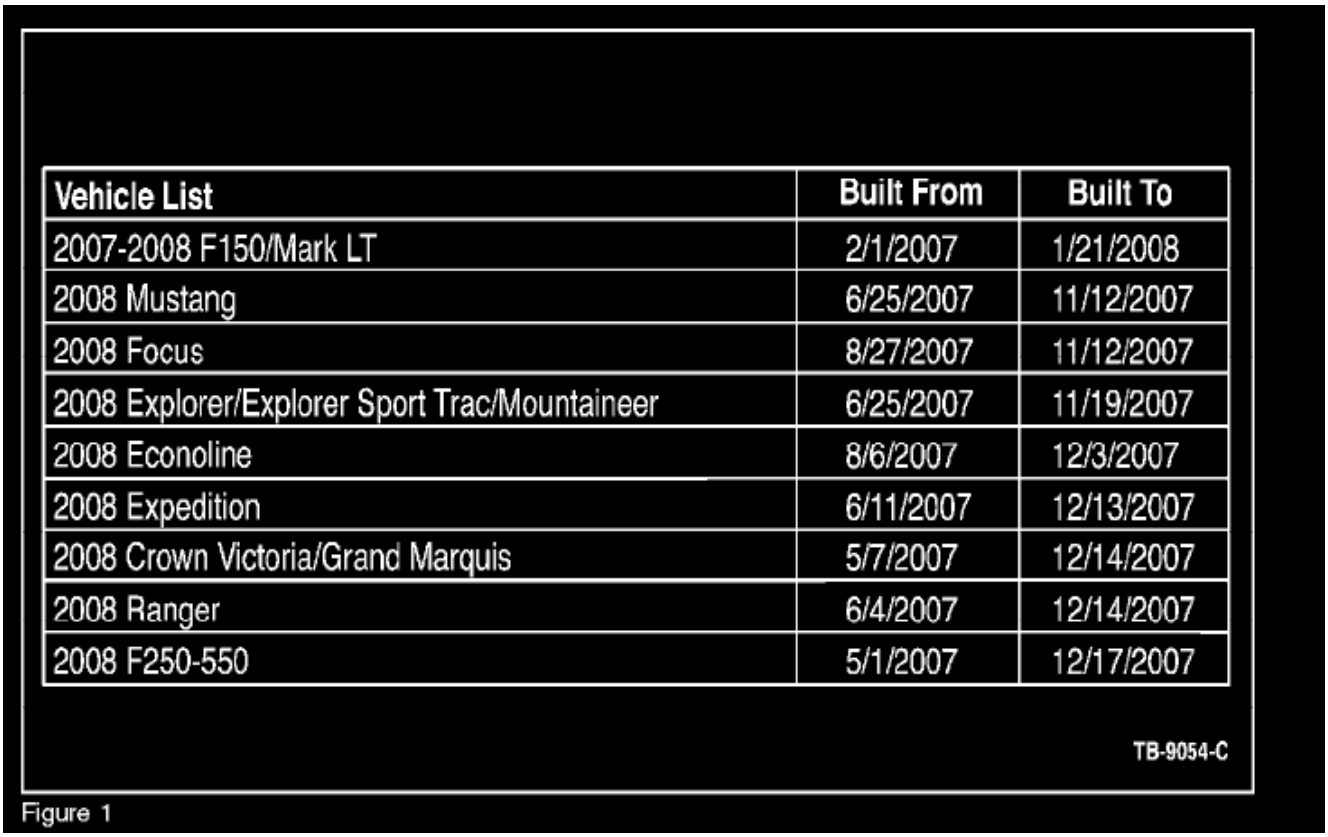
Connector: C2097

Description:	Harness:	Base Part #:
PASSIVE ANTI-THEFT TRANSCEIVER	14401	15607



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD174 (BK-WH)	22	GROUND - TUNNEL	
2	CE517 (BU-GN)	20	DIODE - RELAY POWERTRAIN CONTROL MODULE	
3	VPL56 (BU-GY)	20	RECEIVER - REMOTE RF	
4	VRT07 (VT-BN)	20	CTRL MOD. - POWERTRAIN # TRANSCEIVER TRANSMIT DATA (TX_OUT)	

C2097



Vehicle List	Built From	Built To
2007-2008 F150/Mark LT	2/1/2007	1/21/2008
2008 Mustang	6/25/2007	11/12/2007
2008 Focus	8/27/2007	11/12/2007
2008 Explorer/Explorer Sport Trac/Mountaineer	6/25/2007	11/19/2007
2008 Econoline	8/6/2007	12/3/2007
2008 Expedition	6/11/2007	12/13/2007
2008 Crown Victoria/Grand Marquis	5/7/2007	12/14/2007
2008 Ranger	6/4/2007	12/14/2007
2008 F250-550	5/1/2007	12/17/2007

TB-9054-C

Figure 1

Keyless Entry Transmitter: Customer Interest Keyless Entry - Transmitter May Not Operate

TSB 08-12-9

06/23/08

INOPERATIVE RKE TRANSMITTER (KEY FOB) - DISCHARGED KEY FOB BATTERY

FORD: 2008 Crown Victoria, Focus, Mustang 2007-2008 F-150 2008 E-Series, Expedition, Explorer Sport Trac, Explorer, F-Super Duty, Ranger

LINCOLN: 2007-2008 Mark LT

MERCURY: 2008 Grand Marquis, Mountaineer

ISSUE Some 2007-2008 vehicles equipped with a remote keyless entry (RKE) transmitter may exhibit an inoperative Key Fob due to a discharged Key Fob battery. This may be caused by an internal issue with the Key Fob software. This concern only applies to vehicles built within a specific date range with Key Fobs manufactured within a specific date range.

ACTION Follow the Service Procedure steps to correct the condition.

SERVICE PROCEDURE

NOTE

PERFORMING THIS PROCEDURE WILL HAVE NO EFFECT ON KEY FOB RANGE. REFER TO WORKSHOP MANUAL (WSM), SECTION 501-14 FOR KEY FOB RANGE DIAGNOSTICS.

1. Refer to vehicle list for build date range. (Figure 1)

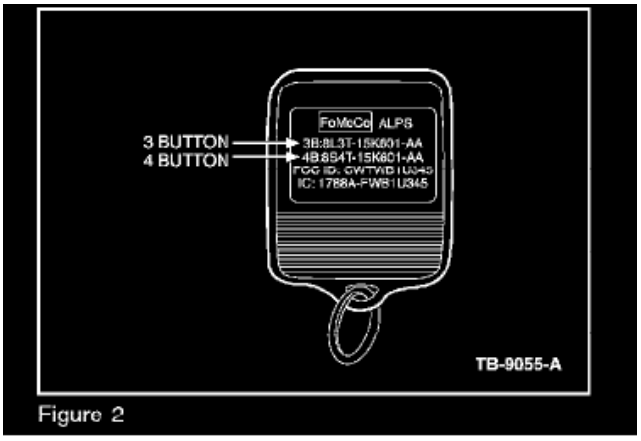


Figure 2

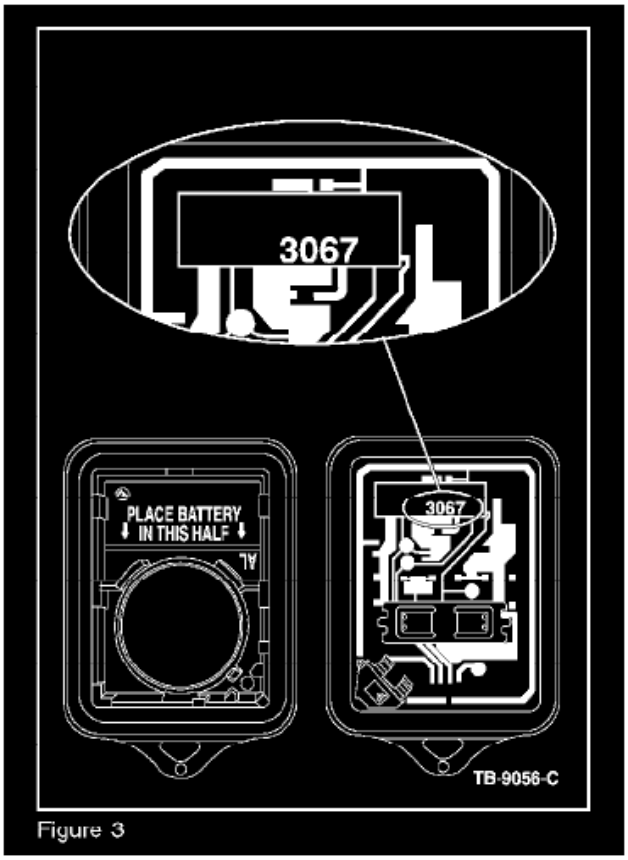


Figure 3

PART NUMBER	PART NAME
8L3Z-15K601-AA	3-Button Key Fob
8S4Z-15K601-A	4-Button Key Fob

a. If the vehicle was built within the date range, then continue with this procedure.

b. If not, then do not proceed. Continue with normal diagnostics per WSM, Section 501-14.

2. Is the vehicle Key Fob part number 8L3T-15K601-AA (3 button) or 8S4T-15K601-AA (4 button)? (Figure 2)

a. Yes - Go to Step 3.

b. No - Do not proceed. Continue with normal diagnostics per WSM, Section 501-14.

3. Using a thin coin, open the Key Fob and inspect manufacturer's date code sticker. The first three digits = day of year. The last digit = year. (Figure 3)

a. If the first 3 digits are equal to or between 005 and 306 (5th day through 306th day) and the last digit is 7 (year), then proceed to Step 4.

b. If the number is outside this specified range, then do not proceed. Continue with normal diagnostics per WSM, Section 501-14.

4. If the Key Fob is inoperative due to a discharged Key Fob battery, and the date code falls within the specified range, then replace Key Fob. Program the new Key Fob transmitter using the IDS RKE Transmitter Programming Procedure. Reassemble old Key Fob for warranty return analysis.

NOTE

KEY FOBS REPLACED UNDER WARRANTY WILL BE REQUESTED FOR ANALYSIS AND VERIFICATION OF THE DATE CODE.

a. IDS RKE Transmitter Programming Procedure

(1) Install known good battery into the suspect Key Fob so that IDS scan tool can identify it.

(2) Connect IDS to vehicle.

(3) From the Main Toolbox tab:

(a) Select - Body.

(b) Select - Security.

(c) Select - Remote Keyless Entry.

(4) Press the "Unlock" button on the suspect Key Fob to view the Transmitter Identification Code (TIC) in IDS.

5. Select "Erase One Key Fob" or the "Erase" button.

6. Select the suspect Key Fob TIC to erase from vehicle memory.

7. Remove battery from suspect Key Fob and reassemble for warranty return.

8. Select "Reprogram a New Keyfob" or the "Program" button.

9. Press the "Unlock" button on the NEW Key Fob.

10. Follow the instructions on the scan tool screen to complete the programming procedure.

WARRANTY STATUS: Eligible Under Provisions Of New Vehicle Limited Warranty Coverage
IMPORTANT: Warranty coverage limits/policies are not altered by a TSB. Warranty coverage limits are determined by the identified causal part.

OPERATION DESCRIPTION TIME

081209A 2008 Focus, Mustang, 0.3 Hr.

Explorer, Explorer Sport Trac, Mountaineer, E-Series, Expedition, Crown Victoria, Grand Marquis, Ranger, F-Super Duty: Replace Key Fob(s), Includes Time To Perform Key Fob Programming Procedure, And Verify Date Code Sticker (Do Not Use With 15601A)

081209A 2007-2008 F-150, Mark 0.3 Hr.

LT: Replace Key Fob(s), Includes Time To Perform Key Fob Programming Procedure, And Verify Date Code Sticker (Do Not Use With 15601A)

NOTE: The information in Technical Service Bulletins is intended for use by trained, professional technicians with the knowledge, tools, and equipment to do the job properly and safely. It informs these technicians of conditions that may occur on some vehicles, or provides information that could assist in proper vehicle service. The procedures should not be performed by "do-it-yourselfers". Do not assume that a condition described affects your car or truck. Contact a Ford, Lincoln, or Mercury dealership to determine whether the Bulletin applies to your vehicle.

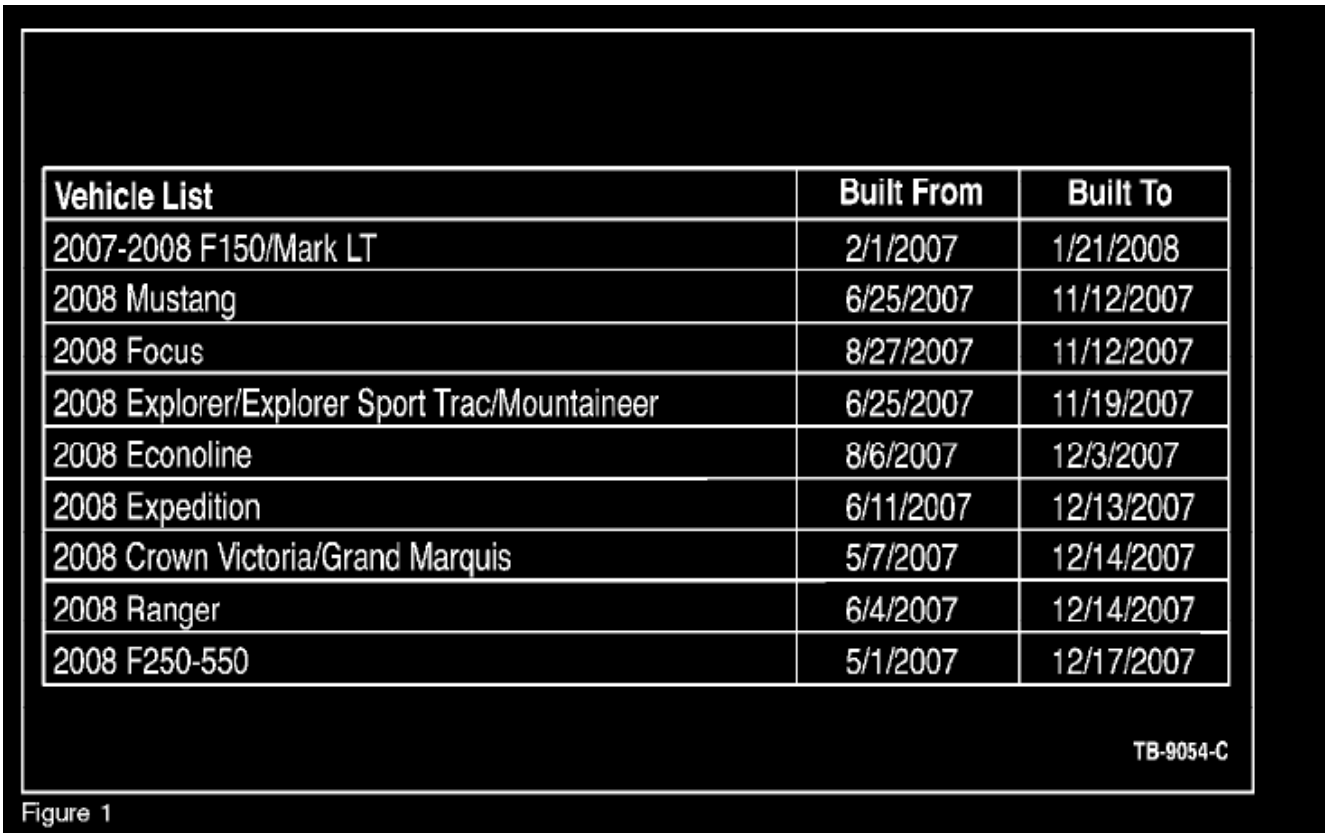
DEALER CODING

CONDITION

BASIC PART NO. CODE

15K601 42

Disclaimer



Vehicle List	Built From	Built To
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2008 Econoline	8/6/2007	12/3/2007
2008 Expedition	6/11/2007	12/13/2007
2008 Crown Victoria/Grand Marquis	5/7/2007	12/14/2007
2008 Ranger	6/4/2007	12/14/2007
2008 F250-550	5/1/2007	12/17/2007

TB-9054-C

Figure 1

Keyless Entry Transmitter: All Technical Service Bulletins Keyless Entry - Transmitter May Not Operate

TSB 08-12-9

06/23/08

INOPERATIVE RKE TRANSMITTER (KEY FOB) - DISCHARGED KEY FOB BATTERY

FORD: 2008 Crown Victoria, Focus, Mustang 2007-2008 F-150 2008 E-Series, Expedition, Explorer Sport Trac, Explorer, F-Super Duty, Ranger

LINCOLN: 2007-2008 Mark LT

MERCURY: 2008 Grand Marquis, Mountaineer

ISSUE Some 2007-2008 vehicles equipped with a remote keyless entry (RKE) transmitter may exhibit an inoperative Key Fob due to a discharged Key Fob battery. This may be caused by an internal issue with the Key Fob software. This concern only applies to vehicles built within a specific date range with Key Fobs manufactured within a specific date range.

ACTION Follow the Service Procedure steps to correct the condition.

SERVICE PROCEDURE

NOTE

PERFORMING THIS PROCEDURE WILL HAVE NO EFFECT ON KEY FOB RANGE. REFER TO WORKSHOP MANUAL (WSM), SECTION 501-14 FOR KEY FOB RANGE DIAGNOSTICS.

1. Refer to vehicle list for build date range. (Figure 1)

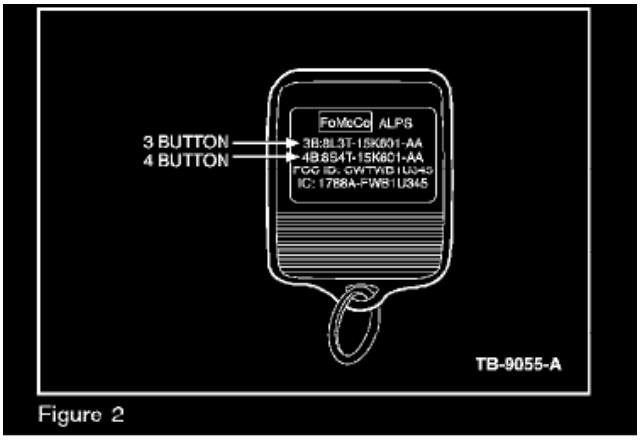


Figure 2

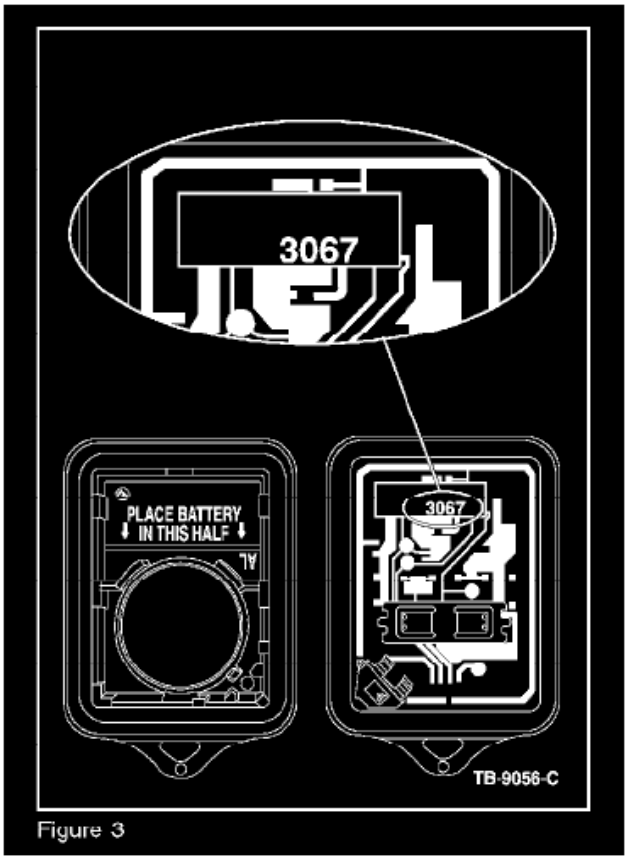


Figure 3

PART NUMBER	PART NAME
8L3Z-15K601-AA	3-Button Key Fob
8S4Z-15K601-A	4-Button Key Fob

a. If the vehicle was built within the date range, then continue with this procedure.

b. If not, then do not proceed. Continue with normal diagnostics per WSM, Section 501-14.

2. Is the vehicle Key Fob part number 8L3T-15K601-AA (3 button) or 8S4T-15K601-AA (4 button)? (Figure 2)

a. Yes - Go to Step 3.

b. No - Do not proceed. Continue with normal diagnostics per WSM, Section 501-14.

3. Using a thin coin, open the Key Fob and inspect manufacturer's date code sticker. The first three digits = day of year. The last digit = year. (Figure 3)

a. If the first 3 digits are equal to or between 005 and 306 (5th day through 306th day) and the last digit is 7 (year), then proceed to Step 4.

b. If the number is outside this specified range, then do not proceed. Continue with normal diagnostics per WSM, Section 501-14.

4. If the Key Fob is inoperative due to a discharged Key Fob battery, and the date code falls within the specified range, then replace Key Fob. Program the new Key Fob transmitter using the IDS RKE Transmitter Programming Procedure. Reassemble old Key Fob for warranty return analysis.

NOTE

KEY FOBS REPLACED UNDER WARRANTY WILL BE REQUESTED FOR ANALYSIS AND VERIFICATION OF THE DATE CODE.

a. IDS RKE Transmitter Programming Procedure

(1) Install known good battery into the suspect Key Fob so that IDS scan tool can identify it.

(2) Connect IDS to vehicle.

(3) From the Main Toolbox tab:

(a) Select - Body.

(b) Select - Security.

(c) Select - Remote Keyless Entry.

(4) Press the "Unlock" button on the suspect Key Fob to view the Transmitter Identification Code (TIC) in IDS.

5. Select "Erase One Key Fob" or the "Erase" button.

6. Select the suspect Key Fob TIC to erase from vehicle memory.

7. Remove battery from suspect Key Fob and reassemble for warranty return.

8. Select "Reprogram a New Keyfob" or the "Program" button.

9. Press the "Unlock" button on the NEW Key Fob.

10. Follow the instructions on the scan tool screen to complete the programming procedure.

WARRANTY STATUS: Eligible Under Provisions Of New Vehicle Limited Warranty Coverage
IMPORTANT: Warranty coverage limits/policies are not altered by a TSB. Warranty coverage limits are determined by the identified causal part.

OPERATION DESCRIPTION TIME

081209A 2008 Focus, Mustang, 0.3 Hr.

Explorer, Explorer Sport Trac, Mountaineer, E-Series, Expedition, Crown Victoria, Grand Marquis, Ranger, F-Super Duty: Replace Key Fob(s), Includes Time To Perform Key Fob Programming Procedure, And Verify Date Code Sticker (Do Not Use With 15601A)

081209A 2007-2008 F-150, Mark 0.3 Hr.

LT: Replace Key Fob(s), Includes Time To Perform Key Fob Programming Procedure, And Verify Date Code Sticker (Do Not Use With 15601A)

NOTE: The information in Technical Service Bulletins is intended for use by trained, professional technicians with the knowledge, tools, and equipment to do the job properly and safely. It informs these technicians of conditions that may occur on some vehicles, or provides information that could assist in proper vehicle service. The procedures should not be performed by "do-it-yourselfers". Do not assume that a condition described affects your car or truck. Contact a Ford, Lincoln, or Mercury dealership to determine whether the Bulletin applies to your vehicle.

DEALER CODING

CONDITION

BASIC PART NO. CODE

15K601 42

Disclaimer

Keyless Entry Transmitter: Testing and Inspection

REMOTE KEYLESS ENTRY TRANSMITTER PROGRAMMING

CAUTION: All remote keyless entry (RKE) transmitters must be programmed at the same time.

1. Before entering the program mode, the vehicle must be electronically unlocked with the RKE transmitter or the door lock control switch while the

driver door is open.

2. Turn the ignition switch from OFF to RUN 8 times within 10 seconds, with the eighth turn ending in RUN. If the module successfully enters

program mode, it locks and then unlocks all the doors.

3. Within 20 seconds, press any button on an RKE transmitter and the doors lock and then unlock to confirm that each RKE transmitter is

programmed. Repeat this step for each RKE transmitter.

4. If the door locks do not respond for any RKE transmitter, wait several seconds and press the button again. If the door locks still fail to respond,

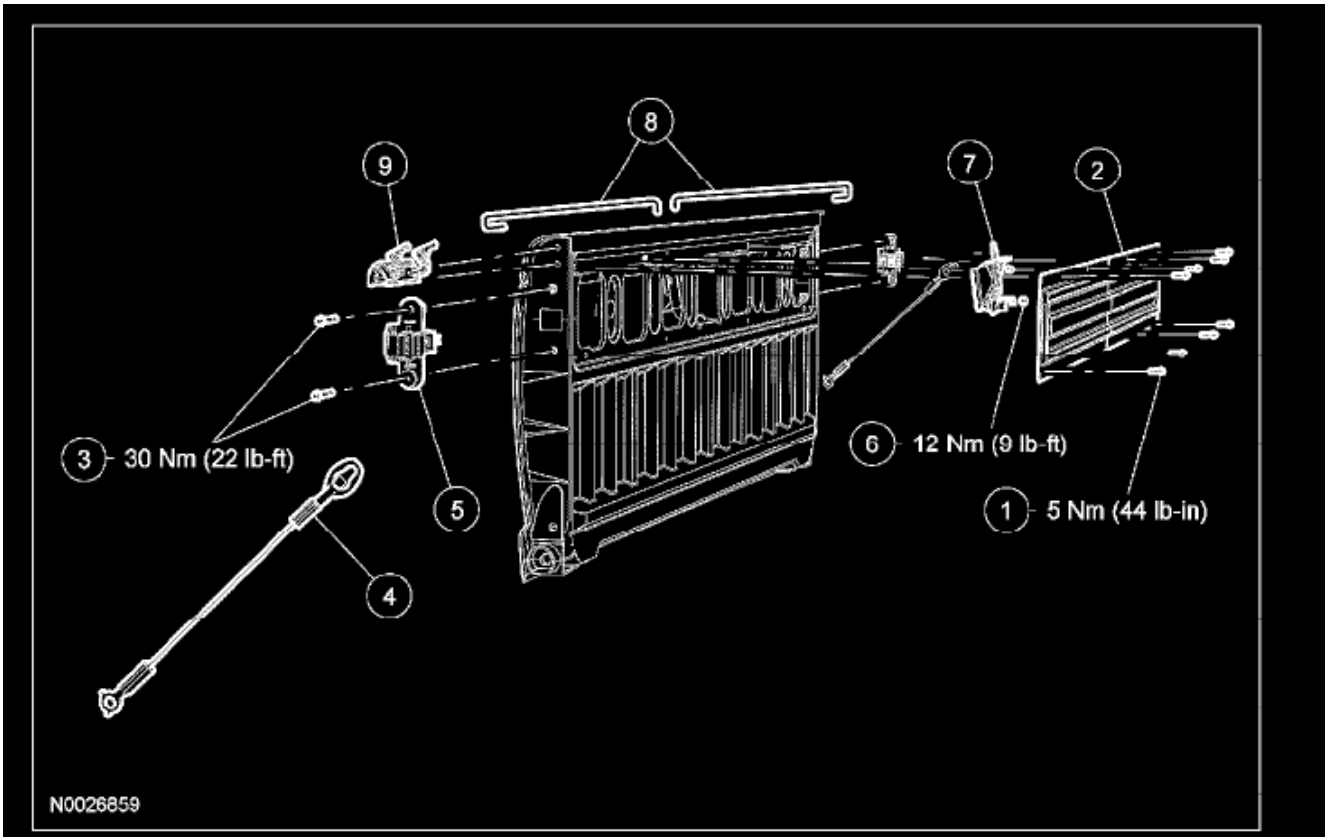
refer to Inspection and Verification. Make sure that no more than the maximum number of RKE transmitters is being programmed. See: Body and Frame/Locks/Power Locks/Testing and Inspection/Initial Inspection and Diagnostic Overview/Inspection and Verification

5. Exiting the programming mode is accomplished if 1 of the following occurs:

- The key transitions to the OFF position.

- 20 seconds have passed since entering programming mode or since the last RKE transmitter was programmed.

- The maximum number of RKE transmitters have been programmed.



Item	Part Number	Description
1	N806149-S439	Tailgate access cover screws (8 required)
2	9943121	Tailgate access cover
3	W706729	Tailgate latch bolts (2 required)
4	9943052/ 9943053	Tailgate support cables (RH/LH)
5	9943150/ 9943151	Tailgate latch (RH/LH)

Item	Part Number	Description
6	N620480-S438	Tailgate latch remote control nuts (2 required)
7	9943170	Tailgate latch remote control
8	99431A78	Tailgate latch actuating rods (2 required)
9	9943400	Tailgate release handle

(Continued)

Keyless Entry Transmitter: Service and Repair

TAILGATE LATCH REMOTE CONTROL

Exploded View

Removal and Installation

1. Remove the 8 screws and the tailgate access cover.

- To install, tighten to 5 Nm (44 lb-in).

2. Open the tailgate latch actuating rod retainers and disconnect the tailgate latch actuating rods from the tailgate latch remote control. 3. Remove the 2 tailgate latch remote control nuts.

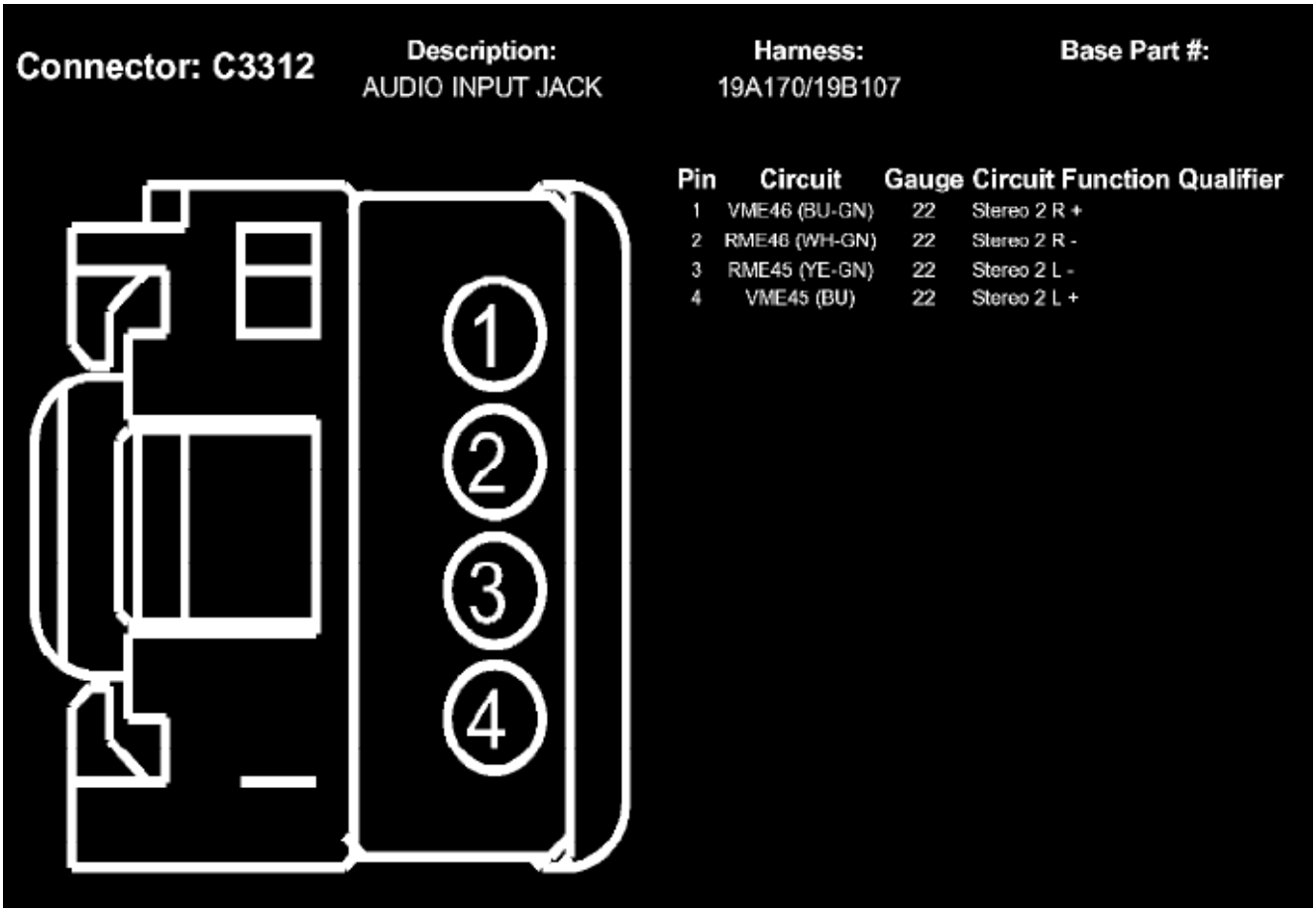
- To install, tighten to 12 Nm (9 lb-ft).

4. Remove the tailgate latch remote control.

5. NOTE: Prior to installation, remove the slack in the tailgate latch release links by pulling the tailgate latch release links to the center of the

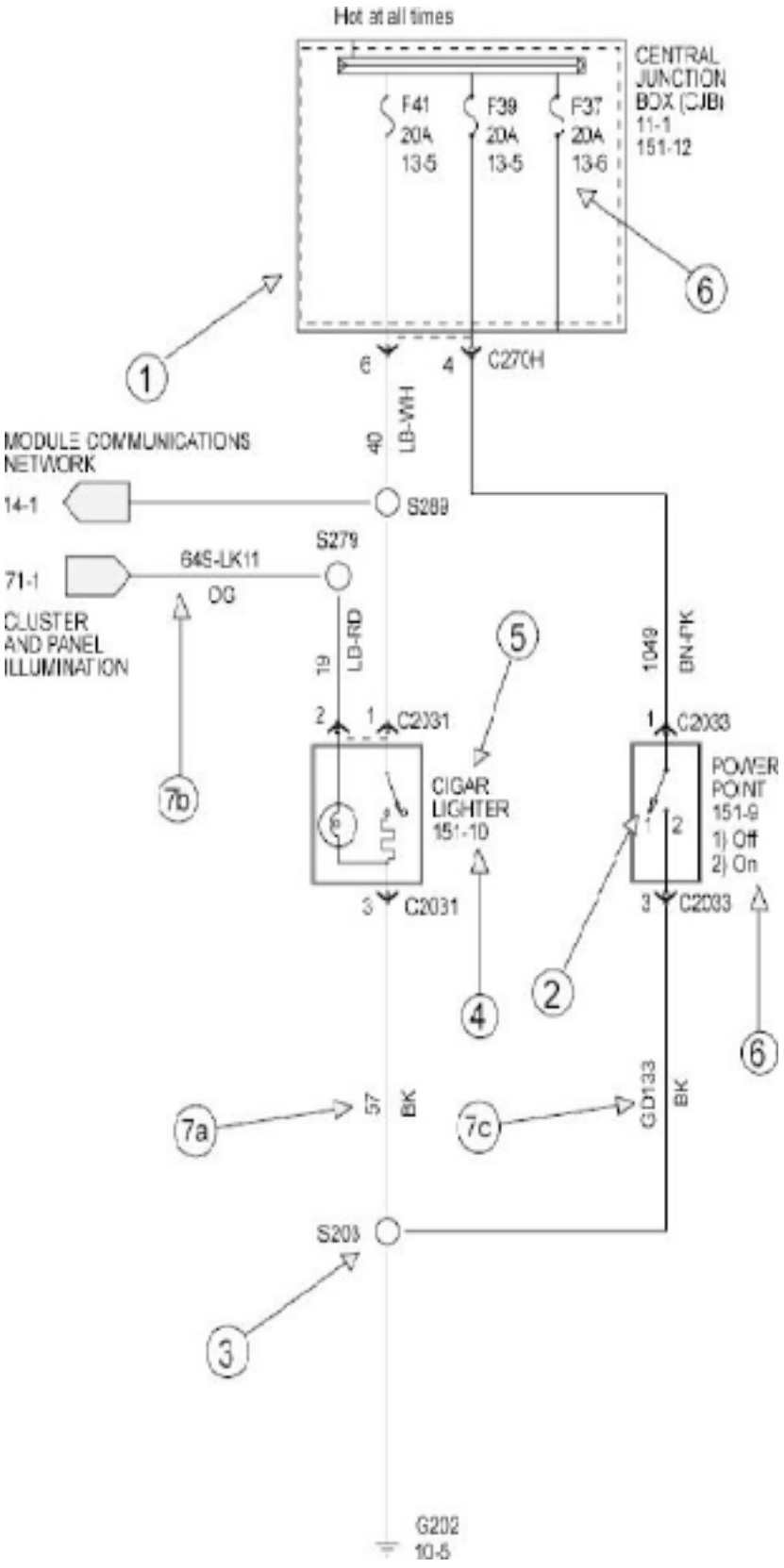
tailgate. Close the plastic clip over the thread of the tailgate latch release links.

To install, reverse the removal procedure.



Pin	Circuit	Gauge	Circuit Function Qualifier
1	VME46 (BU-GN)	22	Stereo 2 R +
2	RME46 (WH-GN)	22	Stereo 2 R -
3	RME45 (YE-GN)	22	Stereo 2 L -
4	VME45 (BU)	22	Stereo 2 L +

C3312


Hot at all times
CENTRAL JUNCTION BOX (CJB)
11-1
151-12
F41
20A
13-5
F39
20A
13-5
F37
20A
13-6
C270H
40
LB-WH
MODULE COMMUNICATIONS NETWORK
14-1
S289
S279
64S-LK11
71-1
DG
CLUSTER AND PANEL ILLUMINATION
19
LB-RD
C2031
CIGAR LIGHTER
151-10
1049
BN-PK
C2033
POWER POINT
151-9
1) Off
2) On
57
BK
GD133
BK
S203
G202
10-5

Navigation System: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

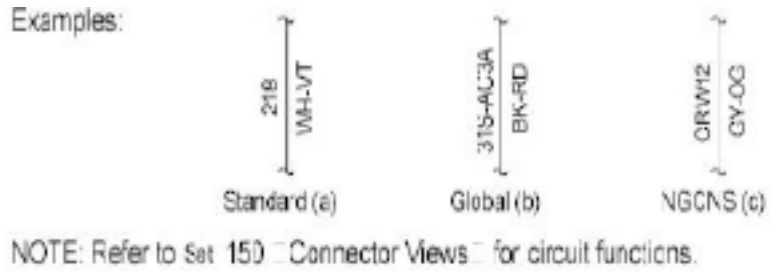
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

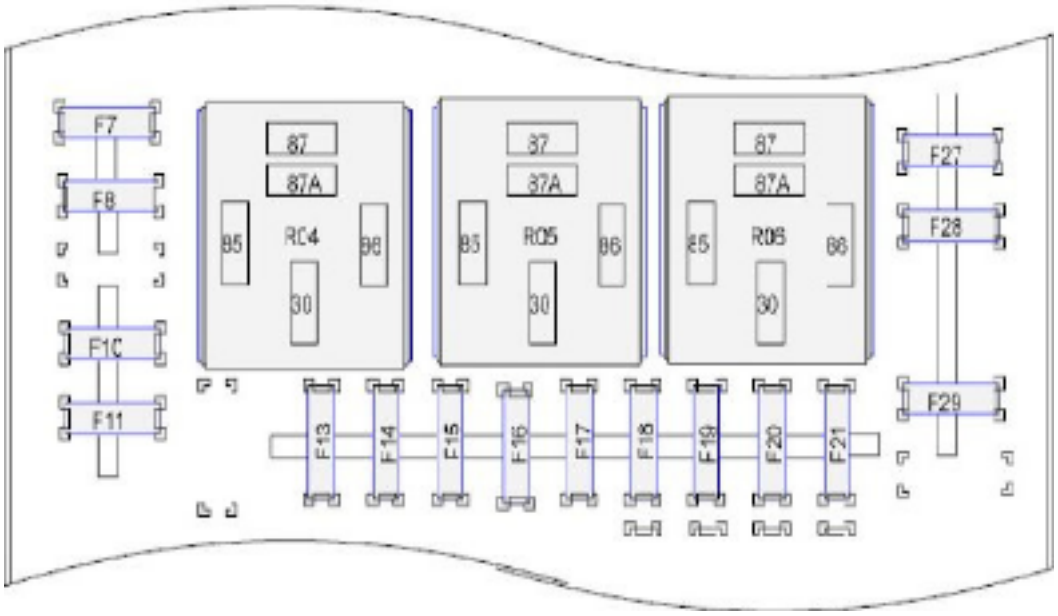
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

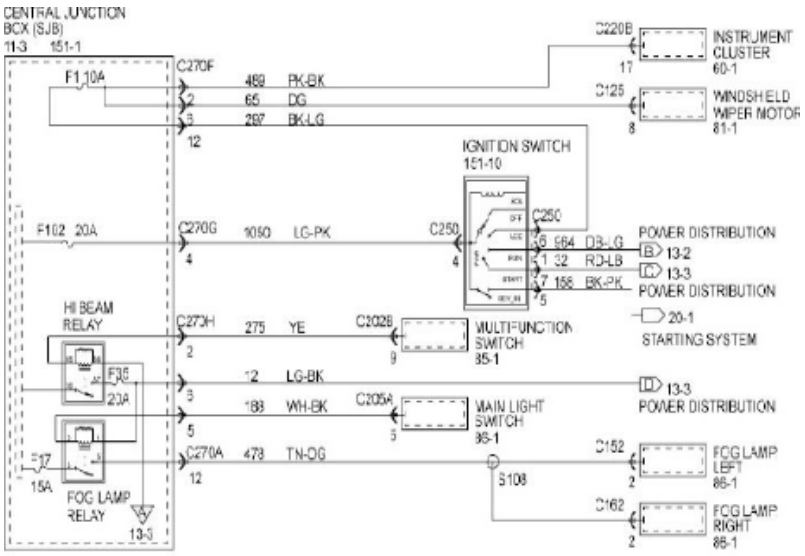
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

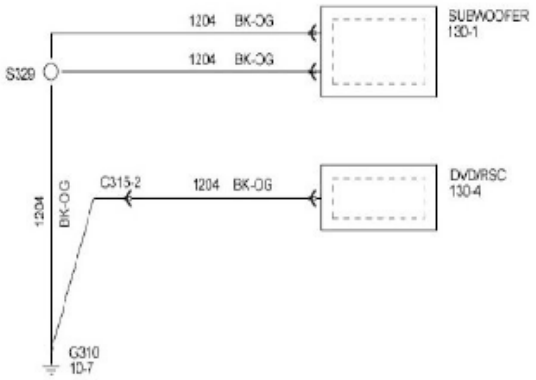
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

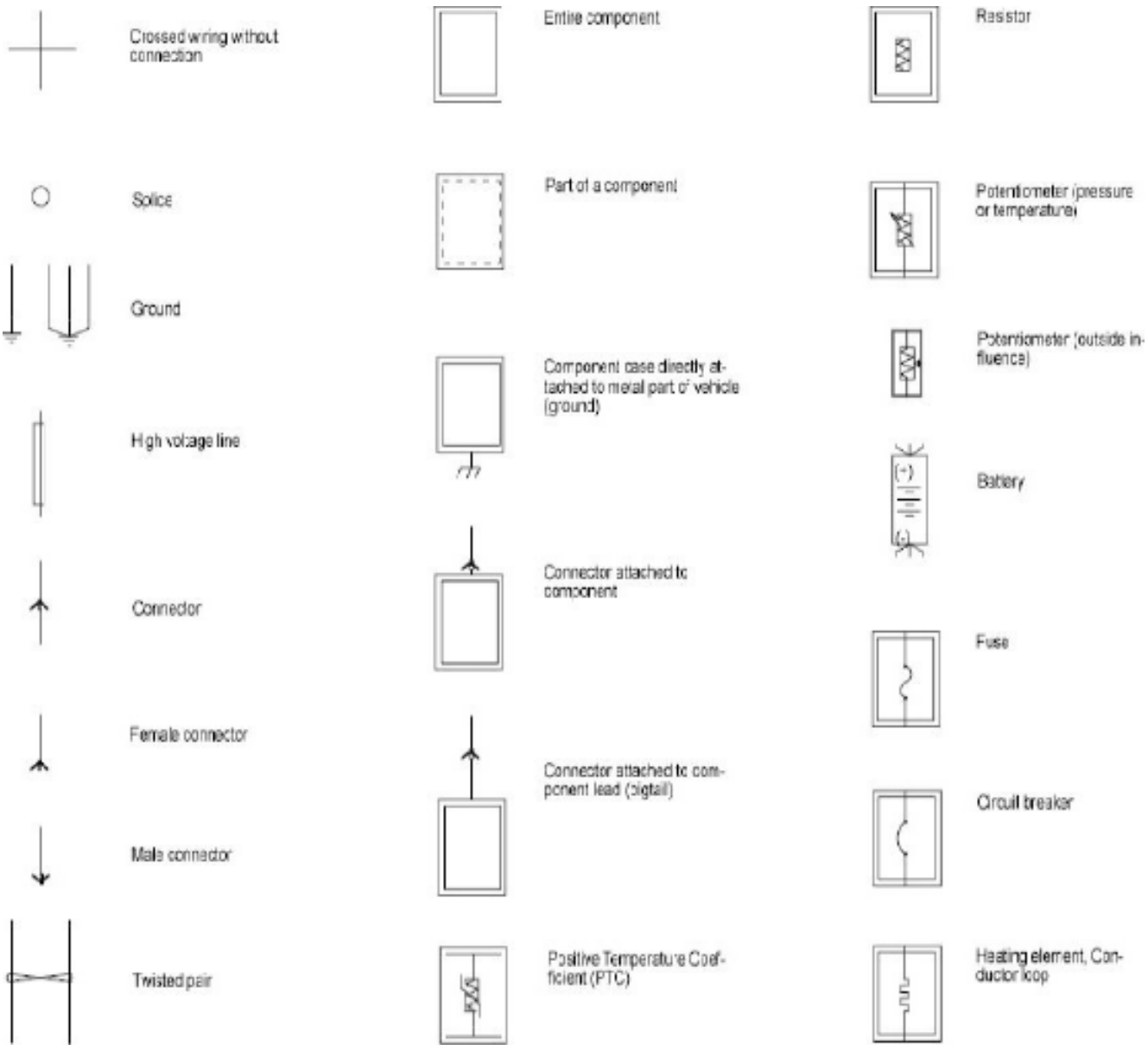
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

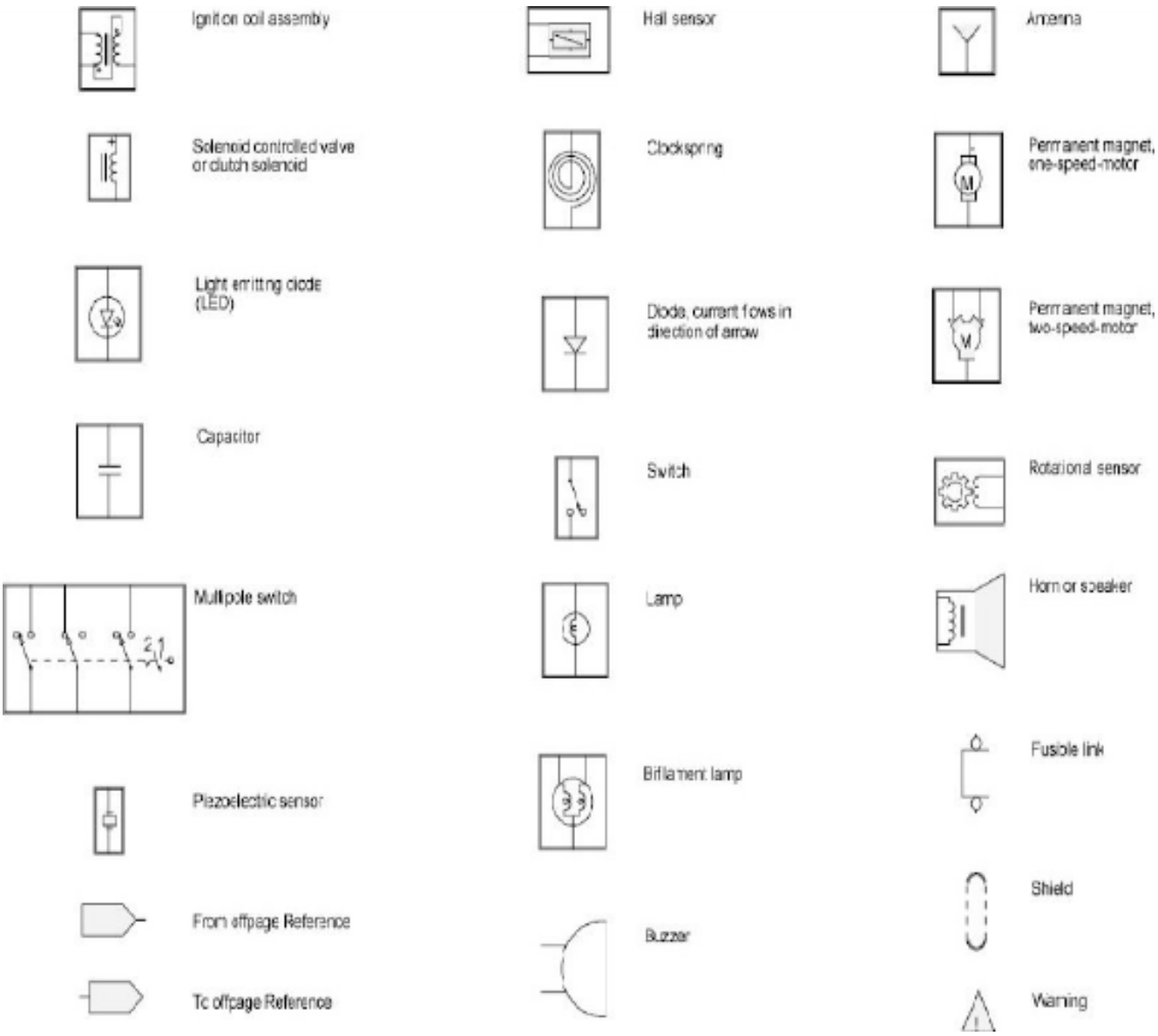
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

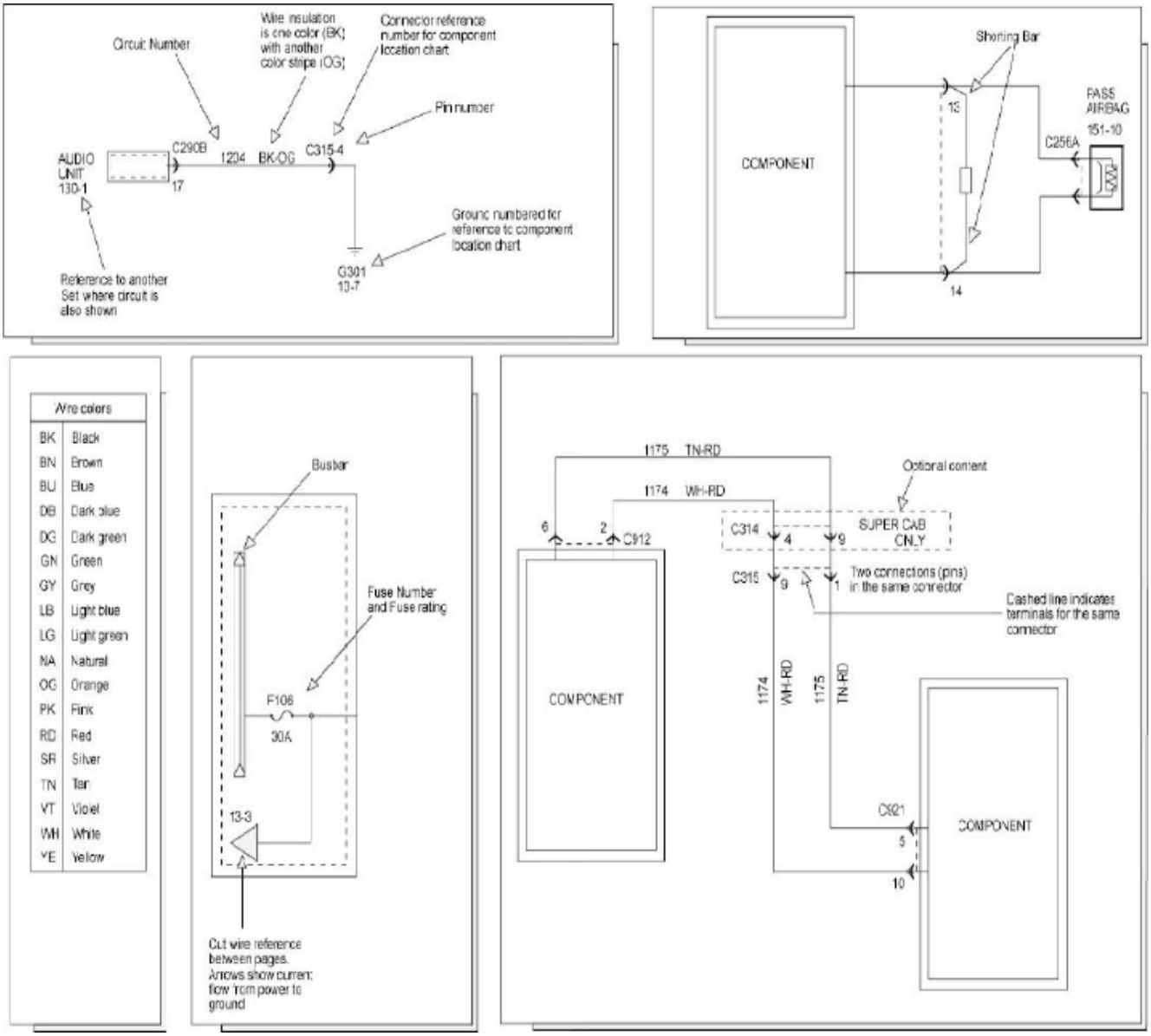
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

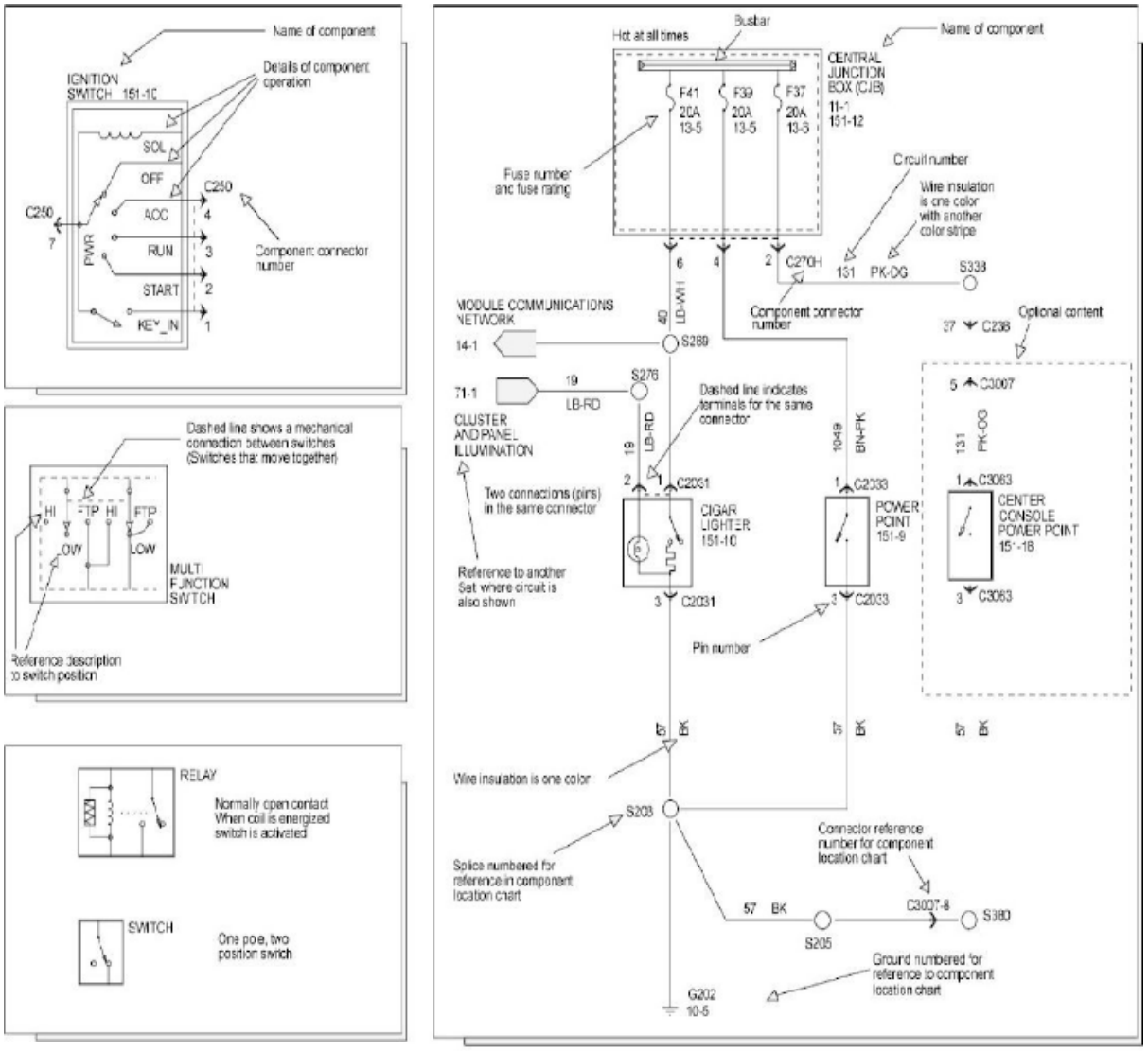
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

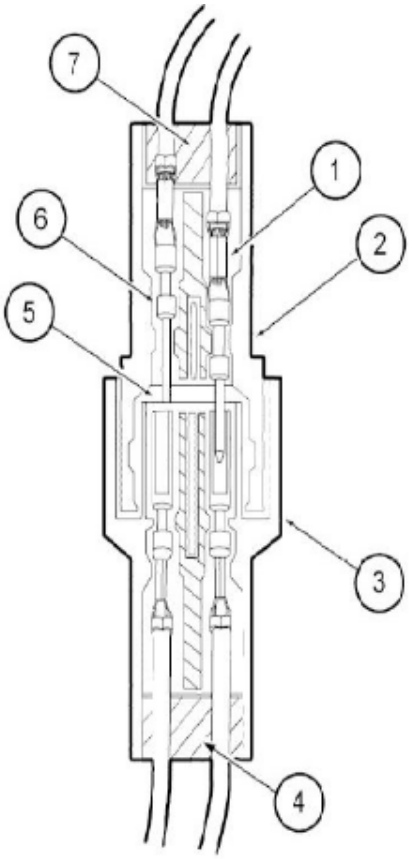


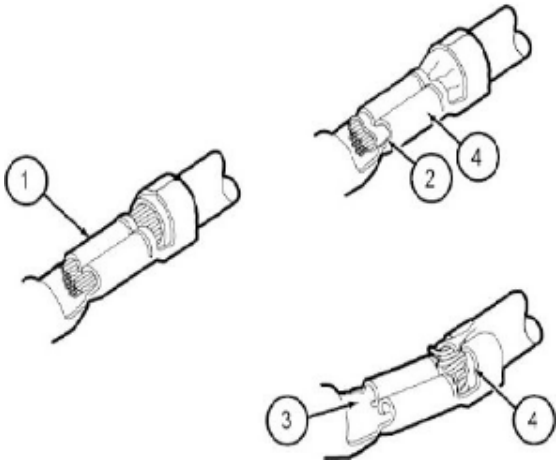
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Navigation System: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

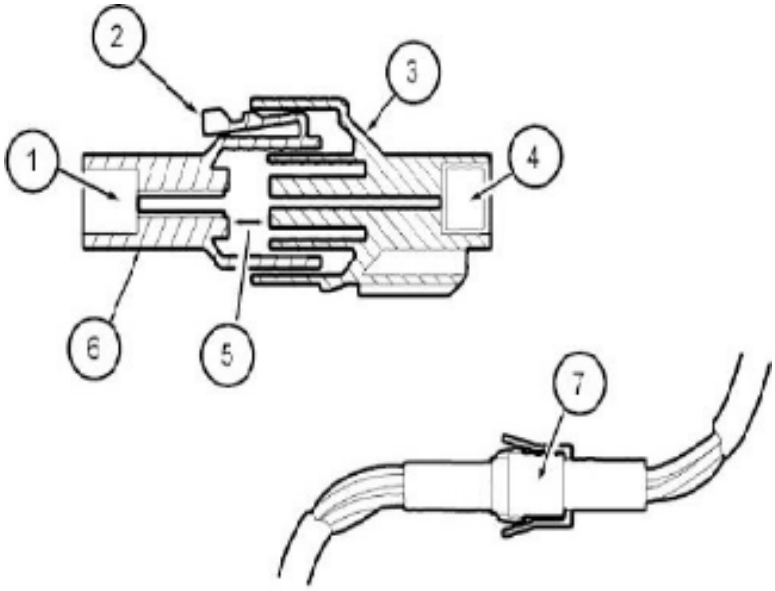
5 = Intermittent contact

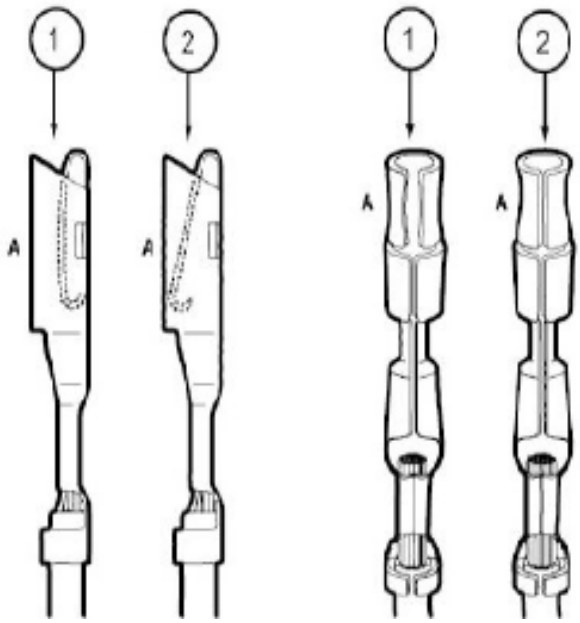
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

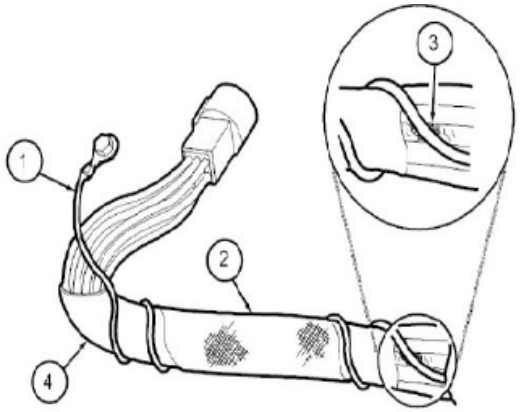
Deformed (enlarged) female terminals

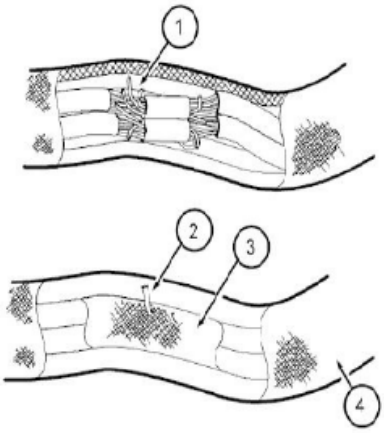
1 = Enlarged

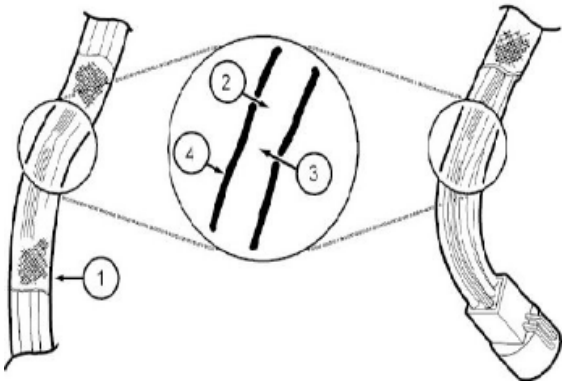
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

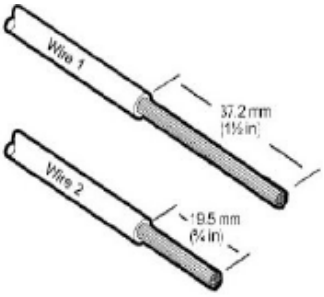
Splice covered 2

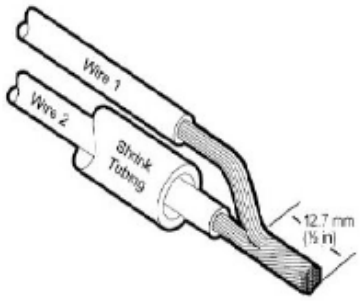
= Wire strand

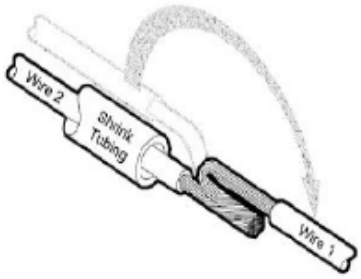
3 = Splice tape

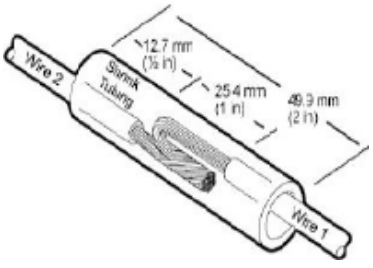
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

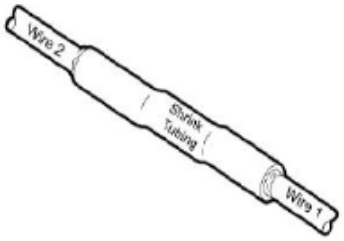
NOTE: -

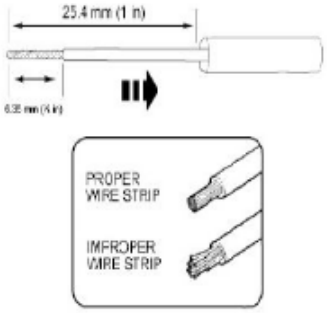
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

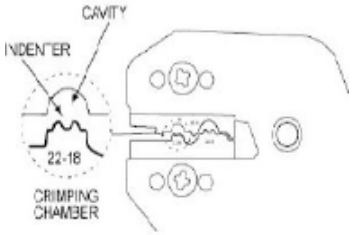
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

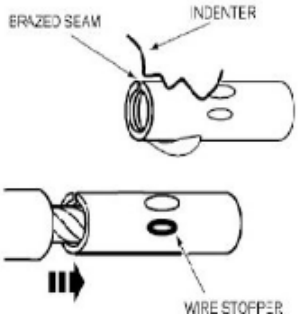
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
6.35 mm (¼ in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

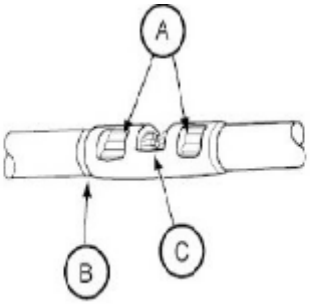
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

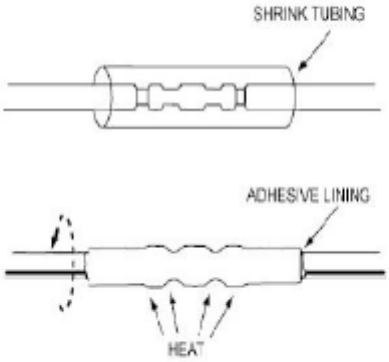
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4□ strip, cut 9 strands	* 1/4□ strip, cut 2 strands	1/4□ strip, no fold	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip, fold 2x dia.	1□ strip, fold 3x dia.
	16-14	* 1/4□ strip, cut 7 strands	1/4□ strip, no fold	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip fold 2x dia	1□ strip, fold 3x dia.	1 1/4□ strip, fold 4x dia.	Not Recommended
	12-10	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip, fold 2x dia.	1□ strip fold 3x cia.	1 1/4□ strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Pigtail only

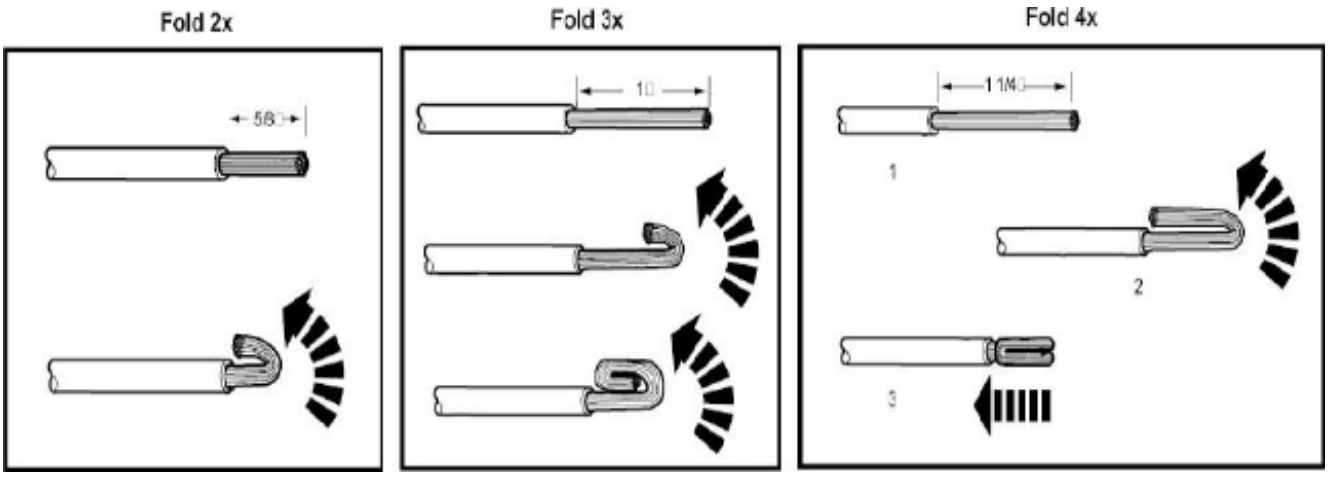
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

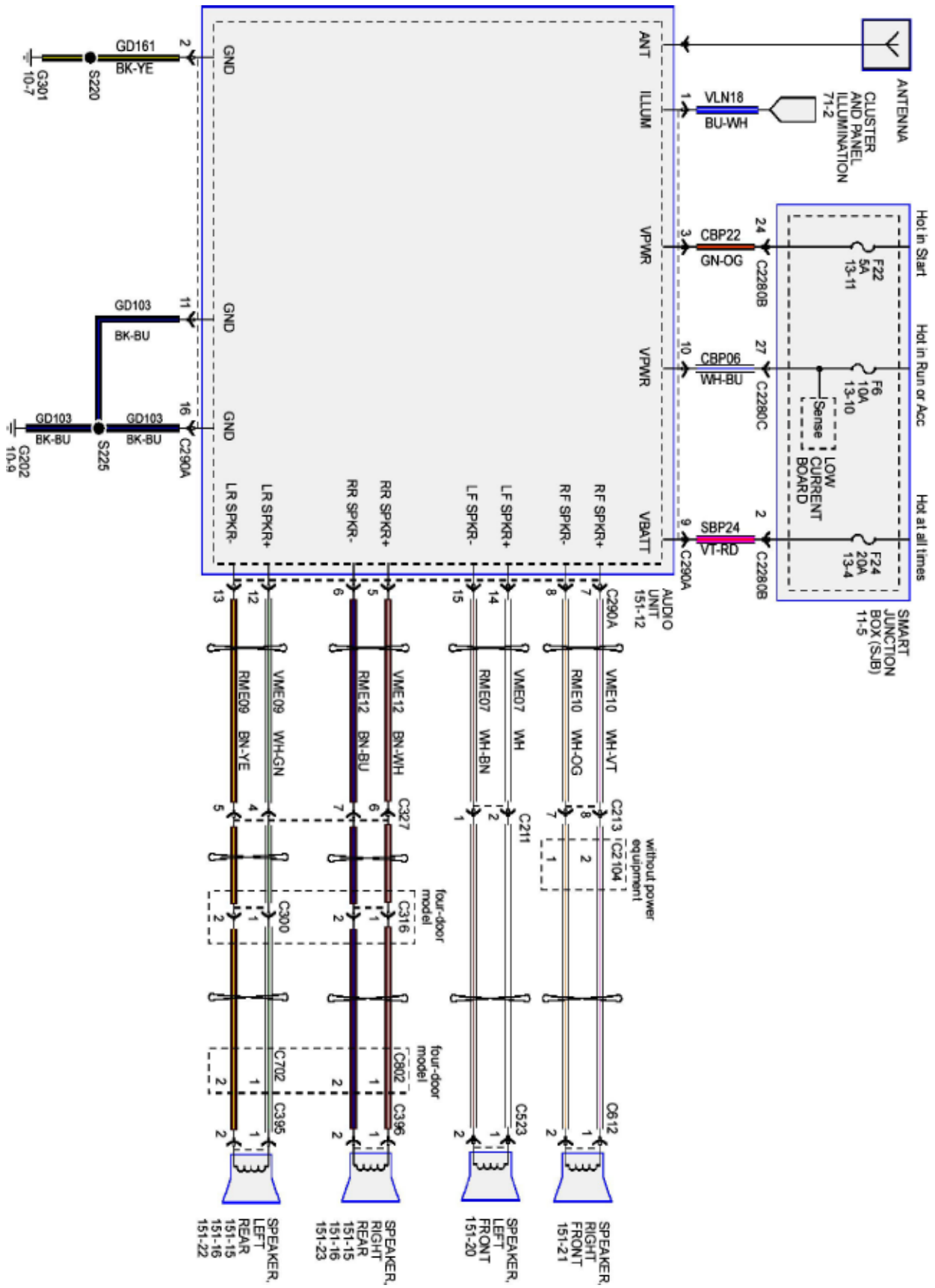
11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

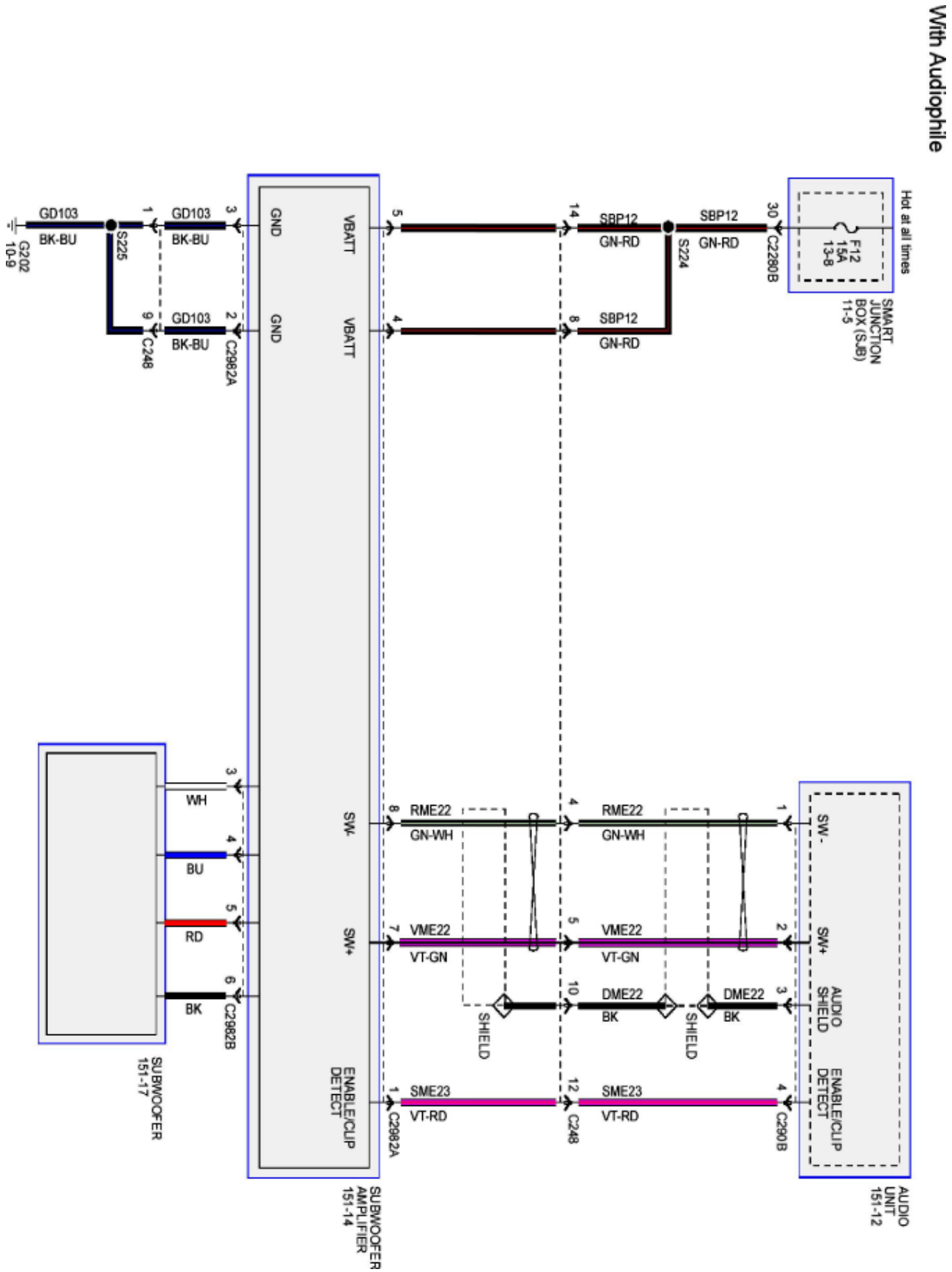

ANTENNA
CLUSTER AND PANEL ILLUMINATION 71-2
VLN18
BU-WH
Hot in Start
Hot in Run or Acc
Hot at all times
F22 5A 13-11
F6 10A 13-10
F24 20A 13-4
CBP22
GN-OG
CBP06
WH-BU
SBP24
VT-RD
C2280B
C2280C
Sense
LOW CURRENT BOARD
SMART JUNCTION BOX (SJB) 11-5
GD161
BK-YE
G301 10-7
S220
GD103
BK-BU
S225
G202 10-9
C290A
AUDIO UNIT 151-12
ANT
ILLUM
VPWR
VBATT
GND
LR SPKR-
LR SPKR+
RR SPKR-
RR SPKR+
LF SPKR-
LF SPKR+
RF SPKR-
RF SPKR+
VME09 WH-GN
RME09 BN-YE
VME12 BN-WH
RME12 BN-BU
VME07 WH
RME07 WH-BN
VME10 WH-VT
RME10 WH-OG
C213
C2104
without power equipment
four-door model
C327
C316
C300
C702
C395
C802
C396
C211
C523
C612
SPEAKER, LEFT REAR 151-15 151-16 151-22
SPEAKER, RIGHT REAR 151-15 151-16 151-23
SPEAKER, LEFT FRONT 151-20
SPEAKER, RIGHT FRONT 151-21

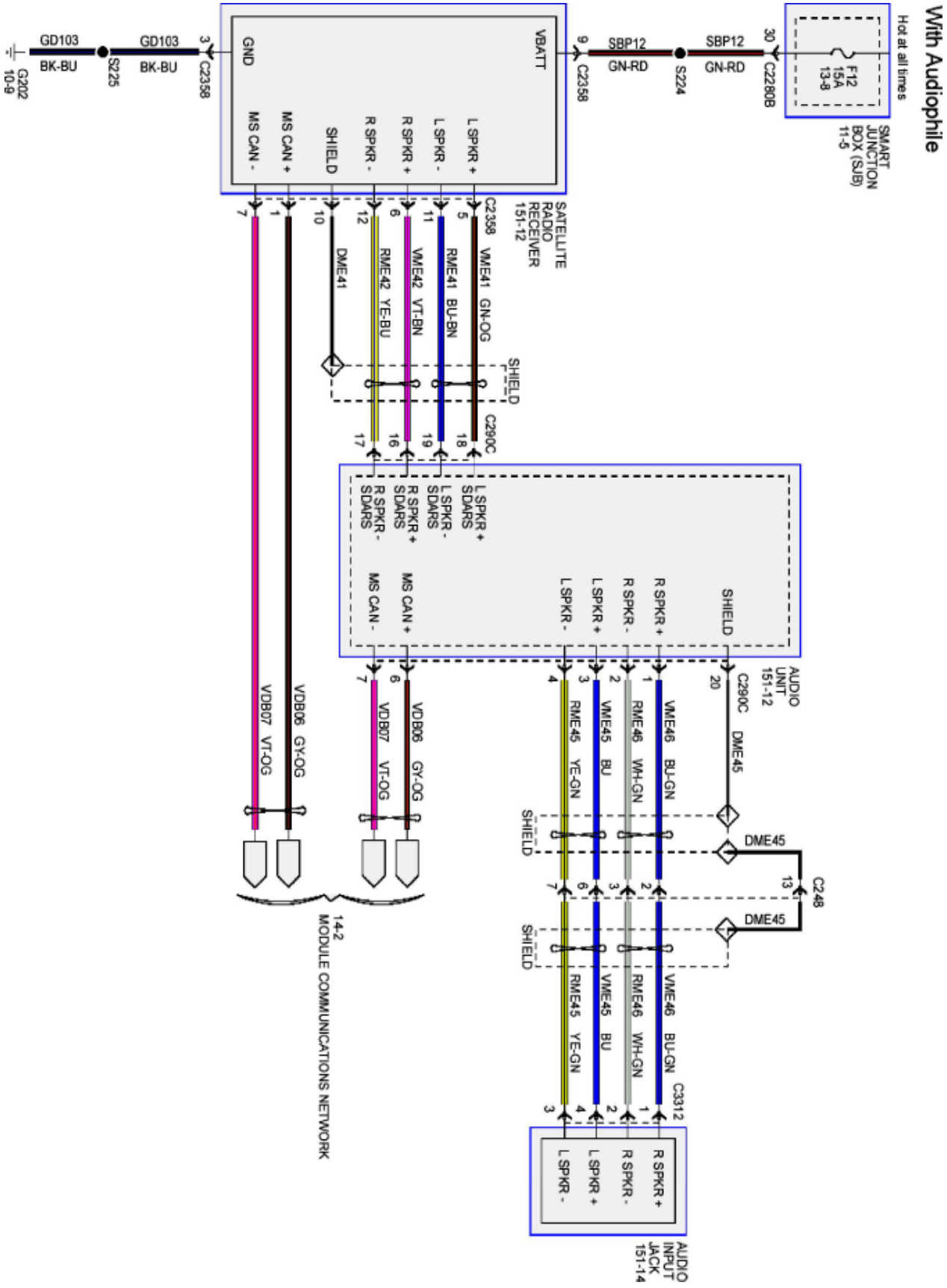
Navigation System: Electrical Diagrams

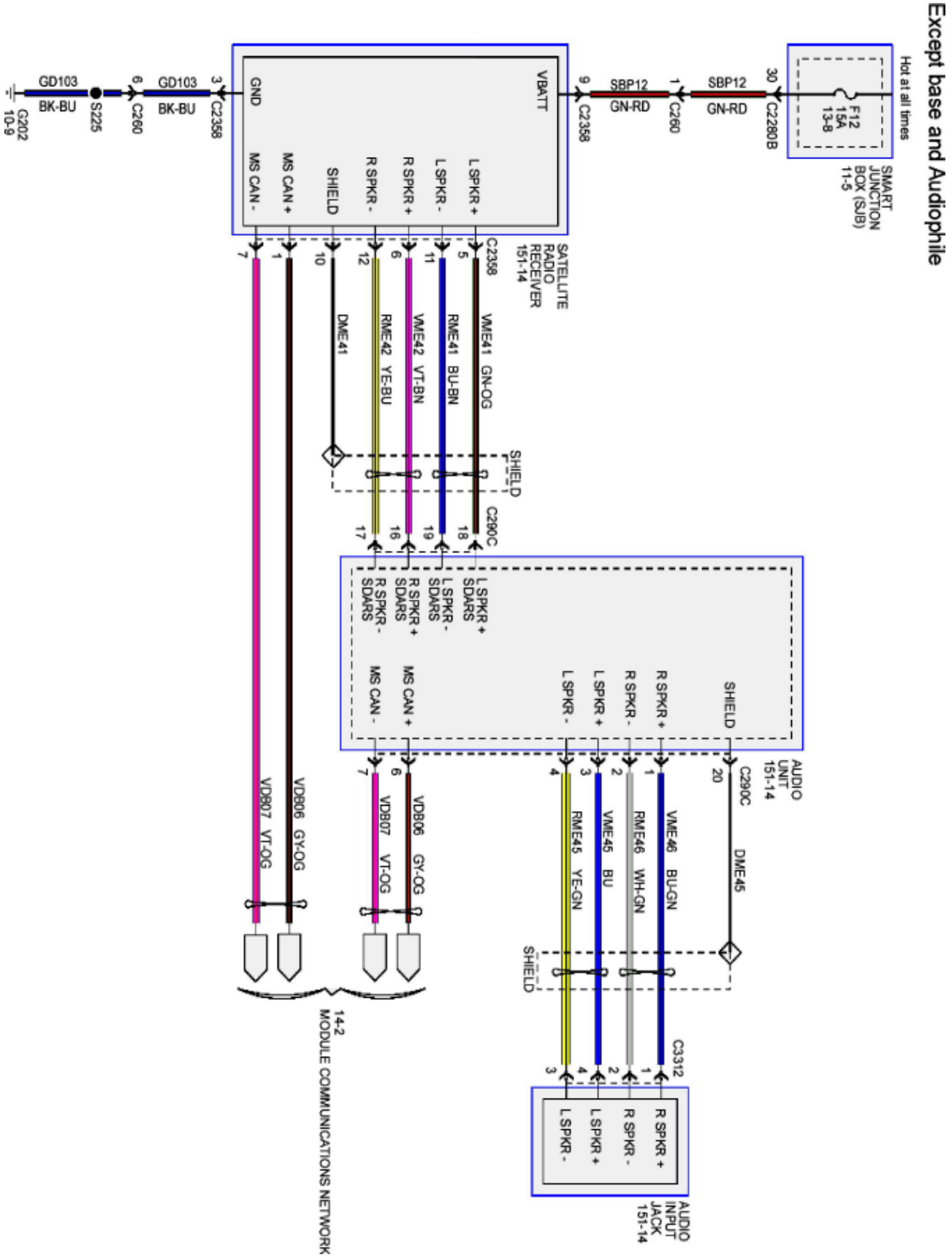
PLEASE NOTE: Some diagrams may appear to be missing because of gaps in the number sequences. These "gaps" are actually for diagrams that do not apply to the vehicle model selected.

130-1

With Audiophile




With Audiophile
Hot at all times
SMART JUNCTION BOX (SJB) 11-5
F12 15A 13-8
C2280B
SBP12
GN-RD
S224
C2358
GD103
BK-BU
S225
G202 10-9
VBATT
GND
MS CAN -
MS CAN +
SHIELD
R SPKR -
R SPKR +
L SPKR -
L SPKR +
SATELLITE RADIO RECEIVER 151-12
VME41 GN-OG
RME41 BU-BN
VME42 VT-BN
RME42 YE-BU
DME41
C290C
AUDIO UNIT 151-12
L SPKR + SDARS
L SPKR - SDARS
R SPKR + SDARS
R SPKR - SDARS
VDB06 GY-OG
VDB07 VT-OG
14-2 MODULE COMMUNICATIONS NETWORK
VME46 BU-GN
RME46 WH-GN
VME45 BU
RME45 YE-GN
DME45
C248
C3312
AUDIO INPUT JACK 151-14


Except base and Audiophile
Hot at all times
SMART JUNCTION BOX (SJB) 11-5
F12 15A 13-8
30
C2280B
SBP12
GN-RD
1
C260
SBP12
GN-RD
9
C2358
VBATT
GND
MS CAN -
MS CAN +
SHIELD
R SPKR -
R SPKR +
L SPKR -
L SPKR +
SATELLITE RADIO RECEIVER 151-14
C2358
GD103
BK-BU
G202 10-9
S225
6
C260
GD103
BK-BU
3
C2358
DME41
RME42 YE-BU
VME42 VT-BN
RME41 BU-BN
VME41 GN-OG
SHIELD
C290C
L SPKR + SDARS
L SPKR - SDARS
R SPKR + SDARS
R SPKR - SDARS
MS CAN -
MS CAN +
SHIELD
R SPKR +
R SPKR -
L SPKR +
L SPKR -
AUDIO UNIT 151-14
C290C
DME45
VME46 BU-GN
RME46 WH-GN
VME45 BU
RME45 YE-GN
SHIELD
C3312
R SPKR +
R SPKR -
L SPKR +
L SPKR -
AUDIO INPUT JACK 151-14
VDB07 VT-OG
VDB06 GY-OG
VDB07 VT-OG
VDB06 GY-OG
14-2 MODULE COMMUNICATIONS NETWORK

Diagrams: Other diagrams referred to by number (i.e. 13-2, 24-6, 10-2, etc.) within these diagrams can be found at Diagrams By Number. See: Diagrams/Electrical Diagrams/Diagrams By Number

Locations: Location Views (reference numbers starting with 151-) referred to within these diagrams can be found at Location Views. See: Locations/Component Locations

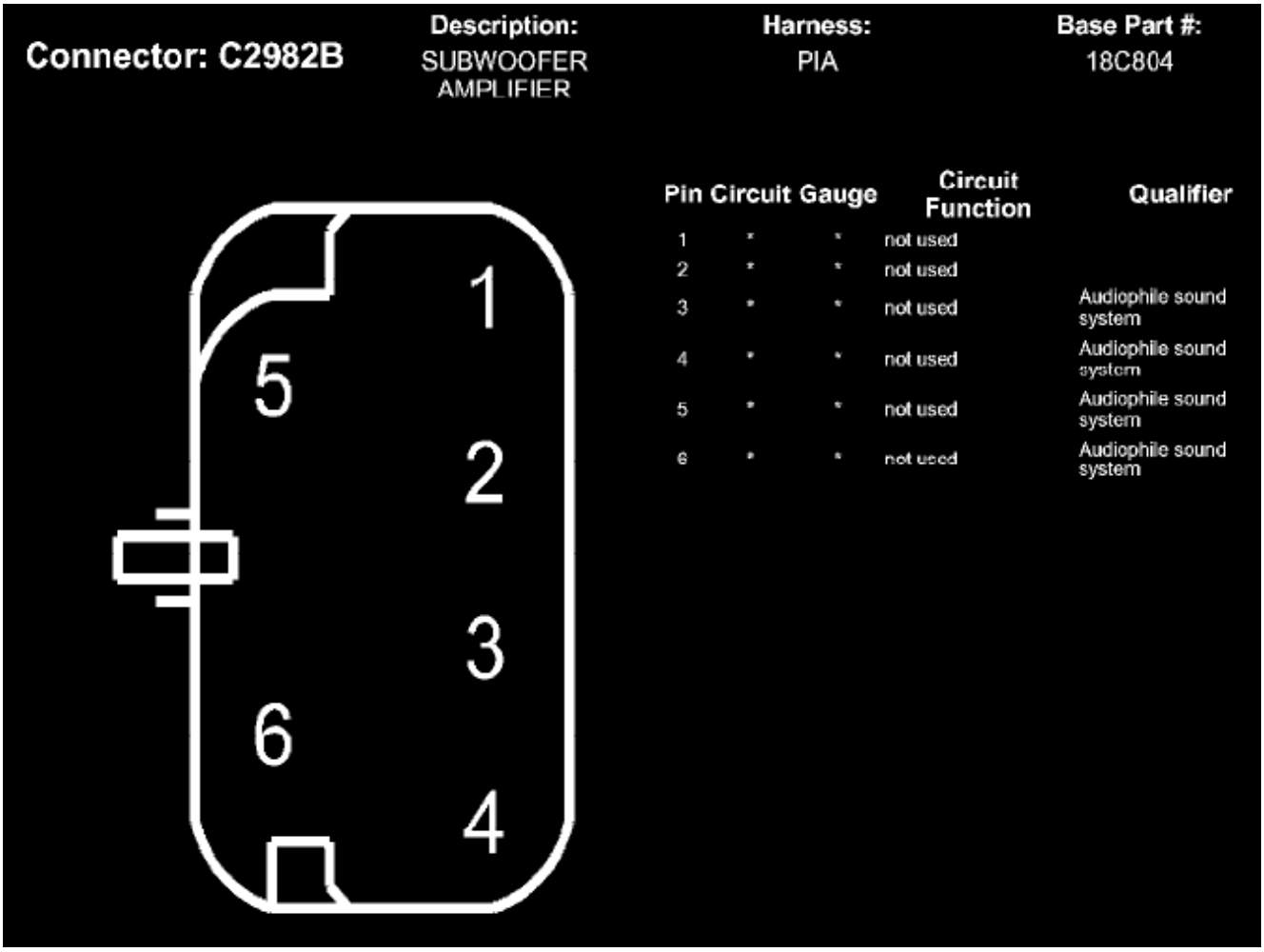
Connector: C2982A

Description:	Harness:	Base Part #:
SUBWOOFER AMPLIFIER	19A170	18C804

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	SME23 (VT-RD)	22	CTRL MOD. - AUDIO # SUBWOOFER/AMPLIFIER ENABLE	Audiophile sound system
2	GD103 (BK-BU)	16	GROUND - *GENERIC LOGICAL TYPE 3 AUDIO/ENTERT.	Audiophile sound system
3	GD103 (BK-BU)	16	GROUND - *GENERIC LOGICAL TYPE 3 AUDIO/ENTERT.	Audiophile sound system
4	SBP12 (GN-RD)	16	FUSE - 12 OR CIRCUIT BREAKER	Audiophile sound system
5	SBP12 (GN-RD)	16	FUSE - 12 OR CIRCUIT BREAKER	Audiophile sound system
6	*	*	not used	Audiophile sound system
7	VME22 (VT-GN)	22	CTRL MOD. - AUDIO # SUBWOOFER/AMPLIFIER AUDIO +	Audiophile sound system
8	RME22 (GN-WH)	22	CTRL MOD. - AUDIO # SUBWOOFER/AMPLIFIER AUDIO -	Audiophile sound system
9	*	*	not used	Audiophile sound system
10	*	*	not used	Audiophile sound system

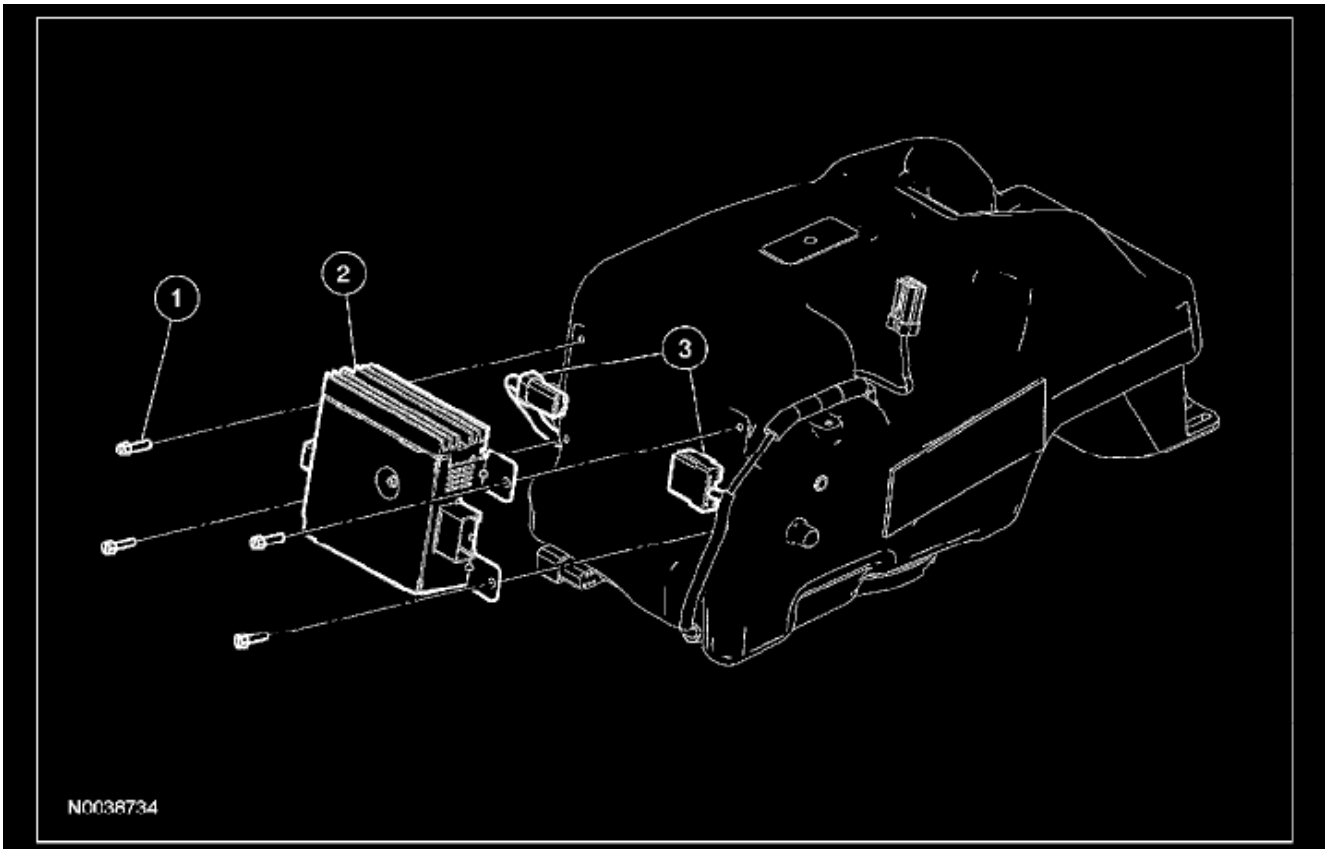
Amplifier: Diagrams

C2982A



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	*	*	not used	
3	*	*	not used	Audiophile sound system
4	*	*	not used	Audiophile sound system
5	*	*	not used	Audiophile sound system
6	*	*	not used	Audiophile sound system

C2982B



Item	Part Number	Description
1	W704650	Subwoofer amplifier screws (4 required)
2	18C804	Subwoofer amplifier
3	—	Subwoofer amplifier electrical connectors (part of 19A170)

Amplifier: Service and Repair

SUBWOOFER AMPLIFIER

Removal and Installation

1. Remove the subwoofer speaker enclosure. 2. Remove the subwoofer amplifier.

1 Disconnect the electrical connectors.

2 Remove the 4 screws.

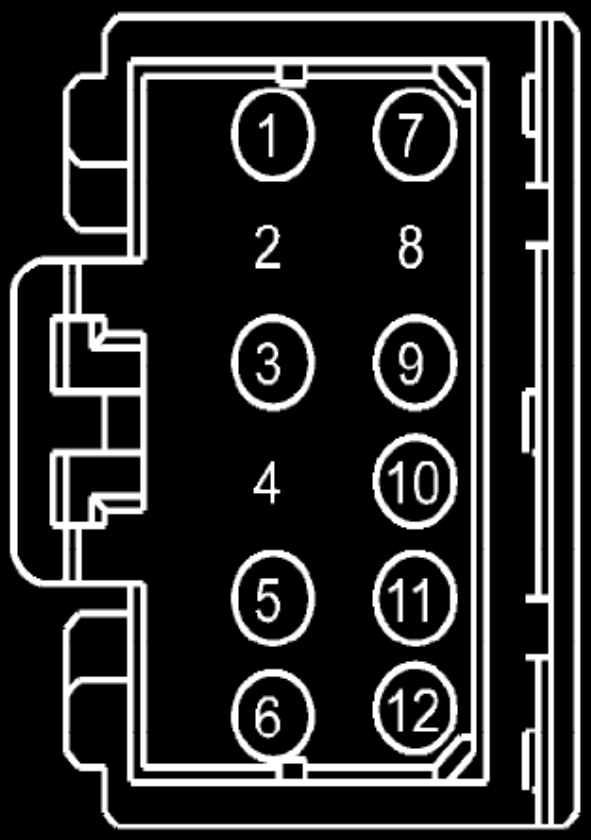
3. To install, reverse the removal procedure.

Connector: C2358

Description: SATELLITE RADIO RECEIVER

Harness: 14401

Base Part #:



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VDB06 (GY-OG)	20	MS CAN +	
2	*	*	not used	
3	GD103 (BK-BU)	20	Ground	
4	*	*	not used	
5	VME41 (GN-OG)	22	SDARS left +	
6	VME42 (VT-BN)	22	SDARS right +	
7	VDB07 (VT-OG)	20	MS CAN -	
8	*	*	not used	
9	SBP12 (GN-RD)	20	Voltage supplied at all times (overload protected)	
10	DME41 (BARE)	18	Shield	
11	RME41 (BU-BN)	22	SDARS left -	
12	RME42 (YE-BU)	22	SDARS right -	

C2358

Radio/Stereo: Procedures

Audio Unit Shipment Mode

AUDIO UNIT SHIPMENT MODE

Entering Shipment Mode

CAUTION: The CD6 audio unit must be placed in shipment mode anytime the audio unit is removed (including for diagnostic purposes). Failure to follow this instruction may result in damage to the audio unit.

NOTE: This procedure applies to the CD6 audio unit.

1. Turn the audio unit on and eject any CDs loaded in the audio unit. 2. Turn the key to OFF. 3. Press and hold presets 2 and 5, simultaneously. 4. While holding the presets, turn the key to ACC or RUN.

- The audio display will flash SHIPMENT.

- When the CD tray has parked, the audio unit will display SHIPMENT ON.

5. Turn the key to OFF. 6. Remove the audio unit.

Exiting Shipment Mode

NOTE: If the audio unit is removed, install the audio unit before beginning this procedure.

1. Turn the key to ACC or RUN. 2. Turn the audio unit on. 3. Press and hold the LOAD button for approximately 2 seconds.

- The audio unit will enter loading mode, at which time the shipment mode will be exited.

4. Turn the audio unit off.

Satellite Radio Receiver Electronic Serial Number (ESN) Retrieval

SATELLITE RADIO RECEIVER ELECTRONIC SERIAL NUMBER (ESN) RETRIEVAL

Audio Units Without Navigation

1. Operate the audio unit in satellite radio mode. 2. Press and hold the AUX button and preset button 1, simultaneously.

- The satellite radio receiver electronic serial number (ESN) will be displayed on the screen.

3. Record the satellite radio receiver ESN. 4. Turn the audio unit off.

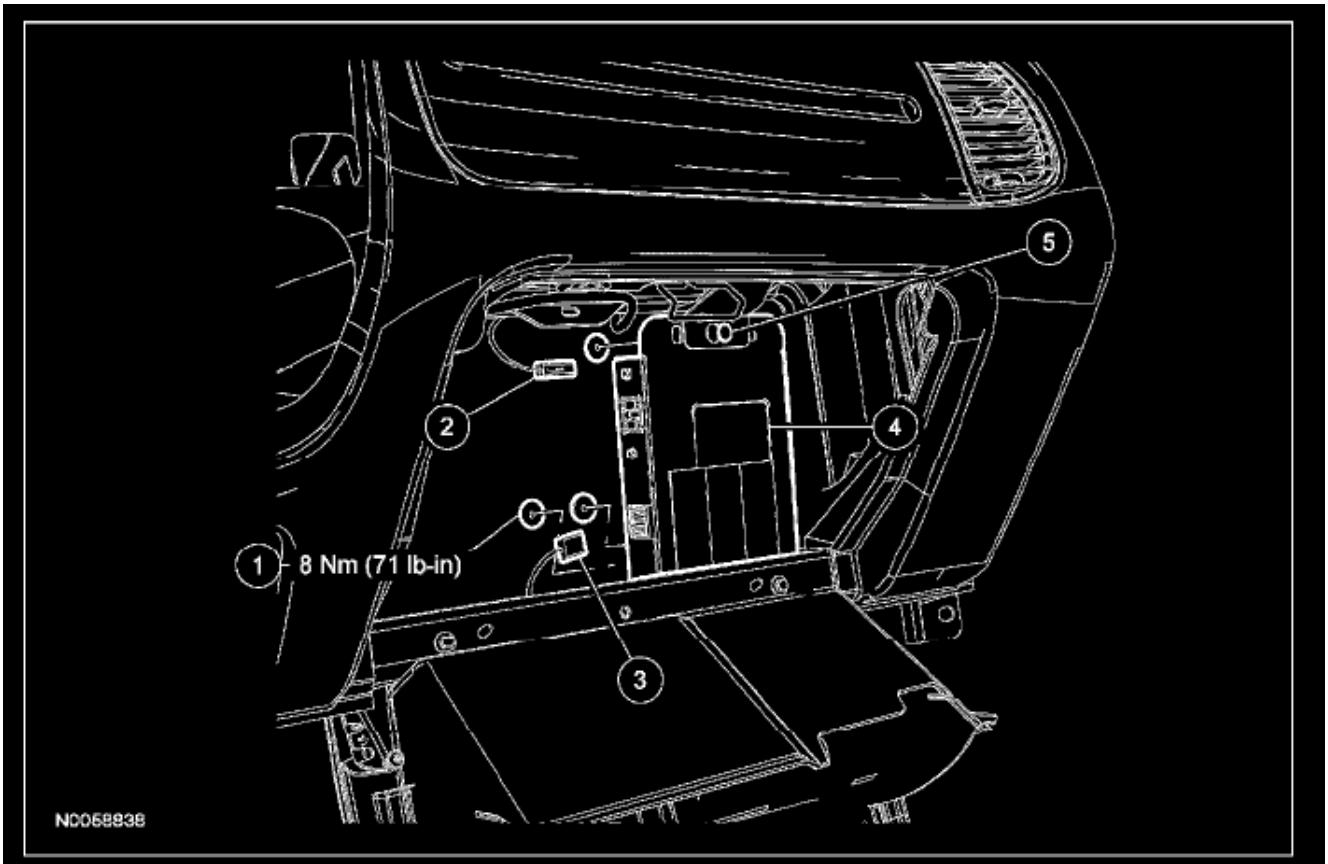
Audio Units With Navigation

1. Turn the audio unit on. 2. Press the MENU button. 3. Select the SYSTEM INFO tab.

4. NOTE: The satellite radio receiver ESN is shown on the lower left corner of the screen with the text "SR ESN:".

Record the satellite radio receiver ESN.

5. Turn the audio unit off.



Item	Part Number	Description
1	N811309	Satellite radio receiver nuts (3 required)
2	—	Satellite antenna cable (part of 19A397)
3	—	Satellite radio receiver electrical connector (part of 14401)
4	18C963	Satellite radio receiver
5	W707293	Satellite radio receiver J-stud (3 required)

Radio/Stereo: Removal and Replacement

SATELLITE RADIO RECEIVER

Removal and Installation

1. Lower the glove compartment completely. 2. Disconnect the satellite antenna cable and the satellite radio receiver electrical connector. 3. Remove the 3 nuts.

- To install, tighten to 8 Nm (71 lb-in).

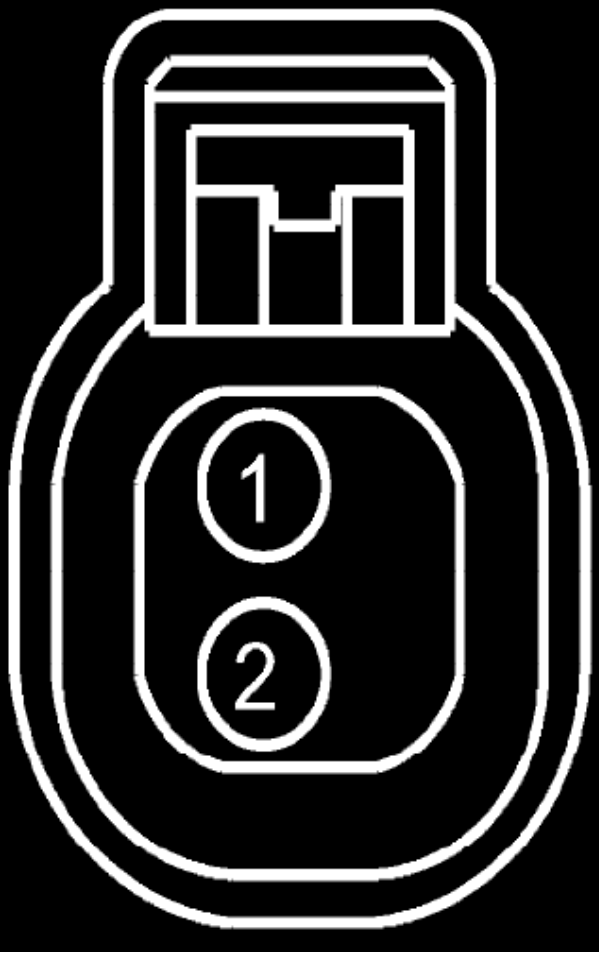
4. Remove the 3 J-studs and the satellite radio receiver. 5. To install, reverse the removal procedure.

Connector: C523

Description: SPEAKER, LEFT FRONT

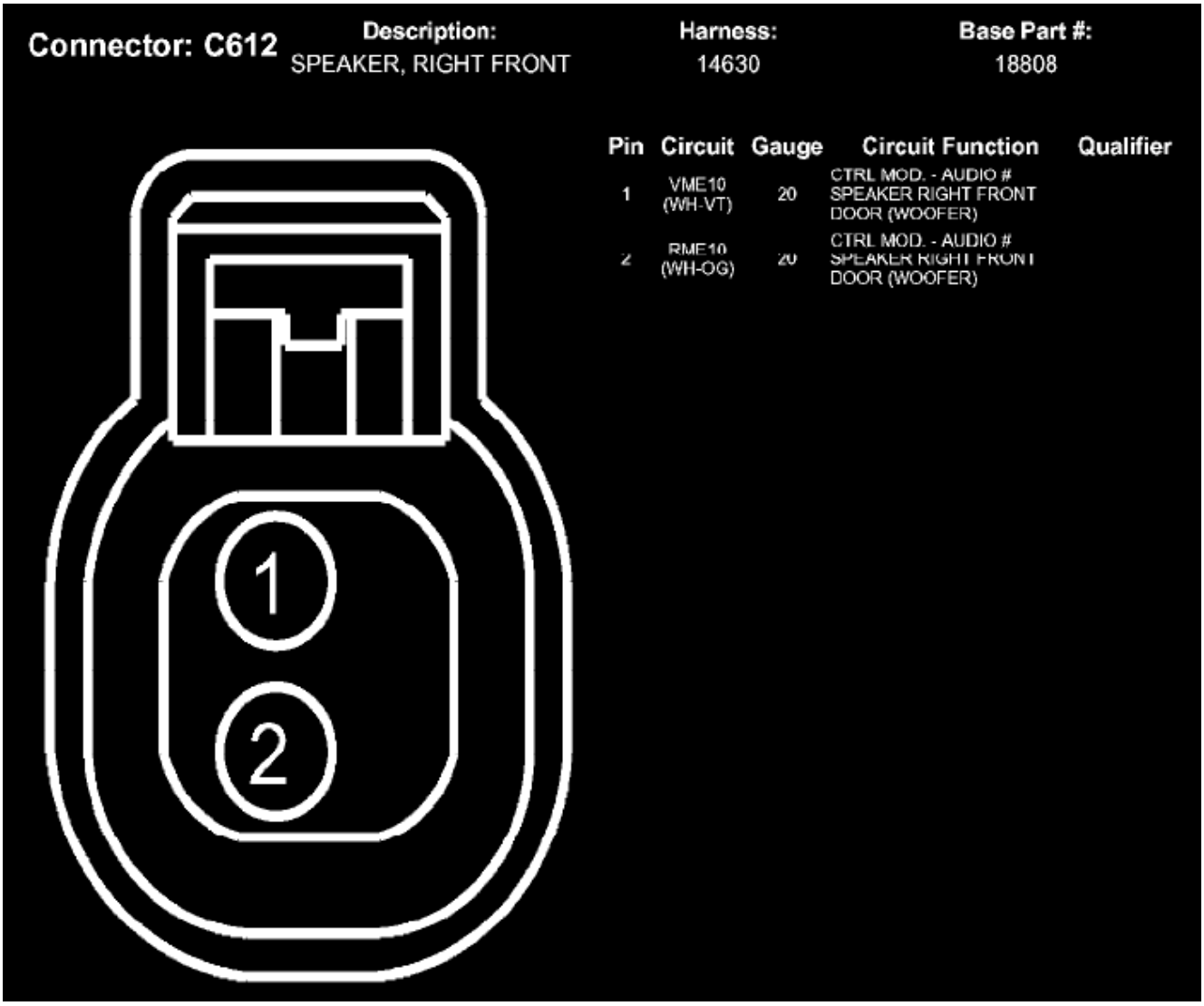
Harness: 14631

Base Part #: 18808

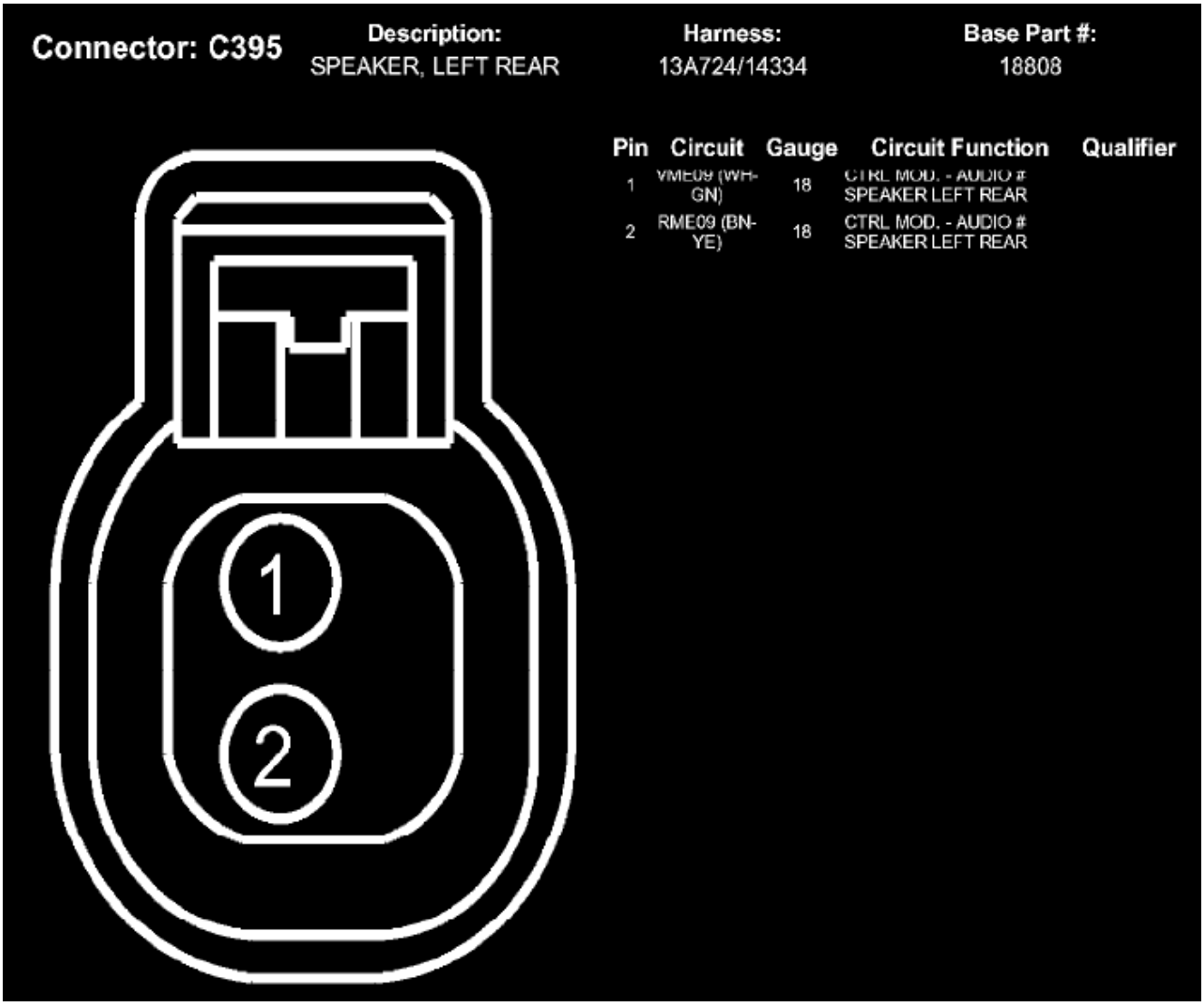


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VME07 (WH)	20	CTRL MOD. - AUDIO # SPEAKER LEFT FRONT DOOR (WOOFER)	
2	RME07 (WH-BN)	20	CTRL MOD. AUDIO # SPEAKER LEFT FRONT DOOR (WOOFER)	

C523


Connector: C612
Description:
SPEAKER, RIGHT FRONT
Harness:
14630
Base Part #:
18808
Pin
Circuit
Gauge
Circuit Function
Qualifier
1
VME10 (WH-VT)
20
CTRL MOD. - AUDIO # SPEAKER RIGHT FRONT DOOR (WOOFER)
2
RME10 (WH-OG)
20
CTRL MOD. - AUDIO # SPEAKER RIGHT FRONT DOOR (WOOFER)
1
2

C612

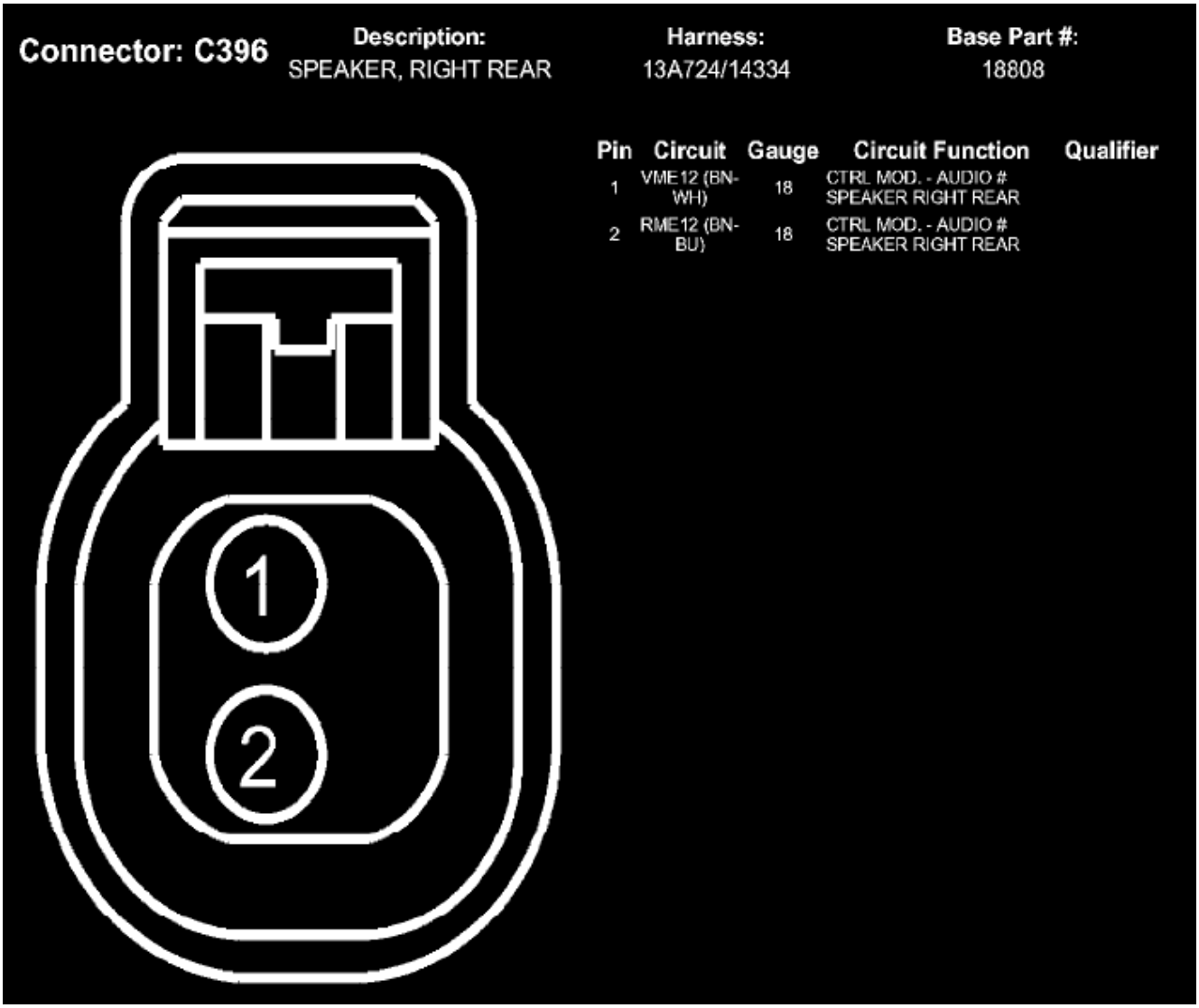


Speaker: Diagrams Speaker, Left Rear

C395

Connector: C702
Description:
SPEAKER, LEFT REAR
Harness:
14633
Base Part #:
18808
Pin
Circuit
Gauge
Circuit Function
Qualifier
1
VME09 (WH-GN)
18
CTRL MOD. - AUDIO # SPEAKER LEFT REAR
2
RME09 (BN-YE)
18
CTRL MOD. - AUDIO # SPEAKER LEFT REAR
1
2

C702



Speaker: Diagrams Speaker, Right Rear

C396

Connector: C802
Description:
SPEAKER, RIGHT REAR
Harness:
14632
Base Part #:
18808
Pin Circuit Gauge Circuit Function Qualifier
1 VME12 (BN-WH) 18 CTRL MOD. - AUDIO # SPEAKER RIGHT REAR
2 RME12 (BN-BU) 18 CTRL MOD. - AUDIO # SPEAKER RIGHT REAR
1
2

C802

Speaker: Testing and Inspection

SPEAKER WALK-AROUND TEST - BASE AM/FM AUDIO UNIT

NOTE: The audio unit must be turned on to enter the speaker walk-around test.

1. To enter the test, press and hold preset buttons 3 and 6 simultaneously for approximately 3 seconds, then release. 2. The test applies sound to each speaker for 1-2 seconds. Speakers are tested in the following sequence: RH, LH. 3. To exit the test, turn the key to OFF or turn the audio unit off. 4. If the concern remains and the fault is not detected, GO to Symptom Chart. See: Testing and Inspection/Symptom Related Diagnostic Procedures

SPEAKER WALK-AROUND TEST - ALL EXCEPT BASE AM/FM AUDIO UNIT

NOTE: -

The audio unit must be turned on and in radio tuner mode to enter the speaker walk-around test or self-diagnostic mode.

- The self-diagnostic mode can only be entered while in the speaker walk-around test.

1. To enter the speaker walk-around test, press and hold preset buttons 3 and 6 simultaneously for approximately 3 seconds, then release. 2. The test applies sound to each speaker for 1-2 seconds. Speakers are tested and shown on the display in the following sequence: RF, LF, LR, RR,

SUBWOOFER.

3. To exit the test, turn the key to OFF, turn the audio unit off, or press preset button 1 for diagnostics.

NOTE: Always document, clear, and carry out the self-test again.

4. The self-diagnostic mode has 5 manual tests available:

- Preset button 1 = Enter diagnostics. This test enters diagnostics from the speaker walk-around test. The on-demand self-test of the audio subsystem is performed. This tests for concerns with random access memory (RAM), read only memory (ROM) or electronically etched programmable read only memory (EEPROM).

- Preset button 2 = Continuous DTCs. This test enters diagnostics from the speaker walk-around test. This test displays any DTCs currently set.

- Preset button 3 = Signal strength test. This test shows the average signal strength of the currently tuned frequency over a 5-second interval.

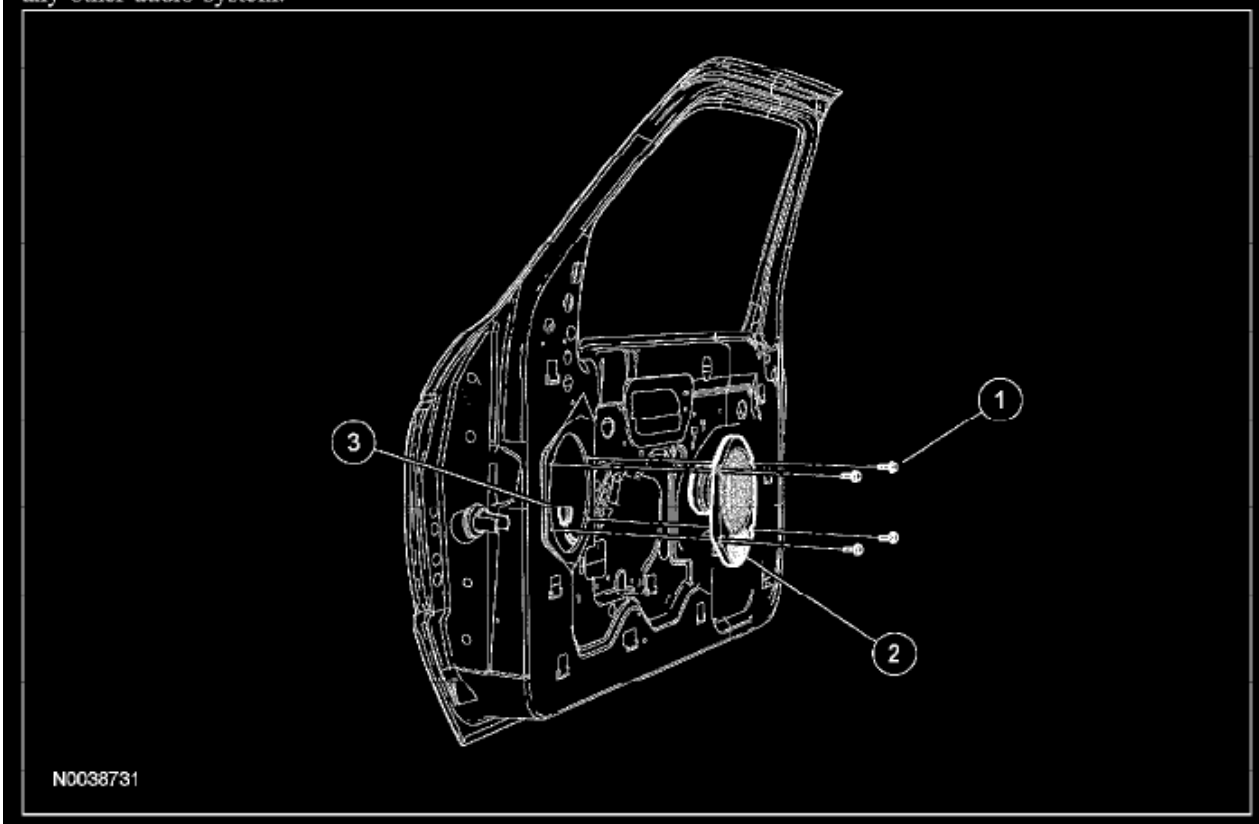
- Preset button 4 = Software configuration level. This test queries each audio unit system controller for its software configuration level.

- Preset button 5 = Display test. This test lights all the display segments for 5 seconds, then turns all segments off.

5. To exit the self-diagnostic mode, turn the key to OFF or turn the audio unit off. 6. If the DTCs retrieved are related to the concern, go to DTC Charts. See: Testing and Inspection/Diagnostic Trouble Code Descriptions 7. If the concern remains and the fault is not detected, GO to Symptom Chart. See: Testing and Inspection/Symptom Related Diagnostic Procedures

NOTE: RH front shown, others similar.

NOTE: The Audiophile system uses 2-voice (speaker with tweeter) speakers that are not interchangeable with any other audio system.



Item	Part Number	Description
1	—	Door speaker screws (4 (required)
2	18808	Door speaker
3	—	Door speaker electrical connector (part of 14630/14631 [LH/RH])

Speaker: Service and Repair Door Speaker

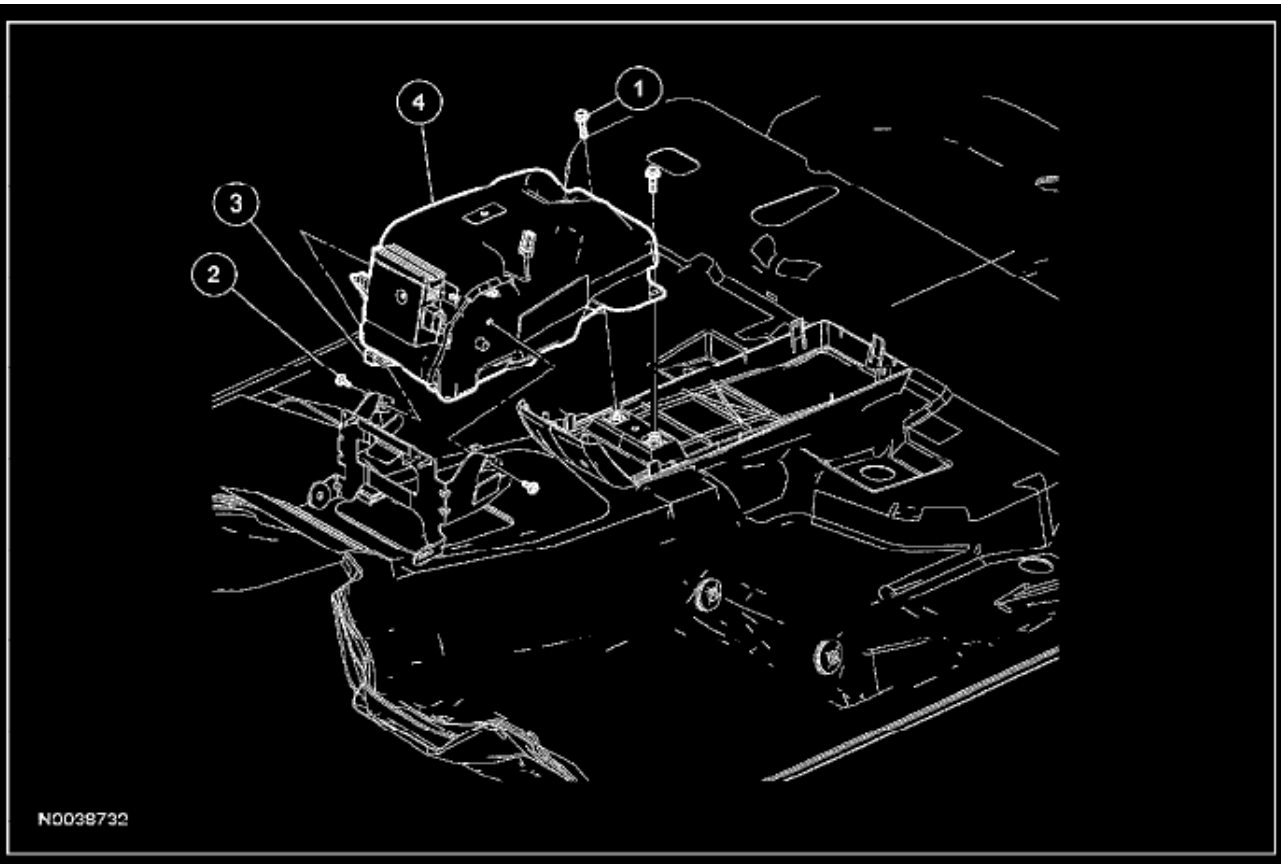
DOOR SPEAKER

Removal and Installation

1. Remove the door trim panel. 2. Remove the 4 screws and the door speaker.

- Disconnect the electrical connector.

3. To install, reverse the removal procedure.



Item	Part Number	Description
1	—	Speaker enclosure bolts (2 required)
2	W505412	Speaker enclosure screws (2 required)
3	—	Speaker enclosure electrical connector (part of 19A170)
4	18C804	Speaker enclosure

Speaker: Service and Repair Speaker Enclosure

SPEAKER ENCLOSURE

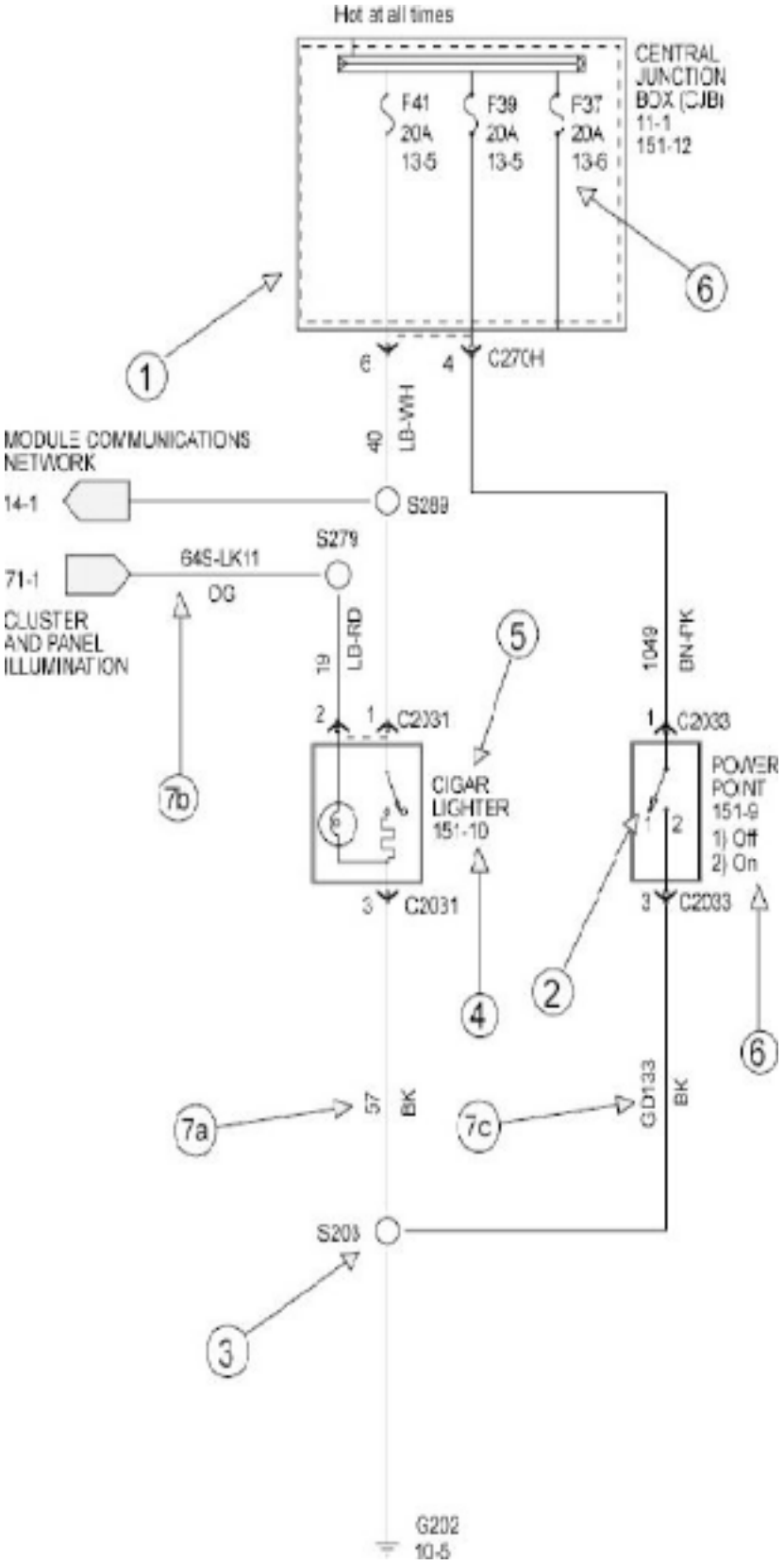
Removal and Installation

1. Remove the front floor console. 2. Remove the 2 screws, the 2 bolts, and the speaker enclosure.

- Disconnect the electrical connector.

3. To install, reverse the removal procedure.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Accessories and Optional Equipment > Relays and Modules - Accessories and Optional Equipment > Accessory Delay Module > Accessory Delay Relay > Component Information > Diagrams > Diagram Information and Instructions



Accessory Delay Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

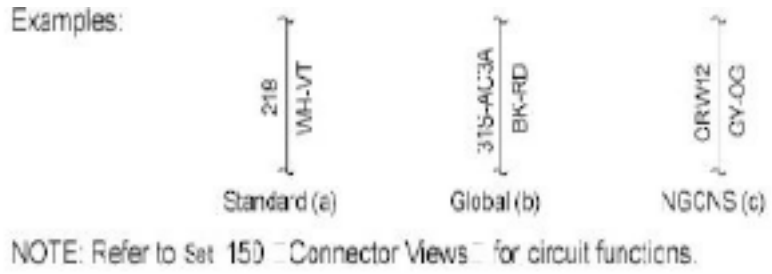
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

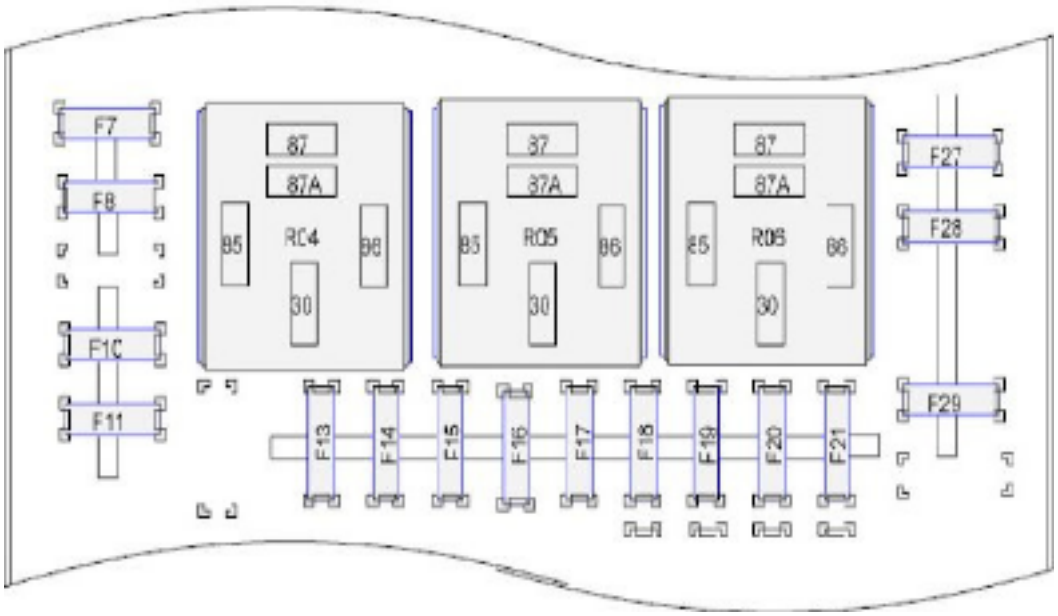
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

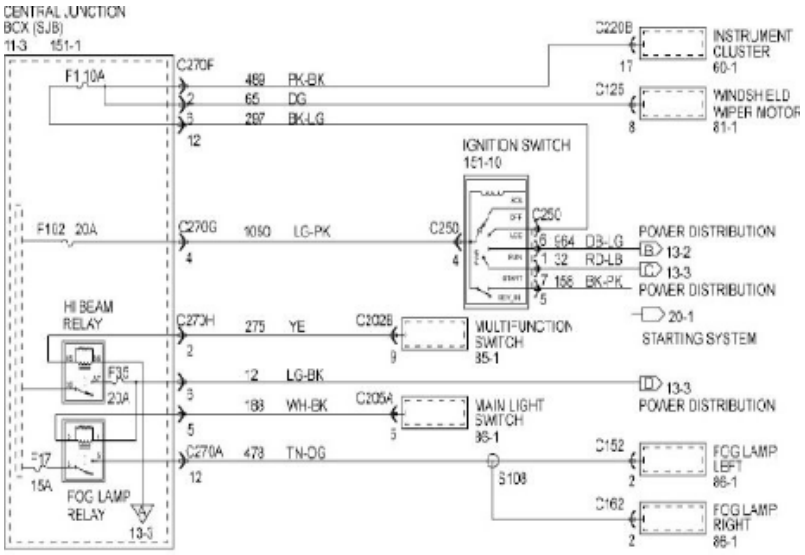
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

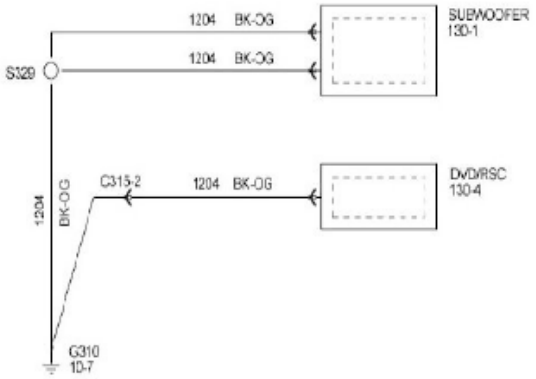
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by

each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

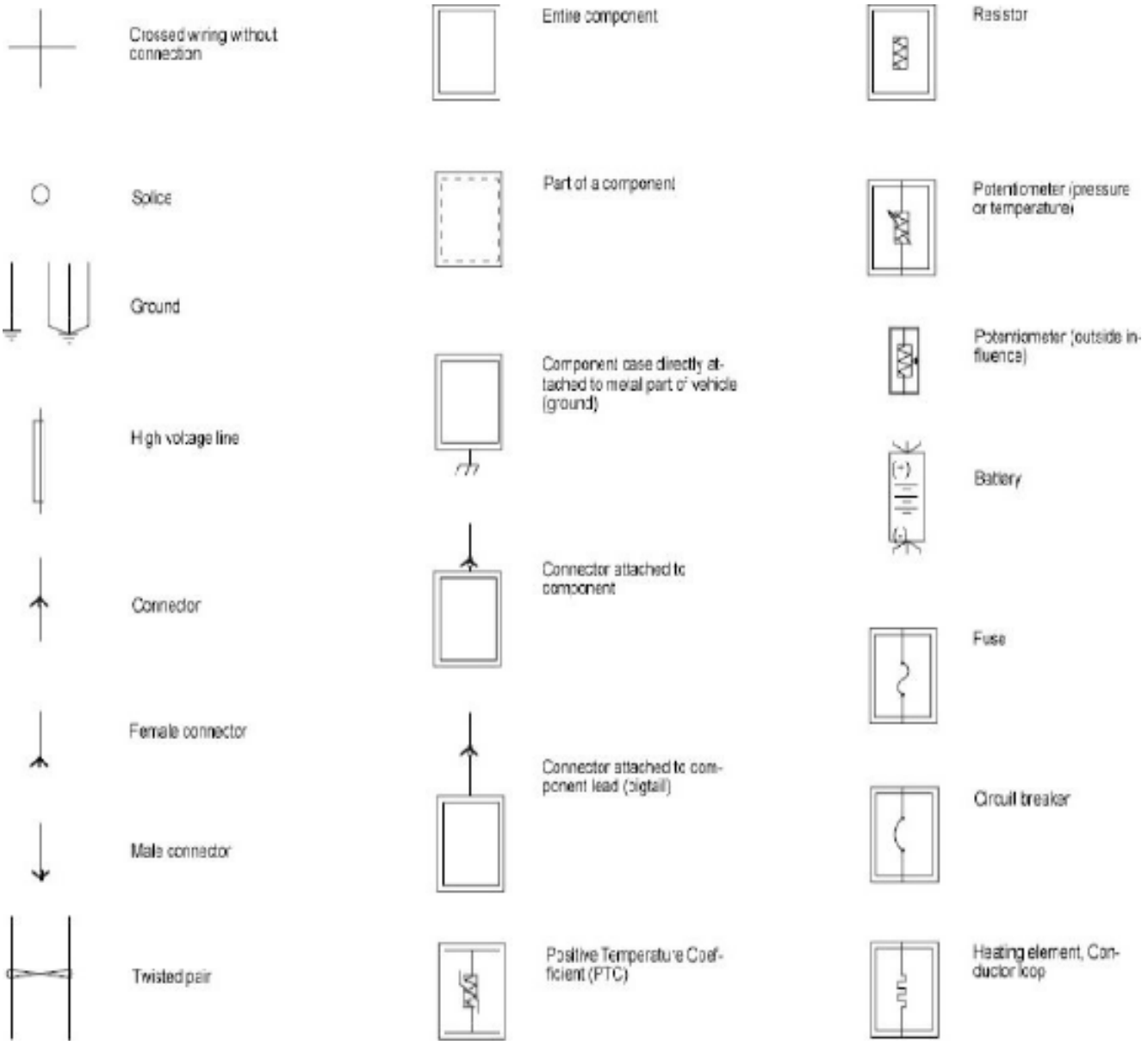
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

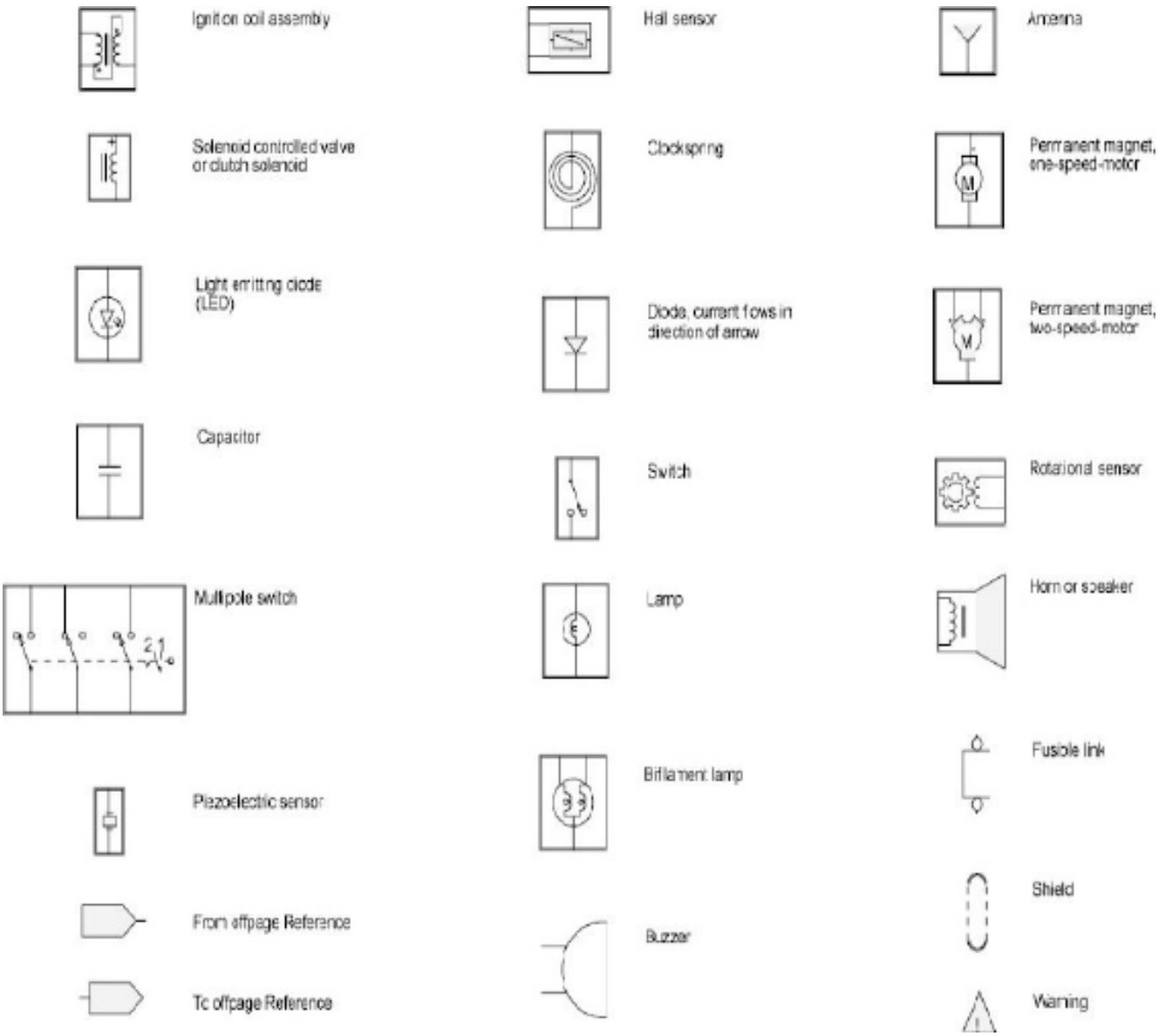
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

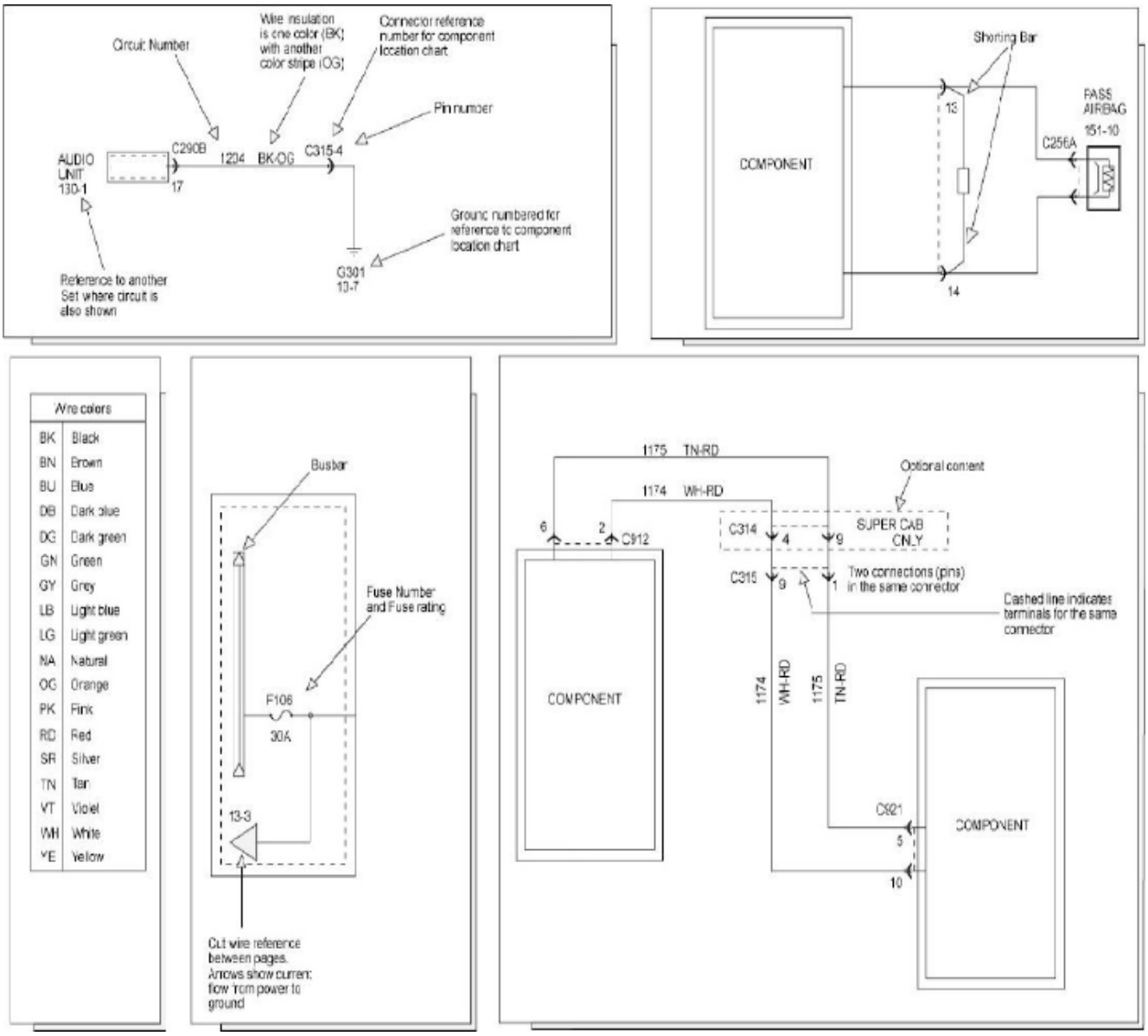
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

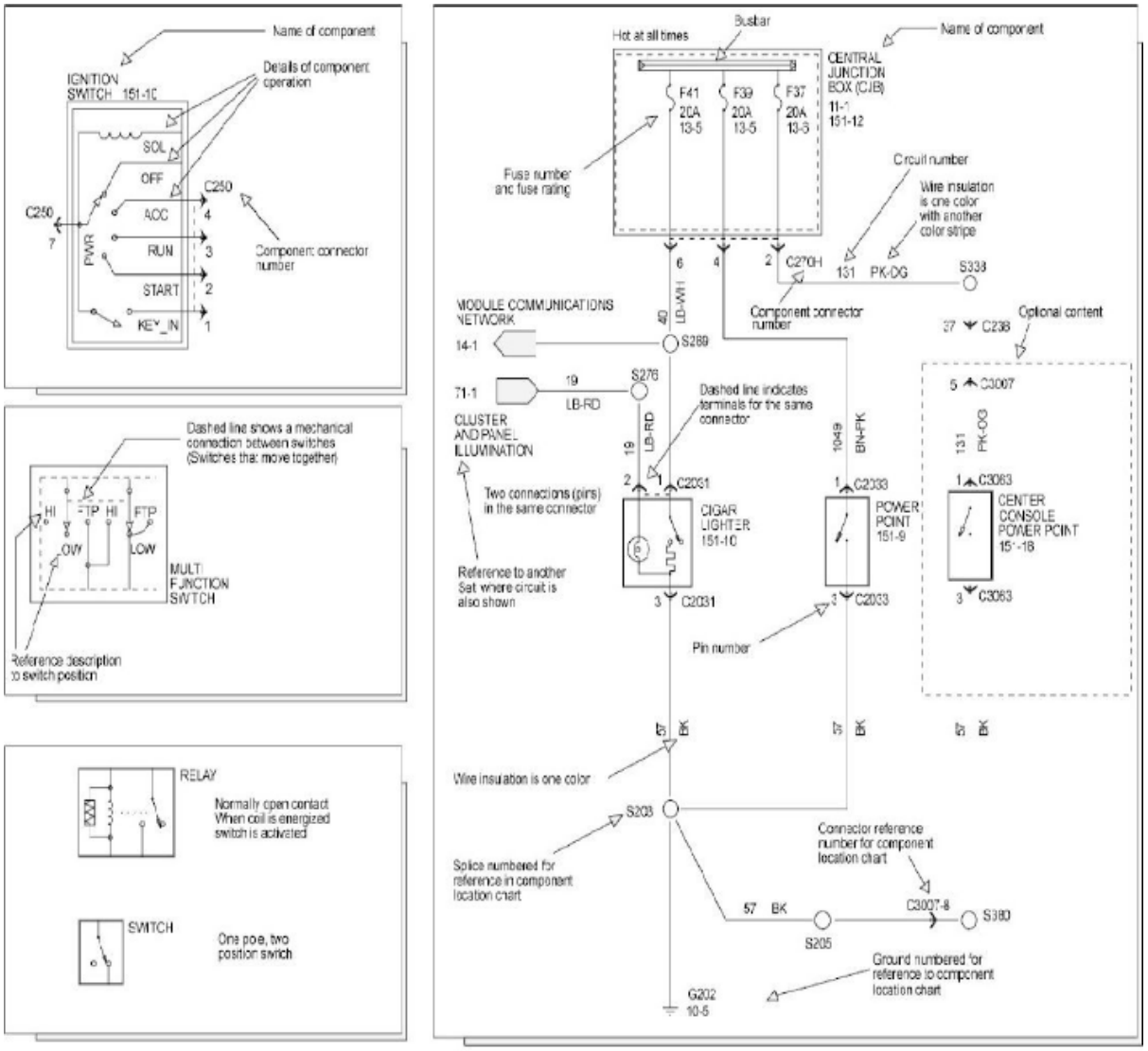
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

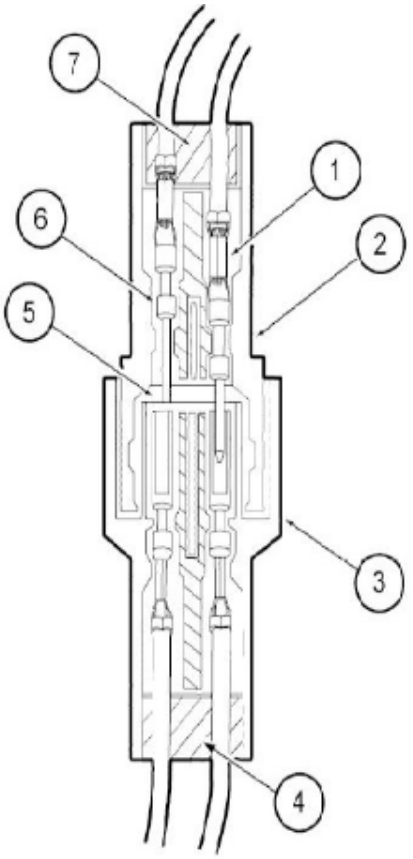


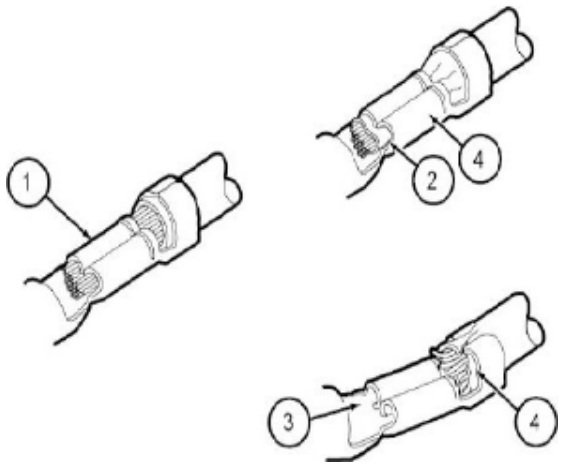
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)





Accessory Delay Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

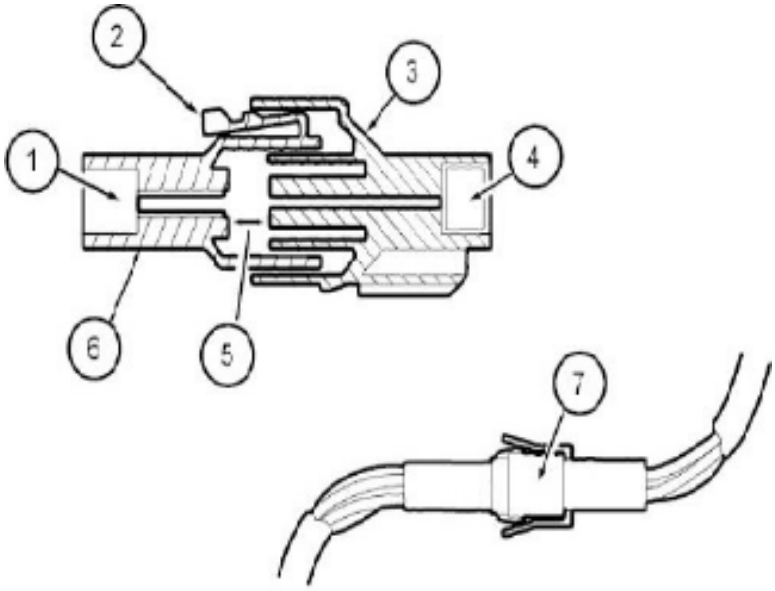
5 = Intermittent contact

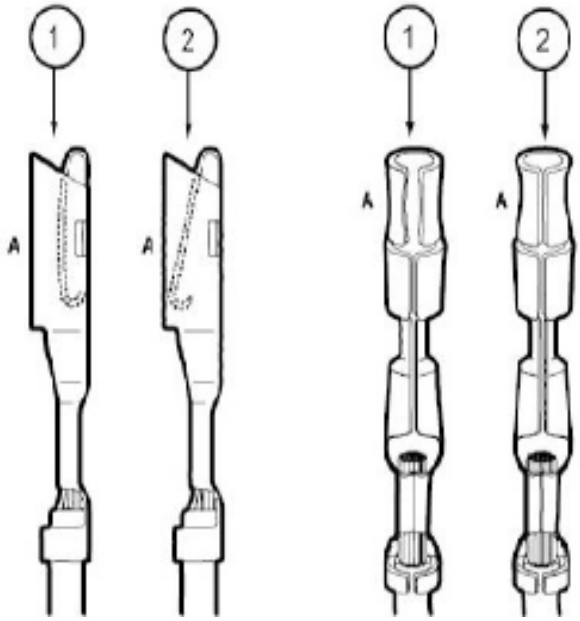
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping





1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

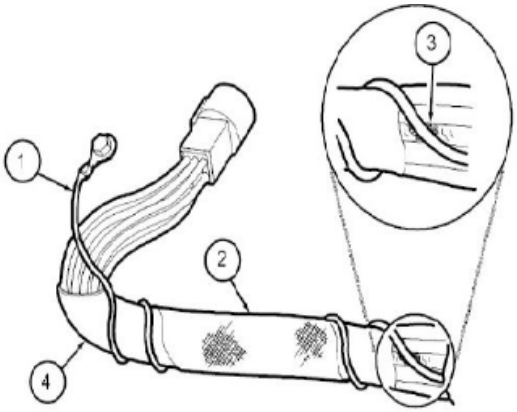
Deformed (enlarged) female terminals

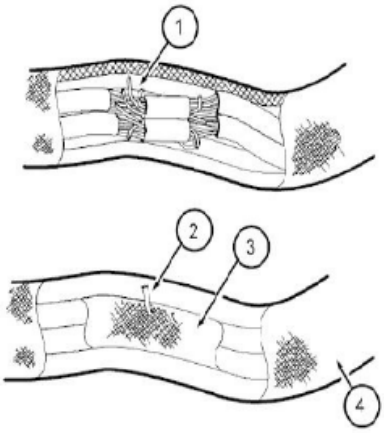
1 = Enlarged

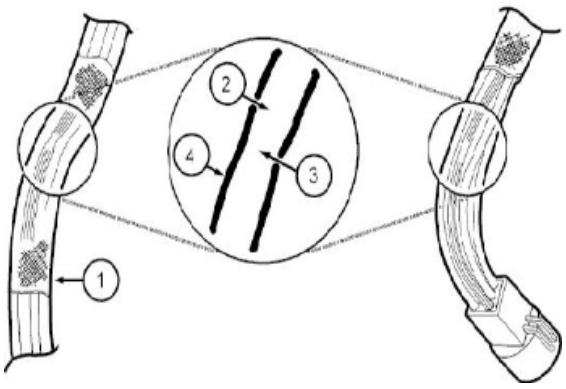
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.







Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

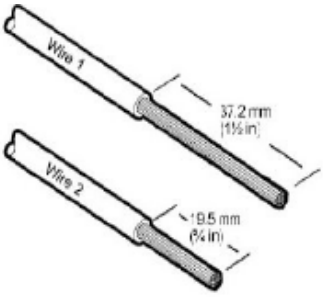
Splice covered 2

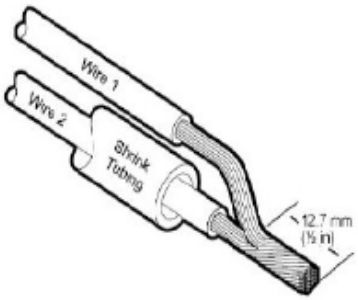
= Wire strand

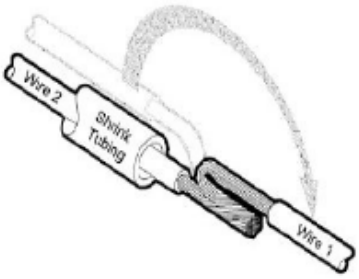
3 = Splice tape

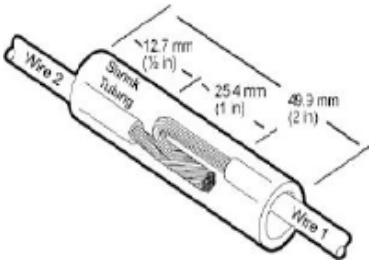
4 = Harness tape

Broken wire strands in harness









1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. lnstall heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

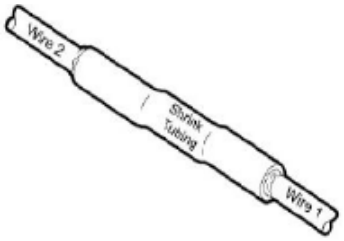
NOTE: -

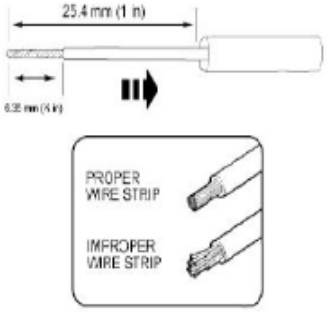
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

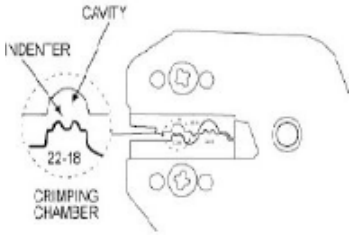
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

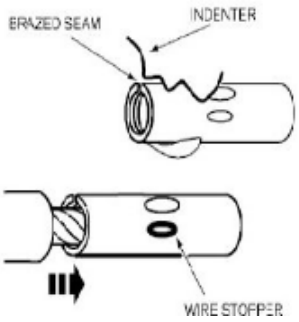
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.









7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

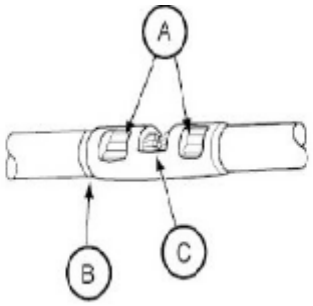
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

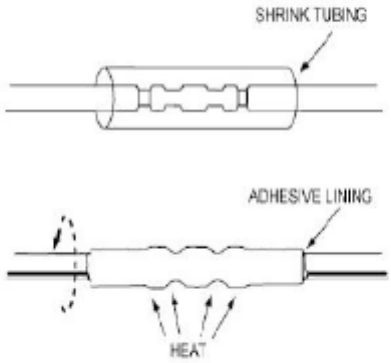
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4 strip, cut 9 strands	* 1/4 strip, cut 2 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip, fold 3x dia.
	16-14	* 1/4 strip, cut 7 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip fold 2x dia	1 strip, fold 3x dia.	1 1/4 strip, fold 4x dia.	Not Recommended
	12-10	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip, fold 3x cia.	1 1/4 strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Pigtail only

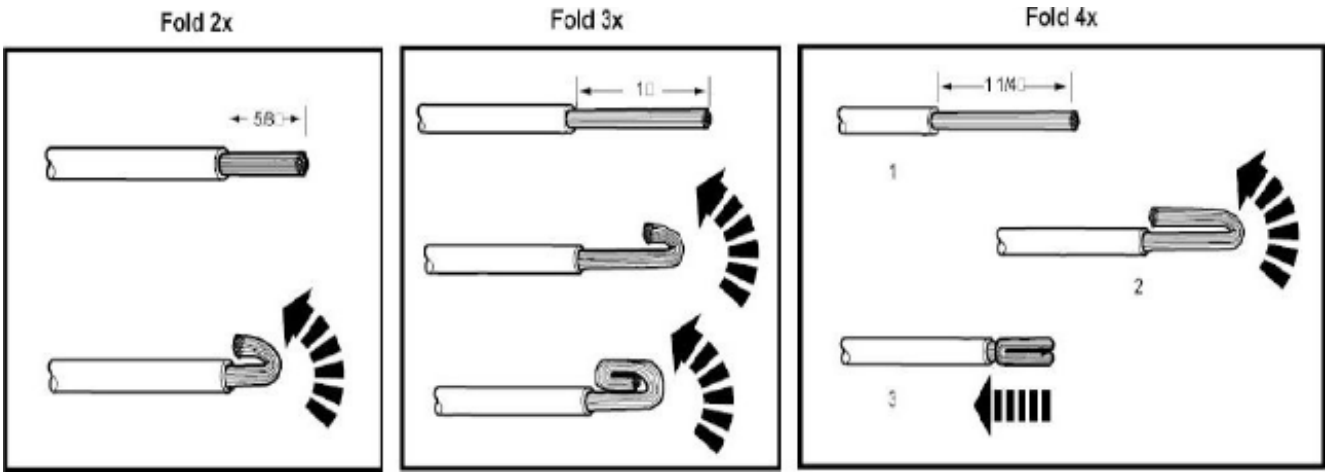
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



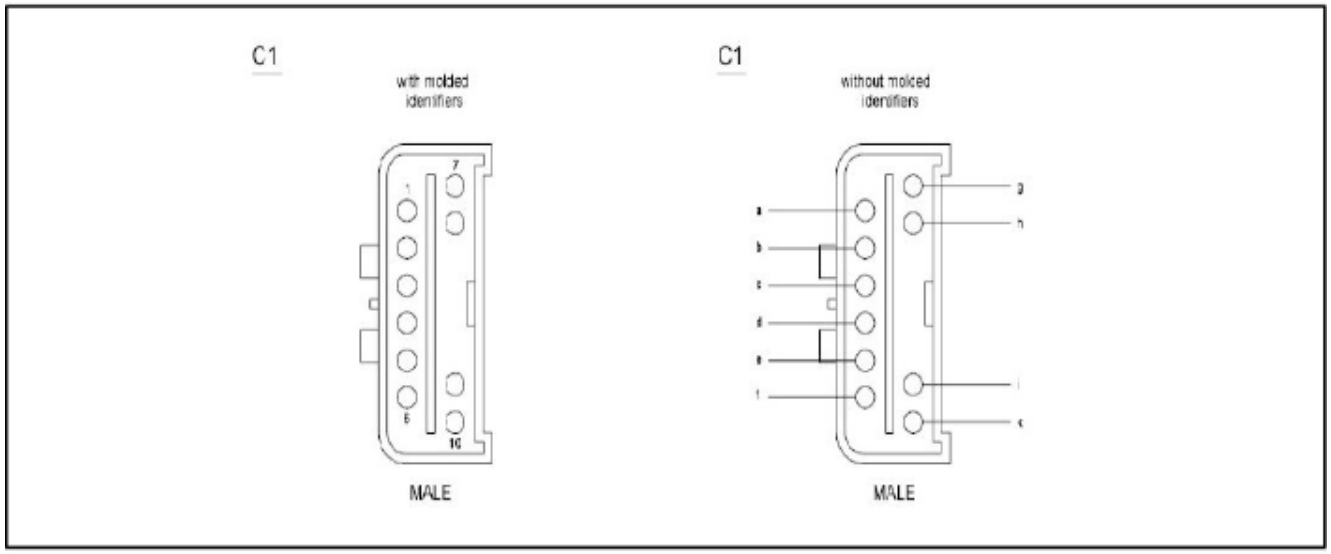
The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



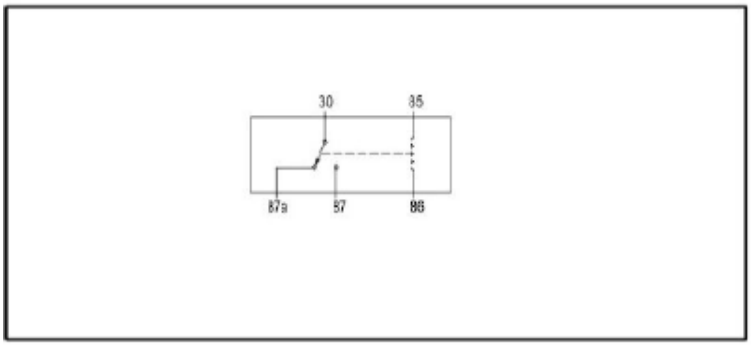
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

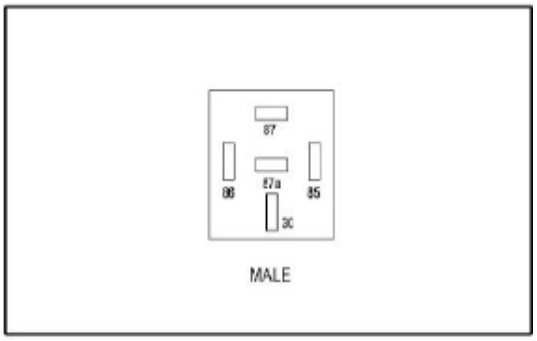
Accessory Delay Relay: Testing and Inspection Mini ISO Relay

Relay □ Mini ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	45 □ 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

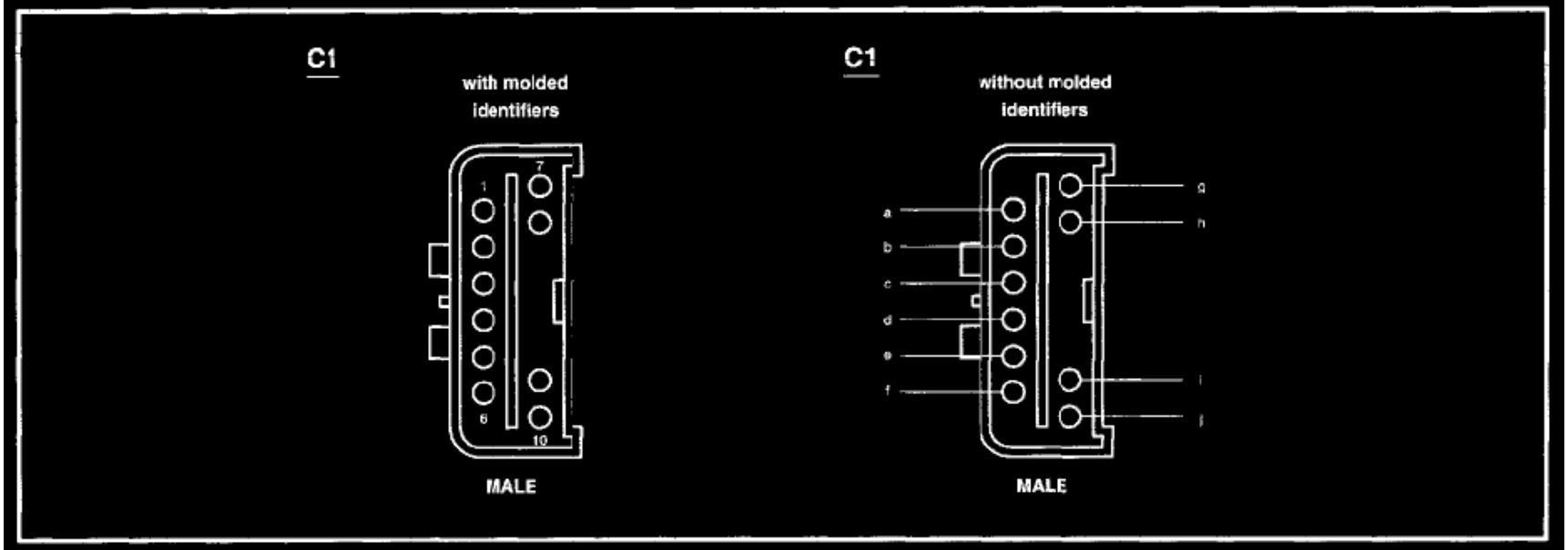
Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step–by–step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals

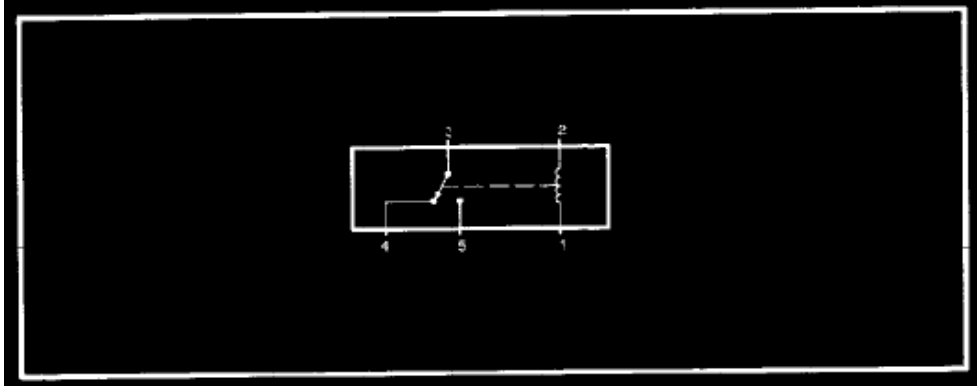


The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

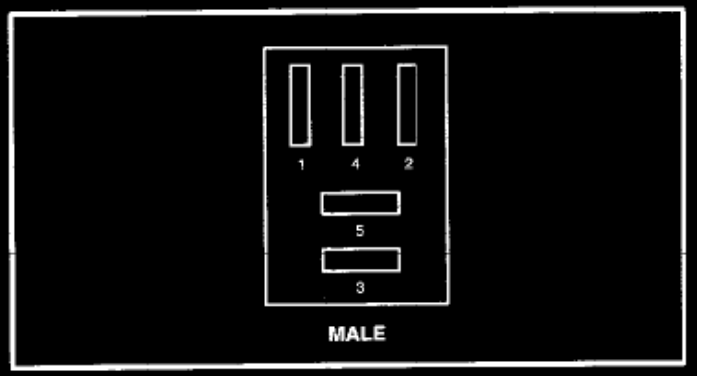
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Relay – Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63–102Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil – Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

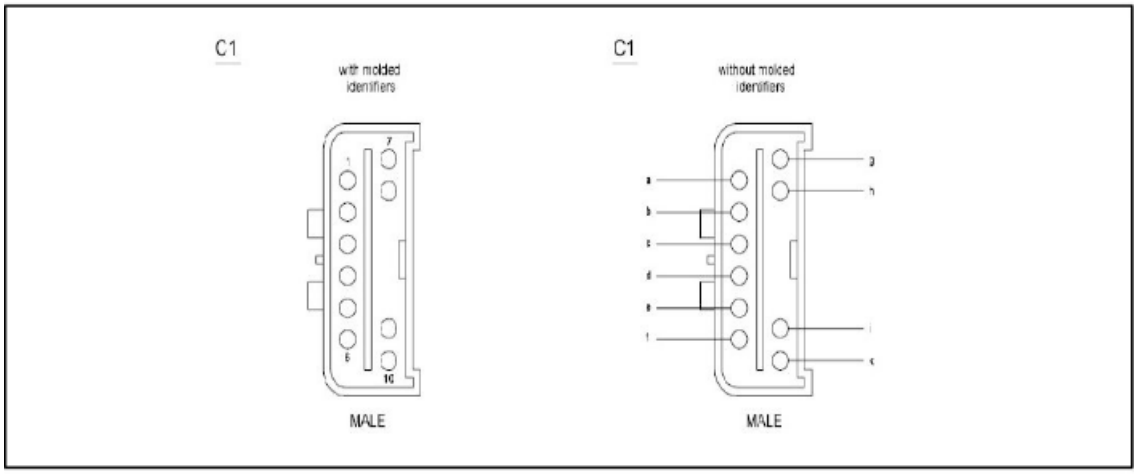
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals

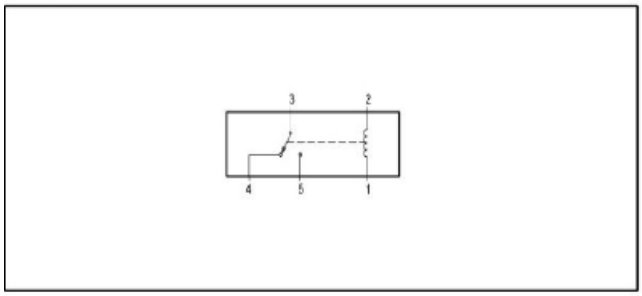


The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

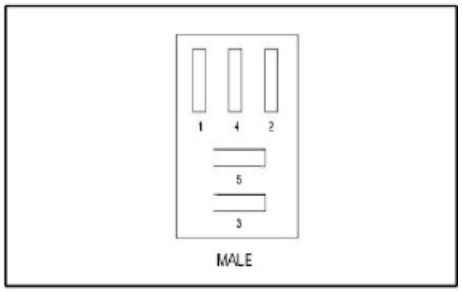
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Relay - Micro ISO

Schematic



Terminals



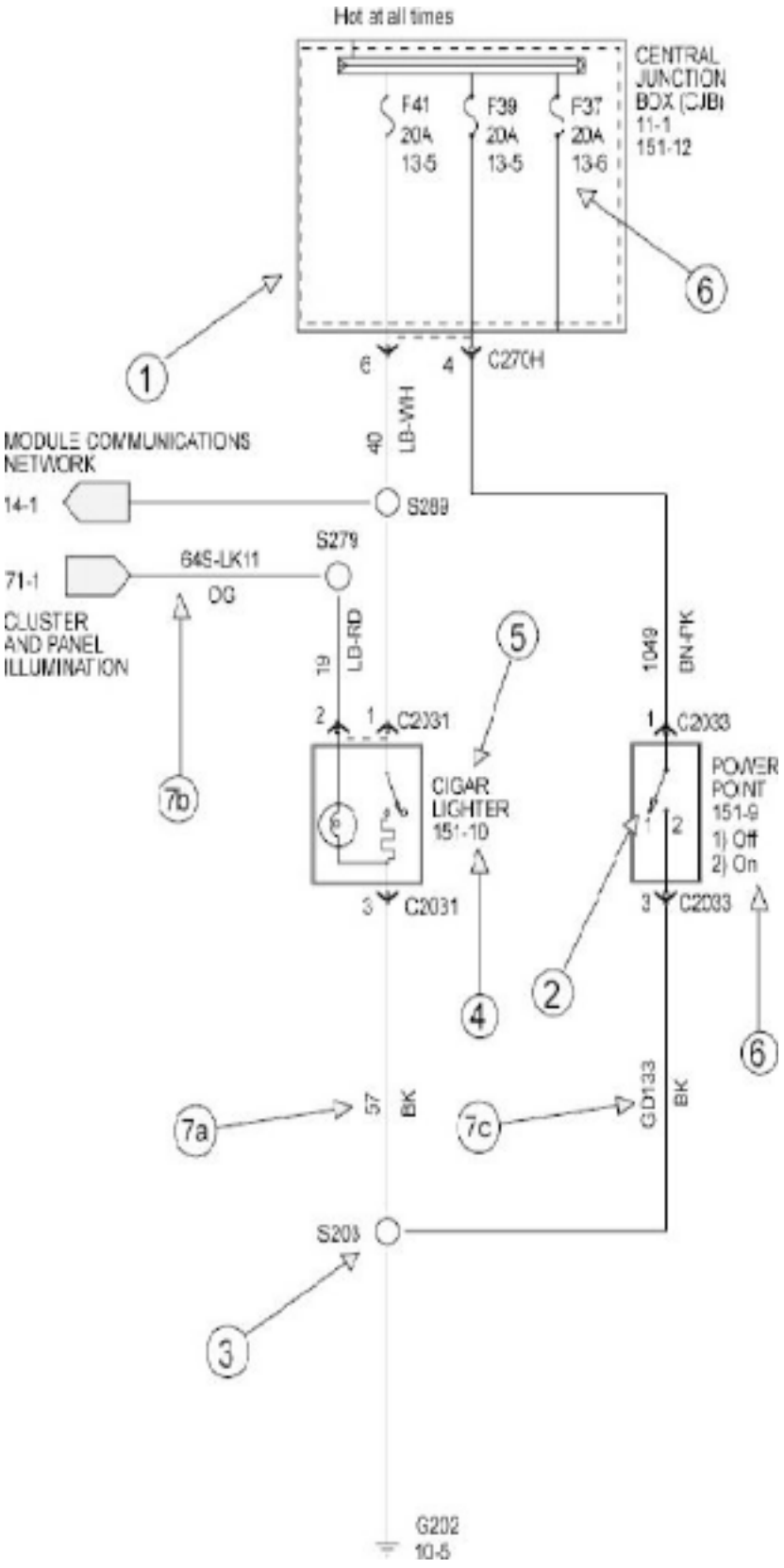
Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63-102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil - Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Accessories and Optional Equipment > Towing / Trailer System > Trailer Connector > Component Information > Diagrams > Diagram Information and Instructions



Trailer Connector: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

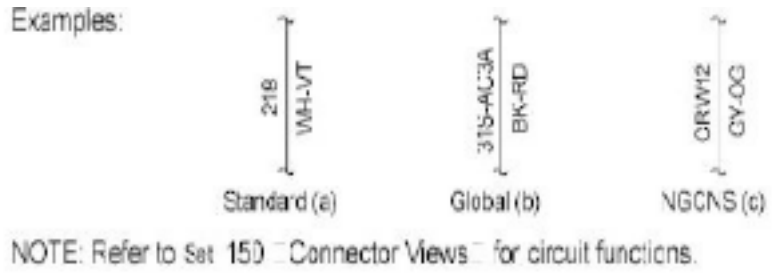
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

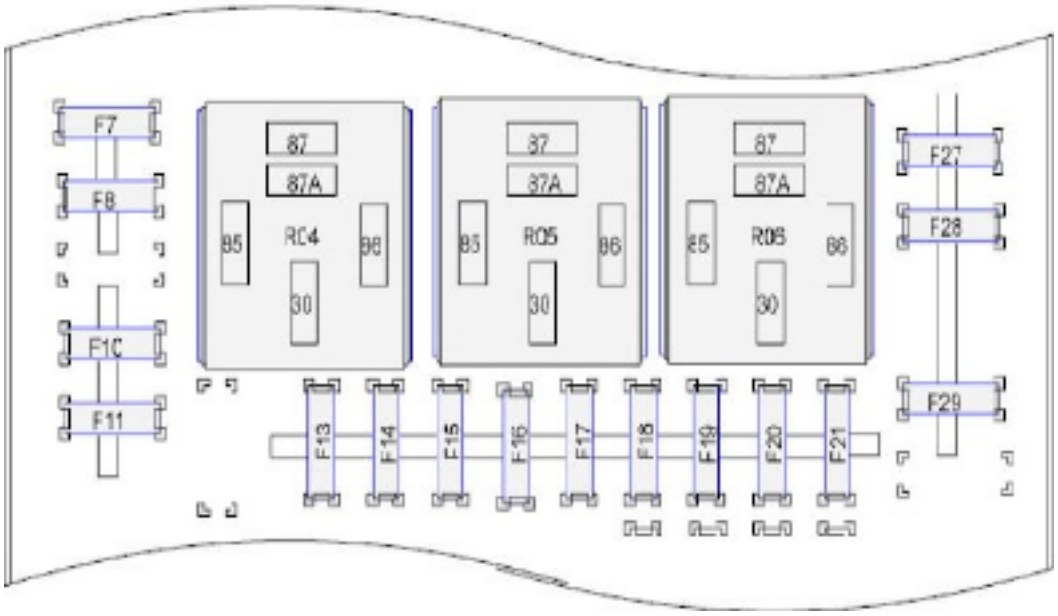
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

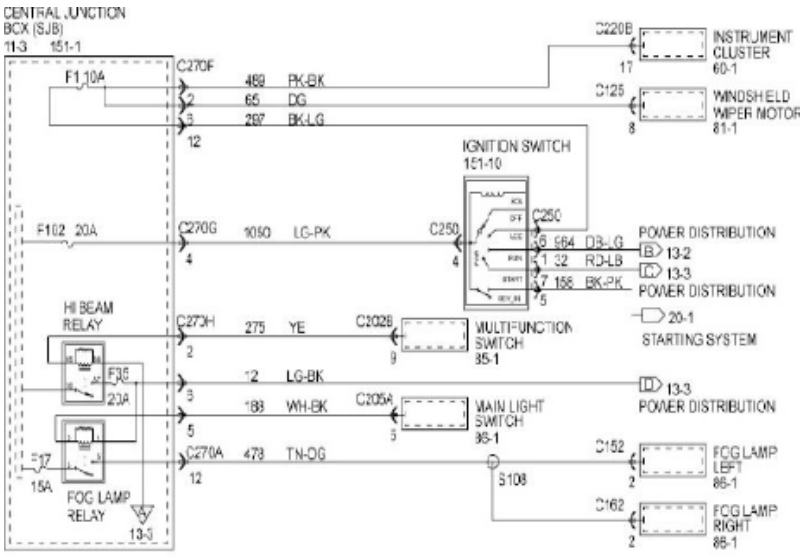
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

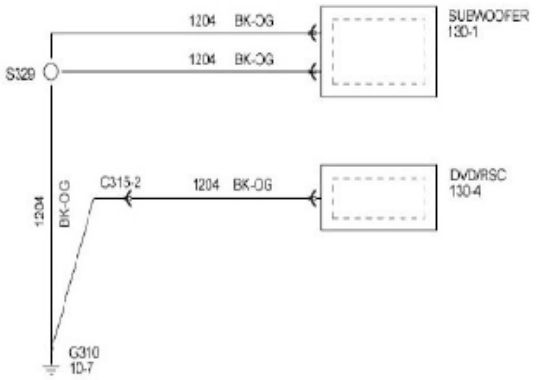
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

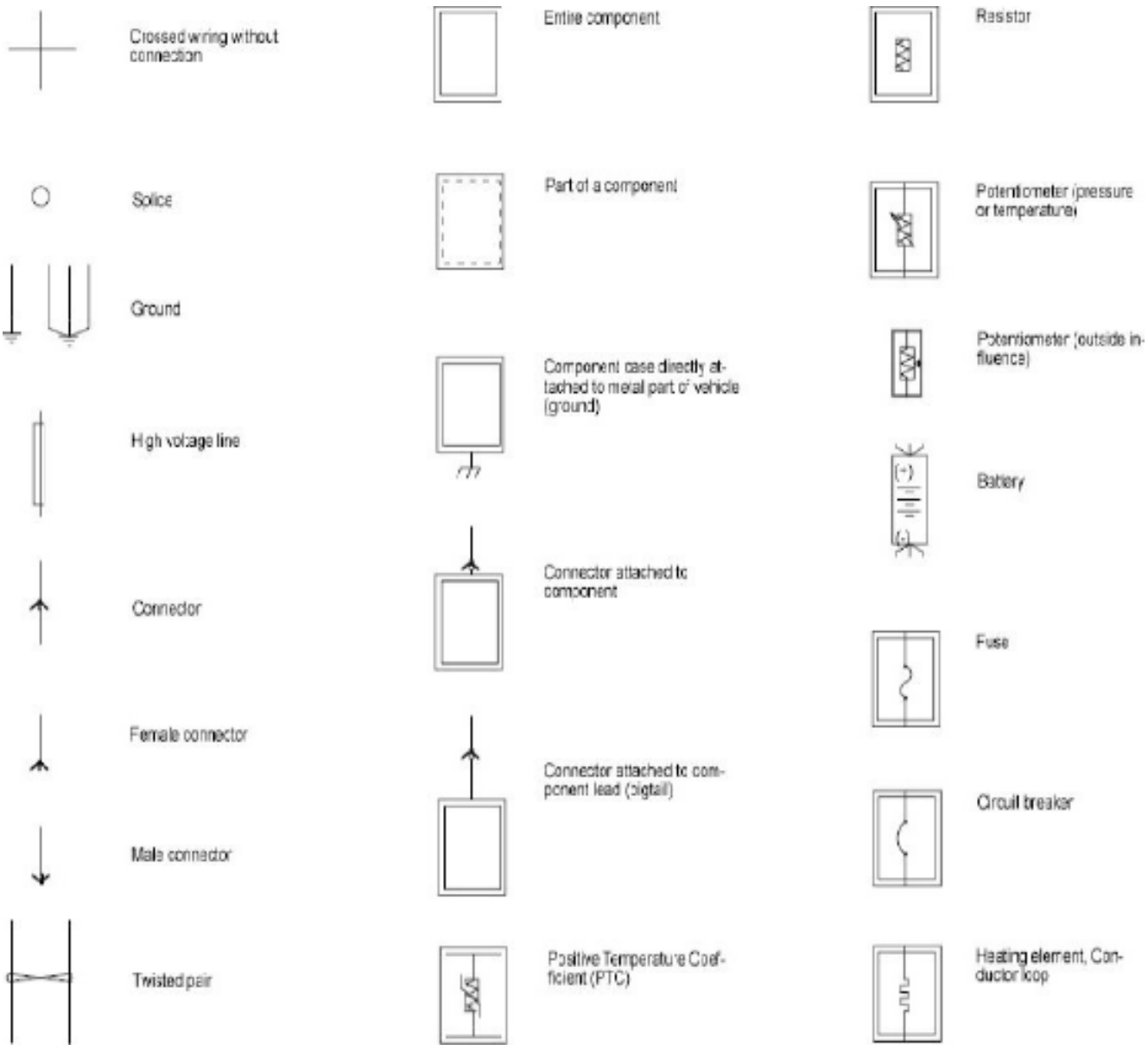
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

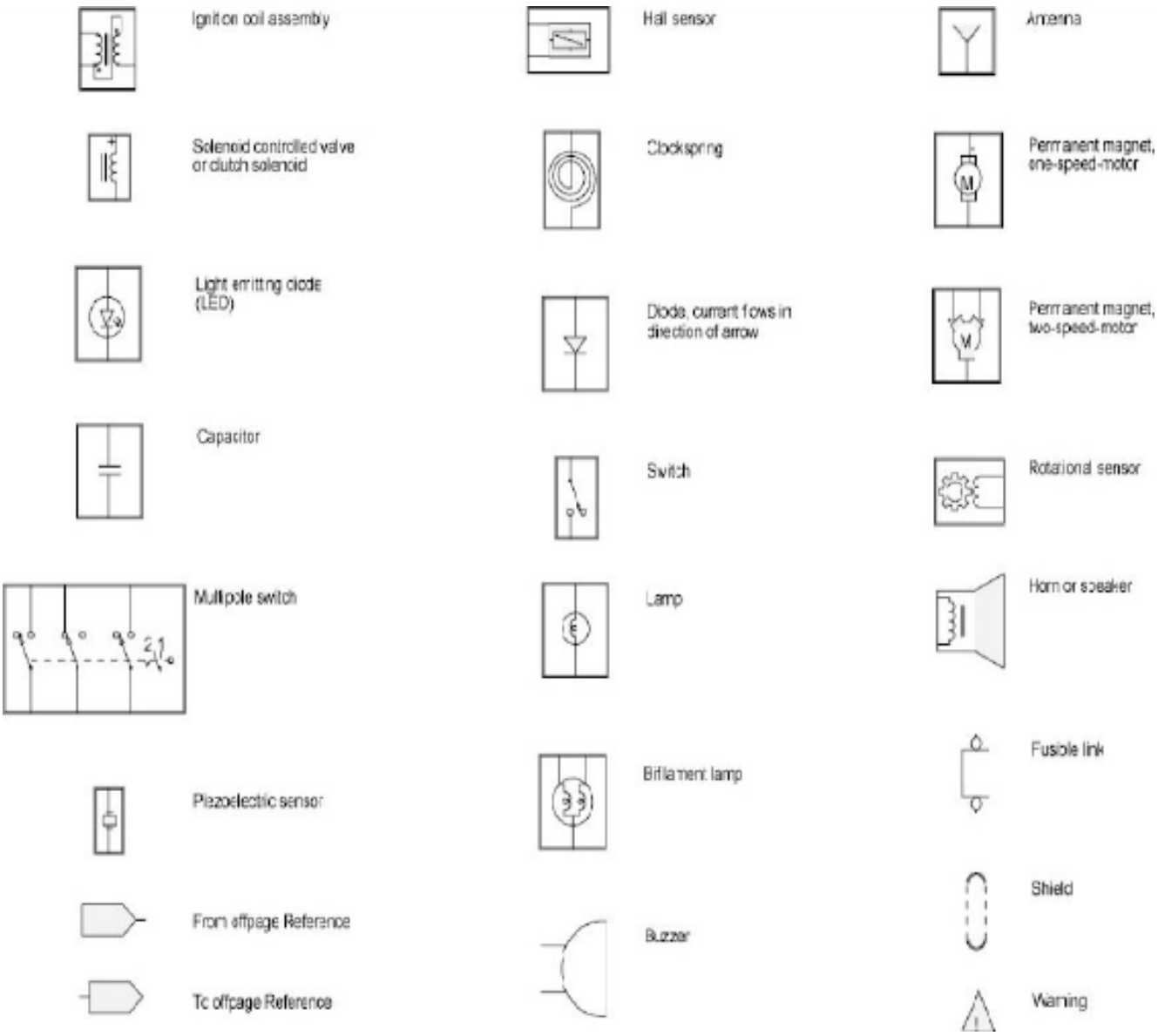
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

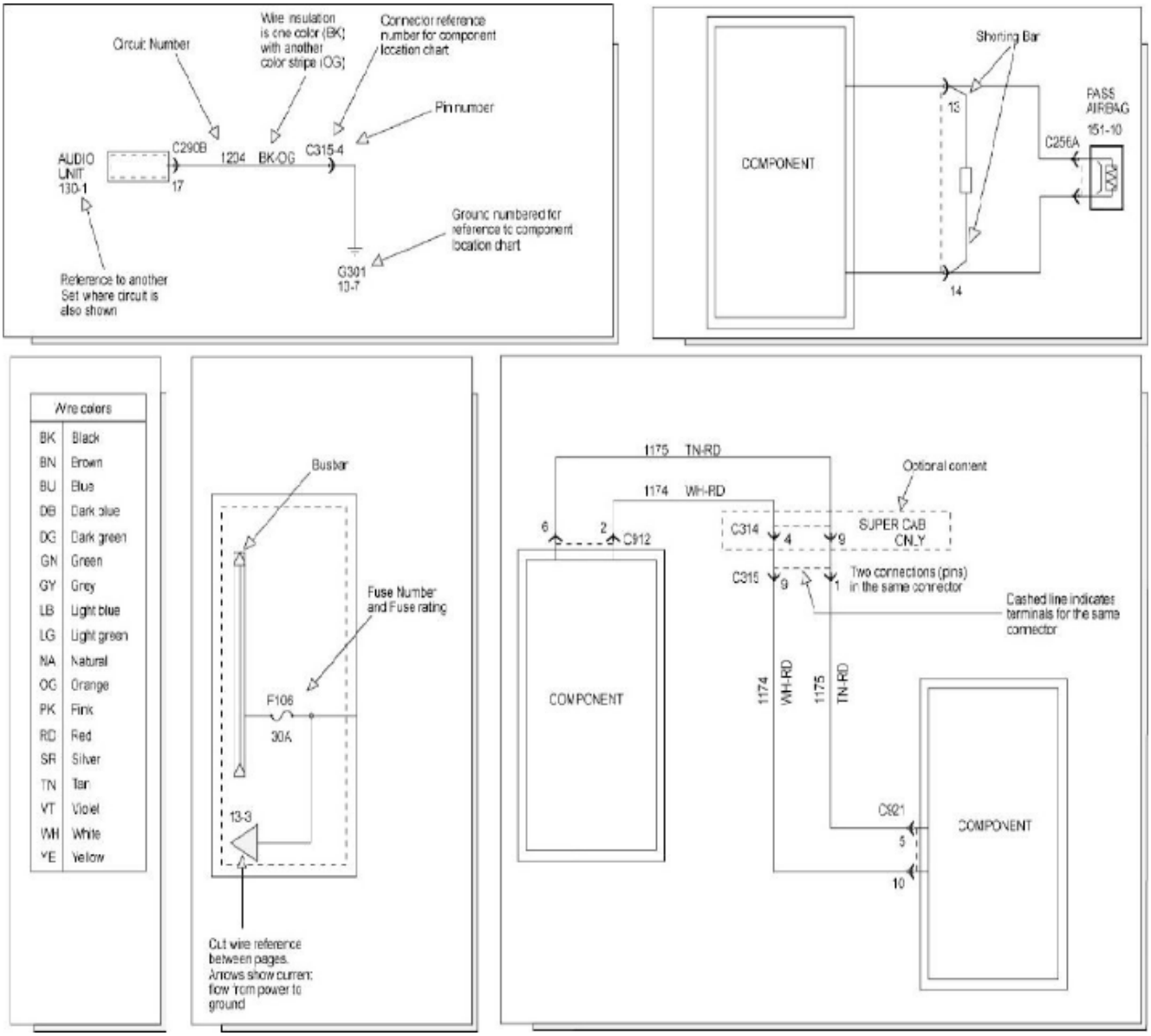
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

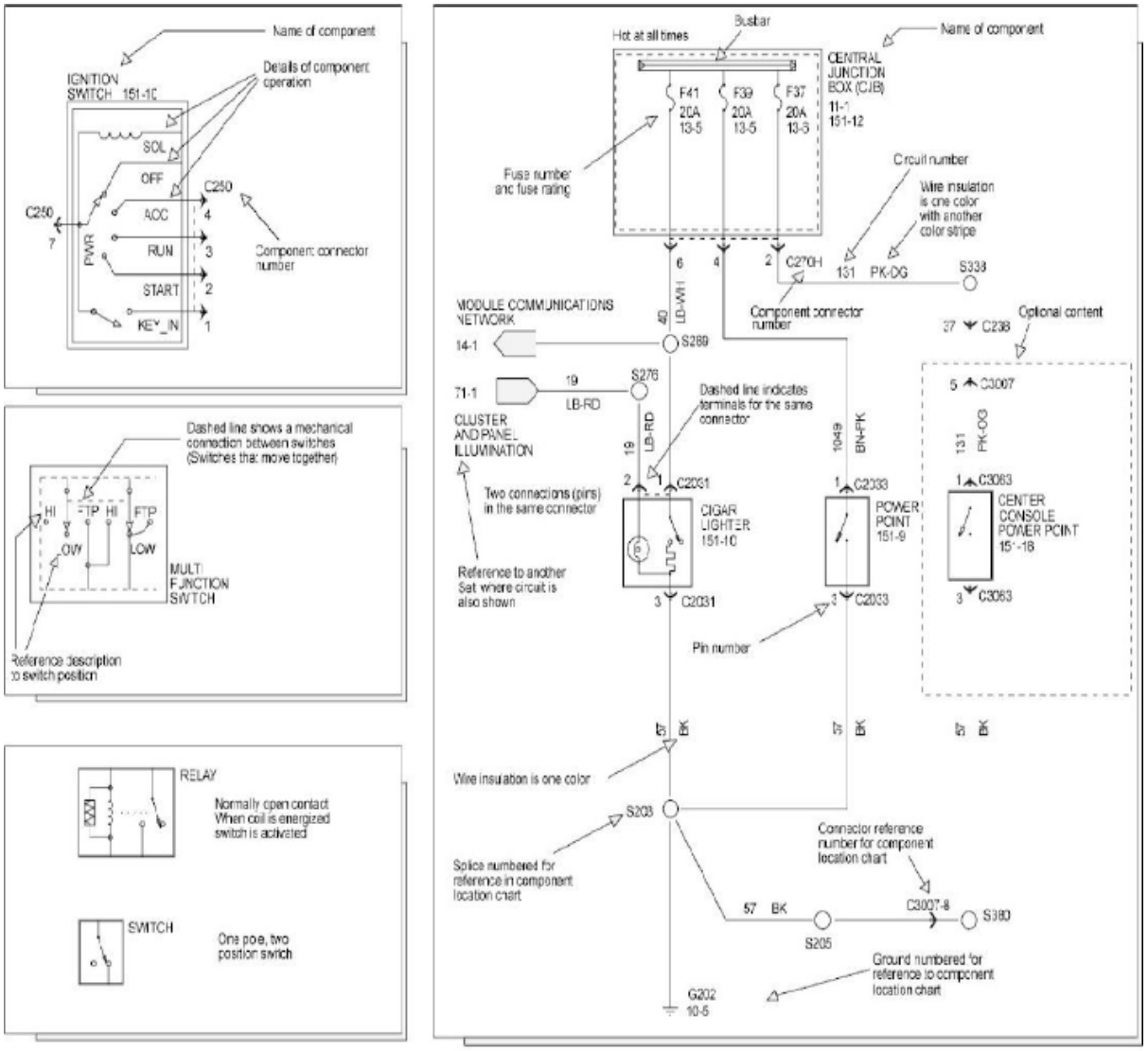
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

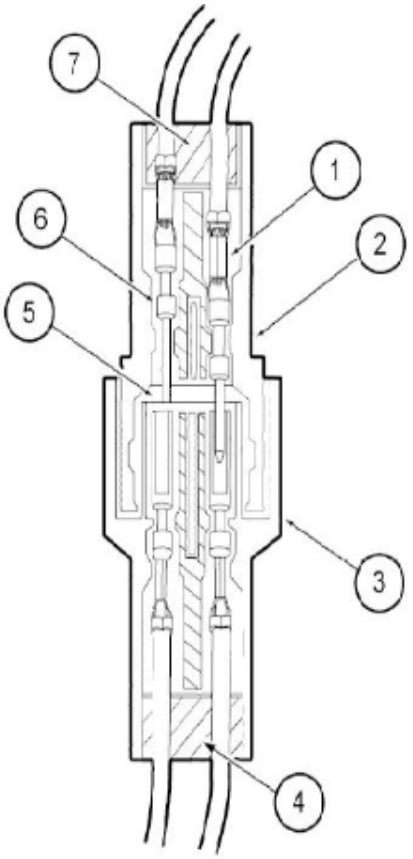


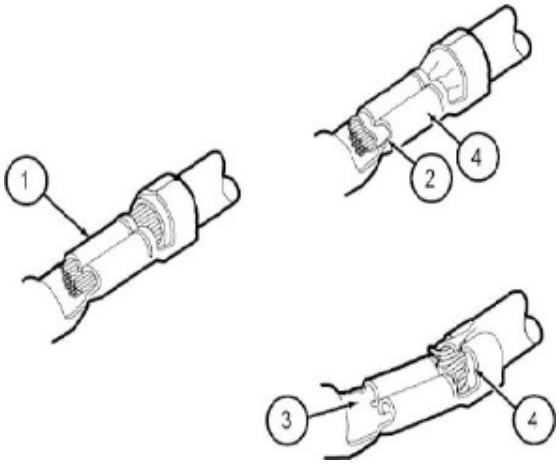
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Trailer Connector: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

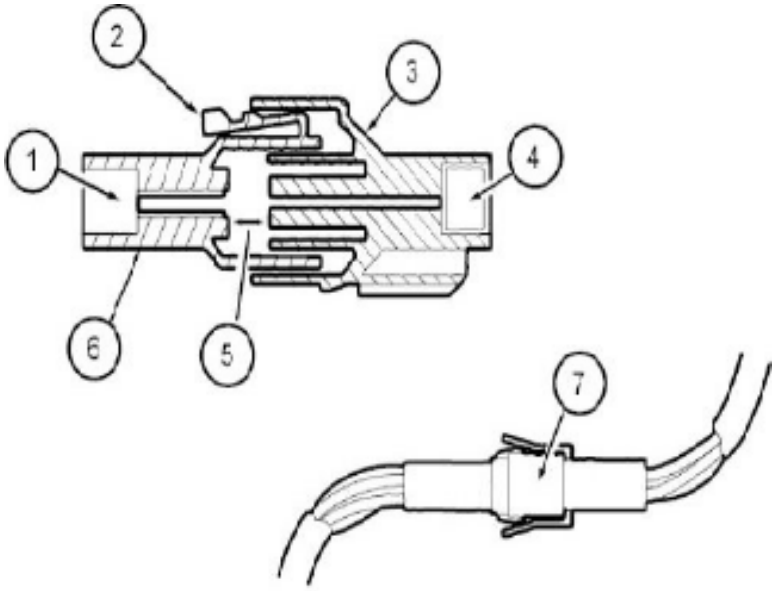
5 = Intermittent contact

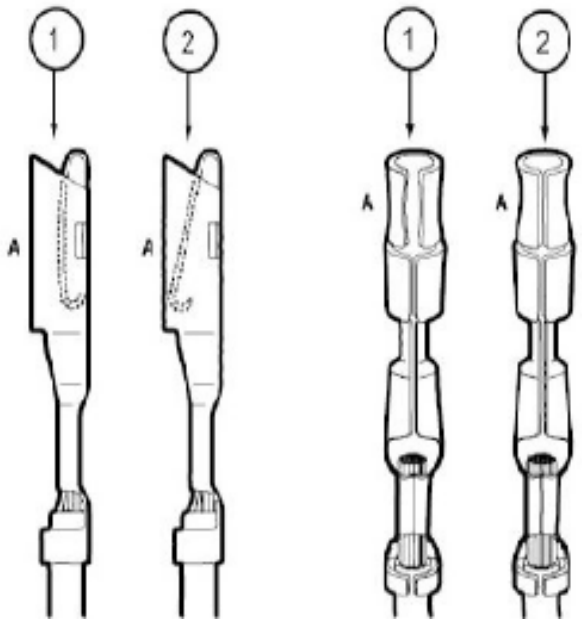
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

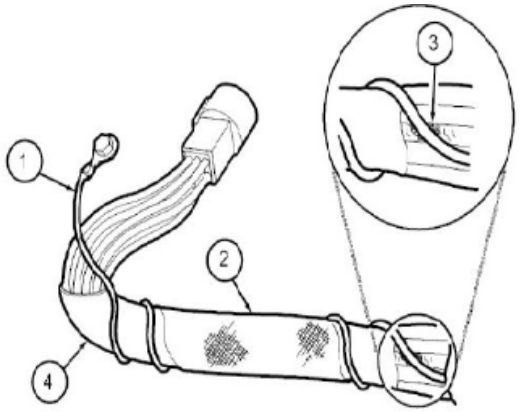
Deformed (enlarged) female terminals

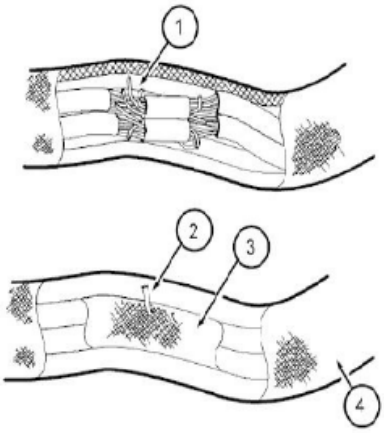
1 = Enlarged

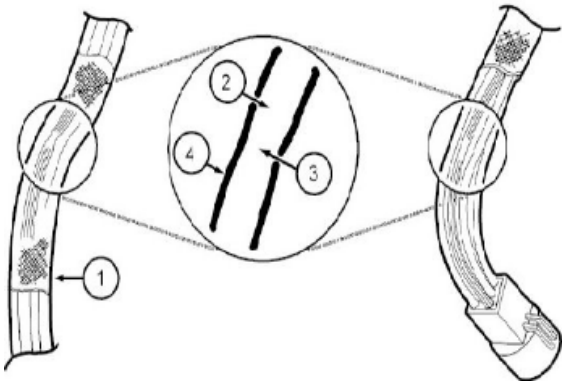
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

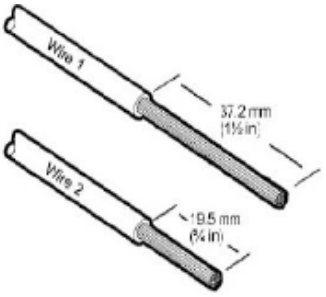
Splice covered 2

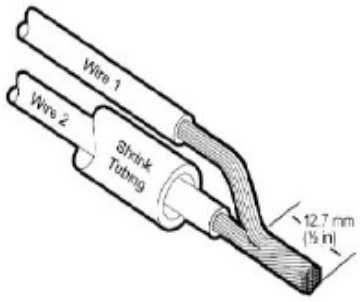
= Wire strand

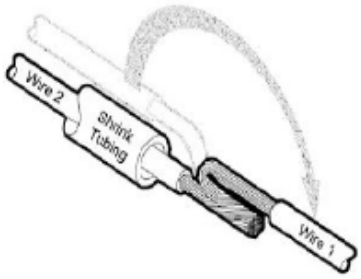
3 = Splice tape

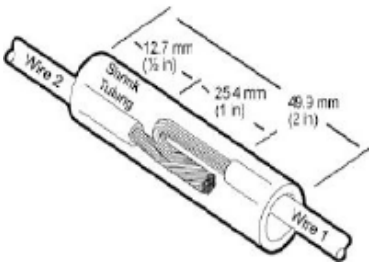
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

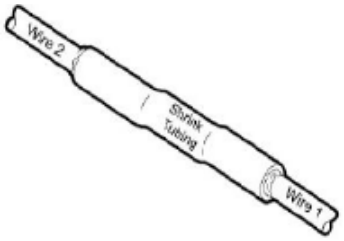
NOTE: -

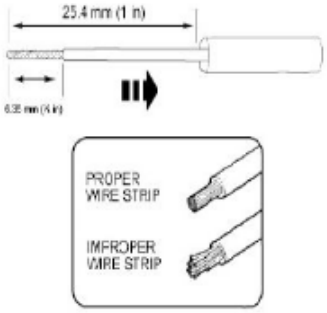
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

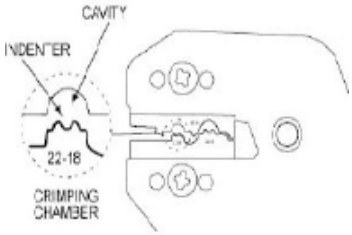
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

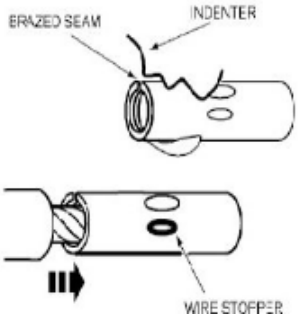
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
6.35 mm (¼ in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

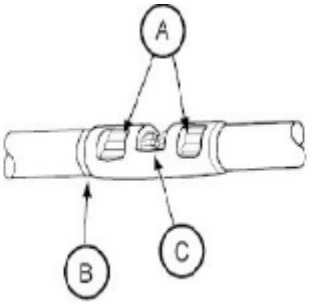
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

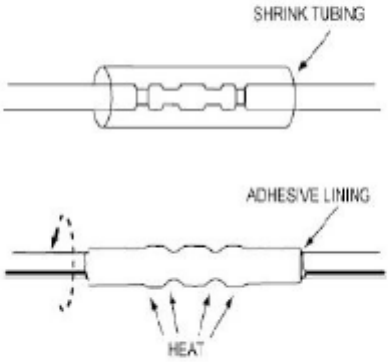
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4□ strip, cut 9 strands	* 1/4□ strip, cut 2 strands	1/4□ strip, no fold	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip, fold 2x dia.	1□ strip, fold 3x dia.
	16-14	* 1/4□ strip, cut 7 strands	1/4□ strip, no fold	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip fold 2x dia	1□ strip, fold 3x dia.	1 1/4□ strip, fold 4x dia.	Not Recommended
	12-10	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip, fold 2x dia.	1□ strip fold 3x cia.	1 1/4□ strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Figtail only

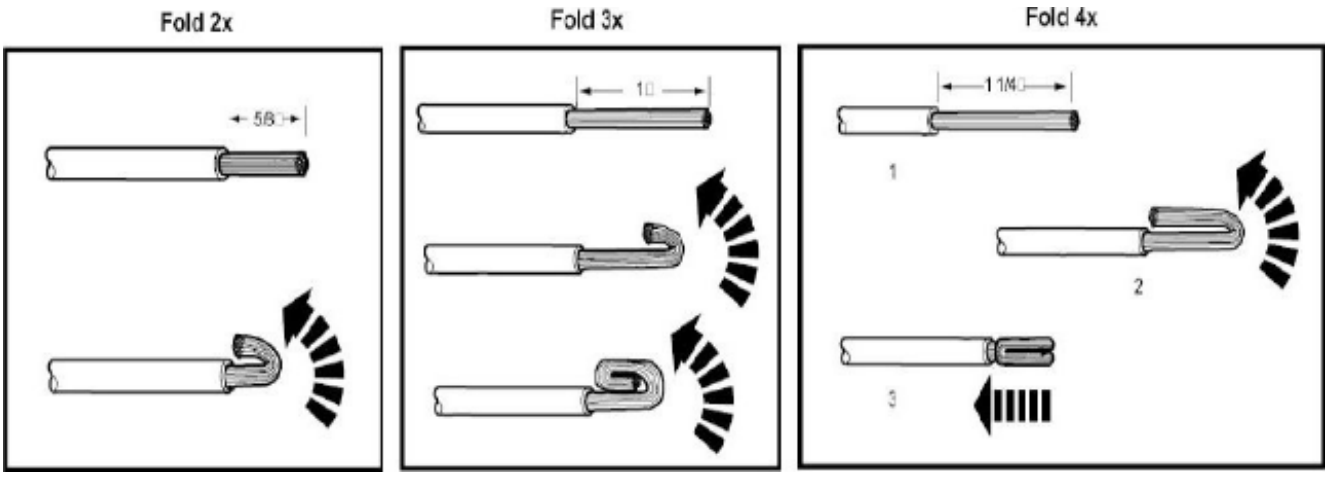
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



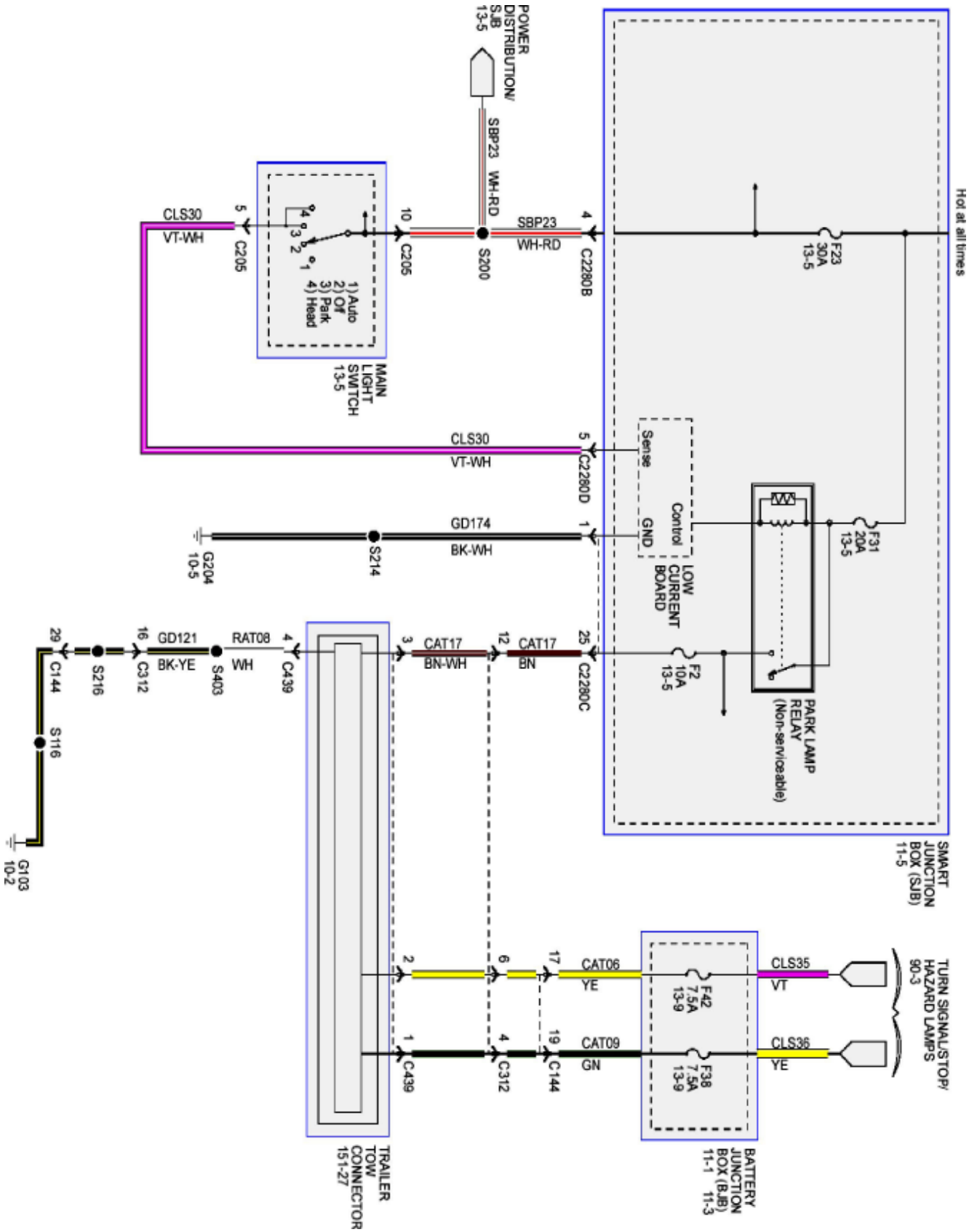
The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Connector: C439

Description:	Harness:	Base Part #:
TRAILER TOW CONNECTOR	14405	15A416

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CAT09 (GN)	16	CTRL MOD. - TRAILER TOW # TURN SIGNAL RIGHT (COLOR TO SAE 1239)	
2	CAT06 (YE)	16	CTRL MOD. - TRAILER TOW # TURN SIGNAL LEFT (COLOR TO SAE 1239)	
3	CAT17 (BN-WH)	16	RELAY - TRAILER TOW PARK LAMPS (COLOR TO SAE 1239)	
4	RAT08 (WH)	16	CTRL MOD. - TRAILER TOW # RETURN	

C439


POWER DISTRIBUTION/ SJB 13-5
SBP23 WH-RD
SBP23 WH-RD
Hot at all times
F23 30A 13-5
CLS30 VT-WH
C205
S200
C2280B
MAIN LIGHT SWITCH 13-5
1) Auto
2) Off
3) Park
4) Head
CLS30 VT-WH
C2280D
Sense
Control
GND
LOW CURRENT BOARD
F31 20A 13-5
GD174 BK-WH
G204 10-5
S214
PARK LAMP RELAY (Non-serviceable)
F2 10A 13-5
GD121 BK-YE
RAT08 WH
S216
C312
S403
C439
CAT17 BN-WH
CAT17 BN
C2280C
SMART JUNCTION BOX (SJB) 11-5
S116
G103 10-2
C144
CAT06 YE
CAT09 GN
F42 7.5A 13-9
F38 7.5A 13-9
CLS35 VT
CLS36 YE
TURN SIGNALS/STOP/ HAZARD LAMPS 90-3
TRAILER TOW CONNECTOR 151-27
BATTERY JUNCTION BOX (BJB) 11-1 11-3

Trailer Connector: Electrical Diagrams

PLEASE NOTE: Some diagrams may appear to be missing because of gaps in the number sequences. These "gaps" are actually for diagrams that do not apply to the vehicle model selected.

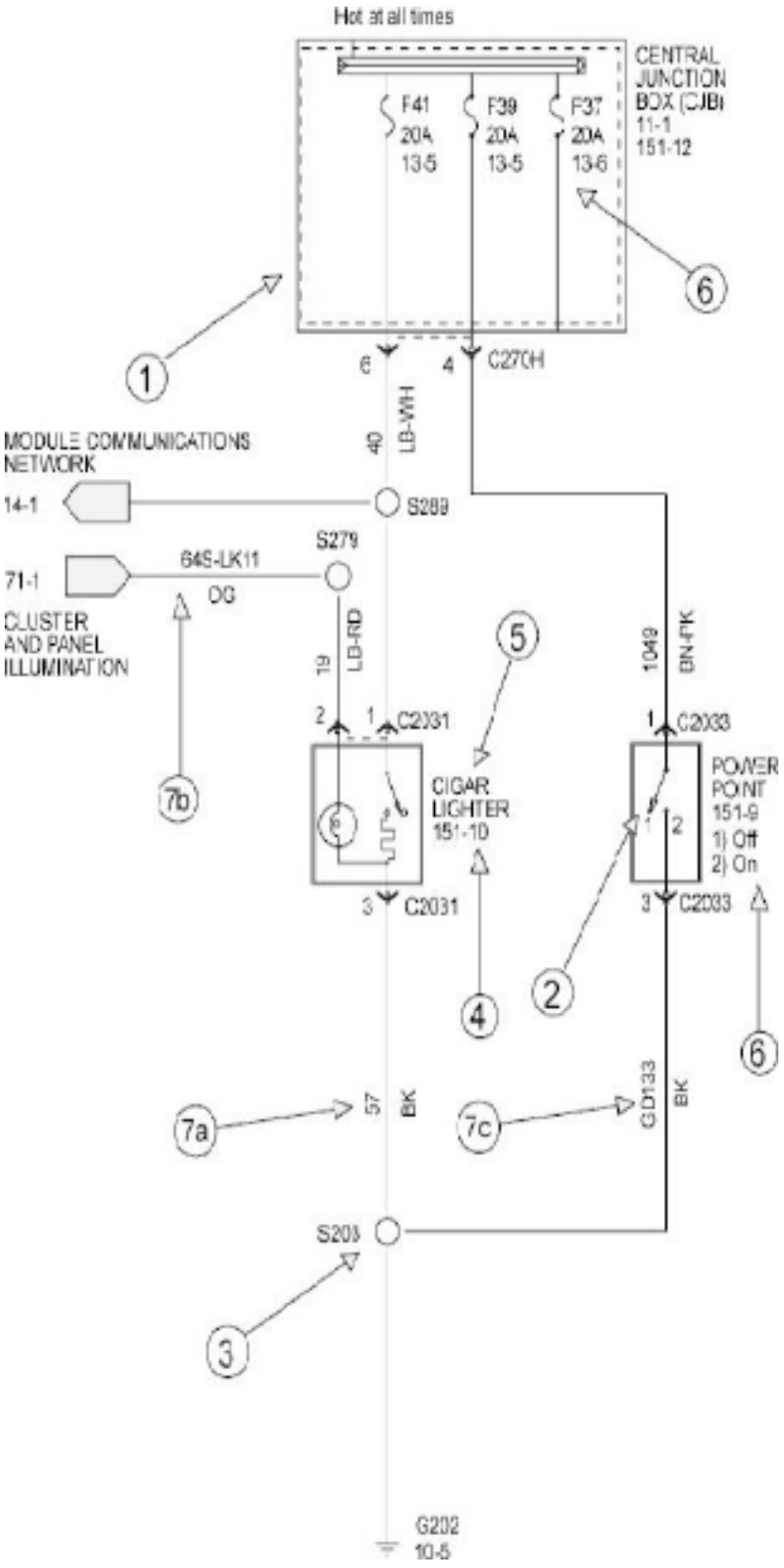
95-1

Diagrams: Other diagrams referred to by number (i.e. 13-2, 24-6, 10-2, etc.) within these diagrams can be found at Diagrams By Number. See:

Diagrams/Electrical Diagrams/Diagrams By Number

Locations: Location Views (reference numbers starting with 151-) referred to within these diagrams can be found at Location Views. See: Locations/Component Locations

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Accessories and Optional Equipment > Towing / Trailer System > Trailer Lamps > Component Information > Diagrams > Diagram Information and Instructions



Trailer Lamps: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

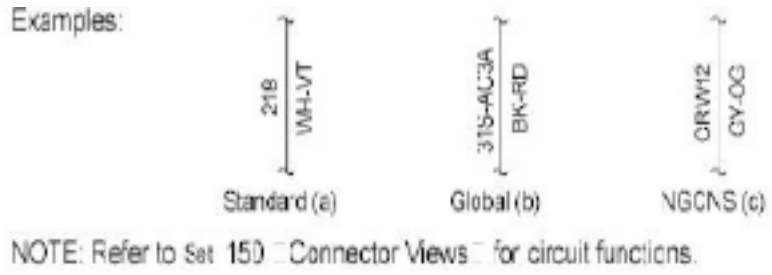
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

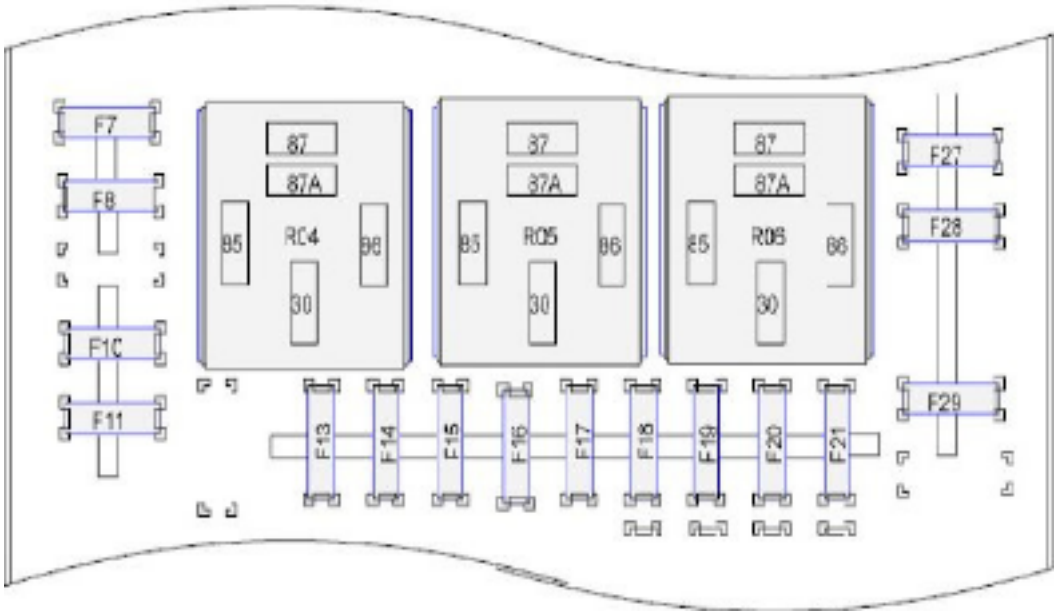
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

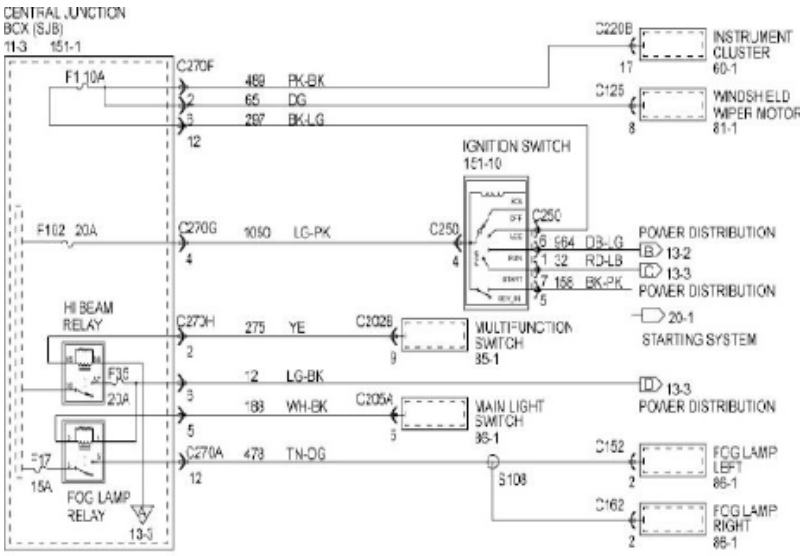
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

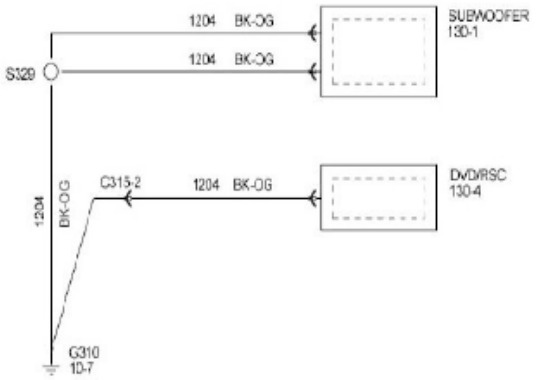
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

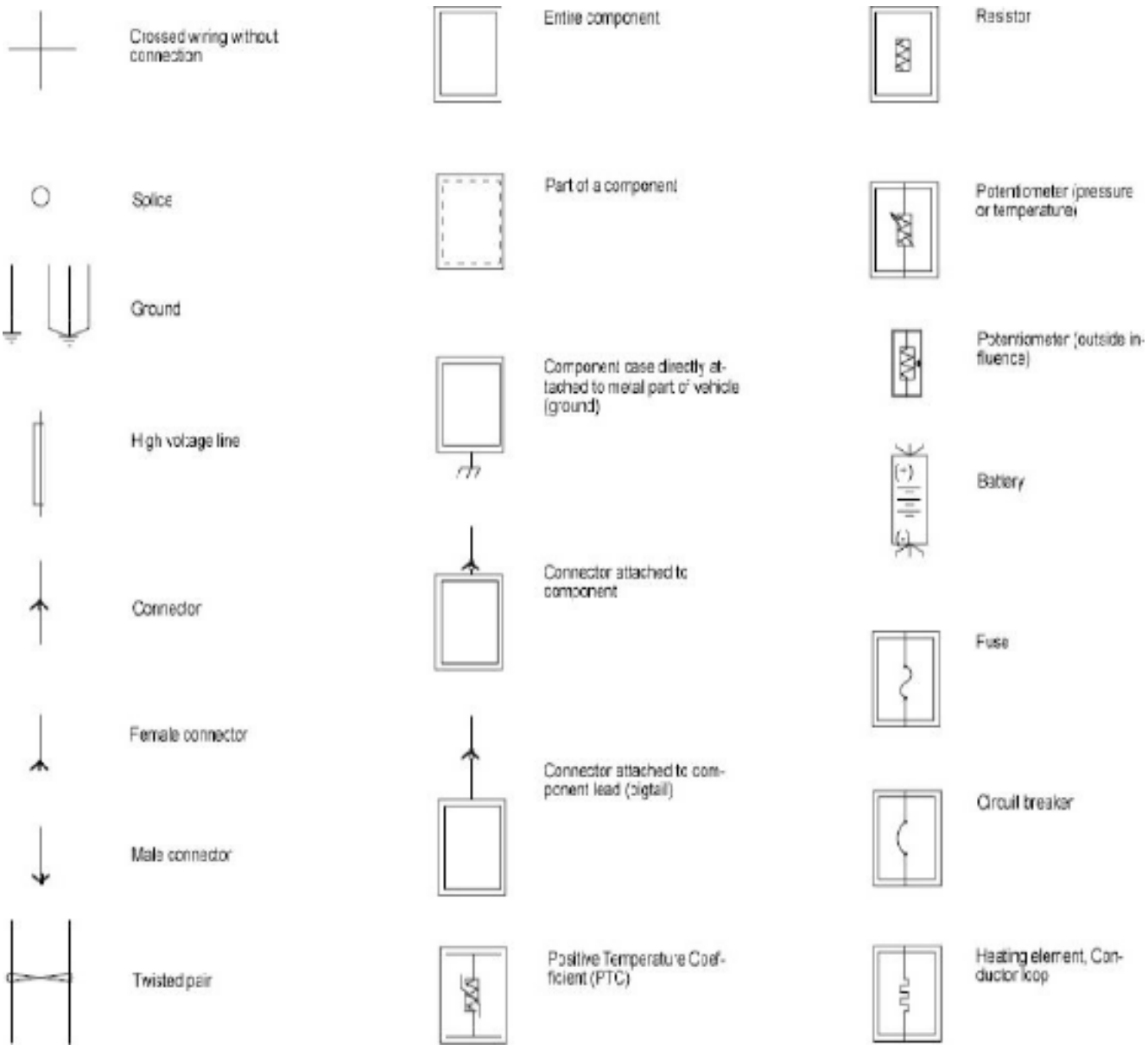
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

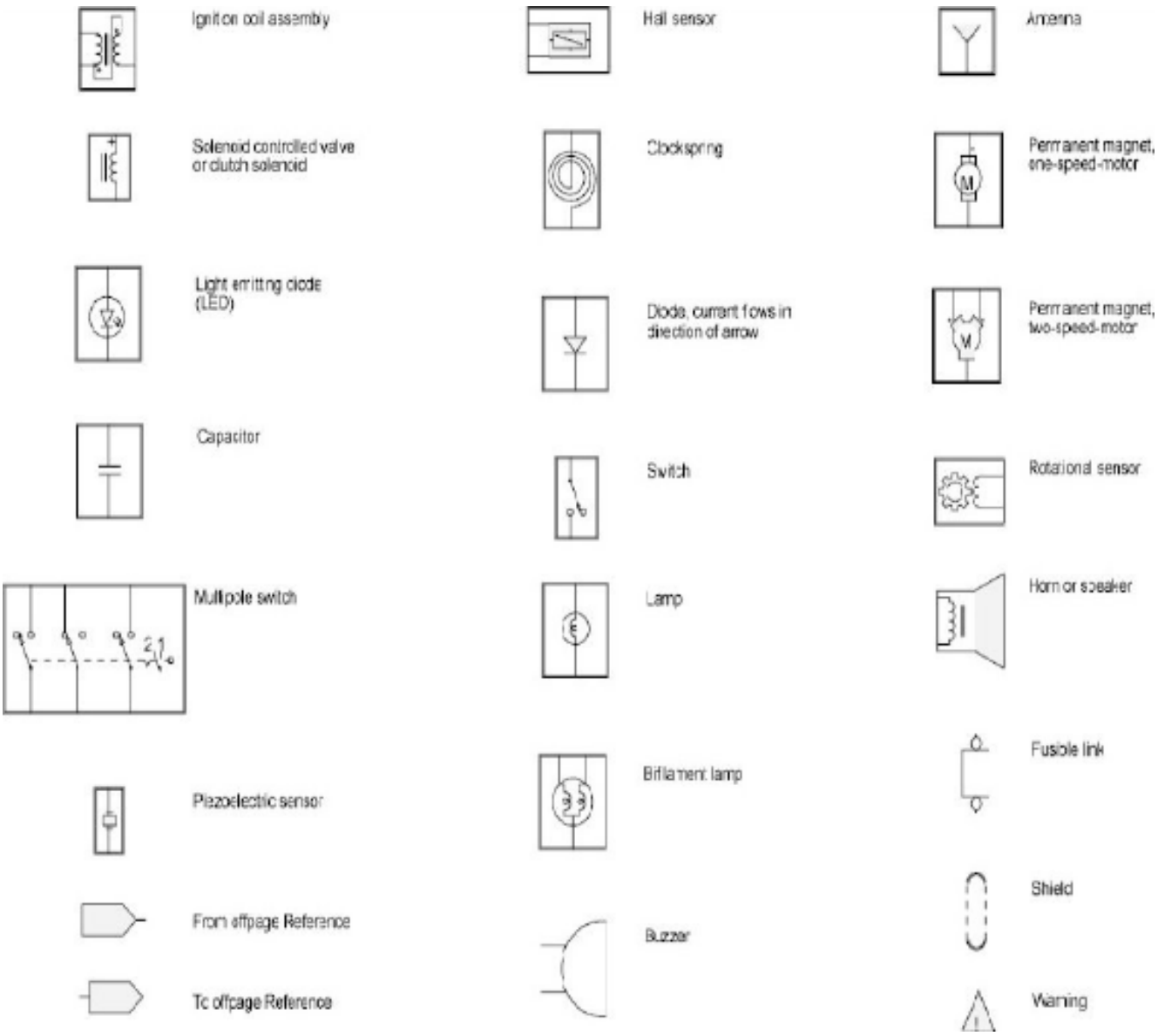
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

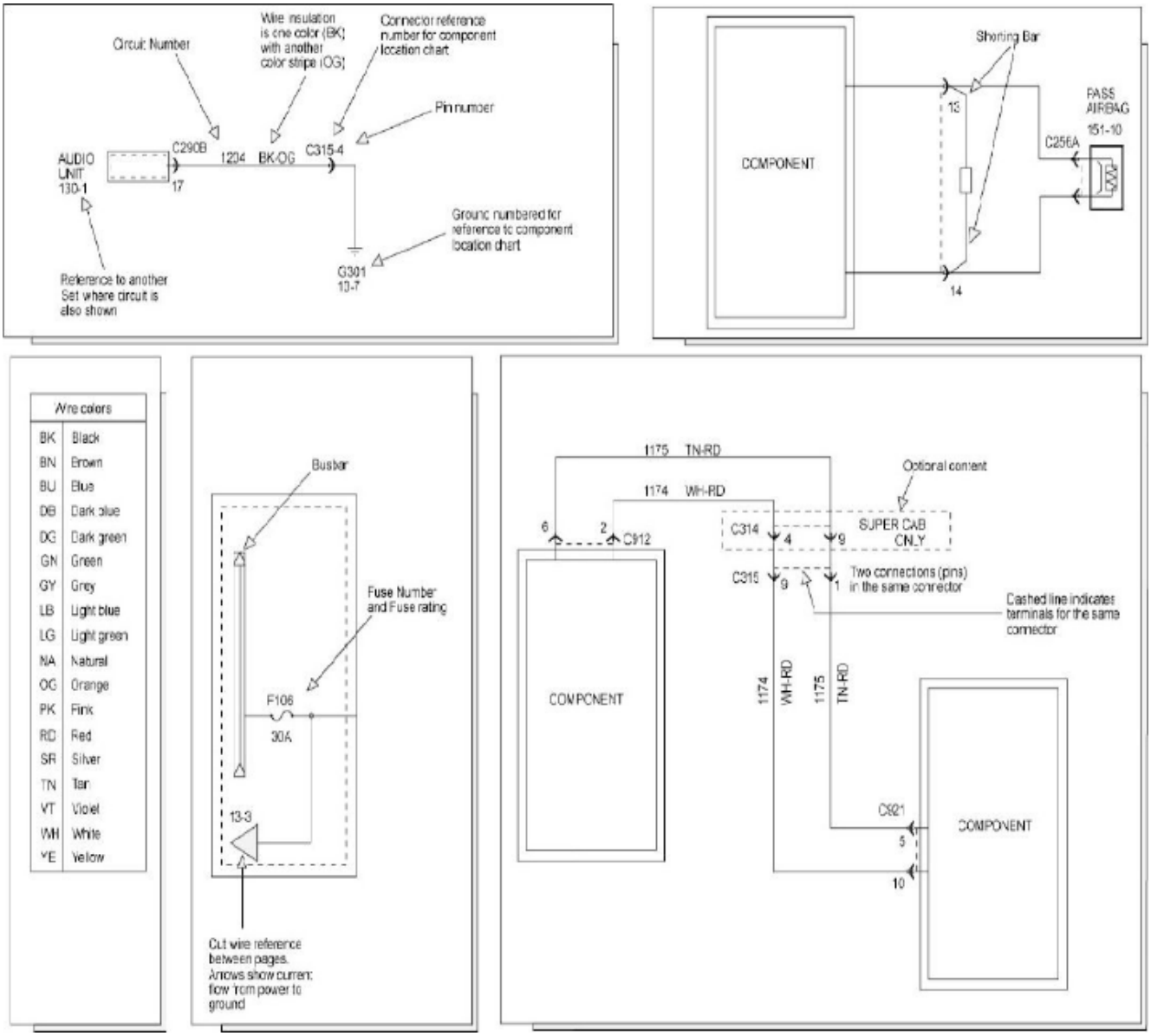
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

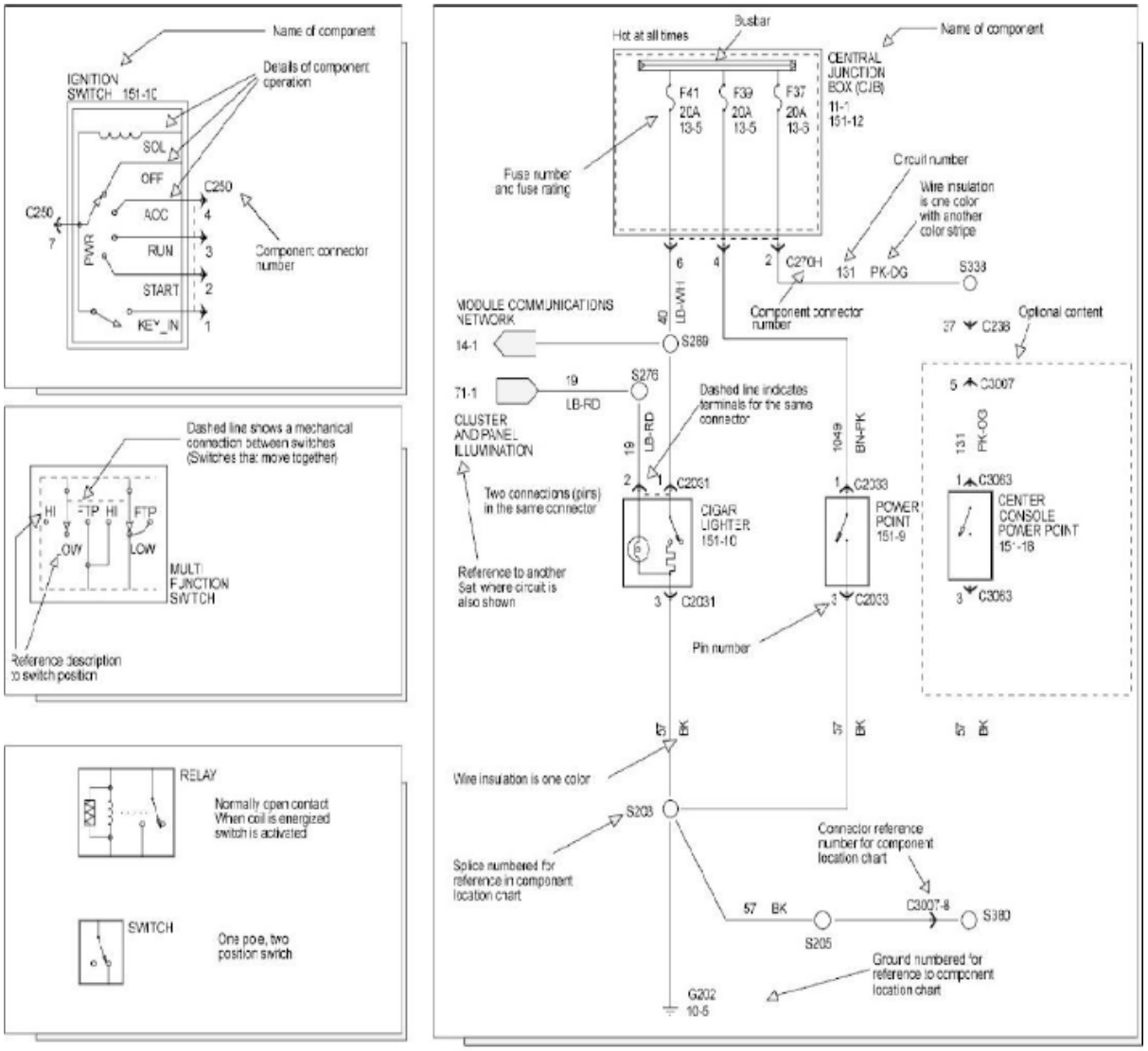
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

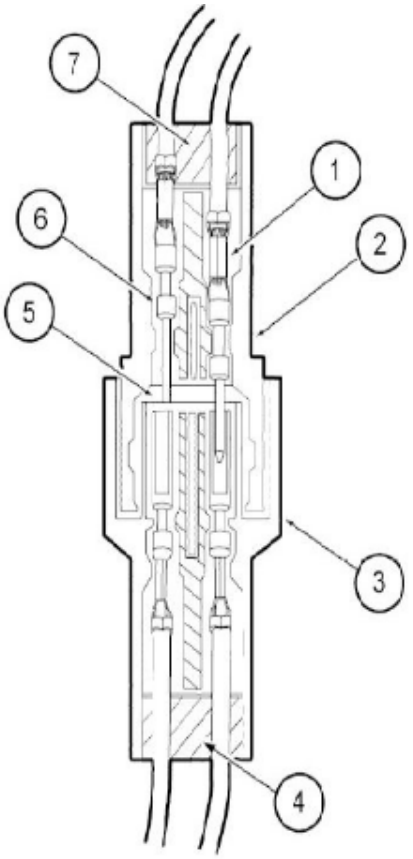


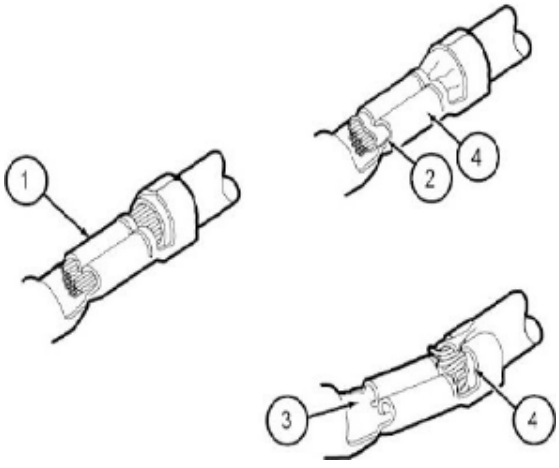
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Trailer Lamps: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

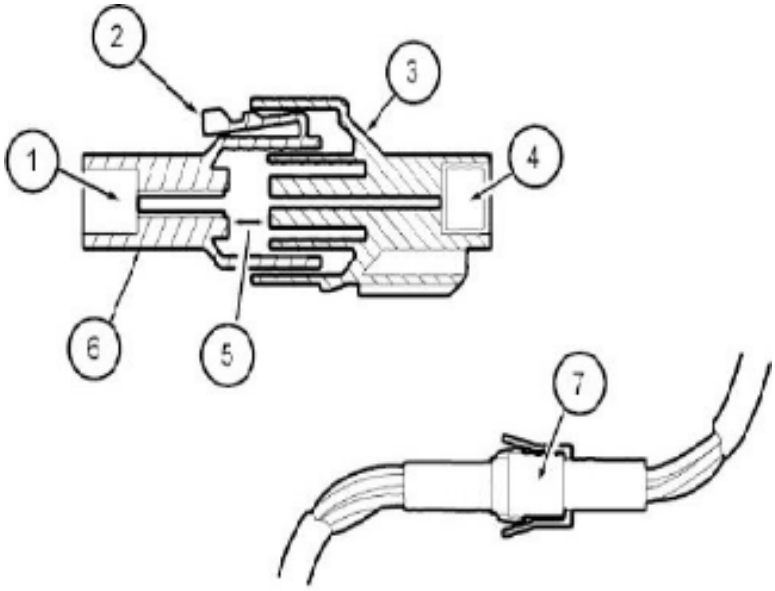
5 = Intermittent contact

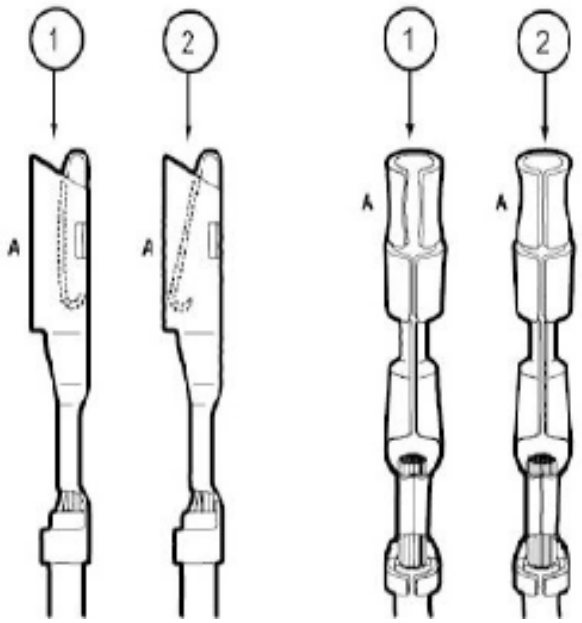
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

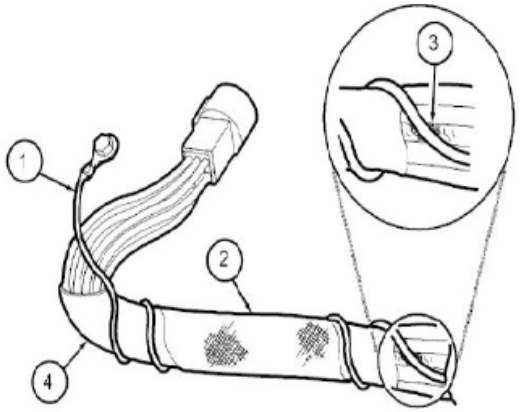
Deformed (enlarged) female terminals

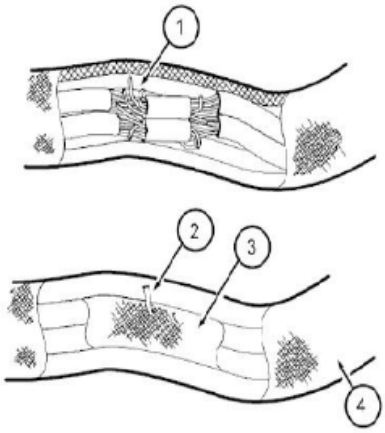
1 = Enlarged

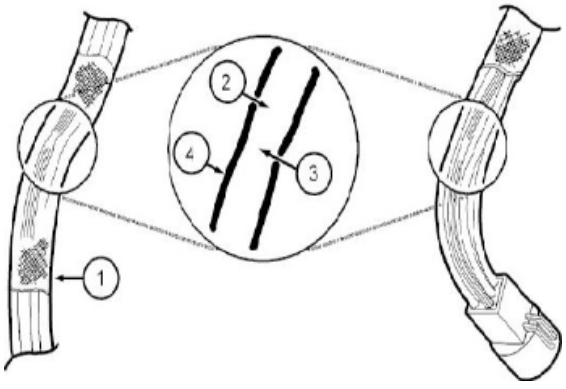
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

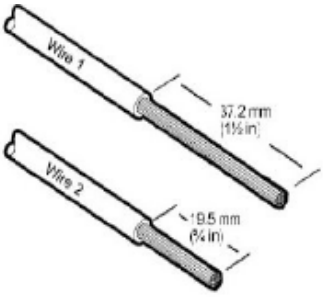
Splice covered 2

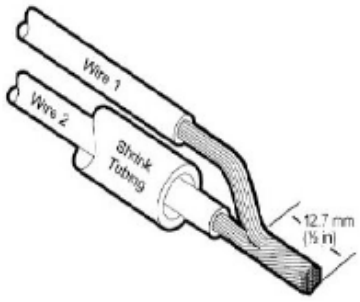
= Wire strand

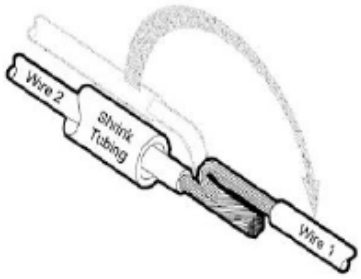
3 = Splice tape

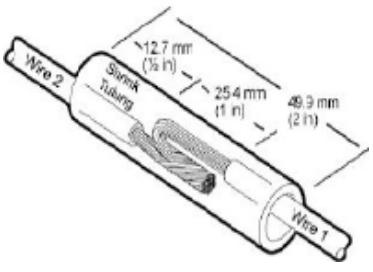
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

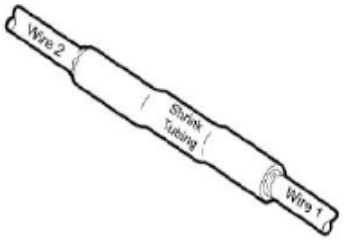
NOTE: -

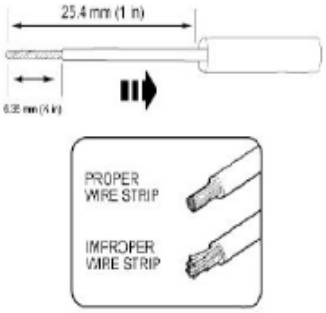
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

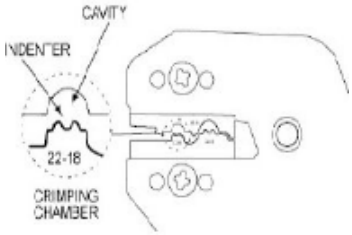
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

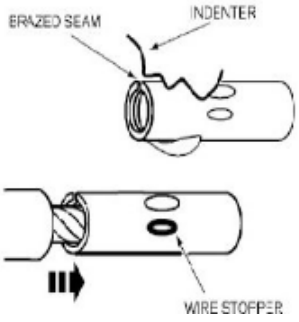
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
6.35 mm (¼ in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

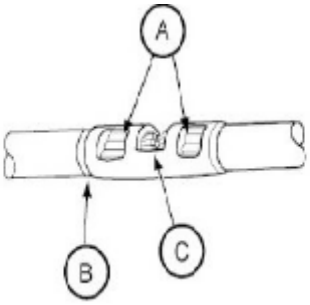
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

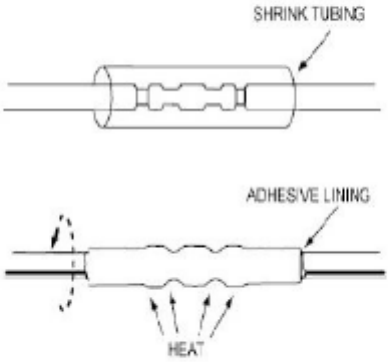
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4 strip, cut 9 strands	* 1/4 strip, cut 2 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip, fold 3x dia.
	16-14	* 1/4 strip, cut 7 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip fold 2x dia	1 strip, fold 3x dia.	1 1/4 strip, fold 4x dia.	Not Recommended
	12-10	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip fold 3x dia.	1 1/4 strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Figtail only

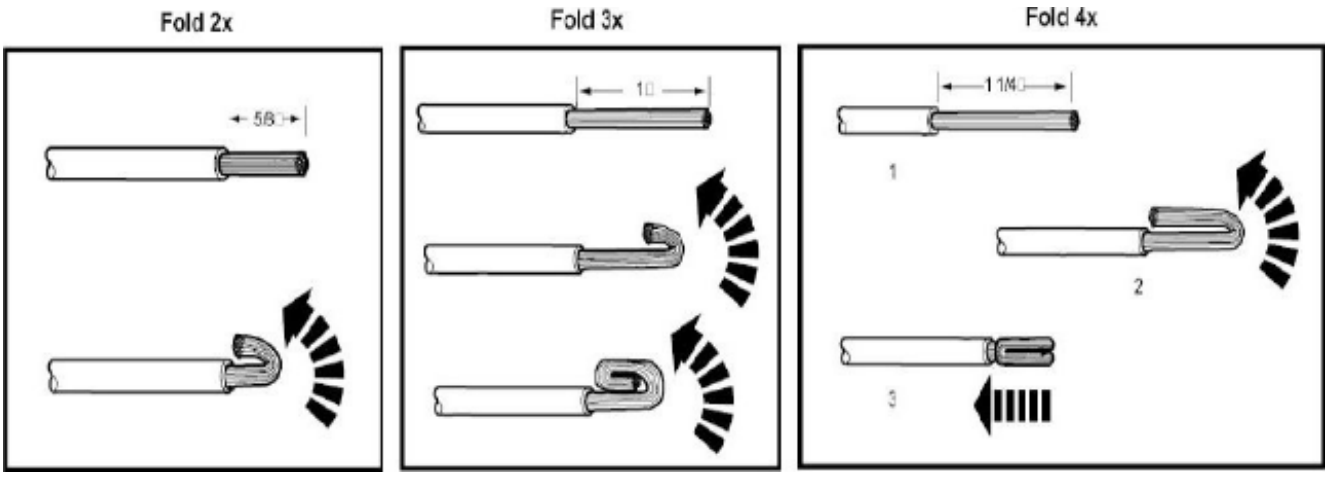
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

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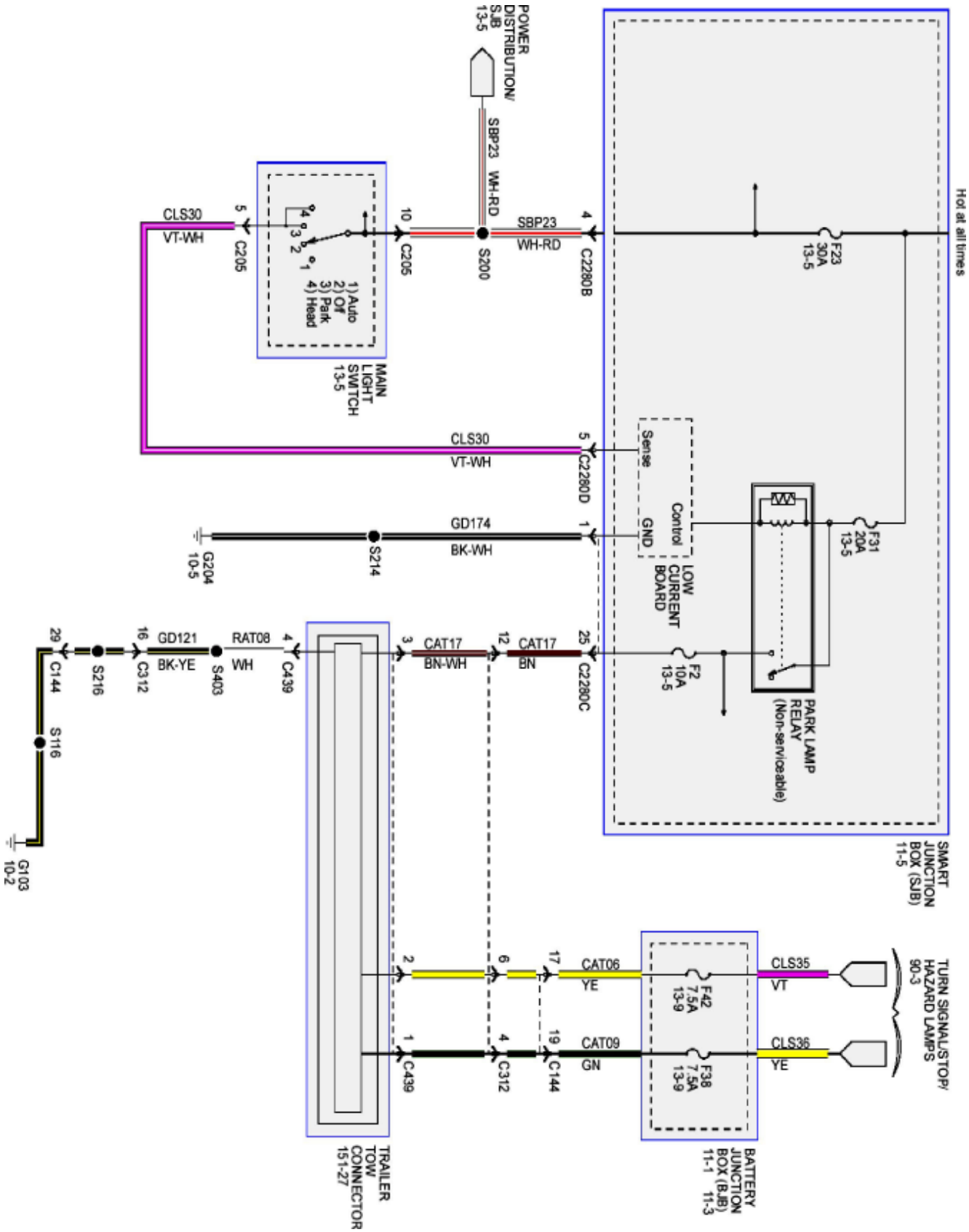
Ford Workshop Manuals > Accessories and Optional Equipment > Towing / Trailer System > Trailer Lamps > Component Information > Diagrams > Diagram Information and Instructions > Page 5568



Trailer Lamps: Electrical Diagrams

PLEASE NOTE: Some diagrams may appear to be missing because of gaps in the number sequences. These "gaps" are actually for diagrams that do not apply to the vehicle model selected.

95-1

Diagrams: Other diagrams referred to by number (i.e. 13-2, 24-6, 10-2, etc.) within these diagrams can be found at Diagrams By Number. See:

Diagrams/Electrical Diagrams/Diagrams By Number

Locations: Location Views (reference numbers starting with 151-) referred to within these diagrams can be found at Location Views. See: Locations/Component Locations

Trailer Lamps: Initial Inspection and Diagnostic Overview

Principles of Operation

PRINCIPLES OF OPERATION

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

Circuitry is supplied to the trailer tow connector to support trailer parking lamps and stop/turn lamp functionality. When the vehicle parking lamps are on, the smart junction box (SJB) supplies voltage to the trailer tow connector for the trailer parking lamps. When the vehicle stop/turn lamps are operating, voltage is supplied to the trailer tow connector for the trailer stop/turn lamps.

Inspection and Verification

INSPECTION AND VERIFICATION

1. Verify the customer concern. 2. Verify the exterior lighting system of the vehicle is operating correctly. If not, refer to the appropriate pinpoint test. 3. Visually inspect for obvious signs of electrical damage.

VISUAL INSPECTION CHART

Electrical -

Battery junction box (BJB) fuse(s): -

38 (7.5A) (trailer tow RH stoplamp)

- 42 (7.5A) (trailer tow LH stoplamp)

- Smart junction box (SJB) fuse 2 (10A) (trailer tow parking lamps)

- Wiring, terminals or connectors

- Bulb(s)

- SJB

4. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step. 5. If the concern is not visually evident, verify the symptom. GO to Symptom Chart. See: Symptom Related Diagnostic Procedures

Symptom Chart

Condition	Possible Sources	Action
• All the trailer lamps are inoperative	• Wiring, terminals or connectors • Trailer	• GO to Pinpoint Test T.
• The trailer parking lamps are inoperative	• Fuse • Wiring, terminals or connectors • Smart junction box (SJB) • Trailer	• GO to Pinpoint Test U.

Symptom Chart (Continued)

Condition	Possible Sources	Action
• The individual trailer lamp is inoperative	• Fuse • Wiring, terminals or connectors • Trailer	• GO to Pinpoint Test V.

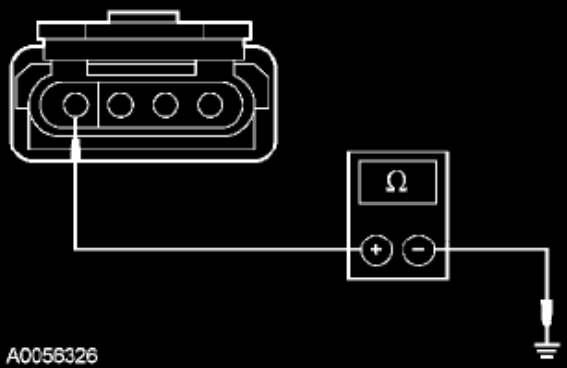
Trailer Lamps: Symptom Related Diagnostic Procedures

Symptom Chart (Part 1)

Symptom Chart (Part 2)

PINPOINT TEST T: ALL THE TRAILER LAMPS ARE INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step		Result / Action to Take
T1	**CHECK CIRCUIT RAT08 (WH) FOR AN OPEN** • Key in OFF position. • Disconnect: Trailer Tow C439. • Measure the resistance between the trailer tow C439-4, circuit RAT08 (WH), harness side and ground.  A0056326 • **Is the resistance less than 5 ohms?**	**Yes** The vehicle is operating correctly. SEND the trailer to an authorized camper/trailer repair facility. **No** REPAIR the circuit. TEST the system for normal operation.

Trailer Lamps: Pinpoint Tests

Test T: All The Trailer Lamps Are Inoperative

PINPOINT TEST T: ALL THE TRAILER LAMPS ARE INOPERATIVE

Normal Operation

The trailer tow connector is provided ground through circuit RAT08 (WH) for the trailer lamps.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors

- Trailer

T1

Test U: The Trailer Parking Lamps Are Inoperative

PINPOINT TEST U: THE TRAILER PARKING LAMPS ARE INOPERATIVE

Normal Operation

When the parking lamps are on, the smart junction box (SJB) provides voltage to the trailer tow connector through circuit CAT17 (BN/WH).

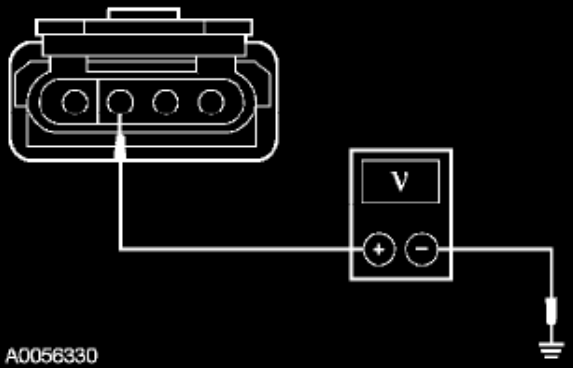
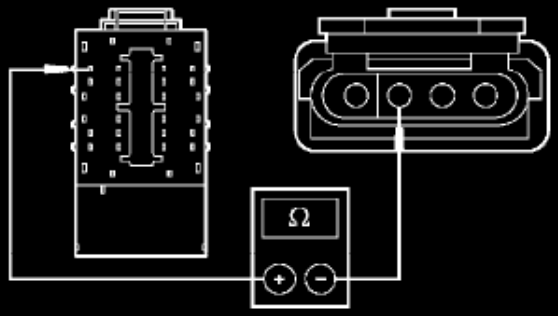
This pinpoint test is intended to diagnose the following:

- Fuse

- Wiring, terminals or connectors
- Trailer
- SJB

PINPOINT TEST U: THE TRAILER PARKING LAMPS ARE INOPERATIVE

⚠ **CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.**

Test Step		Result / Action to Take
U1	**CHECK CIRCUIT CAT17 (BN/WH) FOR VOLTAGE** • Key in OFF position. • Disconnect: Trailer Tow C439. • Place the headlamp switch in the PARKING LAMPS ON position. • Measure the voltage between the trailer tow C439-3, circuit CAT17 (BN/WH), harness side and ground.  A0056330 • **Is the voltage greater than 10 volts?**	**Yes** The vehicle is operating correctly. SEND the trailer to an authorized camper/trailer repair facility. **No** VERIFY the SJB fuse 2 (10A) is OK. If OK, GO to **U2**.
U2	**CHECK CIRCUIT CAT17 (BN/WH) FOR AN OPEN** • Place the headlamp switch in the OFF position. • Disconnect: SJB C2280c. • Measure the resistance between the SJB C2280c-25, circuit CAT17 (BN/WH), harness side and the trailer tow C439-3, circuit CAT17 (BN/WH), harness side.  N0072921 • **Is the resistance less than 5 ohms?**	**Yes** GO to **U3**. **No** REPAIR the circuit. TEST the system for normal operation.
U3	**CHECK FOR CORRECT SJB OPERATION** • Disconnect all the SJB connectors. • Check for: — corrosion — damaged pins — pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

U1-U3

Test V: The Individual Trailer Lamp Is Inoperative

PINPOINT TEST V: THE INDIVIDUAL TRAILER LAMP IS INOPERATIVE

Normal Operation

When the brake pedal is applied, voltage is provided to the trailer tow connector for the LH and RH trailer stoplamps through circuits CAT06 (YE) and CAT09 (GN), respectively.

This pinpoint test is intended to diagnose the following:

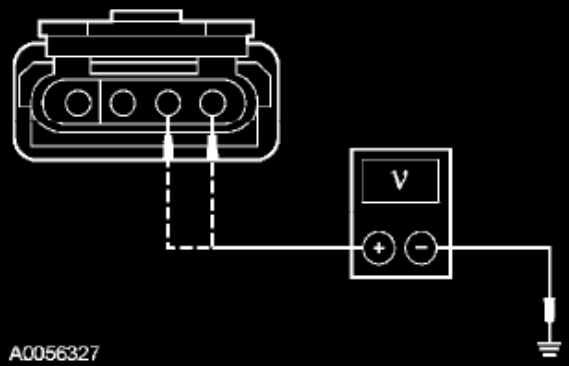
- Fuse

- Wiring, terminals or connectors

- Trailer

PINPOINT TEST V: THE INDIVIDUAL TRAILER LAMP IS INOPERATIVE

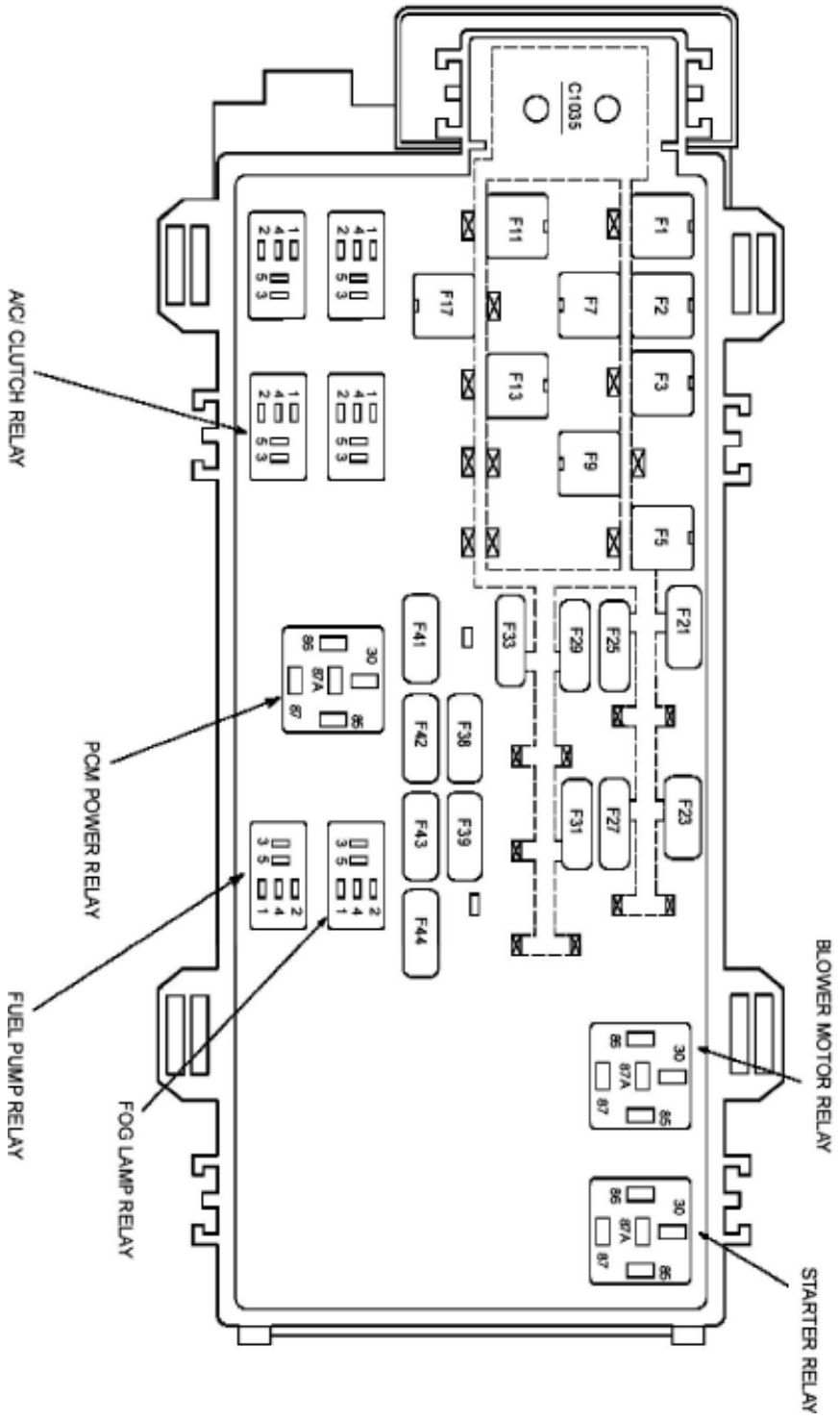
CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step		Result / Action to Take
V1	**DETERMINE THE INOPERATIVE TRAILER LAMP**	
	• Place the headlamp switch in the PARKING LAMPS ON position. • While applying and releasing the brake pedal, observe the trailer tow lamps. • **Is an individual trailer parking lamp inoperative?**	**Yes** The vehicle is operating correctly. SEND the trailer to an authorized camper/trailer repair facility. **No** GO to **V2**.
V2	**CHECK CIRCUIT CAT06 (YE) (LH STOPLAMP) OR CIRCUIT CAT09 (GN) (RH STOPLAMP) FOR AN OPEN**	
	• While applying the brake pedal, measure the voltage between the trailer tow C439-2, circuit CAT06 (YE) (LH stoplamp), harness side and ground; or between the trailer tow C439-1, circuit CAT09 (GN) (RH stoplamp), harness side and ground.  A0056327 • **Is the voltage greater than 10 volts?**	**Yes** The vehicle is operating correctly. SEND the trailer to an authorized camper/trailer repair facility. **No** VERIFY the SJB fuse 42 (7.5A) (LH stoplamp) or fuse 38 (7.5A) (RH stoplamp) is OK. If OK, REPAIR the circuit in question. TEST the system for normal operation.

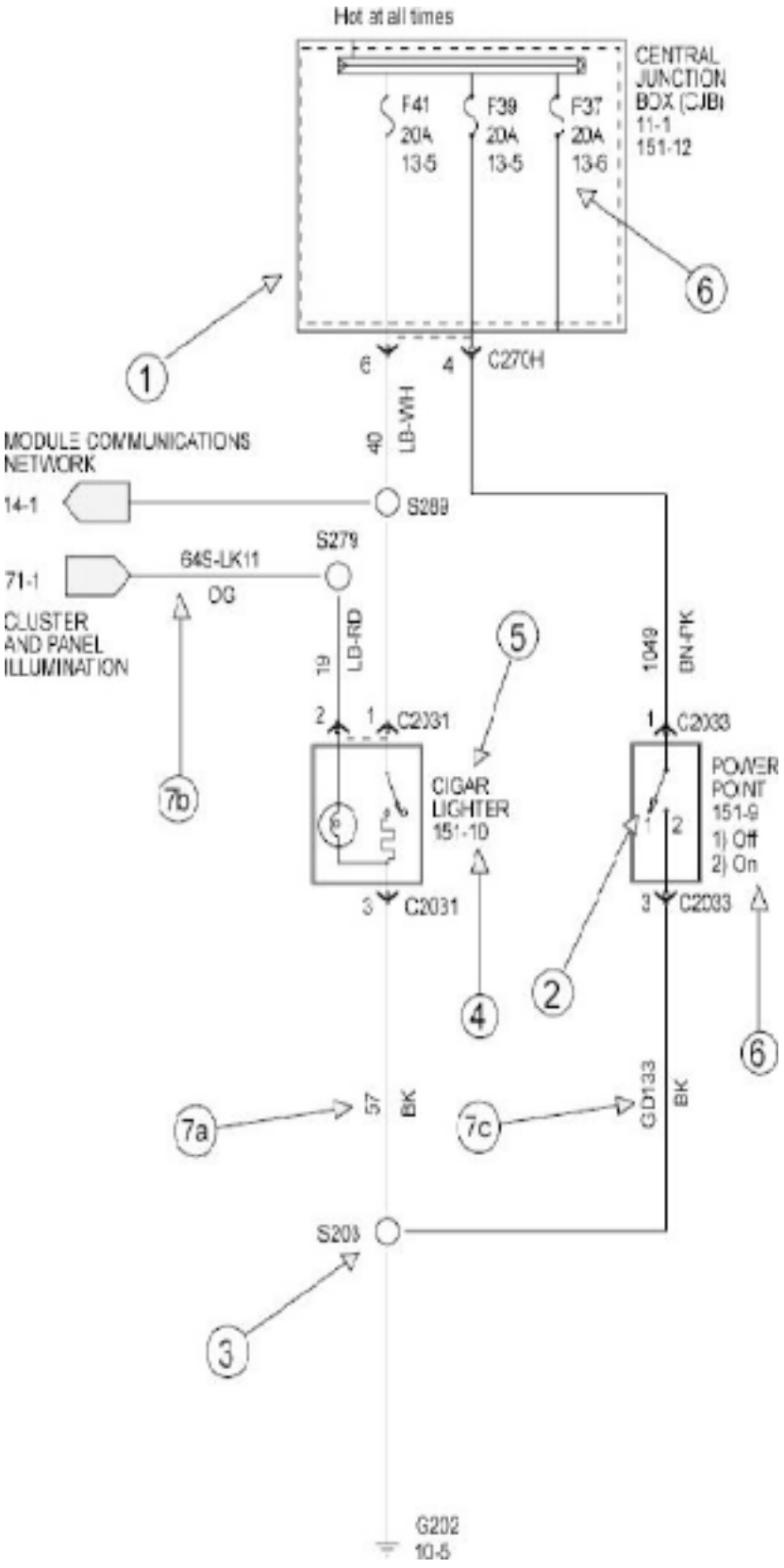
V1-V2

Special Tool(s)

BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L



Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Accessories and Optional Equipment > Towing / Trailer System > Trailer Lighting Relay > Component Information > Diagrams > Diagram Information and Instructions



Trailer Lighting Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

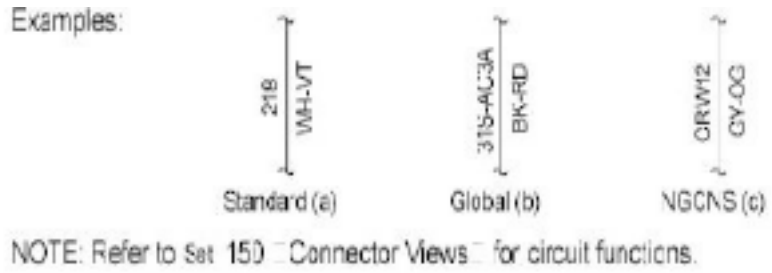
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

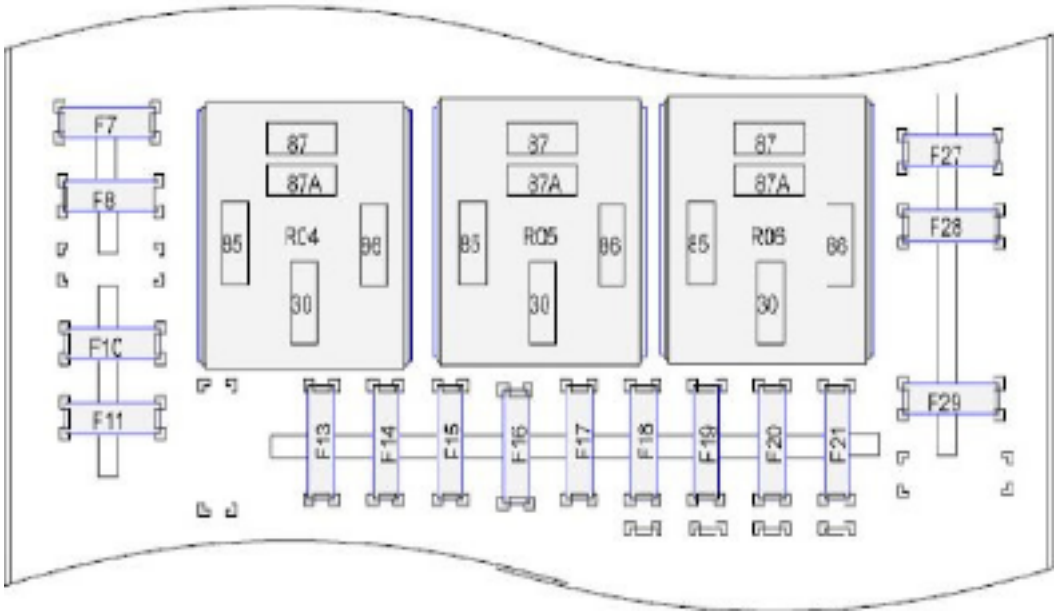
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

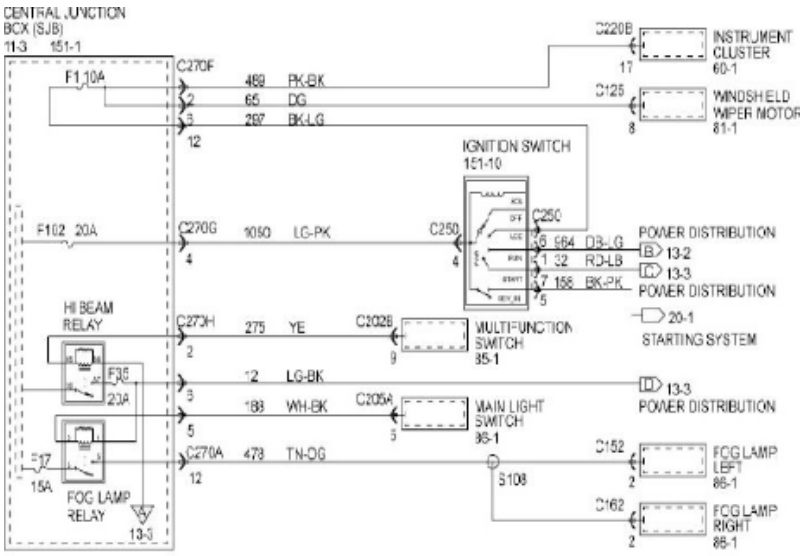
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

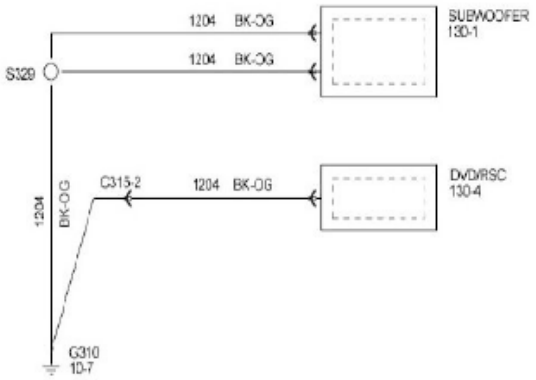
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

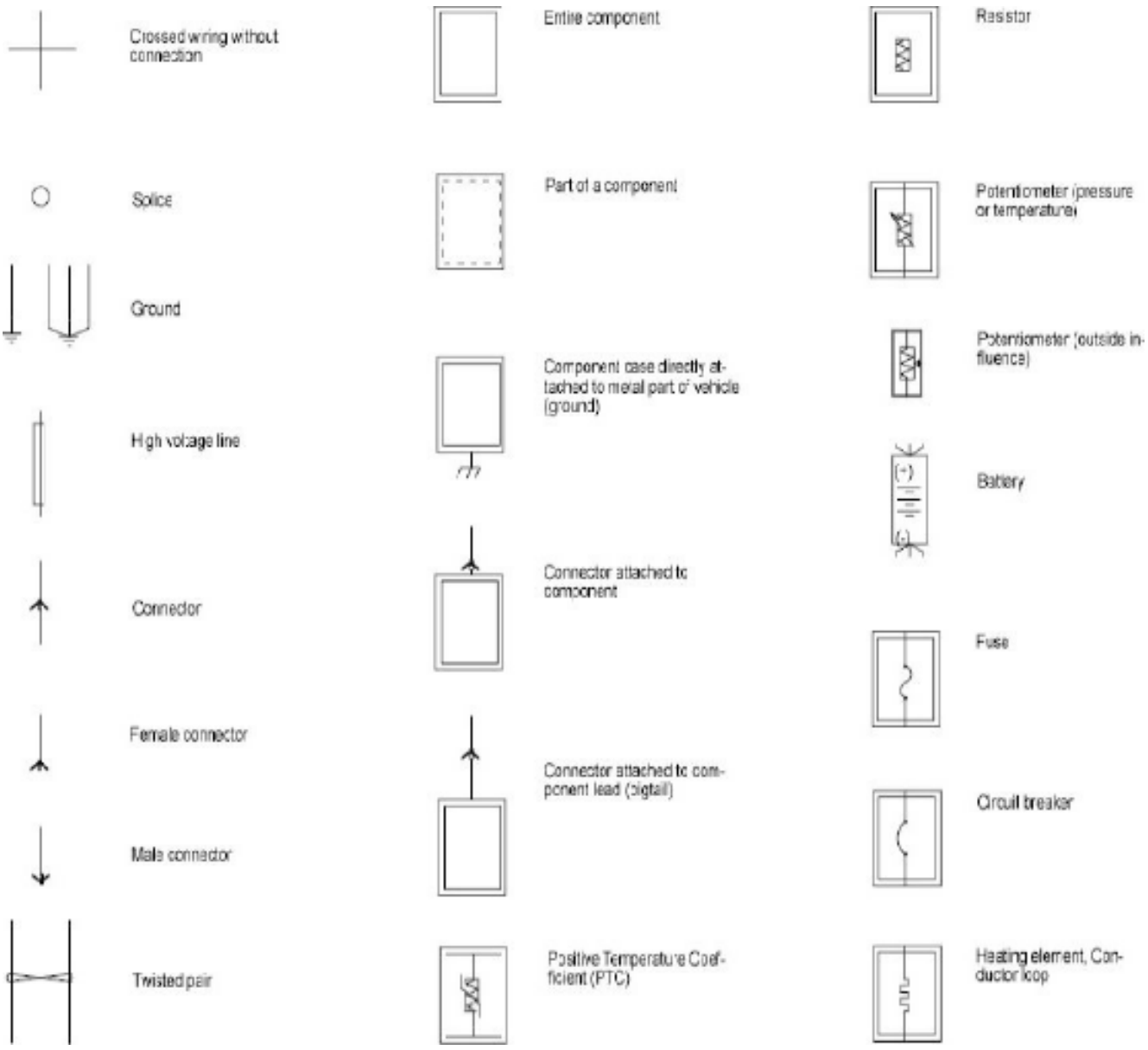
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

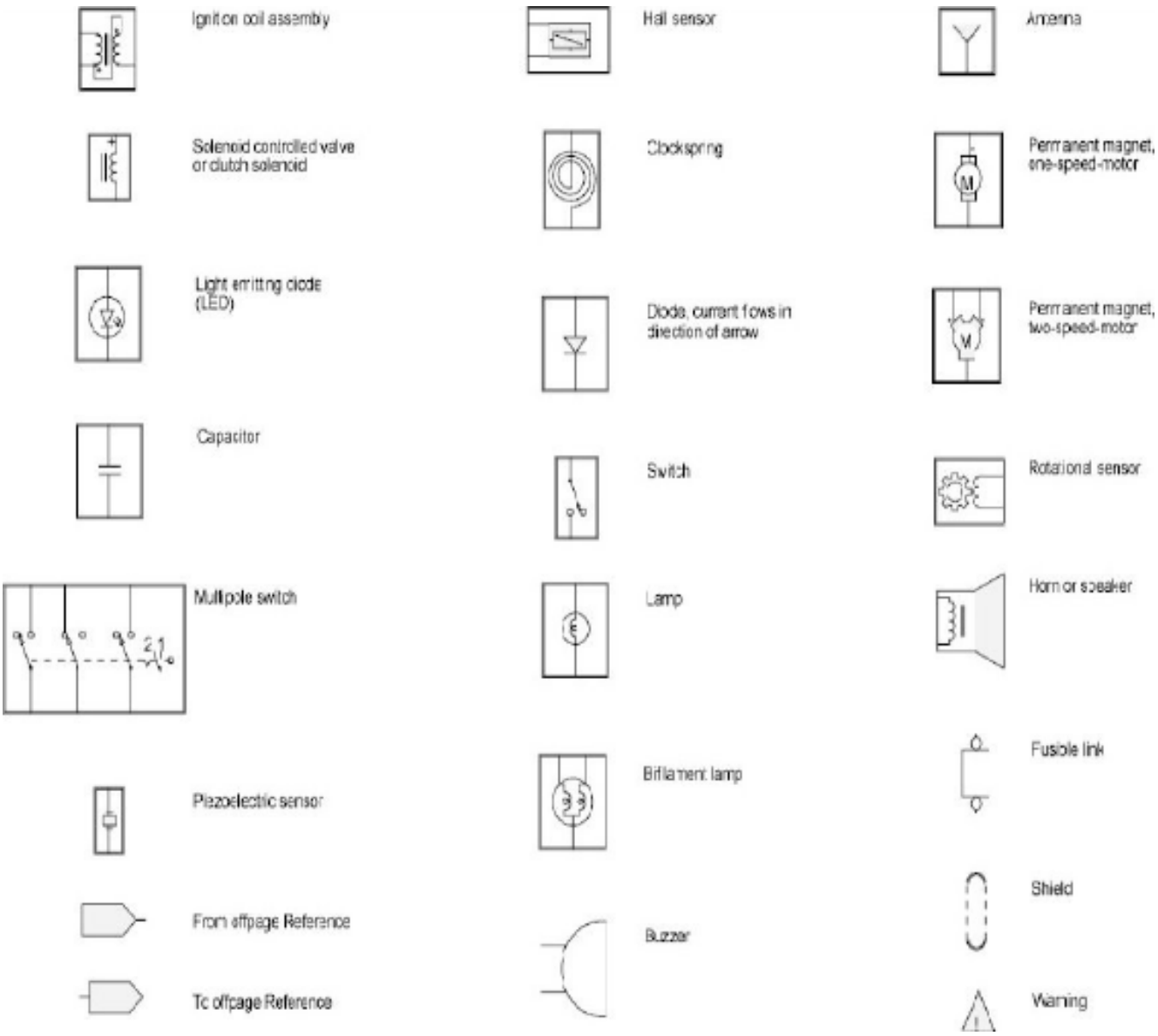
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

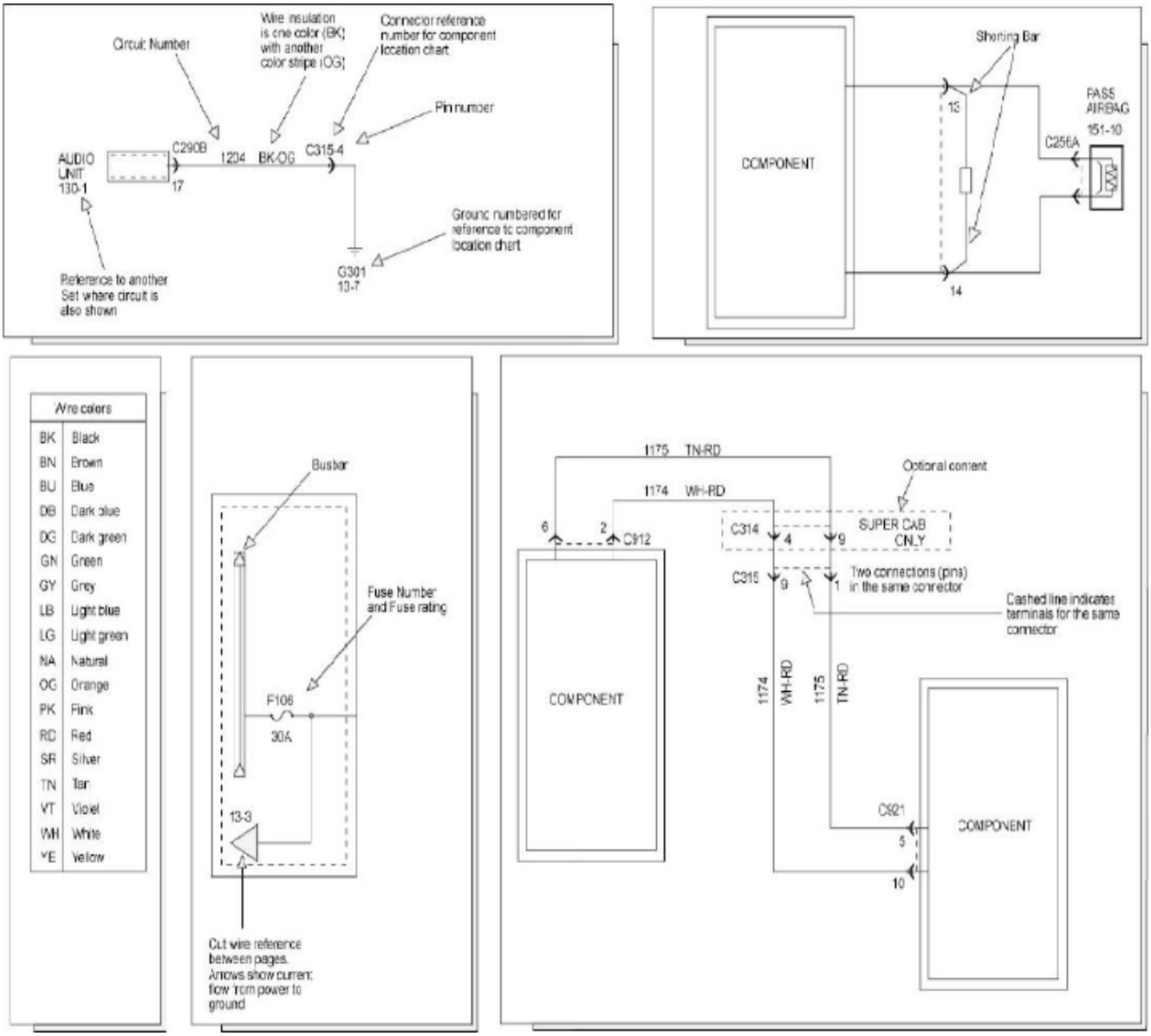
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

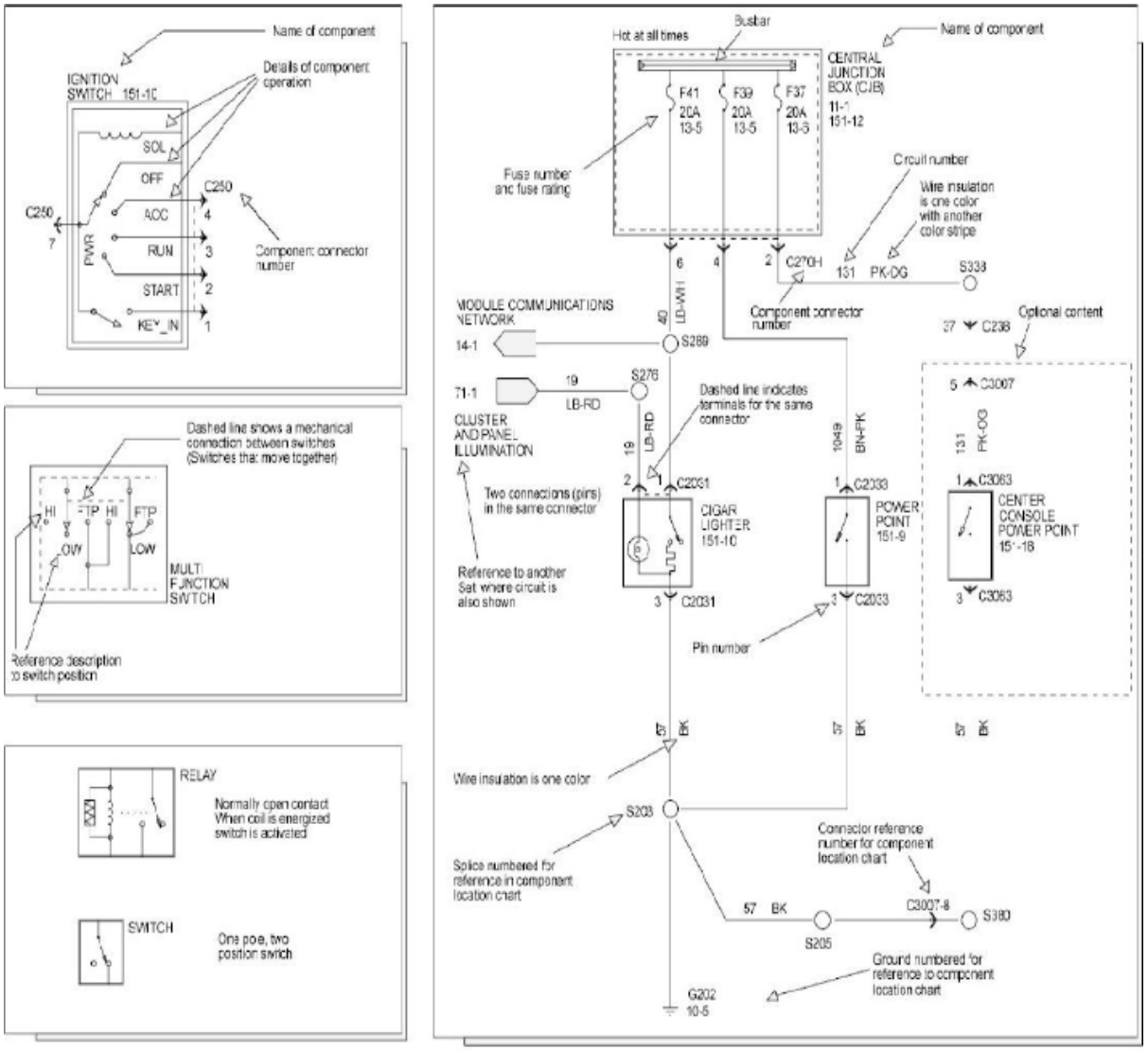
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

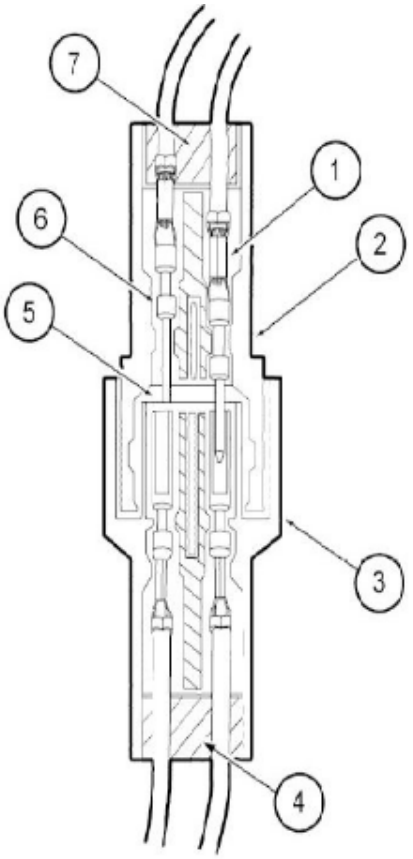


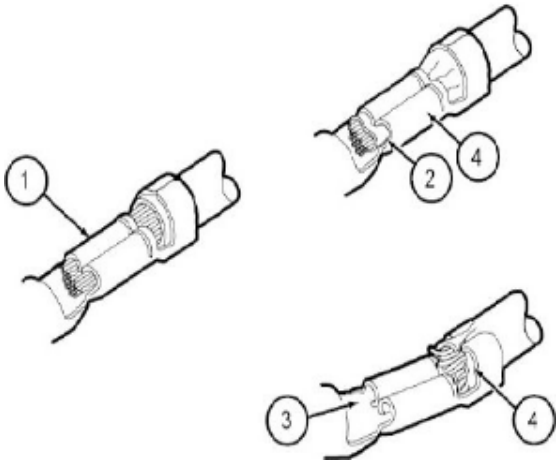
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Trailer Lighting Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

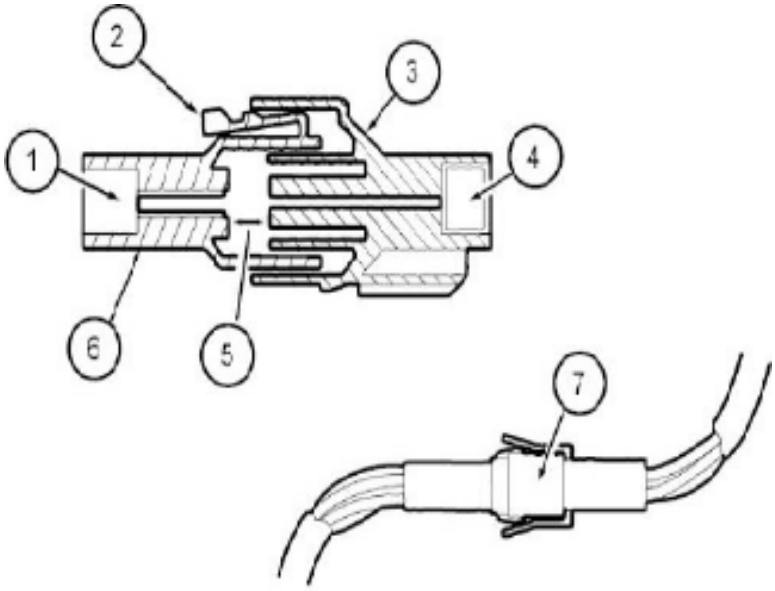
5 = Intermittent contact

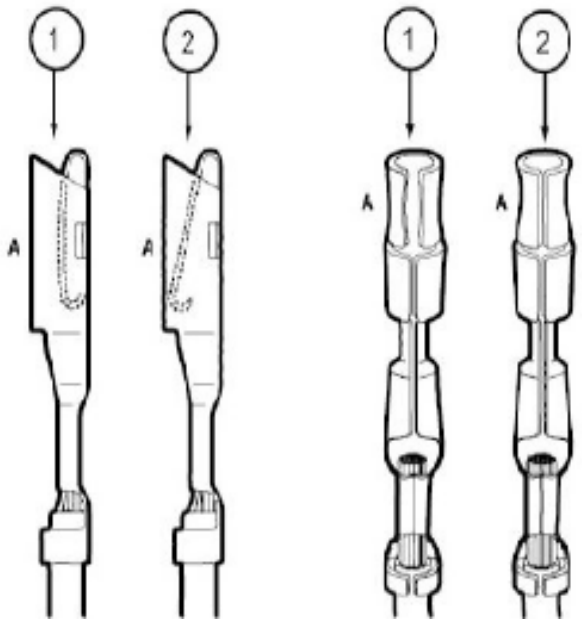
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

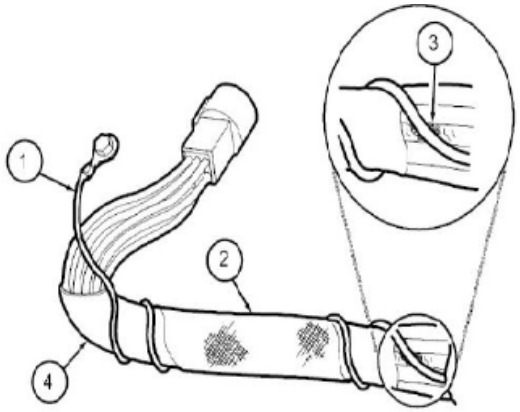
Deformed (enlarged) female terminals

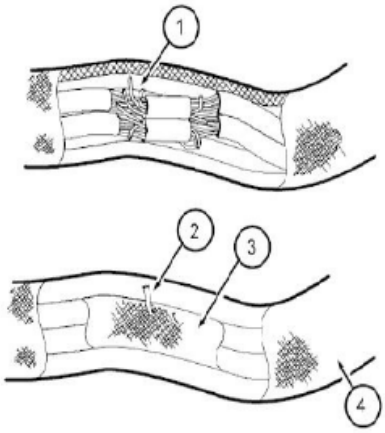
1 = Enlarged

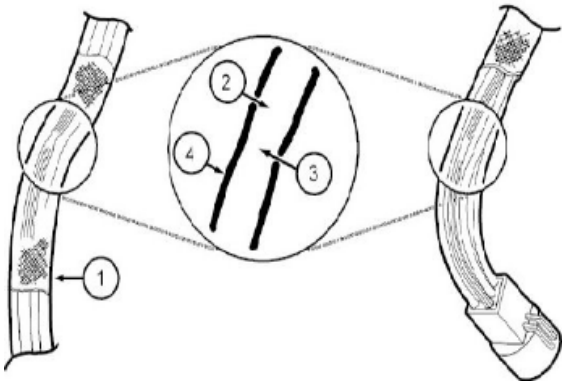
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

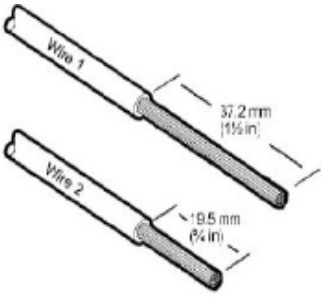
Splice covered 2

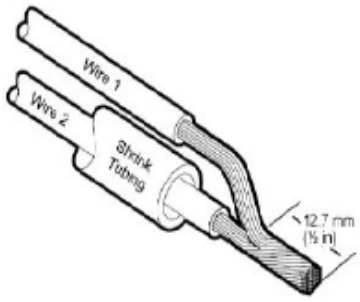
= Wire strand

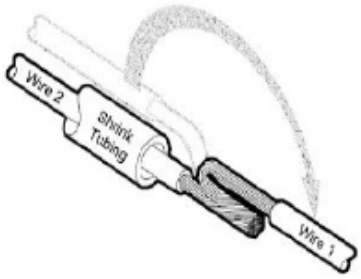
3 = Splice tape

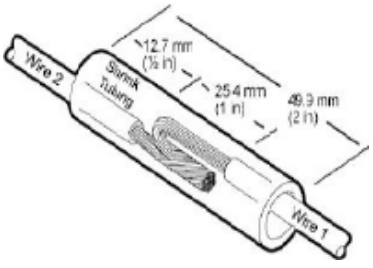
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.9 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

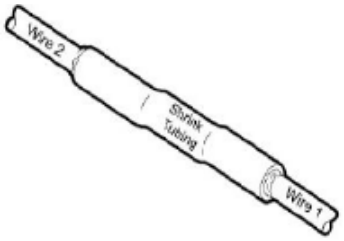
NOTE: -

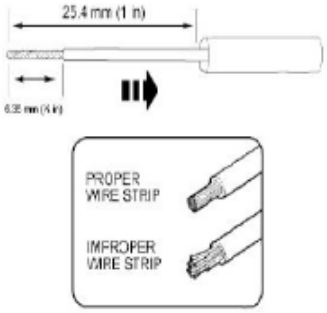
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

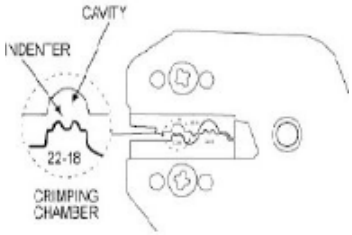
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

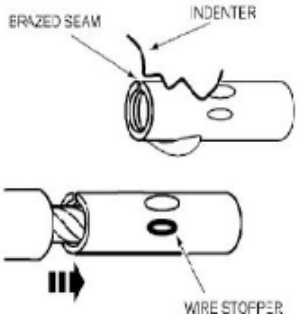
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
6.35 mm (¼ in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

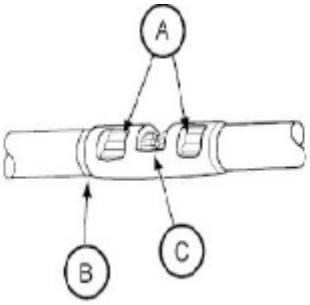
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

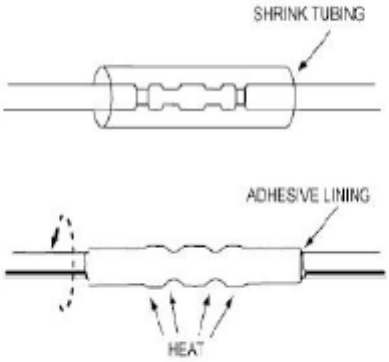
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4 strip, cut 9 strands	* 1/4 strip, cut 2 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip, fold 3x dia.
	16-14	* 1/4 strip, cut 7 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip fold 2x dia	1 strip, fold 3x dia.	1 1/4 strip, fold 4x dia.	Not Recommended
	12-10	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip fold 3x dia.	1 1/4 strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Pigtail only

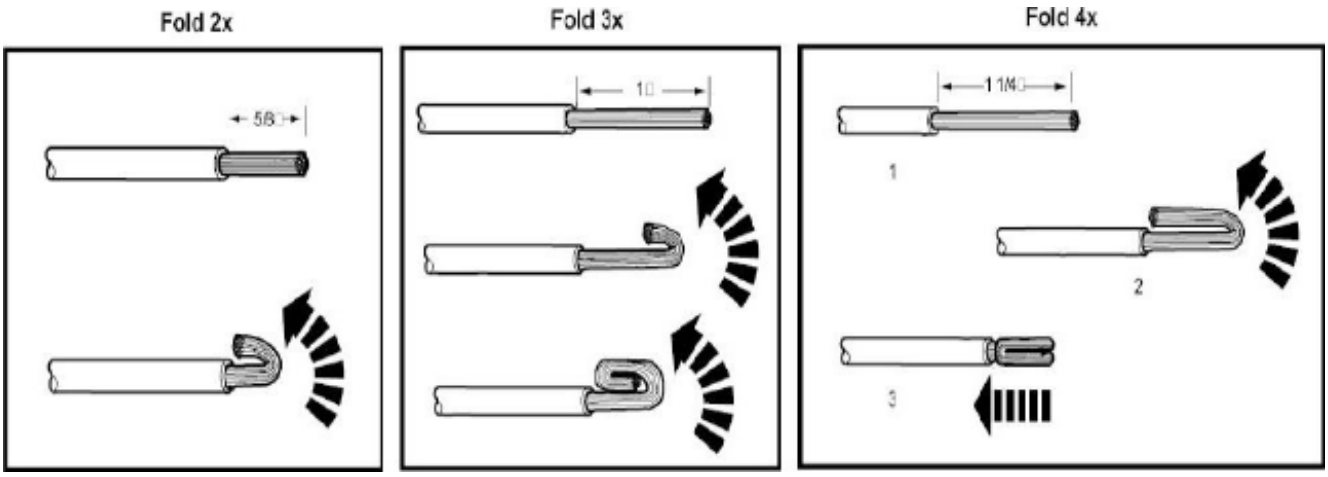
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



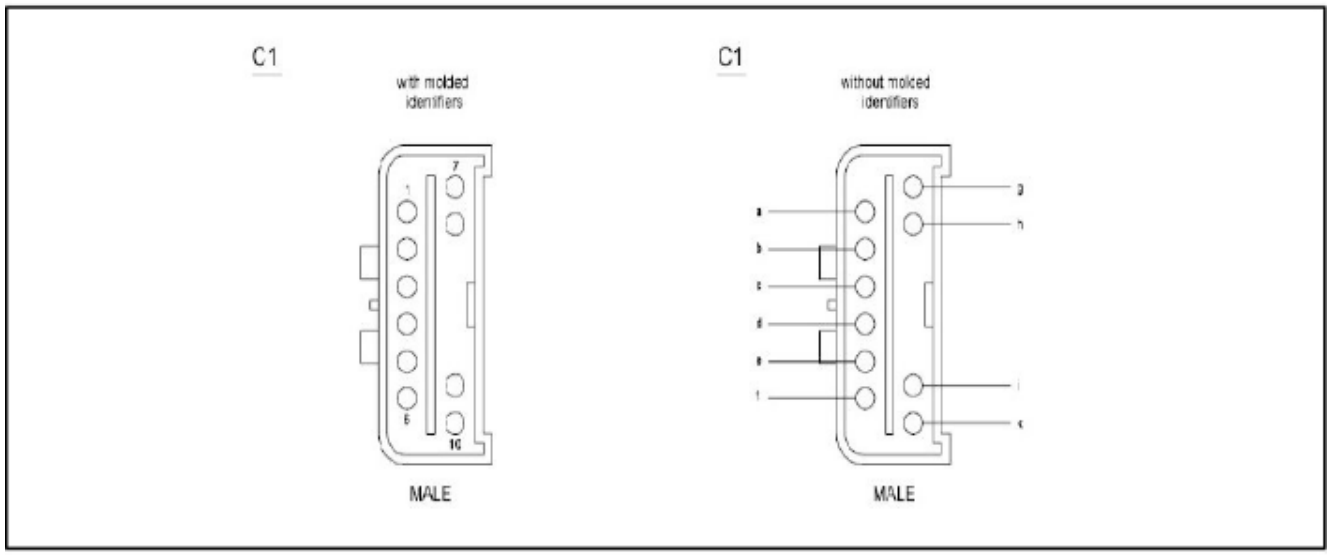
The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals

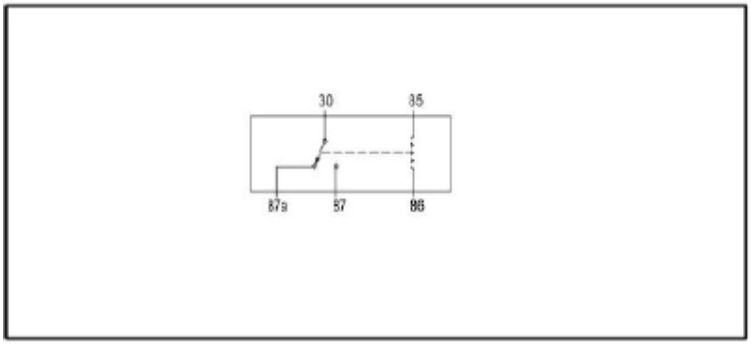


The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

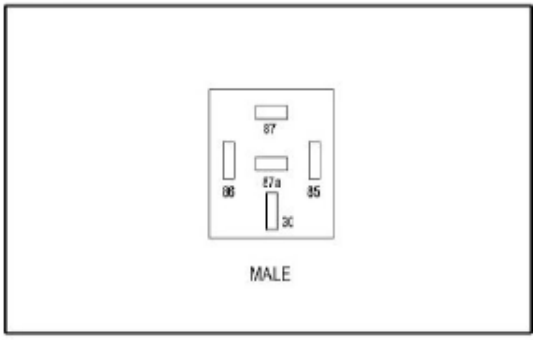
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Relay □ Mini ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 □ 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

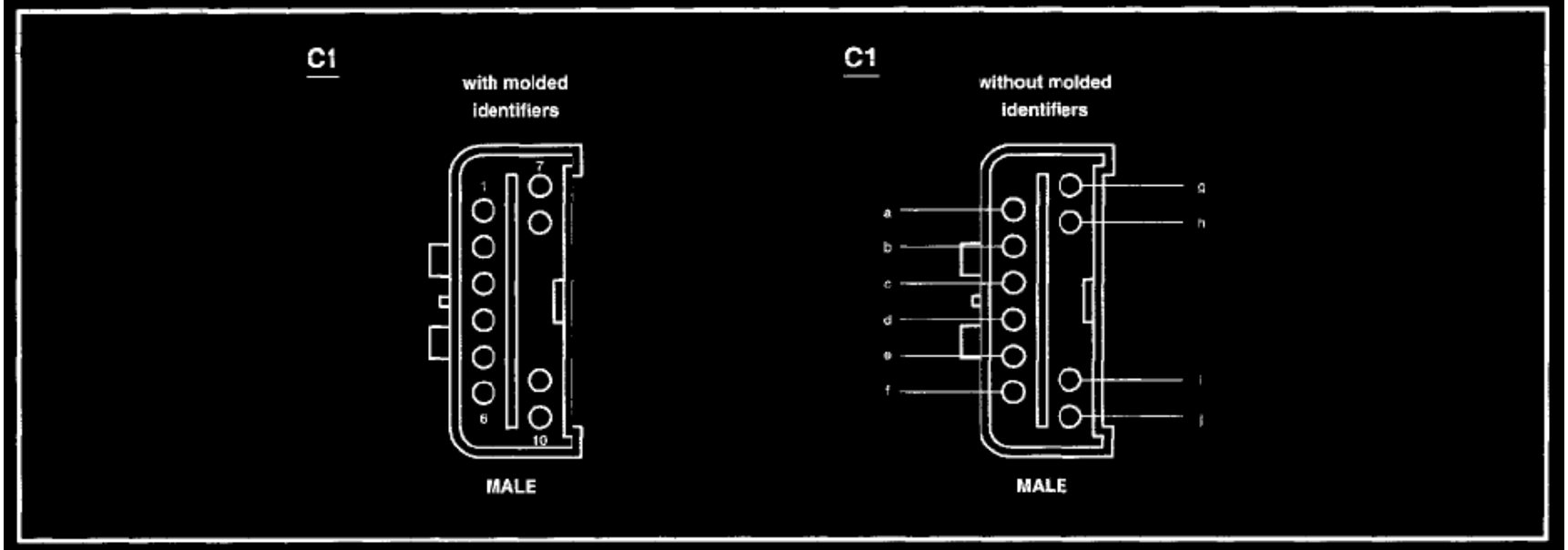
Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step–by–step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



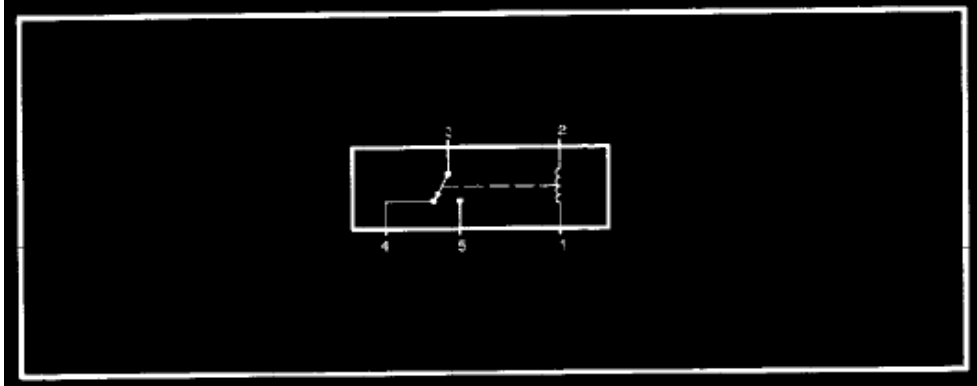
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

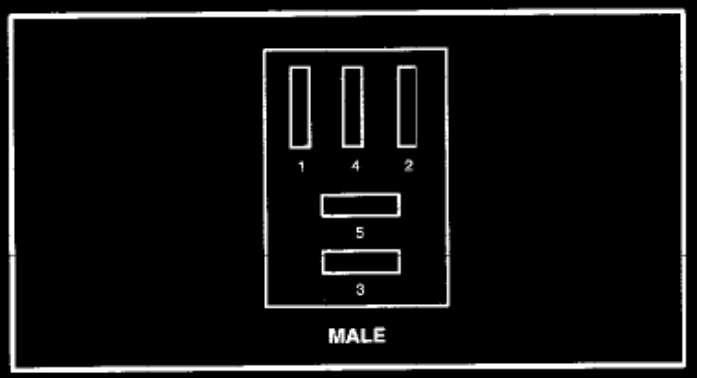
Trailer Lighting Relay: Testing and Inspection Micro ISO Relay

Relay – Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63–102Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil – Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

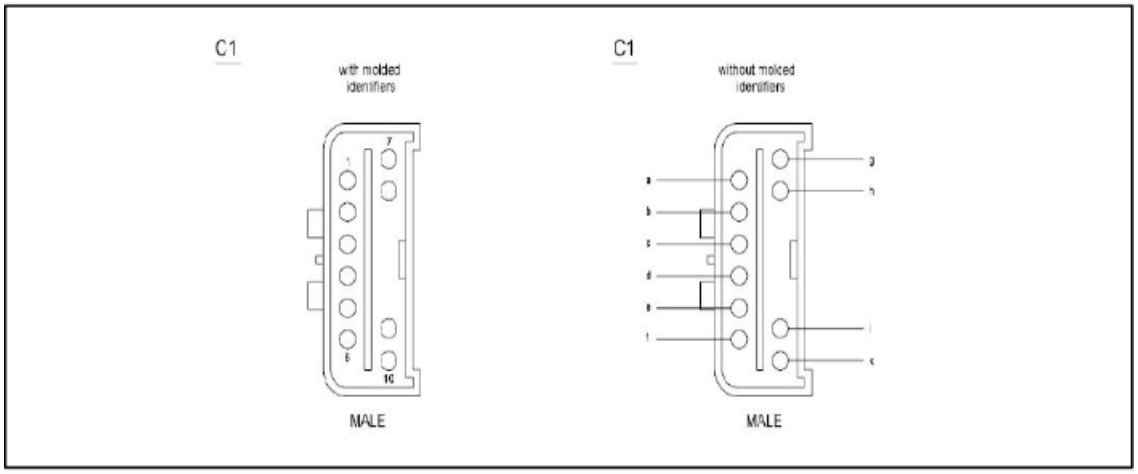
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals

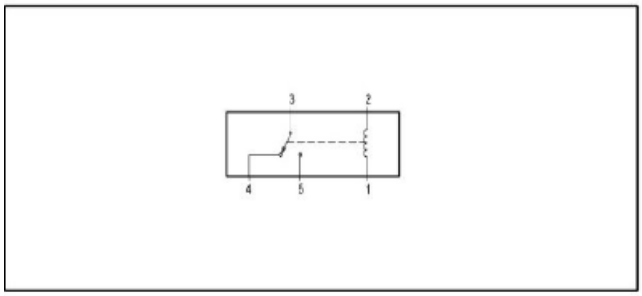


The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

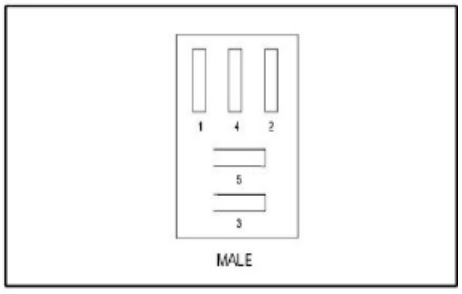
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Relay - Micro ISO

Schematic



Terminals

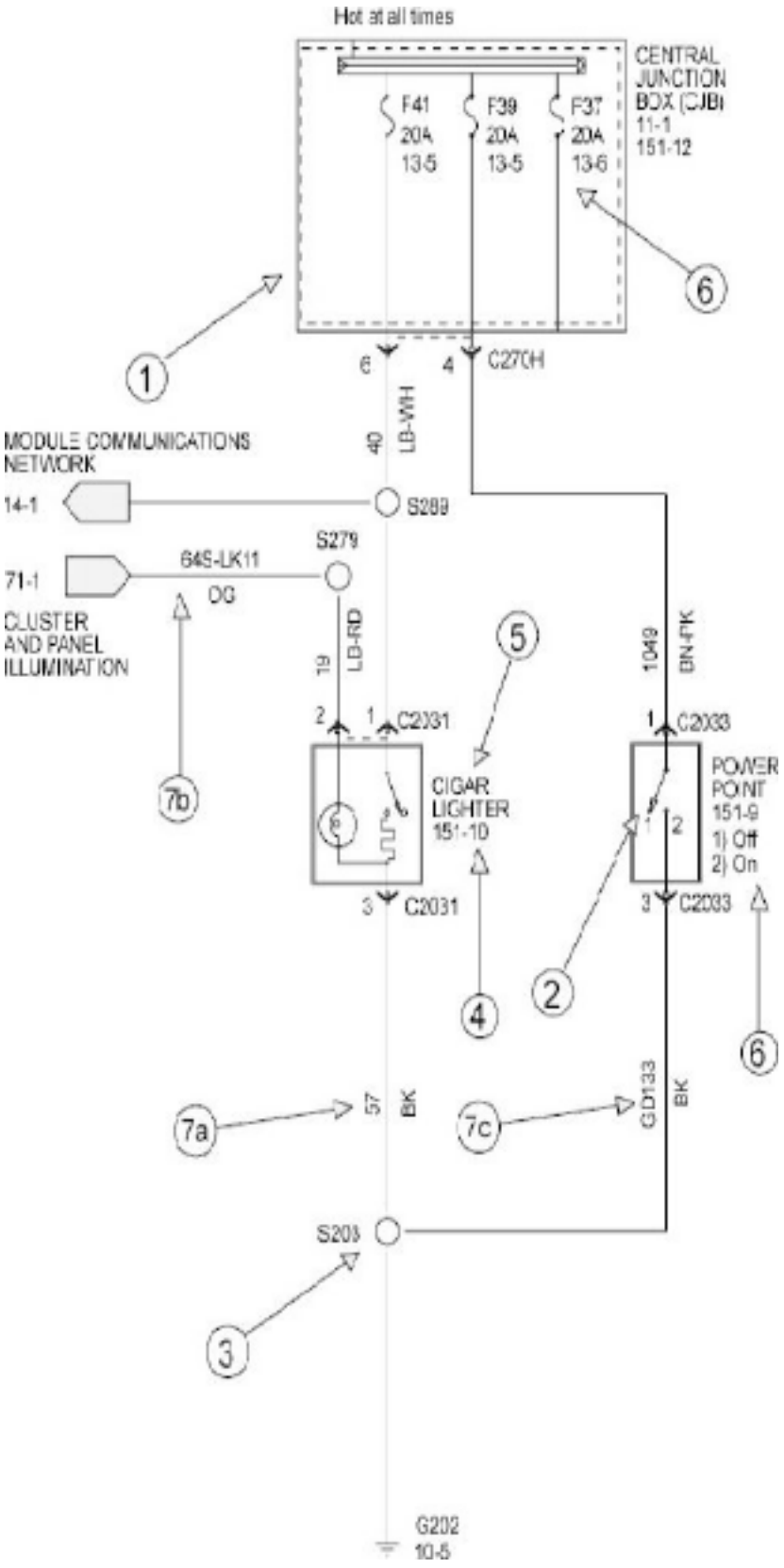


Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63-102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil - Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.


Hot at all times
CENTRAL JUNCTION BOX (CJB)
11-1
151-12
F41
20A
13-5
F39
20A
13-5
F37
20A
13-6
C270H
40
LB-WH
MODULE COMMUNICATIONS NETWORK
14-1
S289
S279
64S-LK11
71-1
DG
CLUSTER AND PANEL ILLUMINATION
19
LB-RD
C2031
CIGAR LIGHTER
151-10
1049
BN-PK
C2033
POWER POINT
151-9
1) Off
2) On
57
BK
GD133
BK
S203
G202
10-5

Trailer Connector: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

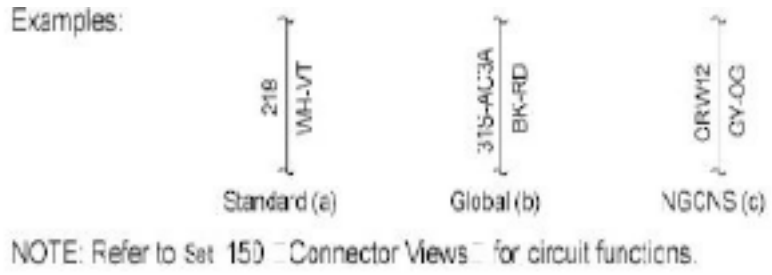
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

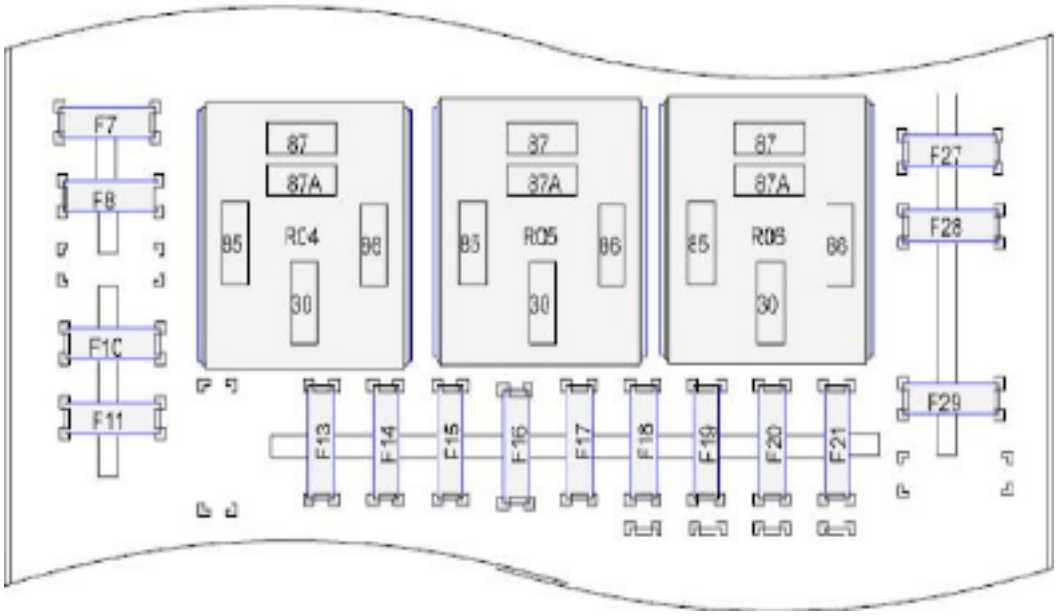
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

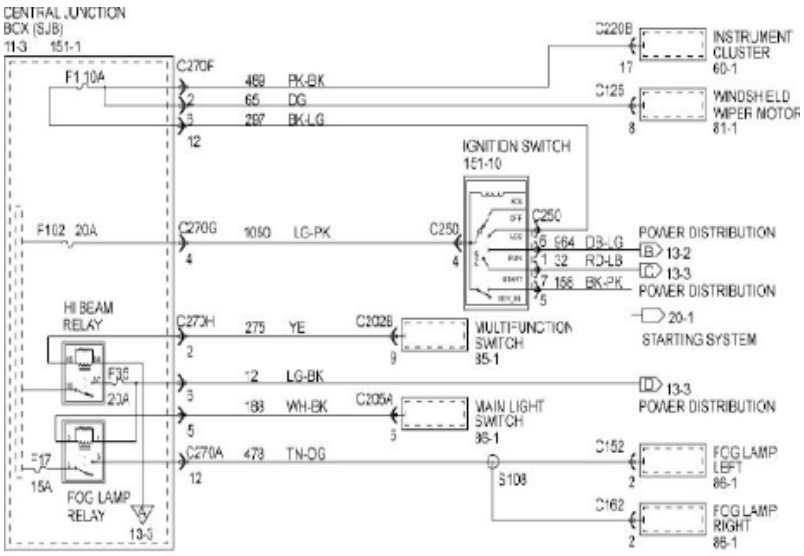
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

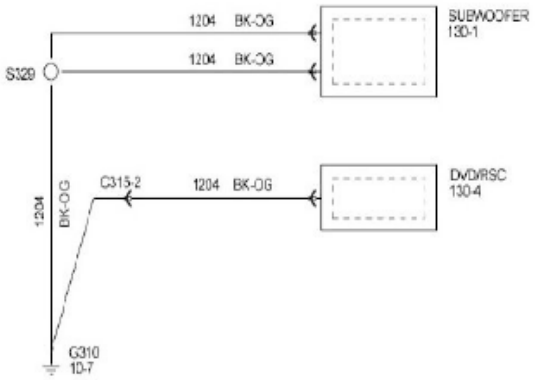
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

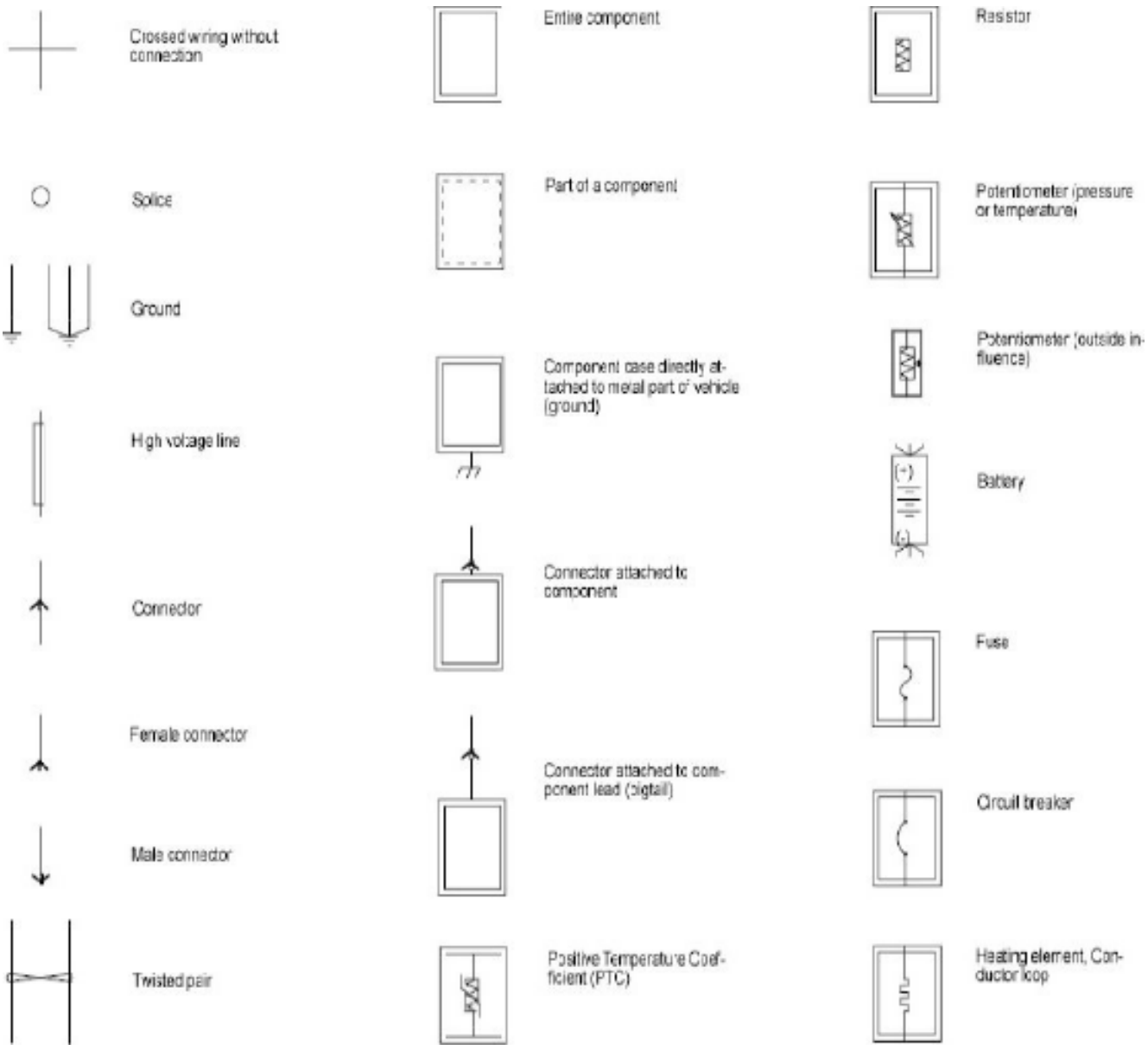
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

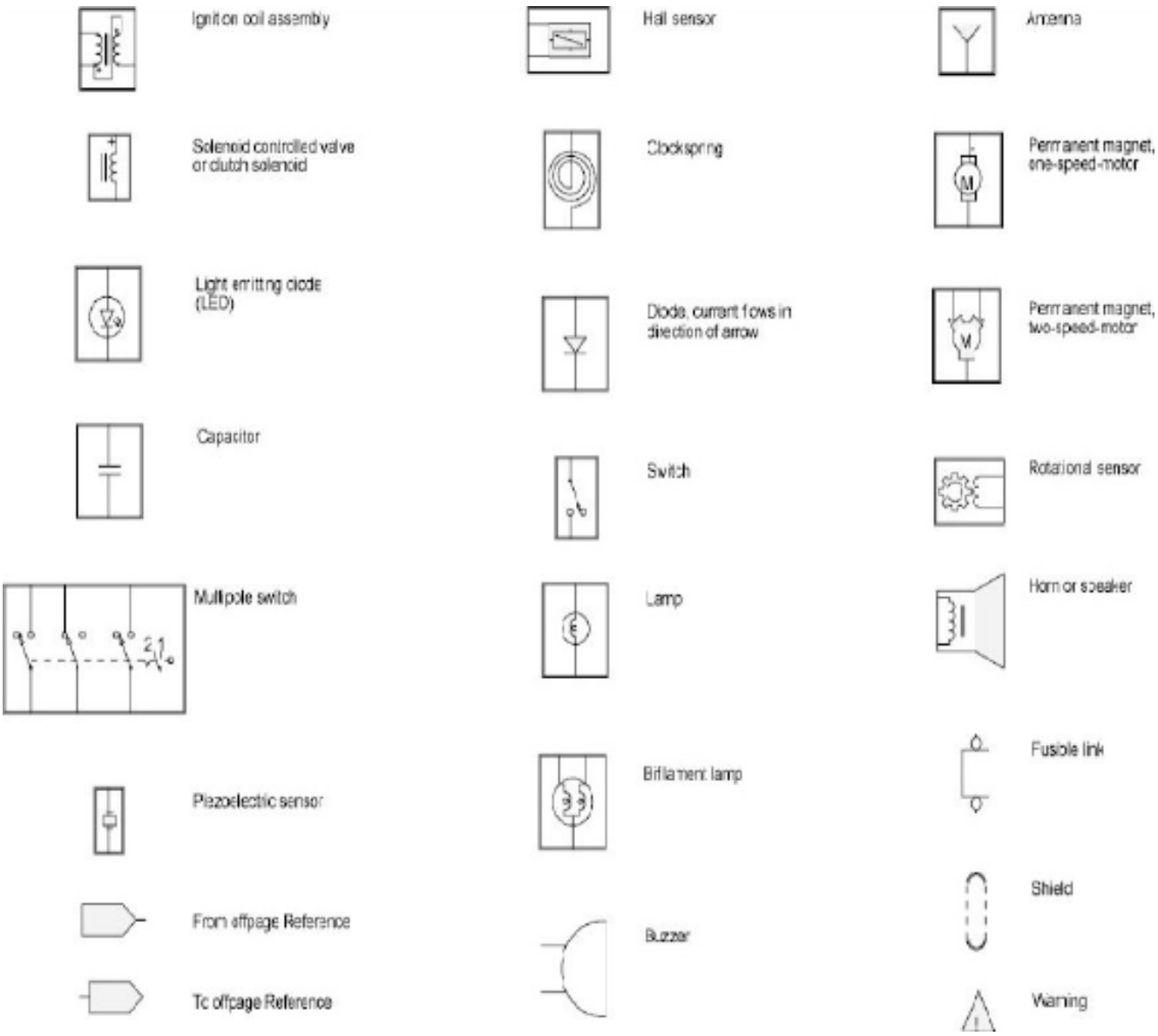
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

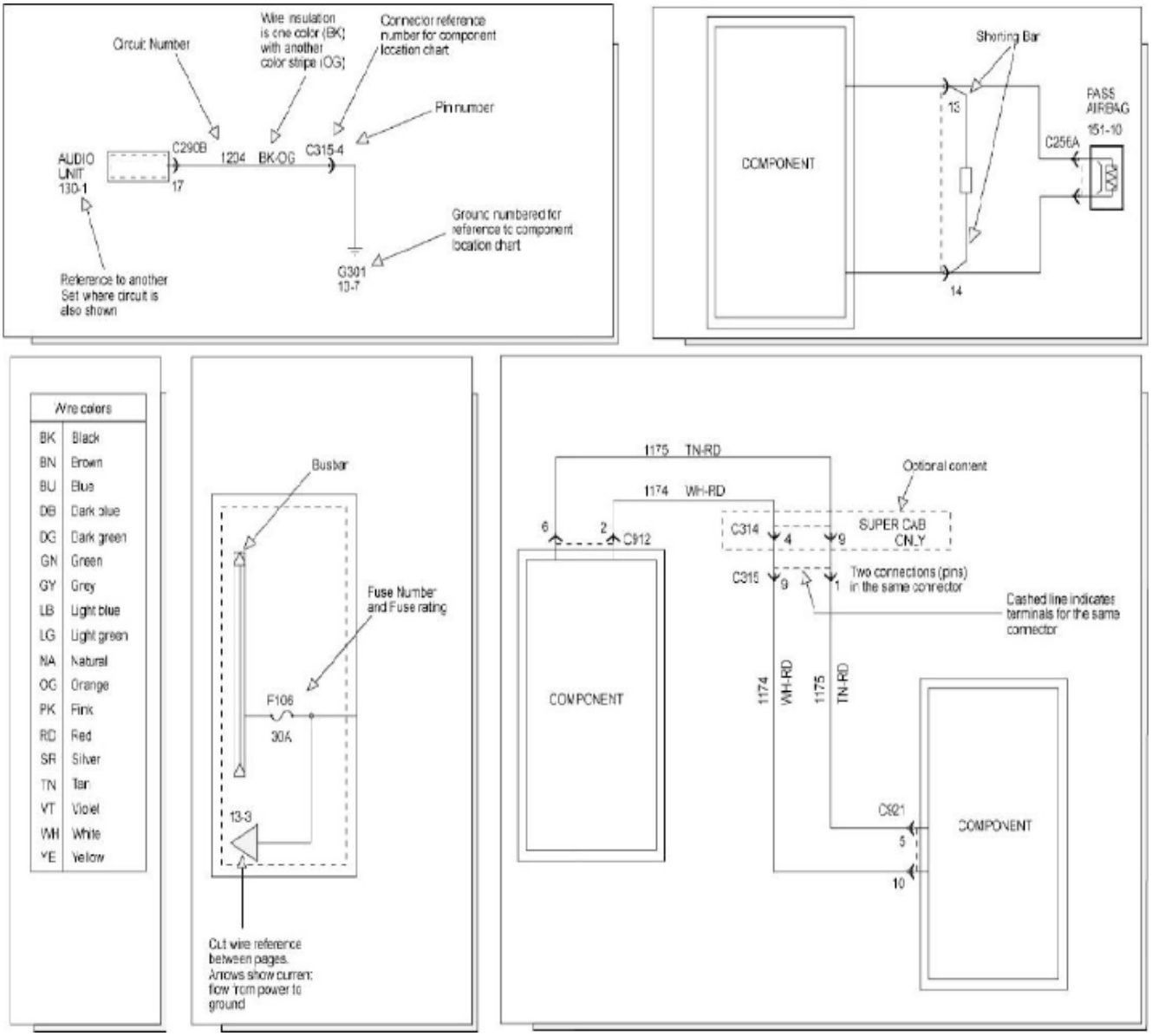
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

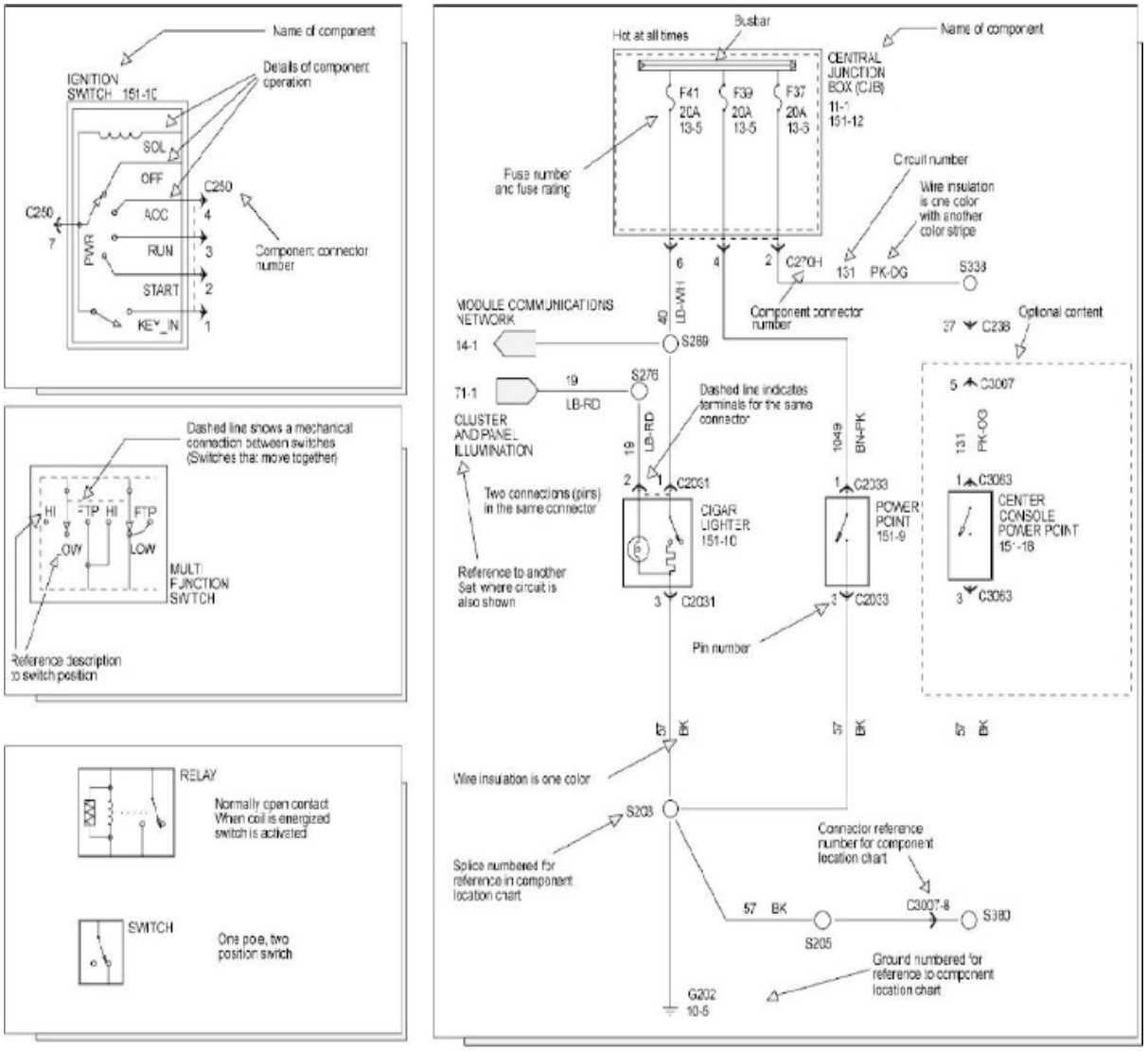
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

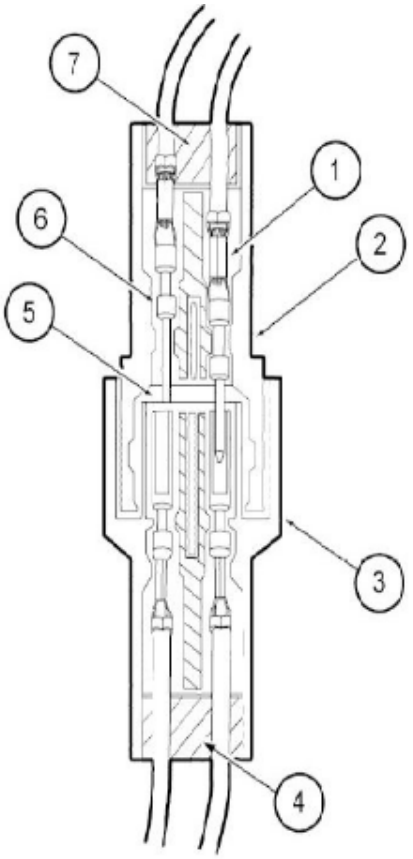


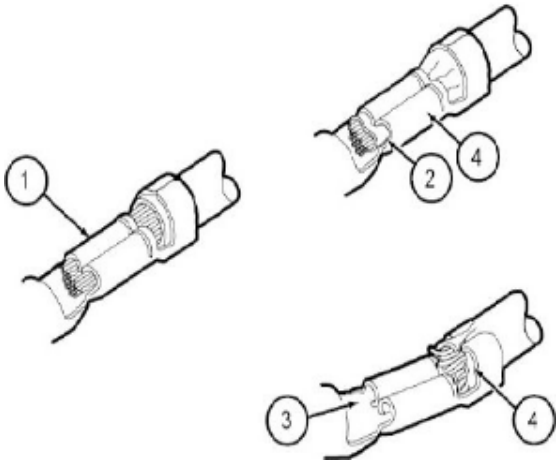
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Trailer Connector: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

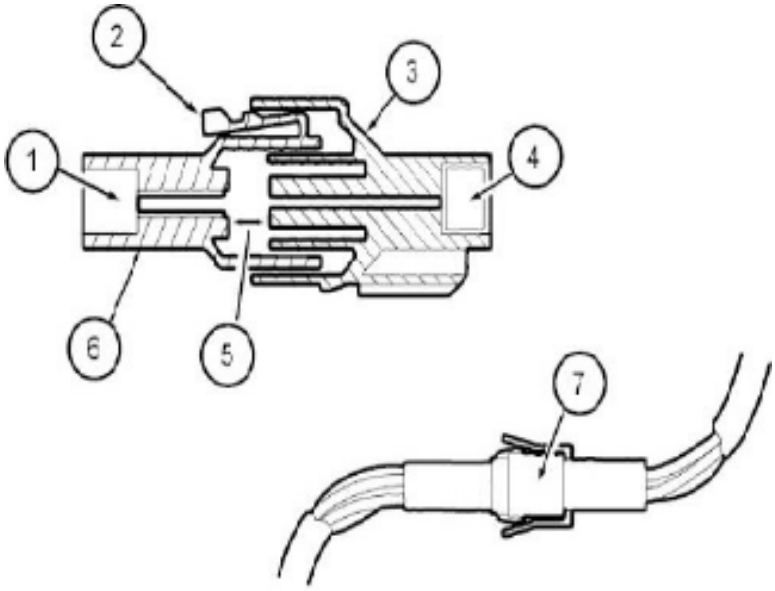
5 = Intermittent contact

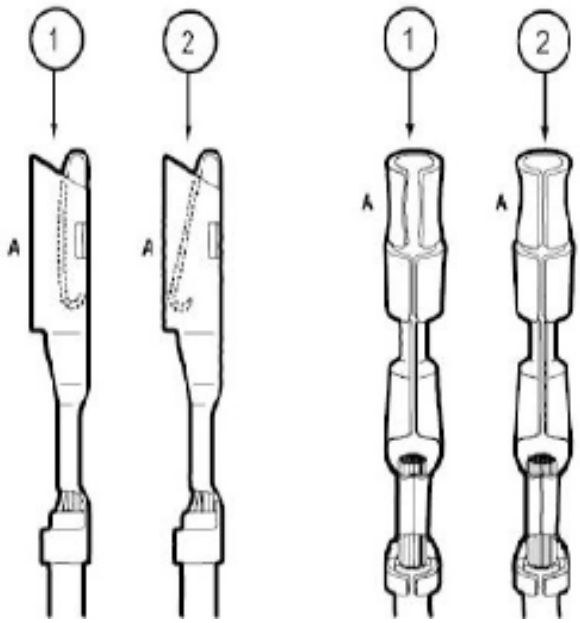
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

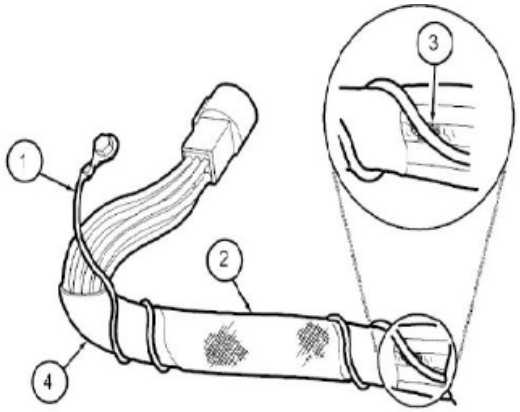
Deformed (enlarged) female terminals

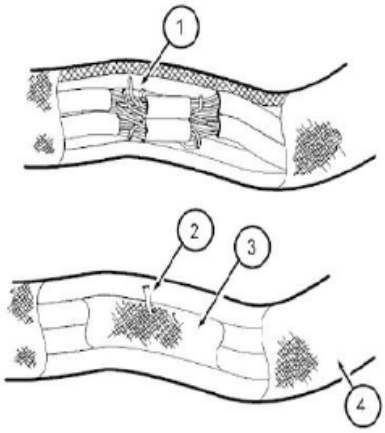
1 = Enlarged

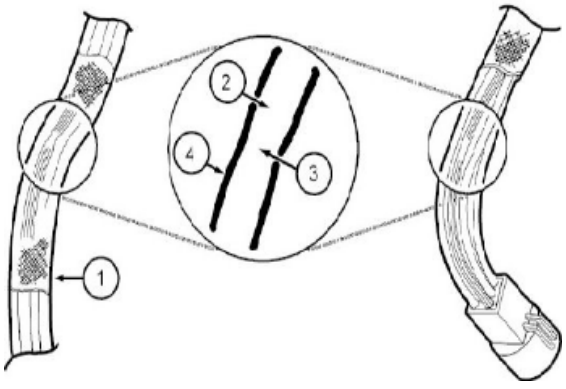
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

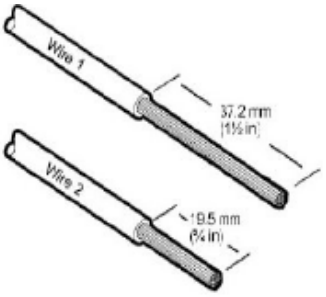
Splice covered 2

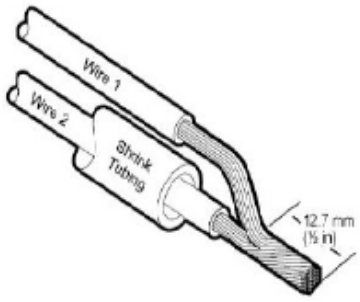
= Wire strand

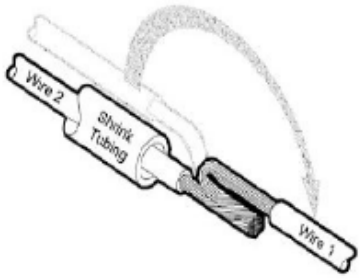
3 = Splice tape

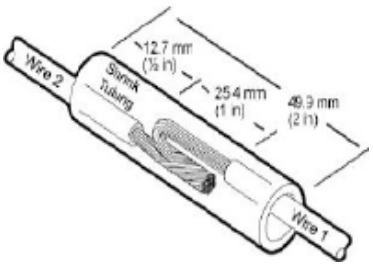
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

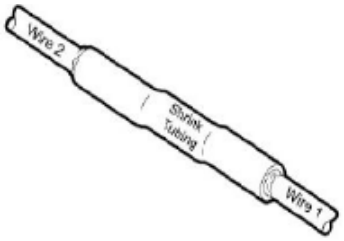
NOTE: -

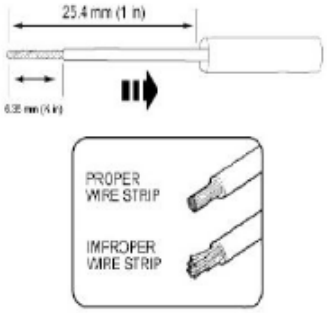
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

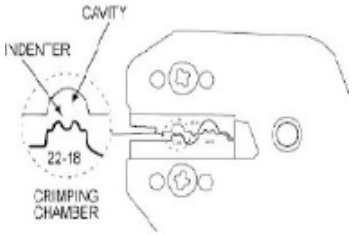
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

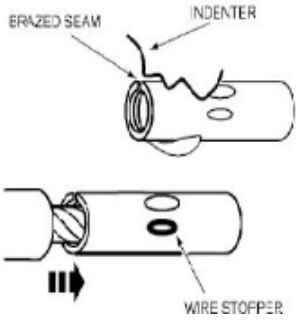
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

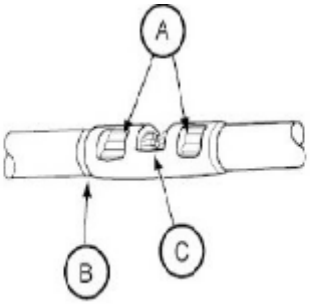
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

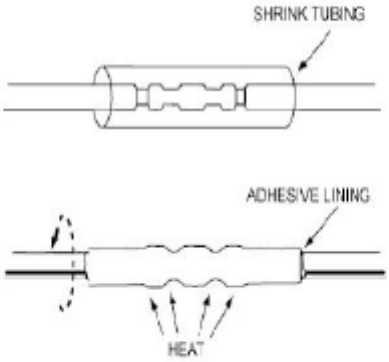
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4 strip, cut 9 strands	* 1/4 strip, cut 2 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip, fold 3x dia.
	16-14	* 1/4 strip, cut 7 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip fold 2x dia	1 strip, fold 3x dia.	1 1/4 strip, fold 4x dia.	Not Recommended
	12-10	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip fold 3x cia.	1 1/4 strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Figtail only

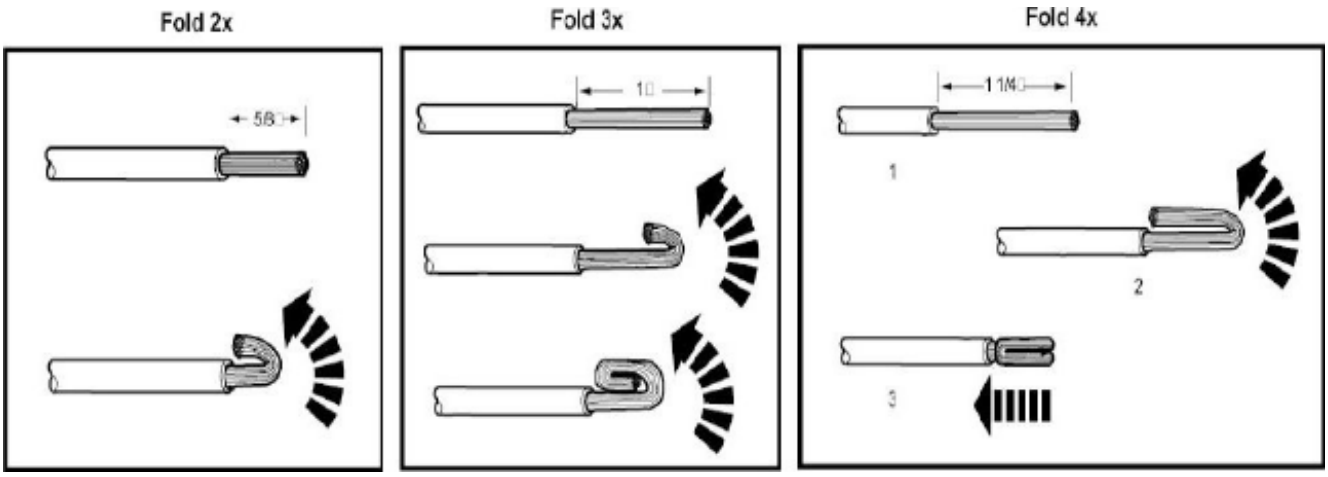
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



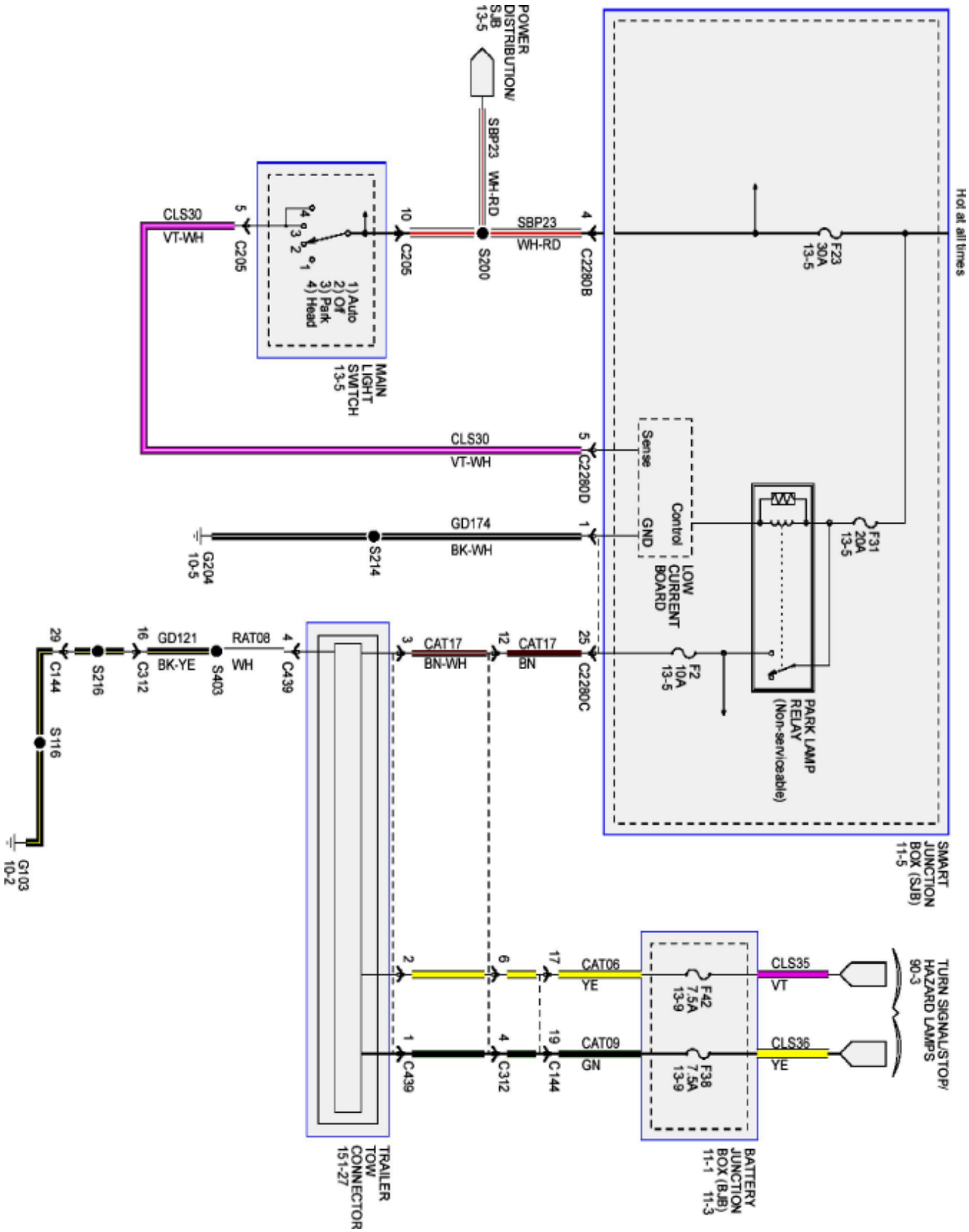
The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Connector: C439

Description:	Harness:	Base Part #:
TRAILER TOW CONNECTOR	14405	15A416

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CAT09 (GN)	16	CTRL MOD. - TRAILER TOW # TURN SIGNAL RIGHT (COLOR TO SAE 1239)	
2	CAT06 (YE)	16	CTRL MOD. - TRAILER TOW # TURN SIGNAL LEFT (COLOR TO SAE 1239)	
3	CAT17 (BN-WH)	16	RELAY - TRAILER TOW PARK LAMPS (COLOR TO SAE 1239)	
4	RAT08 (WH)	16	CTRL MOD. - TRAILER TOW # RETURN	

C439


Hot at all times
POWER DISTRIBUTION/ SJB 13-5
SBP23 WH-RD
SBP23 WH-RD
CLS30 VT-WH
5 C205
10 C205
S200
4 C2280B
1) Auto 2) Off 3) Park 4) Head
MAIN LIGHT SWITCH 13-5
F23 30A 13-5
CLS30 VT-WH
5 C2280D
Sense
Control
GND
LOW CURRENT BOARD
GD174 BK-WH
G204 10-5
S214
1
F31 20A 13-5
PARK LAMP RELAY (Non-serviceable)
F2 10A 13-5
29 C144
S116
G103 10-2
16 GD121 BK-YE
S216
C312
S403
RAT08 WH
4 C439
3 CAT17 BN-WH
12 CAT17 BN
25 C2280C
SMART JUNCTION BOX (SJB) 11-5
2
1 C439
6
4 C312
17
19 C144
CAT06 YE
CAT09 GN
F42 7.5A 13-9
F38 7.5A 13-9
CLS35 VT
CLS36 YE
TURN SIGNALS/STOP/ HAZARD LAMPS 90-3
TRAILER TOW CONNECTOR 151-27
BATTERY JUNCTION BOX (BJB) 11-1 11-3

Trailer Connector: Electrical Diagrams

PLEASE NOTE: Some diagrams may appear to be missing because of gaps in the number sequences. These "gaps" are actually for diagrams that do not apply to the vehicle model selected.

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Diagrams: Other diagrams referred to by number (i.e. 13-2, 24-6, 10-2, etc.) within these diagrams can be found at Diagrams By Number. See:

Diagrams/Electrical Diagrams/Diagrams By Number

Locations: Location Views (reference numbers starting with 151-) referred to within these diagrams can be found at Location Views. See: Locations/Component Locations

Body Control Systems: Description and Operation

MODULE CONTROLLED FUNCTIONS

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

The SJB is the only multifunction electronic module on this vehicle. The SJB is a combination of a multifunction electronic module and a central junction box (CJB). The following systems are controlled by the SJB:

- Accessory delay relay
- Battery saver relay
- Daytime running lamps (DRL) driver
- Fog lamp relay
- Horn relay
- Illuminated entry and interior lighting
- Parking lamps
- Power door locks (if equipped)
- Remote keyless entry (RKE) system (if equipped)
- Tire pressure monitoring system (TPMS) (if equipped)

Body Control Systems: Initial Inspection and Diagnostic Overview

Inspection and Verification

INSPECTION AND VERIFICATION

1. Verify the customer concern. 2. Visually inspect for obvious signs of electrical damage.

VISUAL INSPECTION CHART

Electrical -

Battery junction box (BJB) fuse 5 (50A)

- Smart junction box (SJB) fuse 11 (10A)

- Wiring, terminals or connectors

3. If an obvious cause of an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. NOTE: Make sure to use the latest scan tool software release.

If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

5. NOTE: The vehicle communication module (VCM) prove-out confirms power and ground from the DLC are provided to the VCM.

If the scan tool does not communicate with the VCM: -

Check the VCM connection to the vehicle.

- Check the scan tool connection to the VCM.

- Refer to Information Bus (Module Communications Network), No Power To The Scan Tool, to diagnose no communication with the scan tool.

6. If the scan tool does not communicate with the vehicle:

- Verify the ignition key is in the ON position.

- Verify the scan tool operation with a known good vehicle.

- Refer to Information Bus (Module Communications Network) to diagnose no response from the PCM.

7. Carry out the network test.

- If the scan tool responds with no communication for one or more modules, refer to Information Bus (Module Communications Network).

- If the network test passes, retrieve and record the continuous memory DTCs.

8. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB. 9. If the DTCs retrieved are related to the concern, go to DTC Charts. For all other DTCs, refer to Diagnostic Trouble Code (DTC) Chart. See:

Diagnostic Trouble Code Descriptions/Smart Junction Box (SJB) DTC Chart See: Diagnostic Trouble Code Descriptions/Diagnostic Trouble Code (DTC) Chart

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart. See: Symptom Related Diagnostic Procedures

Principles of Operation

PRINCIPLES OF OPERATION

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

The SJB is a multifunction module that controls many of the vehicle systems. Several SJB functions utilize hardwired inputs and/or outputs. The SJB controls the following hardwired functions, using the corresponding inputs and outputs:

Function	Input(s)	Output(s)
Daytime running lamps (DRL) (if equipped)	• Headlamp switch • Controller area network (CAN) messaging from instrument cluster (IC)	• Low beam headlamps
Fog lamps (if equipped)	• Headlamp switch	• Fog lamp relay
Horn	• Horn switch • Remote keyless entry (RKE) transmitter	• Horn relay
Interior lighting	• Door ajar switches • RKE transmitter	• Interior lamps relay
Parking lamps	• Headlamp switch	• Parking lamps relay
Power locks (if equipped)	• Driver door lock control switch • Passenger door lock control switch • RKE transmitter	• Door lock/unlock relays
RKE system (if equipped)	• RKE transmitter	• Door lock/unlock relays • Interior lamps relay
Tire pressure monitoring system (TPMS)	• TPMS sensors	• CAN message to instrument cluster (IC)

In addition, the SJB is involved in other vehicle systems through communication over the CAN. For a detailed list of SJB network inputs and outputs, refer to Information Bus (Module Communications Network), Principles of Operation.

Some SJB parameters are programmable. Two types of programmable parameters are available: vehicle configuration and customer preference.

The SJB utilizes a protective circuit strategy for many of its outputs (for example, the headlamp output circuit). Output loads are monitored by the SJB for excessive current (typically short circuits) and are shut down (voltage or ground provided by the module are turned off) when a fault is detected. A continuous DTC is stored at that time for the fault. The circuit will then reset after an ignition cycle or customer demand of the function (switching the component on, 30-minute battery saver being energized).

When an excessive circuit load occurs several times, the module shuts down the output until a service procedure is performed. At the same time, the continuous DTC that was stored on the first failure will not clear by a command to clear the continuous DTCs. The module will not allow this code to be cleared or the circuit restored to normal until a successful on-demand self-test proves that the fault has been repaired. After the on-demand self-test has successfully completed (no on-demand DTCs present), the continuous DTC will have been cleared and the circuit function will return.

Diagnostic Trouble Code (DTC) Chart

NOTE: Most powertrain (P-code) DTCs are diagnosed in Computers and Control Systems. If the P-code retrieved is not listed below, refer to Computers and Control Systems to continue diagnostics. The smart junction box (SJB) is also known as the generic electronic module (GEM).

DTC	Description	Source	Action
B106A	TPMS Sensor Pressure Range Bit Incorrect State	SJB	REFER to Wheels, Tires, and Alignment.
B106B	Tire Pressure Sensor Low Battery	SJB	REFER to Wheels, Tires, and Alignment.
B106E	Solid State Driver Disabled Due to Short Circuit	SJB	REFER to Smart Junction Box (SJB).
B106F	Module Disabled Due to External Fault	SJB	REFER to Smart Junction Box (SJB).
B1015	CEI Unconfigured	Instrument Cluster (IC)	REFER to Antitheft and Alarm Systems.
B1118	Passenger Front Crash Sensor Mount/Communication Fault	Restraints Control Module (RCM)	REFER to Air Bag Systems.
B1135	Passenger Front Crash Sensor Internal Fault	RCM	REFER to Air Bag Systems.
B1139	Invalid Transmitter Identification Code	SJB	REFER to Locks.
B1202	Fuel Sender Circuit Open	IC	REFER to Inst., Gauges, Warn Ind..
B1204	Fuel Sender Circuit Short to Ground	IC	REFER to Inst., Gauges, Warn Ind..
B1213	Anti-Theft Number of Programmed Keys is Below Minimum	IC	REFER to Antitheft and Alarm Systems.
B1231	Event Threshold Exceeded	Occupant Classification System Module (OCSM)	INSTALL a new OCSM. TEST the system for normal operation.
B1231	Event Threshold Exceeded	RCM	INSTALL a new RCM. TEST the system for normal operation.
B1302	Accessory Delay Relay Coil Circuit Failure	SJB	REFER to Windows.
B1304	Accessory Delay Relay Coil Circuit Short to Battery	SJB	REFER to Windows.
B1309	Power Door Lock Circuit Short to Ground	SJB	REFER to Locks.
B1317	Battery Voltage High	ABS Module	REFER to (*).
B1317	Battery Voltage High	4X4 Control Module	REFER to Charging System.

(*) Antilock Brakes / Traction Control Systems

Body Control Systems: Diagnostic Trouble Code Descriptions

B106A-B1317

DTC	Description	Source	Action
B1317	Battery Voltage High	IC	REFER to Charging System.
B1317	Battery Voltage High	OCSM	REFER to Air Bag Systems.
B1317	Battery Voltage High	RCM	REFER to Charging System.
B1317	Battery Voltage High	SJB	REFER to Charging System.
B1318	Battery Voltage Low	4X4 Control Module	REFER to Charging System.
B1318	Battery Voltage Low	ABS Module	REFER to (*).
B1318	Battery Voltage Low	IC	REFER to Inst., Gauges, Warn Ind..
B1318	Battery Voltage Low	OCSM	REFER to Air Bag Systems.
B1318	Battery Voltage Low	RCM	REFER to Charging System.
B1318	Battery Voltage Low	SJB	REFER to Charging System.
B1319	Driver Door Ajar Circuit Failure	4X4 Control Module	REFER to Transfer Case.
B1322	Driver Door Ajar Circuit Short to Ground	4X4 Control Module	REFER to Transfer Case.
B1322	Driver Door Ajar Circuit Short to Ground	SJB	REFER to Lighting and Horns.
B1330	Passenger Door Ajar Circuit Short to Ground	SJB	REFER to Lighting and Horns.
B1338	Door Ajar RR Circuit Short to Ground	SJB	REFER to Lighting and Horns.
B1341	Power Door Unlock Circuit Short to Ground	SJB	REFER to Locks.
B1342	ECU is Faulted	4X4 Control Module	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new 4X4 control module. TEST the system for normal operation.
B1342	ECU is Faulted	ABS Module	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new ABS module. TEST the system for normal operation.
B1342	ECU is Faulted	IC	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new IC. TEST the system for normal operation.
B1342	ECU is Faulted	OCSM	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new OCSM. TEST the system for normal operation.
B1342	ECU is Faulted	PCM	CLEAR the DTCs. RETRIEVE the DTCs. If DTC B1342 is retrieved again, INSTALL a new PCM. CLEAR the DTCs. REPEAT the self-test.

(*) Antilock Brakes / Traction Control Systems

B1317-B1342

DTC	Description	Source	Action
B1342	ECU is Faulted	RCM	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new RCM. TEST the system for normal operation.
B1342	ECU is Faulted	SJB	CLEAR the DTCs. REPEAT the self-test. If DTC B1342 is retrieved again, INSTALL a new SJB. TEST the system for normal operation.
B1352	Ignition Key-In Circuit Failure	IC	REFER to Inst., Gauges, Warn Ind..
B1359	Ignition Run/Acc Circuit Failure	SJB	REFER to Ignition Switch.
B1363	Ignition Start Circuit Failure	IC	REFER to Inst., Gauges, Warn Ind..
B1470	Lamp Headlamp Input Circuit Failure	SJB	REFER to Lighting and Horns.
B1483	Brake Pedal Input Circuit Failure	4X4 Control Module	REFER to Transfer Case.
B1485	Brake Pedal Input Short to Battery	ABS Module	REFER to (*).
B1522	Hood Switch Circuit Short to Ground	SJB	DISREGARD the DTC. It is not applicable to this vehicle. The SJB may be incorrectly configured or the SJB may be at fault. CHECK the configuration of the SJB. CLEAR the DTCs. REPEAT the self-test.
B1555	Ignition Run/Start Circuit Failure	4X4 Control Module	REFER to Transfer Case.
B1555	Ignition Run/Start Circuit Failure	SJB	REFER to Ignition Switch.
B1569	Lamp Headlamp High-Beam Circuit Short to Battery	SJB	REFER to Lighting and Horns.
B1574	Door Ajar LR Circuit Short to Ground	SJB	REFER to Lighting and Horns.
B1600	PATS Ignition Key Transponder Signal is Not Received	IC	REFER to Antitheft and Alarm Systems.
B1601	PATS Received Incorrect Key-Code From Ignition Key Transponder	IC	REFER to Antitheft and Alarm Systems.
B1602	PATS Received Invalid Format of Key-Code From Ignition Key Transponder	IC	REFER to Antitheft and Alarm Systems.
B1681	PATS Transceiver Module Signal is Not Received	IC	REFER to Antitheft and Alarm Systems.
B1688	Lamp Dome Input Circuit Short to Ground	SJB	REFER to Lighting and Horns.
B1868	Lamp Air Bag Warning Indicator Circuit Failure	IC	REFER to Instrument Panel, Gauges and Warning Indicators.
B1884	PAD Warning Lamp Circuit Failure	RCM	REFER to Air Bag Systems.
B1890	PAD Warning Lamp Circuit Short to Battery	RCM	REFER to Air Bag Systems.
B1897	Horn Switch Circuit Failure	SJB	REFER to Horn.
B2030	Front Fog Lamp Relay Ckt Failure	SJB	REFER to Lighting and Horns.
B2103	Antenna Not Connected	IC	REFER to Antitheft and Alarm Systems.

(*) Antilock Brakes / Traction Control Systems

B1342-B2103

DTC	Description	Source	Action
B2141	NVM Configuration Failure	IC	REFER to Antitheft and Alarm Systems.
B2143	NVM Memory Failure	IC	REFER to Inst., Gauges, Warn Ind..
B2143	NVM Memory Failure	SJB	CLEAR the DTCs. REPEAT the self-test. If DTC B2143 is retrieved again, INSTALL a new SJB. TEST the system for normal operation.
B2207	ECU ROM Checksum Error	IC	CLEAR the DTCs. REPEAT the self-test. If DTC B2207 is retrieved again, INSTALL a new IC. TEST the system for normal operation.
B2261	Park Lamp Switch Failure	SJB	REFER to Lighting and Horns.
B2276	Less Than 2 Transmitters Programmed	SJB	REFER to Locks.
B2290	Occupant Classification System Fault	OCSM	REFER to Air Bag Systems.
B2290	Occupant Classification System Fault	RCM	REFER to Air Bag Systems.
B2292	Restraint System - Seatbelt Pretensioner Fault	RCM	REFER to Air Bag Systems.
B2293	Restraint System - Airbag Fault	RCM	REFER to Air Bag Systems.
B2296	Restraint System - Impact Sensor Fault	RCM	REFER to Air Bag Systems.
B2425	Remote Keyless Entry Out of Synchronization	SJB	REFER to Locks.
B2431	Transponder Programming Failed	IC	REFER to Antitheft and Alarm Systems.
B2434	Drivers Seat Belt Buckle Switch Circuit Short to Ground	RCM	REFER to Air Bag Systems.
B2435	Drivers Seat Belt Buckle Switch Resistance Out of Range	RCM	REFER to Air Bag Systems.
B2438	Passengers Seat Belt Buckle Switch Circuit Short to Ground	RCM	REFER to Air Bag Systems.
B2439	Passengers Seat Belt Buckle Switch Resistance Out of Range	RCM	REFER to Air Bag Systems.
B2472	Fog Lamp Switch Failure	SJB	REFER to Lighting and Horns.
B2477	Module Configuration Failure	IC	REFER to Information Bus.
B2477	Module Configuration Failure	RCM	REFER to Air Bag Systems.
B2477	Module Configuration Failure	SJB	REFER to Information Bus.
B2512	Front Fog Lamp Relay Ckt Short to Battery	SJB	REFER to Lighting and Horns.
B2607	Harness/Configuration Mismatch	RCM	REFER to Air Bag Systems.
B2675	Trip Reset Button Stuck	IC	CLEAR the DTCs. REPEAT the self-test. If DTC B2675 is retrieved again, INSTALL a new IC. TEST the system for normal operation.
B2691	Seat Belt Buckle Switch Circuit Fault, Front Driver's Side	RCM	REFER to Air Bag Systems.
B2692	Front Passenger's Seat Belt Buckle Switch Circuit Fault	RCM	REFER to Air Bag Systems.

B2141-B2692

DTC	Description	Source	Action
B2792	Cross Link Between Firing Loops	RCM	REFER to Air Bag Systems.
B2844	Ignition Fault	IC	REFER to Inst., Gauges, Warn Ind..
B2868	Left Front Tire Pressure Sensor Fault	SJB	This DTC is only present when a new SJB is installed, the SJB is flashed, or the SJB is configured. REFER to Wheels and Tires to CARRY OUT the tire pressure monitoring system (TPMS) sensor training in order to CLEAR the DTC.
B2869	Right Front Tire Pressure Sensor Fault	SJB	This DTC is only present when a new SJB is installed, the SJB is flashed, or the SJB is configured. REFER to Wheels and Tires to CARRY OUT the tire pressure monitoring system (TPMS) sensor training in order to CLEAR the DTC.
B2870	Right Rear Tire Pressure Sensor Fault	SJB	This DTC is only present when a new SJB is installed, the SJB is flashed, or the SJB is configured. REFER to Wheels and Tires to CARRY OUT the tire pressure monitoring system (TPMS) sensor training in order to CLEAR the DTC.
B2871	Left Rear Tire Pressure Sensor Fault	SJB	This DTC is only present when a new SJB is installed, the SJB is flashed, or the SJB is configured. REFER to Wheels and Tires to CARRY OUT the tire pressure monitoring system (TPMS) sensor training in order to CLEAR the DTC.
B2872	Tire Pressure Sensor Fault	SJB	REFER to Wheels, Tires, and Alignment.
B287A	Tire Pressure System Fault	SJB	REFER to Wheels, Tires, and Alignment.
B2909	Belt Tension Sensor Fault	OCSM	REFER to Air Bag Systems.
B2973	Daytime Running Lamp Output Shorted to Ground	SJB	REFER to Lighting and Horns.
C1095	ABS Hydraulic Pump Motor Circuit Failure	ABS Module	REFER to Antilock Brakes / Traction Control Systems.
C1096	ABS Hydraulic Pump Motor Circuit Open	ABS Module	REFER to Antilock Brakes / Traction Control Systems.
C1126	Cruise Control Command Switch Assembly Circuit Failure	SJB	REFER to Cruise Control.
C1145	Speed Wheel Sensor RF Input Circuit Failure	ABS Module	REFER to Antilock Brakes / Traction Control Systems.
C1148	Speed Wheel Sensor RF Coherency Fault	ABS Module	REFER to (*).
C1155	Speed Wheel Sensor LF Input Circuit Failure	ABS Module	REFER to Antilock Brakes / Traction Control Systems.
C1158	Speed Wheel Sensor LF Coherency Fault	ABS Module	REFER to (*).
C1186	ABS Power Relay Output Open Circuit	ABS Module	REFER to (*).
C1187	Brake Fluid Level Sensor Input Open Circuit	ABS Module	REFER to Antilock Brakes / Traction Control Systems.
C1194	ABS Outlet Valve Coil LF Circuit Failure	ABS Module	REFER to Antilock Brakes / Traction Control Systems.
C1198	ABS Inlet Valve Coil LF Circuit Failure	ABS Module	REFER to (*).

(*) Antilock Brakes / Traction Control Systems

B287A-B2973 / C1095-C1198

DTC	Description	Source	Action
C1210	ABS Outlet Valve Coil RF Circuit Failure	ABS Module	REFER to Antilock Brakes / Traction Control Systems.
C1214	ABS Inlet Valve Coil RF Circuit Failure	ABS Module	REFER to (*).
C1221	Lamp ABS Warning Output Circuit Short to Ground	IC	REFER to Instrument Panel, Gauges and Warning Indicators.
C1226	Lamp Brake Warning Output Circuit Short to Ground	IC	REFER to Instrument Panel, Gauges and Warning Indicators.
C1229	Speed Wheel Sensor Rear Center Coherency Fault	ABS Module	REFER to Antilock Brakes / Traction Control Systems.
C1230	Speed Wheel Sensor Rear Center Input Circuit Failure	ABS Module	REFER to Antilock Brakes / Traction Control Systems.
C1233	Speed Wheel LF Input Signal Missing	ABS Module	REFER to (*).
C1234	Speed Wheel RF Input Signal Missing	ABS Module	REFER to (*).
C1237	Speed Wheel Rear Input Signal Missing	ABS Module	REFER to (*).
C1246	ABS Outlet Valve Coil RR Circuit Failure	ABS Module	REFER to Antilock Brakes / Traction Control Systems.
C1254	ABS Inlet Valve Coil RR Circuit Failure	ABS Module	REFER to (*).
C1266	ABS Valve Power Relay Circuit Failure	ABS Module	REFER to (*).
C1414	Incorrect Module Design Level	ABS Module	REFER to (*).
C1414	Incorrect Module Design Level	RCM	REFER to Air Bag Systems.
C1446	Brake Switch Circuit Failure	SJB	REFER to Wheels, Tires, and Alignment.
C1728	Transfer Case Unable to Transition Between 2H and 4H	4X4 Control Module	REFER to Transfer Case.
C1729	Transfer Case Unable to Transition Between 4H and 4L	4X4 Control Module	REFER to Transfer Case.
C1941	Zero Seat Weight Test Failure	OCSM	REFER to Air Bag Systems.
C1946	Front Driver's Seat Track Position Switch Circuit Open	RCM	REFER to Air Bag Systems.
C1947	Front Driver's Seat Track Position Switch Circuit Short to Ground	RCM	REFER to Air Bag Systems.
C1948	Front Driver's Seat Track Position Switch Circuit Resistance Out of Range	RCM	REFER to Air Bag Systems.
C1949	Accelerometer Sensor Circuit Open	ABS Module (4X4 only)	CLEAR the DTCs. REPEAT the self-test. If DTC C1949 is retrieved again, INSTALL a new ABS module. TEST the system for normal operation.
C1950	Accelerometer Sensor Circuit Failure	ABS Module (4X4 only)	REFER to Antilock Brakes / Traction Control Systems.
C1981	Front Driver's Seat Track Position Switch Circuit Fault	RCM	REFER to Air Bag Systems.
C2780	ECU in Manufacturer Sub-State	SJB	This DTC is only present when a new SJB is installed, the SJB is flashed, or the SJB is configured. REFER to Wheels and Tires to CARRY OUT the tire pressure monitoring system (TPMS) sensor training in order to CLEAR the DTC.

(*) Antilock Brakes / Traction Control Systems

C1210-C2780

DTC	Description	Source	Action
C2784	RAM Checksum Failure	IC	CLEAR the DTCs. REPEAT the self-test. If DTC C2784 is retrieved again, INSTALL a new IC. TEST the system for normal operation.
P1260	Theft Detected, Vehicle Immobilized	PCM	REFER to Antitheft and Alarm Systems.
P1707	Transfer Case Neutral or Park/Neutral Indication Circuit	4X4 Control Module	REFER to Transfer Case.
P1812	4-Wheel Drive Mode Select Circuit Failure	4X4 Control Module	REFER to Transfer Case.
P1815	4-Wheel Drive Mode Select Short Circuit Ground	4X4 Control Module	REFER to Transfer Case.
P1816	Transmission Neutral Safety Switch Circuit Failure	4X4 Control Module	REFER to Transfer Case.
P1819	Transmission Neutral Safety Switch Short Circuit to Ground	4X4 Control Module	REFER to Transfer Case.
P1849	Transfer Case Contact Plate A Short Circuit to Ground	4X4 Control Module	REFER to Transfer Case.
P1853	Transfer Case Contact Plate B Short Circuit to Ground	4X4 Control Module	REFER to Transfer Case.
P1857	Transfer Case Contact Plate C Short Circuit to Ground	4X4 Control Module	REFER to Transfer Case.
P1861	Transfer Case Contact Plate D Short Circuit to Ground	4X4 Control Module	REFER to Transfer Case.
P1867	Transfer Case Contact Plate General Circuit Failure	4X4 Control Module	REFER to Transfer Case.
P1891	Transfer Case Contact Plate Ground Return Open Circuit	4X4 Control Module	REFER to Transfer Case.
PXXXX	All other DTCs	PCM	REFER to Computers and Control Systems.
U0002	High Speed CAN Communication Bus Performance	IC	REFER to Information Bus (Module Communications Network).
U0100	Lost Communication With ECM/PCM	4X4 Control Module	REFER to Information Bus (Module Communications Network).
U0100	Lost Communication With ECM/PCM	IC	REFER to Antitheft and Alarm Systems.
U0100	Lost Communication With ECM/PCM	SJB	REFER to Information Bus.
U0102	Lost Communication with Transfer Case Control Module (4x4CM)	IC	REFER to Instrument Panel, Gauges and Warning Indicators.
U0140	Lost Communication With Body Control Module (GEM)	IC	REFER to Instrument Panel, Gauges and Warning Indicators.
U0151	Lost Communication With Restraints Control Module	IC	REFER to Instrument Panel, Gauges and Warning Indicators.
U0151	Lost Communication With Restraints Control Module	OCSM	REFER to Information Bus (Module Communications Network).
U0155	Lost Communication With Instrument Panel Cluster (IC) Control Module	SJB	REFER to Lighting and Horns.

C2784 / P1260-P1891 / U0002-U0155

DTC	Description	Source	Action
U0300	Internal Control Module Software Incompatibility	RCM	REFER to Air Bag Systems.
U1900	CAN Communication Bus Fault - Receive Error	RCM	REFER to Air Bag Systems.
U2023	Fault Received From External Node	IC	REFER to Inst., Gauges, Warn Ind..
U2023	Fault Received From External Node	SJB	RETRIEVE and FOLLOW non-network DTCs from other modules.
U2050	No Application Present	4X4 Control Module	REFER to Information Bus (Module Communications Network).
U2050	No Application Present	IC	REFER to Information Bus.
U2050	No Application Present	OCSM	REFER to Air Bag Systems.
U2050	No Application Present	RCM	REFER to Air Bag Systems.
U2050	No Application Present	SJB	REFER to Information Bus.
U2051	One or More Calibration Files Missing/Corrupt	OCSM	CONFIGURE the OCSM. REFER to Information Bus (Module Communications Network). CLEAR the DTCs. REPEAT the self-test. If DTC U2051 is retrieved again, INSTALL a new OCSM. TEST the system for normal operation.
U2051	One or More Calibration Files Missing/Corrupt	RCM	CONFIGURE the RCM. REFER to Information Bus (Module Communications Network). CLEAR the DTCs. REPEAT the self-test. If DTC U2051 is retrieved again, INSTALL a new RCM. TEST the system for normal operation.
U2472	Unexpected Ignition State	IC	REFER to Inst., Gauges, Warn Ind..
U2510	CAN - Invalid Data for Vehicle Security	IC	REFER to Antitheft and Alarm Systems.
U2511	CAN - Data Mis-Match (Receive Data Does Not Match Expected)	IC	REFER to Antitheft and Alarm Systems.

Smart Junction Box (SJB) DTC Chart

DTC	Description	Action
B106E	Solid State Driver Disabled Due to Short Circuit	GO to Pinpoint Test A.
B106F	Module Disabled Due to External Fault	GO to Pinpoint Test A.
U0100	Lost Communication With ECM/PCM	REFER to Information Bus.
U0155	Lost Communication With Instrument Panel Cluster (IC) Control Module	REFER to Information Bus (Module Communications Network).
All other DTCs	—	REFER to the Diagnostic Trouble Code (DTC) Chart.

U0300-U2511

B106E-B106F / U0100-U0155

Symptom Chart

Condition	Possible Sources	Action
• The smart junction box (SJB) does not respond to the scan tool	• Fuse • Wiring, terminals or connectors • SJB	• REFER to Information Bus (Module Communications Network).

Symptom Chart

PINPOINT TEST A: DTC B106E — SOLID STATE DRIVER DISABLED DUE TO SHORT CIRCUIT

CAUTION: If DTC B106F is present and the SJB is to be replaced, the fault condition must be corrected first. Failure to correct the fault condition first will cause damage to the new SJB, resulting in a repeat repair.

Test Step		Result / Action to Take
A1	REVIEW THE DTCs • Review the DTCs from the SJB self-test. • **Are only DTC B106E and DTC B106F present?**	**Yes** INSTALL a new SJB. TEST the system for normal operation. **No** CORRECT any DTCs present other than DTC B106E and DTC B106F. REFER to Diagnostic Trouble Code (DTC) Chart. After the repair, GO to **A2**.

(Continued)

PINPOINT TEST A: DTC B106E — SOLID STATE DRIVER DISABLED DUE TO SHORT CIRCUIT (Continued)

Test Step		Result / Action to Take
A2	CARRY OUT THE SJB SELF-TEST • Carry out the SJB self-test. • **Is DTC B106F present?**	**Yes** INSTALL a new SJB. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern was caused by a fault in one of the output circuits.

Body Control Systems: Pinpoint Tests

PINPOINT TEST A: DTC B106E - SOLID STATE DRIVER DISABLED DUE TO SHORT CIRCUIT

Normal Operation

The SJB controls the output of the daytime running lamps (DRL), fog lamps, one-touch down driver power window, accessory delay relay, windshield wiper park/run, windshield wiper speed, and windshield washer. When a repetitive fault causing a circuit overload is detected on any of the output circuits, the SJB disables the circuit by removing voltage, or ground, to the affected circuit. The circuit remains disabled until the fault is corrected and an on-demand self-test is run. After the on-demand self-test has been run, any DTCs related to the fault will be cleared.

- DTC B106E (Solid State Driver Disabled Due to Short Circuit) - sets when the SJB has temporarily disabled a circuit due to a repetitive fault causing a circuit overload. A corresponding DTC for the circuit in question will also set as follows:

- DTC B106F (Module Disabled Due to External Fault) - sets when one or more output functions are permanently disabled due to a repetitive circuit overload fault. DTC B106F will be set with DTC B106E. When DTC B106F is present, the SJB must be replaced after the fault condition has been corrected.

- DTC B1304 (Accessory Delay Relay Coil Circuit Short to Battery) - Accessory delay relay circuit short to battery voltage

- DTC B2512 (Front Fog Lamp Relay Ckt Short to Battery) - Fog lamp relay circuit short to battery voltage

- DTC B2973 (Daytime Running Lamp Output Shorted to Ground) - DRL output short to ground

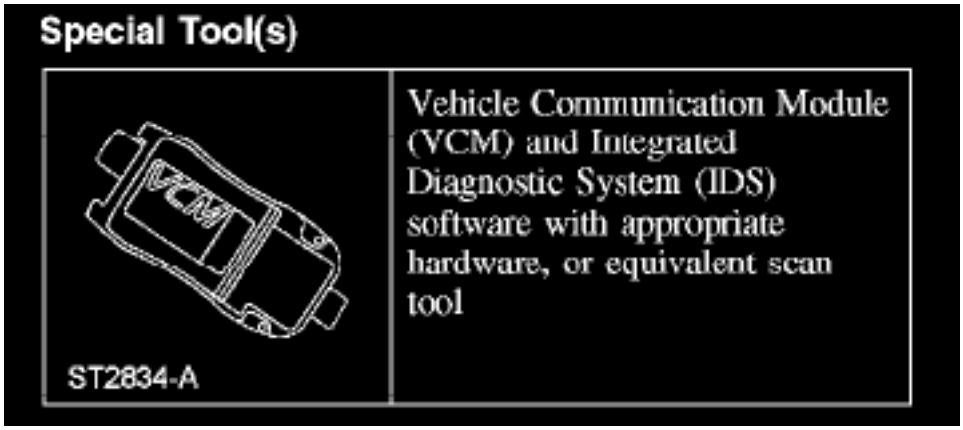
This pinpoint test is intended to diagnose the following:

- Output circuit short to ground or voltage

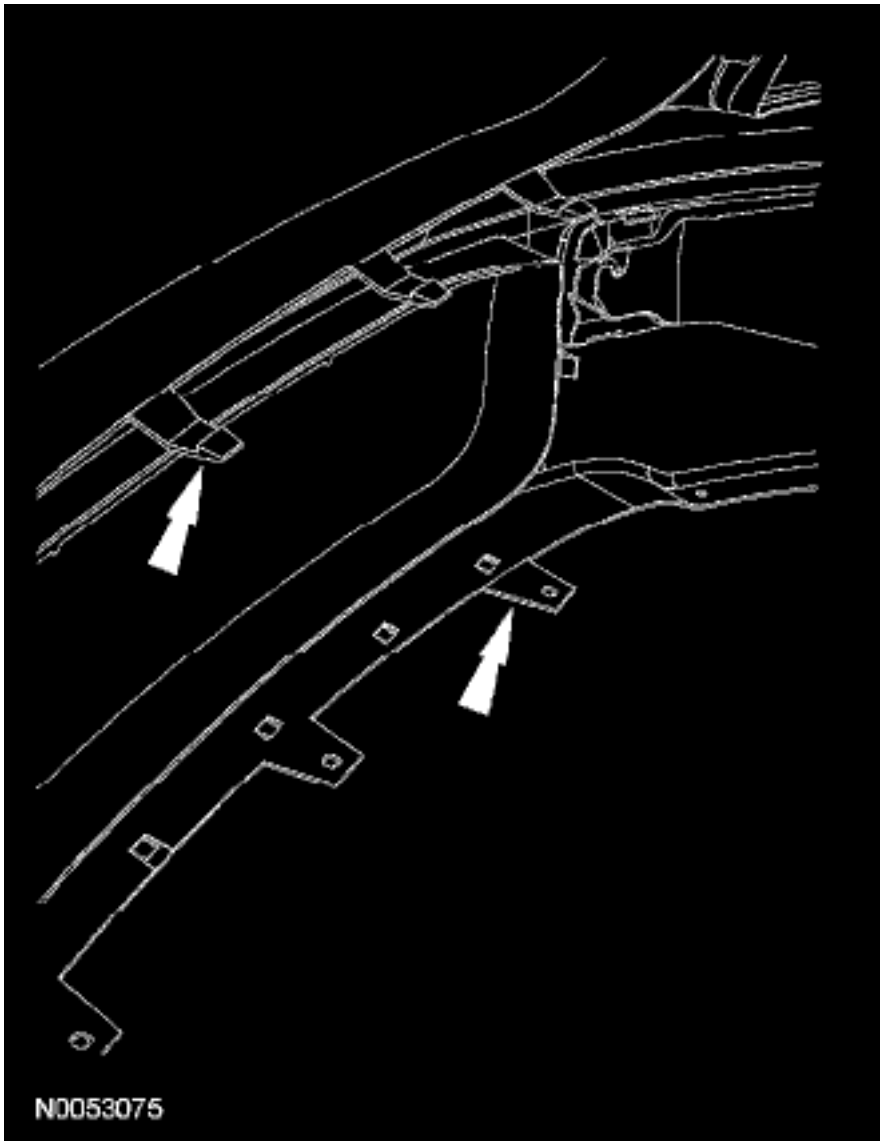
- SJB

A1

A2



Special Tool(s)



Front Bumper Cover / Fascia: Procedures

TAB REPAIR - BUMPER

1. NOTE:

- Inspect the bumper cover to determine if part can be repaired to an acceptable level of quality of appearance, fit and durability. Will labor and material cost of the repair meet or exceed the cost of a new replacement bumper cover? If the bumper cover is determined to be repairable, proceed to the following steps.

- The following steps are to be used as a guideline. Depending on what brand of adhesives or patch materials are used, procedures may vary slightly.

Remove the affected bumper.

2. Clean the broken tab(s) with a plastics wax and grease remover.

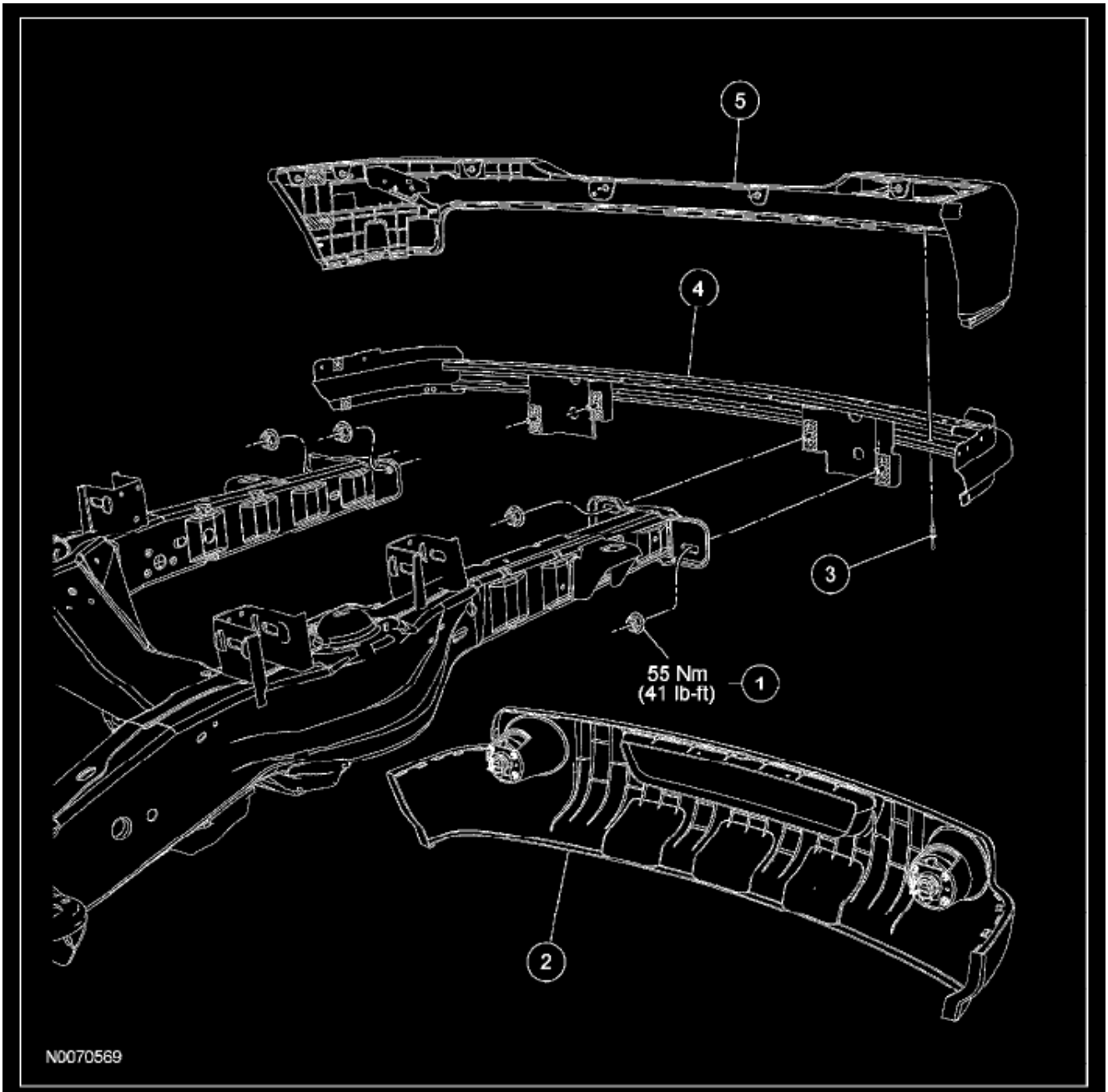
3. Hand sand the repair area with 80-grit sandpaper and remove any foreign material with compressed air. 4. Apply a plastics adhesion promoter per label directions to the repair area. 5. Measure and cut a patch of fiberglass cloth or equivalent large enough to form the front of the tab, then slope back in a wedge shape approximately

51 mm (2 in) from original tab.

6. Prepare the repair adhesive cloth patch per manufacturer's instructions and apply to the affected area.

- Immediately position the plastic repair material patch to form the tab shape.

7. Allow appropriate cure time and shape the repair tab using a small angle sander. Use extreme care to not sand through the exterior surface. 8. Carry out any required paint repair operations to the bumper cover using Ford-approved paint systems. 9. Reassemble and install the bumper cover.



Item	Part Number	Description
1	N621946-S	Front bumper nut (4 required)
2	17F792	Lower front bumper cover
3	—	Front bumper cover plastic rivet (14 required)

Item	Part Number	Description
4	17F021	Front bumper
5	17F003	Upper front bumper cover

(Continued)

Front Bumper Cover / Fascia: Removal and Replacement

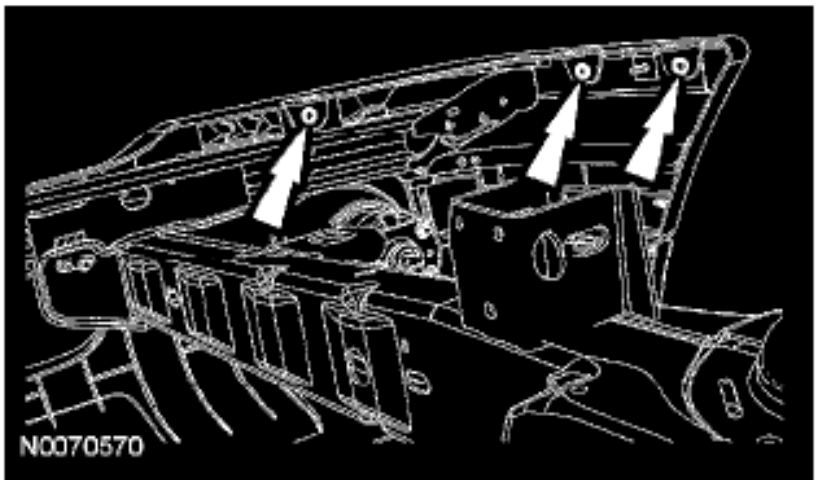
BUMPER COVER - FRONT

Exploded View

Special Tool(s)

Special Tool(s)

ST1132-A	Heavy Duty Riveter 501-D011 (D80L-23200-A) or equivalent



Special Tool(s)

Removal and Installation

Upper and lower bumper cover

1. Remove the front bumper assembly.

Lower bumper cover

2. Remove the lower bumper cover from the upper bumper cover.

- Disengage the lower cover from the clips on the upper cover.

3. Transfer the fog lamp assemblies to the new lower bumper cover, if necessary.

Upper bumper cover

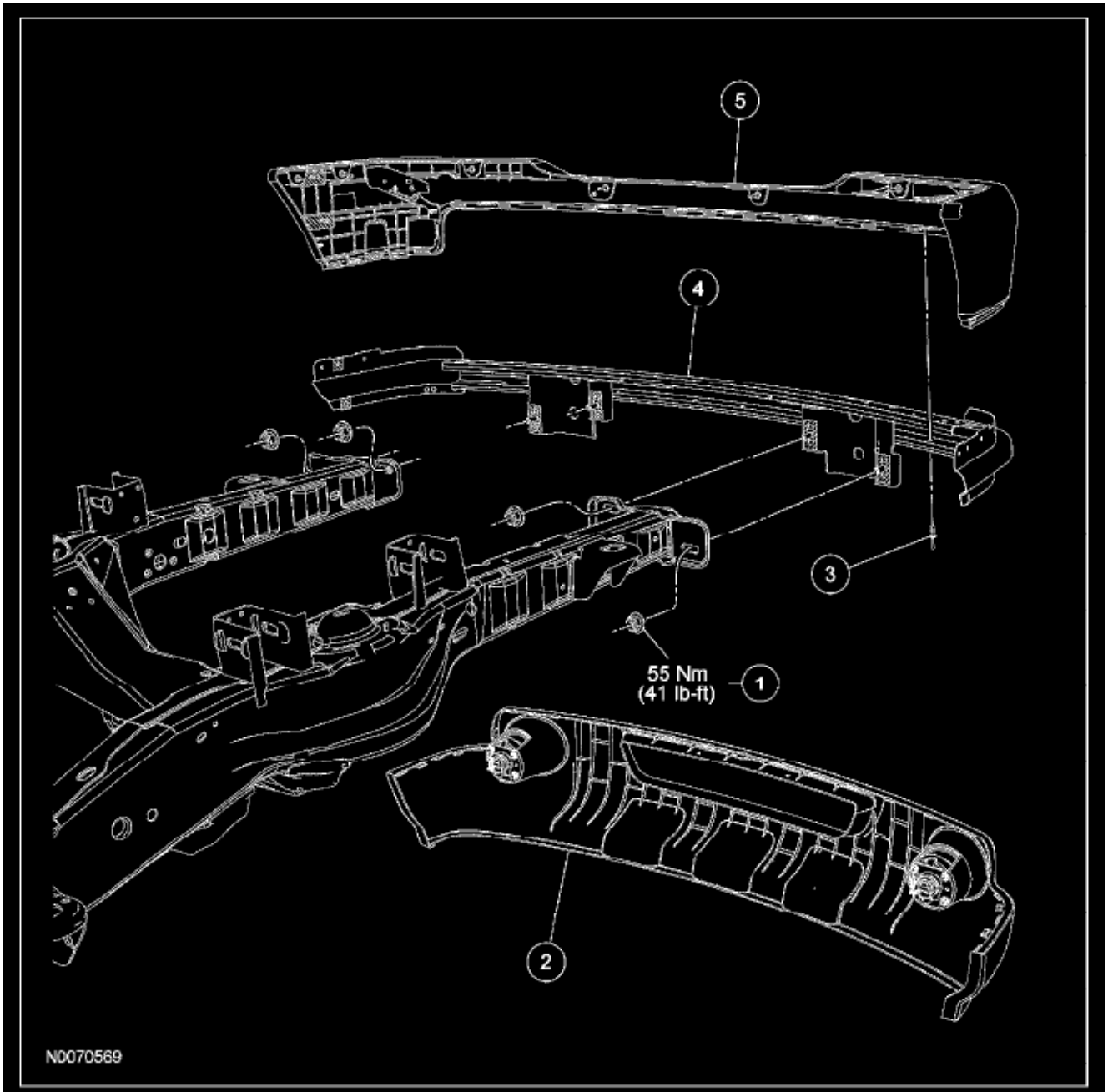
4. Remove the upper bumper cover from the bumper beam.

- Remove the 14 plastic rivets.

- Remove the upper bumper cover.

Upper and lower bumper cover

5. To install, reverse the removal procedure.



Item	Part Number	Description
1	N621946-S	Front bumper nut (4 required)
2	17F792	Lower front bumper cover
3	—	Front bumper cover plastic rivet (14 required)

Item	Part Number	Description
4	17F021	Front bumper
5	17F003	Upper front bumper cover

(Continued)

Front Bumper Reinforcement: Service and Repair

BUMPER - FRONT

Exploded View

Removal and Installation

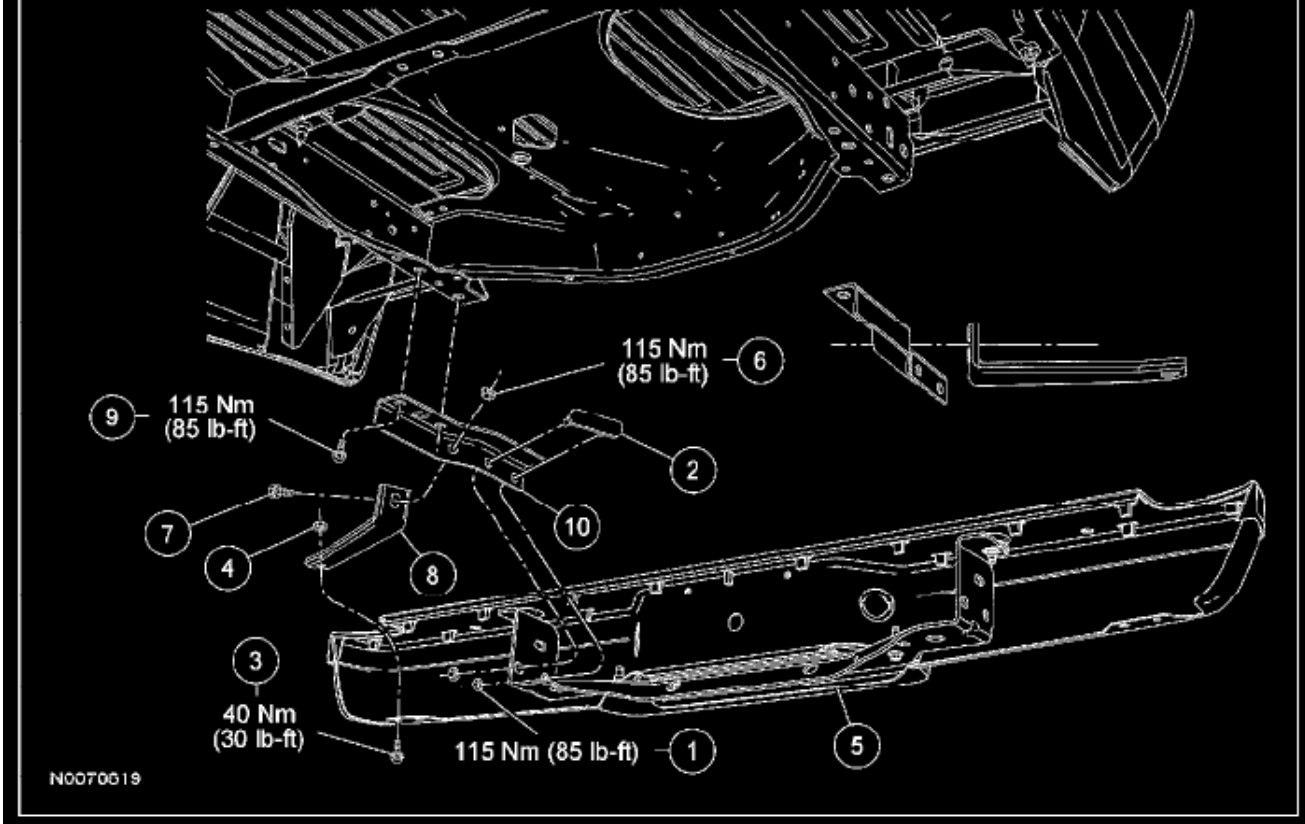
1. Disconnect the fog lamp electrical connectors, if equipped.

2. NOTE: The front bumper and the front bumper cover are removed as an assembly.

Remove the 4 nuts (2 each side) and the front bumper. -

To install, tighten to 55 Nm (41 lb-ft).

3. To install, reverse the removal procedure.



Item	Part Number	Description
1	N620484	Bumper beam-to-inner bumper bracket nut (4 required)
2	N807717	Retainer and bolts assembly (2 required)
3	W710222	Bumper beam-to-outer bumper bracket bolt (2 required)
4	N621942	Bumper beam-to-outer bumper bracket nut (2 required)
5	17906	Rear bumper
6	N621942	Outer bumper bracket-to-inner bumper bracket nut (2 required)

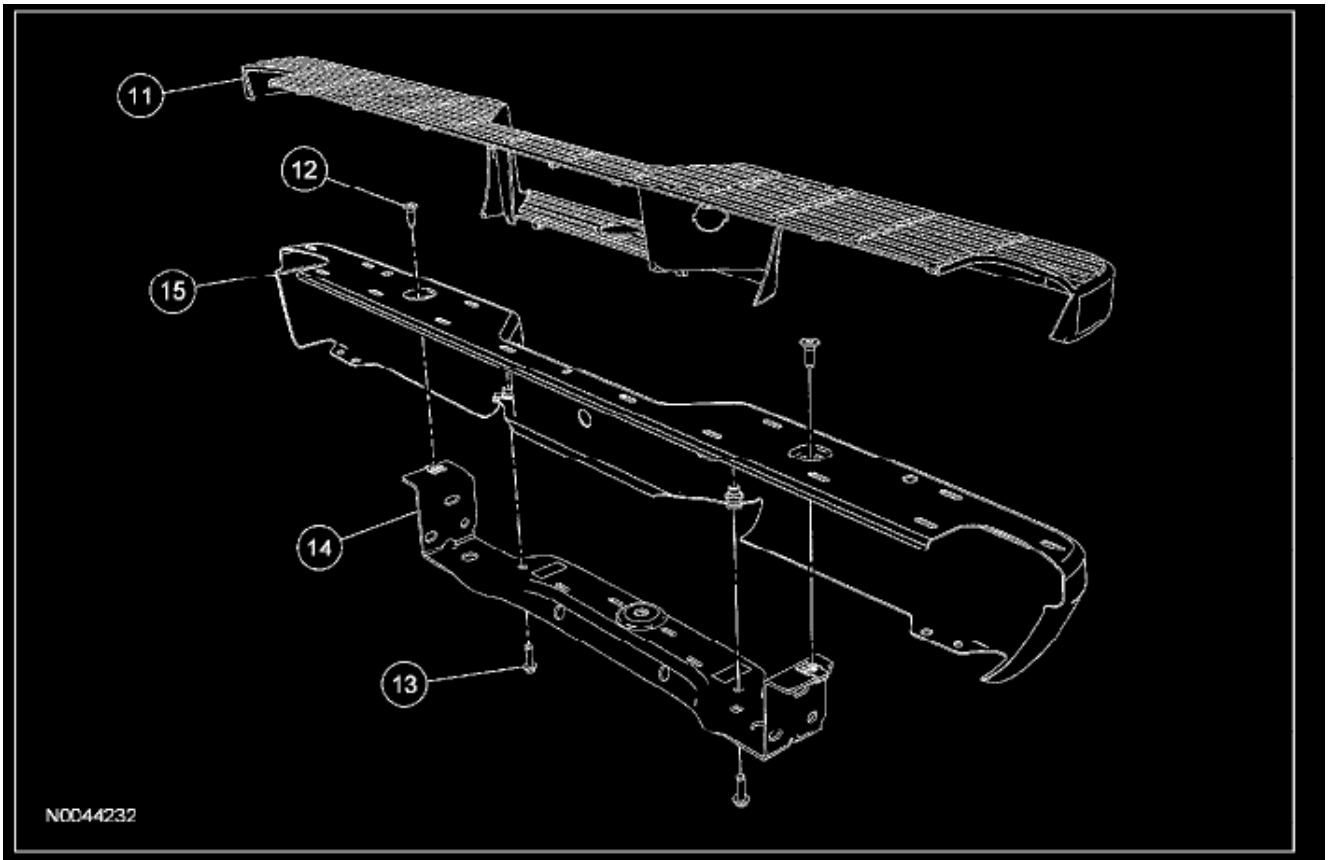
Item	Part Number	Description
7	N605946	Outer bumper bracket-to-inner bumper bracket bolt (2 required)
8	17796 LH/ 17795 RH	Outer bumper bracket (2 required)
9	N605946	Inner bumper bracket-to-frame bolt (4 required)
10	17788 LH/ 17787 RH	Inner bumper bracket (2 required)

(Continued)

Rear Bumper Bracket: Service and Repair

BUMPER BRACKET - REAR

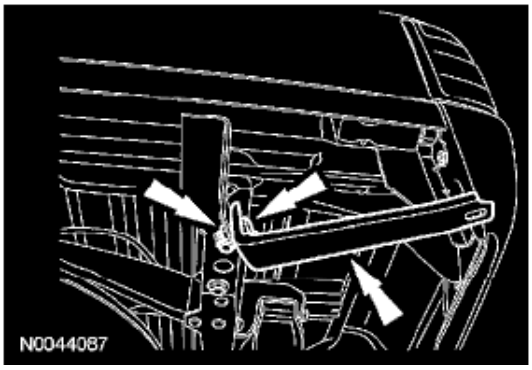
Exploded View



Item	Part Number	Description
11	17B807	Bumper beam step cover
12	N811645	Hitch plate upper bolt (2 required)
13	N606703	Hitch plate lower bolt (2 required)

Item	Part Number	Description
14	N606689	Hitch plate
15	17757	Rear bumper

(Continued)



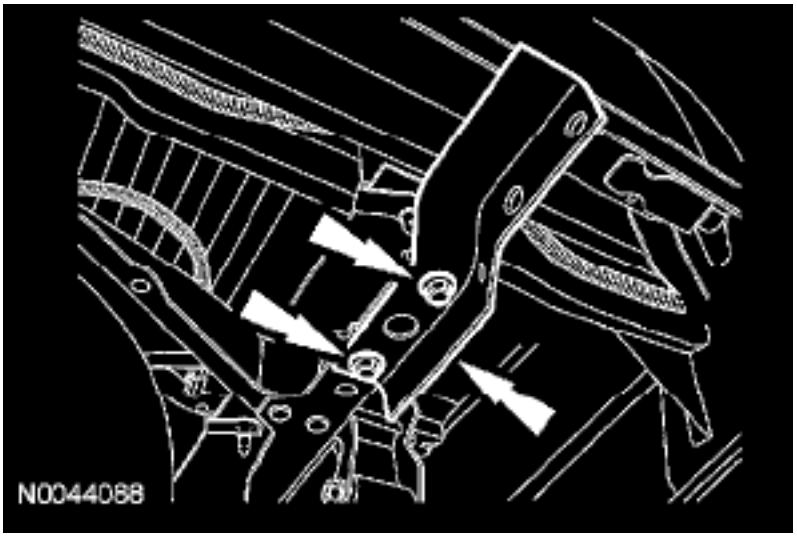
Removal and Installation

1. Remove the rear bumper beam. 2. Remove the bolt and nut from the outer bumper bracket-to-inner bumper bracket.

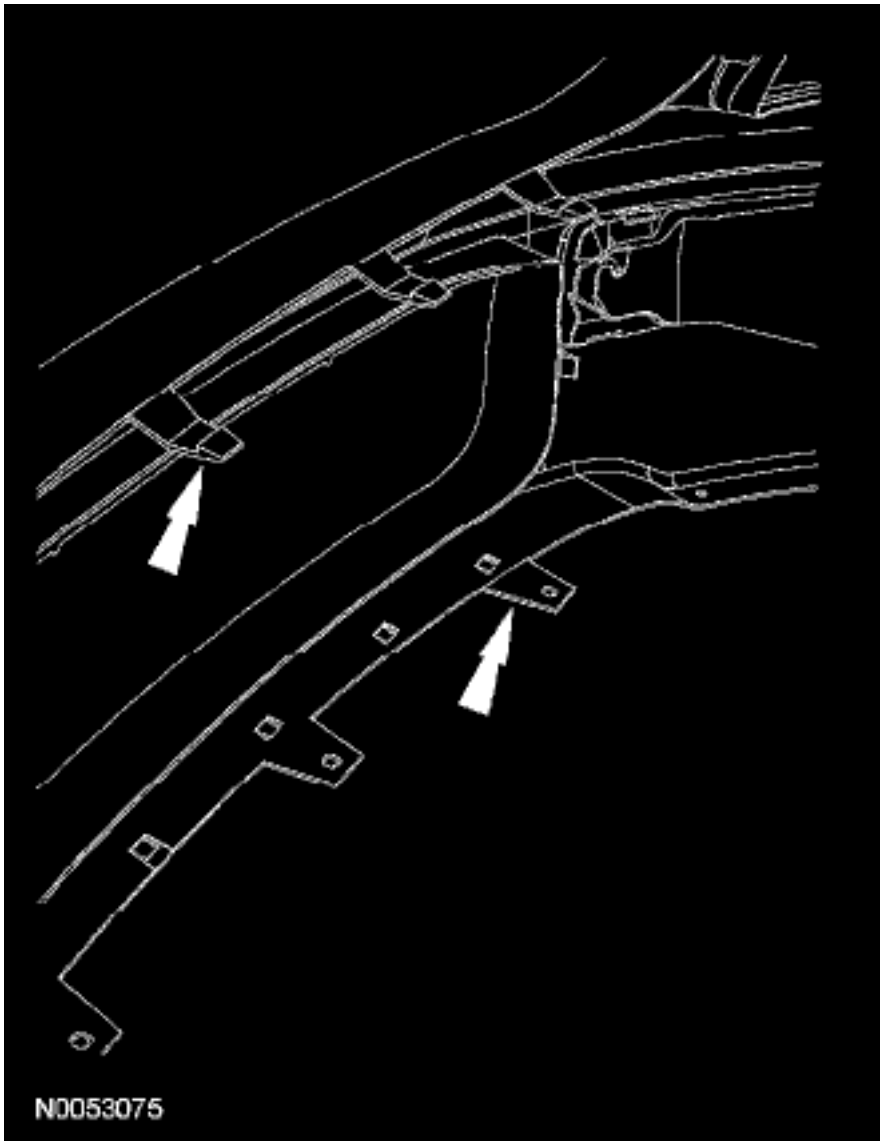
- To install, tighten to 115 Nm (85 lb-ft).

3. Remove the 2 bolts from the inner bumper bracket-to-frame and remove the inner bumper bracket.

- To install, tighten to 115 Nm (85 lb-ft).



4. To install, reverse the removal procedure.



Rear Bumper Cover / Fascia: Service and Repair

TAB REPAIR - BUMPER

1. NOTE:

- Inspect the bumper cover to determine if part can be repaired to an acceptable level of quality of appearance, fit and durability. Will labor and material cost of the repair meet or exceed the cost of a new replacement bumper cover? If the bumper cover is determined to be repairable, proceed to the following steps.

- The following steps are to be used as a guideline. Depending on what brand of adhesives or patch materials are used, procedures may vary slightly.

Remove the affected bumper.

2. Clean the broken tab(s) with a plastics wax and grease remover.

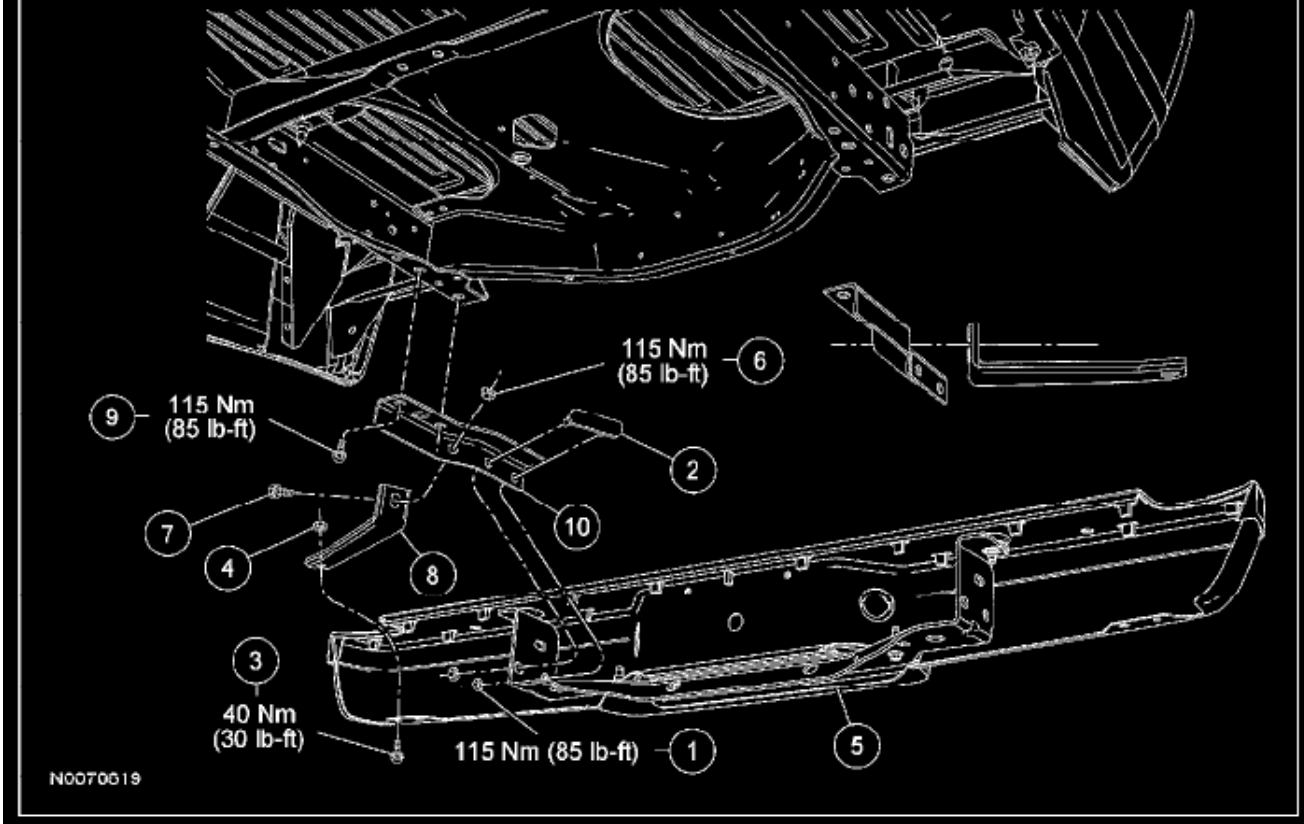
3. Hand sand the repair area with 80-grit sandpaper and remove any foreign material with compressed air. 4. Apply a plastics adhesion promoter per label directions to the repair area. 5. Measure and cut a patch of fiberglass cloth or equivalent large enough to form the front of the tab, then slope back in a wedge shape approximately

51 mm (2 in) from original tab.

6. Prepare the repair adhesive cloth patch per manufacturer's instructions and apply to the affected area.

- Immediately position the plastic repair material patch to form the tab shape.

7. Allow appropriate cure time and shape the repair tab using a small angle sander. Use extreme care to not sand through the exterior surface. 8. Carry out any required paint repair operations to the bumper cover using Ford-approved paint systems. 9. Reassemble and install the bumper cover.



Item	Part Number	Description
1	N620484	Bumper beam-to-inner bumper bracket nut (4 required)
2	N807717	Retainer and bolts assembly (2 required)
3	W710222	Bumper beam-to-outer bumper bracket bolt (2 required)
4	N621942	Bumper beam-to-outer bumper bracket nut (2 required)
5	17906	Rear bumper
6	N621942	Outer bumper bracket-to-inner bumper bracket nut (2 required)

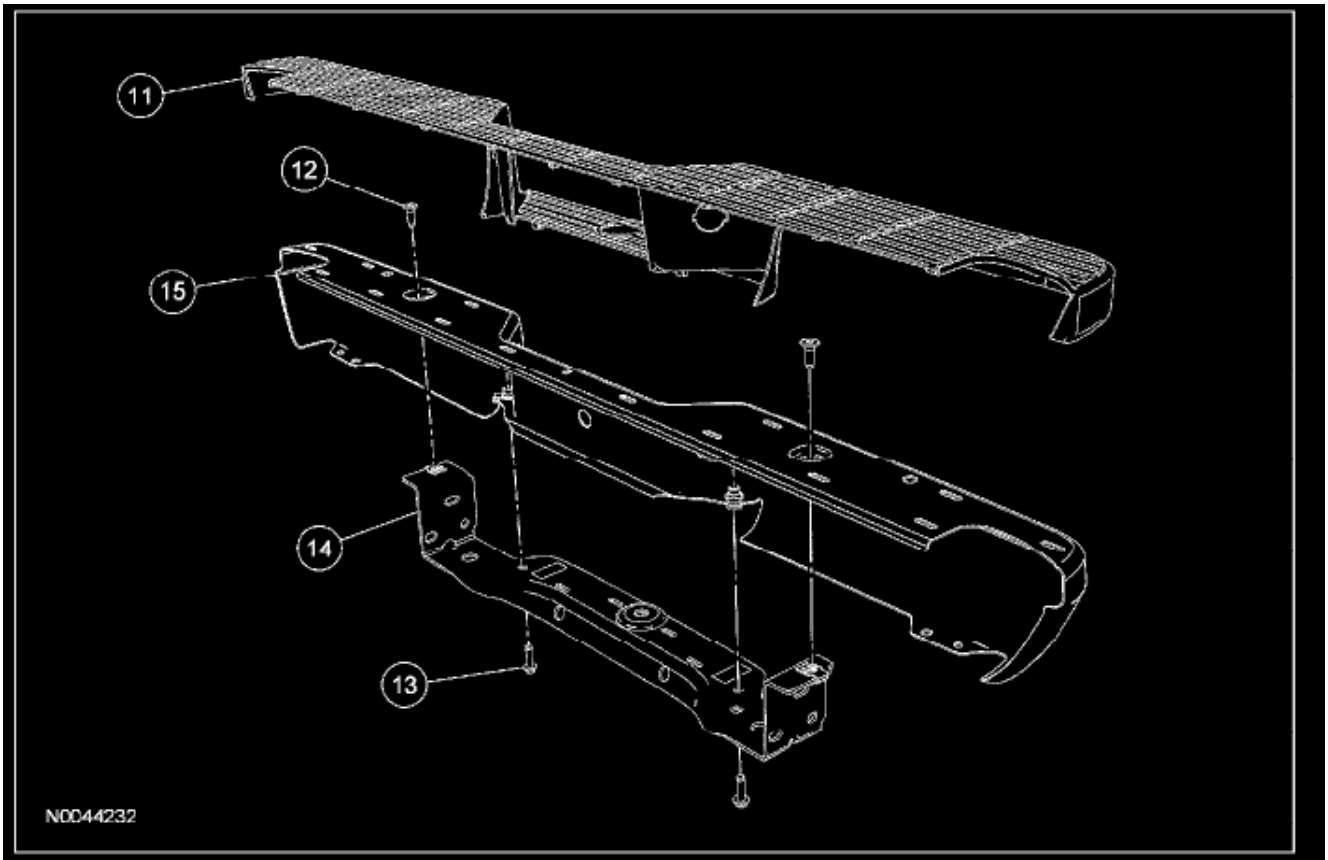
Item	Part Number	Description
7	N605946	Outer bumper bracket-to-inner bumper bracket bolt (2 required)
8	17796 LH/ 17795 RH	Outer bumper bracket (2 required)
9	N605946	Inner bumper bracket-to-frame bolt (4 required)
10	17788 LH/ 17787 RH	Inner bumper bracket (2 required)

(Continued)

Rear Bumper Reinforcement: Service and Repair

BUMPER - REAR, HITCH PLATE

Exploded View



Item	Part Number	Description
11	17B807	Bumper beam step cover
12	N811645	Hitch plate upper bolt (2 required)
13	N606703	Hitch plate lower bolt (2 required)

Item	Part Number	Description
14	N606689	Hitch plate
15	17757	Rear bumper

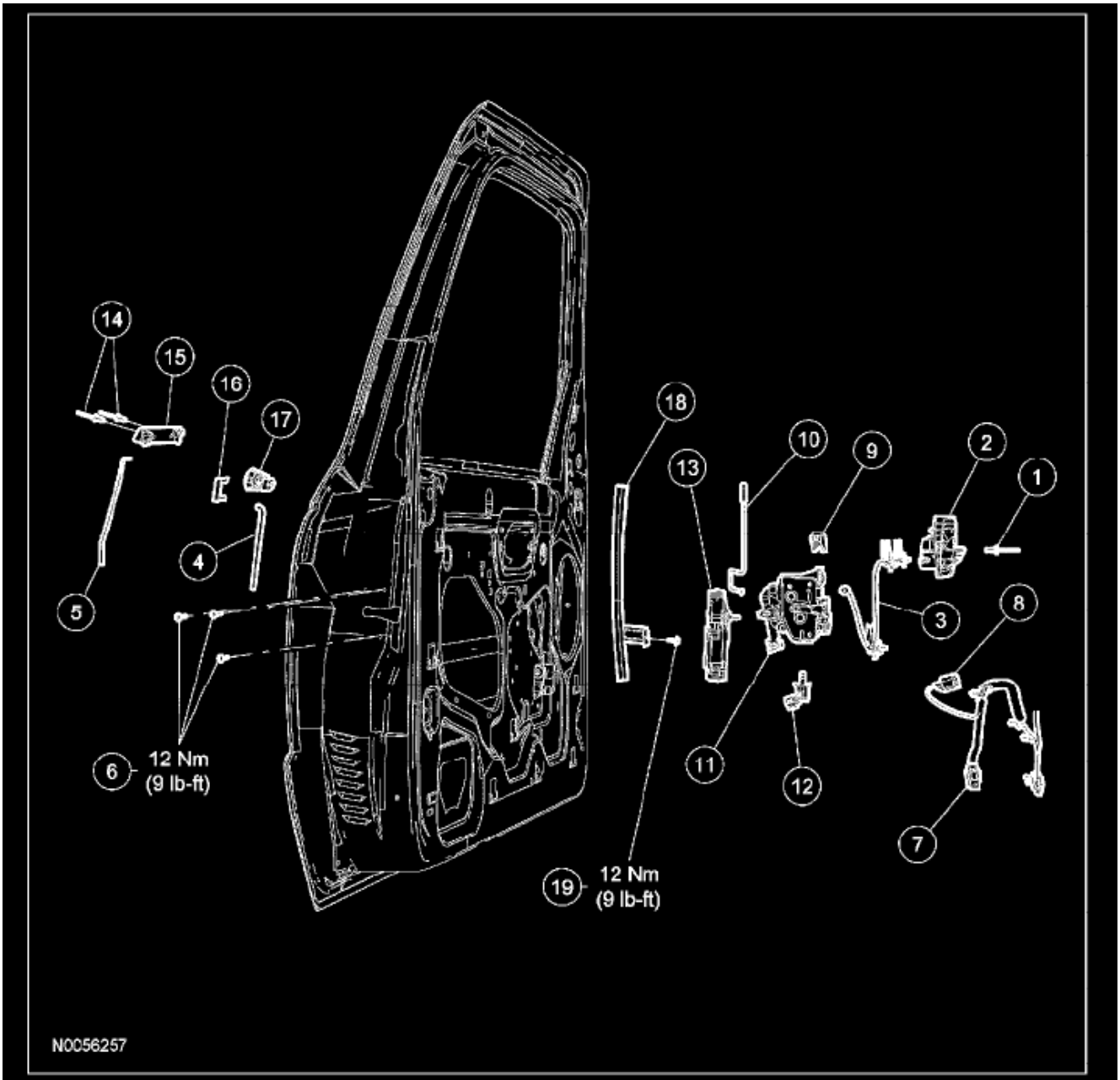
(Continued)

Removal and Installation

1. Remove the rear bumper beam. 2. Remove the rear bumper beam step cover.

- Disconnect the step cover from the rear bumper beam.

3. Remove the 2 hitch plate mounting bolts from the top of the rear bumper. 4. Remove the 2 hitch plate mounting bolts from the bottom of the hitch plate and remove the rear bumper hitch plate. 5. To install, reverse the removal procedure.



Item	Part Number	Description
1	W525172	Interior door handle rivet
2	1022404	Interior door handle
3	10221A00/ 10221A01	Interior door handle actuating cable (RH/LH)
4	1022134/ 1022135	Door lock cylinder actuating rod (RH/LH)

(Continued)

Item	Part Number	Description
5	1022152/ 1022153	Exterior door handle actuating rod (RH/LH)
6	W705830-S901	Front door latch screws (3 required)

(Continued)

Front Door Exterior Handle: Service and Repair

EXTERIOR FRONT DOOR HANDLE

Exploded View

Part 1

Item	Part Number	Description
7	—	Door ajar switch electrical connector (part of 14630/14631) (RH/LH)
8	—	Door lock actuator electrical connector (part of 14630/14631) (RH/LH)
9	15221A06/ 15221A07	Front door latch cable watershield (RH/LH)
10	1021852/ 1021853	Door latch push button rod (RH/LH)
11	1021812/ 1021813	Front door latch (RH/LH)
12	14018/ 10B997	Front door ajar switch (RH/LH)
13	218B20/ 218B21	Door lock actuator (RH/LH)
14	W707874	Exterior front door handle rivets (2 required)
15	1022404	Exterior front door handle
16	1022023	Door lock cylinder retainer
17	7821990	Front door lock cylinder
18	222A00	Door glass channel
19	N6066676-S	Door glass channel bolt

Special Tool(s)

ST1132-A	Heavy Duty Riveter or equivalent 501-D011 (D80L-23200-A)

Part 2

Special Tool(s)

Special Tool(s)

Removal and Installation

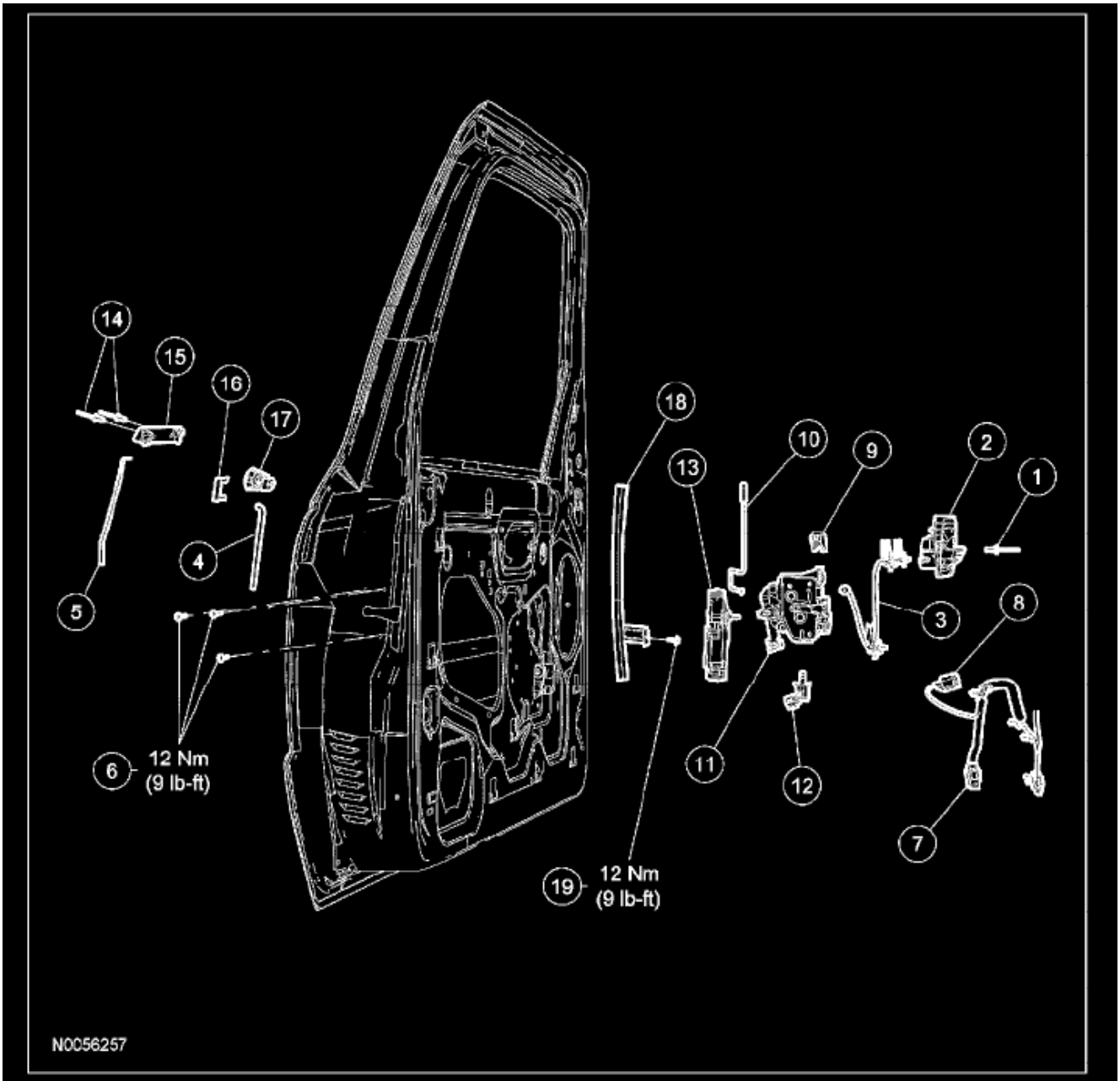
1. Remove the front door trim panel. 2. Position the watershield aside. 3. Disconnect the exterior door handle actuating rod from the front door latch.

4. NOTE: The front door window glass must be completely up.

Remove the 2 rivets and the exterior front door handle.

5. To install, reverse the removal procedure.

- Use the special tool to install the rivets.



Item	Part Number	Description
1	W525172	Interior door handle rivet
2	1022404	Interior door handle
3	10221A00/ 10221A01	Interior door handle actuating cable (RH/LH)
4	1022134/ 1022135	Door lock cylinder actuating rod (RH/LH)

(Continued)

Item	Part Number	Description
5	1022152/ 1022153	Exterior door handle actuating rod (RH/LH)
6	W705830-S901	Front door latch screws (3 required)

(Continued)

Front Door Interior Handle: Service and Repair

INTERIOR DOOR HANDLE

Exploded View

Part 1

Item	Part Number	Description
7	—	Door ajar switch electrical connector (part of 14630/14631) (RH/LH)
8	—	Door lock actuator electrical connector (part of 14630/14631) (RH/LH)
9	15221A06/ 15221A07	Front door latch cable watershield (RH/LH)
10	1021852/ 1021853	Door latch push button rod (RH/LH)
11	1021812/ 1021813	Front door latch (RH/LH)
12	14018/ 10B997	Front door ajar switch (RH/LH)
13	218B20/ 218B21	Door lock actuator (RH/LH)
14	W707874	Exterior front door handle rivets (2 required)
15	1022404	Exterior front door handle
16	1022023	Door lock cylinder retainer
17	7821990	Front door lock cylinder
18	222A00	Door glass channel
19	N6066676-S	Door glass channel bolt

Special Tool(s)

ST1132-A	Heavy Duty Riveter or equivalent 501-D011 (D80L-23200-A)

Part 2

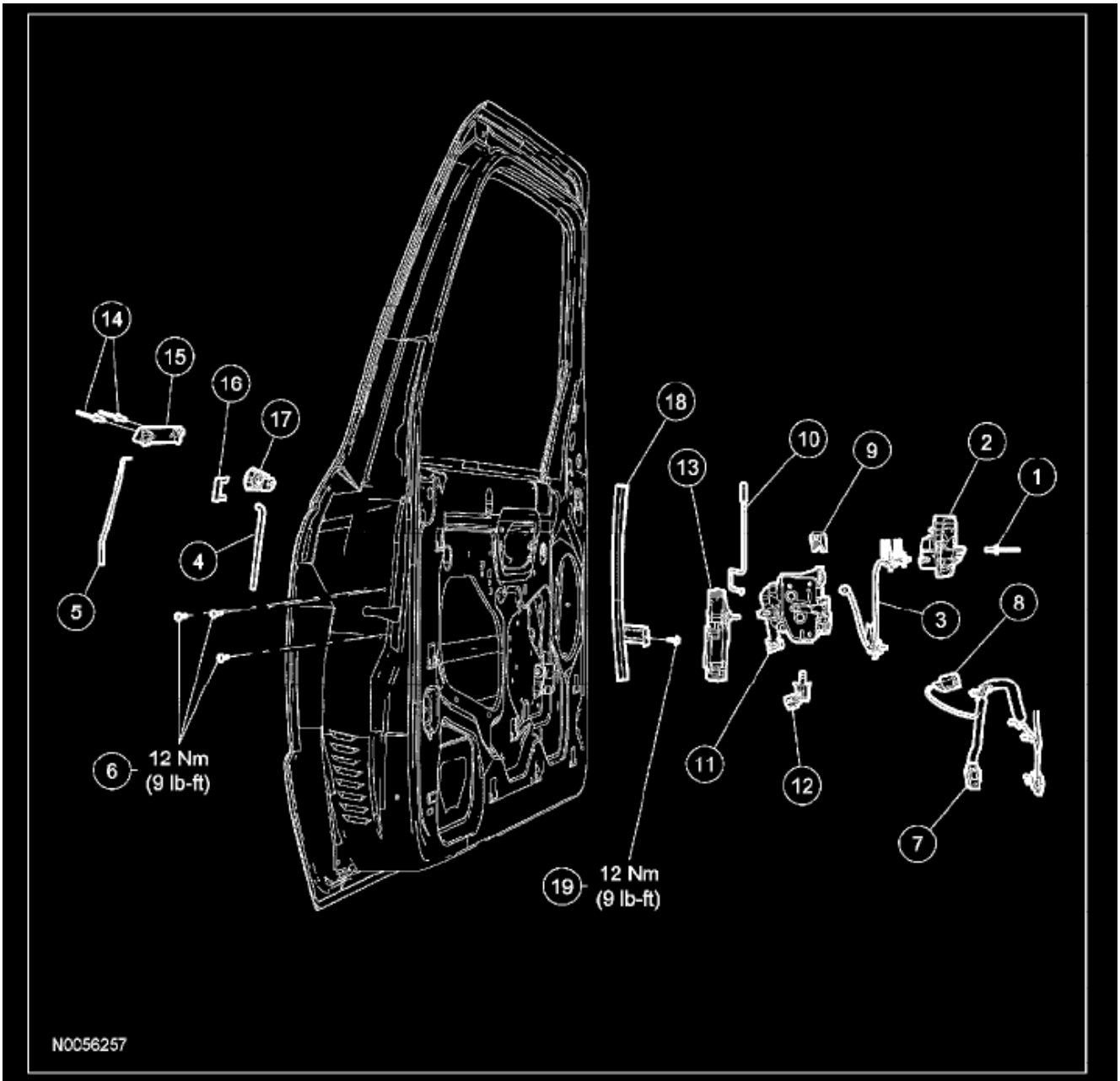
Special Tool(s)

Special Tool(s)

Removal and Installation

1. Remove the front door trim panel. 2. Remove the rivet and position the interior door handle away from the front door. 3. Position the watershield aside. 4. Disconnect the interior door handle actuating cable from the interior door handle. 5. Remove the interior door handle. 6. To install, reverse the removal procedure.

- Use the special tool to install the rivet.



Item	Part Number	Description
1	W525172	Interior door handle rivet
2	1022404	Interior door handle
3	10221A00/ 10221A01	Interior door handle actuating cable (RH/LH)
4	1022134/ 1022135	Door lock cylinder actuating rod (RH/LH)

(Continued)

Item	Part Number	Description
5	1022152/ 1022153	Exterior door handle actuating rod (RH/LH)
6	W705830-S901	Front door latch screws (3 required)

(Continued)

Front Door Latch: Service and Repair

FRONT DOOR LATCH

Exploded View

Part 1

Item	Part Number	Description
7	—	Door ajar switch electrical connector (part of 14630/14631) (RH/LH)
8	—	Door lock actuator electrical connector (part of 14630/14631) (RH/LH)
9	15221A06/ 15221A07	Front door latch cable watershield (RH/LH)
10	1021852/ 1021853	Door latch push button rod (RH/LH)
11	1021812/ 1021813	Front door latch (RH/LH)
12	14018/ 10B997	Front door ajar switch (RH/LH)
13	218B20/ 218B21	Door lock actuator (RH/LH)
14	W707874	Exterior front door handle rivets (2 required)
15	1022404	Exterior front door handle
16	1022023	Door lock cylinder retainer
17	7821990	Front door lock cylinder
18	222A00	Door glass channel
19	N6066676-S	Door glass channel bolt

Part 2

Removal and Installation

1. Remove the front door trim panel. 2. Position the watershield aside. 3. Remove the bolt and the door glass channel.

- To install, tighten to 12 Nm (9 lb-ft).

4. Disconnect the door lock cylinder actuating rod from the front door latch. 5. Unclip the exterior door handle actuating rod from the exterior door handle. 6. Remove the exterior door handle actuating rod. 7. Remove the 3 front door latch screws.

- To install, tighten to 12 Nm (9 lb-ft).

8. Disconnect the door ajar switch electrical connector.

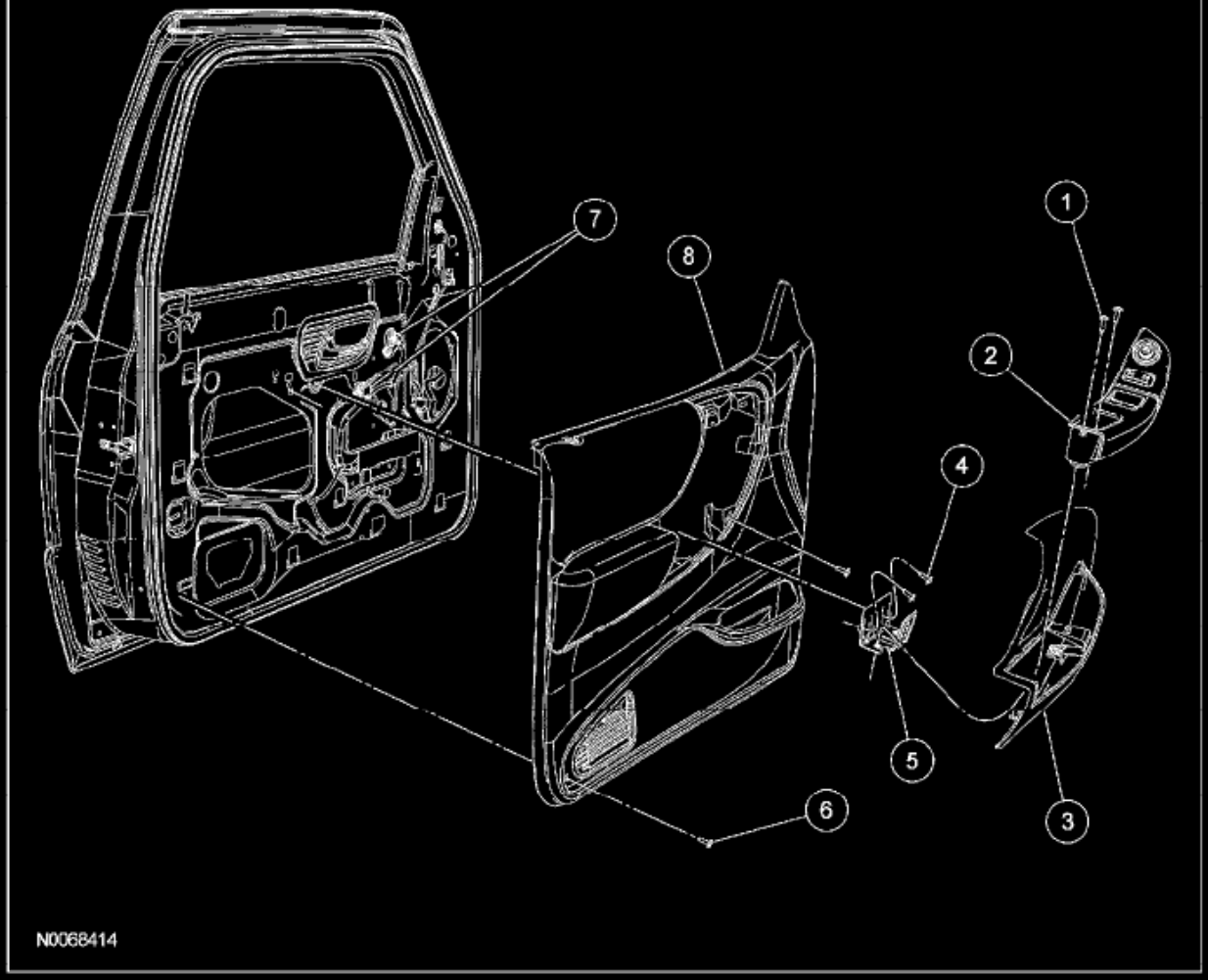
- If equipped, disconnect the door lock actuator electrical connector.

9. Position the door latch assembly aside.

10. Remove the front door latch cable watershield. 11. Disconnect the front door latch cable. 12. If necessary, remove the door latch push button rod. 13. Remove the front door latch. 14. To install, reverse the removal procedure.

NOTE: Left front door trim panel shown, right front door trim panel similar.

NOTE: High series shown, low series similar.



Item	Part Number	Description
1	N804992	Door pull handle screw (2 required)
2	14527	Door pull handle
3	23712	Front door trim finish panel
4	W505004	Door pull handle bracket screw (2 required)
5	24160	Door pull handle bracket
6	56907	Front door trim panel screw (2 required)

Item	Part Number	Description
7	14631	Front door switch panel electrical connectors
8	23942	Front door trim panel

(Continued)

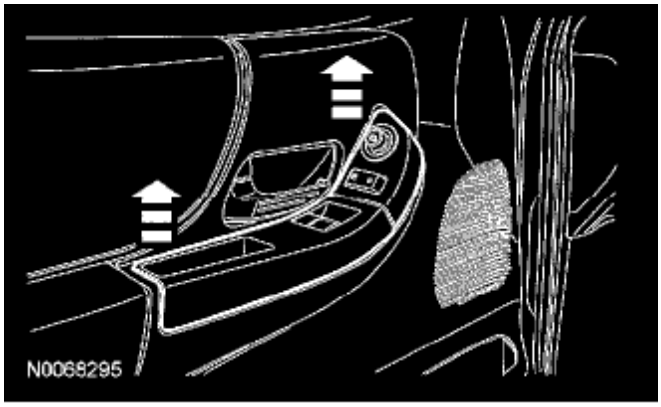
Front Door Panel: Service and Repair

DOOR TRIM PANEL - FRONT

Removal and Installation

High series

1. Remove the 2 door pull handle screws.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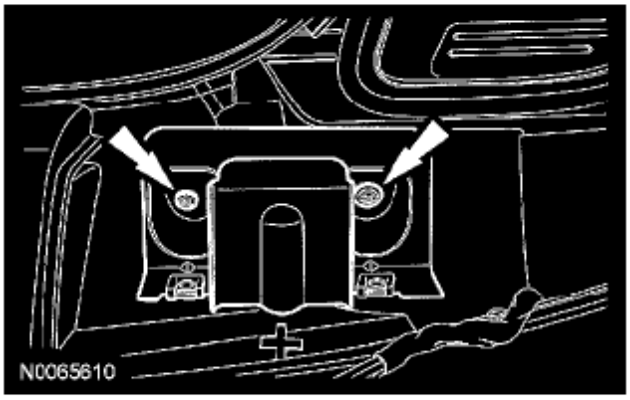
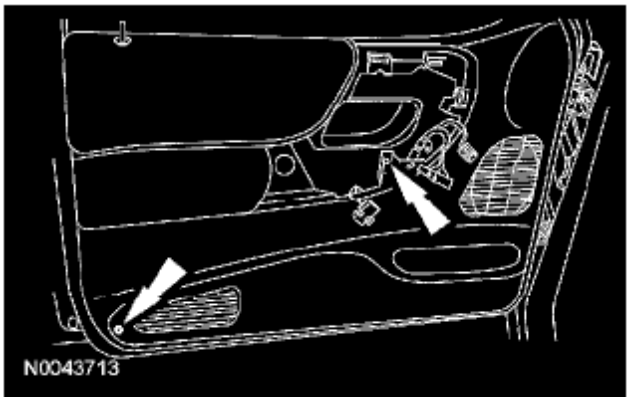

N0065610


N0043713

2. Remove the door pull handle.

- Lift the door pull handle upward to release the door pull handle retaining clips.

- If equipped, disconnect the electrical connectors. -

Remove the wire harness pin-type retainer.

Low series

3. Remove the door pull handle screw. 4. Remove the window regulator handle.

All vehicles

5. Remove the front door trim finish panel.

- Pull the front door trim finish panel outward to release the front door trim finish panel retaining clips.

High series

6. Remove the door pull handle bracket.

- Remove the 2 door pull handle bracket screws.

7. Remove the 2 front door trim panel screws.

Low series

8. Remove the front door trim panel screw.

All vehicles

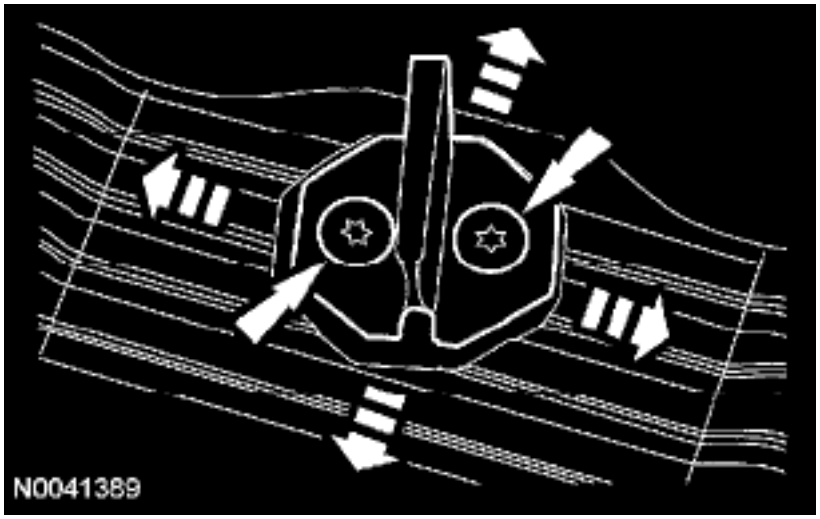
9. CAUTION: Do not pull directly outward on front door trim panel, as damage will occur.

Remove the front door trim panel. -

Lift upward to remove the front door trim panel.

10. CAUTION: Insert the lower panel tabs first or they may break when installing the front door trim panel.

To install, reverse the removal procedure.



Front Door Striker: Adjustments

STRIKER ADJUSTMENT

1. Open and support the door. 2. Mark the current position of the door strikers. 3. Loosen the door striker bolts enough to allow the striker to be moved. 4. Move the striker as needed to make the adjustment and tighten the door striker bolts.

- To install, tighten to 25 Nm (18 lb-ft).

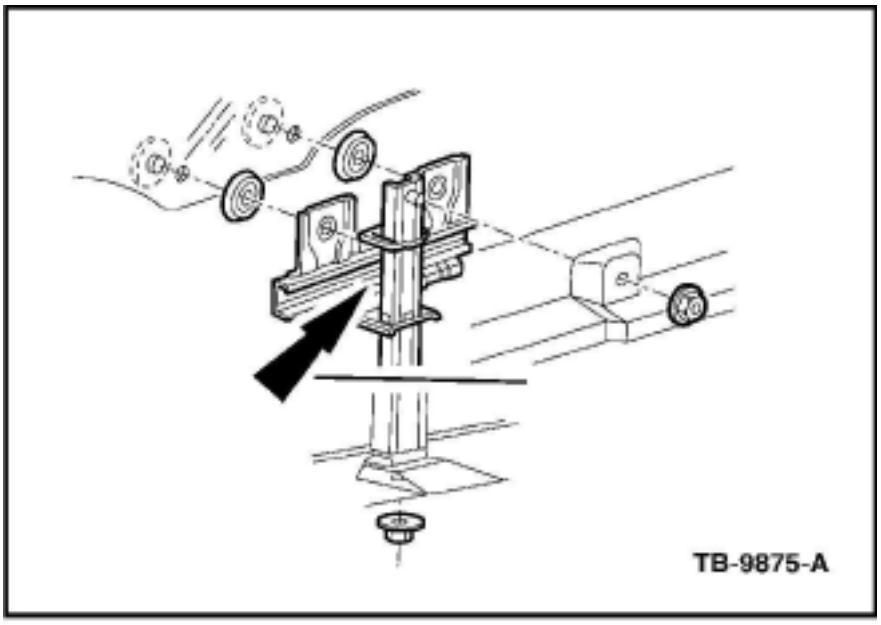


Figure 1

Front Door Window Glass: Customer Interest Body - Window Chatter/Shudder During Operation

TSB 09-22-5

11/16/09

WINDOW CHATTER/SHUDDER

FORD: 2008-2009 Ranger

ISSUE Some 2008-2009 Ranger vehicles may experience window chatter/shudder when the window travels up or down.

ACTION Follow the Service Procedure steps to correct the condition.

SERVICE PROCEDURE

Verify correct grease amount on the window Run. Open the upper door glass Run attachment slot to allow further forward adjustment.

1. Remove door trim panel following Workshop Manual (WSM), Section 501-05.

2. Inspect window Run and add grease if necessary using Motorcraft® Multi-Purpose Grease. (Figure 1)

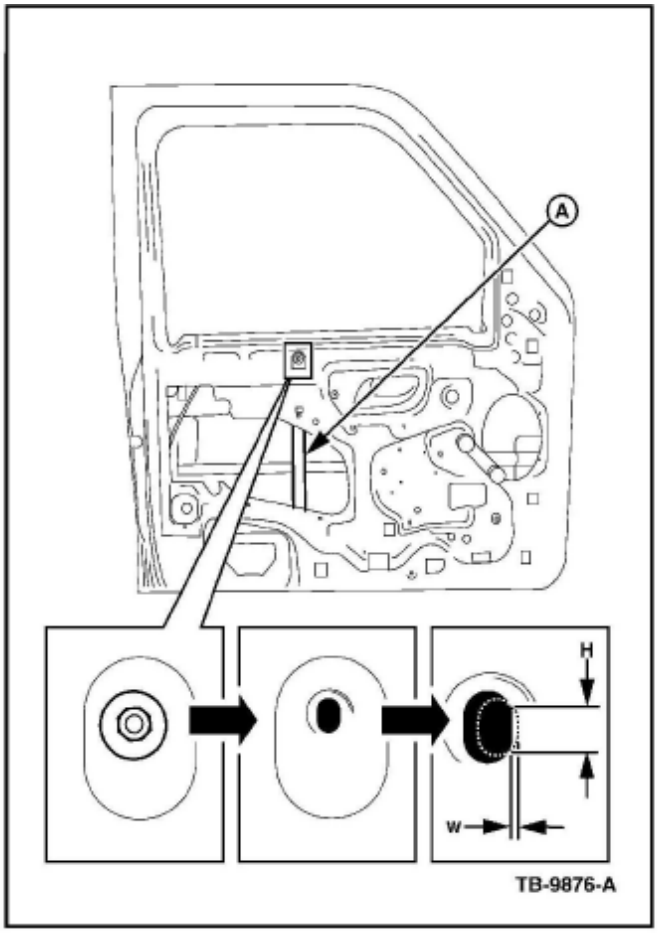


Figure 2

PART NUMBER	PART NAME
XG-4	Motorcraft® Multi-Purpose Grease
PM-13-A	Motorcraft® Anti-Corrosion Coating

3. With window in down position, remove the top and bottom center door glass Run retainer nuts and push door glass Run A to the side. (Figure 2)

4. Rework the upper glass Run attachment slot. (Figure 2)

a. Remove approximately 5/64" (2 mm) of material at W and 25/64" (10 mm) at H.

b. Remove material from the front of vehicle side of the slot. Be careful to not leave burrs on the panel.

c. Coat newly exposed metal areas with Motorcraft(R) Anti-Corrosion Coating.

5. Reposition glass Run A and loosely attach fasteners.

6. Raise glass to full up position. While pushing outward on the lower attachment. Torque glass Run attachment nuts, tighten to 106 lb-in. (12 N.m). Be

careful not to force a different position of the stud when installing the upper nut.

7. Install trim panel following WSM, Section 501-05-1.

Parts Block

WARRANTY STATUS: Eligible Under Provisions Of New Vehicle Limited Warranty Coverage
IMPORTANT: Warranty coverage limits/policies are not altered by a TSB. Warranty coverage limits are determined by the identified causal part.

OPERATION DESCRIPTION TIME

092205A 2008-2009 Ranger: Follow 0.3 Hr.

Service Procedure To Adjust And Grease The Glass Run On One (1) Door (Do Not Use With Any Other Labor

NOTE: The information in Technical Service Bulletins is intended for use by trained, professional technicians with the knowledge, tools, and equipment to do the job properly and safely. It informs these technicians of conditions that may occur on some vehicles, or provides information that could assist in proper vehicle service. The procedures should not be performed by "do-it-yourselfers". Do not assume that a condition described affects your car or truck. Contact a Ford, Lincoln, or Mercury dealership to determine whether the Bulletin applies to your vehicle.

Operations)

092205B 2008-2009 Ranger: Follow 0.6 Hr.

Service Procedure To Adjust And Grease The Glass Run On (2) Doors (Do Not Use With Any Other Labor Operations)

DEALER CODING

CONDITION

BASIC PART NO. CODE

1023288 07

Disclaimer

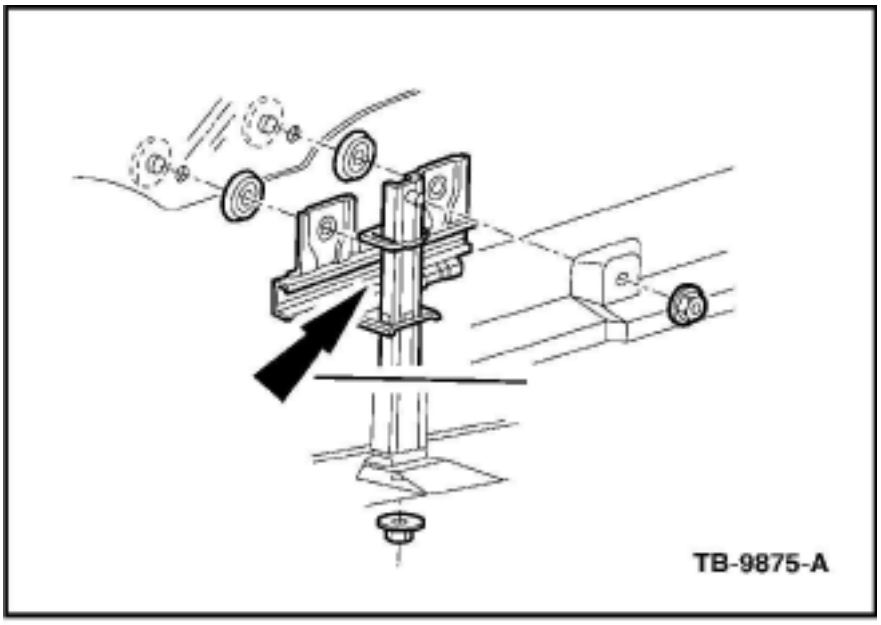


Figure 1

Front Door Window Glass: All Technical Service Bulletins Body - Window Chatter/Shudder During Operation

TSB 09-22-5

11/16/09

WINDOW CHATTER/SHUDDER

FORD: 2008-2009 Ranger

ISSUE Some 2008-2009 Ranger vehicles may experience window chatter/shudder when the window travels up or down.

ACTION Follow the Service Procedure steps to correct the condition.

SERVICE PROCEDURE

Verify correct grease amount on the window Run. Open the upper door glass Run attachment slot to allow further forward adjustment.

1. Remove door trim panel following Workshop Manual (WSM), Section 501-05.

2. Inspect window Run and add grease if necessary using Motorcraft® Multi-Purpose Grease. (Figure 1)

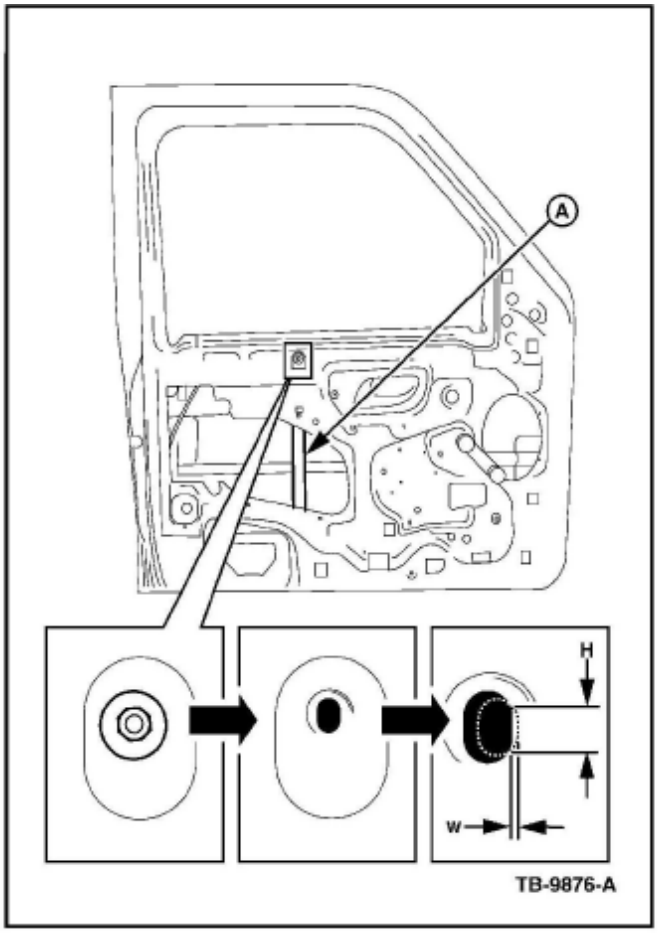


Figure 2

PART NUMBER	PART NAME
XG-4	Motorcraft® Multi-Purpose Grease
PM-13-A	Motorcraft® Anti-Corrosion Coating

3. With window in down position, remove the top and bottom center door glass Run retainer nuts and push door glass Run A to the side. (Figure 2)

4. Rework the upper glass Run attachment slot. (Figure 2)

a. Remove approximately 5/64" (2 mm) of material at W and 25/64" (10 mm) at H.

b. Remove material from the front of vehicle side of the slot. Be careful to not leave burrs on the panel.

c. Coat newly exposed metal areas with Motorcraft(R) Anti-Corrosion Coating.

5. Reposition glass Run A and loosely attach fasteners.

6. Raise glass to full up position. While pushing outward on the lower attachment. Torque glass Run attachment nuts, tighten to 106 lb-in. (12 N.m). Be

careful not to force a different position of the stud when installing the upper nut.

7. Install trim panel following WSM, Section 501-05-1.

Parts Block

WARRANTY STATUS: Eligible Under Provisions Of New Vehicle Limited Warranty Coverage
IMPORTANT: Warranty coverage limits/policies are not altered by a TSB. Warranty coverage limits are determined by the identified causal part.

OPERATION DESCRIPTION TIME

092205A 2008-2009 Ranger: Follow 0.3 Hr.

Service Procedure To Adjust And Grease The Glass Run On One (1) Door (Do Not Use With Any Other Labor

NOTE: The information in Technical Service Bulletins is intended for use by trained, professional technicians with the knowledge, tools, and equipment to do the job properly and safely. It informs these technicians of conditions that may occur on some vehicles, or provides information that could assist in proper vehicle service. The procedures should not be performed by "do-it-yourselfers". Do not assume that a condition described affects your car or truck. Contact a Ford, Lincoln, or Mercury dealership to determine whether the Bulletin applies to your vehicle.

Operations)

092205B 2008-2009 Ranger: Follow 0.6 Hr.

Service Procedure To Adjust And Grease The Glass Run On (2) Doors (Do Not Use With Any Other Labor Operations)

DEALER CODING

CONDITION

BASIC PART NO. CODE

1023288 07

Disclaimer

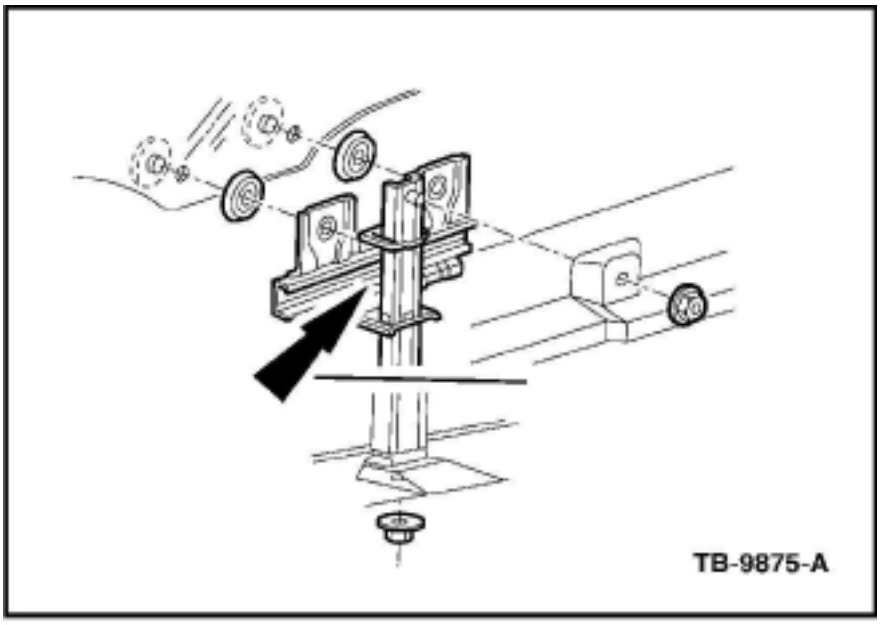


Figure 1

Front Door Window Glass: By Symptom

Technical Service Bulletin # 09-22-5 Date: 091116

Body - Window Chatter/Shudder During Operation

TSB 09-22-5

11/16/09

WINDOW CHATTER/SHUDDER

FORD: 2008-2009 Ranger

ISSUE Some 2008-2009 Ranger vehicles may experience window chatter/shudder when the window travels up or down.

ACTION Follow the Service Procedure steps to correct the condition.

SERVICE PROCEDURE

Verify correct grease amount on the window Run. Open the upper door glass Run attachment slot to allow further forward adjustment.

1. Remove door trim panel following Workshop Manual (WSM), Section 501-05.

2. Inspect window Run and add grease if necessary using Motorcraft® Multi-Purpose Grease. (Figure 1)

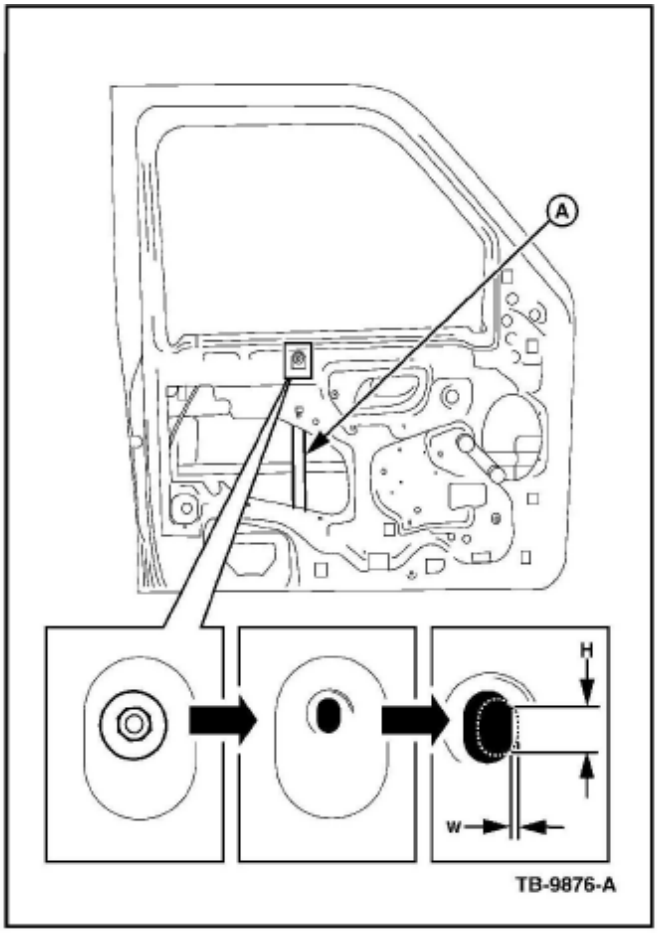


Figure 2

PART NUMBER	PART NAME
XG-4	Motorcraft® Multi-Purpose Grease
PM-13-A	Motorcraft® Anti-Corrosion Coating

3. With window in down position, remove the top and bottom center door glass Run retainer nuts and push door glass Run A to the side. (Figure 2)

4. Rework the upper glass Run attachment slot. (Figure 2)

a. Remove approximately 5/64" (2 mm) of material at W and 25/64" (10 mm) at H.

b. Remove material from the front of vehicle side of the slot. Be careful to not leave burrs on the panel.

c. Coat newly exposed metal areas with Motorcraft(R) Anti-Corrosion Coating.

5. Reposition glass Run A and loosely attach fasteners.

6. Raise glass to full up position. While pushing outward on the lower attachment. Torque glass Run attachment nuts, tighten to 106 lb-in. (12 N.m). Be

careful not to force a different position of the stud when installing the upper nut.

7. Install trim panel following WSM, Section 501-05-1.

Parts Block

WARRANTY STATUS: Eligible Under Provisions Of New Vehicle Limited Warranty Coverage
IMPORTANT: Warranty coverage limits/policies are not altered by a TSB. Warranty coverage limits are determined by the identified causal part.

OPERATION DESCRIPTION TIME

092205A 2008-2009 Ranger: Follow 0.3 Hr.

Service Procedure To Adjust And Grease The Glass Run On One (1) Door (Do Not Use With Any Other Labor

NOTE: The information in Technical Service Bulletins is intended for use by trained, professional technicians with the knowledge, tools, and equipment to do the job properly and safely. It informs these technicians of conditions that may occur on some vehicles, or provides information that could assist in proper vehicle service. The procedures should not be performed by "do-it-yourselfers". Do not assume that a condition described affects your car or truck. Contact a Ford, Lincoln, or Mercury dealership to determine whether the Bulletin applies to your vehicle.

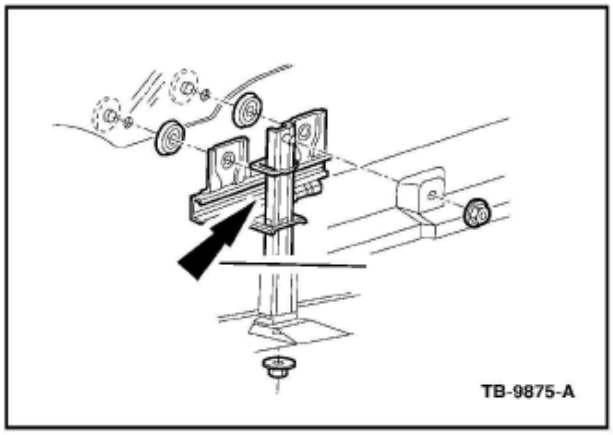


Figure 1

Operations)

092205B 2008-2009 Ranger: Follow 0.6 Hr.

Service Procedure To Adjust And Grease The Glass Run On (2) Doors (Do Not Use With Any Other Labor Operations)

DEALER CODING

CONDITION

BASIC PART NO. CODE

1023288 07

Disclaimer Technical Service Bulletin # 09-22-5 Date: 091116

Body - Window Chatter/Shudder During Operation

TSB 09-22-5

11/16/09

WINDOW CHATTER/SHUDDER

FORD: 2008-2009 Ranger

ISSUE Some 2008-2009 Ranger vehicles may experience window chatter/shudder when the window travels up or down.

ACTION Follow the Service Procedure steps to correct the condition.

SERVICE PROCEDURE

Verify correct grease amount on the window Run. Open the upper door glass Run attachment slot to allow further forward adjustment.

1. Remove door trim panel following Workshop Manual (WSM), Section 501-05.

2. Inspect window Run and add grease if necessary using Motorcraft® Multi-Purpose Grease. (Figure 1)

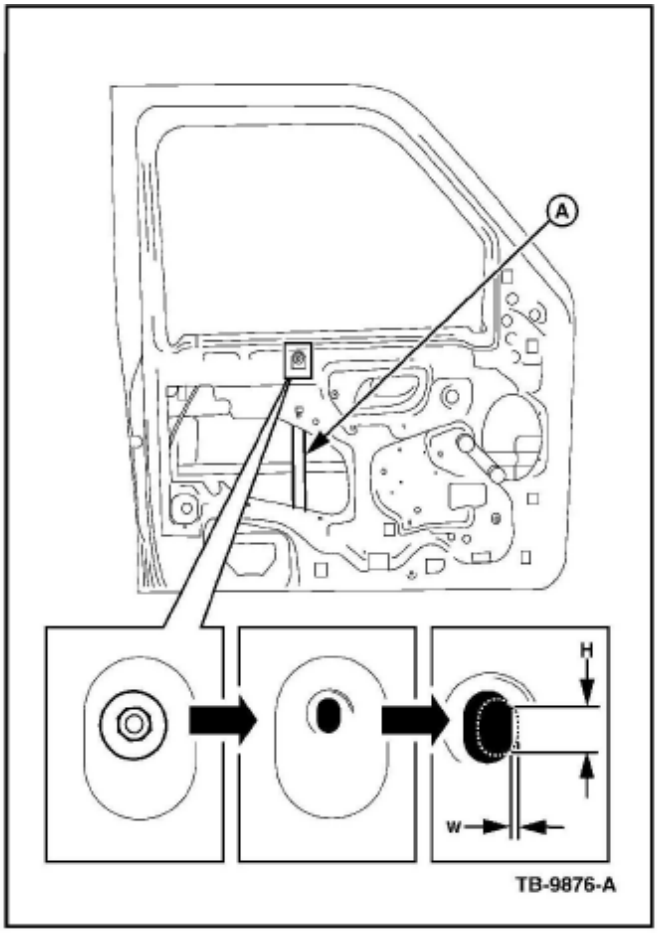


Figure 2

PART NUMBER	PART NAME
XG-4	Motorcraft® Multi-Purpose Grease
PM-13-A	Motorcraft® Anti-Corrosion Coating

3. With window in down position, remove the top and bottom center door glass Run retainer nuts and push door glass Run A to the side. (Figure 2)

4. Rework the upper glass Run attachment slot. (Figure 2)

a. Remove approximately 5/64" (2 mm) of material at W and 25/64" (10 mm) at H.

b. Remove material from the front of vehicle side of the slot. Be careful to not leave burrs on the panel.

c. Coat newly exposed metal areas with Motorcraft(R) Anti-Corrosion Coating.

5. Reposition glass Run A and loosely attach fasteners.

6. Raise glass to full up position. While pushing outward on the lower attachment. Torque glass Run attachment nuts, tighten to 106 lb-in. (12 N.m). Be

careful not to force a different position of the stud when installing the upper nut.

7. Install trim panel following WSM, Section 501-05-1.

Parts Block

WARRANTY STATUS: Eligible Under Provisions Of New Vehicle Limited Warranty Coverage
IMPORTANT: Warranty coverage limits/policies are not altered by a TSB. Warranty coverage limits are determined by the identified causal part.

OPERATION DESCRIPTION TIME

092205A 2008-2009 Ranger: Follow 0.3 Hr.

Service Procedure To Adjust And Grease The Glass Run On One (1) Door (Do Not Use With Any Other Labor

NOTE: The information in Technical Service Bulletins is intended for use by trained, professional technicians with the knowledge, tools, and equipment to do the job properly and safely. It informs these technicians of conditions that may occur on some vehicles, or provides information that could assist in proper vehicle service. The procedures should not be performed by "do-it-yourselfers". Do not assume that a condition described affects your car or truck. Contact a Ford, Lincoln, or Mercury dealership to determine whether the Bulletin applies to your vehicle.

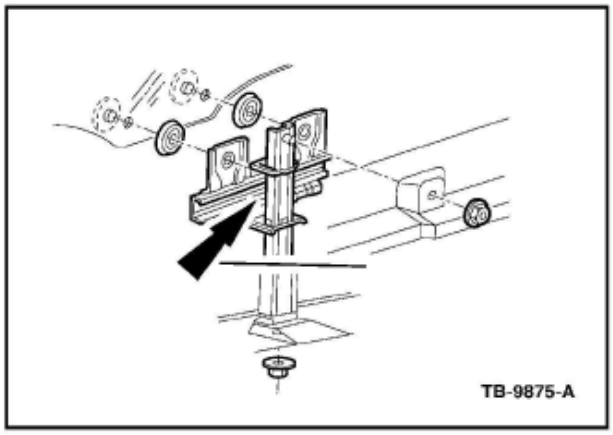


Figure 1

Operations)

092205B 2008-2009 Ranger: Follow 0.6 Hr.

Service Procedure To Adjust And Grease The Glass Run On (2) Doors (Do Not Use With Any Other Labor Operations)

DEALER CODING

CONDITION

BASIC PART NO. CODE

1023288 07

Disclaimer Technical Service Bulletin # 09-22-5 Date: 091116

Body - Window Chatter/Shudder During Operation

TSB 09-22-5

11/16/09

WINDOW CHATTER/SHUDDER

FORD: 2008-2009 Ranger

ISSUE Some 2008-2009 Ranger vehicles may experience window chatter/shudder when the window travels up or down.

ACTION Follow the Service Procedure steps to correct the condition.

SERVICE PROCEDURE

Verify correct grease amount on the window Run. Open the upper door glass Run attachment slot to allow further forward adjustment.

1. Remove door trim panel following Workshop Manual (WSM), Section 501-05.

2. Inspect window Run and add grease if necessary using Motorcraft® Multi-Purpose Grease. (Figure 1)

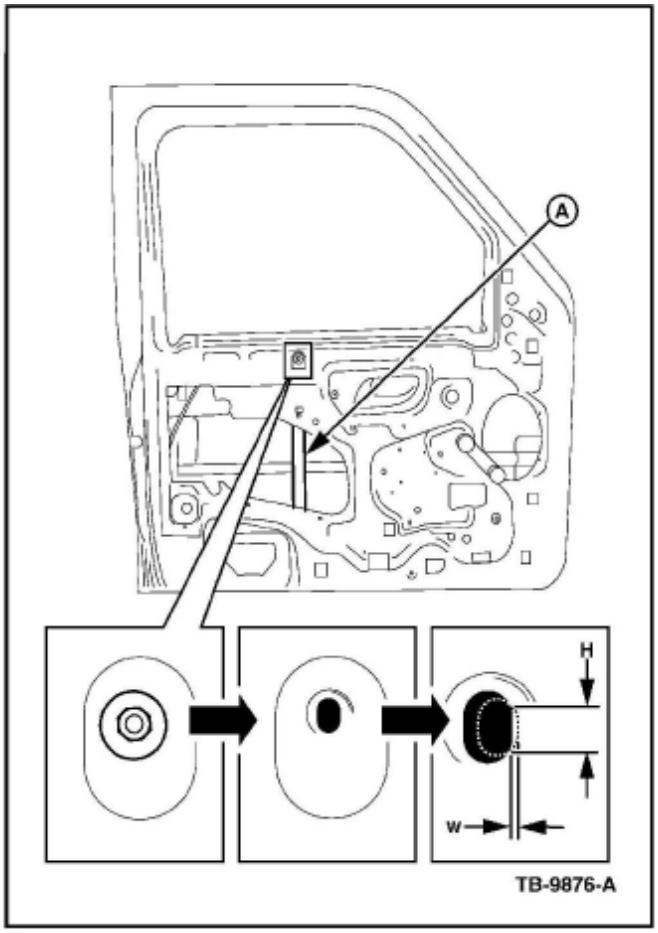


Figure 2

PART NUMBER	PART NAME
XG-4	Motorcraft® Multi-Purpose Grease
PM-13-A	Motorcraft® Anti-Corrosion Coating

3. With window in down position, remove the top and bottom center door glass Run retainer nuts and push door glass Run A to the side. (Figure 2)

4. Rework the upper glass Run attachment slot. (Figure 2)

a. Remove approximately 5/64" (2 mm) of material at W and 25/64" (10 mm) at H.

b. Remove material from the front of vehicle side of the slot. Be careful to not leave burrs on the panel.

c. Coat newly exposed metal areas with Motorcraft(R) Anti-Corrosion Coating.

5. Reposition glass Run A and loosely attach fasteners.

6. Raise glass to full up position. While pushing outward on the lower attachment. Torque glass Run attachment nuts, tighten to 106 lb-in. (12 N.m). Be

careful not to force a different position of the stud when installing the upper nut.

7. Install trim panel following WSM, Section 501-05-1.

Parts Block

WARRANTY STATUS: Eligible Under Provisions Of New Vehicle Limited Warranty Coverage
IMPORTANT: Warranty coverage limits/policies are not altered by a TSB. Warranty coverage limits are determined by the identified causal part.

OPERATION DESCRIPTION TIME

092205A 2008-2009 Ranger: Follow 0.3 Hr.

Service Procedure To Adjust And Grease The Glass Run On One (1) Door (Do Not Use With Any Other Labor

NOTE: The information in Technical Service Bulletins is intended for use by trained, professional technicians with the knowledge, tools, and equipment to do the job properly and safely. It informs these technicians of conditions that may occur on some vehicles, or provides information that could assist in proper vehicle service. The procedures should not be performed by "do-it-yourselfers". Do not assume that a condition described affects your car or truck. Contact a Ford, Lincoln, or Mercury dealership to determine whether the Bulletin applies to your vehicle.

Operations)

092205B 2008-2009 Ranger: Follow 0.6 Hr.

Service Procedure To Adjust And Grease The Glass Run On (2) Doors (Do Not Use With Any Other Labor Operations)

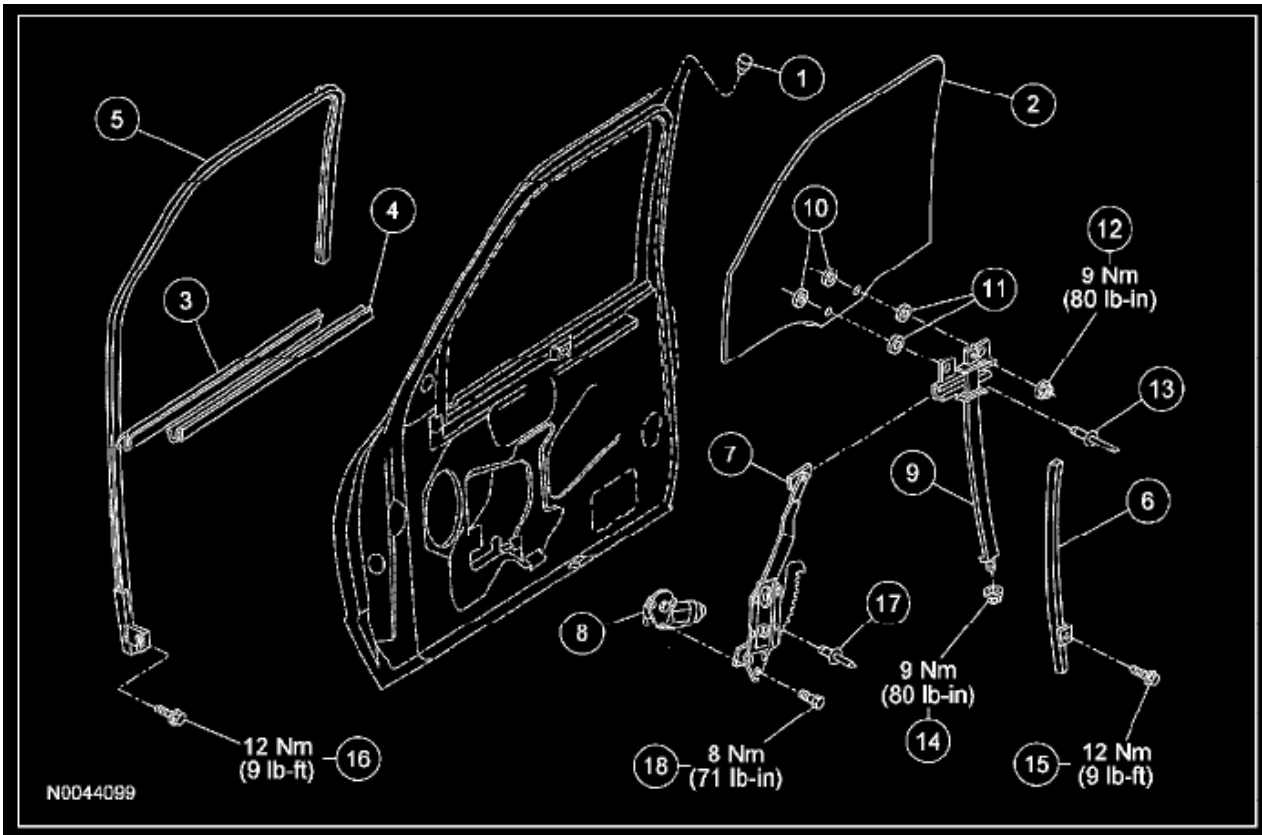
DEALER CODING

CONDITION

BASIC PART NO. CODE

1023288 07

Disclaimer



Item	Part Number	Description
1	N805277-S	Rivet
2	21410	Door glass
3	21452A	Door glass weatherstrip-outer
4	21452B	Door glass weatherstrip-inner
5	21546	Door glass top run
6	222A00	Door glass channel
7	23208	Regulator assembly
8	23394	Motor assembly
9	23288	Center door glass run
10	234A46	Spacers (2 required)
11	234A44	Spacers (2 required)

(Continued)

Item	Part Number	Description
12	N621907-S	Center door glass run nut
13	W525175-S	Window glass rivet (2 required)
14	N621907-S	Center door glass run nut
15	N6066676-S	Door glass channel bolt
16	N6066676-S	Door glass top run bolt
17	W525172-S	Window regulator rivet
18	N808650-S	Window regulator bolt

Special Tool(s)

ST1132-A	Heavy Duty Riveter or equivalent 501-D011 (D80L-23200-A)

Front Door Window Glass: Service and Repair

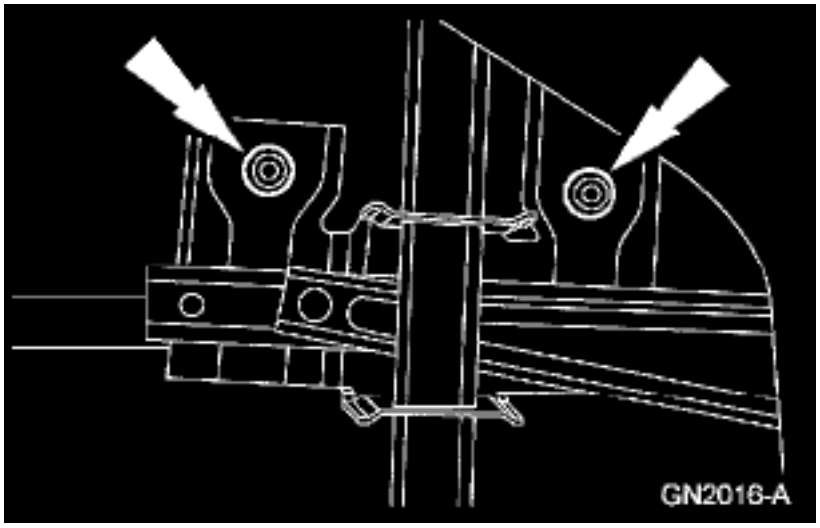
WINDOW GLASS - FRONT DOOR

Exploded View

Special Tool(s)

Special Tool(s)

Removal and Installation



NOTE: Position the window glass halfway up to gain access to the rivets.

1. Remove the front door trim panel. 2. Remove the watershield. 3. Remove the door glass channel.

- Remove the bolt.

- To install, tighten to 12 Nm (9 lb-ft).

4. NOTE:

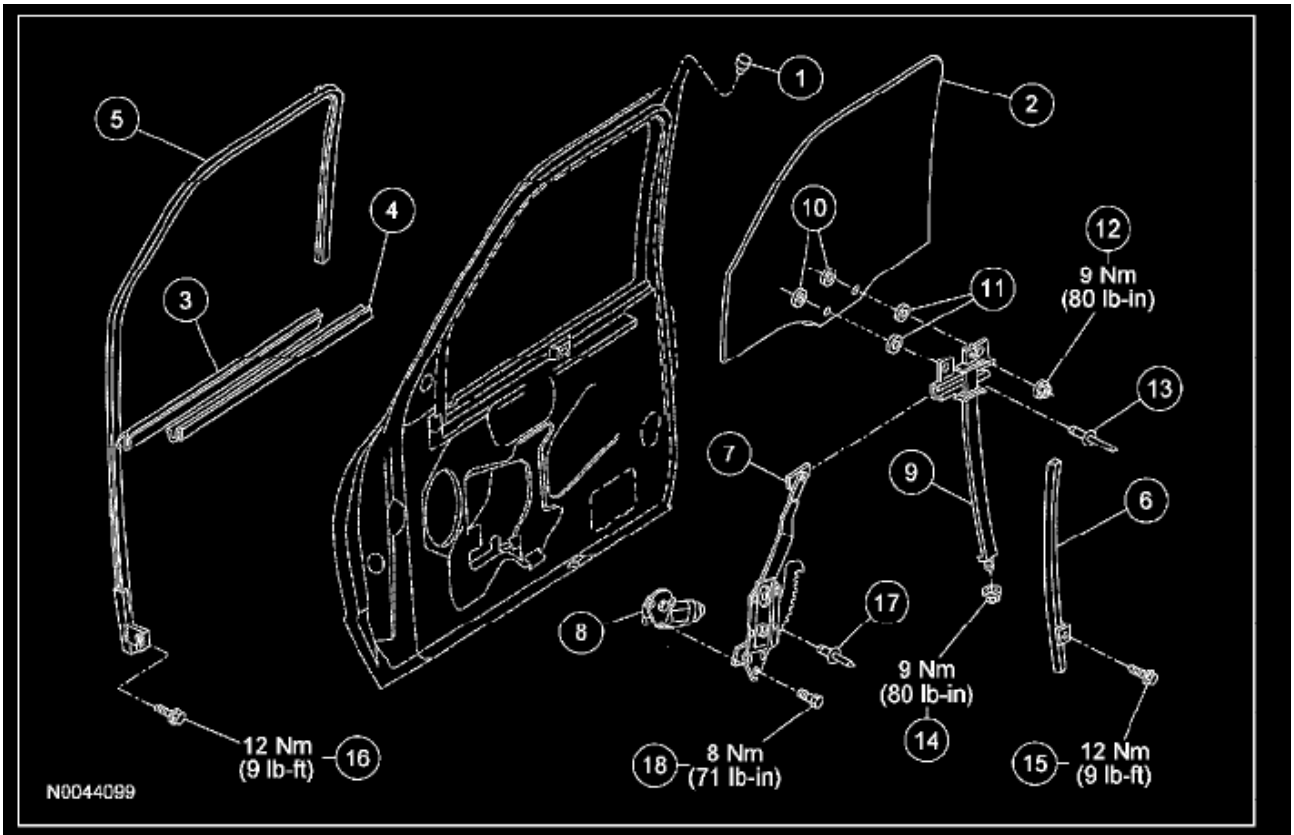
- Support window glass before removing the rivets.

- To remove the rivets, use a drift punch to remove the steel centers and a 6 mm (1/4 in) diameter drill bit to remove the rivets.

Remove the 2 window glass rivets.

5. Remove the front door window glass through the window opening. 6. To install, reverse the removal procedure.

- Use a heavy duty riveter to install the new rivets.



Item	Part Number	Description
1	N805277-S	Rivet
2	21410	Door glass
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7	23208	Regulator assembly
8	23394	Motor assembly
9	23288	Center door glass run
10	234A46	Spacers (2 required)
11	234A44	Spacers (2 required)

(Continued)

Item	Part Number	Description
12	N621907-S	Center door glass run nut
13	W525175-S	Window glass rivet (2 required)
14	N621907-S	Center door glass run nut
15	N6066676-S	Door glass channel bolt
16	N6066676-S	Door glass top run bolt
17	W525172-S	Window regulator rivet
18	N808650-S	Window regulator bolt

Special Tool(s)

ST1132-A	Heavy Duty Riveter or equivalent 501-D011 (D80L-23200-A)

Front Door Window Motor: Service and Repair

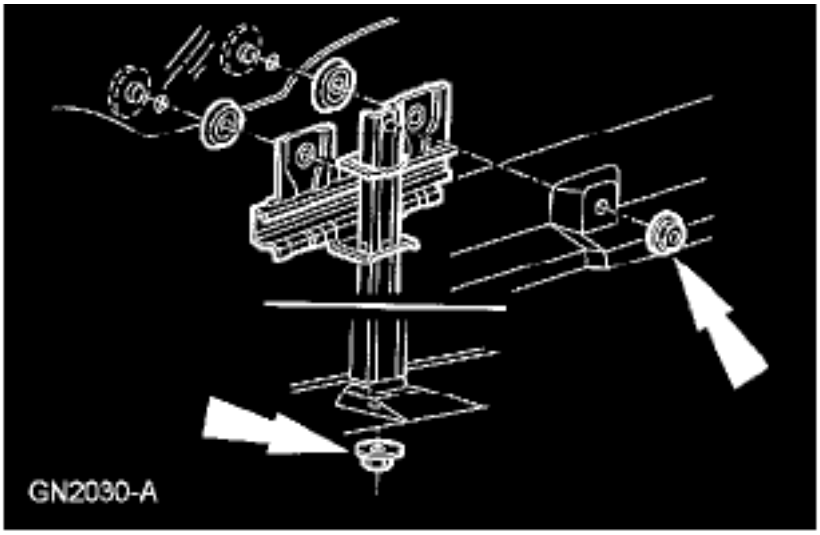
WINDOW REGULATOR AND MOTOR - FRONT DOOR

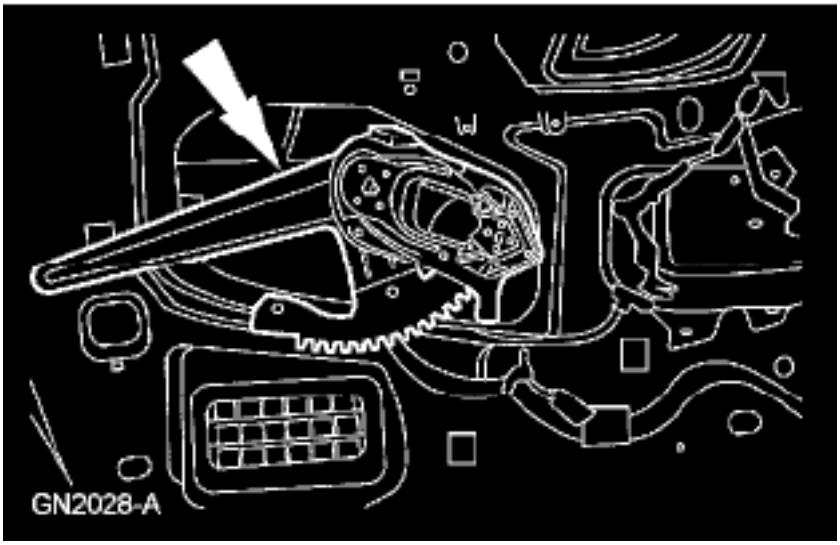
Exploded View

Special Tool(s)

Special Tool(s)

Removal and Installation





1. Remove the door trim panel. 2. Remove the watershield. 3. Support the window glass. 4. If equipped, disconnect the power window motor electrical connector. 5. Remove the top and bottom center door glass run retainer nuts.

- To install, tighten to 9 Nm (80 lb-in).

6. NOTE:

- To remove the rivets, use a drift punch to remove the steel centers and a 6.35 mm (1/4 in) diameter drill bit to remove the rivets.

- The power window regulator has 4 rivets; the manual has 3.

Remove the window regulator rivets. -

Remove the steel centers and rivets.

7. Remove the window regulator.

8. WARNING: When removing the window regulator motor, place the window in the full upward position or block the window regulator

arm to help prevent the counterbalance spring from unwinding with high force. Failure to follow this instruction may result in serious personal injury.

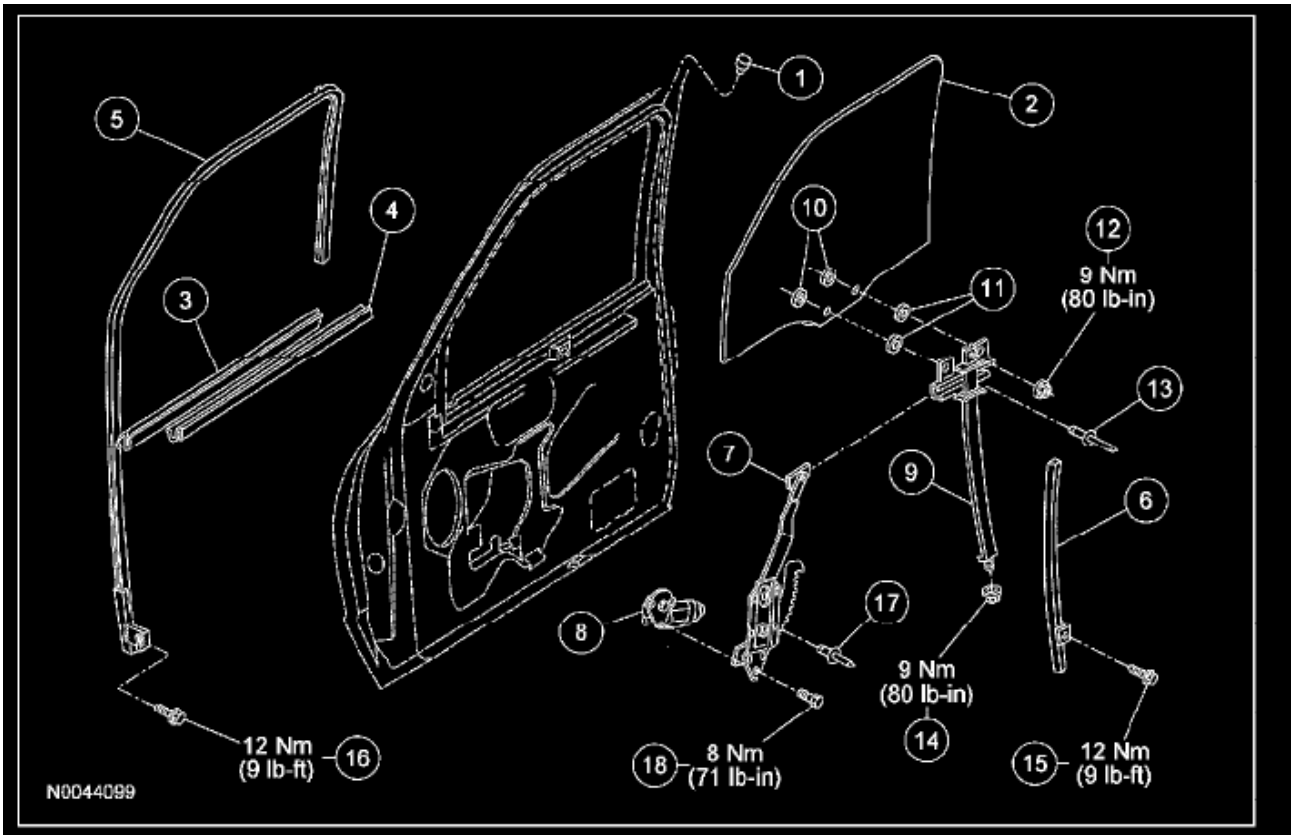
If necessary, remove the window glass motor. -

Remove the bolts.

- To install, tighten to 8 Nm (71 lb-in).

9. To install, reverse the removal procedure.

- Use a heavy duty riveter to install the new rivets.



Item	Part Number	Description
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2	21410	Door glass
3	21452A	Door glass weatherstrip-outer
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5	21546	Door glass top run
6	222A00	Door glass channel
7	23208	Regulator assembly
8	23394	Motor assembly
9	23288	Center door glass run
10	234A46	Spacers (2 required)
11	234A44	Spacers (2 required)

(Continued)

Item	Part Number	Description
12	N621907-S	Center door glass run nut
13	W525175-S	Window glass rivet (2 required)
14	N621907-S	Center door glass run nut
15	N6066676-S	Door glass channel bolt
16	N6066676-S	Door glass top run bolt
17	W525172-S	Window regulator rivet
18	N808650-S	Window regulator bolt

Special Tool(s)

ST1132-A	Heavy Duty Riveter or equivalent 501-D011 (D80L-23200-A)

Front Door Window Regulator: Service and Repair

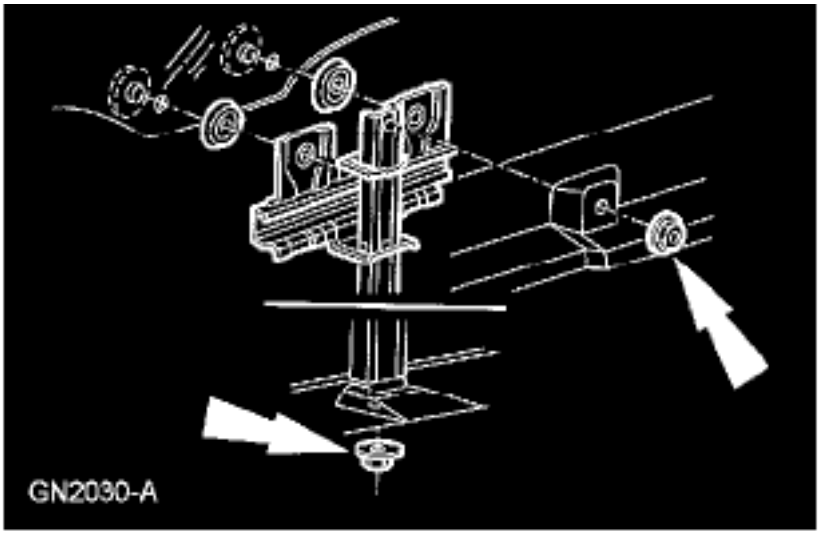
WINDOW REGULATOR AND MOTOR - FRONT DOOR

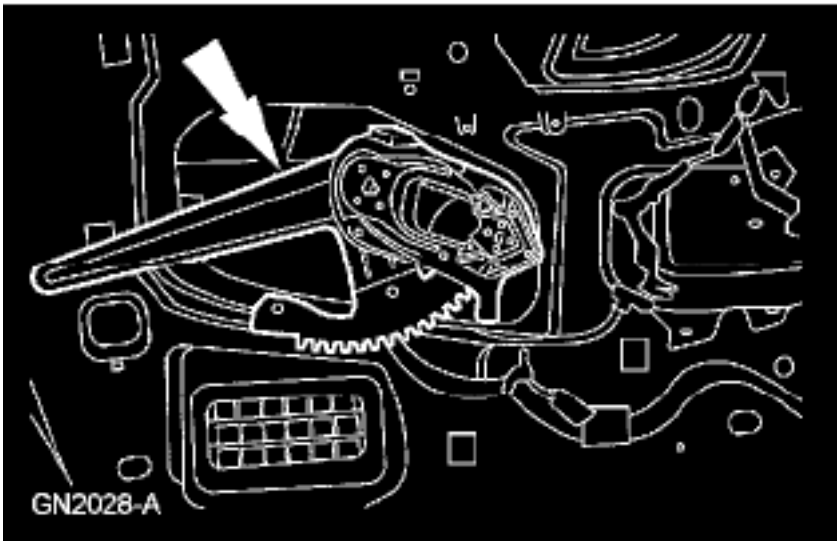
Exploded View

Special Tool(s)

Special Tool(s)

Removal and Installation





1. Remove the door trim panel. 2. Remove the watershield. 3. Support the window glass. 4. If equipped, disconnect the power window motor electrical connector. 5. Remove the top and bottom center door glass run retainer nuts.

- To install, tighten to 9 Nm (80 lb-in).

6. NOTE:

- To remove the rivets, use a drift punch to remove the steel centers and a 6.35 mm (1/4 in) diameter drill bit to remove the rivets.

- The power window regulator has 4 rivets; the manual has 3.

Remove the window regulator rivets. -

Remove the steel centers and rivets.

7. Remove the window regulator.

8. WARNING: When removing the window regulator motor, place the window in the full upward position or block the window regulator

arm to help prevent the counterbalance spring from unwinding with high force. Failure to follow this instruction may result in serious personal injury.

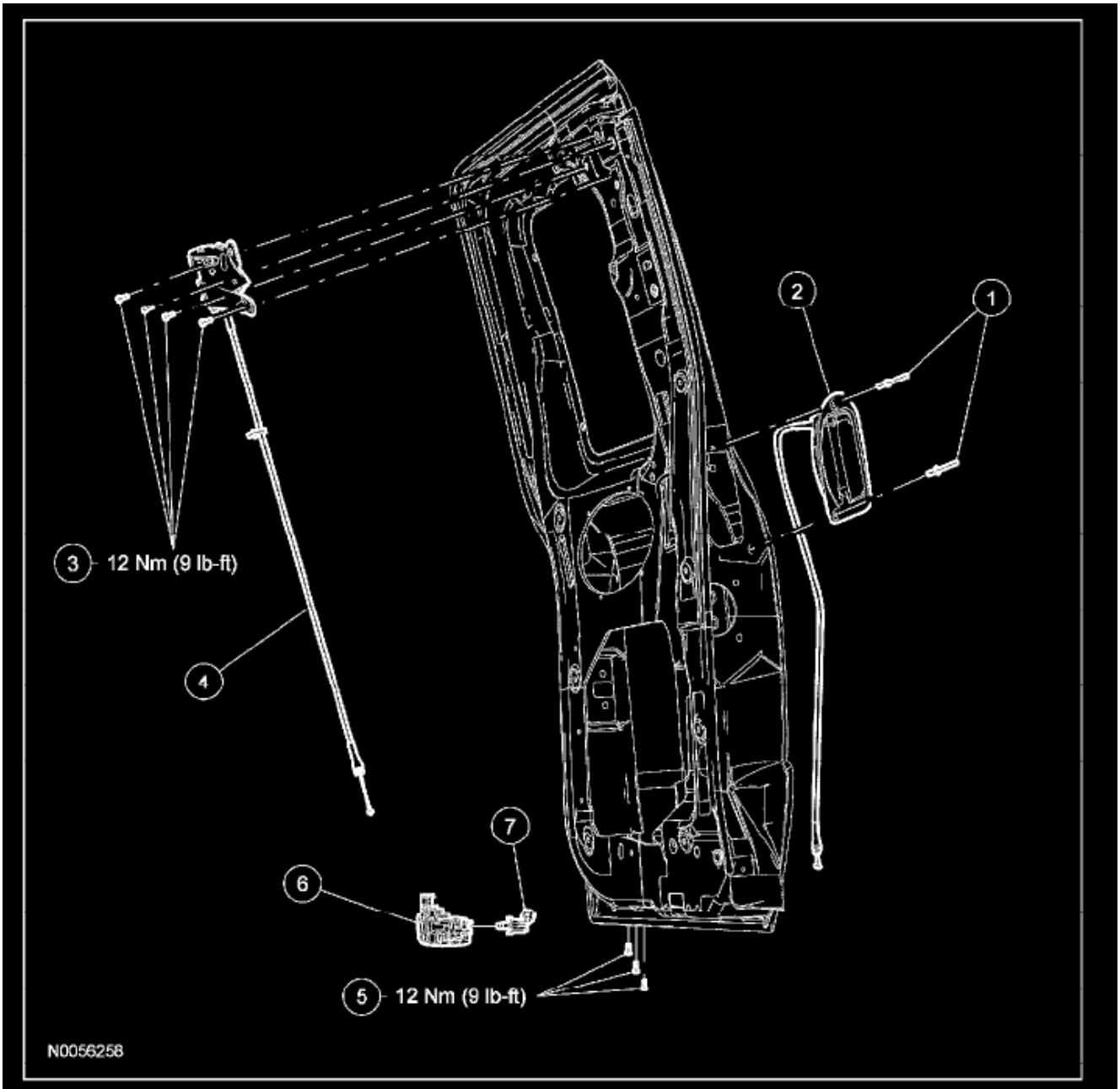
If necessary, remove the window glass motor. -

Remove the bolts.

- To install, tighten to 8 Nm (71 lb-in).

9. To install, reverse the removal procedure.

- Use a heavy duty riveter to install the new rivets.



Item	Part Number	Description
1	W525170	Exterior rear door handle rivets (2 required)
2	136604/ 136605	Exterior rear door handle (RH/LH)
3	W705830-S901	Upper rear door latch screws (4 required)

(Continued)

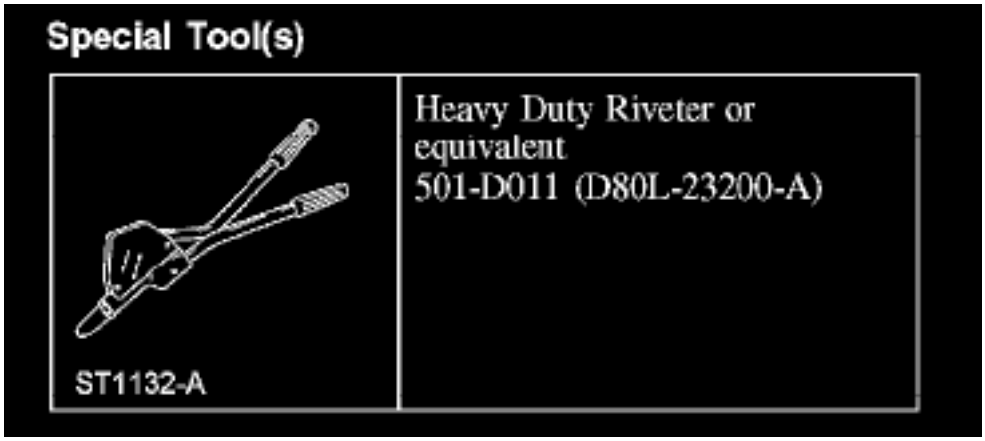
Item	Part Number	Description
4	13264A26/ 13264A27	Upper rear door latch (RH/LH)
5	W705830-S901	Lower rear door latch screws (3 required)
6	1326412/ 1326413	Lower rear door latch (RH/LH)
7	14018	Door ajar switch

Rear Door Exterior Handle: Service and Repair

EXTERIOR REAR DOOR HANDLE

Exploded View

Special Tool(s)



Special Tool(s)

Removal and Installation

1. NOTE: Use a drift punch to remove the steel centers and a 6.35 mm (1/4 in) diameter drill bit to remove the rivets.

Remove the 2 exterior rear door handle rivets.

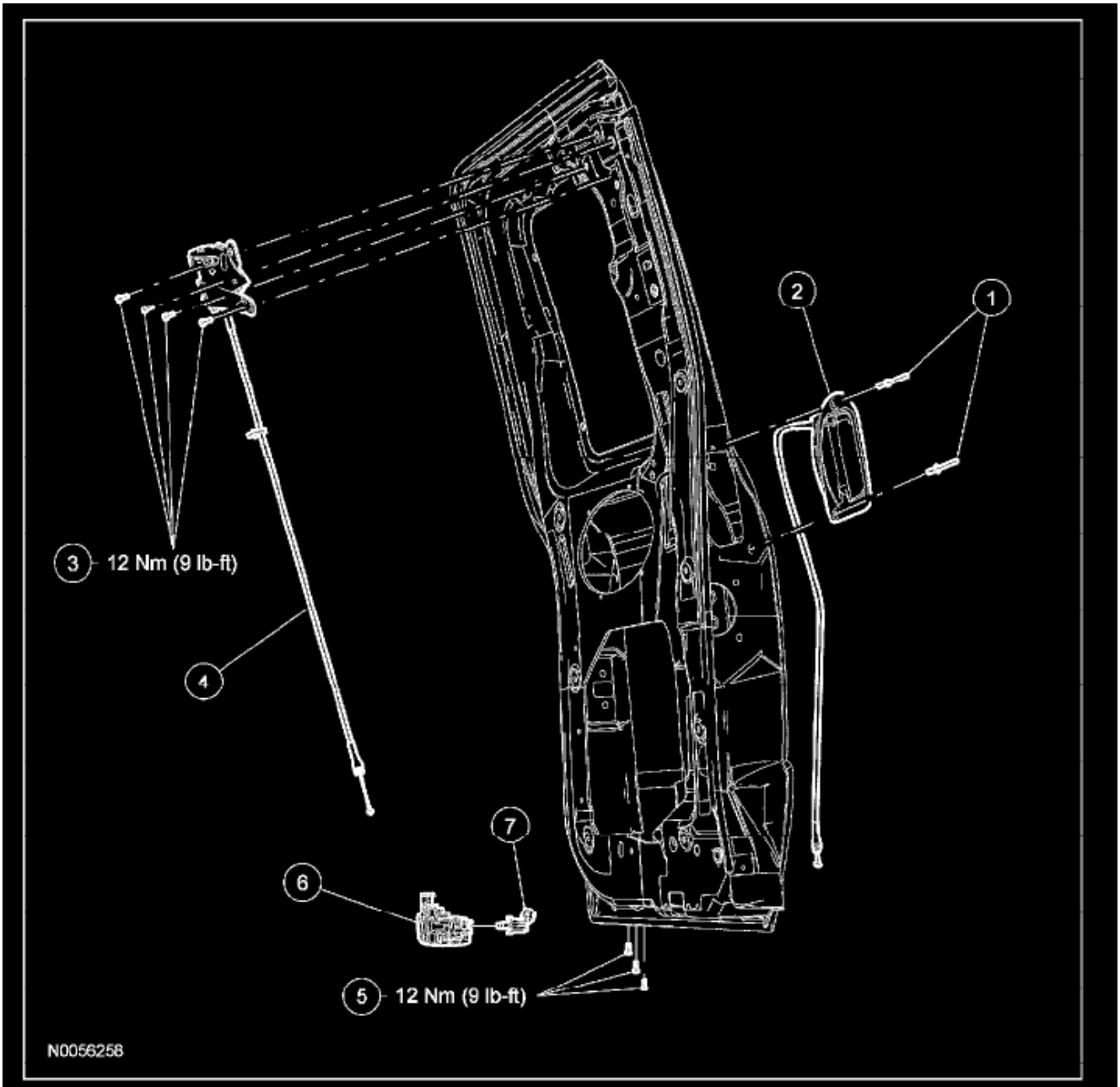
2. Position the exterior door handle aside.

3. NOTE: Hold the handle open while removing the barrel ends of the cable.

Disconnect the upper and lower rear door latch actuating cables from the exterior handle.

4. Remove the exterior rear door handle. 5. To install, reverse the removal procedure.

- Use the special tool to install the rivets.



Item	Part Number	Description
1	W525170	Exterior rear door handle rivets (2 required)
2	136604/ 136605	Exterior rear door handle (RH/LH)
3	W705830-S901	Upper rear door latch screws (4 required)

(Continued)

Item	Part Number	Description
4	13264A26/ 13264A27	Upper rear door latch (RH/LH)
5	W705830-S901	Lower rear door latch screws (3 required)
6	1326412/ 1326413	Lower rear door latch (RH/LH)
7	14018	Door ajar switch

Rear Door Latch: Service and Repair Rear Door Latch - Lower

REAR DOOR LATCH - LOWER

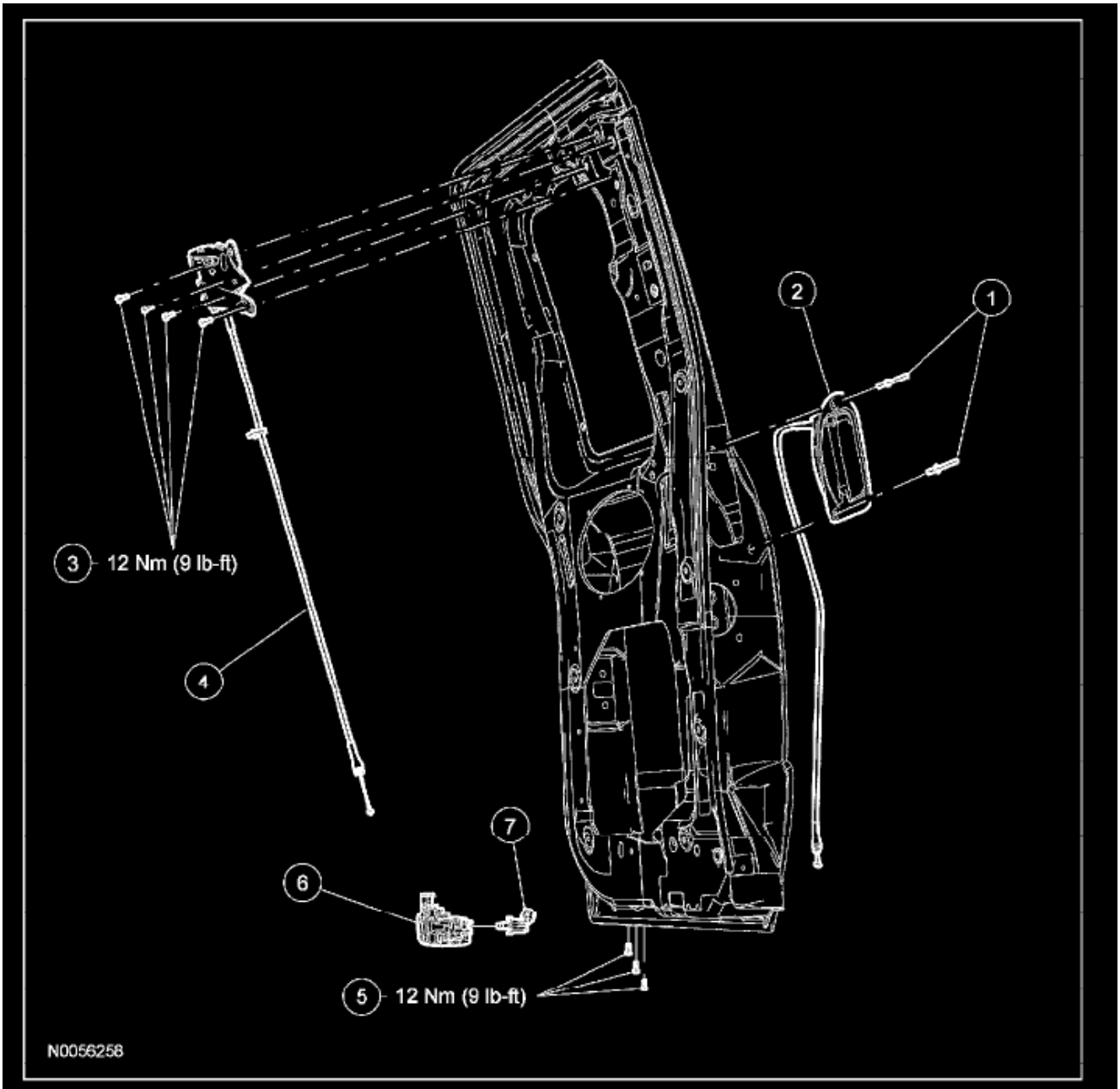
Exploded View

Removal and Installation

1. Remove the rear door trim panel. 2. Remove the 3 screws and position the lower rear door latch aside.

- To install, tighten to 12 Nm (9 lb-ft).

3. Disconnect the door ajar switch electrical connector. 4. Remove the lower rear door latch.



Item	Part Number	Description
1	W525170	Exterior rear door handle rivets (2 required)
2	136604/ 136605	Exterior rear door handle (RH/LH)
3	W705830-S901	Upper rear door latch screws (4 required)

(Continued)

Item	Part Number	Description
4	13264A26/ 13264A27	Upper rear door latch (RH/LH)
5	W705830-S901	Lower rear door latch screws (3 required)
6	1326412/ 1326413	Lower rear door latch (RH/LH)
7	14018	Door ajar switch

Rear Door Latch: Service and Repair Rear Door Latch - Upper

REAR DOOR LATCH - UPPER

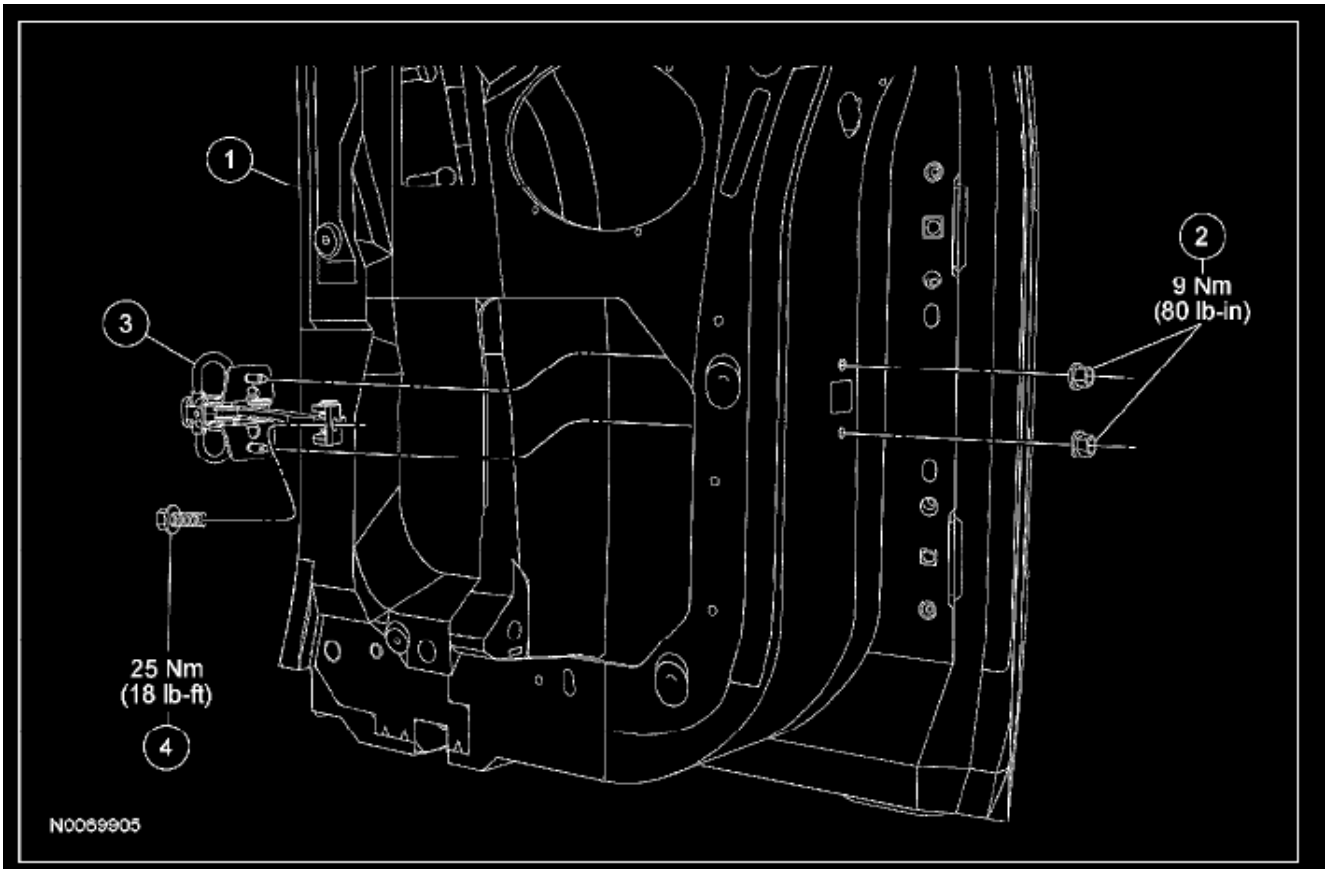
Exploded View

Removal and Installation

1. Remove the rear door trim panel. 2. Remove the exterior rear door handle. 3. Remove the 4 screws and the upper rear door latch.

- To install, tighten to 12 Nm (9 lb-ft).

4. To install, reverse the removal procedure.



Item	Part Number	Description
1	1324630	Door assembly
2	—	Door check arm-to-door nuts (2 required)
3	1327200	Door check arm
4		Door check arm-to-body bolt

Rear Door Limiter: Service and Repair

DOOR CHECK ARM - REAR, SUPERCAB

Removal and Installation

1. Remove the rear door trim panel. 2. Remove the door check arm-to-body bolt.

- To install, tighten to 25 Nm (18 lb-ft).

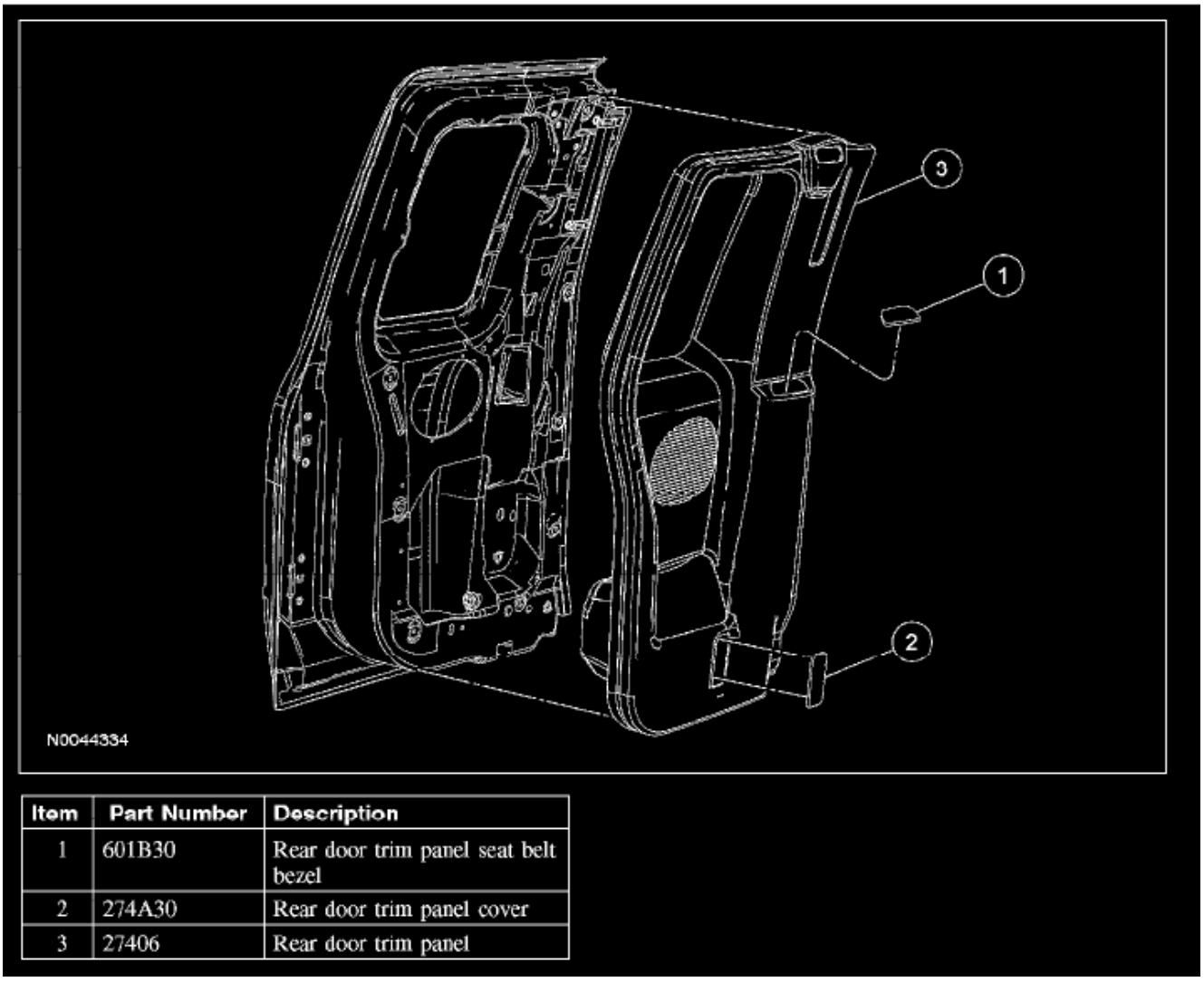
3. Remove the 2 door check arm-to-door nuts.

- To install, tighten to 9 Nm (80 lb-in).

4. Remove the door check arm. 5. To install, reverse the removal procedure.

Special Tool(s)

ST1181-A	Safety Belt Bolt Bit 177L-2100-A



Item	Part Number	Description
1	601B30	Rear door trim panel seat belt bezel
2	274A30	Rear door trim panel cover
3	27406	Rear door trim panel

Rear Door Panel: Service and Repair

DOOR TRIM PANEL - REAR

Special Tool(s)

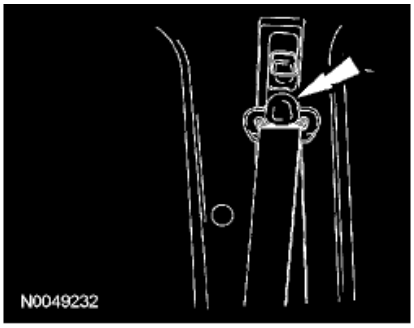
Special Tool(s)

Removal and Installation

1. NOTE: If the safety belt guide cover is damaged or if it does not remain closed, install a new cover.

Remove the front safety belt guide cover. -

Release the retaining tabs and remove the cover.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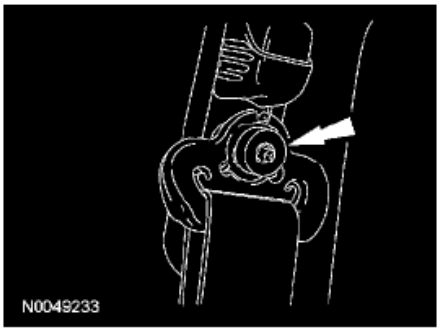
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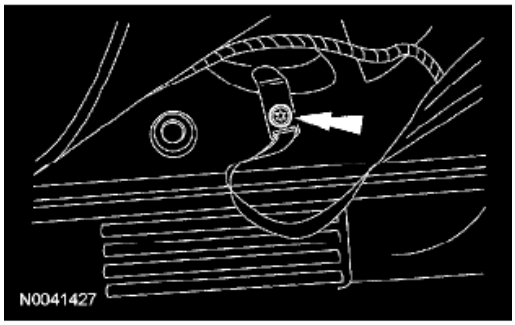
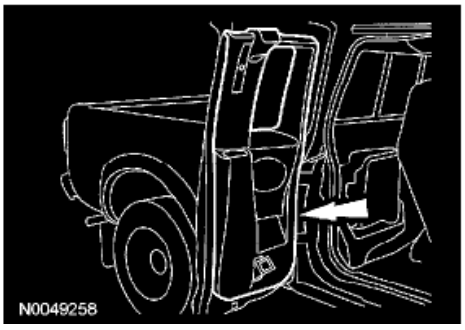

N0041427


N0049258

2. Remove the bolt and safety belt guide.

- Use the Safety Belt Bolt Bit to remove the bolt. -

To install, tighten to 40 Nm (30 lb-ft).

- Remove the safety belt guide.

3. Remove the safety belt anchor.

- Use the Safety Belt Bolt Bit to remove the bolt. -

To install, tighten to 40 Nm (30 lb-ft).

4. Remove the door trim panel.

- Separate the trim panel from the door.

5. To install, reverse the removal procedure.

Hood Latch: Adjustments

LATCH ADJUSTMENT - HOOD

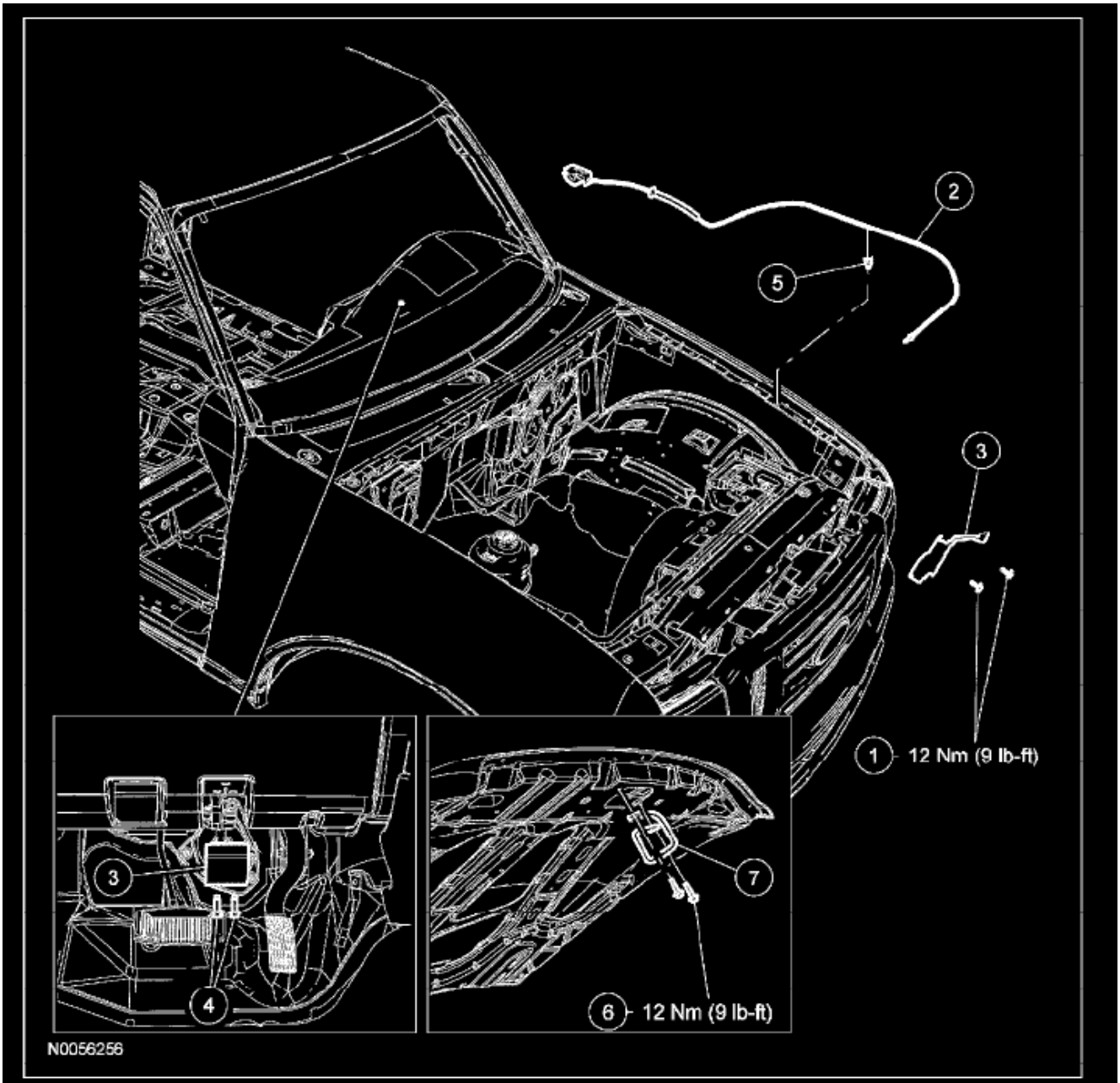
1. Verify the hood alignment. 2. Align the hood latch striker.

- Loosen the hood latch bolts enough to allow for movement of the hood latch.

- Align the hood latch with the hood latch striker.

3. Tighten the hood latch bolts to 12 Nm (9 lb-ft). 4. Verify that the hood latch striker is fully engaging the hood latch.

- Repeat the procedure as necessary.



Item	Part Number	Description
1	N808727-S307	Hood latch bolts (2 required)
2	16916	Hood latch release handle and cable
3	16700	Hood latch release handle
4	N804693-S424	Hood latch release handle bolts (2 required)

(Continued)

Item	Part Number	Description
5	386132	Hood latch release handle cable clip
6	—	Hood latch striker bolts (2 required)
7	—	Hood latch striker

Hood Latch: Service and Repair

HOOD LATCH

Exploded View

Removal and Installation

1. NOTE: Mark the hood latch position prior to removal of the bolts.

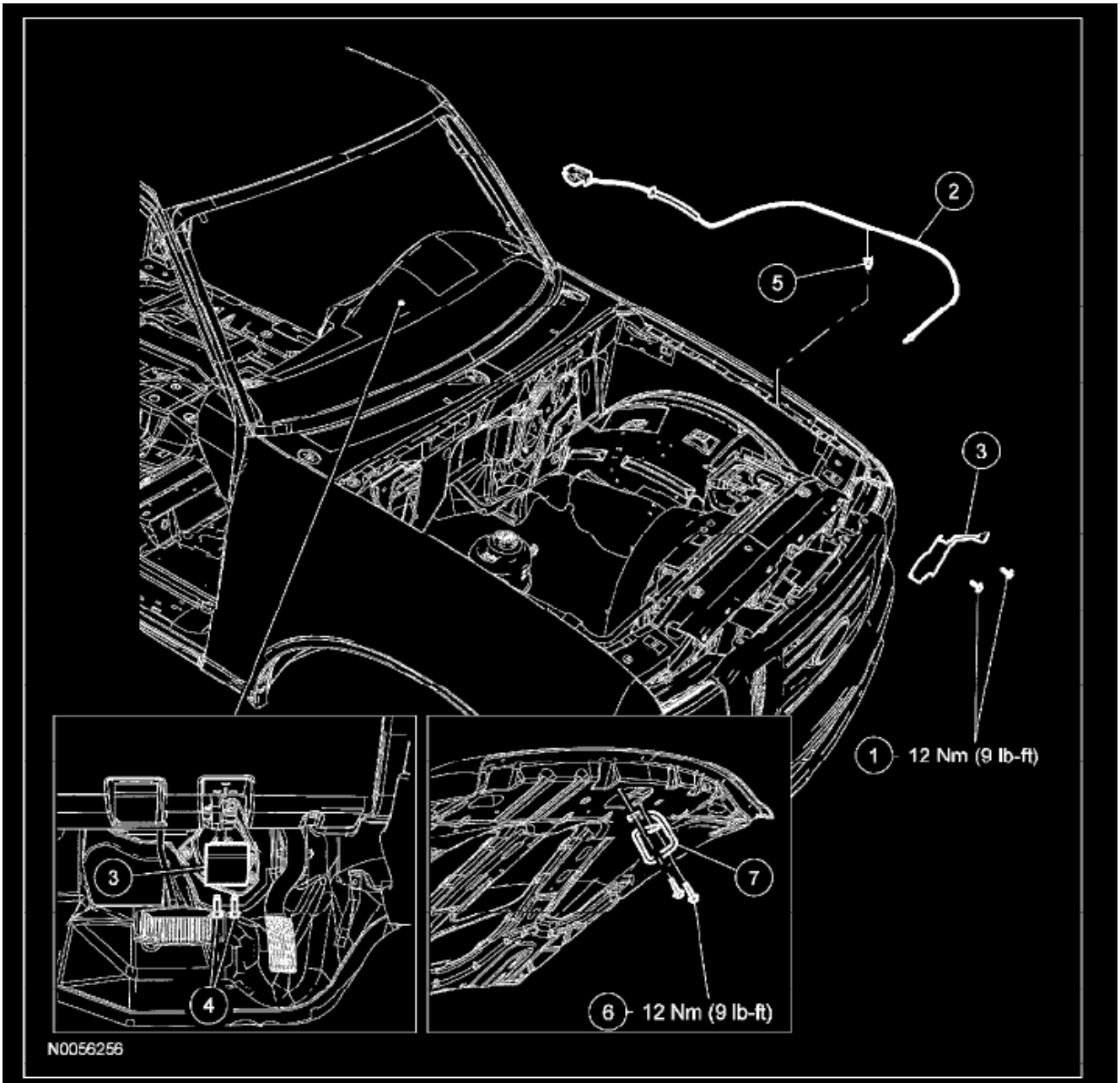
Remove the 2 bolts and position the hood latch aside. -

To install, tighten to 12 Nm (9 lb-ft).

2. Disconnect the hood latch cable from the hood latch release lever. 3. Remove the hood latch.

4. To install, reverse the removal procedure.

- Adjust the hood latch.



Item	Part Number	Description
1	N808727-S307	Hood latch bolts (2 required)
2	16916	Hood latch release handle and cable
3	16700	Hood latch release handle
4	N804693-S424	Hood latch release handle bolts (2 required)

(Continued)

Item	Part Number	Description
5	386132	Hood latch release handle cable clip
6	—	Hood latch striker bolts (2 required)
7	—	Hood latch striker

Hood Latch Release: Service and Repair

HOOD LATCH RELEASE HANDLE

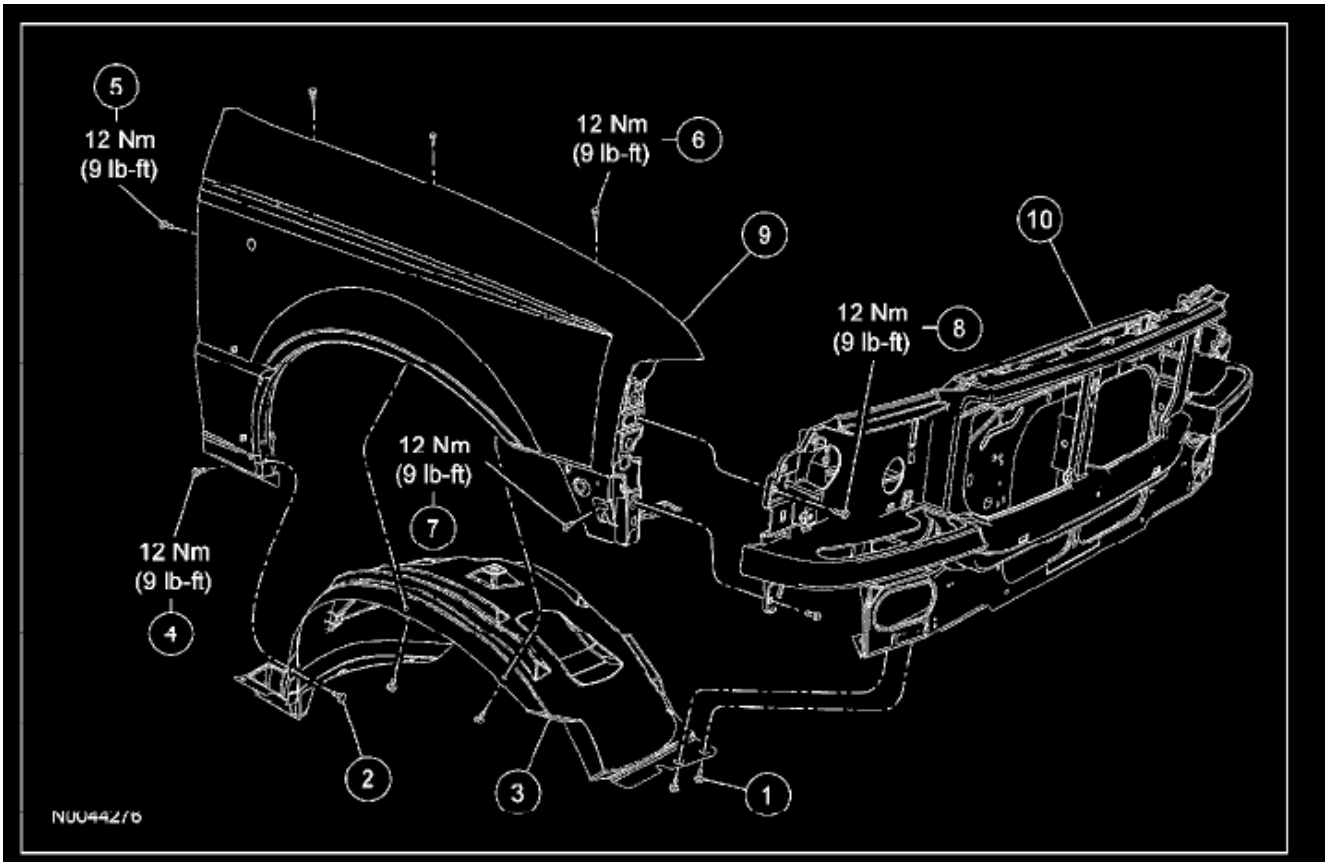
Exploded View

Removal and Installation

NOTE: The hood latch control handle and cable are removed and installed as an assembly.

1. Remove the hood latch. 2. Unclip the hood latch control handle and cable from the inner fender retainer. 3. Unclip the hood latch control handle and cable retainer from the inner fender splash shield. 4. Remove the 2 screws and position the hood latch control handle and cable aside. 5. Remove the hood latch control and cable grommet from the dash panel.

6. Remove the hood latch control handle and cable. 7. To install, reverse the removal procedure.



Item	Part Number	Description
1	—	Front fender splash shield front bolt (2 required)
2	—	Front fender splash shield scrivet (4 required)
3	16054	Front fender splash shield
4	N808650-S	Front fender lower mounting bolt
5	—	Front fender rear mounting bolt
6	—	Front fender upper mounting bolt (3 required)

(Continued)

Item	Part Number	Description
7	—	Front fender-to-fender bracket mounting bolt
8	—	Front fender-to-radiator grille opening panel reinforcement bolt (2 required)
9	16005	Front fender
10	8A284	Radiator grille opening panel reinforcement

Front Fender Liner: Service and Repair

FENDER SPLASH SHIELD

Exploded View

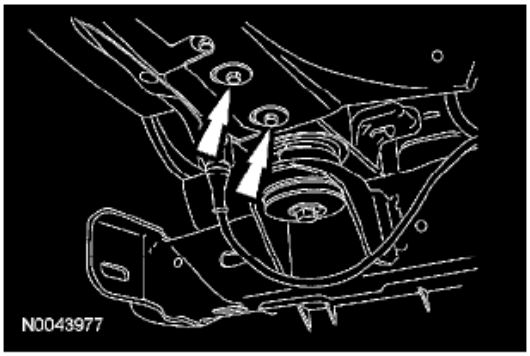
Removal and Installation

1. NOTE: The RH front fender splash shield electrical connector locators must be disconnected from the splash shield prior to splash shield

removal. The LH front fender splash shield vacuum lines must be disconnected from the vacuum storage reservoir prior to splash shield removal.

Remove the 3 scrivets from inside the front fender splash shield.

N0043976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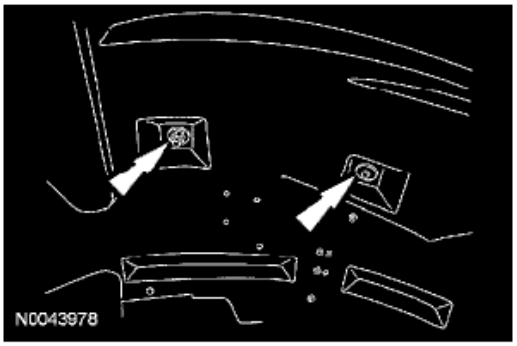
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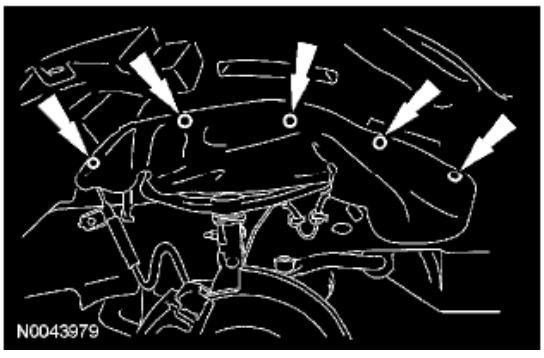

N0043979

2. Remove the 2 bolts from the lower front of the front fender splash shield.

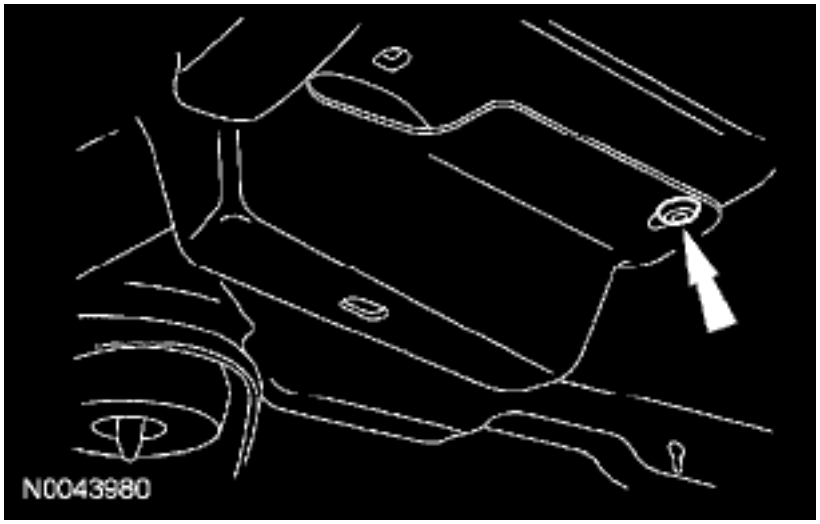
3. NOTE: The LH front fender splash shield is equipped with a bolt and a nut. The RH front fender splash shield is equipped with 2 bolts.

Remove the bolt and the nut from the front fender splash shield.

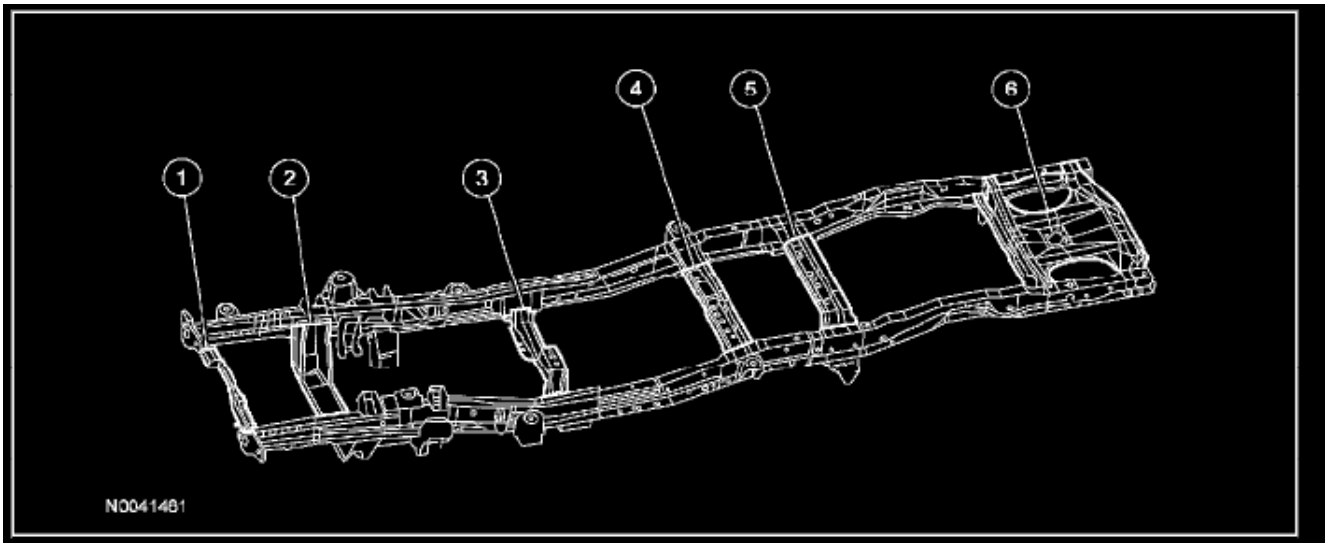
4. Remove the 5 pushpins from the front fender splash shield-to-inner splash shield.

- Remove the inner splash shield.

5. Remove the scrivet from the lower rear splash shield.



6. Remove the front fender splash shield. 7. To install, reverse the removal procedure.



Item	Part Number	Description
1	—	No. 1A crossmember (Four-Wheel Drive (4WD) only)
2	—	No. 1 crossmember
3	—	Transmission crossmember
4	—	Cab support crossmember
5	—	Pickup bed support
6	—	Rear crossmember

Body / Frame Mount Bushing: Description and Operation

FRAME AND BODY MOUNTING

Frame

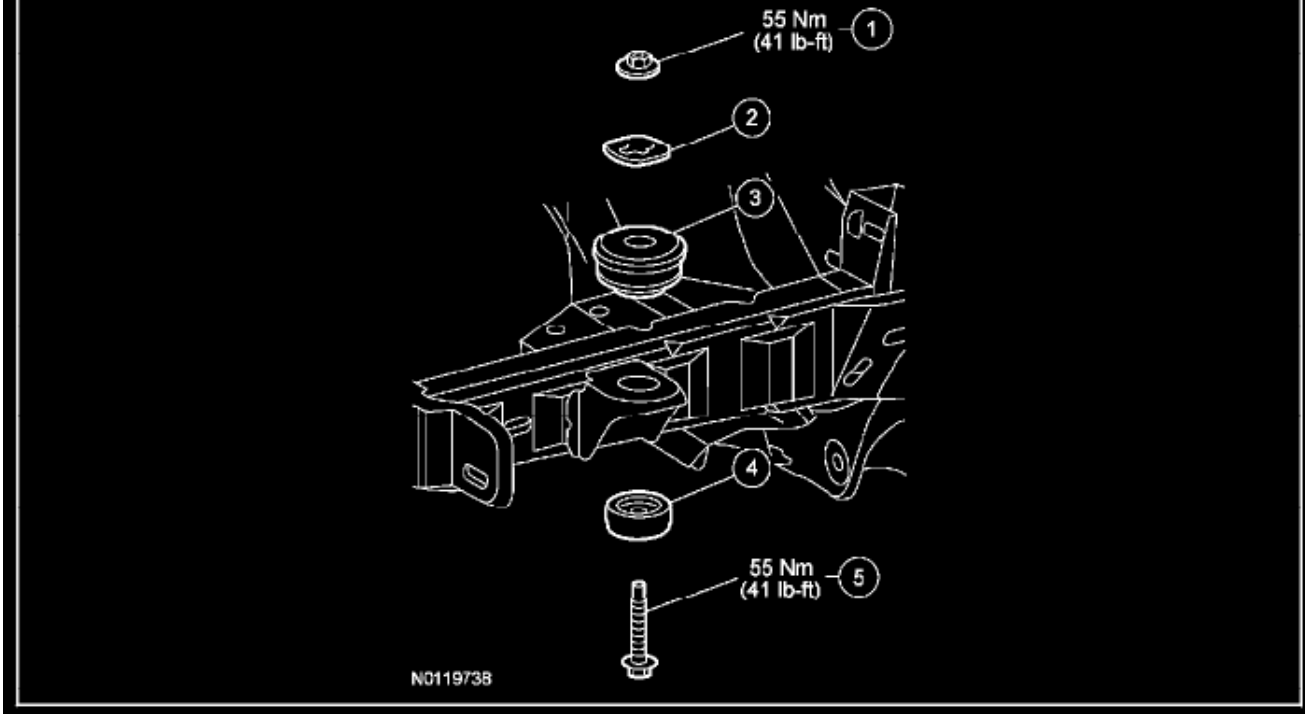
NOTE: Four-Wheel Drive (4WD) short wheelbase shown, all others similar.

Frame

The frame consists of 2 steel channel rails, a rear crossmember, a number of additional support crossmembers and a front crossmember.

The No. 1A (Four-Wheel Drive (4WD) only) and the No. 1 crossmembers are welded to the frame side rails. The remaining frame crossmembers are riveted and/or bolted into place.

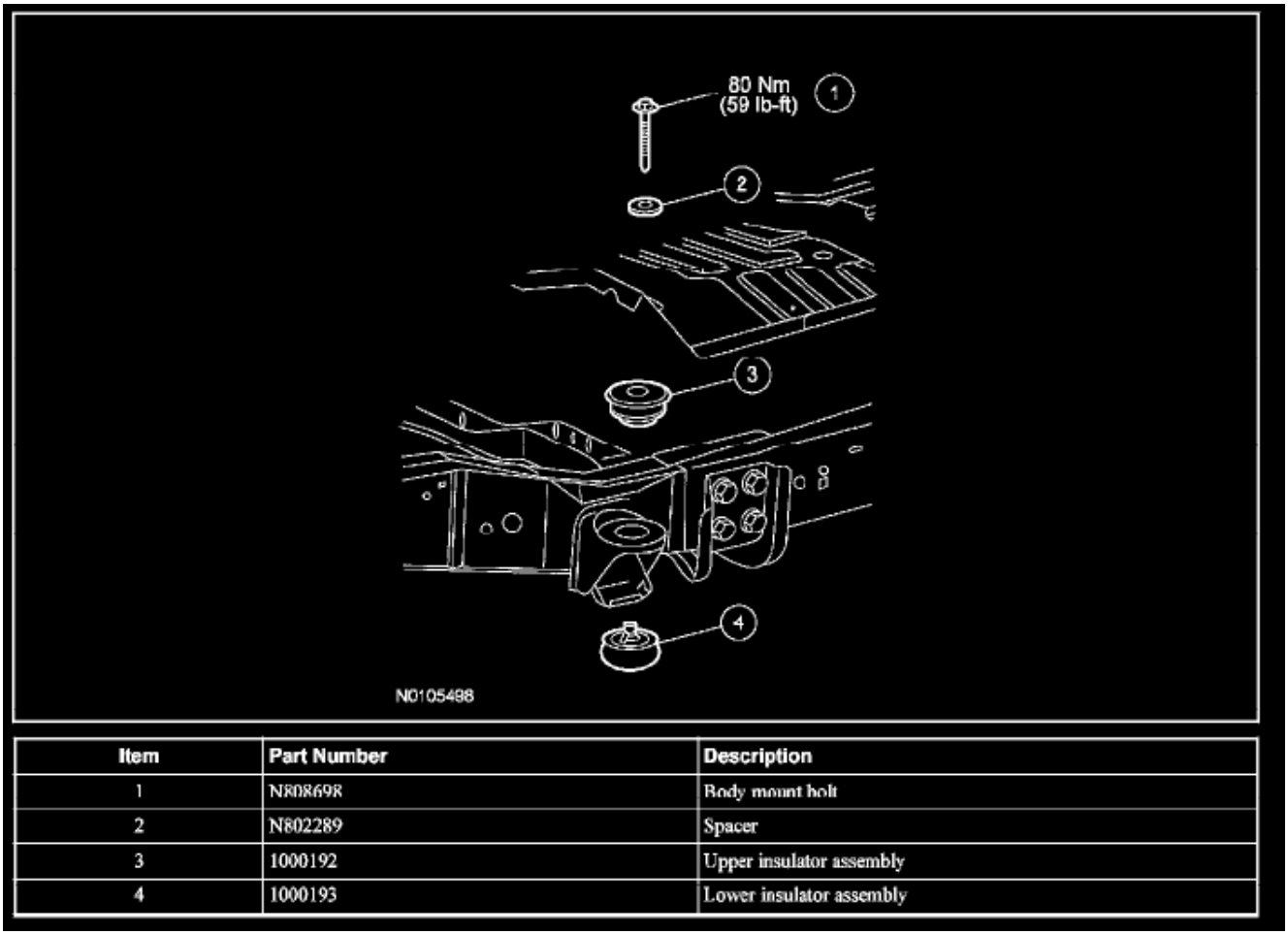
Front End Sheet Metal (FESM) Mounting



Item	Part Number	Description
1	N621946	Front End Sheet Metal (FESM) mount nut
2	N800788	Spacer
3	1000192	Upper insulator assembly
4	1000193	Lower insulator assembly
5	N800442	FESM mount bolt

Front End Sheet Metal (FESM) Mounting

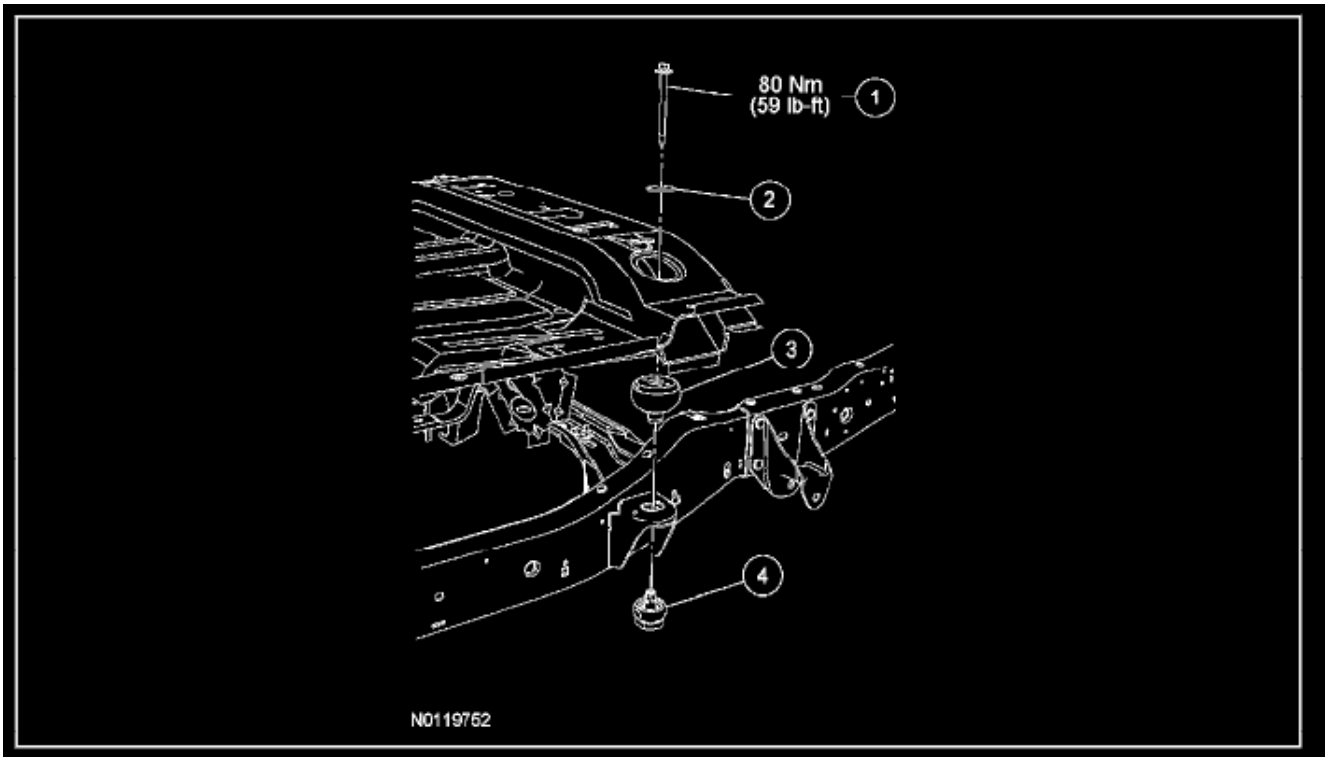
Front Body-to-Frame Mounting



Item	Part Number	Description
1	N808698	Body mount bolt
2	N802289	Spacer
3	1000192	Upper insulator assembly
4	1000193	Lower insulator assembly

Front Body-to-Frame Mounting

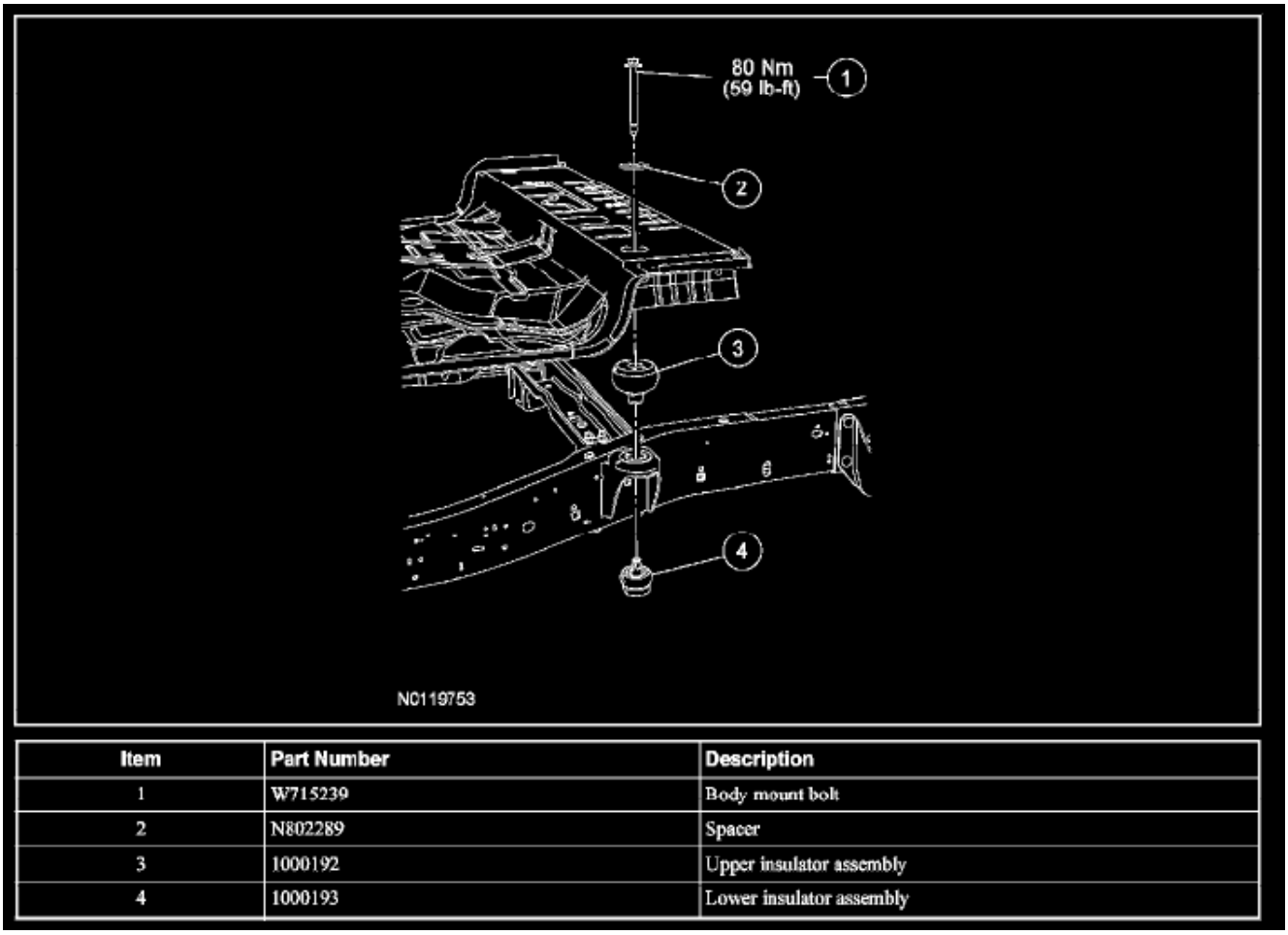
Rear Cab-to-Frame Mount, SuperCab



Item	Part Number	Description
1	W715239	Body mount bolt
2	N802289	Spacer
3	1000192	Upper insulator assembly
4	1000193	Lower insulator assembly

Rear Cab-to-Frame Mount, SuperCab

Rear Cab-to-Frame Mount, Regular Cab



Item	Part Number	Description
1	W715239	Body mount bolt
2	N802289	Spacer
3	1000192	Upper insulator assembly
4	1000193	Lower insulator assembly

Rear Cab-to-Frame Mount, Regular Cab

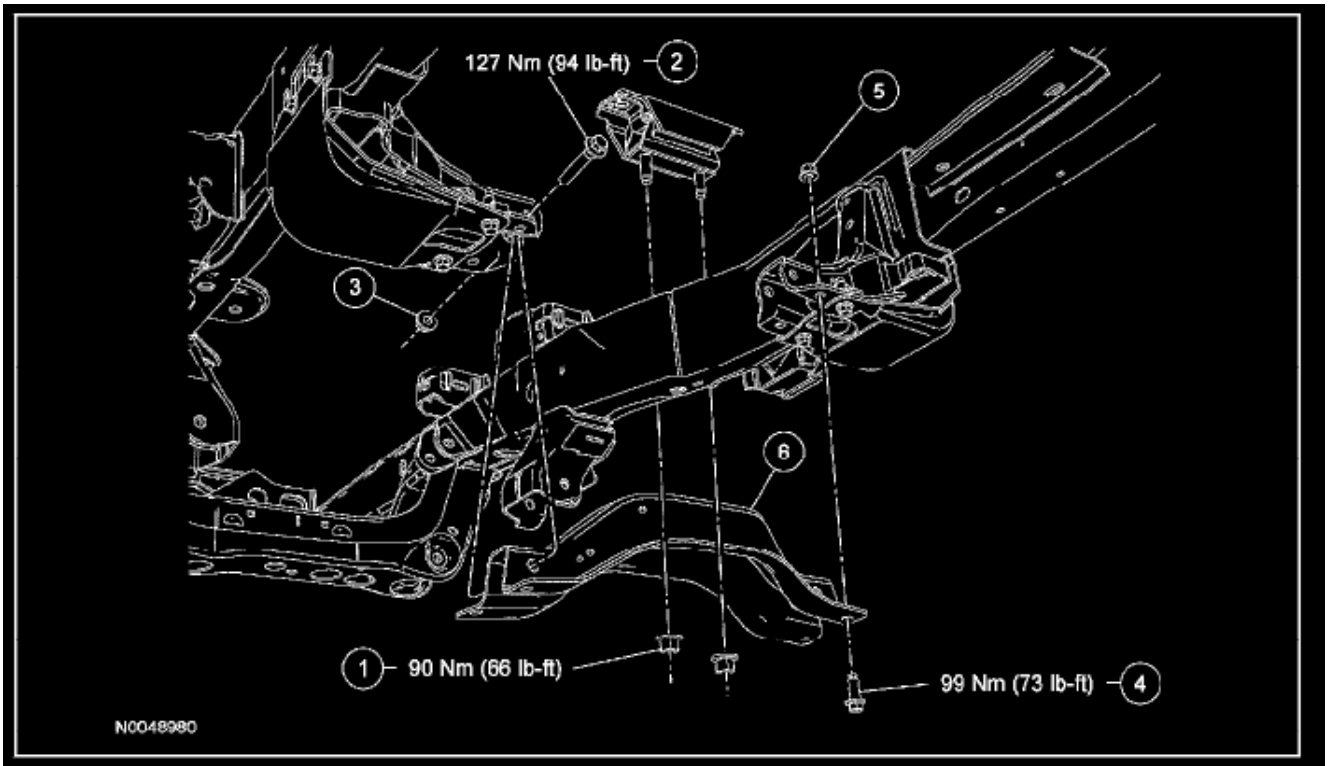
Torque Specifications

Description	Nm	lb-ft
Body mount bolt	80	59
Front End Sheet Metal (FESM) mount bolt	55	41
FESM mount nut	55	41
Horizontal transmission support bolts	127	94
Rear body mount nut	40	30
Transmission mount nuts	90	66
Vertical transmission support bolts	99	73

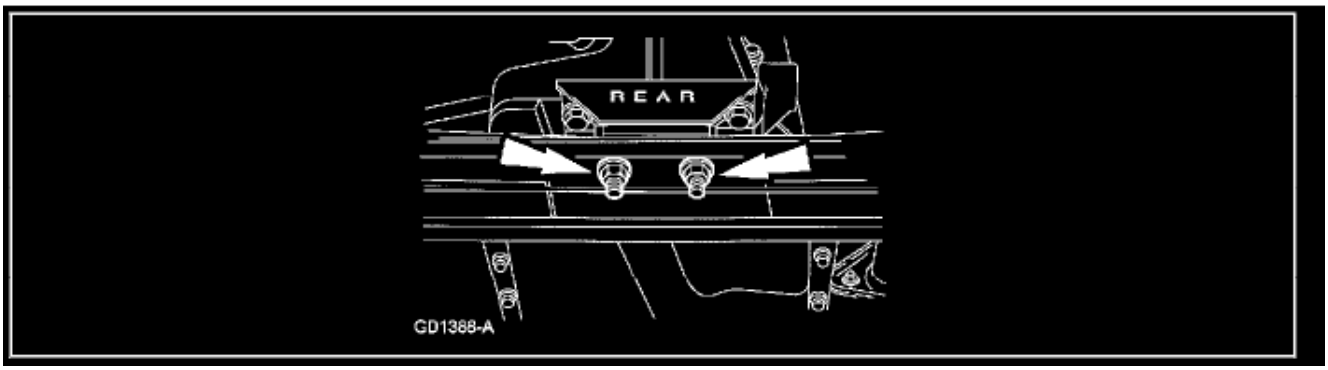
Cross-Member: Specifications

SPECIFICATIONS

Torque Specifications



Item	Part Number	Description
1	N621945	Transmission mount nut (2 required)
2	N802594	Transmission crossmember bolt (2 required)
3	N620482	Transmission crossmember nut (2 required)
4	—	Transmission crossmember bolt (4 required)
5	—	Transmission crossmember nut (4 required)
6	6A023	Transmission crossmember



Cross-Member: Service and Repair

TRANSMISSION SUPPORT CROSSMEMBER

Transmission Support Crossmember

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Remove the 2 transmission mount nuts from the transmission support crossmember. Discard the nuts.

- To install, tighten to 90 Nm (66 lb-ft).

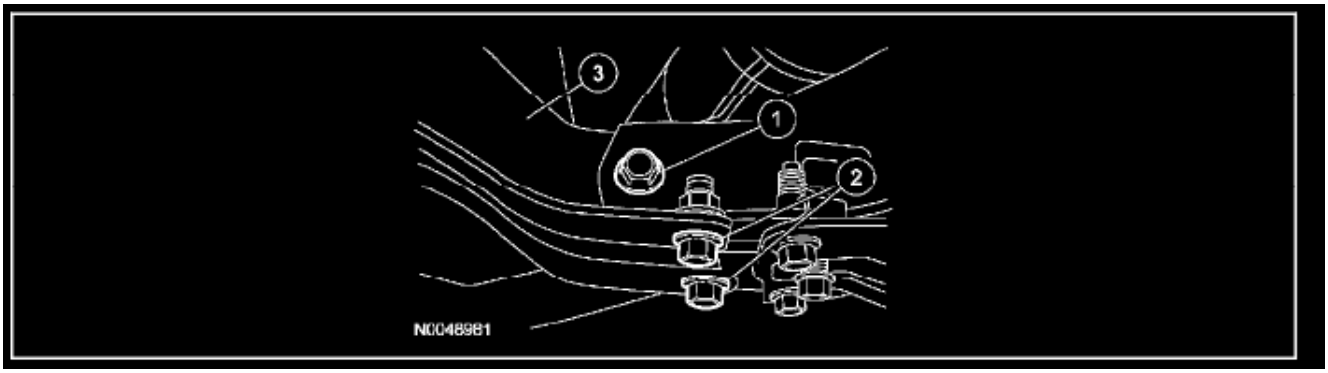
3. NOTE: Do not allow the transmission to hang freely.

Support the transmission with a suitable jack.

4. NOTE: Four-Wheel Drive (4WD) transmission support crossmember shown, Rear Wheel Drive (RWD) transmission support crossmember

similar.

Remove the transmission support crossmember. 1. Remove the 2 horizontal transmission support crossmember bolts and nuts (1 each side).



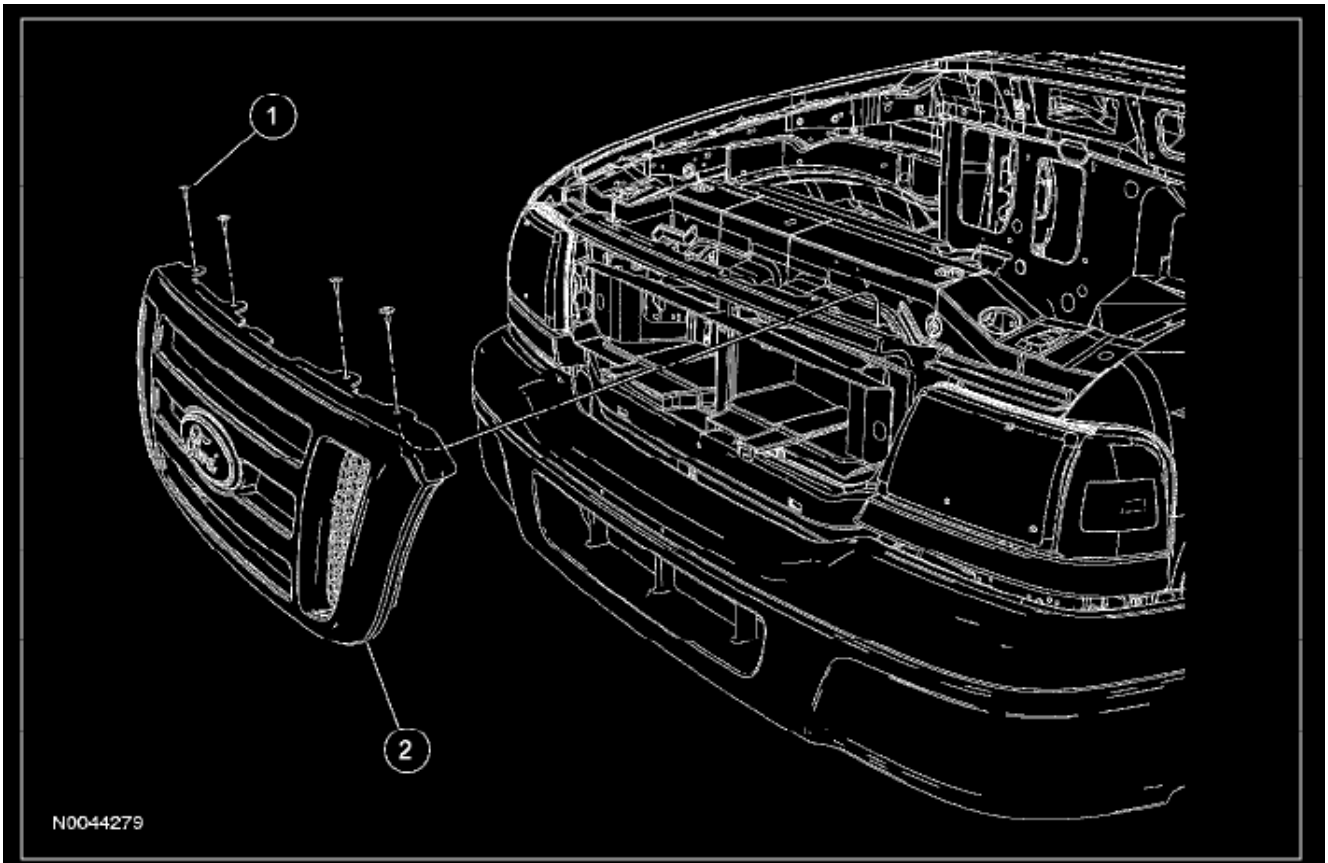
- To install, tighten to 127 Nm (94 lb-ft).

2. Remove the 4 vertical transmission support bolts and nuts (2 each side).

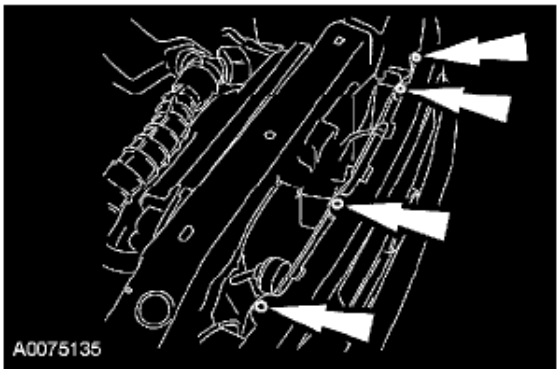
- To install, tighten to 99 Nm (73 lb-ft).

3. Remove the transmission support crossmember.

5. To install, reverse the removal procedure.



Item	Part Number	Description
1	N808650	Radiator grille screw (4 required)
2	8200	Radiator grille



Grille: Service and Repair

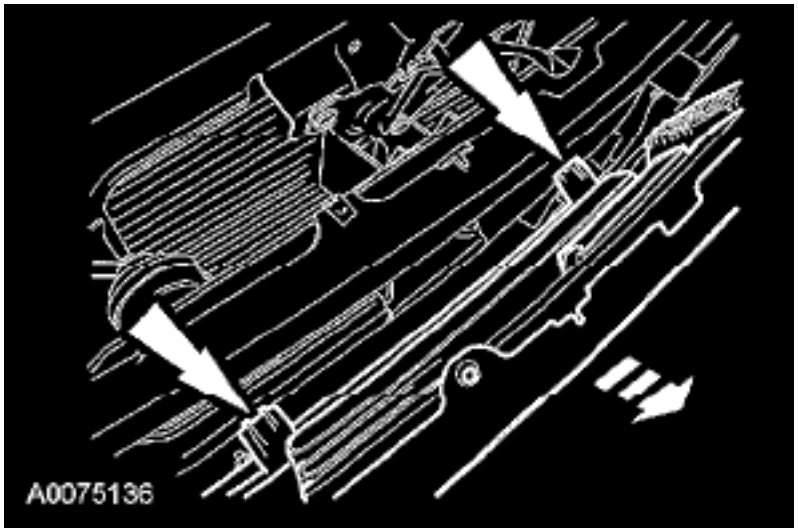
RADIATOR GRILLE

Removal and Installation

1. Remove the radiator grille screws.

2. Remove the radiator grille opening panel.

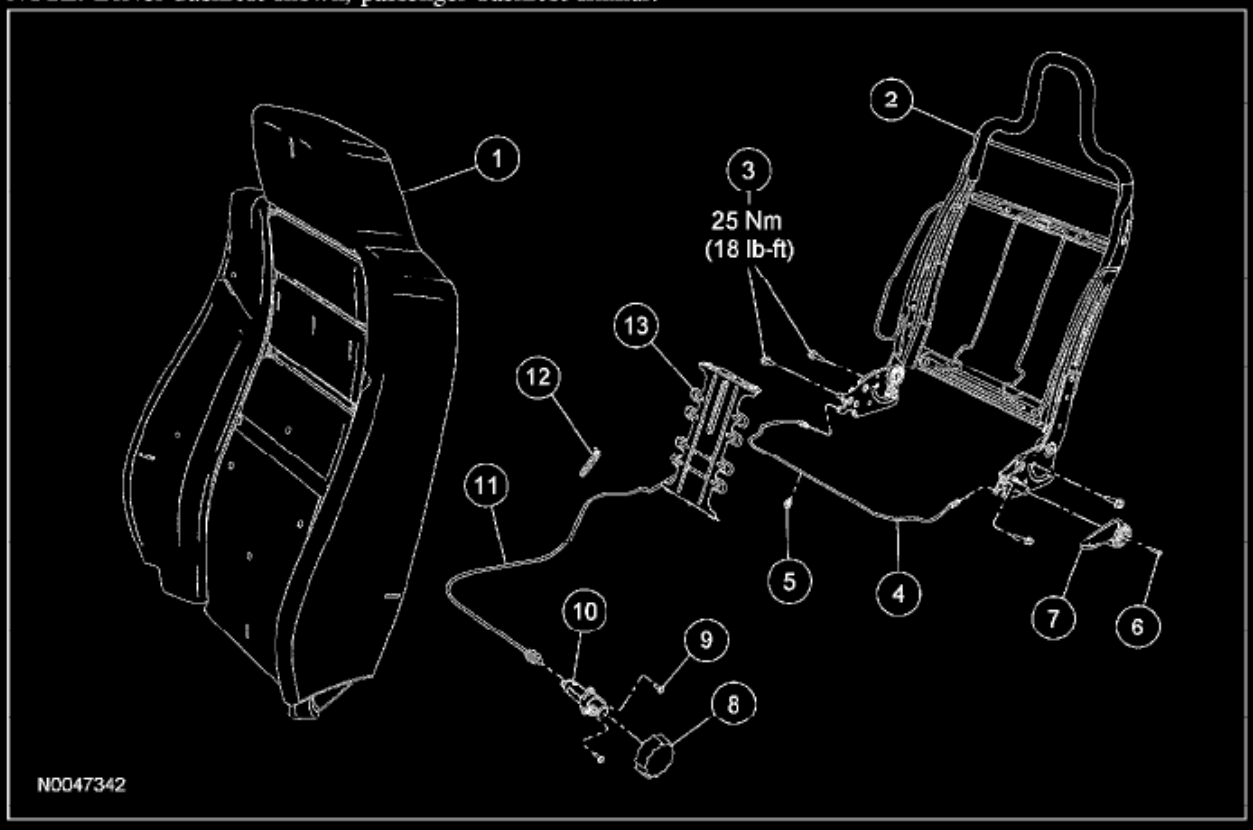
- Position the opening panel outward and release the retaining clips.



3. To install, reverse the removal procedure.

Seat Backrest, Front, 40 Percent

NOTE: Driver backrest shown, passenger backrest similar.



Item	Part Number	Description
1	64416/64810	Backrest trim cover/foam pad
2	61018	Backrest frame
3	60108	Backrest to cushion bolts (4 required)
4	624A54	Backrest latch release cable
5	—	Pin-type retainer
6	56904	Recliner handle screw
7	610A77	Recliner handle
8	61198	Lumber adjust knob, if equipped

Item	Part Number	Description
9	000A25	Lumbar actuator screw (2 required), if equipped
10	610C00	Lumbar actuator, if equipped
11	—	Lumbar actuator cable (part of 62222), if equipped
12		Tie strap, if equipped
13	62222	Lumbar support, if equipped

(Continued)

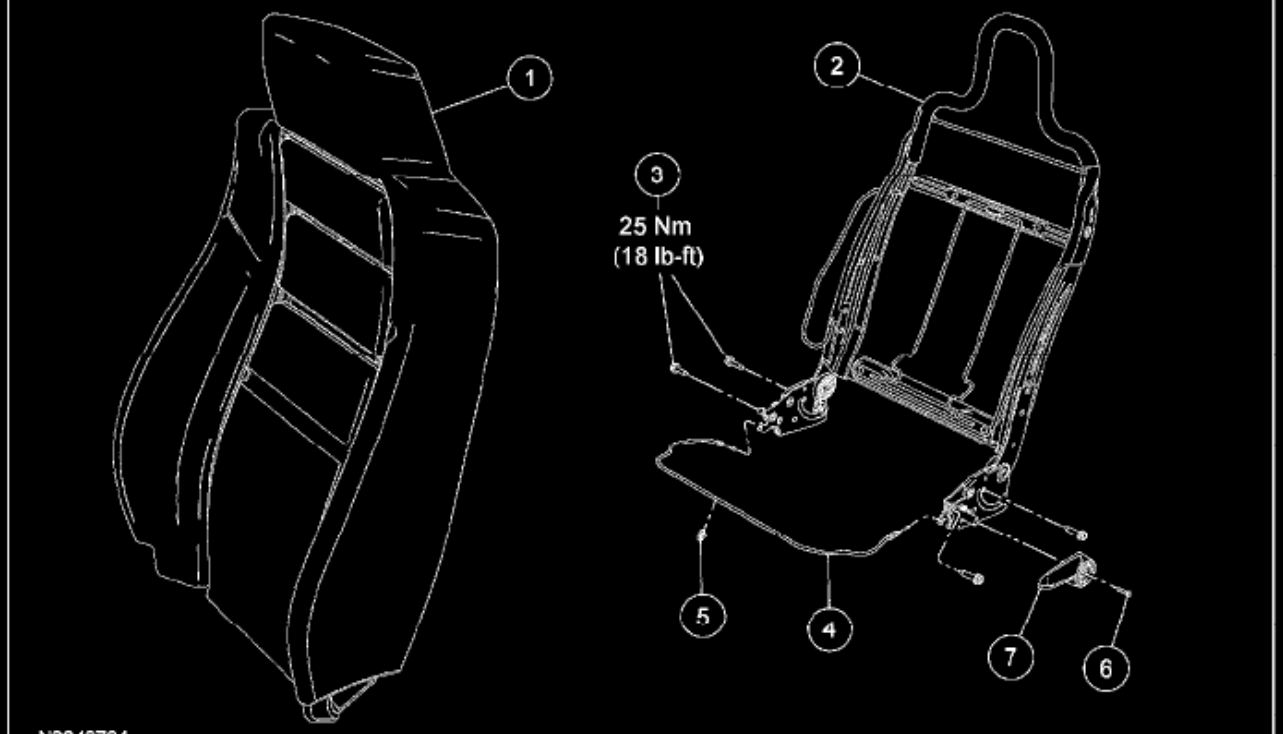
Arm Rest: Service and Repair

SEAT ARMREST - 60 PERCENT

Exploded View

Seat Backrest, Front, 40 Percent

Seat Backrest, Front, 60 Percent

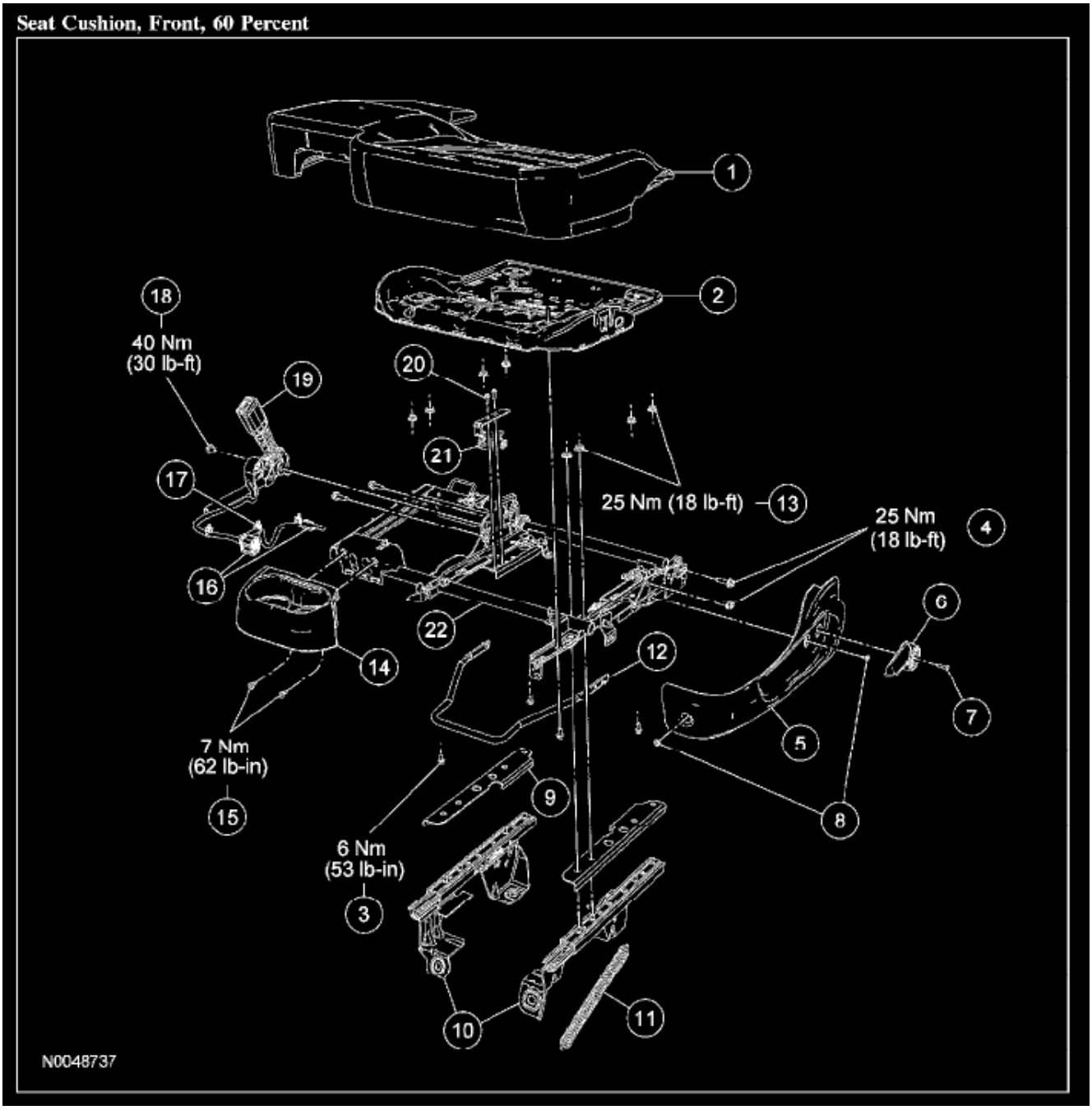


Item	Part Number	Description
1	64416/64810	Backrest trim cover/foam pad
2	61018	Backrest frame
3	60108	Backrest-to-cushion bolts (4 required)
4	624A54	Backrest latch release cable

Item	Part Number	Description
5	—	Pin-type retainer
6	56904	Recliner handle screw
7	610A77	Recliner handle

(Continued)

Seat Backrest, Front, 60 Percent



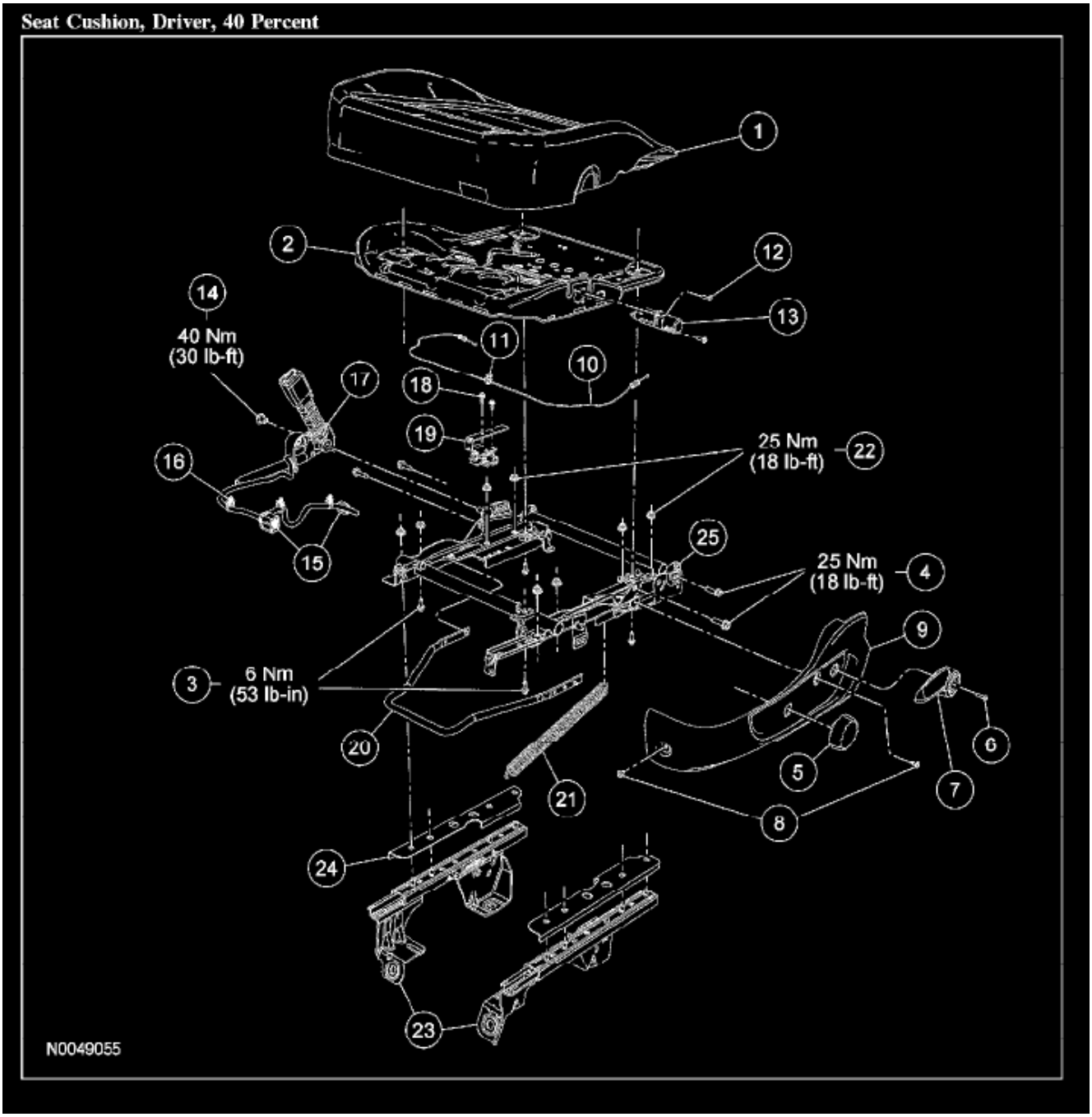
Seat Cushion, Front, 60 Percent (Part 1)

Item	Part Number	Description
1	62900/632A22	Cushion trim cover/foam pad
2	63100	Cushion frame
3	60108	Seat track-to-cushion frame bolt (4 required)
4	60108	Backrest-to-cushion bolts (4 required)
5	62186	Cushion side shield
6	61736	Recliner handle
7	55927	Recliner handle screw
8	000A25	Side shield screws (2 required)
9	617A46	Seat track reinforcement (2 required)
10	61704/61705	Seat track rails
11	61828	Seat track assist spring
12	61736	Seat track adjustment handle
13	W520413	Rail-to-seat track nuts (8 required)

(Continued)

Item	Part Number	Description
14	—	Cup holder
15	000A25	Cup holder mounting screws (2 required)
16	—	Electrical connectors (part of 61203)
17	—	Pin-type retainer (3 required)
18	000A25	Safety belt buckle pretensioner nut
19	61203	Safety belt buckle pretensioner
20	—	Seat position sensor and bracket screw (2 required)
21	14B416	Seat position sensor and bracket
22	613B20	Seat track

Seat Cushion, Front, 60 Percent (Part 2)



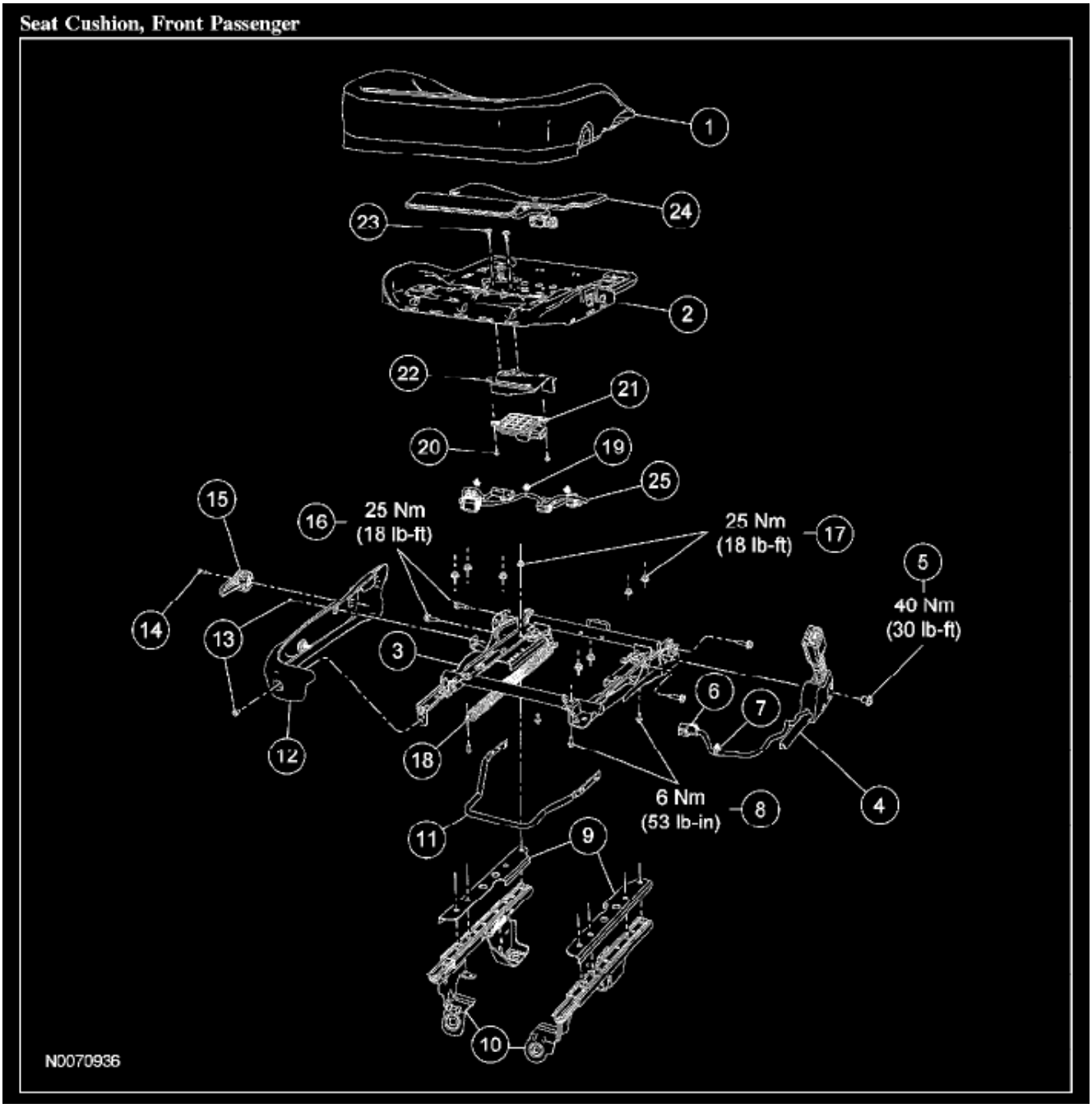
Seat Cushion, Driver, 40 Percent (Part 1)

Item	Part Number	Description
1	62900/632A22	Cushion trim cover/foam pad
2	63100	Cushion frame
3	60108	Seat track-to-cushion frame bolts (4 required)
4	60108	Backrest-to-cushion bolts (4 required)
5	61198	Lumbar adjustment knob
6	55927	Recliner handle screw
7	61736	Recliner handle
8	000A25	Side shield screws (2 required)
9	62186	Cushion side shield
10	624A54	Backrest latch release cable
11	—	Pin-type retainer
12	000A25	Lumbar actuator screw (2 required)
13	610C00	Lumbar actuator
14	000A25	Safety belt buckle pretensioner nut

(Continued)

Item	Part Number	Description
15	—	Electrical connectors (part of 61203)
16	—	Pin-type retainer (3 required)
17	61203	Safety belt buckle pretensioner
18	—	Seat position sensor screw (2 required)
19	14B416	Seat track position sensor
20	61736	Seat track adjustment handle
21	61828	Seat track assist spring
22	W520413	Rail-to-seat track nuts (8 required)
23	61704/61705	Seat track rails
24	617A46	Seat track reinforcement (2 required)
25	620B20	Seat track

Seat Cushion, Driver, 40 Percent (Part 2)



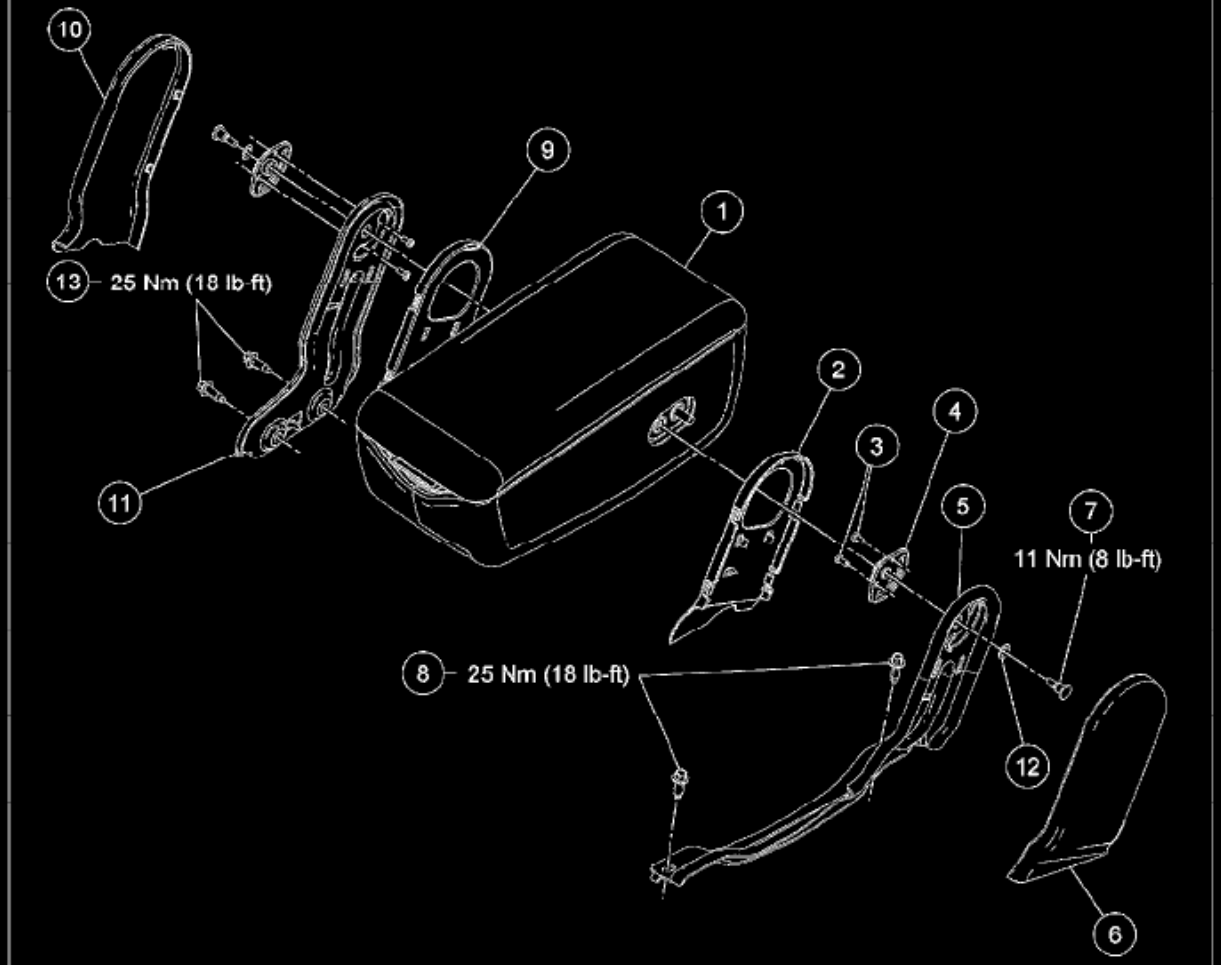
Seat Cushion, Front Passenger (Part 1)

Item	Part Number	Description
1	62900/603B02	Cushion trim cover/foam pad
2	63100	Cushion frame
3	613B20	Seat track
4	61202	Safety belt buckle pretensioner
5	000A25	Safety belt buckle pretensioner nut
6	—	Electrical connector (part of 61202)
7	—	Pin-type retainer
8	60108	Seat track-to-cushion frame bolts (4 required)
9	617A46	Seat track reinforcements
10	61704/61705	Seat track rails
11	61736	Seat track adjustment handle
12	62186	Cushion side shield
13	000A25	Side shield screws (2 required)
14	55927	Recliner handle screw
15	61736	Recliner handle
16	60108	Backrest-to-cushion bolts (4 required)
17	W520413	Rail-to-seat track nuts (8 required)
18	61828	Seat track assist spring
19	—	Pin-type retainer (3 required)
20	—	Screw (2 required)
21	—	Occupant classification system module (OCSM) (part of 603B02)
22	—	OCSM bracket
23	—	Screw (2 required)
24	—	OCS (bladder, hose with pressure sensor, OCSM and seat wiring harness) (part of 603B02)
25	14C719	Wiring harness

(Continued)

Seat Cushion, Front Passenger (Part 2)

Seat Armrest, Front, 60 Percent



Item	Part Number	Description
1	644A22	Armrest
2	672A28B	LH inner trim cover
3	—	Pivot bracket screws (4 required)
4	63076C	Pivot bracket (2 required)
5	63076A	LH armrest bracket
6	672A28A	LH outer trim cover
7	—	Armrest pivot bolts (2 required)
8	—	LH armrest bracket-to-seat frame bolts (2 required)

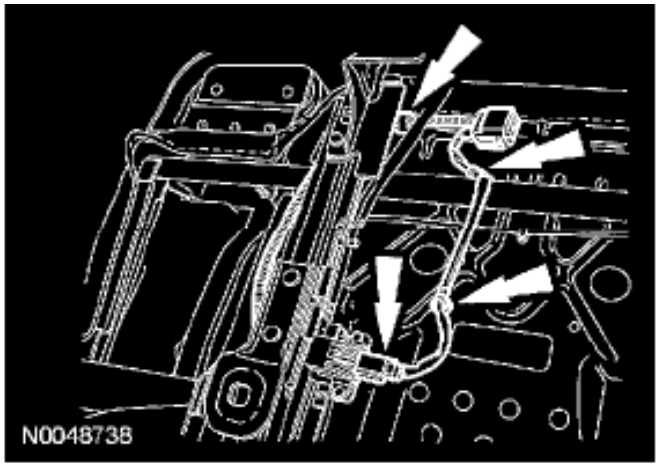
Item	Part Number	Description
9	672A28B	RH inner trim cover
10	672A28A	RH outer trim cover
11	63076B	RH armrest bracket
12	—	Washer (2 required)
13	—	RH armrest bracket-to-seat frame bolts (2 required)

(Continued)

Seat Armrest, Front, 60 Percent

Removal

WARNING: Never probe the electrical connectors on safety belt buckle/retractor pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors, which increases the risk of serious personal injury or death.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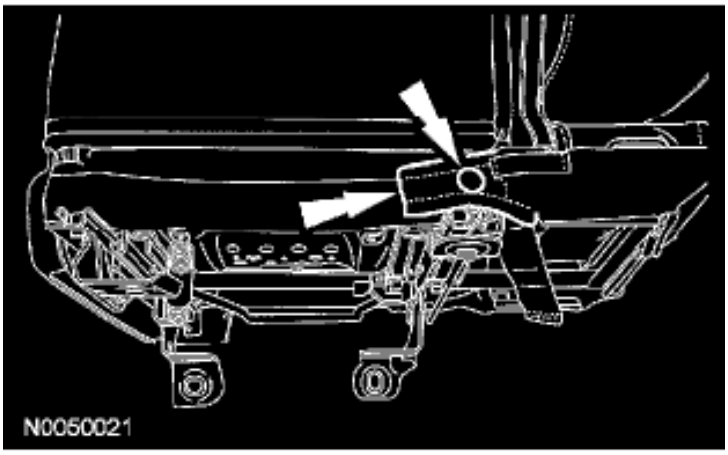
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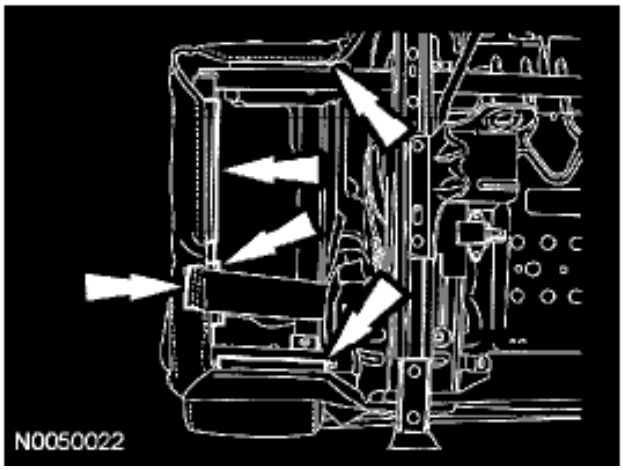
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NOTE: -

The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

- The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1. Remove the 60 percent bench seat. 2. Remove the cup holder and 2 cup holder mounting screws, if equipped.

- Pull upward and forward to release the cup holder.

3. NOTE: Note the routing of the seat wiring harness for installation.

Detach the wiring harness from the cushion. -

Disconnect the seat position sensor electrical connector.

- Detach the wiring harness and electrical connector pin-type retainers.

- Route out the wiring harness.

4. Remove the nut and safety belt buckle pretensioner.

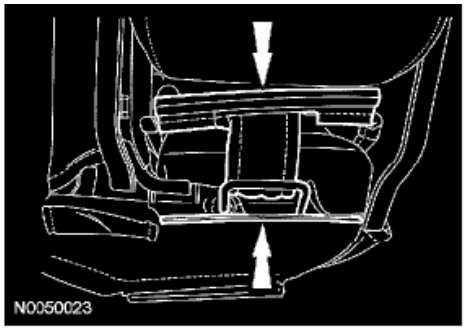
- To install, tighten to 40 Nm (30 lb-ft).

5. Release the rear hook-and-loop strip and detach the pin-type retainer.

6. Release the underside hook-and-loop strip and J-clips.

7. Release the rear J-clip below the armrest and position aside the material from around the child safety seat tether anchor.

- Route out the trim flap through the child safety seat tether anchor.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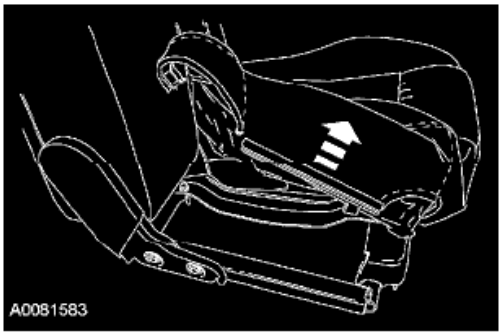
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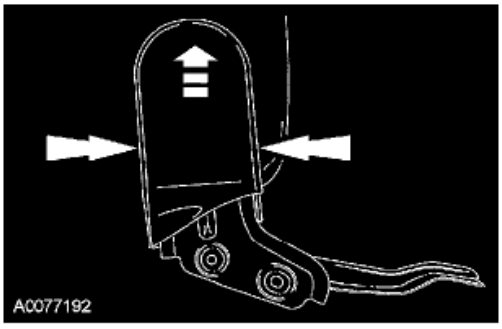
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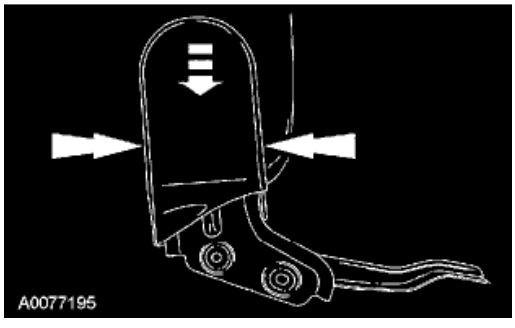
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8. Lift the cushion cover and foam pad for access to the RH and LH armrest bracket-to-seat frame bolts.

9. Remove the 2 RH and 2 LH armrest bracket-to-seat frame bolts and remove the armrest assembly.

10. Release the trim cover clips and slide off the LH inner/outer and RH inner/outer trim covers (RH side shown).

11. Remove the 2 armrest pivot bolts and remove the LH and RH armrest brackets.

Installation

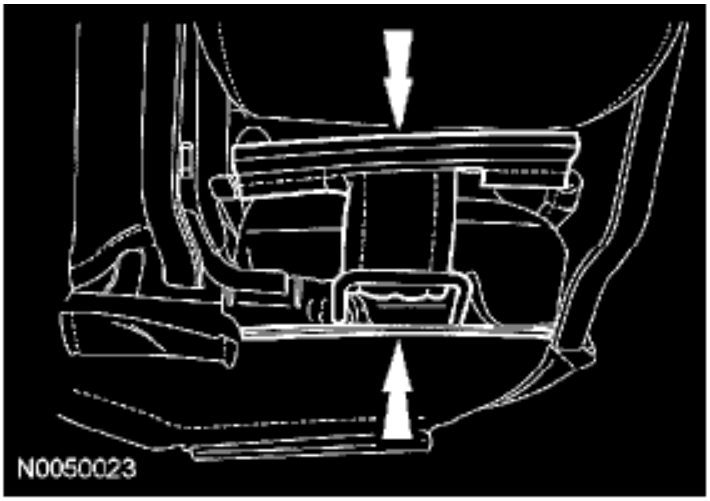
1. Install the LH and RH armrest brackets to the armrest and install the 2 armrest pivot bolts.

- Tighten to 11 Nm (8 lb-ft).

2. Slide on the LH inner/outer and RH inner/outer trim covers and clip in place (RH side shown).

3. Install the armrest assembly and install the 2 LH and 2 RH armrest bracket-to-seat frame bolts.

- Tighten to 25 Nm (18 lb-ft).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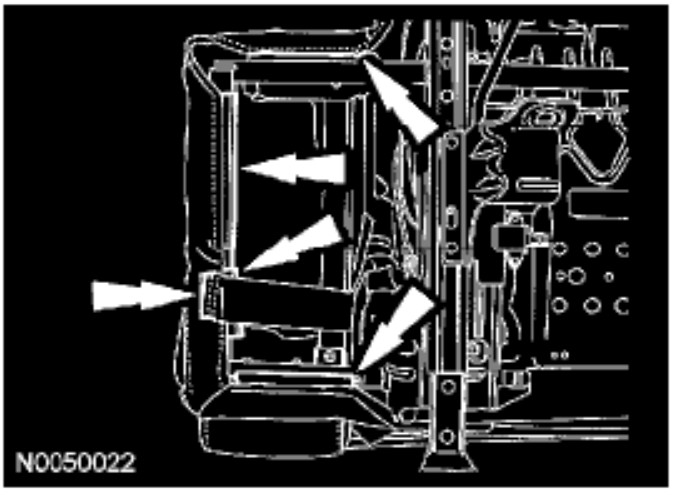
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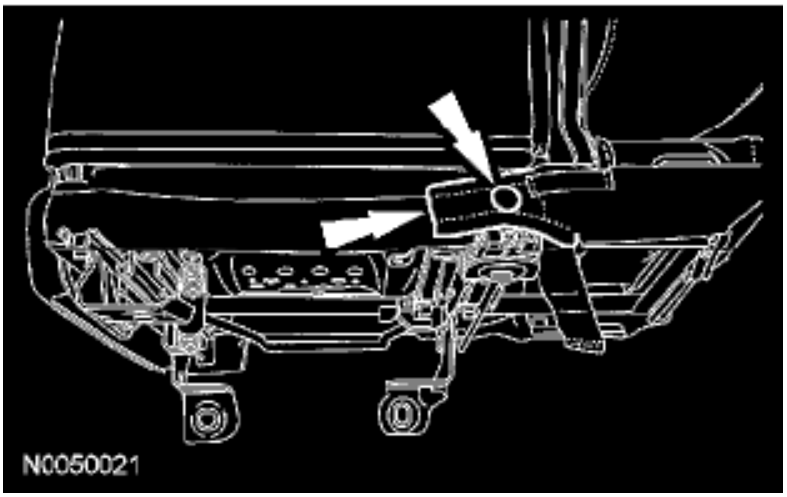

N0050021

4. Position the seat cushion foam pad and seat cover down. 5. Position the material around the child safety seat tether anchor and fasten the rear J-clip below the armrest.

- Route the trim flap through the child safety seat tether anchor.

6. Fasten the J-clips and fasten the underside hook-and-loop strip.

7. Install the pin-type retainer and fasten the rear hook-and-loop strip.

8. Install the safety belt buckle pretensioner and install the nut.

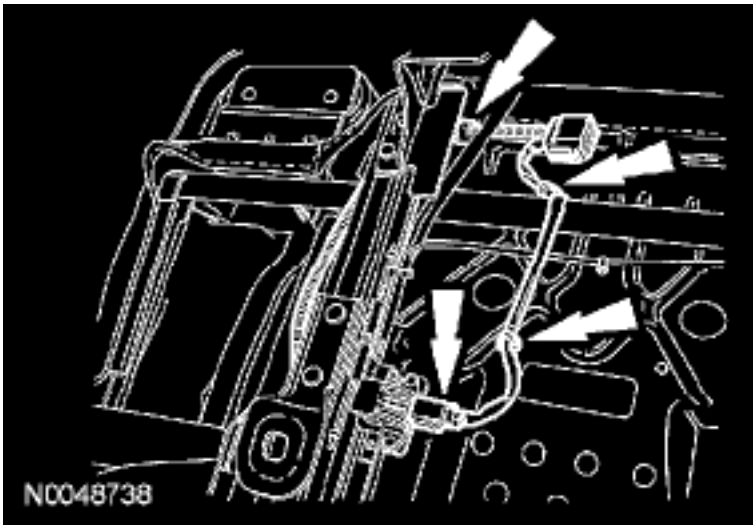
- Tighten to 40 Nm (30 lb-ft).

9. Route the wiring harness to the cushion.

- Route the wiring harness.

- Fasten the wiring harness and electrical connector pin-type retainers.

- Connect the seat position sensor electrical connector.

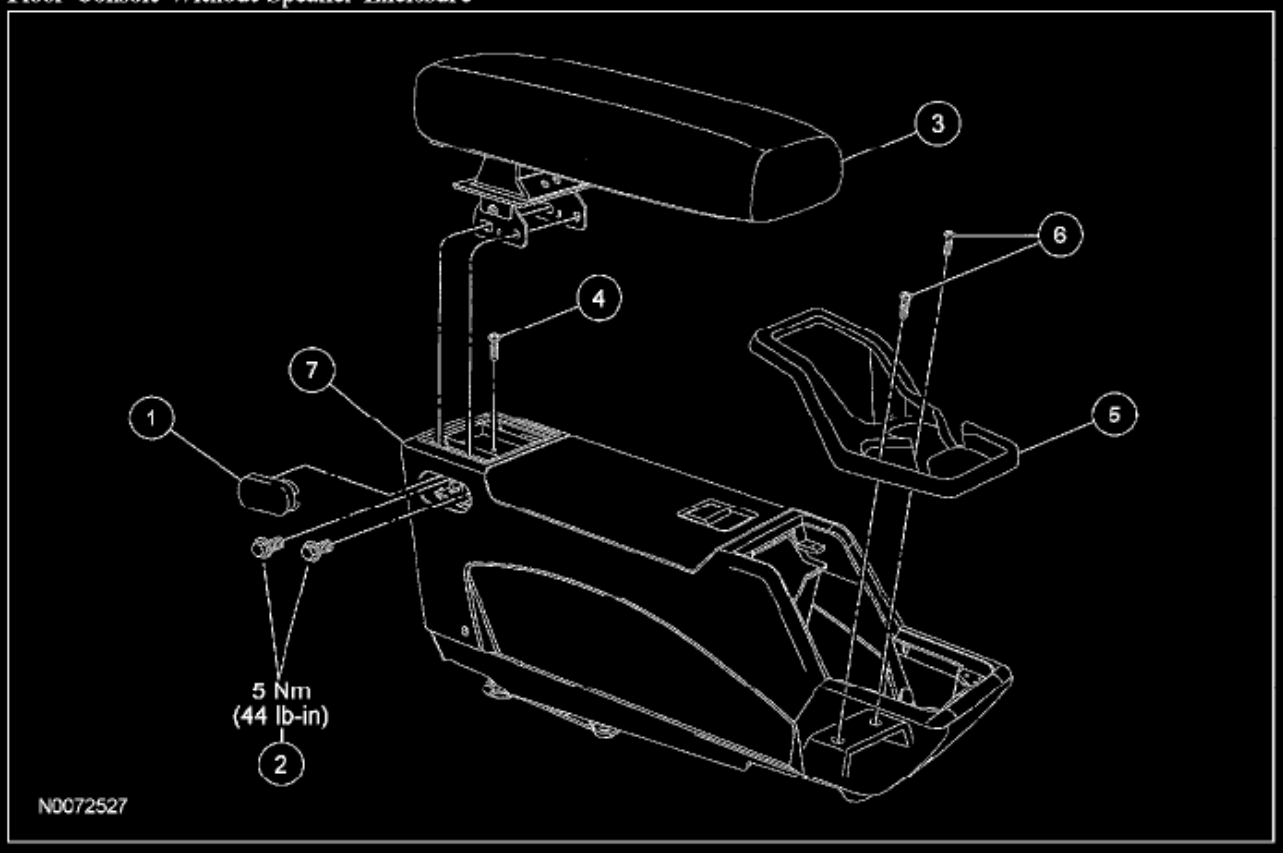


10. Install the 2 cup holder mounting screws and attach the cup holder.

- Tighten to 7 Nm (62 lb-in).

11. Install the 60 percent bench seat.

Floor Console Without Speaker Enclosure



Item	Part Number	Description
1	047A62	Floor console armrest bolt cover
2	W705962	Floor console armrest bolts (4 required)
3	644A22	Floor console armrest
4	—	Floor console rear screw

(Continued)

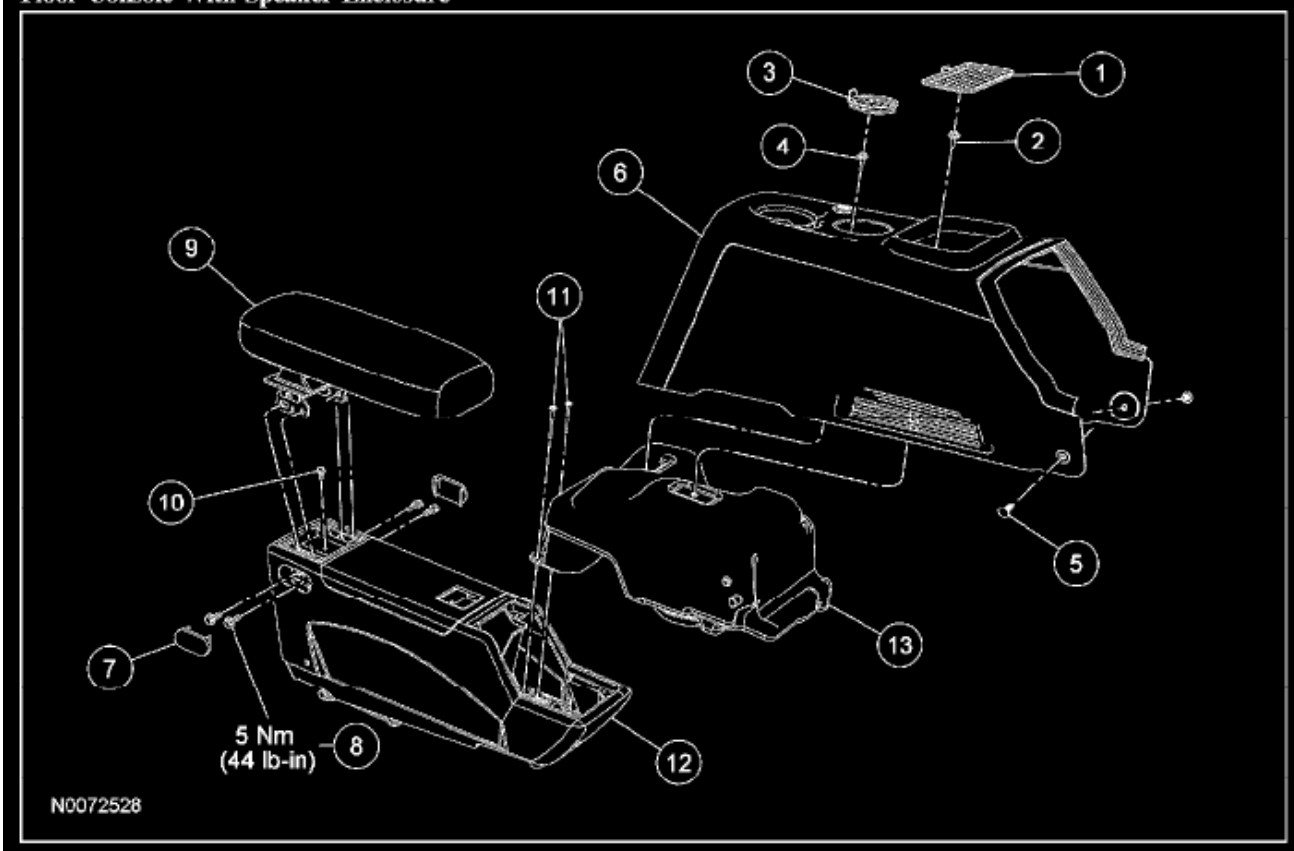
Item	Part Number	Description
5	045C22	Beverage tray
6	385754	Floor console front screws (2 required)
7	045A36	Floor console

Console: Service and Repair

FLOOR CONSOLE

Floor Console Without Speaker Enclosure

Floor Console With Speaker Enclosure



Item	Part Number	Description
1	13586B	Floor console storage tray mat
2	W710006	Floor console storage tray screw
3	13586A	Floor console front cup holder mat
4	W710006	Floor console front cup holder screw
5	N807154	Floor console push-pin retainer (2 required)
6	045A36B	Floor console front section
7	047A62	Floor console armrest bolt cover

Item	Part Number	Description
8	W705962	Floor console armrest bolt (4 required)
9	644A22	Floor console armrest
10	—	Floor console rear screw
11	391010	Floor console front screws (2 required)
12	045A36A	Floor console
13	18C804A	Speaker enclosure

(Continued)

Floor Console With Speaker Enclosure

Removal and Installation

Vehicles with a speaker enclosure

1. Remove the floor console storage tray mat and screw. 2. Remove the floor console front cup holder mat and screw. 3. Remove the LH and RH floor console push-pin retainers. 4. Remove the floor console front section.

All vehicles

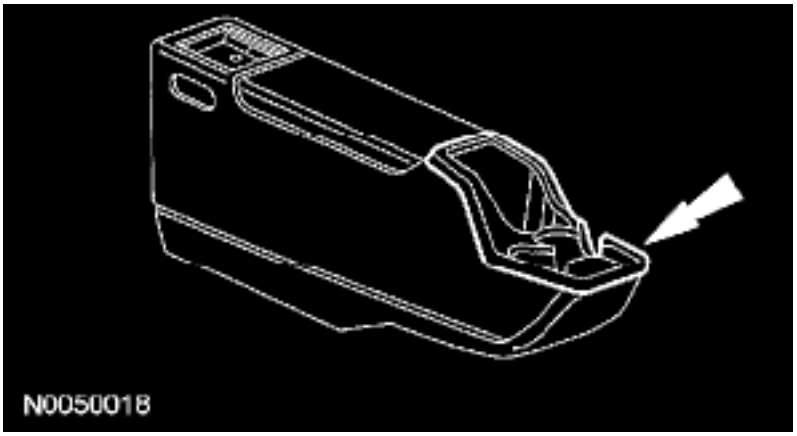
5. Move the front seats to the full forward position. 6. Remove the floor console armrest.

- Remove the LH and RH floor console armrest bolt covers.

- Remove the LH and RH floor console armrest bolts.

- To install, tighten to 5 Nm (44 lb-in).

7. Remove the floor console rear screw. 8. Move the front seats to the full rearward position.



Vehicles without a speaker enclosure

9. Remove the beverage tray.

All vehicles

10. Remove the 2 floor console front screws. 11. Remove the floor console.

- If equipped, lift the rear of the speaker enclosure slightly upward.

12. To install, reverse the removal procedures.

Special Tool(s)

ST2834-A

Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Air Bag(s) Arming and Disarming: Service and Repair Supplemental Restraint System (SRS) Depowering and Repowering

SUPPLEMENTAL RESTRAINT SYSTEM (SRS) DEPOWERING AND REPOWERING

Special Tool(s)

Special Tool(s)

Depowering Procedure

WARNING:

- Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.

- To reduce the risk of accidental deployment, do not use any memory saver devices. Failure to follow this instruction may result in serious personal injury or death.

NOTE:

- The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate an SRS fault.

- The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1. Turn all vehicle accessories OFF. 2. Turn the ignition switch to OFF. 3. At the smart junction box (SJB), located below the RH side of the instrument panel, remove the RH lower cowl trim panel and remove the

restraints control module (RCM) fuse 8 (10A) from the SJB.

4. Turn the ignition ON and visually monitor the air bag warning indicator for at least 30 seconds. The air bag warning indicator will remain lit

continuously (no flashing) if the correct RCM fuse has been removed. If the air bag warning indicator does not remain lit continuously, remove the correct RCM fuse before proceeding.

5. Turn the ignition OFF.

6. WARNING: Always deplete the backup power supply before repairing or installing any new front or side air bag supplemental restraint

system (SRS) component and before servicing, removing, installing, adjusting or striking components near the front or side impact sensors or the restraints control module (RCM). Nearby components include doors, instrument panel, console, door latches, strikers, seats and hood latches.

Refer to the Description and Operation portion of Air Bag Systems for location of the RCM and impact sensor(s).

To deplete the backup power supply energy, disconnect the battery ground cable and wait at least 1 minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Failure to follow these instructions may result in serious personal injury or death in the event of an accidental deployment.

Disconnect the battery ground cable and wait at least one minute.

Repowering Procedure

1. Turn the ignition switch from OFF to ON. 2. Install the RCM fuse 8 (10A) to the SJB and install the RH lower cowl trim panel.

3. WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is

connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

Connect the battery ground cable.

4. Prove out the SRS as follows:

Turn the ignition key from ON to OFF. Wait 10 seconds, then turn the key back to ON and visually monitor the air bag warning indicator with the air bag modules installed. The air bag warning

indicator will light continuously for approximately 6 seconds and then turn off. If an air bag SRS fault is present, the air bag warning indicator will: -

fail to light.

- remain lit continuously.

- flash at a 5Hz rate (RCM not configured).

The air bag warning indicator may not illuminate until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON position. This is the time required for the RCM to complete the testing of the SRS. If the air bag warning indicator is inoperative and a SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag warning indicator and any SRS fault discovered must be diagnosed and repaired.

Clear all continuous RCM and occupant classification system module (OCSM) DTCs using a scan tool.

Special Tool(s)

ST2621-A	Diagnostic Tool, Restraint System (2 required) 418-F395
ST2512-A	Diagnostic Tool, Restraint System 418-F403
ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Air Bag(s) Arming and Disarming: Service and Repair Supplemental Restraint System (SRS) Deactivation and Reactivation

SUPPLEMENTAL RESTRAINT SYSTEM (SRS) DEACTIVATION AND REACTIVATION

Special Tool(s)

Deactivation Procedure

WARNING:

- Always carry or place a live air bag module with the air bag and deployment door/trim cover/tear seam pointed away from the body. Do not set a live air bag module down with the deployment door/trim cover/tear seam face down. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

- Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which

increases the risk of serious personal injury or death.

- To reduce the risk of accidental deployment, do not use any memory saver devices. Failure to follow this instruction may result in serious personal injury or death.

NOTE:

- The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

- No restraint system diagnostic tools are available for the safety belt buckle pretensioners. If the ignition switch is set to RUN or START with either the driver or passenger safety belt buckle pretensioner electrical connector disconnected, the DTCs for an open circuit fault will be active.

- The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1. Turn all vehicle accessories OFF. 2. Turn the ignition switch to OFF. 3. At the smart junction box (SJB), located below the RH side of the instrument panel, remove the restraints control module (RCM) fuse 8 (10A)

from the SJB.

4. Turn the ignition ON and visually monitor the air bag warning indicator for at least 30 seconds. The air bag warning indicator will remain lit

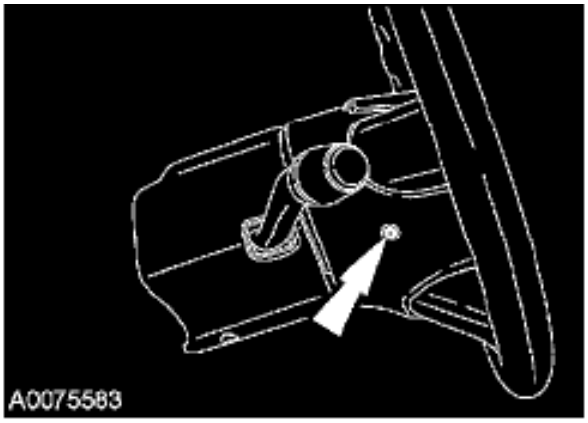
continuously (no flashing) if the correct RCM fuse has been removed. If the air bag warning indicator does not remain lit continuously, remove the correct RCM fuse before proceeding.

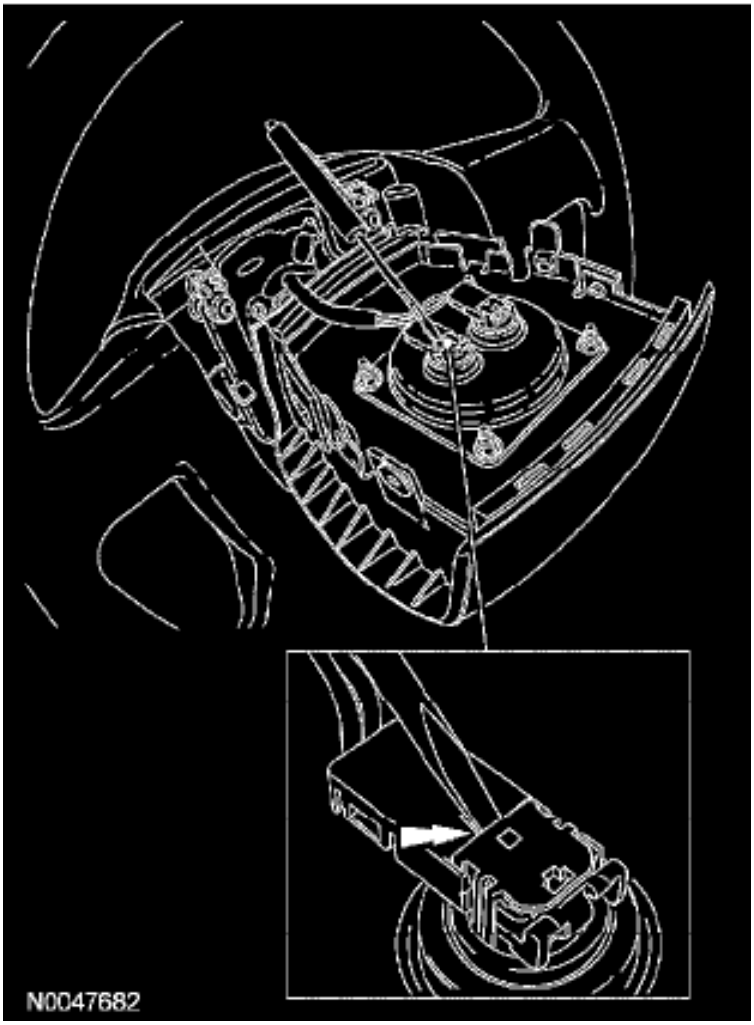
5. Turn the ignition OFF.

6. WARNING: Always deplete the backup power supply before repairing or installing any new front or side air bag supplemental restraint

system (SRS) component and before servicing, removing, installing, adjusting or striking components near the front or side impact sensors or the restraints control module (RCM). Nearby components include doors, instrument panel, console, door latches, strikers, seats and hood latches.

Refer to the Description and Operation portion of Air Bag Systems for location of the RCM and impact sensor(s).





To deplete the backup power supply energy, disconnect the battery ground cable and wait at least 1 minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Failure to follow these instructions may result in serious personal injury or death in the event of an accidental deployment.

Disconnect the battery ground cable and wait at least 1 minute.

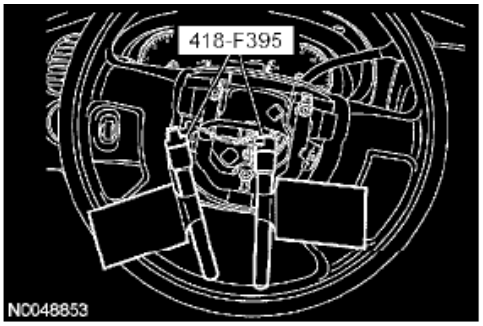
7. Remove the 2 driver air bag module bolts (1 shown).

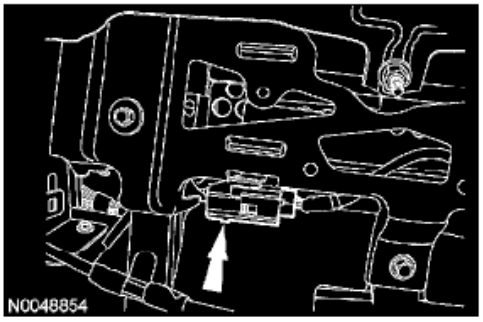
8. CAUTION: Do not pull the driver air bag module electrical connectors out by the locking buttons. Damage to the locking buttons may

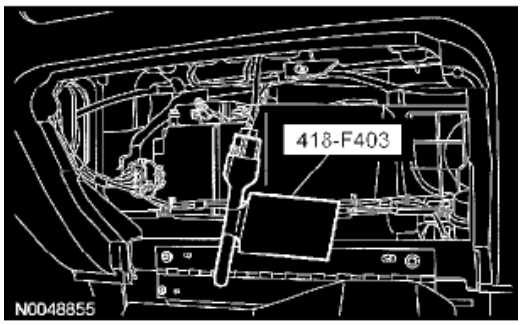
occur.

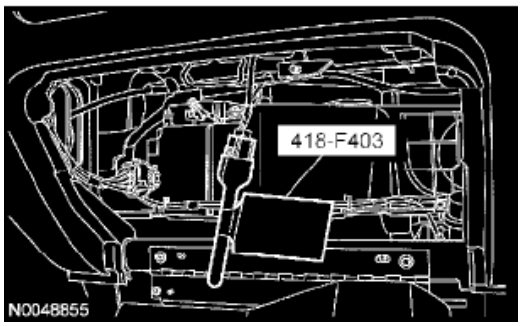
Using a small screwdriver as shown, lift up and release the locking buttons on the driver air bag module electrical connectors. With the locking buttons released, remove the electrical connectors and the driver air bag module.

9. Attach the restraint system diagnostic tools to the clockspring electrical connectors at the top of the steering column.









10. Open the glove compartment door fully to access the passenger air bag electrical connector.
11. Release the tab and disconnect the passenger air bag module electrical connector.

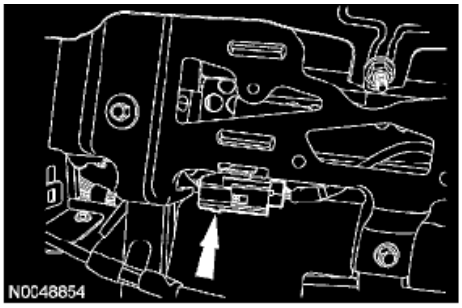
12. Attach the restraint system diagnostic tool to the vehicle harness side of the passenger air bag module electrical connector.

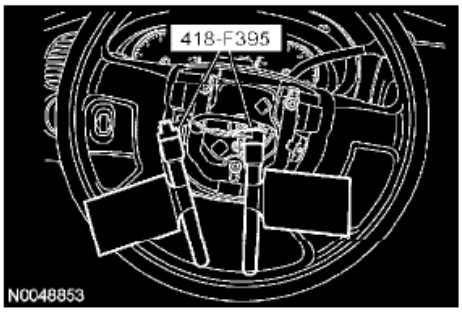
13. Install the RCM fuse 8 (10A) to the SJB. 14. Connect the battery ground cable.

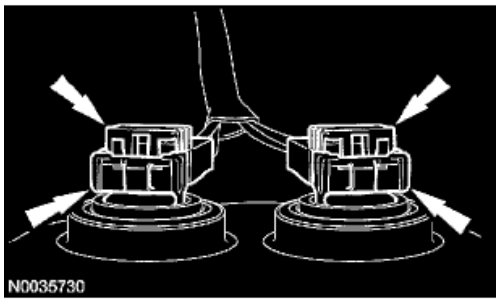
Reactivation Procedure

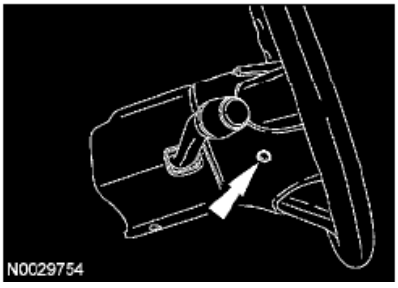
1. Remove the RCM fuse 8 (10A) from the SJB. 2. Disconnect the battery ground cable and wait at least one minute. 3. Remove the restraint system diagnostic tool from the vehicle harness side of the passenger air bag module electrical connector.

4. Connect the passenger air bag module electrical connector.









5. Close the glove compartment door. 6. Remove the restraint system diagnostic tools from the clockspring electrical connectors at the top of the steering column.

7. CAUTION:

- Do not install the driver air bag module electrical connectors by the locking buttons. Damage to the locking buttons may occur.

- The driver air bag module electrical connector locking buttons must be in the released position when the connector is being installed or connector damage may occur.

- The driver air bag module electrical connectors are unique and cannot be reversed when connected to the driver air bag module. Match the electrical connector key to the keyway in the driver air bag module. Do not force the electrical connectors into the driver air bag module. Damage to the connector or component may occur.

With the locking buttons released, install the driver air bag module electrical connectors fully into the driver air bag module and seat the locking buttons.

8. Install the 2 driver air bag module bolts (1 shown).

- Tighten to 6 Nm (53 lb-in).

9. WARNING: Remove restraint system diagnostic tools from the vehicle prior to road testing. If tools are not removed, the supplemental

restraint system (SRS) device may not deploy in a crash. Failure to follow this instruction may result in serious personal injury or death

in a crash and possibly violate vehicle safety standards.

Make sure all restraint system diagnostic tool(s) that may have been installed during the repair have been removed from the vehicle and all SRS components are connected.

10. Turn the ignition from OFF to ON. 11. Install the restraint system control module fuse 8 (10A) to the SJB.

12. WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is

connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

Connect the battery ground cable.

13. Prove out the SRS as follows:

Turn the ignition key from ON to OFF. Wait 10 seconds, then turn the key back to ON and visually monitor the air bag warning indicator with the air bag modules installed. The air bag warning indicator will light continuously for approximately 6 seconds and then turn off. If an air bag SRS fault is present, the air bag warning indicator will: -

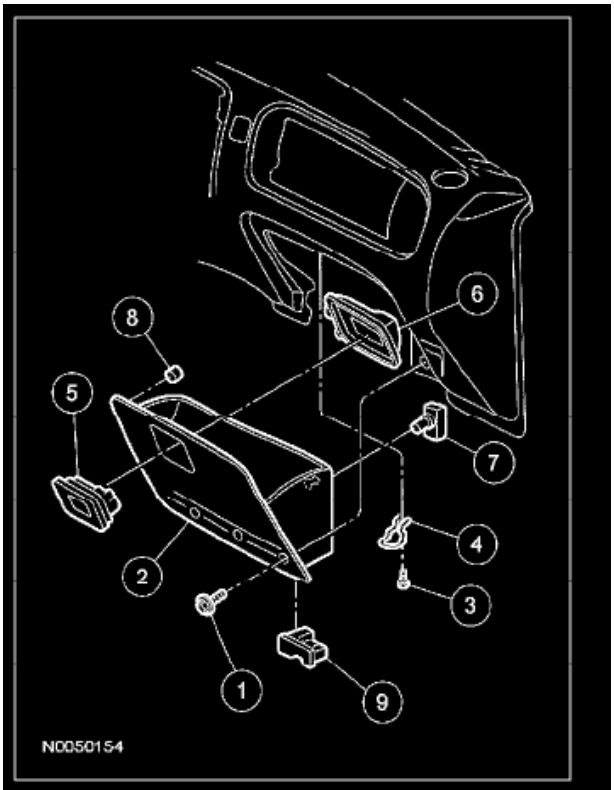
fail to light.

- remain lit continuously.

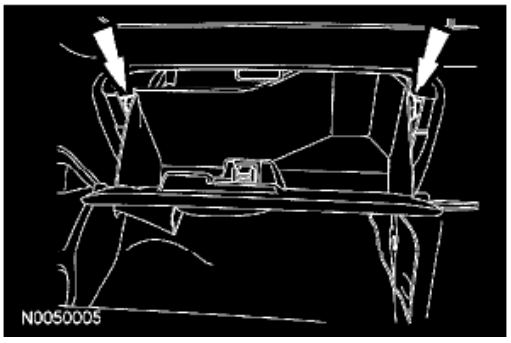
- flash at a 5Hz rate (RCM not configured).

The air bag warning indicator may not illuminate until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON position. This is the time required for the RCM to complete the testing of the SRS. If the air bag warning indicator is inoperative and a SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag warning indicator and any SRS fault discovered must be diagnosed and repaired.

Clear all continuous RCM and occupant classification system module (OCSM) DTCs using a scan tool.



Item	Part Number	Description
1	38574	Glove compartment hinge screw (2 required)
2	06072	Glove compartment door
3	—	Glove compartment striker screw
4	06064	Glove compartment striker
5	06072	Glove compartment lock
6	061A40	Glove compartment inside cover
7	06115	Glove compartment bumper
8	—	Glove compartment stud
9	15A563	Glove compartment lamp



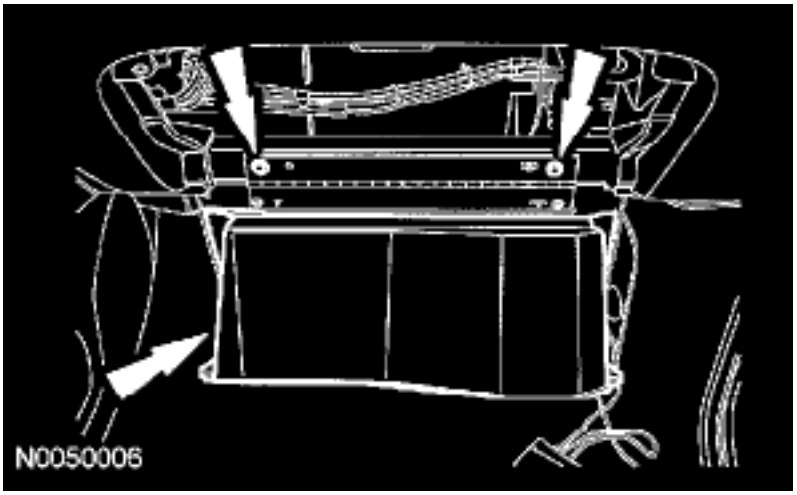
Glove Compartment: Service and Repair

GLOVE COMPARTMENT

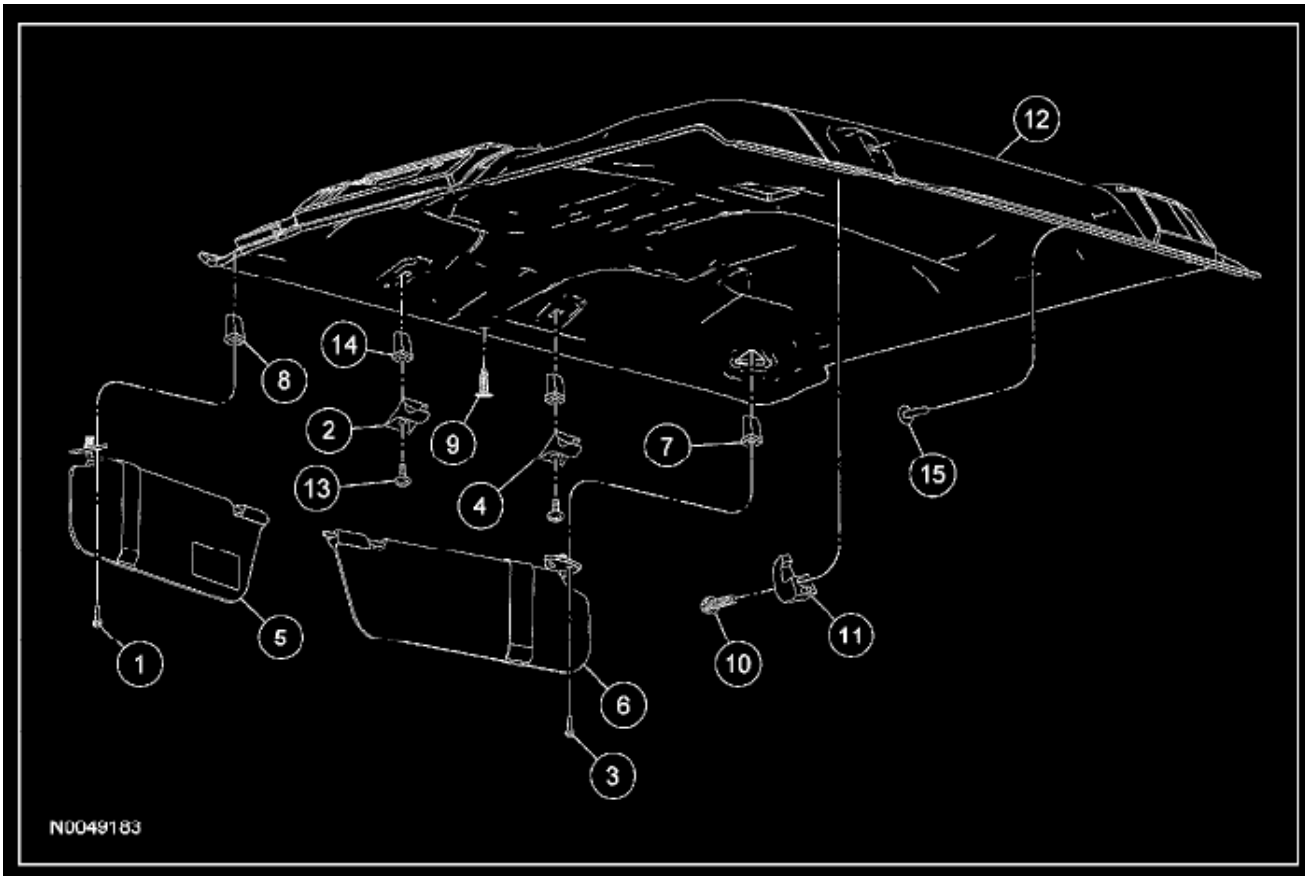
Removal and Installation

1. Open the glove compartment. 2. Depress the 2 side release tabs and allow the glove compartment to open completely.

3. Remove the 2 glove compartment screws and the glove compartment.



4. To install, reverse the removal procedure.



Item	Part Number	Description
1	N610021-S58	Sun visor screw (3 required)
2	04132	Sun visor retainer LH
3	N610021-S58	Sun visor screw (3 required)
4	04132	Sun visor retainer RH
5	04104	Sun visor LH
6	04104	Sun visor RH
7	W711612-S300	Sun visor nut
8	W711612-S300	Sun visor nut
9	5802354	Headliner retainer
10	N806996-S424	Coat hook screw
11	29024	Coat hook
12	51944	Headliner
13	N610021-S300	Sun visor retainer screw (2 required)
14	W711612-S300	Sun visor retainer nut (2 required)
15	5802354	Headliner retainer

Headliner: Service and Repair

HEADLINER

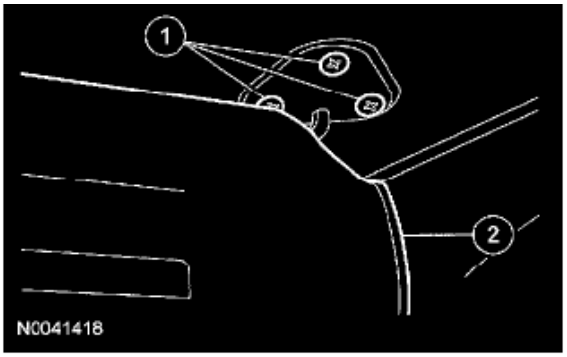
Removal and Installation

All vehicles

1. Remove the sun visors.

1 Remove the 6 screws.

2 Remove the sun visors.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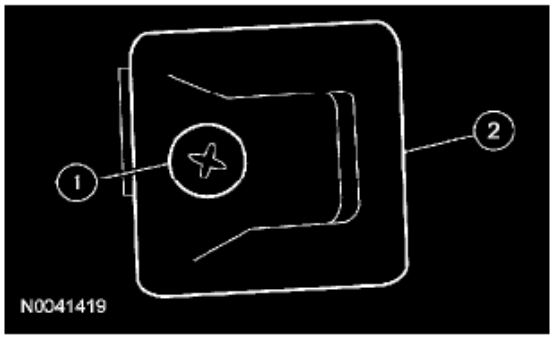
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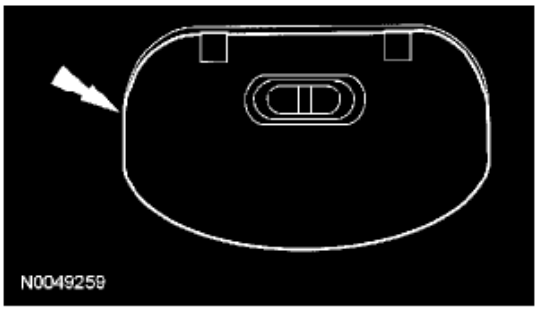
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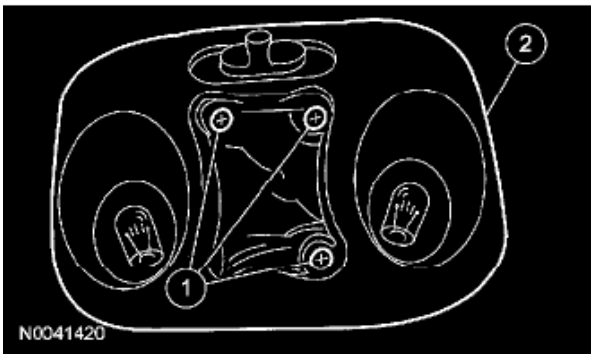

1
2
N0041420

2. Remove the sun visor brackets.

1 Remove the screws.

2 Remove the sun visor brackets.

3. Remove the dome lamp lens.

4. Remove the dome lamp.

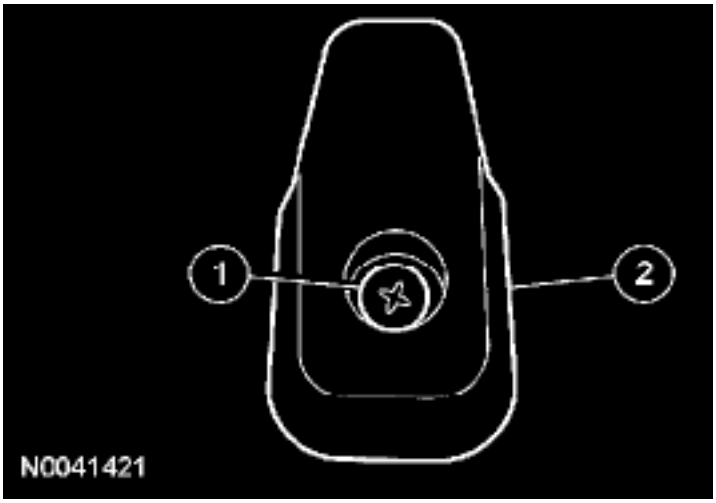
1 Remove the 3 screws.

2 Remove the dome lamp.

5. Remove the coat hooks.

1 Remove the screws.

2 Remove the coat hooks.



Regular cab only

6. Remove the B-pillar trim panels.

SuperCab 2-door only

7. Remove the C-pillar trim panels.

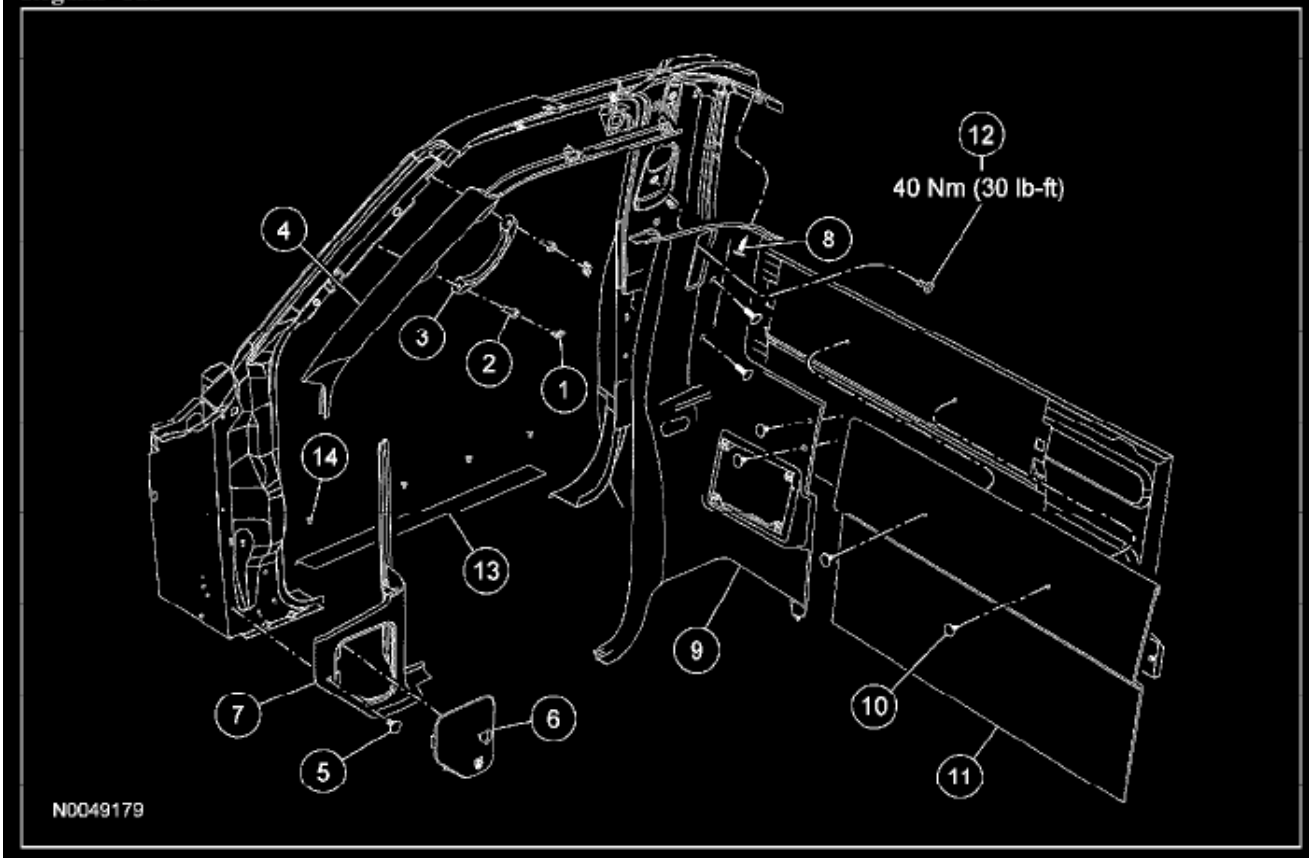
SuperCab 4-door only

8. Remove the A-pillar trim panels. 9. Remove the C-pillar trim panels.

All vehicles

10. Remove the headliner. 11. To install, reverse the removal procedure.

Regular Cab



Item	Part Number	Description
1	31458	Assist handle bolt cover (2 required)
2	N811527-S	Assist handle bolt (2 required)
3	31406	Assist handle
4	03598	A-pillar trim panel
5	W708761-S	Cowl panel retainer
6	023A98	Cowl panel cover
7	02344	Cowl panel

(Continued)

Item	Part Number	Description
8	W708761-S	Pushpin retainer (5 required)
9	278D12	B-pillar trim panel
10	W708761-S	Pushpin retainer (2 required)
11	40374	Cab rear trim panel
12	—	Safety belt guide bolt
13	13260	Scuff plate
14	N800942-S	Scuff plate screw

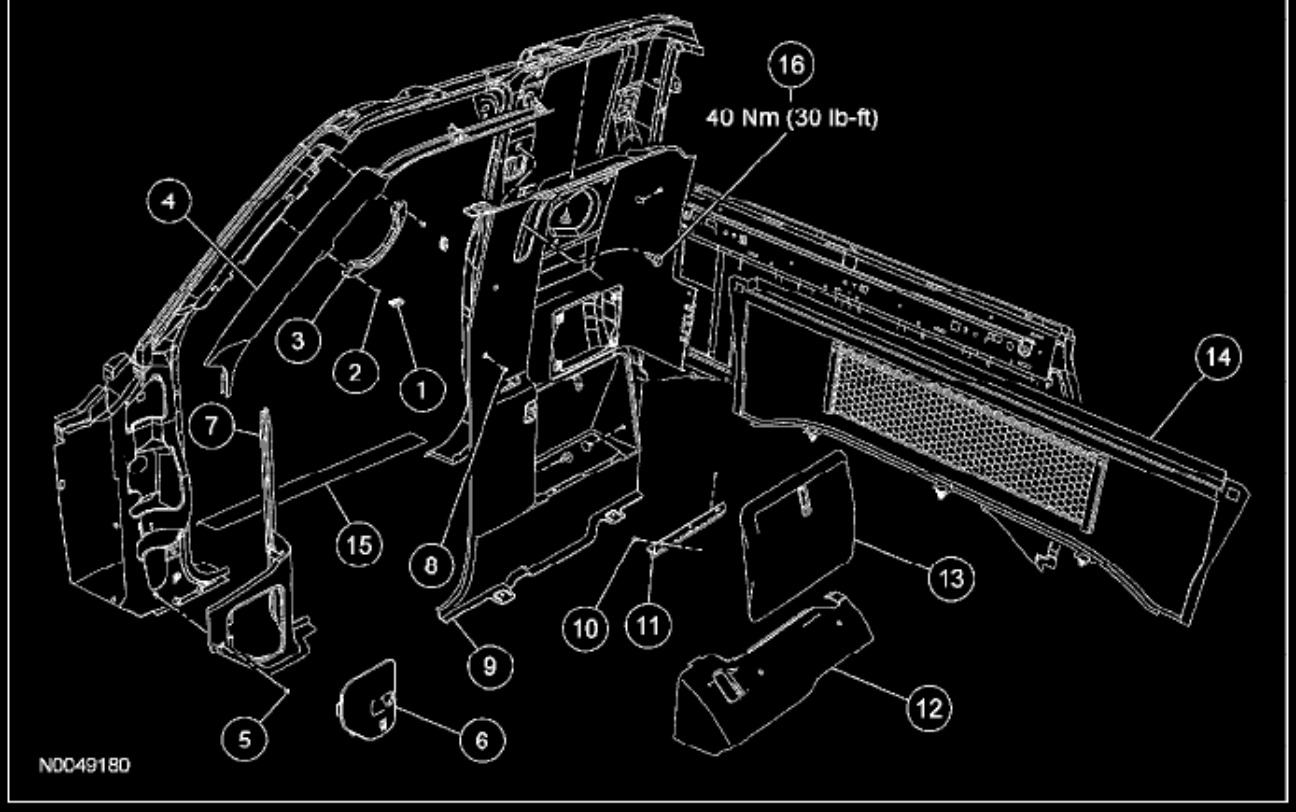
Trim Panel: Service and Repair A-Pillar Trim Panel

A-PILLAR TRIM PANEL

Exploded View

Regular Cab

2-Door SuperCab



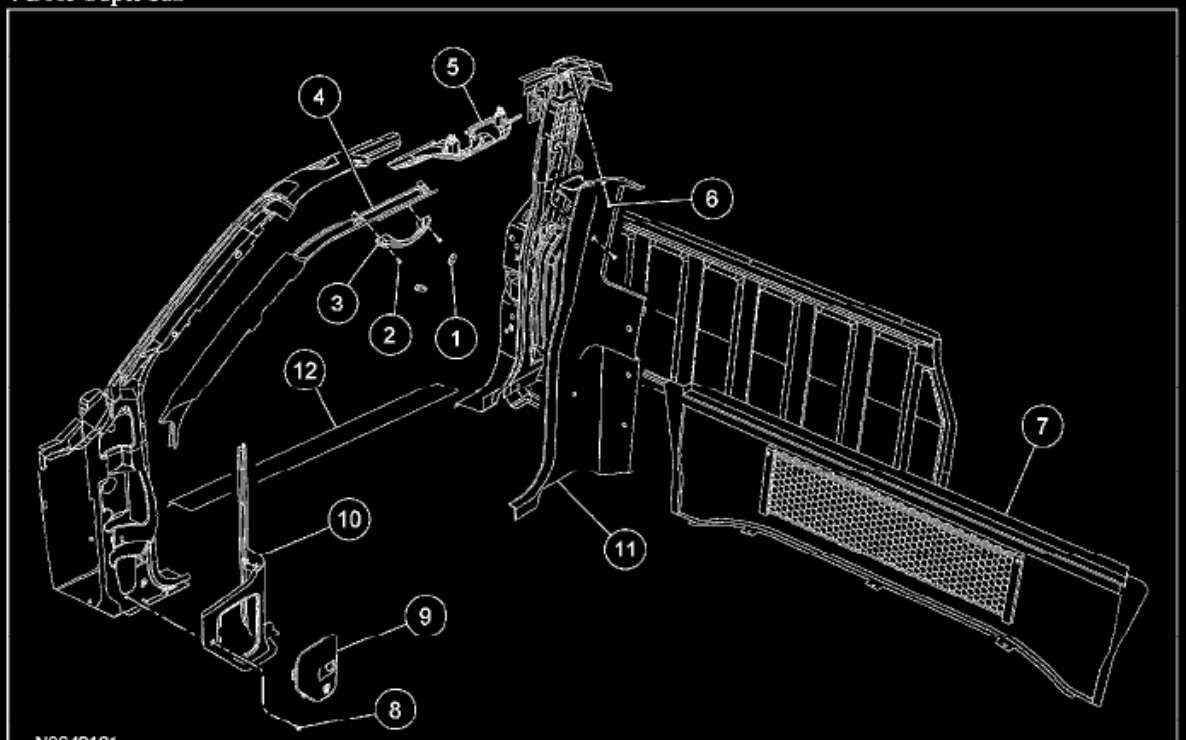
Item	Part Number	Description
1	31458	Assist handle bolt cover (2 required)
2	N811527-S	Assist handle bolt (2 required)
3	31406	Assist handle
4	03598	A-pillar trim panel
5	W708761	Cowl panel retainer
6	023A98	Cowl panel cover
7	02344	Cowl panel
8	5802354	Pushpin retainer (5 required)

Item	Part Number	Description
9	31012	B-pillar trim panel
10	386272-S	Hinge bolt (6 required)
11	31518	Seat hinge
12	31056	Seat lower trim panel
13	31012	Seat
14	40374	Cab rear trim panel
15	13260	Scuff plate
16	—	Safety belt guide bolt

(Continued)

2-Door SuperCab

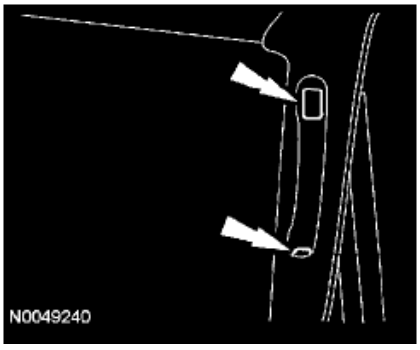
4-Door SuperCab



Item	Part Number	Description
1	31458	Assist handle bolt cover (2 required)
2	N811527-S	Assist handle bolt (2 required)
3	31406	Assist handle
4	03598	A-pillar trim panel
5	51754	Door latch striker cover
6	5802354	Pin-type retainer (4 required)
7	40374	Cab rear trim panel

(Continued)

Item	Part Number	Description
8	W708761	Cowl panel retainer
9	023A98	Cowl panel cover
10	02344	Cowl panel
11	31012	C-pillar trim panel
12	13260	Scuff plate



4-Door SuperCab

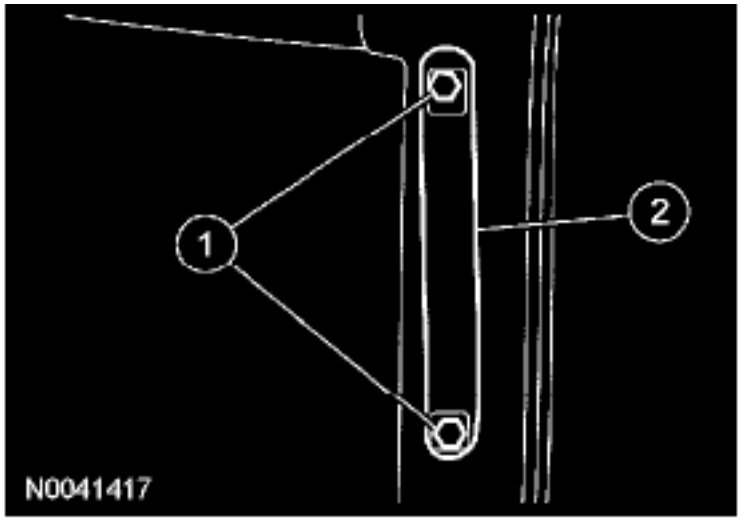
Removal and Installation

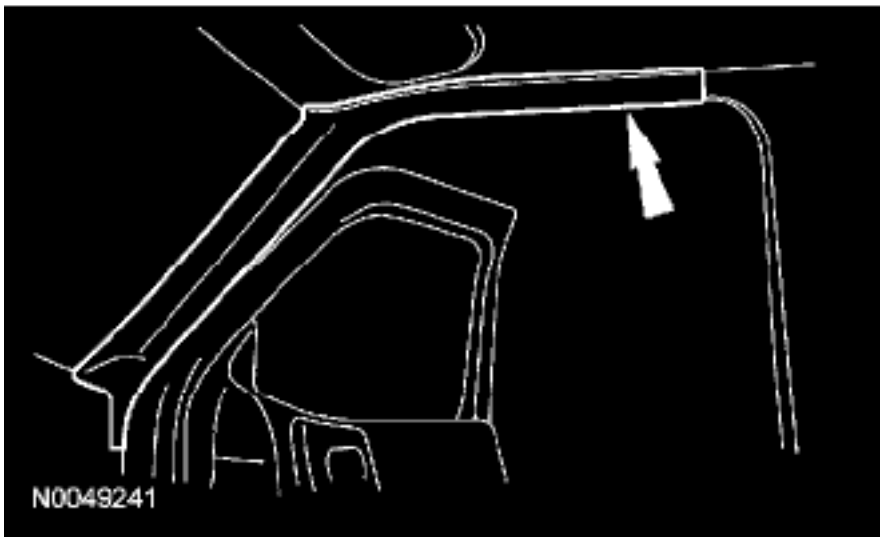
1. Remove the A-pillar trim panel assist handle bolt covers, if equipped.

2. Remove the A-pillar trim panel assist handles, if equipped.

1 Remove the bolts.

2 Remove the handles.

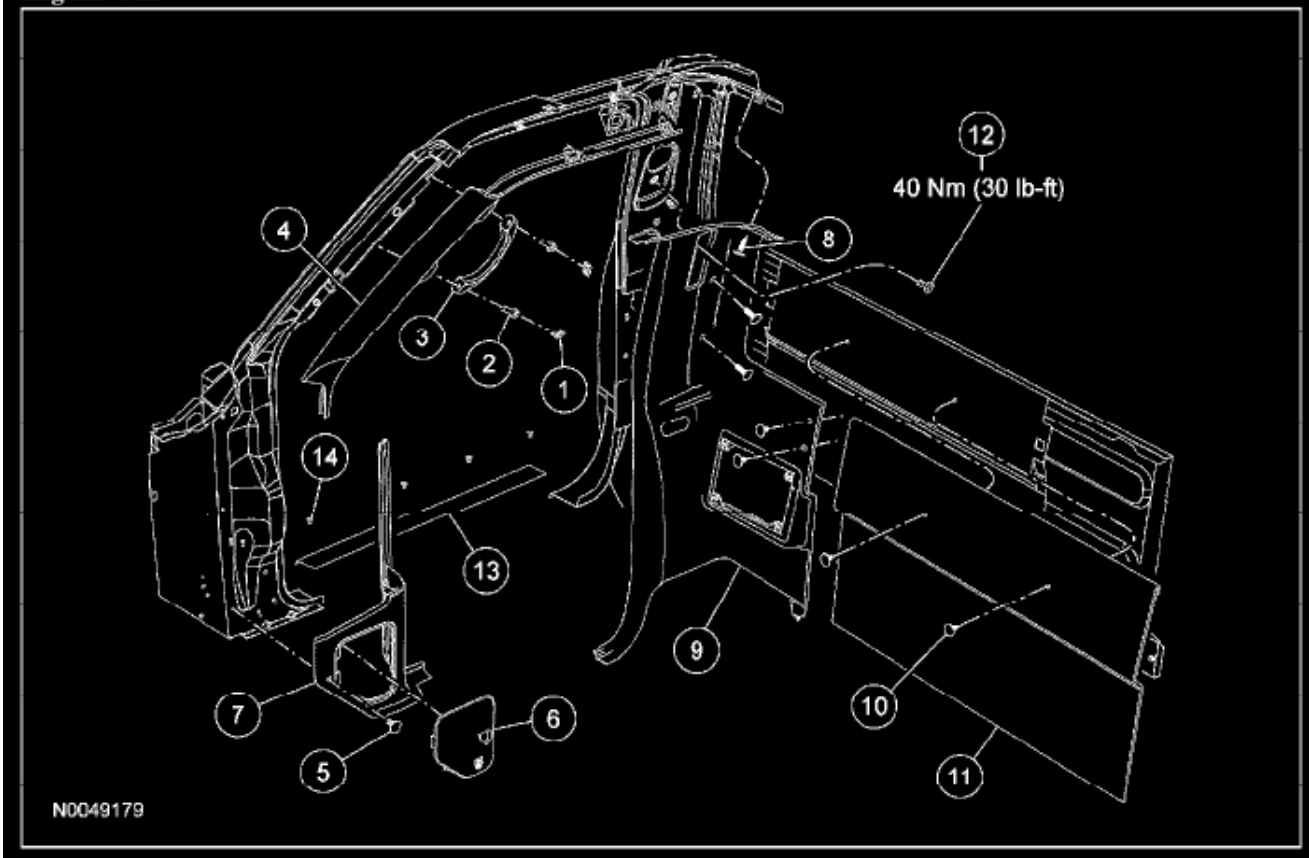




3. Remove the A-pillar trim panel.

4. To install, reverse the removal procedure.

Regular Cab



Item	Part Number	Description
1	31458	Assist handle bolt cover (2 required)
2	N811527-S	Assist handle bolt (2 required)
3	31406	Assist handle
4	03598	A-pillar trim panel
5	W708761-S	Cowl panel retainer
6	023A98	Cowl panel cover
7	02344	Cowl panel

(Continued)

Item	Part Number	Description
8	W708761-S	Pushpin retainer (5 required)
9	278D12	B-pillar trim panel
10	W708761-S	Pushpin retainer (2 required)
11	40374	Cab rear trim panel
12	—	Safety belt guide bolt
13	13260	Scuff plate
14	N800942-S	Scuff plate screw

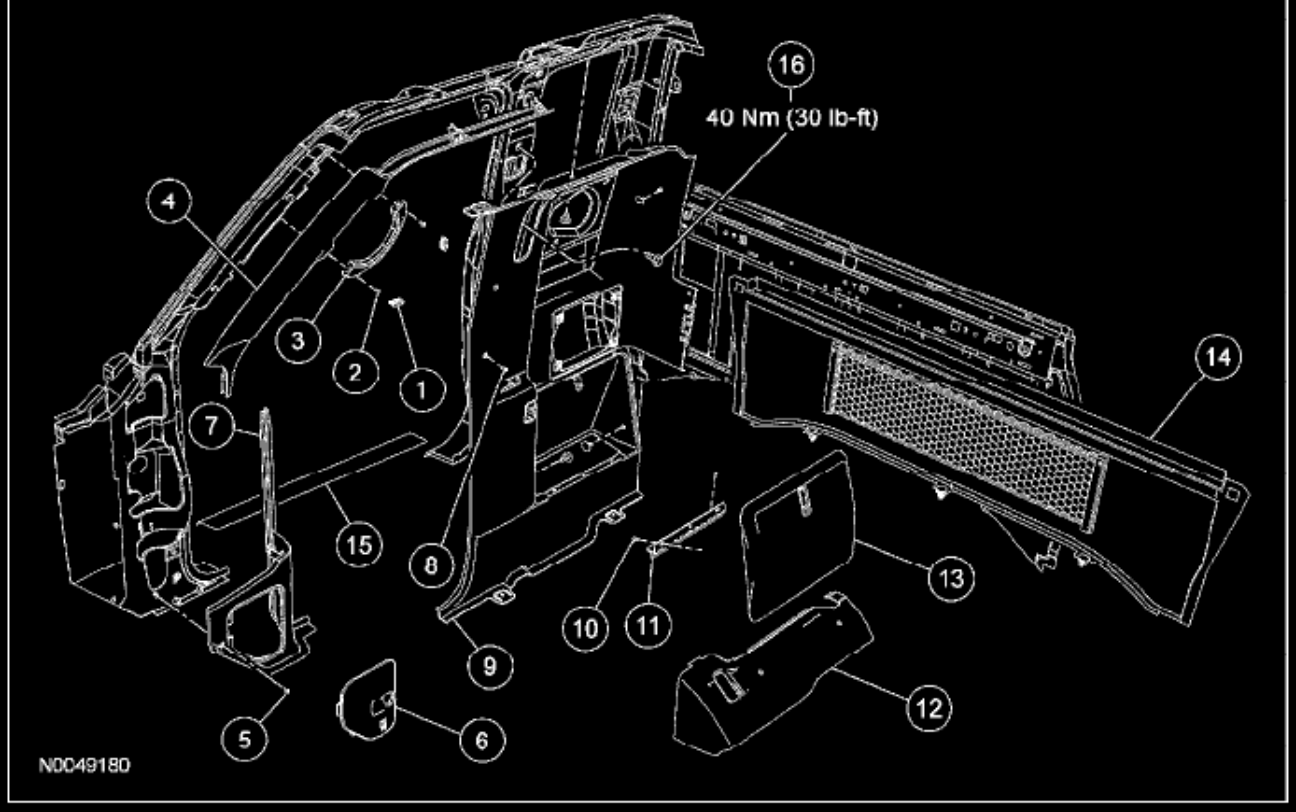
Trim Panel: Service and Repair B-Pillar Trim Panel - Regular Cab

B-PILLAR TRIM PANEL - REGULAR CAB

Exploded View

Regular Cab

2-Door SuperCab



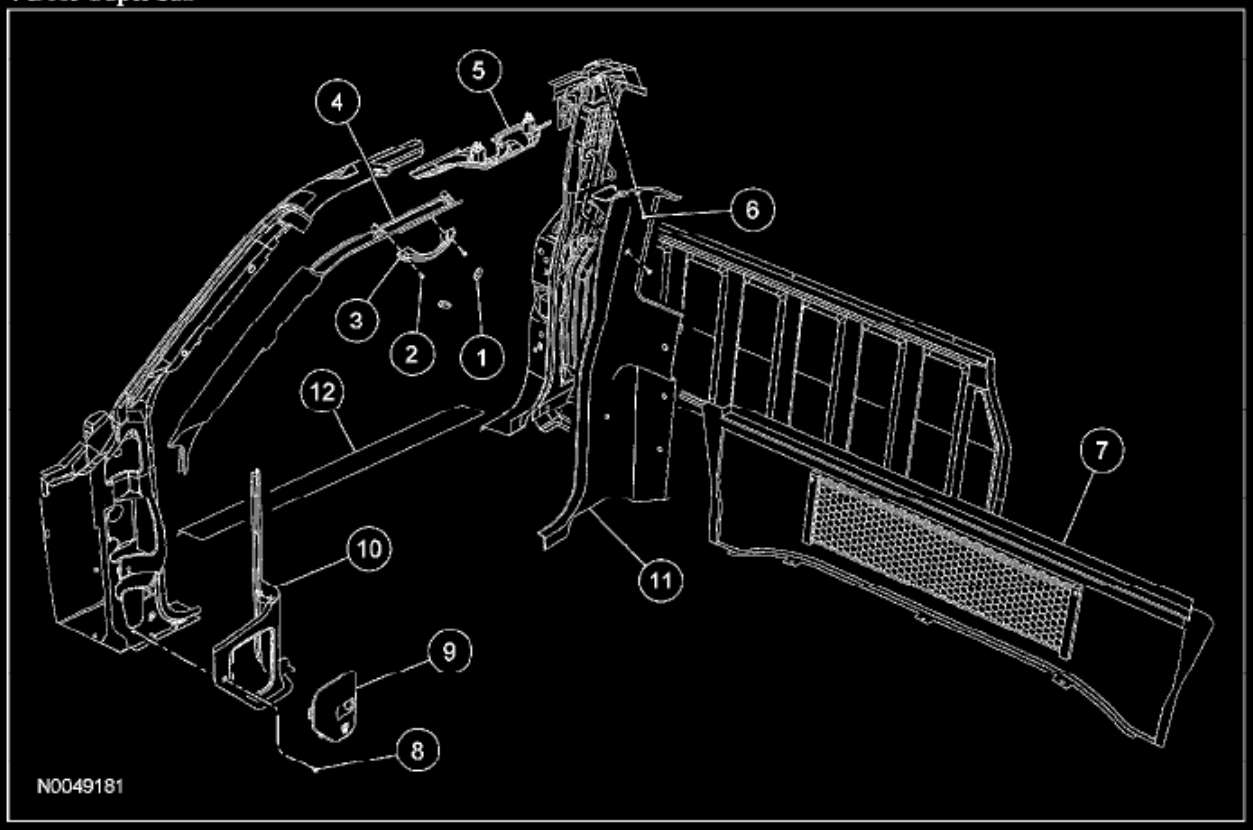
Item	Part Number	Description
1	31458	Assist handle bolt cover (2 required)
2	N811527-S	Assist handle bolt (2 required)
3	31406	Assist handle
4	03598	A-pillar trim panel
5	W708761	Cowl panel retainer
6	023A98	Cowl panel cover
7	02344	Cowl panel
8	5802354	Pushpin retainer (5 required)

Item	Part Number	Description
9	31012	B-pillar trim panel
10	386272-S	Hinge bolt (6 required)
11	31518	Seat hinge
12	31056	Seat lower trim panel
13	31012	Seat
14	40374	Cab rear trim panel
15	13260	Scuff plate
16	—	Safety belt guide bolt

(Continued)

2-Door SuperCab

4-Door SuperCab



Item	Part Number	Description
1	31458	Assist handle bolt cover (2 required)
2	N811527-S	Assist handle bolt (2 required)
3	31406	Assist handle
4	03598	A-pillar trim panel
5	51754	Door latch striker cover
6	5802354	Pin-type retainer (4 required)
7	40374	Cab rear trim panel

(Continued)

Item	Part Number	Description
8	W708761	Cowl panel retainer
9	023A98	Cowl panel cover
10	02344	Cowl panel
11	31012	C-pillar trim panel
12	13260	Scuff plate

Special Tool(s)

Safety Belt Bolt Bit
501-010 (T77L-2100-A)

4-Door SuperCab

Special Tool(s)

Special Tool(s)

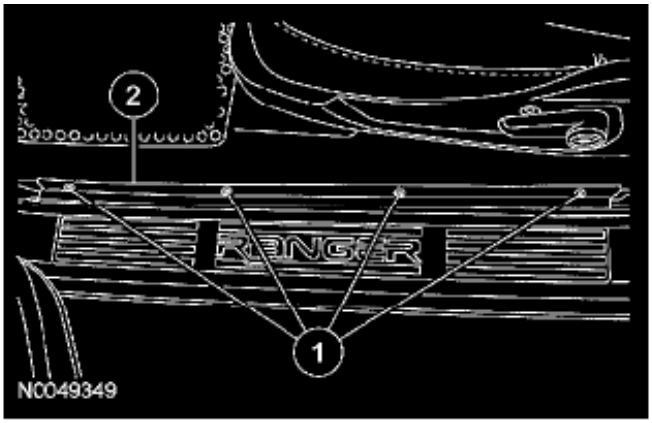
Removal and Installation

Both B-pillar trim panels

1. Remove the door scuff plate trim panel.

1 Remove the screws.

2 Remove the scuff plate.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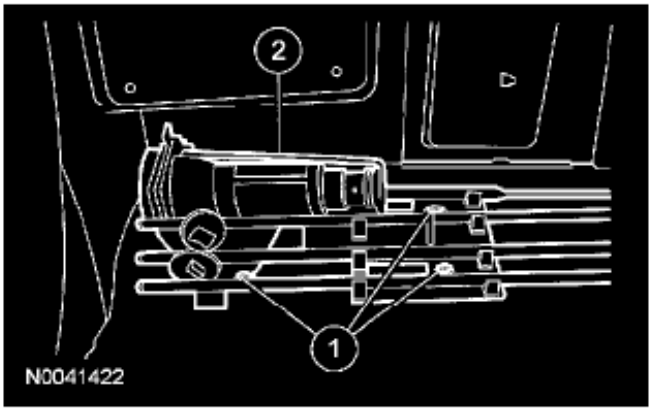
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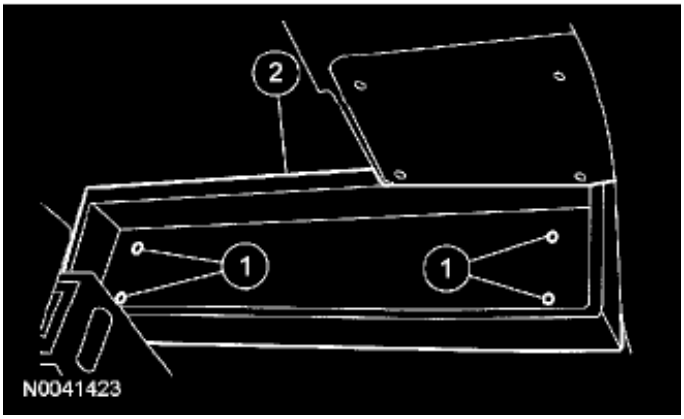

2
1
1
N0041423

RH B-pillar trim panel

2. Remove the handle carrier cover. 3. Remove the jack handle carrier.

1 Remove the screws.

2 Remove the jack handle carrier.

LH B-pillar trim panel

4. Remove the package tray mat. 5. Remove the package tray.

1 Remove the screws.

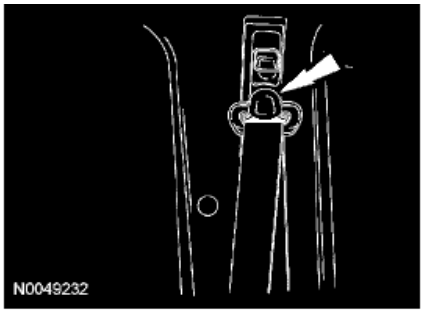
2 Remove the package tray.

Both B-pillar trim panels

6. NOTE: If the safety belt guide cover is damaged or if it does not remain closed, install a new cover.

Remove the front safety belt guide cover. -

Release the tabs and remove the cover.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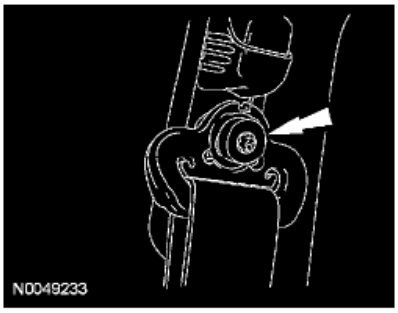
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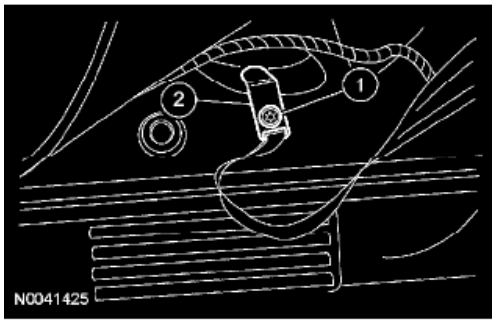
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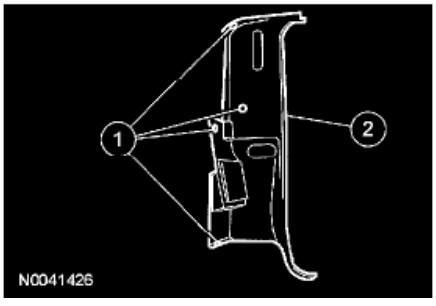
N0041425


1
2
N0041426

7. Remove the bolt and safety belt guide.

- Use the Safety Belt Bolt Bit to remove the bolt. -

To install, tighten to 40 Nm (30 lb-ft).

- Remove the safety belt guide.

8. Disconnect the safety belt anchor.

1 Use the Safety Belt Bolt Bit to remove the bolt. -

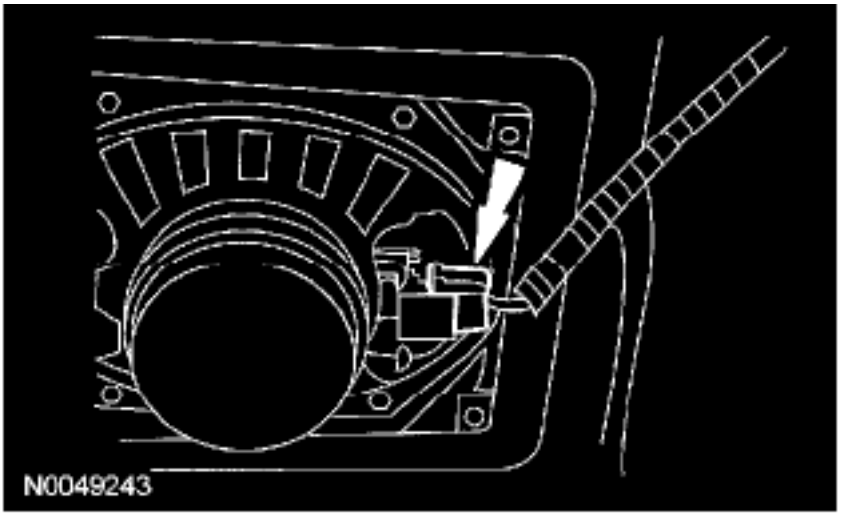
To install, tighten to 40 Nm (30 lb-ft).

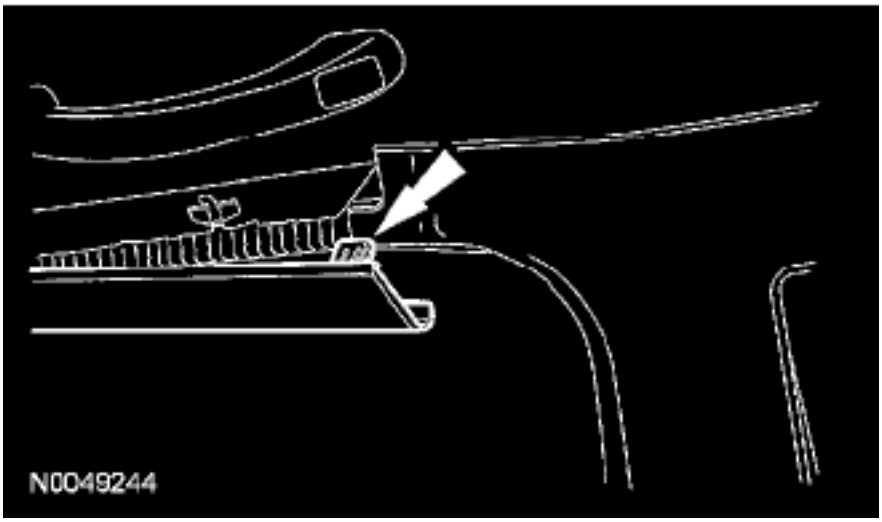
2 Disconnect the safety belt anchor.

9. Reposition the B-pillar trim panel.

1 Remove the pin-type retainers.

2 Reposition the B-pillar trim panel.



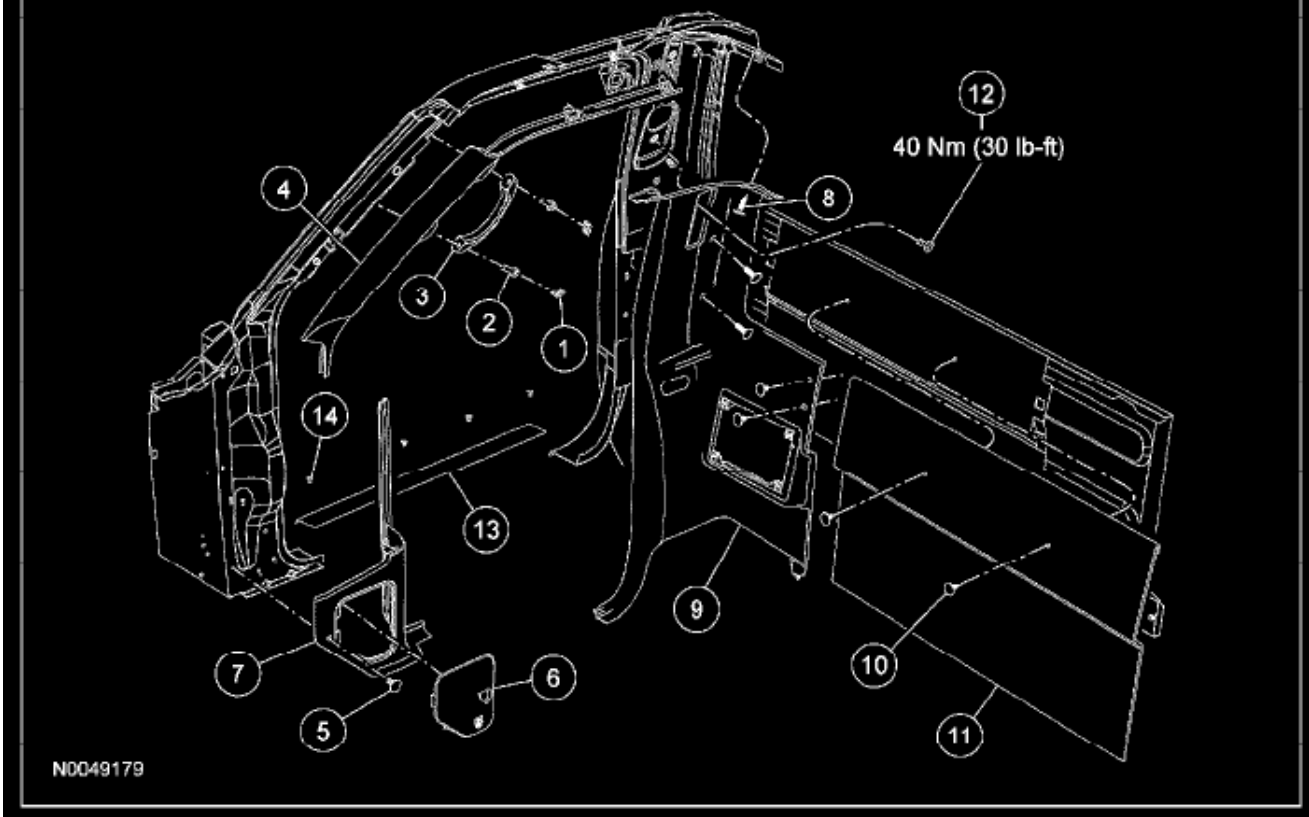


10. Disconnect the radio speaker electrical connector.

11. Lower the rear of the A-pillar trim panel to remove the B-pillar trim panel.

12. Remove the B-pillar trim panel. 13. To install, reverse the removal procedure.

Regular Cab



Item	Part Number	Description
1	31458	Assist handle bolt cover (2 required)
2	N811527-S	Assist handle bolt (2 required)
3	31406	Assist handle
4	03598	A-pillar trim panel
5	W708761-S	Cowl panel retainer
6	023A98	Cowl panel cover
7	02344	Cowl panel

(Continued)

Item	Part Number	Description
8	W708761-S	Pushpin retainer (5 required)
9	278D12	B-pillar trim panel
10	W708761-S	Pushpin retainer (2 required)
11	40374	Cab rear trim panel
12	—	Safety belt guide bolt
13	13260	Scuff plate
14	N800942-S	Scuff plate screw

Trim Panel: Service and Repair C-Pillar Trim Panel - SuperCab

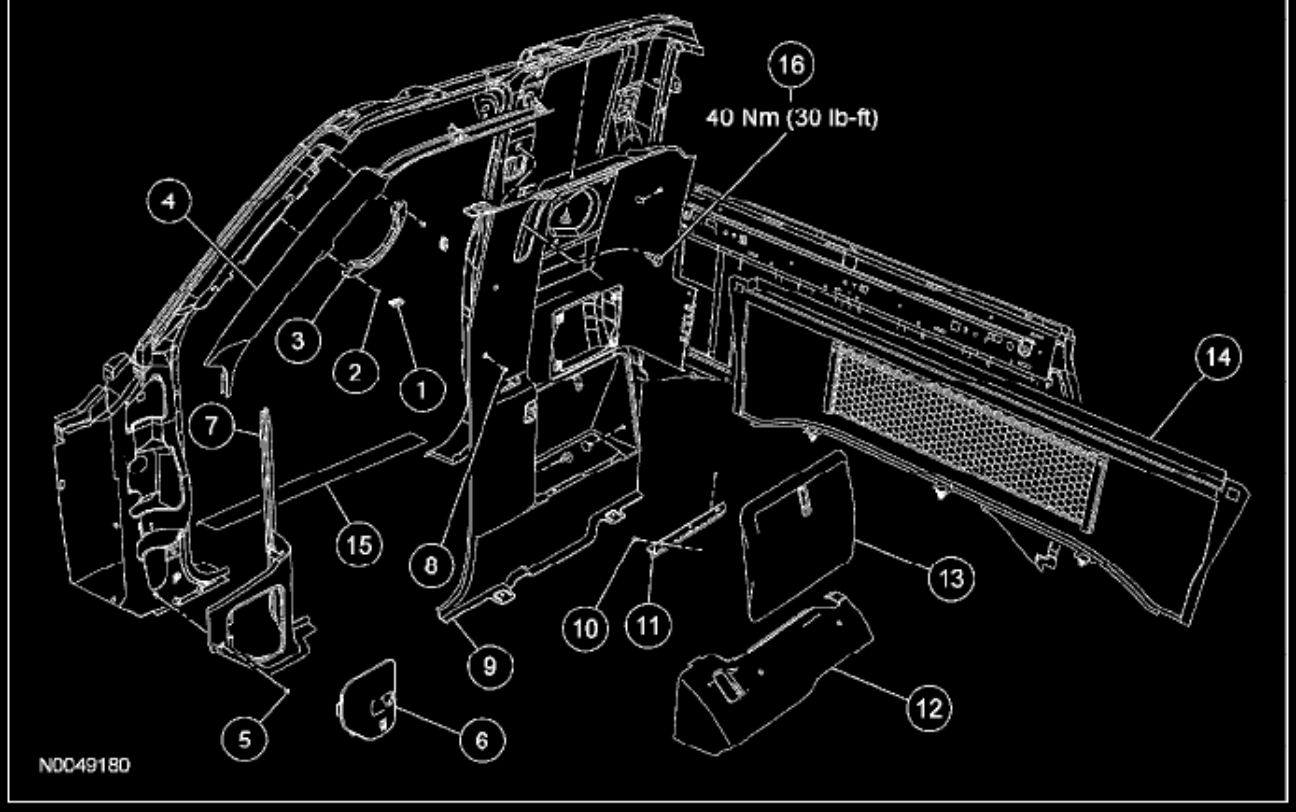
Two-Door

C-PILLAR TRIM PANEL - SUPERCAB TWO-DOOR

Exploded View

Regular Cab

2-Door SuperCab



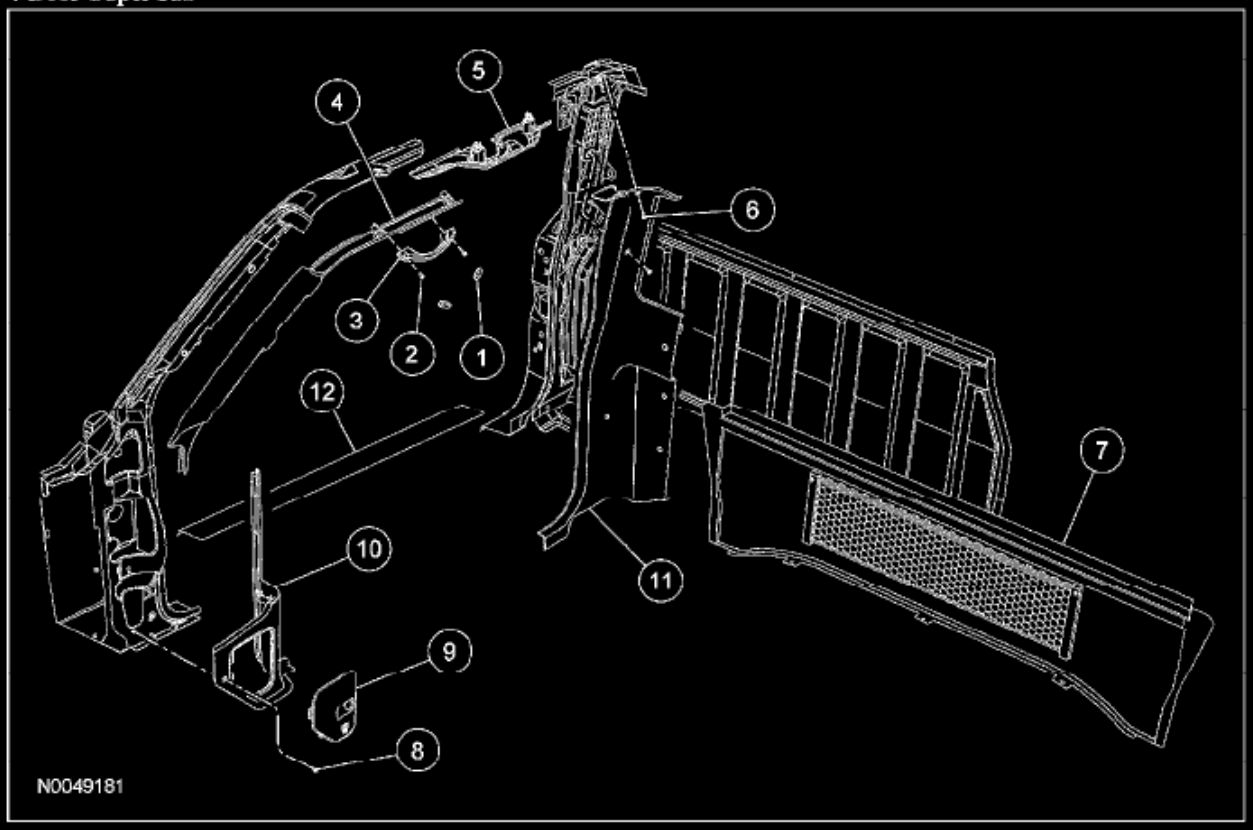
Item	Part Number	Description
1	31458	Assist handle bolt cover (2 required)
2	N811527-S	Assist handle bolt (2 required)
3	31406	Assist handle
4	03598	A-pillar trim panel
5	W708761	Cowl panel retainer
6	023A98	Cowl panel cover
7	02344	Cowl panel
8	5802354	Pushpin retainer (5 required)

(Continued)

Item	Part Number	Description
9	31012	B-pillar trim panel
10	386272-S	Hinge bolt (6 required)
11	31518	Seat hinge
12	31056	Seat lower trim panel
13	31012	Seat
14	40374	Cab rear trim panel
15	13260	Scuff plate
16	—	Safety belt guide bolt

2-Door SuperCab

4-Door SuperCab



Item	Part Number	Description
1	31458	Assist handle bolt cover (2 required)
2	N811527-S	Assist handle bolt (2 required)
3	31406	Assist handle
4	03598	A-pillar trim panel
5	51754	Door latch striker cover
6	5802354	Pin-type retainer (4 required)
7	40374	Cab rear trim panel

(Continued)

Item	Part Number	Description
8	W708761	Cowl panel retainer
9	023A98	Cowl panel cover
10	02344	Cowl panel
11	31012	C-pillar trim panel
12	13260	Scuff plate

Special Tool(s)

ST1181-A	Safety Belt Bolt Bit 501-010 (177L-2100-A)

4-Door SuperCab

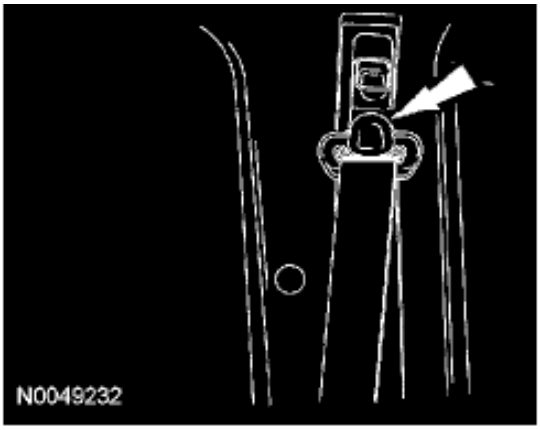
Special Tool(s)

Special Tool(s)

Removal and Installation

All vehicles

1. Remove the door scuff plate trim panel. 2. Remove the A-pillar trim panel. 3. Remove the cab rear trim panel.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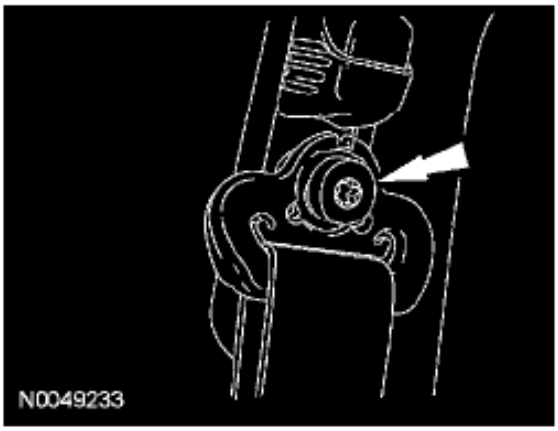
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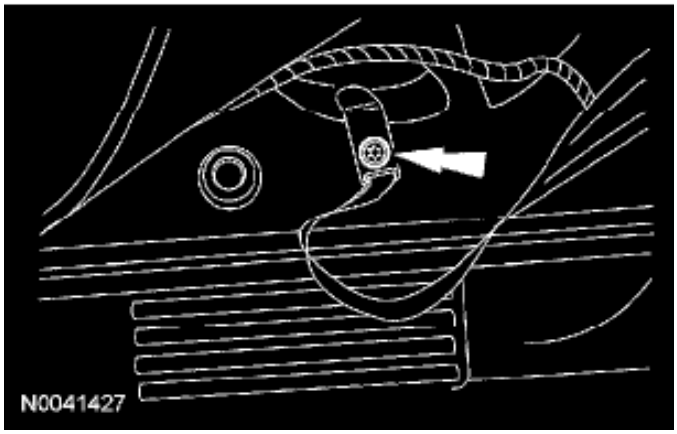

N0041427

4. NOTE: If the safety belt guide cover is damaged or if it does not remain closed, install a new cover.

Remove the front belt guide cover. -

Release the retaining tabs and remove the cover.

5. Remove the bolt and safety belt guide.

- Use the Safety Belt Bolt Bit to remove the bolt. -

To install, tighten to 40 Nm (30 lb-ft).

- Remove the safety belt guide.

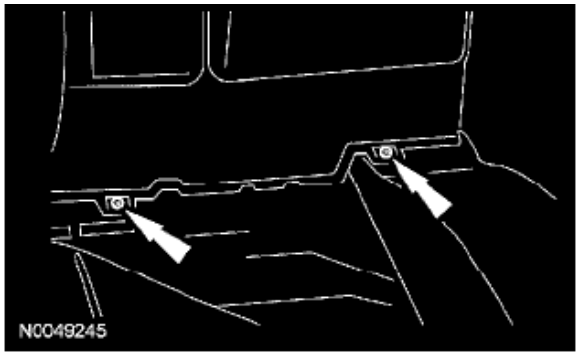
6. Remove the safety belt anchor bolt.

- Use the Safety Belt Bolt Bit to remove the bolt. -

To install, tighten to 40 Nm (30 lb-ft).

Without center-facing rear seat

7. Remove the C-pillar trim panel floor screws.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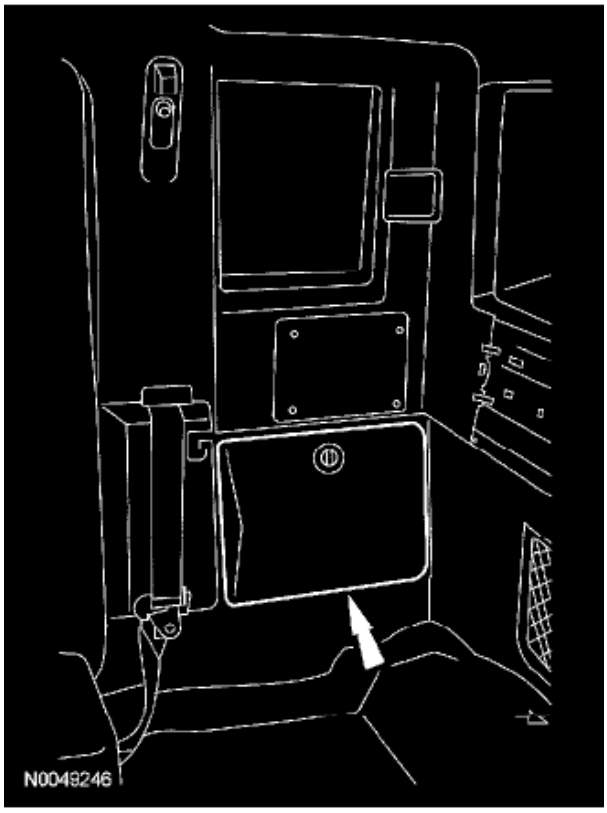
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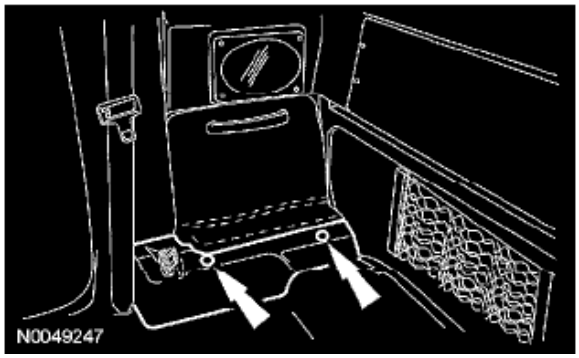
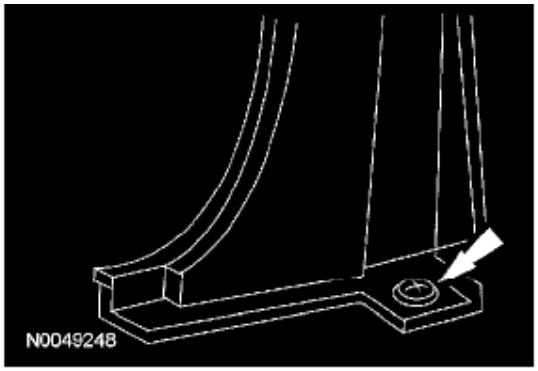

N0049247

8. Open the storage compartment.

With center-facing rear seat

9. Remove the pin-type retainers and lower rear trim panel.

10. Remove the C-pillar trim panel floor screws.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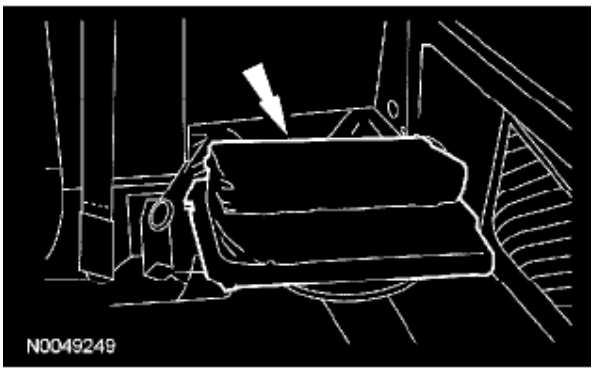
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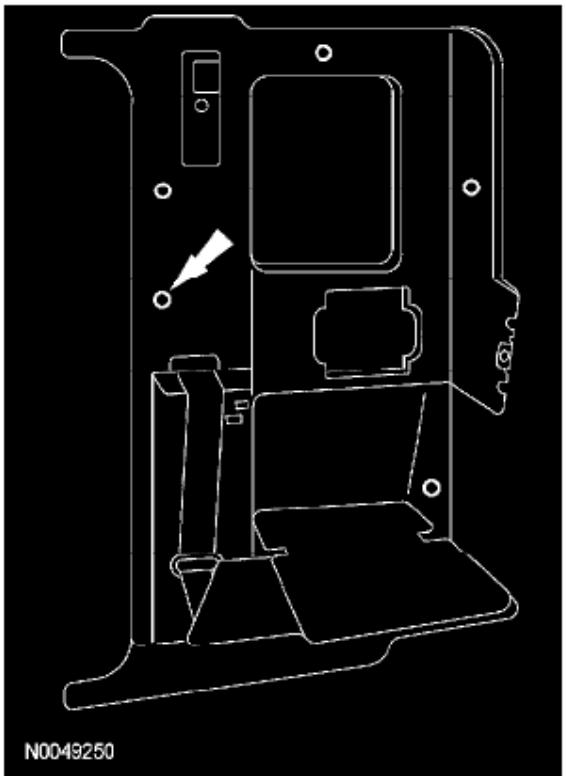

N0049250

11. Open the rear seat.

All vehicles

12. Remove the C-pillar trim panel pin-type retainers.

13. Disconnect the radio speaker electrical connector. 14. Remove the C-pillar trim panel.

- Feed the safety belt webbing through the quarter trim panel.

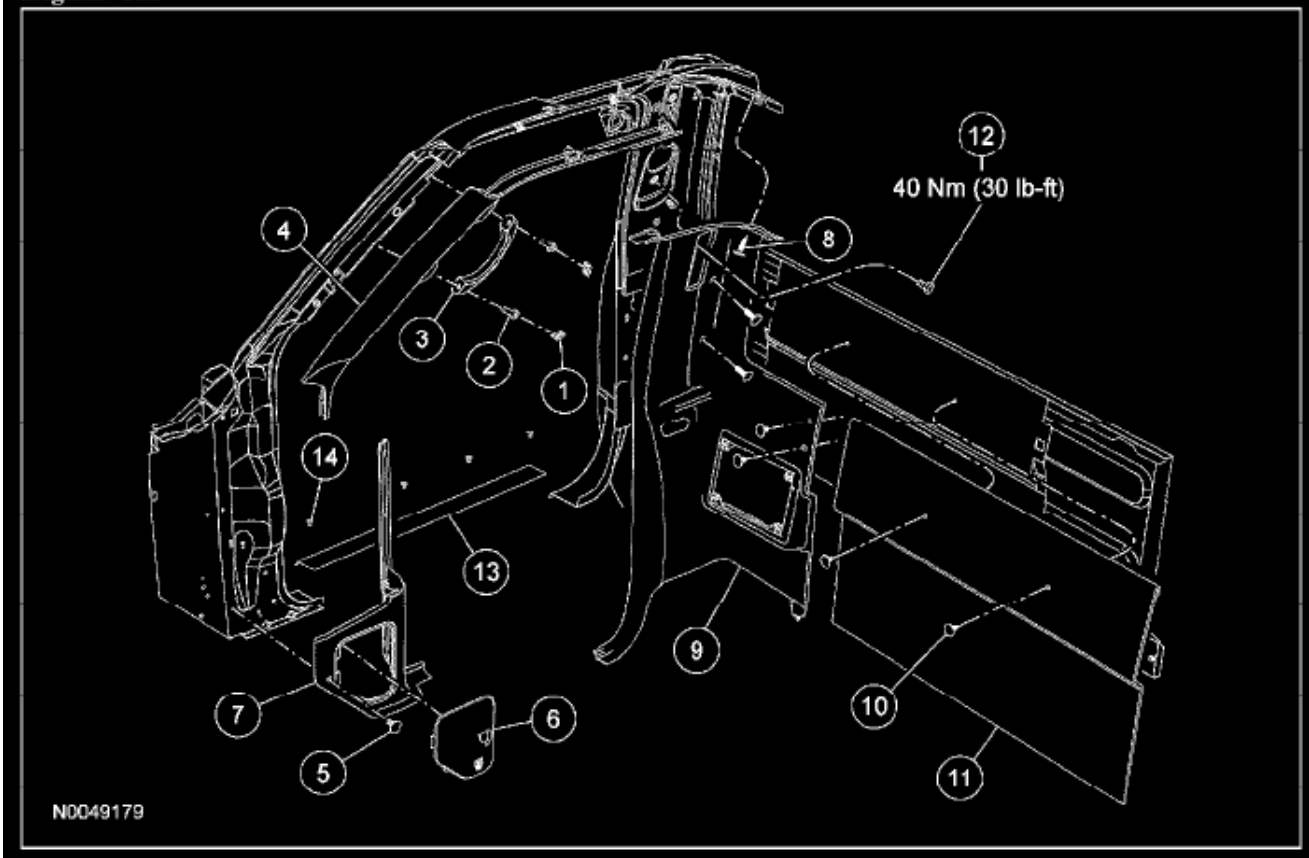
15. To install, reverse the removal procedure.

Four-Door

C-PILLAR TRIM PANEL - SUPERCAB FOUR-DOOR

Exploded View

Regular Cab



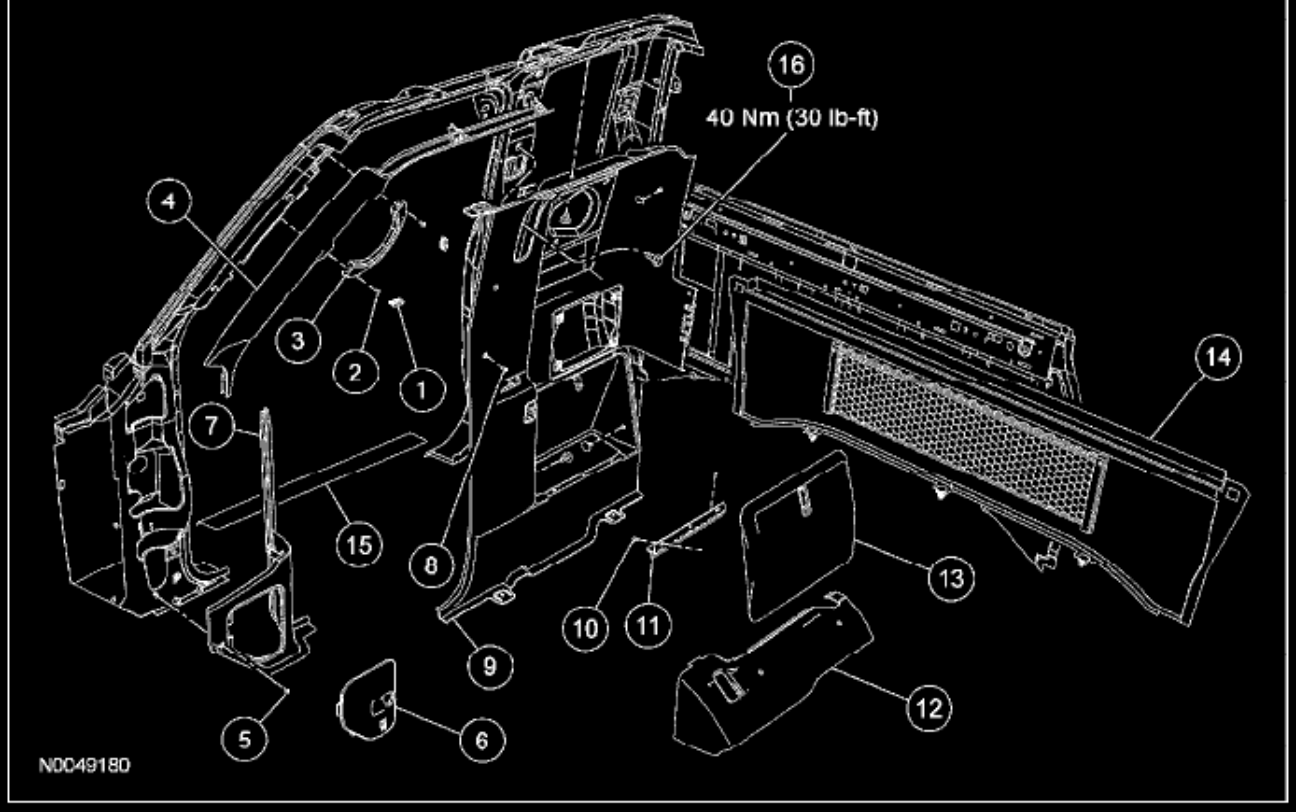
Item	Part Number	Description
1	31458	Assist handle bolt cover (2 required)
2	N811527-S	Assist handle bolt (2 required)
3	31406	Assist handle
4	03598	A-pillar trim panel
5	W708761-S	Cowl panel retainer
6	023A98	Cowl panel cover
7	02344	Cowl panel

(Continued)

Item	Part Number	Description
8	W708761-S	Pushpin retainer (5 required)
9	278D12	B-pillar trim panel
10	W708761-S	Pushpin retainer (2 required)
11	40374	Cab rear trim panel
12	—	Safety belt guide bolt
13	13260	Scuff plate
14	N800942-S	Scuff plate screw

Regular Cab

2-Door SuperCab



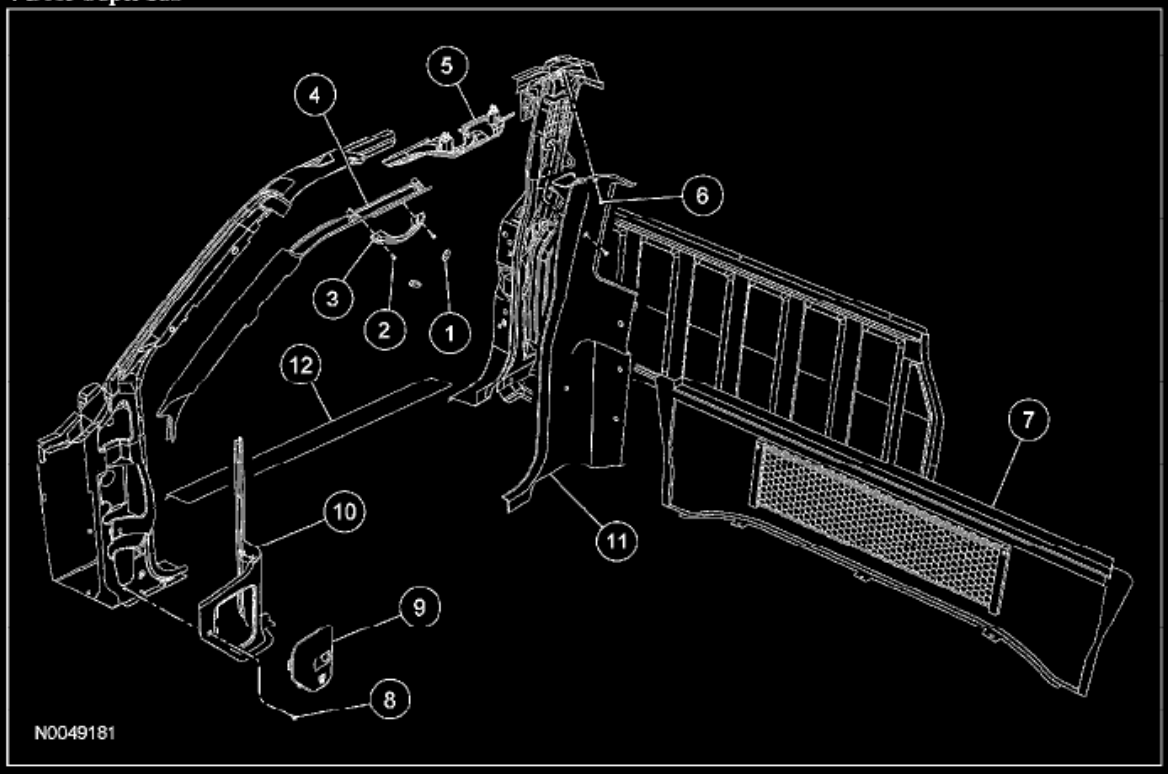
Item	Part Number	Description
1	31458	Assist handle bolt cover (2 required)
2	N811527-S	Assist handle bolt (2 required)
3	31406	Assist handle
4	03598	A-pillar trim panel
5	W708761	Cowl panel retainer
6	023A98	Cowl panel cover
7	02344	Cowl panel
8	5802354	Pushpin retainer (5 required)

Item	Part Number	Description
9	31012	B-pillar trim panel
10	386272-S	Hinge bolt (6 required)
11	31518	Seat hinge
12	31056	Seat lower trim panel
13	31012	Seat
14	40374	Cab rear trim panel
15	13260	Scuff plate
16	—	Safety belt guide bolt

(Continued)

2-Door SuperCab

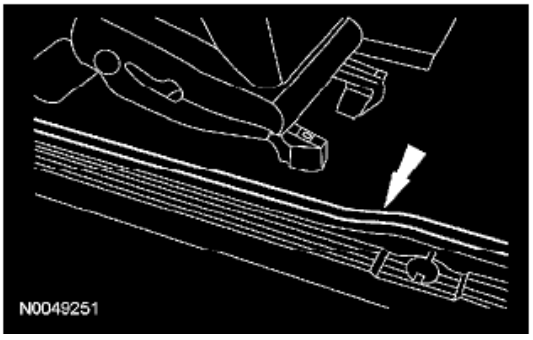
4-Door SuperCab



Item	Part Number	Description
1	31458	Assist handle bolt cover (2 required)
2	N811527-S	Assist handle bolt (2 required)
3	31406	Assist handle
4	03598	A-pillar trim panel
5	51754	Door latch striker cover
6	5802354	Pin-type retainer (4 required)
7	40374	Cab rear trim panel

(Continued)

Item	Part Number	Description
8	W708761	Cowl panel retainer
9	023A98	Cowl panel cover
10	02344	Cowl panel
11	31012	C-pillar trim panel
12	13260	Scuff plate

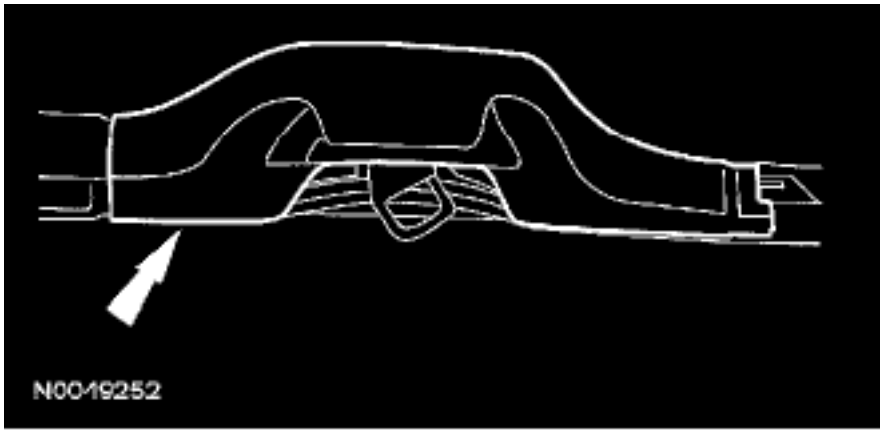


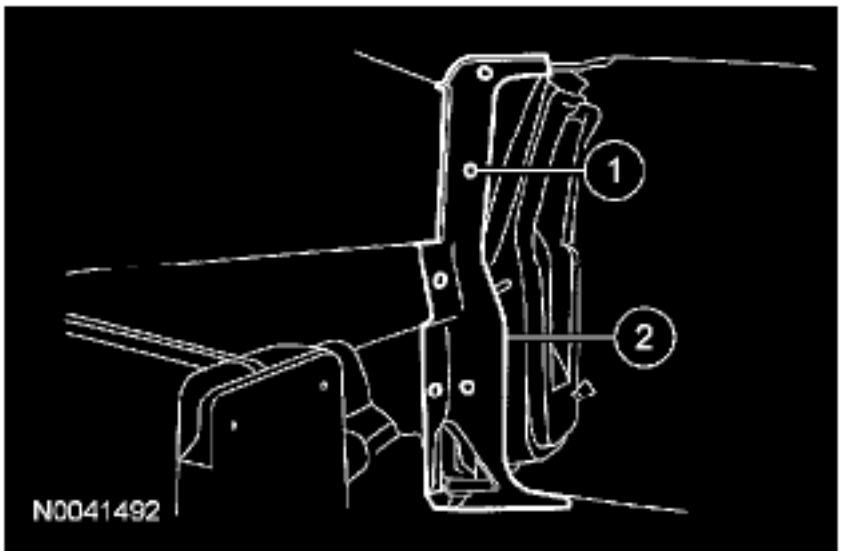
4-Door SuperCab

Removal and Installation

1. Remove the rear seats. 2. Remove the door scuff plate trim.

3. Remove the upper door latch striker cover.



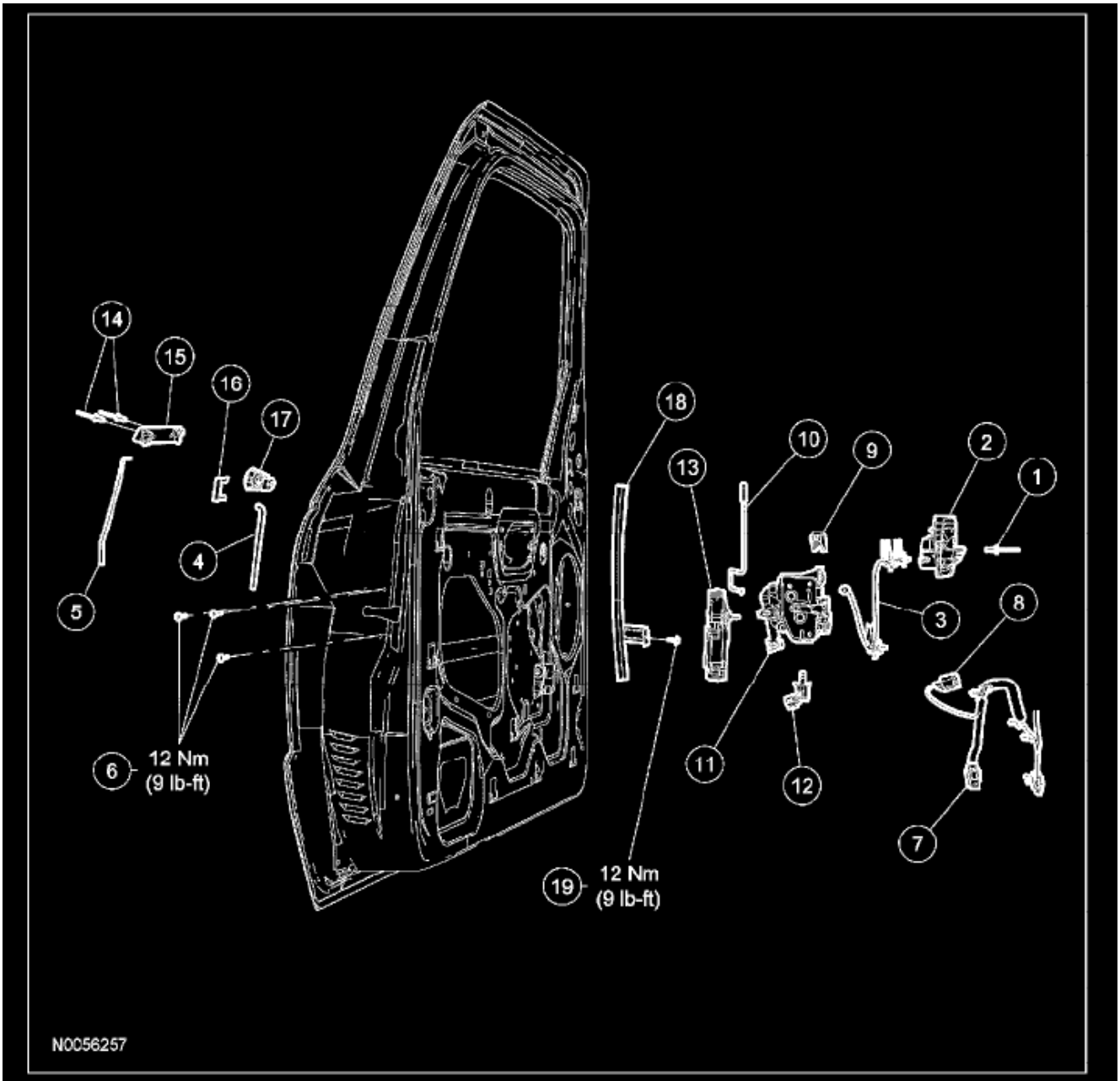


4. Remove the C-pillar.

1 Remove the pin-type retainers.

2 Remove the C-pillar trim panel.

5. To install, reverse the removal procedure.



Item	Part Number	Description
1	W525172	Interior door handle rivet
2	1022404	Interior door handle
3	10221A00/ 10221A01	Interior door handle actuating cable (RH/LH)
4	1022134/ 1022135	Door lock cylinder actuating rod (RH/LH)

(Continued)

Item	Part Number	Description
5	1022152/ 1022153	Exterior door handle actuating rod (RH/LH)
6	W705830-S901	Front door latch screws (3 required)

(Continued)

Door Lock Cylinder: Service and Repair

DOOR LOCK CYLINDER

Exploded View

Part 1

Item	Part Number	Description
7	—	Door ajar switch electrical connector (part of 14630/14631) (RH/LH)
8	—	Door lock actuator electrical connector (part of 14630/14631) (RH/LH)
9	15221A06/ 15221A07	Front door latch cable watershield (RH/LH)
10	1021852/ 1021853	Door latch push button rod (RH/LH)
11	1021812/ 1021813	Front door latch (RH/LH)
12	14018/ 10B997	Front door ajar switch (RH/LH)
13	218B20/ 218B21	Door lock actuator (RH/LH)
14	W707874	Exterior front door handle rivets (2 required)
15	1022404	Exterior front door handle
16	1022023	Door lock cylinder retainer
17	7821990	Front door lock cylinder
18	222A00	Door glass channel
19	N6066676-S	Door glass channel bolt

Part 2

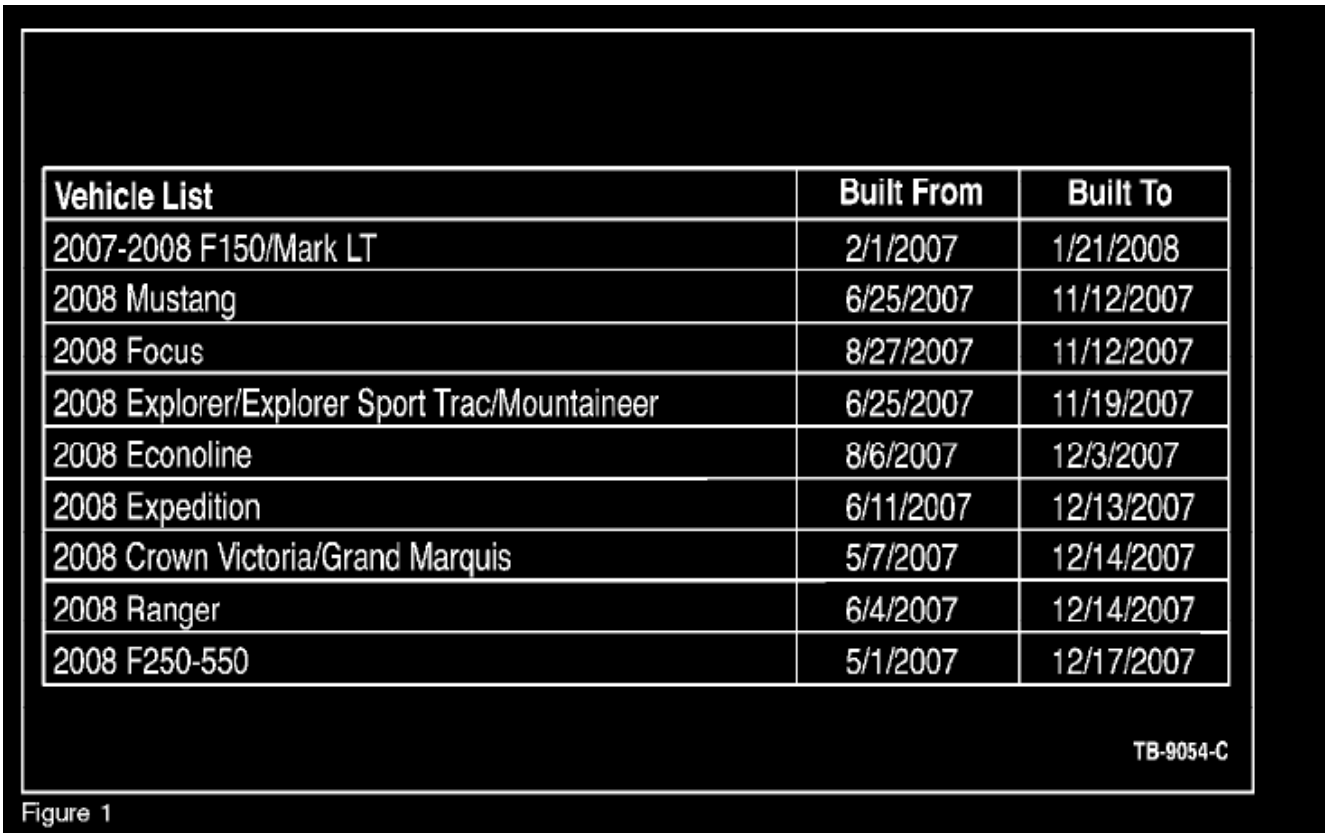
Removal and Installation

NOTE:

- When a new lock cylinder is installed, both door and the ignition lock cylinders should be installed as a set. This eliminates carrying an extra key which fits only 1 lock. If a key is to be replaced, the new key code number is stamped on a metal tag attached to the key.

- Individual lock cylinders are repaired by discarding the inoperative cylinder and building a new lock cylinder using the appropriate lock repair package. The lock repair package includes a detailed instruction sheet to build the new lock cylinder to the correct key code of the vehicle.

1. Raise the front window. 2. Remove the front door trim panel. 3. Position the watershield aside. 4. Disconnect the front door lock cylinder actuating rod from the door lock cylinder lever. 5. Remove the door lock cylinder retainer and the door lock cylinder. 6. To install, reverse the removal procedure.



Vehicle List	Built From	Built To
2007-2008 F150/Mark LT	2/1/2007	1/21/2008
2008 Mustang	6/25/2007	11/12/2007
2008 Focus	8/27/2007	11/12/2007
2008 Explorer/Explorer Sport Trac/Mountaineer	6/25/2007	11/19/2007
2008 Econoline	8/6/2007	12/3/2007
2008 Expedition	6/11/2007	12/13/2007
2008 Crown Victoria/Grand Marquis	5/7/2007	12/14/2007
2008 Ranger	6/4/2007	12/14/2007
2008 F250-550	5/1/2007	12/17/2007

TB-9054-C

Figure 1

Keyless Entry Transmitter: Customer Interest Keyless Entry - Transmitter May Not Operate

TSB 08-12-9

06/23/08

INOPERATIVE RKE TRANSMITTER (KEY FOB) - DISCHARGED KEY FOB BATTERY

FORD: 2008 Crown Victoria, Focus, Mustang 2007-2008 F-150 2008 E-Series, Expedition, Explorer Sport Trac, Explorer, F-Super Duty, Ranger

LINCOLN: 2007-2008 Mark LT

MERCURY: 2008 Grand Marquis, Mountaineer

ISSUE Some 2007-2008 vehicles equipped with a remote keyless entry (RKE) transmitter may exhibit an inoperative Key Fob due to a discharged Key Fob battery. This may be caused by an internal issue with the Key Fob software. This concern only applies to vehicles built within a specific date range with Key Fobs manufactured within a specific date range.

ACTION Follow the Service Procedure steps to correct the condition.

SERVICE PROCEDURE

NOTE

PERFORMING THIS PROCEDURE WILL HAVE NO EFFECT ON KEY FOB RANGE. REFER TO WORKSHOP MANUAL (WSM), SECTION 501-14 FOR KEY FOB RANGE DIAGNOSTICS.

1. Refer to vehicle list for build date range. (Figure 1)

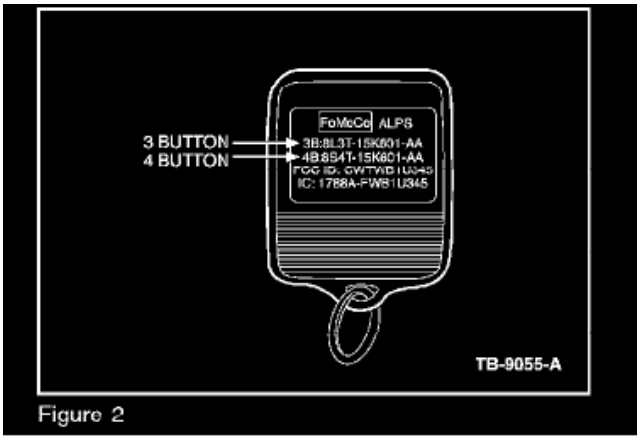


Figure 2

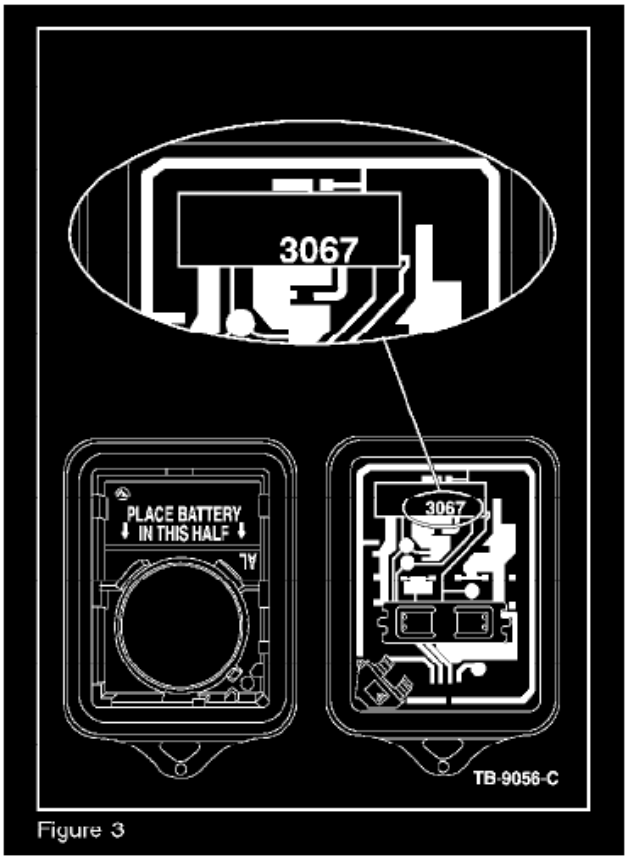


Figure 3

PART NUMBER	PART NAME
8L3Z-15K601-AA	3-Button Key Fob
8S4Z-15K601-A	4-Button Key Fob

a. If the vehicle was built within the date range, then continue with this procedure.

b. If not, then do not proceed. Continue with normal diagnostics per WSM, Section 501-14.

2. Is the vehicle Key Fob part number 8L3T-15K601-AA (3 button) or 8S4T-15K601-AA (4 button)? (Figure 2)

a. Yes - Go to Step 3.

b. No - Do not proceed. Continue with normal diagnostics per WSM, Section 501-14.

3. Using a thin coin, open the Key Fob and inspect manufacturer's date code sticker. The first three digits = day of year. The last digit = year. (Figure 3)

a. If the first 3 digits are equal to or between 005 and 306 (5th day through 306th day) and the last digit is 7 (year), then proceed to Step 4.

b. If the number is outside this specified range, then do not proceed. Continue with normal diagnostics per WSM, Section 501-14.

4. If the Key Fob is inoperative due to a discharged Key Fob battery, and the date code falls within the specified range, then replace Key Fob. Program the new Key Fob transmitter using the IDS RKE Transmitter Programming Procedure. Reassemble old Key Fob for warranty return analysis.

NOTE

KEY FOBS REPLACED UNDER WARRANTY WILL BE REQUESTED FOR ANALYSIS AND VERIFICATION OF THE DATE CODE.

a. IDS RKE Transmitter Programming Procedure

(1) Install known good battery into the suspect Key Fob so that IDS scan tool can identify it.

(2) Connect IDS to vehicle.

(3) From the Main Toolbox tab:

(a) Select - Body.

(b) Select - Security.

(c) Select - Remote Keyless Entry.

(4) Press the "Unlock" button on the suspect Key Fob to view the Transmitter Identification Code (TIC) in IDS.

5. Select "Erase One Key Fob" or the "Erase" button.

6. Select the suspect Key Fob TIC to erase from vehicle memory.

7. Remove battery from suspect Key Fob and reassemble for warranty return.

8. Select "Reprogram a New Keyfob" or the "Program" button.

9. Press the "Unlock" button on the NEW Key Fob.

10. Follow the instructions on the scan tool screen to complete the programming procedure.

WARRANTY STATUS: Eligible Under Provisions Of New Vehicle Limited Warranty Coverage
IMPORTANT: Warranty coverage limits/policies are not altered by a TSB. Warranty coverage limits are determined by the identified causal part.

OPERATION DESCRIPTION TIME

081209A 2008 Focus, Mustang, 0.3 Hr.

Explorer, Explorer Sport Trac, Mountaineer, E-Series, Expedition, Crown Victoria, Grand Marquis, Ranger, F-Super Duty: Replace Key Fob(s), Includes Time To Perform Key Fob Programming Procedure, And Verify Date Code Sticker (Do Not Use With 15601A)

081209A 2007-2008 F-150, Mark 0.3 Hr.

LT: Replace Key Fob(s), Includes Time To Perform Key Fob Programming Procedure, And Verify Date Code Sticker (Do Not Use With 15601A)

NOTE: The information in Technical Service Bulletins is intended for use by trained, professional technicians with the knowledge, tools, and equipment to do the job properly and safely. It informs these technicians of conditions that may occur on some vehicles, or provides information that could assist in proper vehicle service. The procedures should not be performed by "do-it-yourselfers". Do not assume that a condition described affects your car or truck. Contact a Ford, Lincoln, or Mercury dealership to determine whether the Bulletin applies to your vehicle.

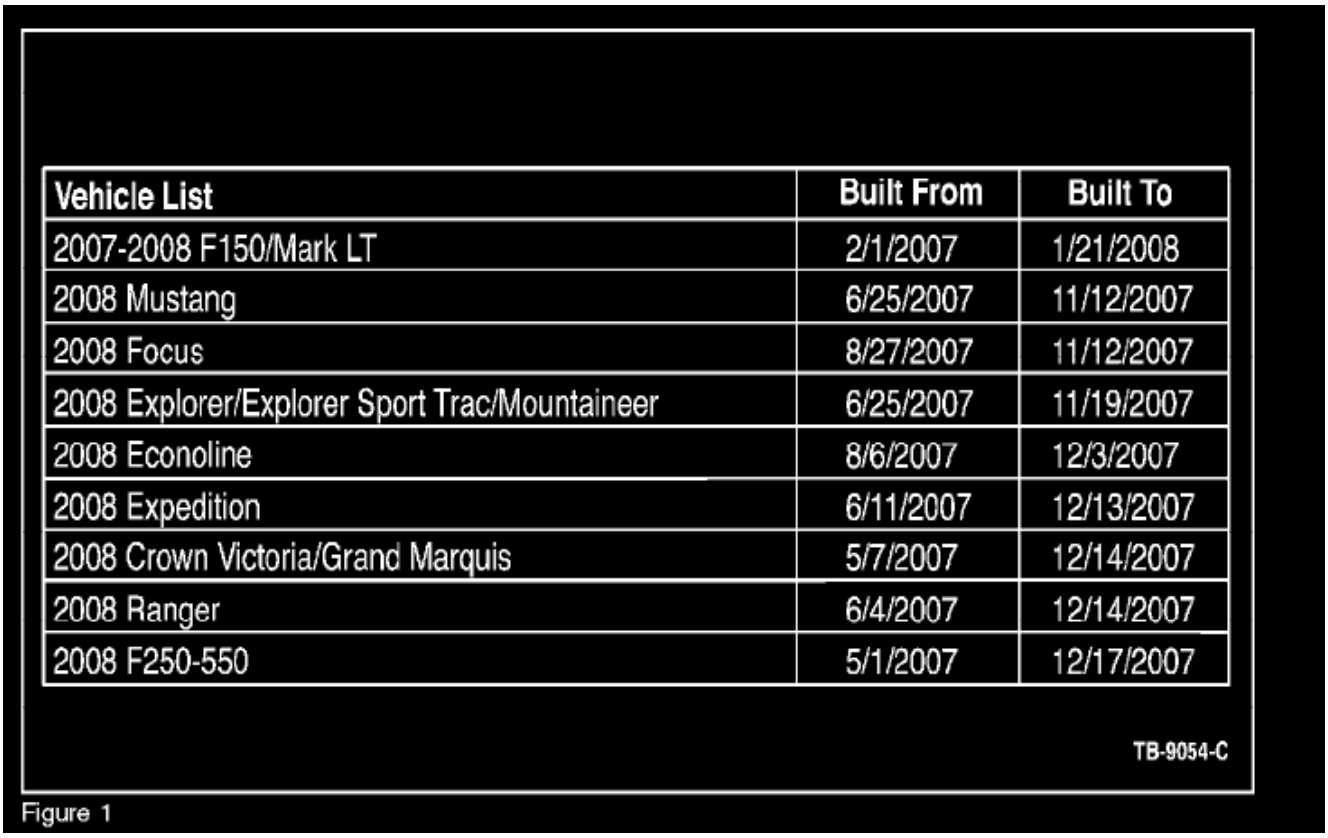
DEALER CODING

CONDITION

BASIC PART NO. CODE

15K601 42

Disclaimer



Vehicle List	Built From	Built To
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2008 Explorer/Explorer Sport Trac/Mountaineer	6/25/2007	11/19/2007
2008 Econoline	8/6/2007	12/3/2007
2008 Expedition	6/11/2007	12/13/2007
2008 Crown Victoria/Grand Marquis	5/7/2007	12/14/2007
2008 Ranger	6/4/2007	12/14/2007
2008 F250-550	5/1/2007	12/17/2007

TB-9054-C

Figure 1

Keyless Entry Transmitter: All Technical Service Bulletins Keyless Entry - Transmitter May Not Operate

TSB 08-12-9

06/23/08

INOPERATIVE RKE TRANSMITTER (KEY FOB) - DISCHARGED KEY FOB BATTERY

FORD: 2008 Crown Victoria, Focus, Mustang 2007-2008 F-150 2008 E-Series, Expedition, Explorer Sport Trac, Explorer, F-Super Duty, Ranger

LINCOLN: 2007-2008 Mark LT

MERCURY: 2008 Grand Marquis, Mountaineer

ISSUE Some 2007-2008 vehicles equipped with a remote keyless entry (RKE) transmitter may exhibit an inoperative Key Fob due to a discharged Key Fob battery. This may be caused by an internal issue with the Key Fob software. This concern only applies to vehicles built within a specific date range with Key Fobs manufactured within a specific date range.

ACTION Follow the Service Procedure steps to correct the condition.

SERVICE PROCEDURE

NOTE

PERFORMING THIS PROCEDURE WILL HAVE NO EFFECT ON KEY FOB RANGE. REFER TO WORKSHOP MANUAL (WSM), SECTION 501-14 FOR KEY FOB RANGE DIAGNOSTICS.

1. Refer to vehicle list for build date range. (Figure 1)

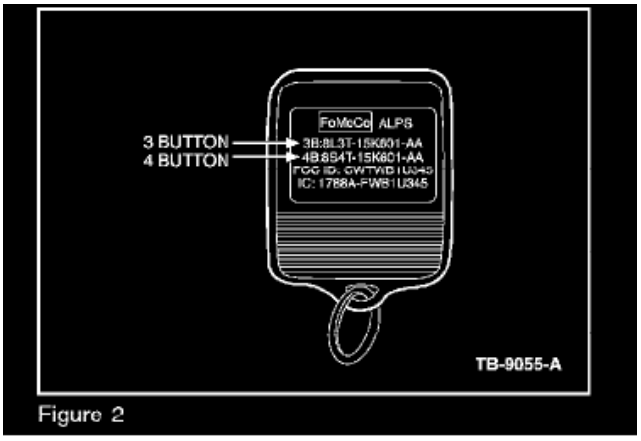


Figure 2

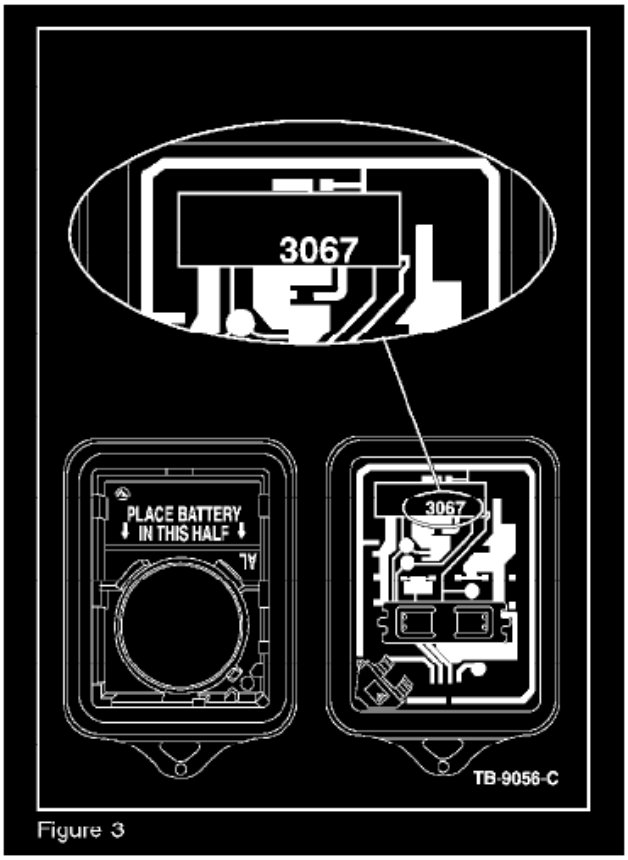


Figure 3

PART NUMBER	PART NAME
8L3Z-15K601-AA	3-Button Key Fob
8S4Z-15K601-A	4-Button Key Fob

a. If the vehicle was built within the date range, then continue with this procedure.

b. If not, then do not proceed. Continue with normal diagnostics per WSM, Section 501-14.

2. Is the vehicle Key Fob part number 8L3T-15K601-AA (3 button) or 8S4T-15K601-AA (4 button)? (Figure 2)

a. Yes - Go to Step 3.

b. No - Do not proceed. Continue with normal diagnostics per WSM, Section 501-14.

3. Using a thin coin, open the Key Fob and inspect manufacturer's date code sticker. The first three digits = day of year. The last digit = year. (Figure 3)

a. If the first 3 digits are equal to or between 005 and 306 (5th day through 306th day) and the last digit is 7 (year), then proceed to Step 4.

b. If the number is outside this specified range, then do not proceed. Continue with normal diagnostics per WSM, Section 501-14.

4. If the Key Fob is inoperative due to a discharged Key Fob battery, and the date code falls within the specified range, then replace Key Fob. Program the new Key Fob transmitter using the IDS RKE Transmitter Programming Procedure. Reassemble old Key Fob for warranty return analysis.

NOTE

KEY FOBS REPLACED UNDER WARRANTY WILL BE REQUESTED FOR ANALYSIS AND VERIFICATION OF THE DATE CODE.

a. IDS RKE Transmitter Programming Procedure

(1) Install known good battery into the suspect Key Fob so that IDS scan tool can identify it.

(2) Connect IDS to vehicle.

(3) From the Main Toolbox tab:

(a) Select - Body.

(b) Select - Security.

(c) Select - Remote Keyless Entry.

(4) Press the "Unlock" button on the suspect Key Fob to view the Transmitter Identification Code (TIC) in IDS.

5. Select "Erase One Key Fob" or the "Erase" button.

6. Select the suspect Key Fob TIC to erase from vehicle memory.

7. Remove battery from suspect Key Fob and reassemble for warranty return.

8. Select "Reprogram a New Keyfob" or the "Program" button.

9. Press the "Unlock" button on the NEW Key Fob.

10. Follow the instructions on the scan tool screen to complete the programming procedure.

WARRANTY STATUS: Eligible Under Provisions Of New Vehicle Limited Warranty Coverage
IMPORTANT: Warranty coverage limits/policies are not altered by a TSB. Warranty coverage limits are determined by the identified causal part.

OPERATION DESCRIPTION TIME

081209A 2008 Focus, Mustang, 0.3 Hr.

Explorer, Explorer Sport Trac, Mountaineer, E-Series, Expedition, Crown Victoria, Grand Marquis, Ranger, F-Super Duty: Replace Key Fob(s), Includes Time To Perform Key Fob Programming Procedure, And Verify Date Code Sticker (Do Not Use With 15601A)

081209A 2007-2008 F-150, Mark 0.3 Hr.

LT: Replace Key Fob(s), Includes Time To Perform Key Fob Programming Procedure, And Verify Date Code Sticker (Do Not Use With 15601A)

NOTE: The information in Technical Service Bulletins is intended for use by trained, professional technicians with the knowledge, tools, and equipment to do the job properly and safely. It informs these technicians of conditions that may occur on some vehicles, or provides information that could assist in proper vehicle service. The procedures should not be performed by "do-it-yourselfers". Do not assume that a condition described affects your car or truck. Contact a Ford, Lincoln, or Mercury dealership to determine whether the Bulletin applies to your vehicle.

DEALER CODING

CONDITION

BASIC PART NO. CODE

15K601 42

Disclaimer

Keyless Entry Transmitter: Testing and Inspection

REMOTE KEYLESS ENTRY TRANSMITTER PROGRAMMING

CAUTION: All remote keyless entry (RKE) transmitters must be programmed at the same time.

1. Before entering the program mode, the vehicle must be electronically unlocked with the RKE transmitter or the door lock control switch while the

driver door is open.

2. Turn the ignition switch from OFF to RUN 8 times within 10 seconds, with the eighth turn ending in RUN. If the module successfully enters

program mode, it locks and then unlocks all the doors.

3. Within 20 seconds, press any button on an RKE transmitter and the doors lock and then unlock to confirm that each RKE transmitter is

programmed. Repeat this step for each RKE transmitter.

4. If the door locks do not respond for any RKE transmitter, wait several seconds and press the button again. If the door locks still fail to respond,

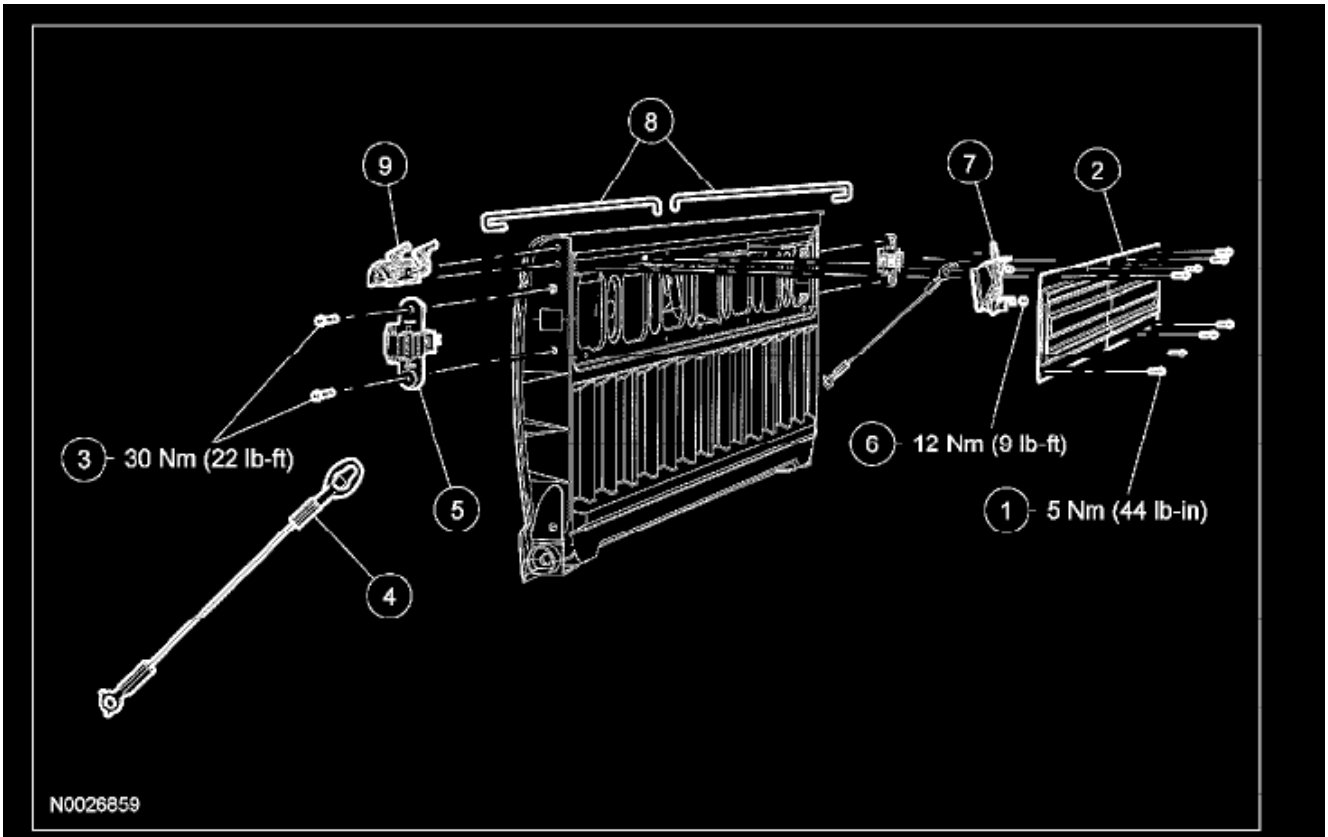
refer to Inspection and Verification. Make sure that no more than the maximum number of RKE transmitters is being programmed. See: Power Locks/Testing and Inspection/Initial Inspection and Diagnostic Overview/Inspection and Verification

5. Exiting the programming mode is accomplished if 1 of the following occurs:

- The key transitions to the OFF position.

- 20 seconds have passed since entering programming mode or since the last RKE transmitter was programmed.

- The maximum number of RKE transmitters have been programmed.



Item	Part Number	Description
1	N806149-S439	Tailgate access cover screws (8 required)
2	9943121	Tailgate access cover
3	W706729	Tailgate latch bolts (2 required)
4	9943052/ 9943053	Tailgate support cables (RH/LH)
5	9943150/ 9943151	Tailgate latch (RH/LH)

Item	Part Number	Description
6	N620480-S438	Tailgate latch remote control nuts (2 required)
7	9943170	Tailgate latch remote control
8	99431A78	Tailgate latch actuating rods (2 required)
9	9943400	Tailgate release handle

(Continued)

Keyless Entry Transmitter: Service and Repair

TAILGATE LATCH REMOTE CONTROL

Exploded View

Removal and Installation

1. Remove the 8 screws and the tailgate access cover.

- To install, tighten to 5 Nm (44 lb-in).

2. Open the tailgate latch actuating rod retainers and disconnect the tailgate latch actuating rods from the tailgate latch remote control. 3. Remove the 2 tailgate latch remote control nuts.

- To install, tighten to 12 Nm (9 lb-ft).

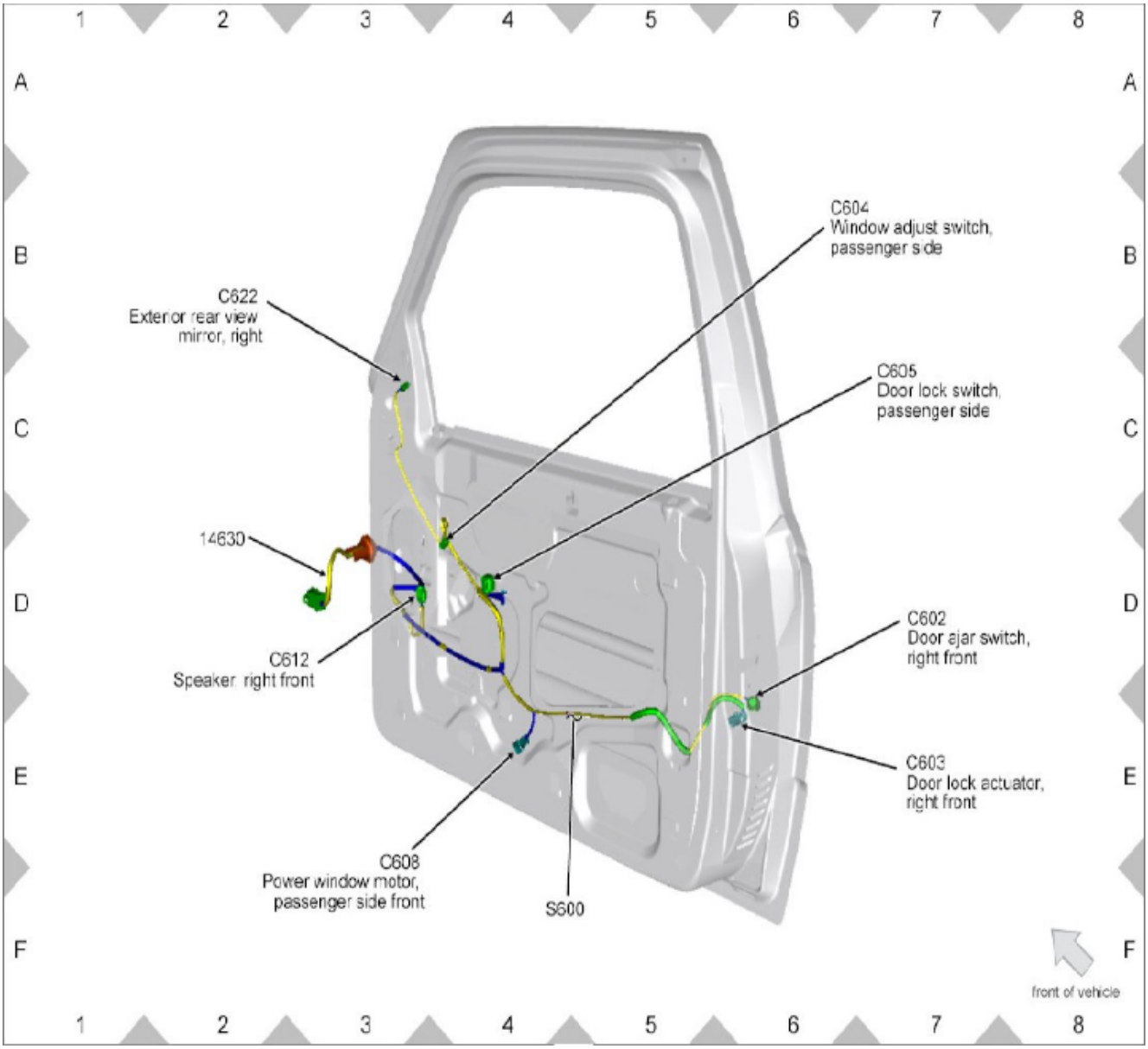
4. Remove the tailgate latch remote control.

5. NOTE: Prior to installation, remove the slack in the tailgate latch release links by pulling the tailgate latch release links to the center of the

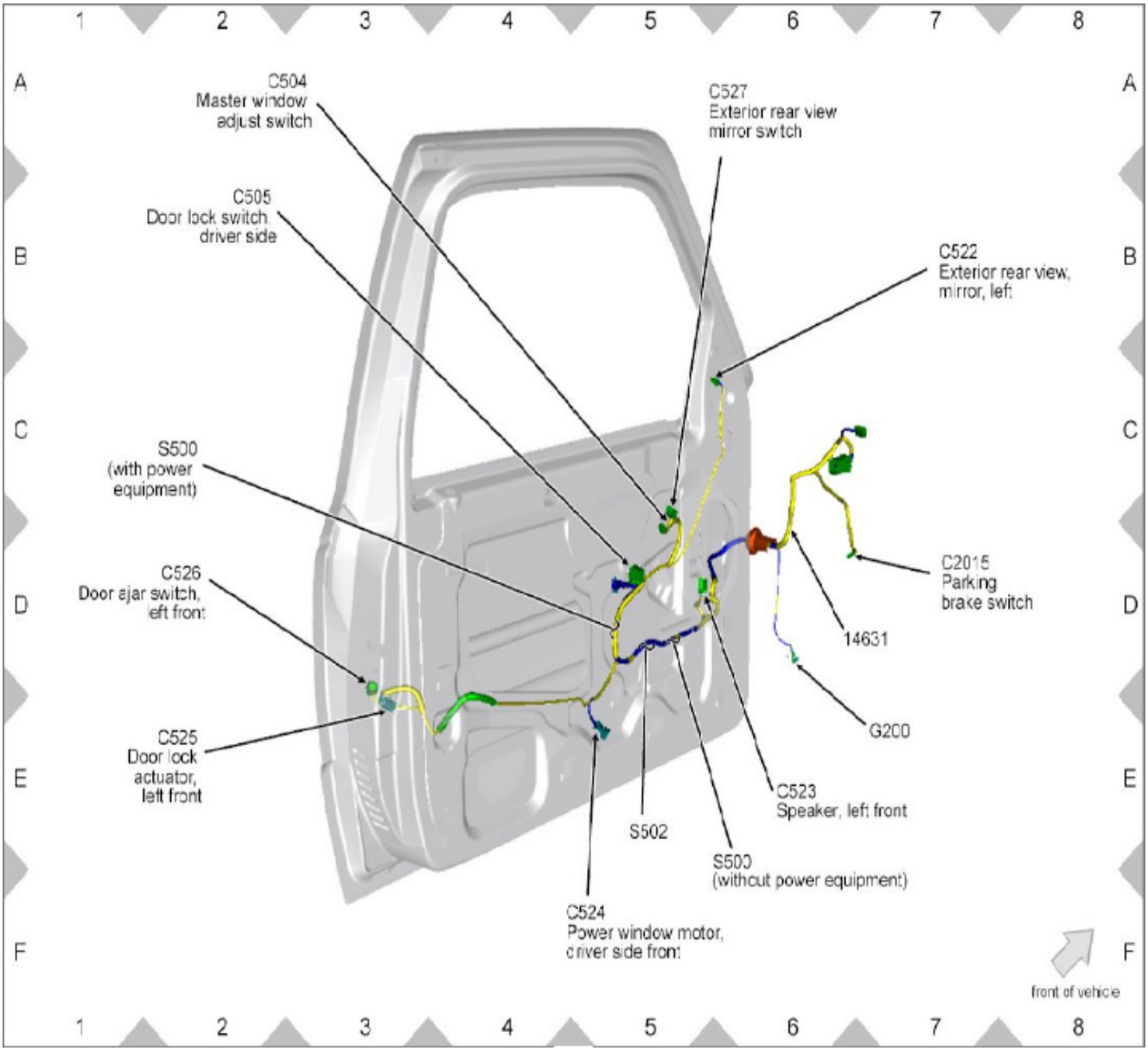
tailgate. Close the plastic clip over the thread of the tailgate latch release links.

To install, reverse the removal procedure.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Body and Frame > Locks > Power Locks > Power Door Lock Actuator > Component Information > Locations > Door Lock Actuator, Right Front



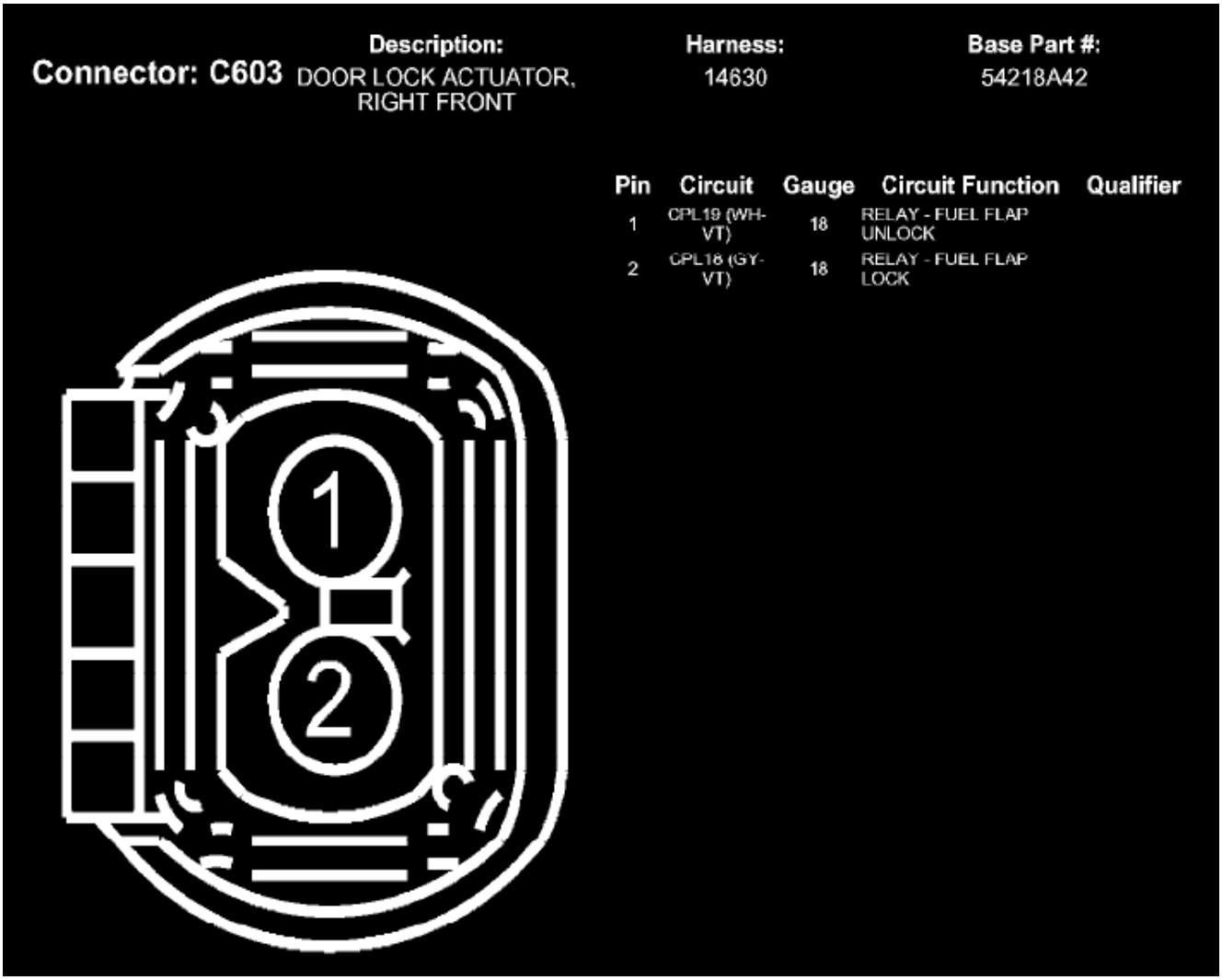
View 151-21


C504
Master window adjust switch
C505
Door lock switch driver side
S500
(with power equipment)
C526
Door ajar switch, left front
C525
Door lock actuator, left front
C527
Exterior rear view mirror switch
C522
Exterior rear view mirror, left
C2015
Parking brake switch
14631
G200
C523
Speaker, left front
S502
S500
(without power equipment)
C524
Power window motor, driver side front
front of vehicle

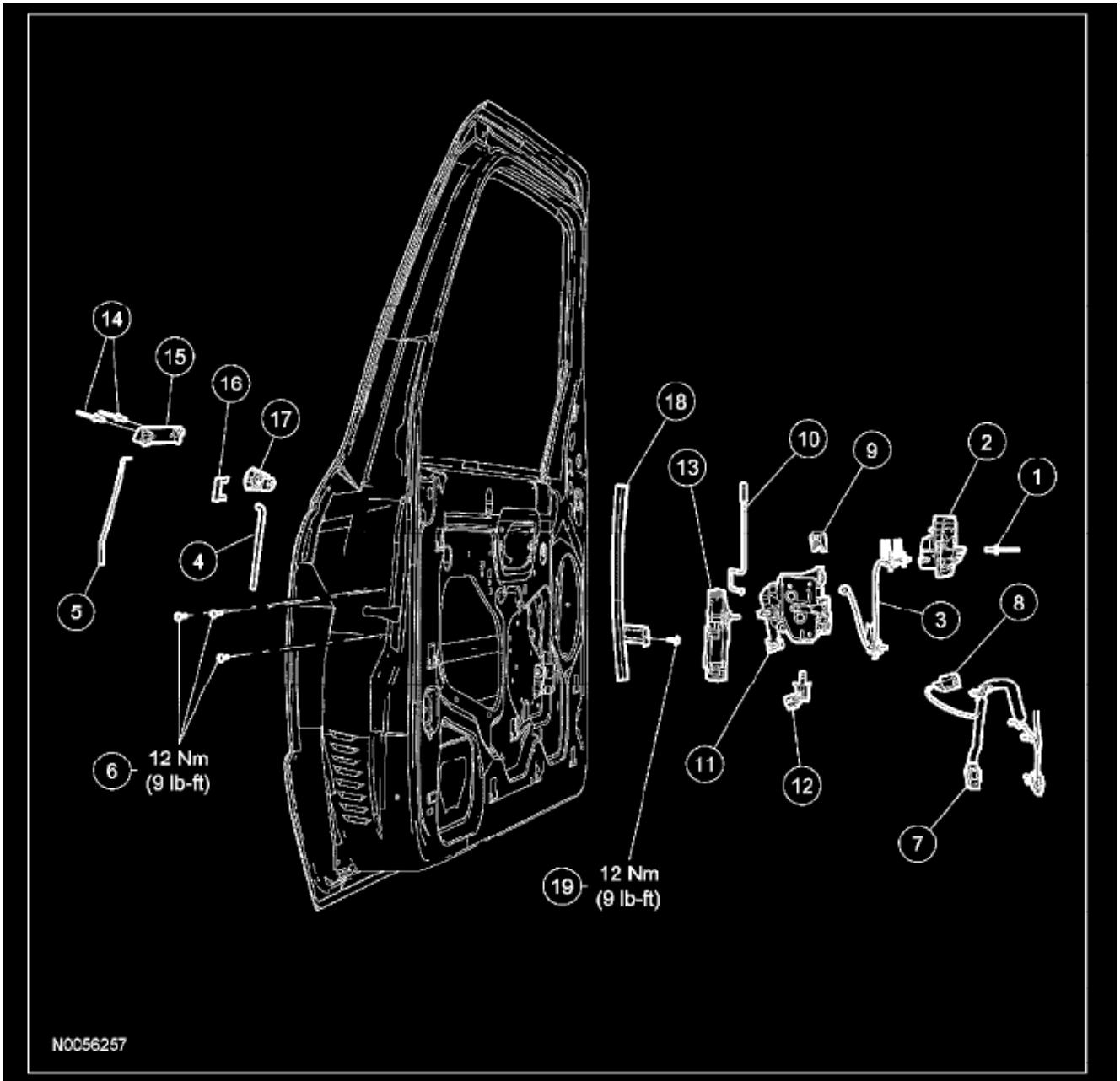
View 151-20

Connector: C525
Description:
DOOR LOCK ACTUATOR, LEFT FRONT
Harness:
14631
Base Part #:
5421BA42
Pin
Circuit
Gauge
Circuit Function
Qualifier
1
CPL11 (GY-BN)
18
CTRL MOD. - DOOR LOCK # ALL LOCK
2
CPL51 (BU-GN)
18
CTRL MOD. - DOOR LOCK # DRIVER UNLOCK
1
2

C525


Connector: C603
Description:
DOOR LOCK ACTUATOR, RIGHT FRONT
Harness:
14630
Base Part #:
54218A42
Pin
Circuit
Gauge
Circuit Function
Qualifier
1
CPL19 (WH-VT)
18
RELAY - FUEL FLAP UNLOCK
2
CPL18 (GY-VT)
18
RELAY - FUEL FLAP LOCK
1
2

C603



Item	Part Number	Description
1	W525172	Interior door handle rivet
2	1022404	Interior door handle
3	10221A00/ 10221A01	Interior door handle actuating cable (RH/LH)
4	1022134/ 1022135	Door lock cylinder actuating rod (RH/LH)

(Continued)

Item	Part Number	Description
5	1022152/ 1022153	Exterior door handle actuating rod (RH/LH)
6	W705830-S901	Front door latch screws (3 required)

(Continued)

Power Door Lock Actuator: Service and Repair

DOOR LOCK ACTUATOR

Exploded View

Part 1

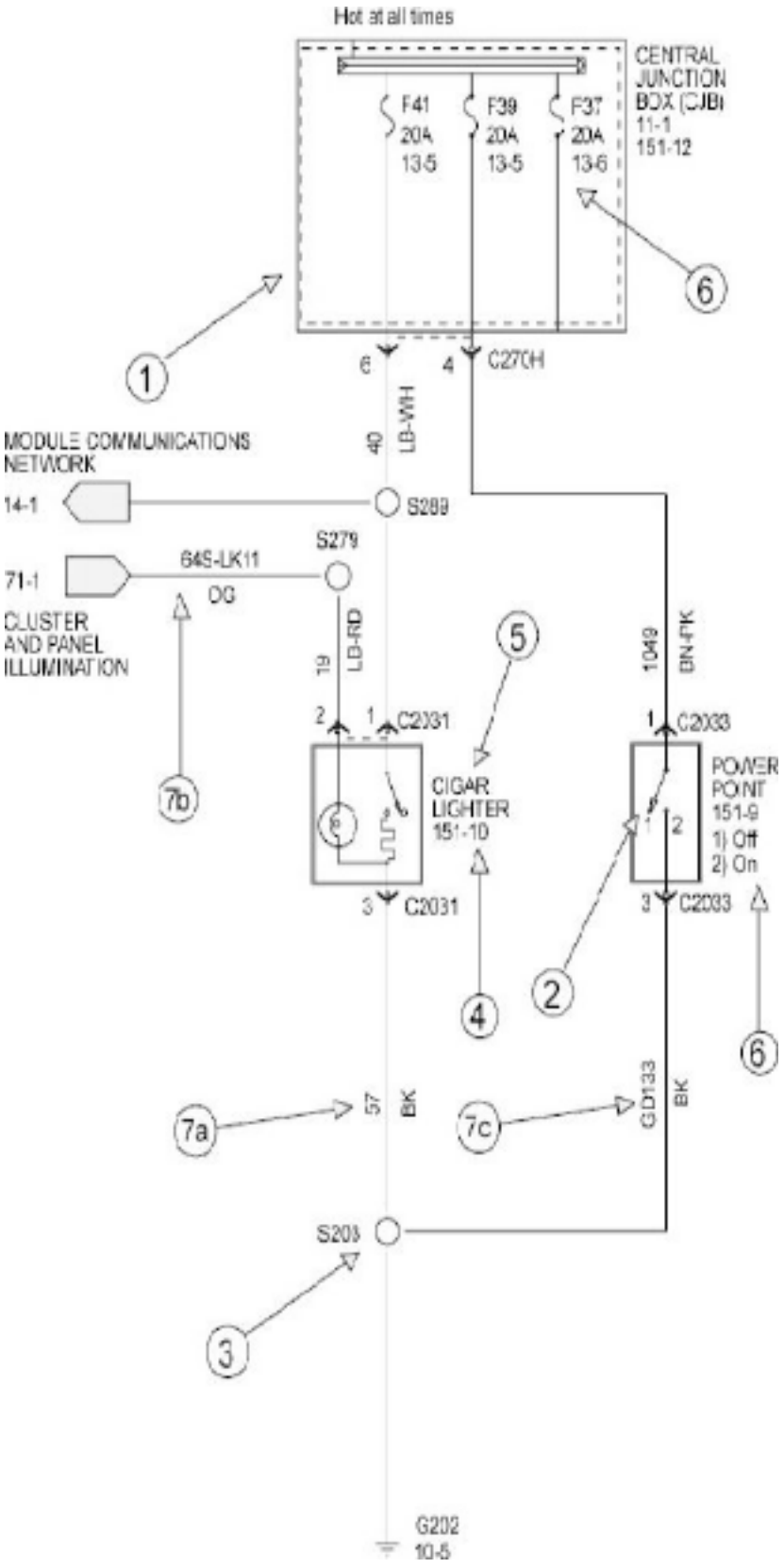
Item	Part Number	Description
7	—	Door ajar switch electrical connector (part of 14630/14631) (RH/LH)
8	—	Door lock actuator electrical connector (part of 14630/14631) (RH/LH)
9	15221A06/ 15221A07	Front door latch cable watershield (RH/LH)
10	1021852/ 1021853	Door latch push button rod (RH/LH)
11	1021812/ 1021813	Front door latch (RH/LH)
12	14018/ 10B997	Front door ajar switch (RH/LH)
13	218B20/ 218B21	Door lock actuator (RH/LH)
14	W707874	Exterior front door handle rivets (2 required)
15	1022404	Exterior front door handle
16	1022023	Door lock cylinder retainer
17	7821990	Front door lock cylinder
18	222A00	Door glass channel
19	N6066676-S	Door glass channel bolt

Part 2

Removal and Installation

1. Remove the front door latch. 2. Slide the front door latch actuator from the front door latch assembly. 3. To install, reverse the removal procedure.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Body and Frame > Locks > Power Locks > Power Door Lock Relay > Component Information > Diagrams > Diagram Information and Instructions



Power Door Lock Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

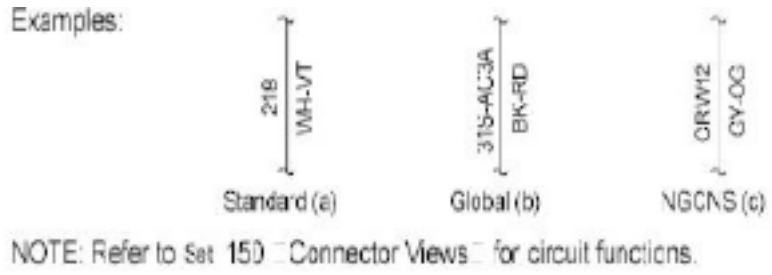
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

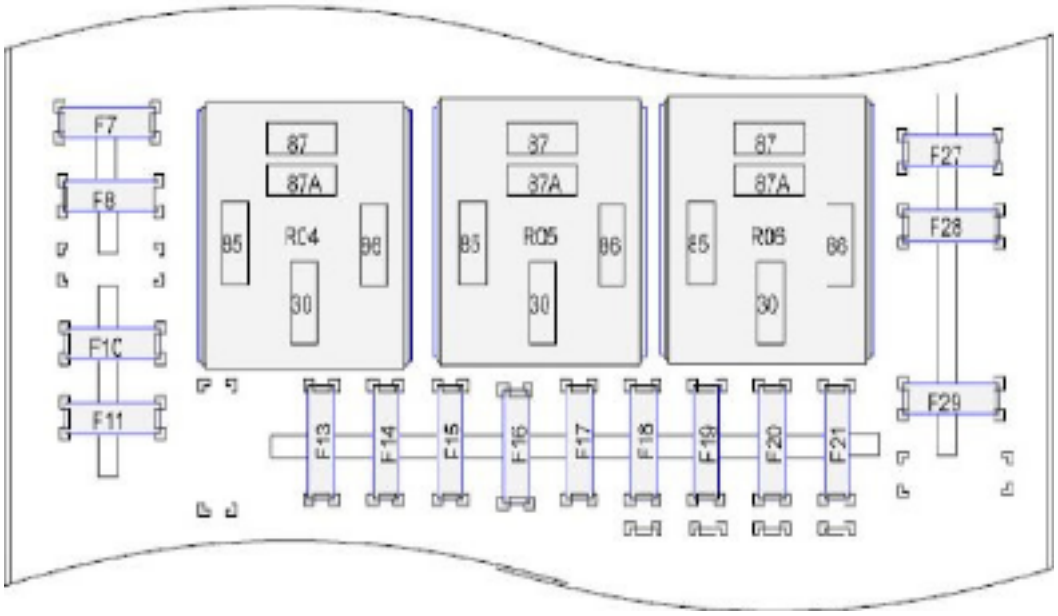
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

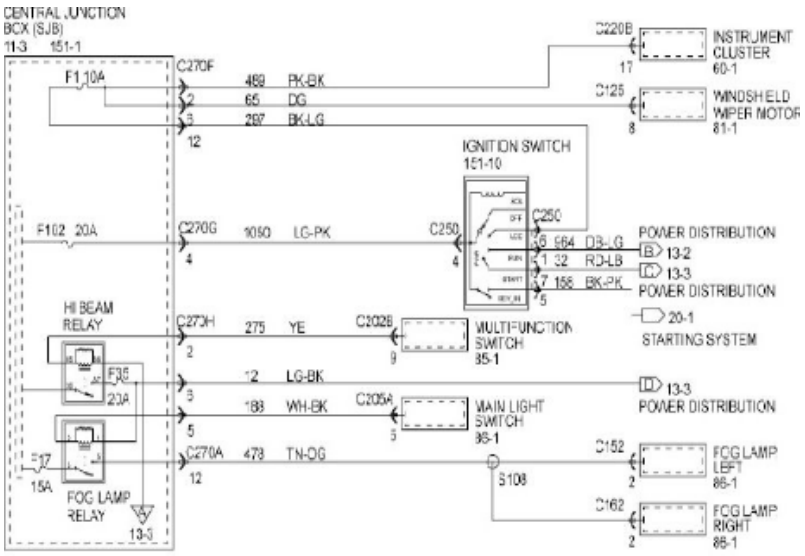
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

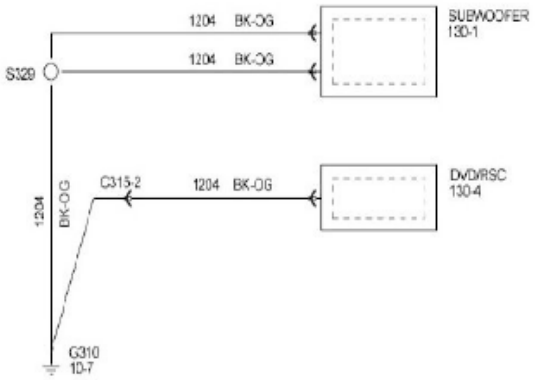
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

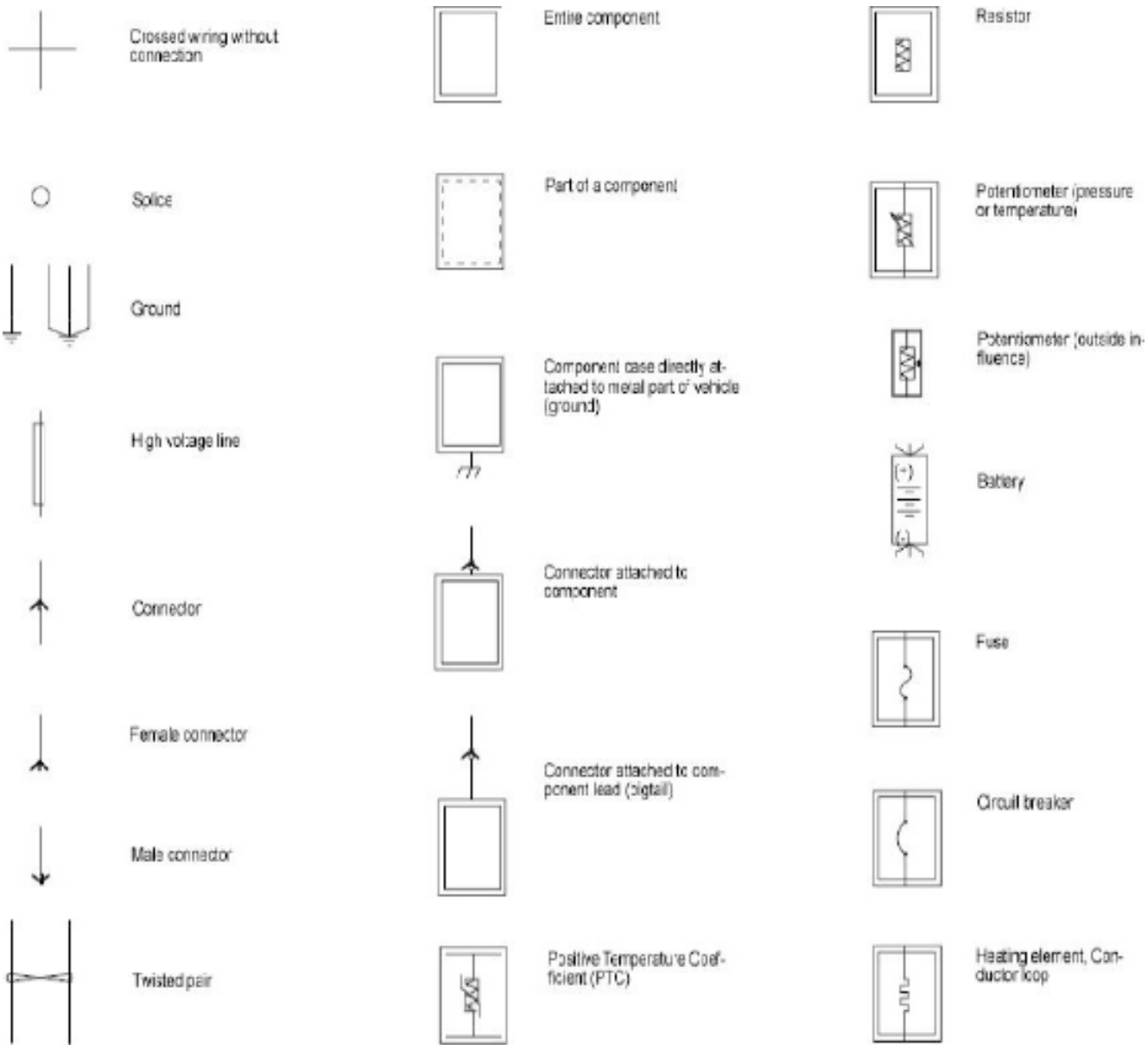
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

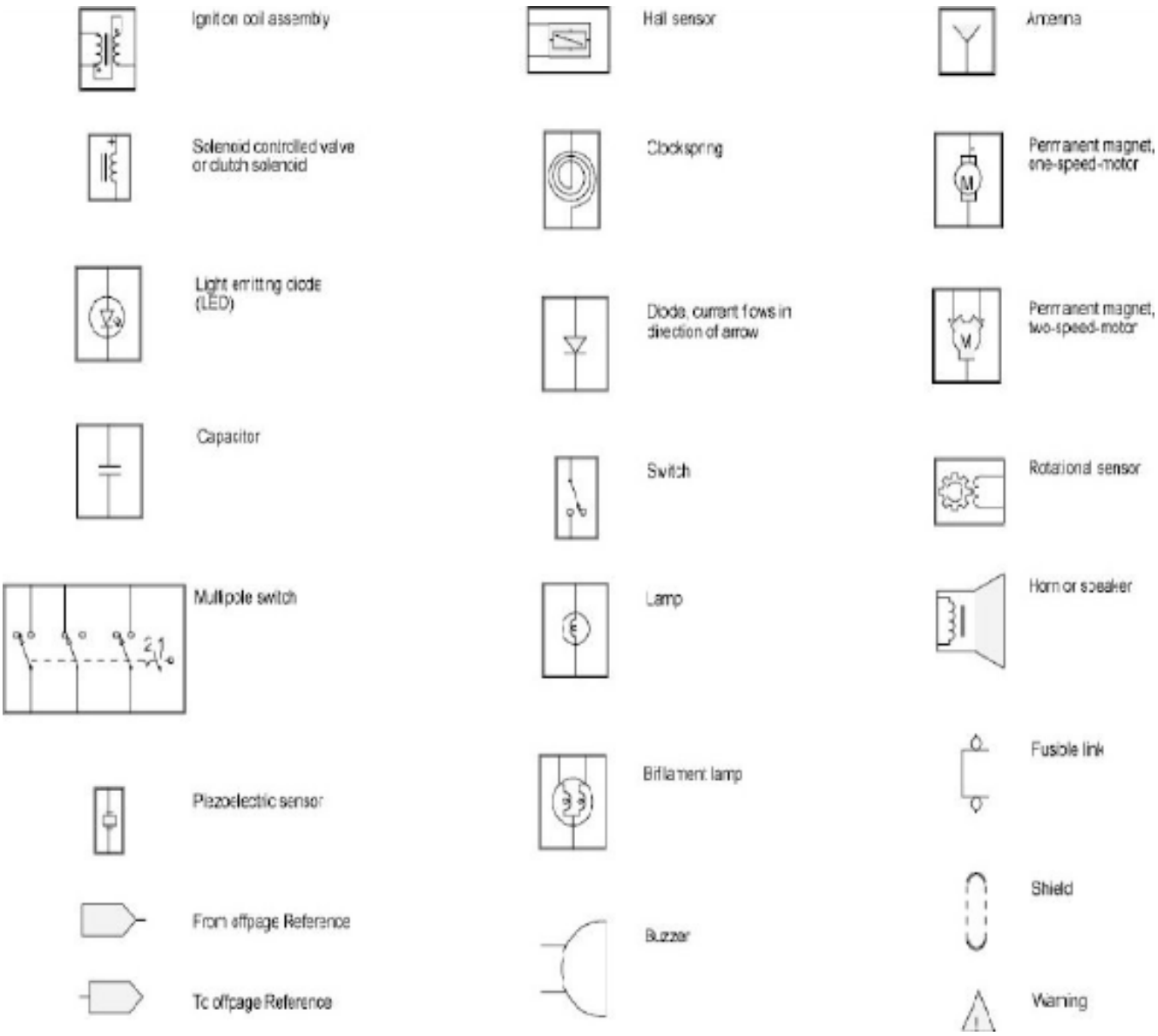
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

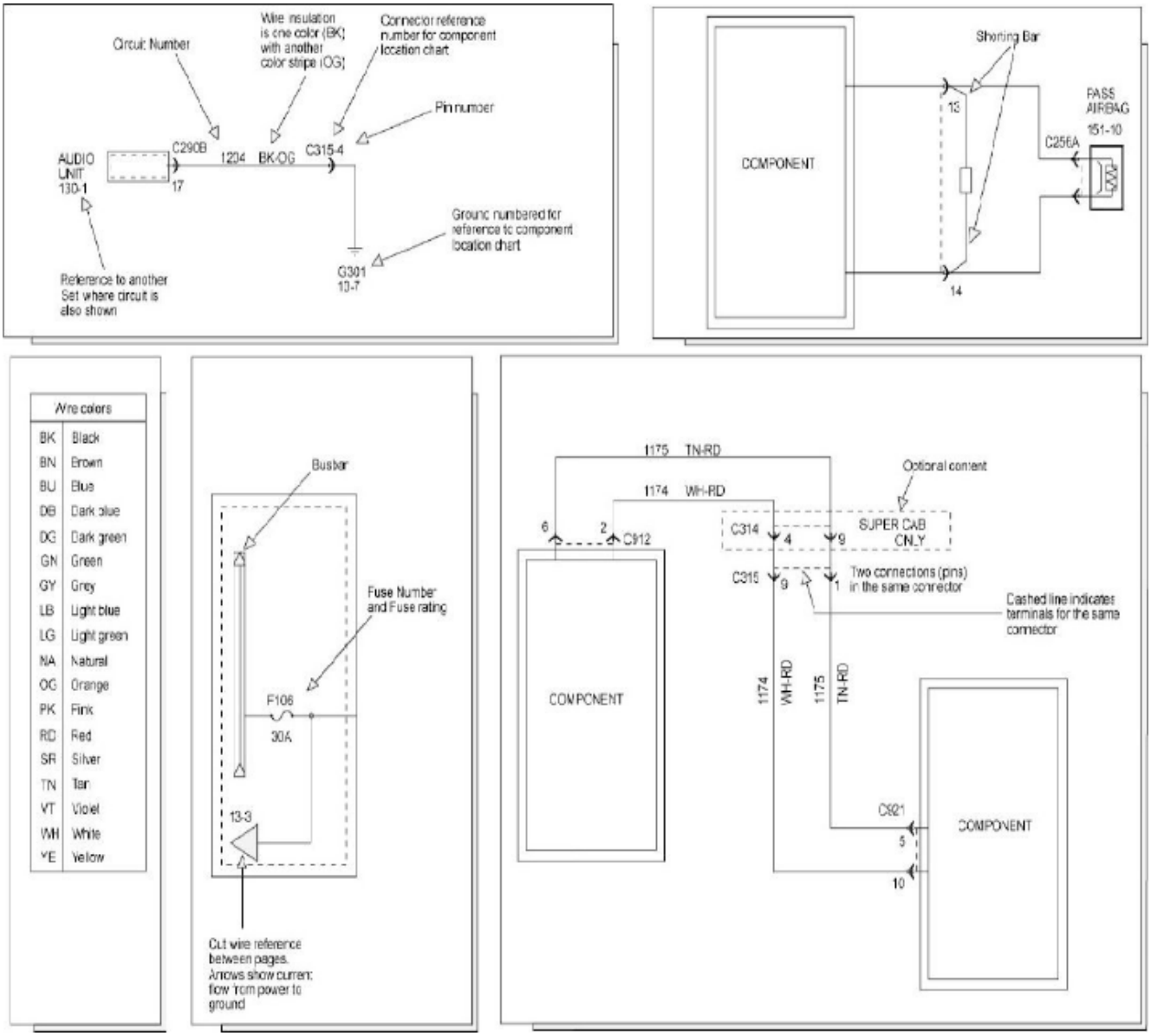
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

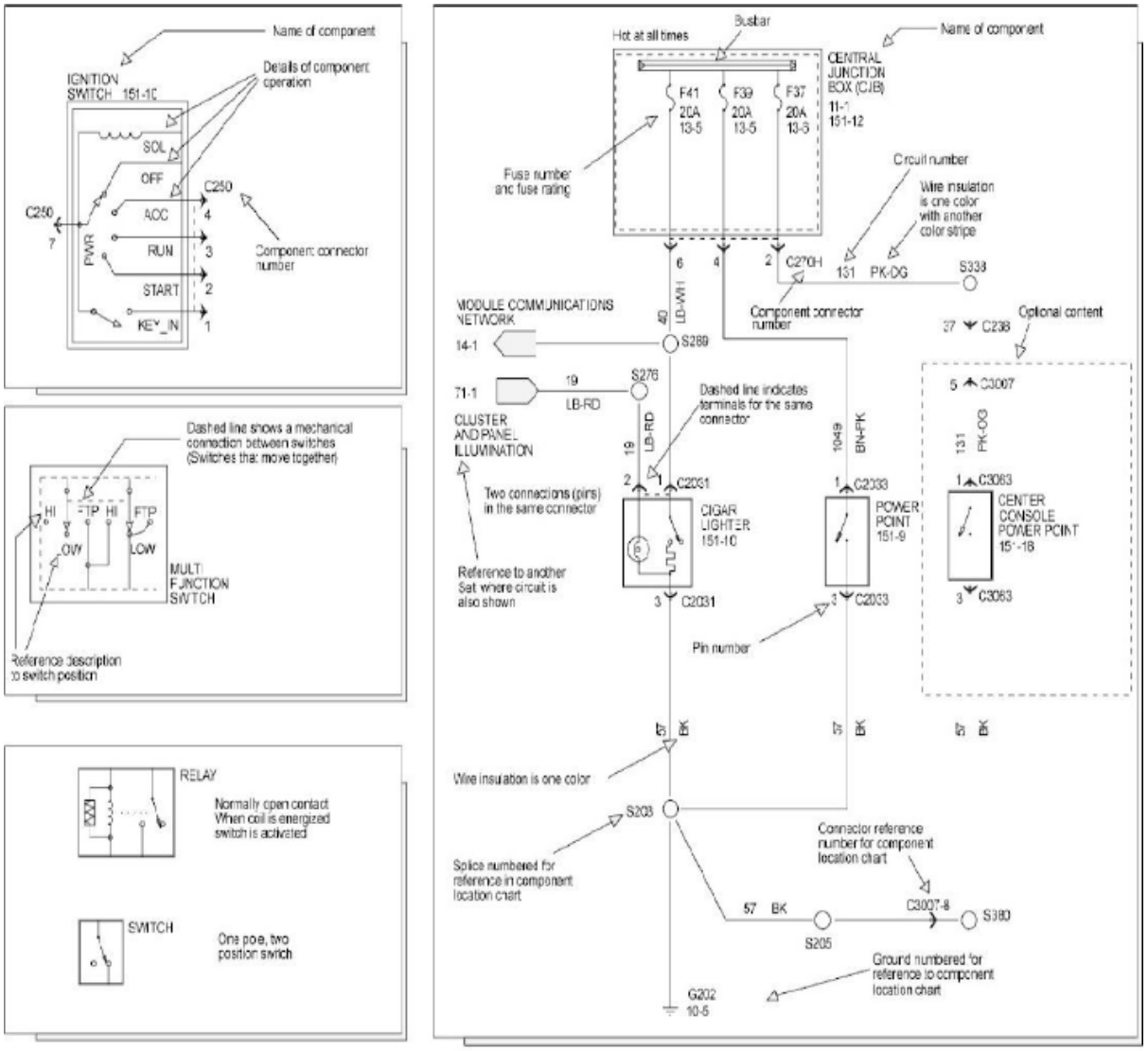
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

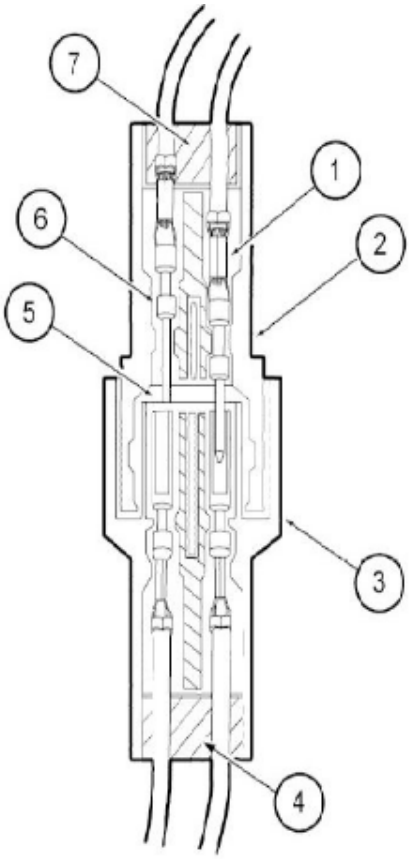


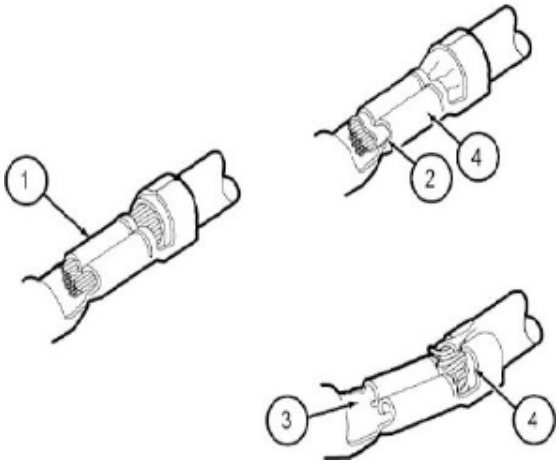
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Power Door Lock Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

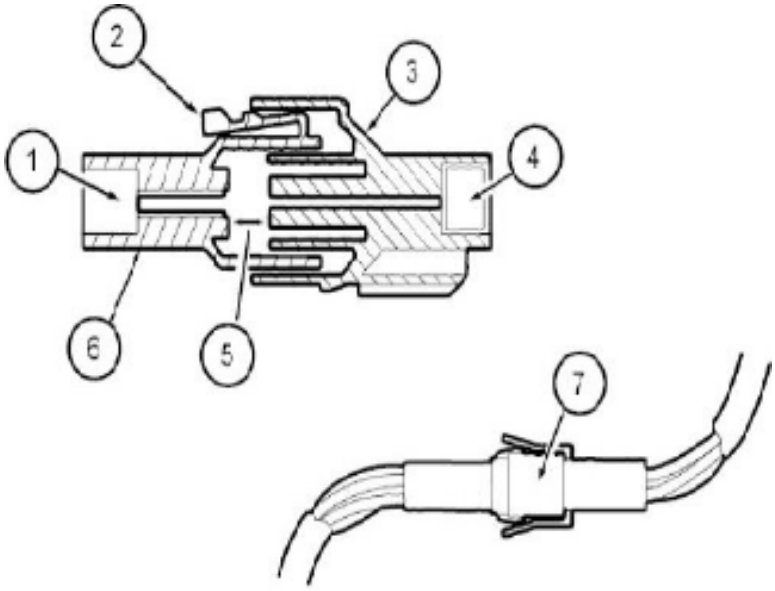
5 = Intermittent contact

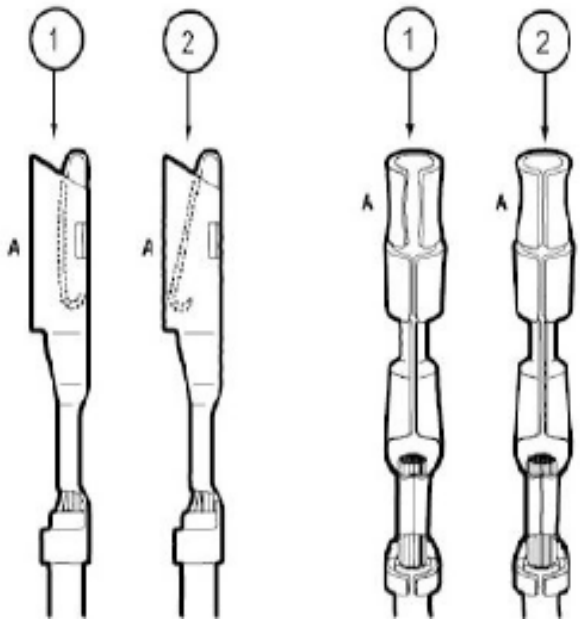
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

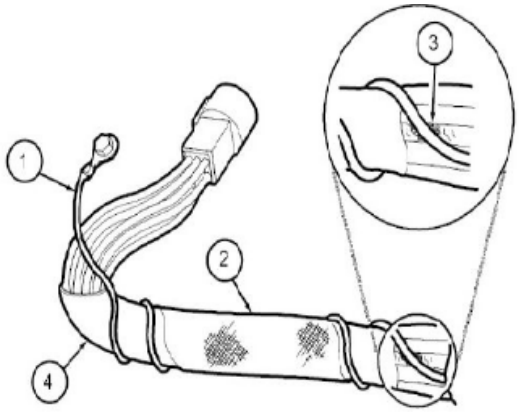
Deformed (enlarged) female terminals

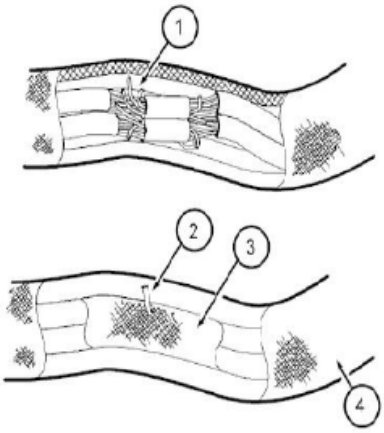
1 = Enlarged

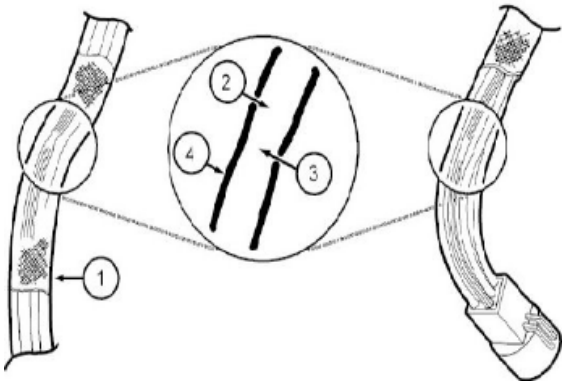
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

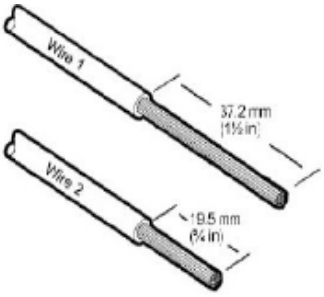
Splice covered 2

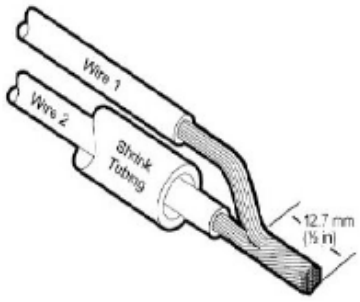
= Wire strand

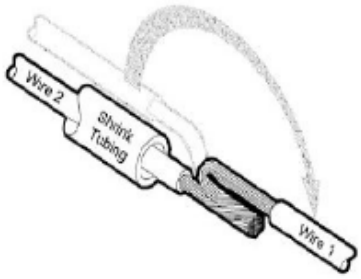
3 = Splice tape

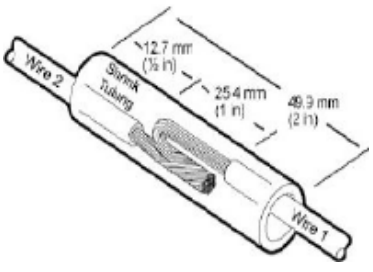
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

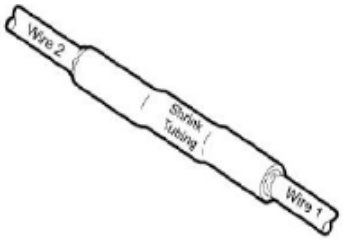
NOTE: -

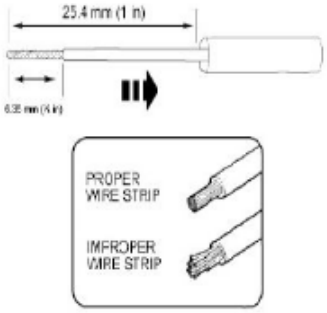
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

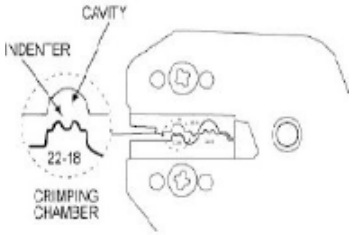
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

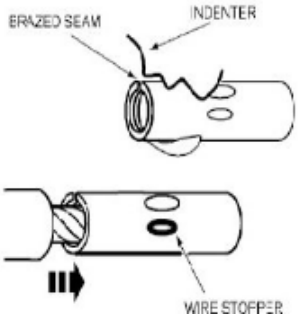
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

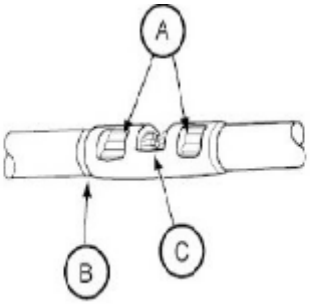
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

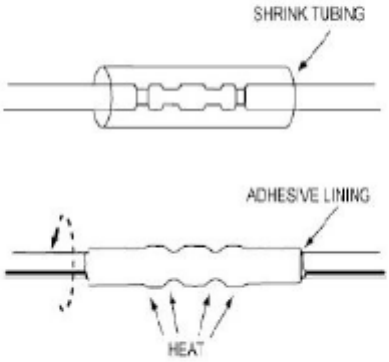
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4 strip, cut 9 strands	* 1/4 strip, cut 2 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip, fold 3x dia.
	16-14	* 1/4 strip, cut 7 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip fold 2x dia	1 strip, fold 3x dia.	1 1/4 strip, fold 4x dia.	Not Recommended
	12-10	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip fold 3x cia.	1 1/4 strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Figtail only

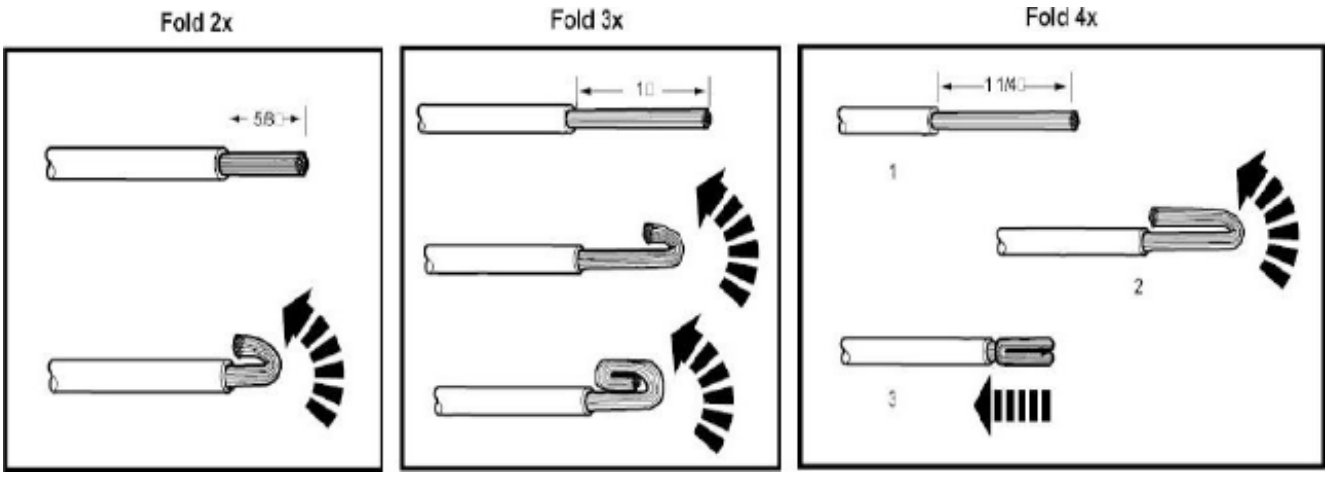
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



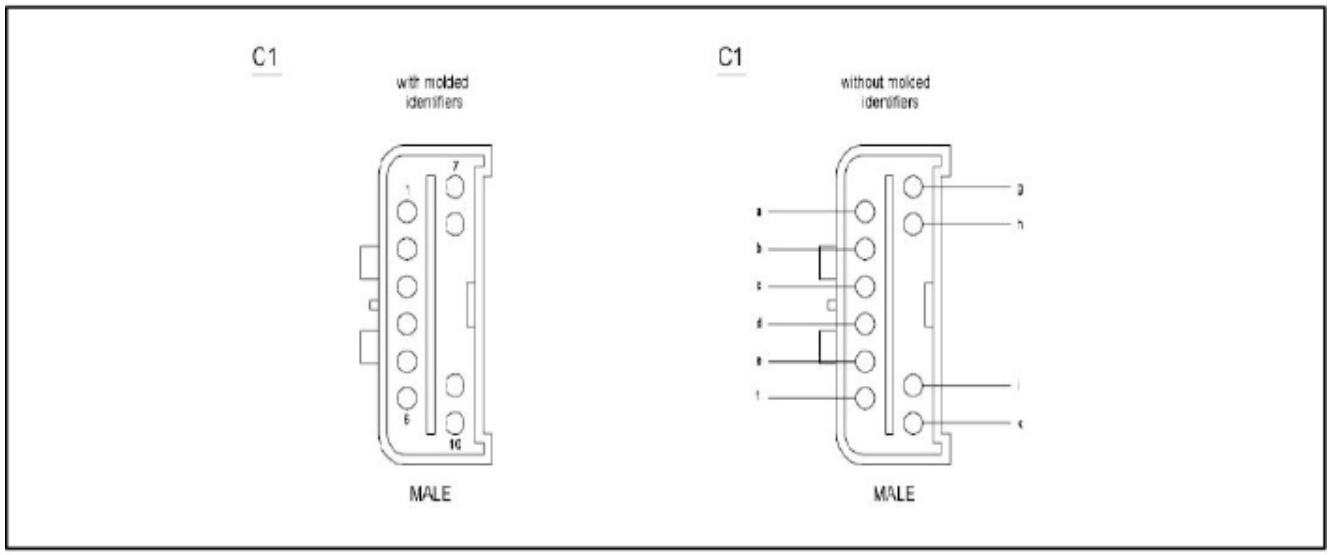
The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



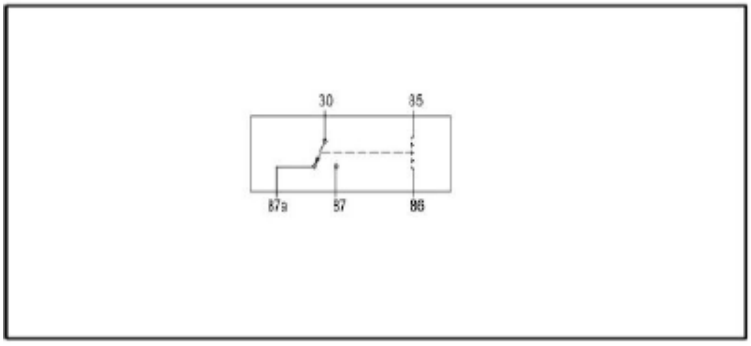
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

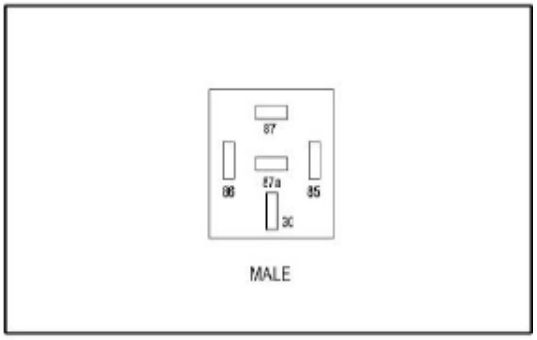
Power Door Lock Relay: Testing and Inspection Mini ISO Relay

Relay □ Mini ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	45 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

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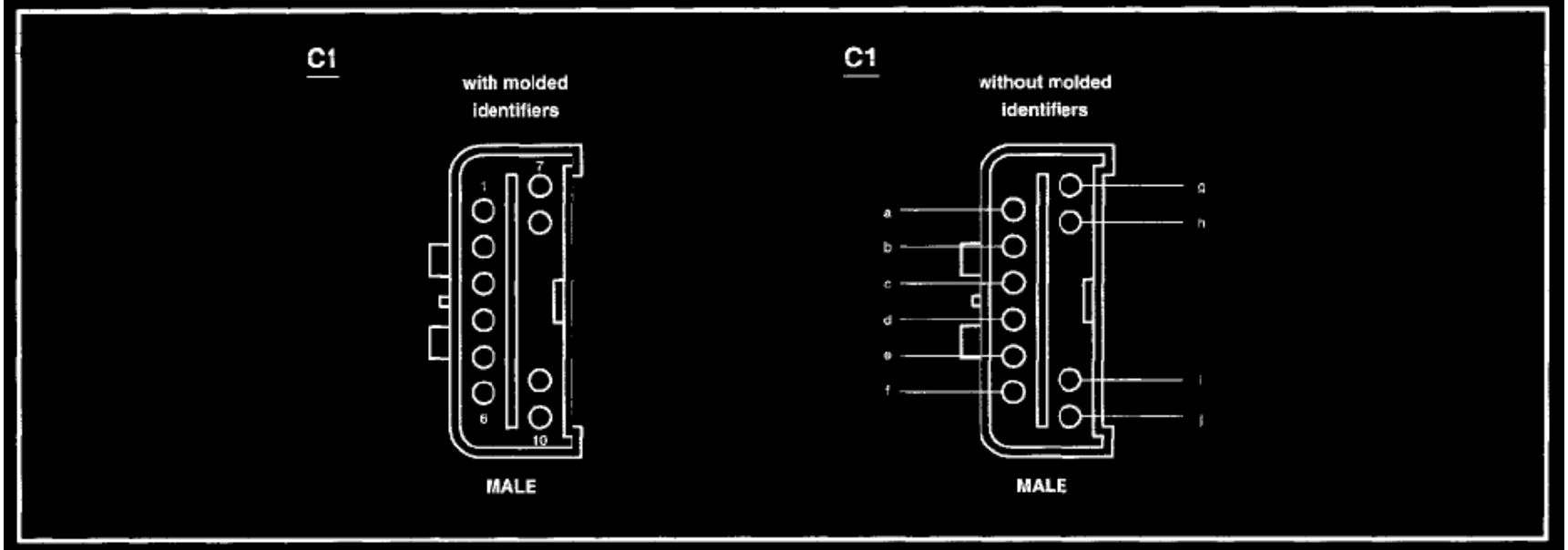
Terminals



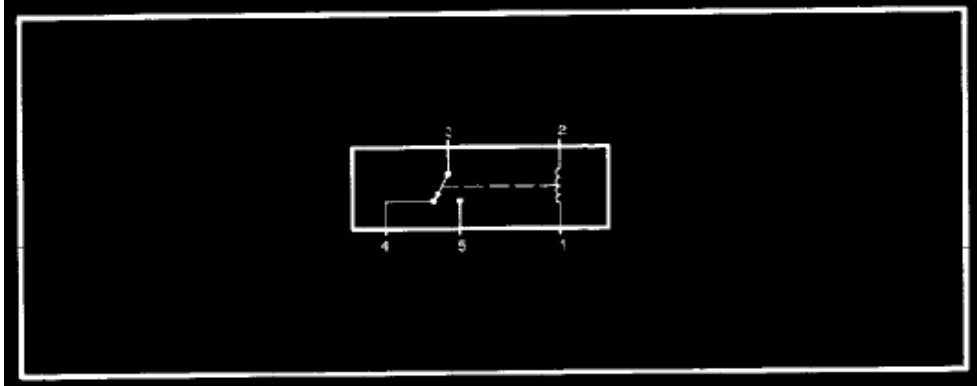
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

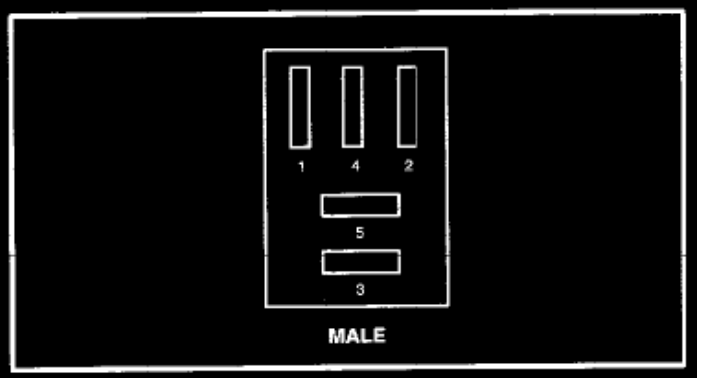
Power Door Lock Relay: Testing and Inspection Micro ISO Relay

Relay – Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63–102Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil – Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

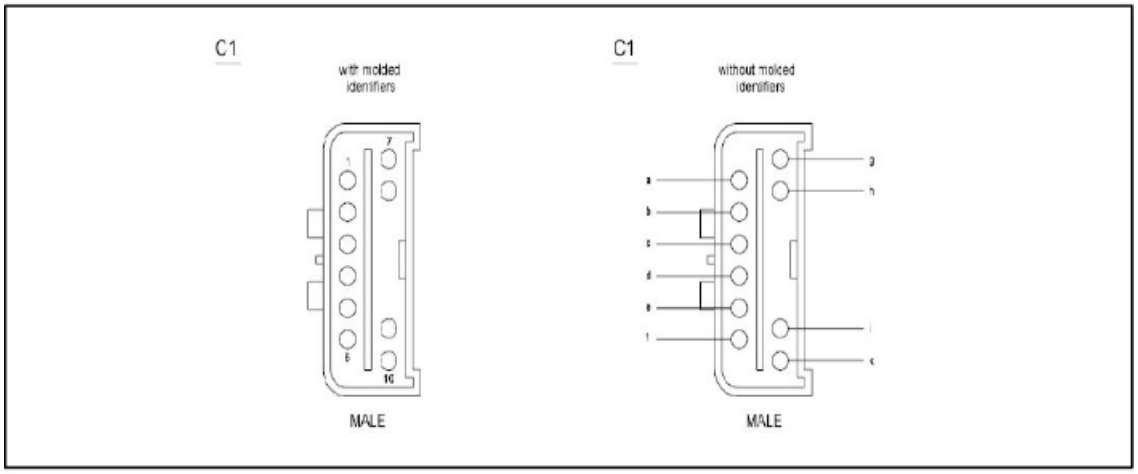
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step□by□step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals

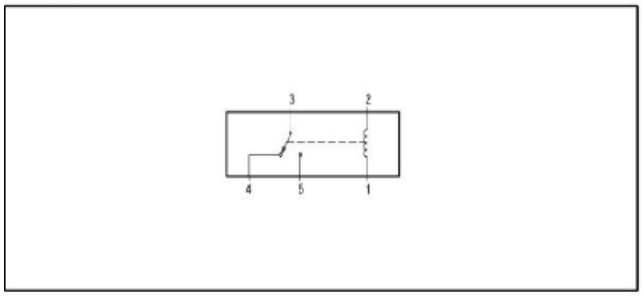


The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column □Circuit to test□. If you wish to test the complete component, perform all tests.

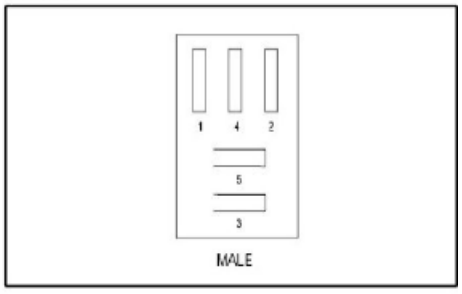
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Relay □ Micro ISO

Schematic



Terminals



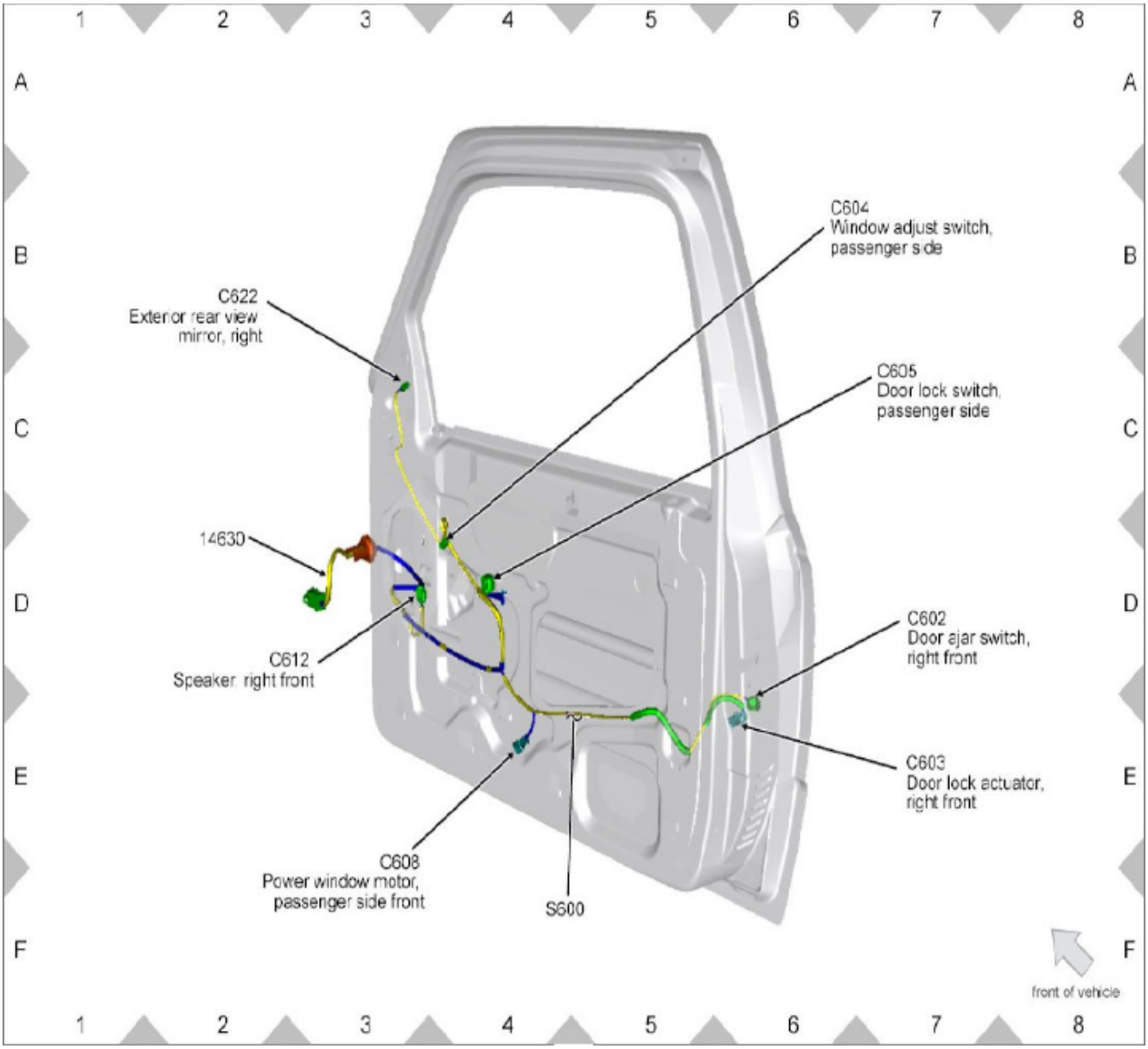
Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63□102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil □ Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

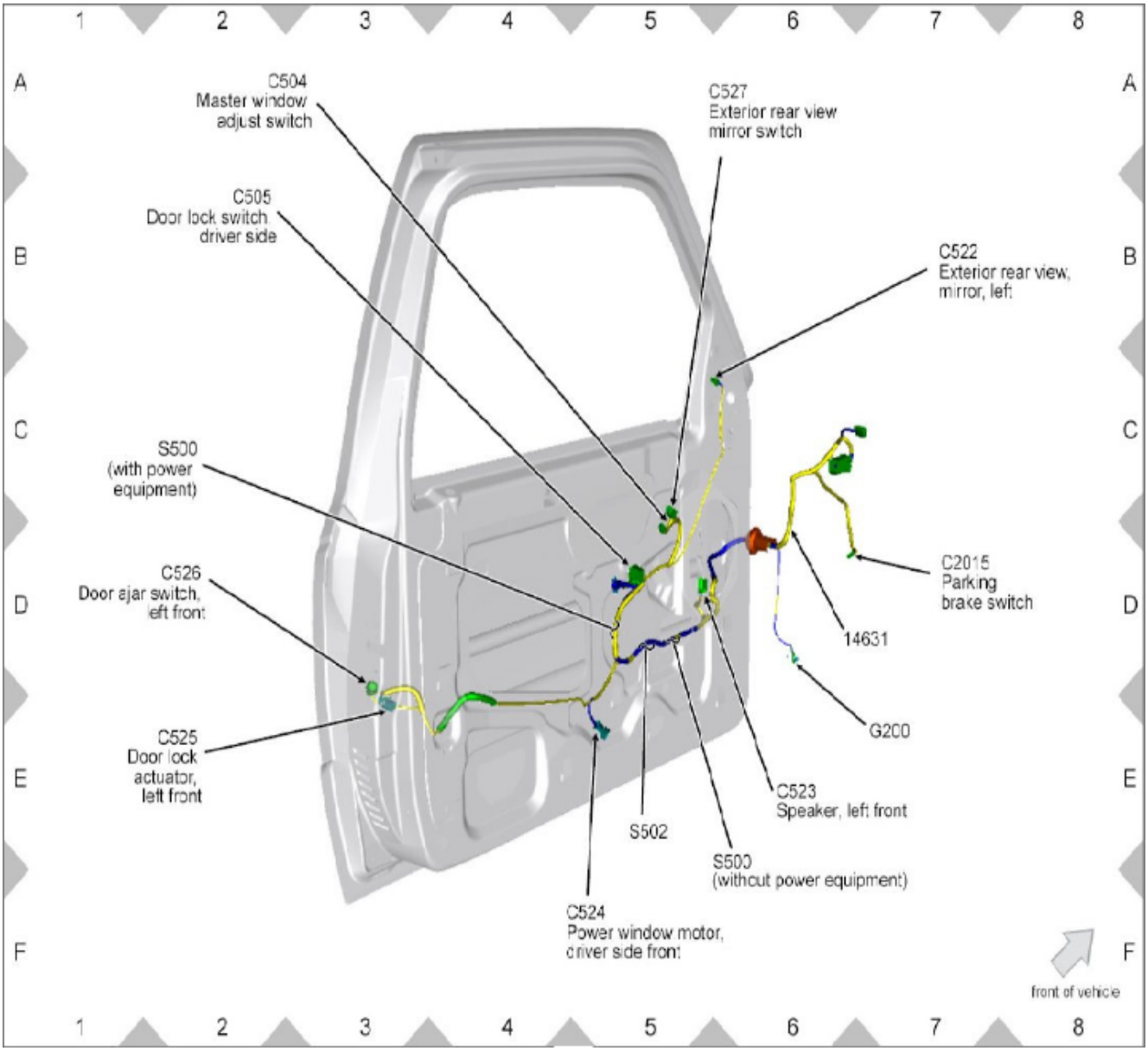
Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

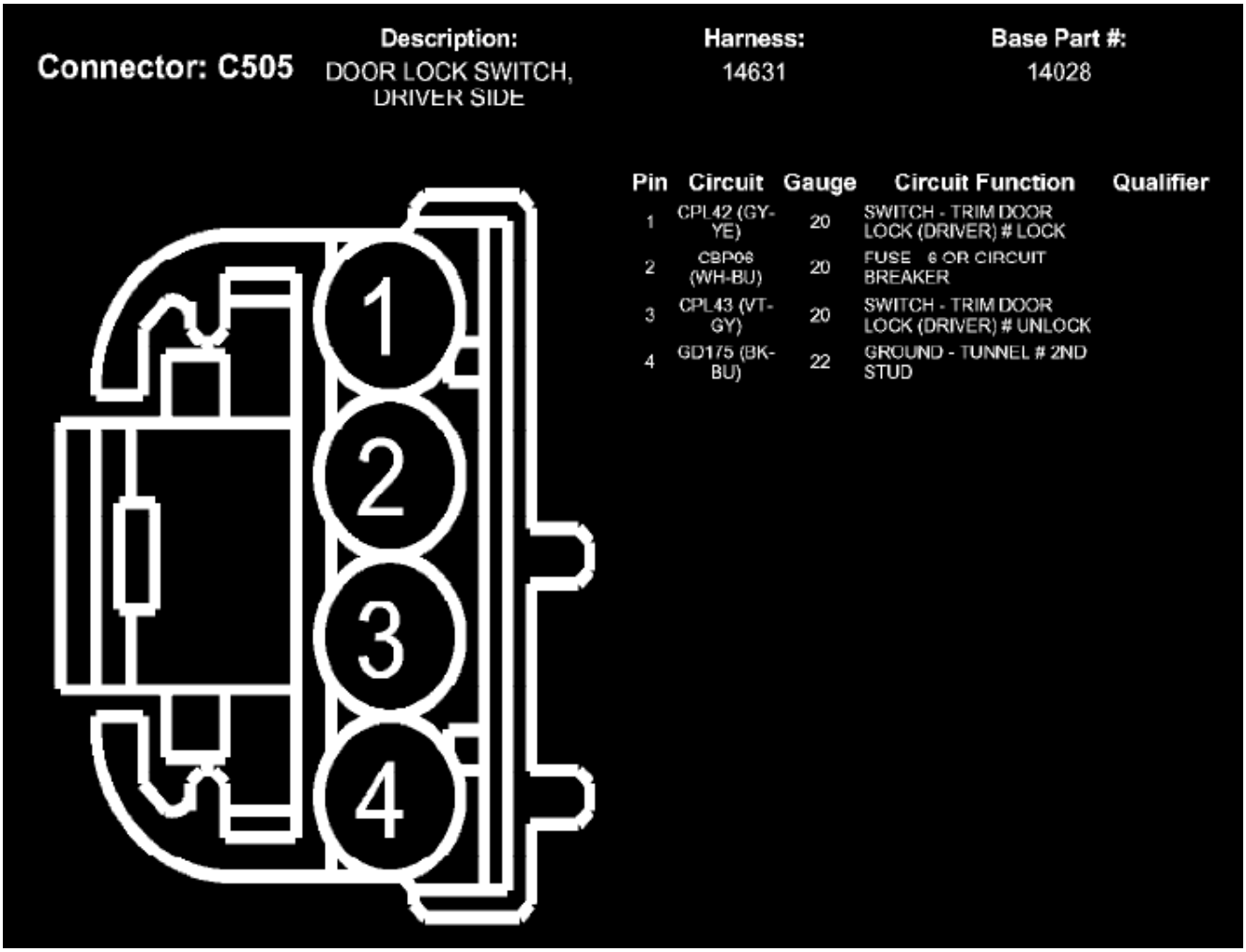
Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Body and Frame > Locks > Power Locks > Power Door Lock Switch > Component Information > Locations > Door Lock Switch, Passenger Side



View 151-21

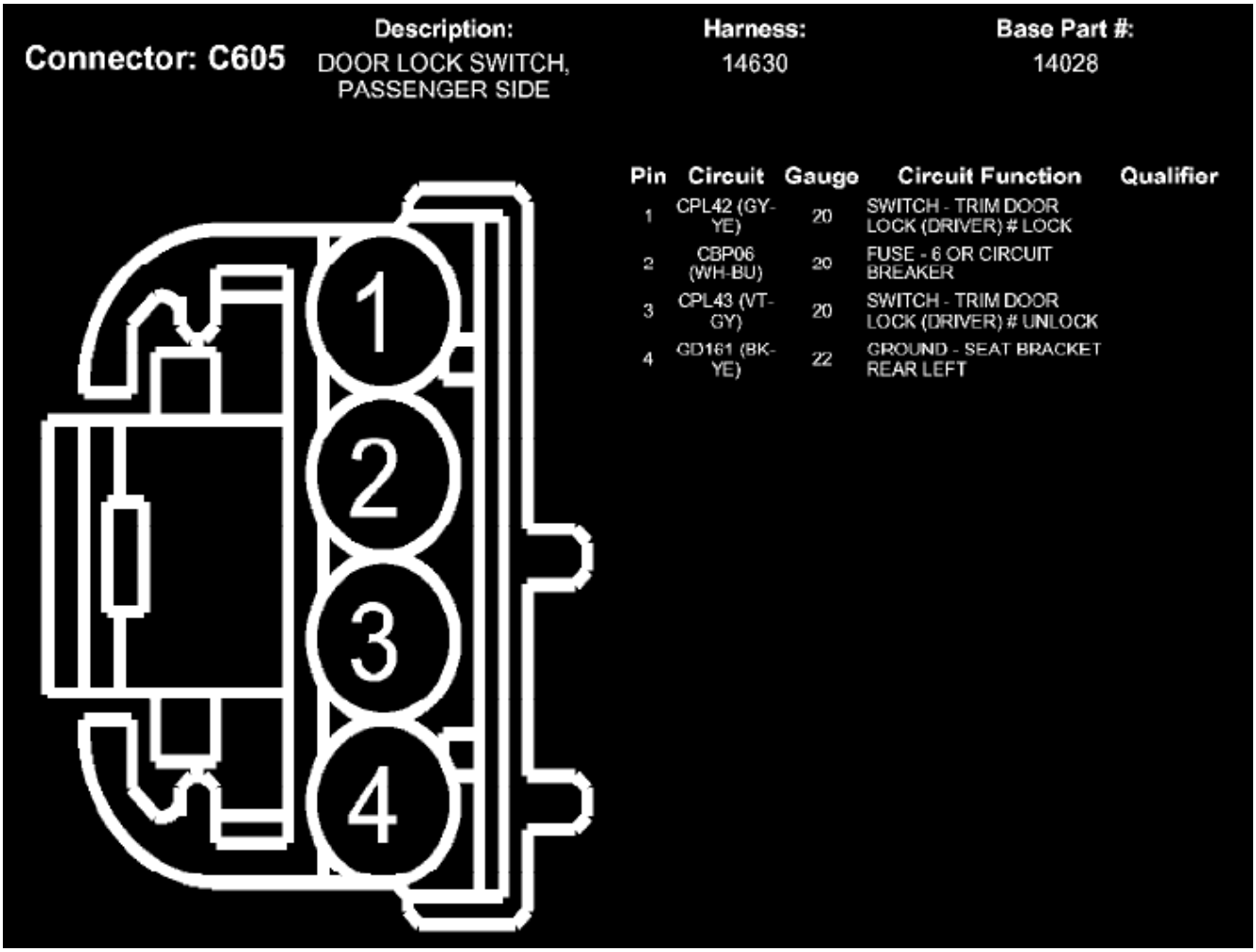

C504
Master window adjust switch
C505
Door lock switch driver side
S500
(with power equipment)
C526
Door ajar switch, left front
C525
Door lock actuator, left front
C524
Power window motor, driver side front
S502
S500
(without power equipment)
C523
Speaker, left front
G200
14631
C2015
Parking brake switch
C522
Exterior rear view mirror, left
C527
Exterior rear view mirror switch
front of vehicle

View 151-20



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPL42 (GY-YE)	20	SWITCH - TRIM DOOR LOCK (DRIVER) # LOCK	
2	CBP06 (WH-BU)	20	FUSE 6 OR CIRCUIT BREAKER	
3	CPL43 (VT-GY)	20	SWITCH - TRIM DOOR LOCK (DRIVER) # UNLOCK	
4	GD175 (BK-BU)	22	GROUND - TUNNEL # 2ND STUD	

C505


Connector: C605
Description:
DOOR LOCK SWITCH, PASSENGER SIDE
Harness:
14630
Base Part #:
14028
1
2
3
4
Pin Circuit Gauge Circuit Function Qualifier
1 CPL42 (GY-YE) 20 SWITCH - TRIM DOOR LOCK (DRIVER) # LOCK
2 CBP06 (WH-BU) 20 FUSE - 6 OR CIRCUIT BREAKER
3 CPL43 (VT-GY) 20 SWITCH - TRIM DOOR LOCK (DRIVER) # UNLOCK
4 GD161 (BK-YE) 22 GROUND - SEAT BRACKET REAR LEFT

C605

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

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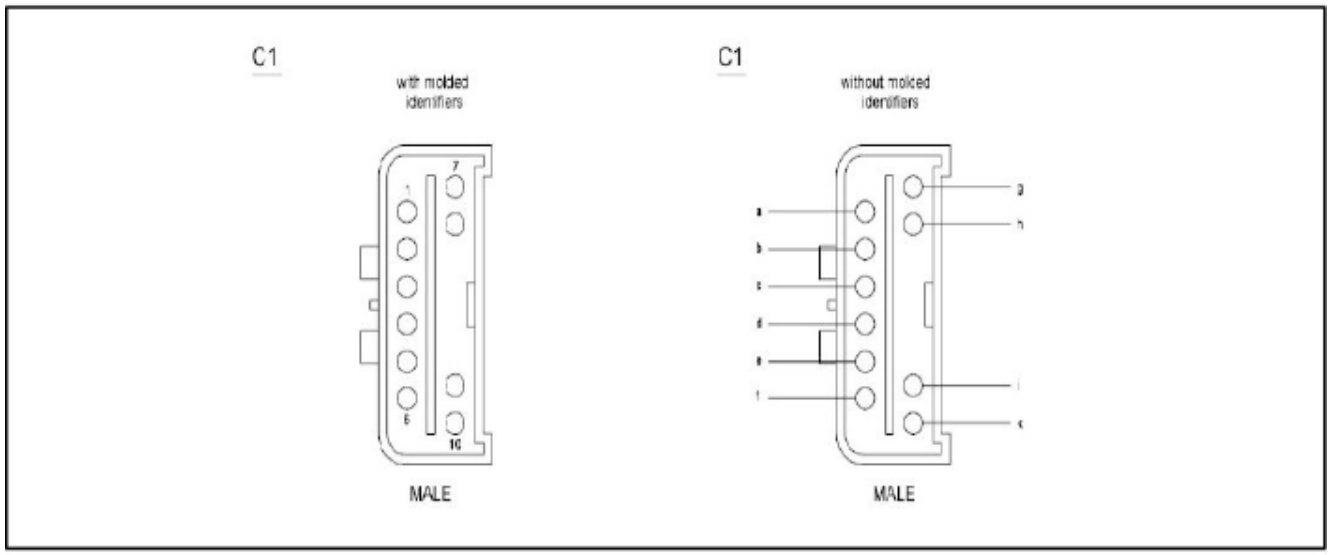
Terminals



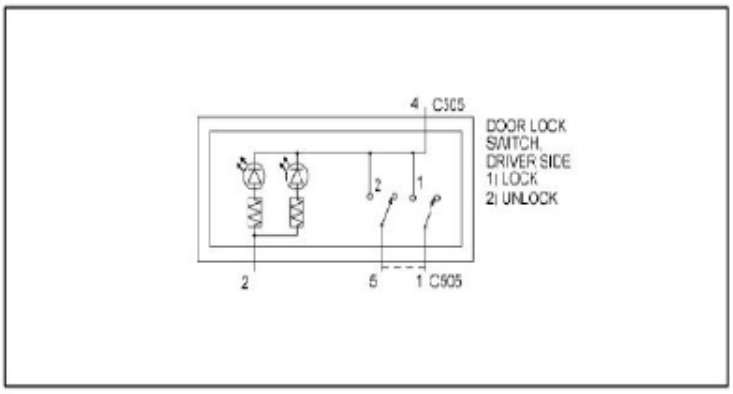
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

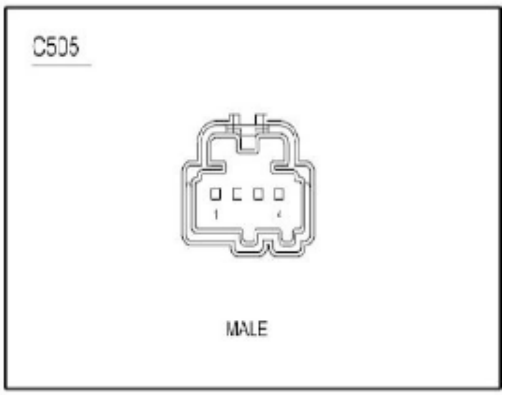
Power Door Lock Switch: Testing and Inspection Door Lock Switch, Driver Side

Door lock switch, Driver side

Schematic



Terminals



Component testing procedure

Circuit to test	Connect self-powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
Door lock switch	1 and 4	Lock	Closed circuit
		Unlock	Open circuit
		Neutral	Open circuit
	5 and 4	Lock	Open circuit
		Unlock	Closed circuit
		Neutral	Open circuit

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

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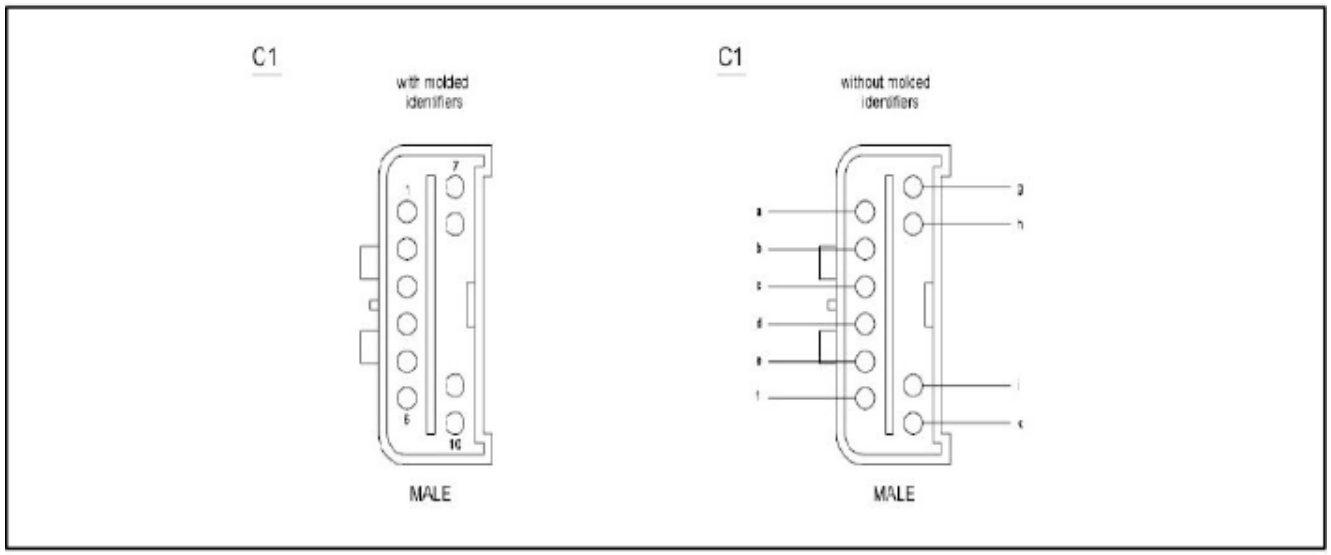
Terminals



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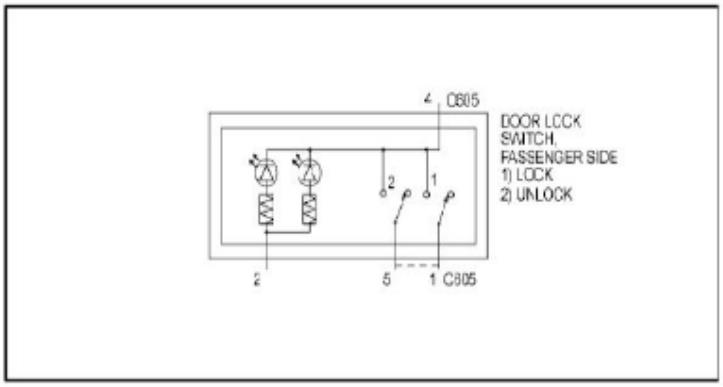
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

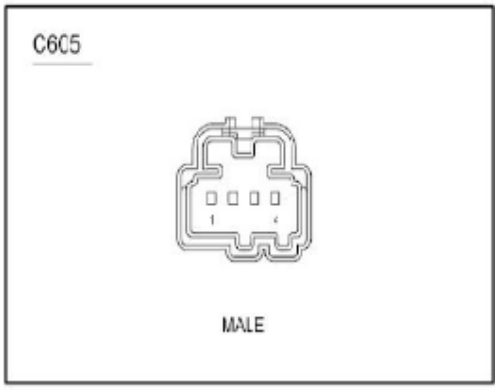
Power Door Lock Switch: Testing and Inspection Door Lock Switch, Passenger Side

Door lock switch, Passenger side

Schematic



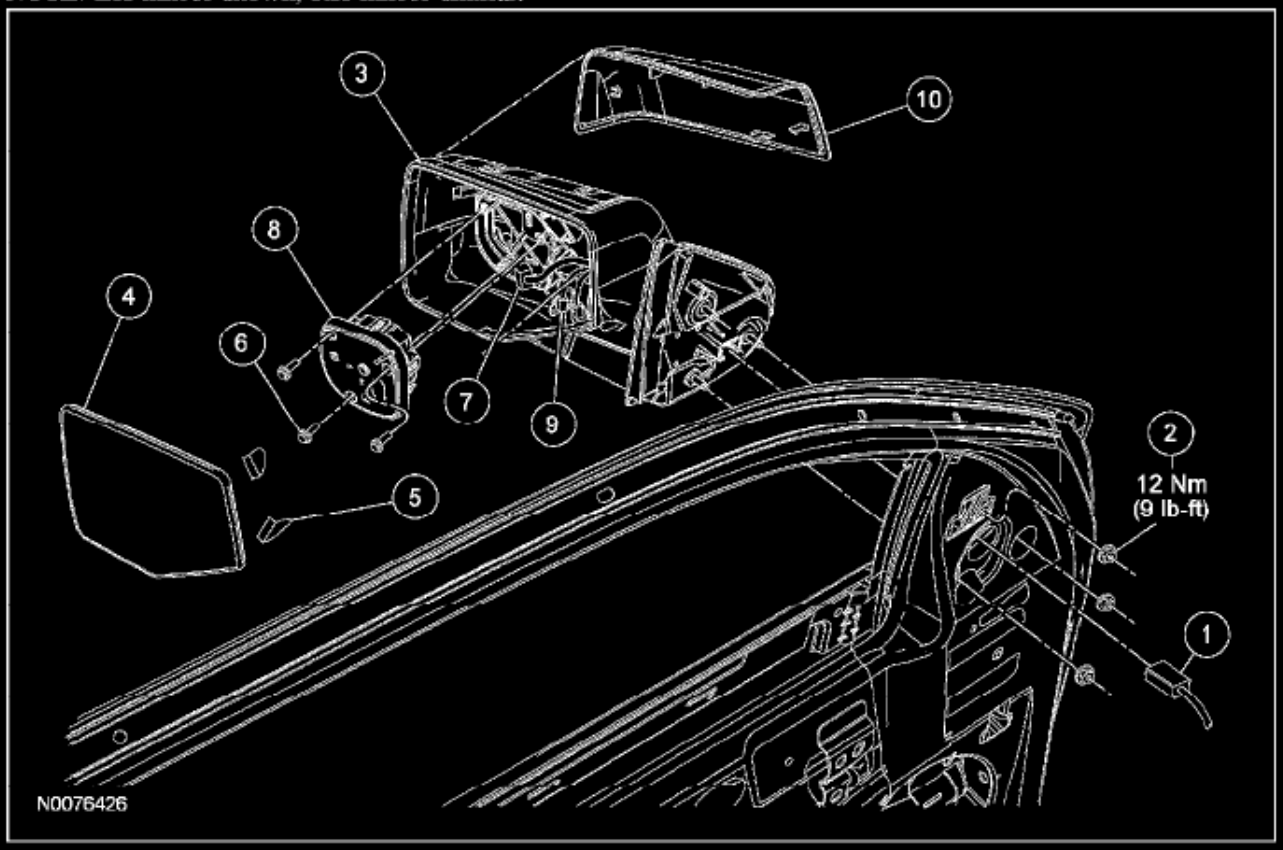
Terminals



Component testing procedure

Circuit to test	Connect self-powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
Door lock switch	1 and 4	Lock	Closed circuit
		Unlock	Open circuit
		Neutral	Open circuit
	5 and 4	Lock	Open circuit
		Unlock	Closed circuit
		Neutral	Open circuit

NOTE: LH mirror shown, RH mirror similar.



Item	Part Number	Description
1	14631	Exterior mirror electrical connector
2	N621905	Exterior mirror nut (3 required)
3	17683 LH/ 17682 RH	Exterior mirror assembly
4	17K707	Exterior mirror glass
5	—	Exterior mirror glass damper spring (part of 17K707)
6	—	Exterior mirror motor screw

Item	Part Number	Description
7	—	Exterior mirror motor electrical connector
8	17D696	Exterior mirror motor
9	—	Exterior mirror glass electrical connector (if equipped)
10	17D742 RH/ 17D743 LH	Exterior mirror cover

(Continued)

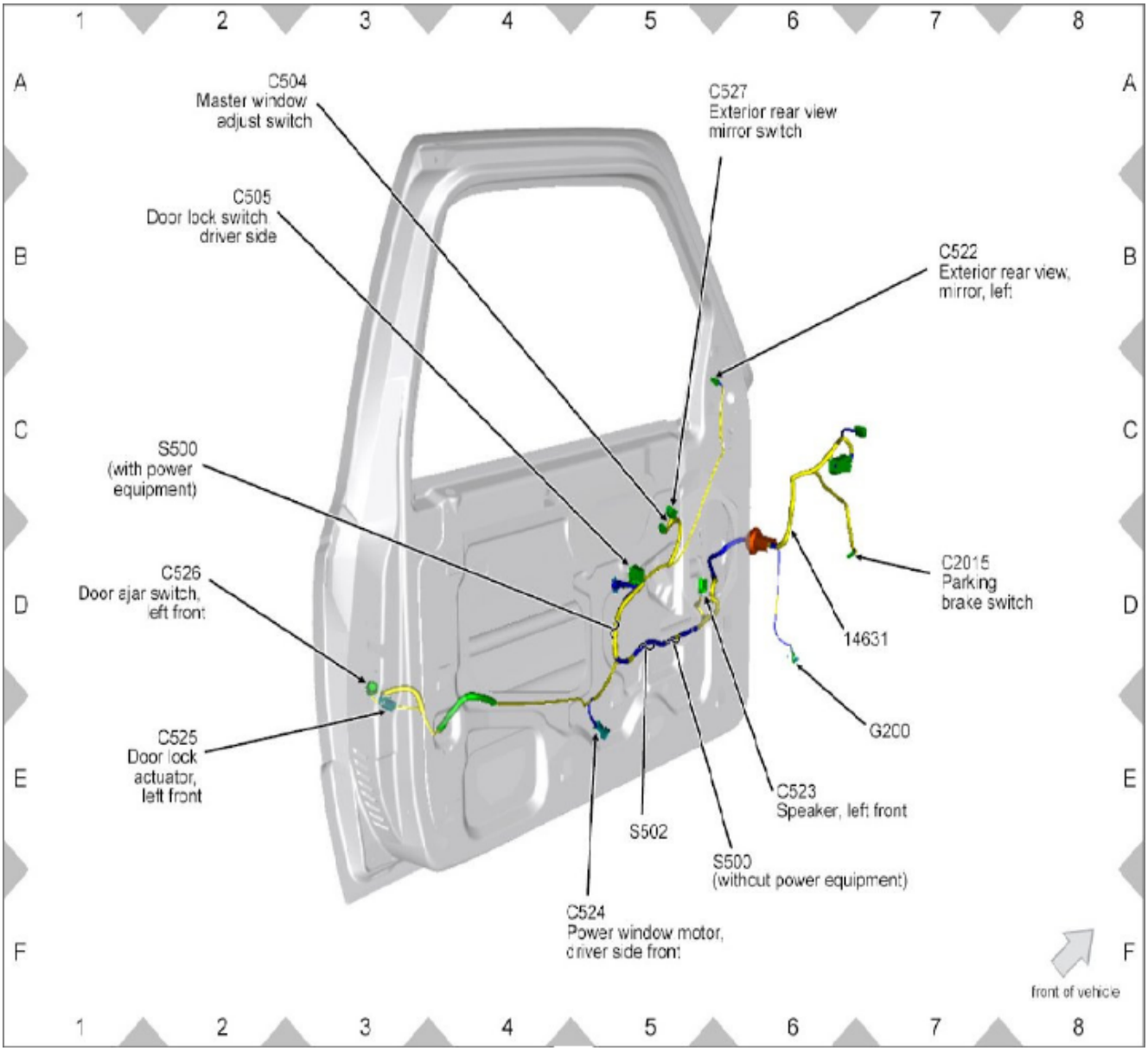
Power Mirror Motor: Service and Repair

EXTERIOR MIRROR MOTOR

Exploded View

Removal and Installation

1. Remove the exterior mirror glass. 2. Remove the 3 exterior mirror motor screws and position aside the exterior mirror motor. 3. Disconnect the electrical connectors and remove the exterior mirror motor 4. To install, reverse the removal procedure.


C504
Master window adjust switch
C505
Door lock switch driver side
S500
(with power equipment)
C526
Door ajar switch, left front
C525
Door lock actuator, left front
C524
Power window motor, driver side front
S502
S500
(without power equipment)
C523
Speaker, left front
G200
14631
C2015
Parking brake switch
C522
Exterior rear view mirror, left
C527
Exterior rear view mirror switch
front of vehicle

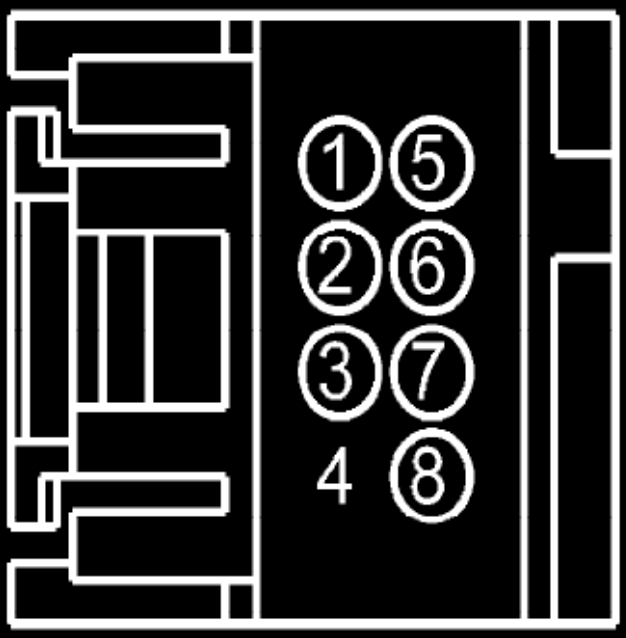
View 151-20

Connector: C527

Description: EXTERIOR REAR VIEW MIRROR SWITCH

Harness: 14631

Base Part #: 17B676



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD175 (BK-BU)	22	GROUND - TUNNEL # 2ND STUD	
2	CPM15 (VT-OG)	22	SWITCH - POWER MIRROR # LEFT MIRROR LEFTWARD (IF PLUS)	
3	SBP30 (BN-RD)	22	FUSE - 30 OR CIRCUIT BREAKER	
4	*	*	not used	
5	CPM19 (GY-OG)	22	SWITCH - POWER MIRROR # RIGHT MIRROR LEFTWARD (IF PLUS)	
6	CPM23 (GY)	22	SWITCH - POWER MIRROR # COMMON ALL MOTORS (LEFT AND RIGHT)	
7	CPM17 (BU-GN)	22	SWITCH - POWER MIRROR # LEFT MIRROR UPWARD (IF PLUS)	
8	CPM21 (YE-VT)	22	SWITCH - POWER MIRROR # RIGHT MIRROR UPWARD (IF PLUS)	

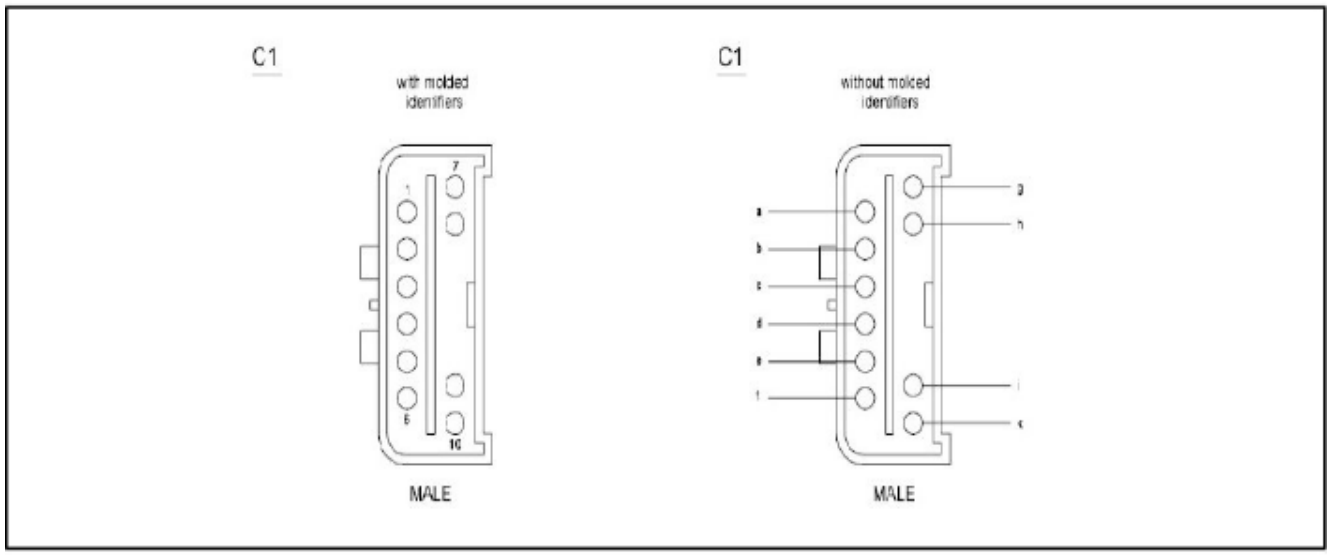
C527

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



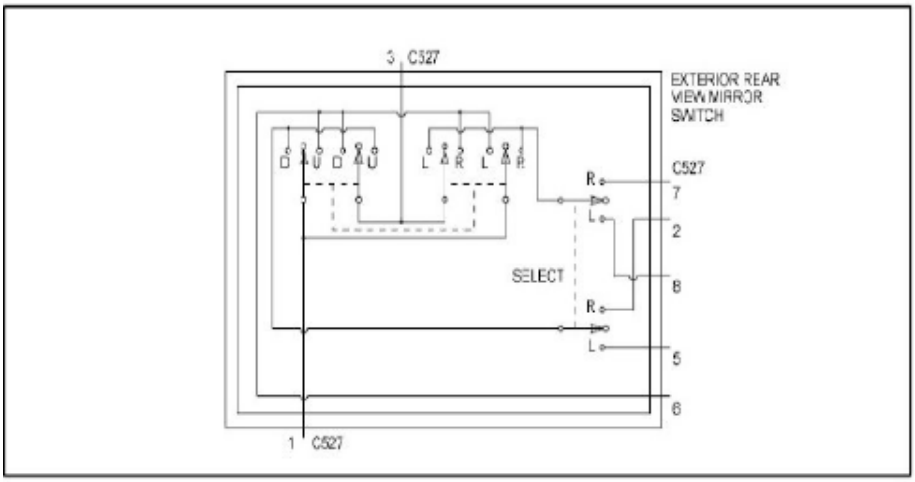
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

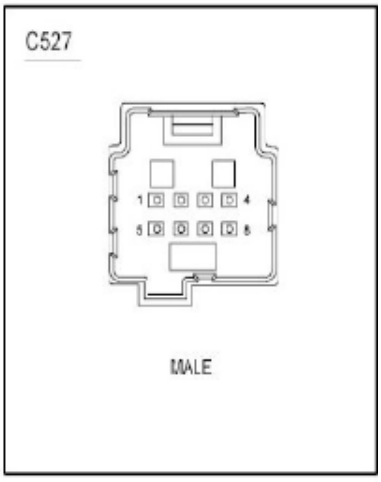
Power Mirror Switch: Testing and Inspection

Exterior rear view mirror switch

Schematic

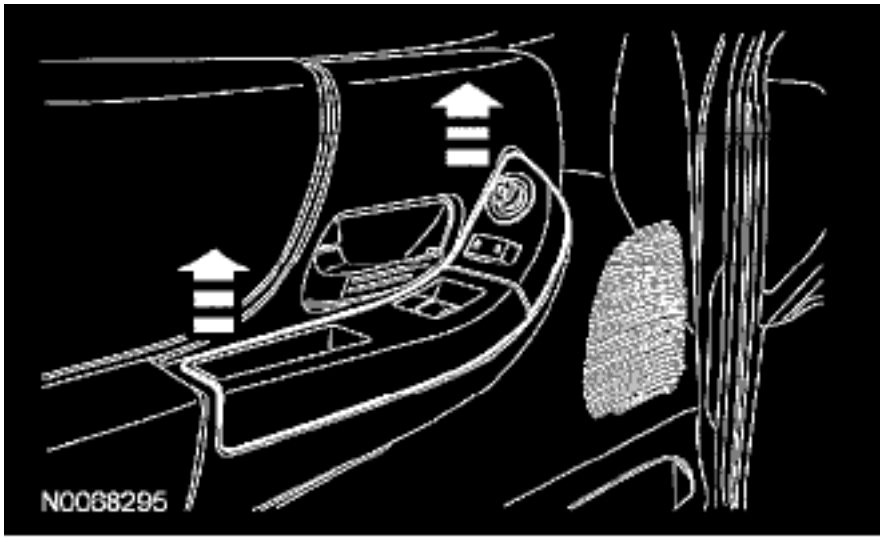


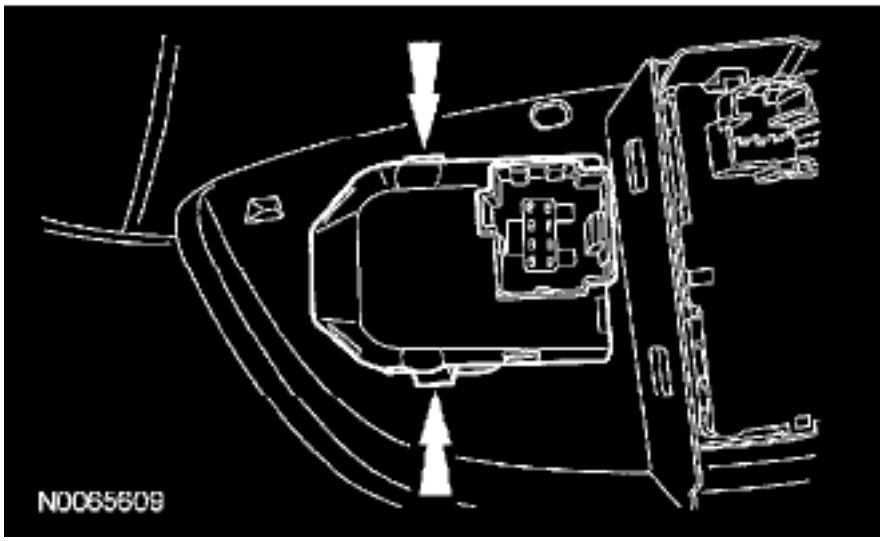
Terminals



Component testing procedure

Circuit to test		Connect self-powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
Left mirror	Up	3 and 5 6 and 1	Selector switch left Adjuster switch up	Closed circuit
	Down	3 and 6 5 and 1	Selector switch left Adjuster switch down	Closed circuit
	Left	3 and 8 6 and 1	Selector switch left Adjuster switch left	Closed circuit
	Right	3 and 6 8 and 1	Selector switch left Adjuster switch right	Closed circuit
Right mirror	Up	3 and 2 6 and 1	Selector switch right Adjuster switch up	Closed circuit
	Down	3 and 6 2 and 1	Selector switch right Adjuster switch down	Closed circuit
	Left	3 and 7 6 and 1	Selector switch right Adjuster switch left	Closed circuit
	Right	3 and 6 7 and 1	Selector switch right Adjuster switch right	Closed circuit





Power Mirror Switch: Service and Repair

EXTERIOR MIRROR CONTROL SWITCH

Removal and Installation

1. Remove the 2 interior door handle trim panel screws. 2. Remove the interior door handle trim panel.

- Lift the interior door handle trim panel upward to release the interior door handle trim panel retaining clips.

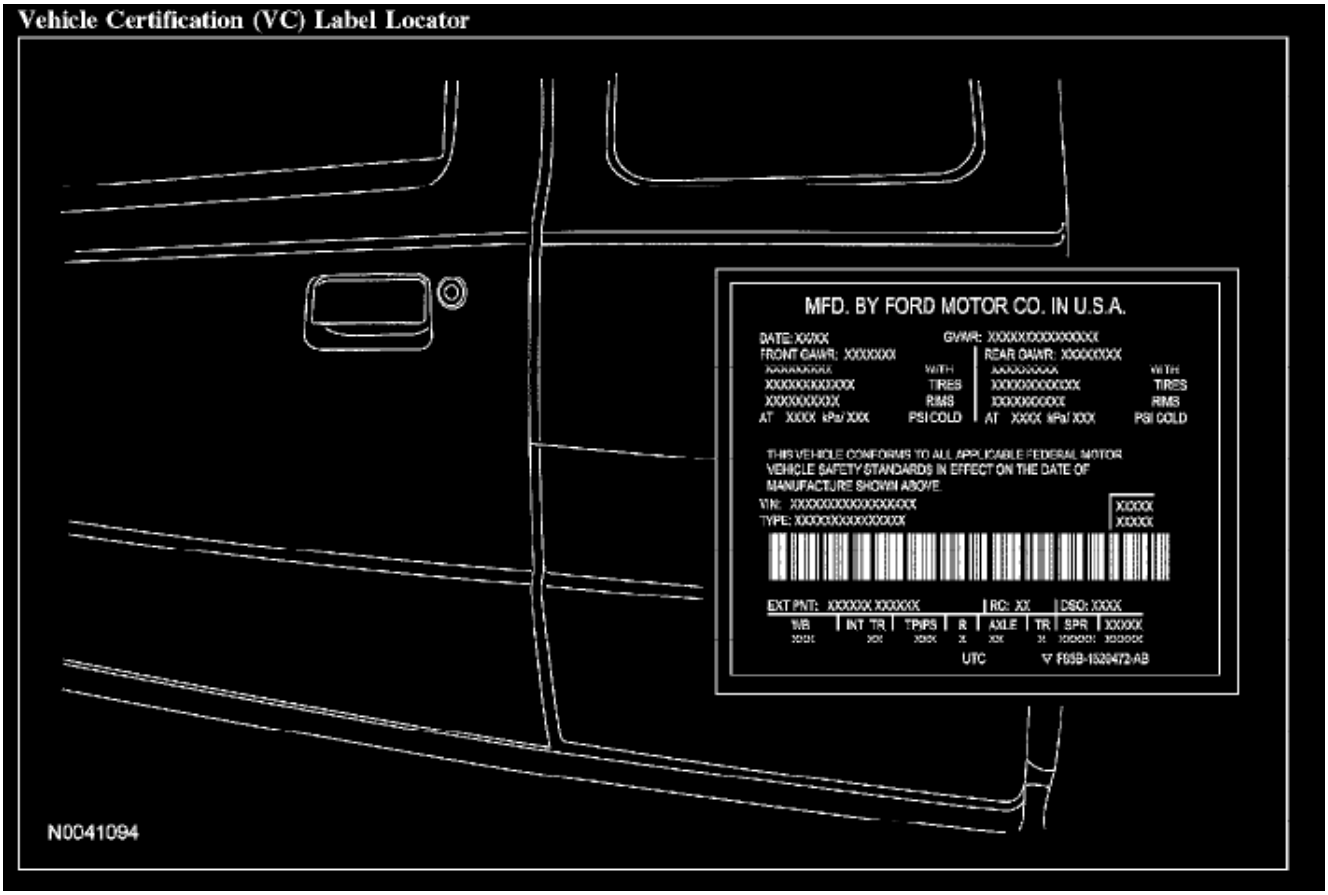
3. Remove the exterior mirror control switch.

- Disconnect the electrical connector.

- Press the 2 exterior mirror control switch retaining tabs.

- Remove the exterior mirror control switch from the interior door handle trim panel.

4. To install, reverse the removal procedure.



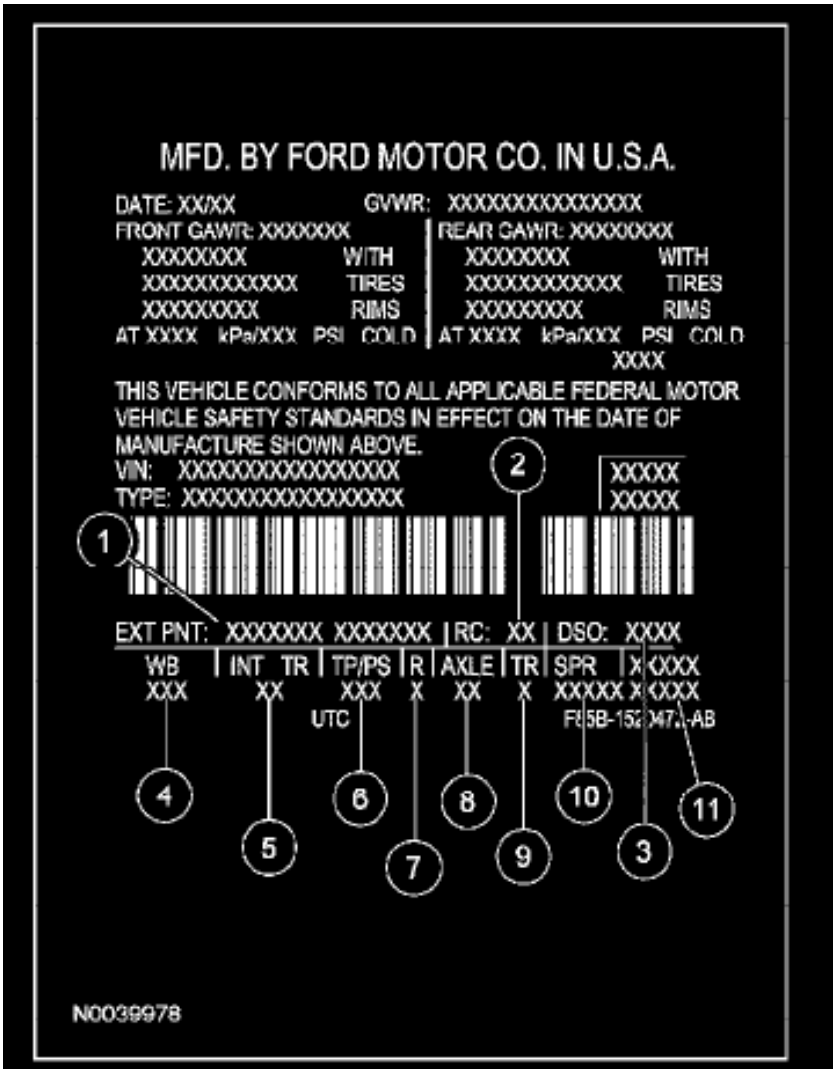
Paint: Application and ID Paint Codes

VEHICLE CERTIFICATION (VC) LABEL

Vehicle Certification (VC) Label Locator

The upper portion of the vehicle certification (VC) label contains the manufacturer name, the month and year of manufacture, the certification statement and the VIN. It also includes gross vehicle weight ratings (GVWR).

If a vehicle requires replacement of the VC label and is 4 years old or less, an authorized dealer must submit the VIN to their respective regional office. The regional office will submit a web form to the assembly plant for the replacement label. Once the label has been printed, a representative from the regional office will deliver the label to the dealer and witness installation on the vehicle. If a vehicle is more than 4 years old and requires a replacement label, the dealer must submit a request to the Department of Motor Vehicles.



Item	Description
1	Exterior paint code
2	Region code
3	Domestic special order code
4	Wheelbase code
5	Interior trim code
6	Tape/paint pinstripe code
7	Radio code
8	Axle code
9	Transmission code
10	Spring code
11	Calibration numbering

Paint Code

Exterior paint codes may be listed as a 2-part code. The first set of letters/numbers identify the vehicle primary body color. The second set of letters/number (if applicable) identify a 2-tone or accent body color. All colors are base coat/clear coat.

Primary Body Color -

CX - Dark Shadow Gray

- D3 - Torch Red

- G2 - Redfire

- G3 - Pueblo Gold

- G9 - Vista Blue

- U3 - Valencia

- UA - Ebony

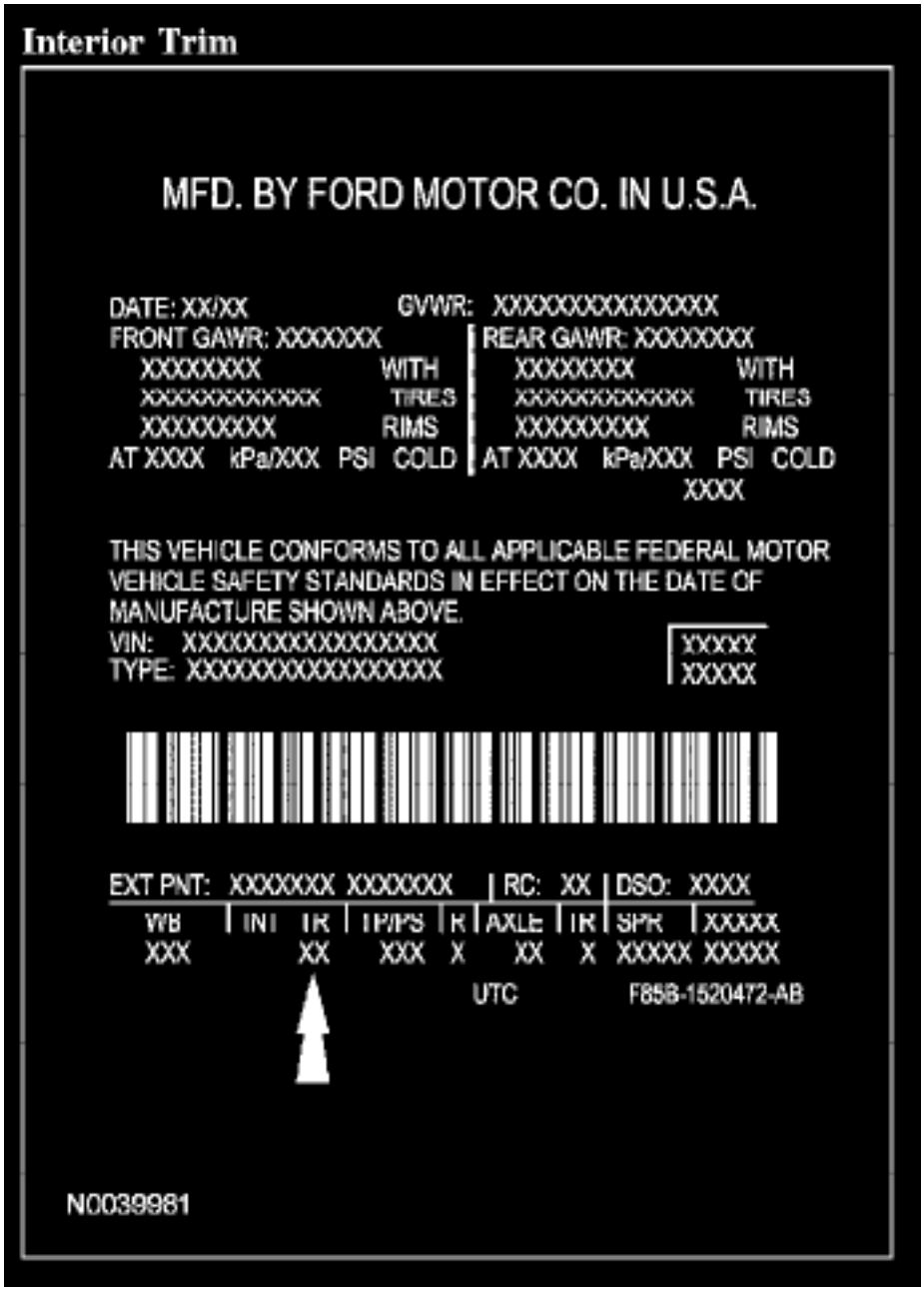
- YN - Silver Metallic #2

- YZ - Oxford White

Accent Body Color -

CX - Dark Shadow Gray

- UA - Ebony



Interior Trim

Interior trim codes are listed as a 2-part code. The first code listed identifies the trim level. The second code listed identifies the interior trim color.

Interior Trim Type -

L - Stockton cloth bucket seats

- M - Stockton 2 cloth bucket seats

- Q - Cenery grain vinyl 60/40 split bench seat

- R - Mortar cloth 60/40 split bench seat

- S - Mortar cloth bucket seats

- T - Imola leather 60/40 split bench seat

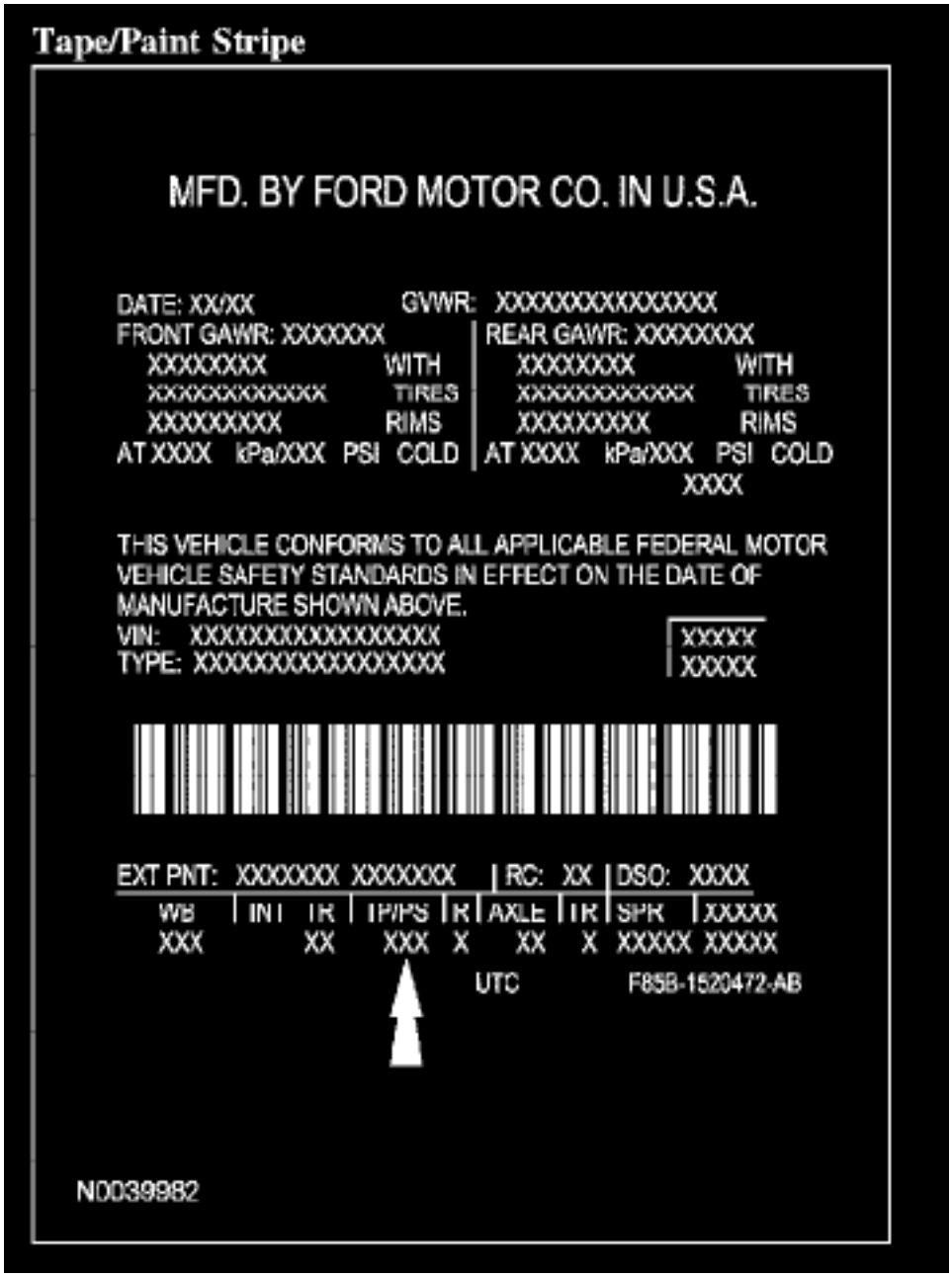
- U - Imola leather bucket seats

- V - Link weave cloth bucket seats

Interior Trim Color -

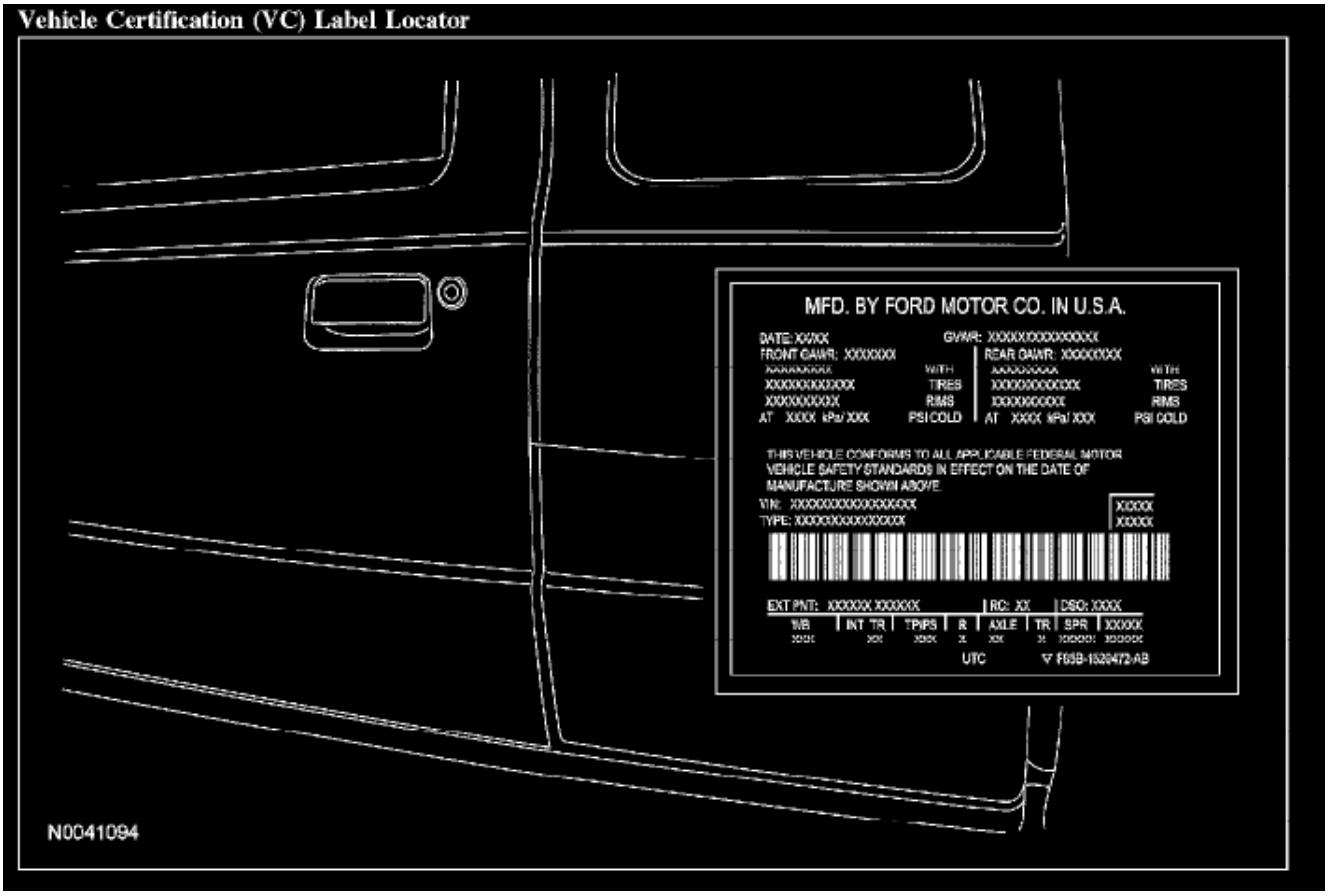
F - Medium/Dark Flint

- P - Medium Pebble



Tape/Paint Stripe

Tape and paint stripe codes do not apply.



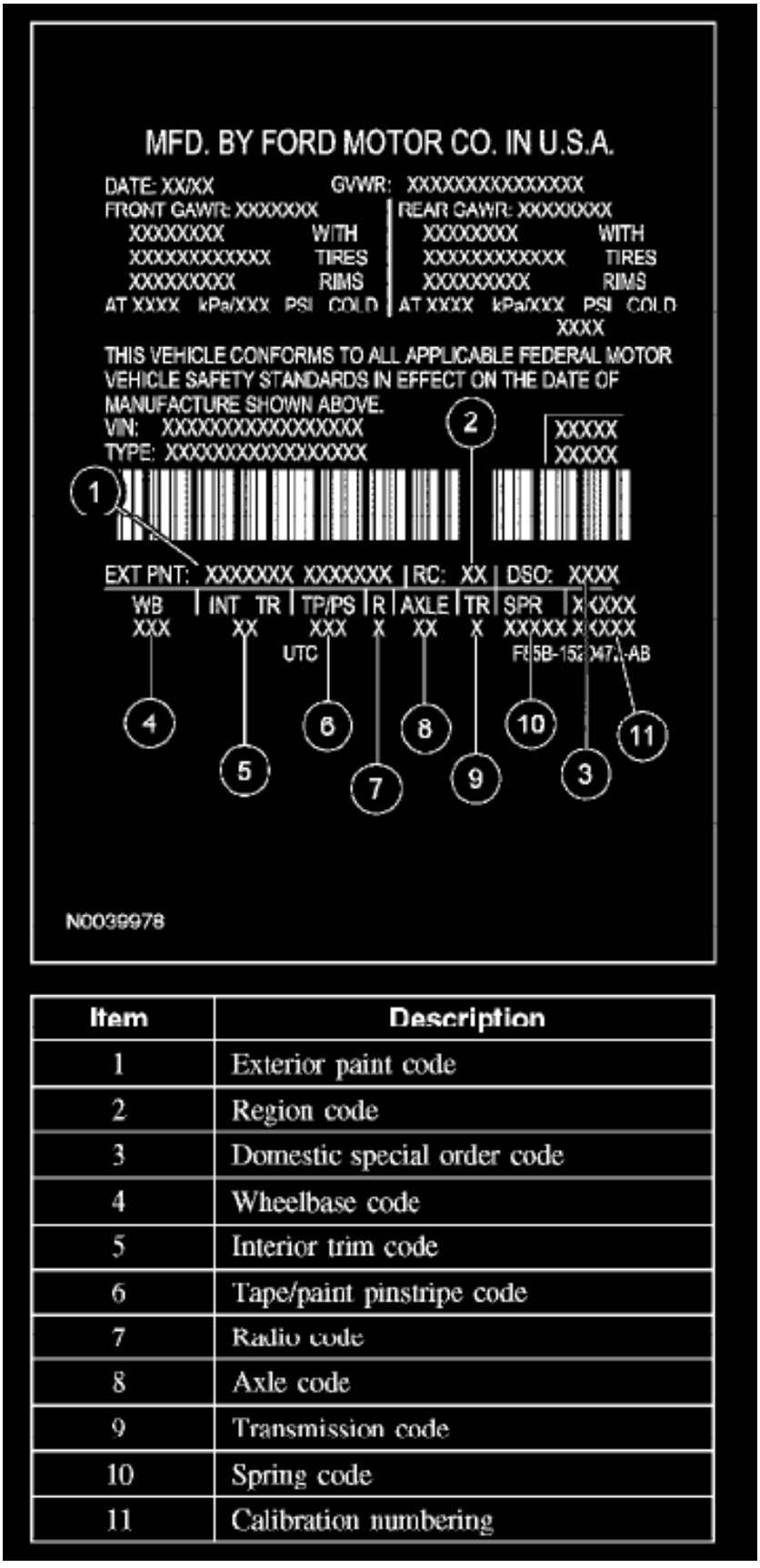
Paint: Application and ID Paint Code Sticker Location

VEHICLE CERTIFICATION (VC) LABEL

Vehicle Certification (VC) Label Locator

The upper portion of the vehicle certification (VC) label contains the manufacturer name, the month and year of manufacture, the certification statement and the VIN. It also includes gross vehicle weight ratings (GVWR).

If a vehicle requires replacement of the VC label and is 4 years old or less, an authorized dealer must submit the VIN to their respective regional office. The regional office will submit a web form to the assembly plant for the replacement label. Once the label has been printed, a representative from the regional office will deliver the label to the dealer and witness installation on the vehicle. If a vehicle is more than 4 years old and requires a replacement label, the dealer must submit a request to the Department of Motor Vehicles.



Item	Description
1	Exterior paint code
2	Region code
3	Domestic special order code
4	Wheelbase code
5	Interior trim code
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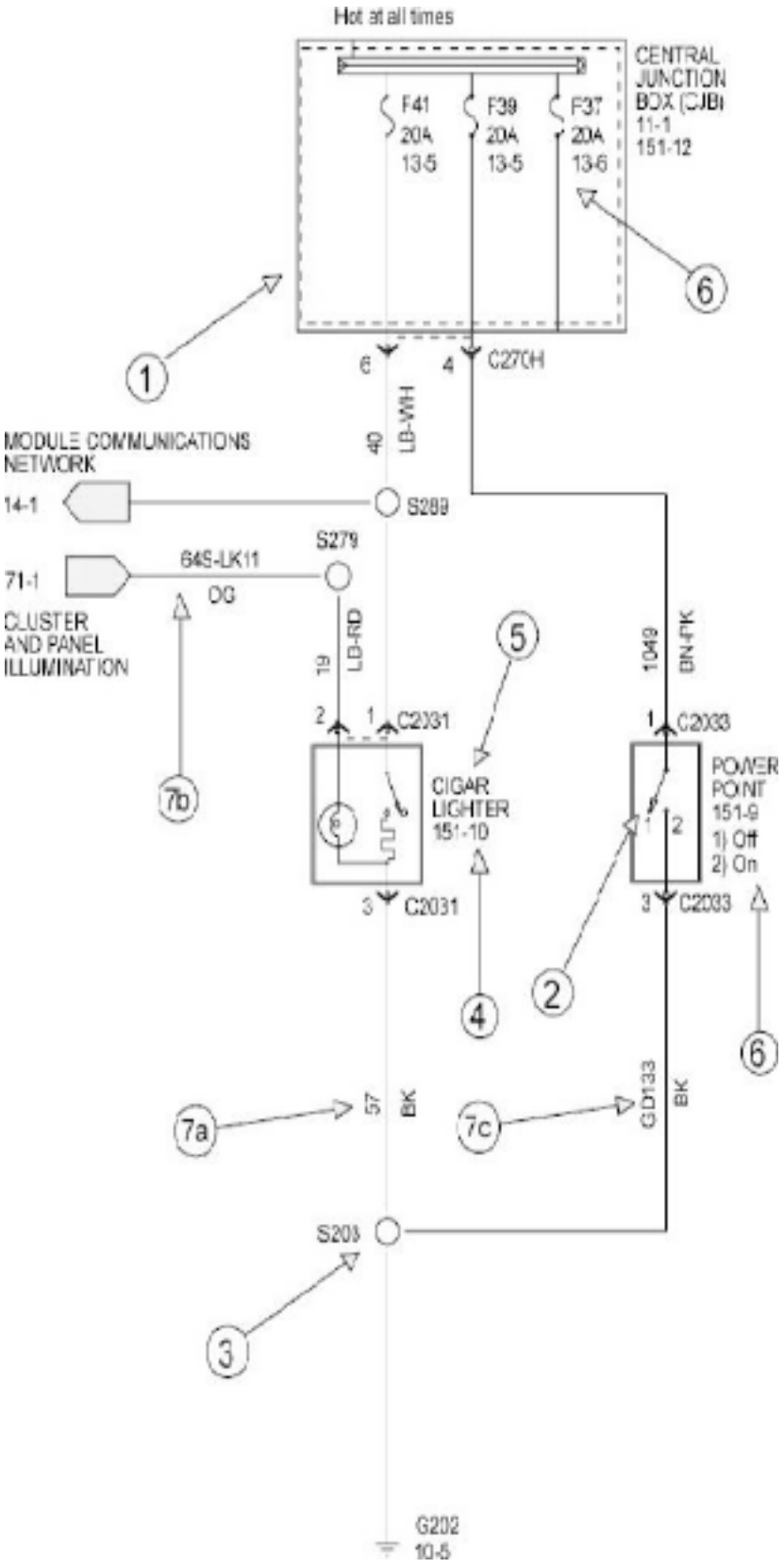
7	Radio code
8	Axle code
9	Transmission code
10	Spring code
11	Calibration numbering

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Body and Frame > Relays and Modules - Body and Frame > Power Door Lock Relay > Component Information > Diagrams > Diagram Information and Instructions



Power Door Lock Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

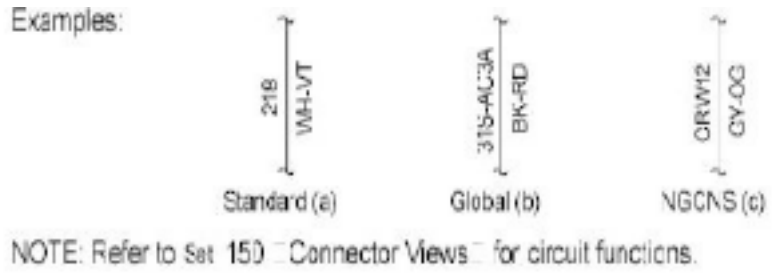
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

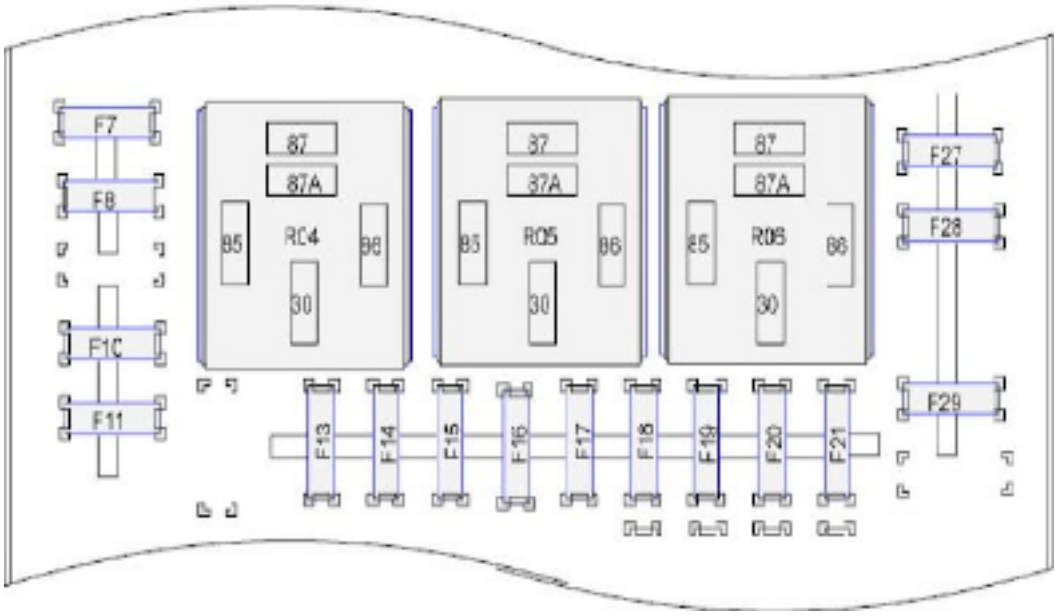
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

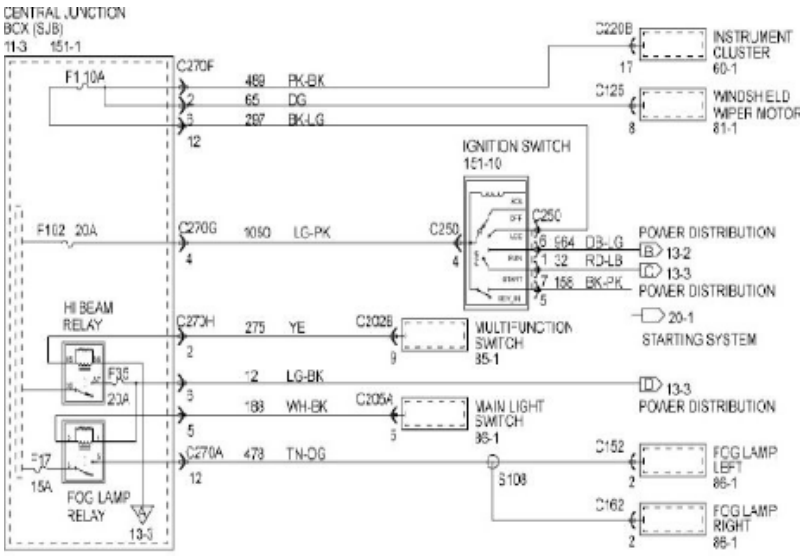
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

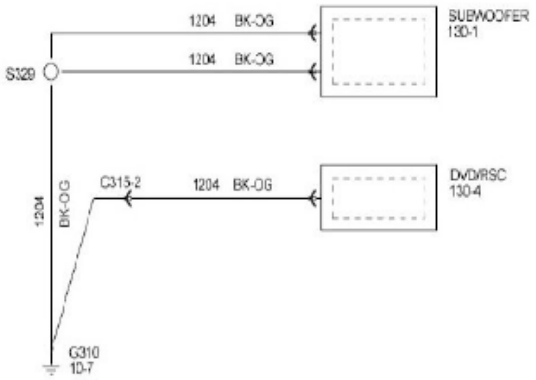
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

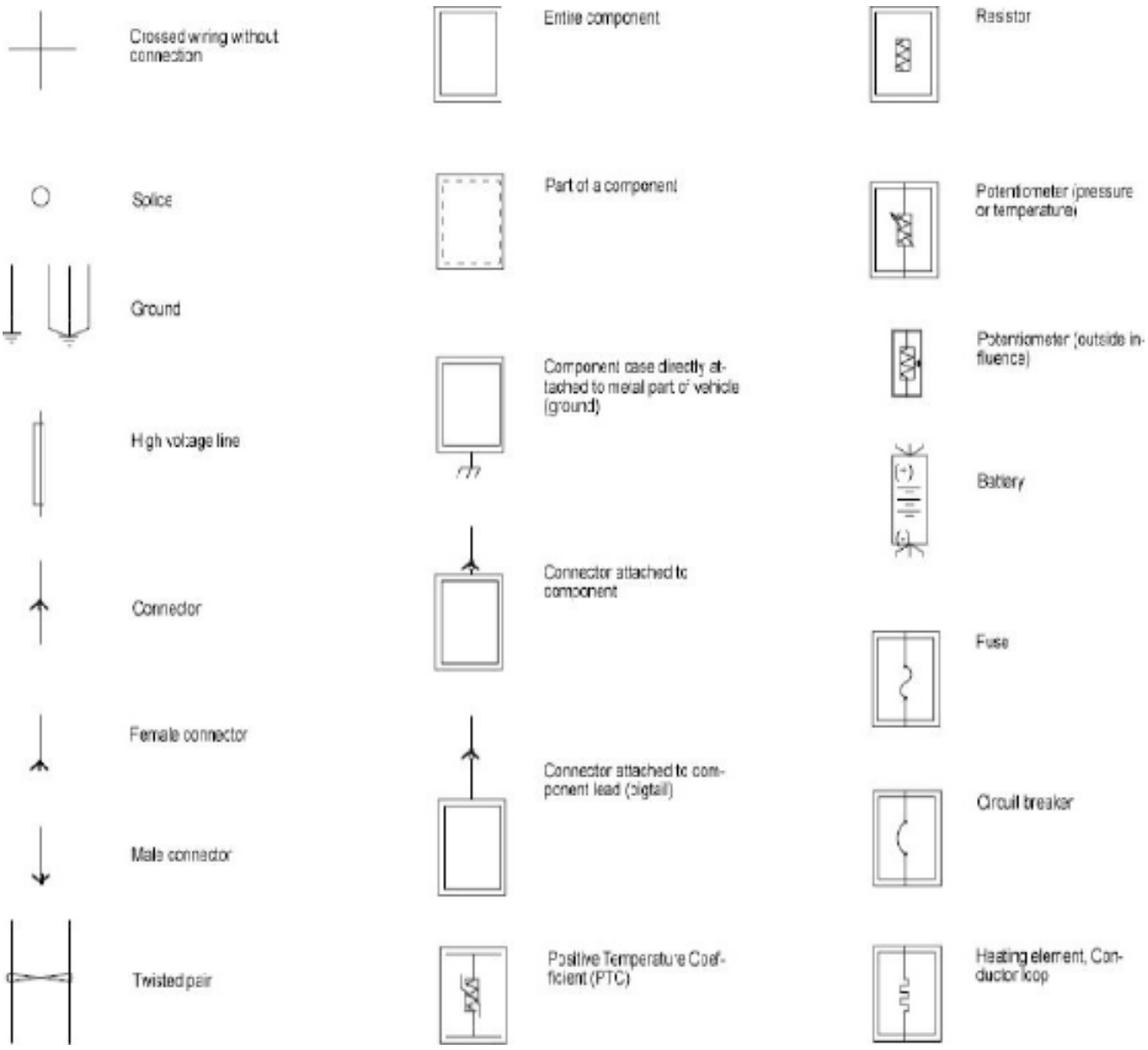
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

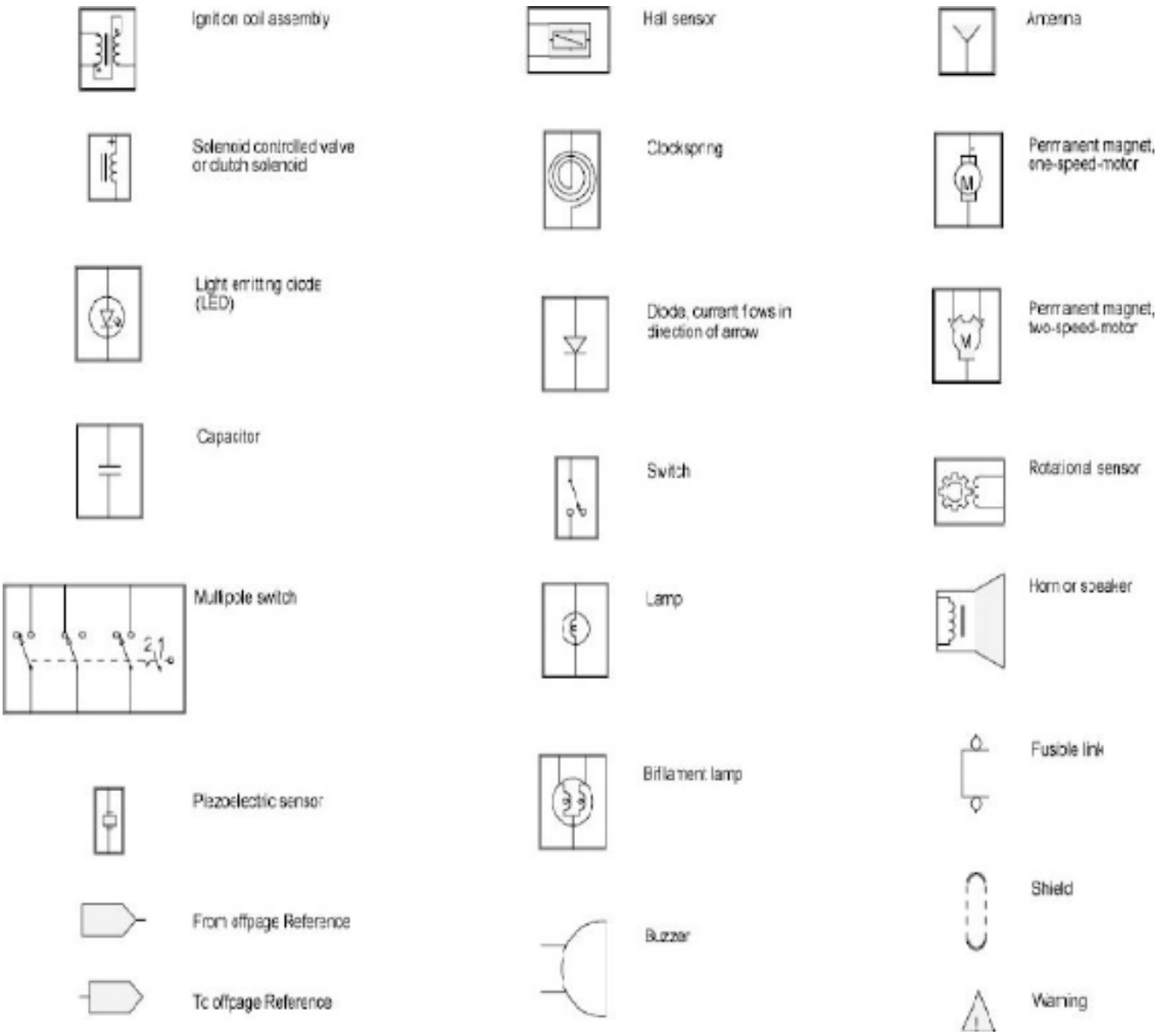
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

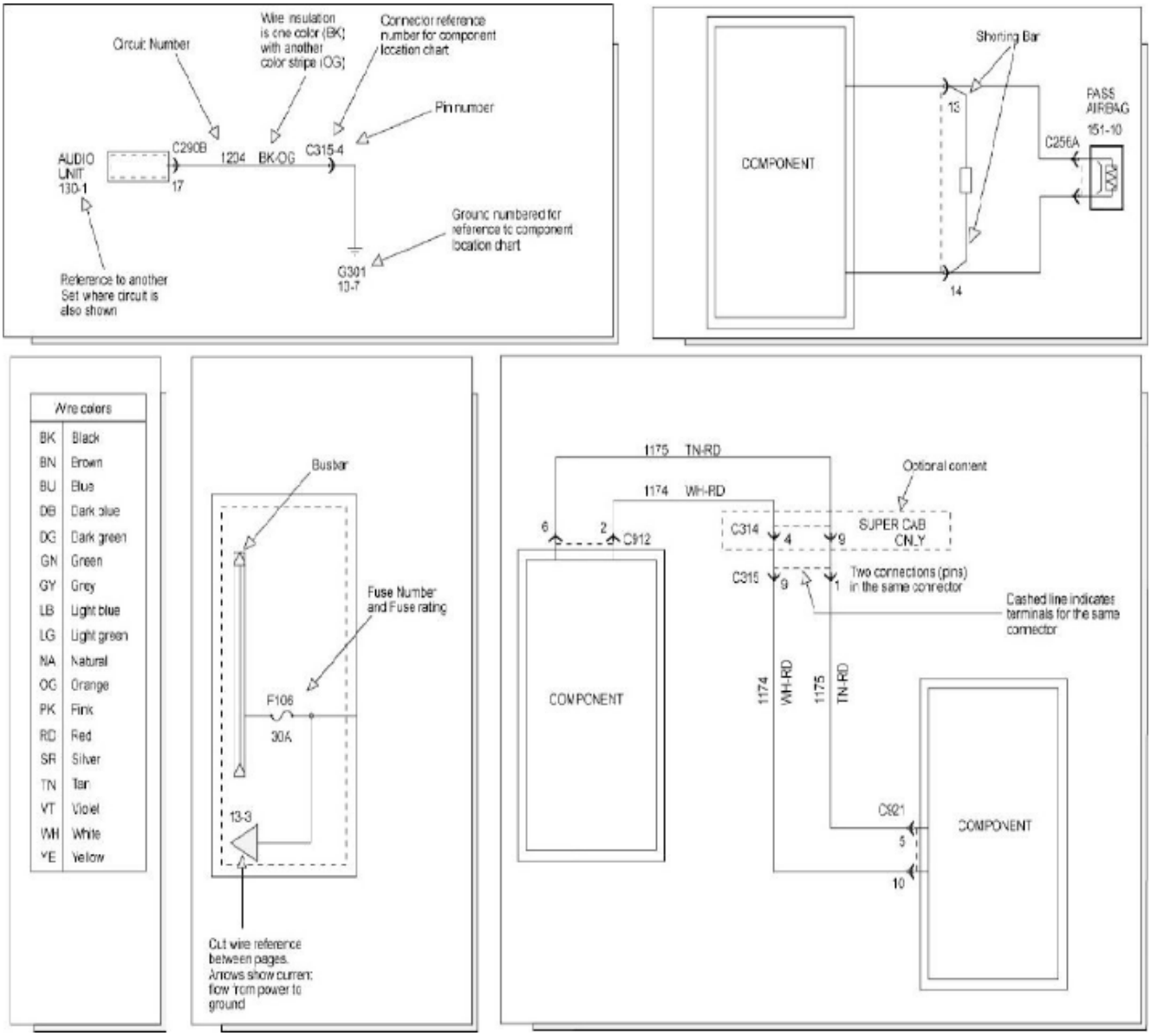
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

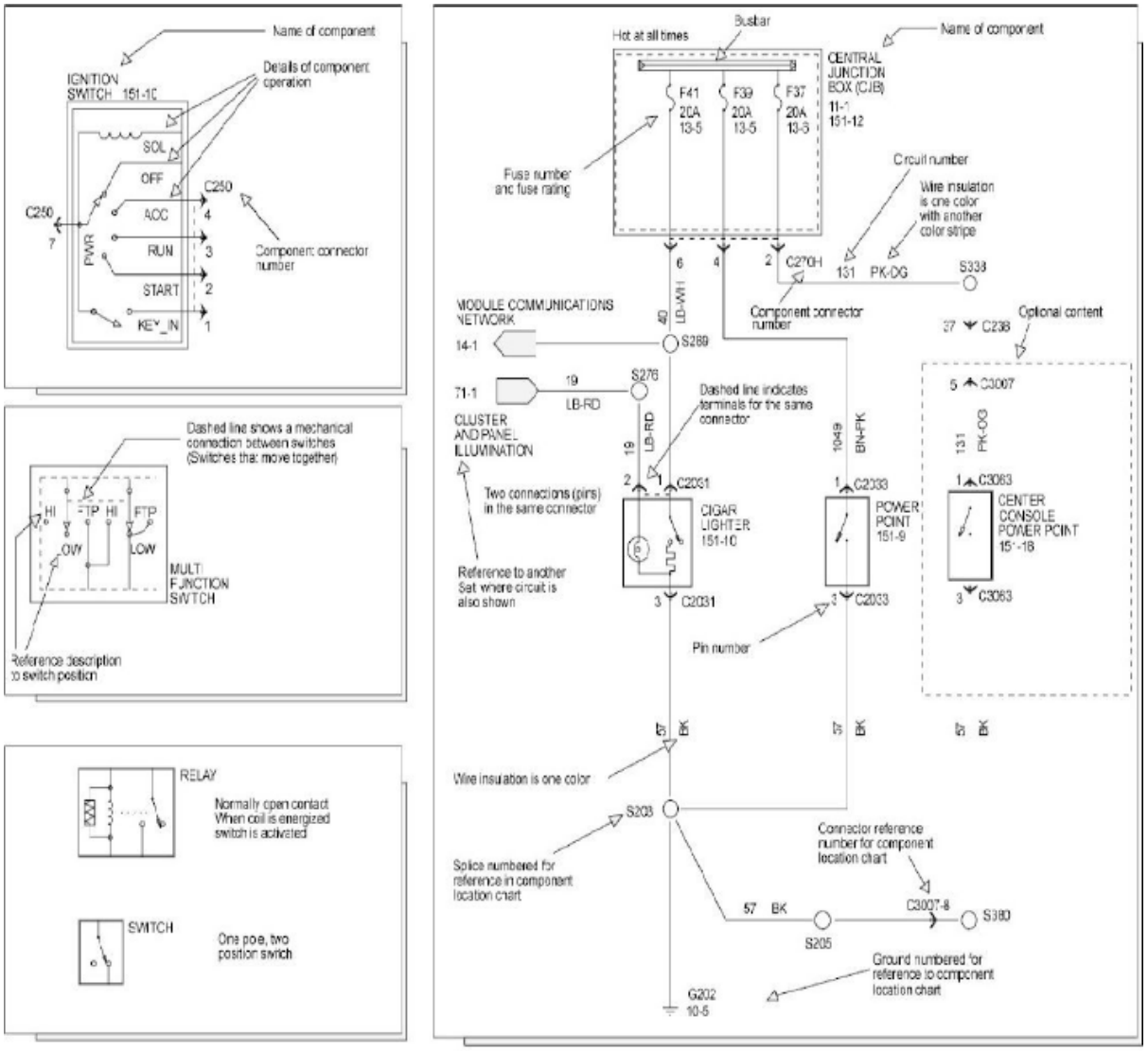
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

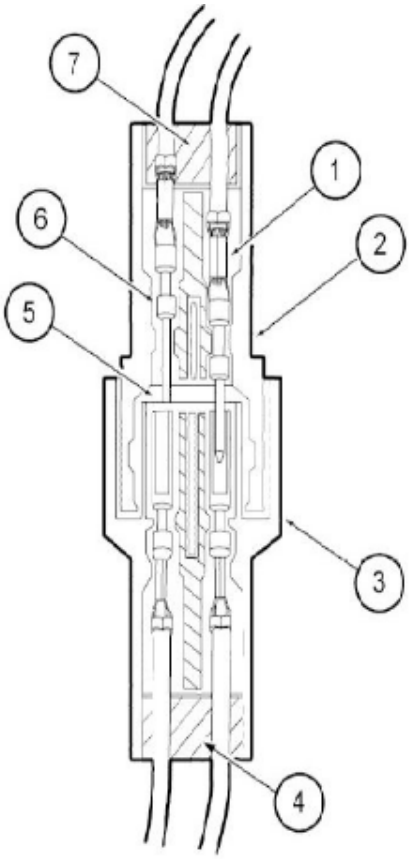


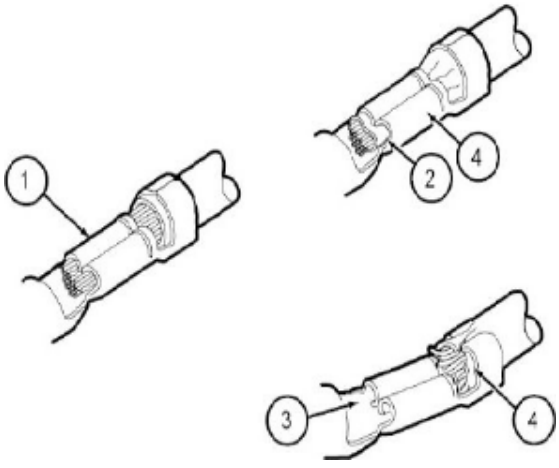
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Power Door Lock Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

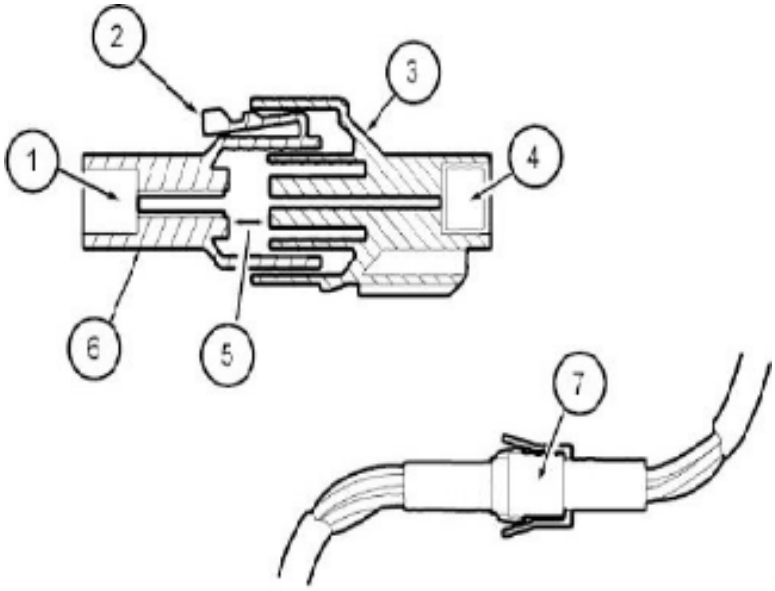
5 = Intermittent contact

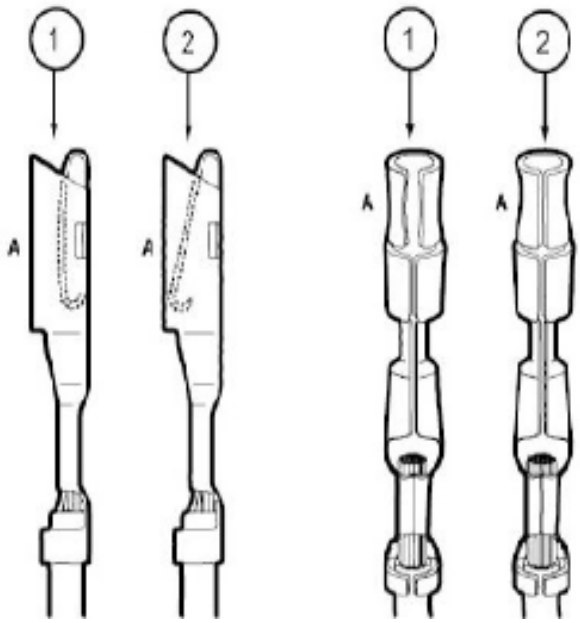
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

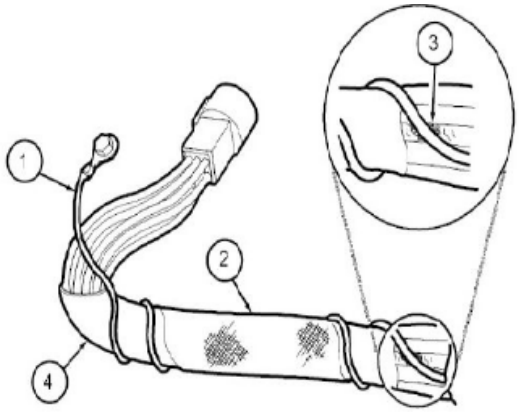
Deformed (enlarged) female terminals

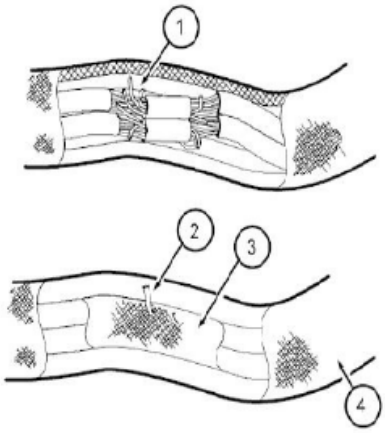
1 = Enlarged

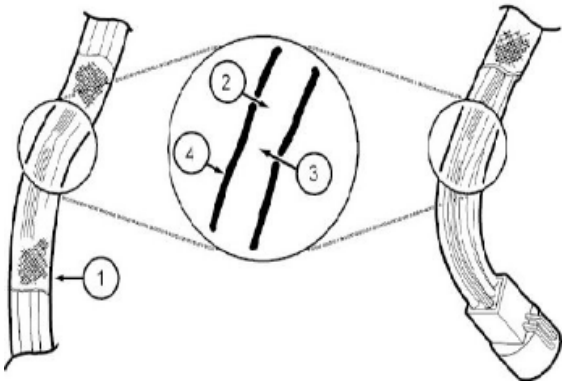
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

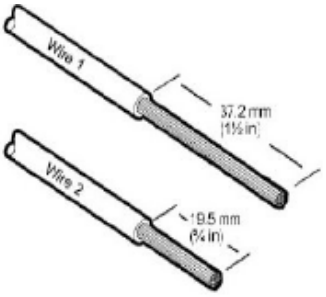
Splice covered 2

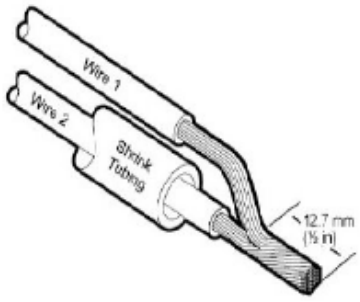
= Wire strand

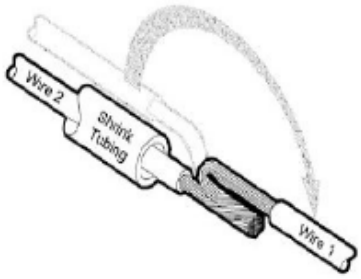
3 = Splice tape

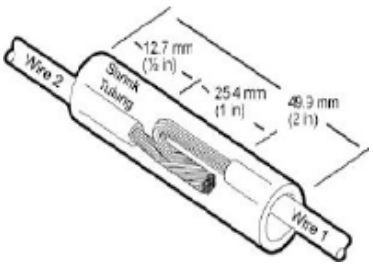
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

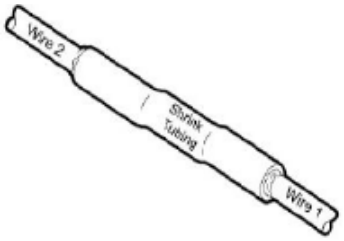
NOTE: -

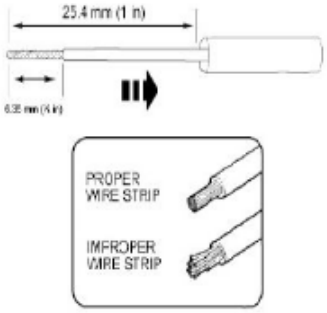
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

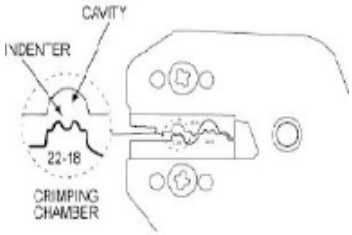
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

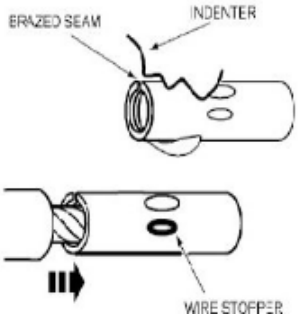
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
6.35 mm (¼ in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

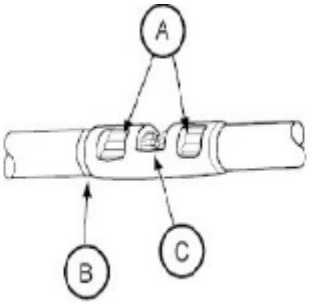
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

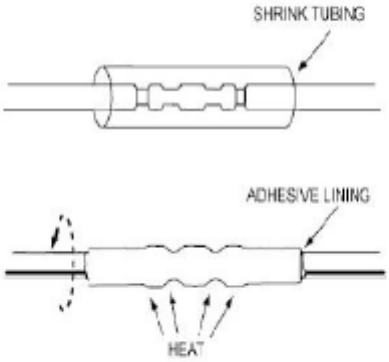
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4 strip, cut 9 strands	* 1/4 strip, cut 2 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip, fold 3x dia.
	16-14	* 1/4 strip, cut 7 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip fold 2x dia	1 strip, fold 3x dia.	1 1/4 strip, fold 4x dia.	Not Recommended
	12-10	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip fold 3x cia.	1 1/4 strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Figtail only

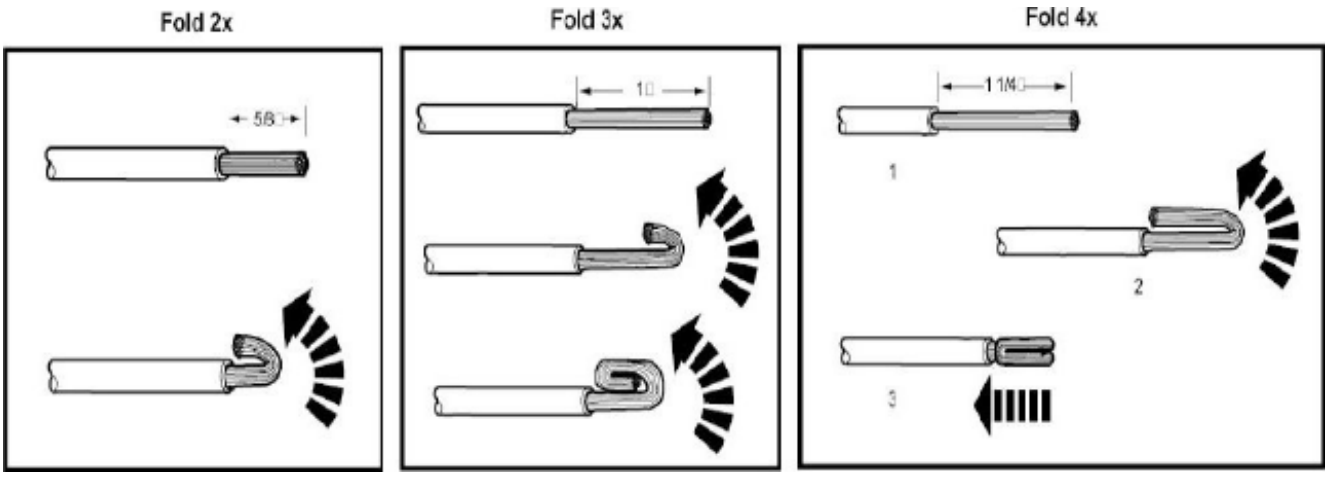
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



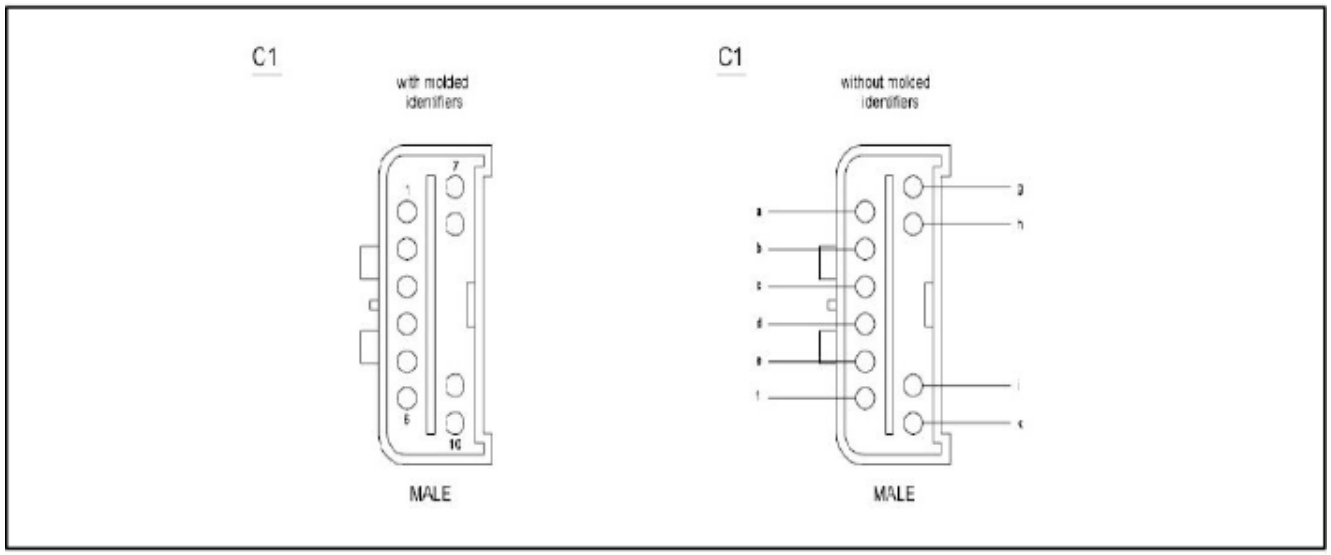
The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



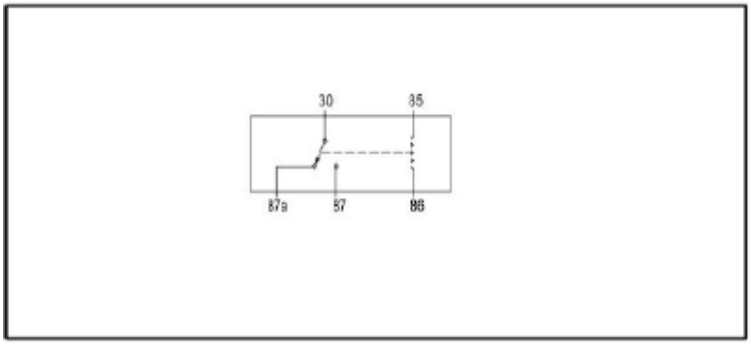
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

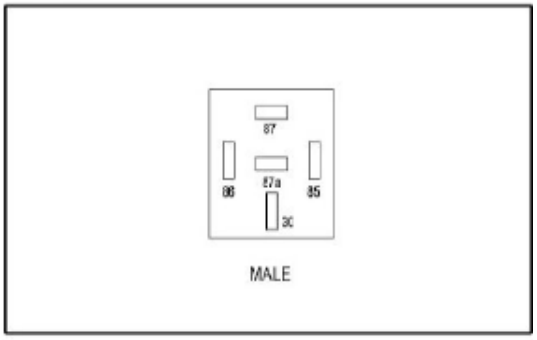
Power Door Lock Relay: Testing and Inspection Mini ISO Relay

Relay □ Mini ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	45 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

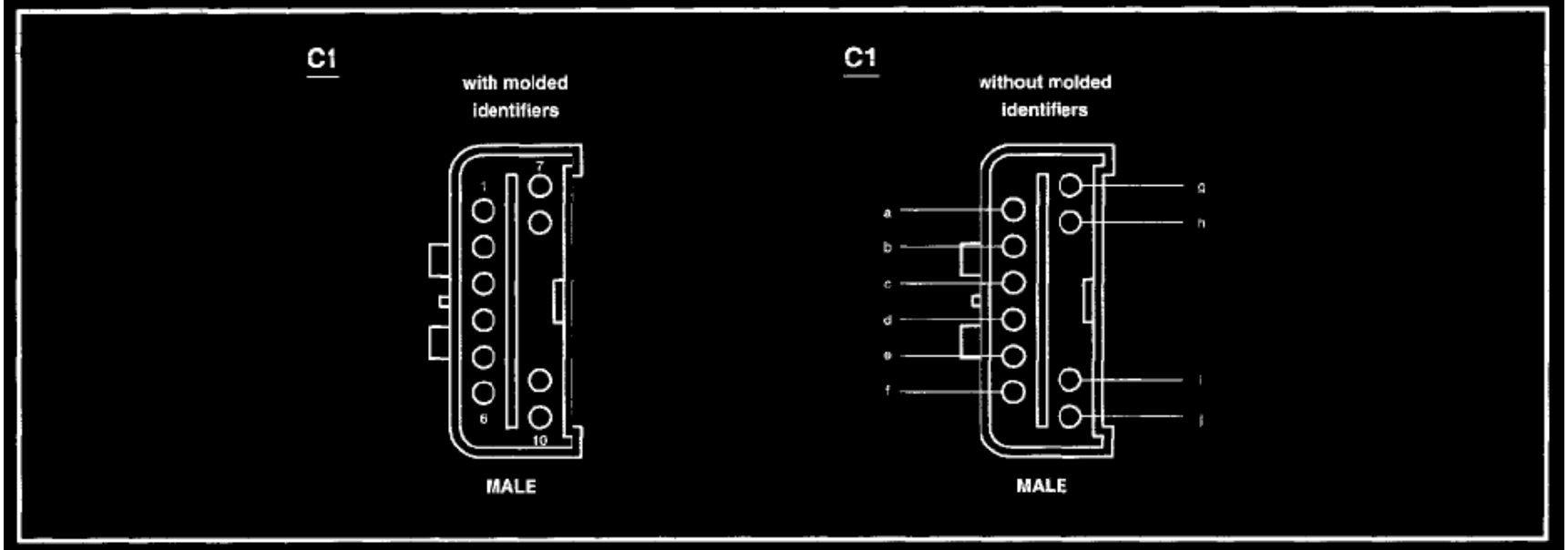
Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step–by–step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



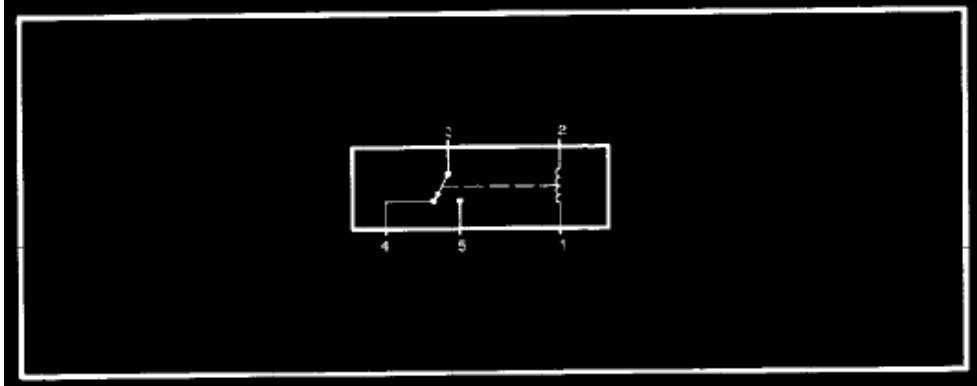
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

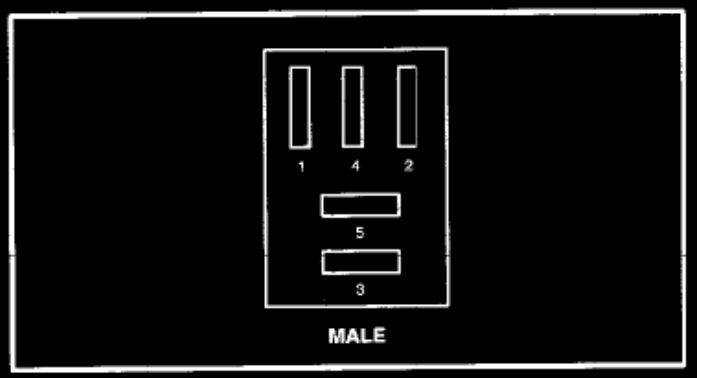
Power Door Lock Relay: Testing and Inspection Micro ISO Relay

Relay – Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63–102Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil – Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

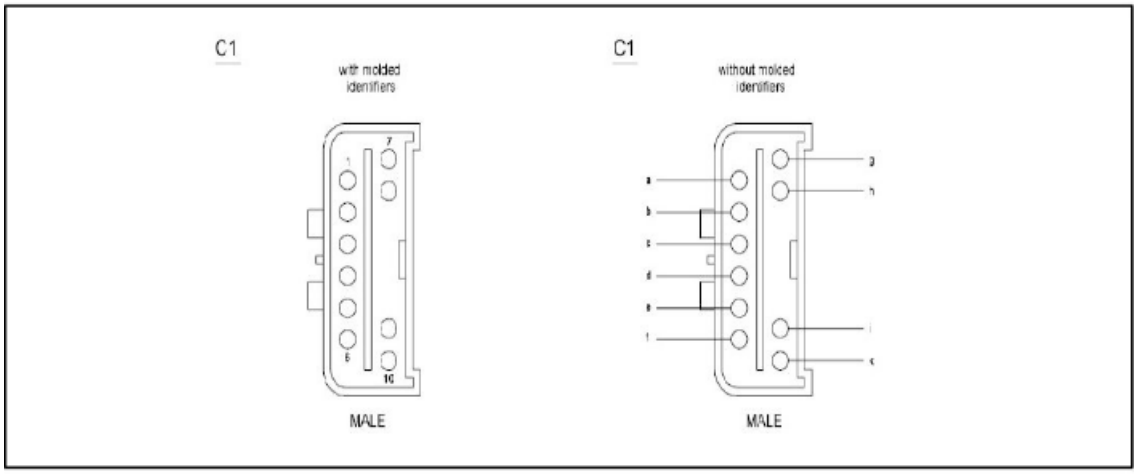
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals

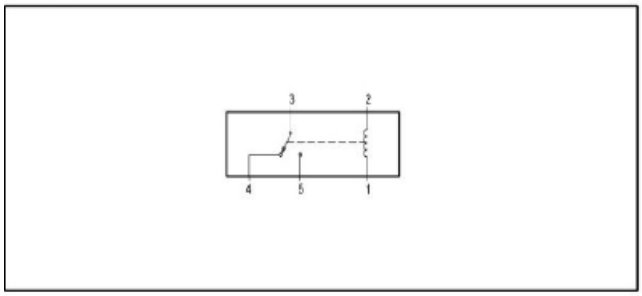


The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

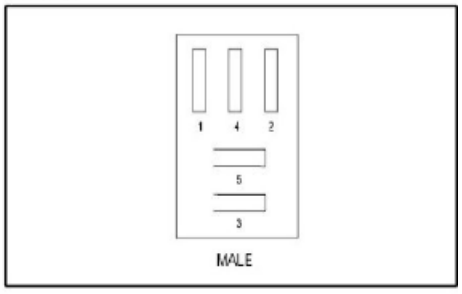
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Relay - Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63-102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil - Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

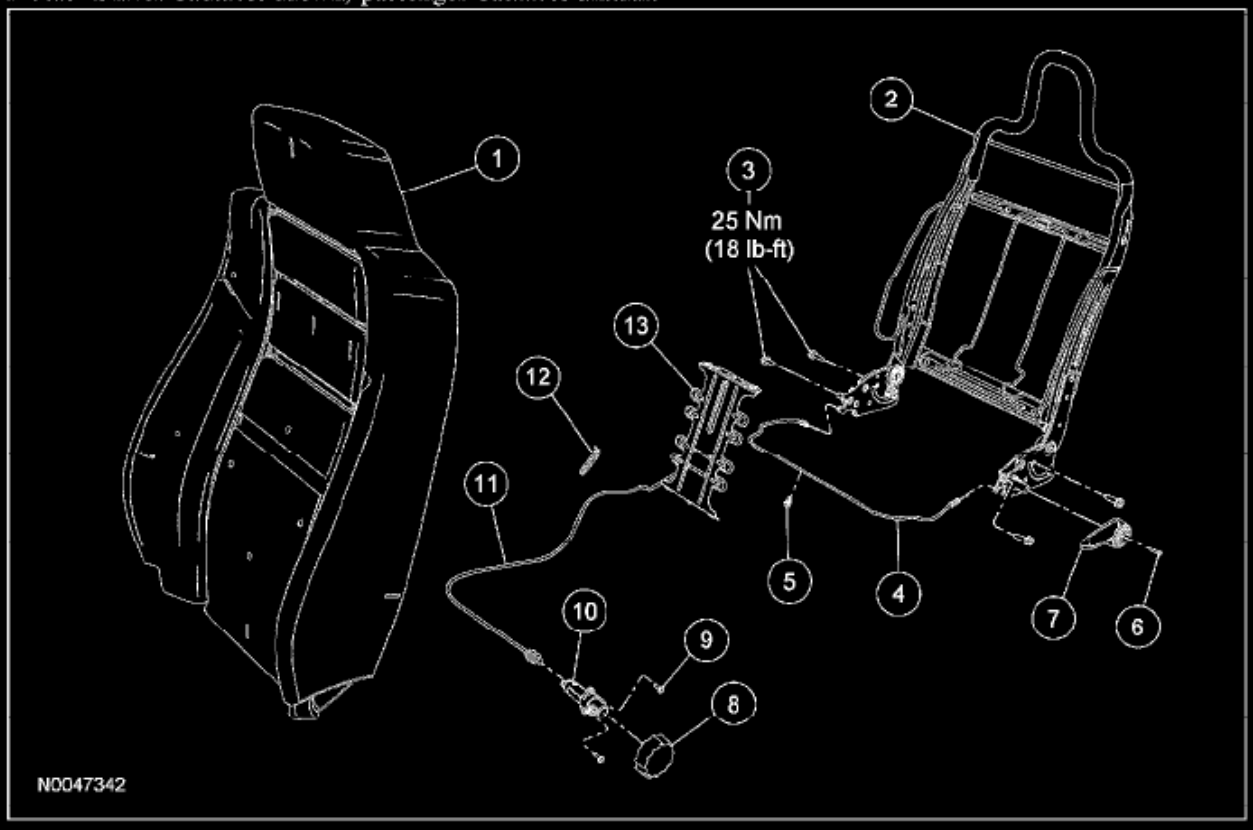
Child Seat: Description and Operation

ATTACHING SAFETY SEATS WITH TETHER STRAPS

Some manufacturers make child safety seats that include a tether strap that goes over the back of the vehicle seat and attaches to an anchoring point. Other manufacturers offer the tether strap as an accessory. Contact the manufacturer of the child safety seat for information about ordering a tether strap.

Seat Backrest, Front, 40 Percent

NOTE: Driver backrest shown, passenger backrest similar.



Item	Part Number	Description
1	64416/64810	Backrest trim cover/foam pad
2	61018	Backrest frame
3	60108	Backrest-to-cushion bolts (4 required)
4	624A54	Backrest latch release cable
5	—	Pin-type retainer
6	56904	Recliner handle screw
7	610A77	Recliner handle
8	61198	Lumber adjust knob, if equipped

Item	Part Number	Description
9	000A25	Lumbar actuator screw (2 required), if equipped
10	610C00	Lumbar actuator, if equipped
11	—	Lumbar actuator cable (part of 62222), if equipped
12		Tie strap, if equipped
13	62222	Lumbar support, if equipped

(Continued)

Seat Back: Removal and Replacement

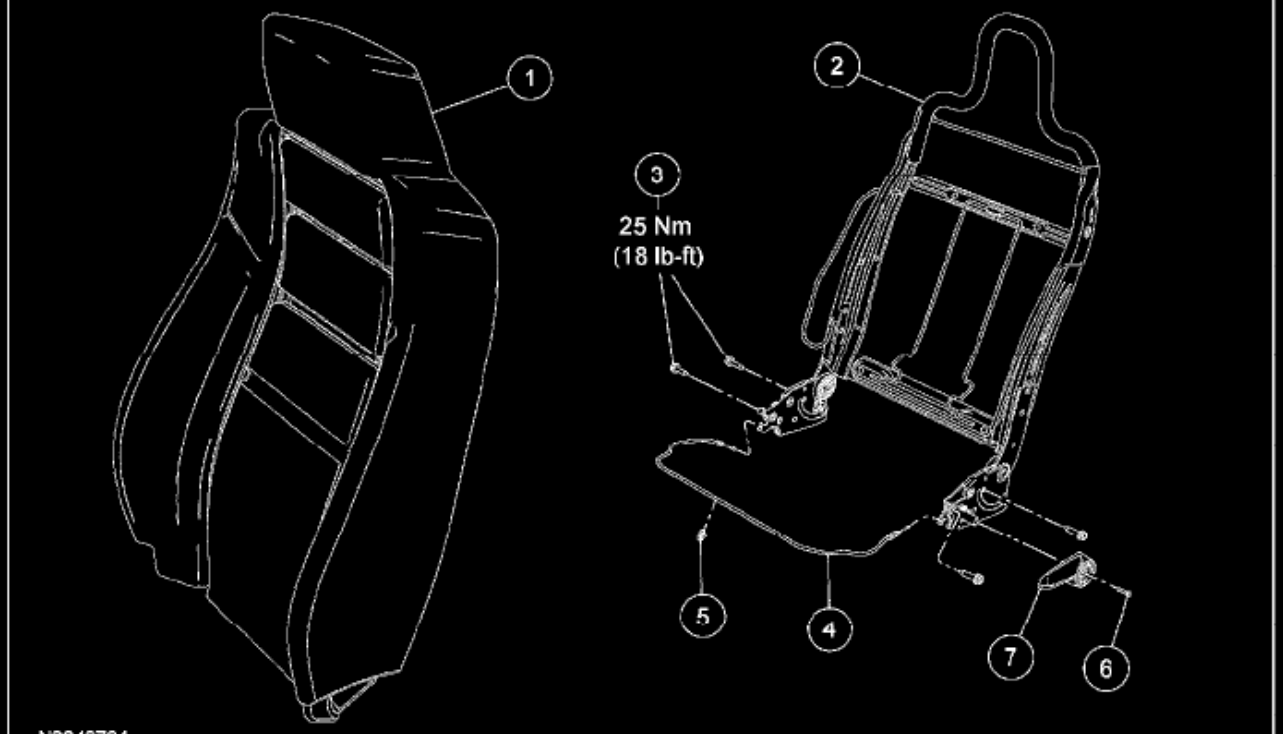
Seat Backrest - Front, 60 Percent

SEAT BACKREST - FRONT, 60 PERCENT

Exploded View

Seat Backrest, Front, 40 Percent

Seat Backrest, Front, 60 Percent

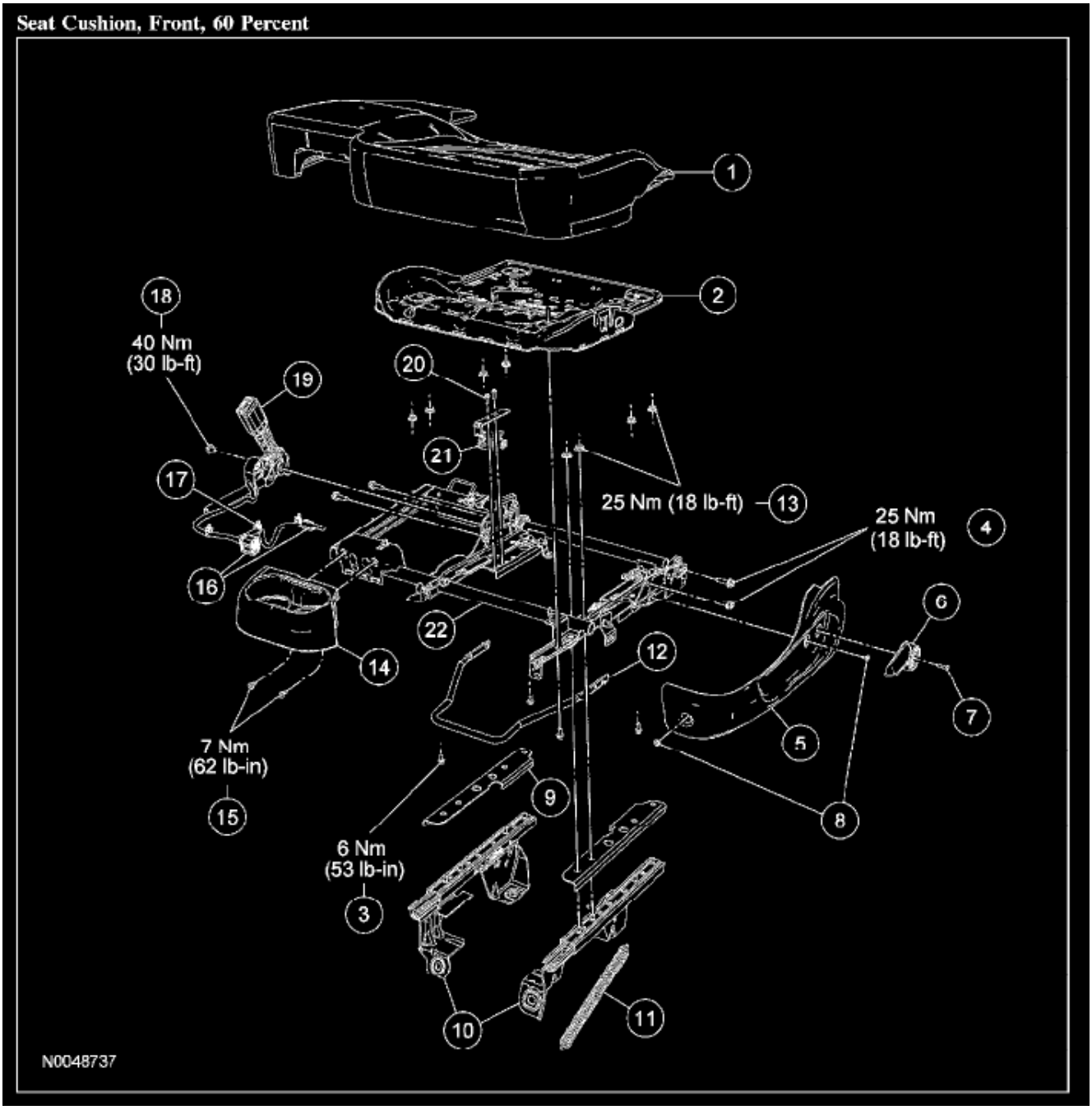


Item	Part Number	Description
1	64416/64810	Backrest trim cover/foam pad
2	61018	Backrest frame
3	60108	Backrest-to-cushion bolts (4 required)
4	624A54	Backrest latch release cable

Item	Part Number	Description
5	—	Pin-type retainer
6	56904	Recliner handle screw
7	610A77	Recliner handle

(Continued)

Seat Backrest, Front, 60 Percent



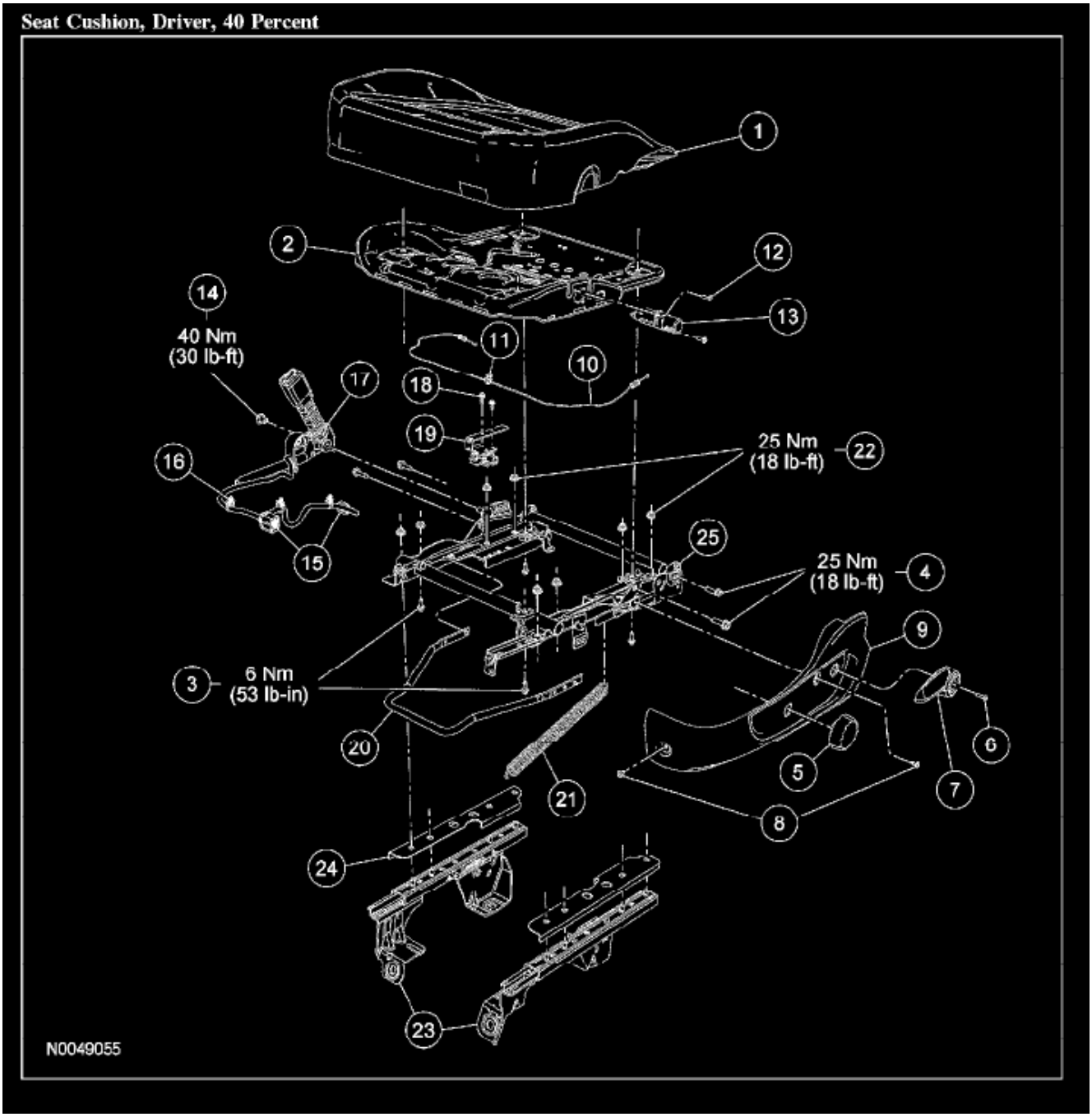
Seat Cushion, Front, 60 Percent (Part 1)

Item	Part Number	Description
1	62900/632A22	Cushion trim cover/foam pad
2	63100	Cushion frame
3	60108	Seat track-to-cushion frame bolt (4 required)
4	60108	Backrest-to-cushion bolts (4 required)
5	62186	Cushion side shield
6	61736	Recliner handle
7	55927	Recliner handle screw
8	000A25	Side shield screws (2 required)
9	617A46	Seat track reinforcement (2 required)
10	61704/61705	Seat track rails
11	61828	Seat track assist spring
12	61736	Seat track adjustment handle
13	W520413	Rail-to-seat track nuts (8 required)

(Continued)

Item	Part Number	Description
14	—	Cup holder
15	000A25	Cup holder mounting screws (2 required)
16	—	Electrical connectors (part of 61203)
17	—	Pin-type retainer (3 required)
18	000A25	Safety belt buckle pretensioner nut
19	61203	Safety belt buckle pretensioner
20	—	Seat position sensor and bracket screw (2 required)
21	14B416	Seat position sensor and bracket
22	613B20	Seat track

Seat Cushion, Front, 60 Percent (Part 2)



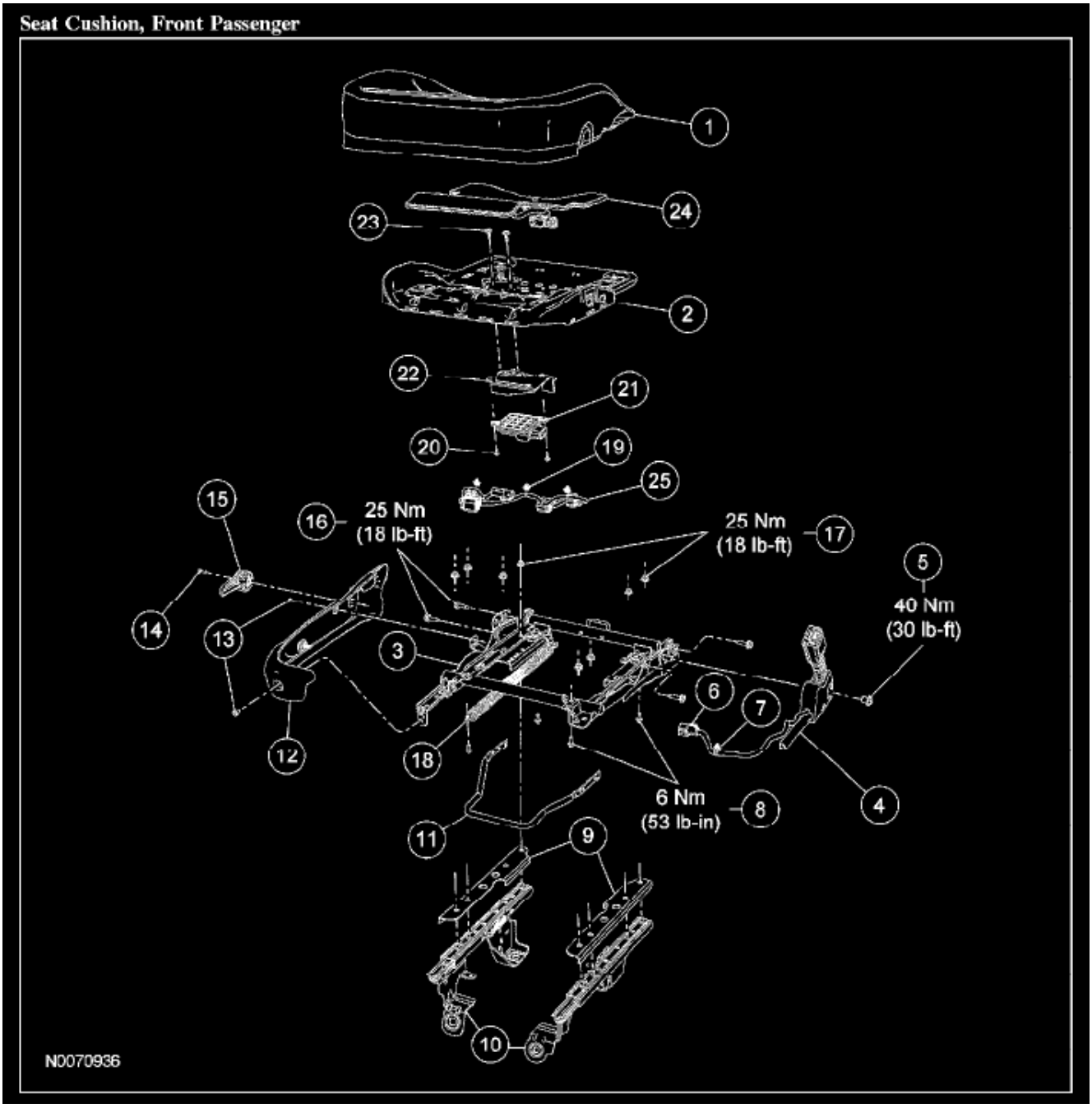
Seat Cushion, Driver, 40 Percent (Part 1)

Item	Part Number	Description
1	62900/632A22	Cushion trim cover/foam pad
2	63100	Cushion frame
3	60108	Seat track-to-cushion frame bolts (4 required)
4	60108	Backrest-to-cushion bolts (4 required)
5	61198	Lumbar adjustment knob
6	55927	Recliner handle screw
7	61736	Recliner handle
8	000A25	Side shield screws (2 required)
9	62186	Cushion side shield
10	624A54	Backrest latch release cable
11	—	Pin-type retainer
12	000A25	Lumbar actuator screw (2 required)
13	610C00	Lumbar actuator
14	000A25	Safety belt buckle pretensioner nut

(Continued)

Item	Part Number	Description
15	—	Electrical connectors (part of 61203)
16	—	Pin-type retainer (3 required)
17	61203	Safety belt buckle pretensioner
18	—	Seat position sensor screw (2 required)
19	14B416	Seat track position sensor
20	61736	Seat track adjustment handle
21	61828	Seat track assist spring
22	W520413	Rail-to-seat track nuts (8 required)
23	61704/61705	Seat track rails
24	617A46	Seat track reinforcement (2 required)
25	620B20	Seat track

Seat Cushion, Driver, 40 Percent (Part 2)



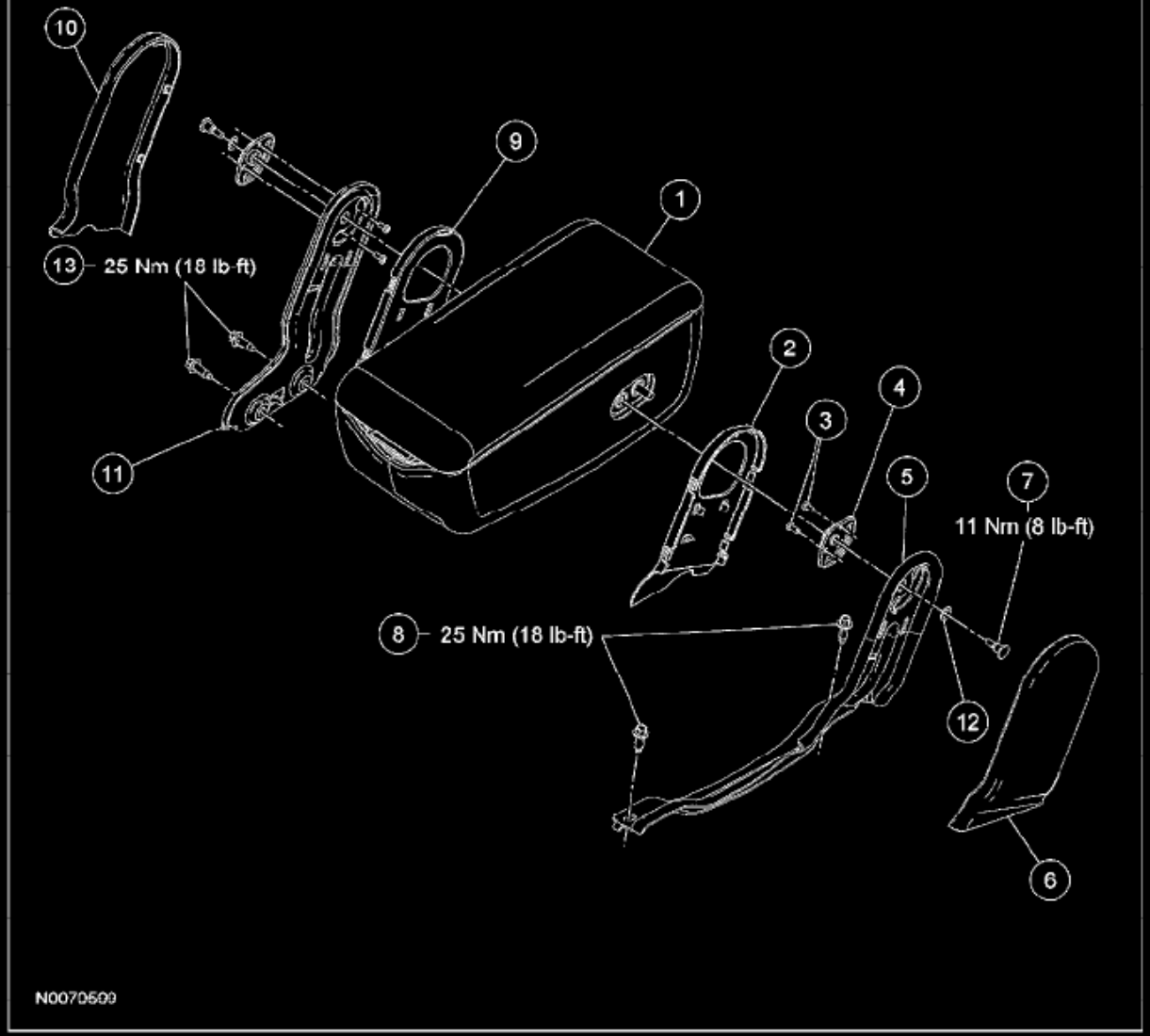
Seat Cushion, Front Passenger (Part 1)

Item	Part Number	Description
1	62900/603B02	Cushion trim cover/foam pad
2	63100	Cushion frame
3	613B20	Seat track
4	61202	Safety belt buckle pretensioner
5	000A25	Safety belt buckle pretensioner nut
6	—	Electrical connector (part of 61202)
7	—	Pin-type retainer
8	60108	Seat track-to-cushion frame bolts (4 required)
9	617A46	Seat track reinforcements
10	61704/61705	Seat track rails
11	61736	Seat track adjustment handle
12	62186	Cushion side shield
13	000A25	Side shield screws (2 required)
14	55927	Recliner handle screw
15	61736	Recliner handle
16	60108	Backrest-to-cushion bolts (4 required)
17	W520413	Rail-to-seat track nuts (8 required)
18	61828	Seat track assist spring
19	—	Pin-type retainer (3 required)
20	—	Screw (2 required)
21	—	Occupant classification system module (OCSM) (part of 603B02)
22	—	OCSM bracket
23	—	Screw (2 required)
24	—	OCS (bladder, hose with pressure sensor, OCSM and seat wiring harness) (part of 603B02)
25	14C719	Wiring harness

(Continued)

Seat Cushion, Front Passenger (Part 2)

Seat Armrest, Front, 60 Percent



Item	Part Number	Description
1	644A22	Armrest
2	672A28B	LH inner trim cover
3	—	Pivot bracket screws (4 required)
4	63076C	Pivot bracket (2 required)
5	63076A	LH armrest bracket
6	672A28A	LH outer trim cover
7	—	Armrest pivot bolts (2 required)
8	—	LH armrest bracket-to-seat frame bolts (2 required)

Item	Part Number	Description
9	672A28B	RH inner trim cover
10	672A28A	RH outer trim cover
11	63076B	RH armrest bracket
12	—	Washer (2 required)
13	—	RH armrest bracket-to-seat frame bolts (2 required)

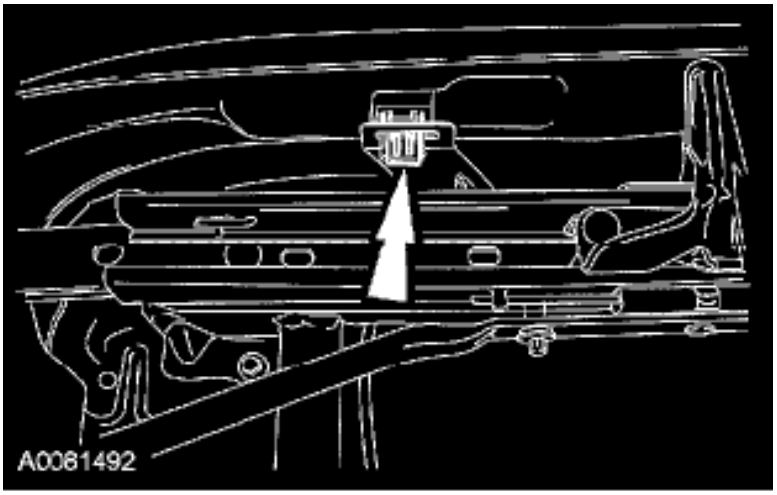
(Continued)

Seat Armrest, Front, 60 Percent

Removal

All seats

WARNING: Never probe the electrical connectors on safety belt buckle/retractor pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors, which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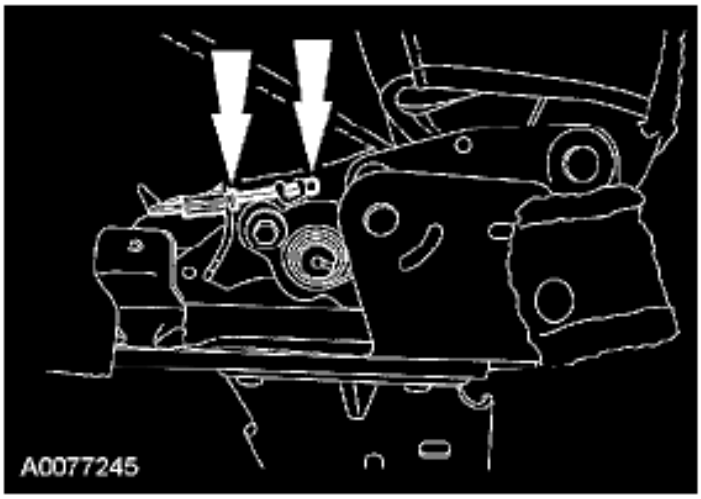
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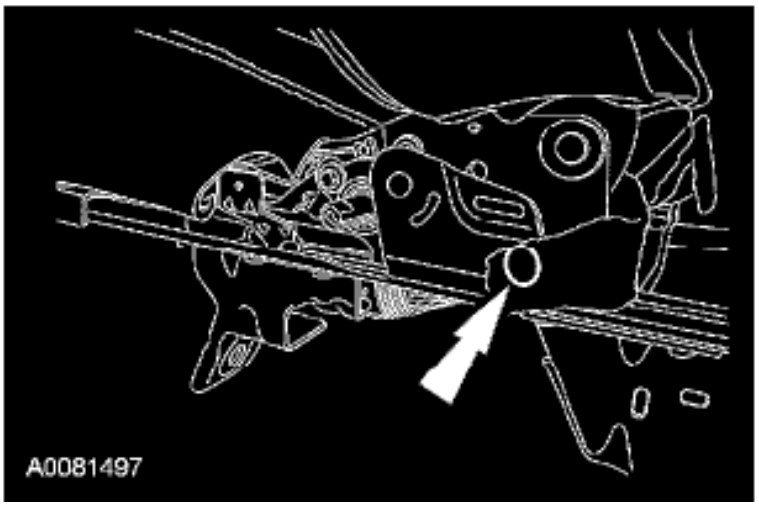

A0081497

increases the risk of serious personal injury or death.

NOTE: -

The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

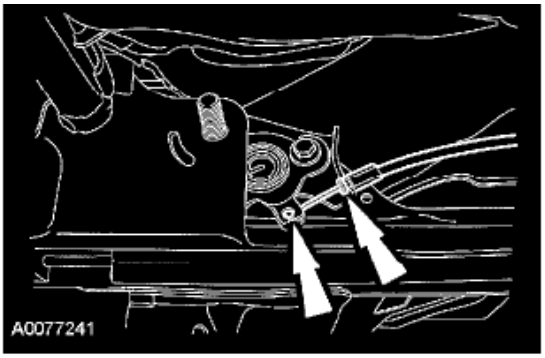
- The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1. Remove the 60 percent bench seat. 2. Remove the 60 percent bench armrest. 3. Remove the backrest recliner handle screw and the handle. 4. Remove the 2 side shield screws. 5. Pull out on the side and the rear of the side shield to detach the 2 clips (1 shown).

6. Remove the outboard recliner cable anchor and swivel and detach the recliner cable end.

7. Remove the outboard pin-type retainer and position the trim cover flap aside.

8. Remove the 2 outboard backrest-to-cushion bolts. 9. Remove the inboard seat backrest latch release cable anchor and swivel and detach the cable end.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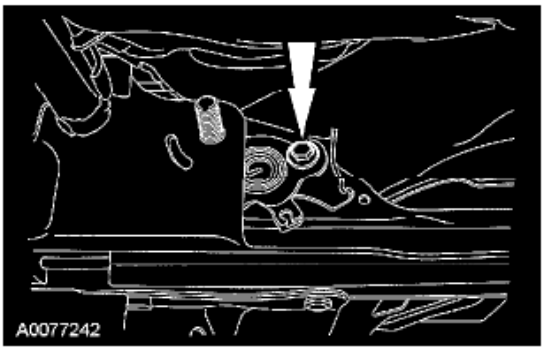
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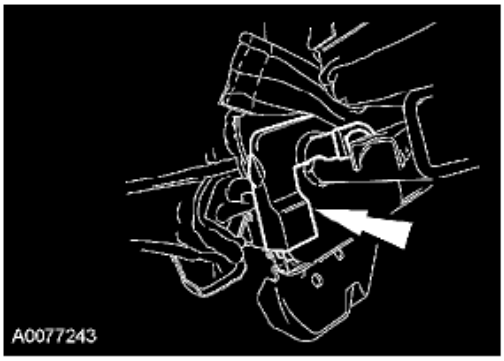
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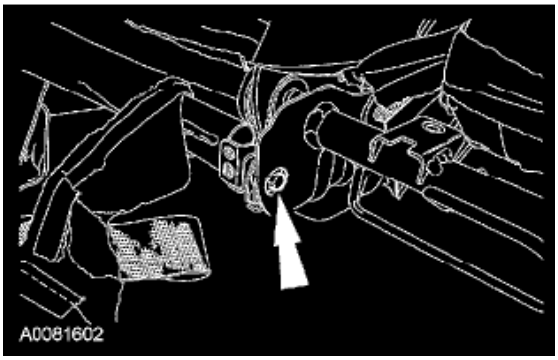

A0081602

10. Remove the front inboard backrest-to-cushion bolt.

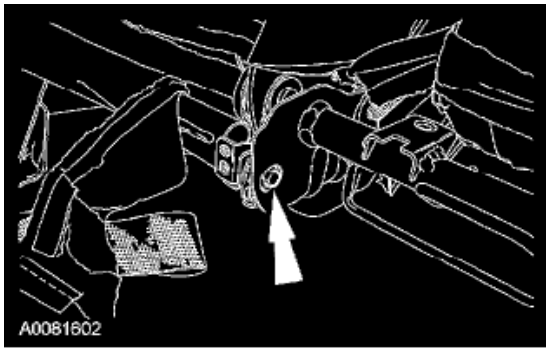
SuperCab seat 11. Remove the inboard rear bolt cover.

All seats 12. Remove the inboard rear backrest-to-cushion bolt.

13. Remove the backrest assembly.

Installation

All seats 1. Install the backrest assembly. 2. Install the inboard rear backrest-to-cushion bolt.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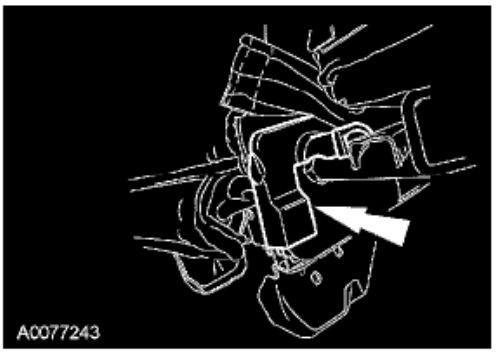
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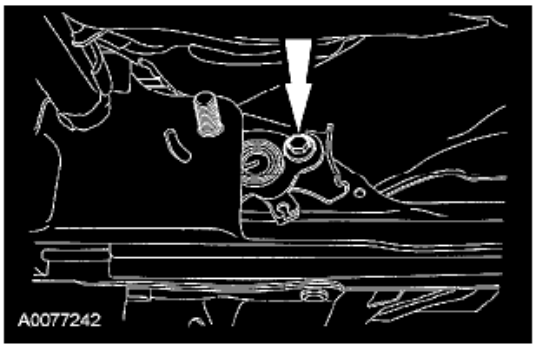
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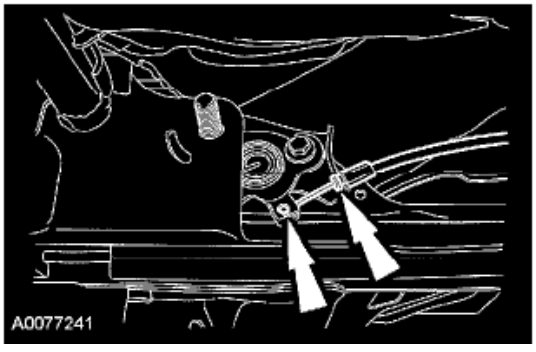
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- Tighten to 25 Nm (18 lb-ft).

SuperCab seat 3. Install the inboard rear bolt cover.

All seats 4. Install the inboard front backrest-to-cushion bolt.

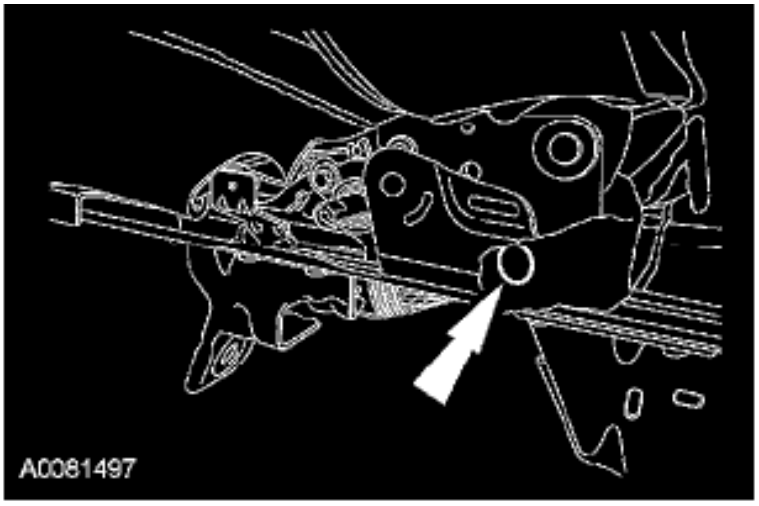
- Tighten to 25 Nm (18 lb-ft).

5. Install the inboard seat backrest latch release cable end and swivel and install the cable anchor.

6. Install the 2 outboard backrest-to-cushion bolts.

- Tighten to 25 Nm (18 lb-ft).

7. Position the trim cover flap and install the outboard pin-type retainer.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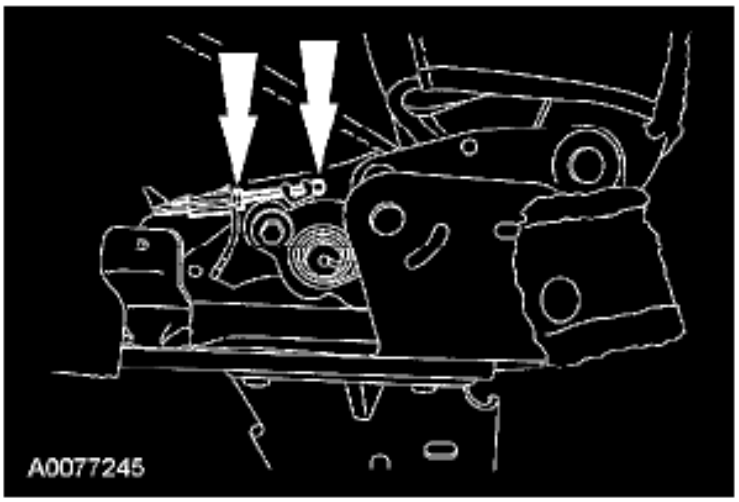
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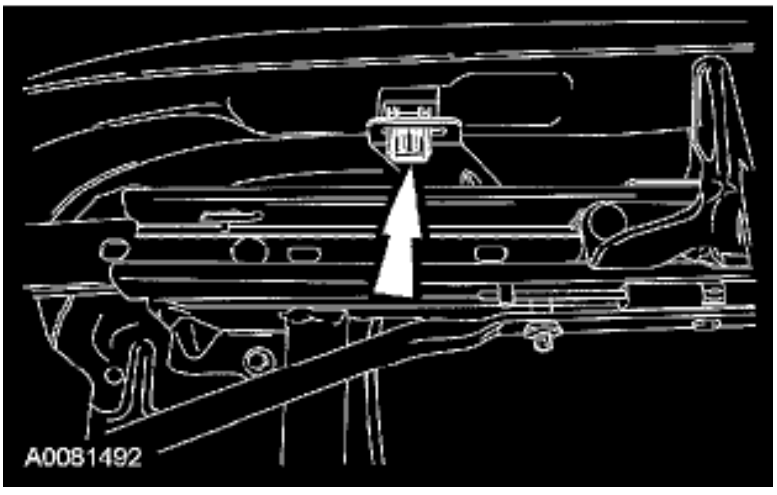
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8. Install the outboard seat backrest latch release cable end and swivel and install the cable anchor.

9. Position the side shield and install the 2 clips (1 shown).

10. Install the 2 side shield screws. 11. Install the backrest recliner handle and screw. 12. Install the 60 percent bench armrest. 13. Install the 60 percent bench seat.

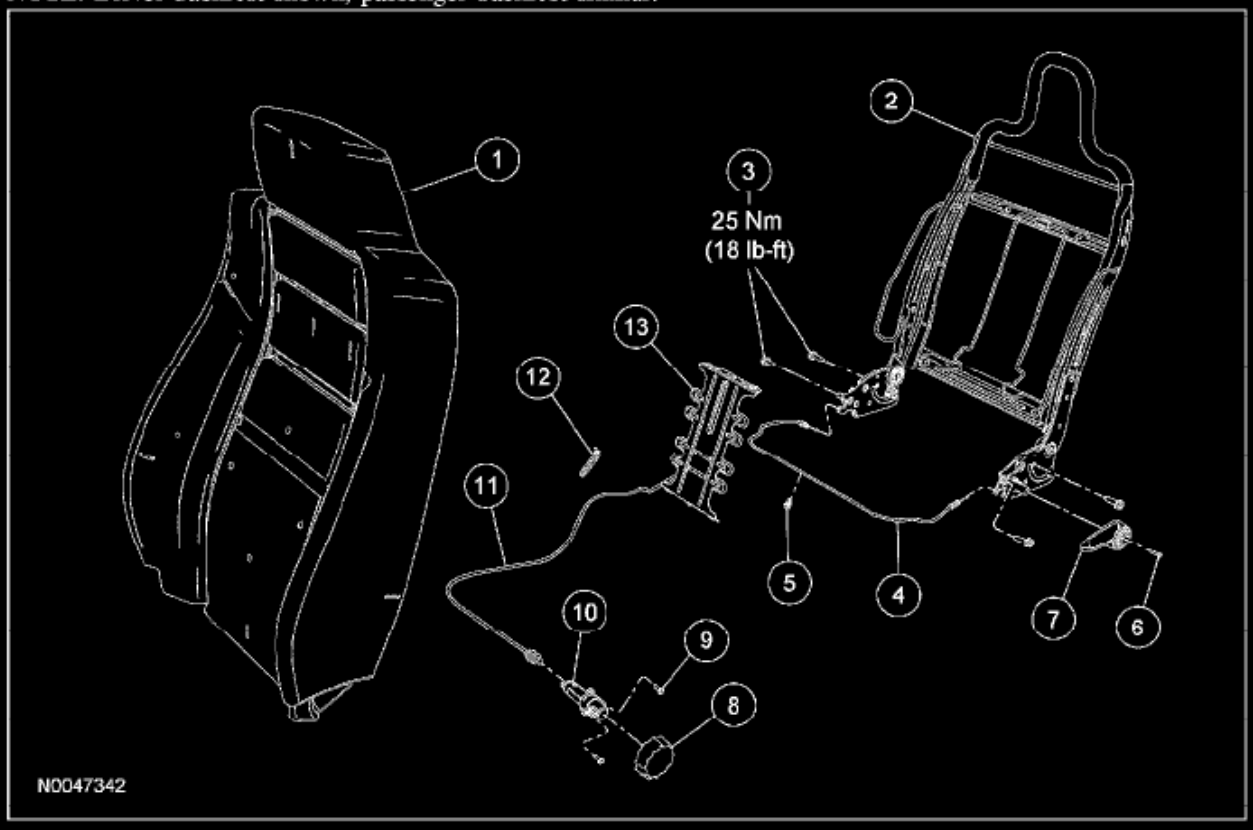
Seat Backrest - Front, Bucket and 40 Percent

SEAT BACKREST - FRONT, BUCKET AND 40 PERCENT

Exploded View

Seat Backrest, Front, 40 Percent

NOTE: Driver backrest shown, passenger backrest similar.



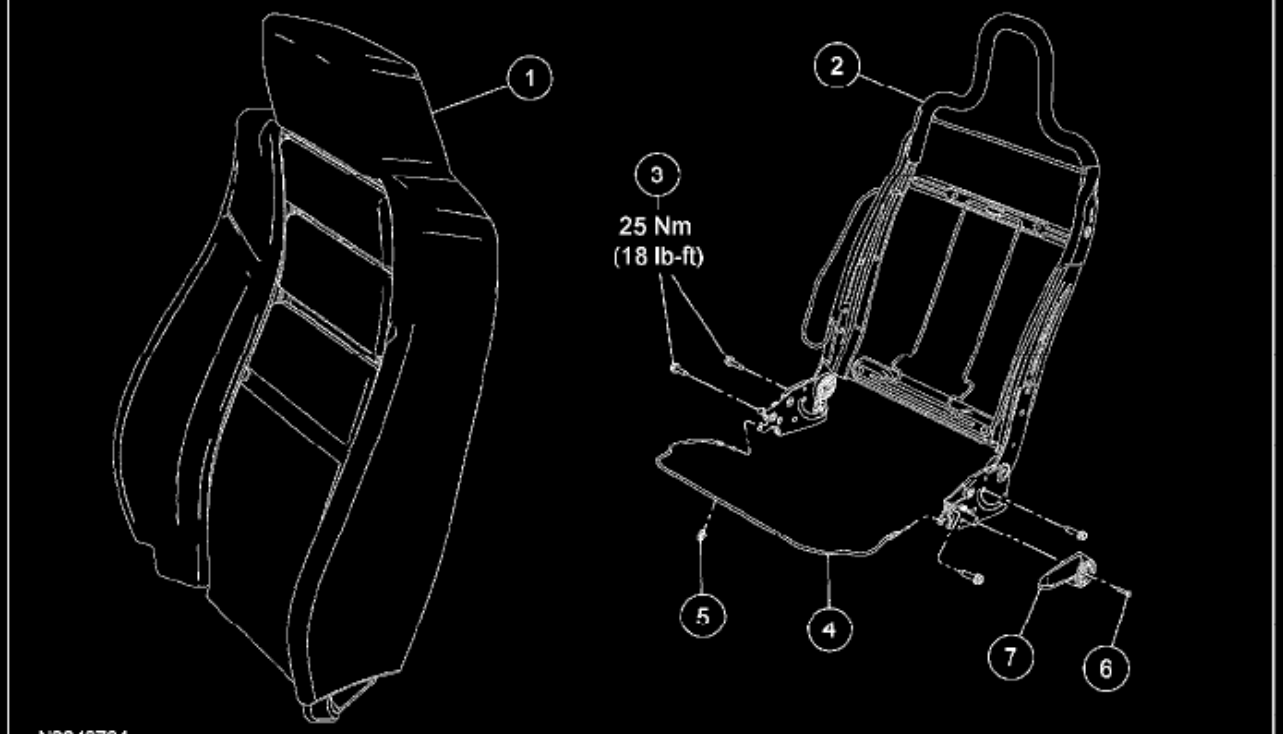
Item	Part Number	Description
1	64416/64810	Backrest trim cover/foam pad
2	61018	Backrest frame
3	60108	Backrest-to-cushion bolts (4 required)
4	624A54	Backrest latch release cable
5	—	Pin-type retainer
6	56904	Recliner handle screw
7	610A77	Recliner handle
8	61198	Lumber adjust knob, if equipped

Item	Part Number	Description
9	000A25	Lumbar actuator screw (2 required), if equipped
10	610C00	Lumbar actuator, if equipped
11	—	Lumbar actuator cable (part of 62222), if equipped
12		Tie strap, if equipped
13	62222	Lumbar support, if equipped

(Continued)

Seat Backrest, Front, 40 Percent

Seat Backrest, Front, 60 Percent

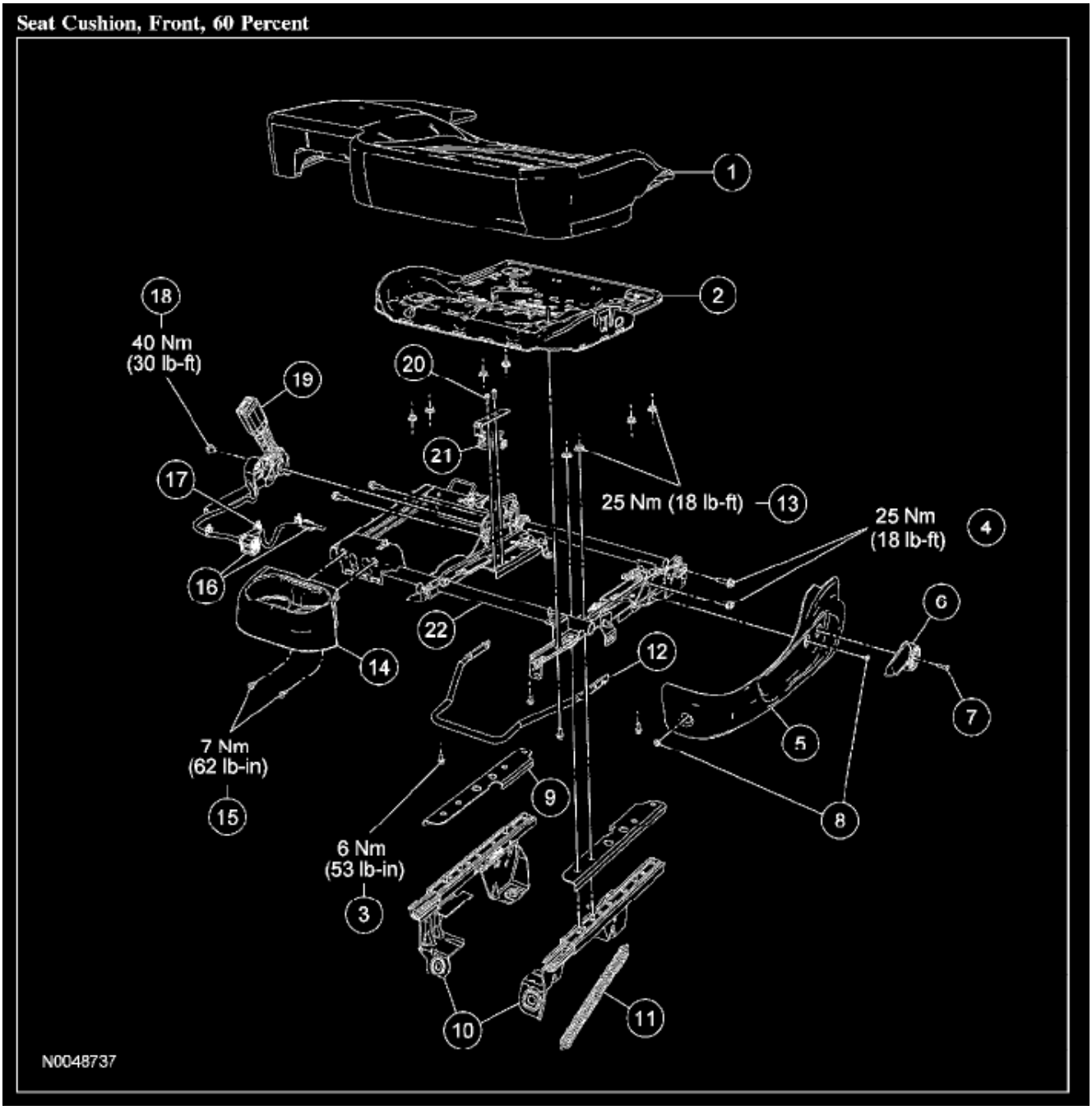


Item	Part Number	Description
1	64416/64810	Backrest trim cover/foam pad
2	61018	Backrest frame
3	60108	Backrest-to-cushion bolts (4 required)
4	624A54	Backrest latch release cable

Item	Part Number	Description
5	—	Pin-type retainer
6	56904	Recliner handle screw
7	610A77	Recliner handle

(Continued)

Seat Backrest, Front, 60 Percent



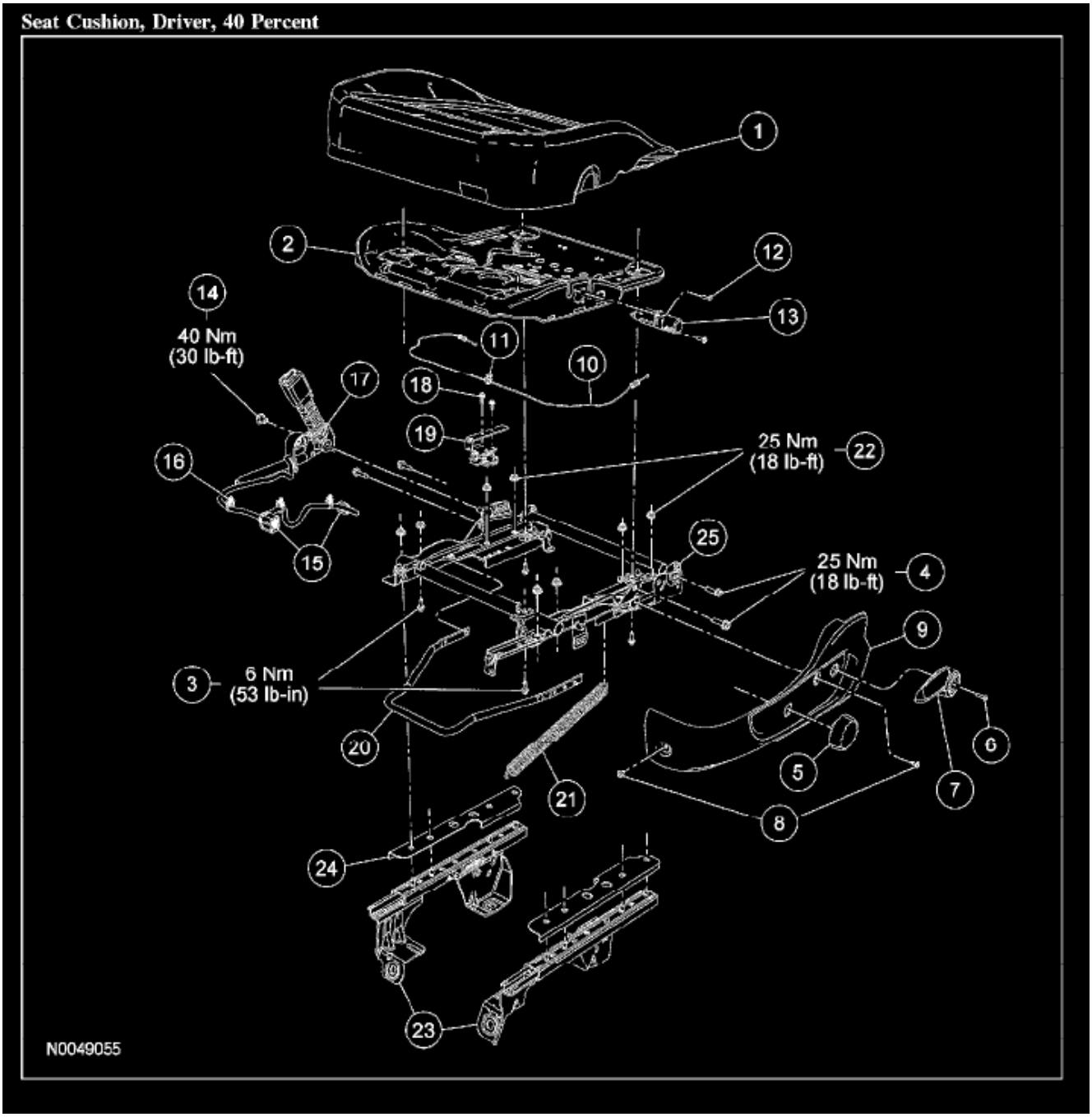
Seat Cushion, Front, 60 Percent (Part 1)

Item	Part Number	Description
1	62900/632A22	Cushion trim cover/foam pad
2	63100	Cushion frame
3	60108	Seat track-to-cushion frame bolt (4 required)
4	60108	Backrest-to-cushion bolts (4 required)
5	62186	Cushion side shield
6	61736	Recliner handle
7	55927	Recliner handle screw
8	000A25	Side shield screws (2 required)
9	617A46	Seat track reinforcement (2 required)
10	61704/61705	Seat track rails
11	61828	Seat track assist spring
12	61736	Seat track adjustment handle
13	W520413	Rail-to-seat track nuts (8 required)

(Continued)

Item	Part Number	Description
14	—	Cup holder
15	000A25	Cup holder mounting screws (2 required)
16	—	Electrical connectors (part of 61203)
17	—	Pin-type retainer (3 required)
18	000A25	Safety belt buckle pretensioner nut
19	61203	Safety belt buckle pretensioner
20	—	Seat position sensor and bracket screw (2 required)
21	14B416	Seat position sensor and bracket
22	613B20	Seat track

Seat Cushion, Front, 60 Percent (Part 2)



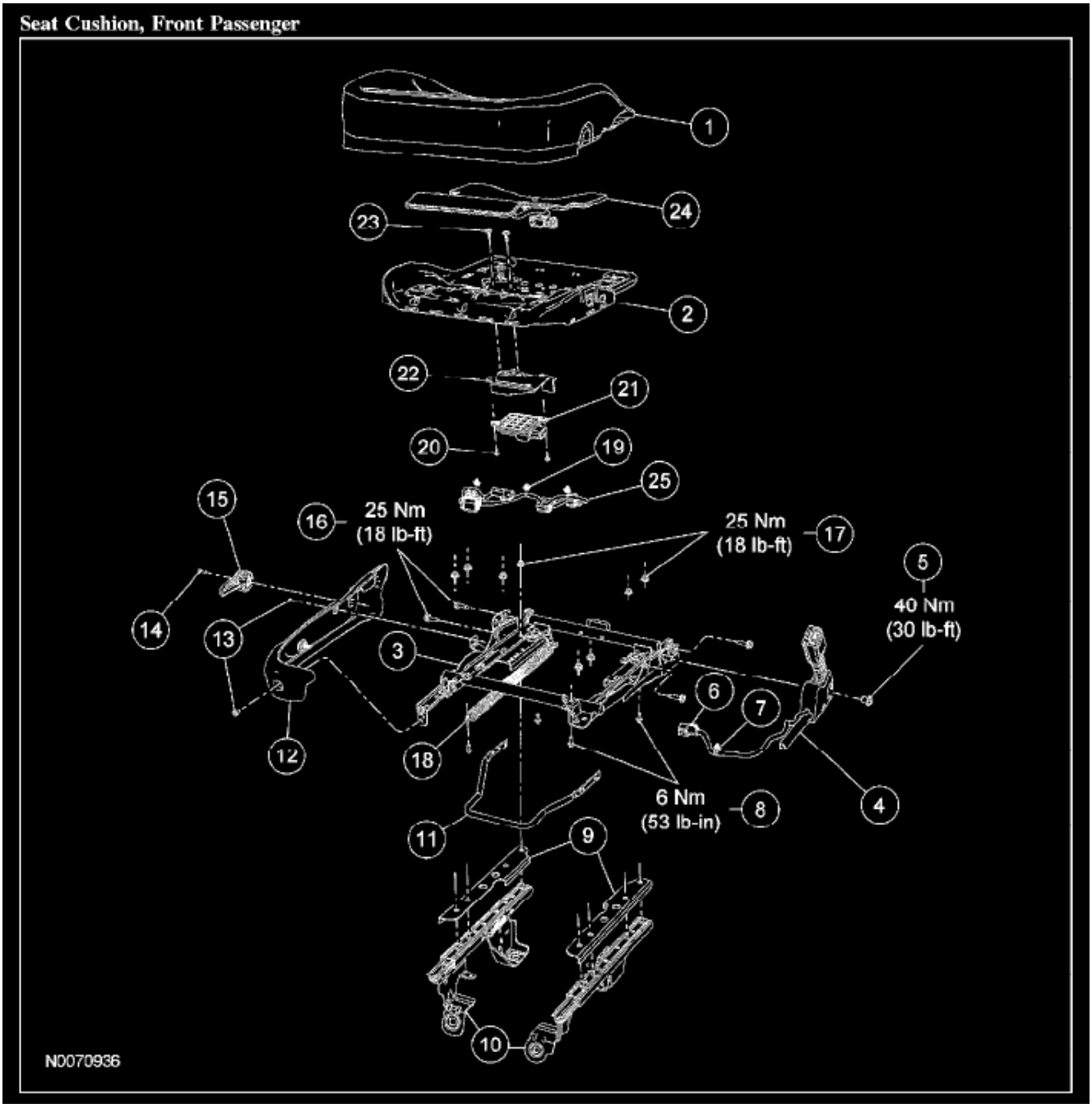
Seat Cushion, Driver, 40 Percent (Part 1)

Item	Part Number	Description
1	62900/632A22	Cushion trim cover/foam pad
2	63100	Cushion frame
3	60108	Seat track-to-cushion frame bolts (4 required)
4	60108	Backrest-to-cushion bolts (4 required)
5	61198	Lumbar adjustment knob
6	55927	Recliner handle screw
7	61736	Recliner handle
8	000A25	Side shield screws (2 required)
9	62186	Cushion side shield
10	624A54	Backrest latch release cable
11	—	Pin-type retainer
12	000A25	Lumbar actuator screw (2 required)
13	610C00	Lumbar actuator
14	000A25	Safety belt buckle pretensioner nut

(Continued)

Item	Part Number	Description
15	—	Electrical connectors (part of 61203)
16	—	Pin-type retainer (3 required)
17	61203	Safety belt buckle pretensioner
18	—	Seat position sensor screw (2 required)
19	14B416	Seat track position sensor
20	61736	Seat track adjustment handle
21	61828	Seat track assist spring
22	W520413	Rail-to-seat track nuts (8 required)
23	61704/61705	Seat track rails
24	617A46	Seat track reinforcement (2 required)
25	620B20	Seat track

Seat Cushion, Driver, 40 Percent (Part 2)



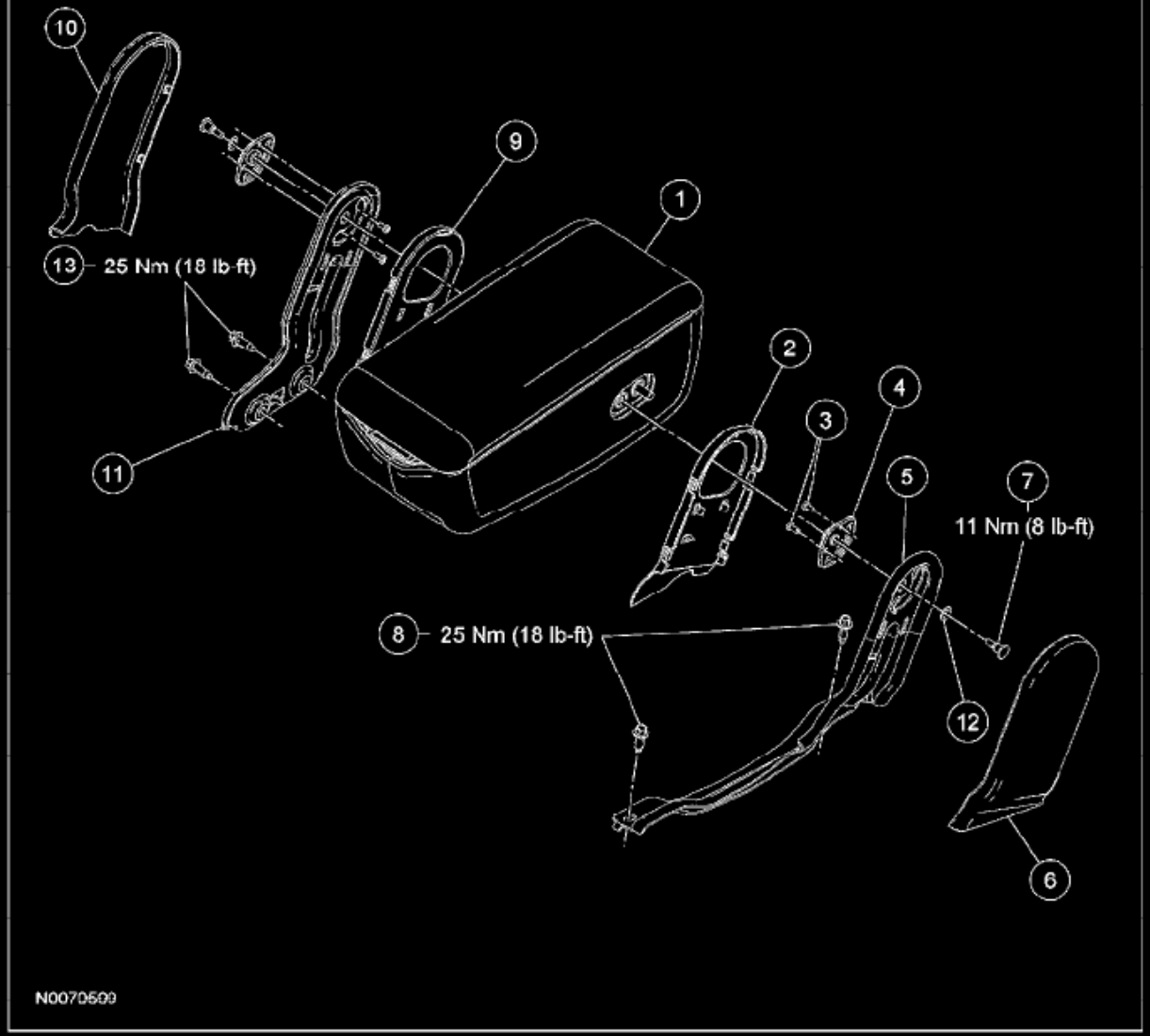
Seat Cushion, Front Passenger (Part 1)

Item	Part Number	Description
1	62900/603B02	Cushion trim cover/foam pad
2	63100	Cushion frame
3	613B20	Seat track
4	61202	Safety belt buckle pretensioner
5	000A25	Safety belt buckle pretensioner nut
6	—	Electrical connector (part of 61202)
7	—	Pin-type retainer
8	60108	Seat track-to-cushion frame bolts (4 required)
9	617A46	Seat track reinforcements
10	61704/61705	Seat track rails
11	61736	Seat track adjustment handle
12	62186	Cushion side shield
13	000A25	Side shield screws (2 required)
14	55927	Recliner handle screw
15	61736	Recliner handle
16	60108	Backrest-to-cushion bolts (4 required)
17	W520413	Rail-to-seat track nuts (8 required)
18	61828	Seat track assist spring
19	—	Pin-type retainer (3 required)
20	—	Screw (2 required)
21	—	Occupant classification system module (OCSM) (part of 603B02)
22	—	OCSM bracket
23	—	Screw (2 required)
24	—	OCS (bladder, hose with pressure sensor, OCSM and seat wiring harness) (part of 603B02)
25	14C719	Wiring harness

(Continued)

Seat Cushion, Front Passenger (Part 2)

Seat Armrest, Front, 60 Percent



Item	Part Number	Description
1	644A22	Armrest
2	672A28B	LH inner trim cover
3	—	Pivot bracket screws (4 required)
4	63076C	Pivot bracket (2 required)
5	63076A	LH armrest bracket
6	672A28A	LH outer trim cover
7	—	Armrest pivot bolts (2 required)
8	—	LH armrest bracket-to-seat frame bolts (2 required)

Item	Part Number	Description
9	672A28B	RH inner trim cover
10	672A28A	RH outer trim cover
11	63076B	RH armrest bracket
12	—	Washer (2 required)
13	—	RH armrest bracket-to-seat frame bolts (2 required)

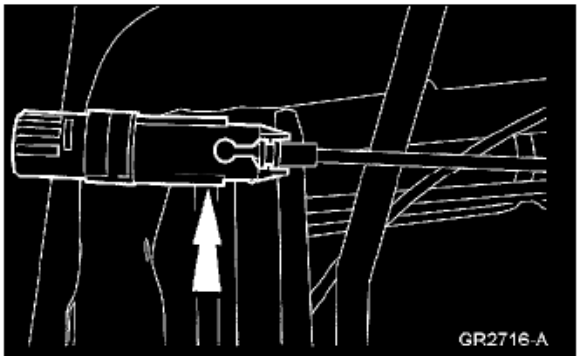
(Continued)

Seat Armrest, Front, 60 Percent

Special Tool(s)

Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool


GR2716-A

Special Tool(s)

Removal

WARNING: Never probe the electrical connectors on safety belt buckle/retractor pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors, which increases the risk of serious personal injury or death.

CAUTION: To prevent system failure, it is necessary to carry out the occupant classification sensor (OCS) system reset when a front passenger seat cushion is disassembled, a new trim cover installed or an OCS system service kit is installed. A scan tool is used to carry out the OCS system reset command.

NOTE: -

The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

- The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

- Driver seat shown, passenger seat similar.

All seats 1. Remove the affected seat. 2. Remove the seat back adjusting handle screw and handle.

Seats with manual lumbar

3. NOTE: The lumbar support assembly must be fully relaxed.

Relax the lumbar support assembly and remove the lumbar knob.

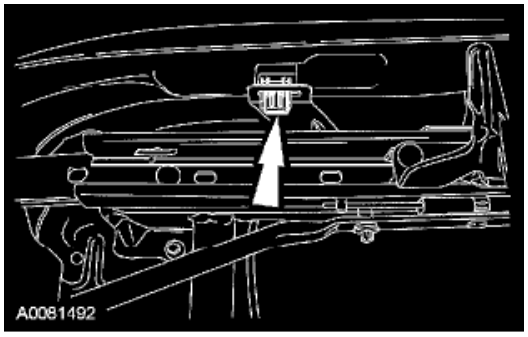
4. Remove the 2 screws and lumbar support adjuster.

5. NOTE: Note the routing of the lumbar cable.

Disconnect the lumbar support adjuster. -

To separate the lumbar support adjuster from the lumbar adjustment cable, align the lumbar adjustment cable ball socket in the lumbar support adjuster keyway and bend the parts 90 degrees to each other.

All seats 6. Remove the 2 side shield screws. 7. Pull out on the side and the rear of the side shield to detach the 2 clips (1 shown).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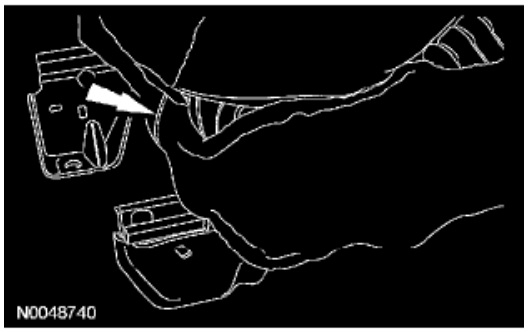
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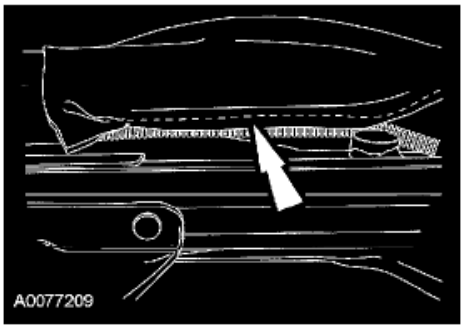
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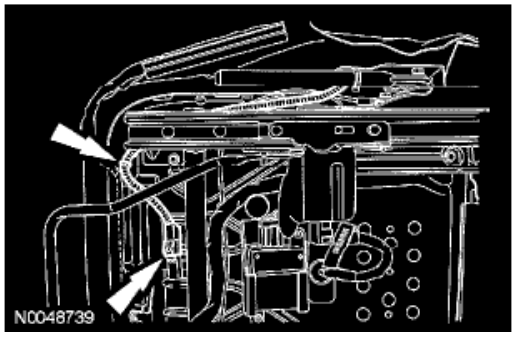
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8. Release the inboard side rear hook-and-loop strip.

9. Release the inboard side bottom J-clip for access to the safety belt buckle pretensioner.

10. NOTE:

- Note the routing of the wire harness through the seat for installation.

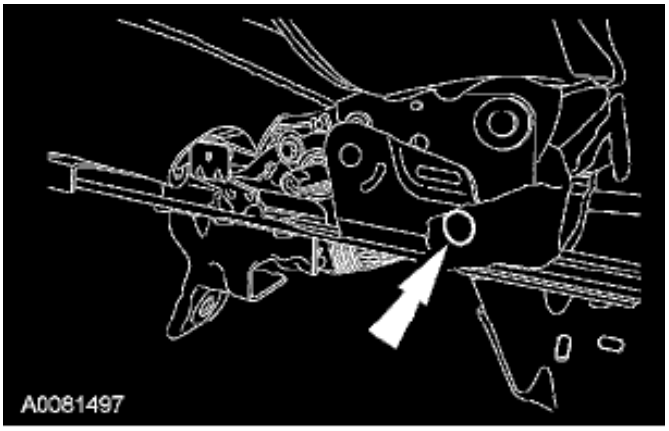
- Passenger seat shown, driver seat similar.

Detach the pin-type retainers and safety belt buckle pretensioner wire harness from the seat cushion pan. -

For driver seat, disconnect the seat position electrical connector.

- For passenger seat, disconnect the safety belt buckle pretensioner electrical connector.

11. Remove the safety belt buckle pretensioner nut and remove the safety belt buckle pretensioner and wire harness. 12. Remove the outboard rear pin-type retainer and position the material to the side.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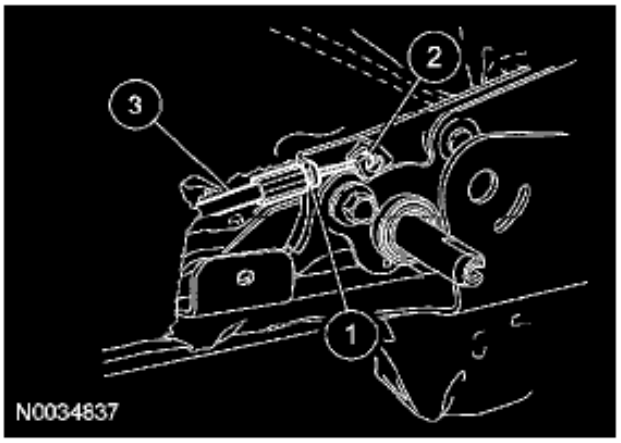
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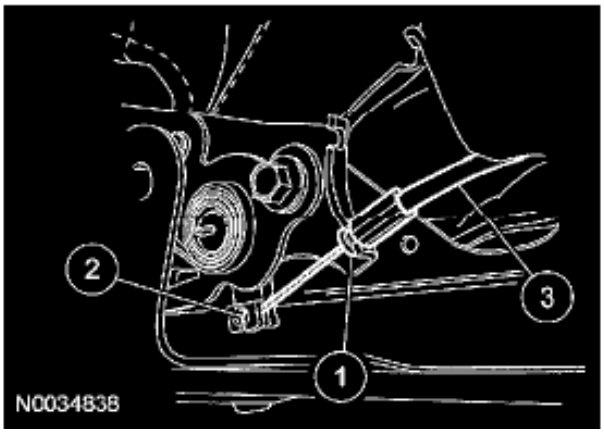
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13. Disconnect the outboard seat back latch release cable end.

1 Detach the cable from its anchor point.

2 Swivel the cable end and remove from the latch retainer.

3 Position the cable aside.

14. Disconnect the inboard seat back latch release cable end.

1 Detach the cable from its anchor point.

2 Swivel the cable end and remove from the latch retainer.

3 Position the cable aside.

15. Remove the 2 inboard seat backrest-to-cushion bolts. 16. Remove the 2 outboard seat backrest-to-cushion bolts.

17. NOTE: If equipped, note position of the lumbar cable where it comes through the seat cushion.

Remove the backrest assembly.

Installation

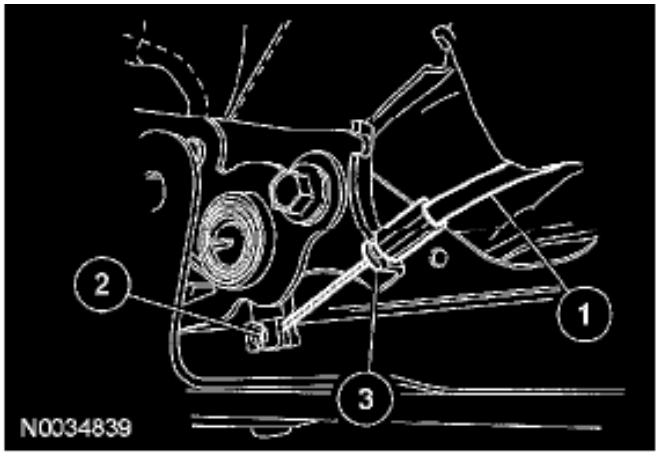
All seats 1. Install the backrest assembly. 2. Install the 2 outboard seat backrest-to-cushion bolts.

- Tighten to 25 Nm (18 lb-ft).

3. Install the 2 inboard seat backrest-to-cushion bolts.

- Tighten to 25 Nm (18 lb-ft).

4. Install the inboard seat backrest latch release cable.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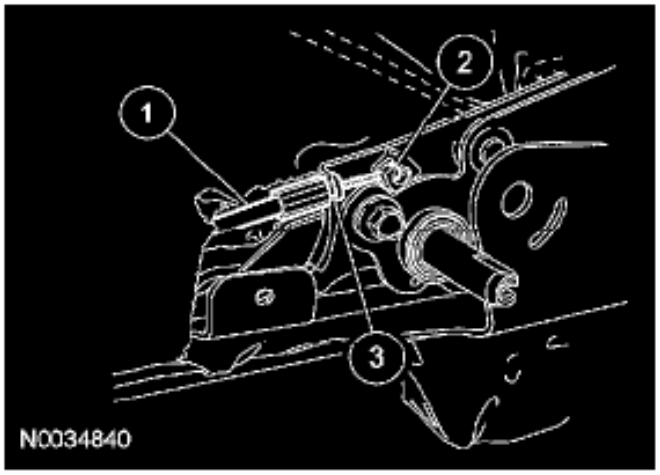
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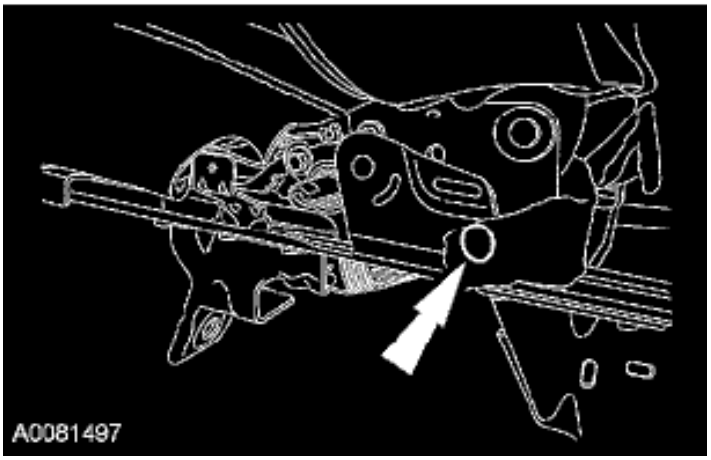
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1 Position the seat back latch release cable.

2 Install the seat back latch release cable end and swivel the cable.

3 Attach the cable at its anchor point.

5. Install the outboard seat backrest latch release cable.

1 Position the cable.

2 Install the seat backrest latch release cable end and swivel the cable.

3 Attach the cable to its anchor point.

6. Position the material and install the outboard pin-type retainer.

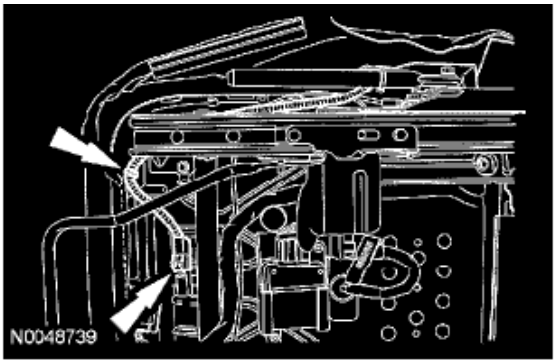
7. Install the safety belt buckle pretensioner and install the safety belt buckle pretensioner nut.

- Tighten to 40 Nm (30 lb-ft).

8. Route the safety belt buckle pretensioner wire harness and install the pin-type retainers.

- For driver seat, connect the seat position electrical connector.

- For passenger seat, connect the safety belt buckle pretensioner electrical connector.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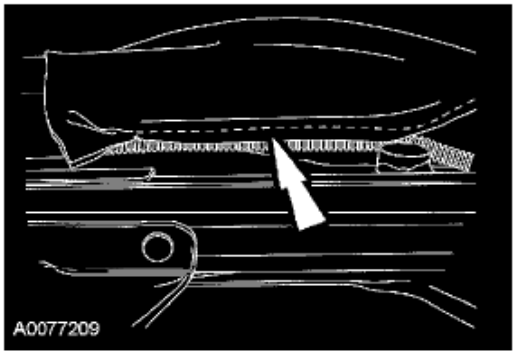
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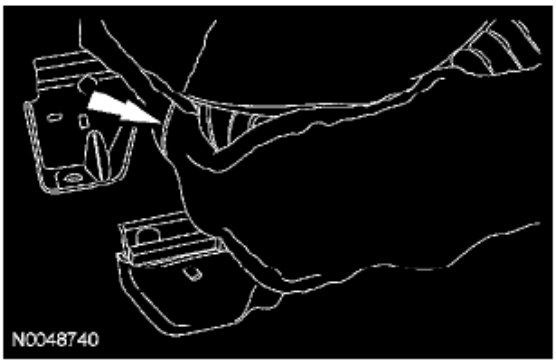
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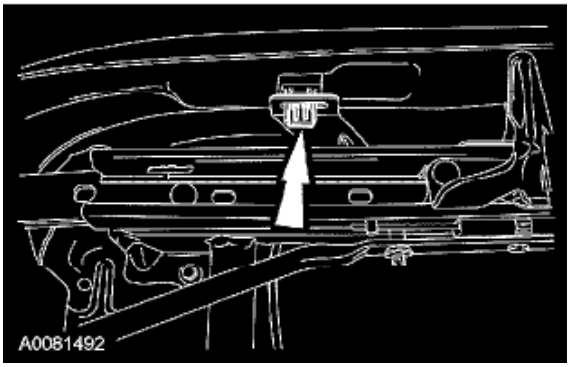
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9. Install the safety belt buckle pretensioner cover and install the screw.

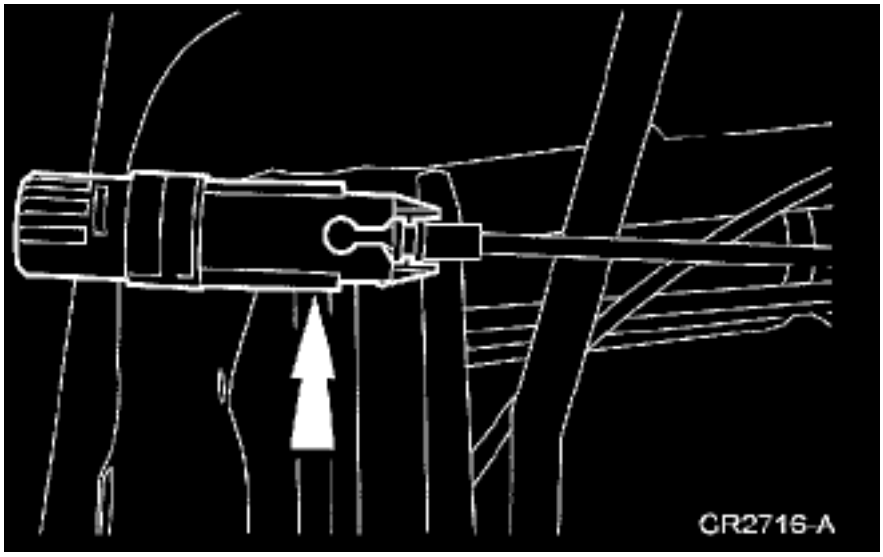
10. Attach the inboard side J-clip.

11. Fasten the inboard side rear hook-and-loop strip.

12. Position the side shield and install the 2 clips (1 shown).

13. Install the 2 front side shield screws.

Seats with manual lumbar 14. Route the lumbar adjustment cable as noted during removal. 15. Connect the lumbar support adjuster and the lumbar adjustment cable.



16. Install the lumbar support adjuster and the 2 screws. 17. Install the lumbar knob.

All seats 18. Install the seat backrest recliner handle and screw. 19. Install the seat. If a passenger seat has been serviced, do not prove out the SRS at this time.

Passenger seat

20. WARNING:

- Install a new occupant classification sensor (OCS) system service kit as a complete assembly. Never install only part of the kit components. Failure to follow this instruction may result in incorrect operation of the OCS system and increases the risk of serious personal injury or death in a crash.

- Make sure the front passenger seat repair is complete, the seat and all attached components (head restraint, seat side shield, etc.) are correctly assembled, and the seat is correctly installed to the vehicle before carrying out the System Reset. Failure to follow these instructions may result in incorrect operation of the occupant classification sensor (OCS) system and increases the risk of serious personal injury or death in a crash.

CAUTION: -

To prevent system failure, it is necessary to carry out the occupant classification sensor (OCS) system reset when a front passenger seat cushion is disassembled, a new trim cover installed or an OCS system service kit is installed. A scan tool is used to carry out the OCS system reset command.

- To prevent system failure, the following precautions must be taken before carrying out the occupant classification sensor (OCS) system reset: -

Make sure the voltage to the occupant classification system module (OCSM) is above 8.0 volts and less than 18.0 volts.

- Make sure the OCS system is not at a temperature below 6°C (42°F) or above 36°C (97°F) when initiating the OCS system reset process. If the vehicle has been exposed to extreme cold or hot temperatures, the vehicle must be exposed and kept at a temperature within the limits, 6°C to 36°C (42°F to 97°F) for a minimum of 30 minutes.

- Make sure nothing is present on the passenger seat before carrying out the OCS system reset and nothing is placed on the seat during the process.

- Make sure a minimum 8-second time period has passed after cycling the ignition switch ON before the carrying out the OCS system reset process.

NOTE: If the first attempt to carry out the occupant classification sensor (OCS) system reset is unsuccessful, a second attempt must be made. If the second attempt is unsuccessful, a new OCS system service kit must be installed.

Carry out the OCS system reset active command.

21. NOTE: The ignition switch must be cycled after the OCS system reset.

Cycle the ignition switch from ON to OFF.

All seats 22. Prove out the SRS as follows:

Turn the ignition key from ON to OFF. Wait 10 seconds, then turn the key back to ON and visually monitor the air bag warning indicator with the air bag modules installed. The air bag warning indicator will light continuously for approximately 6 seconds and then turn off. If an SRS fault is present, the air bag warning indicator will: -

fail to light.

- remain lit continuously.

- flash at a 5Hz rate (RCM not configured).

The air bag warning indicator may not illuminate until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON

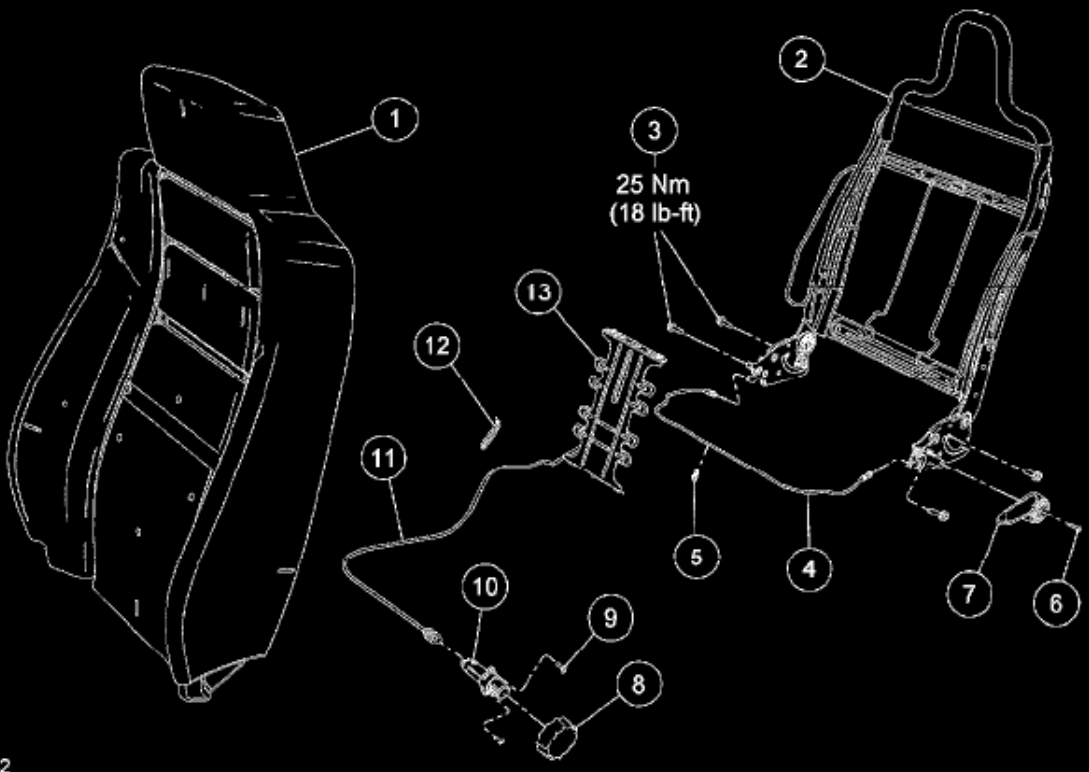
position. This is the time required for the RCM to complete the testing of the SRS. If the air bag warning indicator is inoperative and a SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag warning indicator and any SRS fault discovered must be diagnosed and repaired.

Clear all continuous RCM and occupant classification system module (OCSM) DTCs using a scan tool.

Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

NOTE: Driver backrest shown, passenger backrest similar.



Item	Part Number	Description
1	64416/64810	Backrest trim cover/foam pad
2	61018	Backrest frame
3	60108	Backrest-to-cushion bolts (4 required)
4	624A54	Backrest latch release cable
5	—	Pin-type retainer
6	56904	Recliner handle screw

(Continued)

Item	Part Number	Description
7	610A77	Recliner handle
8	61198	Lumber adjust knob, if equipped
9	000A25	Lumbar actuator screw (2 required), if equipped
10	610C00	Lumbar actuator, if equipped
11	—	Lumbar actuator cable (part of 62222), if equipped
12	—	Tie strap, if equipped
13	62222	Lumbar support, if equipped

Seat Back: Overhaul

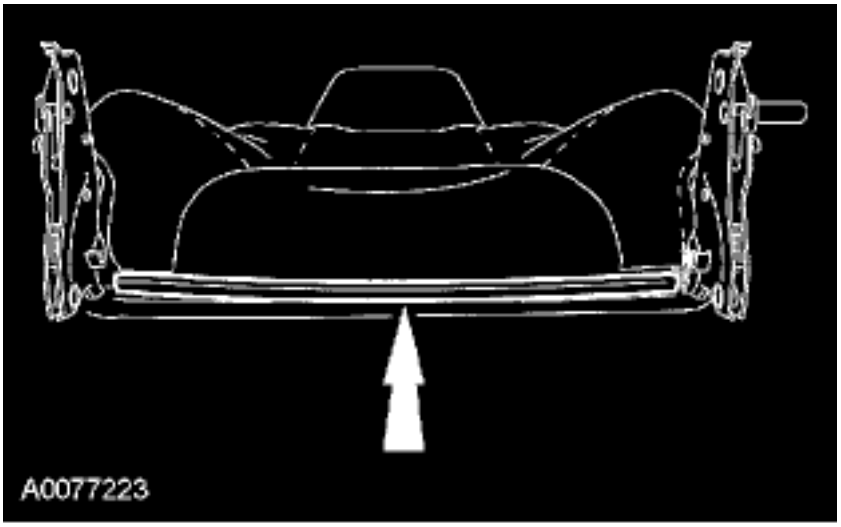
Bucket and 40 Percent

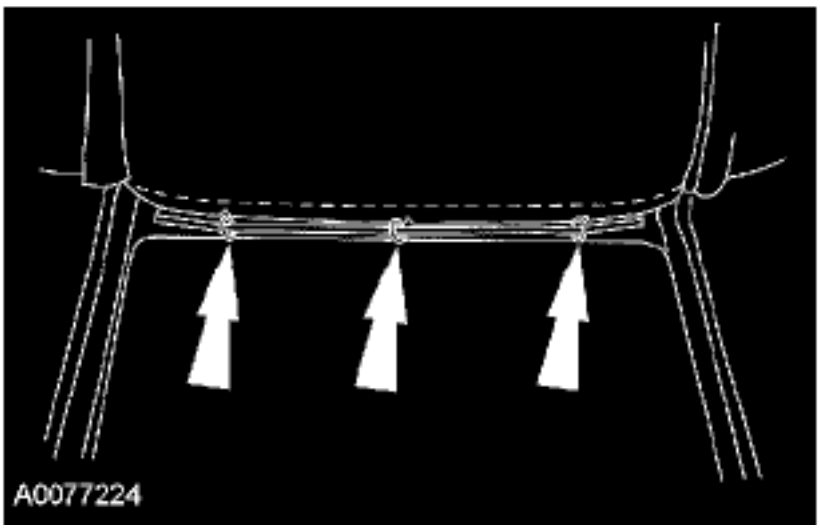
SEAT BACKREST - FRONT, BUCKET AND 40 PERCENT

Special Tool(s)

Special Tool(s)

Disassembly





WARNING: -

Never probe the electrical connectors on safety belt buckle/retractor pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors, which increases the risk of serious personal injury or death.

- Make sure the front passenger seat repair is complete, the seat and all attached components (head restraint, seat side shield, etc.) are correctly assembled, and the seat is correctly installed to the vehicle before carrying out the System Reset. Failure to follow these instructions may result in incorrect operation of the occupant classification sensor (OCS) system and increases the risk of serious personal injury or death in a crash.

CAUTION: To prevent system failure, it is necessary to carry out the occupant classification sensor (OCS) system reset when a front passenger seat cushion is disassembled, a new trim cover installed or an OCS system service kit is installed. A scan tool is used to carry out the OCS system reset command.

NOTE: -

The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

- The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

- Driver seat shown, passenger seat similar.

All seats 1. Remove the affected seat. 2. Remove the affected seat backrest. 3. Release the backrest J-clip.

4. CAUTION: Use care when separating the seat back trim cover from the hook-and-loop strips or the hook-and-loop strips may be torn

from the seat back foam.

Release the hook-and-loop strips and invert the backrest cover to the row of hog rings.

5. Remove the row of hog rings.

6. Remove the backrest trim cover and foam pad.

Seats with manual lumbar 7. Remove the lumbar support assembly.

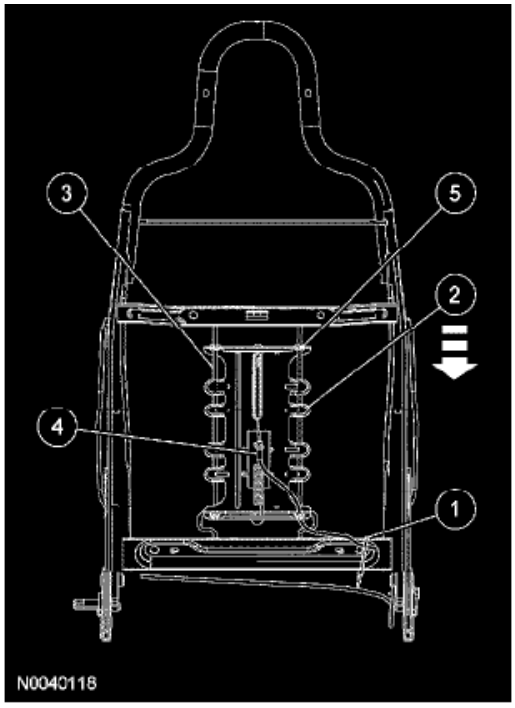
1 Remove and discard the tie strap.

2 Flex the lumbar support.

3 Unhook the lumbar support adjusting cable.

4 Unhook and remove the lumbar support adjusting cable.

5 Detach the lumbar support from the guide wires. Remove the lumbar support.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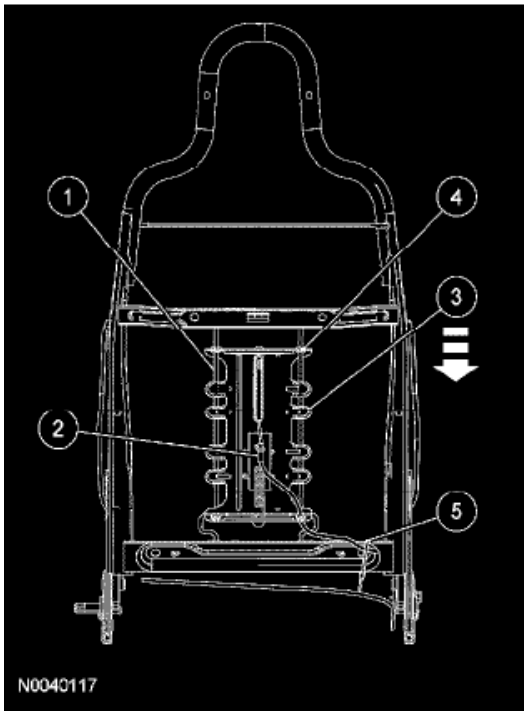
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Assembly

Seats with manual lumbar 1. Install the lumbar support assembly.

1 Install the lumbar support. Attach the lumbar to the guide wires.

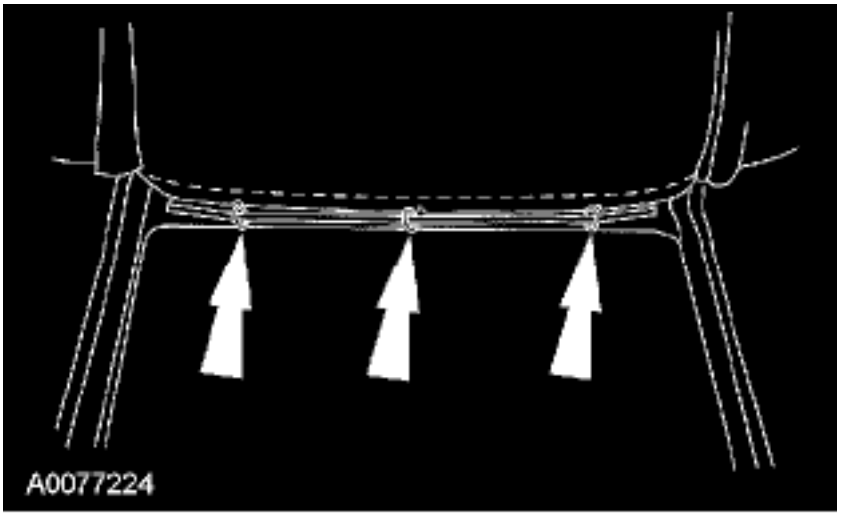
2 Install and hook the lumbar adjusting cable.

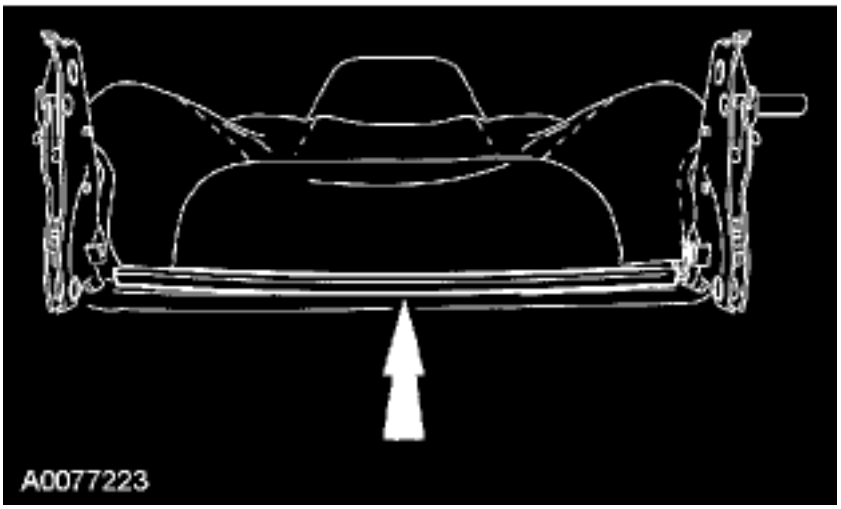
3 Flex the lumbar support.

4 Hook the lumbar support cable.

5 Install the tie strap.

All seats 2. Install the backrest foam pad to the backrest frame. 3. Position the backrest trim cover to the backrest and install the hog rings.





4. Roll the trim cover down the backrest and fasten the hook-and-loop strips. 5. Fasten the backrest J-clip.

6. Install the affected seat backrest. 7. Install the seat. If a passenger seat has been serviced, do not prove out the SRS at this time.

Passenger seat

8. WARNING:

- Install a new occupant classification sensor (OCS) system service kit as a complete assembly. Never install only part of the kit components. Failure to follow this instruction may result in incorrect operation of the OCS system and increases the risk of serious personal injury or death in a crash.

- Make sure the front passenger seat repair is complete, the seat and all attached components (head restraint, seat side shield, etc.) are correctly assembled, and the seat is correctly installed to the vehicle before carrying out the System Reset. Failure to follow these instructions may result in incorrect operation of the occupant classification sensor (OCS) system and increases the risk of serious personal injury or death in a crash.

CAUTION: -

To prevent system failure, it is necessary to carry out the occupant classification sensor (OCS) system reset when a front passenger seat cushion is disassembled, a new trim cover installed or an OCS system service kit is installed. A scan tool is used to carry out the OCS system reset command.

- To prevent system failure, the following precautions must be taken before carrying out the occupant classification sensor (OCS) system reset: -

Make sure the voltage to the occupant classification system module (OCSM) is above 8.0 volts and less than 18.0 volts.

- Make sure the OCS system is not at a temperature below 6°C (42°F) or above 36°C (97°F) when initiating the OCS system reset process. If the vehicle has been exposed to extreme cold or hot temperatures, the vehicle must be exposed and kept at a temperature within the limits, 6°C to 36°C (42°F to 97°F) for a minimum of 30 minutes.

- Make sure nothing is present on the passenger seat before carrying out the OCS system reset and nothing is placed on the seat during the process.

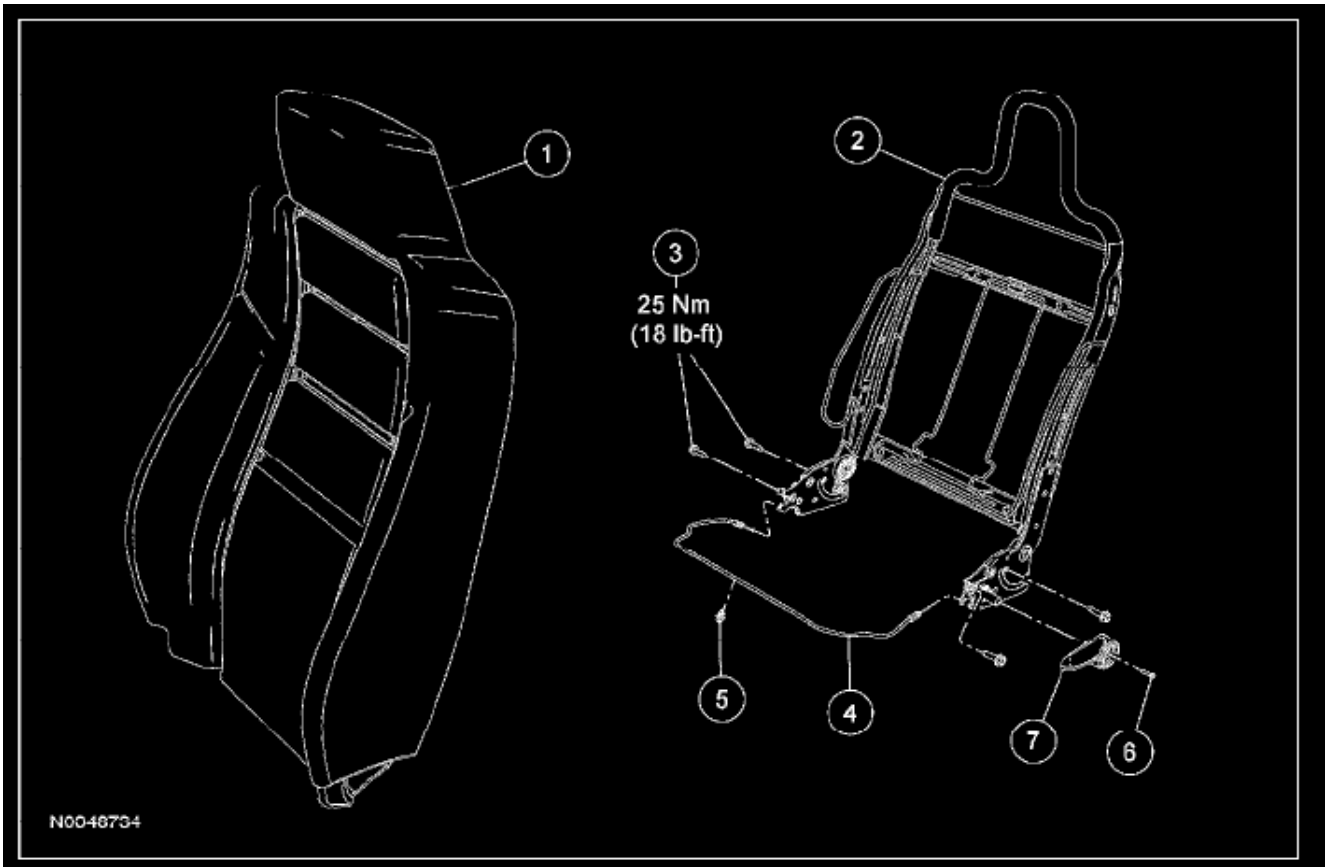
- Make sure a minimum 8-second time period has passed after cycling the ignition switch ON before the carrying out the OCS system reset process.

NOTE: If the first attempt to carry out the occupant classification sensor (OCS) system reset is unsuccessful, a second attempt must be made. If the second attempt is unsuccessful, a new OCS system service kit must be installed.

Carry out the OCS system reset active command.

9. NOTE: The ignition switch must be cycled after the OCS system reset.

Cycle the ignition switch from ON to OFF.



Item	Part Number	Description
1	64416/64810	Backrest trim cover/foam pad
2	61018	Backrest frame
3	60108	Backrest-to-cushion bolts (4 required)
4	624A54	Backrest latch release cable
5	—	Pin-type retainer
6	56904	Recliner handle screw
7	610A77	Recliner handle

All seats 10. Prove out the SRS as follows:

Turn the ignition key from ON to OFF. Wait 10 seconds, then turn the key back to ON and visually monitor the air bag warning indicator with the air bag modules installed. The air bag warning indicator will light continuously for approximately 6 seconds and then turn off. If an SRS fault is present, the air bag warning indicator will: -

fail to light.

- remain lit continuously.

- flash at a 5Hz rate (RCM not configured).

The air bag warning indicator may not illuminate until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON position. This is the time required for the RCM to complete the testing of the SRS. If the air bag warning indicator is inoperative and a SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag warning indicator and any SRS fault discovered must be diagnosed and repaired.

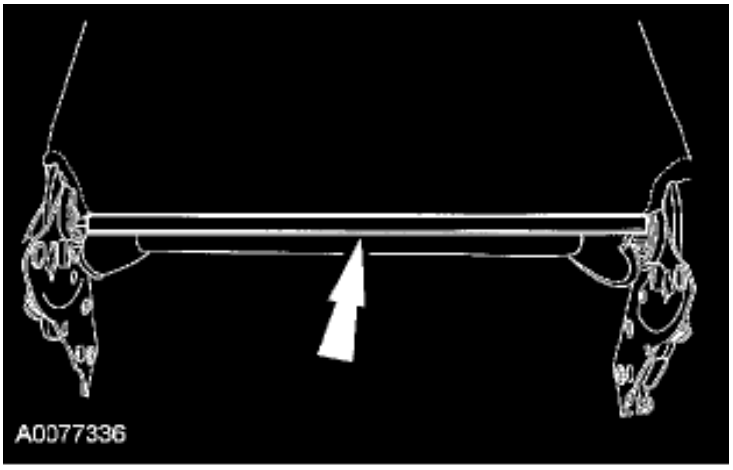
Clear all continuous RCM and occupant classification system module (OCSM) DTCs using a scan tool.

60 Percent

SEAT BACKREST - FRONT, 60 PERCENT

Disassembly

WARNING: Never probe the electrical connectors on safety belt buckle/retractor pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors, which increases the risk of serious personal injury or death.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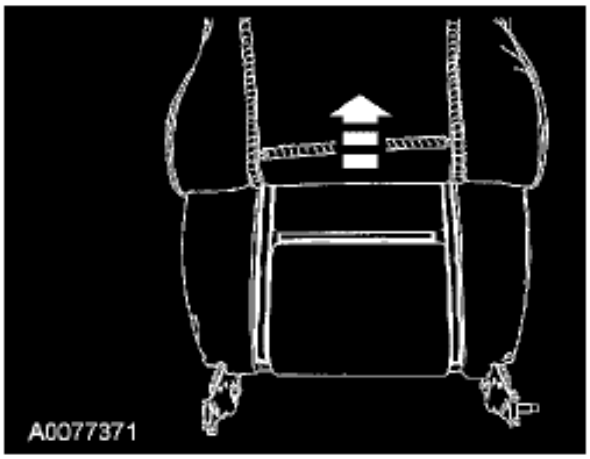
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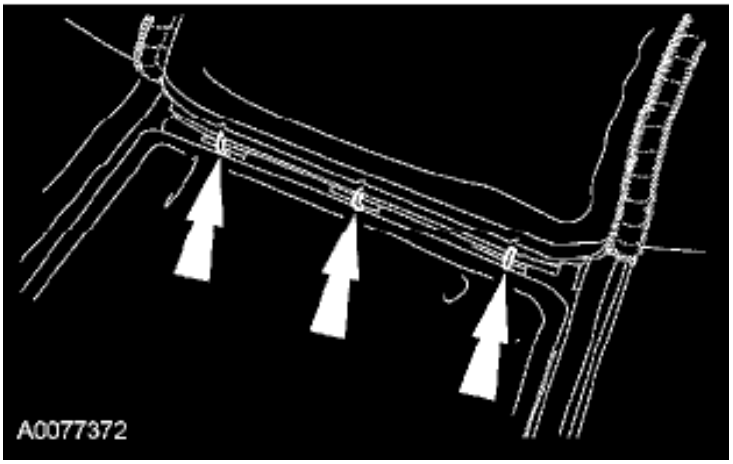
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NOTE: -

The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

- The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1. Remove the affected seat. 2. Remove the 60 percent armrest. 3. Remove the 60 percent seat backrest assembly. 4. Release the backrest J-clip.

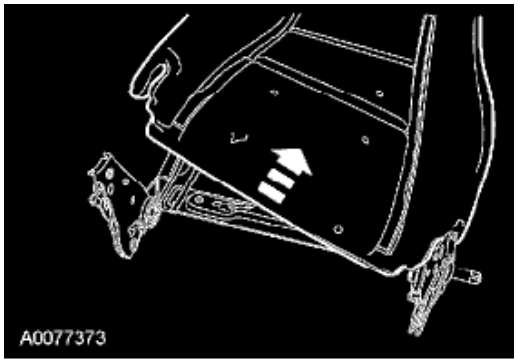
5. CAUTION: Use care when separating the seat back trim cover from the hook-and-loop strips or the hook-and-loop strips may be torn

from the seat back foam.

Invert the backrest trim cover and release the hook-and-loop strips.

6. Remove all the hog rings and remove the backrest trim cover from the backrest foam pad.

7. Lift the lower end of the backrest foam pad off the backrest frame.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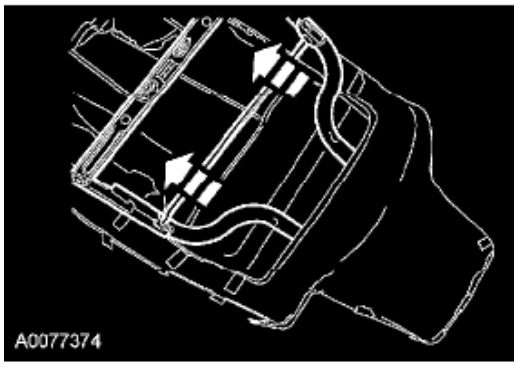
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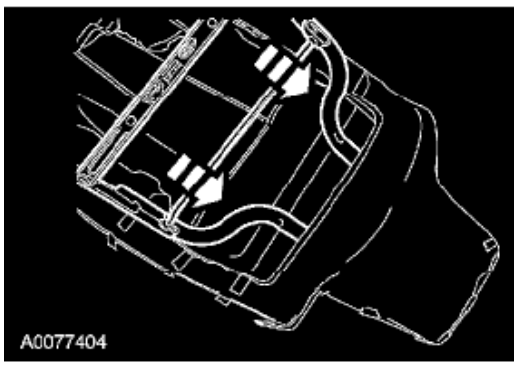
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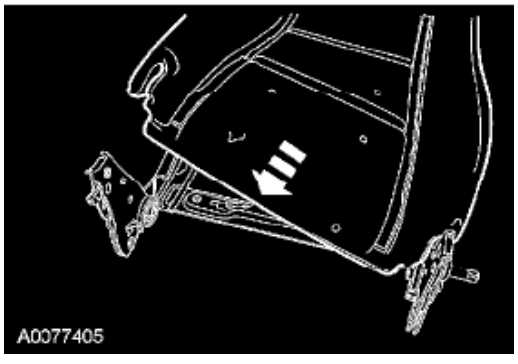

A0077405

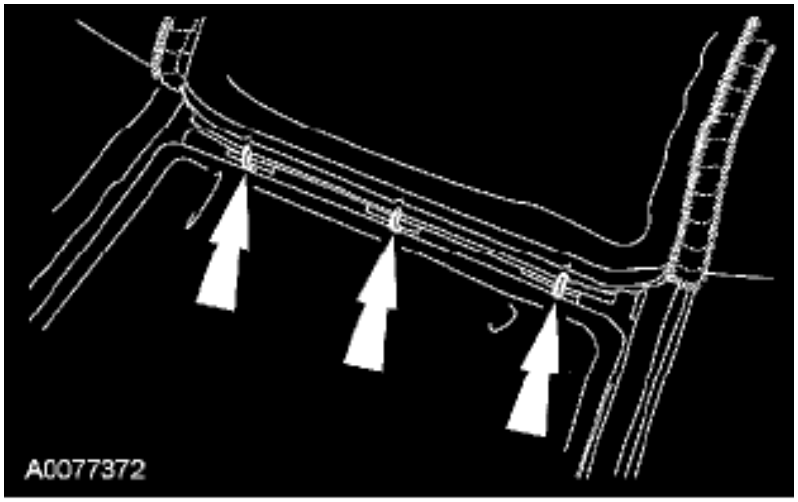
8. Slide the backrest frame down and out of the backrest foam pad headrest pocket.

Assembly

1. Slide the backrest frame into the backrest foam pad.

2. Install the lower end of the backrest foam pad on the backrest frame.

3. Install the backrest trim cover and install all of the hog rings.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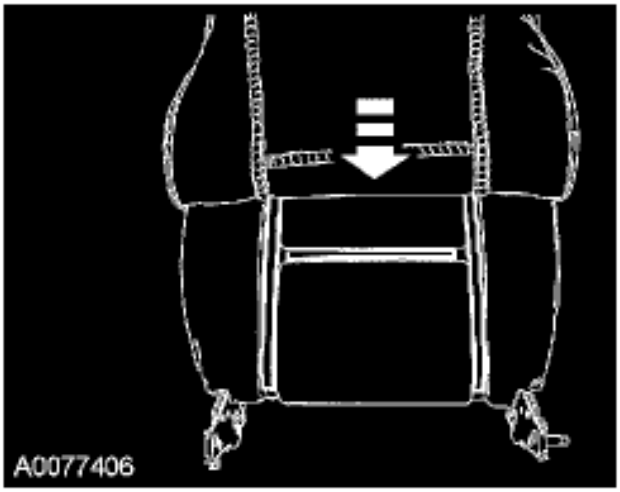
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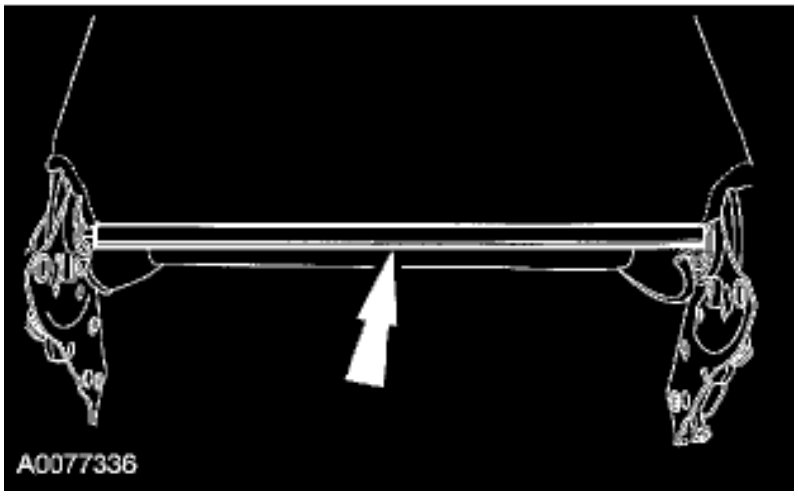

A0077336

4. Pull the backrest trim cover down and secure the hook-and-loop strips to the backrest foam pad.

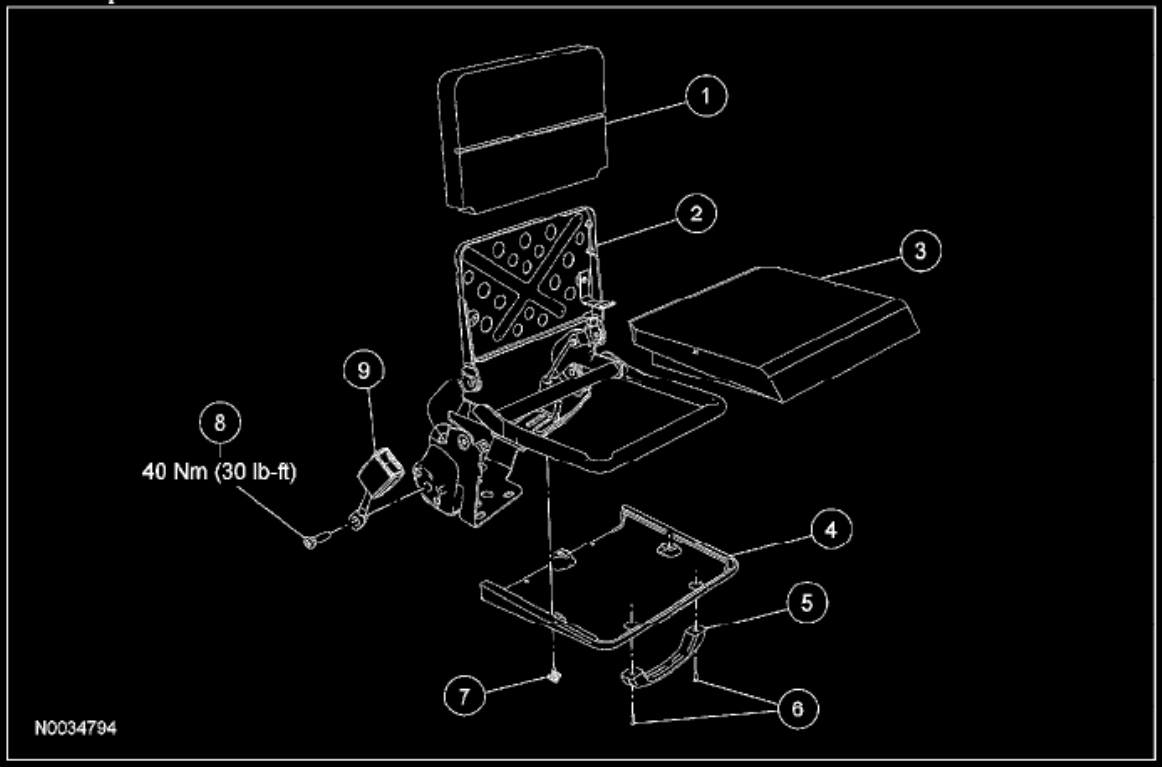
5. Attach the backrest J-clip.

6. Install the 60 percent seat backrest assembly. 7. Install the 60 percent armrest. 8. Install the affected seat.

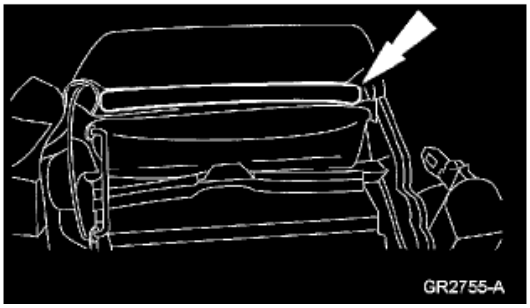
Seat Backrest - Rear, 2-Door, SuperCab

SEAT BACKREST - REAR, 2-DOOR, SUPERCAB

2-Door SuperCab



Item	Part Number	Description
1	64416/64810	Seat backrest trim cover/seat backrest foam pad
2	672A28B	Seat frame assembly
3	62900/632A22	Seat cushion trim cover/cushion foam pad
4	—	Trim cover
5	—	Handle
6	—	Handle screws (2 required)
7	—	Trim cover screw (3 required)
8	—	Safety belt buckle bolt (part of 613B84)
9	613B84	Safety belt buckle

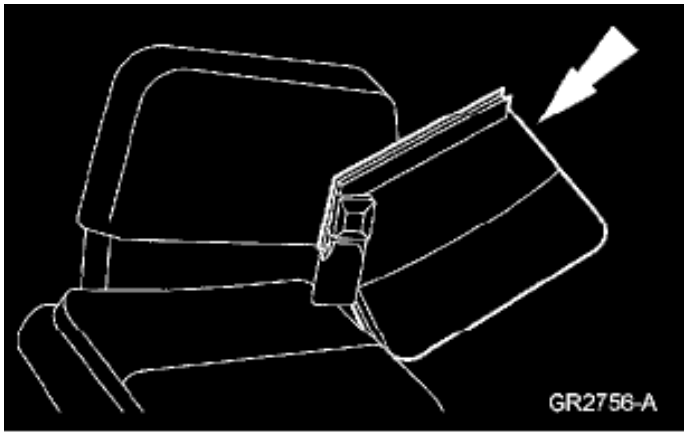


2-Door SuperCab

Disassembly and Assembly

1. Unhook the trim cover retainer.

2. Reposition the backrest trim cover.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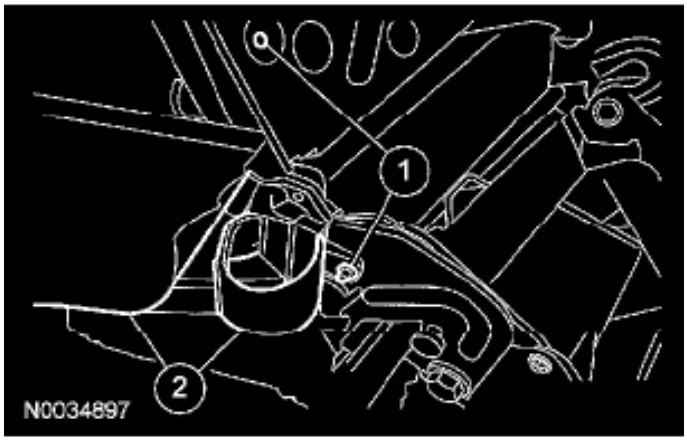
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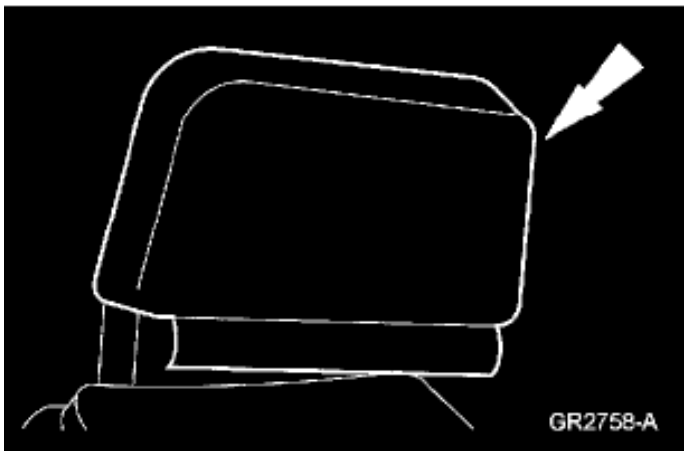

GR2758-A

3. Remove the backrest trim cover and the safety belt buckle.

1 Drill out the rivets.

2 Remove the backrest trim cover and the safety belt buckle.

4. CAUTION: Use care when removing the seat backrest foam pad. It may be attached to the backrest frame with adhesive and tear when

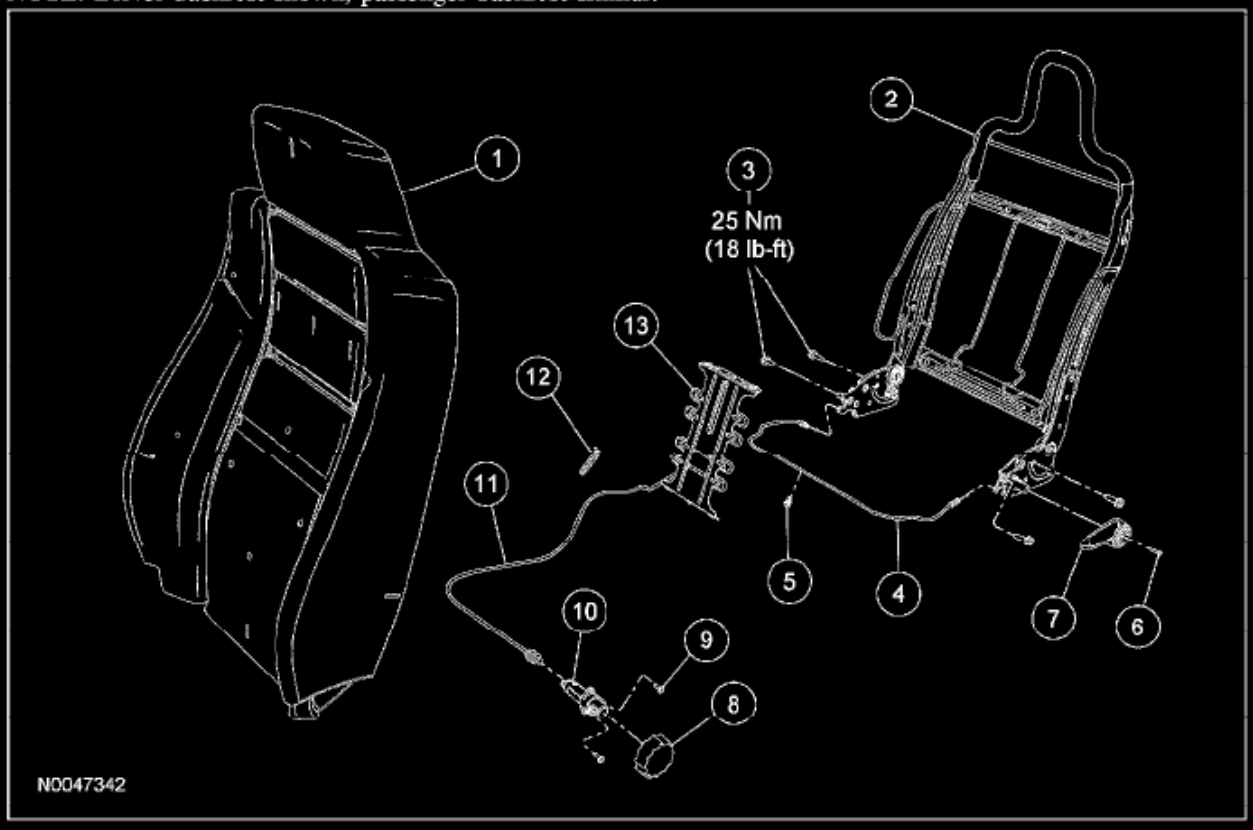
removed.

Remove the backrest foam pad.

5. To assemble, reverse the disassembly procedure. 6. Make sure the safety belts and buckles are accessible to the occupants after installation.

Seat Backrest, Front, 40 Percent

NOTE: Driver backrest shown, passenger backrest similar.



Item	Part Number	Description
1	64416/64810	Backrest trim cover/foam pad
2	61018	Backrest frame
3	60108	Backrest-to-cushion bolts (4 required)
4	624A54	Backrest latch release cable
5	—	Pin-type retainer
6	56904	Recliner handle screw
7	610A77	Recliner handle
8	61198	Lumber adjust knob, if equipped

Item	Part Number	Description
9	000A25	Lumbar actuator screw (2 required), if equipped
10	610C00	Lumbar actuator, if equipped
11	—	Lumbar actuator cable (part of 62222), if equipped
12		Tie strap, if equipped
13	62222	Lumbar support, if equipped

(Continued)

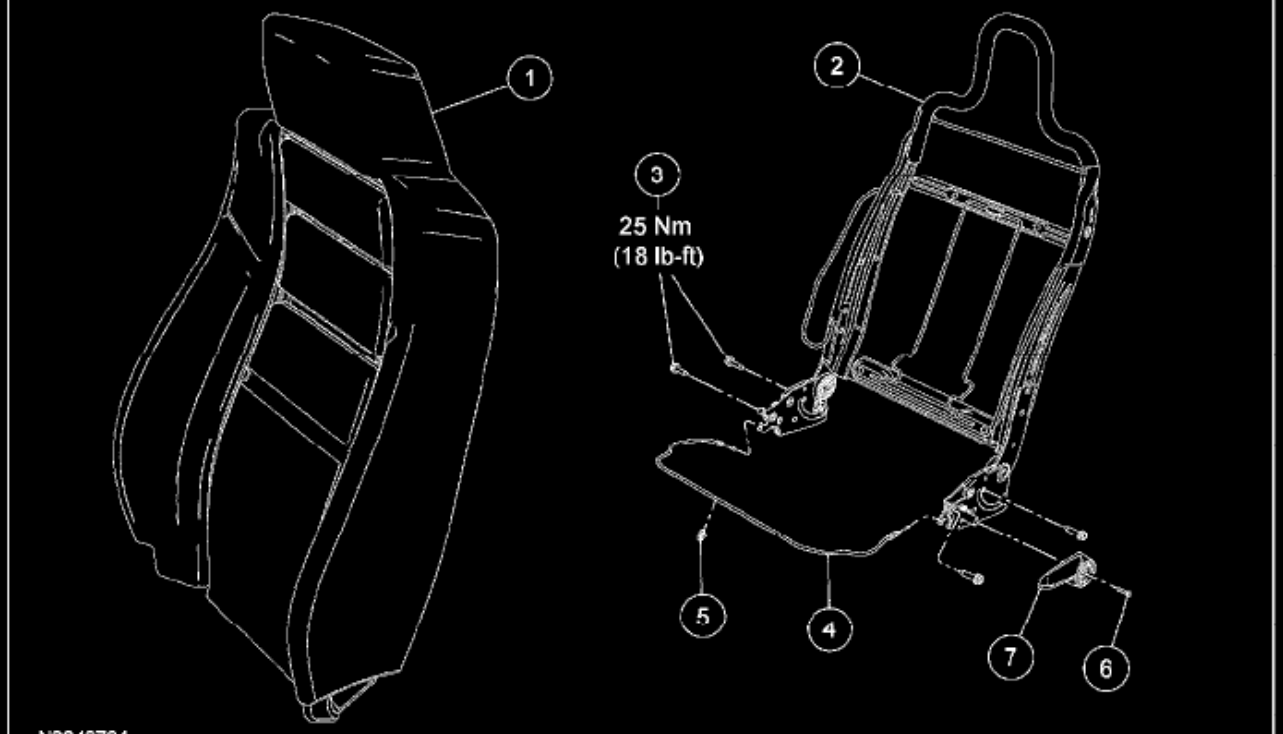
Seat Cover: Service and Repair Seat Backrest Cover - Front

SEAT BACKREST COVER - FRONT

Exploded View

Seat Backrest, Front, 40 Percent

Seat Backrest, Front, 60 Percent

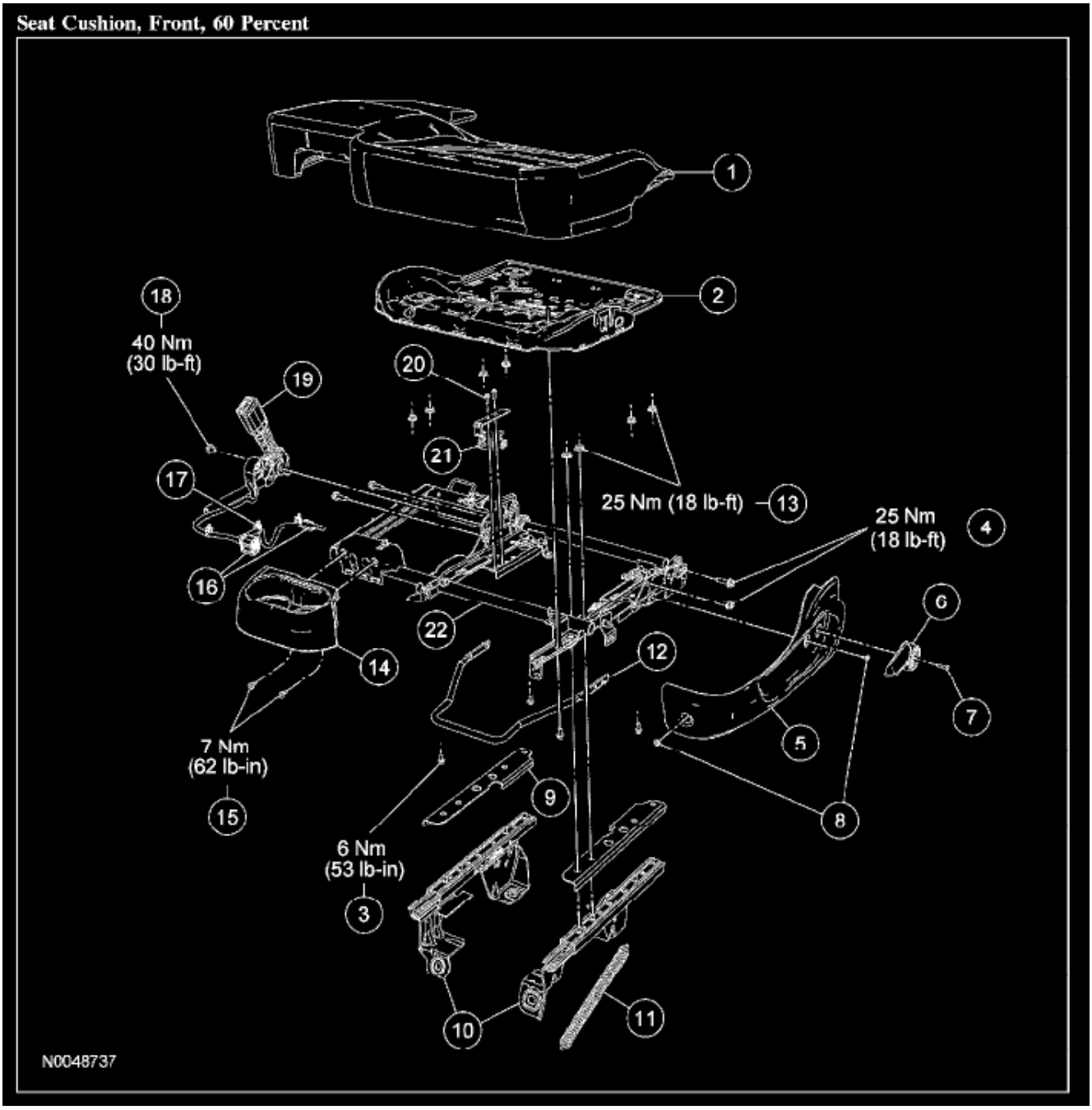


Item	Part Number	Description
1	64416/64810	Backrest trim cover/foam pad
2	61018	Backrest frame
3	60108	Backrest-to-cushion bolts (4 required)
4	624A54	Backrest latch release cable

Item	Part Number	Description
5	—	Pin-type retainer
6	56904	Recliner handle screw
7	610A77	Recliner handle

(Continued)

Seat Backrest, Front, 60 Percent



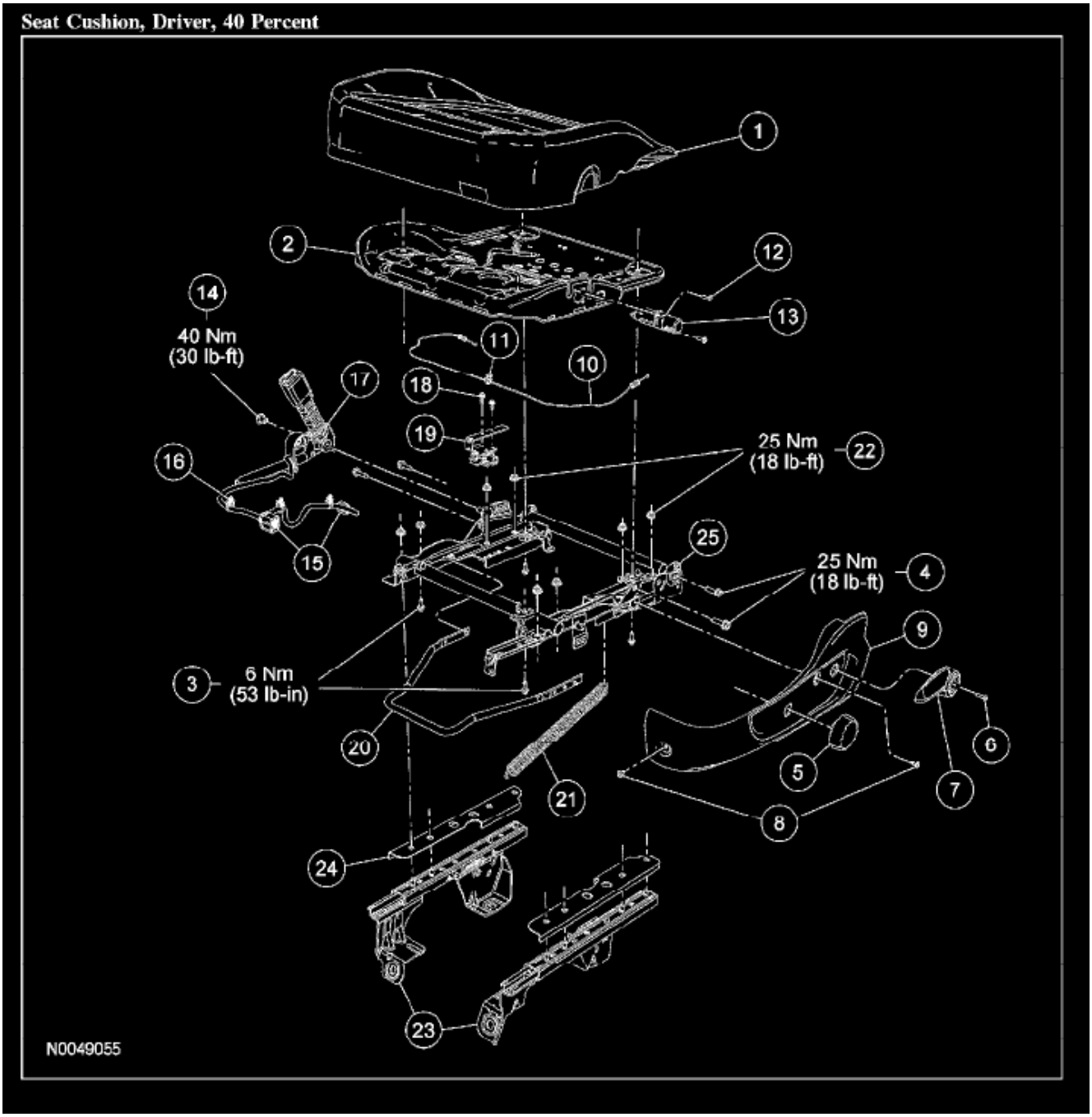
Seat Cushion, Front, 60 Percent (Part 1)

Item	Part Number	Description
1	62900/632A22	Cushion trim cover/foam pad
2	63100	Cushion frame
3	60108	Seat track-to-cushion frame bolt (4 required)
4	60108	Backrest-to-cushion bolts (4 required)
5	62186	Cushion side shield
6	61736	Recliner handle
7	55927	Recliner handle screw
8	000A25	Side shield screws (2 required)
9	617A46	Seat track reinforcement (2 required)
10	61704/61705	Seat track rails
11	61828	Seat track assist spring
12	61736	Seat track adjustment handle
13	W520413	Rail-to-seat track nuts (8 required)

(Continued)

Item	Part Number	Description
14	—	Cup holder
15	000A25	Cup holder mounting screws (2 required)
16	—	Electrical connectors (part of 61203)
17	—	Pin-type retainer (3 required)
18	000A25	Safety belt buckle pretensioner nut
19	61203	Safety belt buckle pretensioner
20	—	Seat position sensor and bracket screw (2 required)
21	14B416	Seat position sensor and bracket
22	613B20	Seat track

Seat Cushion, Front, 60 Percent (Part 2)



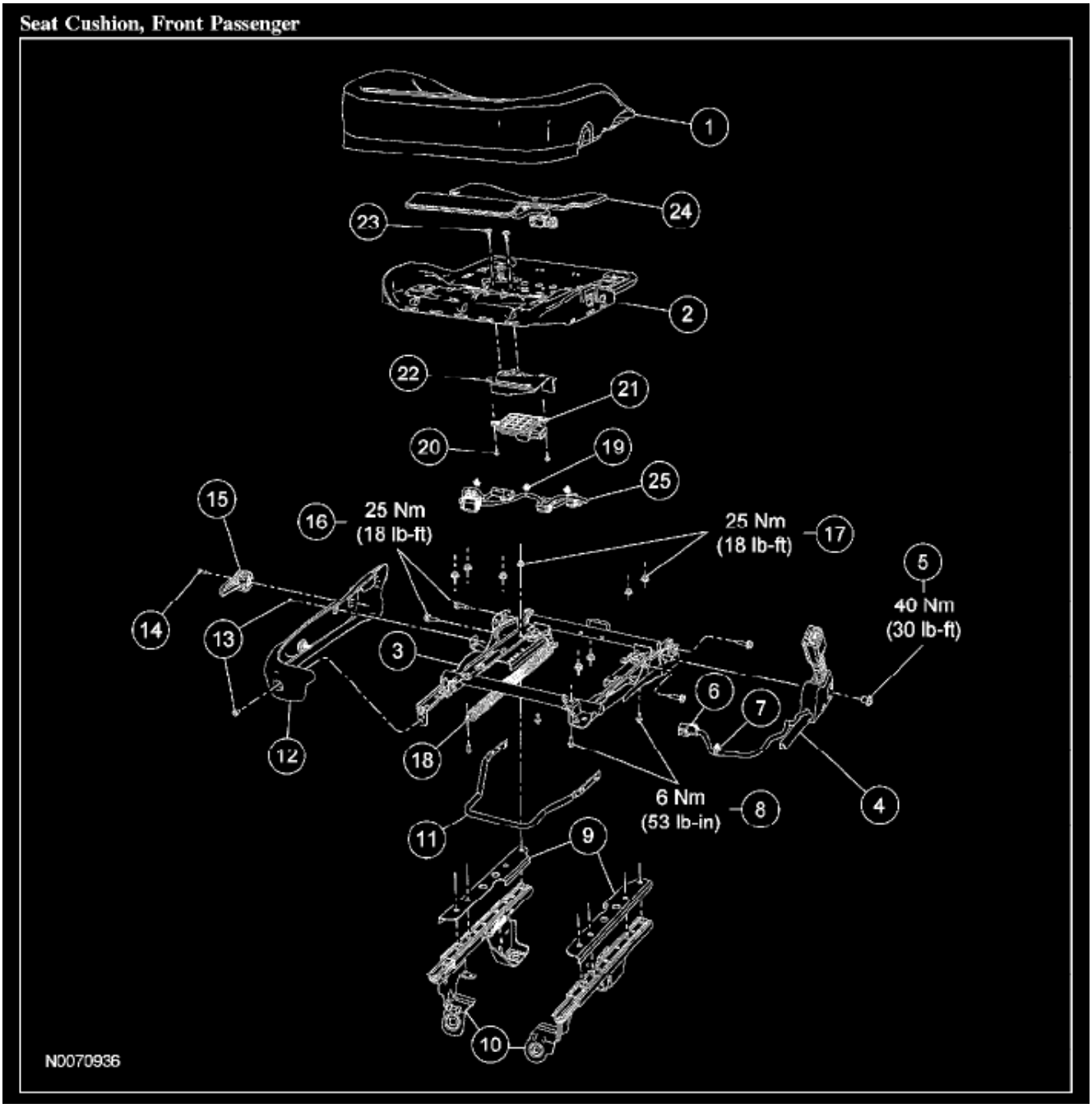
Seat Cushion, Driver, 40 Percent (Part 1)

Item	Part Number	Description
1	62900/632A22	Cushion trim cover/foam pad
2	63100	Cushion frame
3	60108	Seat track-to-cushion frame bolts (4 required)
4	60108	Backrest-to-cushion bolts (4 required)
5	61198	Lumbar adjustment knob
6	55927	Recliner handle screw
7	61736	Recliner handle
8	000A25	Side shield screws (2 required)
9	62186	Cushion side shield
10	624A54	Backrest latch release cable
11	—	Pin-type retainer
12	000A25	Lumbar actuator screw (2 required)
13	610C00	Lumbar actuator
14	000A25	Safety belt buckle pretensioner nut

(Continued)

Item	Part Number	Description
15	—	Electrical connectors (part of 61203)
16	—	Pin-type retainer (3 required)
17	61203	Safety belt buckle pretensioner
18	—	Seat position sensor screw (2 required)
19	14B416	Seat track position sensor
20	61736	Seat track adjustment handle
21	61828	Seat track assist spring
22	W520413	Rail-to-seat track nuts (8 required)
23	61704/61705	Seat track rails
24	617A46	Seat track reinforcement (2 required)
25	620B20	Seat track

Seat Cushion, Driver, 40 Percent (Part 2)



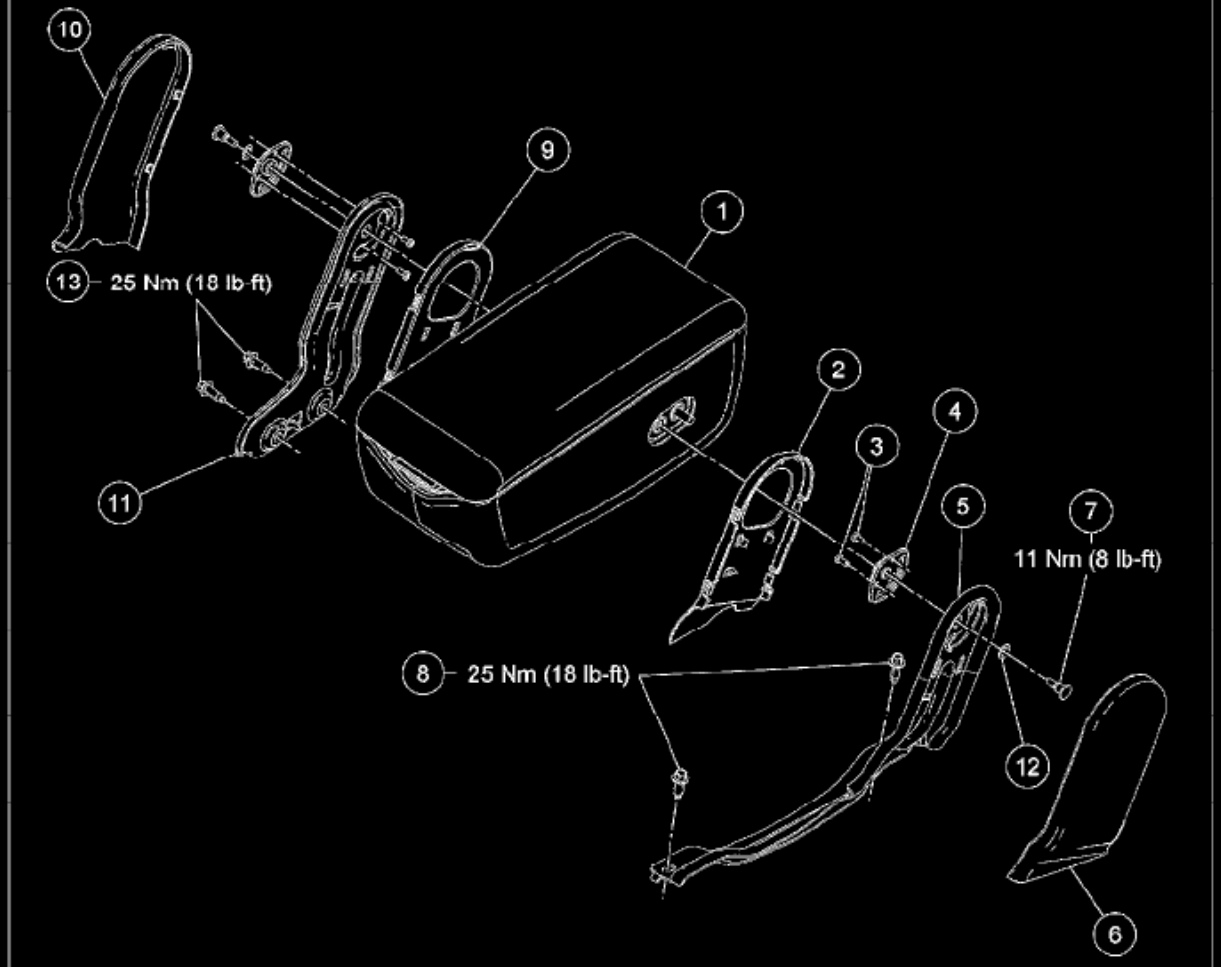
Seat Cushion, Front Passenger (Part 1)

Item	Part Number	Description
1	62900/603B02	Cushion trim cover/foam pad
2	63100	Cushion frame
3	613B20	Seat track
4	61202	Safety belt buckle pretensioner
5	000A25	Safety belt buckle pretensioner nut
6	—	Electrical connector (part of 61202)
7	—	Pin-type retainer
8	60108	Seat track-to-cushion frame bolts (4 required)
9	617A46	Seat track reinforcements
10	61704/61705	Seat track rails
11	61736	Seat track adjustment handle
12	62186	Cushion side shield
13	000A25	Side shield screws (2 required)
14	55927	Recliner handle screw
15	61736	Recliner handle
16	60108	Backrest-to-cushion bolts (4 required)
17	W520413	Rail-to-seat track nuts (8 required)
18	61828	Seat track assist spring
19	—	Pin-type retainer (3 required)
20	—	Screw (2 required)
21	—	Occupant classification system module (OCSM) (part of 603B02)
22	—	OCSM bracket
23	—	Screw (2 required)
24	—	OCS (bladder, hose with pressure sensor, OCSM and seat wiring harness) (part of 603B02)
25	14C719	Wiring harness

(Continued)

Seat Cushion, Front Passenger (Part 2)

Seat Armrest, Front, 60 Percent



Item	Part Number	Description
1	644A22	Armrest
2	672A28B	LH inner trim cover
3	—	Pivot bracket screws (4 required)
4	63076C	Pivot bracket (2 required)
5	63076A	LH armrest bracket
6	672A28A	LH outer trim cover
7	—	Armrest pivot bolts (2 required)
8	—	LH armrest bracket-to-seat frame bolts (2 required)

Item	Part Number	Description
9	672A28B	RH inner trim cover
10	672A28A	RH outer trim cover
11	63076B	RH armrest bracket
12	—	Washer (2 required)
13	—	RH armrest bracket-to-seat frame bolts (2 required)

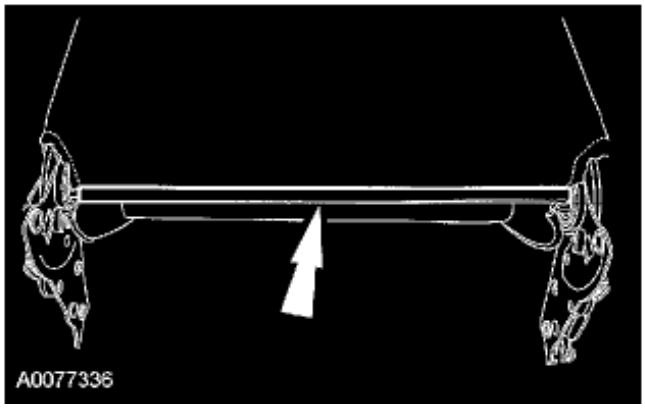
(Continued)

Seat Armrest, Front, 60 Percent

Special Tool(s)

Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool



Special Tool(s)

Removal and Installation

WARNING:

- Never probe the electrical connectors on safety belt buckle/retractor pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors, which increases the risk of serious personal injury or death.

- Make sure the front passenger seat repair is complete, the seat and all attached components (head restraint, seat side shield, etc.) are correctly assembled, and the seat is correctly installed to the vehicle before carrying out the System Reset. Failure to follow these instructions may result in incorrect operation of the occupant classification sensor (OCS) system and increases the risk of serious personal injury or death in a crash.

CAUTION: To prevent system failure, it is necessary to carry out the occupant classification sensor (OCS) system reset when a front passenger seat cushion is disassembled, a new trim cover installed or an OCS system service kit is installed. A scan tool is used to carry out the OCS system reset command.

NOTE:

- The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

- The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

- Driver 60 percent seat backrest shown, passenger and driver 40 percent seat backrest similar.

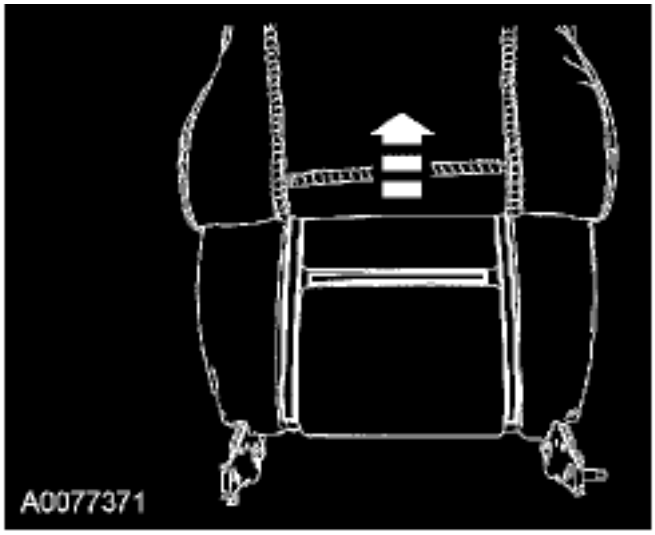
All seats

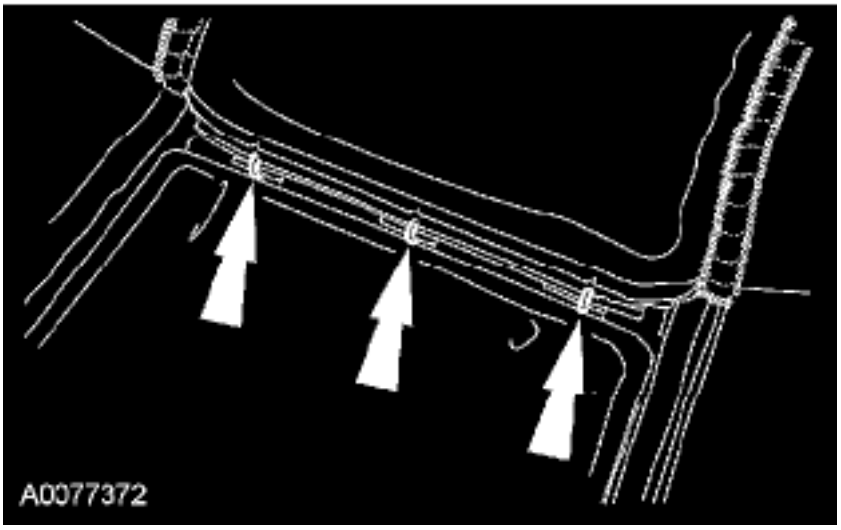
1. Remove the front seat. 2. Remove the front seat backrest. 3. Release the backrest J-clip.

4. CAUTION: Use care when separating the seat back trim cover from the hook-and-loop strips or the hook-and-loop strips may be torn

from the seat back foam.

Invert the backrest trim cover and release the hook-and-loop strips up to the row of hog rings.





5. Remove all the hog rings and remove the backrest trim cover from the backrest foam pad.

6. To install, reverse the removal procedure. 7. Install the front seat backrest. 8. Install the seat. If a passenger seat has been serviced, do not prove out the SRS at this time.

Passenger seat

9. WARNING:

- Install a new occupant classification sensor (OCS) system service kit as a complete assembly. Never install only part of the kit components. Failure to follow this instruction may result in incorrect operation of the OCS system and increases the risk of serious personal injury or death in a crash.

- Make sure the front passenger seat repair is complete, the seat and all attached components (head restraint, seat side shield, etc.) are correctly assembled, and the seat is correctly installed to

the vehicle before carrying out the System Reset. Failure to follow these instructions may result in incorrect operation of the occupant classification sensor (OCS) system and increases the risk of serious personal injury or death in a crash.

CAUTION: -

To prevent system failure, it is necessary to carry out the occupant classification sensor (OCS) system reset when a front passenger seat cushion is disassembled, a new trim cover installed or an OCS system service kit is installed. A scan tool is used to carry out the OCS system reset command.

- To prevent system failure, the following precautions must be taken before carrying out the occupant classification sensor (OCS) system reset: -

Make sure the voltage to the occupant classification system module (OCSM) is above 8.0 volts and less than 18.0 volts.

- Make sure the OCS system is not at a temperature below 6°C (42°F) or above 36°C (97°F) when initiating the OCS system reset process. If the vehicle has been exposed to extreme cold or hot temperatures, the vehicle must be exposed and kept at a temperature within the limits, 6°C to 36°C (42°F to 97°F) for a minimum of 30 minutes.

- Make sure nothing is present on the passenger seat before carrying out the OCS system reset and nothing is placed on the seat during the process.

- Make sure a minimum 8-second time period has passed after cycling the ignition switch ON before the carrying out the OCS system reset process.

NOTE: If the first attempt to carry out the occupant classification sensor (OCS) system reset is unsuccessful, a second attempt must be made. If the second attempt is unsuccessful, a new OCS system service kit must be installed.

Carry out the OCS system reset active command.

10. NOTE: The ignition switch must be cycled after the OCS system reset.

Cycle the ignition switch from ON to OFF.

All seats

11. Prove out the SRS as follows:

Turn the ignition key from ON to OFF. Wait 10 seconds, then turn the key back to ON and visually monitor the air bag warning indicator with the air bag modules installed. The air bag warning indicator will light continuously for approximately 6 seconds and then turn off. If an SRS fault is present, the air bag warning indicator will: -

fail to light.

- remain lit continuously.

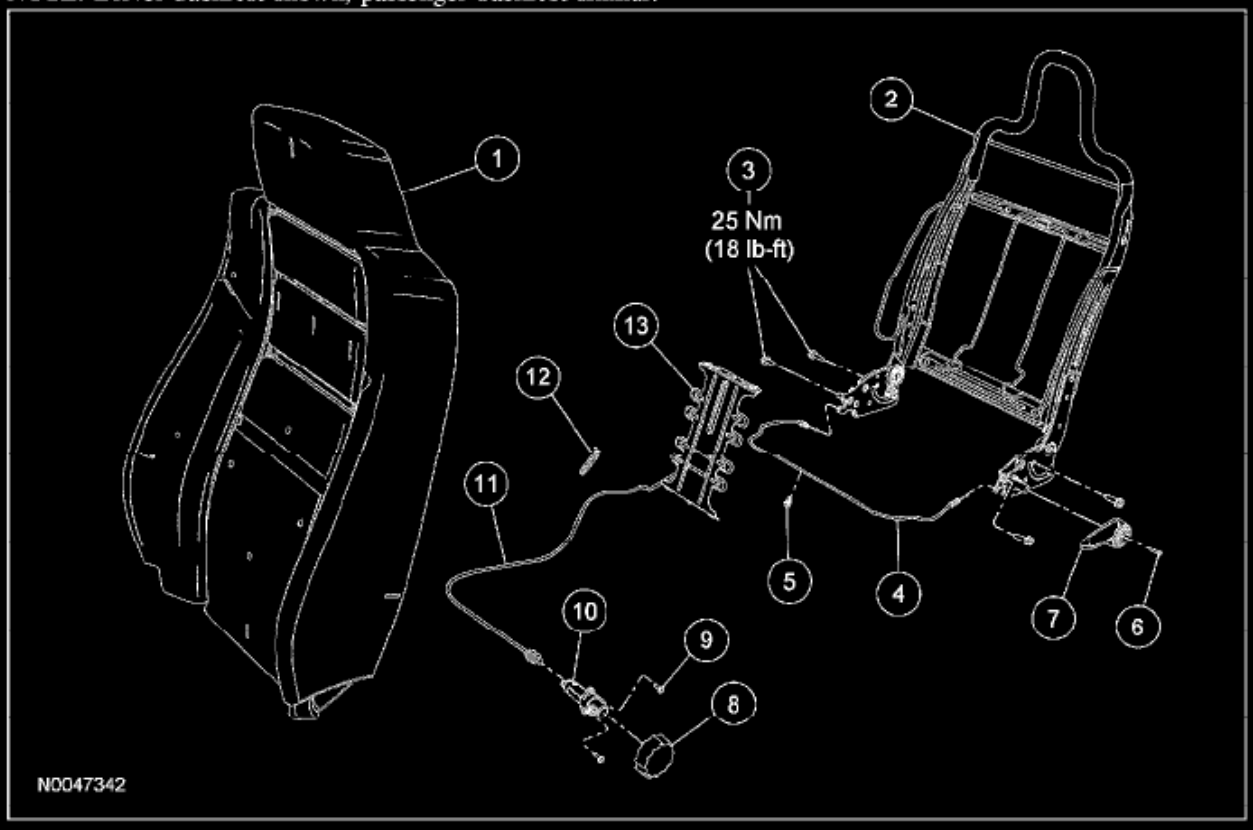
- flash at a 5Hz rate (RCM not configured).

The air bag warning indicator may not illuminate until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON position. This is the time required for the RCM to complete the testing of the SRS. If the air bag warning indicator is inoperative and a SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag warning indicator and any SRS fault discovered must be diagnosed and repaired.

Clear all continuous RCM and occupant classification system module (OCSM) DTCs using a scan tool.

Seat Backrest, Front, 40 Percent

NOTE: Driver backrest shown, passenger backrest similar.



Item	Part Number	Description
1	64416/64810	Backrest trim cover/foam pad
2	61018	Backrest frame
3	60108	Backrest-to-cushion bolts (4 required)
4	624A54	Backrest latch release cable
5	—	Pin-type retainer
6	56904	Recliner handle screw
7	610A77	Recliner handle
8	61198	Lumber adjust knob, if equipped

Item	Part Number	Description
9	600A25	Lumbar actuator screw (2 required), if equipped
10	610C00	Lumbar actuator, if equipped
11	—	Lumbar actuator cable (part of 62222), if equipped
12		Tie strap, if equipped
13	62222	Lumbar support, if equipped

(Continued)

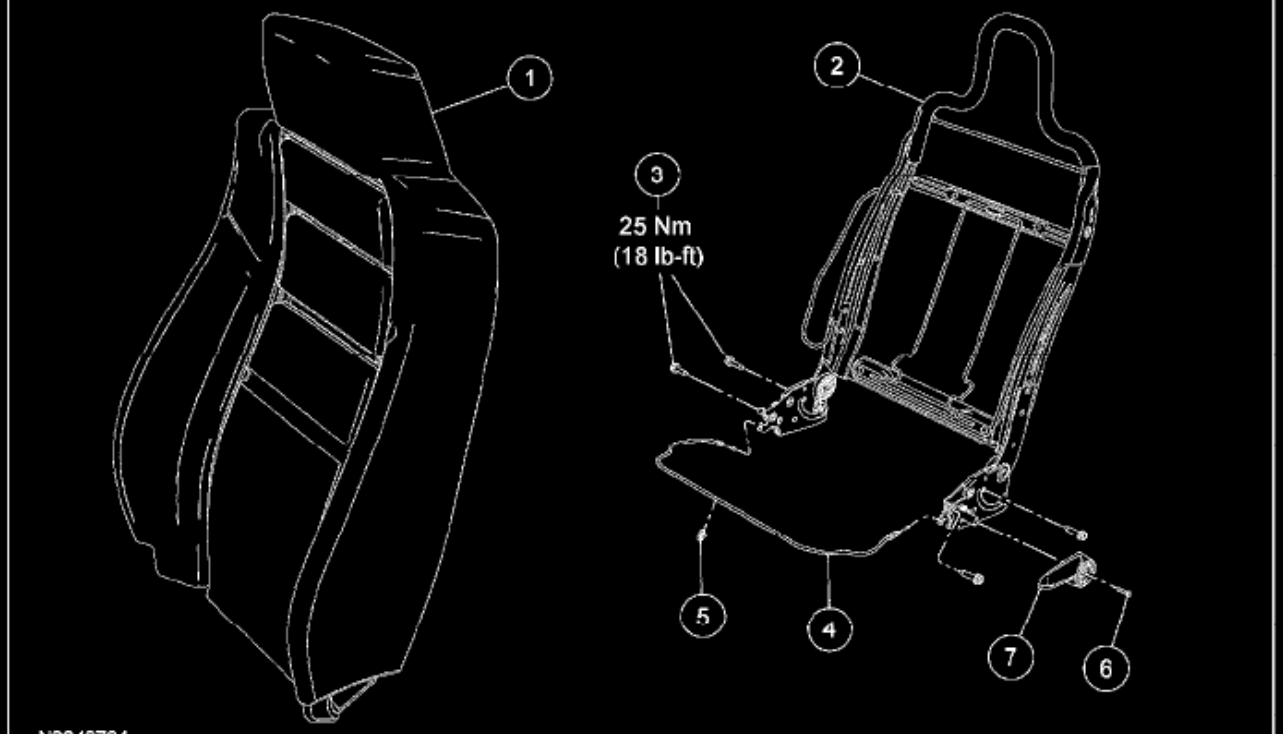
Seat Cover: Service and Repair Seat Cushion Cover - Front

SEAT CUSHION COVER - FRONT

Exploded View

Seat Backrest, Front, 40 Percent

Seat Backrest, Front, 60 Percent

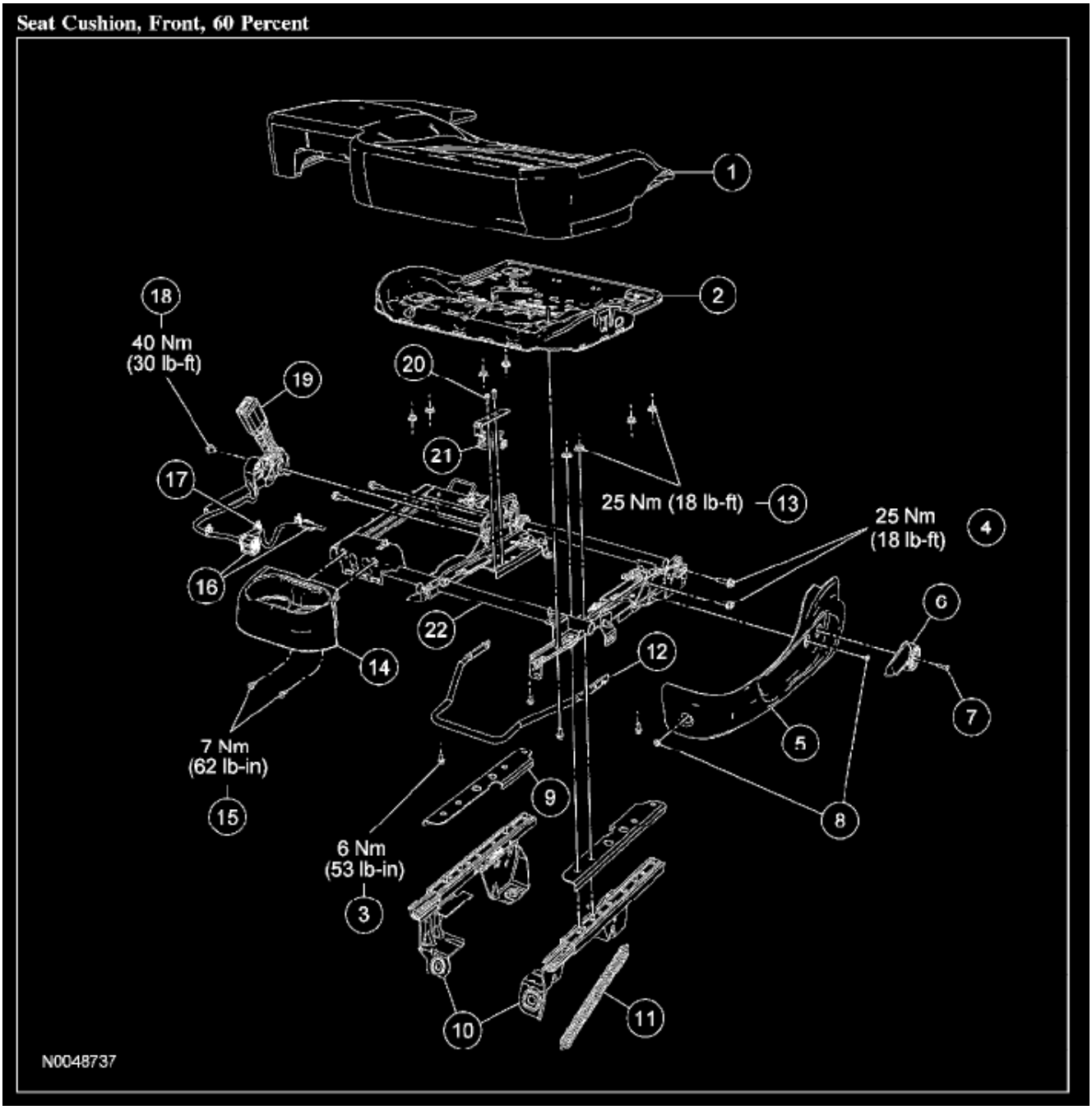


Item	Part Number	Description
1	64416/64810	Backrest trim cover/foam pad
2	61018	Backrest frame
3	60108	Backrest-to-cushion bolts (4 required)
4	624A54	Backrest latch release cable

Item	Part Number	Description
5	—	Pin-type retainer
6	56904	Recliner handle screw
7	610A77	Recliner handle

(Continued)

Seat Backrest, Front, 60 Percent



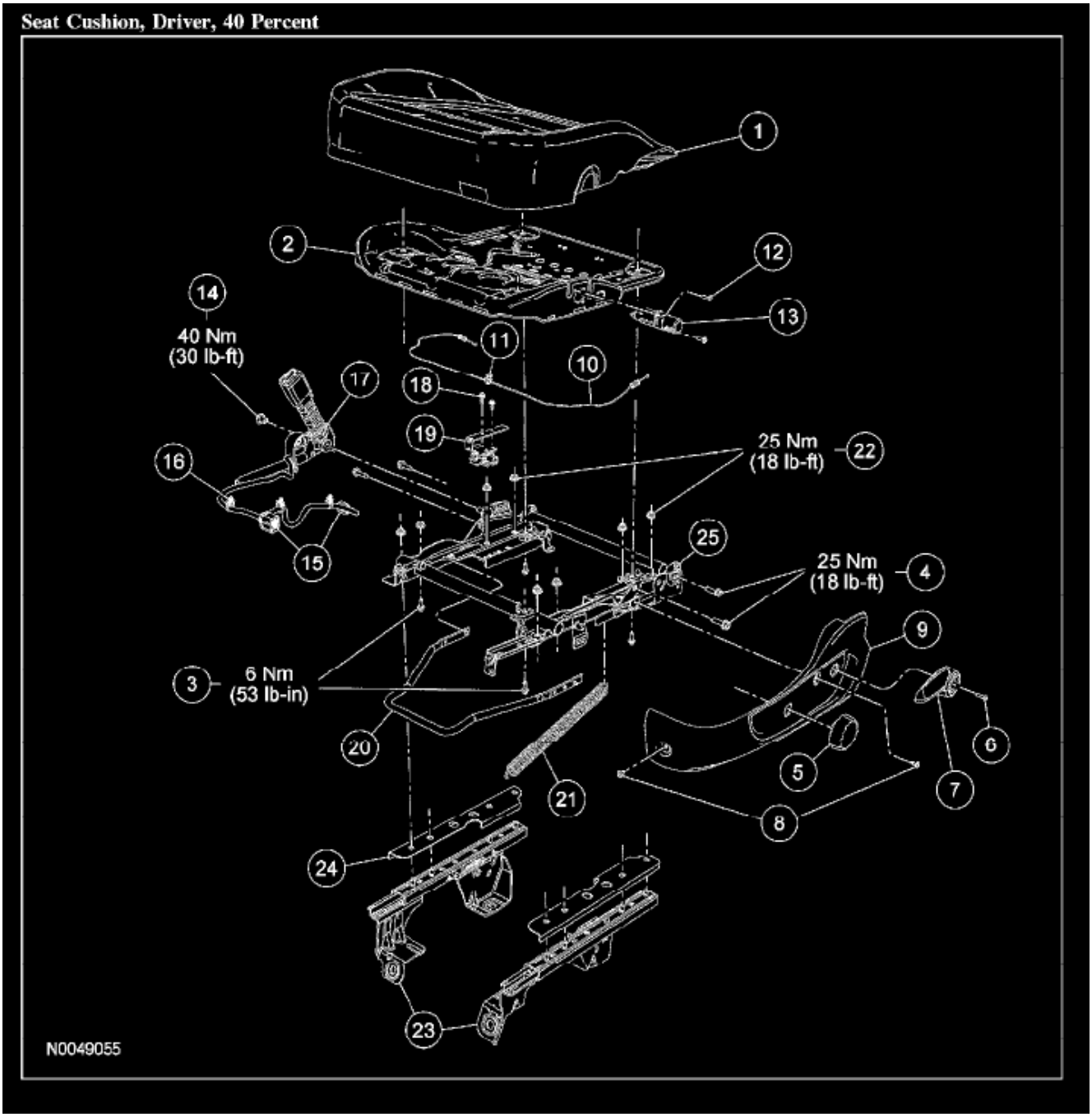
Seat Cushion, Front, 60 Percent (Part 1)

Item	Part Number	Description
1	62900/632A22	Cushion trim cover/foam pad
2	63100	Cushion frame
3	60108	Seat track-to-cushion frame bolt (4 required)
4	60108	Backrest-to-cushion bolts (4 required)
5	62186	Cushion side shield
6	61736	Recliner handle
7	55927	Recliner handle screw
8	000A25	Side shield screws (2 required)
9	617A46	Seat track reinforcement (2 required)
10	61704/61705	Seat track rails
11	61828	Seat track assist spring
12	61736	Seat track adjustment handle
13	W520413	Rail-to-seat track nuts (8 required)

(Continued)

Item	Part Number	Description
14	—	Cup holder
15	000A25	Cup holder mounting screws (2 required)
16	—	Electrical connectors (part of 61203)
17	—	Pin-type retainer (3 required)
18	000A25	Safety belt buckle pretensioner nut
19	61203	Safety belt buckle pretensioner
20	—	Seat position sensor and bracket screw (2 required)
21	14B416	Seat position sensor and bracket
22	613B20	Seat track

Seat Cushion, Front, 60 Percent (Part 2)



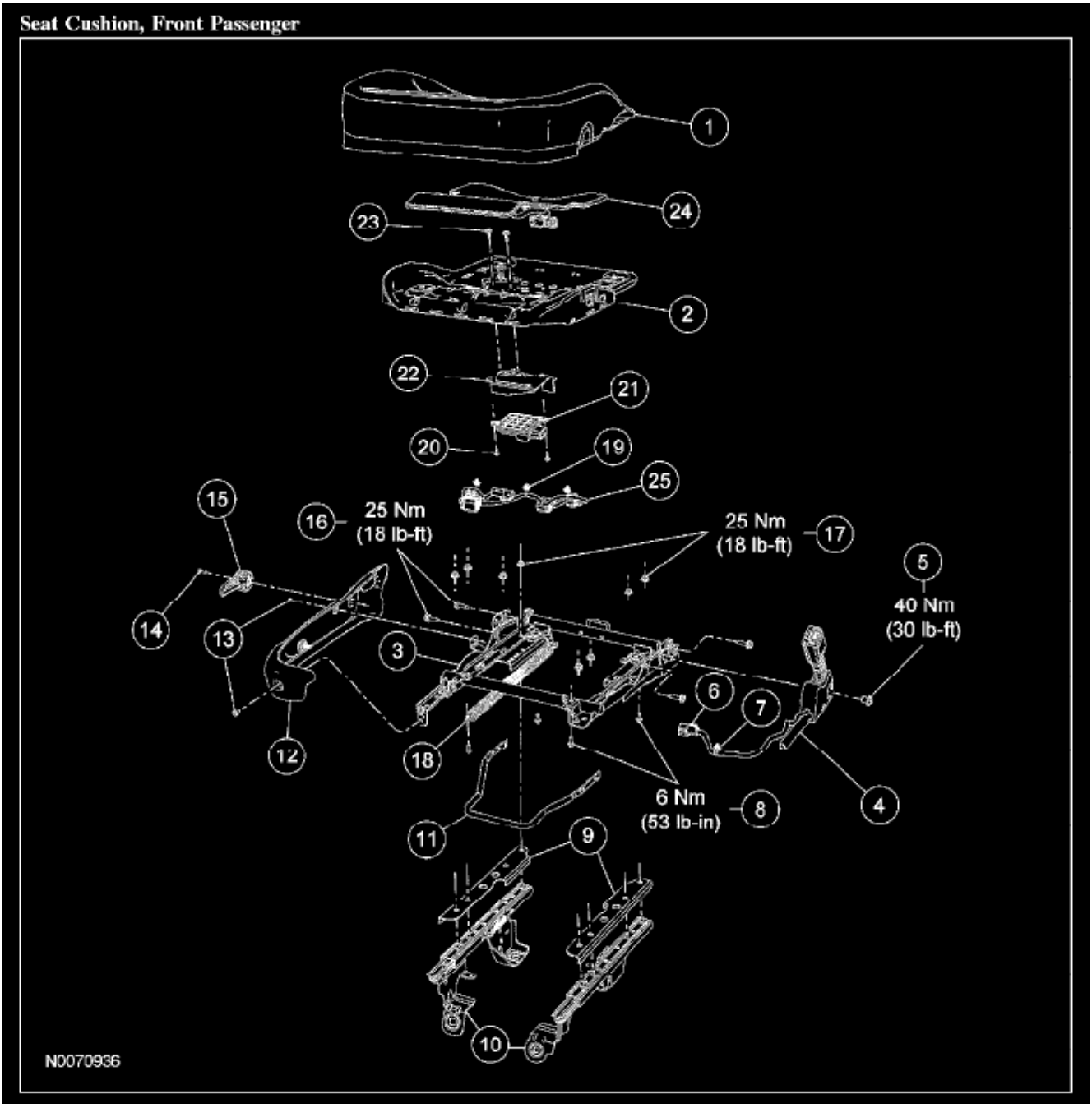
Seat Cushion, Driver, 40 Percent (Part 1)

Item	Part Number	Description
1	62900/632A22	Cushion trim cover/foam pad
2	63100	Cushion frame
3	60108	Seat track-to-cushion frame bolts (4 required)
4	60108	Backrest-to-cushion bolts (4 required)
5	61198	Lumbar adjustment knob
6	55927	Recliner handle screw
7	61736	Recliner handle
8	000A25	Side shield screws (2 required)
9	62186	Cushion side shield
10	624A54	Backrest latch release cable
11	—	Pin-type retainer
12	000A25	Lumbar actuator screw (2 required)
13	610C00	Lumbar actuator
14	000A25	Safety belt buckle pretensioner nut

(Continued)

Item	Part Number	Description
15	—	Electrical connectors (part of 61203)
16	—	Pin-type retainer (3 required)
17	61203	Safety belt buckle pretensioner
18	—	Seat position sensor screw (2 required)
19	14B416	Seat track position sensor
20	61736	Seat track adjustment handle
21	61828	Seat track assist spring
22	W520413	Rail-to-seat track nuts (8 required)
23	61704/61705	Seat track rails
24	617A46	Seat track reinforcement (2 required)
25	620B20	Seat track

Seat Cushion, Driver, 40 Percent (Part 2)



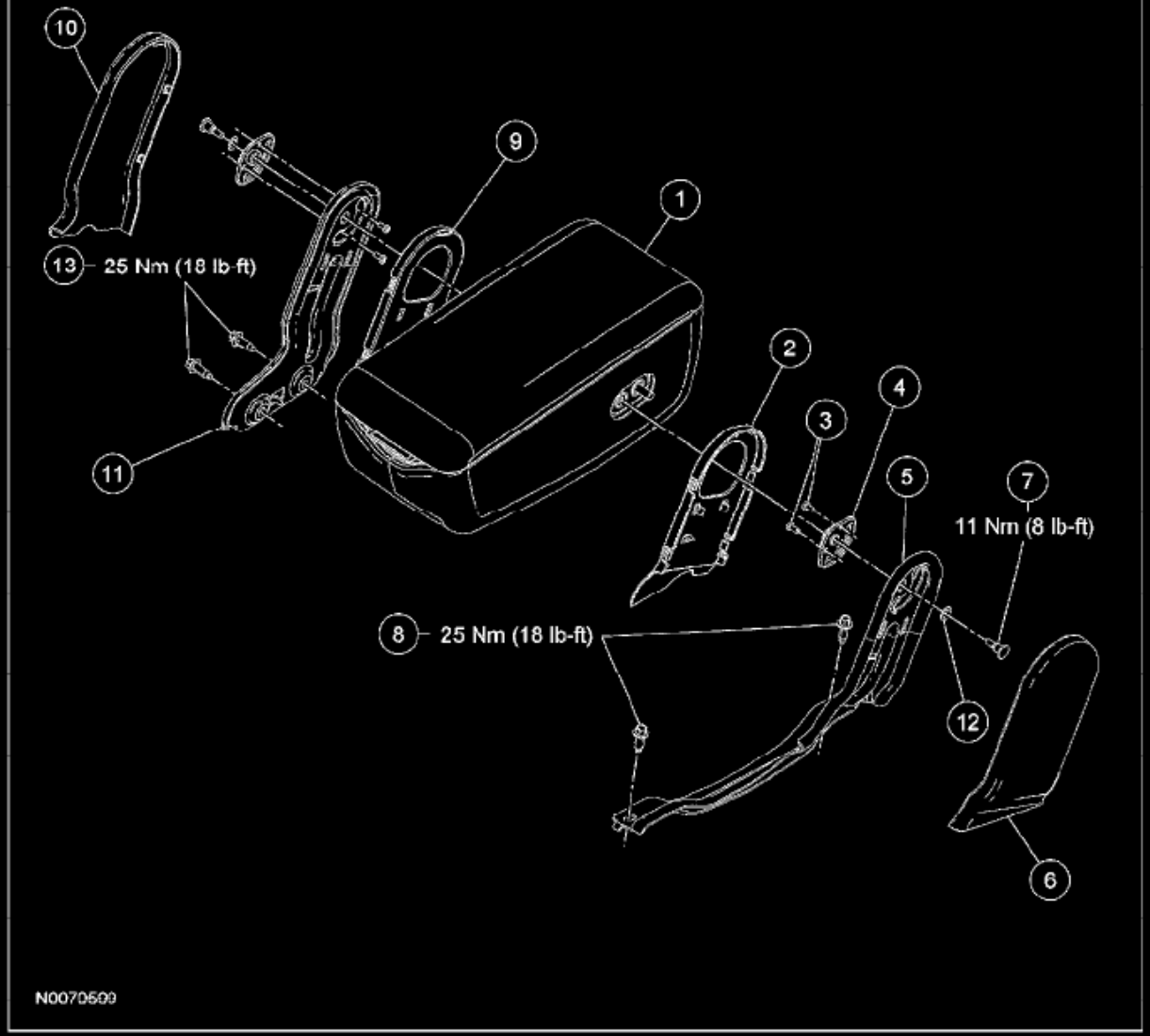
Seat Cushion, Front Passenger (Part 1)

Item	Part Number	Description
1	62900/603B02	Cushion trim cover/foam pad
2	63100	Cushion frame
3	613B20	Seat track
4	61202	Safety belt buckle pretensioner
5	000A25	Safety belt buckle pretensioner nut
6	—	Electrical connector (part of 61202)
7	—	Pin-type retainer
8	60108	Seat track-to-cushion frame bolts (4 required)
9	617A46	Seat track reinforcements
10	61704/61705	Seat track rails
11	61736	Seat track adjustment handle
12	62186	Cushion side shield
13	000A25	Side shield screws (2 required)
14	55927	Recliner handle screw
15	61736	Recliner handle
16	60108	Backrest-to-cushion bolts (4 required)
17	W520413	Rail-to-seat track nuts (8 required)
18	61828	Seat track assist spring
19	—	Pin-type retainer (3 required)
20	—	Screw (2 required)
21	—	Occupant classification system module (OCSM) (part of 603B02)
22	—	OCSM bracket
23	—	Screw (2 required)
24	—	OCS (bladder, hose with pressure sensor, OCSM and seat wiring harness) (part of 603B02)
25	14C719	Wiring harness

(Continued)

Seat Cushion, Front Passenger (Part 2)

Seat Armrest, Front, 60 Percent



Item	Part Number	Description
1	644A22	Armrest
2	672A28B	LH inner trim cover
3	—	Pivot bracket screws (4 required)
4	63076C	Pivot bracket (2 required)
5	63076A	LH armrest bracket
6	672A28A	LH outer trim cover
7	—	Armrest pivot bolts (2 required)
8	—	LH armrest bracket-to-seat frame bolts (2 required)

Item	Part Number	Description
9	672A28B	RH inner trim cover
10	672A28A	RH outer trim cover
11	63076B	RH armrest bracket
12	—	Washer (2 required)
13	—	RH armrest bracket-to-seat frame bolts (2 required)

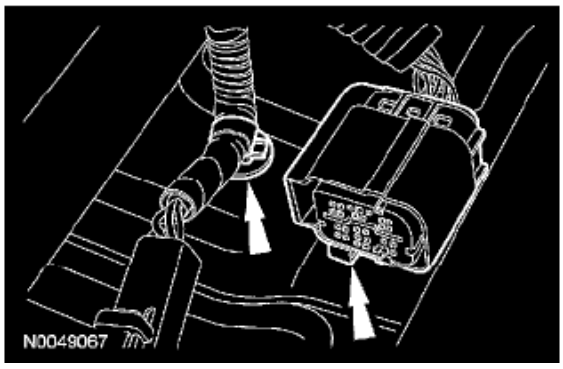
(Continued)

Seat Armrest, Front, 60 Percent

Special Tool(s)

Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool


N0049067

Special Tool(s)

Removal

WARNING: -

Never probe the electrical connectors on safety belt buckle/retractor pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors, which increases the risk of serious personal injury or death.

- Make sure the front passenger seat repair is complete, the seat and all attached components (head restraint, seat side shield, etc.) are correctly assembled, and the seat is correctly installed to the vehicle before carrying out the System Reset. Failure to follow these instructions may result in incorrect operation of the occupant classification sensor (OCS) system and increases the risk of serious personal injury or death in a crash.

CAUTION: To prevent system failure, it is necessary to carry out the occupant classification sensor (OCS) system reset when a front passenger seat cushion is disassembled, a new trim cover installed or an OCS system service kit is installed. A scan tool is used to carry out the OCS system reset command.

NOTE: -

The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

- The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

- When installing a new occupant classification sensor (OCS) system service kit, refer to Air Bag Systems for the OCS removal and installation procedure.

All seats 1. Remove the affected seat. 2. Remove the seat backrest assembly. 3. Release the trim cover rear J-clip from the seat cushion.

Passenger seat

4. NOTE: Note position of wire routing for installation.

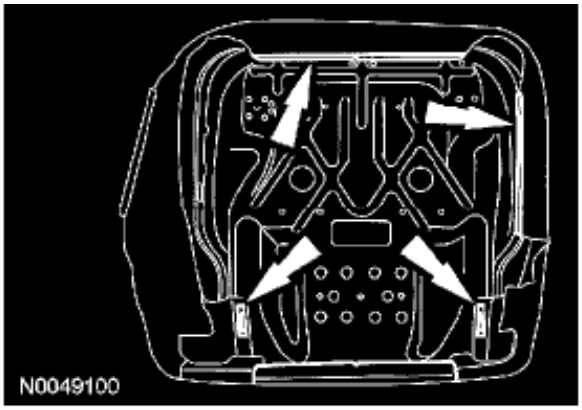
Release the seat wiring harness retainer clip and detach the seat wiring harness connector from the seat cushion frame.

All seats 5. Remove the 4 seat track-to-cushion frame bolts and remove the seat track assembly from the cushion frame.

6. CAUTION: An occupant classification sensor (OCS) service kit will have the OCS bladder attached to the seat cushion foam pad. DO

not separate the OCS bladder from the seat cushion foam pad. Failure to follow these instructions may result in incorrect operation of the OCS system and may cause system failure.

NOTE: Driver 40 percent seat shown, passenger and driver 60 percent seat similar.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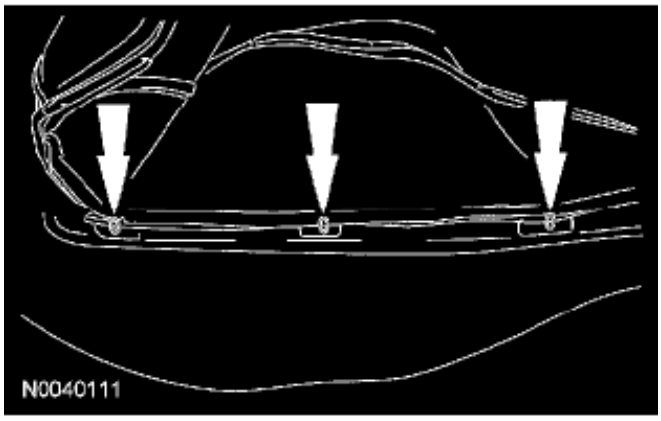
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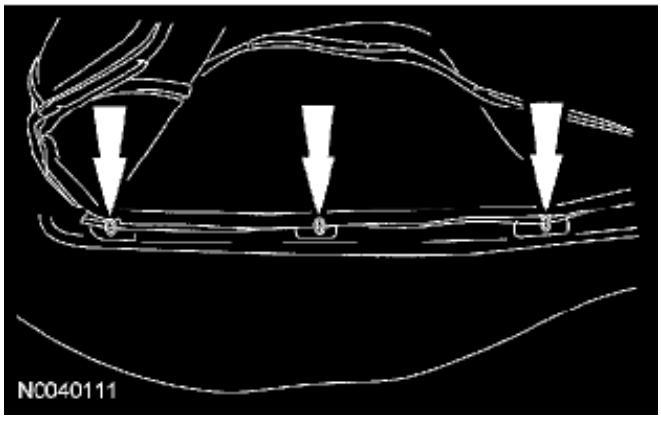

N0040111

Release the J-clips. -

For 60 percent seat, release the side foam pad retainer strap.

7. Remove all rows of hog rings and remove the cushion trim cover.

Installation

All seats

1. CAUTION: Inspect the seat cushion pad and seat cushion trim cover for any foreign objects, before installing the seat cushion trim cover

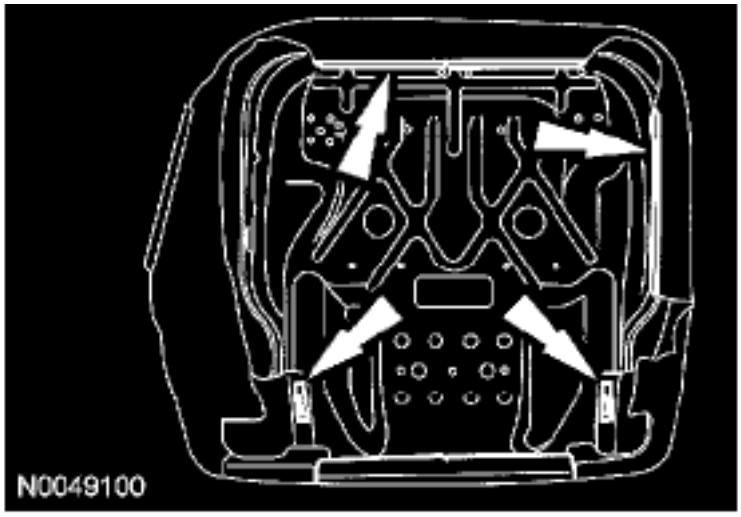
to the seat cushion pad. If any foreign objects are found, remove them. Failure to follow these instructions may result in incorrect operation of the occupant classification sensor (OCS) system and may cause system failure.

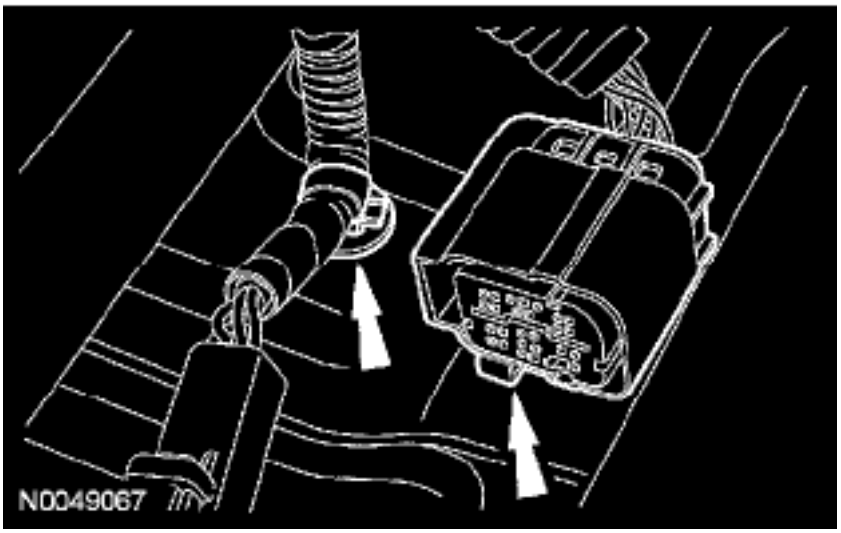
Position the cushion trim cover to the foam pad and install the rows of hog rings.

2. NOTE: Driver 40 percent seat shown, passenger and 60 percent seat similar.

Fasten the J-clips. -

For 60 percent seat, fasten the side foam pad retainer strap.





3. Position the seat track to the cushion frame assembly and install the 4 bolts.

- Tighten to 6 Nm (53 lb-in).

4. Attach the cushion trim cover rear J-clip.

Passenger seat 5. Install the seat wiring harness retainer clip and attach the seat wiring harness connector to the seat cushion frame.

All seats 6. Install the seat backrest. 7. Install the seat. If a passenger seat has been serviced, do not prove out the SRS at this time.

Passenger seat

8. WARNING:

- Install a new occupant classification sensor (OCS) system service kit as a complete assembly. Never install only part of the kit components. Failure to follow this instruction may result in incorrect operation of the OCS system and increases the risk of serious personal injury or death in a crash.

- Make sure the front passenger seat repair is complete, the seat and all attached components (head restraint, seat side shield, etc.) are correctly assembled, and the seat is correctly installed to the vehicle before carrying out the System Reset. Failure to follow these instructions may result in incorrect operation of the occupant classification sensor (OCS) system and increases the risk of serious personal injury or death in a crash.

CAUTION: -

To prevent system failure, it is necessary to carry out the occupant classification sensor (OCS) system reset when a front passenger seat cushion is disassembled, a new trim cover installed or an OCS system service kit is installed. A scan tool is used to carry out the OCS system reset command.

- To prevent system failure, the following precautions must be taken before carrying out the occupant classification sensor (OCS) system reset: -

Make sure the voltage to the occupant classification system module (OCSM) is above 8.0 volts and less than 18.0 volts.

- Make sure the OCS system is not at a temperature below 6°C (42°F) or above 36°C (97°F) when initiating the OCS system reset process. If the vehicle has been exposed to extreme cold or hot temperatures, the vehicle must be exposed and kept at a temperature within the limits, 6°C to 36°C (42°F to 97°F) for a minimum of 30 minutes.

- Make sure nothing is present on the passenger seat before carrying out the OCS system reset and nothing is placed on the seat during the process.

- Make sure a minimum 8-second time period has passed after cycling the ignition switch ON before the carrying out the OCS system reset process.

NOTE: If the first attempt to carry out the occupant classification sensor (OCS) system reset is unsuccessful, a second attempt must be made. If the second attempt is unsuccessful, a new OCS system service kit must be installed.

Carry out the OCS system reset active command.

9. NOTE: The ignition switch must be cycled after the OCS system reset.

Cycle the ignition switch from ON to OFF.

All seats 10. Prove out the SRS as follows:

Turn the ignition key from ON to OFF. Wait 10 seconds, then turn the key back to ON and visually monitor the air bag warning indicator with the air bag modules installed. The air bag warning indicator will light continuously for approximately 6 seconds and then turn off. If an SRS fault is present, the air bag warning indicator will: -

fail to light.

- remain lit continuously.

- flash at a 5Hz rate (RCM not configured).

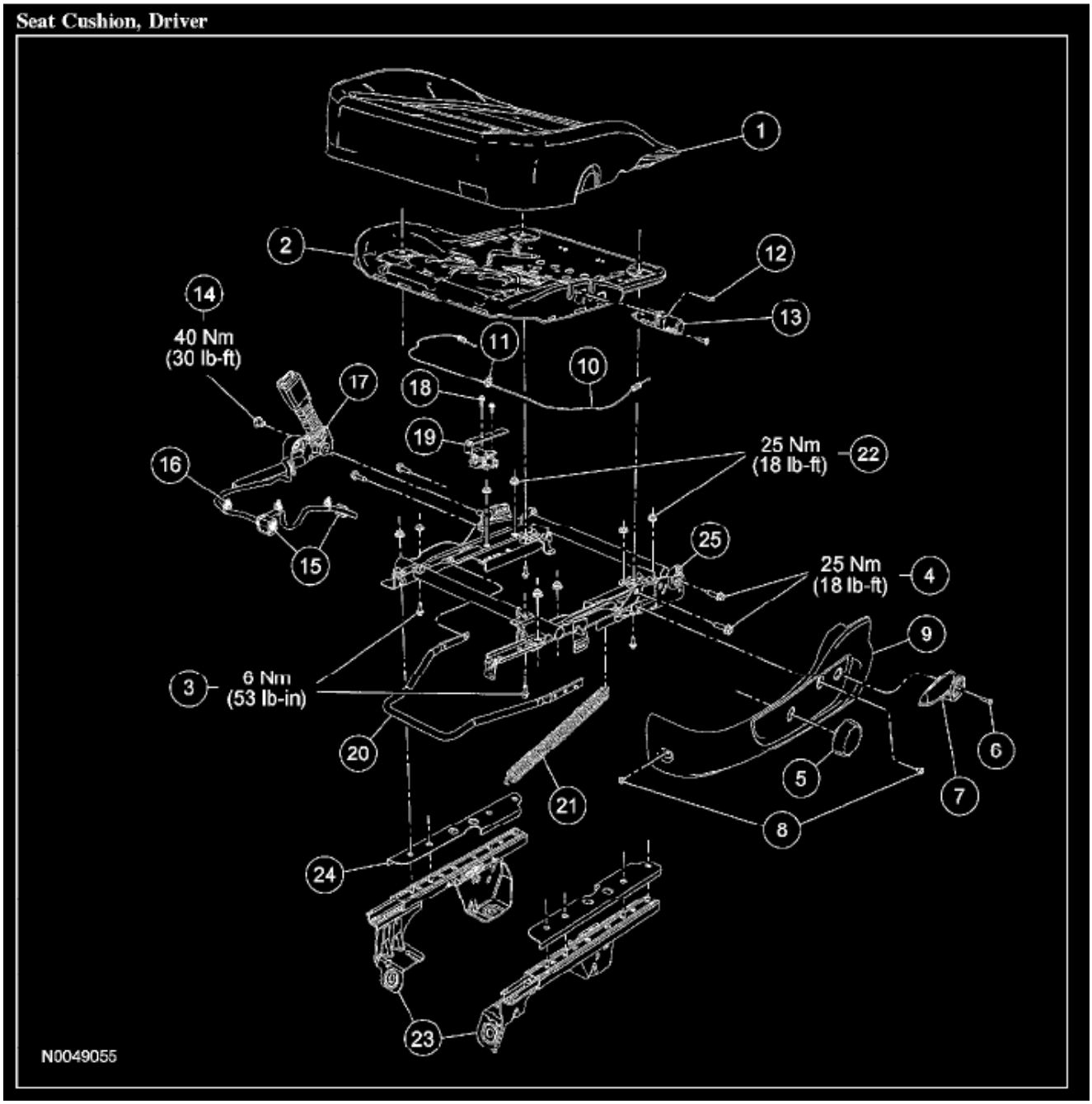
The air bag warning indicator may not illuminate until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON position. This is the time required for the RCM to complete the testing of the SRS. If the air bag warning indicator is inoperative and a SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag warning indicator and any SRS fault discovered must be diagnosed and repaired.

Clear all continuous RCM and occupant classification system module (OCSM) DTCs using a scan tool.

Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Seat Cushion, Driver



Seat Cushion: Service and Repair Seat Cushion - Front

Bucket and 40 Percent

SEAT CUSHION - FRONT, BUCKET AND 40 PERCENT

Special Tool(s)

Special Tool(s)

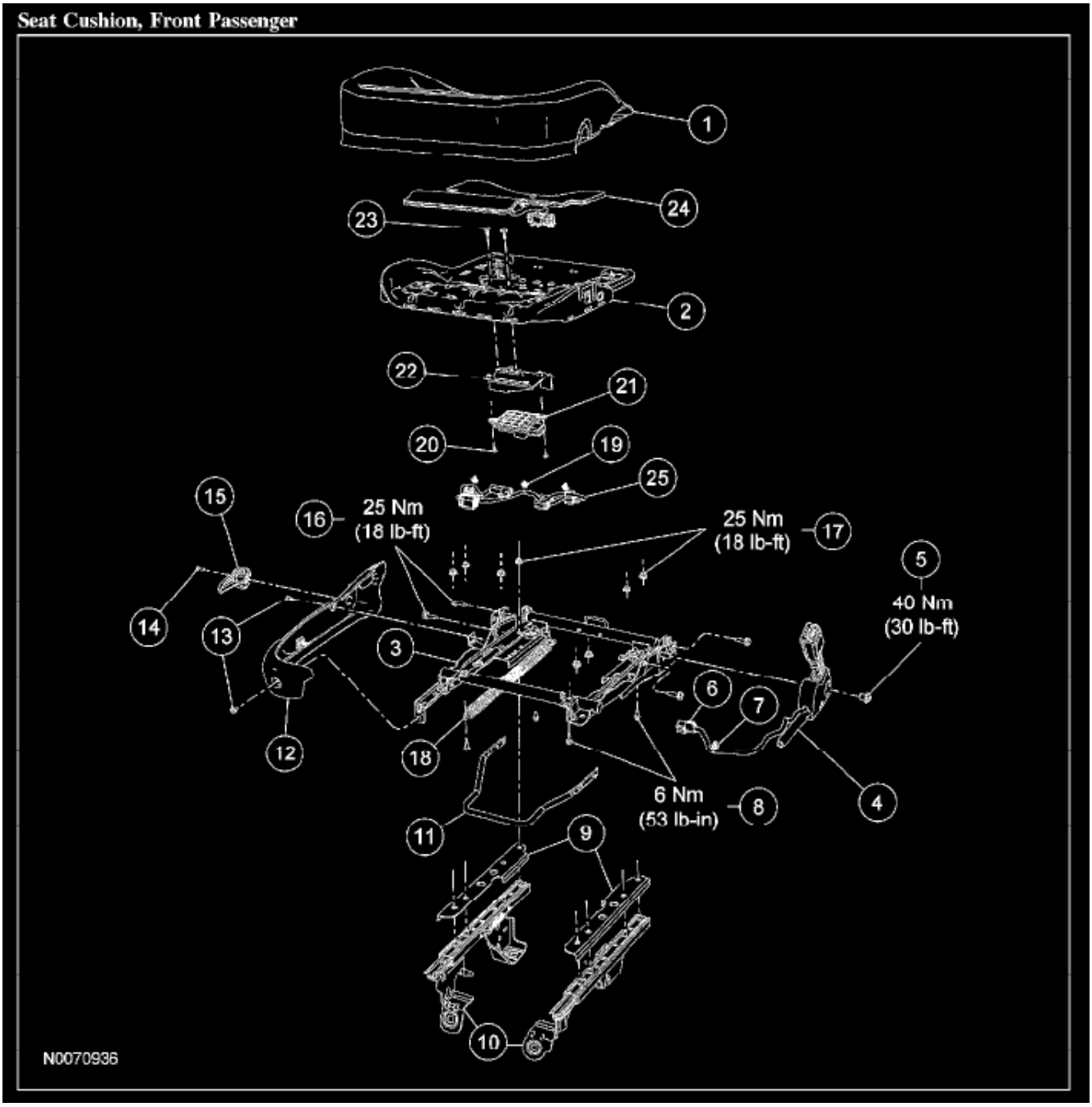
Seat Cushion, Driver (Part 1)

Item	Part Number	Description
1	62900/632A22	Cushion trim cover/foam pad
2	63100	Cushion frame
3	60108	Seat track-to-cushion frame bolts (4 required)
4	60108	Backrest-to-cushion bolts (4 required)
5	61198	Lumbar adjustment knob
6	55927	Recliner handle screw
7	61736	Recliner handle
8	000A25	Side shield screws (2 required)
9	62186	Cushion side shield
10	624A54	Backrest latch release cable
11	—	Pin-type retainer
12	000A25	Lumbar actuator screw (2 required)
13	610C00	Lumbar actuator

(Continued)

Item	Part Number	Description
14	000A25	Safety belt buckle pretensioner nut
15	—	Electrical connectors (part of 61203)
16	—	Pin-type retainer (3 required)
17	61203	Safety belt buckle pretensioner
18	—	Seat position sensor screw (2 required)
19	14B416	Seat track position sensor
20	61736	Seat track adjustment handle
21	61828	Seat track assist spring
22	W520413	Rail-to-seat track nuts (8 required)
23	61704/61705	Seat track rails
24	617A46	Seat track reinforcement (2 required)
25	620B20	Seat track

Seat Cushion, Driver (Part 2)



Seat Cushion, Front Passenger (Part 1)

Item	Part Number	Description
1	62900/603B02	Cushion trim cover/foam pad
2	63100	Cushion frame
3	613B20	Seat track
4	61202	Safety belt buckle pretensioner
5	000A25	Safety belt buckle pretensioner nut
6	—	Electrical connector (part of 61202)
7	—	Pin-type retainer
8	60108	Seat track-to-cushion frame bolts (4 required)
9	617A46	Seat track reinforcements
10	61704/61705	Seat track rails
11	61736	Seat track adjustment handle
12	62186	Cushion side shield
13	000A25	Side shield screws (2 required)

(Continued)

Item	Part Number	Description
14	55927	Recliner handle screw
15	61736	Recliner handle
16	60108	Backrest-to-cushion bolts (4 required)
17	W520413	Rail-to-seat track nuts (8 required)
18	61828	Seat track assist spring
19	—	Pin-type retainer (3 required)
20	—	Screw (2 required)
21	—	Occupant classification system module (OCSM) (part of 603B02)
22	—	OCSM bracket
23	—	Screw (2 required)
24	—	OCS (bladder, hose with pressure sensor, OCSM and seat wiring harness) (part of 603B02)
25	14C719	Wiring harness

Seat Cushion, Front Passenger (Part 2)

Disassembly

WARNING: -

Never probe the electrical connectors on safety belt buckle/retractor pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors, which increases the risk of serious personal injury or death.

- Install a new occupant classification sensor (OCS) system service kit as a complete assembly. Never install only part of the kit components. Failure to follow this instruction may result in incorrect operation of the OCS system and increases the risk of serious personal injury or death in a crash.

- Make sure the front passenger seat repair is complete, the seat and all attached components (head restraint, seat side shield, etc.) are correctly assembled, and the seat is correctly installed to the vehicle before carrying out the System Reset. Failure to follow these instructions may result in incorrect operation of the occupant classification sensor (OCS) system and increases the risk of serious personal injury or death in a crash.

CAUTION: To prevent system failure, it is necessary to carry out the occupant classification sensor (OCS) system reset when a front passenger seat cushion is disassembled, a new trim cover installed or an OCS system service kit is installed. A scan tool is used to carry out the OCS system reset command.

NOTE: -

Occupant classification sensor (OCS) system components (seat cushion foam pad, bladder with pressure sensor and occupant classification system module [OCSM]) are calibrated to each other and are serviced as an assembly. The OCS system components are not to be installed separately. If a new OCS system, OCS system component or seat cushion foam pad are needed, a new OCS system service kit (seat cushion foam pad, bladder with pressure sensor, OCSM and seat wiring harness) must be installed as an assembly.

- To identify between a production occupant classification sensor (OCS) system and a OCS system service kit, inspect the occupant classification system module (OCSM) electrical connector.

A production OCS system allows the disconnection of the OCSM electrical connector.

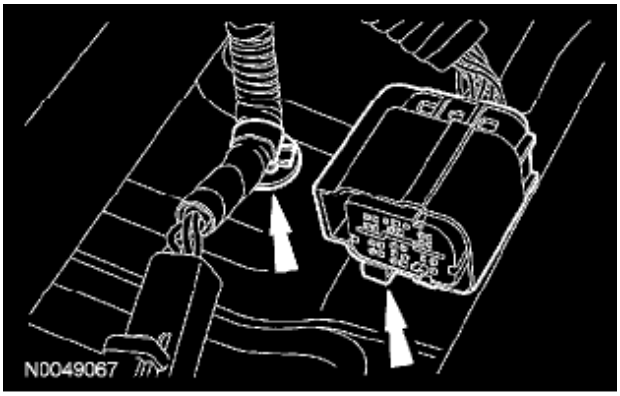
An OCS system service kit has the electrical connector glued to the module, it cannot and should not be disconnected or altered.

- The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

- The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

- When installing a new OCS system service kit, refer to Air Bag Systems for the OCS removal and installation procedure.

All seats 1. Remove the front seat. 2. Remove the front seat backrest. 3. Release the cushion trim cover rear J-clip from the seat cushion.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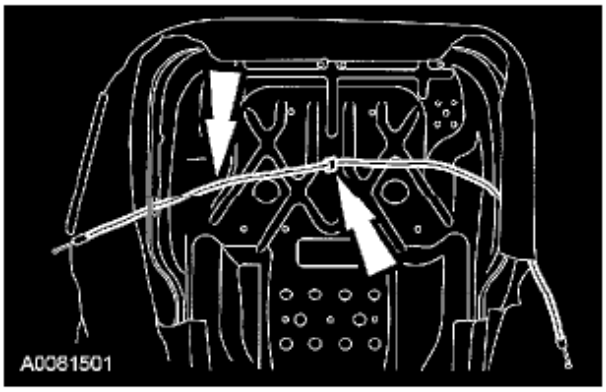
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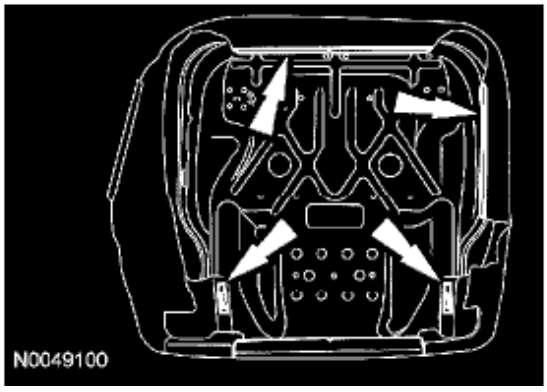
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Passenger seat

4. NOTE: Note position of wire routing for installation.

Release the seat wiring harness retainer clip and detach the seat wiring harness connector from the seat cushion frame.

All seats 5. Remove the 4 seat track-to-cushion frame bolts and remove the seat track assembly from the cushion frame.

Driver seat 6. Remove the 2 screws and seat position sensor from the seat track assembly.

All seats

7. NOTE: Note routing of the seat backrest latch release cable through the seat cushion frame.

Detach the pin-type retainer and remove the backrest latch release cable.

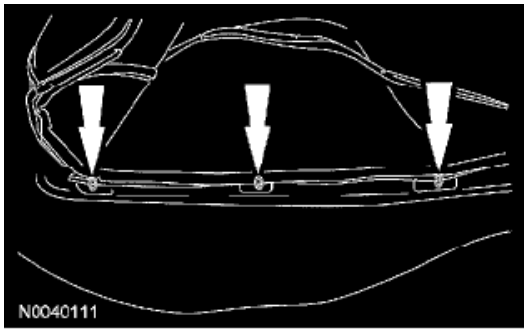
8. Release the remaining cushion trim cover J-clips.

- If driver seat, remove the cushion frame from the foam pad and cushion trim cover.

9. CAUTION: An occupant classification sensor (OCS) system service kit will have the OCS bladder attached to the seat cushion foam pad.

Do not separate the OCS bladder from the seat cushion foam pad. Failure to do so may result in component failure.

Remove all rows of hog rings and remove the cushion trim cover.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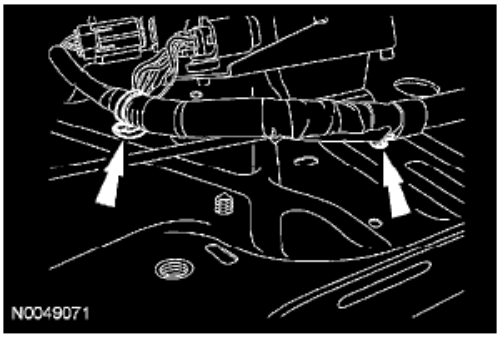
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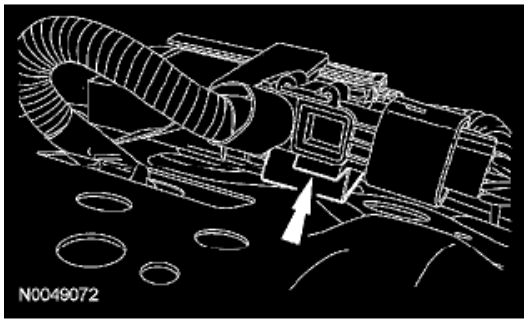
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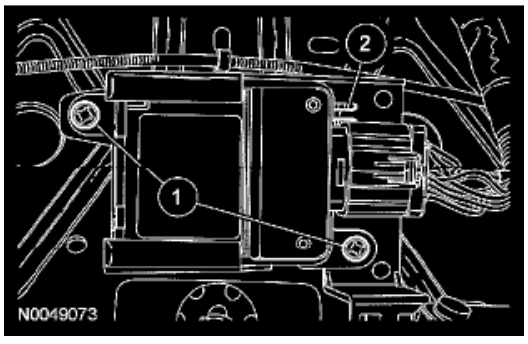
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1
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Passenger seat

10. NOTE: Note position of wire routing for installation.

Release the 2 seat wiring harness routing clips from the seat cushion frame.

11. Release the pressure sensor bracket retainer and slide the pressure sensor off the bracket.

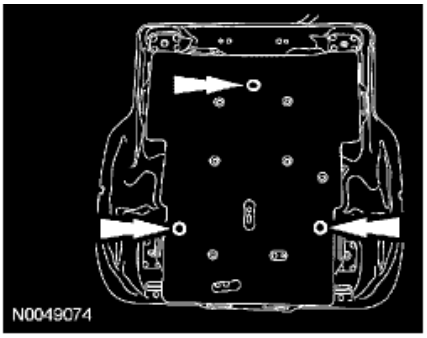
12. Remove the OCSM.

1 Remove the 2 screws from the OCSM.

2 Release the OCSM bracket retainer and slide the OCSM off the bracket.

13. CAUTION: A production occupant classification sensor (OCS) bladder is shown. An OCS service kit will have the OCS bladder attached

to the seat cushion foam pad. Do not separate the OCS bladder from the seat cushion foam pad. Failure to do so can result in component failure.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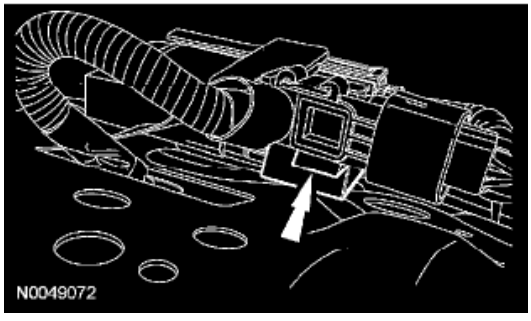
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Release the 3 OCS bladder pin-type retainers from the seat cushion frame.

14. NOTE: Note position of wire routing for installation.

Route the OCS bladder hose and pressure sensor, OCSM and seat wiring harness out through the seat cushion frame opening.

Assembly

Passenger seat

1. WARNING: Install a new occupant classification sensor (OCS) system service kit as a complete assembly. Never install only part of the

kit components. Failure to follow this instruction may result in incorrect operation of the OCS system and increases the risk of serious personal injury or death in a crash.

CAUTION: -

Inspect the occupant classification sensor (OCS) assembly, seat cushion frame and support assembly for any foreign objects before installing the OCS assembly to the seat cushion frame. If any foreign objects are found, remove them. Failure to follow these instructions may result in incorrect OCS system operation or failure.

- Failure to route the seat occupant sensor components through the correct seat cushion support opening can cause component failure.

- While positioning the seat cushion frame and occupant classification sensor assembly, be careful not to damage any of the components. Failure to do so can result in component failure.

NOTE: If the original equipment occupant classification sensor (OCS) is not being installed, install an OCS system service kit using all parts in the kit.

Position the OCS to the seat cushion frame. -

Route the OCS bladder hose and pressure sensor, OCSM and seat wiring harness through the seat cushion frame opening.

2. CAUTION: An occupant classification sensor (OCS) service kit will have the OCS bladder attached to the seat cushion foam pad. Do not

separate the OCS bladder from the seat cushion foam pad. Failure to do so may result in component failure.

Install the 3 OCS bladder pin-type retainers to the seat cushion frame.

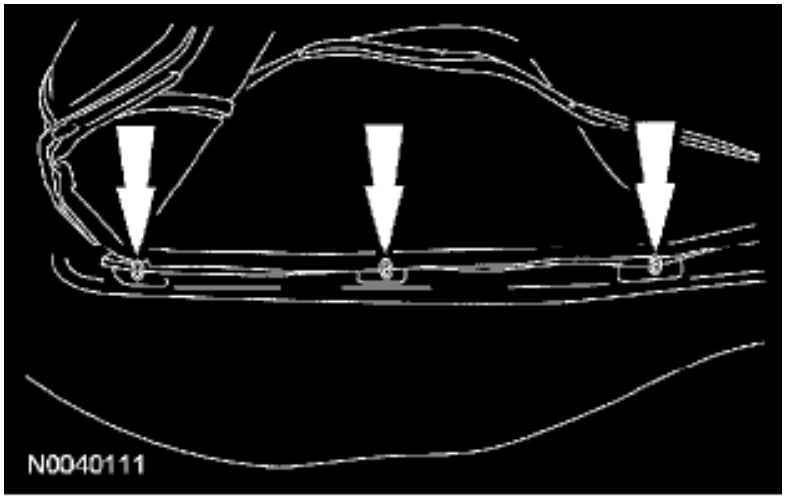
3. Install the OCSM.

- Slide the OCSM back on the OCSM bracket until it is fully seated and locked in past the OCSM bracket retainer.

- Install the 2 screws in the OCSM.

4. Slide the pressure sensor on the bracket until it is fully seated and locked in past the bracket retainer.

5. Install the 2 seat wiring harness routing clips to the seat cushion frame.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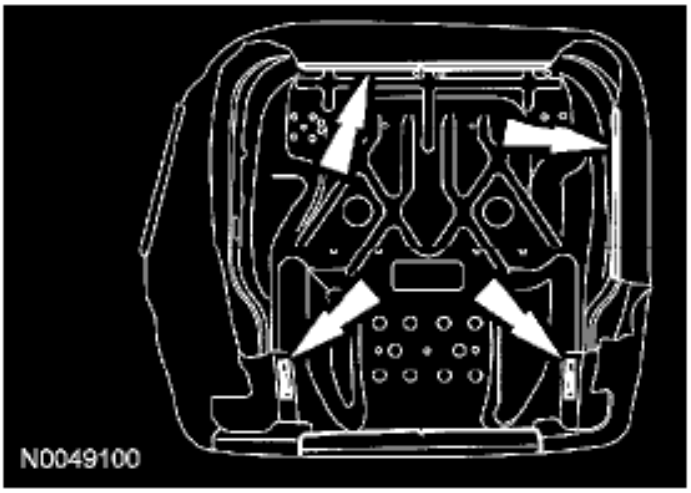
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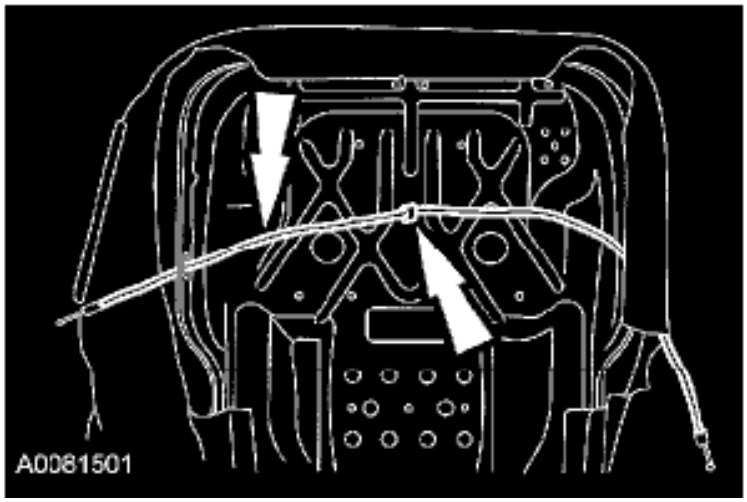
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All seats

6. CAUTION: Inspect the seat cushion pad and seat cushion trim cover for any foreign objects, before installing the seat cushion trim cover

to the seat cushion pad. If any foreign objects are found, remove them. Failure to follow these instructions may result in incorrect operation of the occupant classification sensor (OCS) system and may cause system failure.

Position the cushion trim cover to the foam pad and install the hog rings.

7. Install the foam pad and cushion trim cover to the cushion frame and fasten the J-clips.

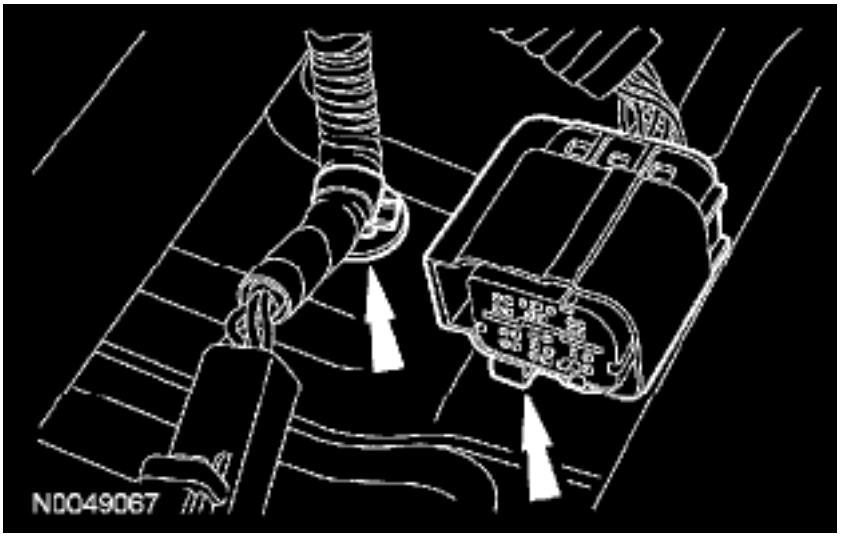
8. Route the backrest latch release cable through the cushion frame and install the pin-type retainer.

Driver seat 9. Install the seat position sensor and 2 screws to the seat track.

All seats 10. Install the seat track assembly and 4 bolts to the cushion frame.

- Tighten to 6 Nm (53 lb-in).

Passenger seat 11. Install the seat wiring harness retainer clip and attach the seat wiring harness connector to the seat cushion frame.



All seats 12. Attach the cushion trim cover rear J-clip. 13. Install the front seat backrest. 14. Install the seat. If a passenger seat has been serviced, do not prove out the SRS at this time.

Passenger seat

15. WARNING:

- Install a new occupant classification sensor (OCS) system service kit as a complete assembly. Never install only part of the kit components. Failure to follow this instruction may result in incorrect operation of the OCS system and increases the risk of serious personal injury or death in a crash.

- Make sure the front passenger seat repair is complete, the seat and all attached components (head restraint, seat side shield, etc.) are correctly assembled, and the seat is correctly installed to the vehicle before carrying out the System Reset. Failure to follow these instructions may result in incorrect operation of the occupant classification sensor (OCS) system and increases the risk of serious personal injury or death in a crash.

CAUTION: -

To prevent system failure, it is necessary to carry out the occupant classification sensor (OCS) system reset when a front passenger seat cushion is disassembled, a new trim cover installed or an OCS system service kit is installed. A scan tool is used to carry out the OCS system reset command.

- To prevent system failure, the following precautions must be taken before carrying out the occupant classification sensor (OCS) system reset: -

Make sure the voltage to the occupant classification system module (OCSM) is above 8.0 volts and less than 18.0 volts.

- Make sure the OCS system is not at a temperature below 6°C (42°F) or above 36°C (97°F) when initiating the OCS system reset process. If the vehicle has been exposed to extreme cold or hot temperatures, the vehicle must be exposed and kept at a temperature within the limits, 6°C to 36°C (42°F to 97°F) for a minimum of 30 minutes.

- Make sure nothing is present on the passenger seat before carrying out the OCS system reset and nothing is placed on the seat during the process.

- Make sure a minimum 8-second time period has passed after cycling the ignition switch ON before the carrying out the OCS system reset process.

NOTE: If the first attempt to carry out the occupant classification sensor (OCS) system reset is unsuccessful, a second attempt must be made. If the second attempt is unsuccessful, a new OCS system service kit must be installed.

Carry out the OCS system reset active command.

16. NOTE: The ignition switch must be cycled after the OCS system reset.

Cycle the ignition switch from ON to OFF.

All seats 17. Prove out the SRS as follows:

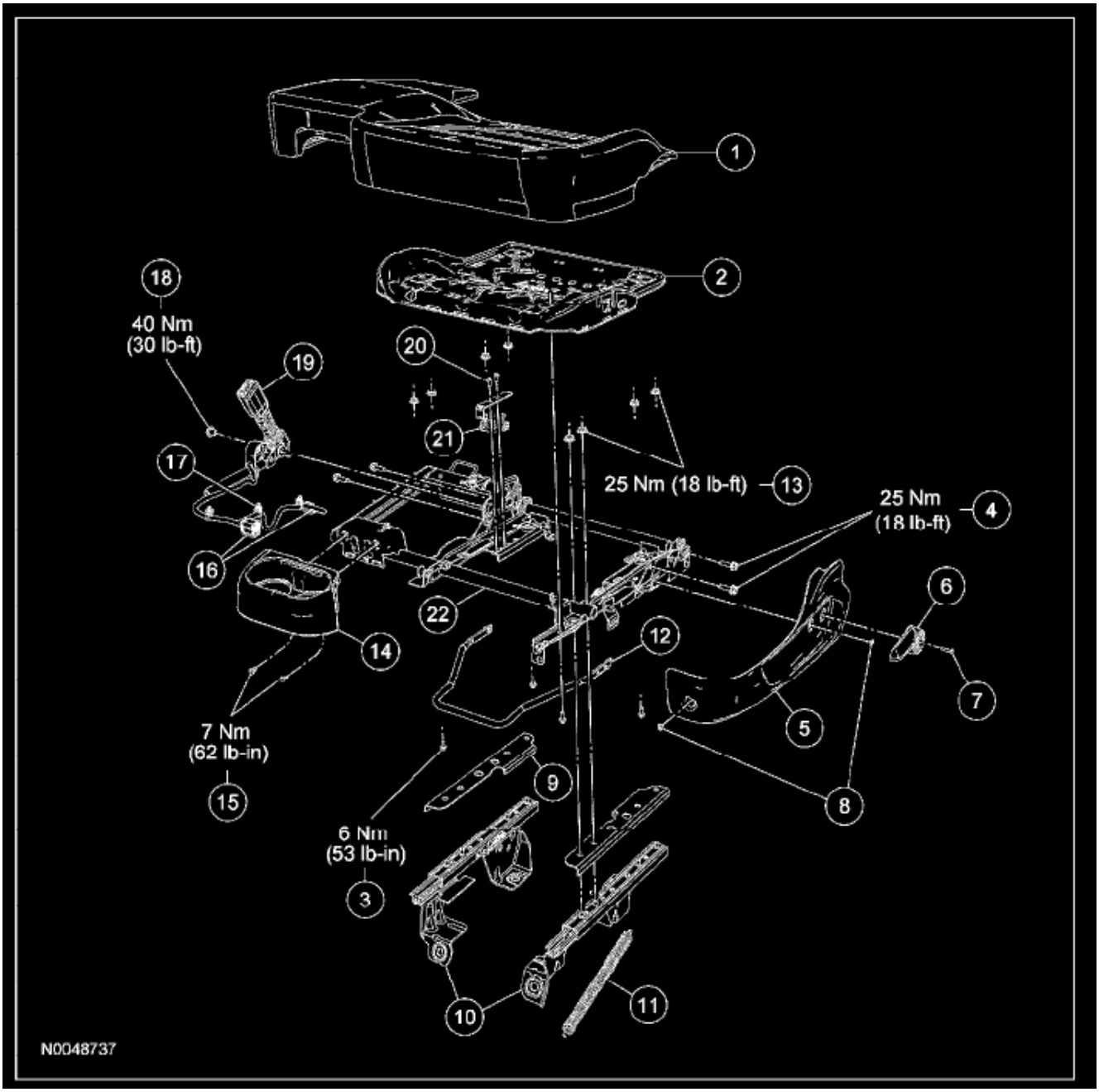
Turn the ignition key from ON to OFF. Wait 10 seconds, then turn the key back to ON and visually monitor the air bag warning indicator with the air bag modules installed. The air bag warning indicator will light continuously for approximately 6 seconds and then turn off. If an SRS fault is present, the air bag warning indicator will: -

fail to light.

- remain lit continuously.

- flash at a 5Hz rate (RCM not configured).

The air bag warning indicator may not illuminate until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON position. This is the time required for the RCM to complete the testing of the SRS. If the air bag warning indicator is inoperative and a SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag warning indicator and any SRS fault discovered must be



diagnosed and repaired.

Clear all continuous RCM and occupant classification system module (OCSM) DTCs using a scan tool.

60 Percent

SEAT CUSHION - FRONT, 60 PERCENT

Part 1

Item	Part Number	Description
1	62900/632A22	Cushion trim cover/foam pad
2	63100	Cushion frame
3	60108	Seat track-to-cushion frame bolt (4 required)
4	60108	Backrest-to-cushion bolts (4 required)
5	62186	Cushion side shield
6	61736	Recliner handle
7	55927	Recliner handle screw
8	000A25	Side shield screws (2 required)
9	617A46	Seat track reinforcement (2 required)
10	61704/61705	Seat track rails
11	61828	Seat track assist spring
12	61736	Seat track adjustment handle
13	W520413	Rail-to-seat track nuts (8 required)
14	—	Cup holder
15	000A25	Cup holder mounting screws (2 required)
16	—	Electrical connectors (part of 61203)
17	—	Pin-type retainer (3 required)
18	000A25	Safety belt buckle pretensioner nut
19	61203	Safety belt buckle pretensioner
20	—	Seat position sensor and bracket screw (2 required)
21	14B416	Seat position sensor and bracket
22	613B20	Seat track

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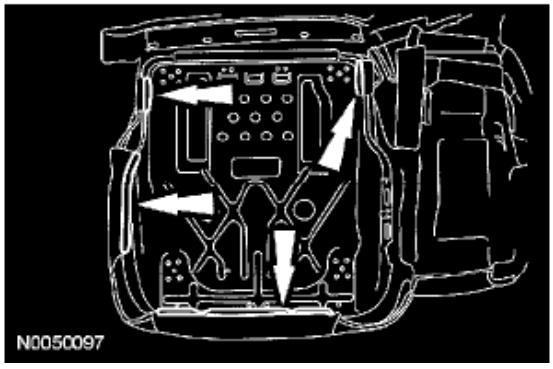


Part 2

Disassembly

WARNING: Never probe the electrical connectors on safety belt buckle/retractor pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors, which increases the risk of serious personal injury or death.

NOTE: -

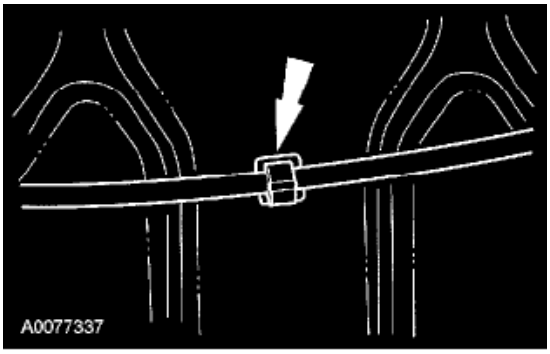
The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

- The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1. Remove the affected seat. 2. Remove the armrest. 3. Remove the backrest assembly. 4. Remove the seat track. 5. Remove the 2 screws and seat track position sensor from the seat track. 6. Release the remaining trim cover J-clips.

7. NOTE: Note the routing of the seat back latch release cable through the seat cushion frame.

Release the pin-type retainer and remove the seat backrest latch release cable.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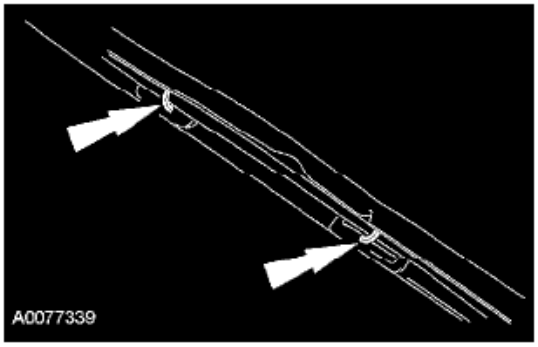
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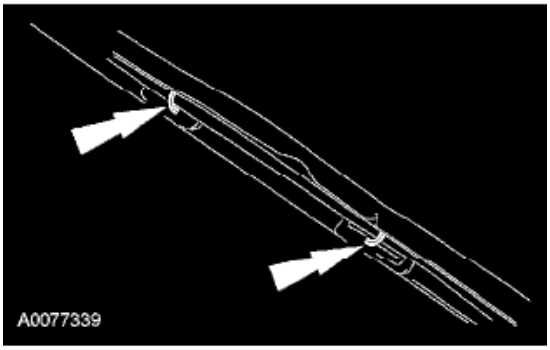
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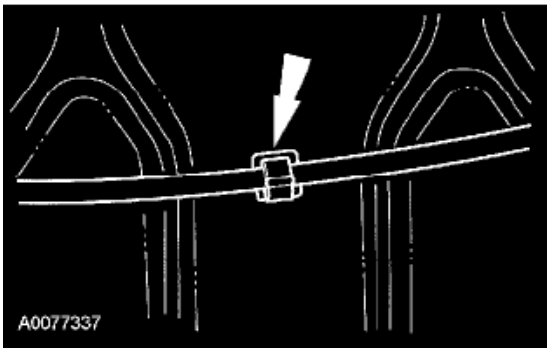
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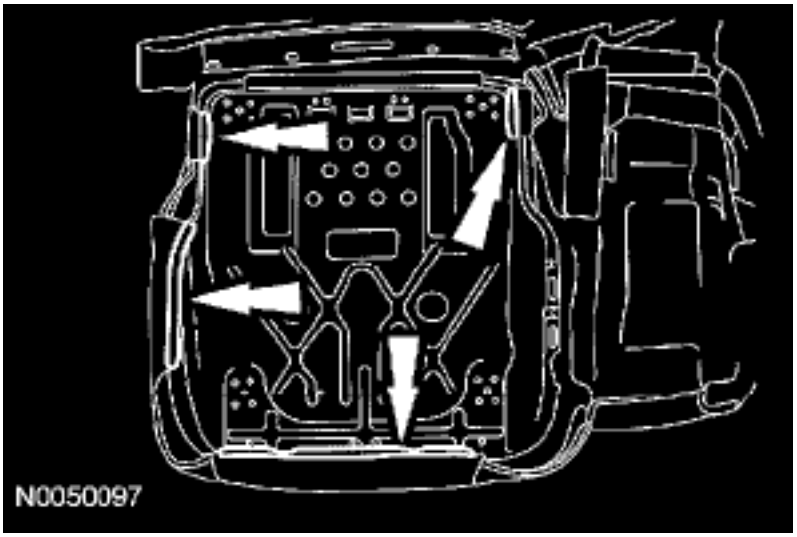
8. Remove the seat cushion frame from the seat cushion foam pad. 9. Remove the rows of hog rings and remove the seat cushion trim cover.

Assembly

1. Position the cushion trim cover to the foam pad and install the rows of hog rings.

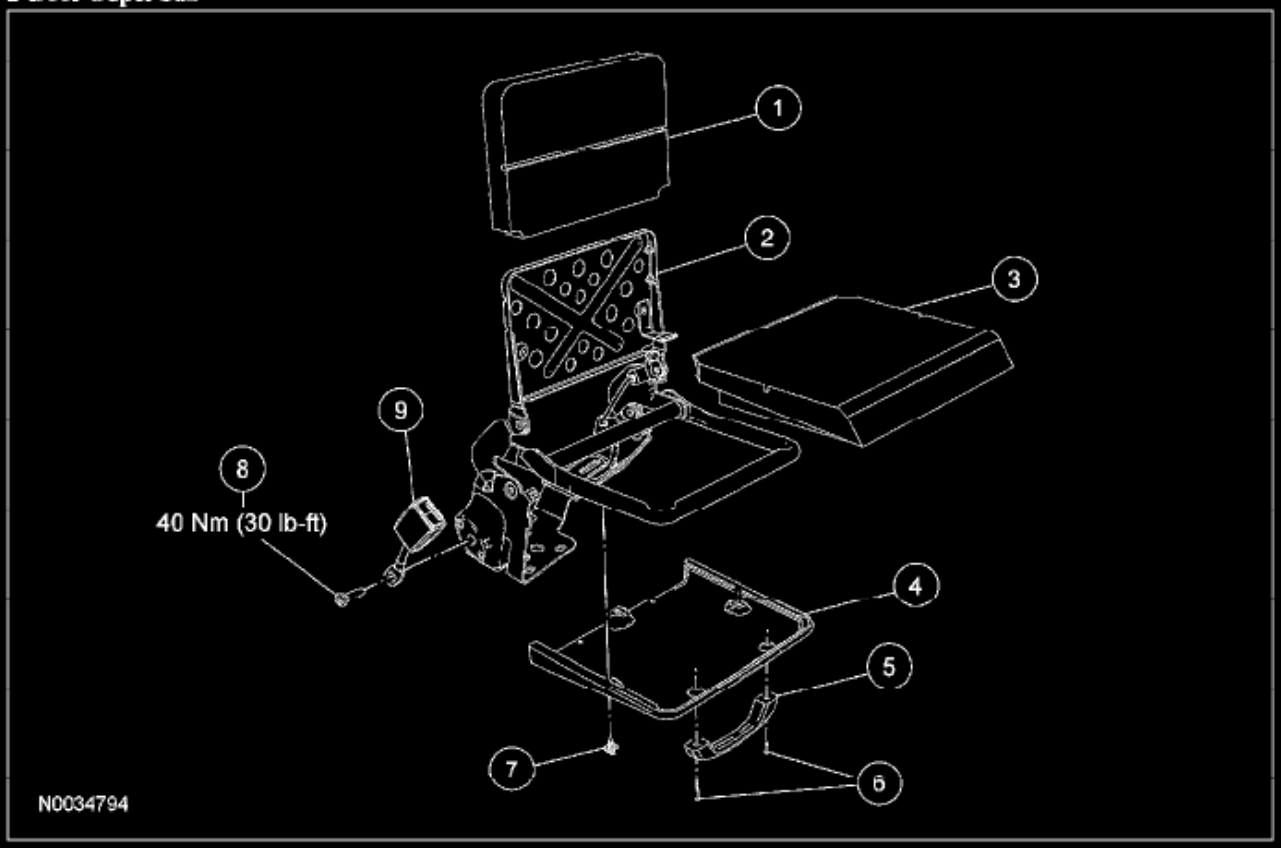
2. Install the foam pad and trim cover to the seat cushion frame. 3. Route the seat backrest latch release cable through the cushion frame and install the pin-type retainer.

4. Fasten the trim cover J-clips.



5. Install the seat track position sensor and 2 screws to the seat track. 6. Install the seat track. 7. Install the backrest assembly. 8. Install the armrest. 9. Install the affected seat.

2-Door SuperCab



Item	Part Number	Description
1	64416/64810	Seat backrest trim cover/seat backrest foam pad
2	672A28B	Frame assembly, seat
3	62900/632A22	Seat cushion trim cover/cushion foam pad
4	—	Trim cover
5	—	Handle
6	—	Screws, handle (2 required)
7	—	Screw, trim cover (3 required)
8	—	Bolt, safety belt buckle (part of 613B84)
9	613B84	Safety belt buckle

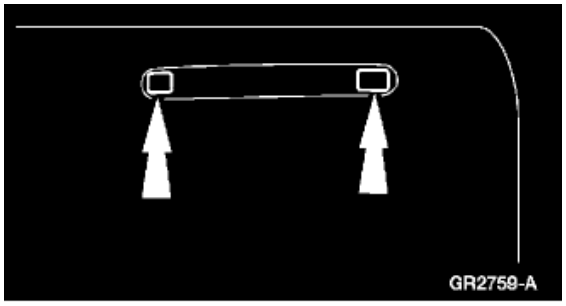
Seat Cushion: Service and Repair Seat Cushion - Rear, 2-Door, SuperCab

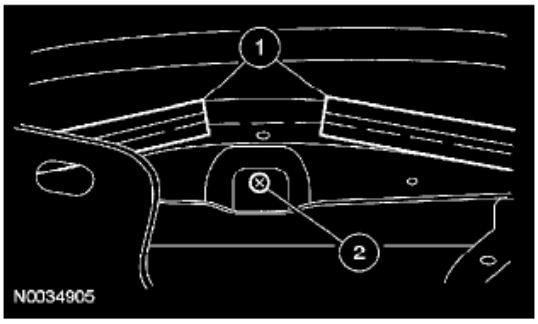
SEAT CUSHION - REAR, 2-DOOR, SUPERCAB

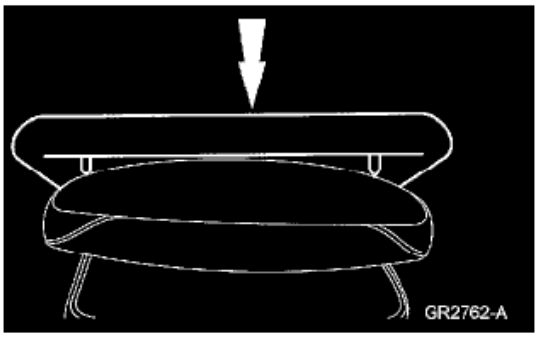
2-Door SuperCab

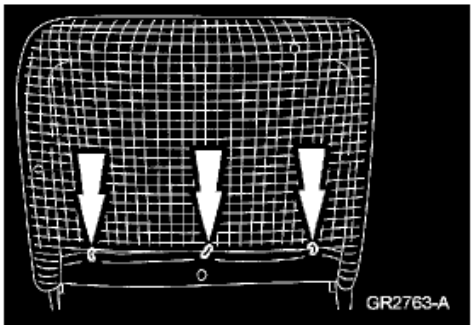
Disassembly and Assembly

1. Remove the screw covers.


GR2759-A


1
2
N0034905


GR2762-A


GR2763-A

2. Remove the assist handle.

1 Remove the screws.

2 Remove the assist handle.

3. Remove the rear seat door trim cover screw.

1 Unhook the rear seat door trim cover retainers.

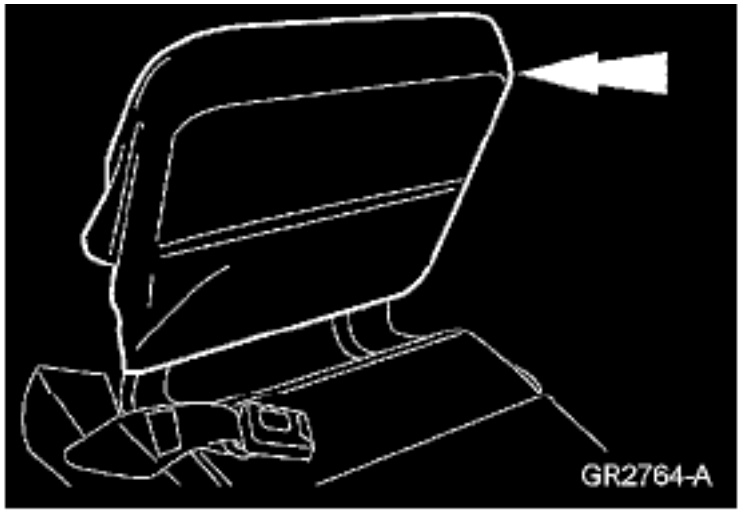
2 Remove the rear seat door trim cover screw.

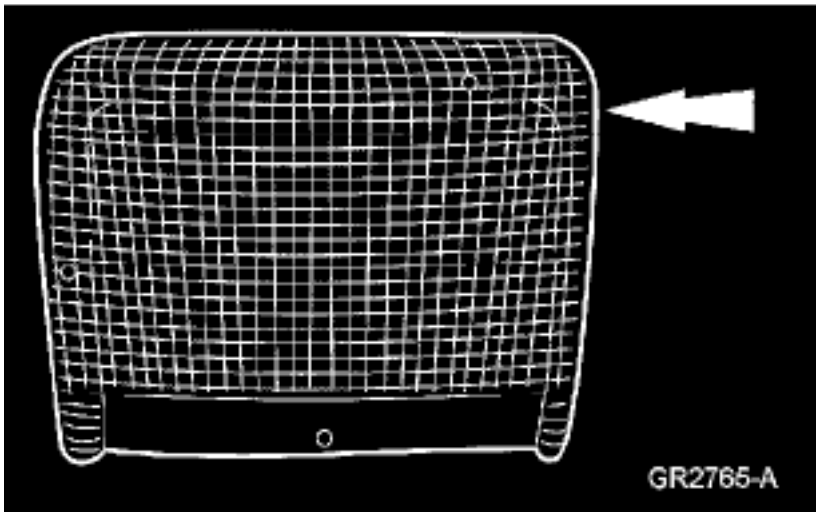
4. Remove the seat door trim cover.

- Disengage the pushpins.

5. Remove the hog rings.

6. Remove the seat base from the seat frame.



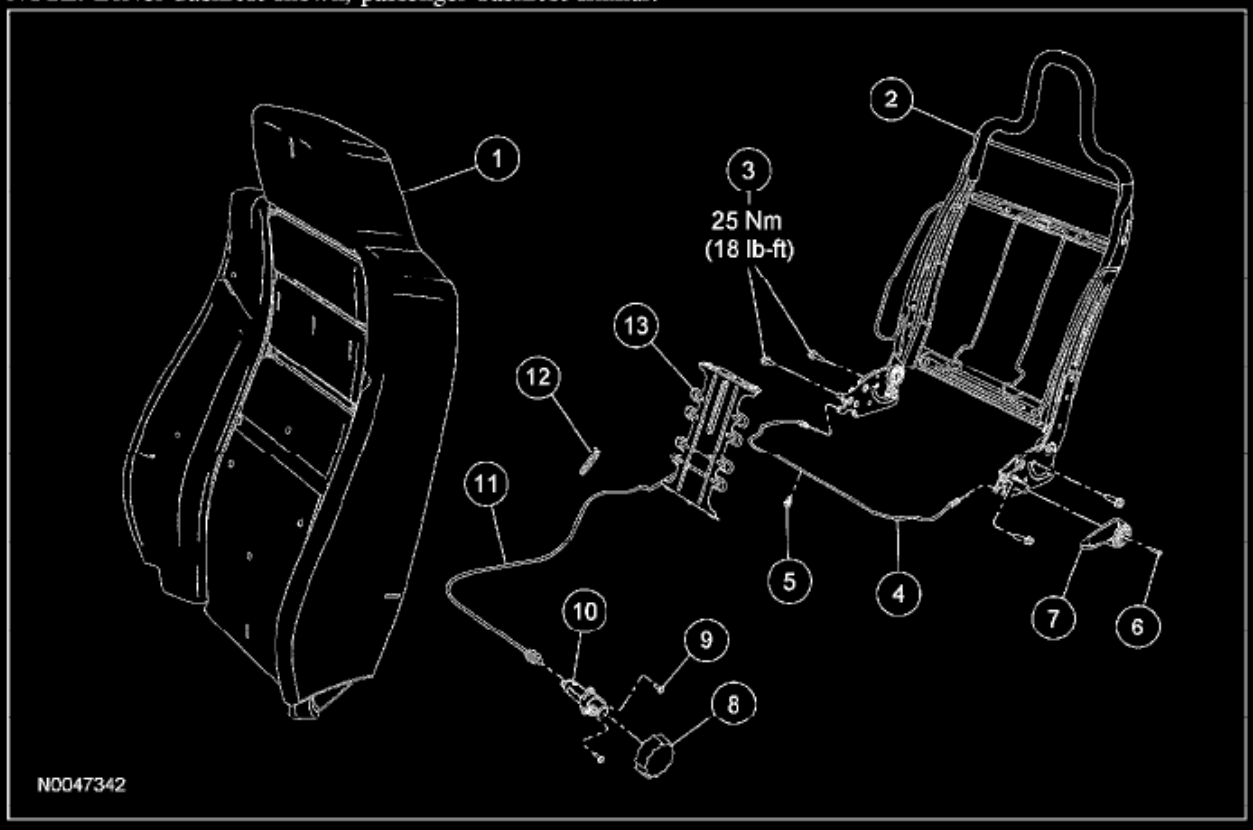


7. Remove the seat base trim cover.

8. To assemble, reverse the disassembly procedure. 9. Make sure the safety belts and buckles are accessible to the occupants after installation.

Seat Backrest, Front, 40 Percent

NOTE: Driver backrest shown, passenger backrest similar.



Item	Part Number	Description
1	64416/64810	Backrest trim cover/foam pad
2	61018	Backrest frame
3	60108	Backrest-to-cushion bolts (4 required)
4	624A54	Backrest latch release cable
5	—	Pin-type retainer
6	56904	Recliner handle screw
7	610A77	Recliner handle
8	61198	Lumber adjust knob, if equipped

Item	Part Number	Description
9	000A25	Lumbar actuator screw (2 required), if equipped
10	610C00	Lumbar actuator, if equipped
11	—	Lumbar actuator cable (part of 62222), if equipped
12		Tie strap, if equipped
13	62222	Lumbar support, if equipped

(Continued)

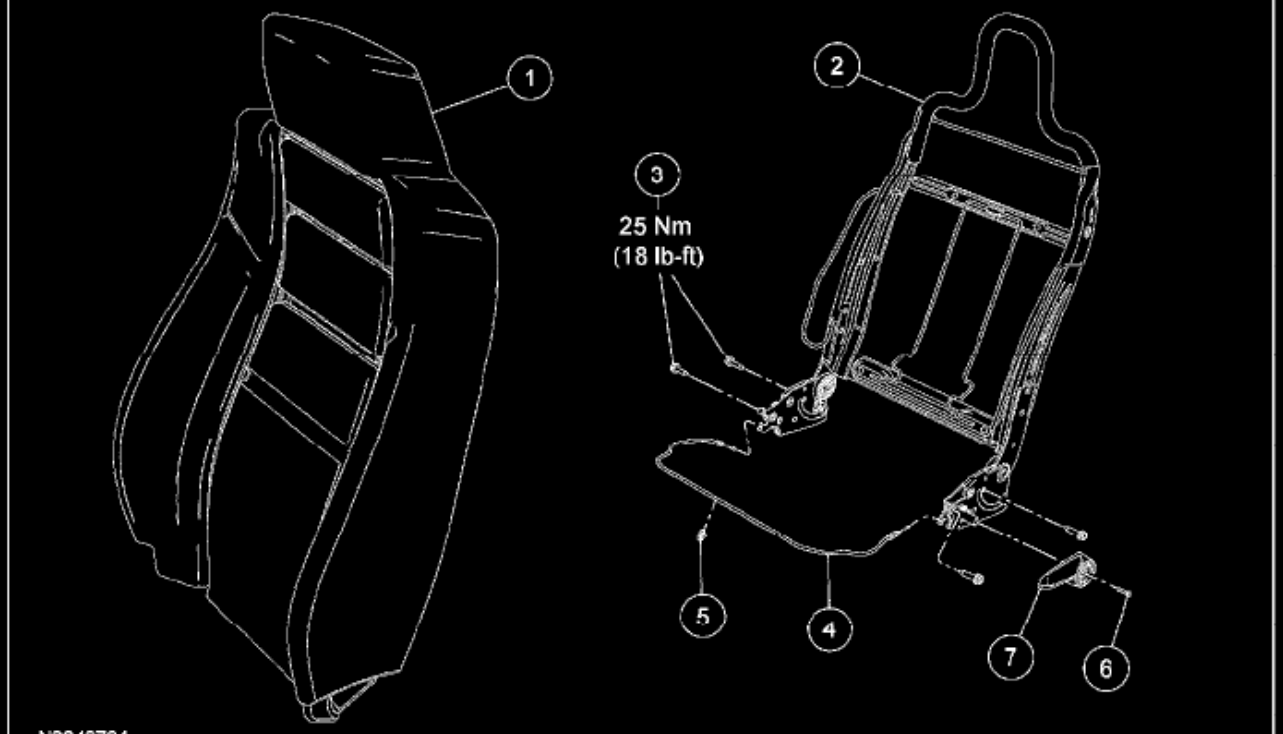
Seat Track: Service and Repair Seat Track - 60 Percent

SEAT TRACK - 60 PERCENT

Exploded View

Seat Backrest, Front, 40 Percent

Seat Backrest, Front, 60 Percent

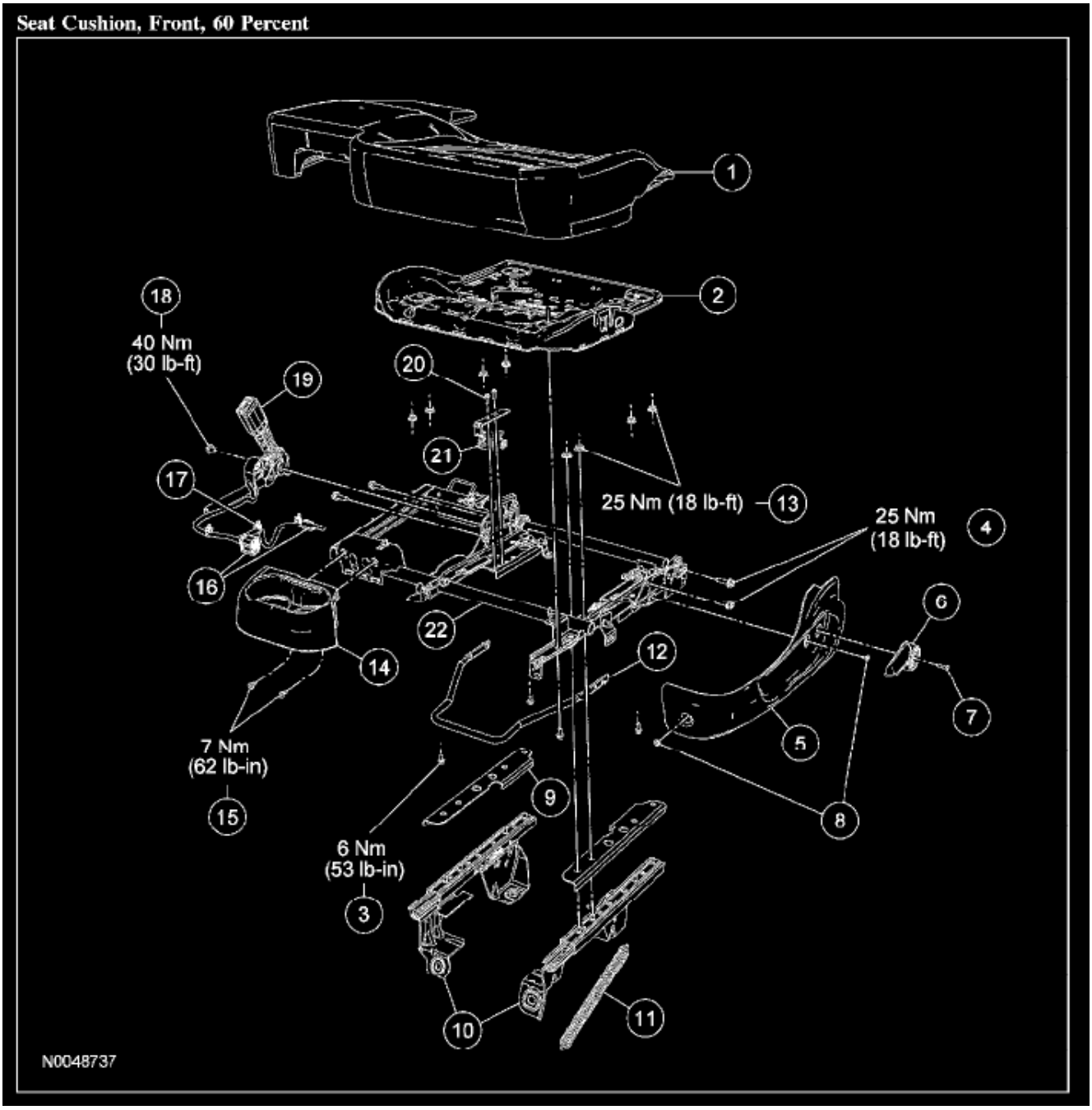


Item	Part Number	Description
1	64416/64810	Backrest trim cover/foam pad
2	61018	Backrest frame
3	60108	Backrest-to-cushion bolts (4 required)
4	624A54	Backrest latch release cable

Item	Part Number	Description
5	—	Pin-type retainer
6	56904	Recliner handle screw
7	610A77	Recliner handle

(Continued)

Seat Backrest, Front, 60 Percent



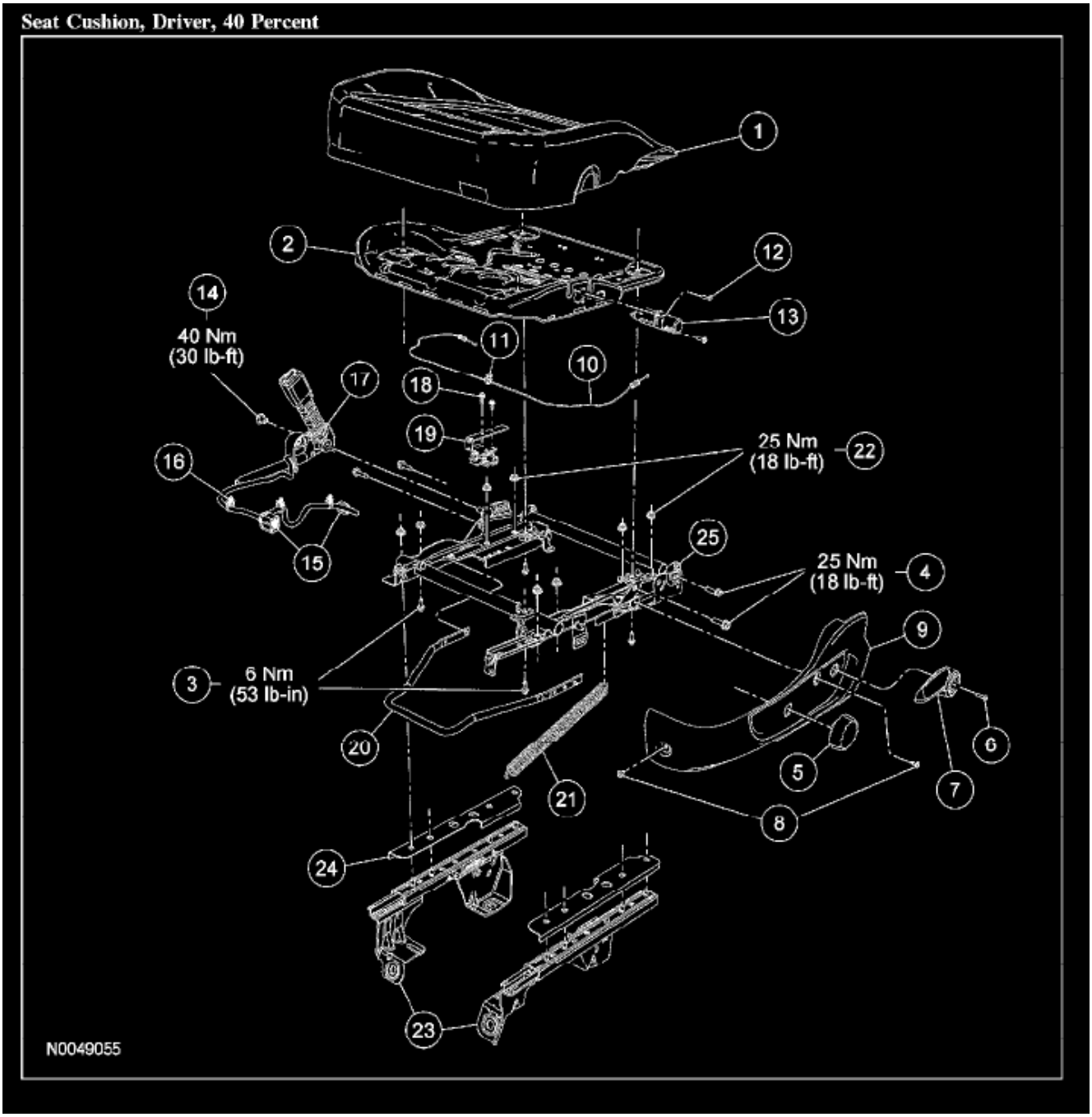
Seat Cushion, Front, 60 Percent (Part 1)

Item	Part Number	Description
1	62900/632A22	Cushion trim cover/foam pad
2	63100	Cushion frame
3	60108	Seat track-to-cushion frame bolt (4 required)
4	60108	Backrest-to-cushion bolts (4 required)
5	62186	Cushion side shield
6	61736	Recliner handle
7	55927	Recliner handle screw
8	000A25	Side shield screws (2 required)
9	617A46	Seat track reinforcement (2 required)
10	61704/61705	Seat track rails
11	61828	Seat track assist spring
12	61736	Seat track adjustment handle
13	W520413	Rail-to-seat track nuts (8 required)

(Continued)

Item	Part Number	Description
14	—	Cup holder
15	000A25	Cup holder mounting screws (2 required)
16	—	Electrical connectors (part of 61203)
17	—	Pin-type retainer (3 required)
18	000A25	Safety belt buckle pretensioner nut
19	61203	Safety belt buckle pretensioner
20	—	Seat position sensor and bracket screw (2 required)
21	14B416	Seat position sensor and bracket
22	613B20	Seat track

Seat Cushion, Front, 60 Percent (Part 2)



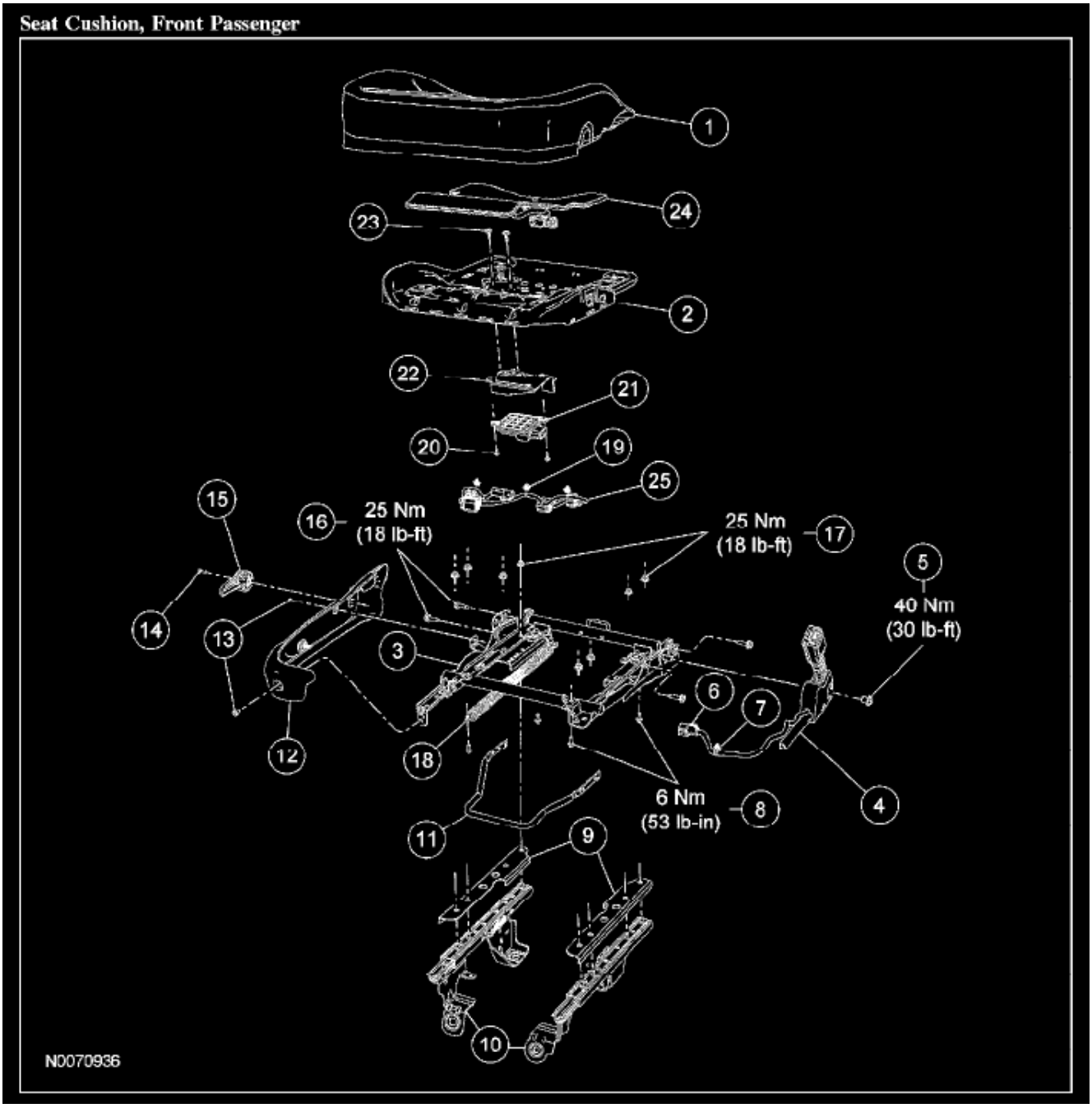
Seat Cushion, Driver, 40 Percent (Part 1)

Item	Part Number	Description
1	62900/632A22	Cushion trim cover/foam pad
2	63100	Cushion frame
3	60108	Seat track-to-cushion frame bolts (4 required)
4	60108	Backrest-to-cushion bolts (4 required)
5	61198	Lumbar adjustment knob
6	55927	Recliner handle screw
7	61736	Recliner handle
8	000A25	Side shield screws (2 required)
9	62186	Cushion side shield
10	624A54	Backrest latch release cable
11	—	Pin-type retainer
12	000A25	Lumbar actuator screw (2 required)
13	610C00	Lumbar actuator
14	000A25	Safety belt buckle pretensioner nut

(Continued)

Item	Part Number	Description
15	—	Electrical connectors (part of 61203)
16	—	Pin-type retainer (3 required)
17	61203	Safety belt buckle pretensioner
18	—	Seat position sensor screw (2 required)
19	14B416	Seat track position sensor
20	61736	Seat track adjustment handle
21	61828	Seat track assist spring
22	W520413	Rail-to-seat track nuts (8 required)
23	61704/61705	Seat track rails
24	617A46	Seat track reinforcement (2 required)
25	620B20	Seat track

Seat Cushion, Driver, 40 Percent (Part 2)



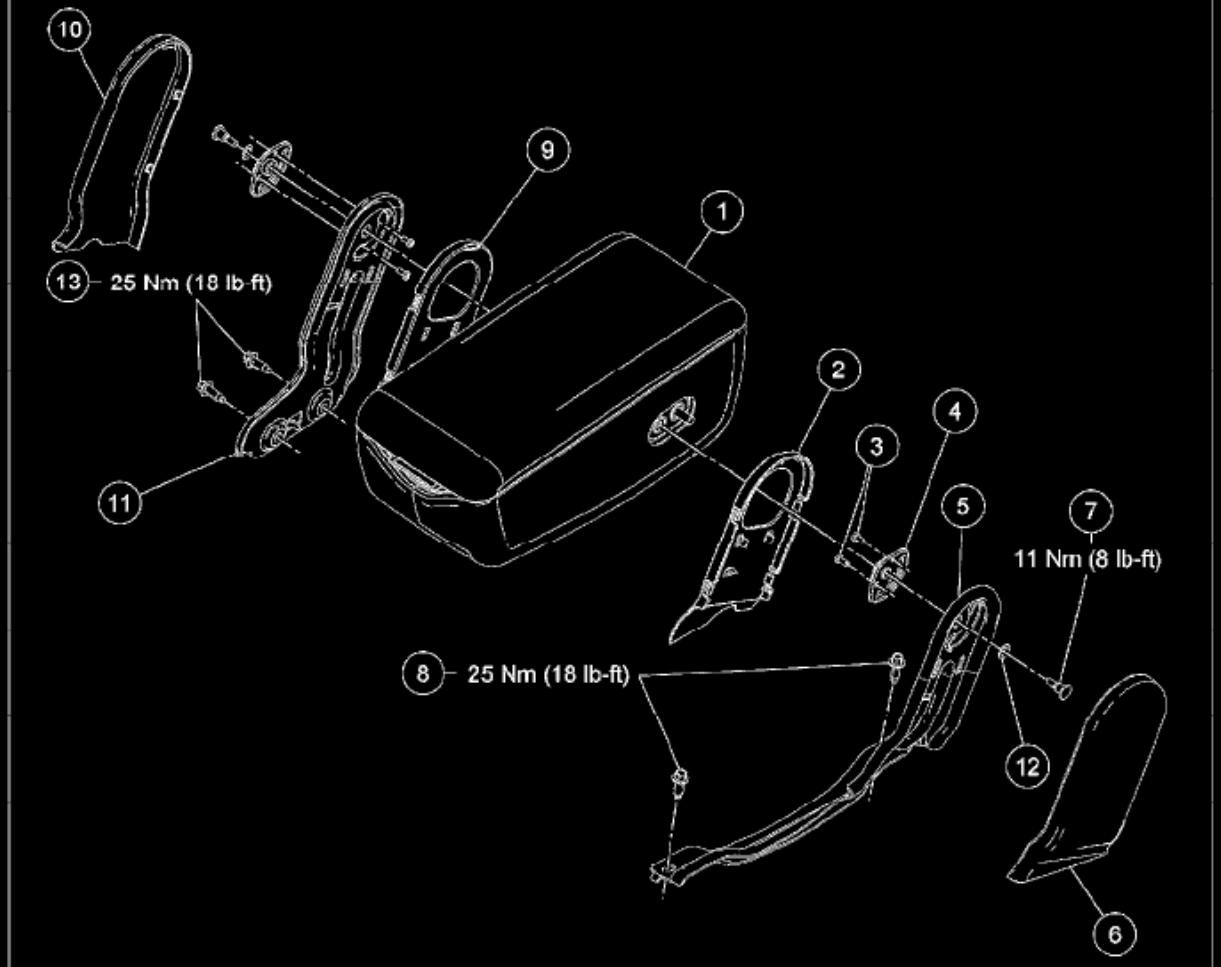
Seat Cushion, Front Passenger (Part 1)

Item	Part Number	Description
1	62900/603B02	Cushion trim cover/foam pad
2	63100	Cushion frame
3	613B20	Seat track
4	61202	Safety belt buckle pretensioner
5	000A25	Safety belt buckle pretensioner nut
6	—	Electrical connector (part of 61202)
7	—	Pin-type retainer
8	60108	Seat track-to-cushion frame bolts (4 required)
9	617A46	Seat track reinforcements
10	61704/61705	Seat track rails
11	61736	Seat track adjustment handle
12	62186	Cushion side shield
13	000A25	Side shield screws (2 required)
14	55927	Recliner handle screw
15	61736	Recliner handle
16	60108	Backrest-to-cushion bolts (4 required)
17	W520413	Rail-to-seat track nuts (8 required)
18	61828	Seat track assist spring
19	—	Pin-type retainer (3 required)
20	—	Screw (2 required)
21	—	Occupant classification system module (OCSM) (part of 603B02)
22	—	OCSM bracket
23	—	Screw (2 required)
24	—	OCS (bladder, hose with pressure sensor, OCSM and seat wiring harness) (part of 603B02)
25	14C719	Wiring harness

(Continued)

Seat Cushion, Front Passenger (Part 2)

Seat Armrest, Front, 60 Percent



Item	Part Number	Description
1	644A22	Armrest
2	672A28B	LH inner trim cover
3	—	Pivot bracket screws (4 required)
4	63076C	Pivot bracket (2 required)
5	63076A	LH armrest bracket
6	672A28A	LH outer trim cover
7	—	Armrest pivot bolts (2 required)
8	—	LH armrest bracket-to-seat frame bolts (2 required)

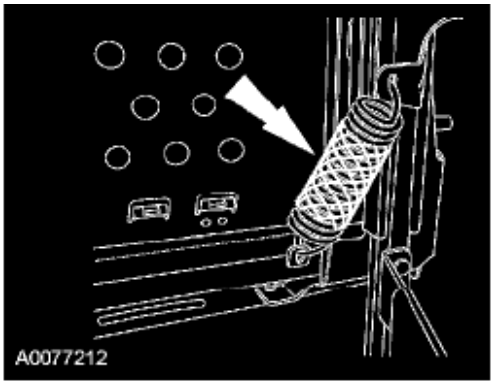
Item	Part Number	Description
9	672A28B	RH inner trim cover
10	672A28A	RH outer trim cover
11	63076B	RH armrest bracket
12	—	Washer (2 required)
13	—	RH armrest bracket-to-seat frame bolts (2 required)

(Continued)

Seat Armrest, Front, 60 Percent

Removal

WARNING: Never probe the electrical connectors on safety belt buckle/retractor pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors, which increases the risk of serious personal injury or death.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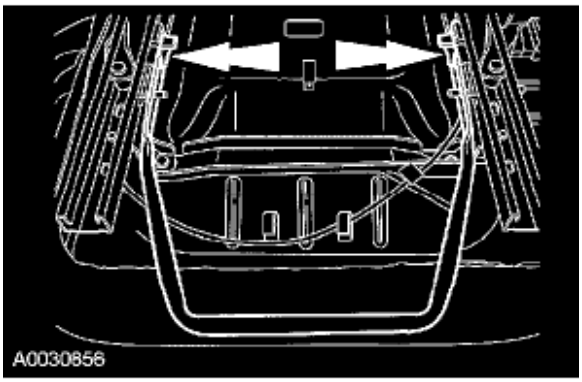
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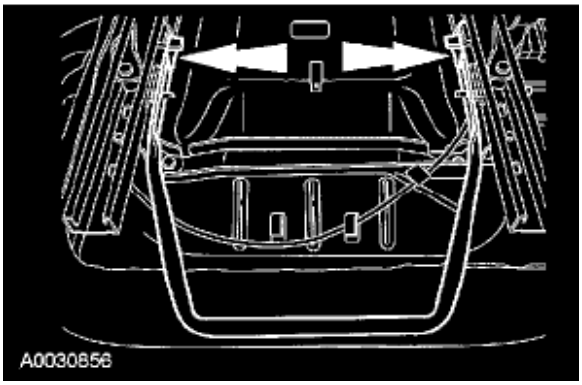

A0030856

NOTE: -

The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

- The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1. Remove the seat. 2. Remove the 60 percent seat armrest. 3. Remove the 60 percent seat backrest assembly. 4. Remove the seat track assist spring.

5. Remove the seat track adjustment handle.

- Remove one side of the seat track adjustment handle at a time.

6. Remove the 4 seat track-to-cushion frame bolts and remove the seat track from the seat cushion frame. 7. Remove the 8 rail-to-seat track nuts and separate the seat track rails from the seat track.

Installation

1. Install the seat track rails to the seat track and install the 8 nuts.

- Tighten to 25 Nm (18 lb-ft).

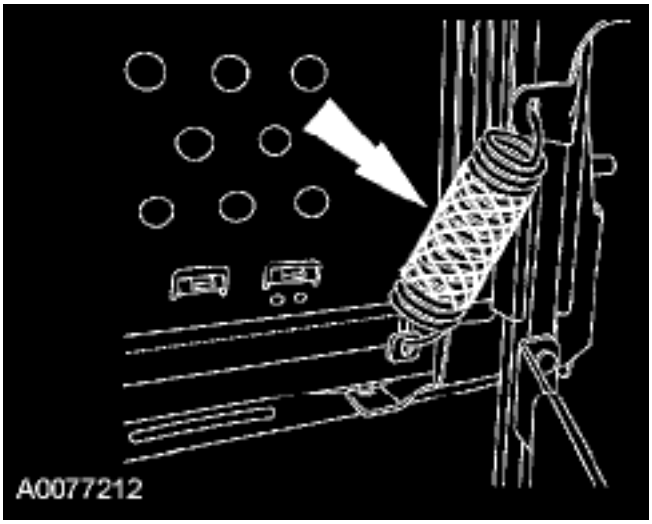
2. Install the seat track and 4 seat track-to-cushion frame bolts.

- Tighten to 6 Nm (53 lb-in).

3. Install the seat track adjustment handle.

- Install one side of the seat track adjustment handle at a time.

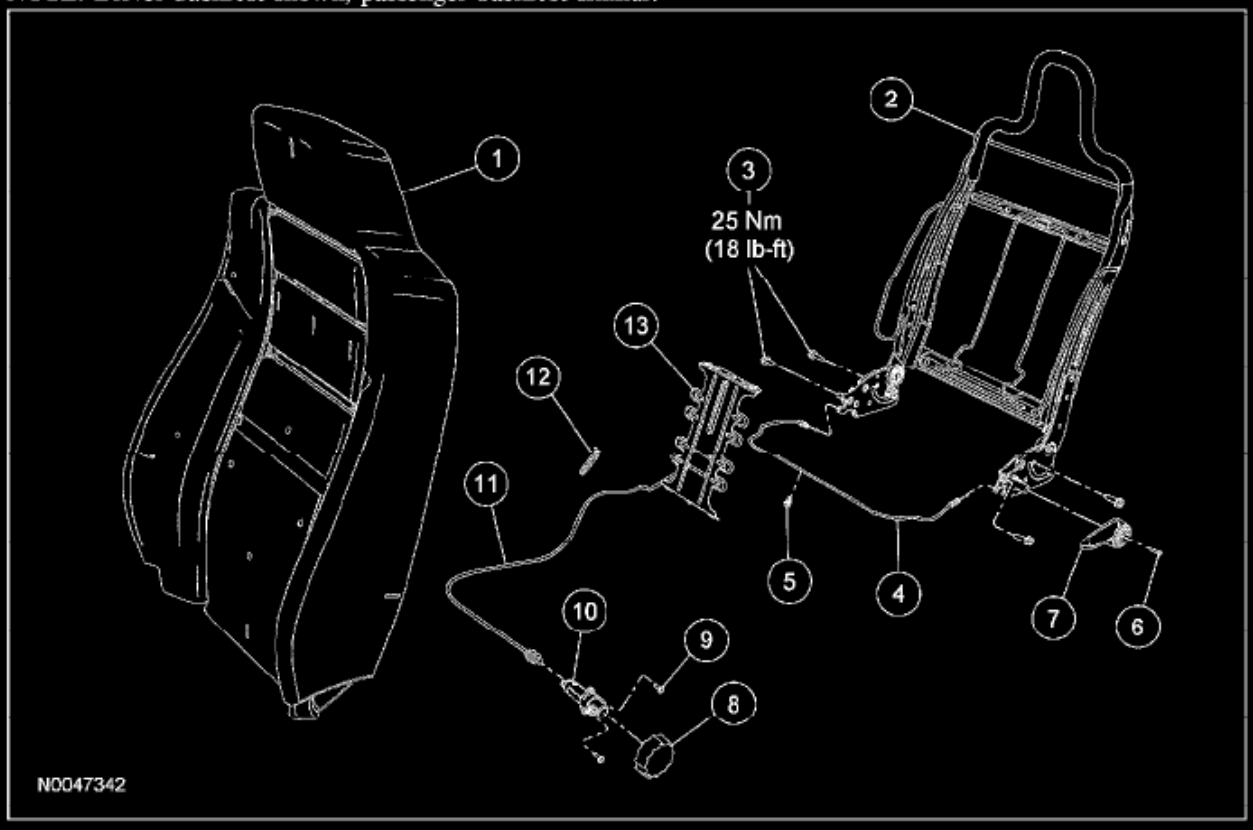
4. Install the seat track assist spring.



5. Install the 60 percent seat backrest assembly. 6. Install the 60 percent seat armrest. 7. Install the seat.

Seat Backrest, Front, 40 Percent

NOTE: Driver backrest shown, passenger backrest similar.



Item	Part Number	Description
1	64416/64810	Backrest trim cover/foam pad
2	61018	Backrest frame
3	60108	Backrest-to-cushion bolts (4 required)
4	624A54	Backrest latch release cable
5	—	Pin-type retainer
6	56904	Recliner handle screw
7	610A77	Recliner handle
8	61198	Lumber adjust knob, if equipped

Item	Part Number	Description
9	000A25	Lumbar actuator screw (2 required), if equipped
10	610C00	Lumbar actuator, if equipped
11	—	Lumbar actuator cable (part of 62222), if equipped
12		Tie strap, if equipped
13	62222	Lumbar support, if equipped

(Continued)

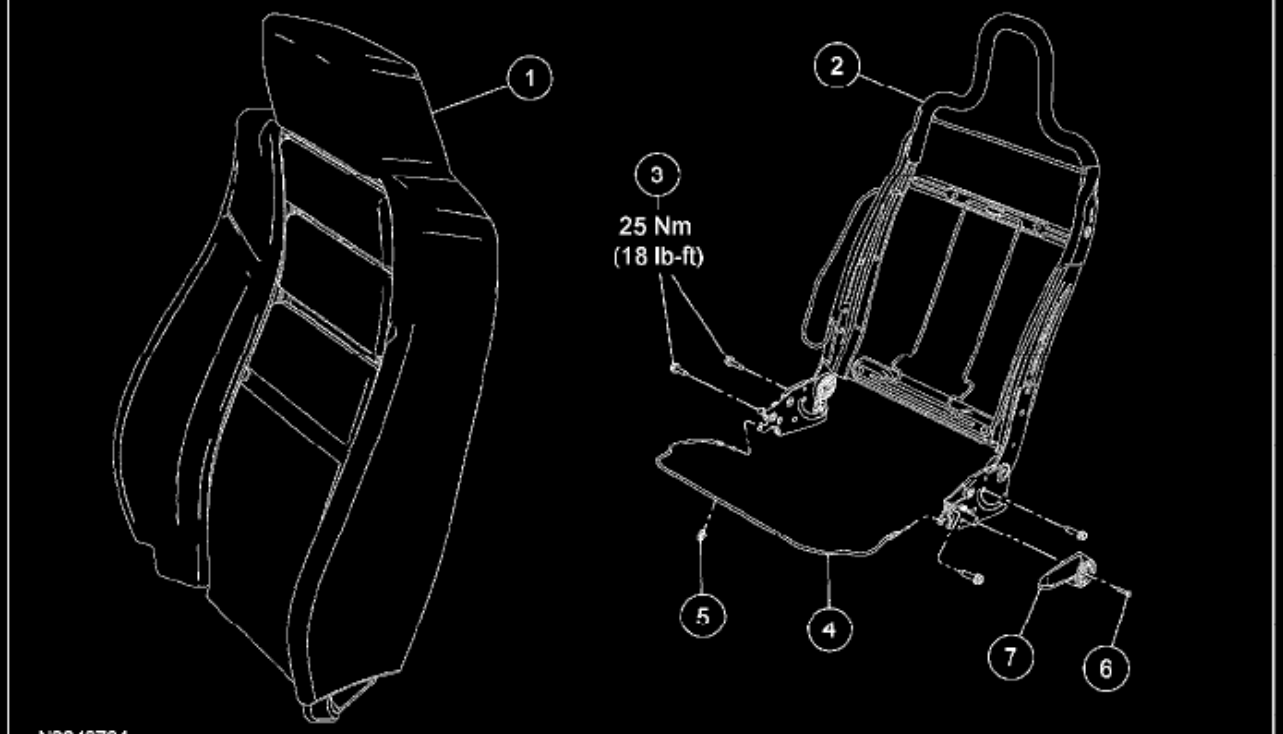
Seat Track: Service and Repair Seat Track - Bucket and 40 Percent

SEAT TRACK - BUCKET AND 40 PERCENT

Exploded View

Seat Backrest, Front, 40 Percent

Seat Backrest, Front, 60 Percent

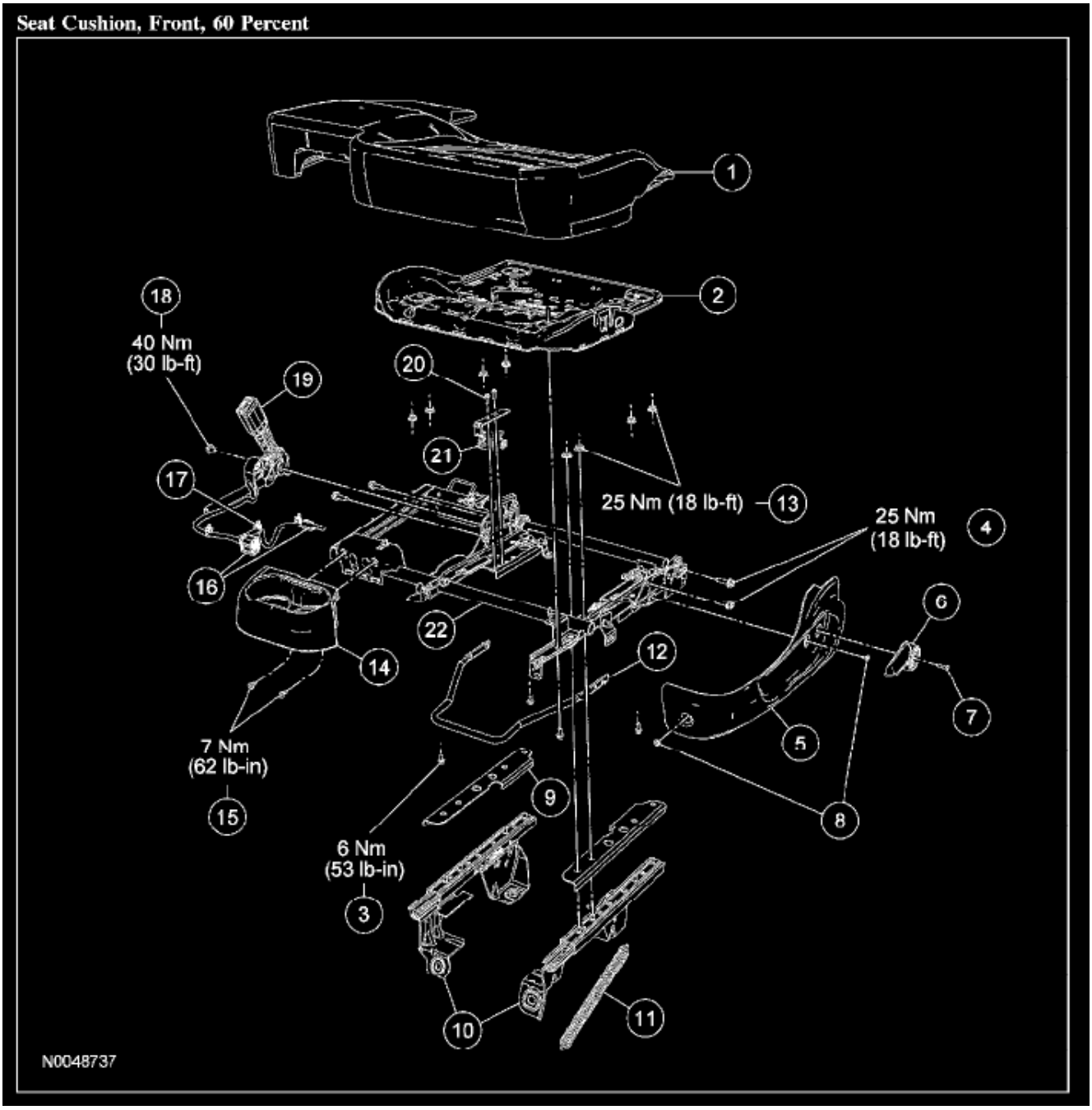


Item	Part Number	Description
1	64416/64810	Backrest trim cover/foam pad
2	61018	Backrest frame
3	60108	Backrest-to-cushion bolts (4 required)
4	624A54	Backrest latch release cable

Item	Part Number	Description
5	—	Pin-type retainer
6	56904	Recliner handle screw
7	610A77	Recliner handle

(Continued)

Seat Backrest, Front, 60 Percent



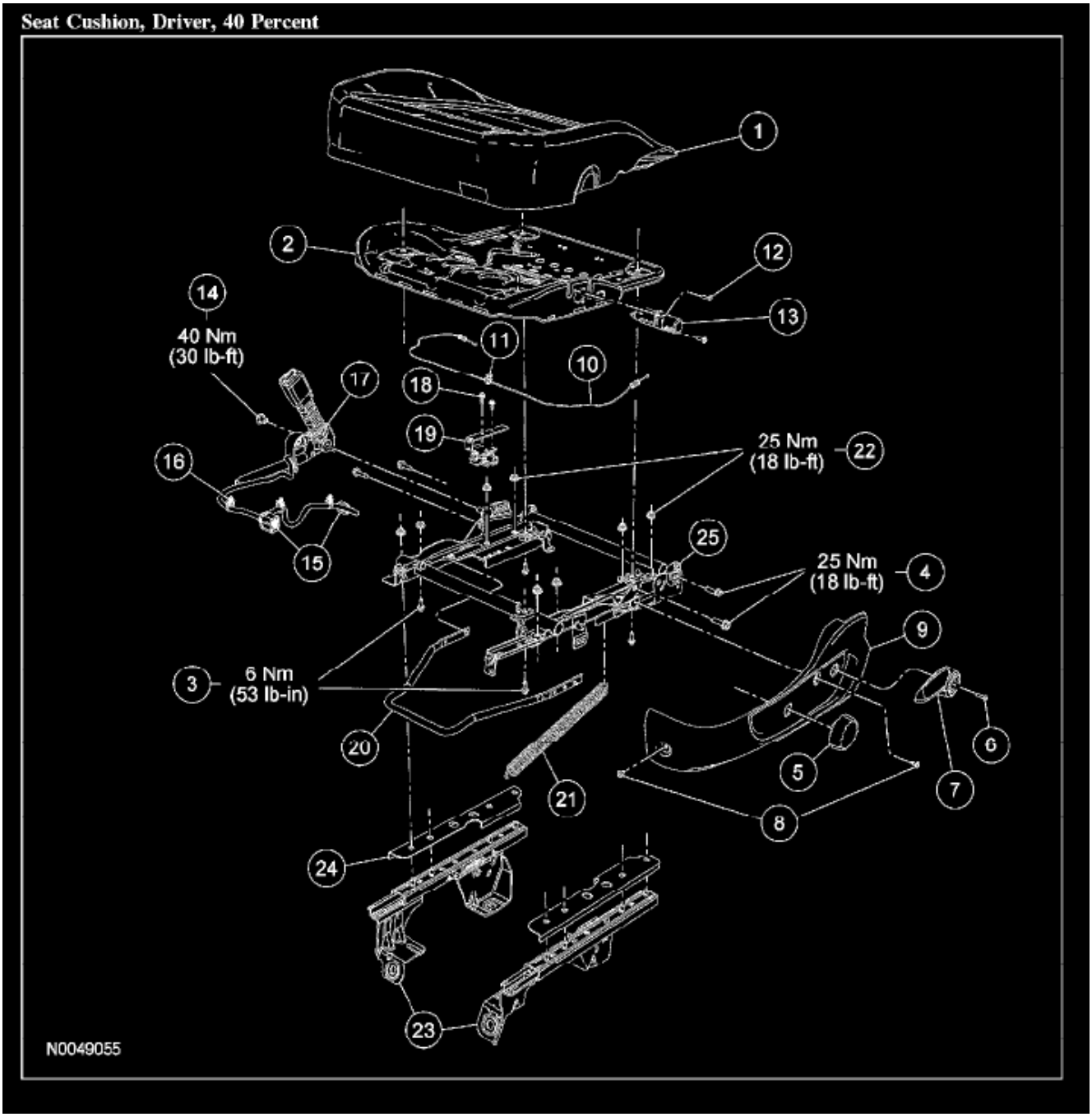
Seat Cushion, Front, 60 Percent (Part 1)

Item	Part Number	Description
1	62900/632A22	Cushion trim cover/foam pad
2	63100	Cushion frame
3	60108	Seat track-to-cushion frame bolt (4 required)
4	60108	Backrest-to-cushion bolts (4 required)
5	62186	Cushion side shield
6	61736	Recliner handle
7	55927	Recliner handle screw
8	000A25	Side shield screws (2 required)
9	617A46	Seat track reinforcement (2 required)
10	61704/61705	Seat track rails
11	61828	Seat track assist spring
12	61736	Seat track adjustment handle
13	W520413	Rail-to-seat track nuts (8 required)

(Continued)

Item	Part Number	Description
14	—	Cup holder
15	000A25	Cup holder mounting screws (2 required)
16	—	Electrical connectors (part of 61203)
17	—	Pin-type retainer (3 required)
18	000A25	Safety belt buckle pretensioner nut
19	61203	Safety belt buckle pretensioner
20	—	Seat position sensor and bracket screw (2 required)
21	14B416	Seat position sensor and bracket
22	613B20	Seat track

Seat Cushion, Front, 60 Percent (Part 2)



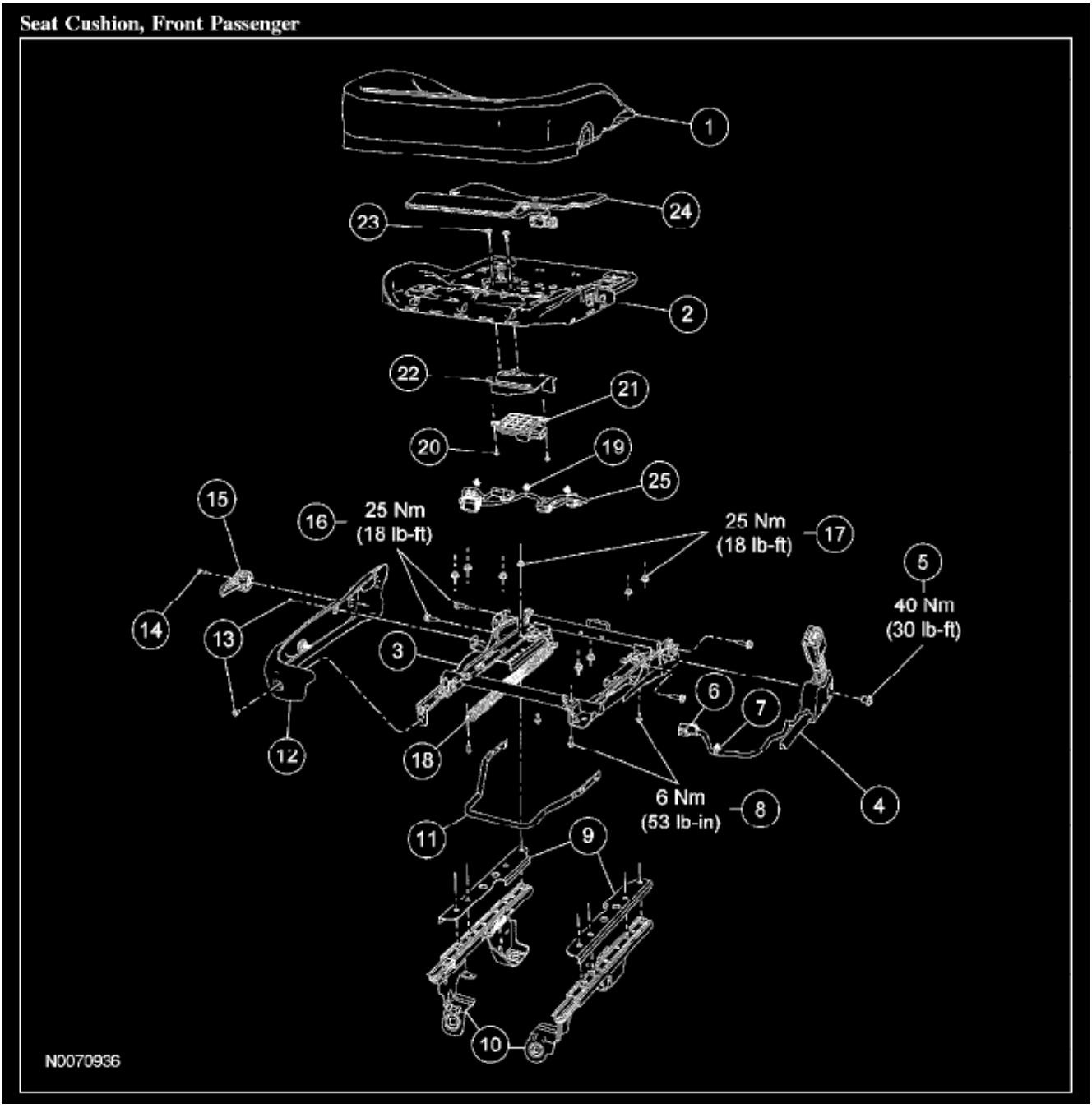
Seat Cushion, Driver, 40 Percent (Part 1)

Item	Part Number	Description
1	62900/632A22	Cushion trim cover/foam pad
2	63100	Cushion frame
3	60108	Seat track-to-cushion frame bolts (4 required)
4	60108	Backrest-to-cushion bolts (4 required)
5	61198	Lumbar adjustment knob
6	55927	Recliner handle screw
7	61736	Recliner handle
8	000A25	Side shield screws (2 required)
9	62186	Cushion side shield
10	624A54	Backrest latch release cable
11	—	Pin-type retainer
12	000A25	Lumbar actuator screw (2 required)
13	610C00	Lumbar actuator
14	000A25	Safety belt buckle pretensioner nut

(Continued)

Item	Part Number	Description
15	—	Electrical connectors (part of 61203)
16	—	Pin-type retainer (3 required)
17	61203	Safety belt buckle pretensioner
18	—	Seat position sensor screw (2 required)
19	14B416	Seat track position sensor
20	61736	Seat track adjustment handle
21	61828	Seat track assist spring
22	W520413	Rail-to-seat track nuts (8 required)
23	61704/61705	Seat track rails
24	617A46	Seat track reinforcement (2 required)
25	620B20	Seat track

Seat Cushion, Driver, 40 Percent (Part 2)



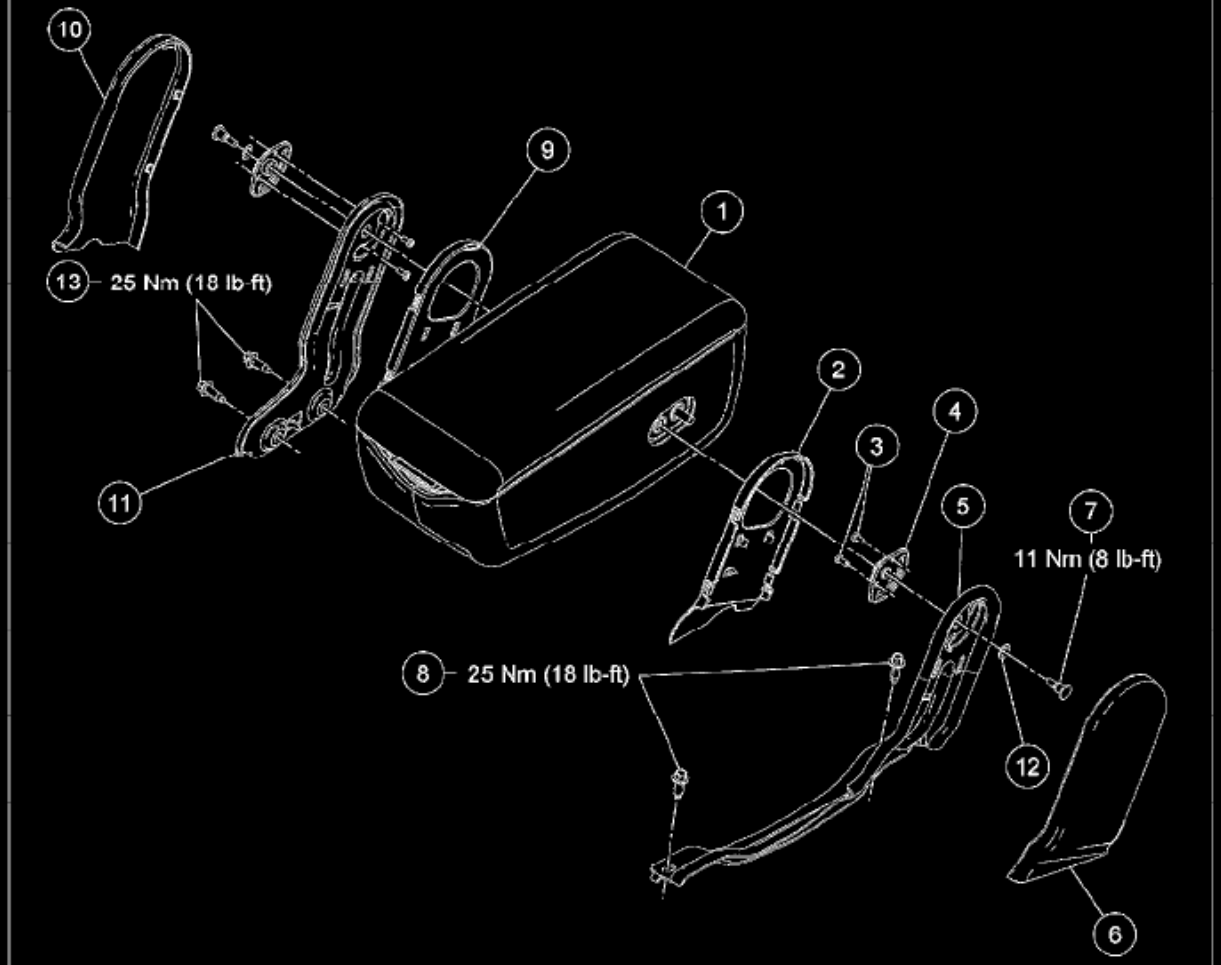
Seat Cushion, Front Passenger (Part 1)

Item	Part Number	Description
1	62900/603B02	Cushion trim cover/foam pad
2	63100	Cushion frame
3	613B20	Seat track
4	61202	Safety belt buckle pretensioner
5	000A25	Safety belt buckle pretensioner nut
6	—	Electrical connector (part of 61202)
7	—	Pin-type retainer
8	60108	Seat track-to-cushion frame bolts (4 required)
9	617A46	Seat track reinforcements
10	61704/61705	Seat track rails
11	61736	Seat track adjustment handle
12	62186	Cushion side shield
13	000A25	Side shield screws (2 required)
14	55927	Recliner handle screw
15	61736	Recliner handle
16	60108	Backrest-to-cushion bolts (4 required)
17	W520413	Rail-to-seat track nuts (8 required)
18	61828	Seat track assist spring
19	—	Pin-type retainer (3 required)
20	—	Screw (2 required)
21	—	Occupant classification system module (OCSM) (part of 603B02)
22	—	OCSM bracket
23	—	Screw (2 required)
24	—	OCS (bladder, hose with pressure sensor, OCSM and seat wiring harness) (part of 603B02)
25	14C719	Wiring harness

(Continued)

Seat Cushion, Front Passenger (Part 2)

Seat Armrest, Front, 60 Percent



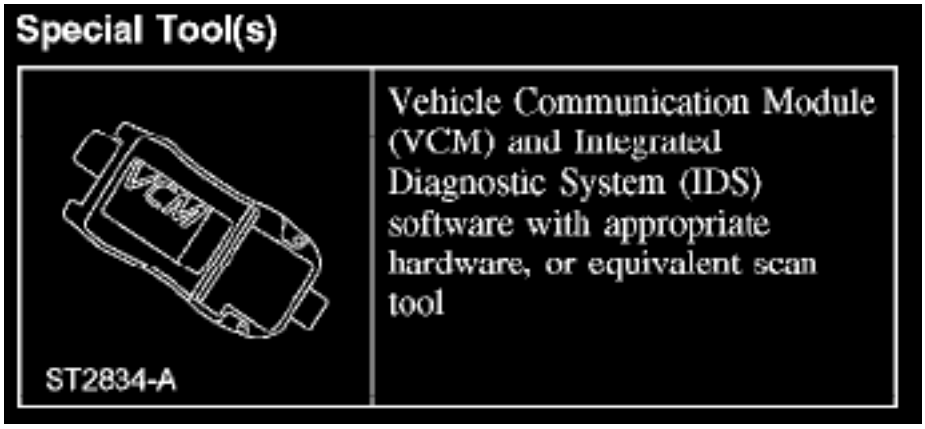
Item	Part Number	Description
1	644A22	Armrest
2	672A28B	LH inner trim cover
3	—	Pivot bracket screws (4 required)
4	63076C	Pivot bracket (2 required)
5	63076A	LH armrest bracket
6	672A28A	LH outer trim cover
7	—	Armrest pivot bolts (2 required)
8	—	LH armrest bracket-to-seat frame bolts (2 required)

Item	Part Number	Description
9	672A28B	RH inner trim cover
10	672A28A	RH outer trim cover
11	63076B	RH armrest bracket
12	—	Washer (2 required)
13	—	RH armrest bracket-to-seat frame bolts (2 required)

(Continued)

Seat Armrest, Front, 60 Percent

Special Tool(s)



Special Tool(s)

Removal

WARNING: -

Never probe the electrical connectors on safety belt buckle/retractor pretensioners or adaptive load limiting retractors. Failure to follow this instruction may result in the accidental deployment of the safety belt pretensioners or adaptive load limiting retractors, which increases the risk of serious personal injury or death.

- Make sure the front passenger seat repair is complete, the seat and all attached components (head restraint, seat side shield, etc.) are correctly assembled, and the seat is correctly installed to the vehicle before carrying out the System Reset. Failure to follow these instructions may result in incorrect operation of the occupant classification sensor (OCS) system and increases the risk of serious personal injury or death in a crash.

CAUTION: To prevent system failure, it is necessary to carry out the occupant classification sensor (OCS) system reset when a front passenger seat cushion is disassembled, a new trim cover installed or an OCS system service kit is installed. A scan tool is used to carry out the OCS system reset command.

NOTE: -

Occupant classification sensor (OCS) system components (seat cushion foam pad, bladder with pressure sensor and occupant classification system module [OCSM]) are calibrated to each other and are serviced as an assembly. The OCS system components are not to be installed separately. If a new OCS system, OCS system component or seat cushion foam pad are needed, a new OCS system service kit (seat cushion foam pad, bladder with pressure sensor, OCSM and seat wiring harness) must be installed as an assembly.

- To identify between a production occupant classification sensor (OCS) system and a OCS system service kit, inspect the occupant classification system module (OCSM) electrical connector.

A production OCS system allows the disconnection of the OCSM electrical connector.

An OCS system service kit has the electrical connector glued to the module, it cannot and should not be disconnected or altered.

- The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

- The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

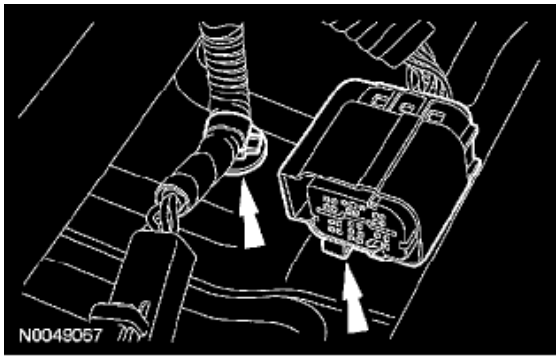
- When installing a new OCS system service kit, refer to Air Bag Systems for the OCS removal and installation procedure.

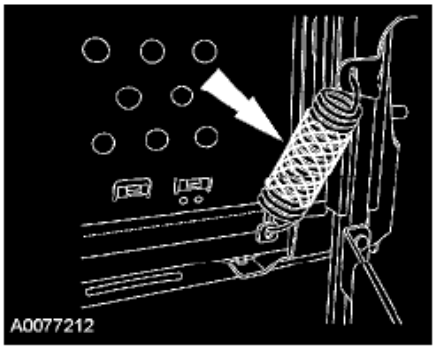
All seats 1. Remove the affected seat. 2. Remove the affected seat backrest assembly.

Passenger seat

3. NOTE: Note position of wire routing for installation.

Release the seat wiring harness retainer clip and detach the seat wiring harness connector from the seat cushion frame.


N0049057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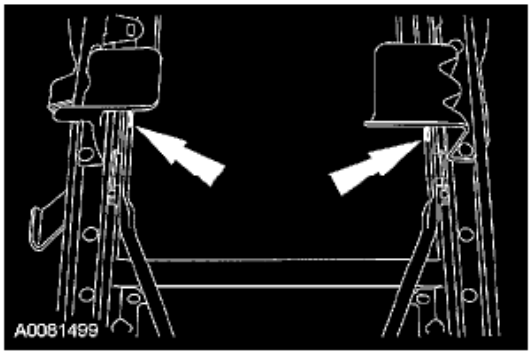
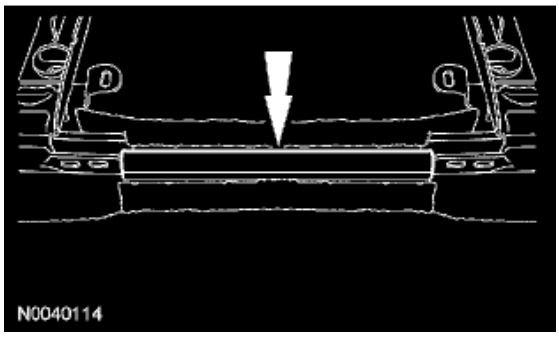

A0081499


N0040114

All seats 4. Remove the seat track assist spring.

5. Remove the 4 seat track-to-cushion frame bolts and remove the cushion assembly. 6. Remove the seat track adjustment handle.

- Remove one side of the seat track adjustment handle at a time.

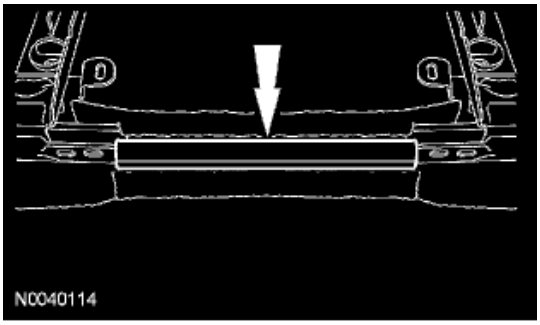
7. Release the cushion trim cover rear J-clip.

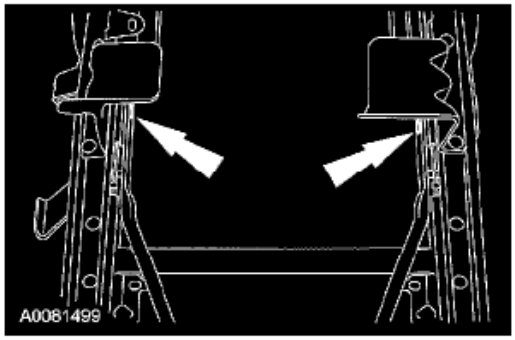
8. Remove the 8 rail-to-seat track nuts and separate the seat track rails from the seat track.

Installation

All seats 1. Install the seat track rails to the seat track and install the 8 nuts.

- Tighten to 25 Nm (18 lb-ft).


N0040114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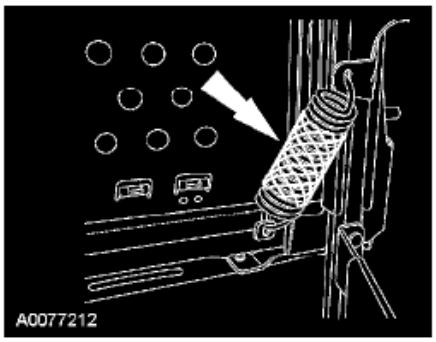
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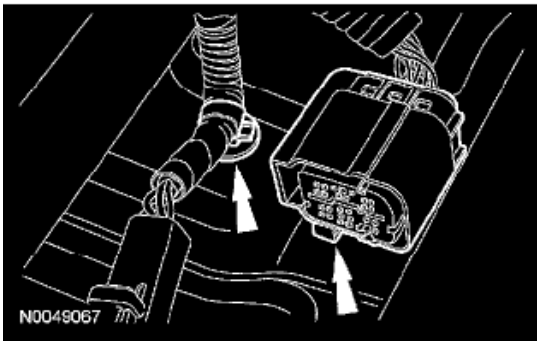

N0049067

2. Fasten the cushion trim cover rear J-clip.

3. Install the seat track adjustment handle.

- Install one side of the seat track adjustment handle at a time.

4. Install the seat track to the cushion assembly and install the 4 seat track-to-cushion frame bolts.

- Tighten to 6 Nm (53 lb-in).

5. Install the seat track spring.

Passenger seat 6. Install the seat wiring harness retainer clip and attach the seat wiring harness connector to the seat cushion frame.

All seats 7. Attach the cushion trim cover rear J-clip.

8. Install the affected seat backrest assembly. 9. Install the seat. If a passenger seat has been serviced, do not prove out the SRS at this time.

Passenger seat

10. WARNING:

- Install a new occupant classification sensor (OCS) system service kit as a complete assembly. Never install only part of the kit components. Failure to follow this instruction may result in incorrect operation of the OCS system and increases the risk of serious personal injury or death in a crash.

- Make sure the front passenger seat repair is complete, the seat and all attached components (head restraint, seat side shield, etc.) are correctly assembled, and the seat is correctly installed to the vehicle before carrying out the System Reset. Failure to follow these instructions may result in incorrect operation of the occupant classification sensor (OCS) system and increases the risk of serious personal injury or death in a crash.

CAUTION: -

To prevent system failure, it is necessary to carry out the occupant classification sensor (OCS) system reset when a front passenger seat cushion is disassembled, a new trim cover installed or an OCS system service kit is installed. A scan tool is used to carry out the OCS system reset command.

- To prevent system failure, the following precautions must be taken before carrying out the occupant classification sensor (OCS) system reset: -

Make sure the voltage to the occupant classification system module (OCSM) is above 8.0 volts and less than 18.0 volts.

- Make sure the OCS system is not at a temperature below 6°C (42°F) or above 36°C (97°F) when initiating the OCS system reset process. If the vehicle has been exposed to extreme cold or hot temperatures, the vehicle must be exposed and kept at a temperature within the limits, 6°C to 36°C (42°F to 97°F) for a minimum of 30 minutes.

- Make sure nothing is present on the passenger seat before carrying out the OCS system reset and nothing is placed on the seat during the process.

- Make sure a minimum 8-second time period has passed after cycling the ignition switch ON before the carrying out the OCS system reset process.

NOTE: If the first attempt to carry out the occupant classification sensor (OCS) system reset is unsuccessful, a second attempt must be made. If the second attempt is unsuccessful, a new OCS system service kit must be installed.

Carry out the OCS system reset active command.

11. NOTE: The ignition switch must be cycled after the OCS system reset.

Cycle the ignition switch from ON to OFF.

All seats 12. Prove out the SRS as follows:

Turn the ignition key from ON to OFF. Wait 10 seconds, then turn the key back to ON and visually monitor the air bag warning indicator with the air bag modules installed. The air bag warning indicator will light continuously for approximately 6 seconds and then turn off. If an SRS fault is present, the air bag warning indicator will: -

fail to light.

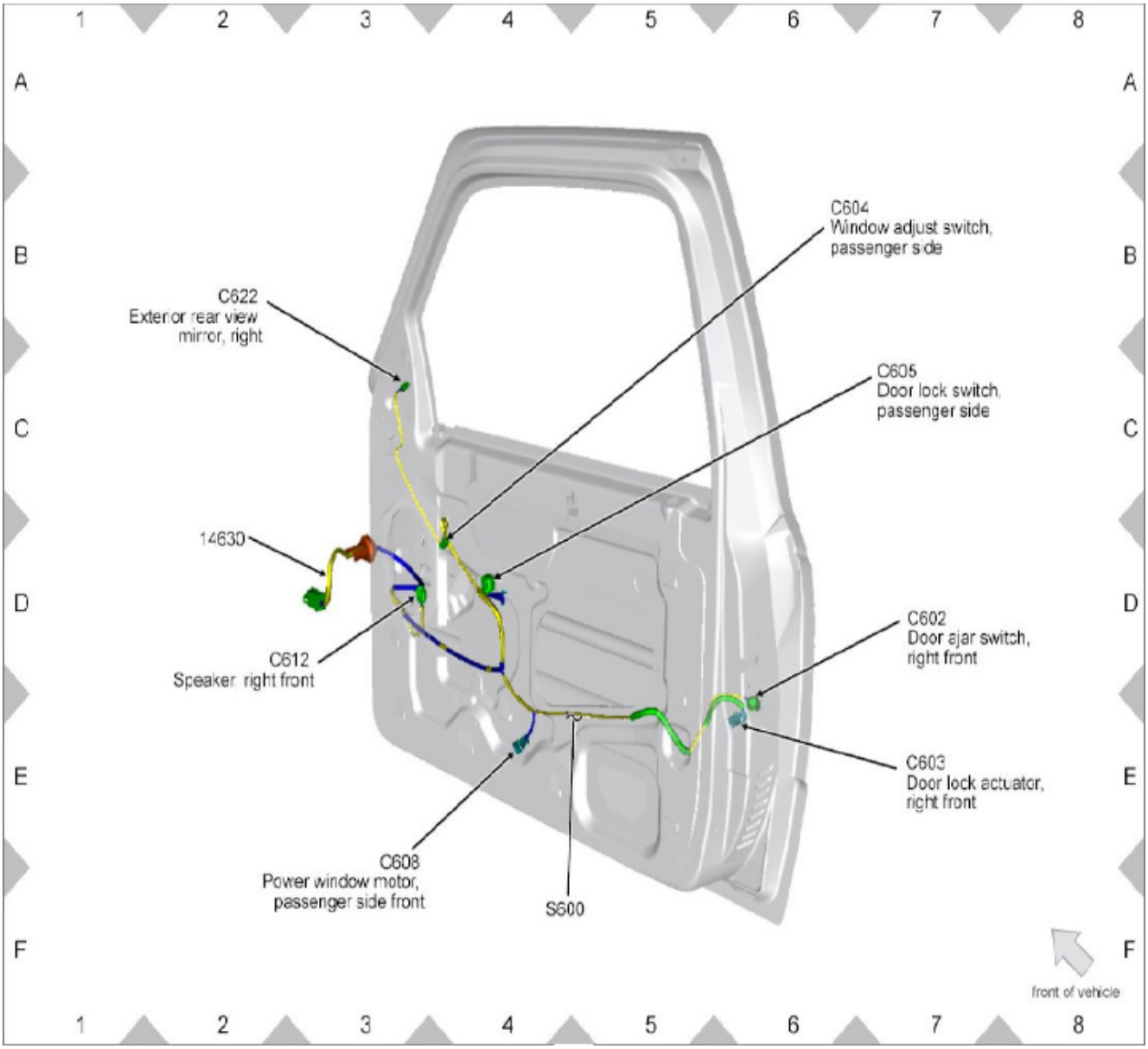
- remain lit continuously.

- flash at a 5Hz rate (RCM not configured).

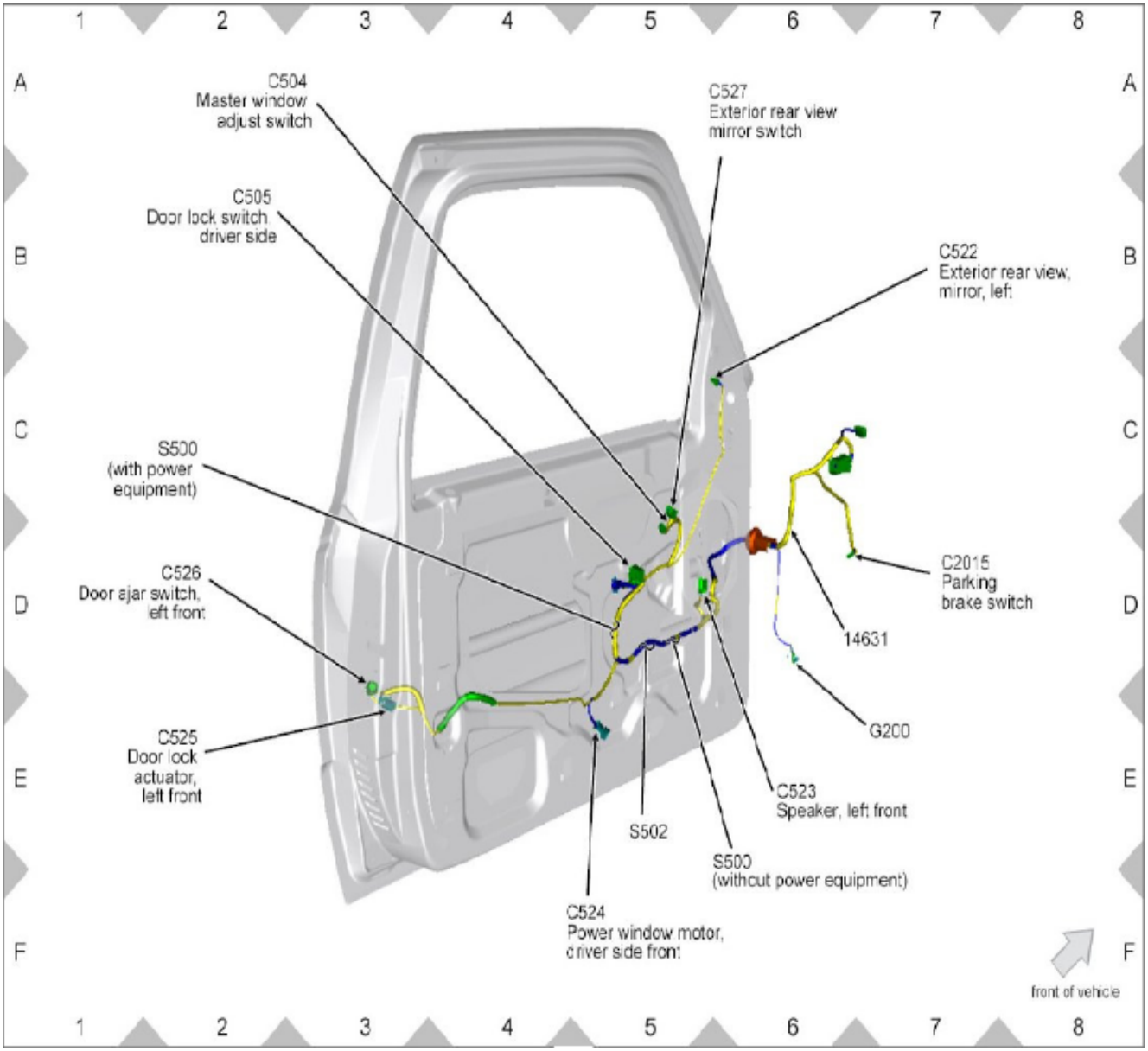
The air bag warning indicator may not illuminate until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON position. This is the time required for the RCM to complete the testing of the SRS. If the air bag warning indicator is inoperative and a SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag warning indicator and any SRS fault discovered must be diagnosed and repaired.

Clear all continuous RCM and occupant classification system module (OCSM) DTCs using a scan tool.

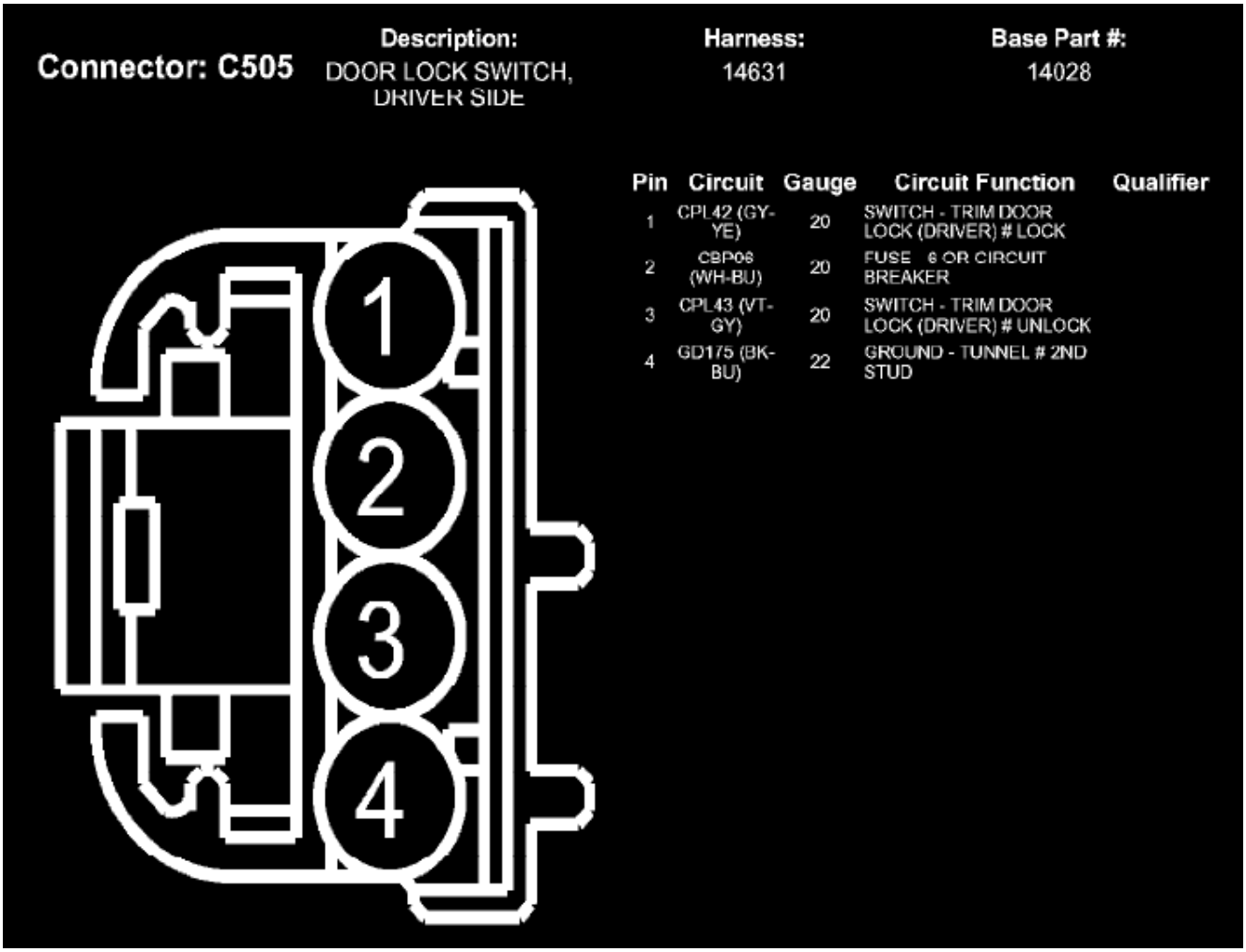
Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Body and Frame > Sensors and Switches - Body and Frame > Power Door Lock Switch > Component Information > Locations > Door Lock Switch, Passenger Side



View 151-21

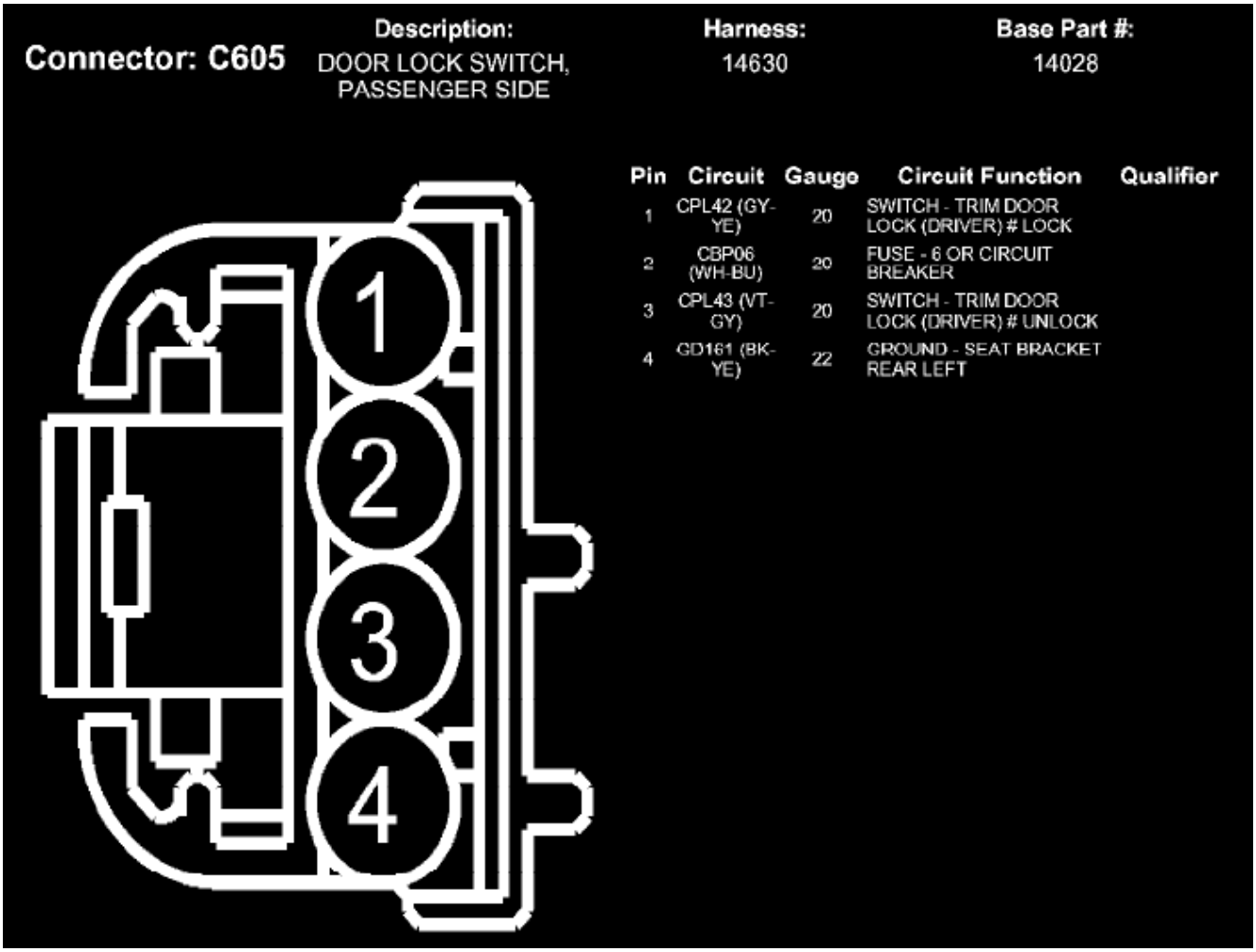

C504
Master window adjust switch
C505
Door lock switch driver side
S500
(with power equipment)
C526
Door ajar switch, left front
C525
Door lock actuator, left front
C524
Power window motor, driver side front
C527
Exterior rear view mirror switch
C522
Exterior rear view mirror, left
C2015
Parking brake switch
14631
G200
C523
Speaker, left front
S502
S500
(without power equipment)
front of vehicle

View 151-20



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPL42 (GY-YE)	20	SWITCH - TRIM DOOR LOCK (DRIVER) # LOCK	
2	CBP06 (WH-BU)	20	FUSE 6 OR CIRCUIT BREAKER	
3	CPL43 (VT-GY)	20	SWITCH - TRIM DOOR LOCK (DRIVER) # UNLOCK	
4	GD175 (BK-BU)	22	GROUND - TUNNEL # 2ND STUD	

C505



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPL42 (GY-YE)	20	SWITCH - TRIM DOOR LOCK (DRIVER) # LOCK	
2	CBP06 (WH-BU)	20	FUSE - 6 OR CIRCUIT BREAKER	
3	CPL43 (VT-GY)	20	SWITCH - TRIM DOOR LOCK (DRIVER) # UNLOCK	
4	GD161 (BK-YE)	22	GROUND - SEAT BRACKET REAR LEFT	

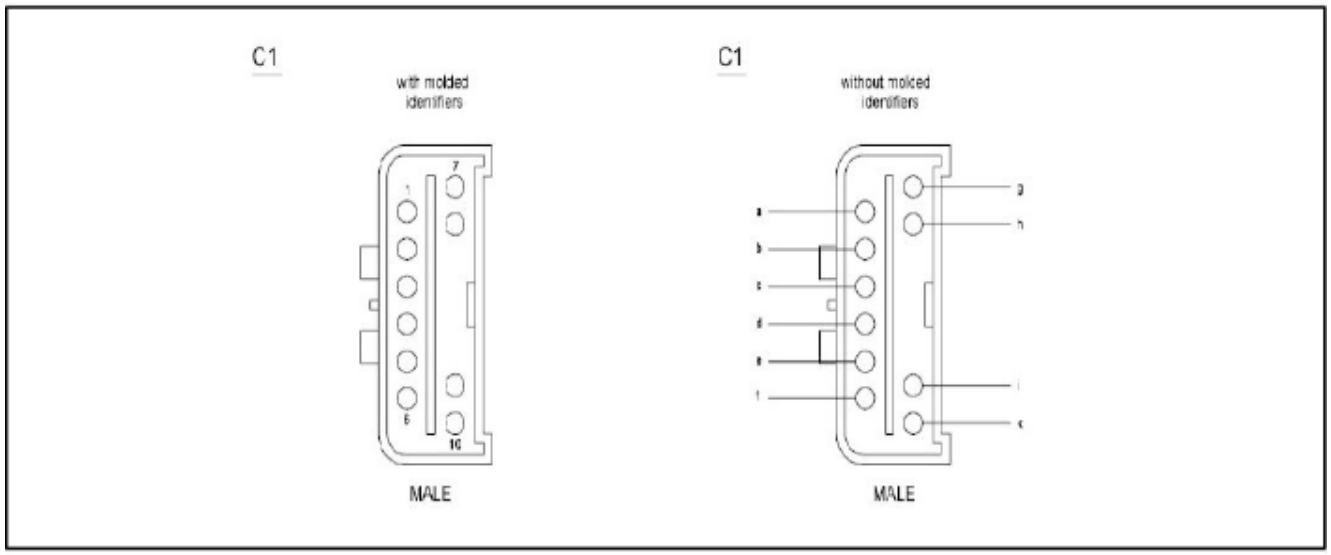
C605

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



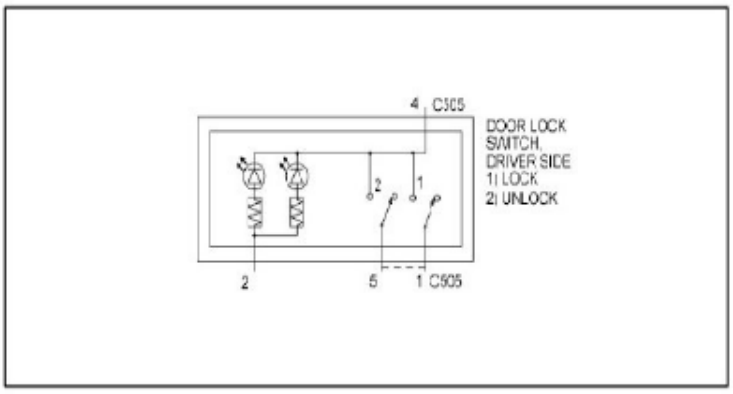
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

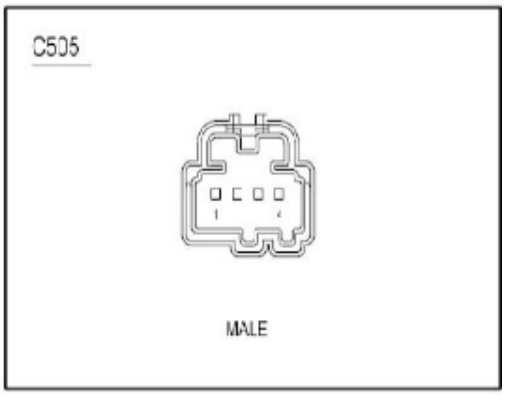
Power Door Lock Switch: Testing and Inspection Door Lock Switch, Driver Side

Door lock switch, Driver side

Schematic



Terminals



Component testing procedure

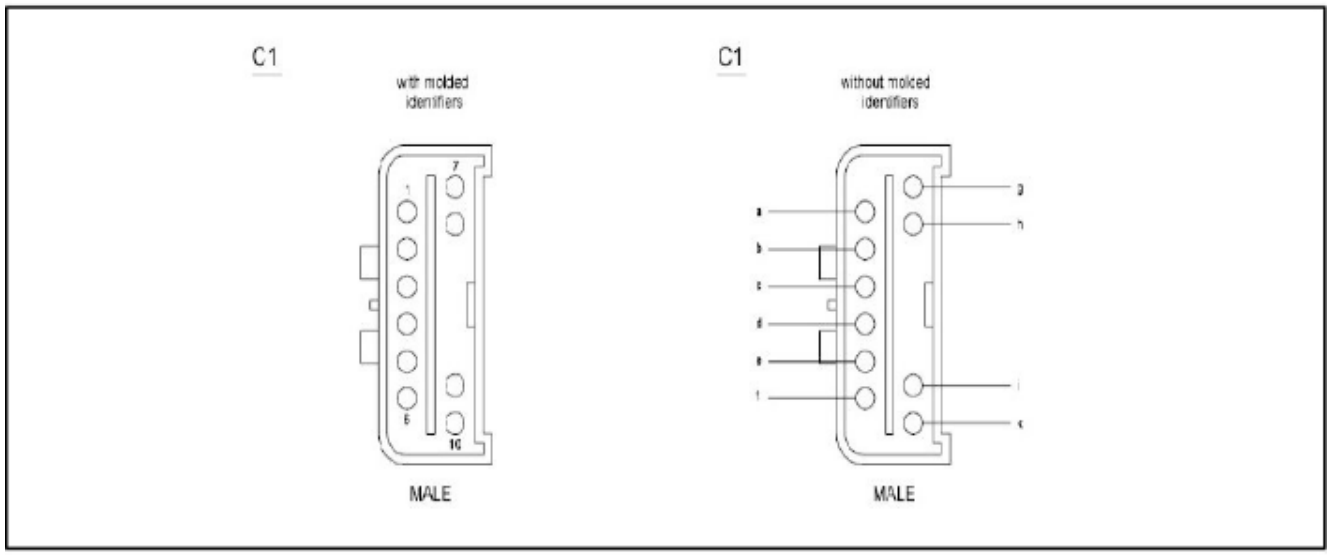
Circuit to test	Connect self-powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
Door lock switch	1 and 4	Lock	Closed circuit
		Unlock	Open circuit
		Neutral	Open circuit
	5 and 4	Lock	Open circuit
		Unlock	Closed circuit
		Neutral	Open circuit

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



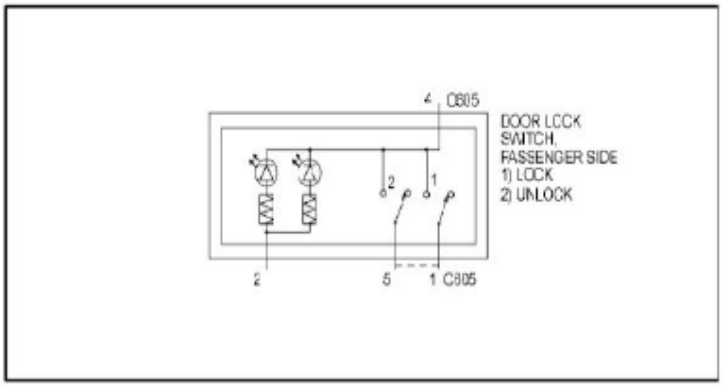
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

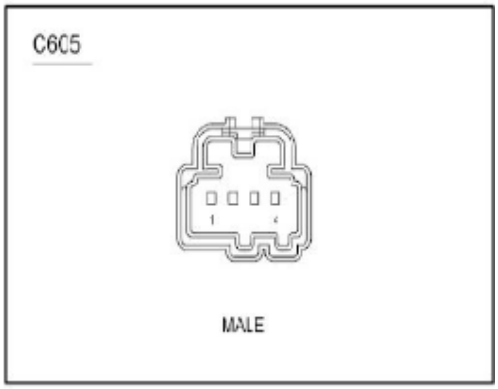
Power Door Lock Switch: Testing and Inspection Door Lock Switch, Passenger Side

Door lock switch, Passenger side

Schematic



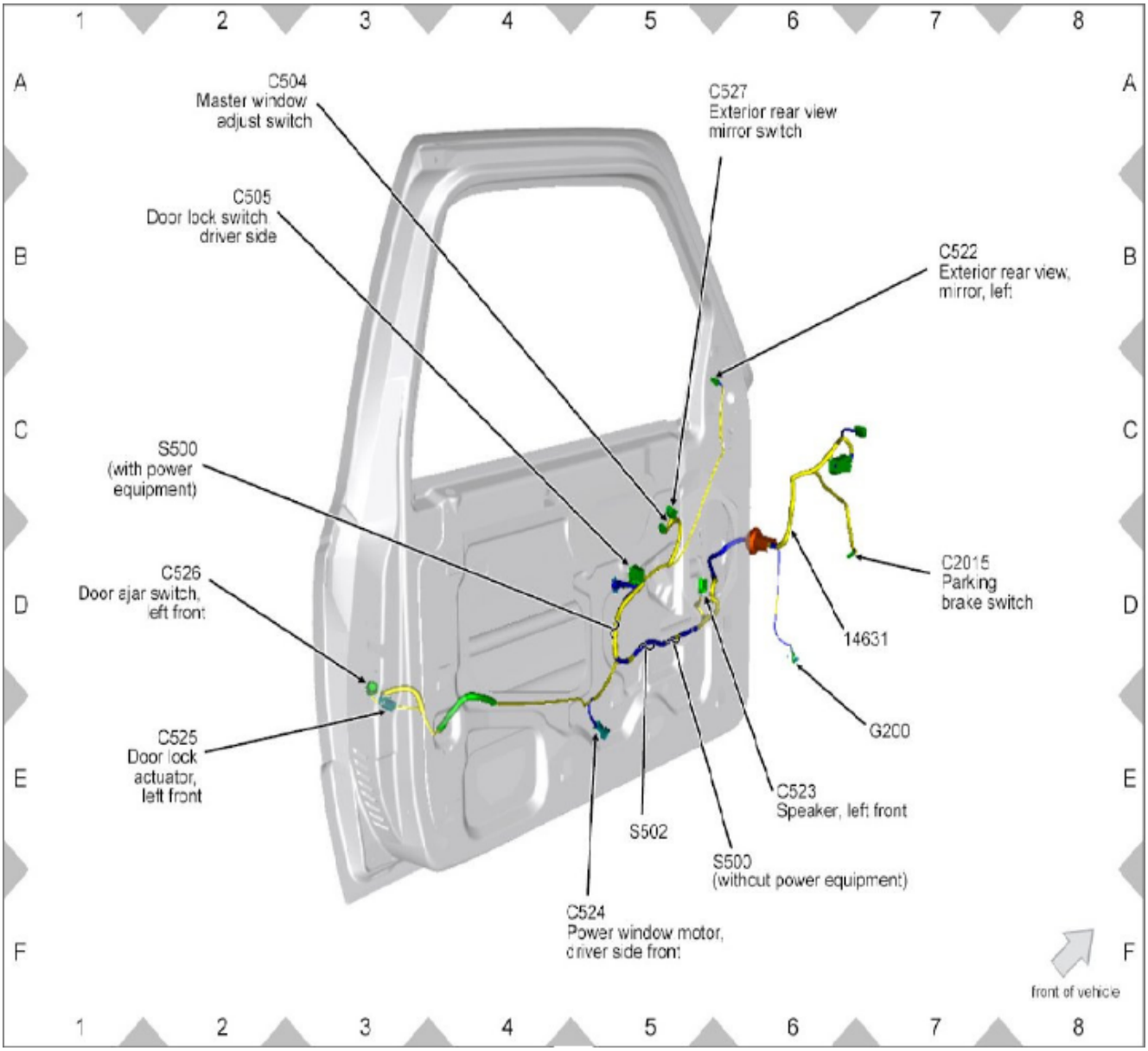
Terminals



Component testing procedure

Circuit to test	Connect self-powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
Door lock switch	1 and 4	Lock	Closed circuit
		Unlock	Open circuit
		Neutral	Open circuit
	5 and 4	Lock	Open circuit
		Unlock	Closed circuit
		Neutral	Open circuit

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Body and Frame > Sensors and Switches - Body and Frame > Power Mirror Switch > Component Information > Locations



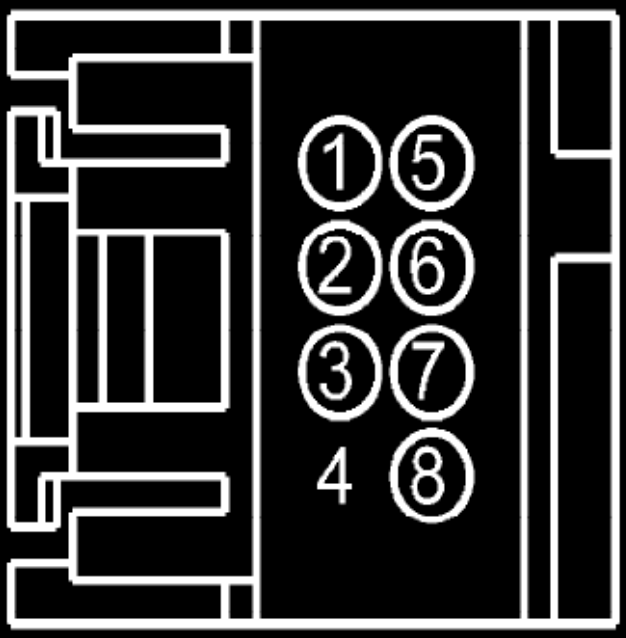
View 151-20

Connector: C527

Description: EXTERIOR REAR VIEW MIRROR SWITCH

Harness: 14631

Base Part #: 17B676



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD175 (BK-BU)	22	GROUND - TUNNEL # 2ND STUD	
2	CPM15 (VT-OG)	22	SWITCH - POWER MIRROR # LEFT MIRROR LEFTWARD (IF PLUS)	
3	SBP30 (BN-RD)	22	FUSE - 30 OR CIRCUIT BREAKER	
4	*	*	not used	
5	CPM19 (GY-OG)	22	SWITCH - POWER MIRROR # RIGHT MIRROR LEFTWARD (IF PLUS)	
6	CPM23 (GY)	22	SWITCH - POWER MIRROR # COMMON ALL MOTORS (LEFT AND RIGHT)	
7	CPM17 (BU-GN)	22	SWITCH - POWER MIRROR # LEFT MIRROR UPWARD (IF PLUS)	
8	CPM21 (YE-VT)	22	SWITCH - POWER MIRROR # RIGHT MIRROR UPWARD (IF PLUS)	

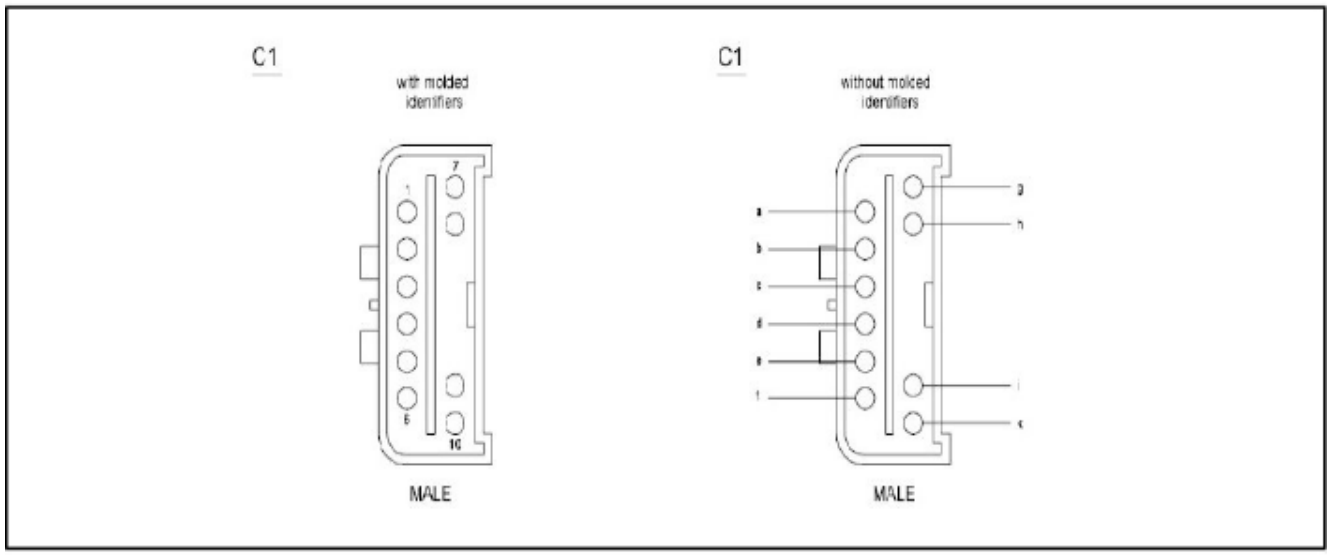
C527

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



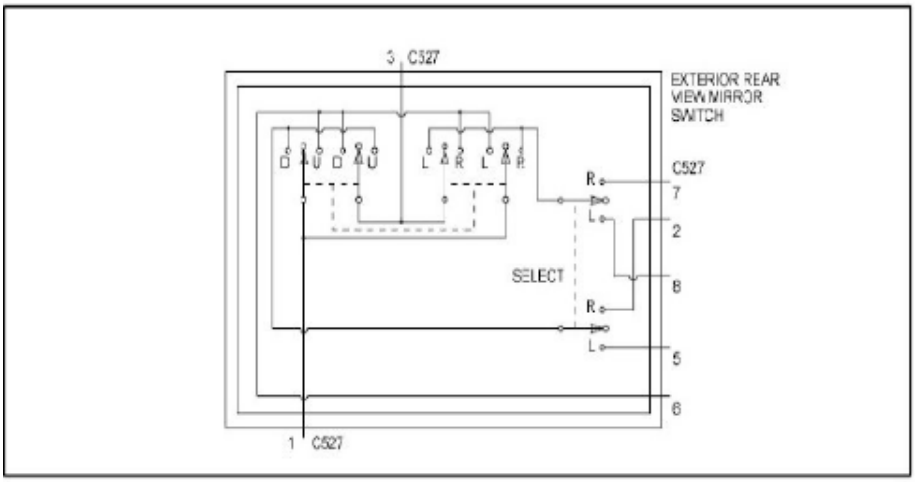
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

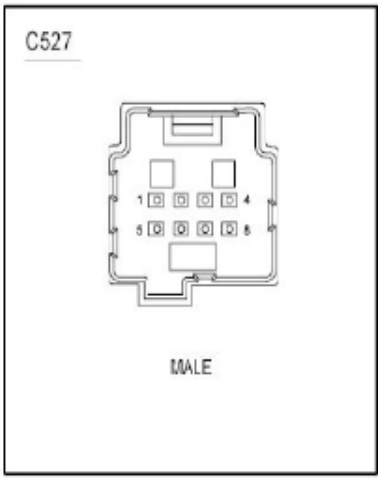
Power Mirror Switch: Testing and Inspection

Exterior rear view mirror switch

Schematic

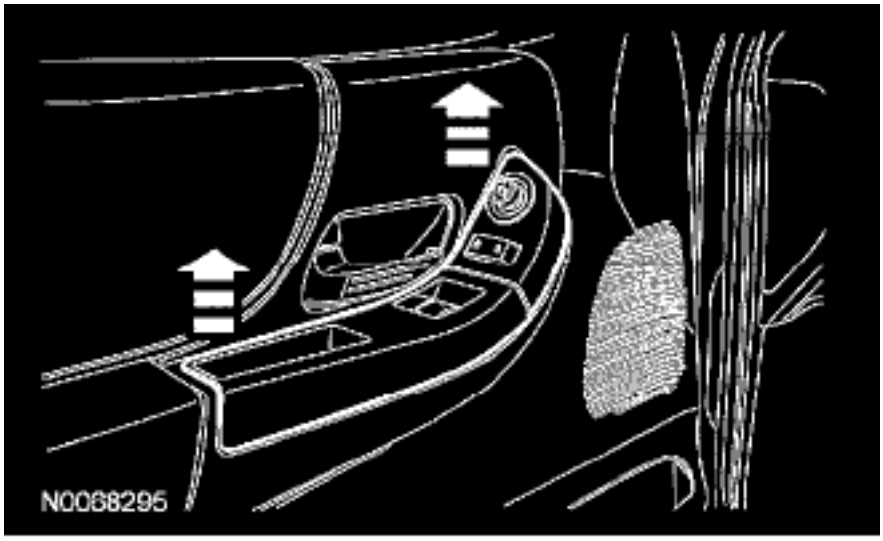


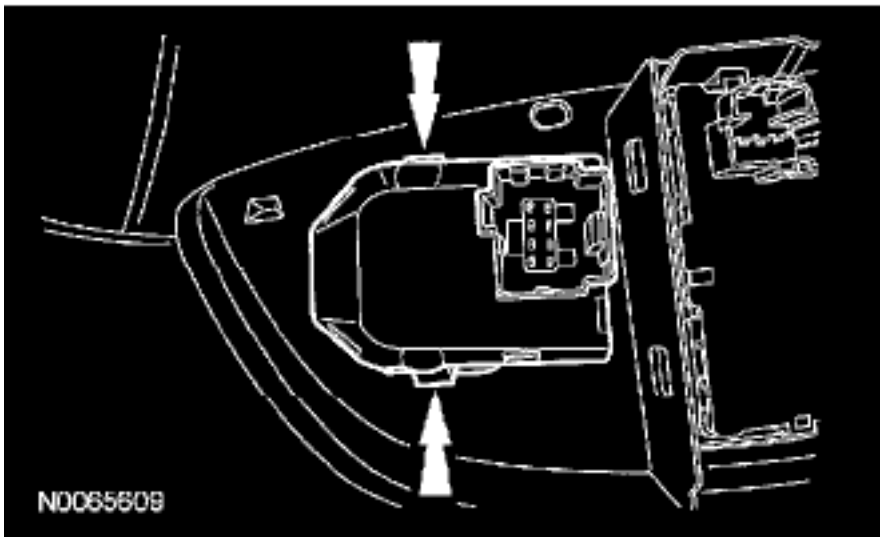
Terminals



Component testing procedure

Circuit to test		Connect self-powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
Left mirror	Up	3 and 5 6 and 1	Selector switch left Adjuster switch up	Closed circuit
	Down	3 and 6 5 and 1	Selector switch left Adjuster switch down	Closed circuit
	Left	3 and 8 6 and 1	Selector switch left Adjuster switch left	Closed circuit
	Right	3 and 6 8 and 1	Selector switch left Adjuster switch right	Closed circuit
Right mirror	Up	3 and 2 6 and 1	Selector switch right Adjuster switch up	Closed circuit
	Down	3 and 6 2 and 1	Selector switch right Adjuster switch down	Closed circuit
	Left	3 and 7 6 and 1	Selector switch right Adjuster switch left	Closed circuit
	Right	3 and 6 7 and 1	Selector switch right Adjuster switch right	Closed circuit





Power Mirror Switch: Service and Repair

EXTERIOR MIRROR CONTROL SWITCH

Removal and Installation

1. Remove the 2 interior door handle trim panel screws. 2. Remove the interior door handle trim panel.

- Lift the interior door handle trim panel upward to release the interior door handle trim panel retaining clips.

3. Remove the exterior mirror control switch.

- Disconnect the electrical connector.

- Press the 2 exterior mirror control switch retaining tabs.

- Remove the exterior mirror control switch from the interior door handle trim panel.

4. To install, reverse the removal procedure.

Sound Proofing / Insulation: Description and Operation

INSULATION

Insulation is used as a sound-deadener to reduce exterior road and powertrain noises from the interior of the vehicle. Mastic insulators are also used as insulation. For information on the location of the mastic insulators, refer to Sound Proofing / Insulation. Insulation is installed:

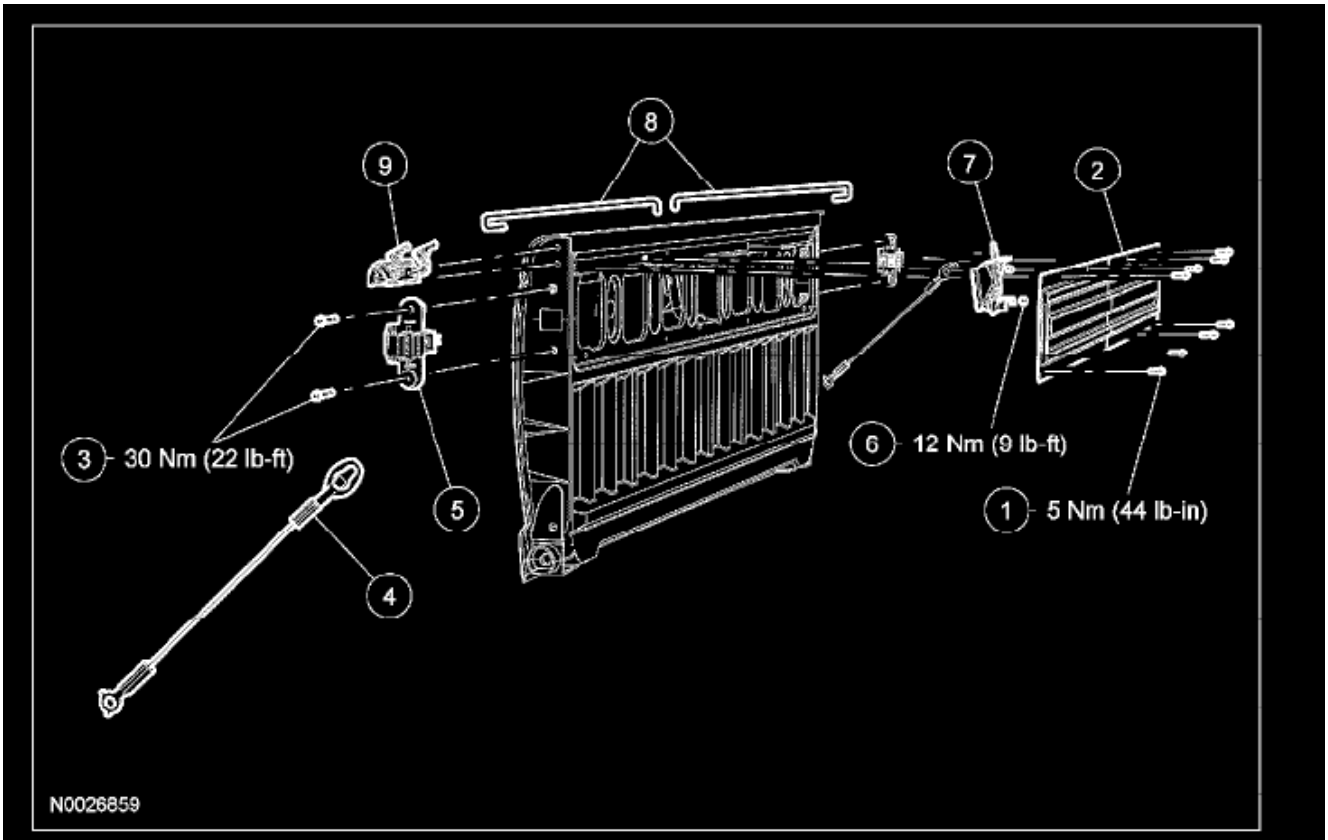
- under the roof.

- above and below the instrument panel.

- at the cowl side panels.

- over the transmission tunnel.

- over the floor pans.



Item	Part Number	Description
1	N806149-S439	Tailgate access cover screws (8 required)
2	9943121	Tailgate access cover
3	W706729	Tailgate latch bolts (2 required)
4	9943052/ 9943053	Tailgate support cables (RH/LH)
5	9943150/ 9943151	Tailgate latch (RH/LH)

Item	Part Number	Description
6	N620480-S438	Tailgate latch remote control nuts (2 required)
7	9943170	Tailgate latch remote control
8	99431A78	Tailgate latch actuating rods (2 required)
9	9943400	Tailgate release handle

(Continued)

Tailgate Latch: Service and Repair

TAILGATE LATCH

Exploded View

Removal and Installation

1. Remove the 8 screws and the tailgate access cover.

- To install, tighten to 5 Nm (44 lb-in).

2. Open the tailgate latch actuating rod retainer and disconnect the tailgate latch actuating rods from the tailgate latch remote control. 3. Disconnect the tailgate support cables from the pickup bed strikers. 4. Remove the 2 tailgate latch bolts.

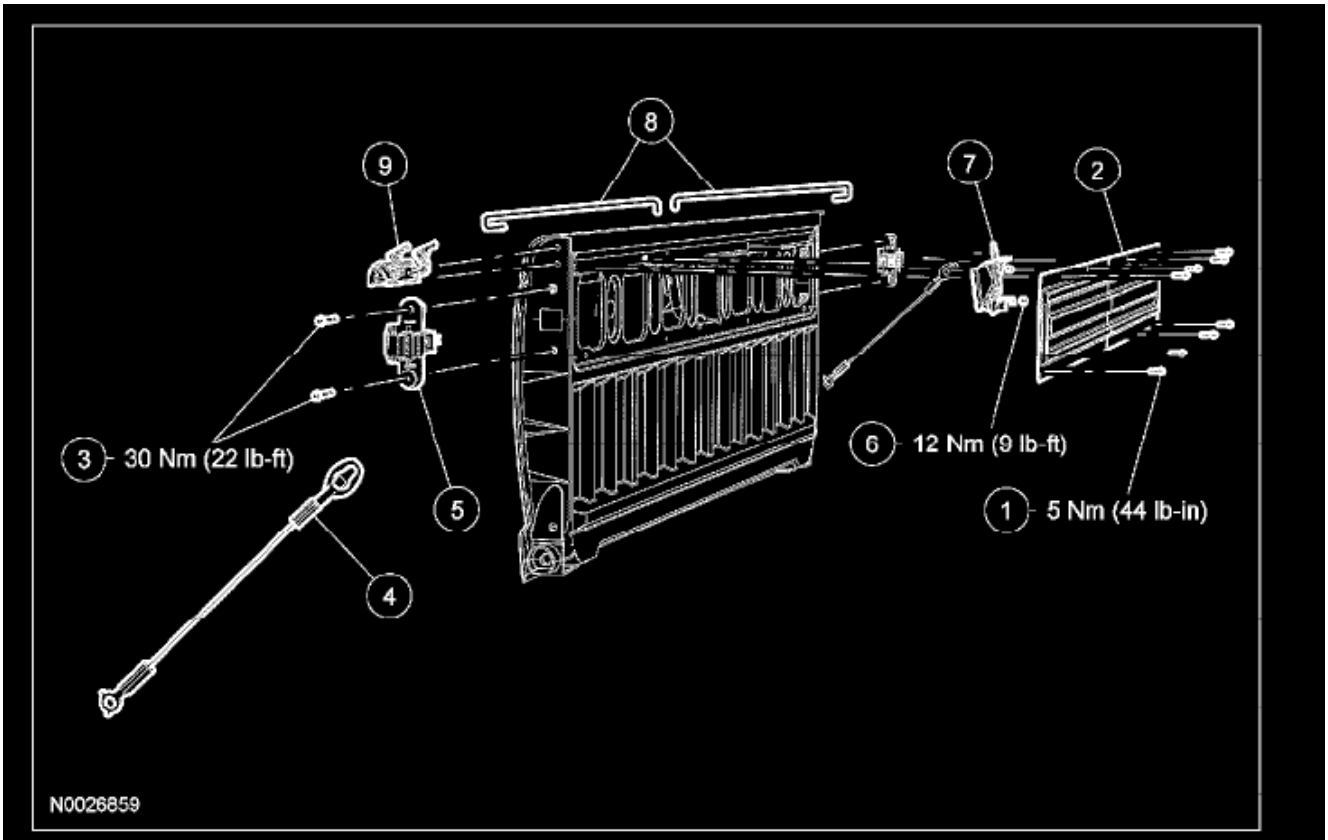
- To install, tighten to 30 Nm (22 lb-ft).

5. Position the tailgate latch aside. 6. Disconnect the tailgate latch actuating rod and remove the tailgate latch.

7. NOTE: Prior to installation, remove the slack in the tailgate latch release link by pulling the tailgate latch release link to the center of the tailgate.

Close the tailgate latch rod retainer over the thread of the tailgate latch release link.

To install, reverse the removal procedure.



Item	Part Number	Description
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2	9943121	Tailgate access cover
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5	9943150/ 9943151	Tailgate latch (RH/LH)

Item	Part Number	Description
6	N620480-S438	Tailgate latch remote control nuts (2 required)
7	9943170	Tailgate latch remote control
8	99431A78	Tailgate latch actuating rods (2 required)
9	9943400	Tailgate release handle

(Continued)

Tailgate Release Handle: Service and Repair

TAILGATE RELEASE HANDLE

Exploded View

Removal and Installation

1. Remove the 8 screws and the tailgate access cover.

- To install, tighten to 5 Nm (44 lb-in).

2. Open the clips and disconnect the tailgate latch actuating rods from the remote control. 3. Remove the tailgate latch remote control nuts.

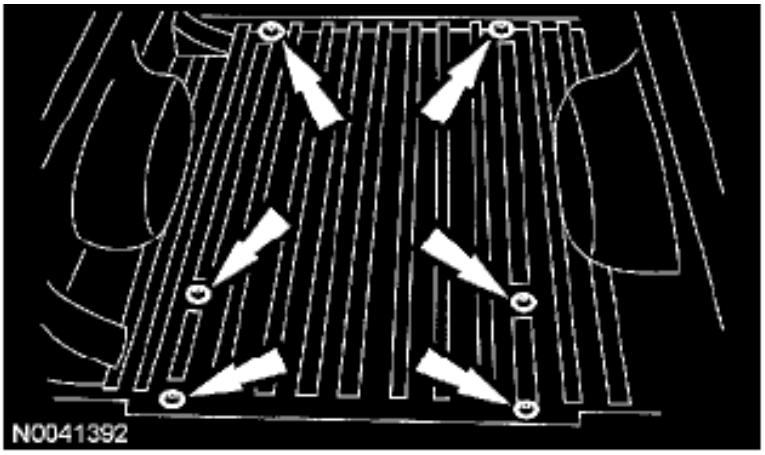
- To install, tighten to 12 Nm (9 lb-ft).

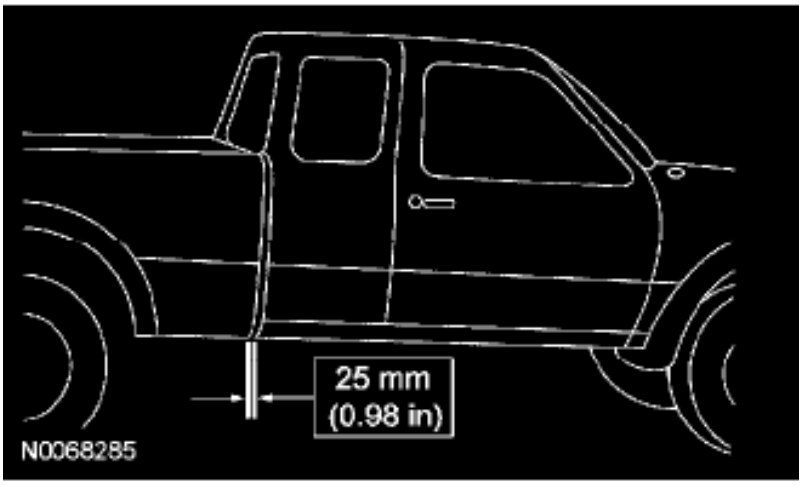
4. Remove the tailgate release handle. 5. To install, reverse the removal procedure.

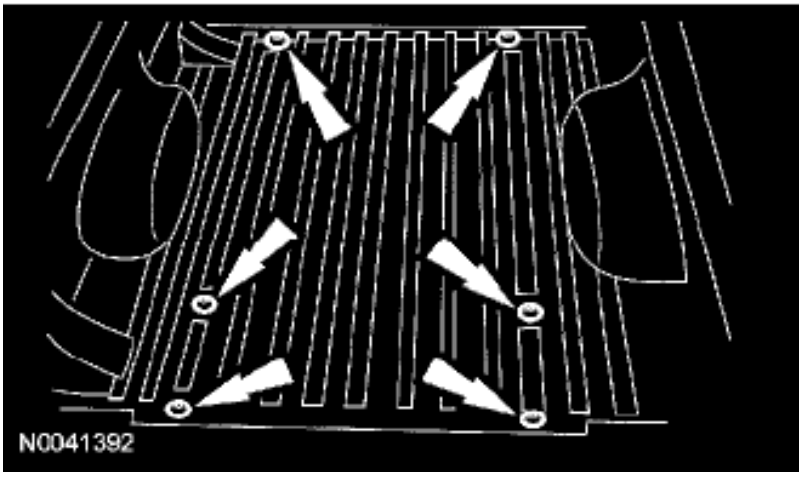
Torque Specifications

Description	Nm	lb-ft
Fender upper moulding screws	12	9
Pickup bed bolts	63	46
Pickup bed-to-fender bolts	12	9
Rear fender lower screws	12	9
Rear fender screws	12	9
Rear lamp opening bolts	12	9
Step screws	12	9
U-bolt nuts	103	76

Torque Specifications


N0041392


25 mm
(0.98 in)
N0068285


N0041392

Truck Bed: Adjustments Pickup Bed Alignment

PICKUP BED ALIGNMENT

1. NOTE: The pickup bed bolts are not identical and new bolts must be installed in the same location that they were removed from.

Remove the 6 pickup bed bolts. Discard the bolts.

2. Center the pickup bed on the rear of the pickup cab. 3. Set the gap between the leading edge of the pickup bed and the back of the cab.

4. Tighten the 6 pickup bed bolts.

- To install, tighten to 63 Nm (46 lb-ft).

Truck Bed: Adjustments Pickup Bed Lean

PICKUP BED LEAN

1. Check the vehicle ride height. 2. Measure and record the distance from the top center of both wheel well lips and calculate the difference. 3. If the difference between the 2 sides is between 0 and 13 mm (0 and 0.5 in), do nothing. The vehicle is within specification. 4. If the difference between the 2 measurements is between 13 and 19.5 mm (0.5 and 0.75 in) shim the pickup bed to the frame. For additional

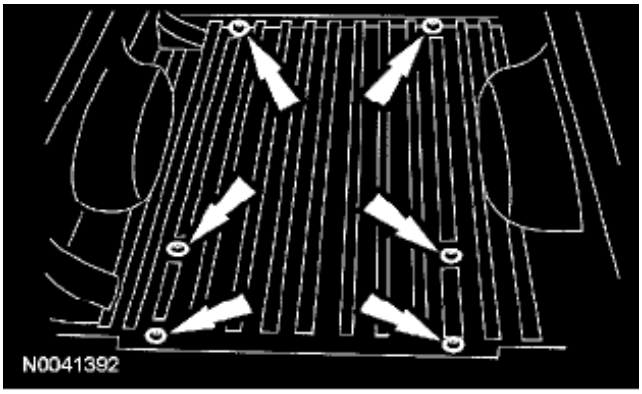
information, refer to Pickup Bed Shimming. See: Pickup Bed Shimming

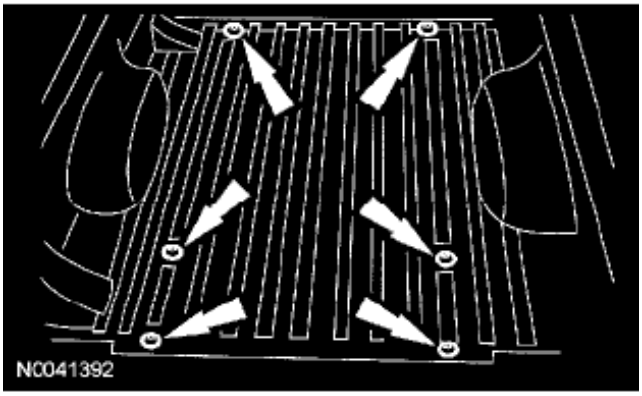
5. If the difference between the 2 measurements is greater than 19.5 mm (0.75 in):

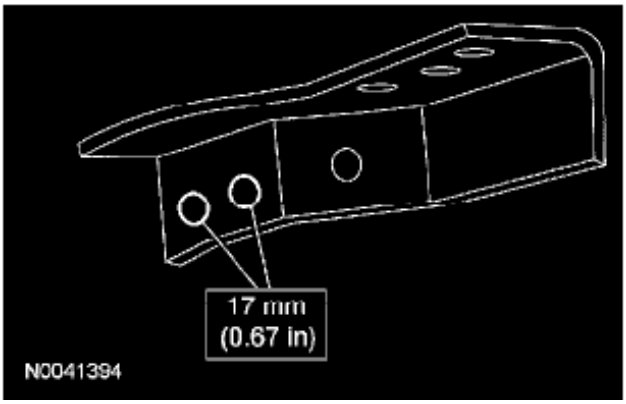
- First shim the axle. -

If additional shimming is needed, shim the pickup bed to the frame. Refer to Pickup Bed Shimming. See: Pickup Bed Shimming

6. If necessary, align the pickup bed. For additional information, refer to Pickup Bed Alignment. See: Pickup Bed Alignment


N0041392


N0041392


17 mm
(0.67 in)
N0041394

Truck Bed: Adjustments Pickup Bed Shimming

PICKUP BED SHIMMING

1. Determine if the pickup bed requires shimming. For additional information, refer to Pickup Bed Lean. See: Pickup Bed Lean

2. NOTE: The pickup bed bolts are not identical and new bolts must be installed in the same location that they were removed from.

Remove the pickup bed bolts. Discard the bolts.

3. Raise the low side of the pickup bed and install the 3 mm (0.12 in) shims between the top of the frame and the bottom of the pickup box

crossmembers. -

Stack the shims as necessary to achieve the desired spacing. It may be necessary to shim both rear bolts on one side to avoid buckling the box when tightening the bolts.

- Paint the shims with frame wax or black paint.

4. Tighten the pickup bed bolts.

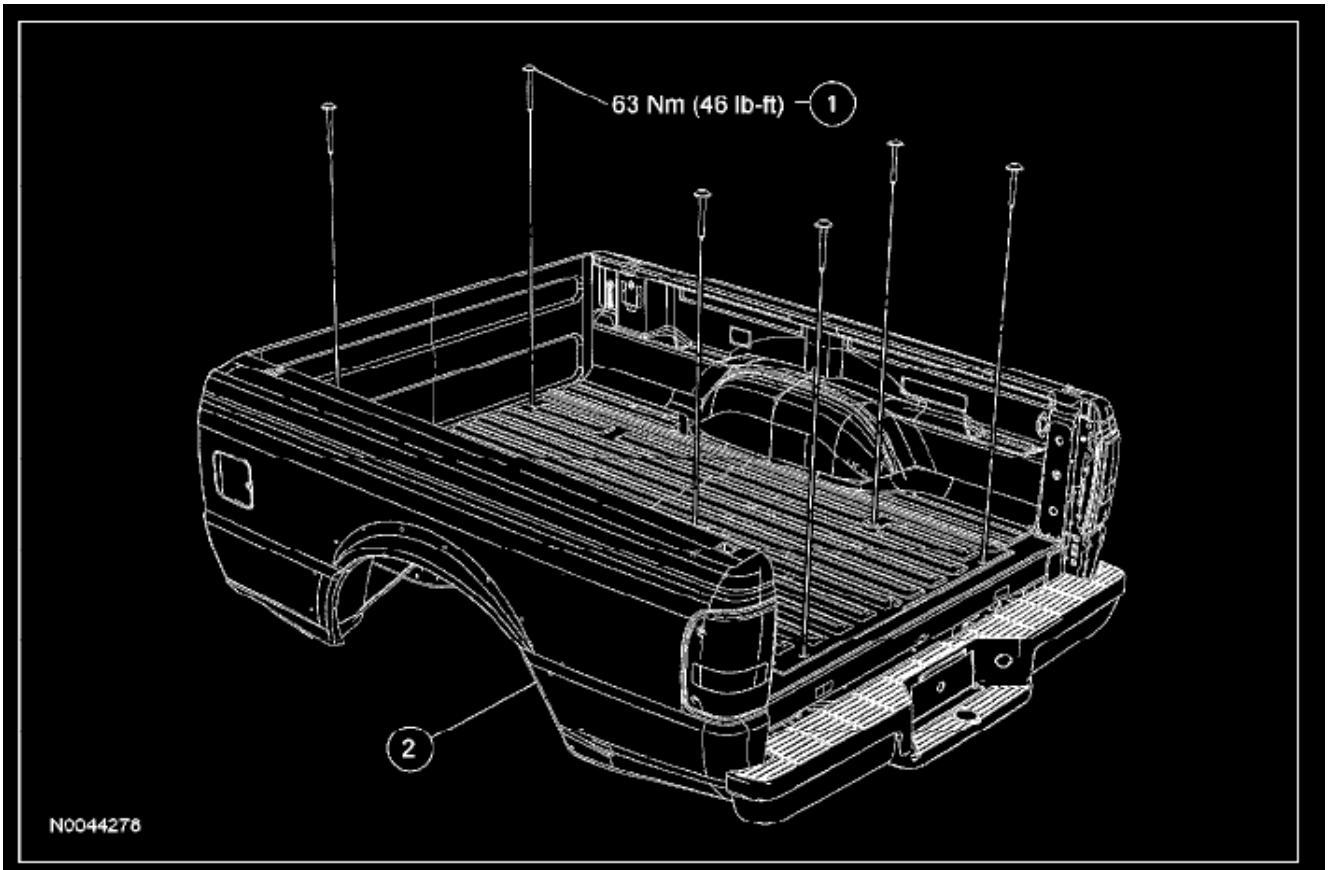
- To install, tighten to 63 Nm (46 lb-ft).

5. If necessary, align the pickup bed. For additional information, refer to Pickup Bed Alignment. See: Pickup Bed Alignment 6. Recheck the vehicle lean. For additional information, refer to Pickup Bed Lean. See: Pickup Bed Lean 7. If necessary, realign the rear bumper. Remove the rear bumper brackets. 8. Ream the holes in the rear bumper bracket for the rear bumper bolts.

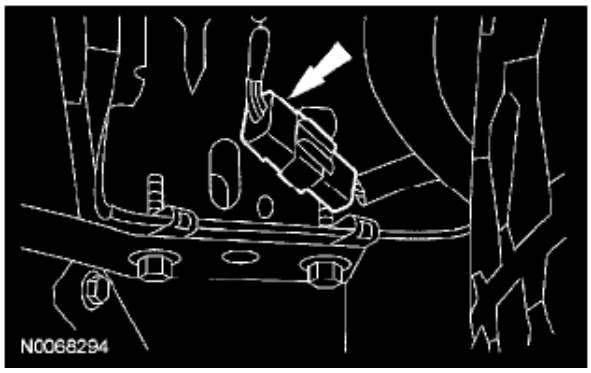
9. Install the rear bumper brackets.

10. NOTE: When installing the rear bumper, be sure to align the bumper with the pickup bed.

Install the rear bumper.



Item	Part Number	Description
1	N806251	Pickup bed bolt (6 required)
2	9928508	Pickup bed assembly



Truck Bed: Service and Repair

PICKUP BED

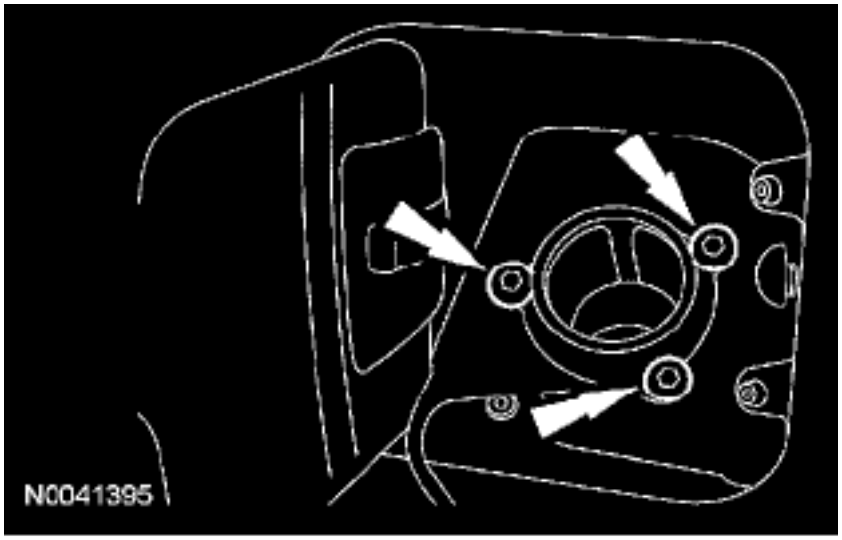
Removal and Installation

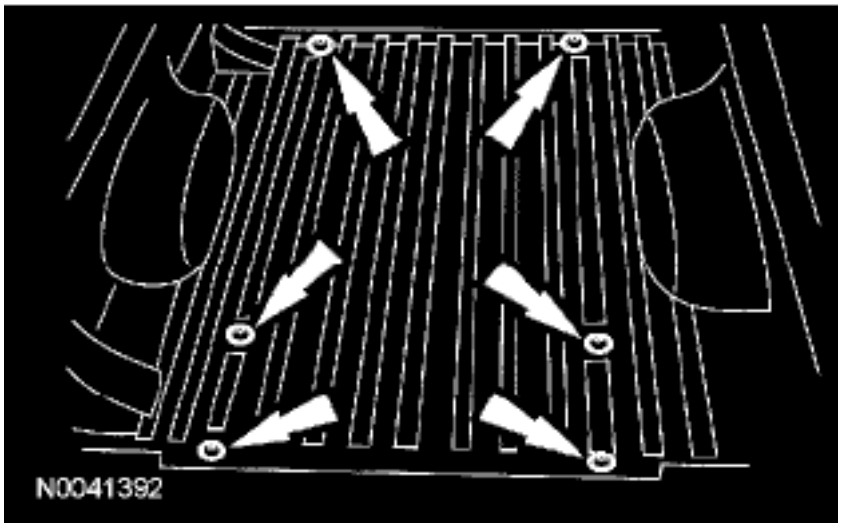
1. Remove the tailgate. 2. Disconnect the taillamp wiring harness electrical connector.

3. Remove the fuel filler cap.

4. NOTE: Mark the position of the fuel filler cap tether for correct installation.

Remove the fuel filler neck screws.





5. NOTE: The pickup bed bolts are not identical and new bolts must be installed in the same location that they were removed from.

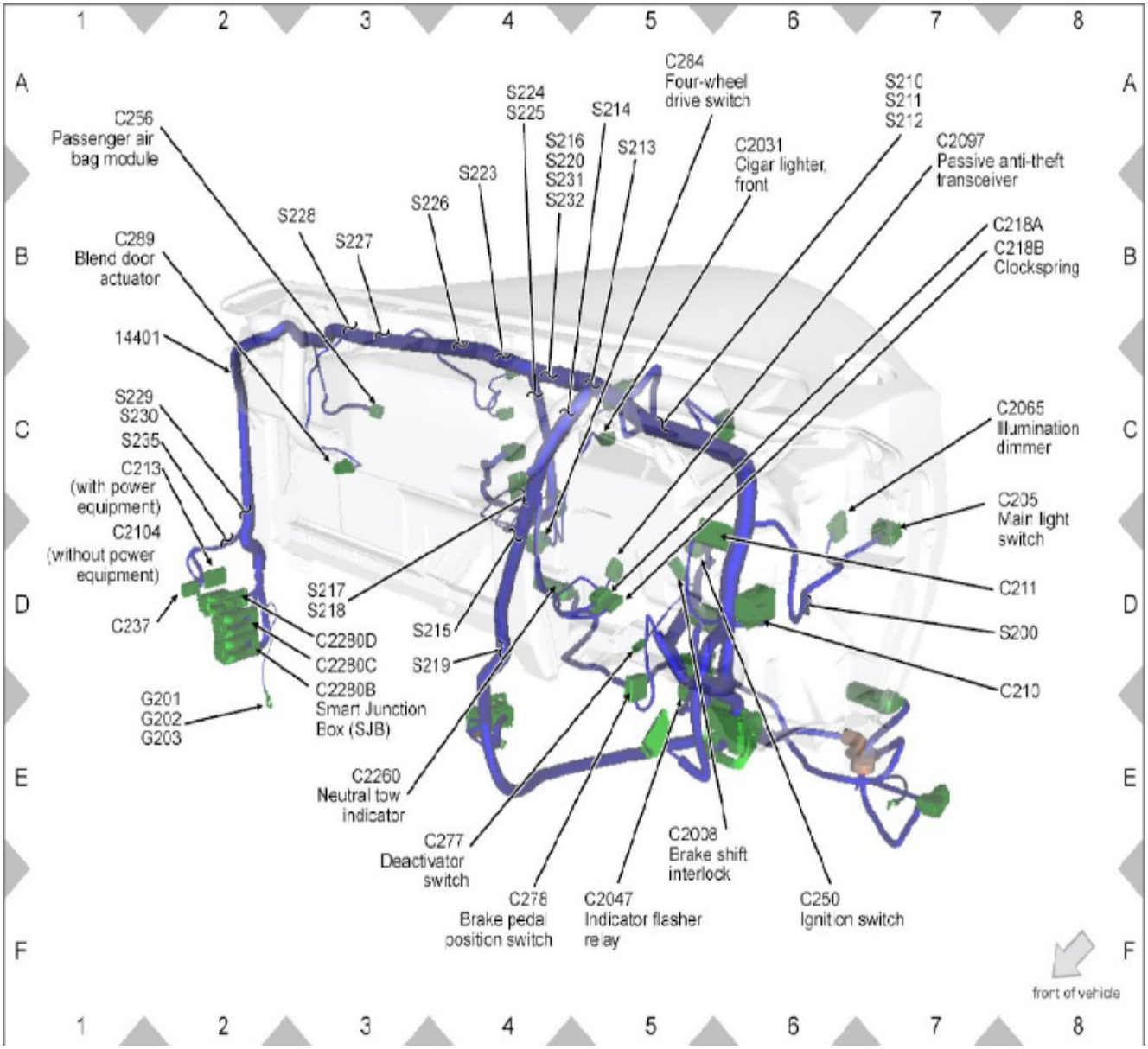
Remove the pickup bed bolts. Discard the bolts. -

To install, tighten to 63 Nm (46 lb-ft).

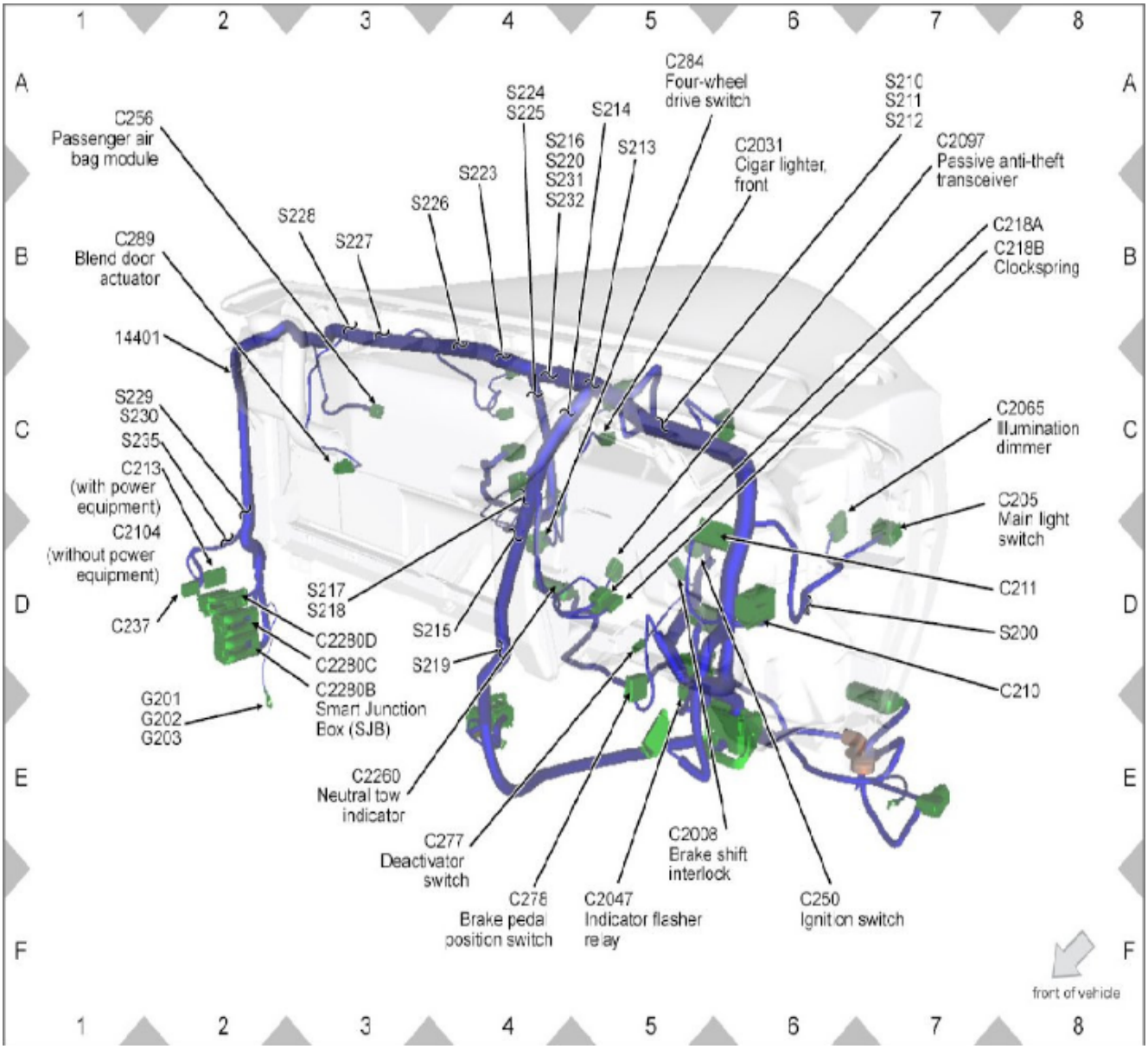
6. NOTE: Lifting the pickup bed requires at least 2 people on each side.

Remove the pickup bed.

7. Inspect the J-nuts for damage. Install new J-nuts if they are damaged. 8. To install, reverse the removal procedure.


C284
Four-wheel drive switch
S224
S225
S214
S216
S220
S231
S232
S213
S223
S226
S228
S227
C256
Passenger air bag module
C289
Blend door actuator
14401
S229
S230
S235
C213
(with power equipment)
C2104
(without power equipment)
C237
S217
S218
S215
S219
C2280D
C2280C
C2280B
Smart Junction Box (SJB)
G201
G202
G203
C2260
Neutral tow indicator
C277
Deactivator switch
C278
Brake pedal position switch
C2047
Indicator flasher relay
C2008
Brake shift interlock
C250
Ignition switch
C2031
Cigar lighter, front
S210
S211
S212
C2097
Passive anti-theft transceiver
C218A
C218B
Clockspring
C2065
Illumination dimmer
C205
Main light switch
C211
S200
C210
front of vehicle

View 151-11


1
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A
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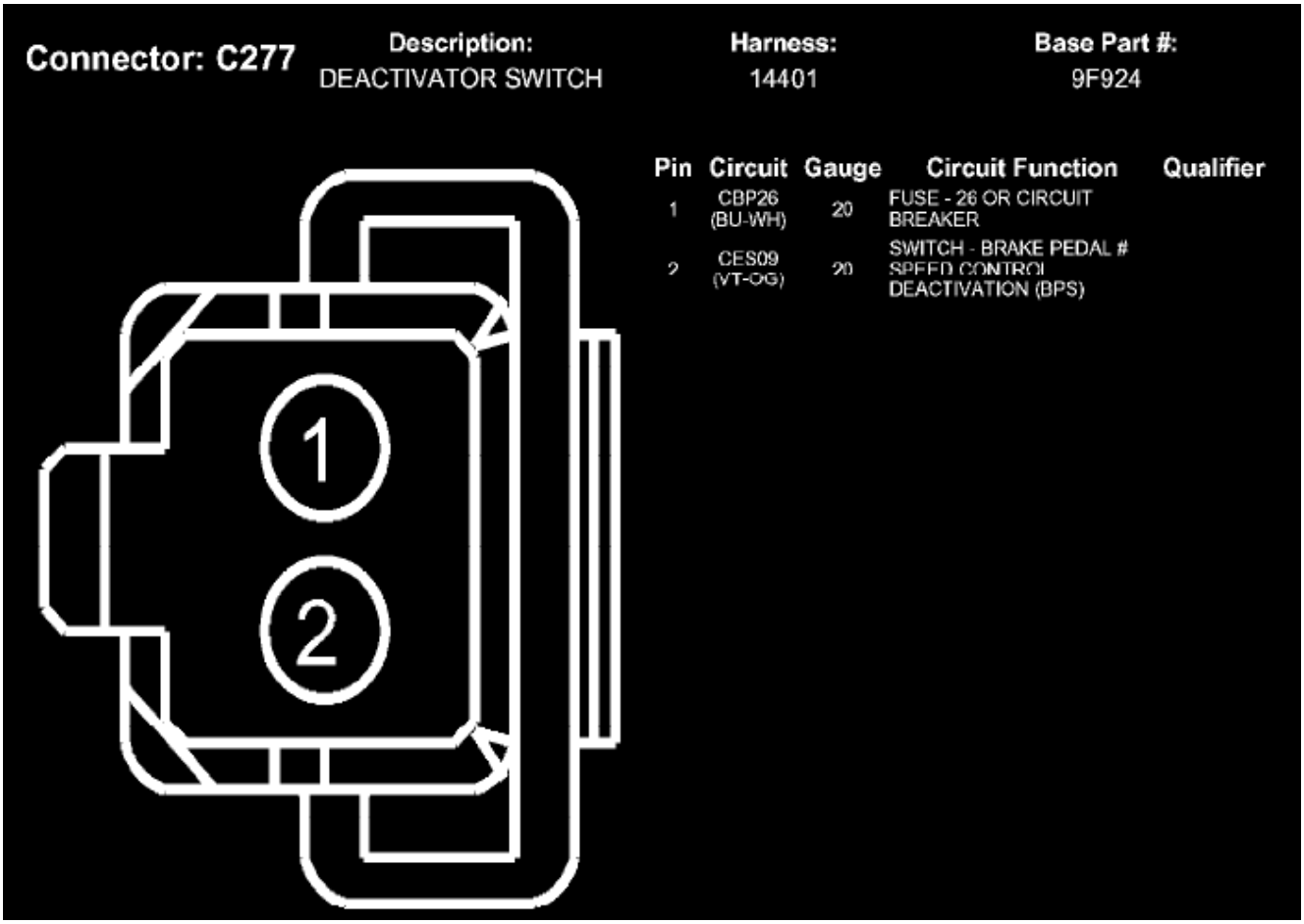
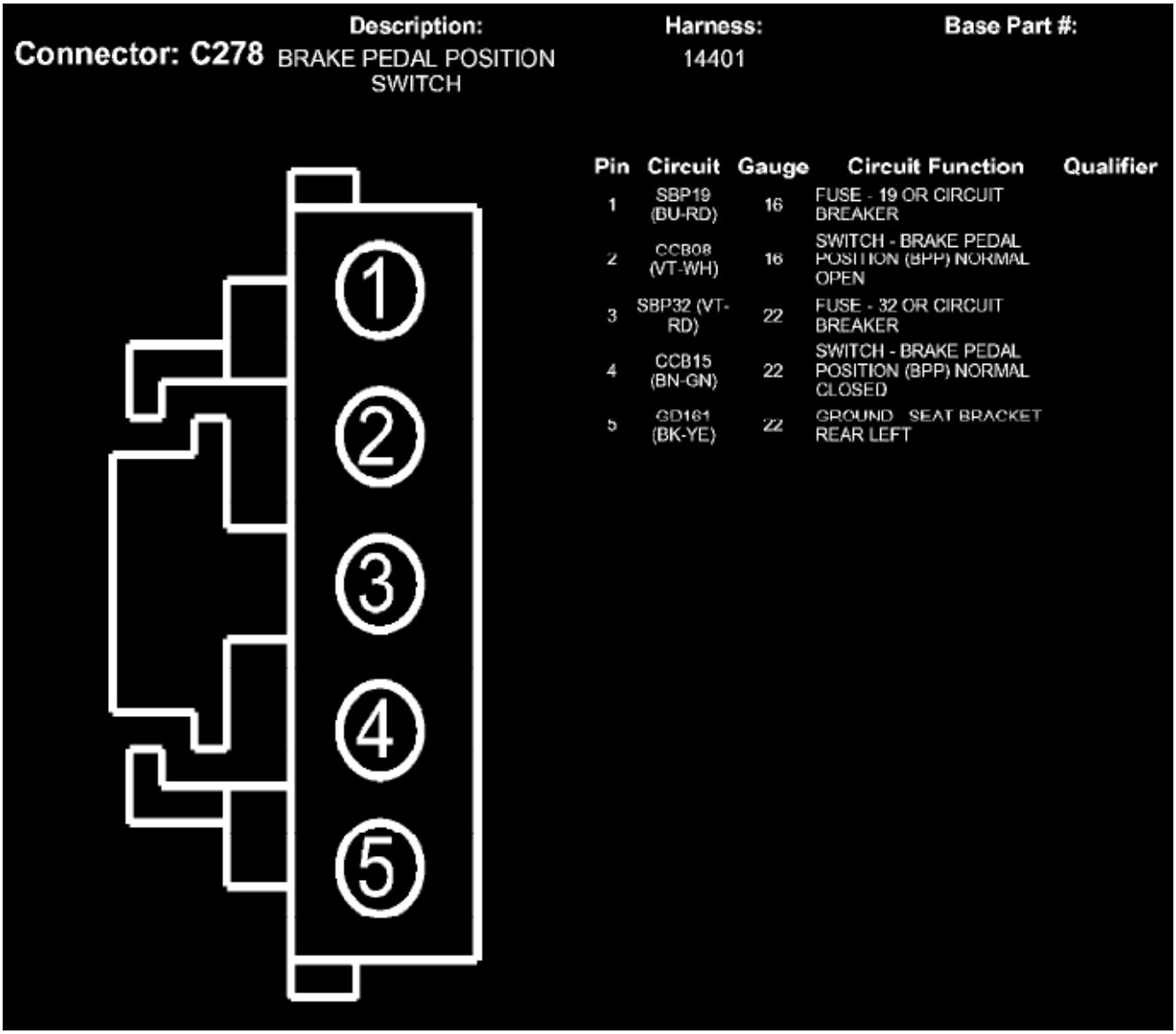
C
D
E
F
C256
Passenger air bag module
C289
Blend door actuator
14401
S229
S230
S235
C213
(with power equipment)
C2104
(without power equipment)
C237
G201
G202
G203
S228
S227
S226
S223
S224
S225
S216
S220
S231
S232
S214
S213
C284
Four-wheel drive switch
C2031
Cigar lighter, front
S210
S211
S212
C2097
Passive anti-theft transceiver
C218A
C218B
Clockspring
C2065
Illumination dimmer
C205
Main light switch
C211
S200
C210
S217
S218
S215
S219
C2280D
C2280C
C2280B
Smart Junction Box (SJB)
C2260
Neutral tow indicator
C277
Deactivator switch
C278
Brake pedal position switch
C2047
Indicator flasher relay
C2008
Brake shift interlock
C250
Ignition switch
front of vehicle

View 151-11

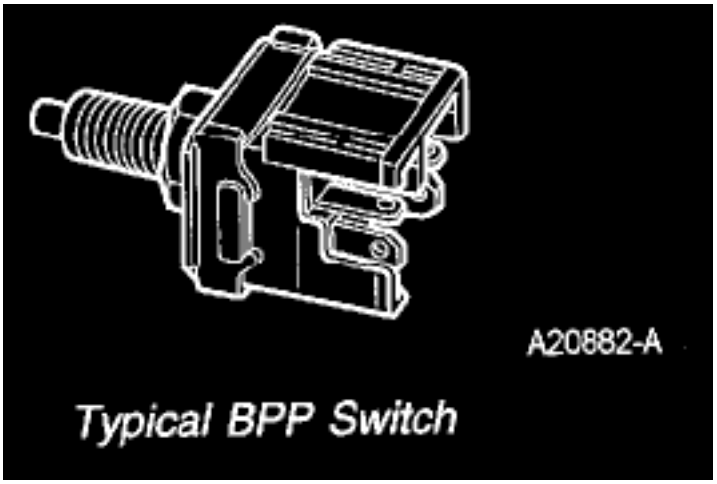

Connector: C277
Description:
DEACTIVATOR SWITCH
Harness:
14401
Base Part #:
9F924
Pin Circuit Gauge Circuit Function Qualifier
1 CBP26 (BU-WH) 20 FUSE - 26 OR CIRCUIT BREAKER
2 CES09 (VT-OG) 20 SWITCH - BRAKE PEDAL # SPEED CONTROL DEACTIVATION (BPS)
1
2

C277



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	SBP19 (BU-RD)	16	FUSE - 19 OR CIRCUIT BREAKER	
2	CCB08 (VT-WH)	16	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL OPEN	
3	SBP32 (VT-RD)	22	FUSE - 32 OR CIRCUIT BREAKER	
4	CCB15 (BN-GN)	22	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL CLOSED	
5	GD161 (BK-YE)	22	GROUND - SEAT BRACKET REAR LEFT	

C278



Brake Switch (Cruise Control): Description and Operation

Brake Pedal Position (BPP) Switch

Typical BPP Switch

The BPP switch is sometimes referred to as the stoplamp switch. The BPP switch provides a signal to the PCM indicating that the brakes are applied. The BPP switch is normally open and is mounted on the brake pedal support. Depending on the vehicle application the BPP switch can be hardwired as follows: -

to the PCM supplying battery positive voltage (B+) when the vehicle brake pedal is applied.

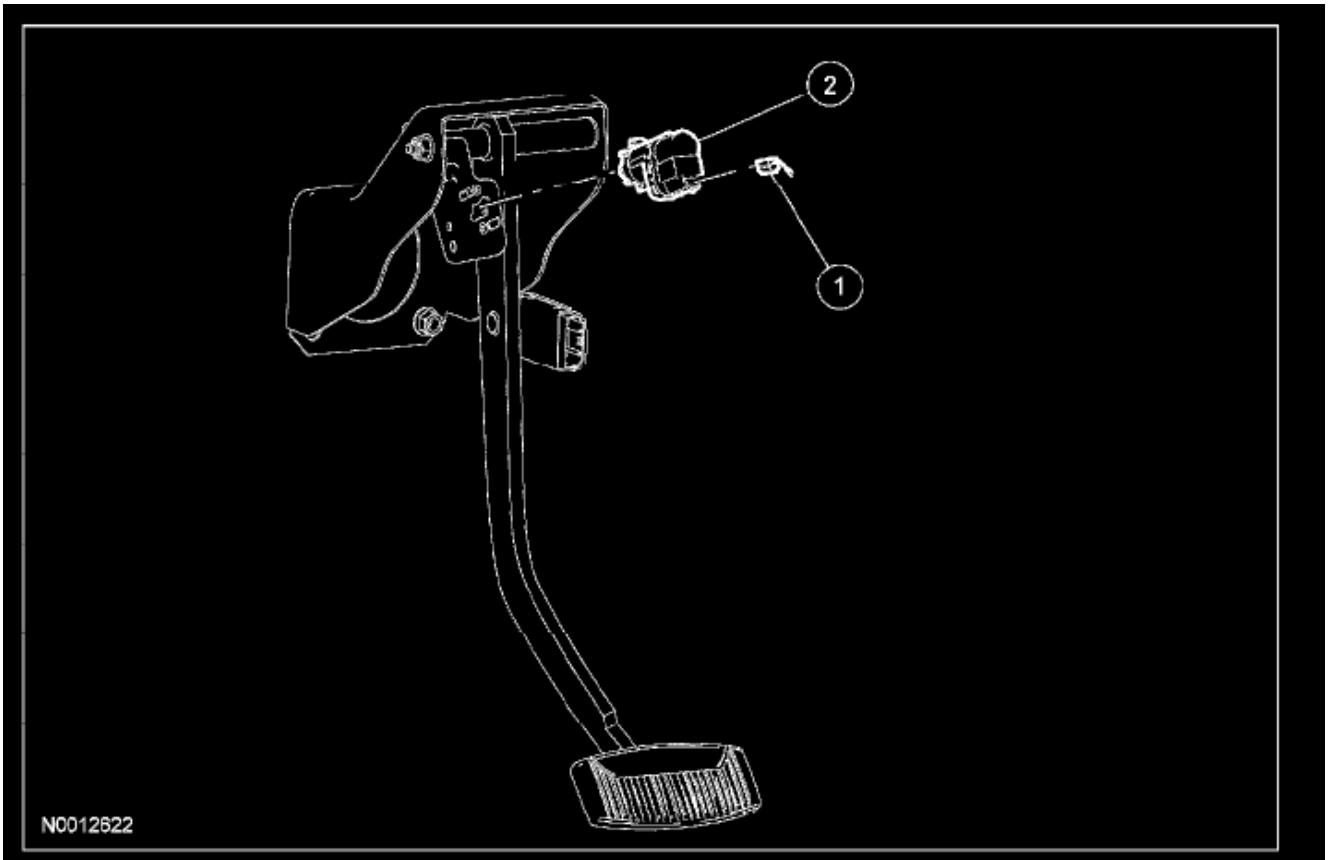
- to the antilock brake system (ABS) module, or lighting control module (LCM), the BPP signal is then broadcast over the network to be received by the PCM.

- to the ABS traction control/stability assist module. The ABS module interprets the BPP switch input along with other ABS inputs and generates an output called the driver brake application (DBA) signal. The DBA signal is then sent to the PCM and to other BPP signal users.

Brake Pedal Switch (BPS)/Brake Deactivator Switch

The BPS, also called the brake deactivator switch, is for vehicle speed control deactivation. A normally closed switch supplies battery positive voltage (B+) to the PCM when the brake pedal is not applied. When the brake pedal is applied, the normally closed switch opens and power is removed from the PCM.

On some applications the normally closed BPS, along with the normally open BPP switch, are used for a brake rationality test within the PCM. The PCM misfire monitor profile learn function may be disabled if a brake switch concern occurs. If one or both brake pedal inputs to the PCM is not changing states when they were expected to, a diagnostic trouble code (DTC) is set by the PCM strategy.



Item	Part Number	Description
1	—	Speed control deactivator switch electrical connector (part of 12A581)
2	9C872	Speed control deactivator switch

Brake Switch (Cruise Control): Service and Repair

SPEED CONTROL DEACTIVATOR SWITCH

Removal and Installation

1. CAUTION: Do not press the brake pedal when removing or installing the speed control deactivator switch or damage to the switch will

occur.

Disconnect the speed control deactivator switch electrical connector.

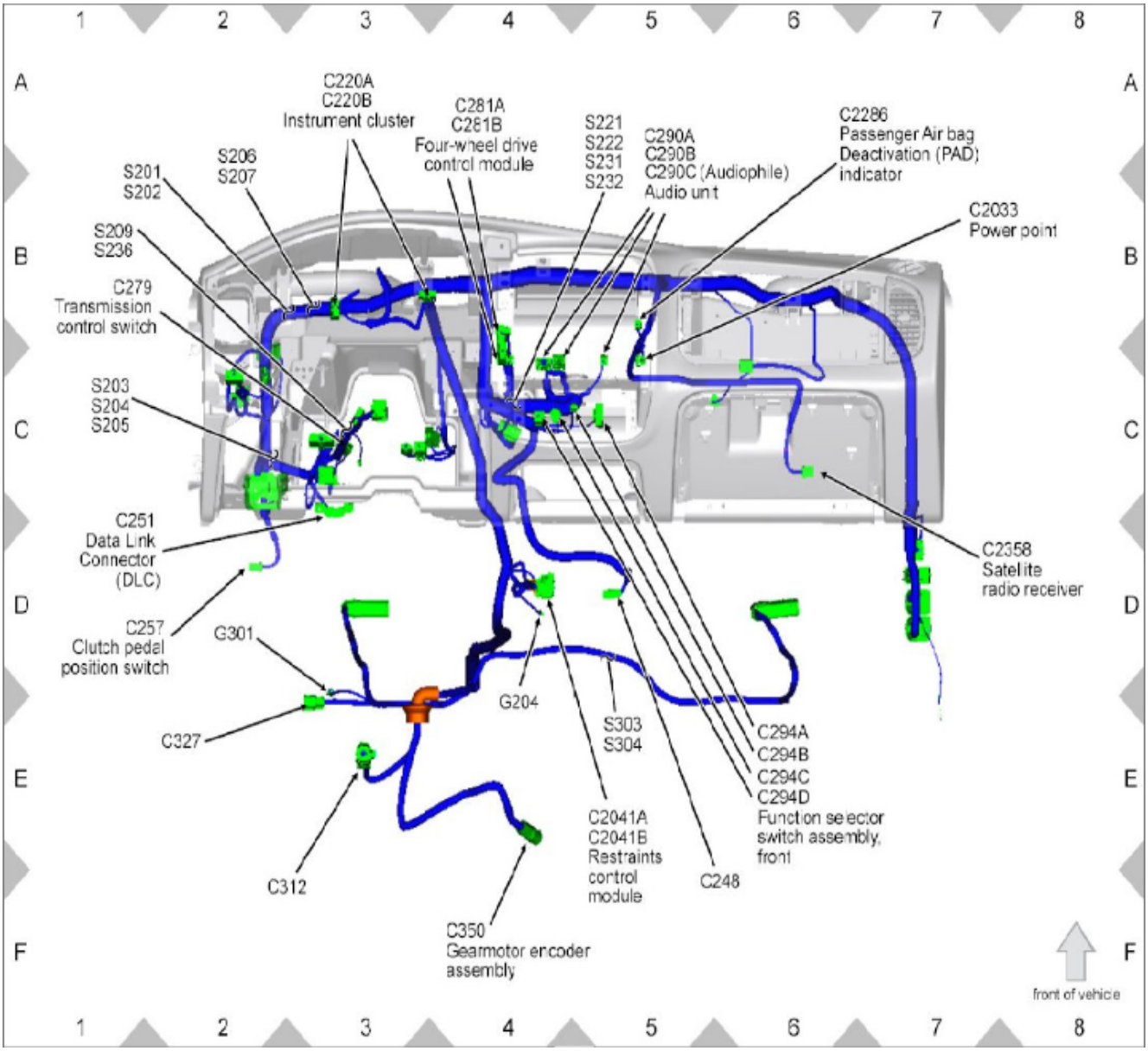
2. Rotate the speed control deactivator switch counterclockwise 45 degrees and remove it.

- Disconnect the electrical connector.

3. NOTE: The speed control deactivator switch is self-adjusting. Do not press the brake pedal during installation. Initial installation of the speed

control deactivator switch allows for one adjustment. If additional adjustments are necessary, install a new speed control deactivator switch.

To install, reverse the removal procedure.


1
2
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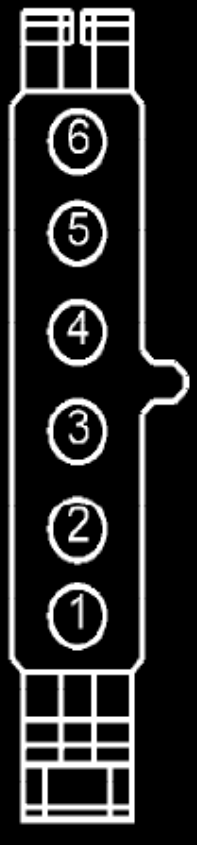
4
5
6
7
8
A
B
C
D
E
F
C220A
C220B
Instrument cluster
C281A
C281B
Four-wheel drive
control module
S221
S222
S231
S232
C290A
C290B
C290C (Audiophile)
Audio unit
C2286
Passenger Air bag
Deactivation (PAD)
indicator
C2033
Power point
S206
S207
S201
S202
S209
S236
C279
Transmission
control switch
S203
S204
S205
C251
Data Link
Connector
(DLC)
C257
Clutch pedal
position switch
G301
C327
C312
G204
S303
S304
C294A
C294B
C294C
C294D
Function selector
switch assembly,
front
C2041A
C2041B
Restraints
control
module
C248
C350
Gearmotor encoder
assembly
C2358
Satellite
radio receiver
front of vehicle

View 151-12

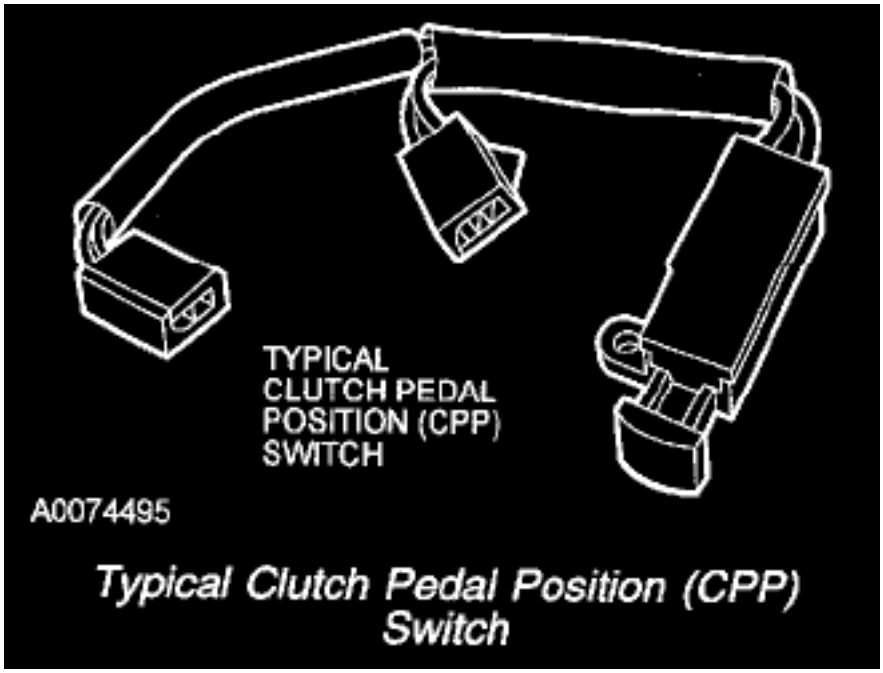
Connector: C257

Description:	Harness:	Base Part #:
CLUTCH PEDAL POSITION SWITCH	14401	11A152



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE904 (GN-VT)	22	SWITCH - CLUTCH PEDAL POSITION # TOP OF TRAVEL (CPP-TT)	
2	GD174 (BK-WH)	22	GROUND - TUNNEL	
3	CCB15 (BN-GN)	22	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL CLOSED	
4	CCB15 (BN-GN)	22	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL CLOSED	
5	GD174 (BK-WH)	22	GROUND - TUNNEL	
6	CDC36 (GN-BN)	22	SWITCH - START INTERLOCK CLUTCH PEDAL	

C257



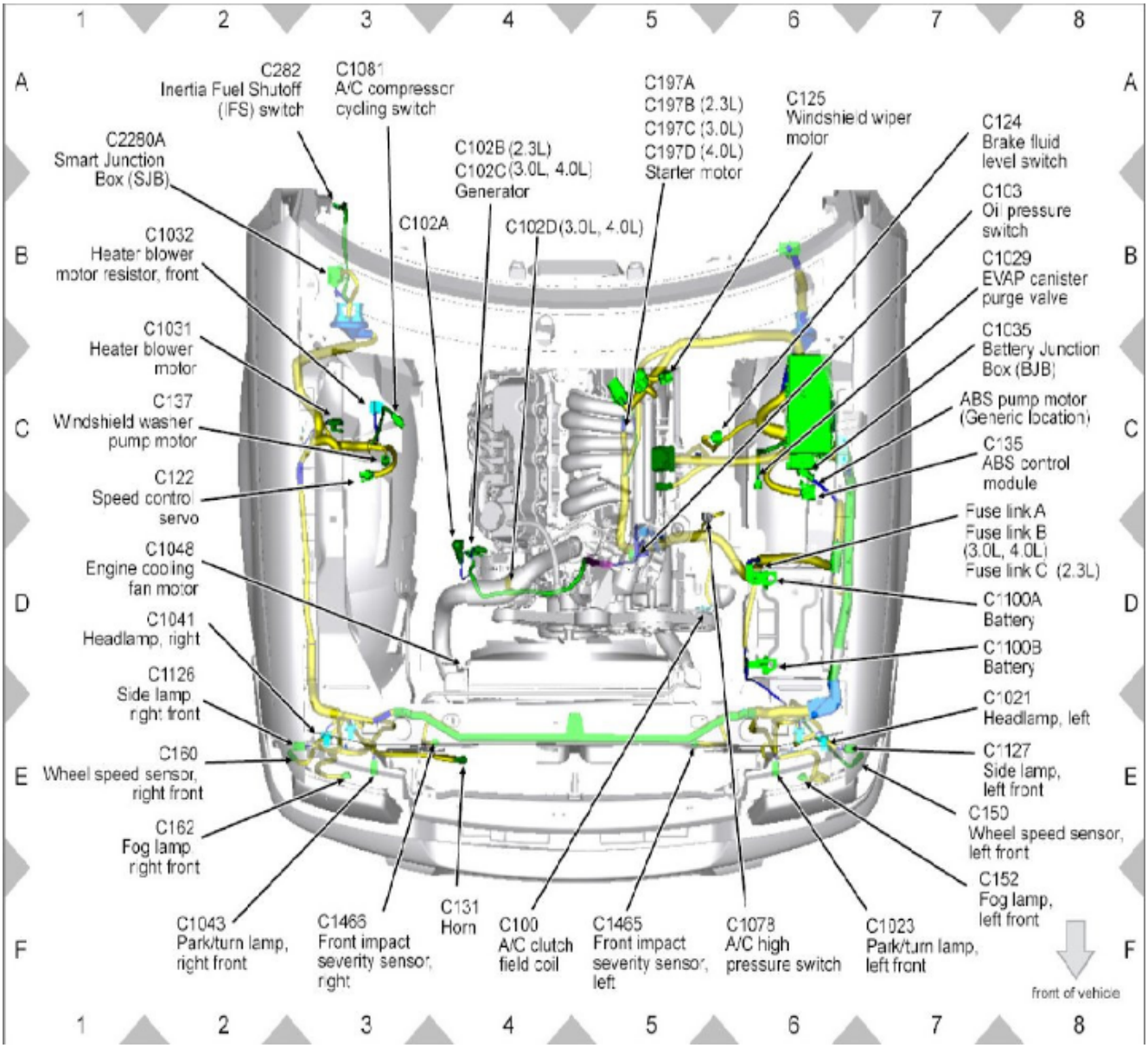
Typical Clutch Pedal Position (CPP) Switch

Clutch Switch: Description and Operation

CLUTCH PEDAL POSITION (CPP) SWITCH

Typical Clutch Pedal Position (CPP) Switch

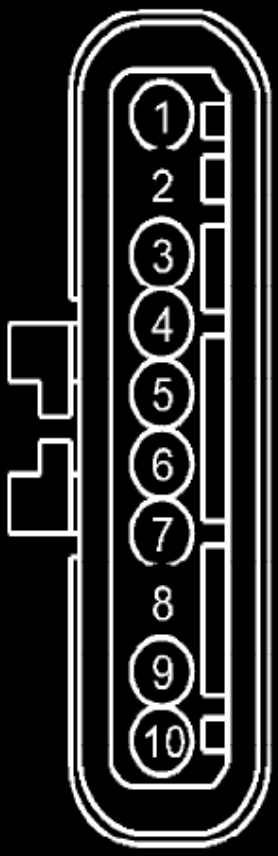
The CPP switch is an input to the PCM indicating the clutch pedal position. The PCM provides a low current voltage on the CPP circuit. When the CPP switch is closed, this voltage is pulled low through the SIG RTN circuit. The CPP input to the PCM is used to detect a reduction in engine load. The PCM uses the load information for mass air flow and fuel calculations.


C282
Inertia Fuel Shutoff (IFS) switch
C1081
A/C compressor cycling switch
C2280A
Smart Junction Box (SJB)
C1032
Heater blower motor resistor, front
C1031
Heater blower motor
C137
Windshield washer pump motor
C122
Speed control servo
C1048
Engine cooling fan motor
C1041
Headlamp, right
C1126
Side lamp right front
C160
Wheel speed sensor, right front
C162
Fog lamp right front
C1043
Park/turn lamp, right front
C1465
Front impact severity sensor, right
C131
Horn
C102A
C102B (2.3L)
C102C (3.0L, 4.0L)
Generator
C102D (3.0L, 4.0L)
C100
A/C clutch field coil
C197A
C197B (2.3L)
C197C (3.0L)
C197D (4.0L)
Starter motor
C1465
Front impact severity sensor, left
C1078
A/C high pressure switch
C125
Windshield wiper motor
C1023
Park/turn lamp, left front
C124
Brake fluid level switch
C103
Oil pressure switch
C1029
EVAP canister purge valve
C1035
Battery Junction Box (BJB)
ABS pump motor (Generic location)
C135
ABS control module
Fuse link A
Fuse link B (3.0L, 4.0L)
Fuse link C (2.3L)
C100A
Battery
C100B
Battery
C1021
Headlamp, left
C1127
Side lamp, left front
C150
Wheel speed sensor, left front
C152
Fog lamp, left front
front of vehicle

View 151-1

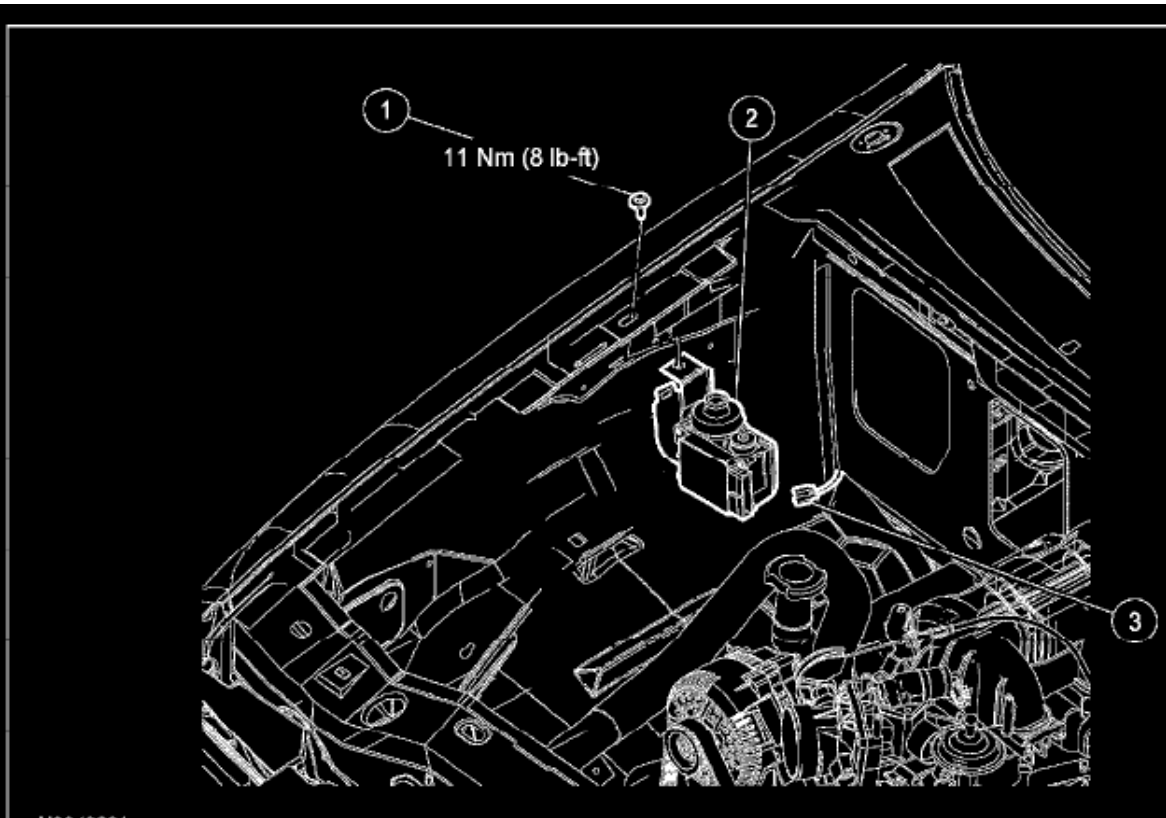
Connector: C122

Description:	Harness:	Base Part #:
SPEED CONTROL SERVO	14290	9C735

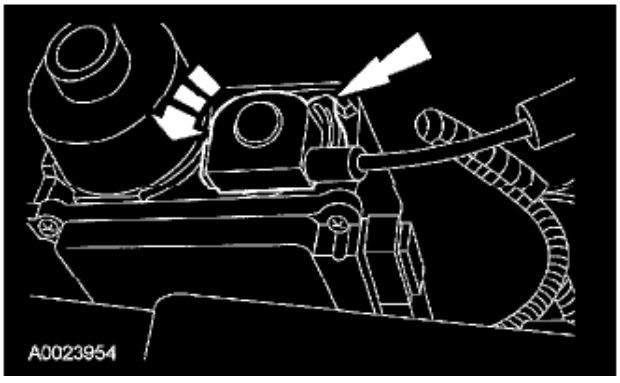


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CES03 (VT-WH)	20	CTRL MOD. - POWERTRAIN # SPEED CONTROL INDICATOR (SCIL)	
2	*	*	not used	
3	VMC05 (VT-OG)	20	CTRL MOD. - VEHICLE SPEED OUTPUT (VSOUT)	
4	CGB15 (BN-GN)	20	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL CLOSED	
5	VES10 (WH)	20	SWITCH - SPEED CONTROL COMMAND (SCCS)	
6	RES08 (GN-BN)	20	CTRL MOD. - POWERTRAIN # SPEED CONTROL COMMAND RETURN (SCCSRTN)	
7	CBP20 (YE-VT)	20	FUSE - 20 OR CIRCUIT BREAKER	
8	*	*	not used	
9	CES09 (VT-OG)	20	SWITCH - BRAKE PEDAL # SPEED CONTROL DEACTIVATION (BPS)	
10	GD123 (BK-GY)	20	GROUND - FENDER FRONT RIGHT	

C122



Item	Part Number	Description
1	—	Speed control actuator bolt
2	9C734	Speed control actuator and bracket assembly
3	—	Speed control actuator electrical connector (part of 14290)



Cruise Control Servo: Service and Repair

SPEED CONTROL ACTUATOR

Removal and Installation

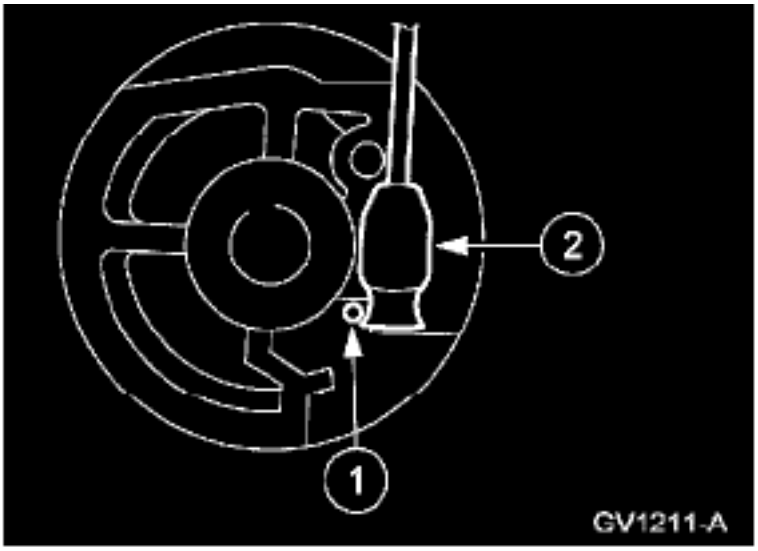
1. Disconnect the speed control actuator electrical connector. 2. Remove the speed control cable cap from the speed control actuator.

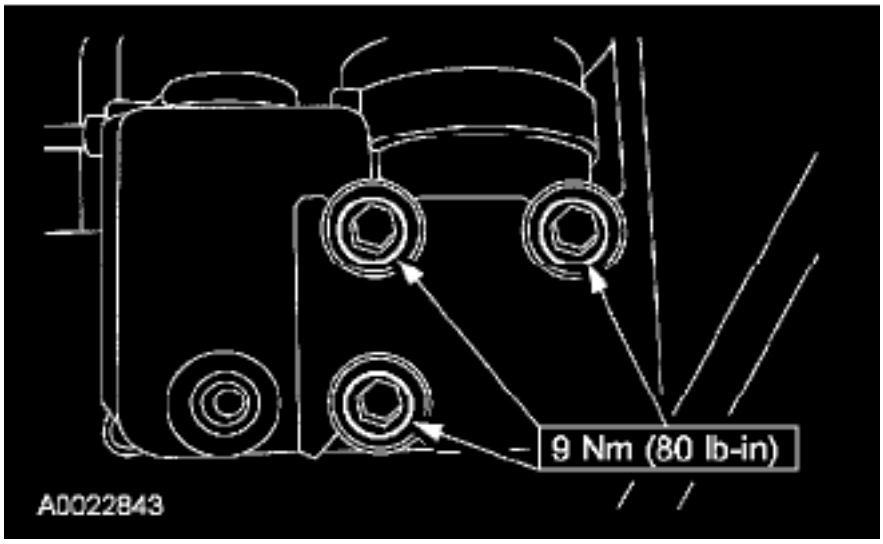
- Push in the locking arm on the speed control cable cap and rotate the cap counterclockwise.

3. Remove the speed control cable.

1 Press the spring retainer.

2 Slide the core wire end out of the speed control actuator pulley and remove the speed control cable.





4. Remove the bolt and the speed control actuator and bracket assembly.

- To install, tighten to 11 Nm (8 lb-ft).

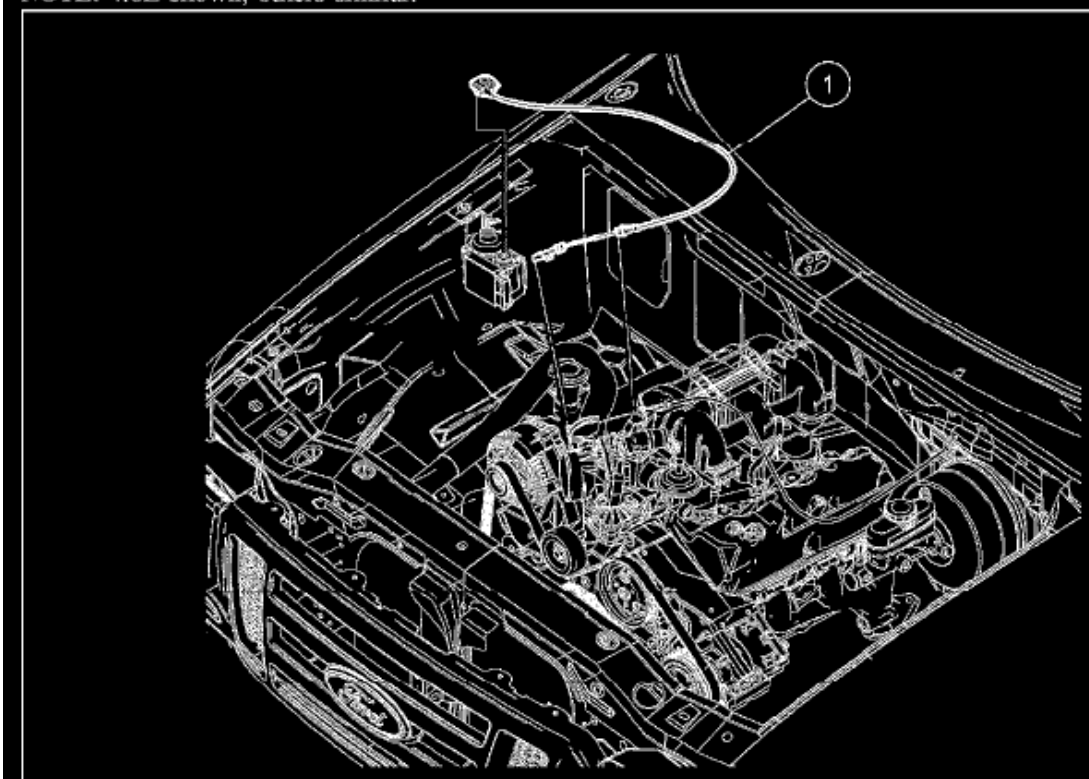
5. Remove the 3 bolts and separate the speed control actuator bracket from the speed control actuator.

- To install, tighten to 9 Nm (80 lb-in).

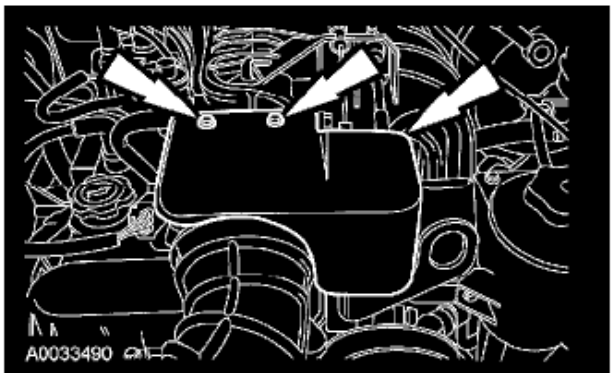
6. NOTE: Make sure the rubber seal is fully seated onto the speed control cable cap.

To install, reverse the removal procedure.

NOTE: 4.0L shown, others similar.



Item	Part Number	Description
1	9A825	Speed control cable



Cruise Control Servo Cable: Service and Repair

SPEED CONTROL CABLE

Removal and Installation

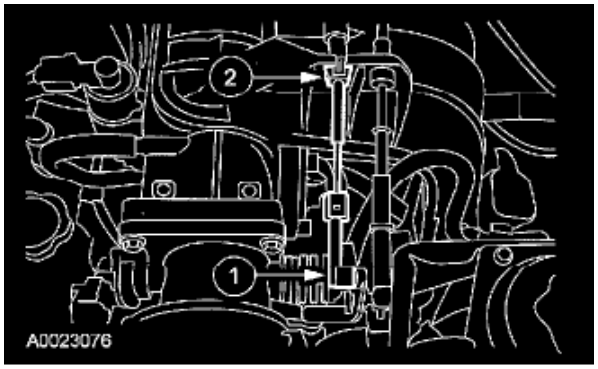
Vehicles with 2.3L engine

1. Remove the 2 bolts and the accelerator control splash shield.

2. Disconnect the speed control cable from the throttle body.

1 Disconnect the cable from the throttle lever.

2 Press the tabs and separate the speed control cable from the intake manifold.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1
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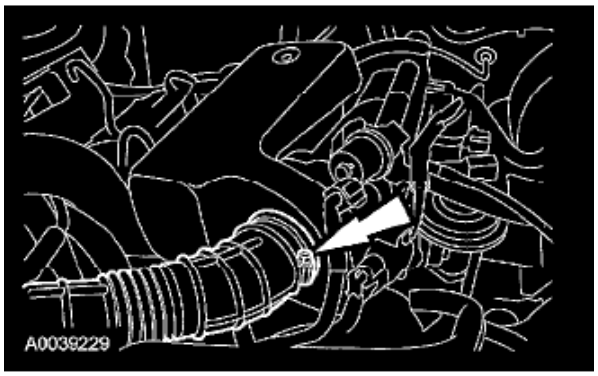
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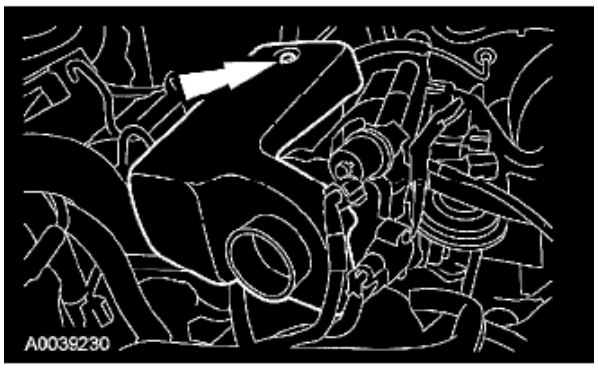
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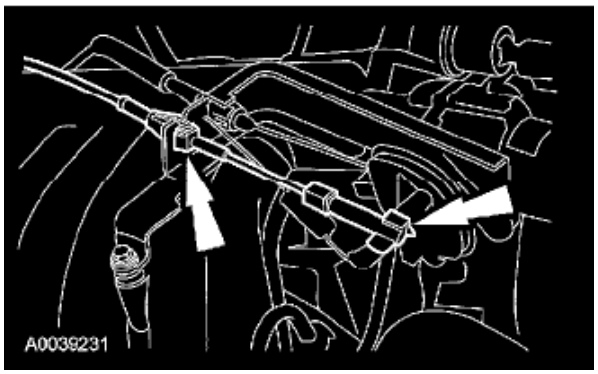

A0039231

3. Disconnect the air cleaner outlet tube from the throttle body.

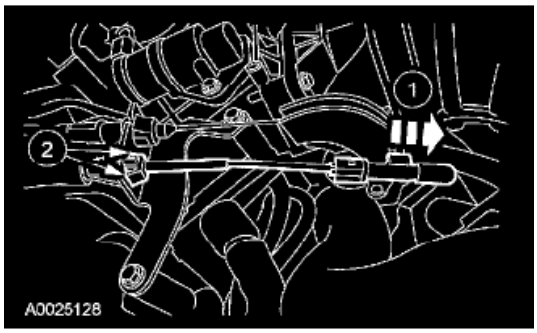
4. Remove the bolt and the accelerator control splash shield.

5. Disconnect the speed control cable and remove the cable from the bracket.

Vehicles with 4.0L engine

6. Remove the 3 bolts and the accelerator control splash shield.

A0025127


1
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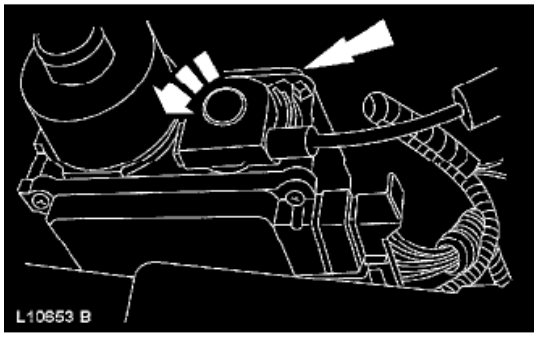
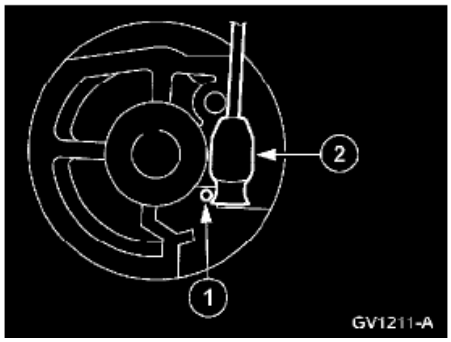
A0025128


L10653 B


2
1
GV1211-A

7. Separate the speed control cable from the intake manifold.

1 Disconnect the cable from the throttle lever.

2 Press the locking tabs and separate the speed control cable from the intake manifold.

All vehicles

8. Remove the speed control cable cap from the speed control actuator.

- Push in the locking arm on the speed control cable cap then rotate the cap counterclockwise.

9. Remove the speed control cable.

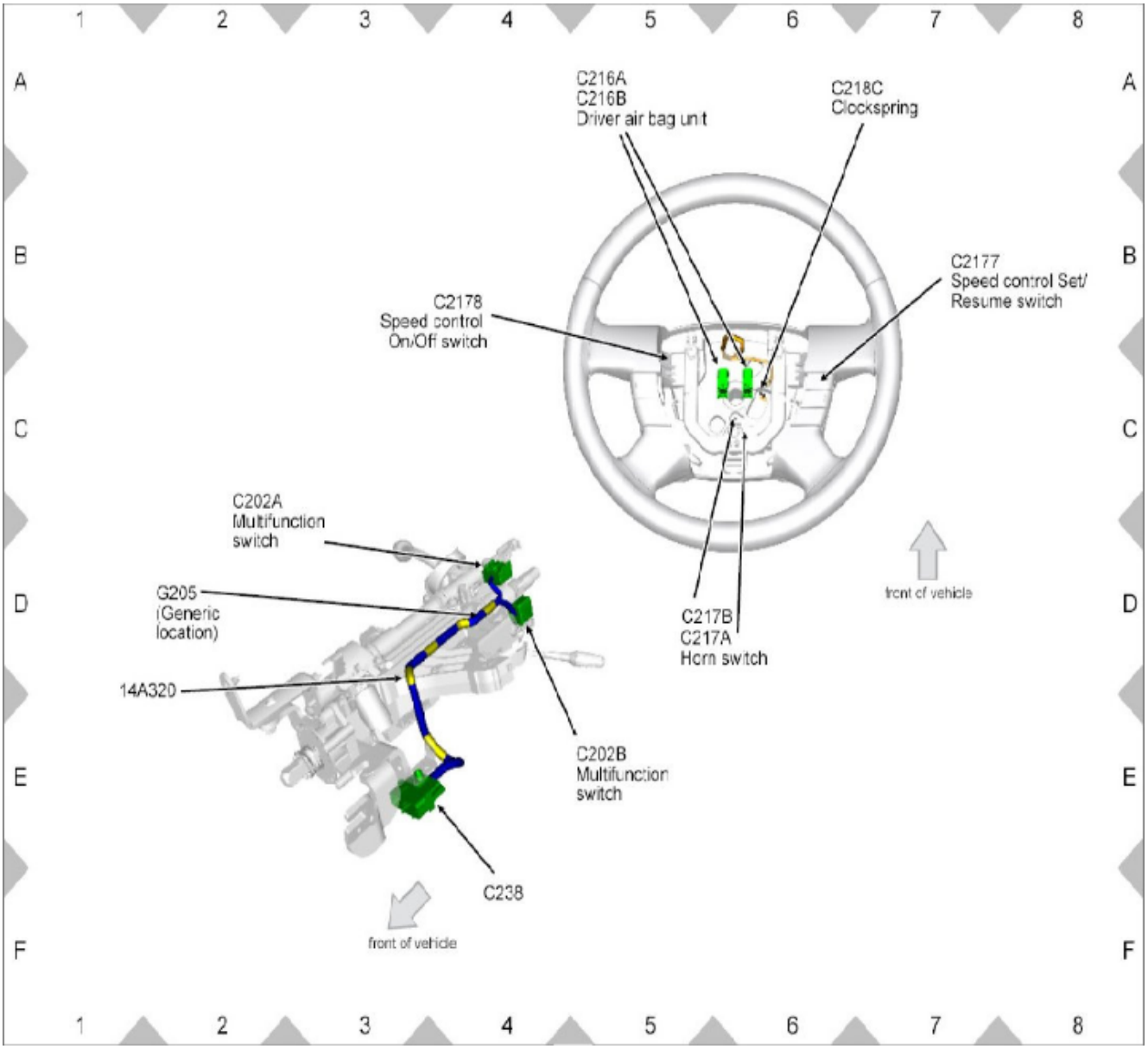
1 Press the spring retainer.

2 Slide the core wire end out of the speed control actuator pulley and remove the speed control cable.

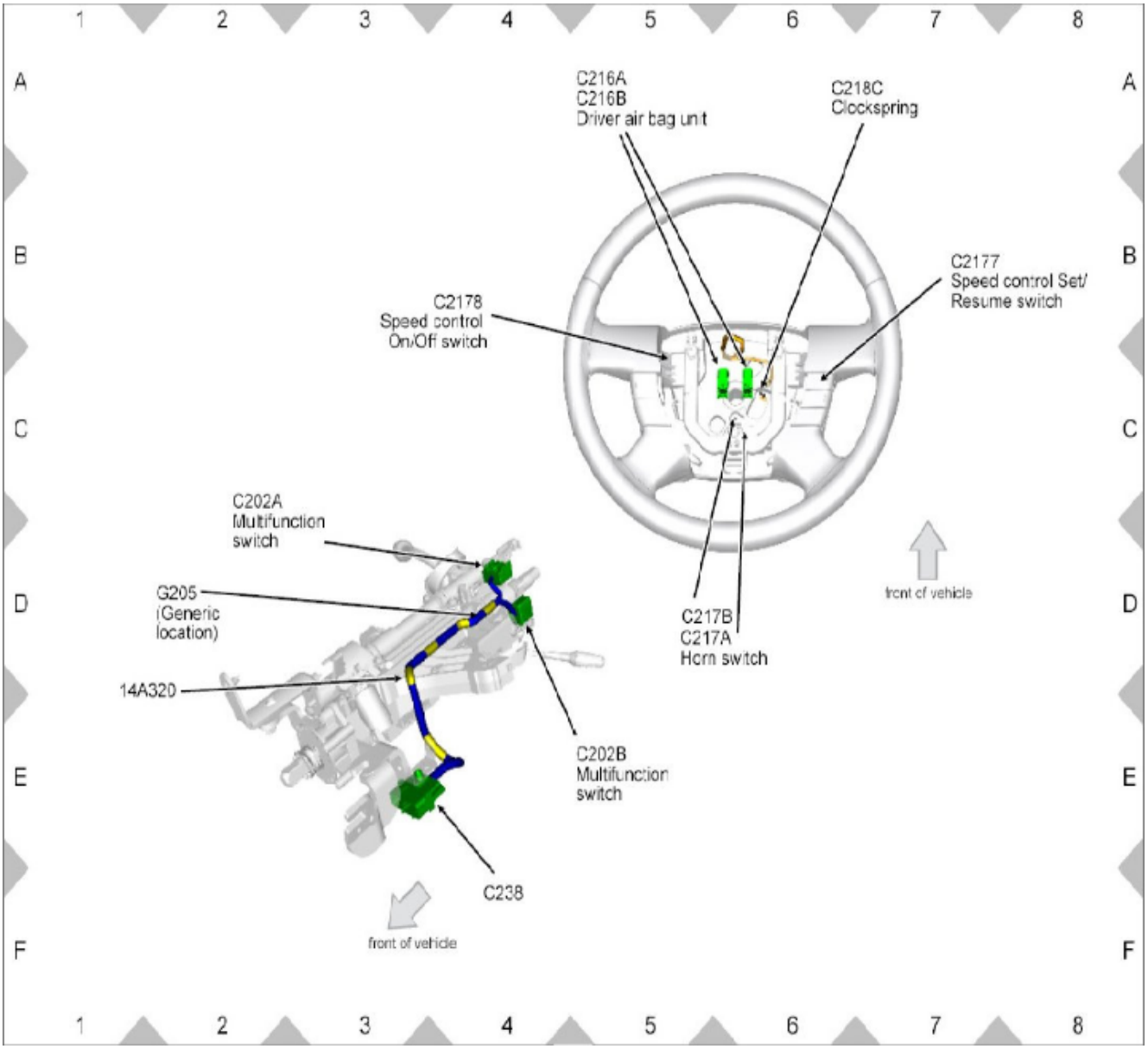
10. NOTE: Make sure the rubber seal is fully seated onto the speed control cable cap.

To install, reverse the removal procedure.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Cruise Control > Cruise Control Switch > Component Information > Locations > Speed Control On/Off Switch



View 151-13


C216A
C216B
Driver air bag unit
C218C
Clockspring
C2177
Speed control Set/
Resume switch
C2178
Speed control
On/Off switch
C202A
Multifunction
switch
G205
(Generic
location)
14A320
C217B
C217A
Horn switch
front of vehicle
C202B
Multifunction
switch
C238
front of vehicle

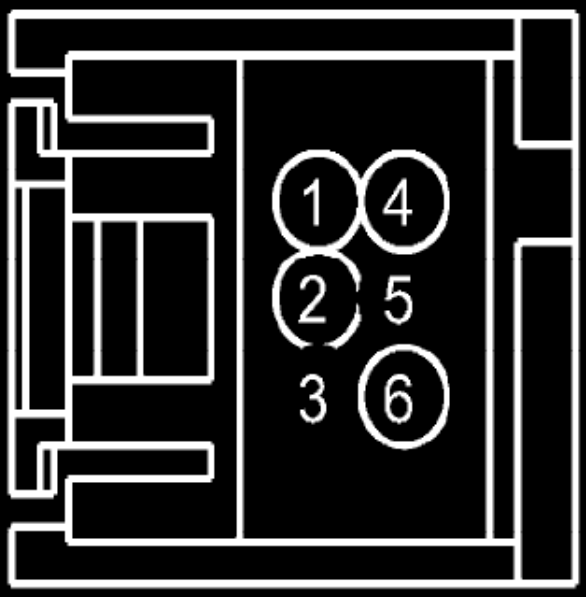
View 151-13

Connector: C2177

Description: SPEED CONTROL SET/RESUME SWITCH

Harness: 17889

Base Part #: 9C888

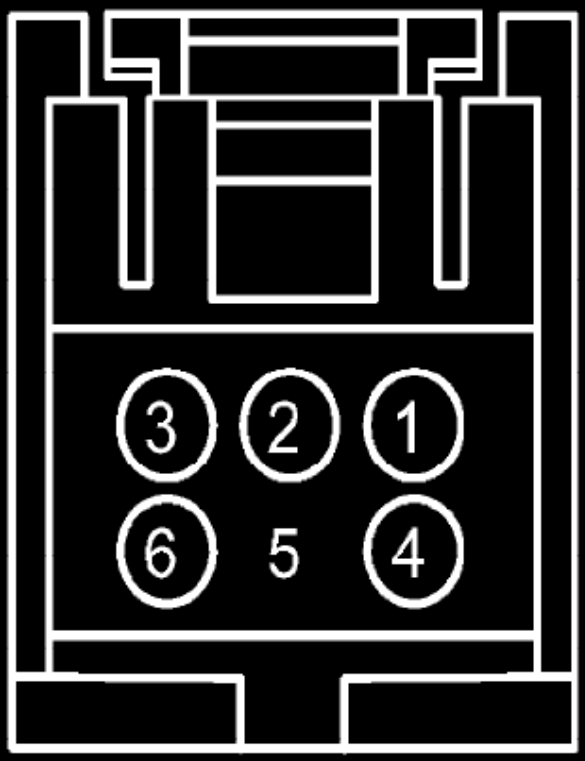


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	57 (GK)	22	GROUND - TUNNEL	
2	151 (LB-BK)	22	SWITCH - SPEED CONTROL COMMAND (SCCS)	
3	*	*	not used	
4	848 (DG-OG)	22	CTRL MOD. - POWERTRAIN # SPEED CONTROL COMMAND RETURN (SCCSRTN)	
5	*	*	not used	
6	235 (RD-BK)	22	DIMMER - IP/SWITCH ILLUMINATION	

C2177

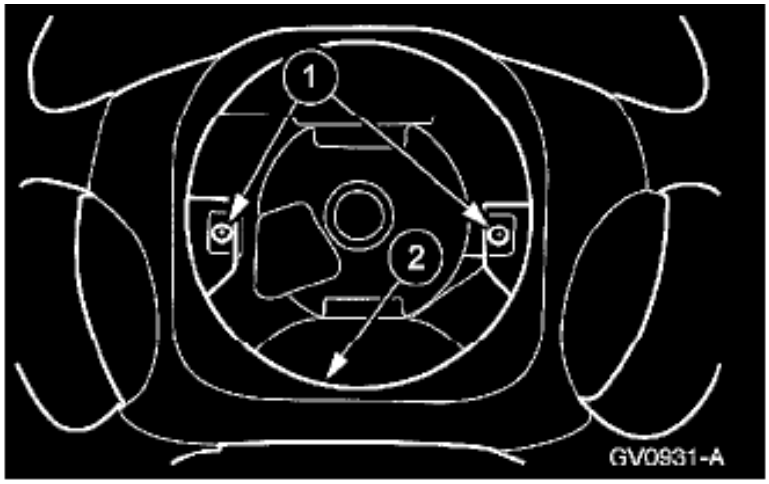
Connector: C2178

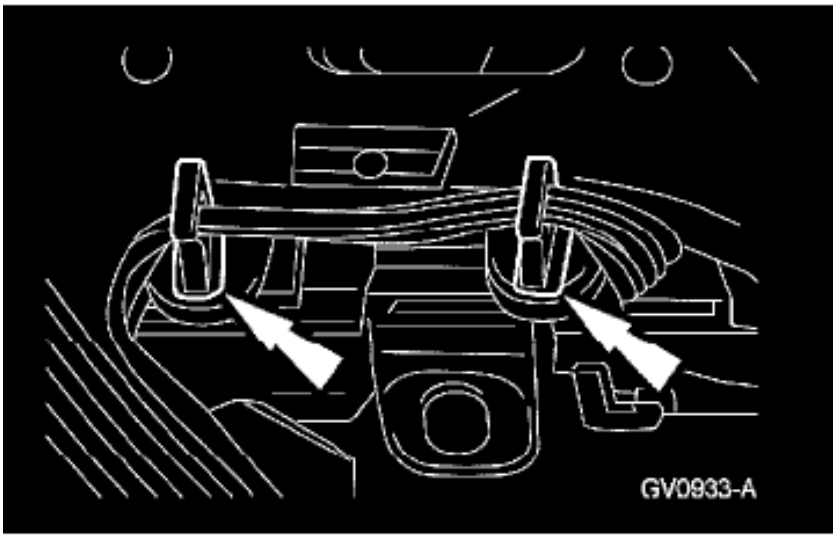
Description:	Harness:	Base Part #:
SPEED CONTROL ON/OFF SWITCH	17889	9C888

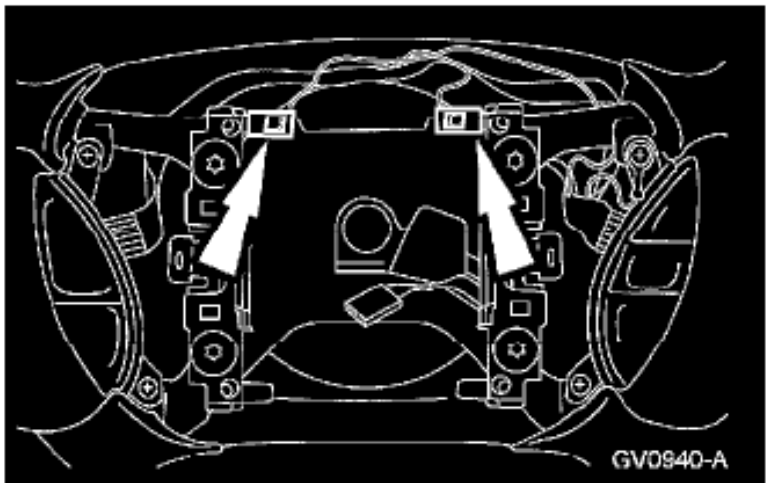


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	848 (DG-OG)	22	CTRL MOD. - POWERTRAIN # SPEED CONTROL COMMAND RETURN (SCCSRTN)	
2	151 (LB-BK)	22	SWITCH - SPEED CONTROL COMMAND (SCCS)	
3	CBP20 (YE-VT)	22	FUSE - 20 OR CIRCUIT BREAKER	
4	235 (RD-BK)	22	DIMMER - IP/SWITCH ILLUMINATION	
5	*	*	not used	
6	57 (BK)	22	GROUND - TUNNEL	

C2178


1
2
GV0931-A


GV0933-A


GV0940-A

Cruise Control Switch: Service and Repair

SPEED CONTROL SWITCH

Removal and Installation

1. Remove the steering wheel. 2. Remove the steering wheel rear cover.

1 Remove the 2 screws.

2 Remove the steering wheel rear cover.

3. Remove the ribbon harness from the clips.

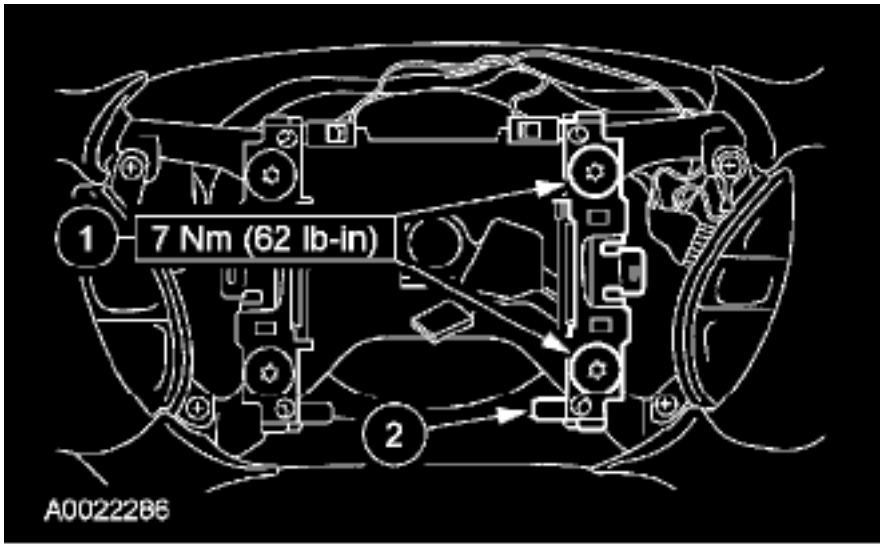
4. Disconnect the horn contact electrical connectors.

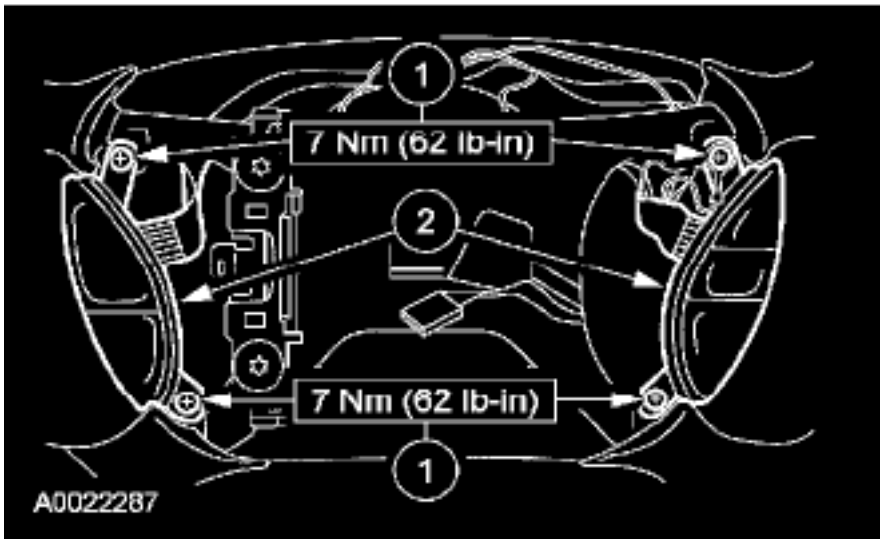
5. Remove the right side horn contact.

1 Remove the 2 screws. -

To install, tighten to 7 Nm (62 lb-in).

2 Remove the horn contact.





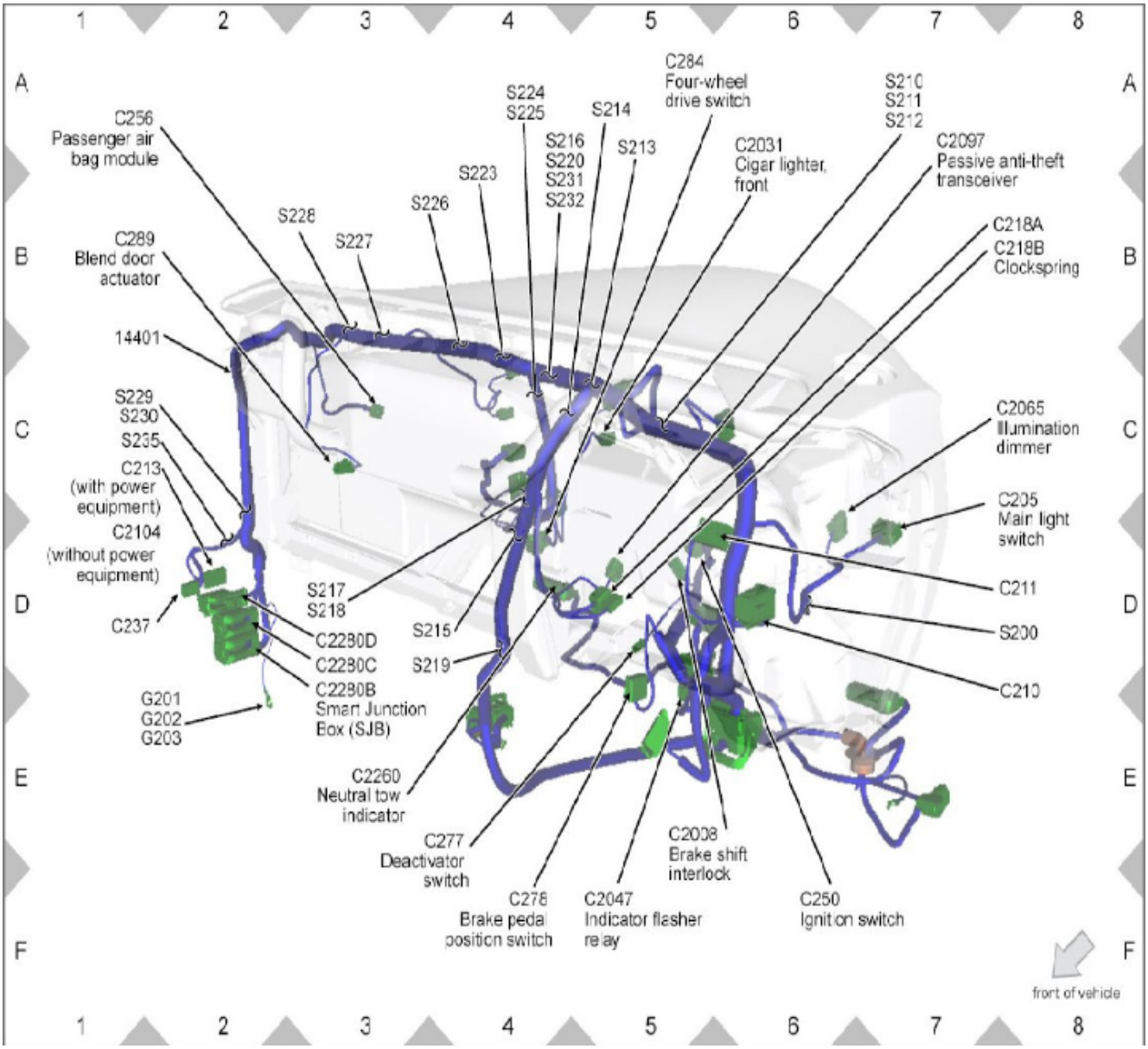
6. Remove the speed control switch assembly.

1 Remove the 4 screws. -

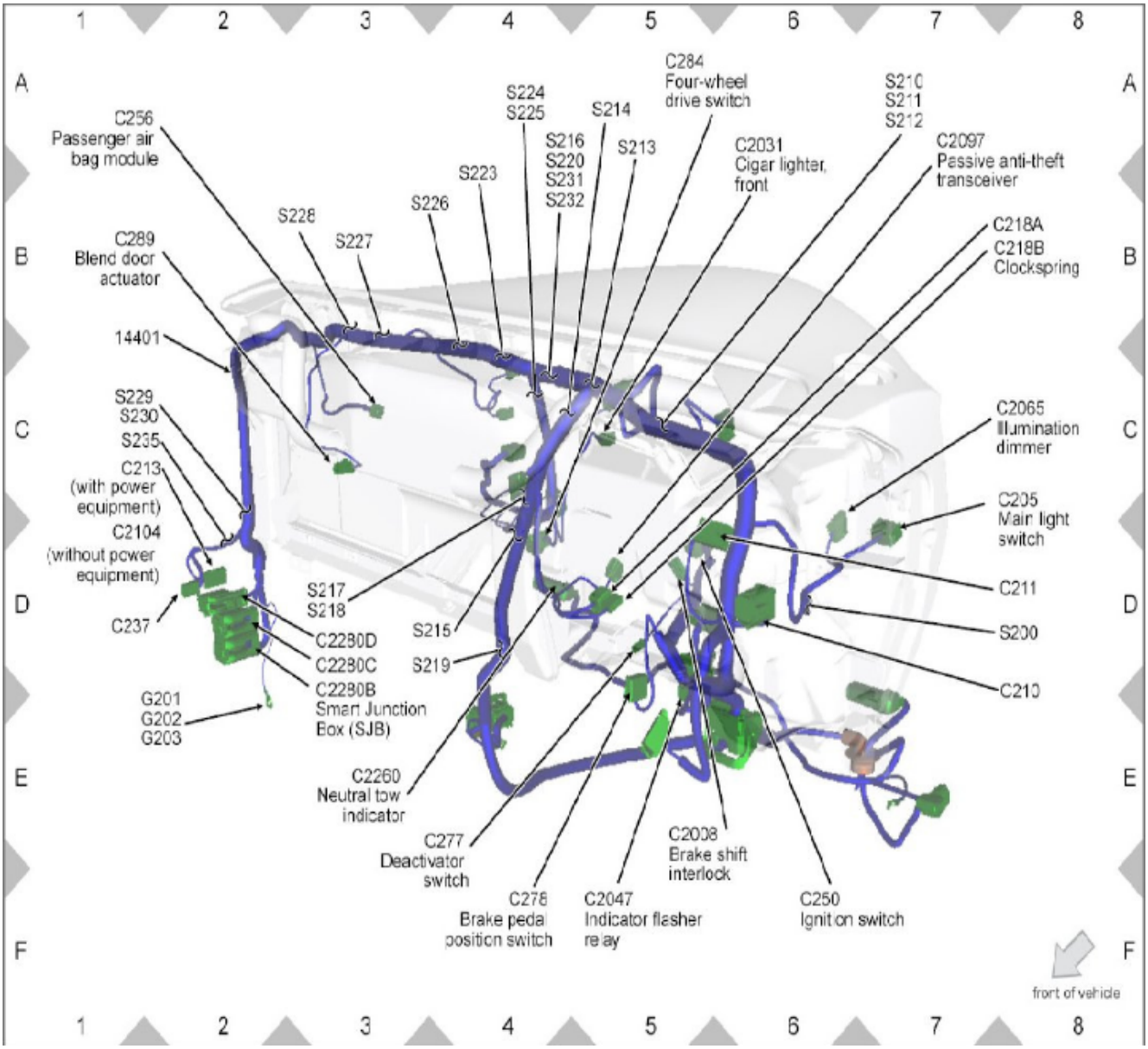
To install, tighten to 7 Nm (62 lb-in).

2 Remove the speed control switch assembly.

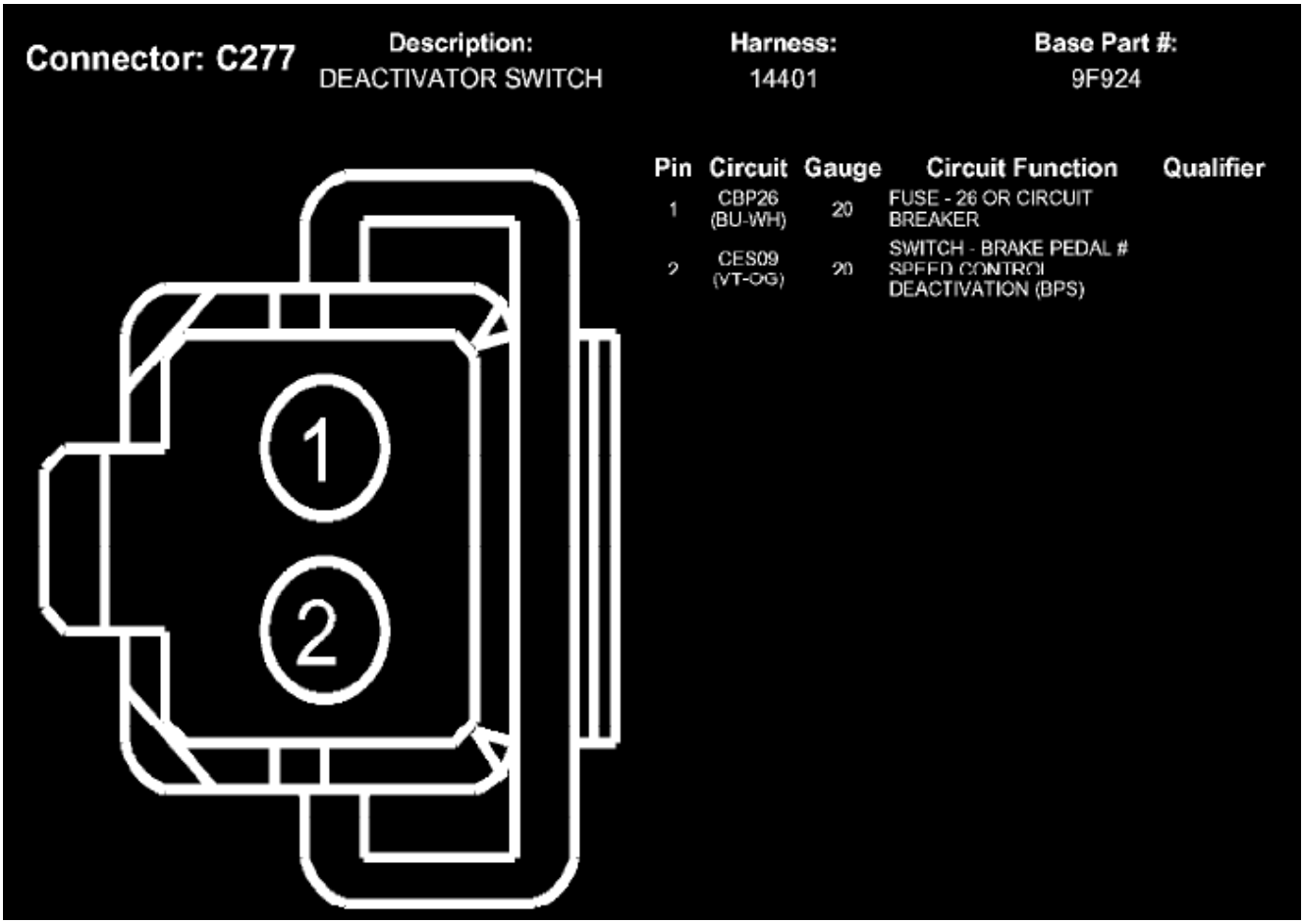
7. To install, reverse the removal procedure.


C256
Passenger air bag module
C289
Blend door actuator
14401
S229
S230
S235
C213
(with power equipment)
C2104
(without power equipment)
C237
G201
G202
G203
S228
S227
S226
S223
S224
S225
S214
S216
S220
S231
S232
S213
C284
Four-wheel drive switch
C2031
Cigar lighter, front
S210
S211
S212
C2097
Passive anti-theft transceiver
C218A
C218B
Clockspring
C2065
Illumination dimmer
C205
Main light switch
C211
S200
C210
S217
S218
S215
S219
C2280D
C2280C
C2280B
Smart Junction Box (SJB)
C2260
Neutral tow indicator
C277
Deactivator switch
C278
Brake pedal position switch
C2047
Indicator flasher relay
C2008
Brake shift interlock
C250
Ignition switch
front of vehicle

View 151-11


1
2
3
4
5
6
7
8
A
B
C
D
E
F
C256
Passenger air bag module
C289
Blend door actuator
14401
S229
S230
S235
C213
(with power equipment)
C2104
(without power equipment)
C237
G201
G202
G203
S228
S227
S226
S223
S224
S225
S216
S220
S231
S232
S214
S213
C284
Four-wheel drive switch
C2031
Cigar lighter, front
S210
S211
S212
C2097
Passive anti-theft transceiver
C218A
C218B
Clockspring
C2065
Illumination dimmer
C205
Main light switch
C211
S200
C210
S217
S218
S215
S219
C2280D
C2280C
C2280B
Smart Junction Box (SJB)
C2260
Neutral tow indicator
C277
Deactivator switch
C278
Brake pedal position switch
C2047
Indicator flasher relay
C2008
Brake shift interlock
C250
Ignition switch
front of vehicle

View 151-11


Connector: C277
Description:
DEACTIVATOR SWITCH
Harness:
14401
Base Part #:
9F924
Pin
Circuit
Gauge
Circuit Function
Qualifier
1
CBP26 (BU-WH)
20
FUSE - 26 OR CIRCUIT BREAKER
2
CES09 (VT-OG)
20
SWITCH - BRAKE PEDAL # SPEED CONTROL DEACTIVATION (BPS)
1
2

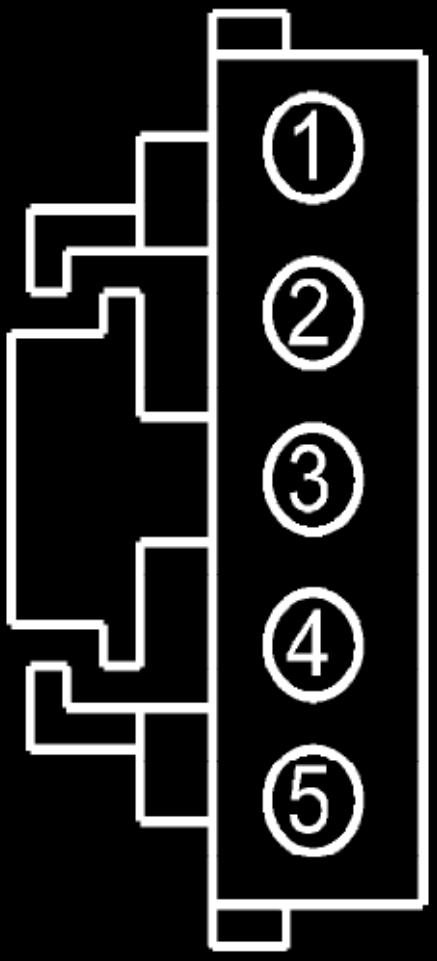
C277

Connector: C278

Description: BRAKE PEDAL POSITION SWITCH

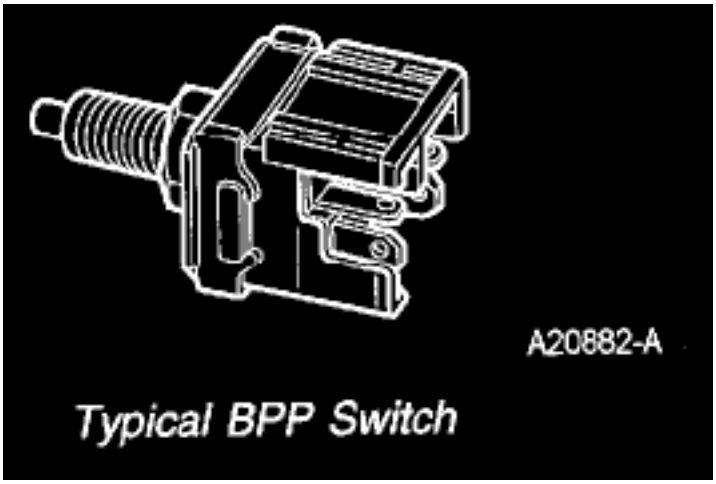
Harness: 14401

Base Part #:



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	SBP19 (BU-RD)	16	FUSE - 19 OR CIRCUIT BREAKER	
2	CCB08 (VT-WH)	16	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL OPEN	
3	SBP32 (VT-RD)	22	FUSE - 32 OR CIRCUIT BREAKER	
4	CCB15 (BN-GN)	22	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL CLOSED	
5	GD161 (BK-YE)	22	GROUND - SEAT BRACKET REAR LEFT	

C278



Brake Switch (Cruise Control): Description and Operation

Brake Pedal Position (BPP) Switch

Typical BPP Switch

The BPP switch is sometimes referred to as the stoplamp switch. The BPP switch provides a signal to the PCM indicating that the brakes are applied. The BPP switch is normally open and is mounted on the brake pedal support. Depending on the vehicle application the BPP switch can be hardwired as follows: -

to the PCM supplying battery positive voltage (B+) when the vehicle brake pedal is applied.

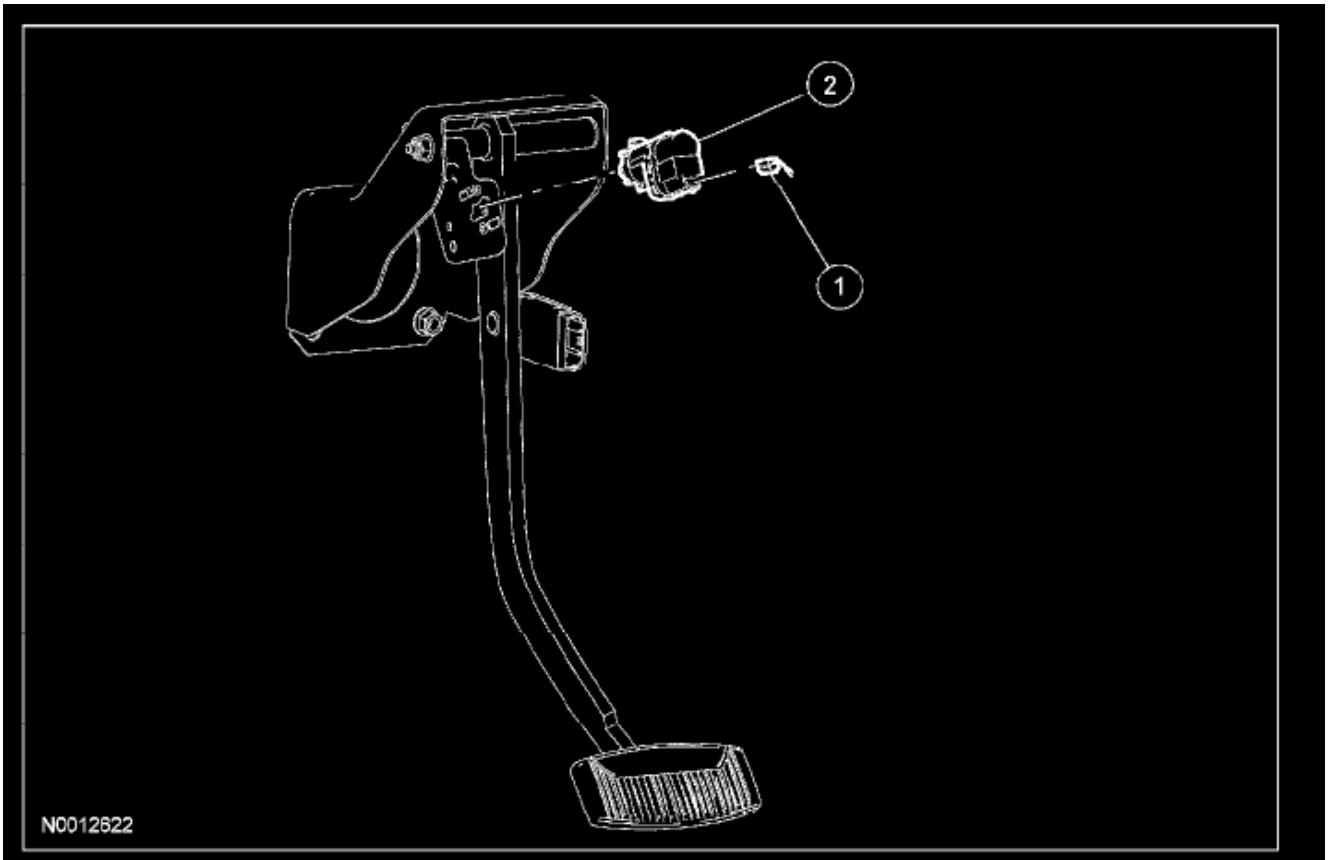
- to the antilock brake system (ABS) module, or lighting control module (LCM), the BPP signal is then broadcast over the network to be received by the PCM.

- to the ABS traction control/stability assist module. The ABS module interprets the BPP switch input along with other ABS inputs and generates an output called the driver brake application (DBA) signal. The DBA signal is then sent to the PCM and to other BPP signal users.

Brake Pedal Switch (BPS)/Brake Deactivator Switch

The BPS, also called the brake deactivator switch, is for vehicle speed control deactivation. A normally closed switch supplies battery positive voltage (B+) to the PCM when the brake pedal is not applied. When the brake pedal is applied, the normally closed switch opens and power is removed from the PCM.

On some applications the normally closed BPS, along with the normally open BPP switch, are used for a brake rationality test within the PCM. The PCM misfire monitor profile learn function may be disabled if a brake switch concern occurs. If one or both brake pedal inputs to the PCM is not changing states when they were expected to, a diagnostic trouble code (DTC) is set by the PCM strategy.



Item	Part Number	Description
1	—	Speed control deactivator switch electrical connector (part of 12A581)
2	9C872	Speed control deactivator switch

Brake Switch (Cruise Control): Service and Repair

SPEED CONTROL DEACTIVATOR SWITCH

Removal and Installation

1. CAUTION: Do not press the brake pedal when removing or installing the speed control deactivator switch or damage to the switch will

occur.

Disconnect the speed control deactivator switch electrical connector.

2. Rotate the speed control deactivator switch counterclockwise 45 degrees and remove it.

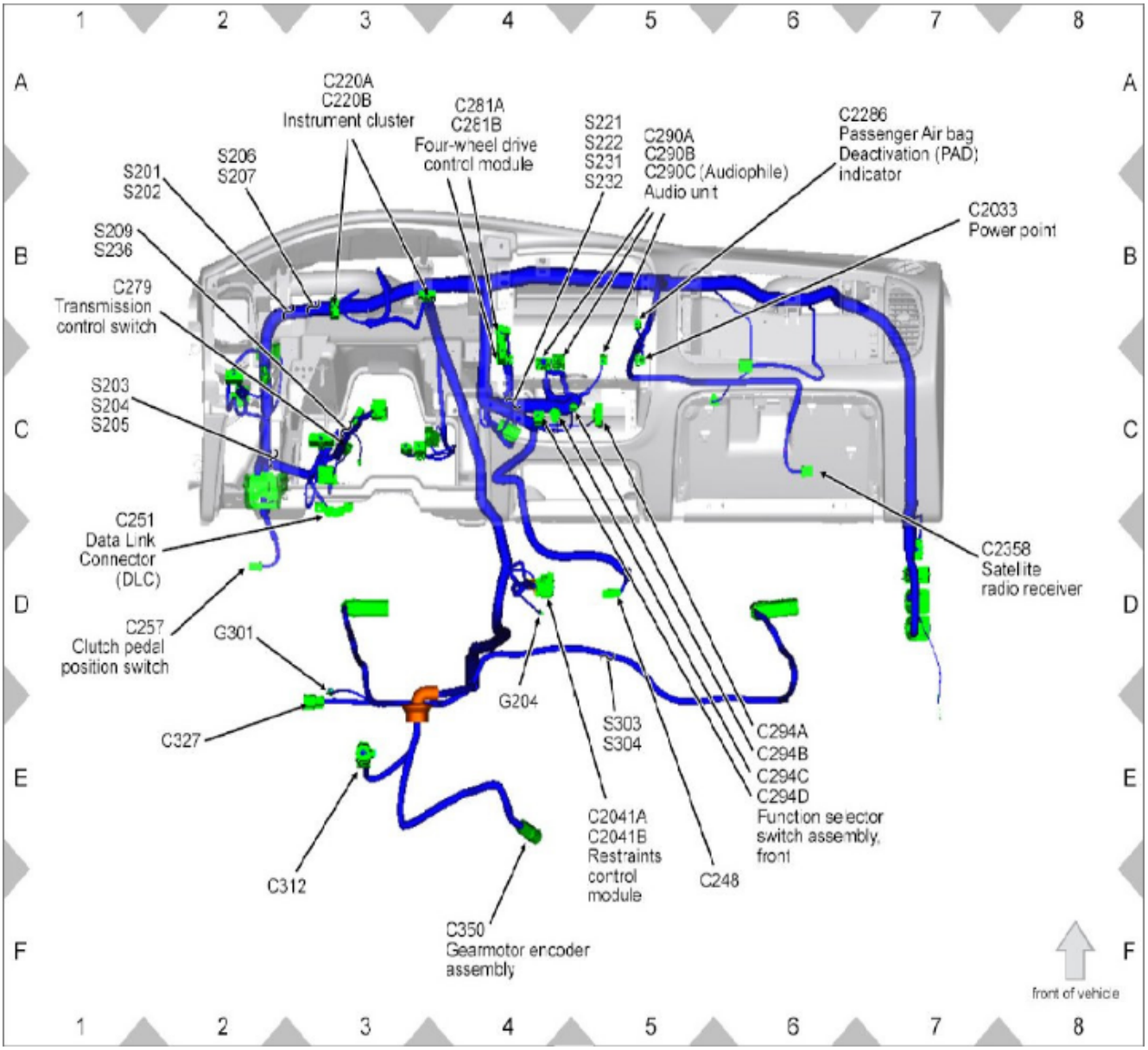
- Disconnect the electrical connector.

3. NOTE: The speed control deactivator switch is self-adjusting. Do not press the brake pedal during installation. Initial installation of the speed

control deactivator switch allows for one adjustment. If additional adjustments are necessary, install a new speed control deactivator switch.

To install, reverse the removal procedure.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Cruise Control > Sensors and Switches - Cruise Control > Clutch Switch, Cruise Control > Component Information > Locations



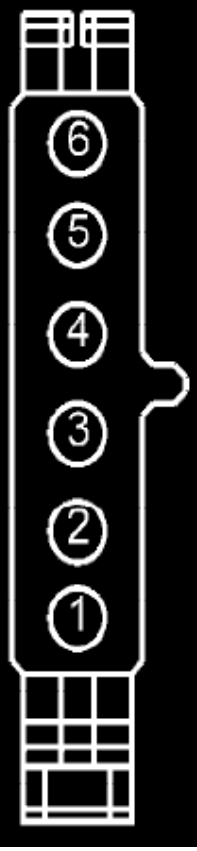
View 151-12

Connector: C257

Description: CLUTCH PEDAL POSITION SWITCH

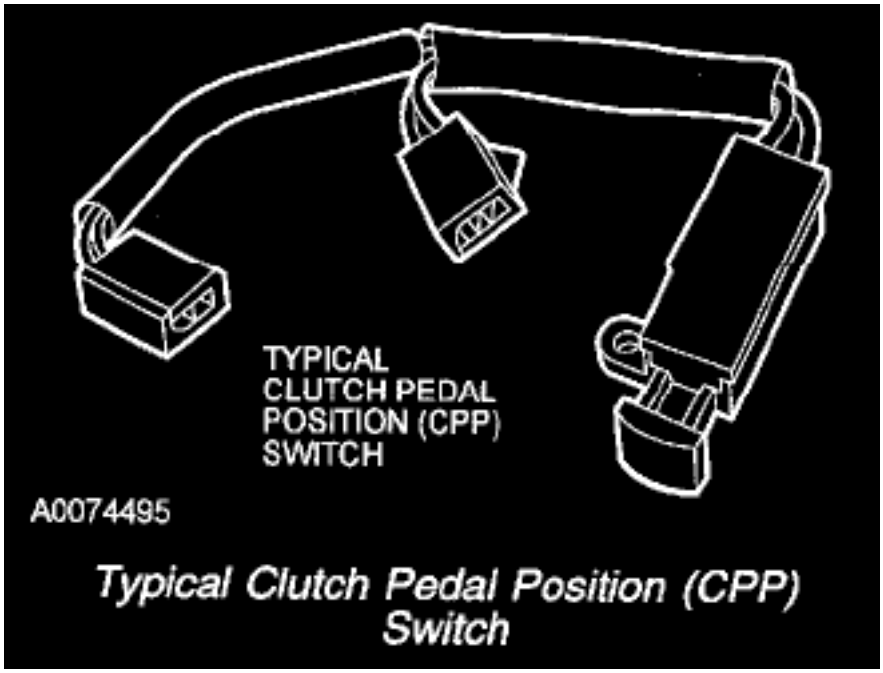
Harness: 14401

Base Part #: 11A152



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CE904 (GN-VT)	22	SWITCH - CLUTCH PEDAL POSITION # TOP OF TRAVEL (CPP-TT)	
2	GD174 (BK-WH)	22	GROUND - TUNNEL	
3	CCB15 (BN-GN)	22	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL CLOSED	
4	CCB15 (BN-GN)	22	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL CLOSED	
5	GD174 (BK-WH)	22	GROUND - TUNNEL	
6	CDC36 (GN-BN)	22	SWITCH - START INTERLOCK CLUTCH PEDAL	

C257



Typical Clutch Pedal Position (CPP) Switch

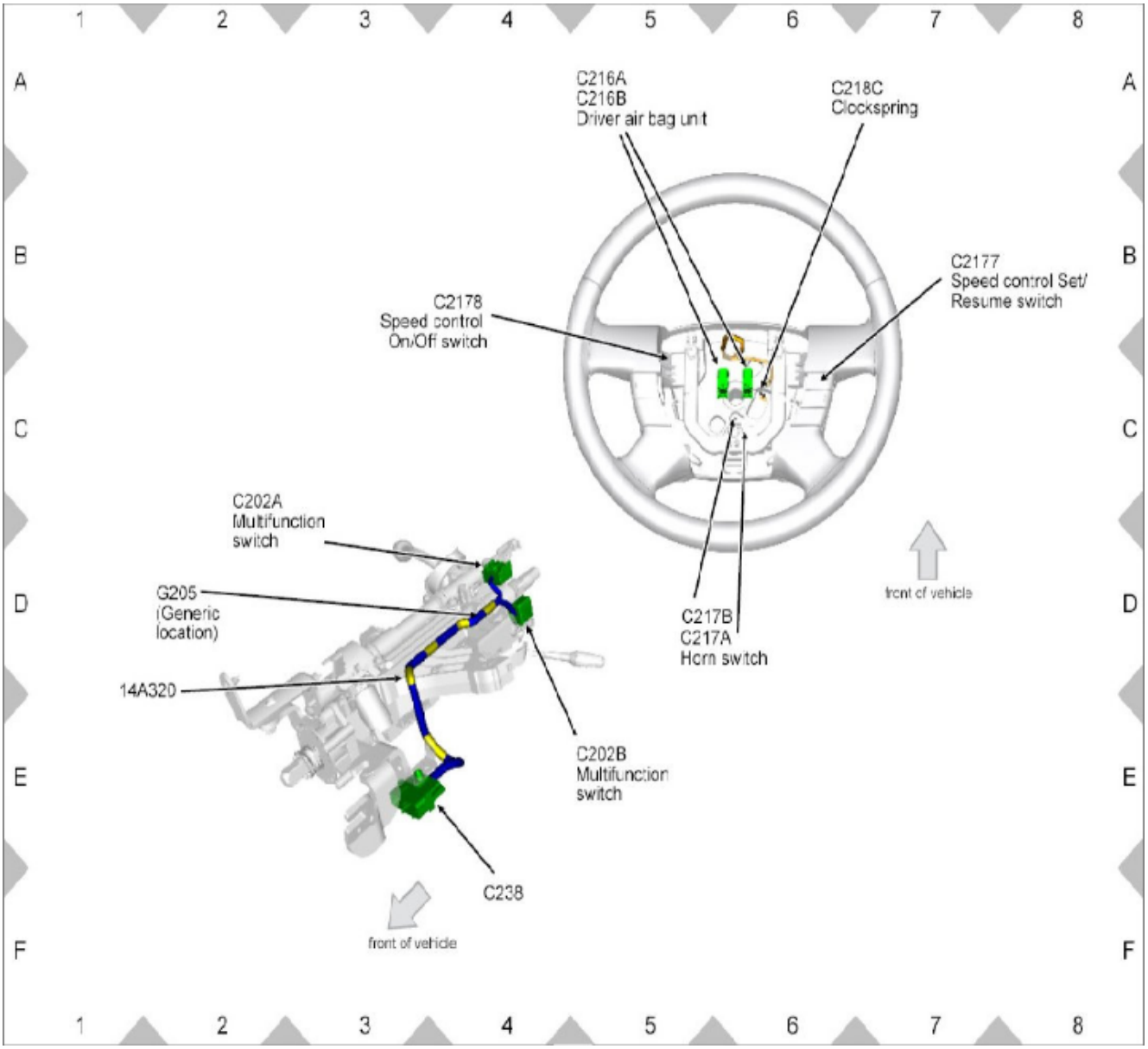
Clutch Switch: Description and Operation

CLUTCH PEDAL POSITION (CPP) SWITCH

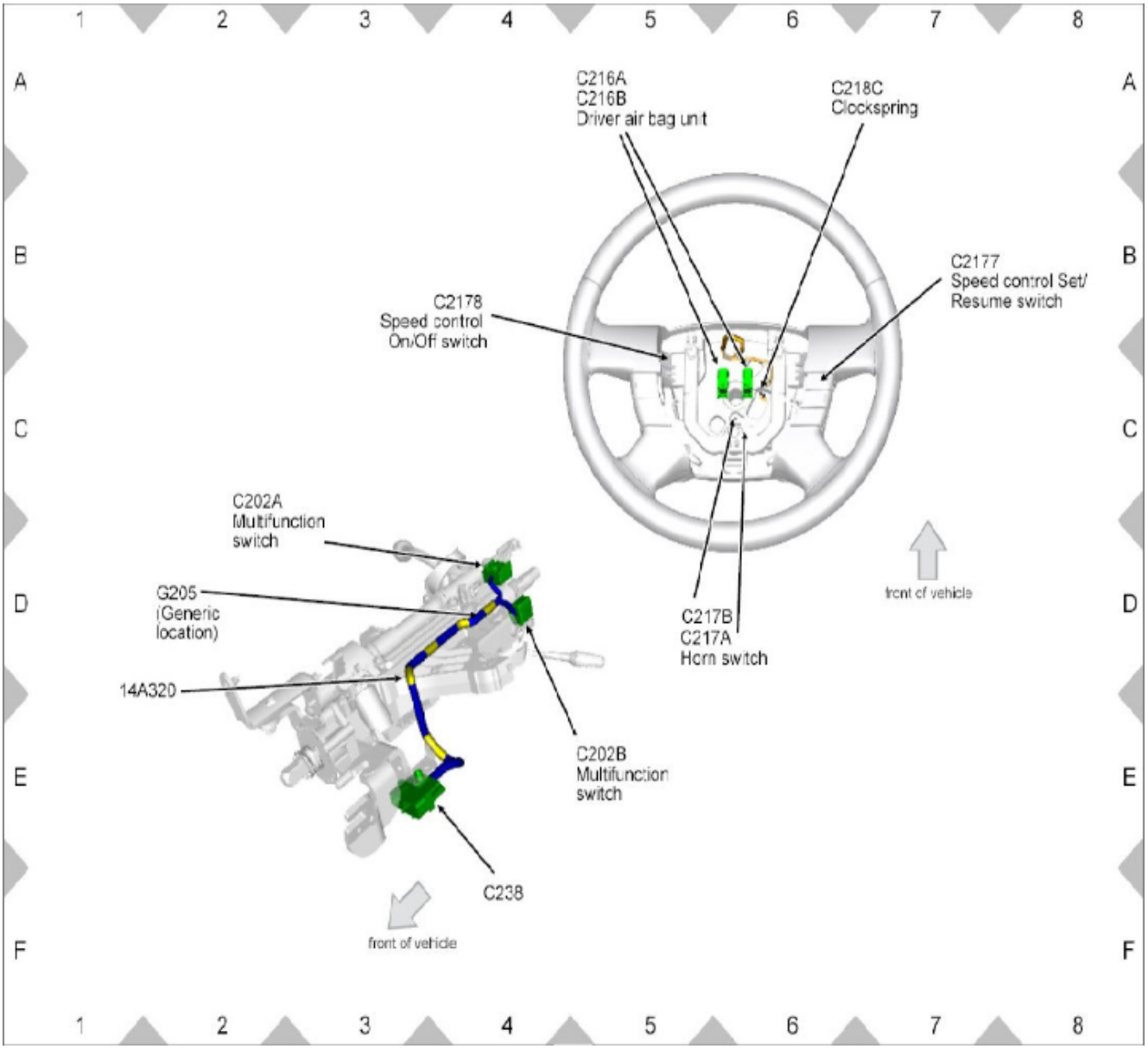
Typical Clutch Pedal Position (CPP) Switch

The CPP switch is an input to the PCM indicating the clutch pedal position. The PCM provides a low current voltage on the CPP circuit. When the CPP switch is closed, this voltage is pulled low through the SIG RTN circuit. The CPP input to the PCM is used to detect a reduction in engine load. The PCM uses the load information for mass air flow and fuel calculations.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Cruise Control > Sensors and Switches - Cruise Control > Cruise Control Switch > Component Information > Locations > Speed Control On/Off Switch



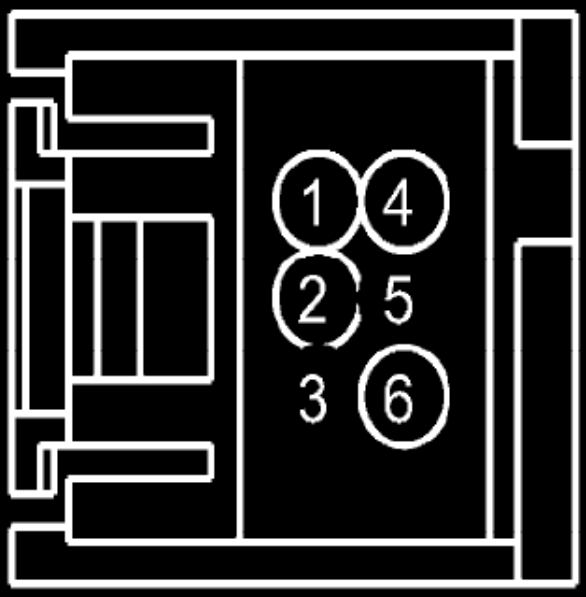
View 151-13


C216A
C216B
Driver air bag unit
C218C
Clockspring
C2177
Speed control Set/
Resume switch
C2178
Speed control
On/Off switch
C202A
Multifunction
switch
G205
(Generic
location)
14A320
C217B
C217A
Horn switch
front of vehicle
C202B
Multifunction
switch
C238
front of vehicle

View 151-13

Connector: C2177

Description:	Harness:	Base Part #:
SPEED CONTROL SET/RESUME SWITCH	17889	9C888

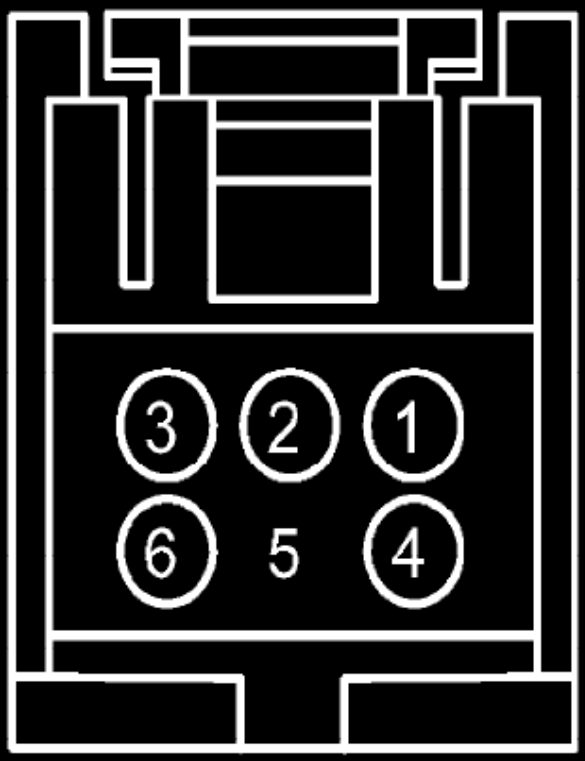


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	57 (GK)	22	GROUND - TUNNEL	
2	151 (LB-BK)	22	SWITCH - SPEED CONTROL COMMAND (SCCS)	
3	*	*	not used	
4	848 (DG-OG)	22	CTRL MOD. - POWERTRAIN # SPEED CONTROL COMMAND RETURN (SCCSRTN)	
5	*	*	not used	
6	235 (RD-BK)	22	DIMMER - IP/SWITCH ILLUMINATION	

C2177

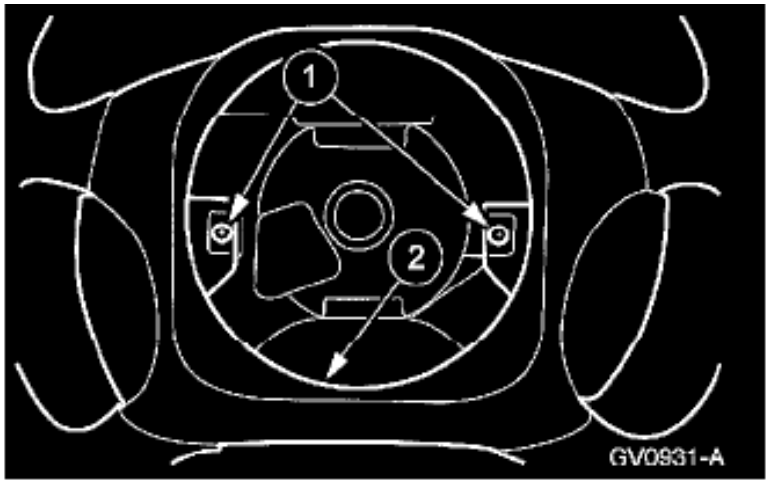
Connector: C2178

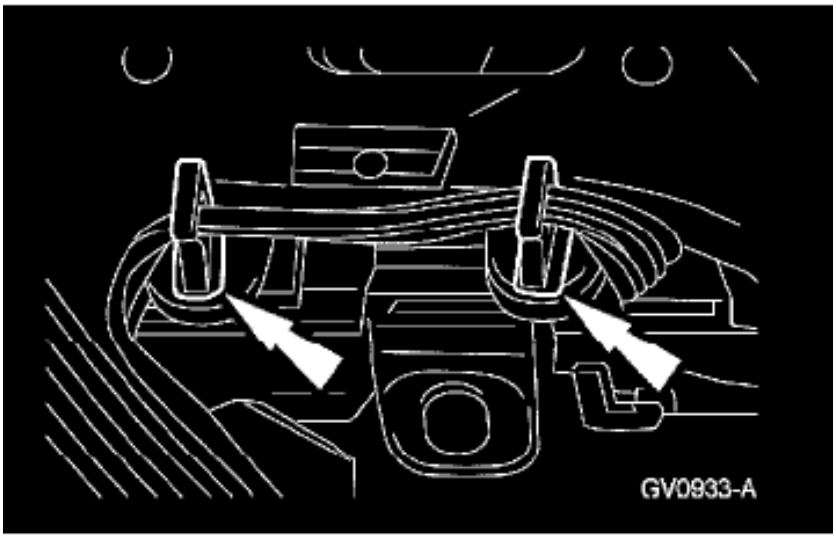
Description:	Harness:	Base Part #:
SPEED CONTROL ON/OFF SWITCH	17889	9C888



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	848 (DG-OG)	22	CTRL MOD. - POWERTRAIN # SPEED CONTROL COMMAND RETURN (SCCSRTN)	
2	151 (LB-BK)	22	SWITCH - SPEED CONTROL COMMAND (SCCS)	
3	CBP20 (YE-VT)	22	FUSE - 20 OR CIRCUIT BREAKER	
4	235 (RD-BK)	22	DIMMER - IP/SWITCH ILLUMINATION	
5	*	*	not used	
6	57 (BK)	22	GROUND - TUNNEL	

C2178


1
2
GV0931-A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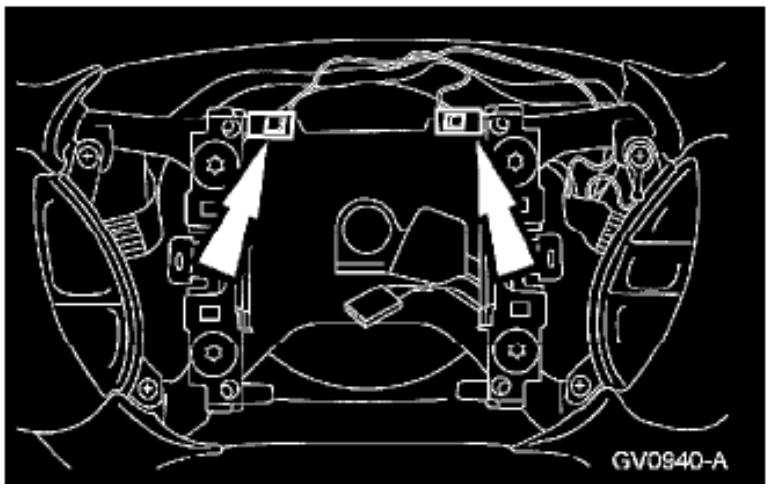

GV0940-A

Cruise Control Switch: Service and Repair

SPEED CONTROL SWITCH

Removal and Installation

1. Remove the steering wheel. 2. Remove the steering wheel rear cover.

1 Remove the 2 screws.

2 Remove the steering wheel rear cover.

3. Remove the ribbon harness from the clips.

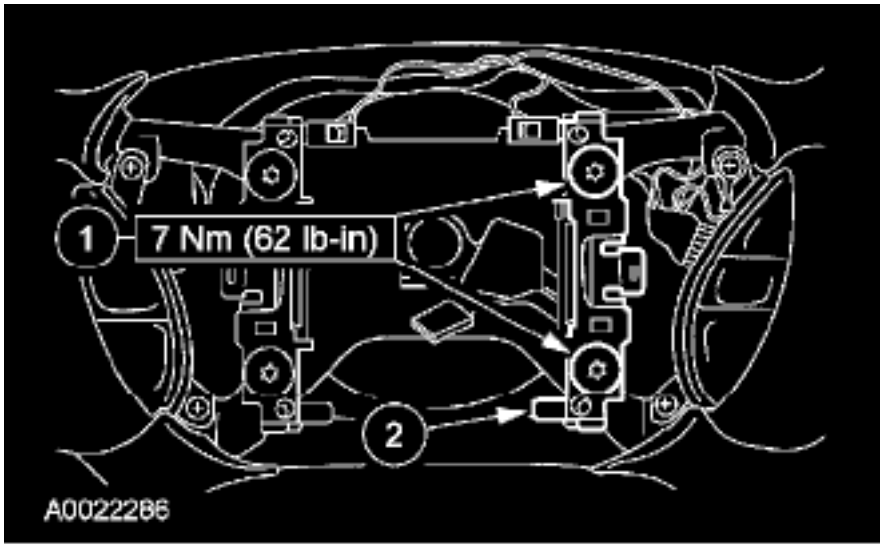
4. Disconnect the horn contact electrical connectors.

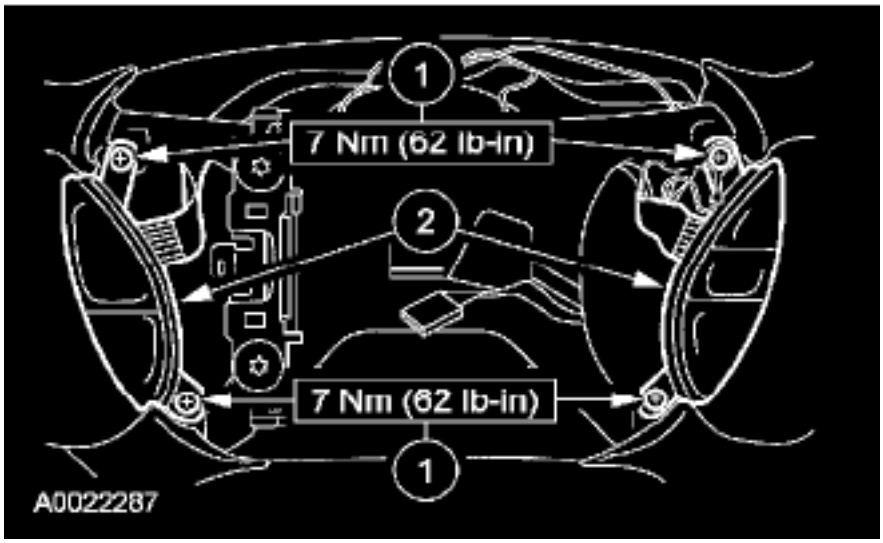
5. Remove the right side horn contact.

1 Remove the 2 screws. -

To install, tighten to 7 Nm (62 lb-in).

2 Remove the horn contact.





6. Remove the speed control switch assembly.

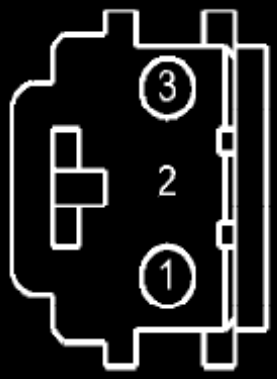
1 Remove the 4 screws. -

To install, tighten to 7 Nm (62 lb-in).

2 Remove the speed control switch assembly.

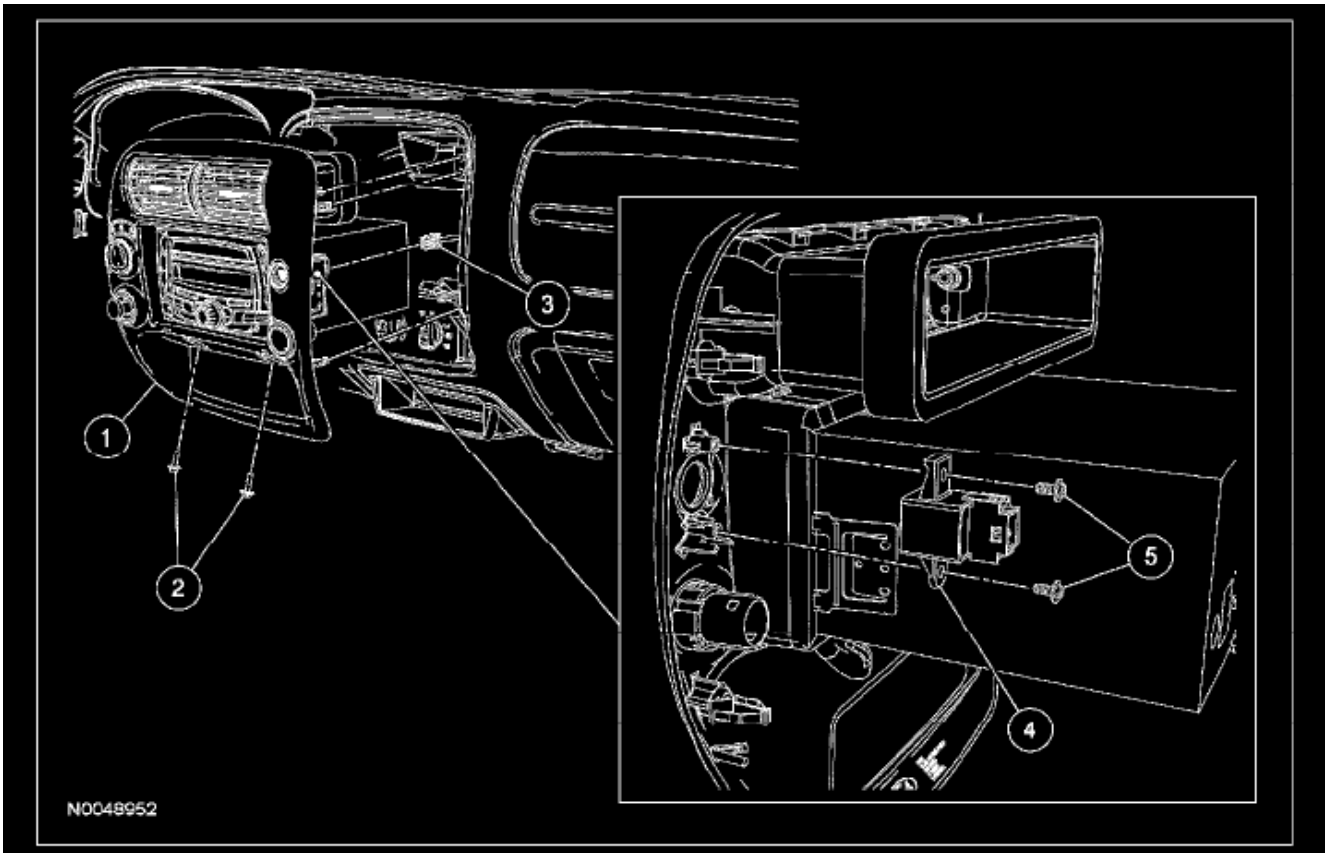
7. To install, reverse the removal procedure.

Connector: C2286	Description:	Harness:	Base Part #:
	PASSENGER AIR BAG DEACTIVATION (PAD) INDICATOR	14401	



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBP08 (GY-YE)	20	FUSE - 8 OR CIRCUIT BREAKER	
2	*	*	not used	
3	CR114 (YE-OG)	20	CTRL MOD. - INDICATOR AIR BAG	

C2286



Item	Part Number	Description
1	04302	Instrument panel (I/P) center finish panel
2	W707628	I/P center finish panel screws (2 required)
3	—	Passenger air bag deactivation (PAD) indicator electrical connector (part of 14401)
4	0A936A	PAD indicator
5	W505942	PAD indicator screws (2 required)

Air Bag Deactivation Indicator: Service and Repair

PASSENGER AIR BAG DEACTIVATION (PAD) INDICATOR

Removal and Installation

NOTE:

- The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

- Repair is made by installing a new part only. If the new part does not correct the condition, install the original part and carry out the diagnostic procedure again.

- The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

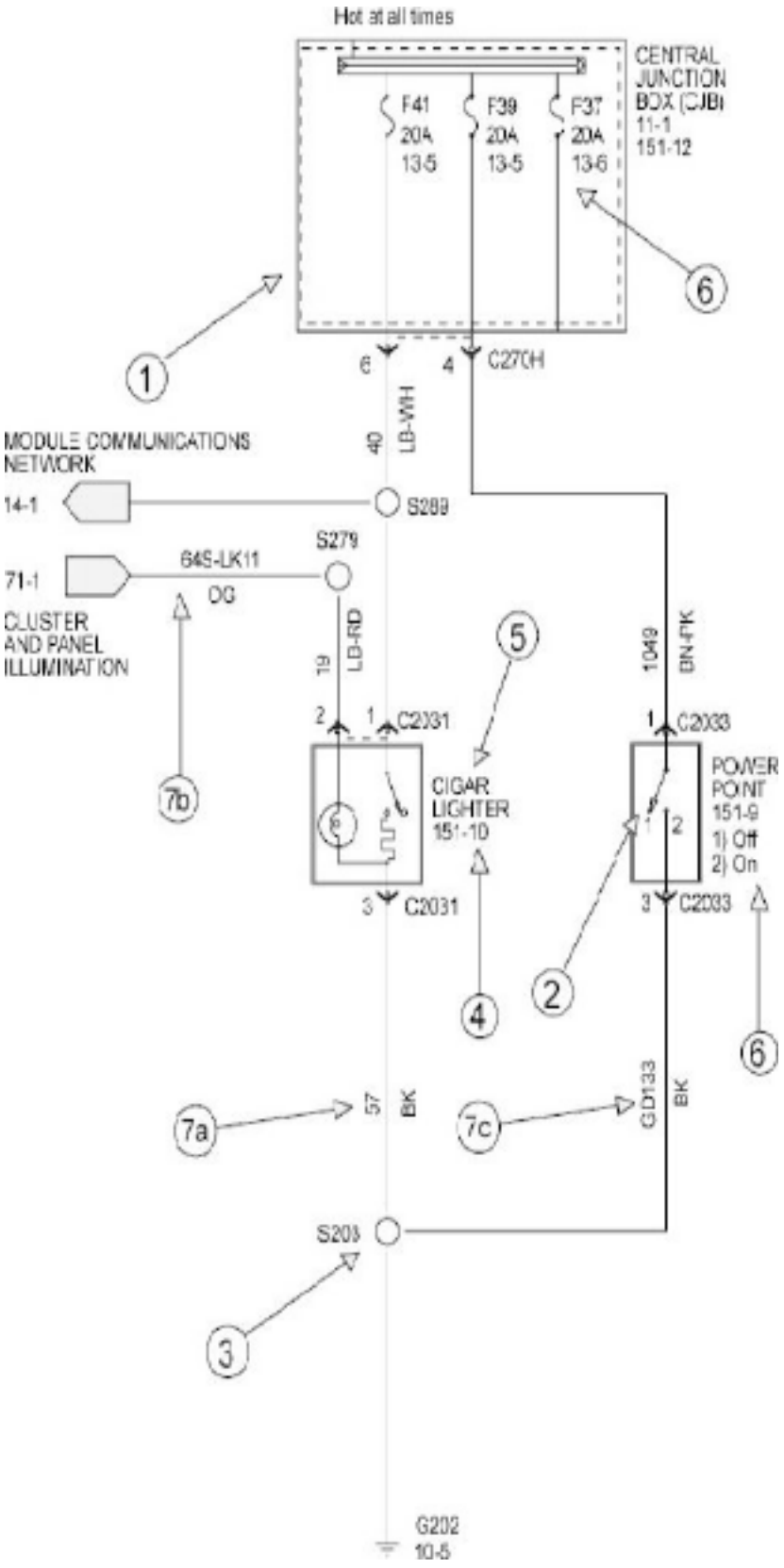
1. Depower the SRS. 2. Remove the 2 instrument panel (I/P) center finish panel screws. 3. Pull out to detach the 4 retaining clips and partially remove the I/P center trim panel. 4. Disconnect the passenger air bag deactivation (PAD) indicator electrical connector. 5. Remove the 2 screws from the PAD indicator and remove it from the I/P center finish panel. 6. To install, reverse the removal procedure. 7. Repower the SRS.

Audible Warning Device: Description and Operation

WARNING SYSTEM - DRIVER SAFETY BELT

The driver safety belt buckle incorporates a safety belt warning indicator switch, warning indicator and chime. The warning indicator and chime are reminders to fasten the safety belt.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Instrument Panel, Gauges and Warning Indicators > Cigarette Lighter > Component Information > Diagrams > Diagram Information and Instructions



Cigarette Lighter: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

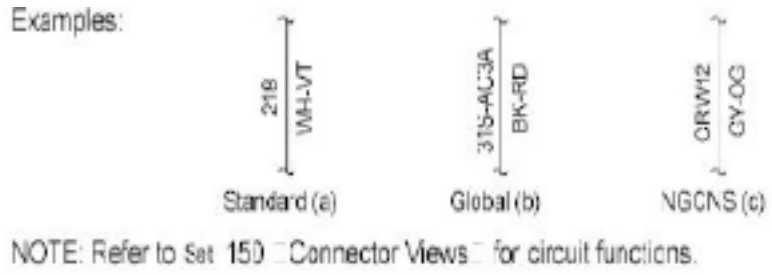
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

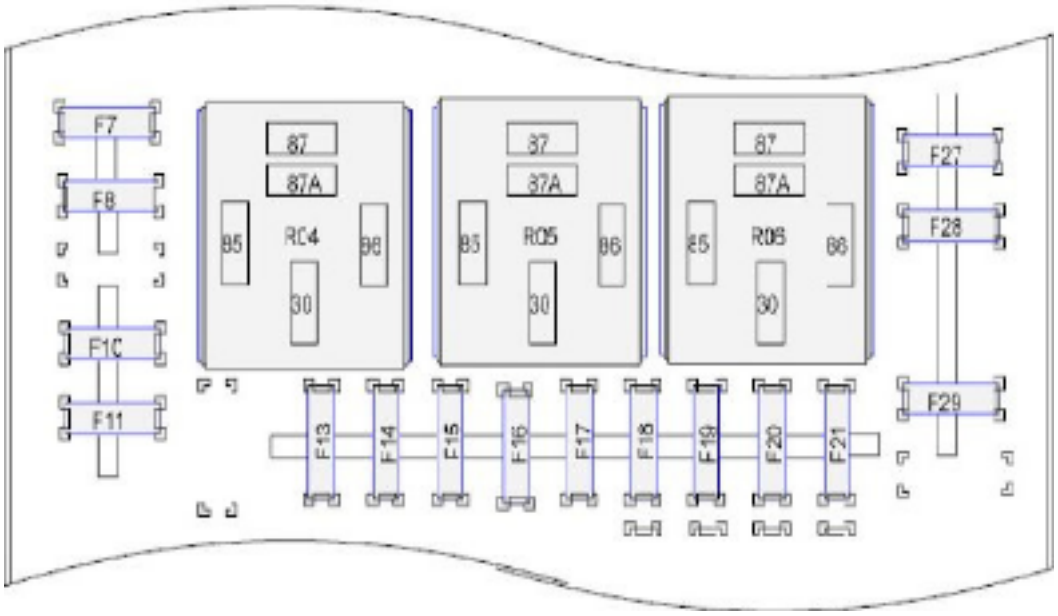
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

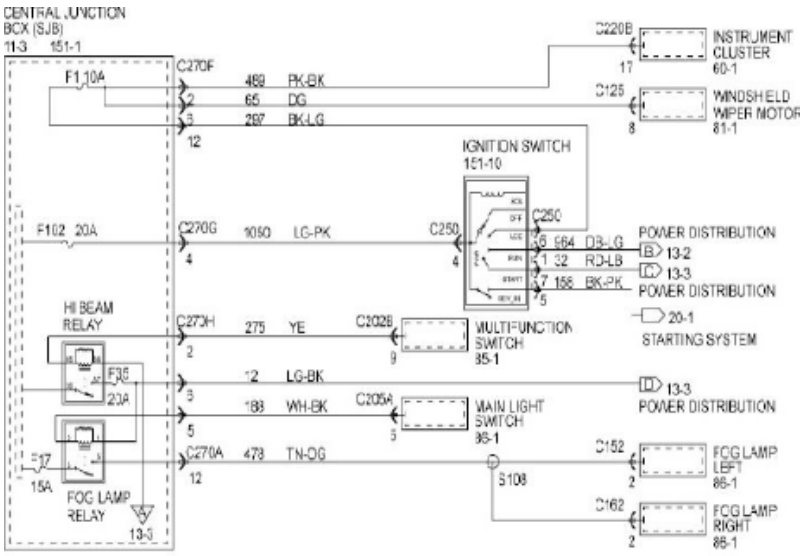
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

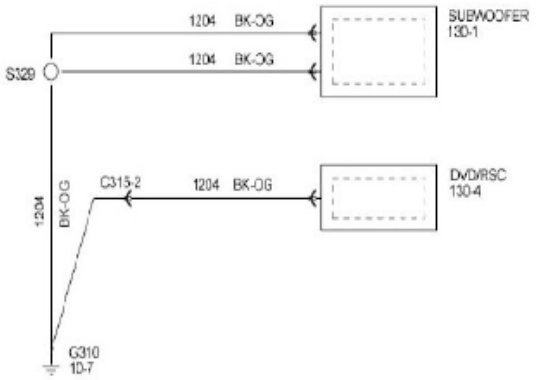
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

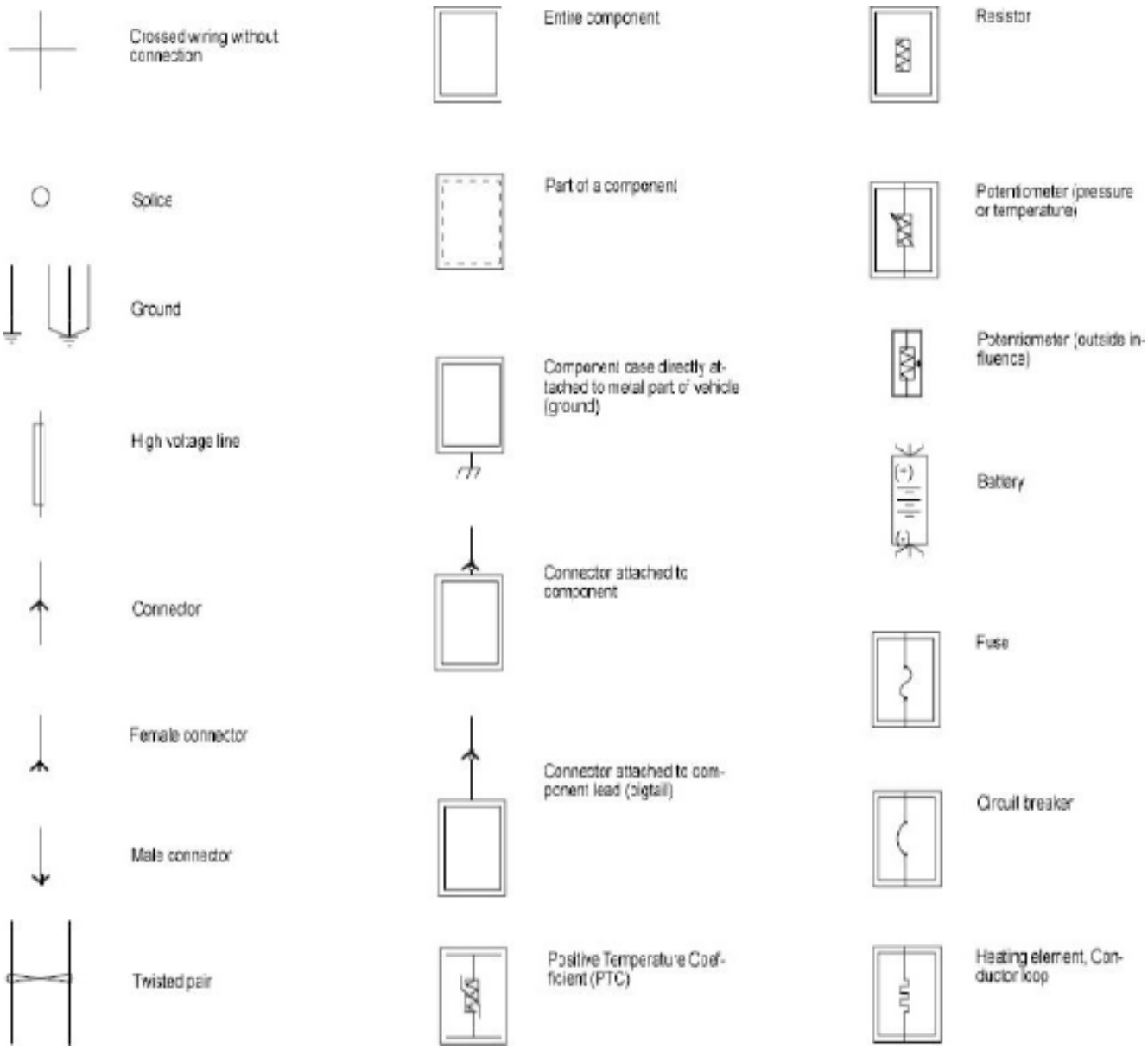
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

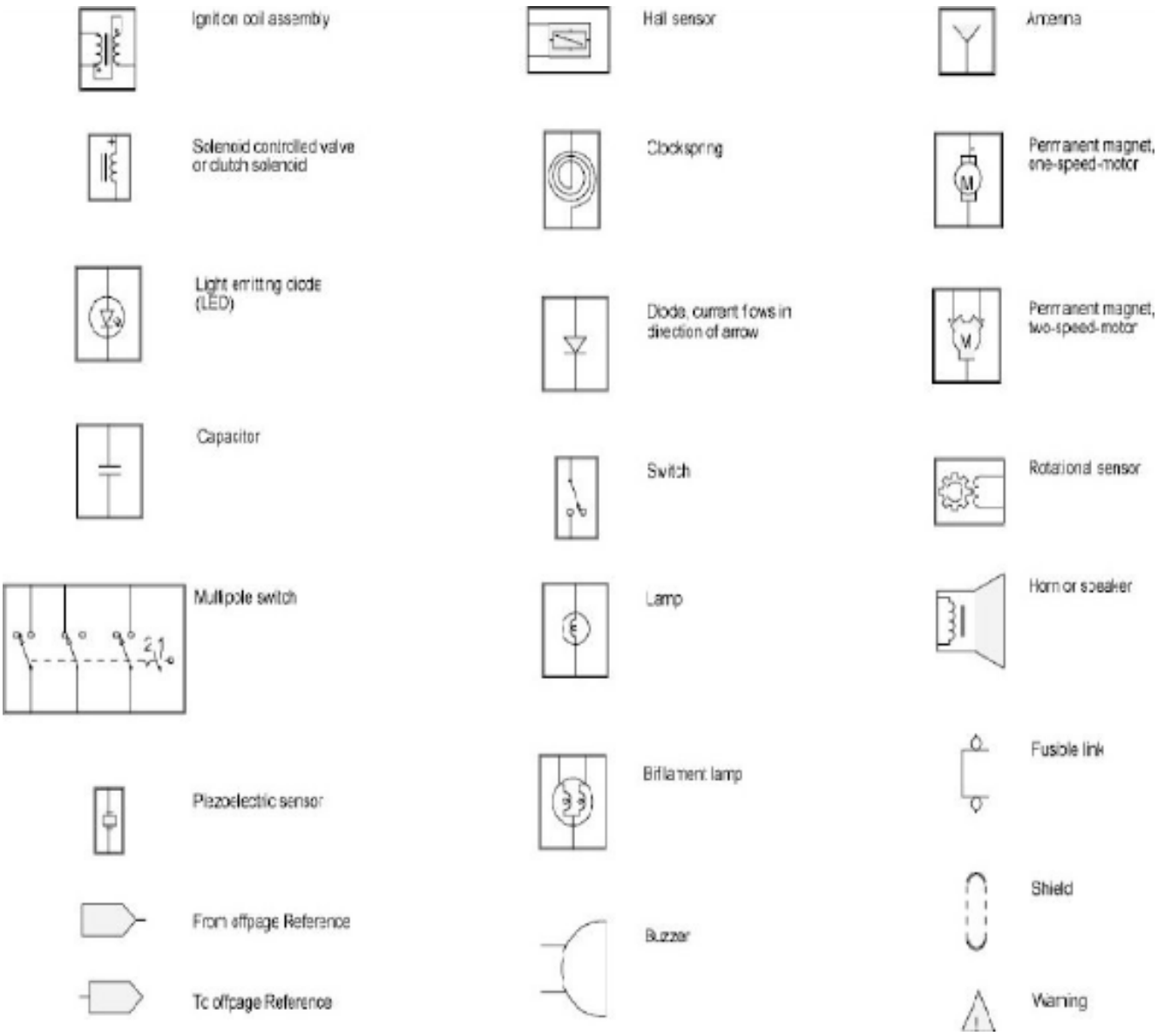
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

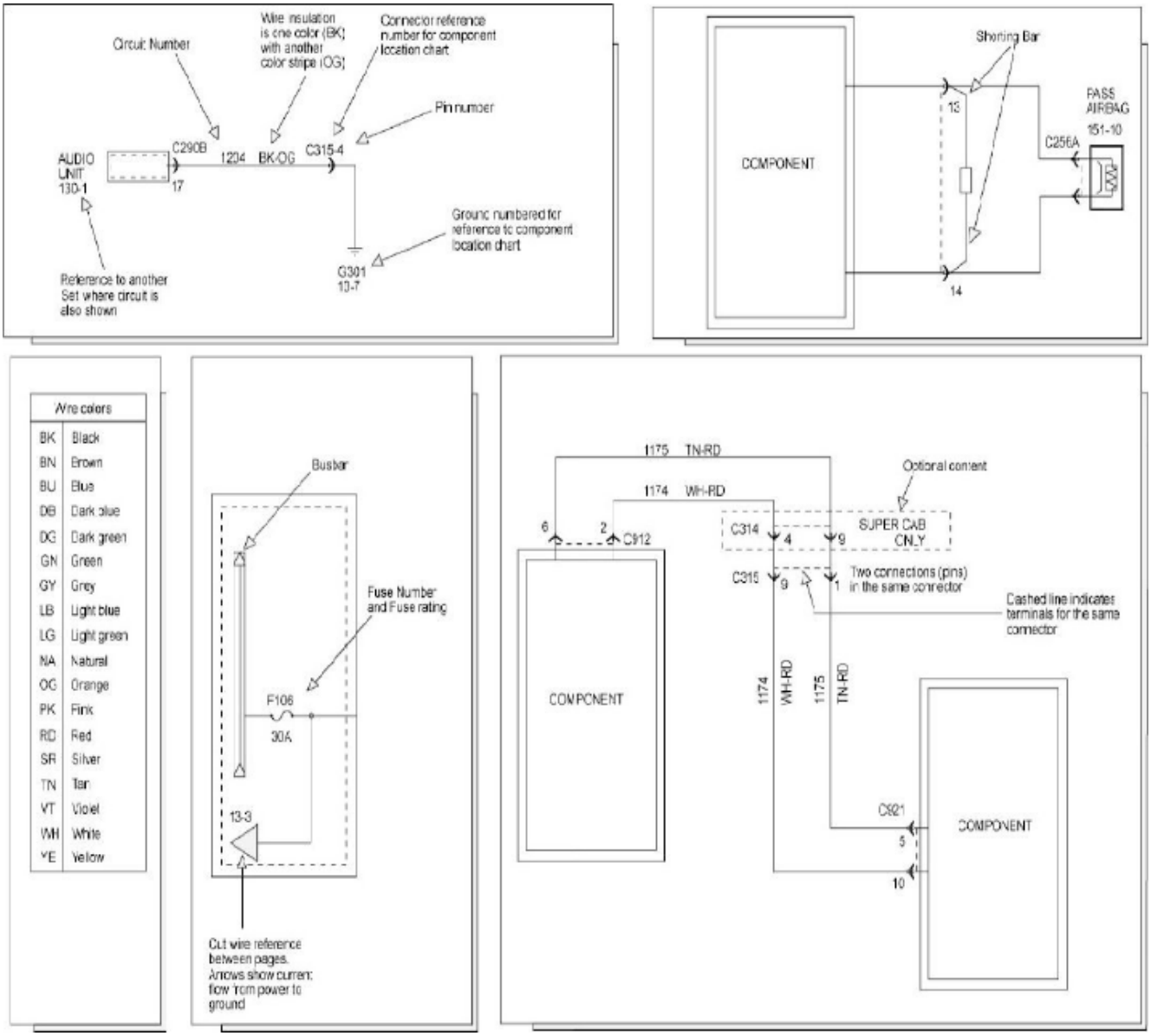
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

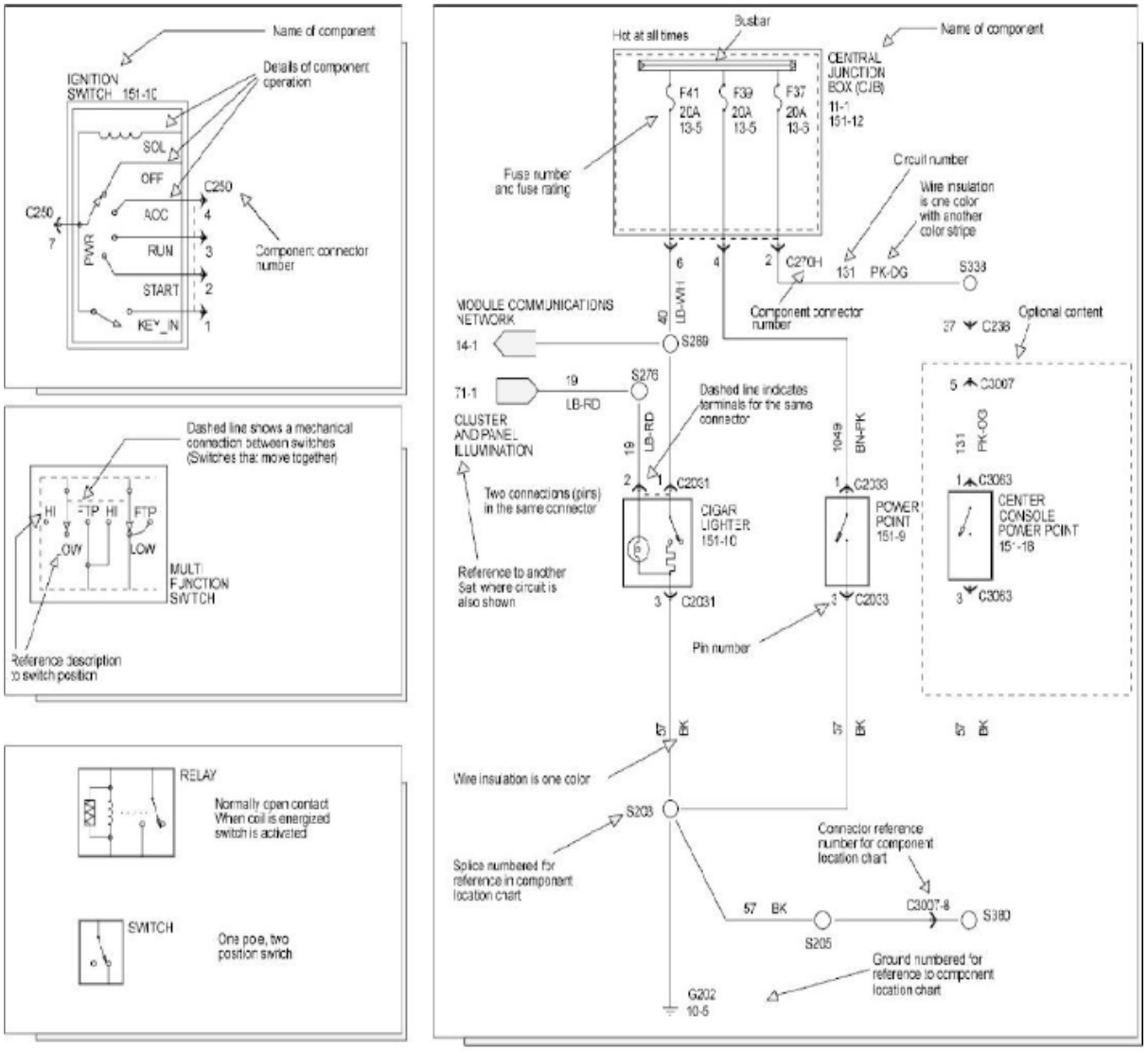
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

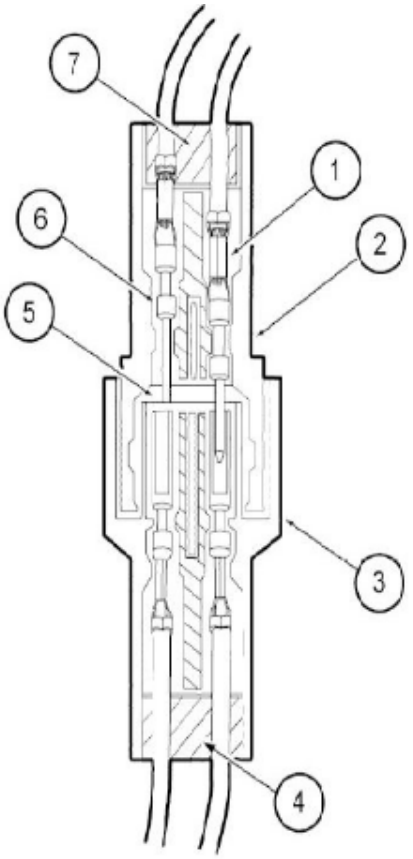


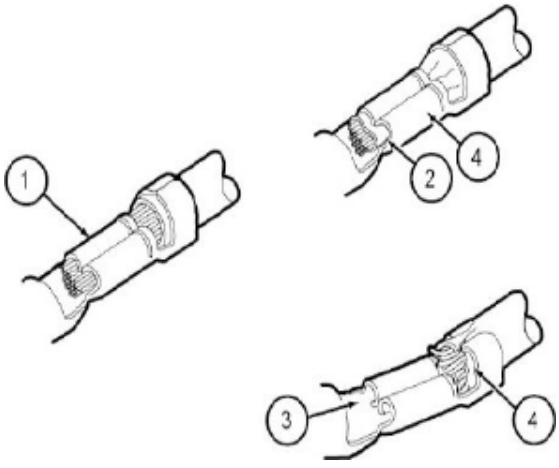
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Cigarette Lighter: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

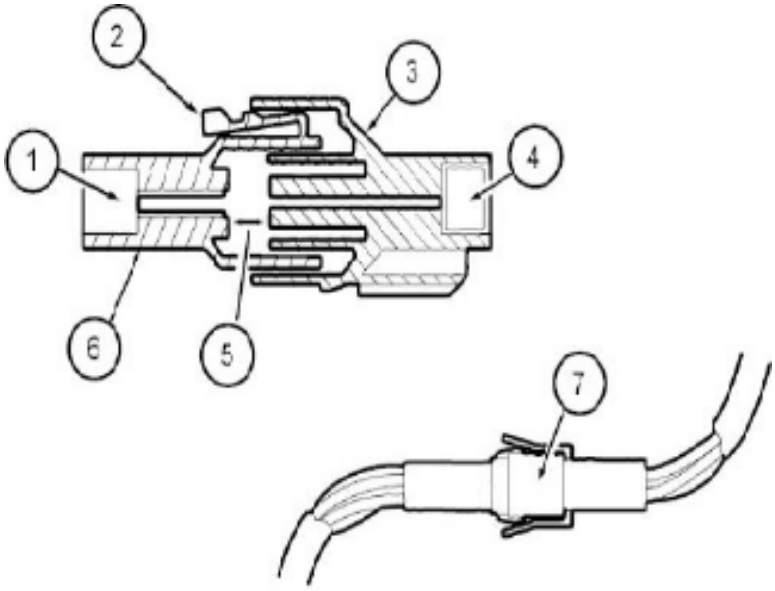
5 = Intermittent contact

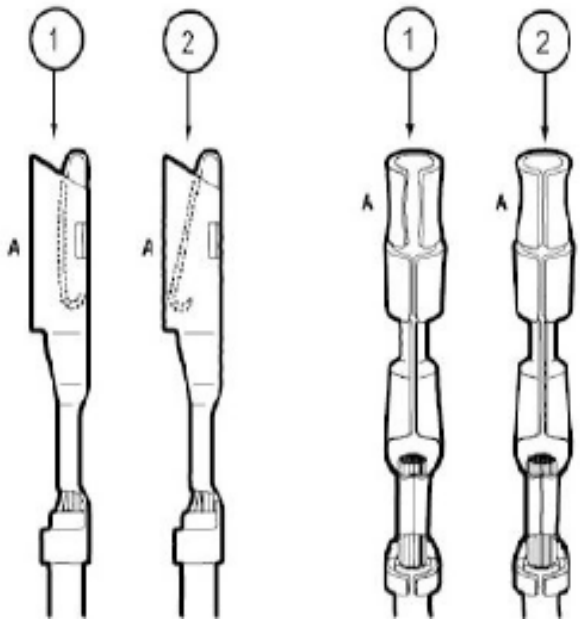
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

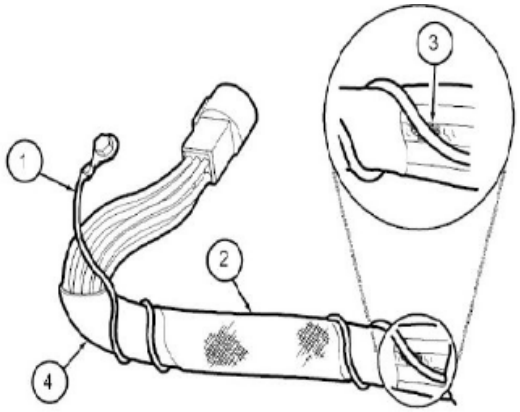
Deformed (enlarged) female terminals

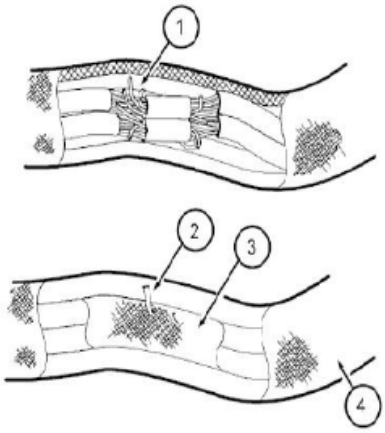
1 = Enlarged

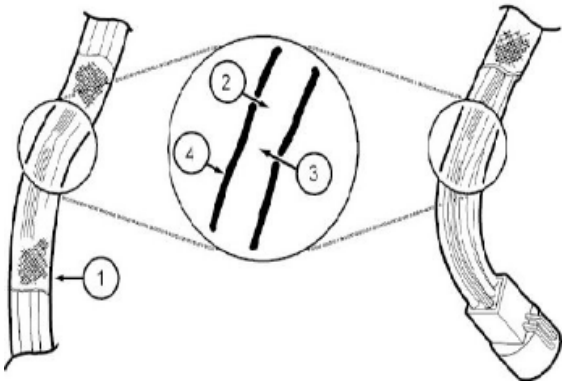
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

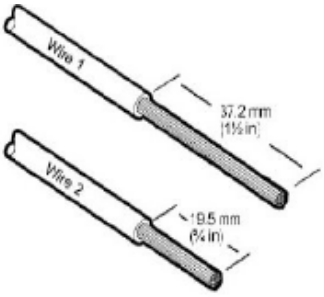
Splice covered 2

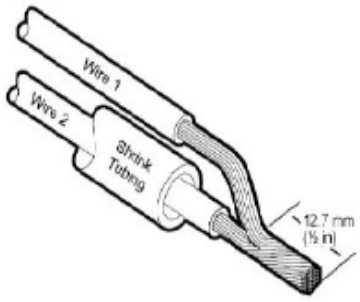
= Wire strand

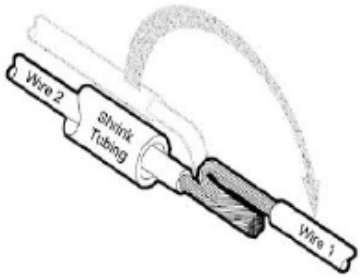
3 = Splice tape

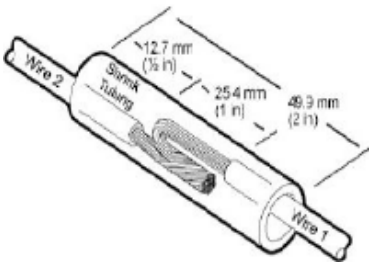
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.9 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

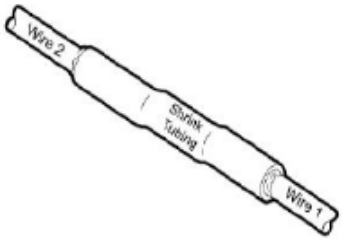
NOTE: -

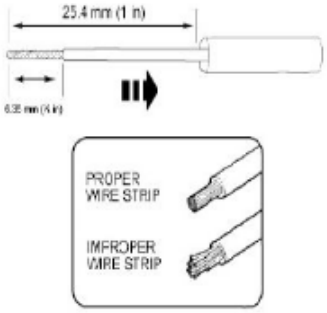
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

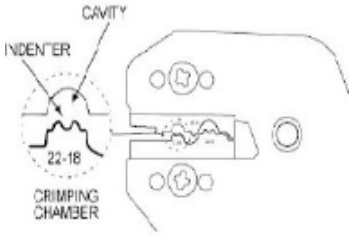
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

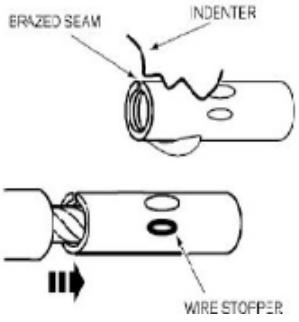
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

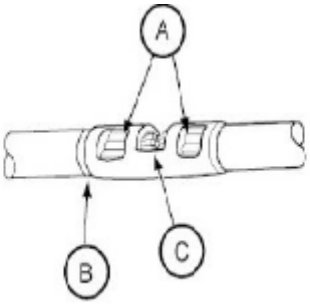
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

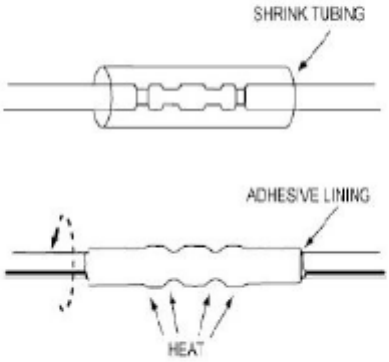
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4□ strip, cut 9 strands	* 1/4□ strip, cut 2 strands	1/4□ strip, no fold	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip, fold 2x dia.	1□ strip, fold 3x dia.
	16-14	* 1/4□ strip, cut 7 strands	1/4□ strip, no fold	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip fold 2x dia	1□ strip, fold 3x dia.	1 1/4□ strip, fold 4x dia.	Not Recommended
	12-10	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip, fold 2x dia.	1□ strip fold 3x cia.	1 1/4□ strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Pigtail only

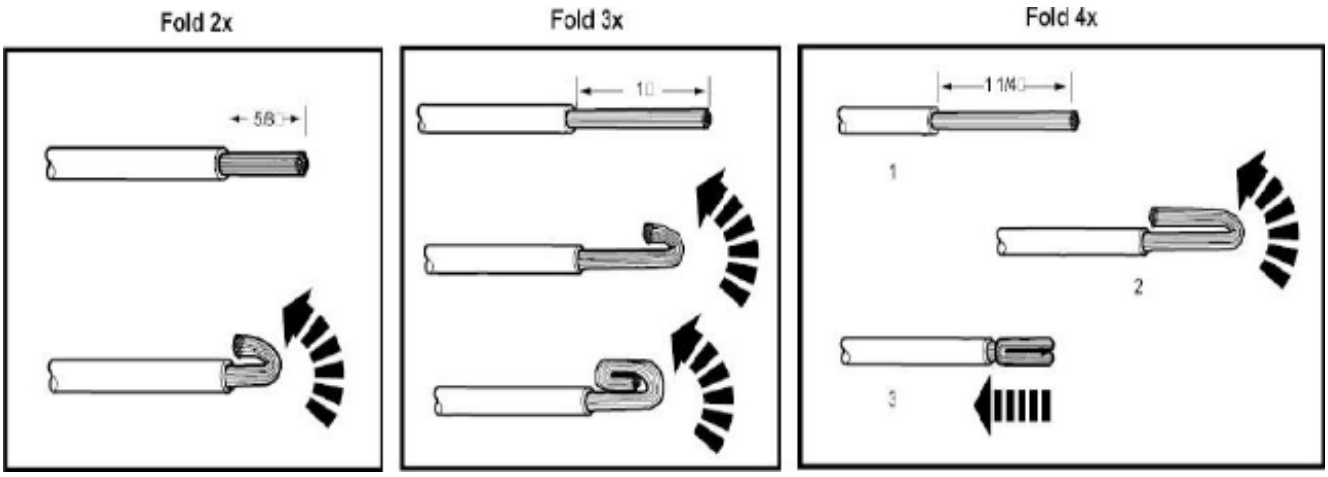
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

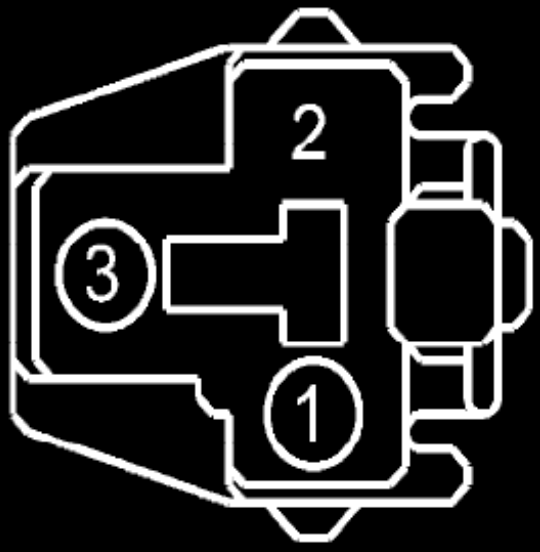
12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

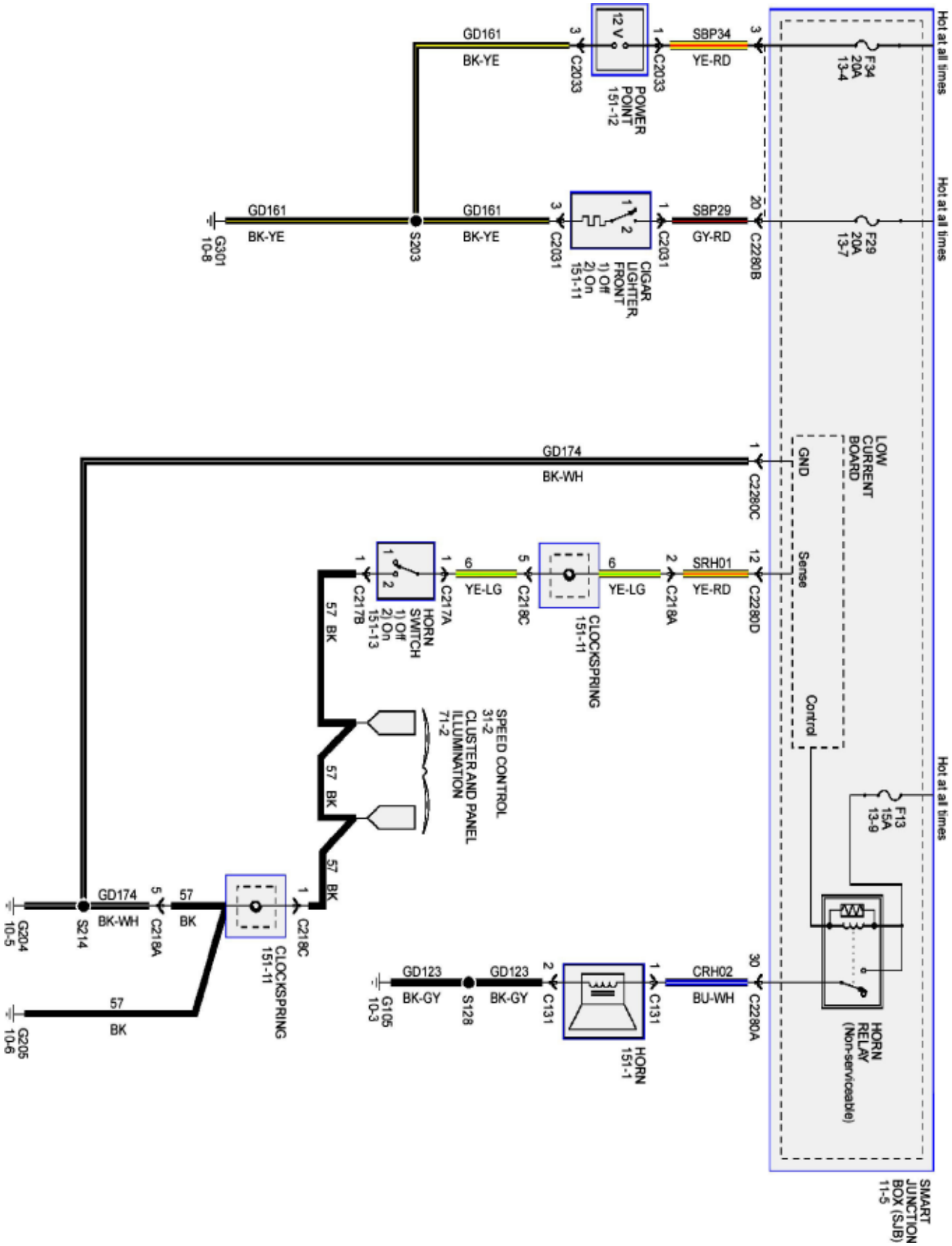
Connector: C2031

Description:	Harness:	Base Part #:
CIGAR LIGHTER, FRONT	14401	15055



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	SBP29 (GY-RD)	16	FUSE - 29 OR CIRCUIT BREAKER	
2	*	*	not used	
3	GD181 (BK-YE)	16	GROUND - SEAT BRACKET REAR LEFT	

C2031


Hot at all times
Hot at all times
Hot at all times
F34
20A
13-4
F29
20A
13-7
F13
15A
13-9
SBP34
YE-RD
SBP29
GY-RD
GD161
BK-YE
GD161
BK-YE
GD161
BK-YE
12 V
POWER POINT
151-12
C2033
C2033
C2031
C2031
CIGAR LIGHTER, FRONT
1) Off
2) On
151-11
G301
10-8
S203
C2280B
20
GD174
BK-WH
C2280C
LOW CURRENT BOARD
GND
Sense
Control
C2280D
SRH01
YE-RD
YE-LG
YE-LG
C217A
C217B
HORN SWITCH
1) Off
2) On
151-13
C218C
C218A
CLOCKSPRING
151-11
57 BK
57 BK
57 BK
SPEED CONTROL
31-2
CLUSTER AND PANEL ILLUMINATION
71-2
GD174
BK-WH
S214
C218A
57
BK
C218C
CLOCKSPRING
151-11
G204
10-5
57
BK
G205
10-6
GD123
BK-GY
GD123
BK-GY
G105
10-3
S128
C131
C131
CRH02
BU-WH
C2280A
HORN
151-1
HORN RELAY
(Non-serviceable)
SMART JUNCTION BOX (SJB)
11-5

Cigarette Lighter: Electrical Diagrams

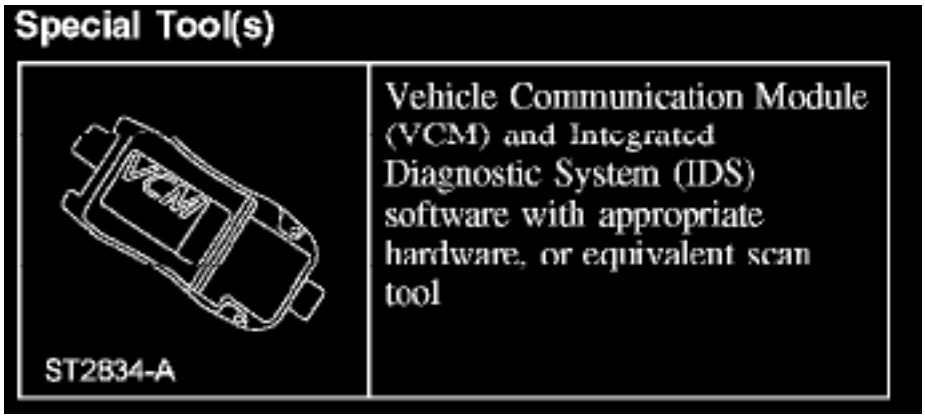
PLEASE NOTE: Some diagrams may appear to be missing because of gaps in the number sequences. These "gaps" are actually for diagrams that do not apply to the vehicle model selected.

44-1

Diagrams: Other diagrams referred to by number (i.e. 13-2, 24-6, 10-2, etc.) within these diagrams can be found at Diagrams By Number. See:

Diagrams/Electrical Diagrams/Diagrams By Number

Locations: Location Views (reference numbers starting with 151-) referred to within these diagrams can be found at Location Views. See: Locations/Component Locations



Air Bag(s) Arming and Disarming: Service and Repair Supplemental Restraint System (SRS) Depowering and Repowering

SUPPLEMENTAL RESTRAINT SYSTEM (SRS) DEPOWERING AND REPOWERING

Special Tool(s)

Special Tool(s)

Depowering Procedure

WARNING:

- Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.

- To reduce the risk of accidental deployment, do not use any memory saver devices. Failure to follow this instruction may result in serious personal injury or death.

NOTE:

- The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate an SRS fault.

- The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1. Turn all vehicle accessories OFF. 2. Turn the ignition switch to OFF. 3. At the smart junction box (SJB), located below the RH side of the instrument panel, remove the RH lower cowl trim panel and remove the

restraints control module (RCM) fuse 8 (10A) from the SJB.

4. Turn the ignition ON and visually monitor the air bag warning indicator for at least 30 seconds. The air bag warning indicator will remain lit

continuously (no flashing) if the correct RCM fuse has been removed. If the air bag warning indicator does not remain lit continuously, remove the correct RCM fuse before proceeding.

5. Turn the ignition OFF.

6. WARNING: Always deplete the backup power supply before repairing or installing any new front or side air bag supplemental restraint

system (SRS) component and before servicing, removing, installing, adjusting or striking components near the front or side impact sensors or the restraints control module (RCM). Nearby components include doors, instrument panel, console, door latches, strikers, seats and hood latches.

Refer to the Description and Operation portion of Air Bag Systems for location of the RCM and impact sensor(s).

To deplete the backup power supply energy, disconnect the battery ground cable and wait at least 1 minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Failure to follow these instructions may result in serious personal injury or death in the event of an accidental deployment.

Disconnect the battery ground cable and wait at least one minute.

Repowering Procedure

1. Turn the ignition switch from OFF to ON. 2. Install the RCM fuse 8 (10A) to the SJB and install the RH lower cowl trim panel.

3. WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is

connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

Connect the battery ground cable.

4. Prove out the SRS as follows:

Turn the ignition key from ON to OFF. Wait 10 seconds, then turn the key back to ON and visually monitor the air bag warning indicator with the air bag modules installed. The air bag warning

indicator will light continuously for approximately 6 seconds and then turn off. If an air bag SRS fault is present, the air bag warning indicator will: -

fail to light.

- remain lit continuously.

- flash at a 5Hz rate (RCM not configured).

The air bag warning indicator may not illuminate until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON position. This is the time required for the RCM to complete the testing of the SRS. If the air bag warning indicator is inoperative and a SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag warning indicator and any SRS fault discovered must be diagnosed and repaired.

Clear all continuous RCM and occupant classification system module (OCSM) DTCs using a scan tool.

Special Tool(s)

ST2621-A	Diagnostic Tool, Restraint System (2 required) 418-F395
ST2512-A	Diagnostic Tool, Restraint System 418-F403
ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Air Bag(s) Arming and Disarming: Service and Repair Supplemental Restraint System (SRS) Deactivation and Reactivation

SUPPLEMENTAL RESTRAINT SYSTEM (SRS) DEACTIVATION AND REACTIVATION

Special Tool(s)

Deactivation Procedure

WARNING:

- Always carry or place a live air bag module with the air bag and deployment door/trim cover/tear seam pointed away from the body. Do not set a live air bag module down with the deployment door/trim cover/tear seam face down. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

- Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which

increases the risk of serious personal injury or death.

- To reduce the risk of accidental deployment, do not use any memory saver devices. Failure to follow this instruction may result in serious personal injury or death.

NOTE:

- The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

- No restraint system diagnostic tools are available for the safety belt buckle pretensioners. If the ignition switch is set to RUN or START with either the driver or passenger safety belt buckle pretensioner electrical connector disconnected, the DTCs for an open circuit fault will be active.

- The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1. Turn all vehicle accessories OFF. 2. Turn the ignition switch to OFF. 3. At the smart junction box (SJB), located below the RH side of the instrument panel, remove the restraints control module (RCM) fuse 8 (10A)

from the SJB.

4. Turn the ignition ON and visually monitor the air bag warning indicator for at least 30 seconds. The air bag warning indicator will remain lit

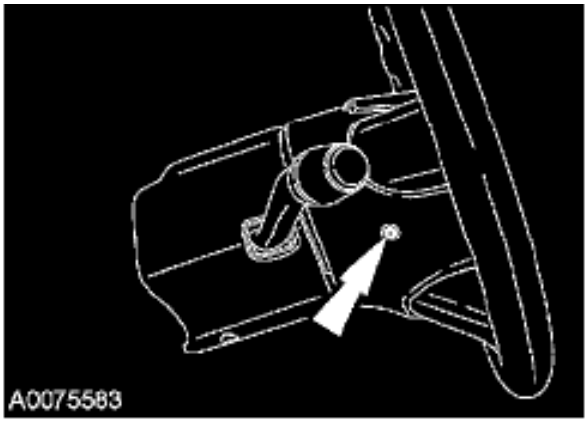
continuously (no flashing) if the correct RCM fuse has been removed. If the air bag warning indicator does not remain lit continuously, remove the correct RCM fuse before proceeding.

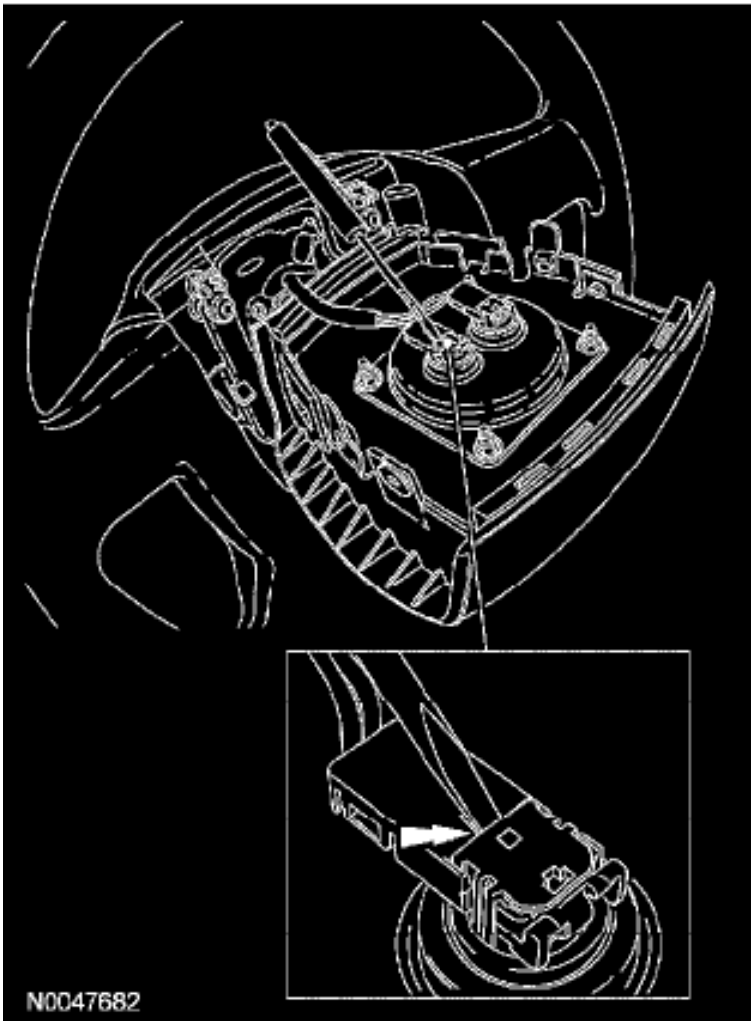
5. Turn the ignition OFF.

6. WARNING: Always deplete the backup power supply before repairing or installing any new front or side air bag supplemental restraint

system (SRS) component and before servicing, removing, installing, adjusting or striking components near the front or side impact sensors or the restraints control module (RCM). Nearby components include doors, instrument panel, console, door latches, strikers, seats and hood latches.

Refer to the Description and Operation portion of Air Bag Systems for location of the RCM and impact sensor(s).





To deplete the backup power supply energy, disconnect the battery ground cable and wait at least 1 minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Failure to follow these instructions may result in serious personal injury or death in the event of an accidental deployment.

Disconnect the battery ground cable and wait at least 1 minute.

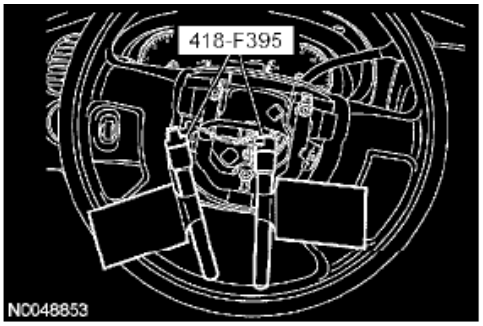
7. Remove the 2 driver air bag module bolts (1 shown).

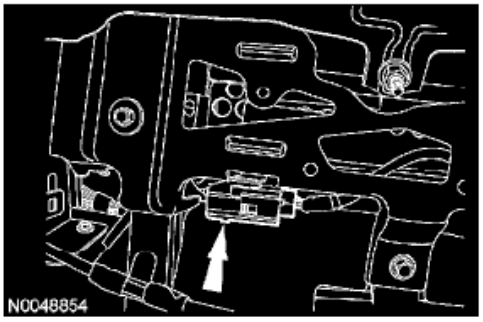
8. CAUTION: Do not pull the driver air bag module electrical connectors out by the locking buttons. Damage to the locking buttons may

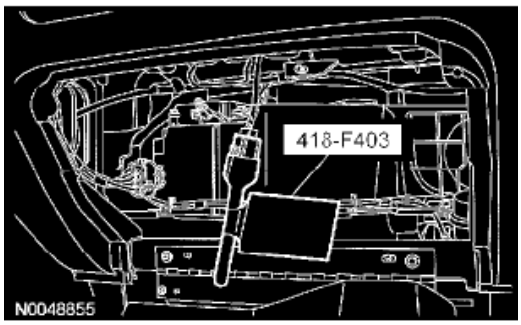
occur.

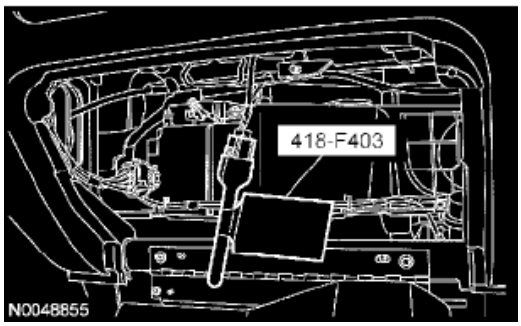
Using a small screwdriver as shown, lift up and release the locking buttons on the driver air bag module electrical connectors. With the locking buttons released, remove the electrical connectors and the driver air bag module.

9. Attach the restraint system diagnostic tools to the clockspring electrical connectors at the top of the steering column.









10. Open the glove compartment door fully to access the passenger air bag electrical connector.
11. Release the tab and disconnect the passenger air bag module electrical connector.

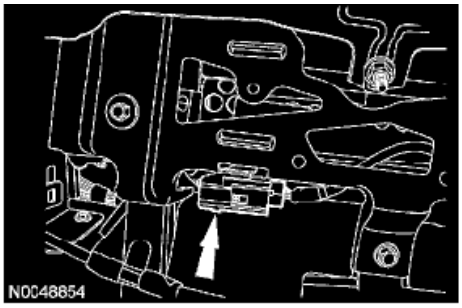
12. Attach the restraint system diagnostic tool to the vehicle harness side of the passenger air bag module electrical connector.

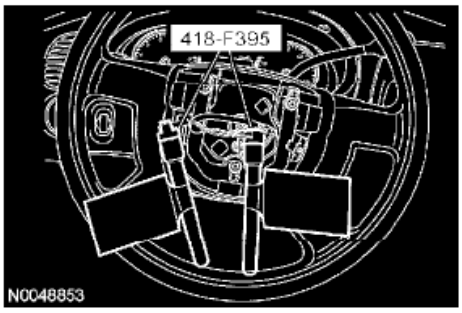
13. Install the RCM fuse 8 (10A) to the SJB. 14. Connect the battery ground cable.

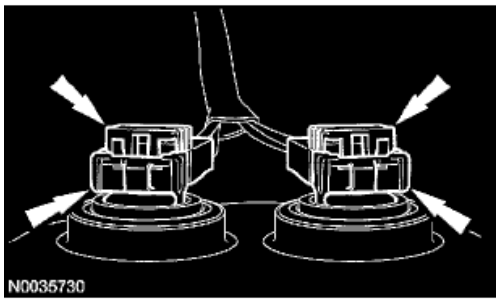
Reactivation Procedure

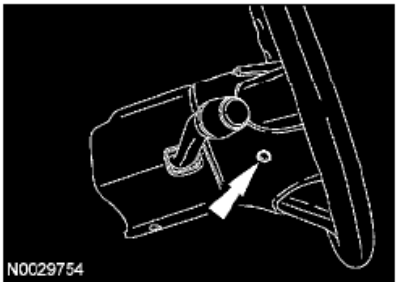
1. Remove the RCM fuse 8 (10A) from the SJB. 2. Disconnect the battery ground cable and wait at least one minute. 3. Remove the restraint system diagnostic tool from the vehicle harness side of the passenger air bag module electrical connector.

4. Connect the passenger air bag module electrical connector.









5. Close the glove compartment door. 6. Remove the restraint system diagnostic tools from the clockspring electrical connectors at the top of the steering column.

7. CAUTION:

- Do not install the driver air bag module electrical connectors by the locking buttons. Damage to the locking buttons may occur.

- The driver air bag module electrical connector locking buttons must be in the released position when the connector is being installed or connector damage may occur.

- The driver air bag module electrical connectors are unique and cannot be reversed when connected to the driver air bag module. Match the electrical connector key to the keyway in the driver air bag module. Do not force the electrical connectors into the driver air bag module. Damage to the connector or component may occur.

With the locking buttons released, install the driver air bag module electrical connectors fully into the driver air bag module and seat the locking buttons.

8. Install the 2 driver air bag module bolts (1 shown).

- Tighten to 6 Nm (53 lb-in).

9. WARNING: Remove restraint system diagnostic tools from the vehicle prior to road testing. If tools are not removed, the supplemental

restraint system (SRS) device may not deploy in a crash. Failure to follow this instruction may result in serious personal injury or death

in a crash and possibly violate vehicle safety standards.

Make sure all restraint system diagnostic tool(s) that may have been installed during the repair have been removed from the vehicle and all SRS components are connected.

10. Turn the ignition from OFF to ON. 11. Install the restraint system control module fuse 8 (10A) to the SJB.

12. WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is

connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

Connect the battery ground cable.

13. Prove out the SRS as follows:

Turn the ignition key from ON to OFF. Wait 10 seconds, then turn the key back to ON and visually monitor the air bag warning indicator with the air bag modules installed. The air bag warning indicator will light continuously for approximately 6 seconds and then turn off. If an air bag SRS fault is present, the air bag warning indicator will: -

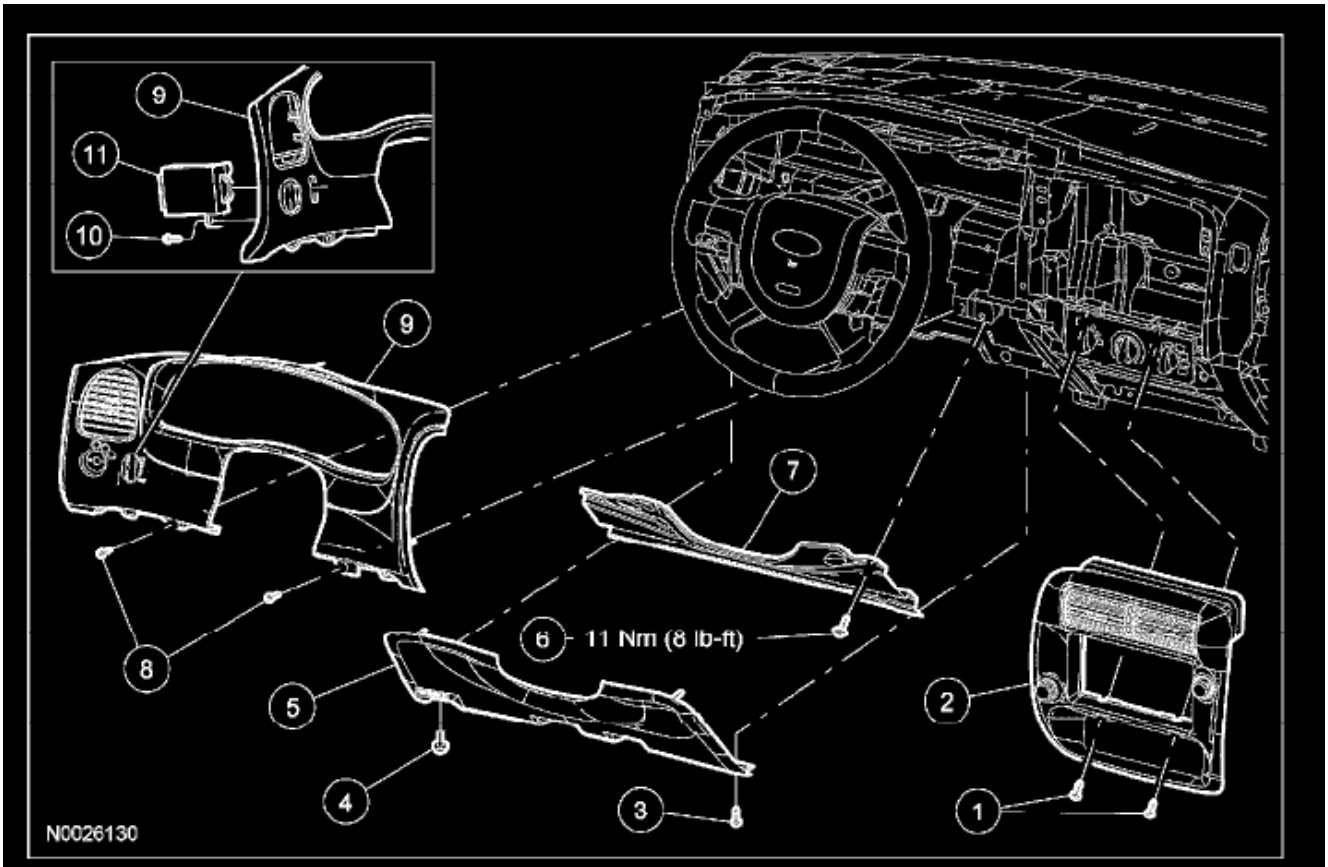
fail to light.

- remain lit continuously.

- flash at a 5Hz rate (RCM not configured).

The air bag warning indicator may not illuminate until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON position. This is the time required for the RCM to complete the testing of the SRS. If the air bag warning indicator is inoperative and a SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag warning indicator and any SRS fault discovered must be diagnosed and repaired.

Clear all continuous RCM and occupant classification system module (OCSM) DTCs using a scan tool.



Item	Part Number	Description
1	W701679	Center instrument panel finish panel screws (2 required)
2	1004302	Center instrument panel finish panel
3	W705314	Instrument panel steering column cover screws (2 required)
4	N807316	Hood latch release handle bolts (2 required)
5	10044F08	Instrument panel steering column cover
6	N807316	Lower instrument panel reinforcement bolts (5 required)
7	10017A28	Lower instrument panel reinforcement
8	W705314	Instrument cluster finish panel screws (5 required)
9	011201	Instrument cluster finish panel
10	385754-S36	Instrument panel dimmer switch screws (2 required)

Item	Part Number	Description
11	11691	Instrument panel dimmer switch

(Continued)

Dimmer Switch: Service and Repair

INSTRUMENT PANEL DIMMER SWITCH

Removal and Installation

1. Remove the radio. 2. Remove the center instrument panel finish panel.

- Remove the 2 screws.

- Disconnect the electrical connectors.

3. Remove the 2 bolts and position aside the hood latch release handle. 4. Remove the 2 screws and remove the instrument panel steering column cover. 5. Remove the 5 bolts and the lower instrument panel reinforcement.

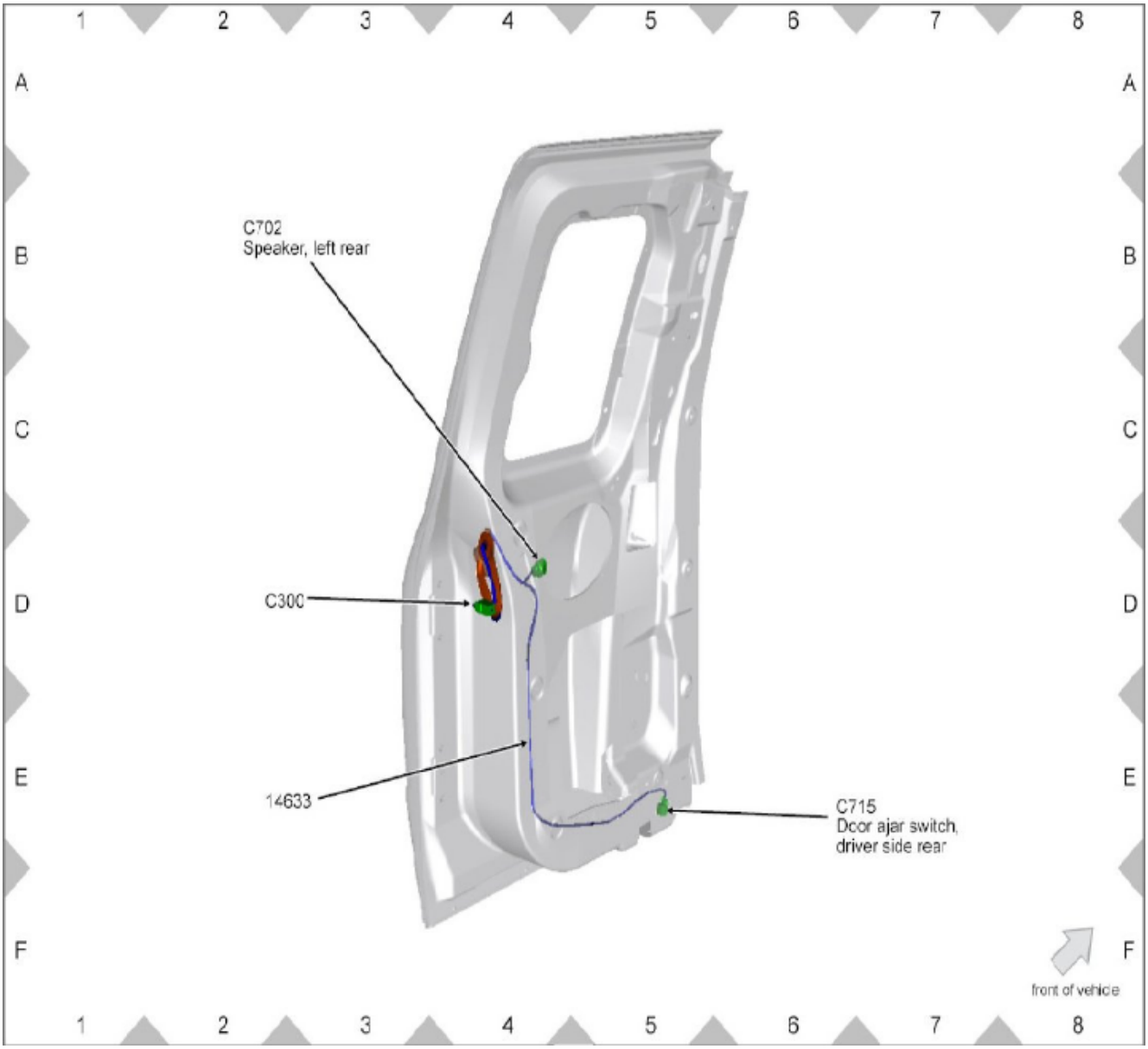
- To install, tighten to 11 Nm (8 lb-ft).

6. If equipped, position the column-mounted transmission range selector lever to the lowest position. 7. Remove the instrument cluster finish panel.

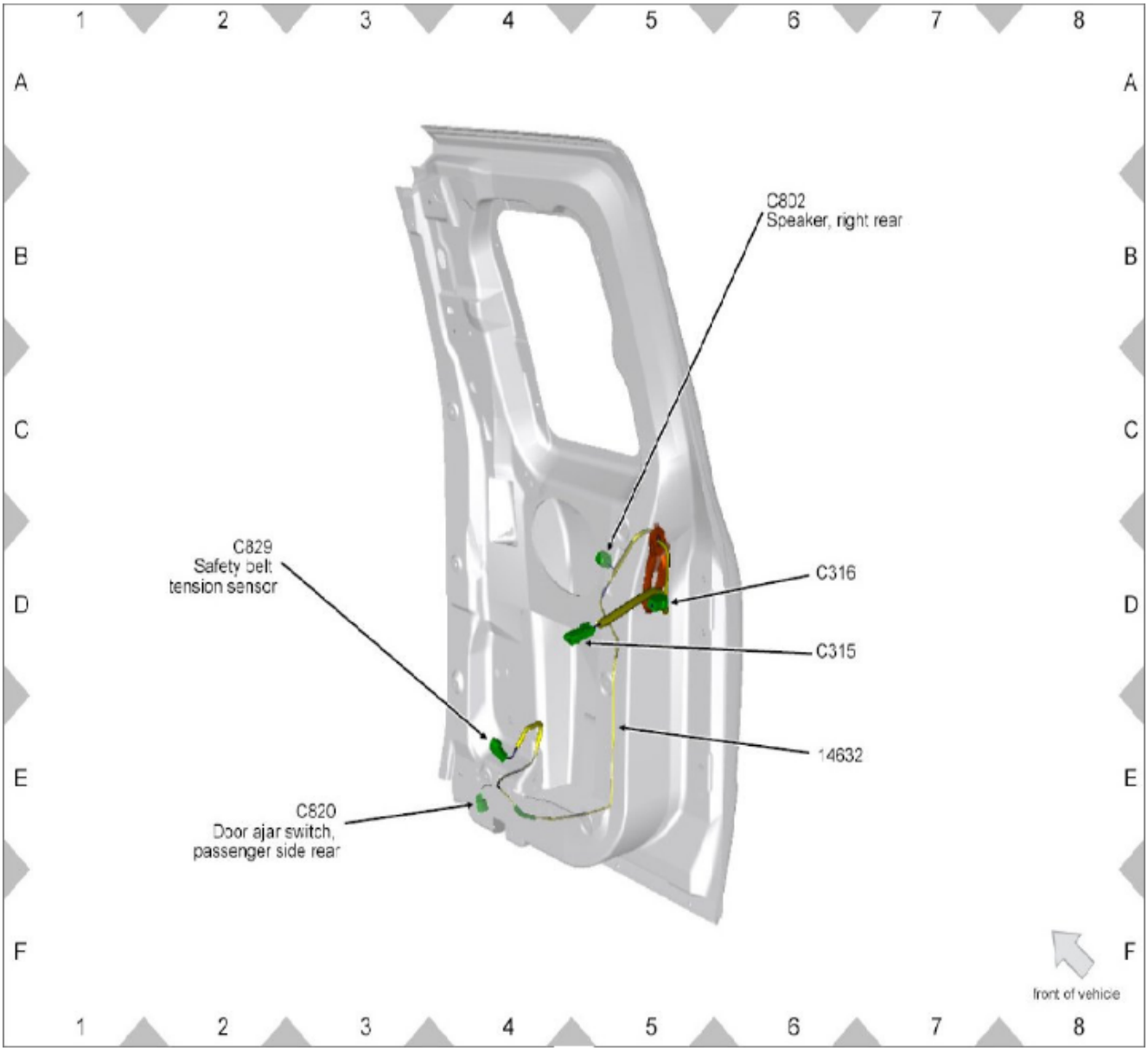
- Remove the 5 screws.

- Disconnect the electrical connectors.

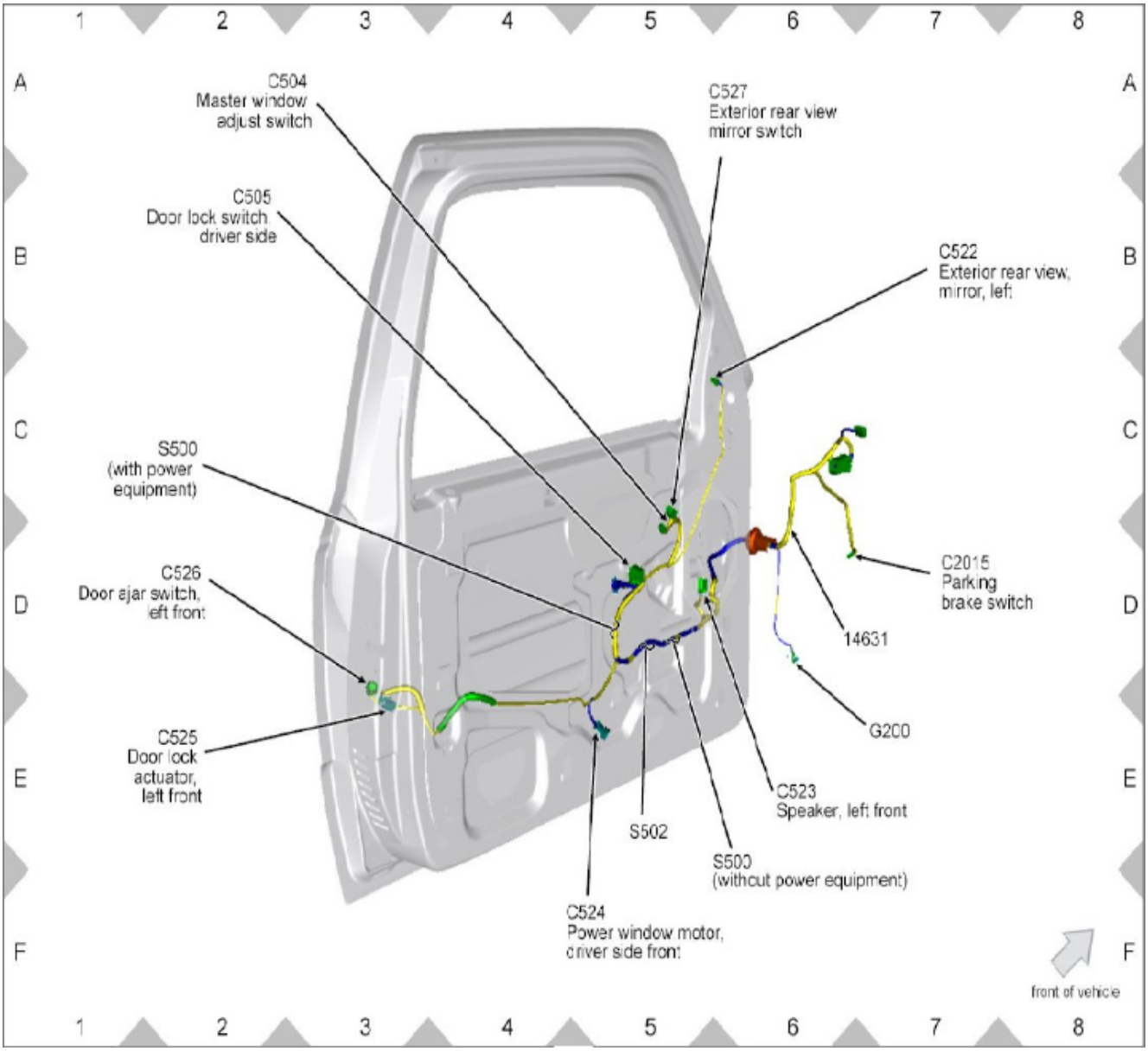
8. Remove the 2 screws and the instrument panel dimmer switch. 9. To install, reverse the removal procedure.


C702
Speaker, left rear
C300
14633
C715
Door ajar switch, driver side rear
front of vehicle

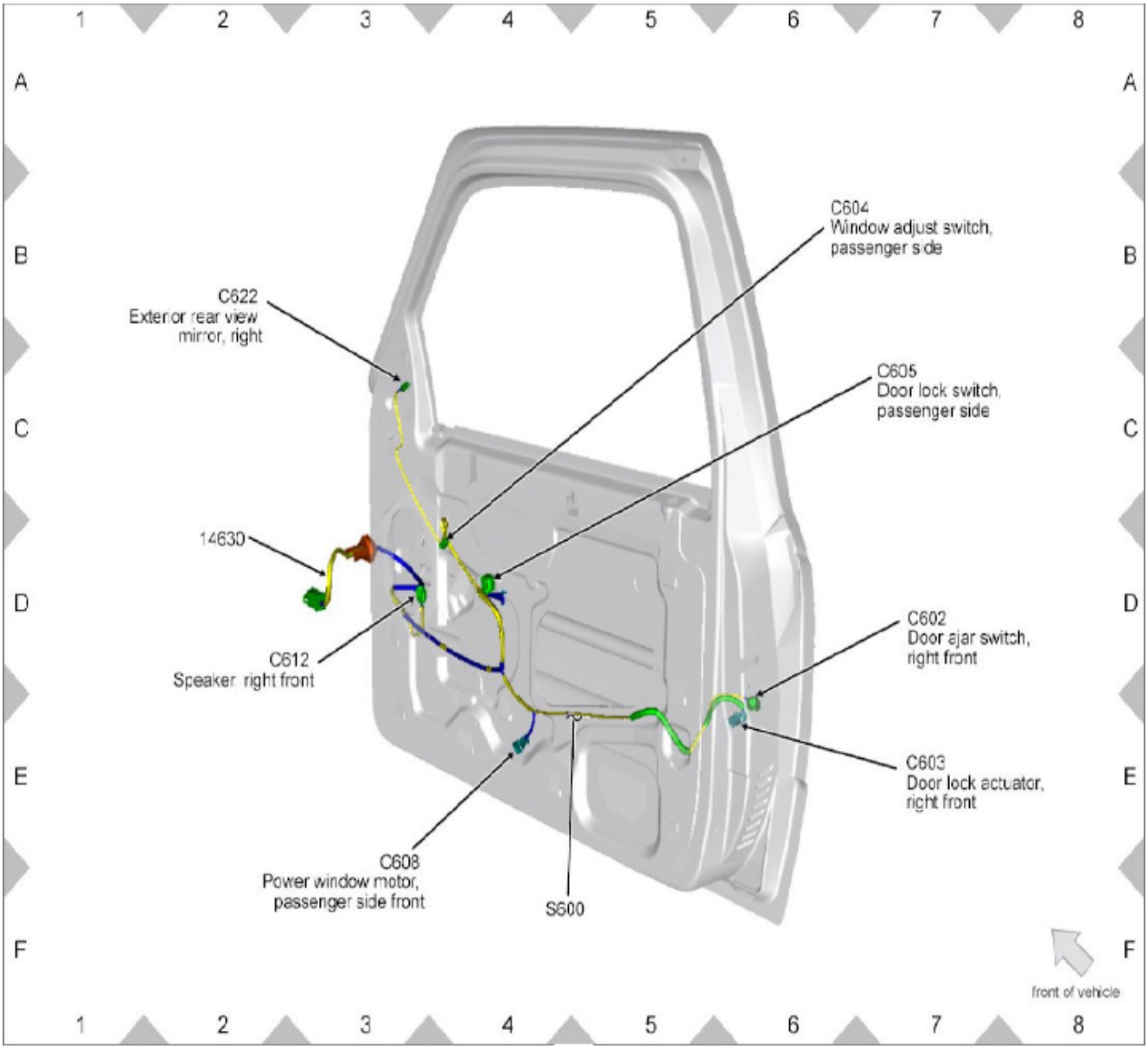
View 151-22


C802
Speaker, right rear
C829
Safety belt tension sensor
C316
C315
14632
C820
Door ajar switch, passenger side rear
front of vehicle

View 151-23


C504
Master window adjust switch
C505
Door lock switch driver side
S500
(with power equipment)
C526
Door ajar switch, left front
C525
Door lock actuator, left front
C527
Exterior rear view mirror switch
C522
Exterior rear view mirror, left
C2015
Parking brake switch
14631
G200
C523
Speaker, left front
S502
S500
(without power equipment)
C524
Power window motor, driver side front
front of vehicle

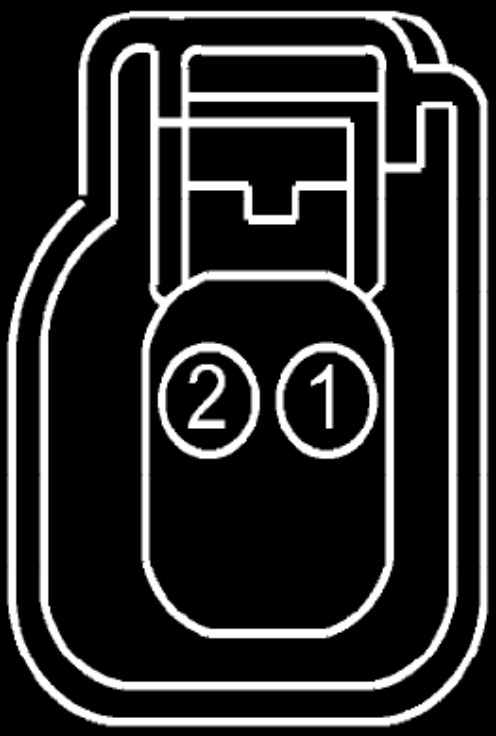
View 151-20


C604
Window adjust switch, passenger side
C622
Exterior rear view mirror, right
C605
Door lock switch, passenger side
14630
C612
Speaker, right front
C602
Door ajar switch, right front
C603
Door lock actuator, right front
C608
Power window motor, passenger side front
S600
front of vehicle

View 151-21

Connector: C526

Description:	Harness:	Base Part #:
DOOR AJAR SWITCH, LEFT FRONT	14631	



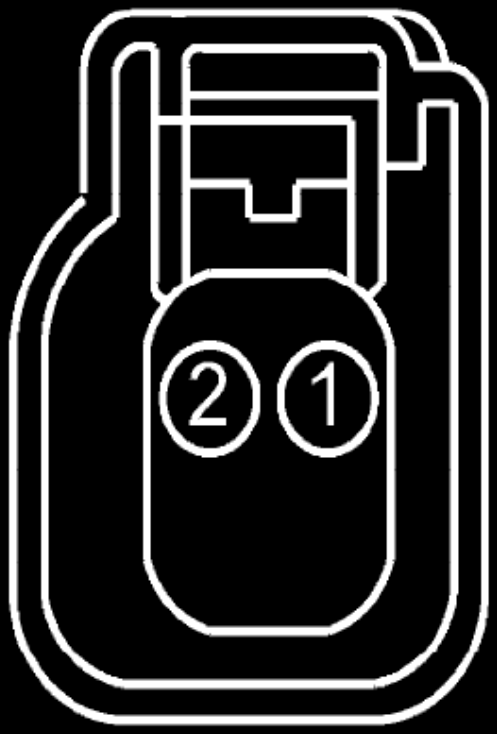
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPL26 (GN-VT)	20	SWITCH - LATCH DRIVER # AJAR	
2	GD175 (BK-BU)	20	GROUND - TUNNEL # 2ND STUD	

C526

Connector: C602

Description:	Harness:	Base Part #:
DOOR AJAR SWITCH, RIGHT FRONT	14630	

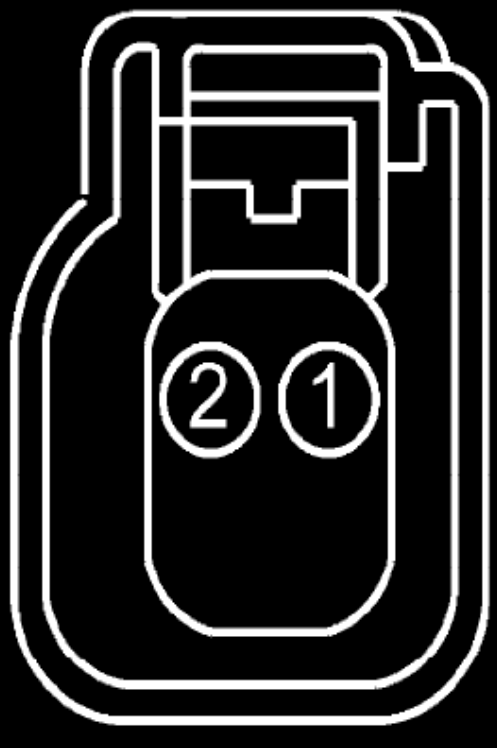
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPL31 (WH)	20	SWITCH - LATCH PASSENGER # AJAR	
2	GD161 (BK-YE)	20	GROUND - SEAT BRACKET REAR LEFT	



C602

Connector: C715

Description:	Harness:	Base Part #:
DOOR AJAR SWITCH, DRIVER SIDE REAR	14633	14018

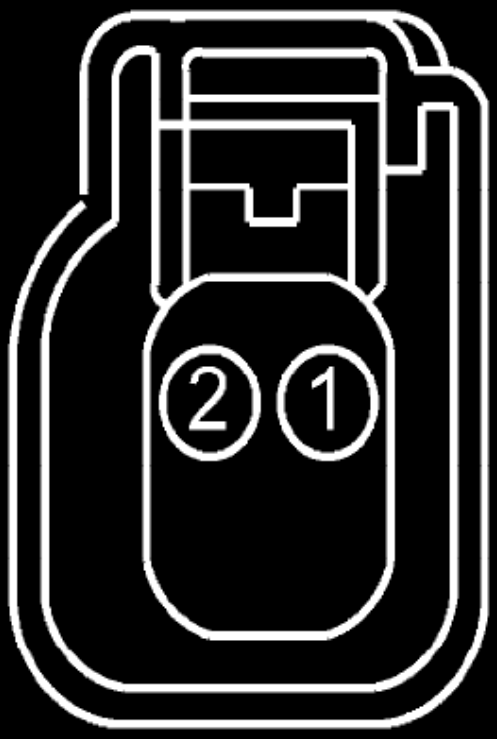


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPL36 (GN)	18	SWITCH - LATCH REAR DRIVER SIDE # AJAR (INCL.SLIDING DOOR)	
2	GD101 (BK-YE)	18	GROUND - SEAT BRACKET REAR LEFT	

C715

Connector: C820

Description:	Harness:	Base Part #:
DOOR AJAR SWITCH, PASSENGER SIDE REAR	14632	14018



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPL39 (YE)	18	SWITCH - LATCH REAR PASSENGER SIDE # AJAR (INCL.SLIDING DOOR)	
2	GD161 (BK-YE)	18	GROUND - SEAT BRACKET REAR LEFT	

C820

Door Switch: Service and Repair Door Ajar Switch

DOOR AJAR SWITCH

Removal and Installation

1. Remove the front door latch. 2. Lift the locking tab, rotate the switch and remove the door ajar switch. 3. To install, reverse the removal procedure.

Door Switch: Service and Repair Door Ajar Switch - SuperCab Four-Door

DOOR AJAR SWITCH - SUPERCAB FOUR-DOOR

Removal and Installation

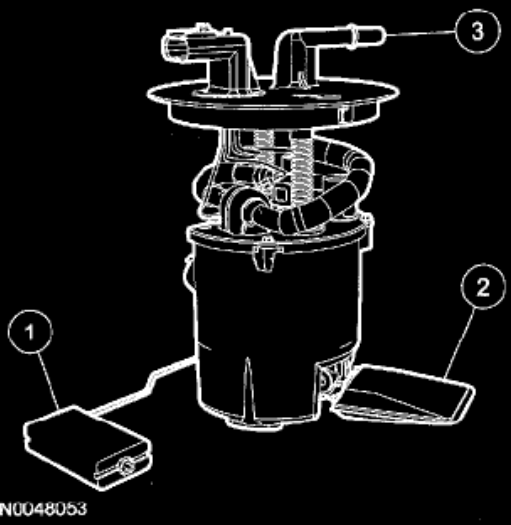
1. Remove the rear door lower latch. 2. Release the locking tabs, rotate the door ajar switch and remove the door ajar switch. 3. To install, reverse the removal procedure.

Fuel Filler Cap Warning Indicator: Description and Operation

CHECK FUEL CAP INDICATOR

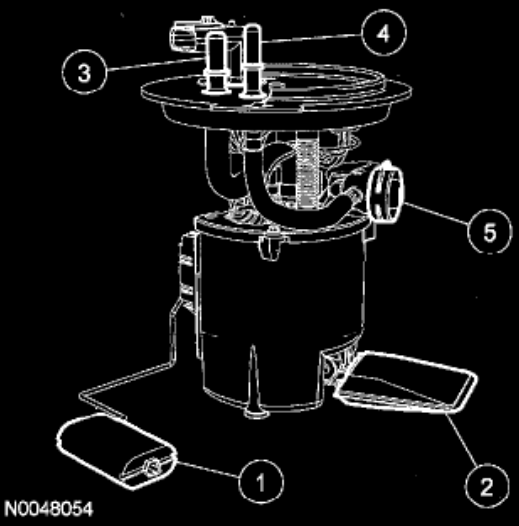
The check fuel cap indicator is a communications network message sent by the PCM. The PCM sends the message to illuminate the lamp when the strategy determines there is a concern in the EVAP system due to the fuel filler cap or capless fuel tank filler pipe not being sealed correctly. This would be detected by the inability to pull vacuum in the fuel tank, after a fueling event.

Typical Electronic Returnless Fuel Pump (FP) Module



Item	Part Number	Description
1	—	Fuel Level Float
2	—	Fuel Intake Filter
3	—	Fuel Supply

Typical Mechanical Returnless Fuel Pump (FP) Module



Item	Part Number	Description
1	—	Fuel Level Float
2	—	Fuel Intake Filter
3	—	Fuel Supply
4	—	Fuel Return from Fuel Filter
5	—	Fuel Pressure Regulator

Fuel Gauge Sender: Description and Operation

Fuel Pump (FP) Module

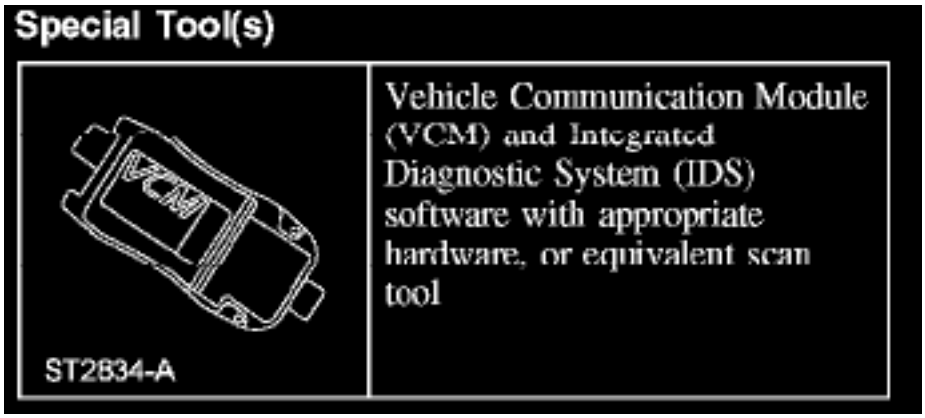
Typical Electronic Returnless Fuel Pump (FP) Module

Typical Mechanical Returnless Fuel Pump (FP) Module

The FP module is a device that contains the fuel pump and sender assembly. The fuel pump is located inside the FP module reservoir and supplies fuel through the FP module manifold to the engine and FP module jet pump. The jet pump continuously refills the reservoir with fuel, and a check valve located in the manifold outlet maintains system pressure when the fuel pump is not energized. A flapper valve located in the bottom of the reservoir allows fuel to enter the reservoir and prime the fuel pump during the initial fill.

Fuel Pump (FP) Module and Reservoir

The FP module is mounted inside the fuel tank in a reservoir. The pump has a discharge check valve that maintains the system pressure after the key has been turned off to minimize starting concerns. The reservoir prevents fuel flow interruptions during extreme vehicle maneuvers with low tank fill levels.



Air Bag(s) Arming and Disarming: Service and Repair Supplemental Restraint System (SRS) Depowering and Repowering

SUPPLEMENTAL RESTRAINT SYSTEM (SRS) DEPOWERING AND REPOWERING

Special Tool(s)

Special Tool(s)

Depowering Procedure

WARNING:

- Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which increases the risk of serious personal injury or death.

- To reduce the risk of accidental deployment, do not use any memory saver devices. Failure to follow this instruction may result in serious personal injury or death.

NOTE:

- The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate an SRS fault.

- The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1. Turn all vehicle accessories OFF. 2. Turn the ignition switch to OFF. 3. At the smart junction box (SJB), located below the RH side of the instrument panel, remove the RH lower cowl trim panel and remove the

restraints control module (RCM) fuse 8 (10A) from the SJB.

4. Turn the ignition ON and visually monitor the air bag warning indicator for at least 30 seconds. The air bag warning indicator will remain lit

continuously (no flashing) if the correct RCM fuse has been removed. If the air bag warning indicator does not remain lit continuously, remove the correct RCM fuse before proceeding.

5. Turn the ignition OFF.

6. WARNING: Always deplete the backup power supply before repairing or installing any new front or side air bag supplemental restraint

system (SRS) component and before servicing, removing, installing, adjusting or striking components near the front or side impact sensors or the restraints control module (RCM). Nearby components include doors, instrument panel, console, door latches, strikers, seats and hood latches.

Refer to the Description and Operation portion of Air Bag Systems for location of the RCM and impact sensor(s).

To deplete the backup power supply energy, disconnect the battery ground cable and wait at least 1 minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Failure to follow these instructions may result in serious personal injury or death in the event of an accidental deployment.

Disconnect the battery ground cable and wait at least one minute.

Repowering Procedure

1. Turn the ignition switch from OFF to ON. 2. Install the RCM fuse 8 (10A) to the SJB and install the RH lower cowl trim panel.

3. WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is

connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

Connect the battery ground cable.

4. Prove out the SRS as follows:

Turn the ignition key from ON to OFF. Wait 10 seconds, then turn the key back to ON and visually monitor the air bag warning indicator with the air bag modules installed. The air bag warning

indicator will light continuously for approximately 6 seconds and then turn off. If an air bag SRS fault is present, the air bag warning indicator will: -

fail to light.

- remain lit continuously.

- flash at a 5Hz rate (RCM not configured).

The air bag warning indicator may not illuminate until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON position. This is the time required for the RCM to complete the testing of the SRS. If the air bag warning indicator is inoperative and a SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag warning indicator and any SRS fault discovered must be diagnosed and repaired.

Clear all continuous RCM and occupant classification system module (OCSM) DTCs using a scan tool.

Special Tool(s)

ST2621-A	Diagnostic Tool, Restraint System (2 required) 418-F395
ST2512-A	Diagnostic Tool, Restraint System 418-F403
ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Air Bag(s) Arming and Disarming: Service and Repair Supplemental Restraint System (SRS) Deactivation and Reactivation

SUPPLEMENTAL RESTRAINT SYSTEM (SRS) DEACTIVATION AND REACTIVATION

Special Tool(s)

Deactivation Procedure

WARNING:

- Always carry or place a live air bag module with the air bag and deployment door/trim cover/tear seam pointed away from the body. Do not set a live air bag module down with the deployment door/trim cover/tear seam face down. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

- Never probe the electrical connectors on air bag, safety canopy or side air curtain modules. Failure to follow this instruction may result in the accidental deployment of these modules, which

increases the risk of serious personal injury or death.

- To reduce the risk of accidental deployment, do not use any memory saver devices. Failure to follow this instruction may result in serious personal injury or death.

NOTE:

- The air bag warning indicator illuminates when the restraints control module (RCM) fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a supplemental restraint system (SRS) fault.

- No restraint system diagnostic tools are available for the safety belt buckle pretensioners. If the ignition switch is set to RUN or START with either the driver or passenger safety belt buckle pretensioner electrical connector disconnected, the DTCs for an open circuit fault will be active.

- The SRS must be fully operational and free of faults before releasing the vehicle to the customer.

1. Turn all vehicle accessories OFF. 2. Turn the ignition switch to OFF. 3. At the smart junction box (SJB), located below the RH side of the instrument panel, remove the restraints control module (RCM) fuse 8 (10A)

from the SJB.

4. Turn the ignition ON and visually monitor the air bag warning indicator for at least 30 seconds. The air bag warning indicator will remain lit

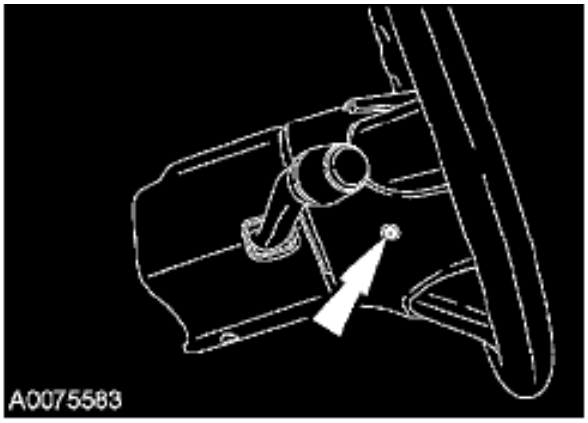
continuously (no flashing) if the correct RCM fuse has been removed. If the air bag warning indicator does not remain lit continuously, remove the correct RCM fuse before proceeding.

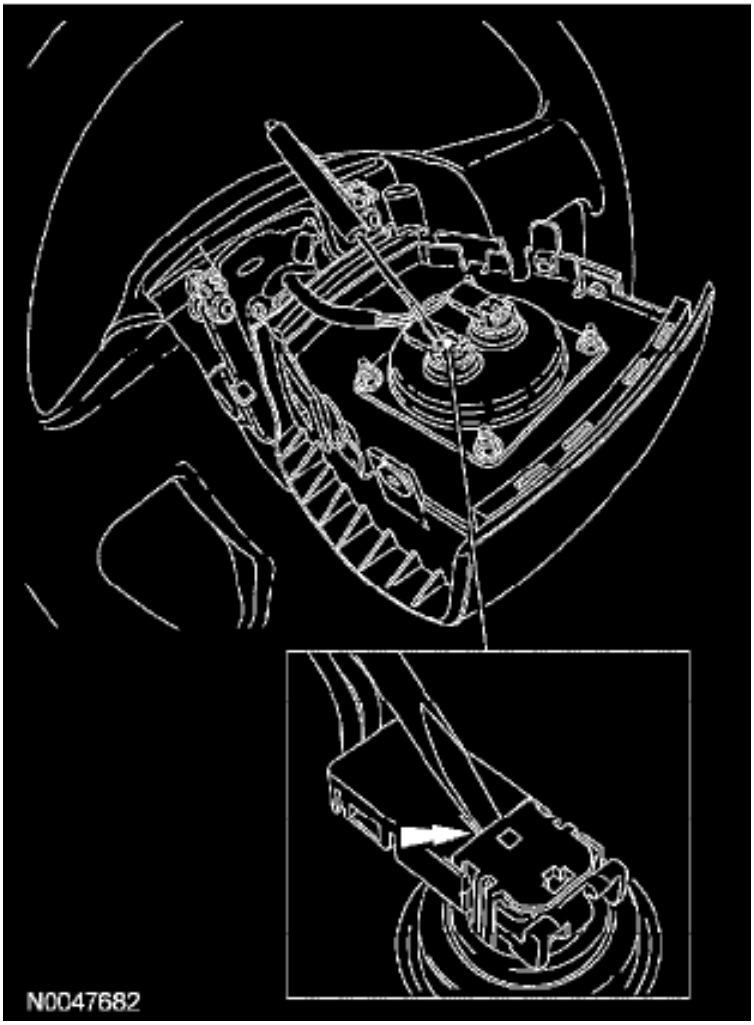
5. Turn the ignition OFF.

6. WARNING: Always deplete the backup power supply before repairing or installing any new front or side air bag supplemental restraint

system (SRS) component and before servicing, removing, installing, adjusting or striking components near the front or side impact sensors or the restraints control module (RCM). Nearby components include doors, instrument panel, console, door latches, strikers, seats and hood latches.

Refer to the Description and Operation portion of Air Bag Systems for location of the RCM and impact sensor(s).





To deplete the backup power supply energy, disconnect the battery ground cable and wait at least 1 minute. Be sure to disconnect auxiliary batteries and power supplies (if equipped).

Failure to follow these instructions may result in serious personal injury or death in the event of an accidental deployment.

Disconnect the battery ground cable and wait at least 1 minute.

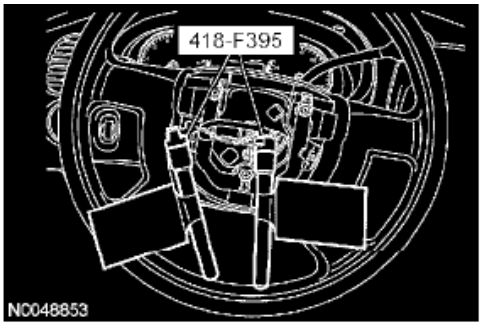
7. Remove the 2 driver air bag module bolts (1 shown).

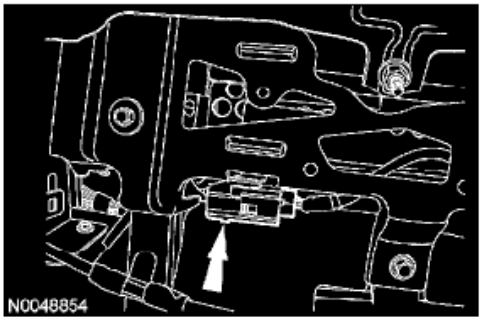
8. CAUTION: Do not pull the driver air bag module electrical connectors out by the locking buttons. Damage to the locking buttons may

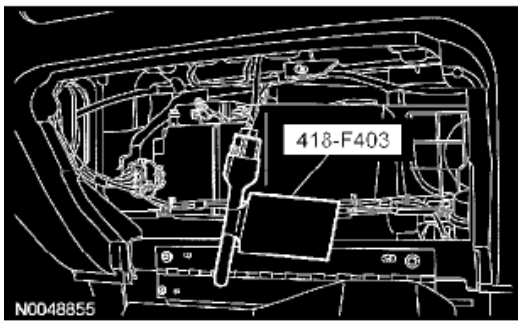
occur.

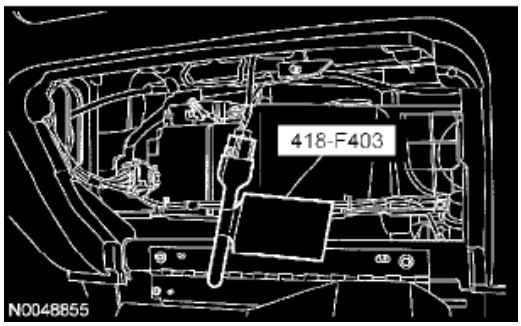
Using a small screwdriver as shown, lift up and release the locking buttons on the driver air bag module electrical connectors. With the locking buttons released, remove the electrical connectors and the driver air bag module.

9. Attach the restraint system diagnostic tools to the clockspring electrical connectors at the top of the steering column.









10. Open the glove compartment door fully to access the passenger air bag electrical connector.
11. Release the tab and disconnect the passenger air bag module electrical connector.

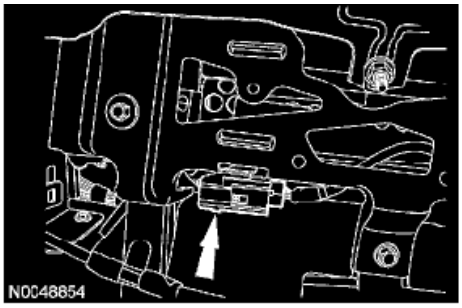
12. Attach the restraint system diagnostic tool to the vehicle harness side of the passenger air bag module electrical connector.

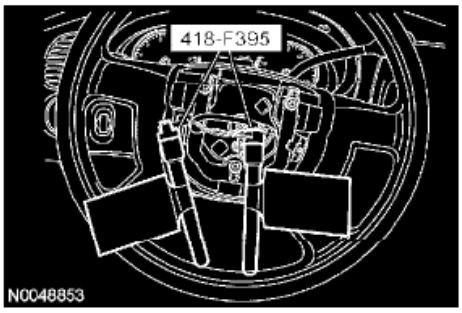
13. Install the RCM fuse 8 (10A) to the SJB. 14. Connect the battery ground cable.

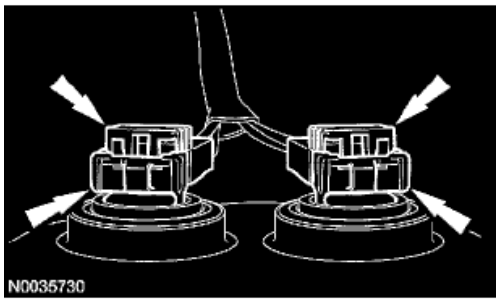
Reactivation Procedure

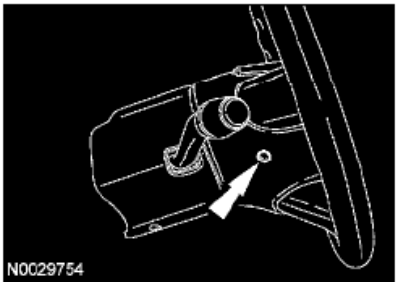
1. Remove the RCM fuse 8 (10A) from the SJB. 2. Disconnect the battery ground cable and wait at least one minute. 3. Remove the restraint system diagnostic tool from the vehicle harness side of the passenger air bag module electrical connector.

4. Connect the passenger air bag module electrical connector.









5. Close the glove compartment door. 6. Remove the restraint system diagnostic tools from the clockspring electrical connectors at the top of the steering column.

7. CAUTION:

- Do not install the driver air bag module electrical connectors by the locking buttons. Damage to the locking buttons may occur.

- The driver air bag module electrical connector locking buttons must be in the released position when the connector is being installed or connector damage may occur.

- The driver air bag module electrical connectors are unique and cannot be reversed when connected to the driver air bag module. Match the electrical connector key to the keyway in the driver air bag module. Do not force the electrical connectors into the driver air bag module. Damage to the connector or component may occur.

With the locking buttons released, install the driver air bag module electrical connectors fully into the driver air bag module and seat the locking buttons.

8. Install the 2 driver air bag module bolts (1 shown).

- Tighten to 6 Nm (53 lb-in).

9. WARNING: Remove restraint system diagnostic tools from the vehicle prior to road testing. If tools are not removed, the supplemental

restraint system (SRS) device may not deploy in a crash. Failure to follow this instruction may result in serious personal injury or death

in a crash and possibly violate vehicle safety standards.

Make sure all restraint system diagnostic tool(s) that may have been installed during the repair have been removed from the vehicle and all SRS components are connected.

10. Turn the ignition from OFF to ON. 11. Install the restraint system control module fuse 8 (10A) to the SJB.

12. WARNING: Make sure no one is in the vehicle and there is nothing blocking or placed in front of any air bag module when the battery is

connected. Failure to follow these instructions may result in serious personal injury in the event of an accidental deployment.

Connect the battery ground cable.

13. Prove out the SRS as follows:

Turn the ignition key from ON to OFF. Wait 10 seconds, then turn the key back to ON and visually monitor the air bag warning indicator with the air bag modules installed. The air bag warning indicator will light continuously for approximately 6 seconds and then turn off. If an air bag SRS fault is present, the air bag warning indicator will: -

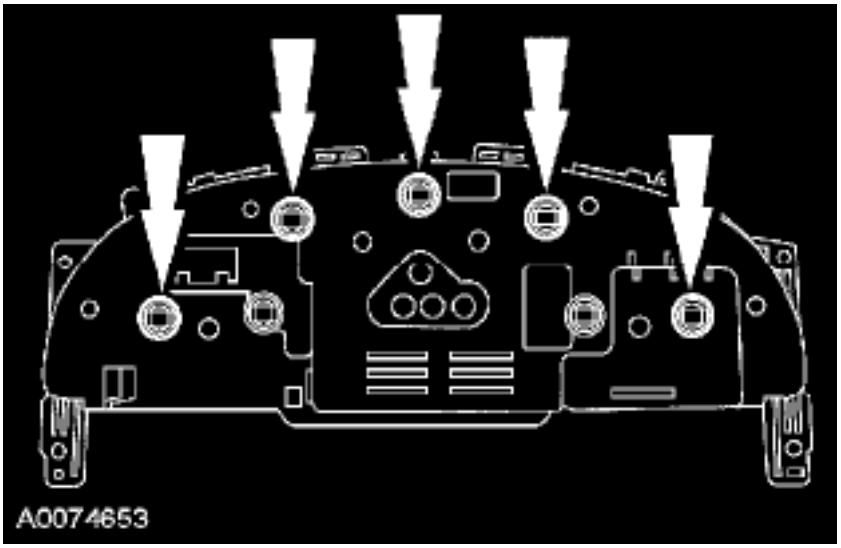
fail to light.

- remain lit continuously.

- flash at a 5Hz rate (RCM not configured).

The air bag warning indicator may not illuminate until approximately 30 seconds after the ignition switch has been turned from the OFF to the ON position. This is the time required for the RCM to complete the testing of the SRS. If the air bag warning indicator is inoperative and a SRS fault exists, a chime will sound in a pattern of 5 sets of 5 beeps. If this occurs, the air bag warning indicator and any SRS fault discovered must be diagnosed and repaired.

Clear all continuous RCM and occupant classification system module (OCSM) DTCs using a scan tool.



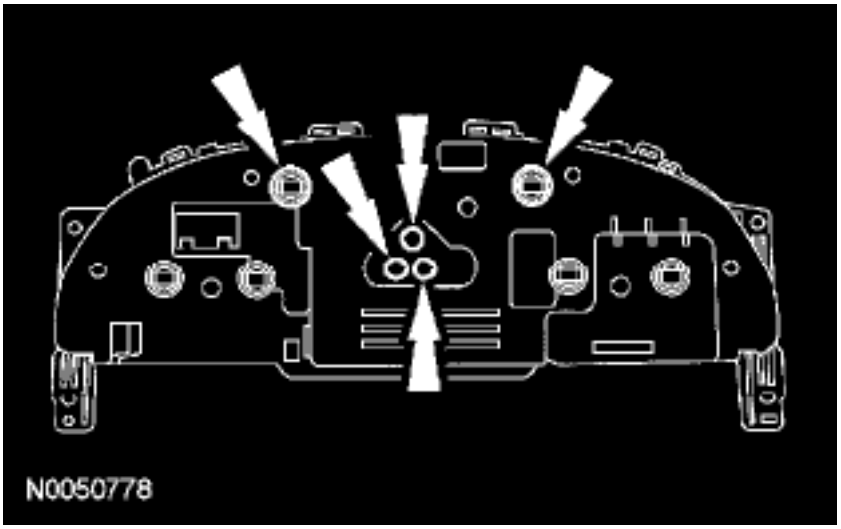
Instrument Panel Bulb: Service and Repair Instrument Cluster Bulb

INSTRUMENT CLUSTER BULB

Removal and Installation

1. Remove the instrument cluster (IC).

2. Remove the illumination sockets and bulbs. 3. To install, reverse the removal procedure.



Instrument Panel Bulb: Service and Repair Warning Indicator Bulb

WARNING INDICATOR BULB

Removal and Installation

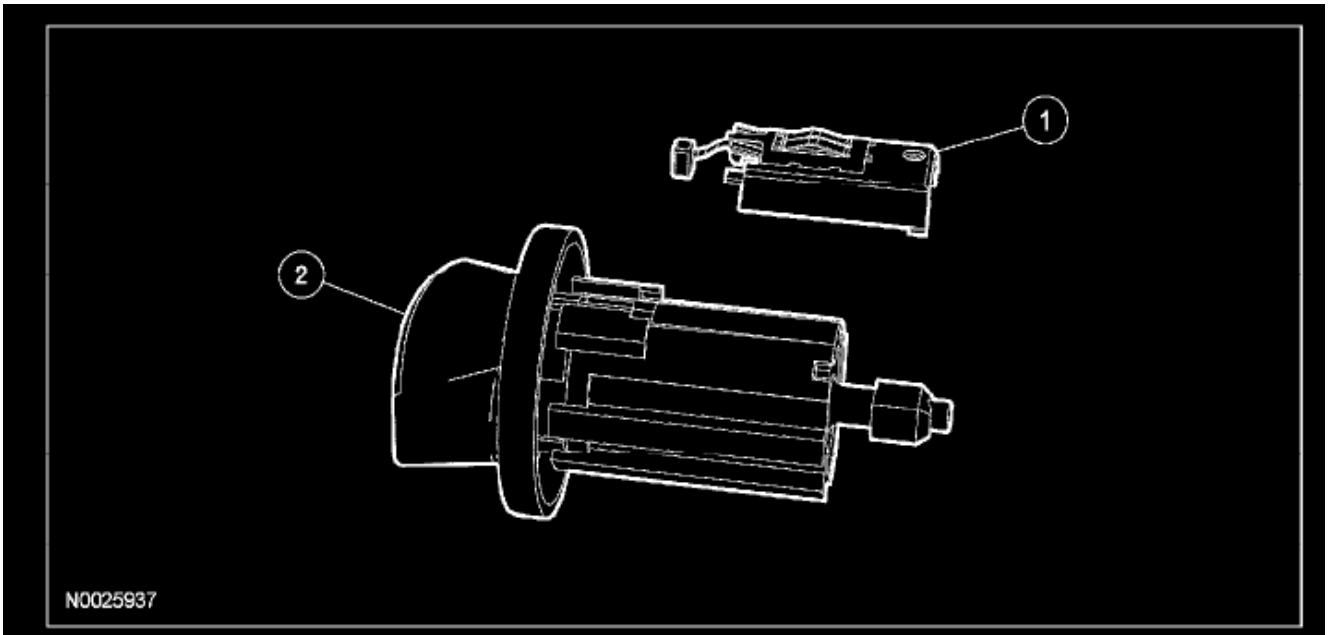
1. Remove the instrument cluster (IC).

2. NOTE: To remove the warning indicator bulb, rotate the bulb one quarter turn counterclockwise and lift it straight out from the instrument cluster

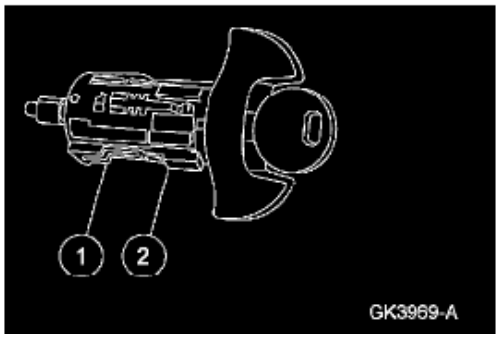
(IC).

Remove the warning indicator bulb in question.

3. To install, reverse the removal procedure.



Item	Part Number	Description
1	11A127	Key-in-ignition warning switch
2	11582	Ignition lock cylinder



Key Reminder Switch: Service and Repair

KEY-IN-IGNITION WARNING SWITCH

Removal and Installation

1. Remove the ignition lock cylinder. 2. Remove the key-in-ignition warning switch.

1 Pry the clip downward.

2 Release the key-in-ignition warning switch from the rear of the ignition lock cylinder.

3. To install, reverse the removal procedure.

Low Tire Pressure Indicator: Testing and Inspection

Tire Pressure Monitoring System (TPMS) Indicator and Message Center Messages

The TPMS indicator and vehicle message center (if equipped) sometimes displays faults that cannot be resolved by the customer. Treat these messages as TPMS faults that must be serviced.

Tire Pressure Monitoring System (TPMS) Indicator Illuminates Continuously

NOTE: If the spare tire is in use, the damaged road tire must be repaired and installed on the vehicle to restore complete TPMS functionality before carrying out any diagnosis.

NOTE: For vehicles with different front and rear tire pressures (such as E-Series and certain F-Series), the tire pressure sensors must be trained following a tire rotation. Failure to train the sensors will cause the TPMS indicator to illuminate.

For vehicles with the same tire pressures for front and rear tires, tire rotation will not affect the system.

1. The TPMS indicator remains on continuously for the following condition:

^ Low Tire Pressure - The TPMS indicator is illuminated solid and the message center displays LOW TIRE PRESSURE (if equipped). This is displayed when any of the tire pressures are low. When this condition exists, the tire pressure must be adjusted to the recommended cold pressure as indicated on the vehicle certification label.

2. NOTE: The TPMS sensors do not transmit when the vehicle is stationary. If the vehicle has been stationary for more than 30 minutes, it will be

necessary to wake up the sensors so they will transmit the latest tire pressure information to the SJB.

If the vehicle has been stationary for more than 30 minutes, refer to Tire Pressure Monitoring System (TPMS) Sensor Activation procedure.

Tire Pressure Monitoring System (TPMS) Indicator Flashes

The TPMS indicator flashes for 70 seconds and then remains ON solid when the ignition key is turned to the ON position for the following conditions: 1. Tire Pressure Sensor Fault - If equipped, the message center will display TIRE SENSOR FAULT when a tire pressure sensor is malfunctioning.

GO to Symptom Chart. See: Tire Monitoring System/Testing and Inspection/Symptom Related Diagnostic Procedures

2. No communication with the SJB (TPMS is integral to the SJB) - The TPMS indicator is illuminated when the instrument cluster has received no

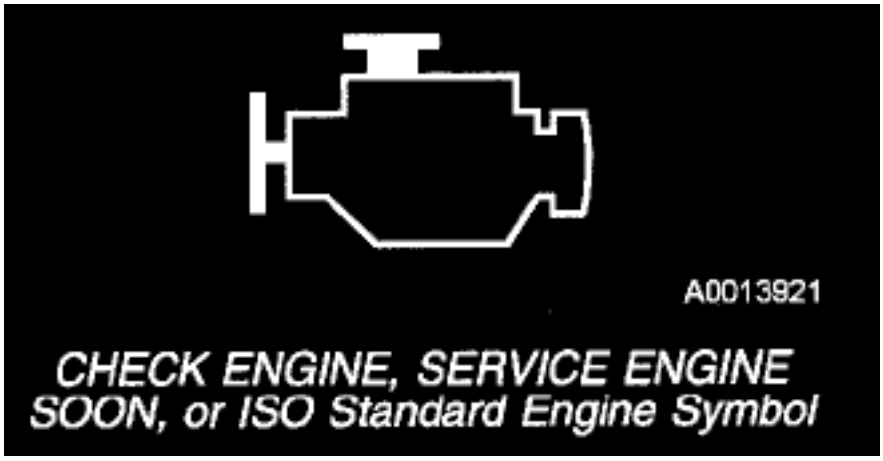
signals from the SJB for more than 5 seconds. If equipped, the message center displays TIRE MONITOR FAULT. GO to Symptom Chart. See: Tire Monitoring System/Testing and Inspection/Symptom Related Diagnostic Procedures

3. Tire Pressure Monitor Fault - If equipped, the message center will display TIRE MONITOR FAULT when the tire pressure monitoring system is

malfunctioning or communication with the instrument cluster has been lost. GO to Symptom Chart. See: Tire Monitoring System/Testing and Inspection/Symptom Related Diagnostic Procedures

Maintenance Required Lamp/Indicator: Service and Repair

This vehicle is not equipped with a Maintenance Required Lamp/Indicator.



Malfunction Indicator Lamp: Description and Operation

MALFUNCTION INDICATOR LAMP (MIL)

Check Engine, Service Engine Soon, Or ISO Standard Engine Symbol

The MIL notifies the driver that the powertrain control module (PCM) has detected an on board diagnostic (OBD) emission-related component or system concern. When this occurs, an OBD diagnostic trouble code (DTC) sets.

- The MIL is located in the instrument cluster and is labeled CHECK ENGINE, SERVICE ENGINE SOON or the international standards organization (ISO) standard engine symbol.

- The MIL is illuminated during the instrument cluster prove out for approximately 4 seconds.

- The MIL remains illuminated after instrument cluster prove out if: -

an emission-related concern and DTC exists.

- the PCM does not send a control message to the instrument cluster (applications with the MIL controlled through the communication link).

- the PCM is operating in the hardware limited operation strategy (HLOS).

- The MIL remains off during the instrument cluster prove out if an indicator or instrument cluster concern is present.

- To turn off the MIL after a repair, a reset command from the scan tool must be sent, or 3 consecutive drive cycles must be completed without a concern.

- For all MIL concerns, go to Symptom Charts. See: Powertrain Management/Computers and Control Systems/Testing and Inspection/Symptom Related Diagnostic Procedures

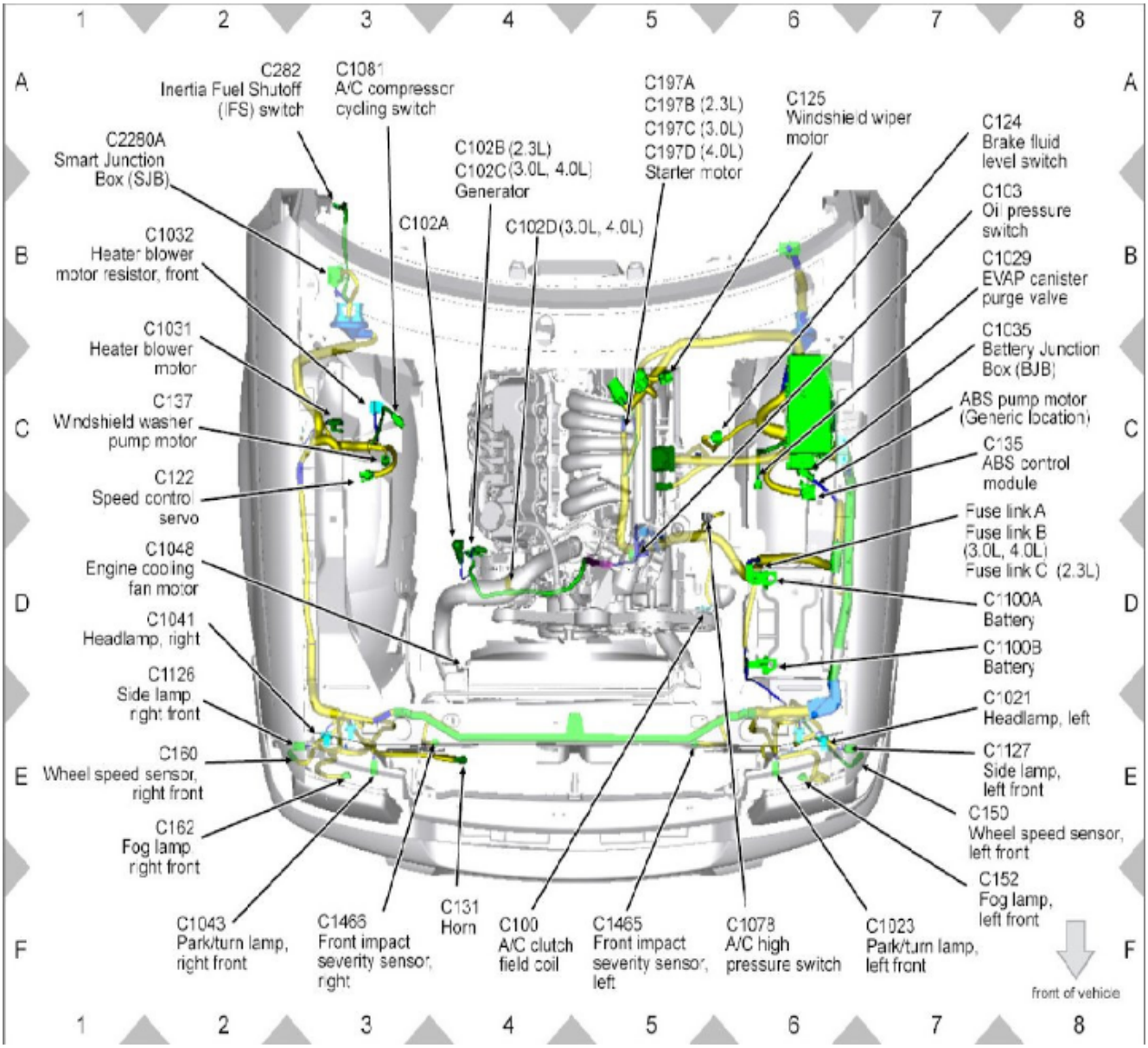
- If the MIL flashes at a steady rate, a severe misfire condition may exist.

- If the MIL flashes erratically, the PCM can reset while cranking if the battery voltage is low.

- The MIL flashes after a period of time with the key in the RUN position (engine not running) if DTC P1000 is set.

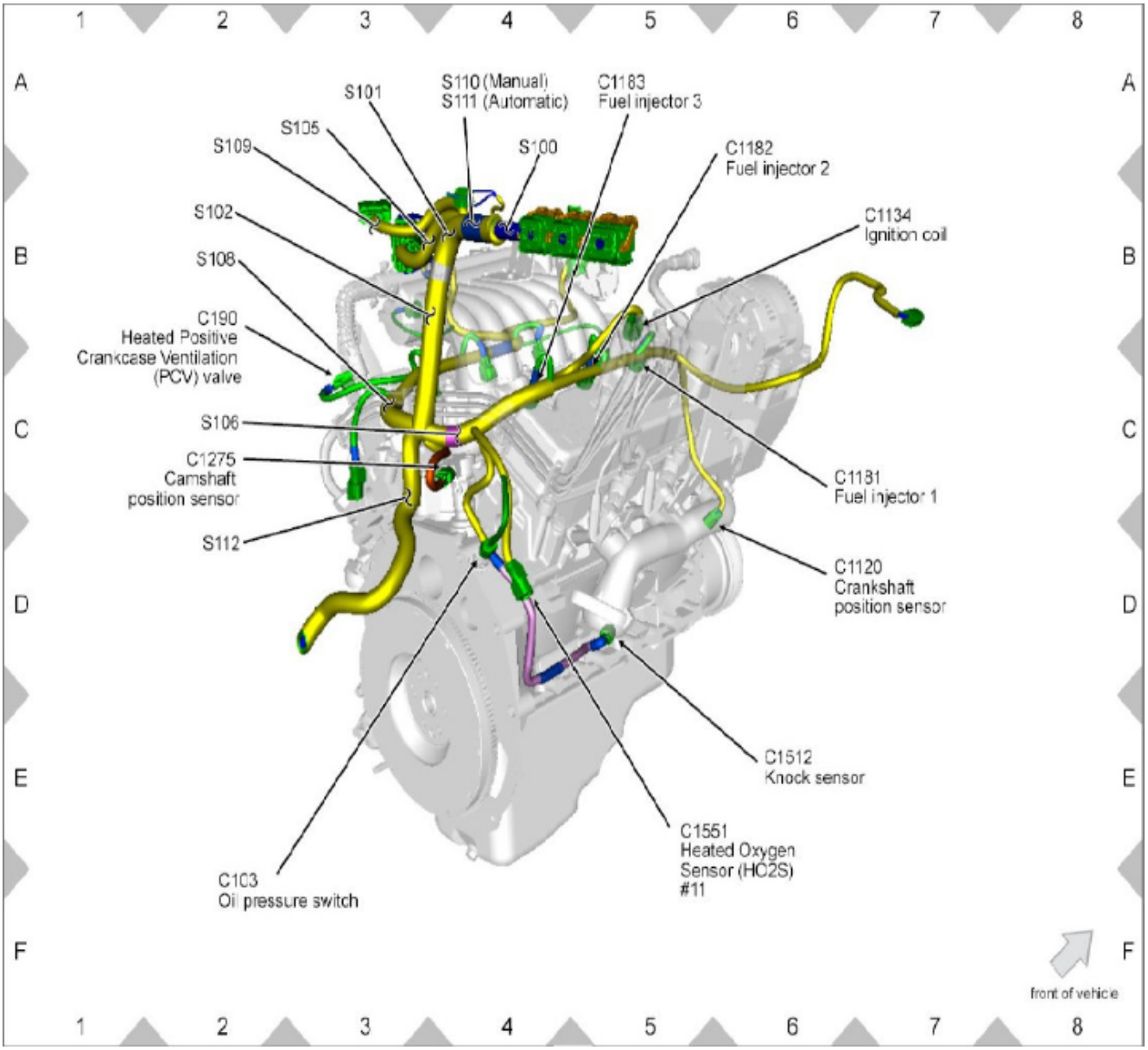
Oil Change Reminder Lamp: Service and Repair

This vehicle is not equipped with an Oil Change Reminder Lamp.

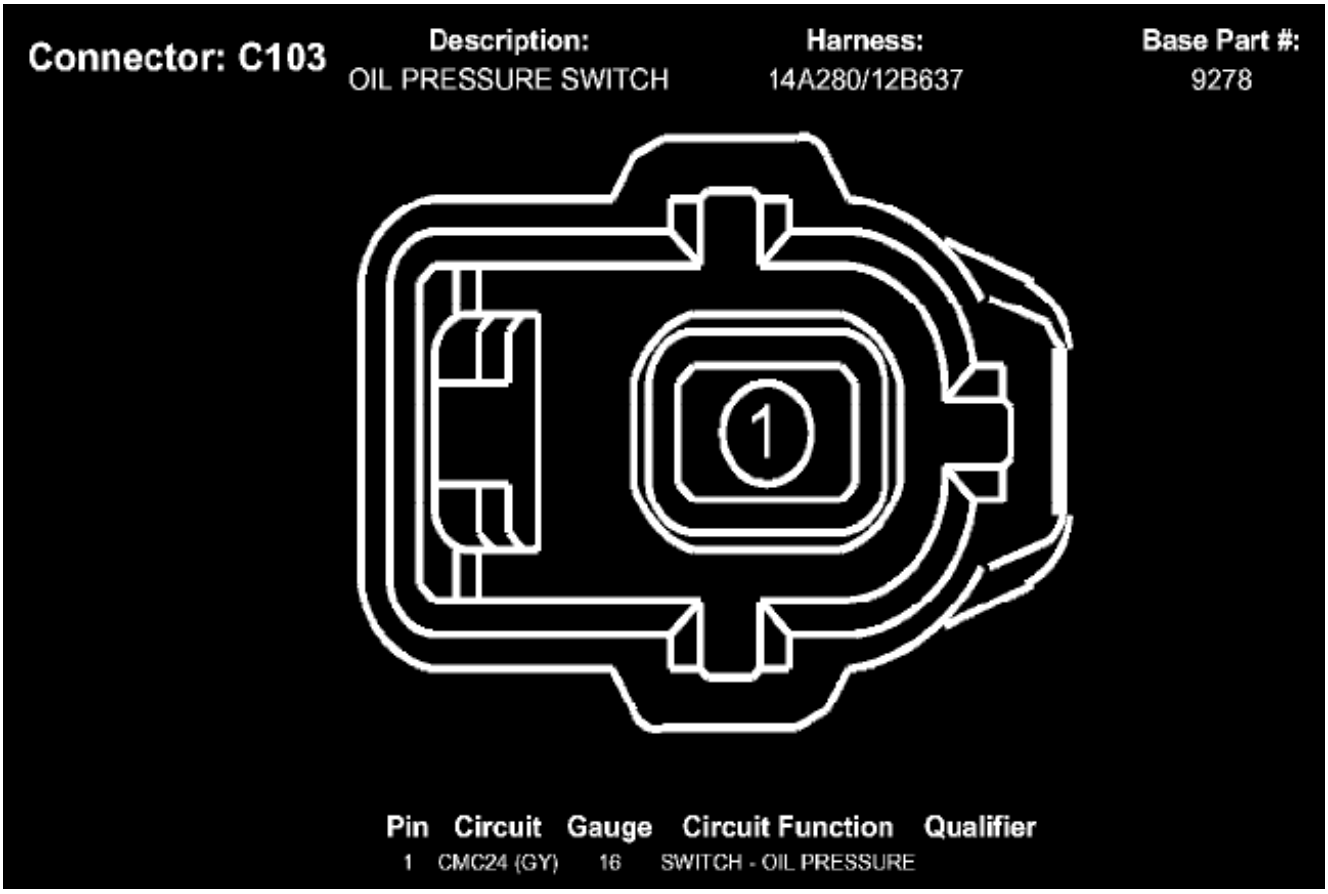


Oil Pressure Sender: Locations

View 151-1

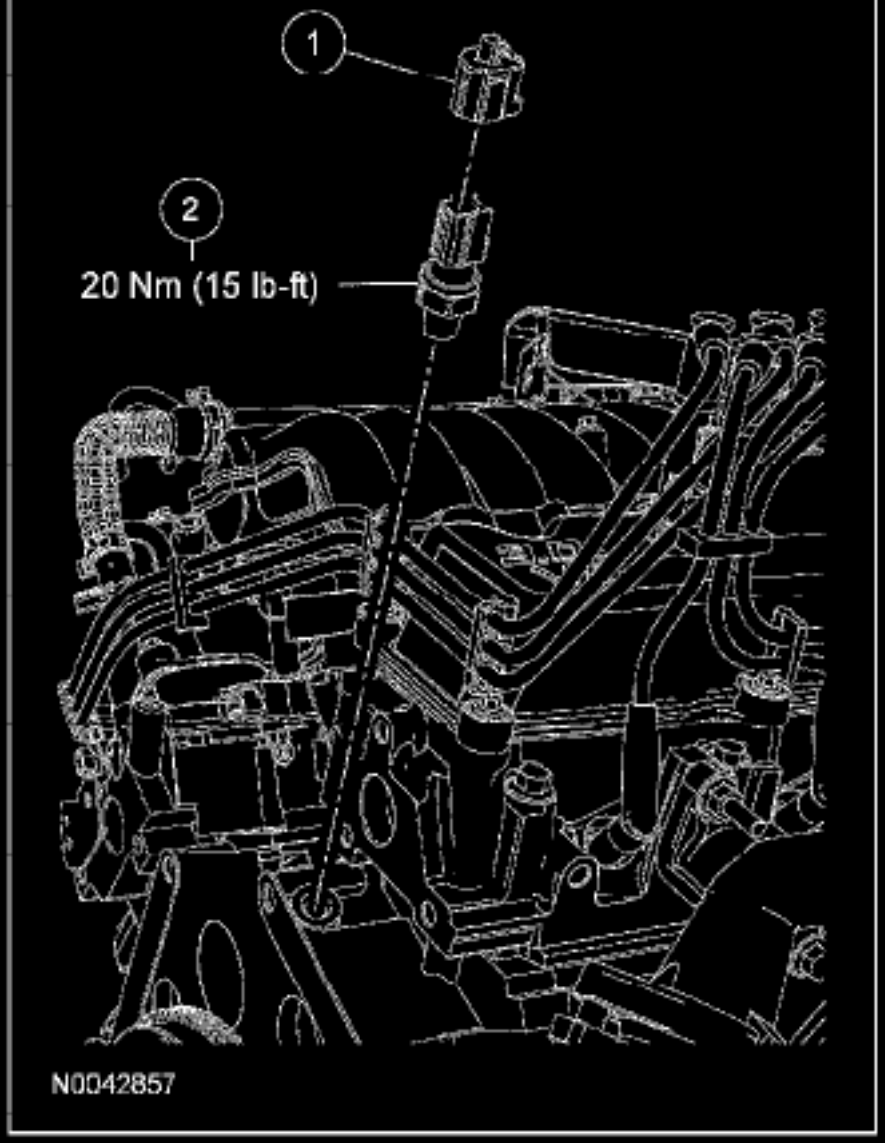

S101
S110 (Manual)
S111 (Automatic)
C1183
Fuel injector 3
S105
S109
S100
C1182
Fuel injector 2
S102
C1134
Ignition coil
S108
C190
Heated Positive
Crankcase Ventilation
(PCV) valve
S106
C1275
Camshaft
position sensor
S112
C1181
Fuel injector 1
C1120
Crankshaft
position sensor
C1512
Knock sensor
C1551
Heated Oxygen
Sensor (HO2S)
#11
C103
Oil pressure switch
front of vehicle

View 151-6


Connector: C103
Description:
OIL PRESSURE SWITCH
Harness:
14A280/12B637
Base Part #:
9278
1
Pin Circuit Gauge Circuit Function Qualifier
1 CMC24 (GY) 16 SWITCH - OIL PRESSURE

C103

Engine Oil Pressure (EOP) Switch



Item	Part Number	Description
1	14A464	Engine oil pressure (EOP) switch electrical connector (part of 12B637)
2	9278	EOP switch

Oil Pressure Sender: Service and Repair

Engine Oil Pressure (EOP) Switch

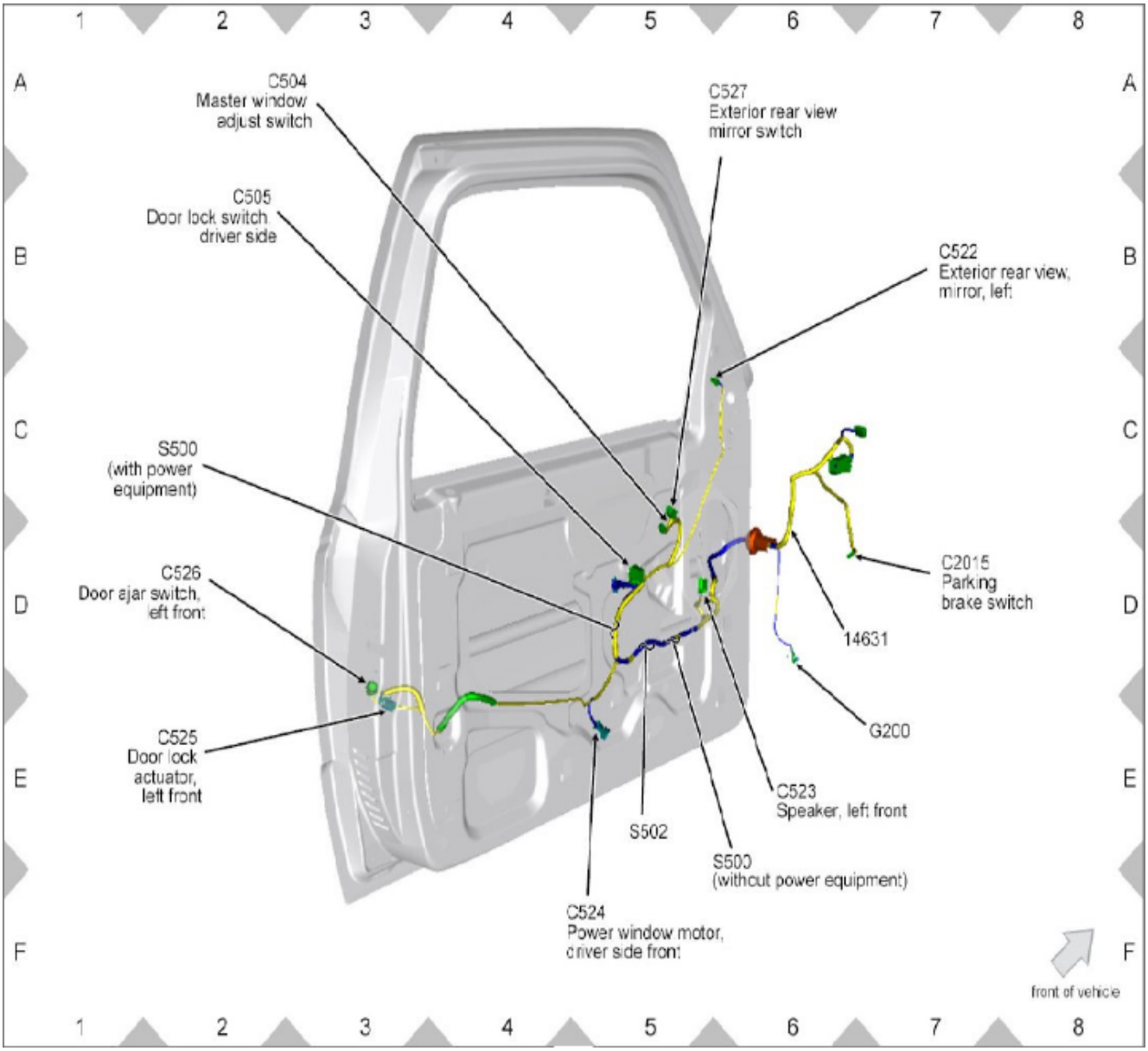
Engine Oil Pressure (EOP) Switch

Removal and Installation

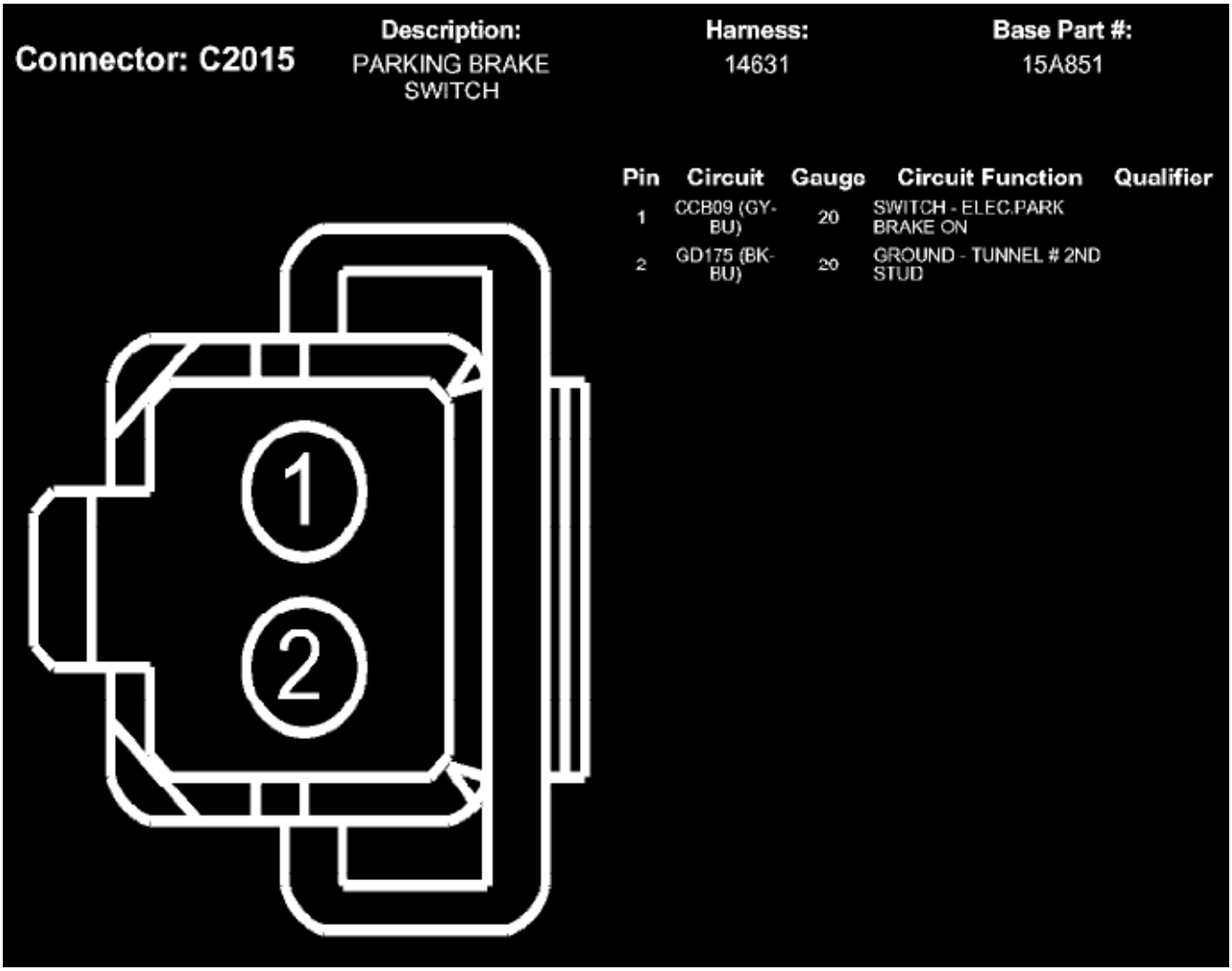
1. Disconnect the engine oil pressure switch electrical connector from the engine oil pressure switch. 2. Remove the engine oil pressure switch.

^ To install, tighten to 20 Nm (15 lb-ft).

3. To install, reverse the removal procedure.


C504
Master window adjust switch
C505
Door lock switch driver side
S500
(with power equipment)
C526
Door ajar switch, left front
C525
Door lock actuator, left front
C527
Exterior rear view mirror switch
C522
Exterior rear view mirror, left
C2015
Parking brake switch
14631
G200
C523
Speaker, left front
S502
S500
(without power equipment)
C524
Power window motor, driver side front
front of vehicle

View 151-20


Connector: C2015
Description:
PARKING BRAKE SWITCH
Harness:
14631
Base Part #:
15A851
Pin
Circuit
Gauge
Circuit Function
Qualifier
1
CCB09 (GY-BU)
20
SWITCH - ELEC.PARK BRAKE ON
2
GD175 (BK-BU)
20
GROUND - TUNNEL # 2ND STUD
1
2

C2015

If...	Then...
The driver's and front passenger's safety belts are buckled before the ignition switch is turned to the ON position or less than 1-2 minutes have elapsed since the ignition switch has been turned ON...	The Belt-Minder® feature will not activate.
The driver's or front passenger's safety belt is not buckled when the vehicle has reached at least 5 km/h (3 mph) and 1-2 minutes have elapsed since the ignition switch has been turned to ON...	The Belt-Minder® feature is activated — the safety belt warning indicator illuminates and the warning chime sounds for 6 seconds every 30 seconds, repeating for approximately 5 minutes or until the safety belts are buckled.
The driver's or front passenger's safety belt becomes unbuckled for approximately one minute while the vehicle is traveling at least 5 km/h (3 mph) and more than 1-2 minutes have elapsed since the ignition switch has been turned to ON...	The Belt-Minder® feature is activated — the safety belt warning indicator illuminates and the warning chime sounds for 6 seconds every 30 seconds, repeating for approximately 5 minutes or until the safety belts are buckled.

Seat Belt Reminder Buzzer: Description and Operation

Safety Belt Warning Indicator and Chime

The safety belt warning indicator and chime remind the driver to fasten their safety belt. The following conditions will take place: -

If the driver's safety belt is not buckled before the ignition is turned to the ON position, the chime will turn on for 4-8 seconds and the indicator will illuminate for 1-2 minutes.

- If the driver's safety belt is buckled while the indicator is on and the chime is sounding, both the indicator and chime will turn off.

- If the driver's safety belt is buckled before the ignition is turned to the ON position, neither the indicator nor the chime will be active.

Belt-Minder(R)

The Belt-Minder(R) feature is a supplemental warning to the safety belt warning function. The feature provides additional reminders by intermittently sounding a chime and illuminating the safety belt warning indicator in the instrument cluster when the driver's and front passenger's safety belt is unbuckled.

The Belt-Minder(R) feature uses information from the front passenger sensing system to determine if a front seat passenger is present and therefore potentially in need of a warning. To avoid activating the Belt-Minder(R) feature for objects placed in the front passenger seat, warnings will only be given to large front seat occupants as determined by the front passenger sensing system.

Both the driver's and passenger's safety belt usages are monitored and either may activate the Belt-Minder(R) feature. The warnings are the same for the driver and front passenger. If the Belt-Minder(R) warnings have expired (warnings for approximately 5 minutes) for one occupant (driver or front passenger), the other occupant can still activate the Belt-Minder(R) feature.

The Belt-Minder(R) feature uses information from the OCS system on the front passenger seat to determine if a front seat passenger is present and therefore potentially in need of a warning. The warning is activated if the OCS system senses weight exceeding a programmed set point.

The driver and front passenger Belt-Minder(R) feature is deactivated/activated independently. When deactivating/activating the Belt-Minder(R) for a seat, do not buckle the safety belts on the other seat, or the process will be terminated. To deactivate/activate the Belt-Minder(R) feature, refer to Instrument Panel, Gauges and Warning Indicators or the Owner's Literature.

If...	Then...
The driver's and front passenger's safety belts are buckled before the ignition switch is turned to the ON position or less than 1-2 minutes have elapsed since the ignition switch has been turned ON...	The Belt-Minder® feature will not activate.
The driver's or front passenger's safety belt is not buckled when the vehicle has reached at least 5 km/h (3 mph) and 1-2 minutes have elapsed since the ignition switch has been turned to ON...	The Belt-Minder® feature is activated — the safety belt warning indicator illuminates and the warning chime sounds for 6 seconds every 30 seconds, repeating for approximately 5 minutes or until the safety belts are buckled.
The driver's or front passenger's safety belt becomes unbuckled for approximately one minute while the vehicle is traveling at least 5 km/h (3 mph) and more than 1-2 minutes have elapsed since the ignition switch has been turned to ON...	The Belt-Minder® feature is activated — the safety belt warning indicator illuminates and the warning chime sounds for 6 seconds every 30 seconds, repeating for approximately 5 minutes or until the safety belts are buckled.

Seat Belt Reminder Lamp: Description and Operation

Safety Belt Warning Indicator and Chime

The safety belt warning indicator and chime remind the driver to fasten their safety belt. The following conditions will take place: -

If the driver's safety belt is not buckled before the ignition is turned to the ON position, the chime will turn on for 4-8 seconds and the indicator will illuminate for 1-2 minutes.

- If the driver's safety belt is buckled while the indicator is on and the chime is sounding, both the indicator and chime will turn off.

- If the driver's safety belt is buckled before the ignition is turned to the ON position, neither the indicator nor the chime will be active.

Belt-Minder(R)

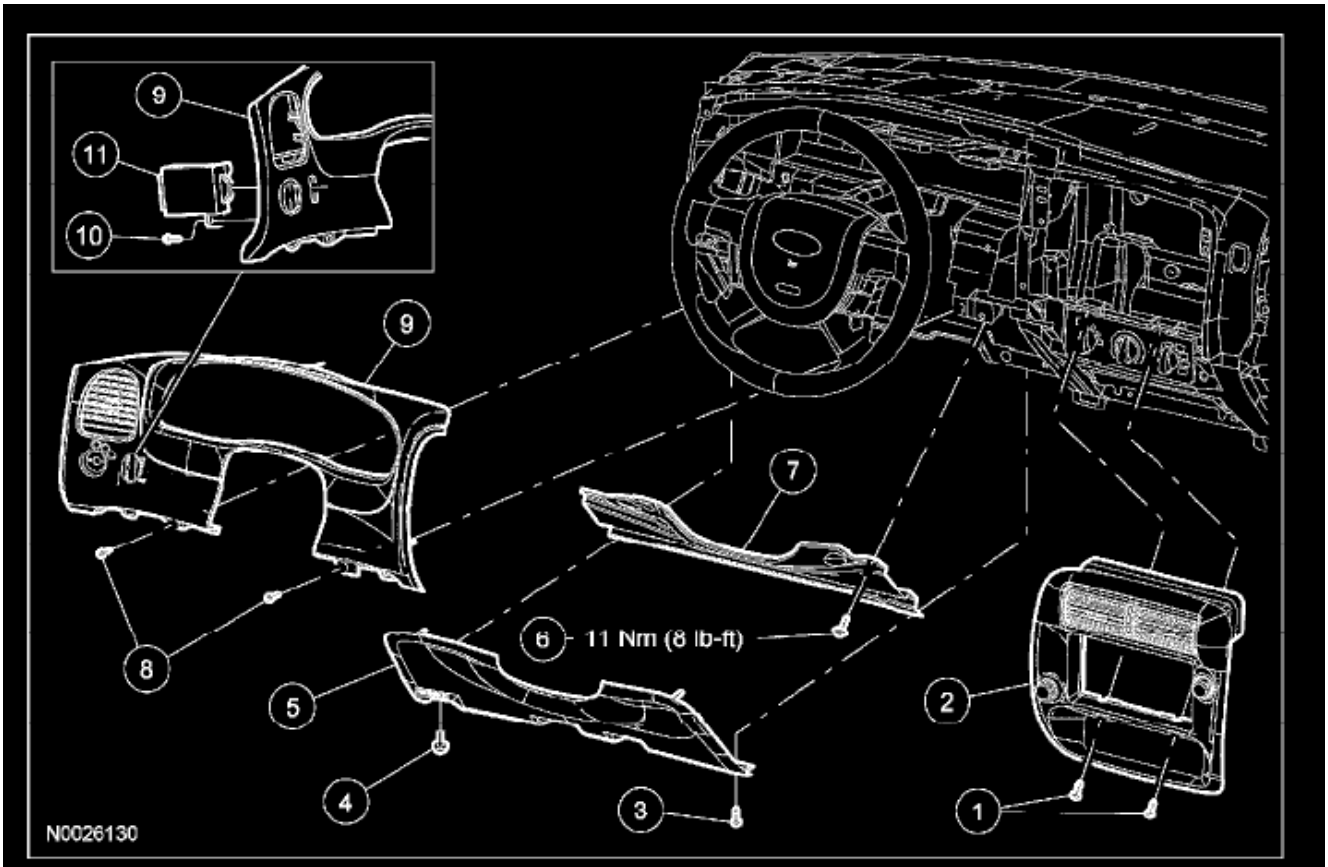
The Belt-Minder(R) feature is a supplemental warning to the safety belt warning function. The feature provides additional reminders by intermittently sounding a chime and illuminating the safety belt warning indicator in the instrument cluster when the driver's and front passenger's safety belt is unbuckled.

The Belt-Minder(R) feature uses information from the front passenger sensing system to determine if a front seat passenger is present and therefore potentially in need of a warning. To avoid activating the Belt-Minder(R) feature for objects placed in the front passenger seat, warnings will only be given to large front seat occupants as determined by the front passenger sensing system.

Both the driver's and passenger's safety belt usages are monitored and either may activate the Belt-Minder(R) feature. The warnings are the same for the driver and front passenger. If the Belt-Minder(R) warnings have expired (warnings for approximately 5 minutes) for one occupant (driver or front passenger), the other occupant can still activate the Belt-Minder(R) feature.

The Belt-Minder(R) feature uses information from the OCS system on the front passenger seat to determine if a front seat passenger is present and therefore potentially in need of a warning. The warning is activated if the OCS system senses weight exceeding a programmed set point.

The driver and front passenger Belt-Minder(R) feature is deactivated/activated independently. When deactivating/activating the Belt-Minder(R) for a seat, do not buckle the safety belts on the other seat, or the process will be terminated. To deactivate/activate the Belt-Minder(R) feature, refer to Instrument Panel, Gauges and Warning Indicators or the Owner's Literature.



Item	Part Number	Description
1	W701679	Center instrument panel finish panel screws (2 required)
2	1004302	Center instrument panel finish panel
3	W705314	Instrument panel steering column cover screws (2 required)
4	N807316	Hood latch release handle bolts (2 required)
5	10044F08	Instrument panel steering column cover
6	N807316	Lower instrument panel reinforcement bolts (5 required)
7	10017A28	Lower instrument panel reinforcement
8	W705314	Instrument cluster finish panel screws (5 required)
9	011201	Instrument cluster finish panel
10	385754-S36	Instrument panel dimmer switch screws (2 required)

Item	Part Number	Description
11	11691	Instrument panel dimmer switch

(Continued)

Dimmer Switch: Service and Repair

INSTRUMENT PANEL DIMMER SWITCH

Removal and Installation

1. Remove the radio. 2. Remove the center instrument panel finish panel.

- Remove the 2 screws.

- Disconnect the electrical connectors.

3. Remove the 2 bolts and position aside the hood latch release handle. 4. Remove the 2 screws and remove the instrument panel steering column cover. 5. Remove the 5 bolts and the lower instrument panel reinforcement.

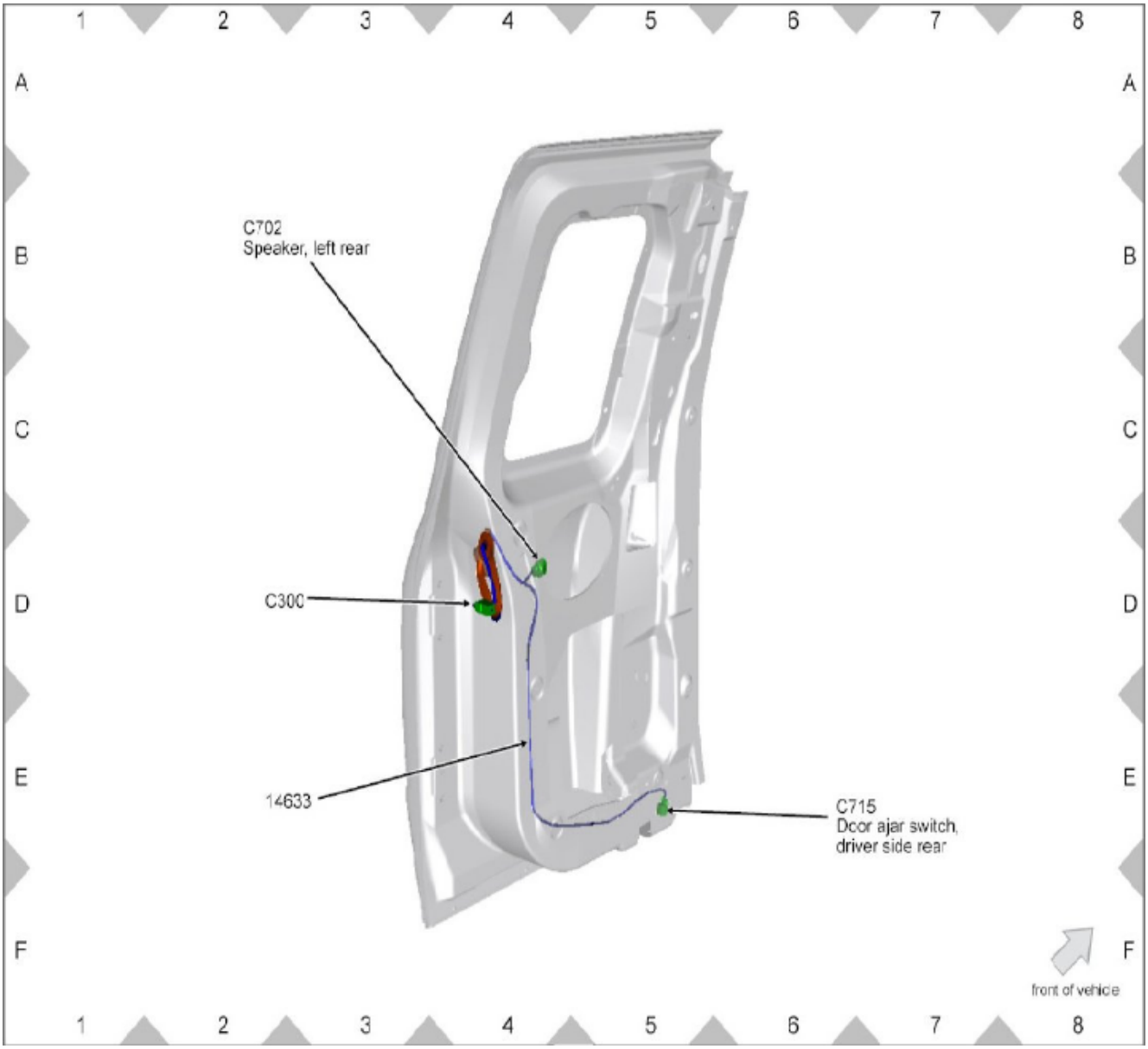
- To install, tighten to 11 Nm (8 lb-ft).

6. If equipped, position the column-mounted transmission range selector lever to the lowest position. 7. Remove the instrument cluster finish panel.

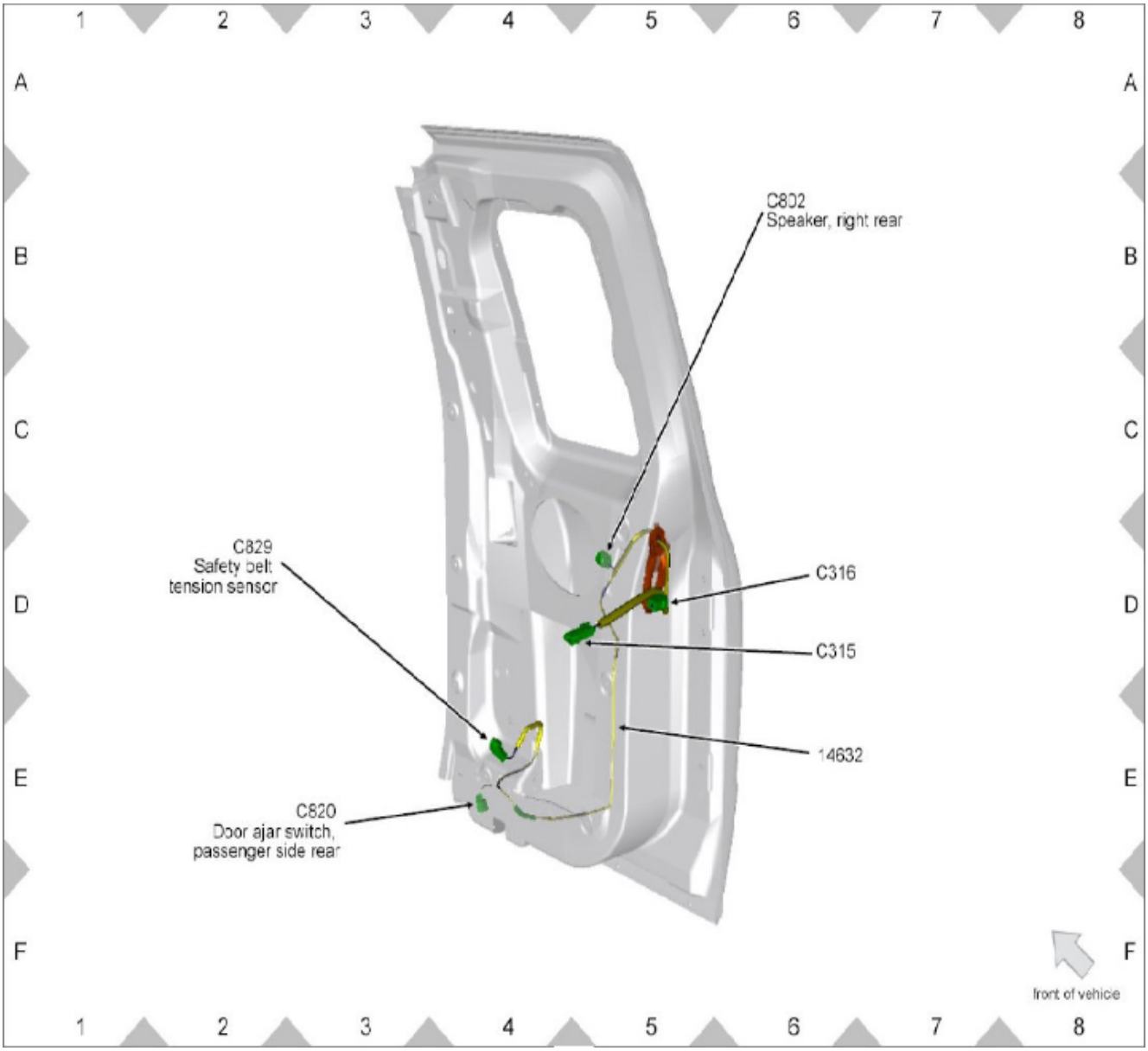
- Remove the 5 screws.

- Disconnect the electrical connectors.

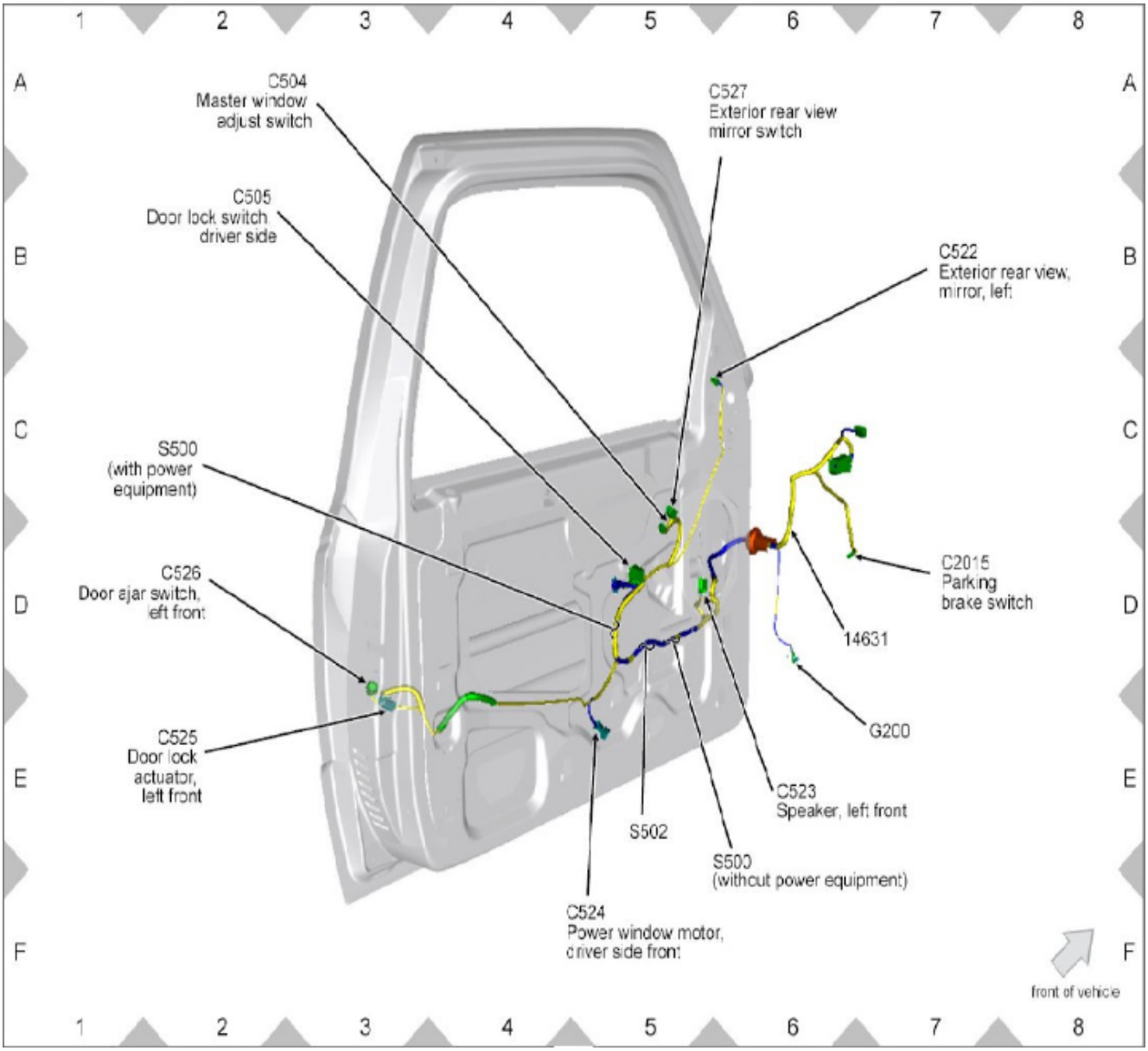
8. Remove the 2 screws and the instrument panel dimmer switch. 9. To install, reverse the removal procedure.


1
2
3
4
5
6
7
8
A
B
C
D
E
F
C702
Speaker, left rear
C300
14633
C715
Door ajar switch, driver side rear
front of vehicle

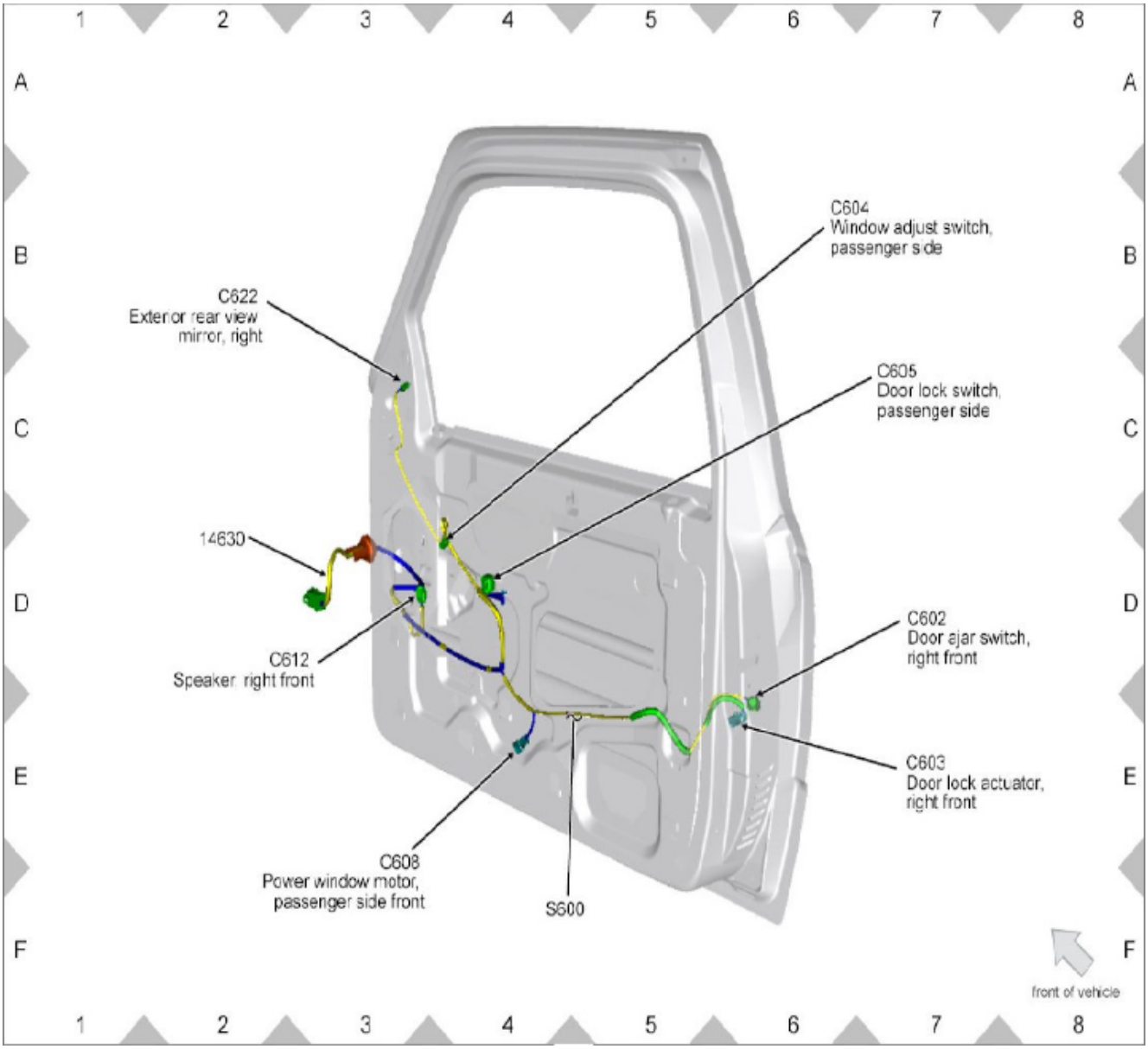
View 151-22


C802
Speaker, right rear
C829
Safety belt tension sensor
C316
C315
14632
C820
Door ajar switch, passenger side rear
front of vehicle

View 151-23


C504
Master window adjust switch
C505
Door lock switch driver side
S500
(with power equipment)
C526
Door ajar switch, left front
C525
Door lock actuator, left front
C524
Power window motor, driver side front
S502
S500
(without power equipment)
C523
Speaker, left front
G200
14631
C2015
Parking brake switch
C522
Exterior rear view mirror, left
C527
Exterior rear view mirror switch
front of vehicle

View 151-20


C604
Window adjust switch, passenger side
C622
Exterior rear view mirror, right
C605
Door lock switch, passenger side
14630
C612
Speaker, right front
C602
Door ajar switch, right front
C603
Door lock actuator, right front
C608
Power window motor, passenger side front
S600
front of vehicle

View 151-21

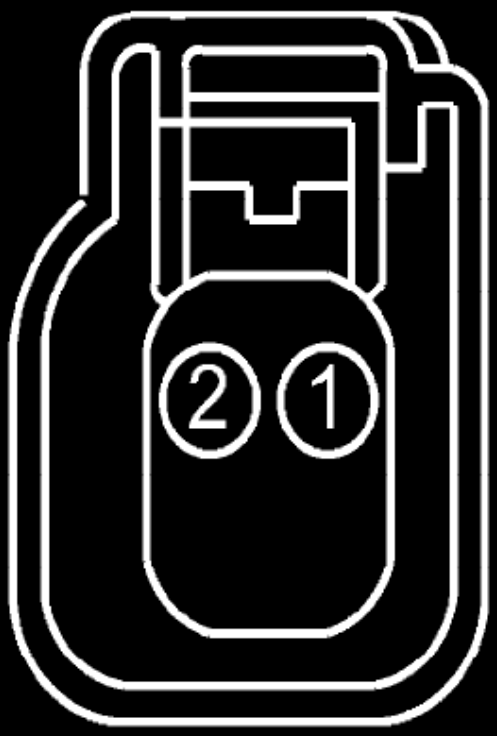
Connector: C526

Description: DOOR AJAR SWITCH, LEFT FRONT

Harness: 14631

Base Part #:

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPL26 (GN-VT)	20	SWITCH - LATCH DRIVER # AJAR	
2	GD175 (BK-BU)	20	GROUND - TUNNEL # 2ND STUD	

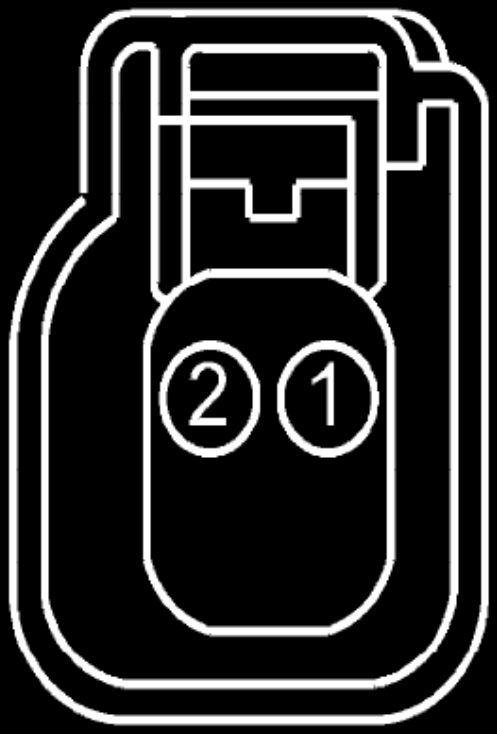


C526

Connector: C602

Description:	Harness:	Base Part #:
DOOR AJAR SWITCH, RIGHT FRONT	14630	

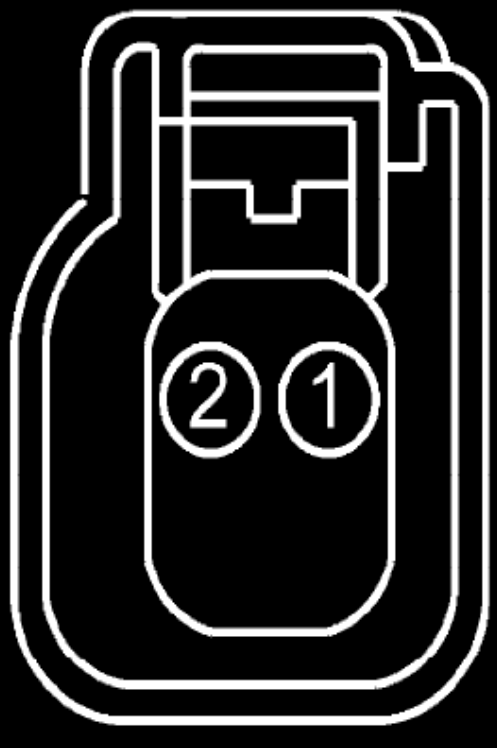
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPL31 (WH)	20	SWITCH - LATCH PASSENGER # AJAR	
2	GD161 (BK-YE)	20	GROUND - SEAT BRACKET REAR LEFT	



C602

Connector: C715

Description:	Harness:	Base Part #:
DOOR AJAR SWITCH, DRIVER SIDE REAR	14633	14018

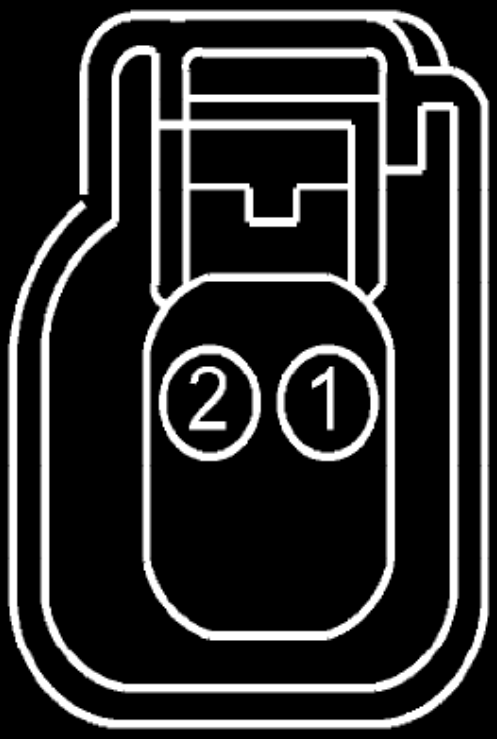


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPL36 (GN)	18	SWITCH - LATCH REAR DRIVER SIDE # AJAR (INCL.SLIDING DOOR)	
2	GD101 (BK-YE)	18	GROUND - SEAT BRACKET REAR LEFT	

C715

Connector: C820

Description:	Harness:	Base Part #:
DOOR AJAR SWITCH, PASSENGER SIDE REAR	14632	14018



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPL39 (YE)	18	SWITCH - LATCH REAR PASSENGER SIDE # AJAR (INCL.SLIDING DOOR)	
2	GD161 (BK-YE)	18	GROUND - SEAT BRACKET REAR LEFT	

C820

Door Switch: Service and Repair Door Ajar Switch

DOOR AJAR SWITCH

Removal and Installation

1. Remove the front door latch. 2. Lift the locking tab, rotate the switch and remove the door ajar switch. 3. To install, reverse the removal procedure.

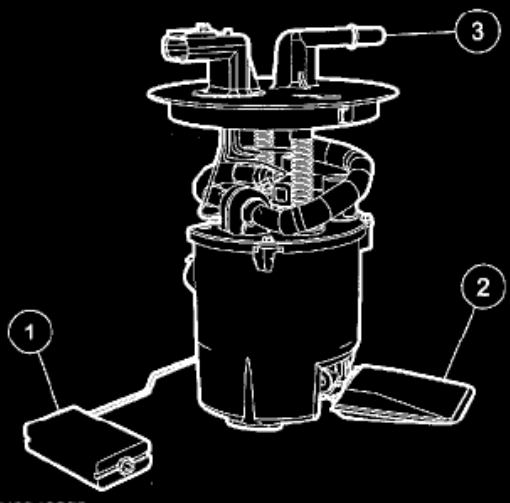
Door Switch: Service and Repair Door Ajar Switch - SuperCab Four-Door

DOOR AJAR SWITCH - SUPERCAB FOUR-DOOR

Removal and Installation

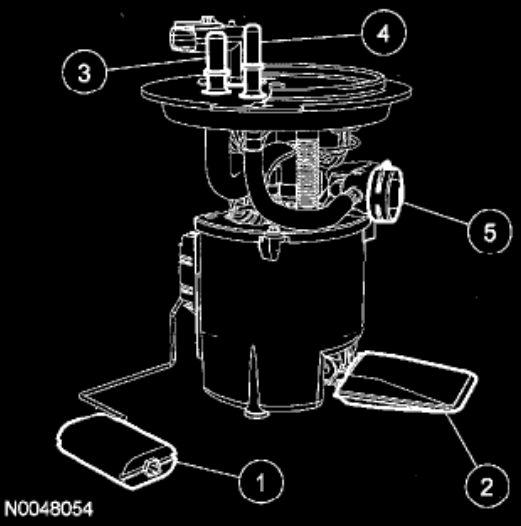
1. Remove the rear door lower latch. 2. Release the locking tabs, rotate the door ajar switch and remove the door ajar switch. 3. To install, reverse the removal procedure.

Typical Electronic Returnless Fuel Pump (FP) Module



Item	Part Number	Description
1	—	Fuel Level Float
2	—	Fuel Intake Filter
3	—	Fuel Supply

Typical Mechanical Returnless Fuel Pump (FP) Module



Item	Part Number	Description
1	—	Fuel Level Float
2	—	Fuel Intake Filter
3	—	Fuel Supply
4	—	Fuel Return from Fuel Filter
5	—	Fuel Pressure Regulator

Fuel Gauge Sender: Description and Operation

Fuel Pump (FP) Module

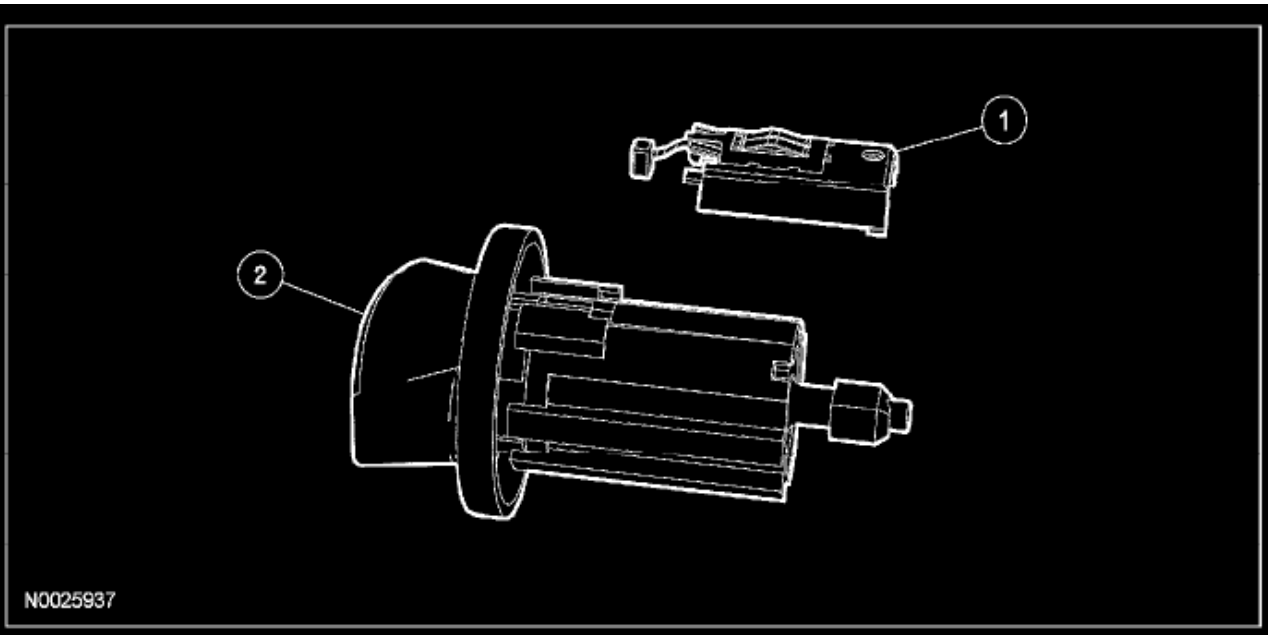
Typical Electronic Returnless Fuel Pump (FP) Module

Typical Mechanical Returnless Fuel Pump (FP) Module

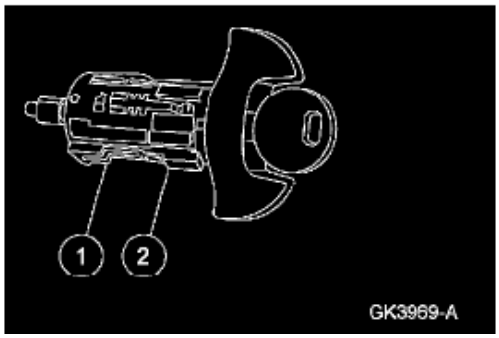
The FP module is a device that contains the fuel pump and sender assembly. The fuel pump is located inside the FP module reservoir and supplies fuel through the FP module manifold to the engine and FP module jet pump. The jet pump continuously refills the reservoir with fuel, and a check valve located in the manifold outlet maintains system pressure when the fuel pump is not energized. A flapper valve located in the bottom of the reservoir allows fuel to enter the reservoir and prime the fuel pump during the initial fill.

Fuel Pump (FP) Module and Reservoir

The FP module is mounted inside the fuel tank in a reservoir. The pump has a discharge check valve that maintains the system pressure after the key has been turned off to minimize starting concerns. The reservoir prevents fuel flow interruptions during extreme vehicle maneuvers with low tank fill levels.



Item	Part Number	Description
1	11A127	Key-in-ignition warning switch
2	11582	Ignition lock cylinder



Key Reminder Switch: Service and Repair

KEY-IN-IGNITION WARNING SWITCH

Removal and Installation

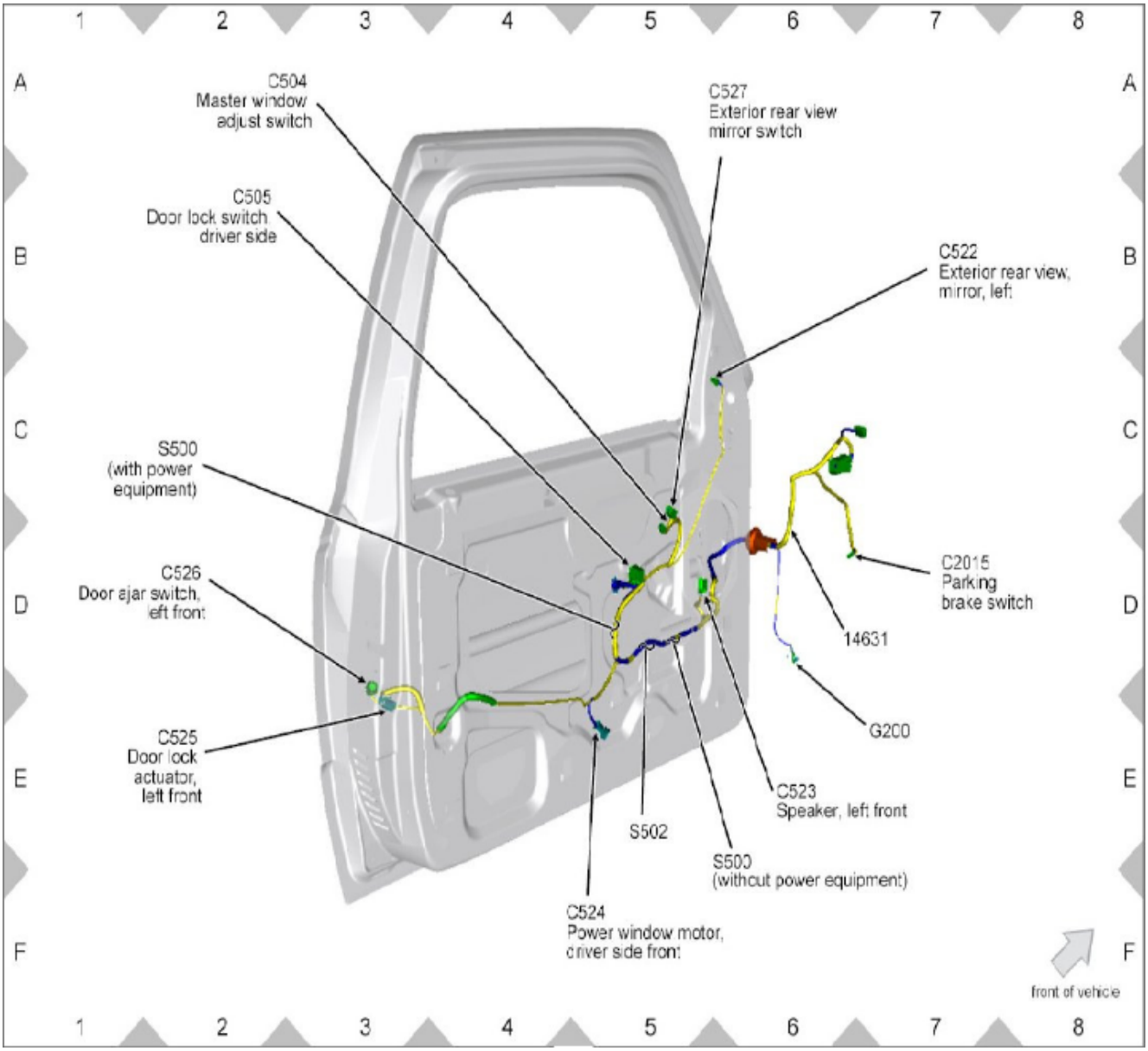
1. Remove the ignition lock cylinder. 2. Remove the key-in-ignition warning switch.

1 Pry the clip downward.

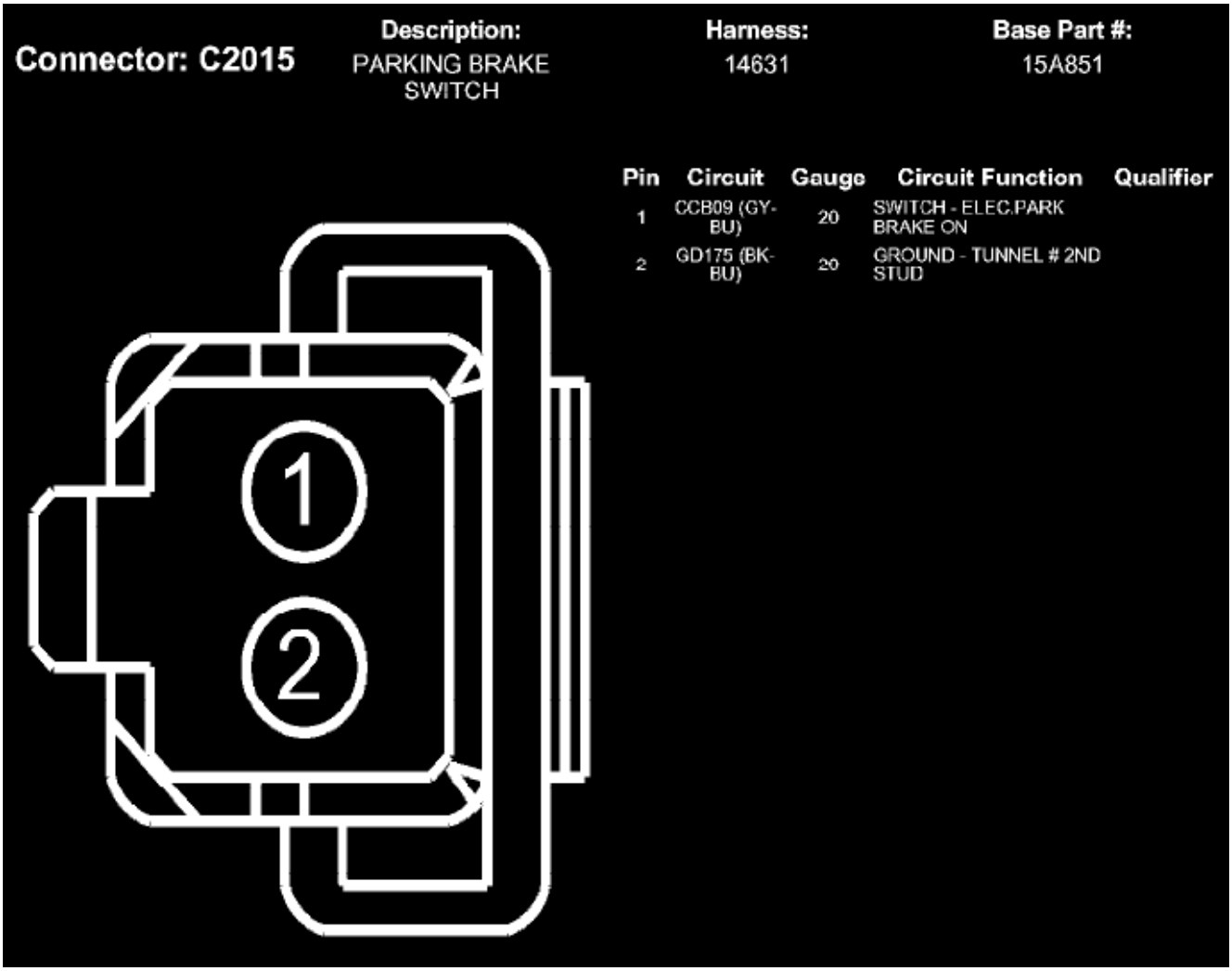
2 Release the key-in-ignition warning switch from the rear of the ignition lock cylinder.

3. To install, reverse the removal procedure.

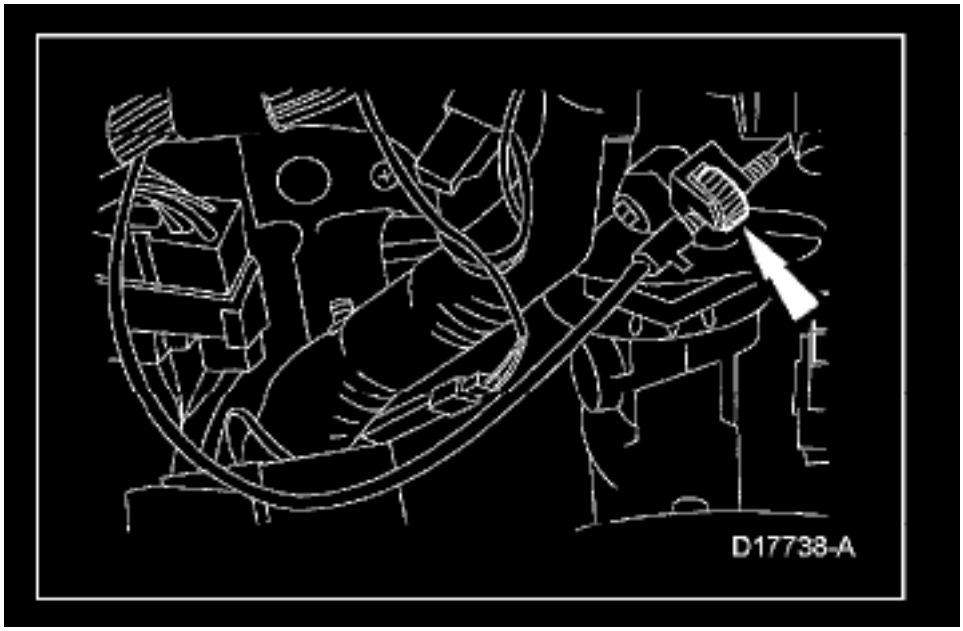
Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Instrument Panel, Gauges and Warning Indicators > Sensors and Switches - Instrument Panel > Parking Brake Warning Switch > Component Information > Locations



View 151-20


Connector: C2015
Description:
PARKING BRAKE SWITCH
Harness:
14631
Base Part #:
15A851
Pin
Circuit
Gauge
Circuit Function
Qualifier
1
CCB09 (GY-BU)
20
SWITCH - ELEC.PARK BRAKE ON
2
GD175 (BK-BU)
20
GROUND - TUNNEL # 2ND STUD
1
2

C2015



Shift Indicator: Adjustments

Selector Lever Indicator Adjustment

1. Remove the upper instrument panel steering column cover. 2. Place the selector lever in the (D) position.

^ Rotate the selector lever clockwise until it bottoms out (1st gear), then rotate 2 detents counterclockwise ((D) position).

3. Hang the 1.4 kg (3 lb) weight on the gearshift lever. 4. Center the pointer in the middle of the (D) position.

^ Rotate the thumb-wheel located on the bottom of the steering column to adjust the pointer.

5. Remove the 1.4 kg (3 lb) weight. 6. Carefully move the selector lever into each detent and compare with the transmission settings.

^ Readjust if necessary.

7. Install the upper instrument panel steering column cover.

Low Tire Pressure Indicator: Testing and Inspection

Tire Pressure Monitoring System (TPMS) Indicator and Message Center Messages

The TPMS indicator and vehicle message center (if equipped) sometimes displays faults that cannot be resolved by the customer. Treat these messages as TPMS faults that must be serviced.

Tire Pressure Monitoring System (TPMS) Indicator Illuminates Continuously

NOTE: If the spare tire is in use, the damaged road tire must be repaired and installed on the vehicle to restore complete TPMS functionality before carrying out any diagnosis.

NOTE: For vehicles with different front and rear tire pressures (such as E-Series and certain F-Series), the tire pressure sensors must be trained following a tire rotation. Failure to train the sensors will cause the TPMS indicator to illuminate.

For vehicles with the same tire pressures for front and rear tires, tire rotation will not affect the system.

1. The TPMS indicator remains on continuously for the following condition:

^ Low Tire Pressure - The TPMS indicator is illuminated solid and the message center displays LOW TIRE PRESSURE (if equipped). This is displayed when any of the tire pressures are low. When this condition exists, the tire pressure must be adjusted to the recommended cold pressure as indicated on the vehicle certification label.

2. NOTE: The TPMS sensors do not transmit when the vehicle is stationary. If the vehicle has been stationary for more than 30 minutes, it will be

necessary to wake up the sensors so they will transmit the latest tire pressure information to the SJB.

If the vehicle has been stationary for more than 30 minutes, refer to Tire Pressure Monitoring System (TPMS) Sensor Activation procedure.

Tire Pressure Monitoring System (TPMS) Indicator Flashes

The TPMS indicator flashes for 70 seconds and then remains ON solid when the ignition key is turned to the ON position for the following conditions: 1. Tire Pressure Sensor Fault - If equipped, the message center will display TIRE SENSOR FAULT when a tire pressure sensor is malfunctioning.

GO to Symptom Chart. See: Testing and Inspection/Symptom Related Diagnostic Procedures

2. No communication with the SJB (TPMS is integral to the SJB) - The TPMS indicator is illuminated when the instrument cluster has received no

signals from the SJB for more than 5 seconds. If equipped, the message center displays TIRE MONITOR FAULT. GO to Symptom Chart. See: Testing and Inspection/Symptom Related Diagnostic Procedures

3. Tire Pressure Monitor Fault - If equipped, the message center will display TIRE MONITOR FAULT when the tire pressure monitoring system is

malfunctioning or communication with the instrument cluster has been lost. GO to Symptom Chart. See: Testing and Inspection/Symptom Related Diagnostic Procedures

Special Tool(s)

ST2941-A	Activation Tool, Tire Pressure Monitor 204-363
ST2634-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Tire Pressure Sensor: Testing and Inspection Tire Pressure Monitoring System (TPMS) Sensor Training

Tire Pressure Monitoring System (TPMS) Sensor Training

NOTE: If the vehicle has been stationary for more than 30 minutes, the sensors will go into a "sleep mode" to conserve battery power. It will be necessary to wake them up so they will transmit the latest tire pressure information to the smart junction box (SJB). For additional information, refer to Tire Pressure Monitoring System (TPMS) Sensor Activation.

NOTE: The tire pressure sensor training procedure must be done on a single vehicle, in an area without radio frequency noise and at least 1 m (3 ft) away from other vehicles equipped with tire pressure monitoring system (TPMS). Radio frequency noise is generated by electrical motors and appliance operation, cellular telephones, remote transmitters, power inverters and portable entertainment equipment.

NOTE: If a sensor does not respond to the activation tool, attempt to activate the same sensor with the activation tool. If the sensor still does not respond, move the vehicle to rotate the wheels at least 1/4 of a turn and attempt to activate the same sensor again.

NOTE: The SJB has a 2-minute time limit between sensor responses. If the SJB does not recognize any 1 of the 4 tire pressure sensors during this time limit, the horn will sound twice and the message center (if equipped) will display TIRE NOT TRAINED REPEAT and the entire procedure must be repeated.

1. NOTE: For vehicles with different front and rear tire pressures (such as the E-Series and certain F-Series), the tire pressure sensors must be

trained following a tire rotation. Failure to train the sensors will cause the TPMS indicator to illuminate. For vehicles with the same tire pressure for front and rear tires, tire rotation will not affect the system.

Turn the ignition switch to the OFF position, then press and release the brake pedal.

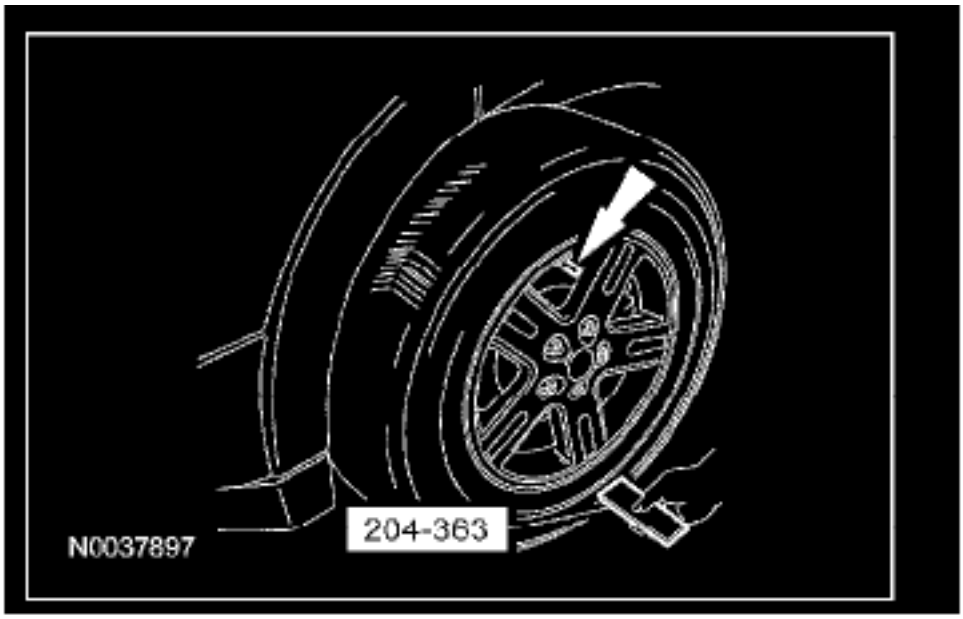
2. Cycle the ignition switch from the OFF position to the RUN position 3 times, ending in the RUN position. 3. Press and release the brake pedal. 4. Turn the ignition switch to the OFF position. 5. Turn the ignition switch from the OFF position to the RUN position 3 times, ending in the RUN position.

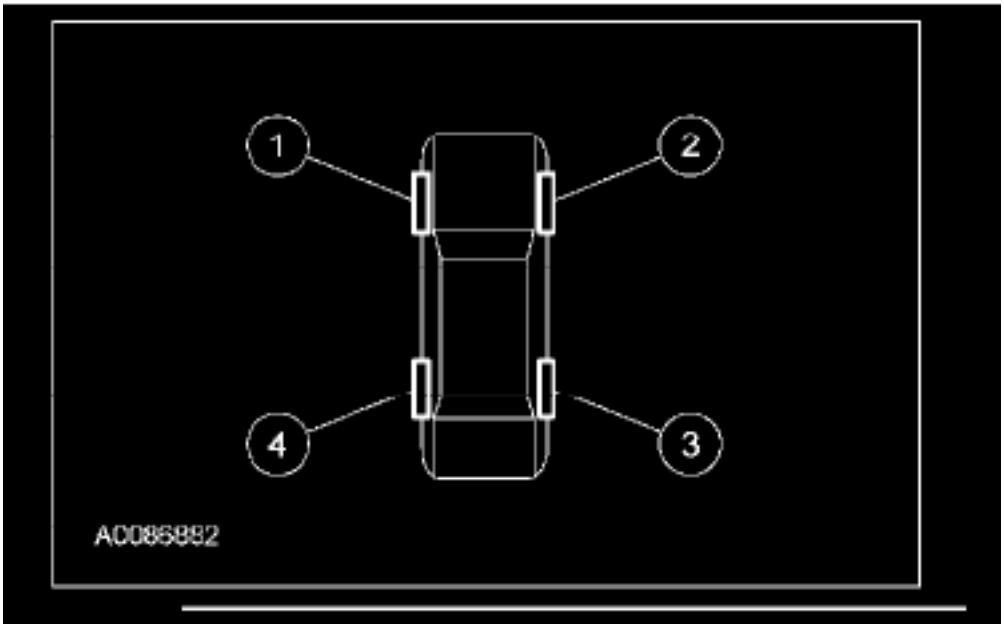
^ The horn will sound once and the TPMS indicator will flash if the training mode has been entered successfully. If equipped, the message center will display TRAIN LF TIRE.

6. NOTE: It may take up to 6 seconds to activate a tire pressure sensor. During this time, the activation tool must remain in place 180 degrees from

the valve stem.

Place the activation tool on the LF tire sidewall opposite (180 degrees) from the valve stem. Press and release the test button on the special tool. The horn will sound briefly to indicate that the tire pressure sensor has been recognized by the SJB.





7. Within 2 minutes of the horn sounding, place the activation tool on the RF tire sidewall opposite (180 degrees) from the valve stem and press and

release the test button to train the RF tire pressure sensor.

8. NOTE: Do not wait more than 2 minutes between training each sensor or the SJB will time out and the entire procedure must be repeated.

Repeat Step 7 for the RR and LR tires. ^

The procedure is completed after the last tire has been trained. When the training procedure is complete, the message center (if equipped) will display TIRE TRAINING COMPLETE.

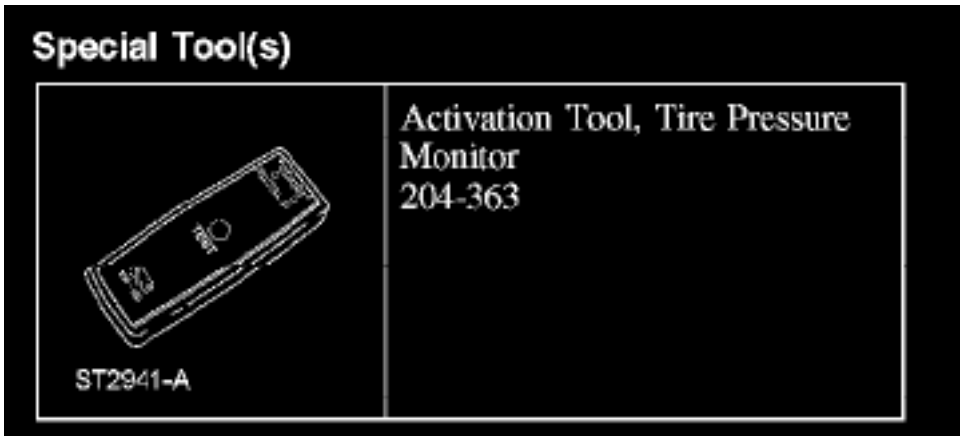
^ For vehicles not equipped with a message center, successful completion of the training procedure will be verified by turning the ignition switch to the OFF position without the horn sounding. If the horn sounds twice when the switch is turned to the OFF position, the training procedure was not successful.

9. Using the scan tool, locate the updated TPMS sensor IDs trained to the SJB and document them on the applicable warranty claim.

10. NOTE: This step is required to clear DTC C2780, cause the SJB to exit the manufacturing mode and to make sure there are no other concerns

with a newly programmed SJB.

If the sensors are being trained due to the installation of a new SJB, clear any DTCs and perform the SJB on-demand self test.



Tire Pressure Sensor: Testing and Inspection Tire Pressure Monitoring System (TPMS) Sensor Activation

Tire Pressure Monitoring System (TPMS) Sensor Activation

NOTE: The tire pressure sensors will go into a 14 sleep mode" after 30 minutes of inactivity to conserve battery power. The sensors do not transmit information while in sleep mode, it will be necessary to wake them up so they will transmit the latest tire pressure information.

1. Turn the ignition switch to the ON position. 2. Position the tire pressure monitor activation tool against the LF tire sidewall 180 degrees from the tire valve stem.

3. NOTE: The activation tool will provide feedback in the form of a flashing green light and a beep sound for each successful response from a tire

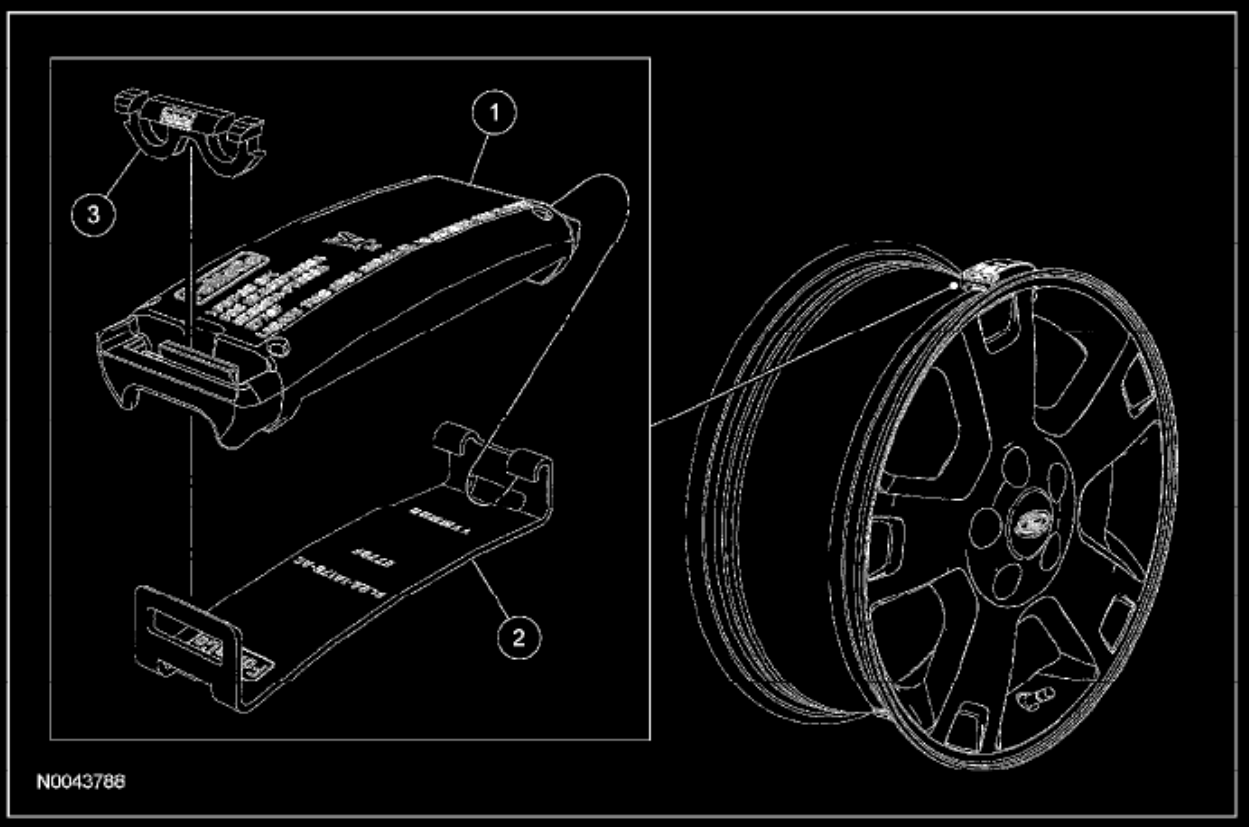
pressure sensor.

Press the test button on the activation tool to activate the sensor, activate the sensor at least 2 times.

4. Repeat Steps 2 and 3 for the remaining tires. 5. If the tire pressure monitoring system (TPMS) indicator remains illuminated after adjusting and activating each sensor, refer to the Symptom Chart

in Diagnosis and Testing.

Tire Pressure Monitoring System (TPMS) Sensor



Item	Part Number	Description
1	1A150/1A189	Tire pressure sensor/sensor kit
2	1A175	Sensor cradle

(Continued)

Item	Part Number	Description
3	14C202	Locking clip (also part of 1A189)

Tire Pressure Sensor: Service and Repair Tire Pressure Monitoring System (TPMS) Sensor

Tire Pressure Monitoring System (TPMS) Sensor

Tire Pressure Monitoring System (TPMS) Sensor

Disassembly

WARNING: The tire pressure monitoring system (TPMS) sensor battery may release hazardous chemicals if exposed to extreme mechanical damage. If these chemicals contact the skin or eyes, flush immediately with water for a minimum of 15 minutes and get prompt medical attention. If any part of the battery is swallowed, contact a physician immediately. When disposing of TPMS sensors, follow the correct procedures for hazardous material disposal. Failure to follow these instructions may result in serious personal injury.

NOTE: Tire pressure sensors are equipped with Lithium-ion batteries and must be disposed of accordingly.

NOTE: Tire pressure sensors are manufactured in multiple colors based on their application. When installing a new sensor, make sure the color of the sensor being installed matches the color of the sensor that was removed. The different colored sensors are not interchangeable.

NOTE: The sensor can be removed and installed without removing the strap or the cradle.

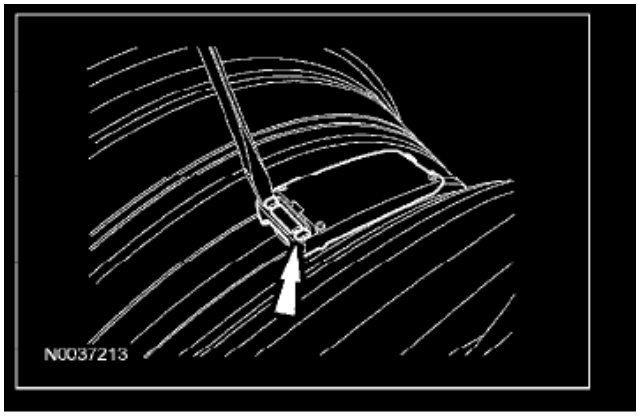
1. CAUTION: The sensor, cradle and strap may be damaged by incorrect tire mounting or dismounting. Dismount the tire only as

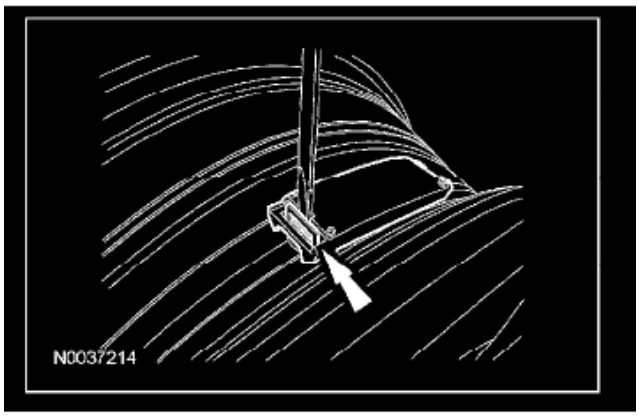
instructed.

Remove the tire from the wheel.

2. CAUTION: Do not use a large screwdriver. Apply minimum force during removal or damage to the sensor locking clip may occur.

Using a pocket screwdriver or similar tool, remove the sensor locking clip.


N0037213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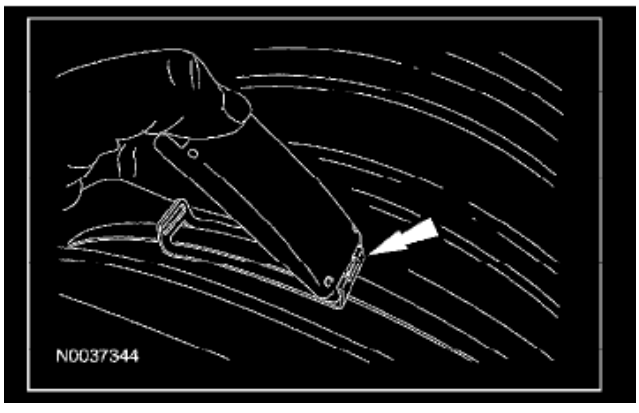

N0037344

3. CAUTION: Do not use a large screwdriver. Apply minimum force during removal or damage to the sensor may occur.

Using a pocket screwdriver or similar tool, detach the sensor from the cradle.

4. Remove the sensor.

Assembly

1. CAUTION: Damage to the sensor may occur if excessive force is applied during sensor installation.

NOTE: Make sure the sensor is fully seated into the cradle. The sensor will make a "click" noise when correctly seated.

Position the sensor into the cradle by inserting the hinge end of the sensor into the hook end of the cradle and pushing the opposite end of the sensor down onto the cradle.

2. NOTE: The locking clip can only be fully seated when installed in the correct orientation. If the sensor locking clip cannot be fully inserted, then

the sensor may not be fully seated on the cradle or the locking clip may be inserted backward.

Insert a new locking clip into the sensor.

3. CAUTION: The sensor, cradle and strap may be damaged by incorrect tire mounting or dismounting. Mount the tire only as instructed.

Install the tire onto the wheel.

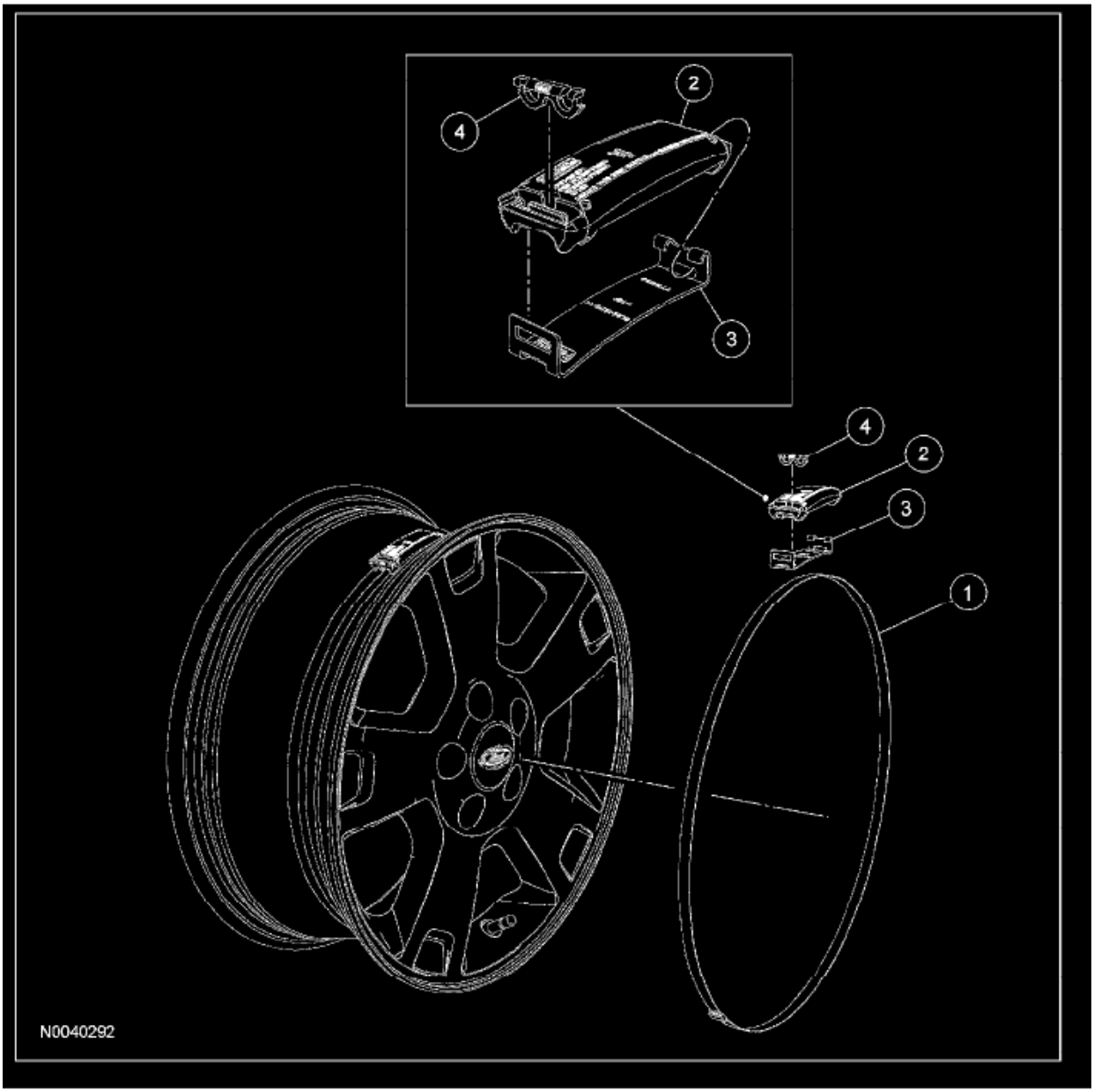
4. NOTE: A new tire pressure sensor is shipped in an off mode (or battery saver mode) and must be turned on before it can be trained. To turn the

sensor on, install it on a wheel, mount the tire and inflate the tire to the recommended inflation pressure. Wait at least 2 minutes, then continue with the sensor training procedure.

Train the tire pressure sensor(s).

Material

Item	Specification
Wheel and Tire Cleaner ZC-27-A or B	—

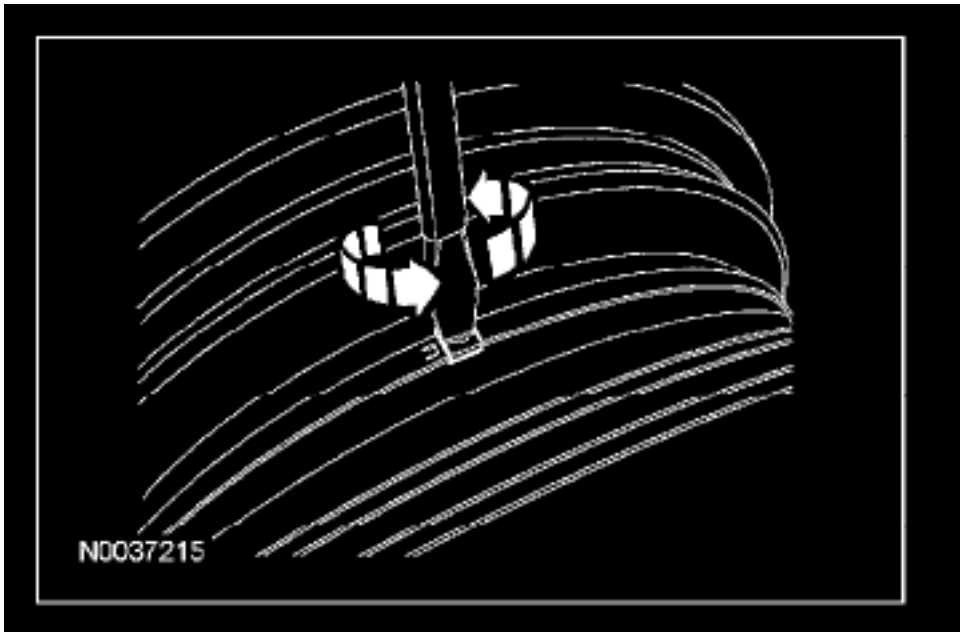


Item	Part Number	Description
1	1A177/1A193	Strap/strap kit
2	1A150/1A189	Tire pressure sensor/sensor kit
3	1A175	Sensor cradle (also part of 1A193)
4	14C202	Locking clip (also part of 1A189)

Tire Pressure Sensor: Service and Repair Tire Pressure Monitoring System (TPMS) Strap and Cradle

Tire Pressure Monitoring System (TPMS) Strap and Cradle

Disassembly



WARNING: The tire pressure monitoring system (TPMS) sensor battery may release hazardous chemicals if exposed to extreme mechanical damage. If these chemicals contact the skin or eyes, flush immediately with water for a minimum of 15 minutes and get prompt medical attention. If any part of the battery is swallowed, contact a physician immediately. When disposing of TPMS sensors, follow the correct procedures for hazardous material disposal. Failure to follow these instructions may result in serious personal injury.

NOTE: Tire pressure sensors are equipped with Lithium-ion batteries and must be disposed of accordingly.

NOTE: Tire pressure sensors are manufactured in multiple colors based on their application. When installing a new sensor, make sure the color of the sensor being installed matches the color of the sensor that was removed. The different colored sensors are not interchangeable.

NOTE: The sensor is available separately, the cradle and strap are available as a strap kit. There are several different strap kits available based on wheel diameter but all strap kits share the same base part number.

1. Remove the tire pressure monitoring system (TPMS) sensor.

2. WARNING: Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.

WARNING: Wear protective gloves when handling components or parts that have pointed or sharp edges. Failure to follow this instruction may result in serious personal injury.

Remove a factory installed strap in the following sequence: 1

Locate the strap buckle and secure the strap to the wheel using duct tape or a similar item, on both sides of the buckle approximately 25 mm (0.98 inch) from the buckle.

2 Using a large screwdriver and a twisting motion, unbuckle the strap.

3 Discard the strap.

3. To remove a dealer installed strap, turn the worm gear screw until the strap is fully released from the worm gear.

^ Discard the strap.

4. NOTE: To aid assembly, mark the location of the cradle prior to disassembly.

Using a screwdriver, or similar tool, remove the cradle by inserting the screwdriver under the cradle and prying up.

Assembly

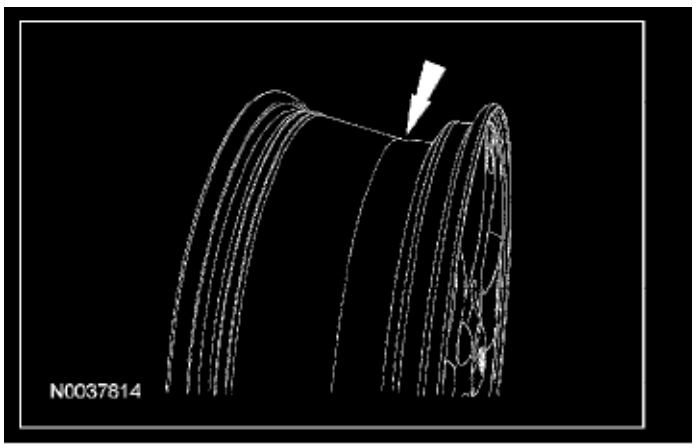
1. NOTE: Make sure the sensor is fully seated into the new cradle. The sensor will make a "click" noise when fully seated.

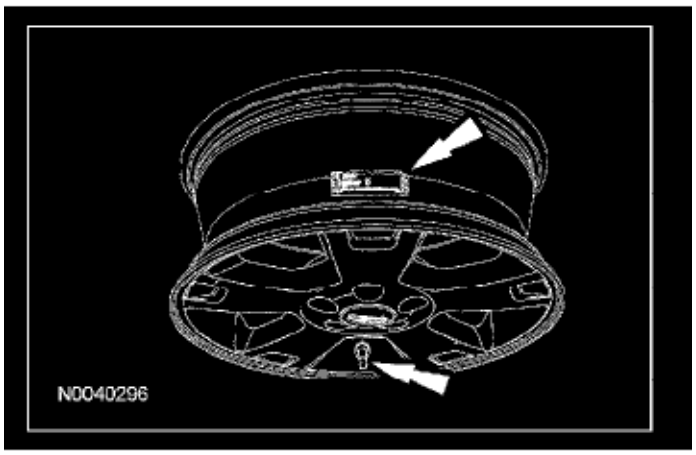
Position the sensor into the new cradle by inserting the hinge end of the sensor into the hook end of the cradle and pushing the opposite end of the sensor down onto the cradle.

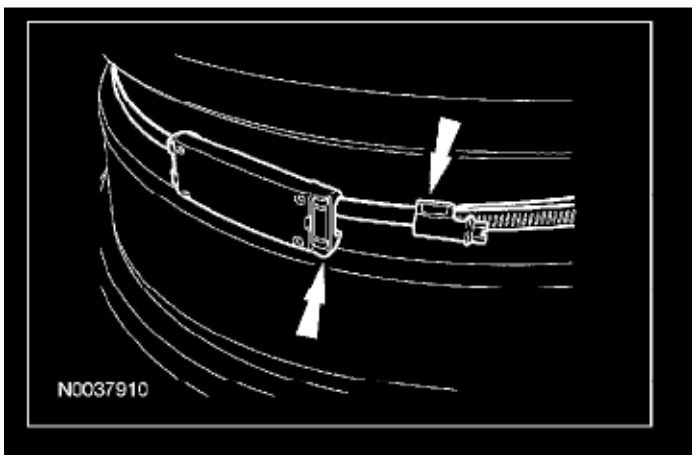
2. CAUTION: Metal scrapers may damage the wheel. Use only plastic or non-metallic scrapers to remove the cradle adhesive strip residue.

NOTE: The sensor and cradle must be installed in the drop well of the wheel, 180 degrees from the valve stem.

Clean the area where the sensor and cradle are to be installed.


N0037814


N0040296


N0037910

3. NOTE: The sensor and cradle must be positioned with the hinge side of the sensor on the RH side when viewed from the curb side (beauty side)

of the wheel.

NOTE: The sensor has raised markings indicating how to position the sensor.

Remove the adhesive tape liner from the cradle and position the sensor and cradle into the wheel drop well 180 degrees from the valve stem.

4. Install the tapered end of the strap through the opening of the cradle on the hinge side of the sensor. This will position the worm gear on the

locking clip side of the sensor.

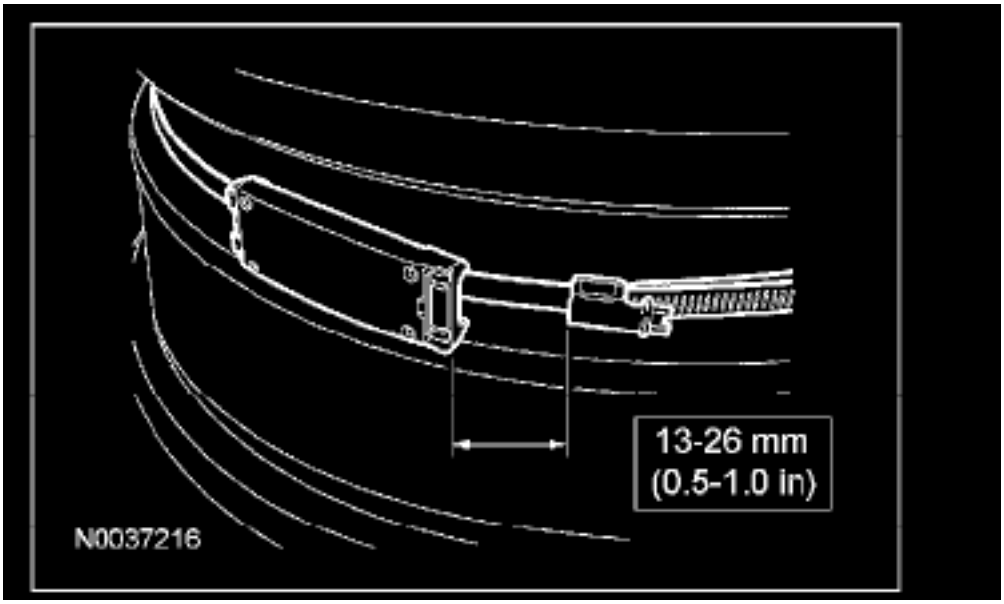
5. CAUTION: Steel wheels have a "high spot" along their circumference. Make sure the strap and sensor are mounted at the lowest spot

possible to avoid damaging the sensor during wheel and tire disassembly and assembly.

NOTE: Keep the strap parallel with the wheel flange while tightening the worm gear.

Position the worm gear 13-26 mm (0.5-1.0 inch) away from the sensor and tighten the worm gear.
^

Tighten to 3 Nm (27 lb-inch).



6. CAUTION: The sensor, cradle and strap may be damaged by incorrect tire mounting or dismounting. Mount the tire only as instructed.

Install the tire onto the wheel.

7. NOTE: A new tire pressure sensor is shipped in an off mode (or battery saver mode) and must be turned on before it can be trained. To turn the

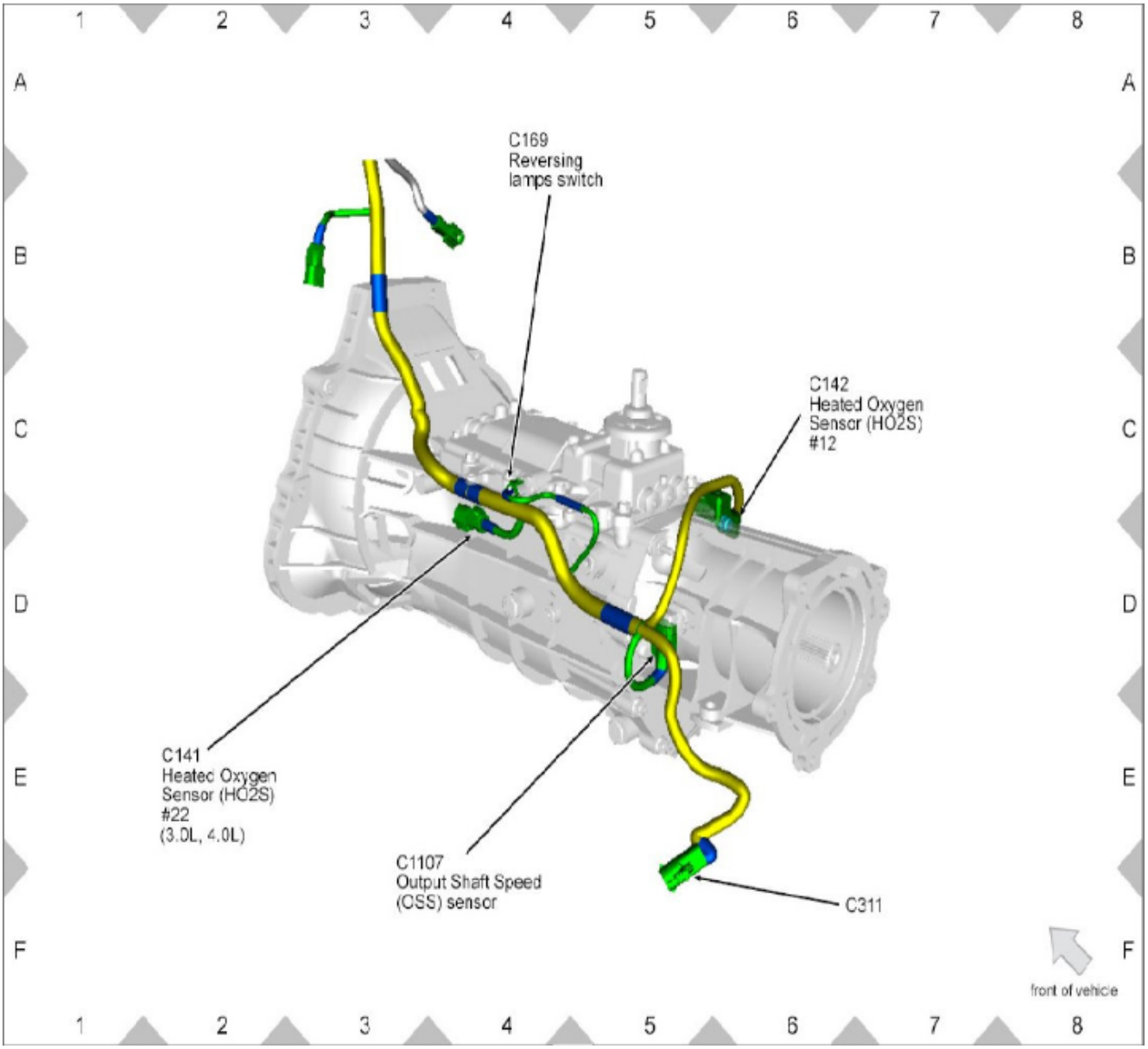
sensor on, install it on a wheel, mount the tire and inflate the tire to the recommended inflation pressure. Wait at least 2 minutes, then continue with the sensor training procedure.

Train the tire pressure sensor(s).

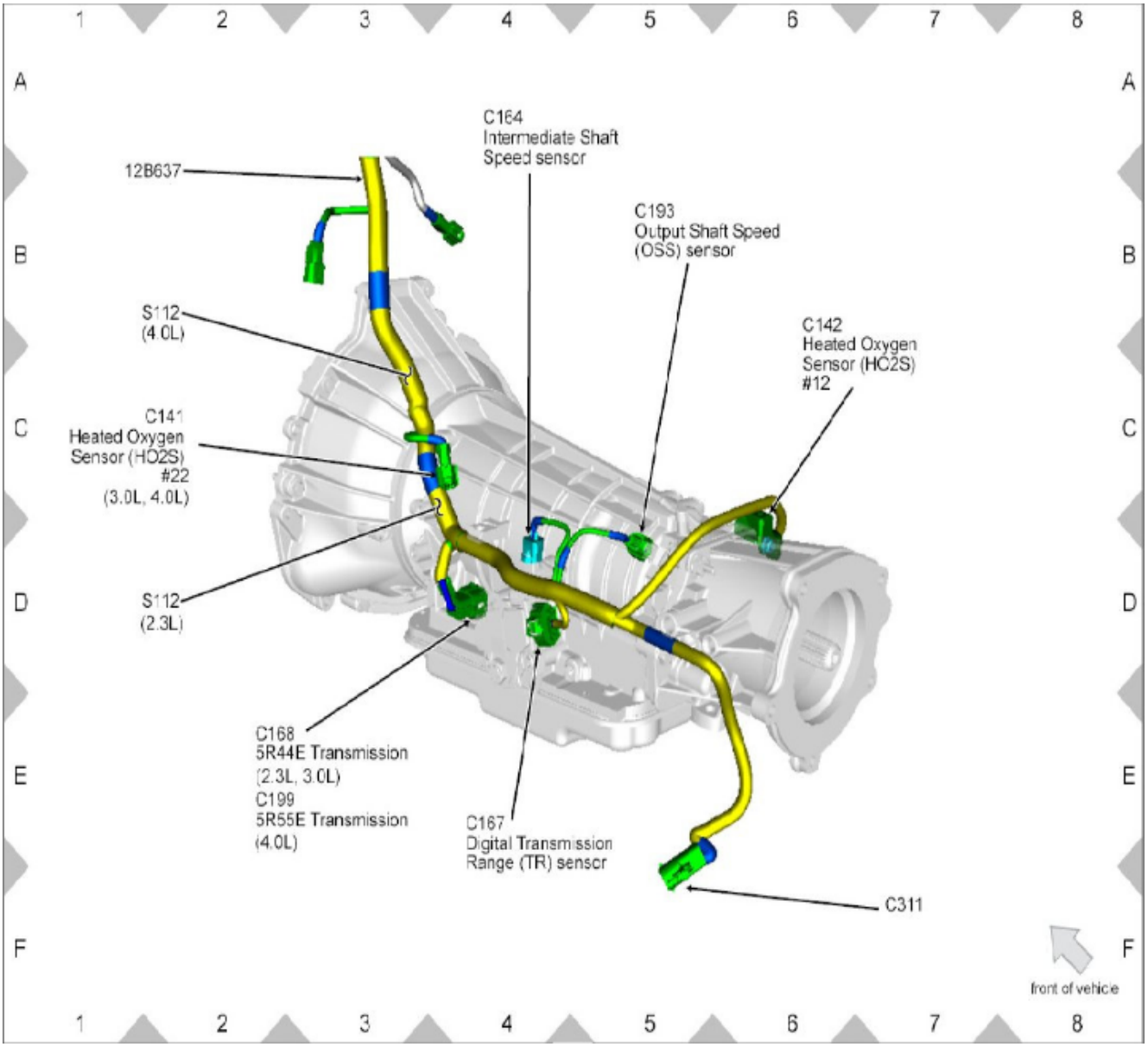
Transmission Mode Indicator - A/T: Description and Operation

TRANSMISSION CONTROL INDICATOR LAMP (TCIL)

The TCIL is an output signal from the PCM that controls the lamp on/off function depending on the engagement or disengagement of overdrive.


C169
Reversing lamps switch
C142
Heated Oxygen Sensor (HO2S) #12
C141
Heatec Oxygen Sensor (HO2S) #22
(3.0L, 4.0L)
C1107
Output Shaft Speed (OSS) sensor
C311
front of vehicle

View 151-9


C164
Intermediate Shaft
Speed sensor
12B637
C193
Output Shaft Speed
(OSS) sensor
S112
(4.0L)
C142
Heated Oxygen
Sensor (HO2S)
#12
C141
Heated Oxygen
Sensor (HO2S)
#22
(3.0L, 4.0L)
S112
(2.3L)
C168
5R44E Transmission
(2.3L, 3.0L)
C199
5R55E Transmission
(4.0L)
C167
Digital Transmission
Range (TR) sensor
C311
front of vehicle

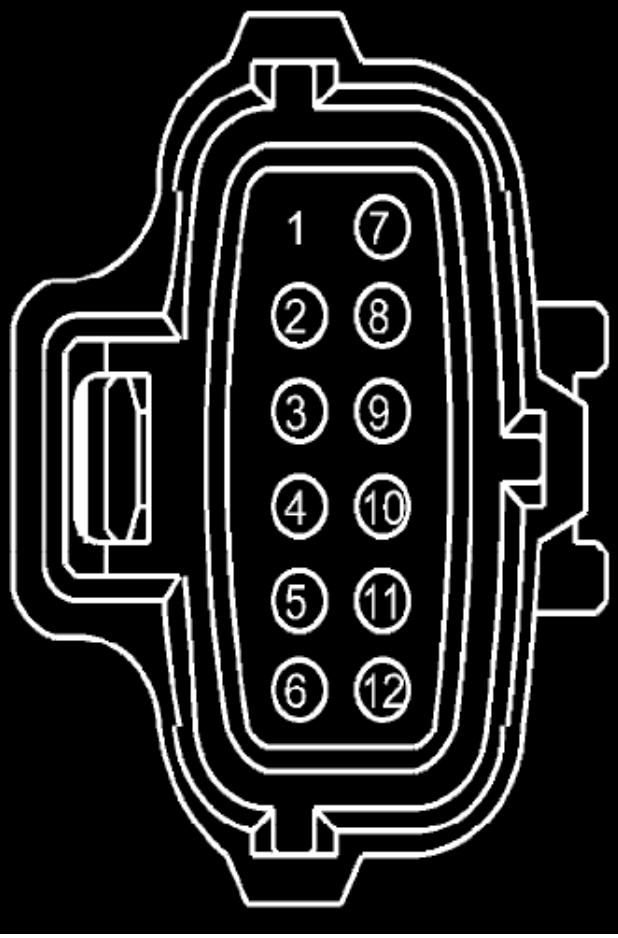
View 151-10

Connector: C167

Description: DIGITAL TRANSMISSION RANGE (TR) SENSOR

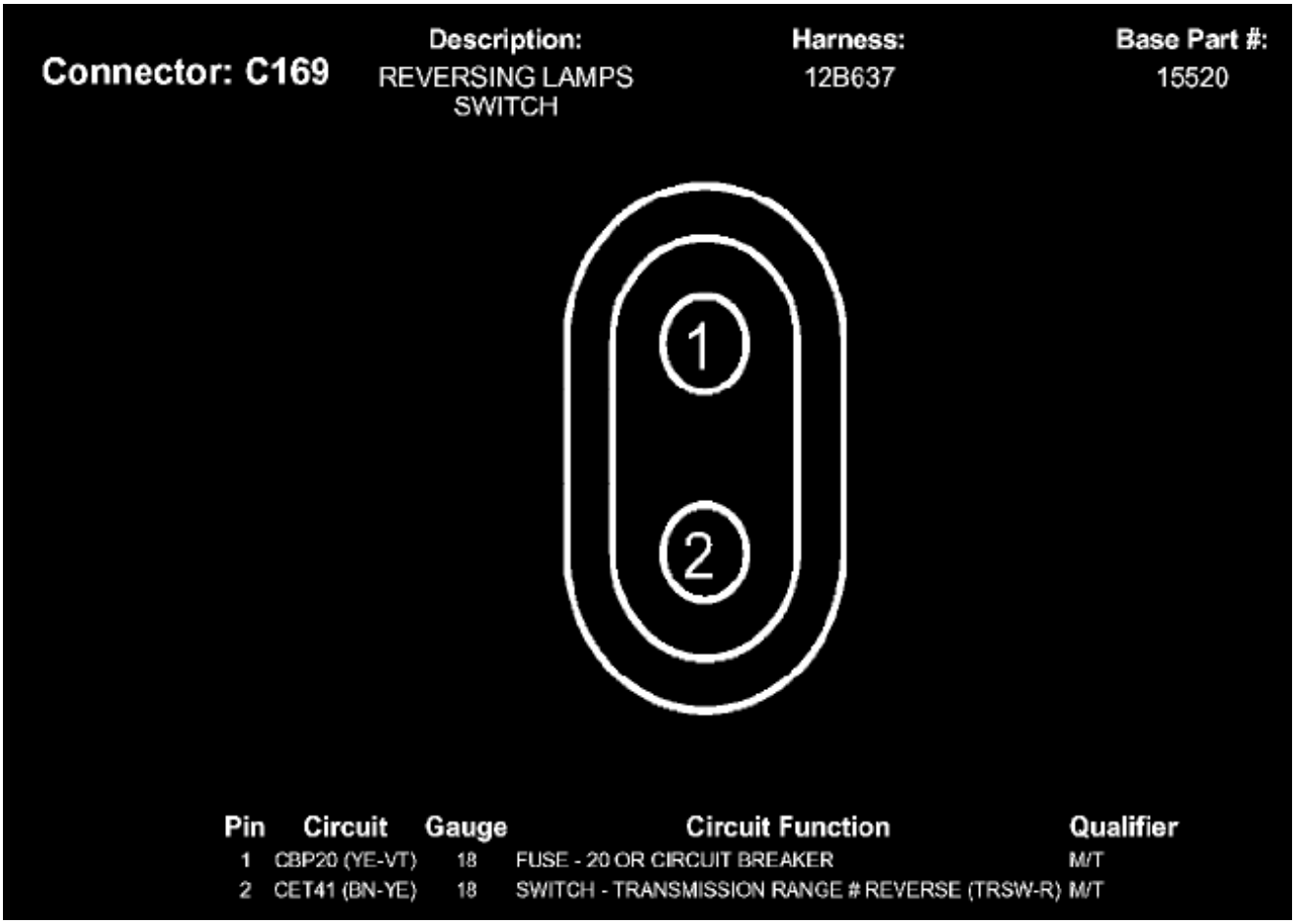
Harness: 12B637

Base Part #: 7F293



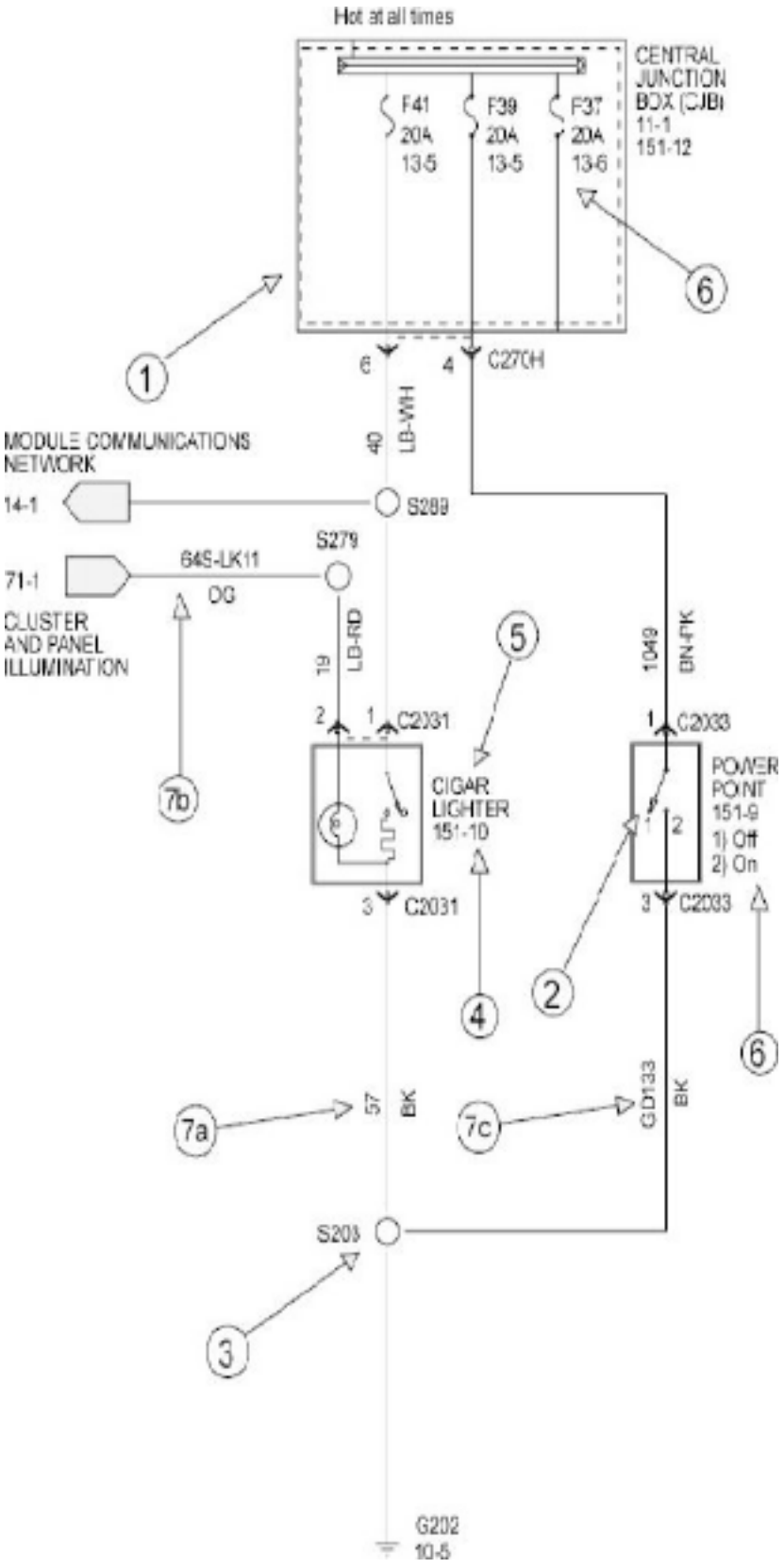
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	RE406 (GY-VT)	18	SIGNAL RETURN	
3	VET28 (GY-VT)	20	TR3A	
4	VET29 (VT-WH)	20	TR1	
5	VET30 (YE)	20	TR2	
6	VET31 (BU-OG)	20	TR4	
7	GD108 (BK-VT)	18	GROUND	4x4
8	CCF20 (GY-VT)	20	NETURAL SENSE	4x4
9	CBP20 (YE-VT)	18	FUSED POWER FEED	
10	CET40 (GN-OG)	20	STARTER CONTROL	
11	CET41 (BN-YE)	18	BACK UP	
12	CBP21 (BU-GY)	20	STARTER TO STARTER INTERRUPT RELAY	

C167



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBP20 (YE-VT)	18	FUSE - 20 OR CIRCUIT BREAKER	M/T
2	CET41 (BN-YE)	18	SWITCH - TRANSMISSION RANGE # REVERSE (TRSW-R)	M/T

C169


Hot at all times
CENTRAL JUNCTION BOX (CJB)
11-1
151-12
F41
20A
13-5
F39
20A
13-5
F37
20A
13-6
C270H
40
LB-WH
MODULE COMMUNICATIONS NETWORK
14-1
S289
S279
64S-LK11
71-1
DG
CLUSTER AND PANEL ILLUMINATION
19
LB-RD
C2031
CIGAR LIGHTER
151-10
C2031
1049
BN-PK
C2033
POWER POINT
151-9
1) Off
2) On
C2033
57
BK
GD133
BK
S203
G202
10-5

Brake Lamp: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

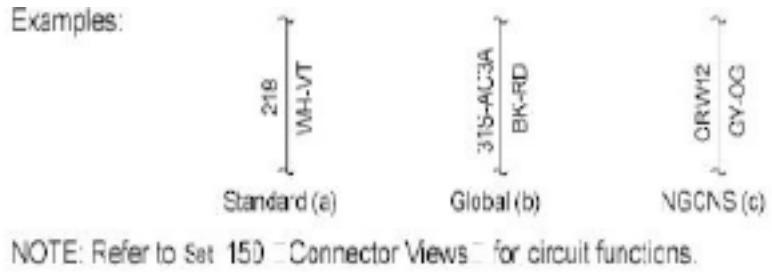
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

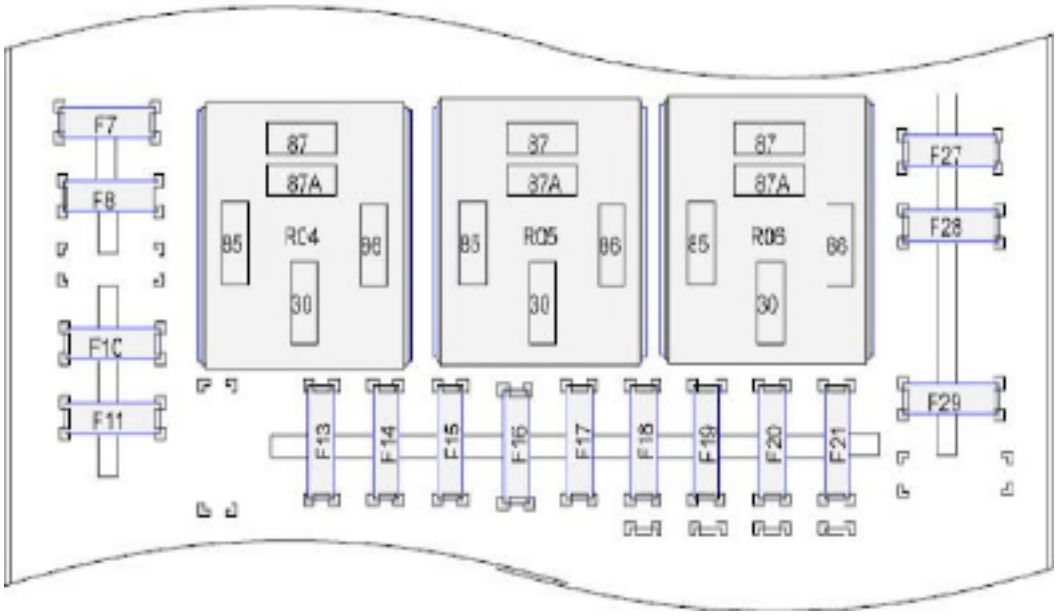
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

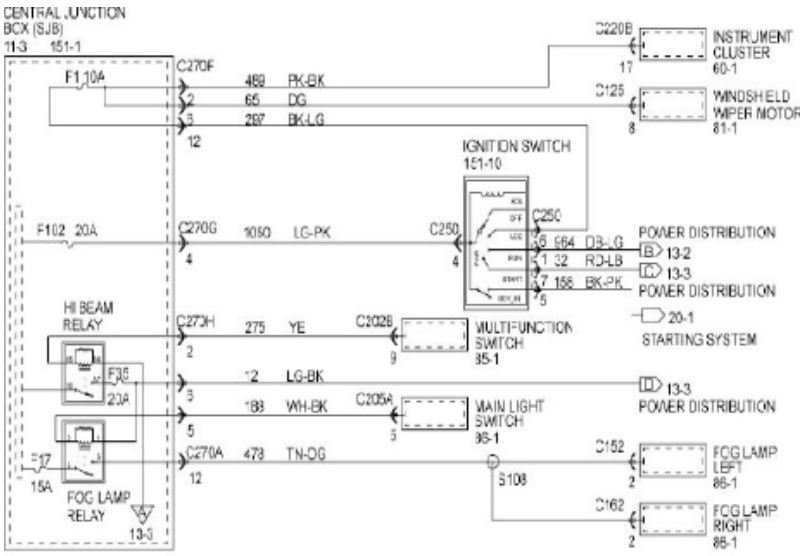
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

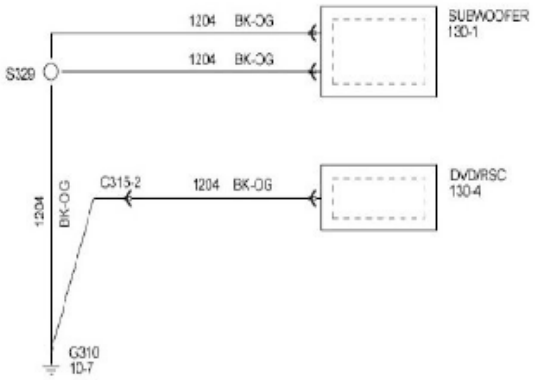
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

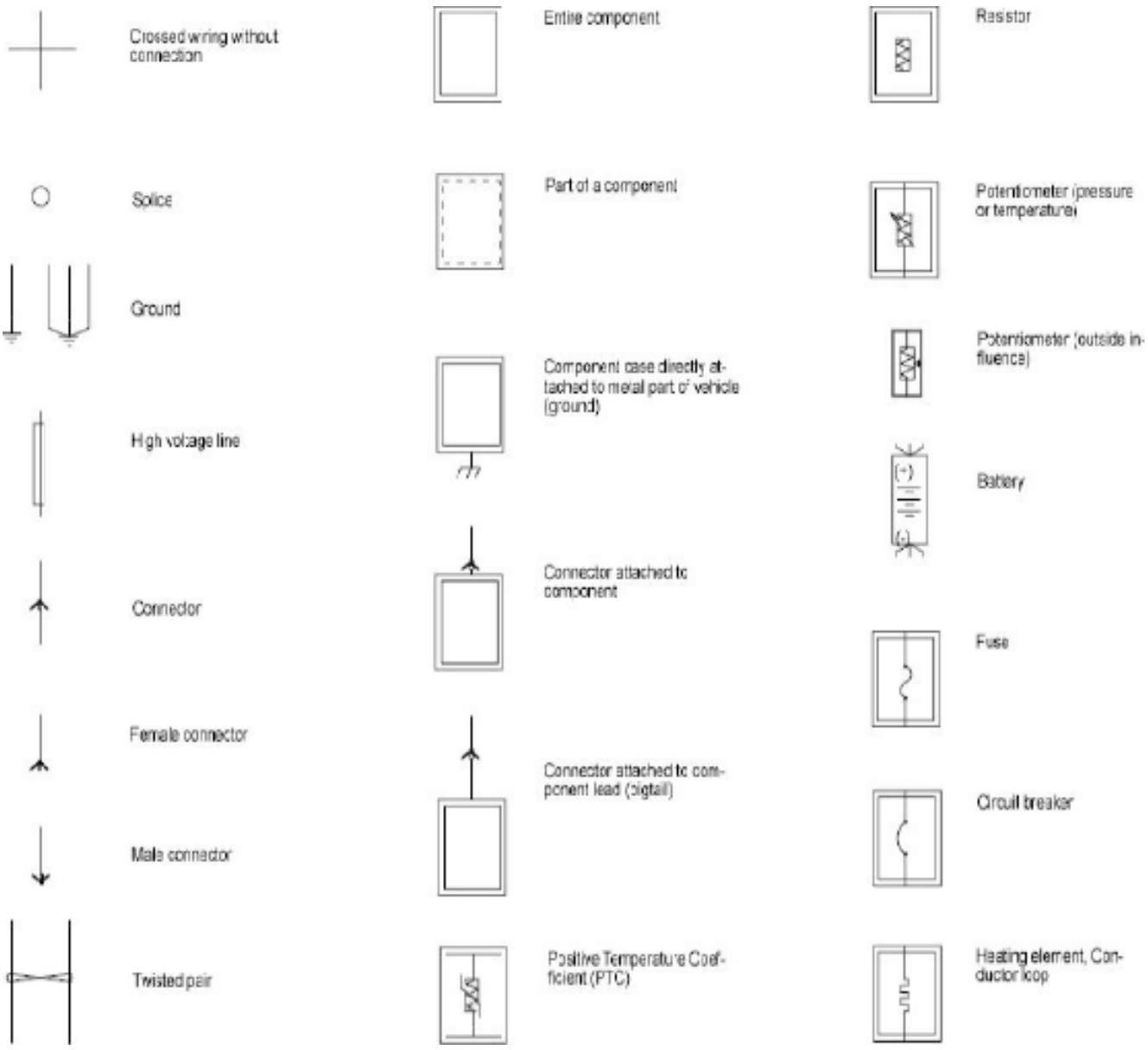
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

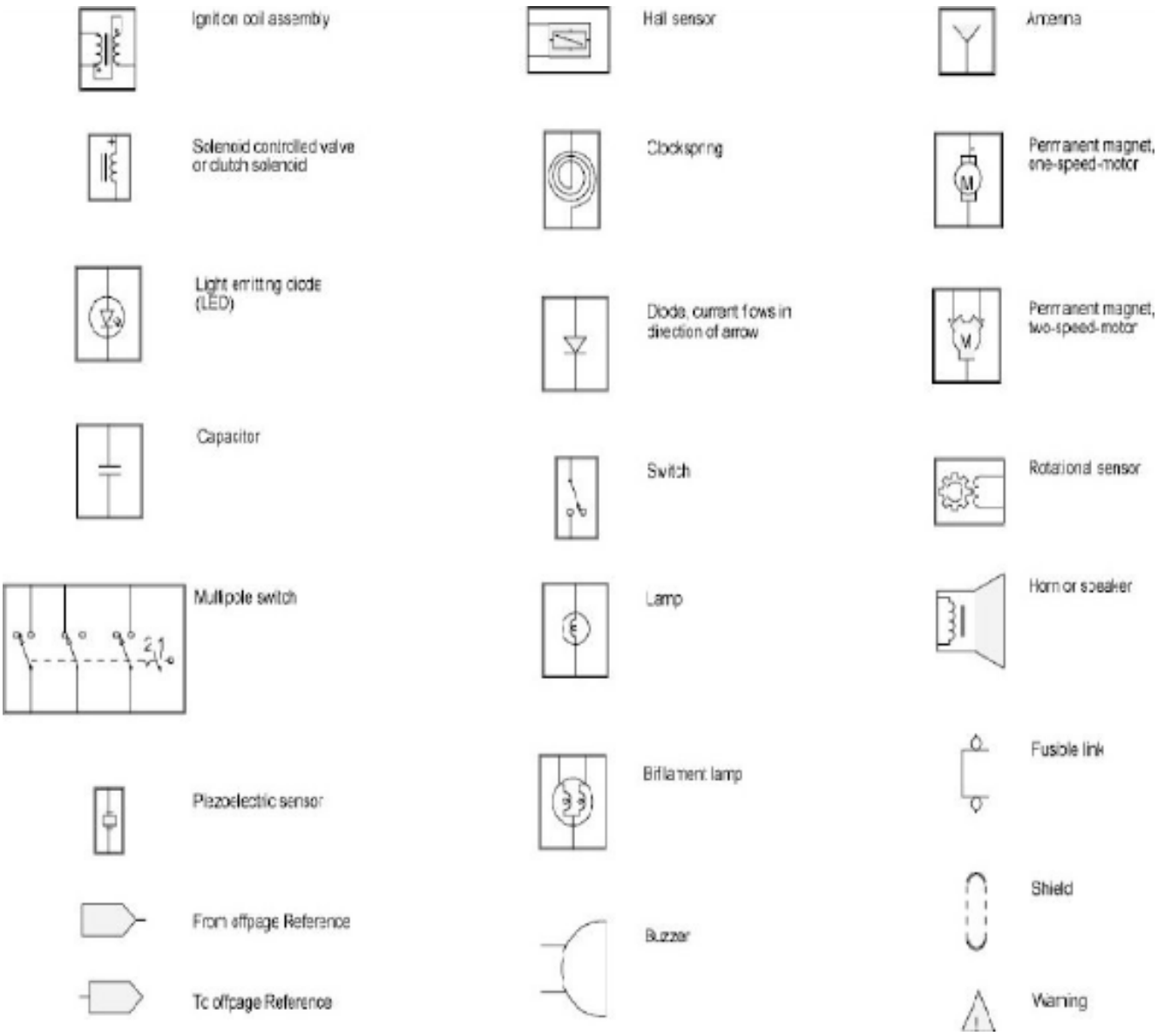
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

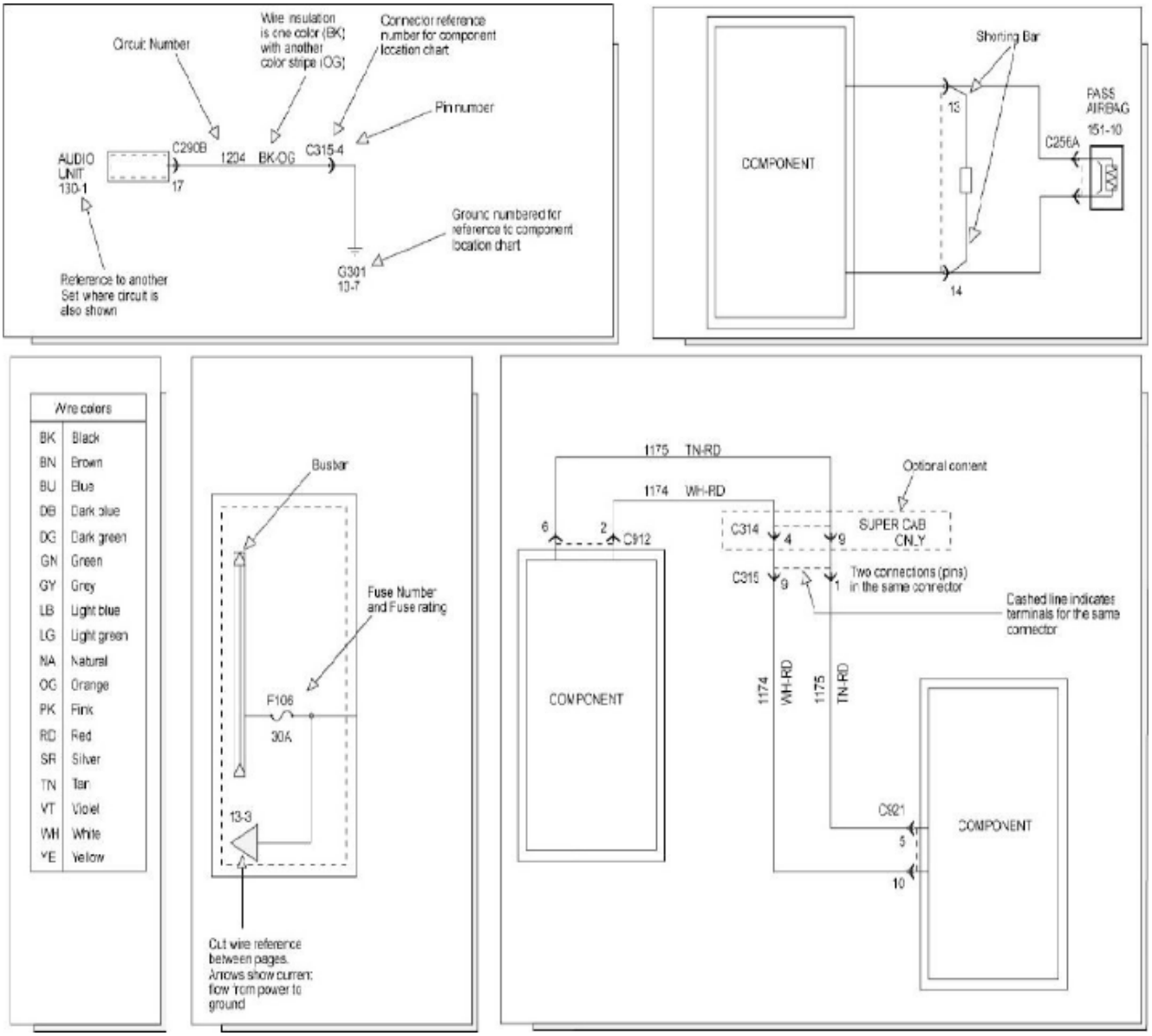
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

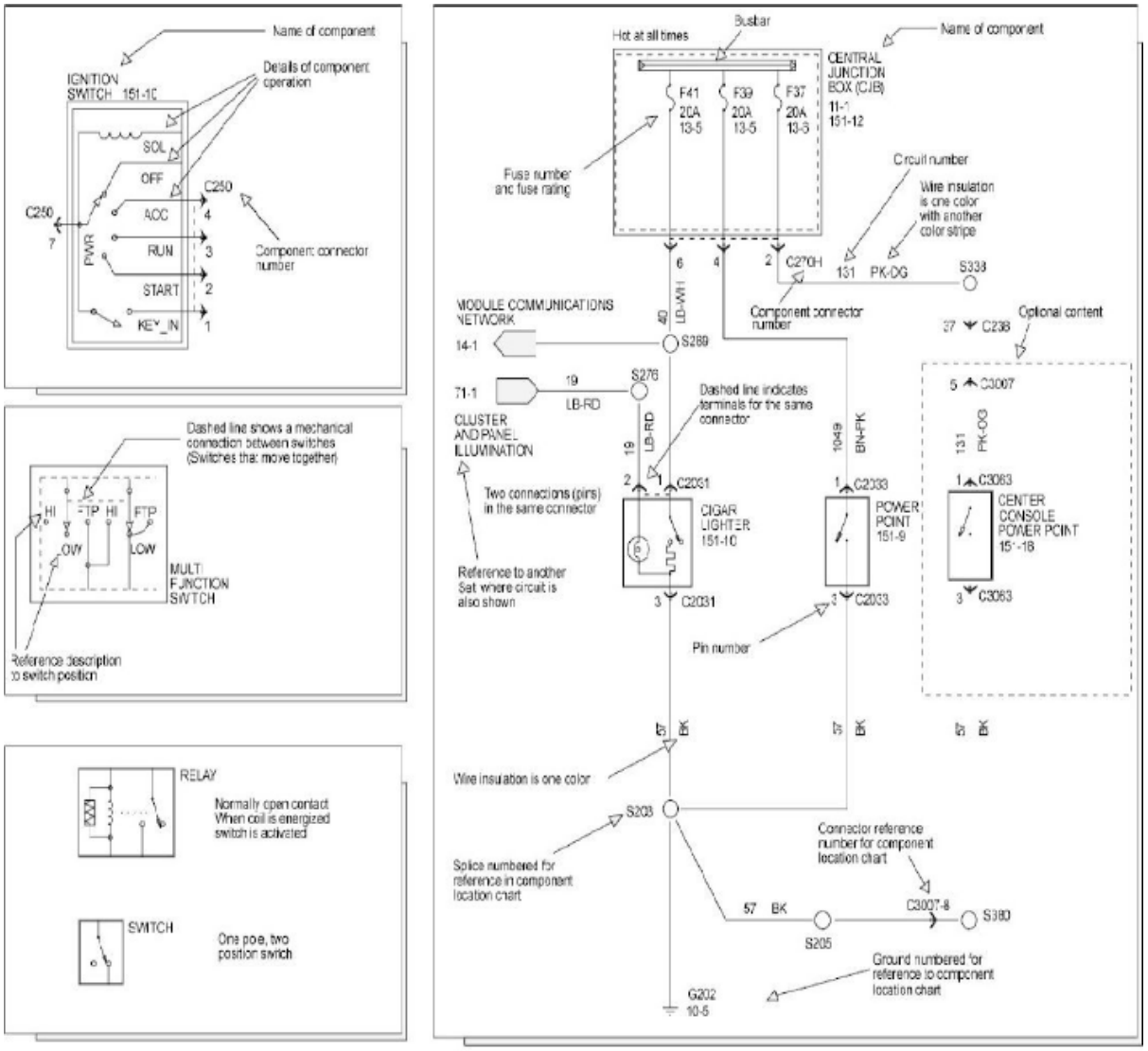
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

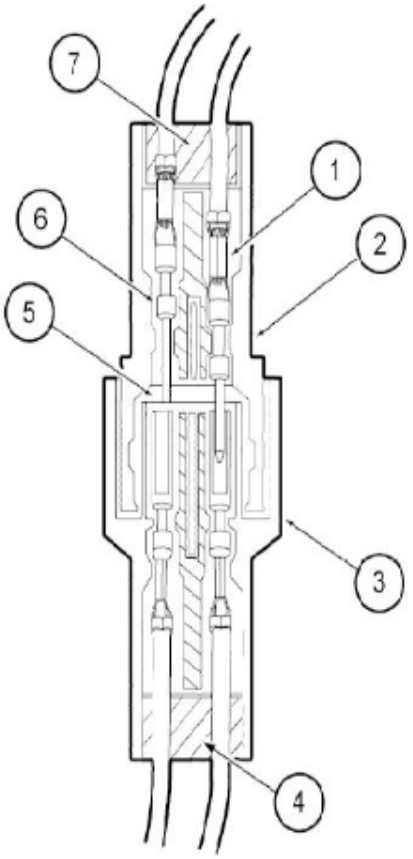


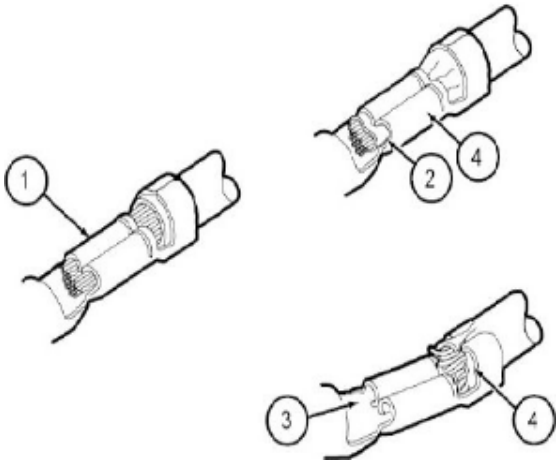
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Brake Lamp: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

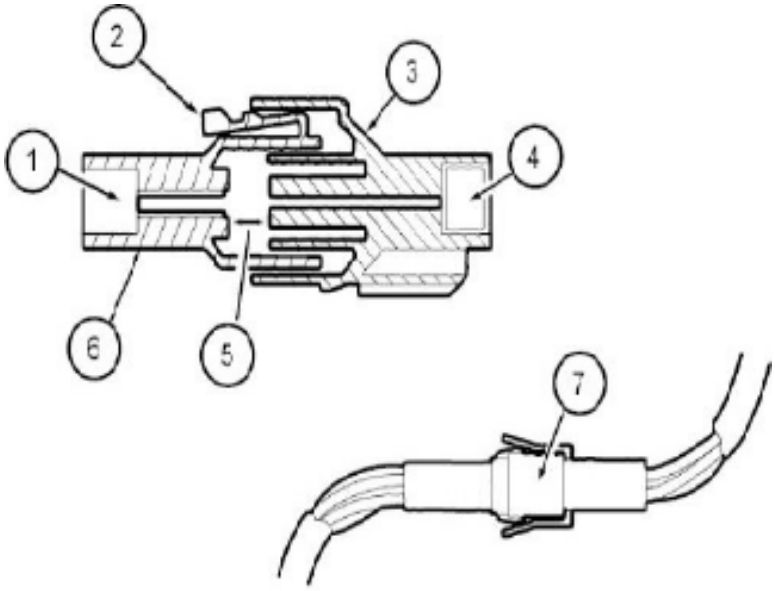
5 = Intermittent contact

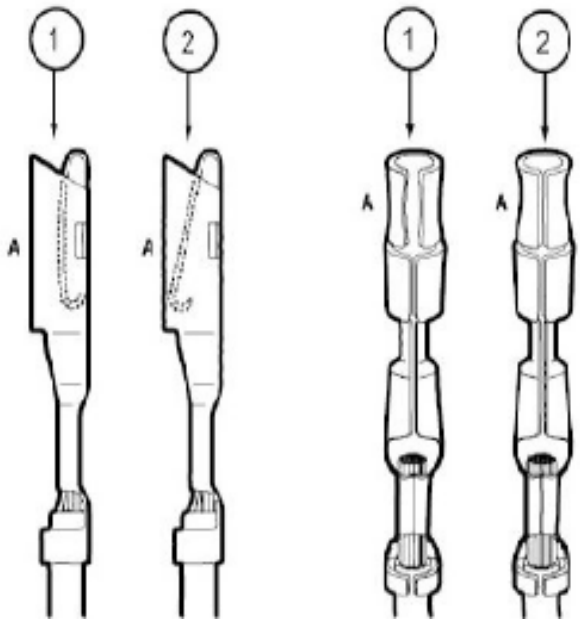
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

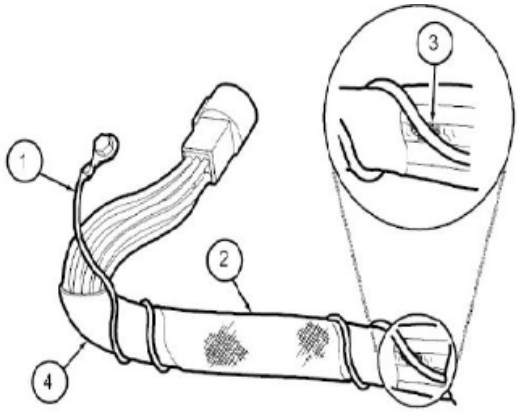
Deformed (enlarged) female terminals

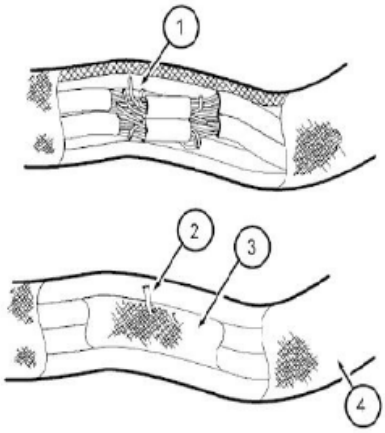
1 = Enlarged

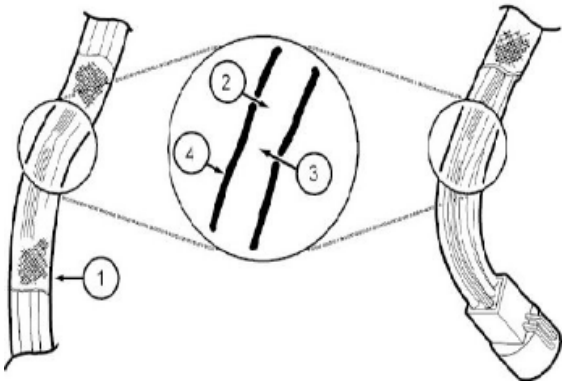
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

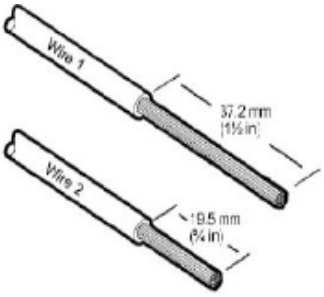
Splice covered 2

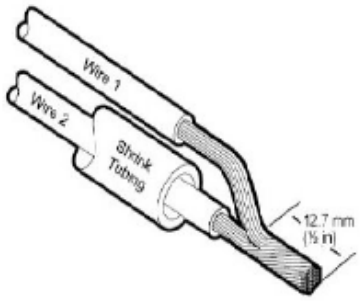
= Wire strand

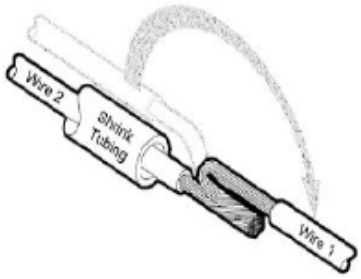
3 = Splice tape

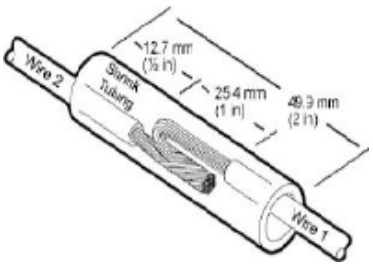
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

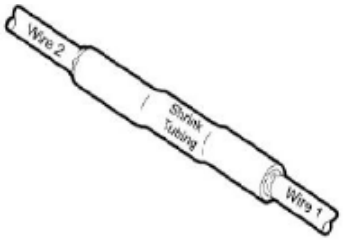
NOTE: -

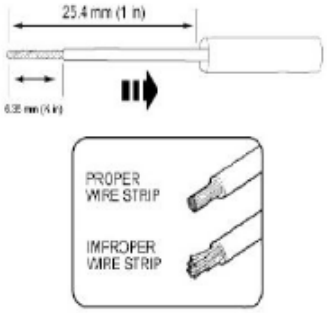
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

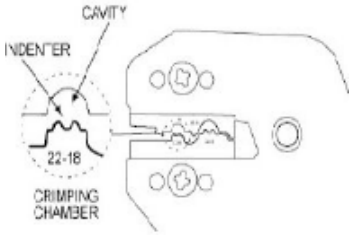
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

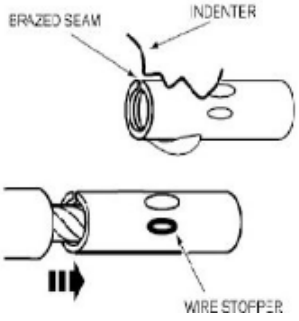
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
6.35 mm (¼ in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

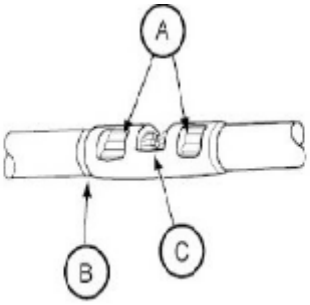
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

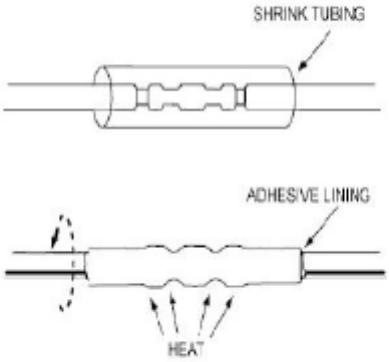
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4 strip, cut 9 strands	* 1/4 strip, cut 2 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip, fold 3x dia.
	16-14	* 1/4 strip, cut 7 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip fold 2x dia	1 strip, fold 3x dia.	1 1/4 strip, fold 4x dia.	Not Recommended
	12-10	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip fold 3x cia.	1 1/4 strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Figtail only

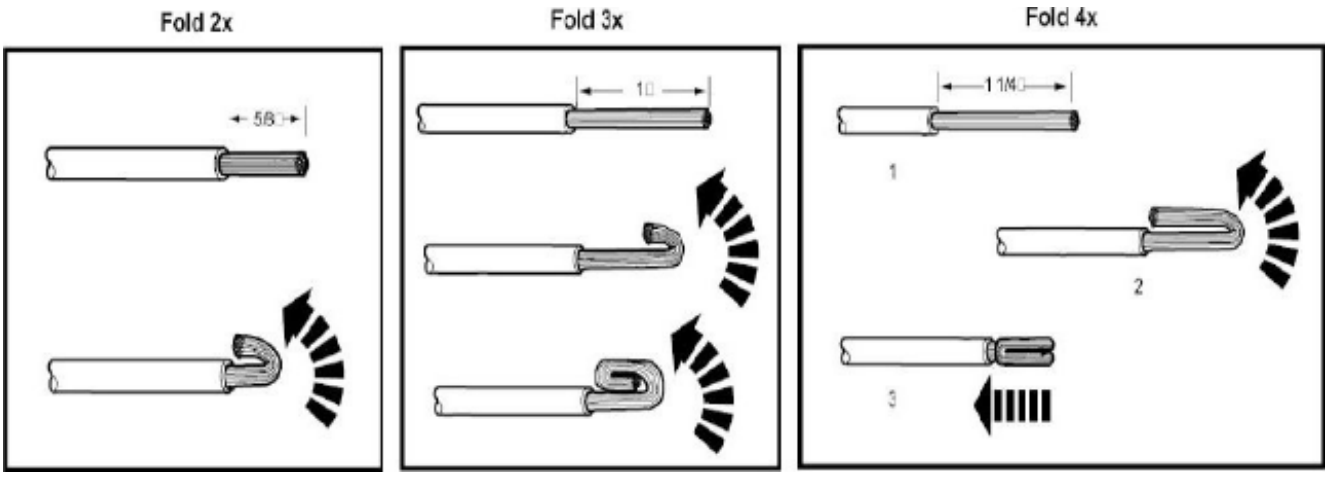
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

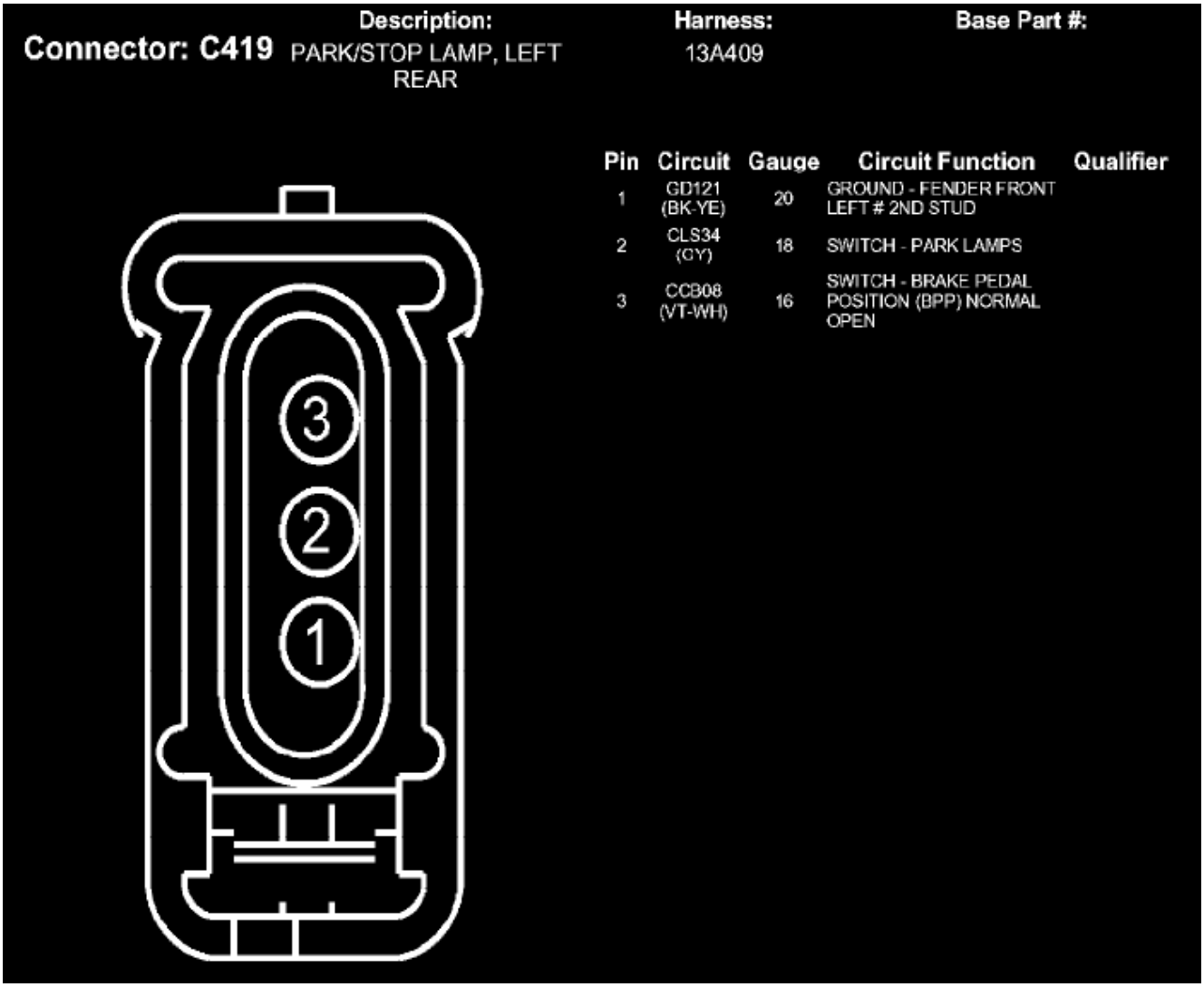
11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD121 (BK-YE)	20	GROUND - FENDER FRONT LEFT # 2ND STUD	
2	CLS34 (GY)	18	SWITCH - PARK LAMPS	
3	CCB08 (VT-WH)	16	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL OPEN	

Brake Lamp: Connector Views

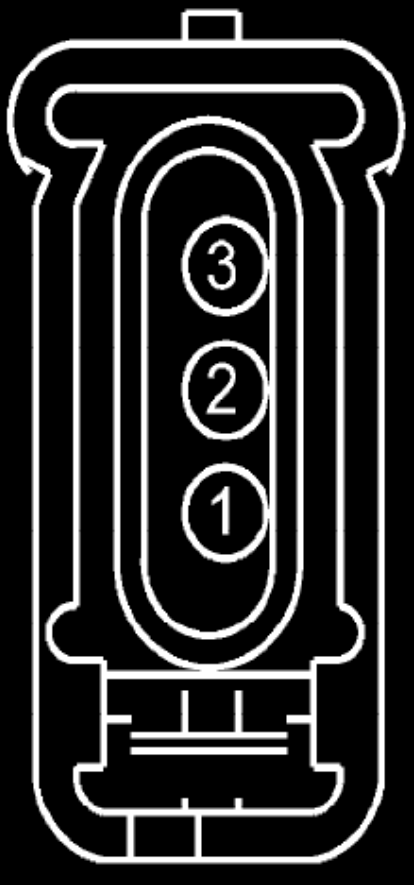
C419

Connector: C418

Description: PARK/STOP LAMP, RIGHT REAR

Harness: 13A409

Base Part #:



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD121 (BK-YE)	20	GROUND - FENDER FRONT LEFT # 2ND STUD	
2	CLS34 (GY)	18	SWITCH - PARK LAMPS	
3	CCB08 (VT-WH)	18	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL OPEN	

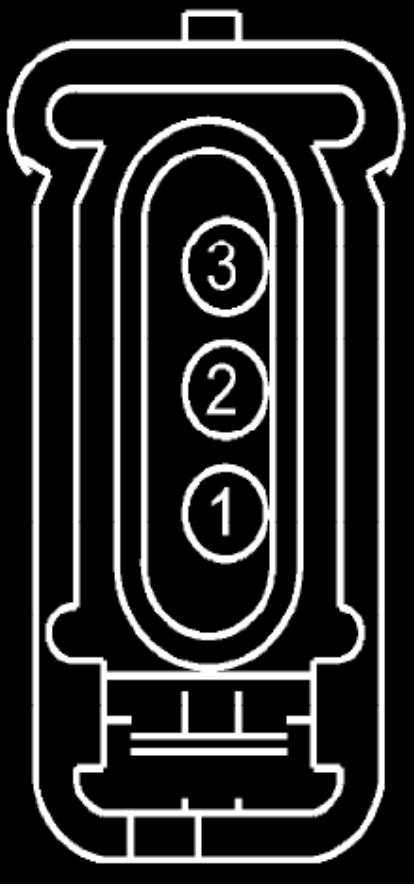
C418

Connector: C415

Description: PARK/STOP/TURN LAMP, RIGHT REAR

Harness: 13A409

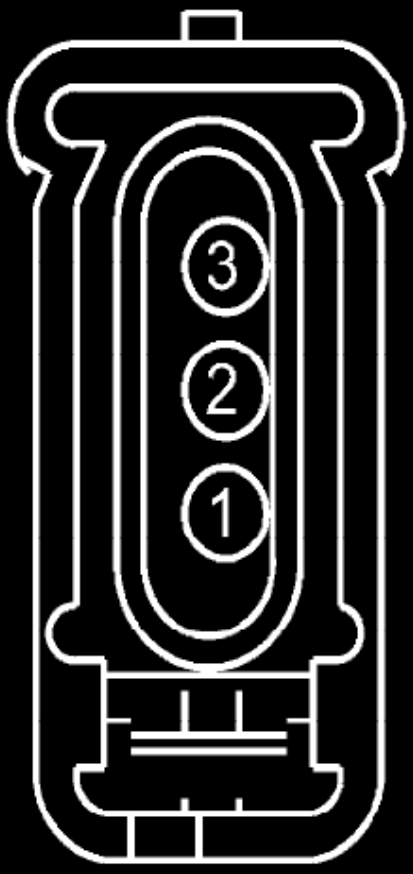
Base Part #:



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD121 (BK-YE)	20	GROUND - FENDER FRONT LEFT # 2ND STUD	
2	CLS34 (GY)	18	SWITCH - PARK LAMPS	
3	CLS36 (YE)	18	SWITCH - PARK LAMPS RIGHT	

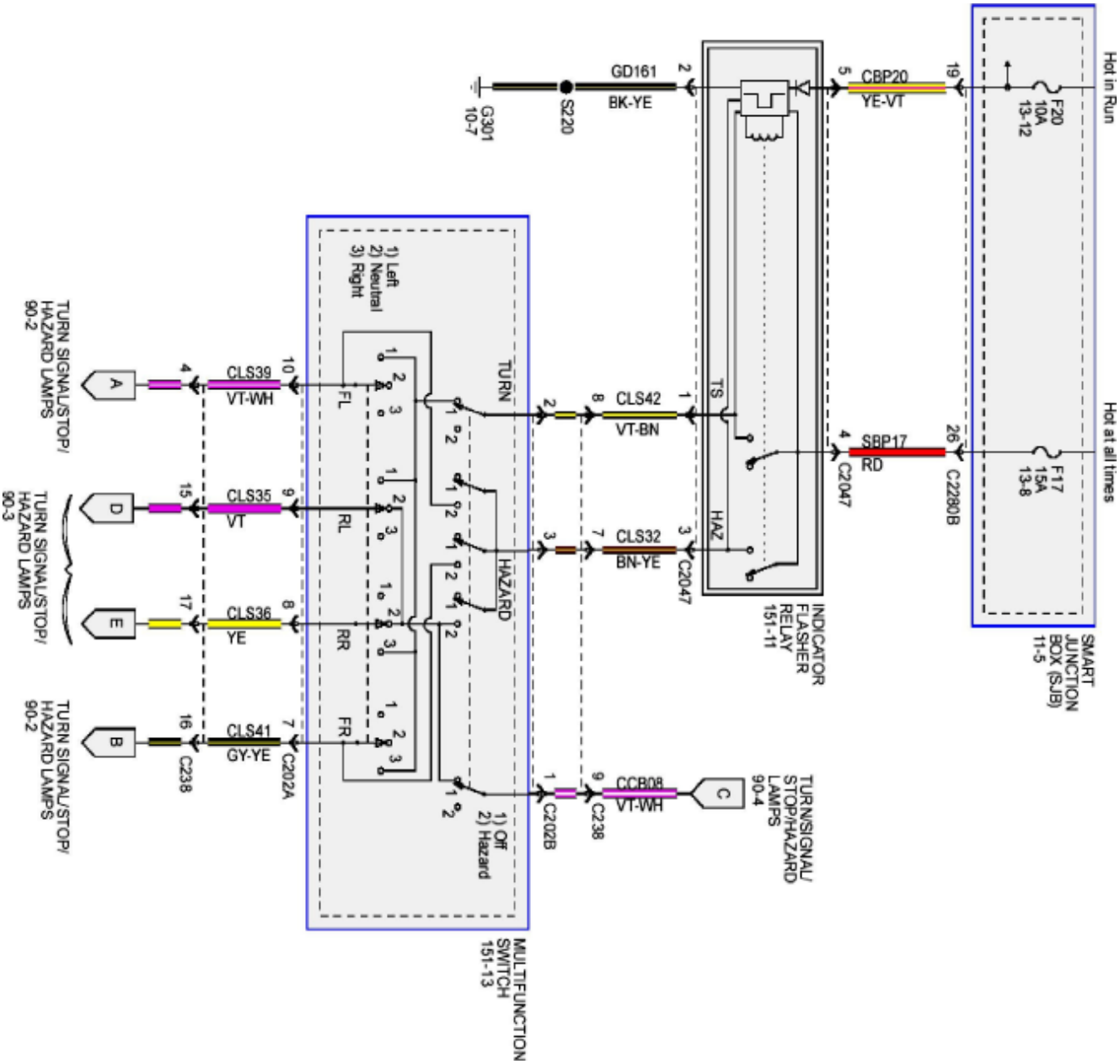
C415

Connector: C412 | **Description:** PARK/STOP/TURN LAMP, LEFT REAR | **Harness:** 13A409 | **Base Part #:**



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD121 (BK-YE)	20	GROUND - FENDER FRONT LEFT # 2ND STUD	
2	CLS34 (GY)	18	SWITCH - PARK LAMPS	
3	CLS35 (VT)	18	SWITCH - PARK LAMPS LEFT	

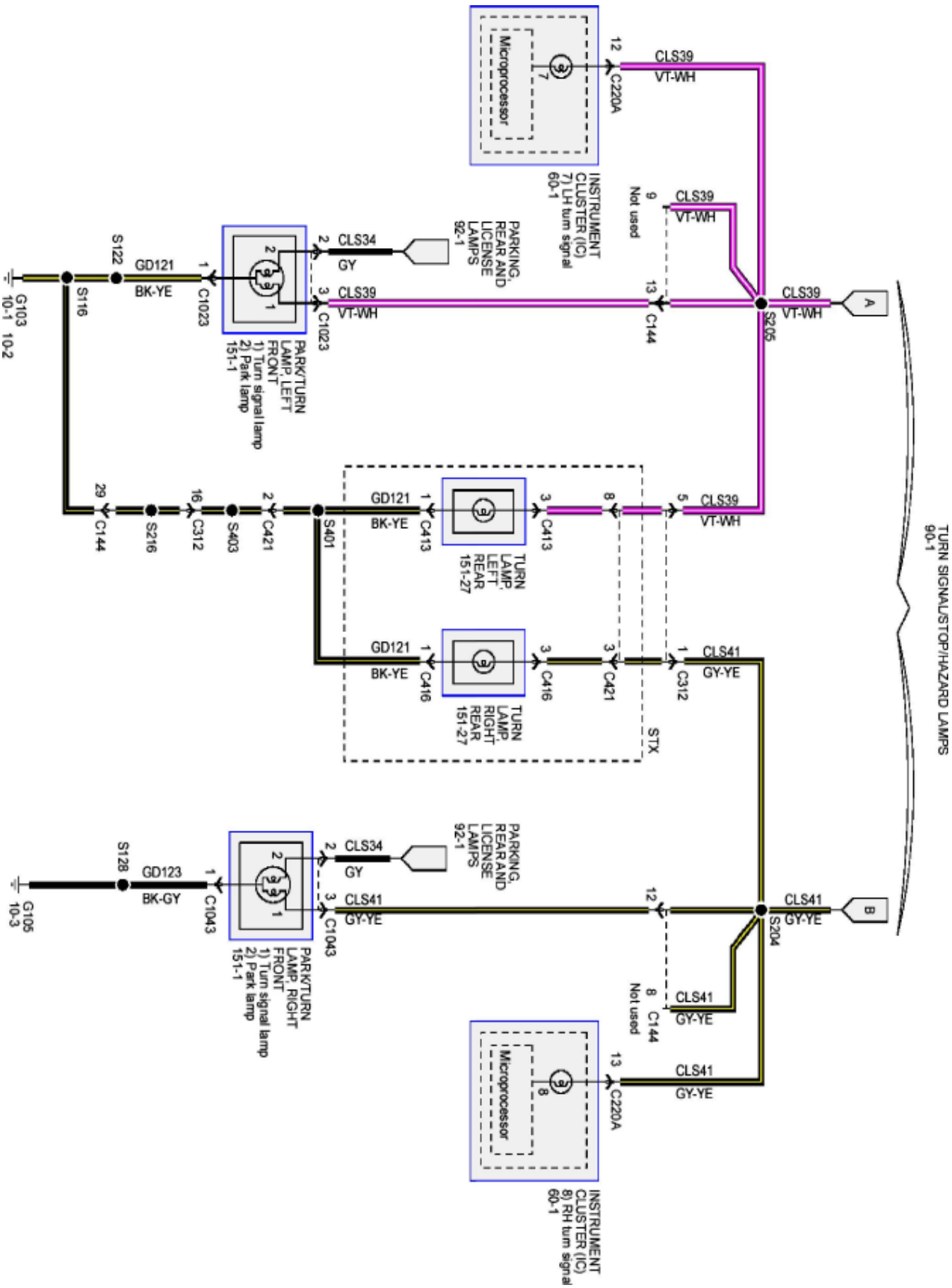
C412

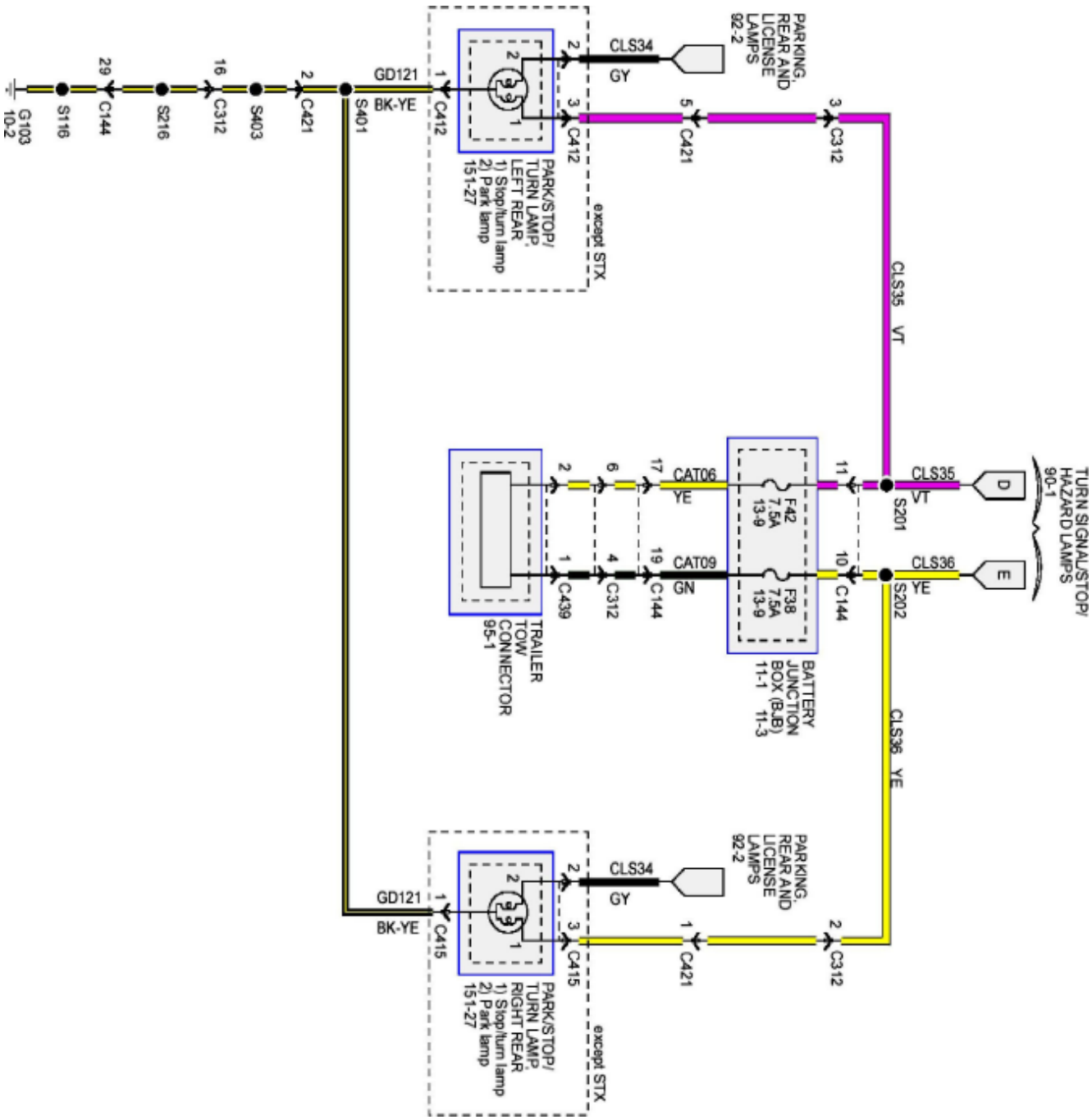


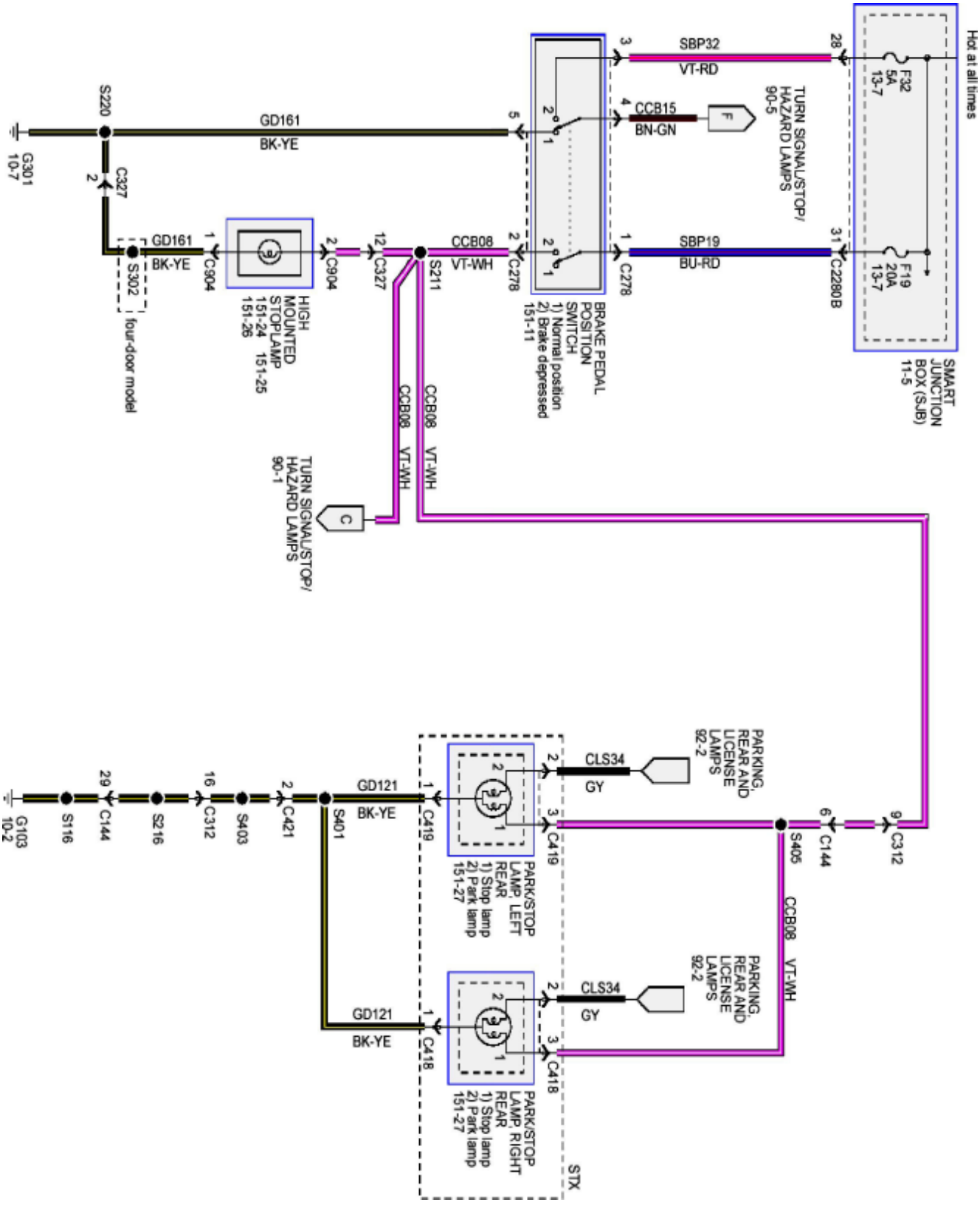
Brake Lamp: Electrical Diagrams

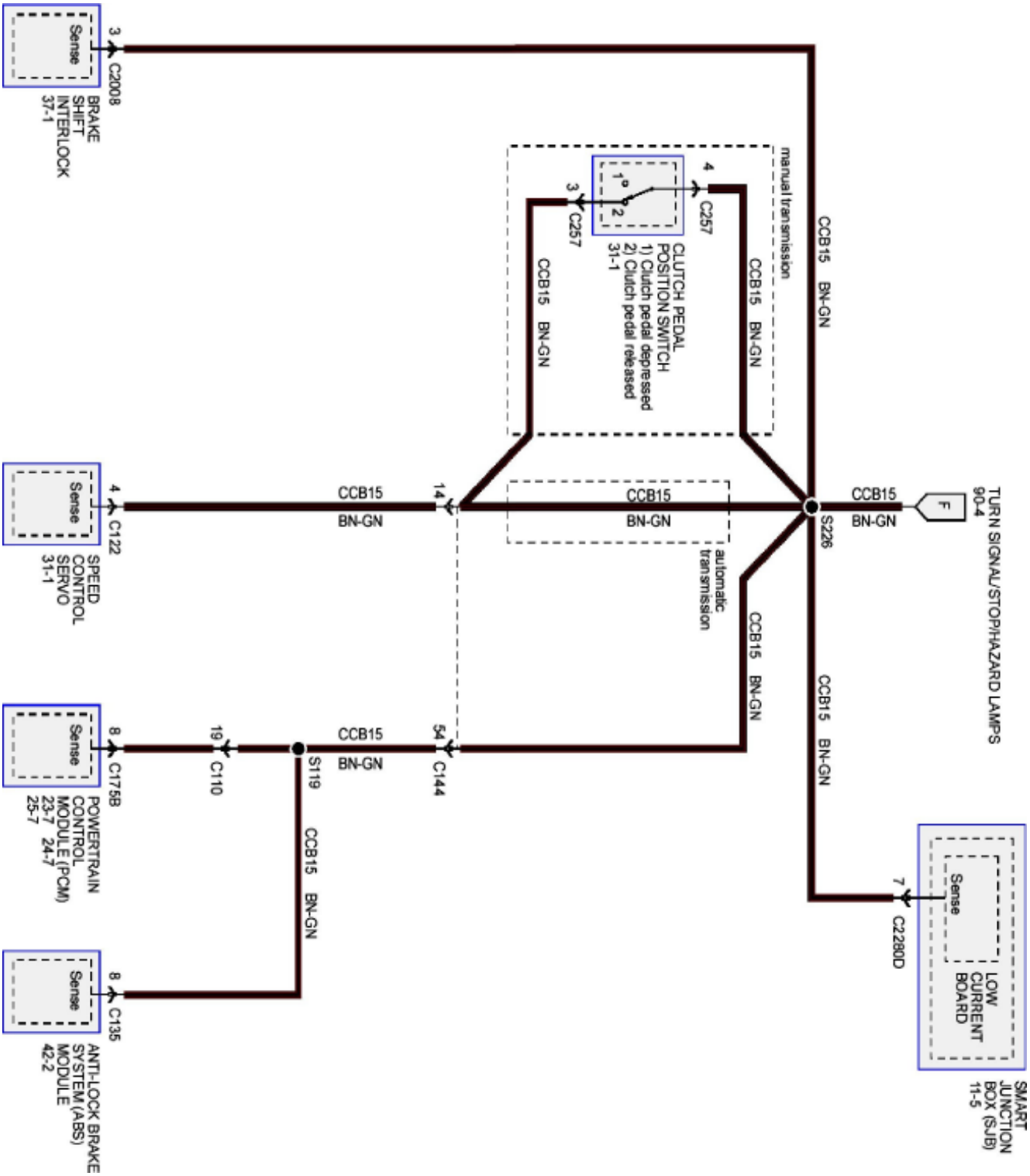
PLEASE NOTE: Some diagrams may appear to be missing because of gaps in the number sequences. These "gaps" are actually for diagrams that do not apply to the vehicle model selected.

90-1


TURN SIGNAL/STOP/HAZARD LAMPS
90-1
INSTRUMENT CLUSTER (IC)
7) LH turn signal
60-1
Microprocessor
C220A
CLS39
VT-WH
Not used
C144
S205
A
PARKING, REAR AND LICENSE LAMPS
92-1
CLS34
GY
GD121
BK-YE
S122
G103
10-1 10-2
S116
C1023
PARK/TURN LAMP, LEFT FRONT
1) Turn signal lamp
2) Park lamp
151-1
S216
S403
S401
C421
C312
C413
C416
TURN LAMP, LEFT REAR
151-27
TURN LAMP, RIGHT REAR
151-27
CLS41
GY-YE
STX
S204
B
GD123
BK-GY
S128
G105
10-3
C1043
PARK/TURN LAMP, RIGHT FRONT
INSTRUMENT CLUSTER (IC)
8) RH turn signal
60-1


G103
10-2
S116
C144
29
S216
C312
16
S403
C421
2
GD121
BK-YE
S401
C412
1
2
3
CLS34
GY
PARKING, REAR AND LICENSE LAMPS
92-2
PARK/STOP/ TURN LAMP LEFT REAR
1) Stop/turn lamp
2) Park lamp
151-27
except STX
C421
5
C312
3
CLS35 VT
TURN SIGNAL/STOP/ HAZARD LAMPS
90-1
D
E
CLS35
VT
S201
CLS36
YE
S202
C144
10
11
F42
7.5A
13-9
F38
7.5A
13-9
BATTERY JUNCTION BOX (BJB)
11-1
11-3
CAT06
YE
CAT09
GN
17
19
C312
6
4
C439
1
2
TRAILER TOW CONNECTOR
95-1
CLS36 YE
GD121
BK-YE
C415
CLS34
GY
PARKING, REAR AND LICENSE LAMPS
92-2
C421
1
C312
2
PARK/STOP/ TURN LAMP RIGHT REAR
1) Stop/turn lamp
2) Park lamp
151-27
except STX


Hot at all times
F32
5A
13-7
F19
20A
13-7
SMART JUNCTION BOX (SJB)
11-5
SBP32
VT-RD
28
3
TURN SIGNAL/STOP/ HAZARD LAMPS
90-5
CCB15
BN-GN
4
F
S220
GD161
BK-YE
5
G301
10-7
C327
2
BRAKE PEDAL POSITION SWITCH
1) Normal position
2) Brake depressed
151-11
C278
SBP19
BU-RD
31
C2280B
GD161
BK-YE
1
C904
HIGH MOUNTED STOPLAMP
151-24 151-25
151-26
2
C904
12
C327
CCB08
VT-WH
S211
C278
S302
four-door model
CCB08 VT-WH
CCB08 VT-WH
TURN SIGNAL/STOP/ HAZARD LAMPS
90-1
C
PARKING, REAR AND LICENSE LAMPS
92-2
CLS34
GY
PARK/STOP LAMP LEFT REAR
1) Stop lamp
2) Park lamp
151-27
C419
C144
6
C312
9
S405
CCB08 VT-WH
GD121
BK-YE
C421
2
S403
16
C312
S216
29
C144
S116
G103
10-2
S401
C419
PARKING, REAR AND LICENSE LAMPS
92-2
CLS34
GY
PARK/STOP LAMP RIGHT REAR
1) Stop lamp
2) Park lamp
151-27
C418
GD121
BK-YE
C418
STX



90-5

Diagrams: Other diagrams referred to by number (i.e. 13-2, 24-6, 10-2, etc.) within these diagrams can be found at Diagrams By Number. See: Diagrams/Electrical Diagrams/Diagrams By Number

Locations: Location Views (reference numbers starting with 151-) referred to within these diagrams can be found at Location Views. See: Locations/Component Locations

Visual Inspection Chart

Mechanical	Electrical
• Multifunction switch • Stoplamp switch	• Smart junction box (SJB) fuse 19 (20A) (stoplamp switch) • Wiring, terminals or connectors • Bulb(s)

Brake Lamp: Initial Inspection and Diagnostic Overview

Inspection and Verification

INSPECTION AND VERIFICATION

1. Verify the customer concern. 2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step. 4. If the concern is not visually evident, verify the symptom. GO to Symptom Chart. See: Symptom Related Diagnostic Procedures

Principles of Operation

PRINCIPLES OF OPERATION

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

Voltage is supplied at all times by the smart junction box (SJB) to the stoplamp switch. When the brake pedal is applied, voltage is supplied to the high mounted stoplamp and the multifunction switch, which routes the voltage to the rear lamps.

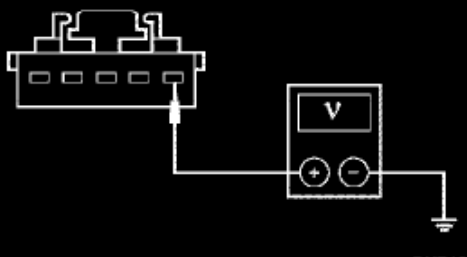
Symptom Chart

Condition	Possible Sources	Action
• One or more stoplamps are inoperative	• Fuse • Wiring, terminals or connectors • Stoplamp switch • High mounted stoplamp • Multifunction switch • Smart junction box (SJB)	• GO to Pinpoint Test G.
• The stoplamps are on continuously	• Wiring, terminals or connectors • Stoplamp switch • Multifunction switch	• GO to Pinpoint Test H.

Symptom Chart

PINPOINT TEST G: ONE OR MORE STOPLAMPS ARE INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step		Result / Action to Take
G1	DETERMINE THE INOPERATIVE STOPLAMP	
	• Key in OFF position. • Observe the stoplamps while applying the brake pedal. • **Are all the stoplamps inoperative?**	**Yes** GO to **G2**. **No** If the high mounted stoplamp is inoperative, GO to **G5**. If one rear stoplamp is inoperative, GO to **G7**. If both rear stoplamps are inoperative,GO to **G9**.
G2	CHECK THE VOLTAGE TO THE STOPLAMP SWITCH	
	• Disconnect: Stoplamp Switch C278. • Measure the voltage between the stoplamp switch C278-1, circuit SBP19 (BU/RD), harness side and ground.  GK7493-A • **Is the voltage greater than 10 volts?**	**Yes** GO to **G4**. **No** VERIFY the SJB fuse 19 (20A) is OK. If OK, GO to **G3**.
G3	CHECK CIRCUIT SBP19 (BU/RD) FOR AN OPEN	
	• Disconnect: SJB C2280b.	

(Continued)

Brake Lamp: Pinpoint Tests

Test G: One Or More Stoplamps Are Inoperative

PINPOINT TEST G: ONE OR MORE STOPLAMPS ARE INOPERATIVE

Normal Operation

The smart junction box (SJB) provides voltage to the stoplamp switch through circuit SBP19 (BU/RD). When the brake pedal is applied, voltage is routed to the high mounted stoplamp and the multifunction switch through circuit CCB08 (VT/WH). The multifunction switch then routes the voltage to the LH and RH rear lamps through circuits CLS35 (VT) and CLS36 (YE), respectively. Ground is provided through circuit GD161 (BK/YE) for the high mounted stoplamp and through circuit GD121 (BK/YE) for the rear lamps.

This pinpoint test is intended to diagnose the following:

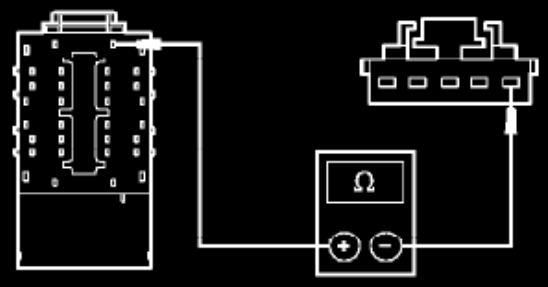
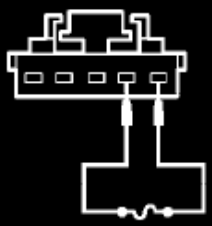
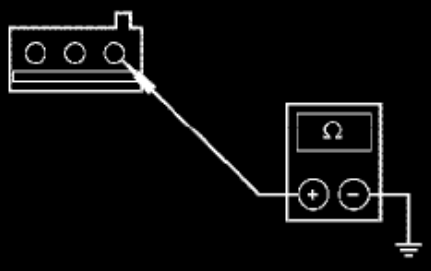
- Fuse

- Wiring, terminals or connectors

- Stoplamp switch
- High mounted stoplamp
- Multifunction switch
- SJB

G1-G3

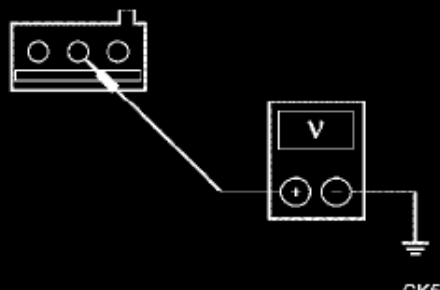
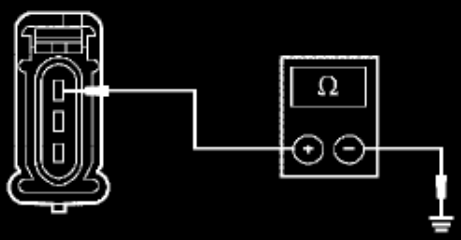
PINPOINT TEST G: ONE OR MORE STOPLAMPS ARE INOPERATIVE (Continued)

Test Step		Result / Action to Take
G3	CHECK CIRCUIT SBP19 (BU/RD) FOR AN OPEN (Continued)	
	• Measure the resistance between the SJB C2280b-31, circuit SBP19 (BU/RD), harness side and the stoplamp switch C278-1, circuit SBP19 (BU/RD), harness side.  A0079390 • **Is the resistance less than 5 ohms?**	**Yes** GO to **G11**. **No** REPAIR the circuit. TEST the system for normal operation.
G4	CHECK CIRCUIT CCB08 (VT/WH) FOR AN OPEN (ALL STOPLAMPS INOPERATIVE)	
	• Connect a fused (20A) jumper wire between the stoplamp switch C278-1, circuit SBP19 (BU/RD), harness side and the stoplamp switch C278-2, circuit CCB08 (VT/WH), harness side.  A0079391 • **Do the stoplamps illuminate?**	**Yes** REMOVE the jumper wire. INSTALL a new stoplamp switch. TEST the system for normal operation. **No** REMOVE the jumper wire. REPAIR the circuit. TEST the system for normal operation.
G5	CHECK CIRCUIT GD161 (BK/YE) FOR AN OPEN	
	• Disconnect: High Mounted Stoplamp C904. • Measure the resistance between the high mounted stoplamp C904-1, circuit GD161 (BK/YE), harness side and ground.  GK5849-A • **Is the resistance less than 5 ohms?**	**Yes** GO to **G6**. **No** REPAIR the circuit. TEST the system for normal operation.

(Continued)

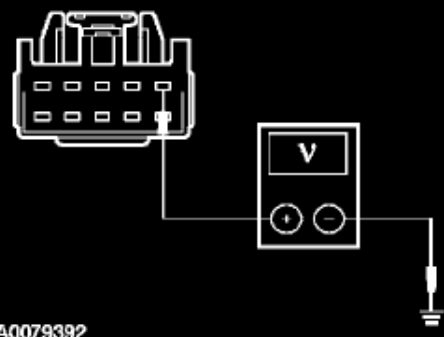
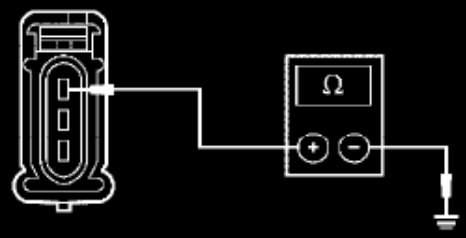
G3-G5

PINPOINT TEST G: ONE OR MORE STOPLAMPS ARE INOPERATIVE (Continued)

Test Step		Result / Action to Take
G6	**CHECK CIRCUIT CCB08 (VT/WH) FOR AN OPEN (HIGH MOUNTED STOPLAMP)**	
	• While applying the brake pedal, measure the voltage between the high mounted stoplamp C904-2, circuit CCB08 (VT/WH), harness side and ground.  GK5848-A • **Is the voltage greater than 10 volts?**	**Yes** INSTALL a new high mounted stoplamp. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.
G7	**CHECK CIRCUIT GD121 (BK/YE) FOR AN OPEN**	
	• Disconnect: Inoperative Rear Stoplamp. • Measure the resistance between the LH rear lamp C412-1, circuit GD121 (BK/YE), harness side and ground; or between the RH rear lamp C415-1, circuit GD121 (BK/YE), harness side and ground.  N0035224 • **Is the resistance less than 5 ohms?**	**Yes** GO to **G8**. **No** REPAIR the circuit. TEST the system for normal operation.
G8	**CHECK THE MULTIFUNCTION SWITCH**	
	• Disconnect: Multifunction Switch. • Carry out the multifunction switch component test. • **Is the multifunction switch OK?**	**Yes** REPAIR circuit CLS35 (VT) (LH rear stoplamp) or circuit CLS36 (YE) (RH rear stoplamp) for an open. TEST the system for normal operation. **No** INSTALL a new multifunction switch. TEST the system for normal operation.
G9	**CHECK CIRCUIT CCB08 (VT/WH) FOR AN OPEN (MULTIFUNCTION SWITCH)**	
	• Disconnect: Multifunction Switch C202b.	

(Continued)

PINPOINT TEST G: ONE OR MORE STOPLAMPS ARE INOPERATIVE (Continued)

Test Step		Result / Action to Take
G9	**CHECK CIRCUIT CCB08 (VT/WH) FOR AN OPEN (MULTIFUNCTION SWITCH) (Continued)** • While applying the brake pedal, measure the voltage between the multifunction switch C202b-1, circuit CCB08 (VT/WH), harness side and ground.  A0079392 • **Is the voltage greater than 10 volts?**	**Yes** GO to **G10**. **No** REPAIR the circuit. TEST the system for normal operation.
G10	**CHECK CIRCUIT GD121 (BK/YE) FOR AN OPEN** • Disconnect: Inoperative Rear Stoplamp. • Measure the resistance between the LH rear lamp C412-1, circuit GD121 (BK/YE), harness side and ground; or between the RH rear lamp C415-1, circuit GD121 (BK/YE), harness side and ground.  N0035224 • **Is the resistance less than 5 ohms?**	**Yes** INSTALL a new multifunction switch. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.
G11	**CHECK FOR CORRECT SJB OPERATION** • Disconnect all the SJB connectors. • Check for: — corrosion — damaged pins — pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

G9-G11

Test H: The Stoplamps Are On Continuously

PINPOINT TEST H: THE STOPLAMPS ARE ON CONTINUOUSLY

Normal Operation

When the brake pedal is applied, the voltage is routed to the high mounted stoplamp and the multifunction switch through circuit CCB08 (VT/WH). The multifunction switch then routes the voltage to the LH and RH rear lamps through circuits CLS35 (VT) and CLS36 (YE), respectively. Voltage to the LH and RH rear lamps also routes through the battery junction box (BJB) fuses 42 (7.5A) and 38 (7.5A) to circuits CAT06 (YE) and CAT09 (GN), respectively, for the trailer tow lamps.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors

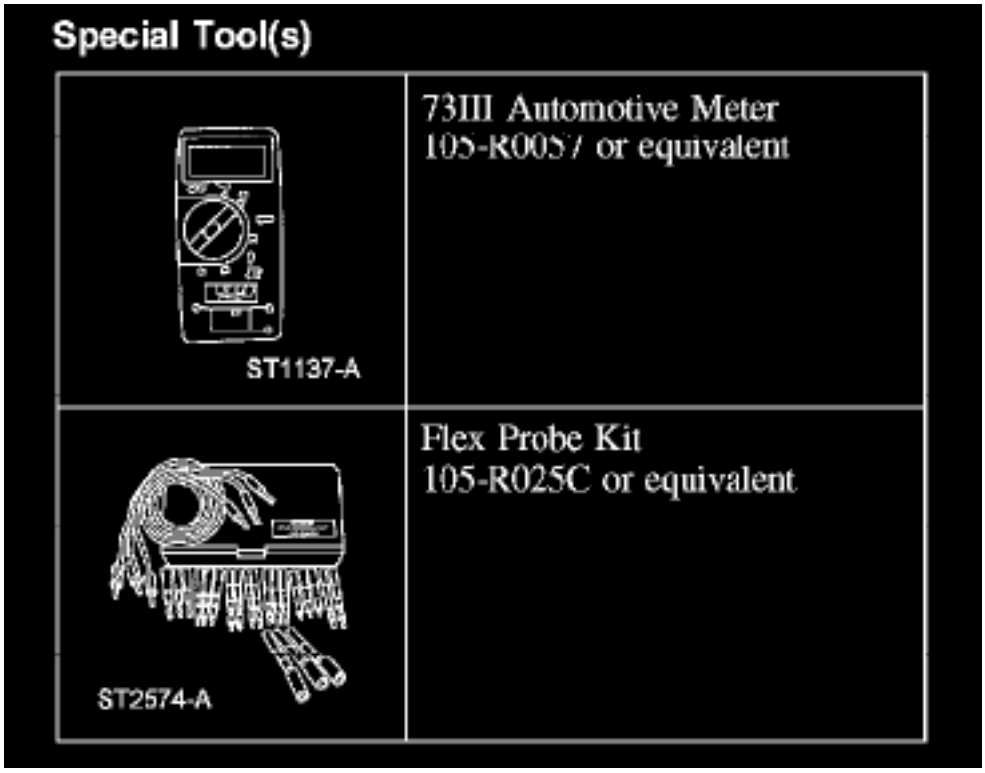
- Stoplamp switch

- Multifunction switch

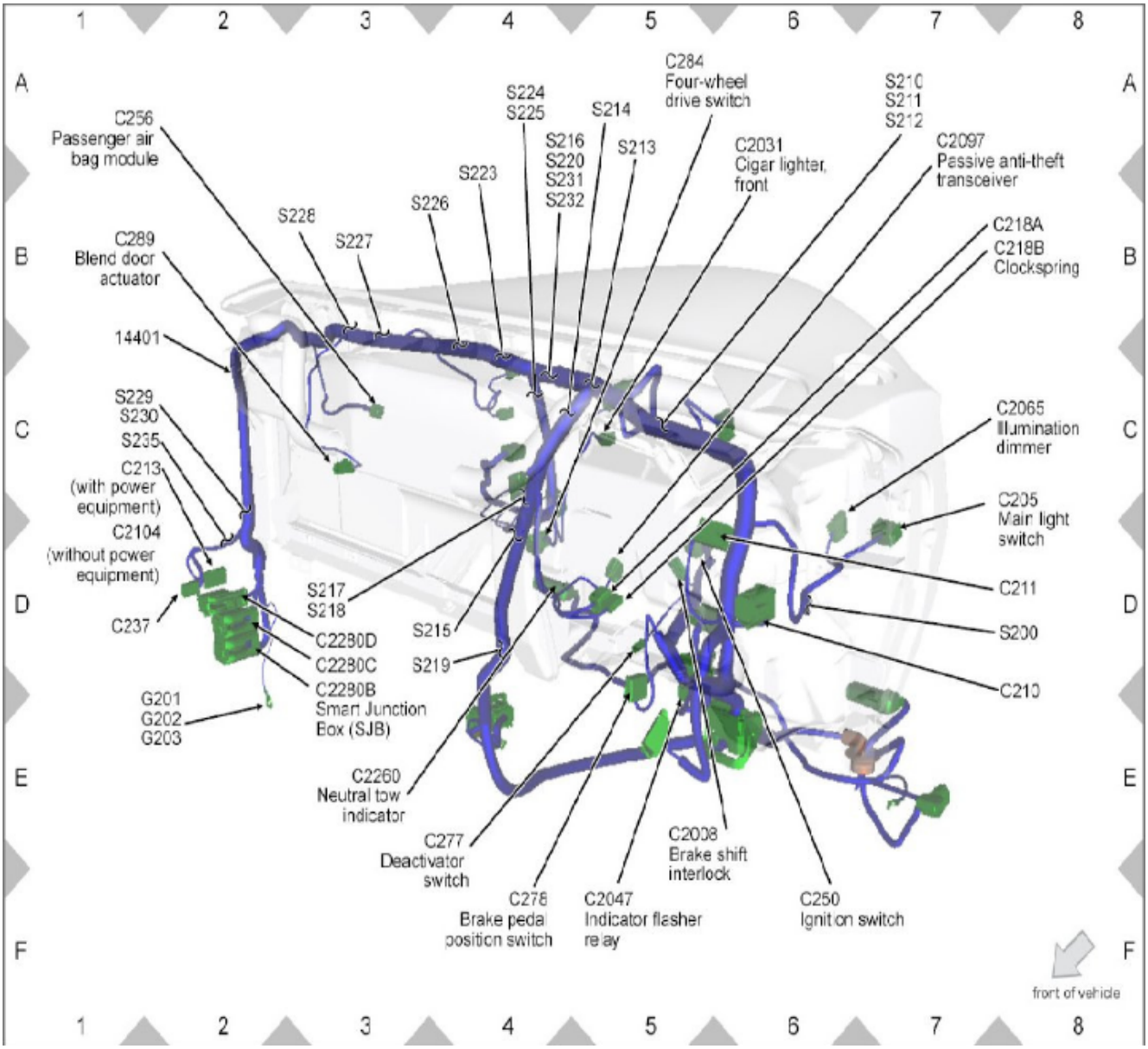
PINPOINT TEST H: THE STOPLAMPS ARE ON CONTINUOUSLY

Test Step		Result / Action to Take
H1	**CHECK THE STOPLAMP SWITCH** • Disconnect: Stoplamp Switch C278. • **Do the stoplamps continue to illuminate?**	**Yes** GO to **H2**. **No** INSTALL a new stoplamp switch. TEST the system for normal operation.
H2	**CHECK CIRCUIT CAT09 (GN) FOR A SHORT TO VOLTAGE** • Key in OFF position. • Disconnect: BJB Fuse 38 (7.5A). • **Do the stoplamps continue to illuminate?**	**Yes** GO to **H3**. **No** REPAIR the circuit. TEST the system for normal operation.
H3	**CHECK CIRCUIT CAT06 (YE) FOR A SHORT TO VOLTAGE** • Disconnect: BJB Fuse 42 (7.5A). • **Do the stoplamps continue to illuminate?**	**Yes** GO to **H4**. **No** REPAIR the circuit. TEST the system for normal operation.
H4	**CHECK THE MULTIFUNCTION SWITCH** • Disconnect: Multifunction Switch C202a. • **Do the stoplamps continue to illuminate?**	**Yes** If the high mounted stoplamp is on continuously, REPAIR circuit CCB08 (VT/WH). TEST the system for normal operation. If the LH rear stoplamp is on continuously, REPAIR circuit CLS35 (VT). TEST the system for normal operation. If the RH rear stoplamp is on continuously, REPAIR circuit CLS36 (YE). TEST the system for normal operation. **No** INSTALL a new multifunction switch. TEST the system for normal operation.

H1-H4

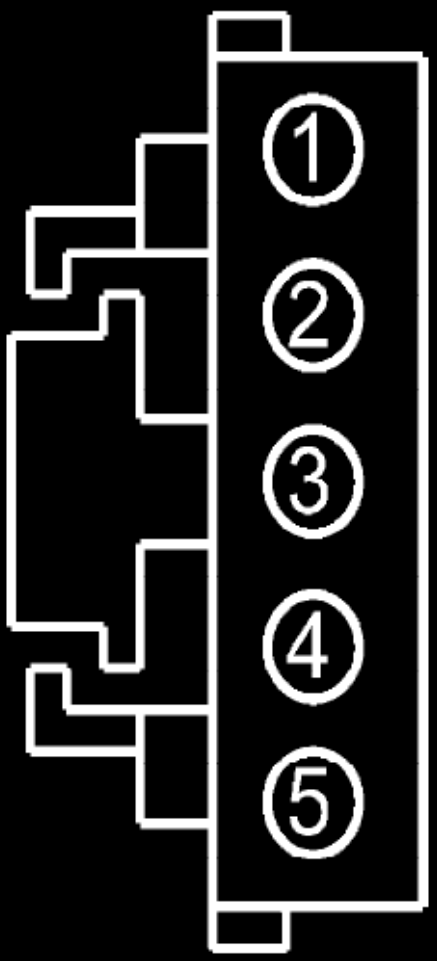


Special Tool(s)


1
2
3
4
5
6
7
8
A
B
C
D
E
F
C256
Passenger air bag module
C289
Blend door actuator
14401
S229
S230
S235
C213
(with power equipment)
C2104
(without power equipment)
C237
G201
G202
G203
S228
S227
S226
S223
S224
S225
S216
S220
S231
S232
S214
S213
C284
Four-wheel drive switch
C2031
Cigar lighter, front
S210
S211
S212
C2097
Passive anti-theft transceiver
C218A
C218B
Clockspring
C2065
Illumination dimmer
C205
Main light switch
C211
S200
C210
S217
S218
S215
S219
C2280D
C2280C
C2280B
Smart Junction Box (SJB)
C2260
Neutral tow indicator
C277
Deactivator switch
C276
Brake pedal position switch
C2047
Indicator flasher relay
C2008
Brake shift interlock
C250
Ignition switch
front of vehicle

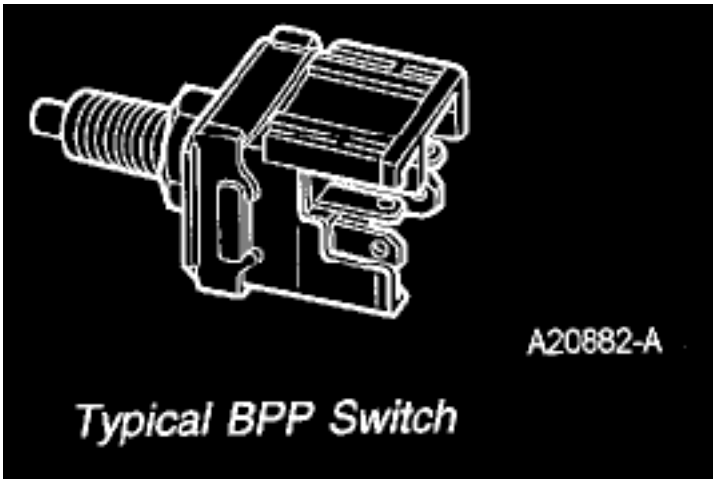
View 151-11

Connector: C278 Description: BRAKE PEDAL POSITION SWITCH | Harness: 14401 | Base Part #:



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	SBP19 (BU-RD)	16	FUSE - 19 OR CIRCUIT BREAKER	
2	CCB08 (VT-WH)	16	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL OPEN	
3	SBP32 (VT-RD)	22	FUSE - 32 OR CIRCUIT BREAKER	
4	CCB15 (BN-GN)	22	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL CLOSED	
5	GD161 (BK-YE)	22	GROUND - SEAT BRACKET REAR LEFT	

C278



Brake Light Switch: Description and Operation

BRAKE PEDAL POSITION (BPP) SWITCH

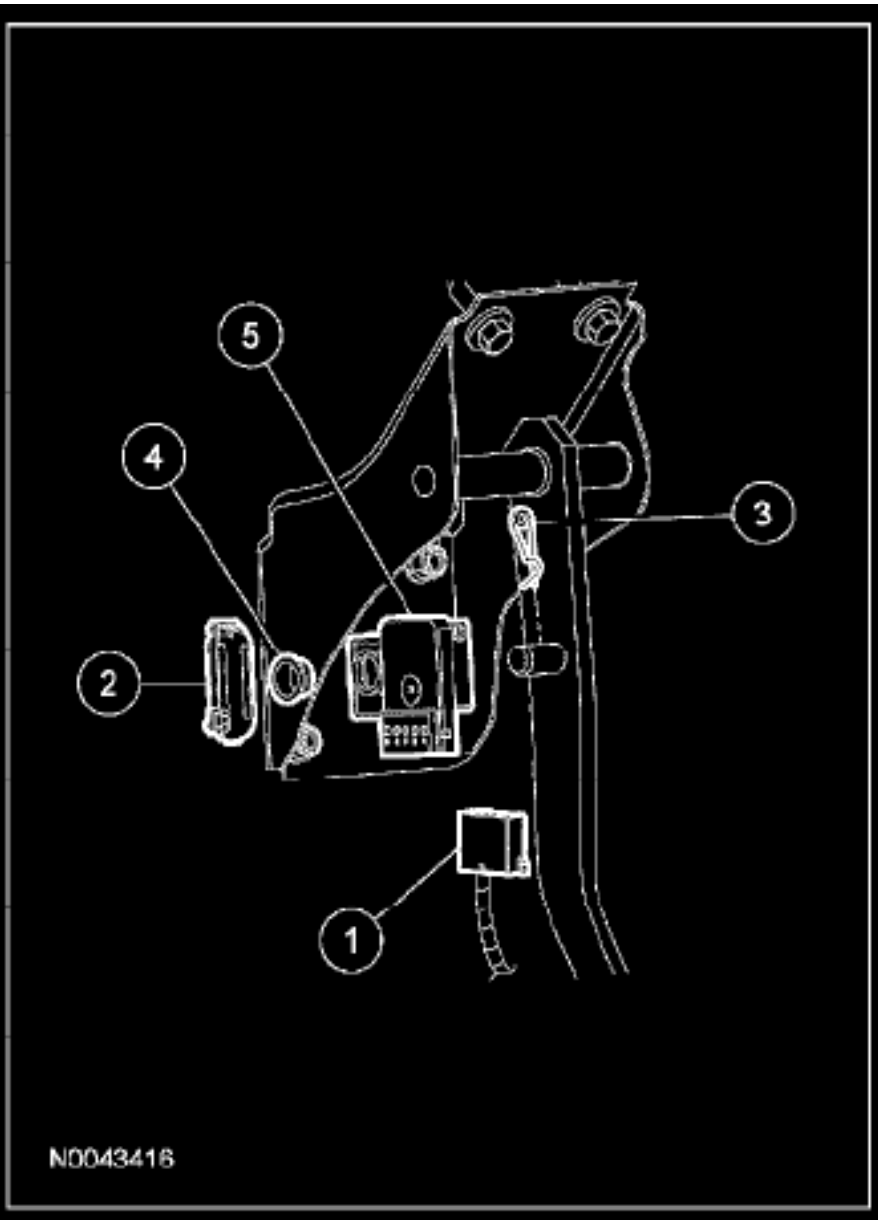
Typical BPP Switch

The BPP switch is sometimes referred to as the stoplamp switch. The BPP switch provides a signal to the PCM indicating that the brakes are applied. The BPP switch is normally open and is mounted on the brake pedal support. Depending on the vehicle application the BPP switch can be hardwired as follows:

- to the PCM supplying battery positive voltage (B+) when the vehicle brake pedal is applied.

- to the antilock brake system (ABS) module, or lighting control module (LCM), the BPP signal is then broadcast over the network to be received by the PCM.

- to the ABS traction control/stability assist module. The ABS module interprets the BPP switch input along with other ABS inputs and generates an output called the driver brake application (DBA) signal. The DBA signal is then sent to the PCM and to other BPP signal users.



Item	Part Number	Description
1	—	Stoplamp switch electrical connector (part of 14401)
2	2475	Stoplamp switch self-locking pin cover
3	380699	Stoplamp switch self-locking pin
4	2B219	Stoplamp switch spacer
5	13480	Stoplamp switch

Brake Light Switch: Service and Repair

STOPLAMP SWITCH

Removal and Installation

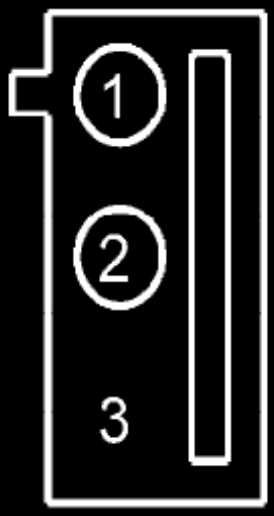
1. Disconnect the stoplamp switch electrical connector. 2. Remove the cover and the self-locking pin. 3. Remove the stoplamp switch from the brake booster push rod and the brake pedal assembly.

- Remove the spacer.

4. To install, reverse the removal procedure.

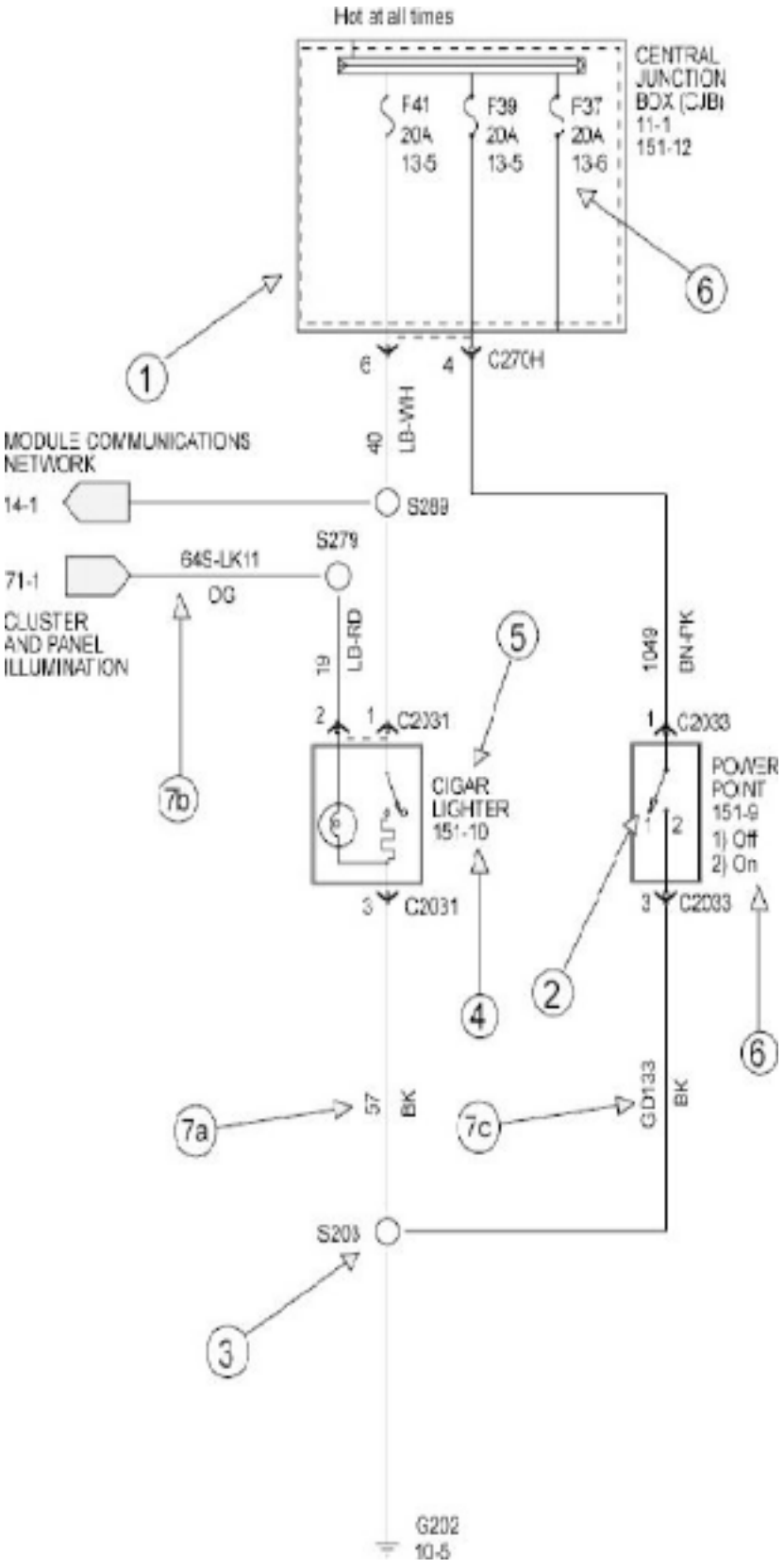
Connector: C904

Description:	Harness:	Base Part #:
HIGH MOUNTED STOPLAMP	13A724/14334	13A613



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD161 (BK-YE)	18	GROUND - SEAT BRACKET REAR LEFT	
2	CCB08 (VT-WH)	16	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL OPEN	
3	*	*	not used	

C904


Hot at all times
CENTRAL JUNCTION BOX (CJB)
11-1
151-12
F41
20A
13-5
F39
20A
13-5
F37
20A
13-6
C270H
40
LB-WH
MODULE COMMUNICATIONS NETWORK
14-1
S289
S279
64S-LK11
71-1
DG
CLUSTER AND PANEL ILLUMINATION
19
LB-RD
C2031
CIGAR LIGHTER
151-10
1049
BN-PK
C2033
POWER POINT
151-9
1) Off
2) On
57
BK
GD133
BK
S203
G202
10-5

Courtesy Lamp: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

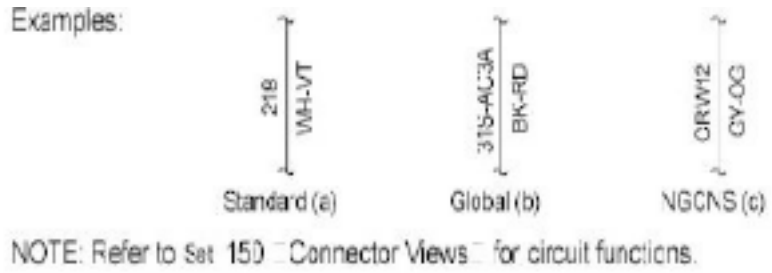
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

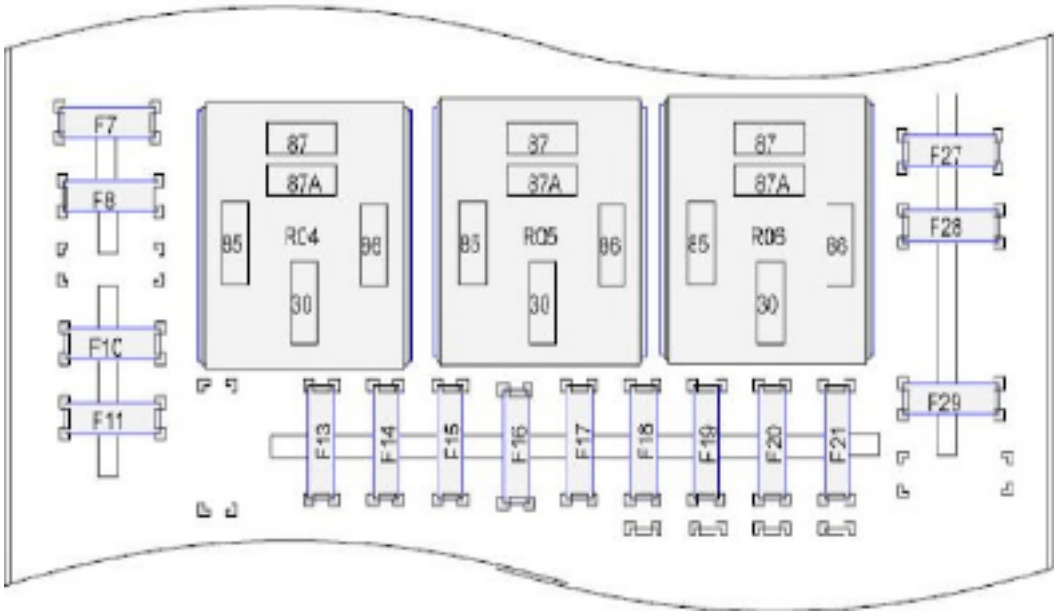
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

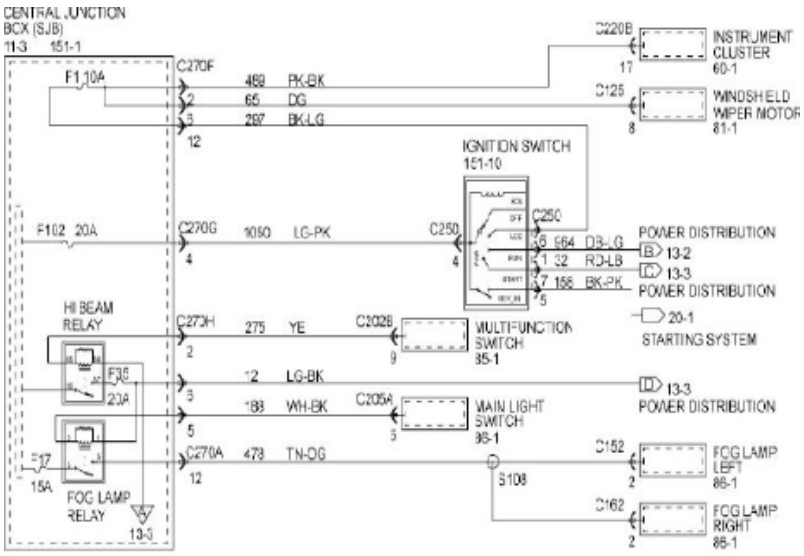
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

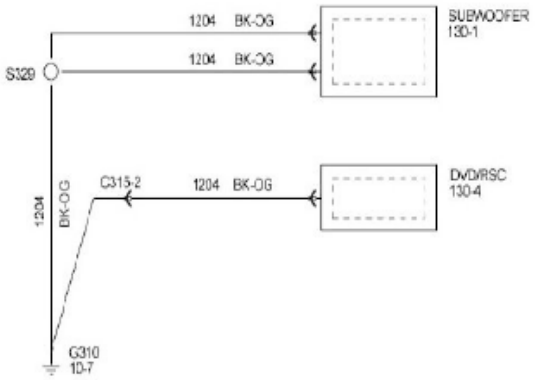
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

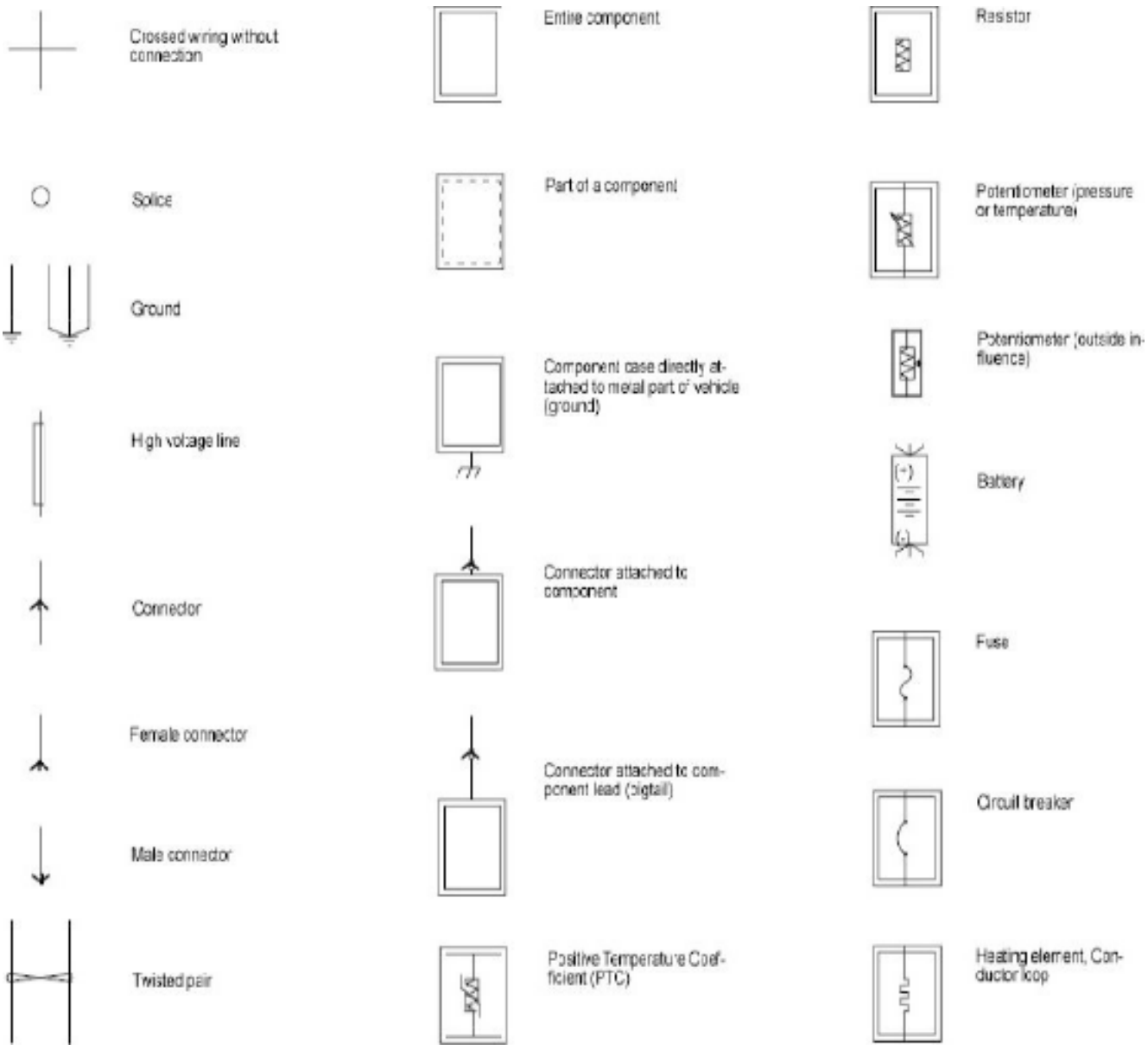
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

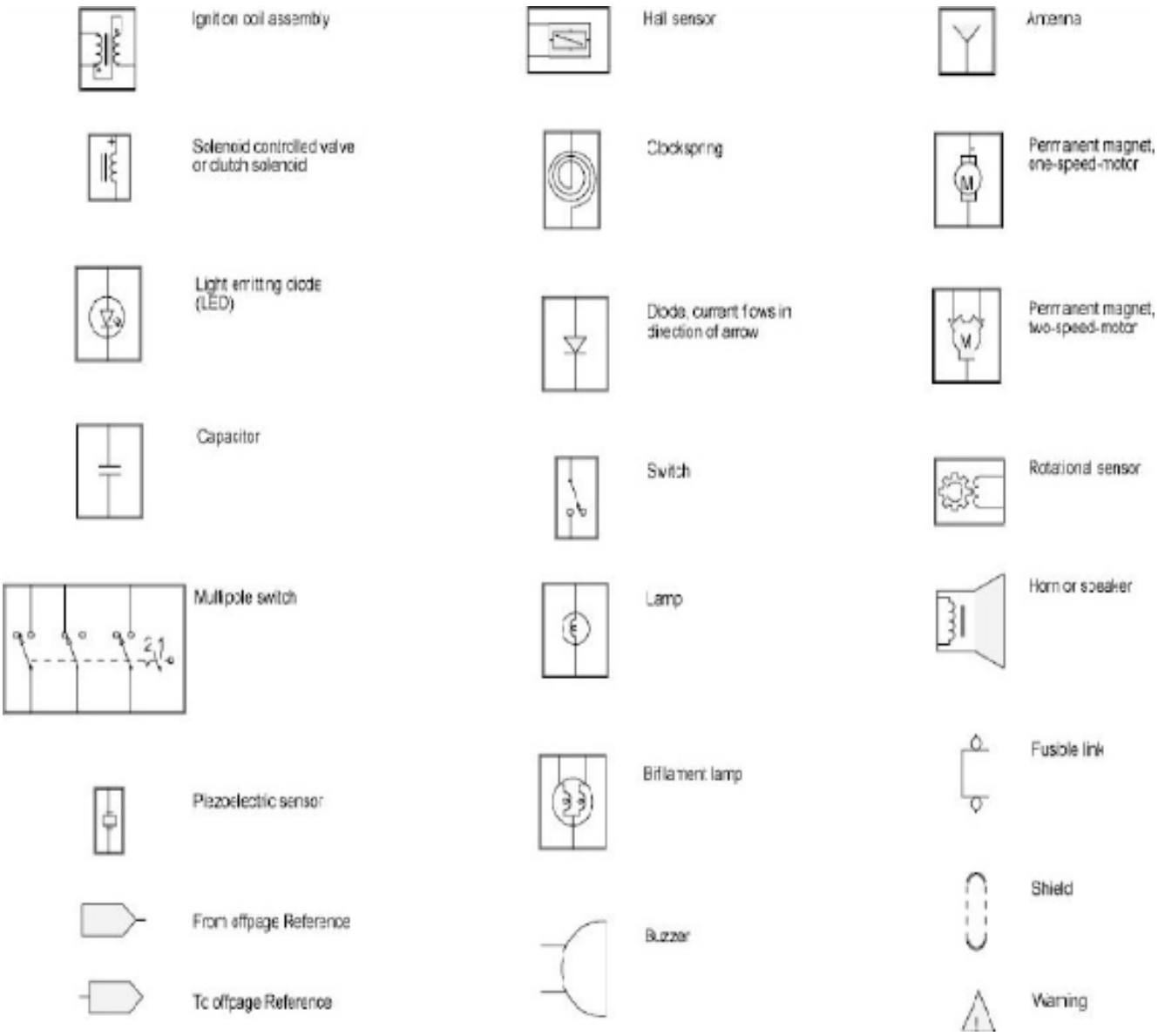
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

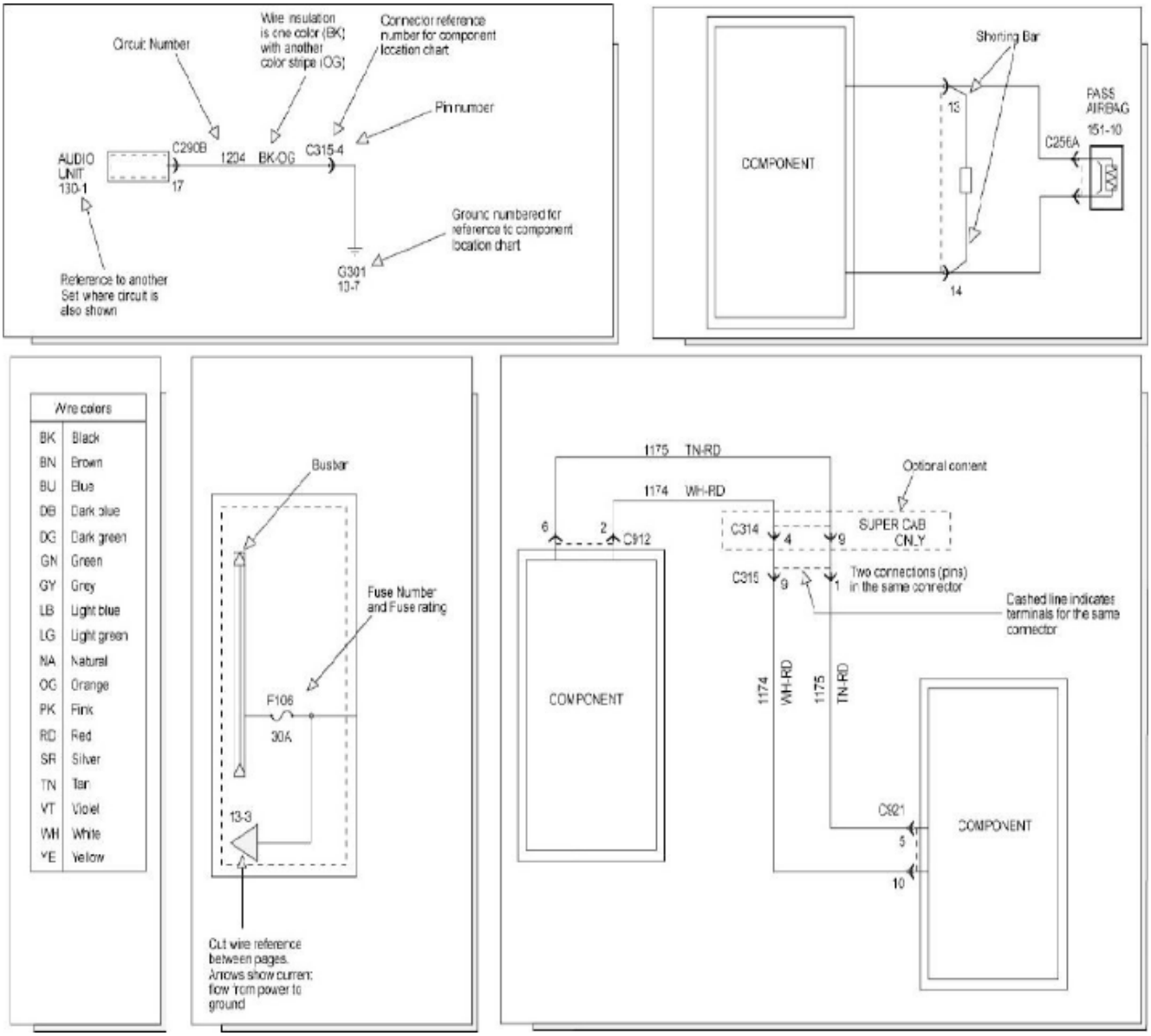
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

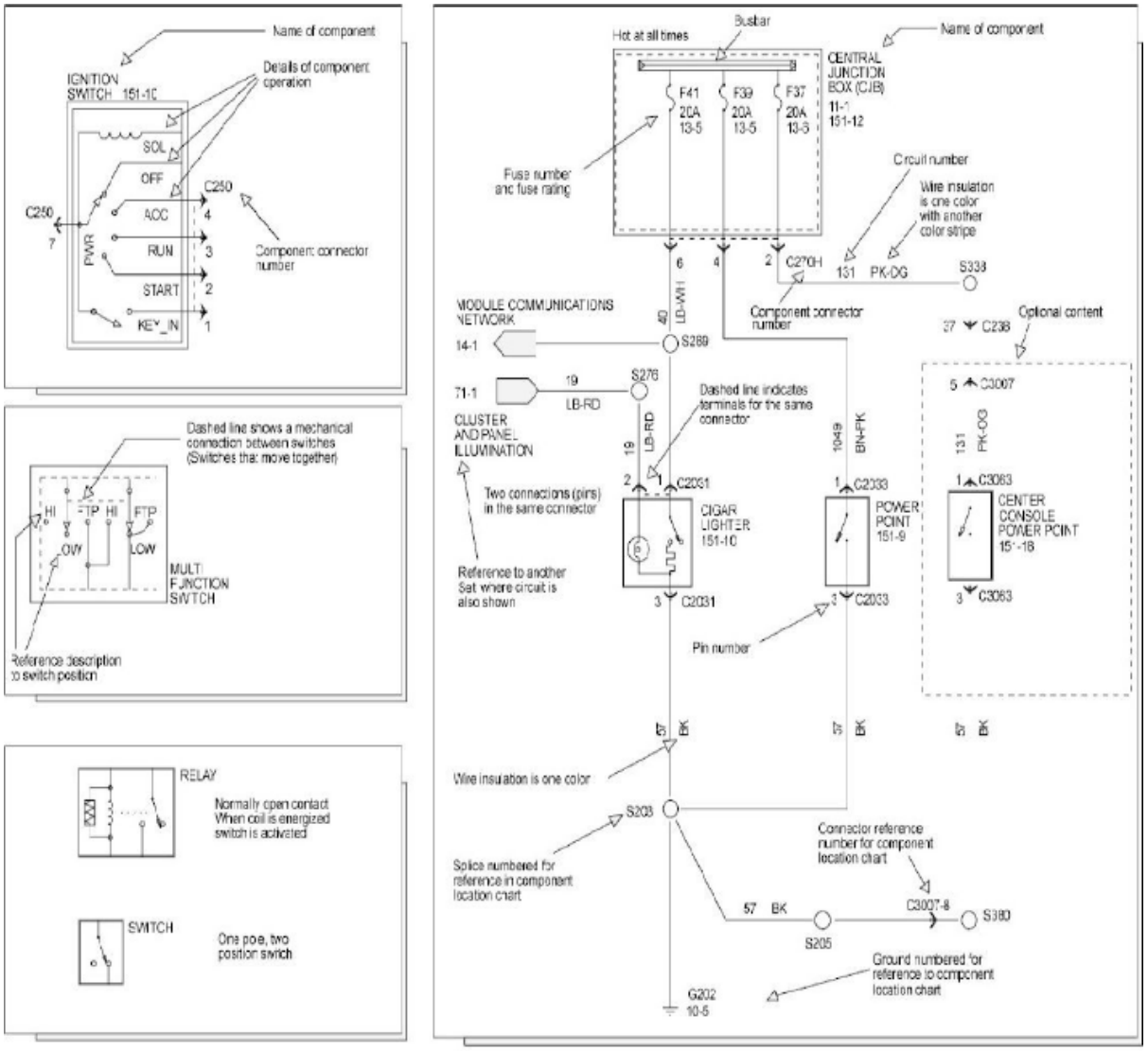
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

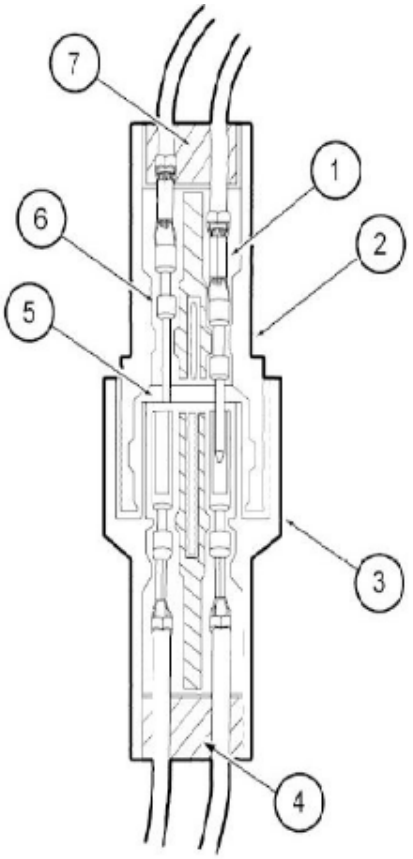


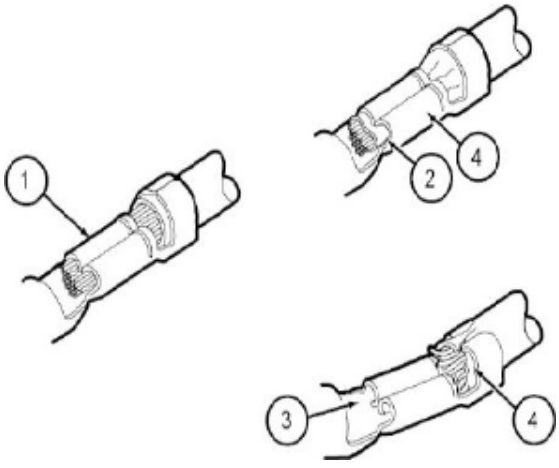
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Courtesy Lamp: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

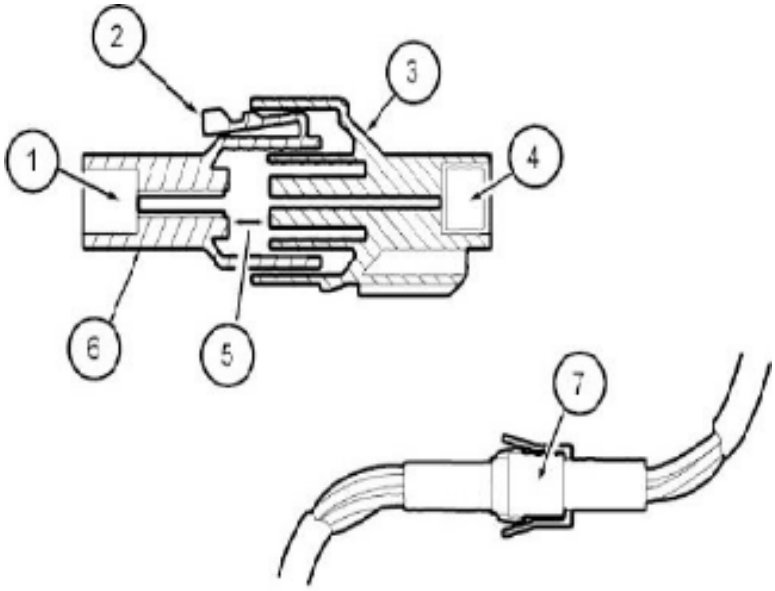
5 = Intermittent contact

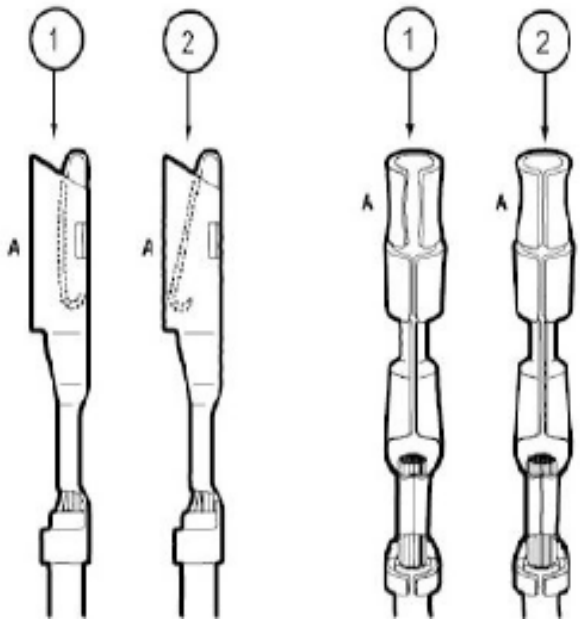
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

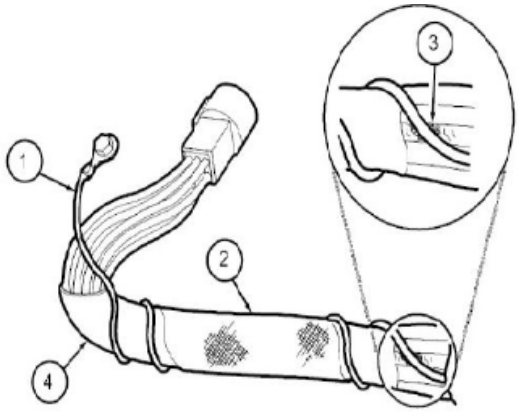
Deformed (enlarged) female terminals

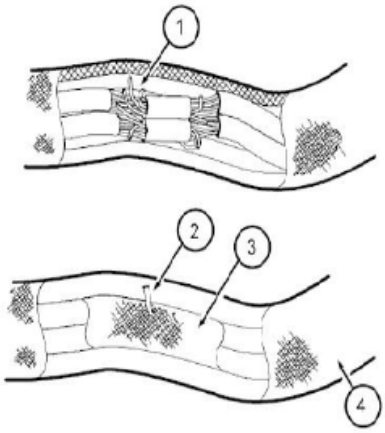
1 = Enlarged

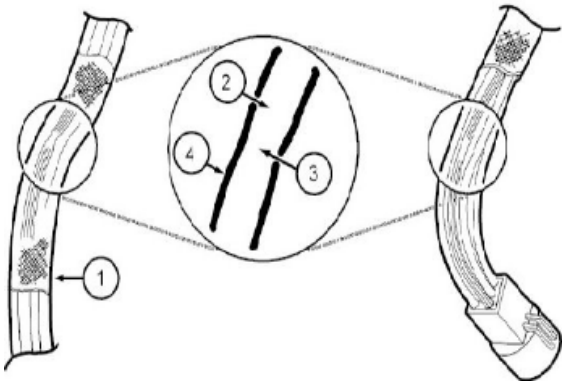
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

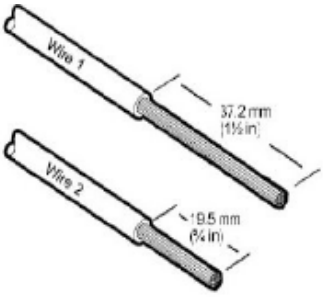
Splice covered 2

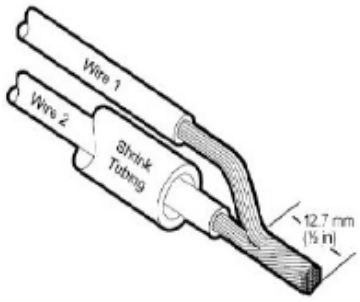
= Wire strand

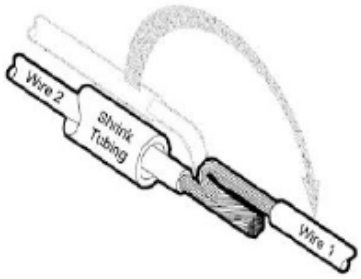
3 = Splice tape

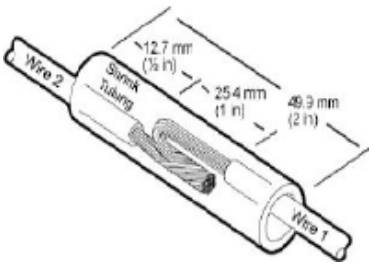
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

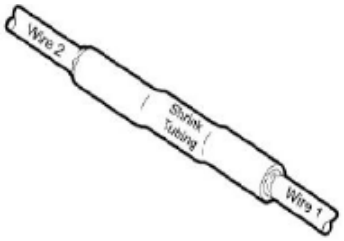
NOTE: -

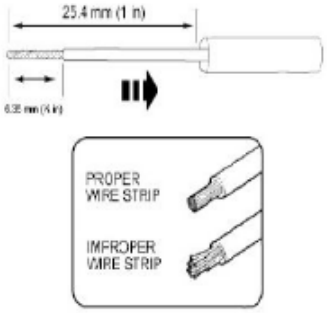
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

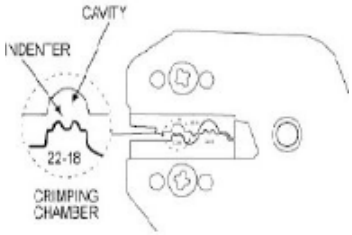
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

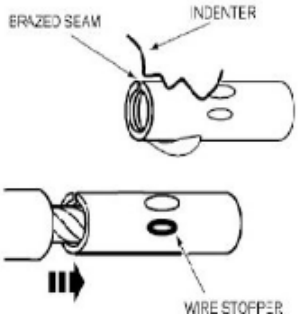
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
6.35 mm (¼ in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

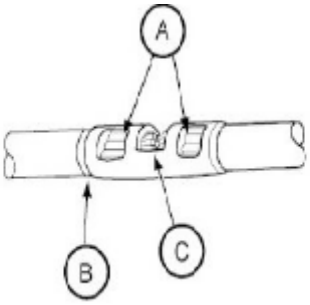
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

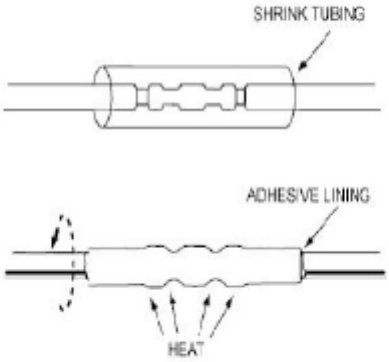
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4□ strip, cut 9 strands	* 1/4□ strip, cut 2 strands	1/4□ strip, no fold	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip, fold 2x dia.	1□ strip, fold 3x dia.
	16-14	* 1/4□ strip, cut 7 strands	1/4□ strip, no fold	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip fold 2x dia	1□ strip, fold 3x dia.	1 1/4□ strip, fold 4x dia.	Not Recommended
	12-10	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip, fold 2x dia.	1□ strip fold 3x cia.	1 1/4□ strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Pigtail only

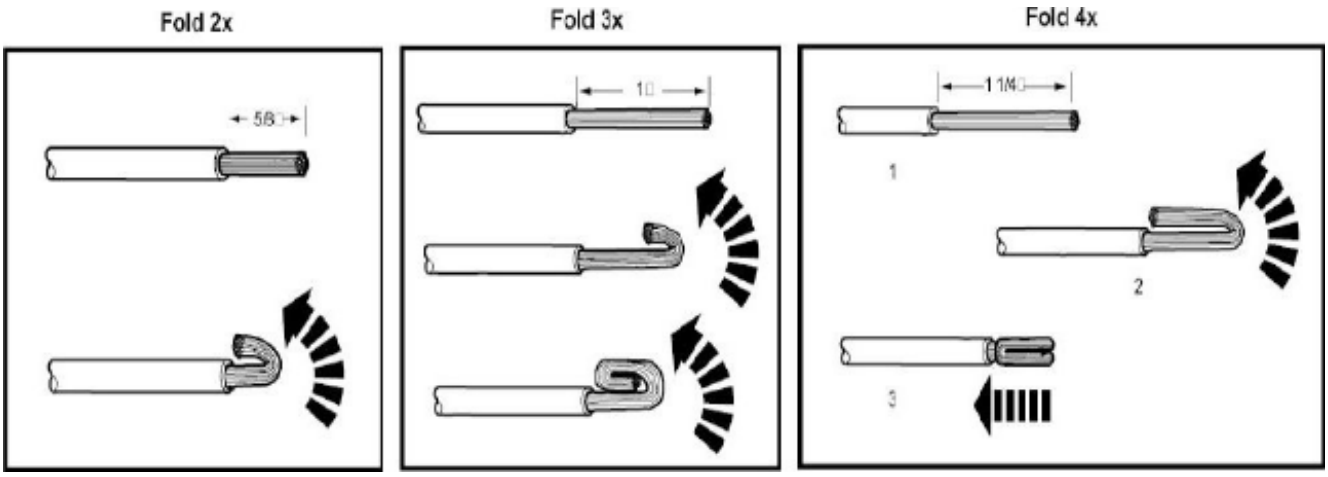
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

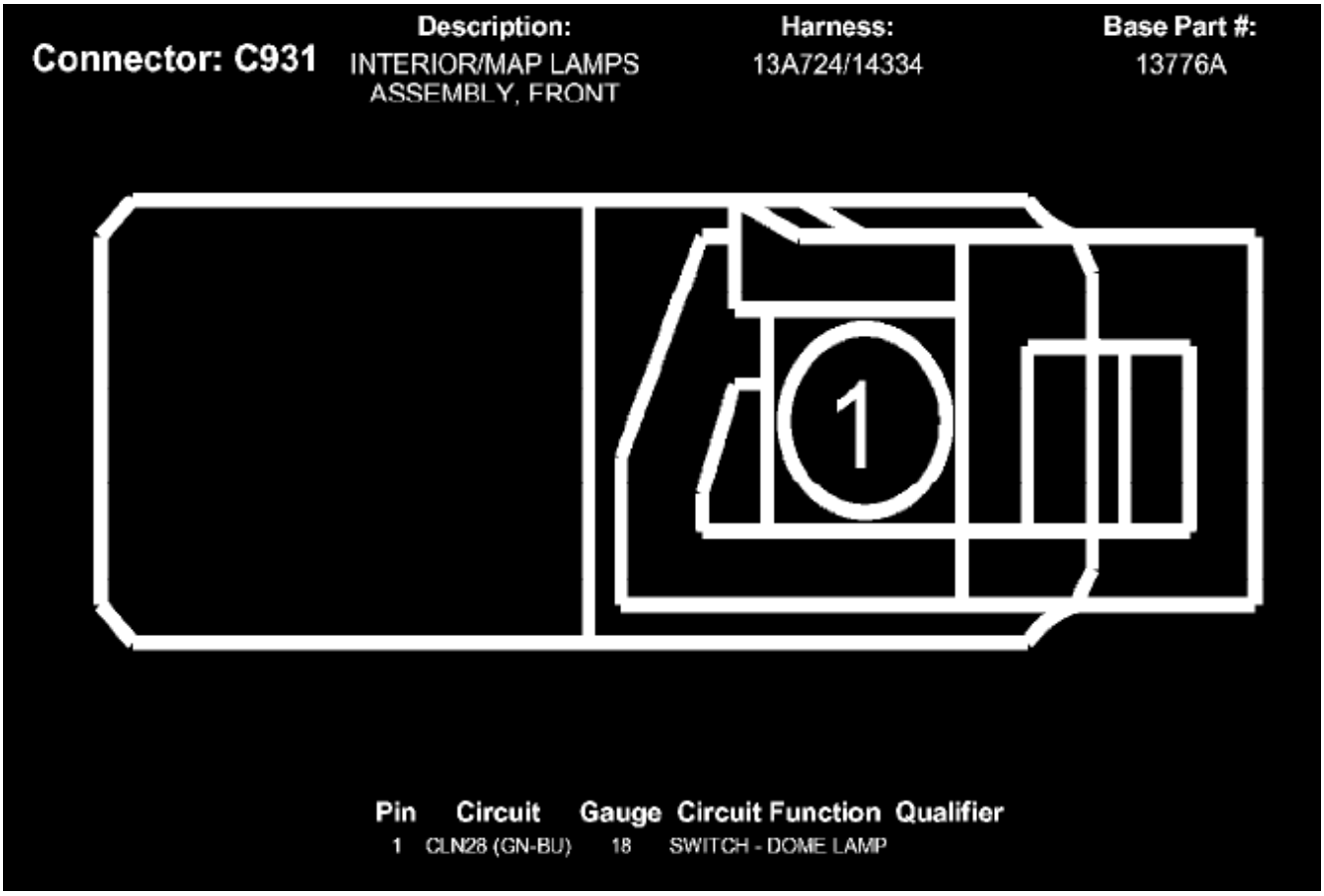
11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

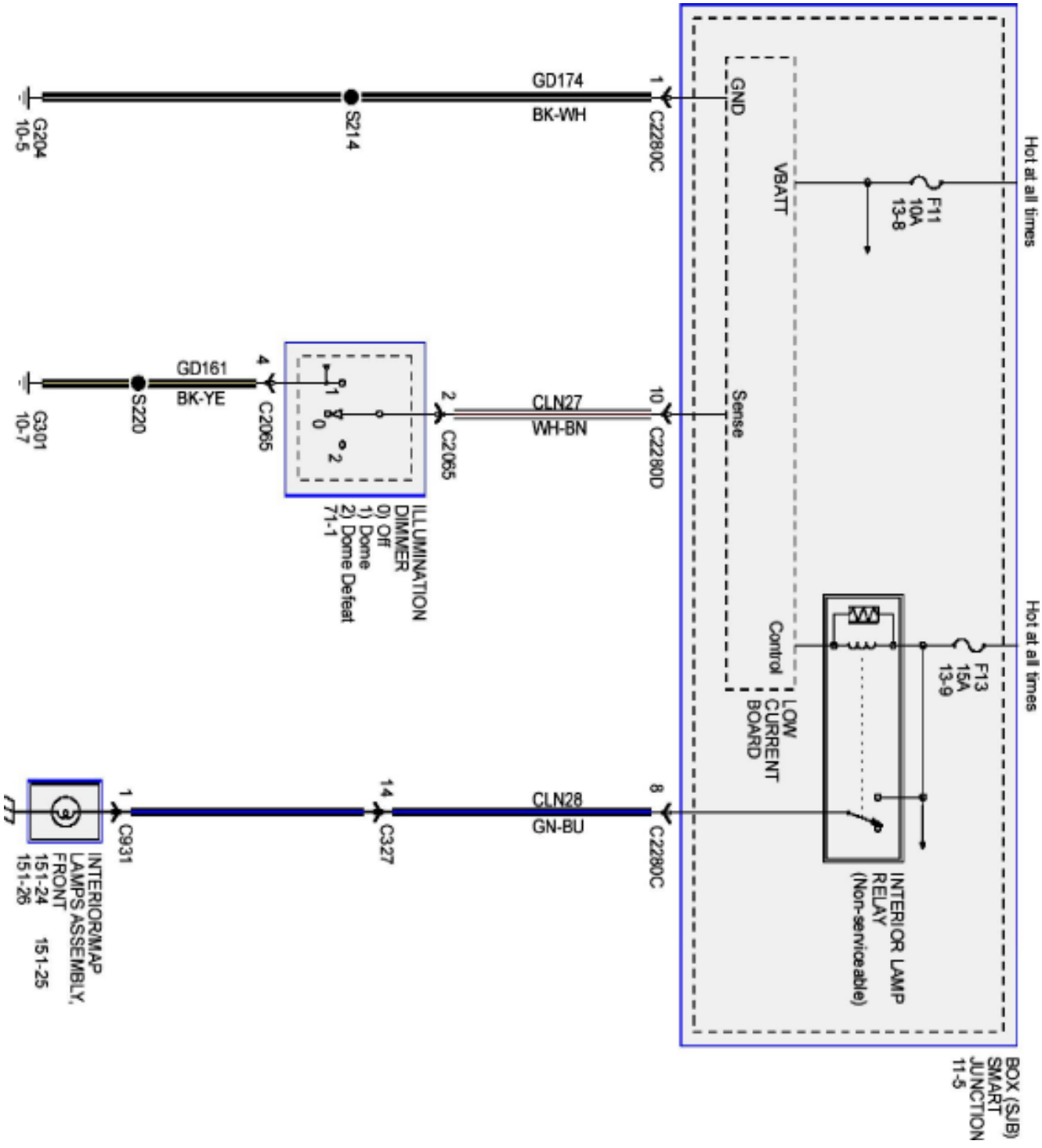
12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.


Connector: C931
Description:
INTERIOR/MAP LAMPS ASSEMBLY, FRONT
Harness:
13A724/14334
Base Part #:
13776A
1
Pin Circuit Gauge Circuit Function Qualifier
1 CLN28 (GN-BU) 18 SWITCH - DOME LAMP

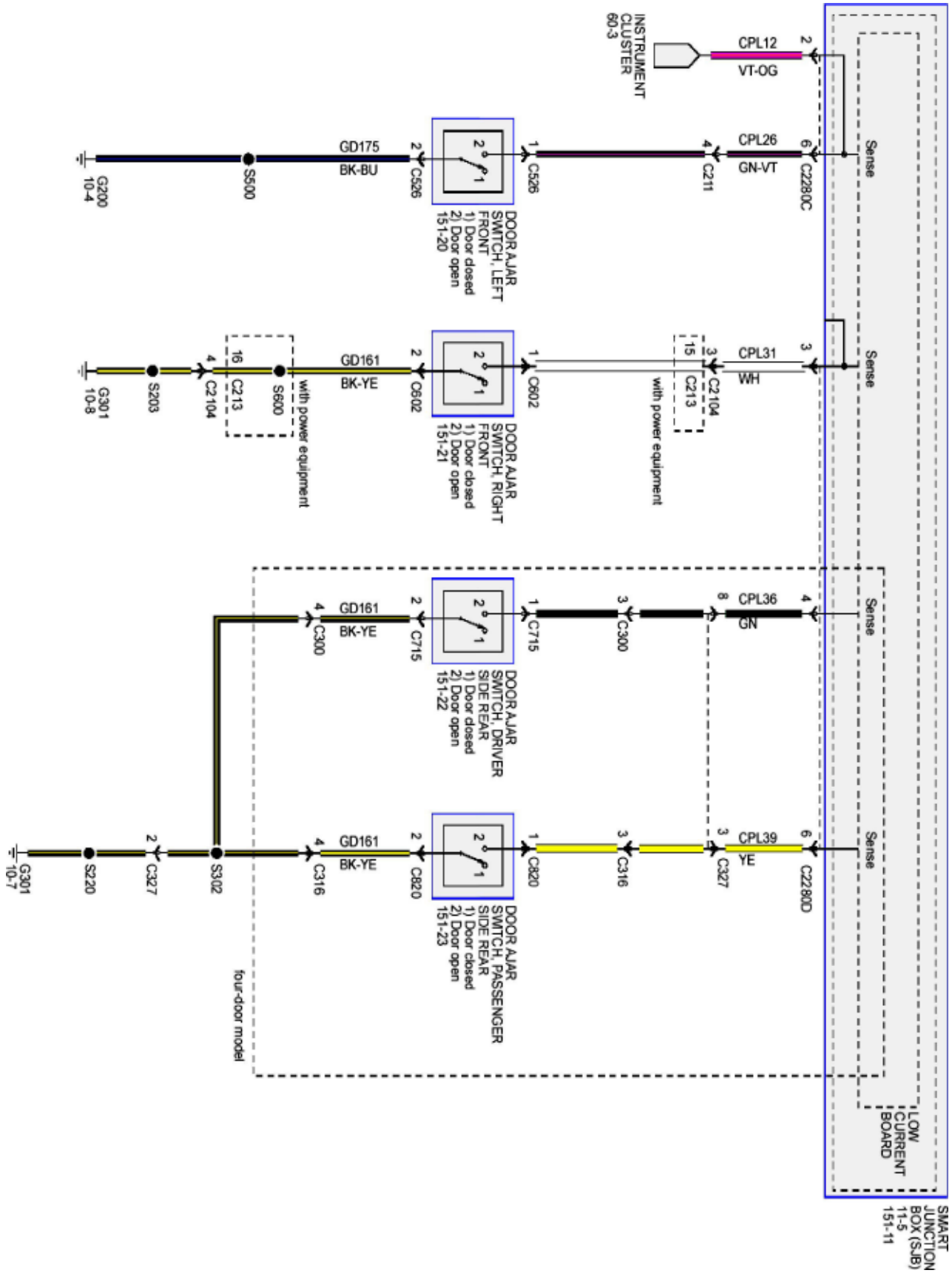
C931



Courtesy Lamp: Electrical Diagrams

PLEASE NOTE: Some diagrams may appear to be missing because of gaps in the number sequences. These "gaps" are actually for diagrams that do not apply to the vehicle model selected.

89-1


INSTRUMENT CLUSTER
60-3
CPL12
VT-OG
CPL26
GN-VT
C2280C
Sense
GD175
BK-BU
G200
10-4
S500
C526
DOOR AJAR SWITCH, LEFT FRONT
1) Door closed
2) Door open
151-20
C211
GD161
BK-YE
G301
10-8
S203
C2104
C213
S600
with power equipment
C602
DOOR AJAR SWITCH, RIGHT FRONT
1) Door closed
2) Door open
151-21
CPL31
WH
C715
DOOR AJAR SWITCH, DRIVER SIDE REAR
1) Door closed
2) Door open
151-22
C300
CPL36
GN
C820
DOOR AJAR SWITCH, PASSENGER SIDE REAR
1) Door closed
2) Door open
151-23
C316
CPL39
YE
C327
C2280D
G301
10-7
S220
S302
four-door model
LOW CURRENT BOARD
SMART JUNCTION BOX (SJB)
11-5
151-11

Diagrams: Other diagrams referred to by number (i.e. 13-2, 24-6, 10-2, etc.) within these diagrams can be found at Diagrams By Number. See: Diagrams/Electrical Diagrams/Diagrams By Number

Locations: Location Views (reference numbers starting with 151-) referred to within these diagrams can be found at Location Views. See: Locations/Component Locations

Visual Inspection Chart

Mechanical	Electrical
• Door ajar switch(es)	• Smart junction box (SJB) fuse 13 (15A) • Lamp • Wiring, terminals or connectors

Courtesy Lamp: Initial Inspection and Diagnostic Overview

Inspection and Verification

INSPECTION AND VERIFICATION

1. Verify the customer concern. 2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. NOTE: Make sure to use the latest scan tool software release.

If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

5. NOTE: The vehicle communication module (VCM) LED prove-out confirms power and ground from the DLC are provided to the VCM.

If the scan tool does not communicate with the VCM: -

Check the VCM connection to the vehicle.

- Check the scan tool connection to the VCM.

- Refer to Information Bus (Module Communications Network), No Power to the Scan Tool, to diagnose no communication with the scan tool.

6. If the scan tool does not communicate with the vehicle:

- Verify the ignition key is in the ON position.

- Verify the scan tool operation with a known good vehicle.

- Refer to Information Bus (Module Communications Network) to diagnose no response from the PCM.

7. Carry out the network test.

- If the scan tool responds with no communication for one or more modules, refer to Information Bus (Module Communications Network).

- If the network test passes, retrieve and record the continuous memory DTCs.

8. Clear the continuous DTCs and carry out the self-test diagnostics for the SJB. 9. If the DTCs retrieved are related to the concern, go to DTC Charts. For all other DTCs, refer to Body Control Systems (Multifunction Electronic

Control Module). See: Diagnostic Trouble Code Descriptions

10. If no DTCs related to the concern are retrieved, GO to Symptom Chart. See: Symptom Related Diagnostic Procedures

Principles of Operation

PRINCIPLES OF OPERATION

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

Interior Lighting

When the SJB detects a request for lighting, it turns on the interior lamp by supplying power to the lamp. The request for lighting can be a signal from a door ajar switch, an interior lighting on command from the instrument panel dimmer switch or an unlock command from a remote keyless entry (RKE) transmitter. The door ajar switches are hard-wired directly to the SJB. The door ajar switches are normally open when the doors are closed. All door ajar switches receives a voltage signal from the SJB and each has its own ground circuit. The instrument panel dimmer switch receives a voltage signal from the SJB and has its own ground circuit. The instrument panel dimmer switch provides variable resistance for backlighting the instrument cluster and a toggle on/off function for the courtesy lamp.

The inputs are: -

Ignition switch position

- LH front door ajar switch

- RH front door ajar switch

- LH rear door ajar switch

- RH rear door ajar switch

- RKE unlock signal

The output is: -

Interior lamp relay.

Illuminated Entry (Option)

The illuminated entry feature requests the interior lamp on when the ignition switch is in the OFF position and the operator activates an external unlock feature (key fob). The illuminated entry feature requests the interior lamp off when: 25 seconds have elapsed, the ignition transitions out of the OFF position, or the customer activates an external lock feature.

The inputs are: -

Ignition switch position

- Unlock request from the RKE transmitter

The output is: -

Interior lamp relay

Demand Lamp

The demand lamp function can be operated independently.

The demand lamp consists of a: -

Interior lamp

- Instrument panel dimmer switch

The demand lamp is also controlled by the interior lighting arbitrator and the interior lamp relay.

Interior Lighting Arbitrator

The interior lighting arbitrator decides between the interior lighting, the illuminated entry lighting, and the battery saver features to determine which feature has precedence for turning on and off the interior light. This feature is internal in the SJB.

The output is: -

Interior lamp relay

Battery Saver

When the ignition is off, the battery saver timer feature provides timed automatic shut-off of power to the interior lamp and the warning chimes. The battery saver has a time-out period of 5 minutes. The battery saver restores power to the interior lamp or resets the 5 minute timer if any of the following interactions are detected: -

The ignition is turned to any position other than OFF.

- Any door becomes ajar.

- Any button of a RKE transmitter which provides access to the vehicle is pressed (key fob).

The inputs are: -

Ignition switch position

- LH front door ajar switch
- RH front door ajar switch
- LH rear door ajar switch
- RH rear door ajar switch
- Any request from the RKE transmitter

The output is: -

Interior lamp relay

Smart Junction Box (SJB) DTC Chart

DTC	Description	Action
B1322	Driver Door Ajar Circuit Short to Ground	GO to Pinpoint Test B.
B1330	Passenger Door Ajar Circuit Short to Ground	GO to Pinpoint Test B.
B1338	Door Ajar RR Circuit Short to Ground	GO to Pinpoint Test B.
B1574	Door Ajar LR Circuit Short to Ground	GO to Pinpoint Test B.
B1688	Dome Lamp Input Circuit Short to Ground	GO to Pinpoint Test B.
All other DTCs	—	REFER to Body Control Systems.

B1322-B1688

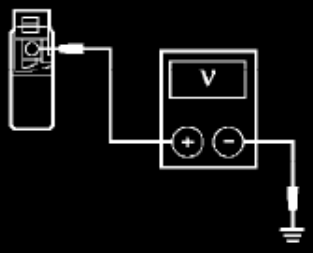
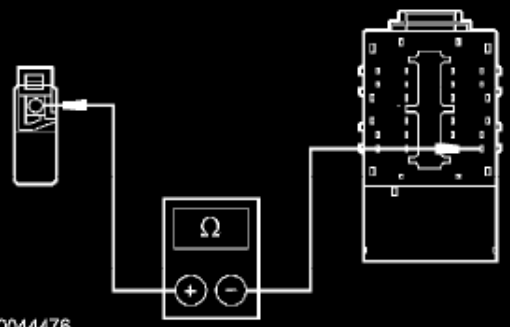
Symptom Chart

Condition	Possible Sources	Action
• The interior lamp is inoperative	• Fuse • Wiring, terminals or connectors • Interior lamp • Smart junction box (SJB)	• GO to Pinpoint Test A.
• The interior lamp stays on continuously	• Wiring, terminals or connectors • Instrument panel dimmer switch • Door ajar switch • Instrument cluster • Four wheel drive (4X4) control module (if equipped) • SJB	• GO to Pinpoint Test B.
• The interior lamp does not turn on with one door open	• Wiring, terminals or connectors • Door ajar switch • SJB	• GO to Pinpoint Test C.
• The illuminated entry is inoperative when using the remote keyless entry (RKE) transmitter	• RKE system • SJB	• GO to Pinpoint Test D.
• The demand lighting is inoperative	• Wiring, terminals or connectors • Instrument panel dimmer switch • SJB	• GO to Pinpoint Test E.
• The battery saver does not deactivate after time-out	• SJB	• INSTALL a new SJB. TEST the system for normal operation.

Symptom Chart

PINPOINT TEST A: THE INTERIOR LAMP IS INOPERATIVE

⚠ CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step		Result / Action to Take
A1	**CHECK CIRCUIT CLN28 (GN/BU) FOR VOLTAGE** • Key in ON position. • Disconnect: Interior Lamp C931. • Open one of the doors. • Measure the voltage between the interior lamp C931-1, circuit CLN28 (GN/BU), harness side and ground.  N0040916 • **Is the voltage greater than 10 volts?**	**Yes** INSTALL a new interior lamp. TEST the system for normal operation. **No** VERIFY the SJB fuse 13 (15A) is OK. If OK, GO to **A2**.
A2	**CHECK CIRCUIT CLN28 (GN/BU) FOR AN OPEN** • Key in OFF position. • Disconnect: SJB C2280c. • Measure the resistance between the SJB C2280c-8, circuit CLN28 (GN/BU), harness side and the interior lamp C931-1, circuit CLN28 (GN/BU), harness side.  N0044476 • **Is the resistance less than 5 ohms?**	**Yes** GO to **A3**. **No** REPAIR the circuit. TEST the system for normal operation.

(Continued)

Courtesy Lamp: Pinpoint Tests

Test A: The Interior Lamp Is Inoperative

PINPOINT TEST A: THE INTERIOR LAMP IS INOPERATIVE

Normal Operation

Voltage is supplied to the SJB through circuit SBB05 (GY/RD). The SJB fuse 13 (15A) supplies voltage to the interior lamp relay (integral to the SJB). When any door is opened, the door ajar

switch closes, signalling the SJB. The SJB monitors the door ajar circuits, and the instrument panel dimmer switch input. Based on these inputs, the SJB supplies voltage to the interior lamp on circuit CLN28 (GN/BU).

This pinpoint test is intended to diagnose the following:

- Fuse

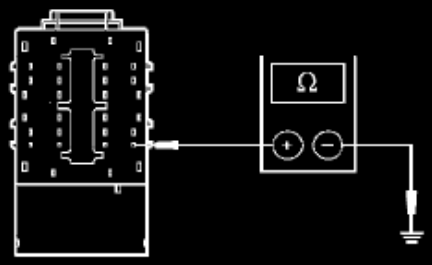
- Wiring, terminals or connectors

- Interior lamp

- SJB

A1-A2

PINPOINT TEST A: THE INTERIOR LAMP IS INOPERATIVE (Continued)

Test Step	Result / Action to Take
A3 CHECK CIRCUIT CLN28 (GN/BU) FOR A SHORT TO GROUND	
• Measure the resistance between the SJB C2280c-8, circuit CLN28 (GN/BU), harness side and ground.  N0044477 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to **A4**. **No** REPAIR the circuit. TEST the system for normal operation.
A4 CHECK FOR CORRECT SJB OPERATION	
• Disconnect all the SJB connectors. • Check for: — corrosion — damaged pins — pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. TEST the system for normal operation.

DTC Description	Fault Trigger Conditions
• B1322 — Driver Door Ajar Circuit Short to Ground	An on-demand DTC that sets when the SJB detects a short to ground from the LH front door ajar circuit.
• B1330 — Passenger Door Ajar Circuit Short to Ground	An on-demand DTC that sets when the SJB detects a short to ground from the RH front door ajar circuit.
• B1338 — Door Ajar RR Circuit Short to Ground	An on-demand DTC that sets when the SJB detects a short to ground from the RH rear door ajar circuit.
• B1574 — Door Ajar LR Circuit Short to Ground	An on-demand DTC that sets when the SJB detects a short to ground from the LH rear door ajar circuit.
• B1688 — Lamp Dome Input Circuit Short to Ground	An on-demand DTC that sets when the SJB detects a short to ground from the dimmer switch circuit.

A3-A4

Test B: The Interior Lamp Stays On Continuously

PINPOINT TEST B: THE INTERIOR LAMP STAYS ON CONTINUOUSLY

Normal Operation

When any door is opened, the door ajar switch closes, signalling the SJB. The SJB monitors the door ajar circuits, and the instrument panel dimmer switch input. Based on these inputs, the SJB will supply voltage to the interior lamp on circuit CLN28 (GN/BU).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors

- Instrument panel dimmer switch

- Four wheel drive (4X4) control module

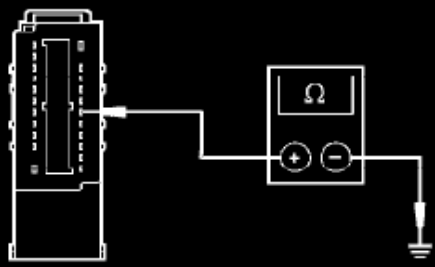
- Instrument cluster

- Door ajar switch

- SJB

PINPOINT TEST B: THE INTERIOR LAMP STAYS ON CONTINUOUSLY

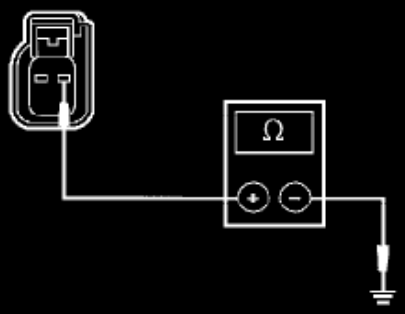
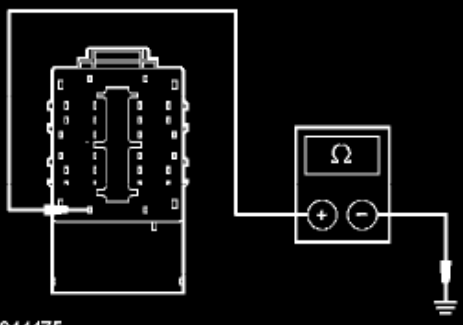
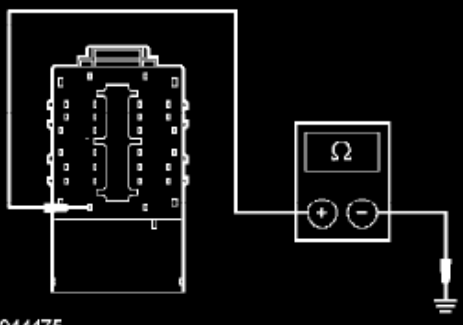
CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step		Result / Action to Take
B1	CHECK THE DOOR AJAR PID STATUS WITH THE SCAN TOOL	
	• Key in ON position. • Close all the doors. • Enter the following diagnostic mode on the scan tool: SJB DataLogger. • Check the SJB PIDs D_DR_SW, P_DR_SW, RRDR_SW, LRDR_SW while opening and closing all the doors. • **Do the door ajar PIDs match the door positions?**	**Yes** GO to **B2**. **No** If the LH front door PID does not match the door position, GO to **B5**. If the RH front door PID does not match the door position, GO to **B10**. If the LH rear door PID (if equipped) does not match the door position, GO to **B12**. If the RH rear door PID (if equipped) does not match the door position, GO to **B14**.
B2	CHECK THE INSTRUMENT PANEL DIMMER SWITCH	
	• Key in OFF position. • Disconnect: Instrument Panel Dimmer Switch C2065. • **Is the interior lamp still illuminated?**	**Yes** GO to **B3**. **No** INSTALL a new instrument panel dimmer switch. TEST the system for normal operation.
B3	CHECK CIRCUIT CLN27 (WH/BN) FOR A SHORT TO GROUND	
	• Disconnect: SJB C2280d. • Measure the resistance between the SJB C2280d-10, circuit CLN27 (WH/BN), harness side and ground.  N0044474 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to **B4**. **No** REPAIR the circuit. TEST the system for normal operation.
B4	CHECK CIRCUIT CLN28 (GN/BU) FOR A SHORT TO VOLTAGE	
	• Disconnect: SJB C2280c. • **Is the interior lamp still illuminated?**	**Yes** REPAIR the circuit. TEST the system for normal operation. **No** GO to **B16**.
B5	CHECK THE LH FRONT DOOR AJAR SWITCH FOR A SHORT TO GROUND	
	• Disconnect: LH Front Door Ajar Switch C526. • Enter the following diagnostic mode on the scan tool: SJB DataLogger. • Monitor the SJB PID D_DR_SW. • **Did the door ajar PID change with the switch disconnected?**	**Yes** INSTALL a new door ajar switch. TEST the system for normal operation. **No** GO to **B6**.
B6	CHECK CIRCUIT CPL26 (GN/VT) FOR A SHORT TO GROUND	
	• Key in OFF position. • Disconnect: SJB C2280c.	

(Continued)

B1-B6

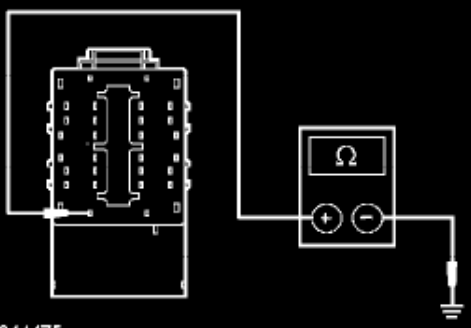
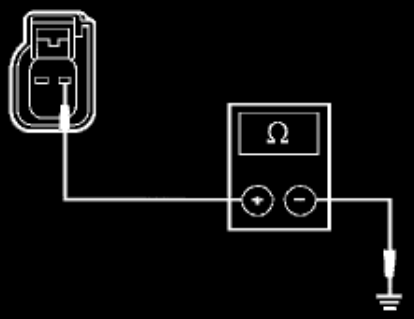
PINPOINT TEST B: THE INTERIOR LAMP STAYS ON CONTINUOUSLY (Continued)

Test Step		Result / Action to Take
B6	CHECK CIRCUIT CPL26 (GN/VT) FOR A SHORT TO GROUND (Continued)	
	• Measure the resistance between the LH front door ajar switch C526-1, circuit CPL26 (GN/VT), harness side and ground.  A0075035 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to **B7**. **No** REPAIR the circuit. TEST the system for normal operation.
B7	CHECK CIRCUIT CPL12 (VT/OG) FOR A SHORT TO GROUND	
	• Measure the resistance between the SJB C2280c-2, circuit CPL12 (VT/OG), harness side and ground.  N0044475 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to **B16**. **No** GO to **B8**.
B8	CHECK THE INSTRUMENT CLUSTER	
	• Disconnect: Instrument Cluster C220a. • Measure the resistance between the SJB C2280c-2, circuit CPL12 (VT/OG), harness side and ground.  N0044475 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to **B17**. **No** GO to **B9**.
B9	CHECK THE 4X4 CONTROL MODULE	
	• Disconnect: 4X4 Control Module C281a.	

(Continued)

B6-B9

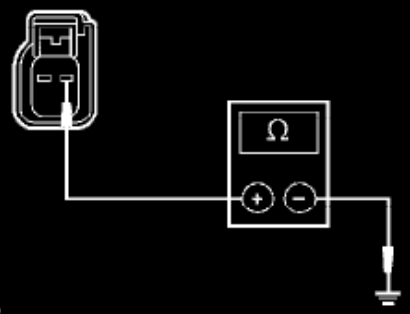
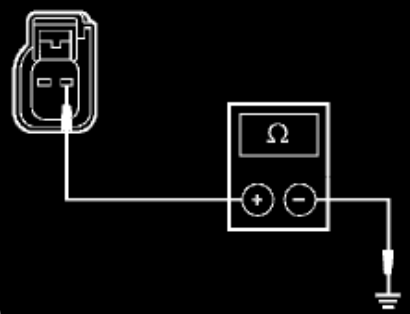
PINPOINT TEST B: THE INTERIOR LAMP STAYS ON CONTINUOUSLY (Continued)

Test Step		Result / Action to Take
B9	CHECK THE 4X4 CONTROL MODULE (Continued)	
	• Measure the resistance between the SJB C2280c-2, circuit CPL12 (VT/OG), harness side and ground.  N0044475 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to **B18**. **No** REPAIR the circuit. TEST the system for normal operation.
B10	CHECK THE RH FRONT DOOR AJAR SWITCH FOR A SHORT TO GROUND	
	• Disconnect: RH Front Door Ajar Switch C602. • Enter the following diagnostic mode on the scan tool: SJB DataLogger. • Monitor the SJB PID P_DR_SW. • **Did the door ajar PID change with the switch disconnected?**	**Yes** INSTALL a new door ajar switch. TEST the system for normal operation. **No** GO to **B11**.
B11	CHECK CIRCUIT CPL31 (WH) FOR A SHORT TO GROUND	
	• Key in OFF position. • Disconnect: SJB C2280d. • Measure the resistance between the RH front door ajar switch C602-1, circuit CPL31 (WH), harness side and ground.  A0075035 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to **B16**. **No** REPAIR the circuit. TEST the system for normal operation.
B12	CHECK THE LH REAR DOOR AJAR SWITCH FOR A SHORT TO GROUND (IF EQUIPPED)	
	• Disconnect: LH Rear Door Ajar Switch C715. • Enter the following diagnostic mode on the scan tool: SJB DataLogger. • Monitor the SJB PID LRDR_SW. • **Did the door ajar PID change with the switch disconnected?**	**Yes** INSTALL a new door ajar switch. TEST the system for normal operation. **No** GO to **B13**.
B13	CHECK CIRCUIT CPL36 (GN) FOR A SHORT TO GROUND	
	• Key in OFF position. • Disconnect: SJB C2280d.	

(Continued)

B9-B13

PINPOINT TEST B: THE INTERIOR LAMP STAYS ON CONTINUOUSLY (Continued)

Test Step		Result / Action to Take
B13	CHECK CIRCUIT CPL36 (GN) FOR A SHORT TO GROUND (Continued)	
	• Measure the resistance between the RH rear door ajar switch C715-1, circuit CPL36 (GN), harness side and ground.  A0075035 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to **B16**. **No** REPAIR the circuit. TEST the system for normal operation.
B14	CHECK THE RH REAR DOOR AJAR SWITCH FOR A SHORT TO GROUND (IF EQUIPPED)	
	• Disconnect: RH Rear Door Ajar Switch C820. • Enter the following diagnostic mode on the scan tool: SJB DataLogger. • Monitor the SJB PID RRDR_SW. • **Did the door ajar PID change with the switch disconnected?**	**Yes** INSTALL a new door ajar switch. TEST the system for normal operation. **No** GO to **B15**.
B15	CHECK CIRCUIT CPL39 (YE) FOR A SHORT TO GROUND	
	• Key in OFF position. • Disconnect: SJB C2280d. • Measure the resistance between the LH rear door ajar switch C820-1, circuit CPL39 (YE), harness side and ground.  A0075035 • **Is the resistance greater than 10,000 ohms?**	**Yes** GO to **B16**. **No** REPAIR the circuit. TEST the system for normal operation.
B16	CHECK FOR CORRECT SJB OPERATION	
	• Disconnect all the SJB connectors. • Check for: — corrosion — damaged pins — pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

(Continued)

B13-B16

PINPOINT TEST B: THE INTERIOR LAMP STAYS ON CONTINUOUSLY (Continued)

Test Step		Result / Action to Take
B17	CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION	
	• Disconnect all the instrument cluster connectors. • Check for: — corrosion — damaged pins — pushed-out pins • Connect all the instrument cluster connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new instrument cluster. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.
B18	CHECK FOR CORRECT 4X4 CONTROL MODULE OPERATION	
	• Disconnect all the 4X4 control module connectors. • Check for: — corrosion — damaged pins — pushed-out pins • Connect all the 4X4 control module connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new 4X4 control module. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST C: THE INTERIOR LAMP DOES NOT TURN ON WITH ONE DOOR OPEN

⚠ CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step		Result / Action to Take
C1	CHECK THE DOOR AJAR PIDs	
	• Key in ON position. • Enter the following diagnostic mode on the scan tool: SJB DataLogger. • Check the SJB PIDs D_DR_SW, P_DR_SW, RRDR_SW, LRDR_SW while opening and closing all the doors. • **Do the PID values agree with all the door positions?**	**Yes** GO to **C5**. **No** GO to **C2**.
C2	CHECK THE GROUND CIRCUIT FOR AN OPEN	
	• Key in OFF position. • Disconnect: Suspect Door Ajar Switch. • Measure the resistance between the suspect door ajar switch, harness side and ground as follows:	

(Continued)

B17-B18

Test C: The Interior Lamp Does Not Turn On With One Door Open

PINPOINT TEST C: THE INTERIOR LAMP DOES NOT TURN ON WITH ONE DOOR OPEN

Normal Operation

When any door is opened, the door ajar switch closes and signals the SJB. The SJB receives the door open signal and activates the interior lamp relay (integral to the SJB) and supplies voltage to circuit CLN28 (GN/BU).

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors

- Door ajar switch

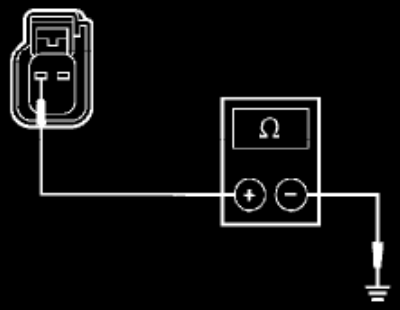
- SJB

C1-C2

PINPOINT TEST C: THE INTERIOR LAMP DOES NOT TURN ON WITH ONE DOOR OPEN (Continued)

Test Step	Result / Action to Take
C2 CHECK THE GROUND CIRCUIT FOR AN OPEN (Continued)	

Location	Connector-Pin	Circuit
LH front	C526-2	GD175 (BK/BU)
RH front	C602-2	GD161 (BK/YE)
LH rear	C715-2	GD161 (BK/YE)
RH rear	C820-2	GD161 (BK/YE)



A0075031

- **Is the resistance less than 5 ohms?**

Yes
GO to **C3**.
No
REPAIR the circuit. TEST the system for normal operation.

C3 CHECK THE DOOR AJAR SIGNAL CIRCUIT FOR AN OPEN

- Disconnect: SJB C2280c (LH Front) or C2280d (All Other Doors).
- Measure the resistance between the inoperative door ajar switch and the SJB as follows:

Location	Door Ajar Connector-Pin	SJB Connector-Pin	Circuit
LH front	C526-1	C2280c-6	CPL26 (GN/VT)
RH front	C602-1	C2280d-3	CPL31 (WH)
LH rear	C715-1	C2280d-4	CPL36 (GN)
RH rear	C820-1	C2280d-6	CPL39 (YE)

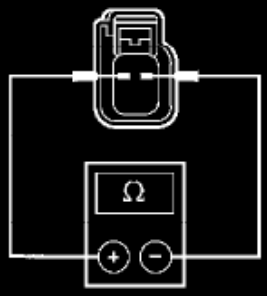
- **Is the resistance less than 5 ohms?**

Yes
GO to **C4**.
No
REPAIR the circuit in question. TEST the system for normal operation.

(Continued)

C2-C3

PINPOINT TEST C: THE INTERIOR LAMP DOES NOT TURN ON WITH ONE DOOR OPEN (Continued)

	Test Step	Result / Action to Take
C4	CHECK THE DOOR AJAR SWITCH	
	• Measure the resistance between the suspect door ajar switch pin 1, component side and the suspect door ajar switch pin 2, component side while toggling the switch open and closed.  A0075036 • **Is the resistance less than 5 ohms when the switch is released and greater than 10,000 ohms when the switch is pressed?**	**Yes** GO to **C5**. **No** INSTALL a new door ajar switch. TEST the system for normal operation.
C5	CHECK FOR CORRECT SJB OPERATION	
	• Disconnect all the SJB connectors. • Check for: — corrosion — damaged pins — pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST D: THE ILLUMINATED ENTRY IS INOPERATIVE WHEN USING THE REMOTE KEYLESS ENTRY (RKE) TRANSMITTER

	Test Step	Result / Action to Take
D1	CHECK THE DOOR LOCK OPERATION USING THE RKE TRANSMITTER	
	• Unlock and lock the doors using the RKE transmitter. • **Do the vehicle doors unlock and lock using the RKE transmitter?**	**Yes** GO to Pinpoint Test A. **No** REFER to Locks to continue diagnosis of the RKE system.

C4-C5

Test D: The Illuminated Entry Is Inoperative When Using the Remote Keyless Entry (RKE) Transmitter

PINPOINT TEST D: THE ILLUMINATED ENTRY IS INOPERATIVE WHEN USING THE REMOTE KEYLESS ENTRY (RKE) TRANSMITTER

Normal Operation

The illuminated entry provides interior lighting when the SJB receives an UNLOCK request from the RKE transmitter. The SJB receives the RKE signal it activates the interior lamp relay (integral to the SJB) and applies voltage to circuit CLN28 (GN/BU).

This pinpoint test is intended to diagnose the following:

- RKE system

- SJB

D1

Test E: The Demand Lighting Is Inoperative

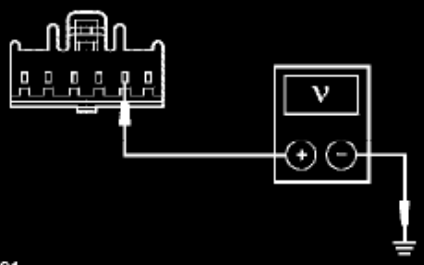
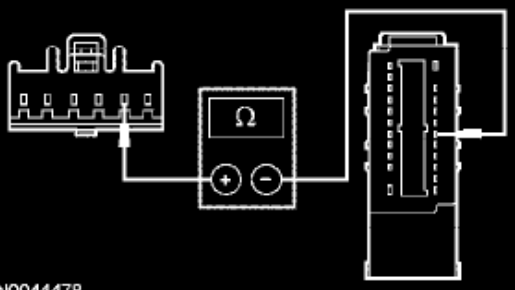
PINPOINT TEST E: THE DEMAND LIGHTING IS INOPERATIVE

Normal Operation

The instrument panel dimmer switch controls the demand lighting function. When the instrument panel dimmer switch is closed, the voltage reference circuit signals from the SJB. The SJB monitors the instrument panel dimmer switch circuit, and based on the status, the SJB supplies voltage to the

PINPOINT TEST E: THE DEMAND LIGHTING IS INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step		Result / Action to Take
E1	CHECK CIRCUIT CLN27 (WH/BN) FOR VOLTAGE • Key in OFF position. • Disconnect: Instrument Panel Dimmer Switch C2065. • Key in ON position. • Measure the voltage between the dimmer control switch C2065-2, circuit CLN27 (WH/BN), harness side and ground.  N0047001 • **Is any voltage present?**	**Yes** GO to **E3**. **No** GO to **E2**.
E2	CHECK CIRCUIT CLN27 (WH/BN) FOR AN OPEN • Key in OFF position. • Disconnect: SJB C2280d. • Measure the resistance between the instrument panel dimmer switch C2065-2, circuit CLN27 (WH/BN), harness side and the SJB C2280d-10, circuit CLN27 (WH/BN), harness side.  N0044478 • **Is the resistance less than 5 ohms?**	**Yes** GO to **E5**. **No** REPAIR the circuit. TEST the system for normal operation.

(Continued)

interior lamp on circuit CLN28 (GN/BU). The interior lamp relay in the SJB deactivates the voltage after a predetermined time-out or if turned off from the instrument panel dimmer switch.

This pinpoint test is intended to diagnose the following:

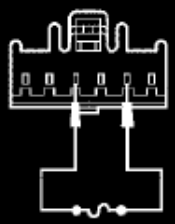
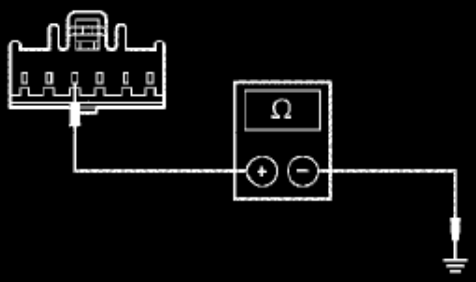
- Wiring, terminals or connectors

- Instrument panel dimmer switch

- SJB

E1-E2

PINPOINT TEST E: THE DEMAND LIGHTING IS INOPERATIVE (Continued)

Test Step		Result / Action to Take
E3	CHECK THE INSTRUMENT PANEL DIMMER SWITCH	
	• Connect a fused (5A) jumper wire between the instrument panel dimmer switch C2065-2, circuit CLN27 (WH/BN), harness side and the instrument panel dimmer switch C2065-4, circuit GD161 (BK/YE), harness side.  N0047002 • **Do the interior lamps illuminate?**	**Yes** REMOVE the jumper wire. INSTALL a new instrument panel dimmer switch. TEST the system for normal operation. **No** REMOVE the jumper wire. GO to **E4**.
E4	CHECK CIRCUIT GD161 (BK/YE) FOR AN OPEN	
	• Measure the resistance between the instrument panel dimmer switch C2065-4, circuit GD161 (BK/YE), harness side and ground.  N0044479 • **Is the resistance less than 5 ohms?**	**Yes** GO to **E5**. **No** REPAIR the circuit. TEST the system for normal operation.
E5	CHECK FOR CORRECT SJB OPERATION	
	• Disconnect all the SJB connectors. • Check for: — corrosion — damaged pins — pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

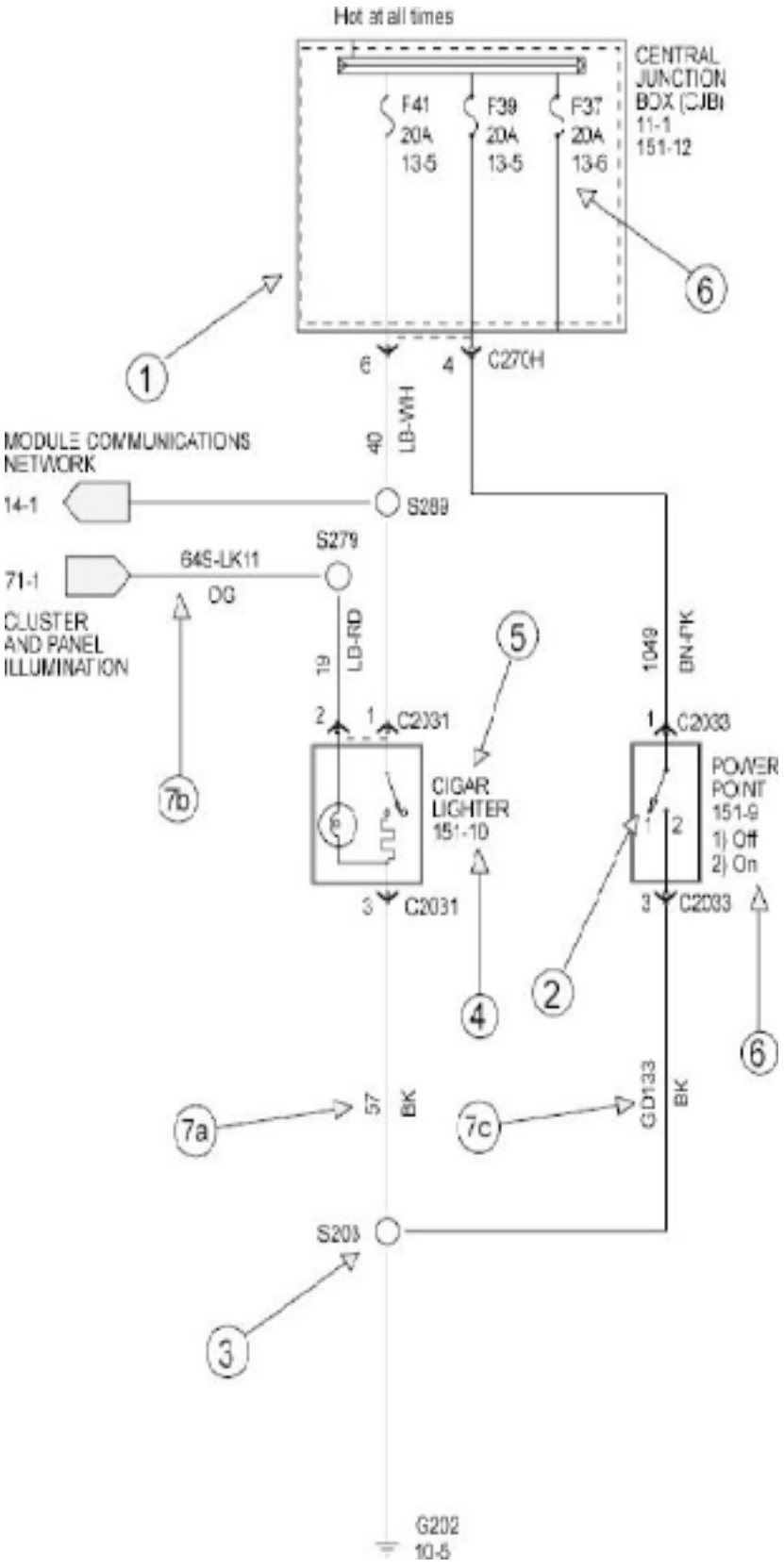
E3-E5

Special Tool(s)

ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool
ST1137-A	73III Automotive Meter 105-R0057 or equivalent
ST2574-A	Flex Probe Kit 105-R025C or equivalent

Special Tool(s)

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Lighting and Horns > Daytime Running Lamp > Component Information > Diagrams > Diagram Information and Instructions



Daytime Running Lamp: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

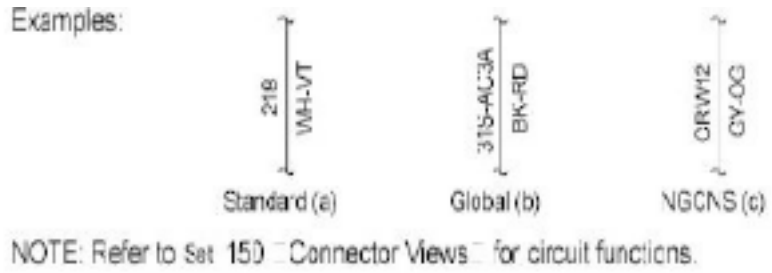
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

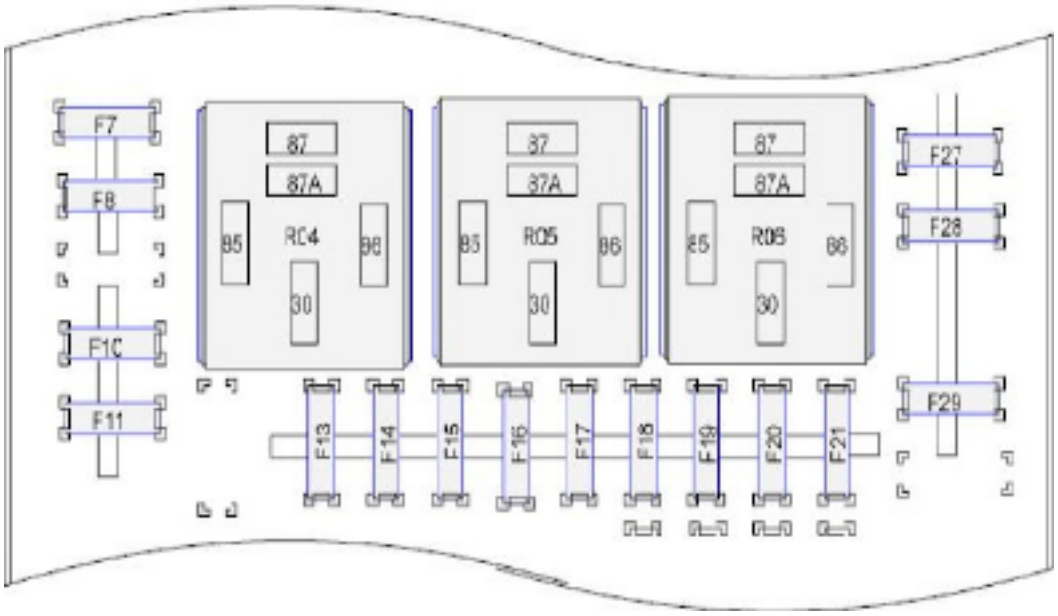
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

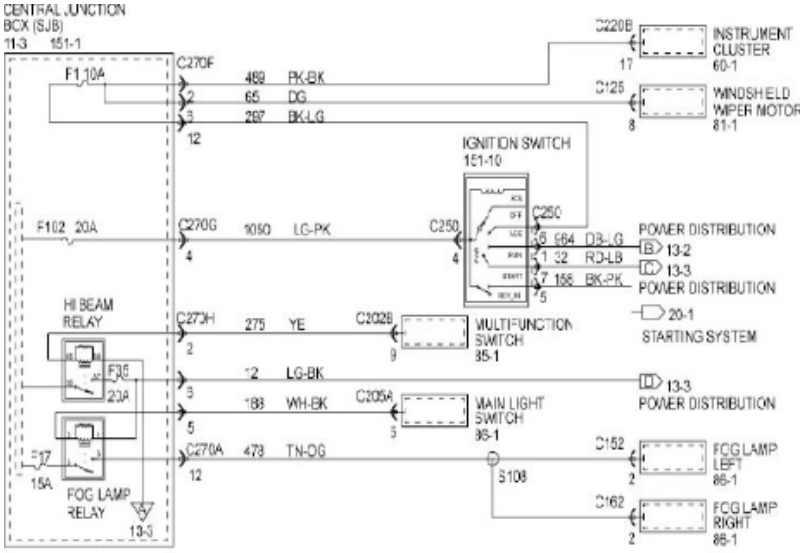
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

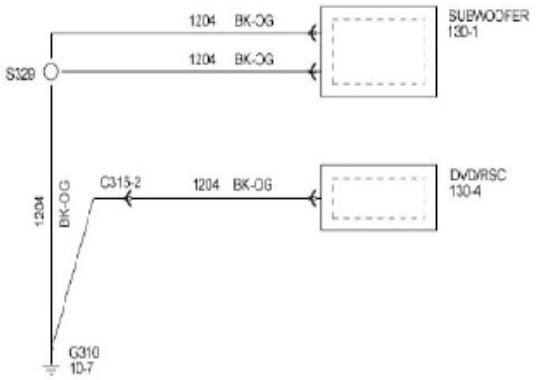
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

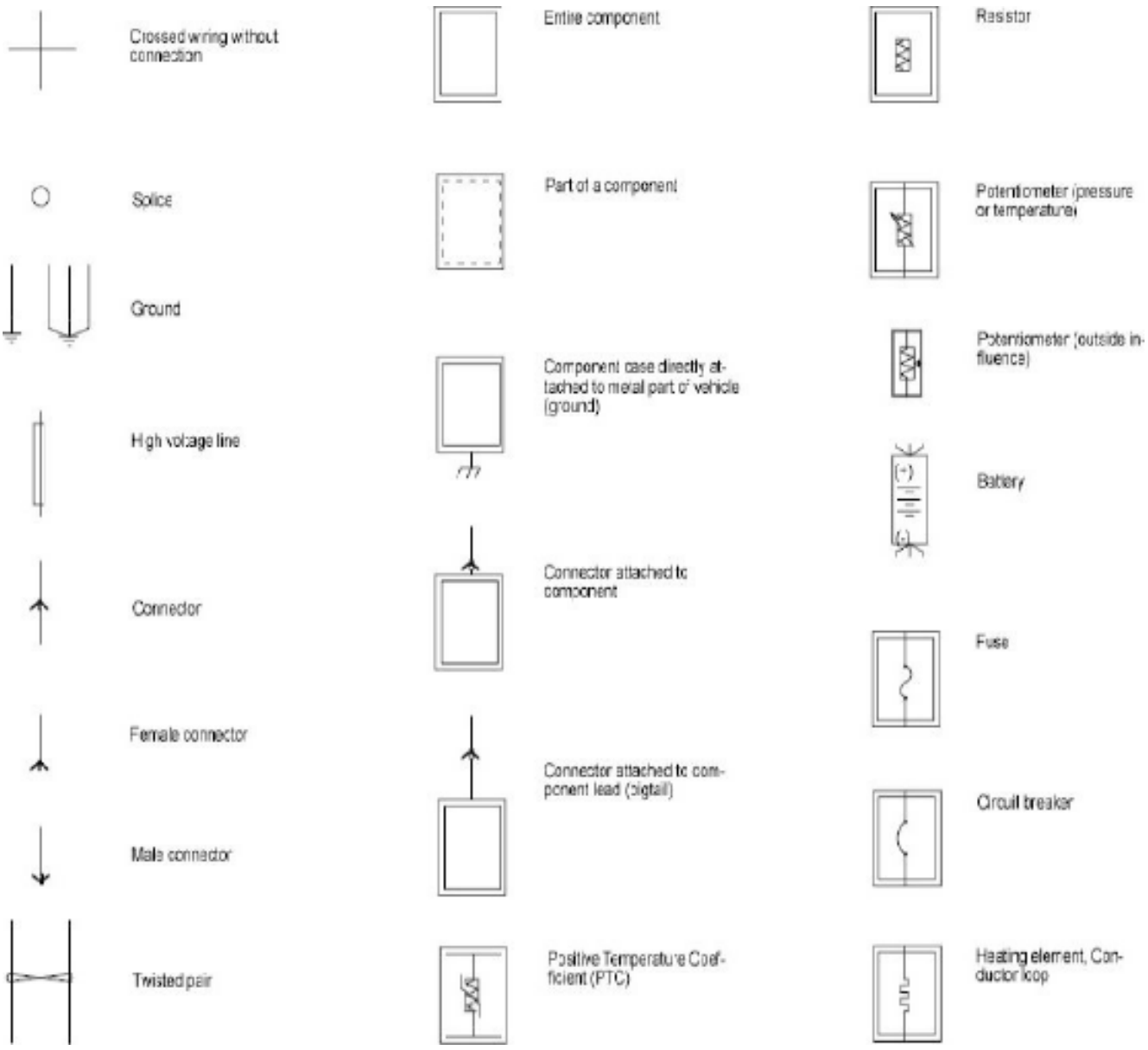
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

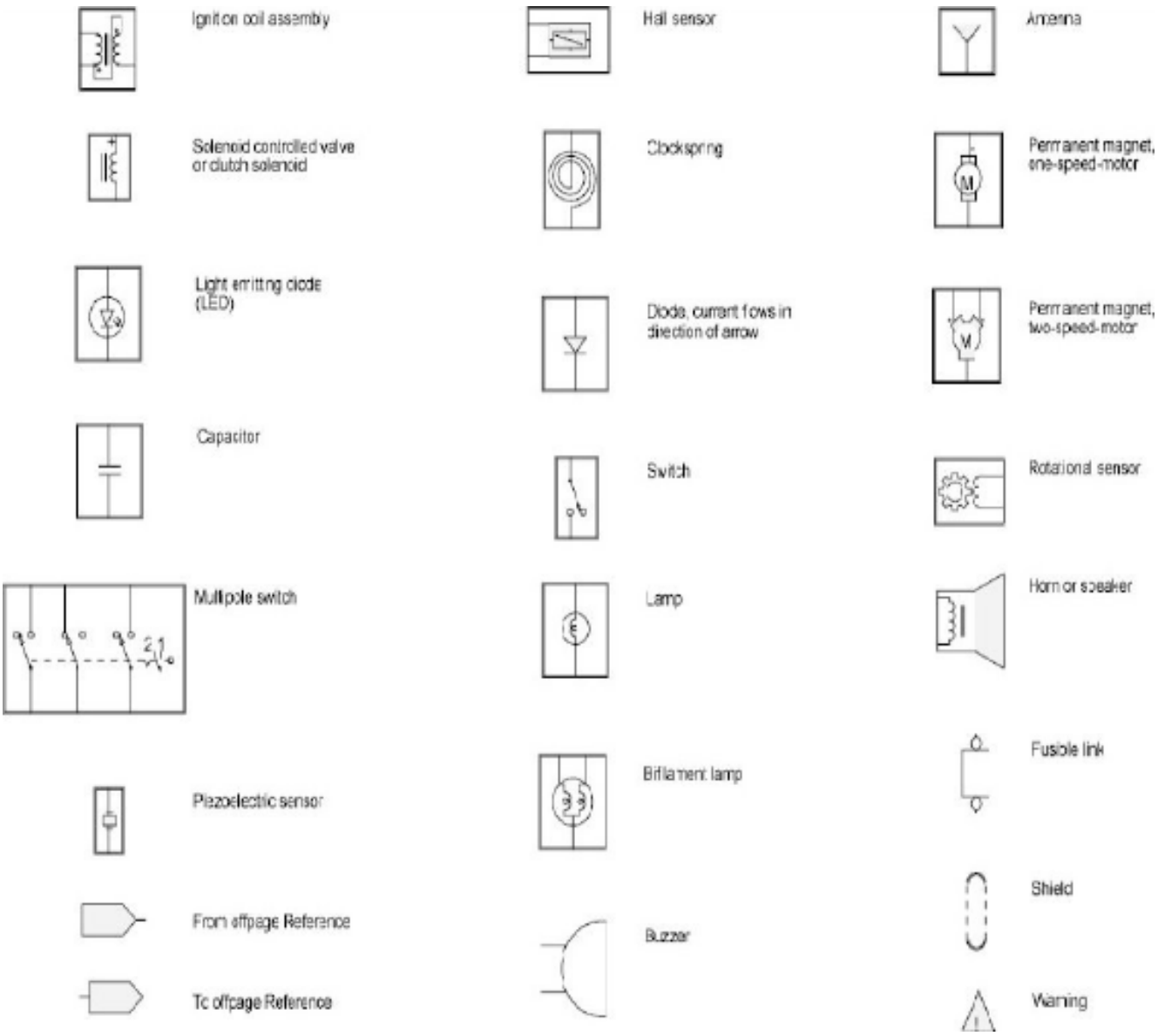
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

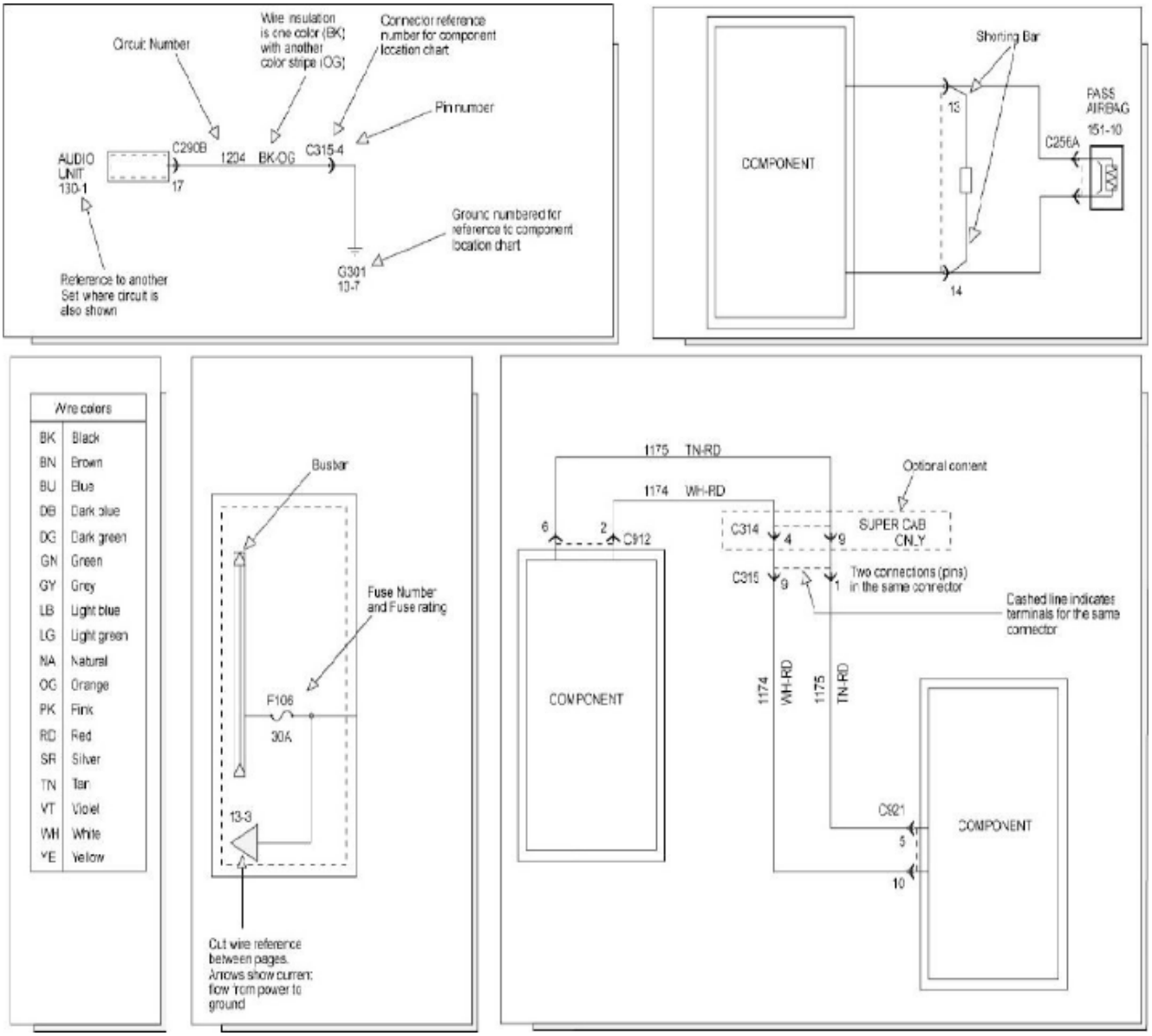
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

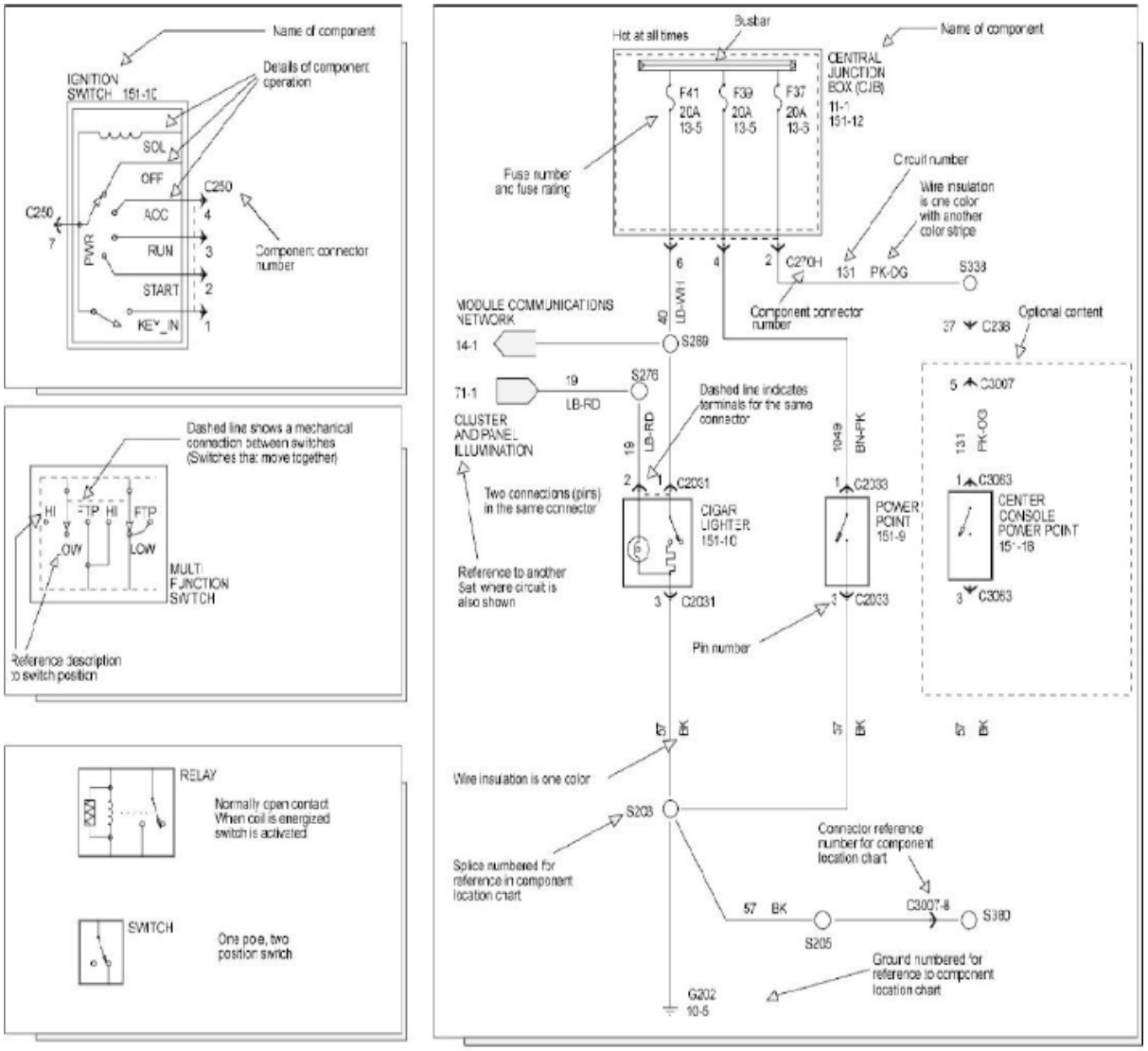
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

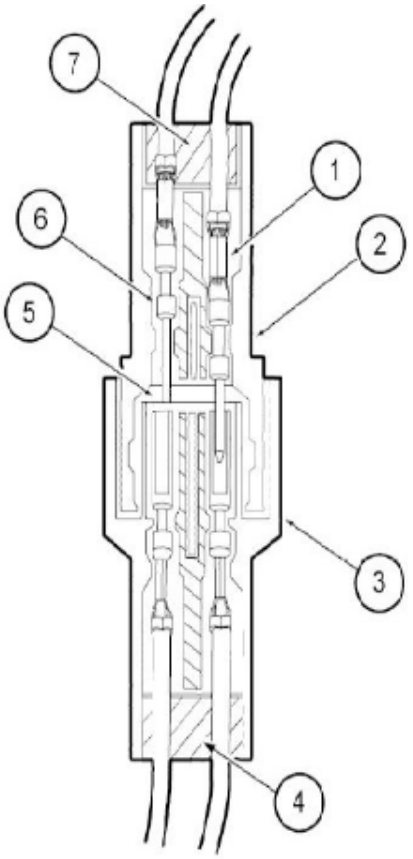


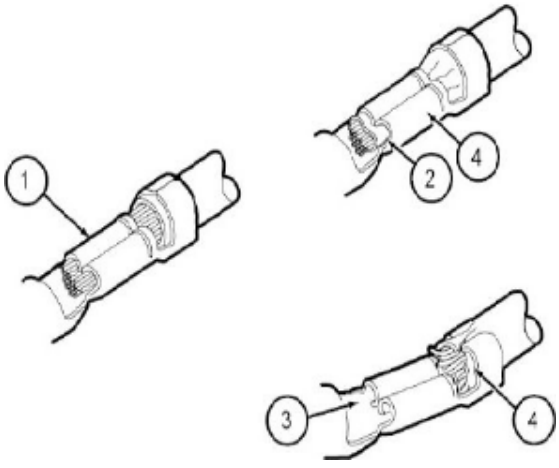
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Daytime Running Lamp: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

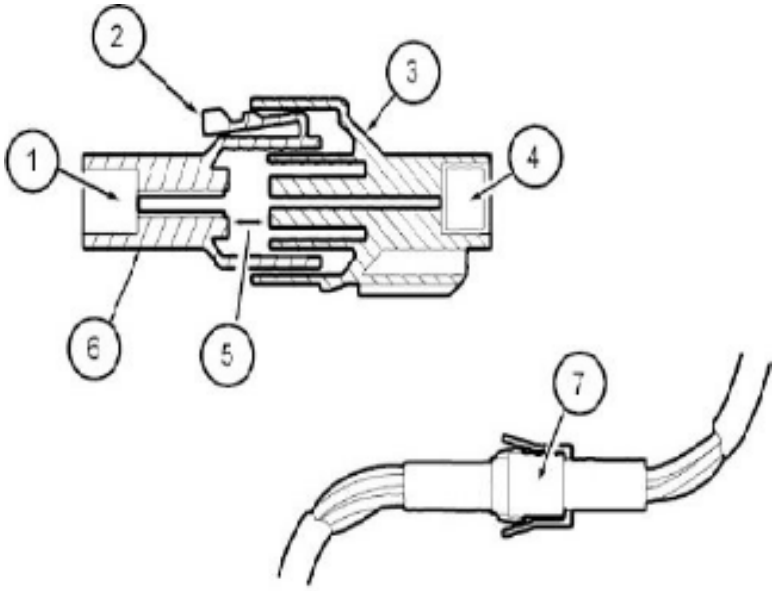
5 = Intermittent contact

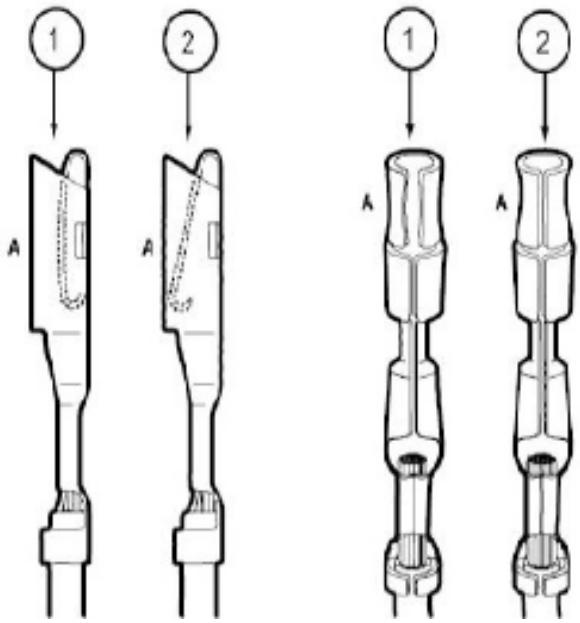
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

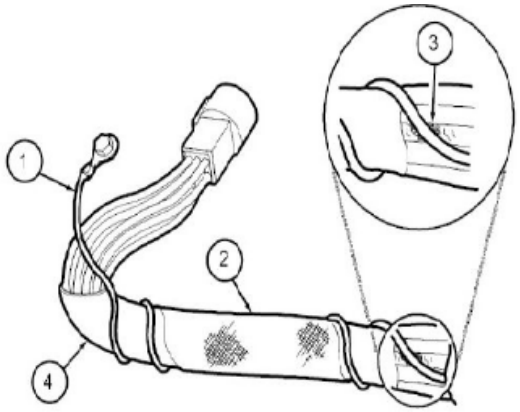
Deformed (enlarged) female terminals

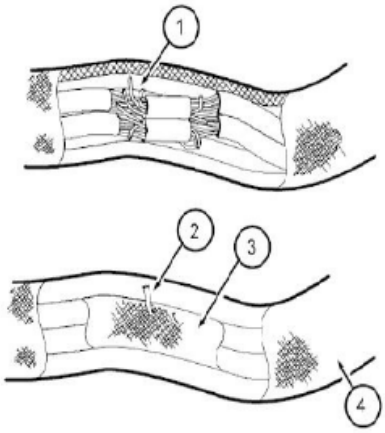
1 = Enlarged

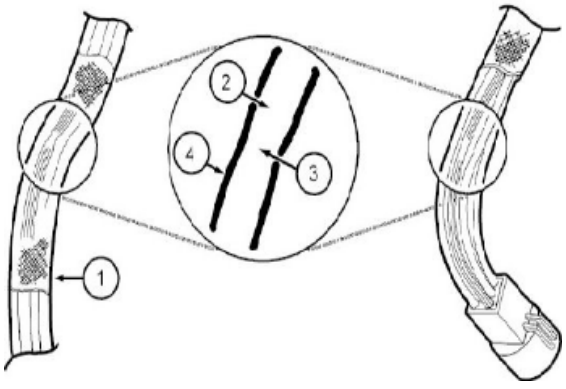
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

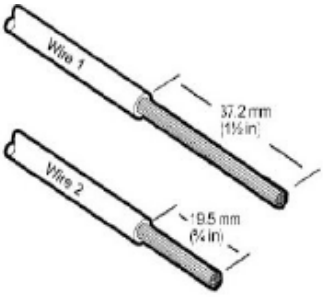
Splice covered 2

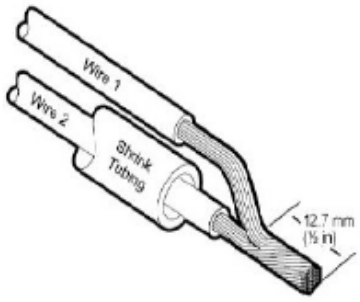
= Wire strand

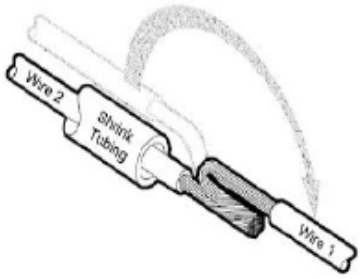
3 = Splice tape

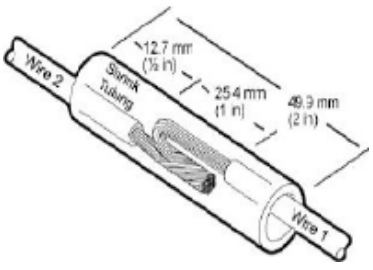
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

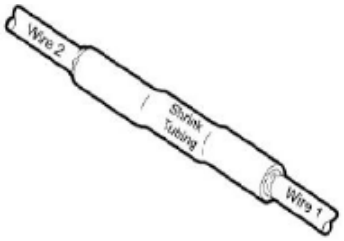
NOTE: -

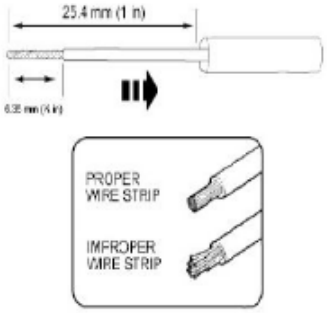
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

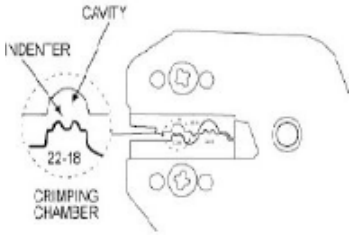
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

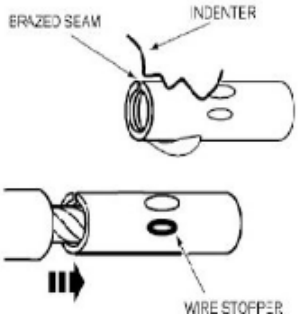
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
6.35 mm (¼ in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

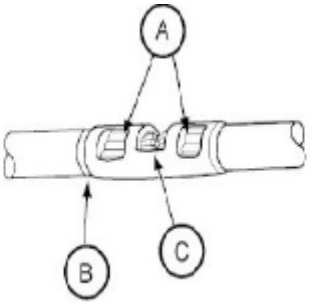
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

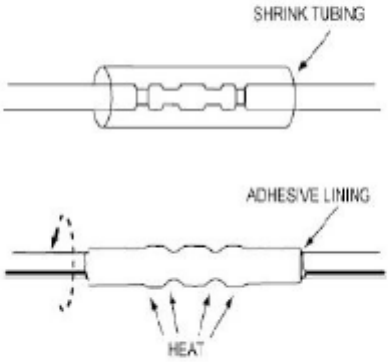
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4 strip, cut 9 strands	* 1/4 strip, cut 2 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip, fold 3x dia.
	16-14	* 1/4 strip, cut 7 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip fold 2x dia	1 strip, fold 3x dia.	1 1/4 strip, fold 4x dia.	Not Recommended
	12-10	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip fold 3x cia.	1 1/4 strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Figtail only

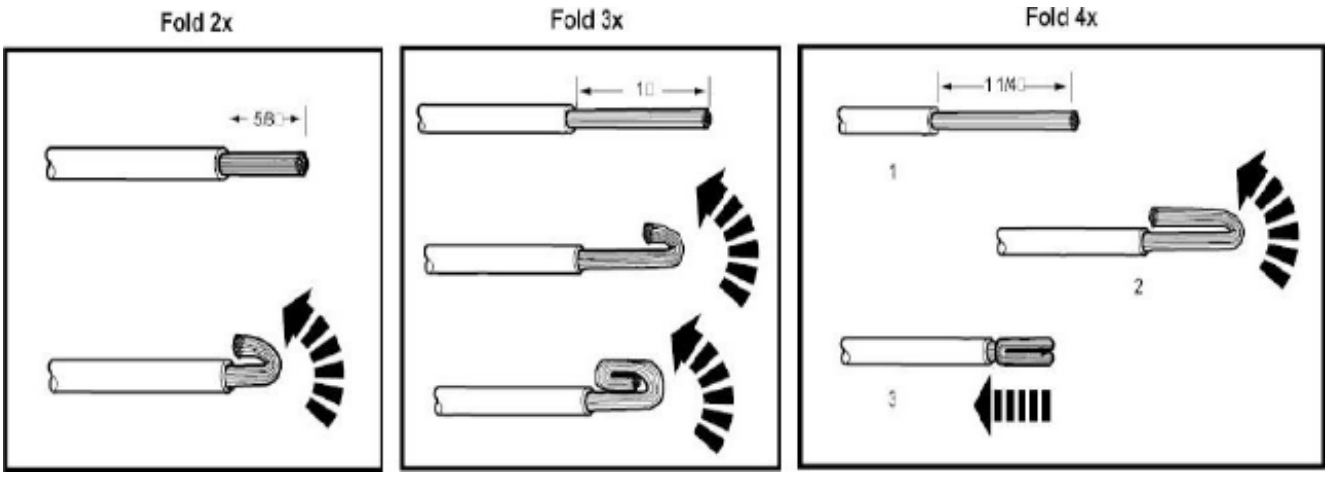
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

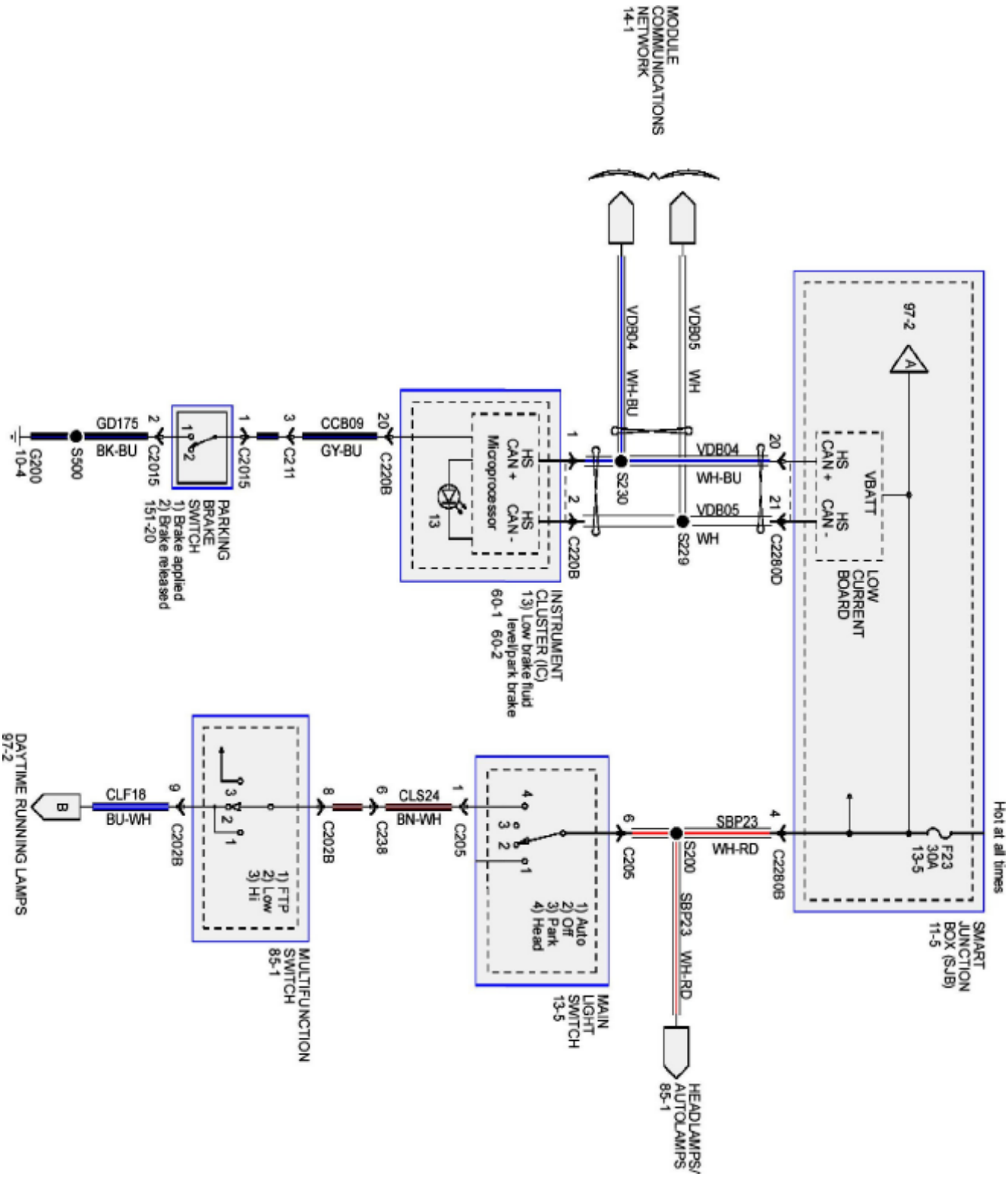
11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



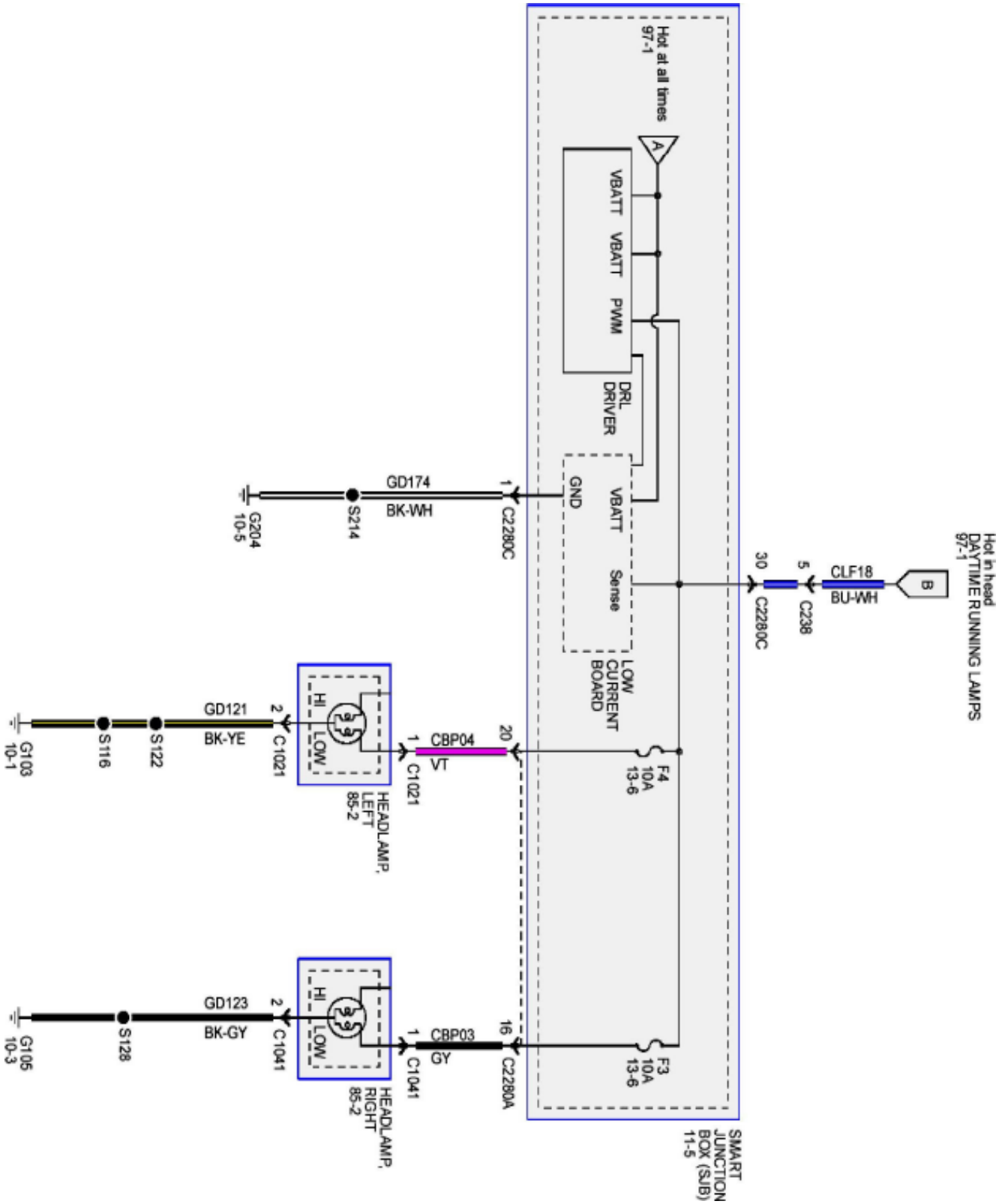
The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.



Daytime Running Lamp: Electrical Diagrams

PLEASE NOTE: Some diagrams may appear to be missing because of gaps in the number sequences. These "gaps" are actually for diagrams that do not apply to the vehicle model selected.

97-1


Hot at all times
97-1
A
VBATT
VBATT
PWM
DRL DRIVER
GND
VBATT
Sense
LOW CURRENT BOARD
SMART JUNCTION BOX (SJB)
11-5
Hot in head DAYTIME RUNNING LAMPS
97-1
B
CLF18
BU-WH
30
5
C238
C2280C
GD174
BK-WH
1
C2280C
S214
G204
10-5
F4
10A
13-6
F3
10A
13-6
CBP04
VT
20
1
C1021
CBP03
GY
16
1
C1041
C2280A
GD121
BK-YE
2
C1021
S116
S122
G103
10-1
GD123
BK-GY
2
C1041
S128
G105
10-3
HI
LOW
HEADLAMP, LEFT
85-2
HEADLAMP, RIGHT
85-2

Diagrams: Other diagrams referred to by number (i.e. 13-2, 24-6, 10-2, etc.) within these diagrams can be found at Diagrams By Number. See: Diagrams/Electrical Diagrams/Diagrams By Number

Locations: Location Views (reference numbers starting with 151-) referred to within these diagrams can be found at Location Views. See: Locations/Component Locations

Daytime Running Lamp: Initial Inspection and Diagnostic Overview

PRINCIPLES OF OPERATION

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

The DRL are controlled by the smart junction box (SJB). The SJB operates the low beam headlamps at a reduced intensity. The DRL driver (integral to the SJB) supplies pulse-width modulated (PWM) voltage to the low beam headlamps when the following conditions are met:

- The high beam headlamps are not on

- The ignition switch is in the RUN position

- The parking brake is not engaged

The SJB utilizes a protective circuit strategy for many of its outputs (for example, the headlamp output circuit). Output loads (current level) are monitored for excessive current (typically short circuits) and are shut down (turns off the voltage or ground provided by the module) when a fault is detected. A continuous DTC is stored at that time of the fault. The circuit then resets after an ignition cycle or customer demand of the function (switching the component on, battery saver being energized).

When an excessive circuit load occurs several times, the module shuts down the output until a service procedure is carried out. At the same time, the continuous DTC that was stored on the first failure cannot be cleared by a command to clear the continuous DTCs. The module does not allow this code to be cleared or the circuit restored to normal until a successful on-demand self-test proves that the fault has been repaired. After the on-demand self-test has successfully completed (no on-demand DTCs present), the continuous DTC clears and the circuit function returns.

Smart Junction Box (SJB) DTC Chart

DTC	Description	Action
B106E	Solid State Driver Disabled Due to Short	GO to Pinpoint Test W.
B2973	Daytime Running Lamps Output Shorted to Ground	GO to Pinpoint Test W.
U0155	Lost Communication With Instrument Panel Cluster (IC) Control Module	GO to Pinpoint Test X.
All other DTCs	—	REFER to Body Control Systems.

B106E-B2973 / U0155

Symptom Chart

Condition	Possible Sources	Action
• The daytime running lamps (DRL) are inoperative	• Headlamp bulbs • Smart junction box (SJB)	• **NOTE:** Make sure the SJB is configured for DRL. PLACE the headlamp switch in the HEADLAMPS ON position. — If the headlamps operate correctly, GO to Pinpoint Test W. — If the headlamps do not operate correctly, REFER to Headlamps.
• The daytime running lamps (DRL) are on with the parking brake set	• Parking brake switch input • SJB	• APPLY the parking brake with the ignition switch in the RUN position. — If the brake warning indicator operates correctly, INSTALL a new SJB. TEST the system for normal operation. — If the brake warning indicator does not operate correctly, REFER to Instrument Panel, Gauges and Warning Indicators to continue diagnosis of the brake warning indicator.

Symptom Chart

PINPOINT TEST W: THE DAYTIME RUNNING LAMPS (DRL) ARE INOPERATIVE

Test Step		Result / Action to Take
W1	CHECK THE HEADLAMP OPERATION	
	• Key in OFF position. • Place the headlamp switch in the HEADLAMPS ON position. • Place the multifunction switch in the LOW BEAM position. • **Do the low beam headlamps illuminate?**	**Yes** GO to **W2**. **No** REFER to Headlamps to continue diagnosis of the headlamps. After the repair, RUN the on-demand self-test (required to clear certain DTCs). CORRECT any unresolved DTCs. CLEAR all DTCs. TEST the system for normal operation.
W2	CHECK FOR CORRECT HEADLAMP BULBS	
	NOTE: Due to varying wattage ratings and resulting current draw, certain aftermarket headlamp bulbs may cause the SJB to shut down the short circuit protection, resulting in the low beams becoming inoperative. • Place the headlamp switch in the OFF position. • Verify the SJB is configured for DRL. Refer to Information Bus (Module Communications Network). • Verify the headlamp bulbs meet Ford specifications. • **Do the headlamp bulbs meet Ford specifications?**	**Yes** GO to **W3**. **No** INSTALL new headlamp bulbs according to Ford specifications. RUN the on-demand self-test (required to clear certain DTCs). CORRECT any unresolved DTCs. CLEAR all DTCs. TEST the system for normal operation.
W3	CHECK FOR CORRECT SJB OPERATION	
	• Disconnect all the SJB connectors. • Check for: — corrosion — damaged pins — pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Daytime Running Lamp: Pinpoint Tests

Test W: The Daytime Running Lamps (DRL) Are Inoperative

PINPOINT TEST W: THE DAYTIME RUNNING LAMPS (DRL) ARE INOPERATIVE

NOTE: When an excessive circuit load occurs several times, the module shuts down the output until a service procedure is carried out. At the same time, the continuous DTC that was stored on the first failure cannot be cleared by a command to clear the continuous DTCs. The module does not allow this code to be cleared or the circuit restored to normal until a successful on-demand self-test proves that the fault has been repaired. After the on-demand self-test has successfully completed (no on-demand DTCs present), the continuous DTC clears and the circuit function returns.

Normal Operation

The DRL are controlled by the smart junction box (SJB). The SJB operates the low beam headlamps at a reduced intensity. The DRL driver (integral to the SJB) supplies pulse-width modulated (PWM) voltage to the low beam headlamps.

This pinpoint test is intended to diagnose the following:

- Headlamp bulbs

- SJB

W1-W3

Test X: DTC U0155 - Lost Communication With Instrument Panel Cluster (IC) Control Module

PINPOINT TEST X: DTC U0155 - LOST COMMUNICATION WITH INSTRUMENT PANEL CLUSTER (IC) CONTROL MODULE

Normal Operation

The smart junction box (SJB) sets DTC U0155 if data messages received from the instrument cluster (IC) over the high speed controller area network (HS-CAN) are missing. For a complete list of all network messages, refer to Information Bus (Module Communications Network).

This pinpoint test is intended to diagnose the following:

- Communication network

- Instrument cluster (IC)

PINPOINT TEST X: DTC U0155 — LOST COMMUNICATION WITH INSTRUMENT PANEL CLUSTER (IC) CONTROL MODULE

Test Step		Result / Action to Take
X1	RETRIEVE THE RECORDED DTCs FROM BOTH THE CONTINUOUS AND ON-DEMAND SJB SELF-TESTS • Check for recorded SJB DTCs from the continuous and on-demand self-tests. • **Is DTC B1318 recorded?**	**Yes** REFER to Charging System. **No** GO to **X2**.

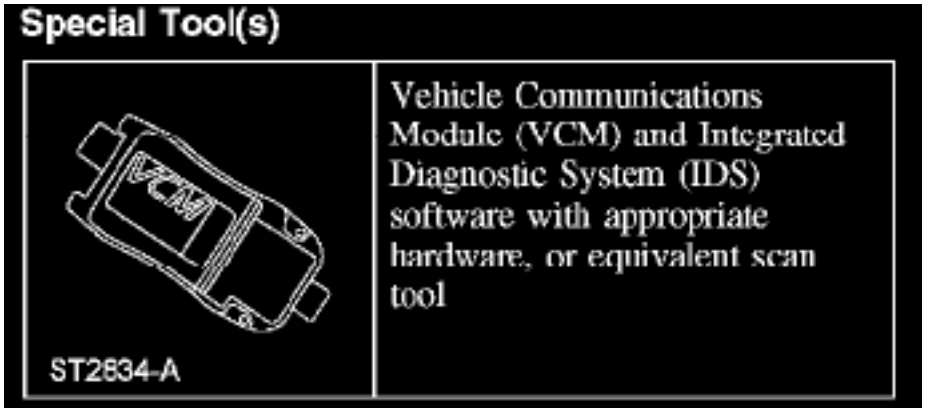
(Continued)

PINPOINT TEST X: DTC U0155 — LOST COMMUNICATION WITH INSTRUMENT PANEL CLUSTER (IC) CONTROL MODULE (Continued)

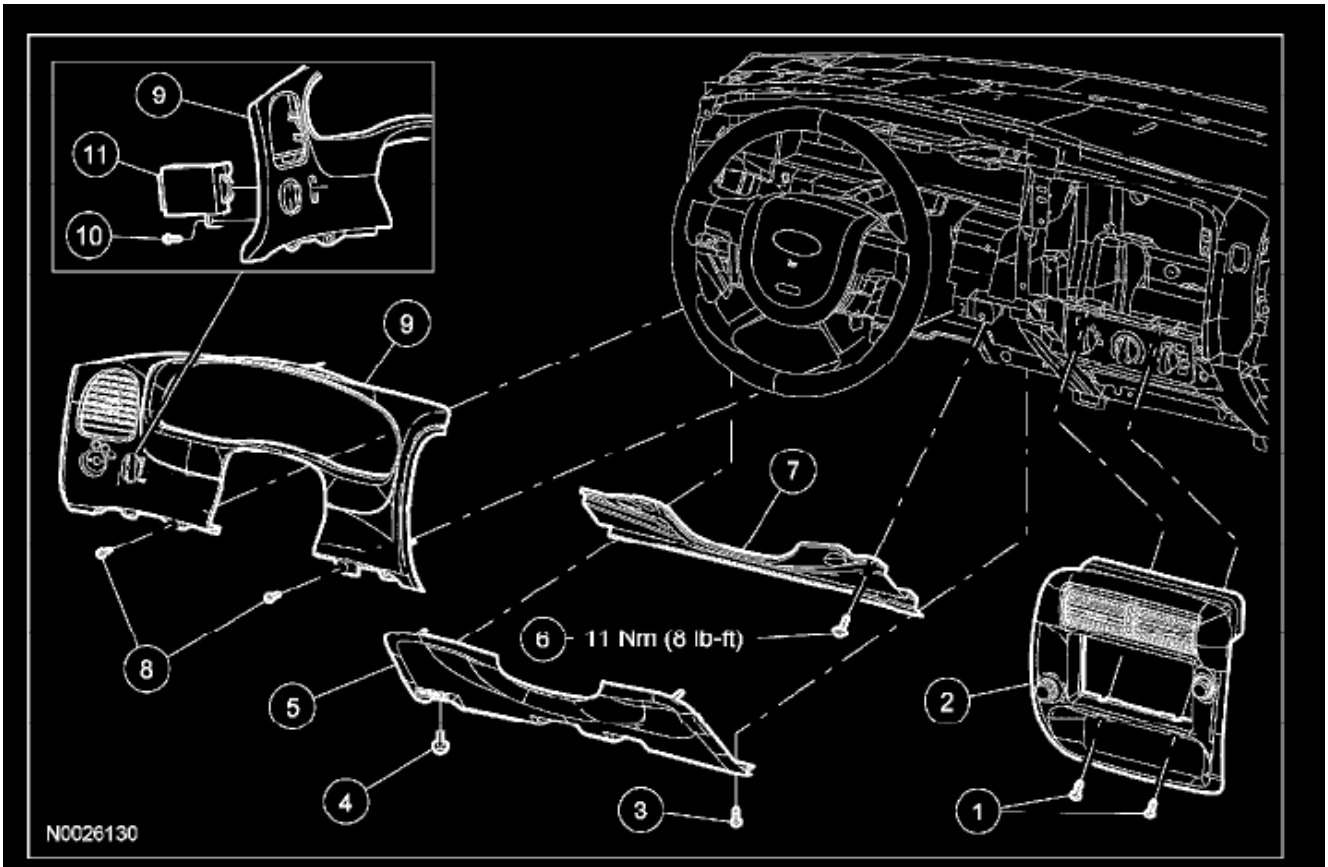
Test Step		Result / Action to Take
X2	RECHECK THE SJB DTCs • Enter the following diagnostic mode on the scan tool: SJB Self-Test. Clear the DTCs and repeat the SJB self-test. • **Is DTC U0155 still present?**	**Yes** GO to **X3**. **No** The system is operating correctly at this time. The DTC may have been set due to an intermittent communication drop off from high network traffic.
X3	RETRIEVE THE RECORDED DTCs FROM THE CONTINUOUS AND KOEO PCM SELF-TESTS • Enter the following diagnostic mode on the scan tool: PCM Self-Test. Check for recorded PCM DTCs from the continuous and KOEO self-tests. • **Is DTC U0155 recorded?**	**Yes** REFER to Information Bus (Module Communications Network) to diagnose no communication with the instrument cluster (IC). **No** GO to **X4**.
X4	CHECK THE NETWORK OPERATION • Enter the following diagnostic mode on the scan tool: Network Test. Carry out the network test. • **Does the instrument cluster (IC) pass the network test?**	**Yes** INSTALL a new instrument cluster (IC). TEST the system for normal operation. **No** REFER to Information Bus (Module Communications Network) to diagnose no communication with the instrument cluster (IC).

X1

X2-X4



Special Tool(s)



Item	Part Number	Description
1	W701679	Center instrument panel finish panel screws (2 required)
2	1004302	Center instrument panel finish panel
3	W705314	Instrument panel steering column cover screws (2 required)
4	N807316	Hood latch release handle bolts (2 required)
5	10044F08	Instrument panel steering column cover
6	N807316	Lower instrument panel reinforcement bolts (5 required)
7	10017A28	Lower instrument panel reinforcement
8	W705314	Instrument cluster finish panel screws (5 required)
9	011201	Instrument cluster finish panel
10	385754-S36	Instrument panel dimmer switch screws (2 required)

Item	Part Number	Description
11	11691	Instrument panel dimmer switch

(Continued)

Dimmer Switch: Service and Repair

INSTRUMENT PANEL DIMMER SWITCH

Removal and Installation

1. Remove the radio. 2. Remove the center instrument panel finish panel.

- Remove the 2 screws.

- Disconnect the electrical connectors.

3. Remove the 2 bolts and position aside the hood latch release handle. 4. Remove the 2 screws and remove the instrument panel steering column cover. 5. Remove the 5 bolts and the lower instrument panel reinforcement.

- To install, tighten to 11 Nm (8 lb-ft).

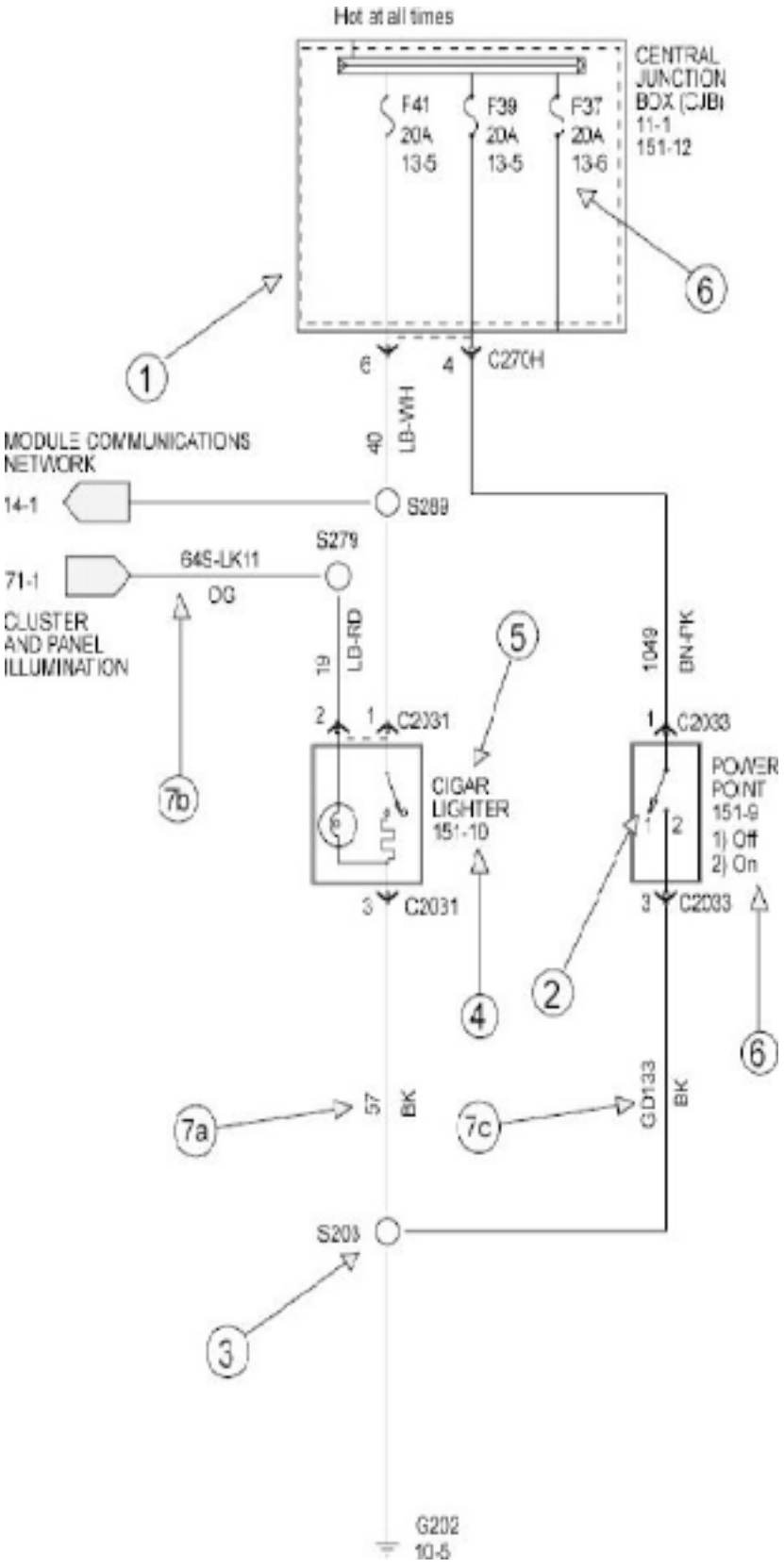
6. If equipped, position the column-mounted transmission range selector lever to the lowest position. 7. Remove the instrument cluster finish panel.

- Remove the 5 screws.

- Disconnect the electrical connectors.

8. Remove the 2 screws and the instrument panel dimmer switch. 9. To install, reverse the removal procedure.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Lighting and Horns > Battery Discharge Protection Relay, Lighting > Component Information > Diagrams > Diagram Information and Instructions



Battery Discharge Protection Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

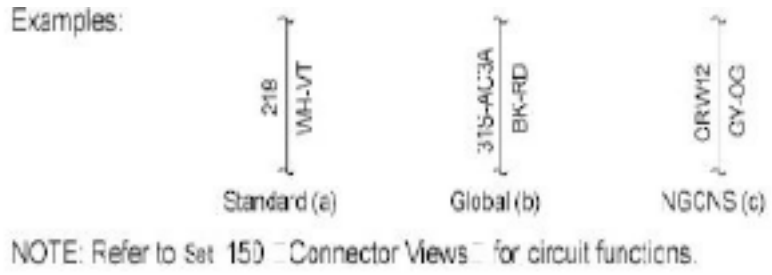
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

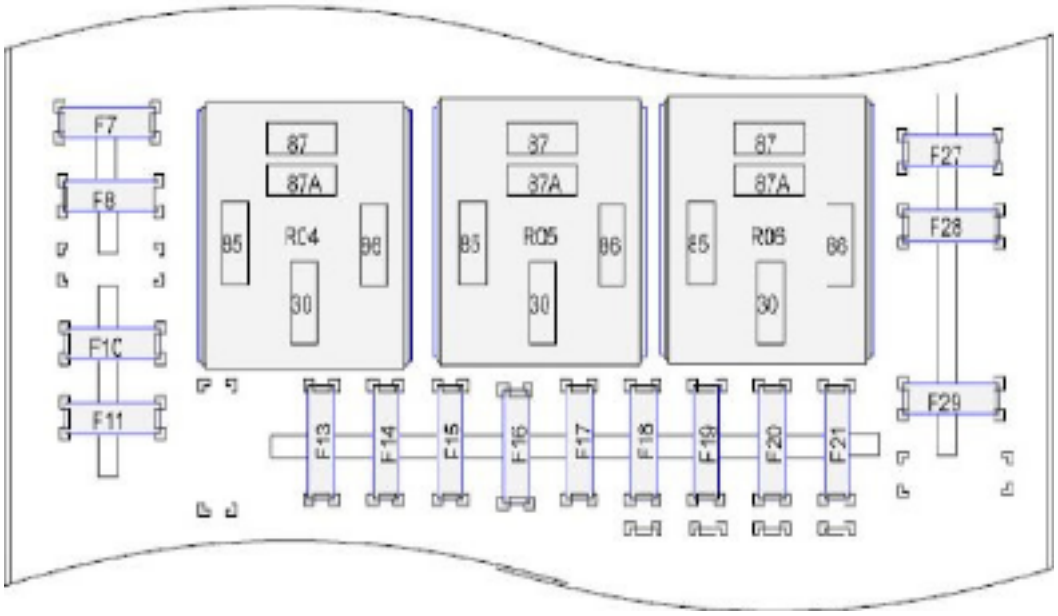
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

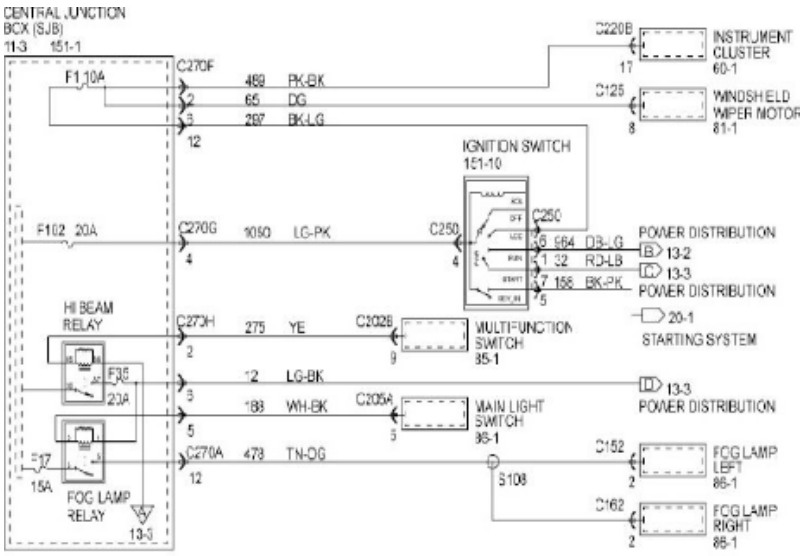
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

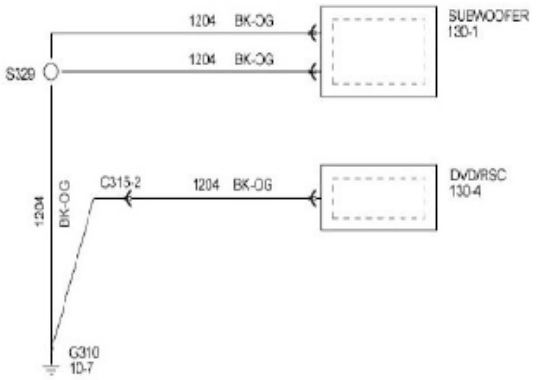
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

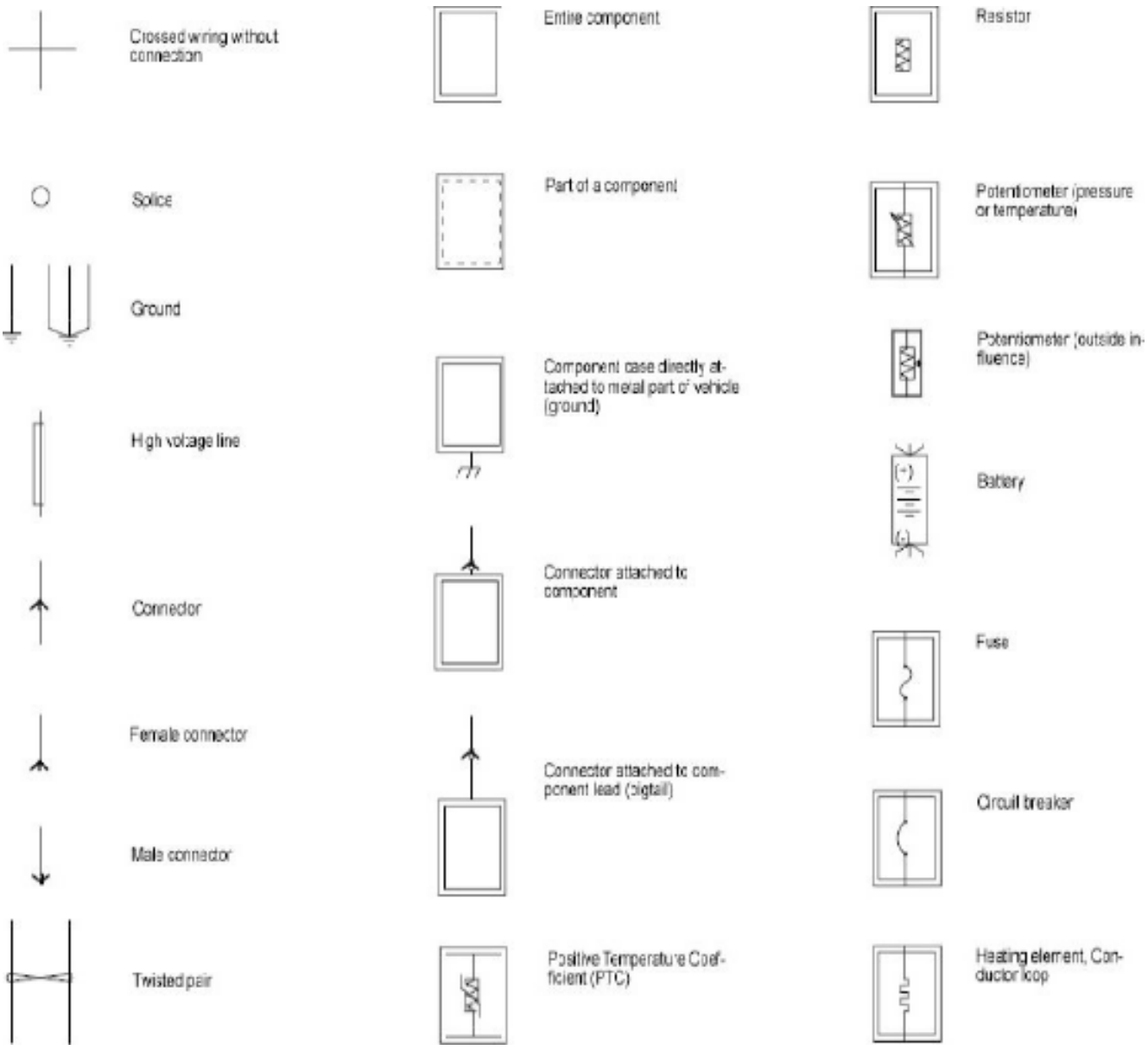
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

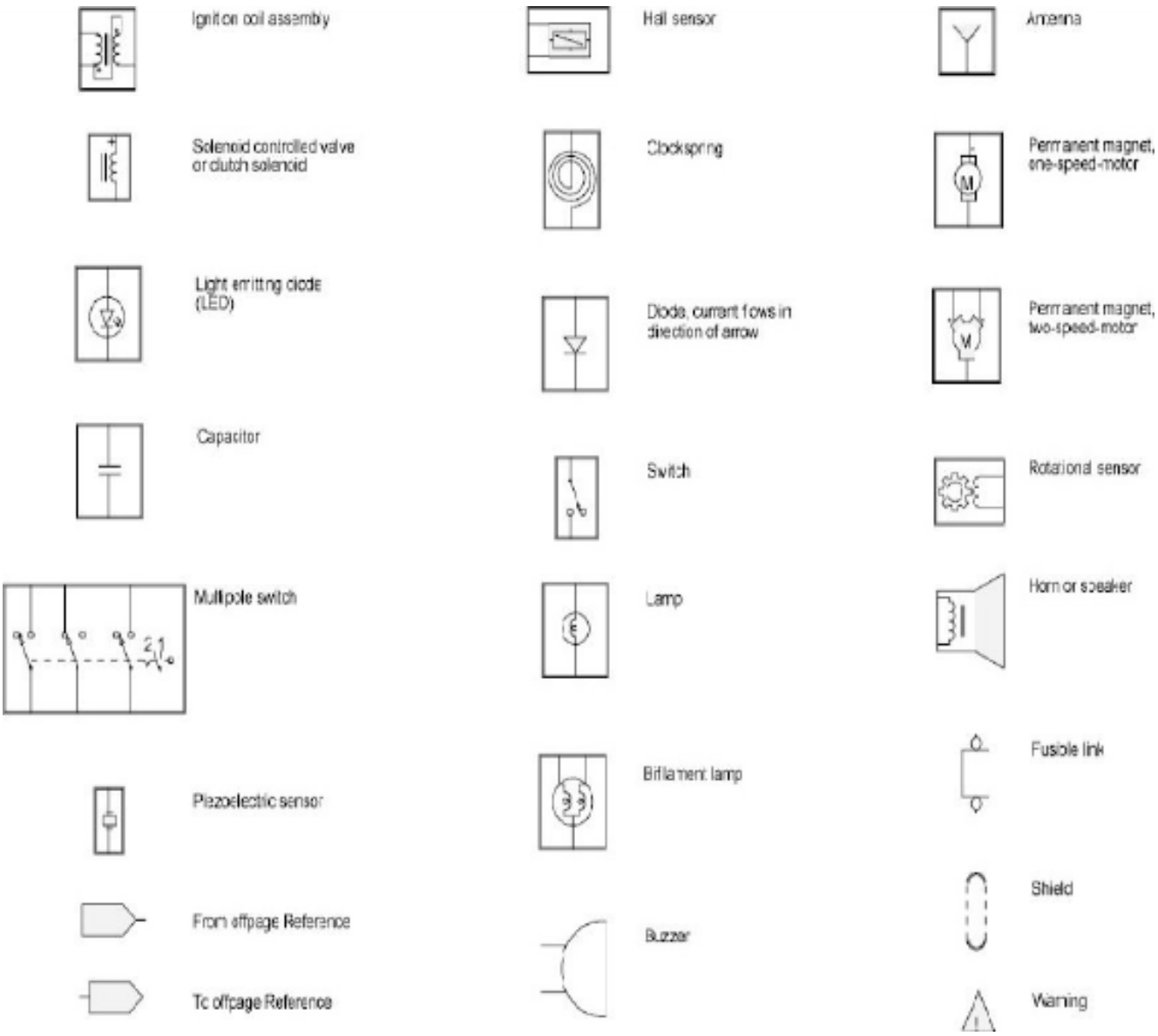
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

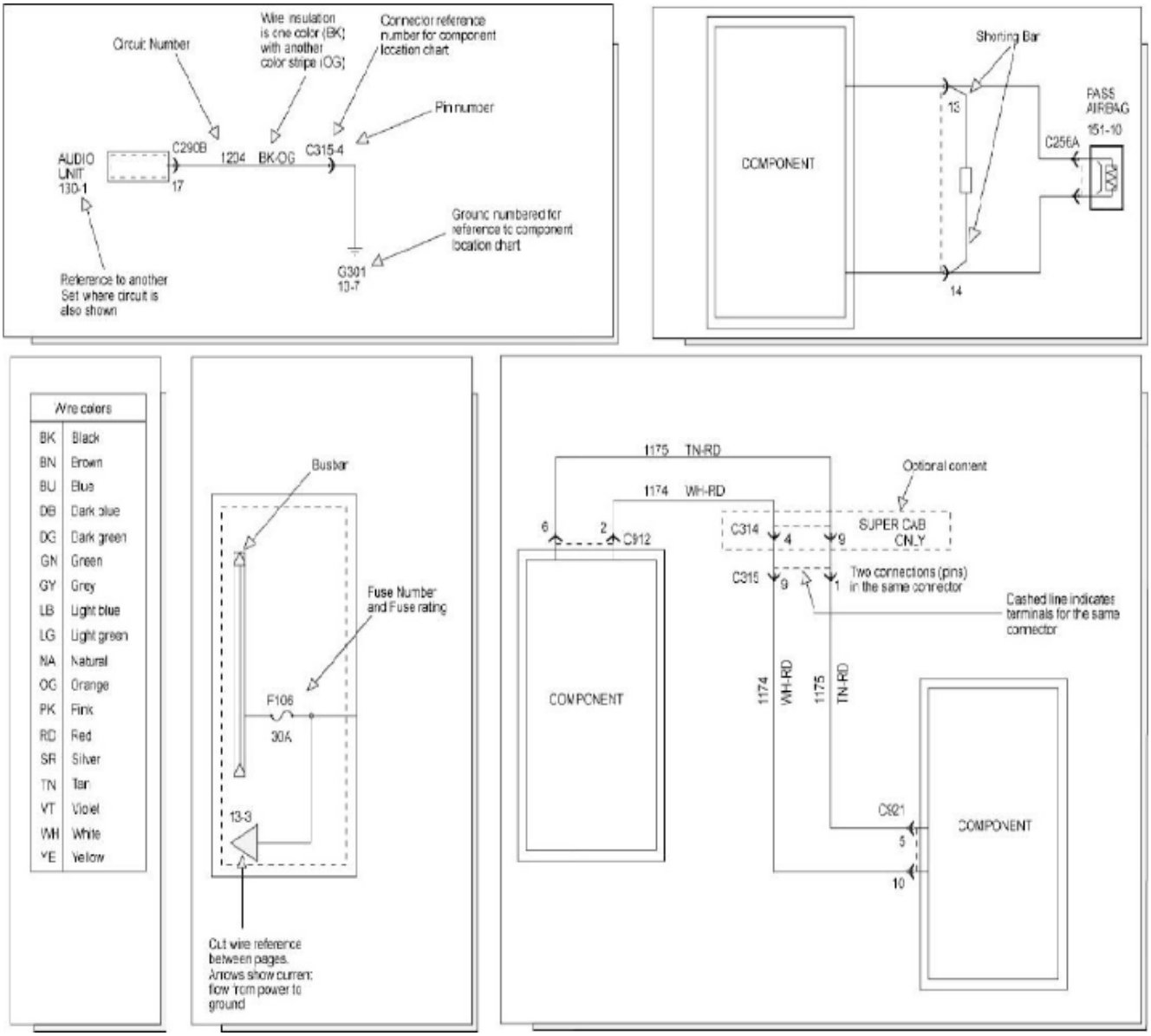
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

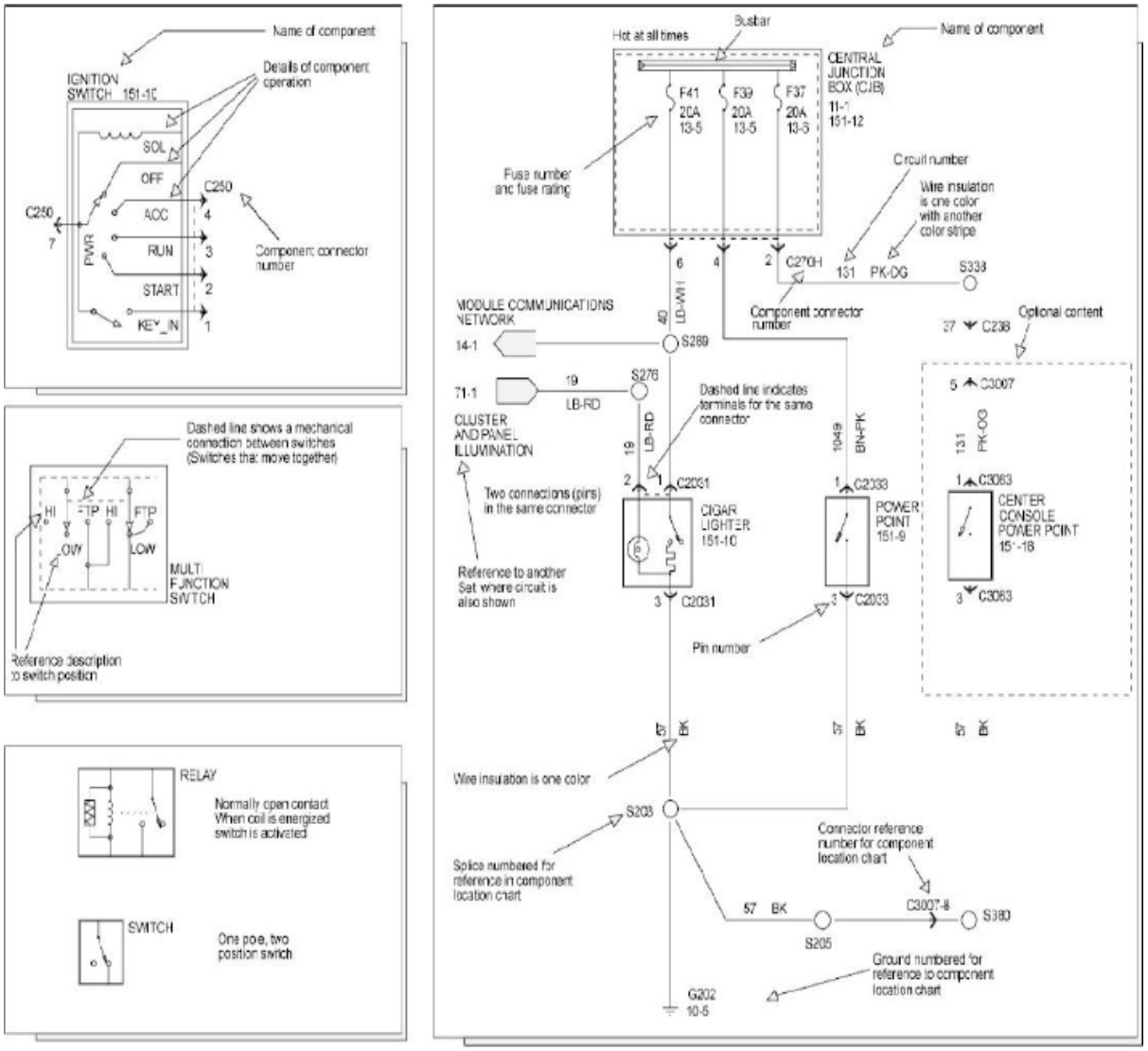
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

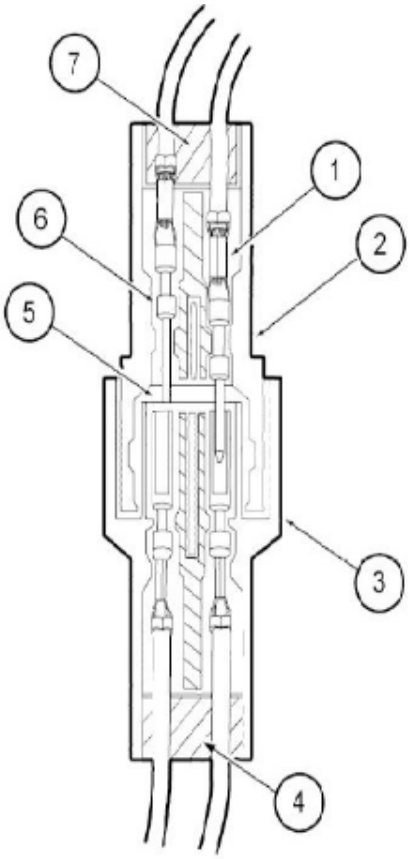


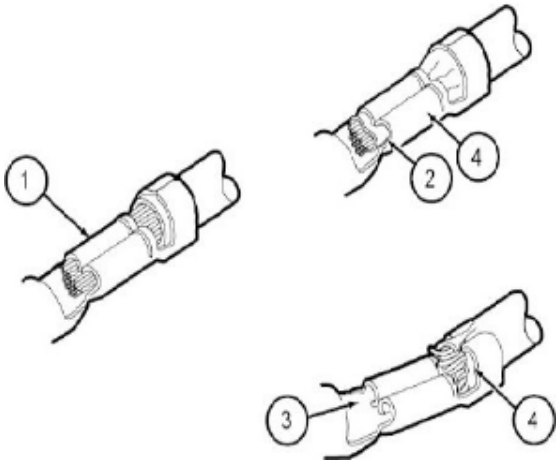
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Battery Discharge Protection Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

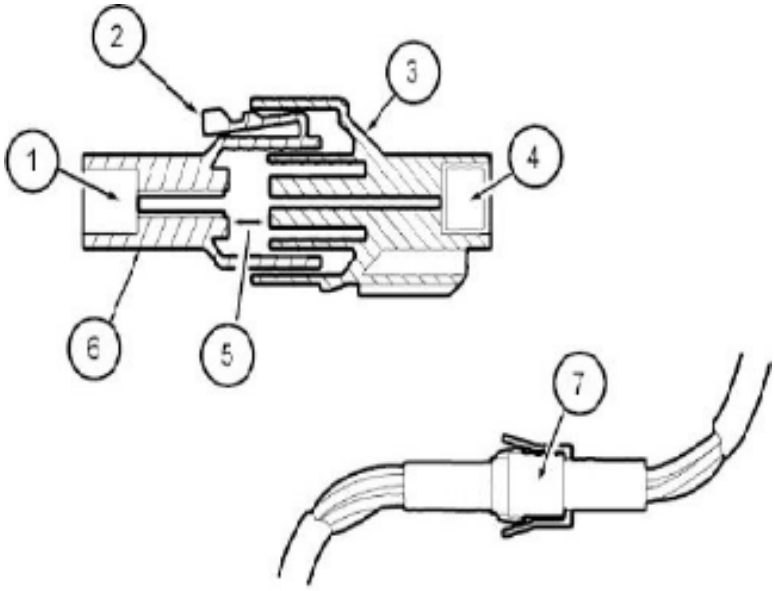
5 = Intermittent contact

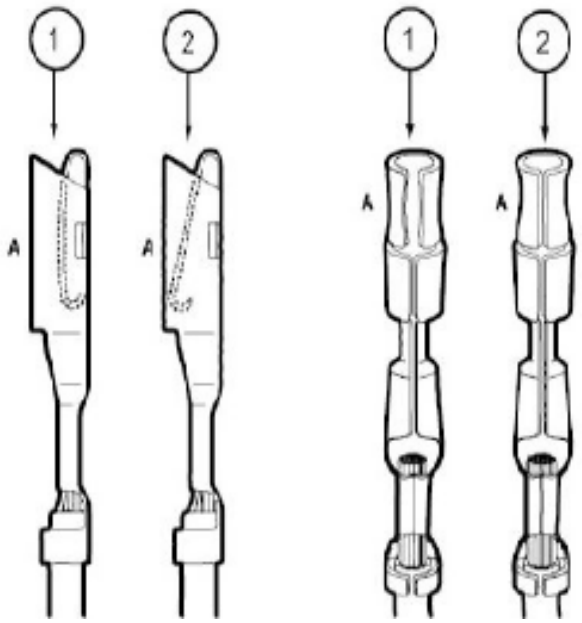
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

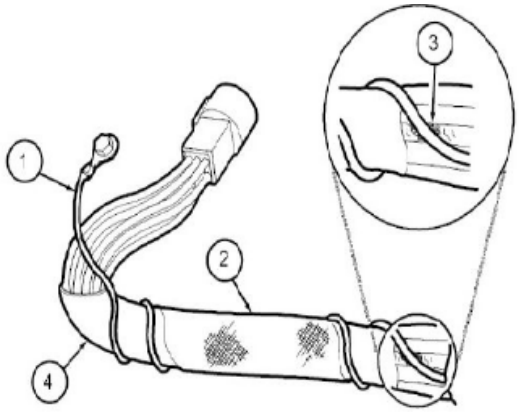
Deformed (enlarged) female terminals

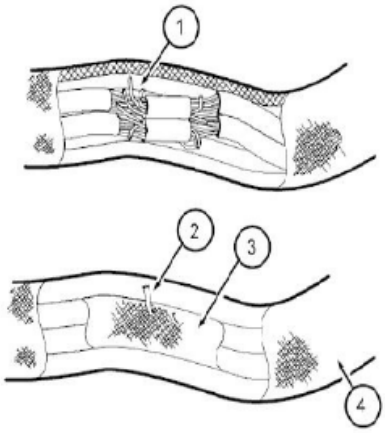
1 = Enlarged

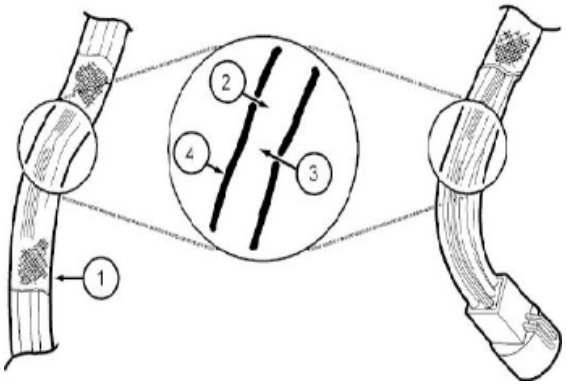
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

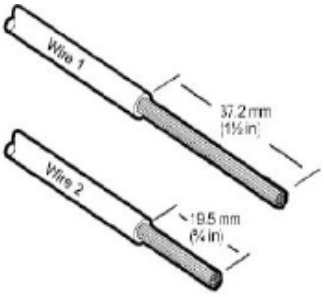
Splice covered 2

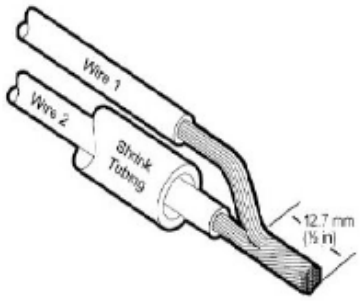
= Wire strand

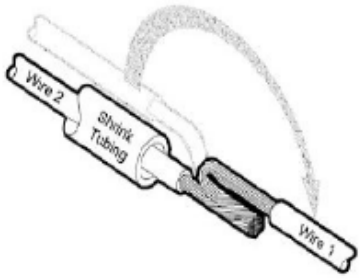
3 = Splice tape

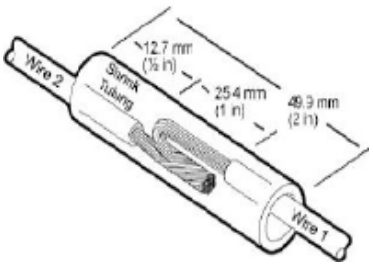
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

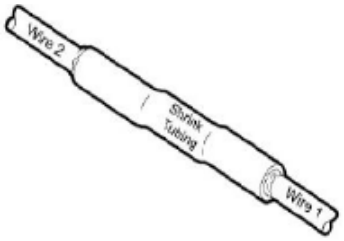
NOTE: -

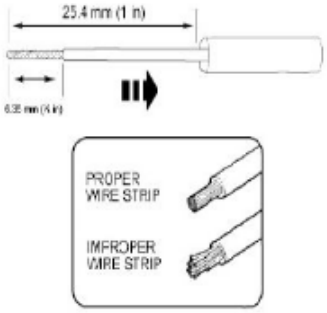
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

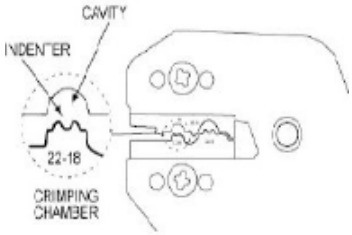
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

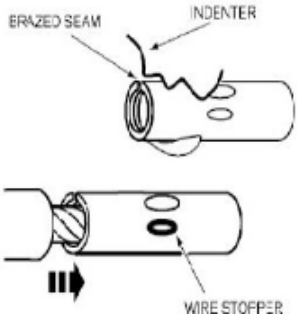
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

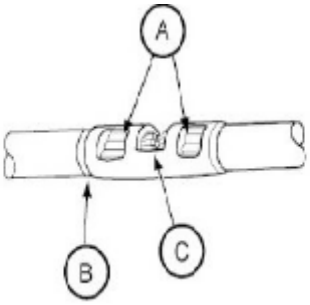
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

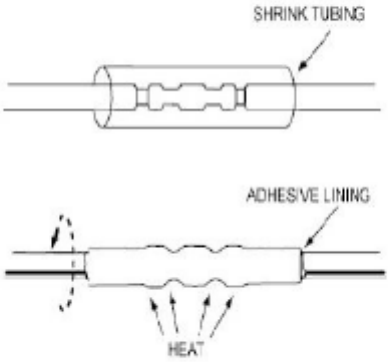
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4 strip, cut 9 strands	* 1/4 strip, cut 2 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip, fold 3x dia.
	16-14	* 1/4 strip, cut 7 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip fold 2x dia	1 strip, fold 3x dia.	1 1/4 strip, fold 4x dia.	Not Recommended
	12-10	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip fold 3x cia.	1 1/4 strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Figtail only

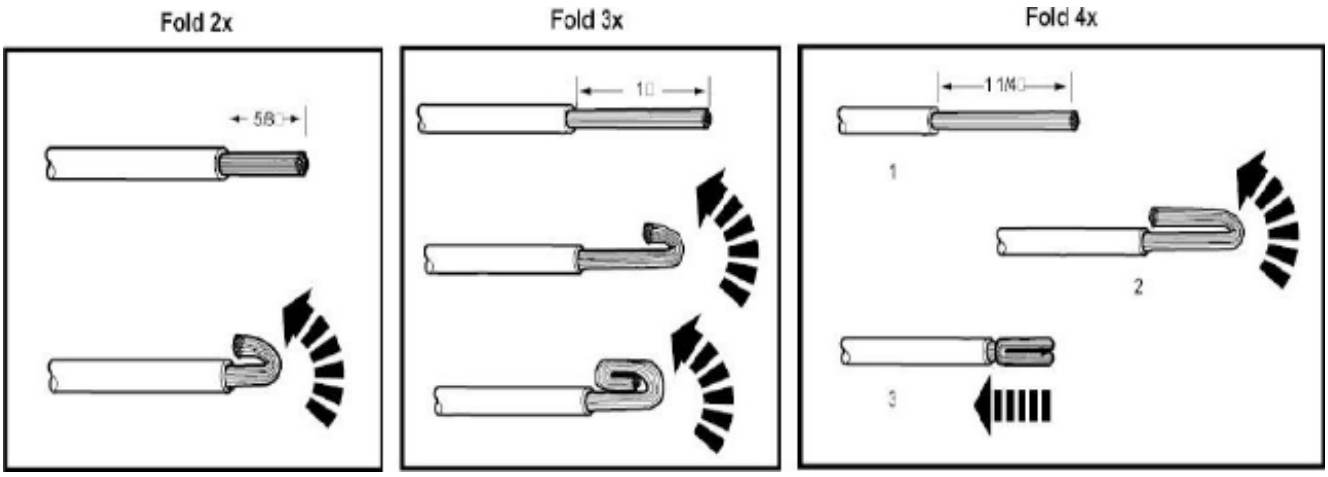
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



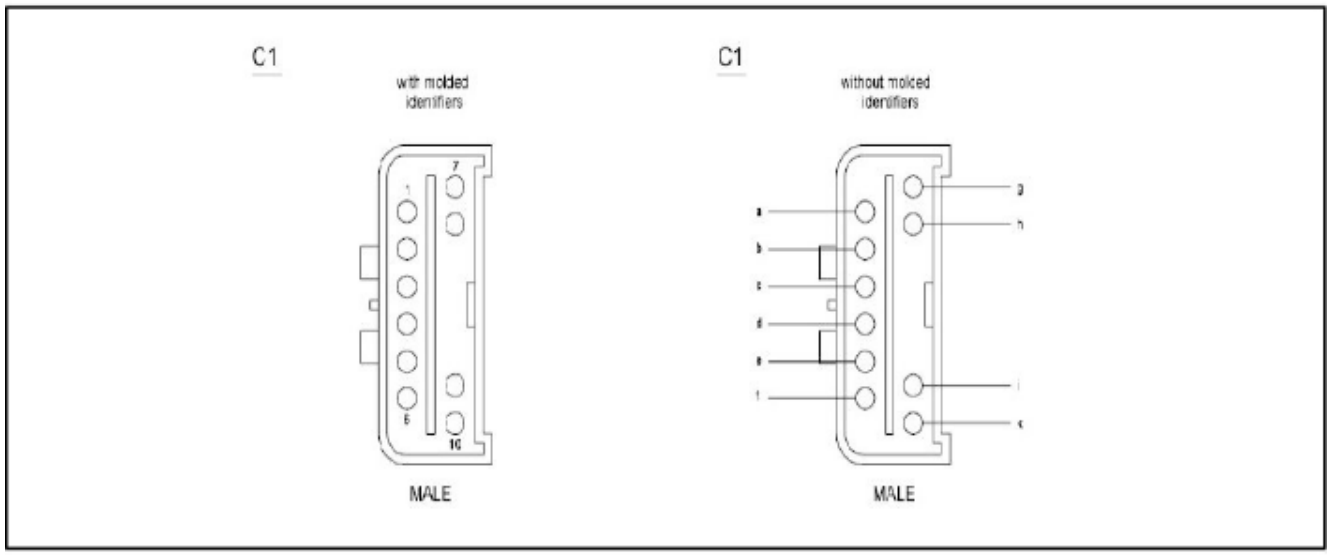
The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



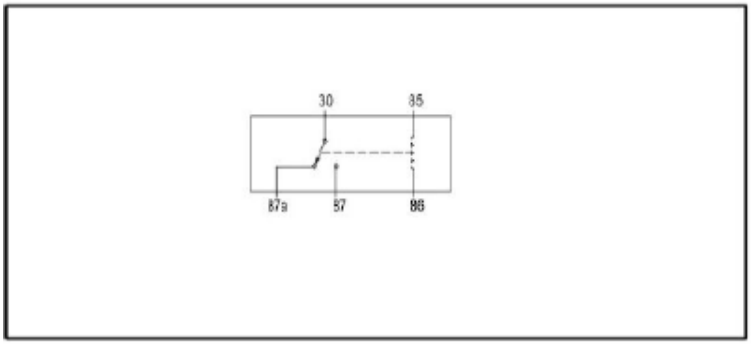
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

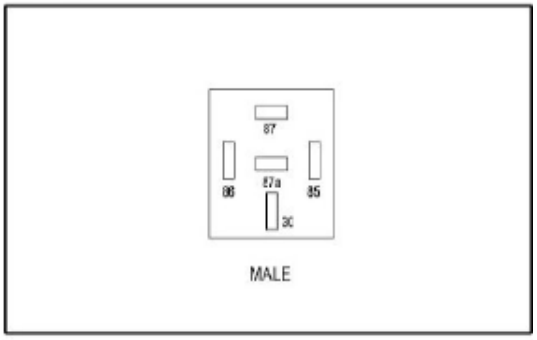
Battery Discharge Protection Relay: Testing and Inspection Mini ISO Relay

Relay □ Mini ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

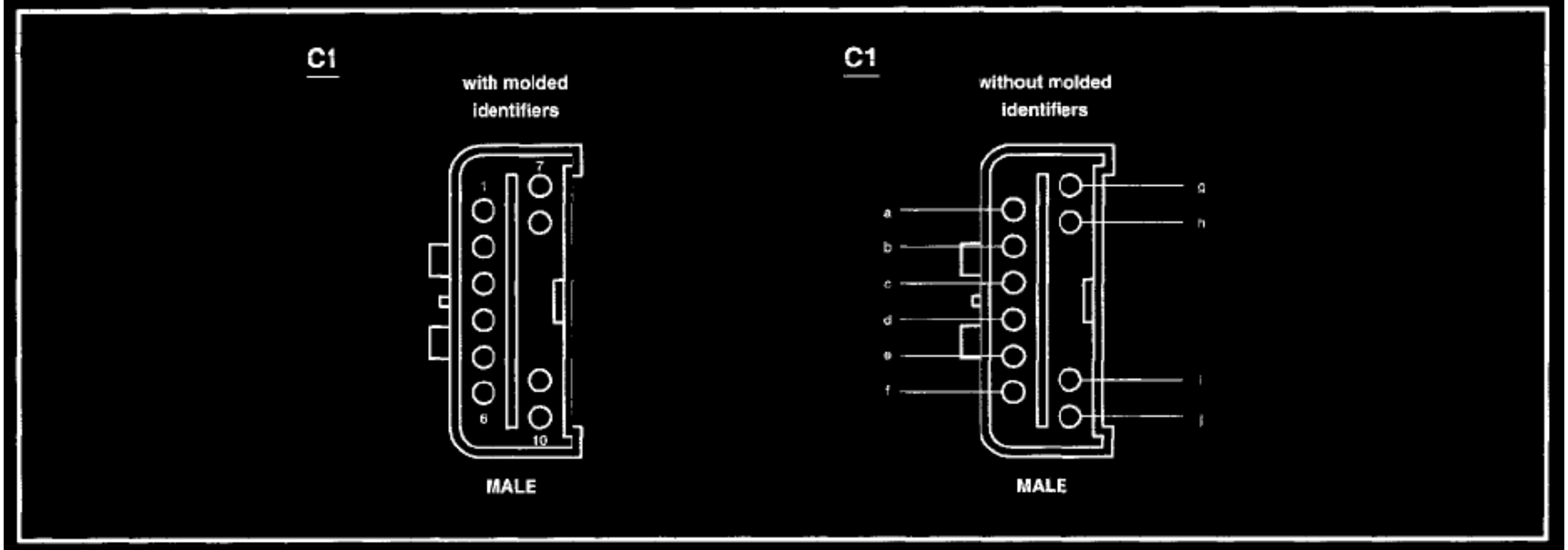
Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step–by–step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



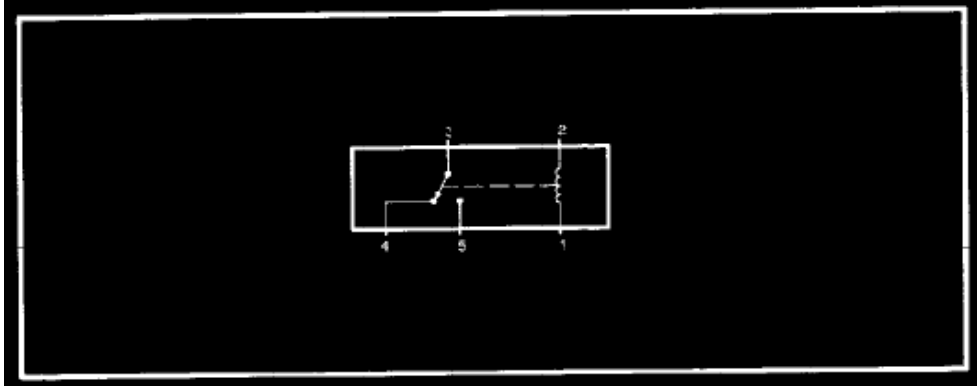
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

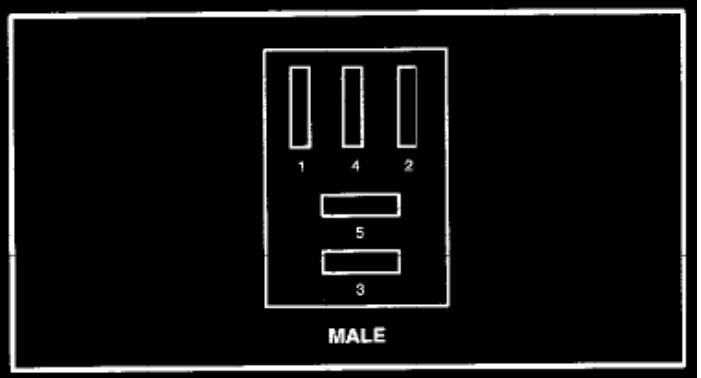
Battery Discharge Protection Relay: Testing and Inspection Micro ISO Relay

Relay – Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63–102Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil – Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

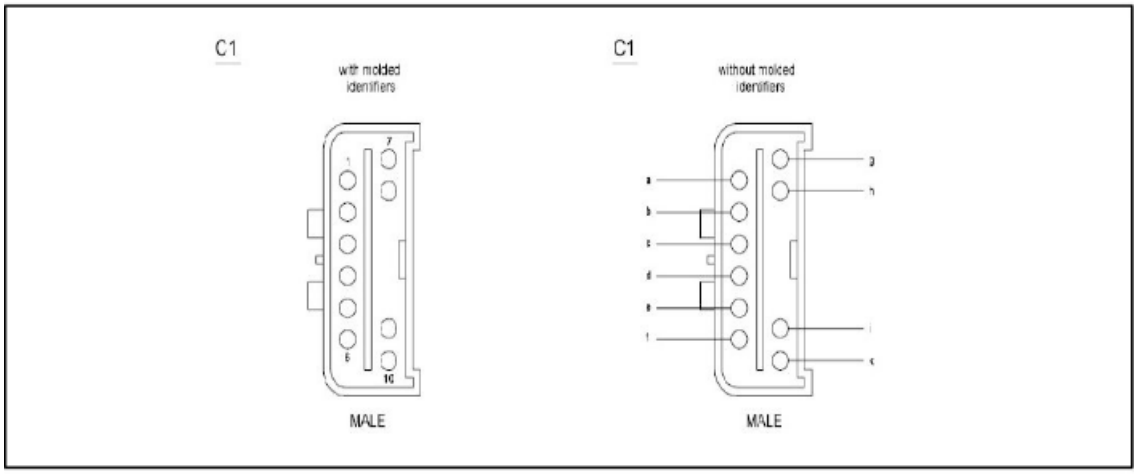
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step□by□step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals

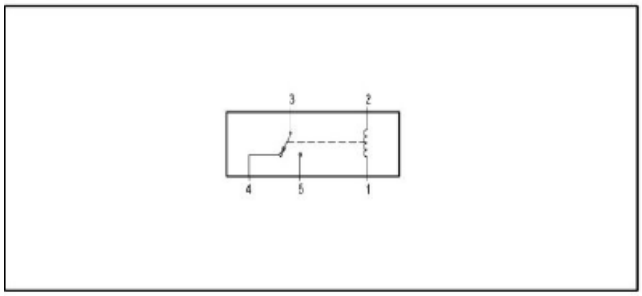


The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column □Circuit to test□. If you wish to test the complete component, perform all tests.

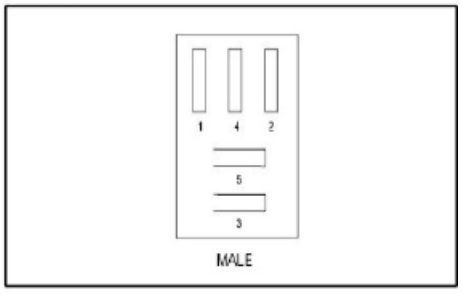
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Relay □ Micro ISO

Schematic



Terminals

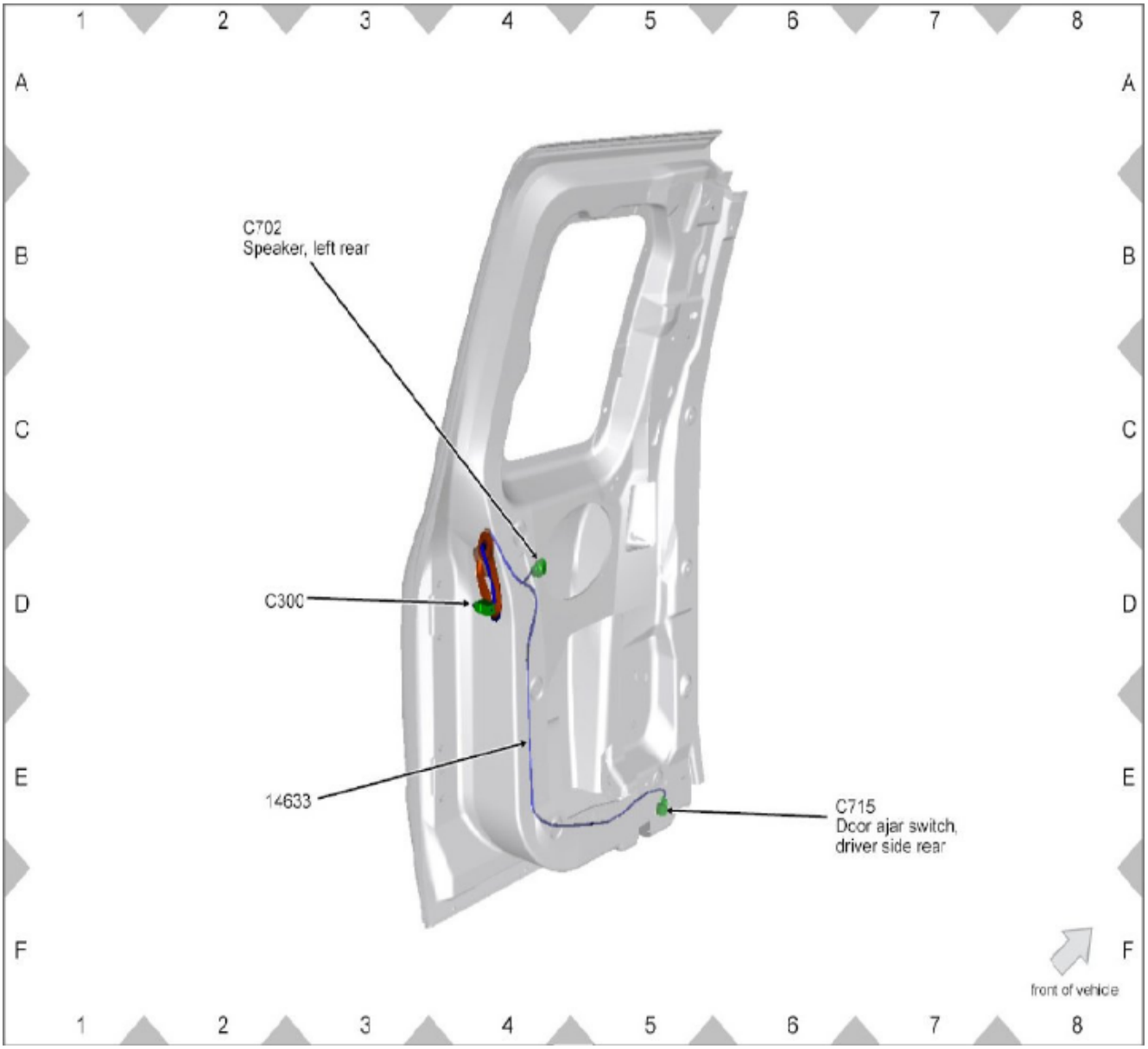


Component testing procedure (no voltage applied)

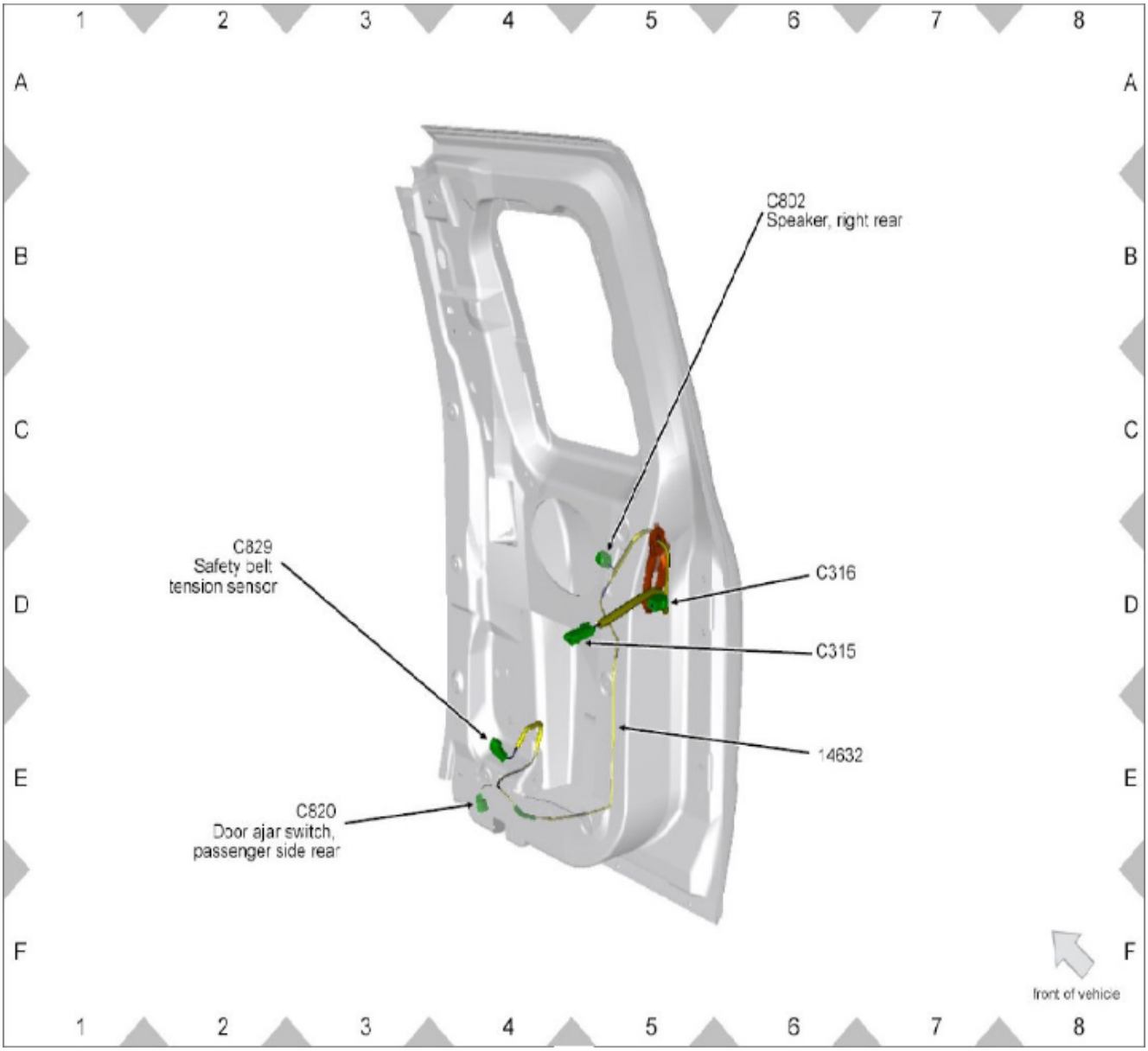
Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63□102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil □ Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

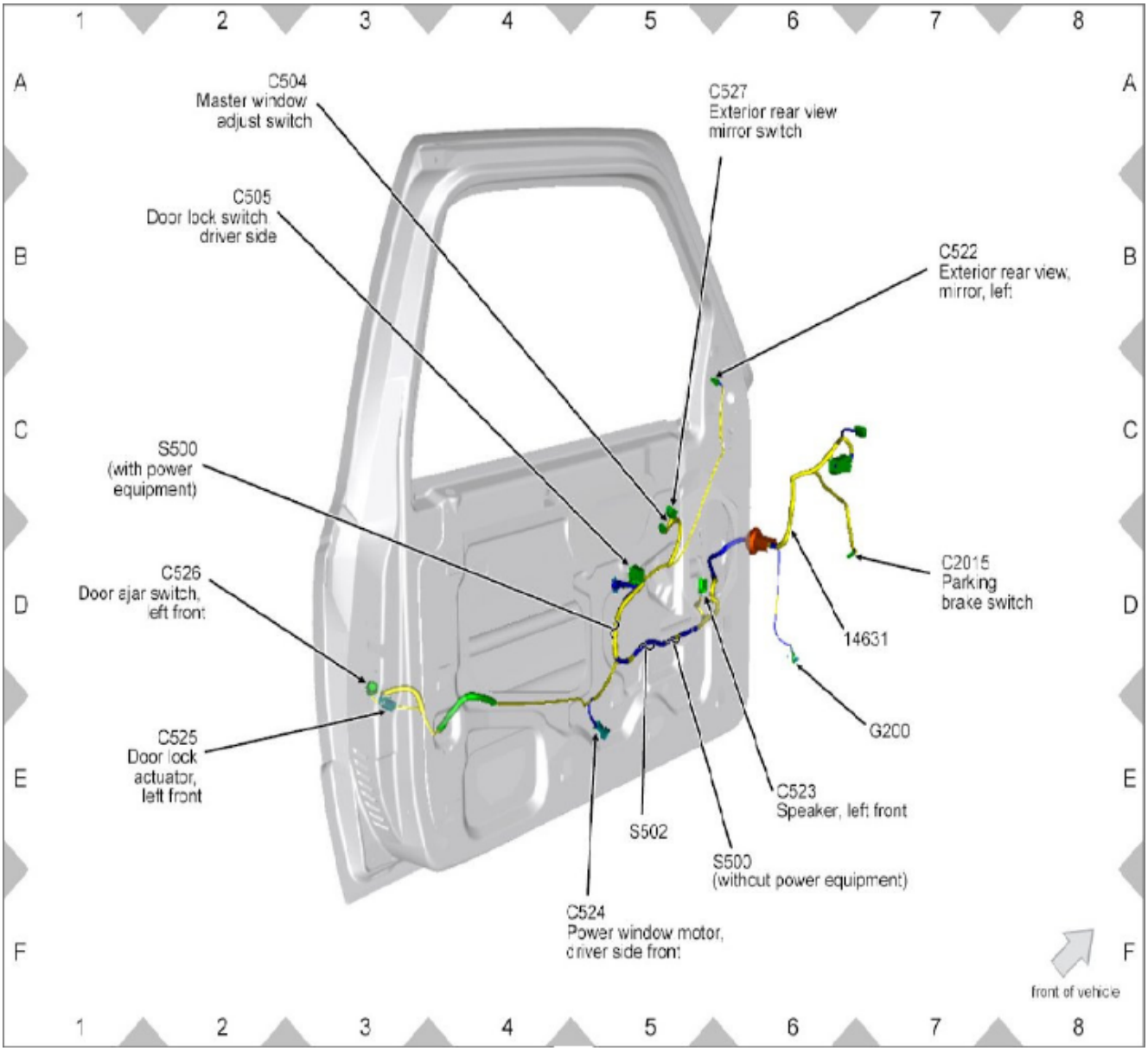
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.


C702
Speaker, left rear
C300
14633
C715
Door ajar switch, driver side rear
front of vehicle

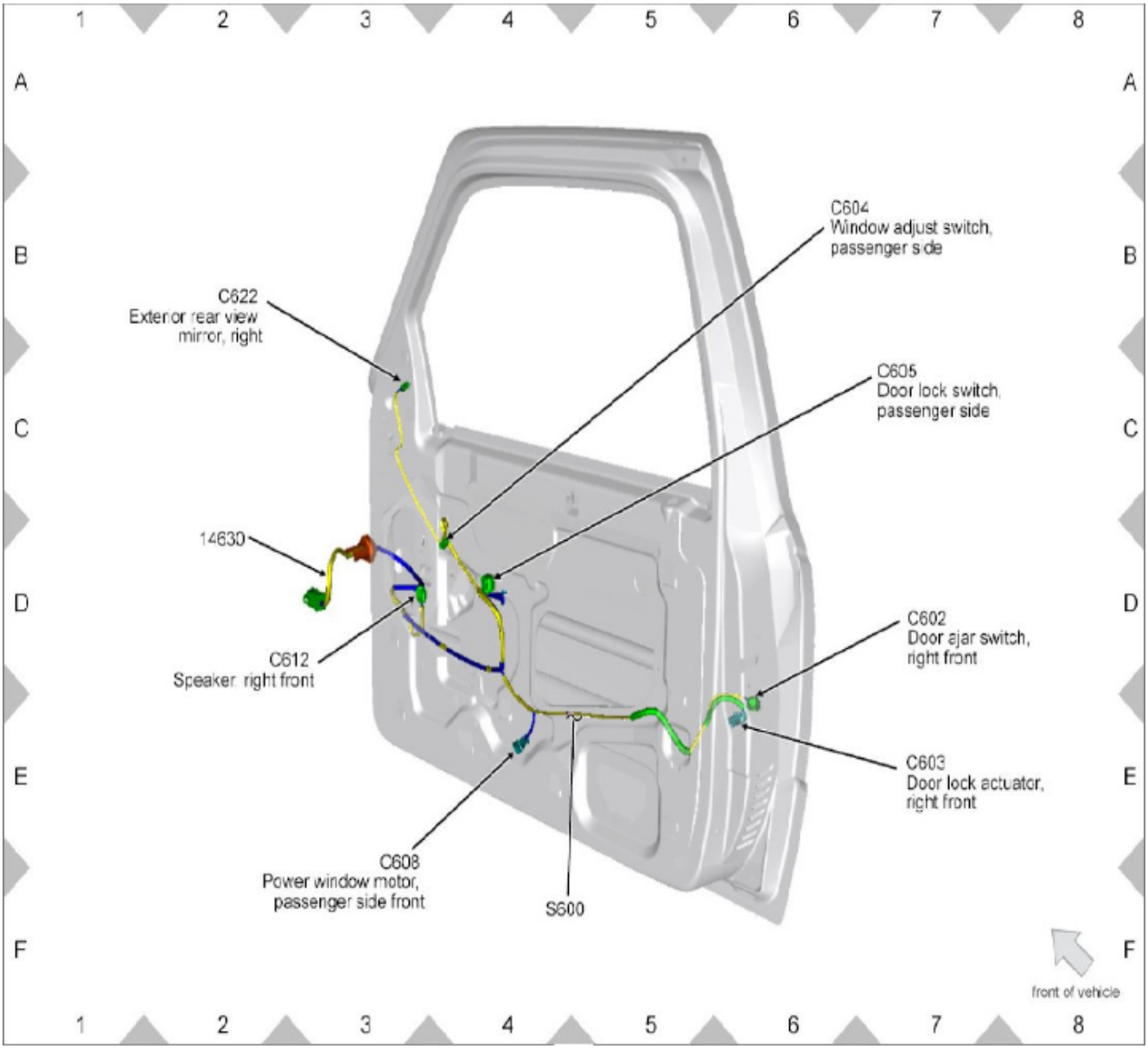
View 151-22


C802
Speaker, right rear
C829
Safety belt tension sensor
C316
C315
14632
C820
Door ajar switch, passenger side rear
front of vehicle

View 151-23


C504
Master window adjust switch
C505
Door lock switch driver side
S500
(with power equipment)
C526
Door ajar switch, left front
C525
Door lock actuator, left front
C524
Power window motor, driver side front
S502
S500
(without power equipment)
C523
Speaker, left front
G200
14631
C2015
Parking brake switch
C522
Exterior rear view mirror, left
C527
Exterior rear view mirror switch
front of vehicle

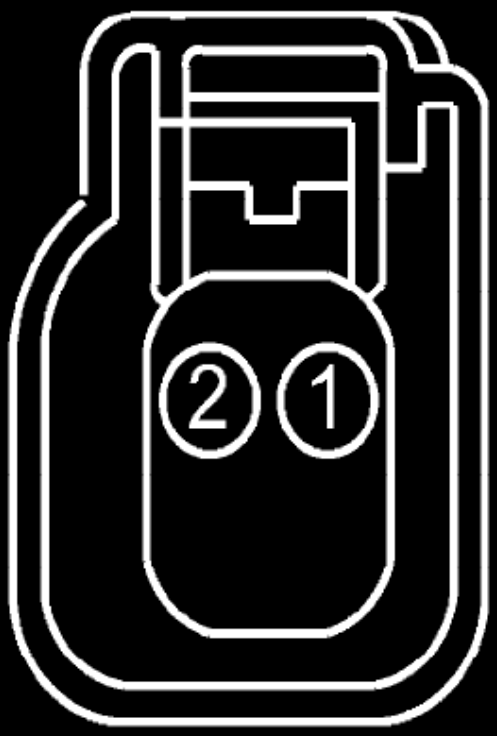
View 151-20


C604
Window adjust switch, passenger side
C622
Exterior rear view mirror, right
C605
Door lock switch, passenger side
14630
C612
Speaker, right front
C602
Door ajar switch, right front
C603
Door lock actuator, right front
C608
Power window motor, passenger side front
S600
front of vehicle

View 151-21

Connector: C526

Description:	Harness:	Base Part #:
DOOR AJAR SWITCH, LEFT FRONT	14631	

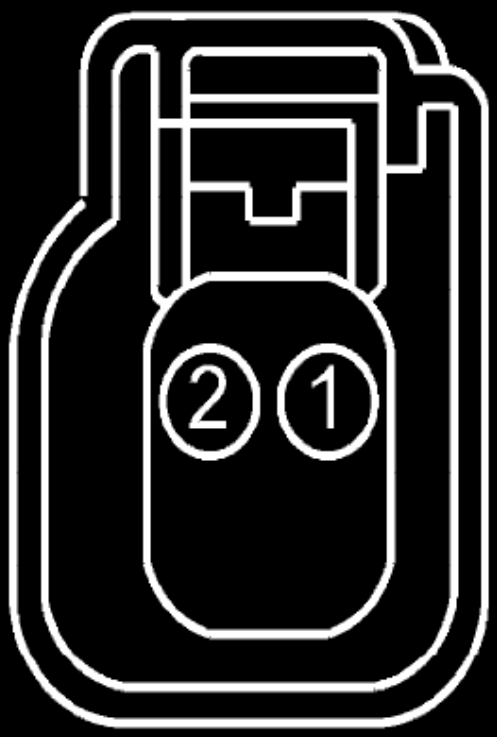


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPL26 (GN-VT)	20	SWITCH - LATCH DRIVER # AJAR	
2	GD175 (BK-BU)	20	GROUND - TUNNEL # 2ND STUD	

C526

Connector: C602

Description:	Harness:	Base Part #:
DOOR AJAR SWITCH, RIGHT FRONT	14630	

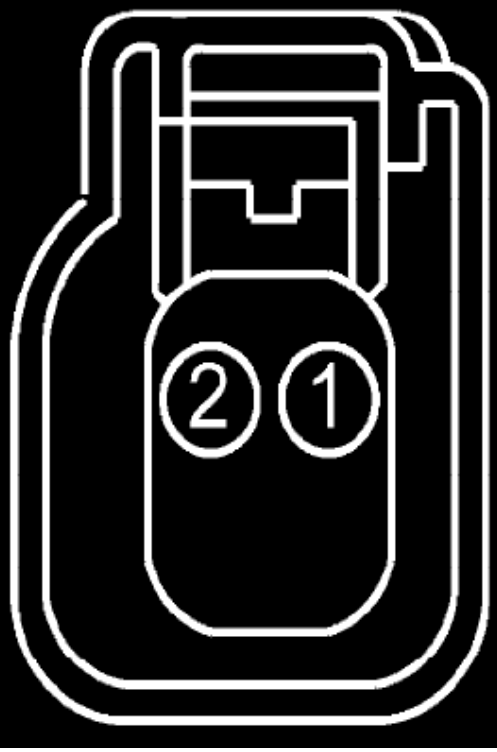


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPL31 (WH)	20	SWITCH - LATCH PASSENGER # AJAR	
2	GD161 (BK-YE)	20	GROUND - SEAT BRACKET REAR LEFT	

C602

Connector: C715

Description:	Harness:	Base Part #:
DOOR AJAR SWITCH, DRIVER SIDE REAR	14633	14018

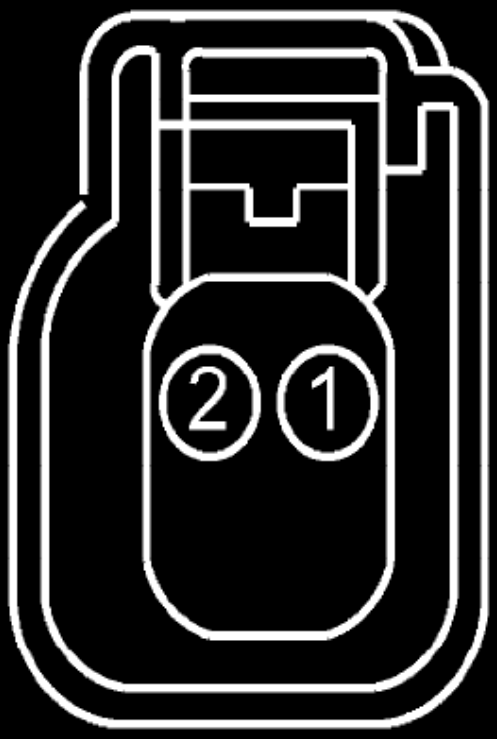


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPL36 (GN)	18	SWITCH - LATCH REAR DRIVER SIDE # AJAR (INCL.SLIDING DOOR)	
2	GD101 (BK-YE)	18	GROUND - SEAT BRACKET REAR LEFT	

C715

Connector: C820

Description:	Harness:	Base Part #:
DOOR AJAR SWITCH, PASSENGER SIDE REAR	14632	14018



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPL39 (YE)	18	SWITCH - LATCH REAR PASSENGER SIDE # AJAR (INCL.SLIDING DOOR)	
2	GD161 (BK-YE)	18	GROUND - SEAT BRACKET REAR LEFT	

C820

Door Switch: Service and Repair Door Ajar Switch

DOOR AJAR SWITCH

Removal and Installation

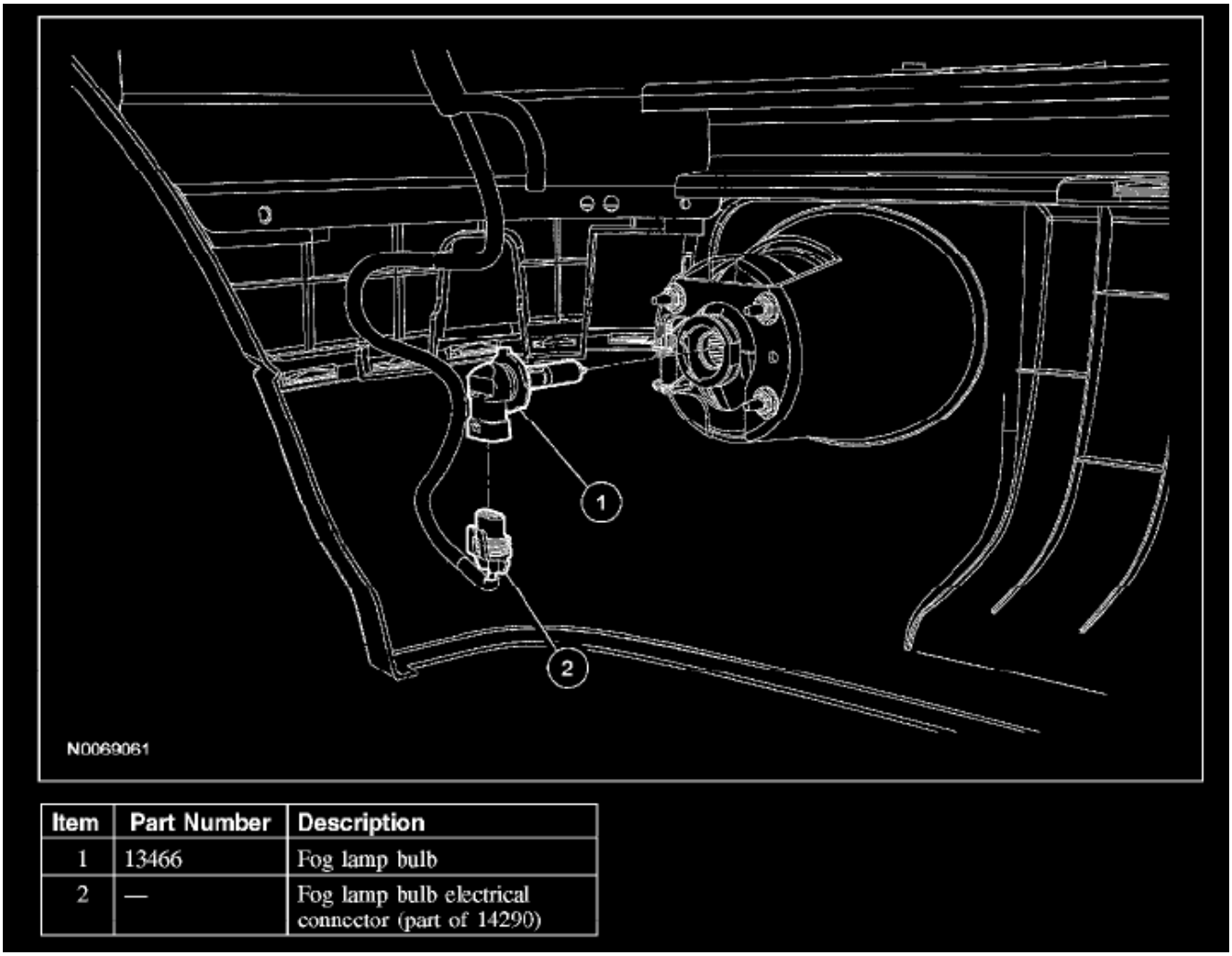
1. Remove the front door latch. 2. Lift the locking tab, rotate the switch and remove the door ajar switch. 3. To install, reverse the removal procedure.

Door Switch: Service and Repair Door Ajar Switch - SuperCab Four-Door

DOOR AJAR SWITCH - SUPERCAB FOUR-DOOR

Removal and Installation

1. Remove the rear door lower latch. 2. Release the locking tabs, rotate the door ajar switch and remove the door ajar switch. 3. To install, reverse the removal procedure.



Item	Part Number	Description
1	13466	Fog lamp bulb
2	—	Fog lamp bulb electrical connector (part of 14290)

Fog/Driving Lamp Bulb: Service and Repair

FOG LAMP BULB

Removal and Installation

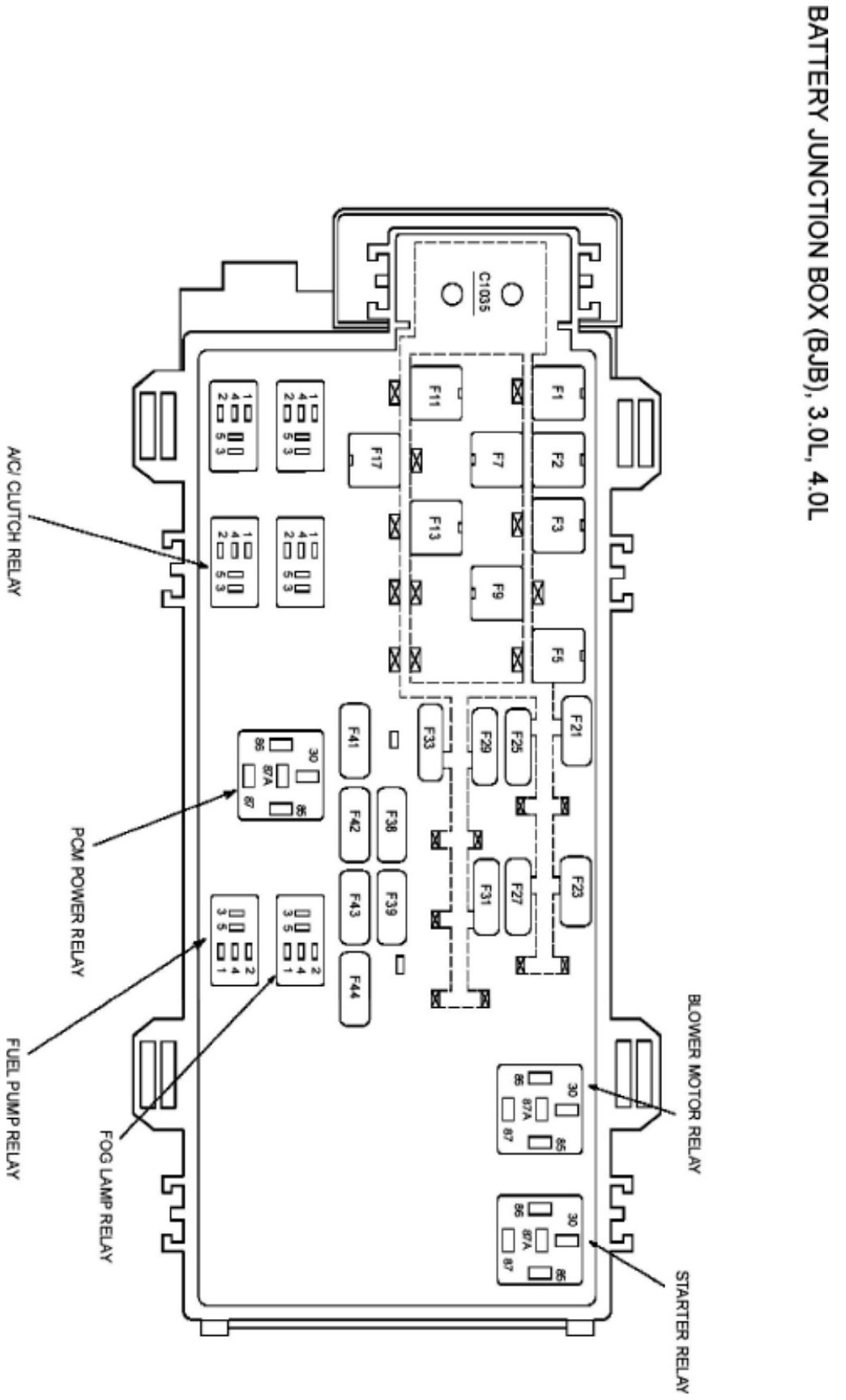
WARNING: The bulb contains gas under pressure. The bulb may shatter if the glass envelope is scratched or if the bulb is dropped. Handle the bulb only by its base. Avoid touching the glass envelope. Failure to follow these instructions may result in personal injury.

NOTE:

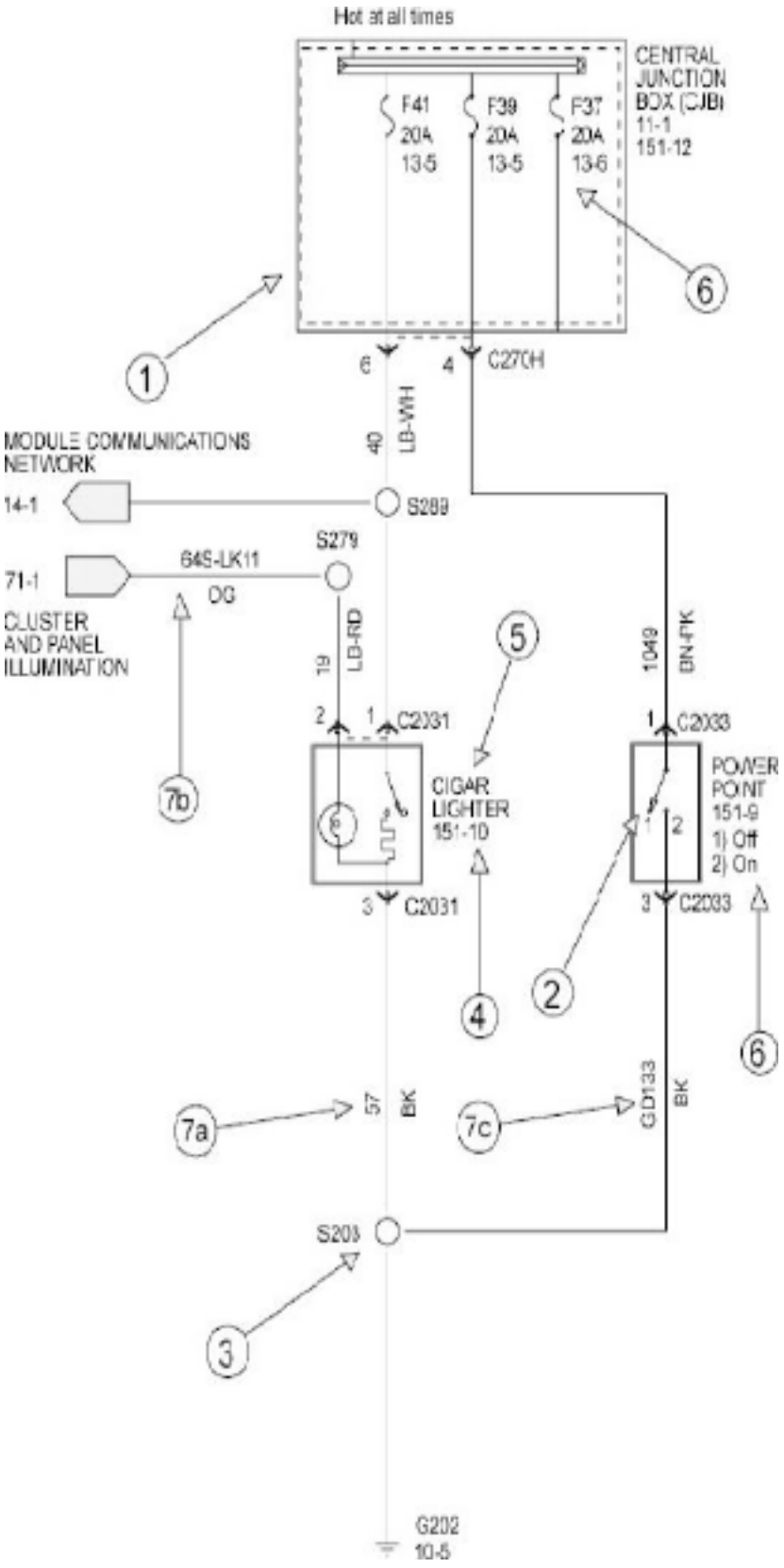
- The fog lamp bulb should not be removed from the fog lamp until just before a replacement bulb is installed. Removing the bulb for an extended period of time may affect fog lamp bulb performance. Contaminants may enter where they can settle on the lens and reflector. Never turn the fog lamps on with the bulb removed.

- Make sure the headlamp switch and the ignition switch are in the OFF position.

1. With the vehicle in NEUTRAL, position it on a hoist. 2. Disconnect the electrical connector and remove the fog lamp bulb. 3. To install, reverse the removal procedure.


BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L
C1035
F1
F2
F3
F5
F7
F9
F11
F13
F17
F21
F23
F25
F27
F29
F31
F33
F38
F39
F41
F42
F43
F44
A/C CLUTCH RELAY
PCM POWER RELAY
FUEL PUMP RELAY
FOG LAMP RELAY
BLOWER MOTOR RELAY
STARTER RELAY

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Lighting and Horns > Fog/Driving Lamp > Fog/Driving Lamp Relay > Component Information > Diagrams > Diagram Information and Instructions



Fog/Driving Lamp Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

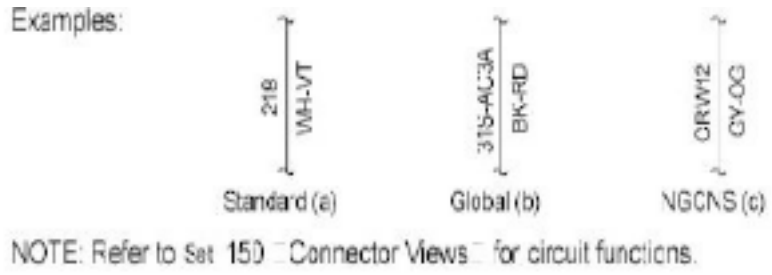
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

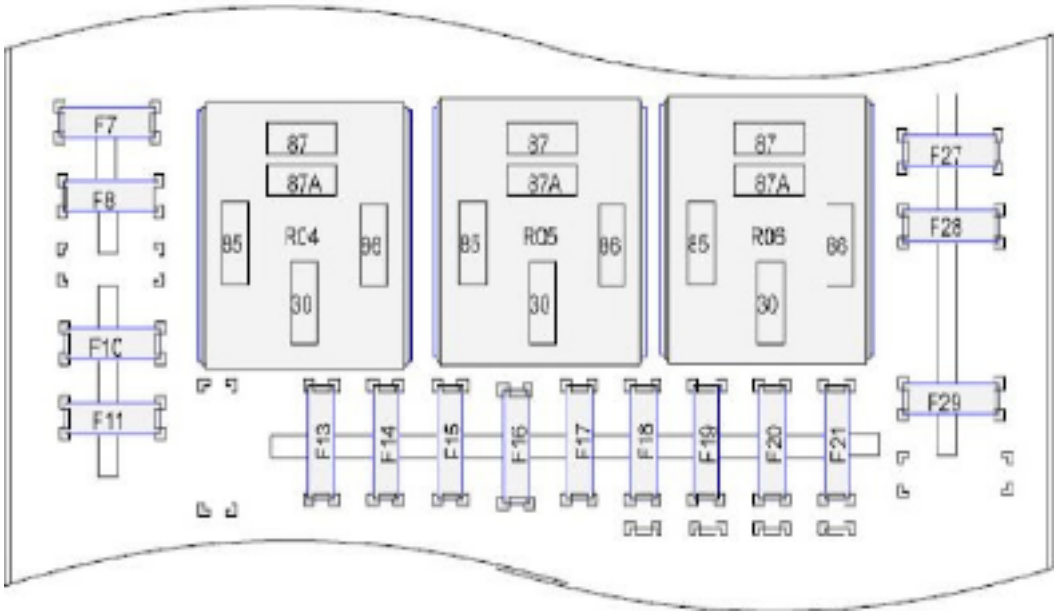
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

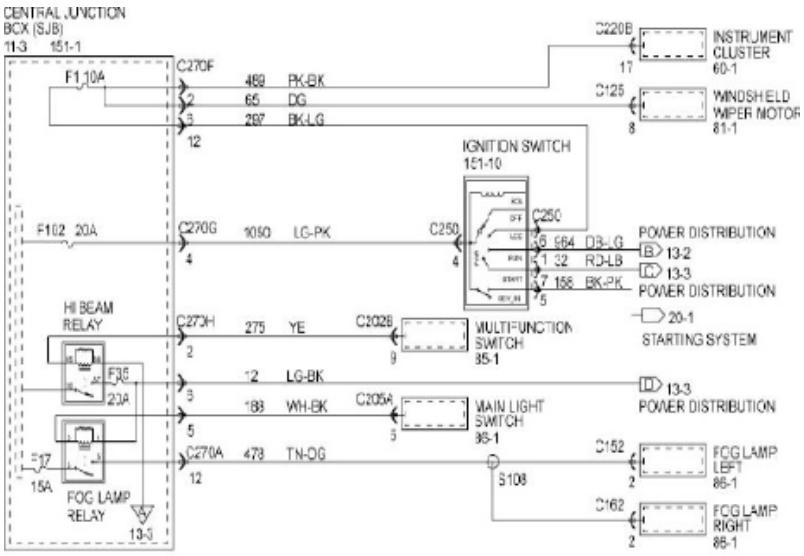
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

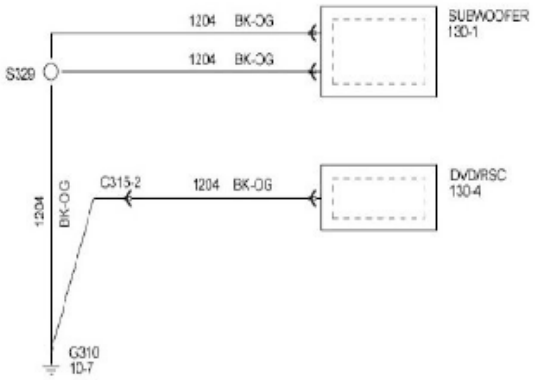
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

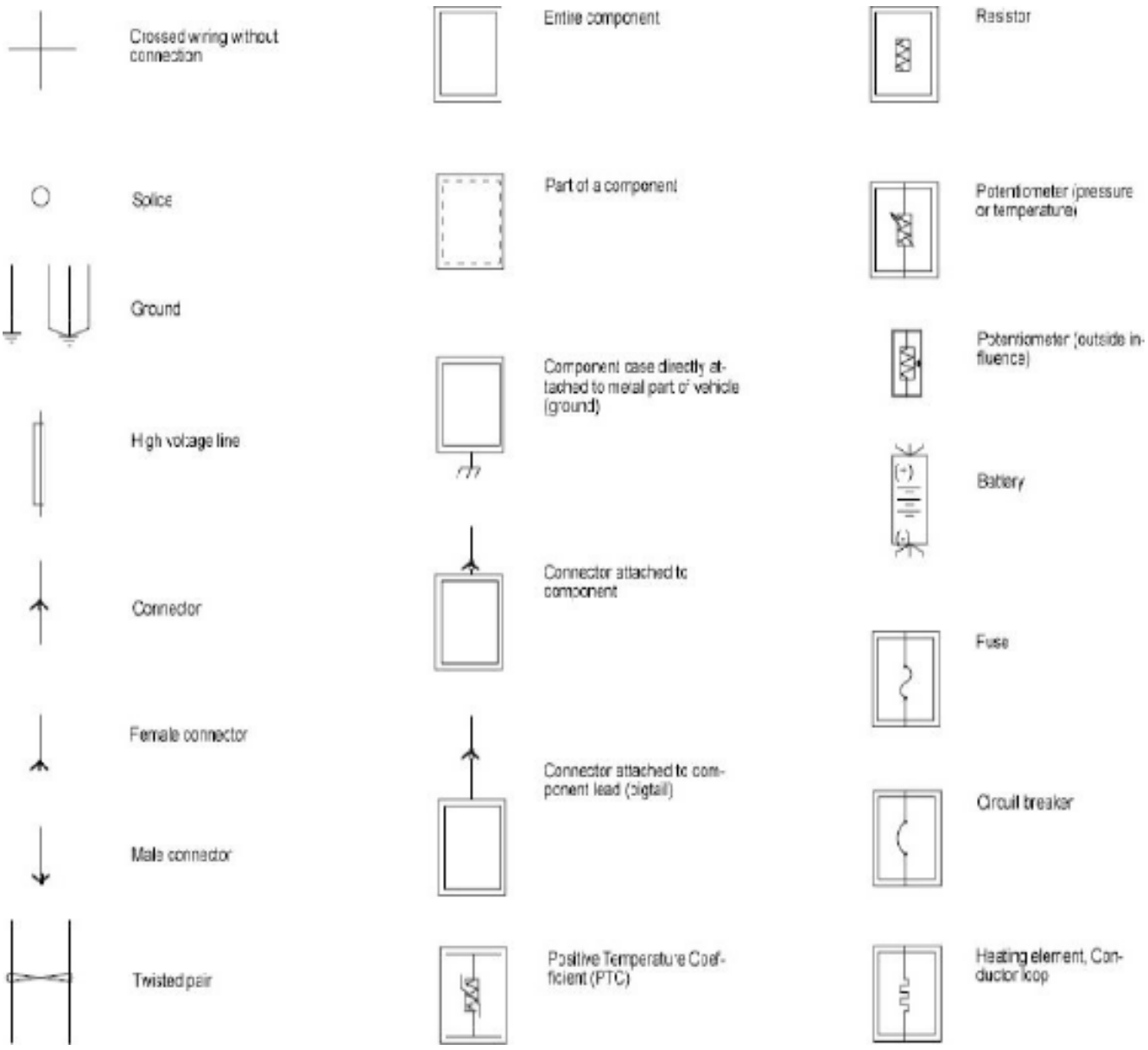
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

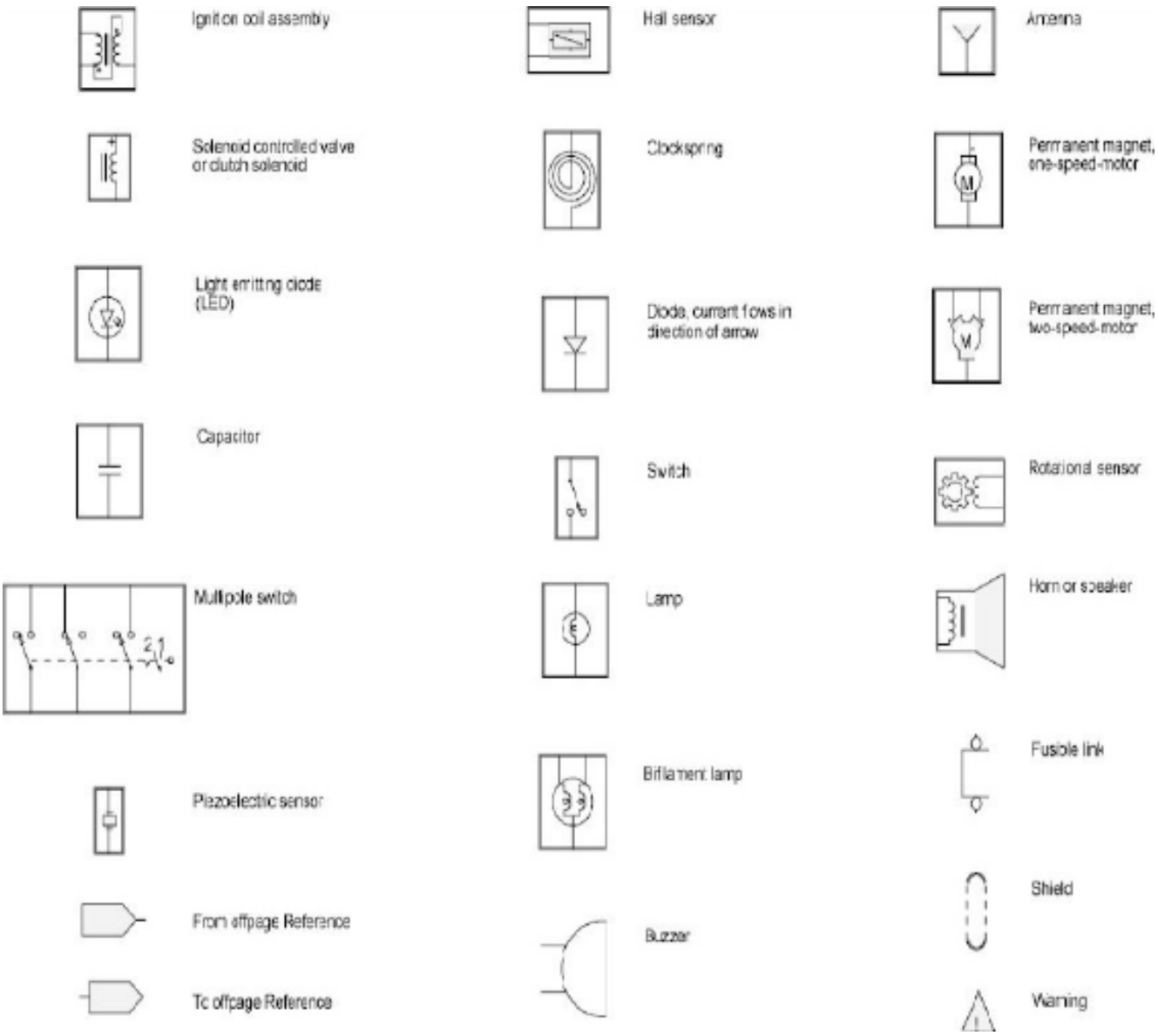
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

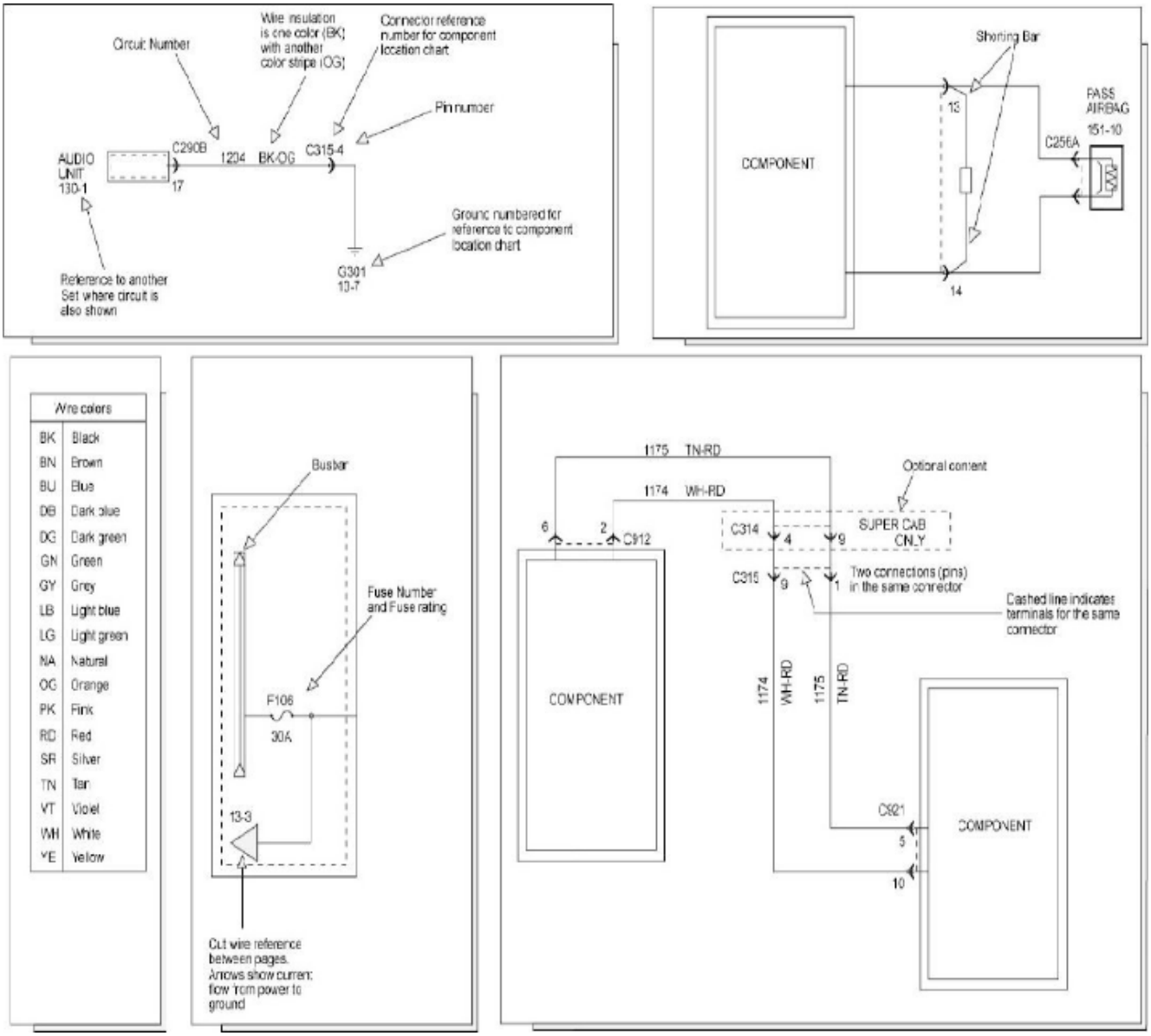
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

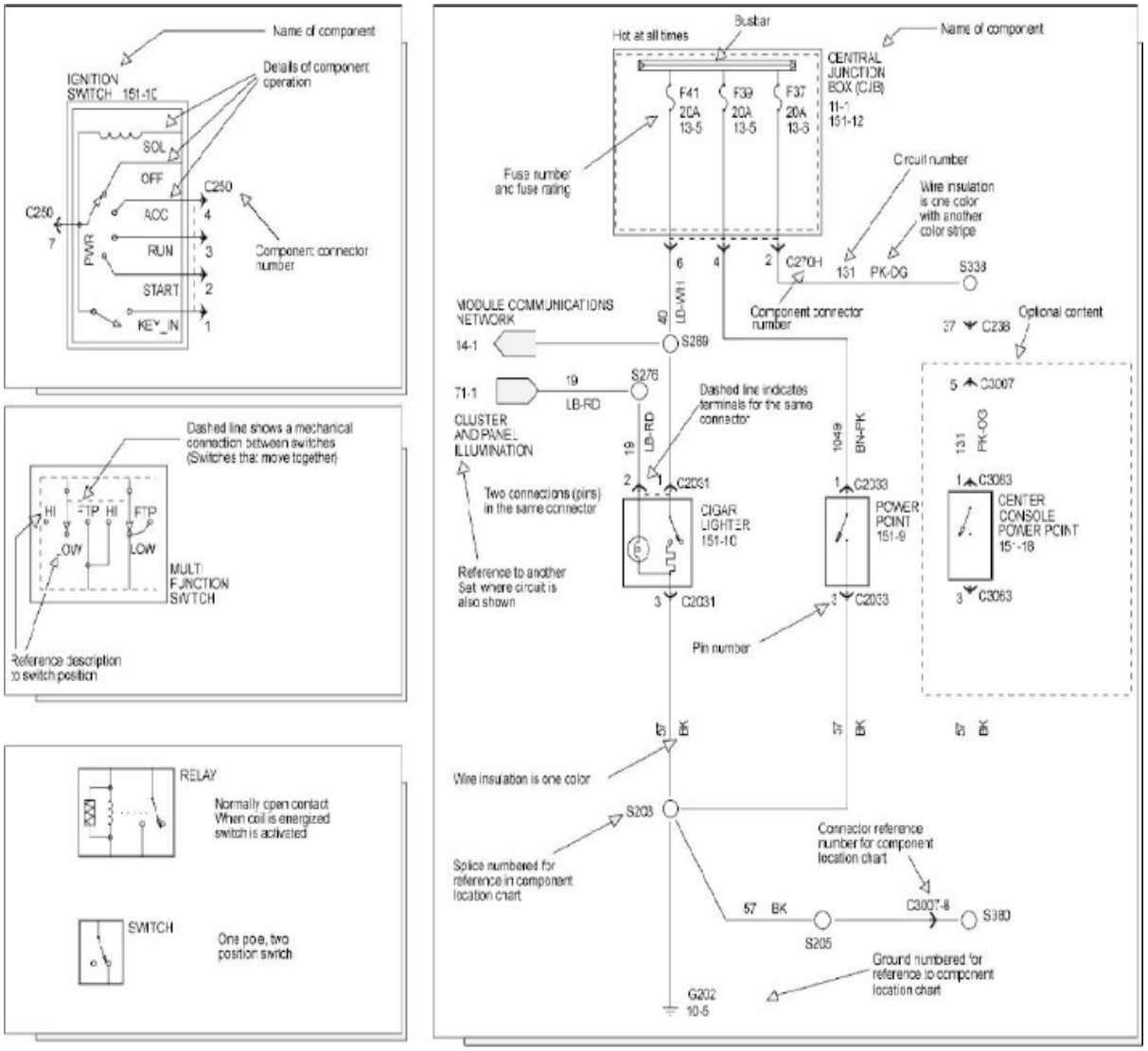
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

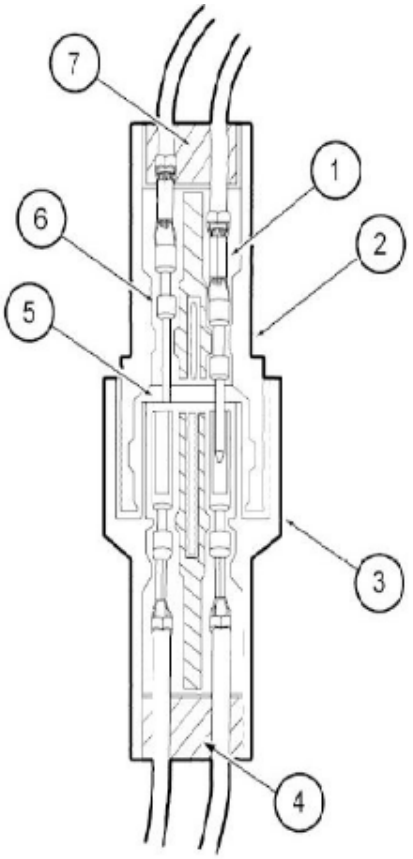


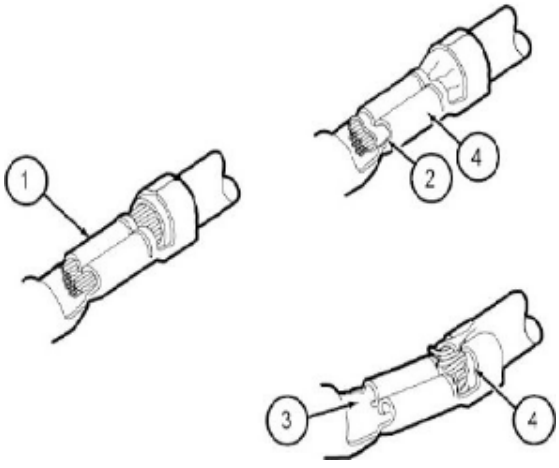
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Fog/Driving Lamp Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

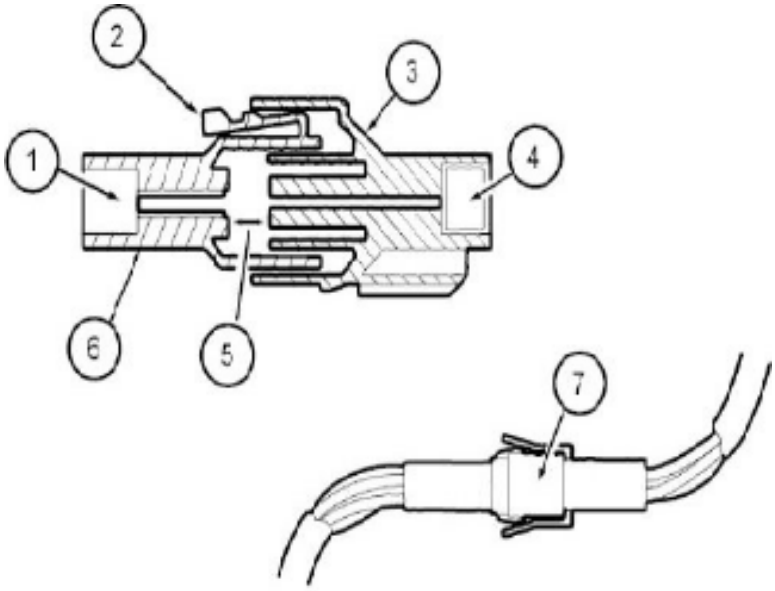
5 = Intermittent contact

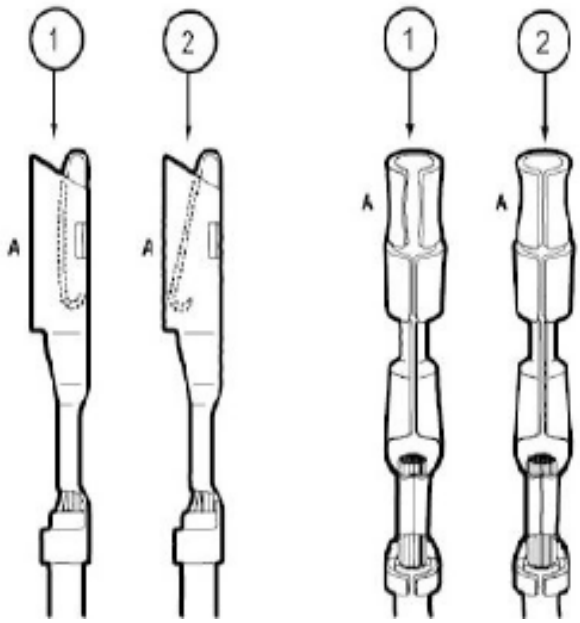
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

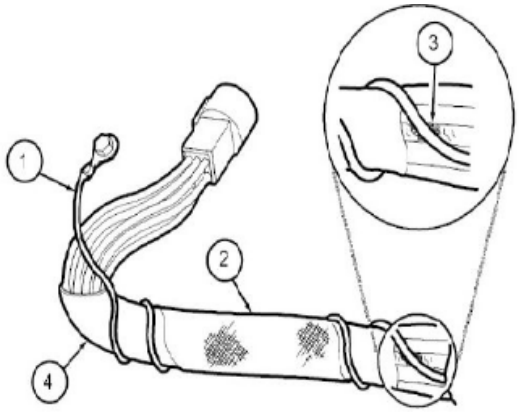
Deformed (enlarged) female terminals

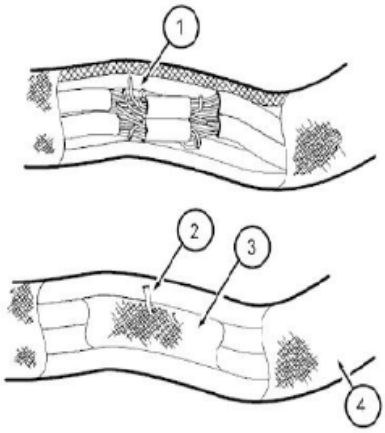
1 = Enlarged

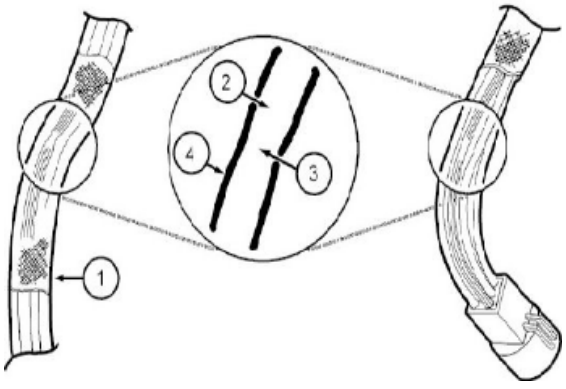
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

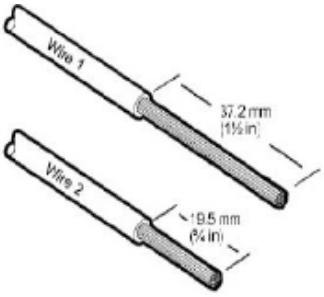
Splice covered 2

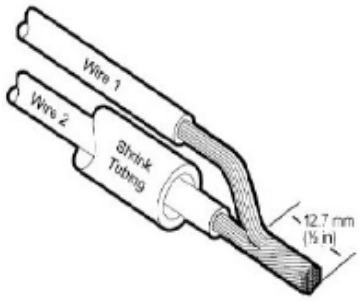
= Wire strand

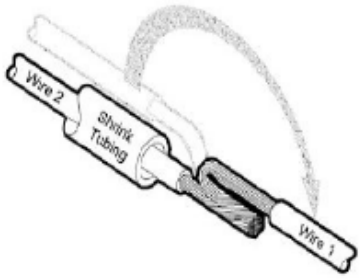
3 = Splice tape

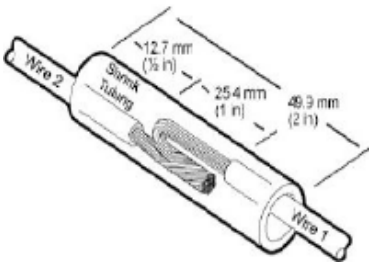
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

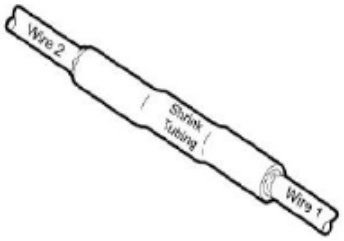
NOTE: -

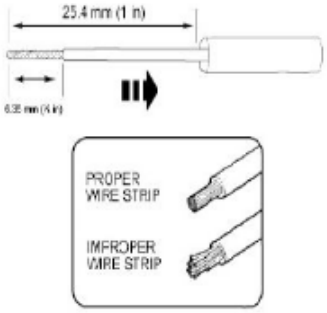
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

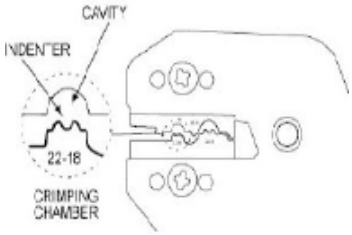
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

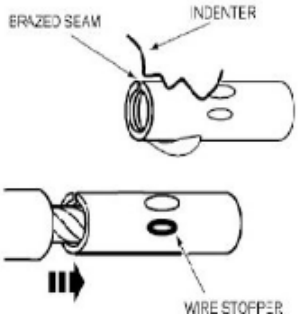
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
6.35 mm (¼ in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

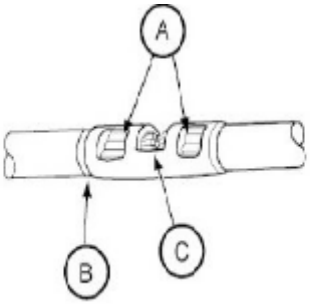
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

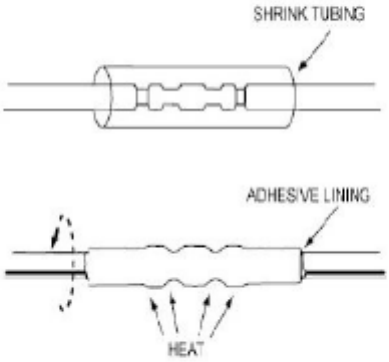
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4 strip, cut 9 strands	* 1/4 strip, cut 2 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip, fold 3x dia.
	16-14	* 1/4 strip, cut 7 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip fold 2x dia	1 strip, fold 3x dia.	1 1/4 strip, fold 4x dia.	Not Recommended
	12-10	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip fold 3x cia.	1 1/4 strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Figtail only

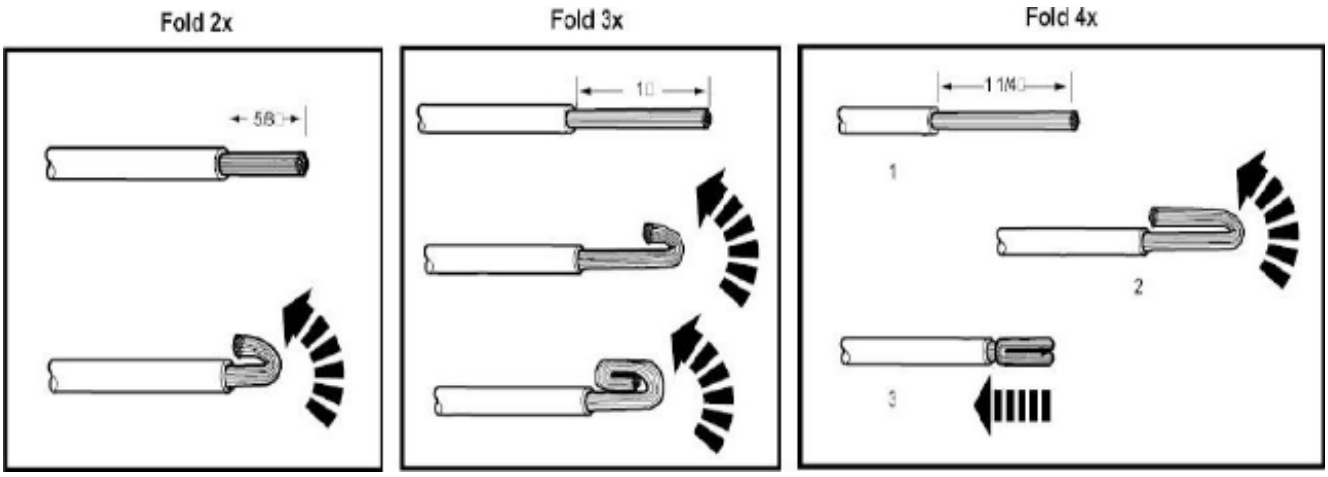
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



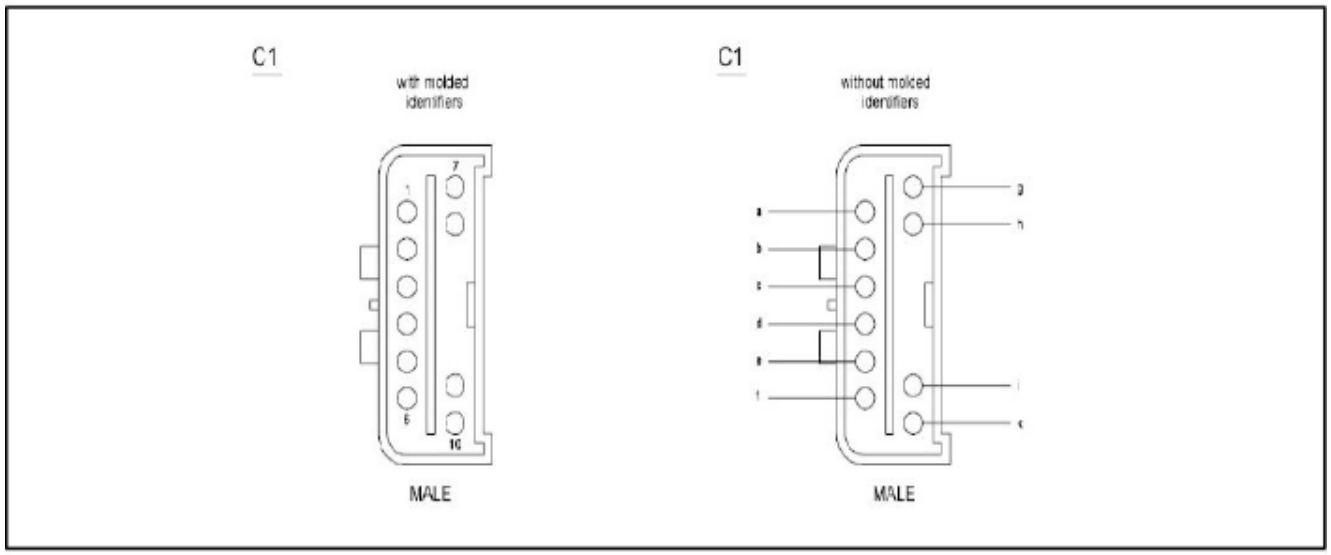
The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



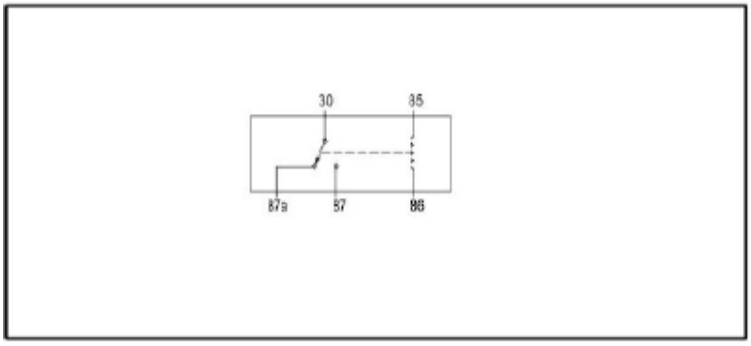
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

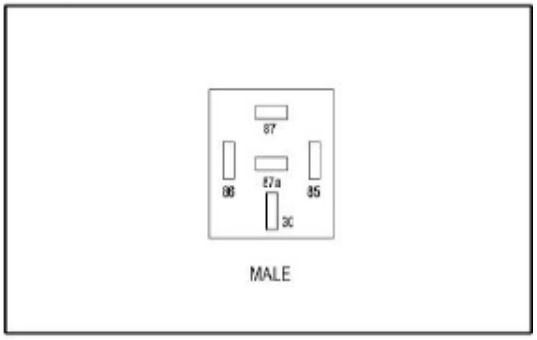
Fog/Driving Lamp Relay: Testing and Inspection Mini ISO Relay

Relay □ Mini ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

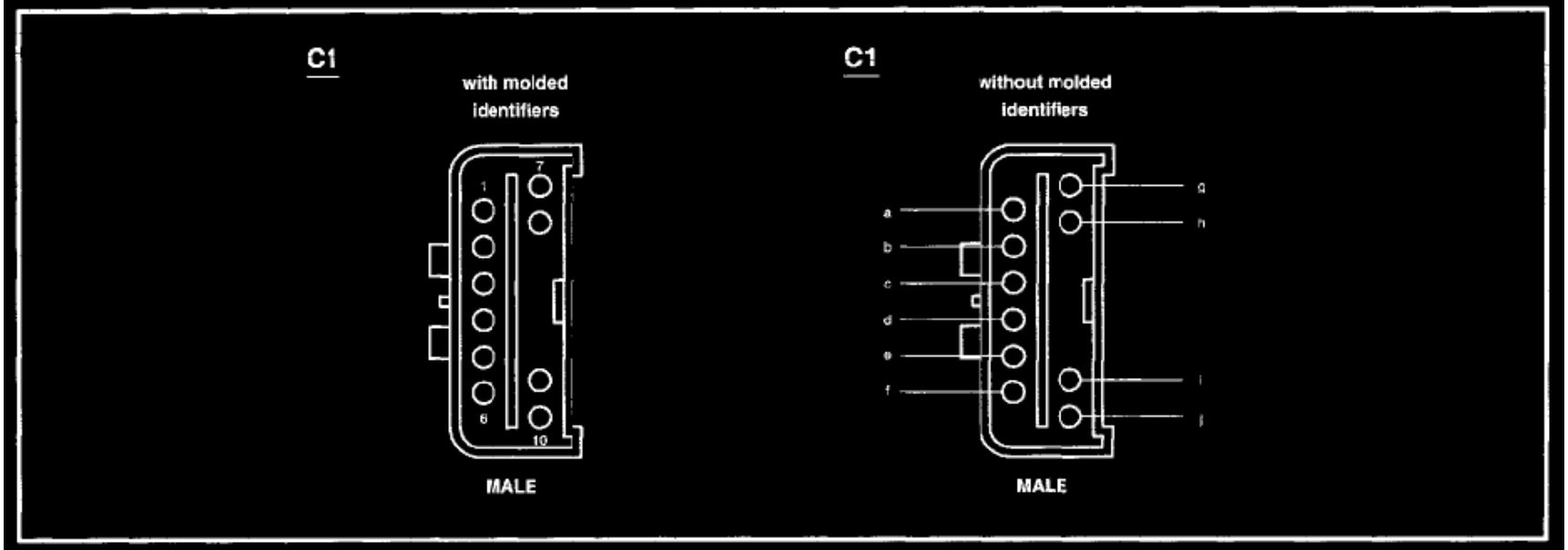
Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step–by–step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



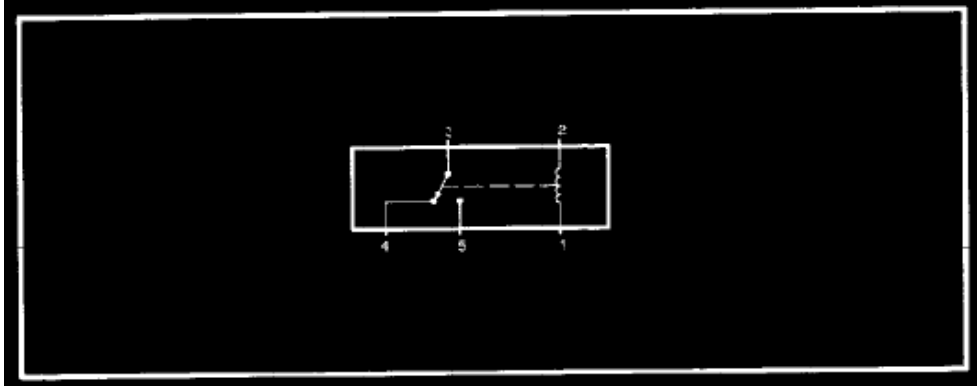
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

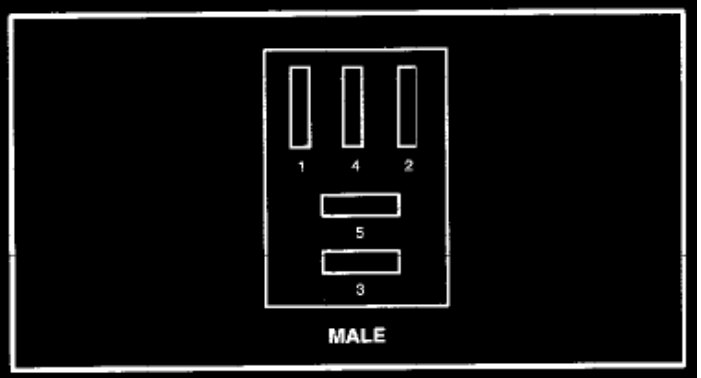
Fog/Driving Lamp Relay: Testing and Inspection Micro ISO Relay

Relay – Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63–102Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil – Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

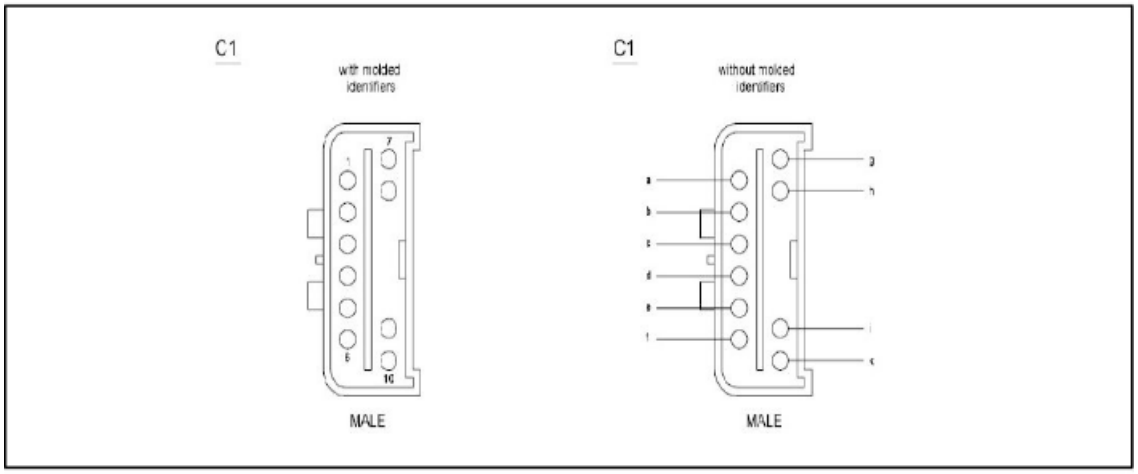
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step□by□step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals

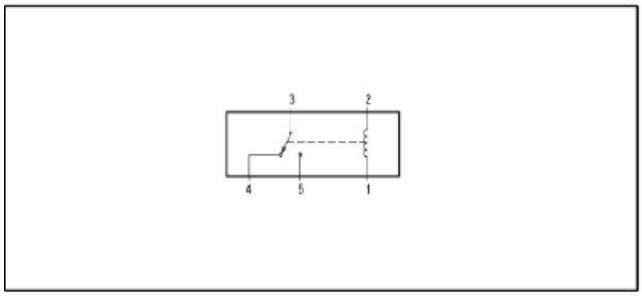


The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column □Circuit to test□. If you wish to test the complete component, perform all tests.

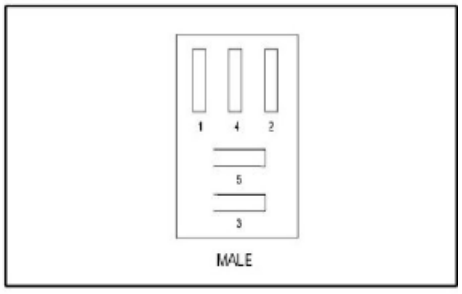
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Relay □ Micro ISO

Schematic



Terminals



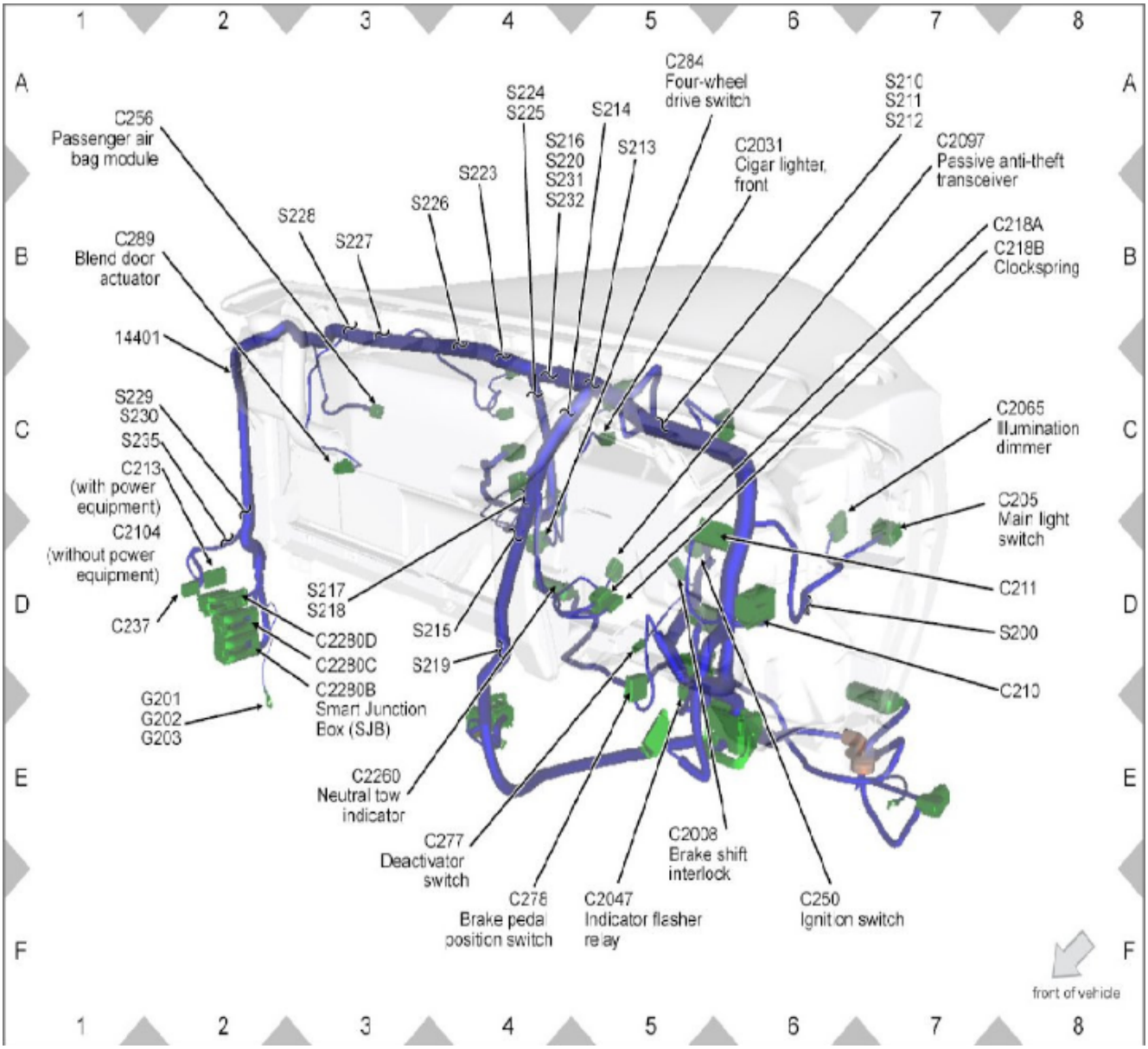
Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63□102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil □ Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

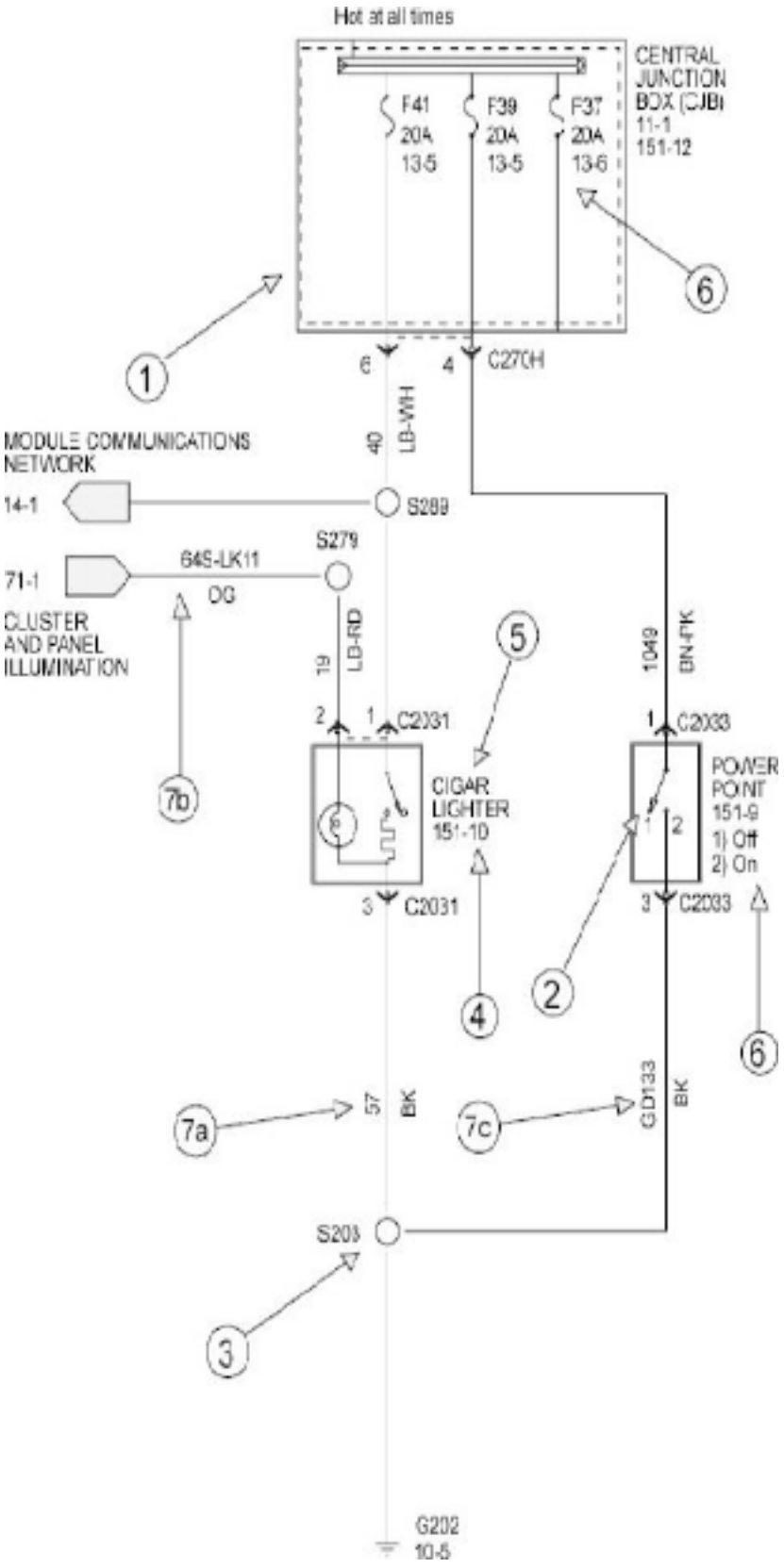
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Lighting and Horns > Hazard Warning Lamps > Hazard Flasher Relay > Component Information > Locations



View 151-11

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Lighting and Horns > Hazard Warning Lamps > Hazard Flasher Relay > Component Information > Diagrams > Diagram Information and Instructions



Hazard Flasher Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

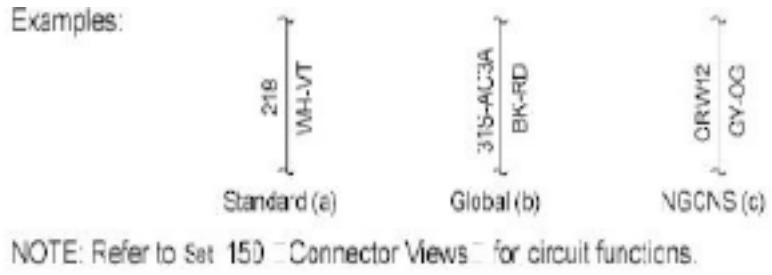
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

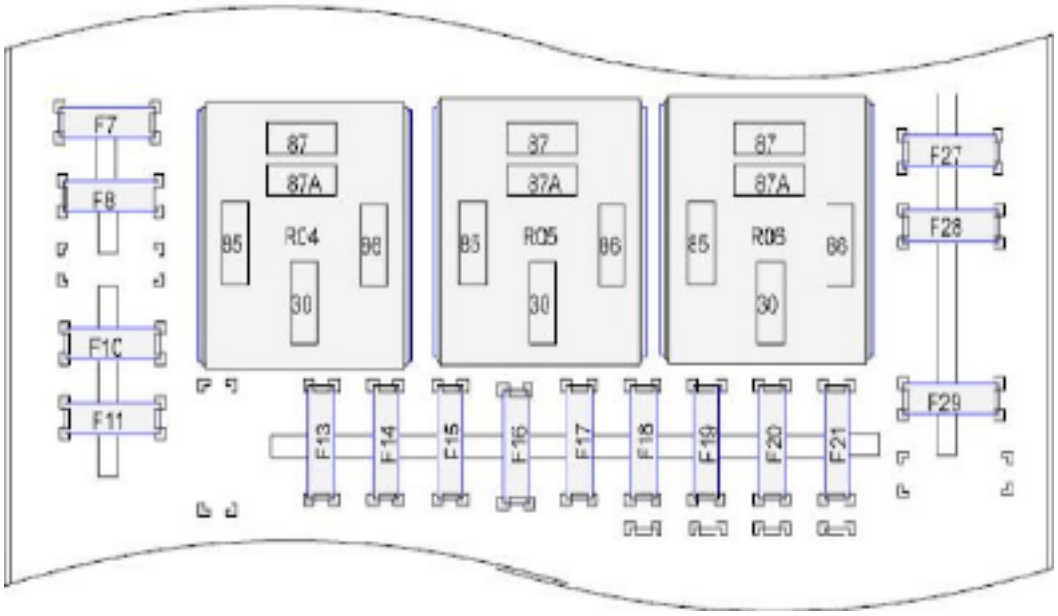
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

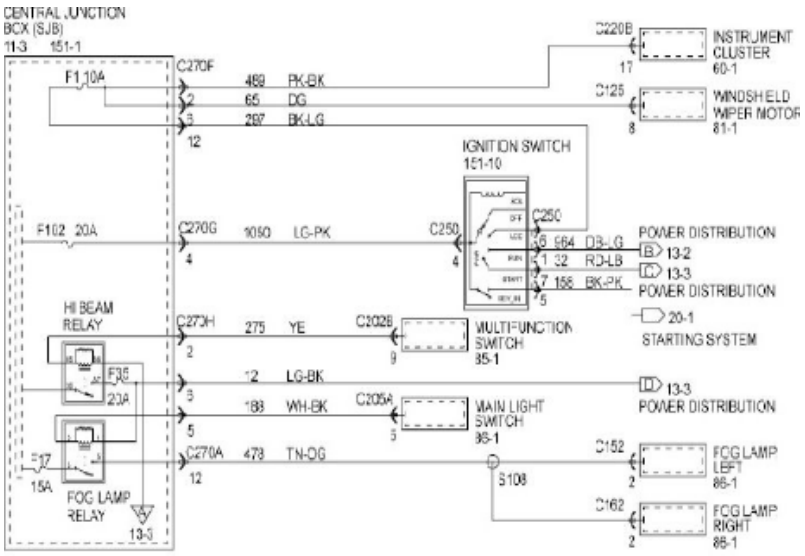
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

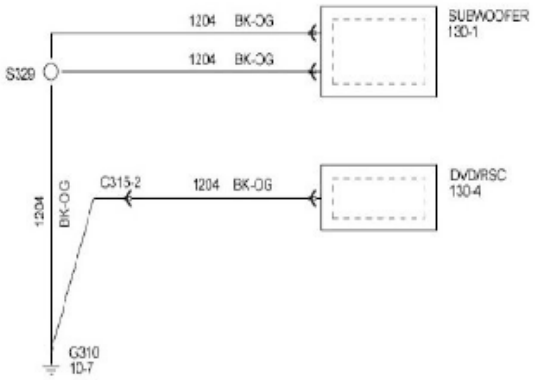
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

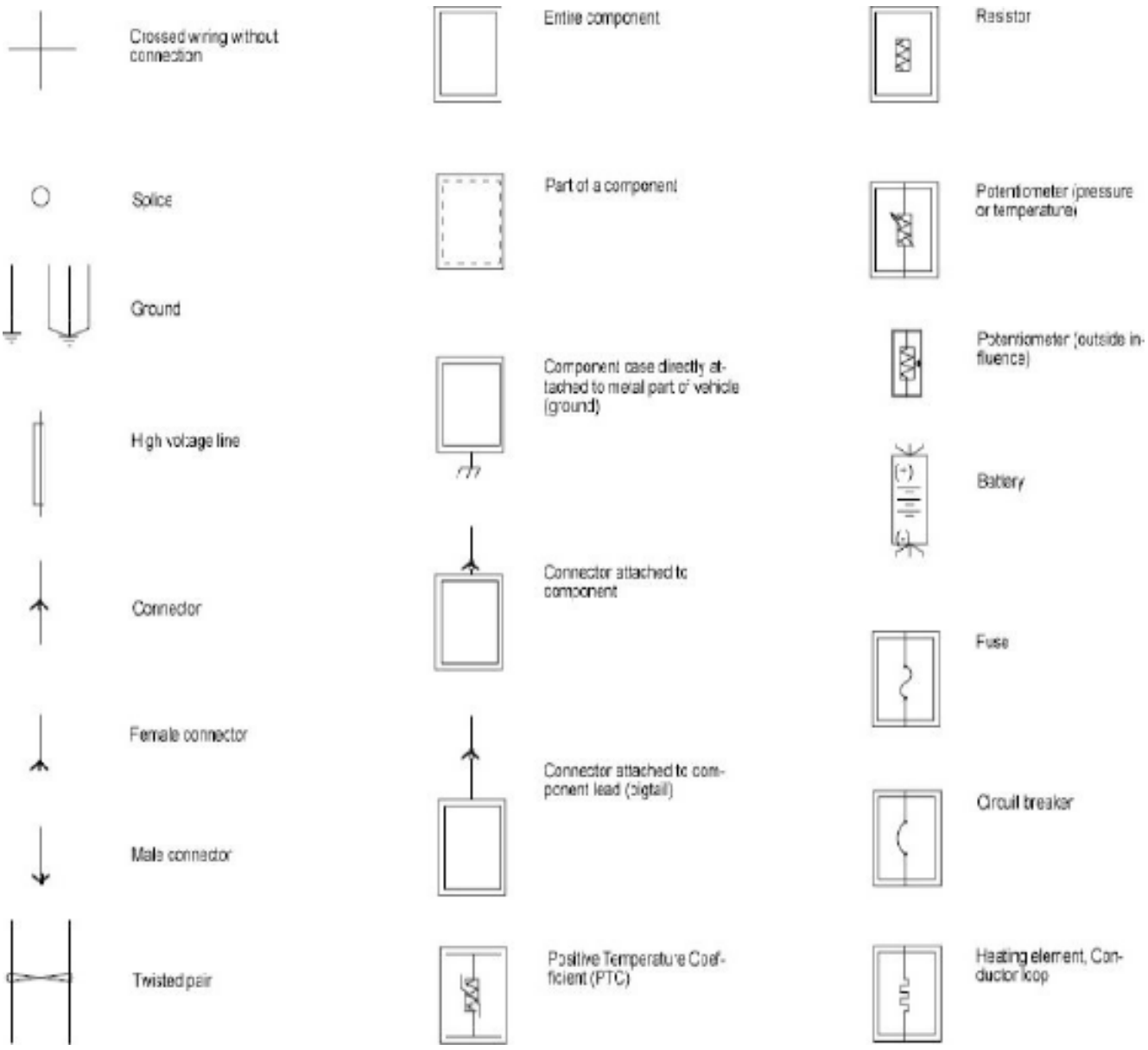
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

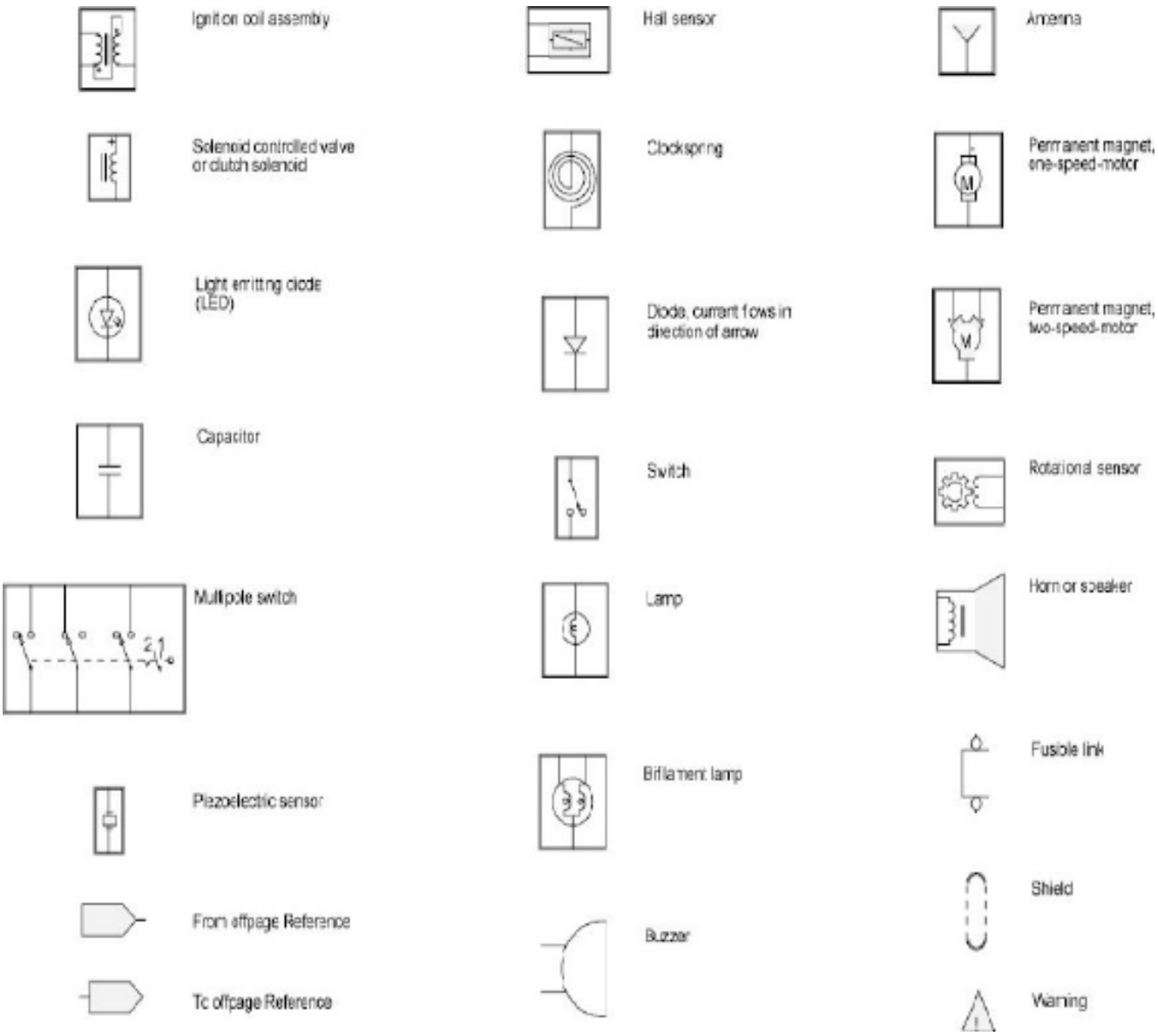
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

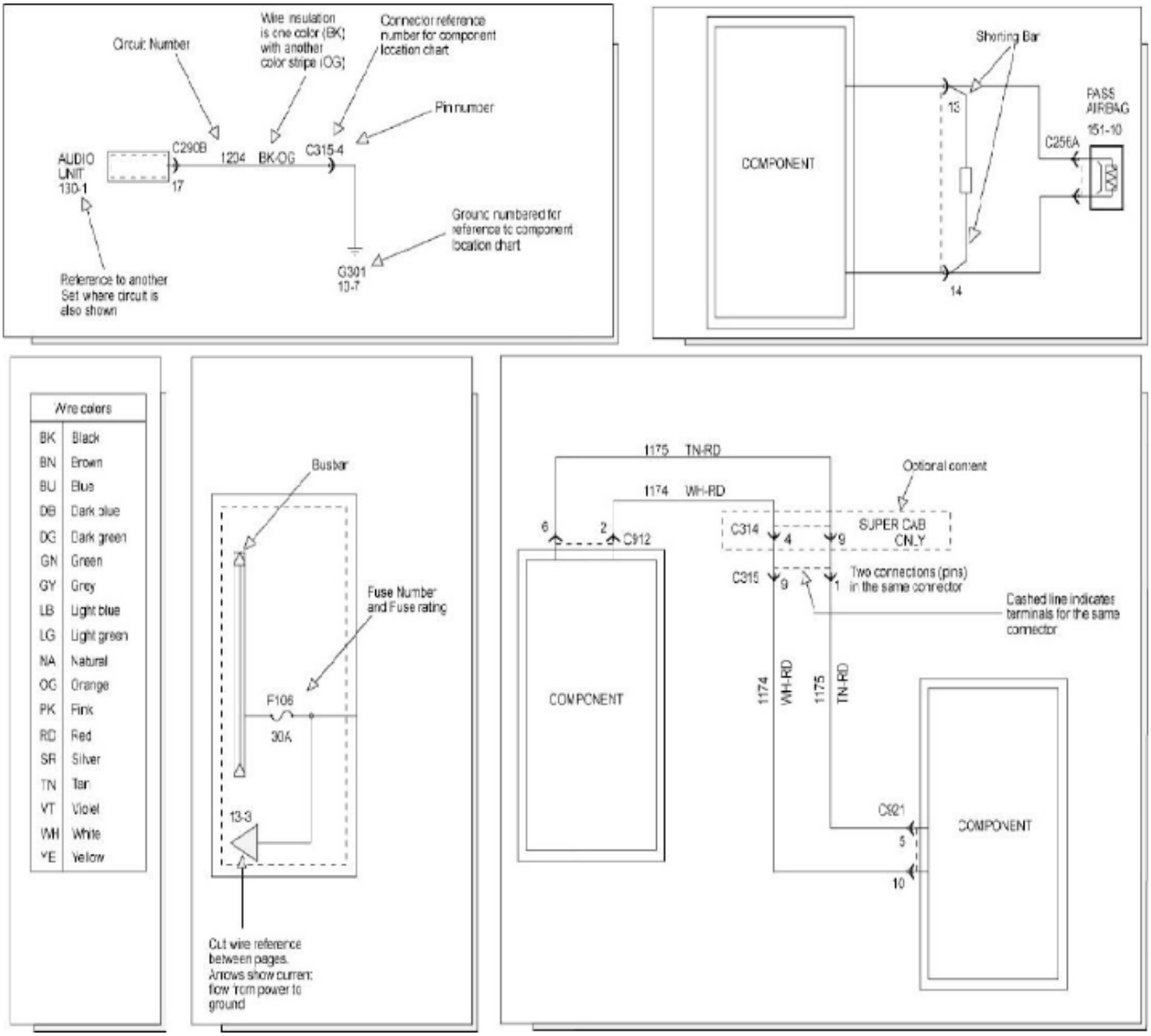
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

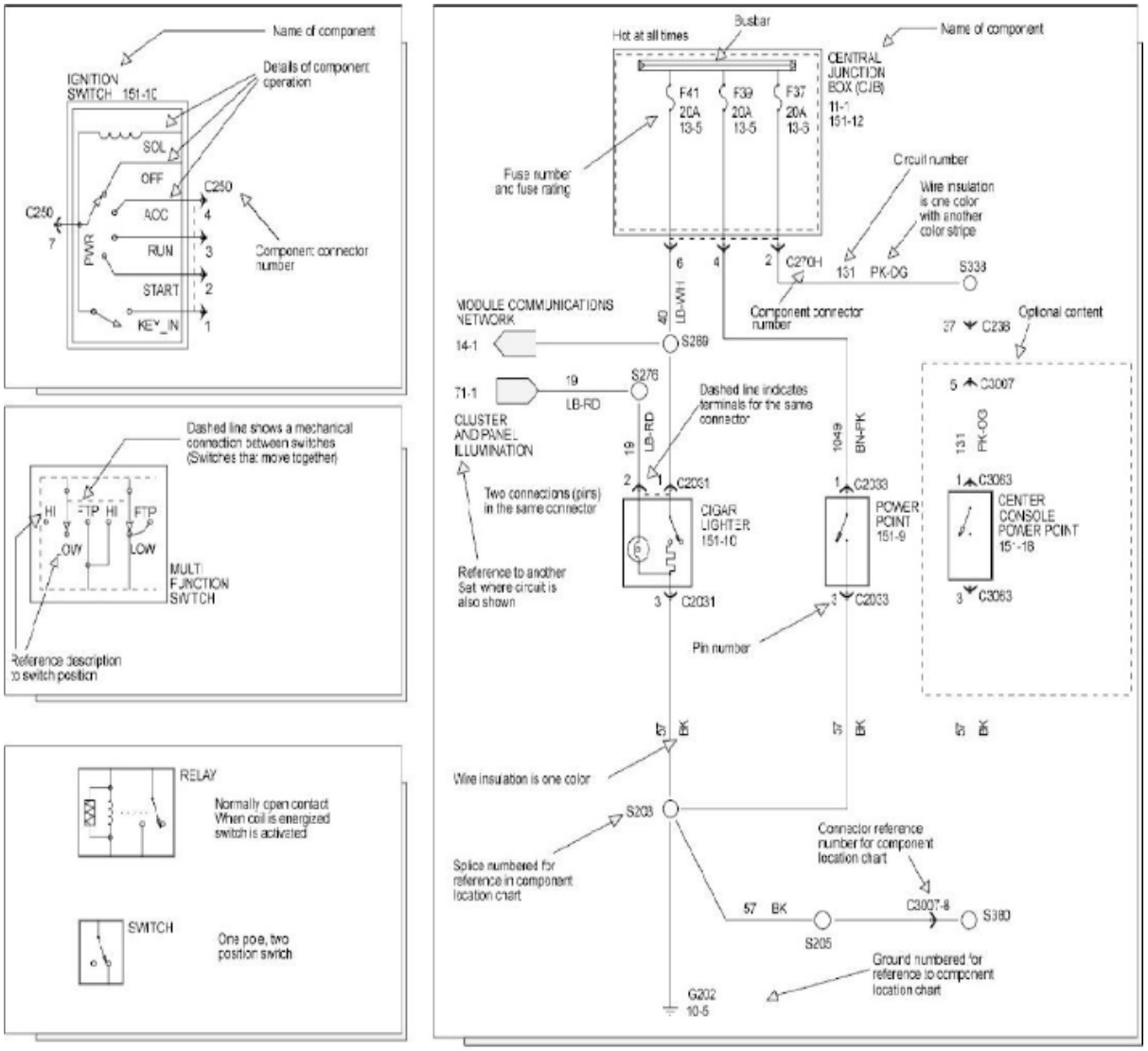
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

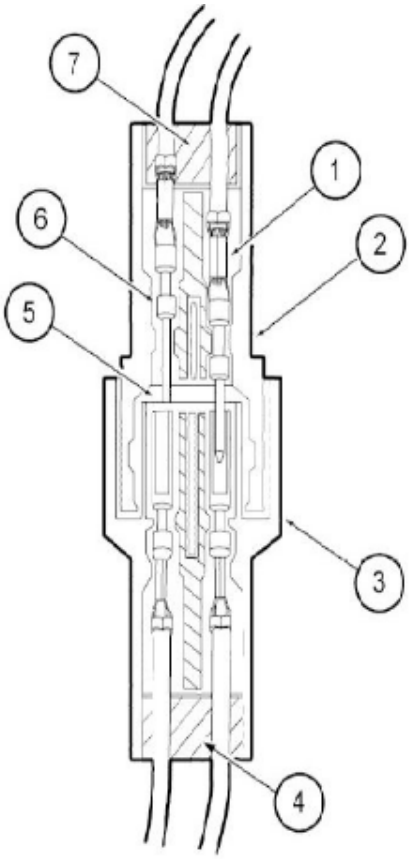


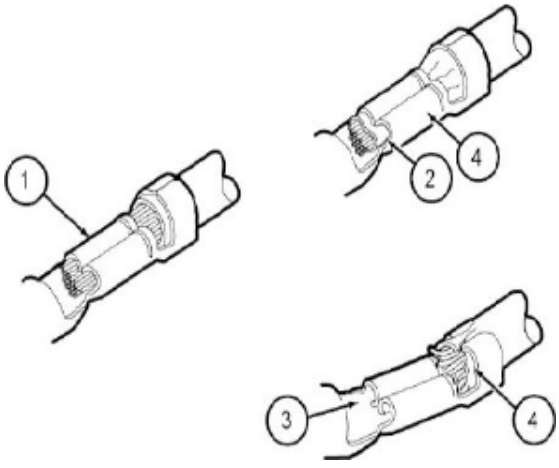
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Hazard Flasher Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

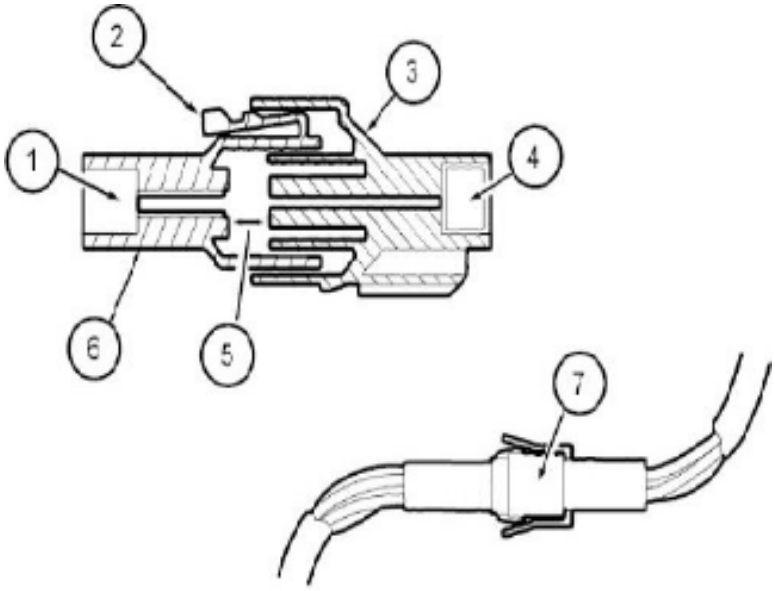
5 = Intermittent contact

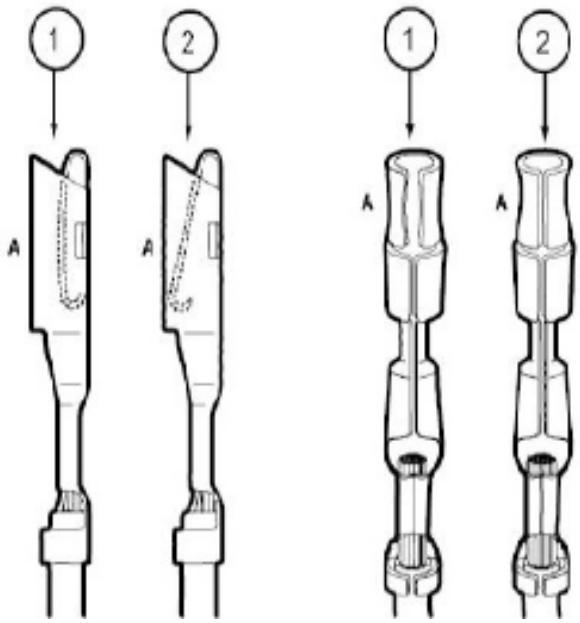
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

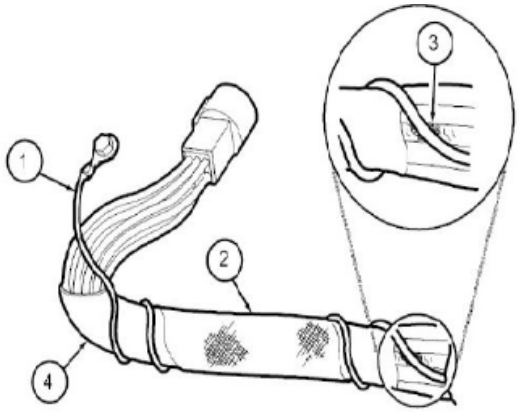
Deformed (enlarged) female terminals

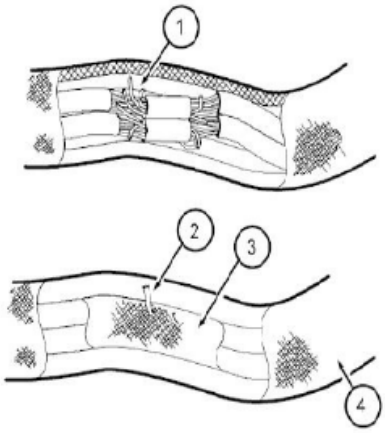
1 = Enlarged

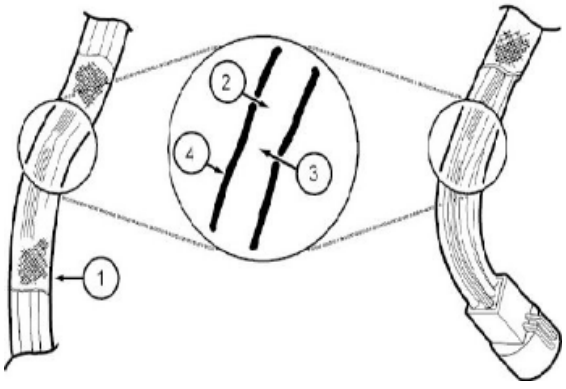
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

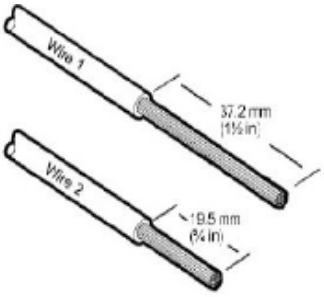
Splice covered 2

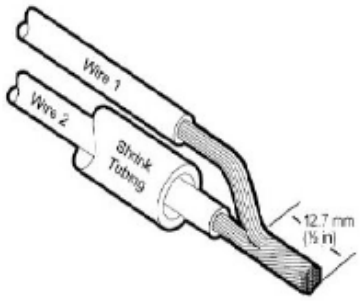
= Wire strand

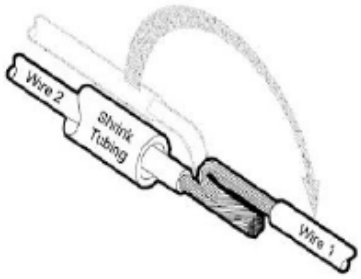
3 = Splice tape

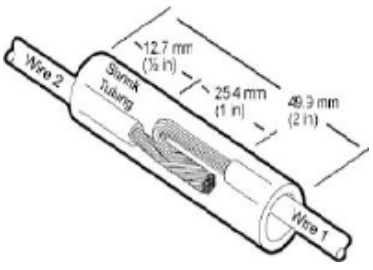
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

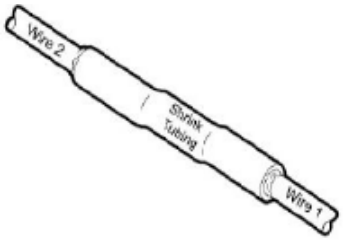
NOTE: -

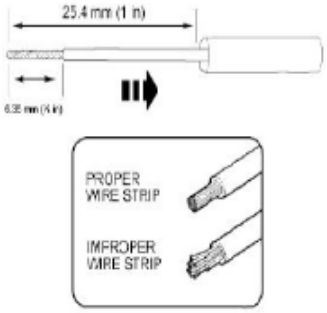
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

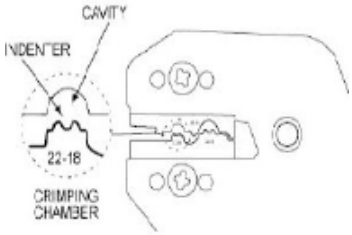
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

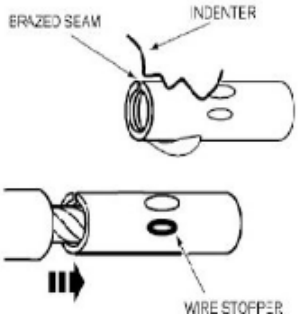
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

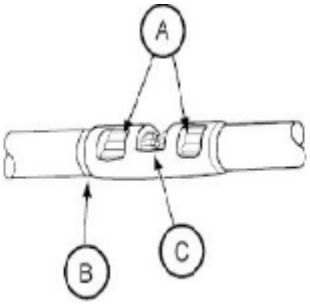
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

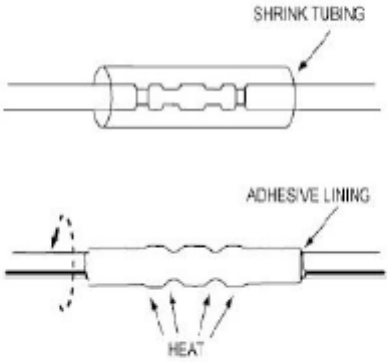
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4□ strip, cut 9 strands	* 1/4□ strip, cut 2 strands	1/4□ strip, no fold	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip, fold 2x dia.	1□ strip, fold 3x dia.
	16-14	* 1/4□ strip, cut 7 strands	1/4□ strip, no fold	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip fold 2x dia	1□ strip, fold 3x dia.	1 1/4□ strip, fold 4x dia.	Not Recommended
	12-10	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip, fold 2x dia.	1□ strip fold 3x cia.	1 1/4□ strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Figtail only

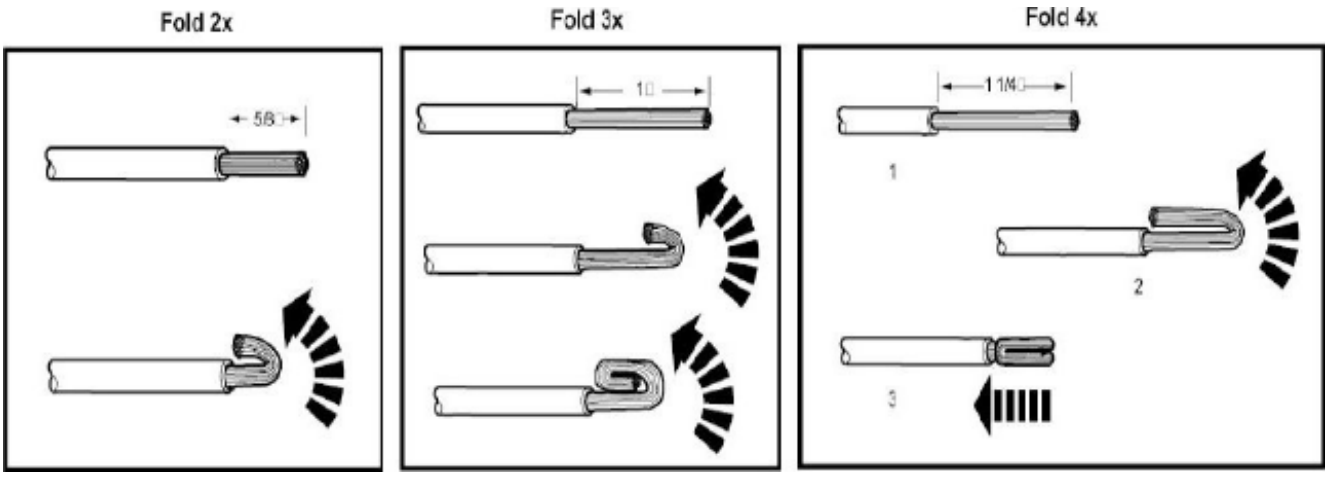
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

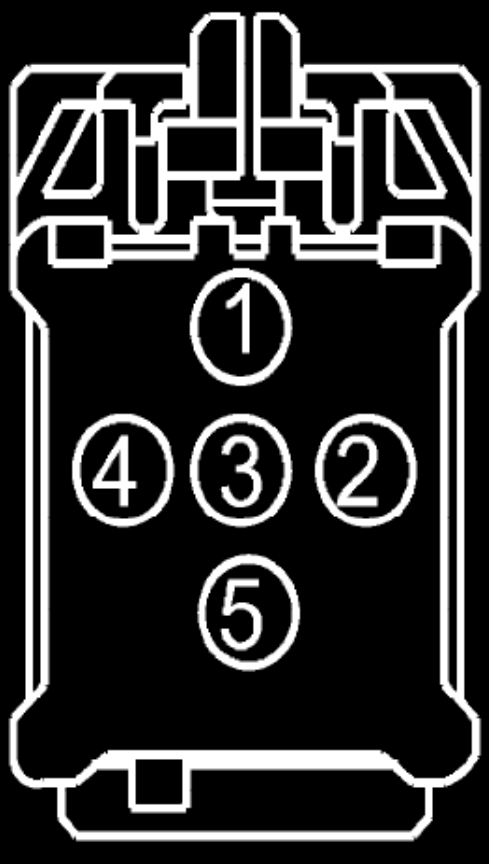
12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Connector: C2047

Description:	Harness:	Base Part #:
INDICATOR FLASHER RELAY	14401	13350



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CLS42 (VT-BN)	18	FLASHER - TURN SIGNAL/HAZARD	
2	GD161 (BK-YE)	18	GROUND - SEAT BRACKET REAR LEFT	
3	CLS32 (BN-YE)	18	SWITCH - HAZARD	
4	SBP17 (RD)	18	FUSE - 17 OR CIRCUIT BREAKER	
5	CBP20 (YE-VT)	18	FUSE - 20 OR CIRCUIT BREAKER	

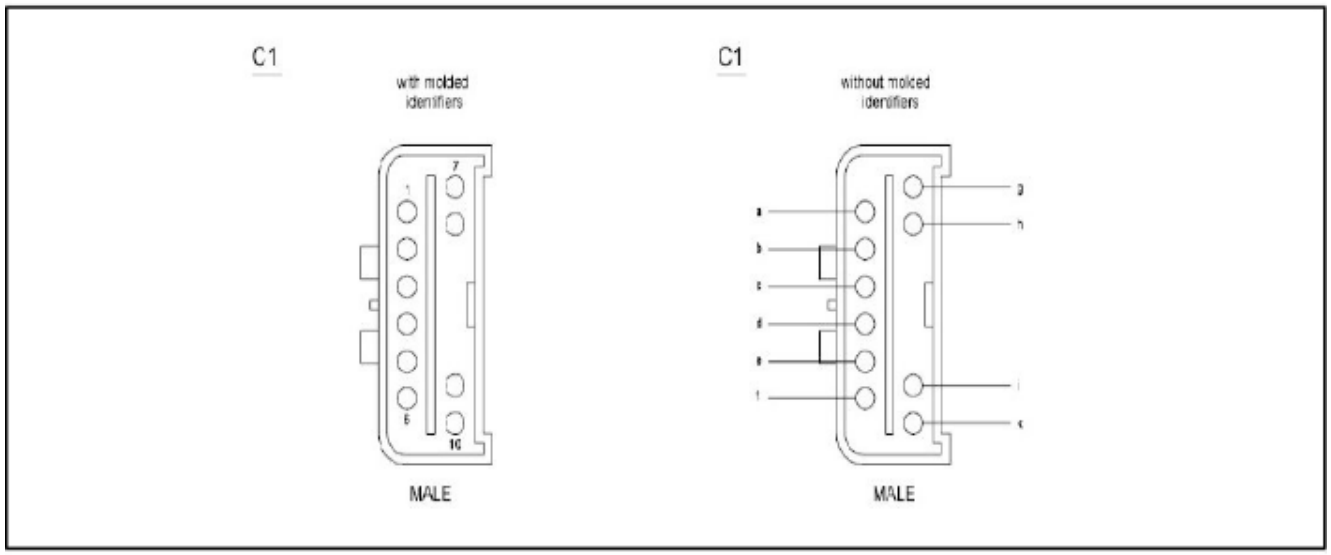
C2047

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



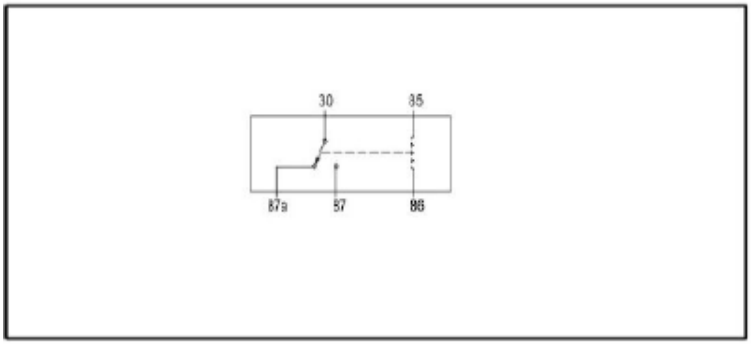
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

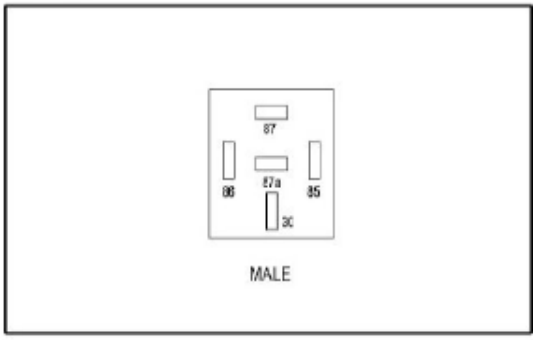
Hazard Flasher Relay: Testing and Inspection Mini ISO Relay

Relay □ Mini ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

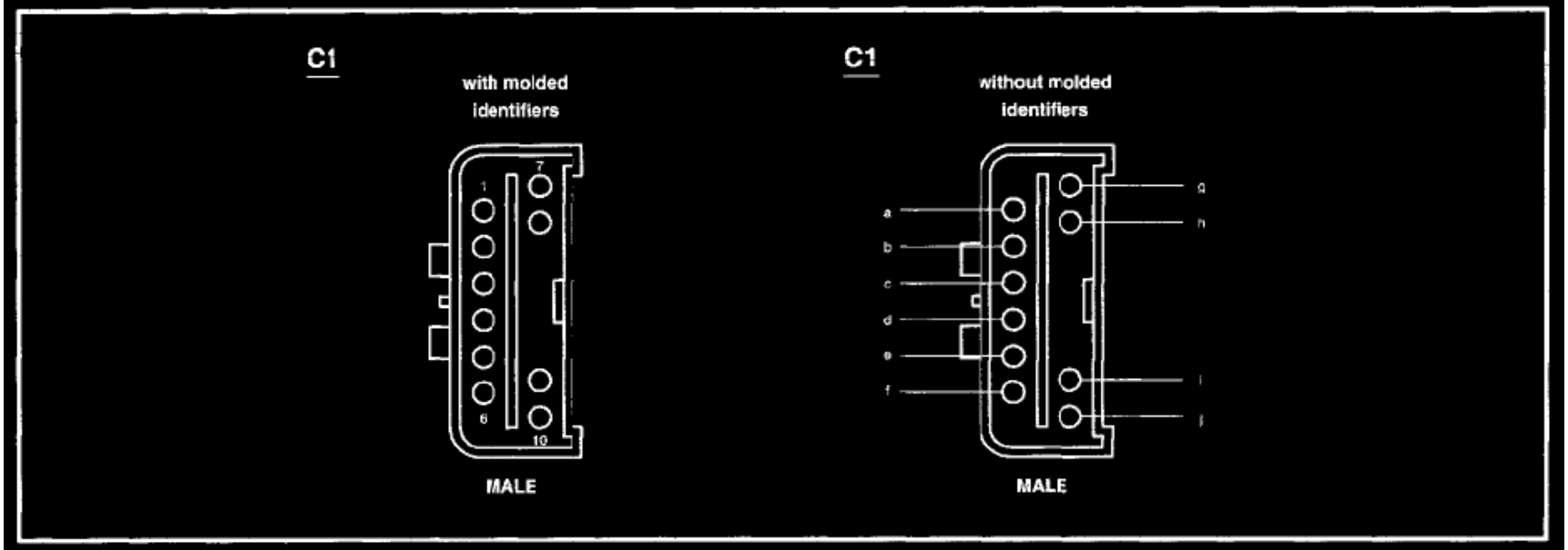
Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step–by–step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



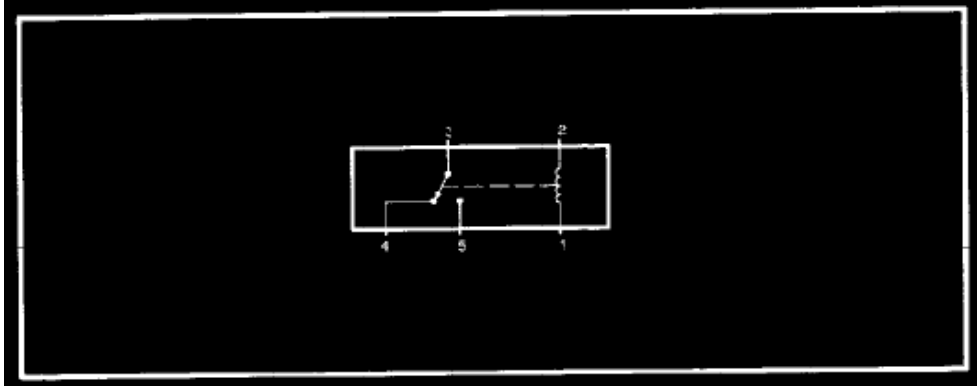
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

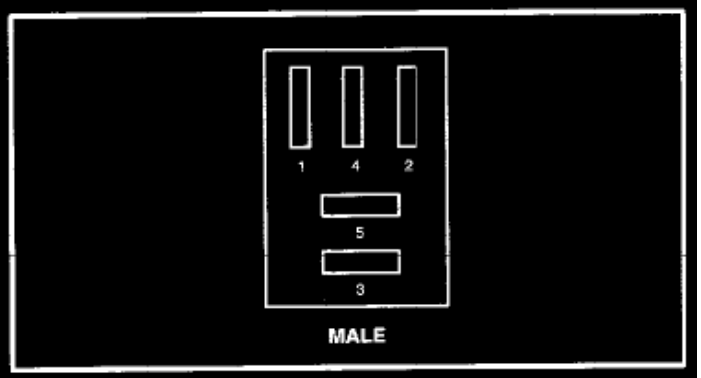
Hazard Flasher Relay: Testing and Inspection Micro ISO Relay

Relay – Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63–102Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil – Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

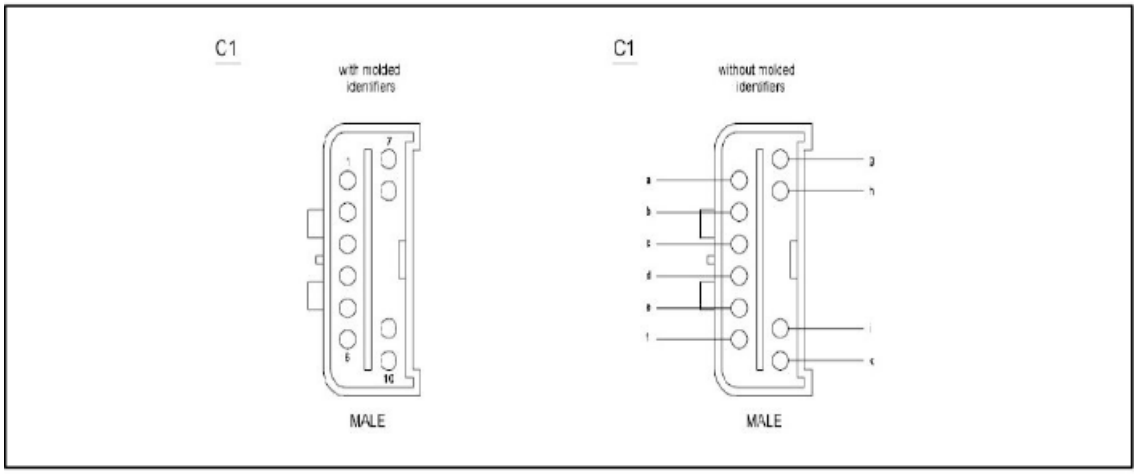
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step□by□step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals

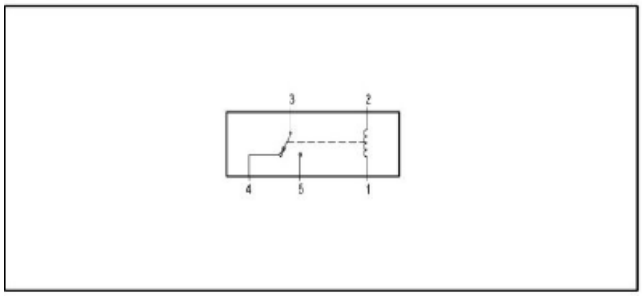


The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column □Circuit to test□. If you wish to test the complete component, perform all tests.

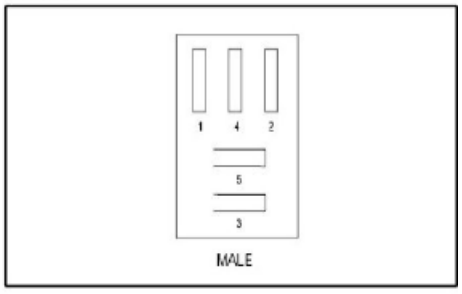
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Relay □ Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63□102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil □ Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

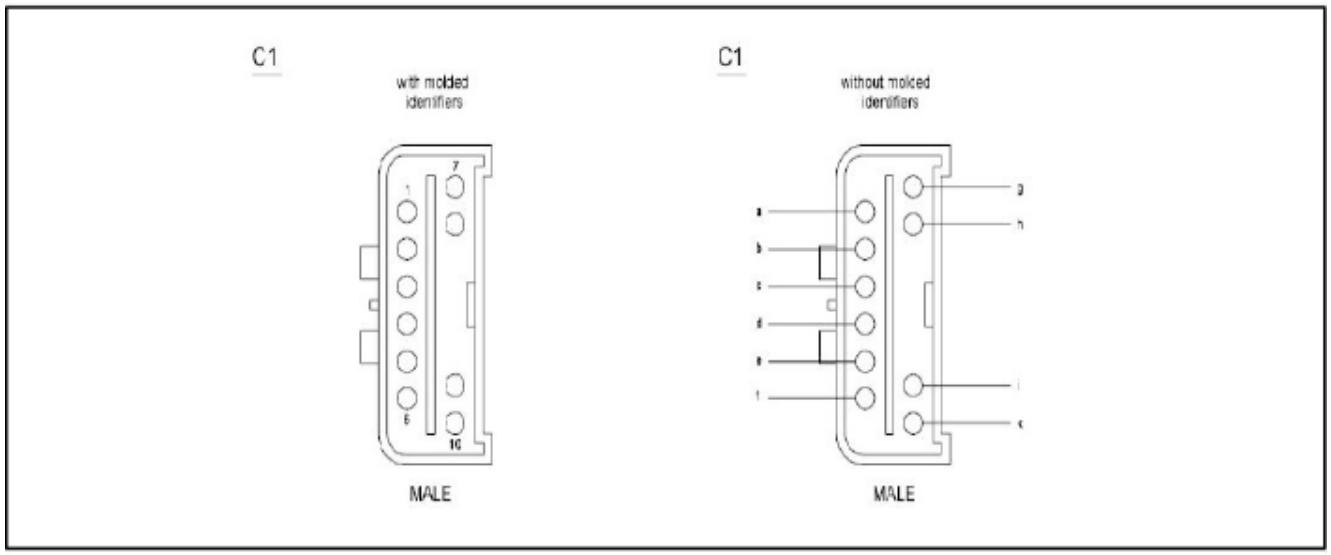
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



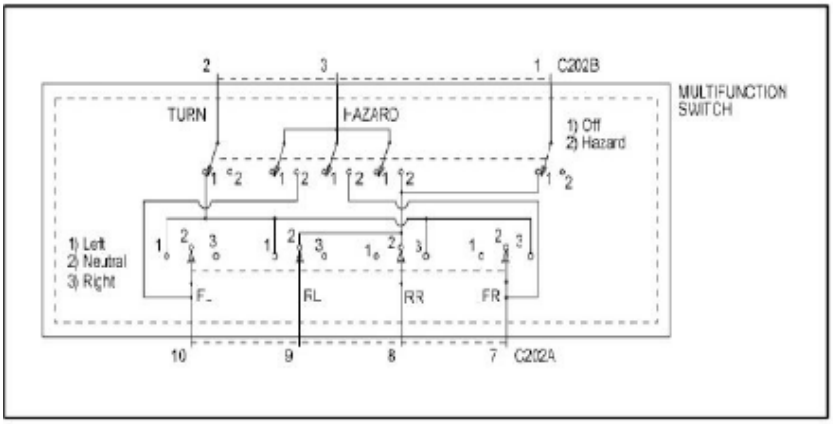
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

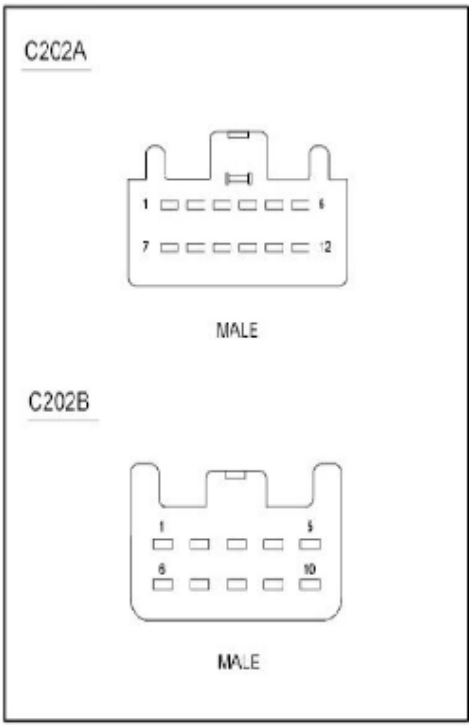
Hazard Warning Switch: Testing and Inspection

Multifunction Switch, Turn Portion

Schematic

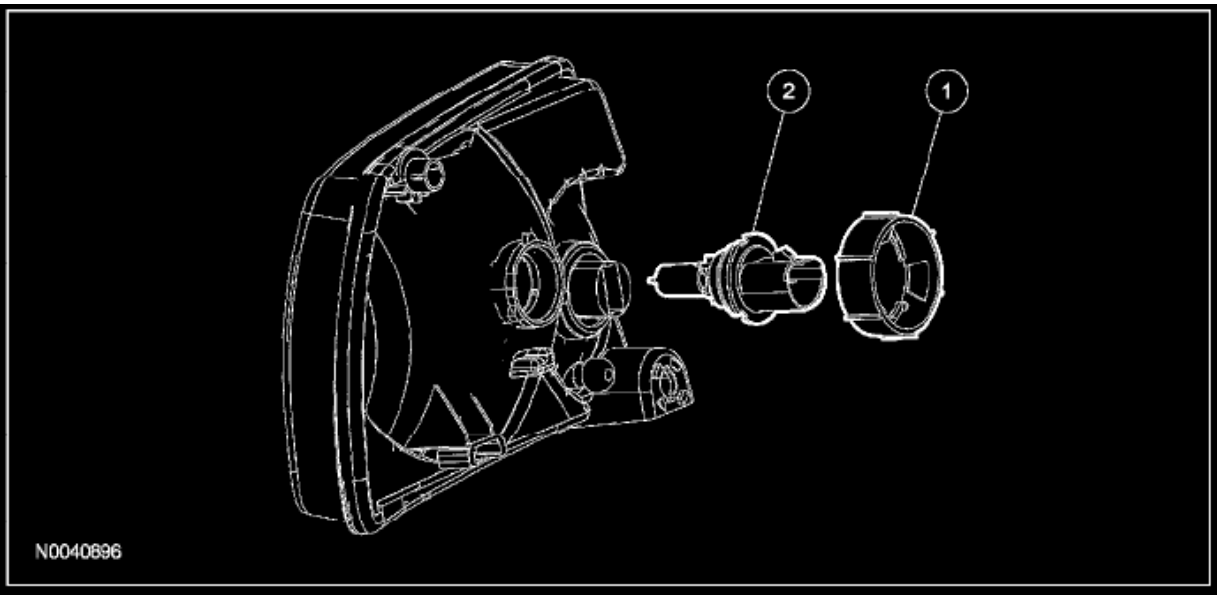


Terminals



Component testing procedure

Circuit to test	Connect self-powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
Turn signal	C202b-2 and C202a-10	Left turn	Closed circuit
	C202b-2 and C202a-9	Left turn	Closed circuit
	C202b-2 and C202a-7	Right turn	Closed circuit
	C202b-2 and C202a-8	Right turn	Closed circuit
Hazard	C202b-3 and C202a-10	Turn signal switch in neutral, Hazard On	Closed circuit
	C202b-3 and C202a-7		
	C202b-3 and C202a-9		
	C202b-3 and C202a-8		
	C202b-1 and C202a-10	Turn signal switch in neutral, Hazard Off	Closed circuit
	C202b-1 and C202a-8		



Item	Part Number	Description
1	13N019	Headlamp bulb retainer
2	13N021	Headlamp bulb

Headlamp Bulb: Service and Repair

HEADLAMP BULB

Removal and Installation

WARNING: The bulb contains gas under pressure. The bulb may shatter if the glass envelope is scratched or if the bulb is dropped. Handle the bulb only by its base. Avoid touching the glass envelope. Failure to follow these instructions may result in personal injury.

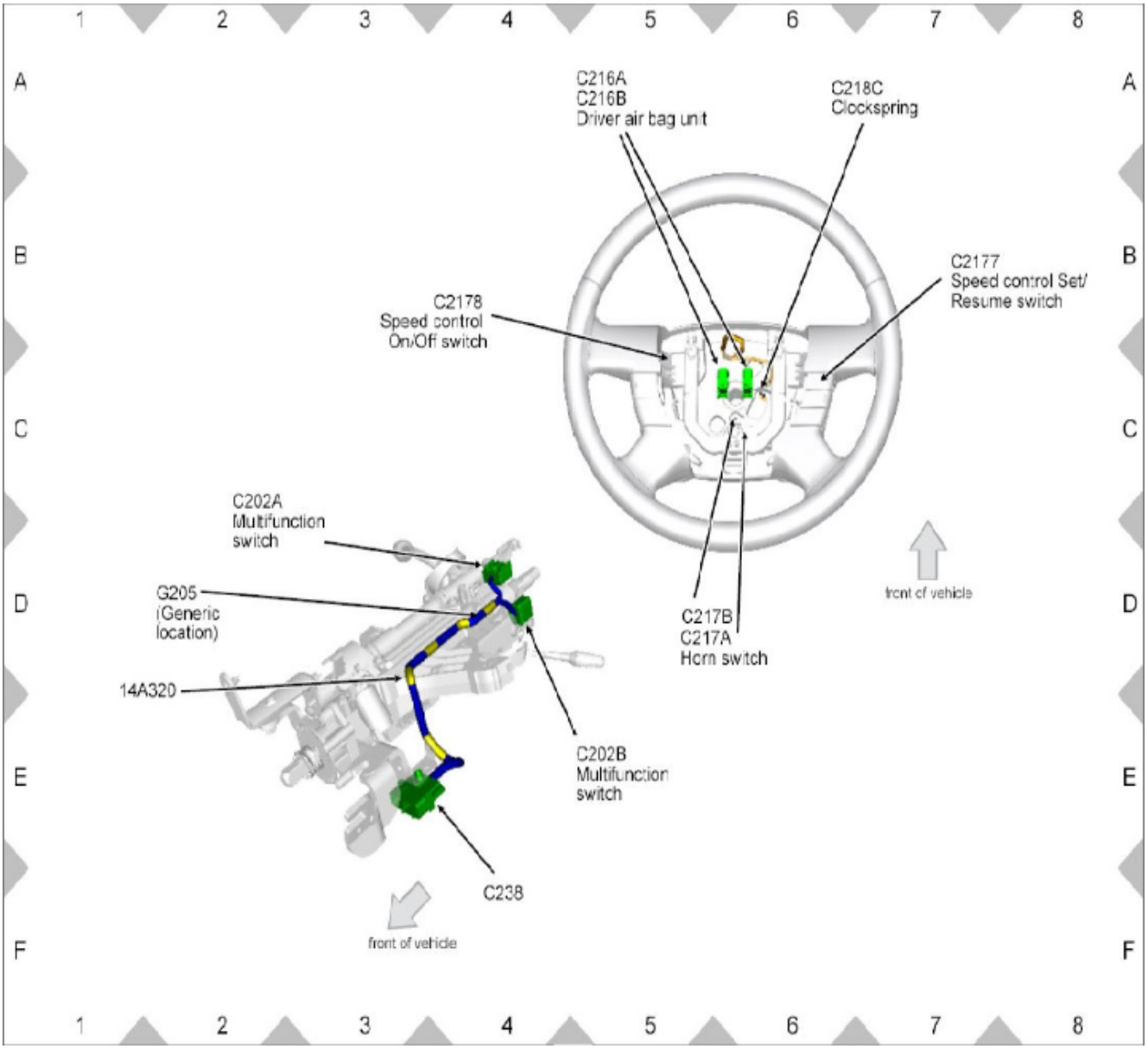
NOTE: The headlamp bulb should not be removed from the headlamp until just before a replacement bulb is installed. Removing the bulb for an extended period of time may affect headlamp bulb performance. Contaminants may enter the headlamp assembly where they can settle on the lens and reflector. Never turn the headlamps on with the bulb removed.

1. Remove the headlamp assembly. 2. Rotate the headlamp bulb retainer approximately one-eighth turn counterclockwise and remove it.

- Remove the headlamp bulb.

3. To install, reverse the removal procedure.

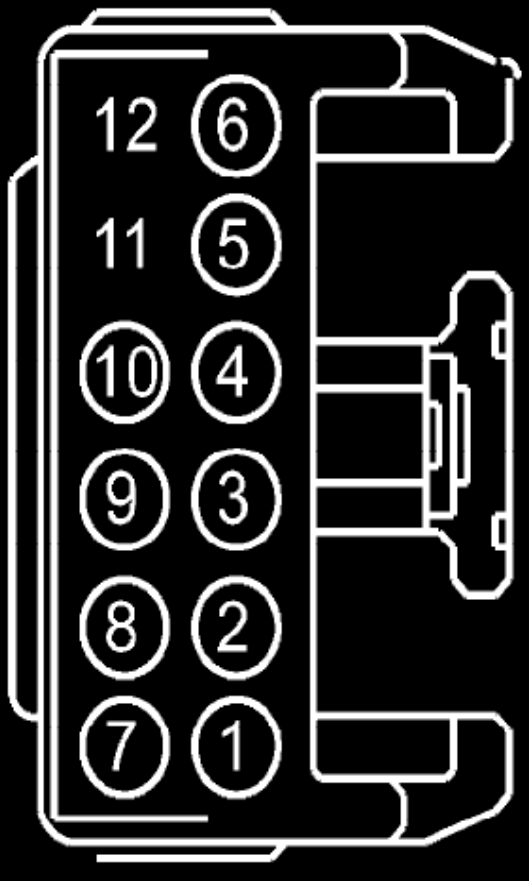
Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Lighting and Horns > Headlamp > Headlamp Dimmer Switch > Component Information > Locations



View 151-13

Connector: C202A

Description:	Harness:	Base Part #:
MULTIFUNCTION SWITCH	14A320	13K359



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CRW17 (GN-VT)	20	SWITCH - FRONT WIPER INTERVAL (A)	
2	CRW19 (BU-OG)	20	SWITCH - FRONT WIPER INTERVAL (C)	
3	CRW18 (VT-WH)	20	SWITCH - FRONT WIPER INTERVAL (B)	
4	CRW15 (BN-WH)	20	CTRL MOD. - FRONT WIPER HIGH	
5	CRW07 (GY-BN)	20	SWITCH - FRONT WASHER	
6	CD161 (BK YE)	18	GROUND SEAT BRACKET REAR LEFT	
7	CLS41 (GY-YE)	22	SWITCH - TURN RIGHT	
8	CLS36 (YE)	18	SWITCH - PARK LAMPS RIGHT	
9	CLS35 (VT)	18	SWITCH - PARK LAMPS LEFT	
10	CLS39 (VT-WH)	22	SWITCH - TURN LEFT	
11	*	*	not used	
12	*	*	not used	

Headlamp Dimmer Switch: Diagrams Multifunction Switch

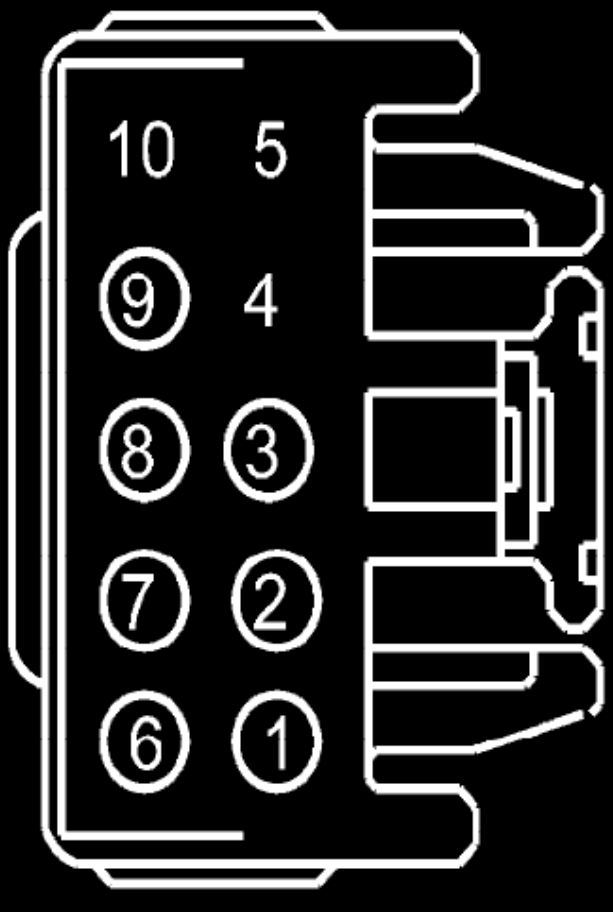
C202A

Connector: C202B

Description: MULTIFUNCTION SWITCH

Harness: 14A320

Base Part #: 13K359



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CCB08 (VT-WH)	16	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL OPEN	
2	CLS42 (VT-BN)	18	INDICATOR FLASHER RELAY - TURN SIGNAL SWITCHED POWER	
3	CLS32 (BN-YE)	18	INDICATOR FLASHER RELAY - HAZARD SWITCHED POWER	
4	*	*	not used	
5	*	*	not used	
6	SBP23 (WH-RD)	14	FUSE - 23 OR CIRCUIT BREAKER	
7	CLF27 (GN-BN)	14	SWITCH - FLASH TO PASS	
8	CLS24 (BN-WH)	16	CTRL MOD. - TURN LAMP RIGHT	
9	CLF18 (BU-WH)	16	SWITCH - BEAM LOW	
10	*	*	not used	

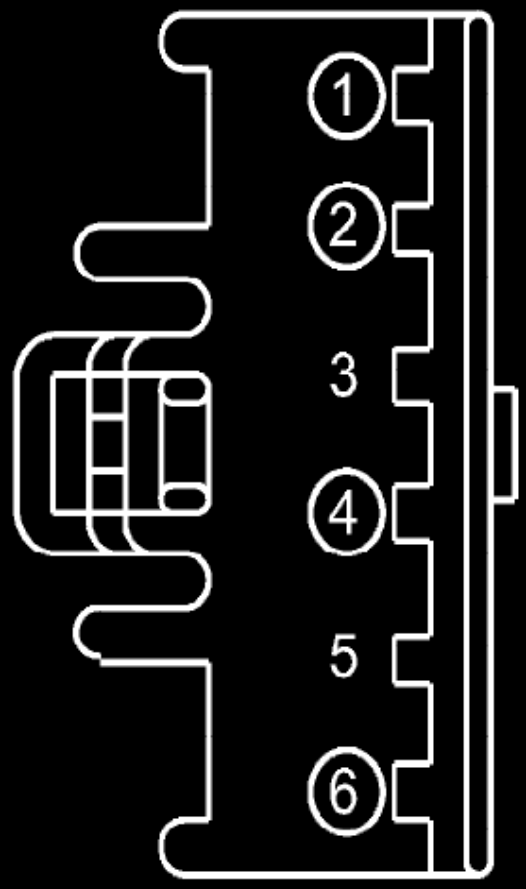
C202B

Connector: C2065

Description: ILLUMINATION DIMMER

Harness: 14401

Base Part #:



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VLN18 (BU-WH)	22	DIMMER - IP/SWITCH ILLUMINATION	
2	CLN27 (WH-BN)	18	CTRL MOD. - DIMMER INSTRUMENT	
3	*	*	not used	
4	GD161 (BK-YE)	22	GROUND - SEAT BRACKET REAR LEFT	
5	*	*	not used	
6	CBP01 (BU)	22	FUSE - 1 OR CIRCUIT BREAKER	

C2065

Introduction

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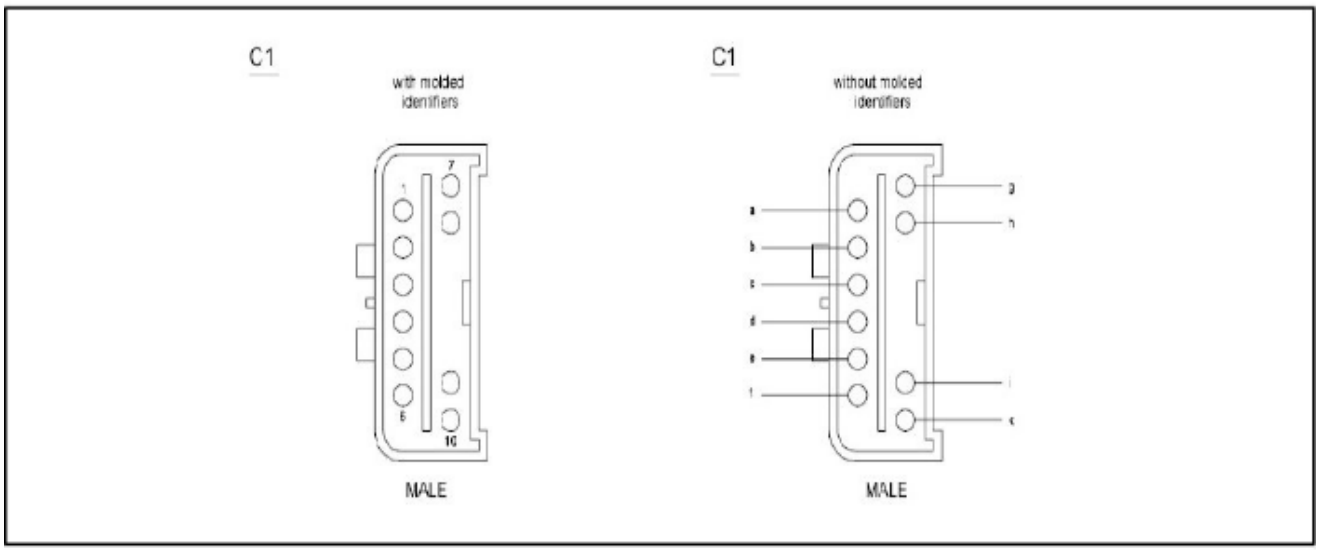
Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals

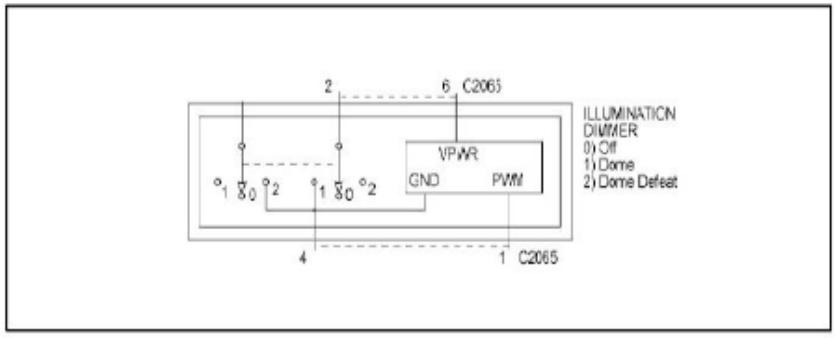


The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

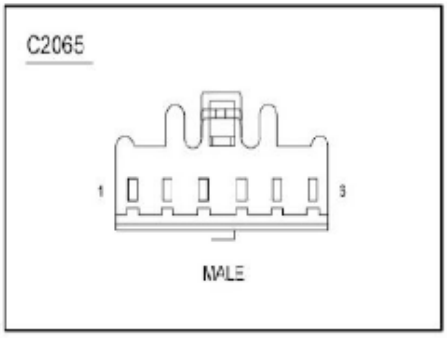
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Illumination dimmer

Schematic



Terminals



Component testing procedure

Circuit to test	Connect self-powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
Dome	2 and 4	On	Closed circuit
		Off	Open circuit

Headlamp Dimmer Switch: Testing and Inspection Illumination Dimmer

Introduction

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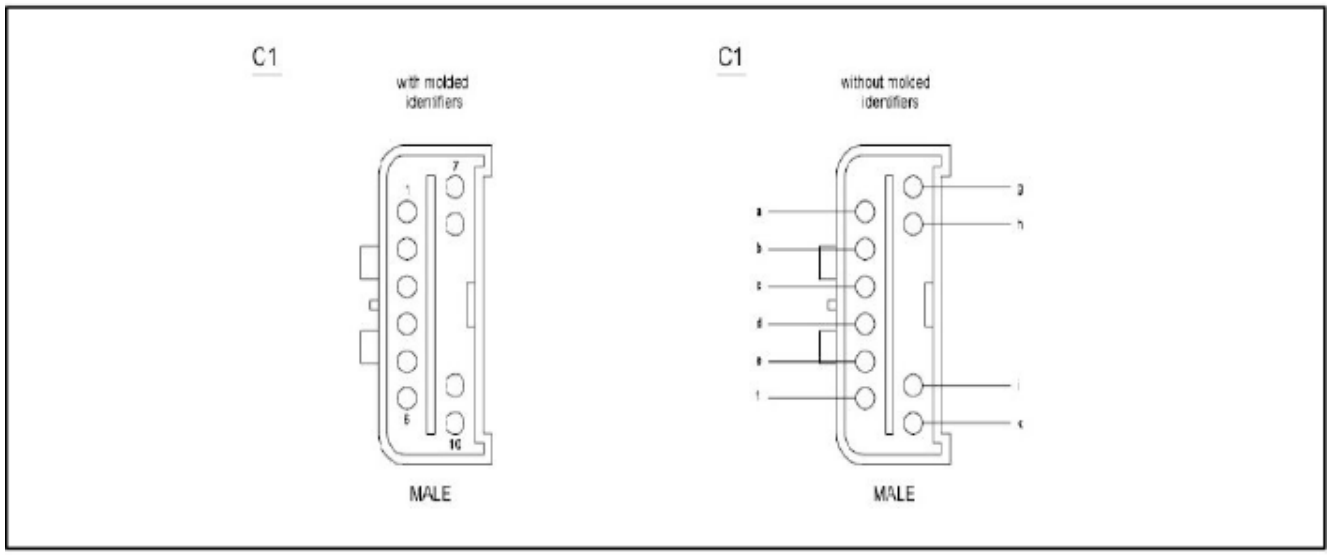
Terminals



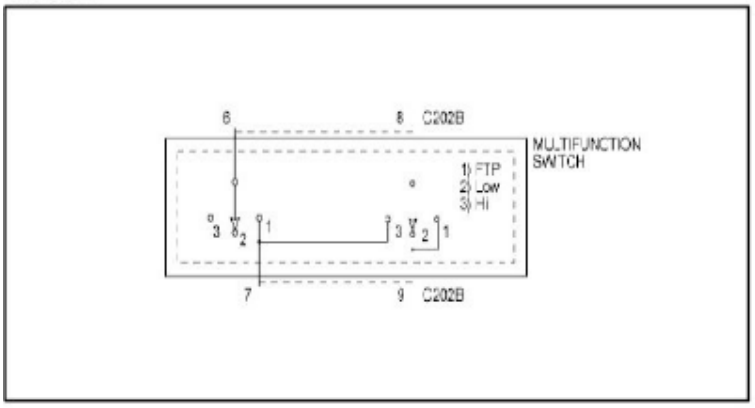
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

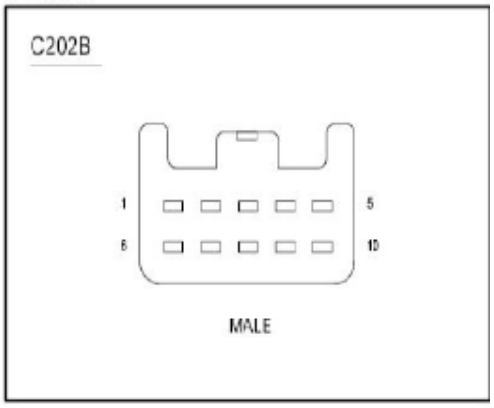
Headlamp Dimmer Switch: Testing and Inspection Multifunction Switch, Lamp Portion

Multifunction Switch, Lamp Portion

Schematic



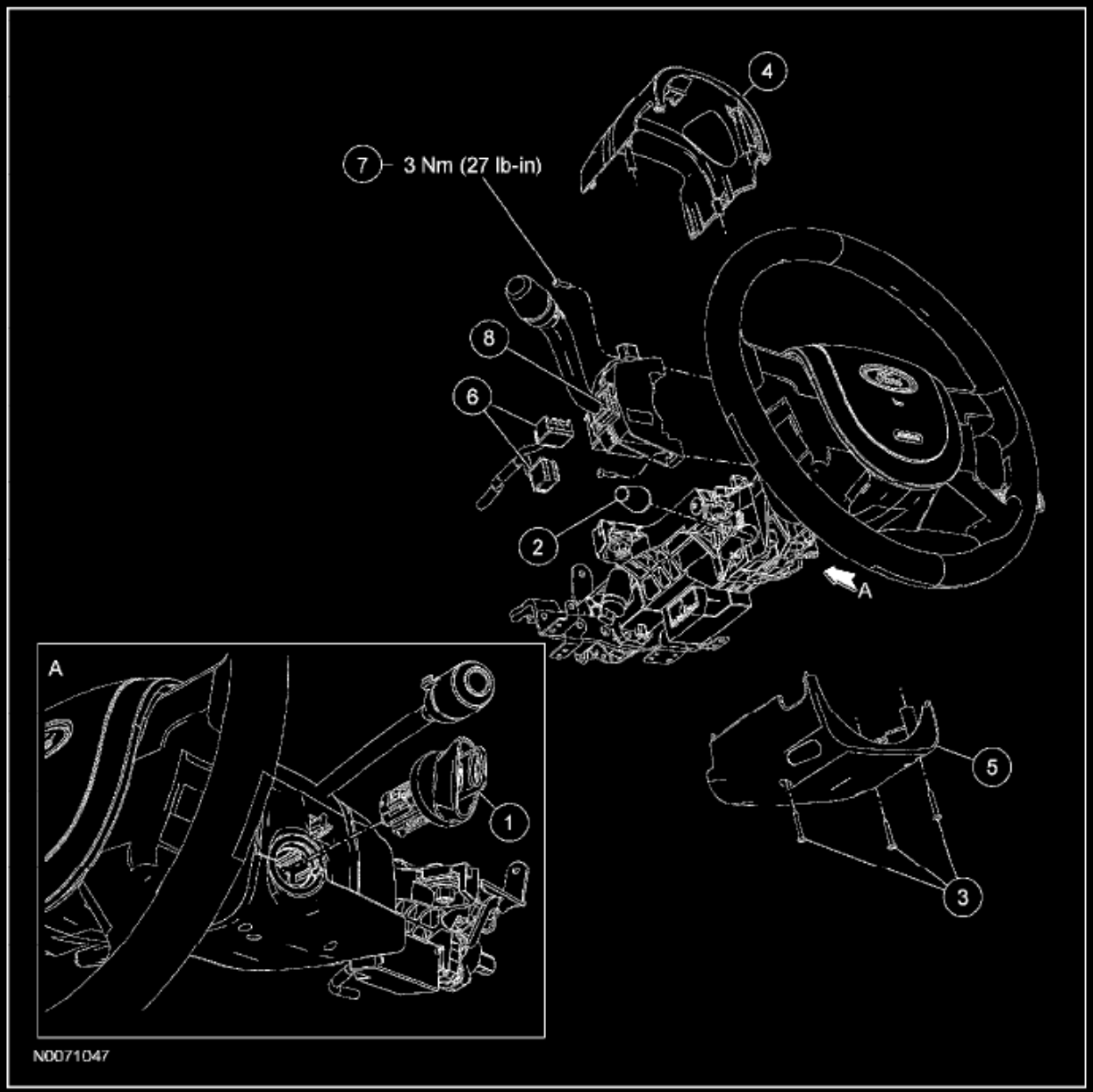
Terminals



Component testing procedure

Circuit to test	Connect self□powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
High beams	8 and 7	High beam	Closed circuit
		Flash□to□pass	Open circuit
		Low beam	Open circuit
Low beam/Flash□ to□pass	8 and 9	High beam	Open circuit
		Flash□to□pass	Closed circuit
		Low beam	Closed circuit
	6 and 7	High beam	Open circuit
		Flash□to□pass	Closed circuit
		Low beam	Open circuit

Steering Column Multifunction Switch



Item	Part Number	Description
1	11582	Ignition switch lock cylinder
2	3F609	Tilt release lever/ handle
3	391727	Steering column shroud screws (3 required)
4	3530	Upper steering column shroud
5	3533	Lower steering column shroud

(Continued)

Item	Part Number	Description
6	—	Steering column multi-function switch electrical connectors (part of 14A320)
7	390345	Steering column multi-function switch screws (2 required)
8	13K359	Steering column multi-function switch

Headlamp Dimmer Switch: Service and Repair

Steering Column Multifunction Switch

Steering Column Multifunction Switch

Removal and Installation

1. Remove the ignition switch lock cylinder.

1 Insert the ignition key into the ignition switch lock cylinder and turn to the RUN position.

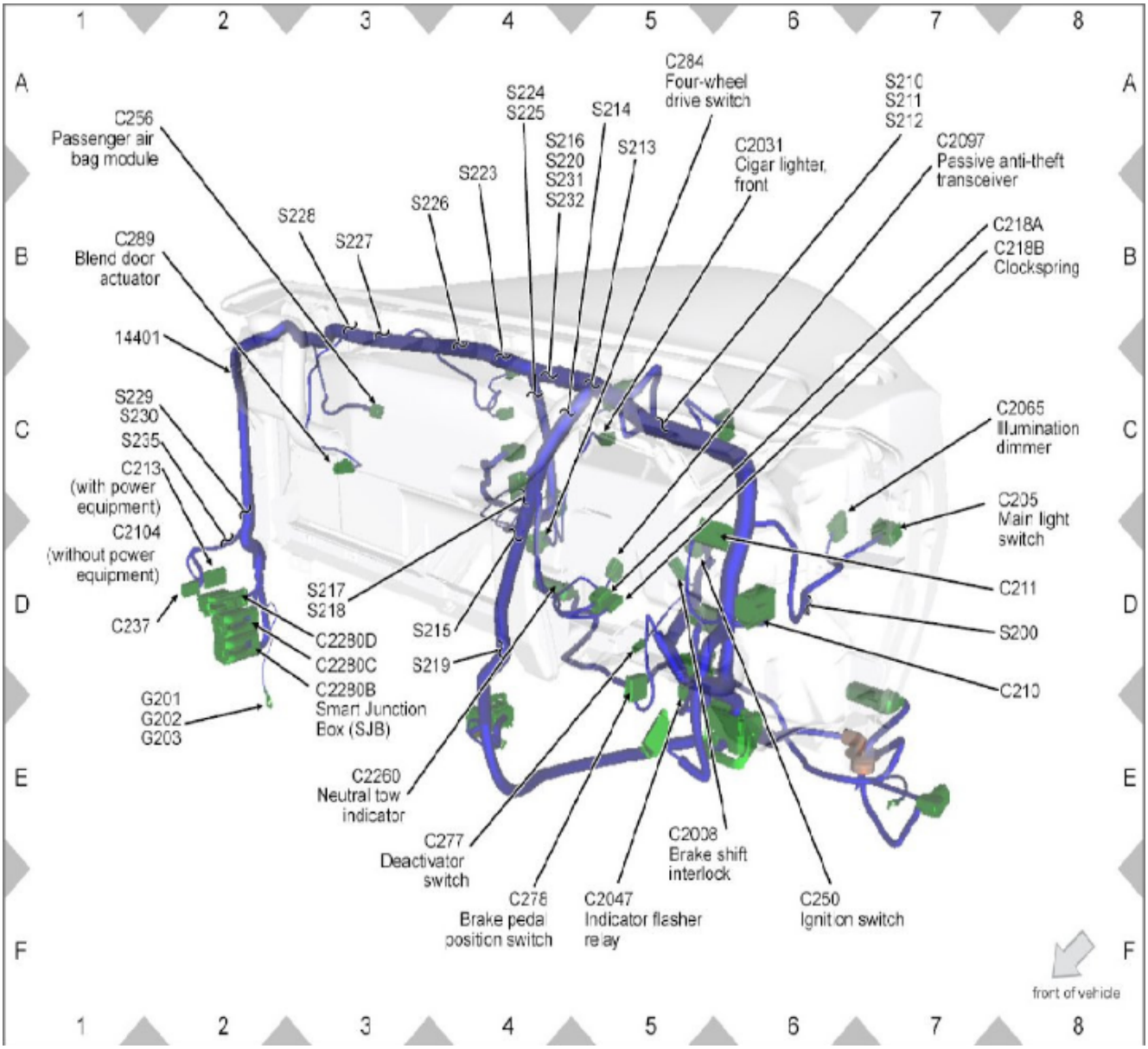
2 Push the ignition switch lock cylinder release tab with a punch while pulling out the ignition switch lock cylinder.

2. If equipped, remove the tilt release lever/ handle.

3. Remove the 3 steering column shroud screws and the upper and lower steering column shrouds. 4. Disconnect the multi-function switch electrical connectors. 5. Remove the 2 multi-function switch screws and the multi-function switch.

^ To install, tighten to 3 Nm (27 lb-inch).

6. To install, reverse the removal procedure.


1
2
3
4
5
6
7
8
A
B
C
D
E
F
C256
Passenger air bag module
C289
Blend door actuator
14401
S229
S230
S235
C213
(with power equipment)
C2104
(without power equipment)
C237
G201
G202
G203
S228
S227
S226
S223
S224
S225
S216
S220
S231
S232
S214
S213
C284
Four-wheel drive switch
C2031
Cigar lighter, front
S210
S211
S212
C2097
Passive anti-theft transceiver
C218A
C218B
Clockspring
C2065
Illumination dimmer
C205
Main light switch
C211
S200
C210
S217
S218
S215
S219
C2280D
C2280C
C2280B
Smart Junction Box (SJB)
C2260
Neutral tow indicator
C277
Deactivator switch
C276
Brake pedal position switch
C2047
Indicator flasher relay
C2008
Brake shift interlock
C250
Ignition switch
front of vehicle

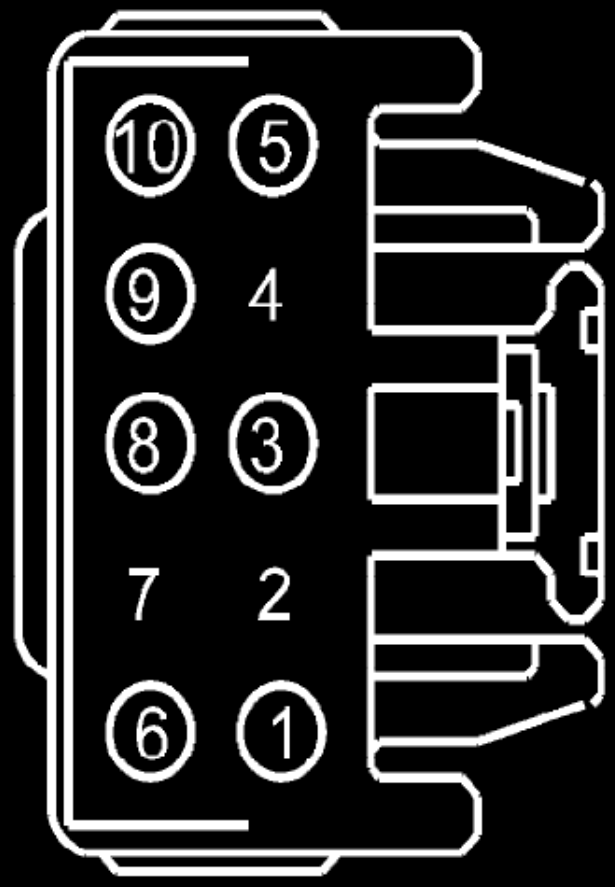
View 151-11

Connector: C205

Description: MAIN LIGHT SWITCH

Harness: 14401

Base Part #: 11654



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CLS24 (BN-WH)	16	CTRL MOD. - TURN LAMP RIGHT	
2	*	*	not used	
3	GD161 (BK YE)	20	GROUND SEAT BRACKET REAR LEFT	
4	*	*	not used	
5	CLS30 (VT-WH)	18	RELAY - PARK LAMP	
6	SBP23 (WH-RD)	14	FUSE - 23 OR CIRCUIT BREAKER	
7	*	*	not used	
8	VLN18 (BU-WH)	20	DIMMER - IP/SWITCH ILLUMINATION	
9	CLF21 (GY-VT)	18	SWITCH - FOG LAMPS FRONT	
10	SBP23 (WH-RD)	16	FUSE - 23 OR CIRCUIT BREAKER	

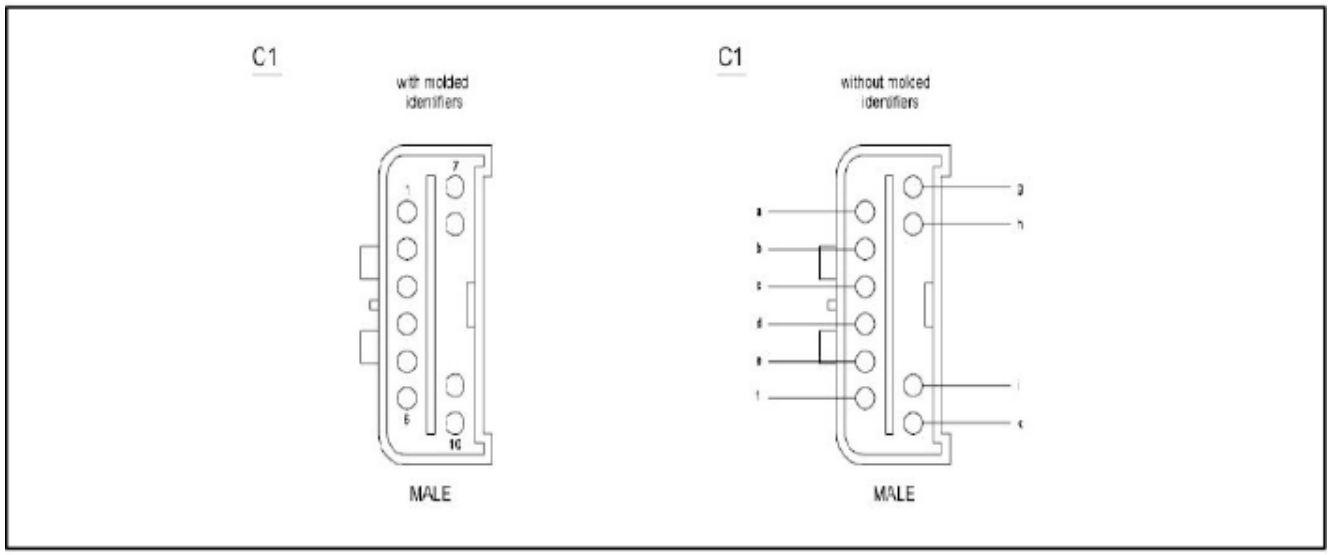
C205

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



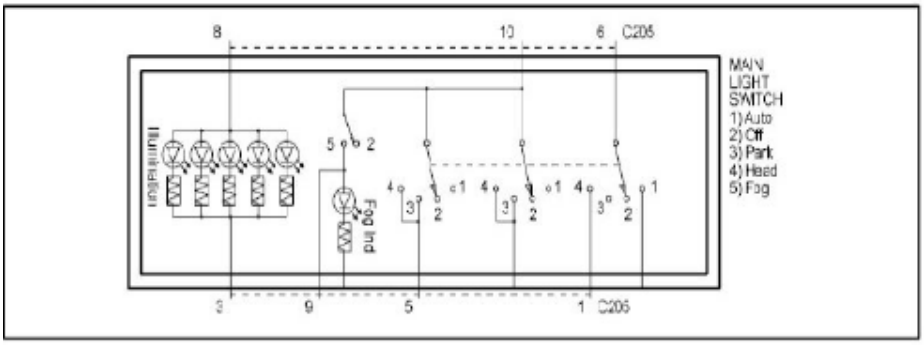
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

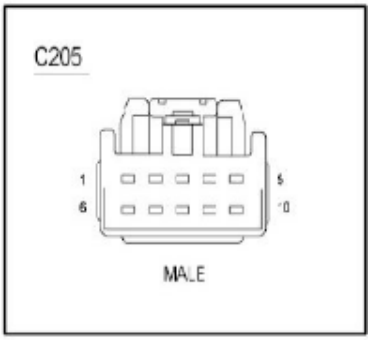
Headlamp Switch: Testing and Inspection

Main light switch, Exterior lamps

Schematic

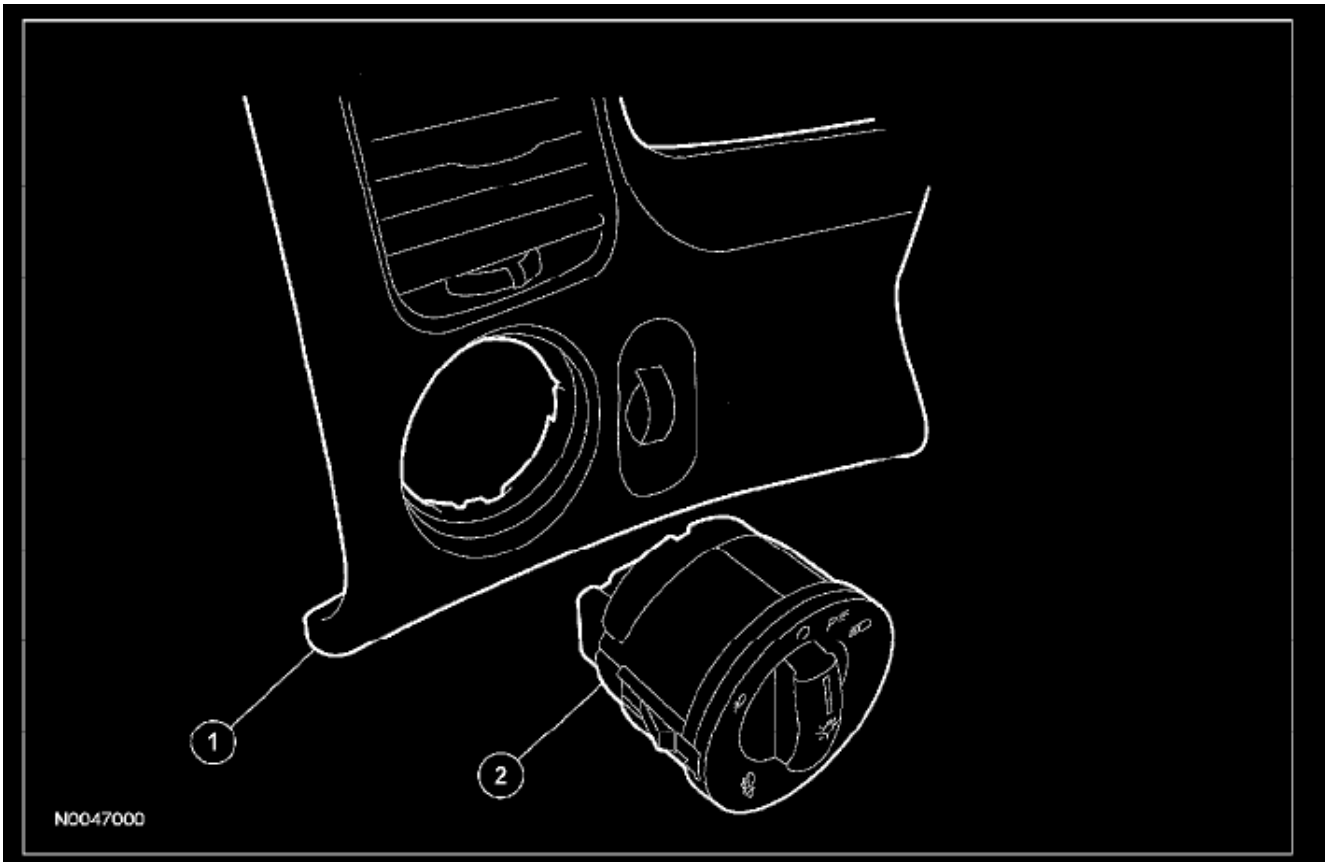


Terminals



Component testing procedure

Circuit to test	Connect self-powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
Headlamp	1 and 6	Off	Open circuit
		Head	Closed circuit
		Park	Open circuit
Park lamps	5 and 10	Off	Open circuit
		Head	Closed circuit
		Fog lamps	Closed circuit
Fog lamps	9 and 10	Off	Open circuit
		Park	Closed circuit
		Head	Closed circuit



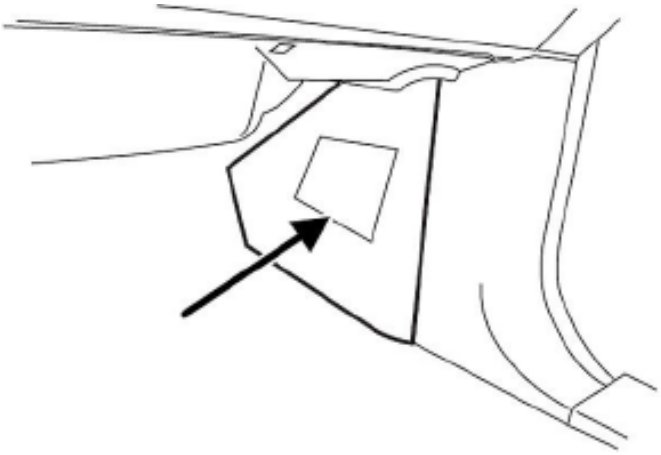
Item	Part Number	Description
1	044D70	Instrument panel finish panel
2	11654	Headlamp switch

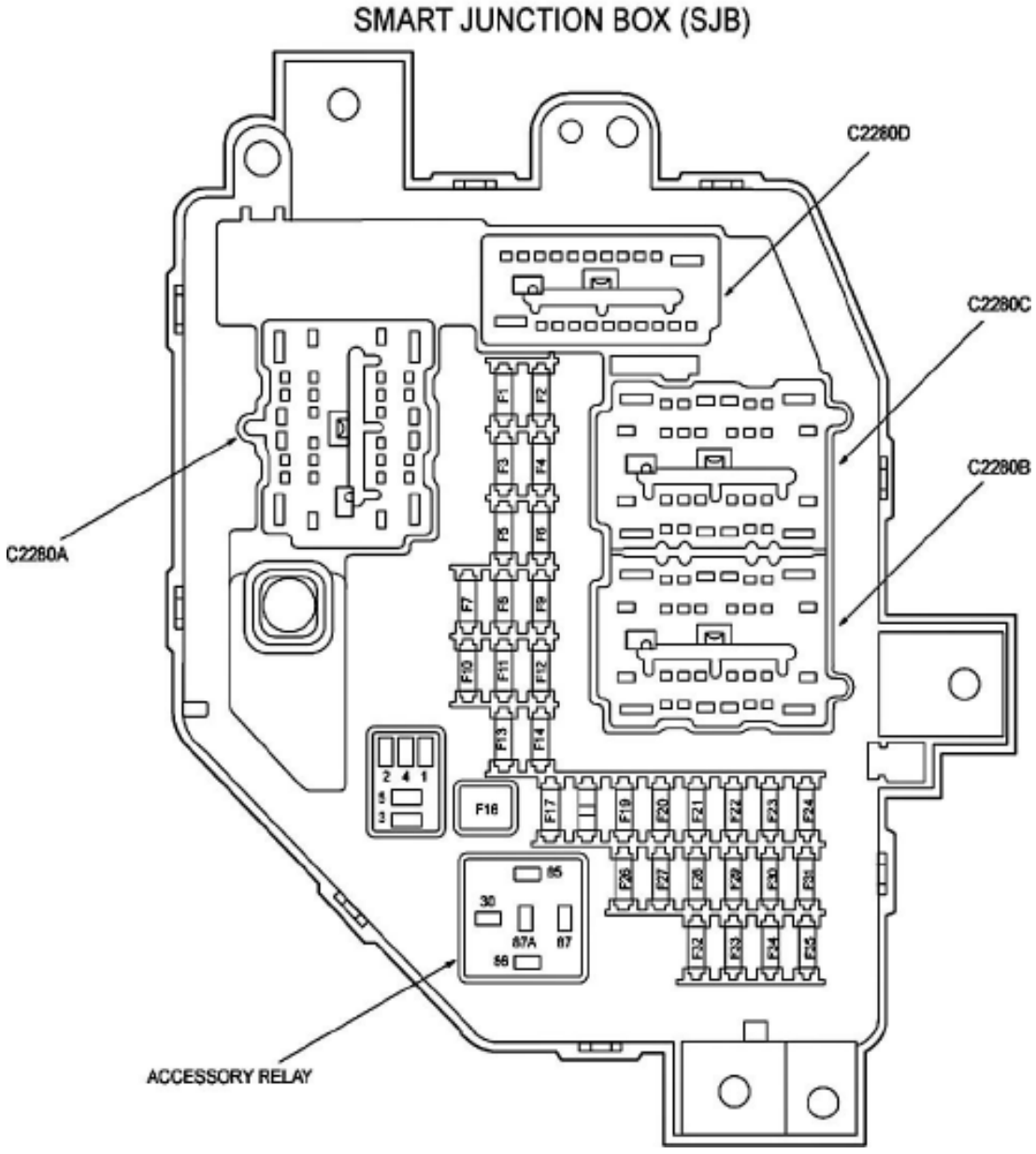
Headlamp Switch: Service and Repair

HEADLAMP SWITCH

Removal and Installation

1. Remove the instrument panel finish panel. 2. Release the tabs and remove the headlamp switch.
3. To install, reverse the removal procedure.

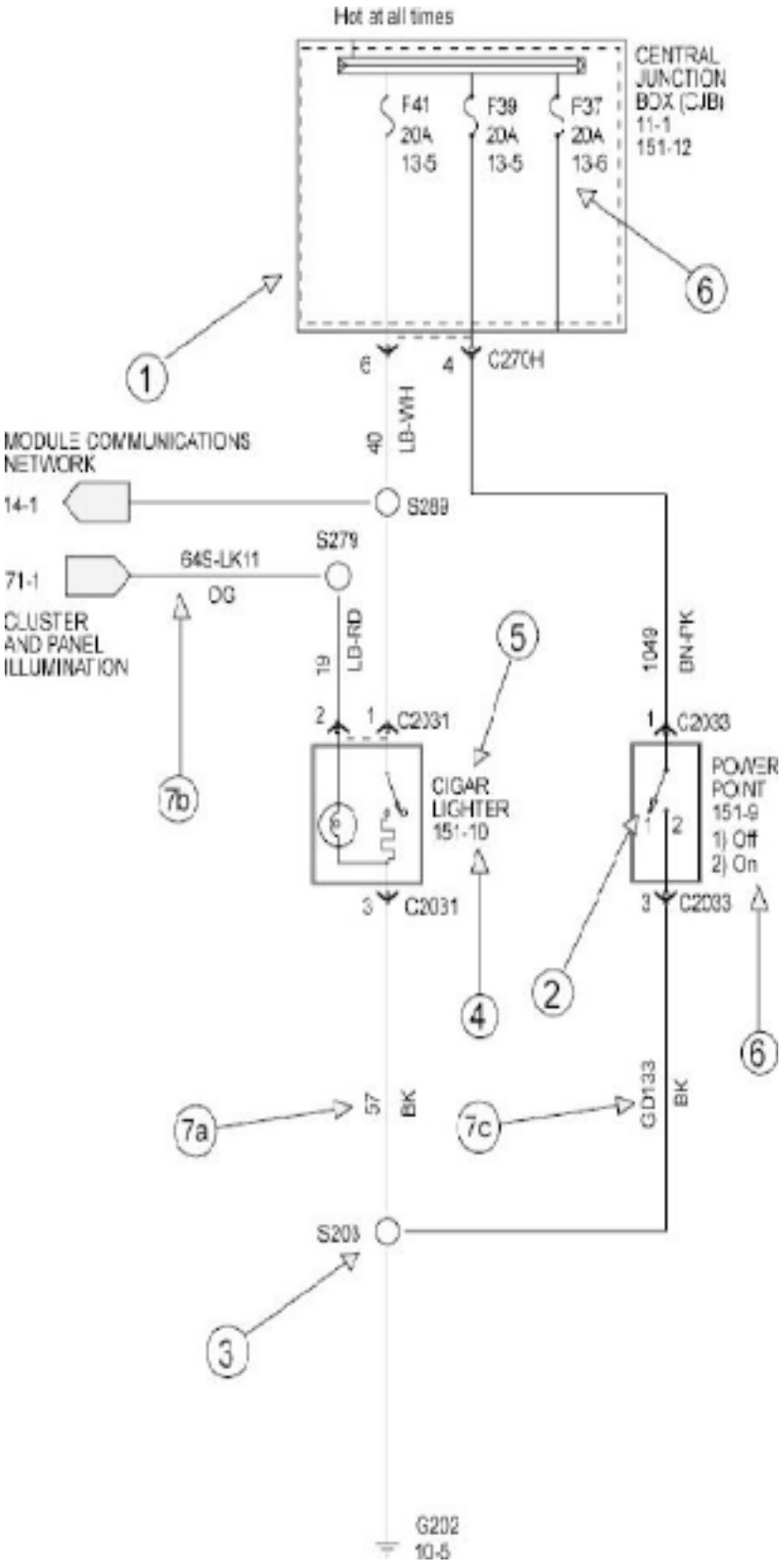



SMART JUNCTION BOX (SJB)
C2280D
C2280C
C2280B
C2280A
ACCESSORY RELAY
F1
F2
F3
F4
F5
F6
F7
F8
F9
F10
F11
F12
F13
F14
F16
F17
F19
F20
F21
F22
F23
F24
F26
F27
F28
F29
F30
F31
F32
F33
F34
F35
85
30
87A
87
86
2 4 1
5
3

Horn Relay: Locations

FUSE	AMPS	Circuits Protected
F1	5A	Illumination dimmer
F2	10A	Trailer tow connector - Park
F3	10A	Headlamp, right (Low beam lamp feed)
F4	10A	Headlamp, left (Low beam lamp feed)
F5	5A	Windshield wiper module
F6	10A	Audio unit, Door lock switch illumination
F7	5A	Not Used
F8	10A	Restraints Control Module (RCM), Occupant Classification System Module (OCSM), Passenger Air bag Deactivation (PAD) Indicator
F9	5A	Instrument Cluster (IC), Air bag indicator
F10	10A	4X4 control module, Instrument Cluster (IC)
F11	10A	Smart Junction Box (SJB), logic power
F12	15A	Subwoofer amplifier with audiophile, Satellite radio receiver
F13	15A	Interior lamp relay, Horn relay
F14	15A	High beam lamp feed to High beam indicator, Headlamp, right, Headlamp, left
F16	30A	Accessory relay (Power windows)
F17	15A	Indicator flasher relay
F18	-	Not Used

FUSE	AMPS	Circuits Protected
F19	20A	Brake pedal position switch (Stoplamps)
F20	10A	Transmission control switch, Digital Transmission Range (TR) sensor, Speed control servo, Anti-lock Brake System (ABS) module, Indicator flasher relay, Reversing lamps switch, Speed control On/Off switch, Speed control Set/Resume switch
F21	5A	Digital Transmission Range (TR) sensor, Starter relay, Powertrain Control Module (PCM)
F22	5A	Audio unit
F23	30A	Main light switch, Multifunction switch
F24	20A	Audio unit
F26	2A	Deactivator switch
F27	10A	Blend door actuator, Climate control assembly
F28	15A	4X4 control module
F29	20A	Cigar lighter, front, Data Link Connector (DLC)
F30	5A	Exterior rear view mirror switch
F31	20A	Park lamp relay
F32	5A	Brake pedal position switch (logic power), Brake shift interlock
F33	5A	Instrument Cluster (IC), Neutral tow indicator
F34	20A	Power point
F35	15A	Door lock/unlock relay, Driver door unlock relay


Hot at all times
CENTRAL JUNCTION BOX (CJB)
11-1
151-12
F41
20A
13-5
F39
20A
13-5
F37
20A
13-6
C270H
40
LB-WH
MODULE COMMUNICATIONS NETWORK
14-1
S289
S279
64S-LK11
71-1
DG
CLUSTER AND PANEL ILLUMINATION
19
LB-RD
C2031
CIGAR LIGHTER
151-10
1049
BN-PK
C2033
POWER POINT
151-9
1) Off
2) On
57
BK
GD133
BK
S203
G202
10-5

Horn Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

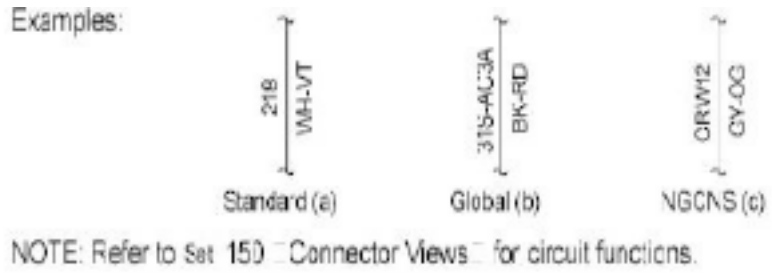
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

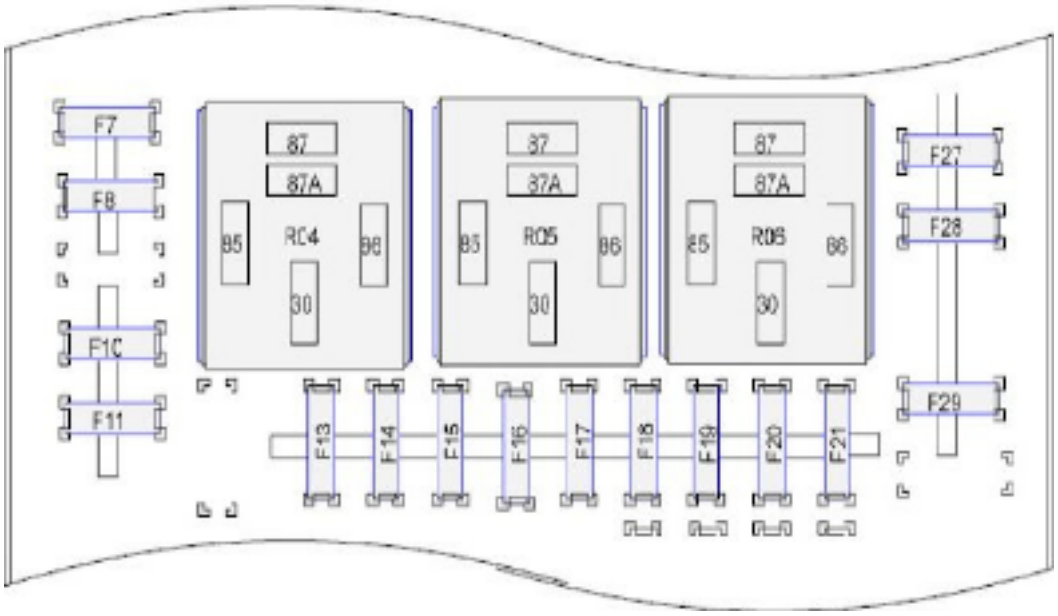
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

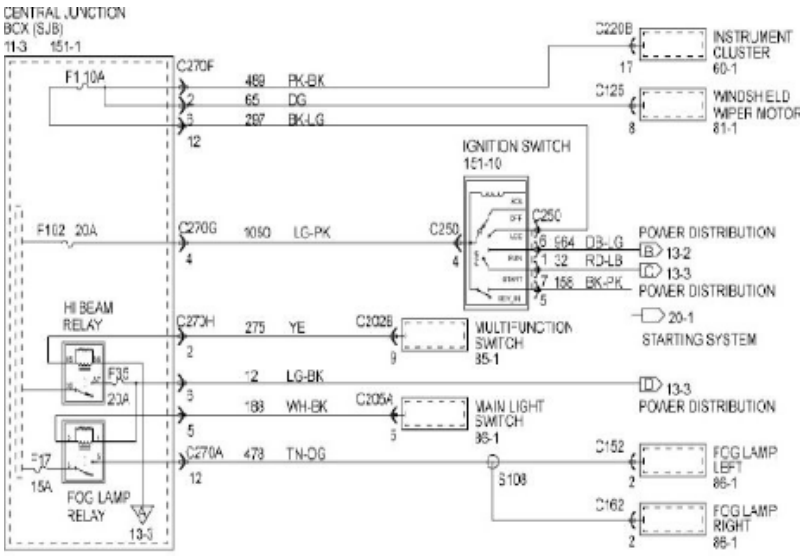
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

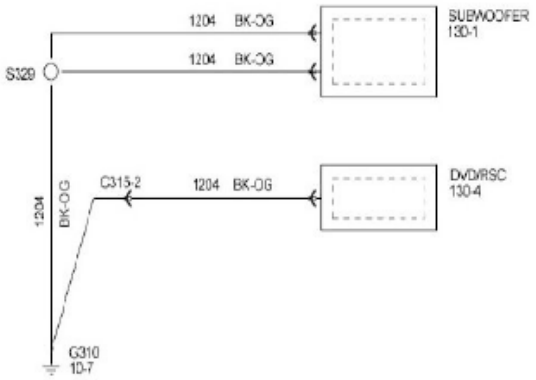
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

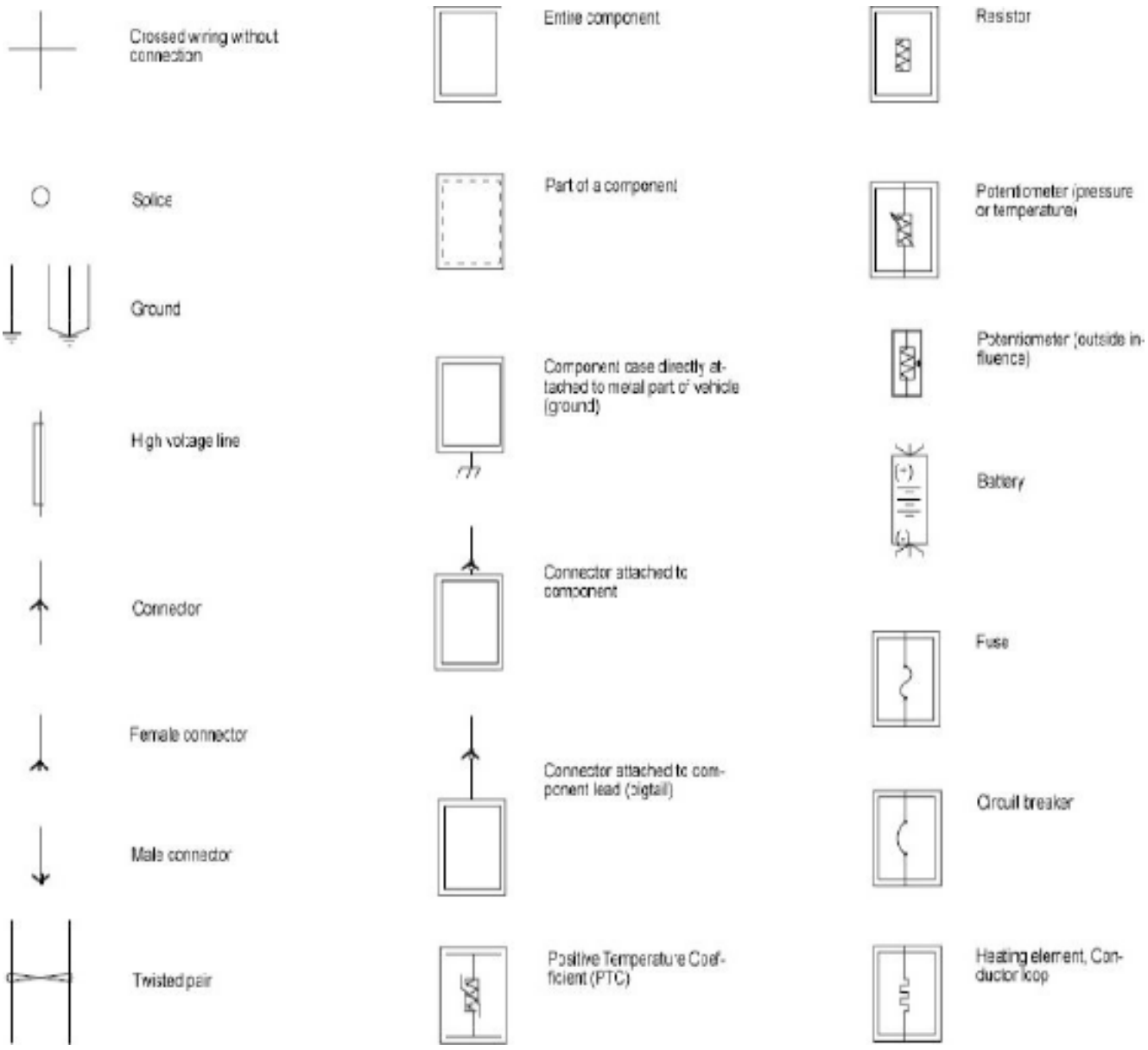
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

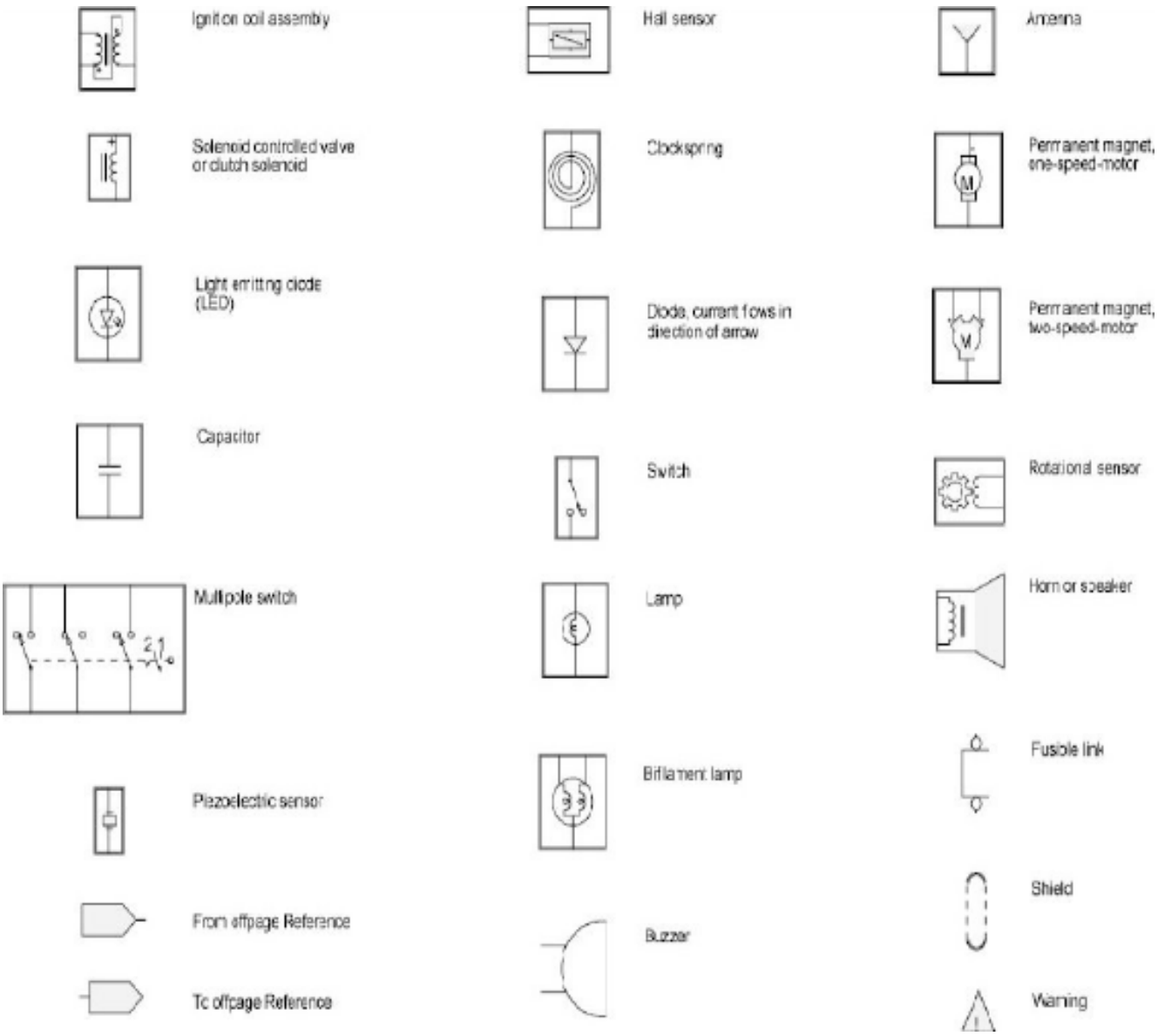
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

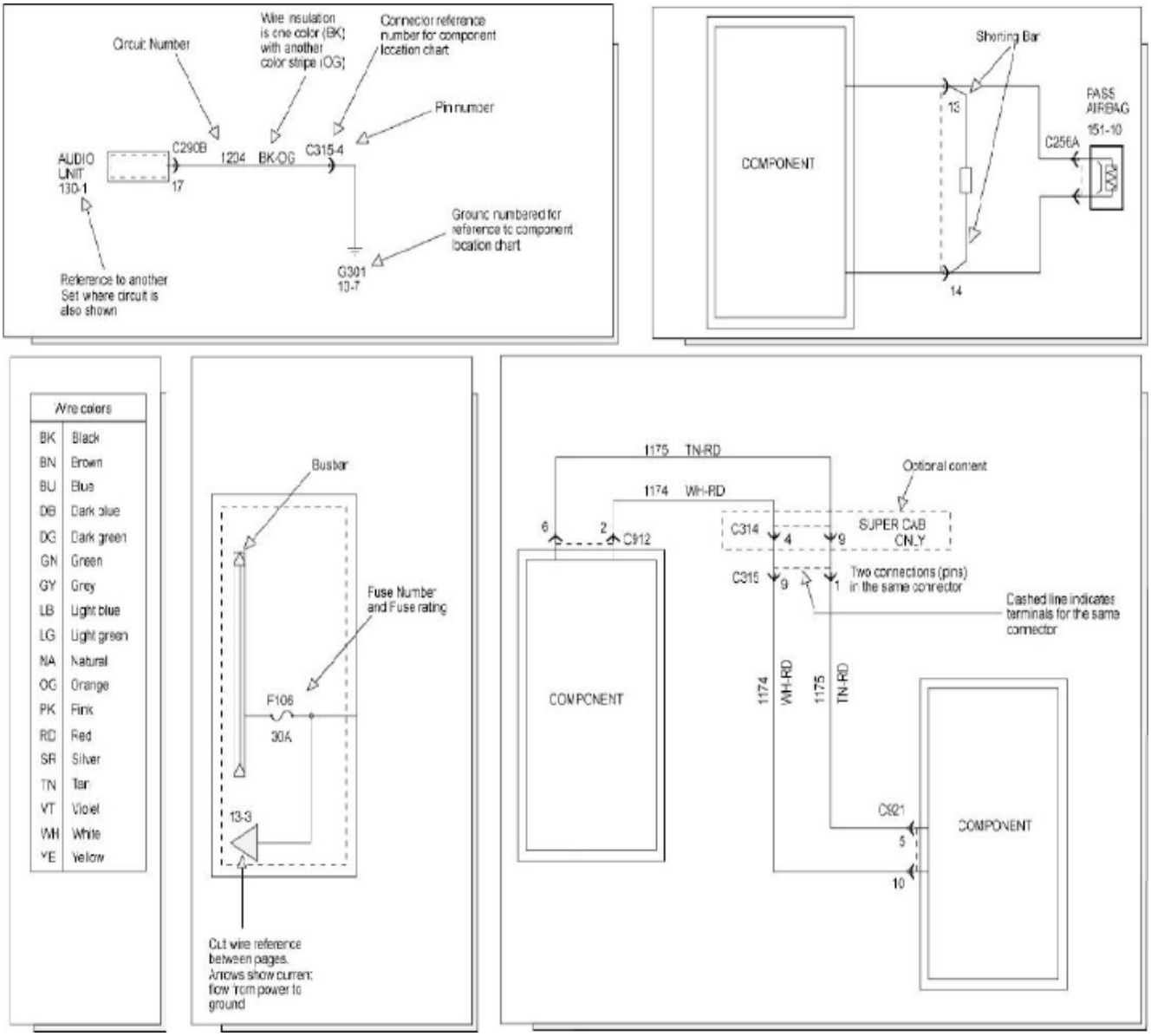
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

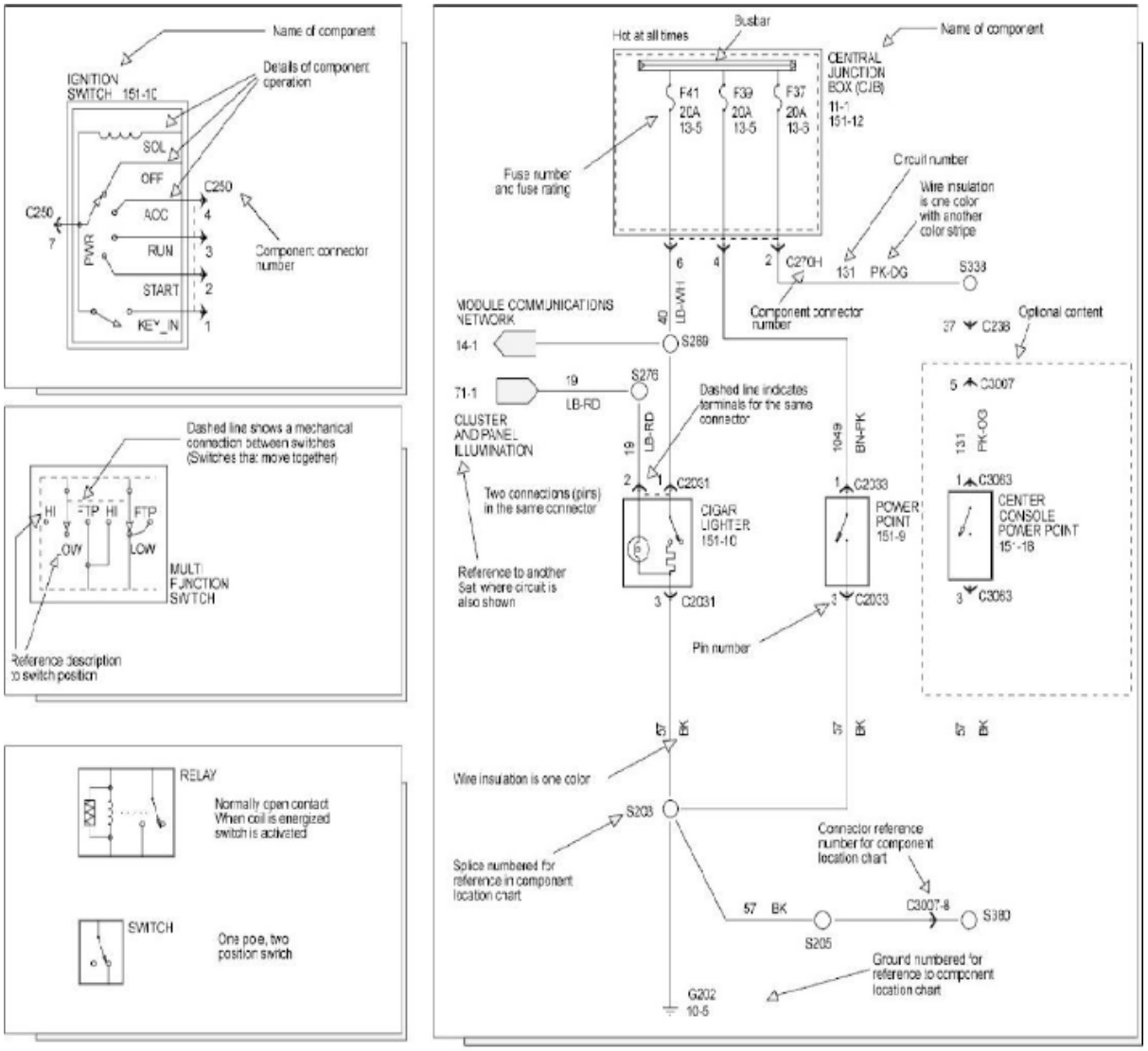
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

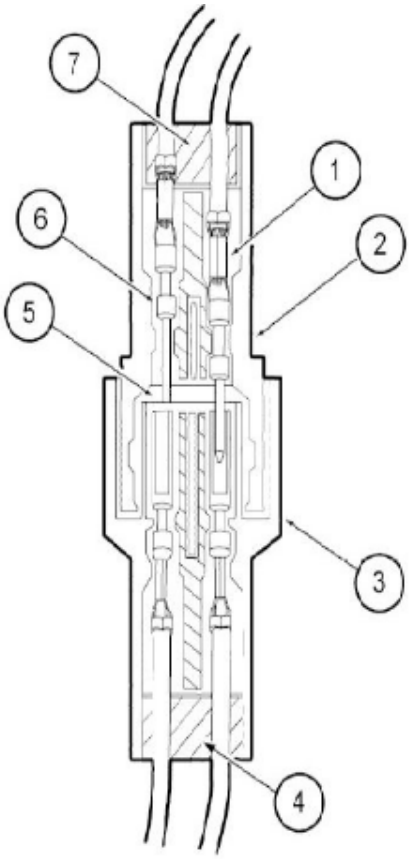


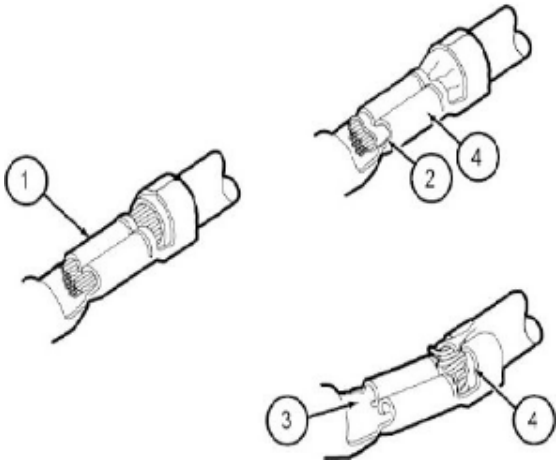
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Horn Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

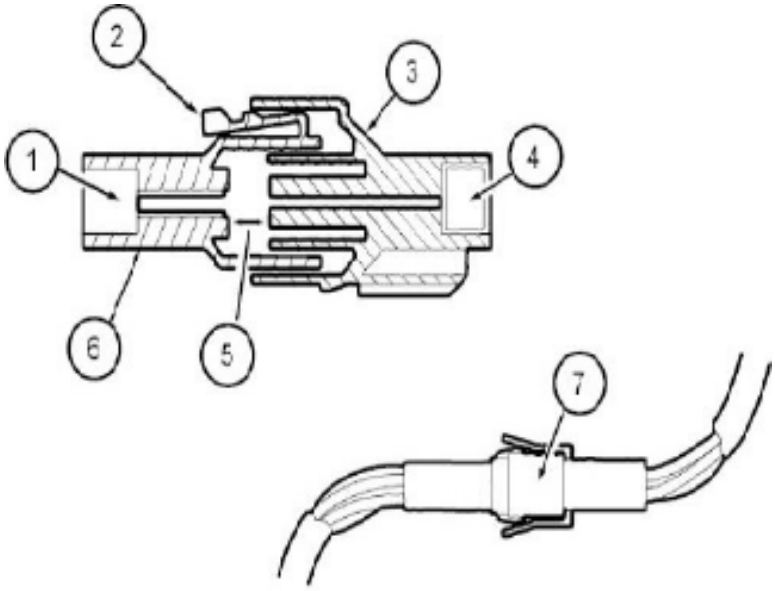
5 = Intermittent contact

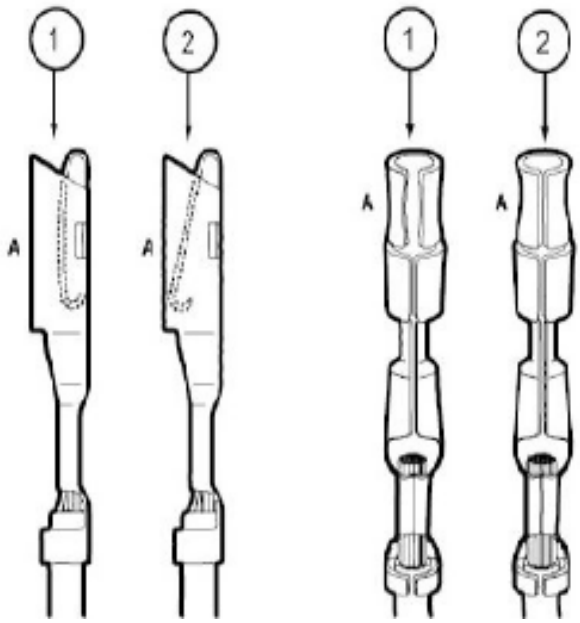
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

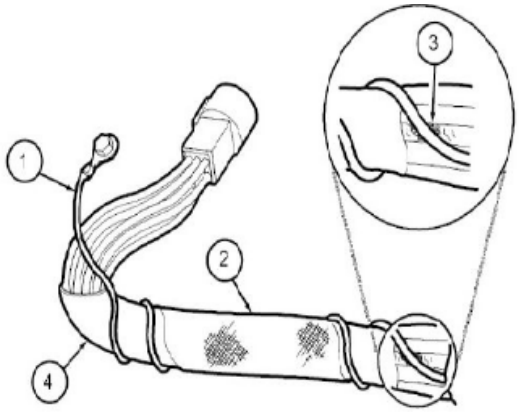
Deformed (enlarged) female terminals

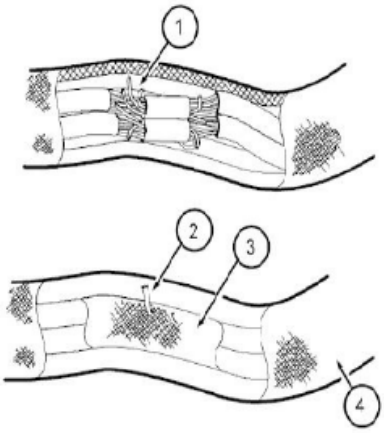
1 = Enlarged

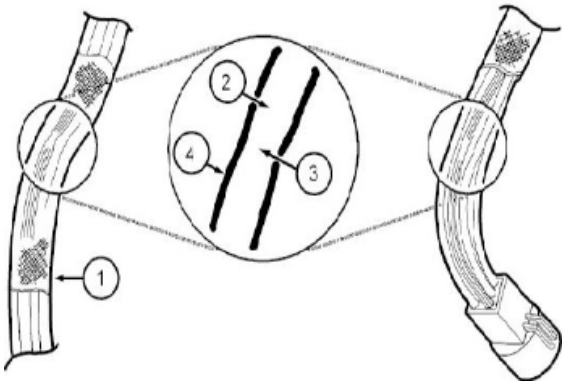
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

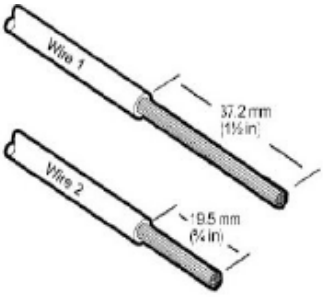
Splice covered 2

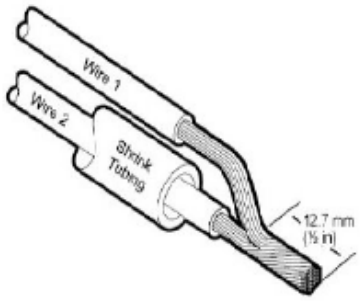
= Wire strand

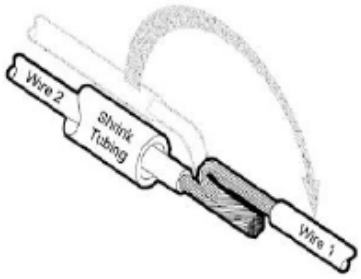
3 = Splice tape

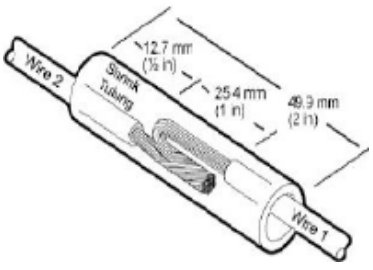
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.9 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

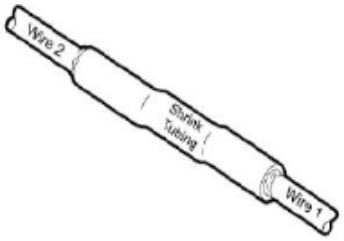
NOTE: -

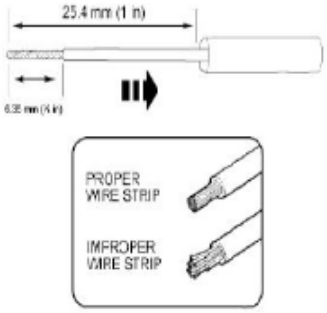
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

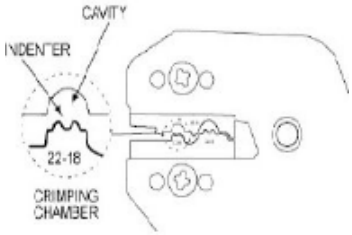
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

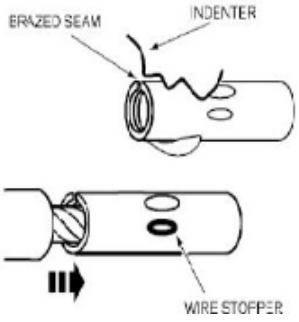
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

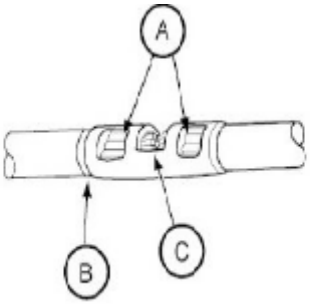
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

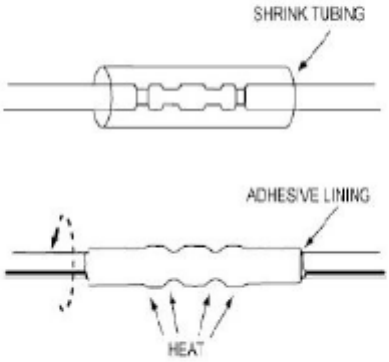
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4 strip, cut 9 strands	* 1/4 strip, cut 2 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip, fold 3x dia.
	16-14	* 1/4 strip, cut 7 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip fold 2x dia	1 strip, fold 3x dia.	1 1/4 strip, fold 4x dia.	Not Recommended
	12-10	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip fold 3x cia.	1 1/4 strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Figtail only

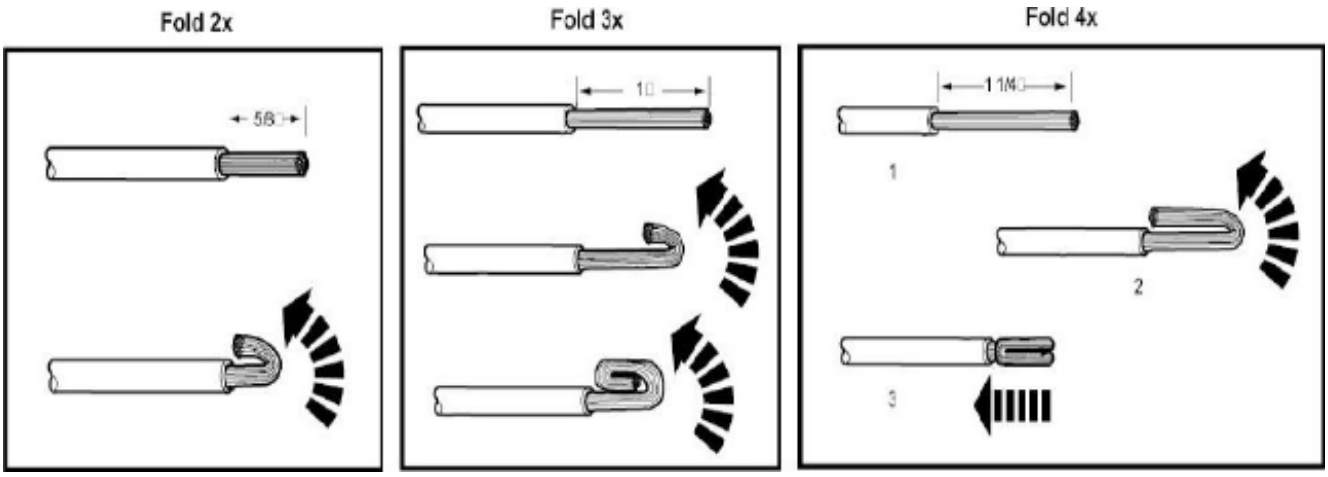
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



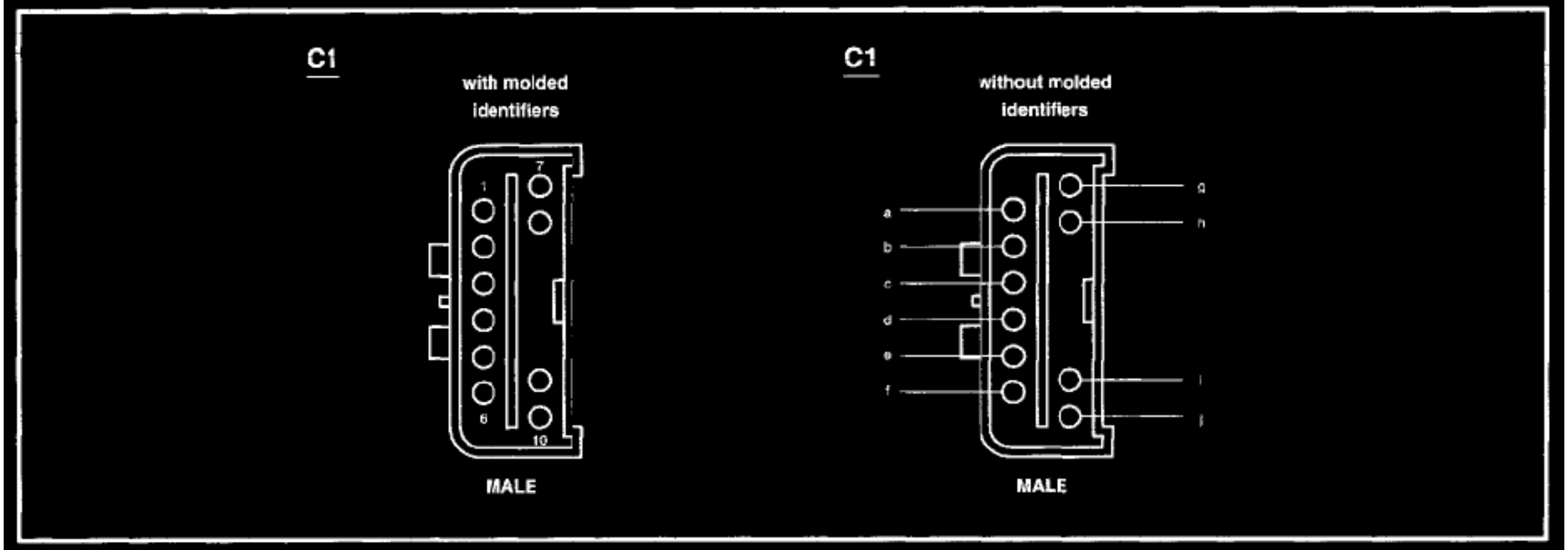
The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step–by–step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



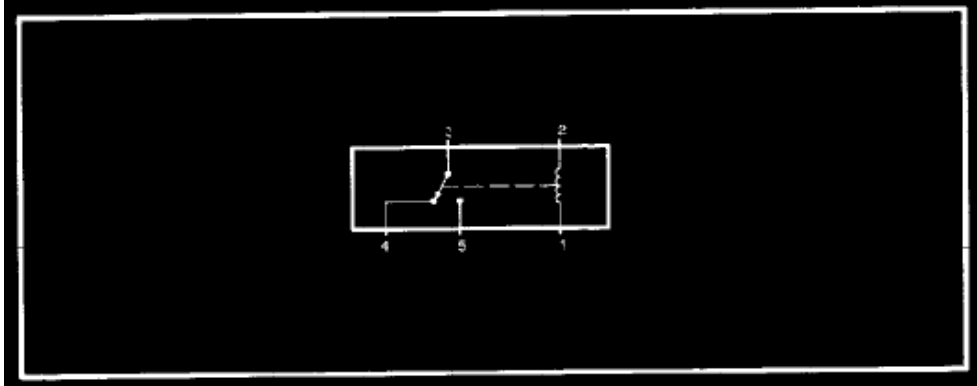
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

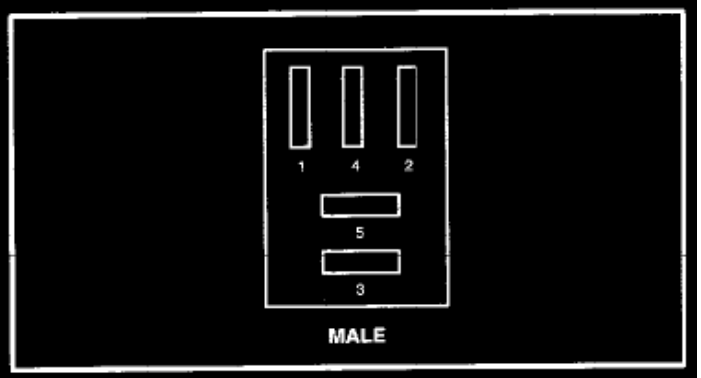
Horn Relay: Testing and Inspection Micro ISO Relay

Relay – Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63–102Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil – Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

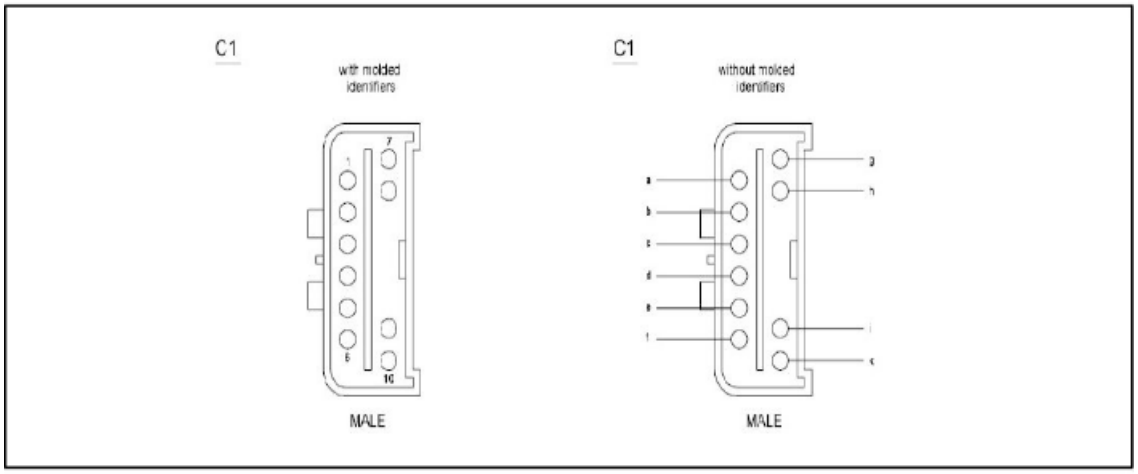
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step□by□step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column □Circuit to test□. If you wish to test the complete component, perform all tests.

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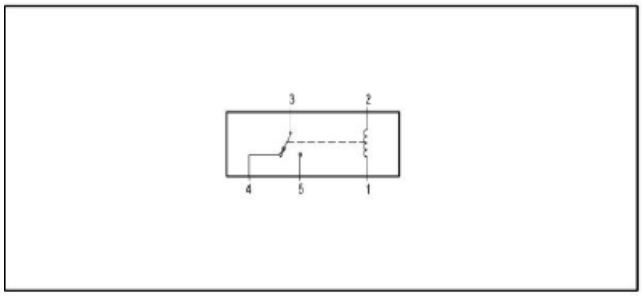
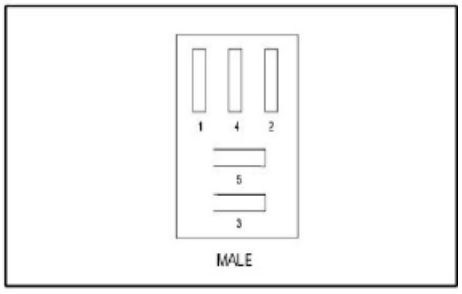
Relay □ Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63□102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil □ Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

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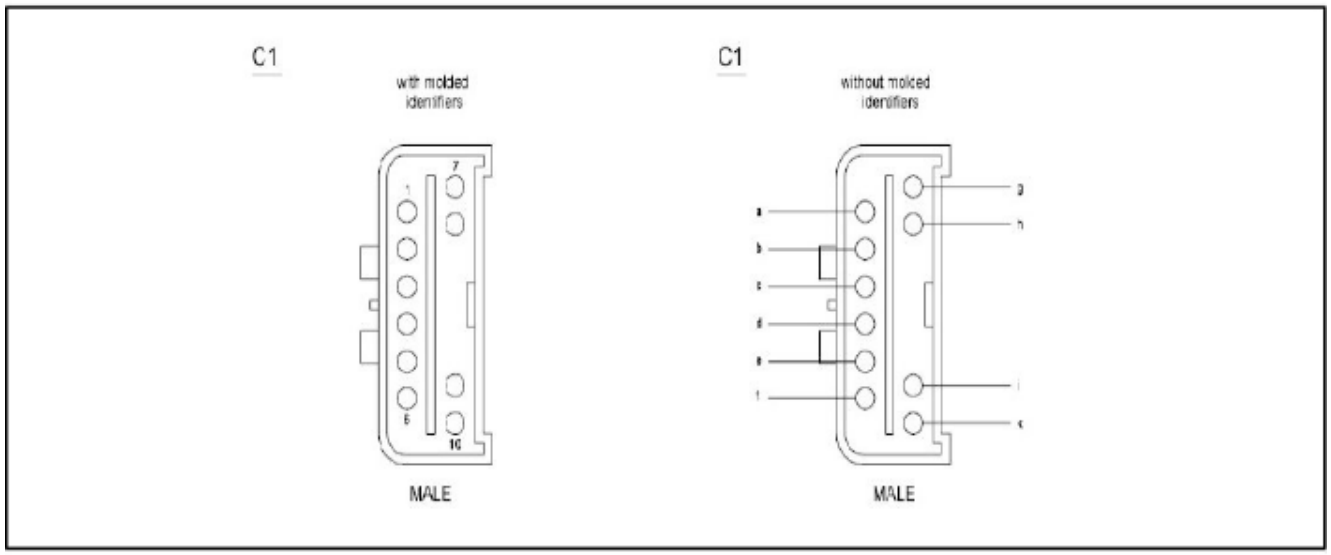
Testing information for each component includes a schematic, a view of the terminal locations and step by step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



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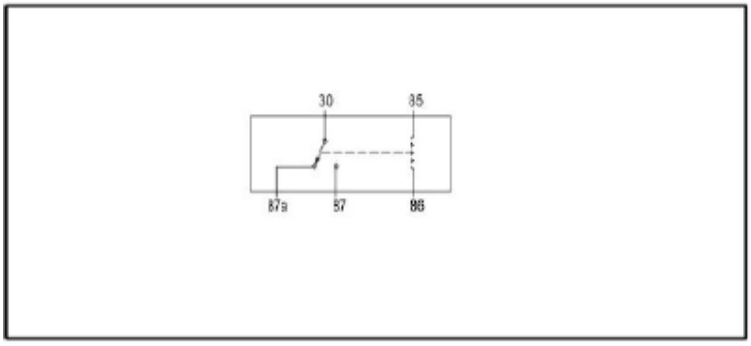
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

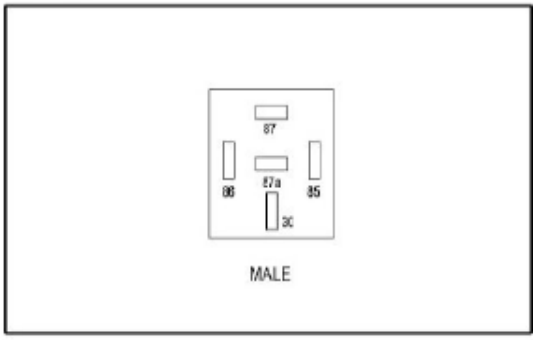
Horn Relay: Testing and Inspection Mini ISO Relay

Relay □ Mini ISO

Schematic



Terminals

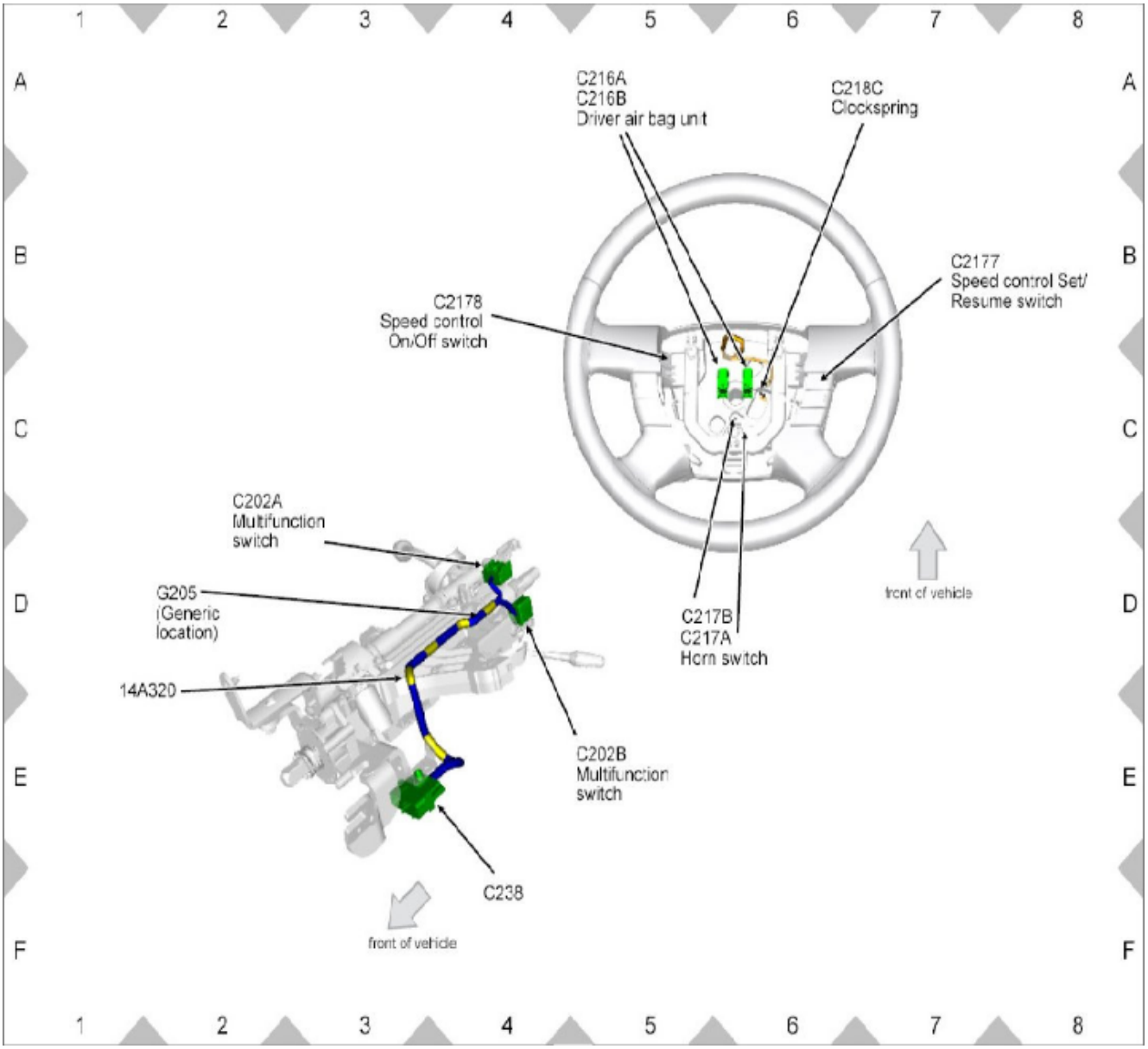


Component testing procedure (no voltage applied)

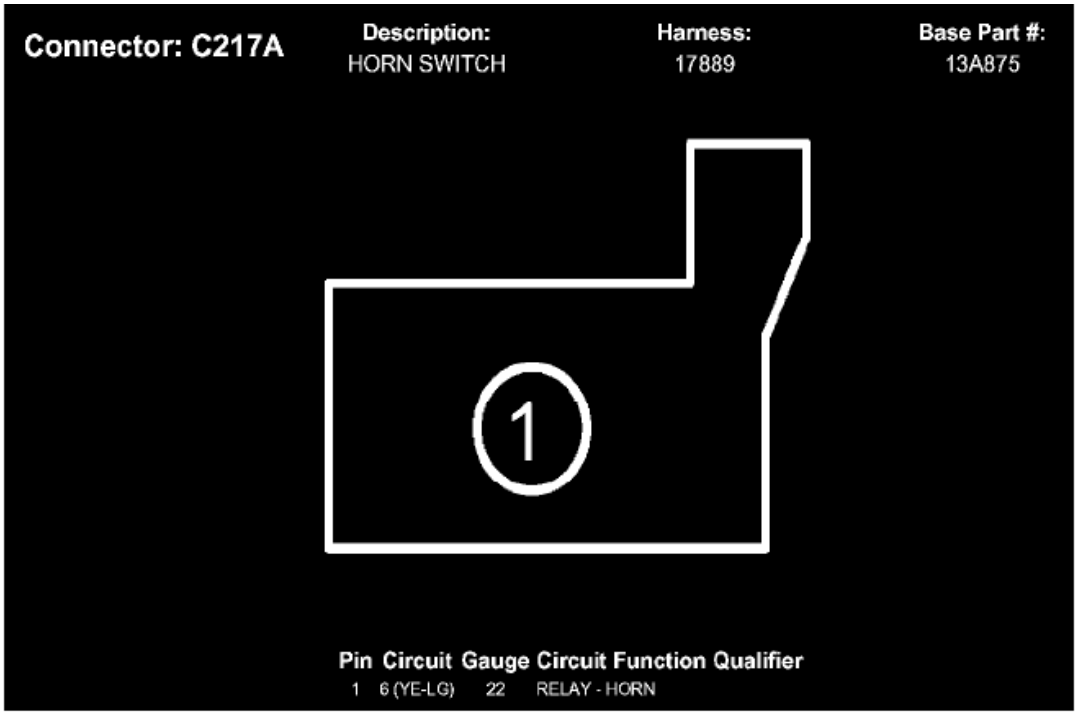
Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 □ 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

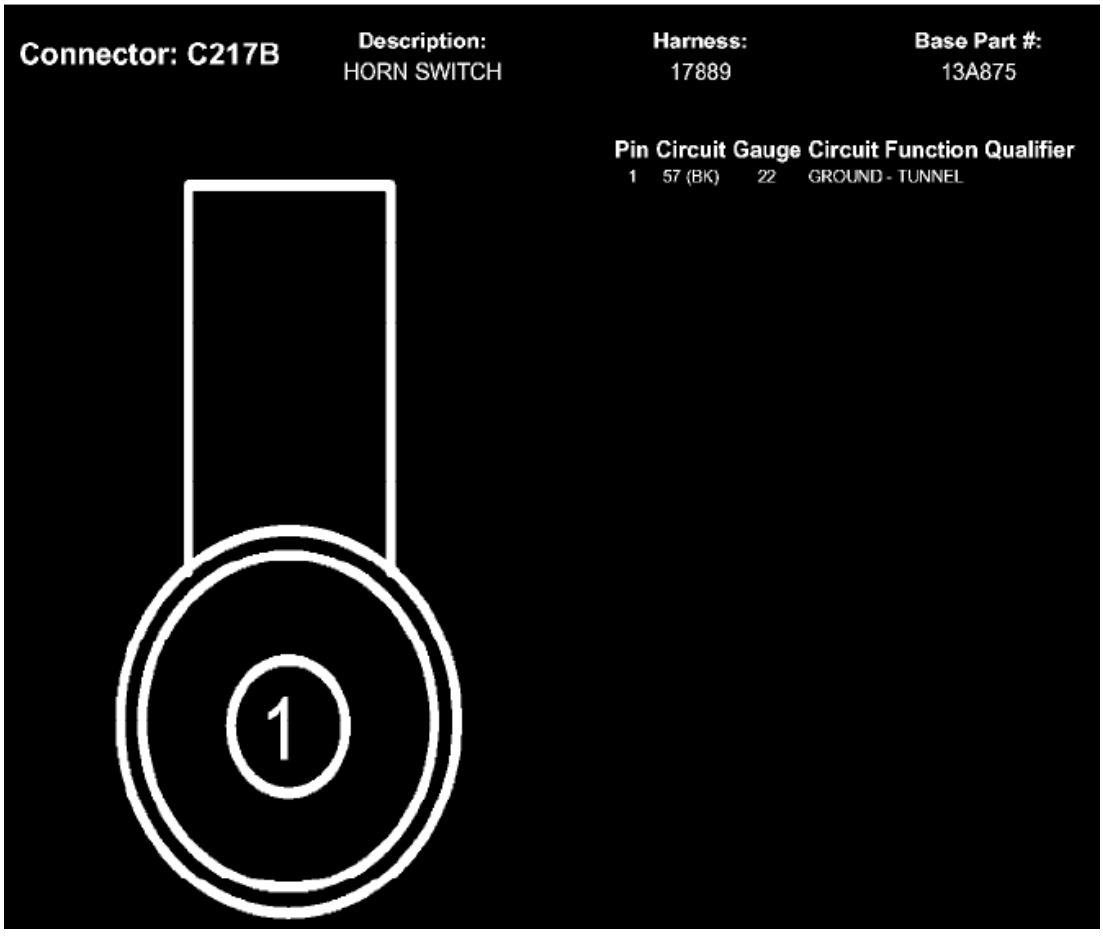
Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.


C216A
C216B
Driver air bag unit
C218C
Clockspring
C2177
Speed control Set/
Resume switch
C2178
Speed control
On/Off switch
C202A
Multifunction
switch
G205
(Generic
location)
14A320
C202B
Multifunction
switch
C238
C217B
C217A
Horn switch
front of vehicle
front of vehicle

View 151-13


Connector: C217A
Description:
HORN SWITCH
Harness:
17889
Base Part #:
13A875
1
Pin Circuit Gauge Circuit Function Qualifier
1 6 (YE-LG) 22 RELAY - HORN


Connector: C217B
Description:
HORN SWITCH
Harness:
17889
Base Part #:
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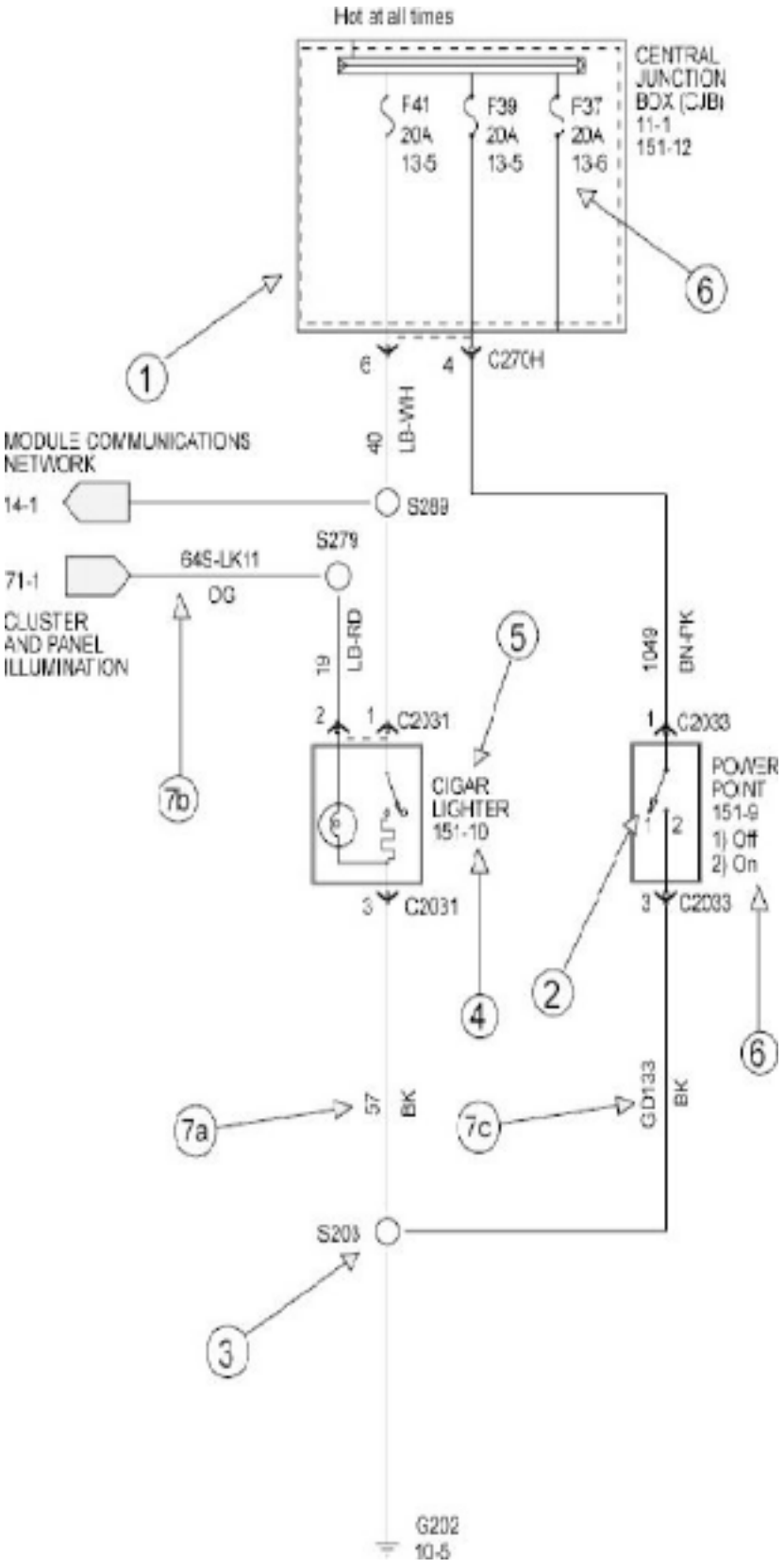
Pin Circuit Gauge Circuit Function Qualifier
1 57 (BK) 22 GROUND - TUNNEL
1

Horn Switch: Diagrams

C217A

C217B


Hot at all times
CENTRAL JUNCTION BOX (CJB)
11-1
151-12
F41
20A
13-5
F39
20A
13-5
F37
20A
13-6
C270H
MODULE COMMUNICATIONS NETWORK
14-1
S289
S279
71-1
64S-LK11
DG
CLUSTER AND PANEL ILLUMINATION
19
LB-RD
40
LB-WH
1049
BN-PK
C2031
C2033
CIGAR LIGHTER
151-10
POWER POINT
151-9
1) Off
2) On
57
BK
GD133
BK
S203
G202
10-5

Interior Lighting Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

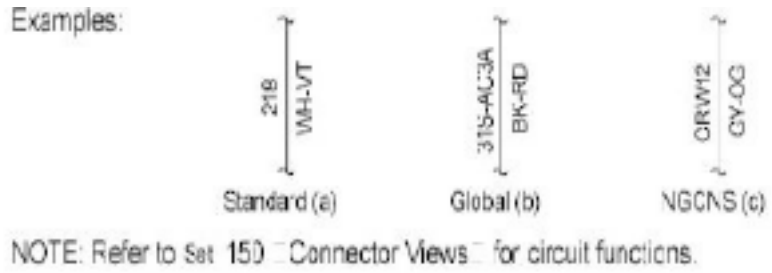
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

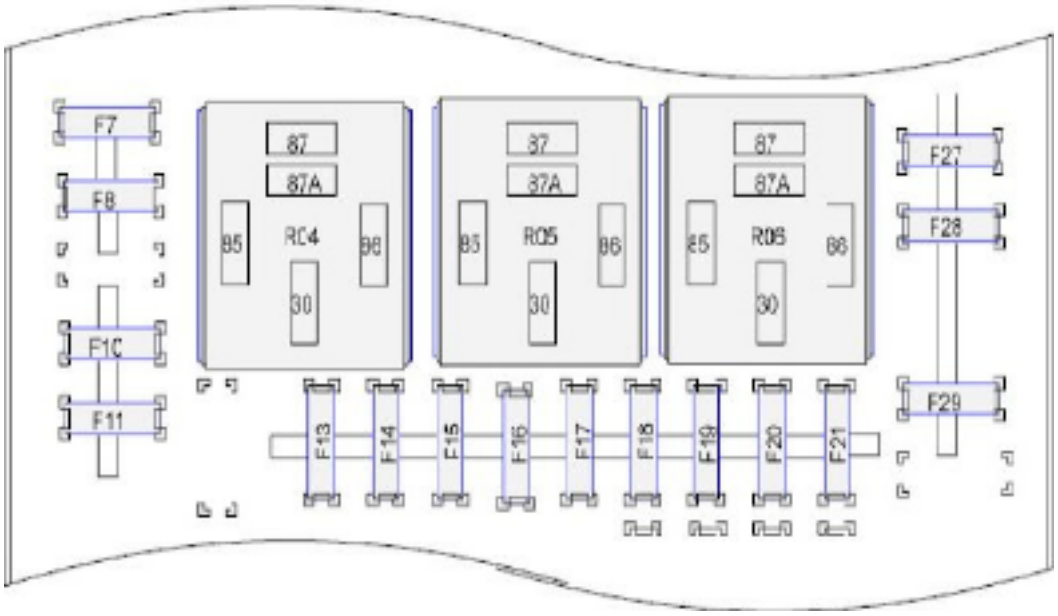
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

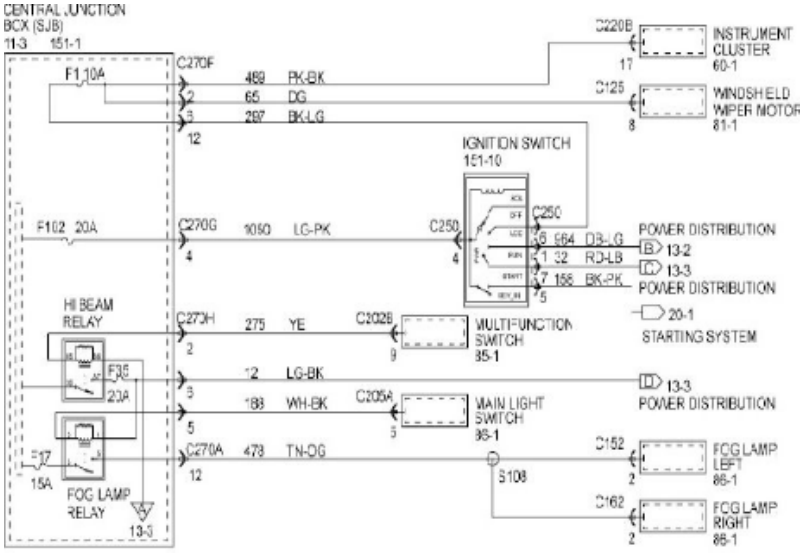
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

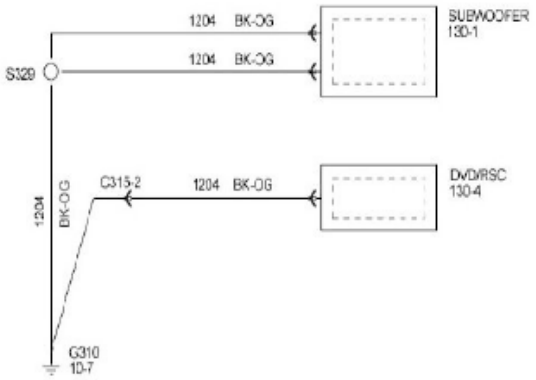
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

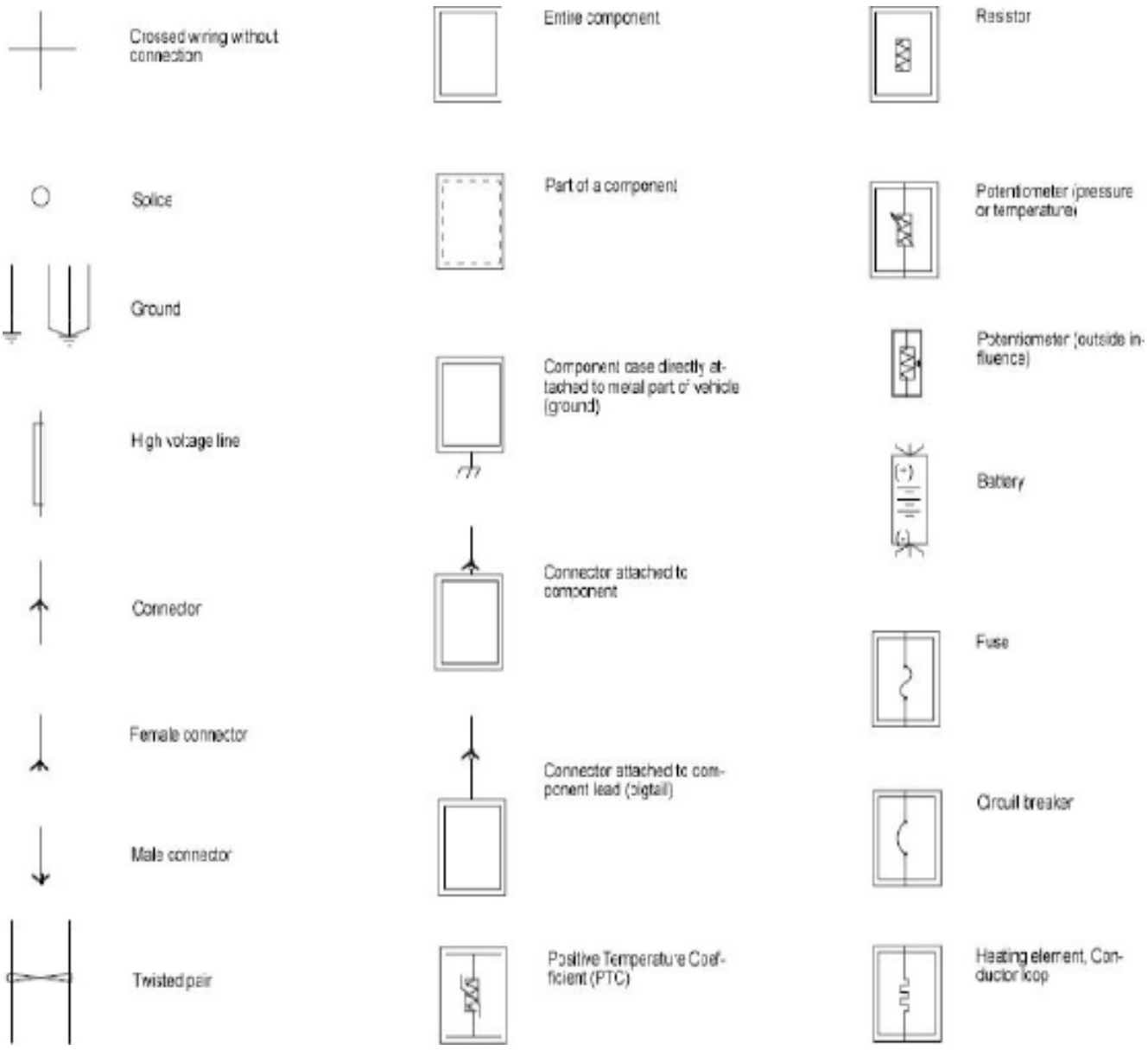
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

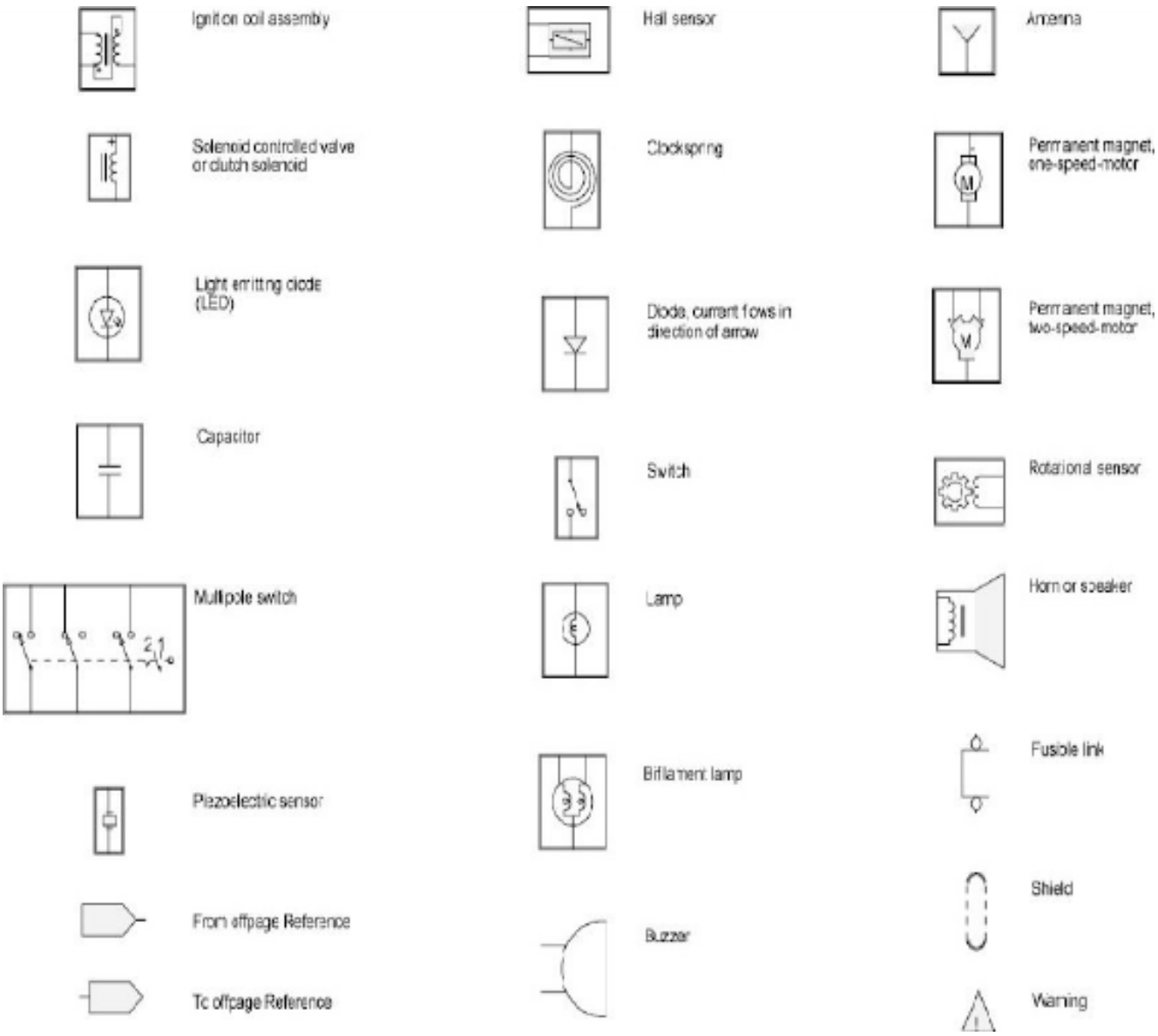
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

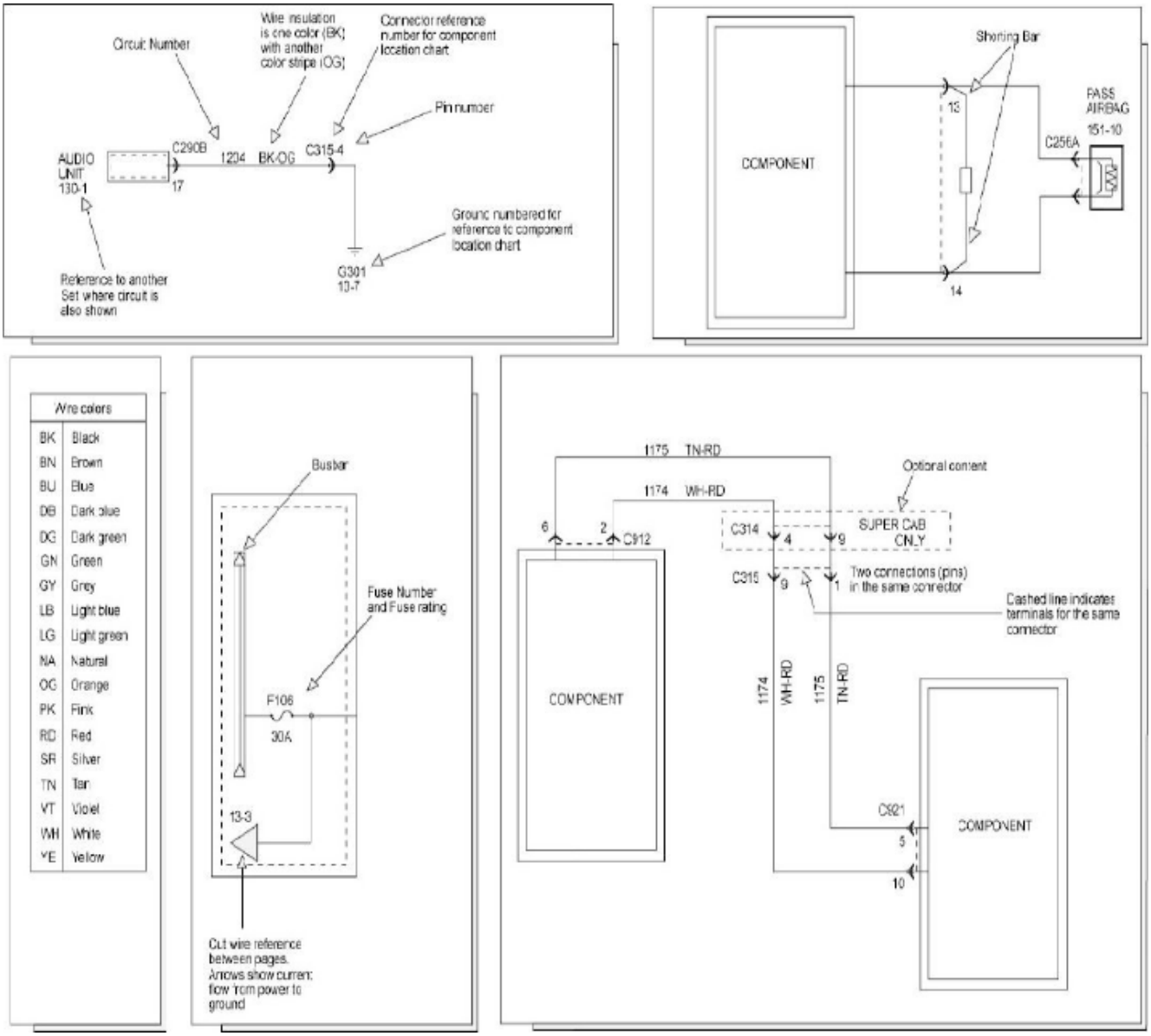
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

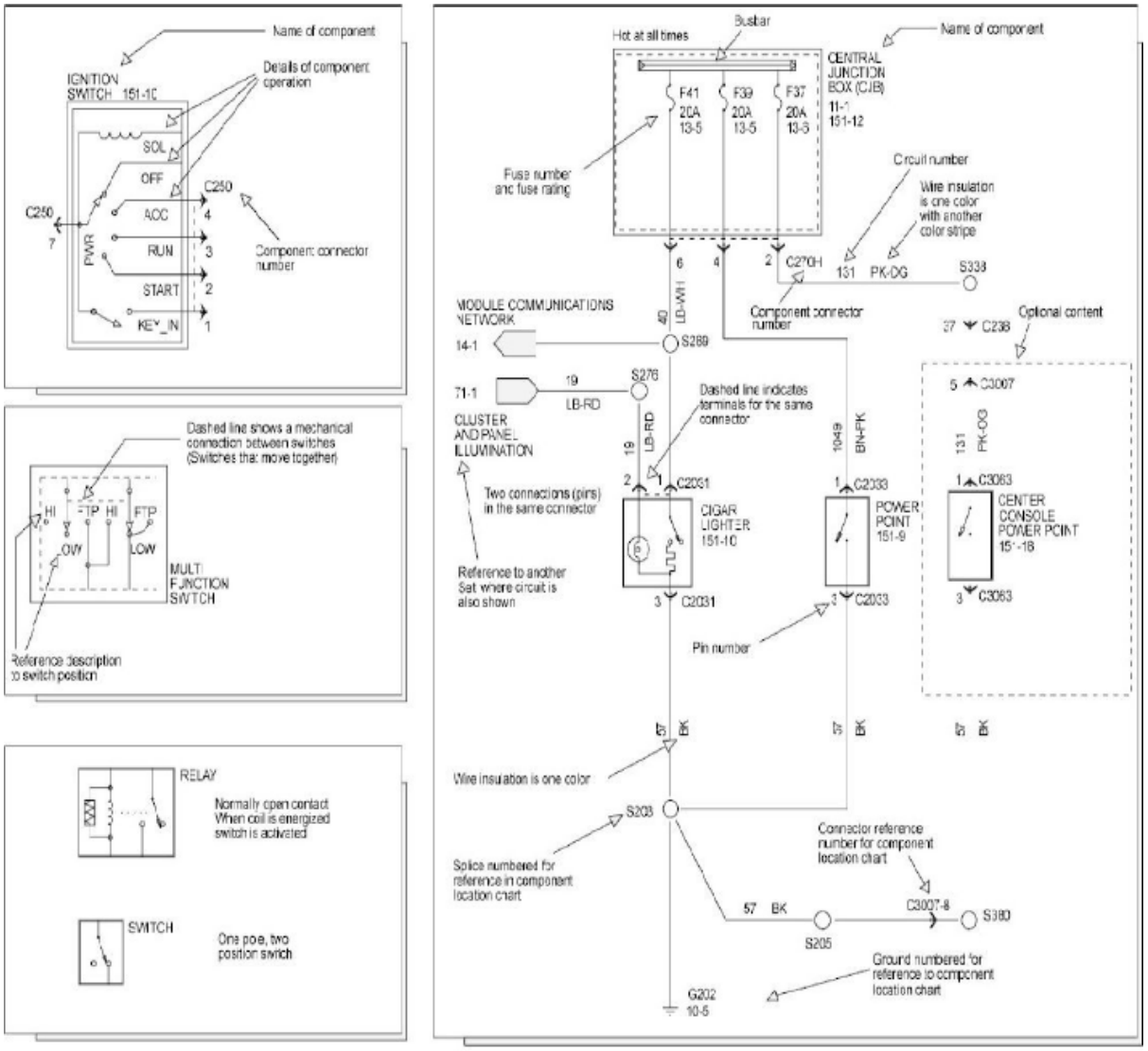
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

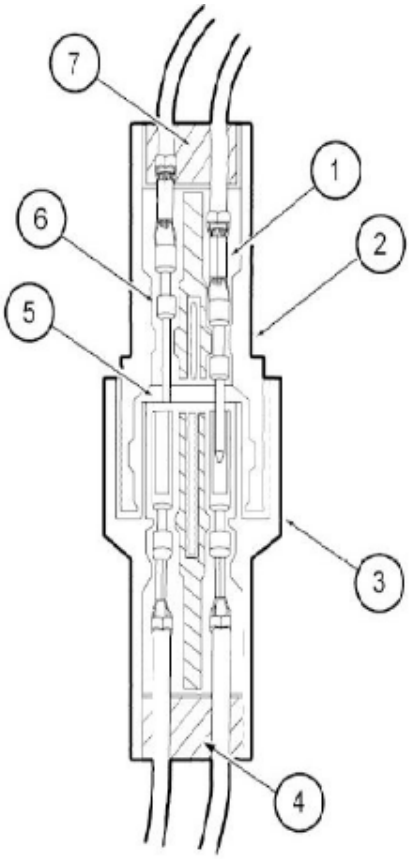


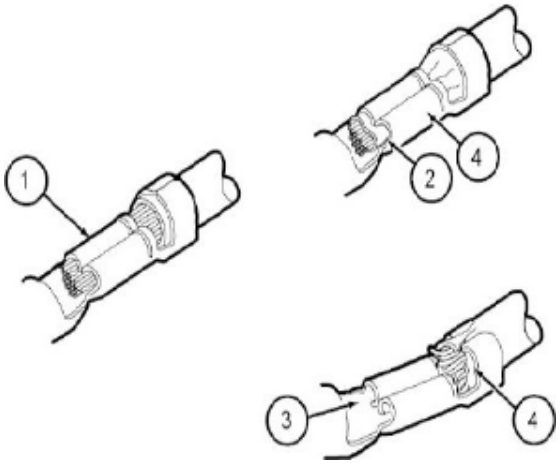
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Interior Lighting Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

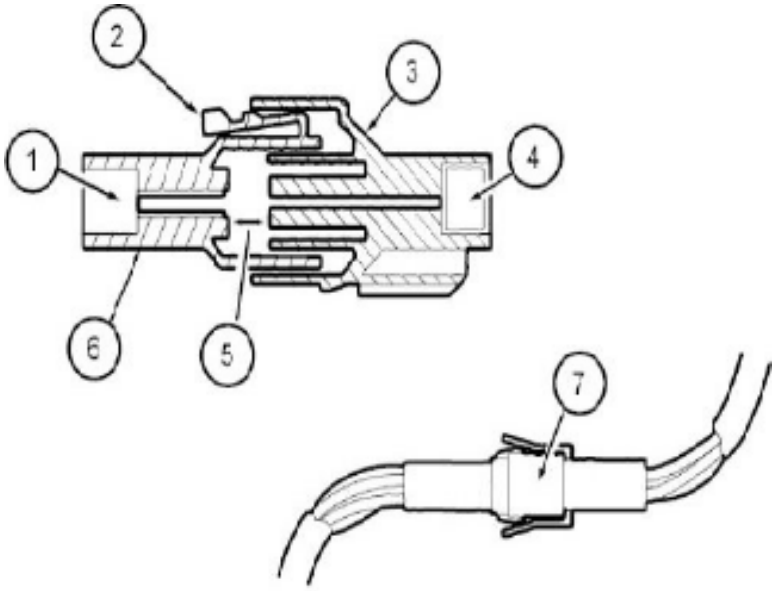
5 = Intermittent contact

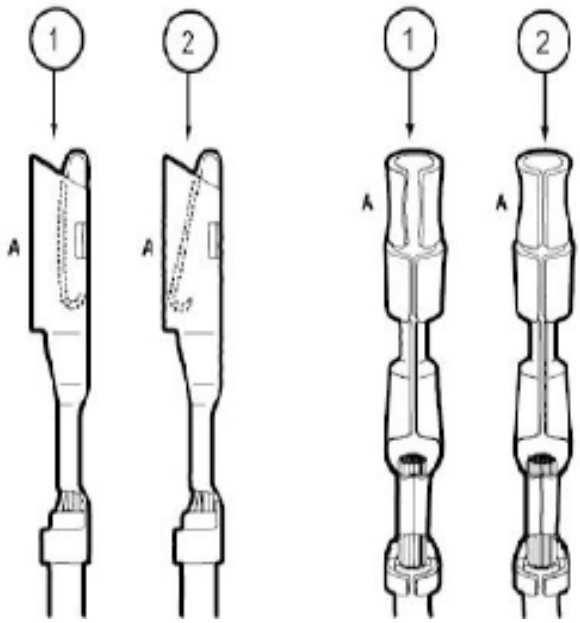
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

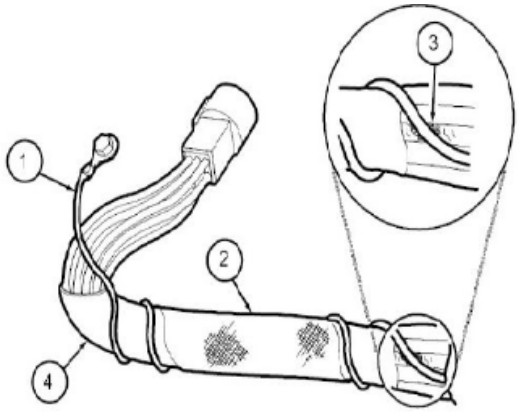
Deformed (enlarged) female terminals

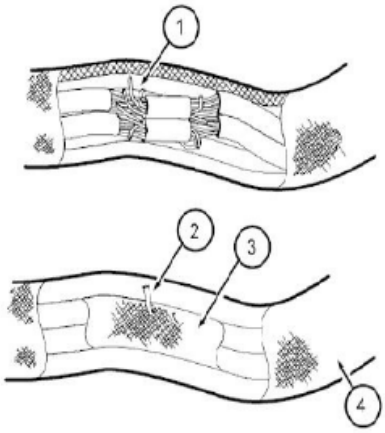
1 = Enlarged

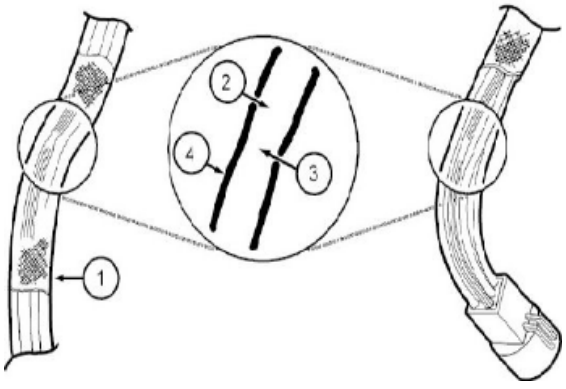
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

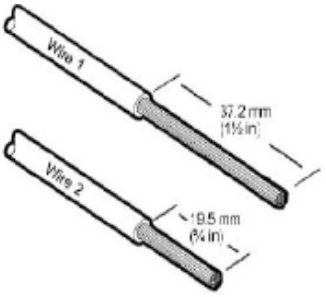
Splice covered 2

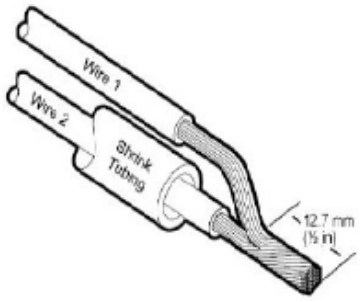
= Wire strand

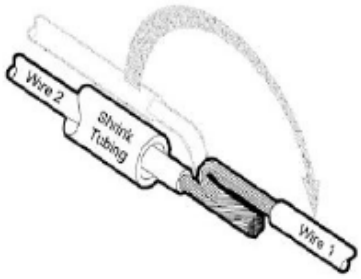
3 = Splice tape

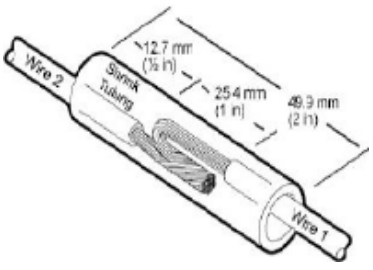
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

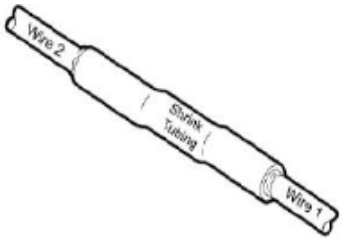
NOTE: -

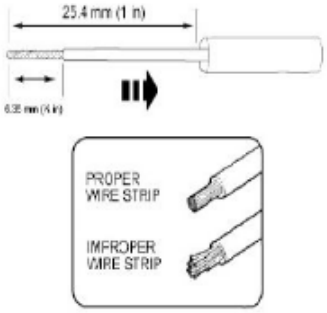
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

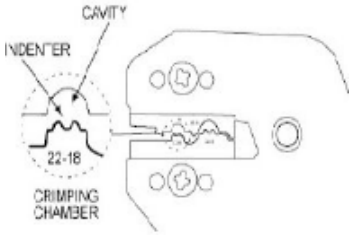
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

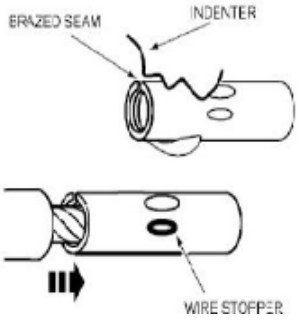
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

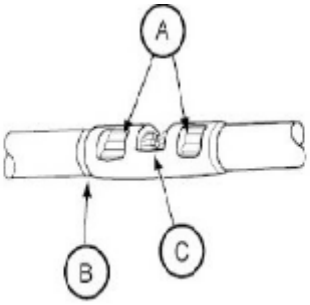
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

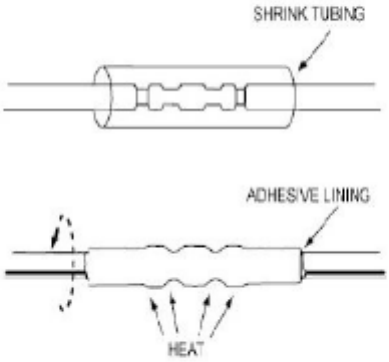
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4□ strip, cut 9 strands	* 1/4□ strip, cut 2 strands	1/4□ strip, no fold	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip, fold 2x dia.	1□ strip, fold 3x dia.
	16-14	* 1/4□ strip, cut 7 strands	1/4□ strip, no fold	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip fold 2x dia	1□ strip, fold 3x dia.	1 1/4□ strip, fold 4x dia.	Not Recommended
	12-10	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip, fold 2x dia.	1□ strip fold 3x cia.	1 1/4□ strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Figtail only

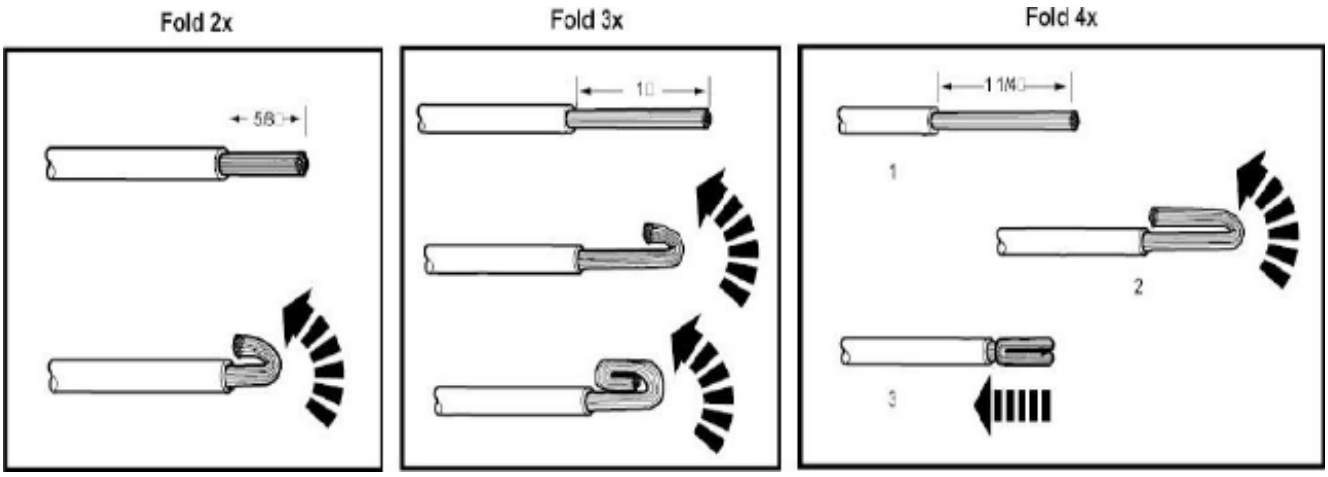
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



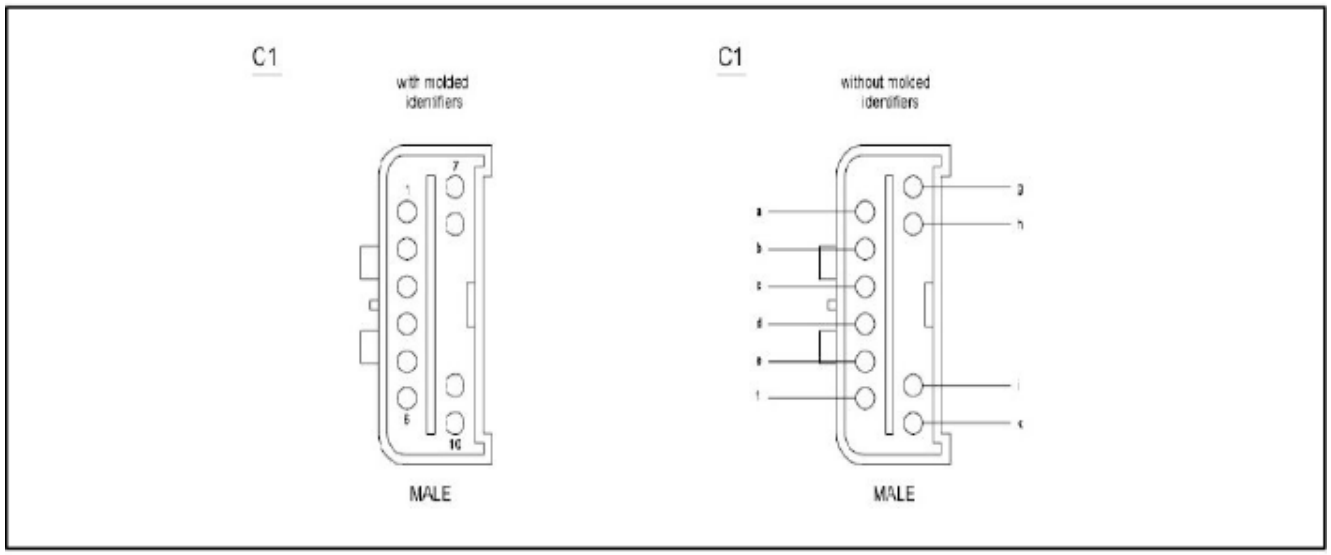
The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step by step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



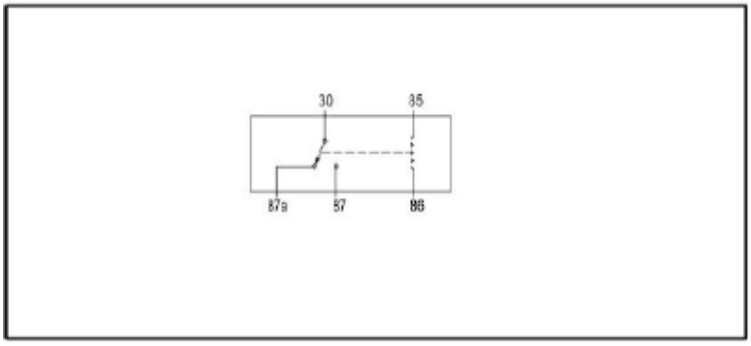
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

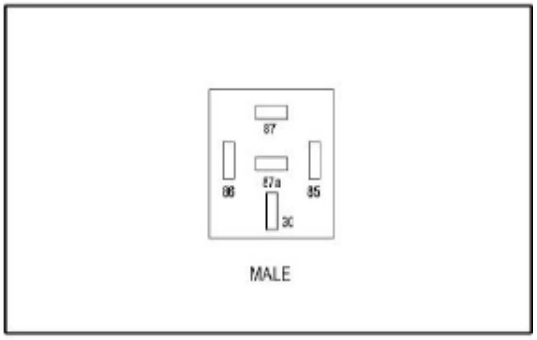
Interior Lighting Relay: Testing and Inspection Mini ISO Relay

Relay □ Mini ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

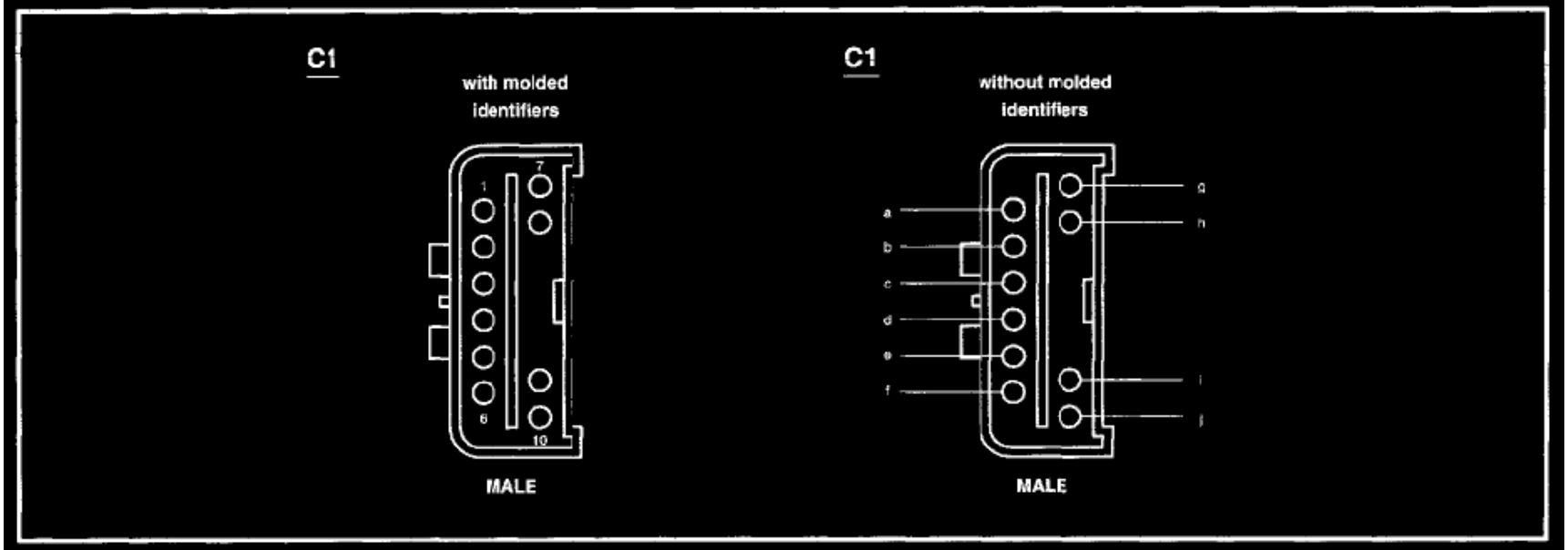
Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step–by–step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



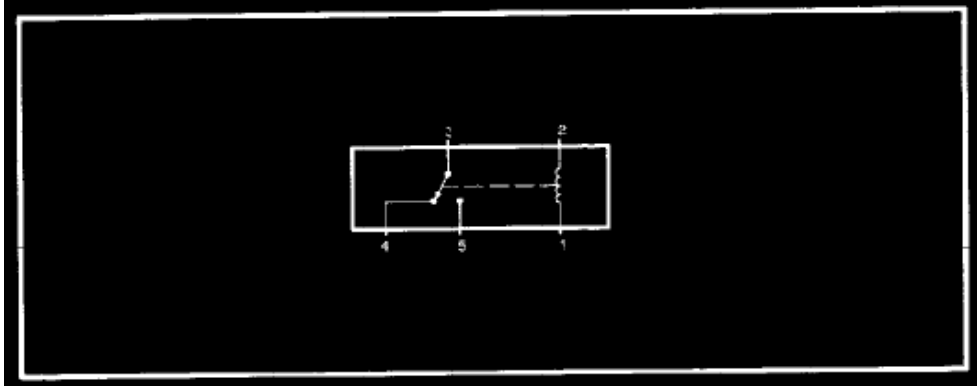
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

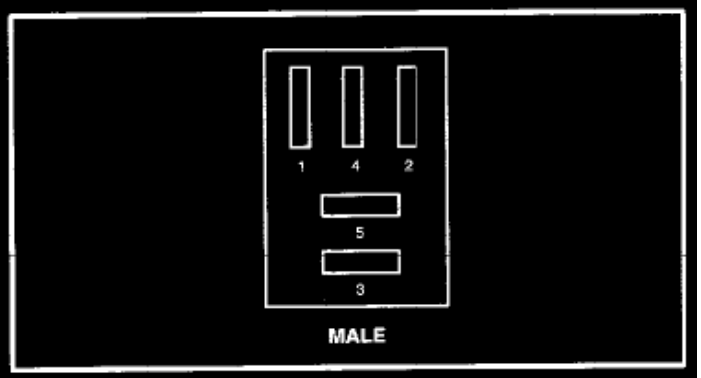
Interior Lighting Relay: Testing and Inspection Micro ISO Relay

Relay – Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63–102Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil – Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

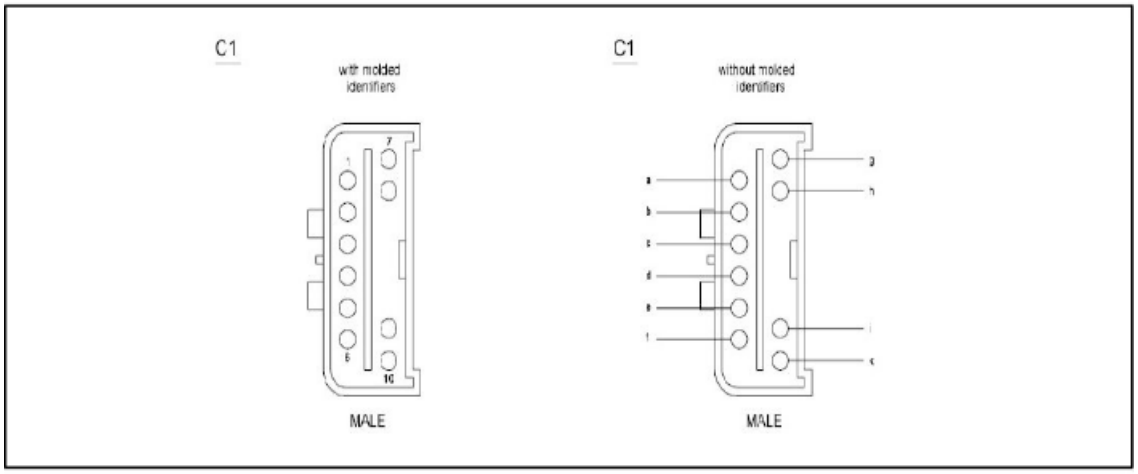
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals

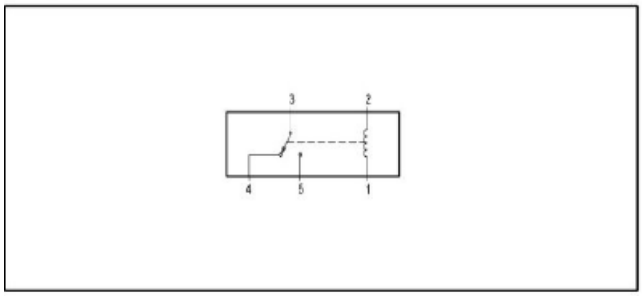


The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

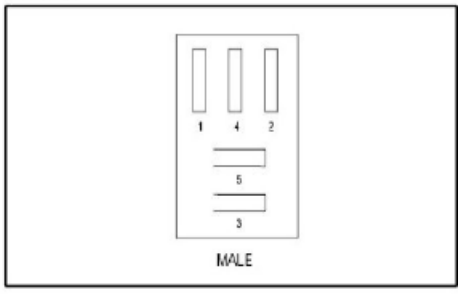
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Relay - Micro ISO

Schematic



Terminals



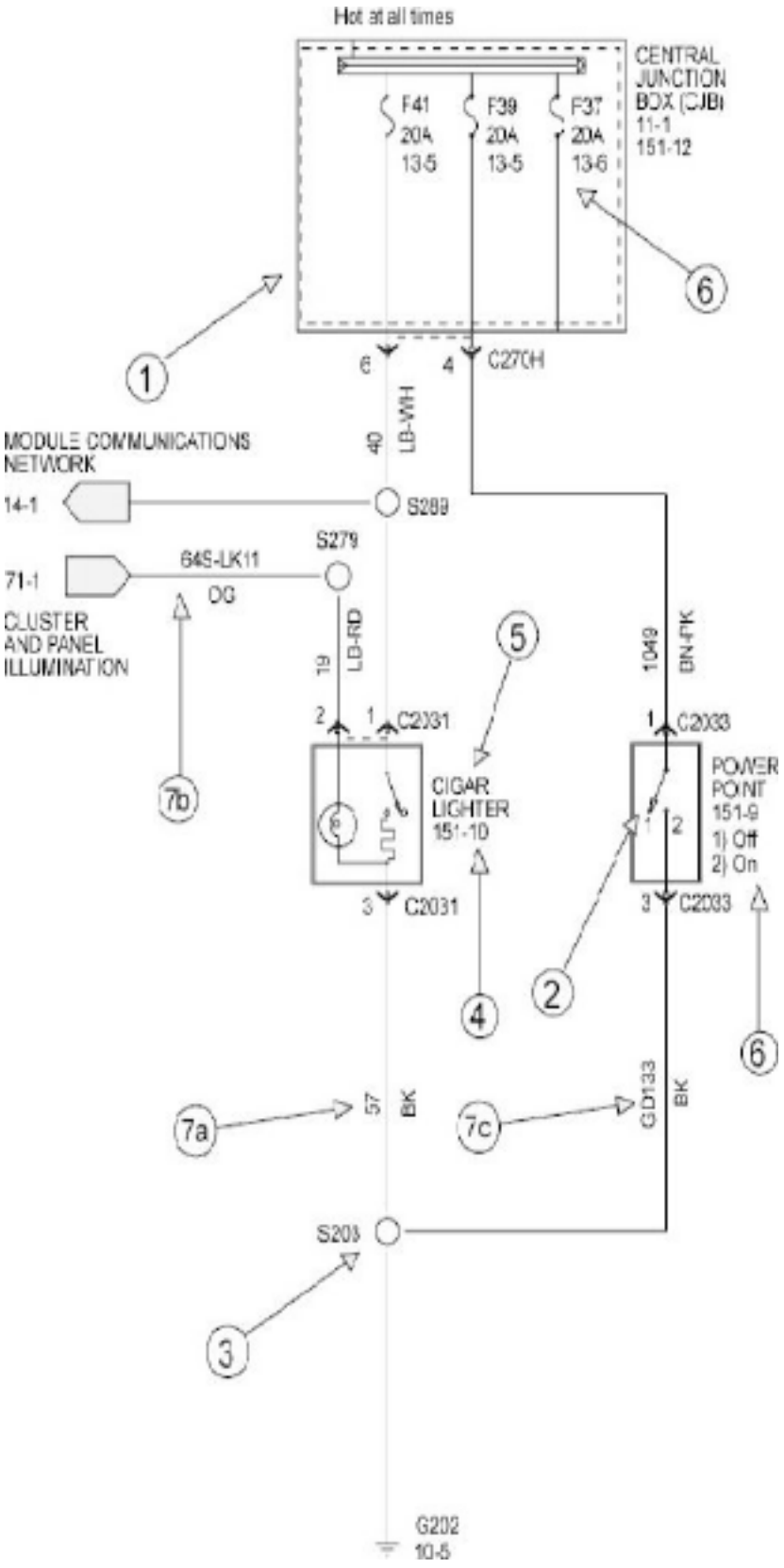
Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63-102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil - Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Lighting and Horns > License Plate Lamp > Component Information > Diagrams > Diagram Information and Instructions



License Plate Lamp: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

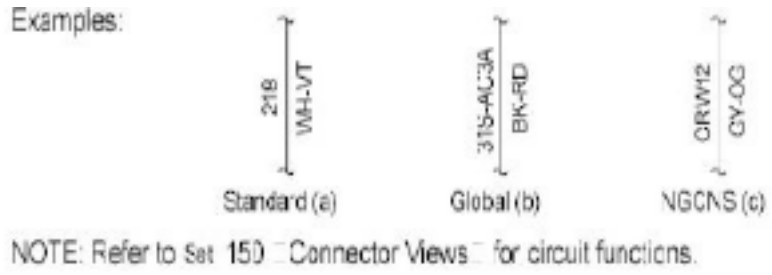
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

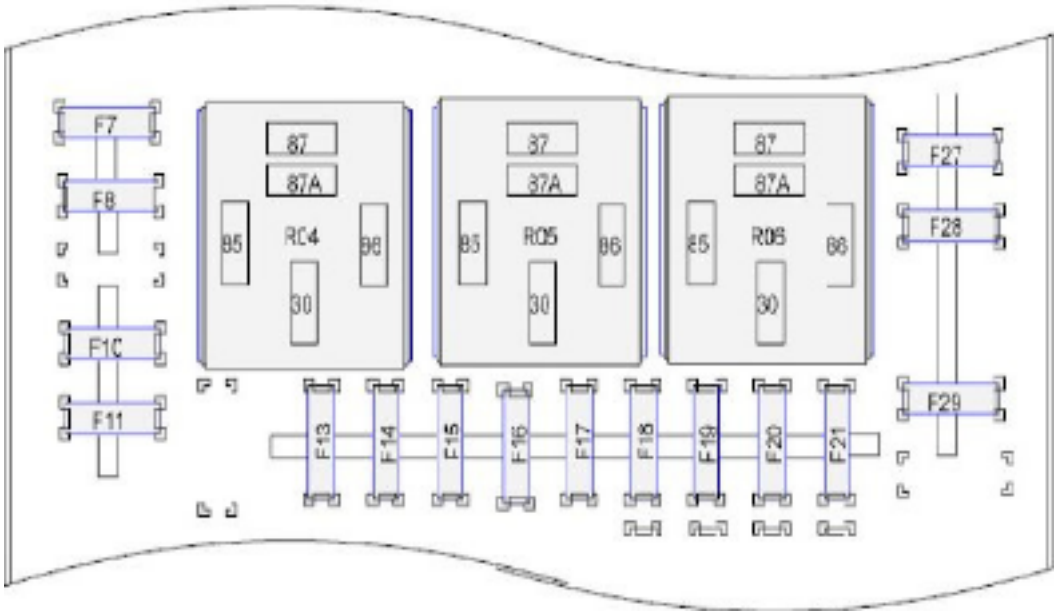
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

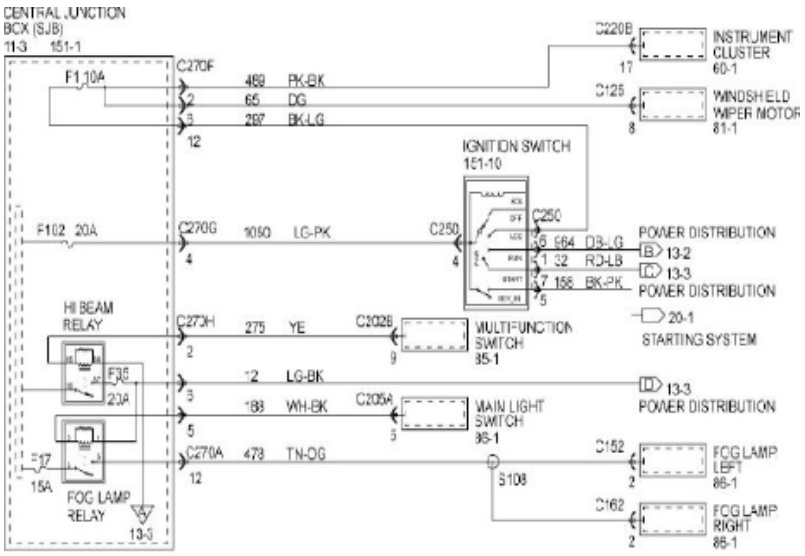
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

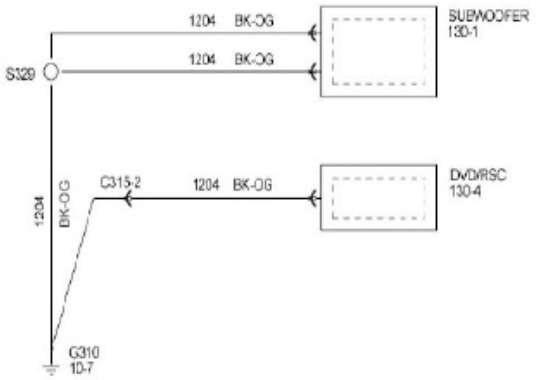
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

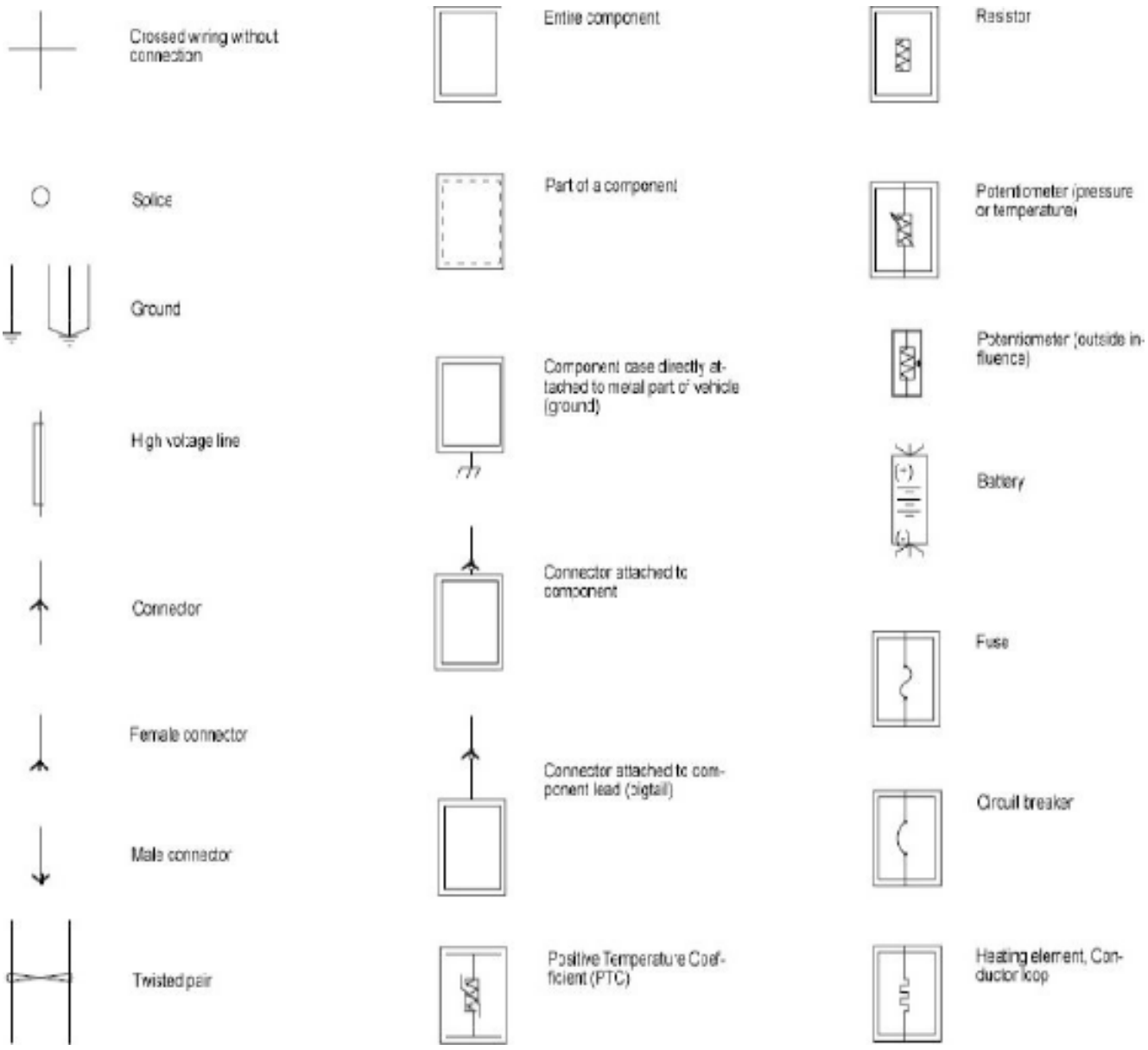
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

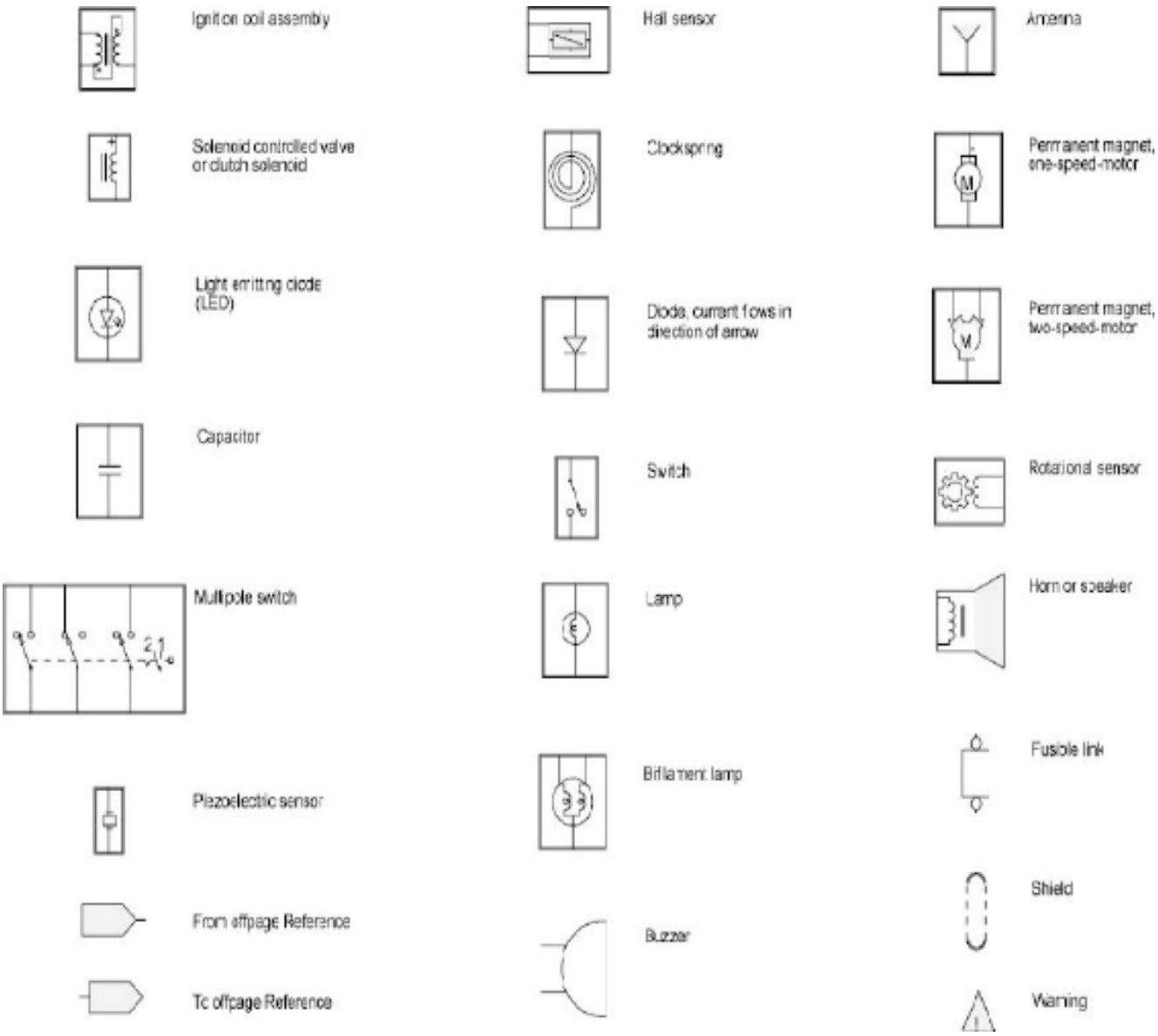
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

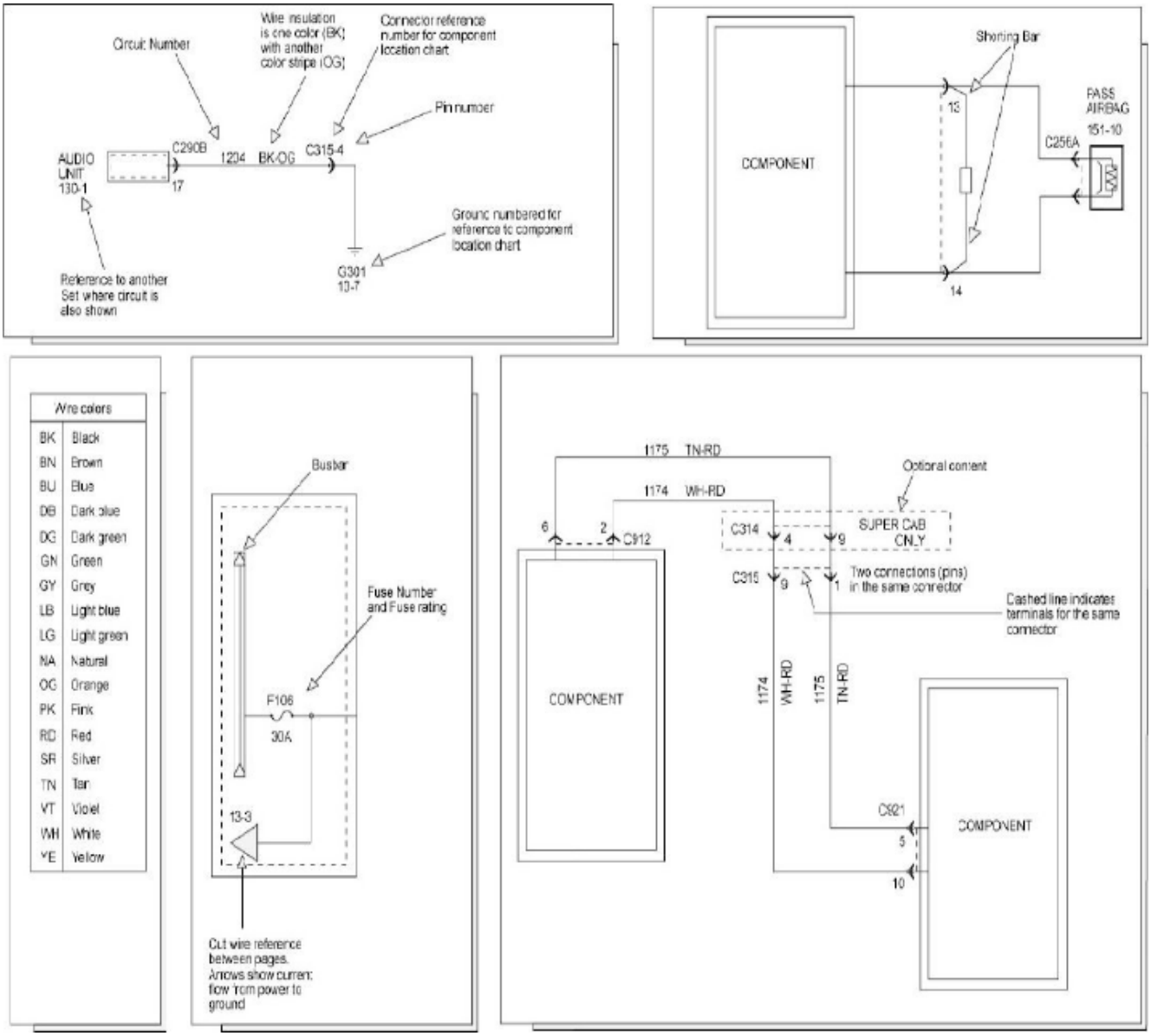
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

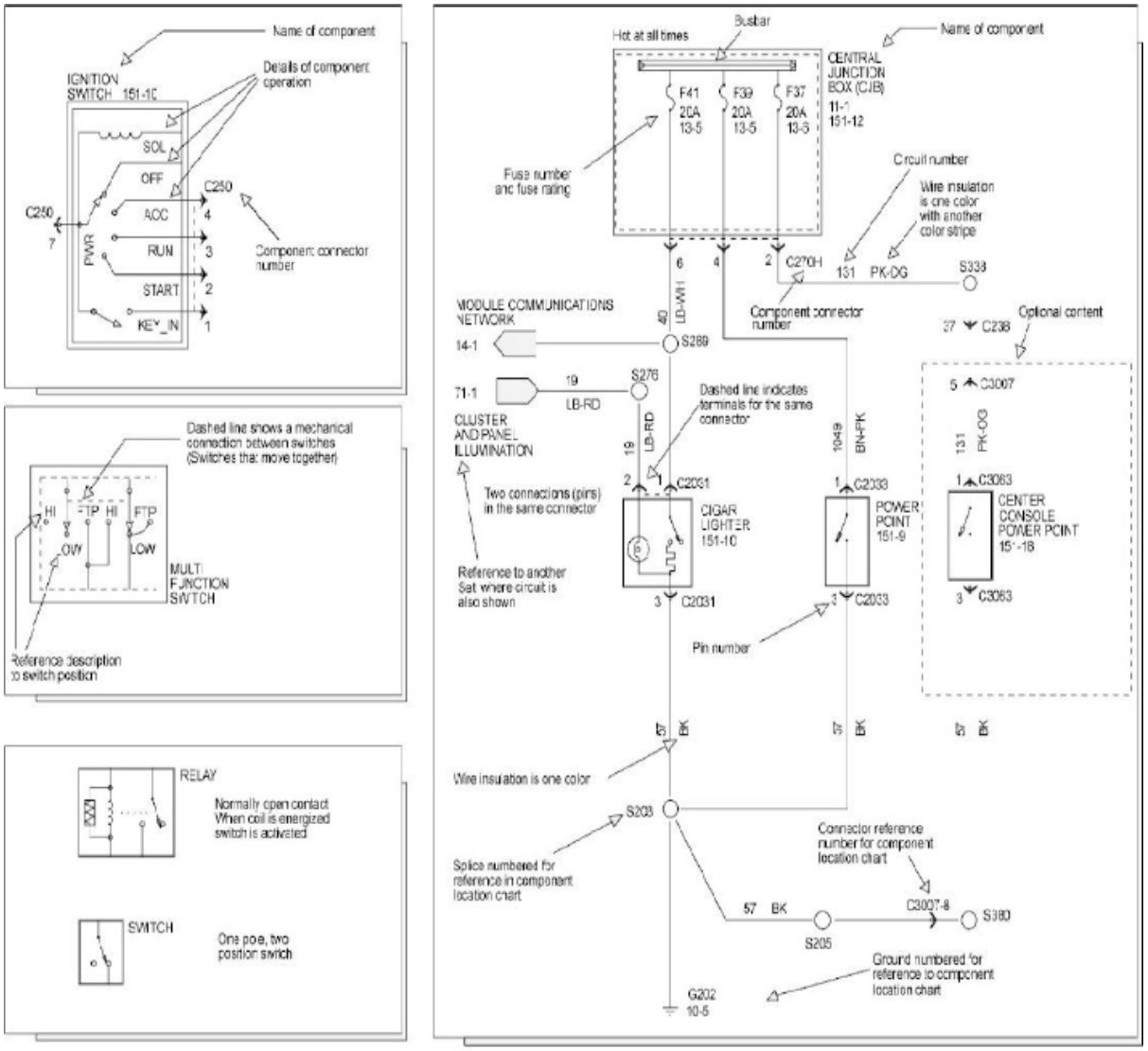
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

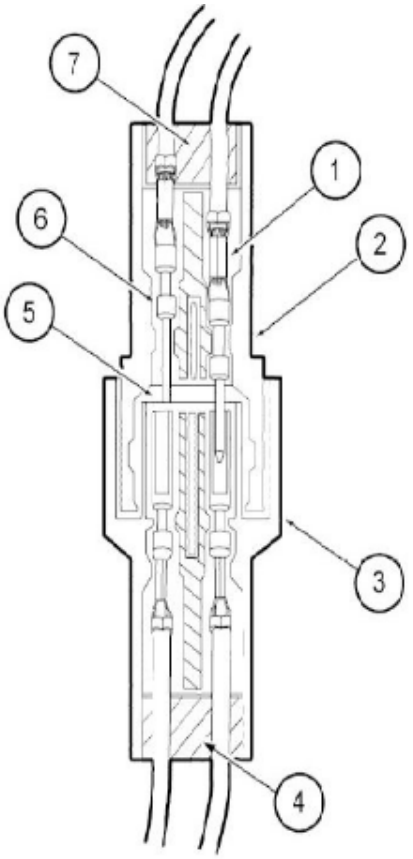


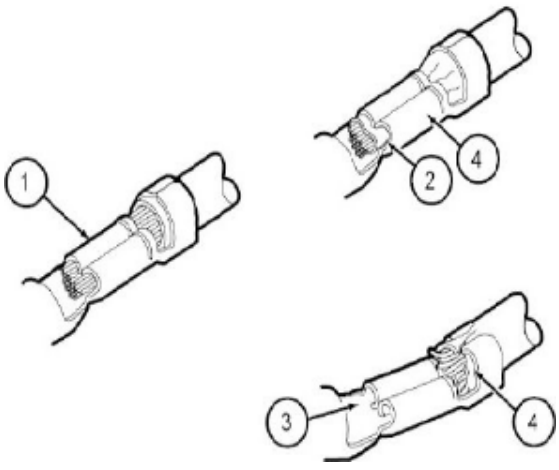
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

License Plate Lamp: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

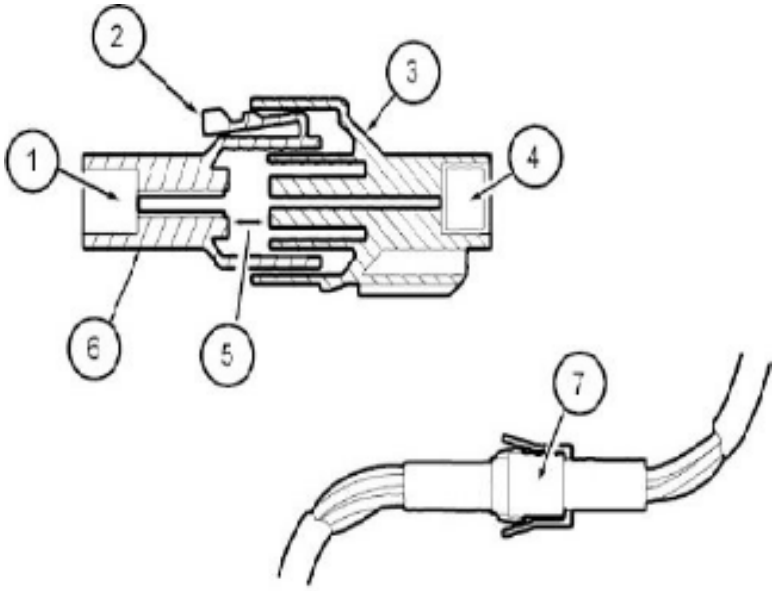
5 = Intermittent contact

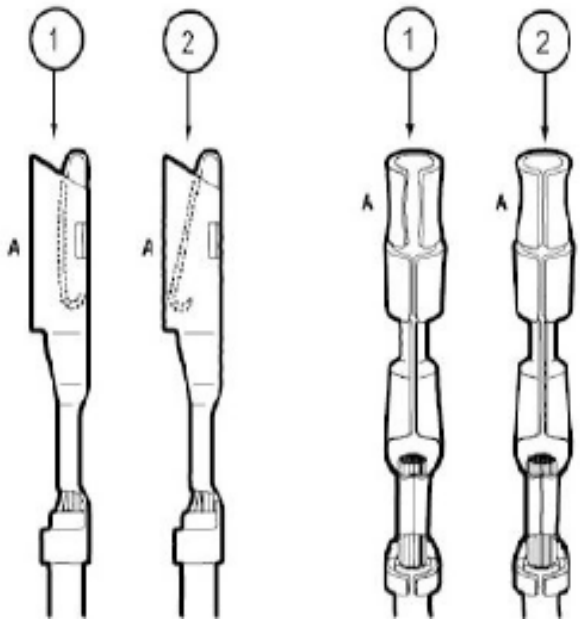
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

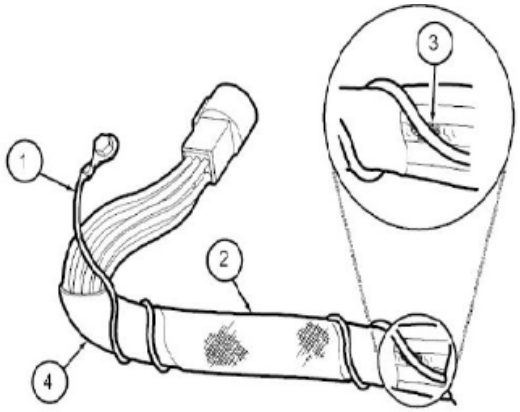
Deformed (enlarged) female terminals

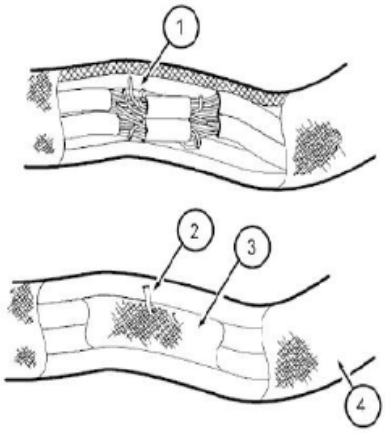
1 = Enlarged

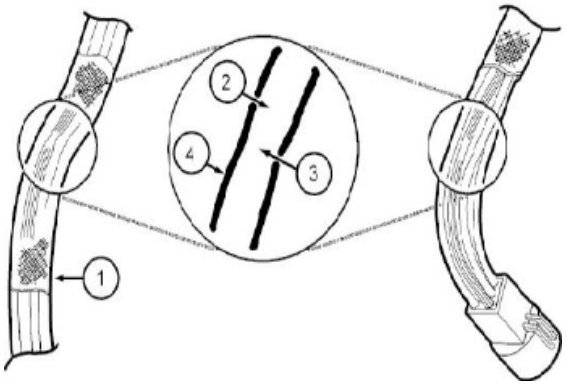
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

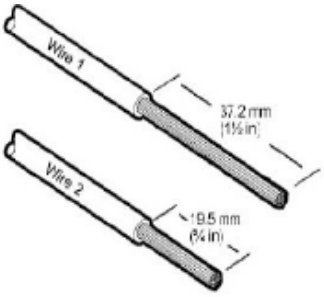
Splice covered 2

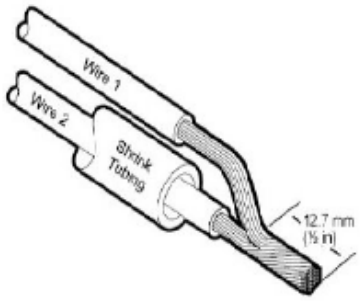
= Wire strand

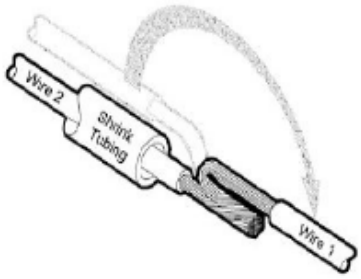
3 = Splice tape

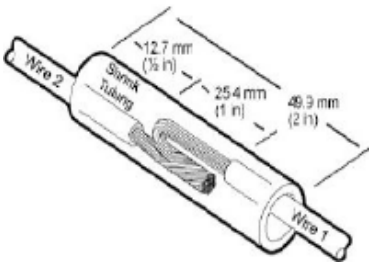
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

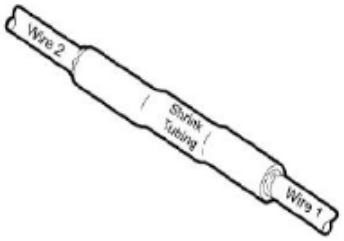
NOTE: -

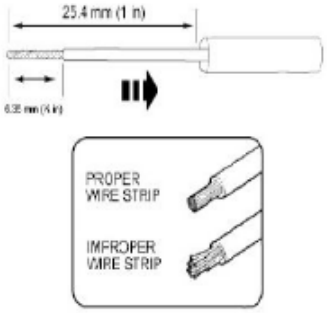
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

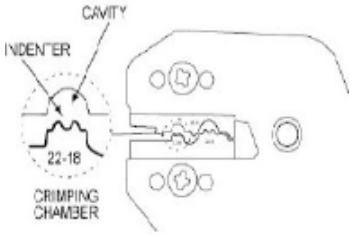
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

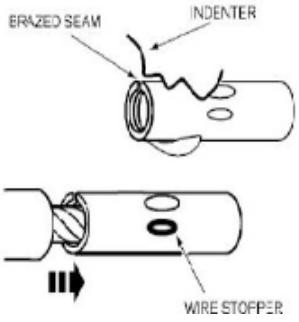
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

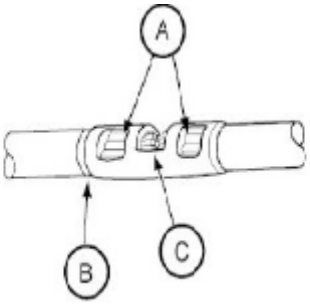
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

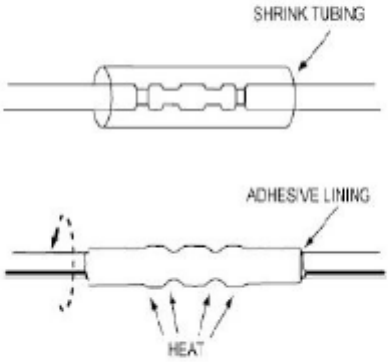
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4 strip, cut 9 strands	* 1/4 strip, cut 2 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip, fold 3x dia.
	16-14	* 1/4 strip, cut 7 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip fold 2x dia	1 strip, fold 3x dia.	1 1/4 strip, fold 4x dia.	Not Recommended
	12-10	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip fold 3x cia.	1 1/4 strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Figtail only

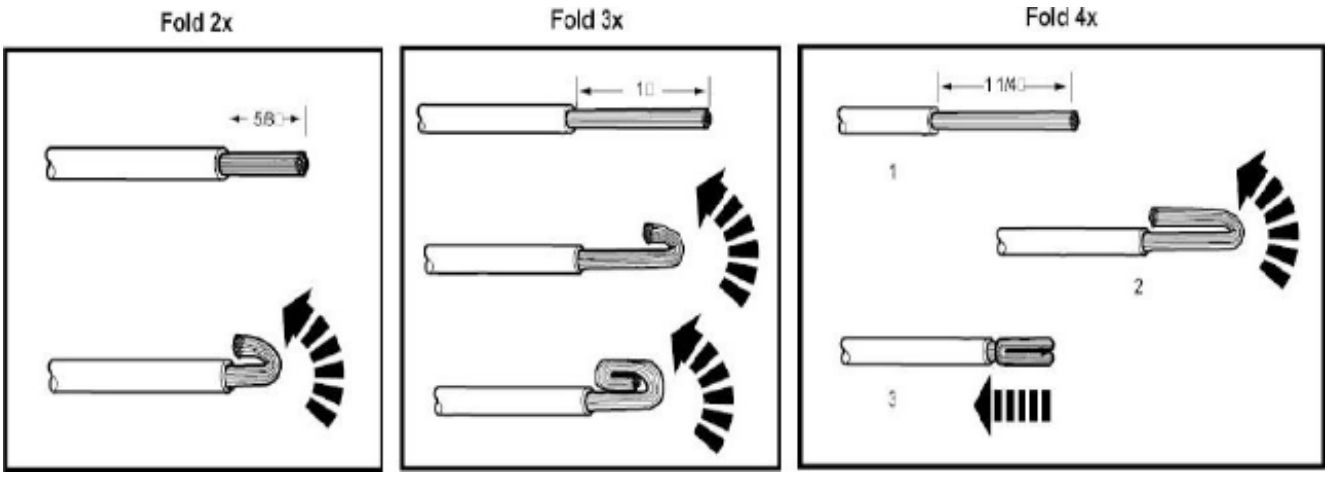
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

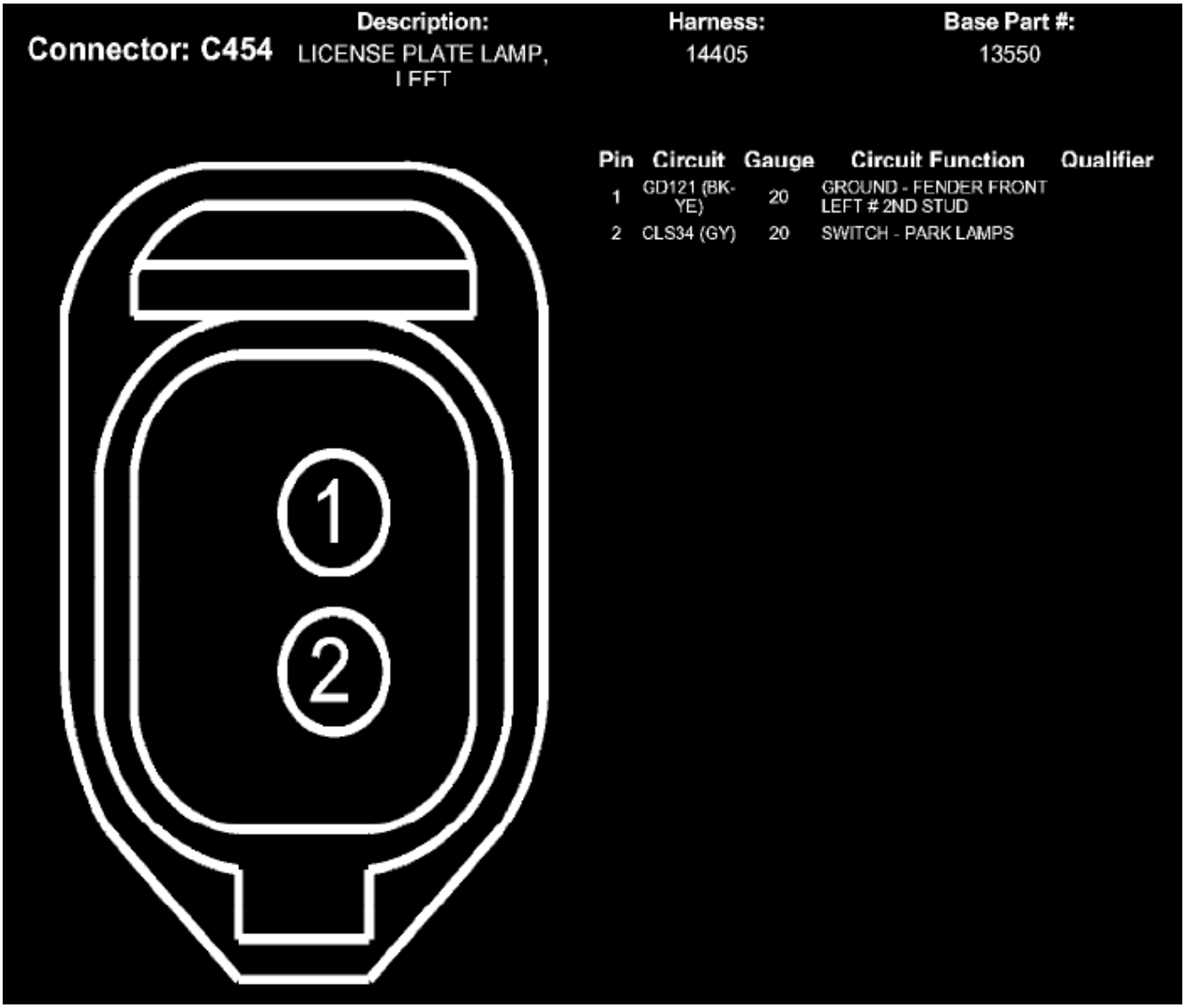
11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.

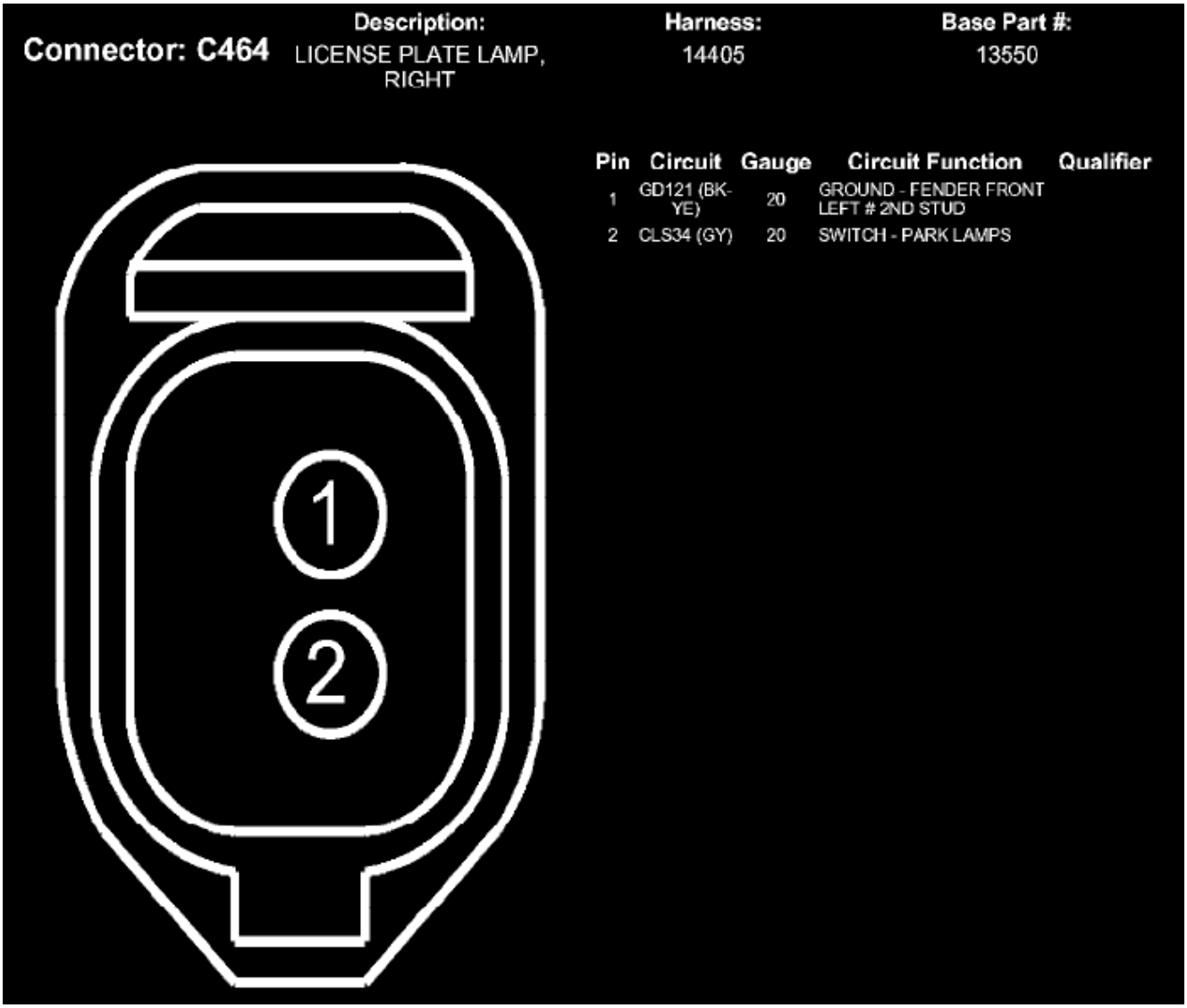


The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

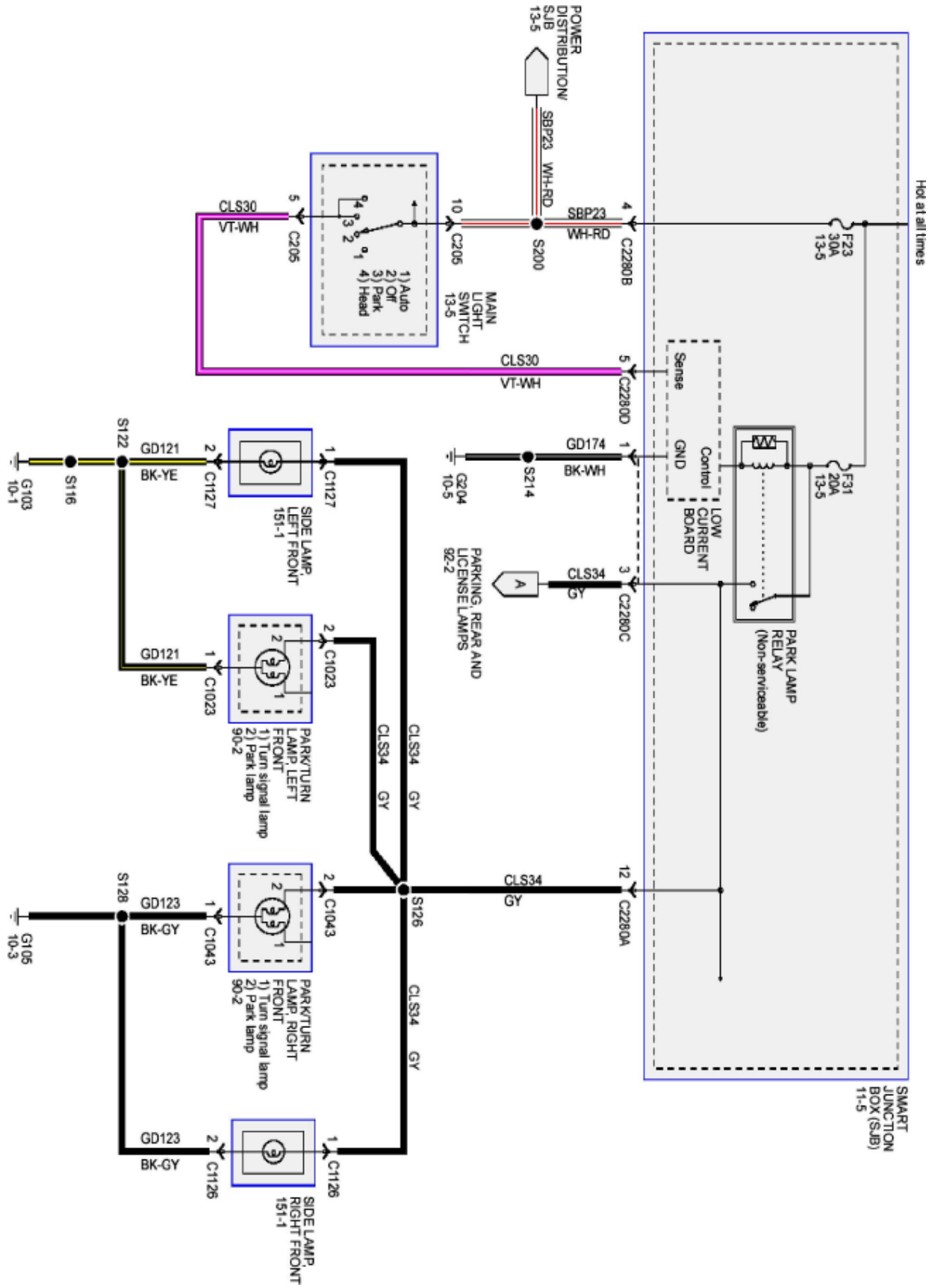


License Plate Lamp: Connector Views

C454


Connector: C464
Description:
LICENSE PLATE LAMP, RIGHT
Harness:
14405
Base Part #:
13550
Pin Circuit Gauge Circuit Function Qualifier
1 GD121 (BK-YE) 20 GROUND - FENDER FRONT LEFT # 2ND STUD
2 CLS34 (GY) 20 SWITCH - PARK LAMPS
1
2

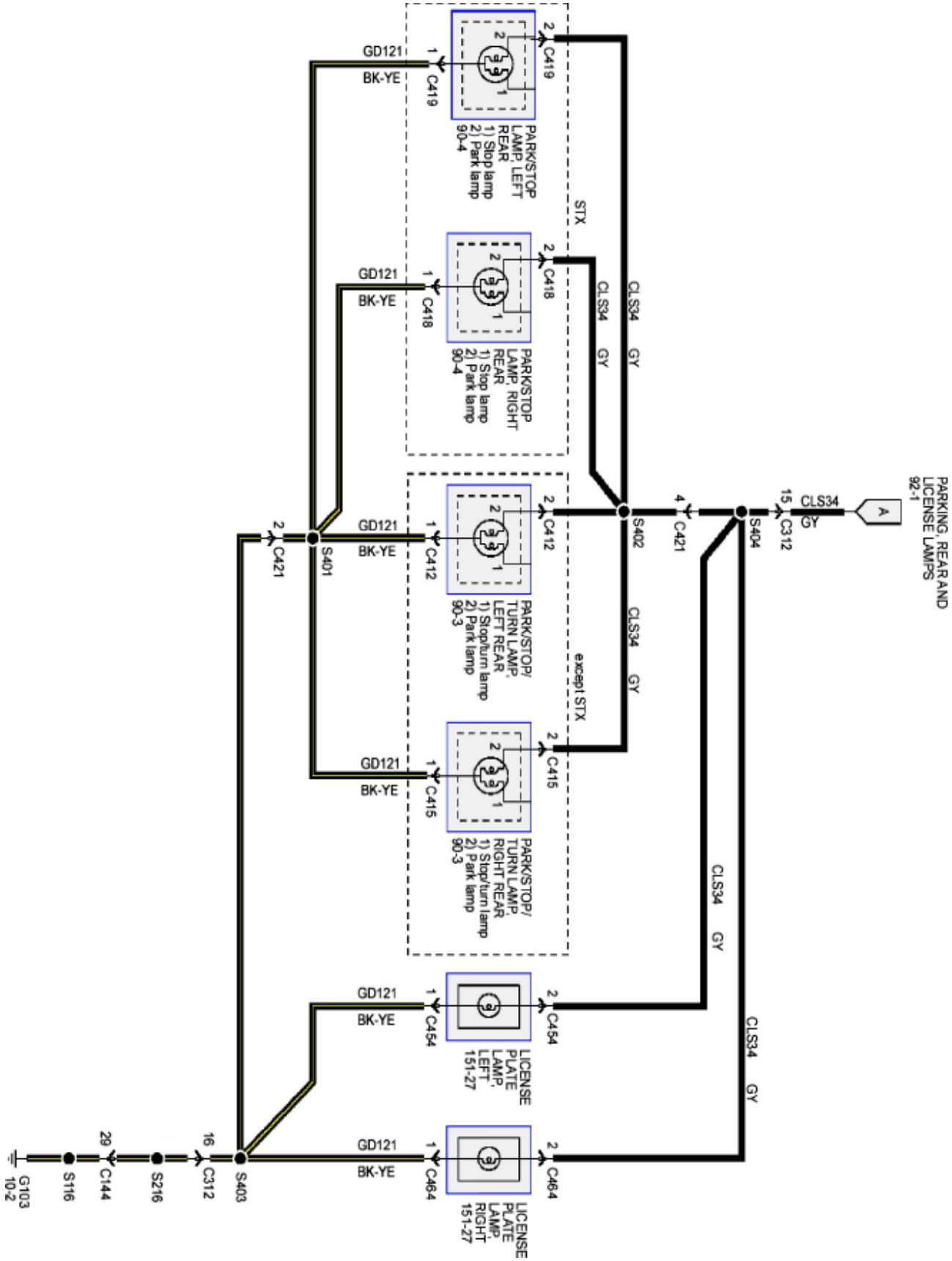
C464


POWER DISTRIBUTION SJB 13-5
SBP23 WH-RD
S200
SBP23 WH-RD
C2280B
4
Hot at all times
F23 30A 13-5
CLS30 VT-WH
5
C205
10
C205
1) Auto
2) Off
3) Park
4) Head
MAIN LIGHT SWITCH 13-5
CLS30 VT-WH
5
C2280D
Sense
GND
Control
LOW CURRENT BOARD
PARK LAMP RELAY (Non-serviceable)
F31 20A 13-5
S122
GD121
BK-YE
2
C1127
1
C1127
SIDE LAMP, LEFT FRONT 151-1
G103 10-1
S116
GD174
BK-WH
1
S214
G204 10-5
PARKING, REAR AND LICENSE LAMPS 92-2
A
CLS34 GY
3
C2280C
GD121
BK-YE
1
C1023
2
C1023
PARK/TURN LAMP, LEFT FRONT
1) Turn signal lamp
2) Park lamp
90-2
CLS34 GY
CLS34 GY
S128
GD123
BK-GY
1
C1043
2
C1043
PARK/TURN LAMP, RIGHT FRONT
1) Turn signal lamp
2) Park lamp
90-2
G105 10-3
CLS34 GY
12
C2280A
S126
CLS34 GY
GD123
BK-GY
2
C1126
1
C1126
SIDE LAMP, RIGHT FRONT 151-1
SMART JUNCTION BOX (SJB) 11-5

License Plate Lamp: Electrical Diagrams

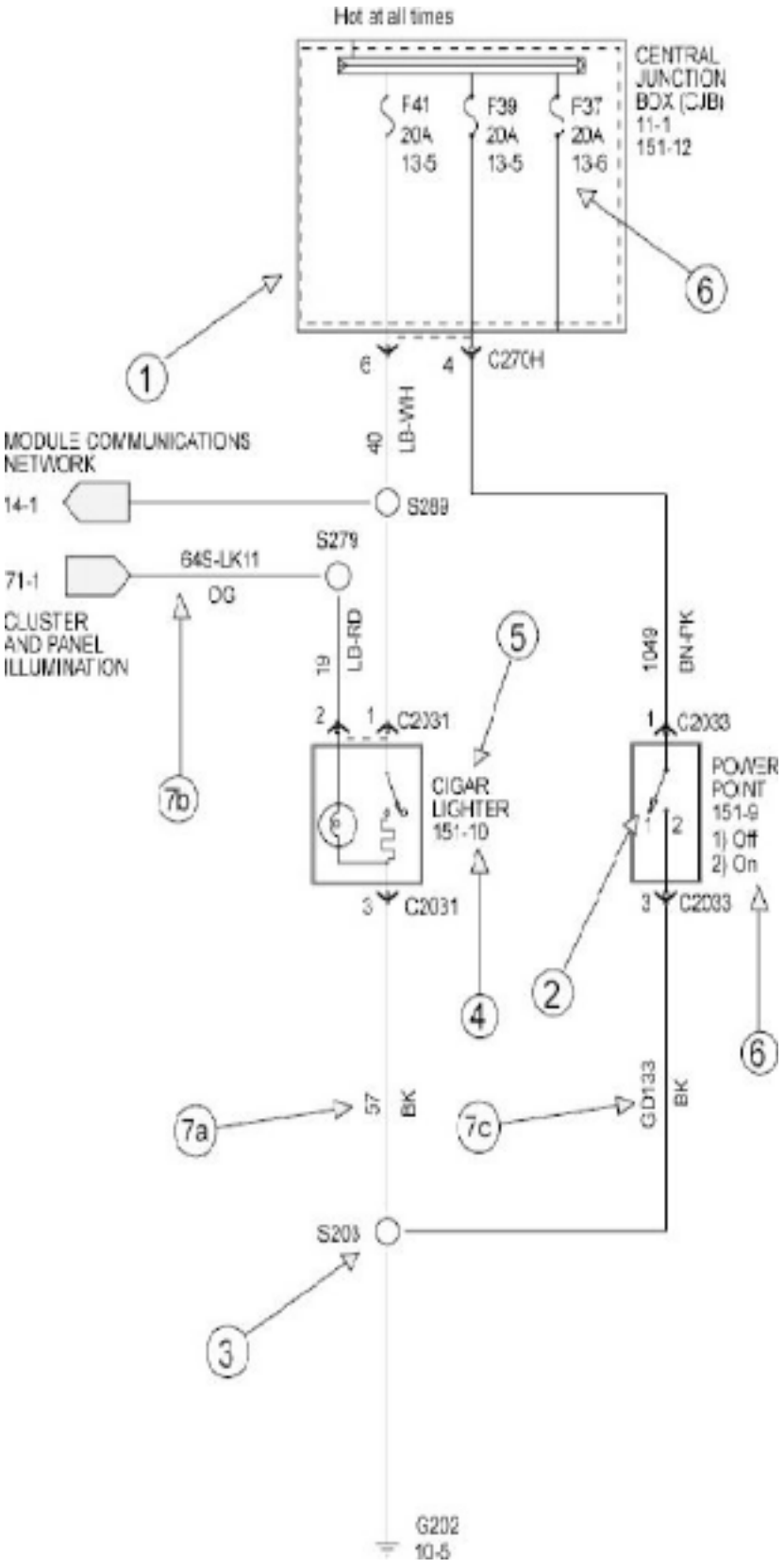
PLEASE NOTE: Some diagrams may appear to be missing because of gaps in the number sequences. These "gaps" are actually for diagrams that do not apply to the vehicle model selected.

92-1


PARKING, REAR AND LICENSE LAMPS 92-1
A
CLS34 GY
15 C312
S404
4 C421
S402
CLS34 GY
except STX
CLS34 GY
STX
CLS34 GY
CLS34 GY
2 C421
S401
GD121 BK-YE
1 C419
2 C419
PARK/STOP LAMP, LEFT REAR 1) Stop lamp 2) Park lamp 90-4
1 C418
2 C418
PARK/STOP LAMP, RIGHT REAR 1) Stop lamp 2) Park lamp 90-4
1 C412
2 C412
PARK/STOP/ TURN LAMP, LEFT REAR 1) Stop/turn lamp 2) Park lamp 90-3
1 C415
2 C415
PARK/STOP/ TURN LAMP, RIGHT REAR 1) Stop/turn lamp 2) Park lamp 90-3
1 C454
2 C454
LICENSE PLATE LAMP, LEFT 151-27
1 C464
2 C464
LICENSE PLATE LAMP, RIGHT 151-27
S403
16 C312
S216
29 C144
S116
G103 10-2

Diagrams: Other diagrams referred to by number (i.e. 13-2, 24-6, 10-2, etc.) within these diagrams can be found at Diagrams By Number. See: Diagrams/Electrical Diagrams/Diagrams By Number

Locations: Location Views (reference numbers starting with 151-) referred to within these diagrams can be found at Location Views. See: Locations/Component Locations


Hot at all times
CENTRAL JUNCTION BOX (CJB)
11-1
151-12
F41
20A
13-5
F39
20A
13-5
F37
20A
13-6
C270H
40
LB-WH
MODULE COMMUNICATIONS NETWORK
14-1
S289
S279
64S-LK11
DG
71-1
CLUSTER AND PANEL ILLUMINATION
19
LB-RD
C2031
1049
BN-PK
C2033
CIGAR LIGHTER
151-10
POWER POINT
151-9
1) Off
2) On
57
BK
GD133
S203
G202
10-5

Marker Lamp: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

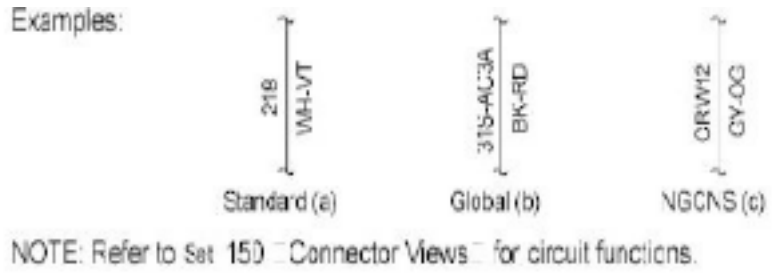
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

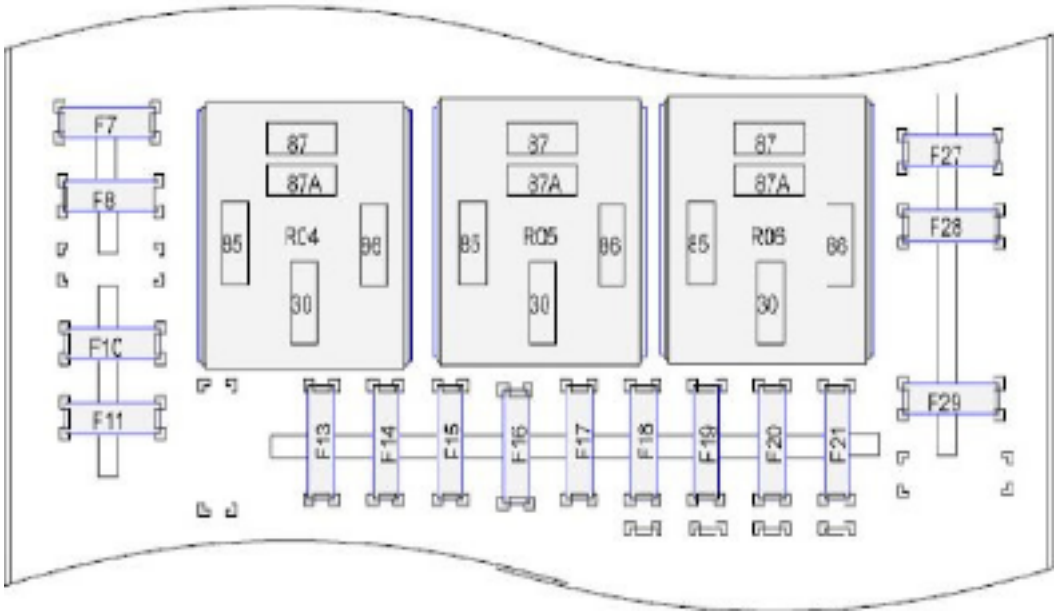
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

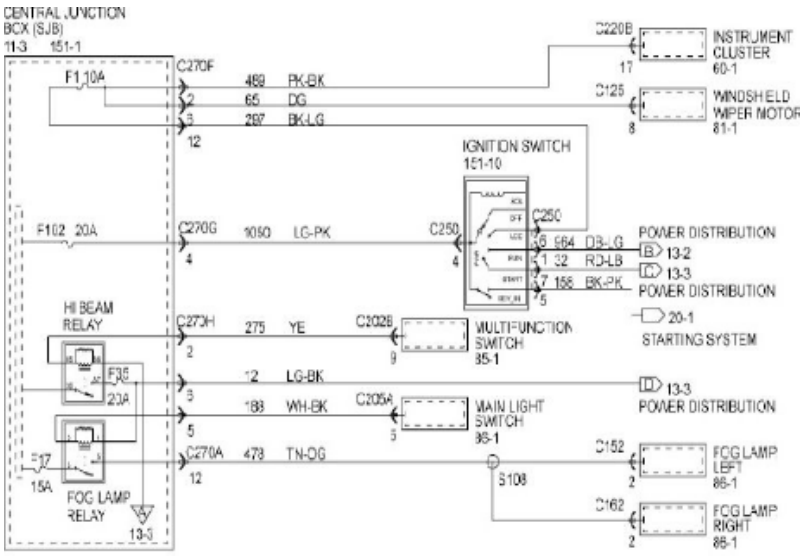
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

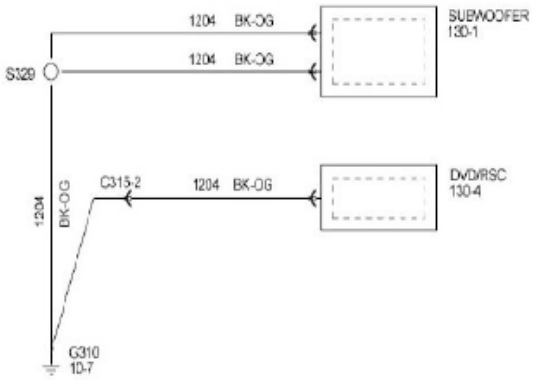
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

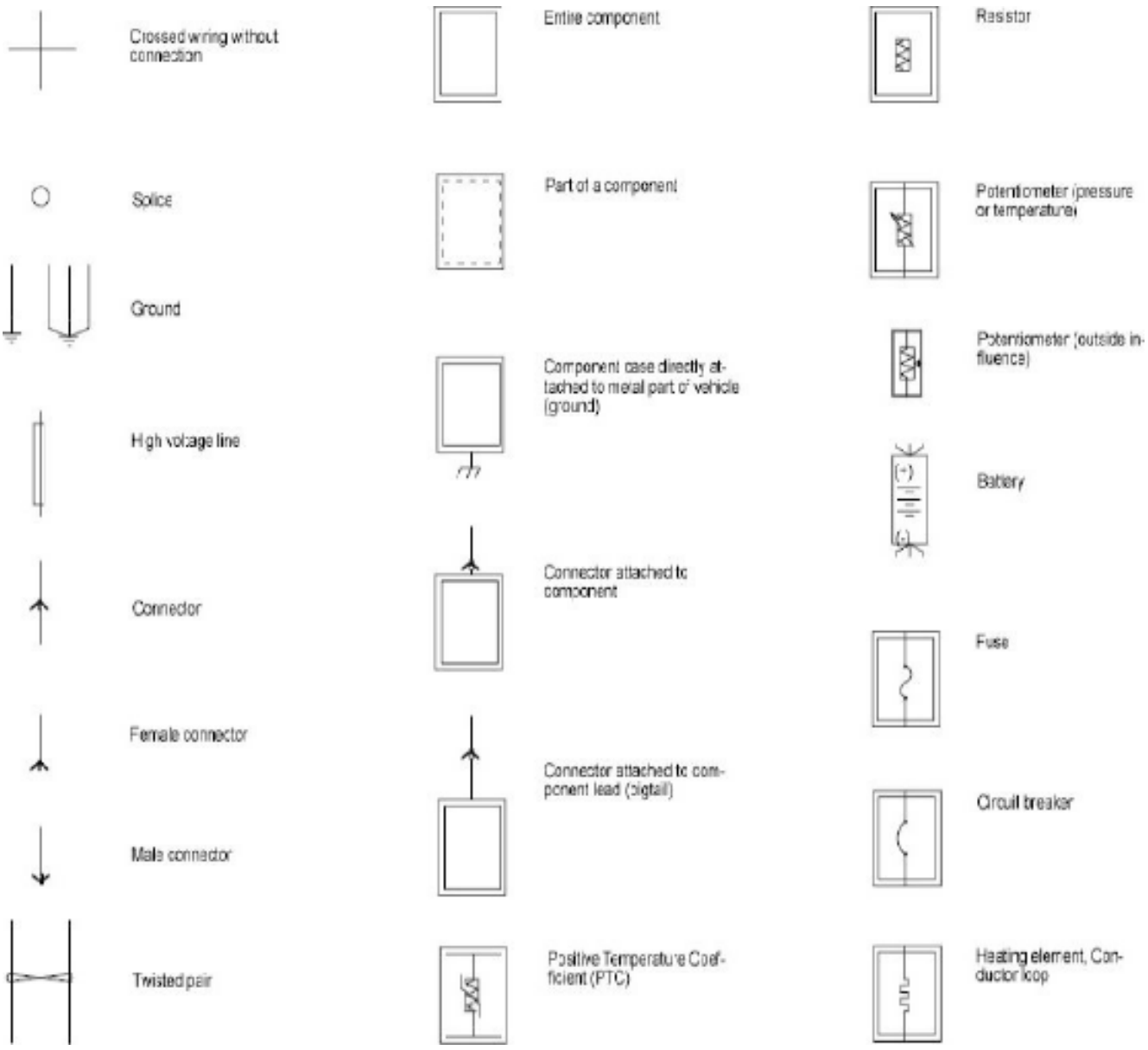
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

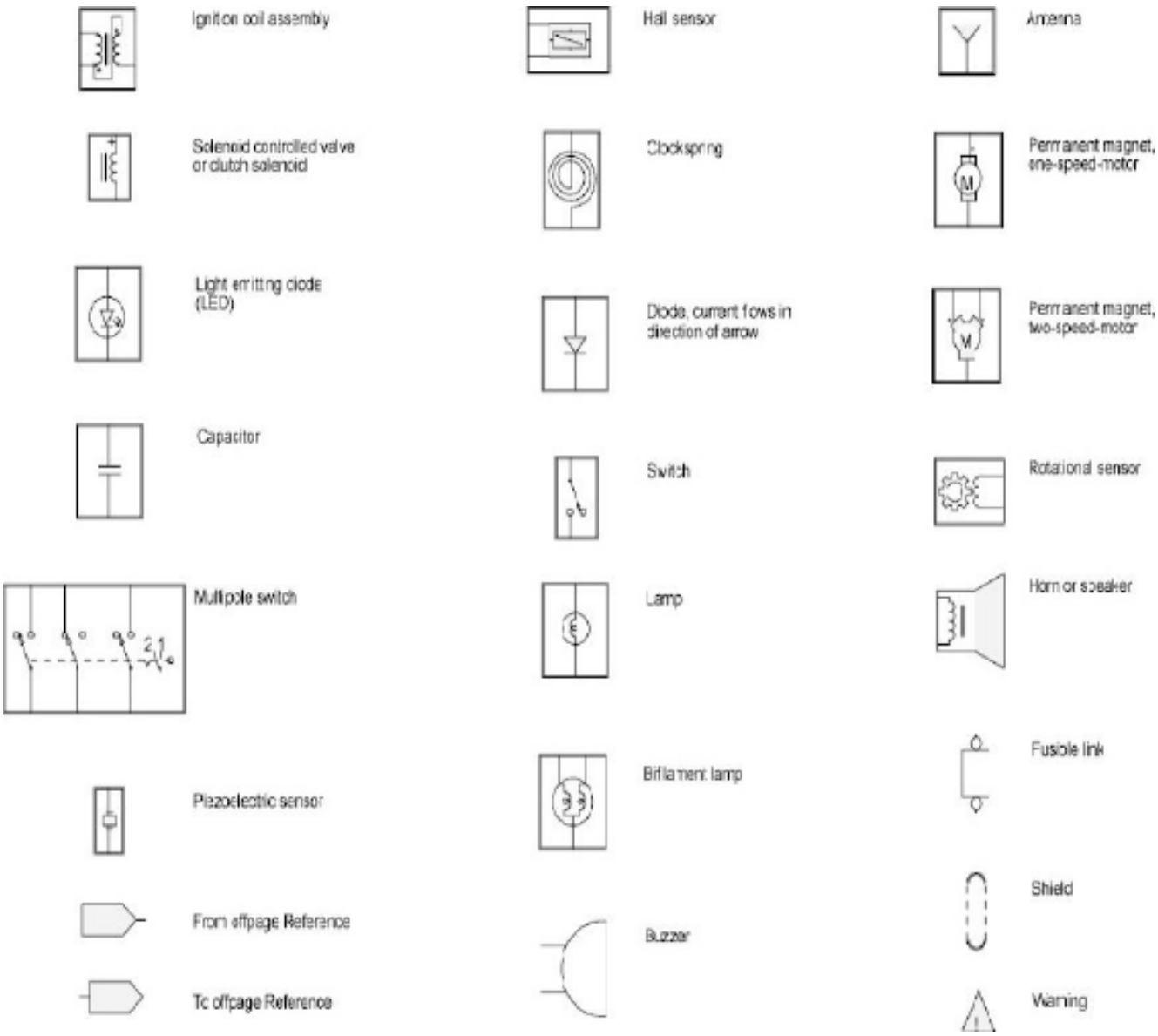
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

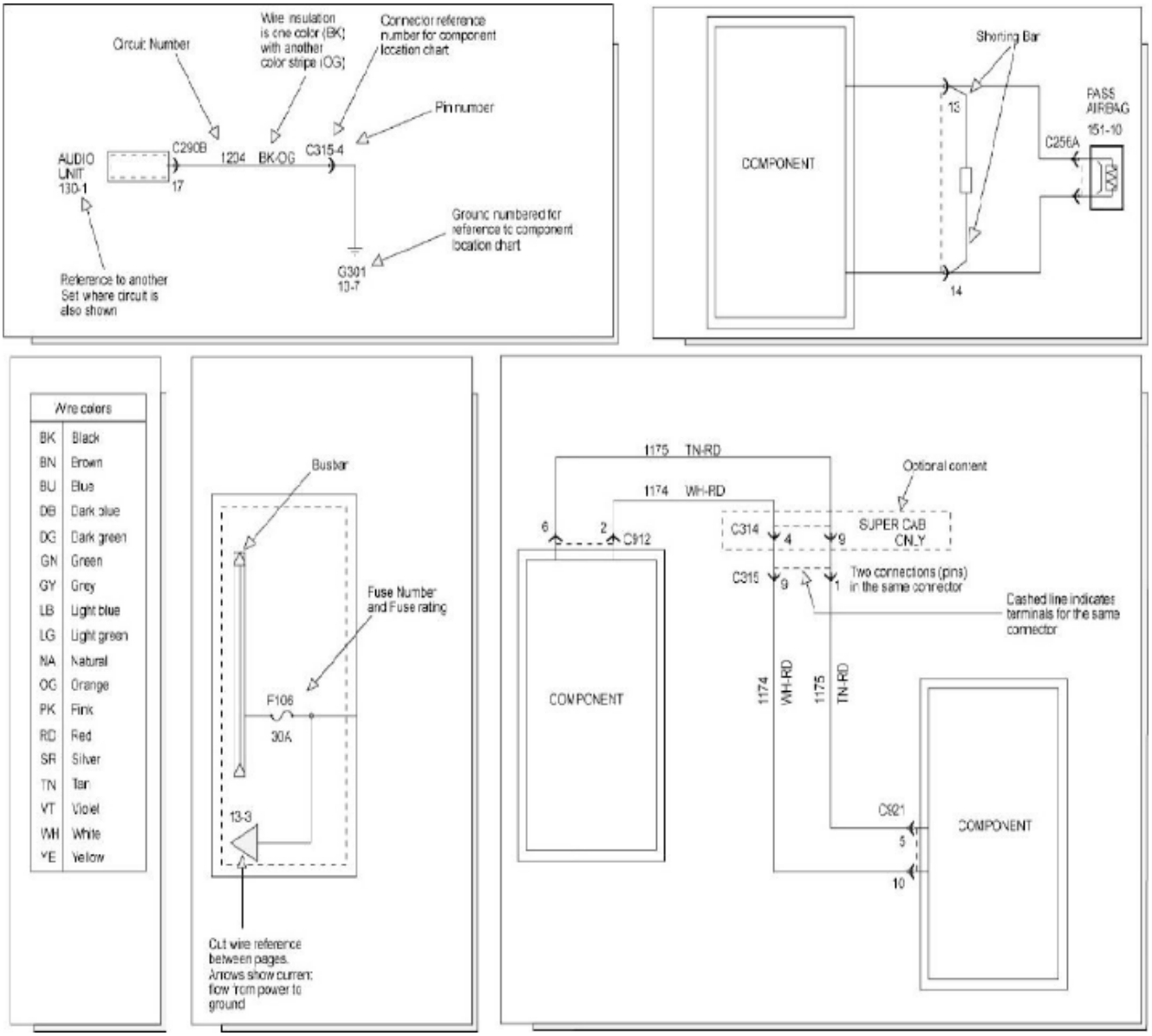
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

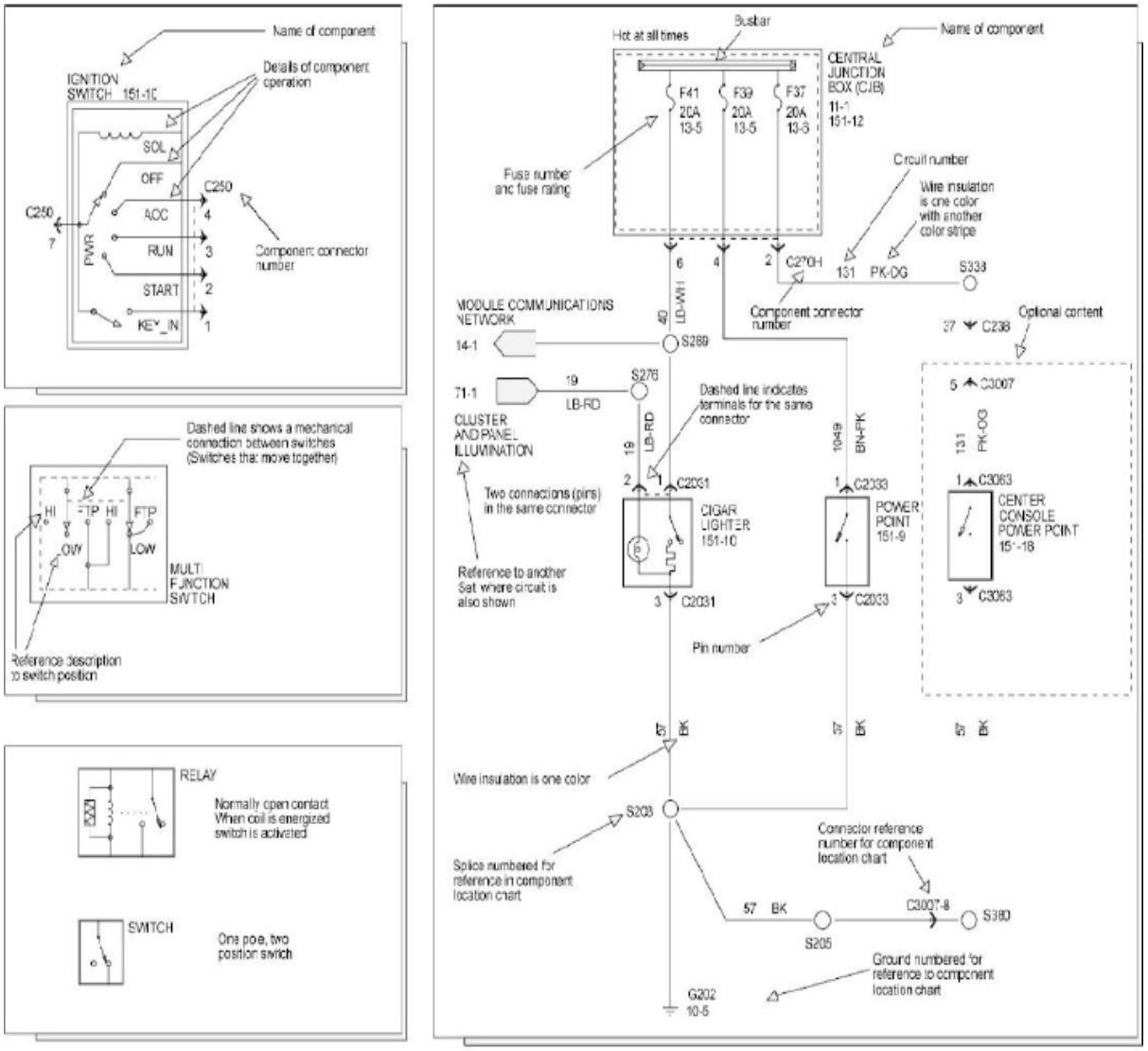
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

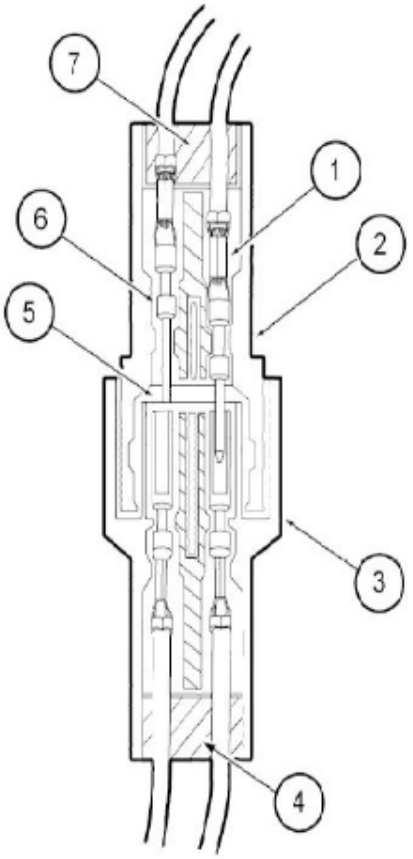


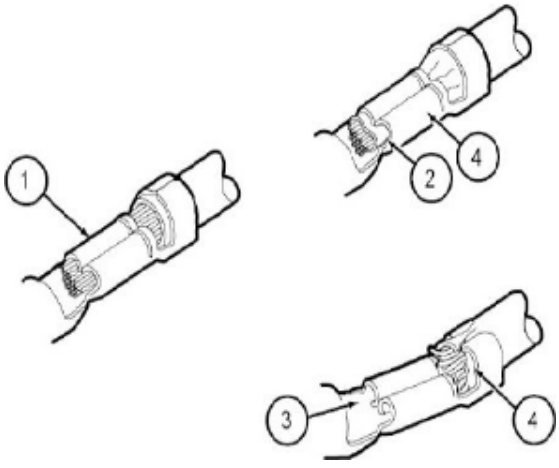
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Marker Lamp: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

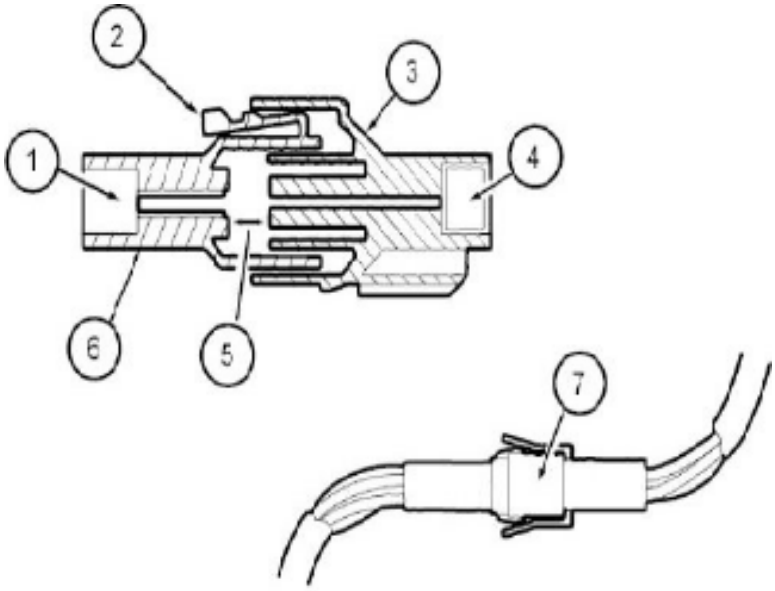
5 = Intermittent contact

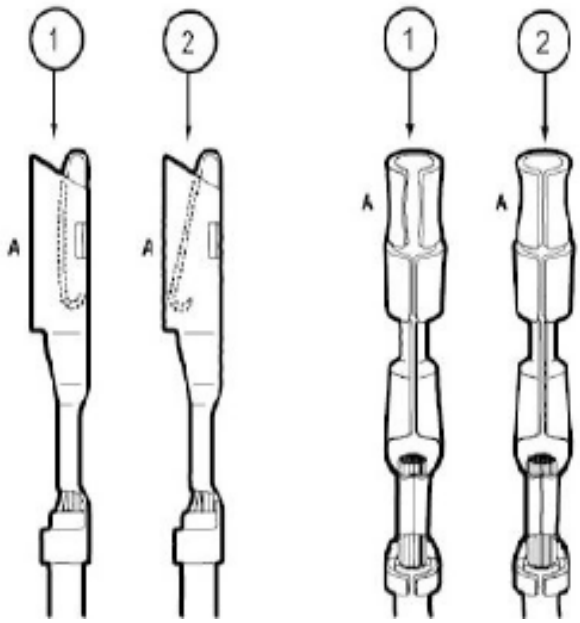
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

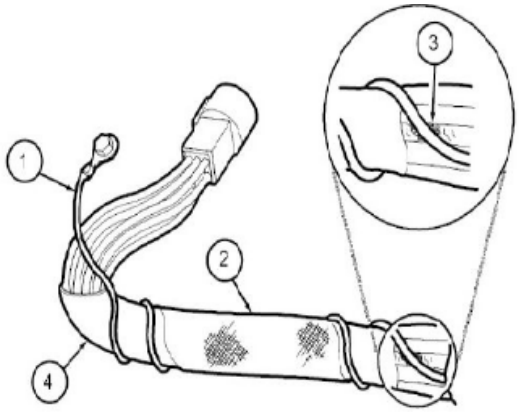
Deformed (enlarged) female terminals

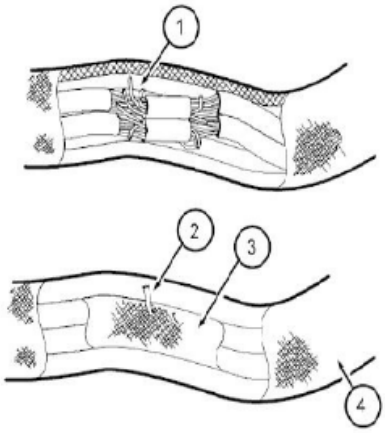
1 = Enlarged

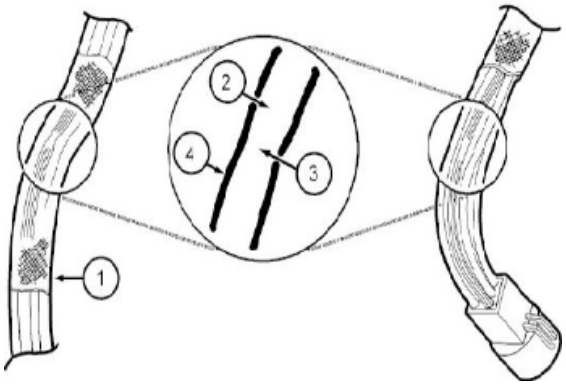
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

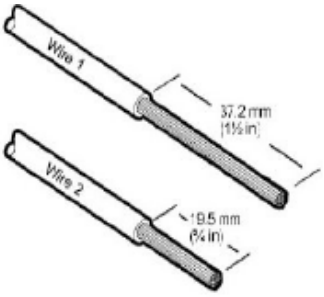
Splice covered 2

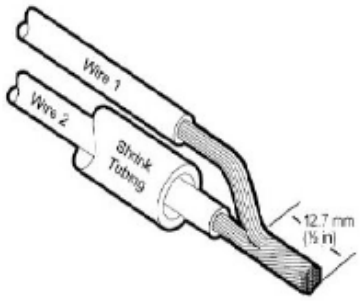
= Wire strand

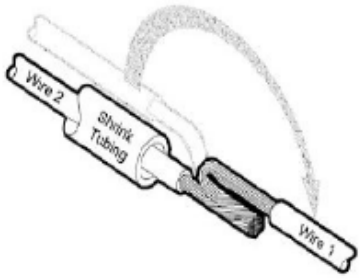
3 = Splice tape

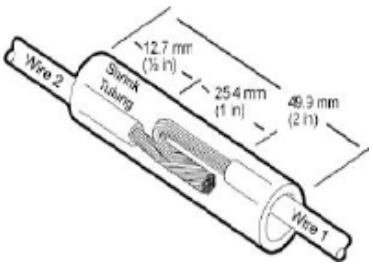
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

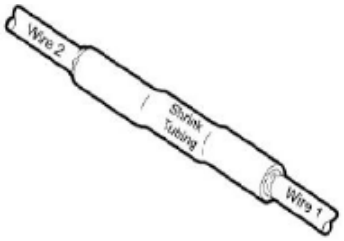
NOTE: -

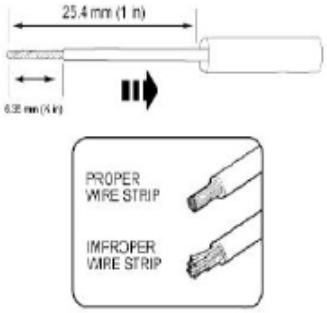
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

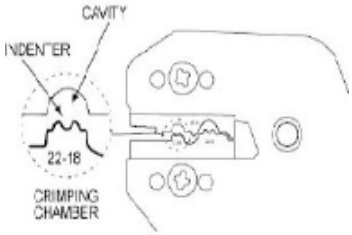
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

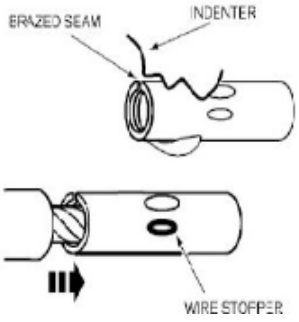
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

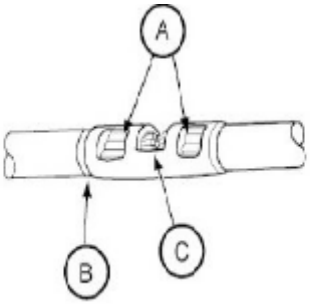
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

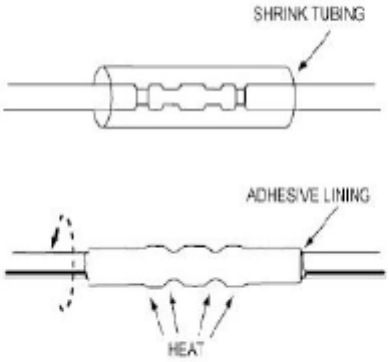
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4□ strip, cut 9 strands	* 1/4□ strip, cut 2 strands	1/4□ strip, no fold	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip, fold 2x dia.	1□ strip, fold 3x dia.
	16-14	* 1/4□ strip, cut 7 strands	1/4□ strip, no fold	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip fold 2x dia	1□ strip, fold 3x dia.	1 1/4□ strip, fold 4x dia.	Not Recommended
	12-10	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip, fold 2x dia.	1□ strip fold 3x cia.	1 1/4□ strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Figtail only

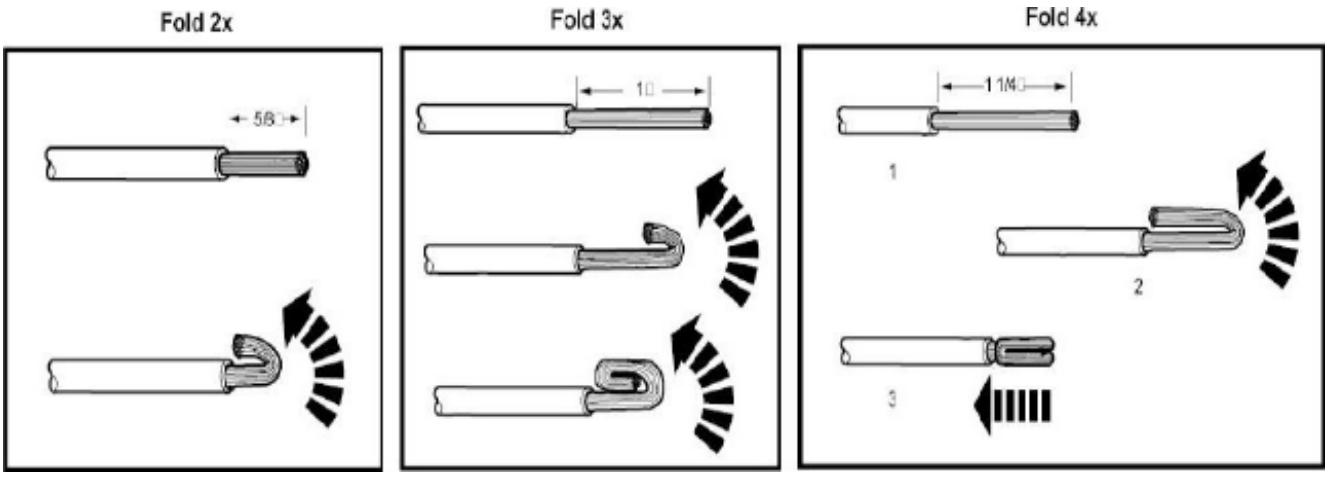
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

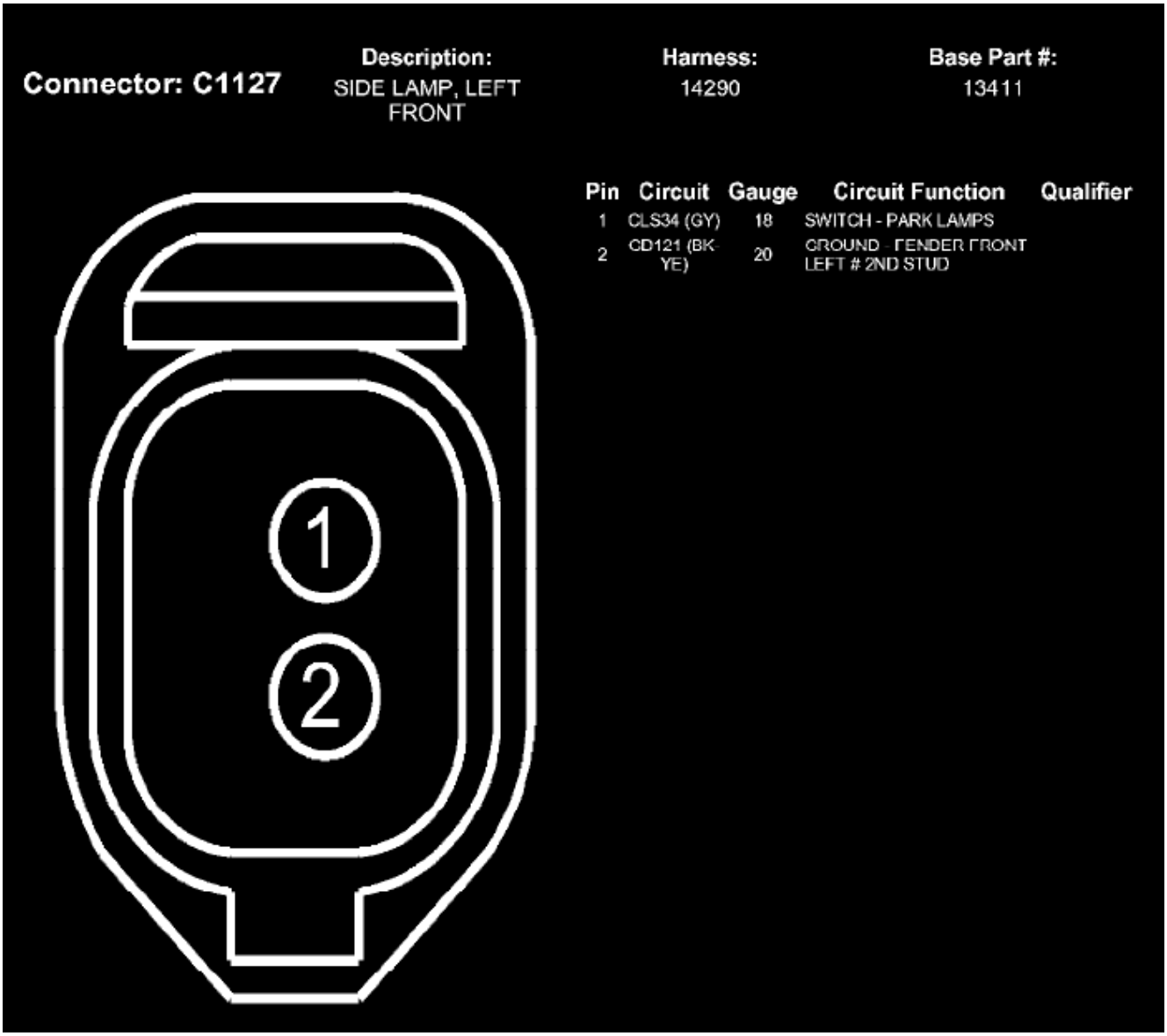
11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.

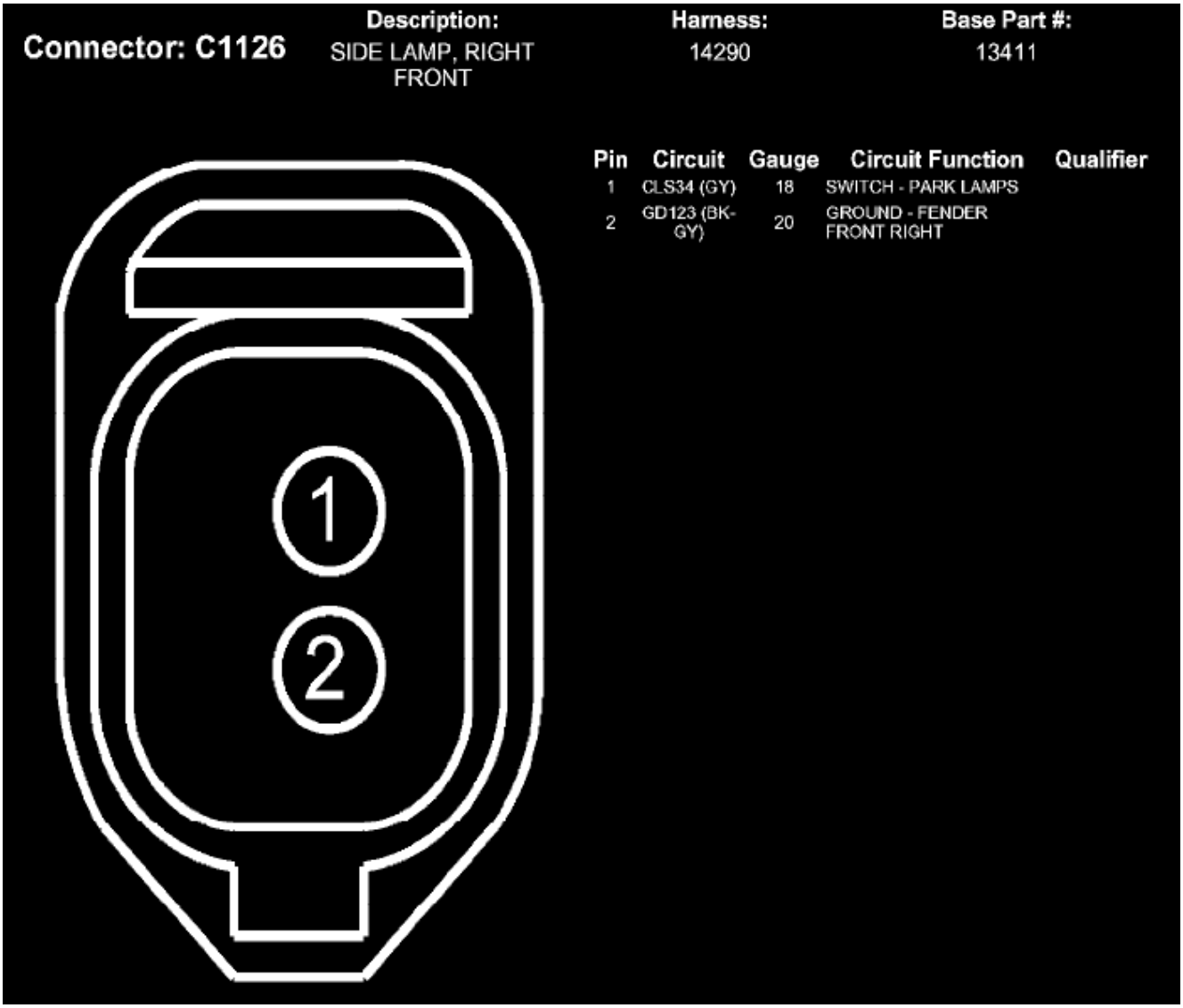


The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

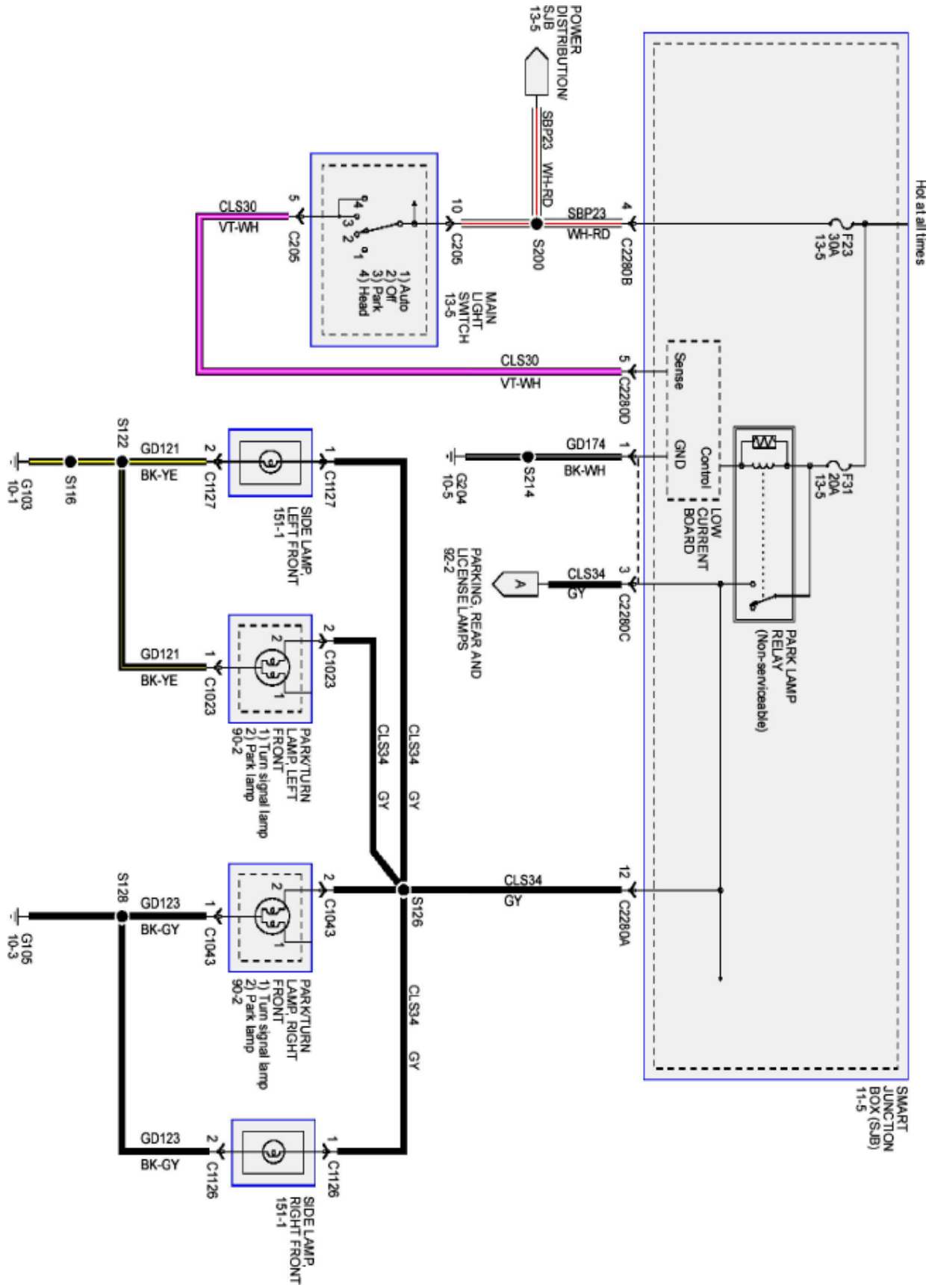


Marker Lamp: Connector Views

C1127


Connector: C1126
Description:
SIDE LAMP, RIGHT FRONT
Harness:
14290
Base Part #:
13411
Pin
Circuit
Gauge
Circuit Function
Qualifier
1
CLS34 (GY)
18
SWITCH - PARK LAMPS
2
GD123 (BK-GY)
20
GROUND - FENDER FRONT RIGHT
1
2

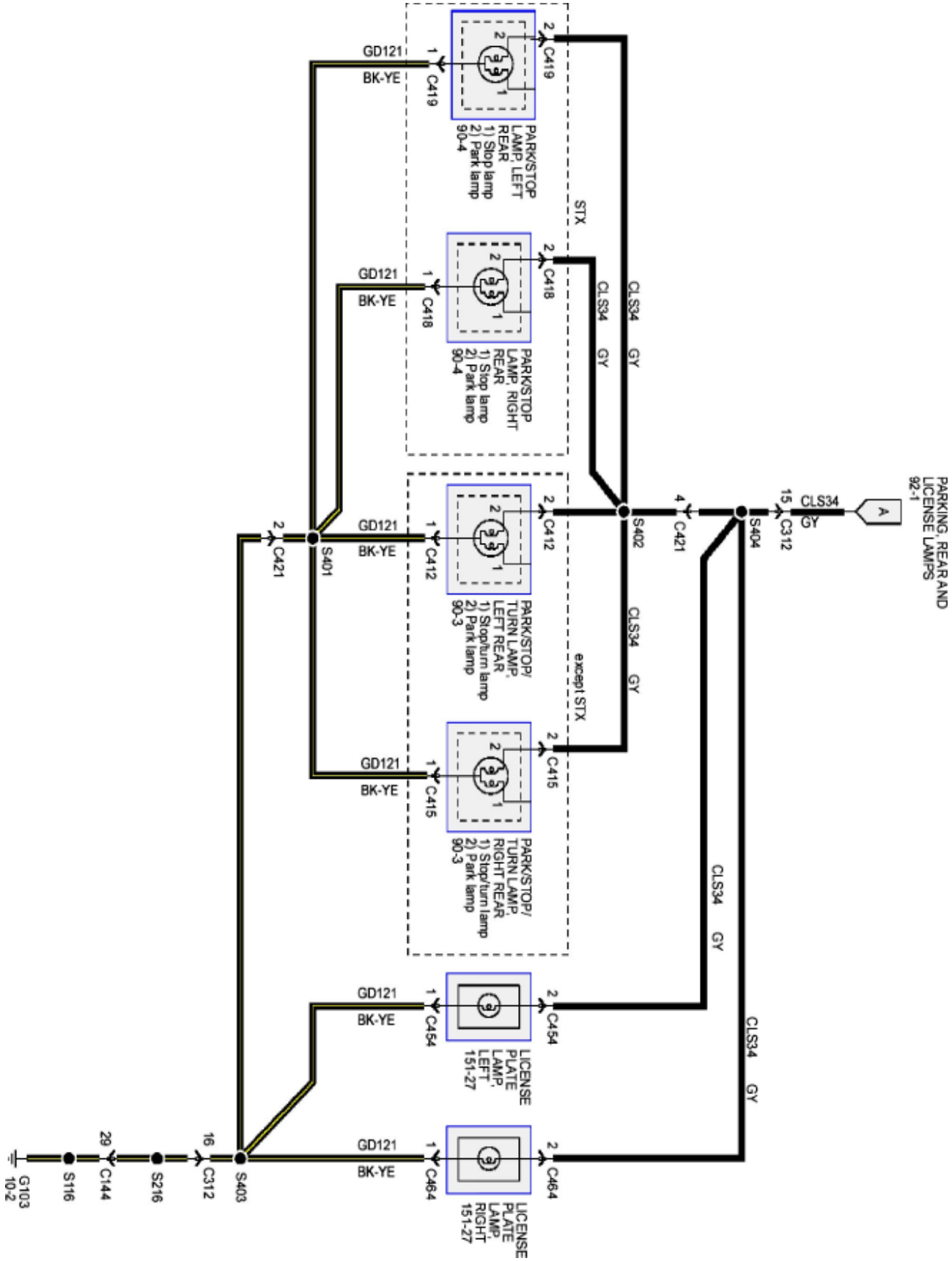
C1126


POWER DISTRIBUTION SJB 13-5
SBP23 WH-RD
S200
SBP23 WH-RD
C2280B
4
F23 30A 13-5
Hot at all times
CLS30 VT-WH
5
C205
10
C205
MAIN LIGHT SWITCH 13-5
1) Auto
2) Off
3) Park
4) Head
CLS30 VT-WH
5
C2280D
Sense
GND
Control
LOW CURRENT BOARD
F31 20A 13-5
PARK LAMP RELAY (Non-serviceable)
GD174
BK-WH
S214
G204 10-5
CLS34 GY
3
C2280C
A
PARKING, REAR AND LICENSE LAMPS 92-2
S122
GD121
BK-YE
2
C1127
1
C1127
SIDE LAMP, LEFT FRONT 151-1
G103 10-1
S116
GD121
BK-YE
1
C1023
2
C1023
PARK/TURN LAMP, LEFT FRONT
1) Turn signal lamp
2) Park lamp
90-2
CLS34 GY
CLS34 GY
S128
GD123
BK-GY
1
C1043
2
C1043
PARK/TURN LAMP, RIGHT FRONT
1) Turn signal lamp
2) Park lamp
90-2
G105 10-3
CLS34 GY
12
C2280A
S126
CLS34 GY
GD123
BK-GY
2
C1126
1
C1126
SIDE LAMP, RIGHT FRONT 151-1
SMART JUNCTION BOX (SJB) 11-5

Marker Lamp: Electrical Diagrams

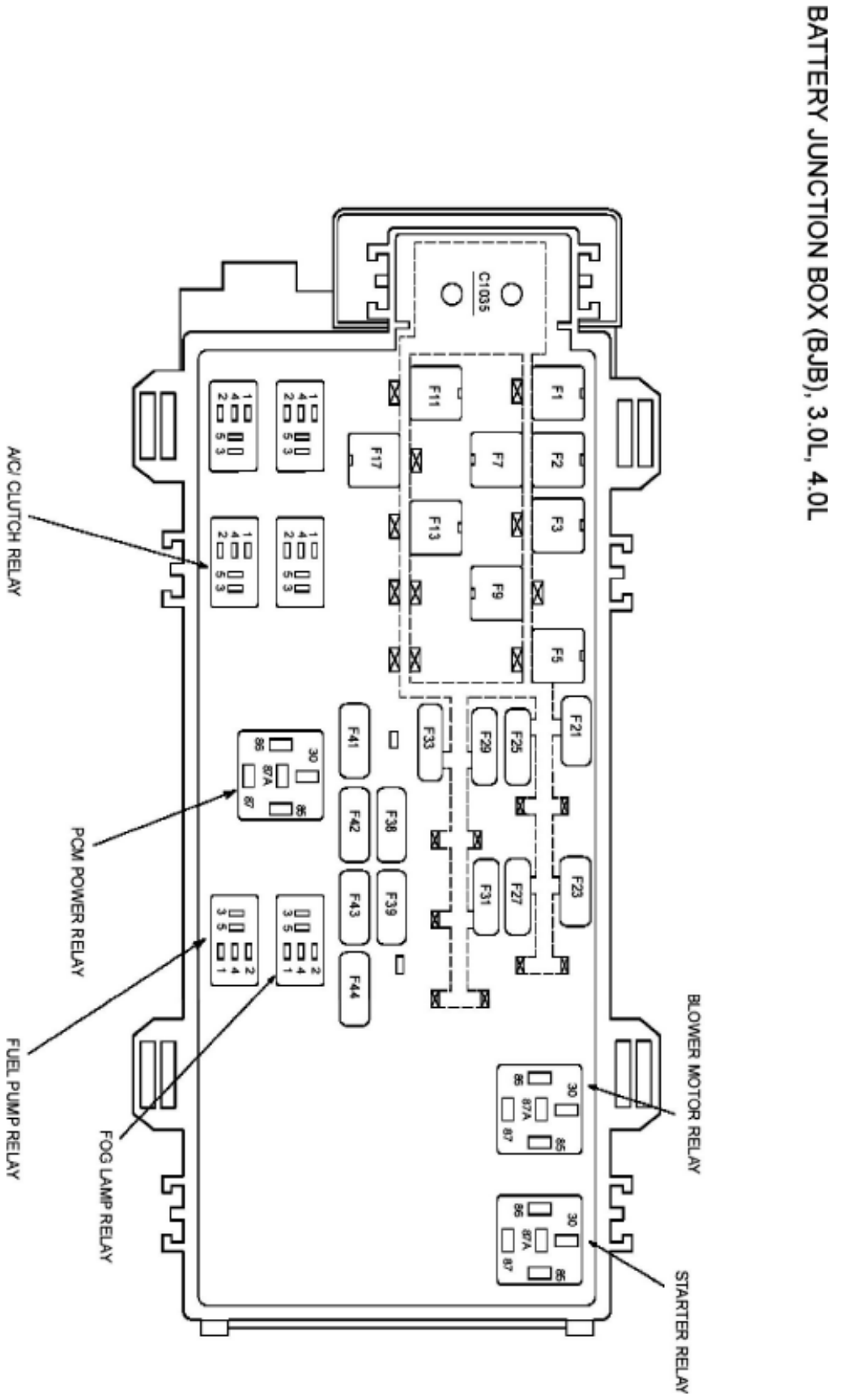
PLEASE NOTE: Some diagrams may appear to be missing because of gaps in the number sequences. These "gaps" are actually for diagrams that do not apply to the vehicle model selected.

92-1


PARKING, REAR AND LICENSE LAMPS 92-1
A
CLS34 GY
15 C312
S404
4 C421
S402
CLS34 GY
except STX
CLS34 GY
STX
CLS34 GY
CLS34 GY
2 C421
S401
GD121 BK-YE
1 C419
2 C419
PARK/STOP LAMP, LEFT REAR 1) Stop lamp 2) Park lamp 90-4
1 C418
2 C418
PARK/STOP LAMP, RIGHT REAR 1) Stop lamp 2) Park lamp 90-4
1 C412
2 C412
PARK/STOP/ TURN LAMP, LEFT REAR 1) Stop/turn lamp 2) Park lamp 90-3
1 C415
2 C415
PARK/STOP/ TURN LAMP, RIGHT REAR 1) Stop/turn lamp 2) Park lamp 90-3
1 C454
2 C454
LICENSE PLATE LAMP, LEFT 151-27
1 C464
2 C464
LICENSE PLATE LAMP, RIGHT 151-27
S403
16 C312
29 C144
S216
S116
G103 10-2

Diagrams: Other diagrams referred to by number (i.e. 13-2, 24-6, 10-2, etc.) within these diagrams can be found at Diagrams By Number. See: Diagrams/Electrical Diagrams/Diagrams By Number

Locations: Location Views (reference numbers starting with 151-) referred to within these diagrams can be found at Location Views. See: Locations/Component Locations

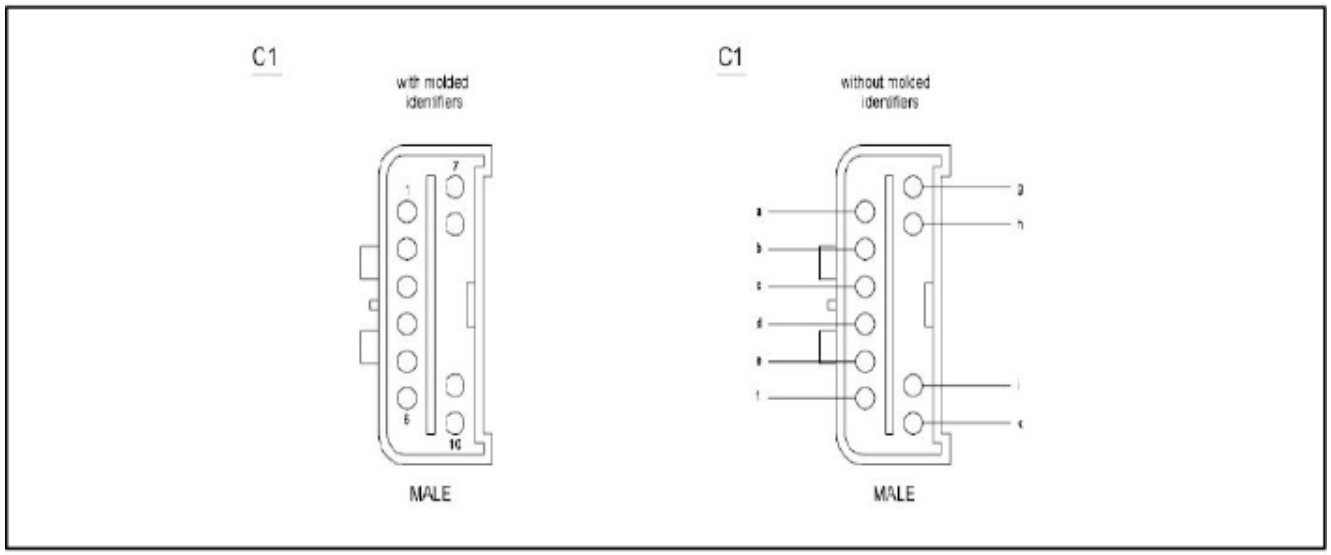

BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L
C1035
F1
F2
F3
F5
F7
F9
F11
F13
F17
F21
F23
F25
F27
F29
F31
F33
F38
F39
F41
F42
F43
F44
A/C CLUTCH RELAY
PCM POWER RELAY
FUEL PUMP RELAY
FOG LAMP RELAY
BLOWER MOTOR RELAY
STARTER RELAY

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



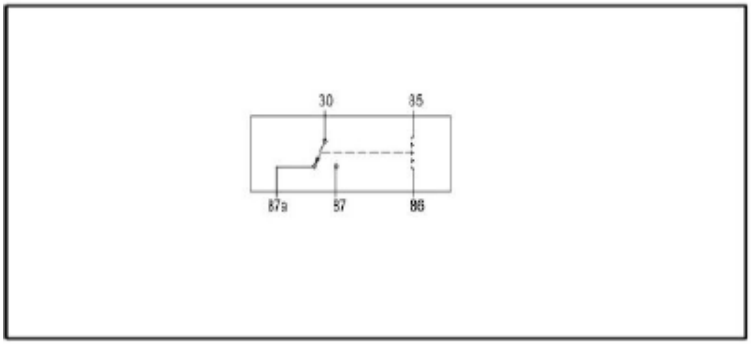
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

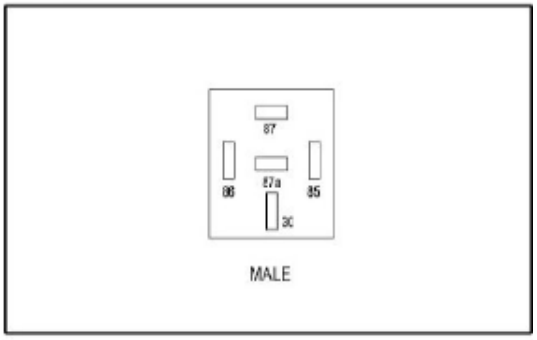
Parking Lamp Relay: Testing and Inspection Mini ISO Relay

Relay □ Mini ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 □ 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

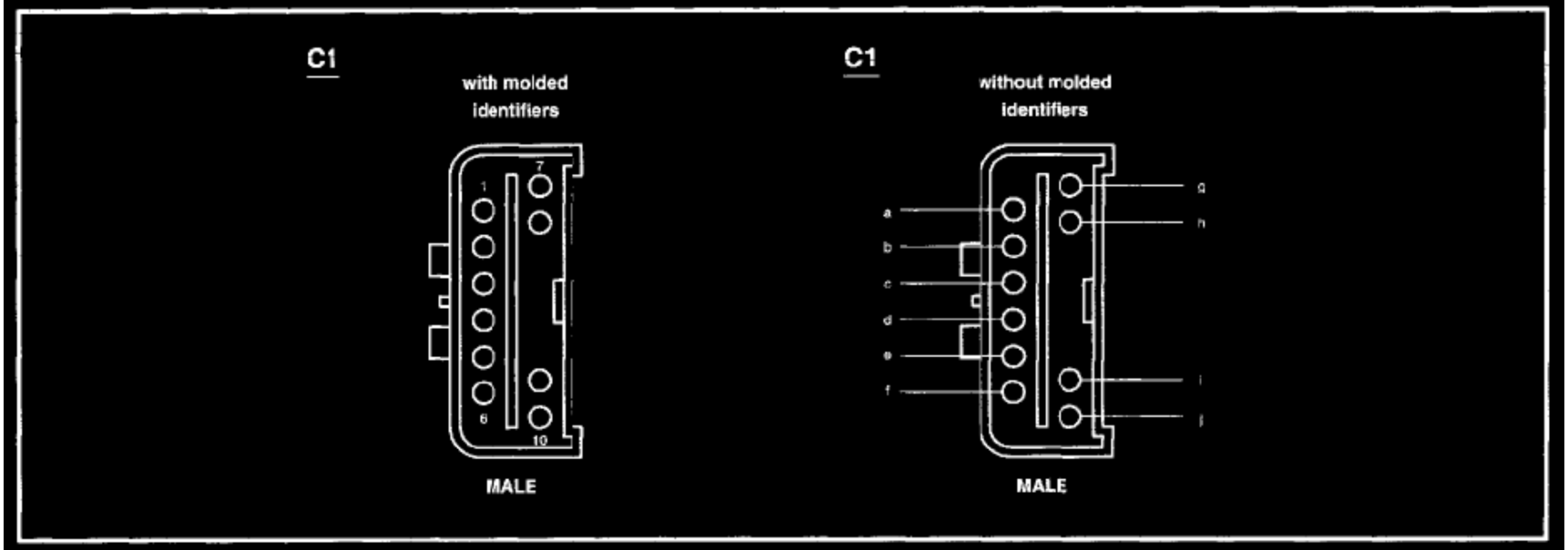
Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step–by–step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



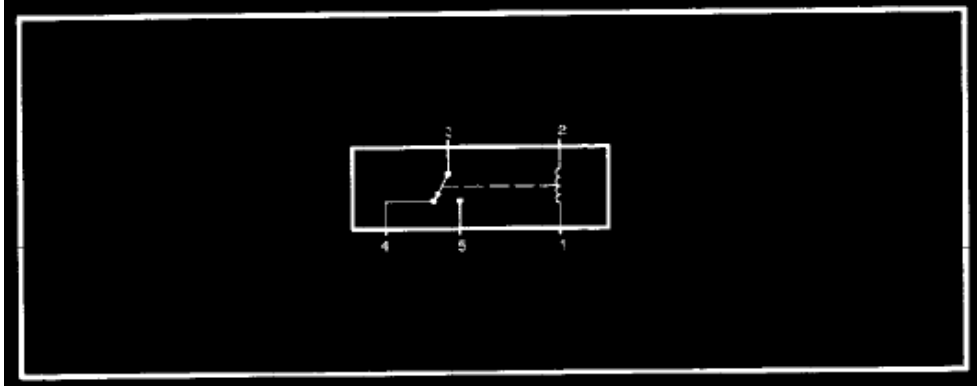
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

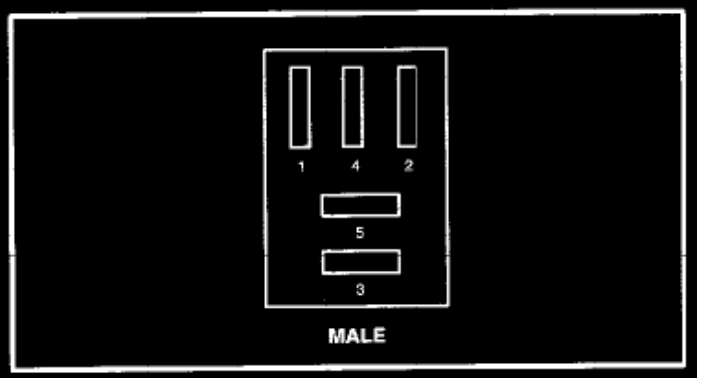
Parking Lamp Relay: Testing and Inspection Micro ISO Relay

Relay – Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63–102Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil – Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

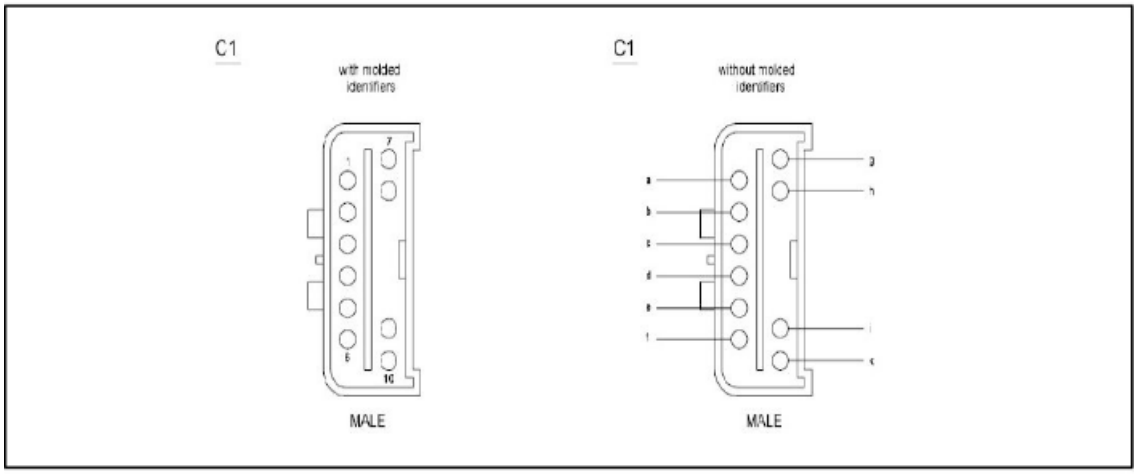
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step□by□step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals

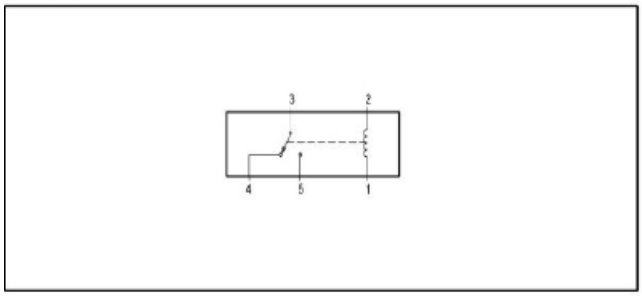


The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column □Circuit to test□. If you wish to test the complete component, perform all tests.

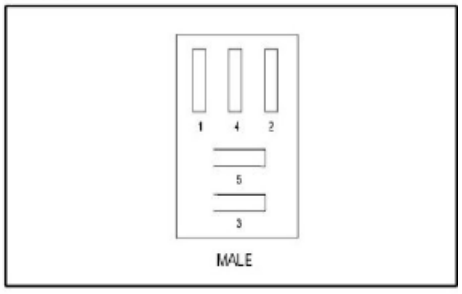
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Relay □ Micro ISO

Schematic



Terminals



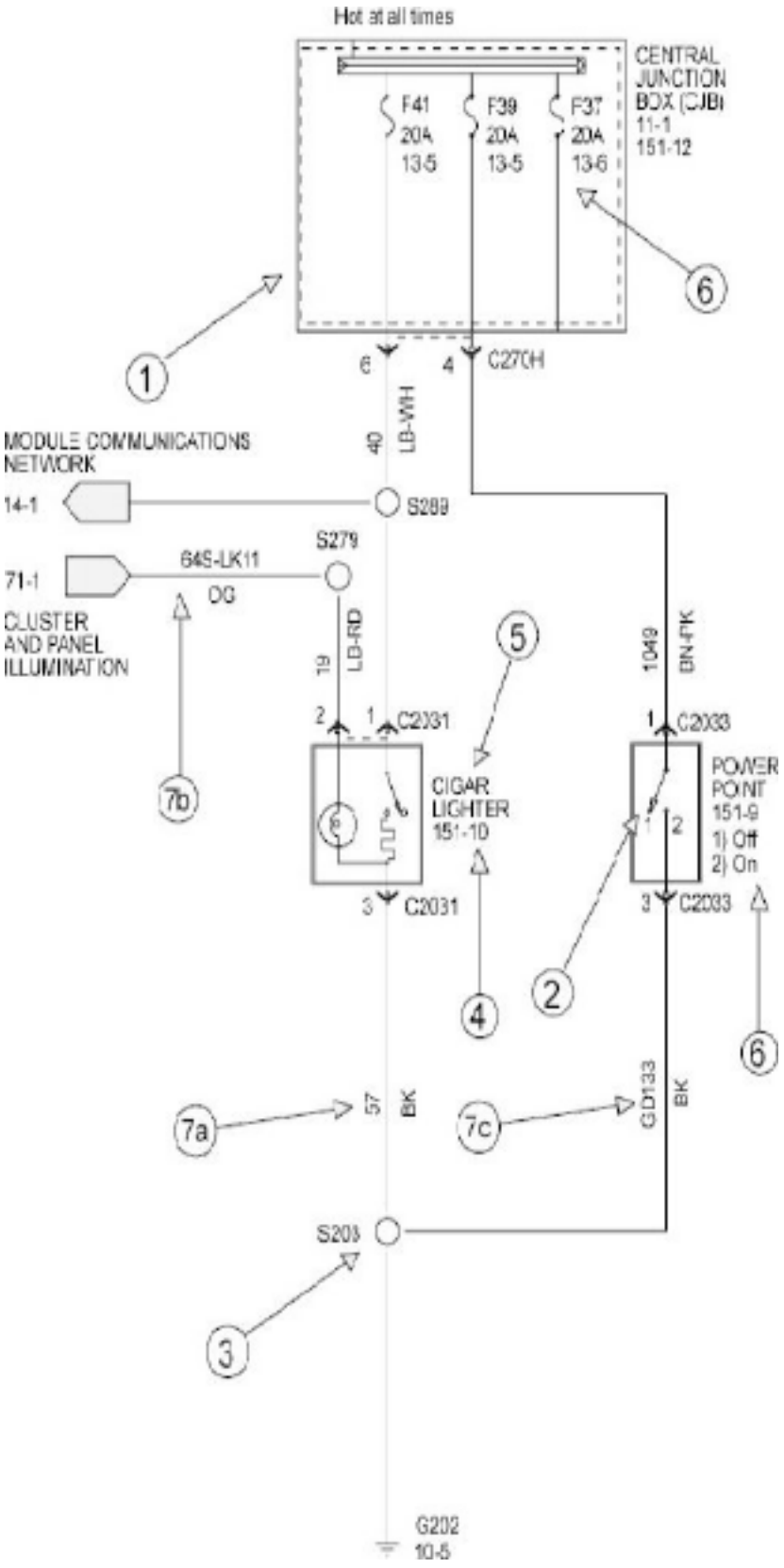
Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63□102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil □ Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Lighting and Horns > Relays and Modules - Lighting and Horns > Battery Discharge Protection Relay, Lighting > Component Information > Diagrams > Diagram Information and Instructions



Battery Discharge Protection Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

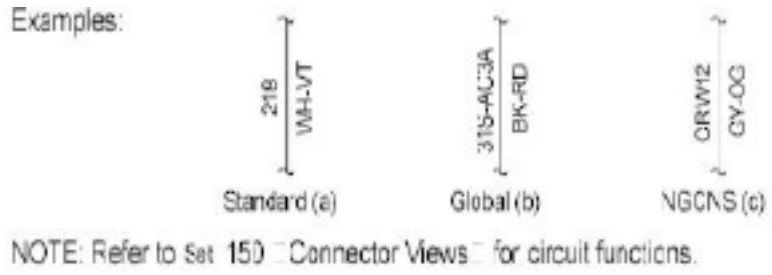
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

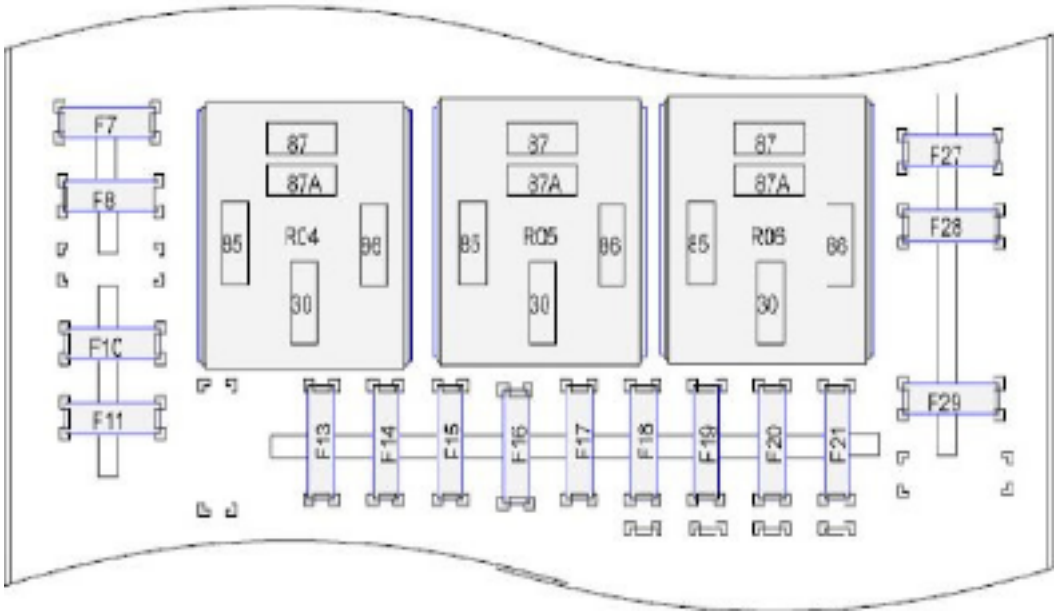
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

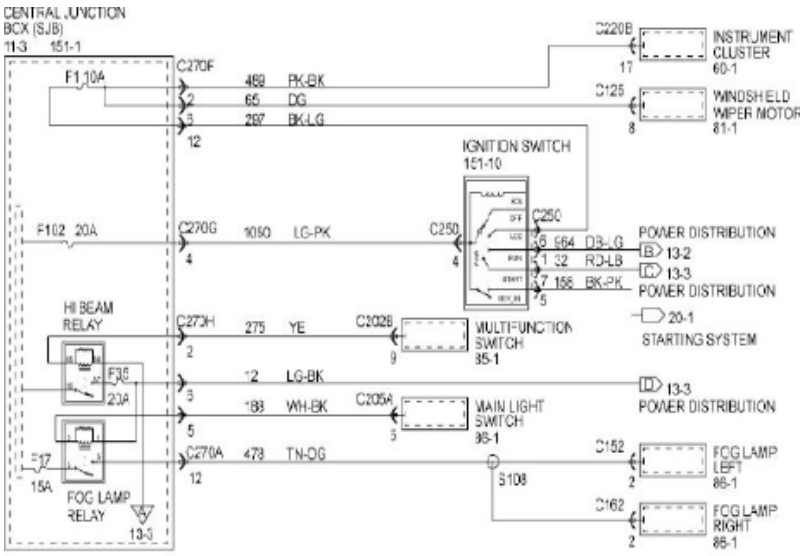
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

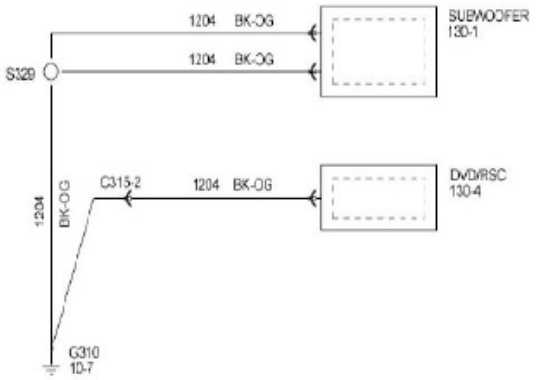
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

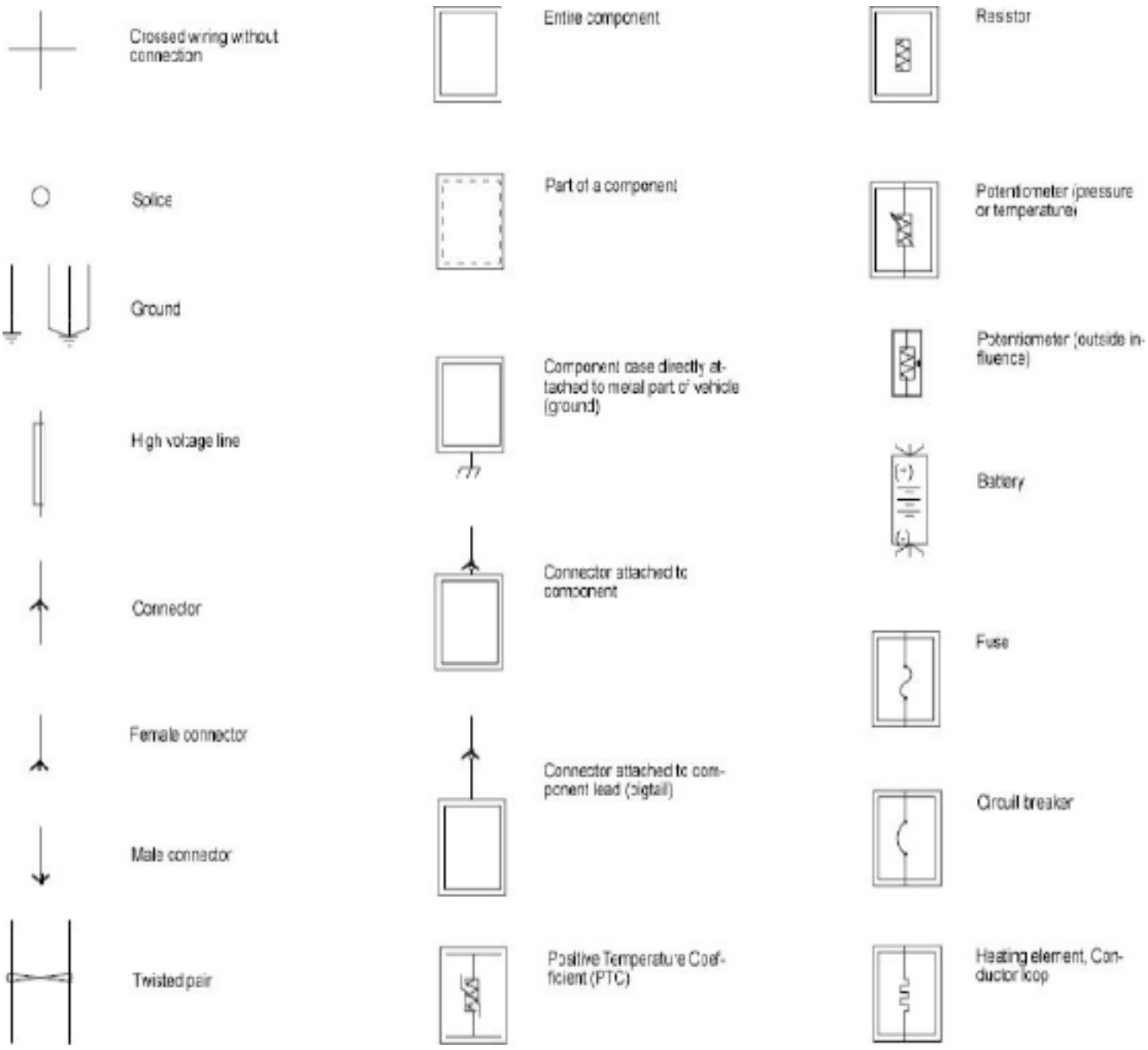
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

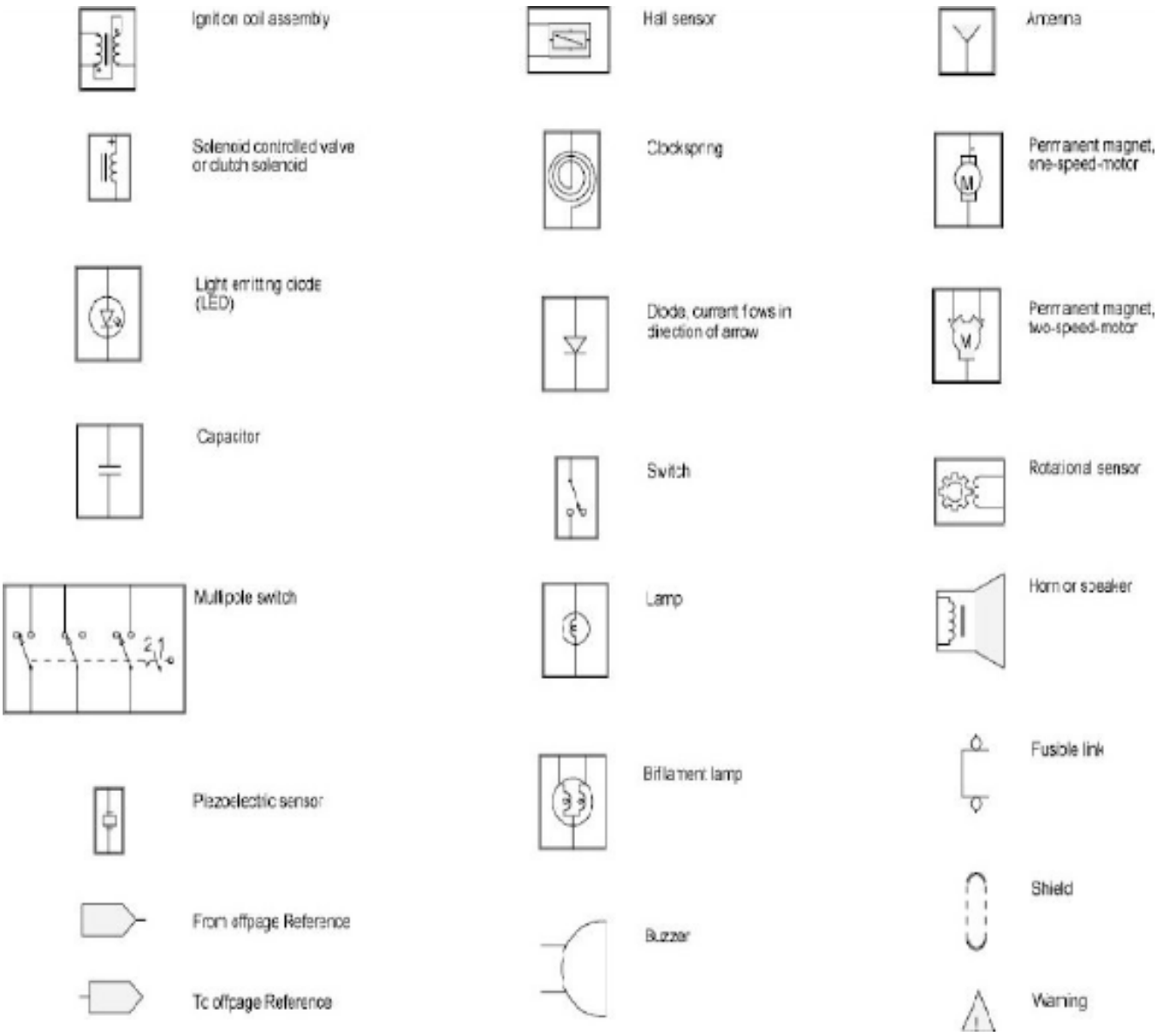
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

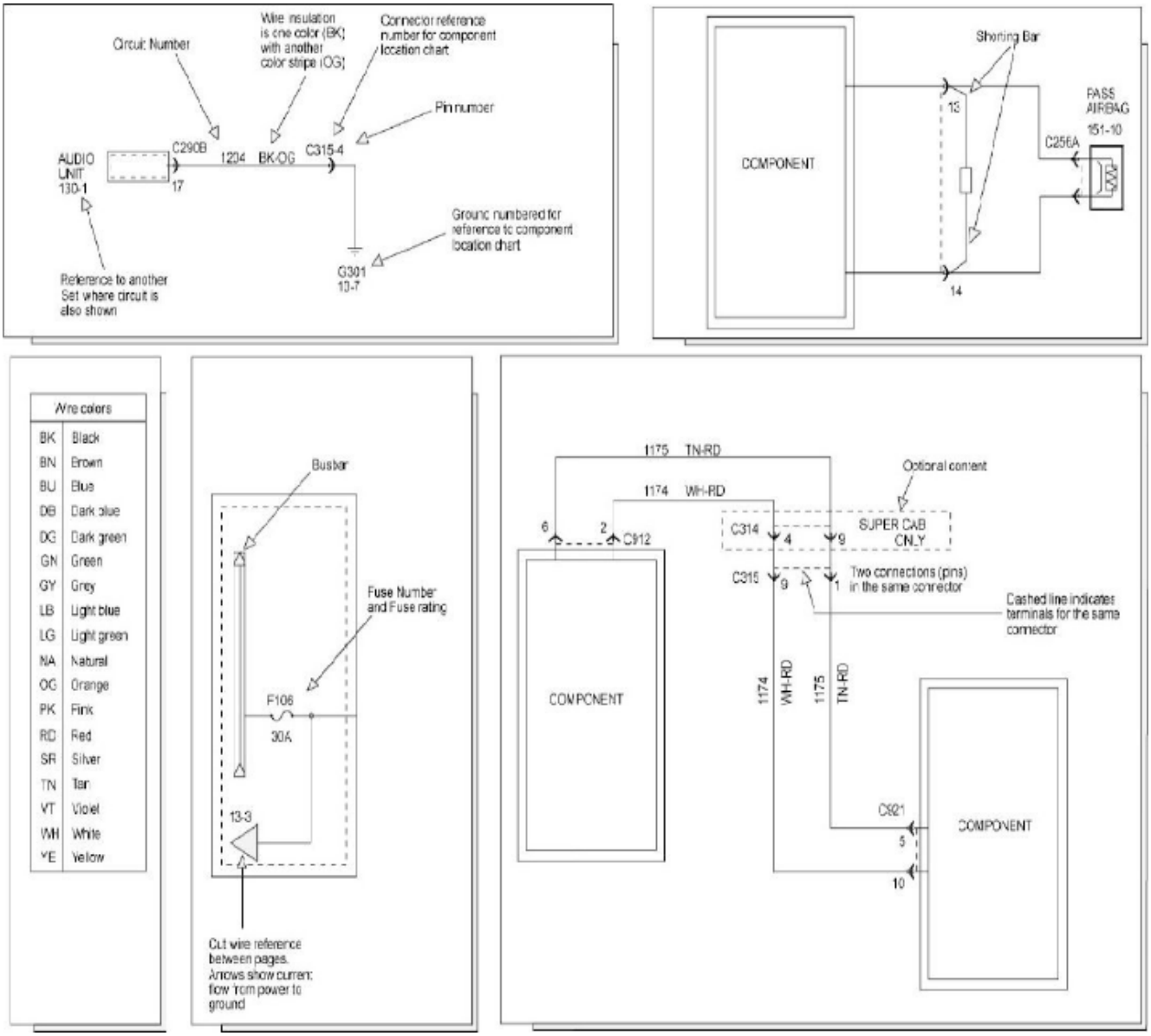
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

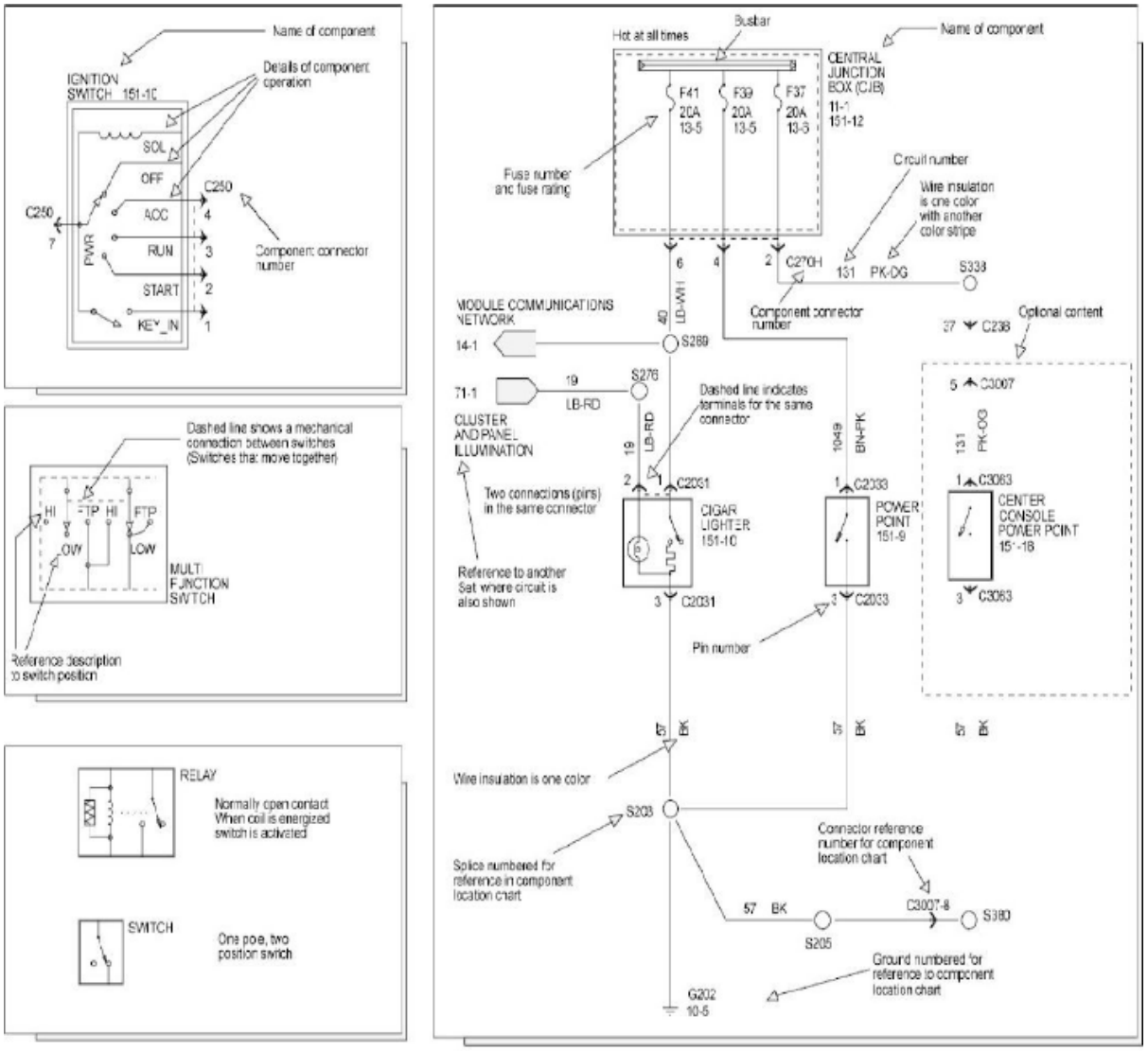
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

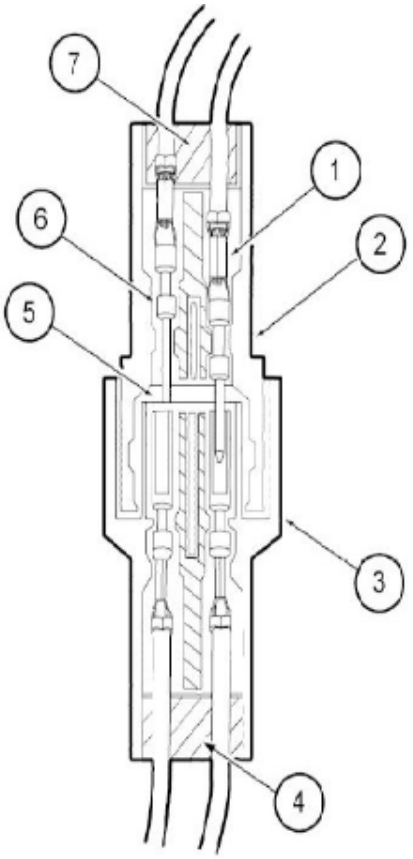


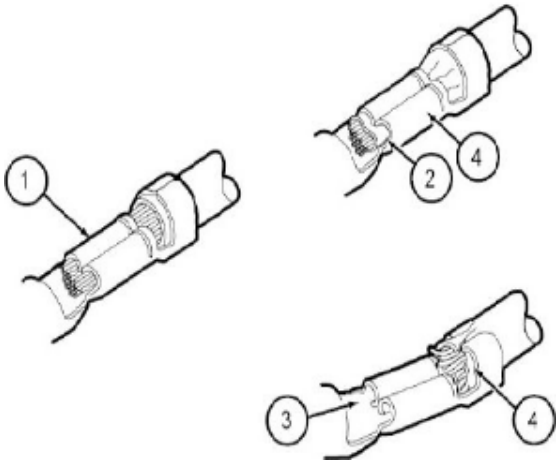
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Battery Discharge Protection Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

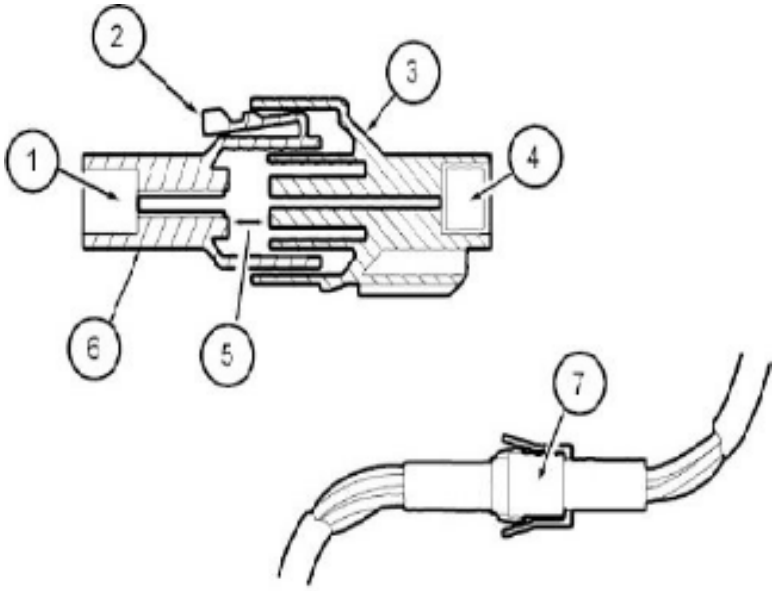
5 = Intermittent contact

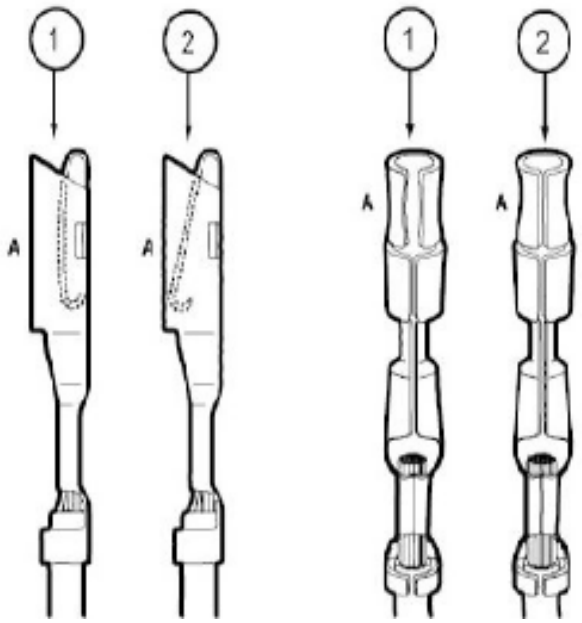
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

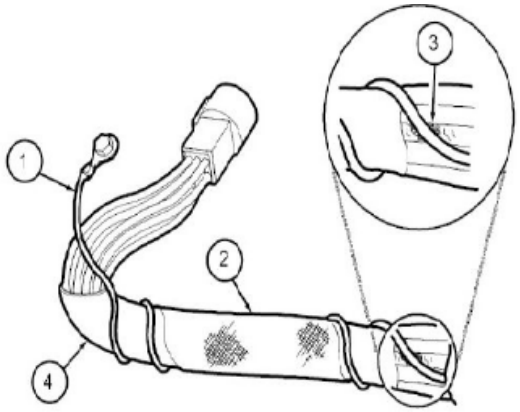
Deformed (enlarged) female terminals

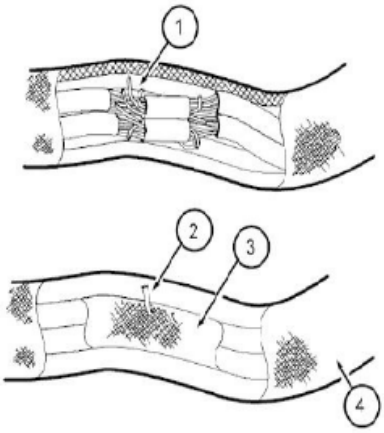
1 = Enlarged

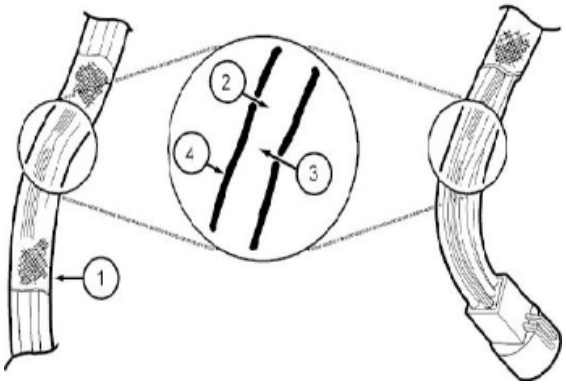
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

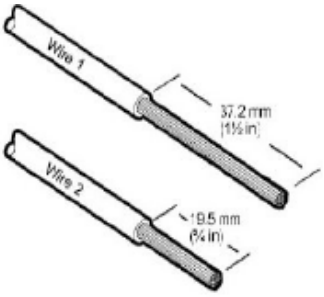
Splice covered 2

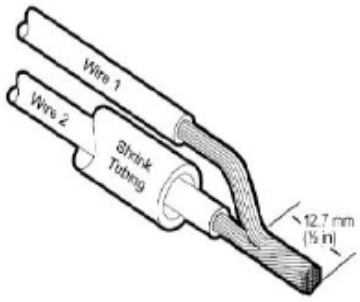
= Wire strand

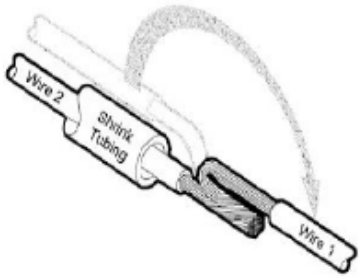
3 = Splice tape

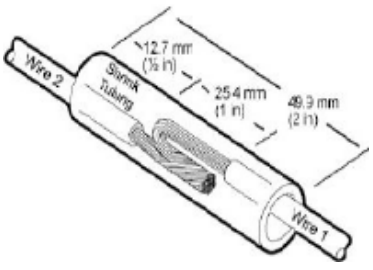
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

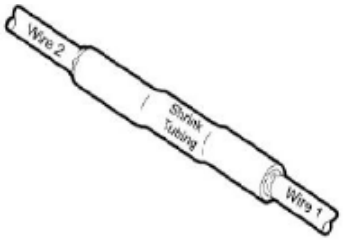
NOTE: -

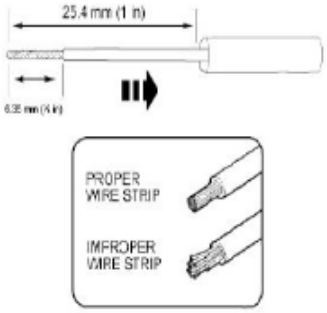
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

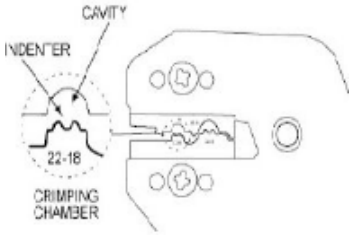
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

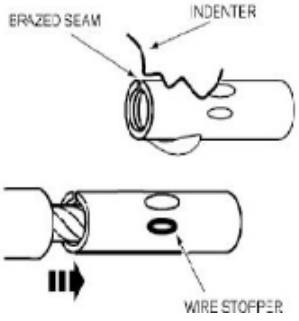
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
6.35 mm (¼ in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

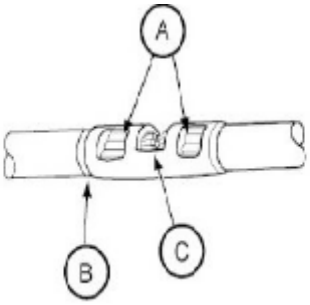
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

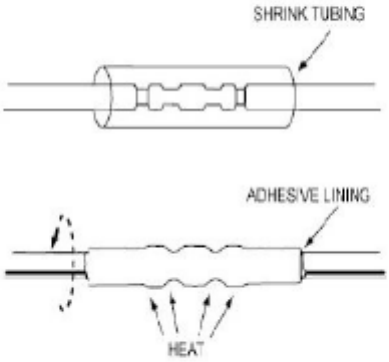
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4 strip, cut 9 strands	* 1/4 strip, cut 2 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip, fold 3x dia.
	16-14	* 1/4 strip, cut 7 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip fold 2x dia	1 strip, fold 3x dia.	1 1/4 strip, fold 4x dia.	Not Recommended
	12-10	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip fold 3x dia.	1 1/4 strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Pigtail only

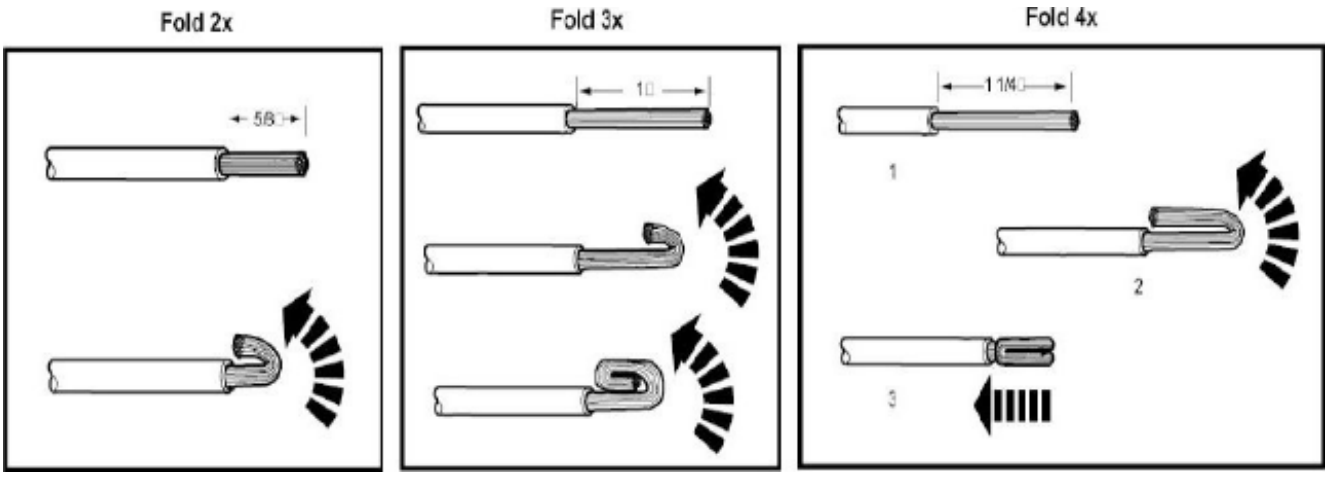
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



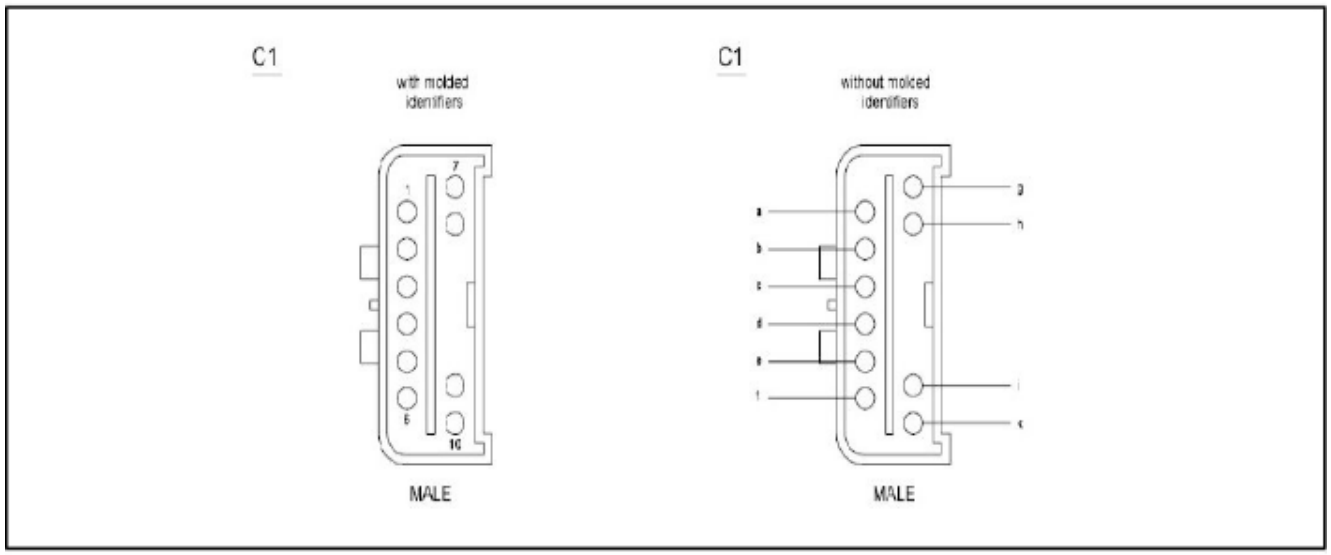
The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



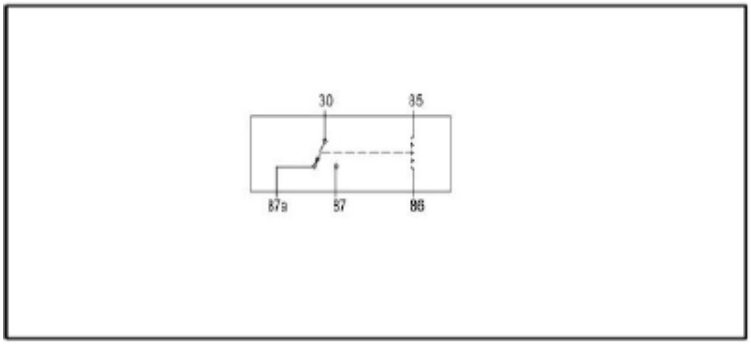
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

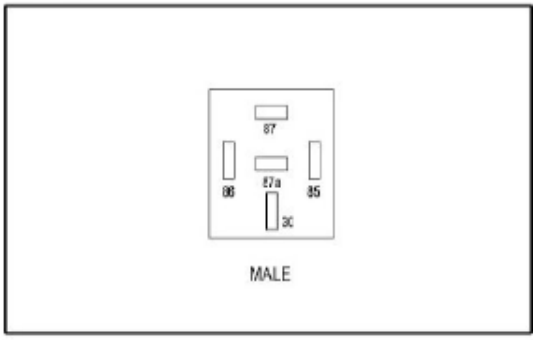
Battery Discharge Protection Relay: Testing and Inspection Mini ISO Relay

Relay □ Mini ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

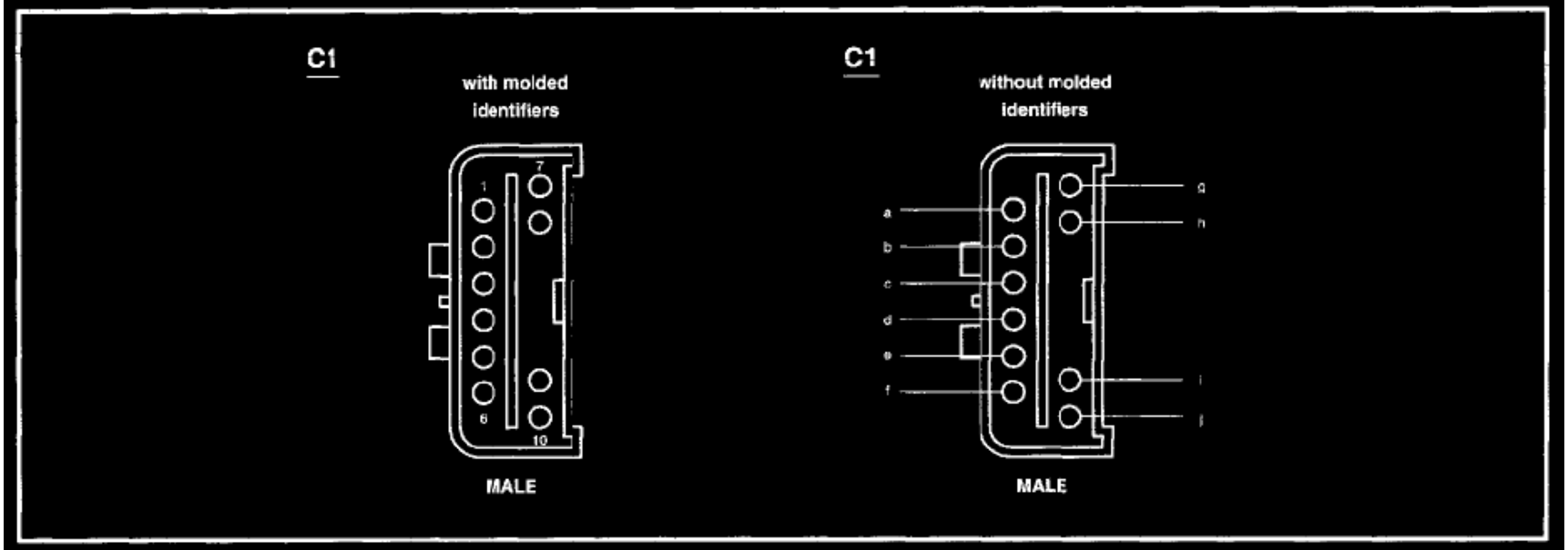
Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step–by–step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



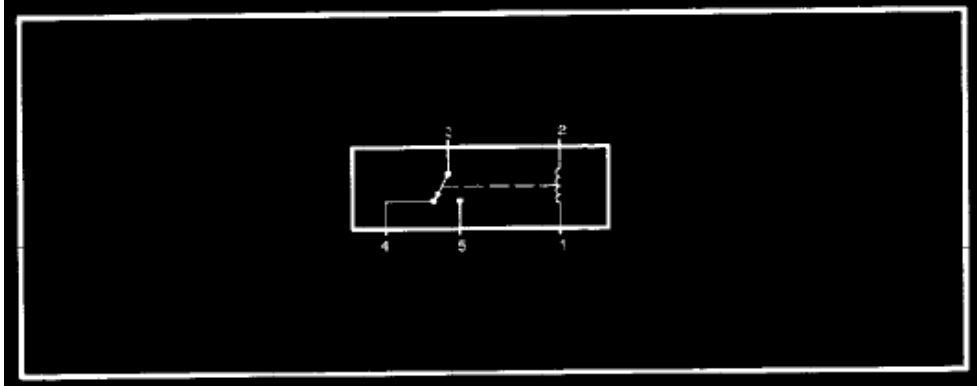
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

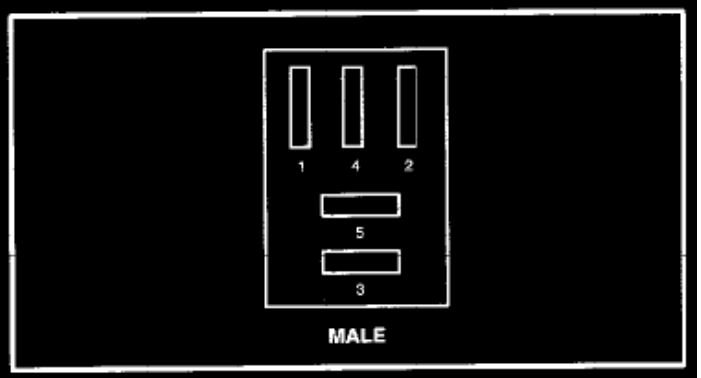
Battery Discharge Protection Relay: Testing and Inspection Micro ISO Relay

Relay – Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63–102Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil – Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

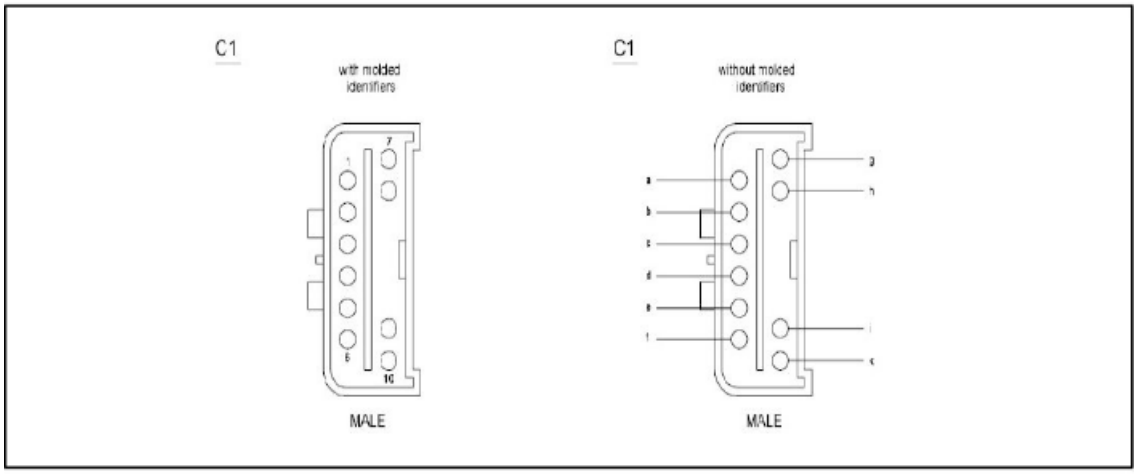
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step□by□step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals

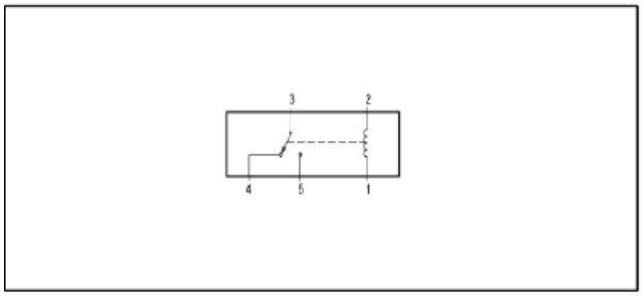


The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column □Circuit to test□. If you wish to test the complete component, perform all tests.

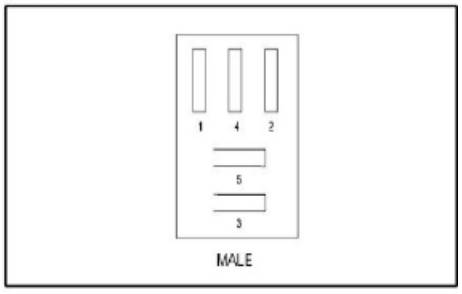
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Relay □ Micro ISO

Schematic



Terminals

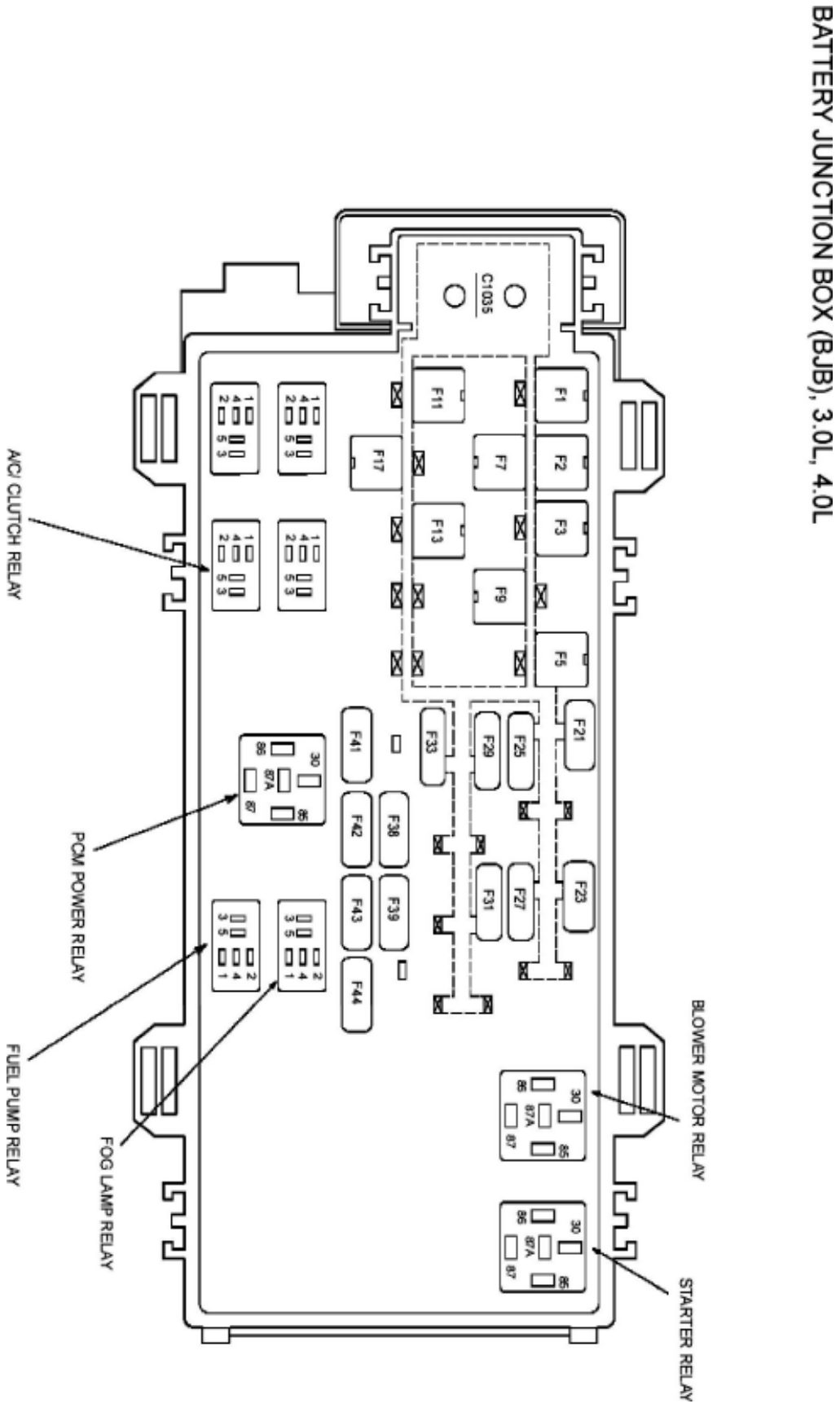


Component testing procedure (no voltage applied)

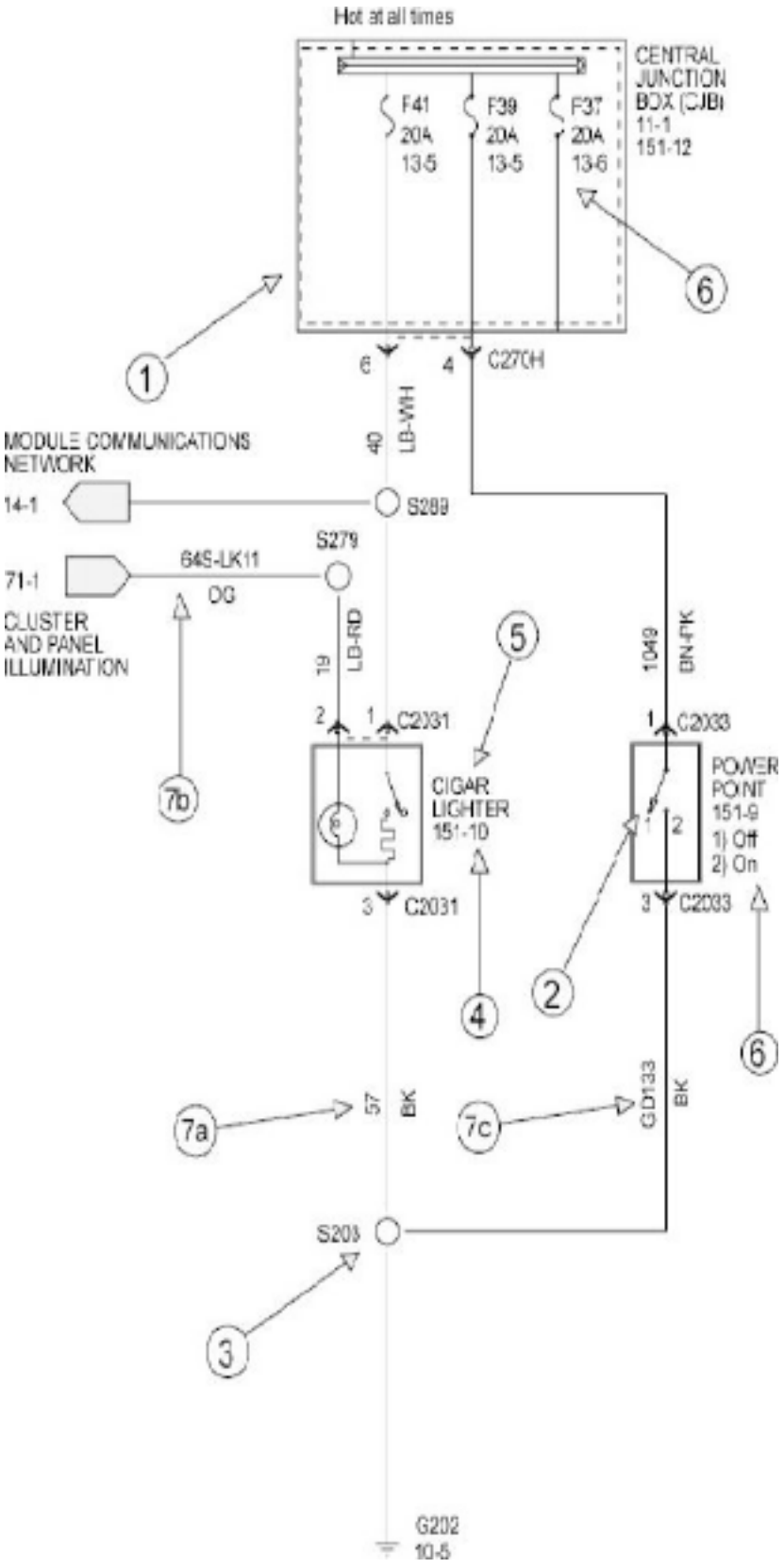
Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63□102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil □ Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.


BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L
C1035
F1
F2
F3
F5
F7
F9
F11
F13
F17
F21
F23
F25
F27
F29
F31
F33
F38
F39
F41
F42
F43
F44
A/C CLUTCH RELAY
PCM POWER RELAY
FUEL PUMP RELAY
FOG LAMP RELAY
BLOWER MOTOR RELAY
STARTER RELAY

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Lighting and Horns > Relays and Modules - Lighting and Horns > Fog/Driving Lamp Relay > Component Information > Diagrams > Diagram Information and Instructions



Fog/Driving Lamp Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

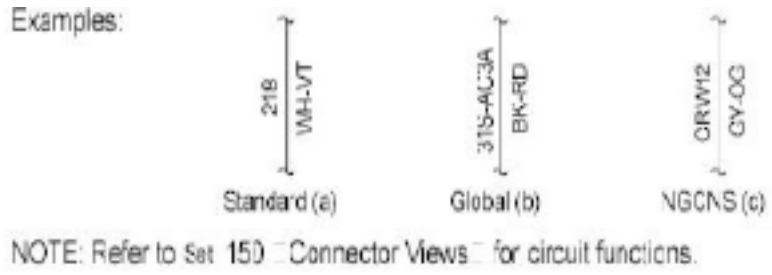
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

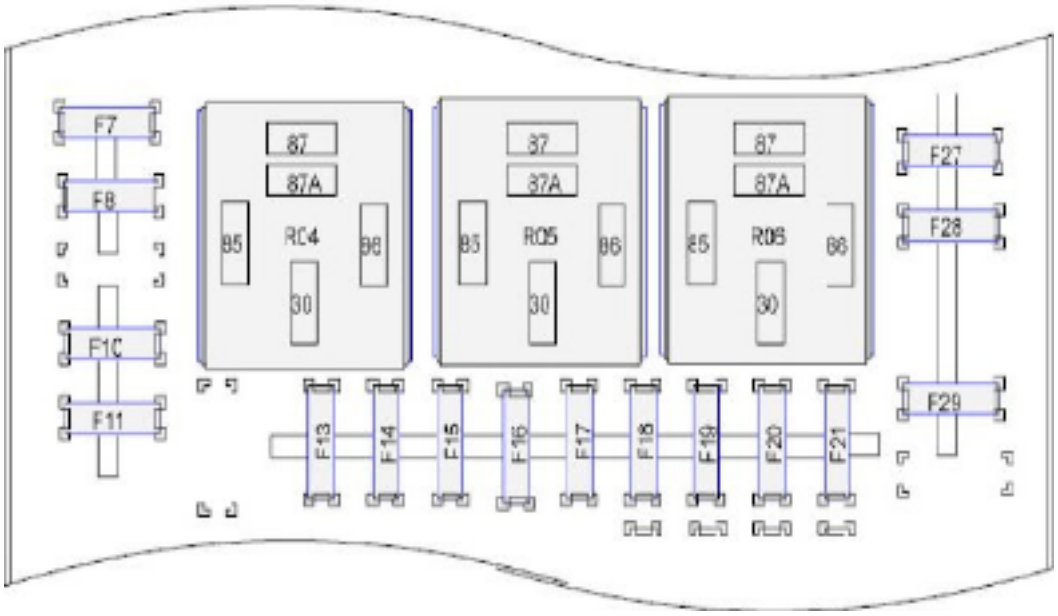
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

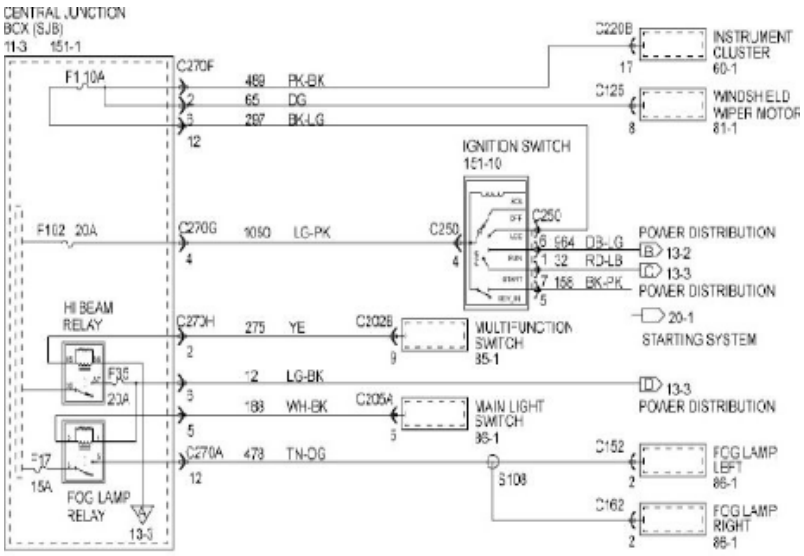
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

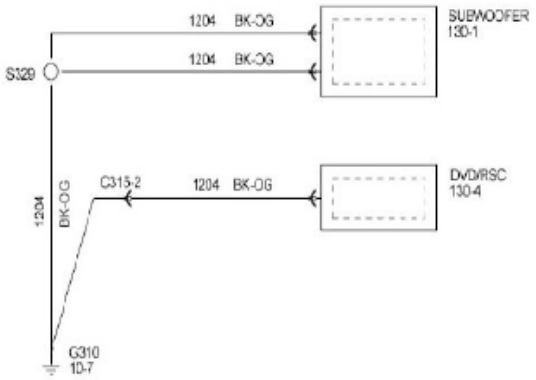
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

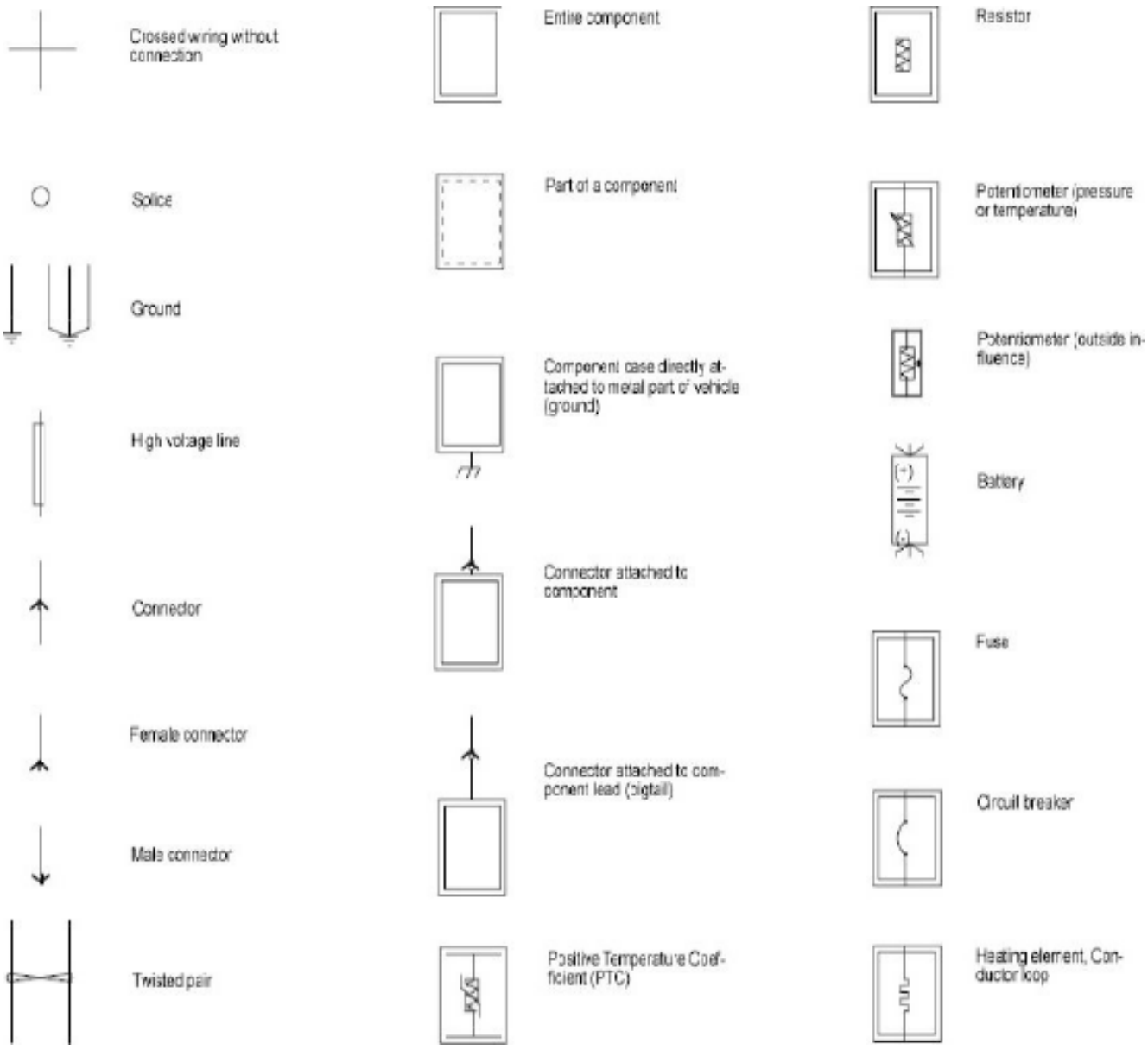
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

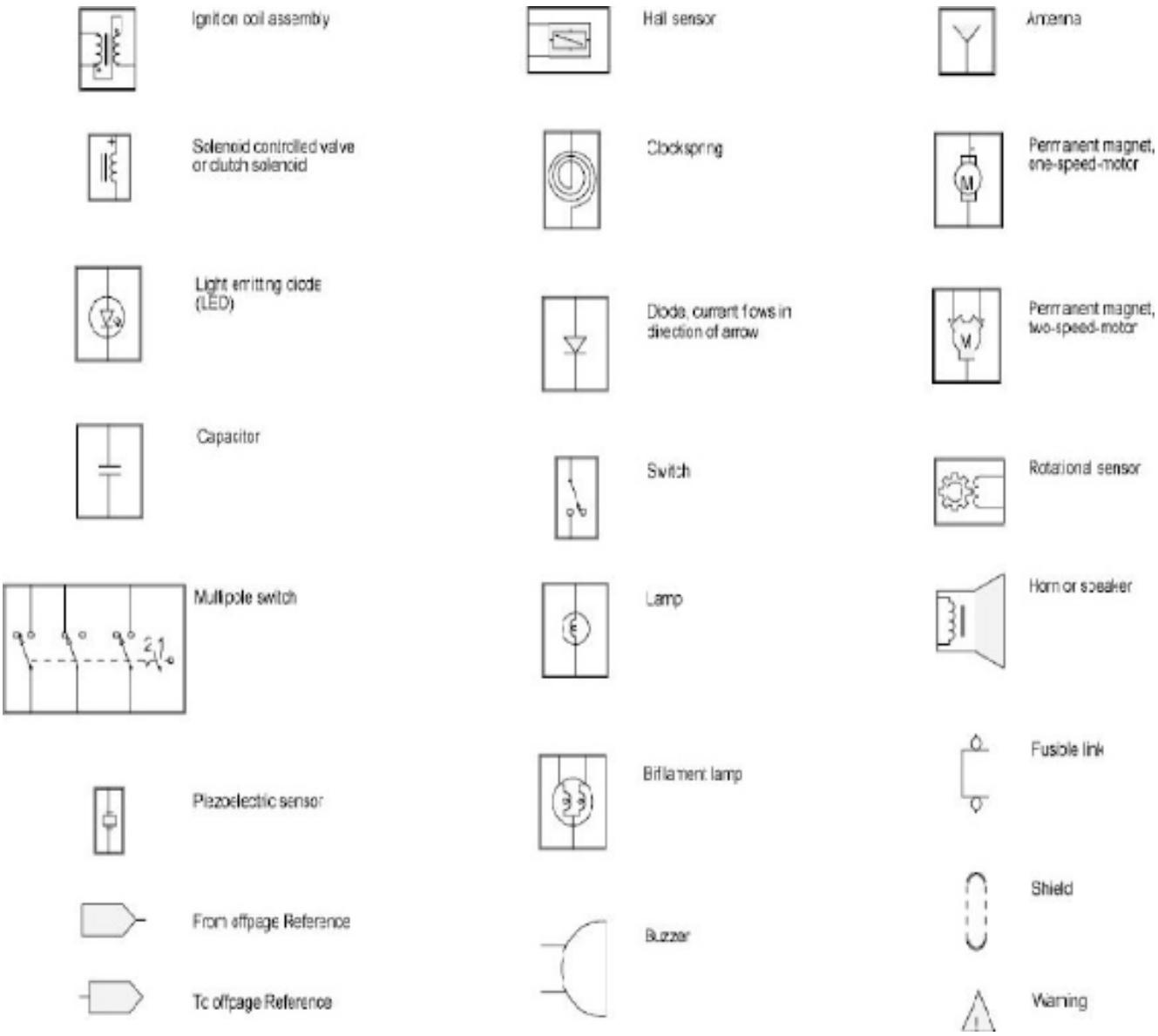
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

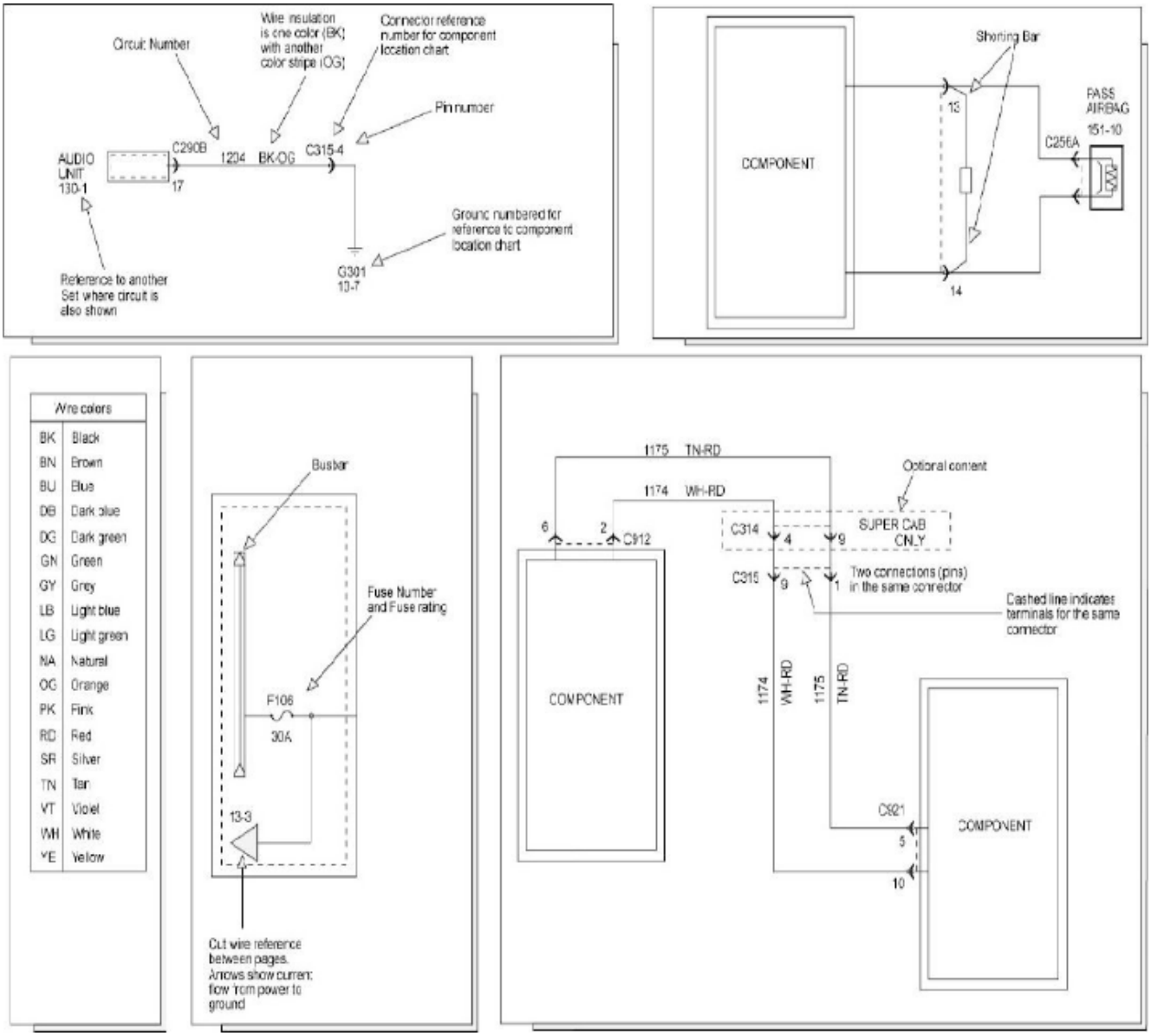
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

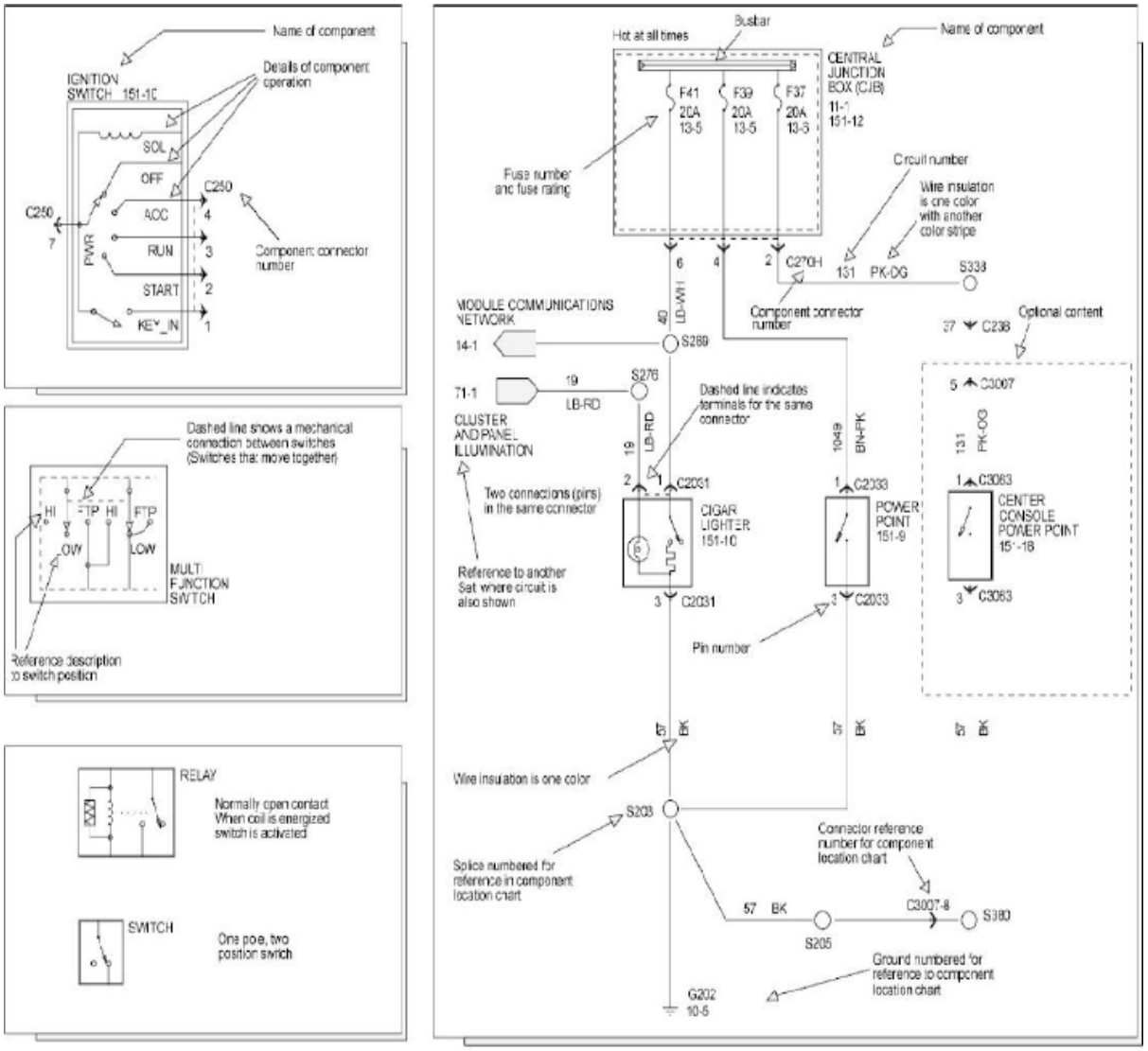
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

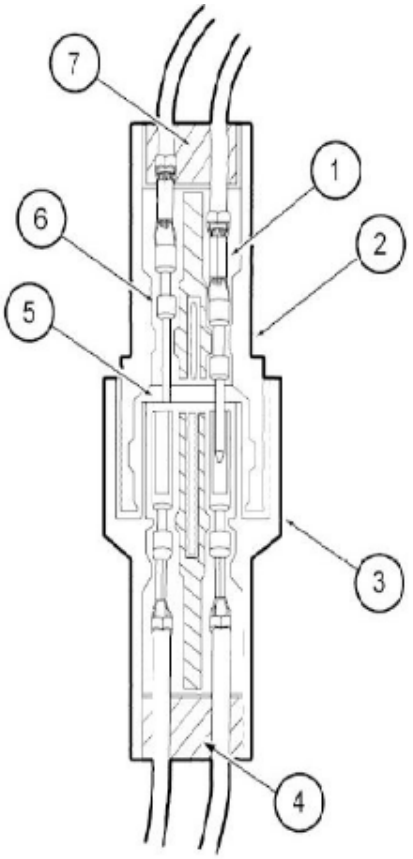


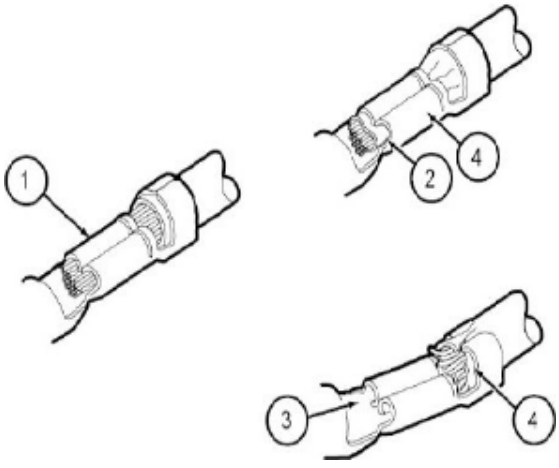
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Fog/Driving Lamp Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

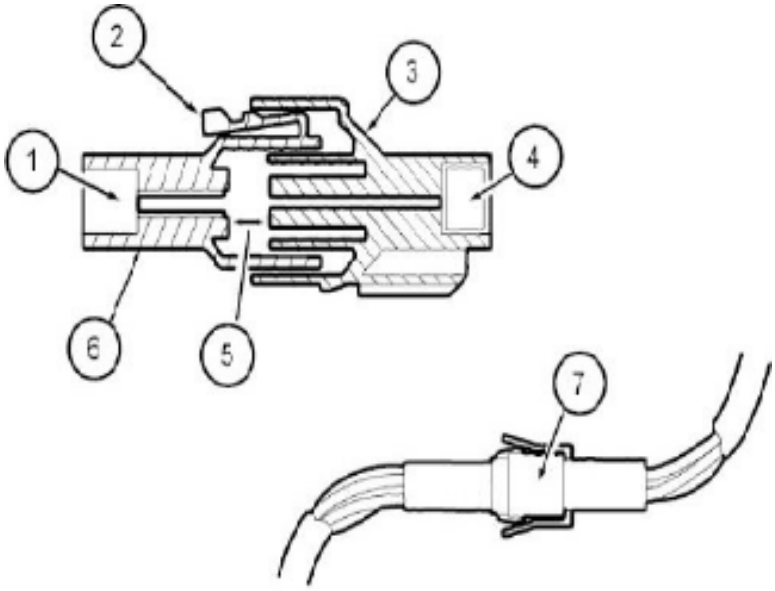
5 = Intermittent contact

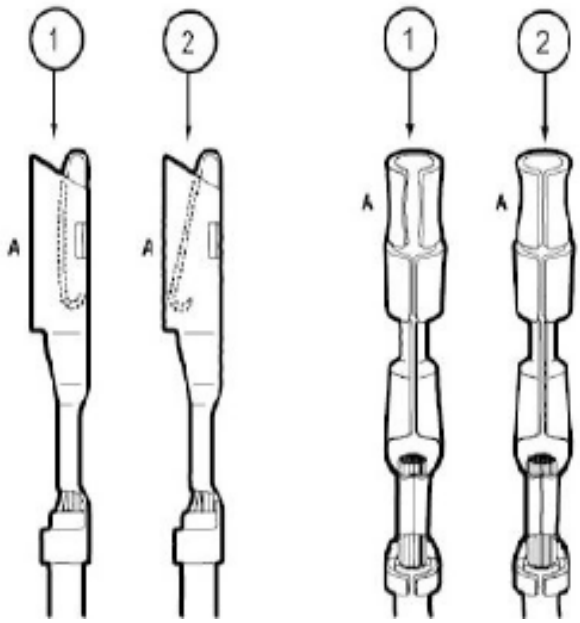
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

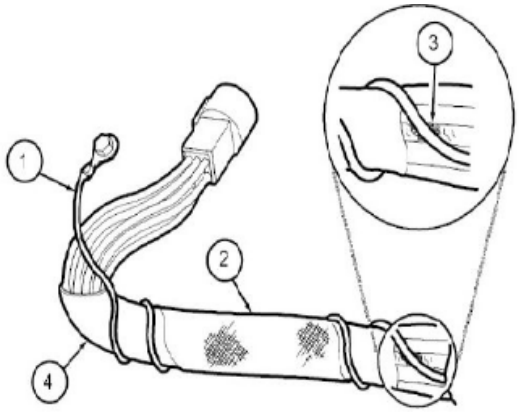
Deformed (enlarged) female terminals

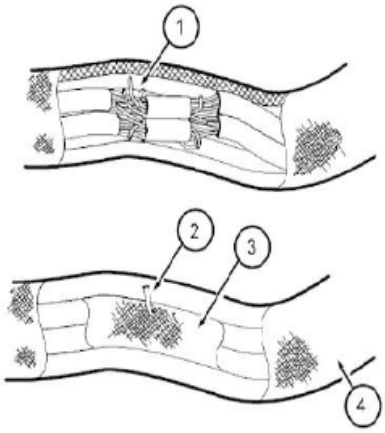
1 = Enlarged

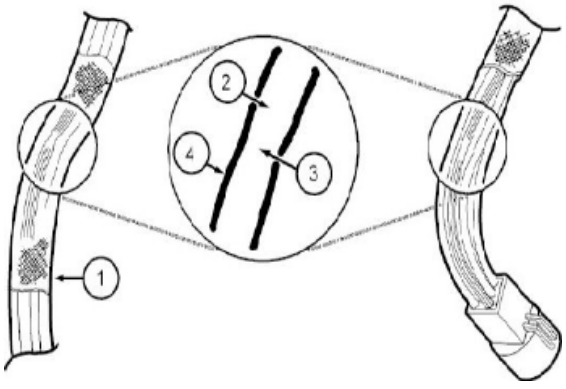
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

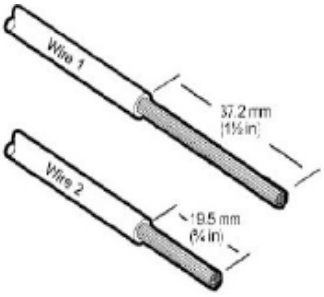
Splice covered 2

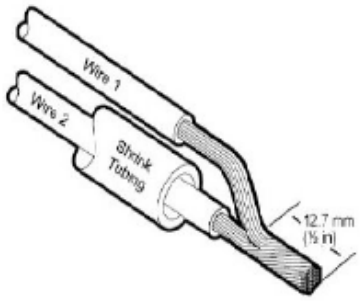
= Wire strand

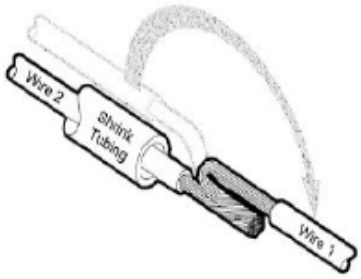
3 = Splice tape

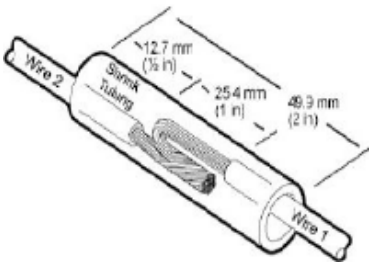
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

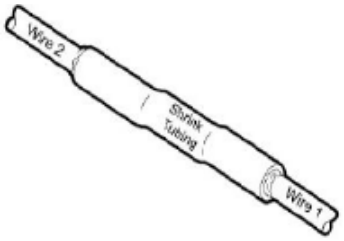
NOTE: -

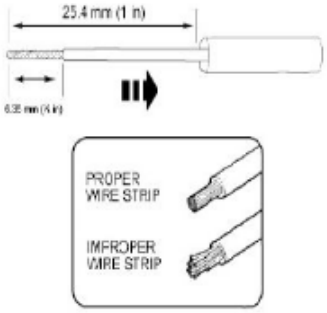
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

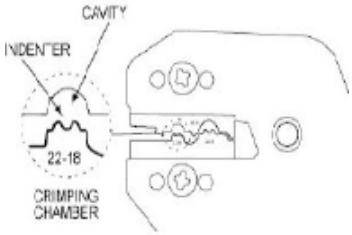
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

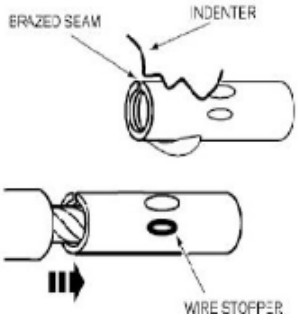
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
6.35 mm (¼ in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

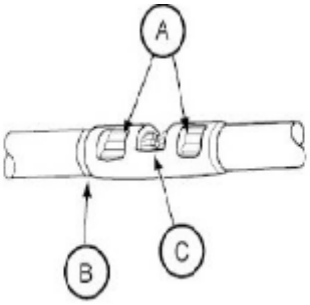
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

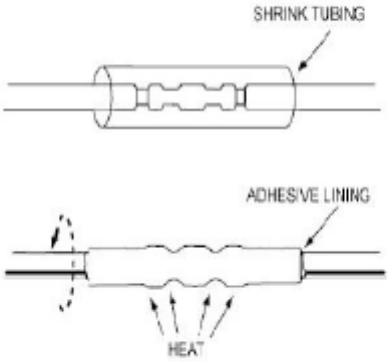
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4 strip, cut 9 strands	* 1/4 strip, cut 2 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip, fold 3x dia.
	16-14	* 1/4 strip, cut 7 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip fold 2x dia	1 strip, fold 3x dia.	1 1/4 strip, fold 4x dia.	Not Recommended
	12-10	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip fold 3x cia.	1 1/4 strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Figtail only

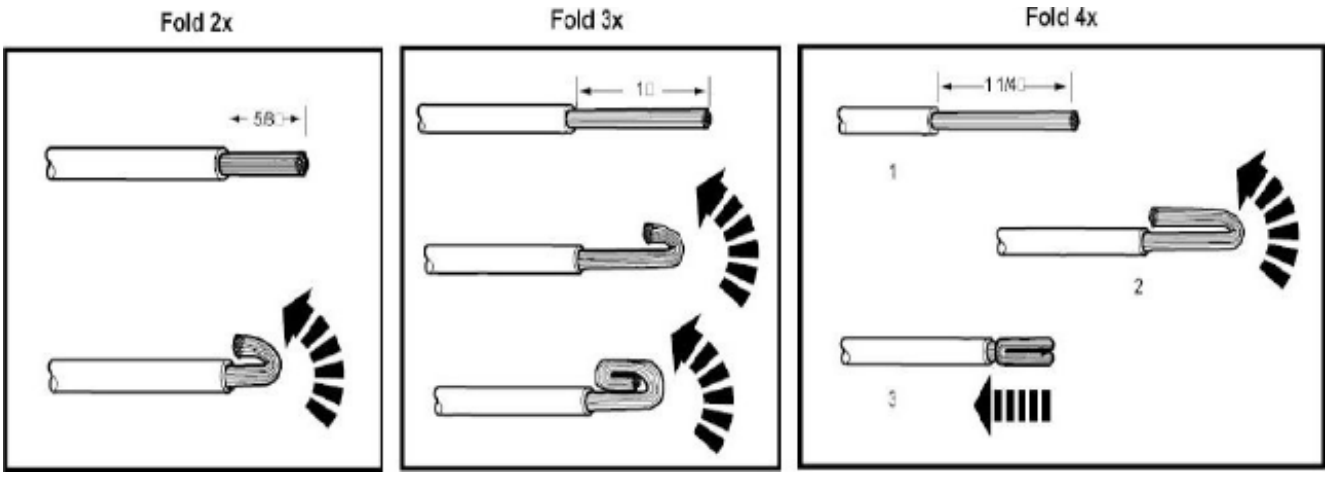
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



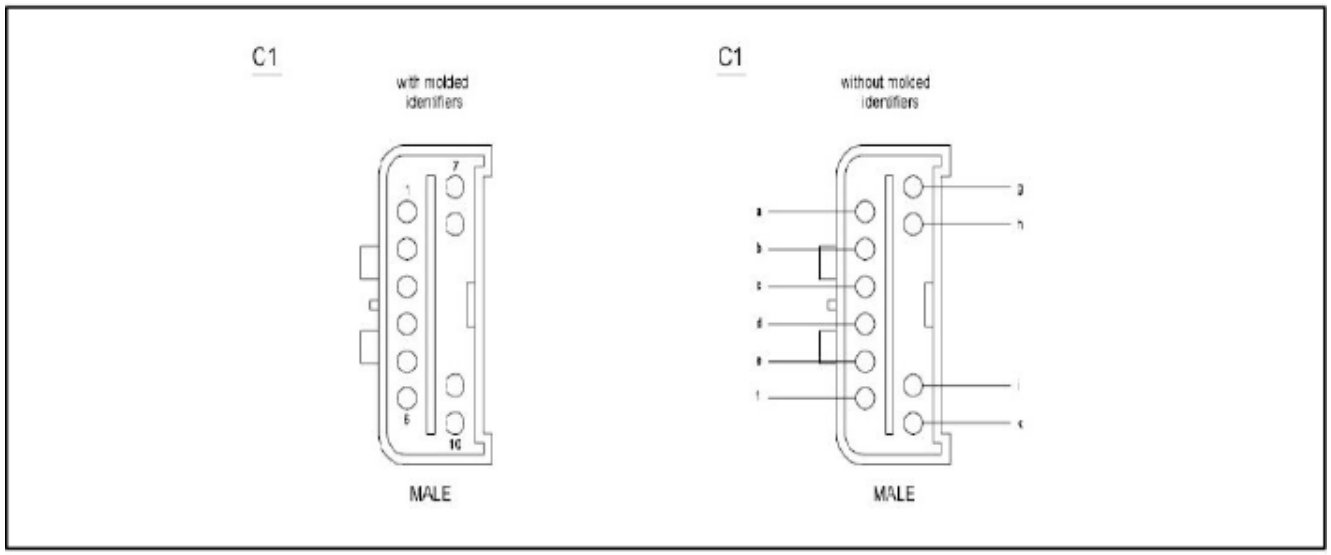
The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



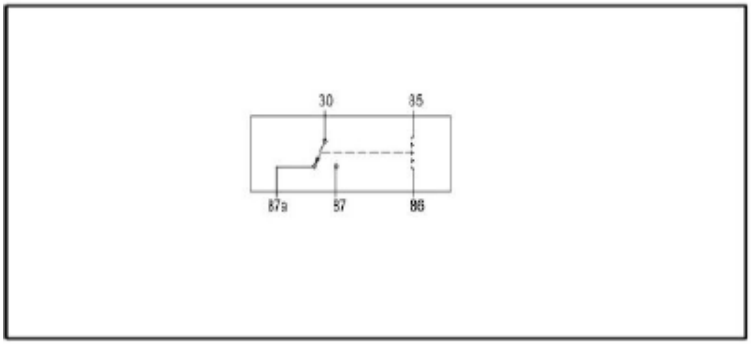
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

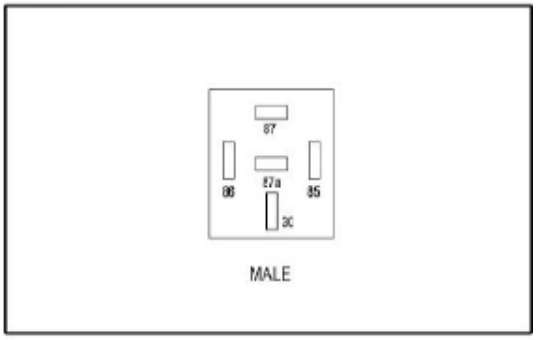
Fog/Driving Lamp Relay: Testing and Inspection Mini ISO Relay

Relay □ Mini ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

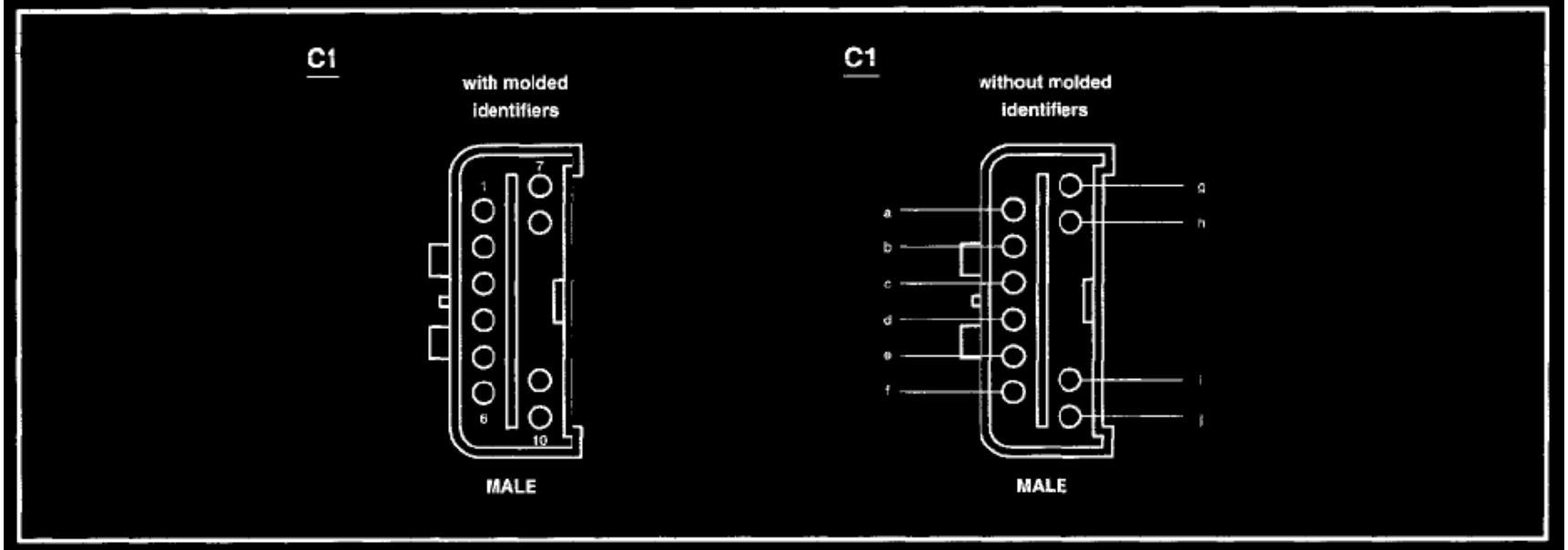
Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step–by–step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



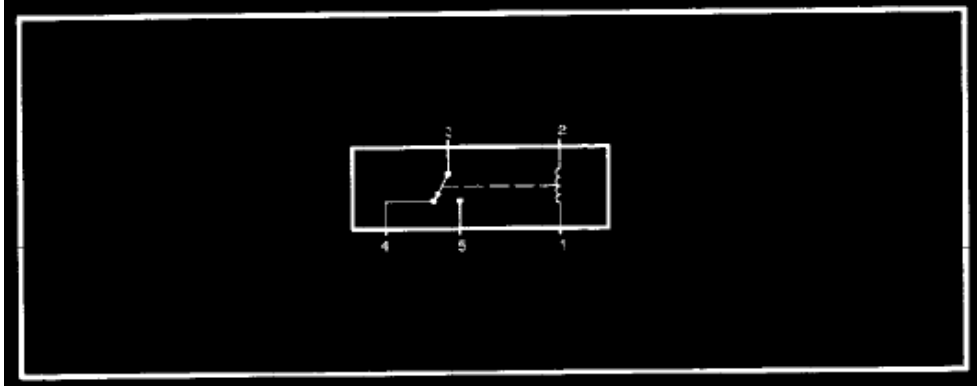
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

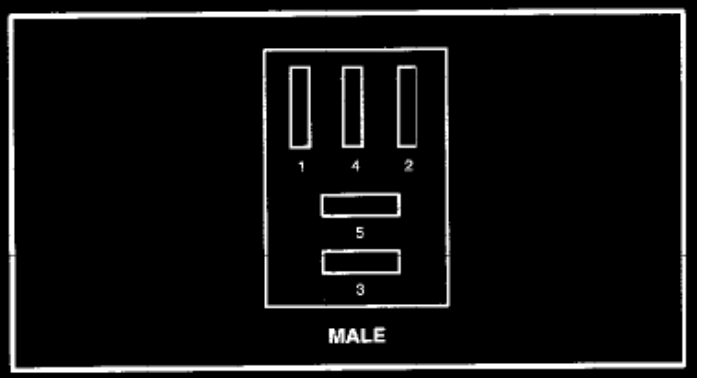
Fog/Driving Lamp Relay: Testing and Inspection Micro ISO Relay

Relay – Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63–102Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil – Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

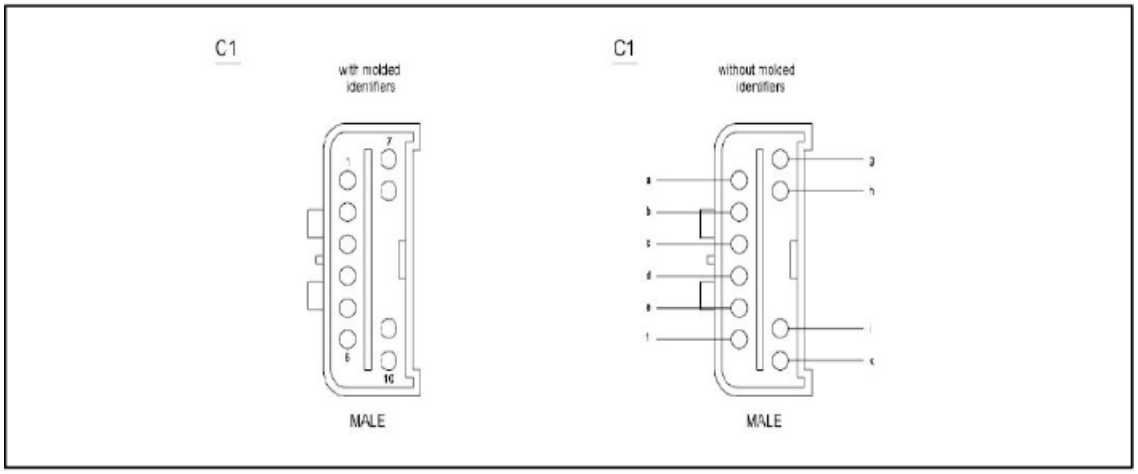
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step□by□step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals

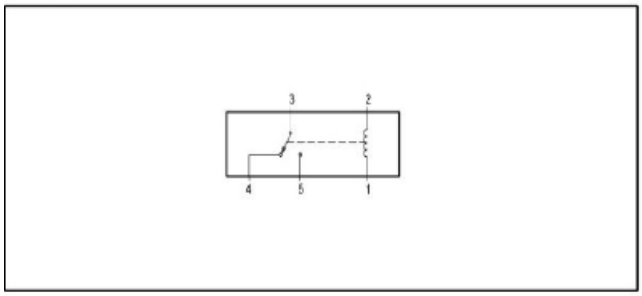


The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column □Circuit to test□. If you wish to test the complete component, perform all tests.

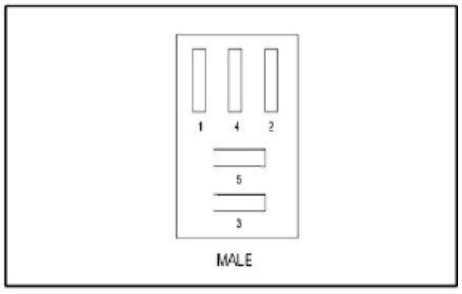
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Relay □ Micro ISO

Schematic



Terminals



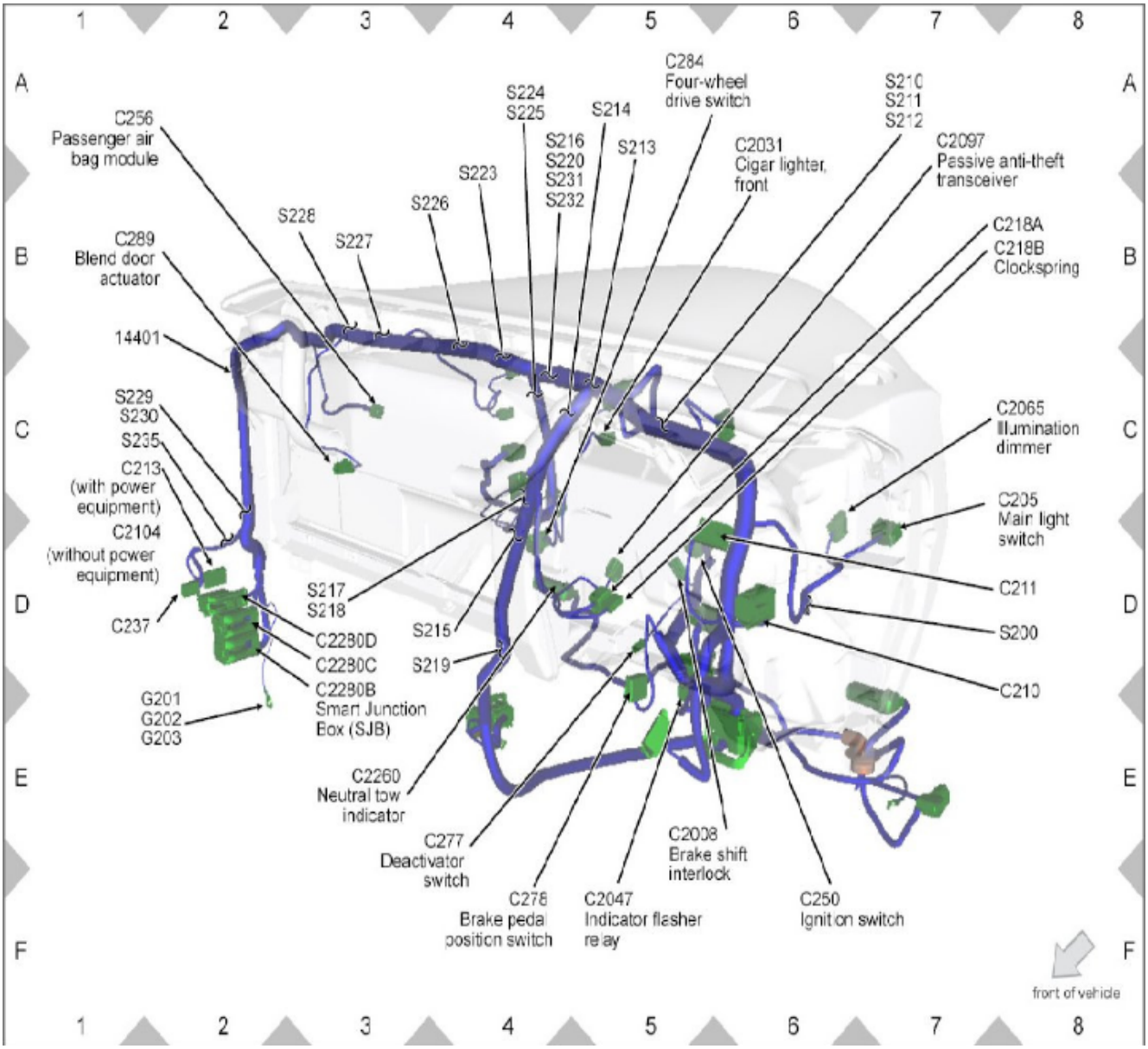
Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63□102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil □ Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

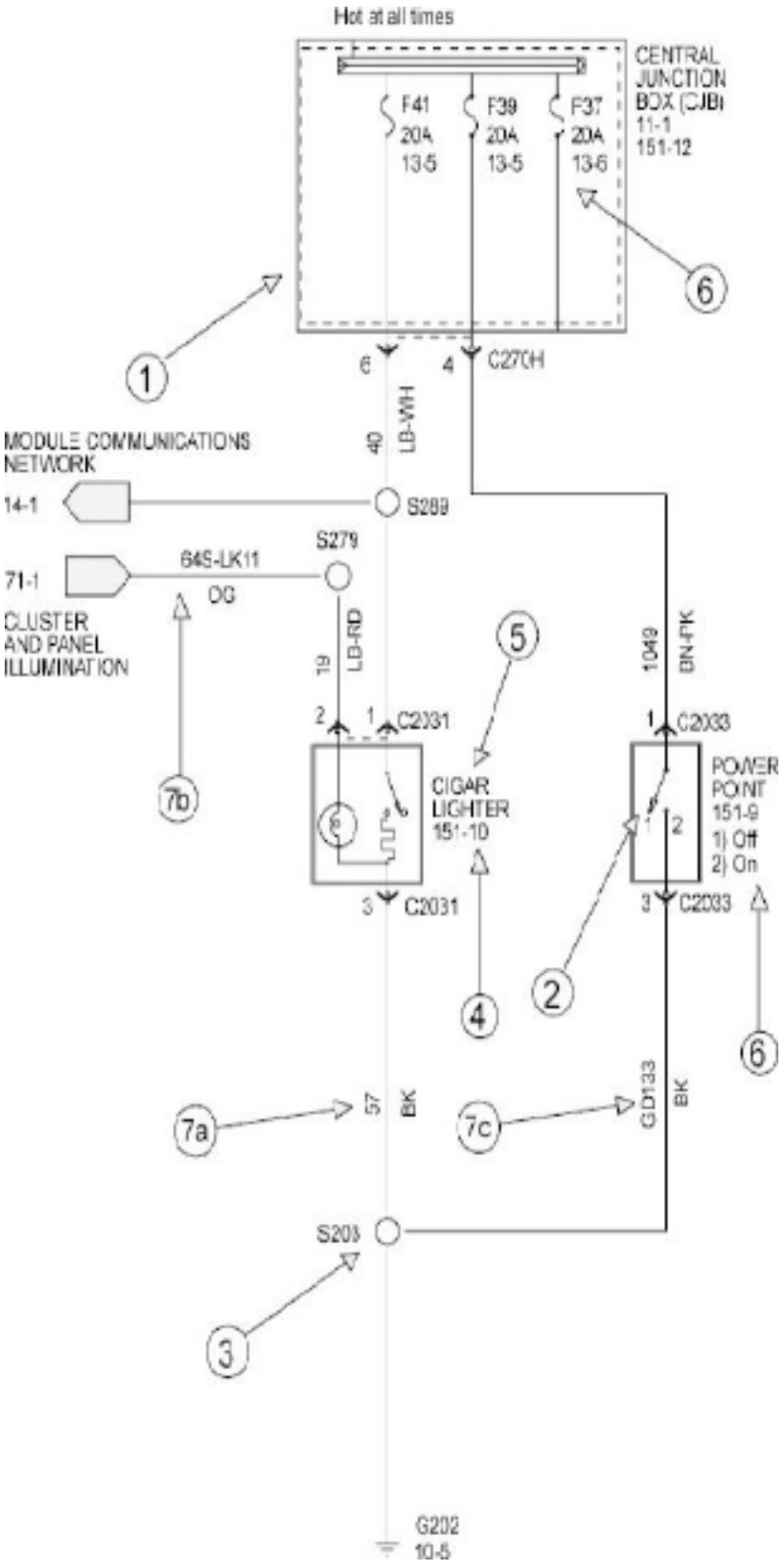
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Lighting and Horns > Relays and Modules - Lighting and Horns > Hazard Flasher Relay > Component Information > Locations



View 151-11

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Lighting and Horns > Relays and Modules - Lighting and Horns > Hazard Flasher Relay > Component Information > Diagrams > Diagram Information and Instructions



Hazard Flasher Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

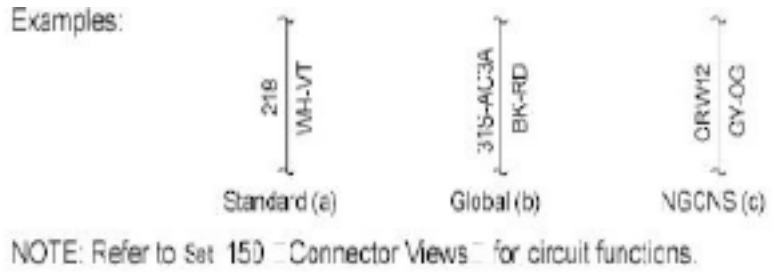
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

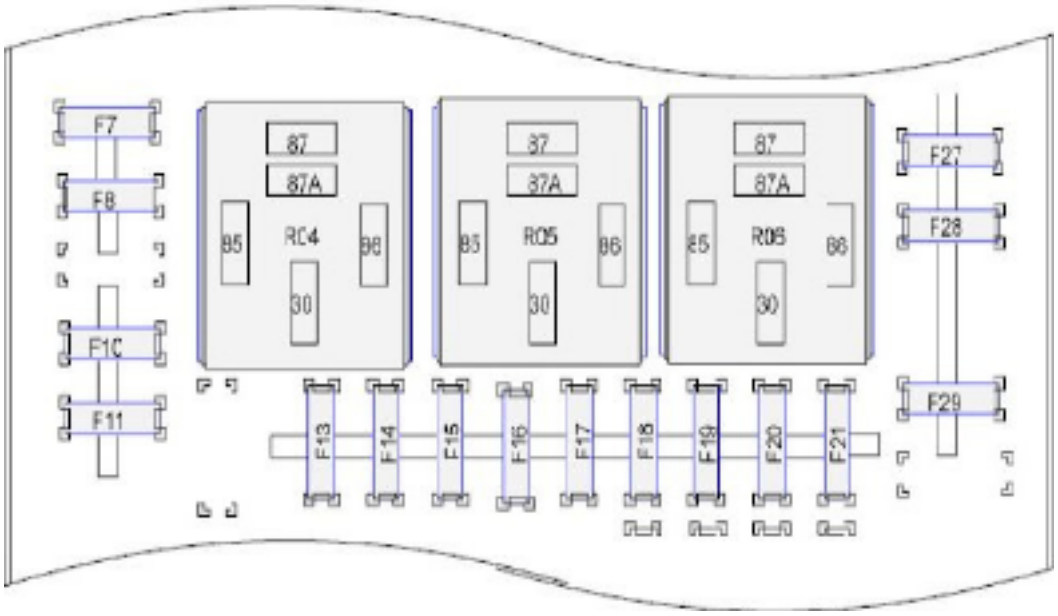
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

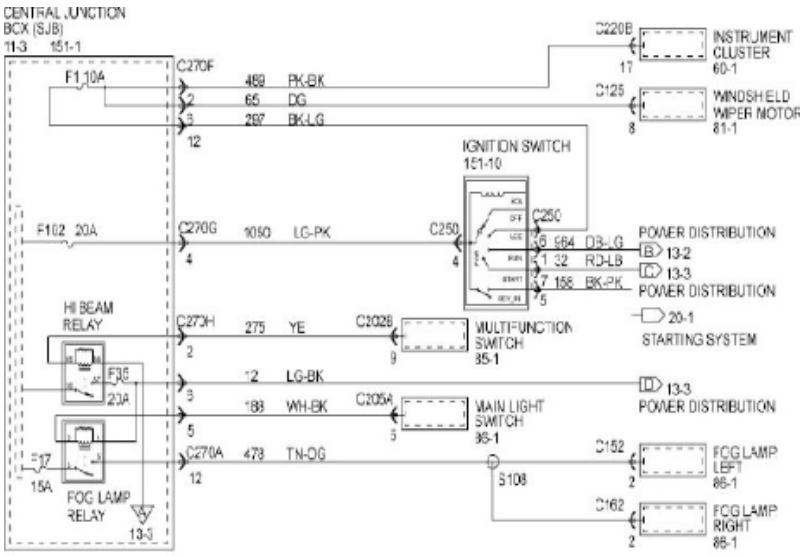
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

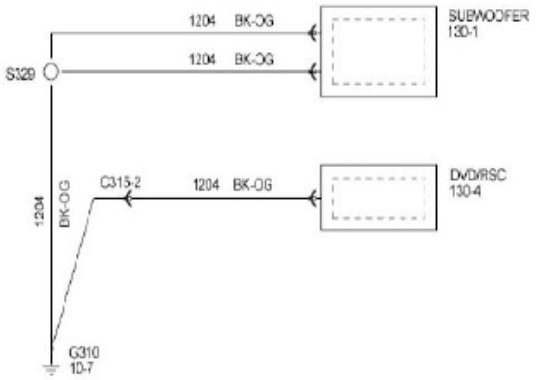
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

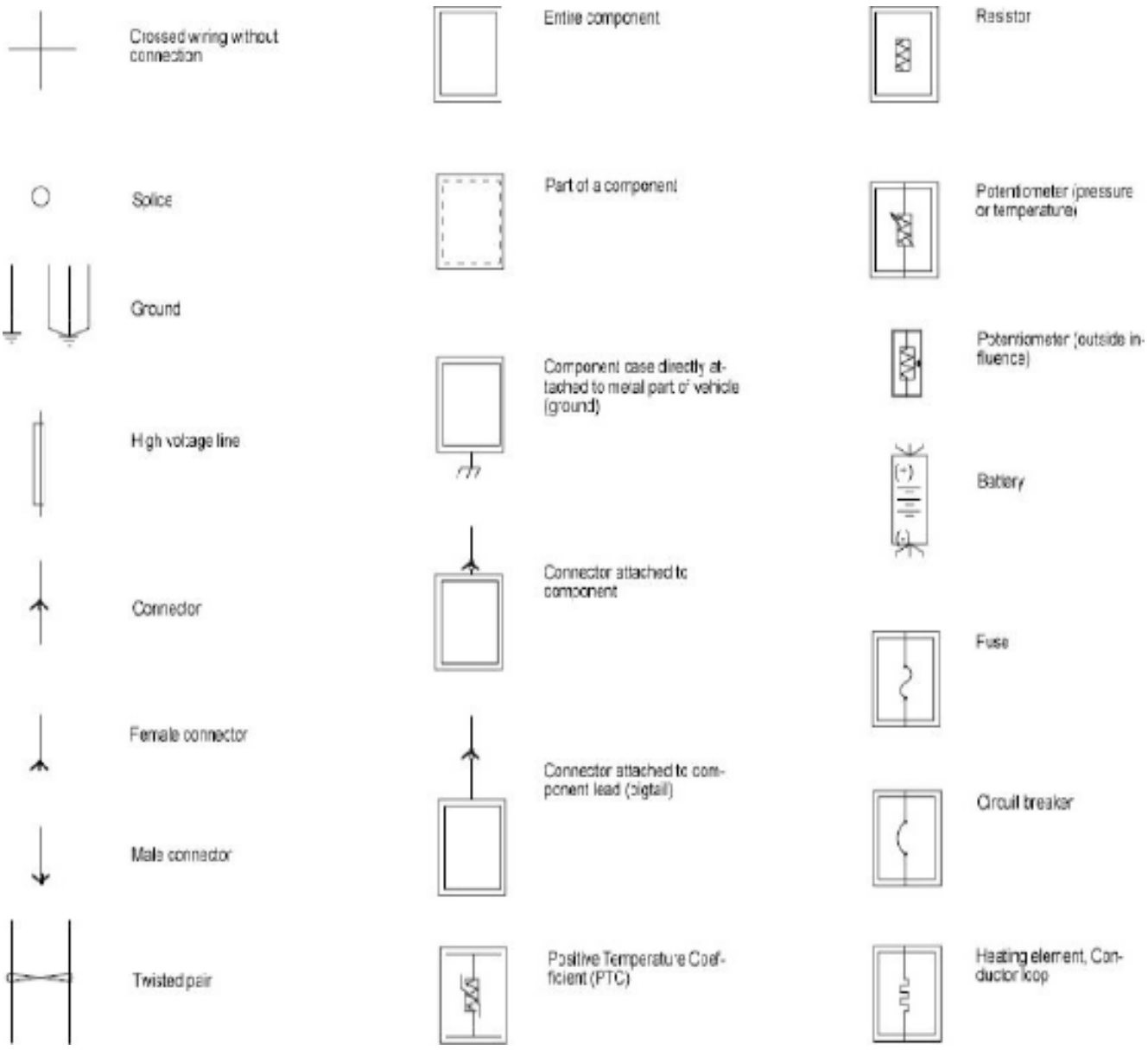
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

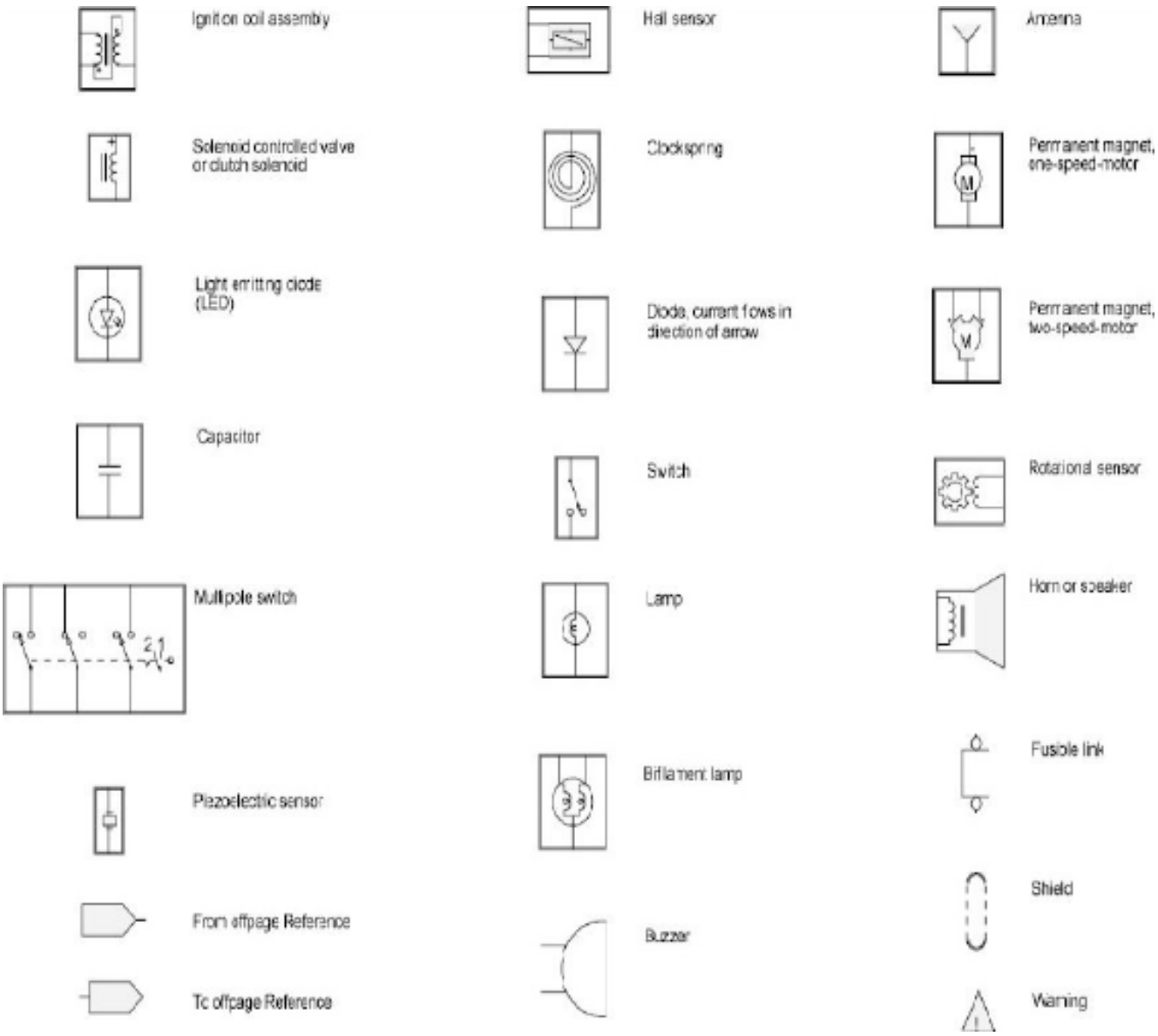
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

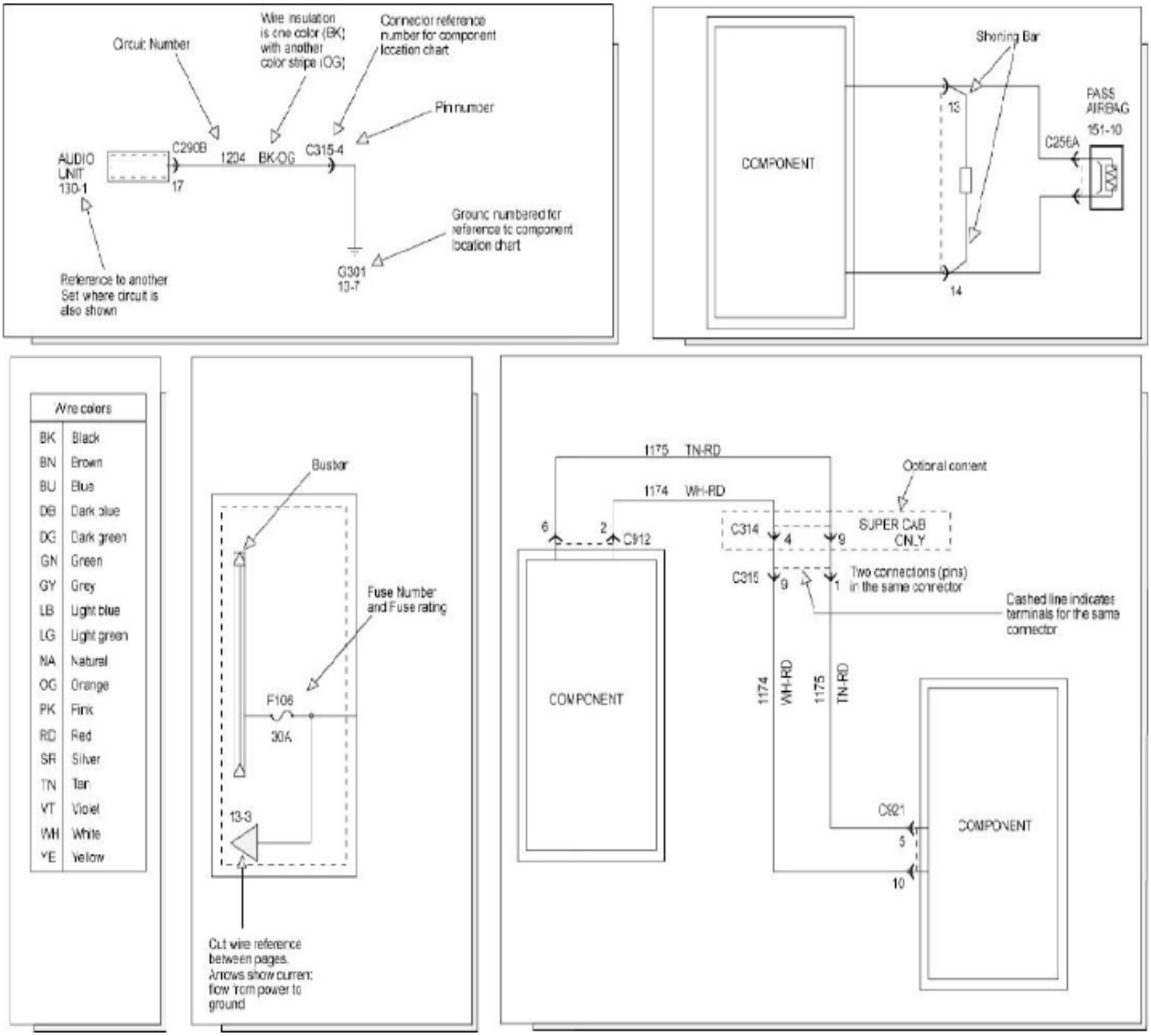
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

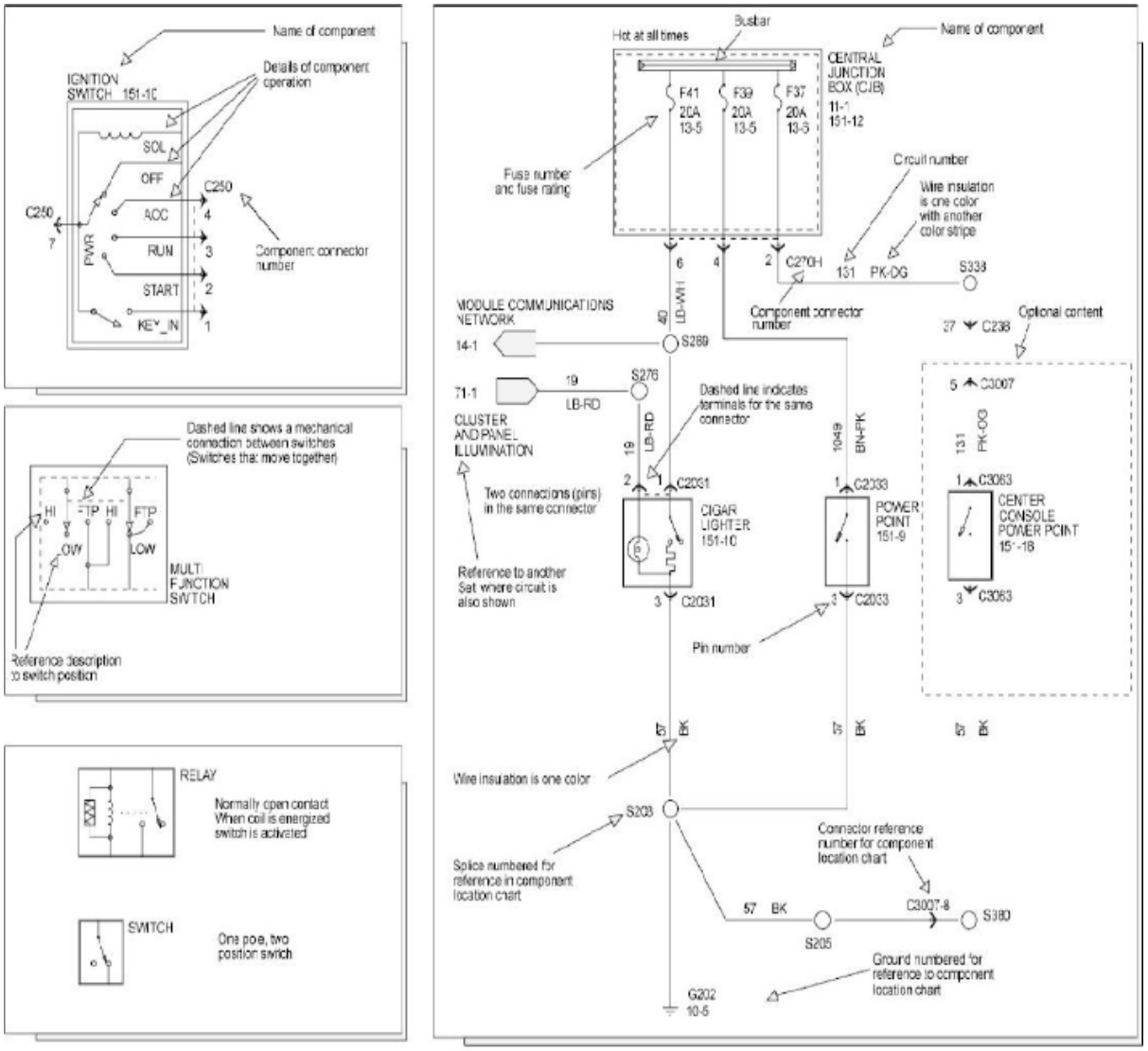
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

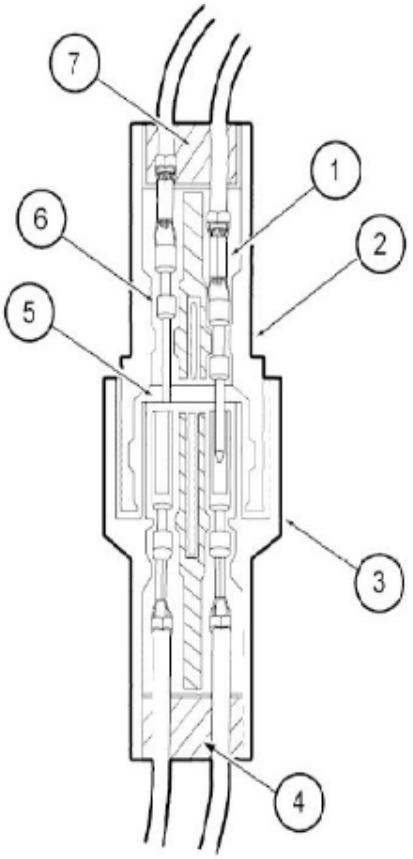


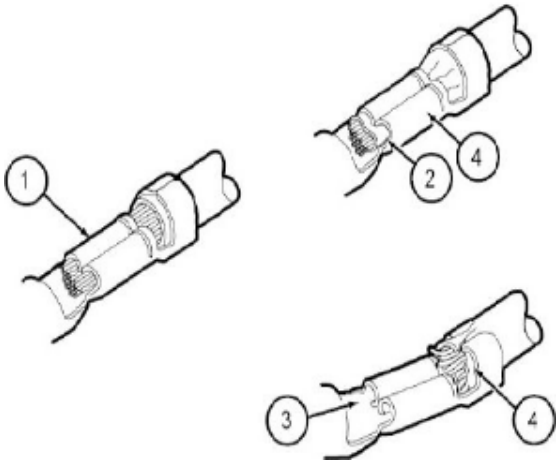
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Hazard Flasher Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

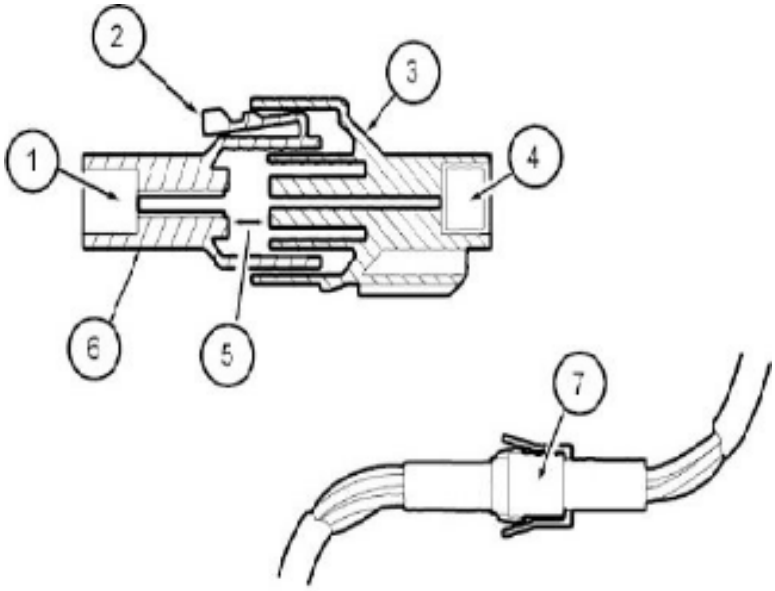
5 = Intermittent contact

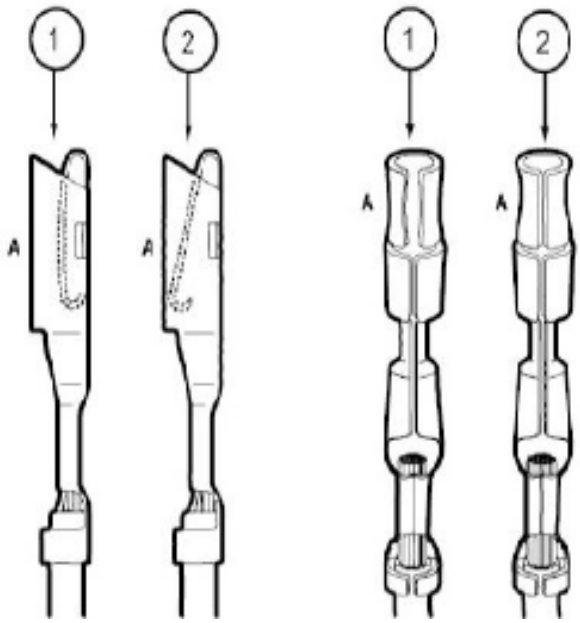
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

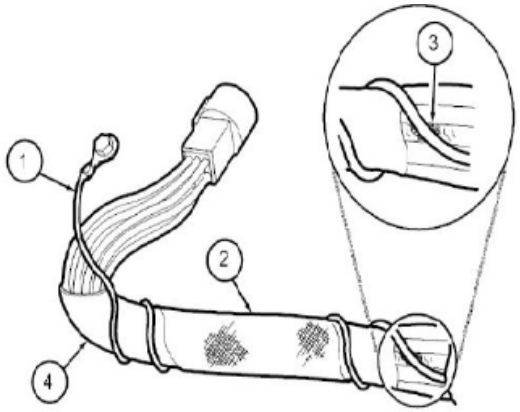
Deformed (enlarged) female terminals

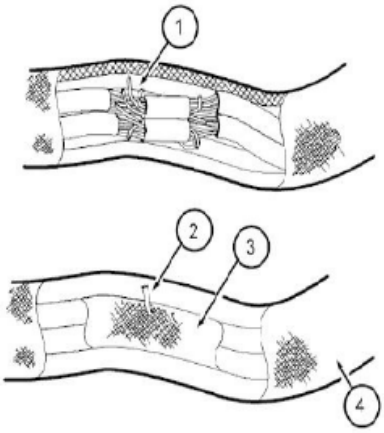
1 = Enlarged

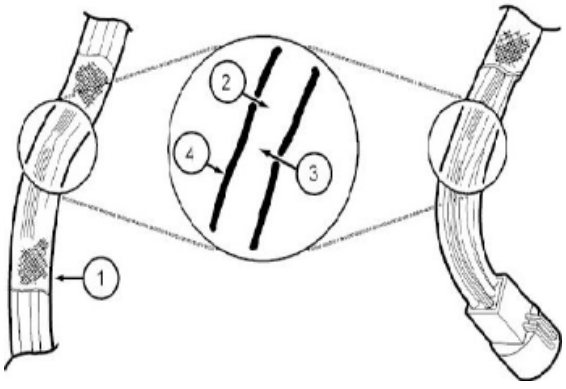
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

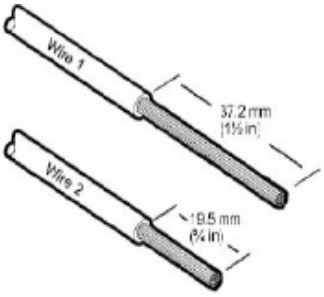
Splice covered 2

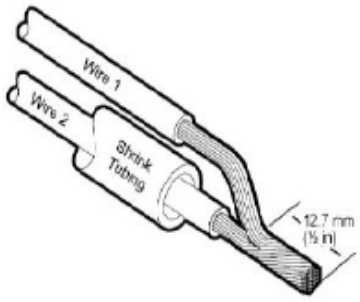
= Wire strand

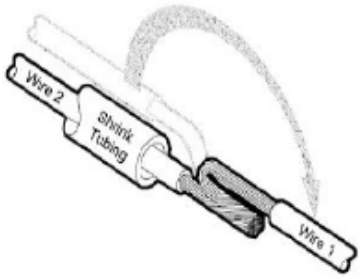
3 = Splice tape

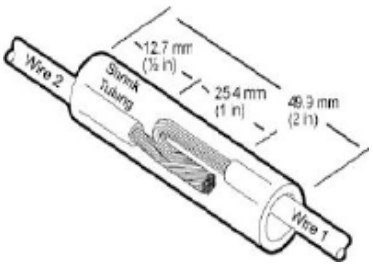
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

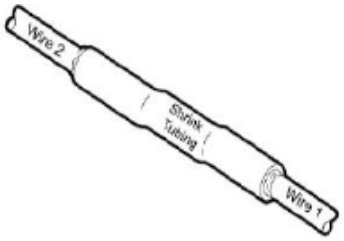
NOTE: -

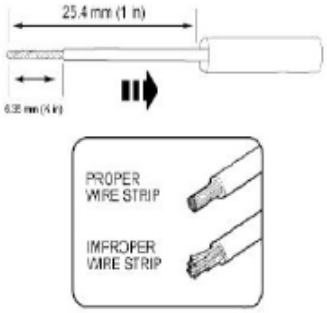
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

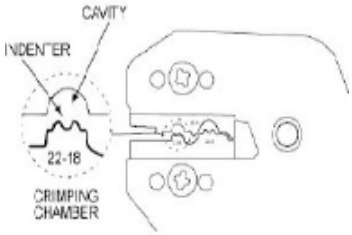
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

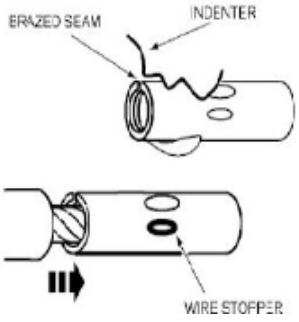
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
6.35 mm (¼ in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

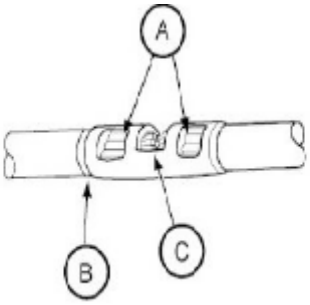
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

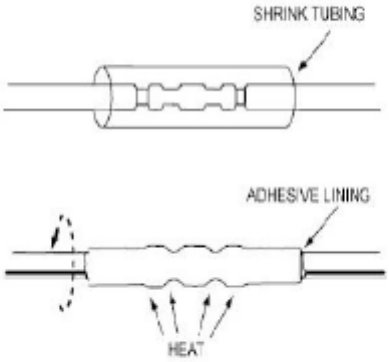
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4 strip, cut 9 strands	* 1/4 strip, cut 2 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip, fold 3x dia.
	16-14	* 1/4 strip, cut 7 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip fold 2x dia	1 strip, fold 3x dia.	1 1/4 strip, fold 4x dia.	Not Recommended
	12-10	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip fold 3x dia.	1 1/4 strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Pigtail only

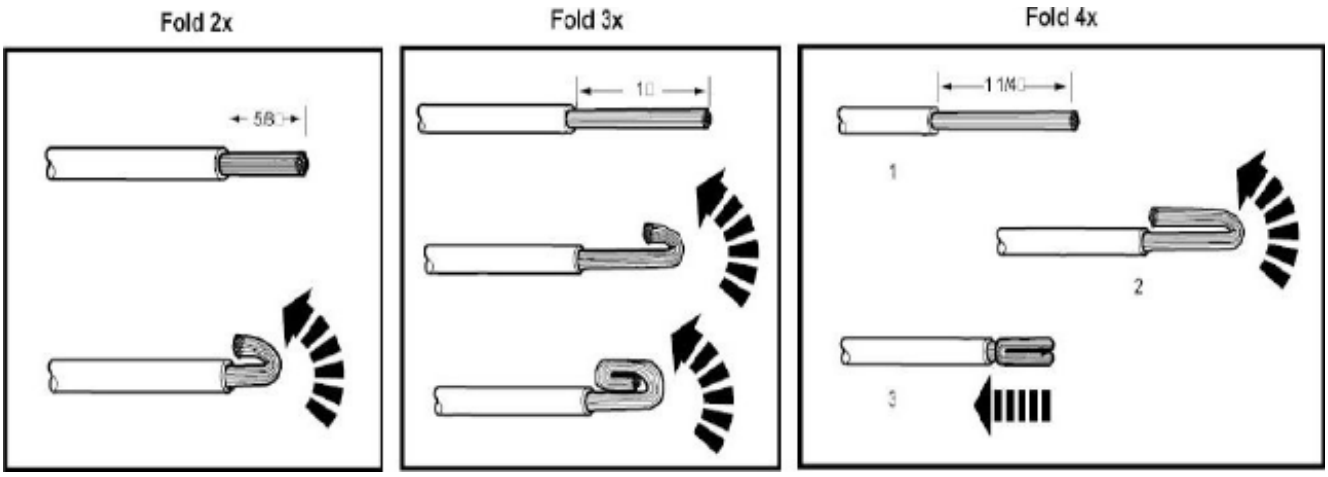
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

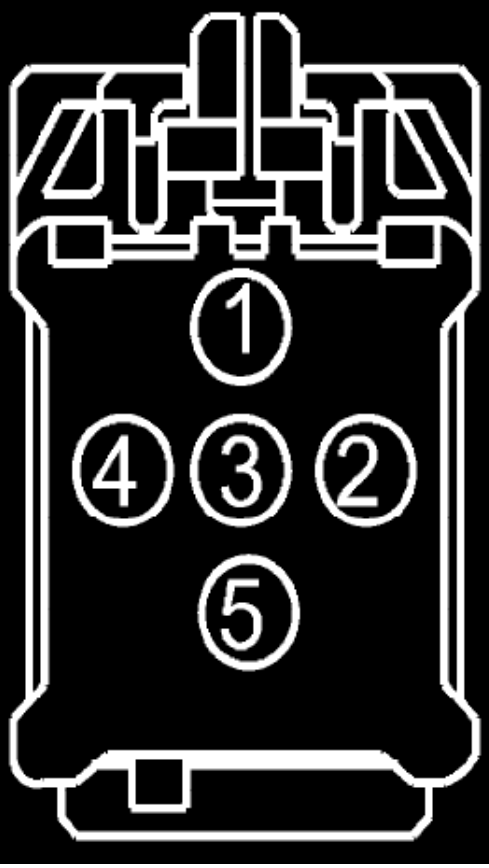
12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Connector: C2047

Description:	Harness:	Base Part #:
INDICATOR FLASHER RELAY	14401	13350



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CLS42 (VT-BN)	18	FLASHER - TURN SIGNAL/HAZARD	
2	GD161 (BK-YE)	18	GROUND - SEAT BRACKET REAR LEFT	
3	CLS32 (BN-YE)	18	SWITCH - HAZARD	
4	SBP17 (RD)	18	FUSE - 17 OR CIRCUIT BREAKER	
5	CBP20 (YE-VT)	18	FUSE - 20 OR CIRCUIT BREAKER	

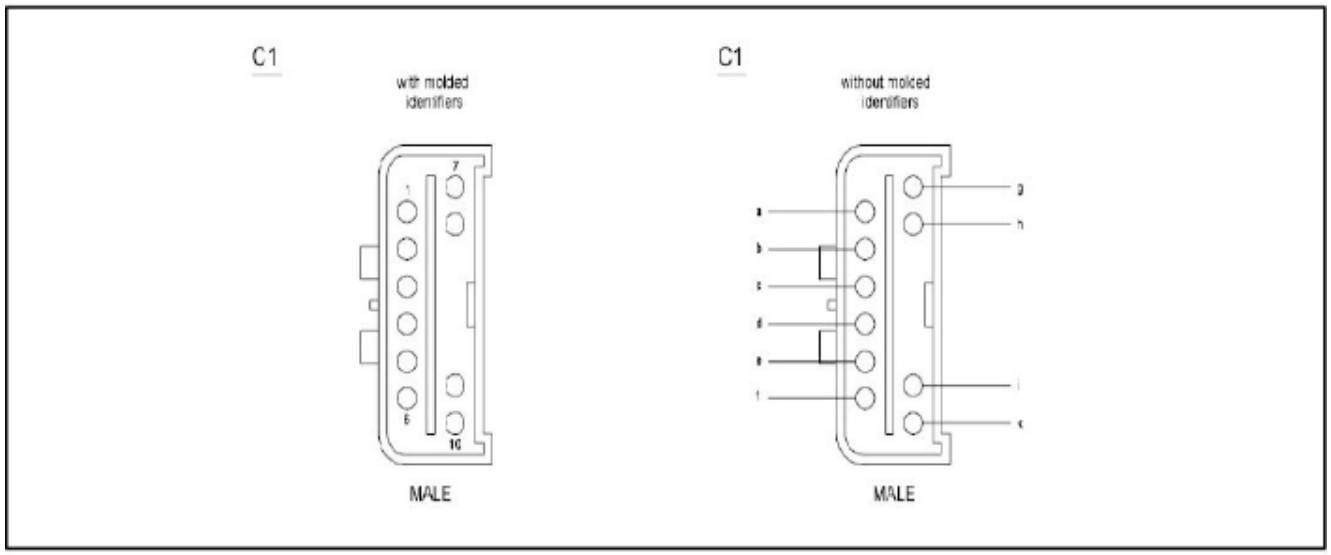
C2047

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



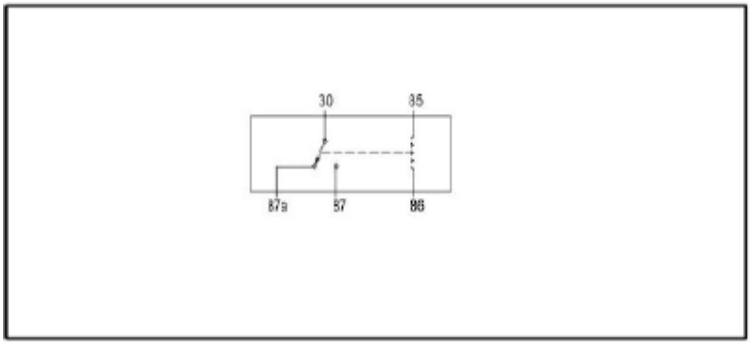
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

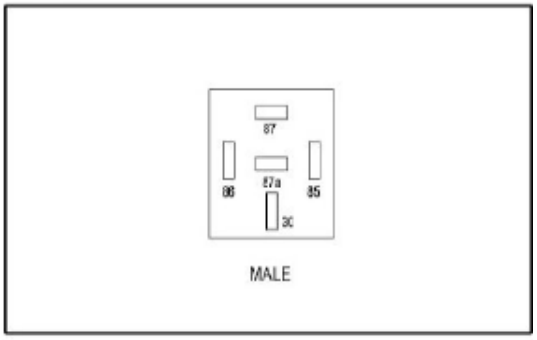
Hazard Flasher Relay: Testing and Inspection Mini ISO Relay

Relay □ Mini ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

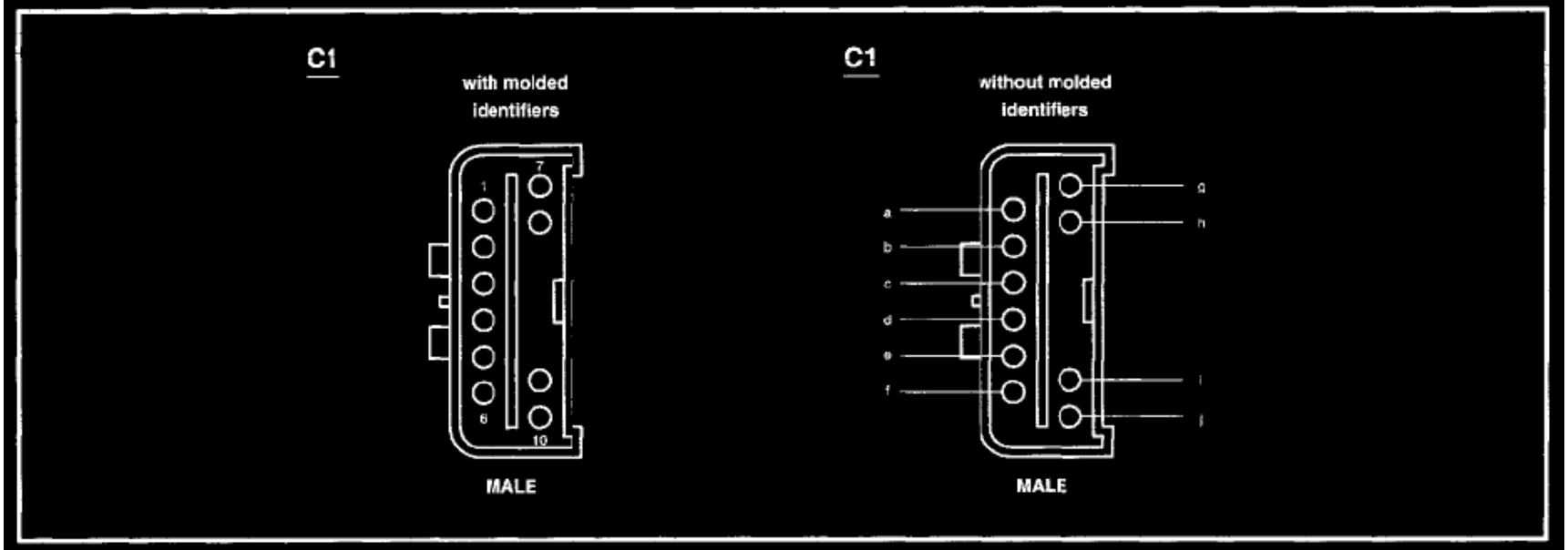
Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step–by–step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



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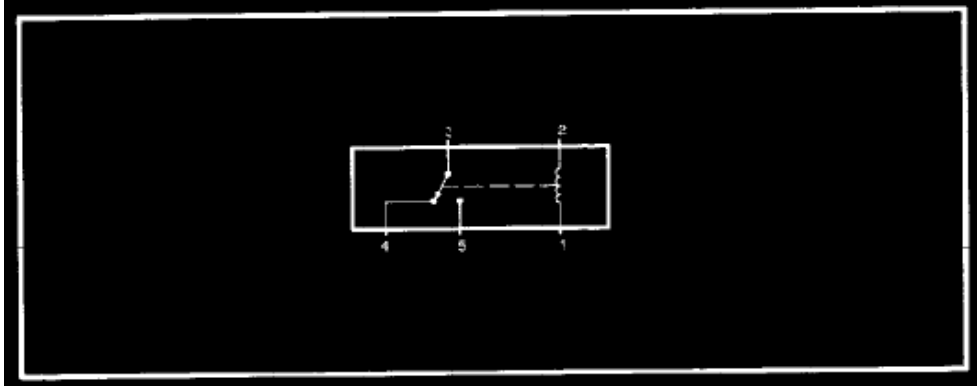
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

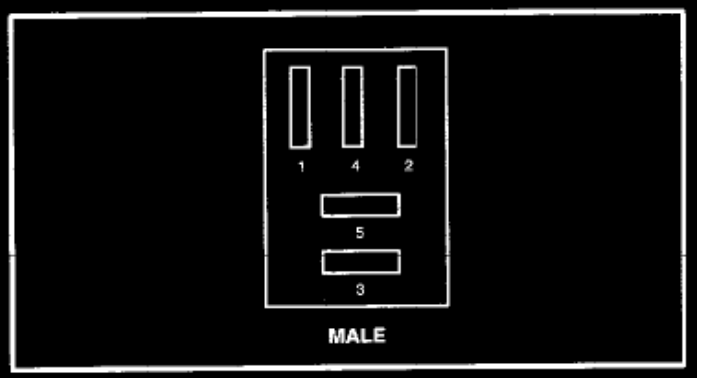
Hazard Flasher Relay: Testing and Inspection Micro ISO Relay

Relay – Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63–102Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil – Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

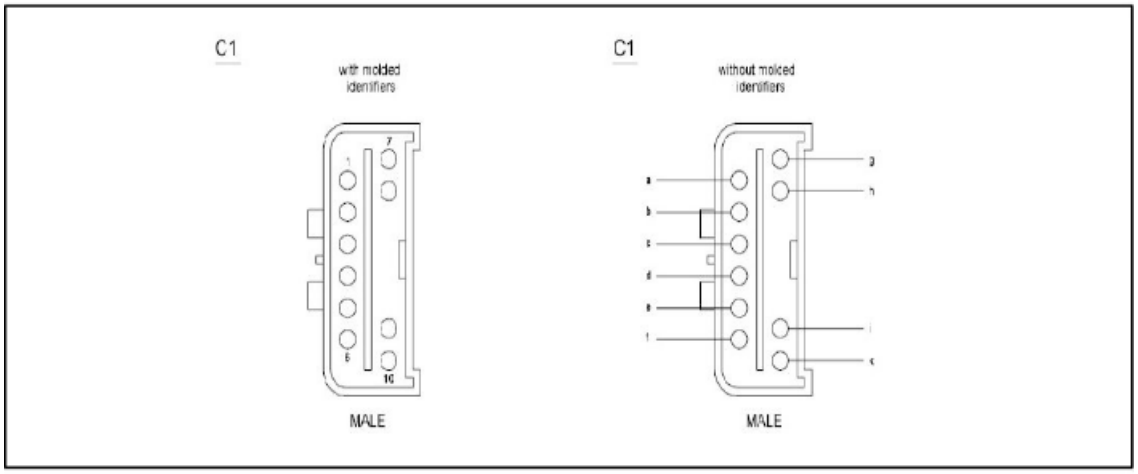
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step□by□step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals

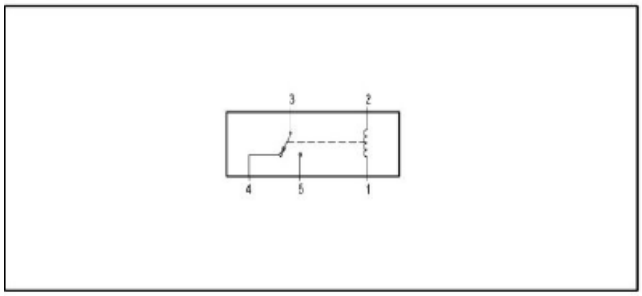


The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column □Circuit to test□. If you wish to test the complete component, perform all tests.

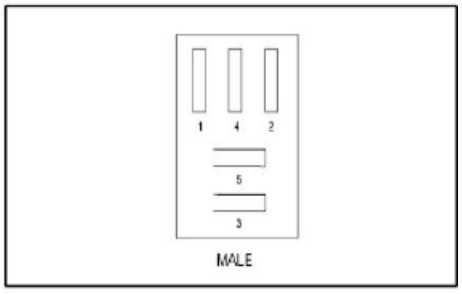
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Relay □ Micro ISO

Schematic



Terminals



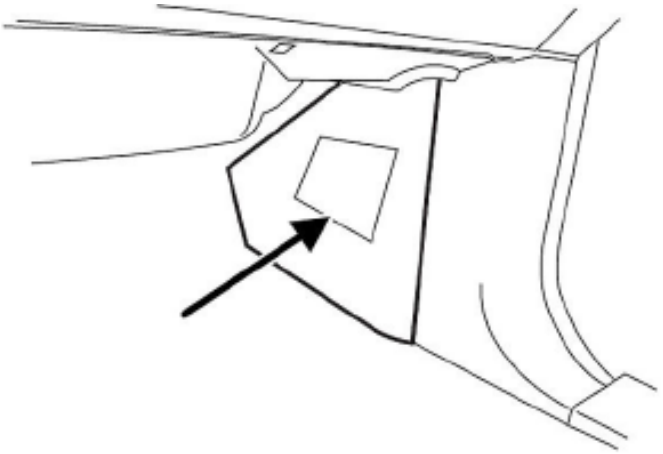
Component testing procedure (no voltage applied)

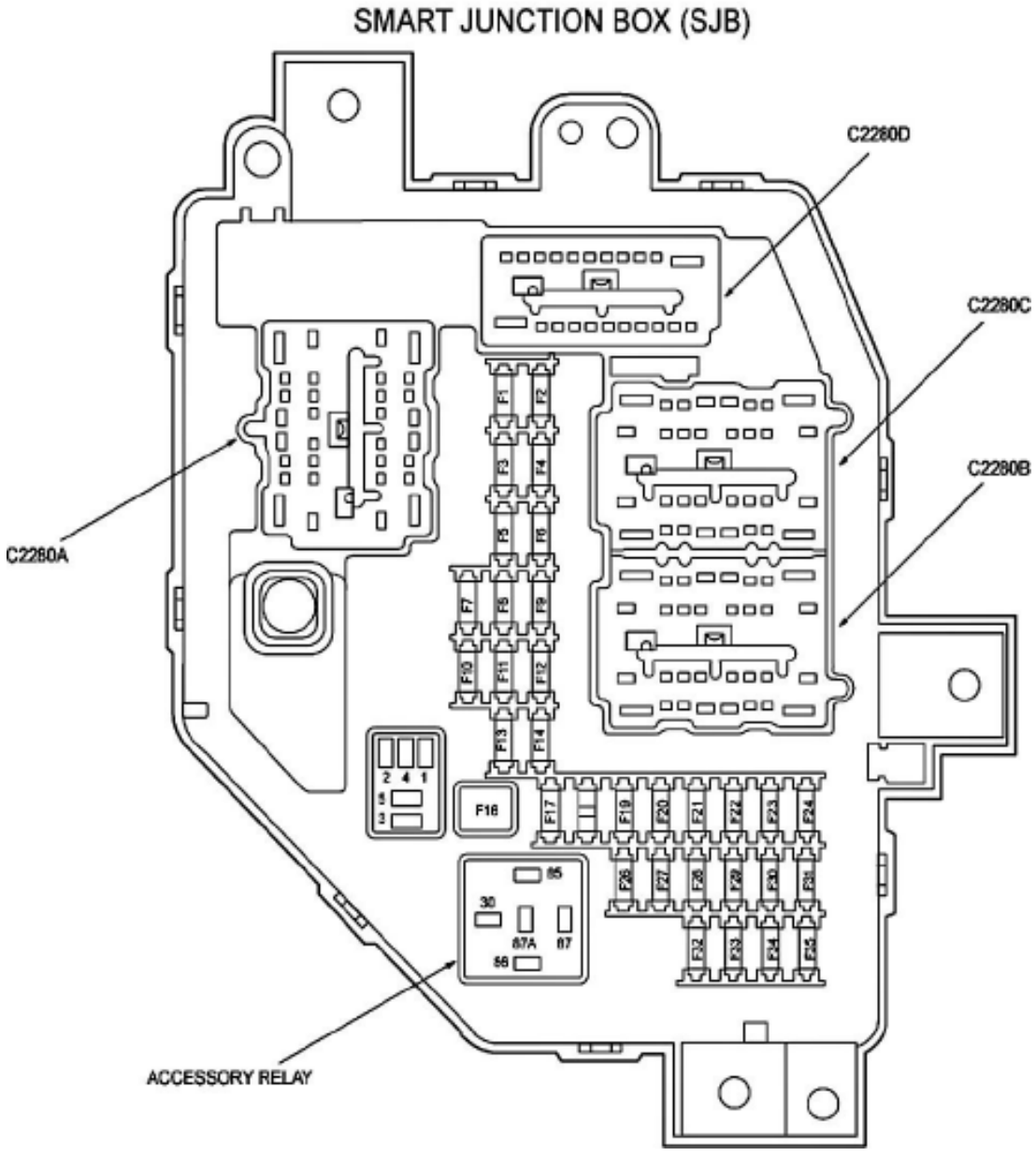
Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63□102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil □ Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Lighting and Horns > Relays and Modules - Lighting and Horns > Horn Relay > Component Information > Locations



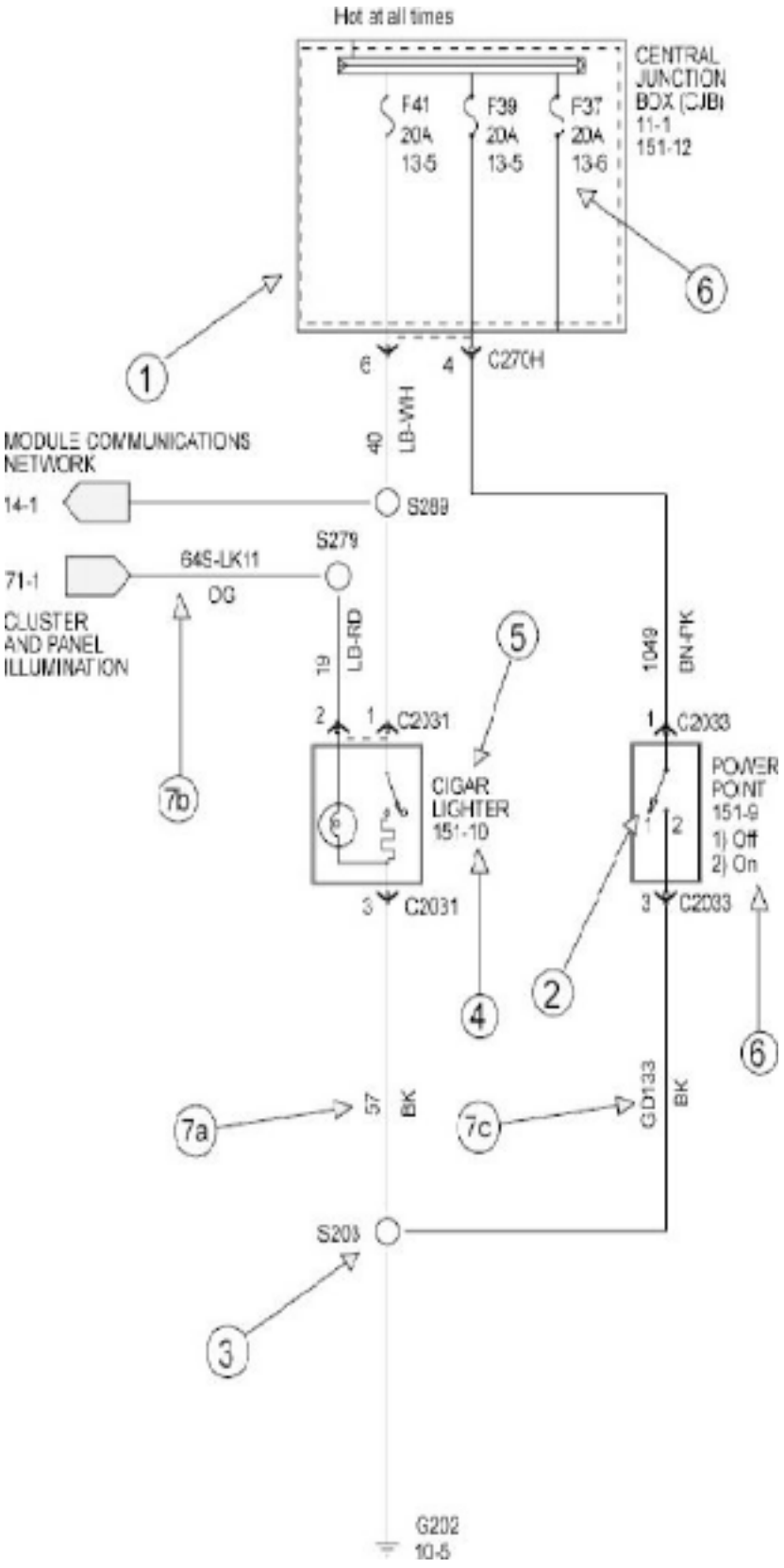


Horn Relay: Locations

FUSE	AMPS	Circuits Protected
F1	5A	Illumination dimmer
F2	10A	Trailer tow connector - Park
F3	10A	Headlamp, right (Low beam lamp feed)
F4	10A	Headlamp, left (Low beam lamp feed)
F5	5A	Windshield wiper module
F6	10A	Audio unit, Door lock switch illumination
F7	5A	Not Used
F8	10A	Restraints Control Module (RCM), Occupant Classification System Module (OCSM), Passenger Air bag Deactivation (PAD) Indicator
F9	5A	Instrument Cluster (IC), Air bag indicator
F10	10A	4X4 control module, Instrument Cluster (IC)
F11	10A	Smart Junction Box (SJB), logic power
F12	15A	Subwoofer amplifier with audiophile, Satellite radio receiver
F13	15A	Interior lamp relay, Horn relay
F14	15A	High beam lamp feed to High beam indicator, Headlamp, right, Headlamp, left
F16	30A	Accessory relay (Power windows)
F17	15A	Indicator flasher relay
F18	-	Not Used

FUSE	AMPS	Circuits Protected
F19	20A	Brake pedal position switch (Stoplamps)
F20	10A	Transmission control switch, Digital Transmission Range (TR) sensor, Speed control servo, Anti-lock Brake System (ABS) module, Indicator flasher relay, Reversing lamps switch, Speed control On/Off switch, Speed control Set/Resume switch
F21	5A	Digital Transmission Range (TR) sensor, Starter relay, Powertrain Control Module (PCM)
F22	5A	Audio unit
F23	30A	Main light switch, Multifunction switch
F24	20A	Audio unit
F26	2A	Deactivator switch
F27	10A	Blend door actuator, Climate control assembly
F28	15A	4X4 control module
F29	20A	Cigar lighter, front, Data Link Connector (DLC)
F30	5A	Exterior rear view mirror switch
F31	20A	Park lamp relay
F32	5A	Brake pedal position switch (logic power), Brake shift interlock
F33	5A	Instrument Cluster (IC), Neutral tow indicator
F34	20A	Power point
F35	15A	Door lock/unlock relay, Driver door unlock relay

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Lighting and Horns > Relays and Modules - Lighting and Horns > Horn Relay > Component Information > Diagrams > Diagram Information and Instructions



Horn Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

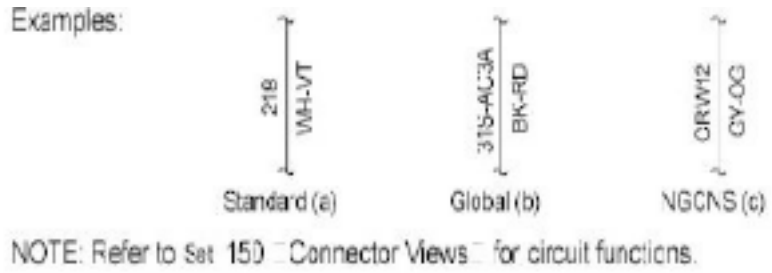
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

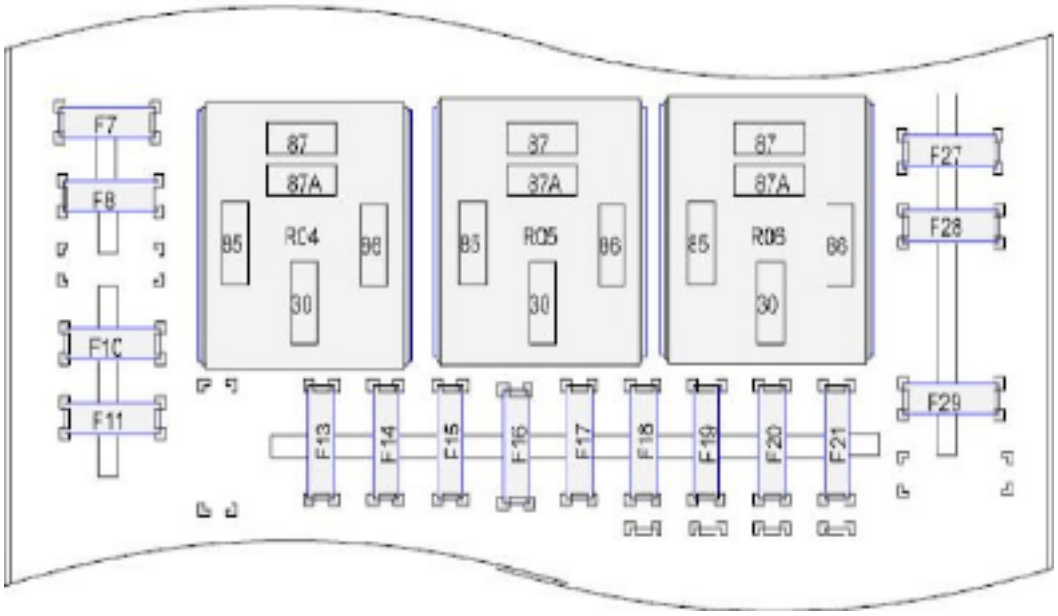
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

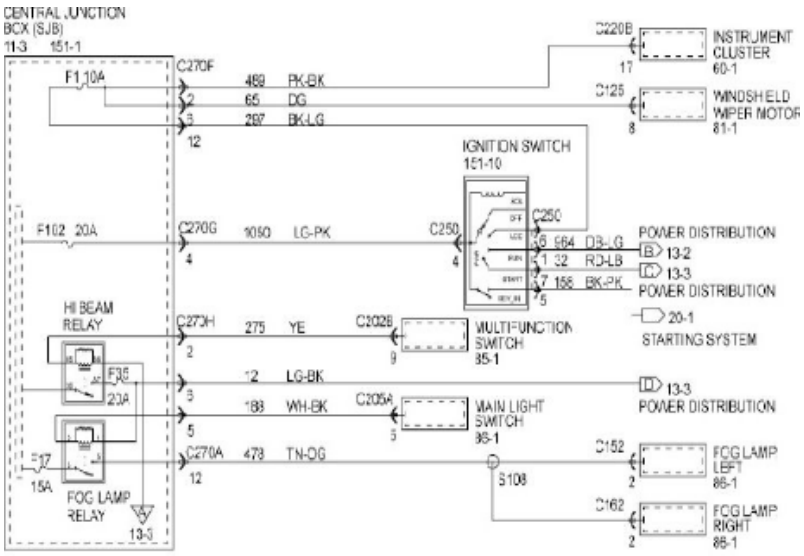
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

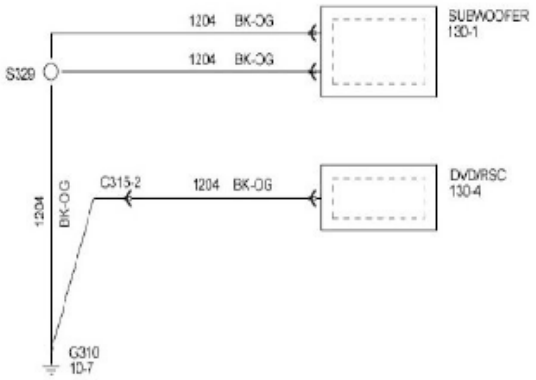
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

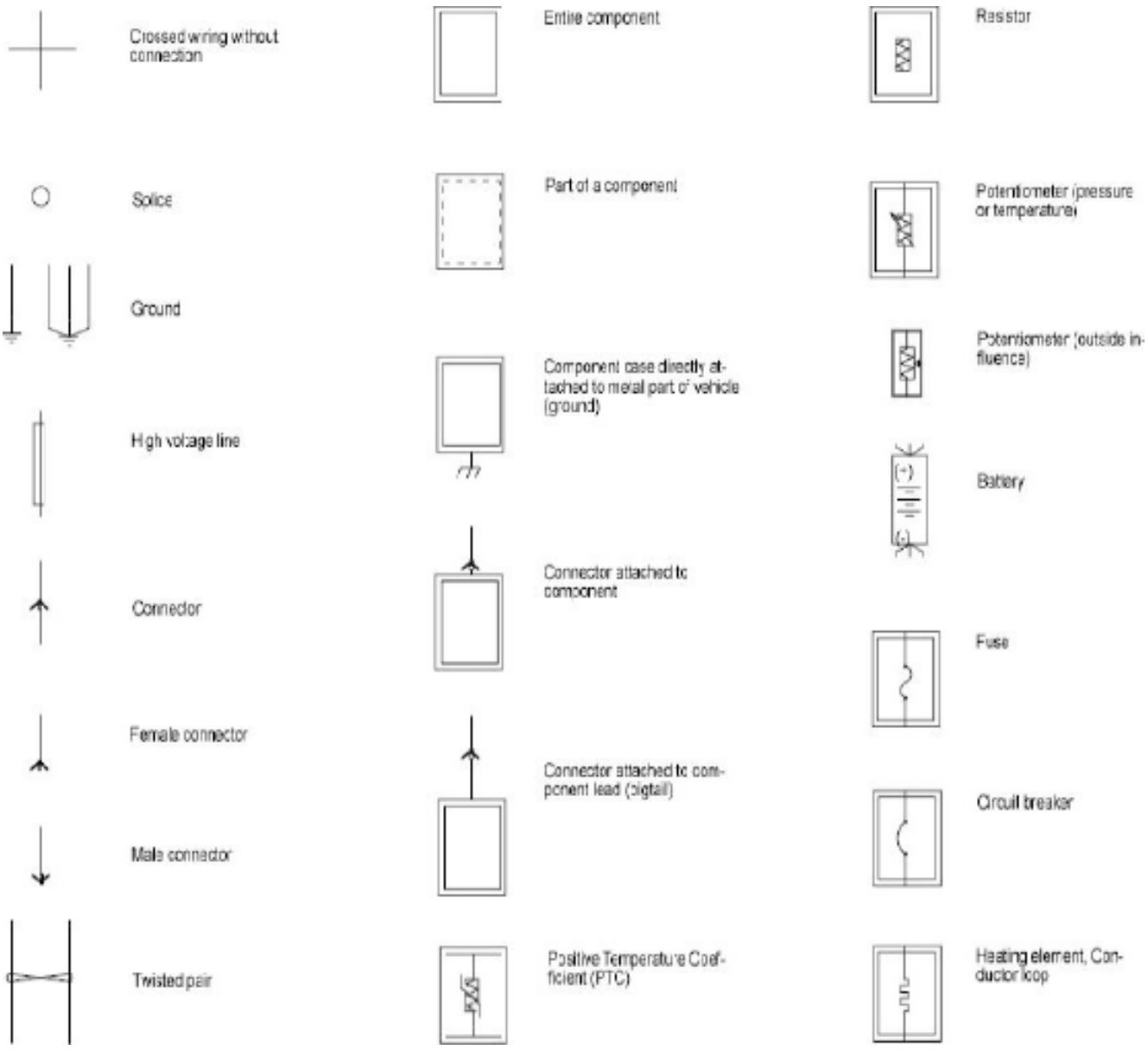
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

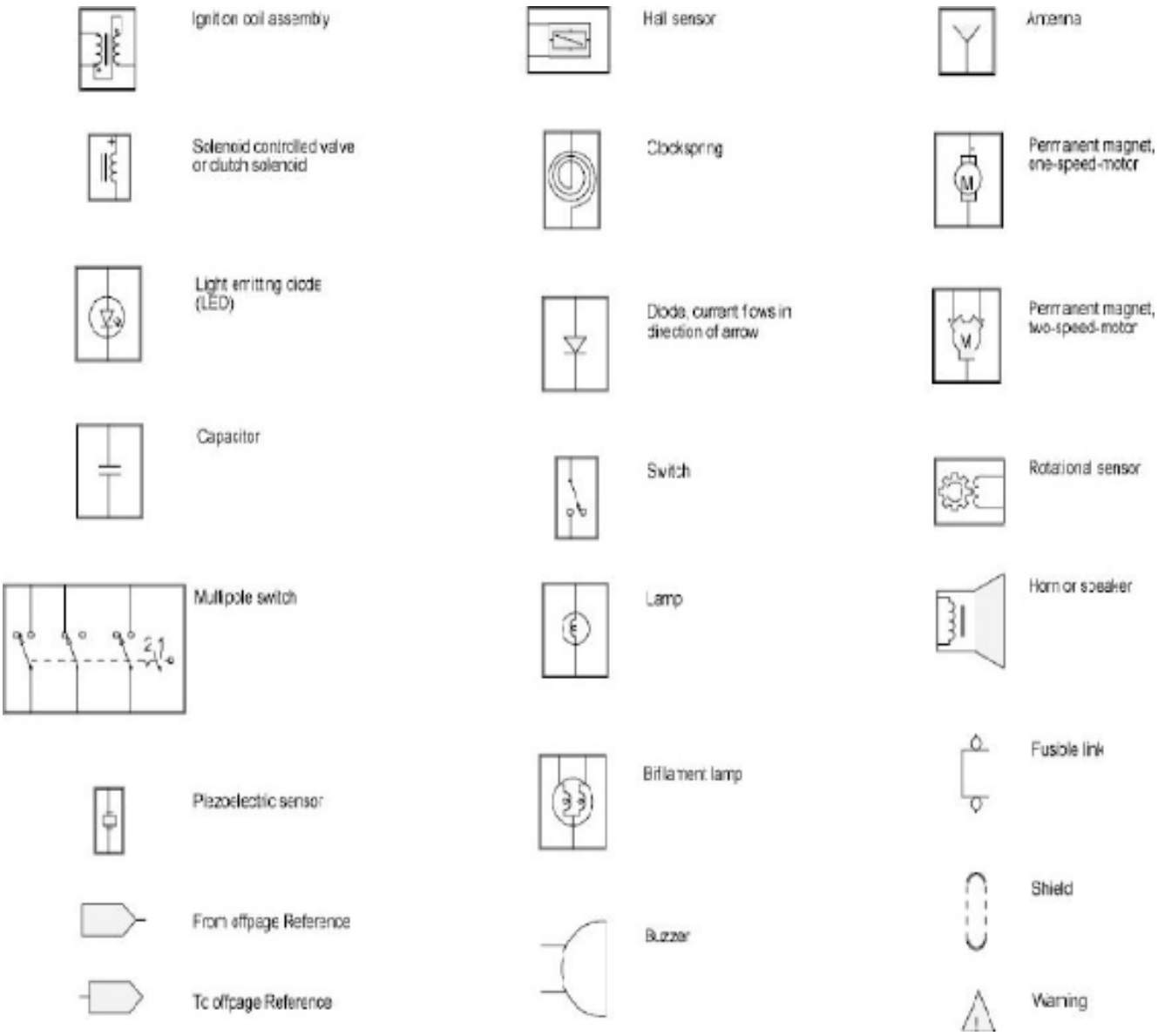
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

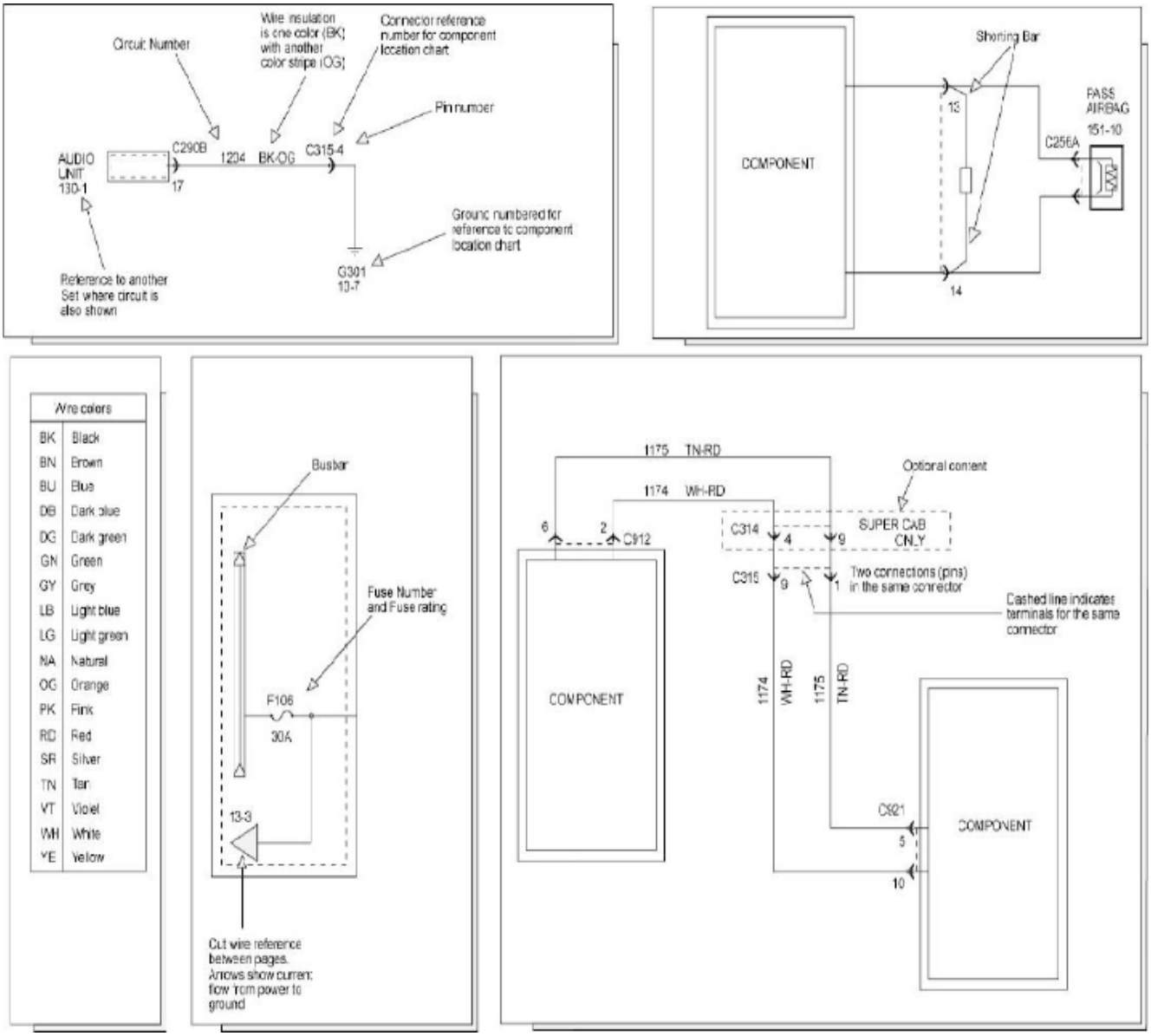
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

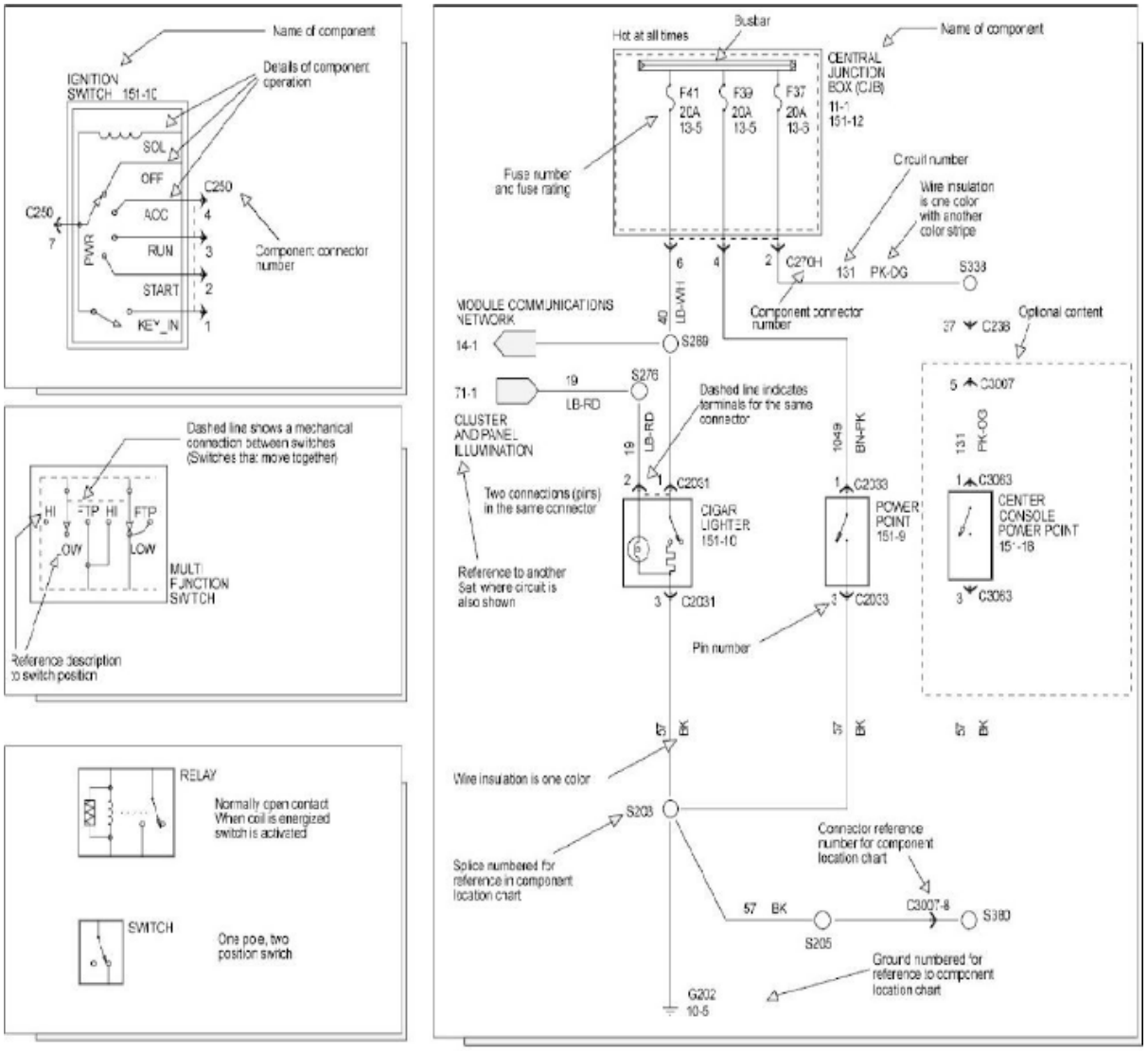
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

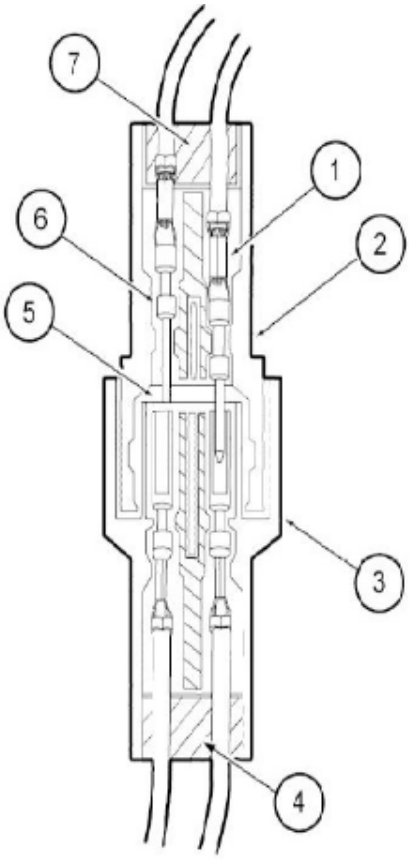


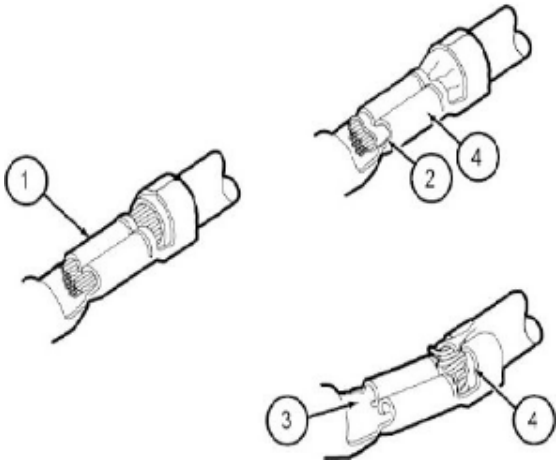
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Horn Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

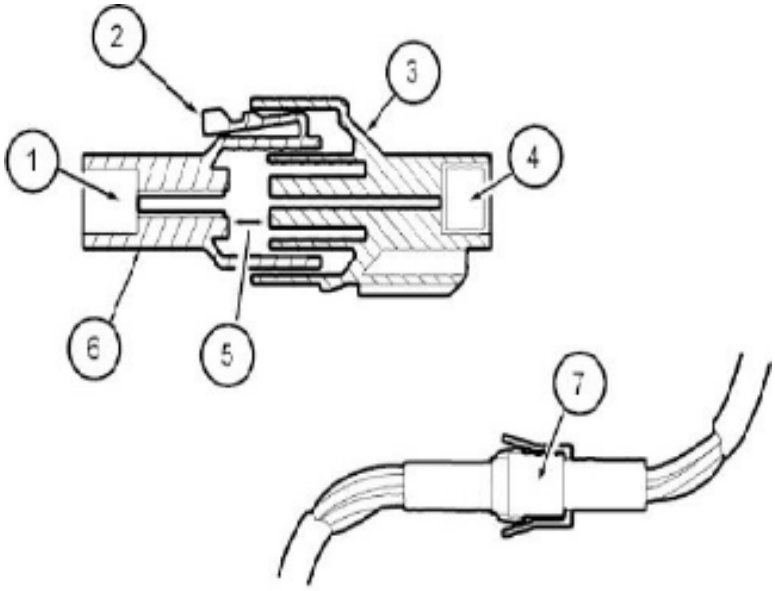
5 = Intermittent contact

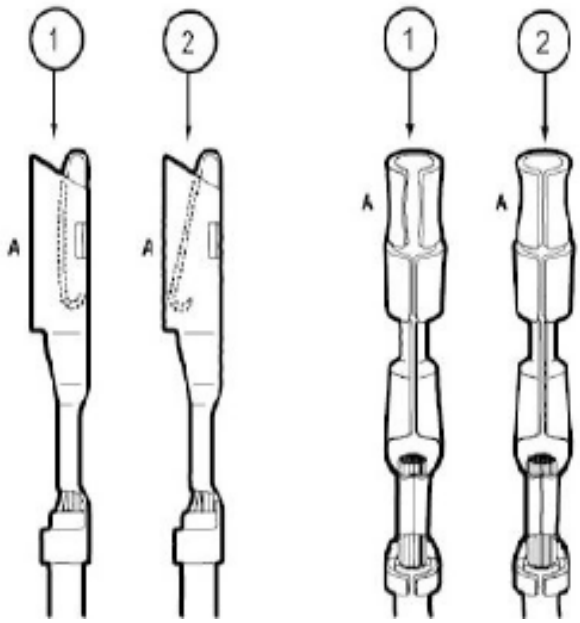
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

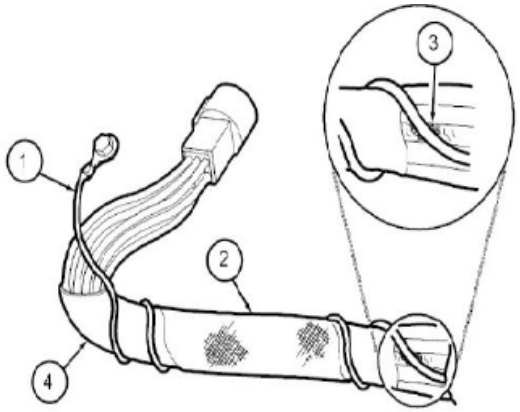
Deformed (enlarged) female terminals

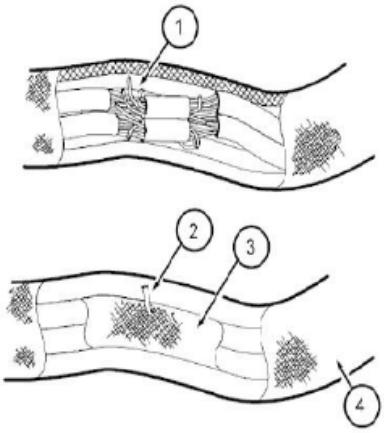
1 = Enlarged

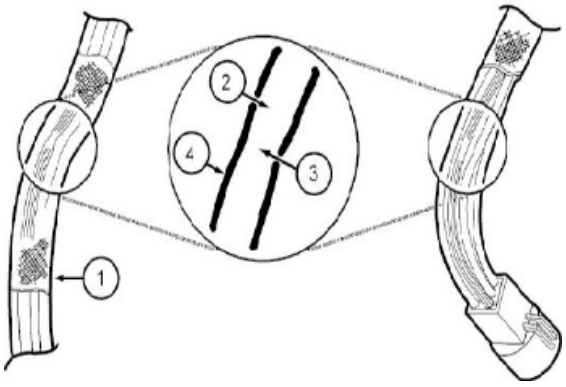
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

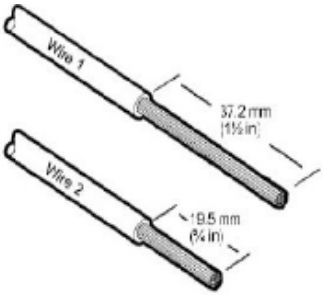
Splice covered 2

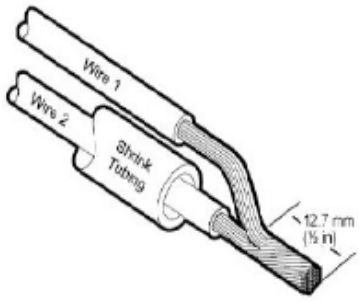
= Wire strand

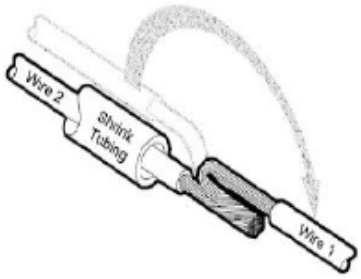
3 = Splice tape

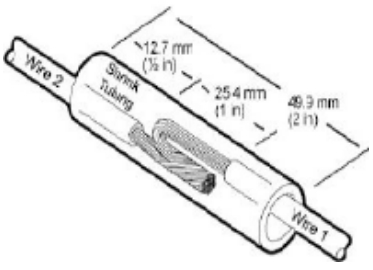
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

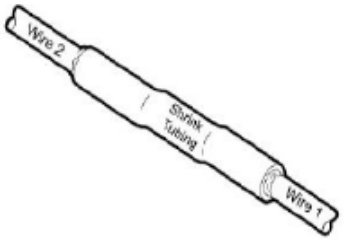
NOTE: -

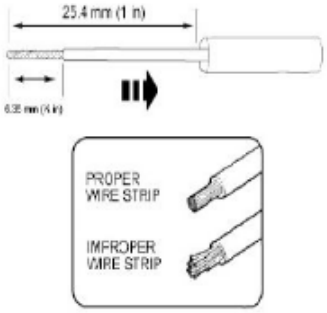
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

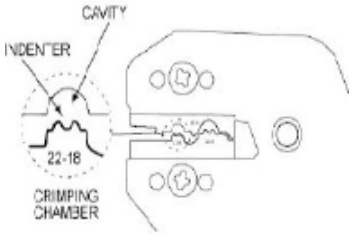
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

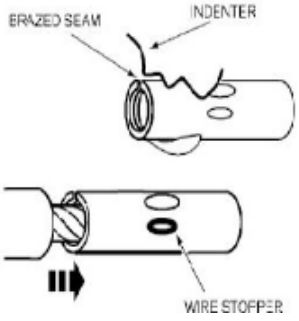
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
6.35 mm (¼ in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

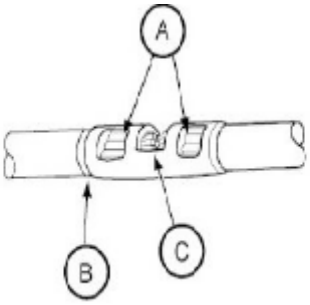
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

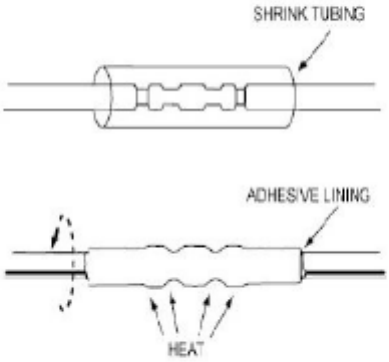
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4□ strip, cut 9 strands	* 1/4□ strip, cut 2 strands	1/4□ strip, no fold	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip, fold 2x dia.	1□ strip, fold 3x dia.
	16-14	* 1/4□ strip, cut 7 strands	1/4□ strip, no fold	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip fold 2x dia	1□ strip, fold 3x dia.	1 1/4□ strip, fold 4x dia.	Not Recommended
	12-10	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip, fold 2x dia.	1□ strip fold 3x dia.	1 1/4□ strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Pigtail only

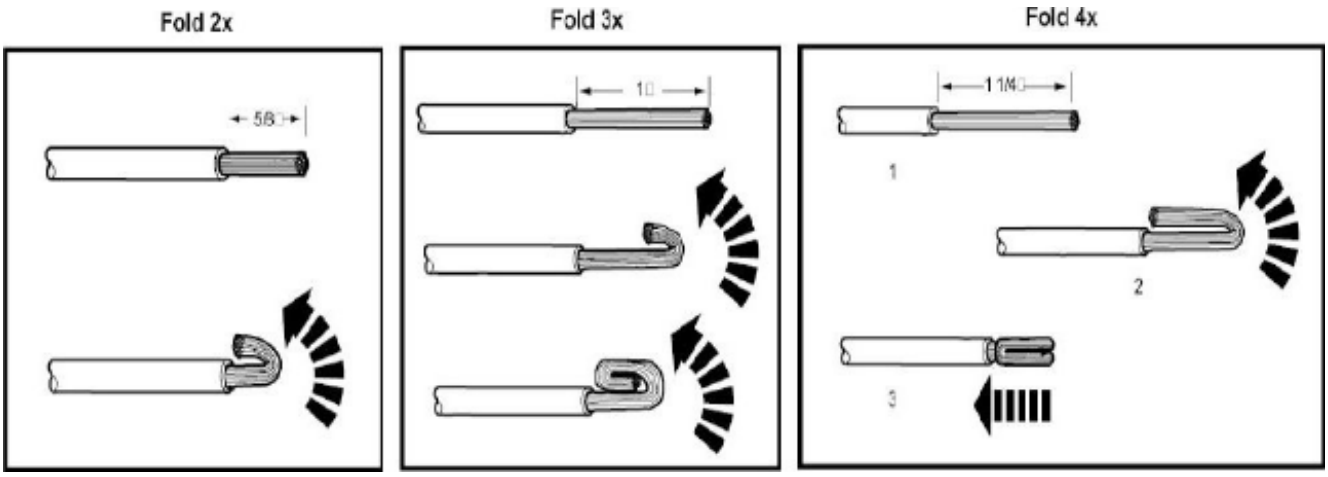
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



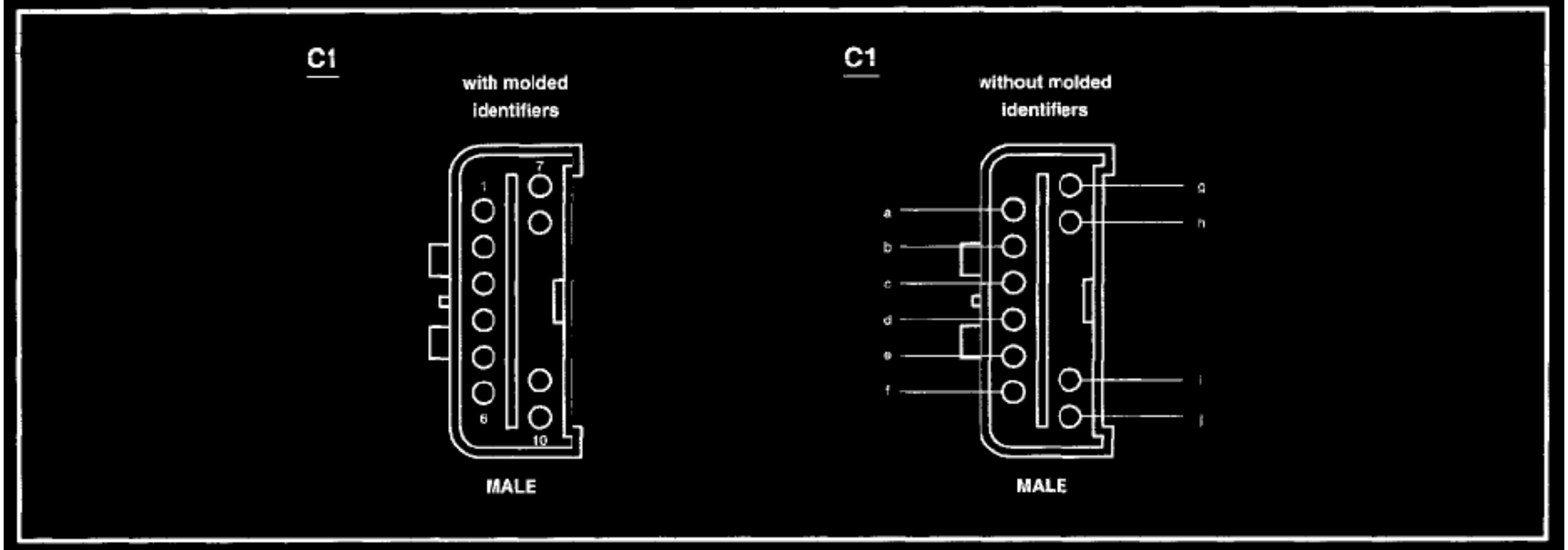
The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step–by–step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



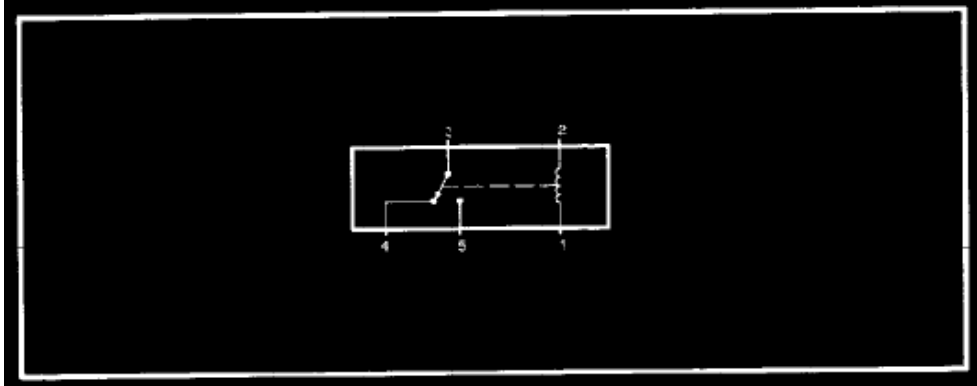
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

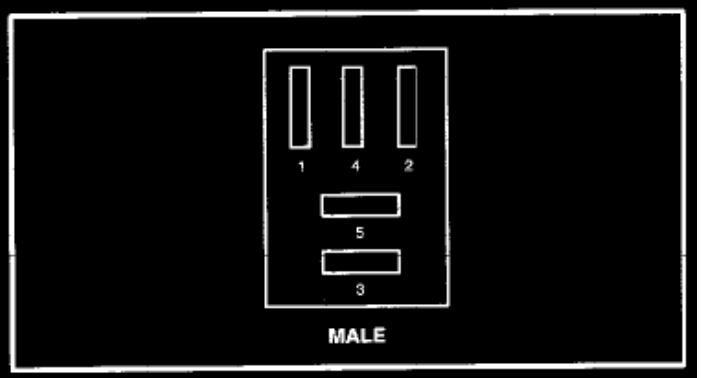
Horn Relay: Testing and Inspection Micro ISO Relay

Relay – Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63–102Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil – Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

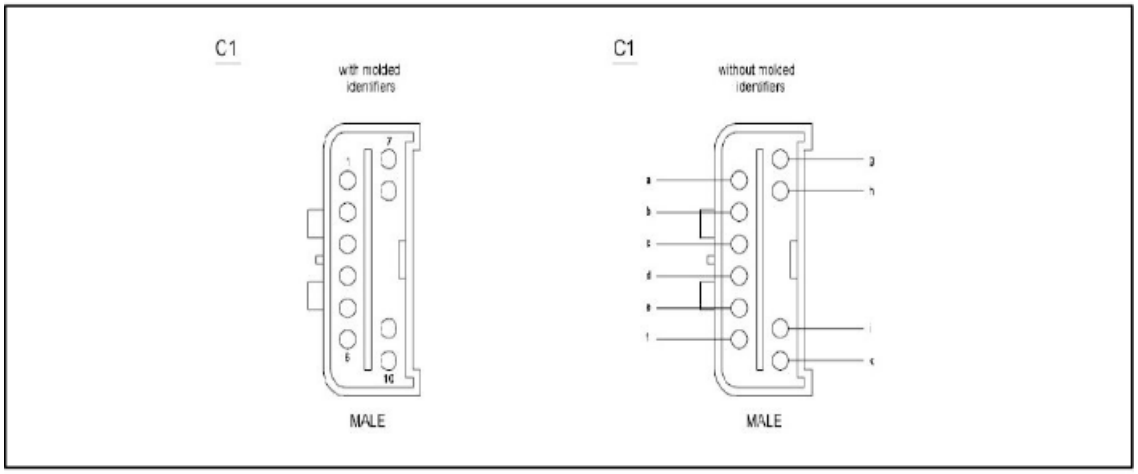
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step□by□step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals

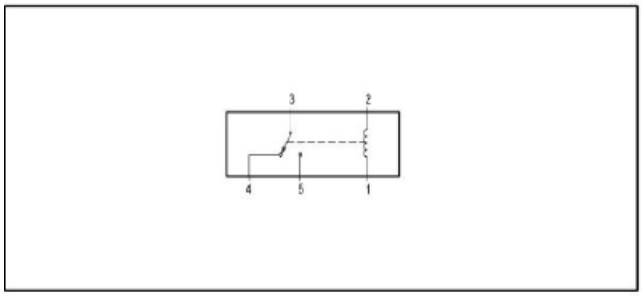


The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column □Circuit to test□. If you wish to test the complete component, perform all tests.

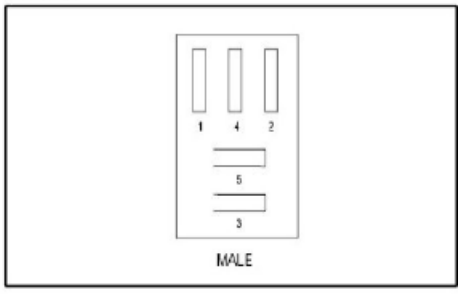
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Relay □ Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63□102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil □ Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

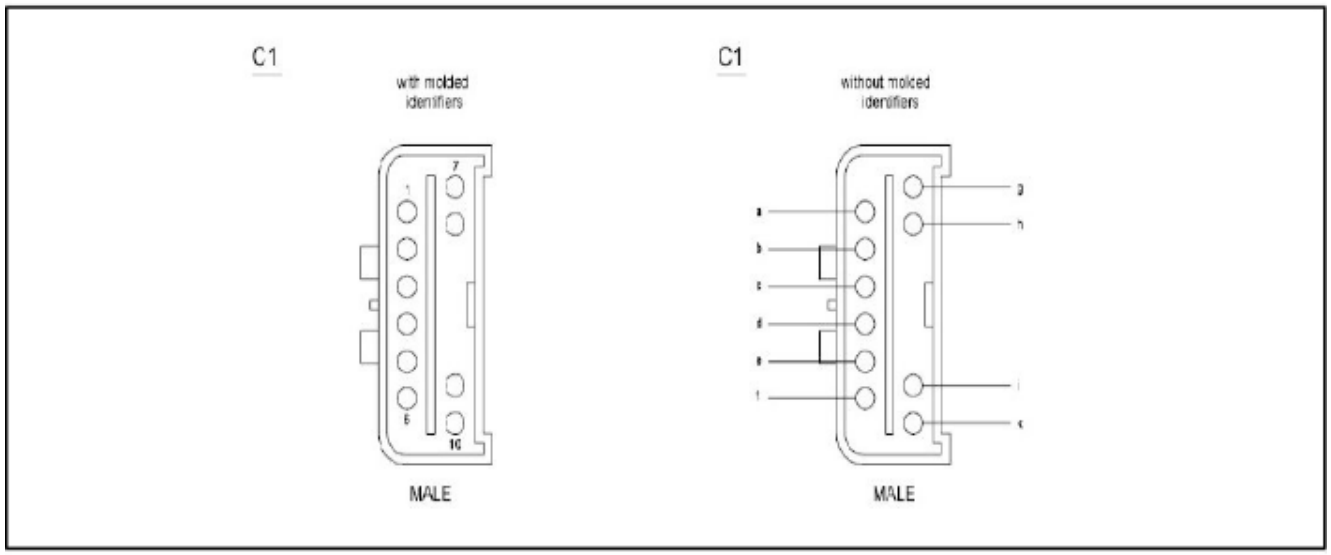
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step by step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



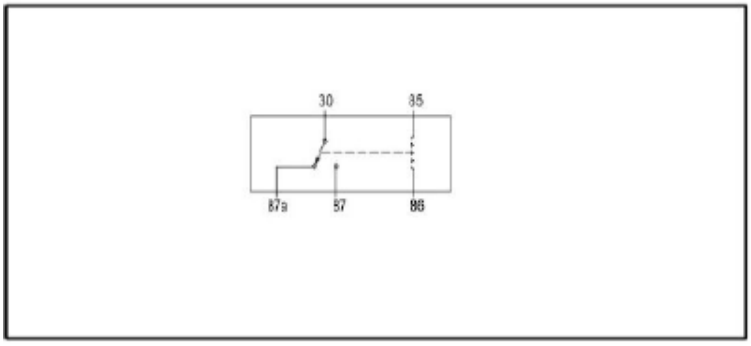
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

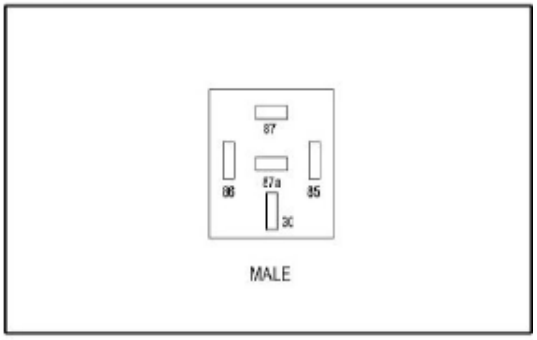
Horn Relay: Testing and Inspection Mini ISO Relay

Relay □ Mini ISO

Schematic



Terminals



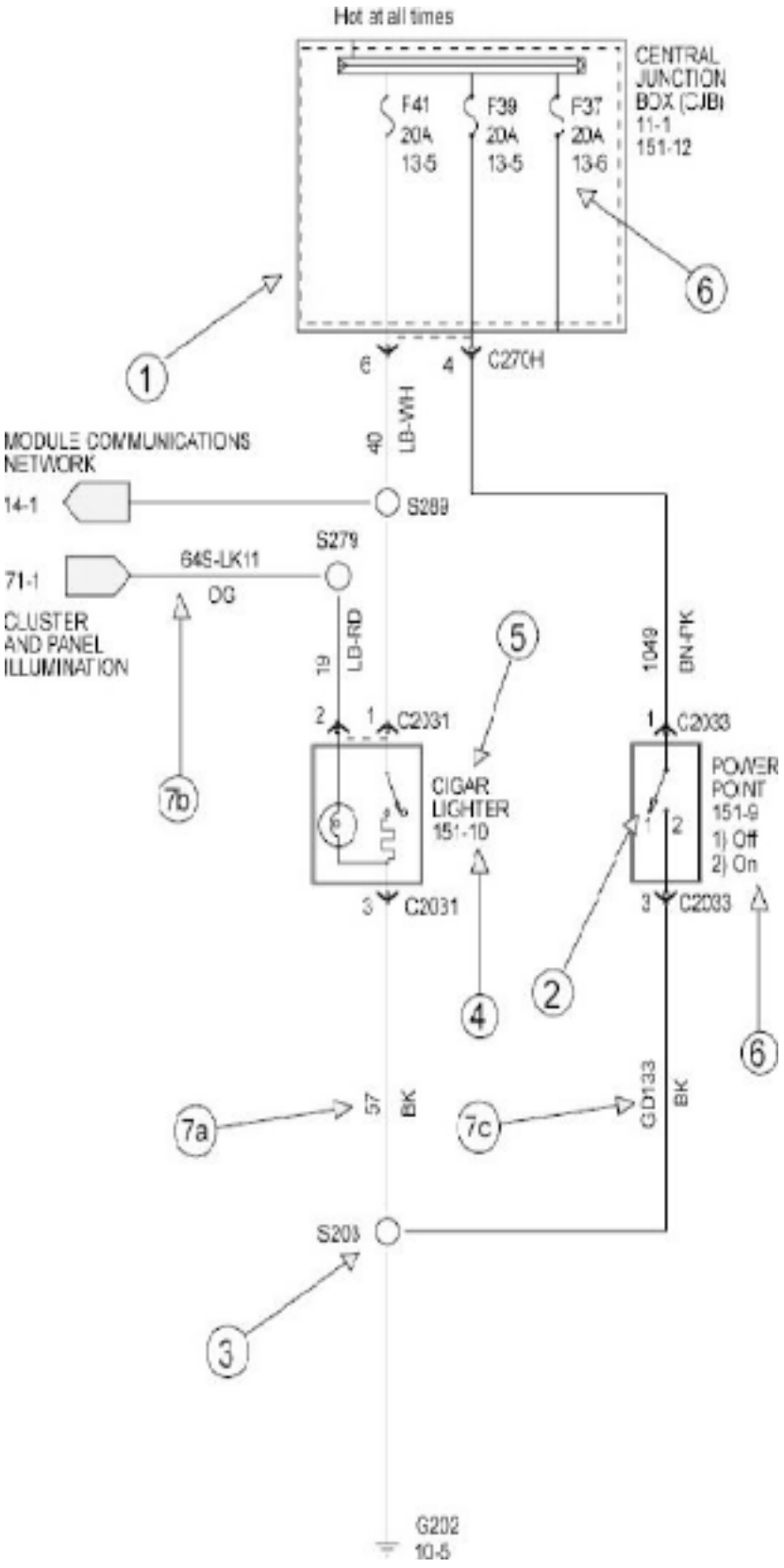
Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	45 □ 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Lighting and Horns > Relays and Modules - Lighting and Horns > Interior Lighting Relay > Component Information > Diagrams > Diagram Information and Instructions



Interior Lighting Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

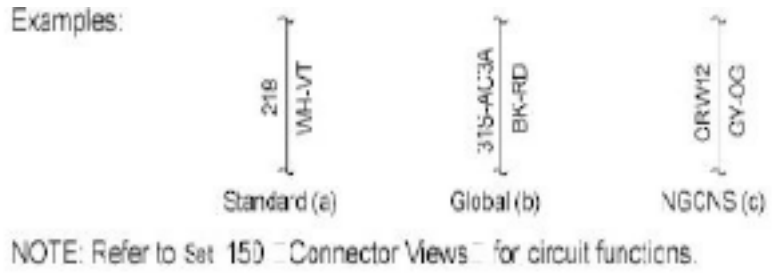
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

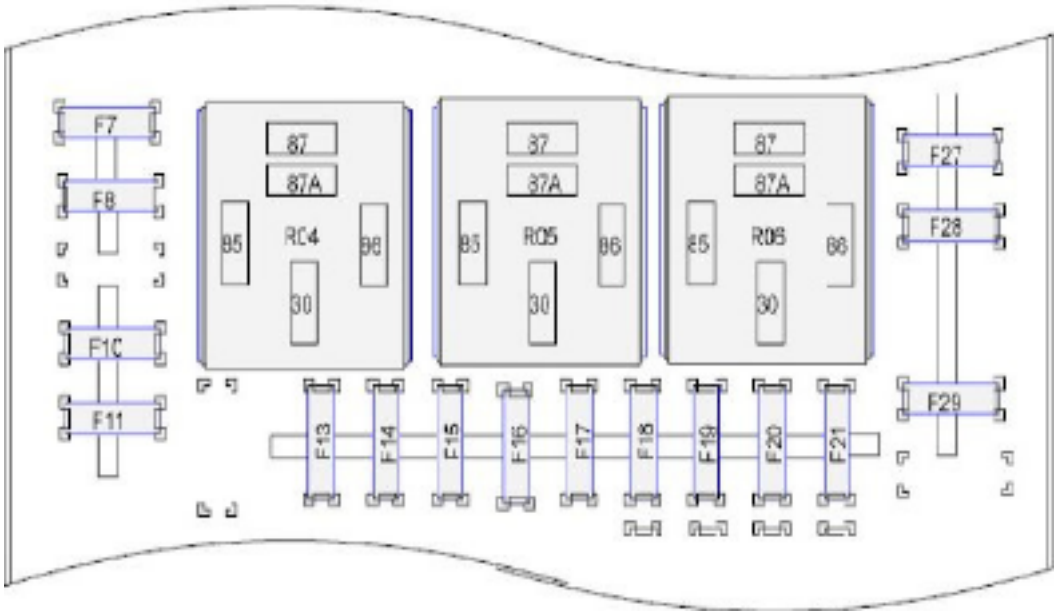
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

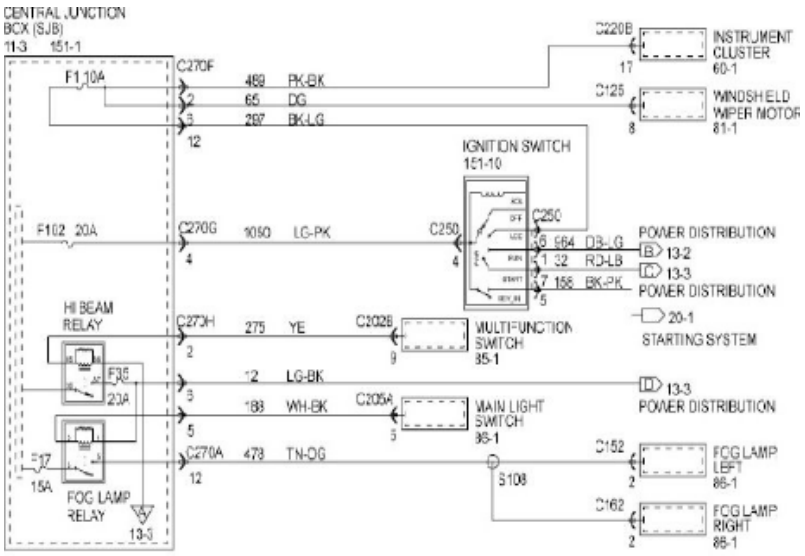
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

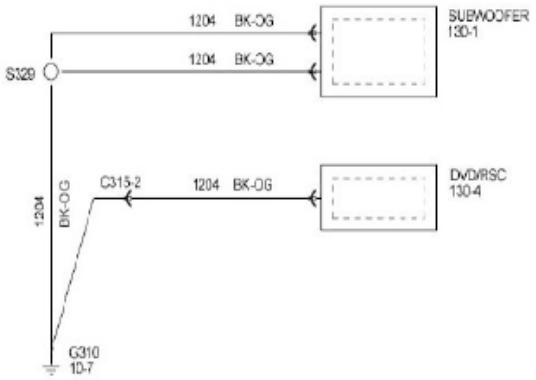
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

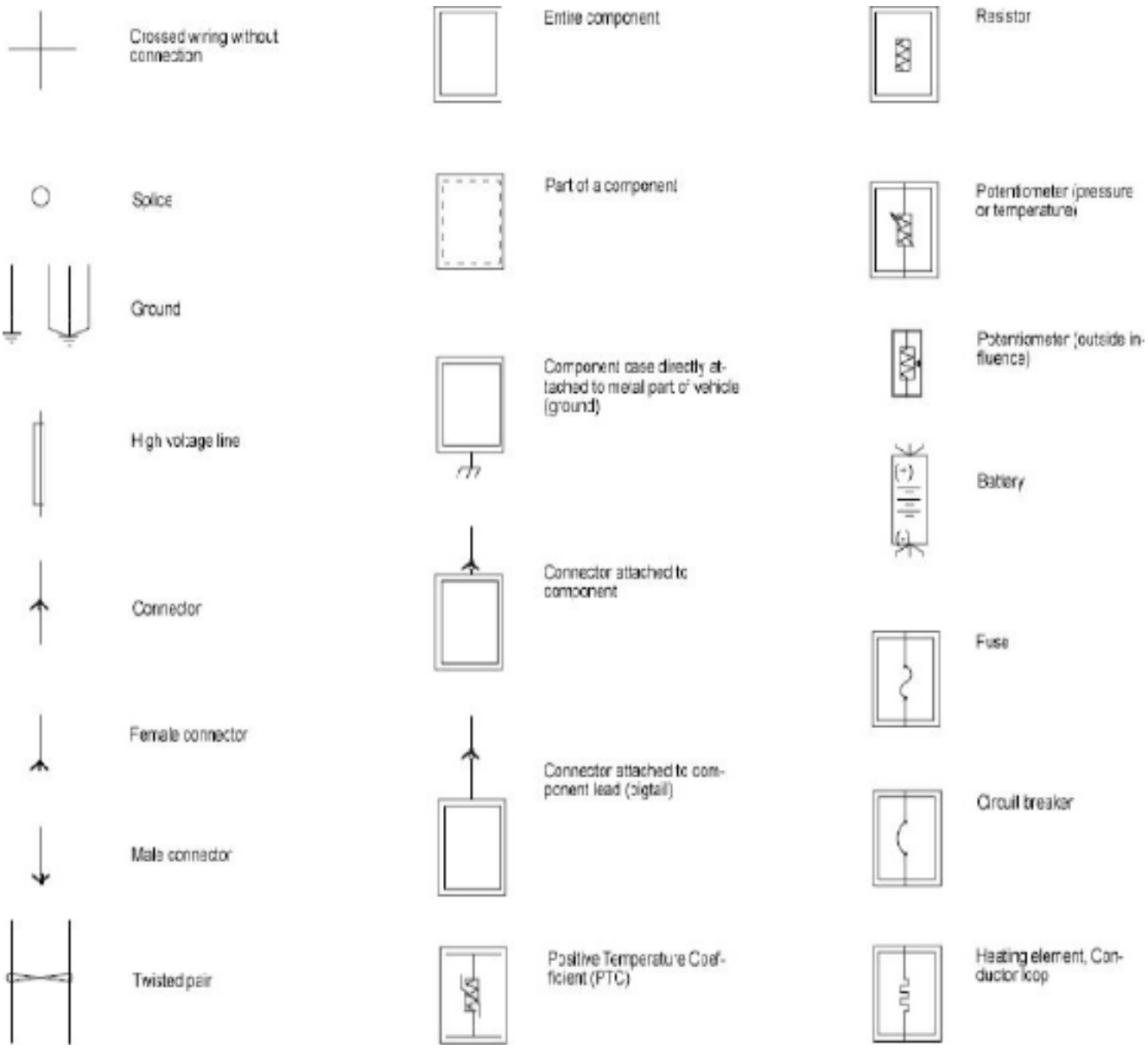
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

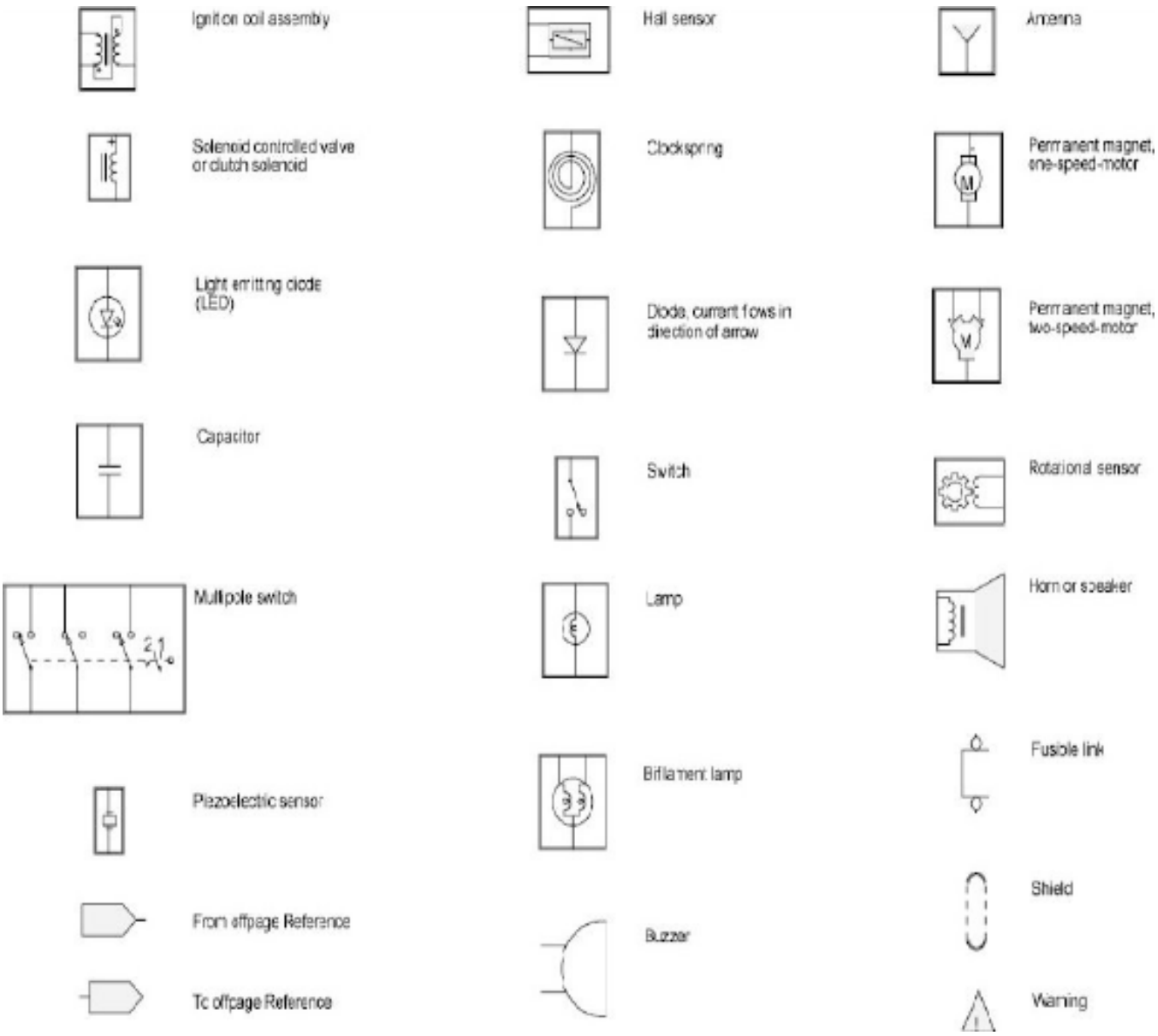
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

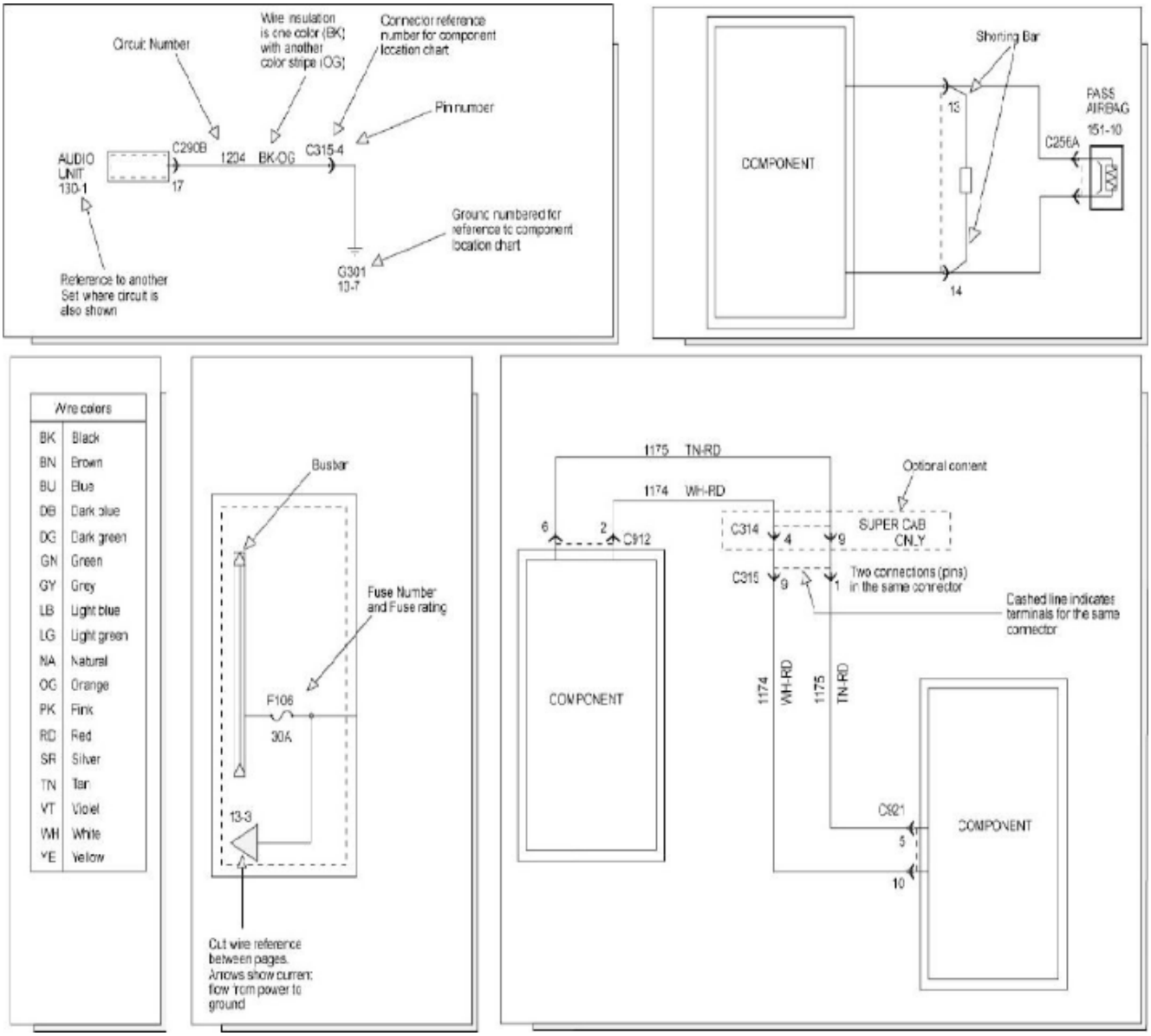
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

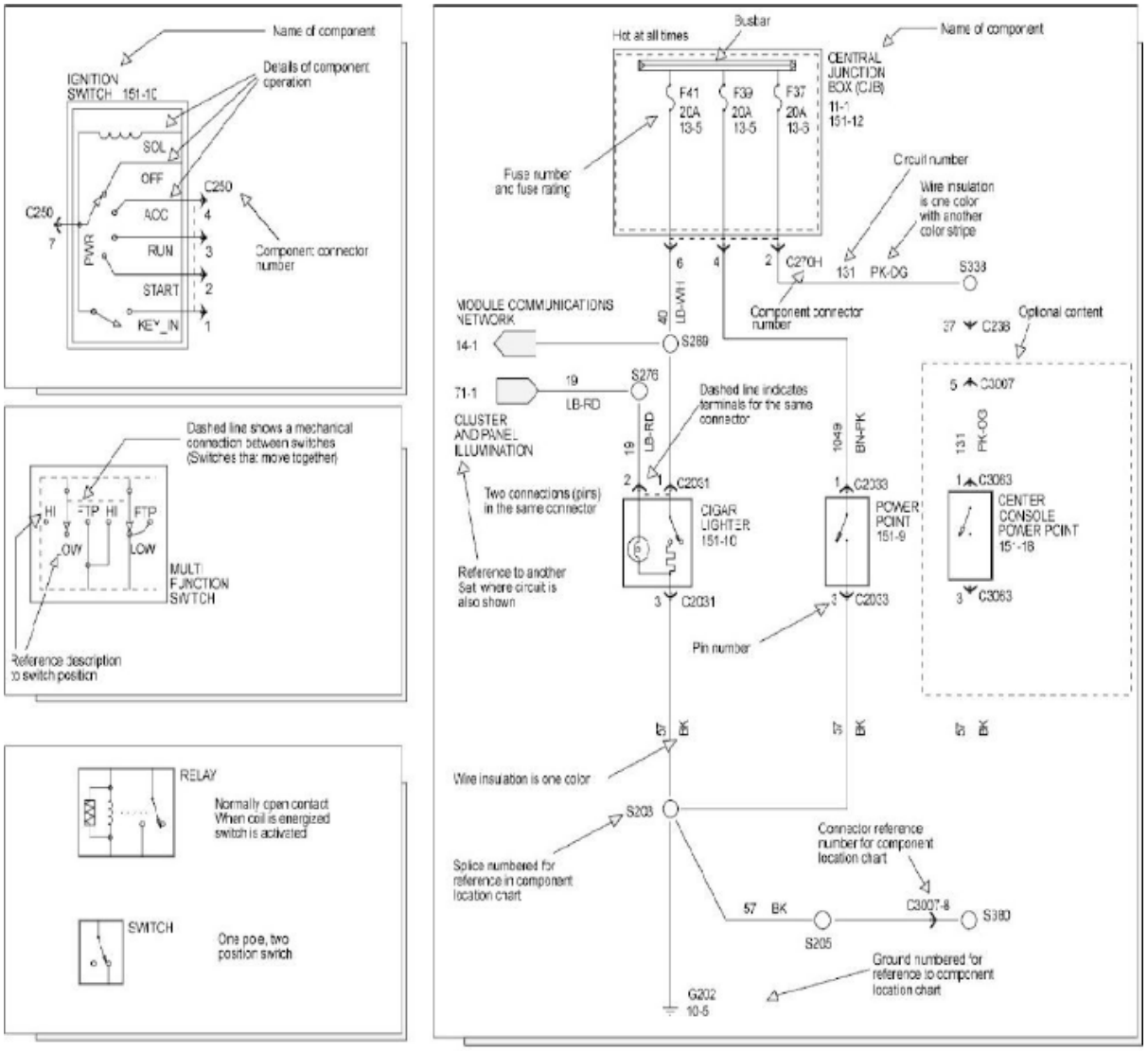
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

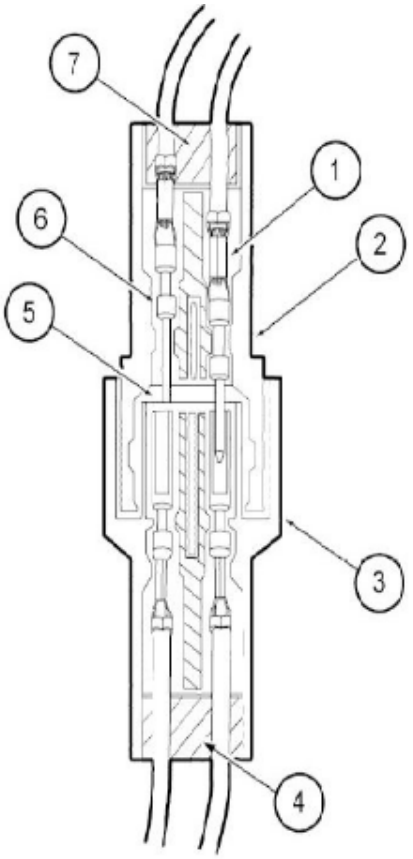


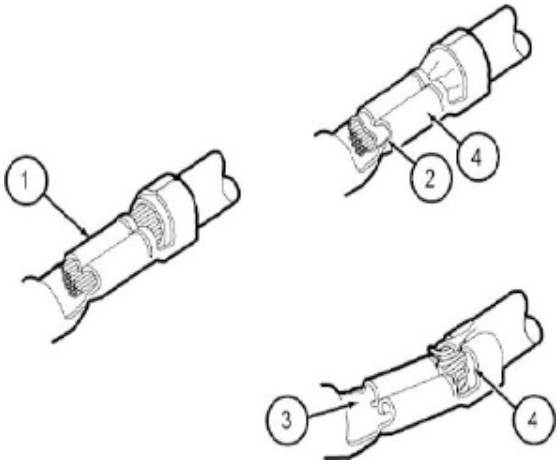
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Interior Lighting Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

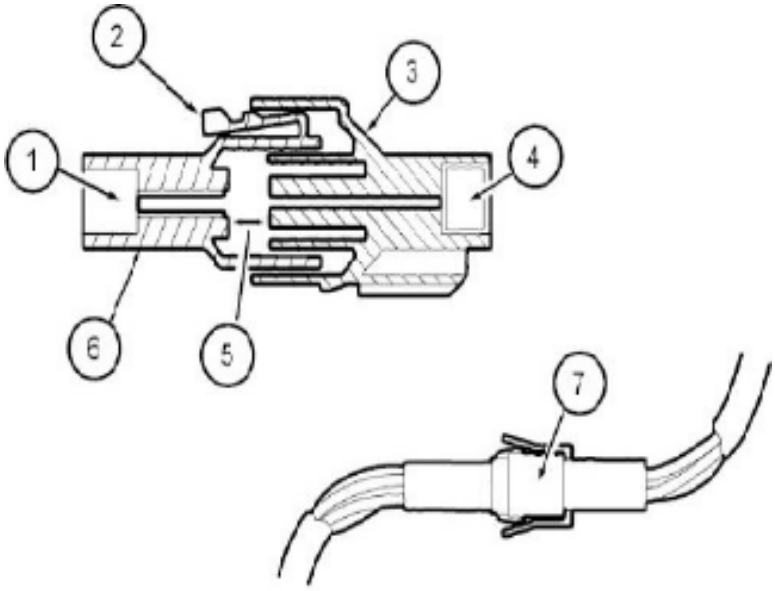
5 = Intermittent contact

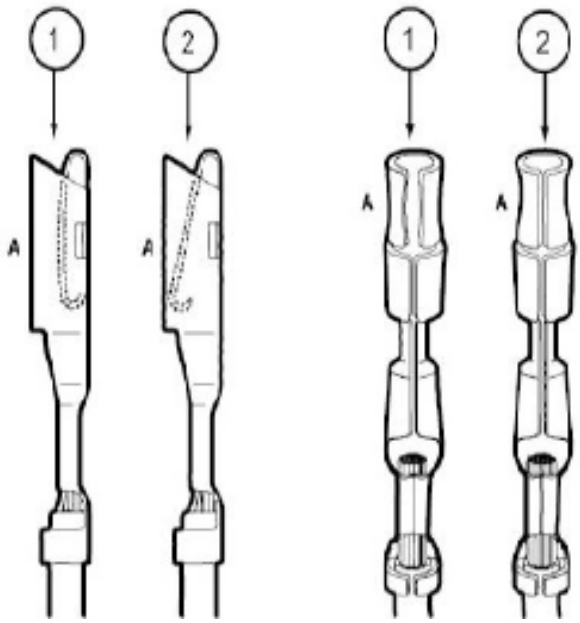
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

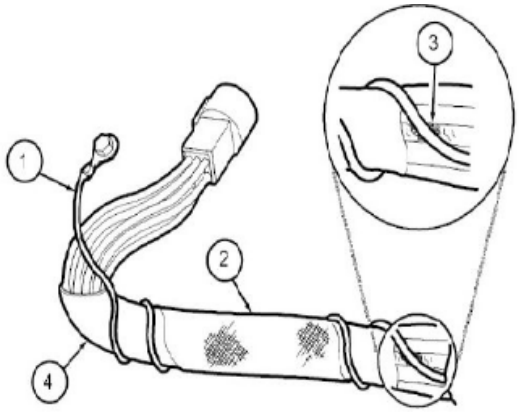
Deformed (enlarged) female terminals

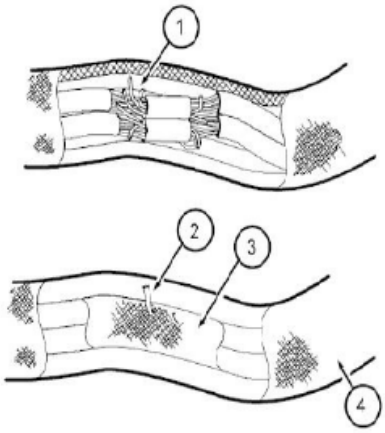
1 = Enlarged

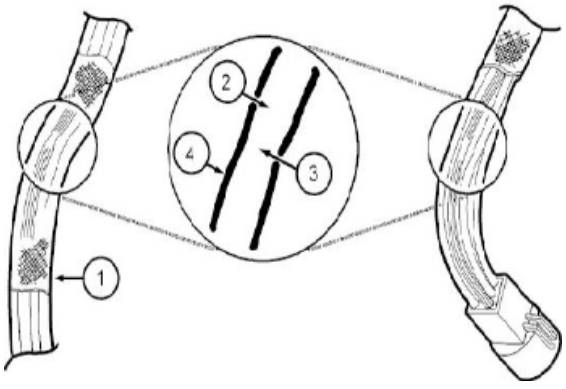
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

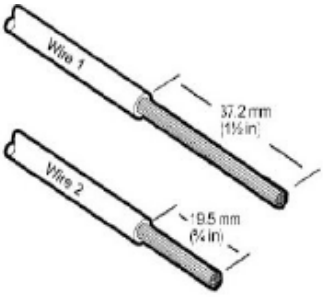
Splice covered 2

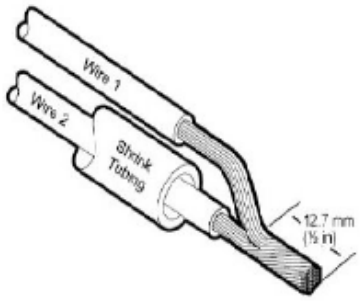
= Wire strand

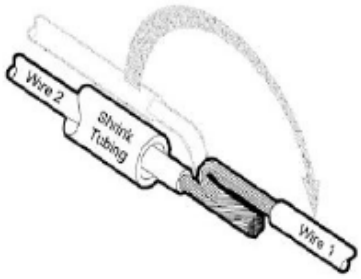
3 = Splice tape

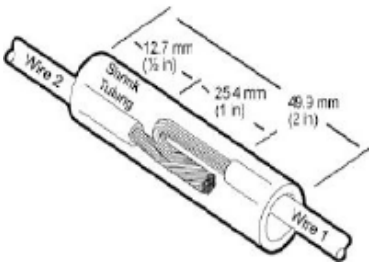
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

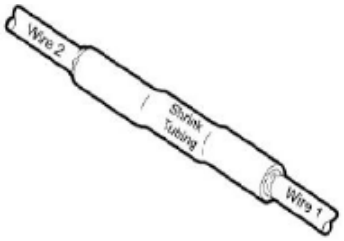
NOTE: -

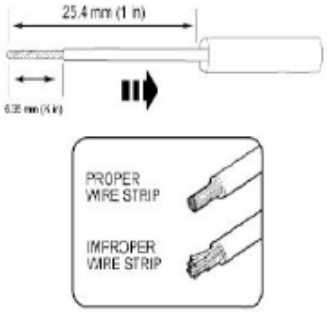
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

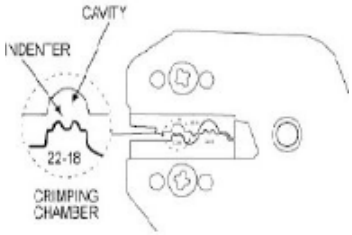
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

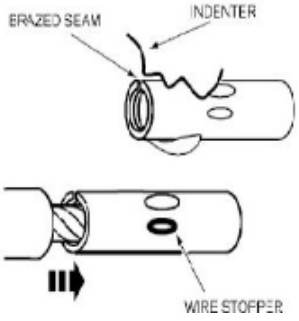
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

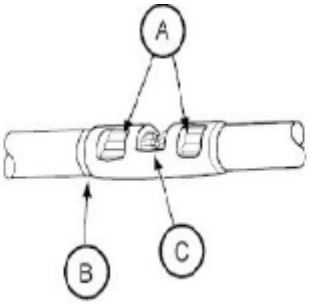
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

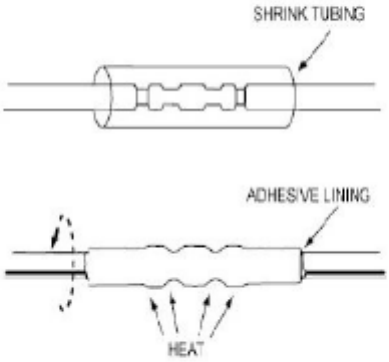
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4" strip, cut 9 strands	* 1/4" strip, cut 2 strands	1/4" strip, no fold	1/4" strip, no fold	1/4" strip, no fold	5/8" strip, fold 2x dia.	1" strip, fold 3x dia.
	16-14	* 1/4" strip, cut 7 strands	1/4" strip, no fold	1/4" strip, no fold	1/4" strip, no fold	5/8" strip fold 2x dia	1" strip, fold 3x dia.	1 1/4" strip, fold 4x dia.	Not Recommended
	12-10	1/4" strip, no fold	1/4" strip, no fold	5/8" strip, fold 2x dia.	1" strip fold 3x dia.	1 1/4" strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Pigtail only

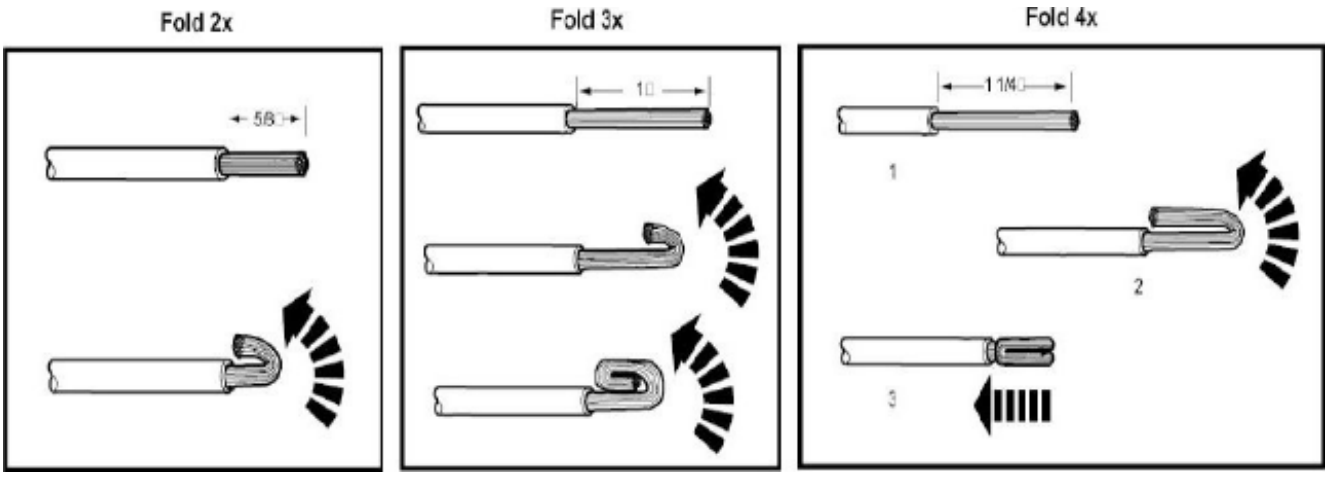
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



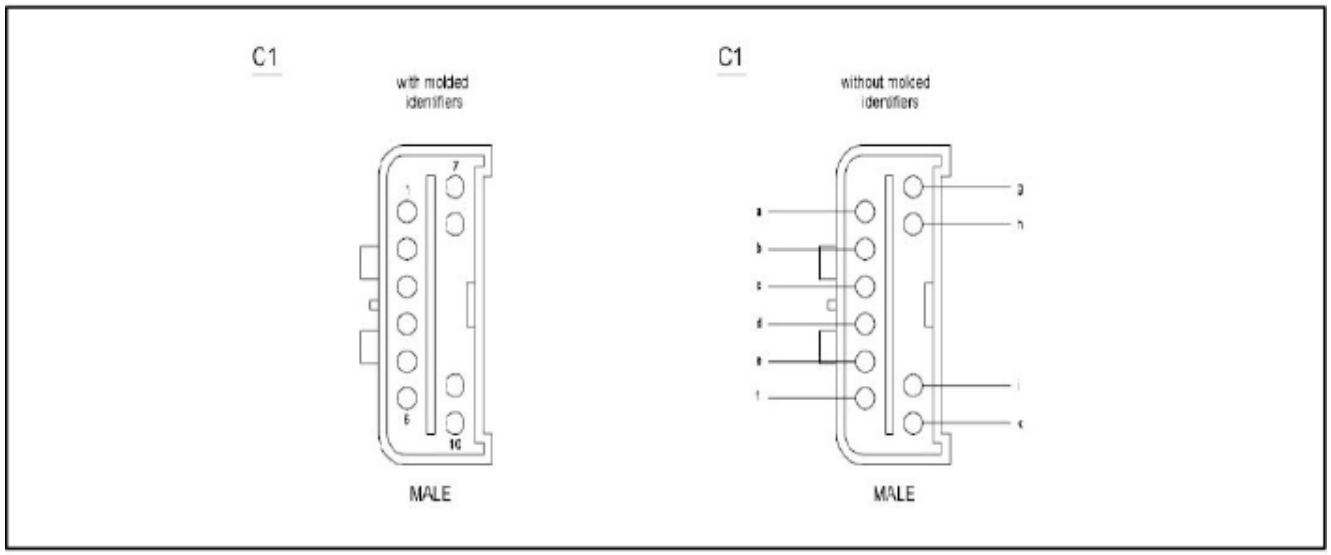
The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



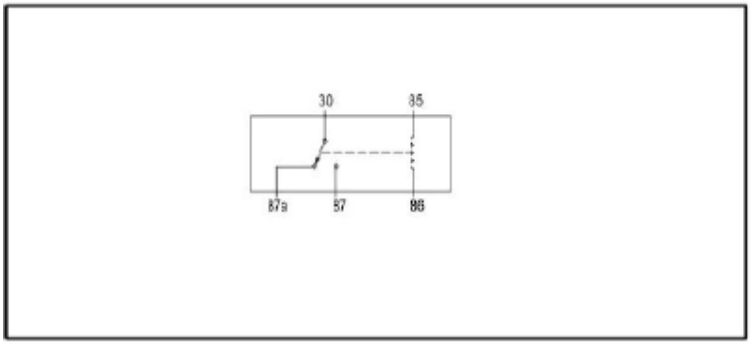
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

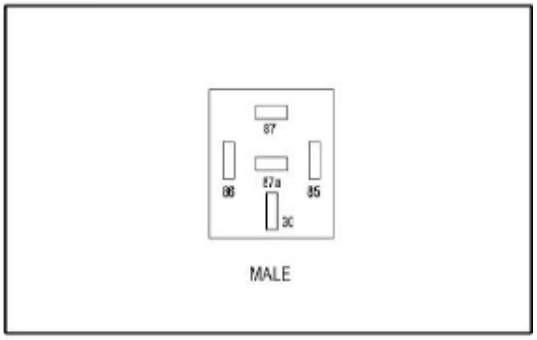
Interior Lighting Relay: Testing and Inspection Mini ISO Relay

Relay □ Mini ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

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Component testing procedures are provided to determine whether a component is good or bad.

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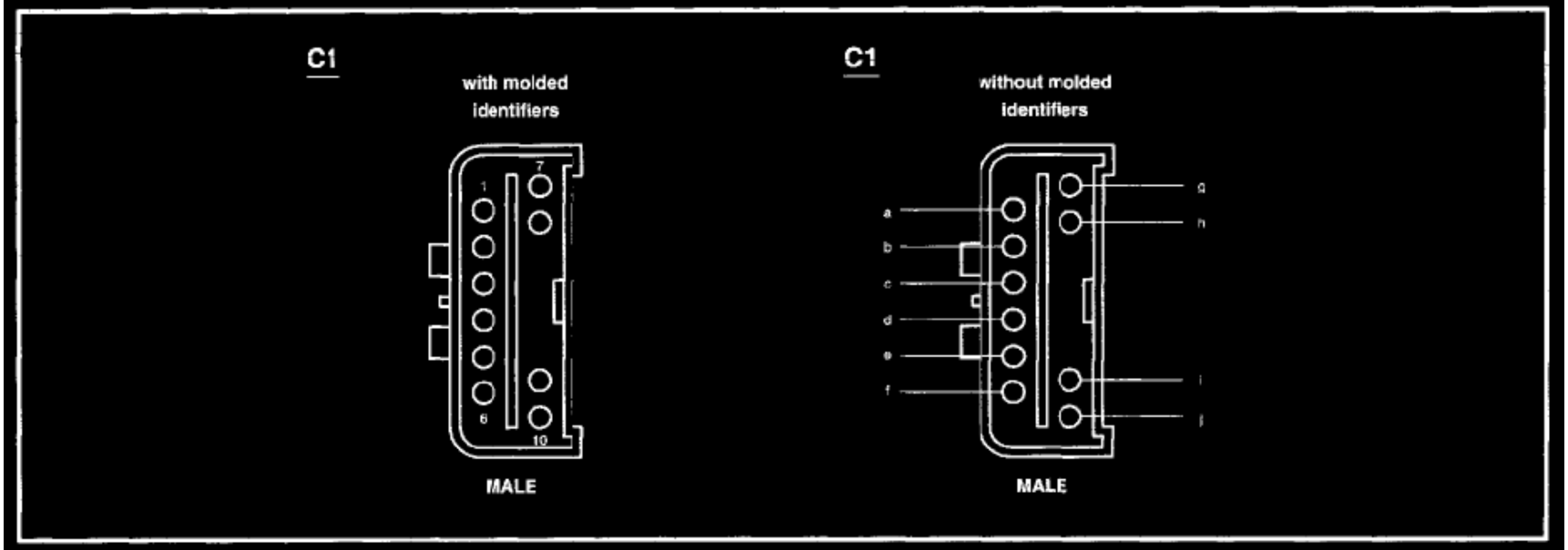

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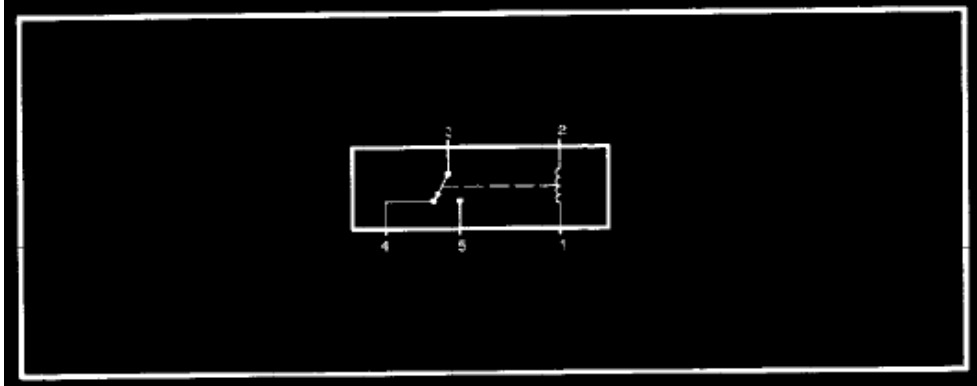
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

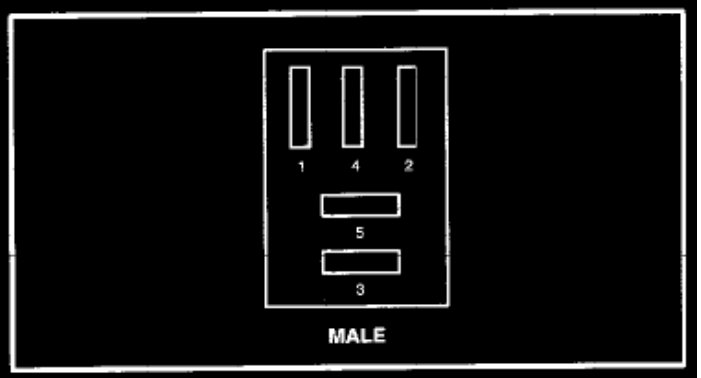
Interior Lighting Relay: Testing and Inspection Micro ISO Relay

Relay – Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63–102Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil – Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

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Component testing procedures are provided to determine whether a component is good or bad.

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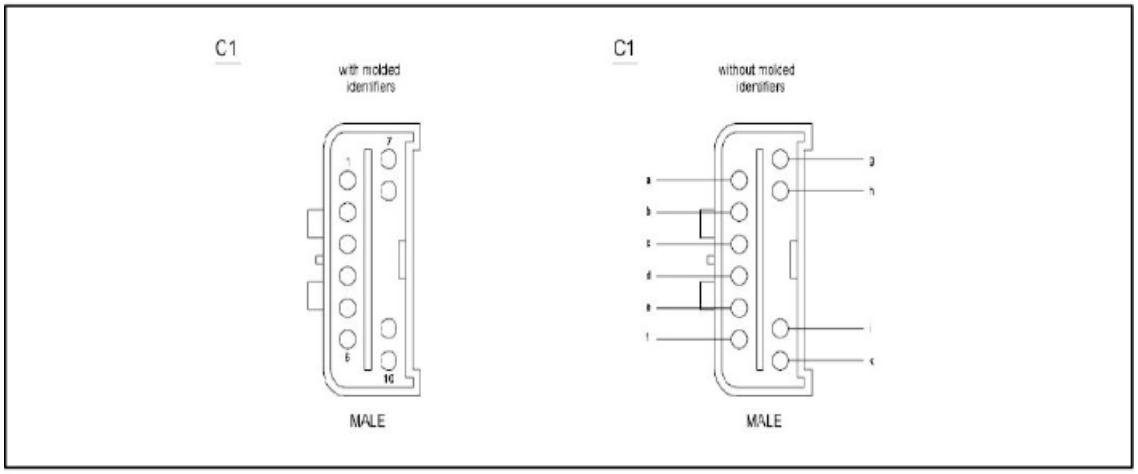

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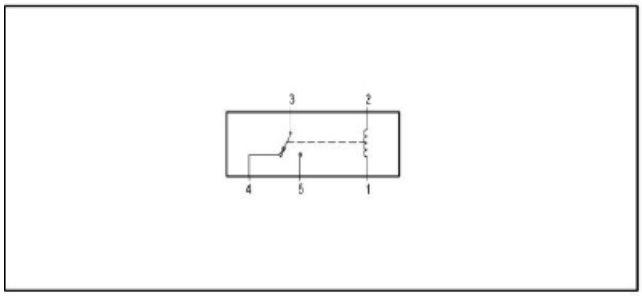
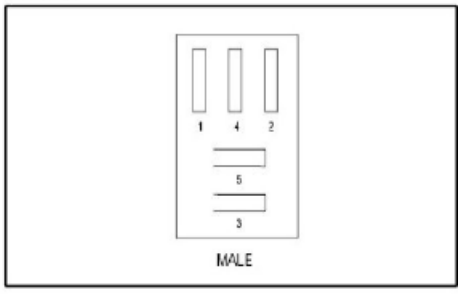
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Relay □ Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63□102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil □ Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

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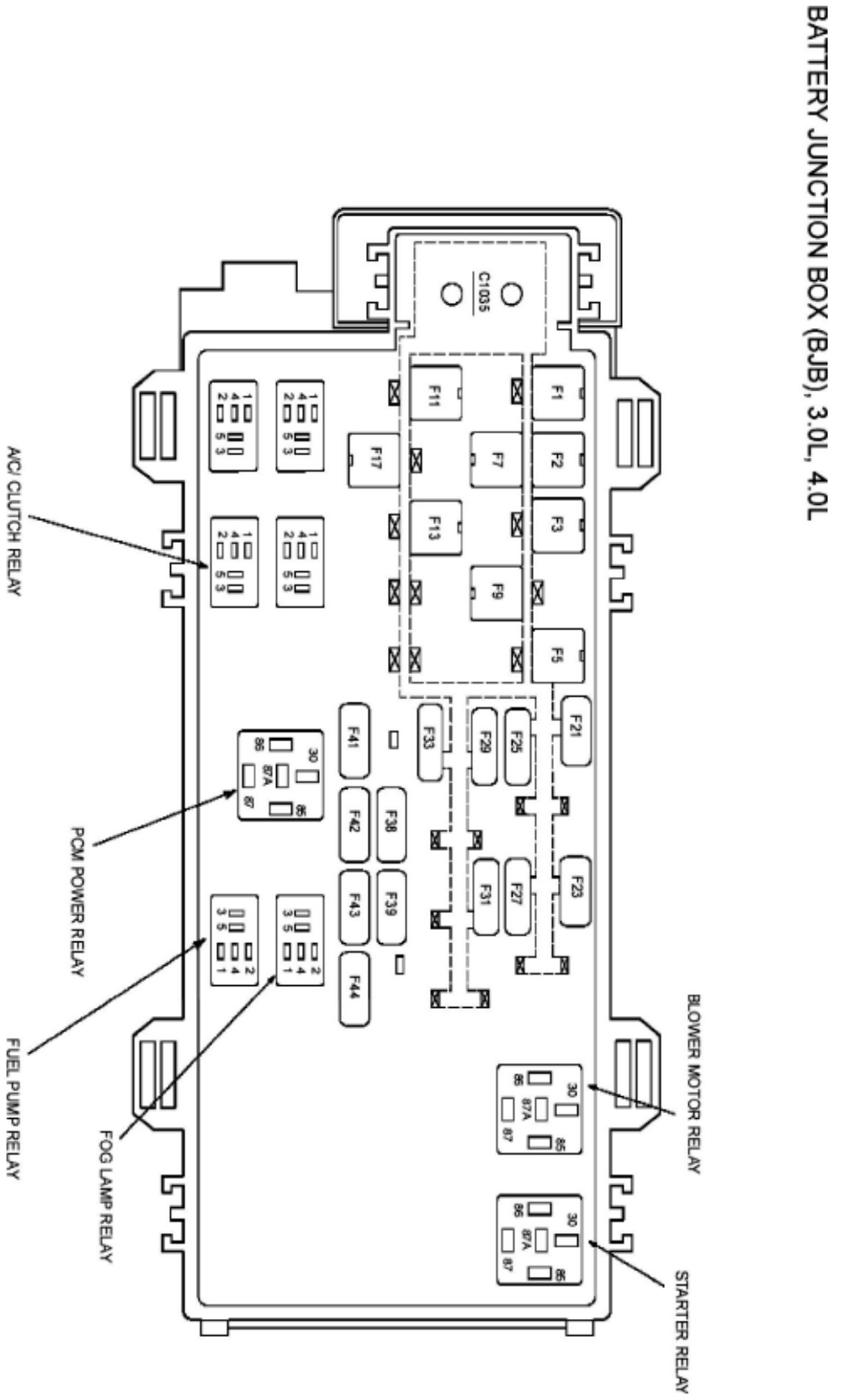
BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L
C1035
F1
F2
F3
F5
F7
F9
F11
F13
F17
F21
F23
F25
F27
F29
F31
F33
F38
F39
F41
F42
F43
F44
A/C CLUTCH RELAY
PCM POWER RELAY
FUEL PUMP RELAY
FOG LAMP RELAY
BLOWER MOTOR RELAY
STARTER RELAY

Introduction

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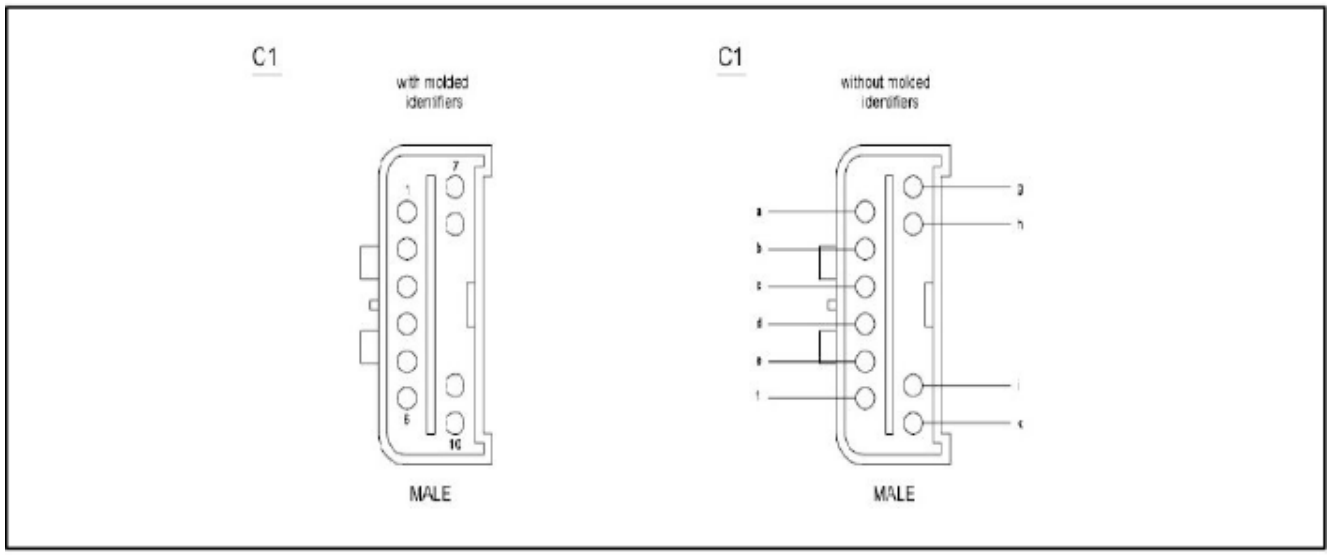

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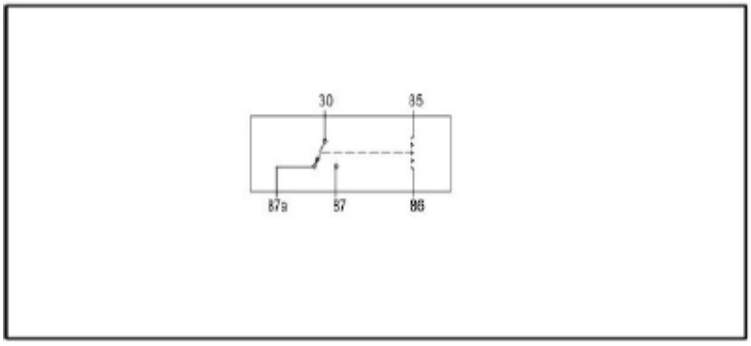
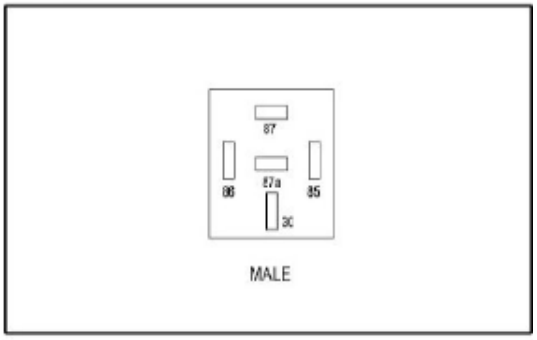
Parking Lamp Relay: Testing and Inspection Mini ISO Relay

Relay □ Mini ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	45 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

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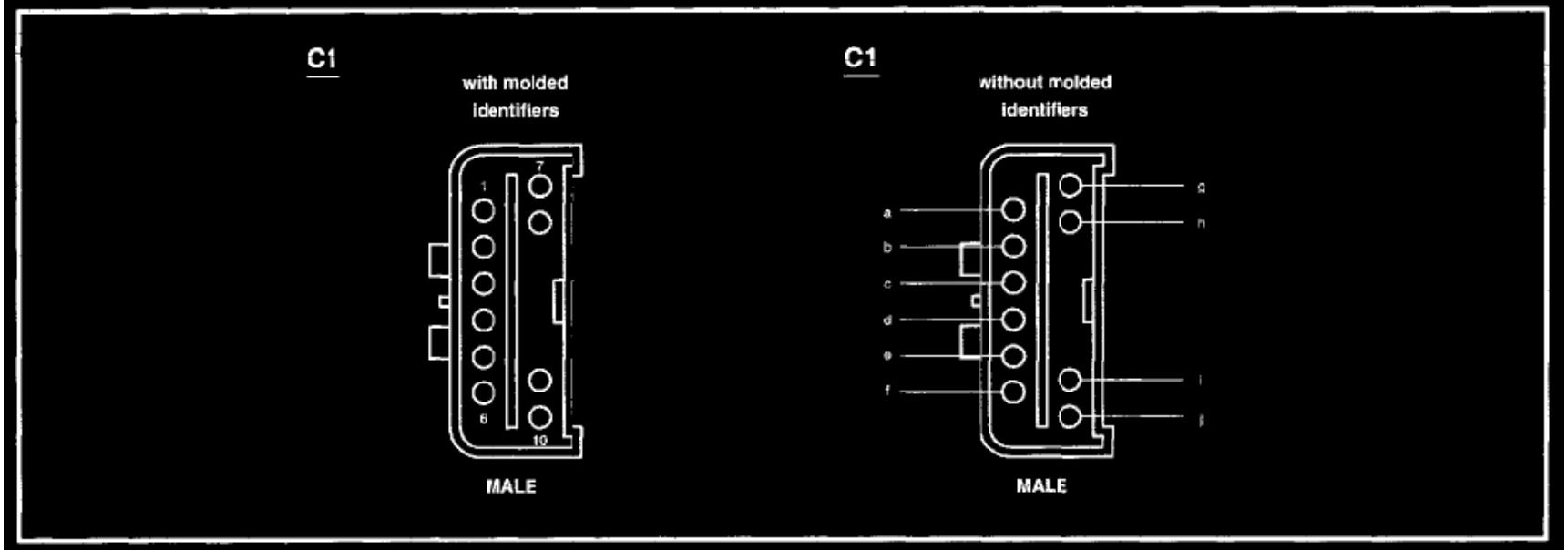

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Parking Lamp Relay: Testing and Inspection Micro ISO Relay

Relay – Micro ISO

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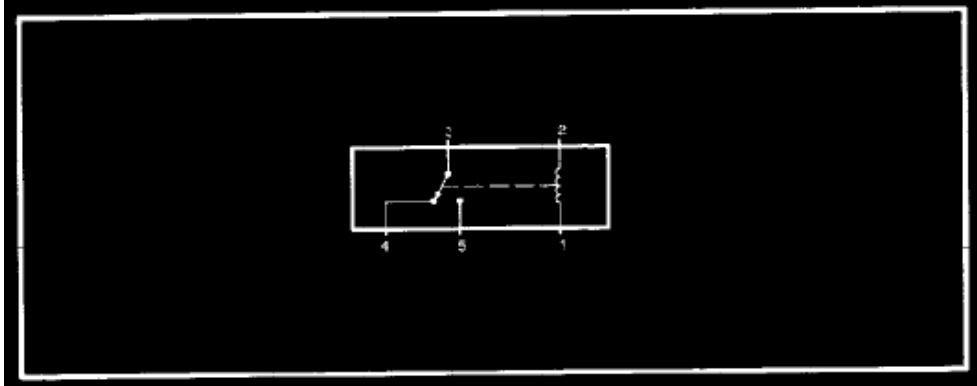

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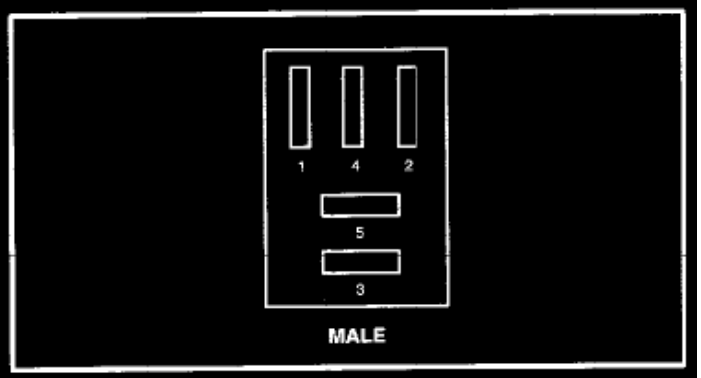

Component testing procedure (no voltage applied)

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Coil	1 and 2	63–102Ω
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Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

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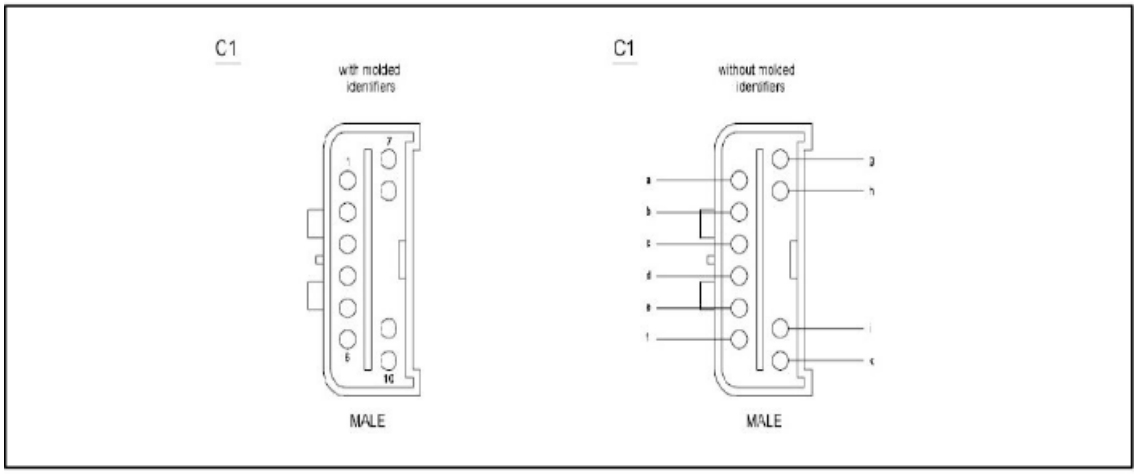

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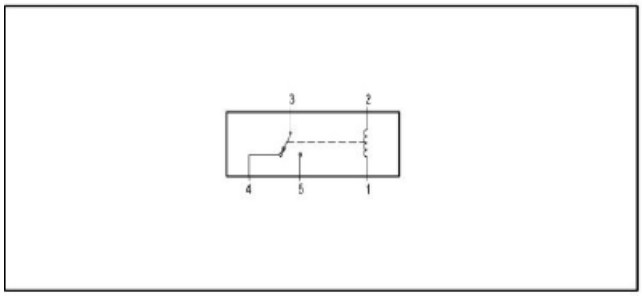
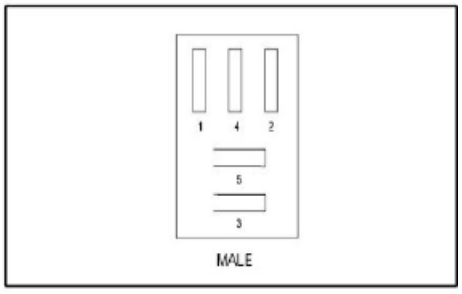
Relay □ Micro ISO

Schematic



Terminals



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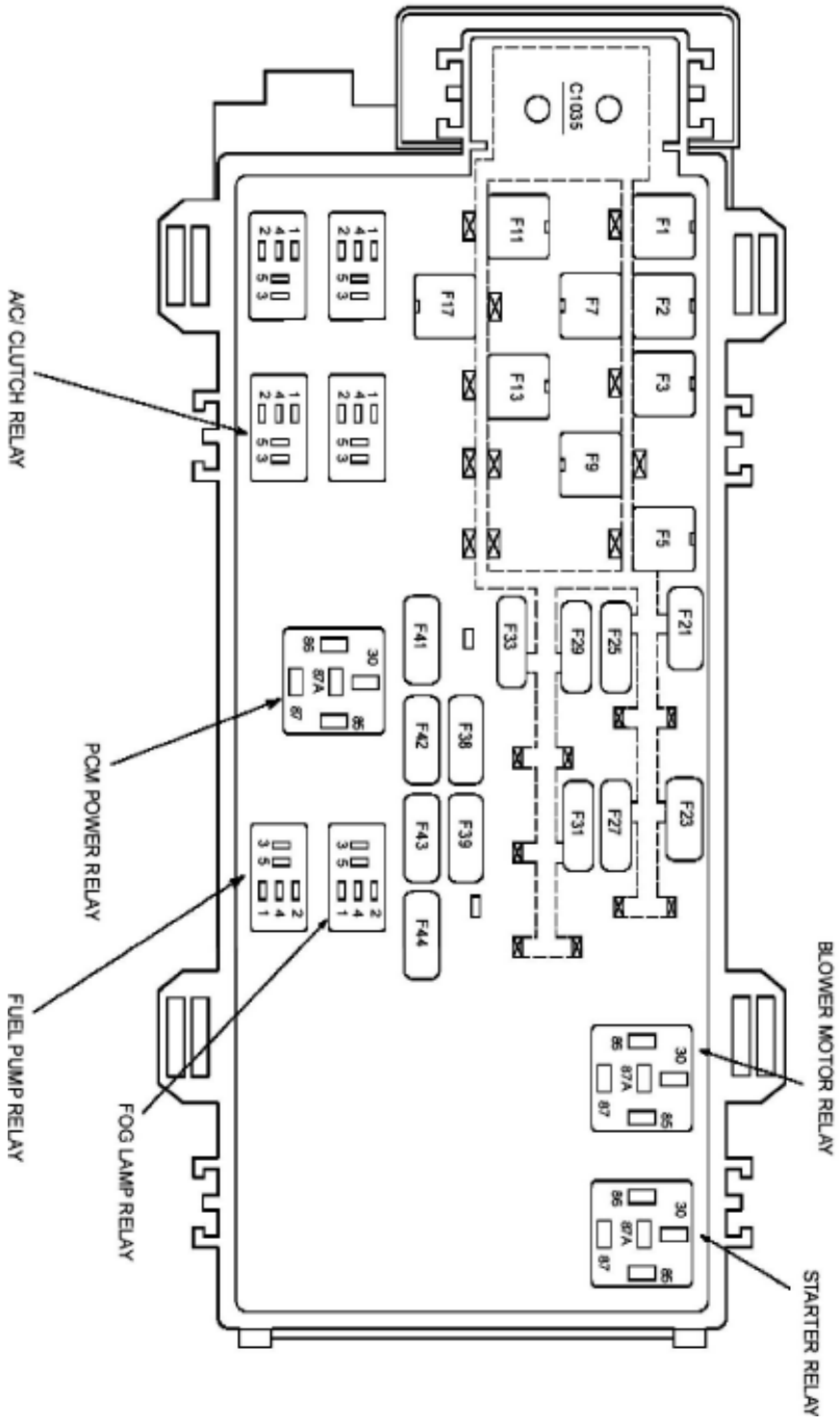
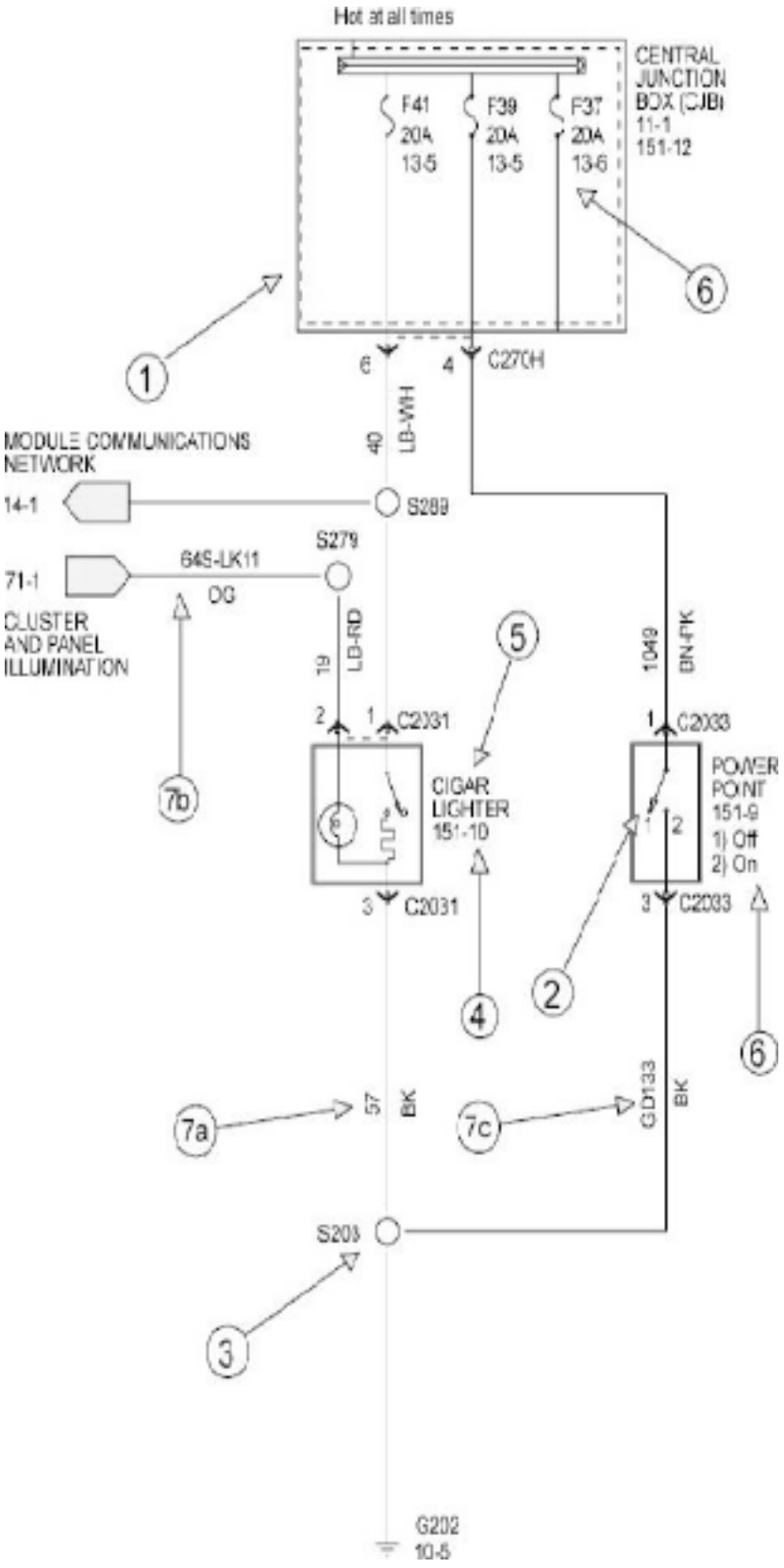
BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L



Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Lighting and Horns > Relays and Modules - Lighting and Horns > Trailer Lighting Relay > Component Information > Diagrams > Diagram Information and Instructions



Trailer Lighting Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

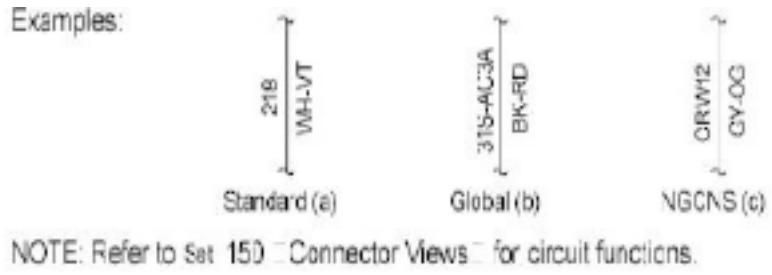
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

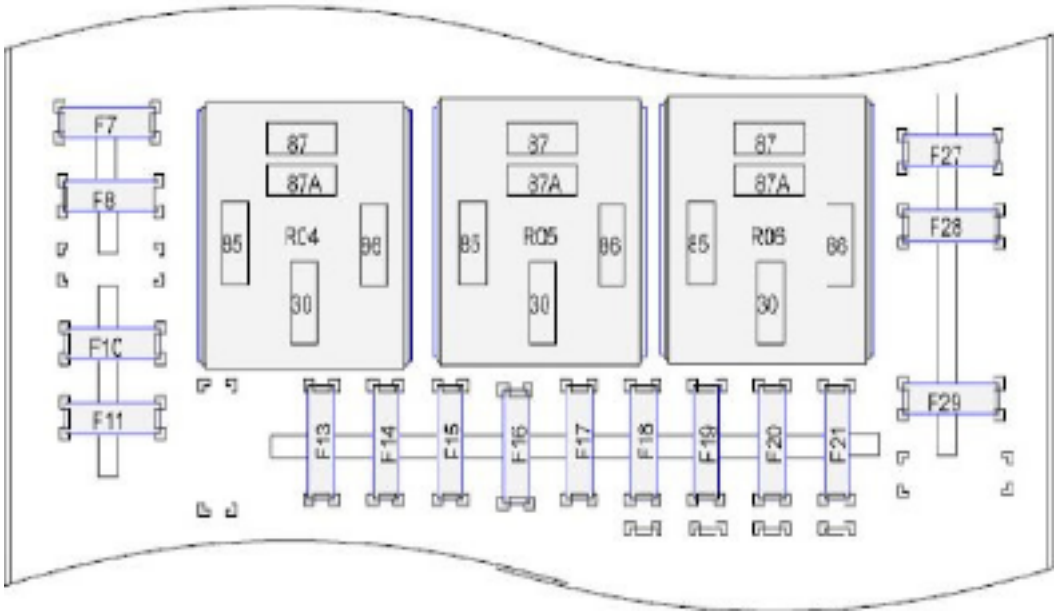
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

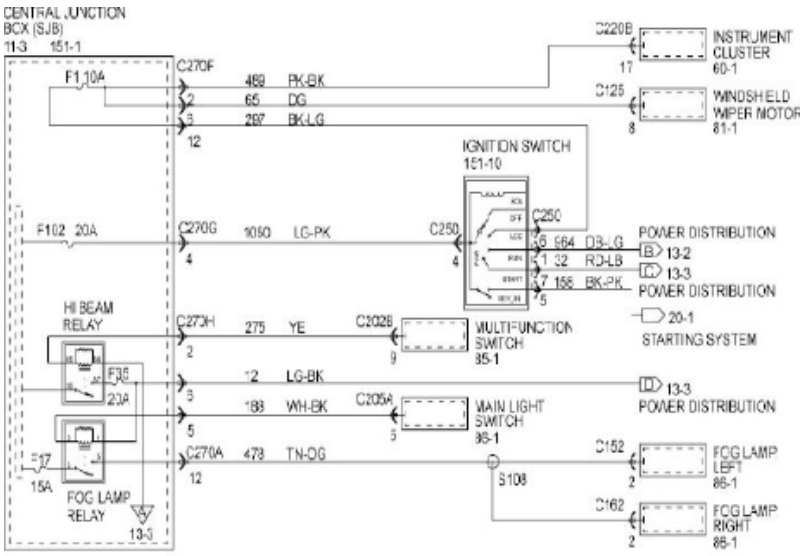
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

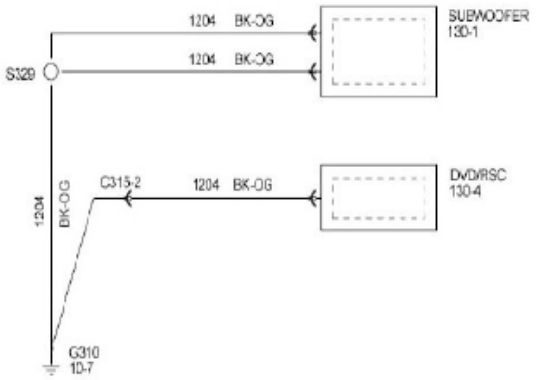
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

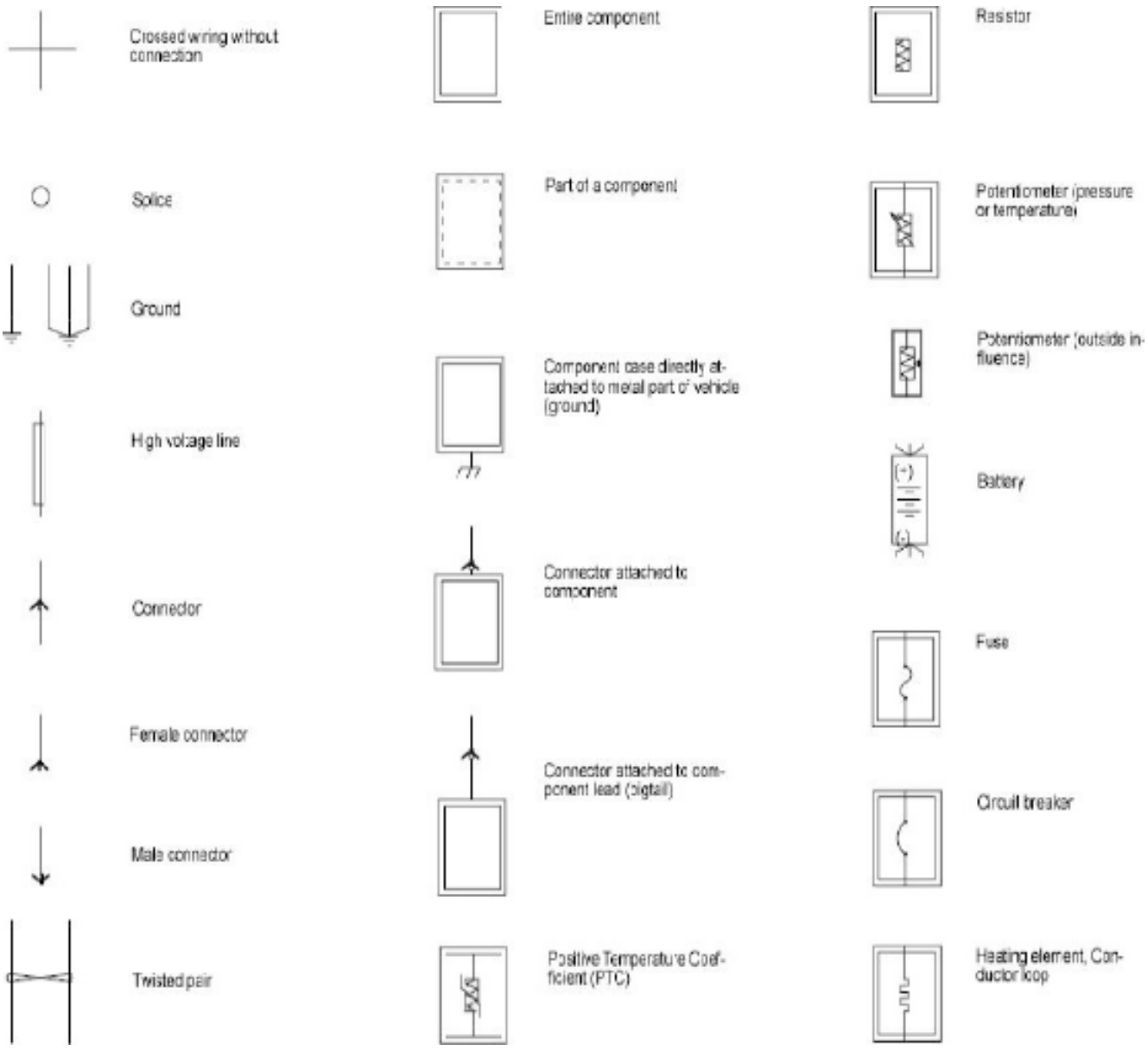
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

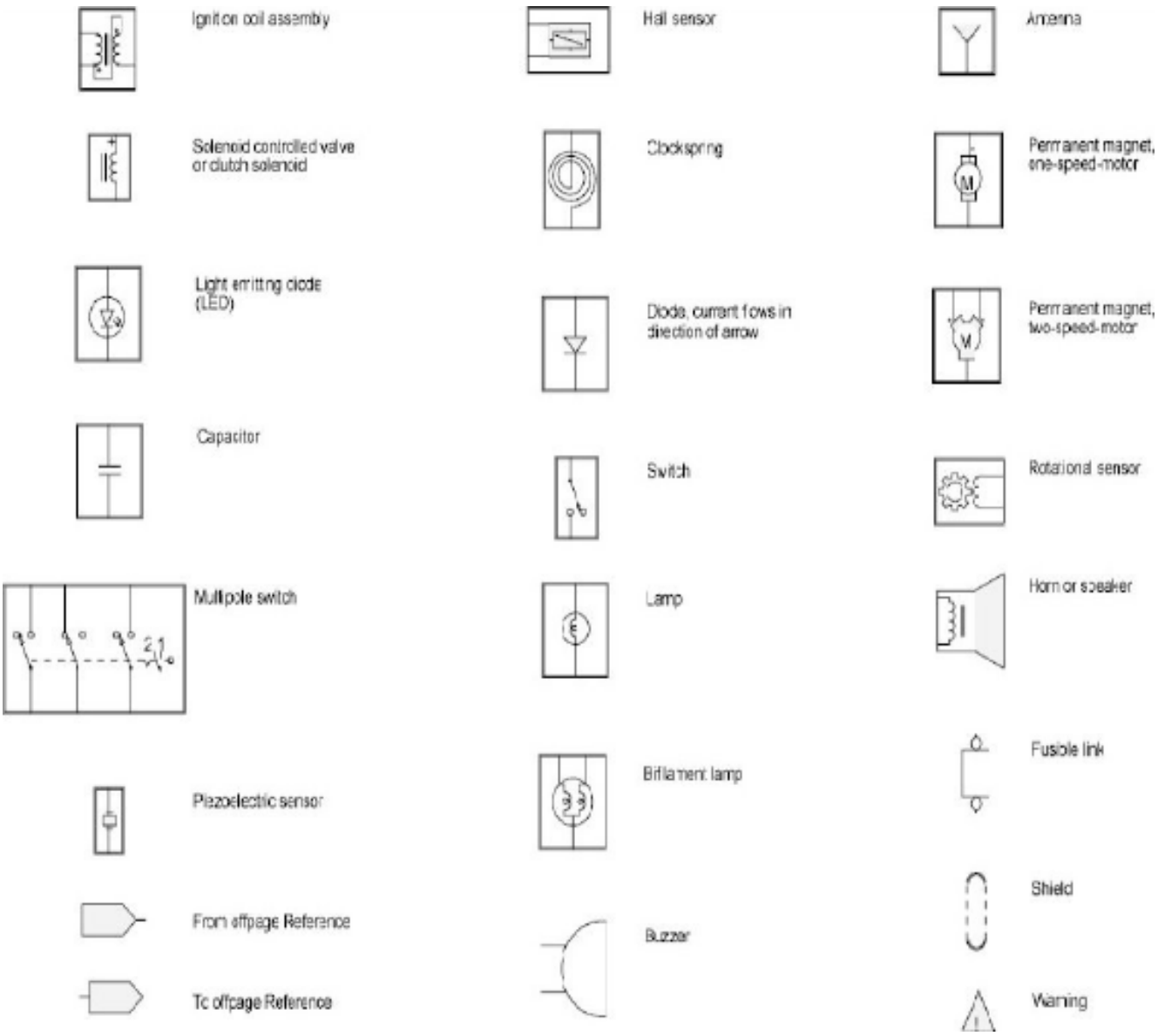
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

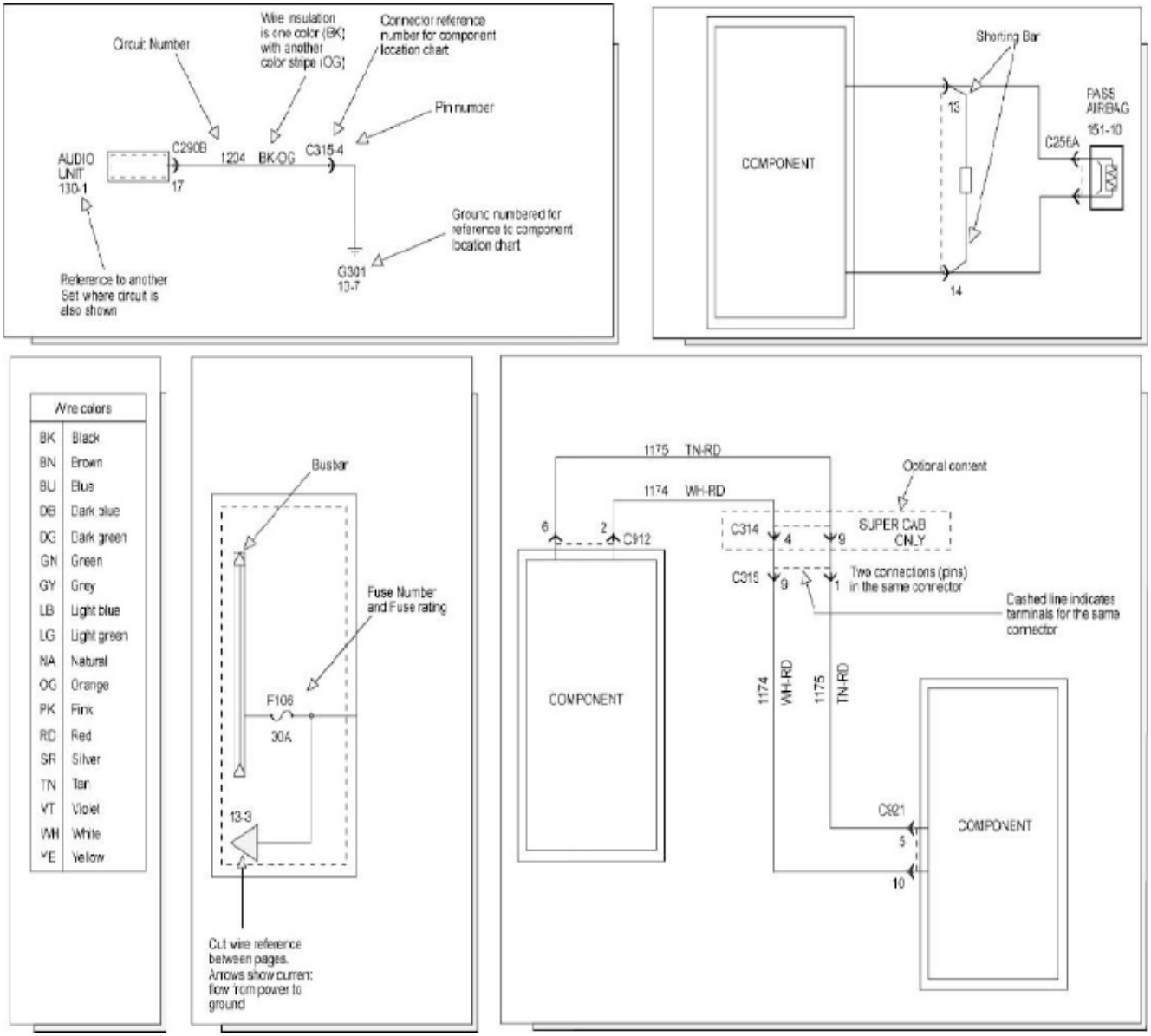
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

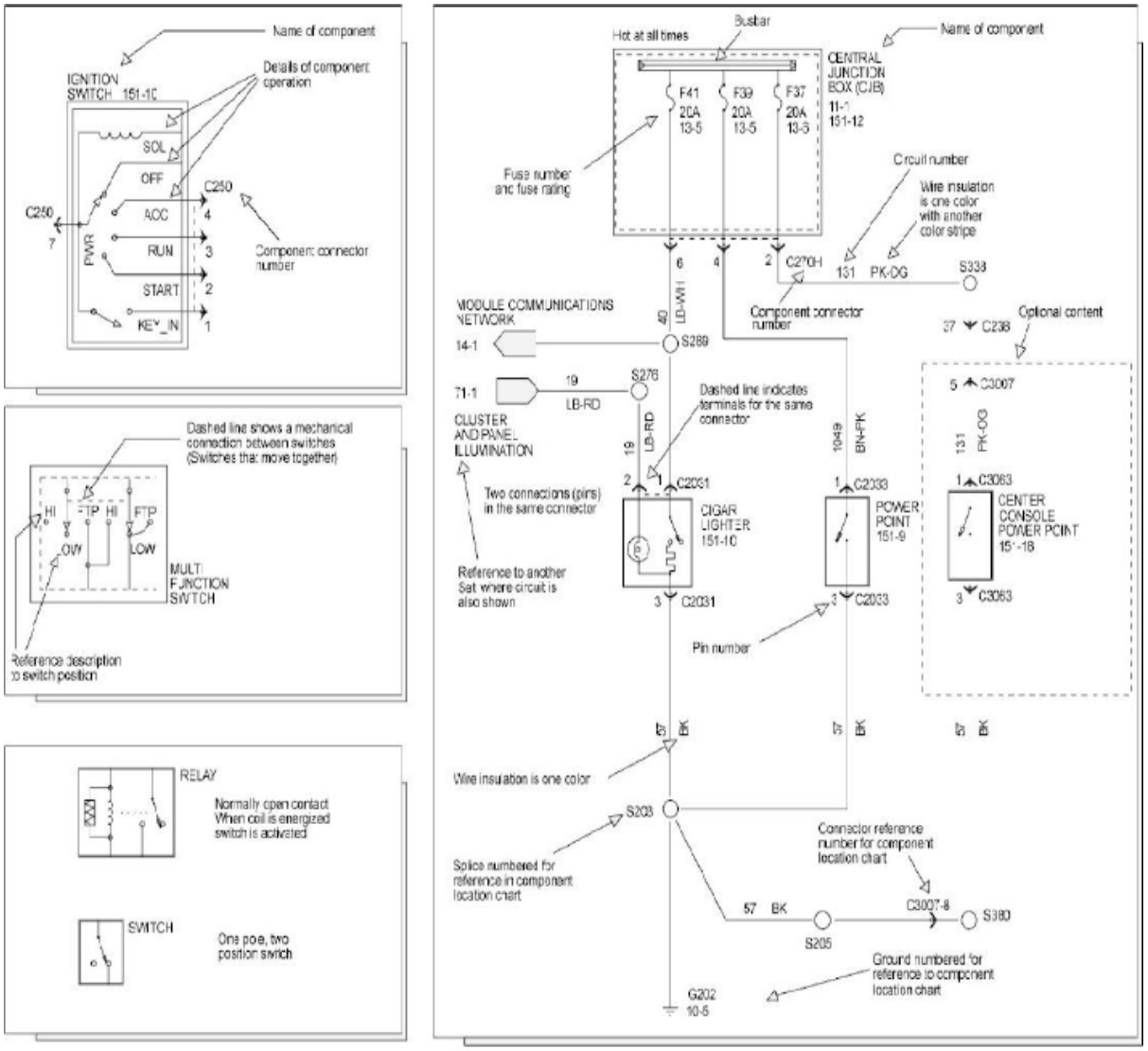
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

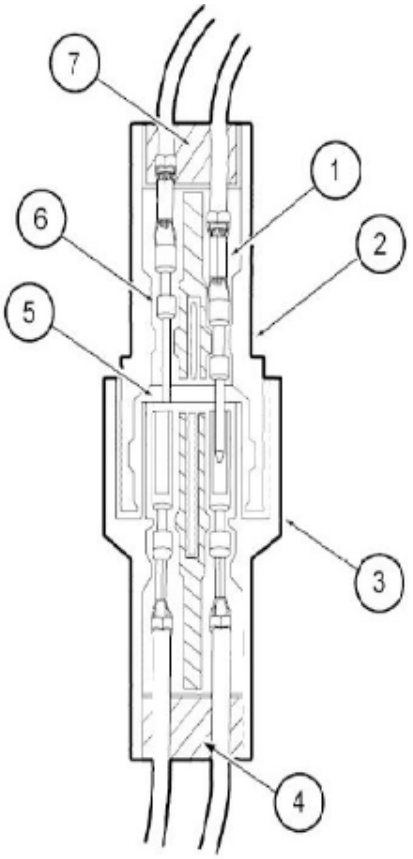


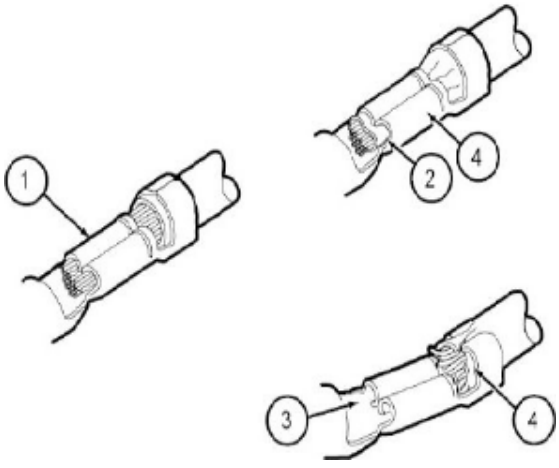
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Trailer Lighting Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

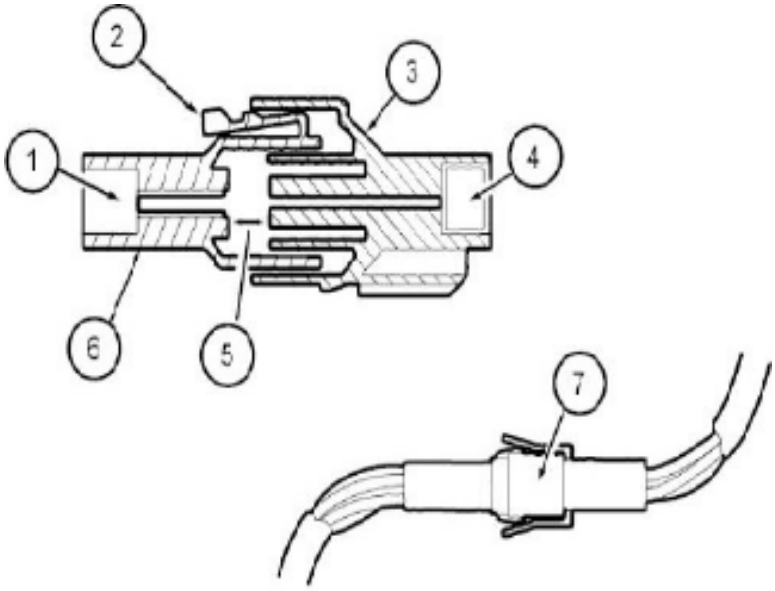
5 = Intermittent contact

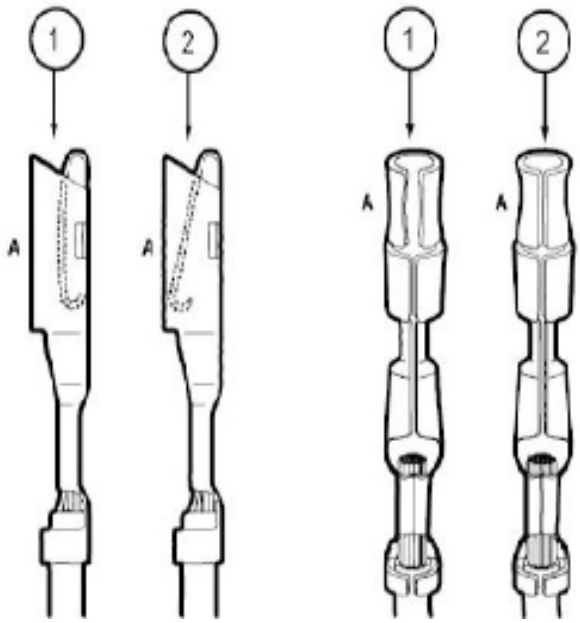
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

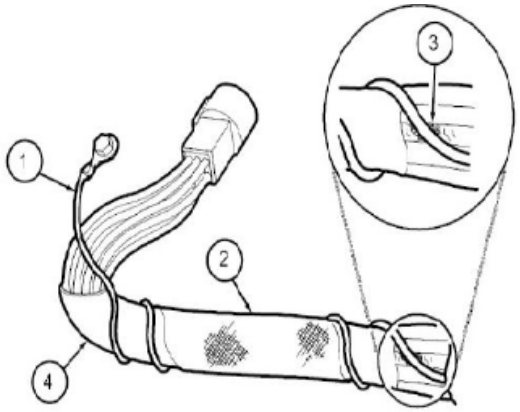
Deformed (enlarged) female terminals

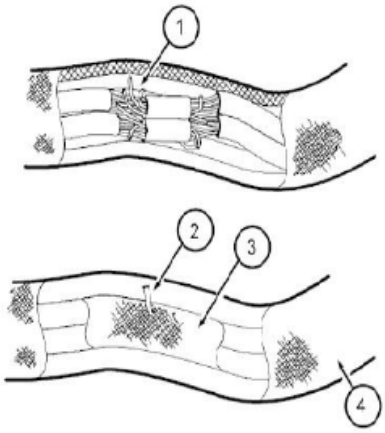
1 = Enlarged

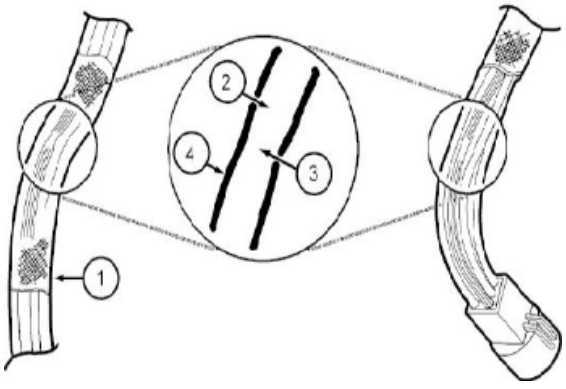
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

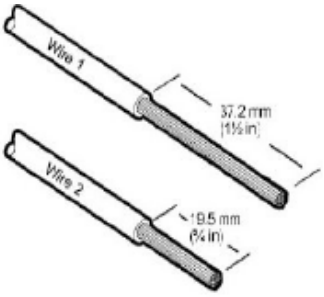
Splice covered 2

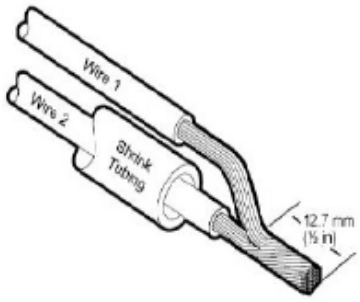
= Wire strand

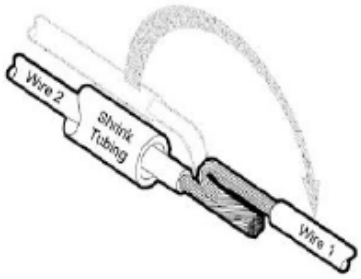
3 = Splice tape

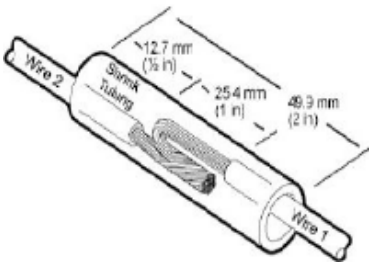
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

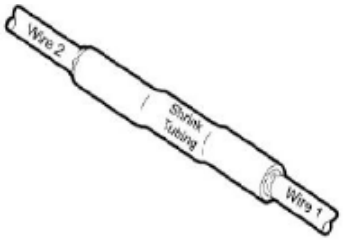
NOTE: -

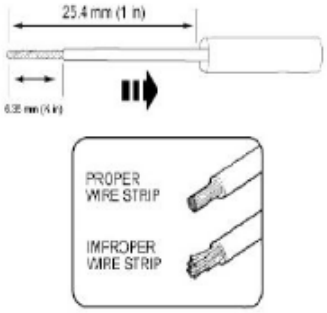
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

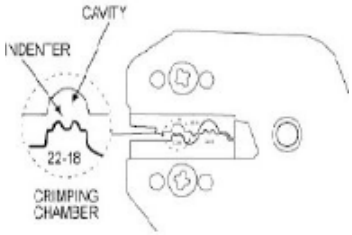
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

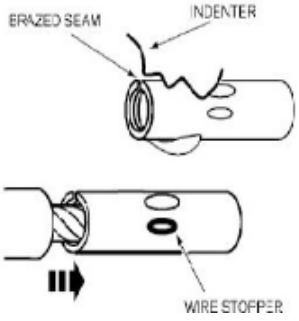
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

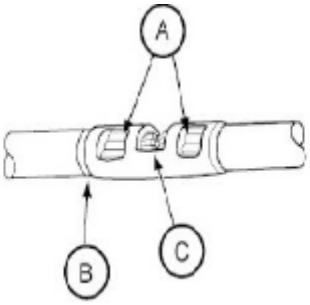
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

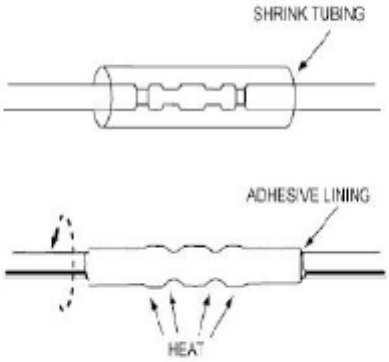
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4 strip, cut 9 strands	* 1/4 strip, cut 2 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip, fold 3x dia.
	16-14	* 1/4 strip, cut 7 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip fold 2x dia	1 strip, fold 3x dia.	1 1/4 strip, fold 4x dia.	Not Recommended
	12-10	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip fold 3x dia.	1 1/4 strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Pigtail only

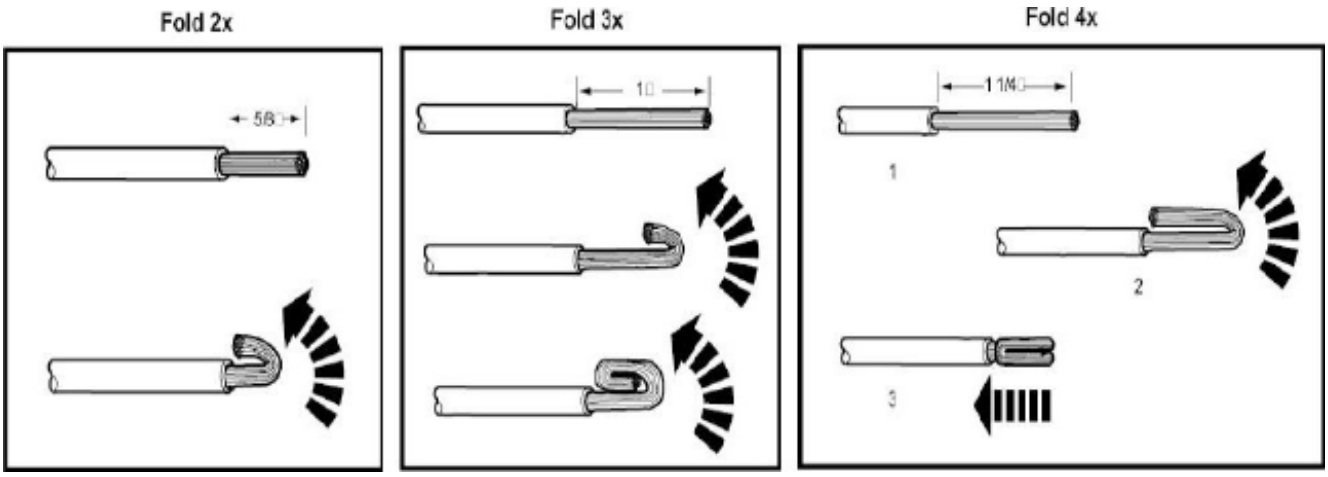
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



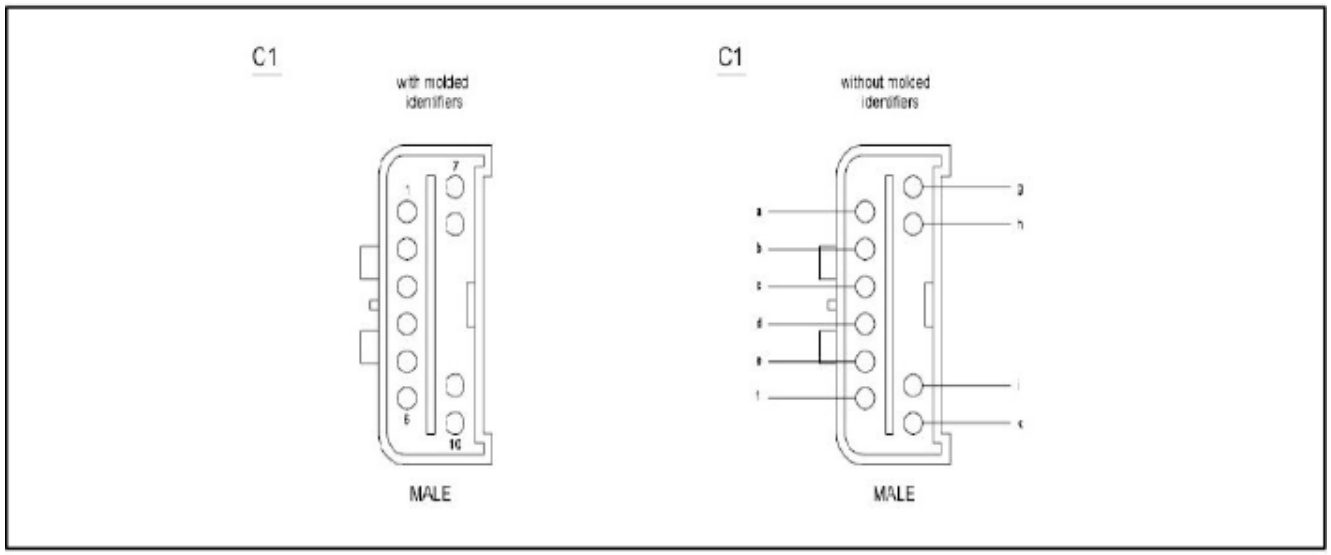
The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals

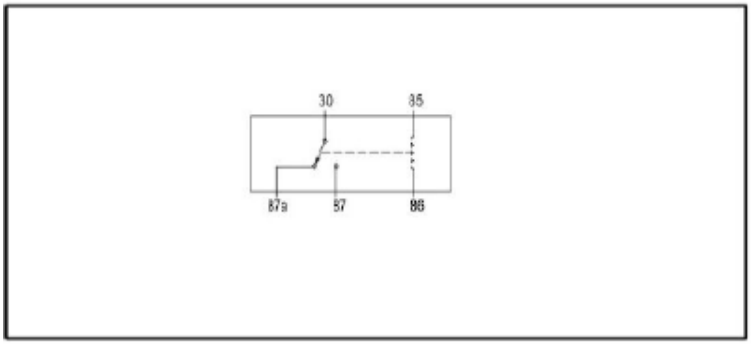


The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

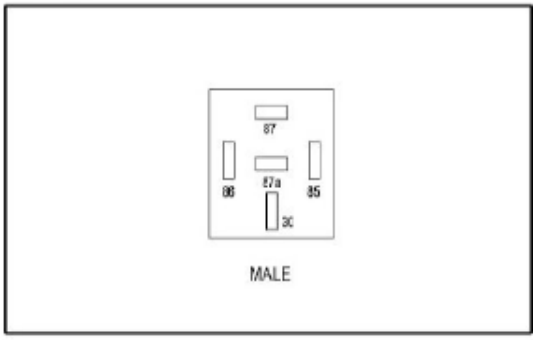
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Relay □ Mini ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

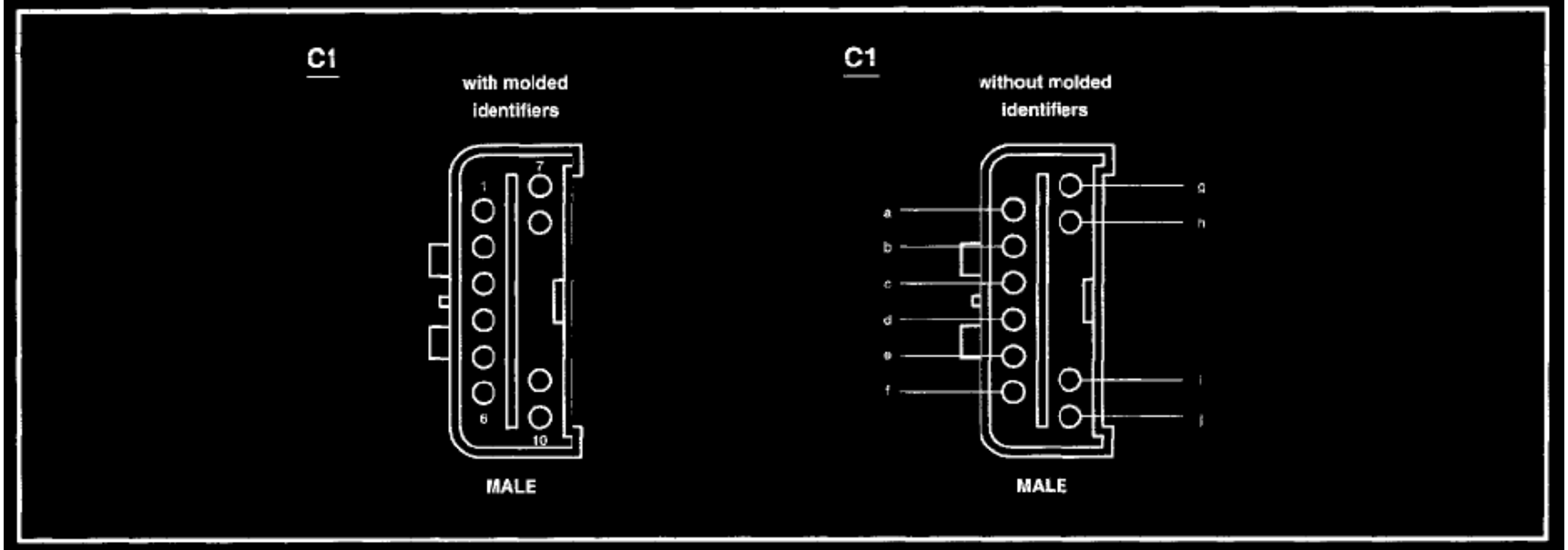
Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step–by–step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



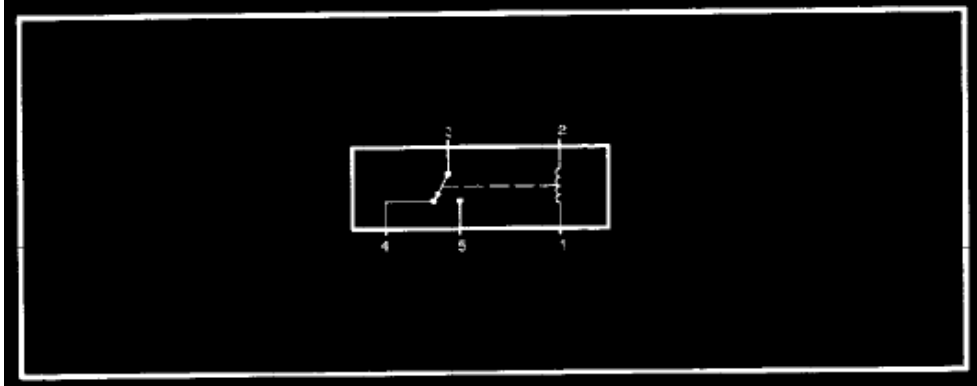
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

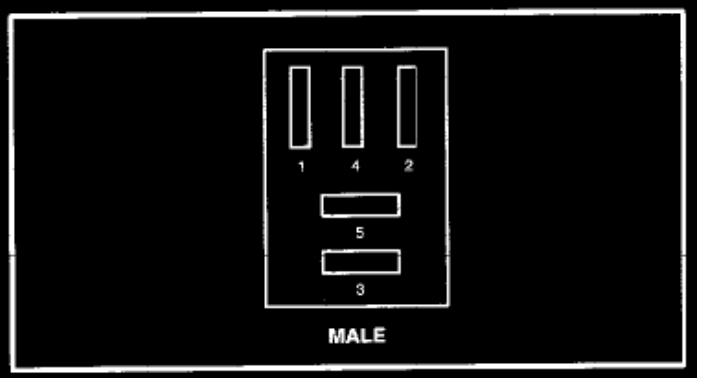
Trailer Lighting Relay: Testing and Inspection Micro ISO Relay

Relay – Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63–102Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil – Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

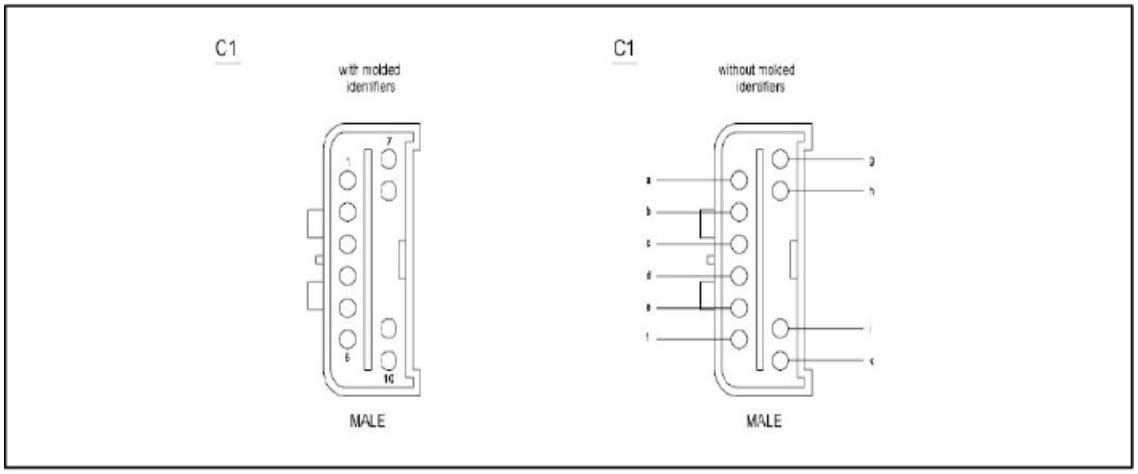
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step□by□step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals

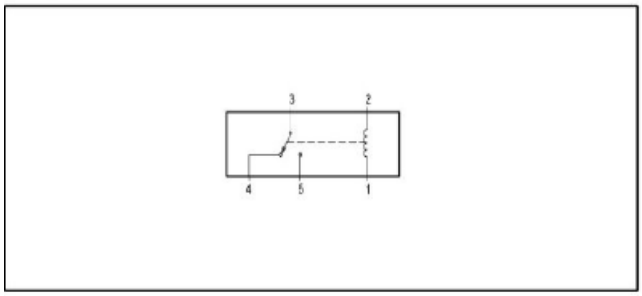


The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column □Circuit to test□. If you wish to test the complete component, perform all tests.

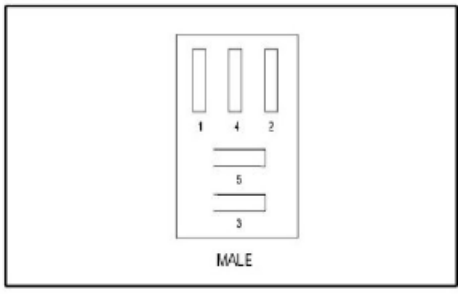
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Relay □ Micro ISO

Schematic



Terminals

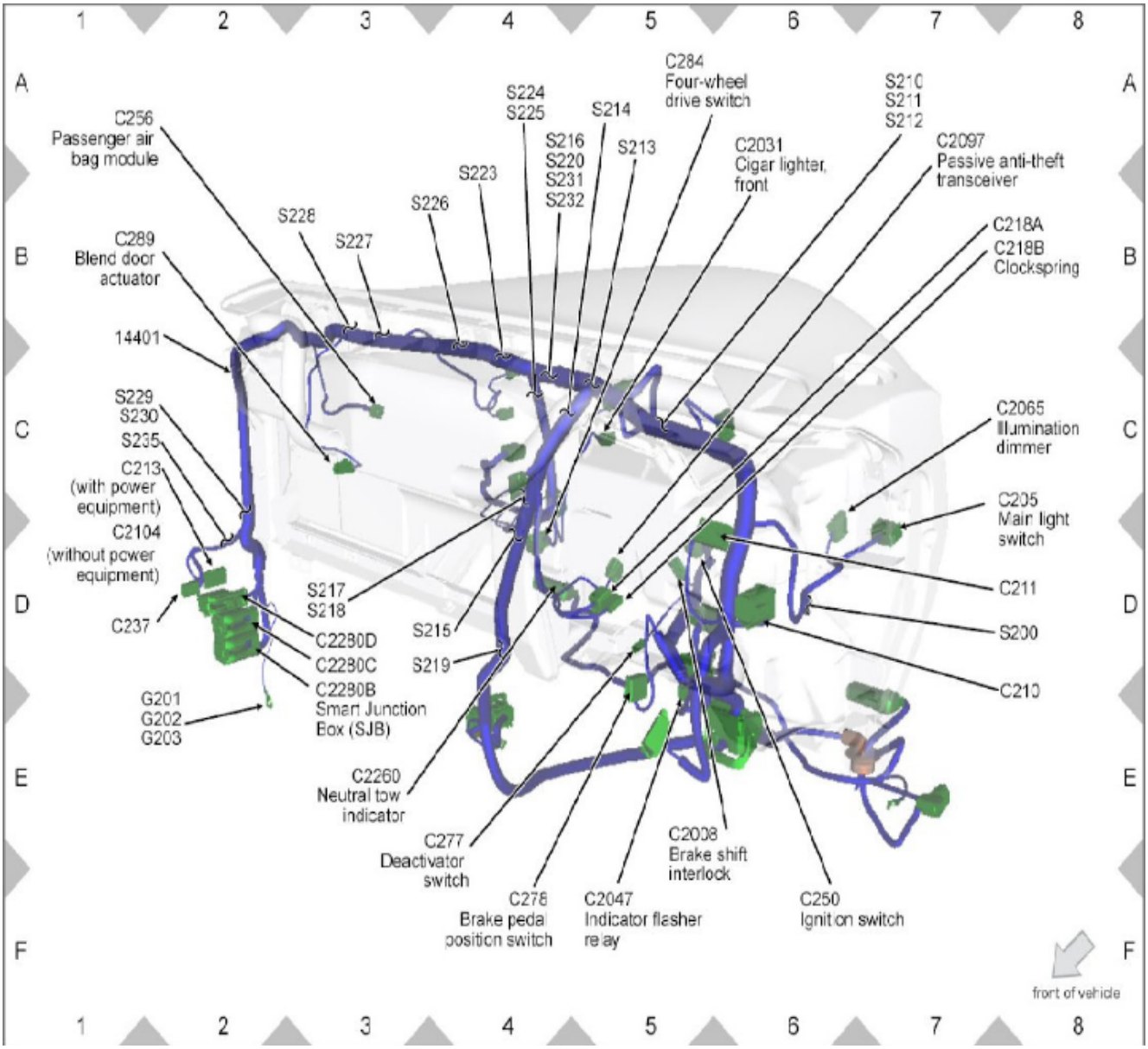


Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63□102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil □ Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

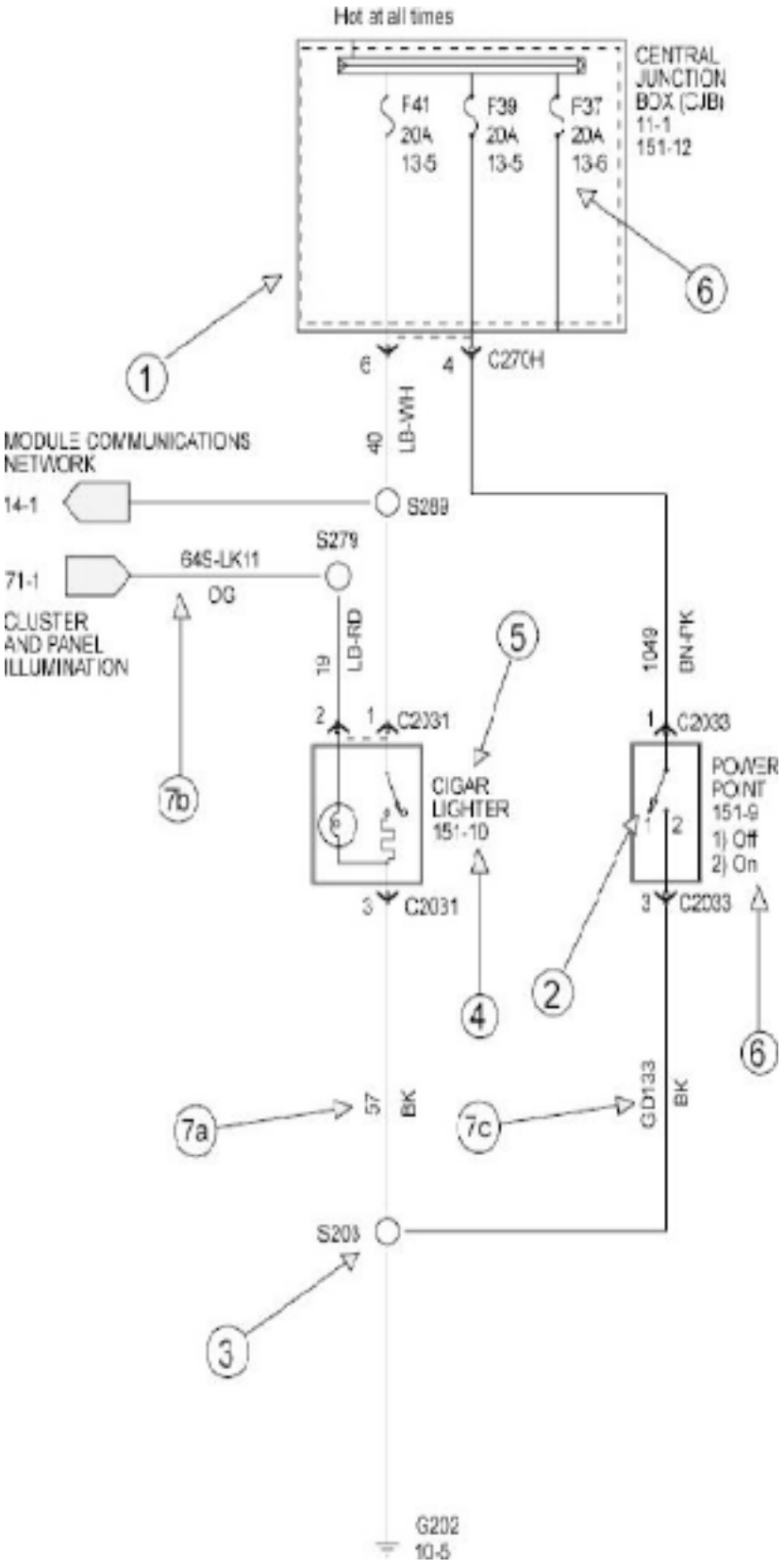
Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.


1
2
3
4
5
6
7
8
A
B
C
D
E
F
C256
Passenger air bag module
C289
Blend door actuator
14401
S229
S230
S235
C213
(with power equipment)
C2104
(without power equipment)
C237
G201
G202
G203
S228
S227
S226
S223
S224
S225
S216
S220
S231
S232
S214
S213
C284
Four-wheel drive switch
C2031
Cigar lighter, front
S210
S211
S212
C2097
Passive anti-theft transceiver
C218A
C218B
Clockspring
C2065
Illumination dimmer
C205
Main light switch
C211
S200
C210
S217
S218
S215
S219
C2280D
C2280C
C2280B
Smart Junction Box (SJB)
C2260
Neutral tow indicator
C277
Deactivator switch
C278
Brake pedal position switch
C2047
Indicator flasher relay
C2008
Brake shift interlock
C250
Ignition switch
front of vehicle

View 151-11

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Lighting and Horns > Relays and Modules - Lighting and Horns > Turn Signal Relay > Component Information > Diagrams > Diagram Information and Instructions



Turn Signal Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

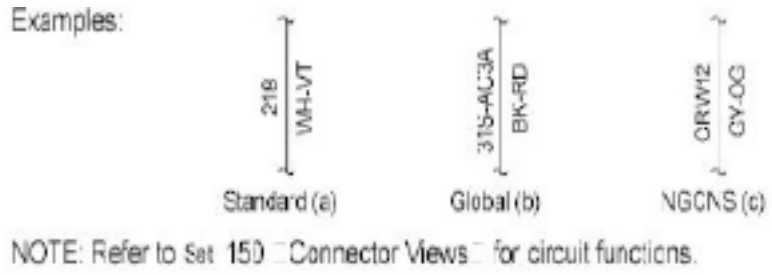
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

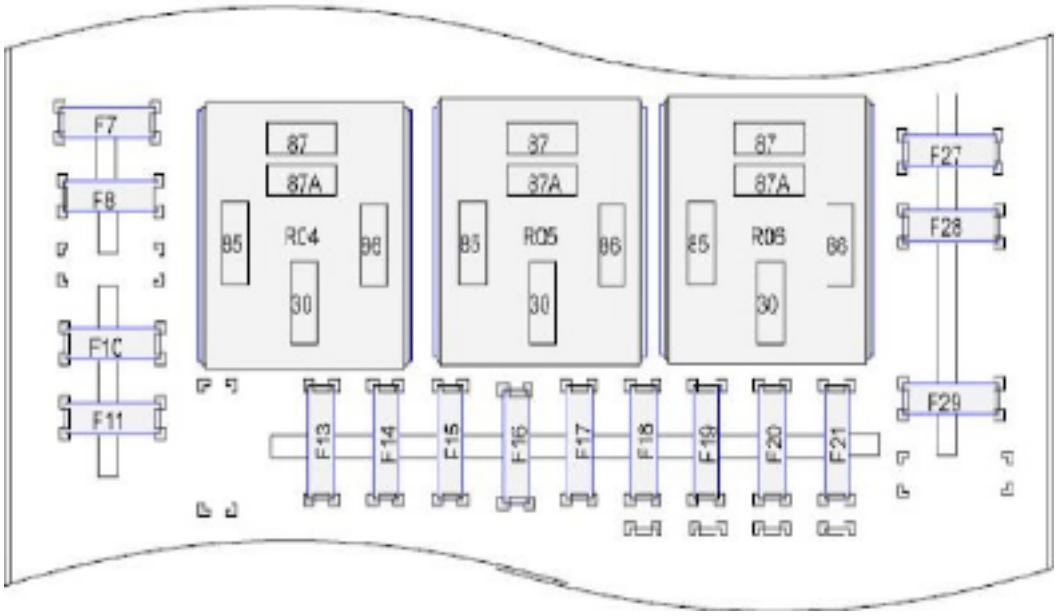
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

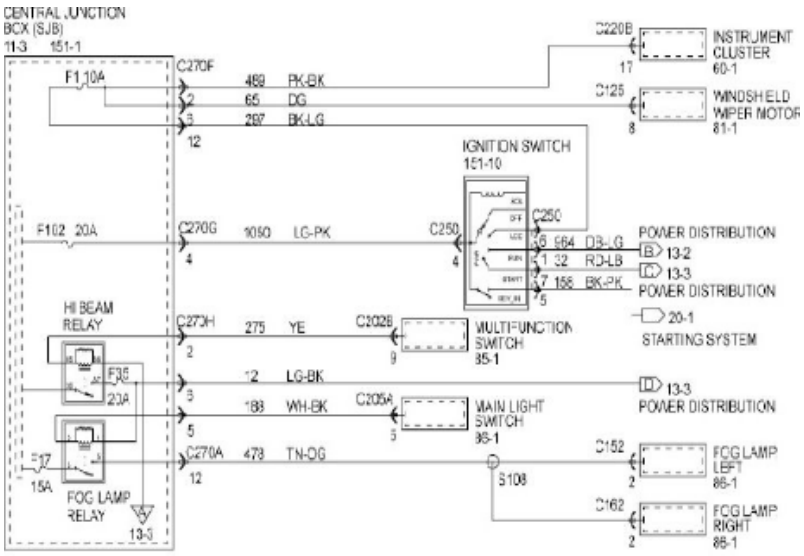
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

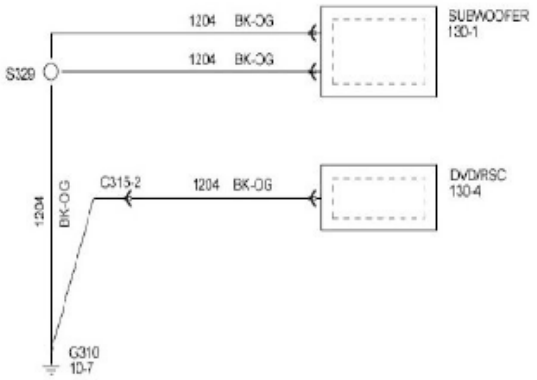
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

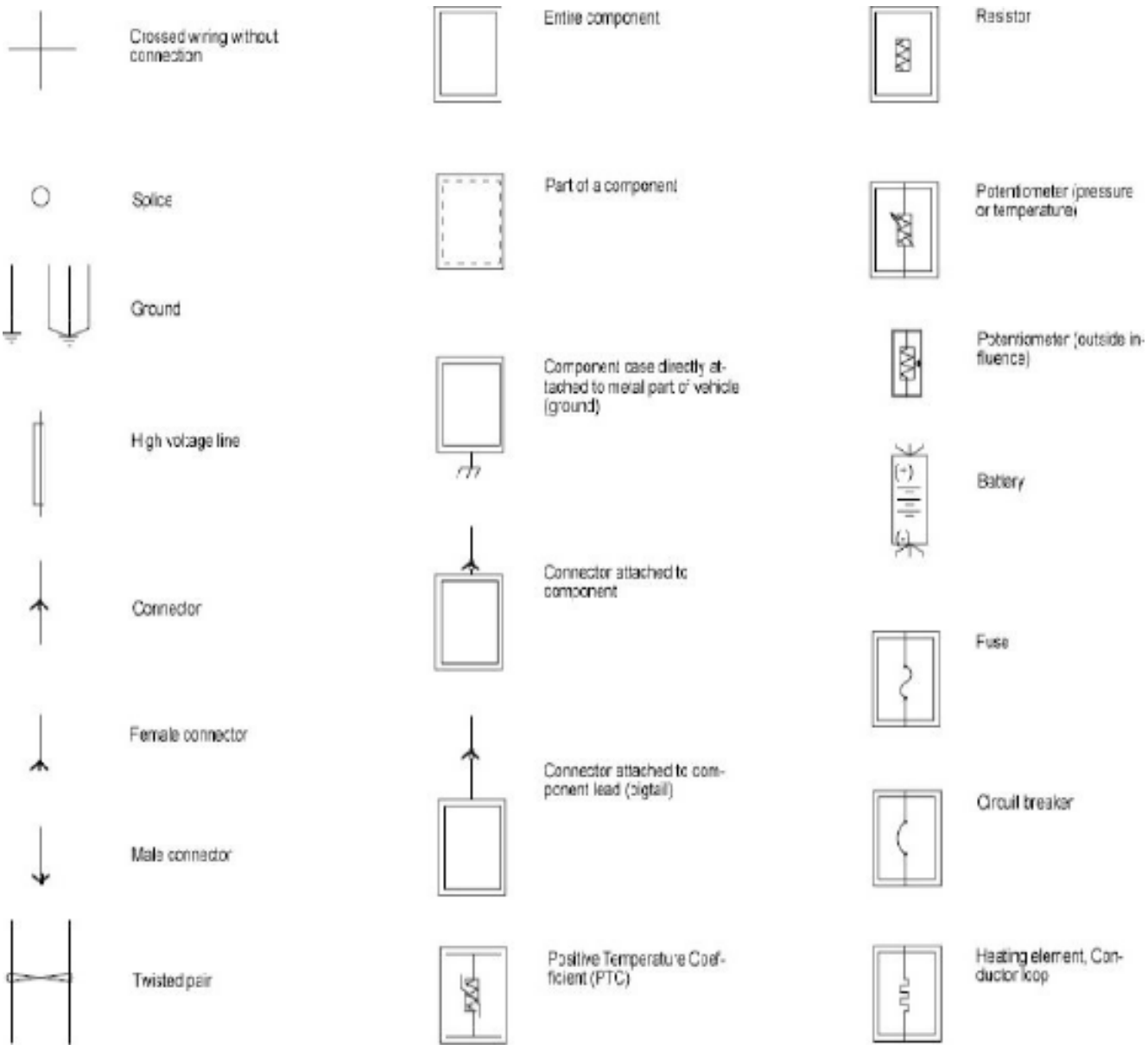
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

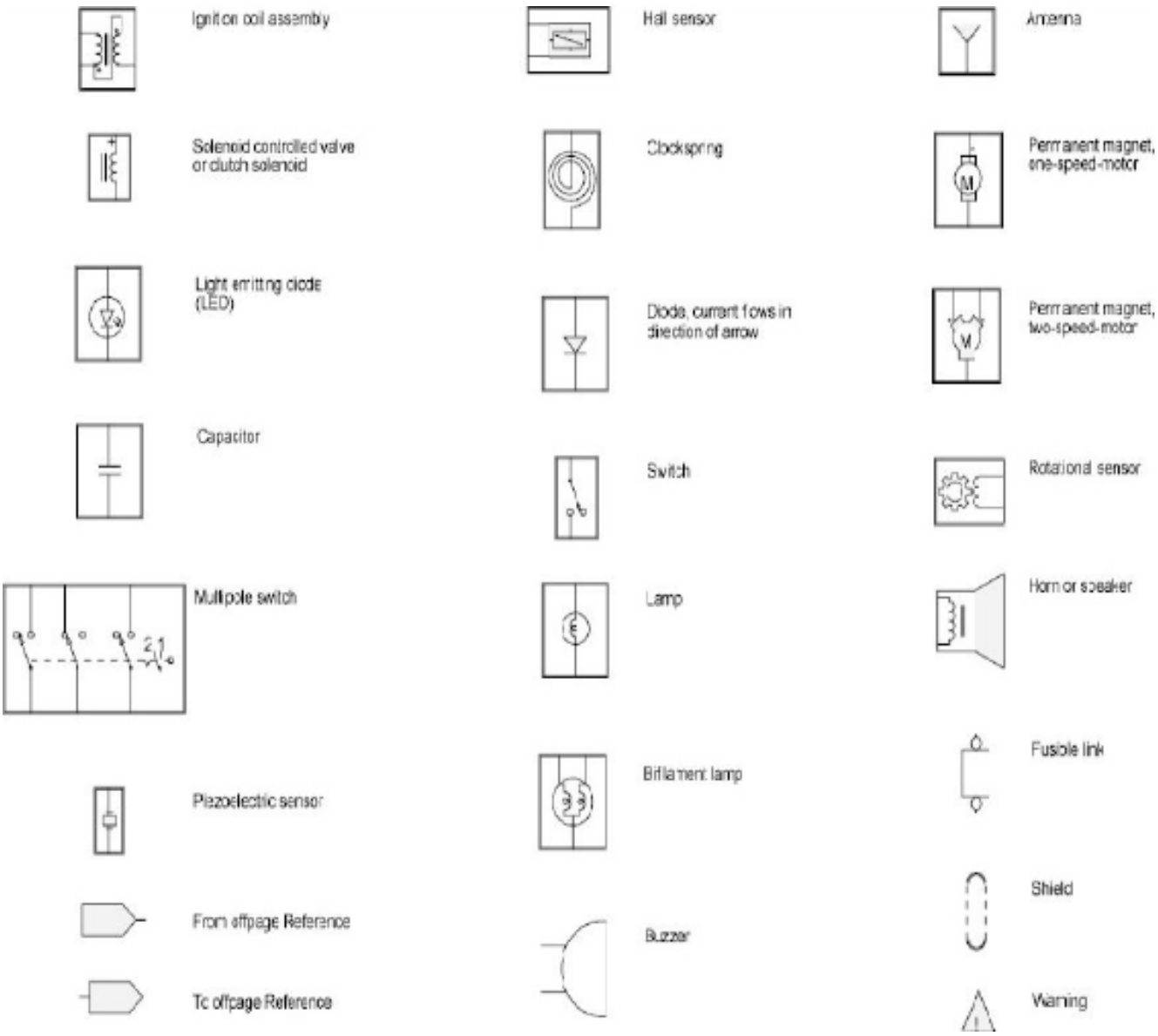
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

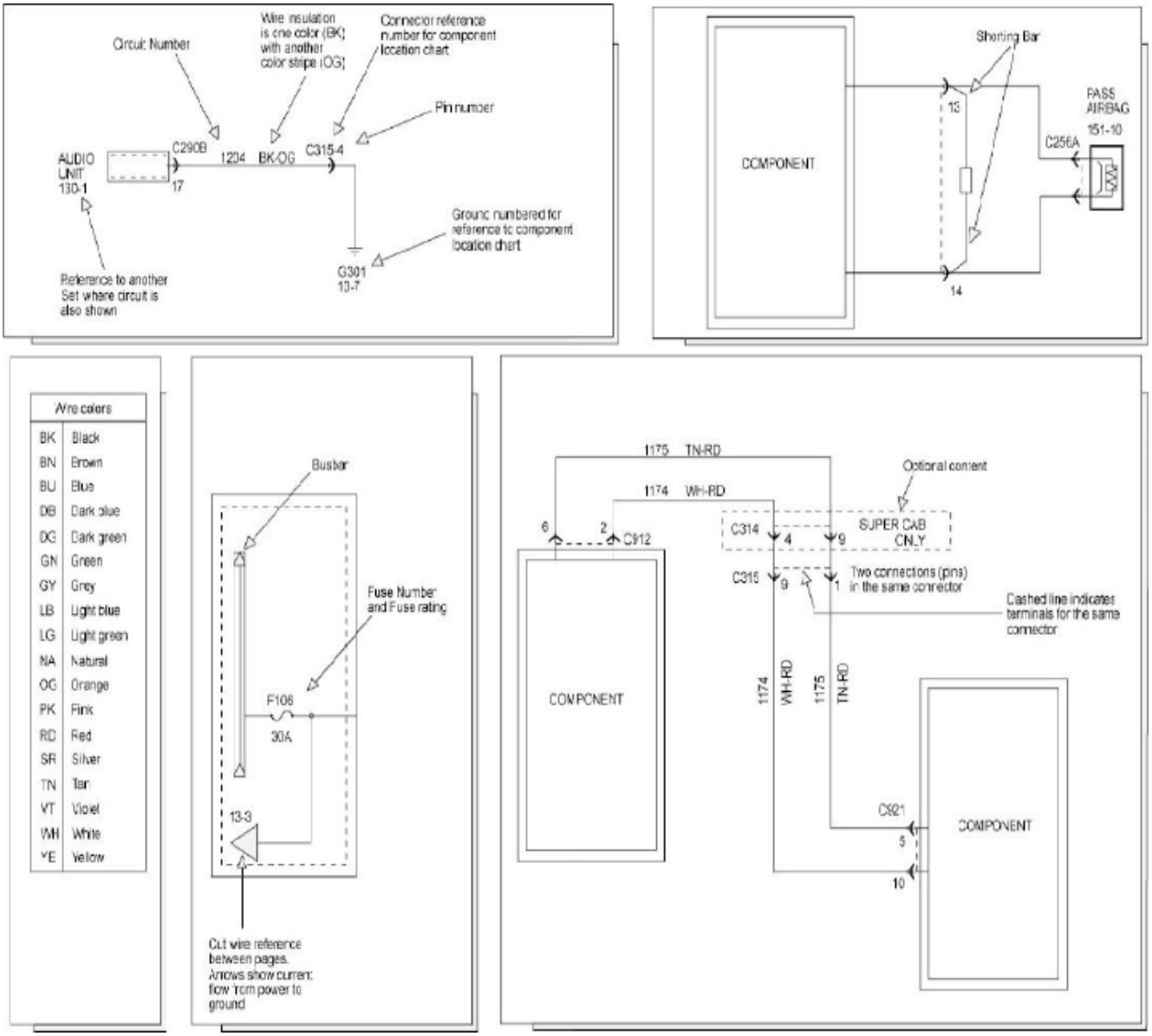
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

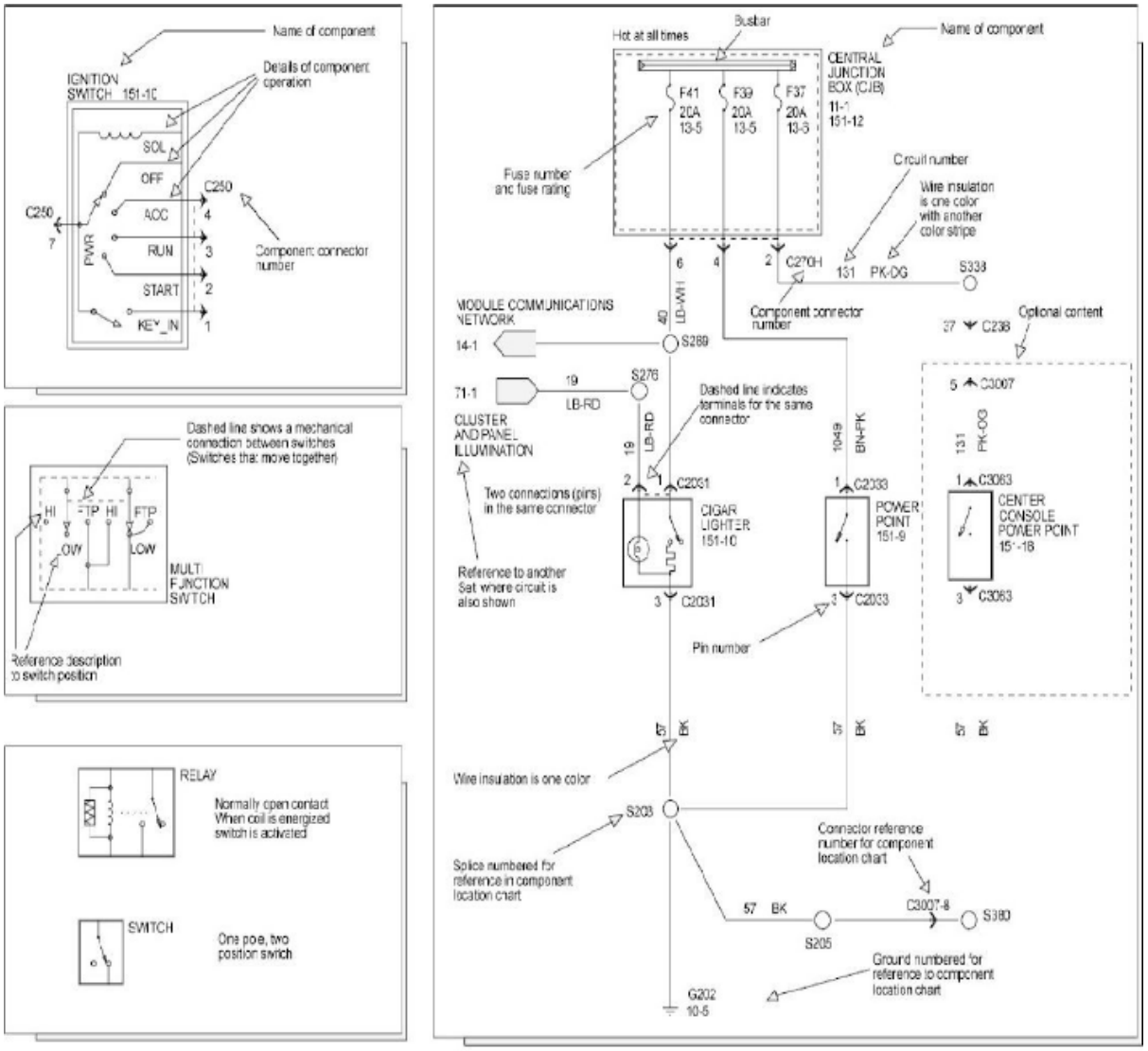
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

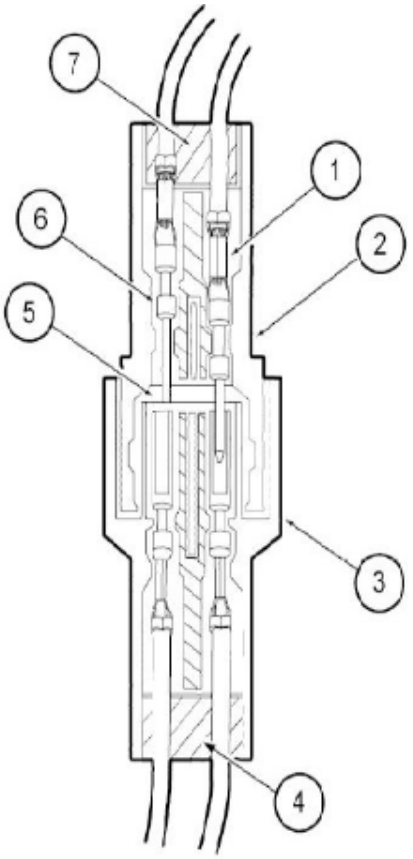


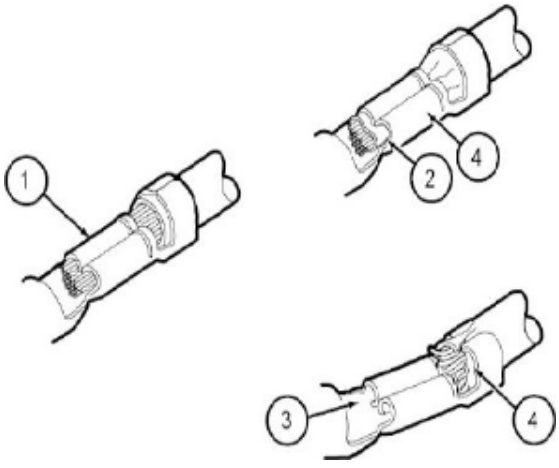
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Turn Signal Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

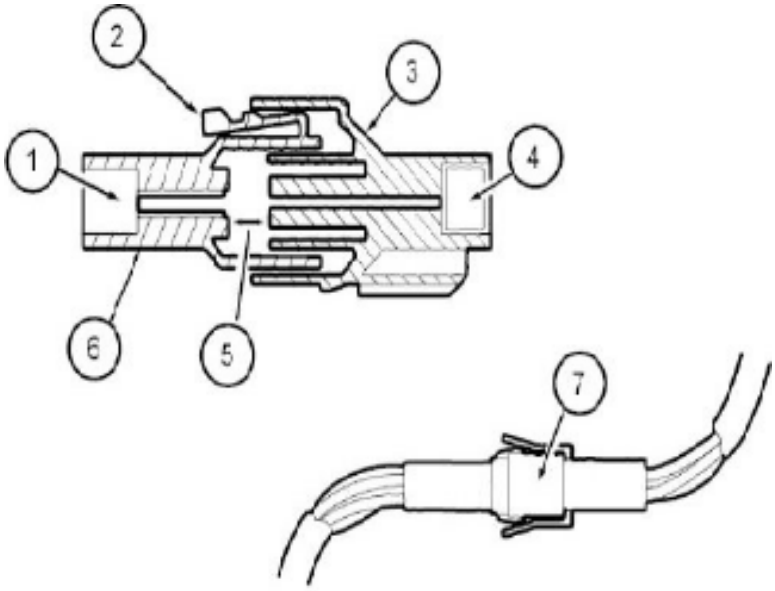
5 = Intermittent contact

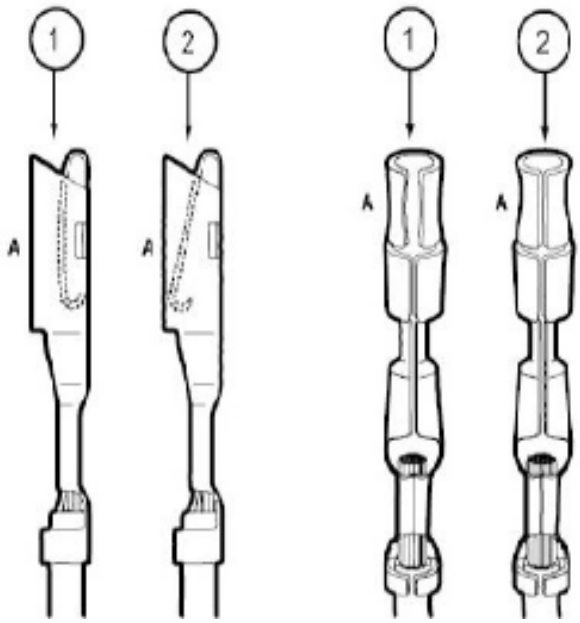
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

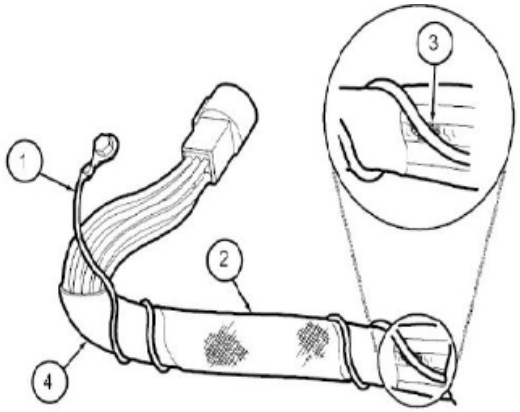
Deformed (enlarged) female terminals

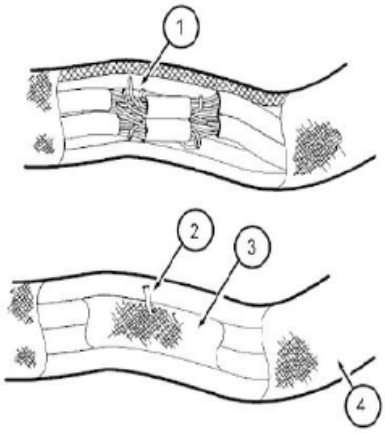
1 = Enlarged

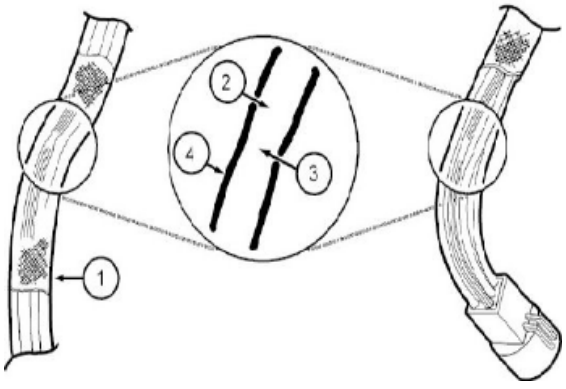
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

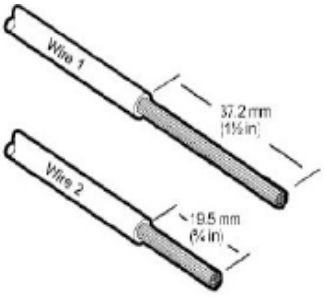
Splice covered 2

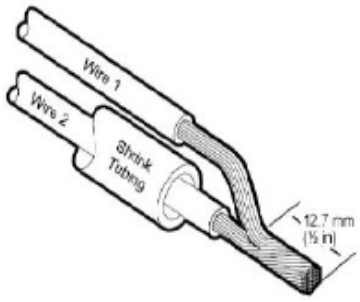
= Wire strand

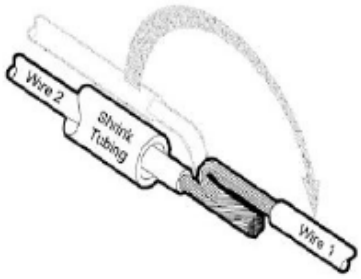
3 = Splice tape

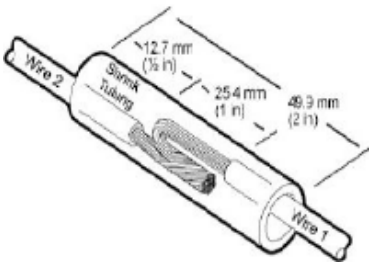
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

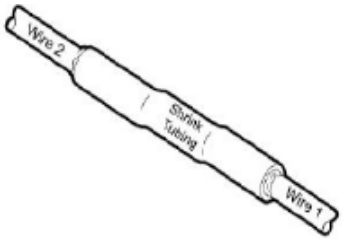
NOTE: -

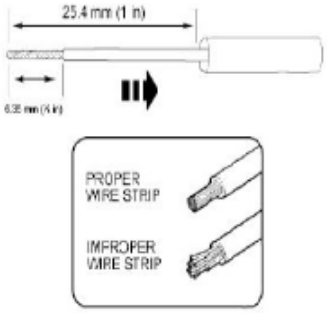
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

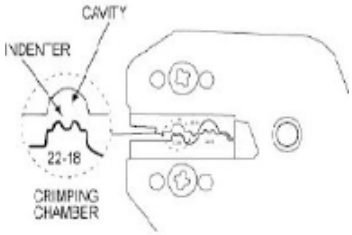
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

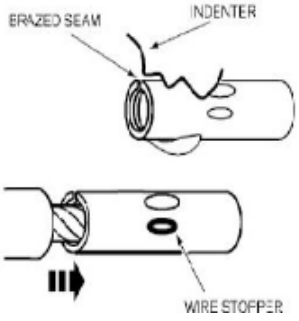
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
6.35 mm (¼ in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

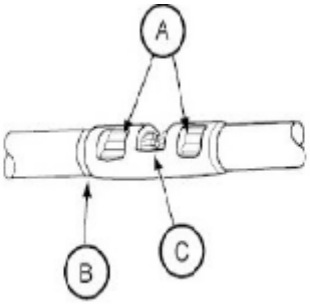
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

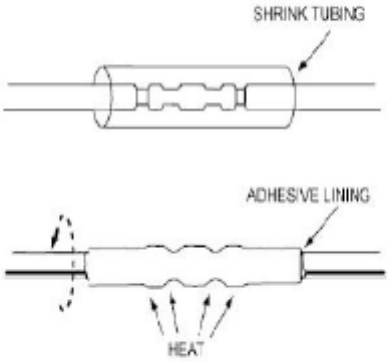
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4 strip, cut 9 strands	* 1/4 strip, cut 2 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip, fold 3x dia.
	16-14	* 1/4 strip, cut 7 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip fold 2x dia	1 strip, fold 3x dia.	1 1/4 strip, fold 4x dia.	Not Recommended
	12-10	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip fold 3x dia.	1 1/4 strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Pigtail only

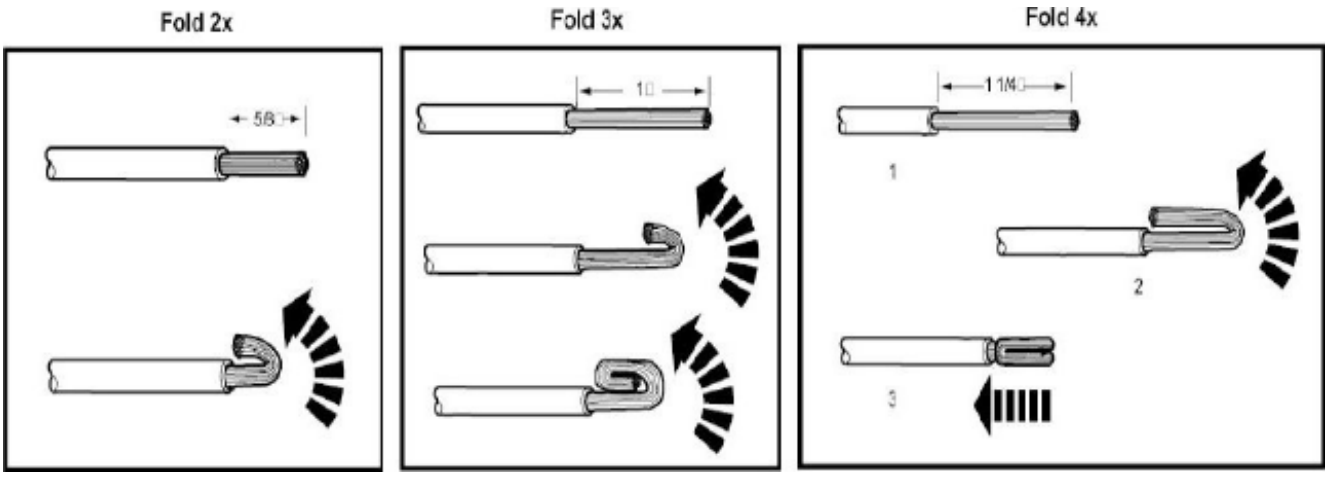
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

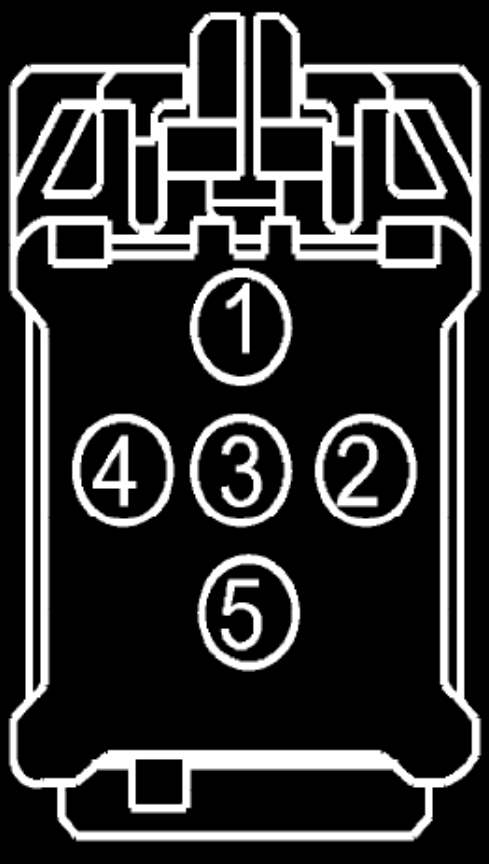
12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Connector: C2047

Description:	Harness:	Base Part #:
INDICATOR FLASHER RELAY	14401	13350



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CLS42 (VT-BN)	18	FLASHER - TURN SIGNAL/HAZARD	
2	GD161 (BK-YE)	18	GROUND - SEAT BRACKET REAR LEFT	
3	CLS32 (BN-YE)	18	SWITCH - HAZARD	
4	SBP17 (RD)	18	FUSE - 17 OR CIRCUIT BREAKER	
5	CBP20 (YE-VT)	18	FUSE - 20 OR CIRCUIT BREAKER	

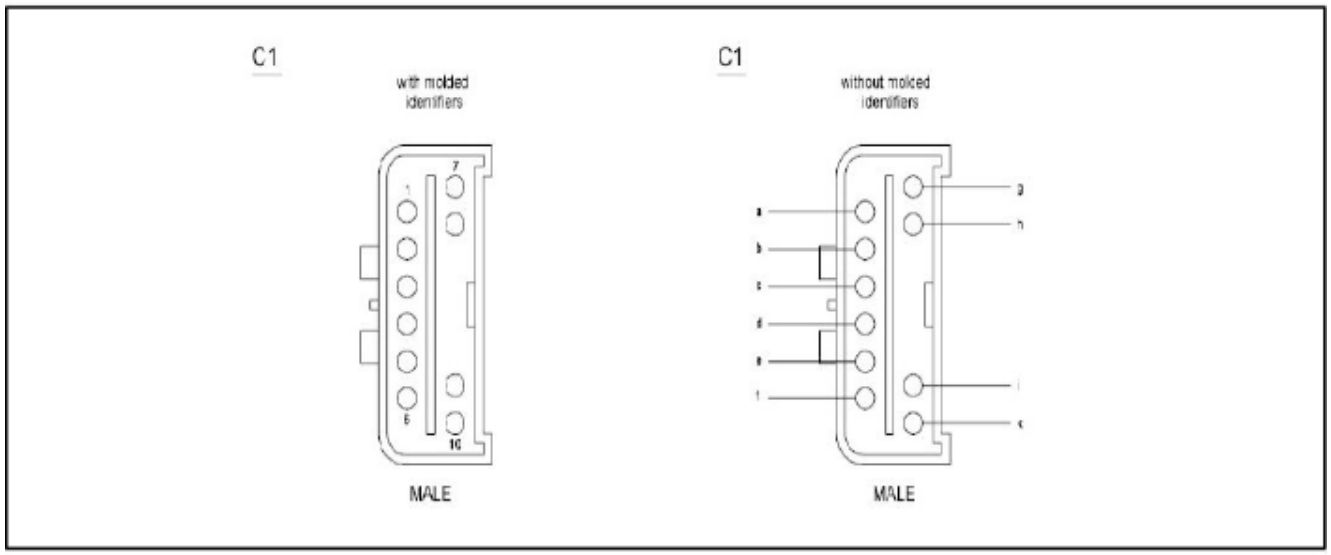
C2047

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



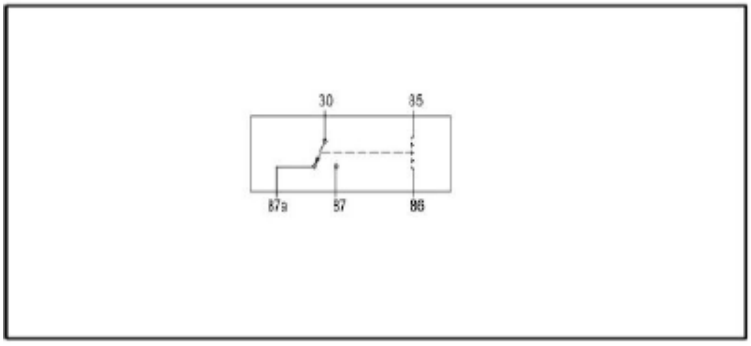
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

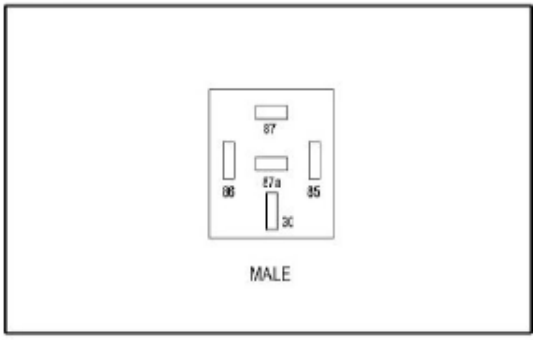
Turn Signal Relay: Testing and Inspection Mini ISO Relay

Relay □ Mini ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

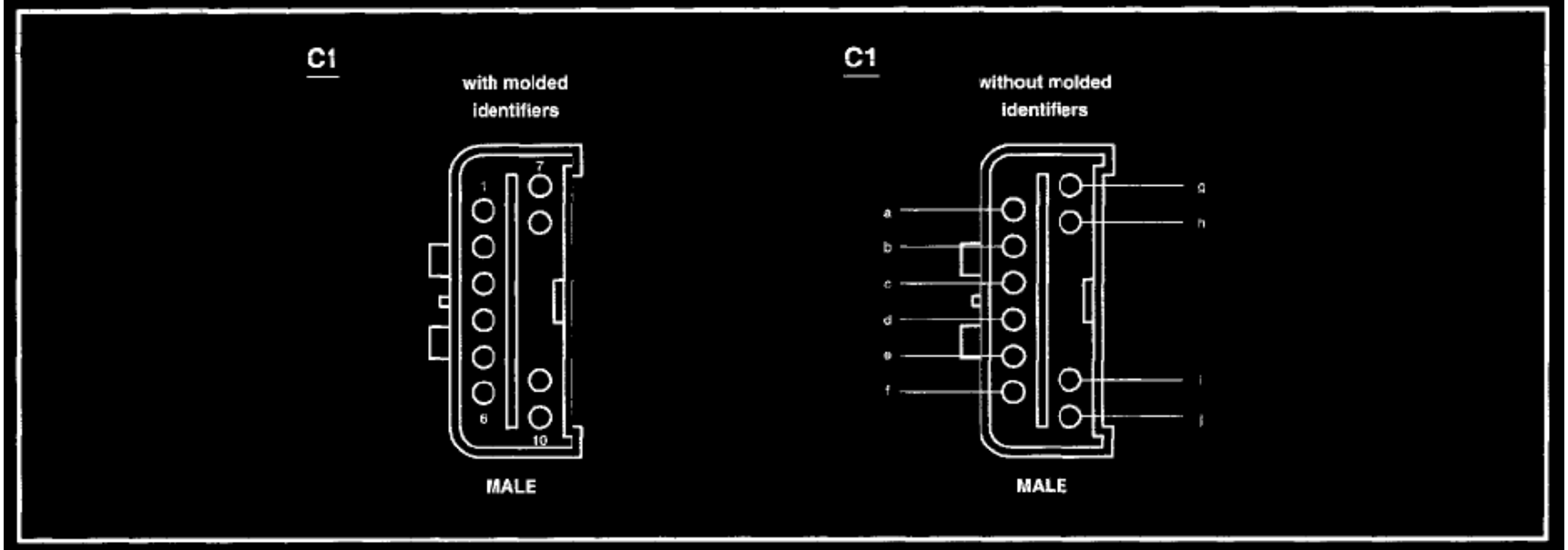
Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step–by–step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



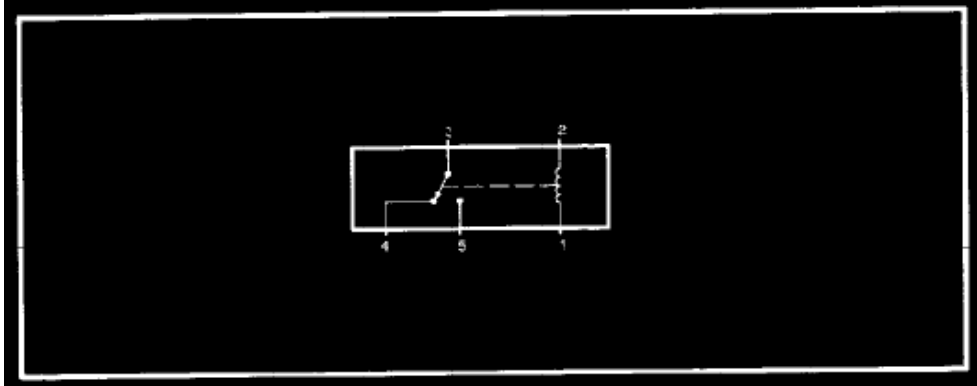
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

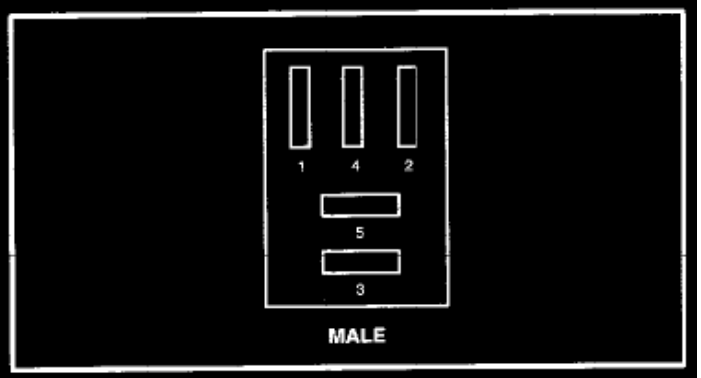
Turn Signal Relay: Testing and Inspection Micro ISO Relay

Relay – Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63–102Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil – Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

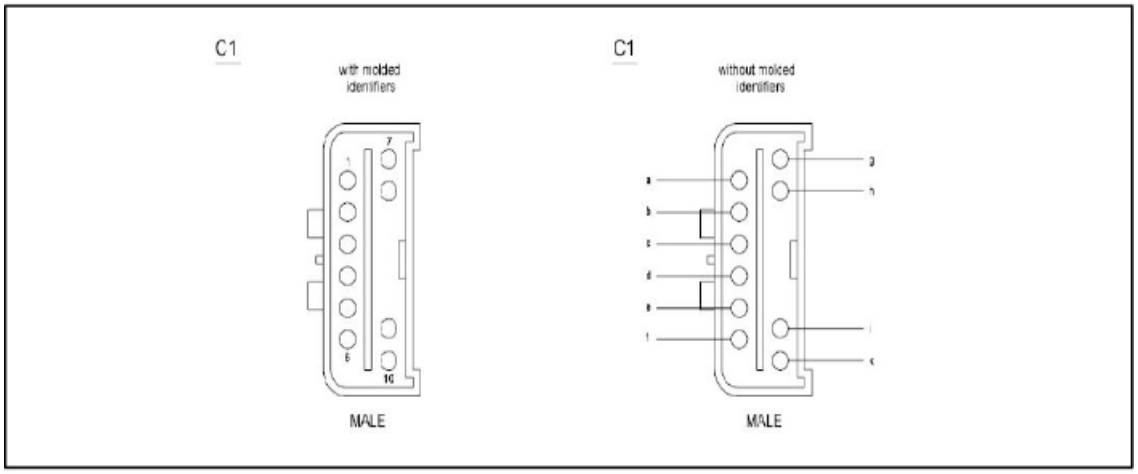
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step□by□step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals

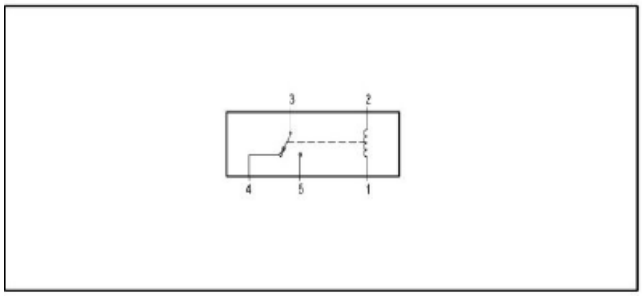


The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column □Circuit to test□. If you wish to test the complete component, perform all tests.

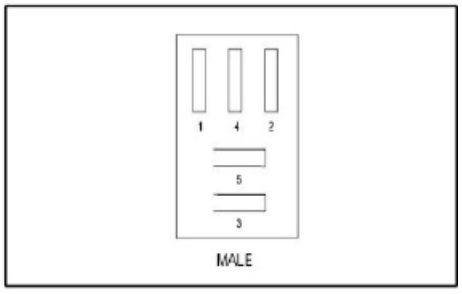
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Relay □ Micro ISO

Schematic



Terminals



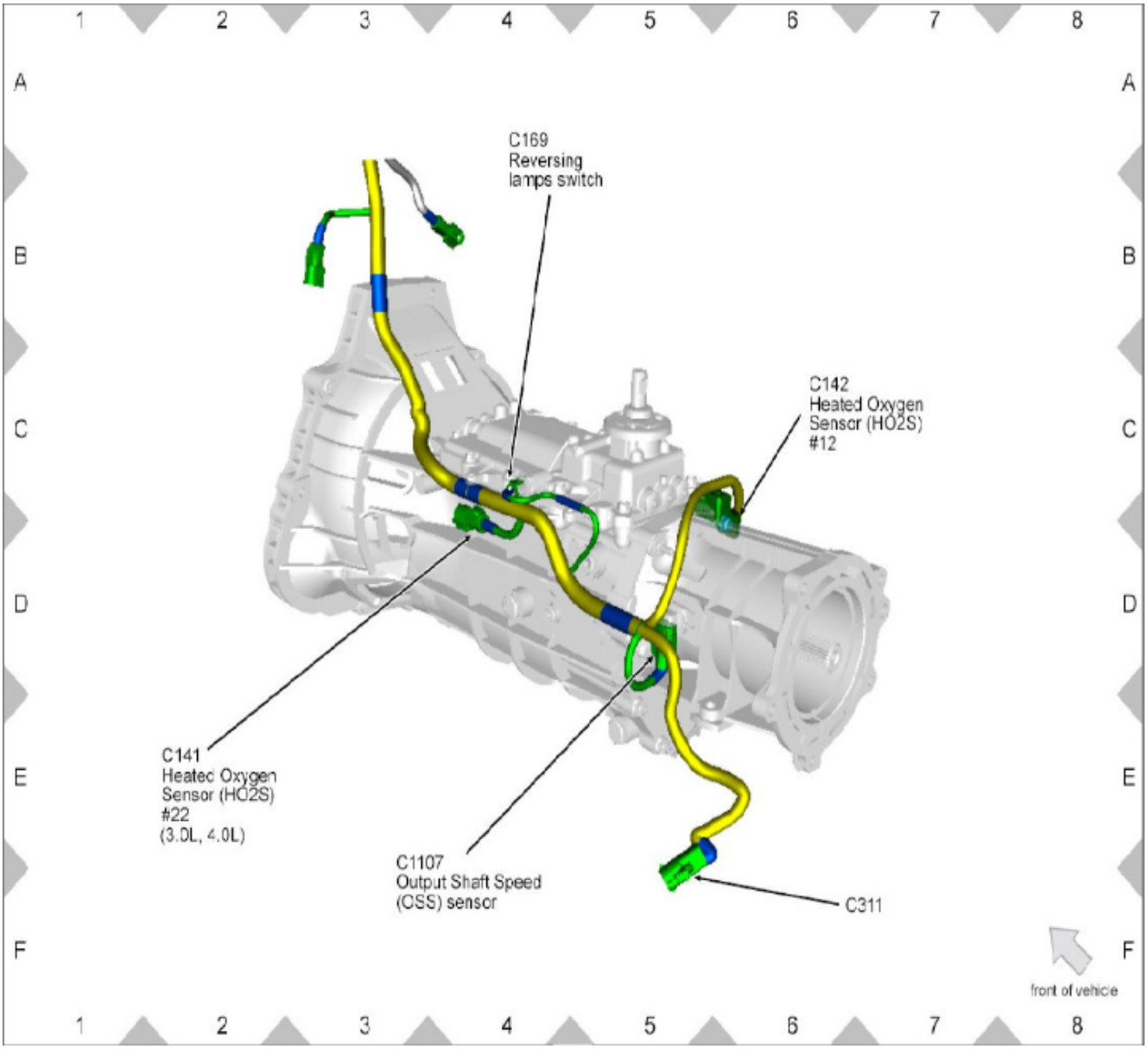
Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63□102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil □ Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

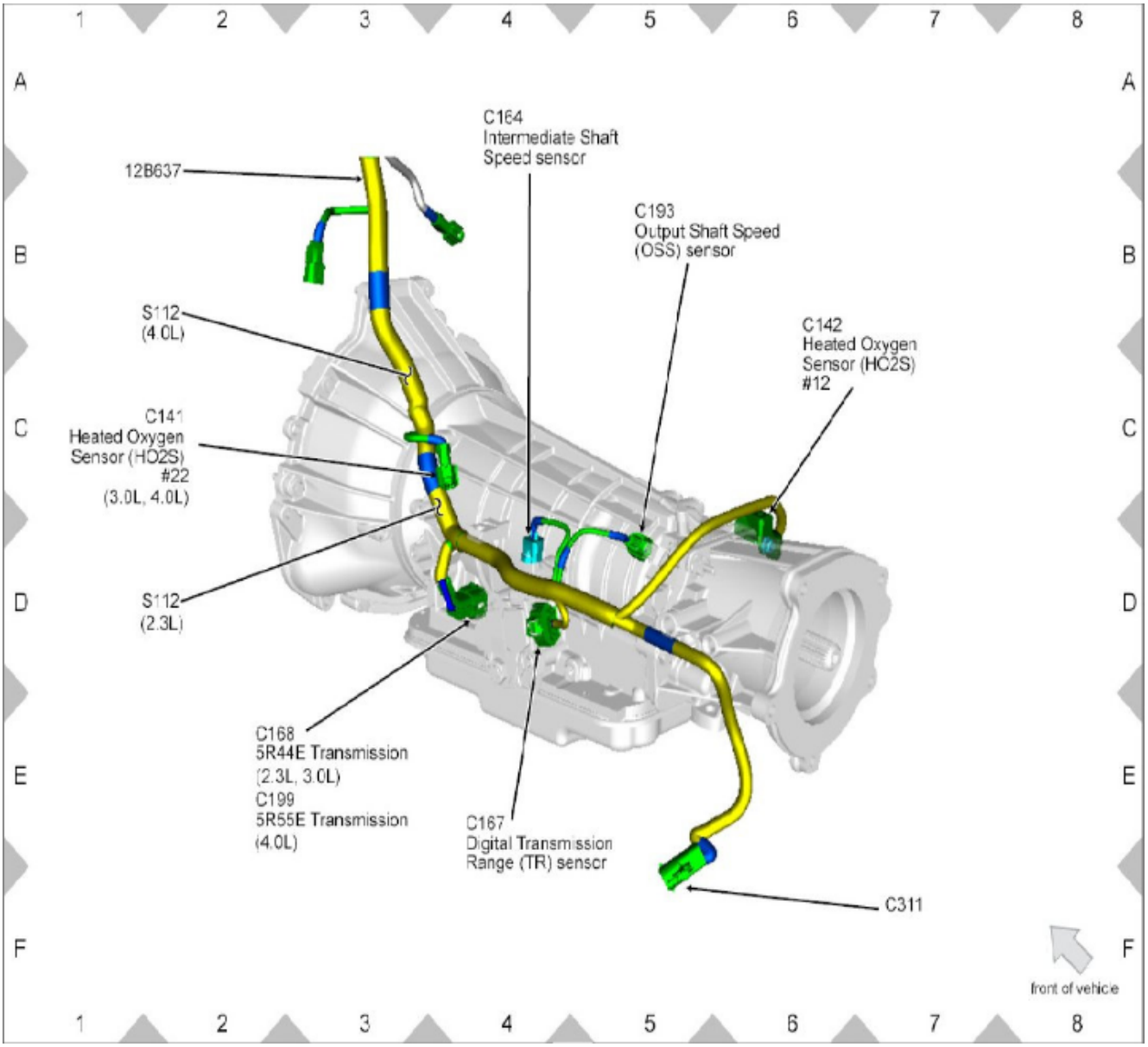
Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Lighting and Horns > Sensors and Switches - Lighting and Horns > Backup Lamp Switch > Component Information > Locations > Reversing Lamps Switch



View 151-9


1
2
3
4
5
6
7
8
A
B
C
D
E
F
C164
Intermediate Shaft
Speed sensor
12B637
C193
Output Shaft Speed
(OSS) sensor
S112
(4.0L)
C142
Heated Oxygen
Sensor (HO2S)
#12
C141
Heated Oxygen
Sensor (HO2S)
#22
(3.0L, 4.0L)
S112
(2.3L)
C168
5R44E Transmission
(2.3L, 3.0L)
C199
5R55E Transmission
(4.0L)
C167
Digital Transmission
Range (TR) sensor
C311
front of vehicle

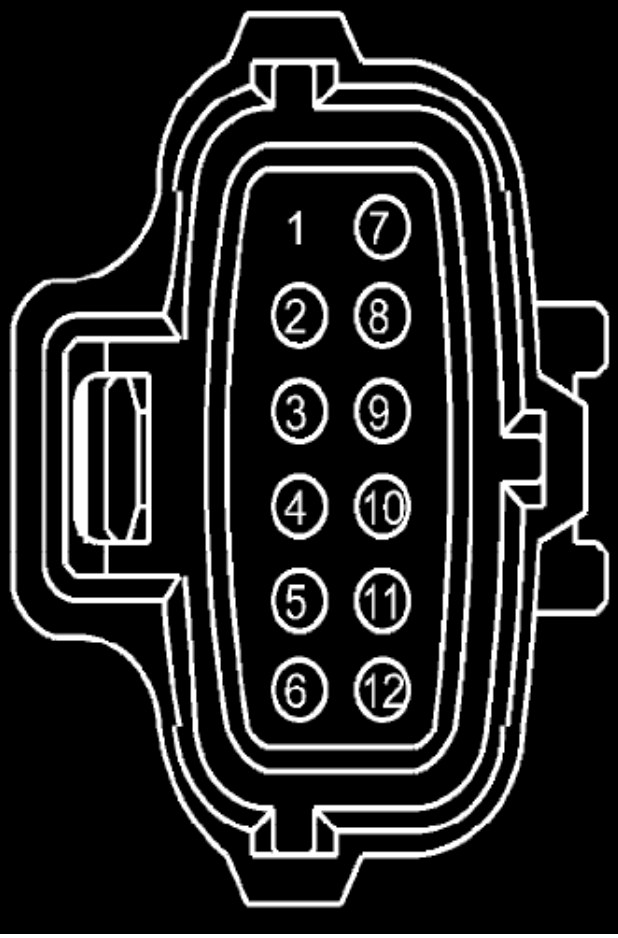
View 151-10

Connector: C167

Description: DIGITAL TRANSMISSION RANGE (TR) SENSOR

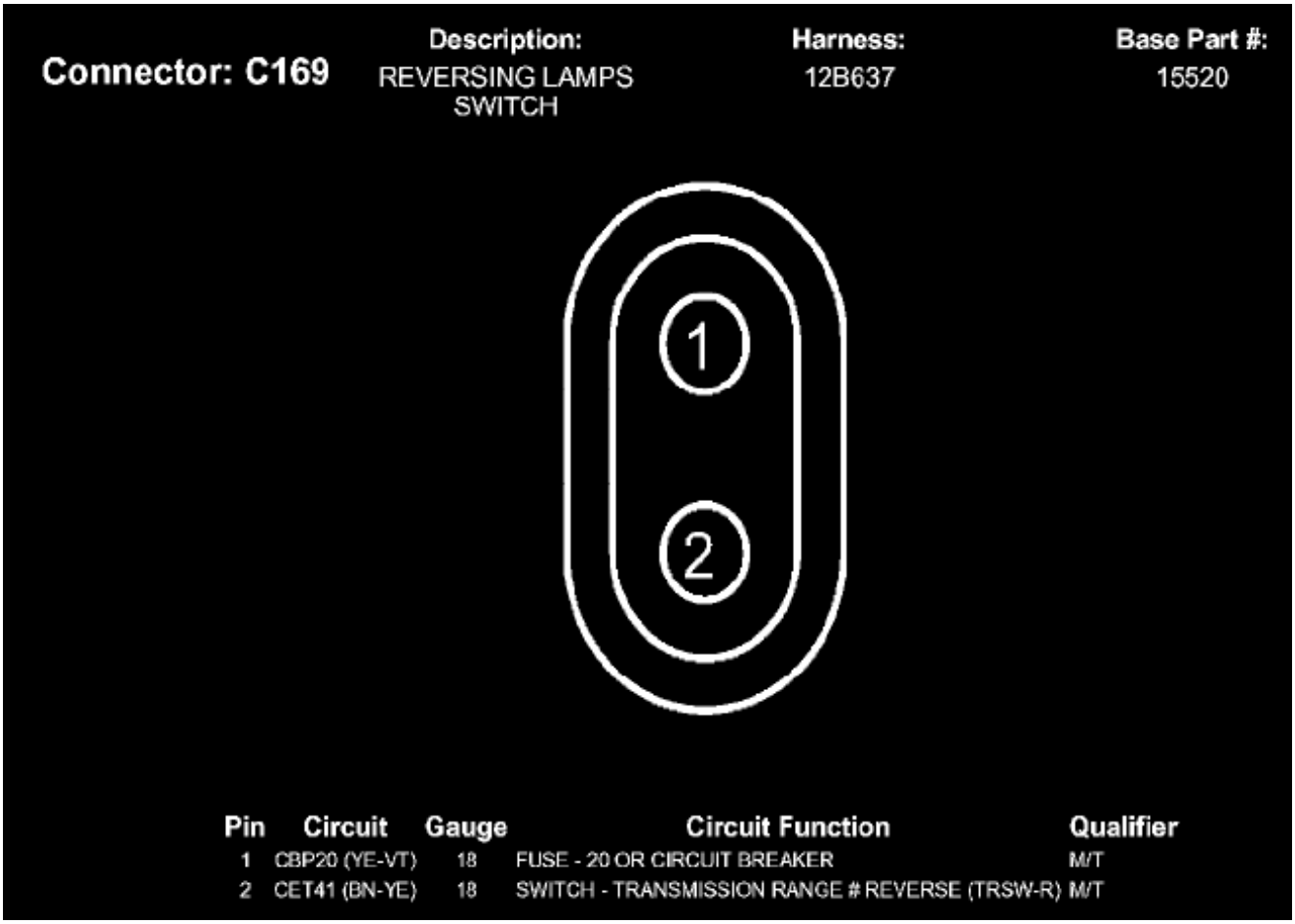
Harness: 12B637

Base Part #: 7F293



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	*	*	not used	
2	RE406 (GY-VT)	18	SIGNAL RETURN	
3	VET28 (GY-VT)	20	TR3A	
4	VET29 (VT-WH)	20	TR1	
5	VET30 (YE)	20	TR2	
6	VET31 (BU-OG)	20	TR4	
7	GD108 (BK-VT)	18	GROUND	4x4
8	CCF20 (GY-VT)	20	NETURAL SENSE	4x4
9	CBP20 (YE-VT)	18	FUSED POWER FEED	
10	CET40 (GN-OG)	20	STARTER CONTROL	
11	CET41 (BN-YE)	18	BACK UP	
12	CBP21 (BU-GY)	20	STARTER TO STARTER INTERRUPT RELAY	

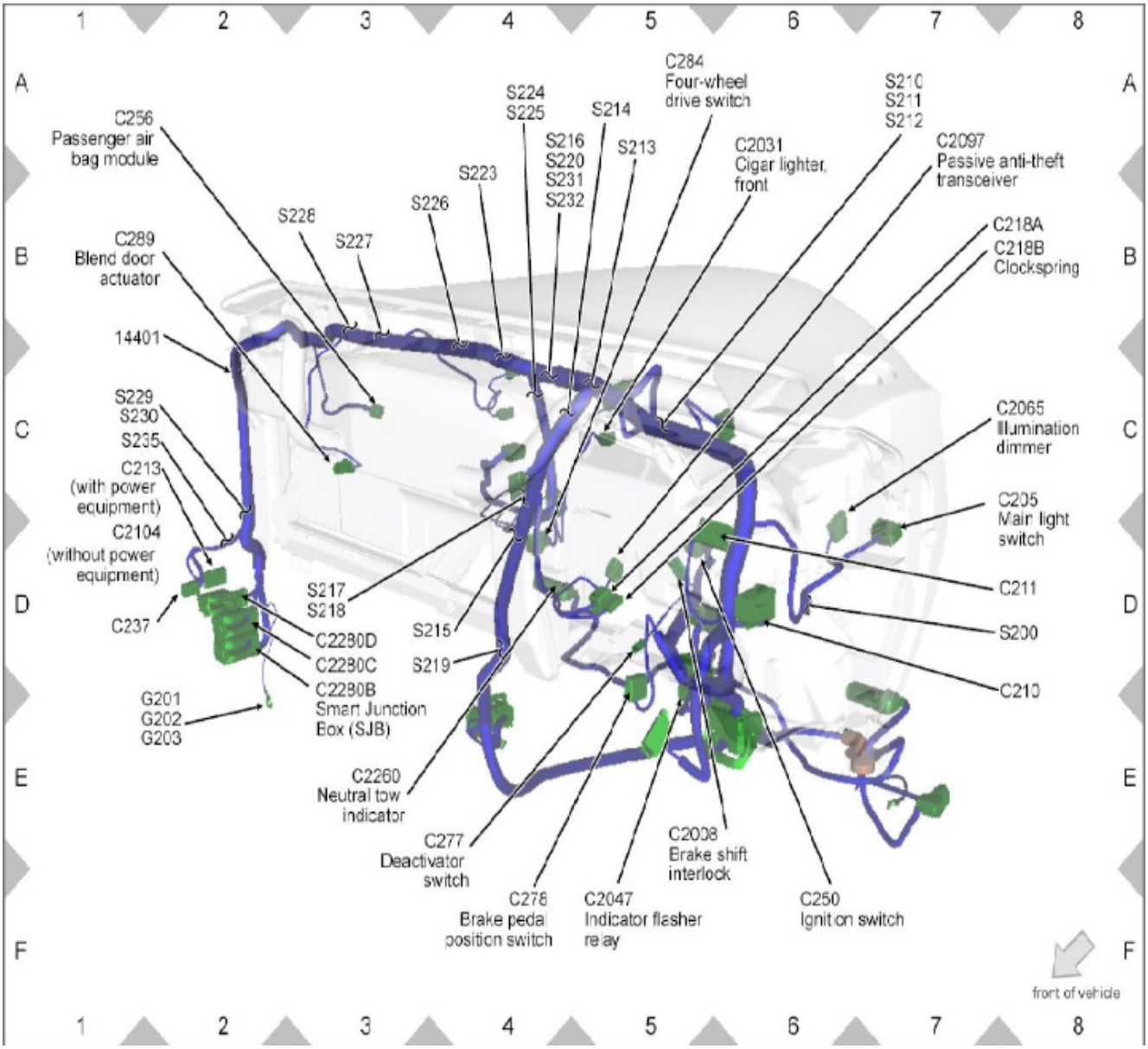
C167



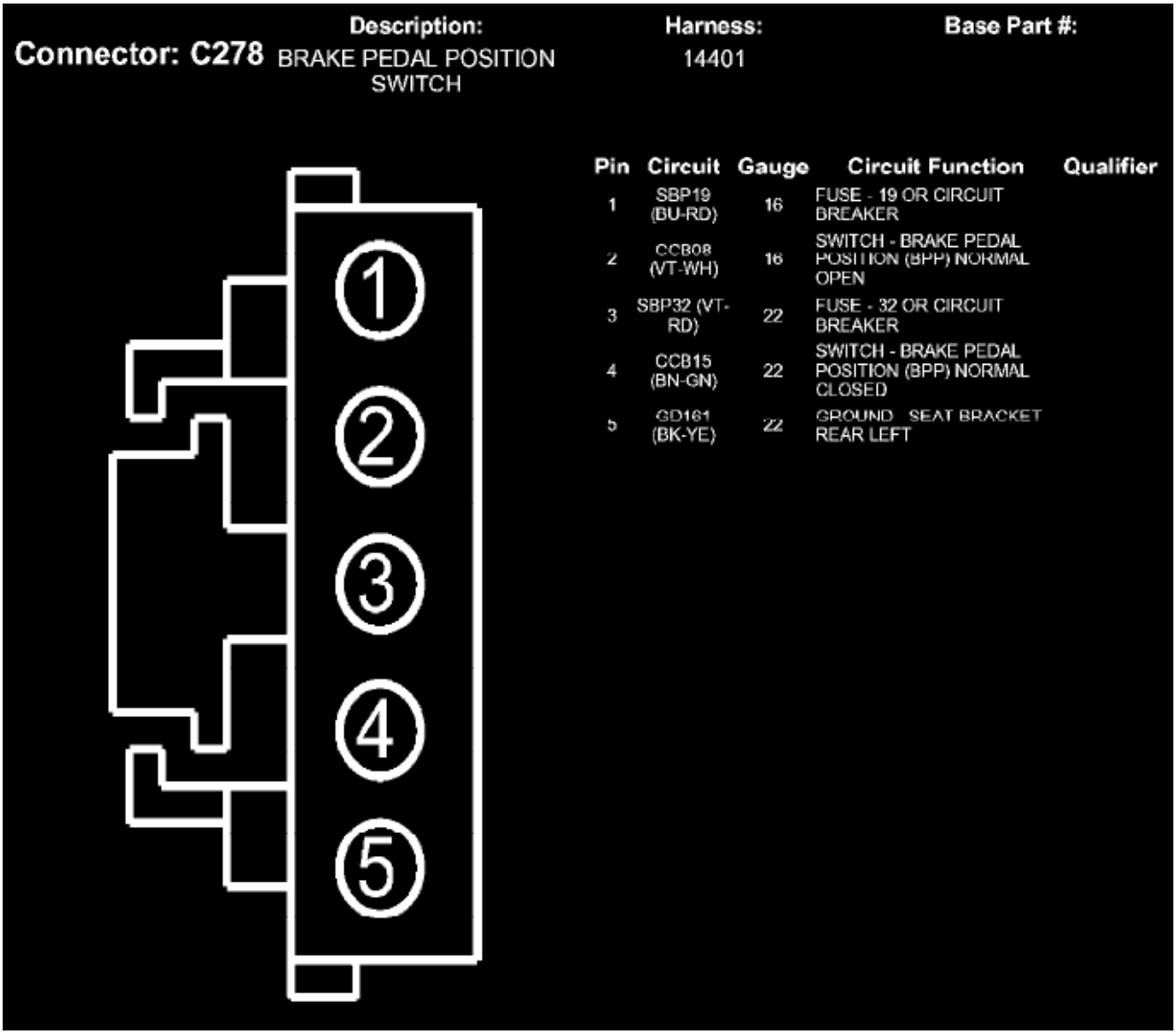
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CBP20 (YE-VT)	18	FUSE - 20 OR CIRCUIT BREAKER	M/T
2	CET41 (BN-YE)	18	SWITCH - TRANSMISSION RANGE # REVERSE (TRSW-R)	M/T

C169

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Lighting and Horns > Sensors and Switches - Lighting and Horns > Brake Light Switch > Component Information > Locations

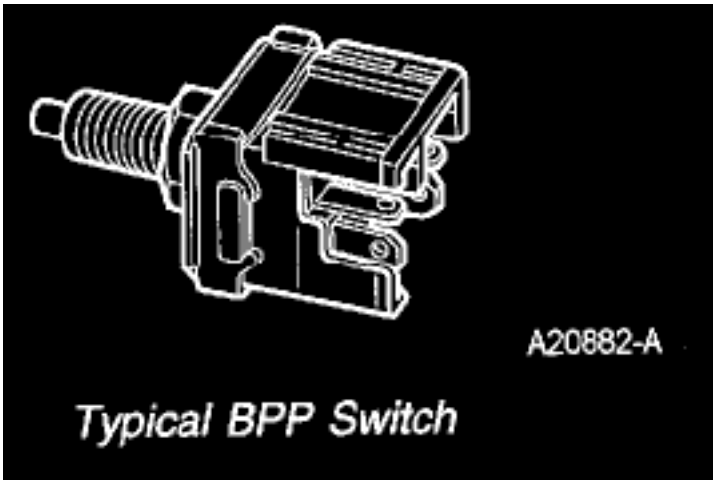


View 151-11



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	SBP19 (BU-RD)	16	FUSE - 19 OR CIRCUIT BREAKER	
2	CCB08 (VT-WH)	16	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL OPEN	
3	SBP32 (VT-RD)	22	FUSE - 32 OR CIRCUIT BREAKER	
4	CCB15 (BN-GN)	22	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL CLOSED	
5	GD161 (BK-YE)	22	GROUND SEAT BRACKET REAR LEFT	

C278



Brake Light Switch: Description and Operation

BRAKE PEDAL POSITION (BPP) SWITCH

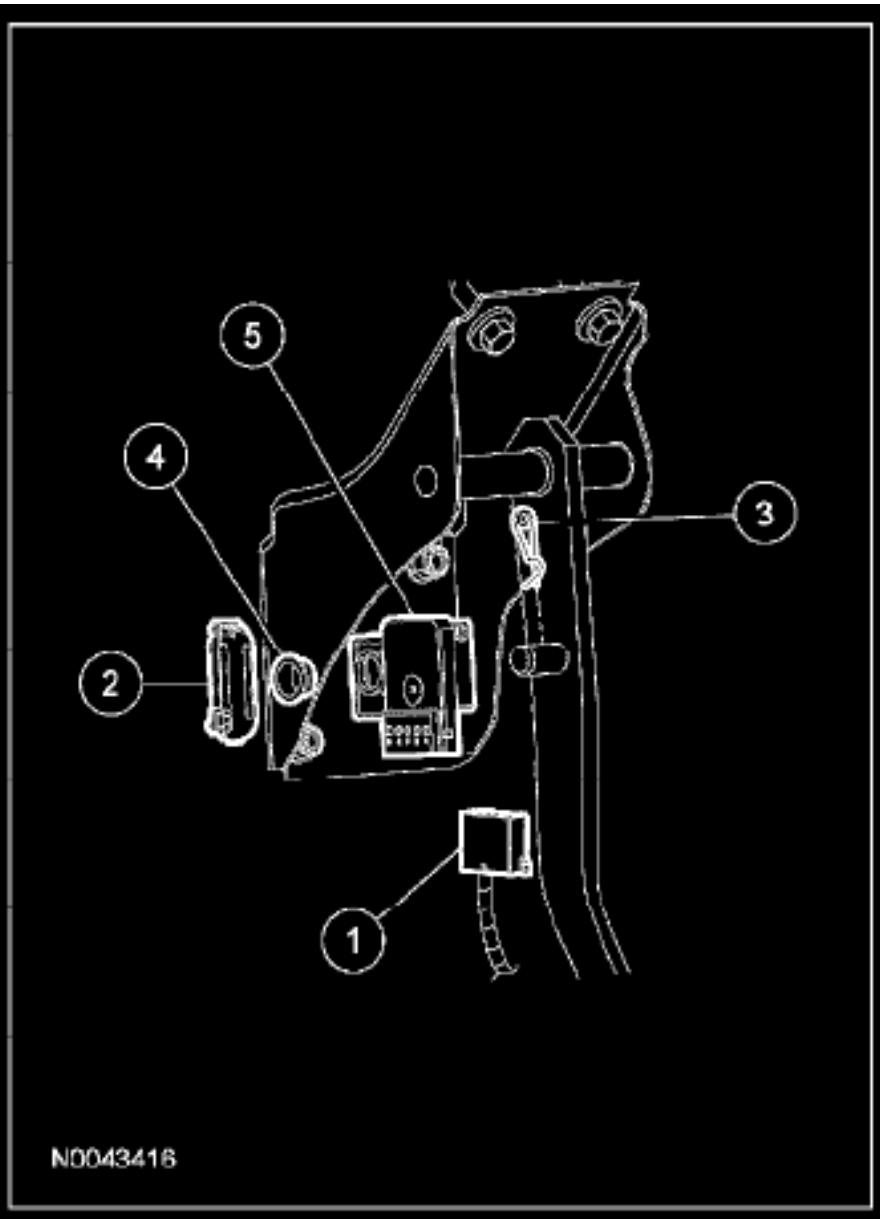
Typical BPP Switch

The BPP switch is sometimes referred to as the stoplamp switch. The BPP switch provides a signal to the PCM indicating that the brakes are applied. The BPP switch is normally open and is mounted on the brake pedal support. Depending on the vehicle application the BPP switch can be hardwired as follows:

- to the PCM supplying battery positive voltage (B+) when the vehicle brake pedal is applied.

- to the antilock brake system (ABS) module, or lighting control module (LCM), the BPP signal is then broadcast over the network to be received by the PCM.

- to the ABS traction control/stability assist module. The ABS module interprets the BPP switch input along with other ABS inputs and generates an output called the driver brake application (DBA) signal. The DBA signal is then sent to the PCM and to other BPP signal users.



Item	Part Number	Description
1	—	Stoplamp switch electrical connector (part of 14401)
2	2475	Stoplamp switch self-locking pin cover
3	380699	Stoplamp switch self-locking pin
4	2B219	Stoplamp switch spacer
5	13480	Stoplamp switch

Brake Light Switch: Service and Repair

STOPLAMP SWITCH

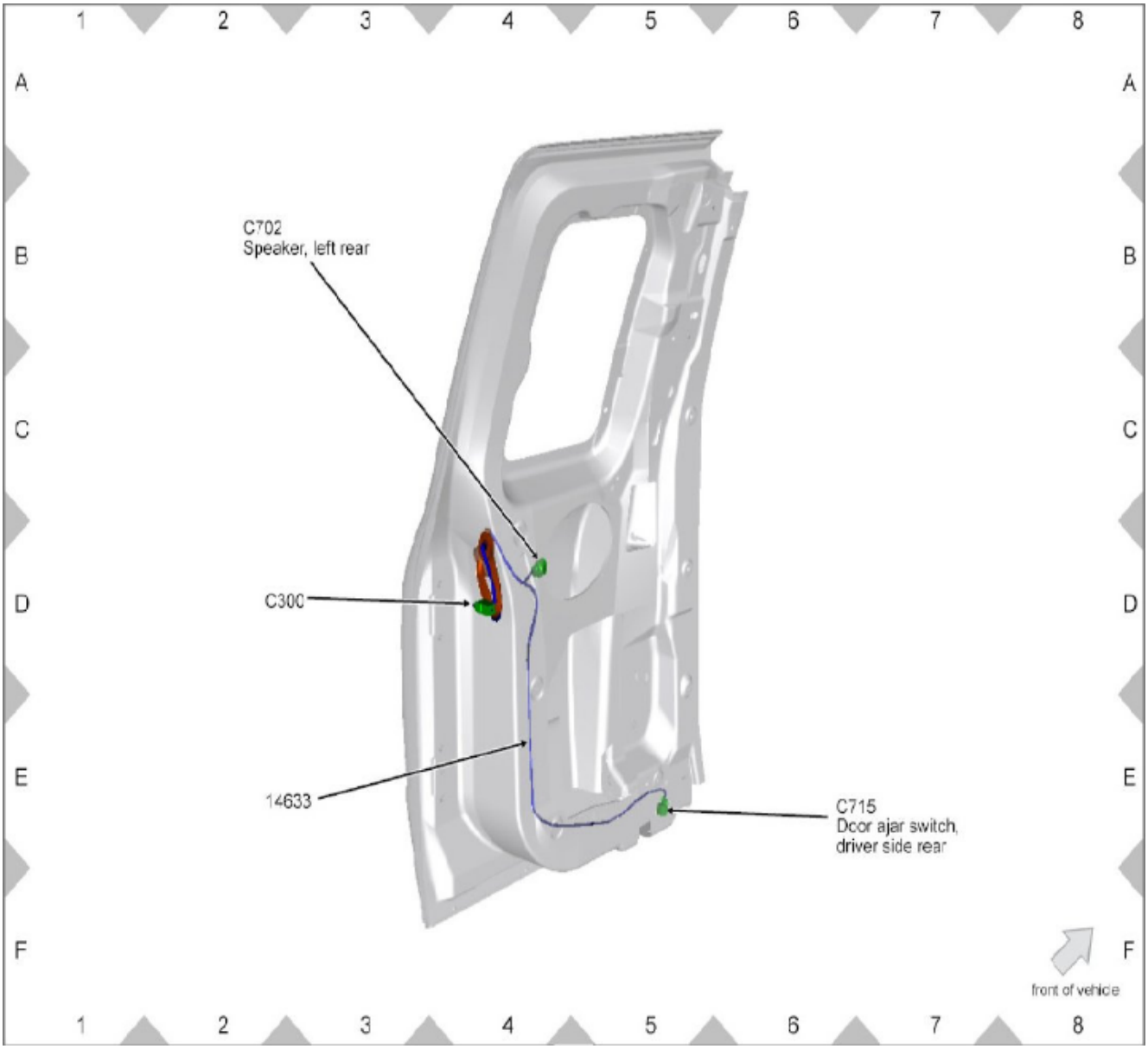
Removal and Installation

1. Disconnect the stoplamp switch electrical connector. 2. Remove the cover and the self-locking pin. 3. Remove the stoplamp switch from the brake booster push rod and the brake pedal assembly.

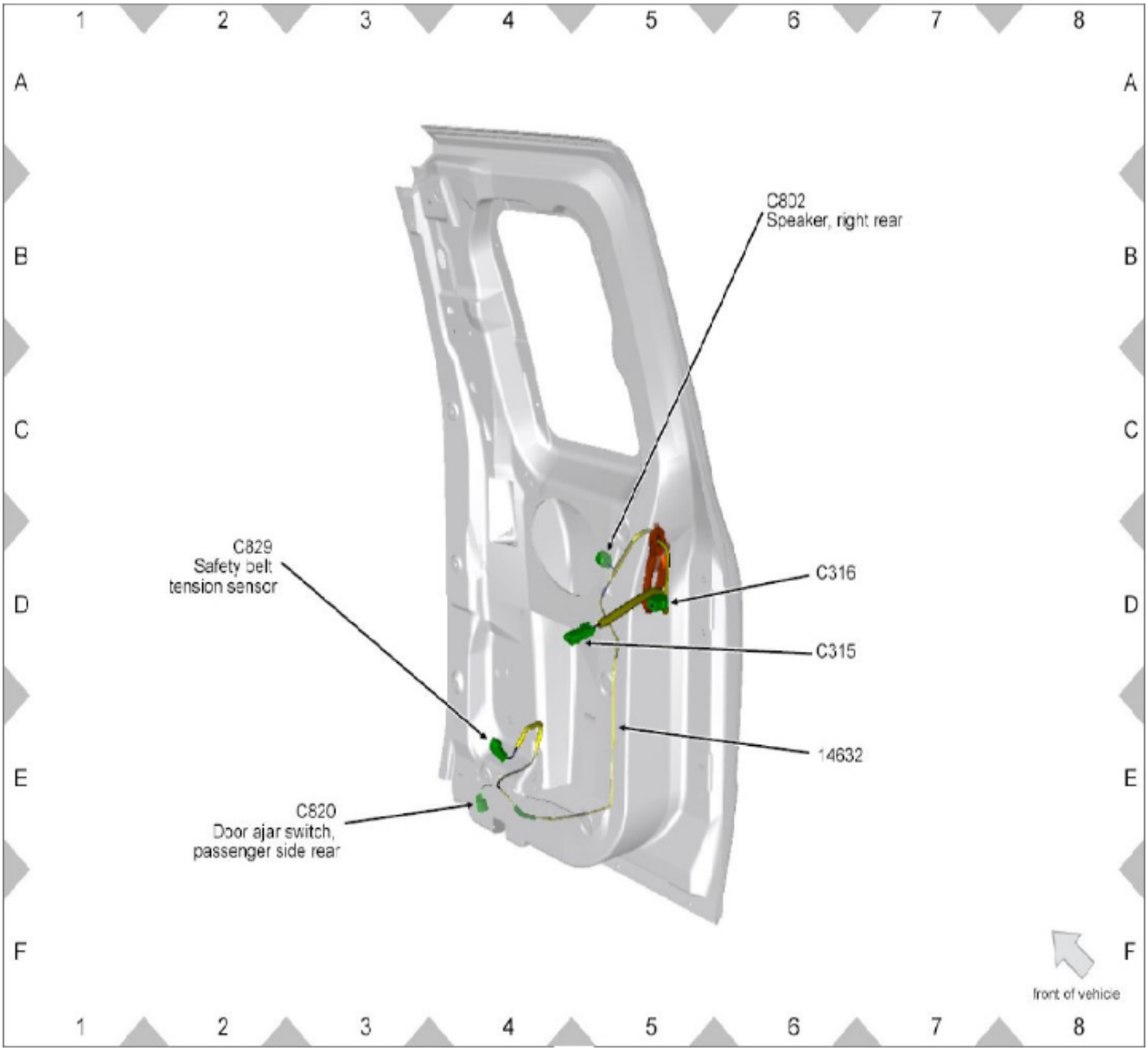
- Remove the spacer.

4. To install, reverse the removal procedure.

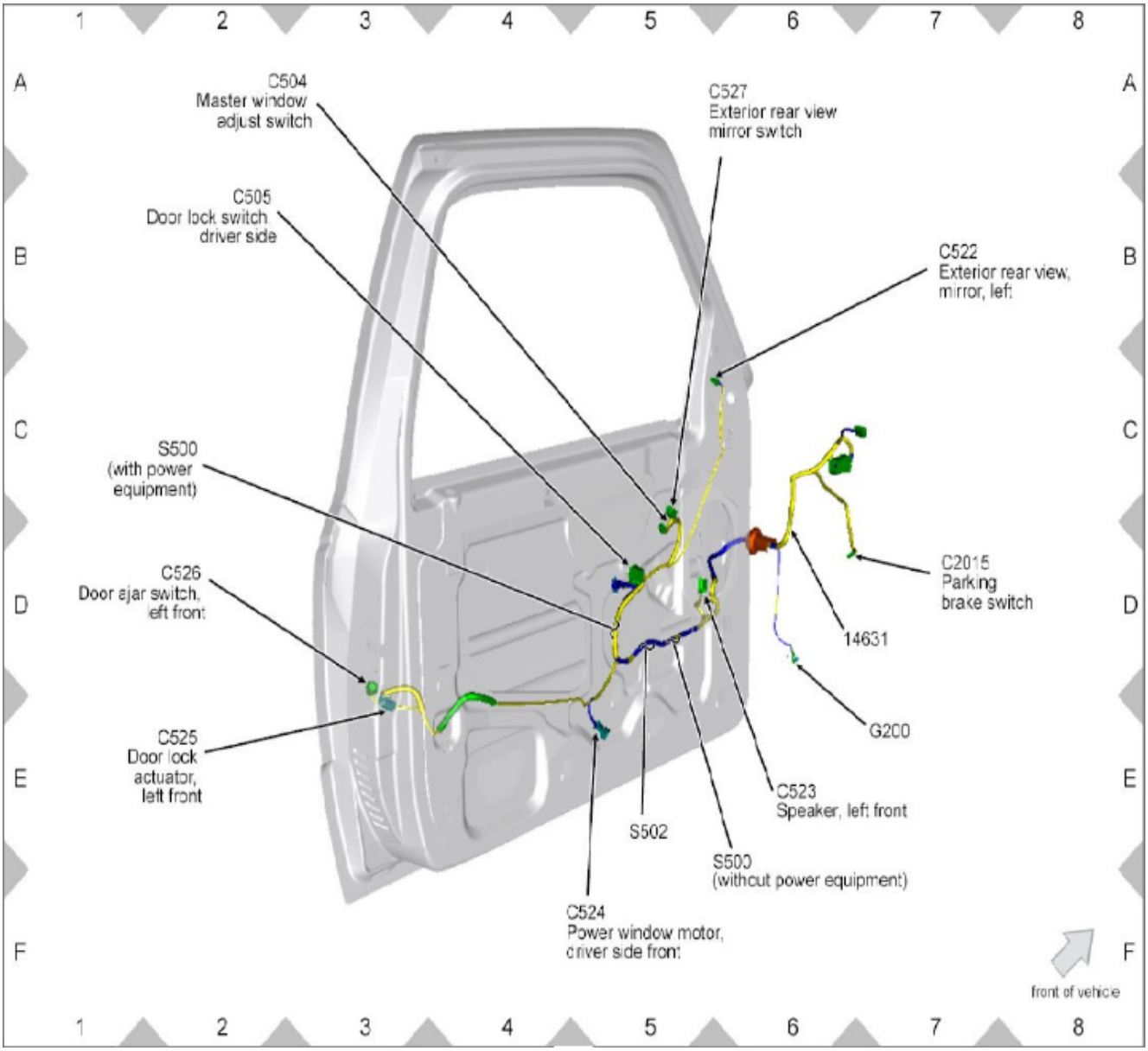
Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Lighting and Horns > Sensors and Switches - Lighting and Horns > Door Switch > Component Information > Locations > Door Ajar Switch, Driver Side Rear



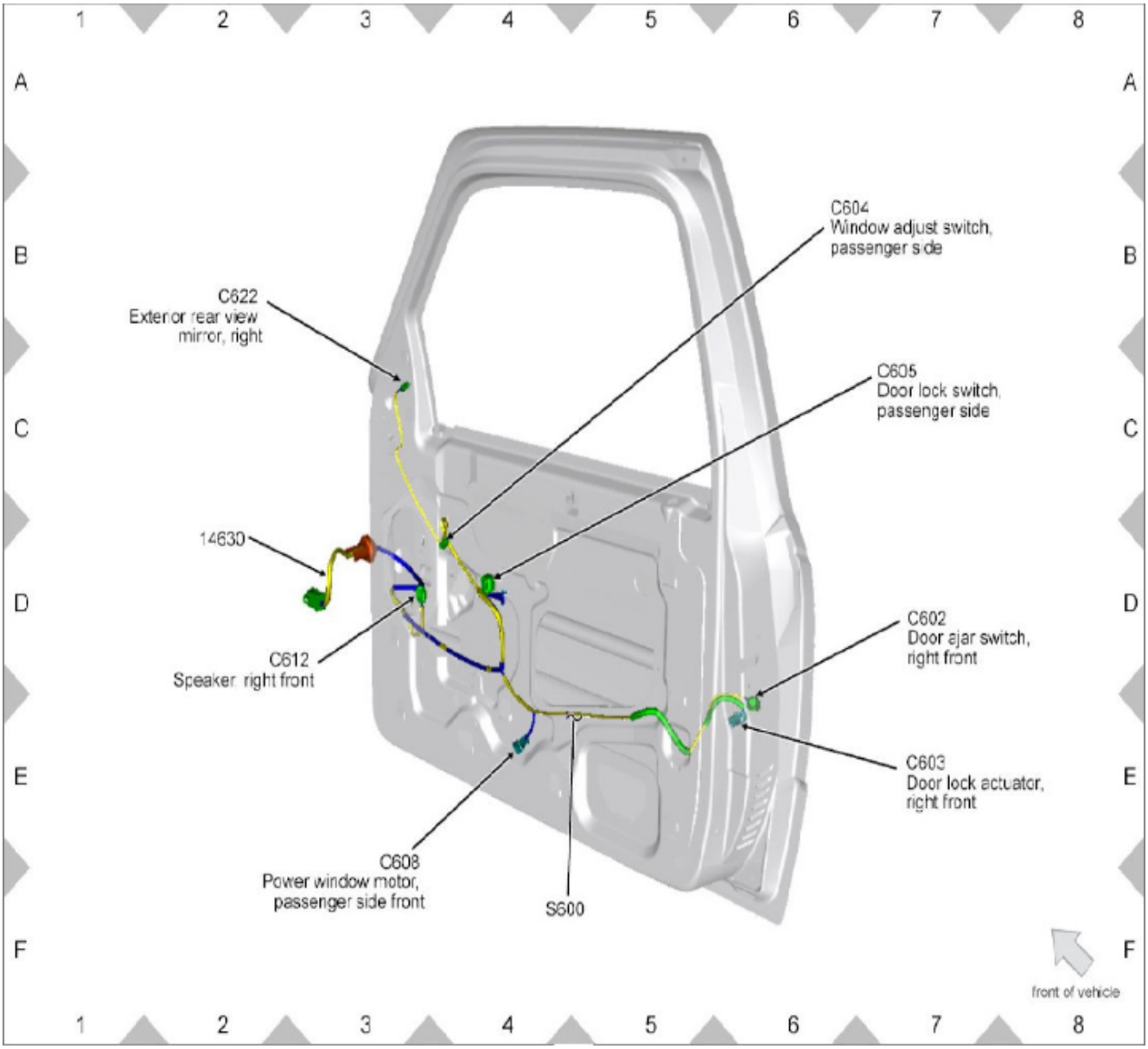
View 151-22


C802
Speaker, right rear
C829
Safety belt tension sensor
C316
C315
14632
C820
Door ajar switch, passenger side rear
front of vehicle

View 151-23


C504
Master window adjust switch
C505
Door lock switch driver side
S500
(with power equipment)
C526
Door ajar switch, left front
C525
Door lock actuator, left front
C527
Exterior rear view mirror switch
C522
Exterior rear view mirror, left
C2015
Parking brake switch
14631
G200
C523
Speaker, left front
S502
S500
(without power equipment)
C524
Power window motor, driver side front
front of vehicle

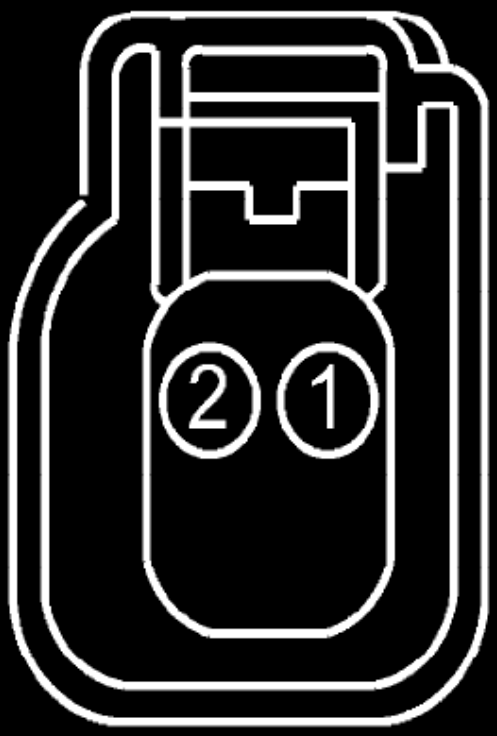
View 151-20


C604
Window adjust switch, passenger side
C622
Exterior rear view mirror, right
C605
Door lock switch, passenger side
14630
C612
Speaker, right front
C602
Door ajar switch, right front
C603
Door lock actuator, right front
C608
Power window motor, passenger side front
S600
front of vehicle

View 151-21

Connector: C526

Description:	Harness:	Base Part #:
DOOR AJAR SWITCH, LEFT FRONT	14631	



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPL26 (GN-VT)	20	SWITCH - LATCH DRIVER # AJAR	
2	GD175 (BK-BU)	20	GROUND - TUNNEL # 2ND STUD	

C526

Connector: C602
Description:
DOOR AJAR SWITCH, RIGHT FRONT
Harness:
14630
Base Part #:
Pin Circuit Gauge Circuit Function Qualifier
1 CPL31 (WH) 20 SWITCH - LATCH PASSENGER # AJAR
2 GD161 (BK-YE) 20 GROUND - SEAT BRACKET REAR LEFT
2
1

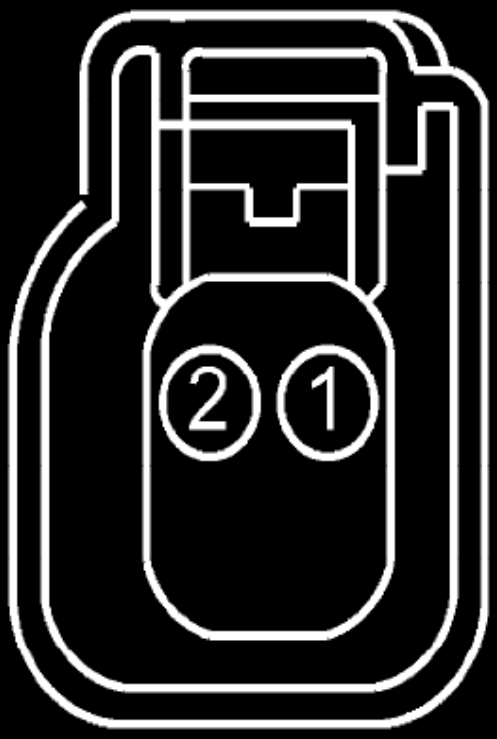
C602

Connector: C715
Description:
DOOR AJAR SWITCH, DRIVER SIDE REAR
Harness:
14633
Base Part #:
14018
Pin Circuit Gauge Circuit Function Qualifier
1 CPL36 (GN) 18 SWITCH - LATCH REAR DRIVER SIDE # AJAR (INCL.SLIDING DOOR)
2 GD101 (BK-YE) 18 GROUND - SEAT BRACKET REAR LEFT
2
1

C715

Connector: C820

Description:	Harness:	Base Part #:
DOOR AJAR SWITCH, PASSENGER SIDE REAR	14632	14018



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPL39 (YE)	18	SWITCH - LATCH REAR PASSENGER SIDE # AJAR (INCL.SLIDING DOOR)	
2	GD161 (BK-YE)	18	GROUND - SEAT BRACKET REAR LEFT	

C820

Door Switch: Service and Repair Door Ajar Switch

DOOR AJAR SWITCH

Removal and Installation

1. Remove the front door latch. 2. Lift the locking tab, rotate the switch and remove the door ajar switch. 3. To install, reverse the removal procedure.

Door Switch: Service and Repair Door Ajar Switch - SuperCab Four-Door

DOOR AJAR SWITCH - SUPERCAB FOUR-DOOR

Removal and Installation

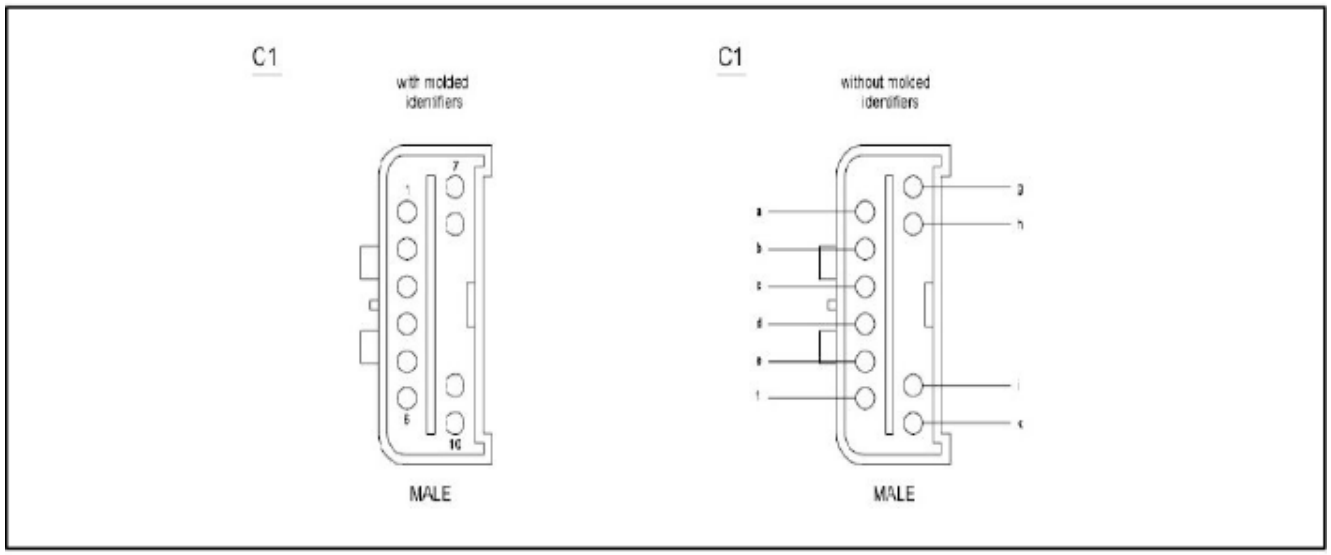
1. Remove the rear door lower latch. 2. Release the locking tabs, rotate the door ajar switch and remove the door ajar switch. 3. To install, reverse the removal procedure.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



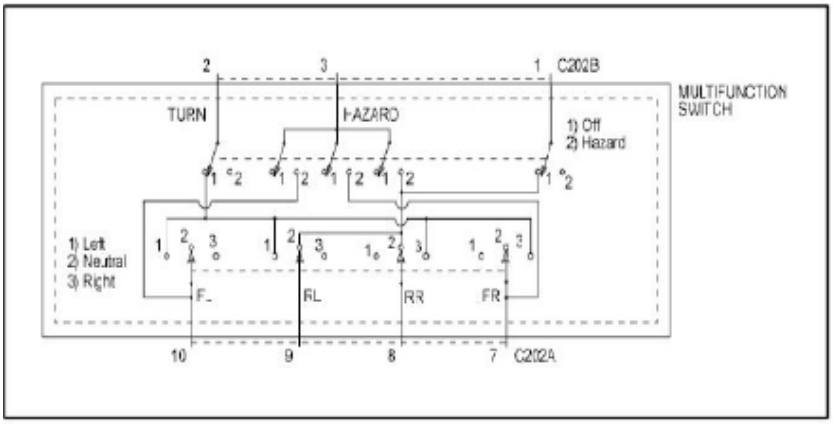
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

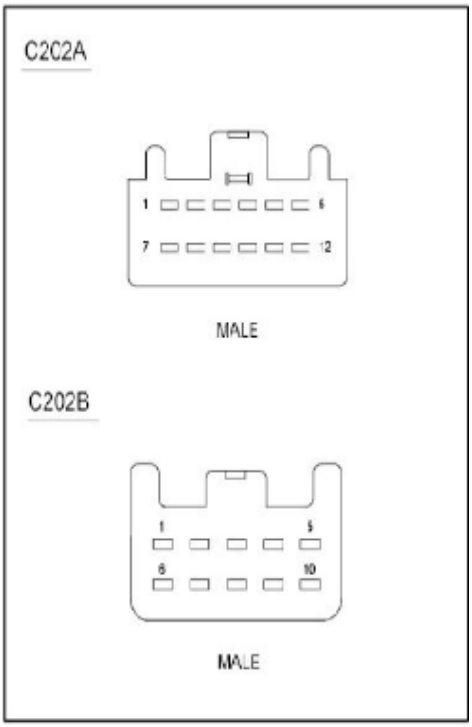
Hazard Warning Switch: Testing and Inspection

Multifunction Switch, Turn Portion

Schematic

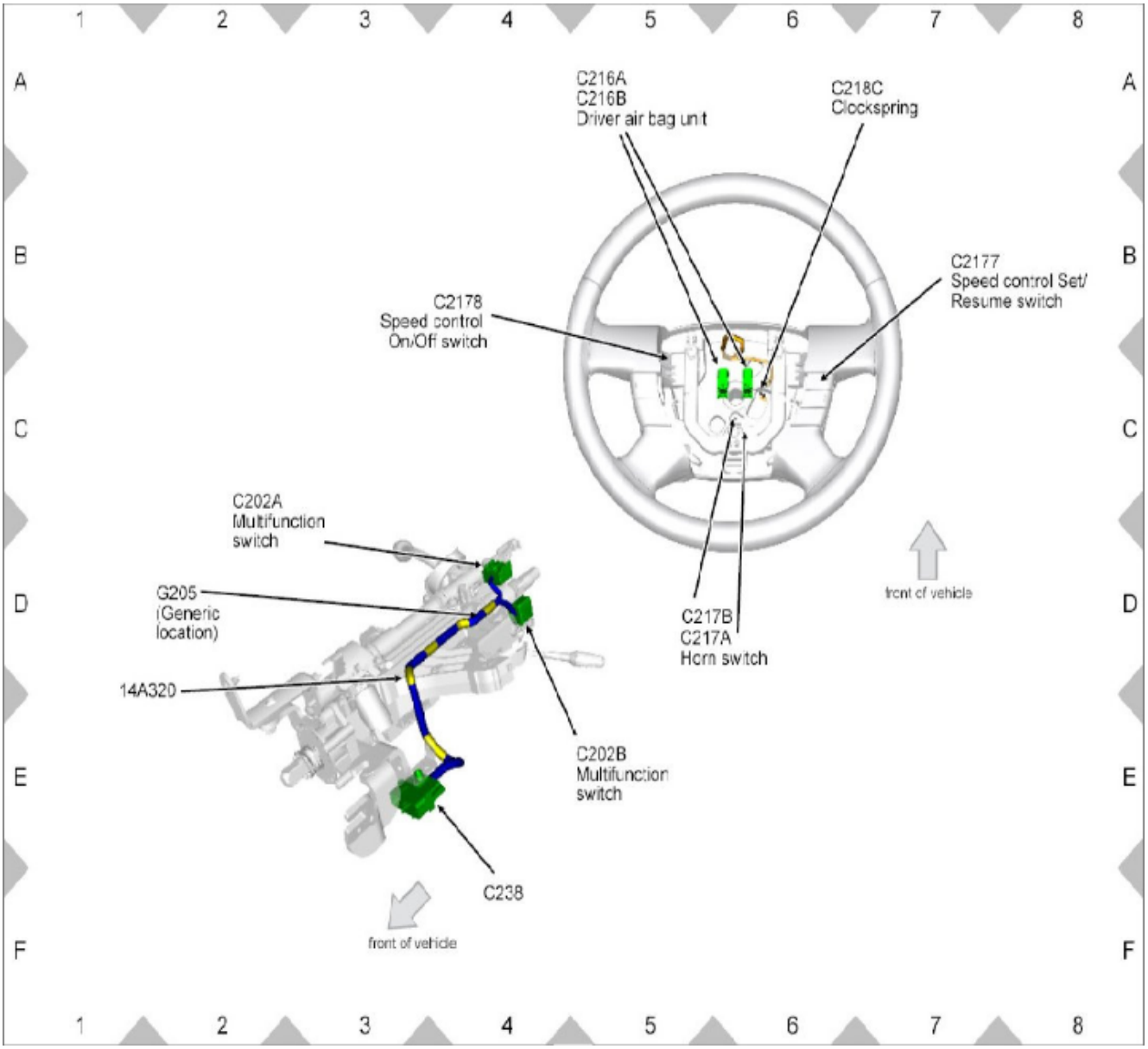


Terminals

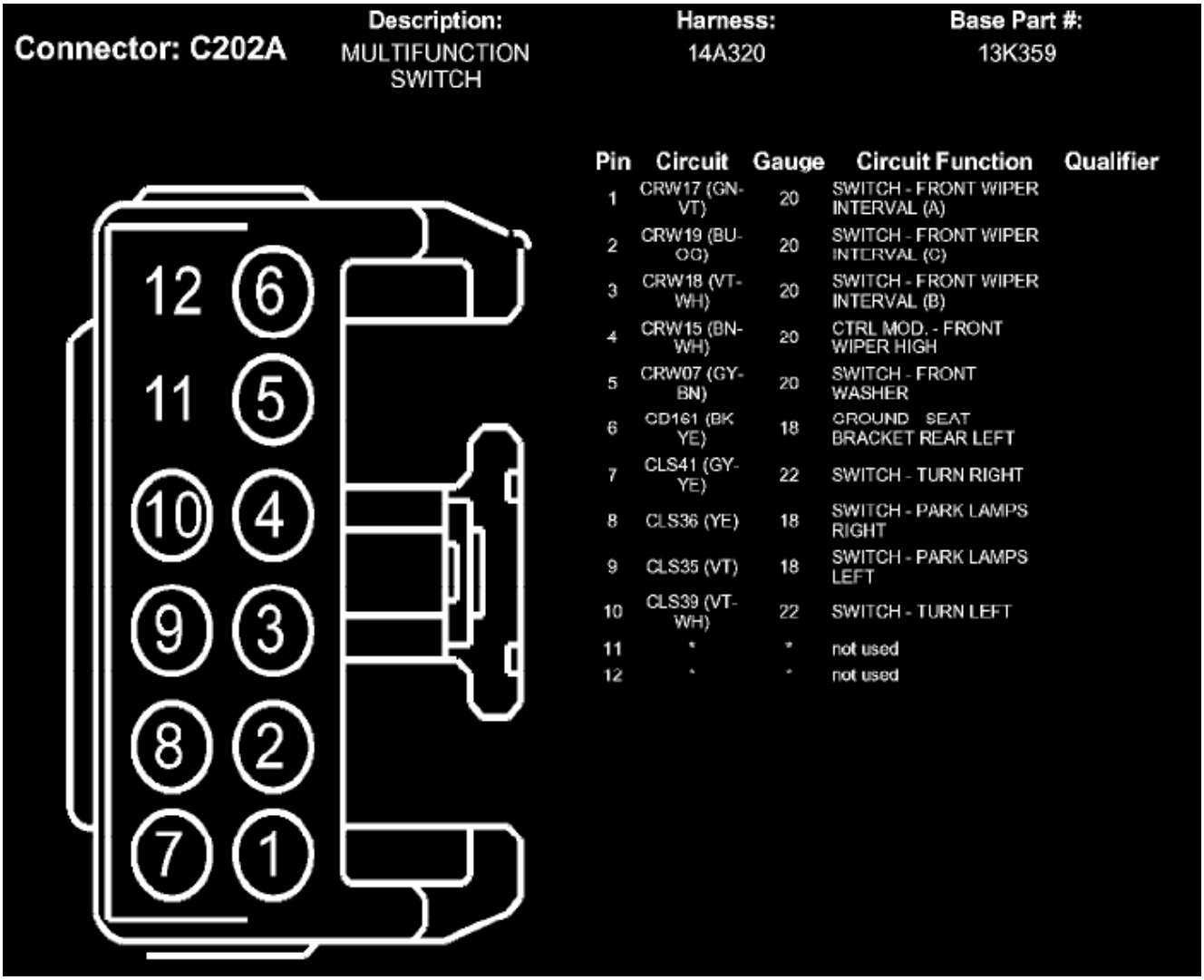


Component testing procedure

Circuit to test	Connect self-powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
Turn signal	C202b-2 and C202a-10	Left turn	Closed circuit
	C202b-2 and C202a-9	Left turn	Closed circuit
	C202b-2 and C202a-7	Right turn	Closed circuit
	C202b-2 and C202a-8	Right turn	Closed circuit
Hazard	C202b-3 and C202a-10	Turn signal switch in neutral, Hazard On	Closed circuit
	C202b-3 and C202a-7		
	C202b-3 and C202a-9		
	C202b-3 and C202a-8		
	C202b-1 and C202a-10	Turn signal switch in neutral, Hazard Off	Closed circuit
	C202b-1 and C202a-8		


C216A
C216B
Driver air bag unit
C218C
Clockspring
C2177
Speed control Set/
Resume switch
C2178
Speed control
On/Off switch
C202A
Multifunction
switch
G205
(Generic
location)
14A320
C217B
C217A
Horn switch
front of vehicle
C202B
Multifunction
switch
C238
front of vehicle

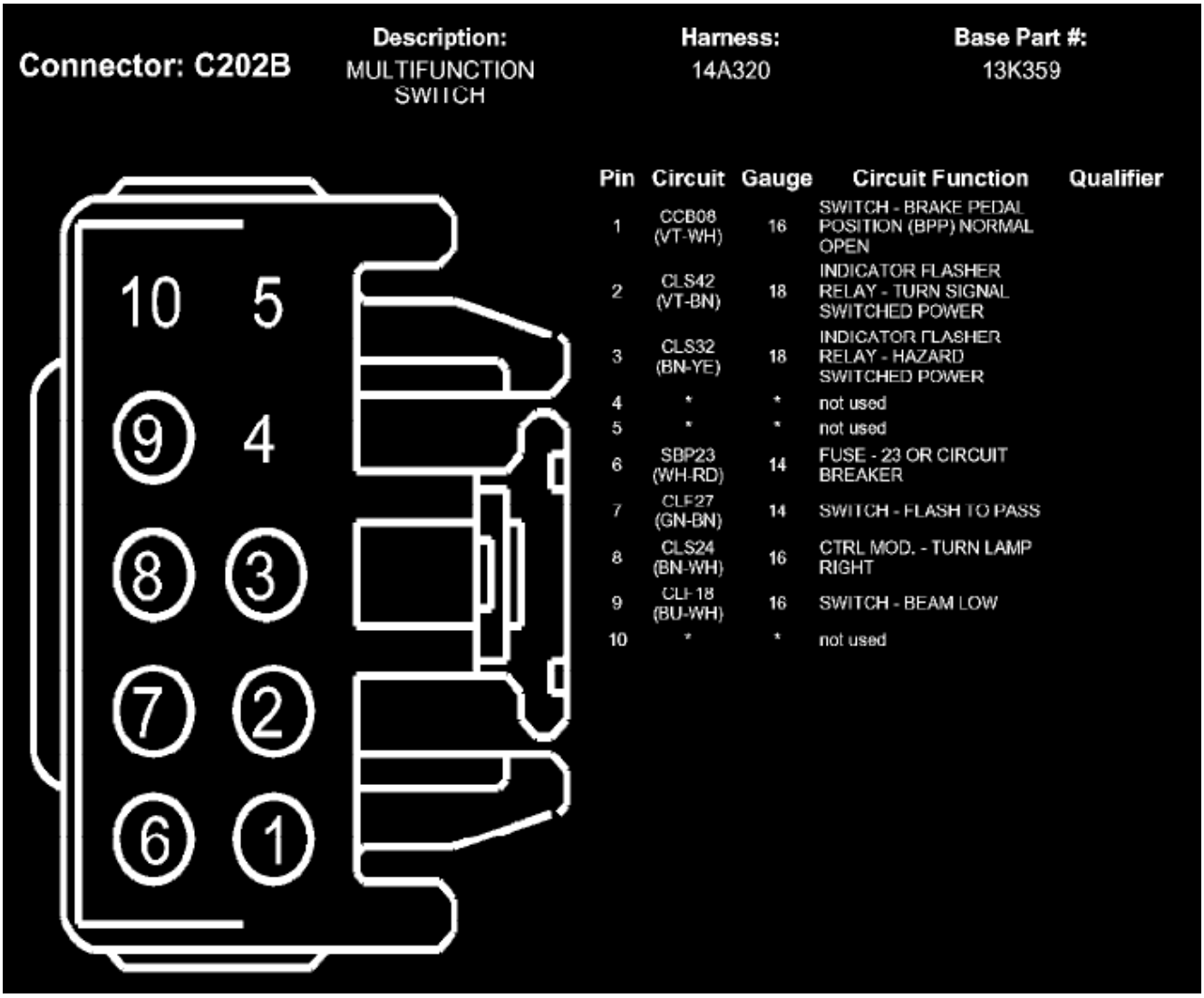
View 151-13



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CRW17 (GN-VT)	20	SWITCH - FRONT WIPER INTERVAL (A)	
2	CRW19 (BU-OG)	20	SWITCH - FRONT WIPER INTERVAL (C)	
3	CRW18 (VT-WH)	20	SWITCH - FRONT WIPER INTERVAL (B)	
4	CRW15 (BN-WH)	20	CTRL MOD. - FRONT WIPER HIGH	
5	CRW07 (GY-BN)	20	SWITCH - FRONT WASHER	
6	CD161 (BK YE)	18	GROUND SEAT BRACKET REAR LEFT	
7	CLS41 (GY-YE)	22	SWITCH - TURN RIGHT	
8	CLS36 (YE)	18	SWITCH - PARK LAMPS RIGHT	
9	CLS35 (VT)	18	SWITCH - PARK LAMPS LEFT	
10	CLS39 (VT-WH)	22	SWITCH - TURN LEFT	
11	*	*	not used	
12	*	*	not used	

Headlamp Dimmer Switch: Diagrams Multifunction Switch

C202A



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CCB08 (VT-WH)	16	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL OPEN	
2	CLS42 (VT-BN)	18	INDICATOR FLASHER RELAY - TURN SIGNAL SWITCHED POWER	
3	CLS32 (BN-YE)	18	INDICATOR FLASHER RELAY - HAZARD SWITCHED POWER	
4	*	*	not used	
5	*	*	not used	
6	SBP23 (WH-RD)	14	FUSE - 23 OR CIRCUIT BREAKER	
7	CLF27 (GN-BN)	14	SWITCH - FLASH TO PASS	
8	CLS24 (BN-WH)	16	CTRL MOD. - TURN LAMP RIGHT	
9	CLH18 (BU-WH)	16	SWITCH - BEAM LOW	
10	*	*	not used	

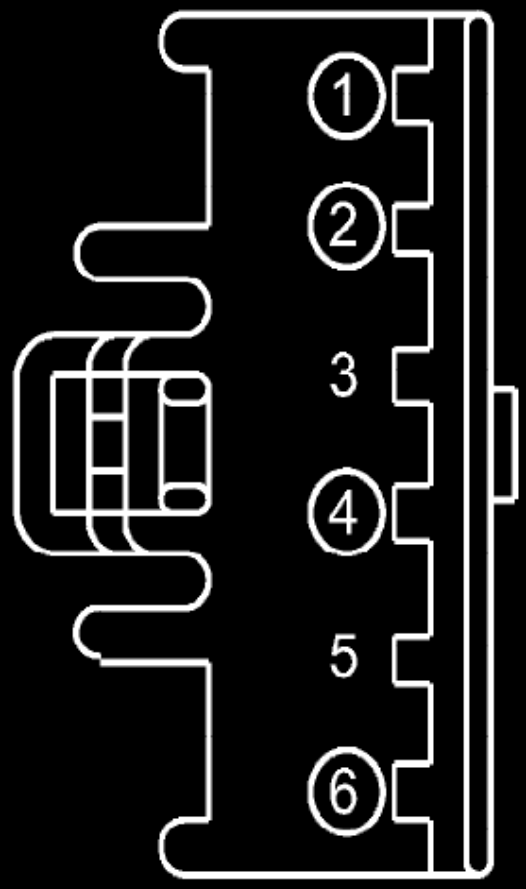
C202B

Connector: C2065

Description: ILLUMINATION DIMMER

Harness: 14401

Base Part #:



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	VLN18 (BU-WH)	22	DIMMER - IP/SWITCH ILLUMINATION	
2	CLN27 (WH-BN)	18	CTRL MOD. - DIMMER INSTRUMENT	
3	*	*	not used	
4	GD161 (BK-YE)	22	GROUND - SEAT BRACKET REAR LEFT	
5	*	*	not used	
6	CBP01 (BU)	22	FUSE - 1 OR CIRCUIT BREAKER	

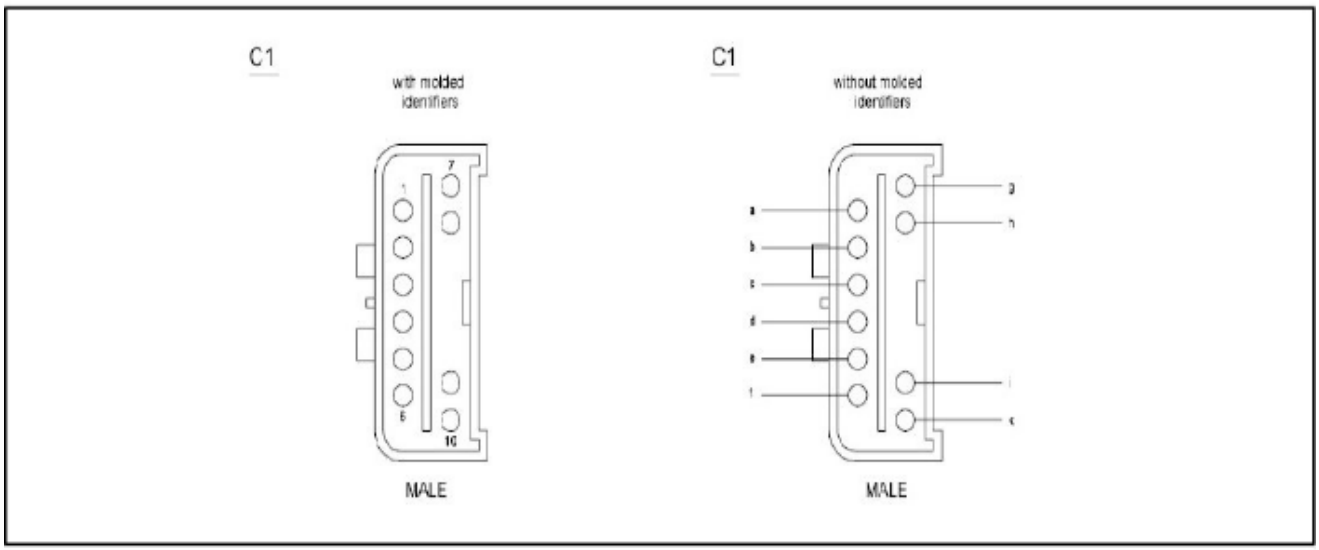
C2065

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals

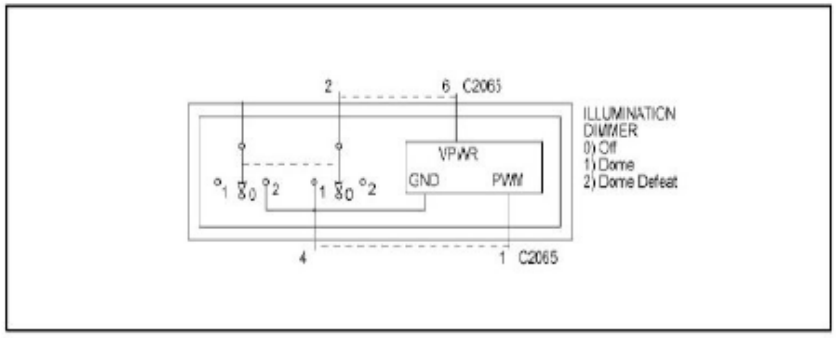


The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

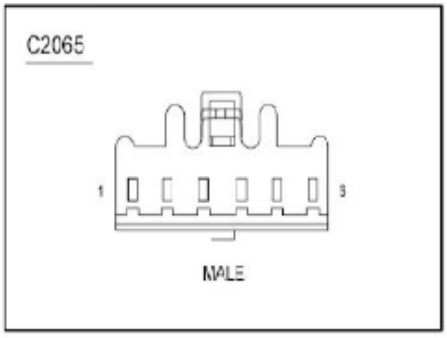
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Illumination dimmer

Schematic



Terminals



Component testing procedure

Circuit to test	Connect self-powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
Dome	2 and 4	On	Closed circuit
		Off	Open circuit

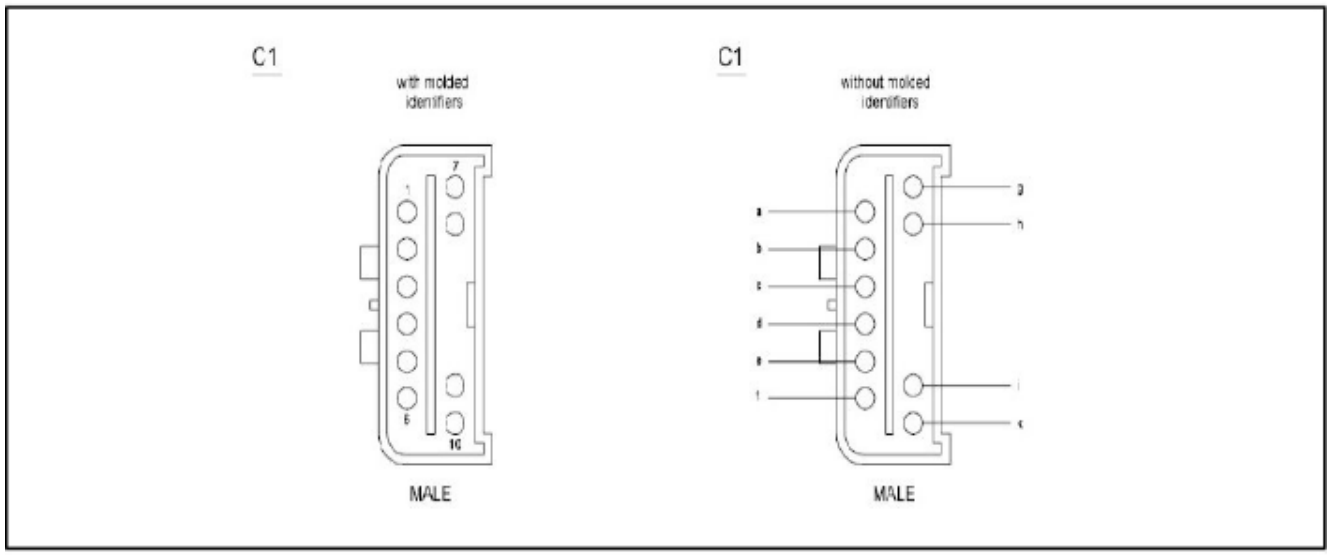
Headlamp Dimmer Switch: Testing and Inspection Illumination Dimmer

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step by step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



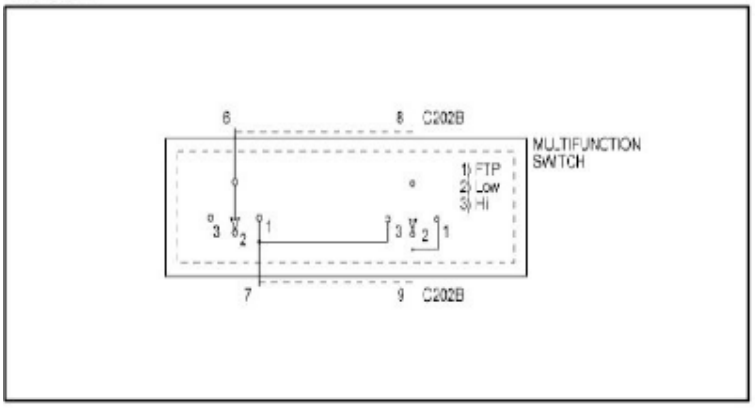
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

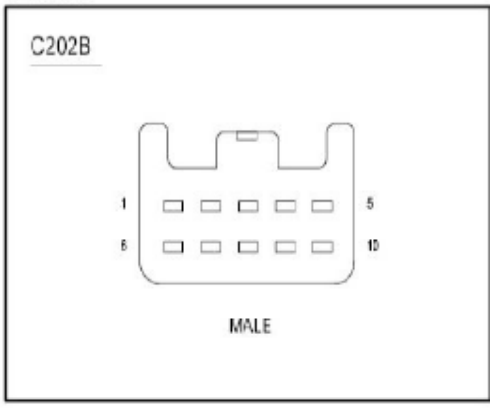
Headlamp Dimmer Switch: Testing and Inspection Multifunction Switch, Lamp Portion

Multifunction Switch, Lamp Portion

Schematic



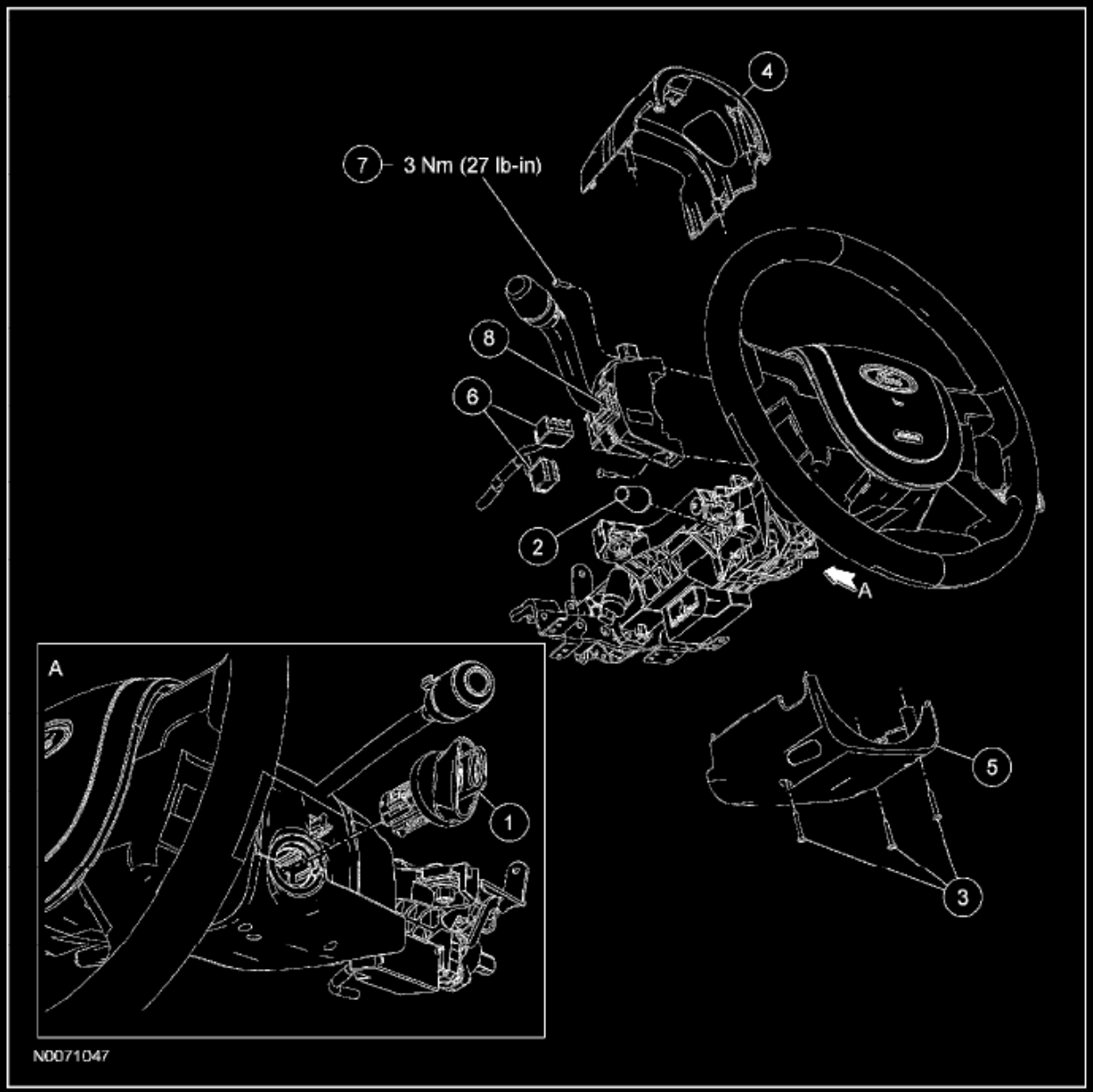
Terminals



Component testing procedure

Circuit to test	Connect self□powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
High beams	8 and 7	High beam	Closed circuit
		Flash□to□pass	Open circuit
		Low beam	Open circuit
Low beam/Flash□ to□pass	8 and 9	High beam	Open circuit
		Flash□to□pass	Closed circuit
		Low beam	Closed circuit
	6 and 7	High beam	Open circuit
		Flash□to□pass	Closed circuit
		Low beam	Open circuit

Steering Column Multifunction Switch



Item	Part Number	Description
1	11582	Ignition switch lock cylinder
2	3F609	Tilt release lever/ handle
3	391727	Steering column shroud screws (3 required)
4	3530	Upper steering column shroud
5	3533	Lower steering column shroud

(Continued)

Item	Part Number	Description
6	—	Steering column multi-function switch electrical connectors (part of 14A320)
7	390345	Steering column multi-function switch screws (2 required)
8	13K359	Steering column multi-function switch

Headlamp Dimmer Switch: Service and Repair

Steering Column Multifunction Switch

Steering Column Multifunction Switch

Removal and Installation

1. Remove the ignition switch lock cylinder.

1 Insert the ignition key into the ignition switch lock cylinder and turn to the RUN position.

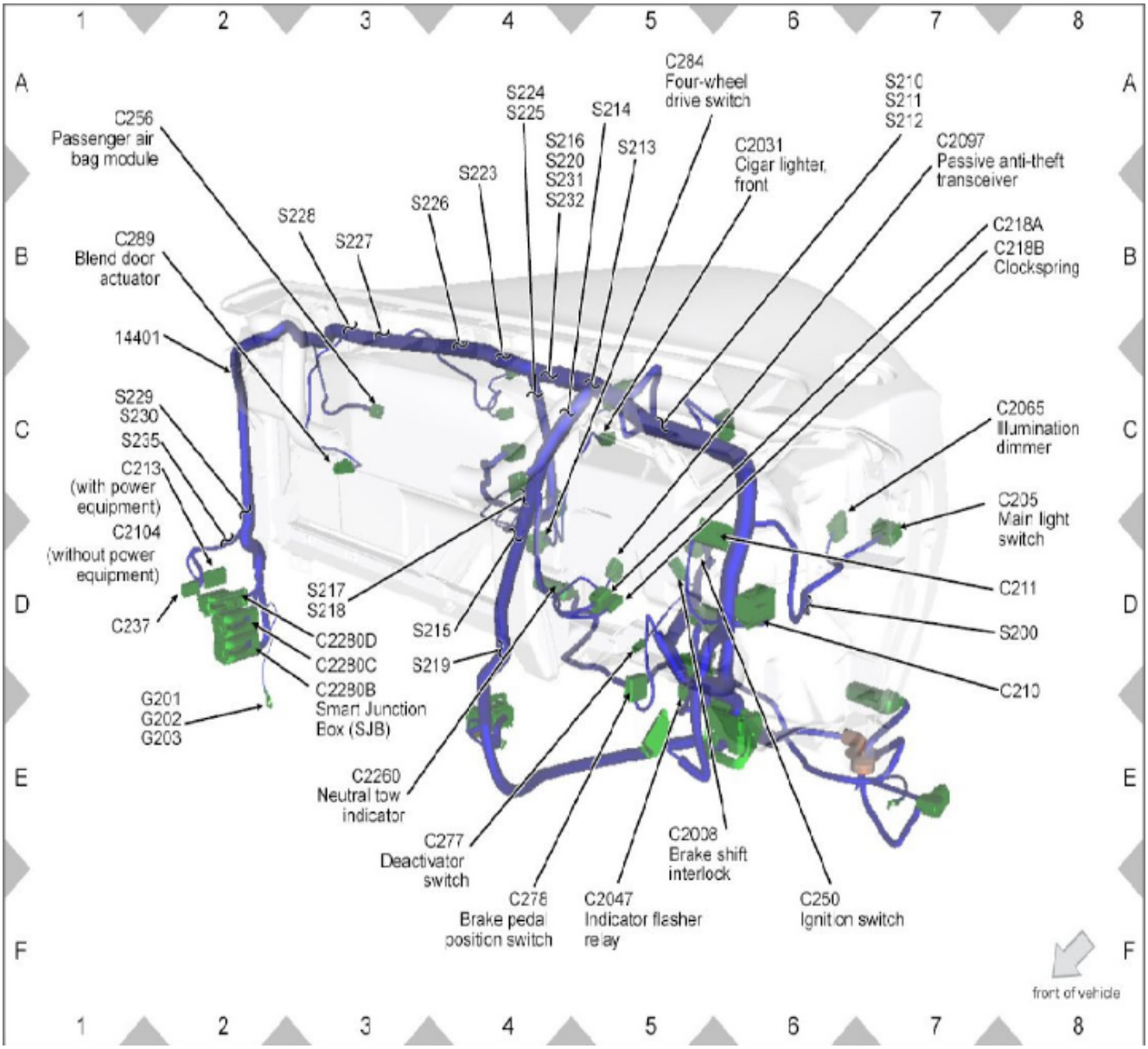
2 Push the ignition switch lock cylinder release tab with a punch while pulling out the ignition switch lock cylinder.

2. If equipped, remove the tilt release lever/ handle.

3. Remove the 3 steering column shroud screws and the upper and lower steering column shrouds. 4. Disconnect the multi-function switch electrical connectors. 5. Remove the 2 multi-function switch screws and the multi-function switch.

^ To install, tighten to 3 Nm (27 lb-inch).

6. To install, reverse the removal procedure.


1
2
3
4
5
6
7
8
A
B
C
D
E
F
C256
Passenger air bag module
C289
Blend door actuator
14401
S229
S230
S235
C213
(with power equipment)
C2104
(without power equipment)
C237
G201
G202
G203
S228
S227
S226
S223
S224
S225
S216
S220
S231
S232
S214
S213
C284
Four-wheel drive switch
C2031
Cigar lighter, front
S210
S211
S212
C2097
Passive anti-theft transceiver
C218A
C218B
Clockspring
C2065
Illumination dimmer
C205
Main light switch
C211
S200
C210
S217
S218
S215
S219
C2280D
C2280C
C2280B
Smart Junction Box (SJB)
C2260
Neutral tow indicator
C277
Deactivator switch
C278
Brake pedal position switch
C2047
Indicator flasher relay
C2008
Brake shift interlock
C250
Ignition switch
front of vehicle

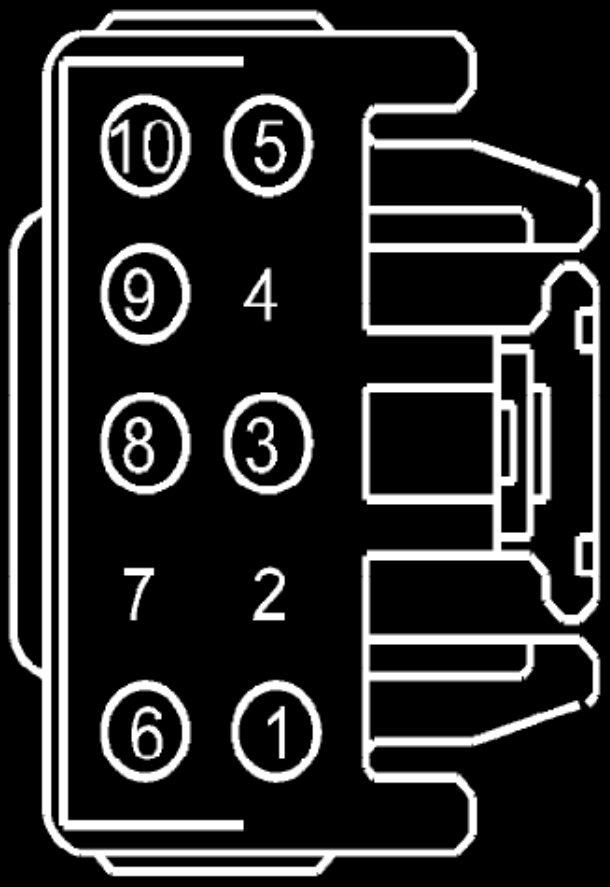
View 151-11

Connector: C205

Description: MAIN LIGHT SWITCH

Harness: 14401

Base Part #: 11654



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CLS24 (BN-WH)	16	CTRL MOD. - TURN LAMP RIGHT	
2	*	*	not used	
3	GD161 (BK YE)	20	GROUND SEAT BRACKET REAR LEFT	
4	*	*	not used	
5	CLS30 (VT-WH)	18	RELAY - PARK LAMP	
6	SBP23 (WH-RD)	14	FUSE - 23 OR CIRCUIT BREAKER	
7	*	*	not used	
8	VLN18 (BU-WH)	20	DIMMER - IP/SWITCH ILLUMINATION	
9	CLF21 (GY-VT)	18	SWITCH - FOG LAMPS FRONT	
10	SBP23 (WH-RD)	16	FUSE - 23 OR CIRCUIT BREAKER	

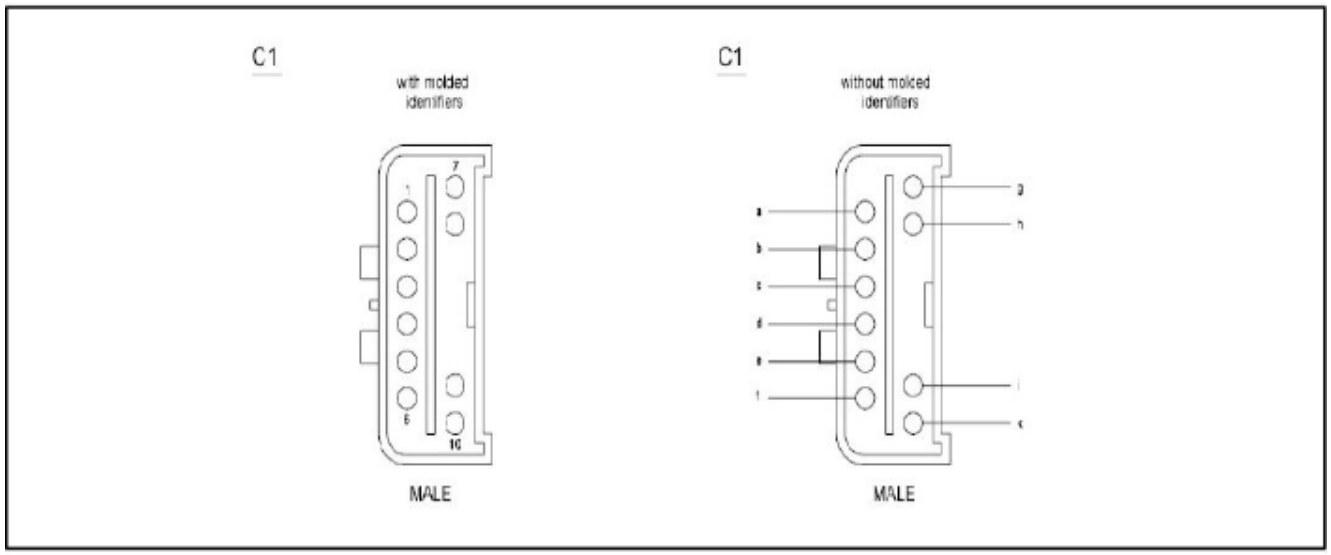
C205

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step by step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



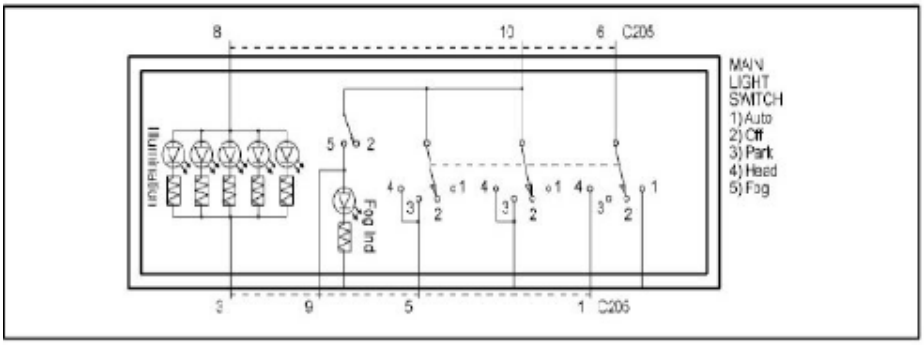
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

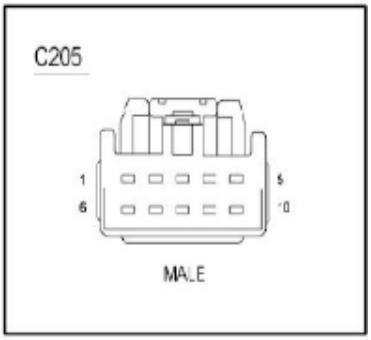
Headlamp Switch: Testing and Inspection

Main light switch, Exterior lamps

Schematic

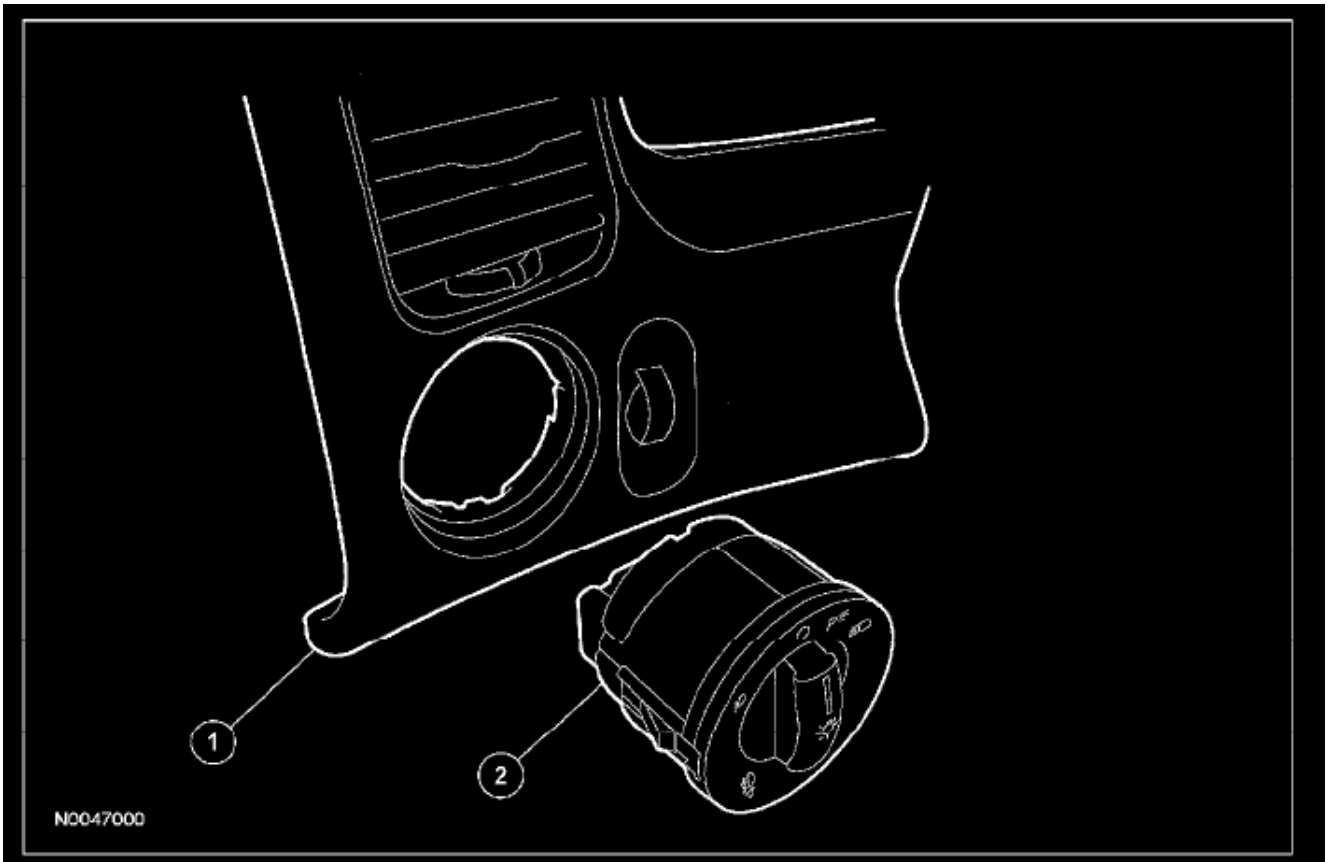


Terminals



Component testing procedure

Circuit to test	Connect self-powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
Headlamp	1 and 6	Off	Open circuit
		Head	Closed circuit
		Park	Open circuit
Park lamps	5 and 10	Off	Open circuit
		Head	Closed circuit
		Fog lamps	Closed circuit
Fog lamps	9 and 10	Off	Open circuit
		Park	Closed circuit
		Head	Closed circuit



Item	Part Number	Description
1	044D70	Instrument panel finish panel
2	11654	Headlamp switch

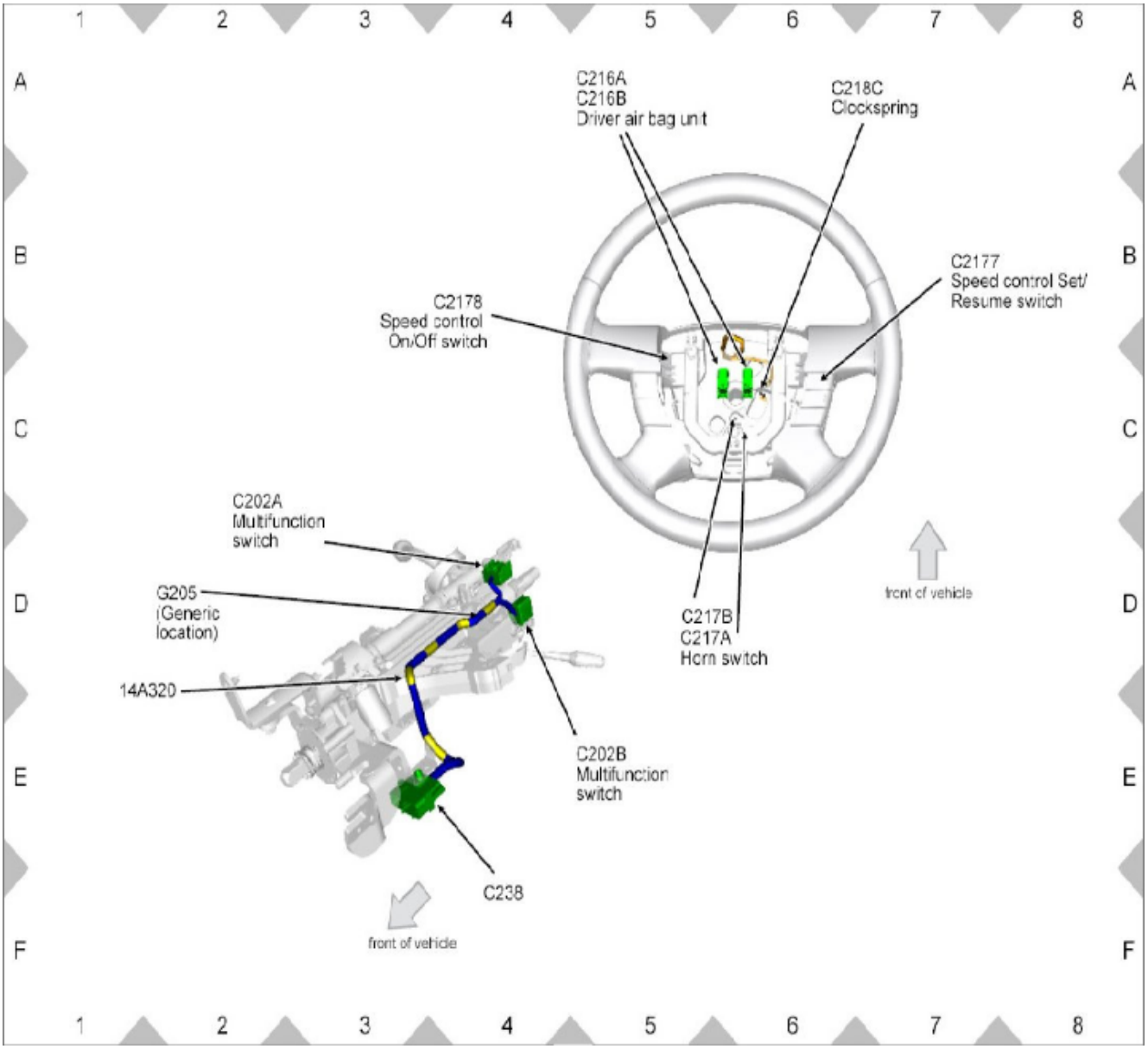
Headlamp Switch: Service and Repair

HEADLAMP SWITCH

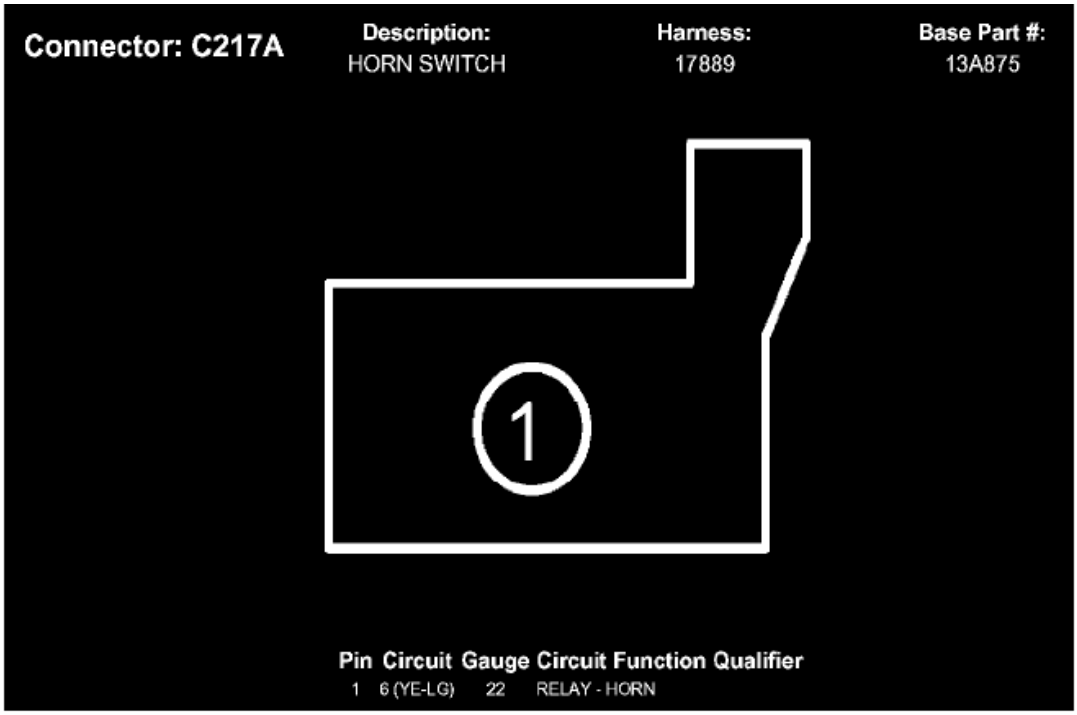
Removal and Installation

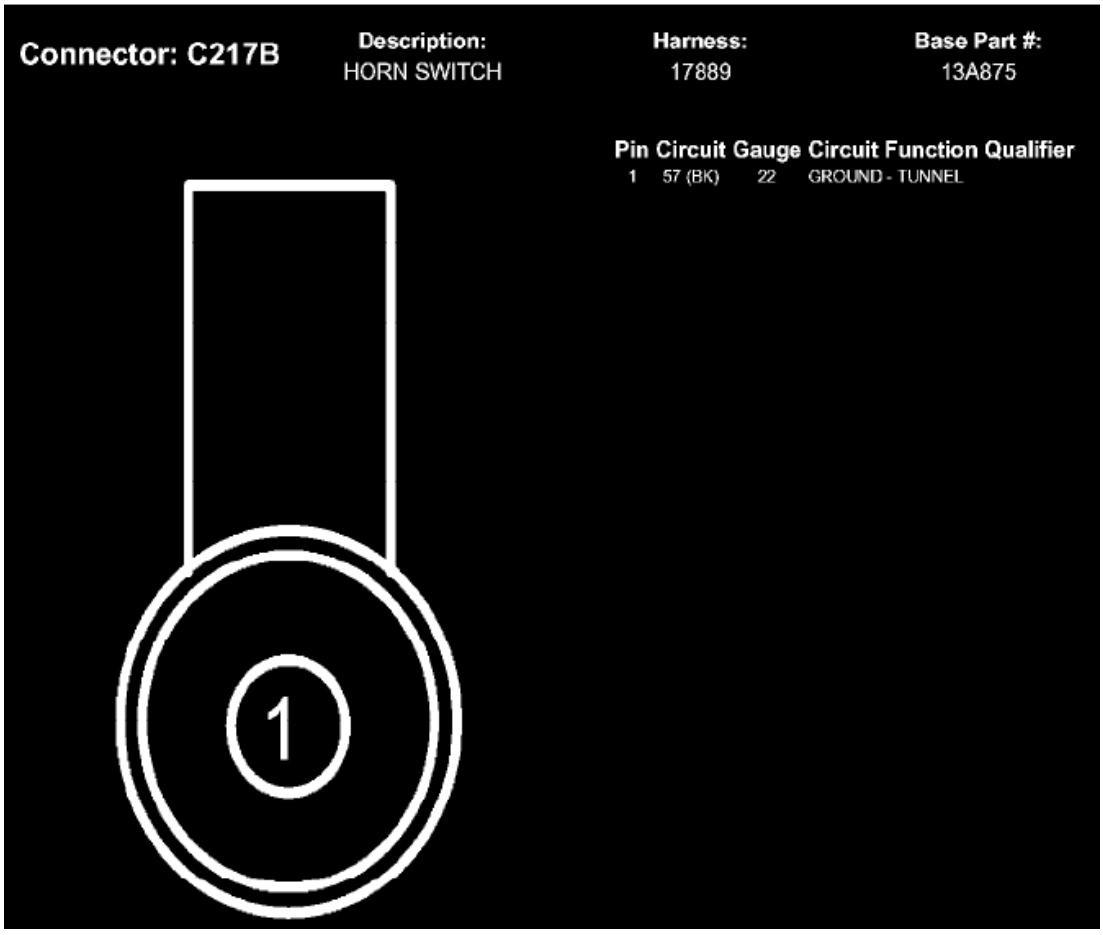
1. Remove the instrument panel finish panel. 2. Release the tabs and remove the headlamp switch.
3. To install, reverse the removal procedure.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Lighting and Horns > Sensors and Switches - Lighting and Horns > Horn Switch > Component Information > Locations



View 151-13

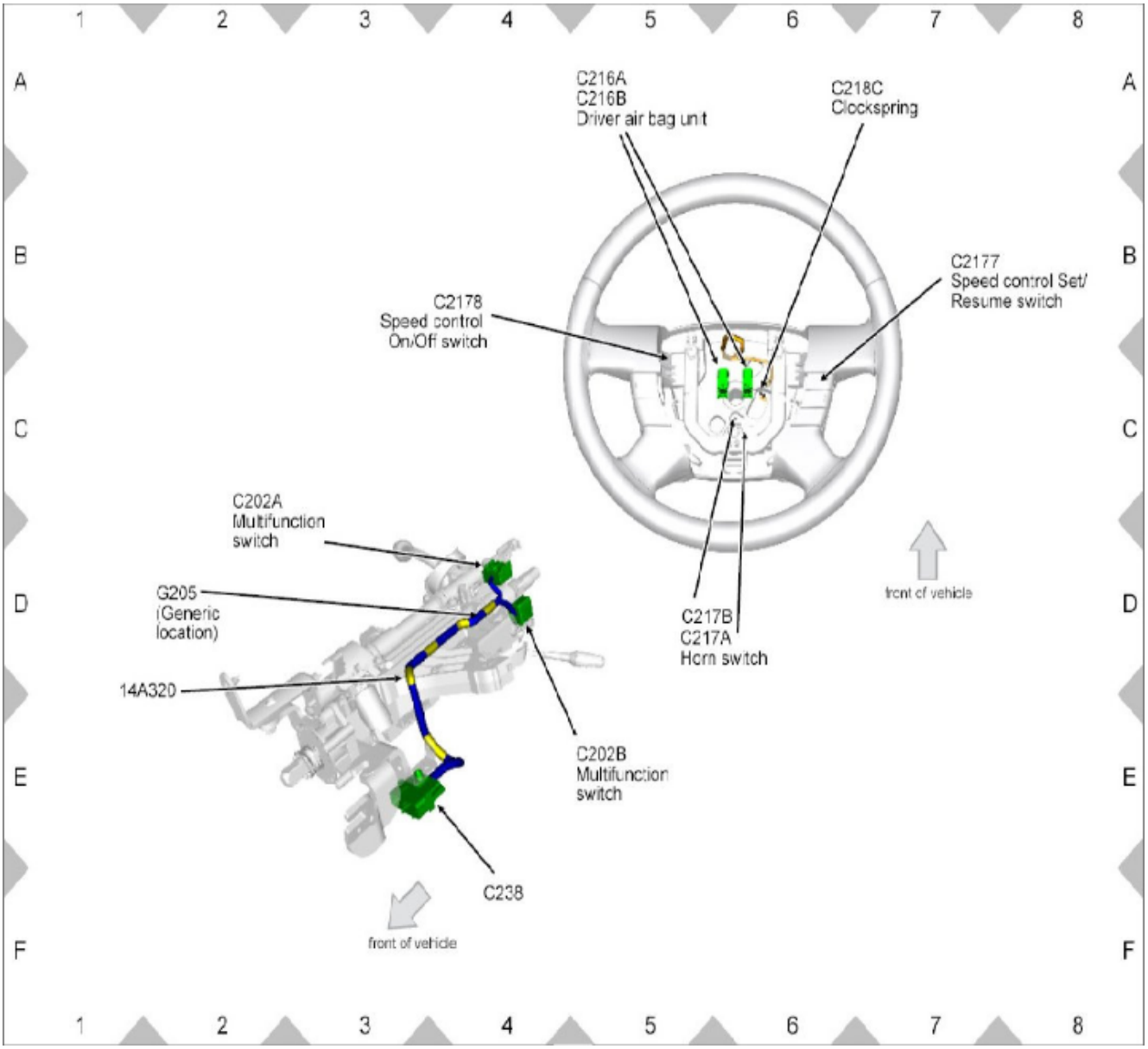

Connector: C217A
Description:
HORN SWITCH
Harness:
17889
Base Part #:
13A875
1
Pin Circuit Gauge Circuit Function Qualifier
1 6 (YE-LG) 22 RELAY - HORN


Connector: C217B
Description:
HORN SWITCH
Harness:
17889
Base Part #:
13A875
Pin Circuit Gauge Circuit Function Qualifier
1 57 (BK) 22 GROUND - TUNNEL
1

Horn Switch: Diagrams

C217A

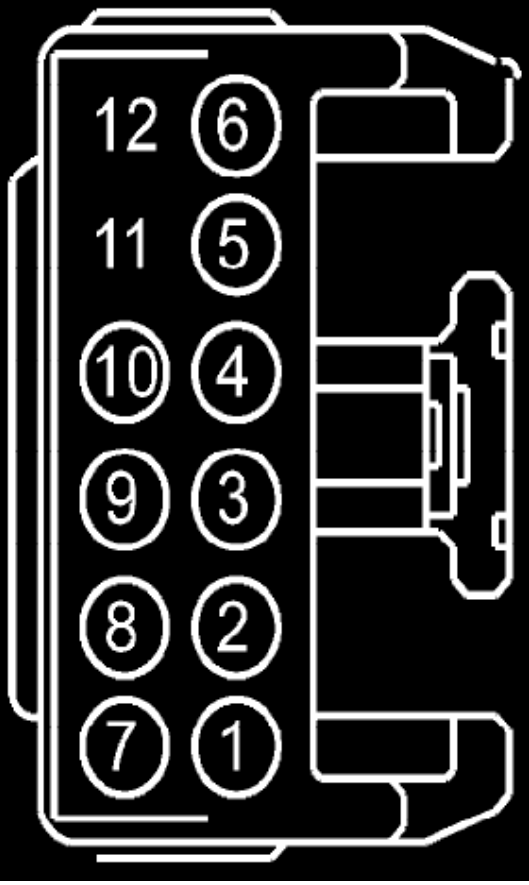
C217B


C216A
C216B
Driver air bag unit
C218C
Clockspring
C2177
Speed control Set/
Resume switch
C2178
Speed control
On/Off switch
C202A
Multifunction
switch
G205
(Generic
location)
14A320
C217B
C217A
Horn switch
front of vehicle
C202B
Multifunction
switch
C238
front of vehicle

View 151-13

Connector: C202A

Description:	Harness:	Base Part #:
MULTIFUNCTION SWITCH	14A320	13K359



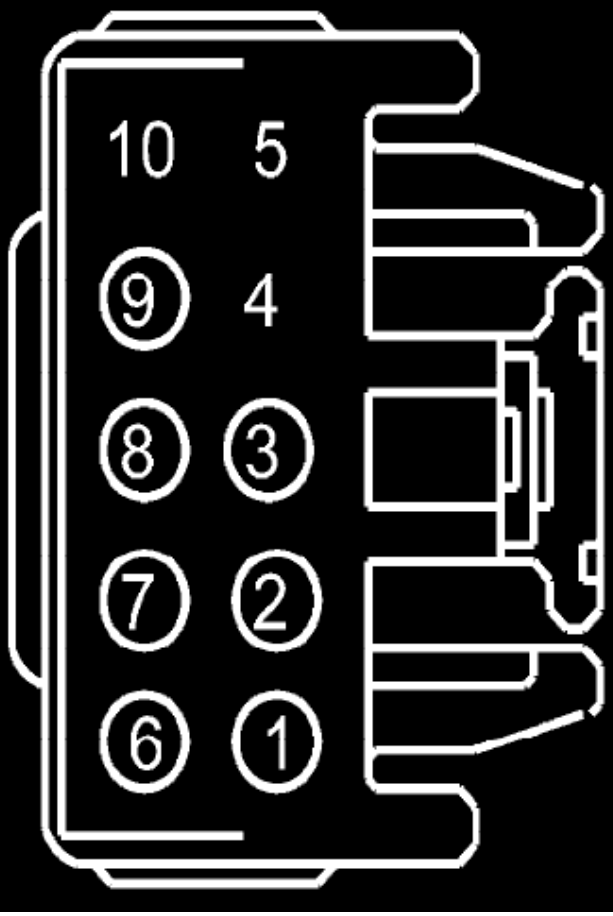
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CRW17 (GN-VT)	20	SWITCH - FRONT WIPER INTERVAL (A)	
2	CRW19 (BU-OG)	20	SWITCH - FRONT WIPER INTERVAL (C)	
3	CRW18 (VT-WH)	20	SWITCH - FRONT WIPER INTERVAL (B)	
4	CRW15 (BN-WH)	20	CTRL MOD. - FRONT WIPER HIGH	
5	CRW07 (GY-BN)	20	SWITCH - FRONT WASHER	
6	CD161 (BK YE)	18	GROUND SEAT BRACKET REAR LEFT	
7	CLS41 (GY-YE)	22	SWITCH - TURN RIGHT	
8	CLS36 (YE)	18	SWITCH - PARK LAMPS RIGHT	
9	CLS35 (VT)	18	SWITCH - PARK LAMPS LEFT	
10	CLS39 (VT-WH)	22	SWITCH - TURN LEFT	
11	*	*	not used	
12	*	*	not used	

Turn Signal Switch: Diagrams

C202A

Connector: C202B

Description:	Harness:	Base Part #:
MULTIFUNCTION SWITCH	14A320	13K359



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CCB08 (VT-WH)	16	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL OPEN	
2	CLS42 (VT-BN)	18	INDICATOR FLASHER RELAY - TURN SIGNAL SWITCHED POWER	
3	CLS32 (BN-YE)	18	INDICATOR FLASHER RELAY - HAZARD SWITCHED POWER	
4	*	*	not used	
5	*	*	not used	
6	SBP23 (WH-RD)	14	FUSE - 23 OR CIRCUIT BREAKER	
7	CLF27 (GN-BN)	14	SWITCH - FLASH TO PASS	
8	CLS24 (BN-WH)	16	CTRL MOD. - TURN LAMP RIGHT	
9	CLF18 (BU-WH)	16	SWITCH - BEAM LOW	
10	*	*	not used	

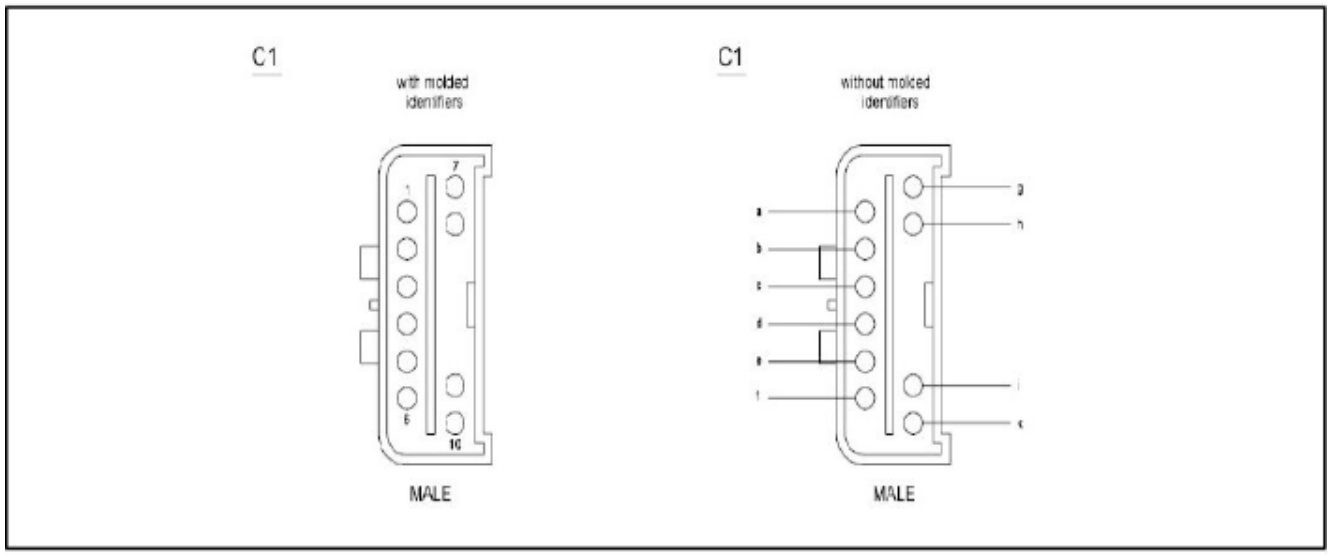
C202B

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



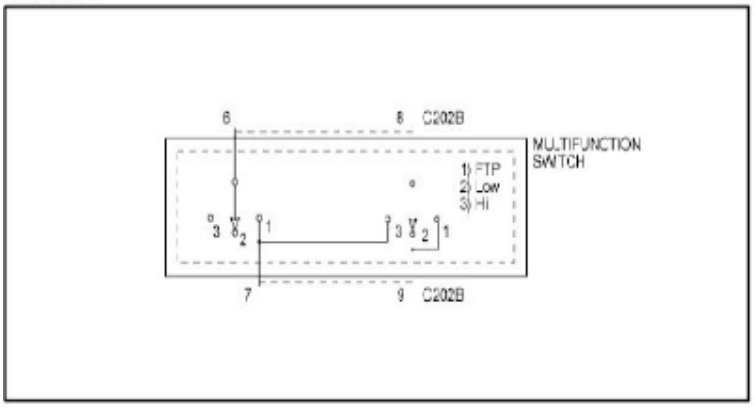
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

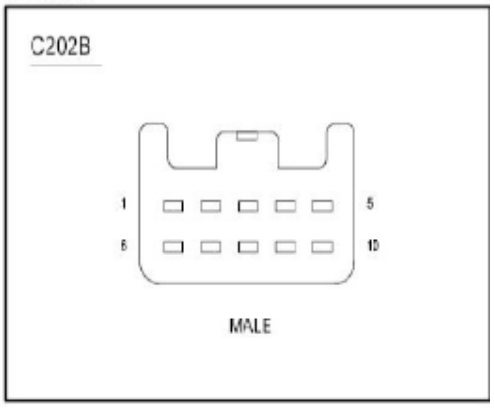
Turn Signal Switch: Testing and Inspection Multifunction Switch, Lamp Portion

Multifunction Switch, Lamp Portion

Schematic



Terminals



Component testing procedure

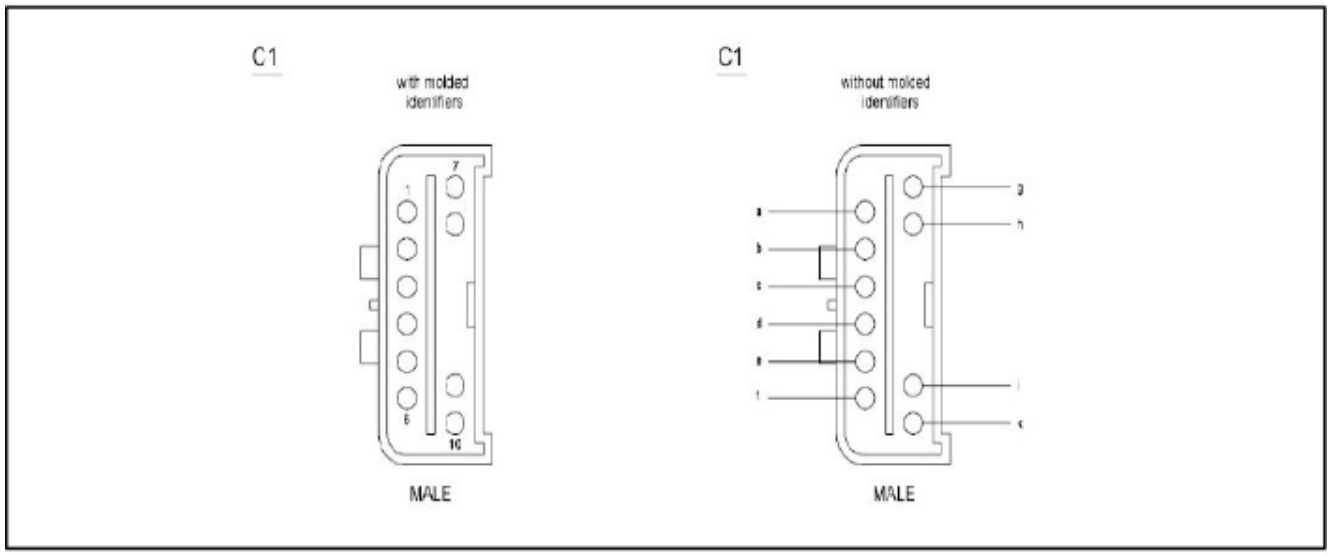
Circuit to test	Connect self□powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
High beams	8 and 7	High beam	Closed circuit
		Flash□to□pass	Open circuit
		Low beam	Open circuit
Low beam/Flash□ to□pass	8 and 9	High beam	Open circuit
		Flash□to□pass	Closed circuit
		Low beam	Closed circuit
	6 and 7	High beam	Open circuit
		Flash□to□pass	Closed circuit
		Low beam	Open circuit

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



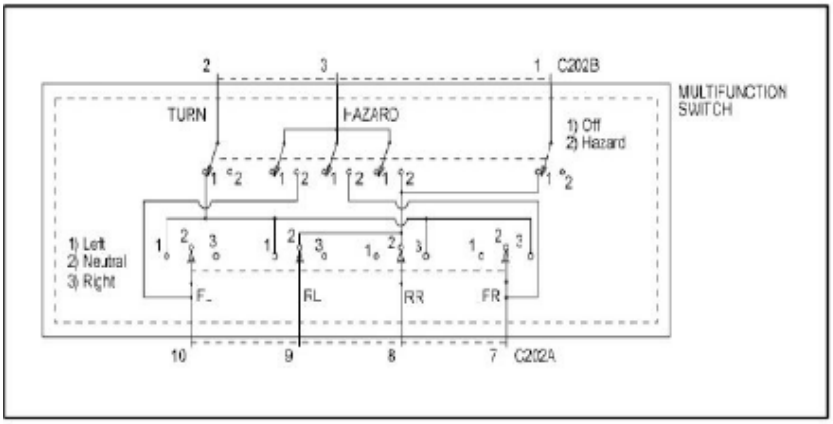
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

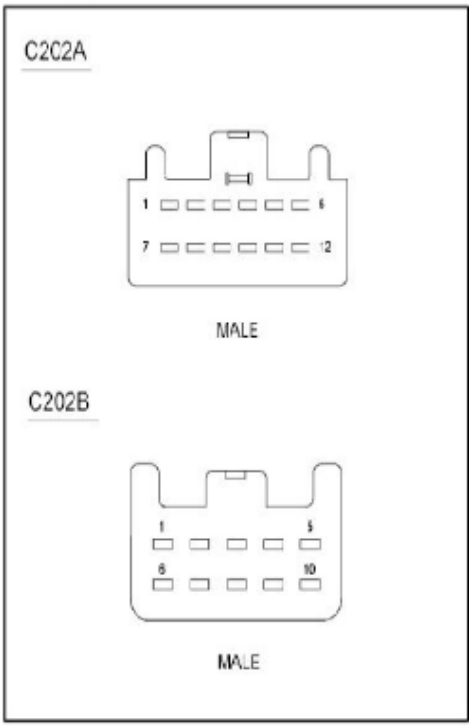
Turn Signal Switch: Testing and Inspection Multifunction Switch, Turn Portion

Multifunction Switch, Turn Portion

Schematic



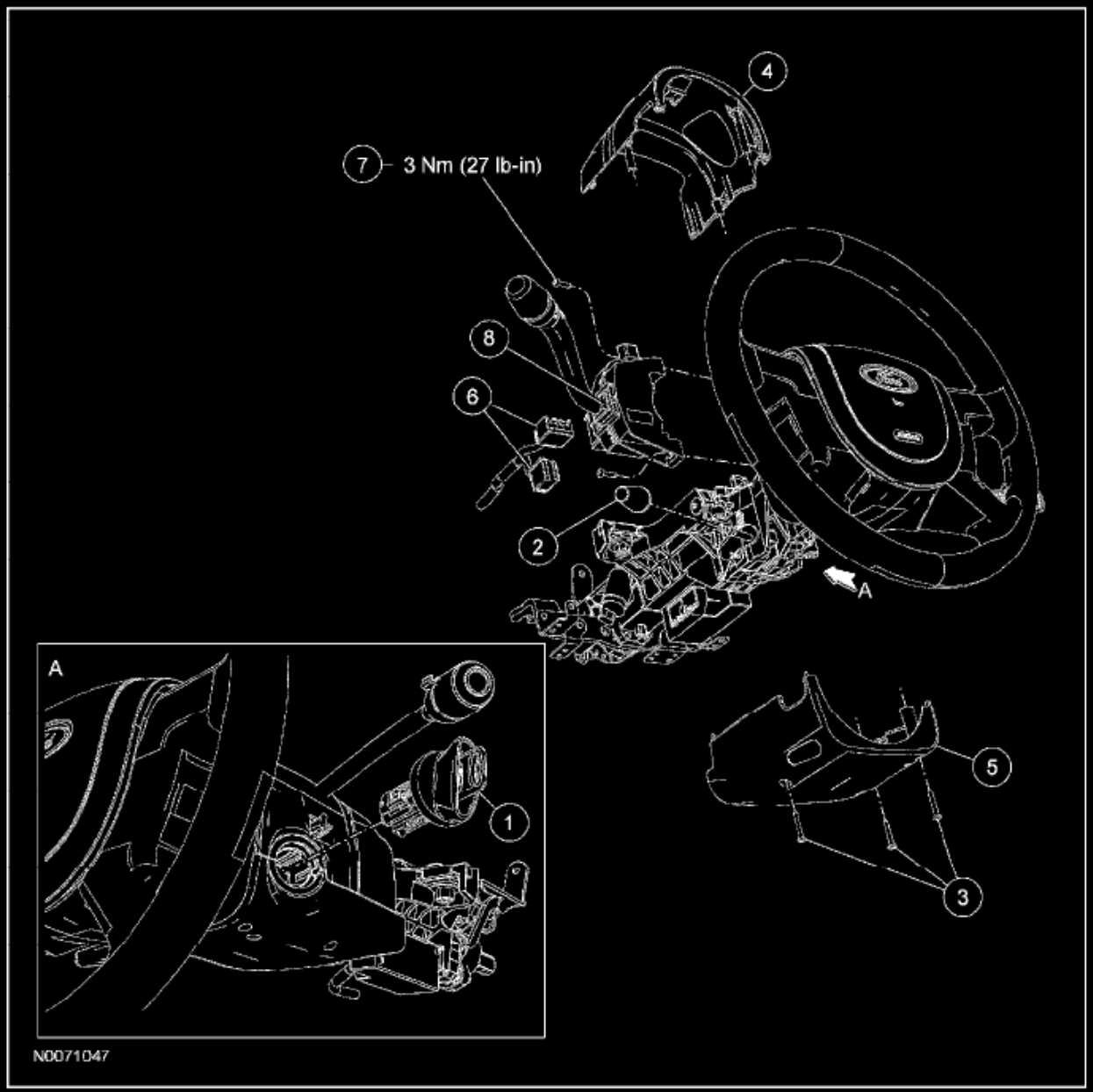
Terminals



Component testing procedure

Circuit to test	Connect self-powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
Turn signal	C202b-2 and C202a-10	Left turn	Closed circuit
	C202b-2 and C202a-9	Left turn	Closed circuit
	C202b-2 and C202a-7	Right turn	Closed circuit
	C202b-2 and C202a-8	Right turn	Closed circuit
Hazard	C202b-3 and C202a-10	Turn signal switch in neutral, Hazard On	Closed circuit
	C202b-3 and C202a-7		
	C202b-3 and C202a-9		
	C202b-3 and C202a-8		
	C202b-1 and C202a-10	Turn signal switch in neutral, Hazard Off	Closed circuit
	C202b-1 and C202a-8		

Steering Column Multifunction Switch



Item	Part Number	Description
1	11582	Ignition switch lock cylinder
2	3F609	Tilt release lever/ handle
3	391727	Steering column shroud screws (3 required)
4	3530	Upper steering column shroud
5	3533	Lower steering column shroud

(Continued)

Item	Part Number	Description
6	—	Steering column multi-function switch electrical connectors (part of 14A320)
7	390345	Steering column multi-function switch screws (2 required)
8	13K359	Steering column multi-function switch

Turn Signal Switch: Service and Repair

Steering Column Multifunction Switch

Steering Column Multifunction Switch

Removal and Installation

1. Remove the ignition switch lock cylinder.

1 Insert the ignition key into the ignition switch lock cylinder and turn to the RUN position.

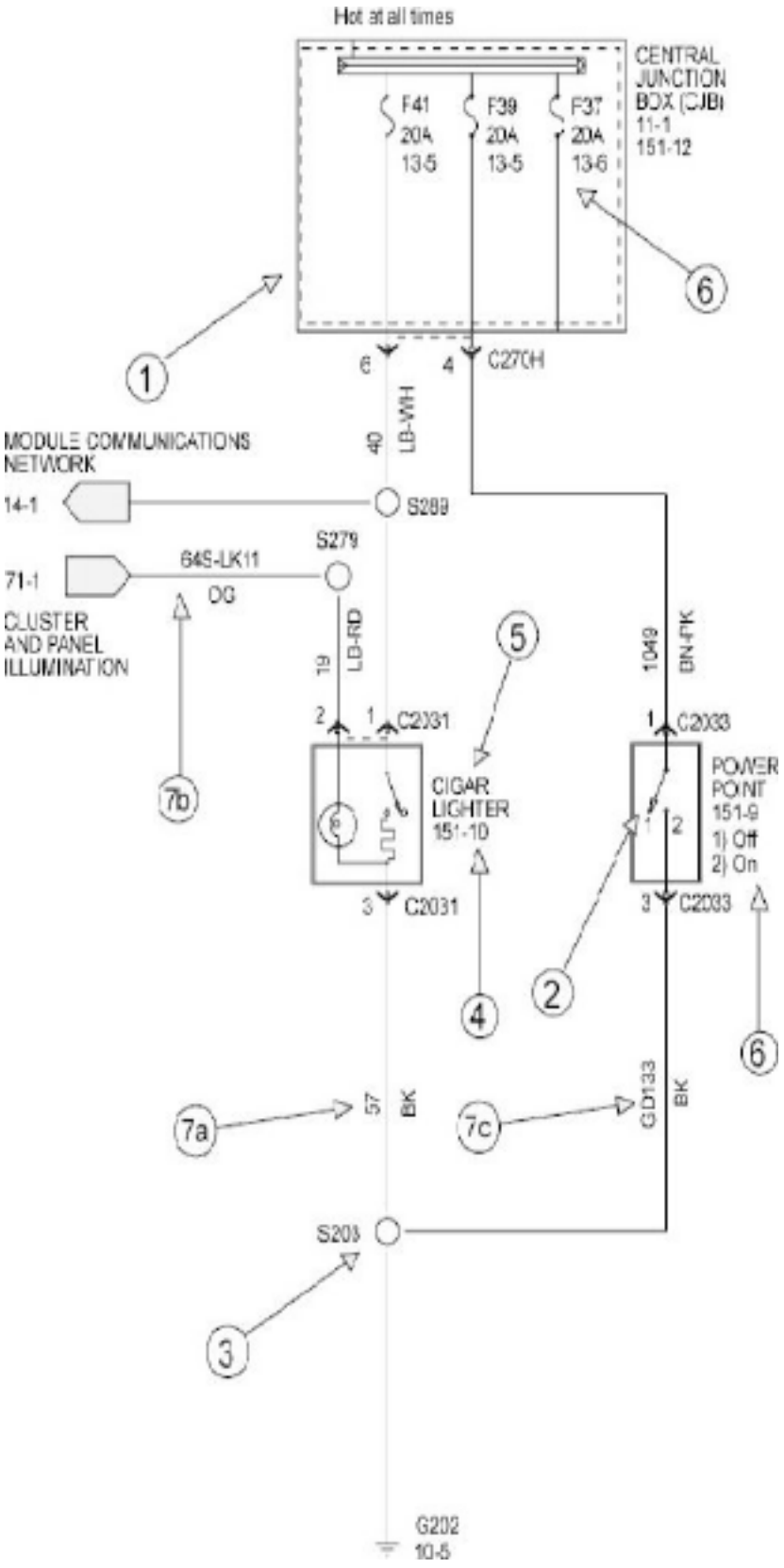
2 Push the ignition switch lock cylinder release tab with a punch while pulling out the ignition switch lock cylinder.

2. If equipped, remove the tilt release lever/ handle.

3. Remove the 3 steering column shroud screws and the upper and lower steering column shrouds. 4. Disconnect the multi-function switch electrical connectors. 5. Remove the 2 multi-function switch screws and the multi-function switch.

^ To install, tighten to 3 Nm (27 lb-inch).

6. To install, reverse the removal procedure.


Hot at all times
CENTRAL JUNCTION BOX (CJB)
11-1
151-12
F41
20A
13-5
F39
20A
13-5
F37
20A
13-6
C270H
40
LB-WH
MODULE COMMUNICATIONS NETWORK
14-1
S289
S279
64S-LK11
71-1
DG
CLUSTER AND PANEL ILLUMINATION
19
LB-RD
C2031
CIGAR LIGHTER
151-10
1049
BN-PK
C2033
POWER POINT
151-9
1) Off
2) On
57
BK
GD133
BK
S203
G202
10-5

Tail Lamp: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

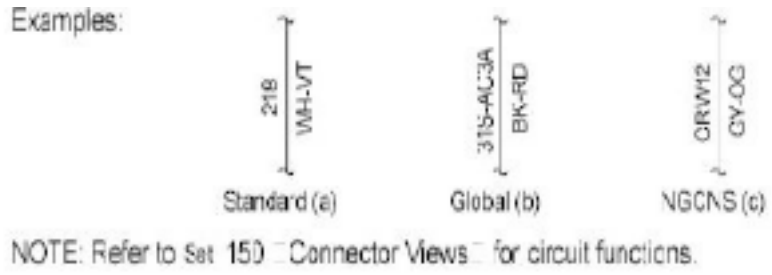
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

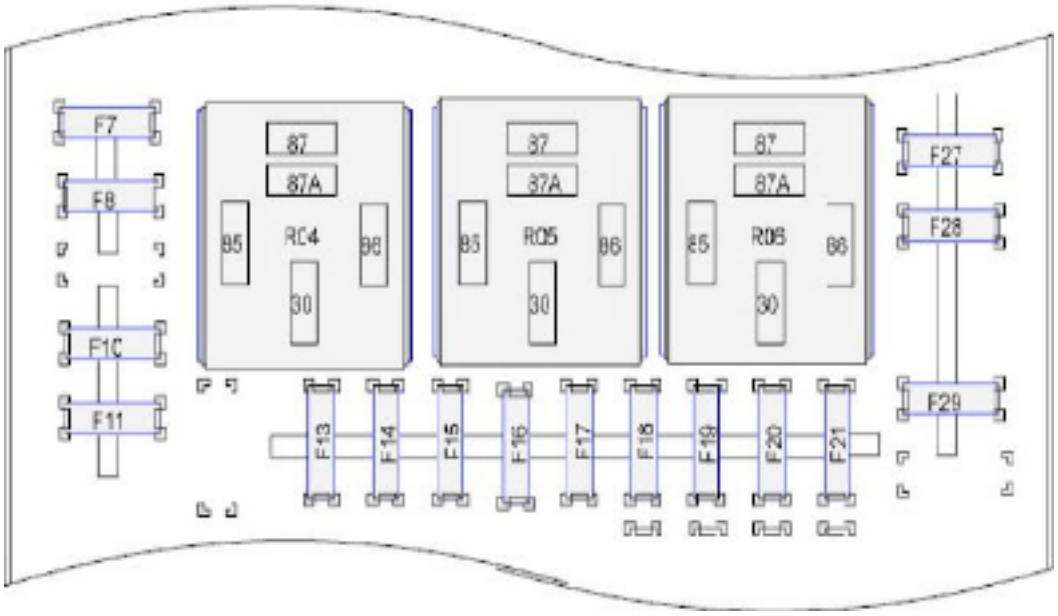
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

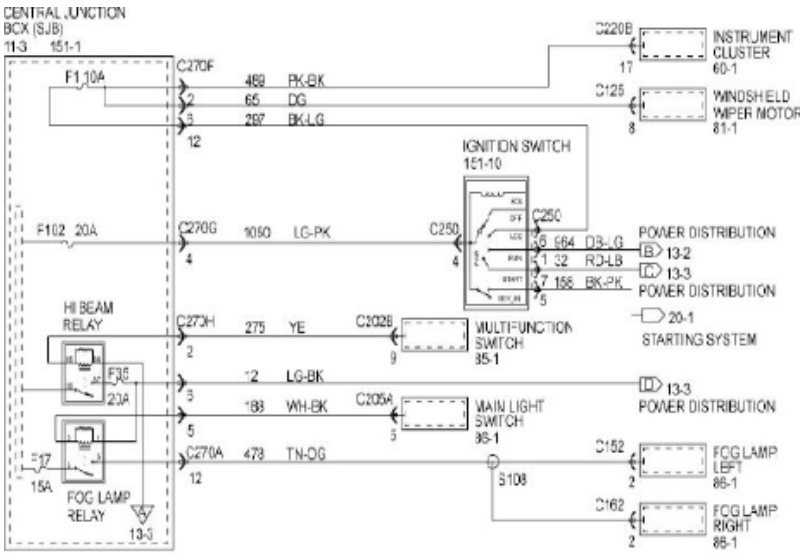
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

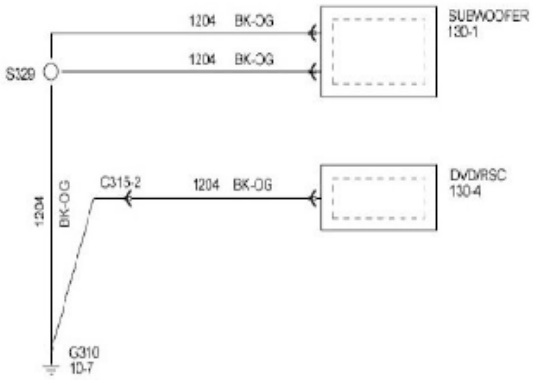
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

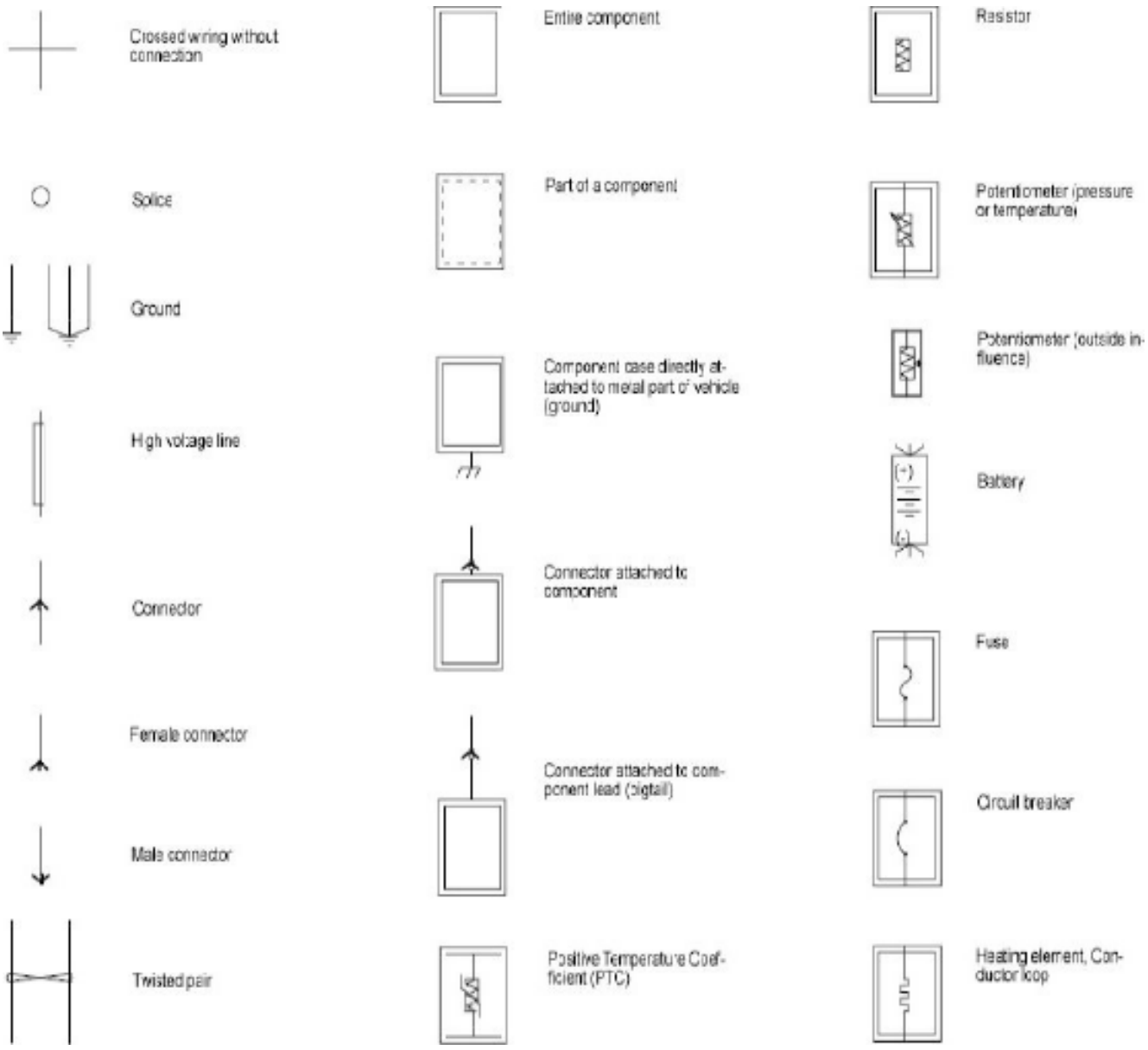
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

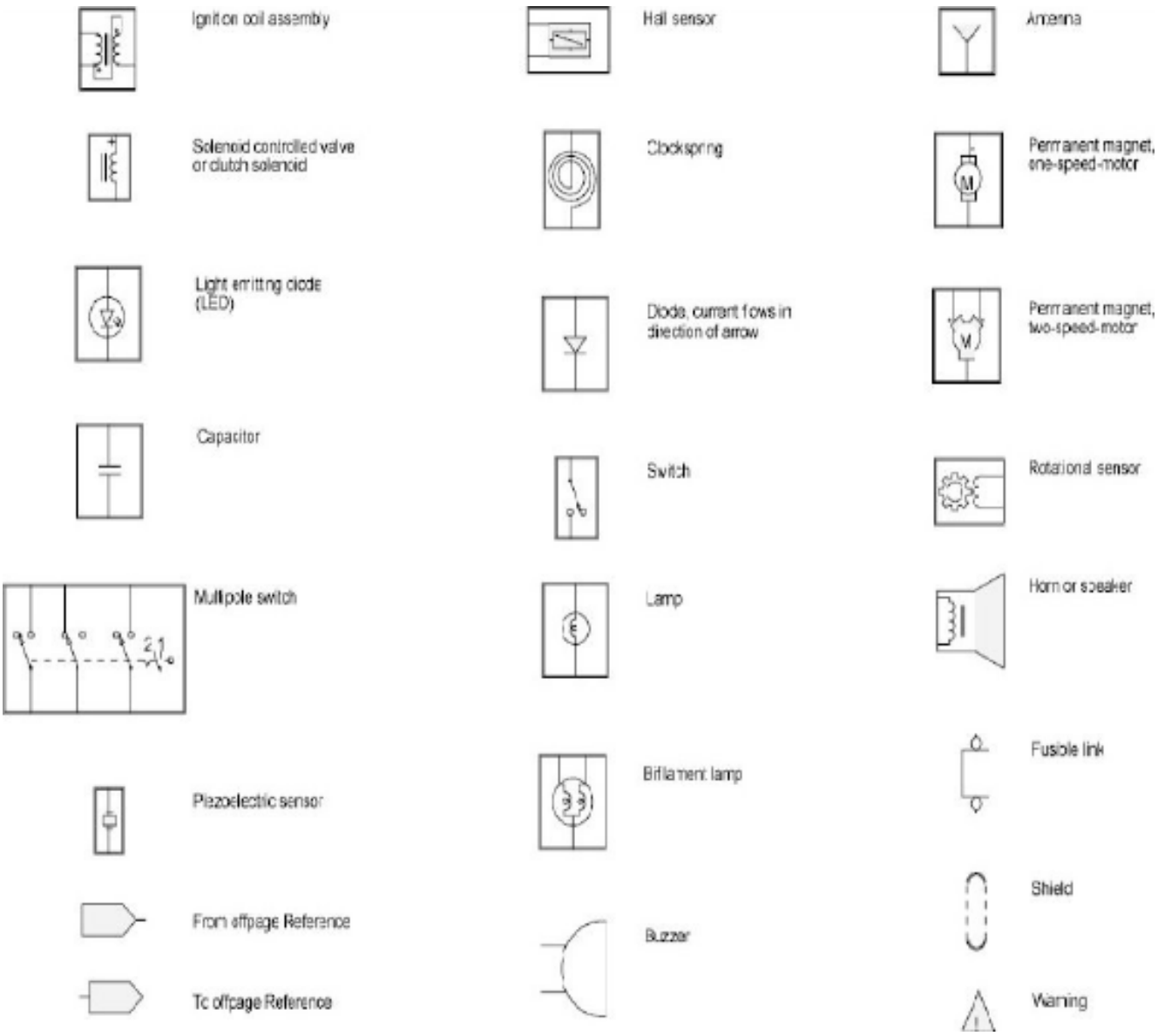
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

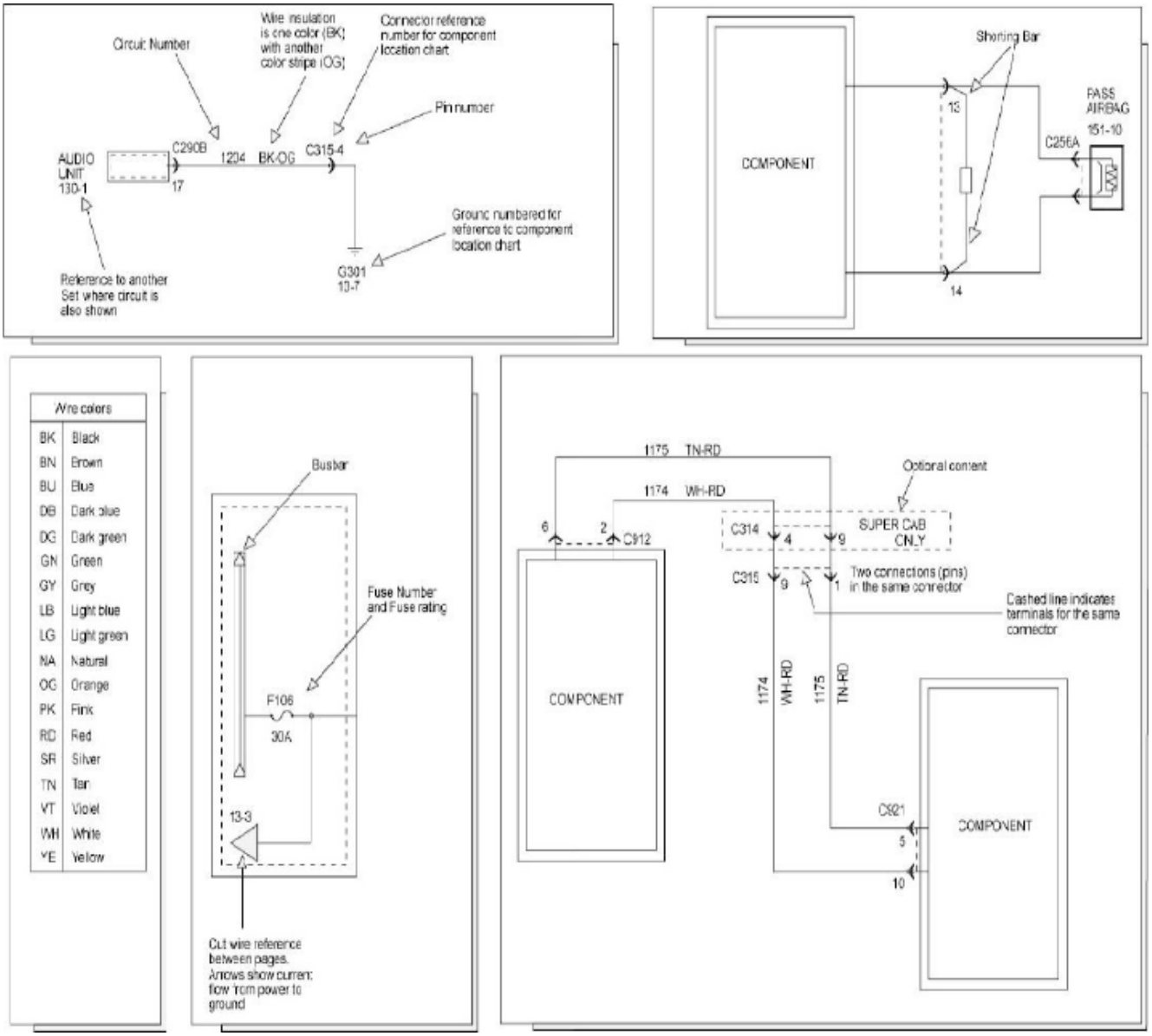
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

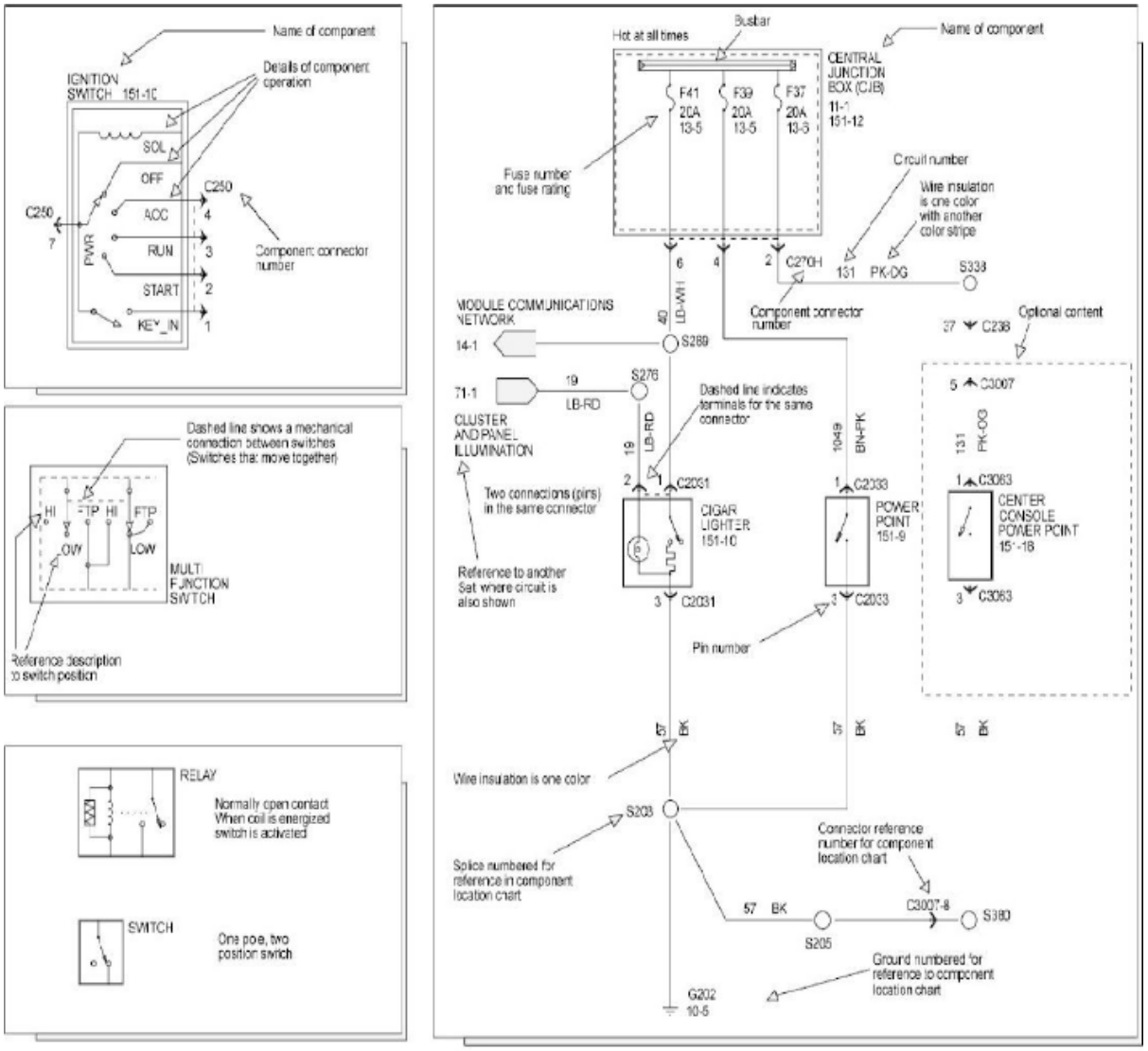
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

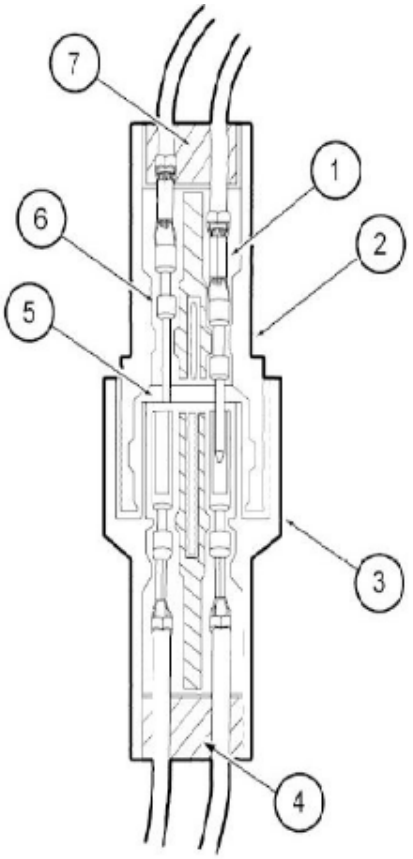


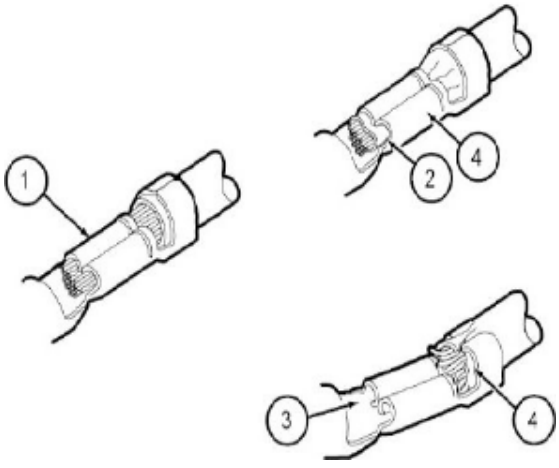
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Tail Lamp: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

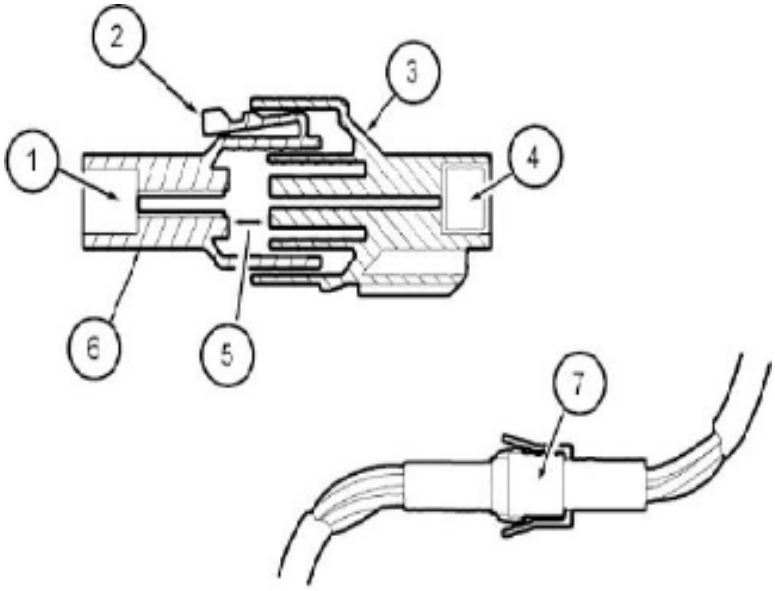
5 = Intermittent contact

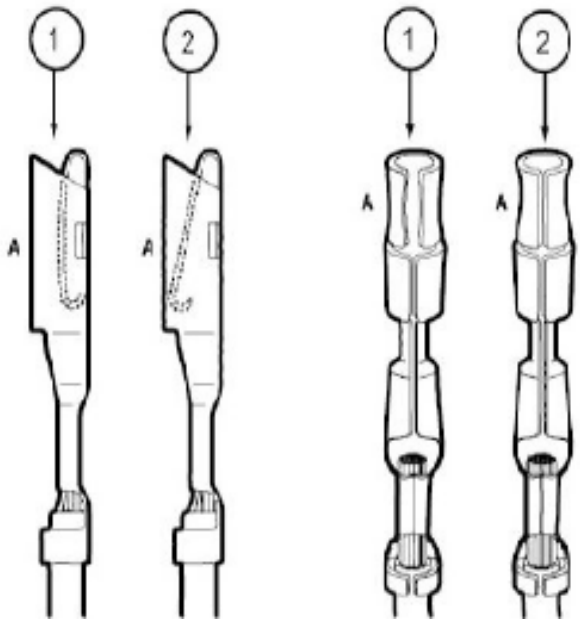
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

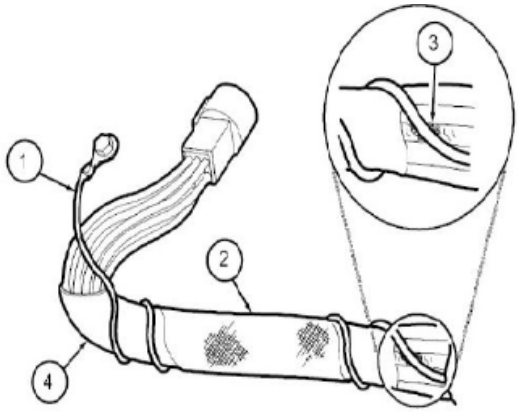
Deformed (enlarged) female terminals

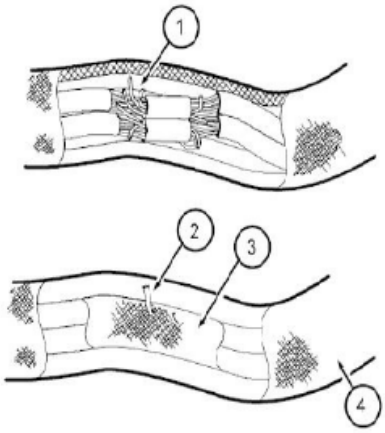
1 = Enlarged

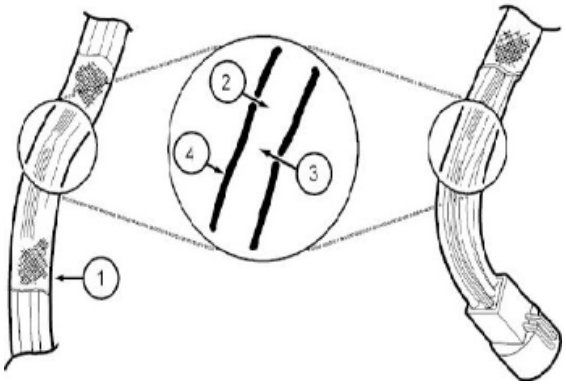
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

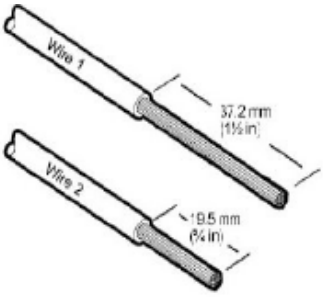
Splice covered 2

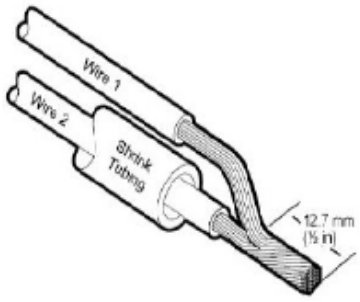
= Wire strand

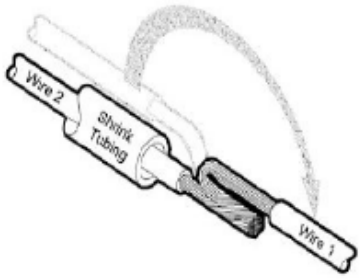
3 = Splice tape

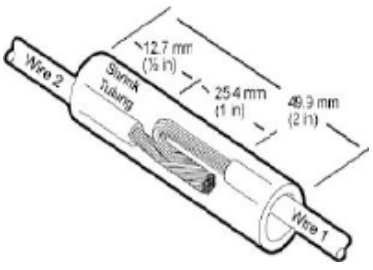
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

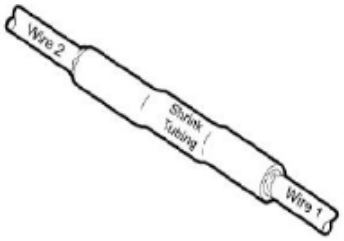
NOTE: -

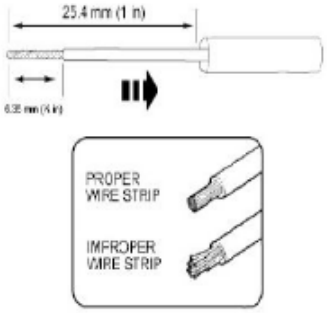
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

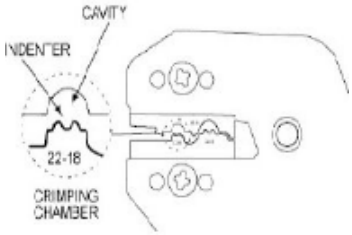
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

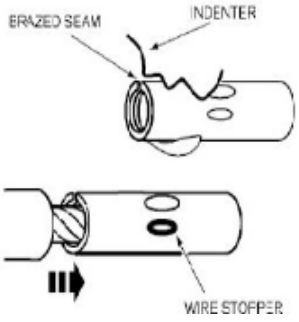
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

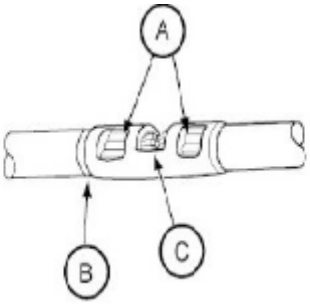
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

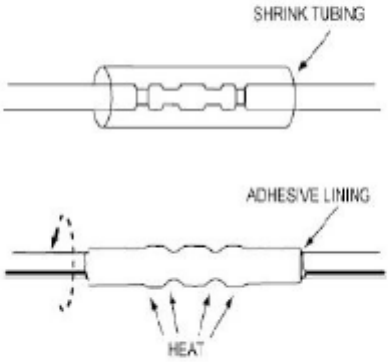
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4 strip, cut 9 strands	* 1/4 strip, cut 2 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip, fold 3x dia.
	16-14	* 1/4 strip, cut 7 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip fold 2x dia	1 strip, fold 3x dia.	1 1/4 strip, fold 4x dia.	Not Recommended
	12-10	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip fold 3x cia.	1 1/4 strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Figtail only

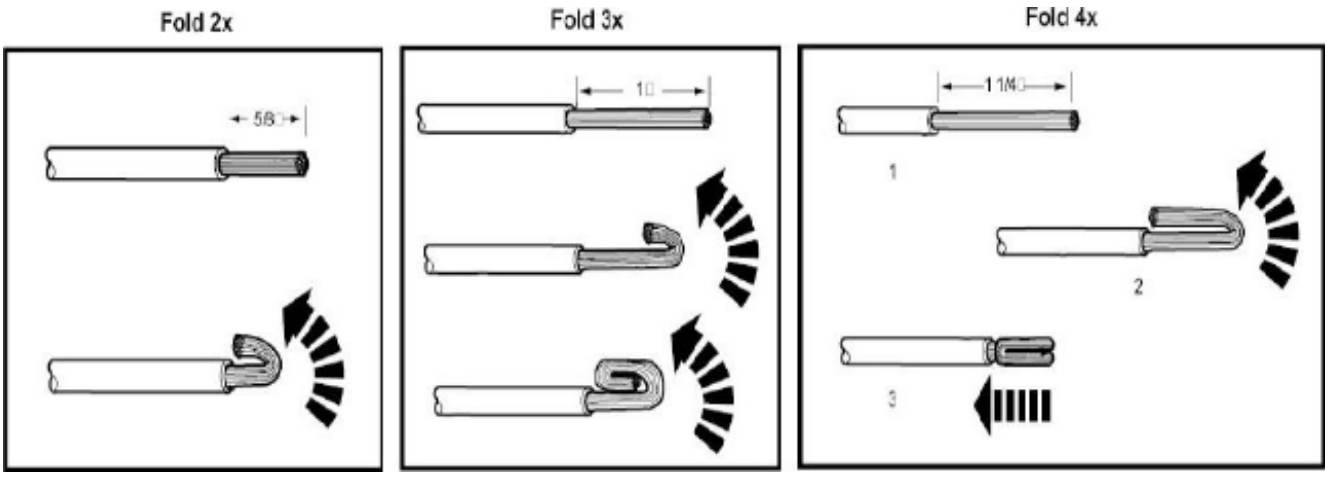
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

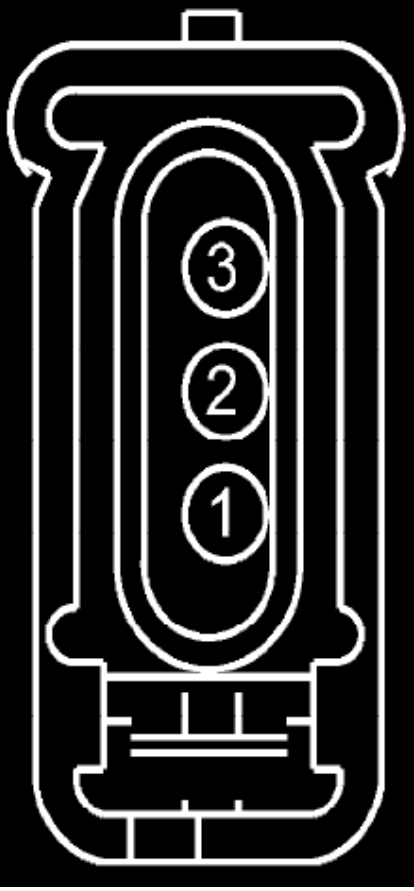
12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Connector: C418

Description:	Harness:	Base Part #:
PARK/STOP LAMP, RIGHT REAR	13A409	



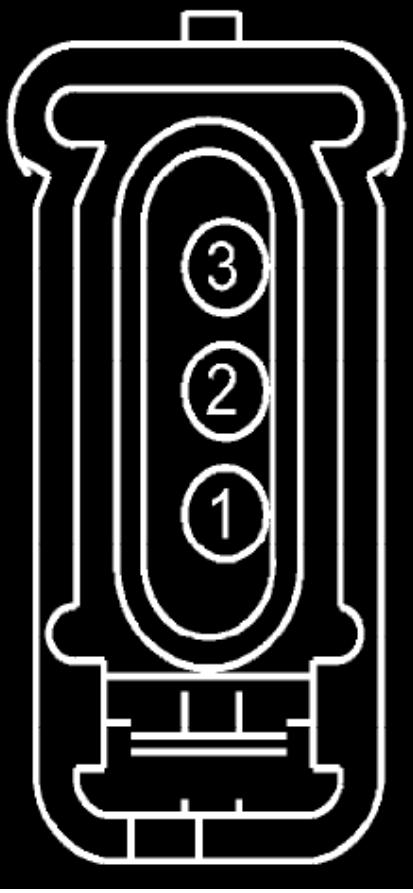
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD121 (BK-YE)	20	GROUND - FENDER FRONT LEFT # 2ND STUD	
2	CLS34 (GY)	18	SWITCH - PARK LAMPS	
3	CCB08 (VT-WH)	18	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL OPEN	

Tail Lamp: Connector Views

C418

Connector: C419

Description:	Harness:	Base Part #:
PARK/STOP LAMP, LEFT REAR	13A409	



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD121 (BK-YE)	20	GROUND - FENDER FRONT LEFT # 2ND STUD	
2	CLS34 (GY)	18	SWITCH - PARK LAMPS	
3	CCB08 (VT-WH)	16	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL OPEN	

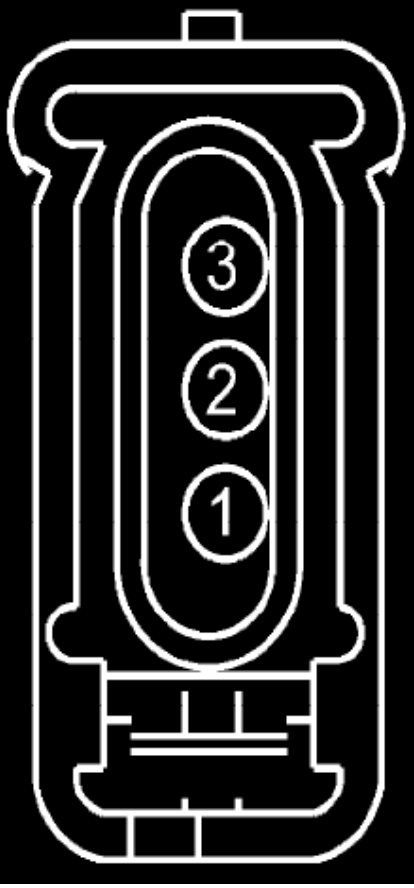
C419

Connector: C415

Description: PARK/STOP/TURN LAMP, RIGHT REAR

Harness: 13A409

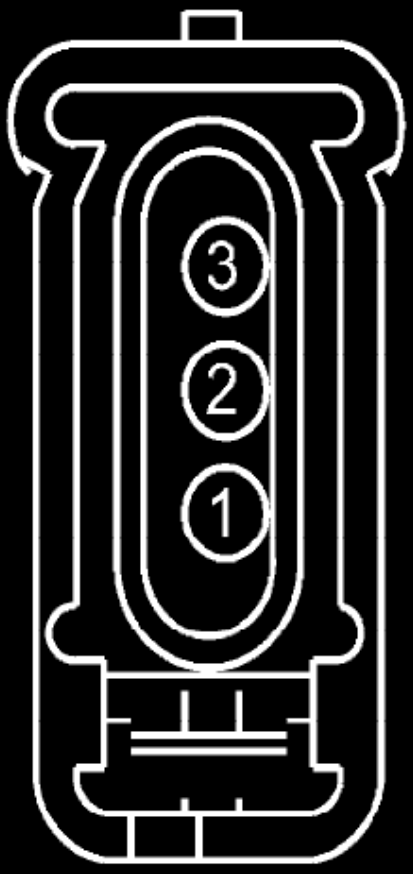
Base Part #:



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD121 (BK-YE)	20	GROUND - FENDER FRONT LEFT # 2ND STUD	
2	CLS34 (GY)	18	SWITCH - PARK LAMPS	
3	CLS36 (YE)	18	SWITCH - PARK LAMPS RIGHT	

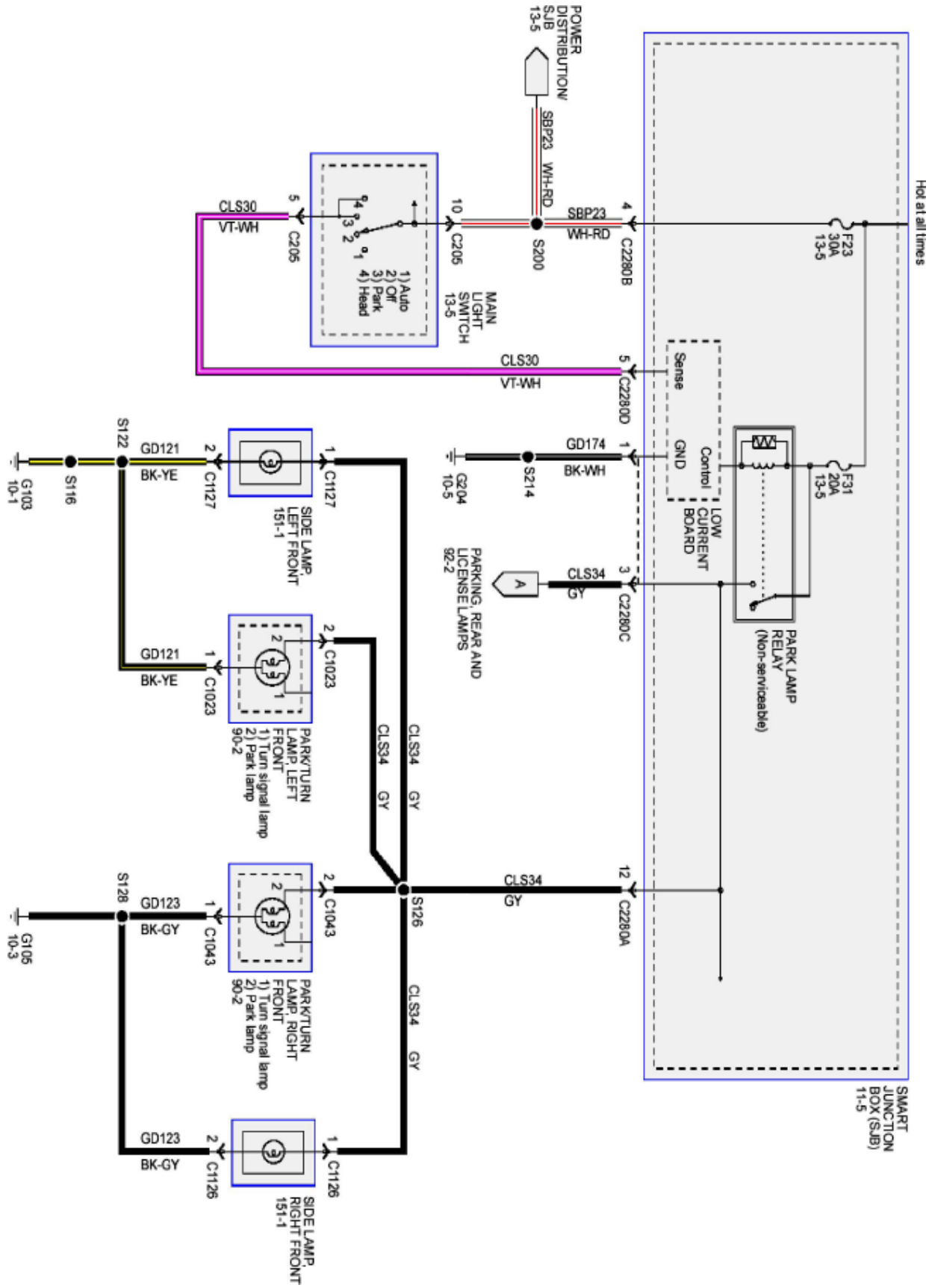
C415

Connector: C412 | **Description:** PARK/STOP/TURN LAMP, LEFT REAR | **Harness:** 13A409 | **Base Part #:**



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD121 (BK-YE)	20	GROUND - FENDER FRONT LEFT # 2ND STUD	
2	CLS34 (GY)	18	SWITCH - PARK LAMPS	
3	CLS35 (VT)	18	SWITCH - PARK LAMPS LEFT	

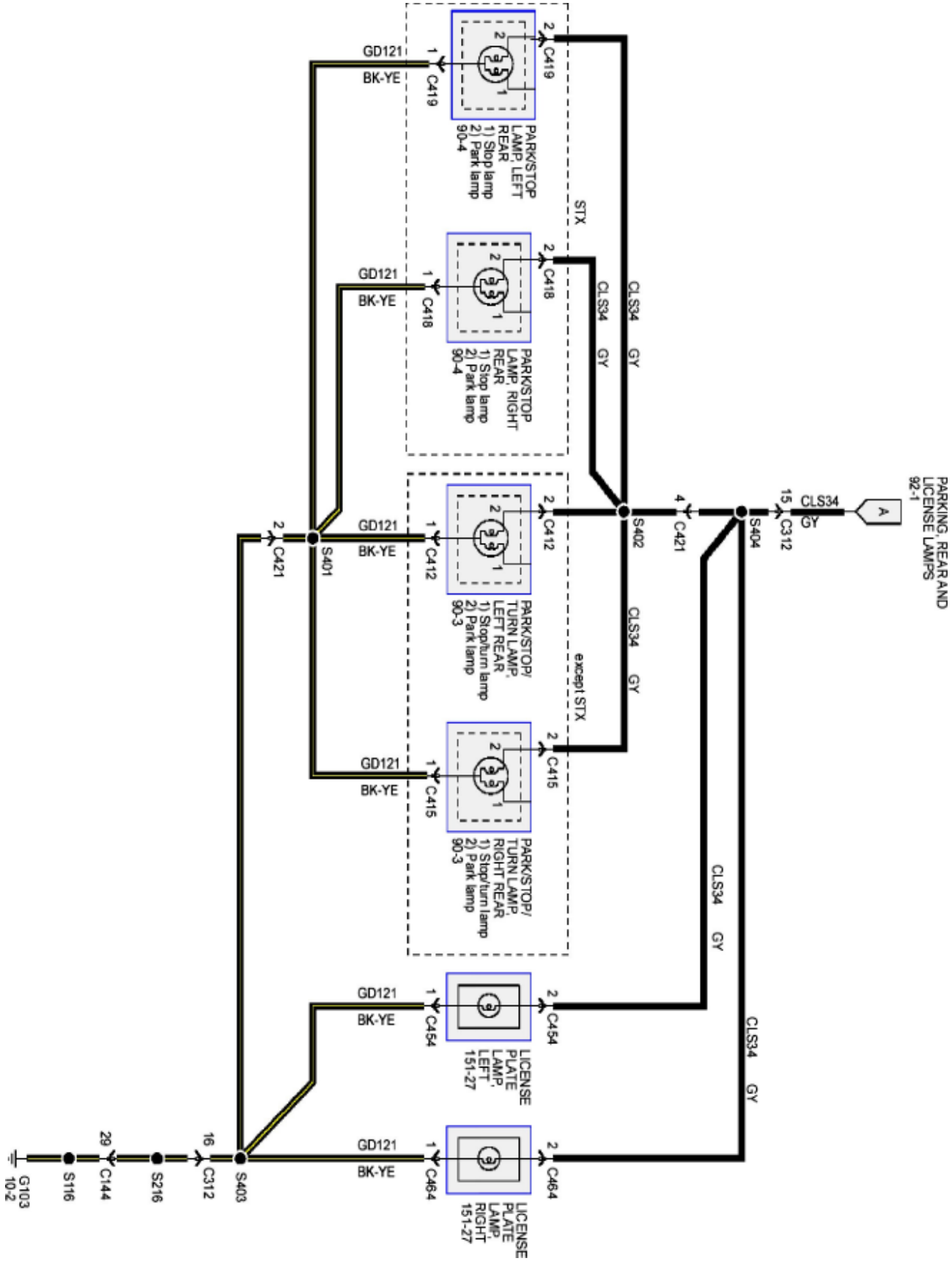
C412


POWER DISTRIBUTION SJB 13-5
SBP23 WH-RD
SBP23 WH-RD
4
C2280B
S200
10
C205
CLS30 VT-WH
5
C205
1) Auto
2) Off
3) Park
4) Head
MAIN LIGHT SWITCH 13-5
CLS30 VT-WH
5
C2280D
Hot at all times
F23 30A 13-5
F31 20A 13-5
Sense
GND
Control
LOW CURRENT BOARD
PARK LAMP RELAY (Non-serviceable)
GD174
BK-WH
S214
G204 10-5
CLS34 GY
3
C2280C
A
PARKING, REAR AND LICENSE LAMPS 92-2
SMART JUNCTION BOX (SJB) 11-5
S122
GD121
BK-YE
2
C1127
1
C1127
SIDE LAMP, LEFT FRONT 151-1
G103 10-1
S116
GD121
BK-YE
1
C1023
2
C1023
PARK/TURN LAMP, LEFT FRONT
1) Turn signal lamp
2) Park lamp
90-2
CLS34 GY
CLS34 GY
S126
CLS34 GY
12
C2280A
S128
GD123
BK-GY
1
C1043
2
C1043
PARK/TURN LAMP, RIGHT FRONT
1) Turn signal lamp
2) Park lamp
90-2
G105 10-3
CLS34 GY
GD123
BK-GY
2
C1126
1
C1126
SIDE LAMP, RIGHT FRONT 151-1

Tail Lamp: Electrical Diagrams

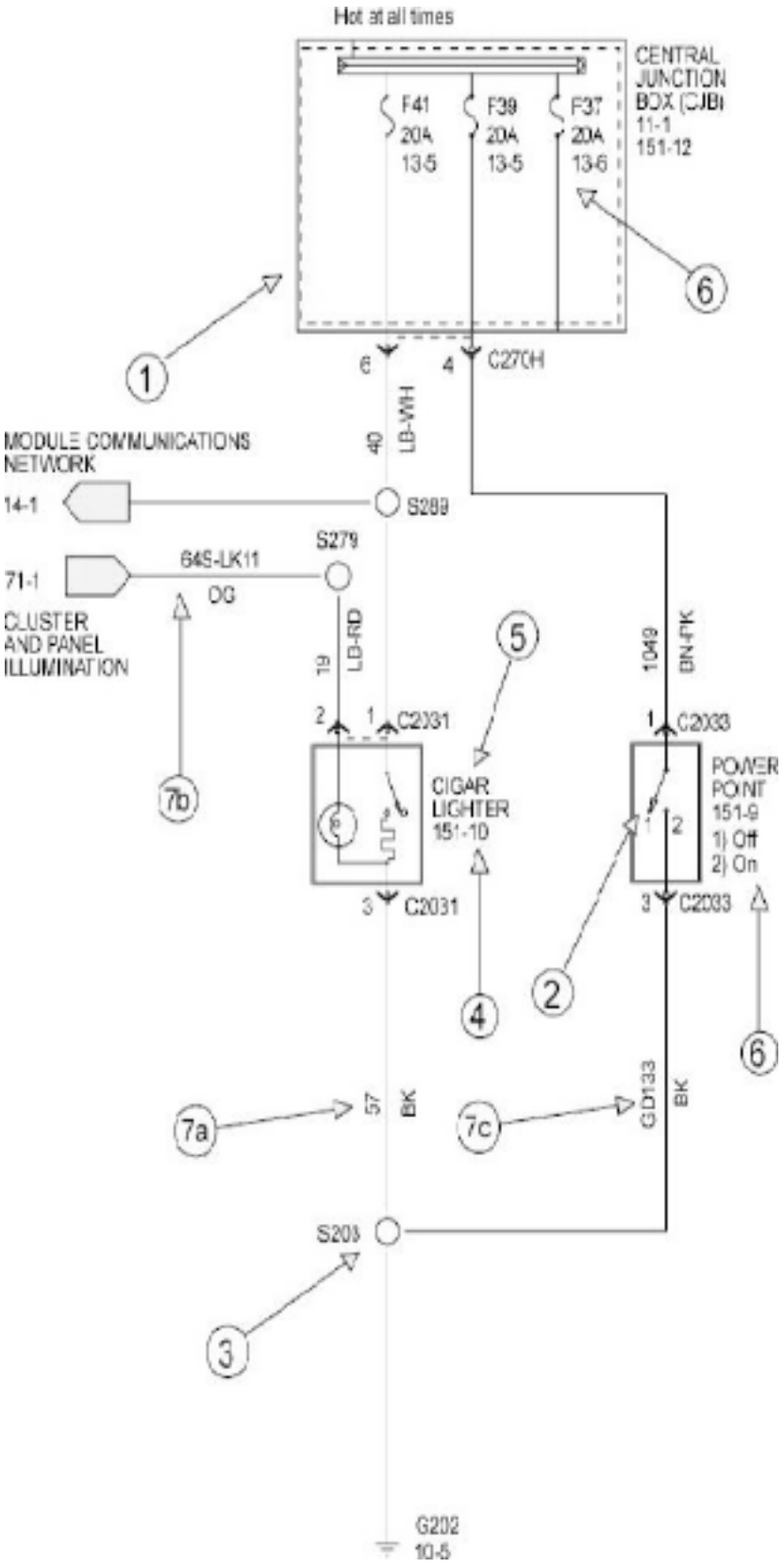
PLEASE NOTE: Some diagrams may appear to be missing because of gaps in the number sequences. These "gaps" are actually for diagrams that do not apply to the vehicle model selected.

92-1


PARKING, REAR AND LICENSE LAMPS 92-1
A
CLS34 GY
15 C312
S404
4 C421
S402
CLS34 GY
except STX
CLS34 GY
STX
CLS34 GY
CLS34 GY
2 C421
S401
GD121 BK-YE
1 C419
2 C419
PARK/STOP LAMP, LEFT REAR 1) Stop lamp 2) Park lamp 90-4
GD121 BK-YE
1 C418
2 C418
PARK/STOP LAMP, RIGHT REAR 1) Stop lamp 2) Park lamp 90-4
GD121 BK-YE
1 C412
2 C412
PARK/STOP/ TURN LAMP, LEFT REAR 1) Stop/turn lamp 2) Park lamp 90-3
GD121 BK-YE
1 C415
2 C415
PARK/STOP/ TURN LAMP, RIGHT REAR 1) Stop/turn lamp 2) Park lamp 90-3
GD121 BK-YE
1 C454
2 C454
LICENSE PLATE LAMP, LEFT 151-27
GD121 BK-YE
1 C464
2 C464
LICENSE PLATE LAMP, RIGHT 151-27
S403
16 C312
S216
29 C144
S116
G103 10-2

Diagrams: Other diagrams referred to by number (i.e. 13-2, 24-6, 10-2, etc.) within these diagrams can be found at Diagrams By Number. See: Diagrams/Electrical Diagrams/Diagrams By Number

Locations: Location Views (reference numbers starting with 151-) referred to within these diagrams can be found at Location Views. See: Locations/Component Locations


Hot at all times
CENTRAL JUNCTION BOX (CJB)
11-1
151-12
F41
20A
13-5
F39
20A
13-5
F37
20A
13-6
C270H
40 LB-WH
MODULE COMMUNICATIONS NETWORK
14-1
S289
S279
64S-LK11
71-1
DG
CLUSTER AND PANEL ILLUMINATION
19 LB-RD
C2031
CIGAR LIGHTER
151-10
1049 BN-PK
C2033
POWER POINT
151-9
1) Off
2) On
57 BK
GD133 BK
S203
G202
10-5

Trailer Lamps: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

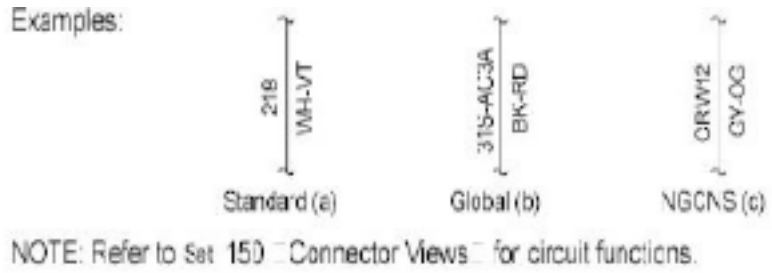
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

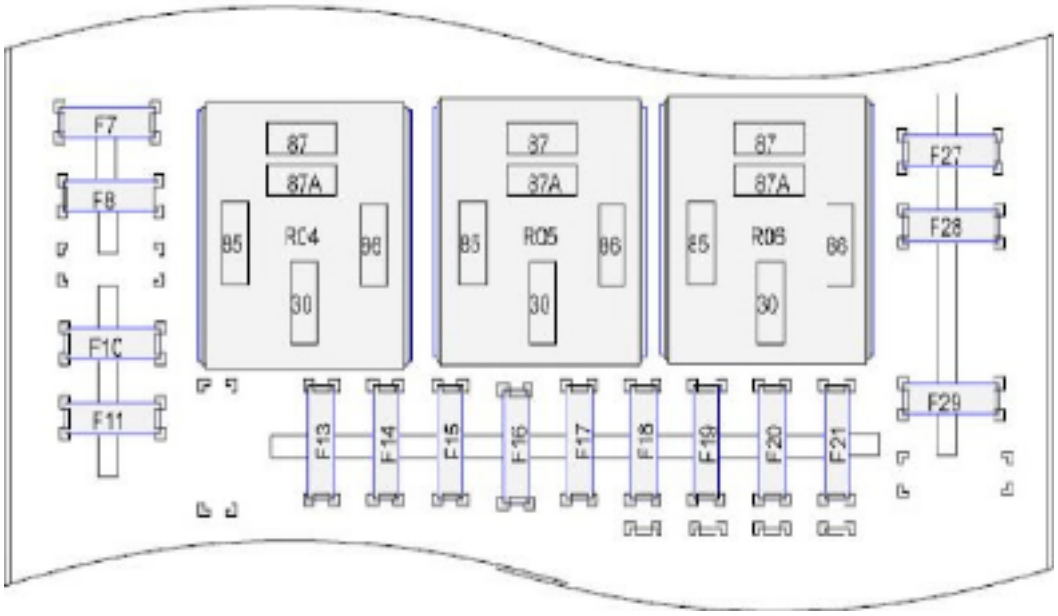
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

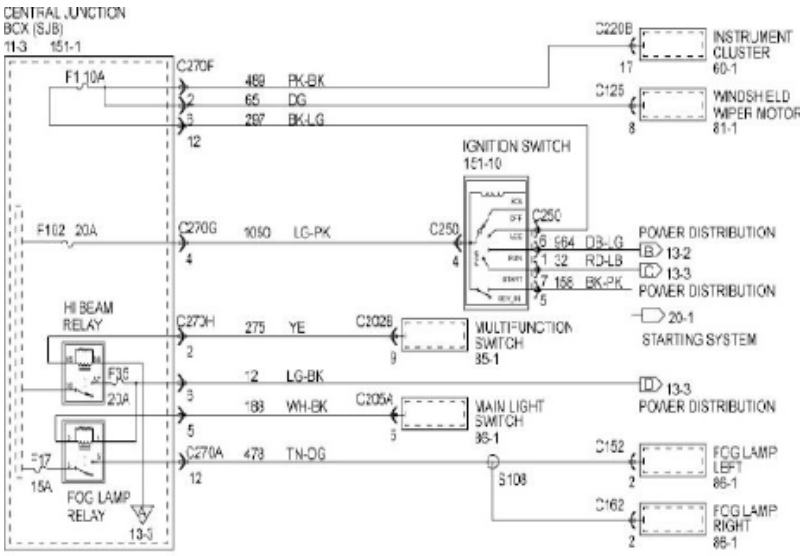
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

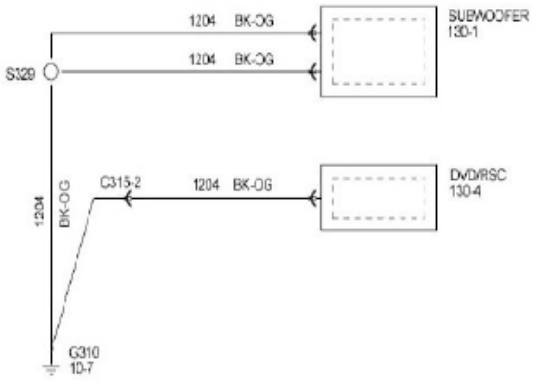
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

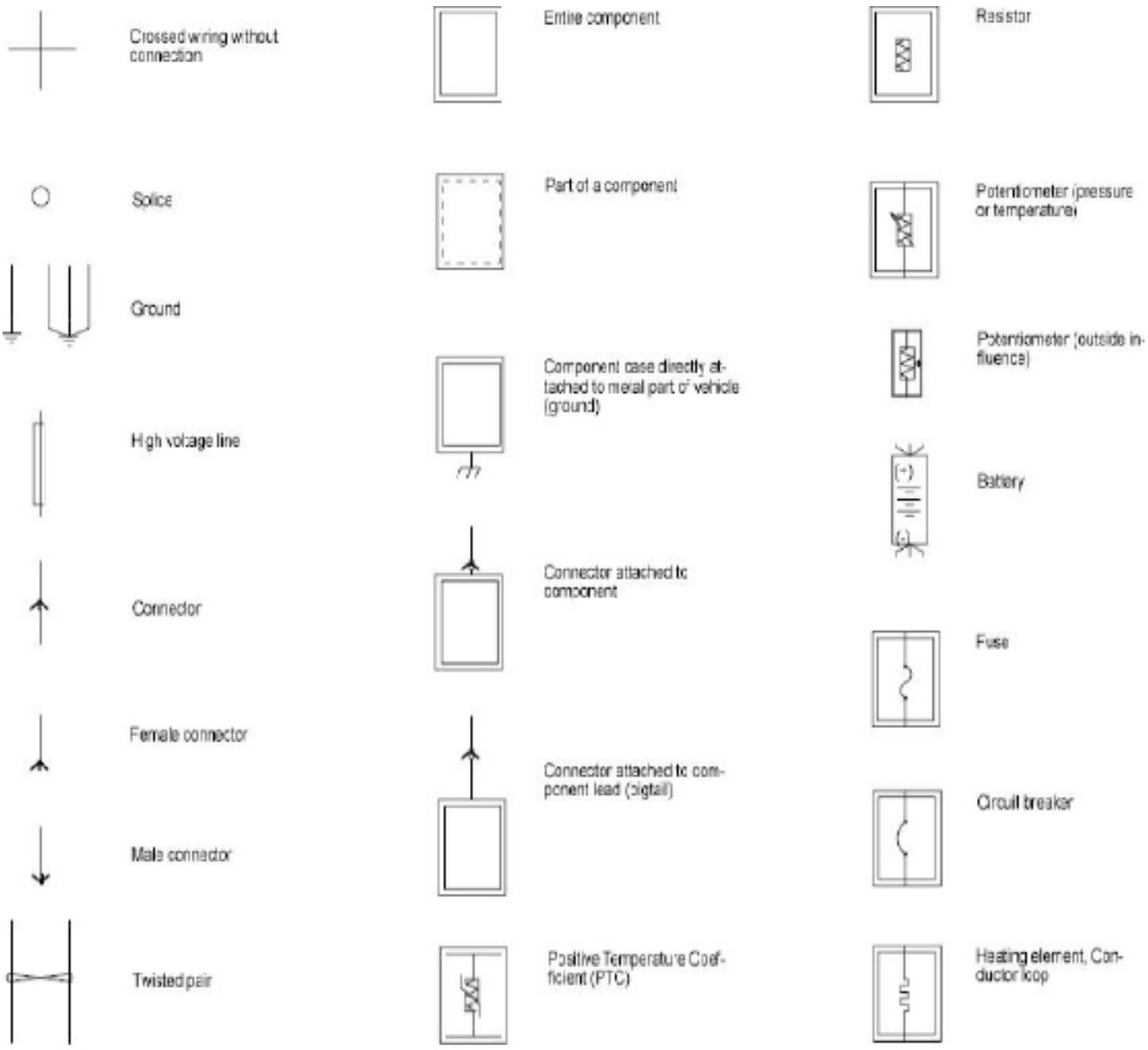
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

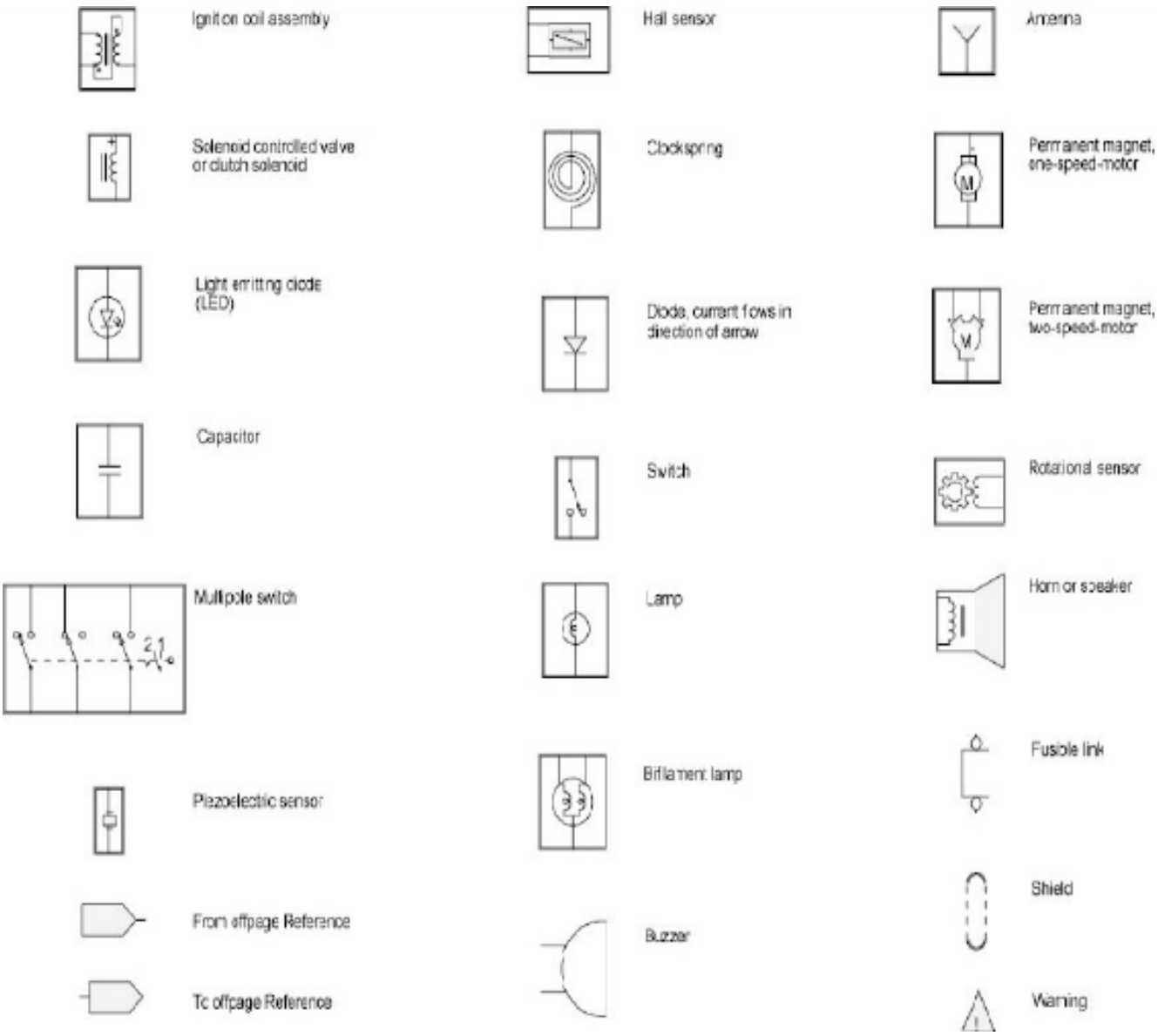
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

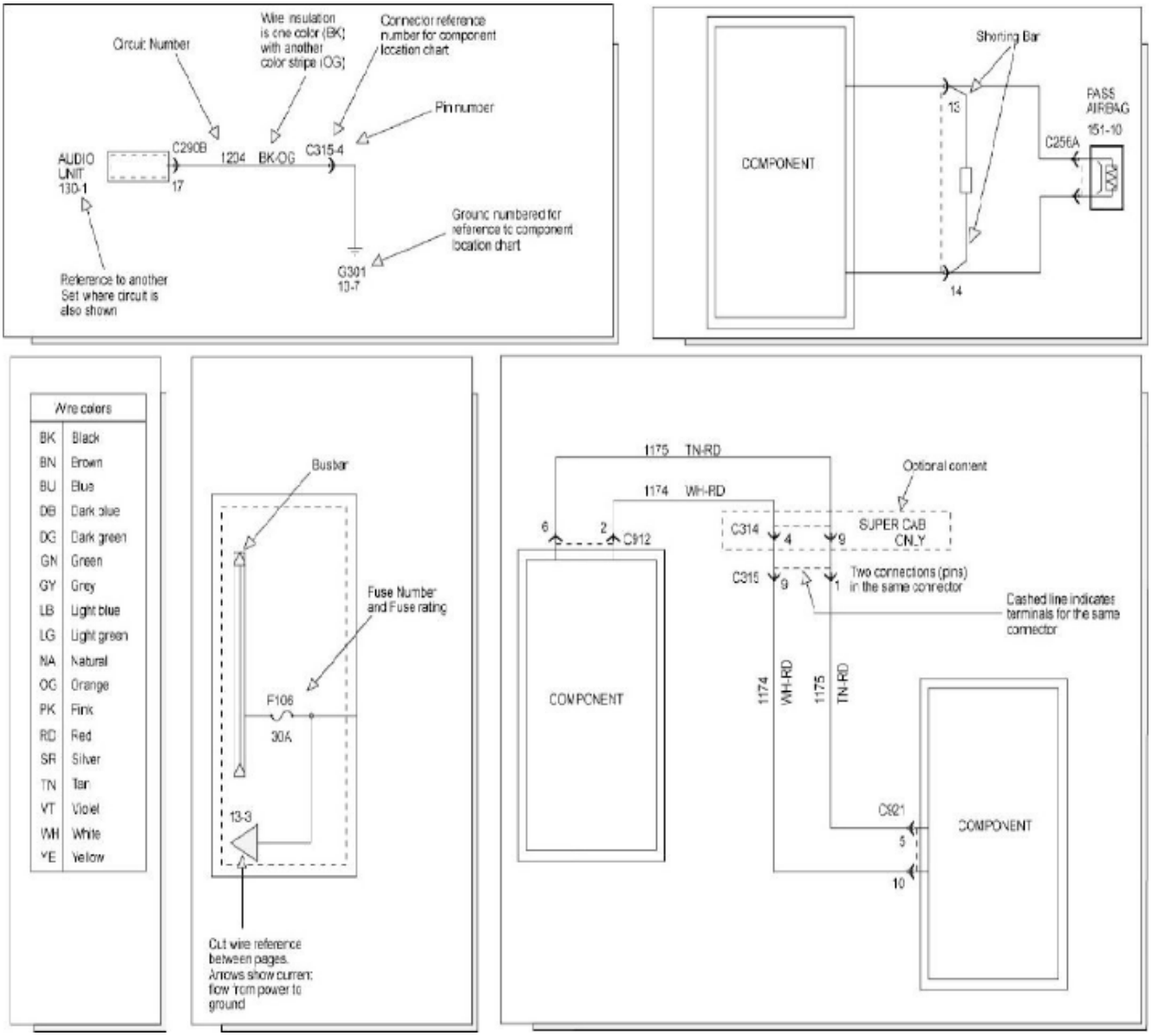
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

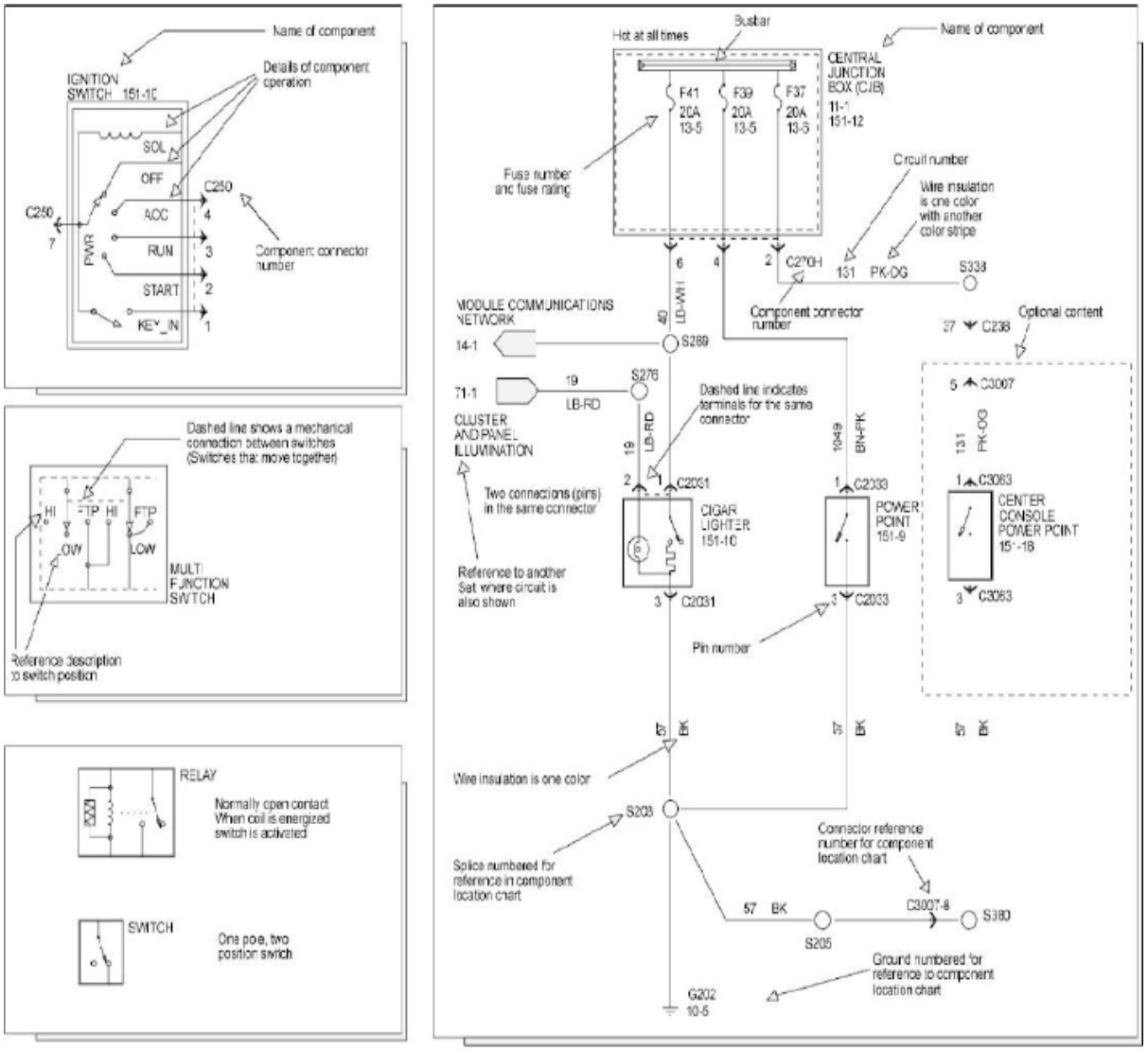
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

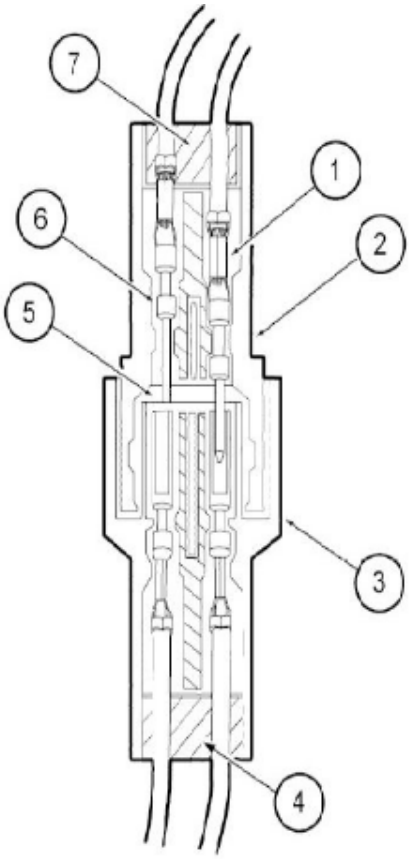


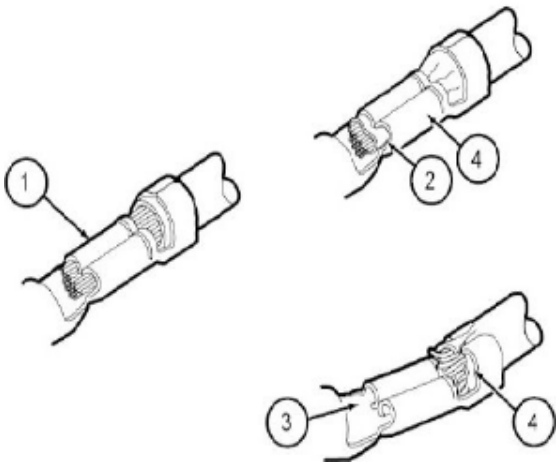
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Trailer Lamps: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

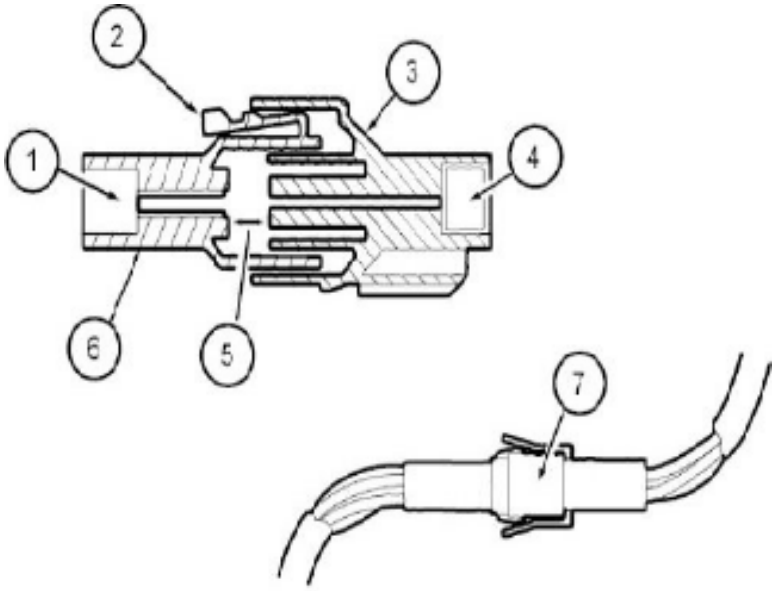
5 = Intermittent contact

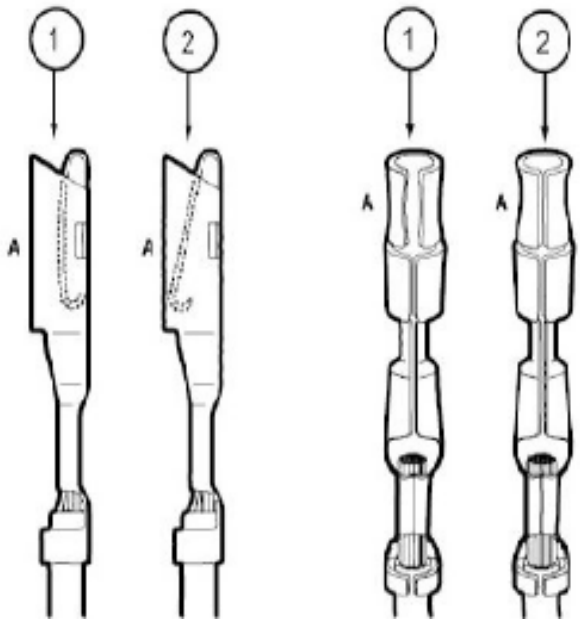
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

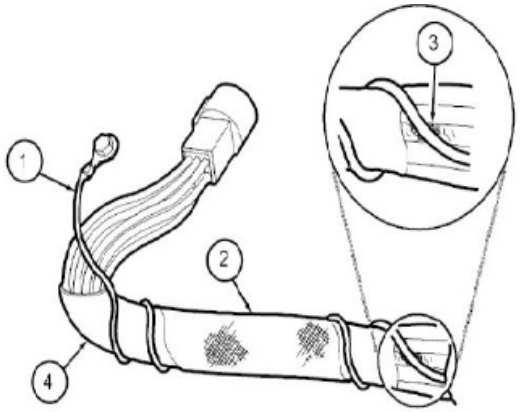
Deformed (enlarged) female terminals

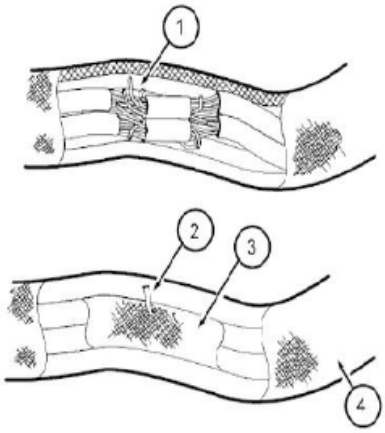
1 = Enlarged

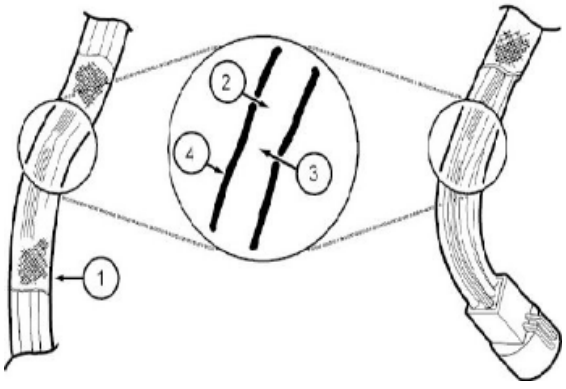
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

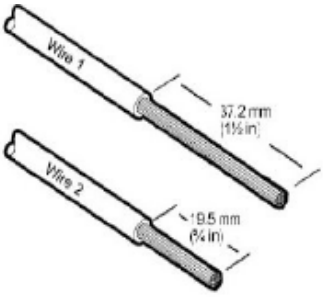
Splice covered 2

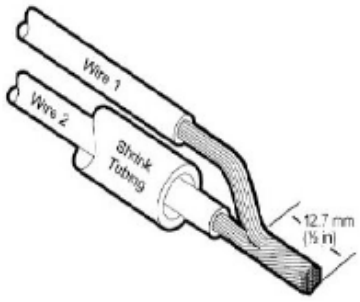
= Wire strand

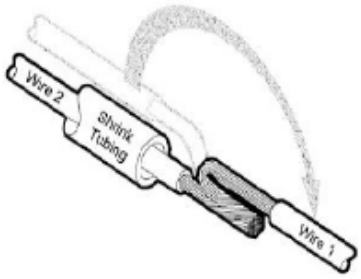
3 = Splice tape

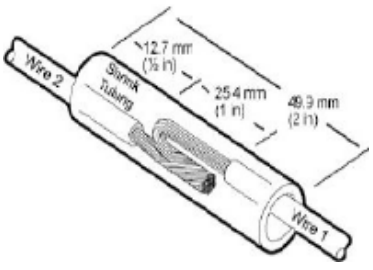
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

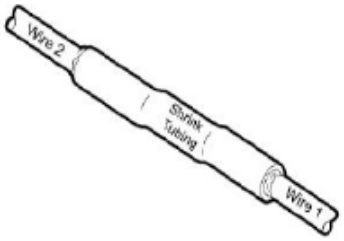
NOTE: -

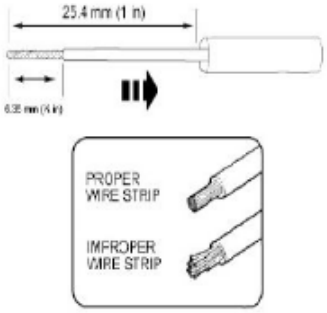
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

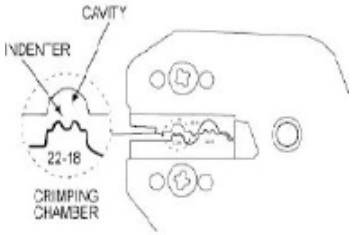
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

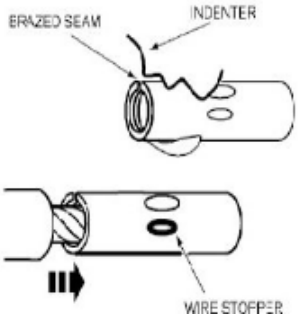
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
6.35 mm (¼ in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

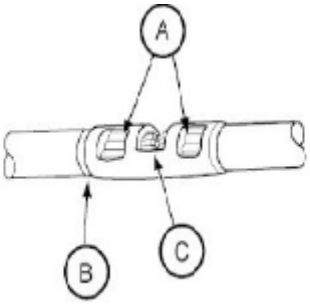
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

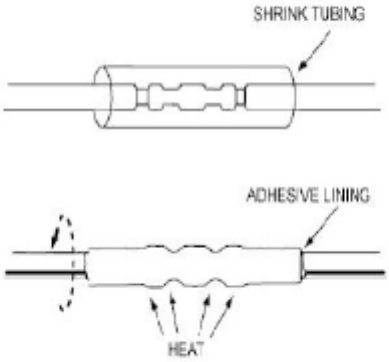
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4 strip, cut 9 strands	* 1/4 strip, cut 2 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip, fold 3x dia.
	16-14	* 1/4 strip, cut 7 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip fold 2x dia	1 strip, fold 3x dia.	1 1/4 strip, fold 4x dia.	Not Recommended
	12-10	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip fold 3x cia.	1 1/4 strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Figtail only

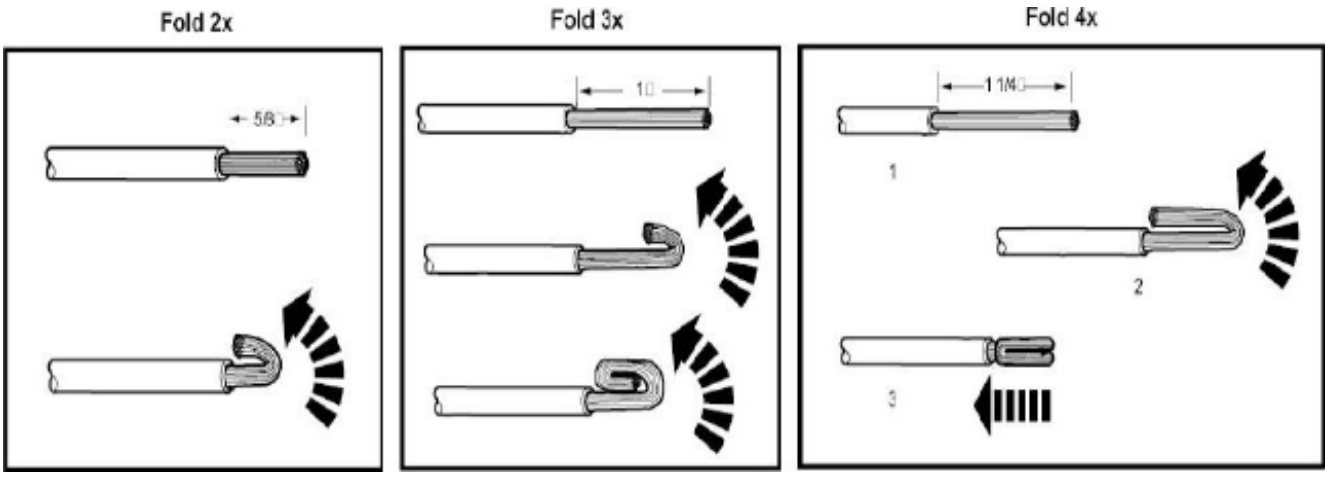
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

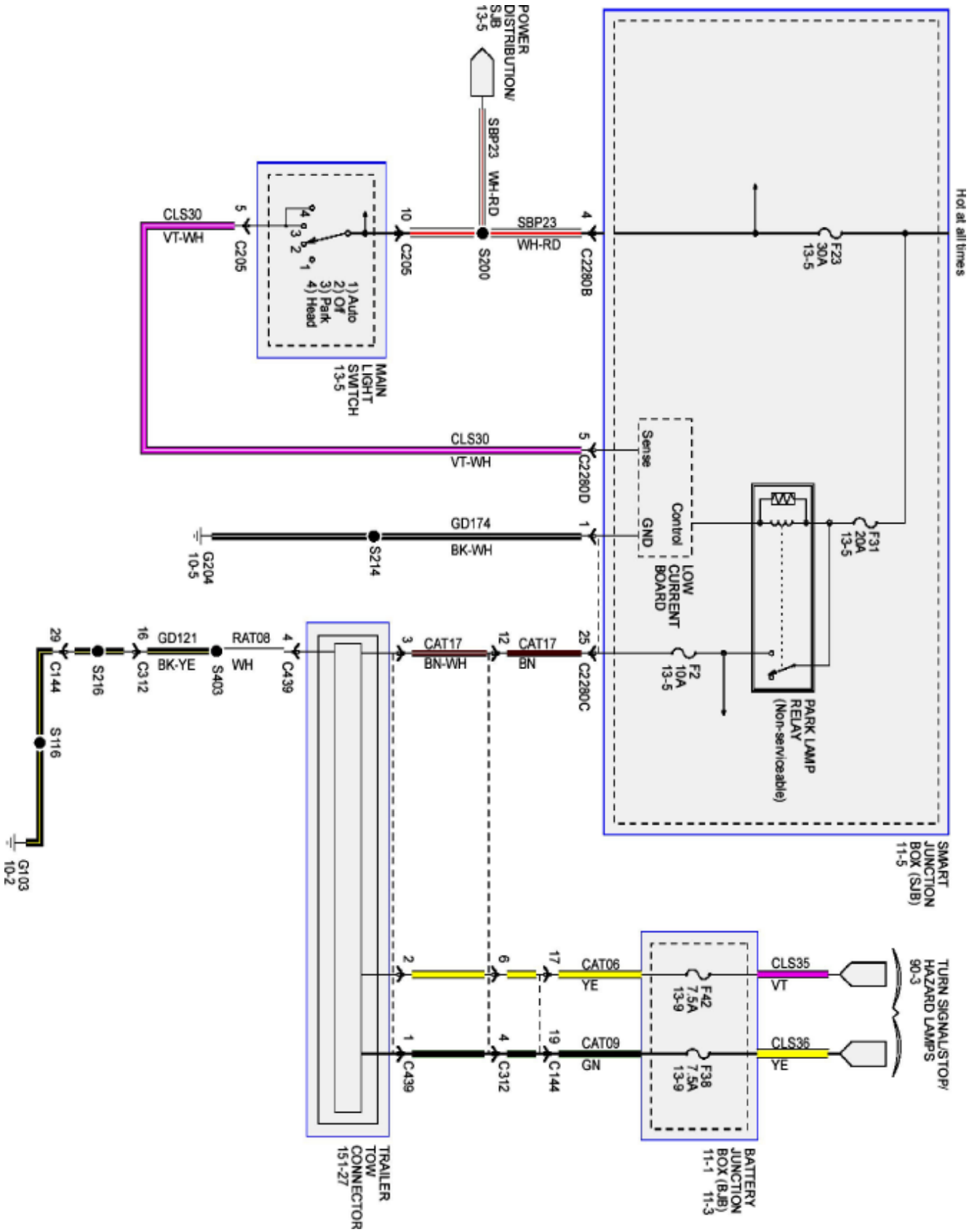
11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.


Hot at all times
POWER DISTRIBUTION/ SJB 13-5
SBP23 WH-RD
SBP23 WH-RD
S200
C205
10
4
C2280B
CLS30 VT-WH
5
C205
1) Auto
2) Off
3) Park
4) Head
MAIN LIGHT SWITCH 13-5
F23 30A 13-5
CLS30 VT-WH
5
C2280D
Sense
Control
GND
LOW CURRENT BOARD
GD174 BK-WH
1
S214
G204 10-5
F31 20A 13-5
PARK LAMP RELAY (Non-serviceable)
F2 10A 13-5
3
CAT17 BN-WH
12
CAT17 BN
25
C2280C
SMART JUNCTION BOX (SJB) 11-5
29
C144
S116
G103 10-2
16
GD121 BK-YE
S216
C312
RAT08 WH
S403
4
C439
TRAILER TOW CONNECTOR 151-27
2
1
C439
6
4
C312
17
19
C144
CAT06 YE
CAT09 GN
F42 7.5A 13-9
F38 7.5A 13-9
CLS35 VT
CLS36 YE
TURN SIGNAL/STOP/ HAZARD LAMPS 90-3
BATTERY JUNCTION BOX (BJB) 11-1 11-3

Trailer Lamps: Electrical Diagrams

PLEASE NOTE: Some diagrams may appear to be missing because of gaps in the number sequences. These "gaps" are actually for diagrams that do not apply to the vehicle model selected.

95-1

Diagrams: Other diagrams referred to by number (i.e. 13-2, 24-6, 10-2, etc.) within these diagrams can be found at Diagrams By Number. See:

Diagrams/Electrical Diagrams/Diagrams By Number

Locations: Location Views (reference numbers starting with 151-) referred to within these diagrams can be found at Location Views. See: Locations/Component Locations

Trailer Lamps: Initial Inspection and Diagnostic Overview

Principles of Operation

PRINCIPLES OF OPERATION

NOTE: The smart junction box (SJB) is also known as the generic electronic module (GEM).

Circuitry is supplied to the trailer tow connector to support trailer parking lamps and stop/turn lamp functionality. When the vehicle parking lamps are on, the smart junction box (SJB) supplies voltage to the trailer tow connector for the trailer parking lamps. When the vehicle stop/turn lamps are operating, voltage is supplied to the trailer tow connector for the trailer stop/turn lamps.

Inspection and Verification

INSPECTION AND VERIFICATION

1. Verify the customer concern. 2. Verify the exterior lighting system of the vehicle is operating correctly. If not, refer to the appropriate pinpoint test. 3. Visually inspect for obvious signs of electrical damage.

VISUAL INSPECTION CHART

Electrical -

Battery junction box (BJB) fuse(s): -

38 (7.5A) (trailer tow RH stoplamp)

- 42 (7.5A) (trailer tow LH stoplamp)

- Smart junction box (SJB) fuse 2 (10A) (trailer tow parking lamps)

- Wiring, terminals or connectors

- Bulb(s)

- SJB

4. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step. 5. If the concern is not visually evident, verify the symptom. GO to Symptom Chart. See: Symptom Related Diagnostic Procedures

Symptom Chart

Condition	Possible Sources	Action
• All the trailer lamps are inoperative	• Wiring, terminals or connectors • Trailer	• GO to Pinpoint Test T.
• The trailer parking lamps are inoperative	• Fuse • Wiring, terminals or connectors • Smart junction box (SJB) • Trailer	• GO to Pinpoint Test U.

Symptom Chart (Continued)

Condition	Possible Sources	Action
• The individual trailer lamp is inoperative	• Fuse • Wiring, terminals or connectors • Trailer	• GO to Pinpoint Test V.

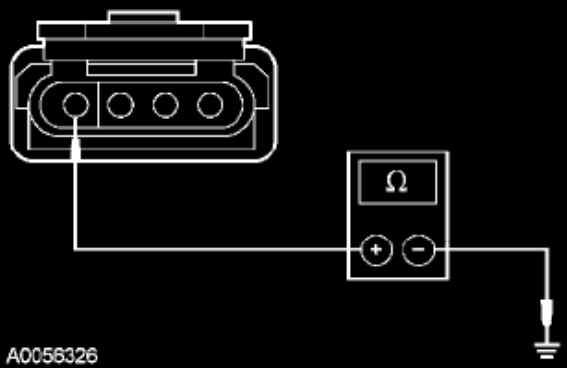
Trailer Lamps: Symptom Related Diagnostic Procedures

Symptom Chart (Part 1)

Symptom Chart (Part 2)

PINPOINT TEST T: ALL THE TRAILER LAMPS ARE INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step		Result / Action to Take
T1	**CHECK CIRCUIT RAT08 (WH) FOR AN OPEN** • Key in OFF position. • Disconnect: Trailer Tow C439. • Measure the resistance between the trailer tow C439-4, circuit RAT08 (WH), harness side and ground.  A0056326 • **Is the resistance less than 5 ohms?**	**Yes** The vehicle is operating correctly. SEND the trailer to an authorized camper/trailer repair facility. **No** REPAIR the circuit. TEST the system for normal operation.

Trailer Lamps: Pinpoint Tests

Test T: All The Trailer Lamps Are Inoperative

PINPOINT TEST T: ALL THE TRAILER LAMPS ARE INOPERATIVE

Normal Operation

The trailer tow connector is provided ground through circuit RAT08 (WH) for the trailer lamps.

This pinpoint test is intended to diagnose the following:

- Wiring, terminals or connectors

- Trailer

T1

Test U: The Trailer Parking Lamps Are Inoperative

PINPOINT TEST U: THE TRAILER PARKING LAMPS ARE INOPERATIVE

Normal Operation

When the parking lamps are on, the smart junction box (SJB) provides voltage to the trailer tow connector through circuit CAT17 (BN/WH).

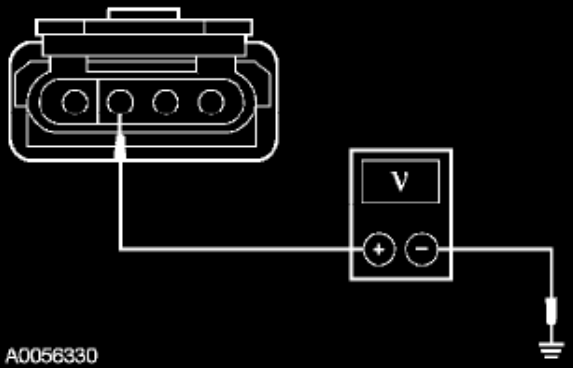
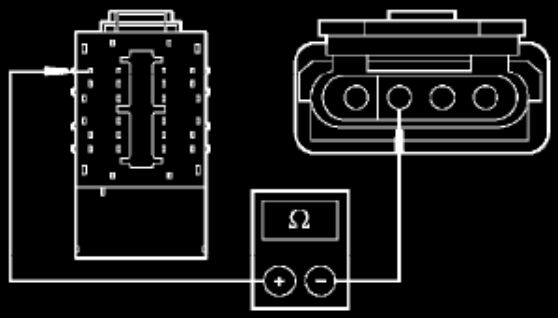
This pinpoint test is intended to diagnose the following:

- Fuse

- Wiring, terminals or connectors
- Trailer
- SJB

PINPOINT TEST U: THE TRAILER PARKING LAMPS ARE INOPERATIVE

CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

Test Step	Result / Action to Take
U1 CHECK CIRCUIT CAT17 (BN/WH) FOR VOLTAGE • Key in OFF position. • Disconnect: Trailer Tow C439. • Place the headlamp switch in the PARKING LAMPS ON position. • Measure the voltage between the trailer tow C439-3, circuit CAT17 (BN/WH), harness side and ground.  A0056330 • **Is the voltage greater than 10 volts?**	**Yes** The vehicle is operating correctly. SEND the trailer to an authorized camper/trailer repair facility. **No** VERIFY the SJB fuse 2 (10A) is OK. If OK, GO to **U2**.
U2 CHECK CIRCUIT CAT17 (BN/WH) FOR AN OPEN • Place the headlamp switch in the OFF position. • Disconnect: SJB C2280c. • Measure the resistance between the SJB C2280c-25, circuit CAT17 (BN/WH), harness side and the trailer tow C439-3, circuit CAT17 (BN/WH), harness side.  N0072921 • **Is the resistance less than 5 ohms?**	**Yes** GO to **U3**. **No** REPAIR the circuit. TEST the system for normal operation.
U3 CHECK FOR CORRECT SJB OPERATION • Disconnect all the SJB connectors. • Check for: — corrosion — damaged pins — pushed-out pins • Connect all the SJB connectors and make sure they seat correctly. • Operate the system and verify the concern is still present. • **Is the concern still present?**	**Yes** INSTALL a new SJB. TEST the system for normal operation. **No** The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

Test V: The Individual Trailer Lamp Is Inoperative

PINPOINT TEST V: THE INDIVIDUAL TRAILER LAMP IS INOPERATIVE

Normal Operation

When the brake pedal is applied, voltage is provided to the trailer tow connector for the LH and RH trailer stoplamps through circuits CAT06 (YE) and CAT09 (GN), respectively.

This pinpoint test is intended to diagnose the following:

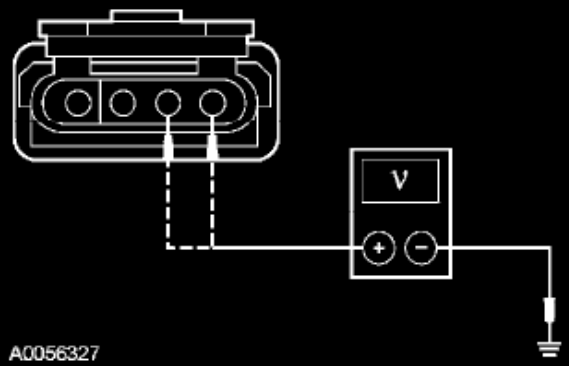
- Fuse

- Wiring, terminals or connectors

- Trailer

PINPOINT TEST V: THE INDIVIDUAL TRAILER LAMP IS INOPERATIVE

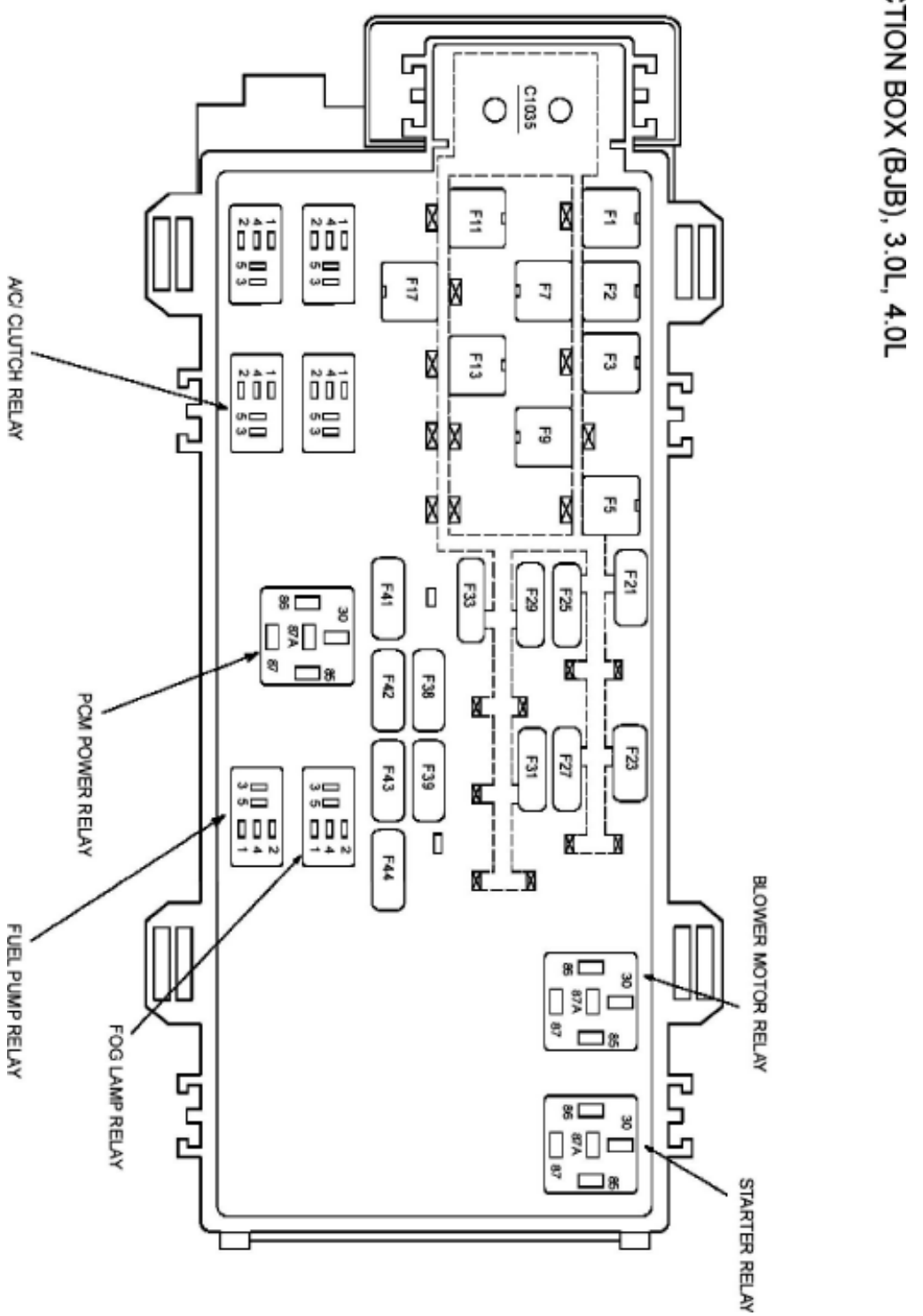
CAUTION: Use the correct probe adapter(s) when making measurements. Failure to use the correct probe adapter(s) may damage the connector.

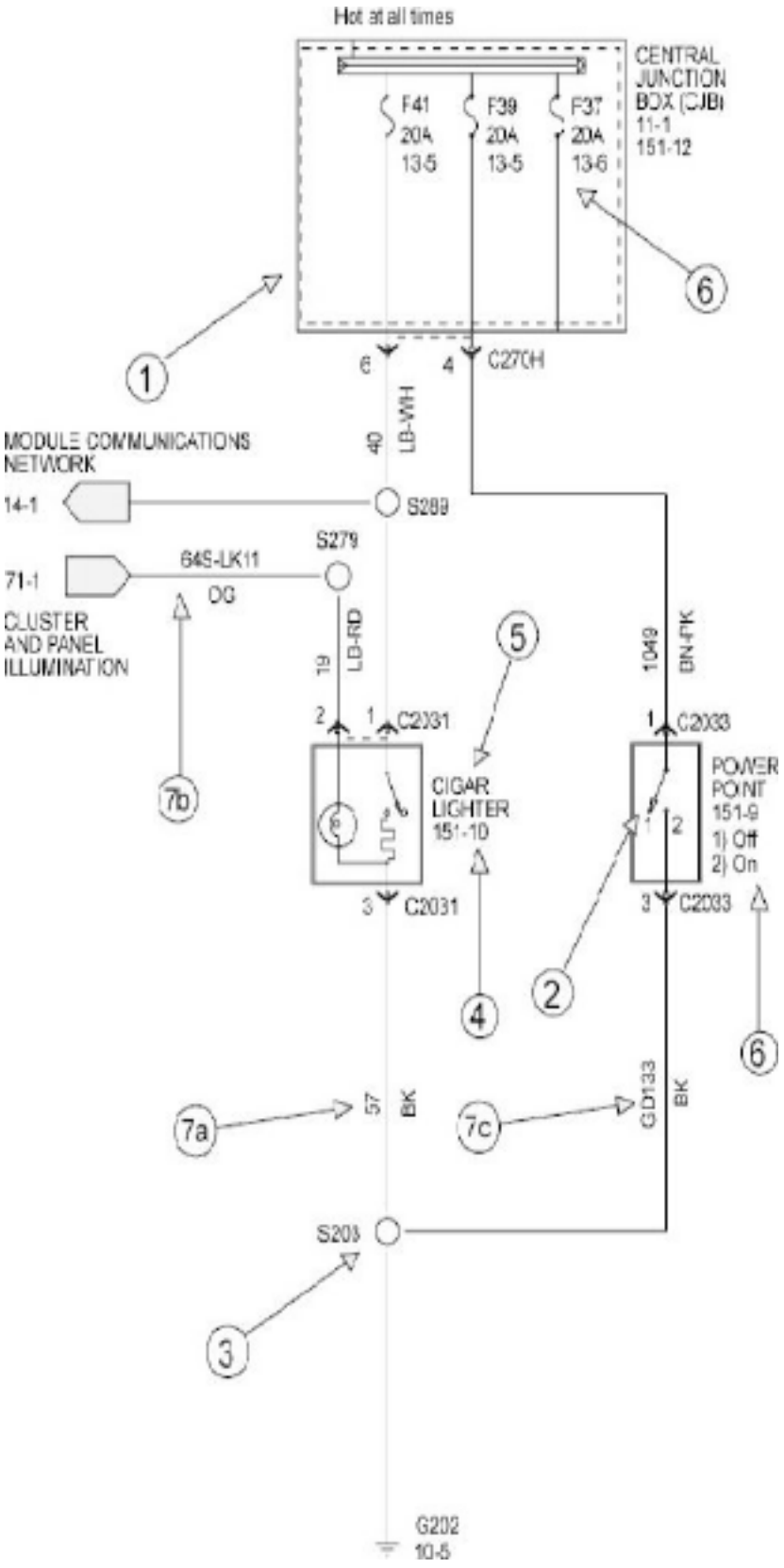
Test Step		Result / Action to Take
V1	DETERMINE THE INOPERATIVE TRAILER LAMP	
	• Place the headlamp switch in the PARKING LAMPS ON position. • While applying and releasing the brake pedal, observe the trailer tow lamps. • **Is an individual trailer parking lamp inoperative?**	**Yes** The vehicle is operating correctly. SEND the trailer to an authorized camper/trailer repair facility. **No** GO to **V2**.
V2	CHECK CIRCUIT CAT06 (YE) (LH STOPLAMP) OR CIRCUIT CAT09 (GN) (RH STOPLAMP) FOR AN OPEN	
	• While applying the brake pedal, measure the voltage between the trailer tow C439-2, circuit CAT06 (YE) (LH stoplamp), harness side and ground; or between the trailer tow C439-1, circuit CAT09 (GN) (RH stoplamp), harness side and ground.  A0056327 • **Is the voltage greater than 10 volts?**	**Yes** The vehicle is operating correctly. SEND the trailer to an authorized camper/trailer repair facility. **No** VERIFY the SJB fuse 42 (7.5A) (LH stoplamp) or fuse 38 (7.5A) (RH stoplamp) is OK. If OK, REPAIR the circuit in question. TEST the system for normal operation.

V1-V2

Special Tool(s)

BATTERY JUNCTION BOX (BJB), 3.0L, 4.0L




Hot at all times
CENTRAL JUNCTION BOX (CJB)
11-1
151-12
F41
20A
13-5
F39
20A
13-5
F37
20A
13-6
C270H
6
4
40
LB-WH
MODULE COMMUNICATIONS NETWORK
14-1
S289
S279
64S-LK11
71-1
DG
CLUSTER AND PANEL ILLUMINATION
19
LB-RD
2
1
C2031
CIGAR LIGHTER
151-10
3
C2031
1049
BN-PK
1
C2033
POWER POINT
151-9
1) Off
2) On
3
C2033
57
BK
GD133
BK
S203
G202
10-5
1
2
3
4
5
6
7a
7b
7c

Trailer Lighting Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

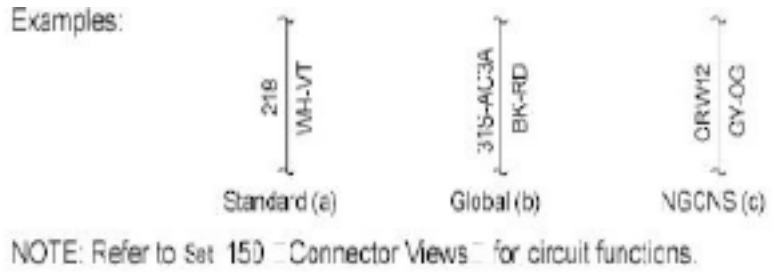
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

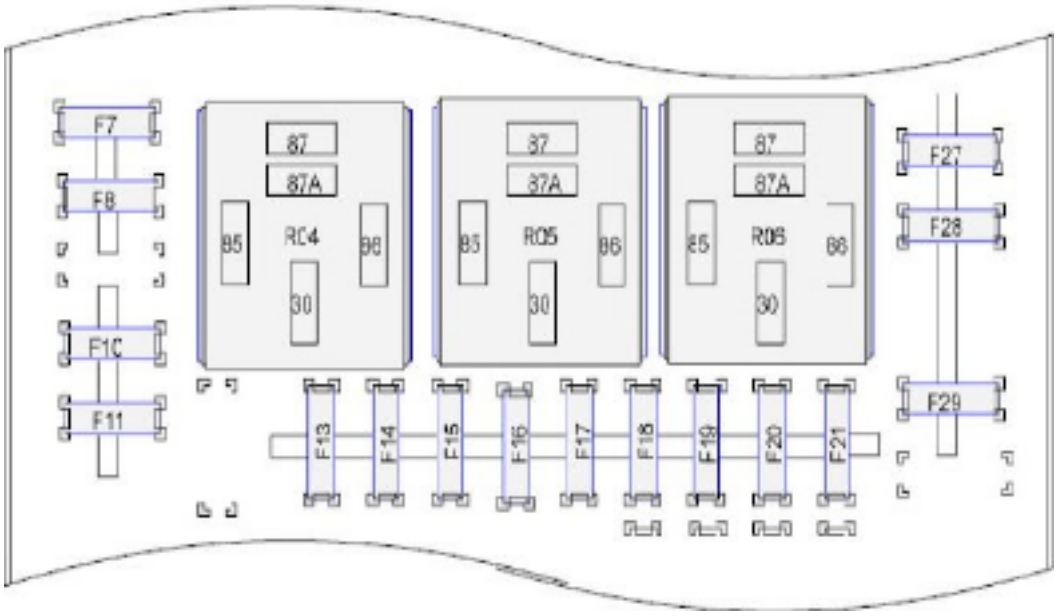
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

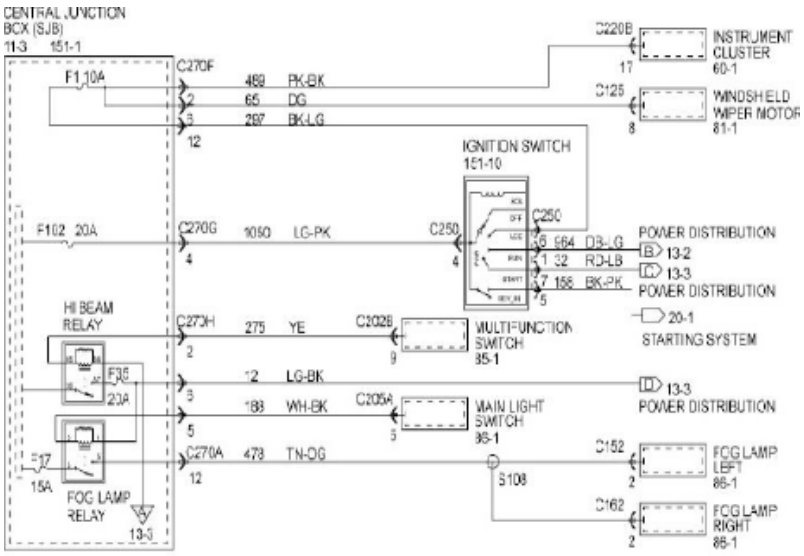
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

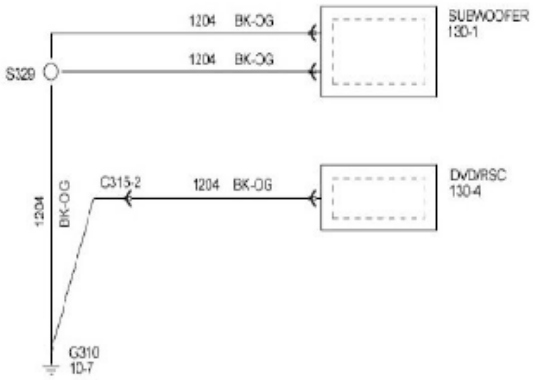
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

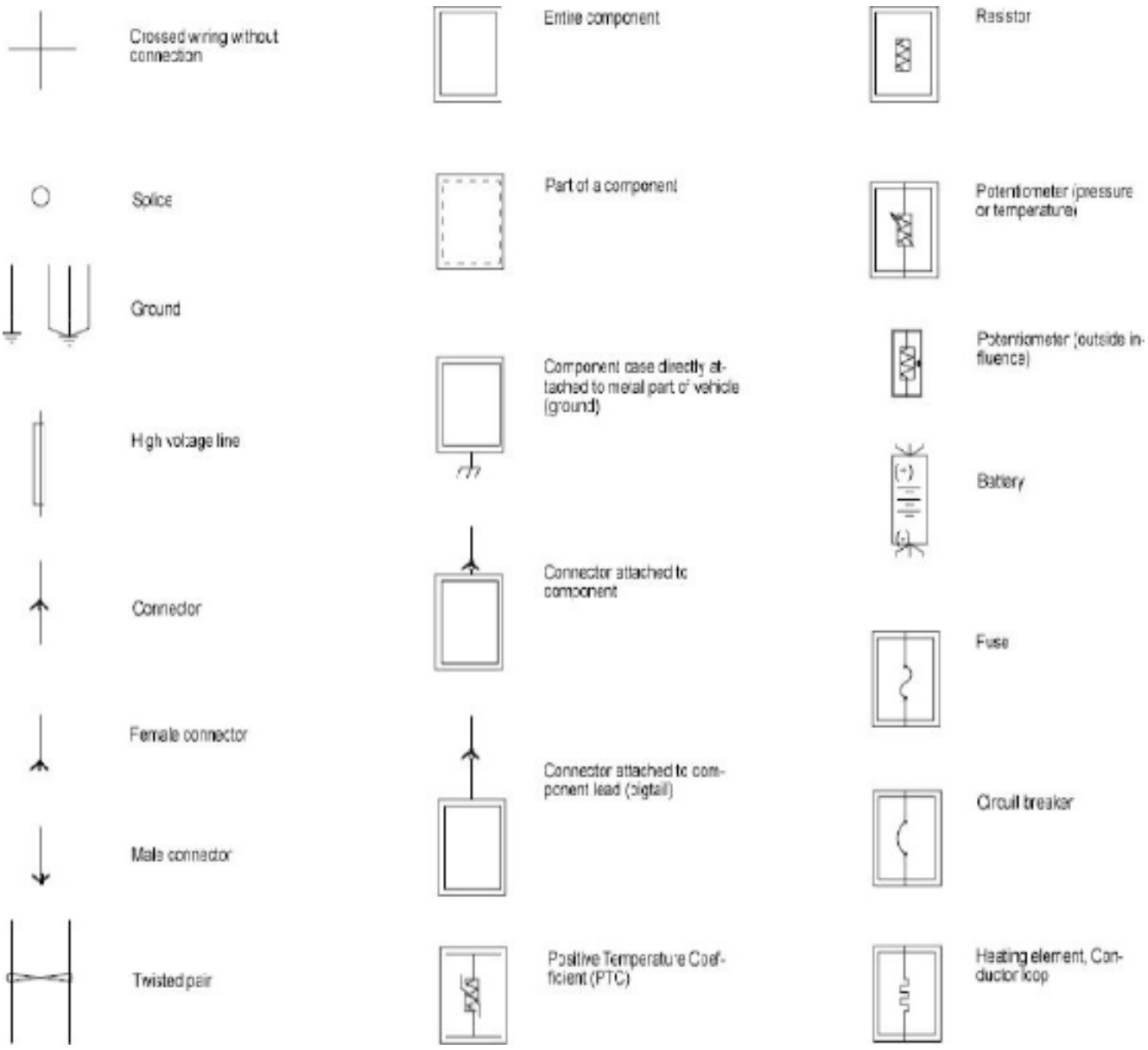
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

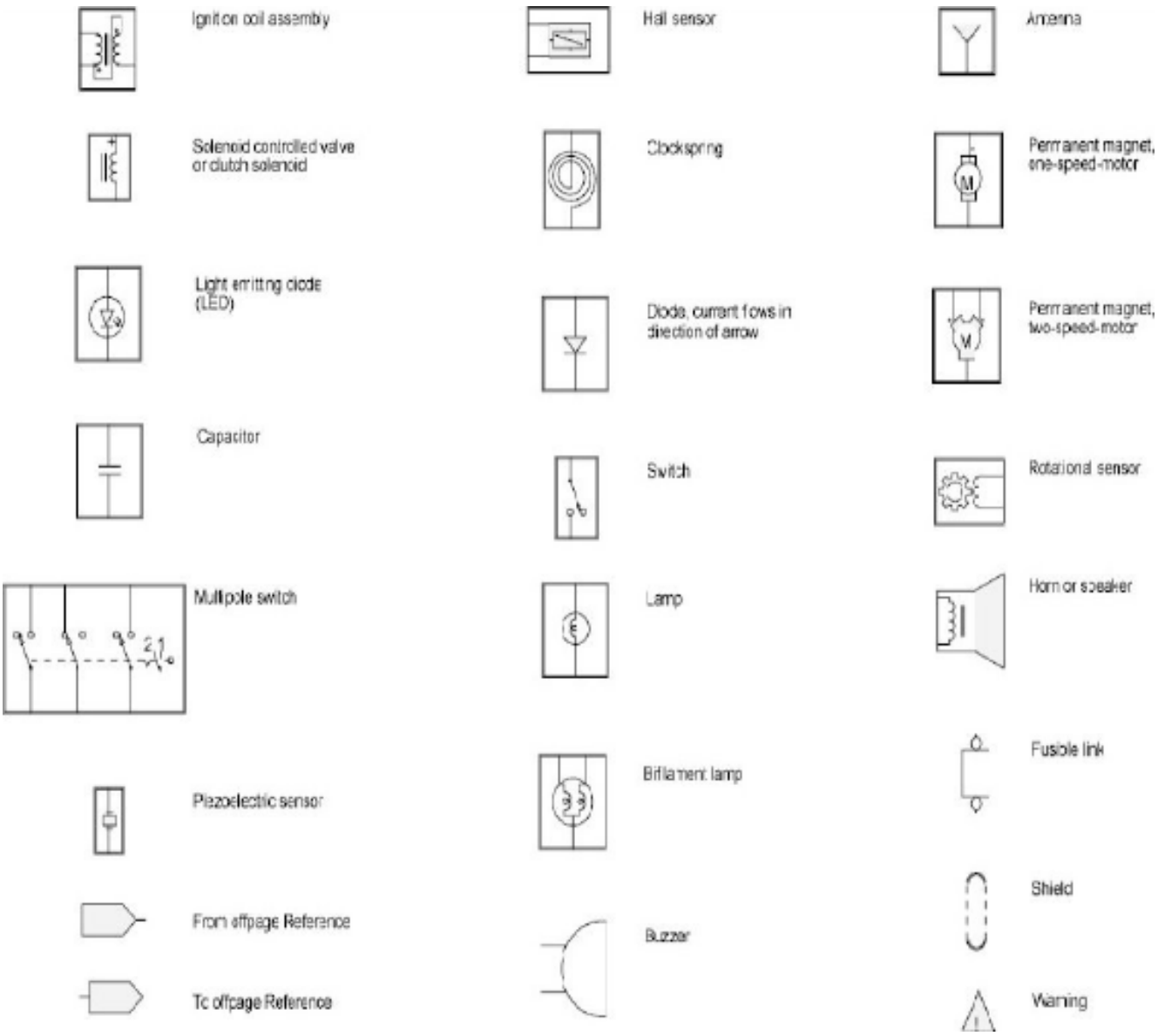
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

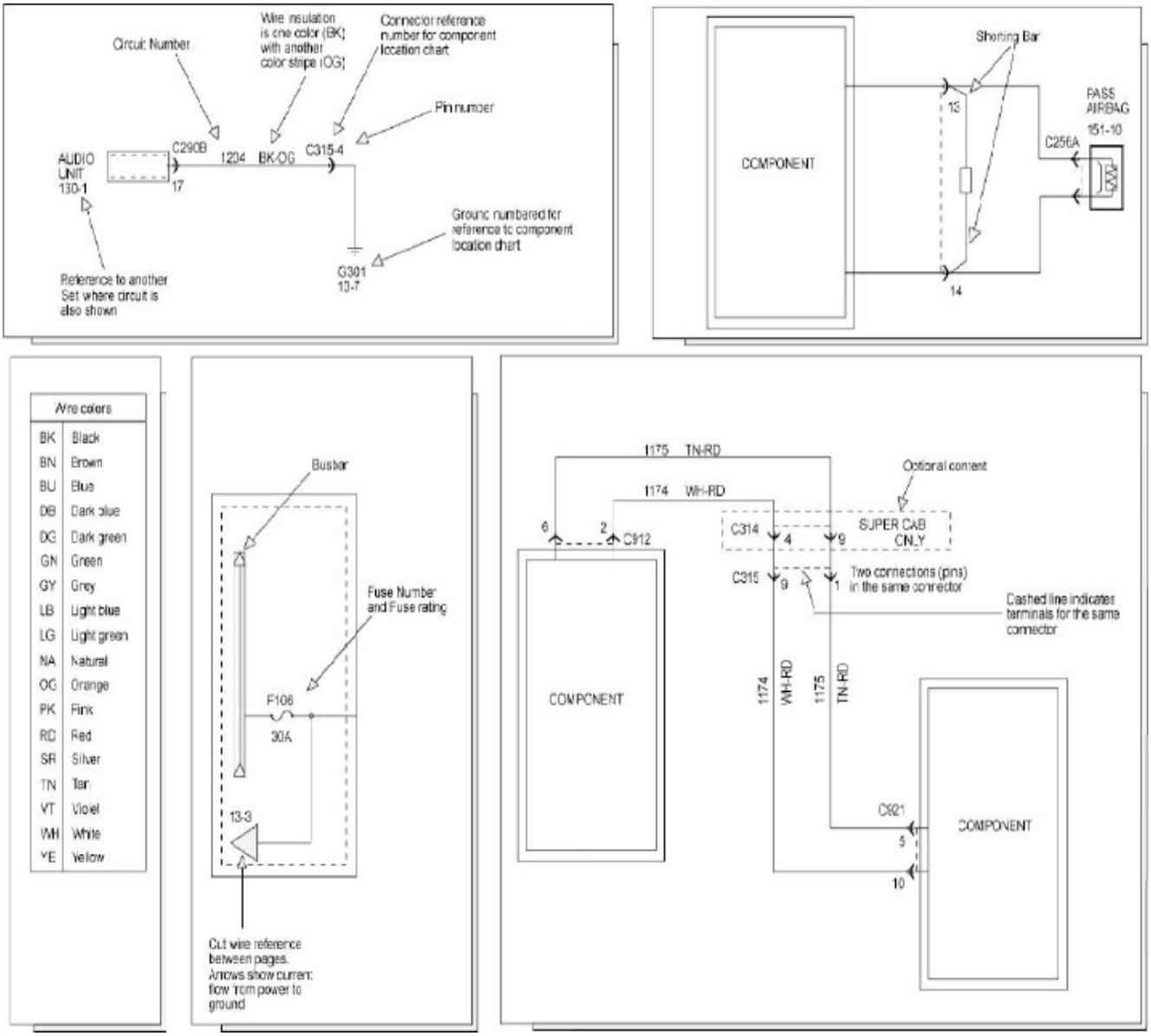
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

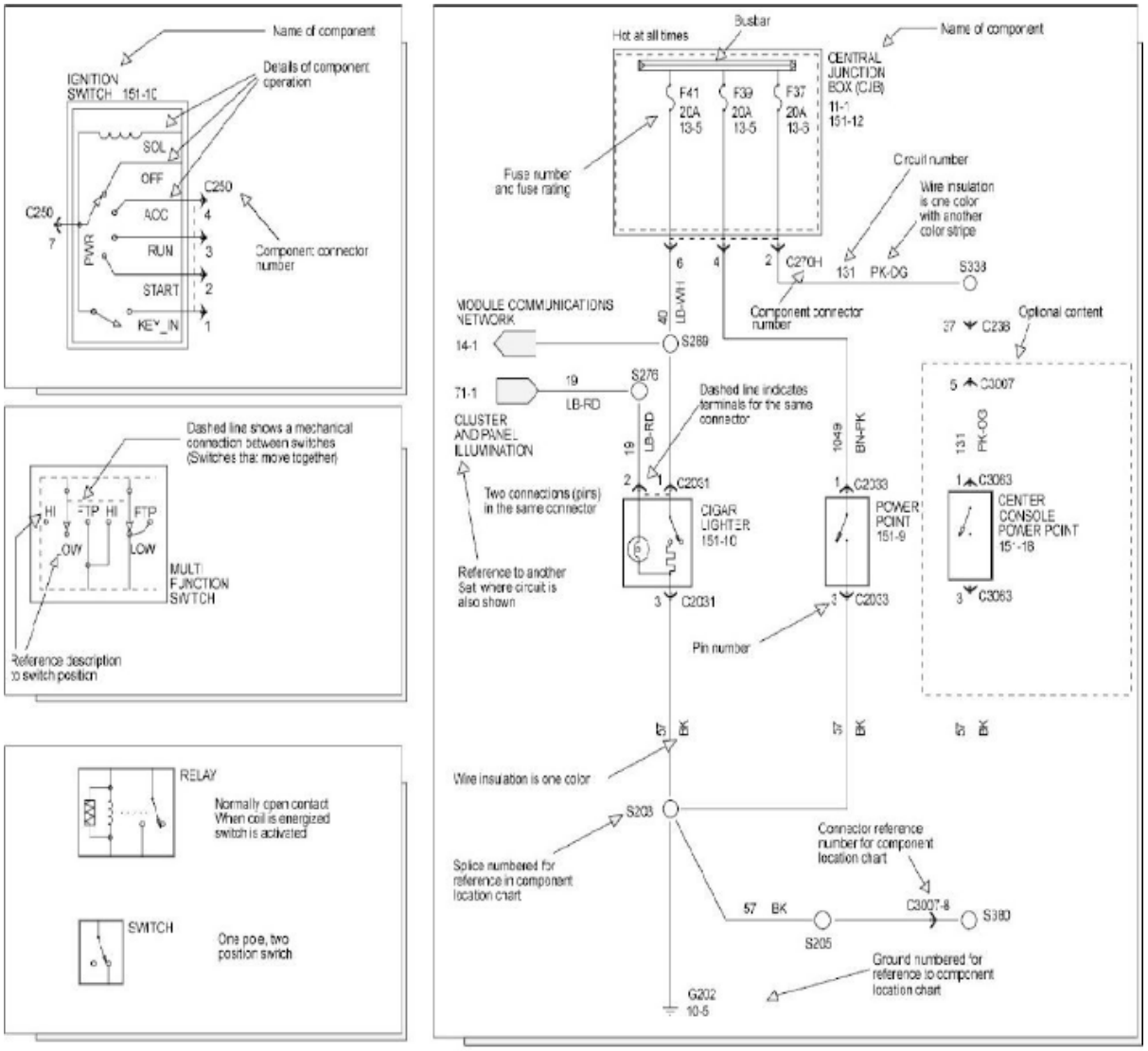
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

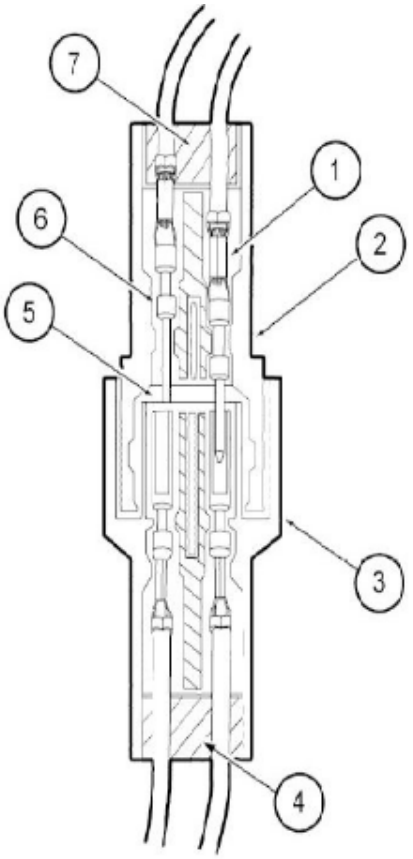


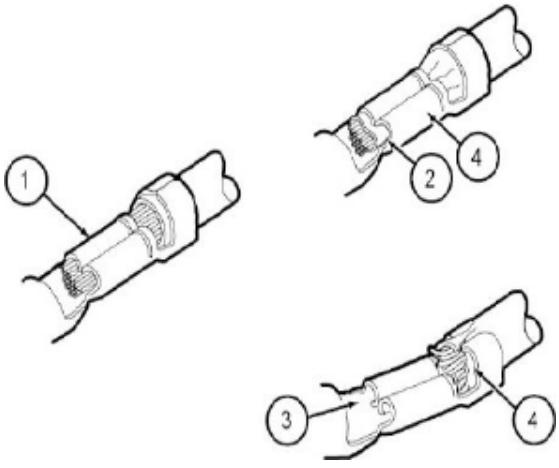
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Trailer Lighting Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

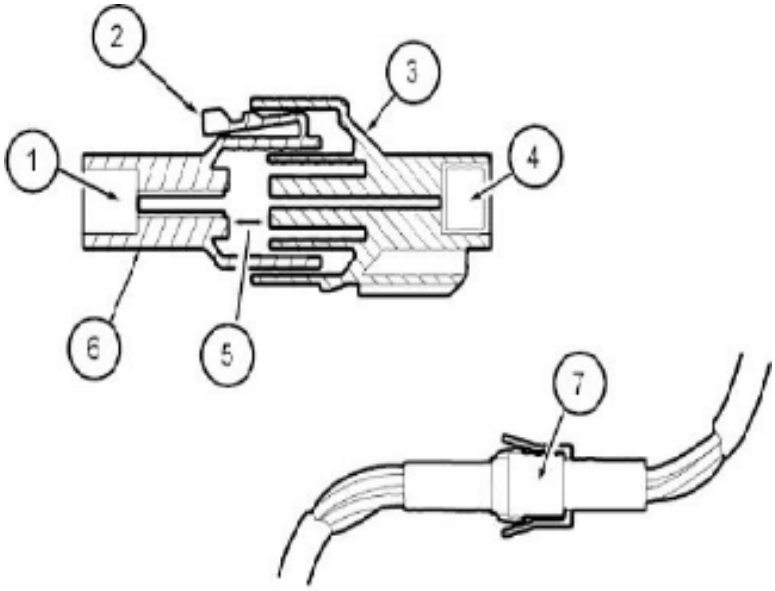
5 = Intermittent contact

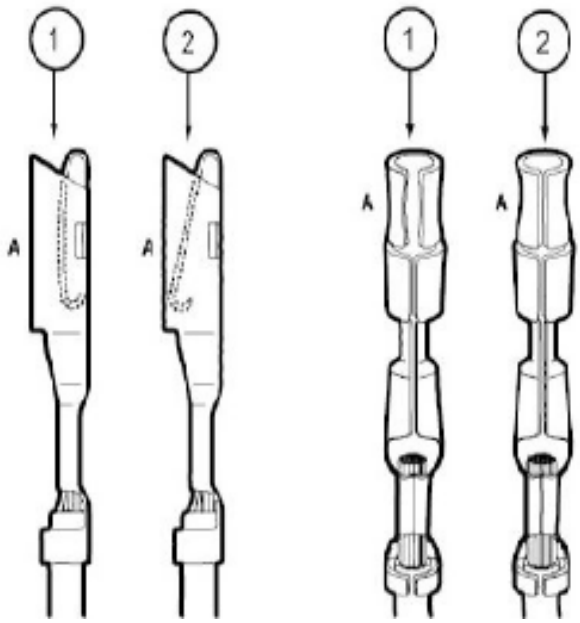
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

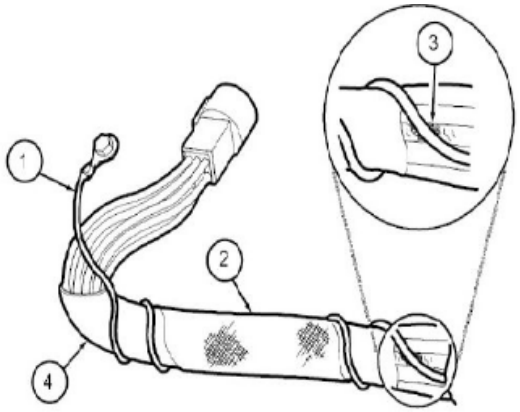
Deformed (enlarged) female terminals

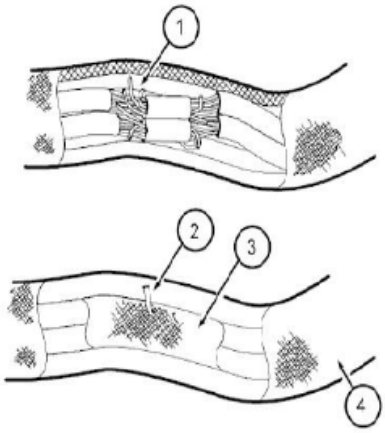
1 = Enlarged

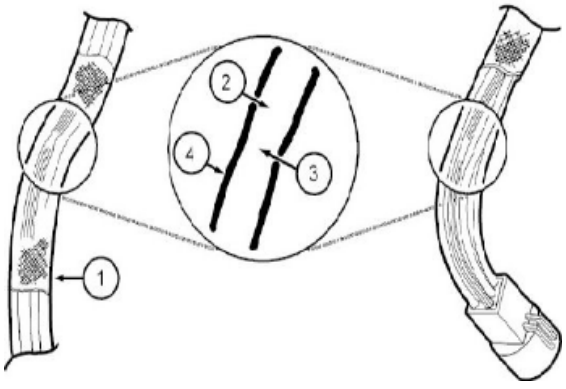
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

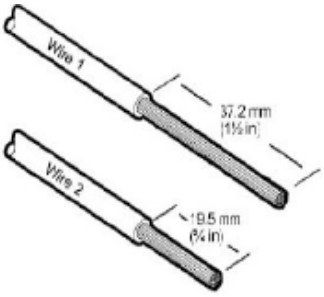
Splice covered 2

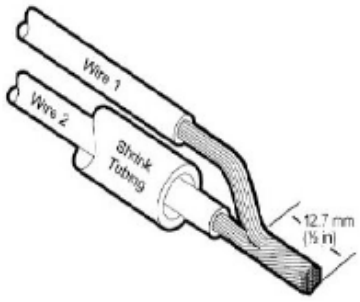
= Wire strand

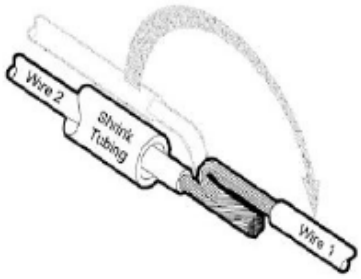
3 = Splice tape

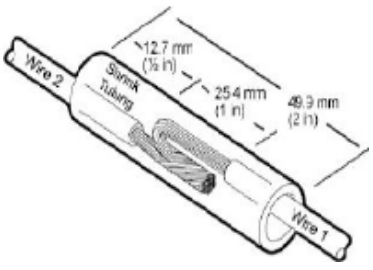
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.9 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

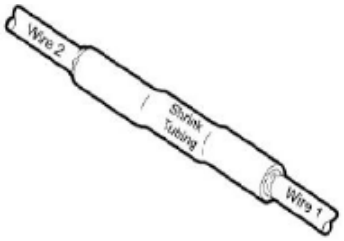
NOTE: -

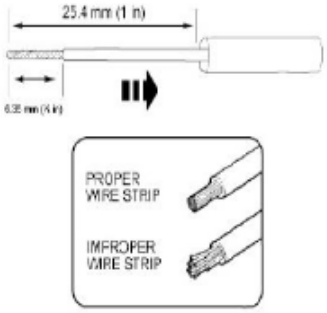
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

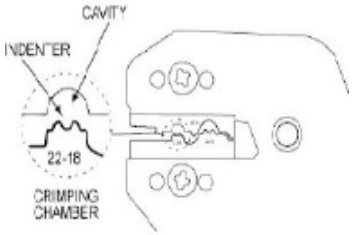
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

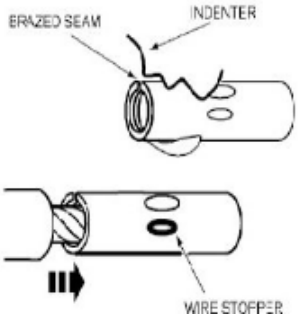
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
6.35 mm (¼ in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

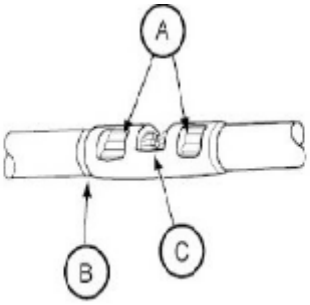
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

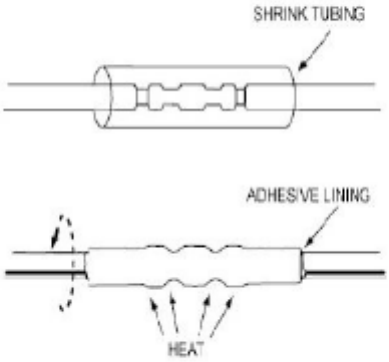
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4□ strip, cut 9 strands	* 1/4□ strip, cut 2 strands	1/4□ strip, no fold	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip, fold 2x dia.	1□ strip, fold 3x dia.
	16-14	* 1/4□ strip, cut 7 strands	1/4□ strip, no fold	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip fold 2x dia	1□ strip, fold 3x dia.	1 1/4□ strip, fold 4x dia.	Not Recommended
	12-10	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip, fold 2x dia.	1□ strip fold 3x cia.	1 1/4□ strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Pigtail only

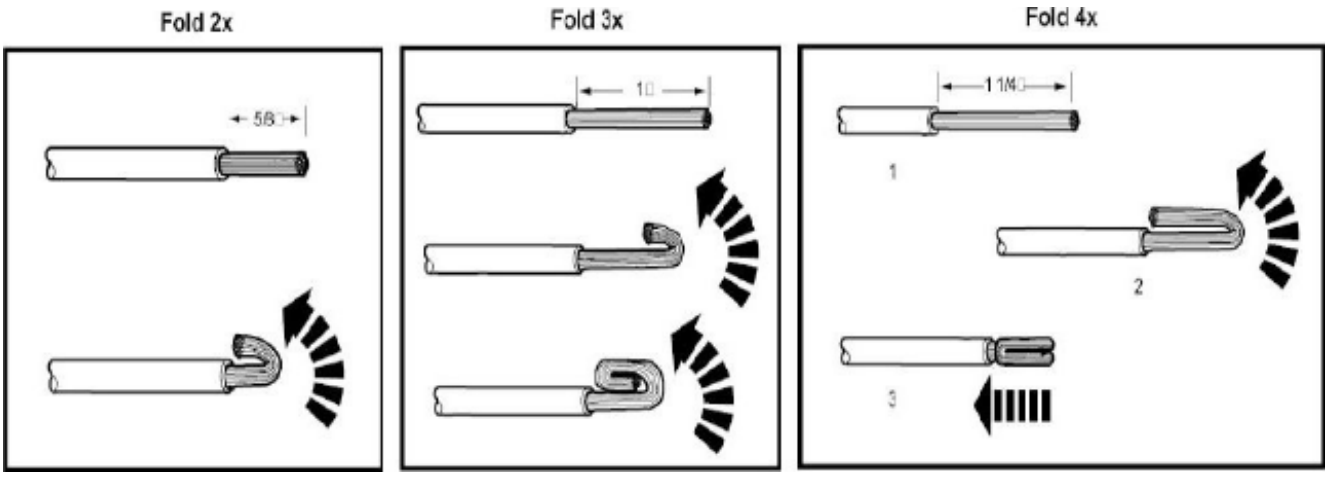
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



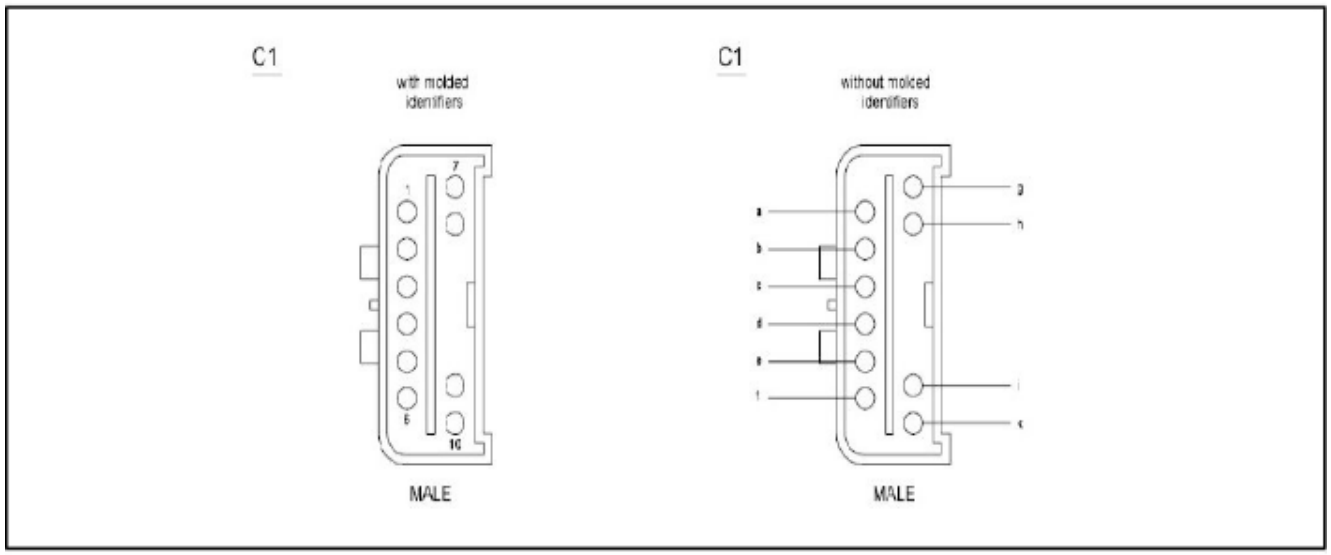
The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



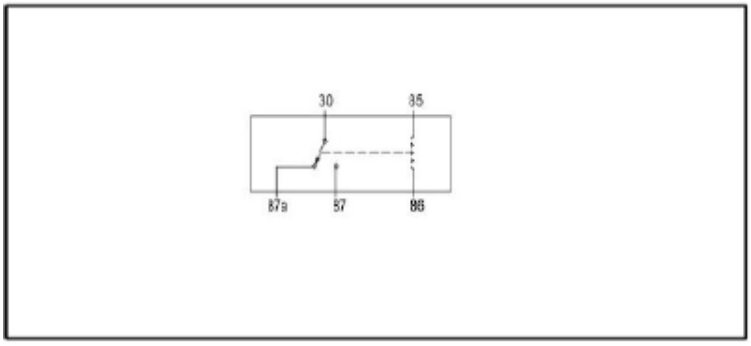
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

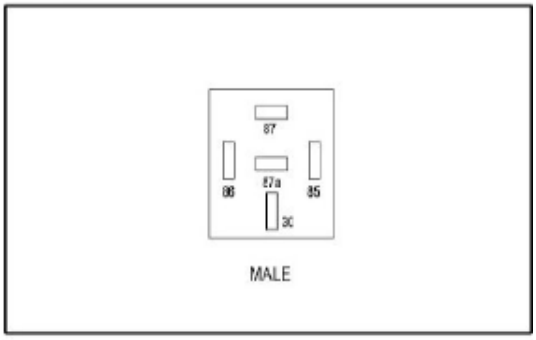
Trailer Lighting Relay: Testing and Inspection Mini ISO Relay

Relay □ Mini ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

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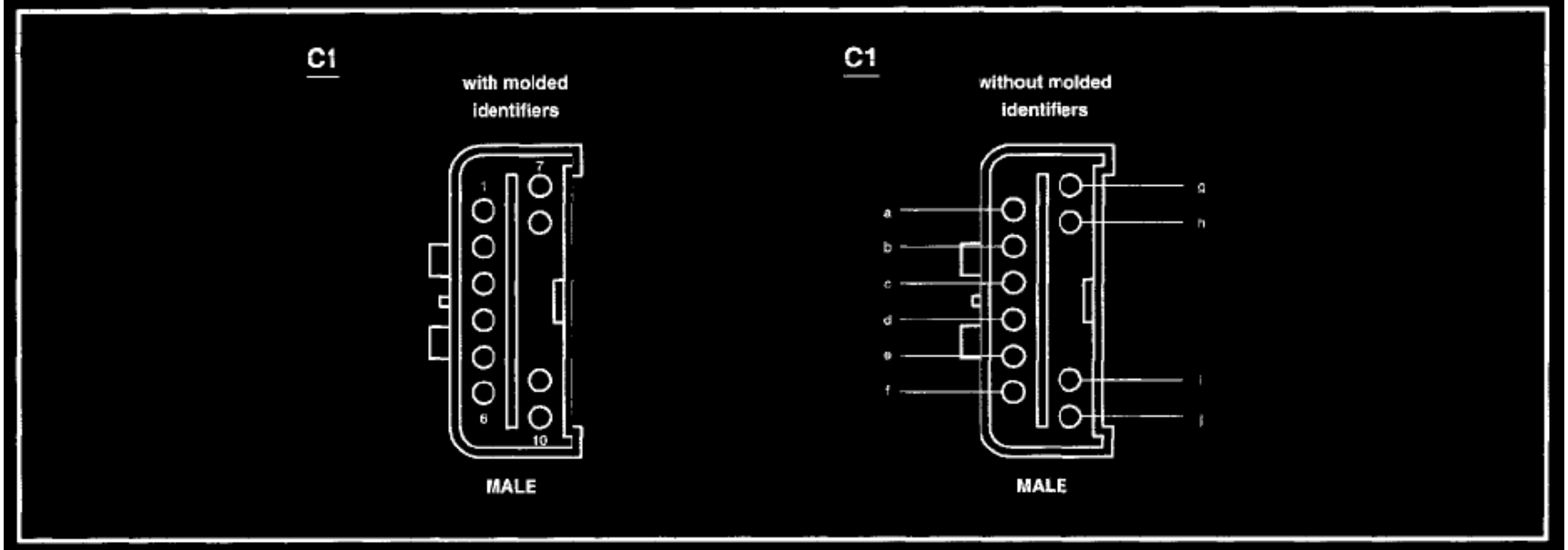
Terminals



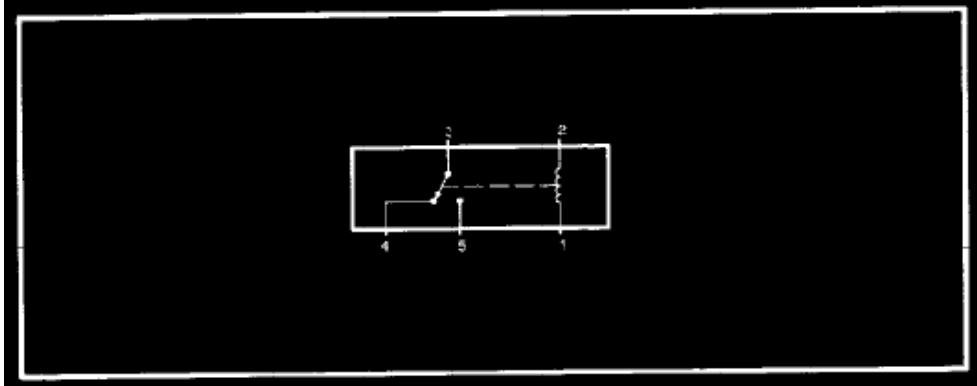
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

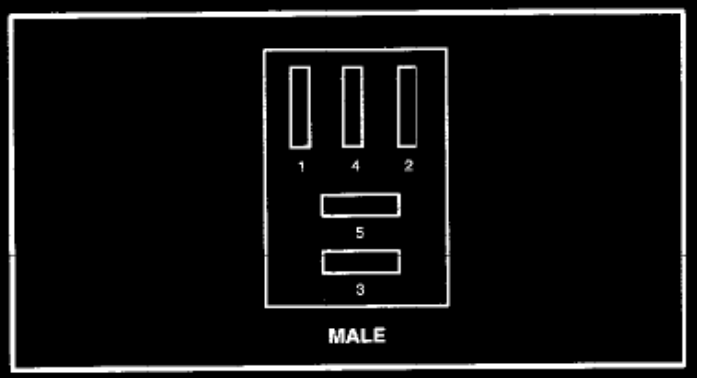
Trailer Lighting Relay: Testing and Inspection Micro ISO Relay

Relay – Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63–102Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil – Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

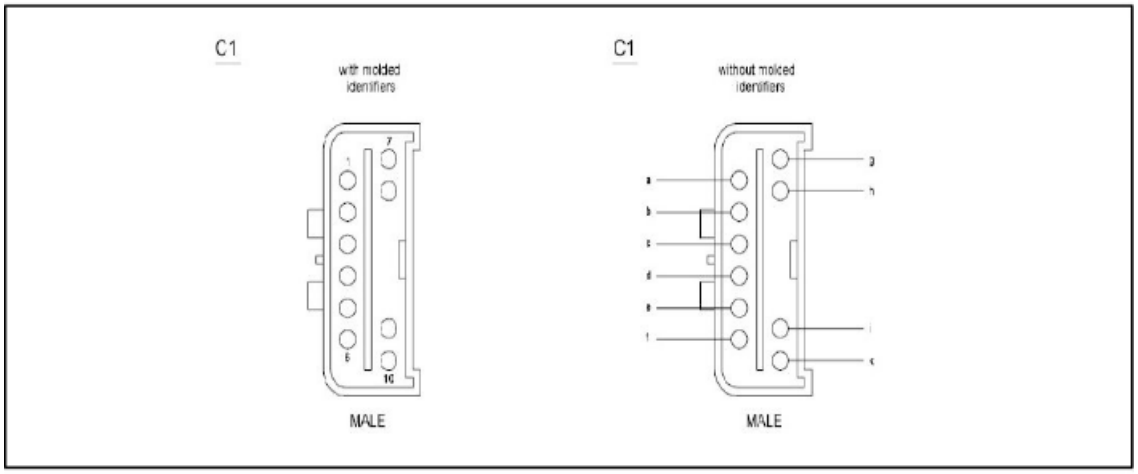
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step□by□step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals

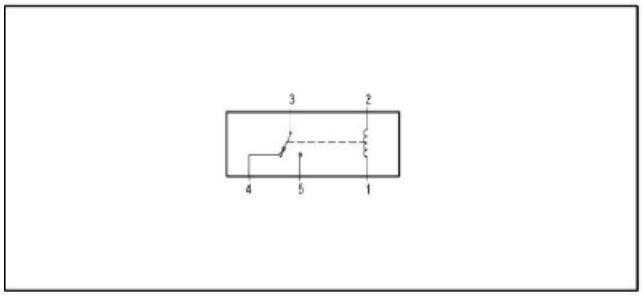


The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column □Circuit to test□. If you wish to test the complete component, perform all tests.

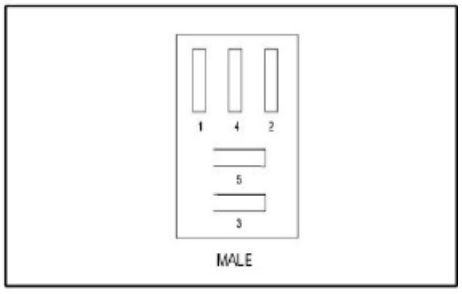
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Relay □ Micro ISO

Schematic



Terminals

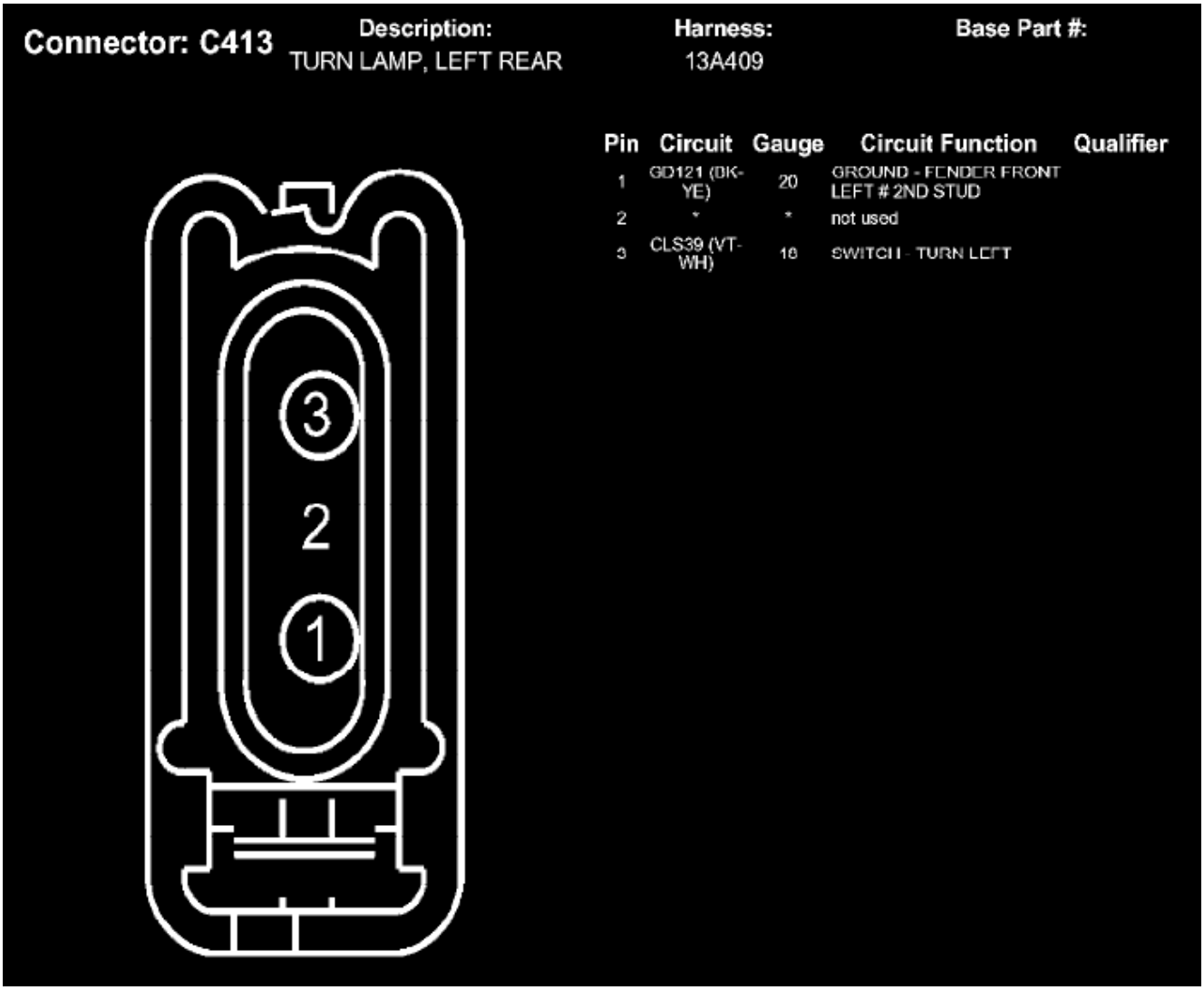


Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63□102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil □ Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

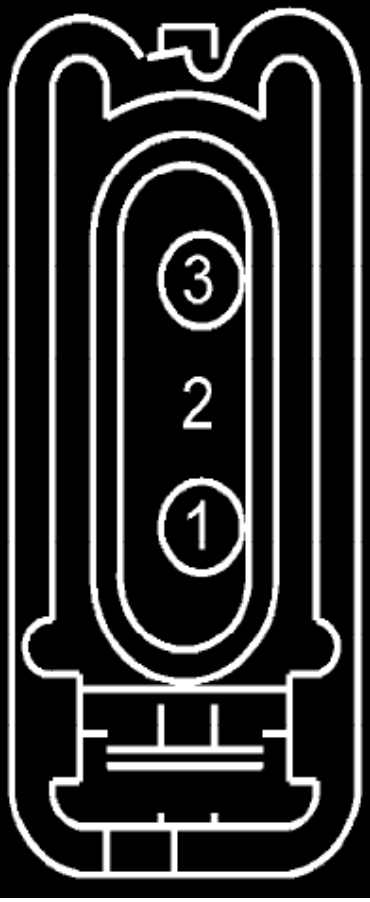
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.


Connector: C413
Description:
TURN LAMP, LEFT REAR
Harness:
13A409
Base Part #:
3
2
1
Pin Circuit Gauge Circuit Function Qualifier
1 GD121 (DK-YE) 20 GROUND - FENDER FRONT LEFT # 2ND STUD
2 * * not used
3 CLS39 (VT-WH) 18 SWITCH - TURN LEFT

C413

Connector: C416

Description:	Harness:	Base Part #:
TURN LAMP, RIGHT REAR	13A409	

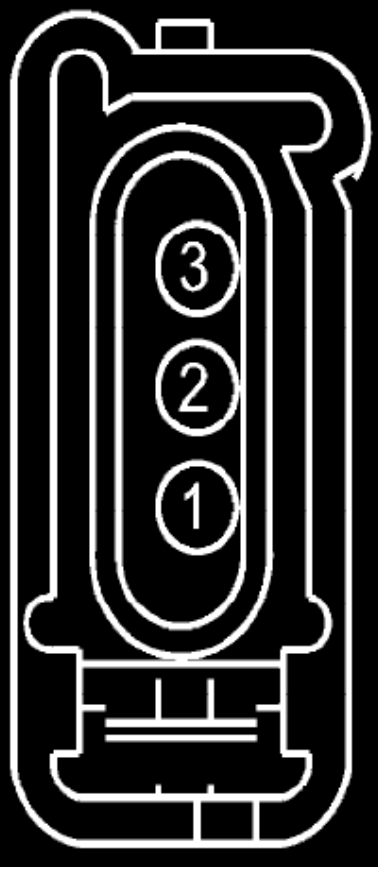


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD121 (BK-YE)	20	GROUND - FENDER FRONT LEFT # 2ND STUD	
2	*	*	not used	
3	CLS41 (GY-YE)	18	SWITCH - TURN RIGHT	

C416

Connector: C1023

Description:	Harness:	Base Part #:
PARK/TURN LAMP, LEFT FRONT	14290	13411



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD121 (BK-YE)	20	GROUND - FENDER FRONT LEFT # 2ND STUD	
2	CLS34 (GY)	18	SWITCH - PARK LAMPS	
3	CLS39 (VT-WH)	18	SWITCH - TURN LEFT	

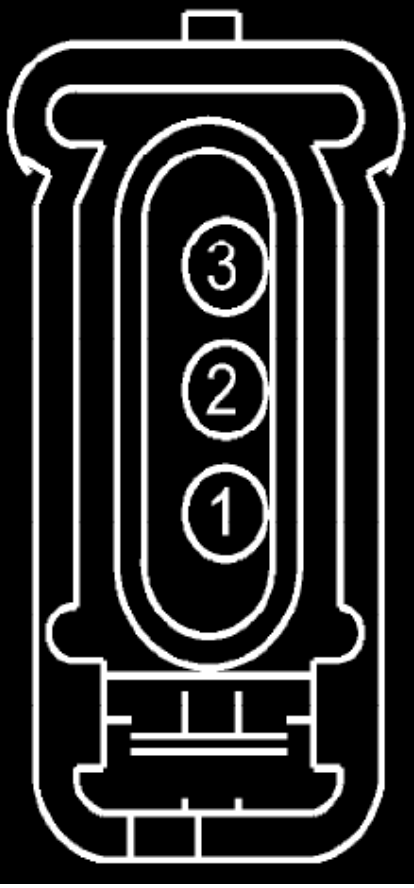
C1023

Connector: C415

Description: PARK/STOP/TURN LAMP, RIGHT REAR

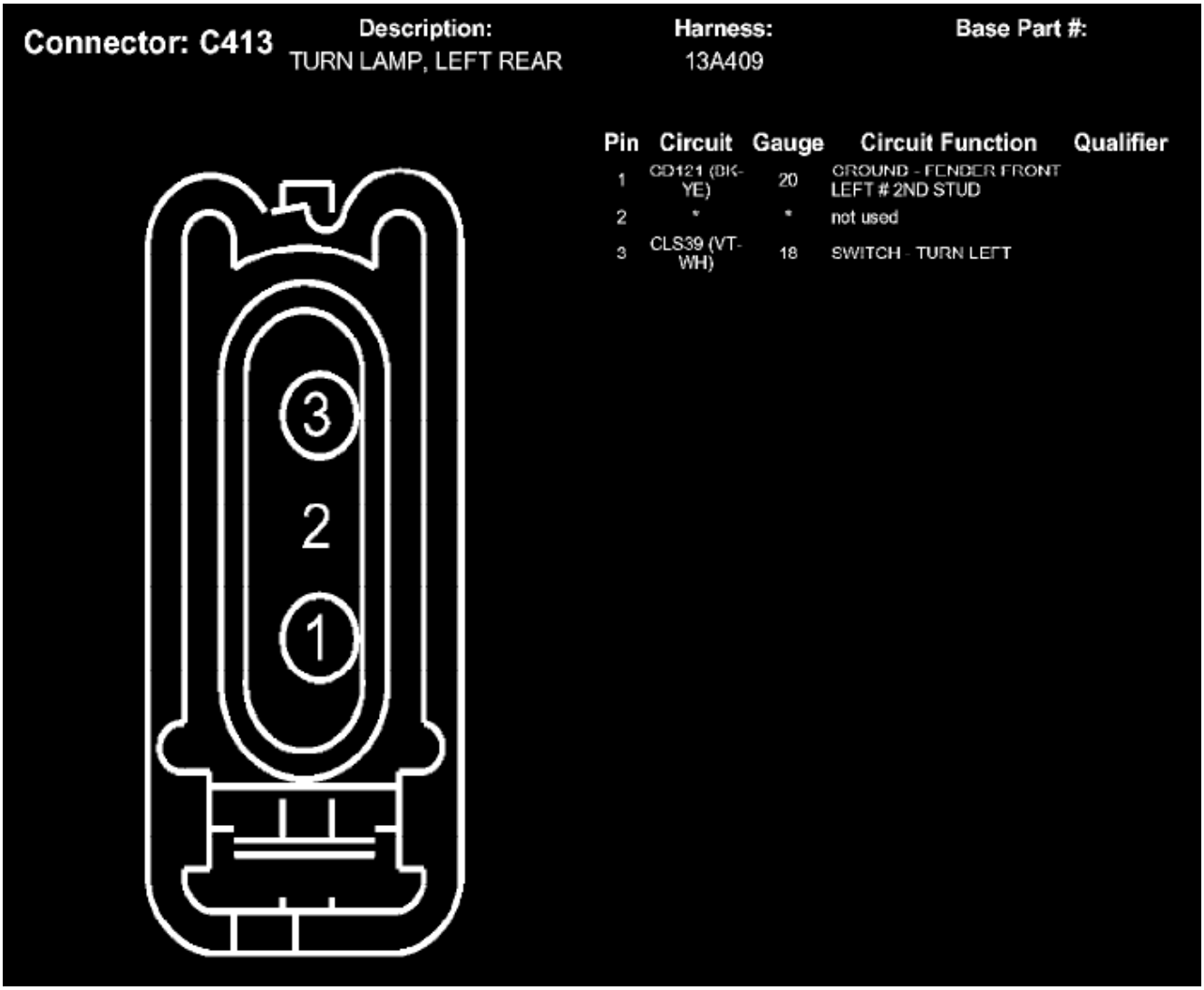
Harness: 13A409

Base Part #:



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD121 (BK-YE)	20	GROUND - FENDER FRONT LEFT # 2ND STUD	
2	CLS34 (GY)	18	SWITCH - PARK LAMPS	
3	CLS36 (YE)	18	SWITCH - PARK LAMPS RIGHT	

C415

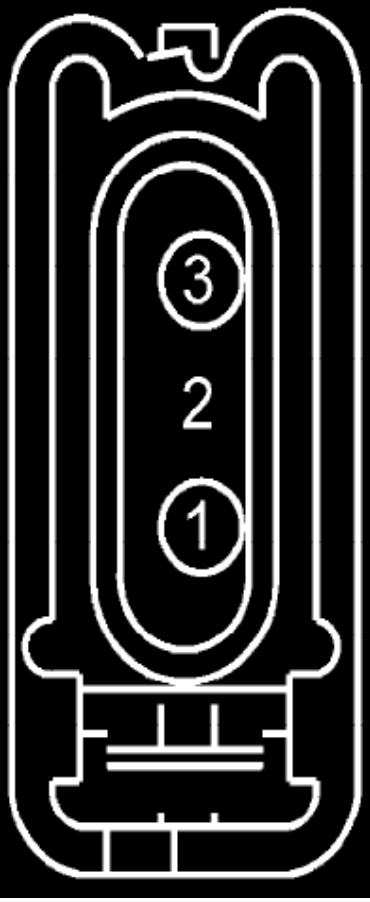


Turn Signal Lamp: Diagrams

C413

Connector: C416

Description:	Harness:	Base Part #:
TURN LAMP, RIGHT REAR	13A409	

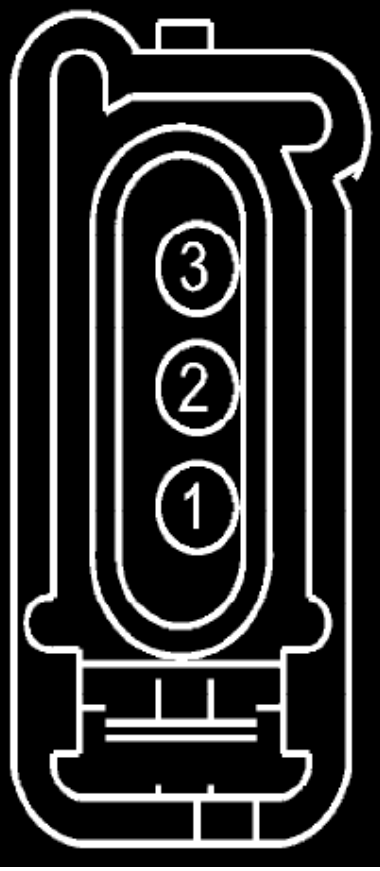


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD121 (BK-YE)	20	GROUND - FENDER FRONT LEFT # 2ND STUD	
2	*	*	not used	
3	CLS41 (GY-YE)	18	SWITCH - TURN RIGHT	

C416

Connector: C1023

Description:	Harness:	Base Part #:
PARK/TURN LAMP, LEFT FRONT	14290	13411



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD121 (BK-YE)	20	GROUND - FENDER FRONT LEFT # 2ND STUD	
2	CLS34 (GY)	18	SWITCH - PARK LAMPS	
3	CLS39 (VT-WH)	18	SWITCH - TURN LEFT	

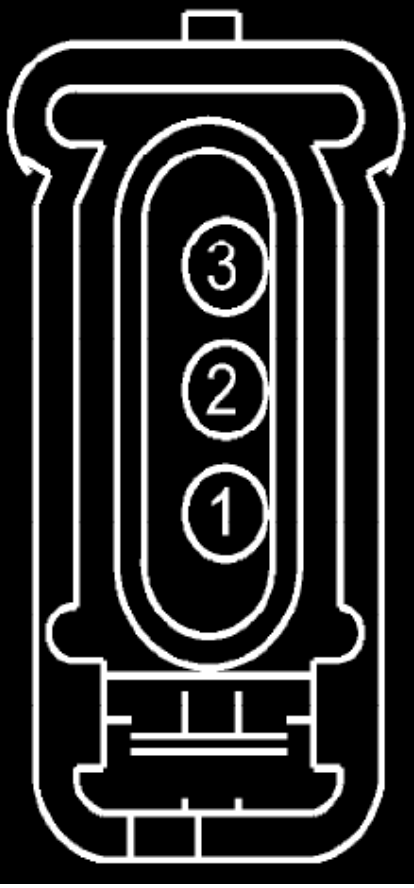
C1023

Connector: C415

Description: PARK/STOP/TURN LAMP, RIGHT REAR

Harness: 13A409

Base Part #:

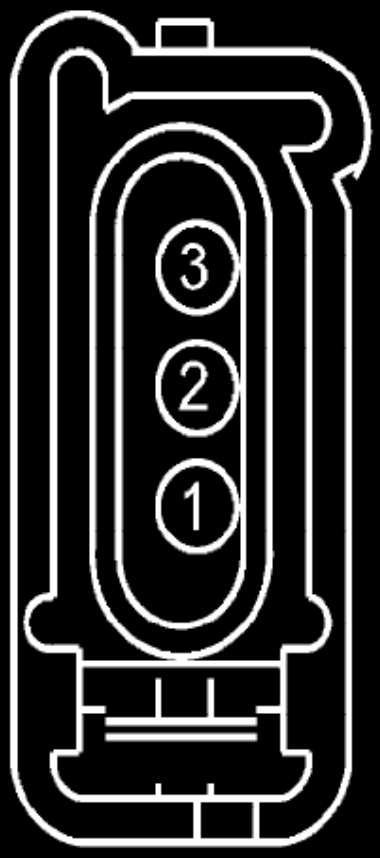


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD121 (BK-YE)	20	GROUND - FENDER FRONT LEFT # 2ND STUD	
2	CLS34 (GY)	18	SWITCH - PARK LAMPS	
3	CLS36 (YE)	18	SWITCH - PARK LAMPS RIGHT	

C415

Connector: C1043

Description:	Harness:	Base Part #:
PARK/TURN LAMP, RIGHT FRONT	14290	13411



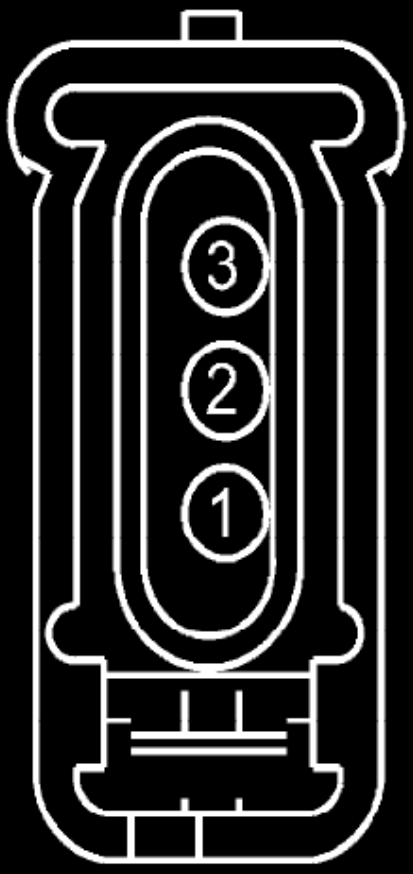
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD123 (BK-GY)	20	GROUND - FENDER FRONT RIGHT	
2	CLS34 (GY)	18	SWITCH - PARK LAMPS	
3	CLS41 (GY-YE)	18	SWITCH - TURN RIGHT	

C1043

Connector: C412 Description: PARK/STOP/TURN LAMP, LEFT REAR

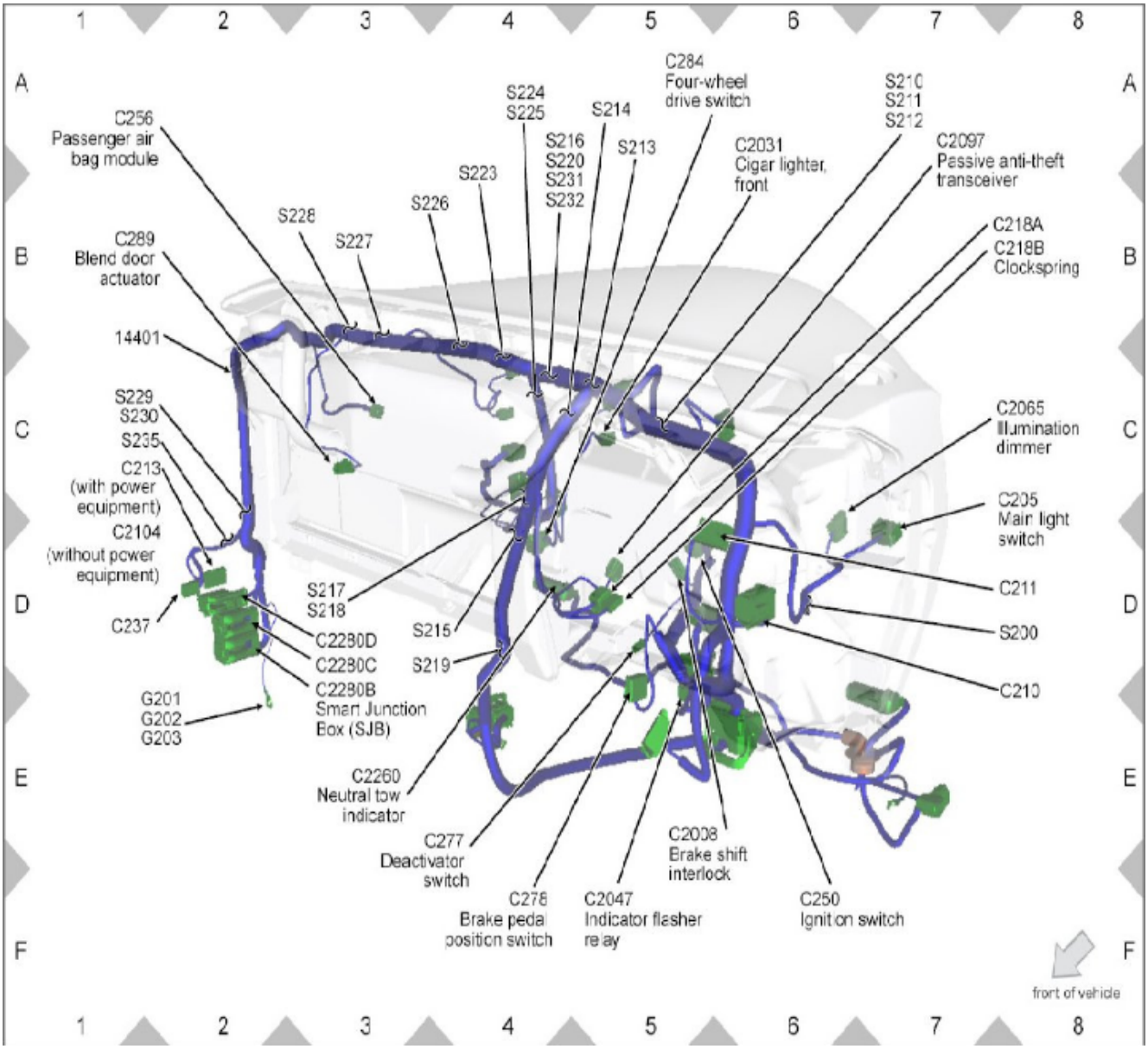
Harness: 13A409

Base Part #:



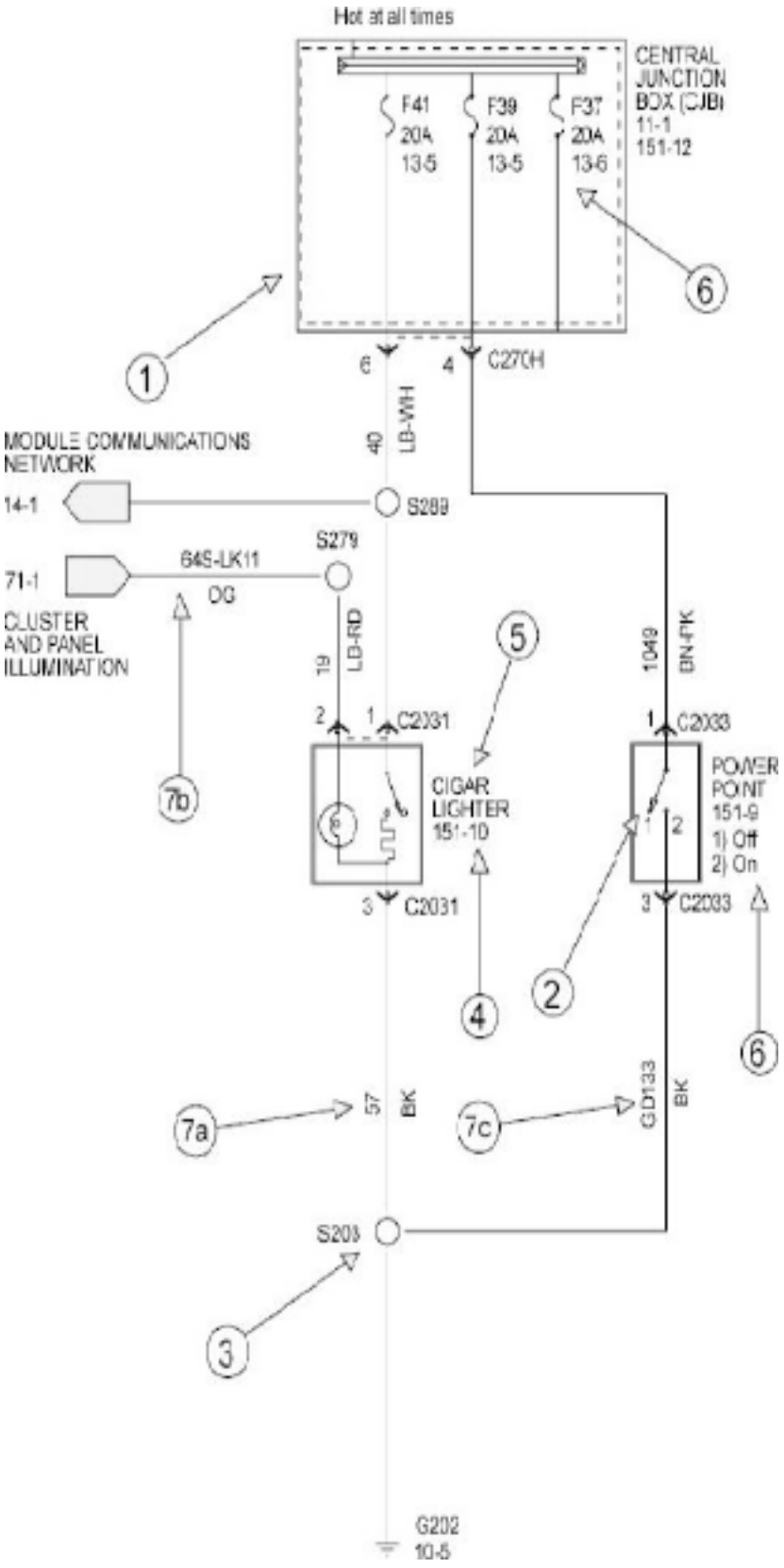
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	GD121 (BK-YE)	20	GROUND - FENDER FRONT LEFT # 2ND STUD	
2	CLS34 (GY)	18	SWITCH - PARK LAMPS	
3	CLS35 (VT)	18	SWITCH - PARK LAMPS LEFT	

C412


C256
Passenger air bag module
C289
Blend door actuator
14401
S229
S230
S235
C213
(with power equipment)
C2104
(without power equipment)
C237
G201
G202
G203
S228
S227
S226
S223
S224
S225
S216
S220
S231
S232
S214
S213
C284
Four-wheel drive switch
C2031
Cigar lighter, front
S210
S211
S212
C2097
Passive anti-theft transceiver
C218A
C218B
Clockspring
C2065
Illumination dimmer
C205
Main light switch
C211
S200
C210
S217
S218
S215
S219
C2280D
C2280C
C2280B
Smart Junction Box (SJB)
C2260
Neutral tow indicator
C277
Deactivator switch
C2008
Brake shift interlock
C276
Brake pedal position switch
C2047
Indicator flasher relay
C250
Ignition switch
front of vehicle

View 151-11

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Lighting and Horns > Turn Signals > Turn Signal Relay > Component Information > Diagrams > Diagram Information and Instructions



Turn Signal Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

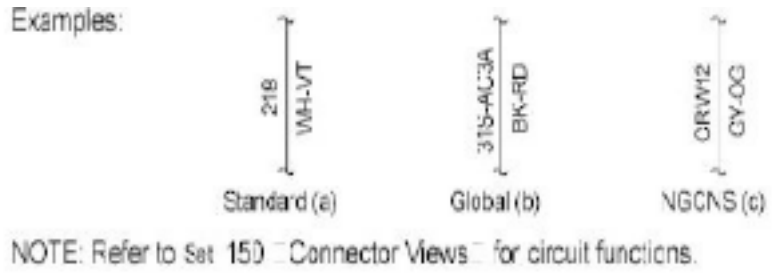
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

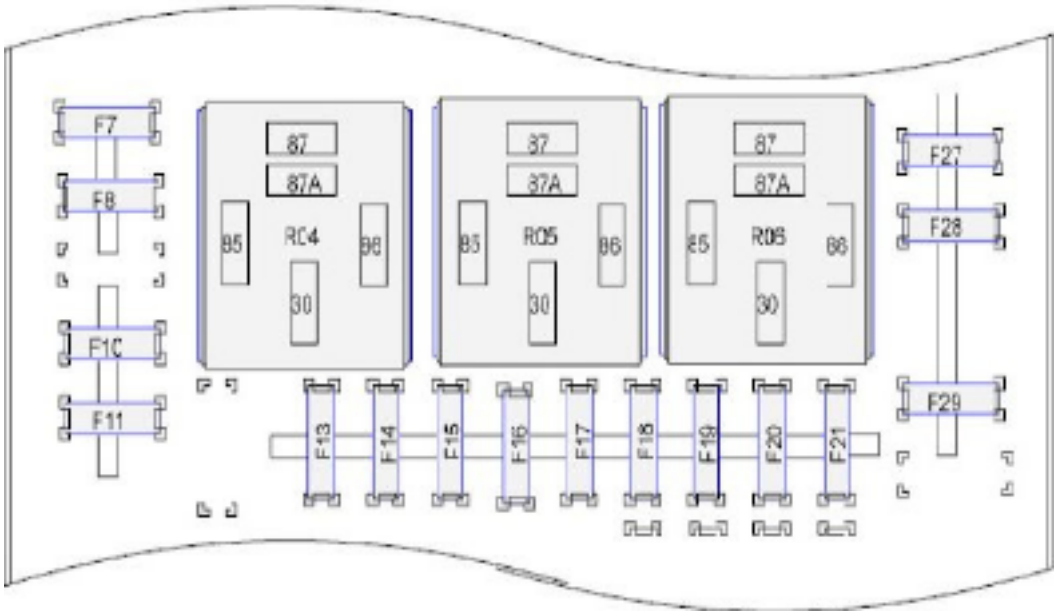
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

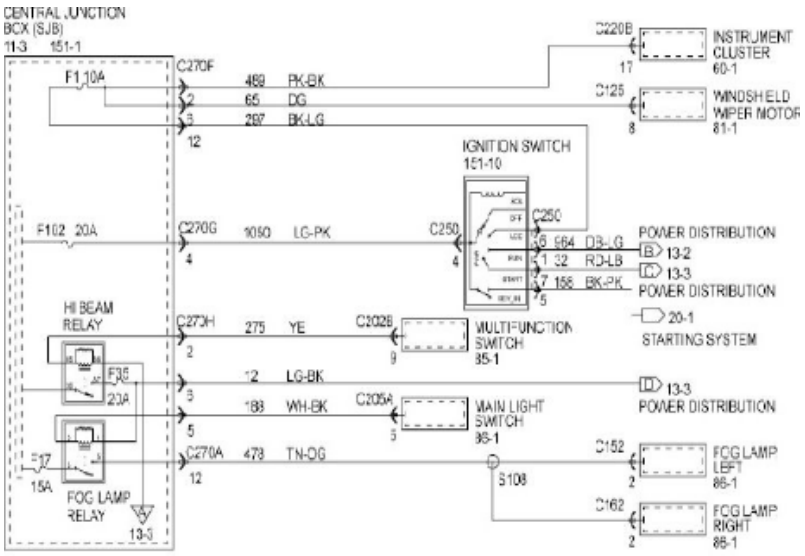
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

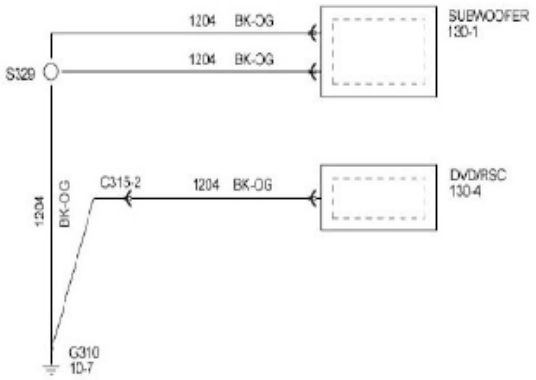
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

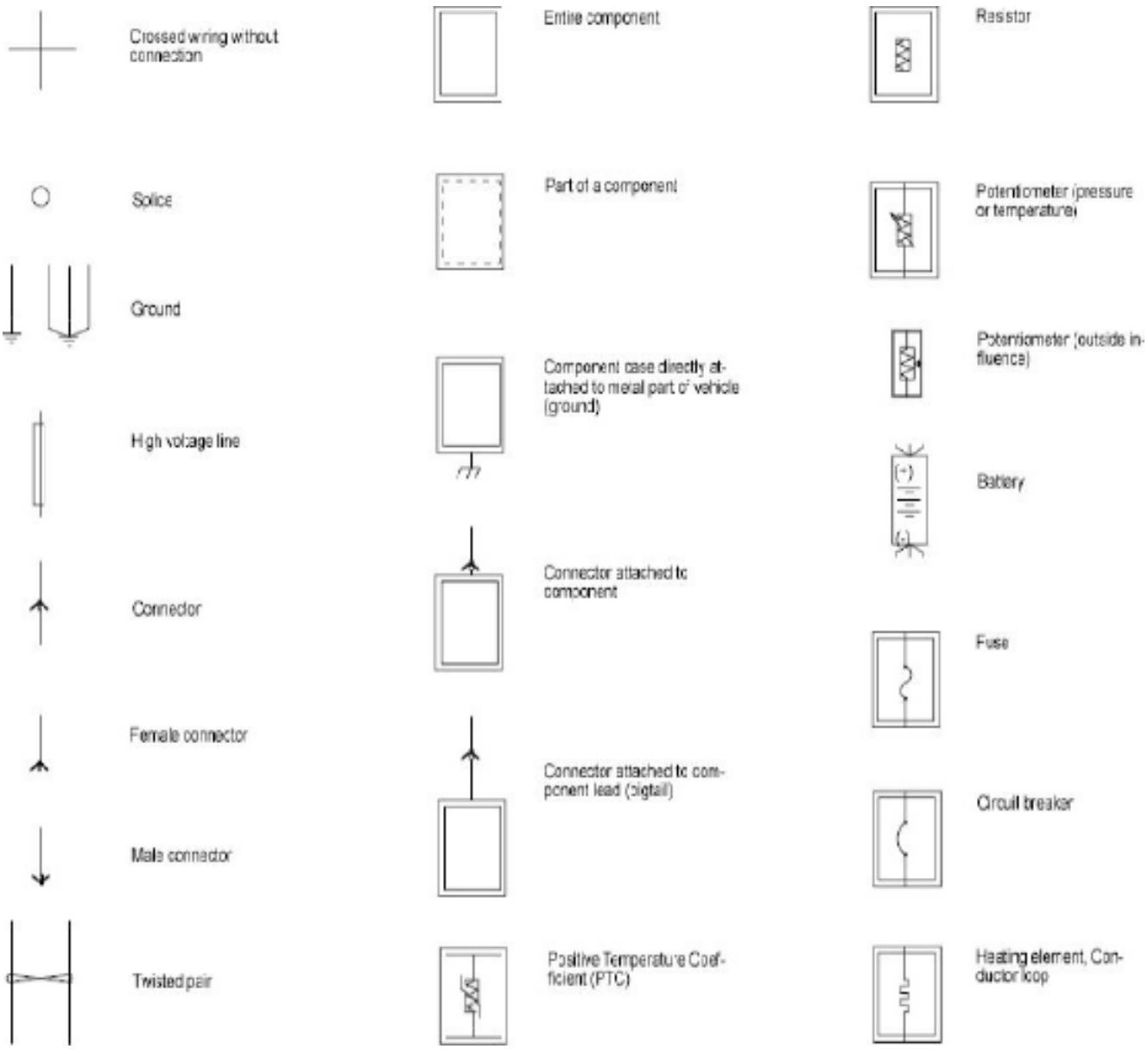
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

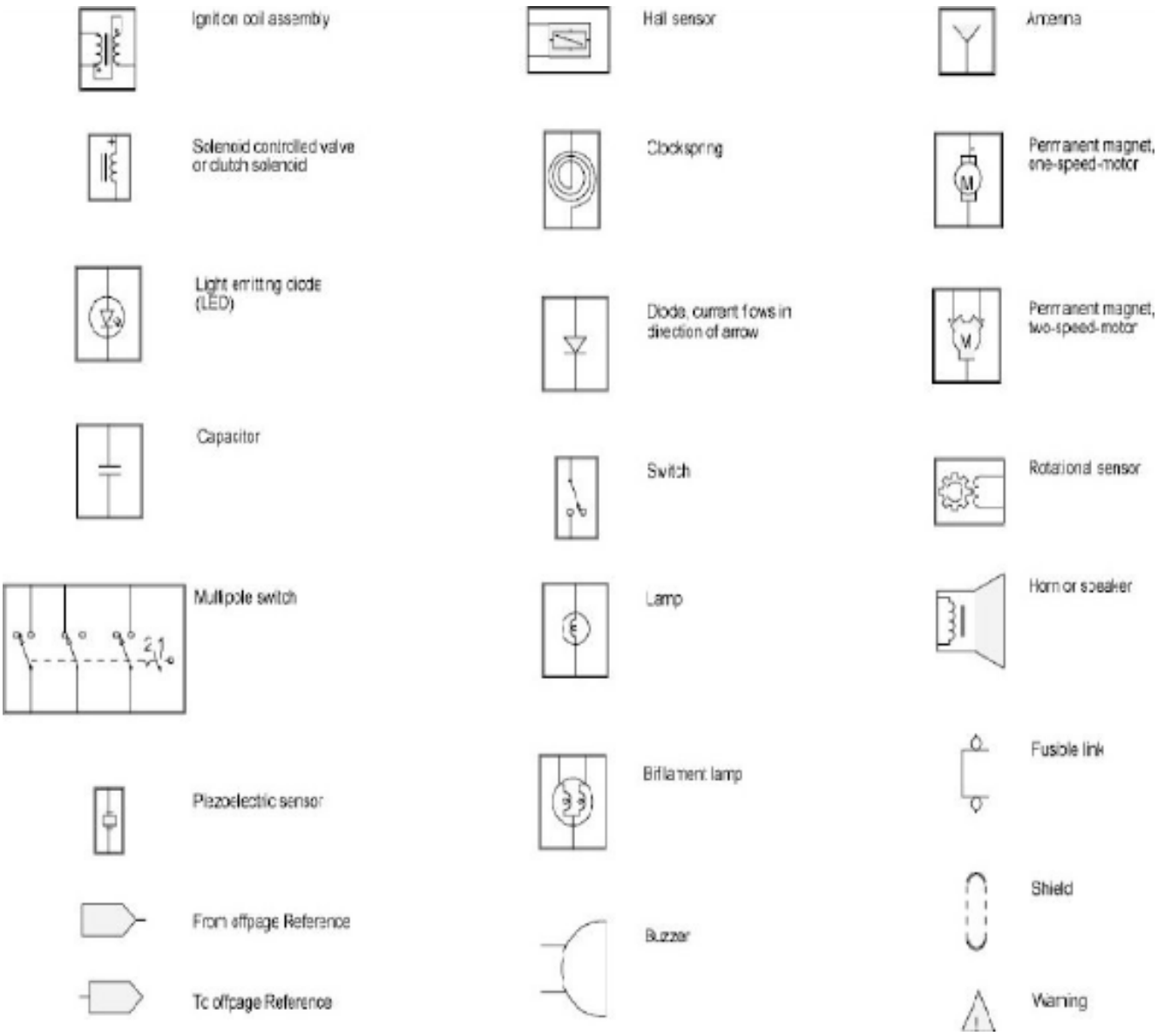
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

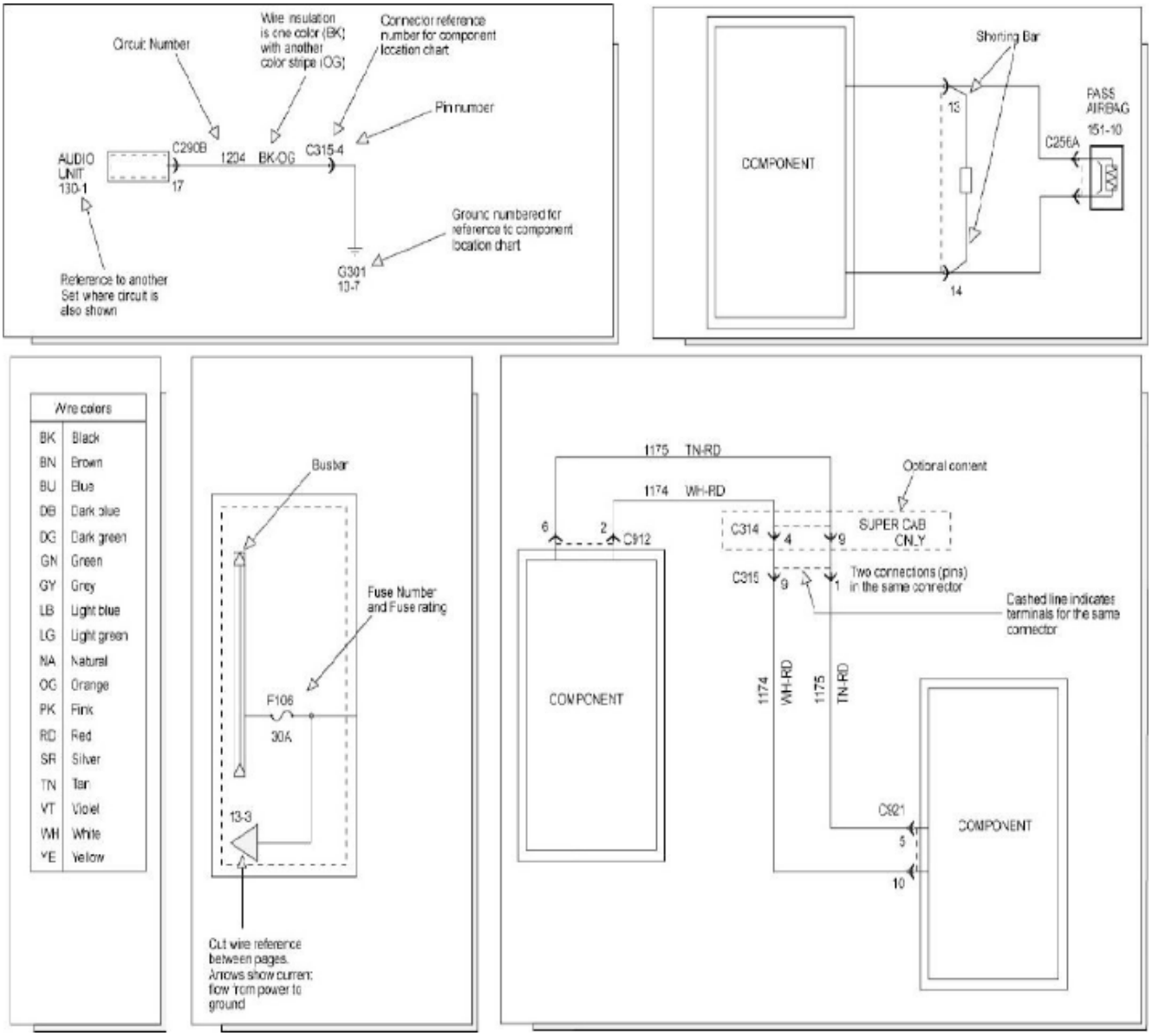
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

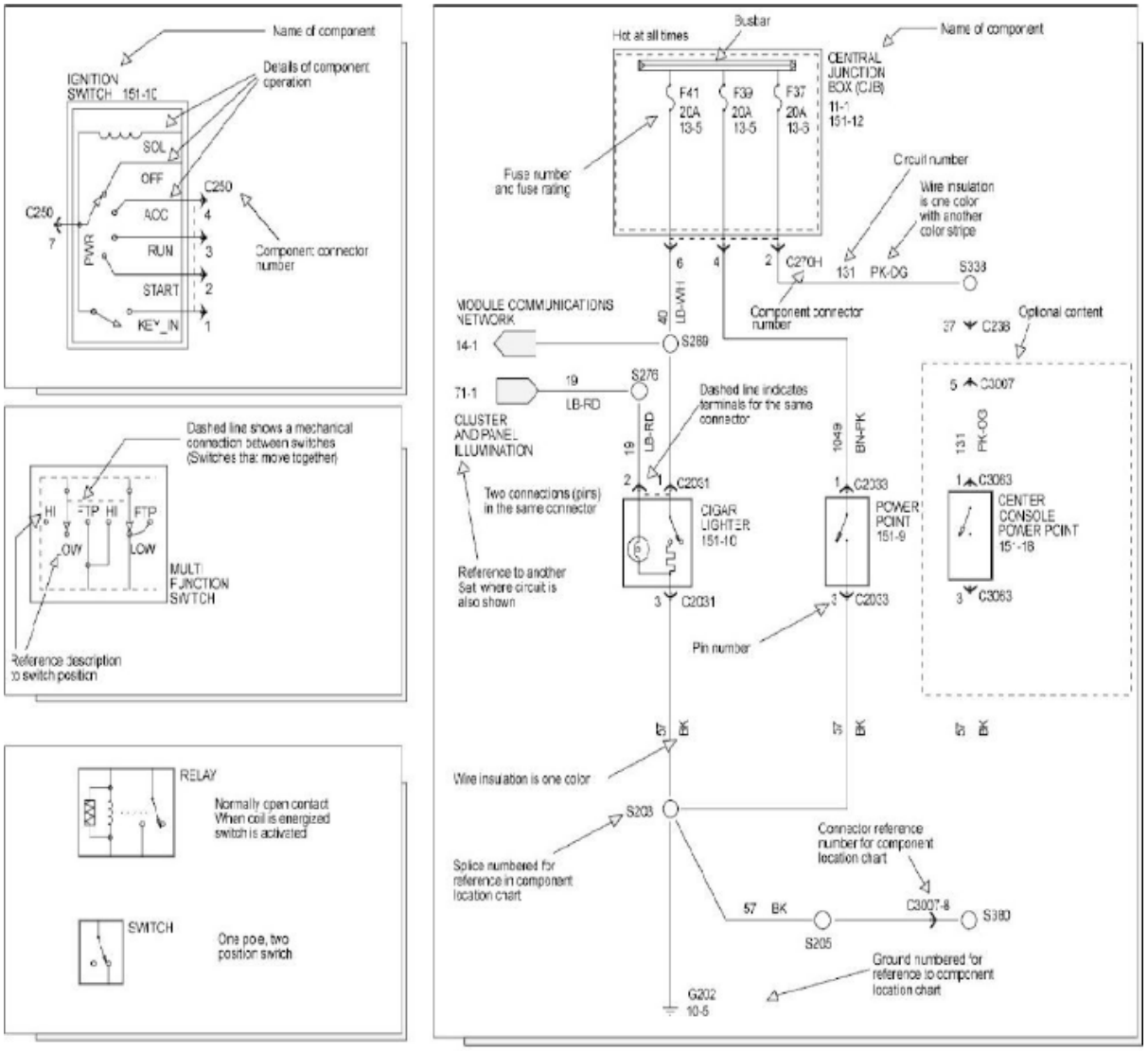
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

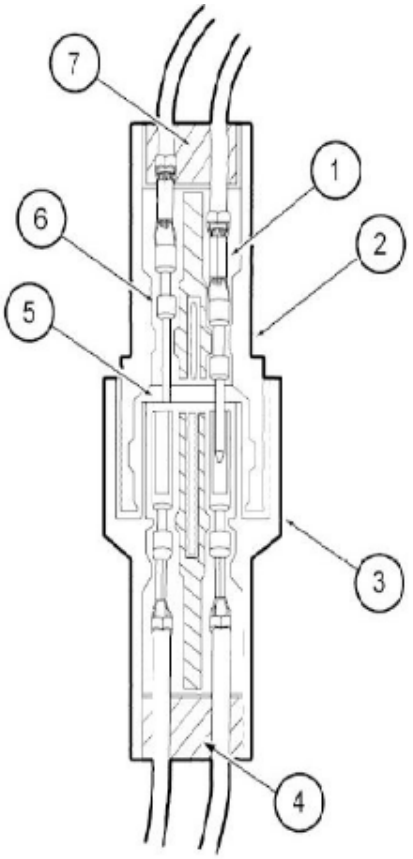


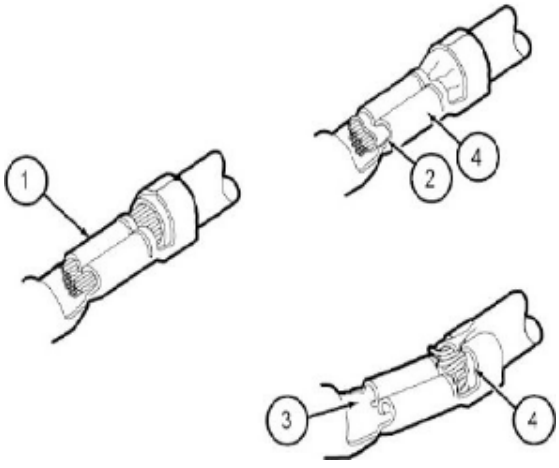
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Turn Signal Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

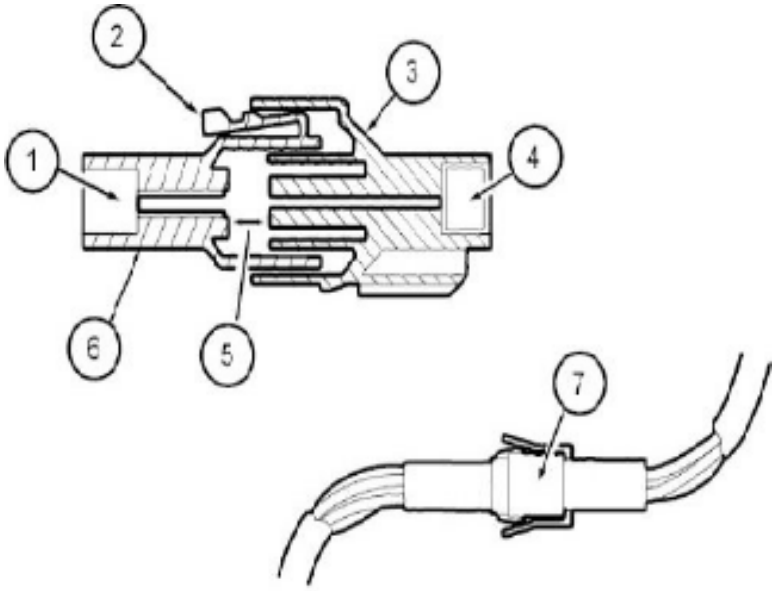
5 = Intermittent contact

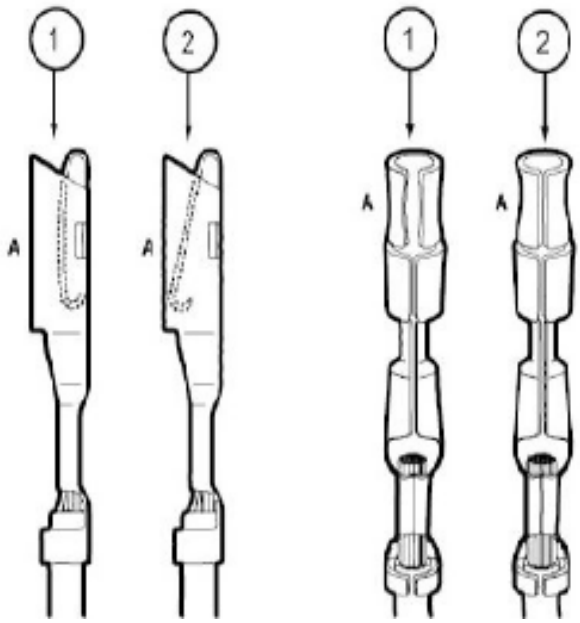
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

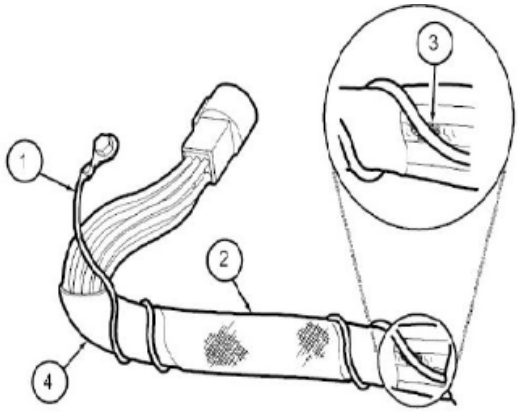
Deformed (enlarged) female terminals

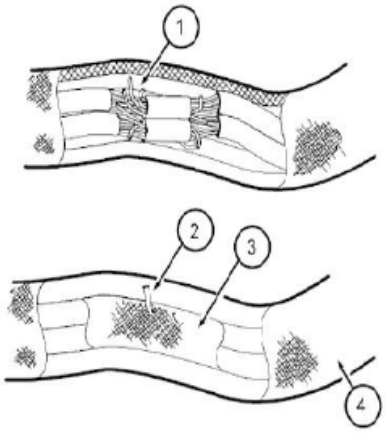
1 = Enlarged

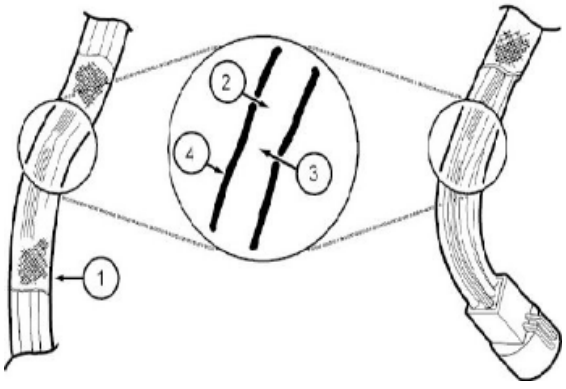
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

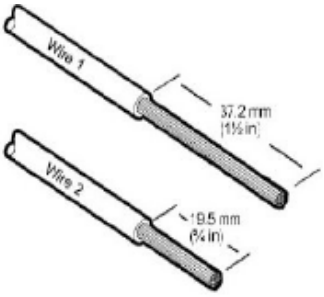
Splice covered 2

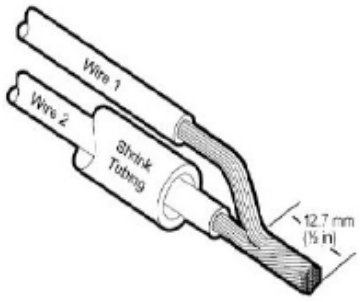
= Wire strand

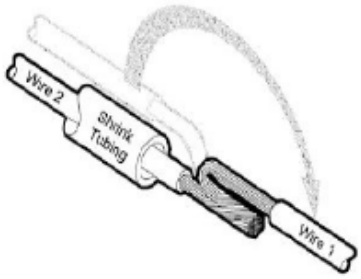
3 = Splice tape

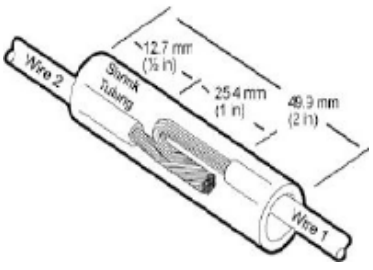
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

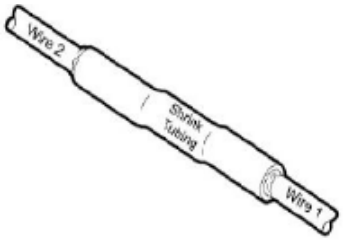
NOTE: -

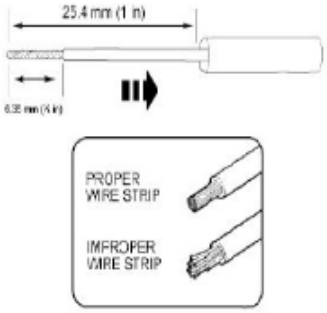
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

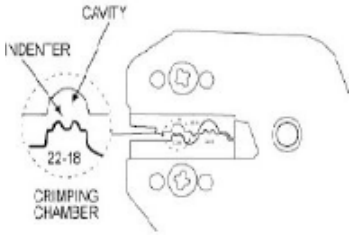
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

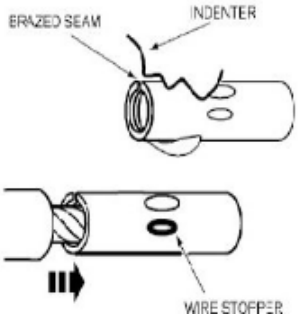
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
6.35 mm (¼ in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

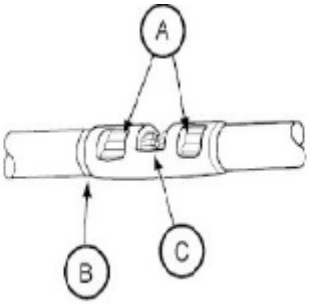
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

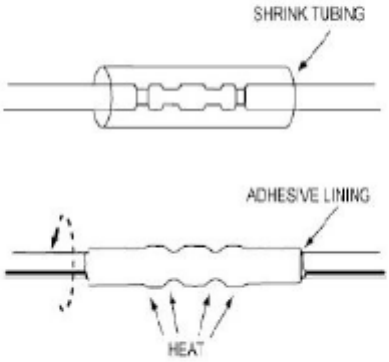
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4 strip, cut 9 strands	* 1/4 strip, cut 2 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip, fold 3x dia.
	16-14	* 1/4 strip, cut 7 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip fold 2x dia	1 strip, fold 3x dia.	1 1/4 strip, fold 4x dia.	Not Recommended
	12-10	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip fold 3x cia.	1 1/4 strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Figtail only

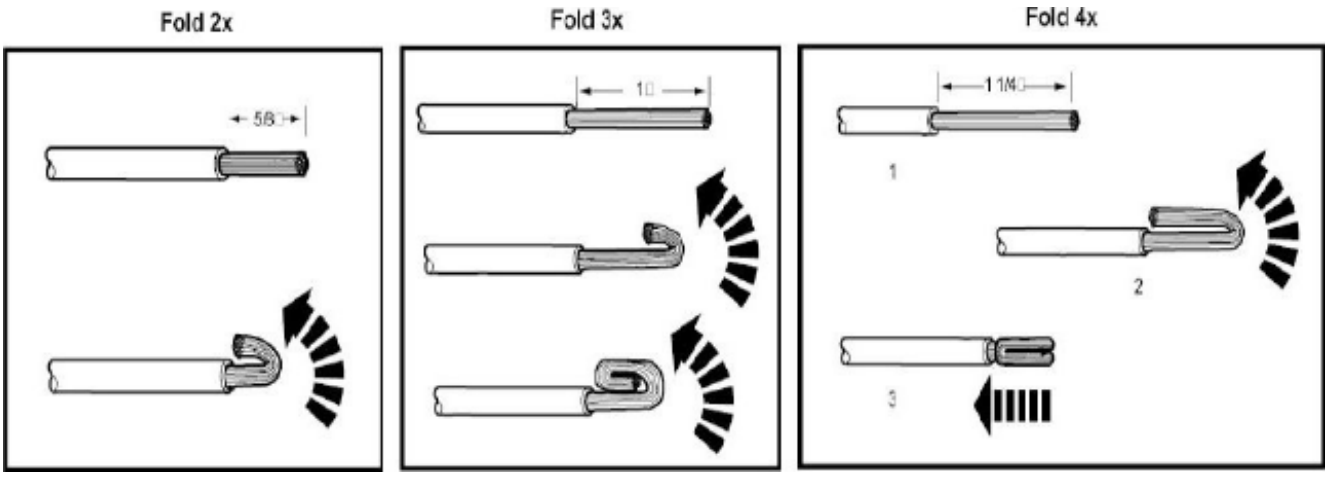
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

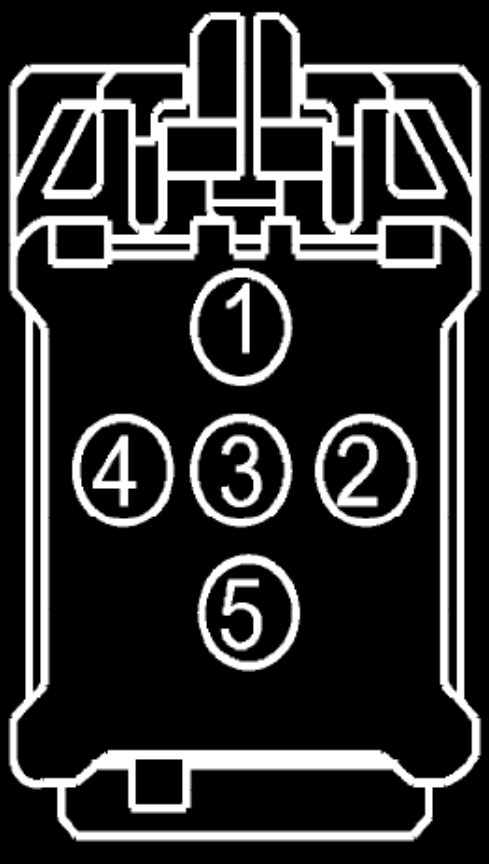
12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Connector: C2047

Description:	Harness:	Base Part #:
INDICATOR FLASHER RELAY	14401	13350



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CLS42 (VT-BN)	18	FLASHER - TURN SIGNAL/HAZARD	
2	GD161 (BK-YE)	18	GROUND - SEAT BRACKET REAR LEFT	
3	CLS32 (BN-YE)	18	SWITCH - HAZARD	
4	SBP17 (RD)	18	FUSE - 17 OR CIRCUIT BREAKER	
5	CBP20 (YE-VT)	18	FUSE - 20 OR CIRCUIT BREAKER	

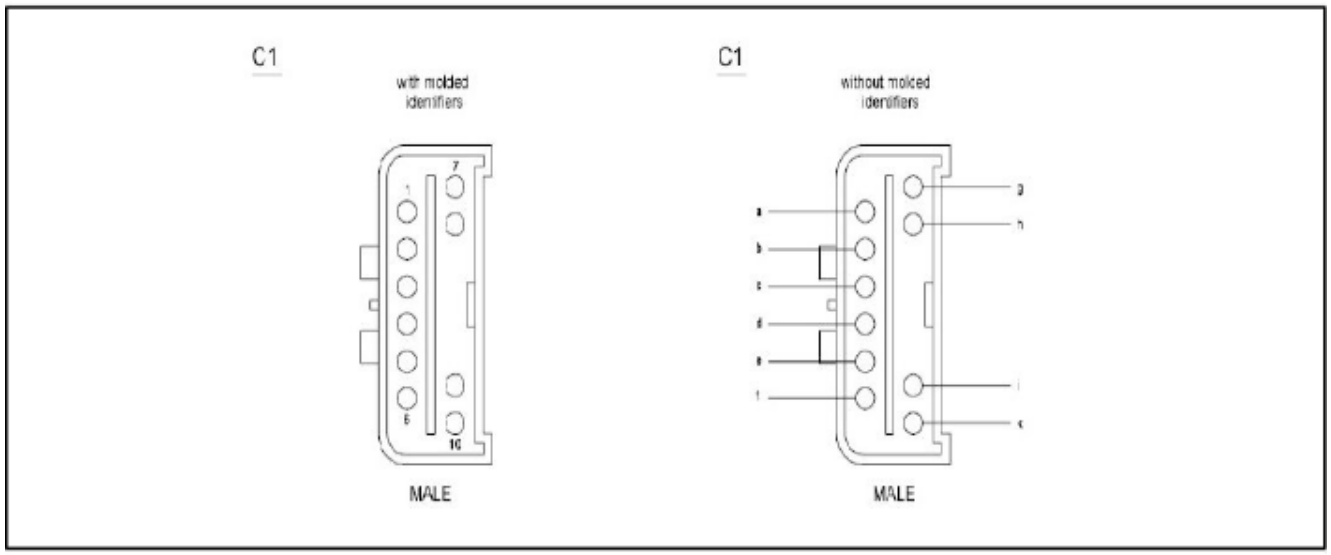
C2047

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



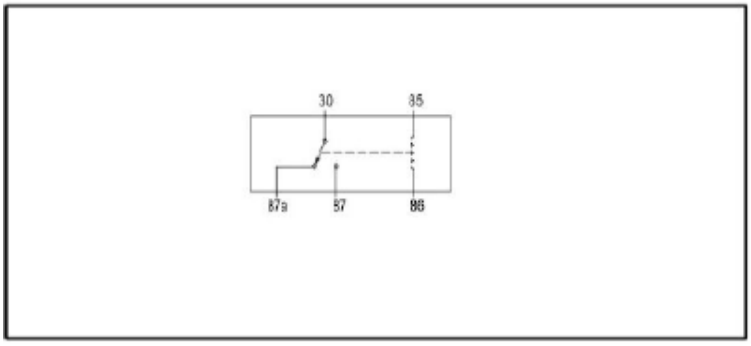
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

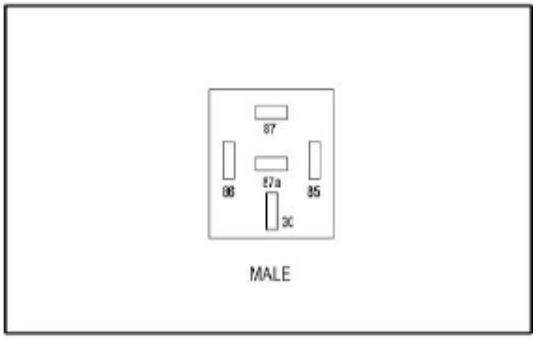
Turn Signal Relay: Testing and Inspection Mini ISO Relay

Relay □ Mini ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	45 □ 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

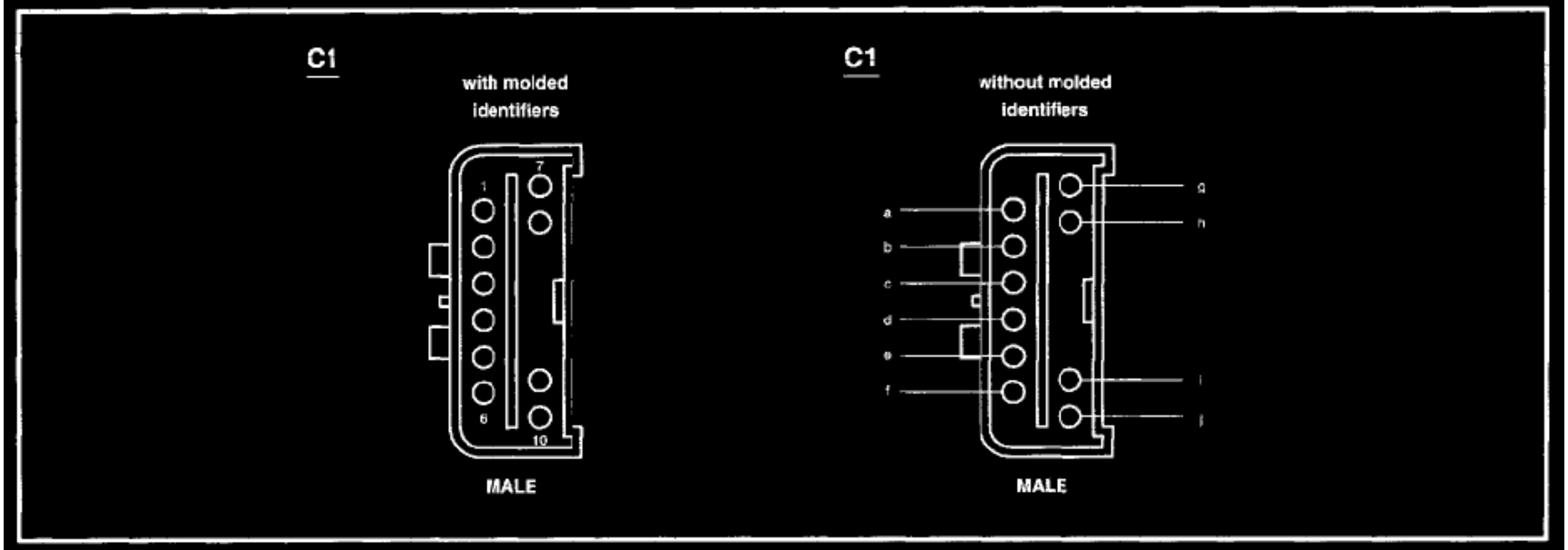
Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step–by–step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



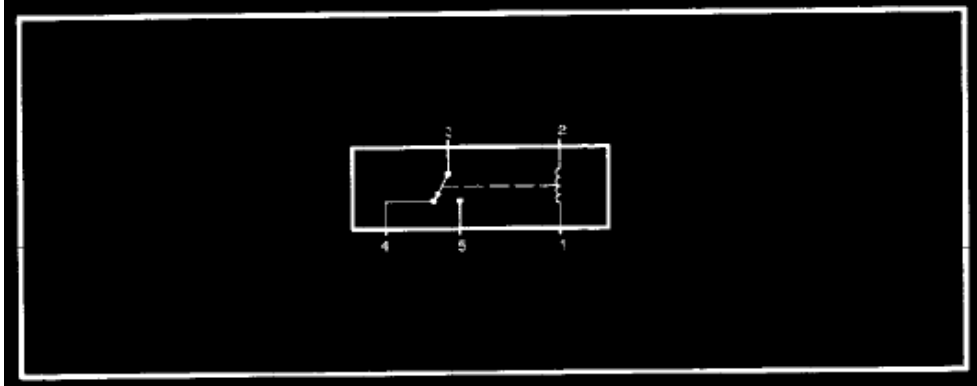
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

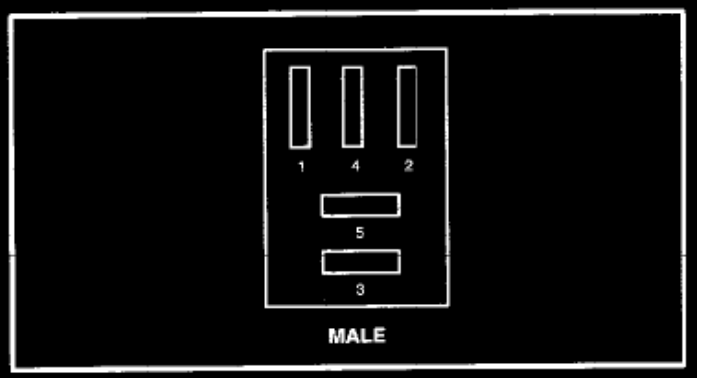
Turn Signal Relay: Testing and Inspection Micro ISO Relay

Relay – Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63–102Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil – Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

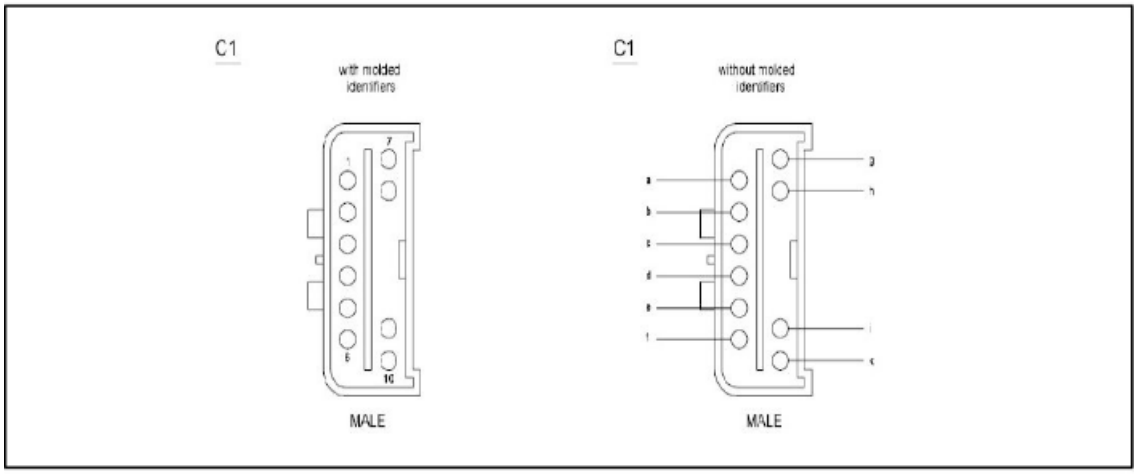
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step□by□step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals

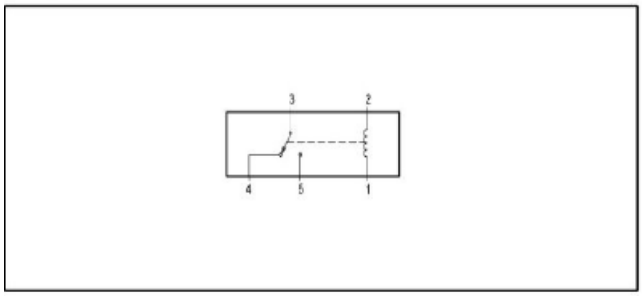


The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column □Circuit to test□. If you wish to test the complete component, perform all tests.

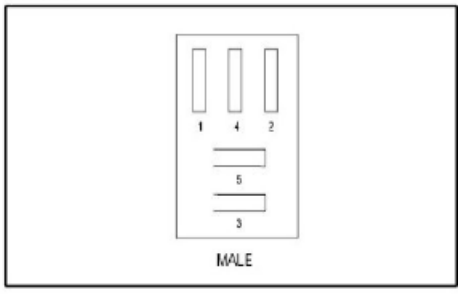
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Relay □ Micro ISO

Schematic



Terminals

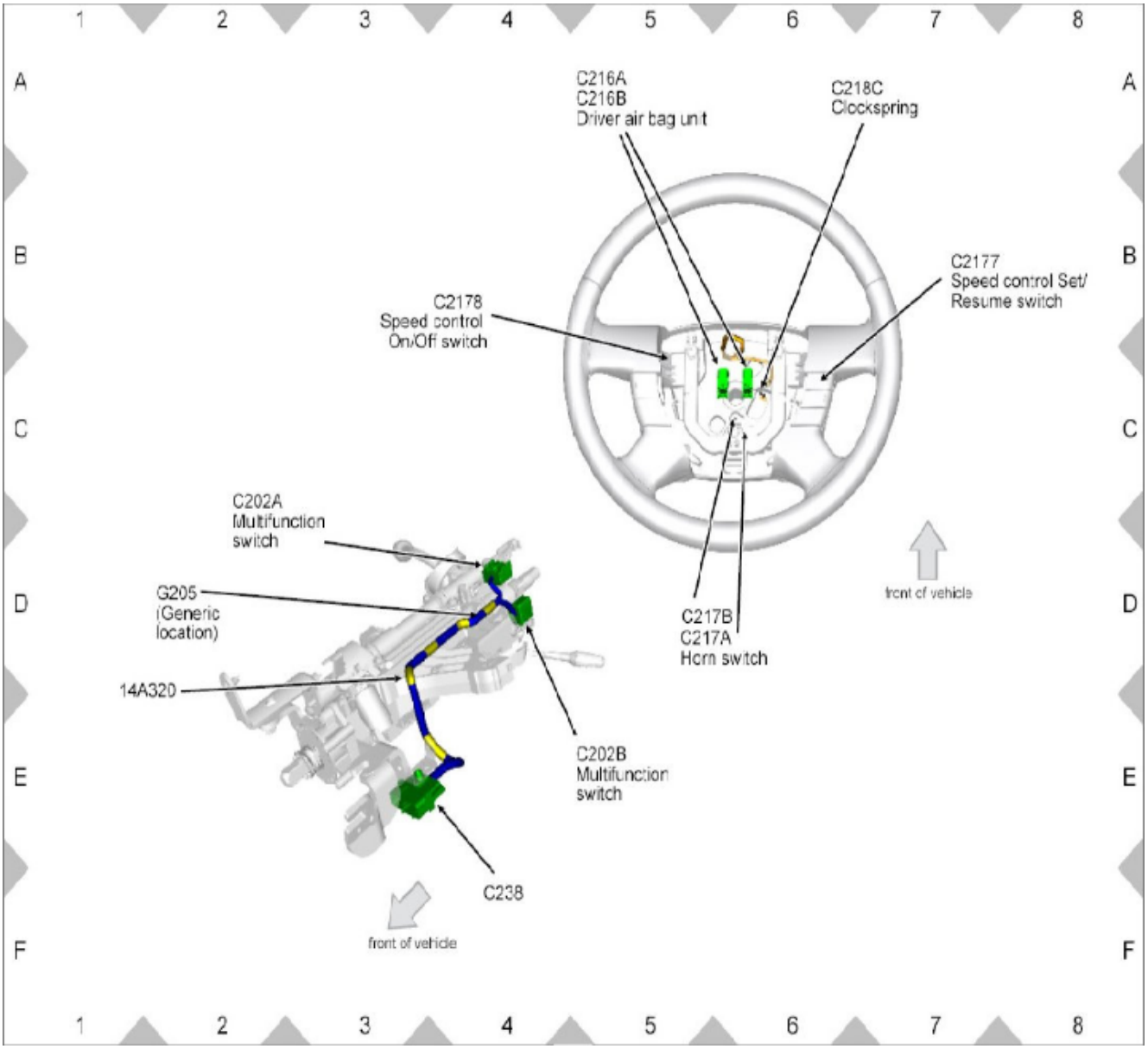


Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63□102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil □ Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

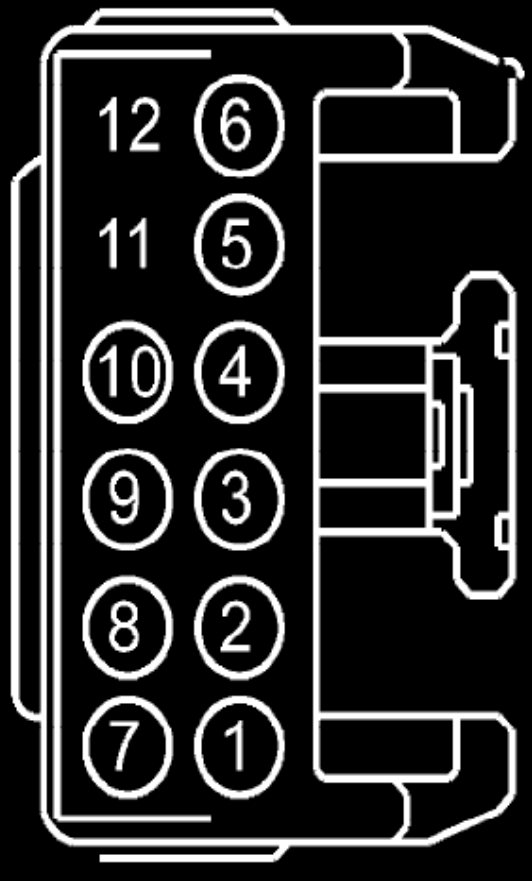
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.


C216A
C216B
Driver air bag unit
C218C
Clockspring
C2177
Speed control Set/
Resume switch
C2178
Speed control
On/Off switch
C202A
Multifunction
switch
G205
(Generic
location)
14A320
C217B
C217A
Horn switch
front of vehicle
C202B
Multifunction
switch
C238
front of vehicle

View 151-13

Connector: C202A

Description:	Harness:	Base Part #:
MULTIFUNCTION SWITCH	14A320	13K359



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CRW17 (GN-VT)	20	SWITCH - FRONT WIPER INTERVAL (A)	
2	CRW19 (BU-OG)	20	SWITCH - FRONT WIPER INTERVAL (C)	
3	CRW18 (VT-WH)	20	SWITCH - FRONT WIPER INTERVAL (B)	
4	CRW15 (BN-WH)	20	CTRL MOD. - FRONT WIPER HIGH	
5	CRW07 (GY-BN)	20	SWITCH - FRONT WASHER	
6	CD161 (BK YE)	18	GROUND SEAT BRACKET REAR LEFT	
7	CLS41 (GY-YE)	22	SWITCH - TURN RIGHT	
8	CLS36 (YE)	18	SWITCH - PARK LAMPS RIGHT	
9	CLS35 (VT)	18	SWITCH - PARK LAMPS LEFT	
10	CLS39 (VT-WH)	22	SWITCH - TURN LEFT	
11	*	*	not used	
12	*	*	not used	

Turn Signal Switch: Diagrams

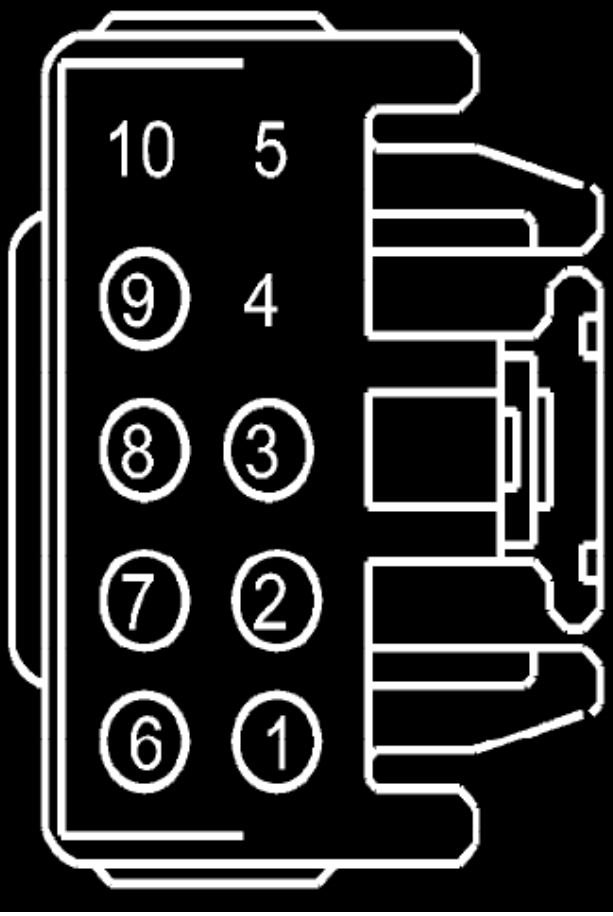
C202A

Connector: C202B

Description: MULTIFUNCTION SWITCH

Harness: 14A320

Base Part #: 13K359



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CCB08 (VT-WH)	16	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL OPEN	
2	CLS42 (VT-BN)	18	INDICATOR FLASHER RELAY - TURN SIGNAL SWITCHED POWER	
3	CLS32 (BN-YE)	18	INDICATOR FLASHER RELAY - HAZARD SWITCHED POWER	
4	*	*	not used	
5	*	*	not used	
6	SBP23 (WH-RD)	14	FUSE - 23 OR CIRCUIT BREAKER	
7	CLF27 (GN-BN)	14	SWITCH - FLASH TO PASS	
8	CLS24 (BN-WH)	16	CTRL MOD. - TURN LAMP RIGHT	
9	CLF18 (BU-WH)	16	SWITCH - BEAM LOW	
10	*	*	not used	

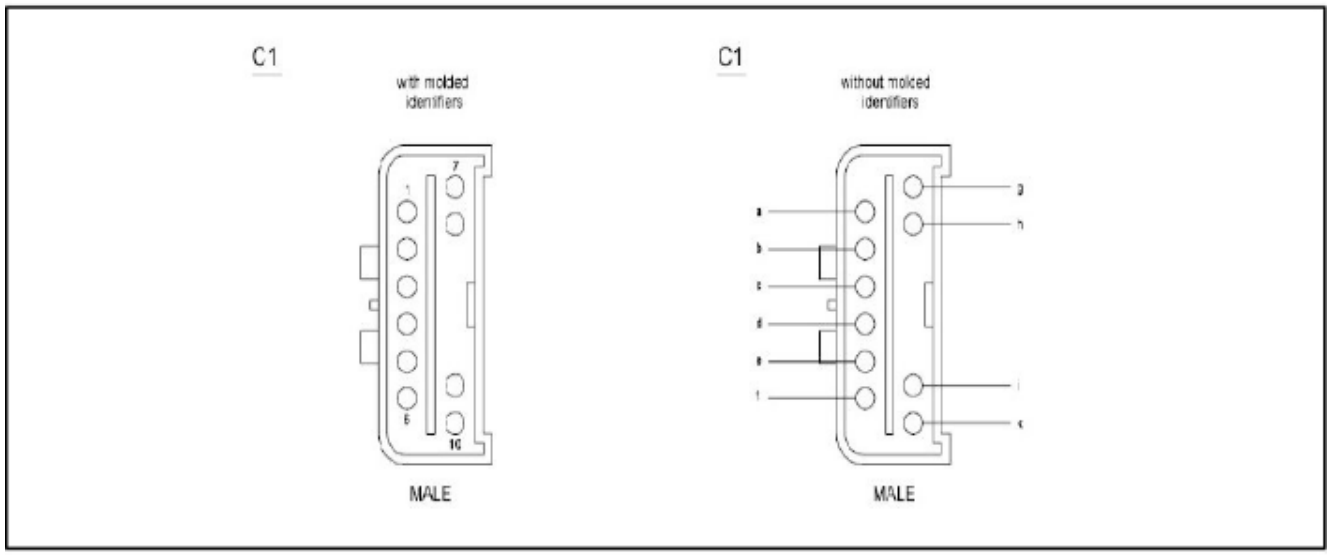
C202B

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



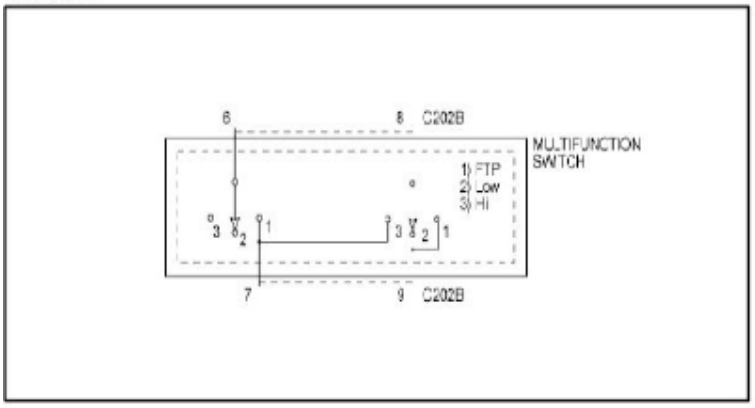
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

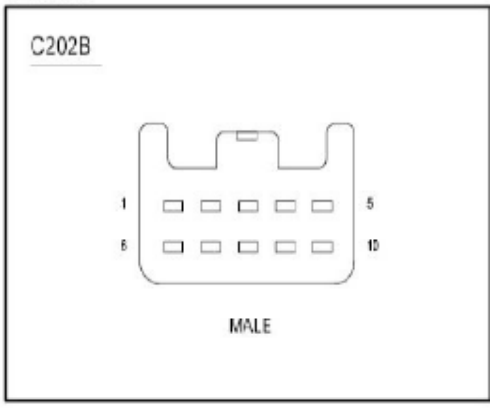
Turn Signal Switch: Testing and Inspection Multifunction Switch, Lamp Portion

Multifunction Switch, Lamp Portion

Schematic



Terminals



Component testing procedure

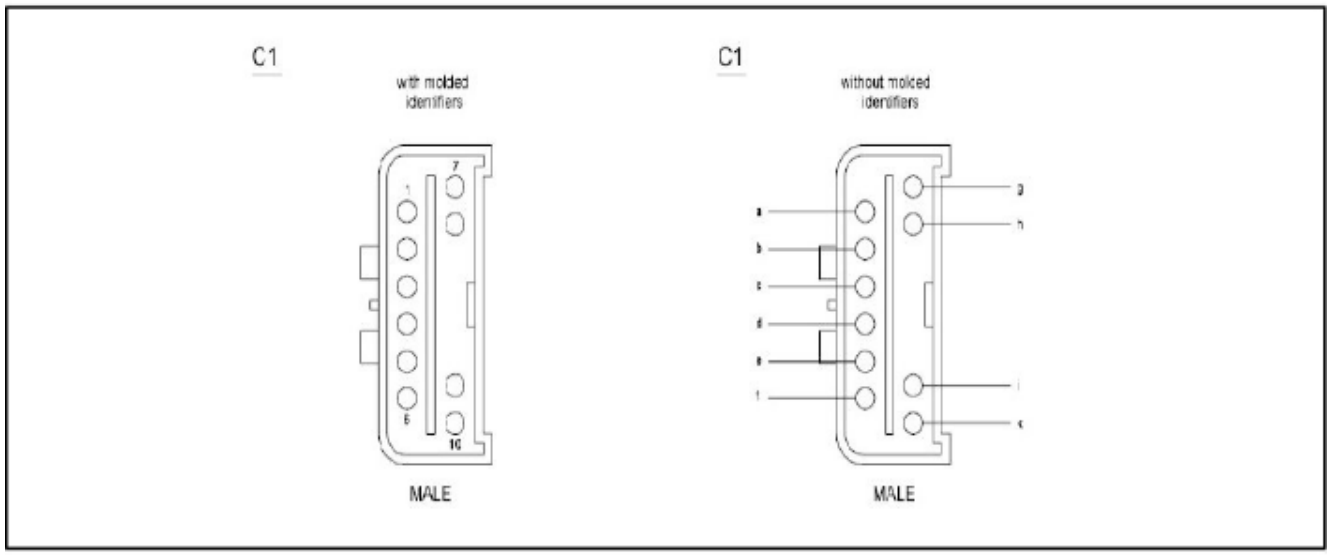
Circuit to test	Connect self□powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
High beams	8 and 7	High beam	Closed circuit
		Flash□to□pass	Open circuit
		Low beam	Open circuit
Low beam/Flash□ to□pass	8 and 9	High beam	Open circuit
		Flash□to□pass	Closed circuit
		Low beam	Closed circuit
	6 and 7	High beam	Open circuit
		Flash□to□pass	Closed circuit
		Low beam	Open circuit

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



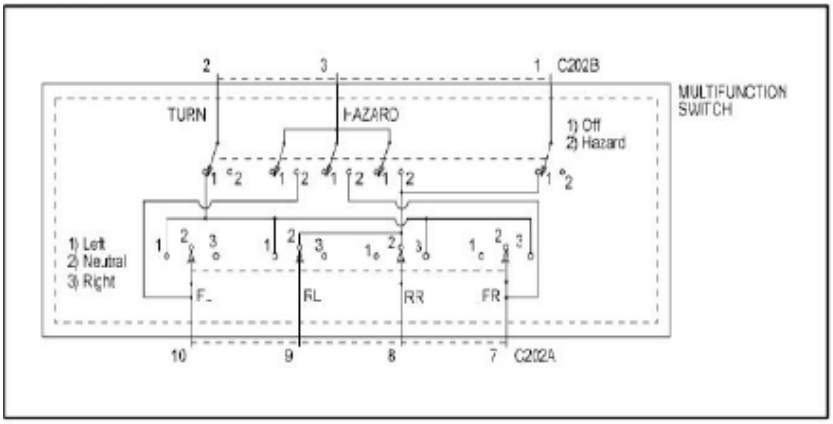
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

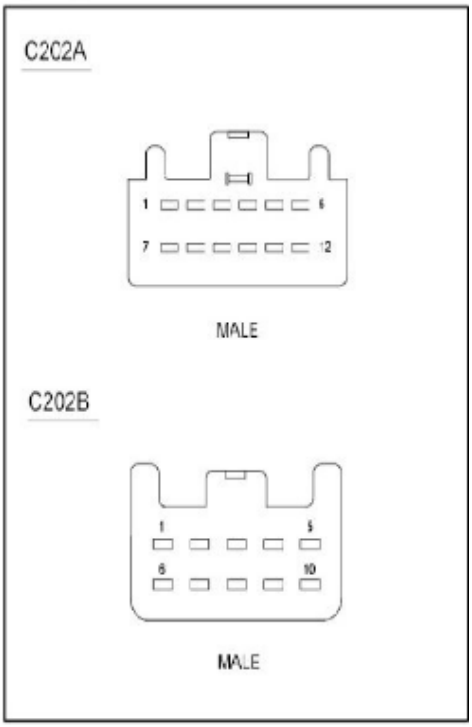
Turn Signal Switch: Testing and Inspection Multifunction Switch, Turn Portion

Multifunction Switch, Turn Portion

Schematic



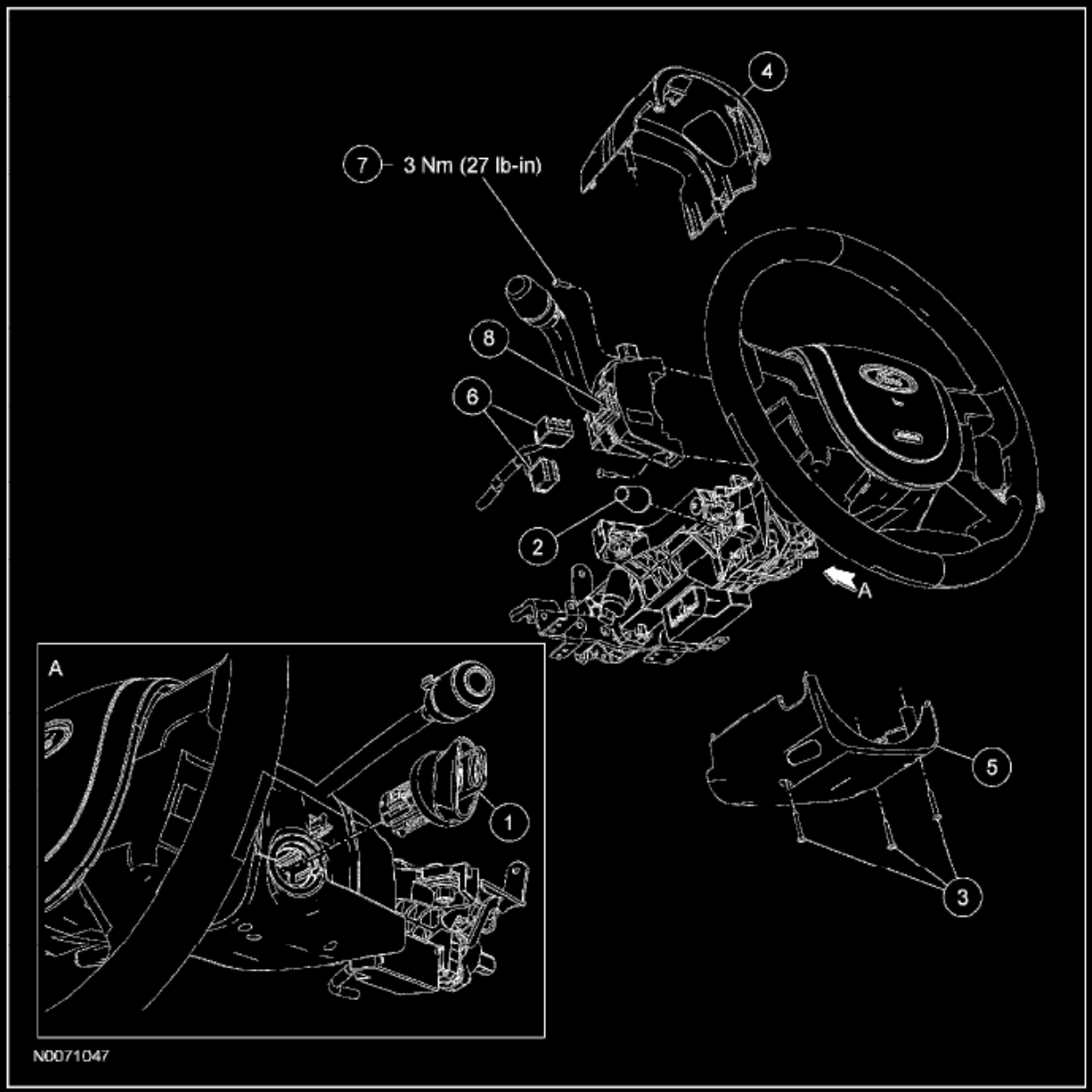
Terminals



Component testing procedure

Circuit to test	Connect self-powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
Turn signal	C202b-2 and C202a-10	Left turn	Closed circuit
	C202b-2 and C202a-9	Left turn	Closed circuit
	C202b-2 and C202a-7	Right turn	Closed circuit
	C202b-2 and C202a-8	Right turn	Closed circuit
Hazard	C202b-3 and C202a-10	Turn signal switch in neutral, Hazard On	Closed circuit
	C202b-3 and C202a-7		
	C202b-3 and C202a-9		
	C202b-3 and C202a-8		
	C202b-1 and C202a-10	Turn signal switch in neutral, Hazard Off	Closed circuit
	C202b-1 and C202a-8		

Steering Column Multifunction Switch



Item	Part Number	Description
1	11582	Ignition switch lock cylinder
2	3F609	Tilt release lever/ handle
3	391727	Steering column shroud screws (3 required)
4	3530	Upper steering column shroud
5	3533	Lower steering column shroud

(Continued)

Item	Part Number	Description
6	—	Steering column multi-function switch electrical connectors (part of 14A320)
7	390345	Steering column multi-function switch screws (2 required)
8	13K359	Steering column multi-function switch

Turn Signal Switch: Service and Repair

Steering Column Multifunction Switch

Steering Column Multifunction Switch

Removal and Installation

1. Remove the ignition switch lock cylinder.

1 Insert the ignition key into the ignition switch lock cylinder and turn to the RUN position.

2 Push the ignition switch lock cylinder release tab with a punch while pulling out the ignition switch lock cylinder.

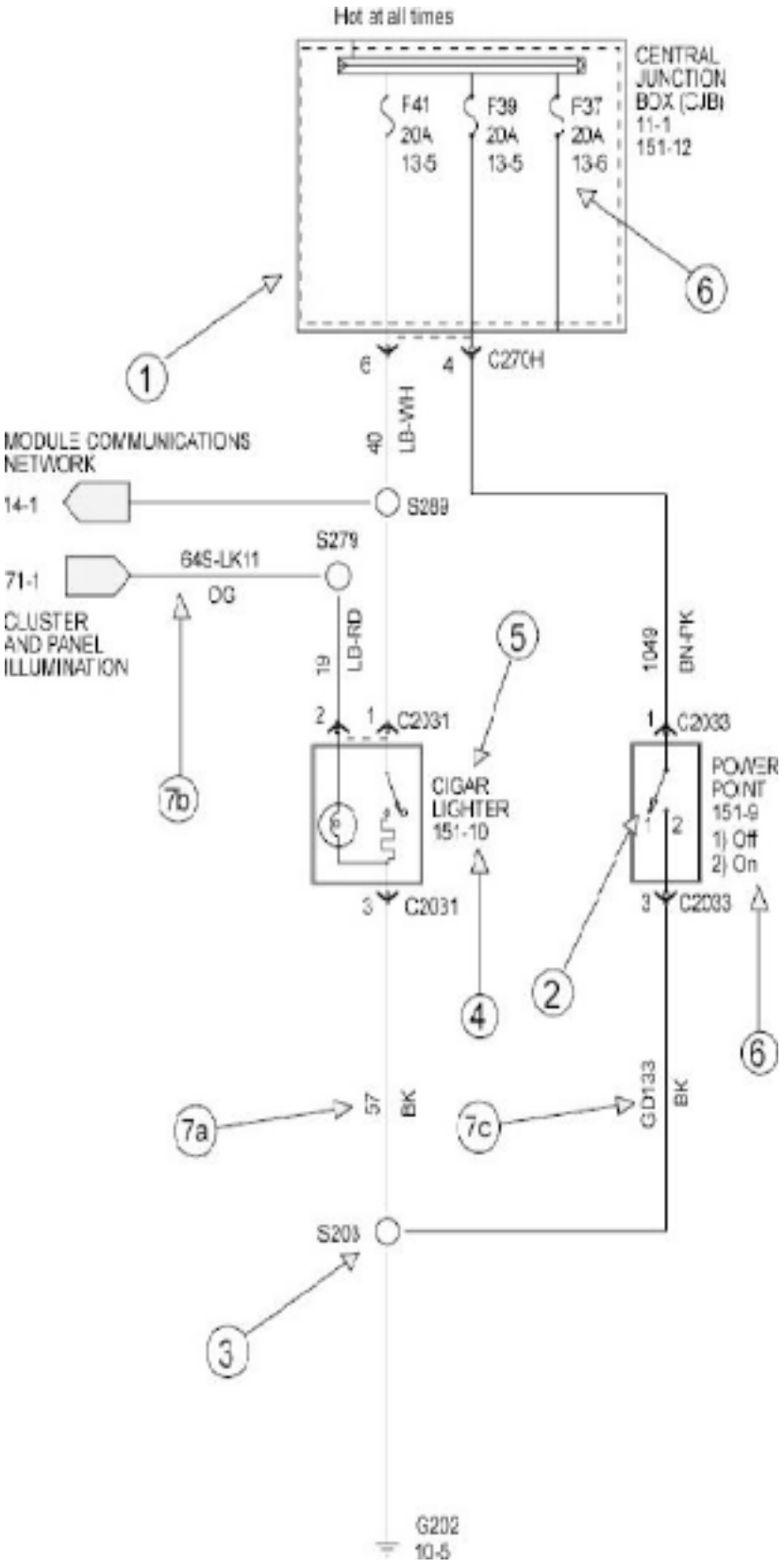
2. If equipped, remove the tilt release lever/ handle.

3. Remove the 3 steering column shroud screws and the upper and lower steering column shrouds. 4. Disconnect the multi-function switch electrical connectors. 5. Remove the 2 multi-function switch screws and the multi-function switch.

^ To install, tighten to 3 Nm (27 lb-inch).

6. To install, reverse the removal procedure.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Windows and Glass > Relays and Modules - Windows and Glass > Power Window Relay > Component Information > Diagrams > Diagram Information and Instructions



Power Window Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

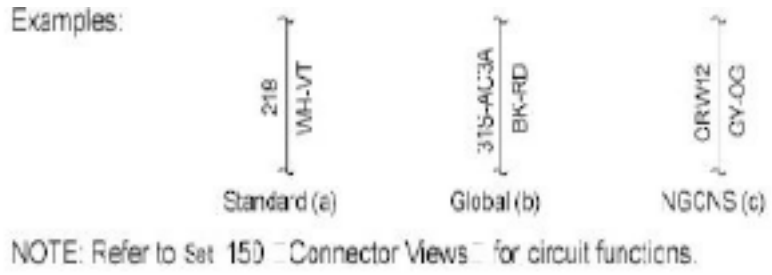
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

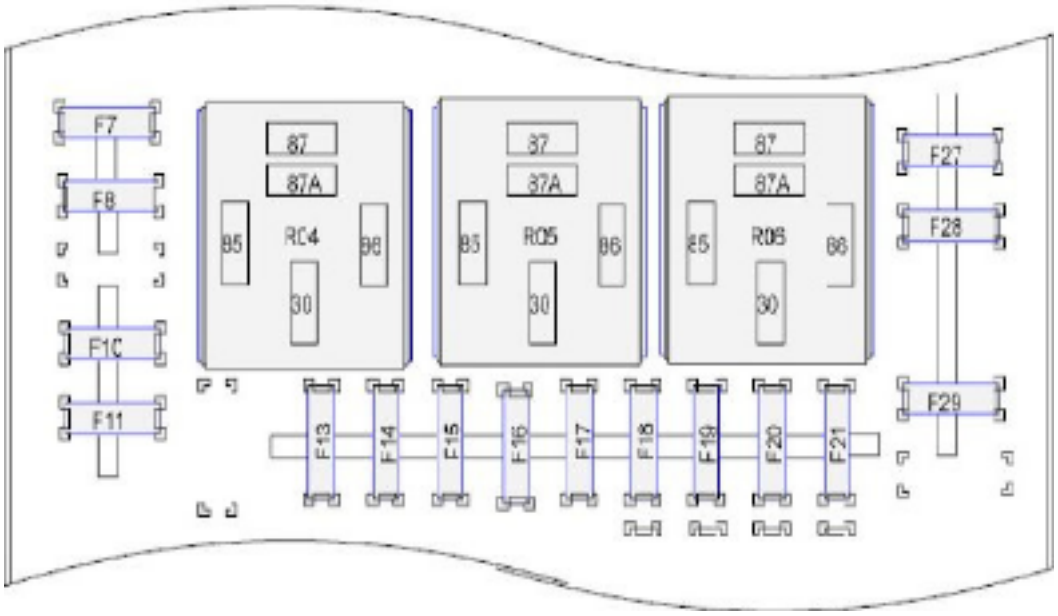
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

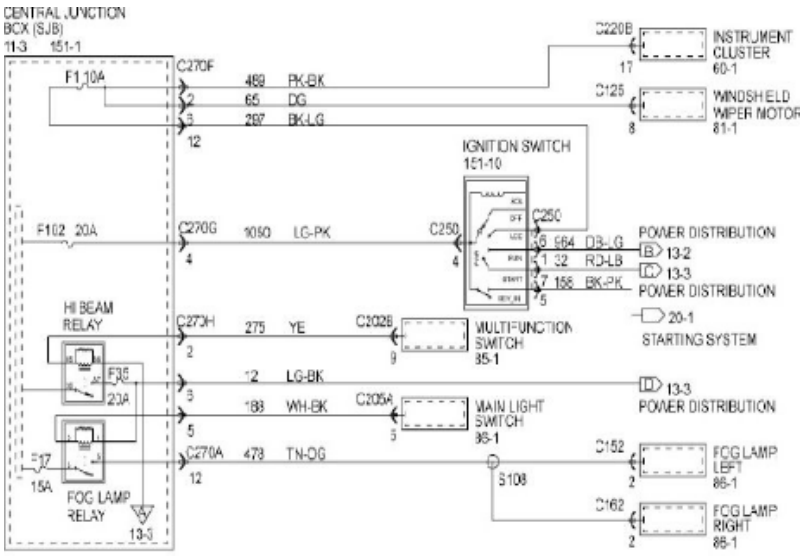
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

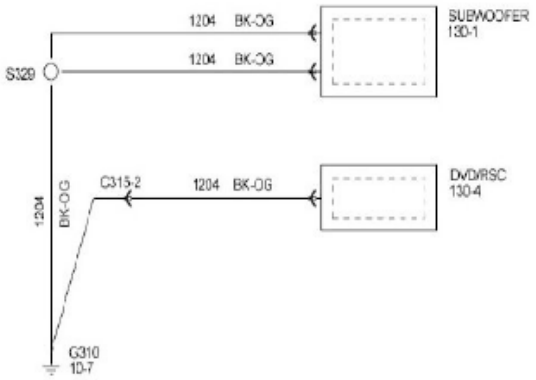
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

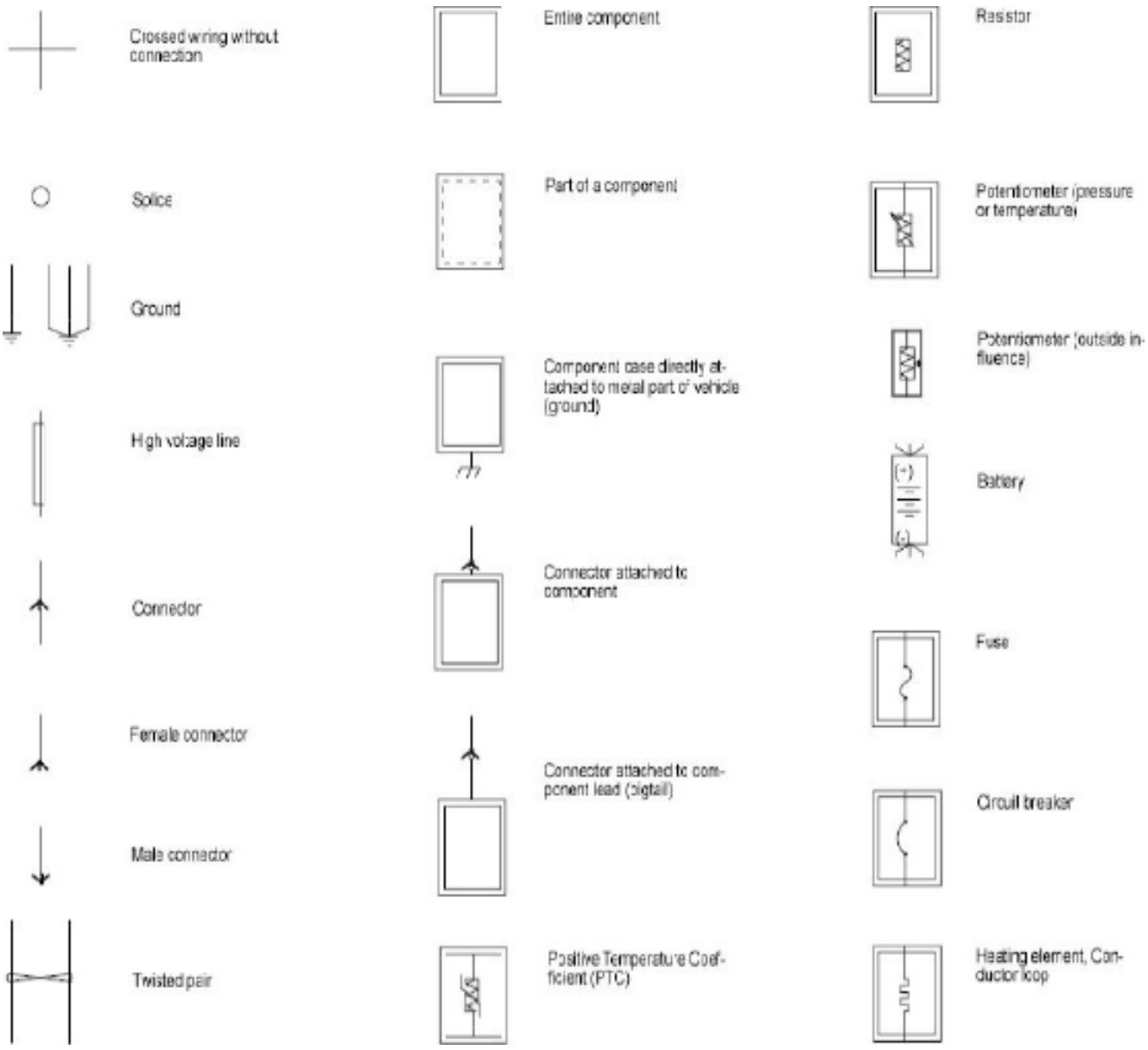
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

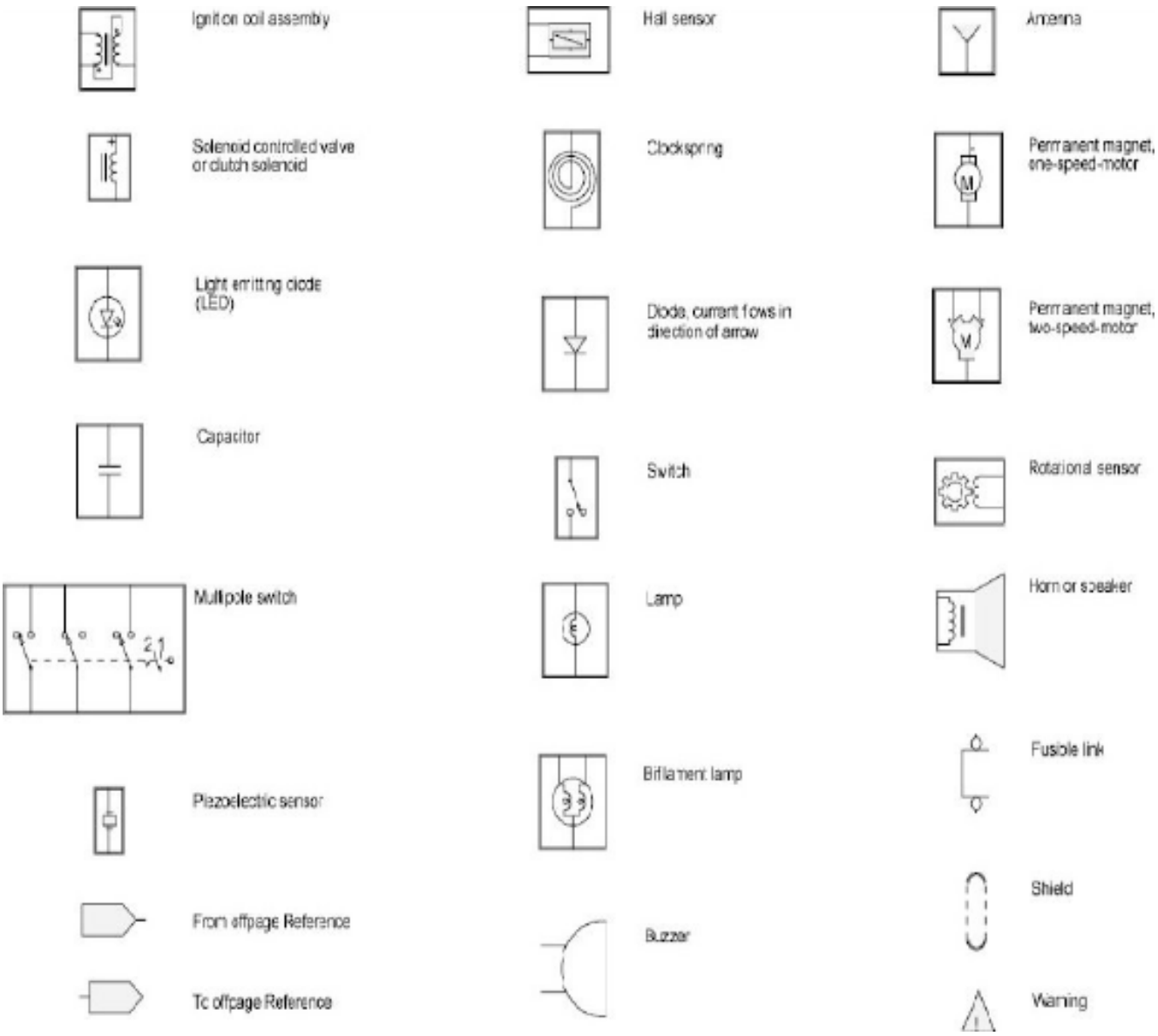
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

Symbols (Part 1)



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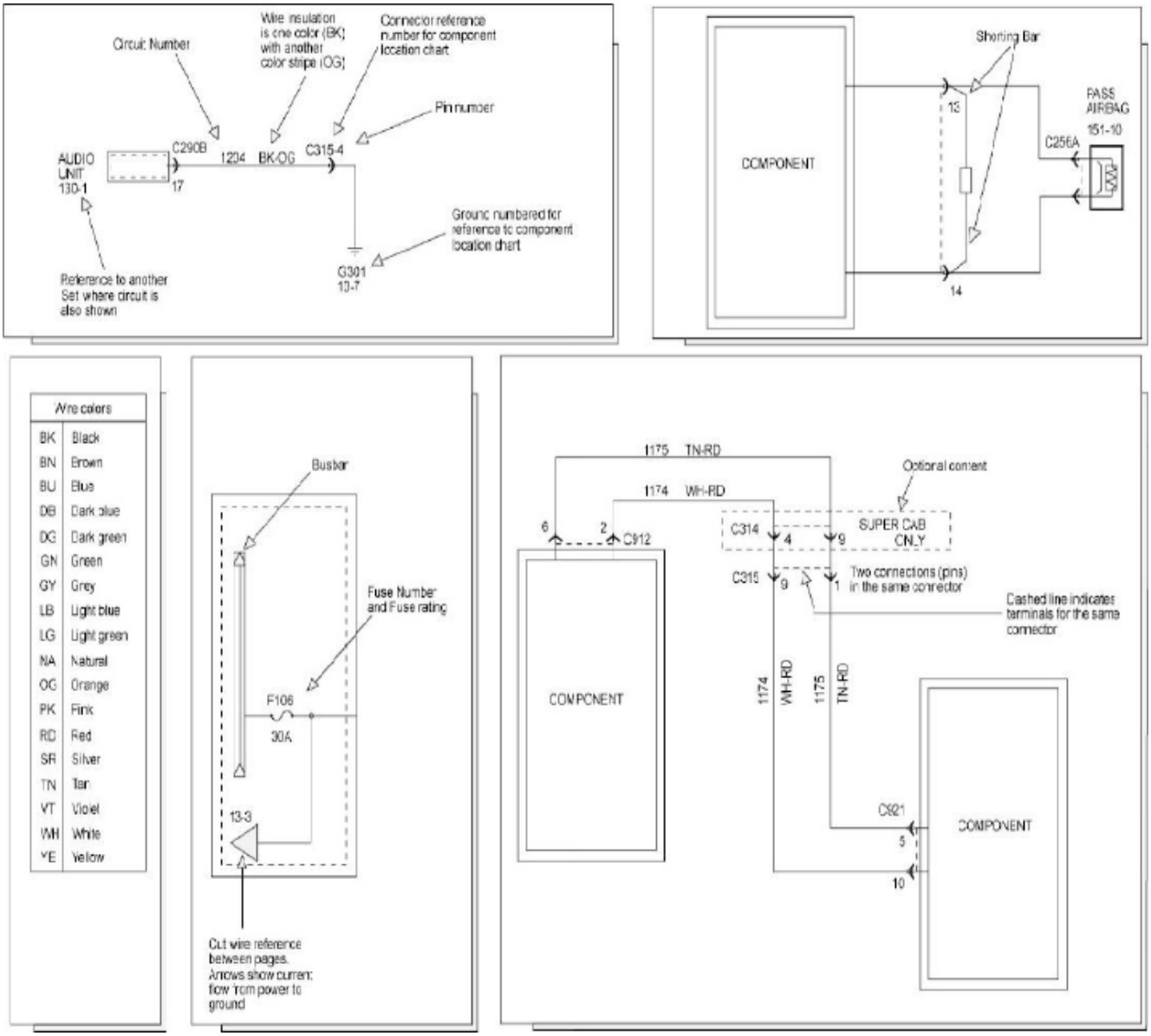
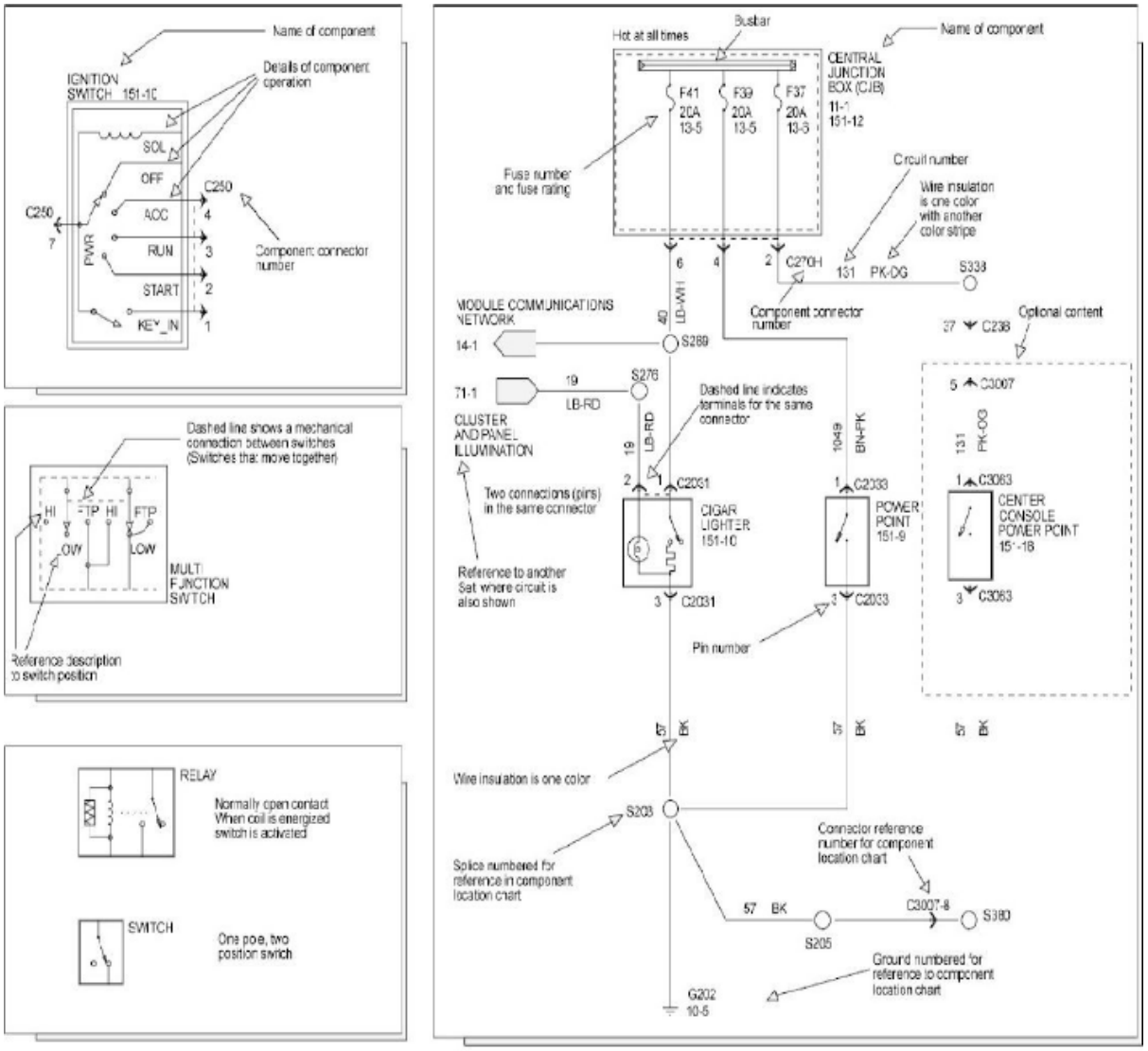


Symbols (Part 3)

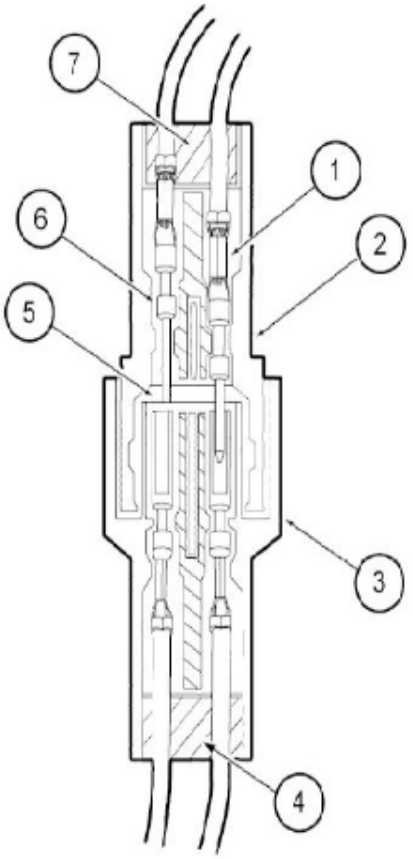


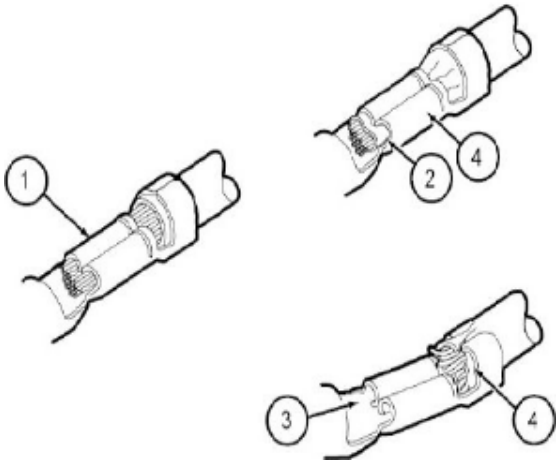
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Power Window Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

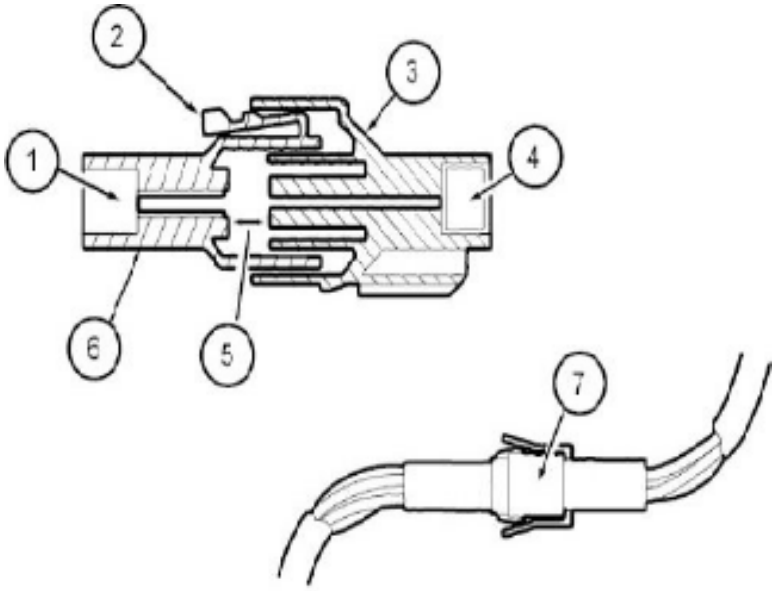
5 = Intermittent contact

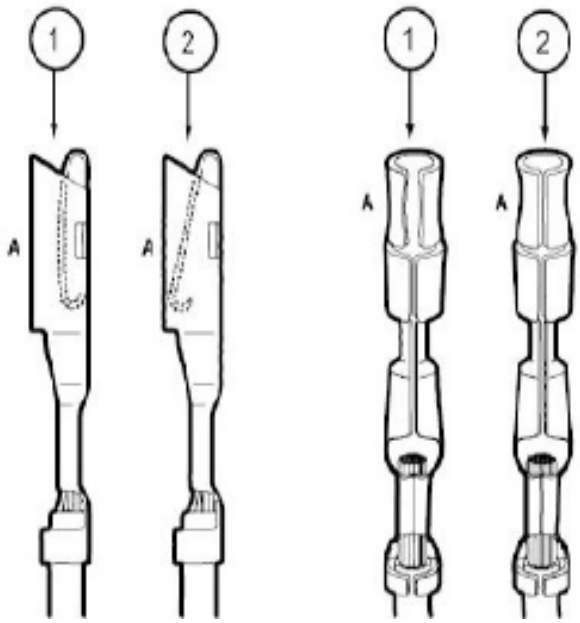
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

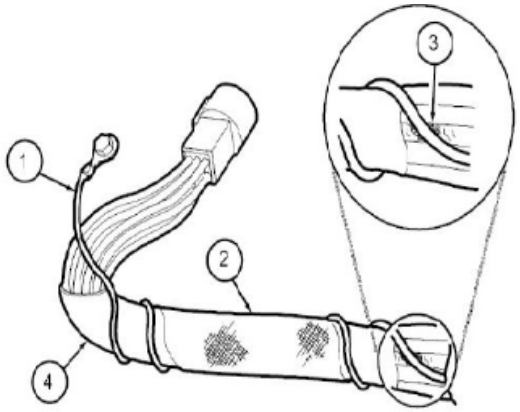
Deformed (enlarged) female terminals

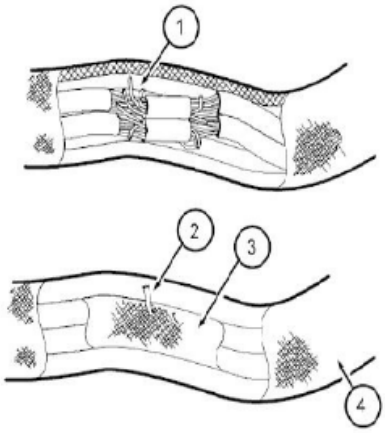
1 = Enlarged

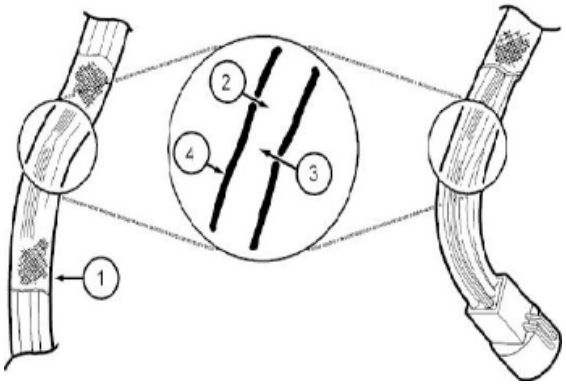
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

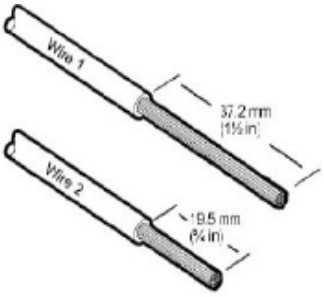
Splice covered 2

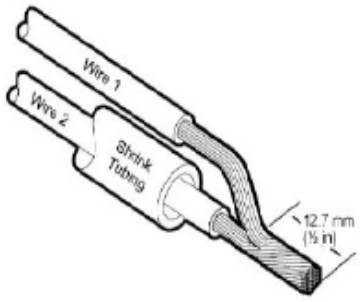
= Wire strand

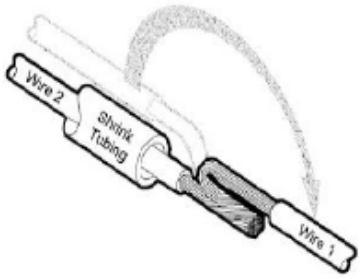
3 = Splice tape

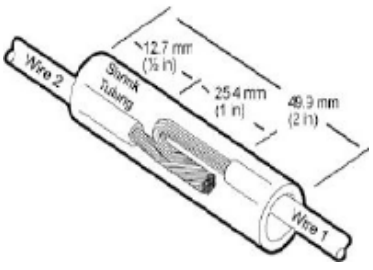
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.9 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

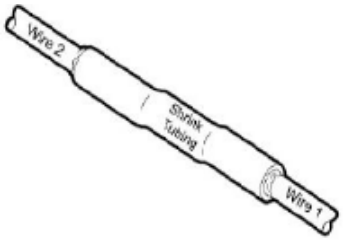
NOTE: -

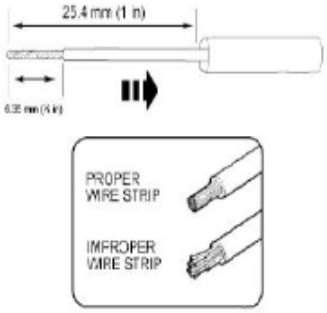
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

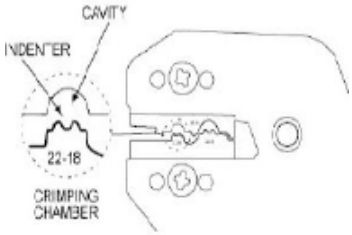
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

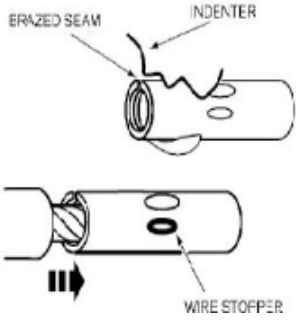
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
6.35 mm (¼ in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

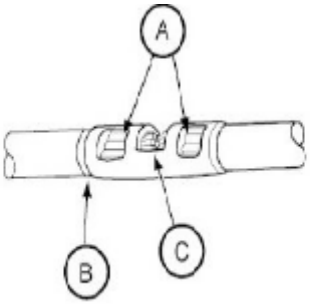
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

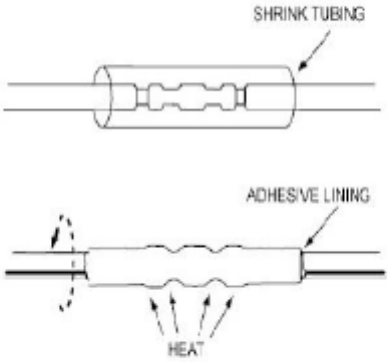
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4 strip, cut 9 strands	* 1/4 strip, cut 2 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip, fold 3x dia.
	16-14	* 1/4 strip, cut 7 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip fold 2x dia	1 strip, fold 3x dia.	1 1/4 strip, fold 4x dia.	Not Recommended
	12-10	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip fold 3x dia.	1 1/4 strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Figtail only

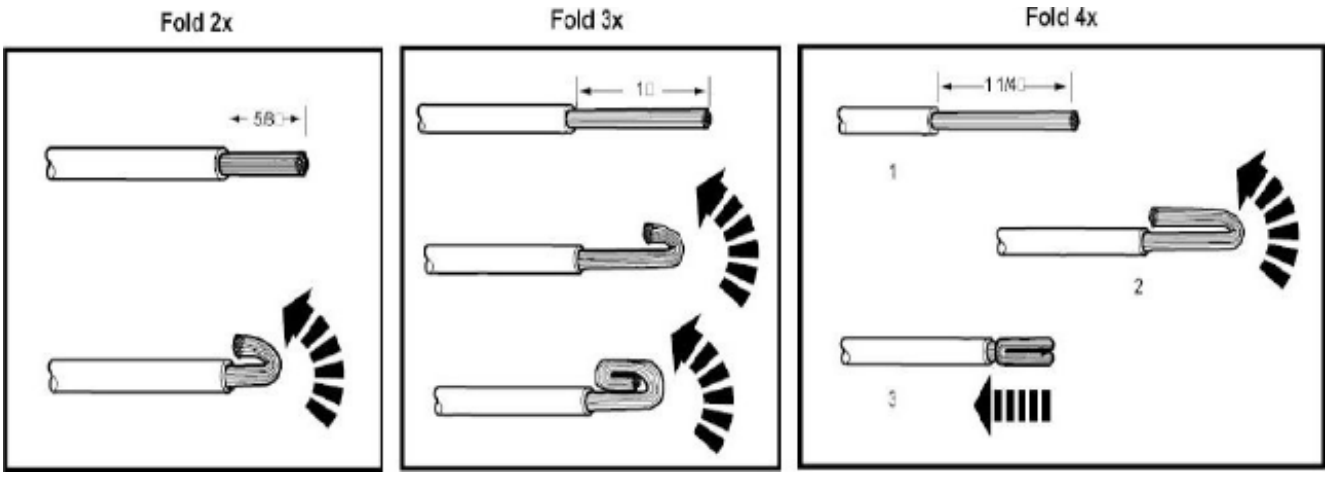
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



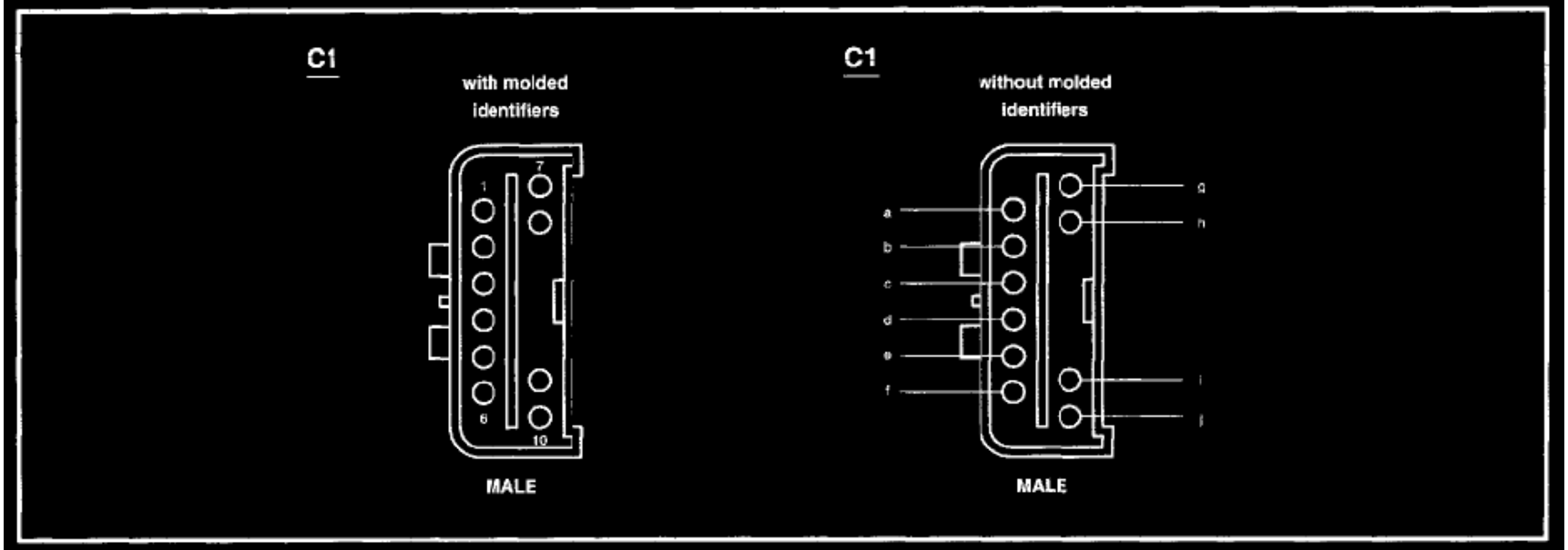
The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step–by–step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



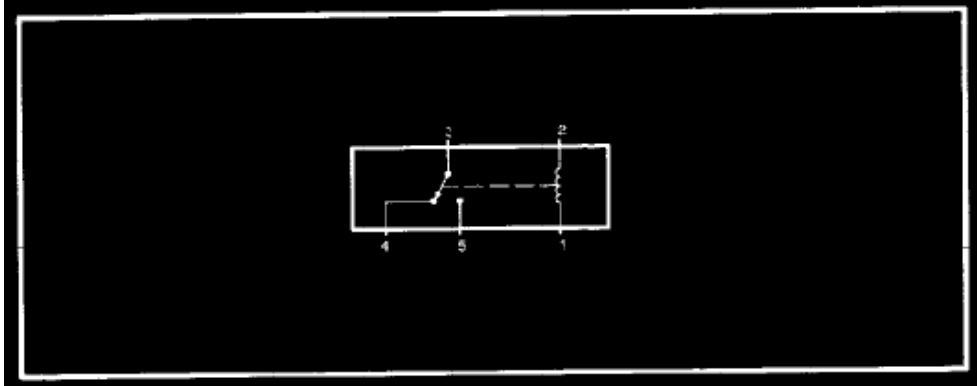
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

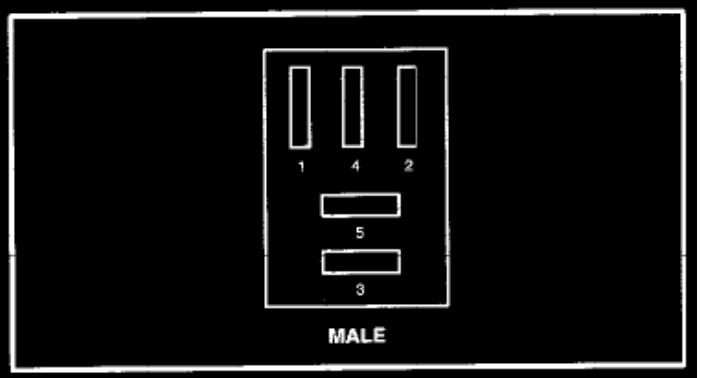
Power Window Relay: Testing and Inspection Micro ISO Relay

Relay – Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63–102Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil – Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

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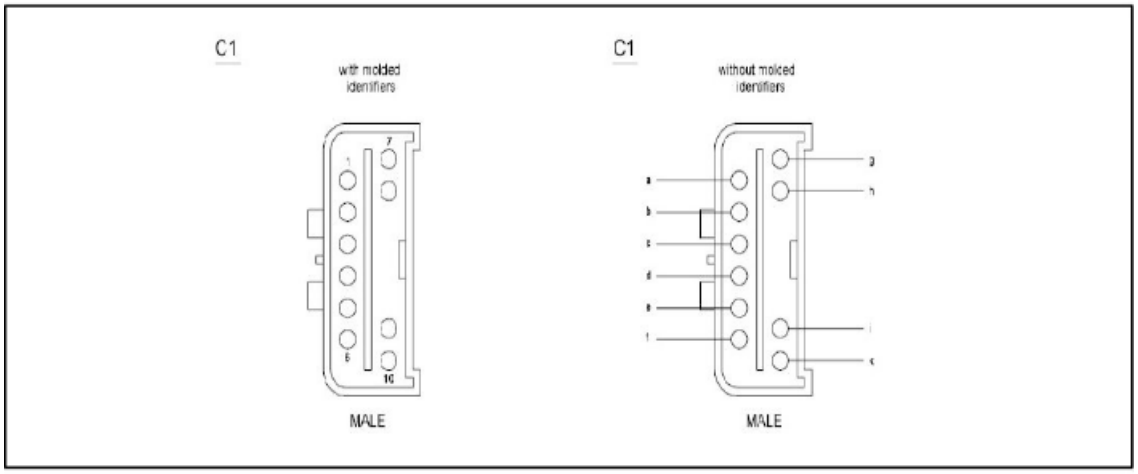

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Relay - Micro ISO

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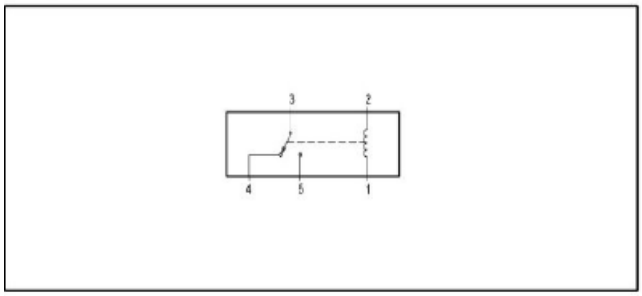
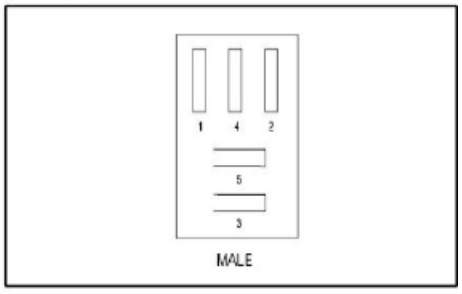


Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63-102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil - Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

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Introduction

Component testing procedures are provided to determine whether a component is good or bad.

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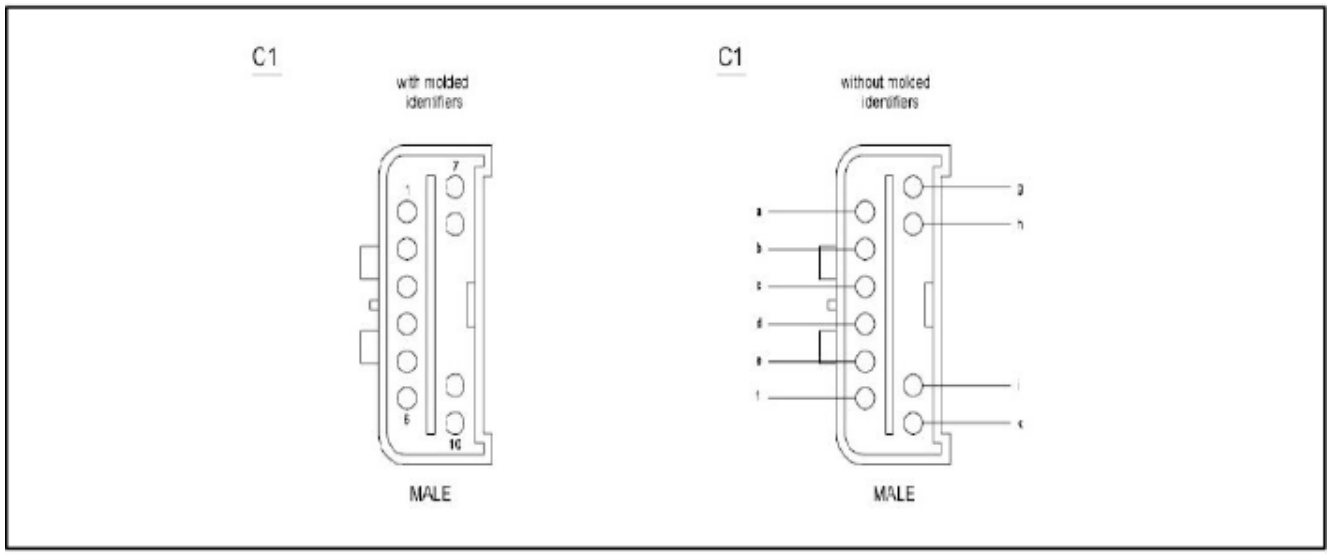
Terminals



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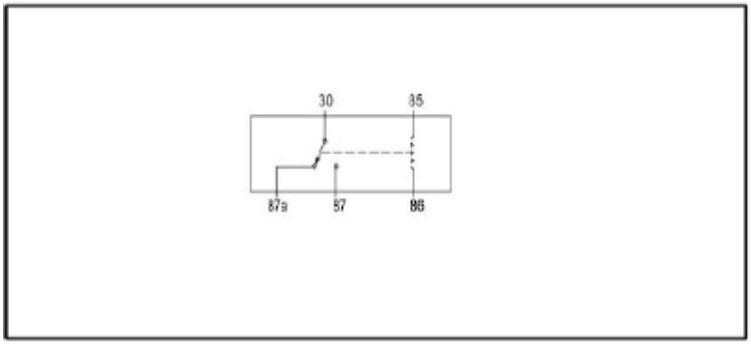
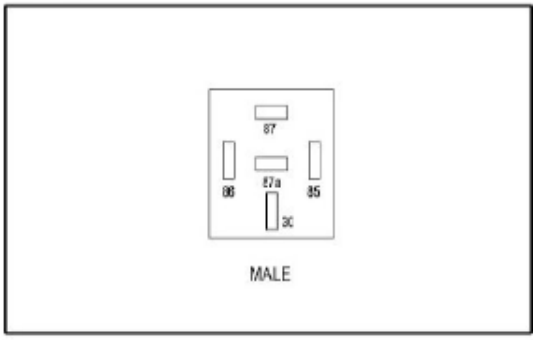
Power Window Relay: Testing and Inspection Mini ISO Relay

Relay □ Mini ISO

Schematic



Terminals



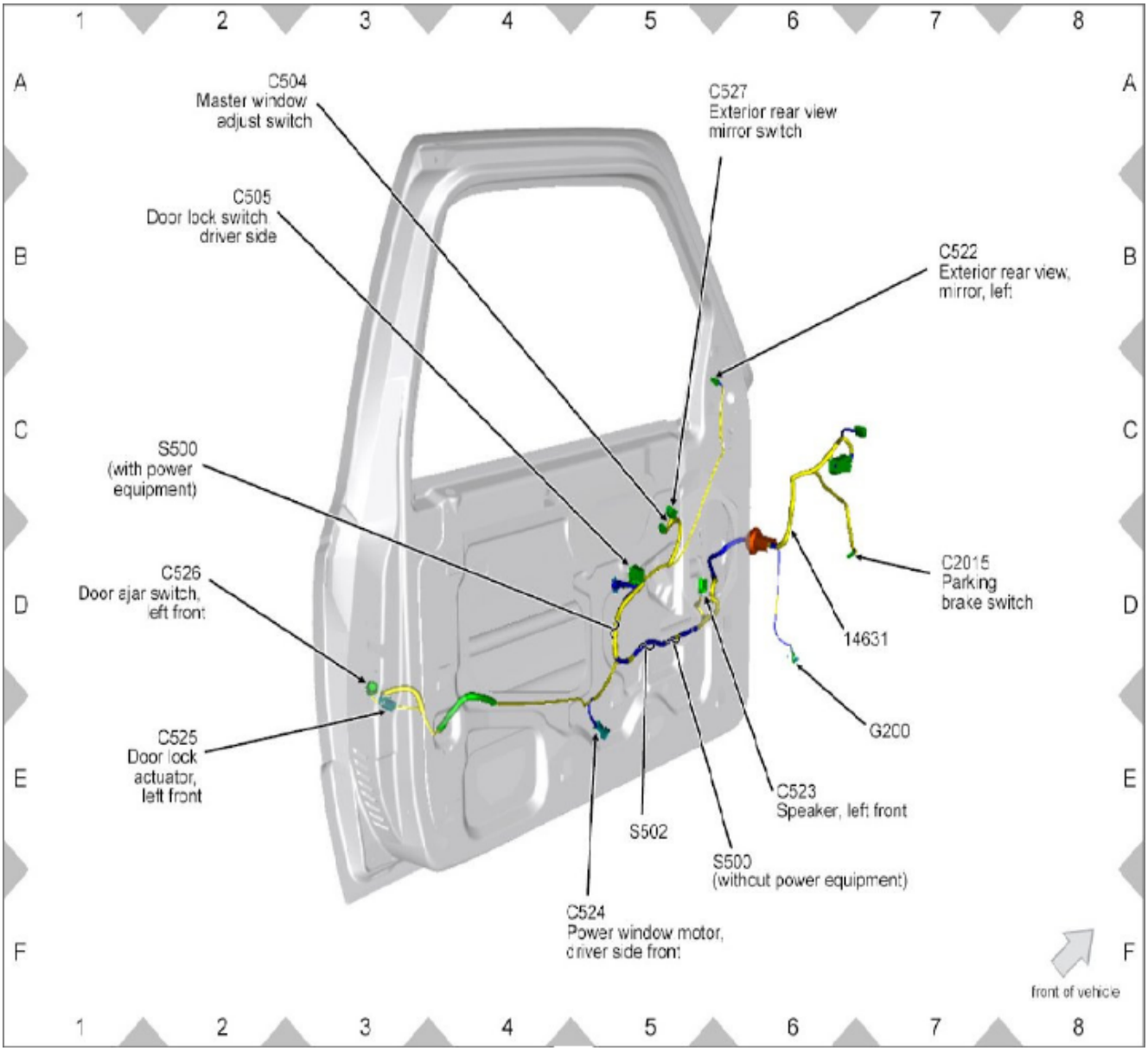
Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

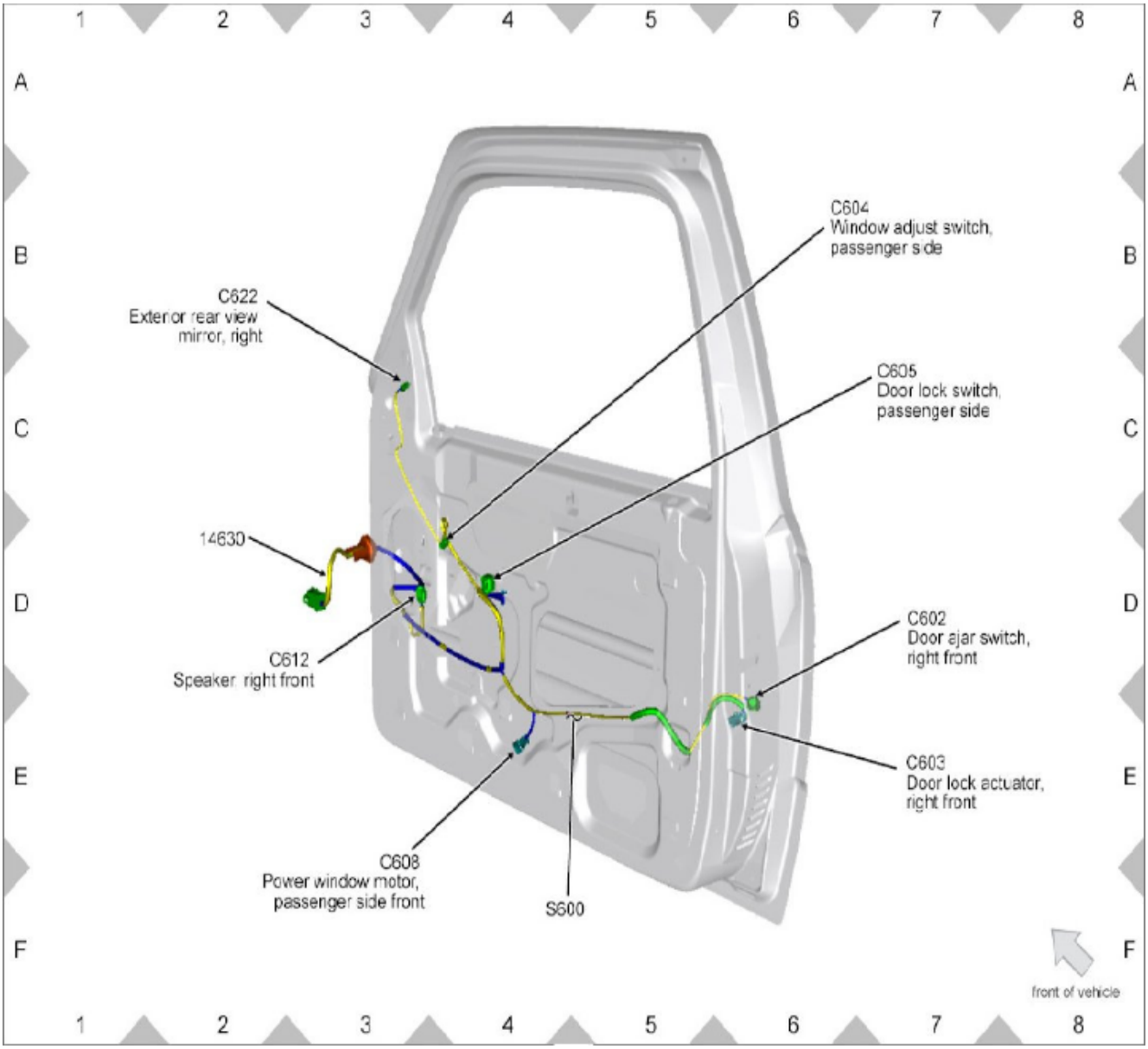
Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

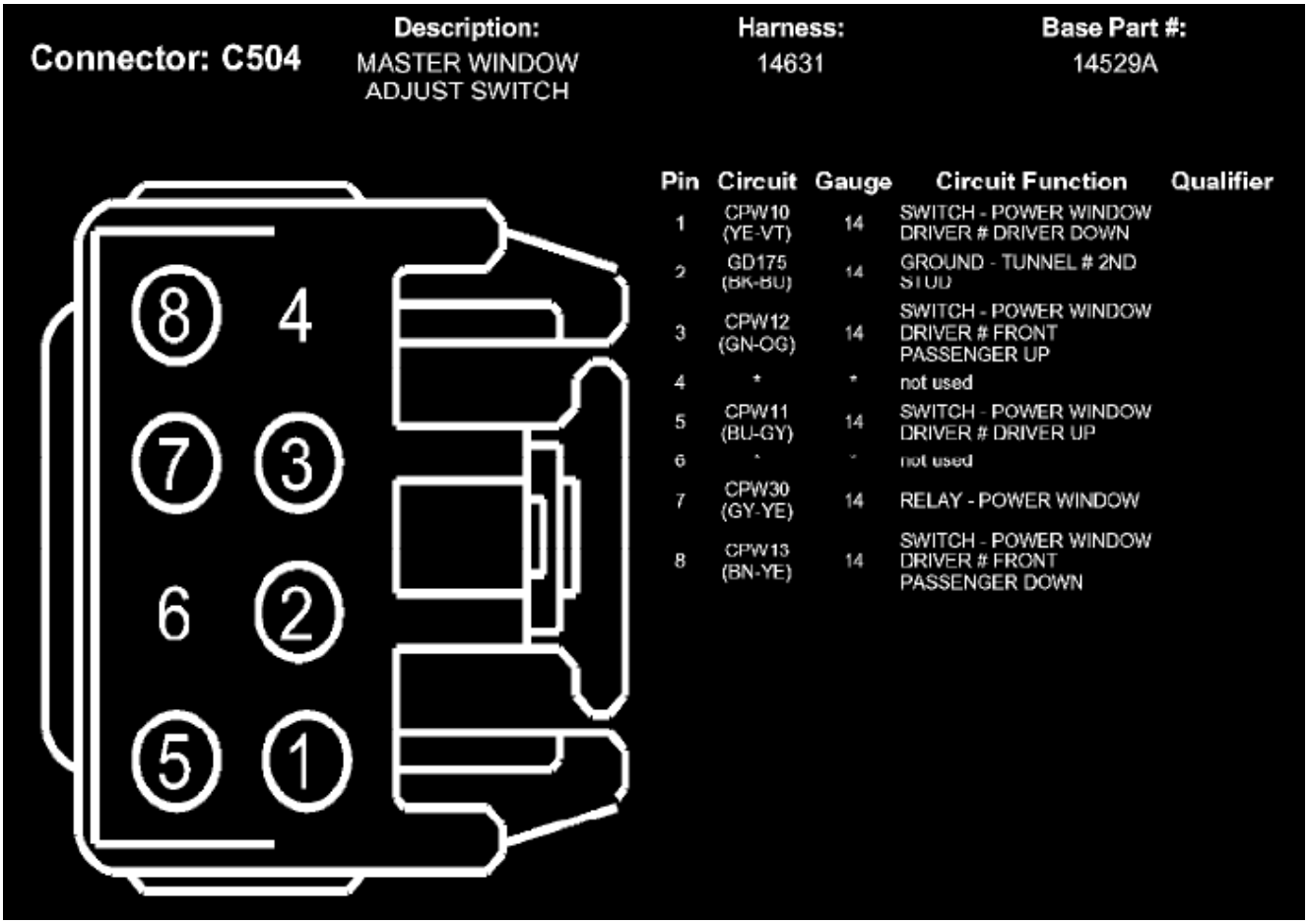
Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Windows and Glass > Sensors and Switches - Windows and Glass > Power Window Switch > Component Information > Locations > Master Window Adjust Switch



View 151-20


C604
Window adjust switch, passenger side
C622
Exterior rear view mirror, right
C605
Door lock switch, passenger side
14630
C612
Speaker, right front
C602
Door ajar switch, right front
C603
Door lock actuator, right front
C608
Power window motor, passenger side front
S600
front of vehicle

View 151-21


Connector: C504
Description:
MASTER WINDOW ADJUST SWITCH
Harness:
14631
Base Part #:
14529A
8
4
7
3
6
2
5
1
Pin Circuit Gauge Circuit Function Qualifier
1 CPW10 (YE-VT) 14 SWITCH - POWER WINDOW DRIVER # DRIVER DOWN
2 GD175 (BK-BU) 14 GROUND - TUNNEL # 2ND STUD
3 CPW12 (GN-OG) 14 SWITCH - POWER WINDOW DRIVER # FRONT PASSENGER UP
4 * * not used
5 CPW11 (BU-GY) 14 SWITCH - POWER WINDOW DRIVER # DRIVER UP
6 * * not used
7 CPW30 (GY-YE) 14 RELAY - POWER WINDOW
8 CPW13 (BN-YE) 14 SWITCH - POWER WINDOW DRIVER # FRONT PASSENGER DOWN

C504

Connector: C604

Description:	Harness:	Base Part #:
WINDOW ADJUST SWITCH, PASSENGER SIDE	14630	14529

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPW12 (GN-OG)	14	SWITCH - POWER WINDOW DRIVER # FRONT PASSENGER UP	
2	CPW19 (VT)	14	SWITCH - POWER WINDOW FRONT PASSENGER # DOWN	
3	CPW14 (VT-WH)	14	SWITCH - POWER WINDOW DRIVER # PASSENGER LOCK OUT (ENABLE)	
4	*	*	not used	
5	CPW20 (WH-OG)	14	SWITCH - POWER WINDOW FRONT PASSENGER # UP	
6	CPW13 (BN-YE)	14	SWITCH - POWER WINDOW DRIVER # FRONT PASSENGER DOWN	

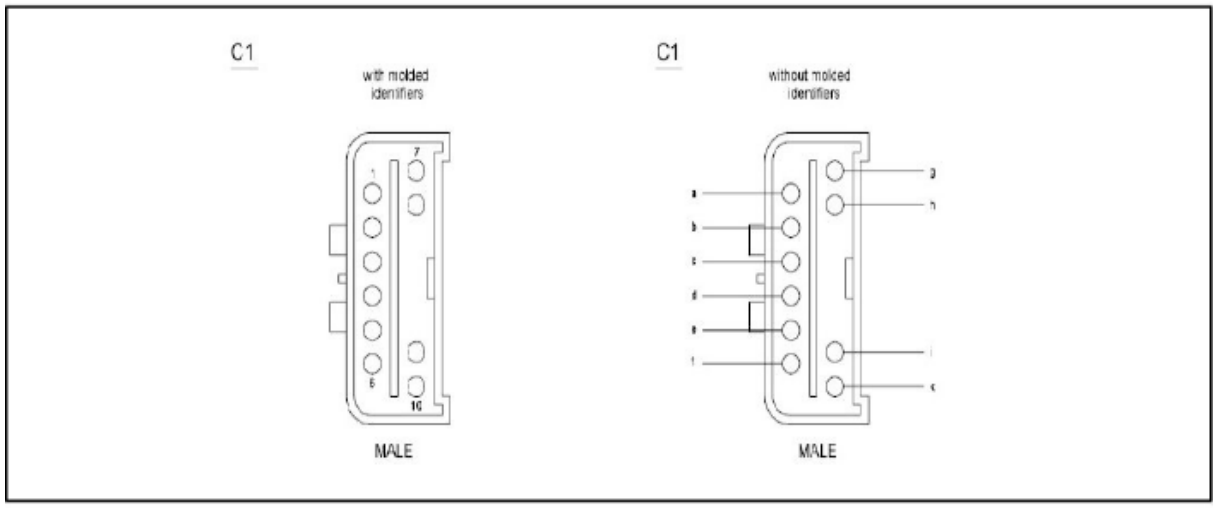
C604

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step by step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals

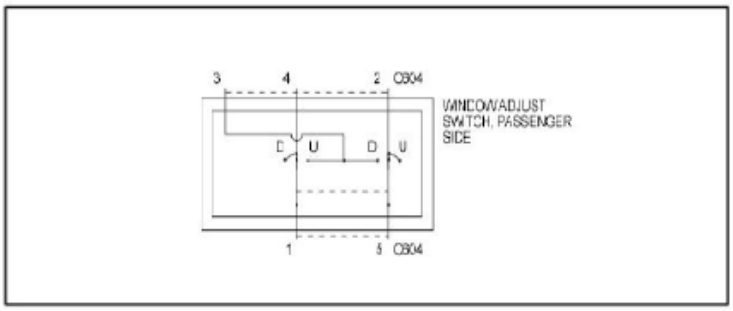


The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

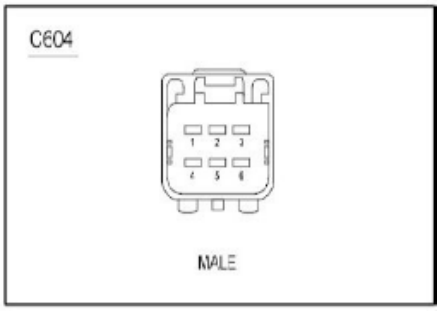
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Power Window Switch, Passenger Door

Schematic



Terminals



Component testing procedure

Circuit to test	Connect self-powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
Window adjust switches	3 and 1 4 and 5	Up	Closed circuit
	3 and 5 1 and 2	Down	Closed circuit
	4 and 5 2 and 1	Off	Closed circuit

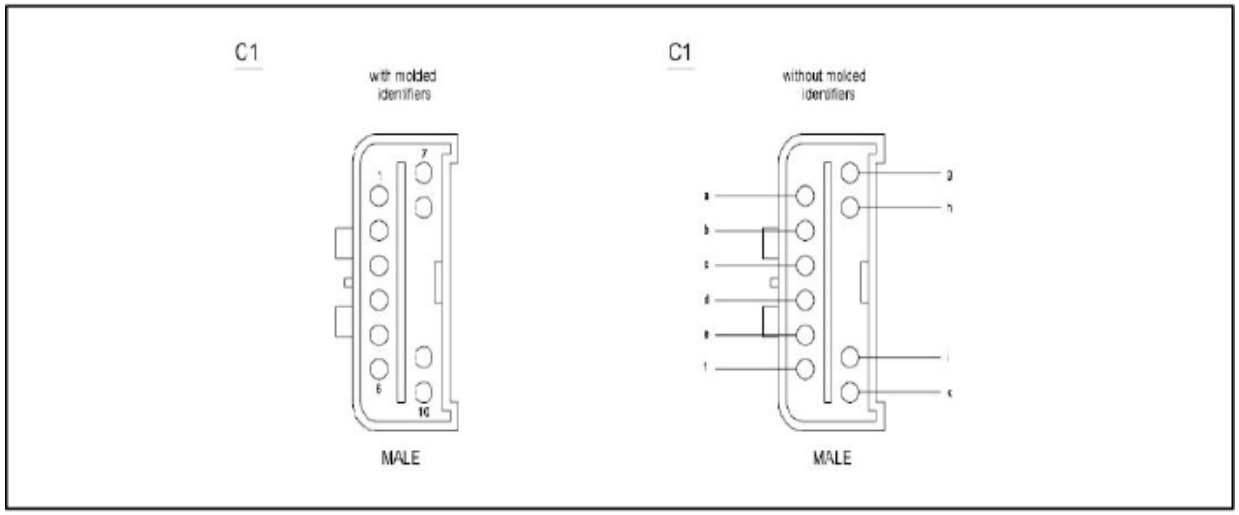
Power Window Switch: Testing and Inspection Power Window Switch, Passenger Door

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals

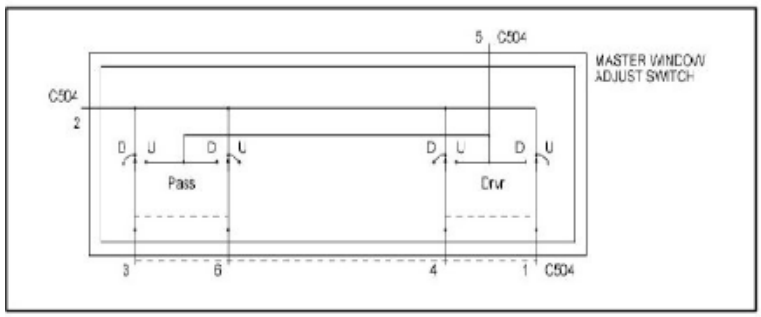


The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

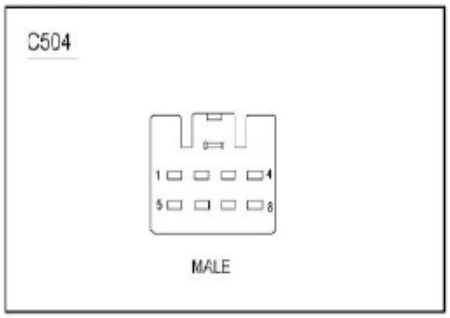
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Master window adjust switch

Schematic



Terminals

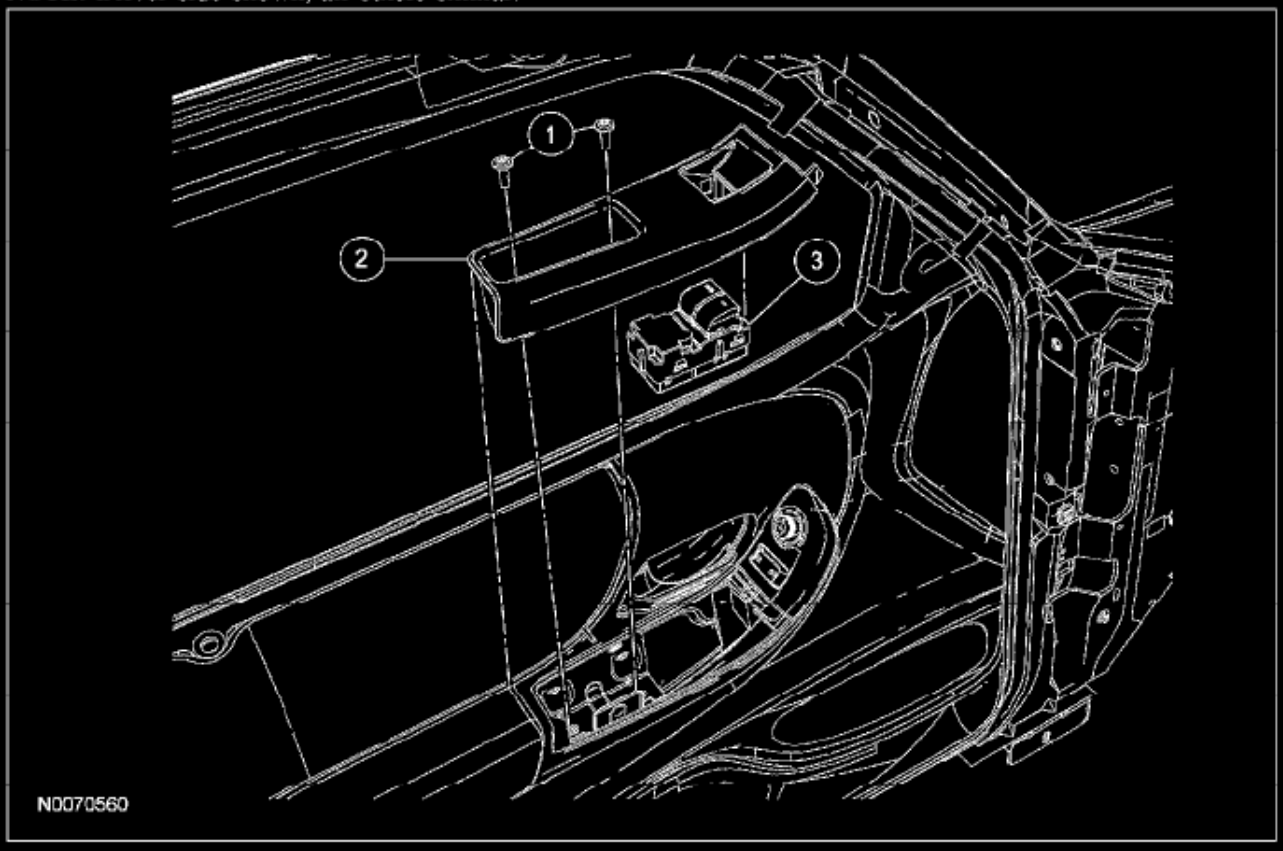


Component testing procedure

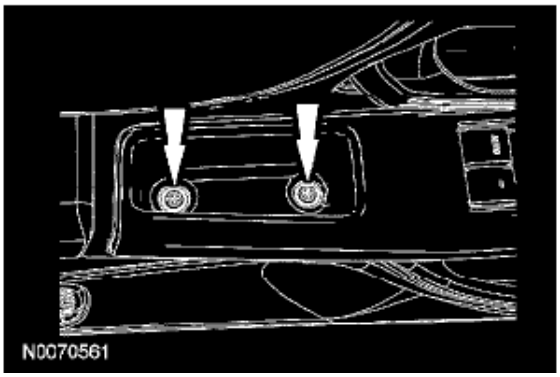
Circuit to test	Connect self-powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
Driver window circuit	5 and 4, 2 and 1	Up	Closed circuit
	5 and 1, 2 and 4	Down	Closed circuit
	2 and 4, 2 and 1	Rest	Closed circuit
Passenger window circuit	5 and 3, 2 and 6	Up	Closed circuit
	5 and 6, 2 and 3	Down	Closed circuit
	2 and 6, 2 and 3	Rest	Closed circuit

Power Window Switch: Testing and Inspection Master Window Adjust Switch

NOTE: Driver side shown, all others similar.



Item	Part Number	Description
1	56912-S	Finish panel screws (2 required)
2	14528	Finish panel
3	14529	Window control switch



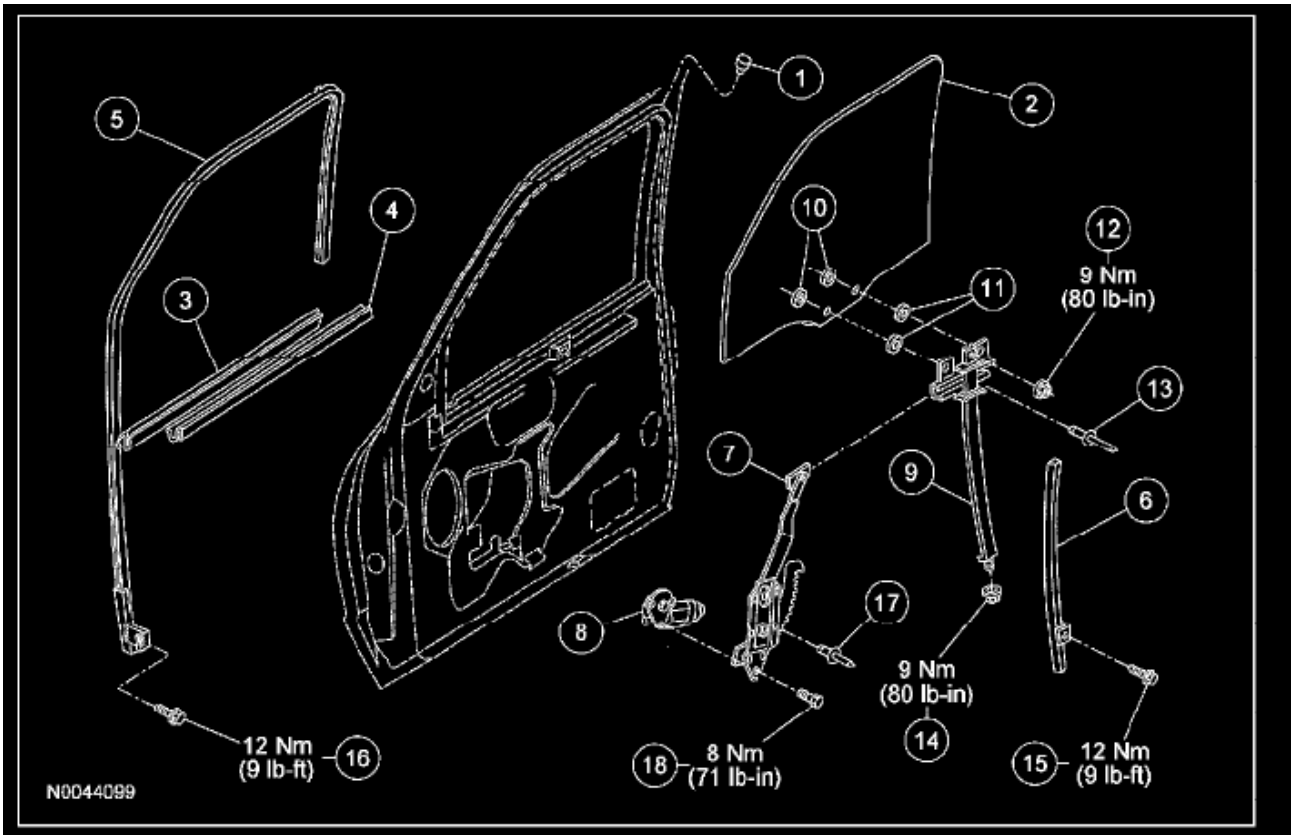
Power Window Switch: Service and Repair

WINDOW CONTROL SWITCH

Removal and Installation

1. Remove the door trim panel finish panel screws.

2. Remove the door trim panel finish panel. 3. Disconnect the electrical connector. 4. Remove the window control switch from the finish panel. 5. To install, reverse the removal procedure.



Item	Part Number	Description
1	N805277-S	Rivet
2	21410	Door glass
3	21452A	Door glass weatherstrip-outer
4	21452B	Door glass weatherstrip-inner
5	21546	Door glass top run
6	222A00	Door glass channel
7	23208	Regulator assembly
8	23394	Motor assembly
9	23288	Center door glass run
10	234A46	Spacers (2 required)
11	234A44	Spacers (2 required)

(Continued)

Item	Part Number	Description
12	N621907-S	Center door glass run nut
13	W525175-S	Window glass rivet (2 required)
14	N621907-S	Center door glass run nut
15	N6066676-S	Door glass channel bolt
16	N6066676-S	Door glass top run bolt
17	W525172-S	Window regulator rivet
18	N808650-S	Window regulator bolt

Special Tool(s)

ST1132-A	Heavy Duty Riveter or equivalent 501-D011 (D80L-23200-A)

Front Door Window Motor: Service and Repair

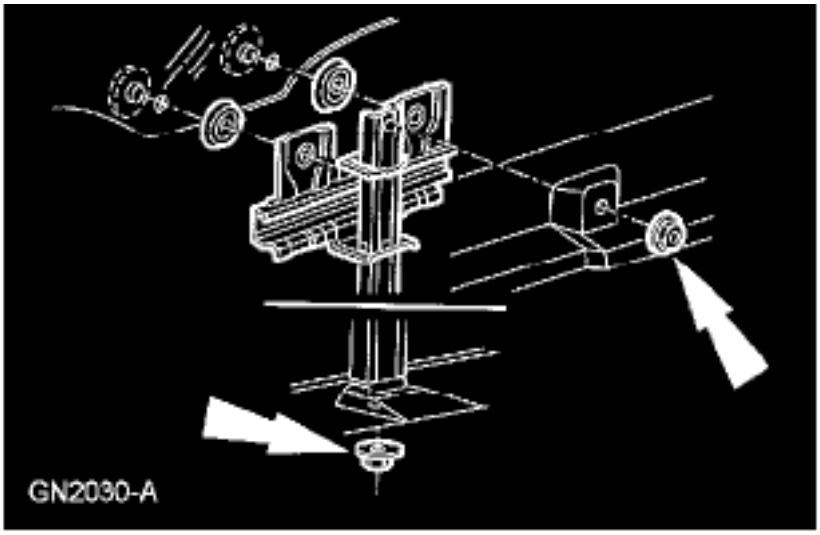
WINDOW REGULATOR AND MOTOR - FRONT DOOR

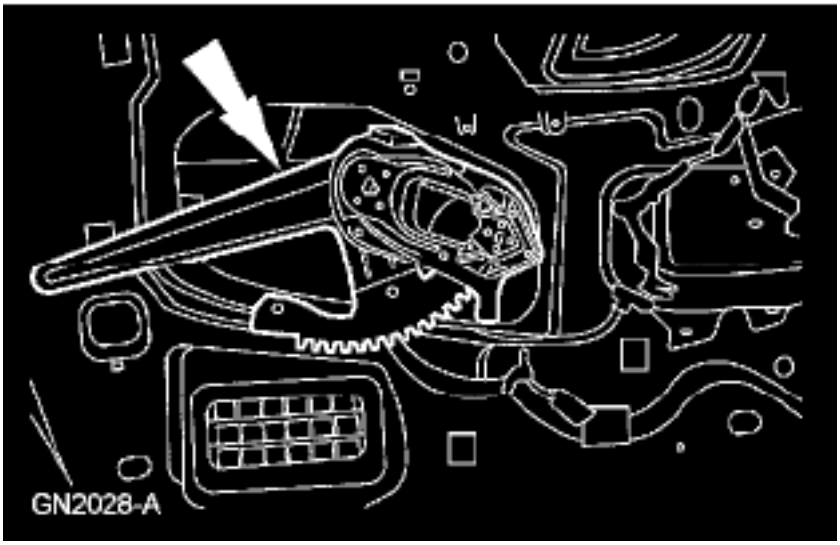
Exploded View

Special Tool(s)

Special Tool(s)

Removal and Installation





1. Remove the door trim panel. 2. Remove the watershield. 3. Support the window glass. 4. If equipped, disconnect the power window motor electrical connector. 5. Remove the top and bottom center door glass run retainer nuts.

- To install, tighten to 9 Nm (80 lb-in).

6. NOTE:

- To remove the rivets, use a drift punch to remove the steel centers and a 6.35 mm (1/4 in) diameter drill bit to remove the rivets.

- The power window regulator has 4 rivets; the manual has 3.

Remove the window regulator rivets. -

Remove the steel centers and rivets.

7. Remove the window regulator.

8. WARNING: When removing the window regulator motor, place the window in the full upward position or block the window regulator

arm to help prevent the counterbalance spring from unwinding with high force. Failure to follow this instruction may result in serious personal injury.

If necessary, remove the window glass motor. -

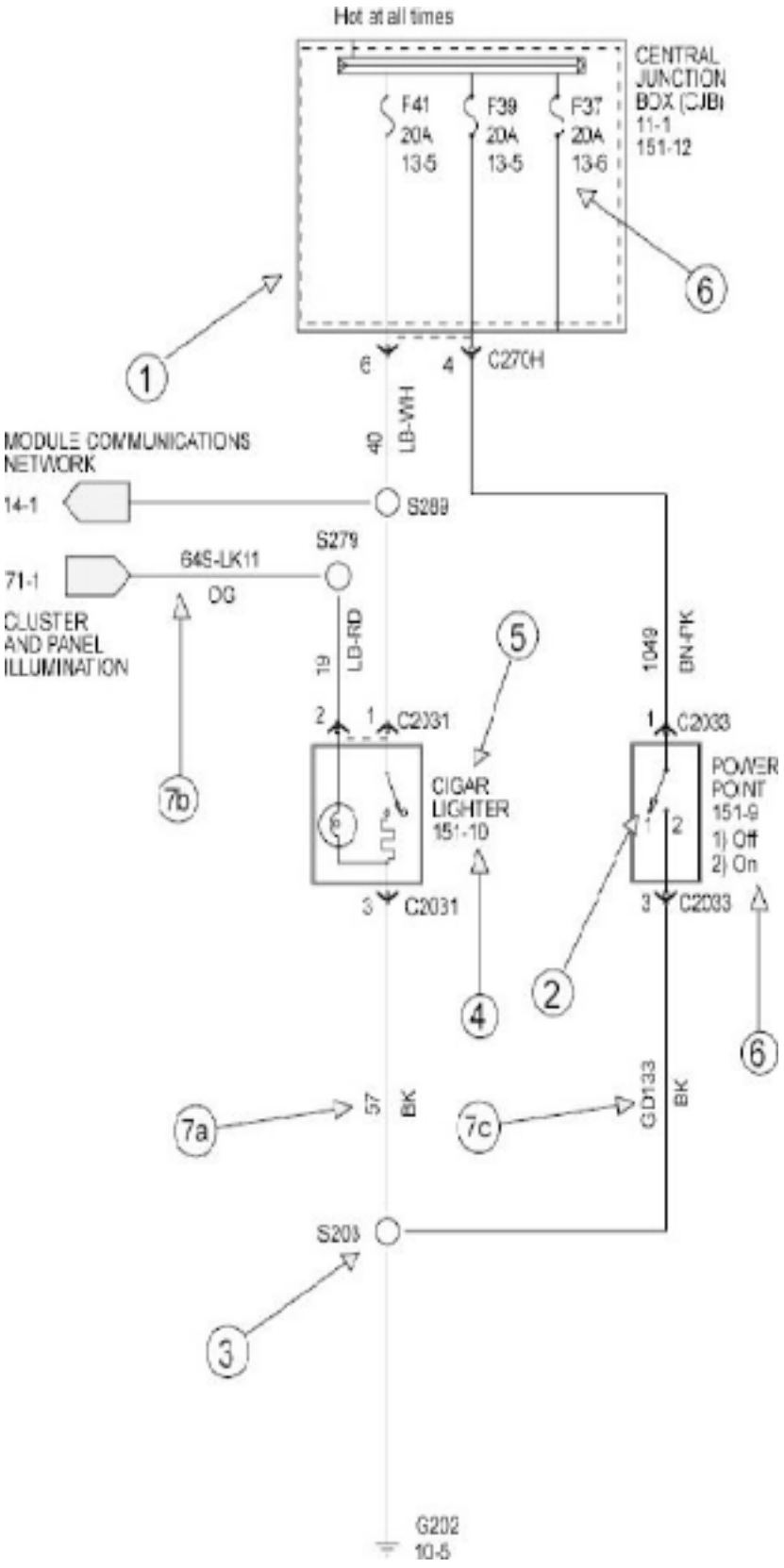
Remove the bolts.

- To install, tighten to 8 Nm (71 lb-in).

9. To install, reverse the removal procedure.

- Use a heavy duty riveter to install the new rivets.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Windows and Glass > Windows > Power Window Relay > Component Information > Diagrams > Diagram Information and Instructions



Power Window Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

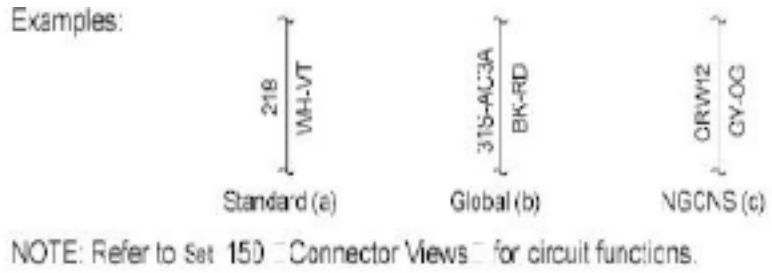
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

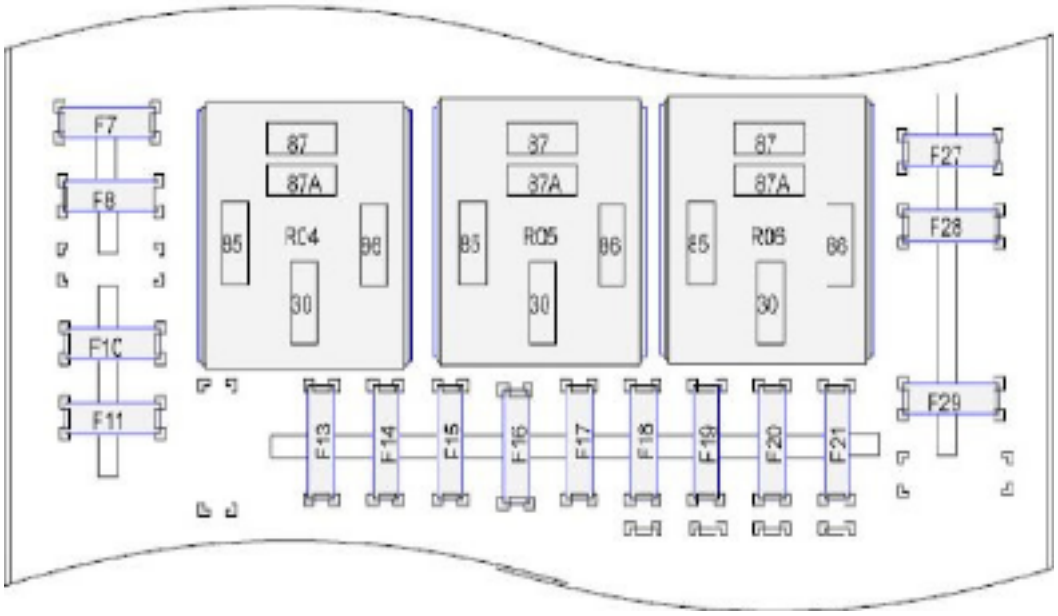
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

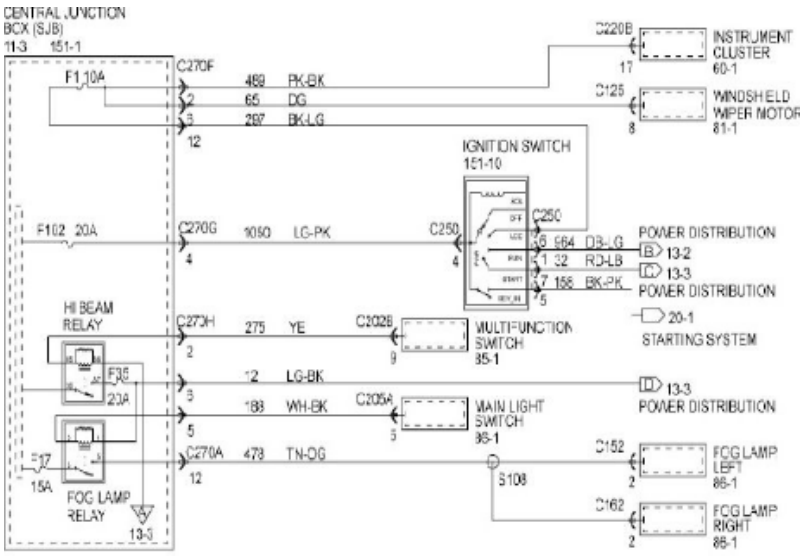
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

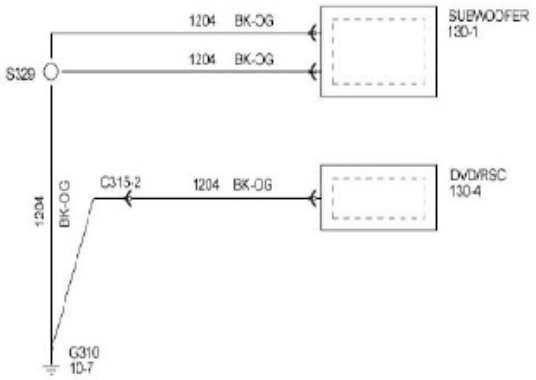
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

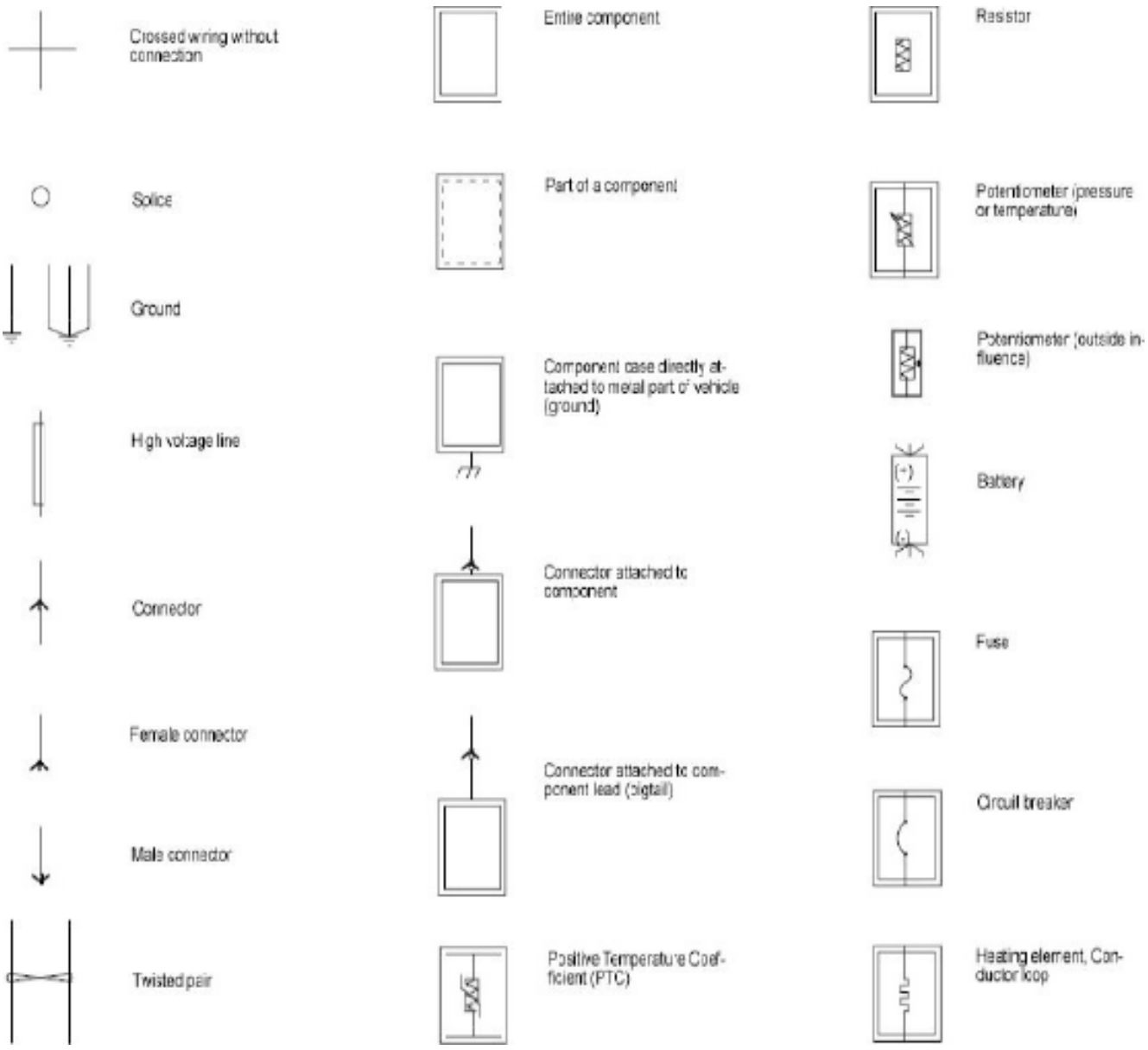
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

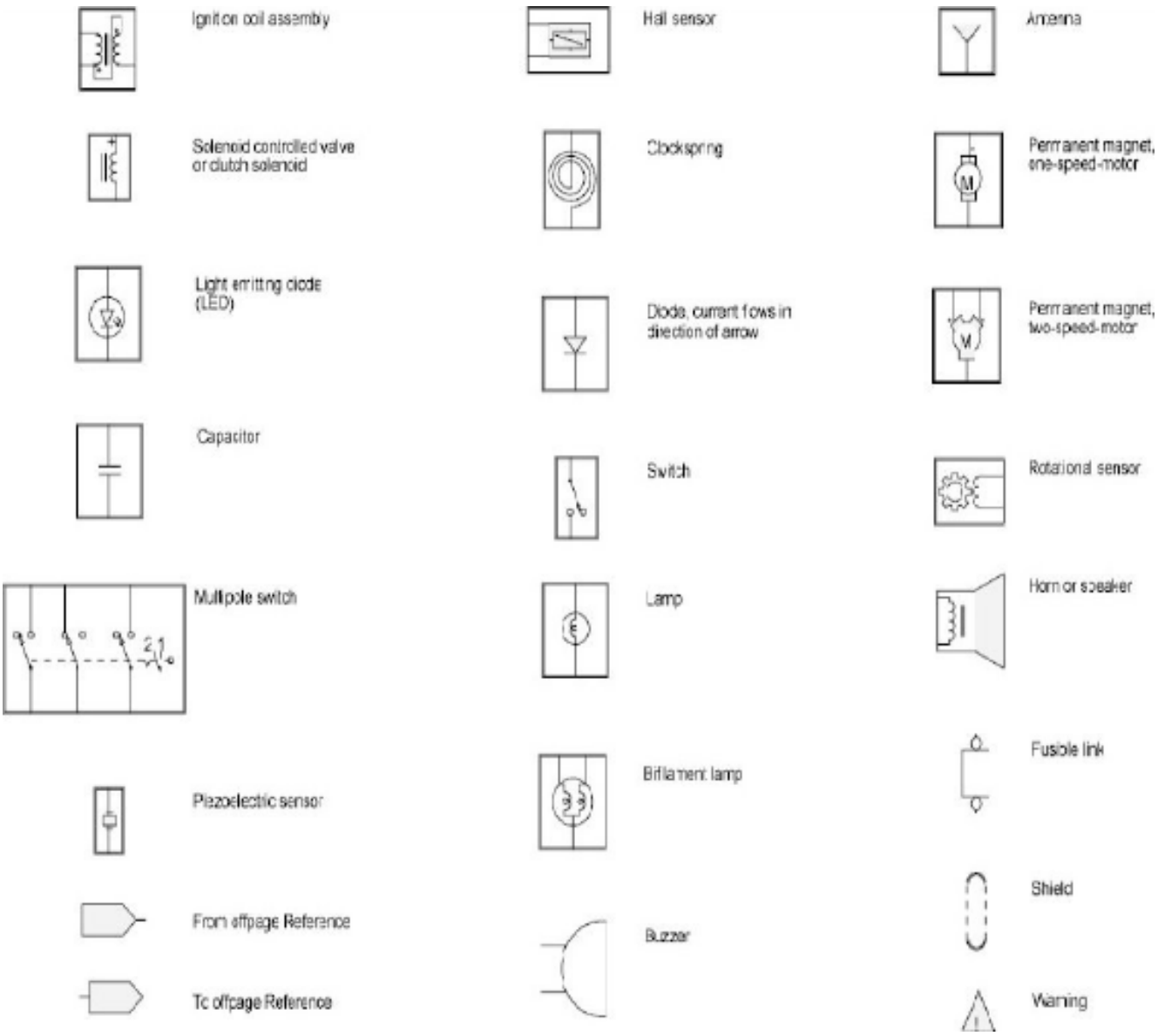
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

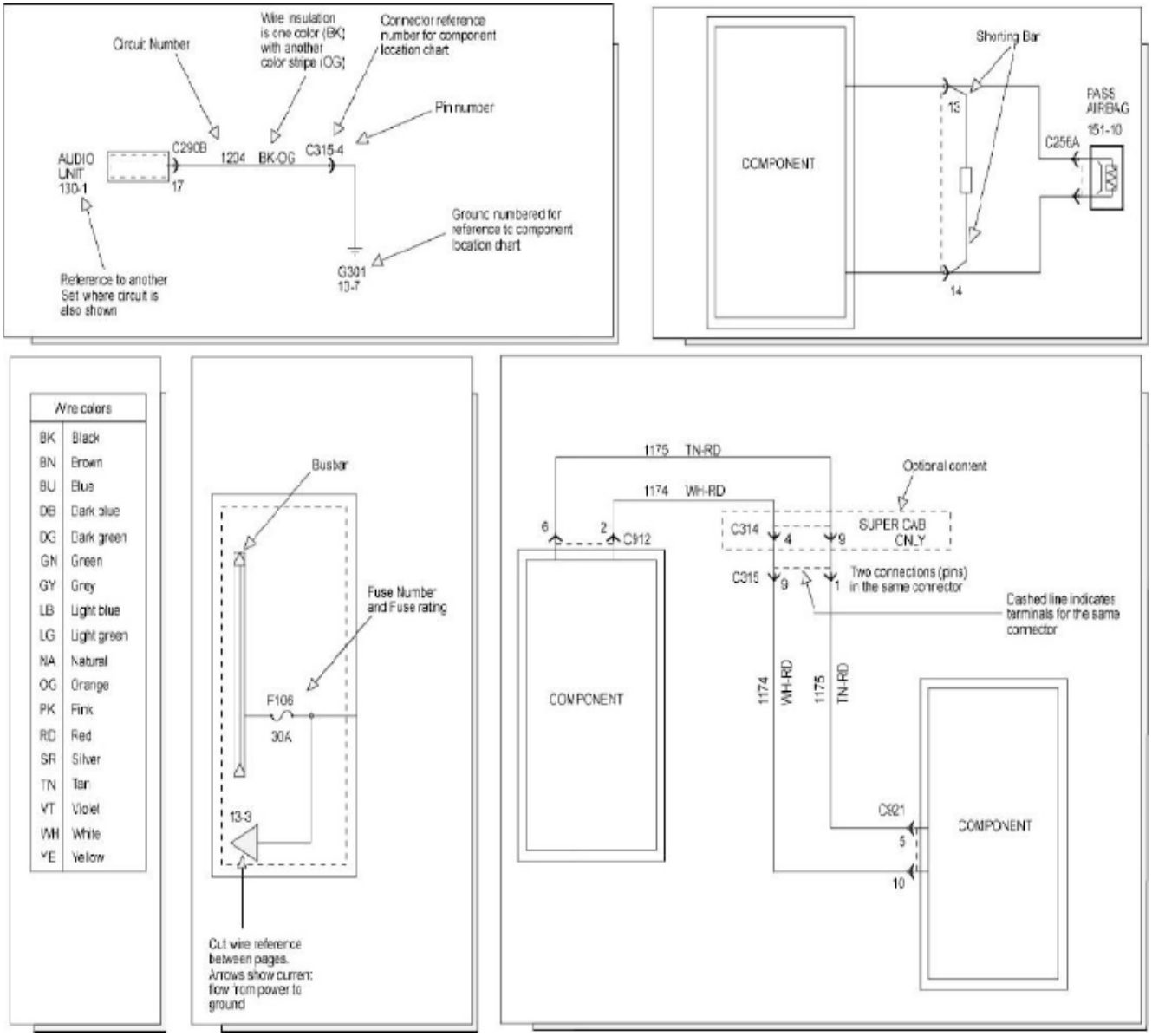
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

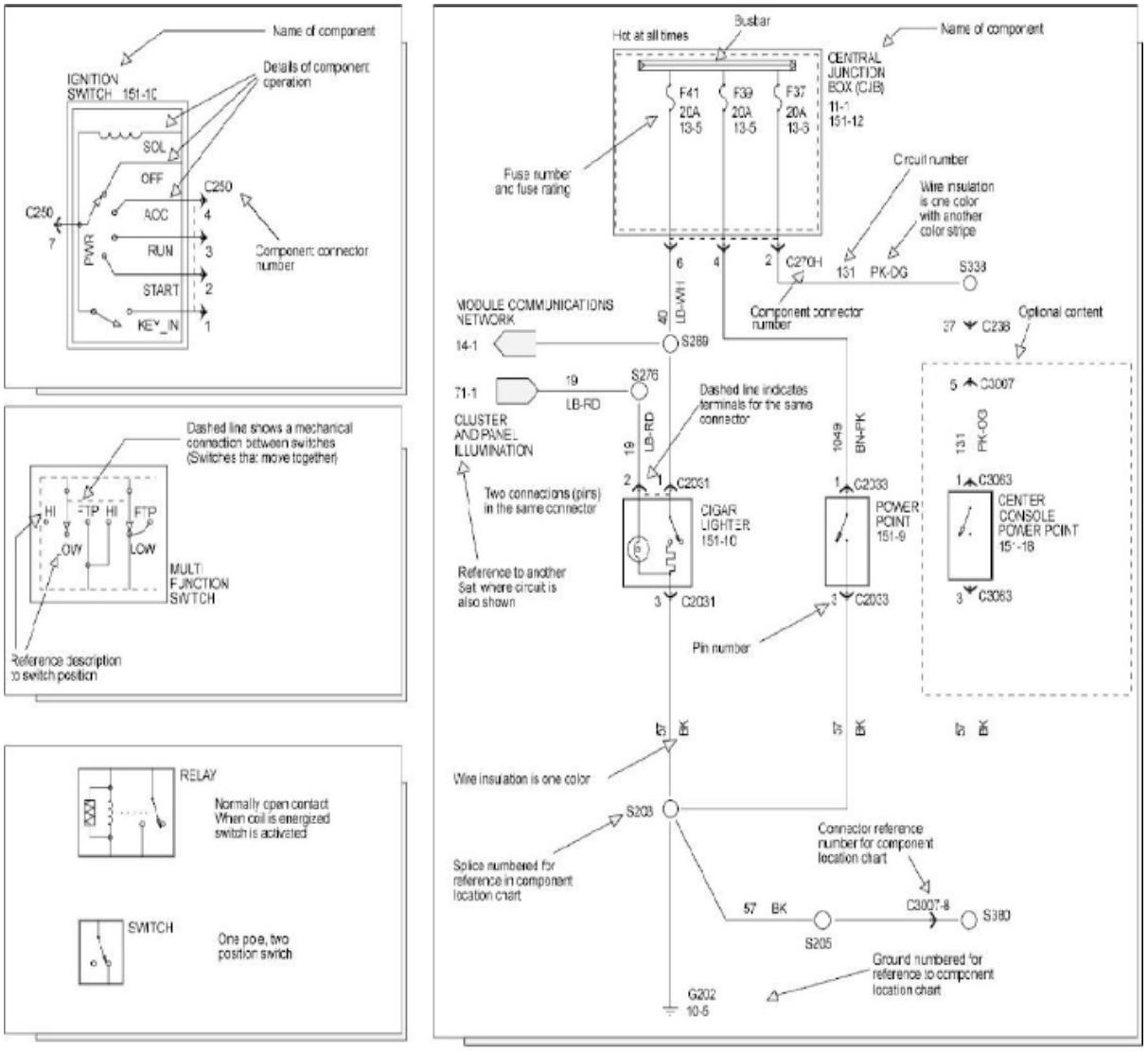
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

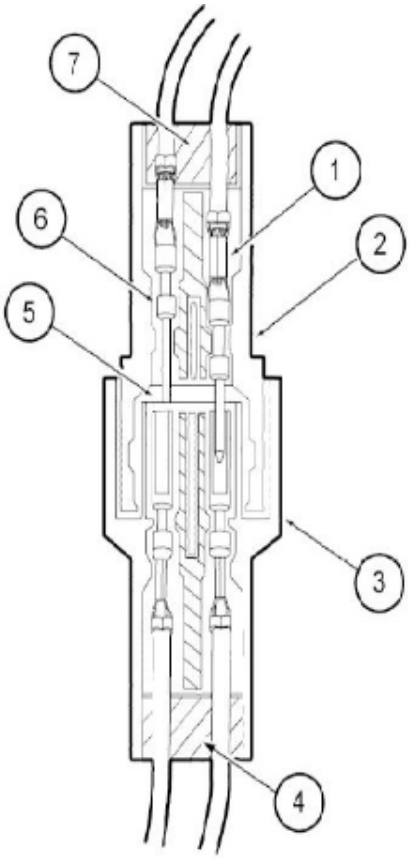


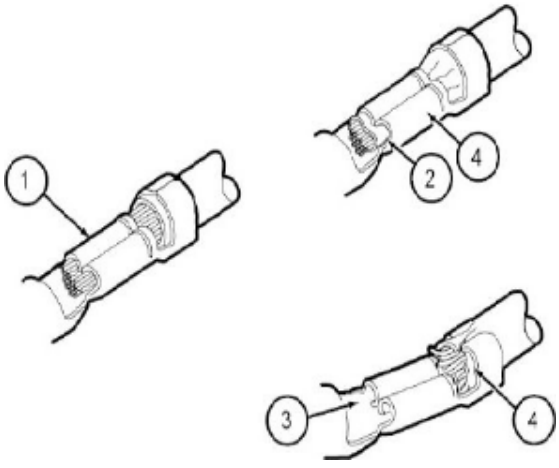
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Power Window Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

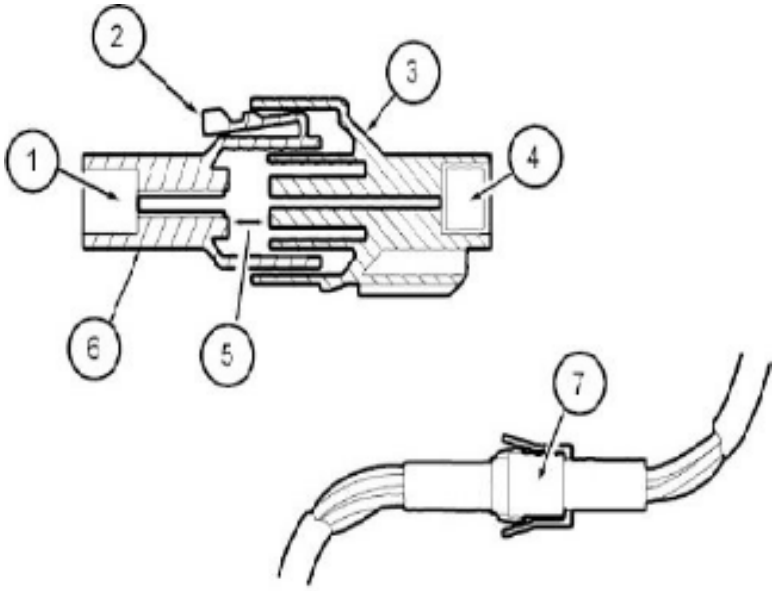
5 = Intermittent contact

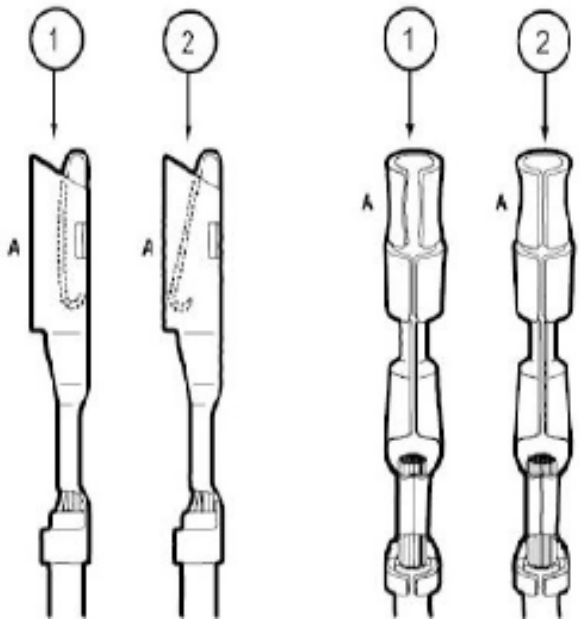
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

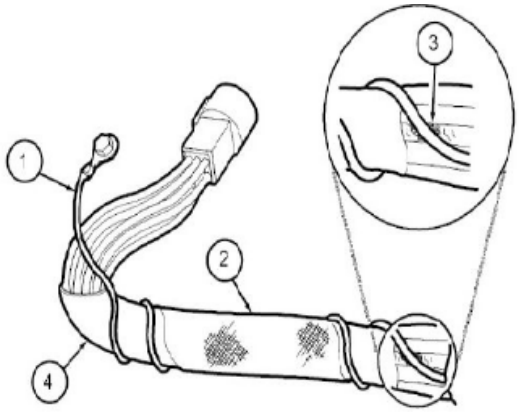
Deformed (enlarged) female terminals

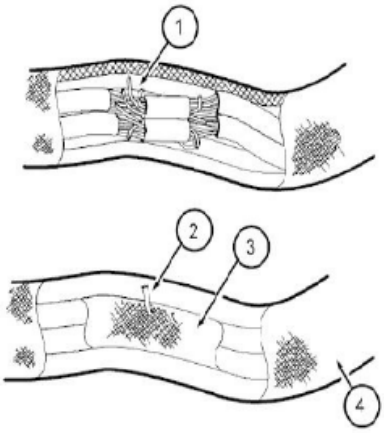
1 = Enlarged

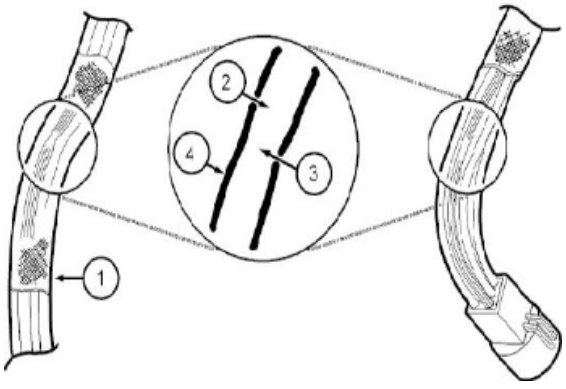
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

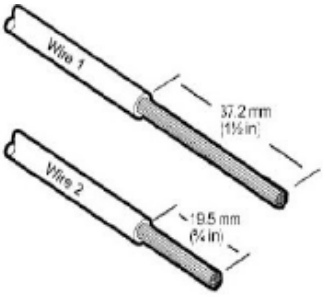
Splice covered 2

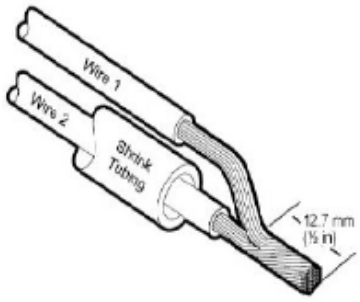
= Wire strand

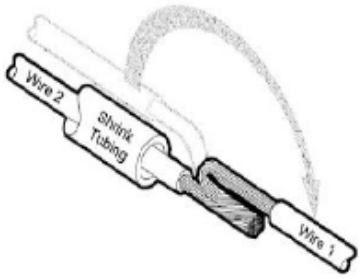
3 = Splice tape

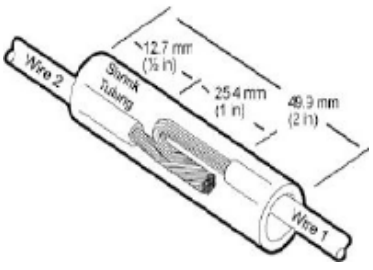
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

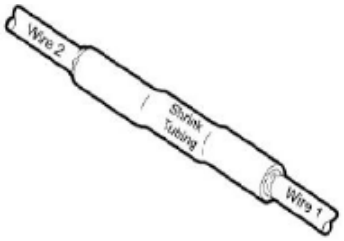
NOTE: -

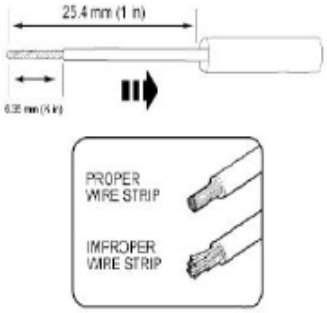
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

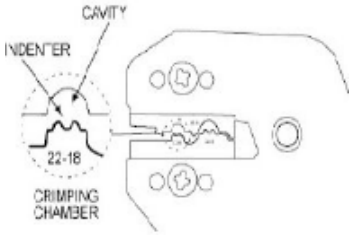
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

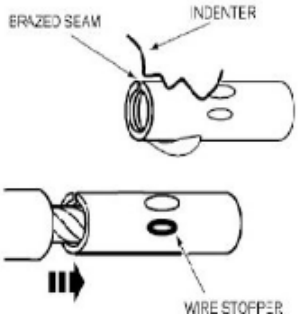
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

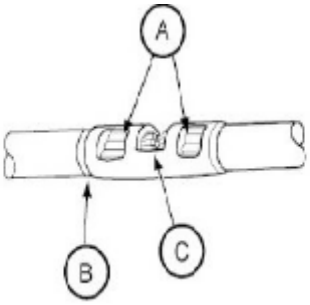
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

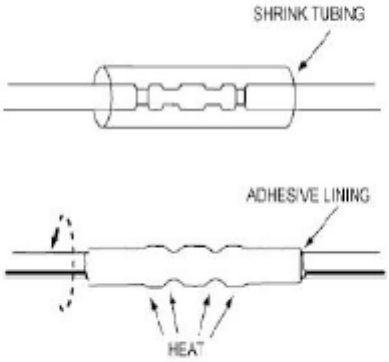
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4 strip, cut 9 strands	* 1/4 strip, cut 2 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip, fold 3x dia.
	16-14	* 1/4 strip, cut 7 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip fold 2x dia	1 strip, fold 3x dia.	1 1/4 strip, fold 4x dia.	Not Recommended
	12-10	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip fold 3x cia.	1 1/4 strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Figtail only

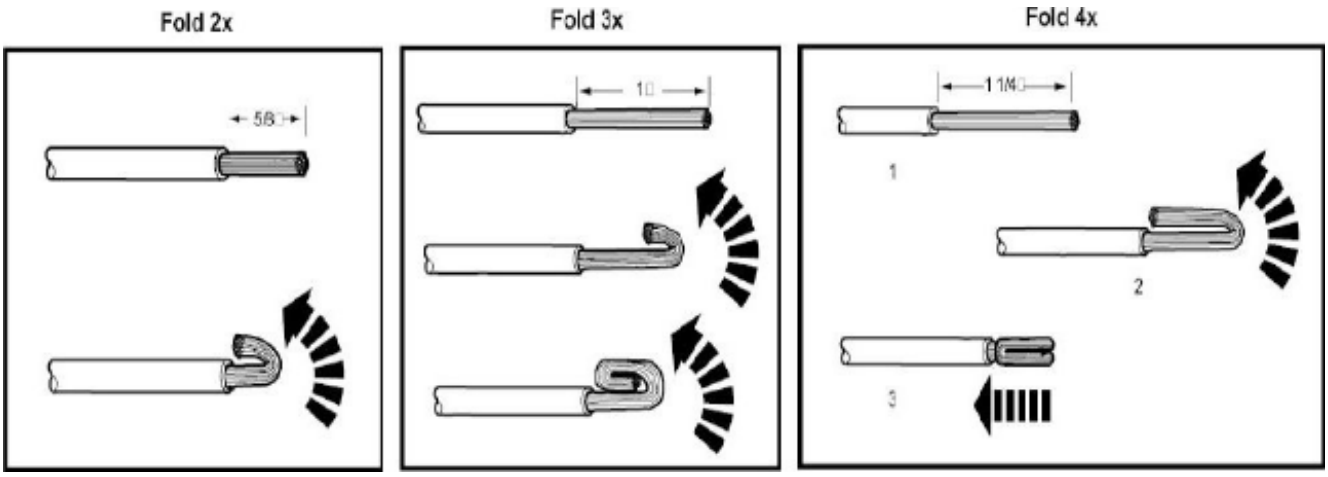
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



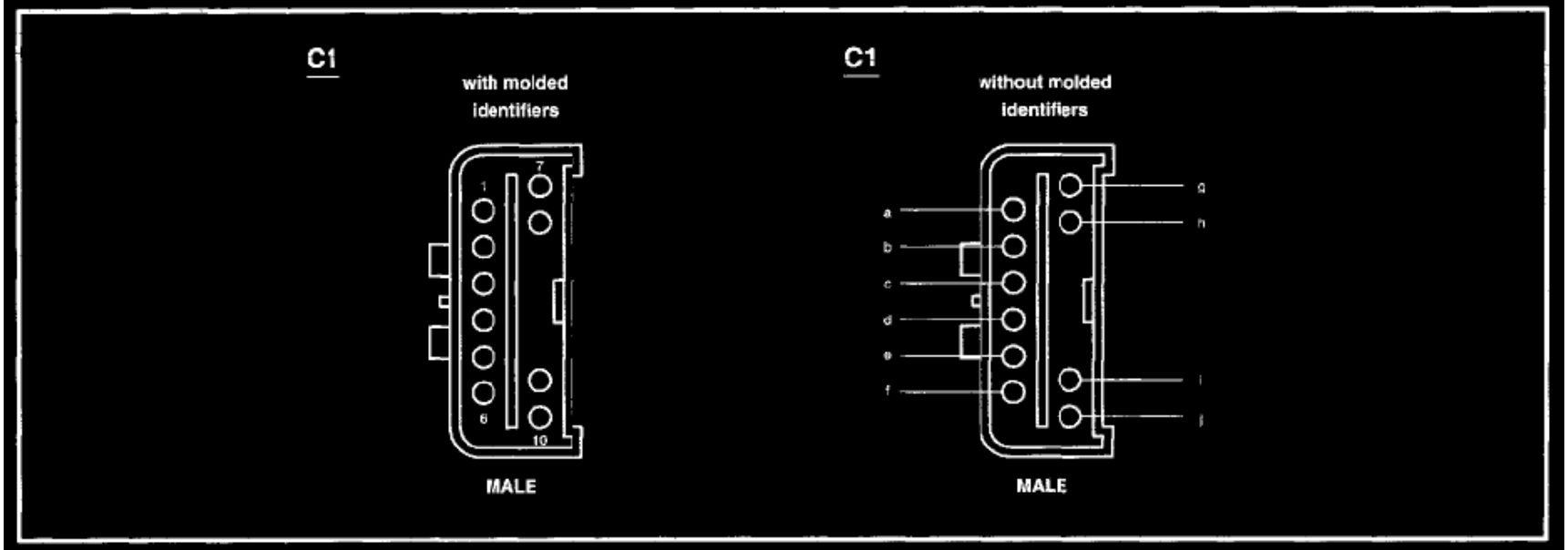
The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step–by–step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



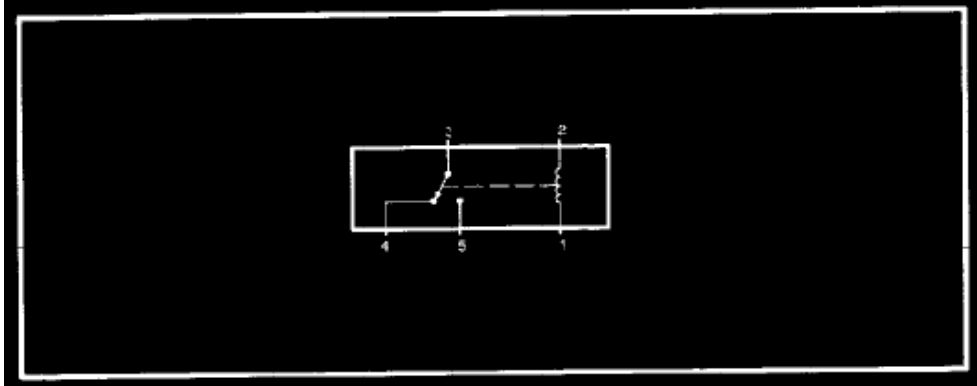
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

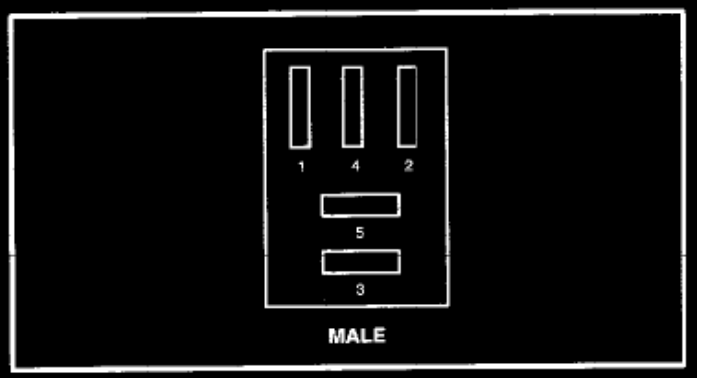
Power Window Relay: Testing and Inspection Micro ISO Relay

Relay – Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63–102Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil – Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

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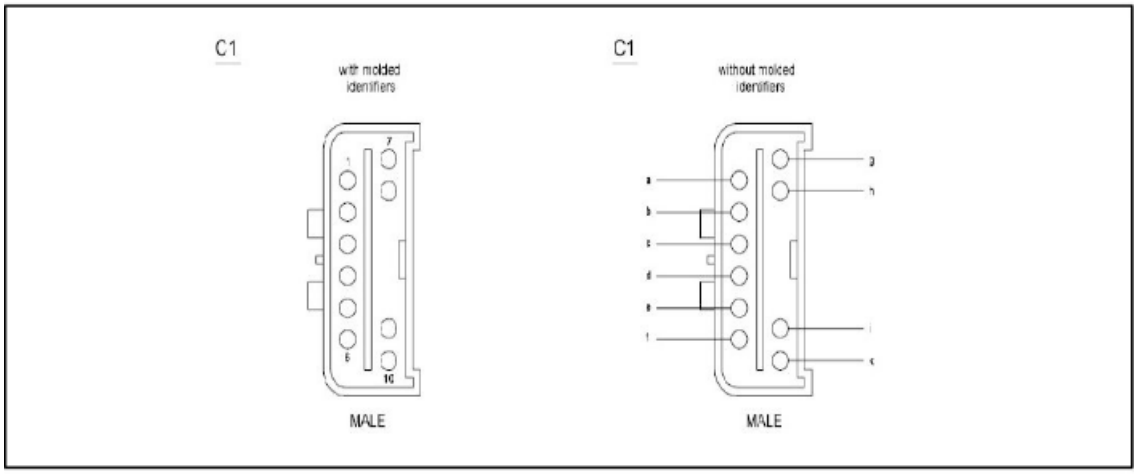
Terminals



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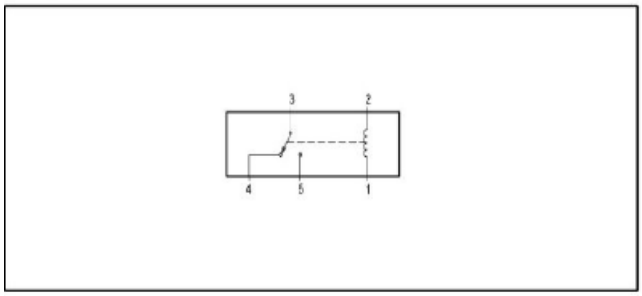
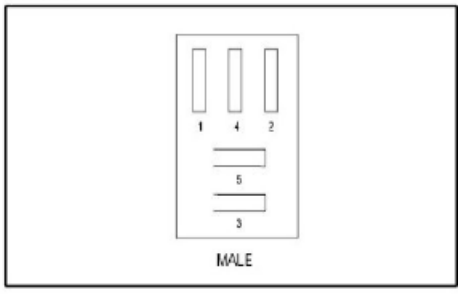
Relay □ Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63□102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil □ Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

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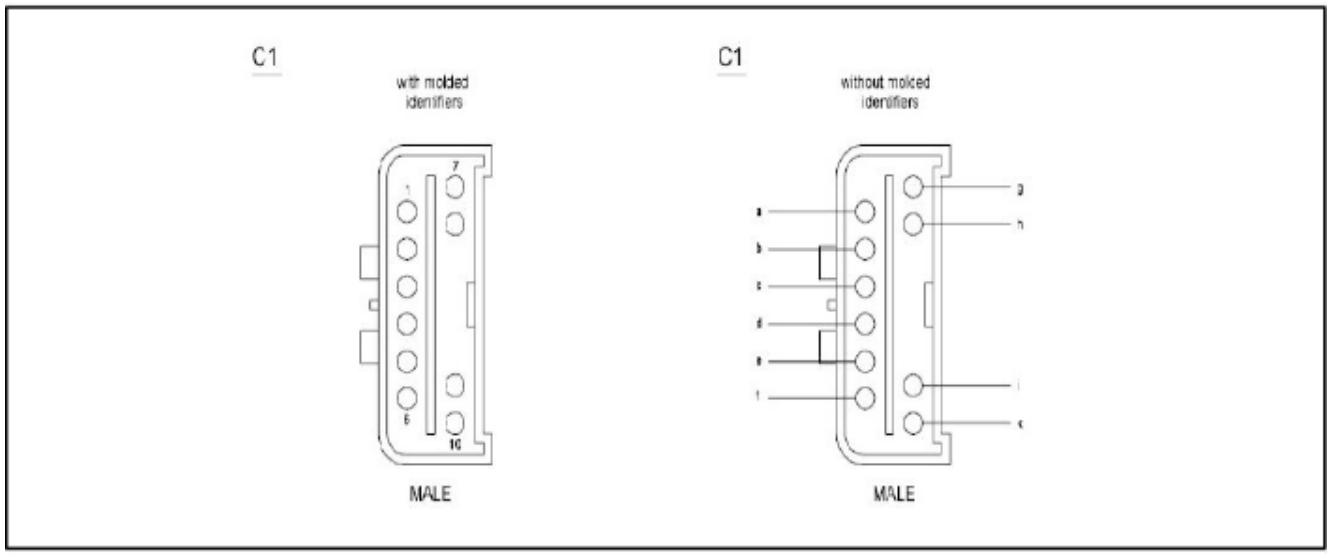
Terminals



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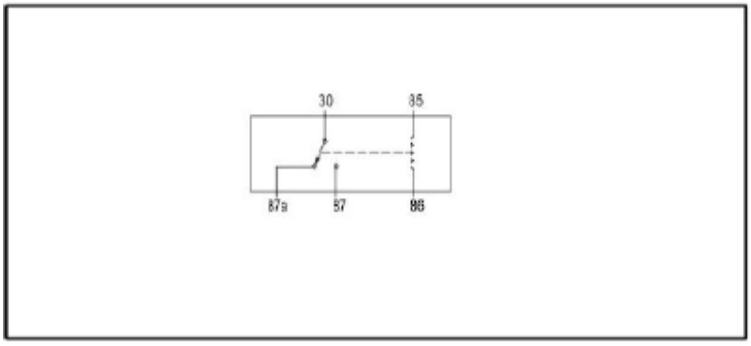
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

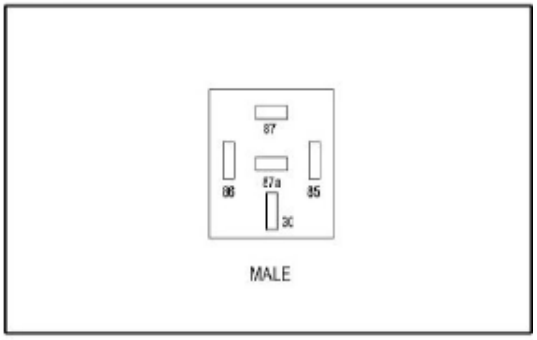
Power Window Relay: Testing and Inspection Mini ISO Relay

Relay □ Mini ISO

Schematic



Terminals



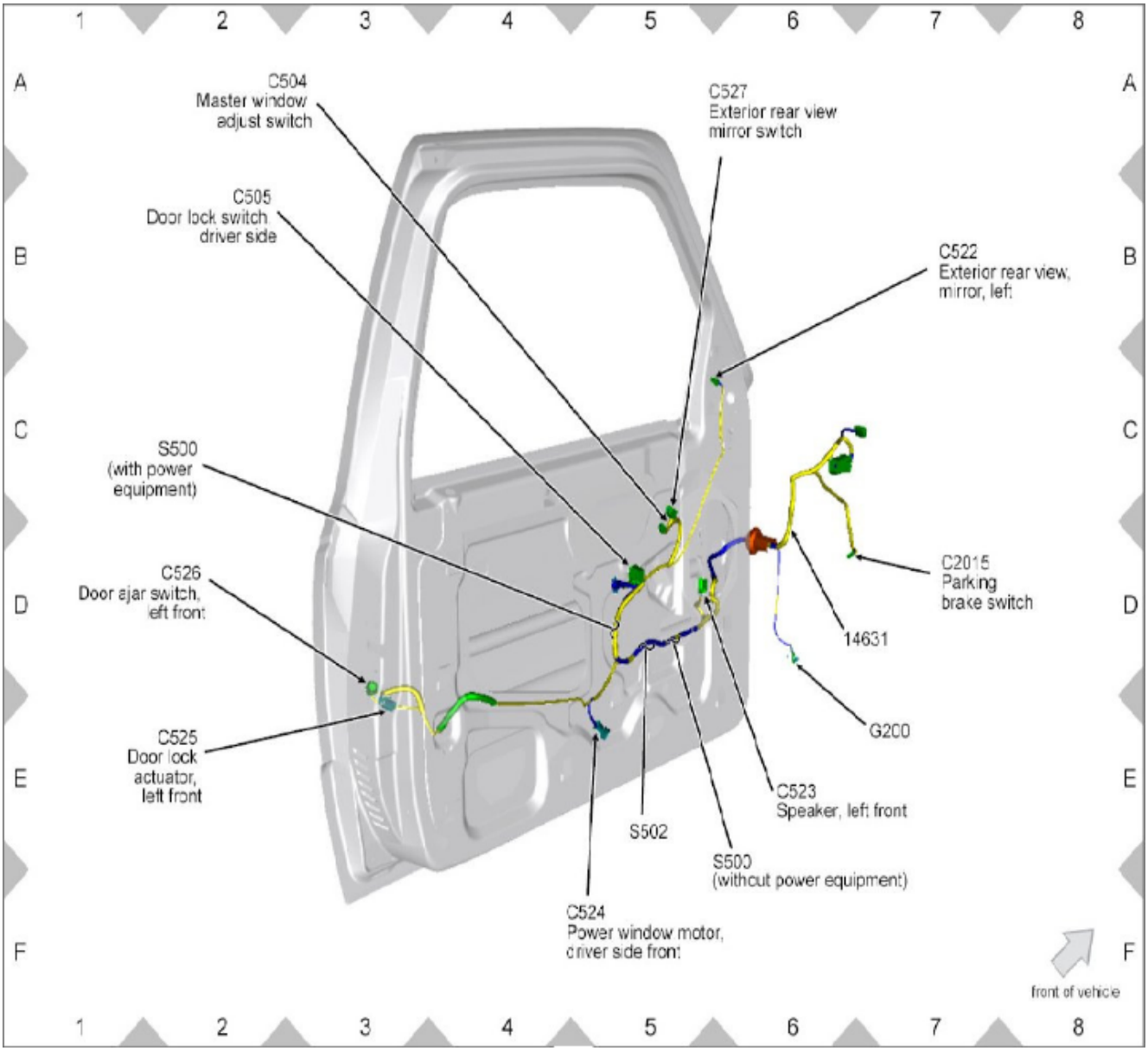
Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 □ 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

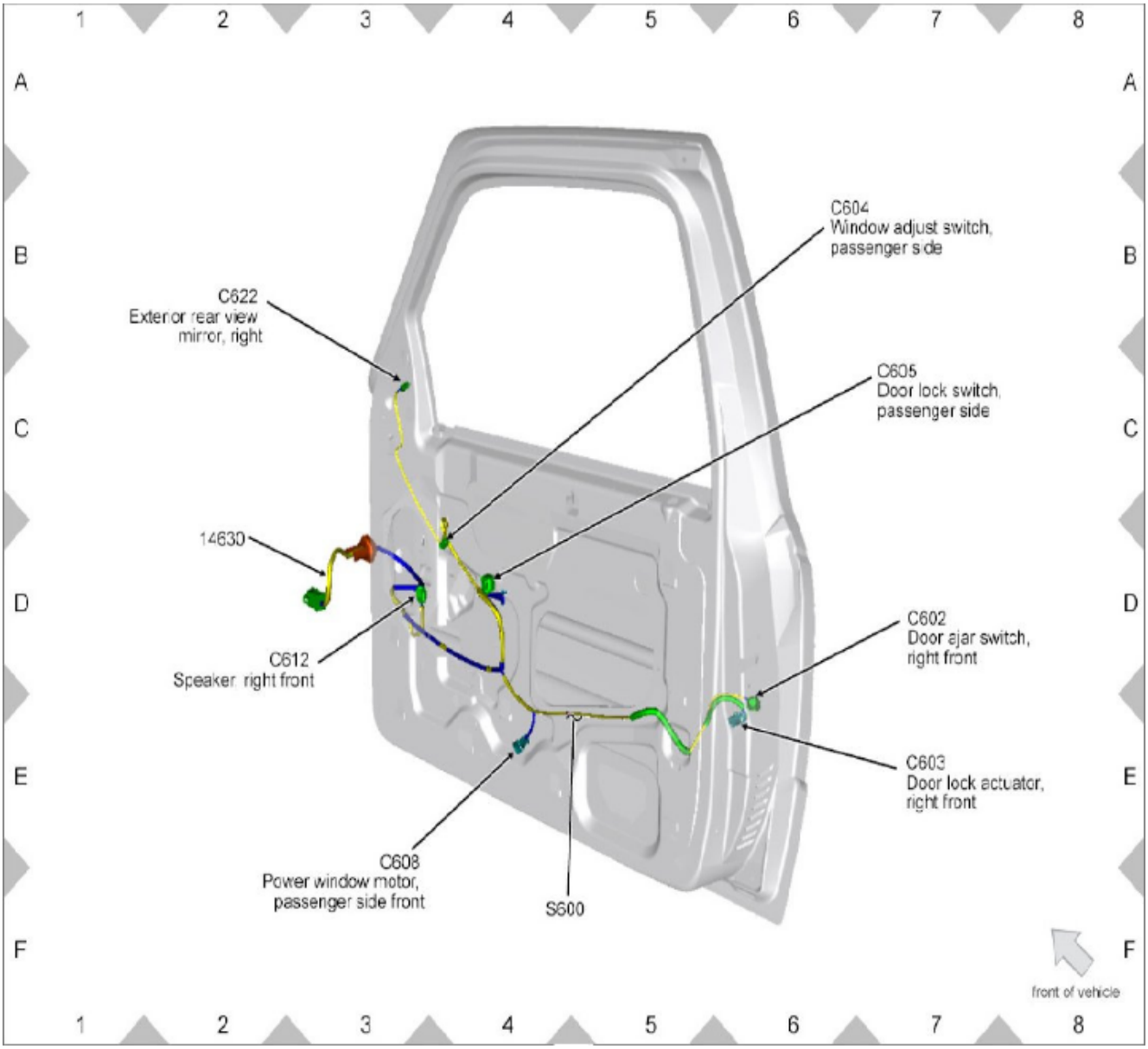
Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

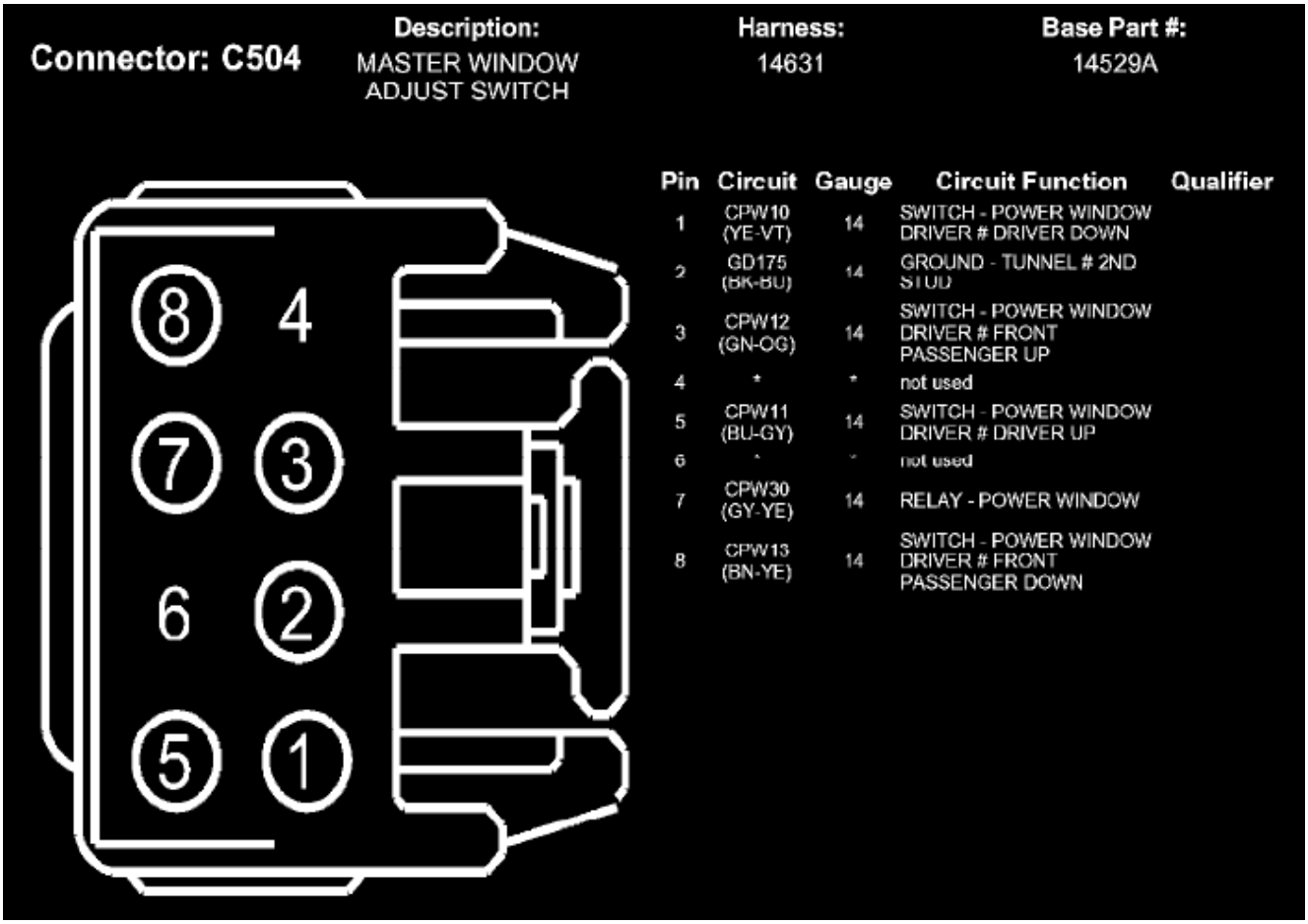
Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Windows and Glass > Windows > Power Window Switch > Component Information > Locations > Master Window Adjust Switch



View 151-20


C604
Window adjust switch, passenger side
C622
Exterior rear view mirror, right
C605
Door lock switch, passenger side
14630
C612
Speaker, right front
C602
Door ajar switch, right front
C603
Door lock actuator, right front
C608
Power window motor, passenger side front
S600
front of vehicle

View 151-21

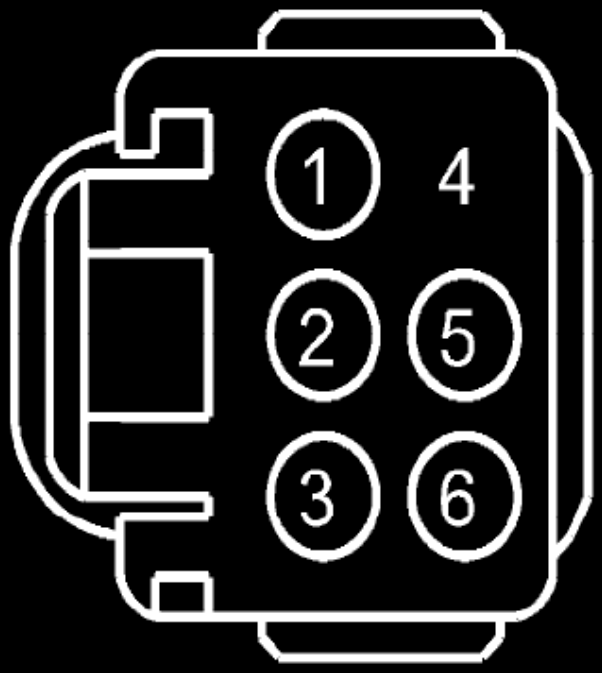


Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPW10 (YE-VT)	14	SWITCH - POWER WINDOW DRIVER # DRIVER DOWN	
2	GD175 (BK-BU)	14	GROUND - TUNNEL # 2ND STUD	
3	CPW12 (GN-OG)	14	SWITCH - POWER WINDOW DRIVER # FRONT PASSENGER UP	
4	*	*	not used	
5	CPW11 (BU-GY)	14	SWITCH - POWER WINDOW DRIVER # DRIVER UP	
6	*	*	not used	
7	CPW30 (GY-YE)	14	RELAY - POWER WINDOW	
8	CPW13 (BN-YE)	14	SWITCH - POWER WINDOW DRIVER # FRONT PASSENGER DOWN	

C504

Connector: C604

Description:	Harness:	Base Part #:
WINDOW ADJUST SWITCH, PASSENGER SIDE	14630	14529



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CPW12 (GN-OG)	14	SWITCH - POWER WINDOW DRIVER # FRONT PASSENGER UP	
2	CPW19 (VT)	14	SWITCH - POWER WINDOW FRONT PASSENGER # DOWN	
3	CPW14 (VT-WH)	14	SWITCH - POWER WINDOW DRIVER # PASSENGER LOCK OUT (ENABLE)	
4	*	*	not used	
5	CPW20 (WH-OG)	14	SWITCH - POWER WINDOW FRONT PASSENGER # UP	
6	CPW13 (BN-YE)	14	SWITCH - POWER WINDOW DRIVER # FRONT PASSENGER DOWN	

C604

Introduction

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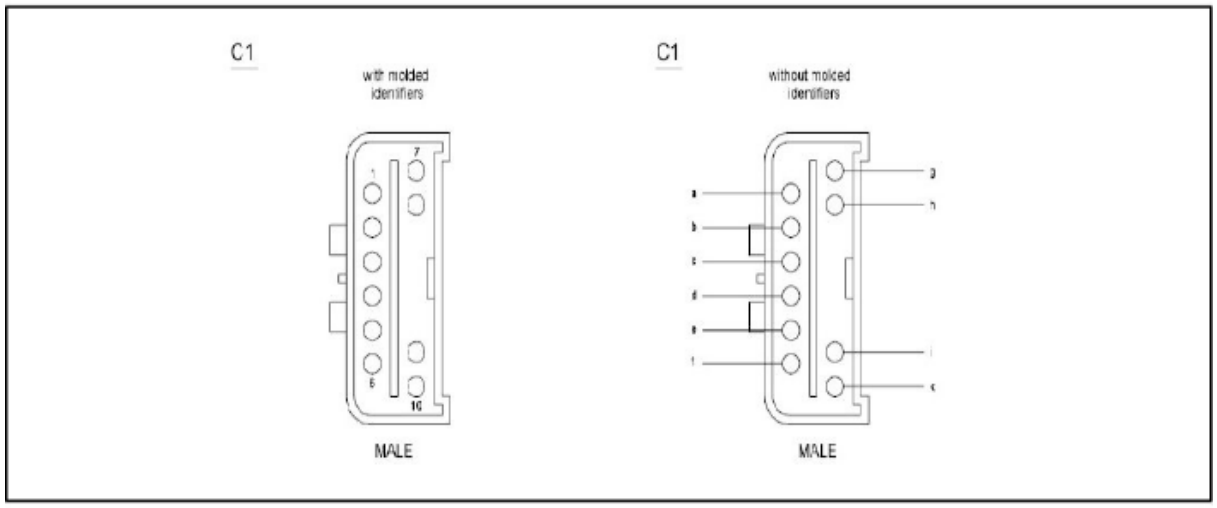
Terminals

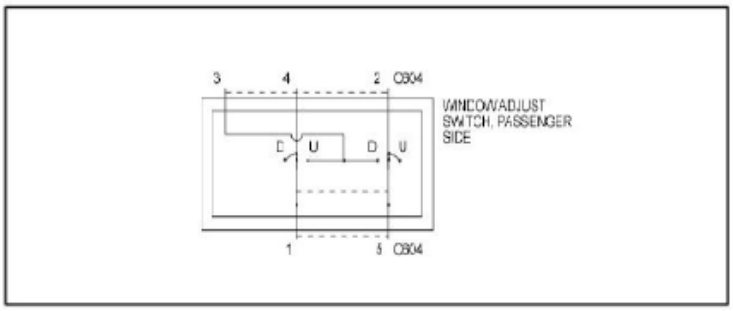


The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

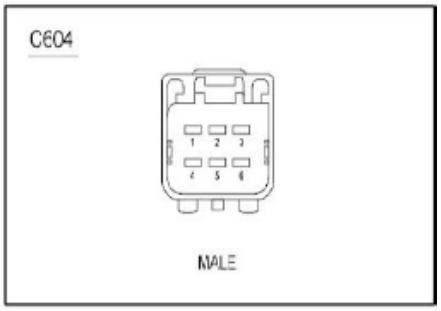
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Power Window Switch, Passenger Door

Schematic



Terminals



Component testing procedure

Circuit to test	Connect self-powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
Window adjust switches	3 and 1 4 and 5	Up	Closed circuit
	3 and 5 1 and 2	Down	Closed circuit
	4 and 5 2 and 1	Off	Closed circuit

Power Window Switch: Testing and Inspection Power Window Switch, Passenger Door

Introduction

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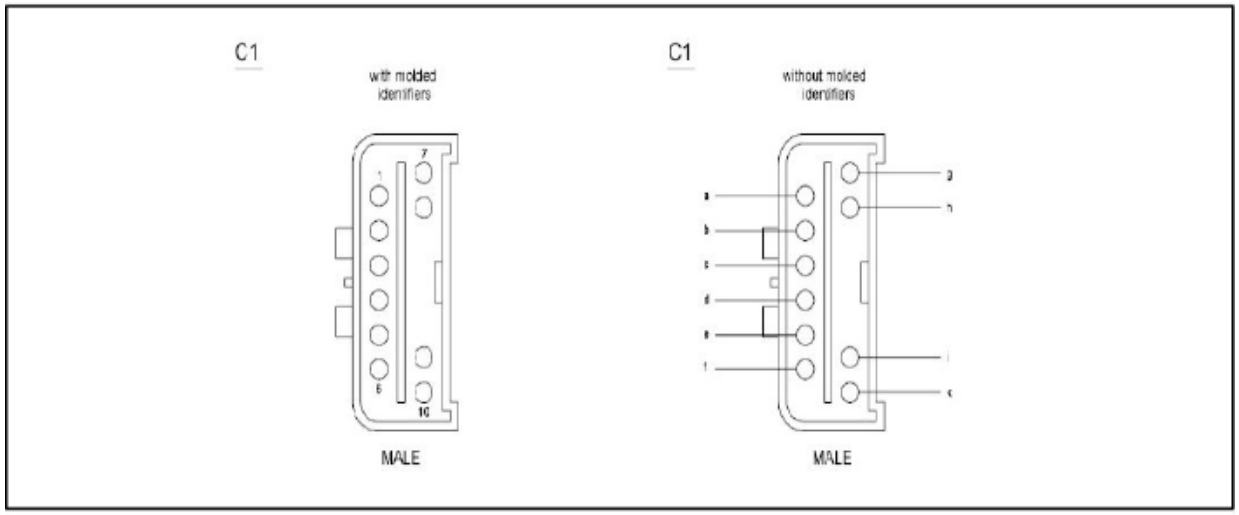
Terminals



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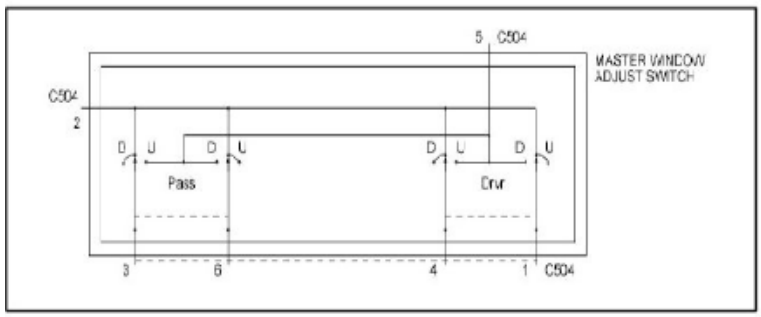
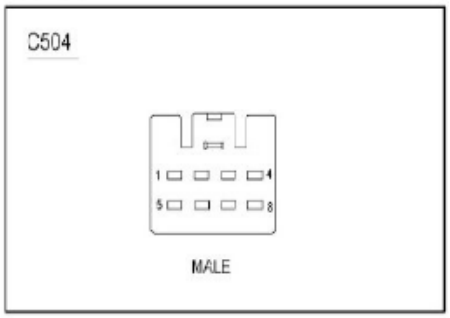
Master window adjust switch

Schematic



Terminals

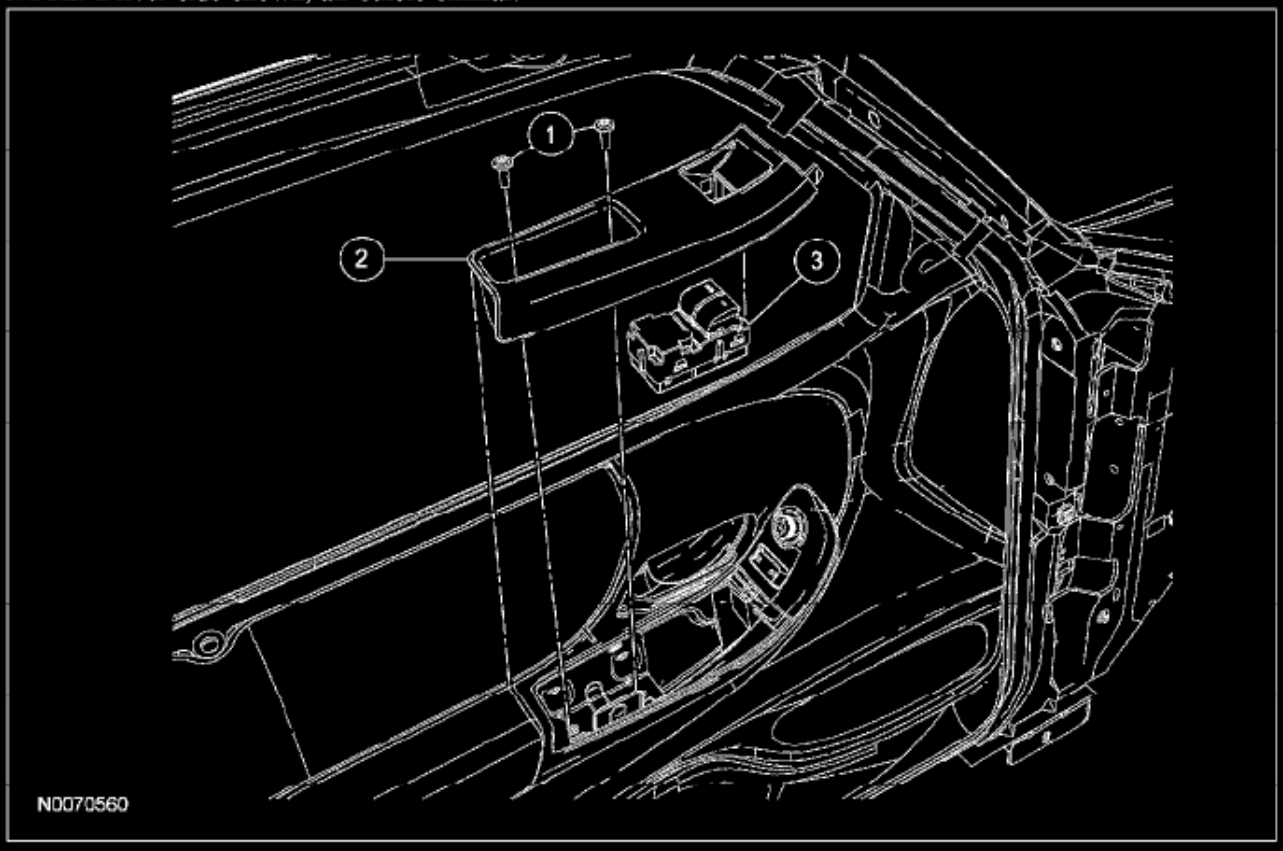


Component testing procedure

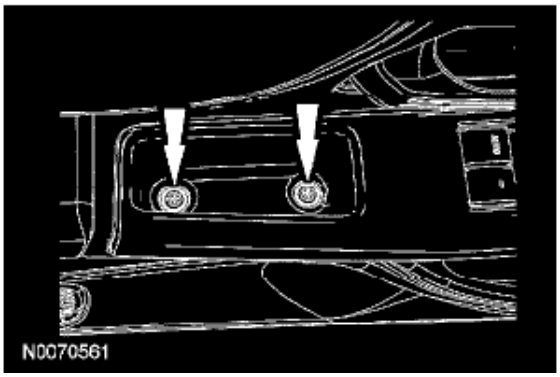
Circuit to test	Connect self-powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
Driver window circuit	5 and 4, 2 and 1	Up	Closed circuit
	5 and 1, 2 and 4	Down	Closed circuit
	2 and 4, 2 and 1	Rest	Closed circuit
Passenger window circuit	5 and 3, 2 and 6	Up	Closed circuit
	5 and 6, 2 and 3	Down	Closed circuit
	2 and 6, 2 and 3	Rest	Closed circuit

Power Window Switch: Testing and Inspection Master Window Adjust Switch

NOTE: Driver side shown, all others similar.



Item	Part Number	Description
1	56912-S	Finish panel screws (2 required)
2	14528	Finish panel
3	14529	Window control switch



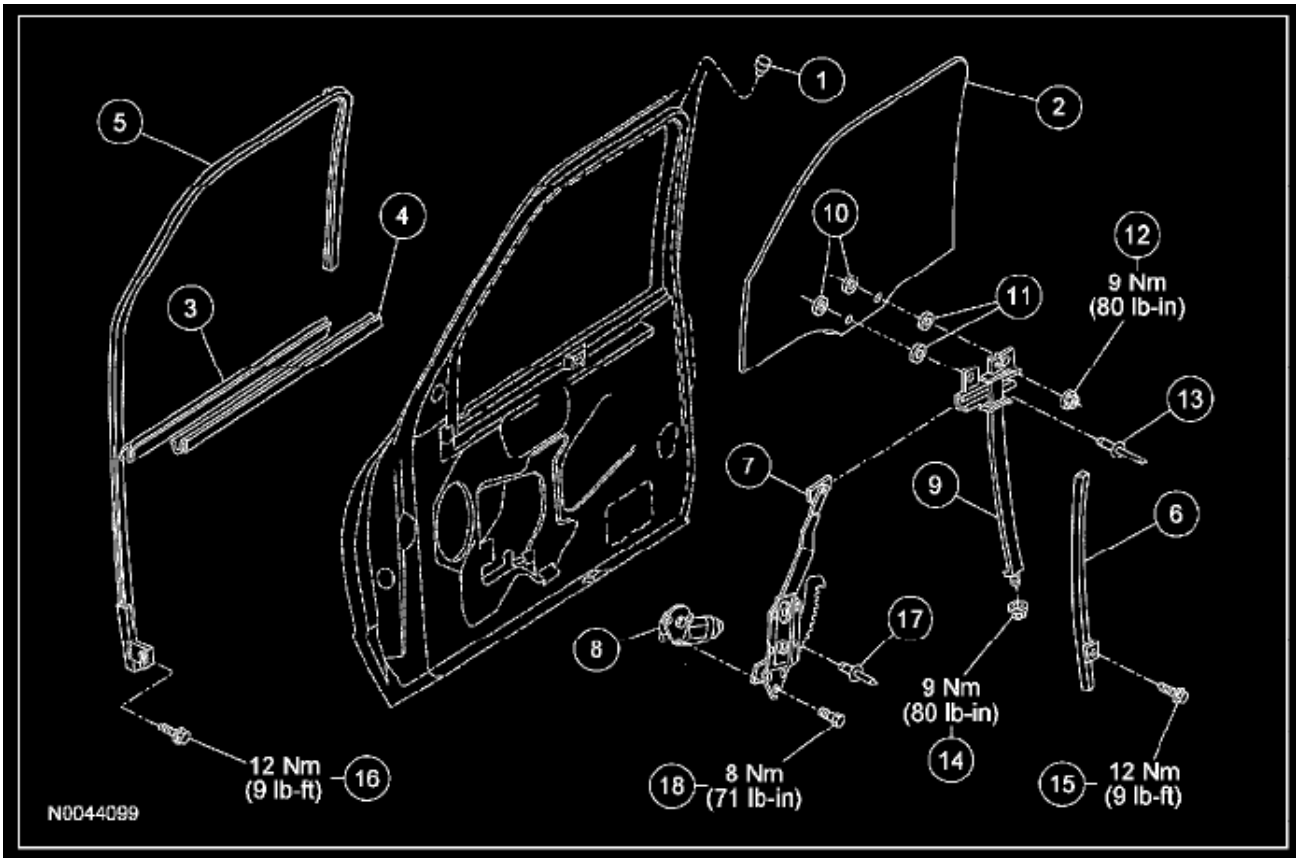
Power Window Switch: Service and Repair

WINDOW CONTROL SWITCH

Removal and Installation

1. Remove the door trim panel finish panel screws.

2. Remove the door trim panel finish panel. 3. Disconnect the electrical connector. 4. Remove the window control switch from the finish panel. 5. To install, reverse the removal procedure.



Item	Part Number	Description
1	N805277-S	Rivet
2	21410	Door glass
3	21452A	Door glass weatherstrip-outer
4	21452B	Door glass weatherstrip-inner
5	21546	Door glass top run
6	222A00	Door glass channel
7	23208	Regulator assembly
8	23394	Motor assembly
9	23288	Center door glass run
10	234A46	Spacers (2 required)
11	234A44	Spacers (2 required)

(Continued)

Item	Part Number	Description
12	N621907-S	Center door glass run nut
13	W525175-S	Window glass rivet (2 required)
14	N621907-S	Center door glass run nut
15	N6066676-S	Door glass channel bolt
16	N6066676-S	Door glass top run bolt
17	W525172-S	Window regulator rivet
18	N808650-S	Window regulator bolt

Material

Item	Specification
Foam Core Butyl E69Z-19562-A	WSB-M3G143-B

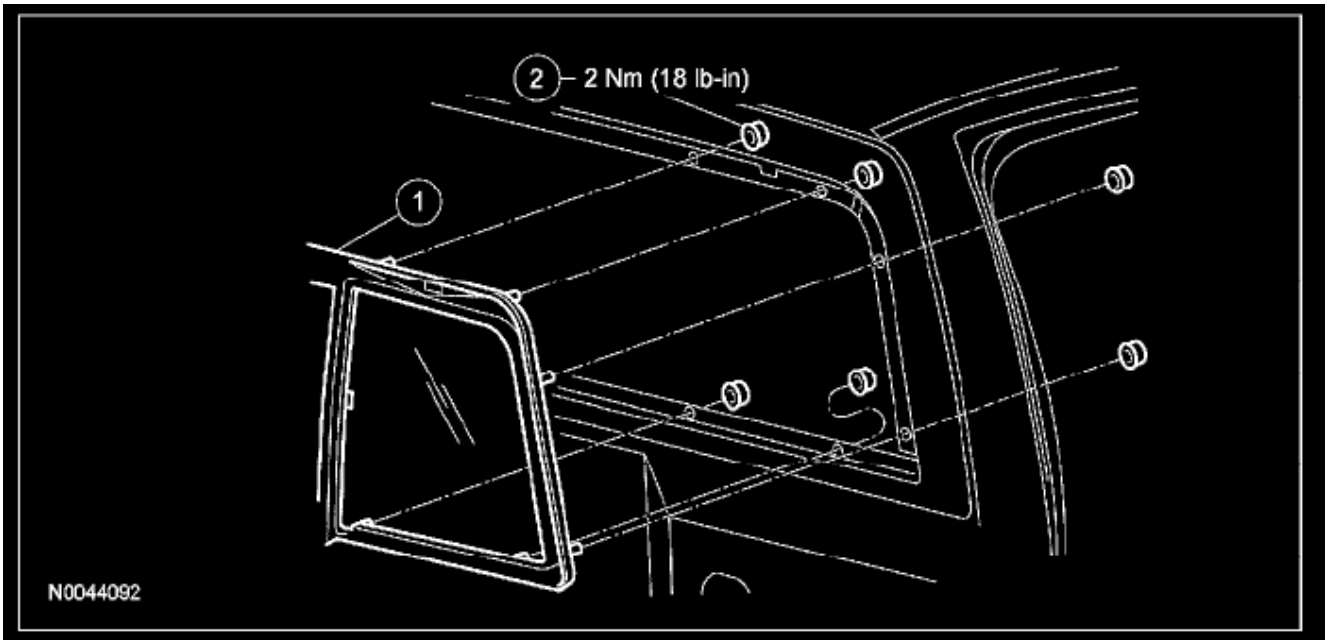
Back Window Glass: Service and Repair

WINDOW GLASS - REAR

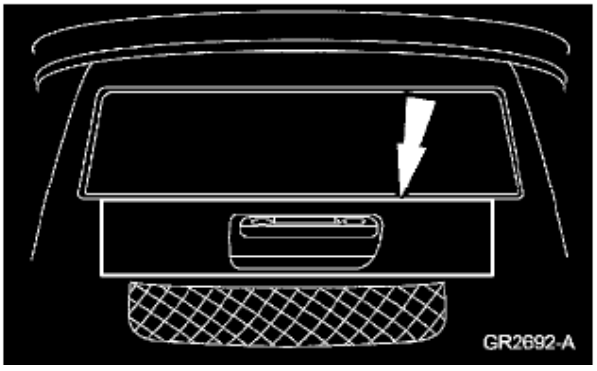
Exploded View

Material

Material



Item	Part Number	Description
1	422B30/42006	Rear window glass (sliding/fixed)
2	—	Rear window glass nut



Removal

NOTE: If the rear window glass is being removed to repair a dust/water leak, remove and reinstall the existing rear window glass.

1. Remove the rear window glass garnish moulding.

2. Lower the headliner. 3. Remove the rear window glass nuts.

4. NOTE: Use only a plastic windshield setting tool to slide under the seal to separate the foam core butyl from the glass. Once the glass starts to

separate from the body, constant hand pressure will break the seal and the glass can be removed. Failure to use a plastic windshield setting tool can damage the body or the glass frame.

Remove the rear window glass.

Installation

1. NOTE: Remove as much as possible of the foam core butyl from the body and rear window glass prior to installation

Install the rear window glass. -

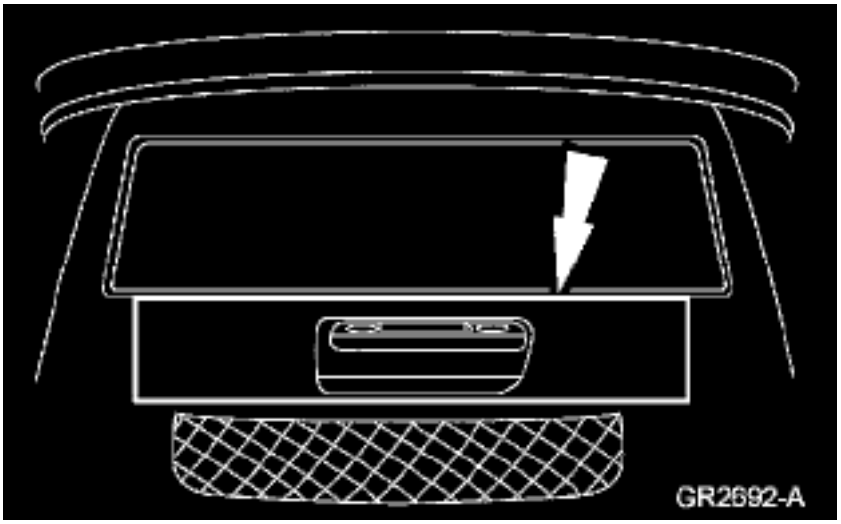
Apply foam core butyl to the window. Overlap the foam core butyl by 25 mm (1 in) at the bottom middle of the rear window glass.

- Carefully install the rear window glass into the body opening.

2. Install the rear window glass nuts.

- Tighten to 2 Nm (18 lb-in).

- Test the rear window glass for water leaks.



3. Install the headliner. 4. Install the rear window glass garnish moulding.

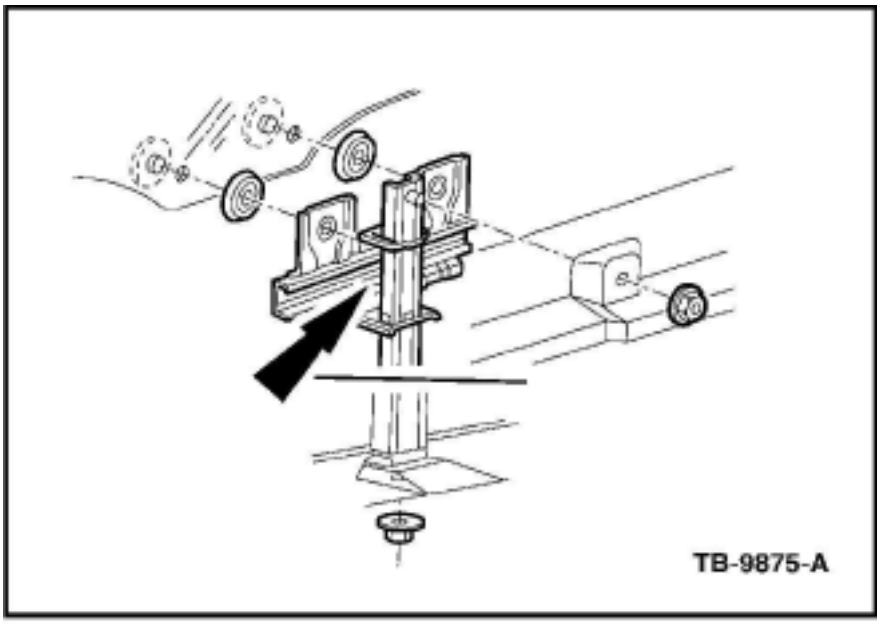


Figure 1

Front Door Window Glass: Customer Interest Body - Window Chatter/Shudder During Operation

TSB 09-22-5

11/16/09

WINDOW CHATTER/SHUDDER

FORD: 2008-2009 Ranger

ISSUE Some 2008-2009 Ranger vehicles may experience window chatter/shudder when the window travels up or down.

ACTION Follow the Service Procedure steps to correct the condition.

SERVICE PROCEDURE

Verify correct grease amount on the window Run. Open the upper door glass Run attachment slot to allow further forward adjustment.

1. Remove door trim panel following Workshop Manual (WSM), Section 501-05.

2. Inspect window Run and add grease if necessary using Motorcraft® Multi-Purpose Grease. (Figure 1)

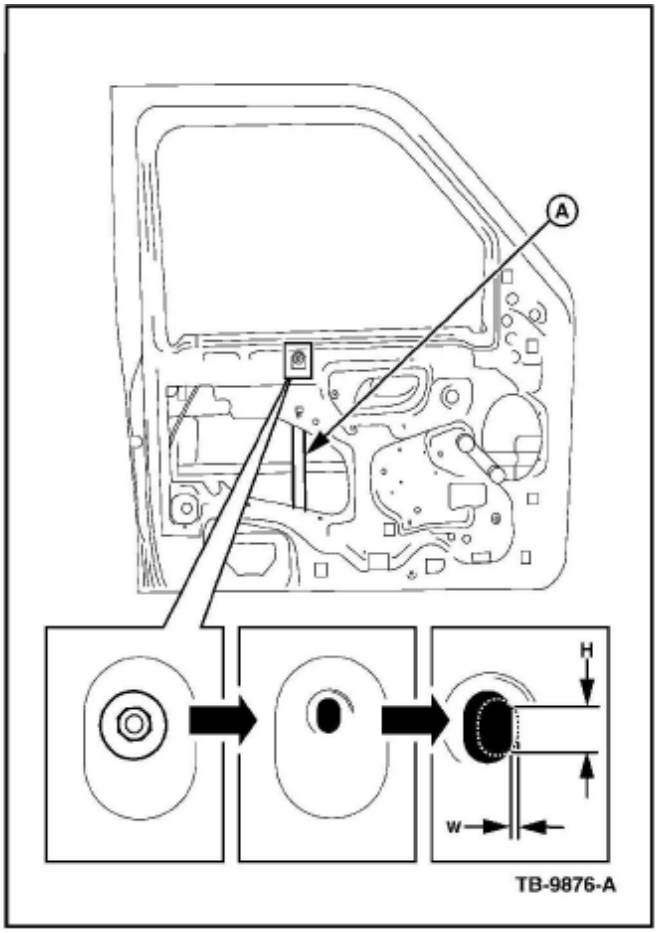


Figure 2

PART NUMBER	PART NAME
XG-4	Motorcraft® Multi-Purpose Grease
PM-13-A	Motorcraft® Anti-Corrosion Coating

3. With window in down position, remove the top and bottom center door glass Run retainer nuts and push door glass Run A to the side. (Figure 2)

4. Rework the upper glass Run attachment slot. (Figure 2)

a. Remove approximately 5/64" (2 mm) of material at W and 25/64" (10 mm) at H.

b. Remove material from the front of vehicle side of the slot. Be careful to not leave burrs on the panel.

c. Coat newly exposed metal areas with Motorcraft(R) Anti-Corrosion Coating.

5. Reposition glass Run A and loosely attach fasteners.

6. Raise glass to full up position. While pushing outward on the lower attachment. Torque glass Run attachment nuts, tighten to 106 lb-in. (12 N.m). Be

careful not to force a different position of the stud when installing the upper nut.

7. Install trim panel following WSM, Section 501-05-1.

Parts Block

WARRANTY STATUS: Eligible Under Provisions Of New Vehicle Limited Warranty Coverage
IMPORTANT: Warranty coverage limits/policies are not altered by a TSB. Warranty coverage limits are determined by the identified causal part.

OPERATION DESCRIPTION TIME

092205A 2008-2009 Ranger: Follow 0.3 Hr.

Service Procedure To Adjust And Grease The Glass Run On One (1) Door (Do Not Use With Any Other Labor

NOTE: The information in Technical Service Bulletins is intended for use by trained, professional technicians with the knowledge, tools, and equipment to do the job properly and safely. It informs these technicians of conditions that may occur on some vehicles, or provides information that could assist in proper vehicle service. The procedures should not be performed by "do-it-yourselfers". Do not assume that a condition described affects your car or truck. Contact a Ford, Lincoln, or Mercury dealership to determine whether the Bulletin applies to your vehicle.

Operations)

092205B 2008-2009 Ranger: Follow 0.6 Hr.

Service Procedure To Adjust And Grease The Glass Run On (2) Doors (Do Not Use With Any Other Labor Operations)

DEALER CODING

CONDITION

BASIC PART NO. CODE

1023288 07

Disclaimer

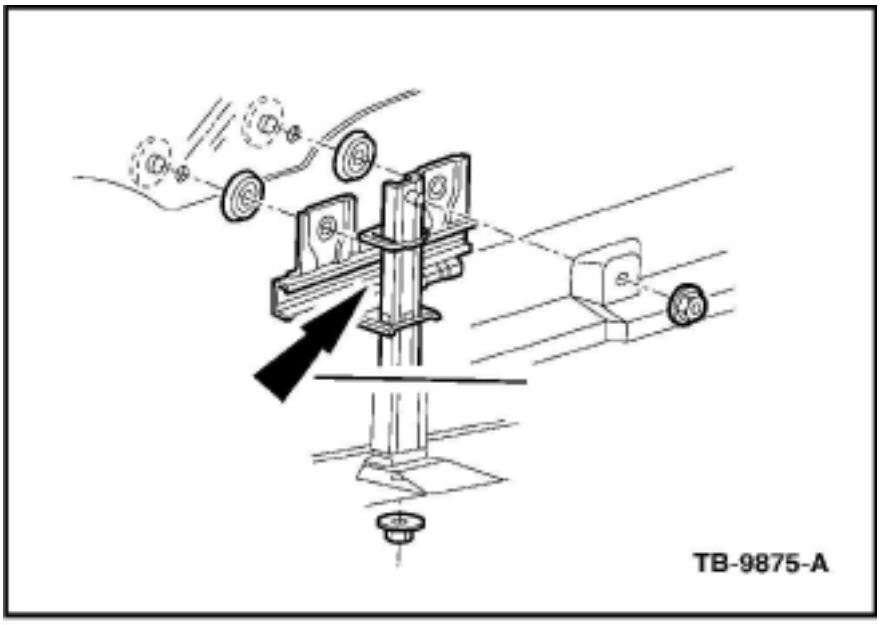


Figure 1

Front Door Window Glass: All Technical Service Bulletins Body - Window Chatter/Shudder During Operation

TSB 09-22-5

11/16/09

WINDOW CHATTER/SHUDDER

FORD: 2008-2009 Ranger

ISSUE Some 2008-2009 Ranger vehicles may experience window chatter/shudder when the window travels up or down.

ACTION Follow the Service Procedure steps to correct the condition.

SERVICE PROCEDURE

Verify correct grease amount on the window Run. Open the upper door glass Run attachment slot to allow further forward adjustment.

1. Remove door trim panel following Workshop Manual (WSM), Section 501-05.

2. Inspect window Run and add grease if necessary using Motorcraft® Multi-Purpose Grease. (Figure 1)

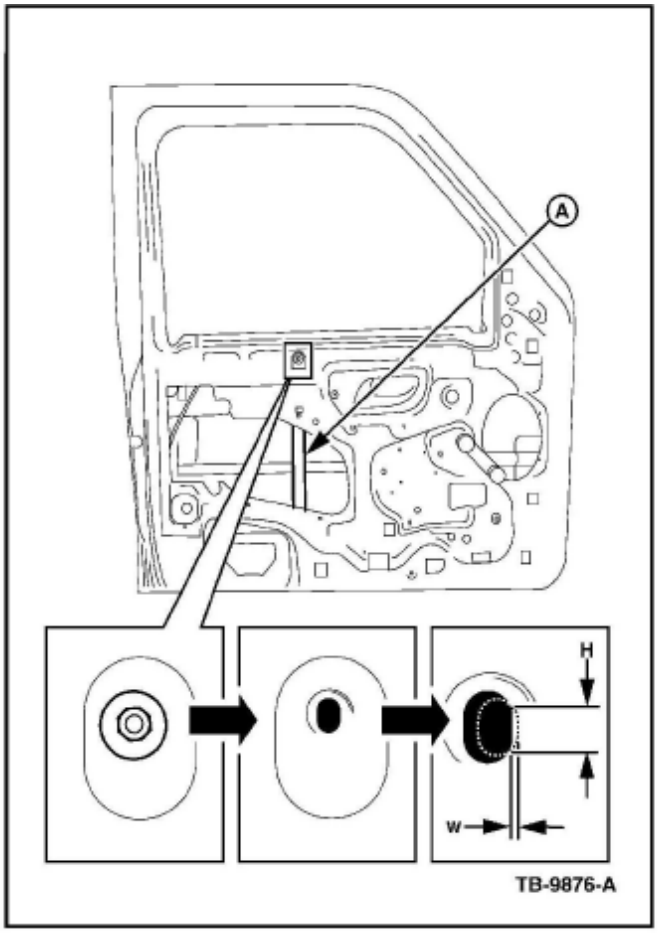


Figure 2

PART NUMBER	PART NAME
XG-4	Motorcraft® Multi-Purpose Grease
PM-13-A	Motorcraft® Anti-Corrosion Coating

3. With window in down position, remove the top and bottom center door glass Run retainer nuts and push door glass Run A to the side. (Figure 2)

4. Rework the upper glass Run attachment slot. (Figure 2)

a. Remove approximately 5/64" (2 mm) of material at W and 25/64" (10 mm) at H.

b. Remove material from the front of vehicle side of the slot. Be careful to not leave burrs on the panel.

c. Coat newly exposed metal areas with Motorcraft(R) Anti-Corrosion Coating.

5. Reposition glass Run A and loosely attach fasteners.

6. Raise glass to full up position. While pushing outward on the lower attachment. Torque glass Run attachment nuts, tighten to 106 lb-in. (12 N.m). Be

careful not to force a different position of the stud when installing the upper nut.

7. Install trim panel following WSM, Section 501-05-1.

Parts Block

WARRANTY STATUS: Eligible Under Provisions Of New Vehicle Limited Warranty Coverage
IMPORTANT: Warranty coverage limits/policies are not altered by a TSB. Warranty coverage limits are determined by the identified causal part.

OPERATION DESCRIPTION TIME

092205A 2008-2009 Ranger: Follow 0.3 Hr.

Service Procedure To Adjust And Grease The Glass Run On One (1) Door (Do Not Use With Any Other Labor

NOTE: The information in Technical Service Bulletins is intended for use by trained, professional technicians with the knowledge, tools, and equipment to do the job properly and safely. It informs these technicians of conditions that may occur on some vehicles, or provides information that could assist in proper vehicle service. The procedures should not be performed by "do-it-yourselfers". Do not assume that a condition described affects your car or truck. Contact a Ford, Lincoln, or Mercury dealership to determine whether the Bulletin applies to your vehicle.

Operations)

092205B 2008-2009 Ranger: Follow 0.6 Hr.

Service Procedure To Adjust And Grease The Glass Run On (2) Doors (Do Not Use With Any Other Labor Operations)

DEALER CODING

CONDITION

BASIC PART NO. CODE

1023288 07

Disclaimer

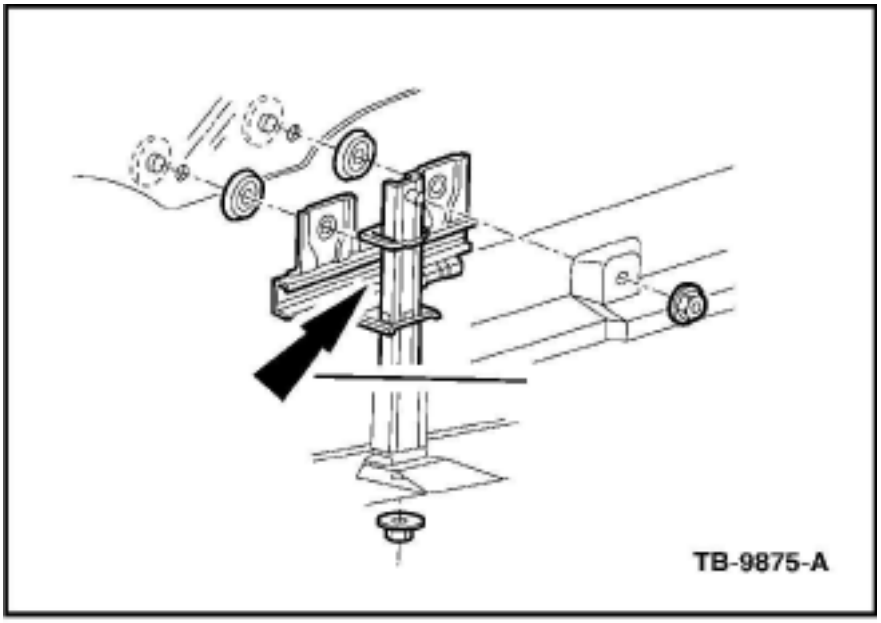


Figure 1

Front Door Window Glass: By Symptom

Technical Service Bulletin # 09-22-5 Date: 091116

Body - Window Chatter/Shudder During Operation

TSB 09-22-5

11/16/09

WINDOW CHATTER/SHUDDER

FORD: 2008-2009 Ranger

ISSUE Some 2008-2009 Ranger vehicles may experience window chatter/shudder when the window travels up or down.

ACTION Follow the Service Procedure steps to correct the condition.

SERVICE PROCEDURE

Verify correct grease amount on the window Run. Open the upper door glass Run attachment slot to allow further forward adjustment.

1. Remove door trim panel following Workshop Manual (WSM), Section 501-05.

2. Inspect window Run and add grease if necessary using Motorcraft® Multi-Purpose Grease. (Figure 1)

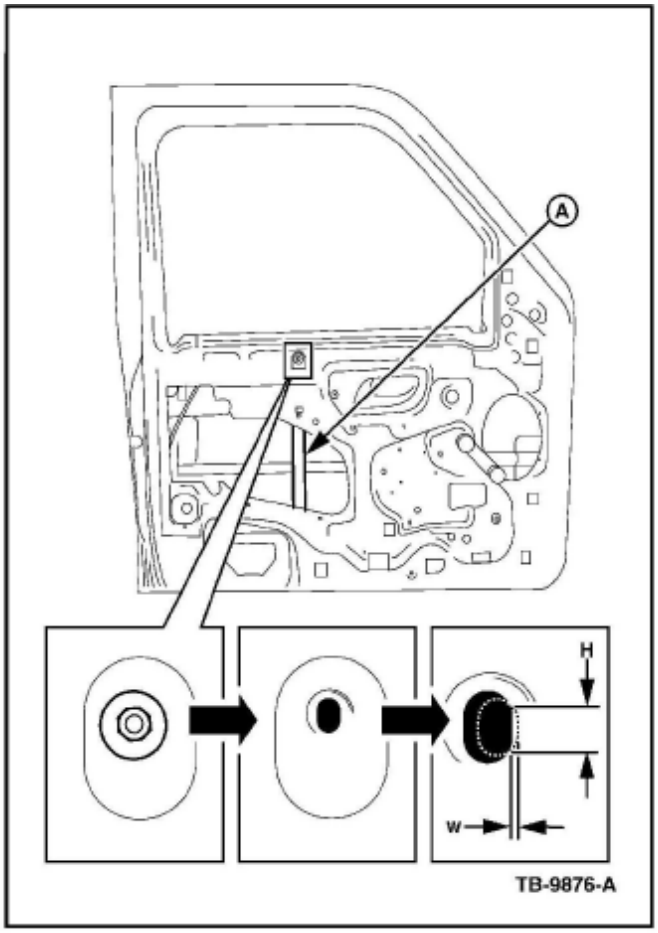


Figure 2

PART NUMBER	PART NAME
XG-4	Motorcraft® Multi-Purpose Grease
PM-13-A	Motorcraft® Anti-Corrosion Coating

3. With window in down position, remove the top and bottom center door glass Run retainer nuts and push door glass Run A to the side. (Figure 2)

4. Rework the upper glass Run attachment slot. (Figure 2)

a. Remove approximately 5/64" (2 mm) of material at W and 25/64" (10 mm) at H.

b. Remove material from the front of vehicle side of the slot. Be careful to not leave burrs on the panel.

c. Coat newly exposed metal areas with Motorcraft(R) Anti-Corrosion Coating.

5. Reposition glass Run A and loosely attach fasteners.

6. Raise glass to full up position. While pushing outward on the lower attachment. Torque glass Run attachment nuts, tighten to 106 lb-in. (12 N.m). Be

careful not to force a different position of the stud when installing the upper nut.

7. Install trim panel following WSM, Section 501-05-1.

Parts Block

WARRANTY STATUS: Eligible Under Provisions Of New Vehicle Limited Warranty Coverage
IMPORTANT: Warranty coverage limits/policies are not altered by a TSB. Warranty coverage limits are determined by the identified causal part.

OPERATION DESCRIPTION TIME

092205A 2008-2009 Ranger: Follow 0.3 Hr.

Service Procedure To Adjust And Grease The Glass Run On One (1) Door (Do Not Use With Any Other Labor

NOTE: The information in Technical Service Bulletins is intended for use by trained, professional technicians with the knowledge, tools, and equipment to do the job properly and safely. It informs these technicians of conditions that may occur on some vehicles, or provides information that could assist in proper vehicle service. The procedures should not be performed by "do-it-yourselfers". Do not assume that a condition described affects your car or truck. Contact a Ford, Lincoln, or Mercury dealership to determine whether the Bulletin applies to your vehicle.

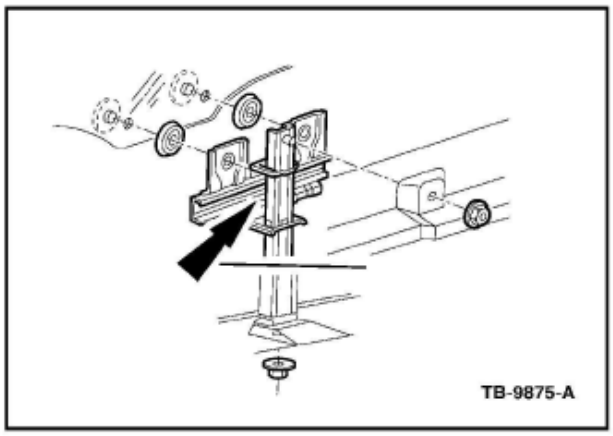


Figure 1

Operations)

092205B 2008-2009 Ranger: Follow 0.6 Hr.

Service Procedure To Adjust And Grease The Glass Run On (2) Doors (Do Not Use With Any Other Labor Operations)

DEALER CODING

CONDITION

BASIC PART NO. CODE

1023288 07

Disclaimer Technical Service Bulletin # 09-22-5 Date: 091116

Body - Window Chatter/Shudder During Operation

TSB 09-22-5

11/16/09

WINDOW CHATTER/SHUDDER

FORD: 2008-2009 Ranger

ISSUE Some 2008-2009 Ranger vehicles may experience window chatter/shudder when the window travels up or down.

ACTION Follow the Service Procedure steps to correct the condition.

SERVICE PROCEDURE

Verify correct grease amount on the window Run. Open the upper door glass Run attachment slot to allow further forward adjustment.

1. Remove door trim panel following Workshop Manual (WSM), Section 501-05.

2. Inspect window Run and add grease if necessary using Motorcraft® Multi-Purpose Grease. (Figure 1)

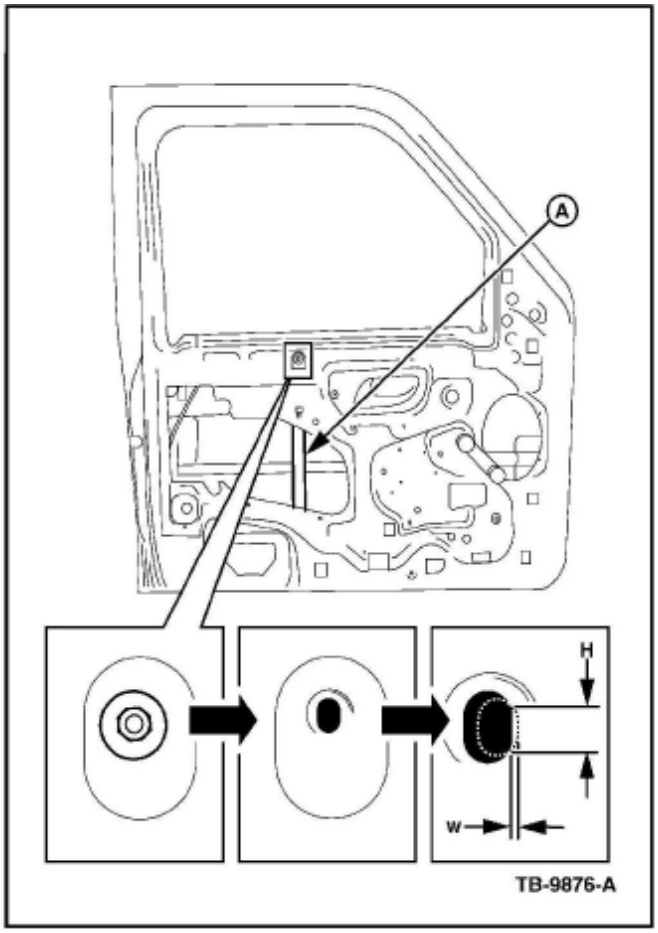


Figure 2

PART NUMBER	PART NAME
XG-4	Motorcraft® Multi-Purpose Grease
PM-13-A	Motorcraft® Anti-Corrosion Coating

3. With window in down position, remove the top and bottom center door glass Run retainer nuts and push door glass Run A to the side. (Figure 2)

4. Rework the upper glass Run attachment slot. (Figure 2)

a. Remove approximately 5/64" (2 mm) of material at W and 25/64" (10 mm) at H.

b. Remove material from the front of vehicle side of the slot. Be careful to not leave burrs on the panel.

c. Coat newly exposed metal areas with Motorcraft(R) Anti-Corrosion Coating.

5. Reposition glass Run A and loosely attach fasteners.

6. Raise glass to full up position. While pushing outward on the lower attachment. Torque glass Run attachment nuts, tighten to 106 lb-in. (12 N.m). Be

careful not to force a different position of the stud when installing the upper nut.

7. Install trim panel following WSM, Section 501-05-1.

Parts Block

WARRANTY STATUS: Eligible Under Provisions Of New Vehicle Limited Warranty Coverage
IMPORTANT: Warranty coverage limits/policies are not altered by a TSB. Warranty coverage limits are determined by the identified causal part.

OPERATION DESCRIPTION TIME

092205A 2008-2009 Ranger: Follow 0.3 Hr.

Service Procedure To Adjust And Grease The Glass Run On One (1) Door (Do Not Use With Any Other Labor

NOTE: The information in Technical Service Bulletins is intended for use by trained, professional technicians with the knowledge, tools, and equipment to do the job properly and safely. It informs these technicians of conditions that may occur on some vehicles, or provides information that could assist in proper vehicle service. The procedures should not be performed by "do-it-yourselfers". Do not assume that a condition described affects your car or truck. Contact a Ford, Lincoln, or Mercury dealership to determine whether the Bulletin applies to your vehicle.

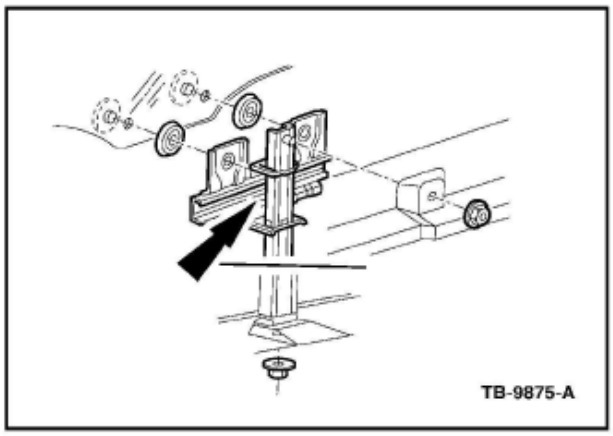


Figure 1

Operations)

092205B 2008-2009 Ranger: Follow 0.6 Hr.

Service Procedure To Adjust And Grease The Glass Run On (2) Doors (Do Not Use With Any Other Labor Operations)

DEALER CODING

CONDITION

BASIC PART NO. CODE

1023288 07

Disclaimer Technical Service Bulletin # 09-22-5 Date: 091116

Body - Window Chatter/Shudder During Operation

TSB 09-22-5

11/16/09

WINDOW CHATTER/SHUDDER

FORD: 2008-2009 Ranger

ISSUE Some 2008-2009 Ranger vehicles may experience window chatter/shudder when the window travels up or down.

ACTION Follow the Service Procedure steps to correct the condition.

SERVICE PROCEDURE

Verify correct grease amount on the window Run. Open the upper door glass Run attachment slot to allow further forward adjustment.

1. Remove door trim panel following Workshop Manual (WSM), Section 501-05.

2. Inspect window Run and add grease if necessary using Motorcraft® Multi-Purpose Grease. (Figure 1)

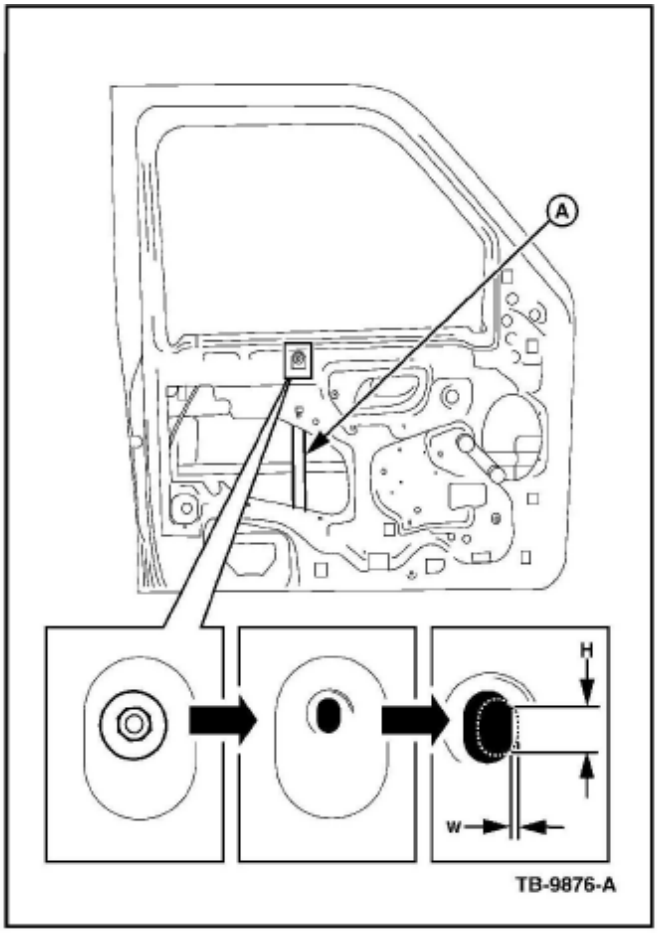


Figure 2

PART NUMBER	PART NAME
XG-4	Motorcraft® Multi-Purpose Grease
PM-13-A	Motorcraft® Anti-Corrosion Coating

3. With window in down position, remove the top and bottom center door glass Run retainer nuts and push door glass Run A to the side. (Figure 2)

4. Rework the upper glass Run attachment slot. (Figure 2)

a. Remove approximately 5/64" (2 mm) of material at W and 25/64" (10 mm) at H.

b. Remove material from the front of vehicle side of the slot. Be careful to not leave burrs on the panel.

c. Coat newly exposed metal areas with Motorcraft(R) Anti-Corrosion Coating.

5. Reposition glass Run A and loosely attach fasteners.

6. Raise glass to full up position. While pushing outward on the lower attachment. Torque glass Run attachment nuts, tighten to 106 lb-in. (12 N.m). Be

careful not to force a different position of the stud when installing the upper nut.

7. Install trim panel following WSM, Section 501-05-1.

Parts Block

WARRANTY STATUS: Eligible Under Provisions Of New Vehicle Limited Warranty Coverage
IMPORTANT: Warranty coverage limits/policies are not altered by a TSB. Warranty coverage limits are determined by the identified causal part.

OPERATION DESCRIPTION TIME

092205A 2008-2009 Ranger: Follow 0.3 Hr.

Service Procedure To Adjust And Grease The Glass Run On One (1) Door (Do Not Use With Any Other Labor

NOTE: The information in Technical Service Bulletins is intended for use by trained, professional technicians with the knowledge, tools, and equipment to do the job properly and safely. It informs these technicians of conditions that may occur on some vehicles, or provides information that could assist in proper vehicle service. The procedures should not be performed by "do-it-yourselfers". Do not assume that a condition described affects your car or truck. Contact a Ford, Lincoln, or Mercury dealership to determine whether the Bulletin applies to your vehicle.

Operations)

092205B 2008-2009 Ranger: Follow 0.6 Hr.

Service Procedure To Adjust And Grease The Glass Run On (2) Doors (Do Not Use With Any Other Labor Operations)

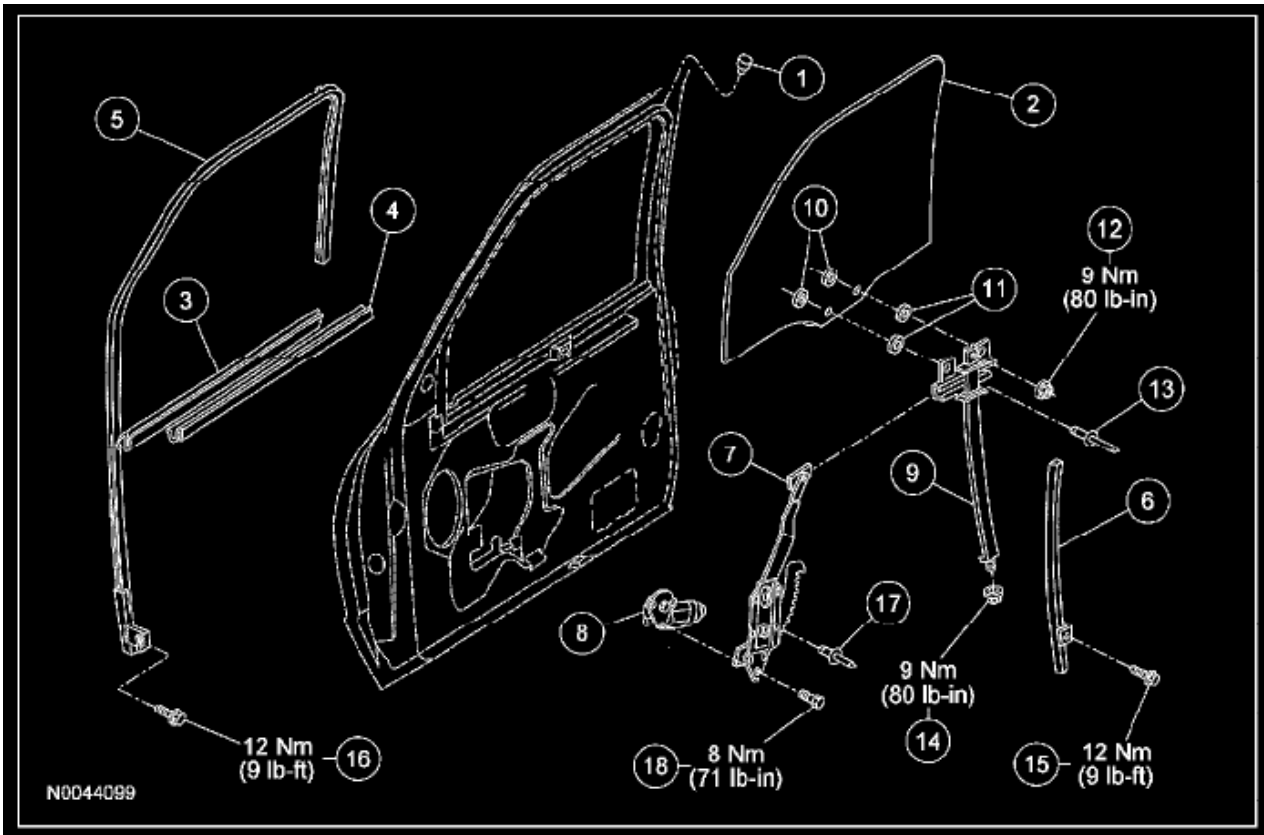
DEALER CODING

CONDITION

BASIC PART NO. CODE

1023288 07

Disclaimer



Item	Part Number	Description
1	N805277-S	Rivet
2	21410	Door glass
3	21452A	Door glass weatherstrip-outer
4	21452B	Door glass weatherstrip-inner
5	21546	Door glass top run
6	222A00	Door glass channel
7	23208	Regulator assembly
8	23394	Motor assembly
9	23288	Center door glass run
10	234A46	Spacers (2 required)
11	234A44	Spacers (2 required)

(Continued)

Item	Part Number	Description
12	N621907-S	Center door glass run nut
13	W525175-S	Window glass rivet (2 required)
14	N621907-S	Center door glass run nut
15	N6066676-S	Door glass channel bolt
16	N6066676-S	Door glass top run bolt
17	W525172-S	Window regulator rivet
18	N808650-S	Window regulator bolt

Special Tool(s)

ST1132-A	Heavy Duty Riveter or equivalent 501-D011 (D80L-23200-A)

Front Door Window Glass: Service and Repair

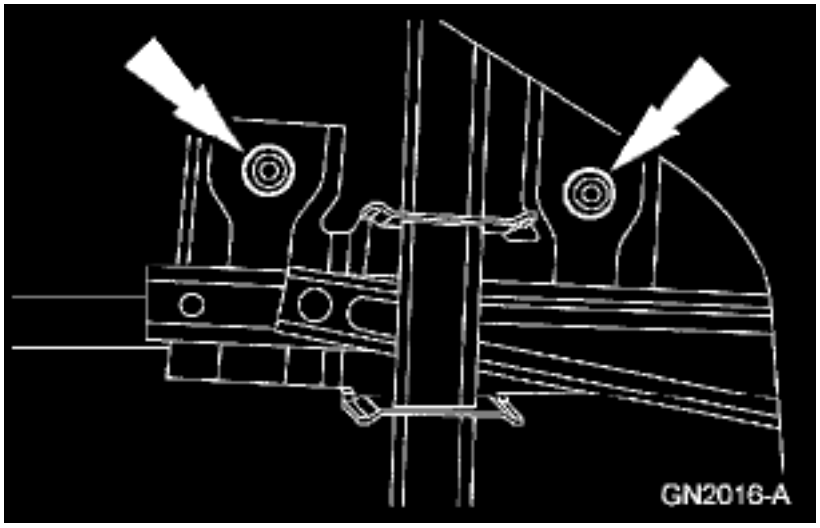
WINDOW GLASS - FRONT DOOR

Exploded View

Special Tool(s)

Special Tool(s)

Removal and Installation



NOTE: Position the window glass halfway up to gain access to the rivets.

1. Remove the front door trim panel. 2. Remove the watershield. 3. Remove the door glass channel.

- Remove the bolt.

- To install, tighten to 12 Nm (9 lb-ft).

4. NOTE:

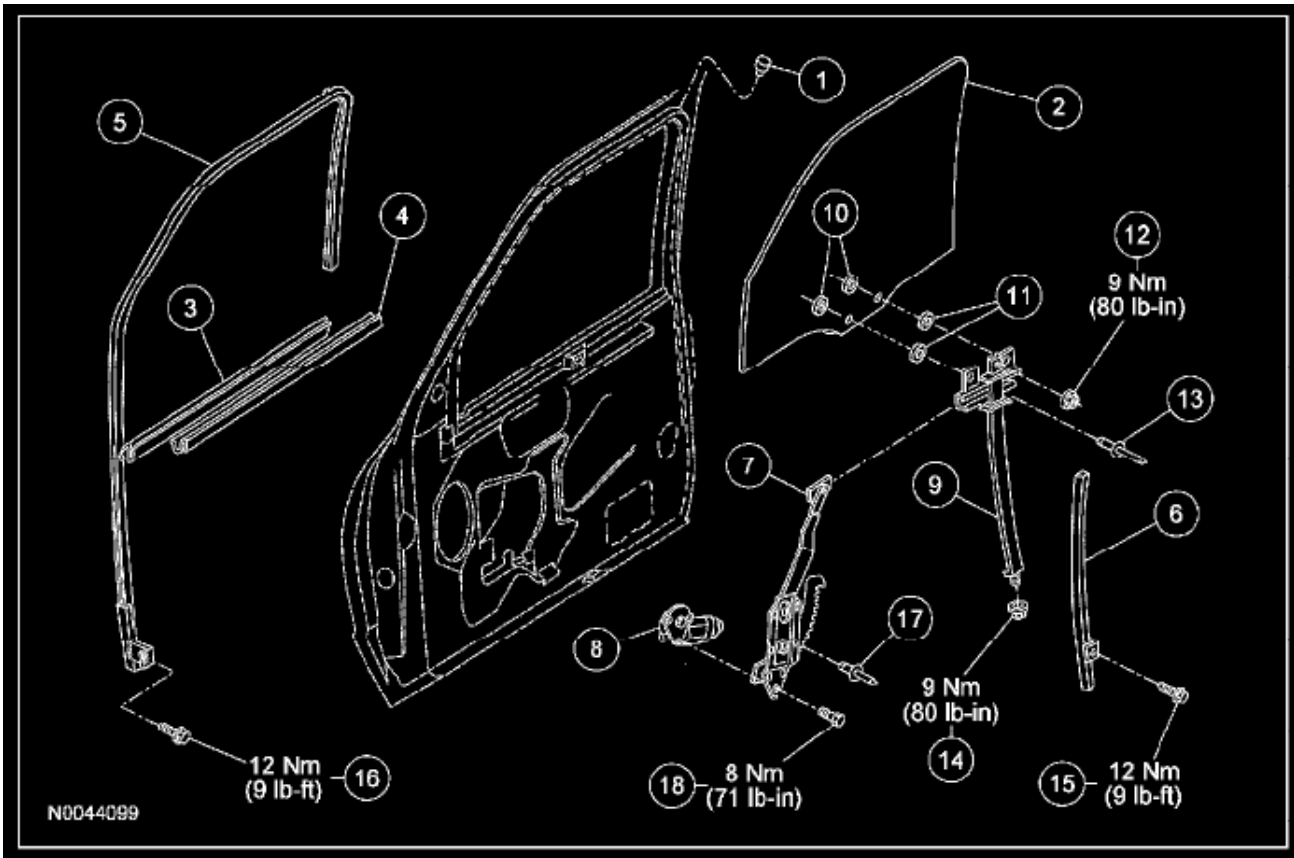
- Support window glass before removing the rivets.

- To remove the rivets, use a drift punch to remove the steel centers and a 6 mm (1/4 in) diameter drill bit to remove the rivets.

Remove the 2 window glass rivets.

5. Remove the front door window glass through the window opening. 6. To install, reverse the removal procedure.

- Use a heavy duty riveter to install the new rivets.



Item	Part Number	Description
1	N805277-S	Rivet
2	21410	Door glass
3	21452A	Door glass weatherstrip-outer
4	21452B	Door glass weatherstrip-inner
5	21546	Door glass top run
6	222A00	Door glass channel
7	23208	Regulator assembly
8	23394	Motor assembly
9	23288	Center door glass run
10	234A46	Spacers (2 required)
11	234A44	Spacers (2 required)

(Continued)

Item	Part Number	Description
12	N621907-S	Center door glass run nut
13	W525175-S	Window glass rivet (2 required)
14	N621907-S	Center door glass run nut
15	N6066676-S	Door glass channel bolt
16	N6066676-S	Door glass top run bolt
17	W525172-S	Window regulator rivet
18	N808650-S	Window regulator bolt

Material

Item	Specification
Foam Core Butyl E69Z-19562-A	WSB-M3G143-B

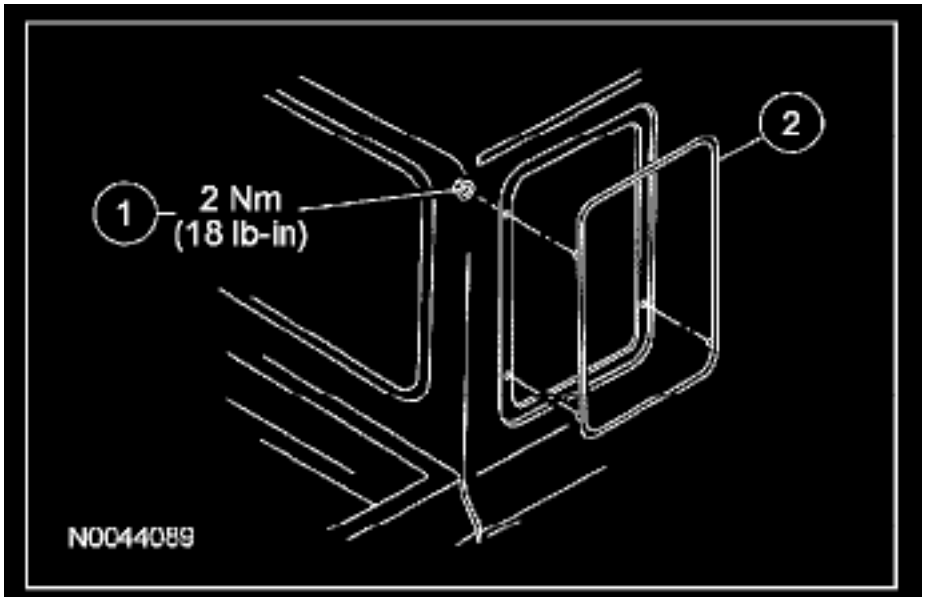
Quarter Window Glass: Service and Repair

WINDOW GLASS - REAR QUARTER

Exploded View

Material

Material



Item	Part Number	Description
1	N621900-S	Rear quarter window glass nut (4 required)
2	29700	Rear quarter window glass

Removal

NOTE: If the rear quarter window glass is being removed to repair a dust/water leak, remove and reinstall the existing rear quarter window glass.

1. Remove the rear door trim panel or C-pillar trim panel. 2. Remove the rear quarter window glass nuts.

3. NOTE: Use only a plastic windshield setting tool to slide under the seal to separate the foam core butyl from the glass. Once the glass starts to

separate from the body, constant hand pressure will break the seal and the glass can be removed. Failure to use a plastic windshield setting tool can damage the body or the glass frame.

Remove the rear quarter window glass.

Installation

1. NOTE: Remove as much as possible of the foam core butyl from the body and rear quarter window glass prior to installation.

Install the rear quarter window glass. -

Apply foam core butyl to the window. Overlap the foam core butyl by 25 mm (1 in) at the bottom middle of the rear quarter window glass.

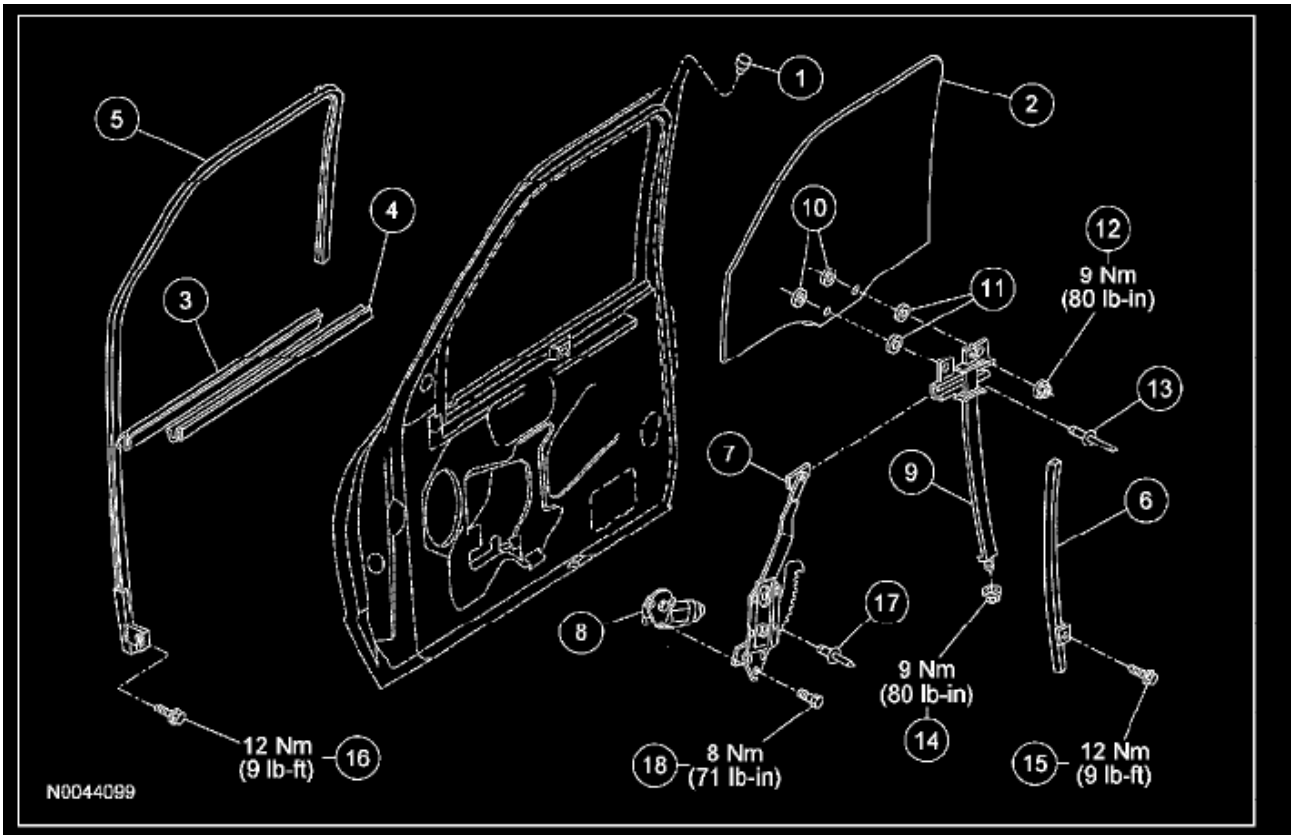
- Place glass in body opening.

2. Install the rear quarter window glass nuts.

- Tighten to 2 Nm (18 lb-in).

- Test the rear quarter window glass for water leaks.

3. Install the rear door trim panel or C-pillar trim panel.



Item	Part Number	Description
1	N805277-S	Rivet
2	21410	Door glass
3	21452A	Door glass weatherstrip-outer
4	21452B	Door glass weatherstrip-inner
5	21546	Door glass top run
6	222A00	Door glass channel
7	23208	Regulator assembly
8	23394	Motor assembly
9	23288	Center door glass run
10	234A46	Spacers (2 required)
11	234A44	Spacers (2 required)

(Continued)

Item	Part Number	Description
12	N621907-S	Center door glass run nut
13	W525175-S	Window glass rivet (2 required)
14	N621907-S	Center door glass run nut
15	N6066676-S	Door glass channel bolt
16	N6066676-S	Door glass top run bolt
17	W525172-S	Window regulator rivet
18	N808650-S	Window regulator bolt

Special Tool(s)

ST1132-A	Heavy Duty Riveter or equivalent 501-D011 (D80L-23200-A)

Front Door Window Regulator: Service and Repair

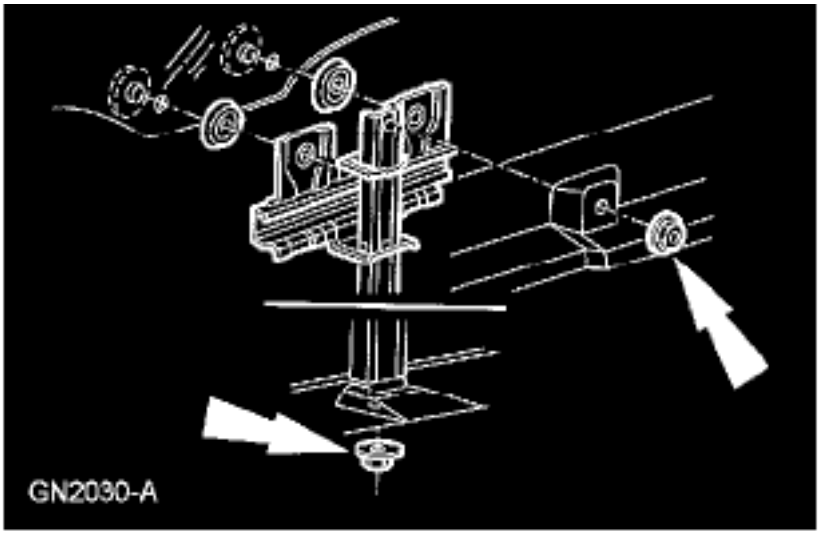
WINDOW REGULATOR AND MOTOR - FRONT DOOR

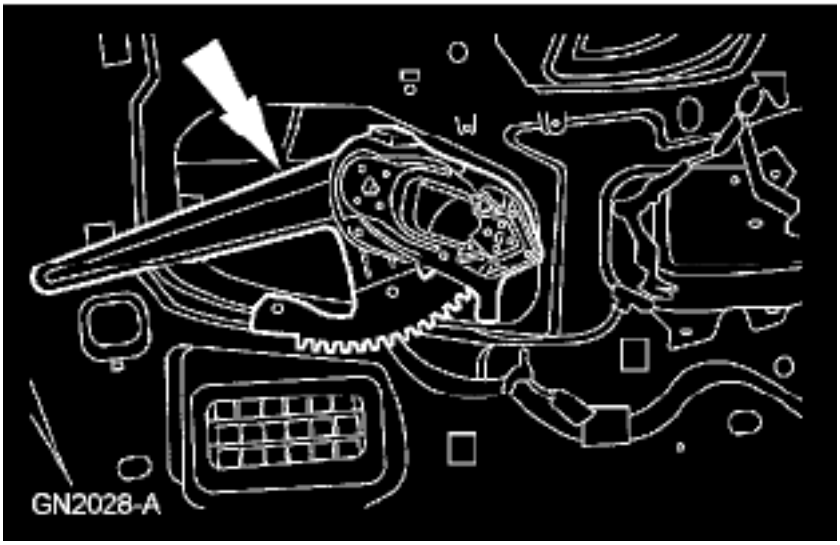
Exploded View

Special Tool(s)

Special Tool(s)

Removal and Installation





1. Remove the door trim panel. 2. Remove the watershield. 3. Support the window glass. 4. If equipped, disconnect the power window motor electrical connector. 5. Remove the top and bottom center door glass run retainer nuts.

- To install, tighten to 9 Nm (80 lb-in).

6. NOTE:

- To remove the rivets, use a drift punch to remove the steel centers and a 6.35 mm (1/4 in) diameter drill bit to remove the rivets.

- The power window regulator has 4 rivets; the manual has 3.

Remove the window regulator rivets. -

Remove the steel centers and rivets.

7. Remove the window regulator.

8. WARNING: When removing the window regulator motor, place the window in the full upward position or block the window regulator

arm to help prevent the counterbalance spring from unwinding with high force. Failure to follow this instruction may result in serious personal injury.

If necessary, remove the window glass motor. -

Remove the bolts.

- To install, tighten to 8 Nm (71 lb-in).

9. To install, reverse the removal procedure.

- Use a heavy duty riveter to install the new rivets.

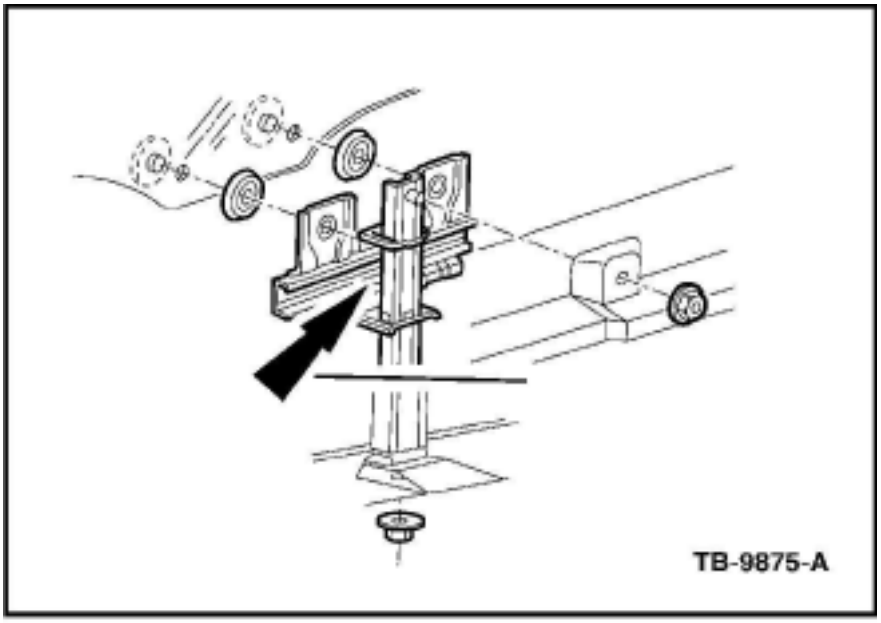


Figure 1

Window Track: Customer Interest Body - Window Chatter/Shudder During Operation

TSB 09-22-5

11/16/09

WINDOW CHATTER/SHUDDER

FORD: 2008-2009 Ranger

ISSUE Some 2008-2009 Ranger vehicles may experience window chatter/shudder when the window travels up or down.

ACTION Follow the Service Procedure steps to correct the condition.

SERVICE PROCEDURE

Verify correct grease amount on the window Run. Open the upper door glass Run attachment slot to allow further forward adjustment.

1. Remove door trim panel following Workshop Manual (WSM), Section 501-05.

2. Inspect window Run and add grease if necessary using Motorcraft® Multi-Purpose Grease. (Figure 1)

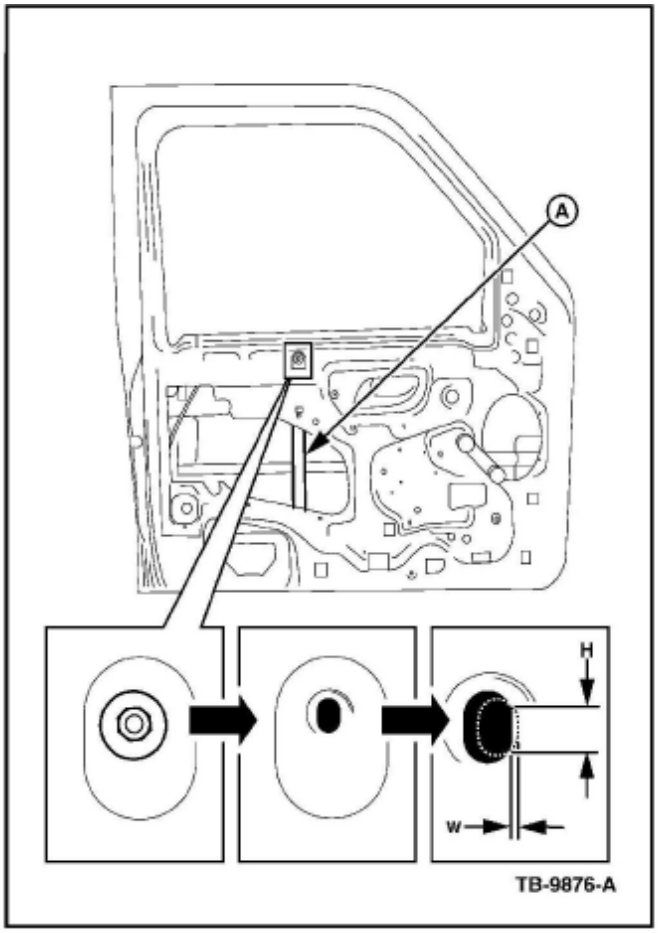


Figure 2

PART NUMBER	PART NAME
XG-4	Motorcraft® Multi-Purpose Grease
PM-13-A	Motorcraft® Anti-Corrosion Coating

3. With window in down position, remove the top and bottom center door glass Run retainer nuts and push door glass Run A to the side. (Figure 2)

4. Rework the upper glass Run attachment slot. (Figure 2)

a. Remove approximately 5/64" (2 mm) of material at W and 25/64" (10 mm) at H.

b. Remove material from the front of vehicle side of the slot. Be careful to not leave burrs on the panel.

c. Coat newly exposed metal areas with Motorcraft(R) Anti-Corrosion Coating.

5. Reposition glass Run A and loosely attach fasteners.

6. Raise glass to full up position. While pushing outward on the lower attachment. Torque glass Run attachment nuts, tighten to 106 lb-in. (12 N.m). Be

careful not to force a different position of the stud when installing the upper nut.

7. Install trim panel following WSM, Section 501-05-1.

Parts Block

WARRANTY STATUS: Eligible Under Provisions Of New Vehicle Limited Warranty Coverage
IMPORTANT: Warranty coverage limits/policies are not altered by a TSB. Warranty coverage limits are determined by the identified causal part.

OPERATION DESCRIPTION TIME

092205A 2008-2009 Ranger: Follow 0.3 Hr.

Service Procedure To Adjust And Grease The Glass Run On One (1) Door (Do Not Use With Any Other Labor

NOTE: The information in Technical Service Bulletins is intended for use by trained, professional technicians with the knowledge, tools, and equipment to do the job properly and safely. It informs these technicians of conditions that may occur on some vehicles, or provides information that could assist in proper vehicle service. The procedures should not be performed by "do-it-yourselfers". Do not assume that a condition described affects your car or truck. Contact a Ford, Lincoln, or Mercury dealership to determine whether the Bulletin applies to your vehicle.

Operations)

092205B 2008-2009 Ranger: Follow 0.6 Hr.

Service Procedure To Adjust And Grease The Glass Run On (2) Doors (Do Not Use With Any Other Labor Operations)

DEALER CODING

CONDITION

BASIC PART NO. CODE

1023288 07

Disclaimer

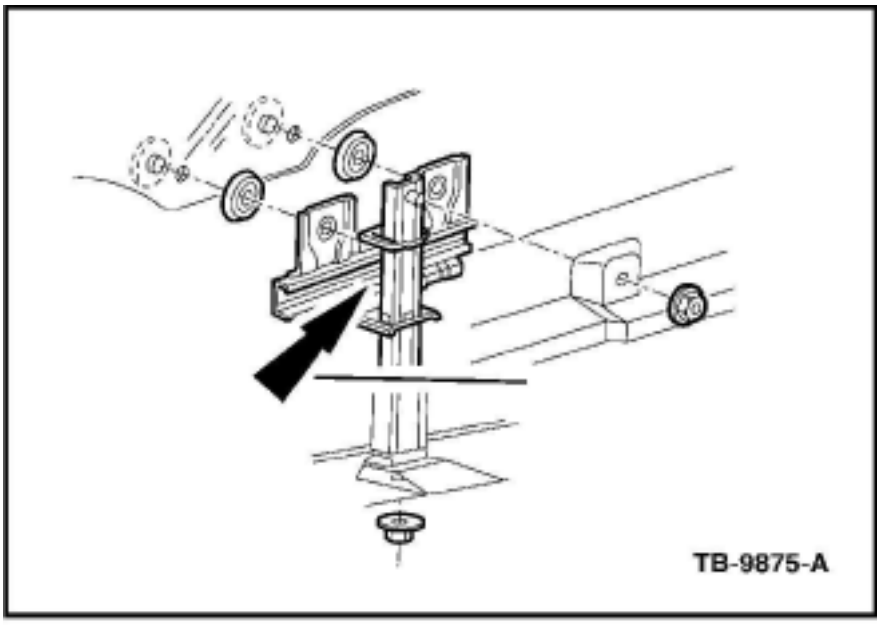


Figure 1

Window Track: All Technical Service Bulletins Body - Window Chatter/Shudder During Operation

TSB 09-22-5

11/16/09

WINDOW CHATTER/SHUDDER

FORD: 2008-2009 Ranger

ISSUE Some 2008-2009 Ranger vehicles may experience window chatter/shudder when the window travels up or down.

ACTION Follow the Service Procedure steps to correct the condition.

SERVICE PROCEDURE

Verify correct grease amount on the window Run. Open the upper door glass Run attachment slot to allow further forward adjustment.

1. Remove door trim panel following Workshop Manual (WSM), Section 501-05.

2. Inspect window Run and add grease if necessary using Motorcraft® Multi-Purpose Grease. (Figure 1)

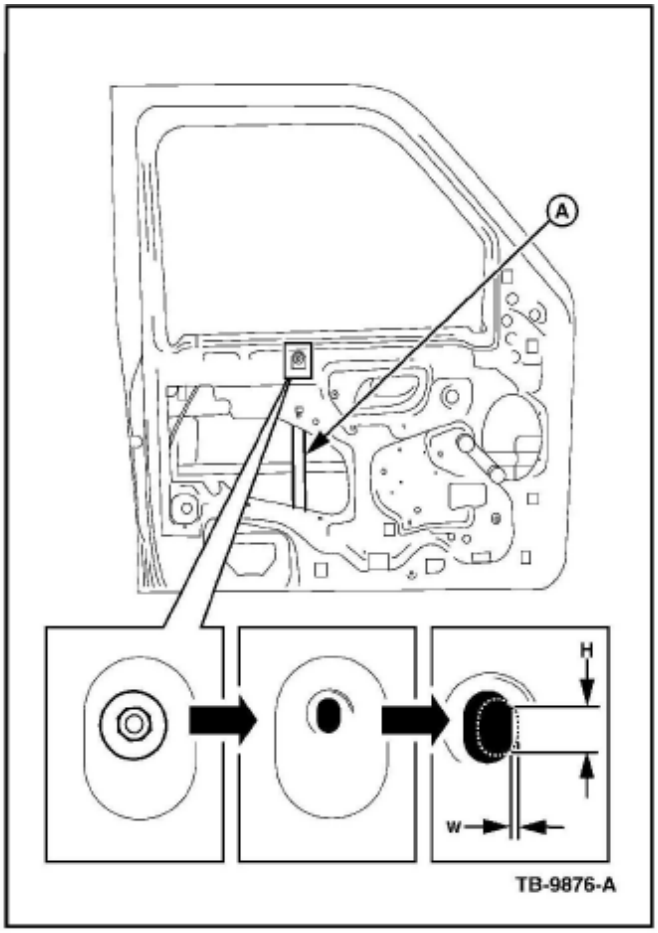


Figure 2

PART NUMBER	PART NAME
XG-4	Motorcraft® Multi-Purpose Grease
PM-13-A	Motorcraft® Anti-Corrosion Coating

3. With window in down position, remove the top and bottom center door glass Run retainer nuts and push door glass Run A to the side. (Figure 2)

4. Rework the upper glass Run attachment slot. (Figure 2)

a. Remove approximately 5/64" (2 mm) of material at W and 25/64" (10 mm) at H.

b. Remove material from the front of vehicle side of the slot. Be careful to not leave burrs on the panel.

c. Coat newly exposed metal areas with Motorcraft(R) Anti-Corrosion Coating.

5. Reposition glass Run A and loosely attach fasteners.

6. Raise glass to full up position. While pushing outward on the lower attachment. Torque glass Run attachment nuts, tighten to 106 lb-in. (12 N.m). Be

careful not to force a different position of the stud when installing the upper nut.

7. Install trim panel following WSM, Section 501-05-1.

Parts Block

WARRANTY STATUS: Eligible Under Provisions Of New Vehicle Limited Warranty Coverage
IMPORTANT: Warranty coverage limits/policies are not altered by a TSB. Warranty coverage limits are determined by the identified causal part.

OPERATION DESCRIPTION TIME

092205A 2008-2009 Ranger: Follow 0.3 Hr.

Service Procedure To Adjust And Grease The Glass Run On One (1) Door (Do Not Use With Any Other Labor

NOTE: The information in Technical Service Bulletins is intended for use by trained, professional technicians with the knowledge, tools, and equipment to do the job properly and safely. It informs these technicians of conditions that may occur on some vehicles, or provides information that could assist in proper vehicle service. The procedures should not be performed by "do-it-yourselfers". Do not assume that a condition described affects your car or truck. Contact a Ford, Lincoln, or Mercury dealership to determine whether the Bulletin applies to your vehicle.

Operations)

092205B 2008-2009 Ranger: Follow 0.6 Hr.

Service Procedure To Adjust And Grease The Glass Run On (2) Doors (Do Not Use With Any Other Labor Operations)

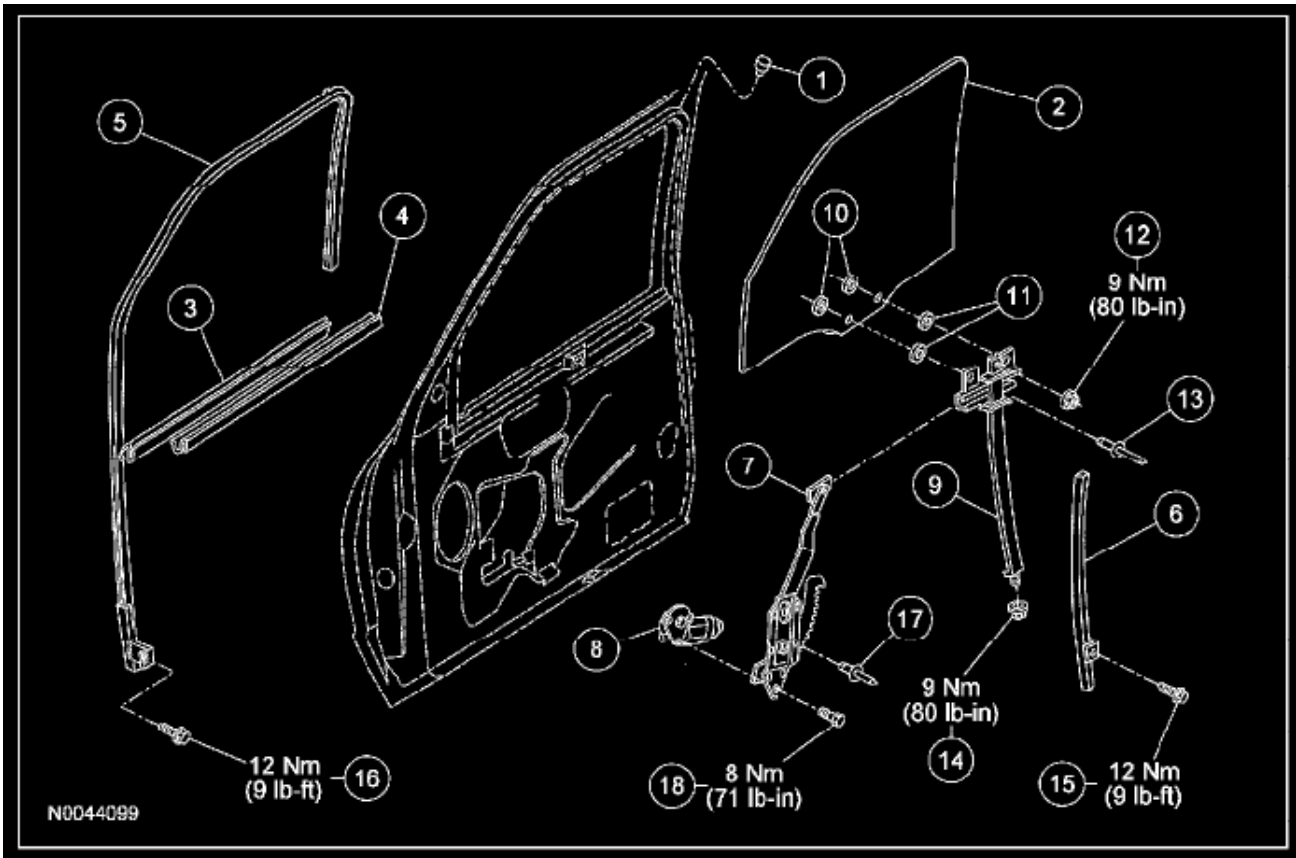
DEALER CODING

CONDITION

BASIC PART NO. CODE

1023288 07

Disclaimer



Item	Part Number	Description
1	N805277-S	Rivet
2	21410	Door glass
3	21452A	Door glass weatherstrip-outer
4	21452B	Door glass weatherstrip-inner
5	21546	Door glass top run
6	222A00	Door glass channel
7	23208	Regulator assembly
8	23394	Motor assembly
9	23288	Center door glass run
10	234A46	Spacers (2 required)
11	234A44	Spacers (2 required)

(Continued)

Item	Part Number	Description
12	N621907-S	Center door glass run nut
13	W525175-S	Window glass rivet (2 required)
14	N621907-S	Center door glass run nut
15	N6066676-S	Door glass channel bolt
16	N6066676-S	Door glass top run bolt
17	W525172-S	Window regulator rivet
18	N808650-S	Window regulator bolt

Window Track: Service and Repair

DOOR GLASS TOP RUN

Exploded View

Removal and Installation

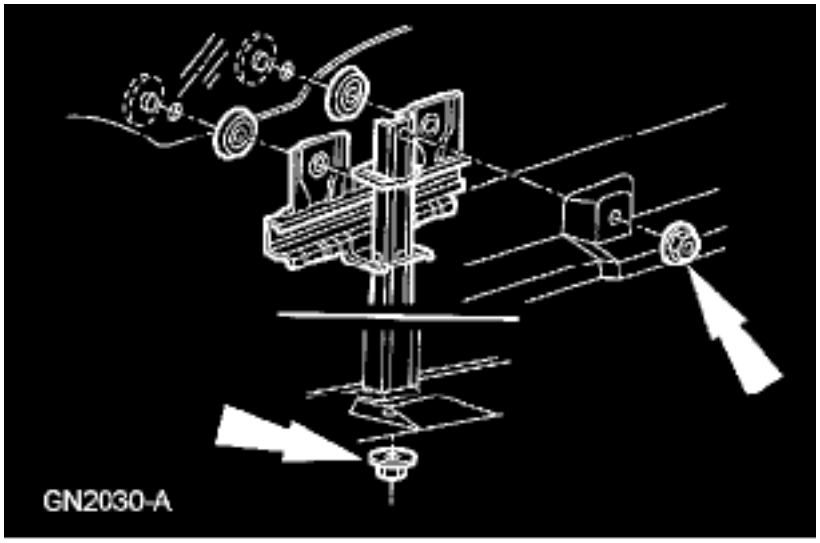
Top run and center run

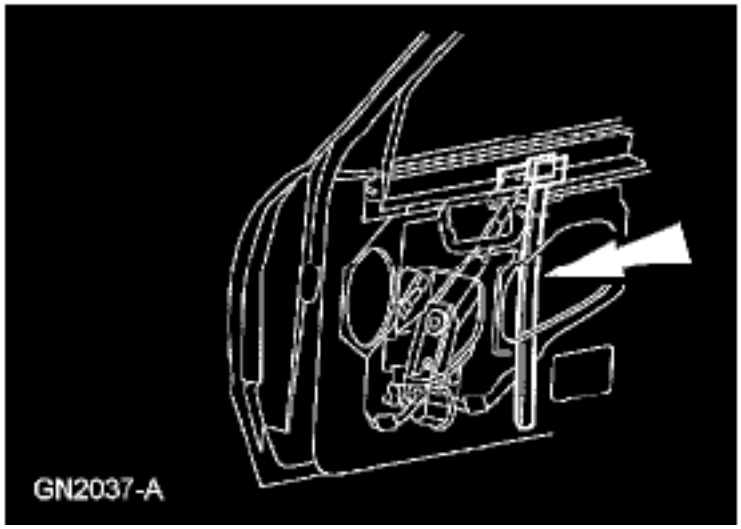
1. Remove the front door window glass.

Center run

2. Remove the top and bottom center door glass run retainer nuts.

- To install, tighten to 9 Nm (80 lb-in).





3. Remove the center door glass run.

Top run

4. Remove the front door beltline inside and outside weatherstrips. 5. Remove the door glass top run bolt.

- To install, tighten to 12 Nm (9 lb-ft).

6. Remove the door glass top run.

Top run and center run

7. To install, reverse the removal procedure.

Windshield: Description and Operation

WINDSHIELD GLASS

The windshield glass is standard plastic and glass laminate safety glass. The windshield glass is bonded to the window opening flange with urethane adhesive.

Special Tool(s)

ST1320-A	Interior Auto Glass Cut-Out Knife Kit or equivalent 164-R2450
ST1109-A	Pneumatic Knife with Offset Blade or equivalent 164-R1511
ST2085-A	The Pumper or equivalent 164-R2459

Material

Item	Specification
DOW AUTOMOTIVE 2-HOUR CURE	
Dow Urethane Adhesive Betaseal® Express	—
Dow Urethane One Step Glass Primer Betaprime® 5500 / 5500A / 5500SA	—
SIKA 2-HOUR CURE	
Sika Urethane Adhesive Sika Tack ASAP	—
Sika Urethane Metal and Glass Primer Sika 206 G+P	—
Ultra-Clear Spray Glass Cleaner ZC-23	ESR-M14P5-A

Windshield: Service and Repair

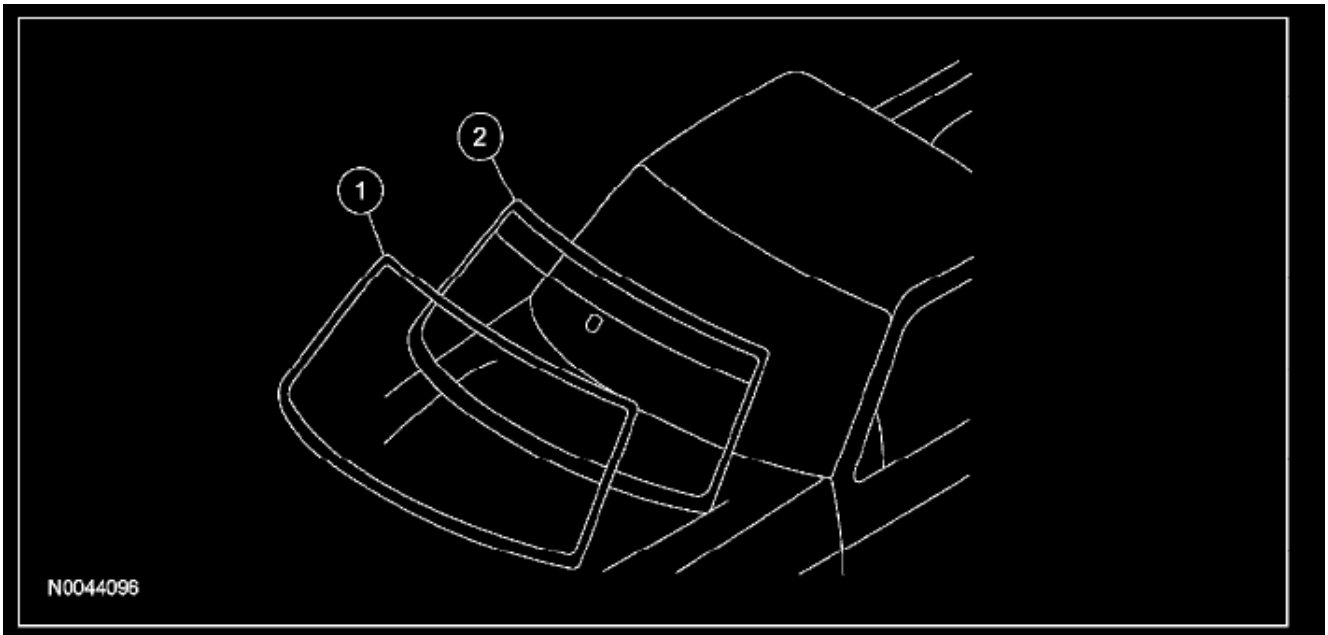
WINDSHIELD GLASS

Special Tool(s)

Special Tool(s)

Material

Material



Item	Part Number	Description
1	03144	Mouldings
2	03100	Windshield

Removal

1. Remove the windshield wiper pivot arms. 2. Remove the A-pillar trim panel. 3. Remove the sun visors. 4. Remove the sun visor clips. 5. Lower the front portion of the headliner. 6. Remove the interior rear view mirror. 7. Using a soft brush or vacuum, remove any dirt or foreign material from the pinch weld area.

8. NOTE: Refer to manufacturer's instructions before using the tool.

Lubricate the urethane adhesive with water to aid the Interior Auto Glass Cut-Out Knife Kit when cutting the urethane adhesive.

9. WARNING:

- Always wear eye protection when servicing a vehicle. Failure to follow this instruction may result in serious personal injury.

- Wear protective gloves when handling components or parts that have pointed or sharp edges. Failure to follow this instruction may result in serious personal injury.

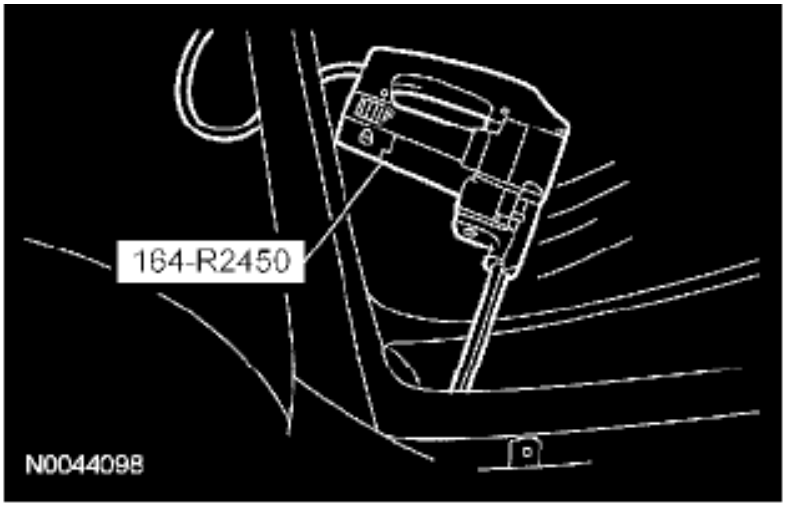
CAUTION: To avoid rust formation, use extreme care not to scratch the paint or primer, or otherwise damage the pinch weld during glass removal.

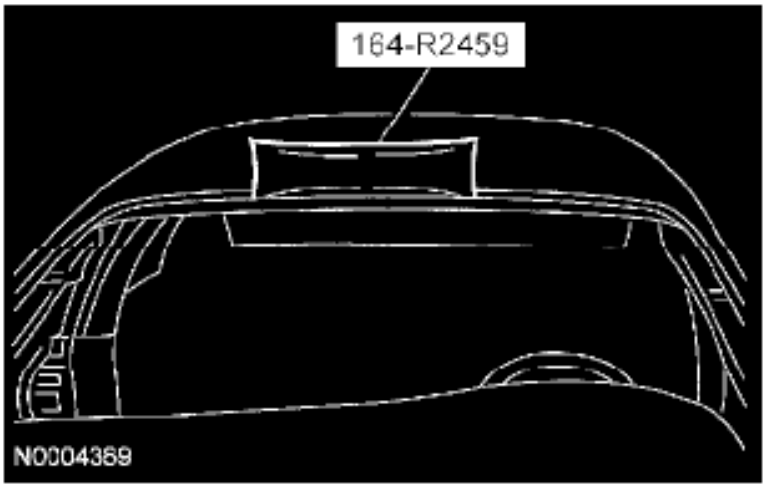
NOTE: -

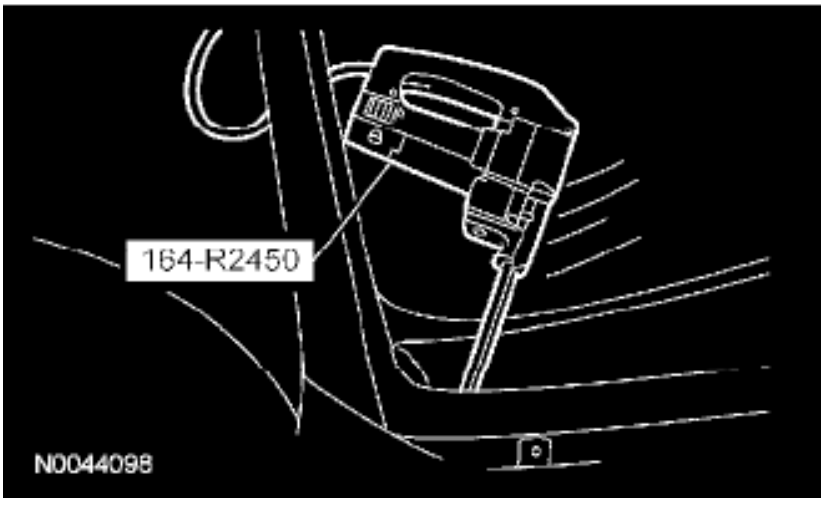
Insert the blade into the special tool so that the flat side is against the glass. This will leave the entire urethane adhesive bead on the pinch weld and allow a dry fit of the replacement windshield glass.

- Support the windshield glass as necessary to prevent the glass from dropping while cutting the urethane adhesive.

Insert the special tool at the upper center of the windshield glass and work toward the bottom corners.


164-R2450
N0044098


164-R2459
N0004369


164-R2450
N0044098

10. Using the special tool, distance the windshield glass from the body.

11. Using the special tool, cut the remaining urethane adhesive and carefully remove the windshield glass and place on a stable work surface.

Installation

1. Dry fit the windshield glass on the existing urethane bead on the pinch weld.

- Position the windshield glass on the pinch weld.

- Center the windshield glass in the opening.

- Adjust the windshield glass stop blocks (if equipped) as needed for best fit.

- Make alignment marks with tape or non-staining grease pencil (preferably at the windshield glass stop blocks, if equipped) on the windshield glass and the body.

2. After the dry-fit alignment, remove the glass from the windshield opening and place on a stable work surface with the interior side of the glass

facing up.

3. Using a clean shop towel, brush or oil-free compressed air, clean the pinch weld area around the existing urethane. Remove any foreign material or

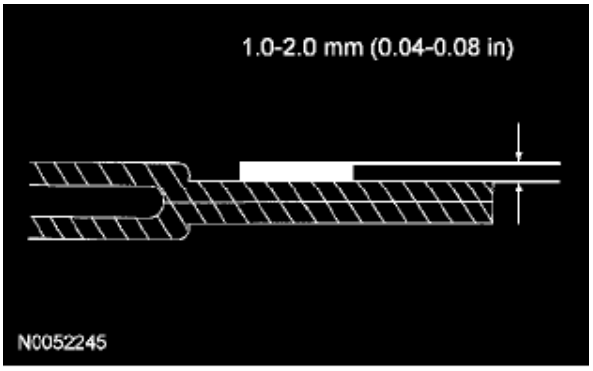
water that may have entered during windshield removal.

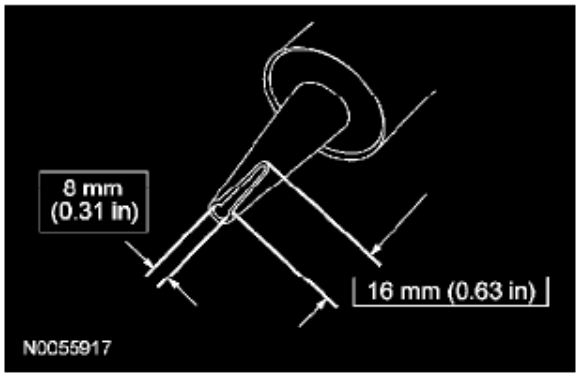
4. WARNING: Repair any corrosion found on the pinch weld. The pinch weld is a structural component of the vehicle. Corrosion left

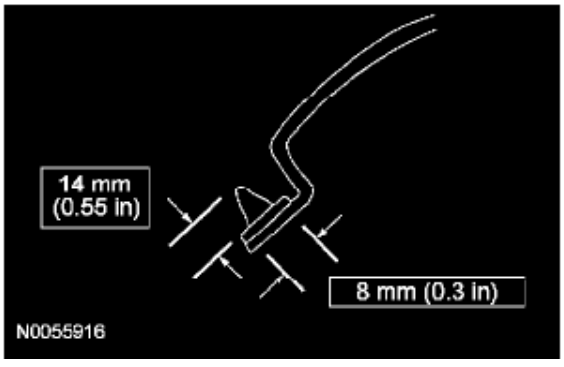
unrepaired may reduce the structural integrity of the vehicle. Failure to follow this instruction may result in serious injury to vehicle occupant(s).

NOTE: Avoid scratching the pinch weld. For minor scratches or exposed metal on the pinch weld, see the manufacturer's recommendations.

Using an appropriate tool, trim the urethane adhesive leaving a 1-2 mm (0.04-0.08 in) base of original equipment urethane on the pinch weld.


1.0-2.0 mm (0.04-0.08 in)
N0052245


8 mm
(0.31 in)
16 mm (0.63 in)
N0055917


14 mm
(0.55 in)
8 mm (0.3 in)
N0055916

5. If reinstalling the same windshield glass, remove the remaining urethane adhesive from the glass leaving a thin layer to bond with the new urethane

bead.

6. Clean the inside of the glass surface with glass cleaner.

7. NOTE:

- Be sure to use the same brand and cure-rate products for the adhesive and primer. Do not mix different brands of urethane and primer. Refer to the Material Chart in this procedure.

- Sika uses the same black primer for the glass and pinch weld area.

If installing a new windshield glass, apply urethane glass primer according to manufacturer's instructions. Allow at least 6 minutes to dry.

8. Cut the urethane applicator tip to specification.

9. NOTE: Use either a high-ratio, electric or battery-operated caulk gun that will apply the urethane with less effort and a continuous bead.

Apply urethane adhesive on top of the existing trimmed urethane adhesive bead on the pinch weld. Make sure that all gaps in the urethane adhesive are smoothed into one continuous bead starting and ending at the bottom of the windshield near the center.

WARNING: Do not drive vehicle until the urethane seal has cured. Follow urethane manufacturer's curing directions. Inadequate or incorrect curing of the urethane seal will adversely affect glass retention. Failure to follow these instructions may result in serious injury to vehicle occupant(s).

CAUTION: Before positioning the windshield glass, open vehicle window to prevent the air pressure of closing doors from affecting the adhesive bond.

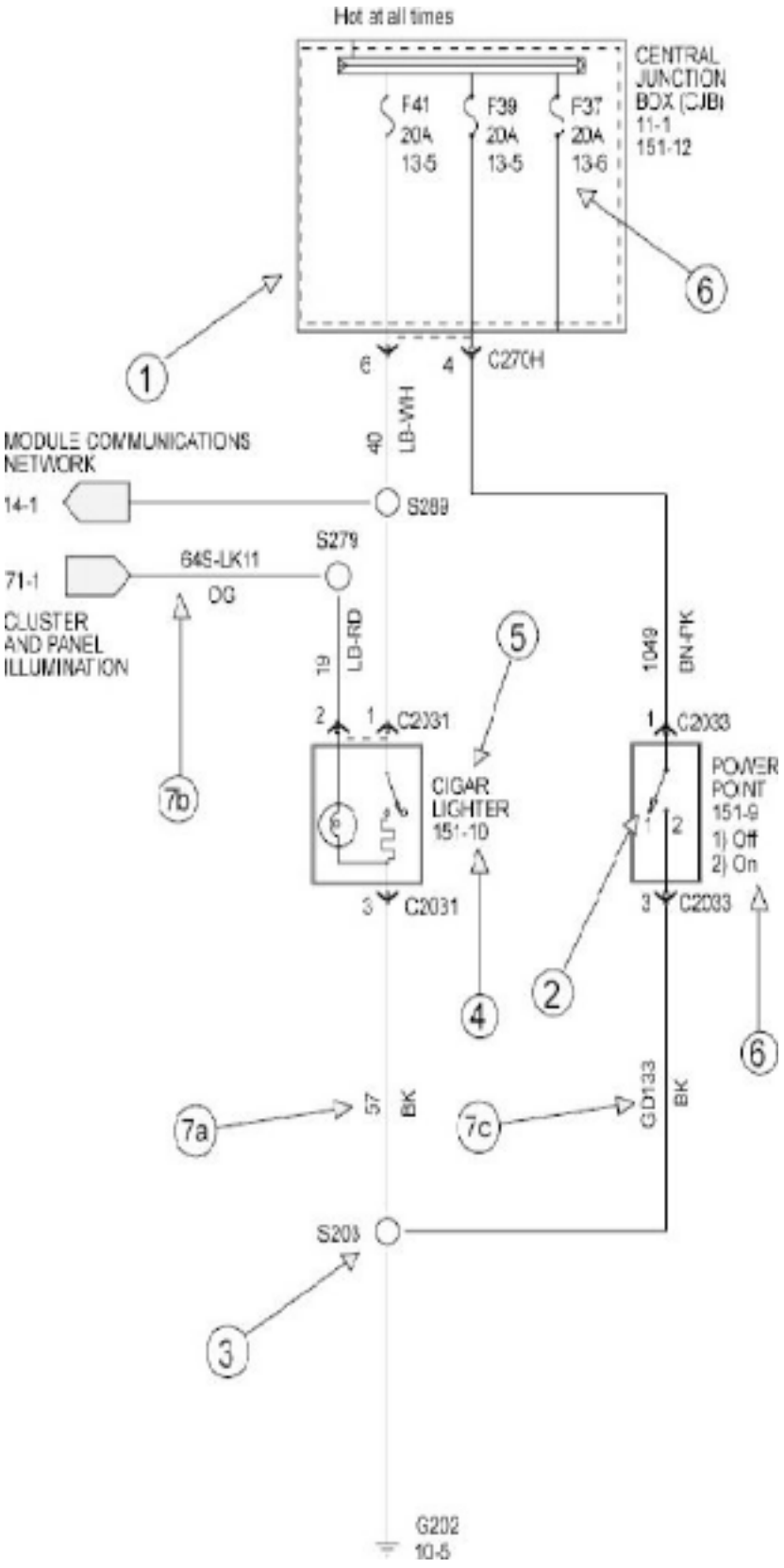
10. Position the windshield glass, aligning the marks made previously.

11. NOTE: The urethane adhesive must cure for a minimum of one hour before testing for air or water leaks.

Check the installation for air and water leaks through the urethane bond and add urethane adhesive where needed.

12. Install the A-pillar trim panel. 13. Install the inside rear view mirror. 14. Install the sun visor clips. 15. Install the sun visors. 16. Install the windshield wiper pivot arms.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Wiper and Washer Systems > Relays and Modules - Wiper and Washer Systems > Windshield Washer Relay > Component Information > Diagrams > Diagram Information and Instructions



Windshield Washer Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

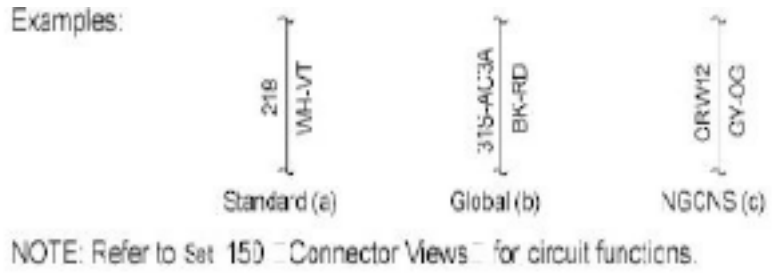
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

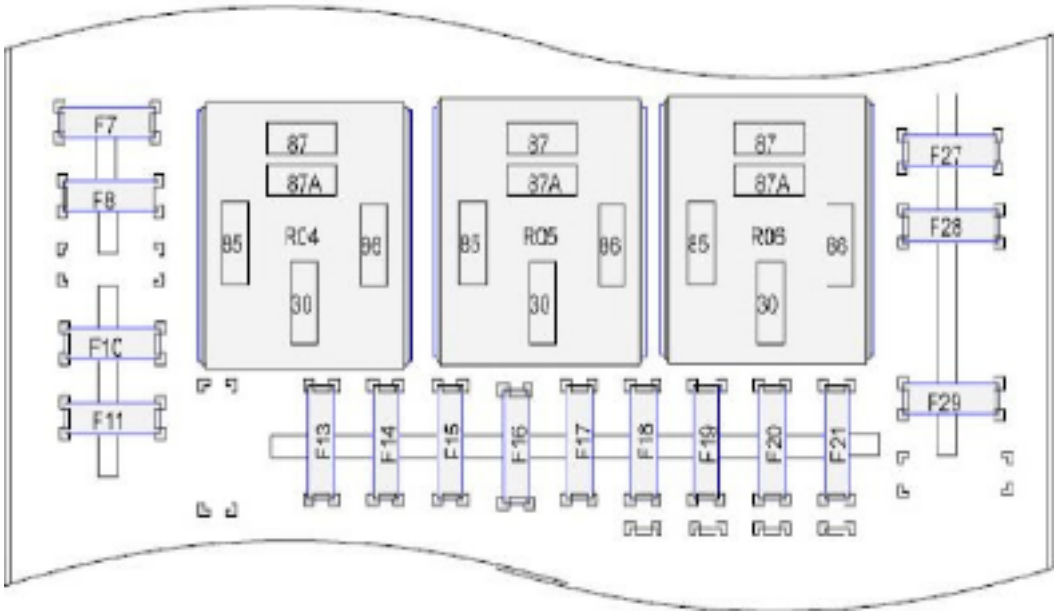
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

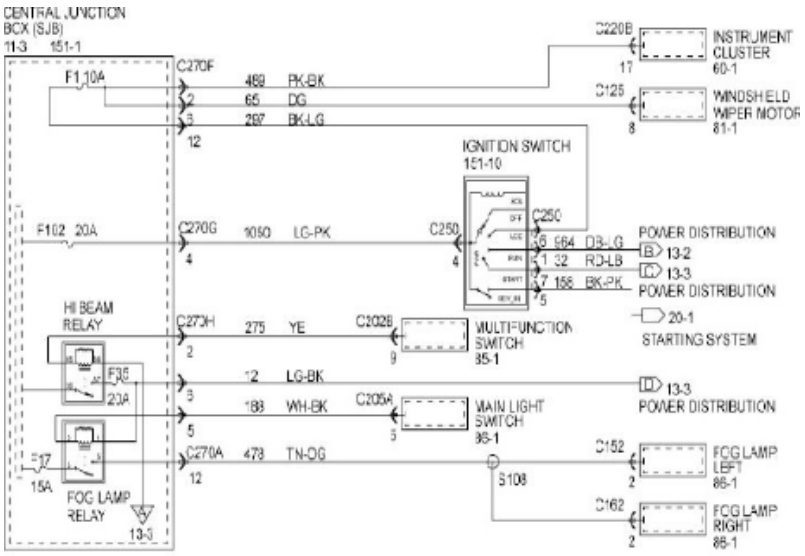
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

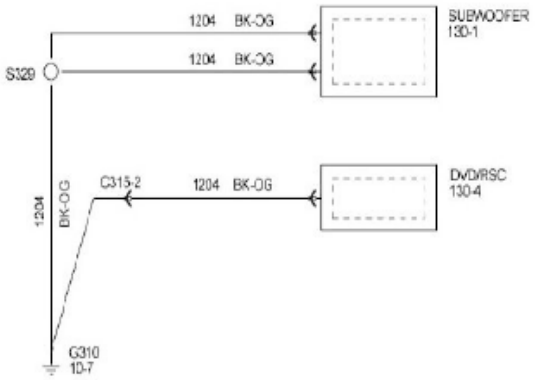
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

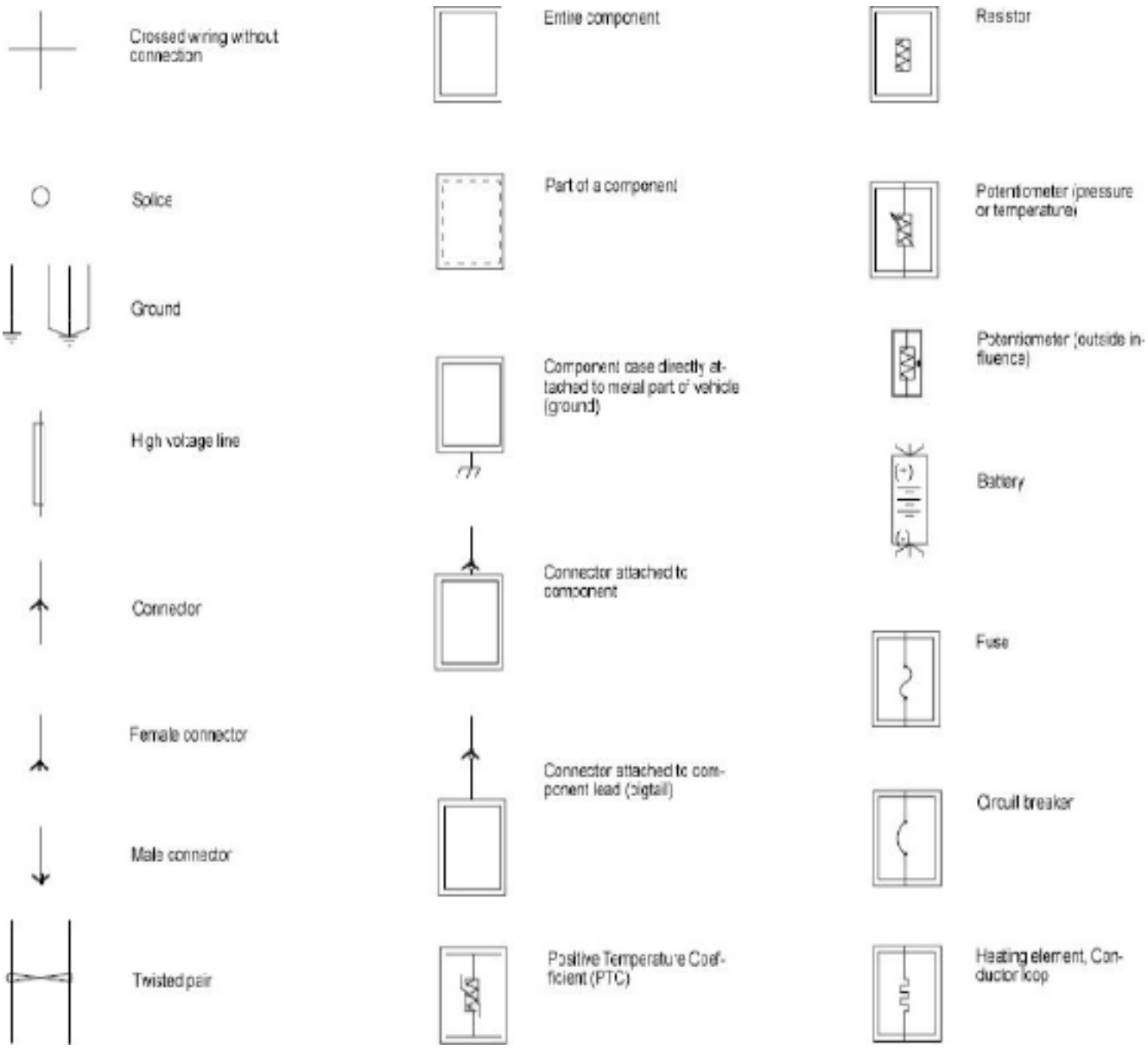
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

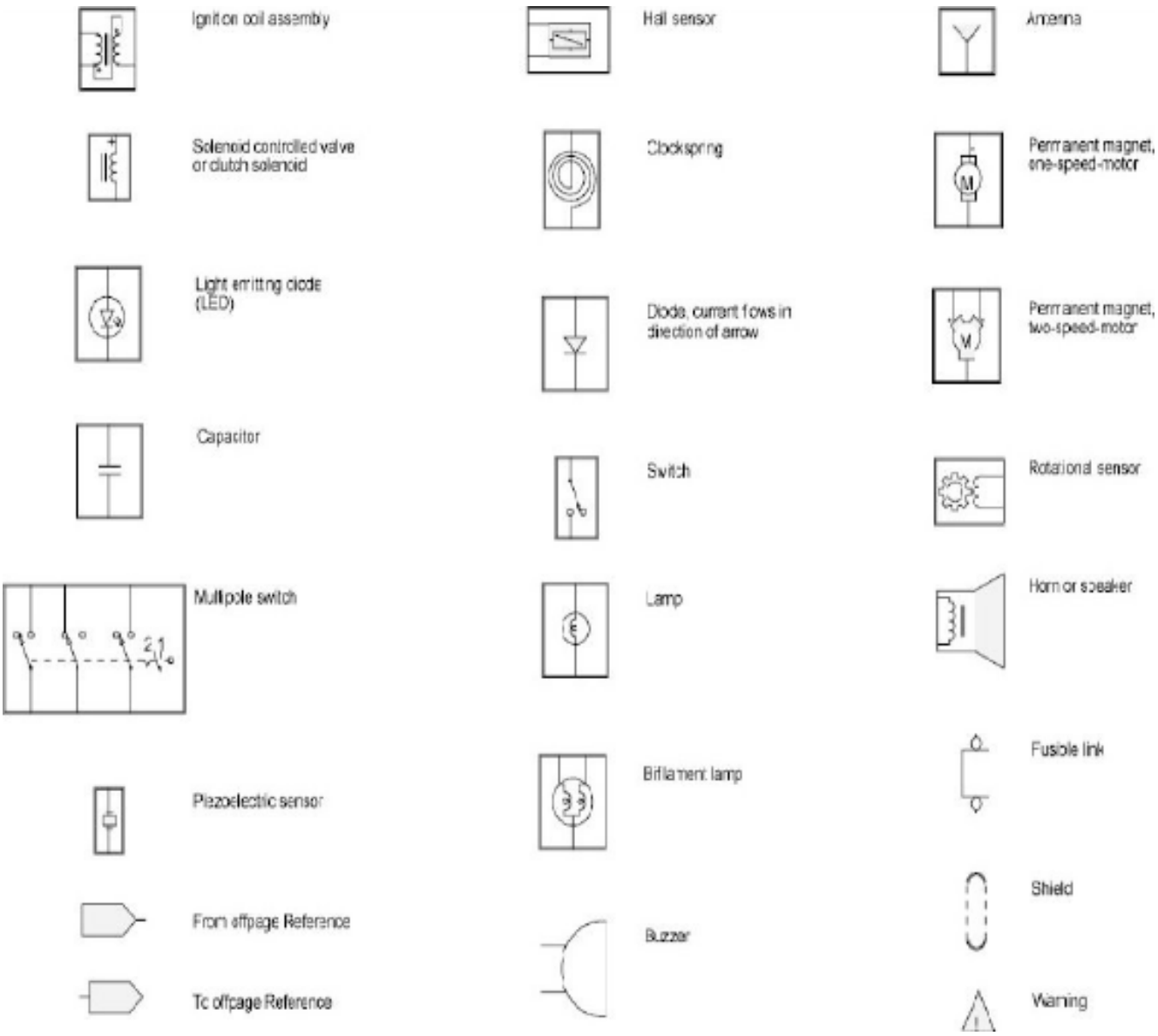
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

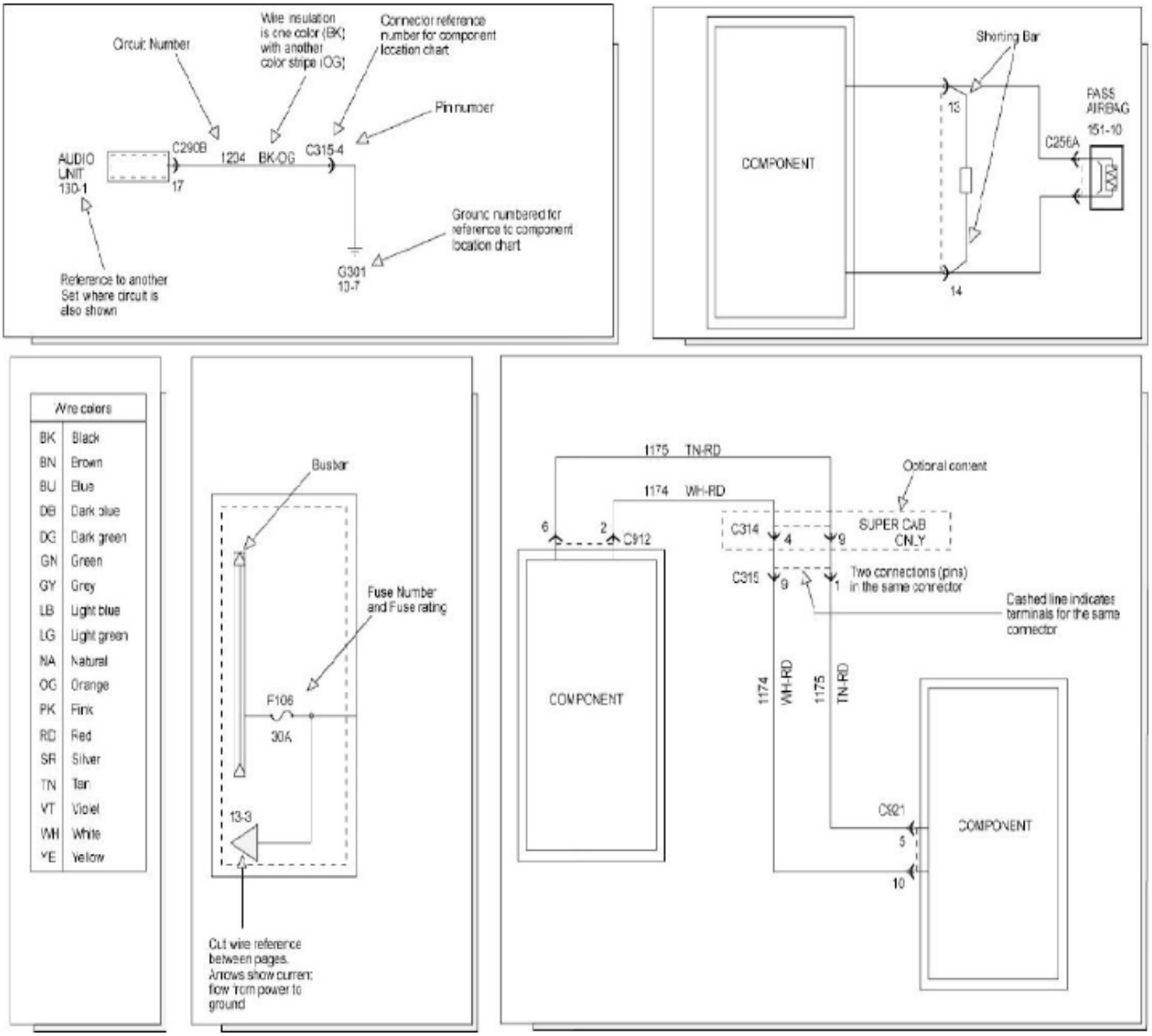
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

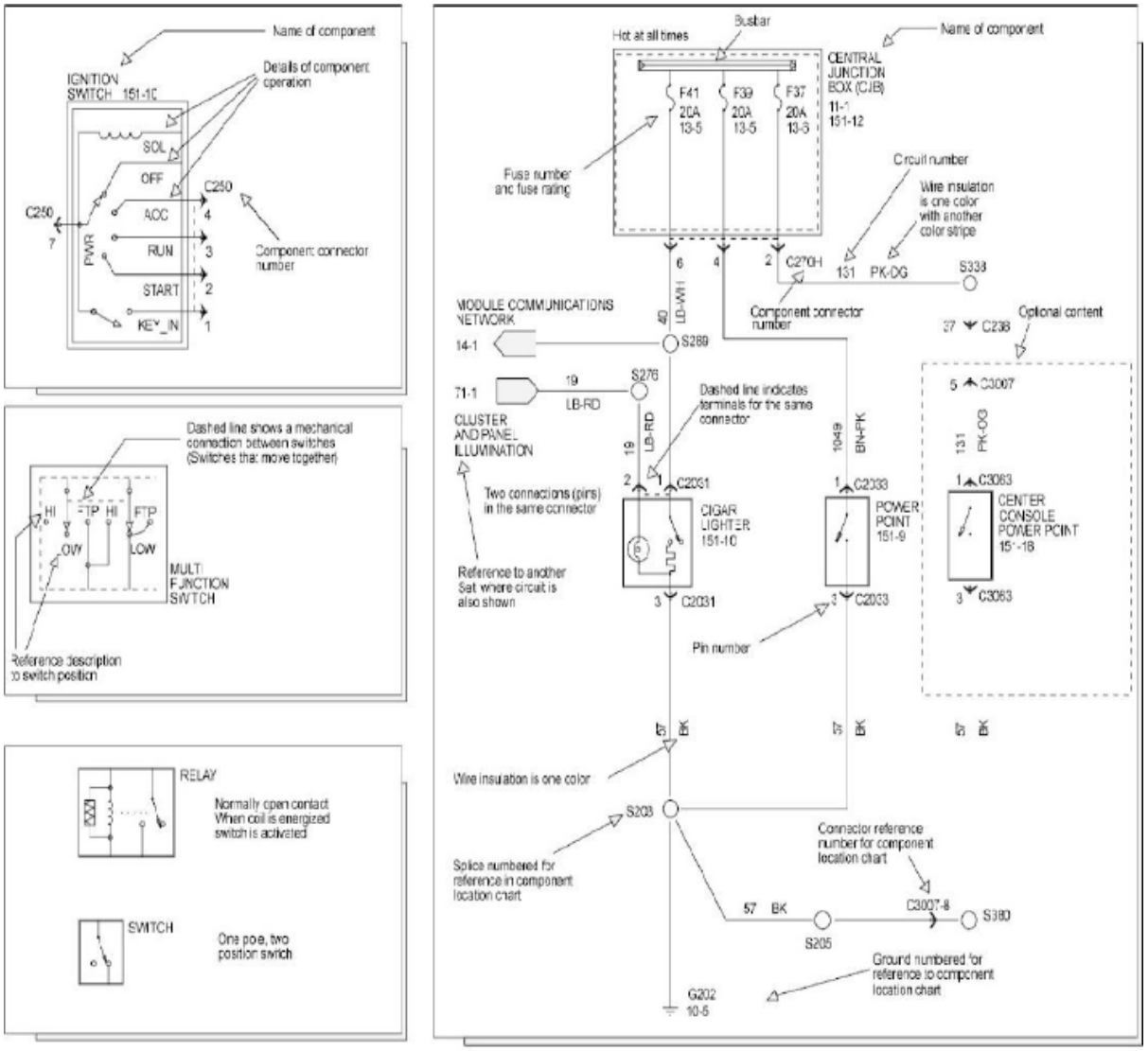
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

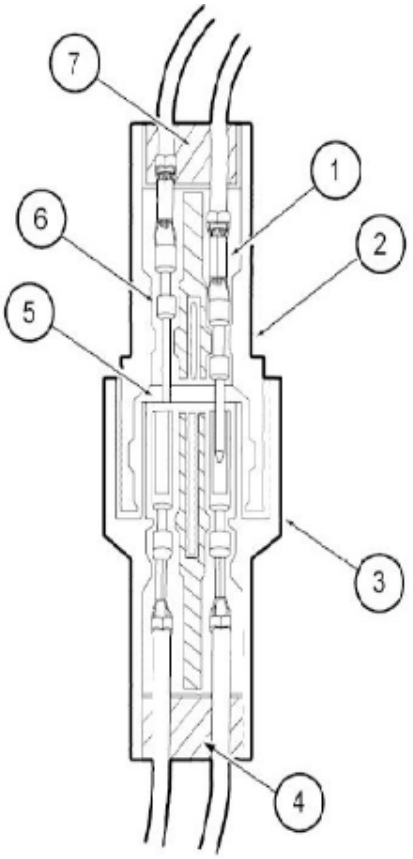


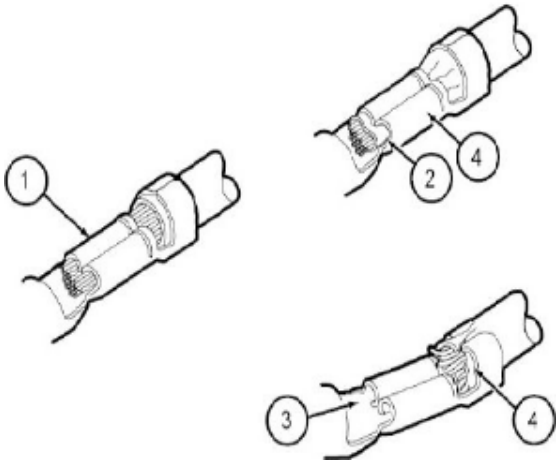
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Windshield Washer Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

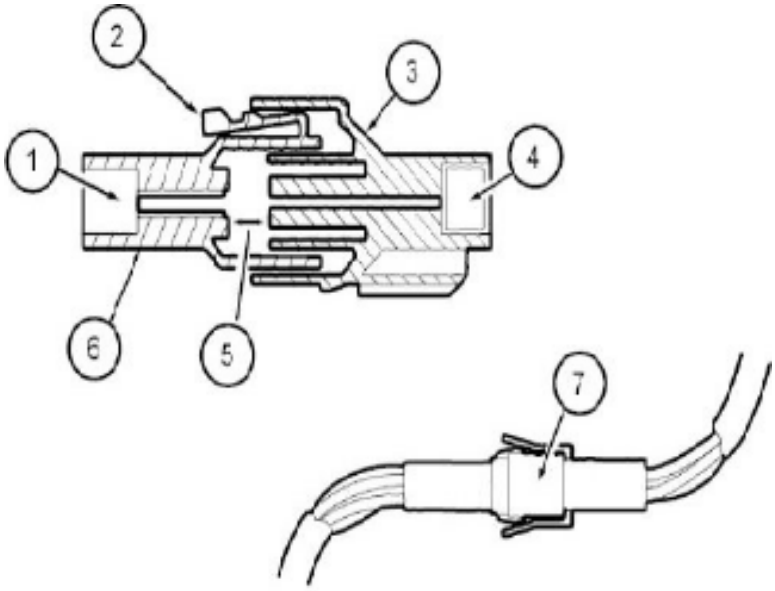
5 = Intermittent contact

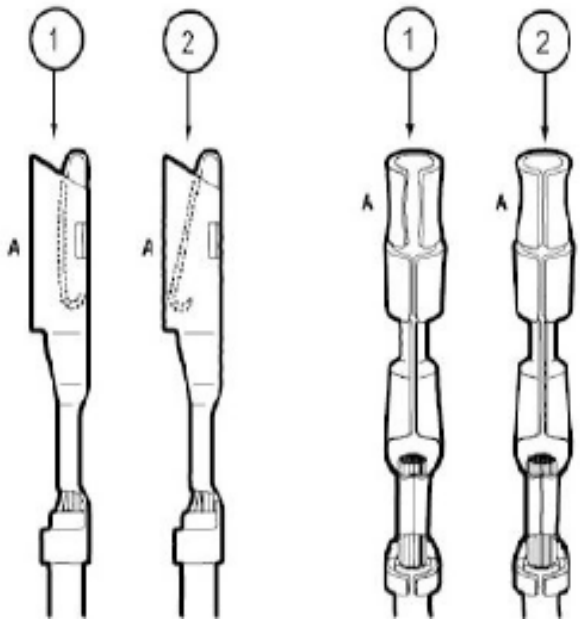
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

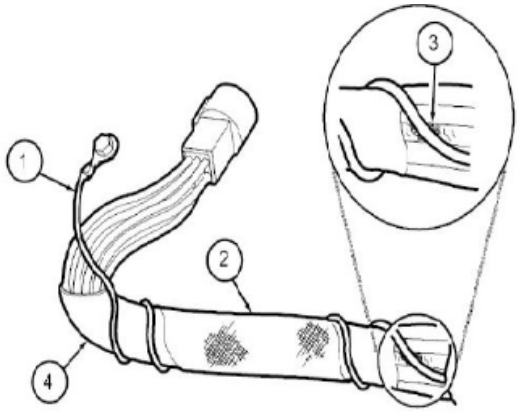
Deformed (enlarged) female terminals

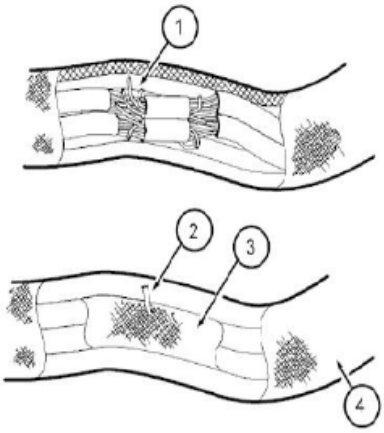
1 = Enlarged

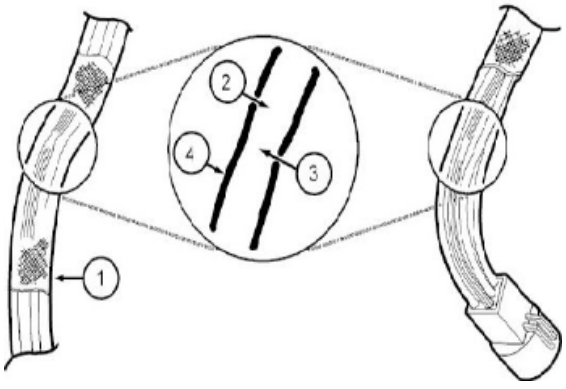
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

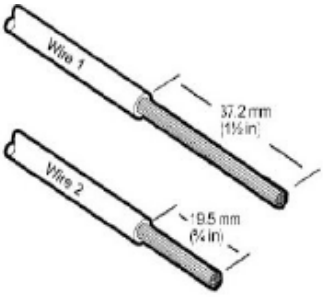
Splice covered 2

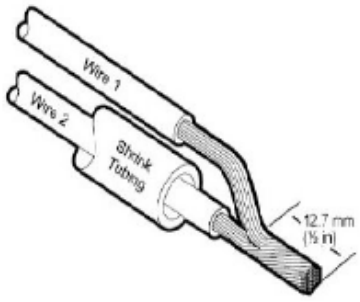
= Wire strand

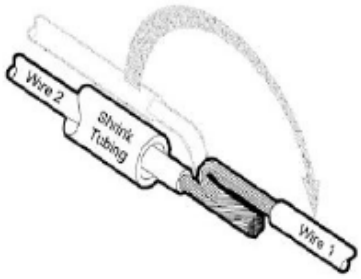
3 = Splice tape

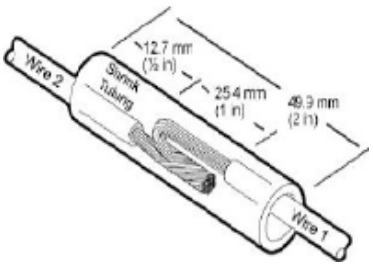
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

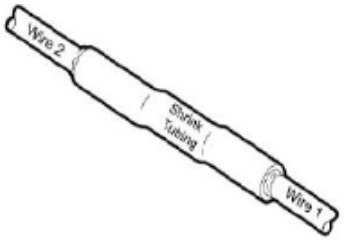
NOTE: -

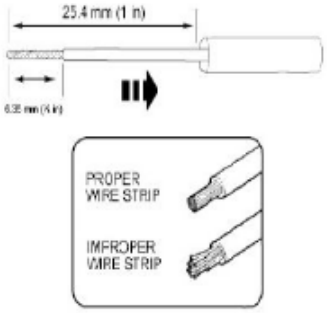
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

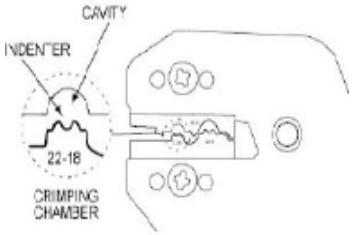
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

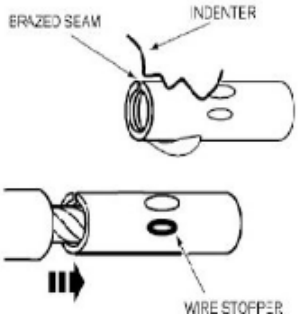
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

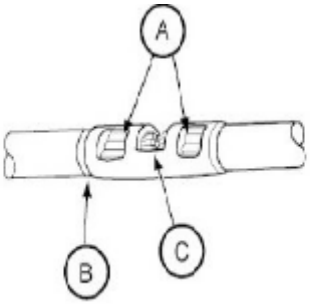
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

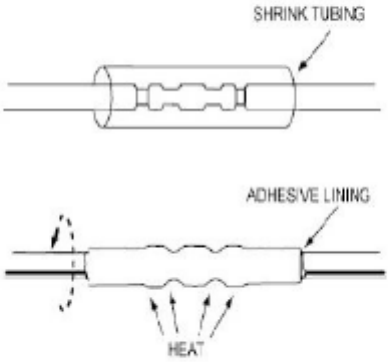
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4 strip, cut 9 strands	* 1/4 strip, cut 2 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip, fold 3x dia.
	16-14	* 1/4 strip, cut 7 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip fold 2x dia	1 strip, fold 3x dia.	1 1/4 strip, fold 4x dia.	Not Recommended
	12-10	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip fold 3x cia.	1 1/4 strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Figtail only

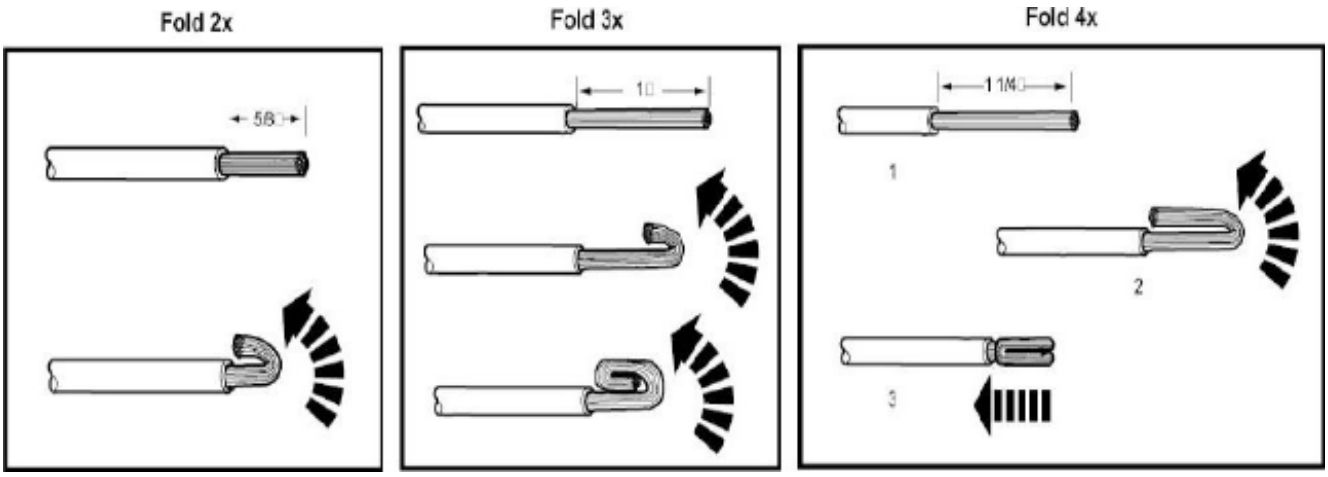
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



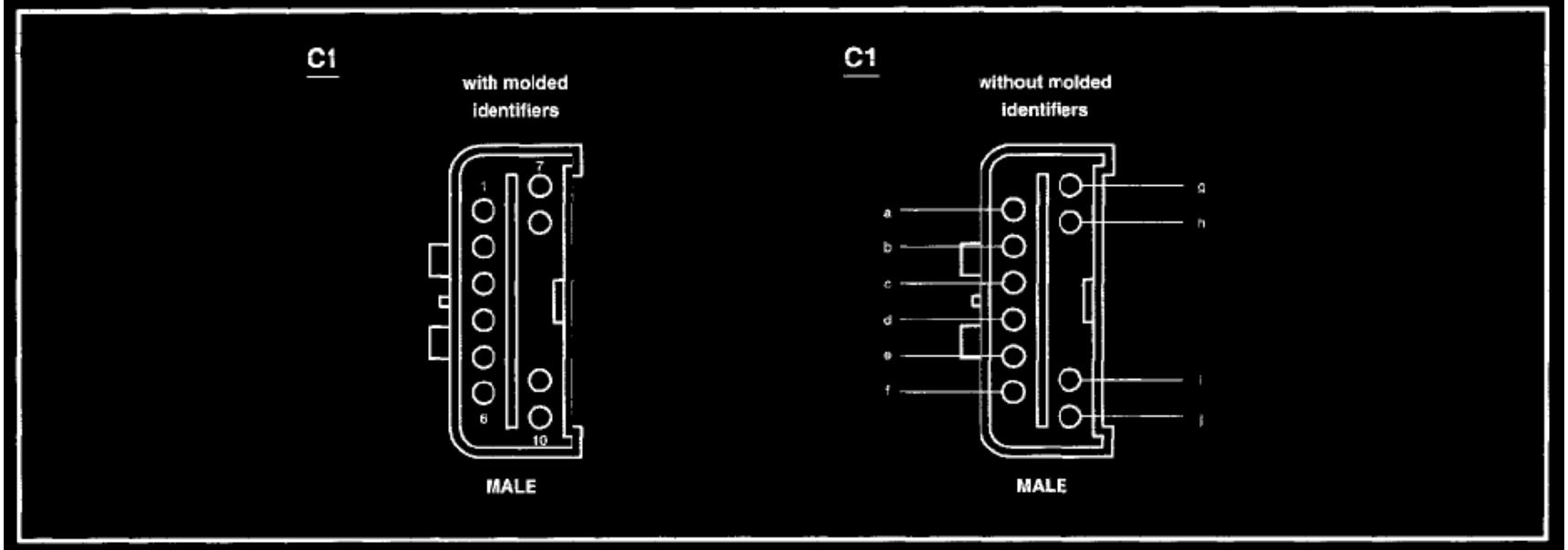
The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step–by–step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



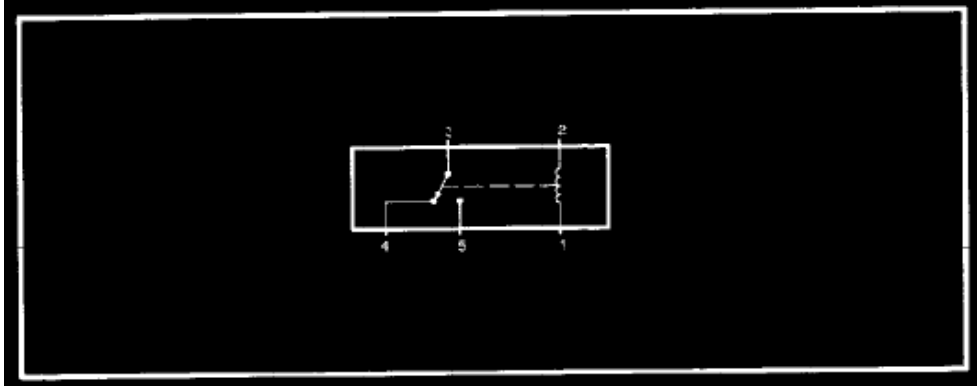
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

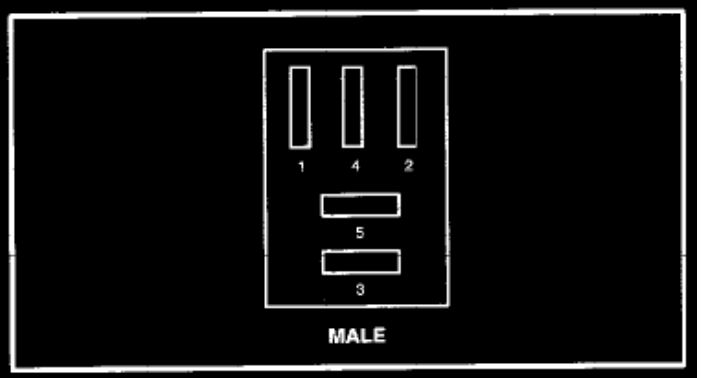
Windshield Washer Relay: Testing and Inspection Micro ISO Relay

Relay – Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63–102Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil – Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

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Component testing procedures are provided to determine whether a component is good or bad.

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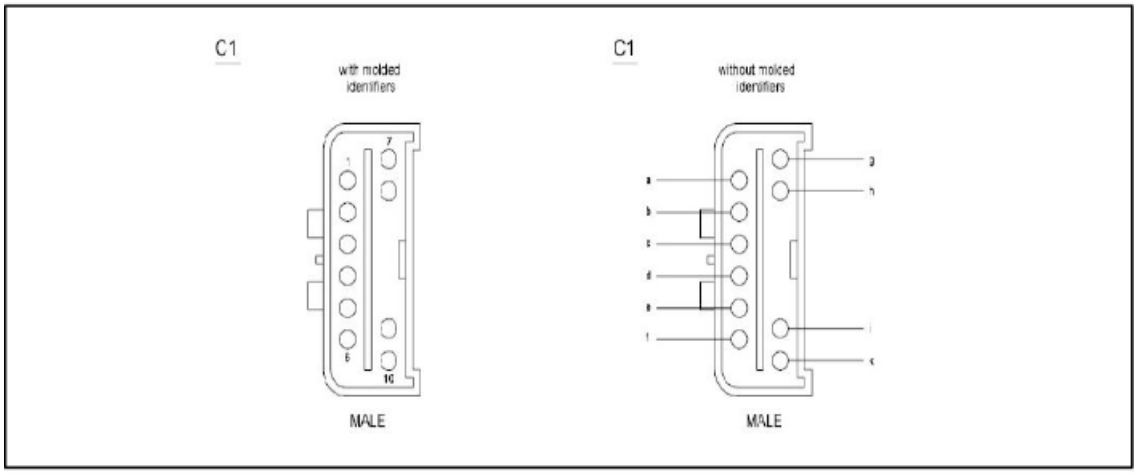
Terminals



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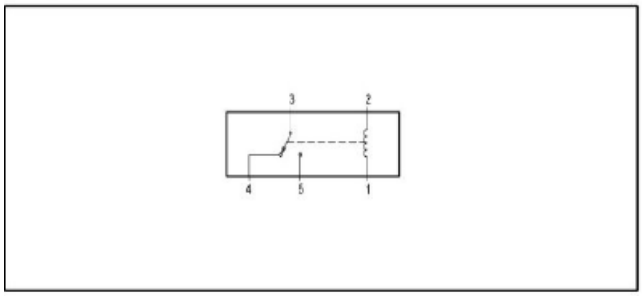
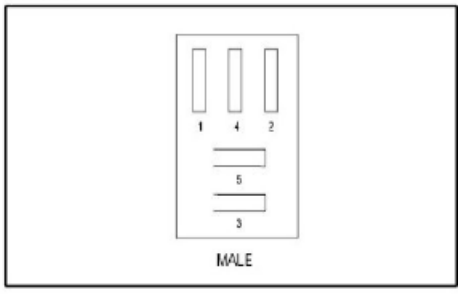
Relay - Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63-102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil - Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

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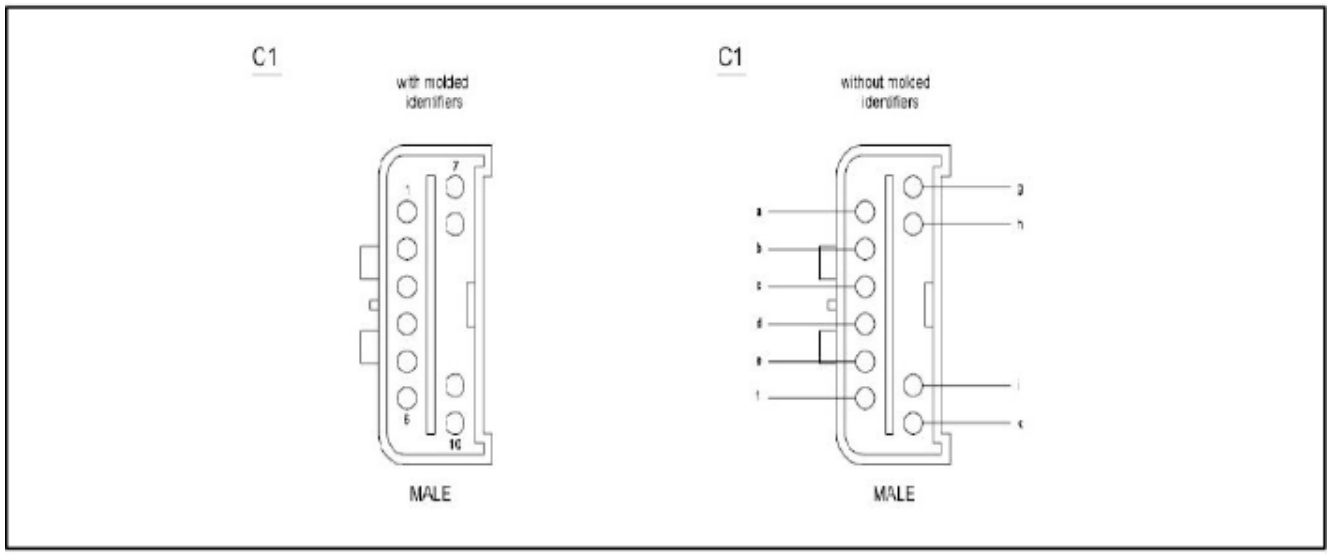
Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step by step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



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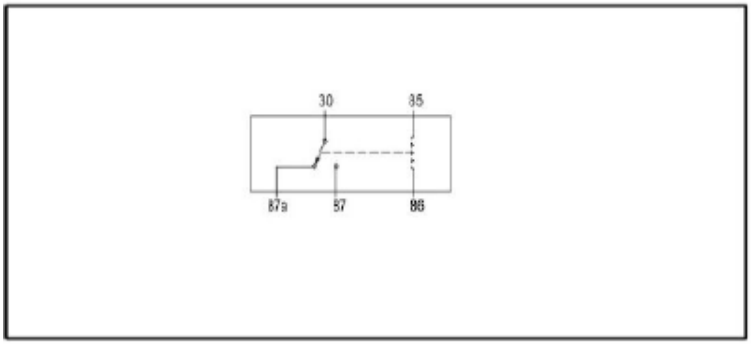
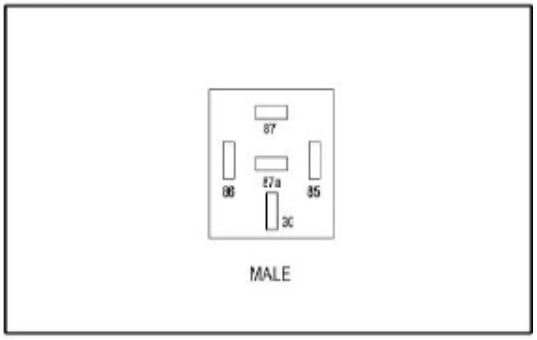
Windshield Washer Relay: Testing and Inspection Mini ISO Relay

Relay □ Mini ISO

Schematic



Terminals



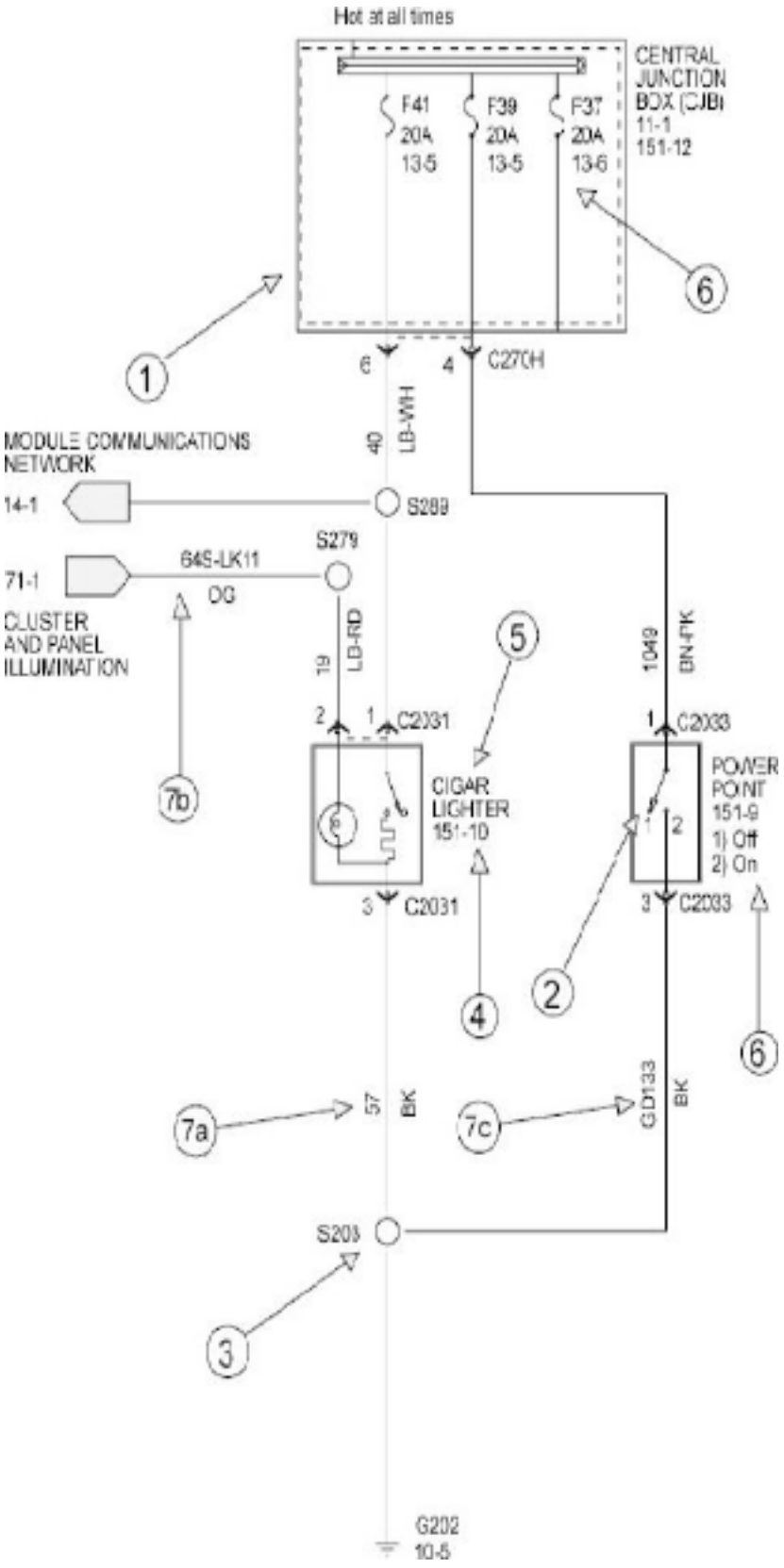
Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Wiper and Washer Systems > Relays and Modules - Wiper and Washer Systems > Wiper Relay > Component Information > Diagrams > Diagram Information and Instructions



Wiper Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

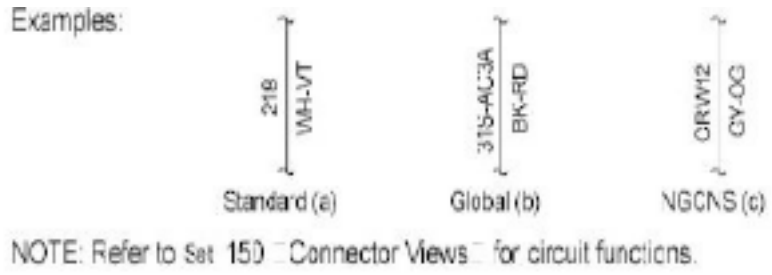
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

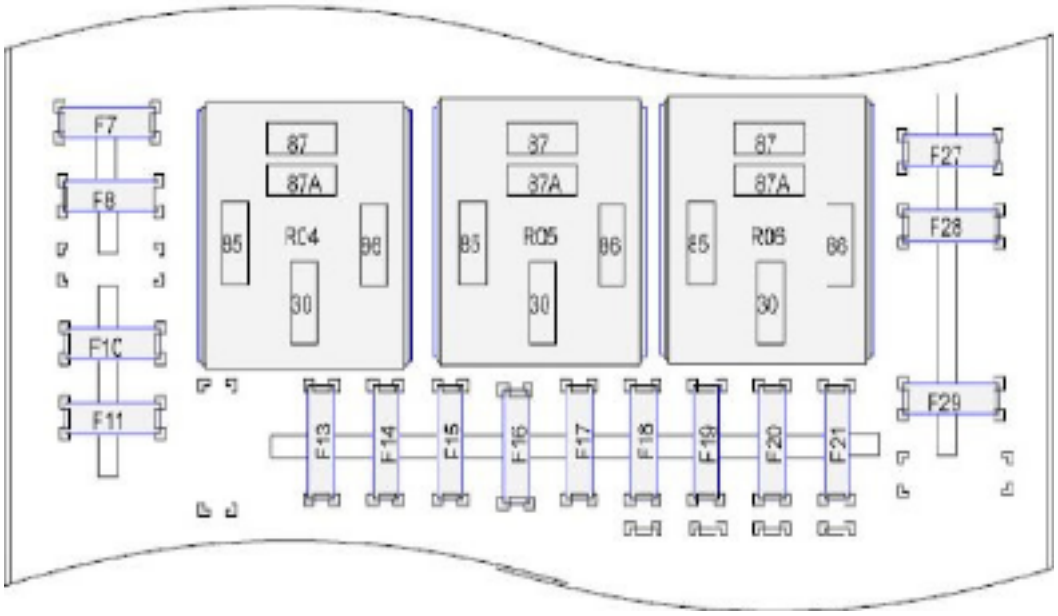
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

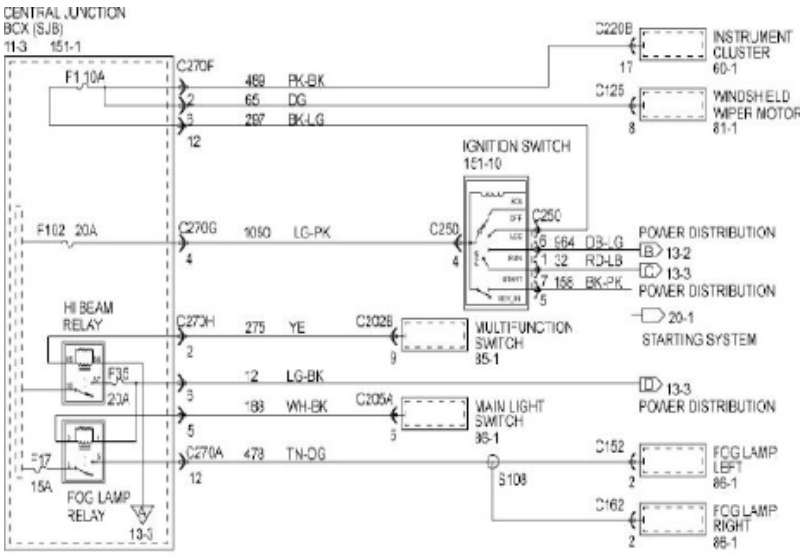
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

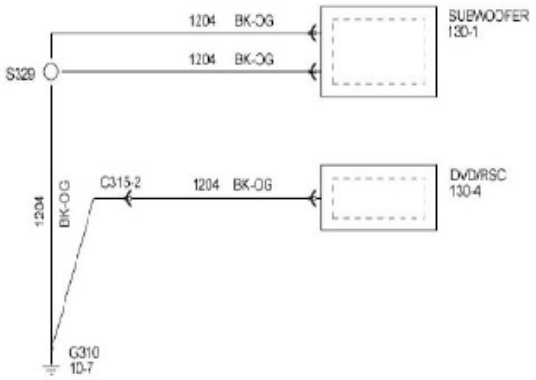
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

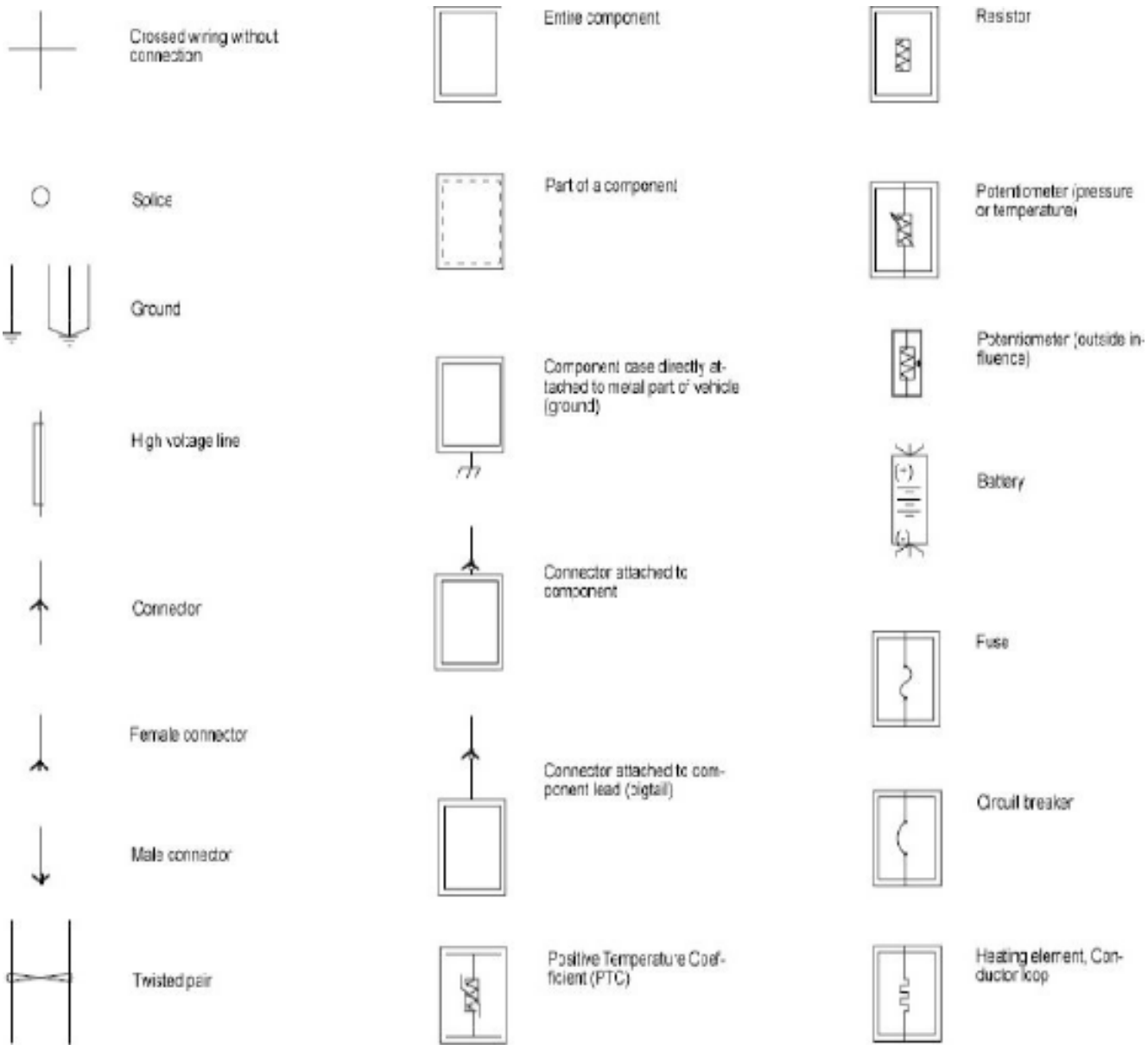
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

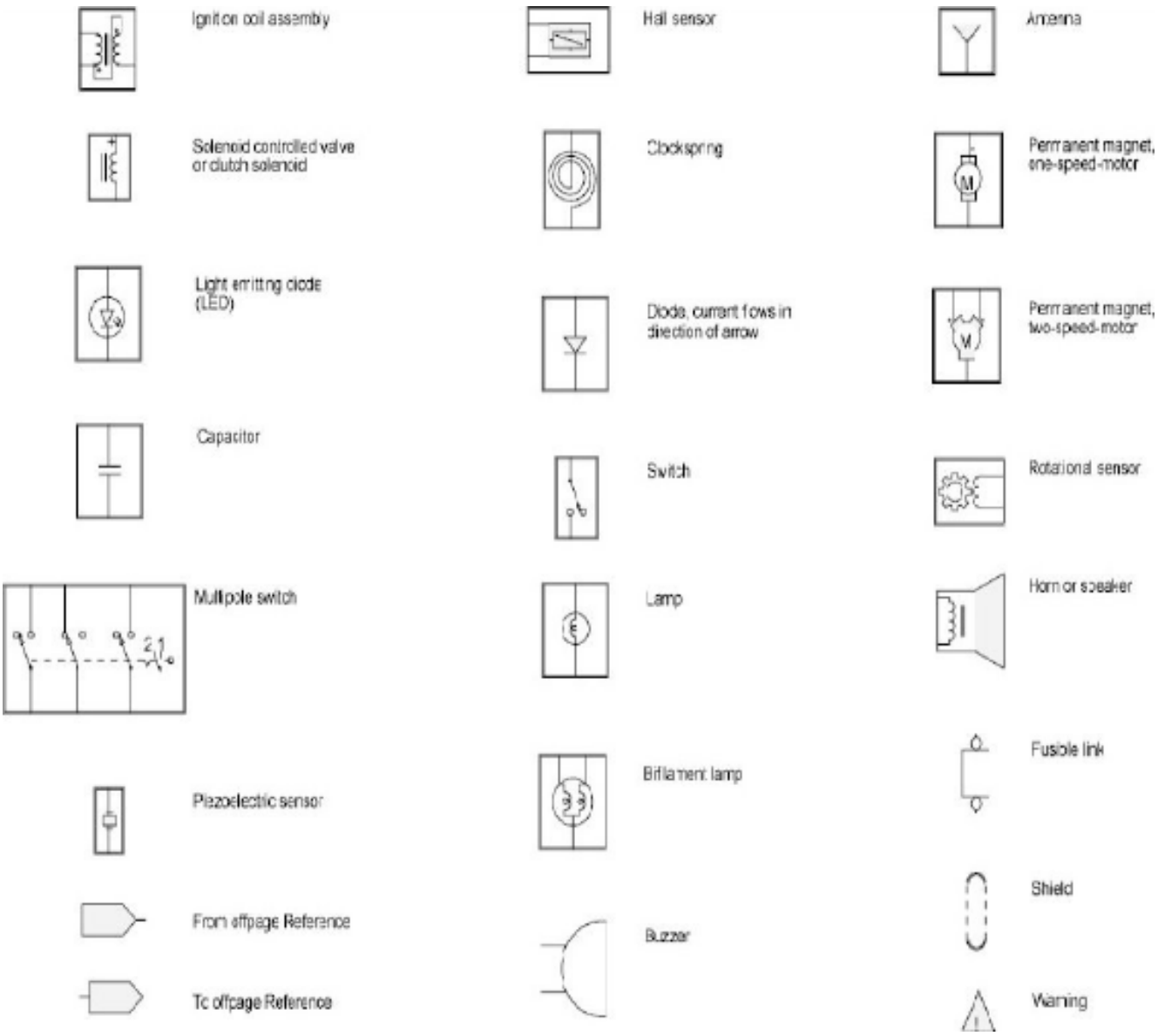
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

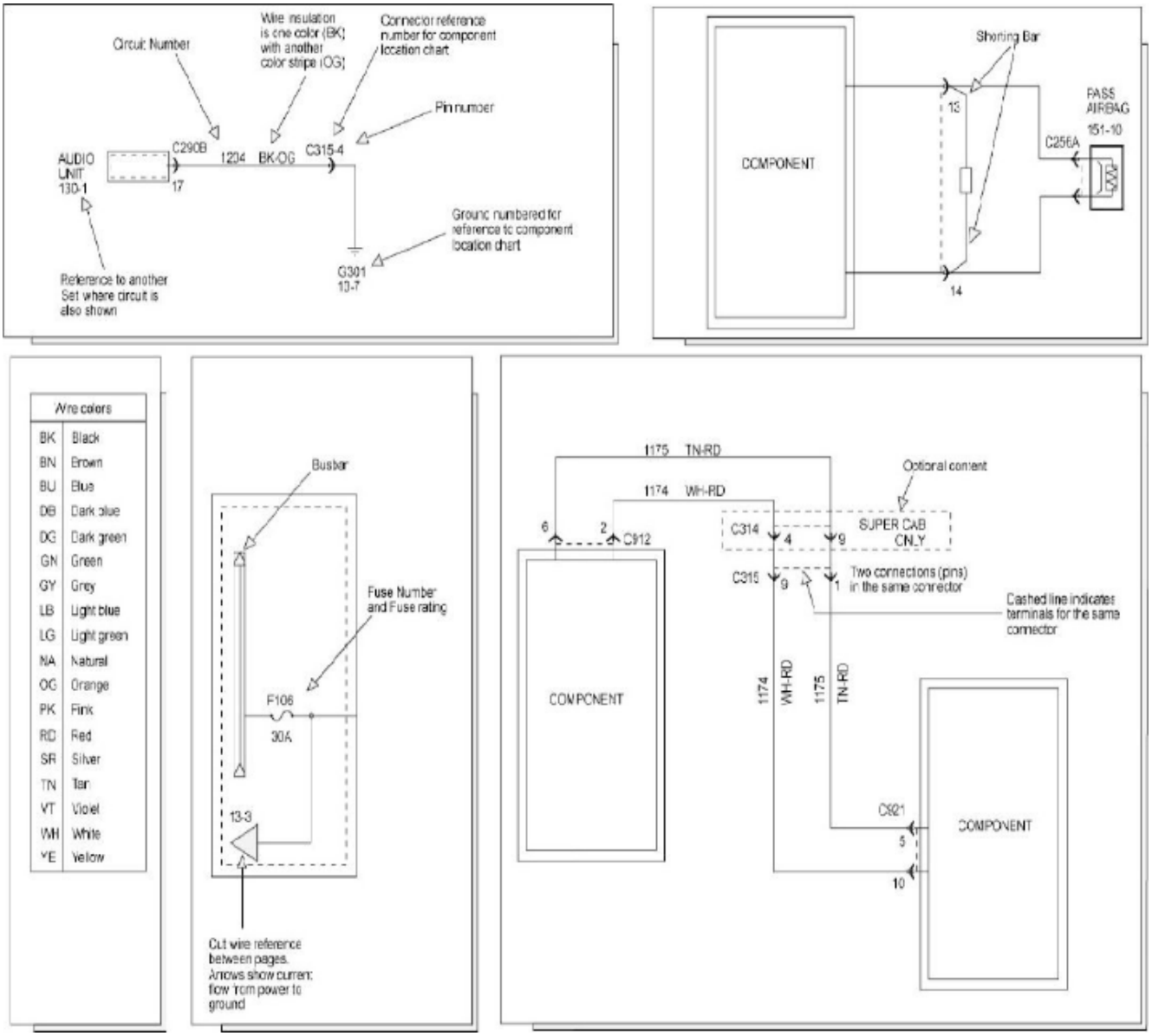
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

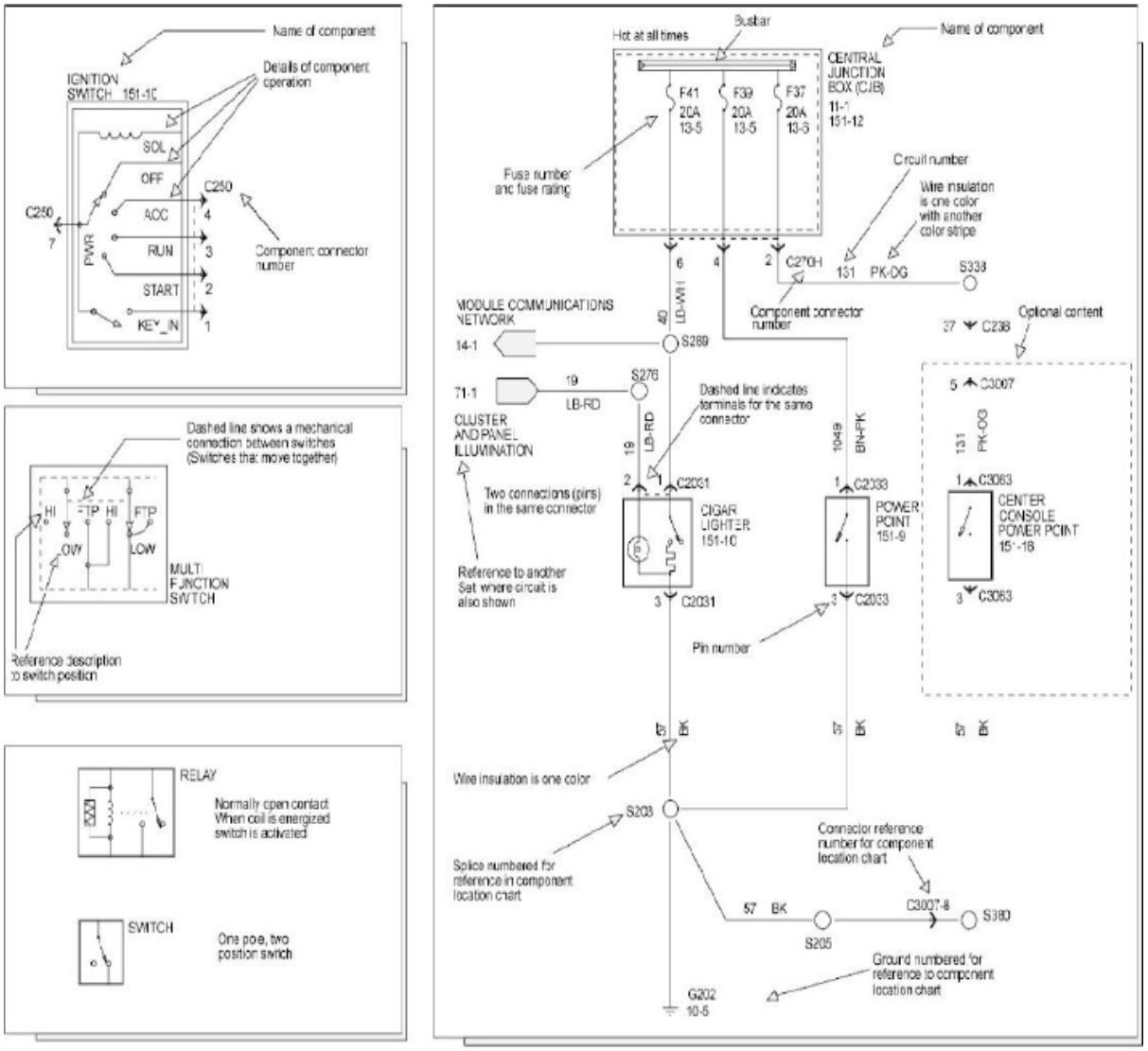
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

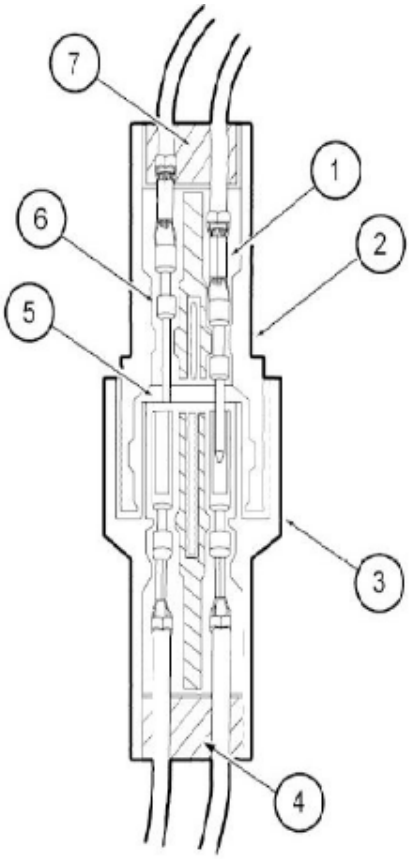


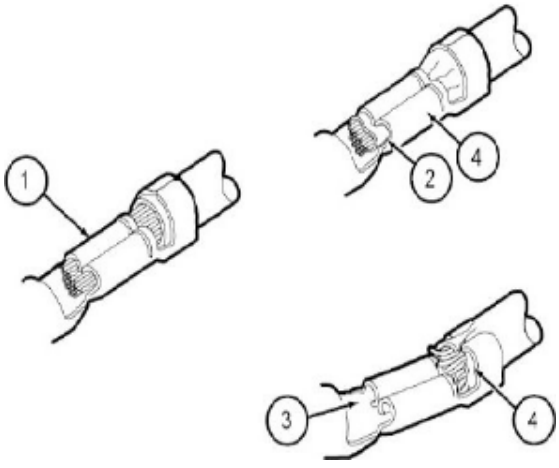
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Wiper Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

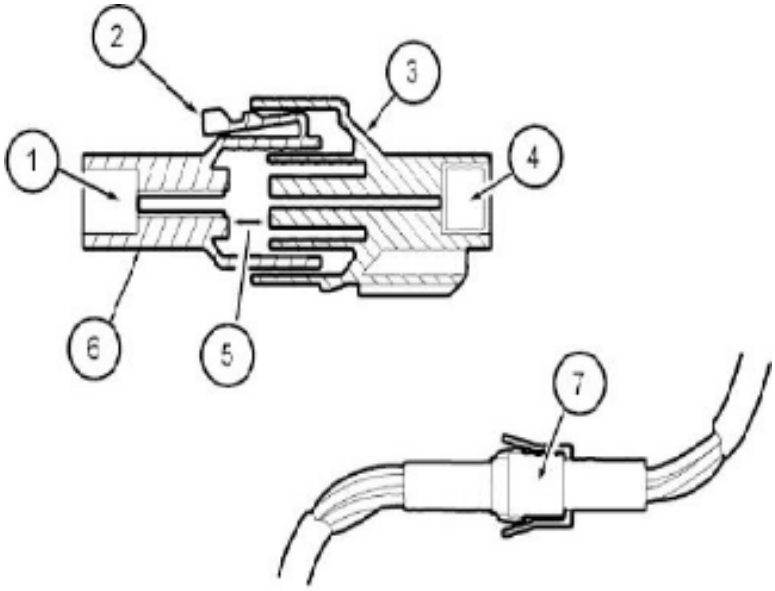
5 = Intermittent contact

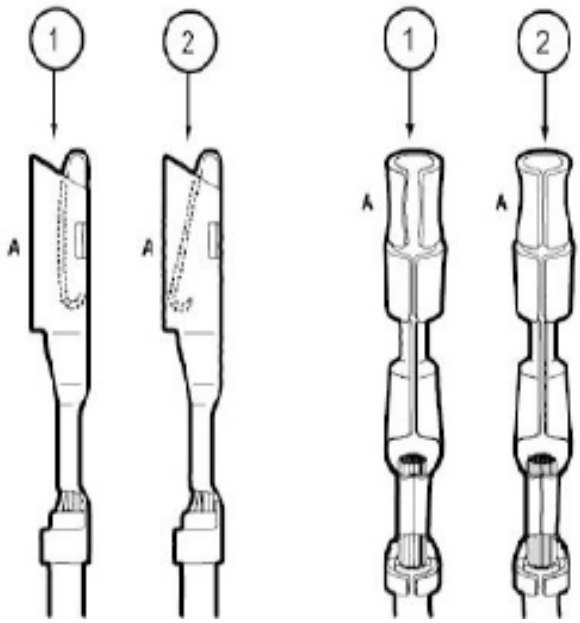
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

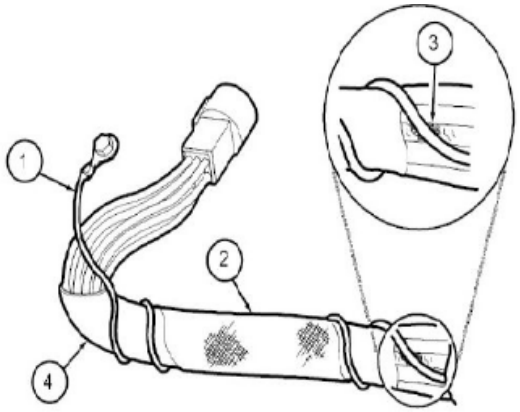
Deformed (enlarged) female terminals

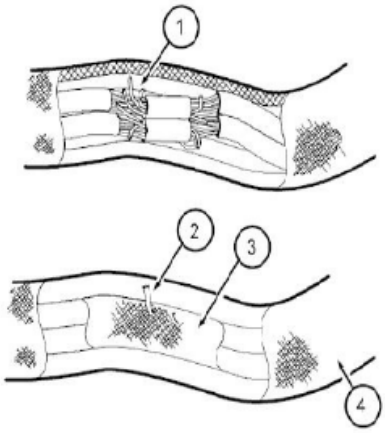
1 = Enlarged

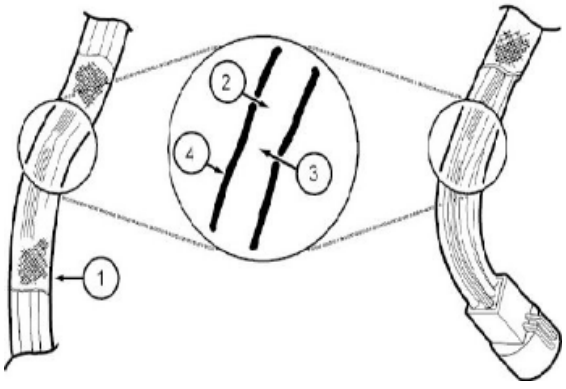
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

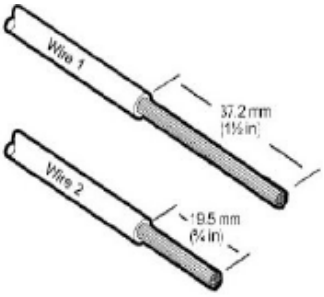
Splice covered 2

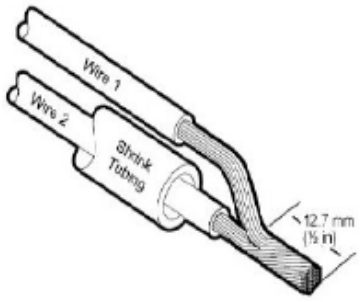
= Wire strand

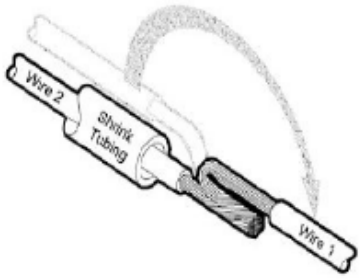
3 = Splice tape

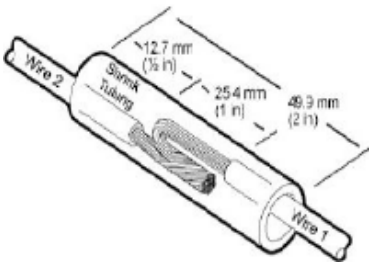
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.9 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

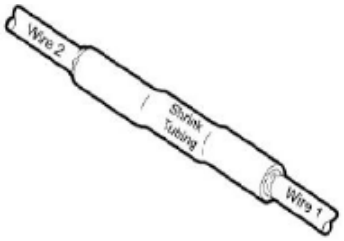
NOTE: -

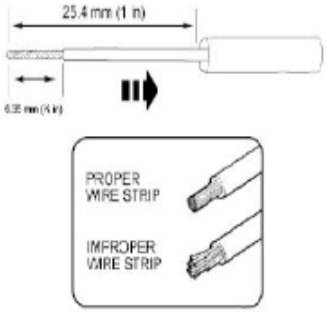
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

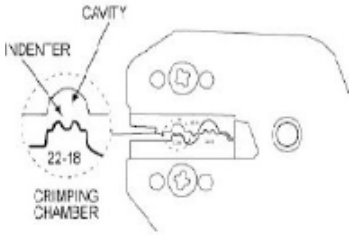
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

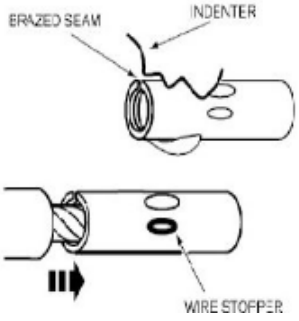
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
6.35 mm (¼ in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

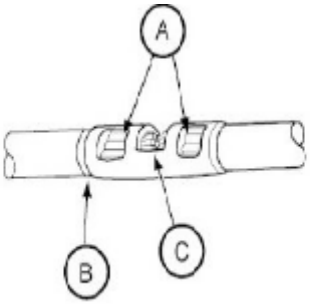
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

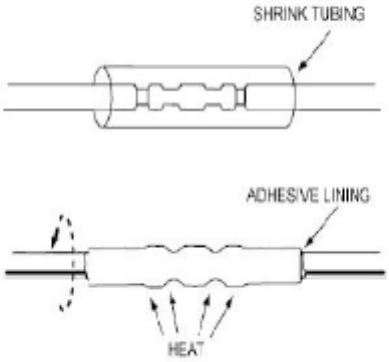
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4□ strip, cut 9 strands	* 1/4□ strip, cut 2 strands	1/4□ strip, no fold	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip, fold 2x dia.	1□ strip, fold 3x dia.
	16-14	* 1/4□ strip, cut 7 strands	1/4□ strip, no fold	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip fold 2x dia	1□ strip, fold 3x dia.	1 1/4□ strip, fold 4x dia.	Not Recommended
	12-10	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip, fold 2x dia.	1□ strip fold 3x cia.	1 1/4□ strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Figtail only

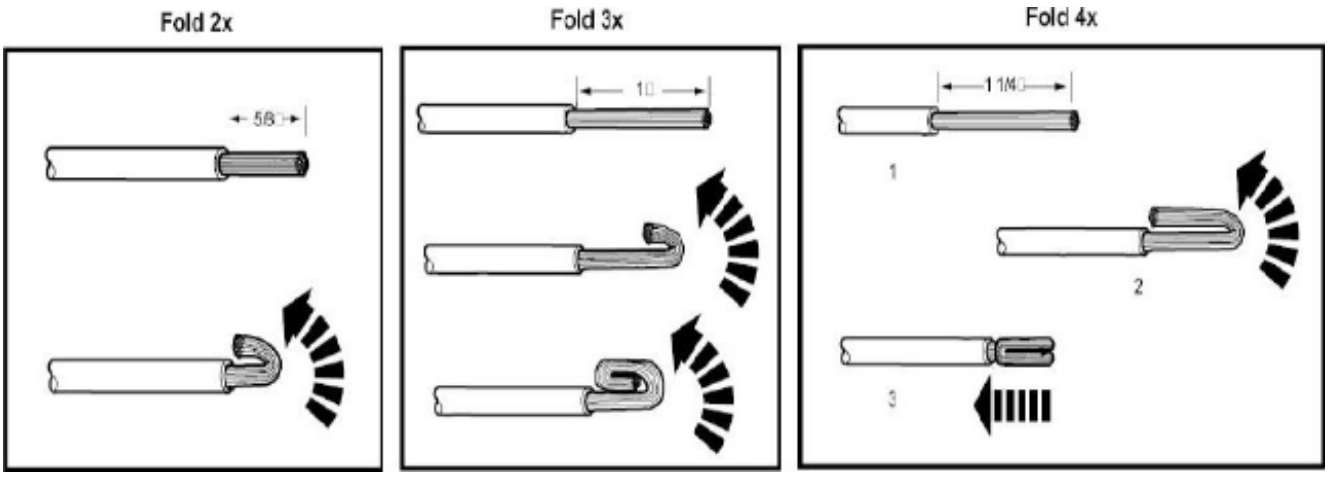
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



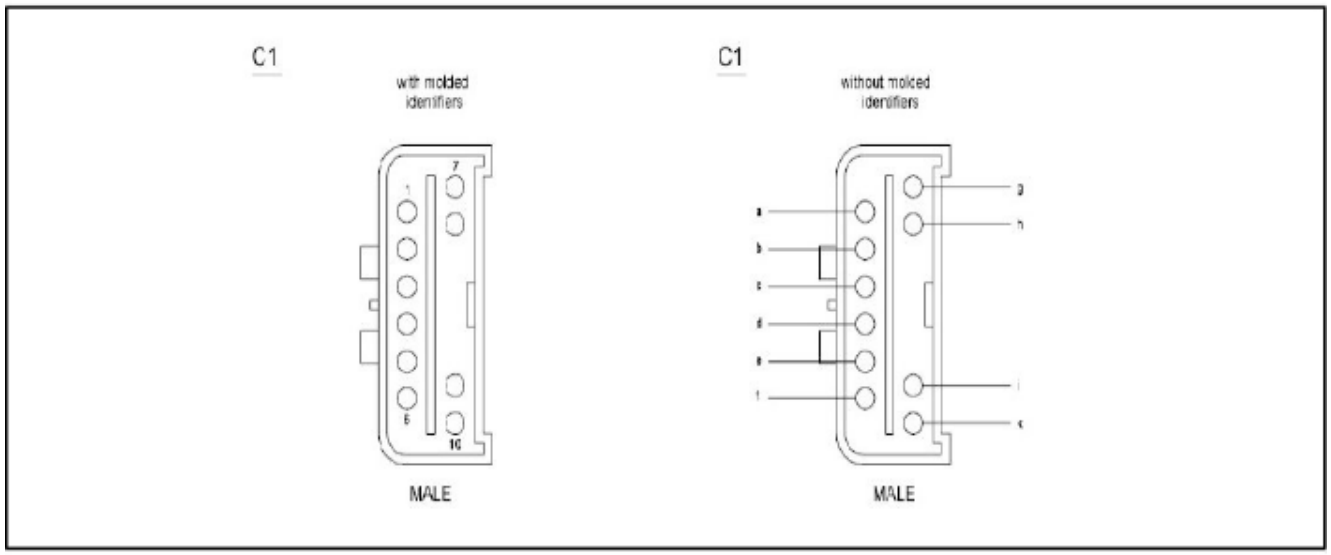
The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



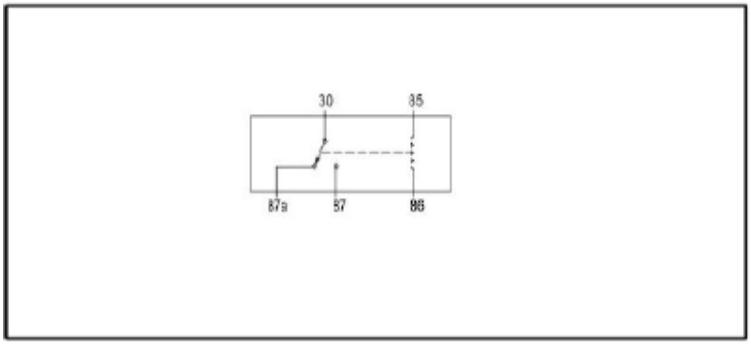
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

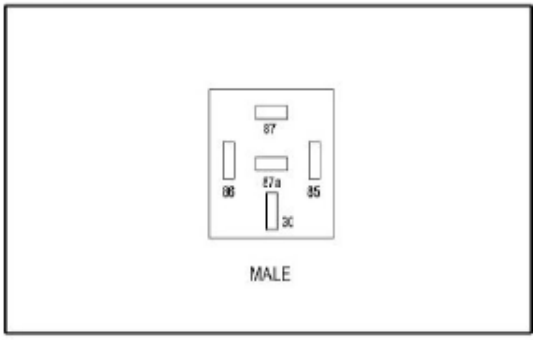
Wiper Relay: Testing and Inspection Mini ISO Relay

Relay □ Mini ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

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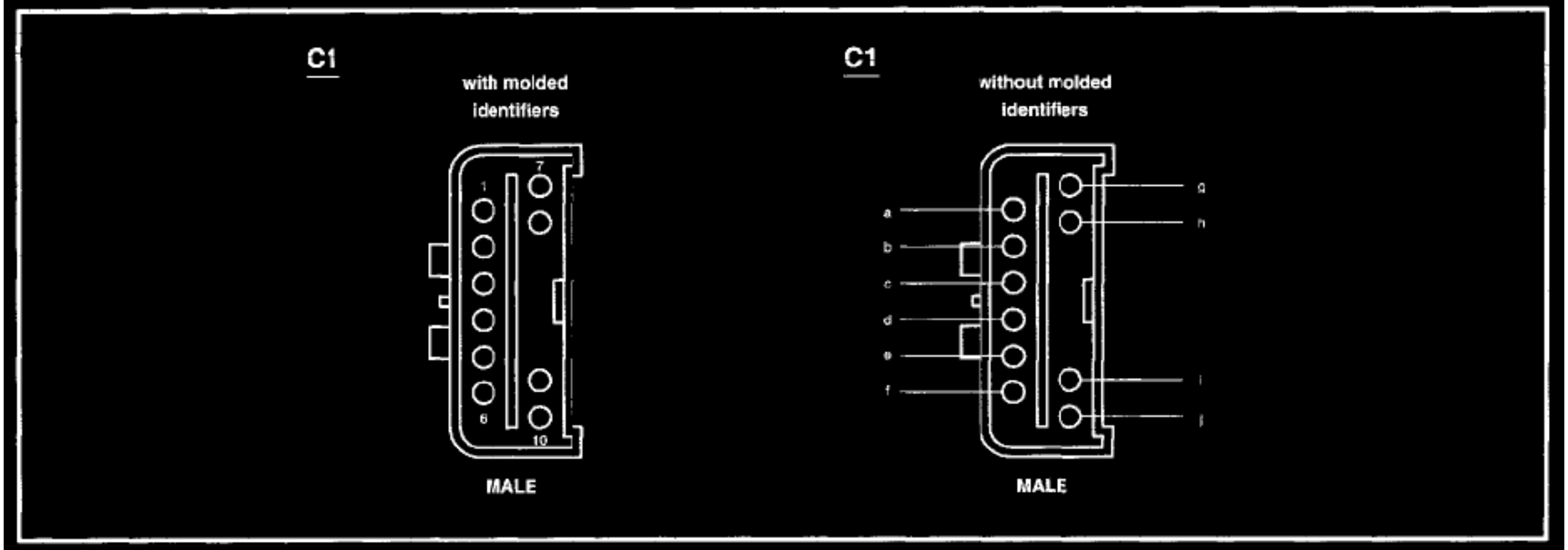
Testing information for each component includes a schematic, a view of the terminal locations and step–by–step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



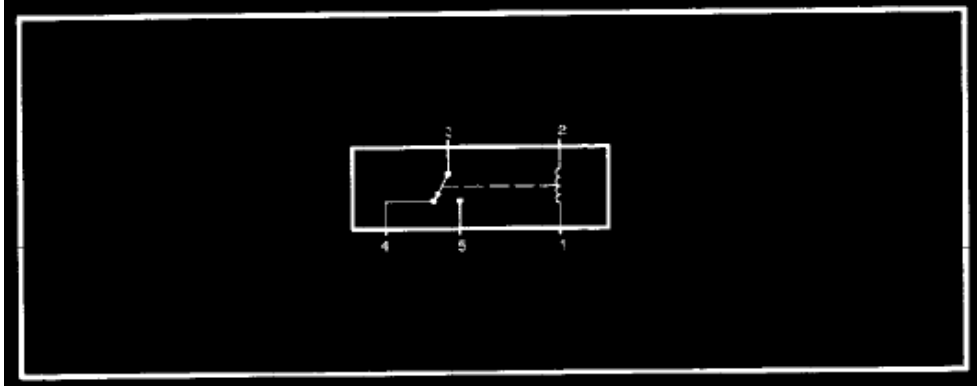
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

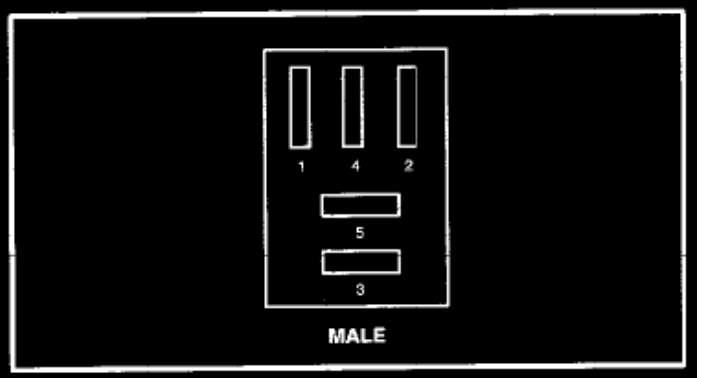
Wiper Relay: Testing and Inspection Micro ISO Relay

Relay – Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63–102Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil – Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

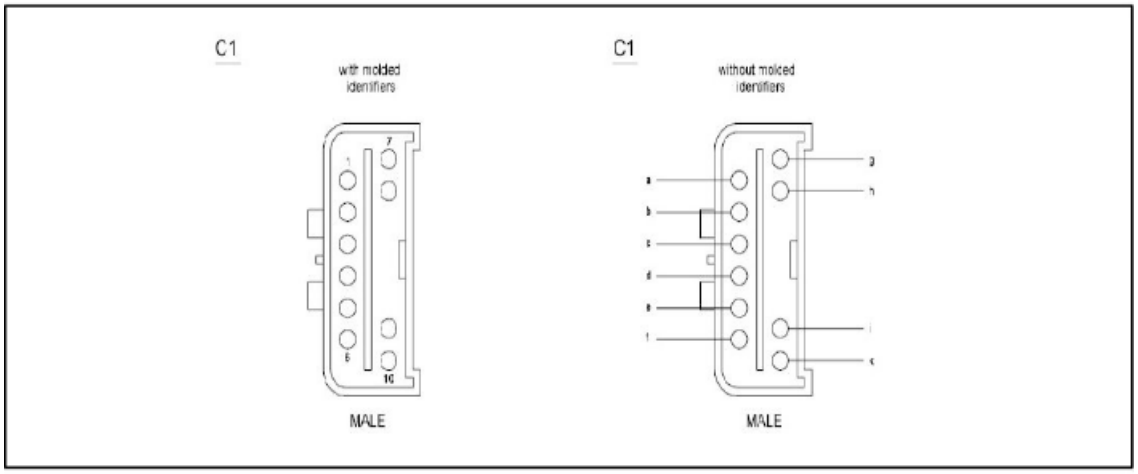
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals

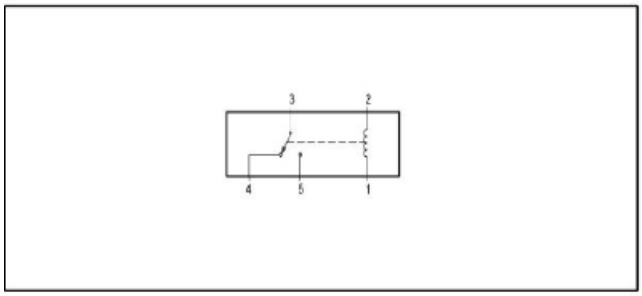


The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

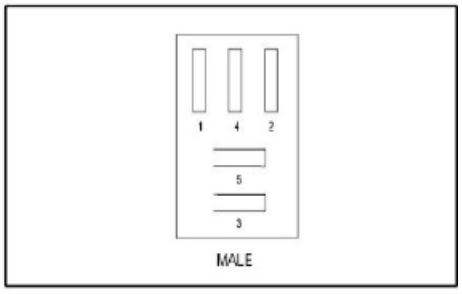
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Relay - Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63-102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil - Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

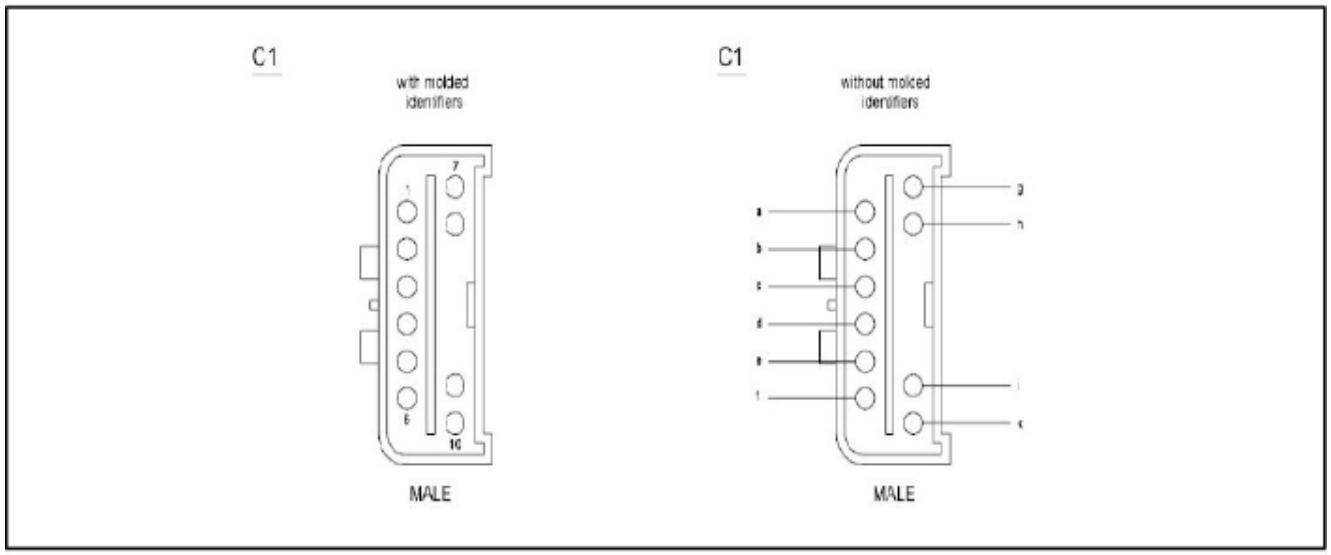
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



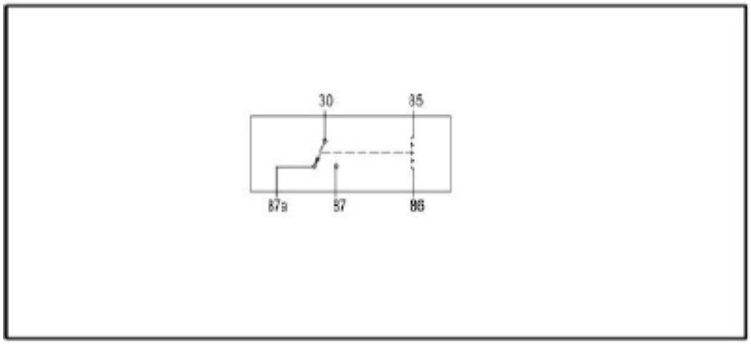
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

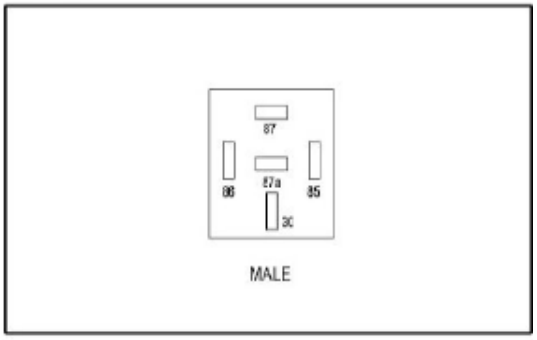
Wiper Relay: Testing and Inspection Wiper Run/Park Relay

Relay □ Mini ISO

Schematic



Terminals



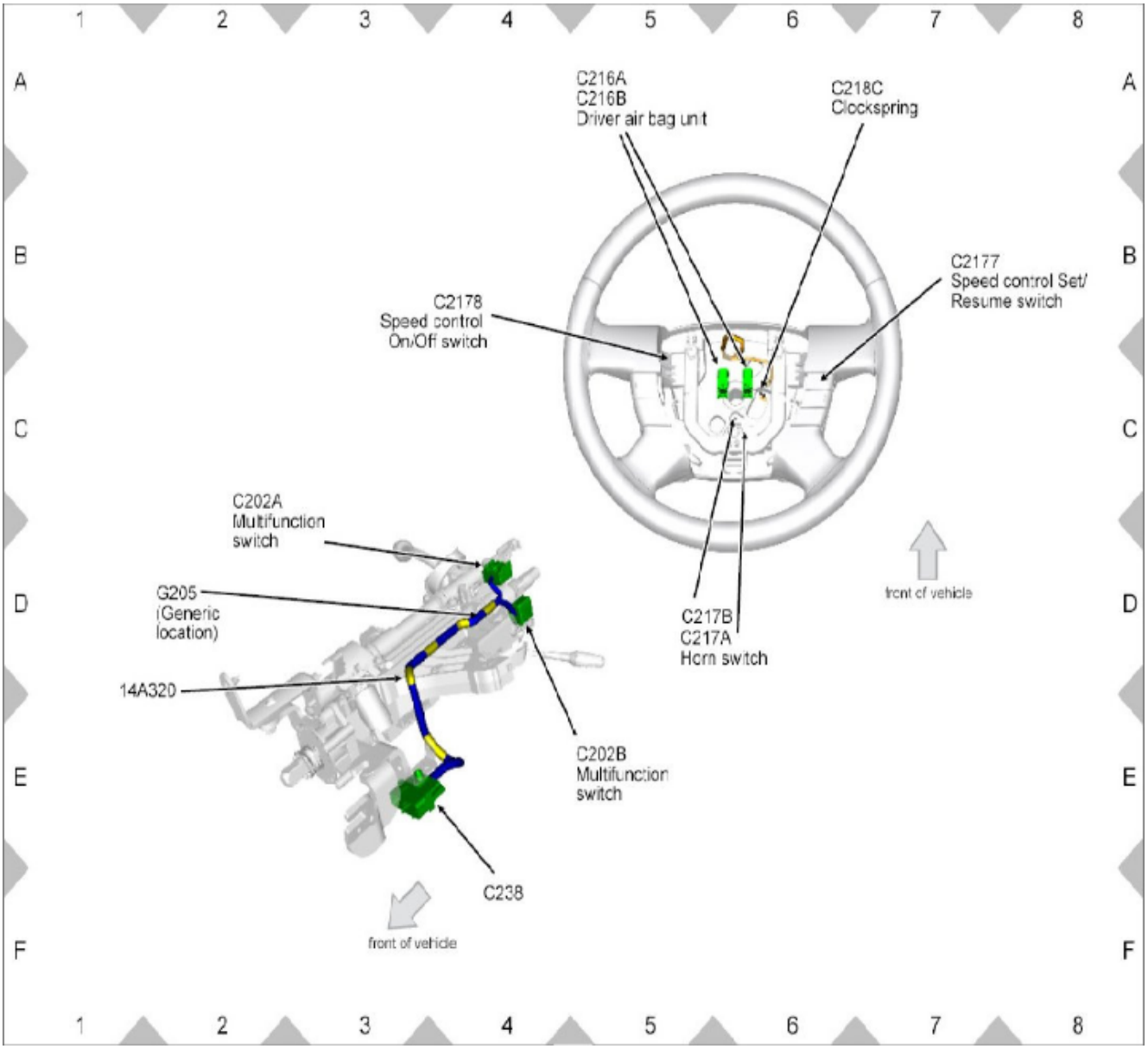
Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

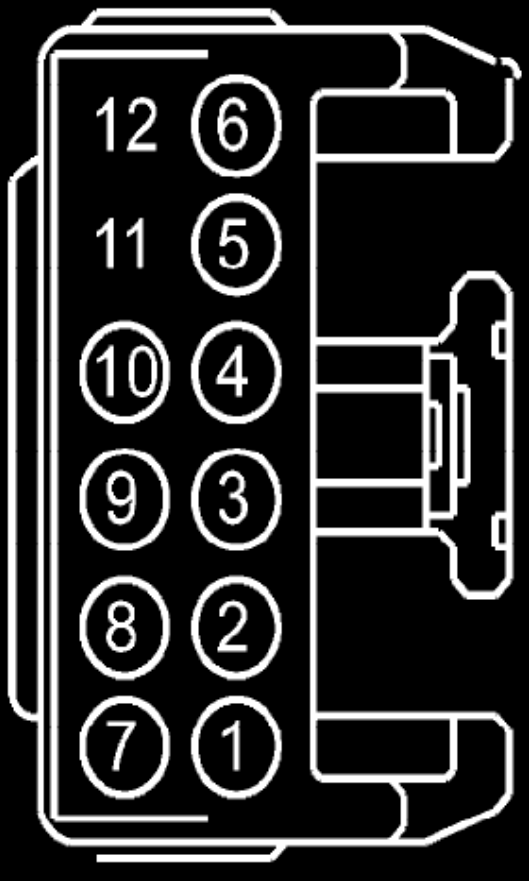
Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Wiper and Washer Systems > Sensors and Switches - Wiper and Washer Systems > Windshield Washer Switch > Component Information > Locations



View 151-13

Connector: C202A

Description:	Harness:	Base Part #:
MULTIFUNCTION SWITCH	14A320	13K359



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CRW17 (GN-VT)	20	SWITCH - FRONT WIPER INTERVAL (A)	
2	CRW19 (BU-OG)	20	SWITCH - FRONT WIPER INTERVAL (C)	
3	CRW18 (VT-WH)	20	SWITCH - FRONT WIPER INTERVAL (B)	
4	CRW15 (BN-WH)	20	CTRL MOD. - FRONT WIPER HIGH	
5	CRW07 (GY-BN)	20	SWITCH - FRONT WASHER	
6	CD161 (BK YE)	18	GROUND SEAT BRACKET REAR LEFT	
7	CLS41 (GY-YE)	22	SWITCH - TURN RIGHT	
8	CLS36 (YE)	18	SWITCH - PARK LAMPS RIGHT	
9	CLS35 (VT)	18	SWITCH - PARK LAMPS LEFT	
10	CLS39 (VT-WH)	22	SWITCH - TURN LEFT	
11	*	*	not used	
12	*	*	not used	

Windshield Washer Switch: Diagrams

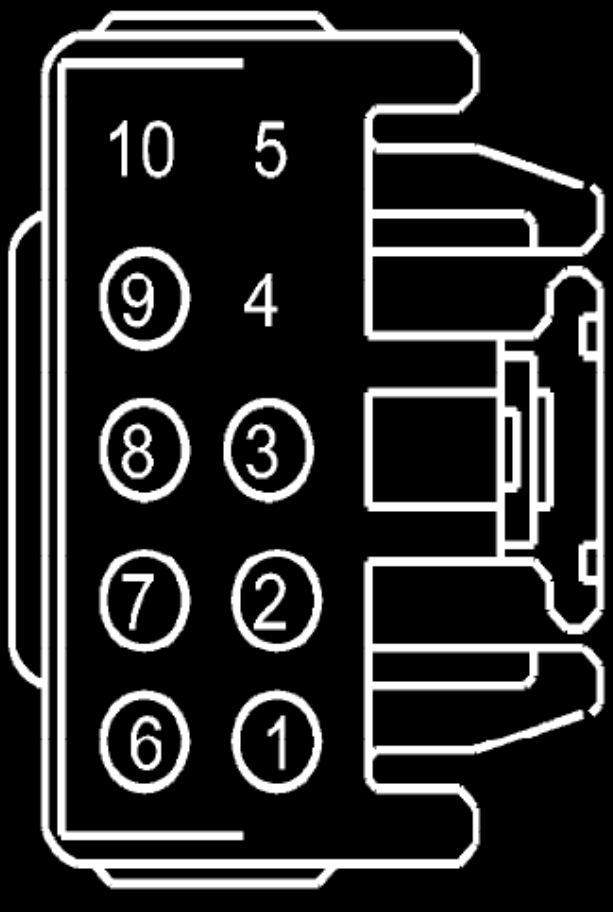
C202A

Connector: C202B

Description: MULTIFUNCTION SWITCH

Harness: 14A320

Base Part #: 13K359



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CCB08 (VT-WH)	16	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL OPEN	
2	CLS42 (VT-BN)	18	INDICATOR FLASHER RELAY - TURN SIGNAL SWITCHED POWER	
3	CLS32 (BN-YE)	18	INDICATOR FLASHER RELAY - HAZARD SWITCHED POWER	
4	*	*	not used	
5	*	*	not used	
6	SBP23 (WH-RD)	14	FUSE - 23 OR CIRCUIT BREAKER	
7	CLF27 (GN-BN)	14	SWITCH - FLASH TO PASS	
8	CLS24 (BN-WH)	16	CTRL MOD. - TURN LAMP RIGHT	
9	CLF18 (BU-WH)	16	SWITCH - BEAM LOW	
10	*	*	not used	

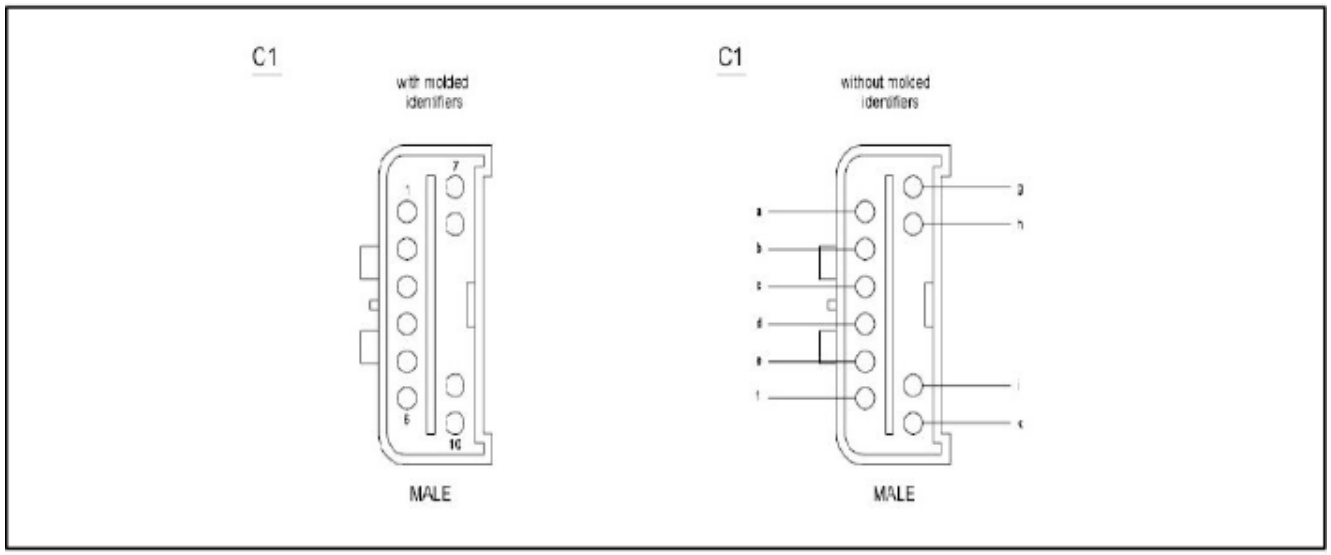
C202B

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



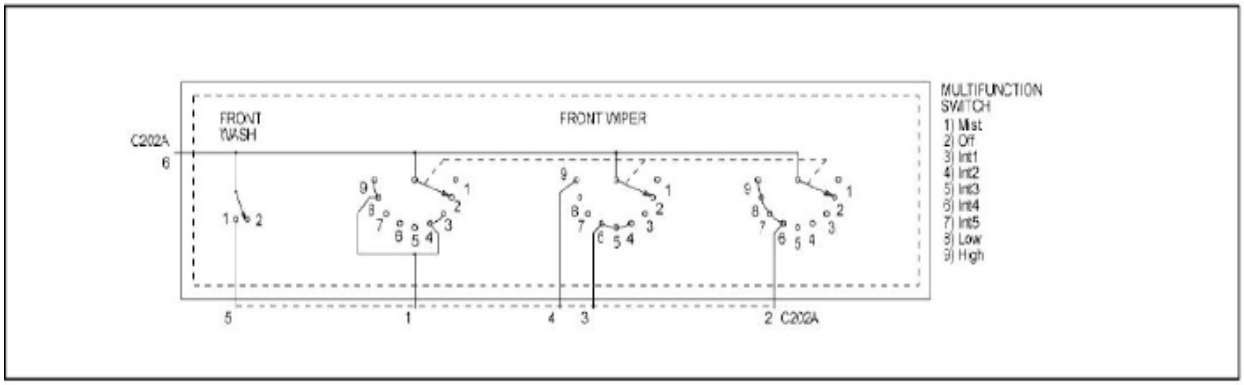
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Windshield Washer Switch: Testing and Inspection

Multifunction Switch, Wiper/Washer Portion

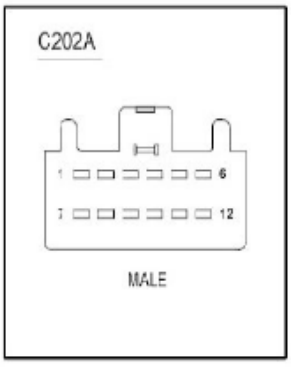
Schematic



Component testing procedure

Circuit to test	Connect self-powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
Front washer switch circuit	5 and 3	Front washer	Closed circuit
		Off	Open circuit
Front wiper switch circuit	1 and 3	Off	Open circuit
		Low	Closed circuit
		High	
	4 and 3	Off	Open circuit
		Low	
		High	Closed circuit
	2 and 3	Off	Open circuit
		Low	Closed circuit
		High	

Terminals

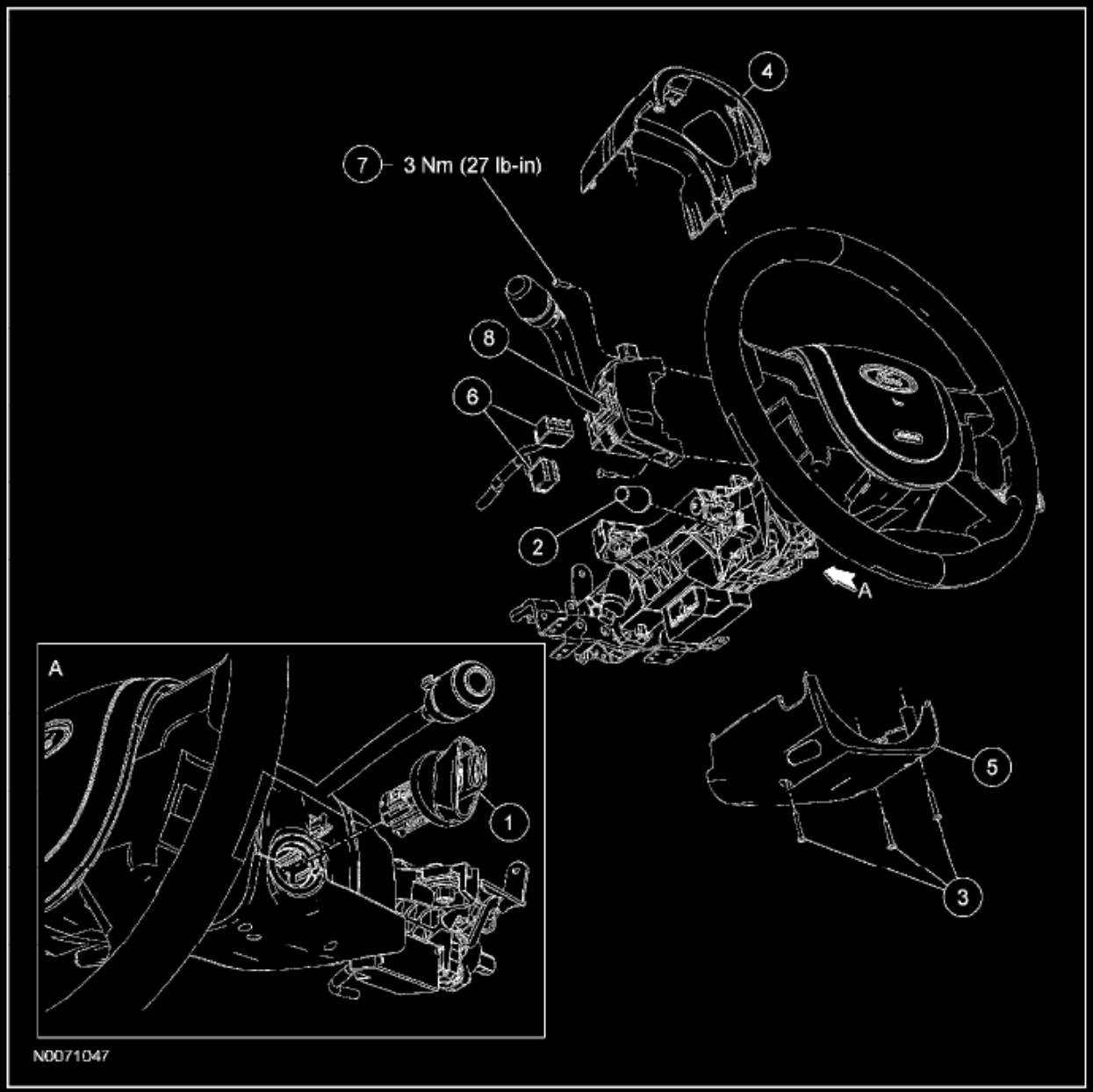


Multifunction Switch, Wiper/Washer Portion (continued)

Component testing procedure

Circuit to test	Connect self-powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
Intermittent wiper circuit, front	1 and 6	Interval 1	Closed circuit
		Interval 2	
		Interval 3	Open circuit
		Interval 4	
		Interval 5	
	3 and 6	Interval 1	Open circuit
		Interval 2	Closed circuit
		Interval 3	
		Interval 4	
		Interval 5	Open circuit
	2 and 6	Interval 1	Open circuit
		Interval 2	
		Interval 3	
		Interval 4	Closed circuit
		Interval 5	

Steering Column Multifunction Switch



Item	Part Number	Description
1	11582	Ignition switch lock cylinder
2	3F609	Tilt release lever/ handle
3	391727	Steering column shroud screws (3 required)
4	3530	Upper steering column shroud
5	3533	Lower steering column shroud

(Continued)

Item	Part Number	Description
6	—	Steering column multi-function switch electrical connectors (part of 14A320)
7	390345	Steering column multi-function switch screws (2 required)
8	13K359	Steering column multi-function switch

Windshield Washer Switch: Service and Repair

Steering Column Multifunction Switch

Steering Column Multifunction Switch

Removal and Installation

1. Remove the ignition switch lock cylinder.

1 Insert the ignition key into the ignition switch lock cylinder and turn to the RUN position.

2 Push the ignition switch lock cylinder release tab with a punch while pulling out the ignition switch lock cylinder.

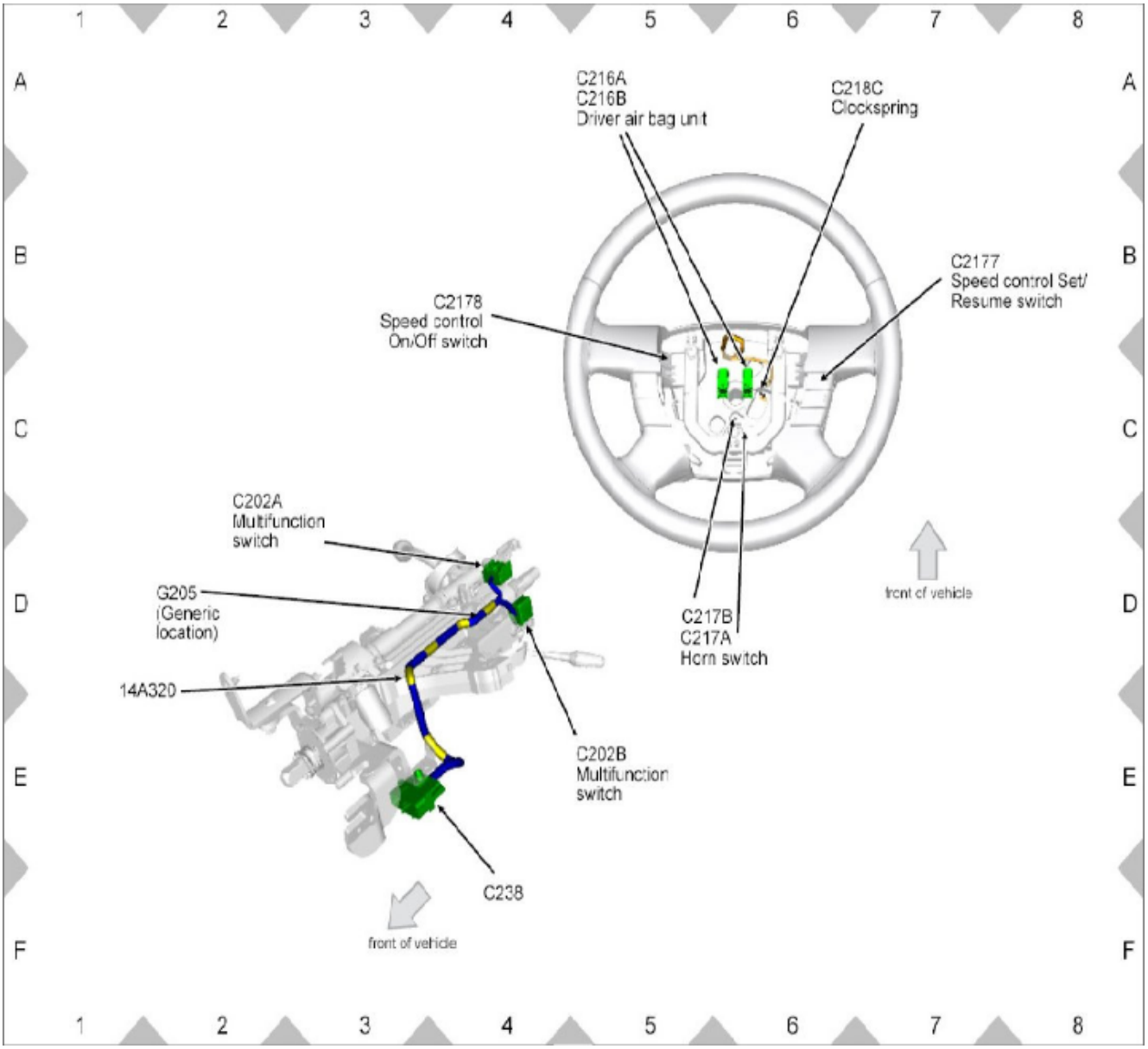
2. If equipped, remove the tilt release lever/ handle.

3. Remove the 3 steering column shroud screws and the upper and lower steering column shrouds. 4. Disconnect the multi-function switch electrical connectors. 5. Remove the 2 multi-function switch screws and the multi-function switch.

^ To install, tighten to 3 Nm (27 lb-inch).

6. To install, reverse the removal procedure.

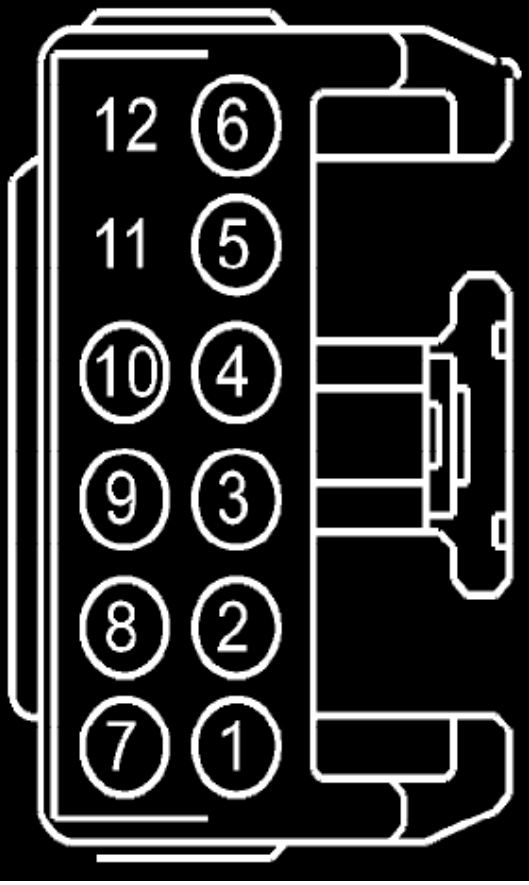
Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Wiper and Washer Systems > Sensors and Switches - Wiper and Washer Systems > Wiper Switch > Component Information > Locations



View 151-13

Connector: C202A

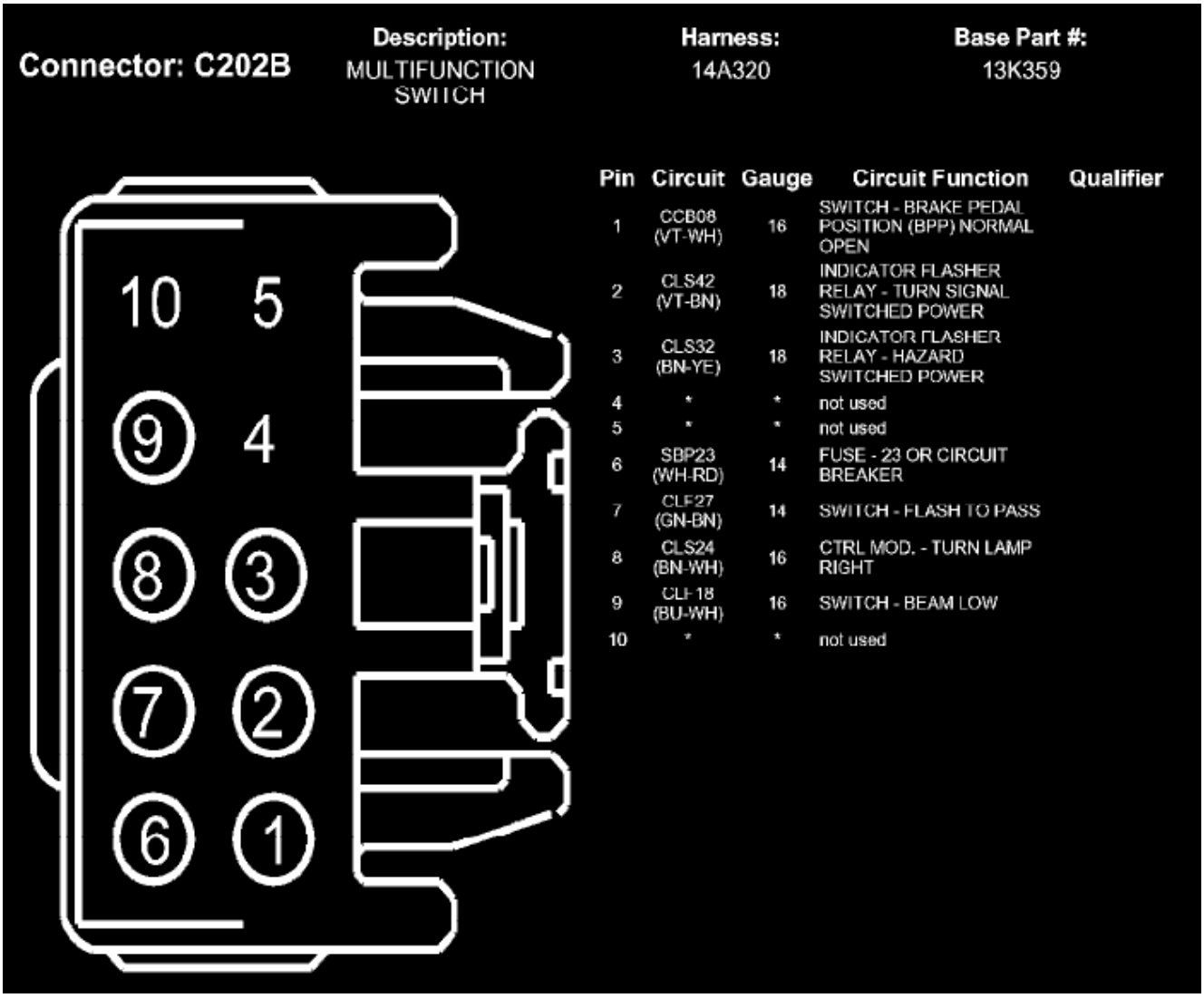
Description:	Harness:	Base Part #:
MULTIFUNCTION SWITCH	14A320	13K359



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CRW17 (GN-VT)	20	SWITCH - FRONT WIPER INTERVAL (A)	
2	CRW19 (BU-OG)	20	SWITCH - FRONT WIPER INTERVAL (C)	
3	CRW18 (VT-WH)	20	SWITCH - FRONT WIPER INTERVAL (B)	
4	CRW15 (BN-WH)	20	CTRL MOD. - FRONT WIPER HIGH	
5	CRW07 (GY-BN)	20	SWITCH - FRONT WASHER	
6	CD161 (BK YE)	18	GROUND SEAT BRACKET REAR LEFT	
7	CLS41 (GY-YE)	22	SWITCH - TURN RIGHT	
8	CLS36 (YE)	18	SWITCH - PARK LAMPS RIGHT	
9	CLS35 (VT)	18	SWITCH - PARK LAMPS LEFT	
10	CLS39 (VT-WH)	22	SWITCH - TURN LEFT	
11	*	*	not used	
12	*	*	not used	

Wiper Switch: Diagrams

C202A



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CCB08 (VT-WH)	16	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL OPEN	
2	CLS42 (VT-BN)	18	INDICATOR FLASHER RELAY - TURN SIGNAL SWITCHED POWER	
3	CLS32 (BN-YE)	18	INDICATOR FLASHER RELAY - HAZARD SWITCHED POWER	
4	*	*	not used	
5	*	*	not used	
6	SBP23 (WH-RD)	14	FUSE - 23 OR CIRCUIT BREAKER	
7	CLF27 (GN-BN)	14	SWITCH - FLASH TO PASS	
8	CLS24 (BN-WH)	16	CTRL MOD. - TURN LAMP RIGHT	
9	CLF18 (BU-WH)	16	SWITCH - BEAM LOW	
10	*	*	not used	

C202B

Introduction

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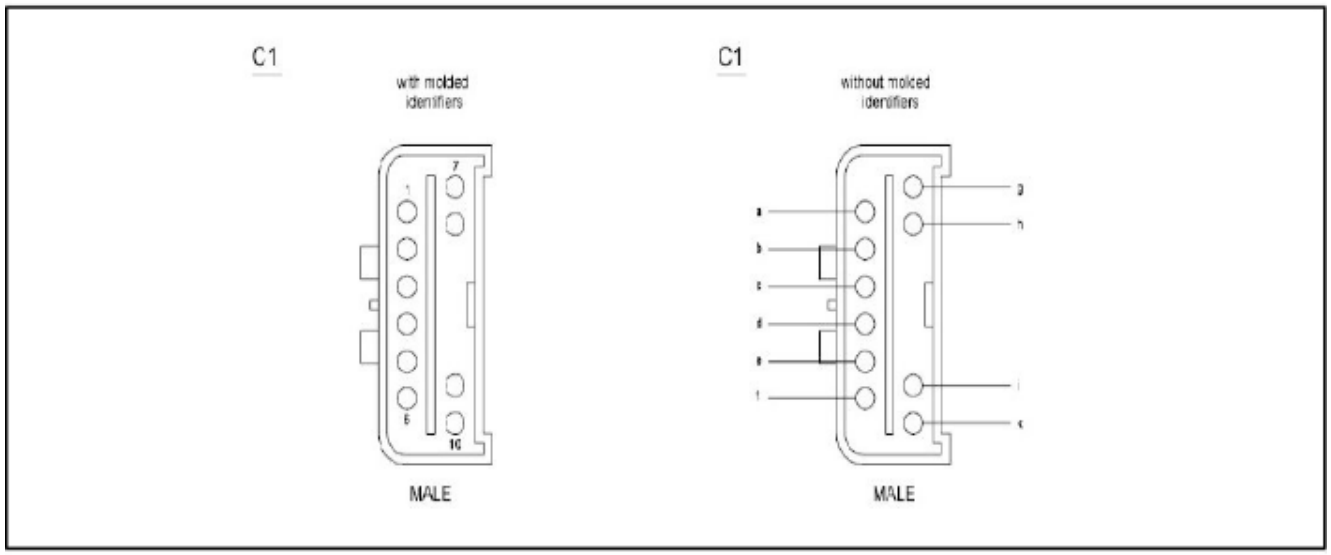
Terminals



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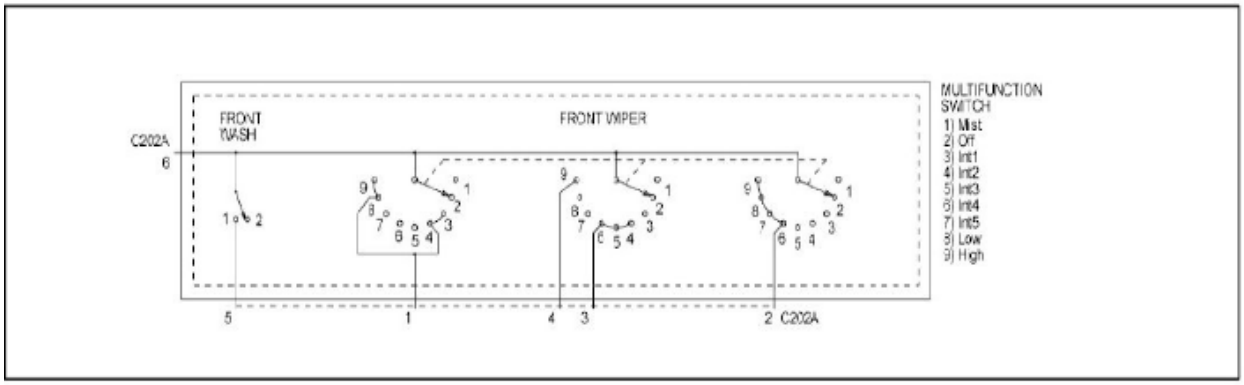
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Wiper Switch: Testing and Inspection

Multifunction Switch, Wiper/Washer Portion

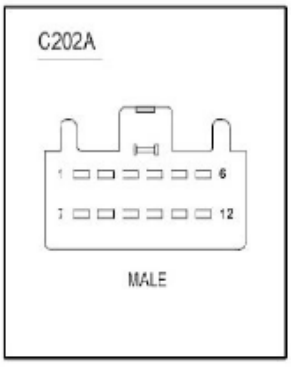
Schematic



Component testing procedure

Circuit to test	Connect self-powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
Front washer switch circuit	5 and 3	Front washer	Closed circuit
		Off	Open circuit
Front wiper switch circuit	1 and 3	Off	Open circuit
		Low	Closed circuit
		High	
	4 and 3	Off	Open circuit
		Low	
		High	Closed circuit
	2 and 3	Off	Open circuit
		Low	Closed circuit
		High	

Terminals

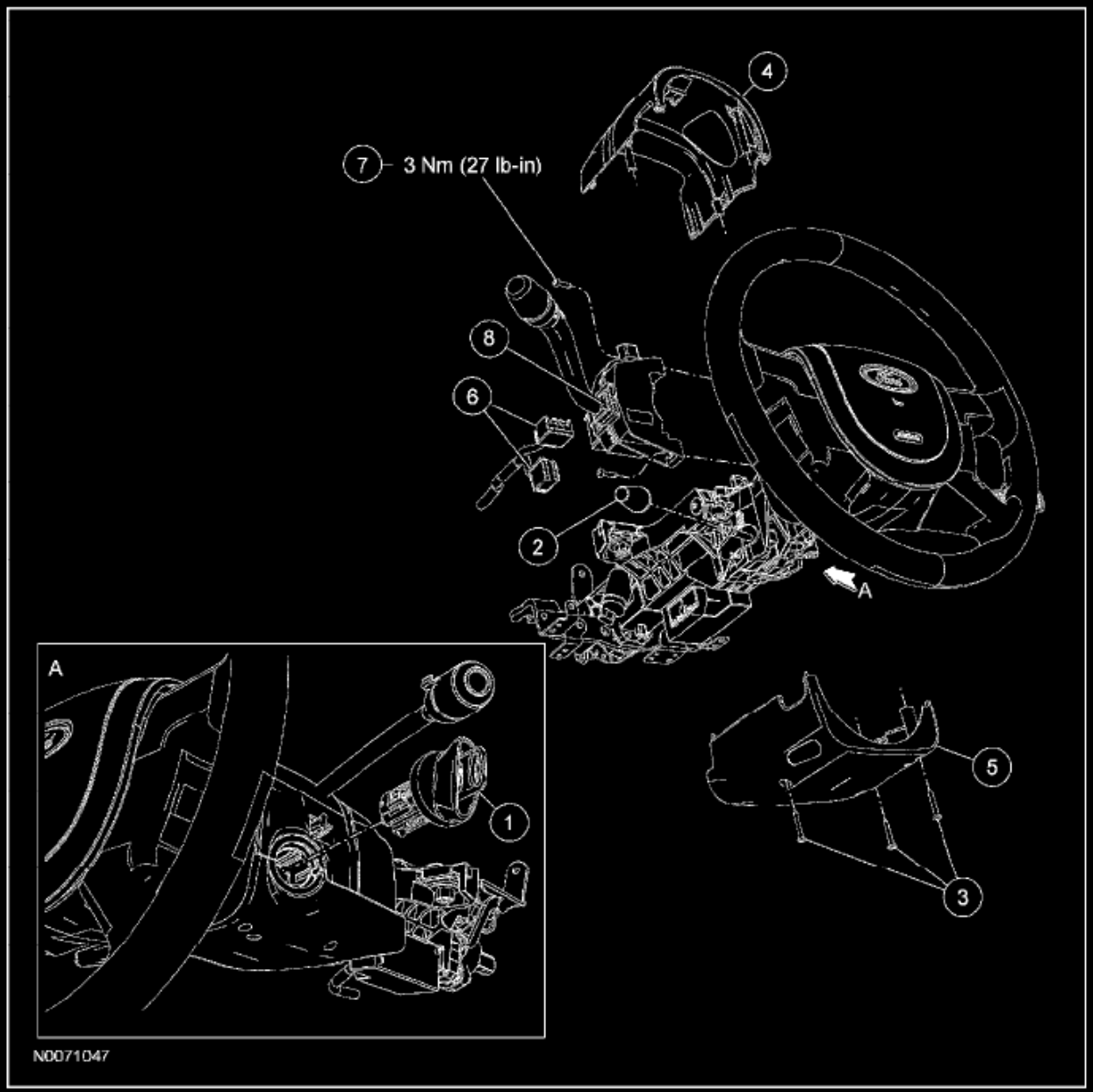


Multifunction Switch, Wiper/Washer Portion (continued)

Component testing procedure

Circuit to test	Connect self-powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
Intermittent wiper circuit, front	1 and 6	Interval 1	Closed circuit
		Interval 2	
		Interval 3	Open circuit
		Interval 4	
		Interval 5	
	3 and 6	Interval 1	Open circuit
		Interval 2	Closed circuit
		Interval 3	
		Interval 4	
		Interval 5	Open circuit
	2 and 6	Interval 1	Open circuit
		Interval 2	
		Interval 3	
		Interval 4	Closed circuit
		Interval 5	

Steering Column Multifunction Switch



Item	Part Number	Description
1	11582	Ignition switch lock cylinder
2	3F609	Tilt release lever/ handle
3	391727	Steering column shroud screws (3 required)
4	3530	Upper steering column shroud
5	3533	Lower steering column shroud

(Continued)

Item	Part Number	Description
6	—	Steering column multi-function switch electrical connectors (part of 14A320)
7	390345	Steering column multi-function switch screws (2 required)
8	13K359	Steering column multi-function switch

Wiper Switch: Service and Repair

Steering Column Multifunction Switch

Steering Column Multifunction Switch

Removal and Installation

1. Remove the ignition switch lock cylinder.

1 Insert the ignition key into the ignition switch lock cylinder and turn to the RUN position.

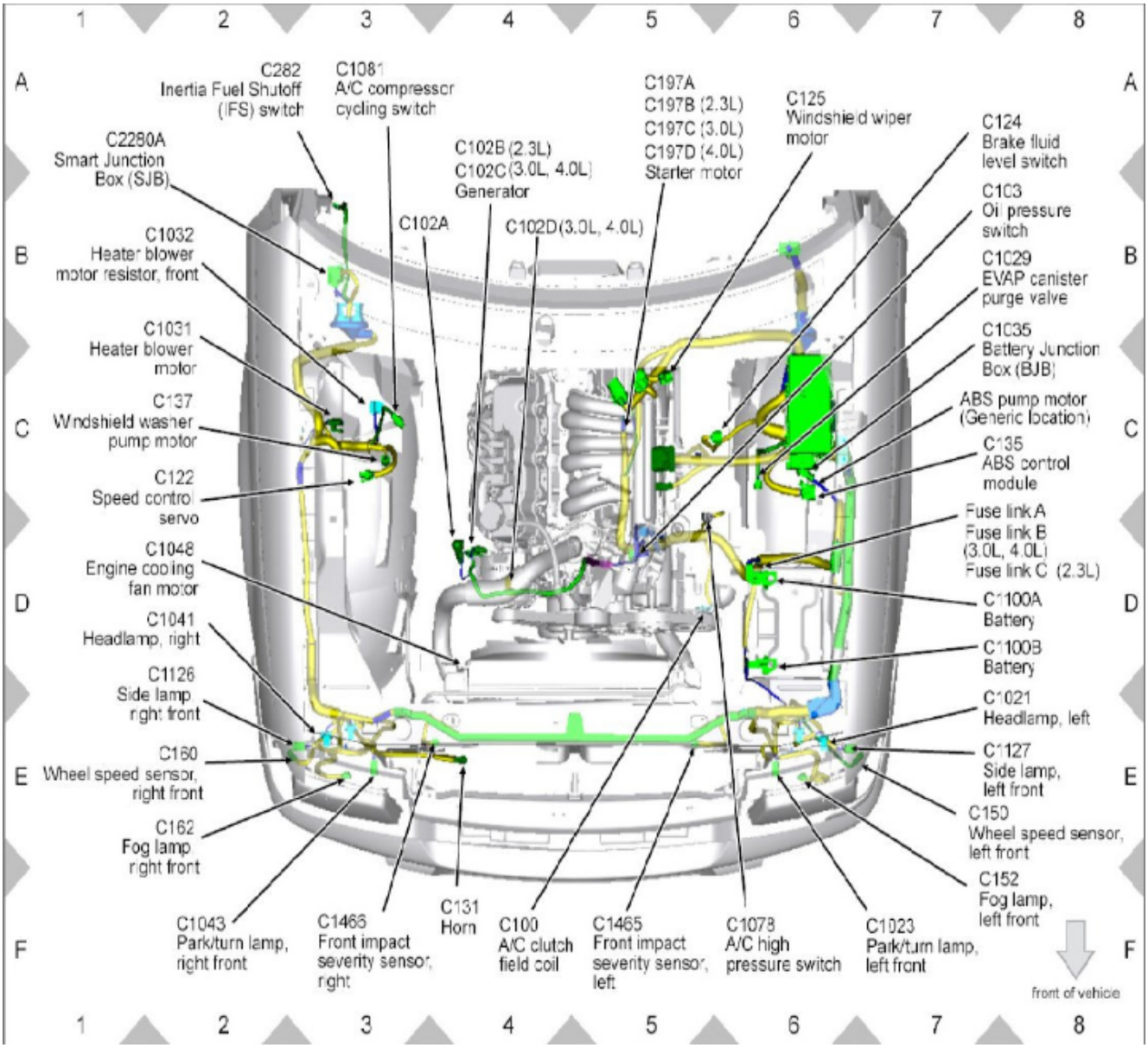
2 Push the ignition switch lock cylinder release tab with a punch while pulling out the ignition switch lock cylinder.

2. If equipped, remove the tilt release lever/ handle.

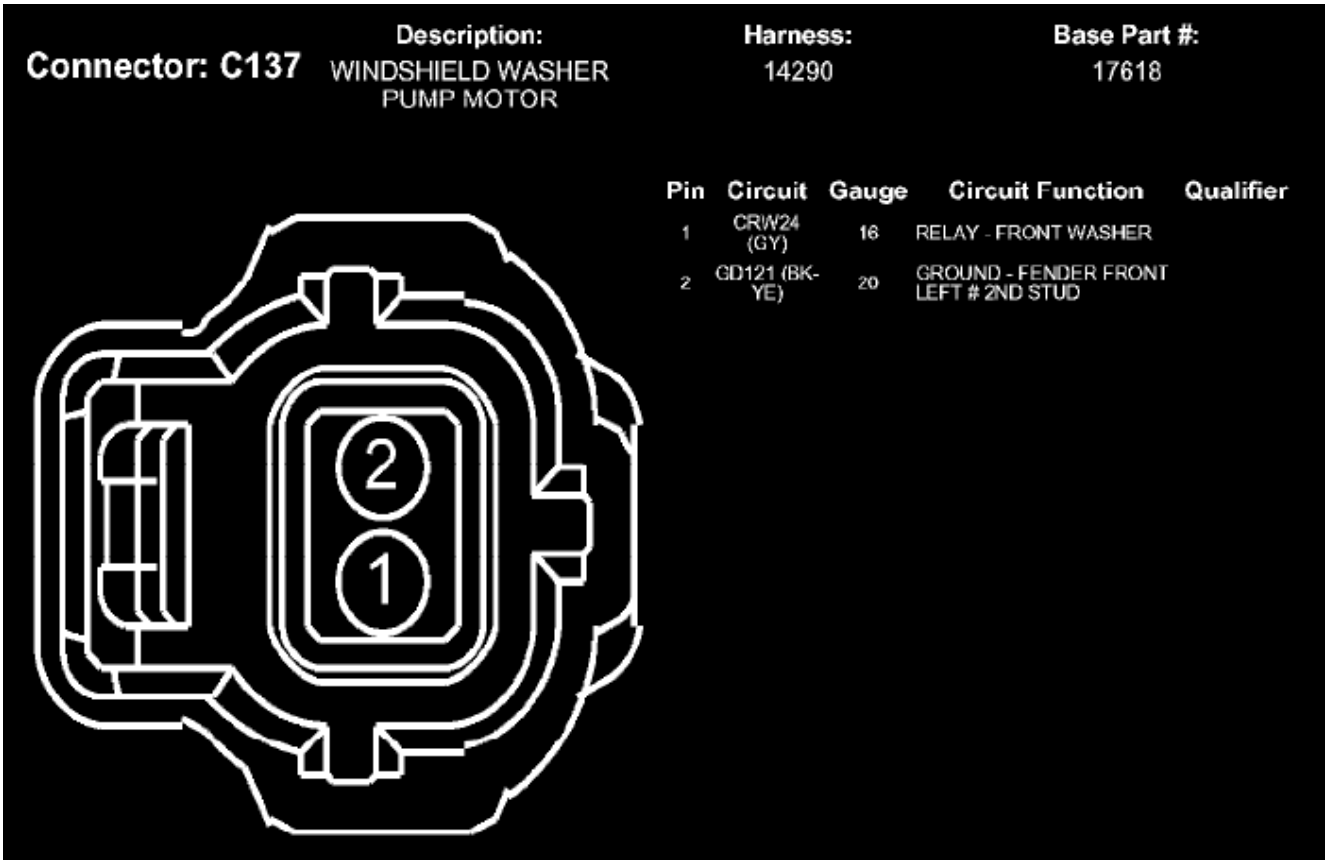
3. Remove the 3 steering column shroud screws and the upper and lower steering column shrouds. 4. Disconnect the multi-function switch electrical connectors. 5. Remove the 2 multi-function switch screws and the multi-function switch.

^ To install, tighten to 3 Nm (27 lb-inch).

6. To install, reverse the removal procedure.


1
2
3
4
5
6
7
8
A
B
C
D
E
F
C282
Inertia Fuel Shutoff (IFS) switch
C1081
A/C compressor cycling switch
C2280A
Smart Junction Box (SJB)
C1032
Heater blower motor resistor, front
C1031
Heater blower motor
C137
Windshield washer pump motor
C122
Speed control servo
C1048
Engine cooling fan motor
C1041
Headlamp, right
C1126
Side lamp, right front
C160
Wheel speed sensor, right front
C162
Fog lamp, right front
C1043
Park/turn lamp, right front
C1465
Front impact severity sensor, right
C131
Horn
C102A
C102B (2.3L)
C102C (3.0L, 4.0L)
Generator
C102D (3.0L, 4.0L)
C197A
C197B (2.3L)
C197C (3.0L)
C197D (4.0L)
Starter motor
C100
A/C clutch field coil
C1465
Front impact severity sensor, left
C1078
A/C high pressure switch
C125
Windshield wiper motor
C1023
Park/turn lamp, left front
C124
Brake fluid level switch
C103
Oil pressure switch
C1029
EVAP canister purge valve
C1035
Battery Junction Box (BJB)
ABS pump motor (Generic location)
C135
ABS control module
Fuse link A
Fuse link B (3.0L, 4.0L)
Fuse link C (2.3L)
C100A
Battery
C100B
Battery
C1021
Headlamp, left
C1127
Side lamp, left front
C150
Wheel speed sensor, left front
C152
Fog lamp, left front
front of vehicle

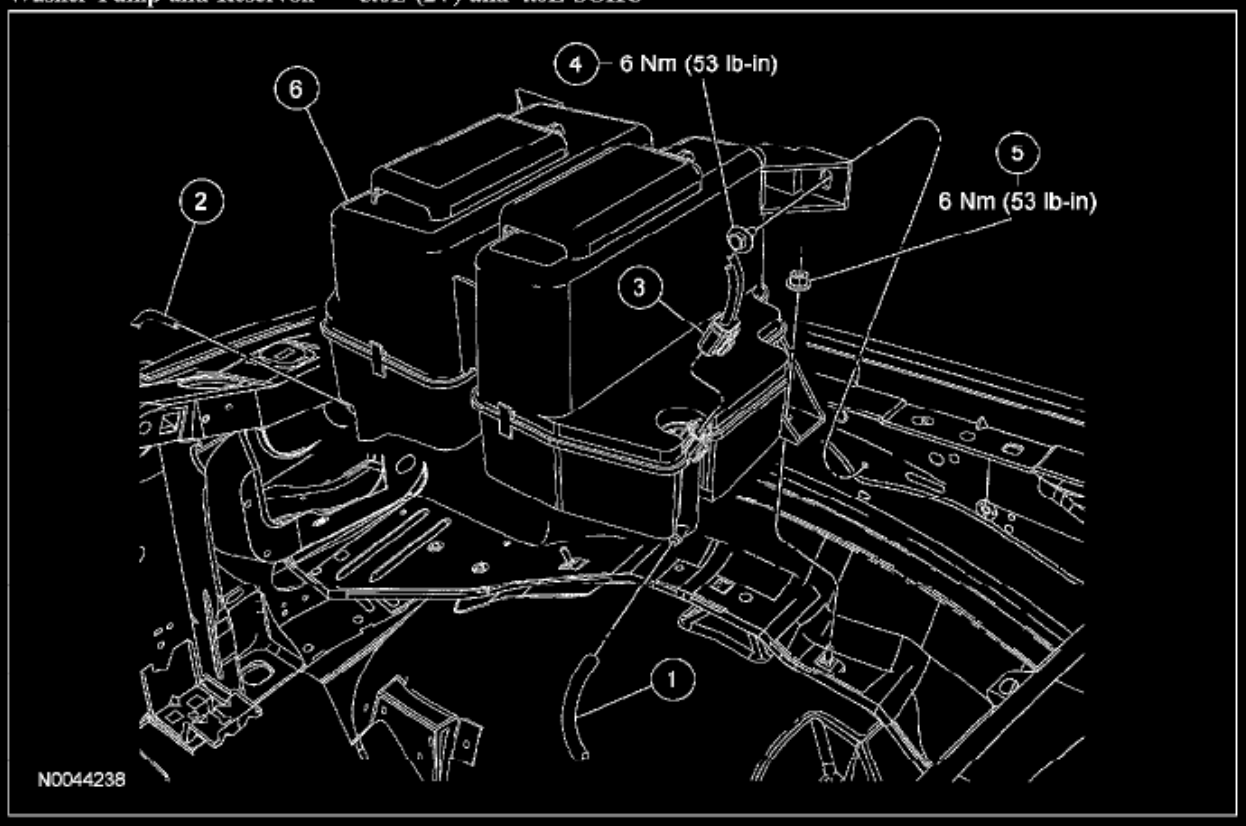
View 151-1



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CRW24 (GY)	16	RELAY - FRONT WASHER	
2	GD121 (BK-YE)	20	GROUND - FENDER FRONT LEFT # 2ND STUD	

C137

Washer Pump and Reservoir — 3.0L (2V) and 4.0L SOHC



Item	Part Number	Description
1	17K605	Windshield washer hose
2	8N023	Coolant hose
3	14290	Electrical connector
4	W611102	Reservoir mounting bolt (2 required)

Item	Part Number	Description
5	N806385	Reservoir mounting nut (2 required)
6	17618	Coolant and windshield reservoir assembly

(Continued)

Windshield Washer Pump: Service and Repair

WASHER PUMP AND RESERVOIR

Exploded View

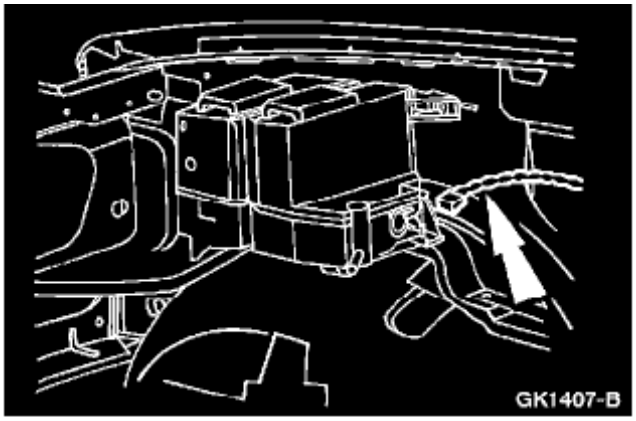
Washer Pump And Reservoir - 3.0L, (2V) And 4.0L SOHC

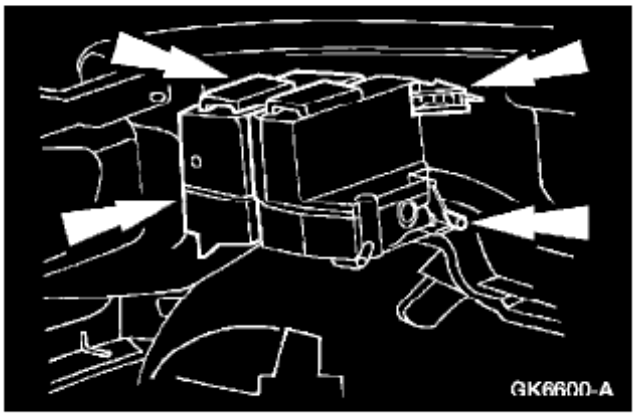
Removal and Installation

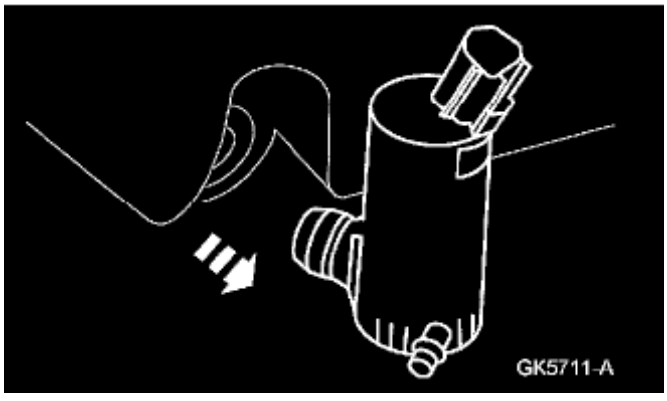
WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. Consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

NOTE: To prevent spilling windshield washer fluid, drain the windshield washer reservoir before removal.

1. Disconnect the overflow hoses from the engine coolant overflow reservoir and plug the outlet ports of the reservoir. 2. Disconnect the windshield washer reservoir pump electrical connector.


GK1407-B


GK6600-A


GK5711-A

3. Remove the air cleaner assembly.

4. NOTE: The windshield washer reservoir and the washer pump are serviced independently.

Remove the 2 reservoir bolts and 2 reservoir nuts and remove the windshield washer reservoir. -

To install, tighten to 6 Nm (53 lb-in).

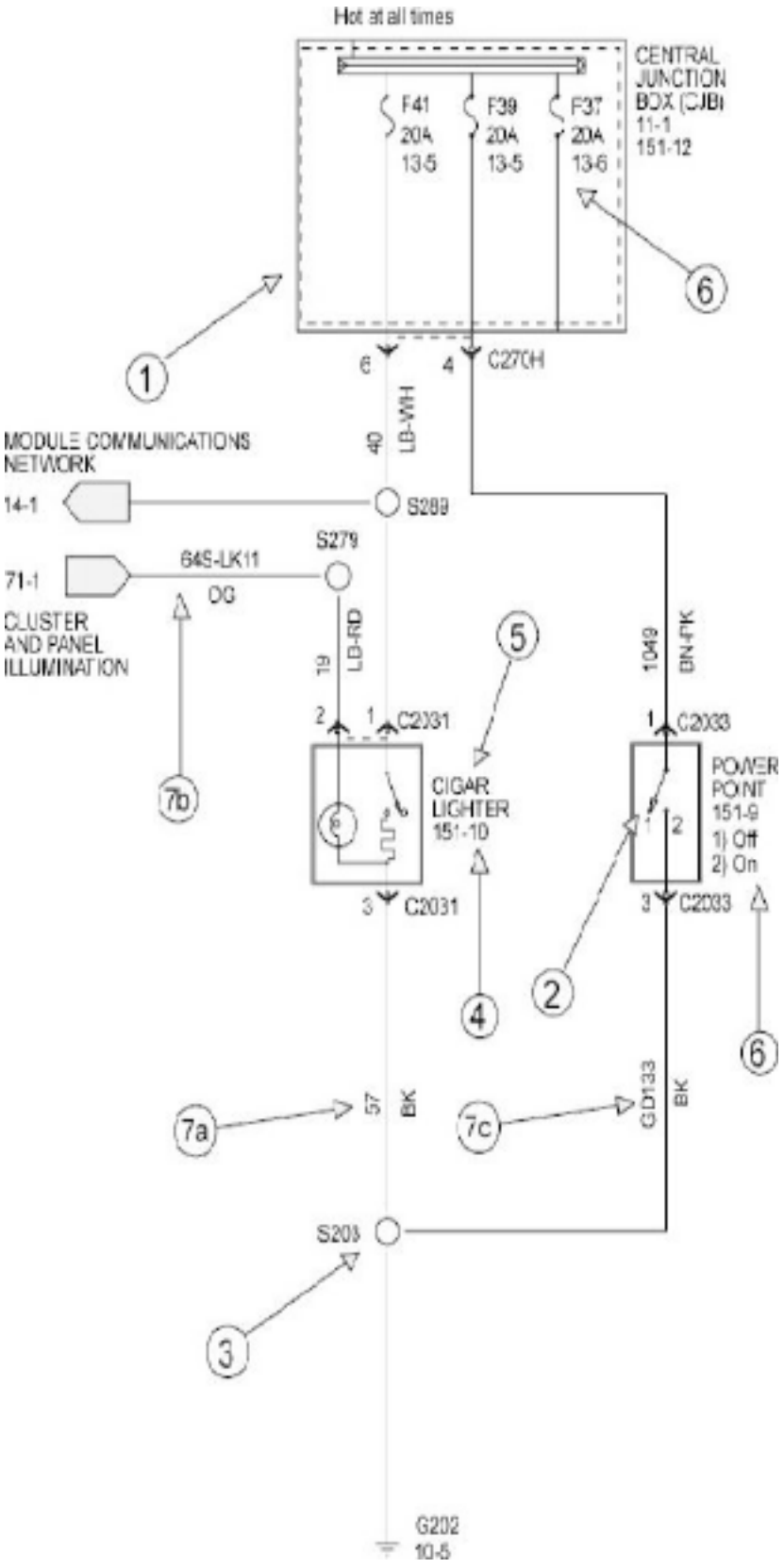
5. Disconnect the windshield washer hose from the windshield washer pump.

6. NOTE: When removing the washer pump from the washer reservoir, be sure not to damage the rubber grommet.

Remove the washer pump from the washer reservoir.

7. To install, reverse the removal procedure.

Ford Ranger 2wd Workshop Manual (V6-3.0L (2008))
Ford Workshop Manuals > Wiper and Washer Systems > Windshield Washer Relay > Component Information > Diagrams > Diagram Information and Instructions



Windshield Washer Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

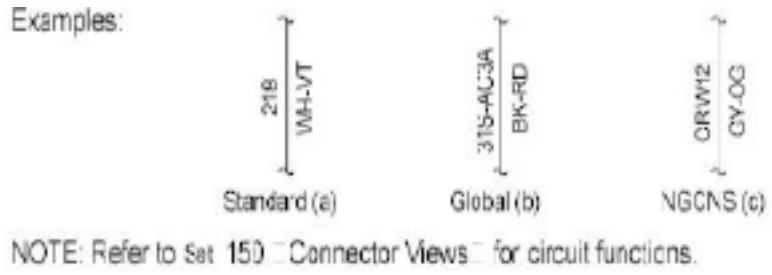
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

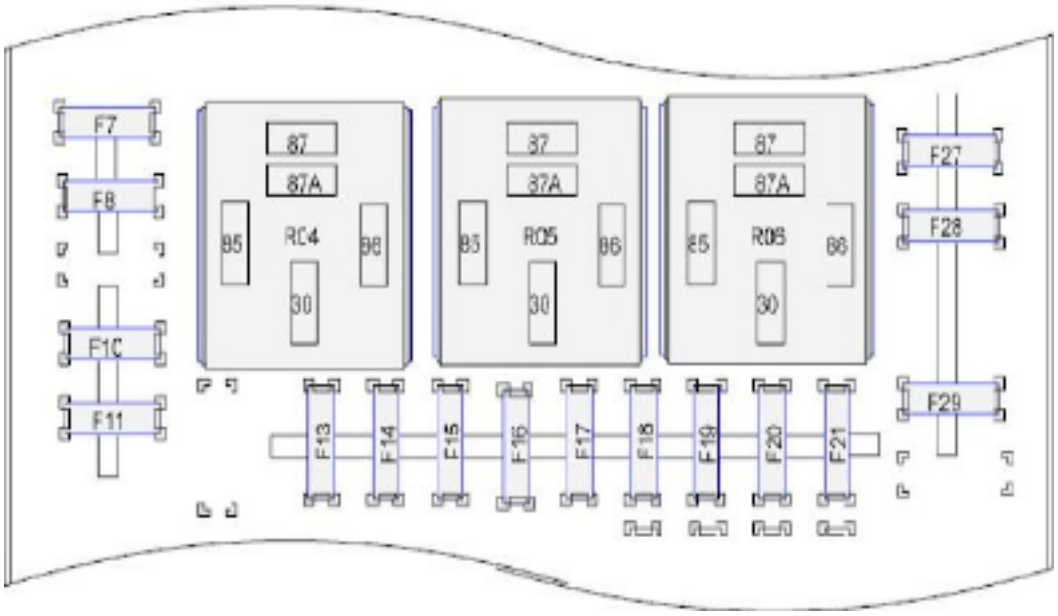
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

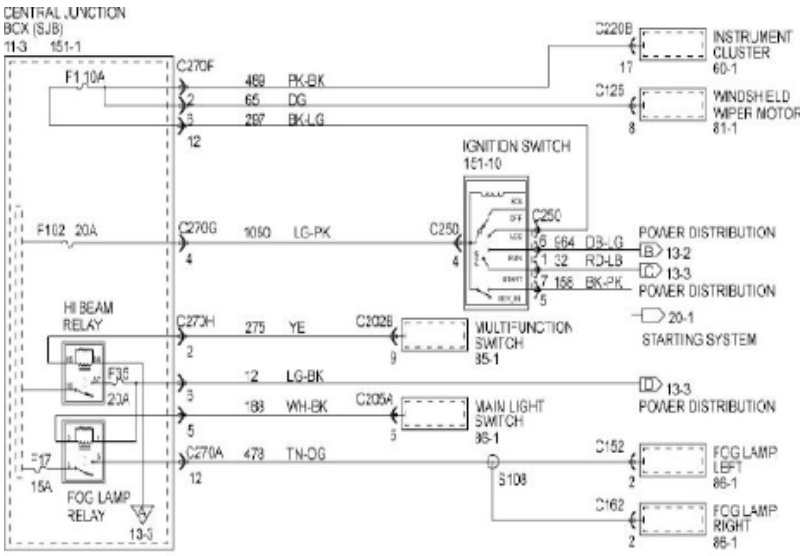
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

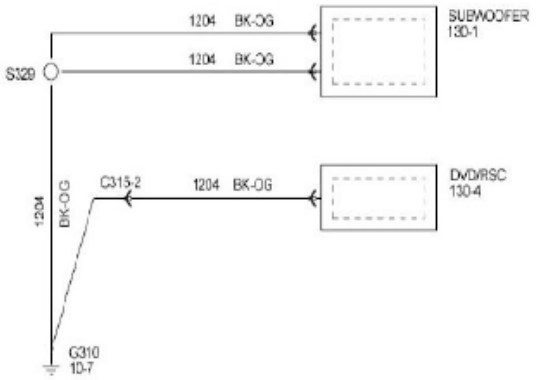
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

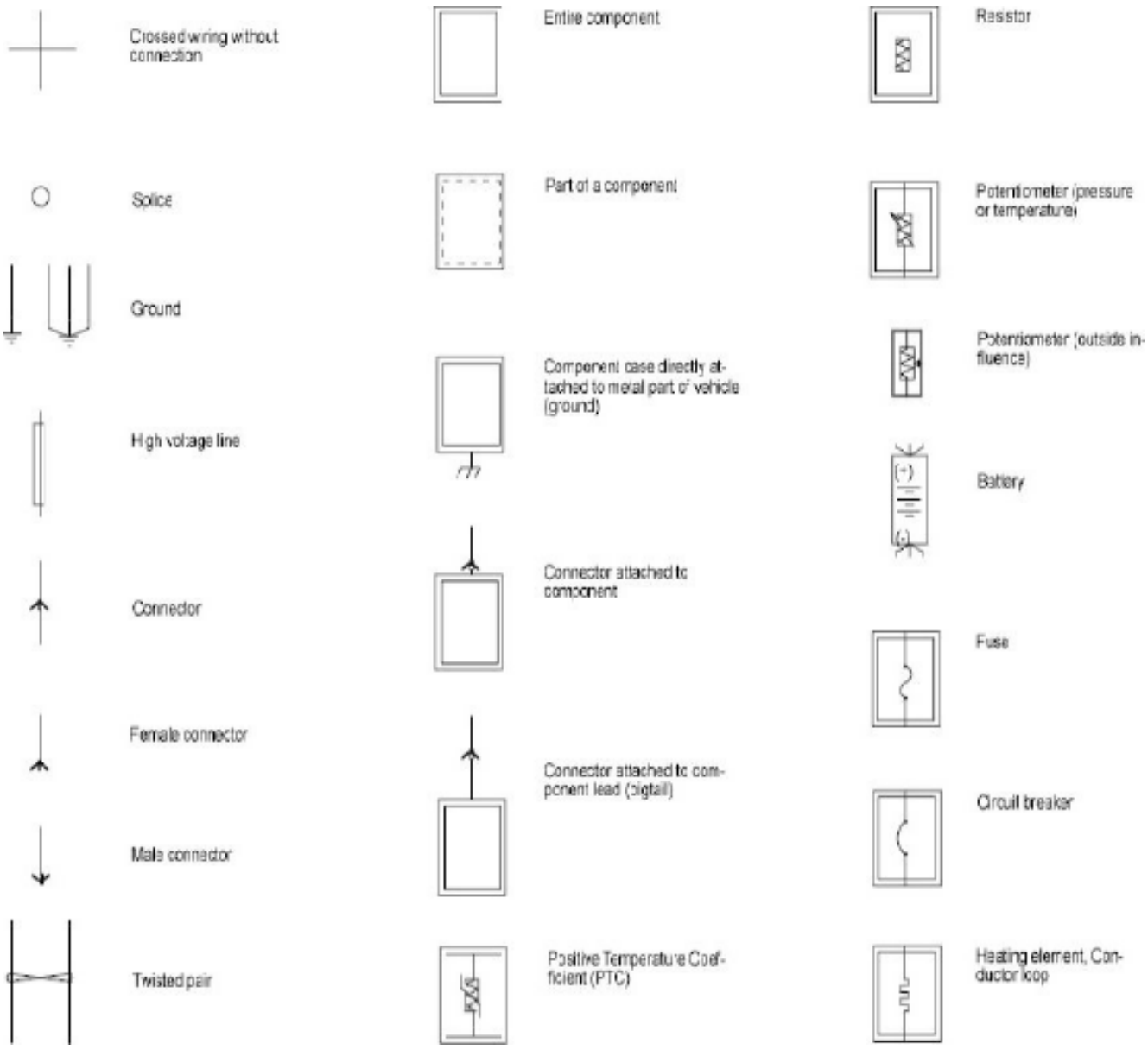
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

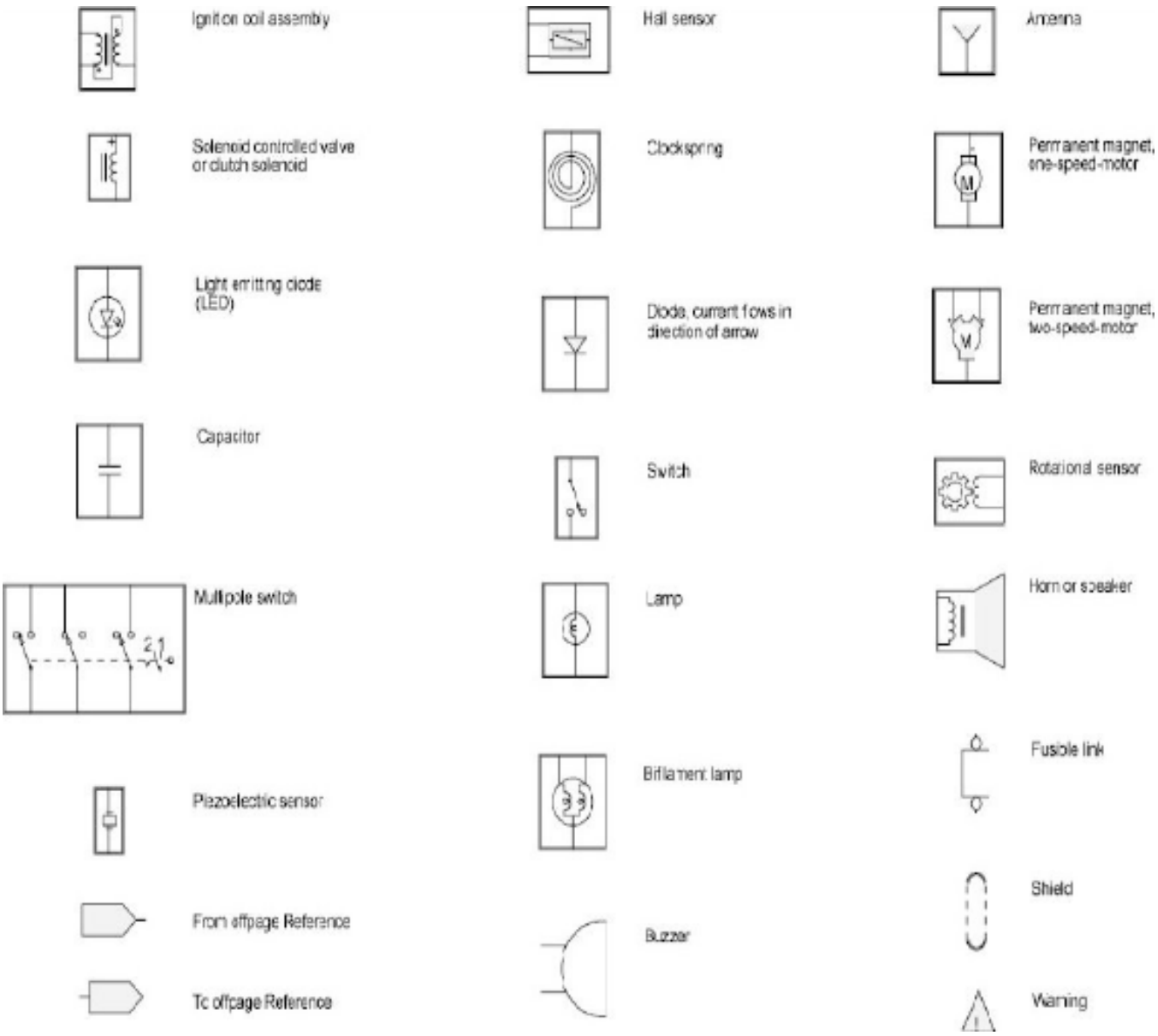
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

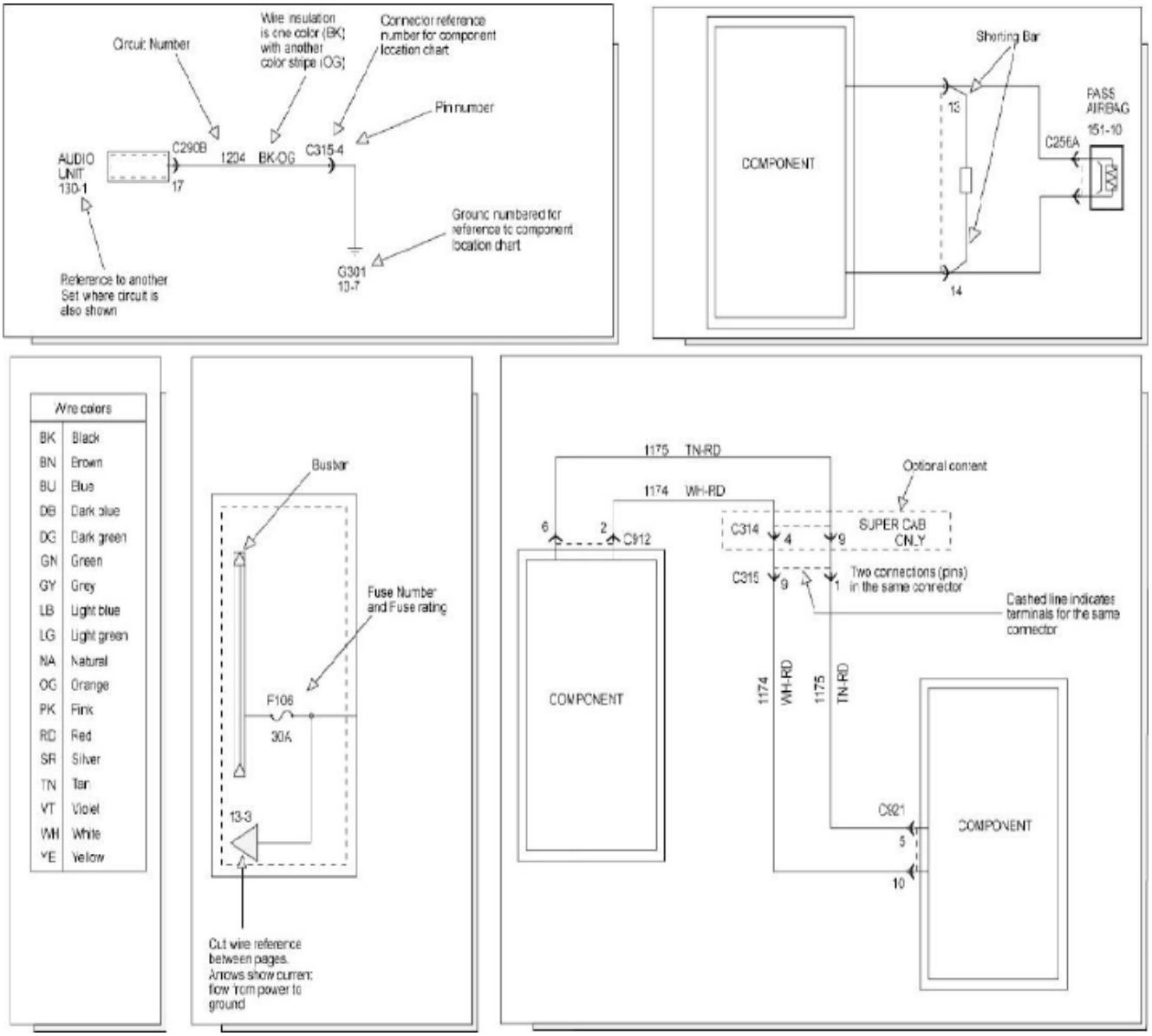
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

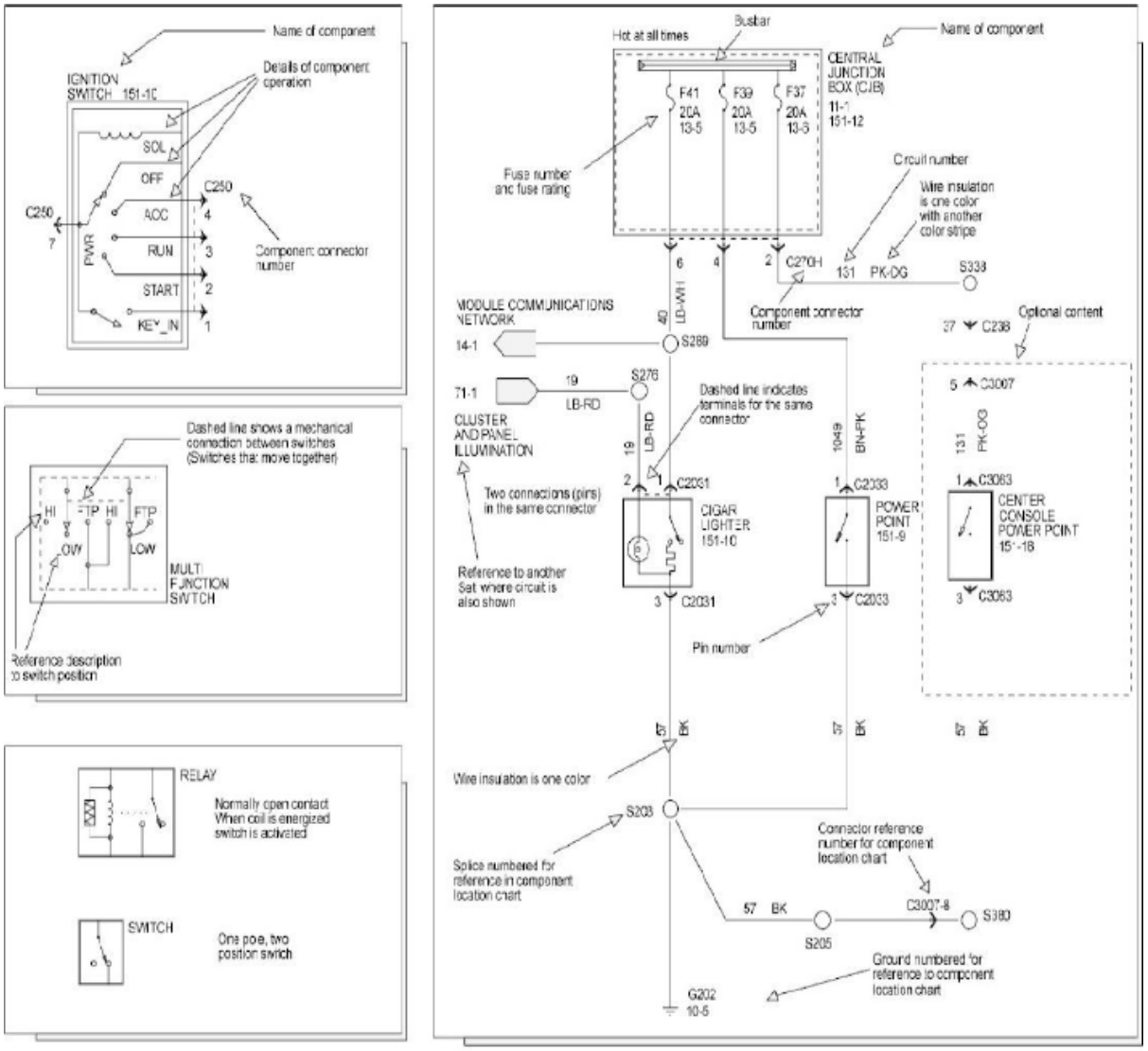
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

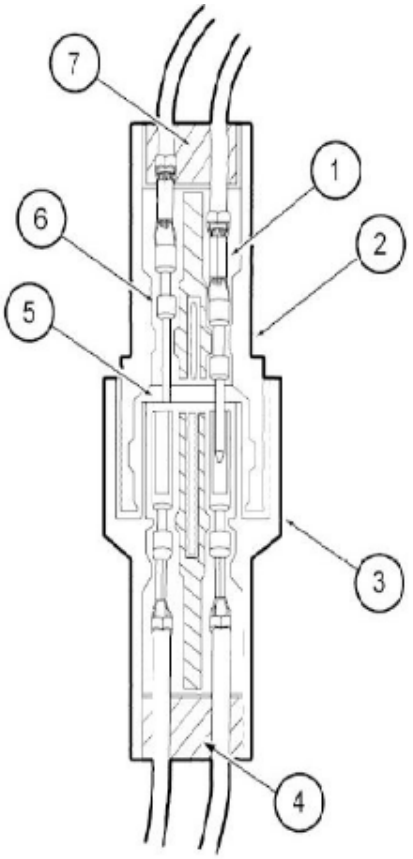


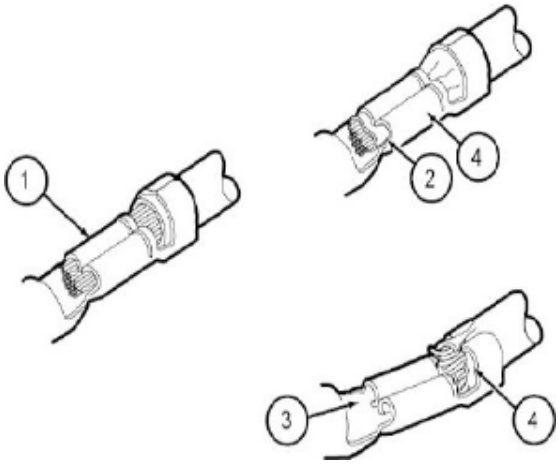
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Windshield Washer Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

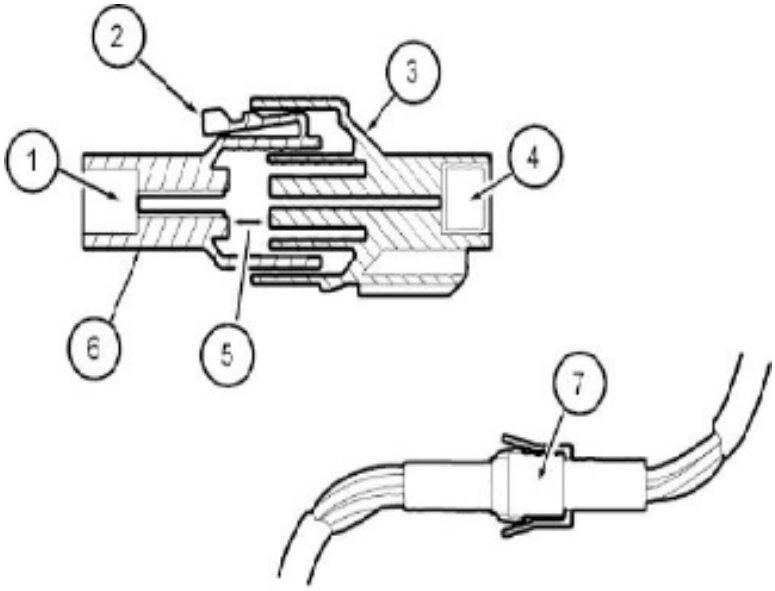
5 = Intermittent contact

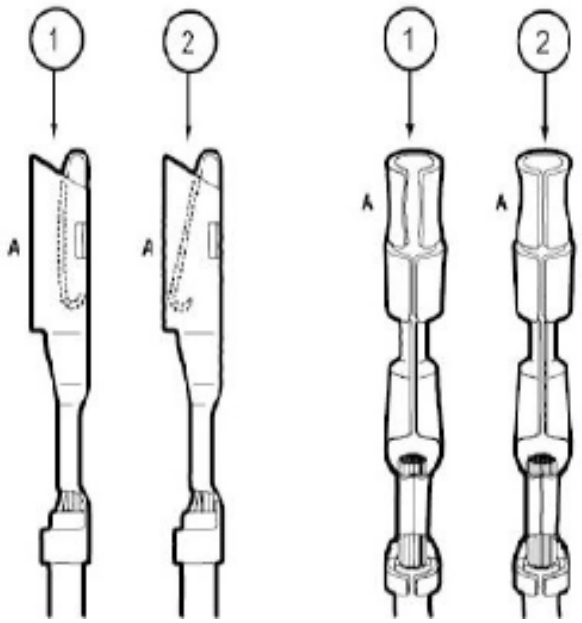
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

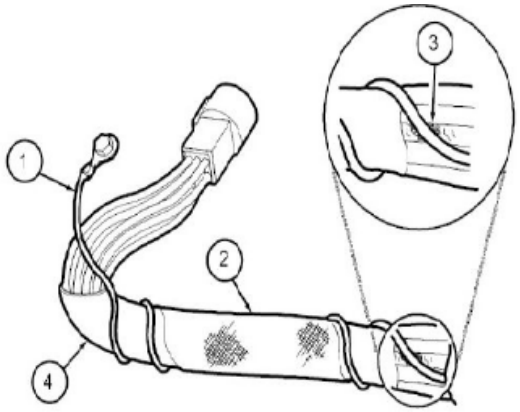
Deformed (enlarged) female terminals

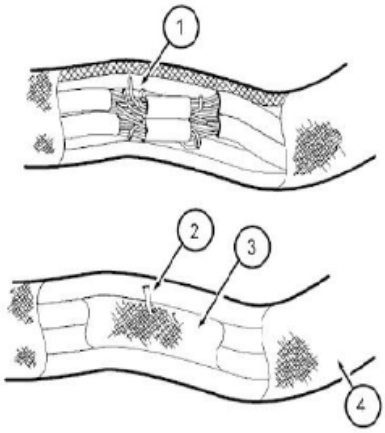
1 = Enlarged

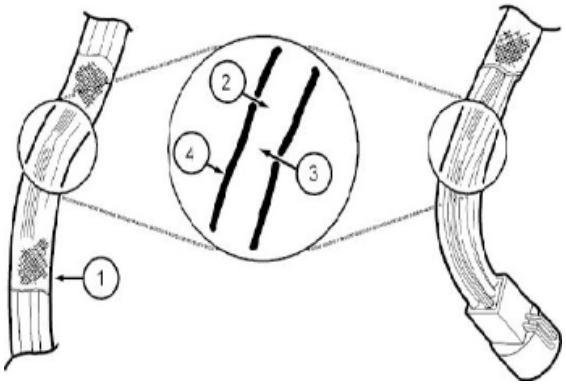
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

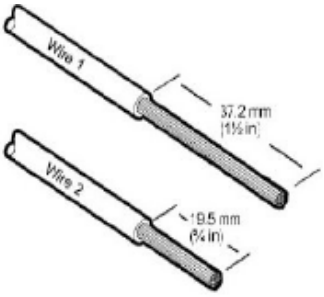
Splice covered 2

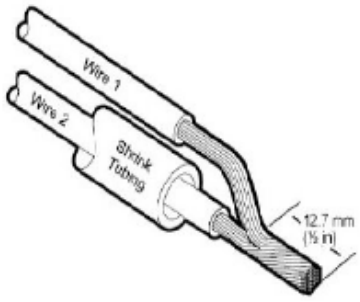
= Wire strand

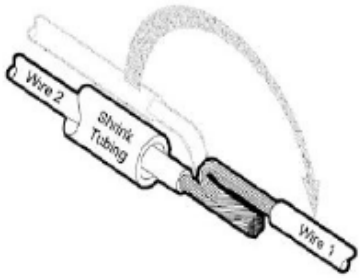
3 = Splice tape

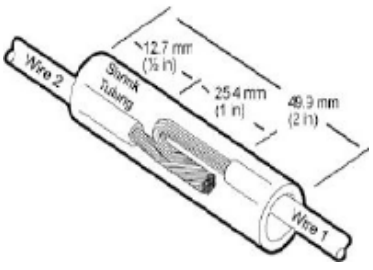
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

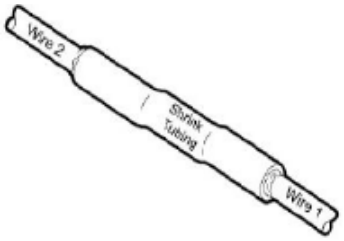
NOTE: -

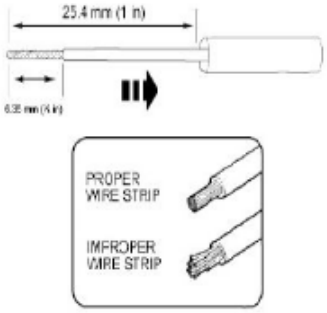
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

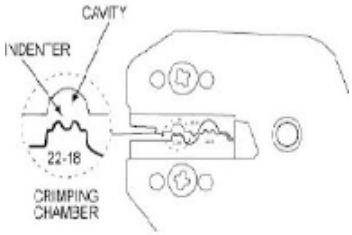
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

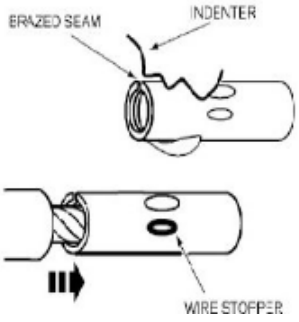
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
6.35 mm (¼ in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

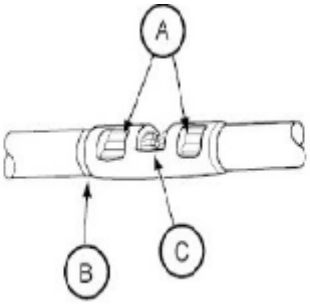
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

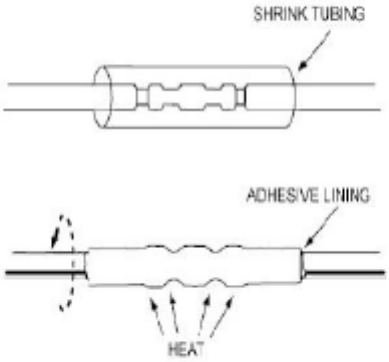
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4 strip, cut 9 strands	* 1/4 strip, cut 2 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip, fold 3x dia.
	16-14	* 1/4 strip, cut 7 strands	1/4 strip, no fold	1/4 strip, no fold	1/4 strip, no fold	5/8 strip fold 2x dia	1 strip, fold 3x dia.	1 1/4 strip, fold 4x dia.	Not Recommended
	12-10	1/4 strip, no fold	1/4 strip, no fold	5/8 strip, fold 2x dia.	1 strip fold 3x cia.	1 1/4 strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Figtail only

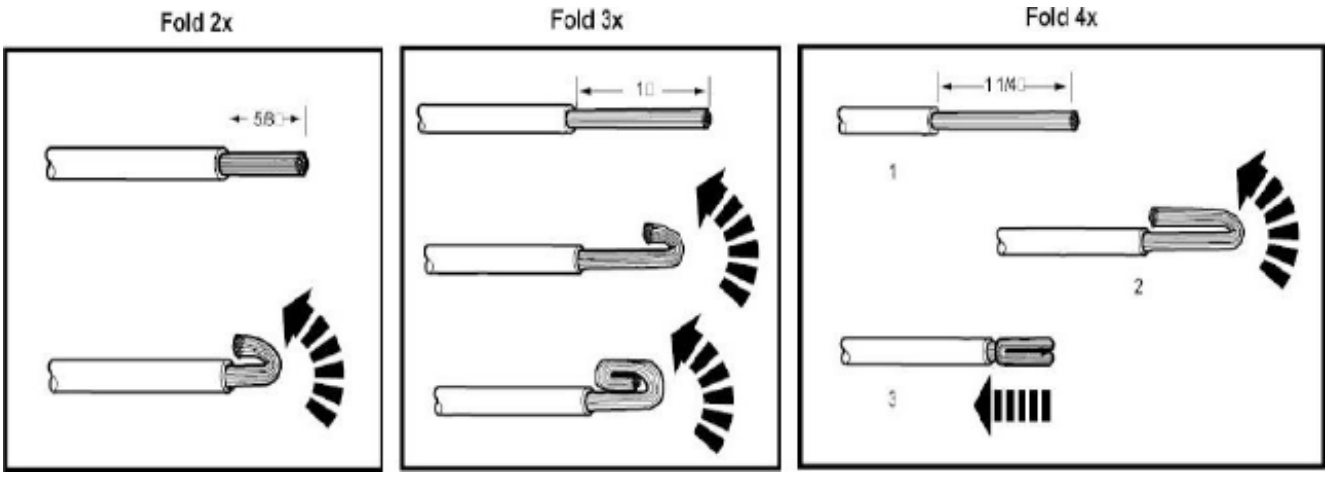
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



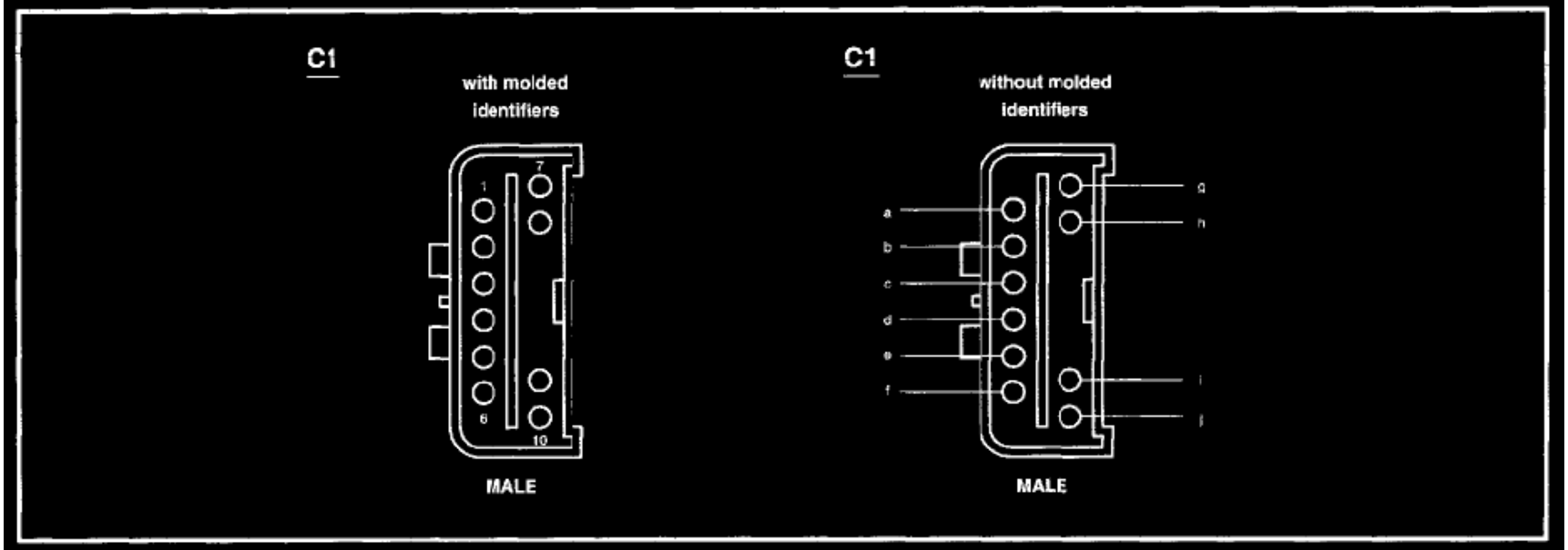
The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step–by–step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



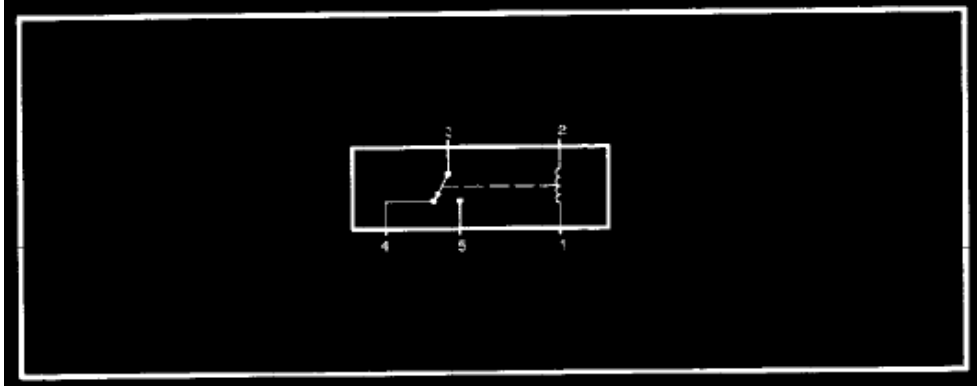
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

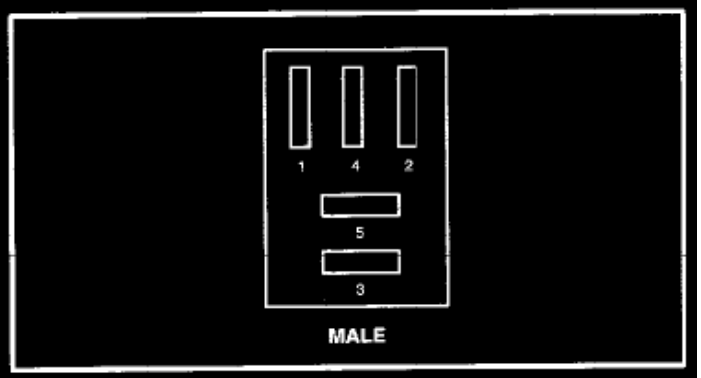
Windshield Washer Relay: Testing and Inspection Micro ISO Relay

Relay – Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63–102Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil – Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

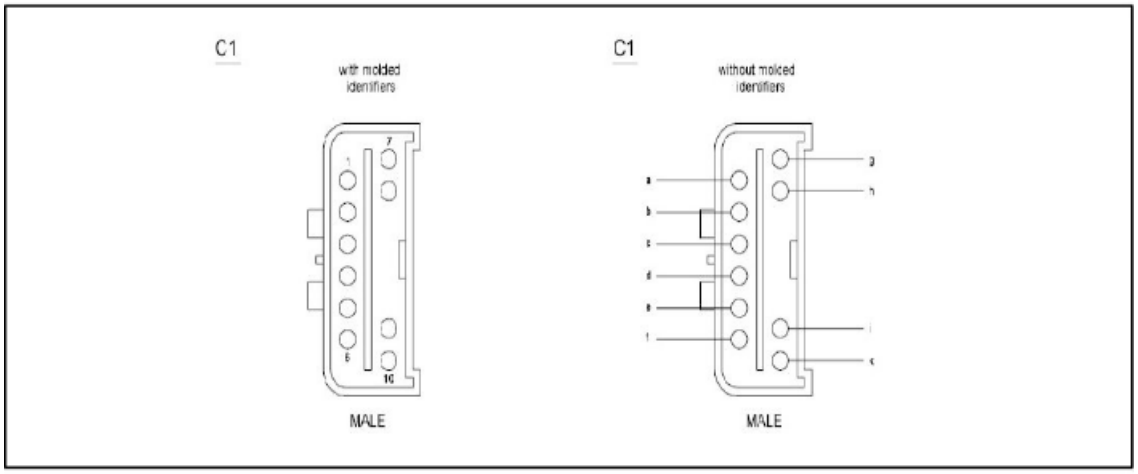
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step□by□step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals

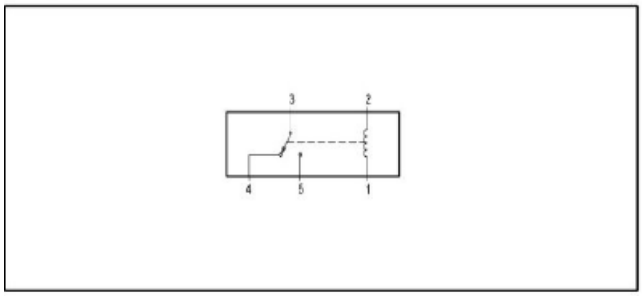


The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column □Circuit to test□. If you wish to test the complete component, perform all tests.

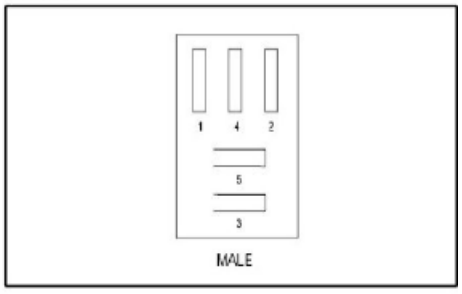
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Relay □ Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63□102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil □ Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

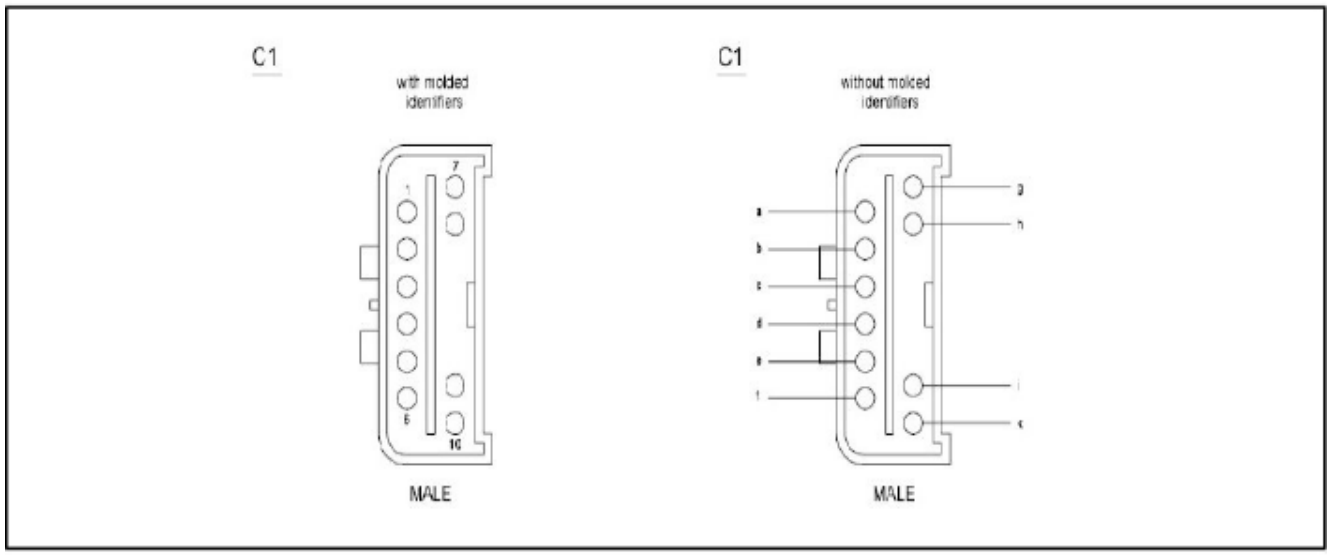
Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step by step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



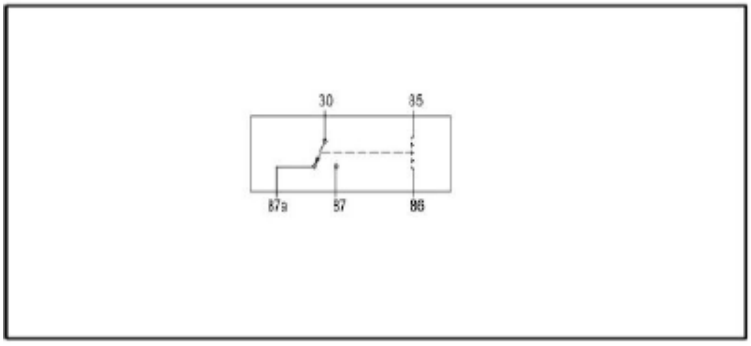
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

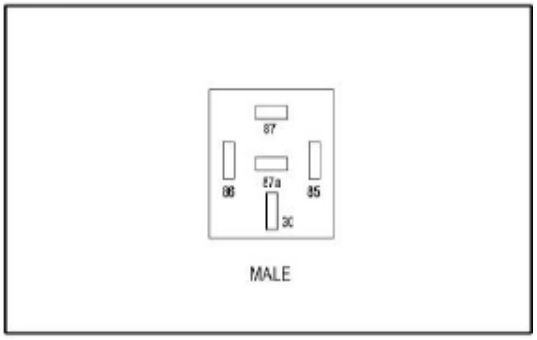
Windshield Washer Relay: Testing and Inspection Mini ISO Relay

Relay □ Mini ISO

Schematic



Terminals



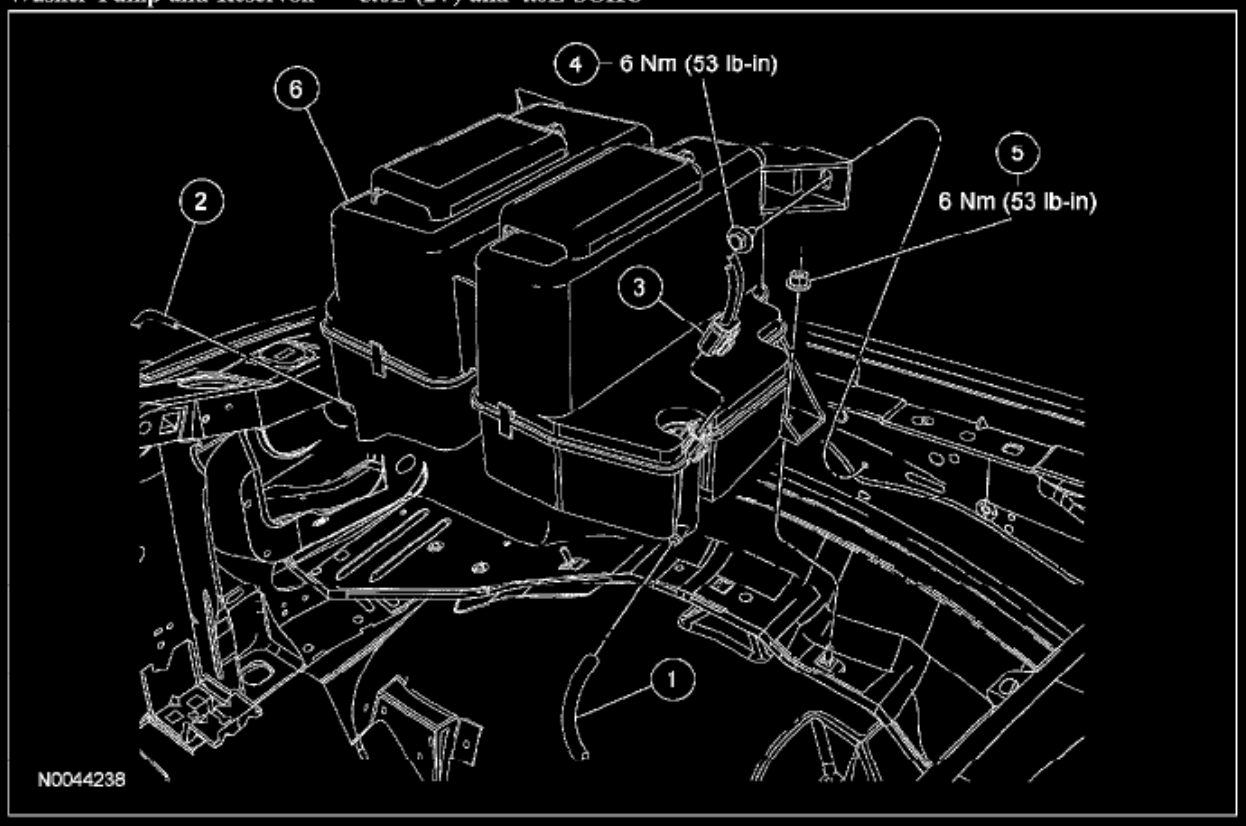
Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	45 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

Washer Pump and Reservoir — 3.0L (2V) and 4.0L SOHC



Item	Part Number	Description
1	17K605	Windshield washer hose
2	8N023	Coolant hose
3	14290	Electrical connector
4	W611102	Reservoir mounting bolt (2 required)

Item	Part Number	Description
5	N806385	Reservoir mounting nut (2 required)
6	17618	Coolant and windshield reservoir assembly

(Continued)

Windshield Washer Reservoir: Service and Repair

WASHER PUMP AND RESERVOIR

Exploded View

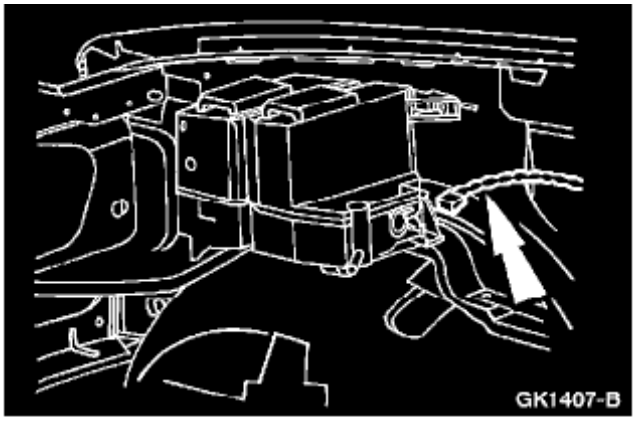
Washer Pump And Reservoir - 3.0L, (2V) And 4.0L SOHC

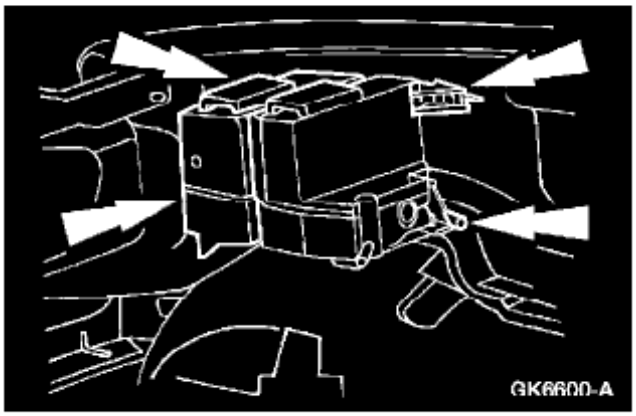
Removal and Installation

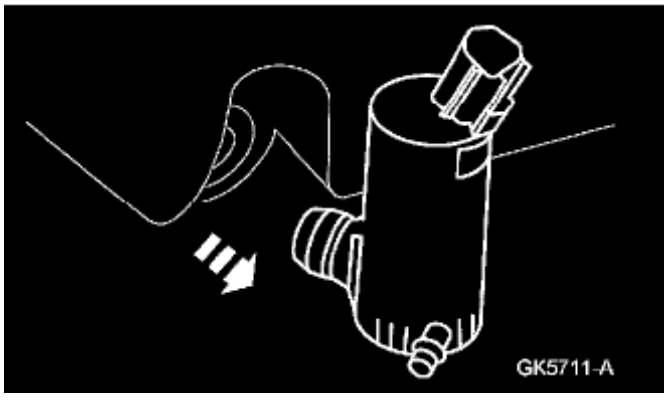
WARNING: Carefully read cautionary information on product label. For EMERGENCY MEDICAL INFORMATION seek medical advice. Consult the product Material Safety Data Sheet (MSDS) if available. Failure to follow these instructions may result in serious personal injury.

NOTE: To prevent spilling windshield washer fluid, drain the windshield washer reservoir before removal.

1. Disconnect the overflow hoses from the engine coolant overflow reservoir and plug the outlet ports of the reservoir. 2. Disconnect the windshield washer reservoir pump electrical connector.


GK1407-B


GK6600-A


GK5711-A

3. Remove the air cleaner assembly.

4. NOTE: The windshield washer reservoir and the washer pump are serviced independently.

Remove the 2 reservoir bolts and 2 reservoir nuts and remove the windshield washer reservoir. -

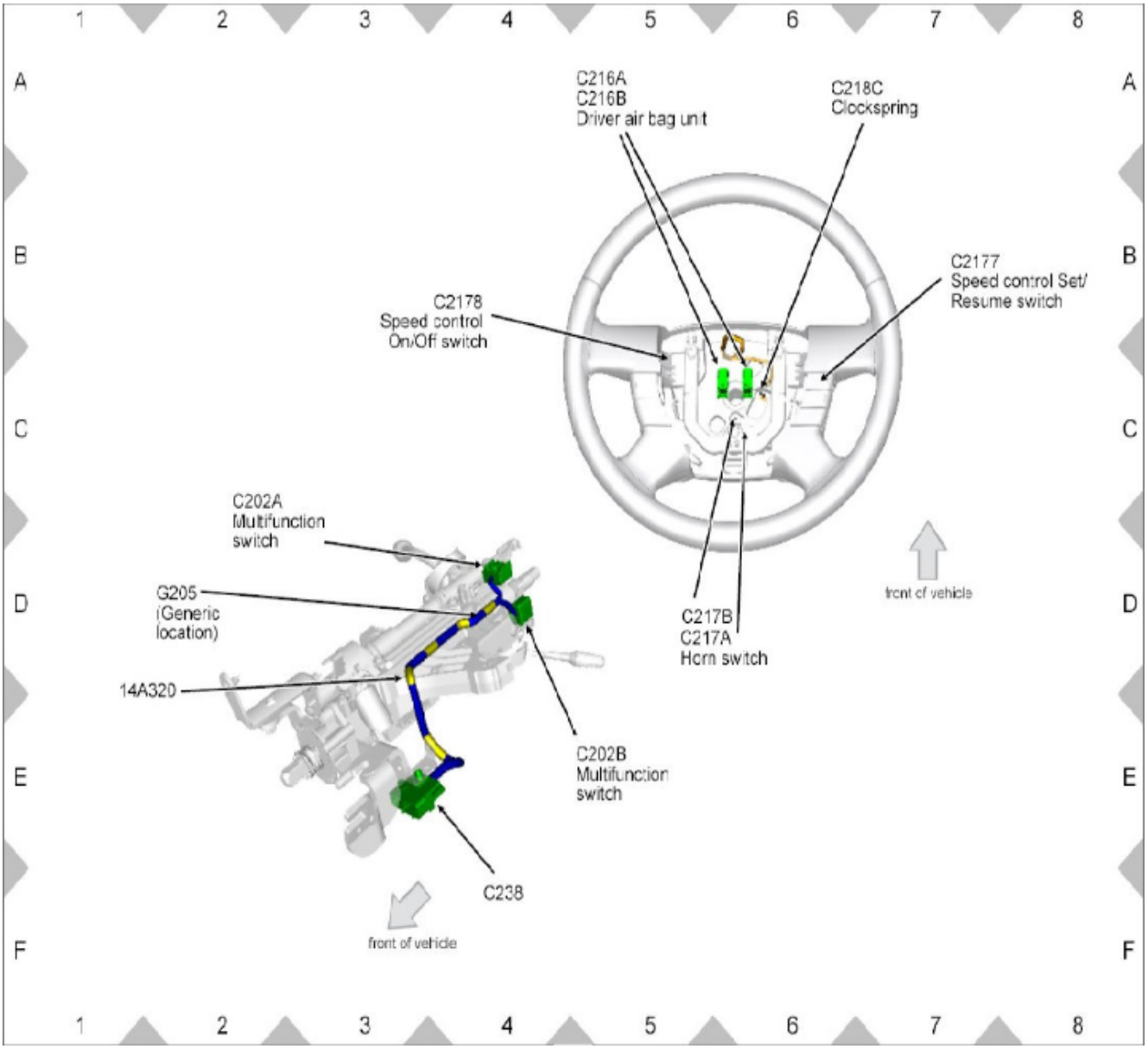
To install, tighten to 6 Nm (53 lb-in).

5. Disconnect the windshield washer hose from the windshield washer pump.

6. NOTE: When removing the washer pump from the washer reservoir, be sure not to damage the rubber grommet.

Remove the washer pump from the washer reservoir.

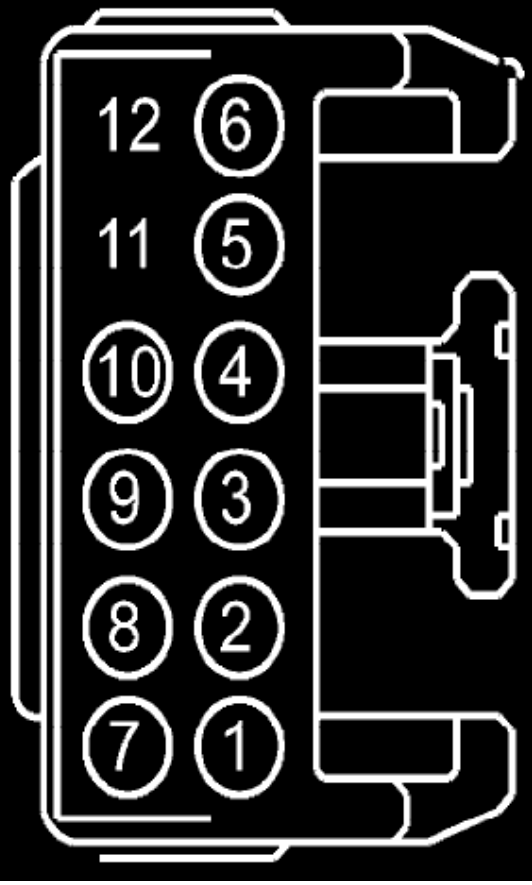
7. To install, reverse the removal procedure.


C216A
C216B
Driver air bag unit
C218C
Clockspring
C2177
Speed control Set/
Resume switch
C2178
Speed control
On/Off switch
C202A
Multifunction
switch
G205
(Generic
location)
14A320
C217B
C217A
Horn switch
front of vehicle
C202B
Multifunction
switch
C238
front of vehicle

View 151-13

Connector: C202A

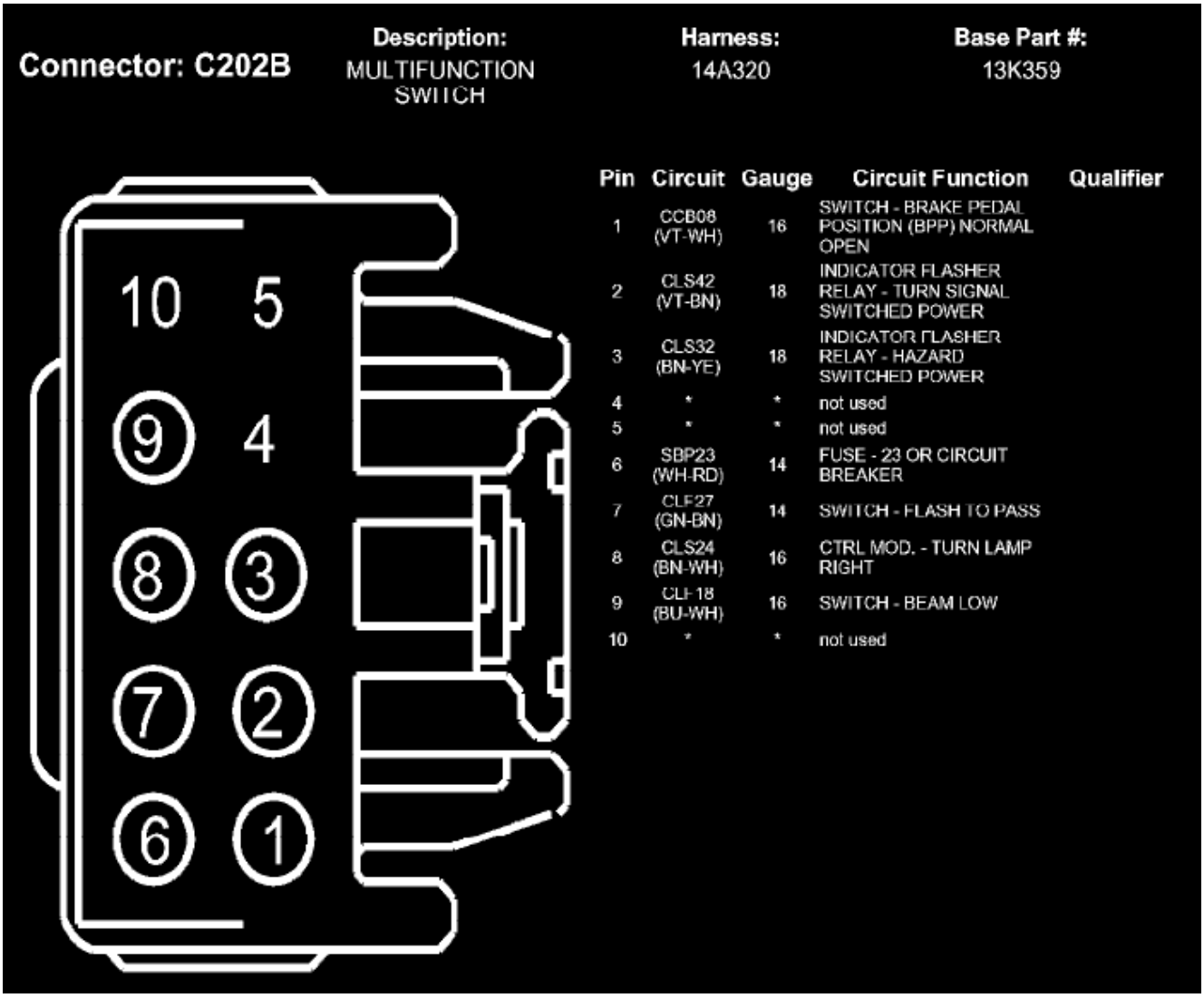
Description:	Harness:	Base Part #:
MULTIFUNCTION SWITCH	14A320	13K359



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CRW17 (GN-VT)	20	SWITCH - FRONT WIPER INTERVAL (A)	
2	CRW19 (BU-OG)	20	SWITCH - FRONT WIPER INTERVAL (C)	
3	CRW18 (VT-WH)	20	SWITCH - FRONT WIPER INTERVAL (B)	
4	CRW15 (BN-WH)	20	CTRL MOD. - FRONT WIPER HIGH	
5	CRW07 (GY-BN)	20	SWITCH - FRONT WASHER	
6	CD161 (BK YE)	18	GROUND SEAT BRACKET REAR LEFT	
7	CLS41 (GY-YE)	22	SWITCH - TURN RIGHT	
8	CLS36 (YE)	18	SWITCH - PARK LAMPS RIGHT	
9	CLS35 (VT)	18	SWITCH - PARK LAMPS LEFT	
10	CLS39 (VT-WH)	22	SWITCH - TURN LEFT	
11	*	*	not used	
12	*	*	not used	

Windshield Washer Switch: Diagrams

C202A



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CCB08 (VT-WH)	16	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL OPEN	
2	CLS42 (VT-BN)	18	INDICATOR FLASHER RELAY - TURN SIGNAL SWITCHED POWER	
3	CLS32 (BN-YE)	18	INDICATOR FLASHER RELAY - HAZARD SWITCHED POWER	
4	*	*	not used	
5	*	*	not used	
6	SBP23 (WH-RD)	14	FUSE - 23 OR CIRCUIT BREAKER	
7	CLF27 (GN-BN)	14	SWITCH - FLASH TO PASS	
8	CLS24 (BN-WH)	16	CTRL MOD. - TURN LAMP RIGHT	
9	CLF18 (BU-WH)	16	SWITCH - BEAM LOW	
10	*	*	not used	

C202B

Introduction

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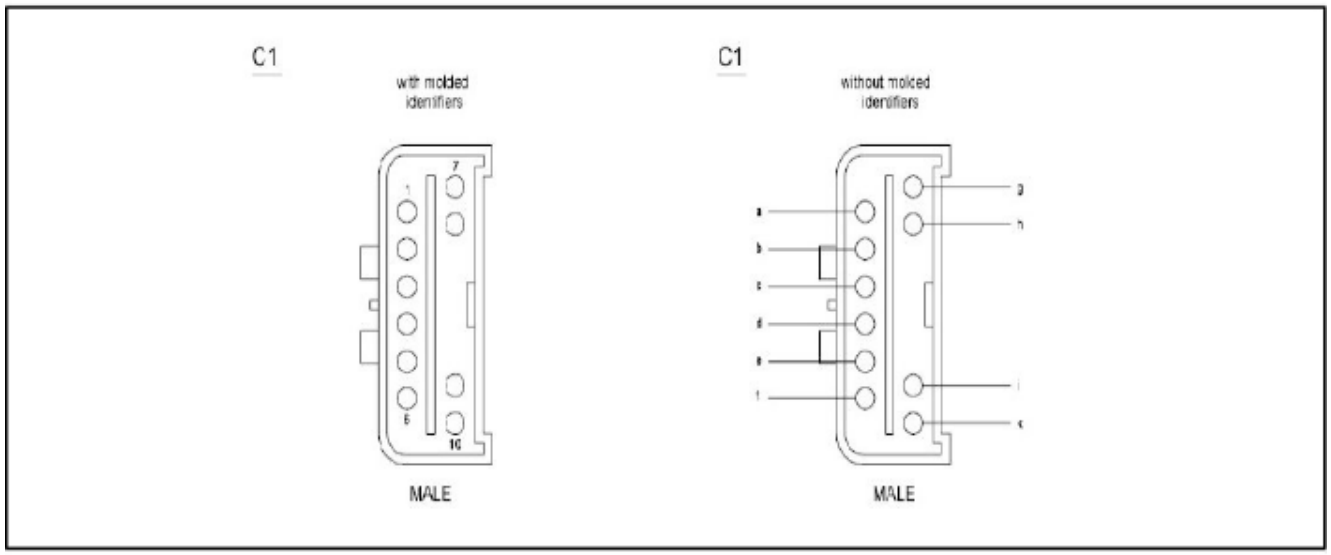
Terminals



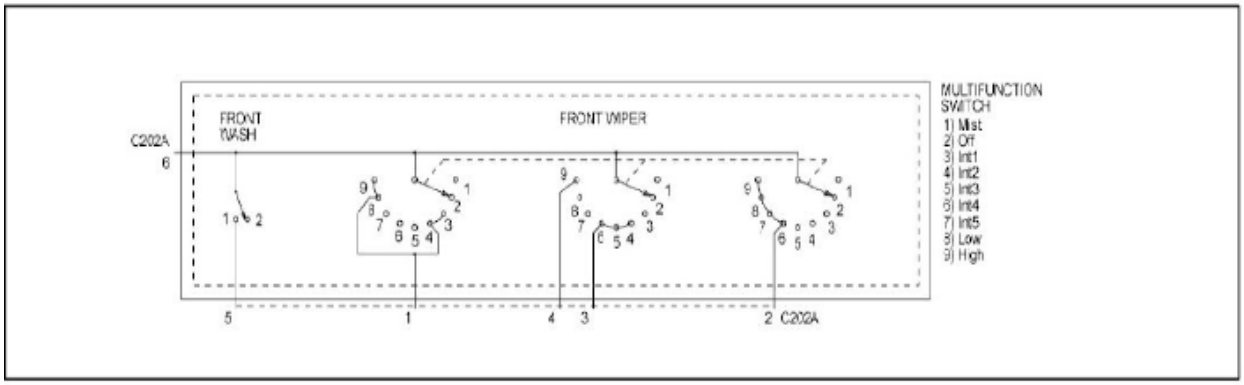
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Windshield Washer Switch: Testing and Inspection

Multifunction Switch, Wiper/Washer Portion

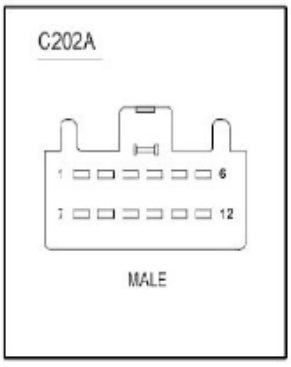
Schematic



Component testing procedure

Circuit to test	Connect self-powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
Front washer switch circuit	5 and 3	Front washer	Closed circuit
		Off	Open circuit
Front wiper switch circuit	1 and 3	Off	Open circuit
		Low	Closed circuit
		High	
	4 and 3	Off	Open circuit
		Low	
		High	Closed circuit
	2 and 3	Off	Open circuit
		Low	Closed circuit
		High	

Terminals

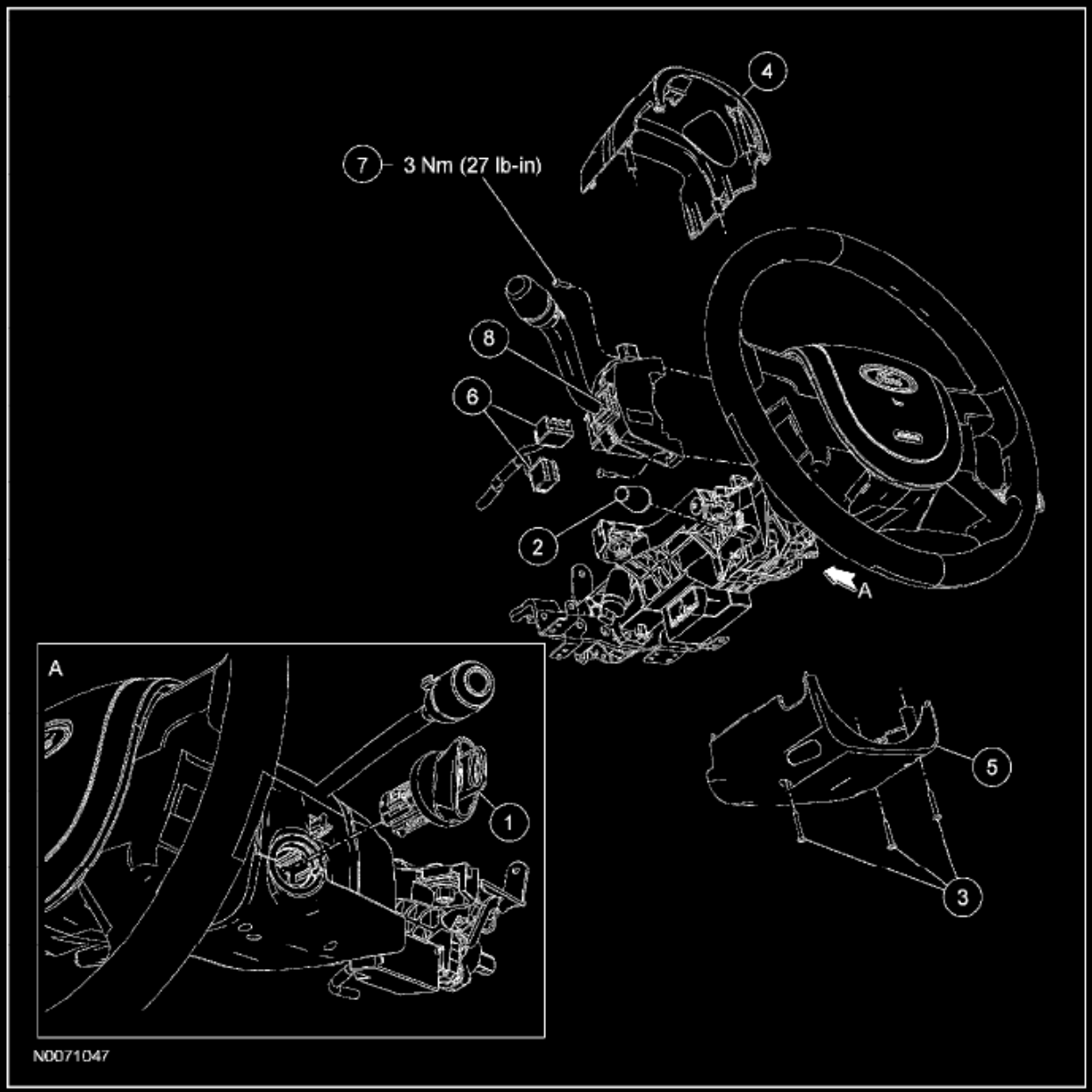


Multifunction Switch, Wiper/Washer Portion (continued)

Component testing procedure

Circuit to test	Connect self-powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
Intermittent wiper circuit, front	1 and 6	Interval 1	Closed circuit
		Interval 2	
		Interval 3	Open circuit
		Interval 4	
		Interval 5	
	3 and 6	Interval 1	Open circuit
		Interval 2	Closed circuit
		Interval 3	
		Interval 4	
		Interval 5	Open circuit
	2 and 6	Interval 1	Open circuit
		Interval 2	
		Interval 3	
		Interval 4	Closed circuit
		Interval 5	

Steering Column Multifunction Switch



Item	Part Number	Description
1	11582	Ignition switch lock cylinder
2	3F609	Tilt release lever/ handle
3	391727	Steering column shroud screws (3 required)
4	3530	Upper steering column shroud
5	3533	Lower steering column shroud

(Continued)

Item	Part Number	Description
6	—	Steering column multi-function switch electrical connectors (part of 14A320)
7	390345	Steering column multi-function switch screws (2 required)
8	13K359	Steering column multi-function switch

Windshield Washer Switch: Service and Repair

Steering Column Multifunction Switch

Steering Column Multifunction Switch

Removal and Installation

1. Remove the ignition switch lock cylinder.

1 Insert the ignition key into the ignition switch lock cylinder and turn to the RUN position.

2 Push the ignition switch lock cylinder release tab with a punch while pulling out the ignition switch lock cylinder.

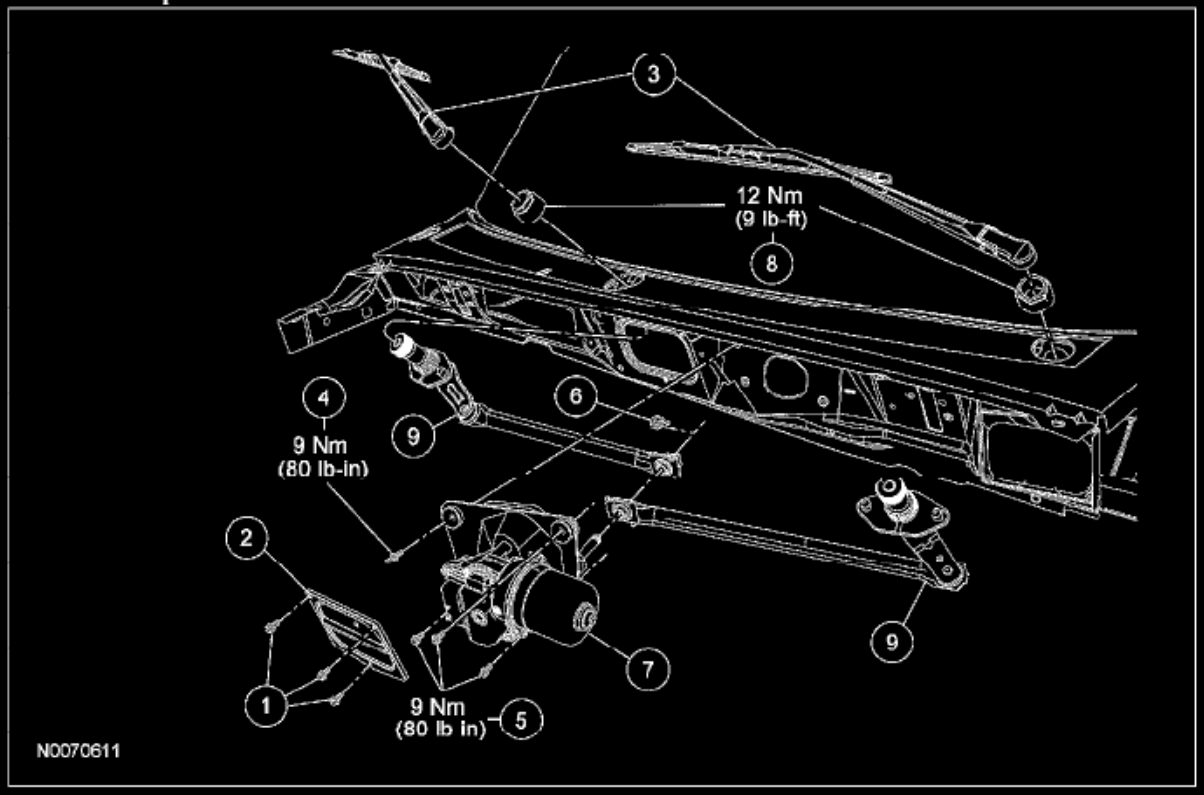
2. If equipped, remove the tilt release lever/ handle.

3. Remove the 3 steering column shroud screws and the upper and lower steering column shrouds. 4. Disconnect the multi-function switch electrical connectors. 5. Remove the 2 multi-function switch screws and the multi-function switch.

^ To install, tighten to 3 Nm (27 lb-inch).

6. To install, reverse the removal procedure.

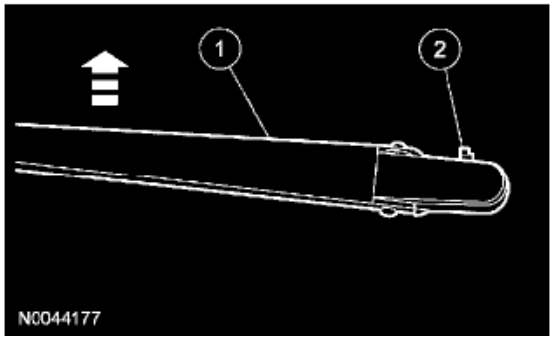
Windshield Wipers



Item	Part Number	Description
1	—	Access cover screws (3 required)
2	—	Access cover
3	17526	Wiper pivot arms (2 required)
4	N802449	Wiper motor stud
5	W709945	Wiper motor bolts (3 required)

Item	Part Number	Description
6	—	Wiper motor retaining clip
7	17508	Wiper motor assembly
8	17D499	Pivot arm retaining nuts (2 required)
9	17566	Mounting arm and pivot shafts (linkage)

(Continued)



Wiper Arm: Service and Repair Wiper Pivot Arm

WIPER PIVOT ARM

Exploded View

Windshield Wipers

Removal and Installation

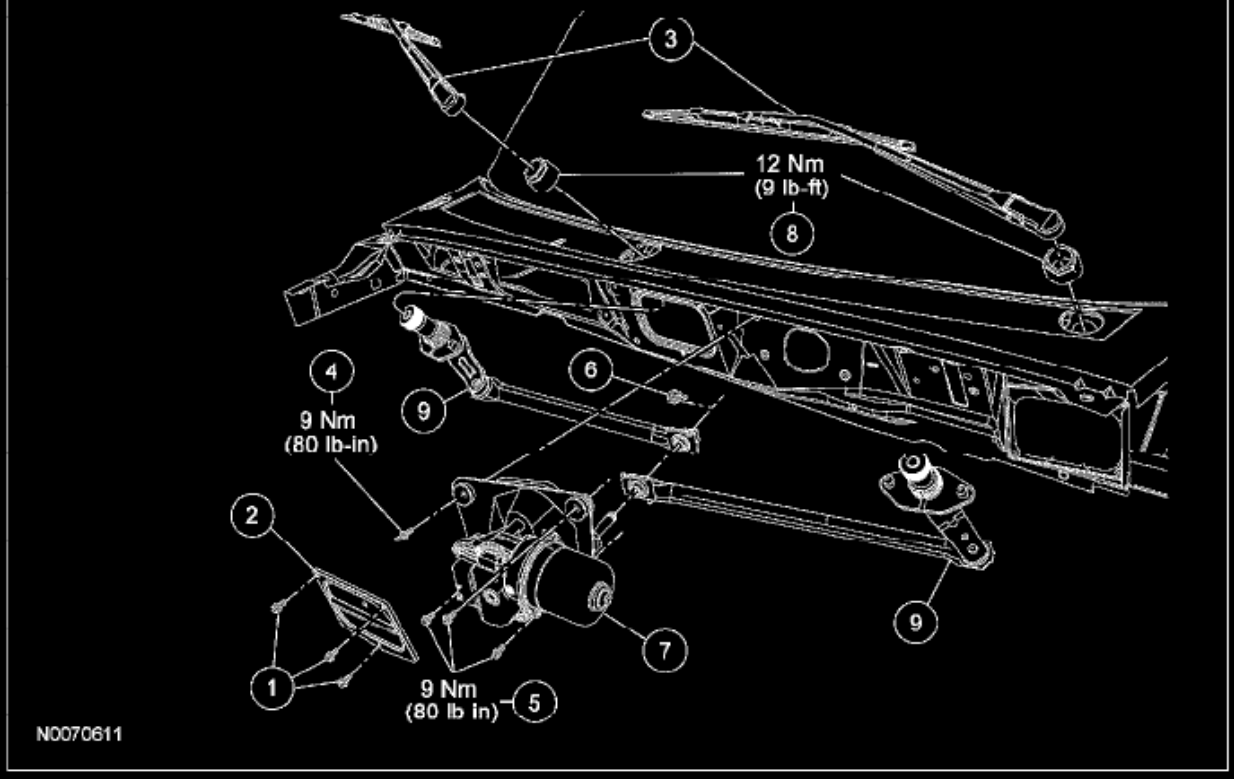
1. Remove the windshield wiper pivot arm.

1 Pull up on the pivot arms.

2 Pull out on the retainer tabs.

2. To install, reverse the removal procedure.

Windshield Wipers



Item	Part Number	Description
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2	—	Access cover
3	17526	Wiper pivot arms (2 required)
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5	W709945	Wiper motor bolts (3 required)

Item	Part Number	Description
6	—	Wiper motor retaining clip
7	17508	Wiper motor assembly
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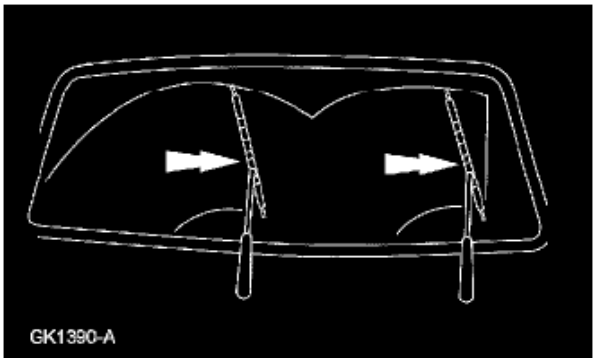
9	17566	Mounting arm and pivot shafts (linkage)

(Continued)



Wiper Arm: Service and Repair Wiper Mounting Arm and Pivot Shaft

WIPER MOUNTING ARM AND PIVOT SHAFT

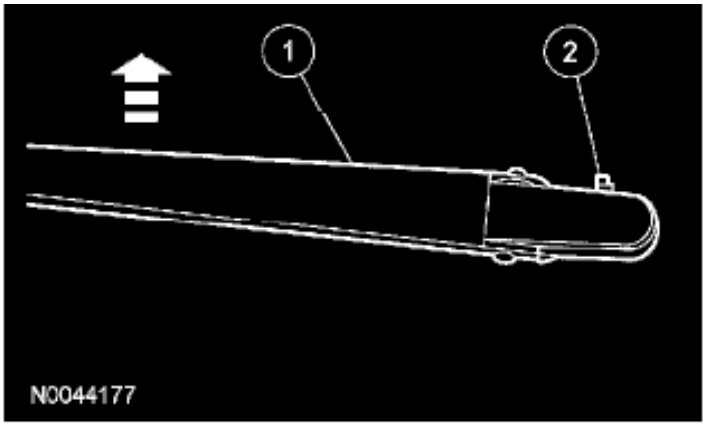
Exploded View

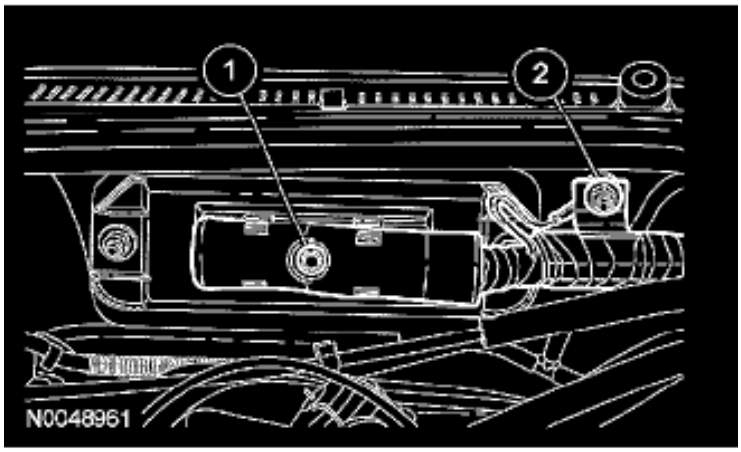
Windshield Wipers

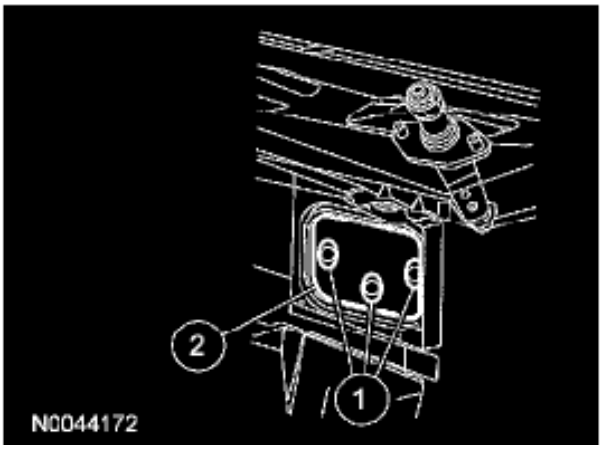
Removal and Installation

1. Cycle the windshield wiper blades until they are in the straight UP position.

2. Disconnect the battery ground cable.


1
2
N0044177


1
2
N0048961


2
1
N0044172

- To install, tighten to 9 Nm (80 lb-in).

3. Remove the RH and LH windshield wiper pivot arms.

1 Pull up on the pivot arm.

2 Pull out on the retainer tab.

4. Position the PCM connector and harness aside.

1 Loosen the bolt.

2 Remove the nut and stud.

- Disconnect the PCM electrical connector and position the harness aside.

5. Remove the RH access cover.

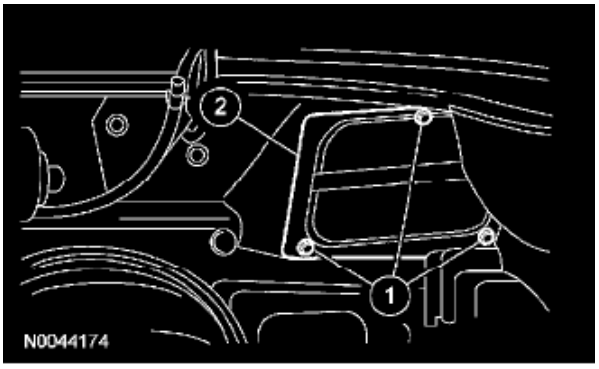
1 Remove the screws.

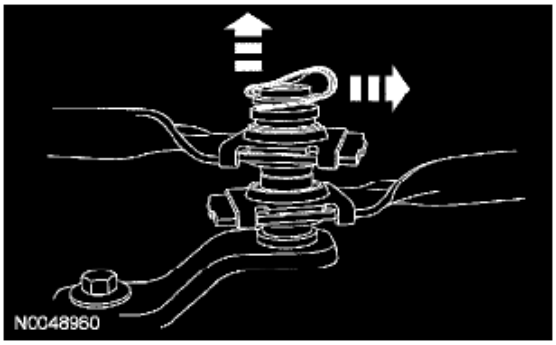
2 Remove the access cover.

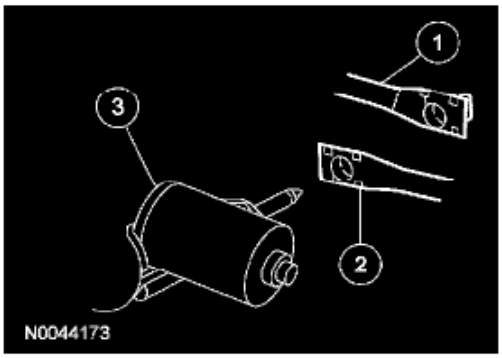
6. Position the power distribution box aside and remove the LH access cover.

1 Remove the screws.

2 Remove the access cover.


2
1
N0044174


N0048860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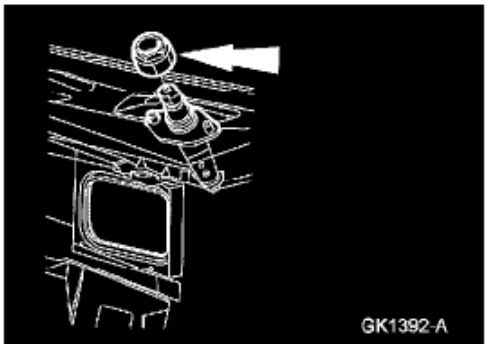

GK1392-A

7. Reach through the RH access cover opening and remove the wiper motor clip from the RH mounting arm and pivot shaft.

8. Disconnect the (1) RH windshield wiper mounting arm and pivot shaft from the (2) LH windshield wiper mounting arm and pivot shaft, and move

both away from the (3) windshield wiper motor.

9. Remove the RH and LH pivot nuts.

- To install, tighten to 12 Nm (9 lb-ft).

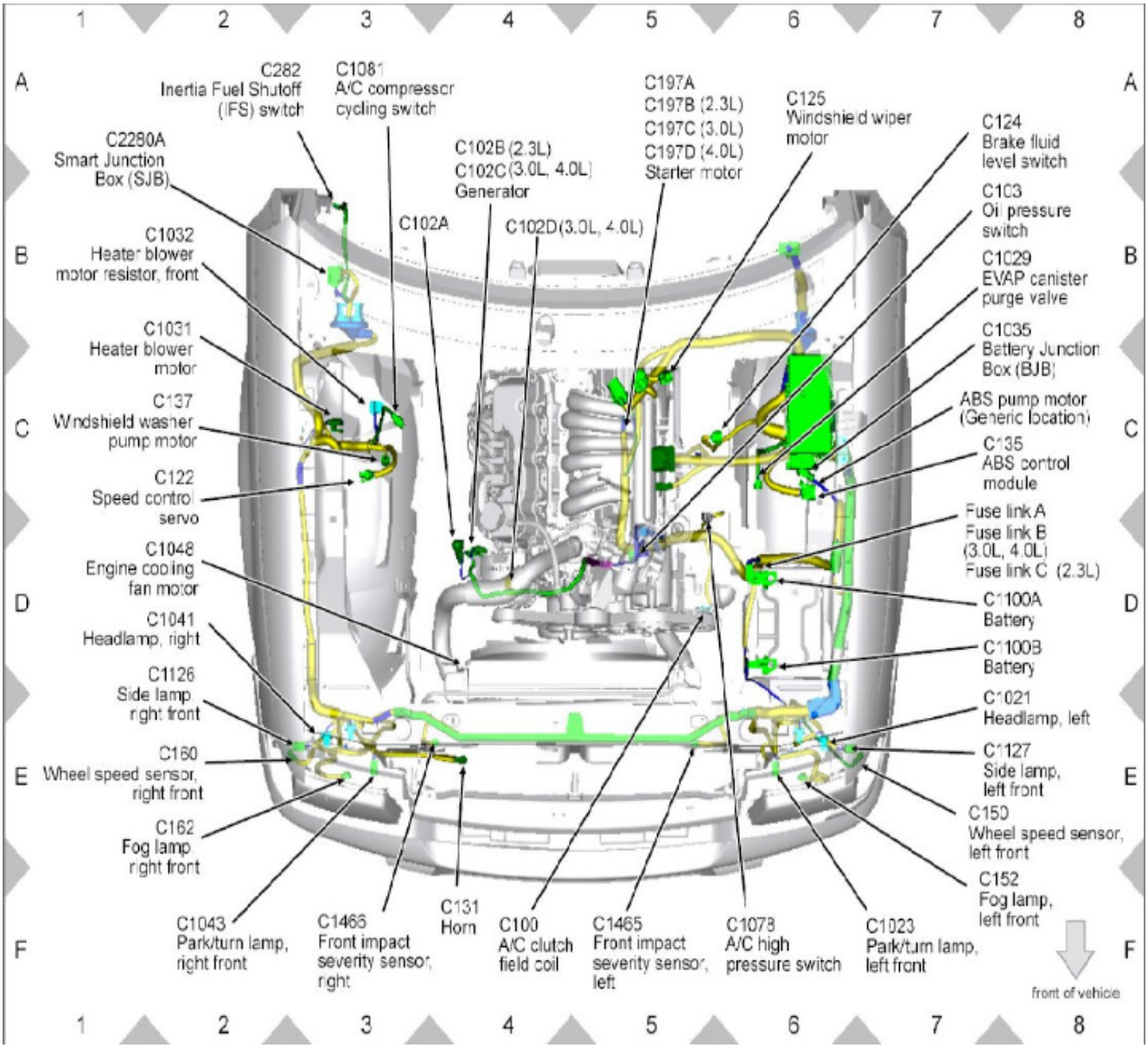
10. Remove the RH and LH mounting arm and pivot shafts through the RH access opening.

11. CAUTION: To avoid possible damage to the windshield wiper adapter and connecting arm clip, be sure the clip is fully seated before

installing the adapter and connecting the arm clip on the windshield wiper motor crank pin.

NOTE: Be sure to install the RH windshield wiper mounting arm and pivot shaft onto the windshield wiper motor crank pin until it snaps into place.

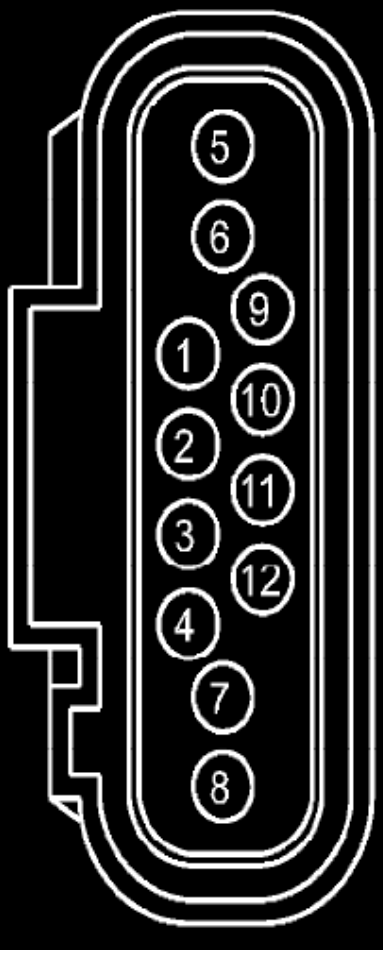
To install, reverse the removal procedure.


C282
Inertia Fuel Shutoff (IFS) switch
C1081
A/C compressor cycling switch
C2280A
Smart Junction Box (SJB)
C1032
Heater blower motor resistor, front
C1031
Heater blower motor
C137
Windshield washer pump motor
C122
Speed control servo
C1048
Engine cooling fan motor
C1041
Headlamp, right
C1126
Side lamp right front
C160
Wheel speed sensor, right front
C162
Fog lamp right front
C1043
Park/turn lamp, right front
C1465
Front impact severity sensor, right
C131
Horn
C102A
C102B (2.3L)
C102C (3.0L, 4.0L)
Generator
C102D (3.0L, 4.0L)
C100
A/C clutch field coil
C197A
C197B (2.3L)
C197C (3.0L)
C197D (4.0L)
Starter motor
C1465
Front impact severity sensor, left
C1078
A/C high pressure switch
C125
Windshield wiper motor
C1023
Park/turn lamp, left front
C124
Brake fluid level switch
C103
Oil pressure switch
C1029
EVAP canister purge valve
C1035
Battery Junction Box (BJB)
ABS pump motor (Generic location)
C135
ABS control module
Fuse link A
Fuse link B (3.0L, 4.0L)
Fuse link C (2.3L)
C100A
Battery
C100B
Battery
C1021
Headlamp, left
C1127
Side lamp, left front
C150
Wheel speed sensor, left front
C152
Fog lamp, left front
front of vehicle

View 151-1

Connector: C125

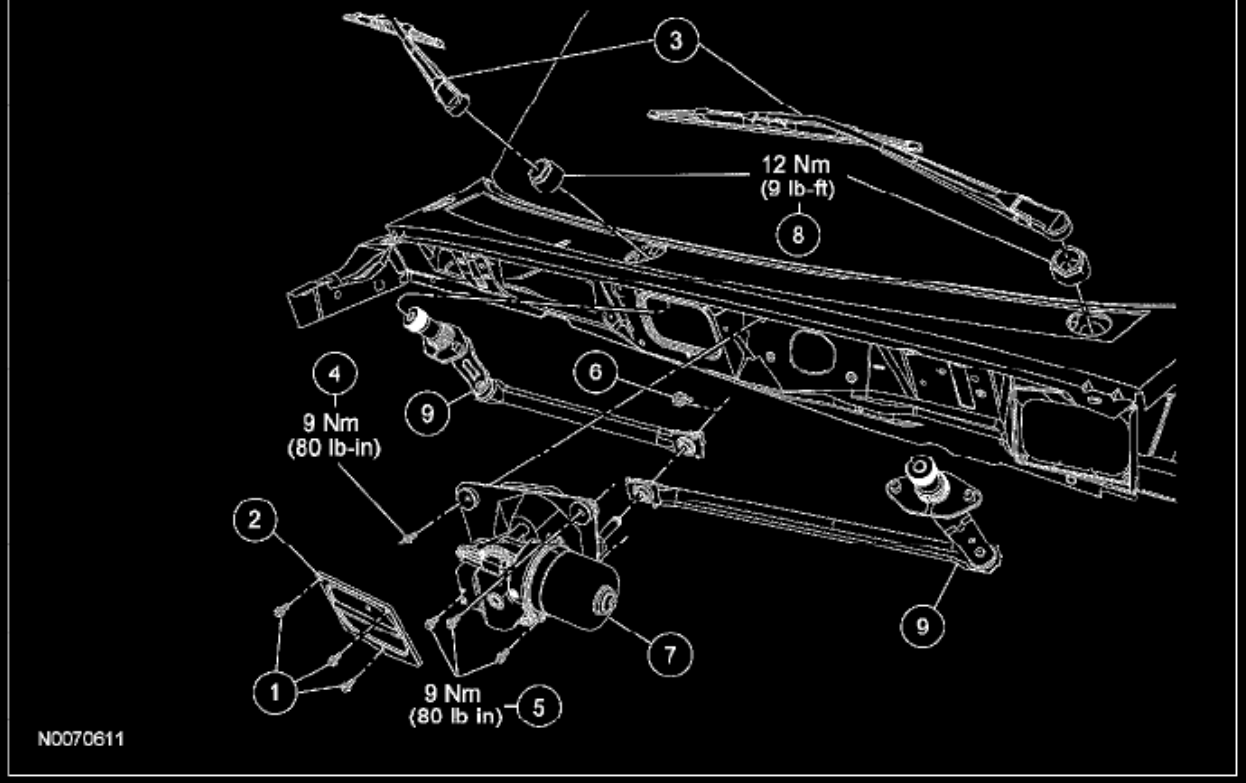
Description:	Harness:	Base Part #:
WINDSHIELD WIPER MOTOR	14290	17508



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CRW15 (BN-WH)	20	CTRL MOD. - FRONT WIPER HIGH	
2	*	*	not used	
3	GD174 (BK-WH)	20	GROUND - TUNNEL	
4	*	*	not used	
5	SBB29 (GY-RD)	16	FUSE - 29 OR CIRCUIT BREAKER	
6	GD121 (BK-YE)	16	GROUND - FENDER FRONT LEFT # 2ND STUD	
7	CRW24 (GY)	16	CTRL MOD. - RELAY FRONT WIPER RUN/PARK	
8	CBP05 (YE)	20	FUSE - 5 OR CIRCUIT BREAKER	
9	CRW17 (GN-VT)	20	SWITCH - FRONT WIPER INTERVAL (A)	
10	CRW19 (BU-OG)	20	SWITCH - FRONT WIPER INTERVAL (C)	
11	CRW18 (VT-WH)	20	SWITCH - FRONT WIPER INTERVAL (B)	
12	CRW07 (GY-BN)	20	SWITCH - FRONT WASHER	

C125

Windshield Wipers



Item	Part Number	Description
1	—	Access cover screws (3 required)
2	—	Access cover
3	17526	Wiper pivot arms (2 required)
4	N802449	Wiper motor stud
5	W709945	Wiper motor bolts (3 required)

Item	Part Number	Description
6	—	Wiper motor retaining clip
7	17508	Wiper motor assembly
8	17D499	Pivot arm retaining nuts (2 required)
9	17566	Mounting arm and pivot shafts (linkage)

(Continued)

Wiper Motor: Service and Repair

WIPER MOTOR

Exploded View

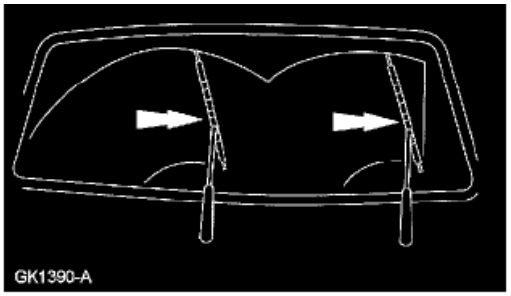
Windshield Wipers

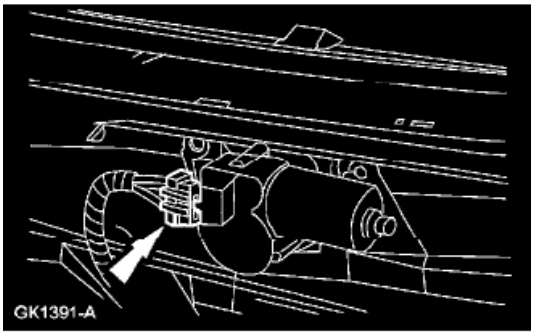
Removal and Installation

CAUTION: The internal permanent magnets used in the windshield wiper motor are made of a glass-like material. To avoid damaging the magnets, do not strike the motor with a hammer or any other object.

NOTE: The windshield wiper motor is not a repairable item. If worn or damaged, a new motor must be installed.

1. Cycle the windshield wiper blades until they are in the straight UP position.


GK1390-A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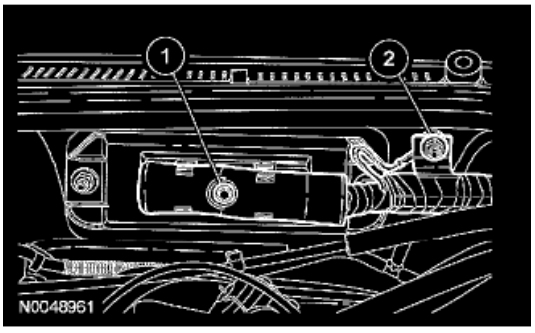
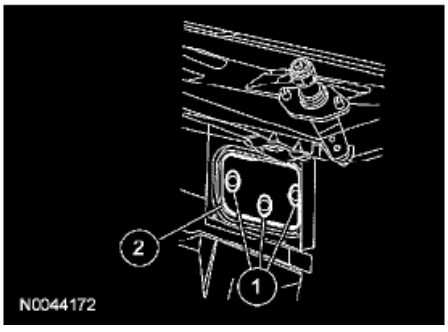

1
2
N0048961


2
1
N0044172

2. Disconnect the battery ground cable.

- To install, tighten to 9 Nm (80 lb-in).

3. Disconnect the windshield wiper motor electrical connector.

4. Position the PCM connector and harness aside.

1 Loosen the bolt.

2 Remove the nut and stud.

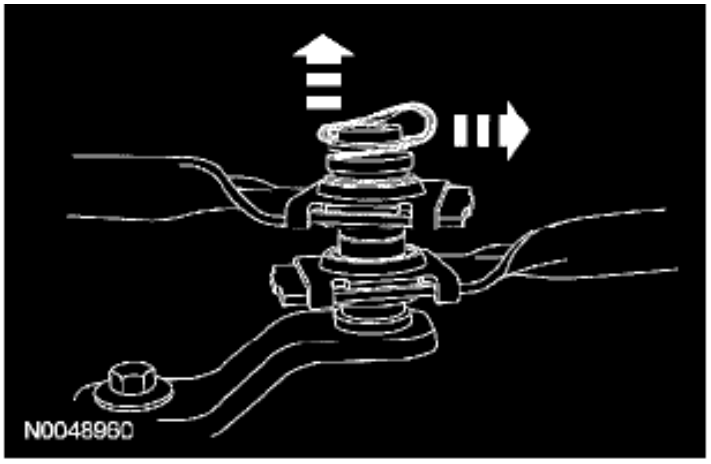
- Disconnect the PCM electrical connector and position the harness aside.

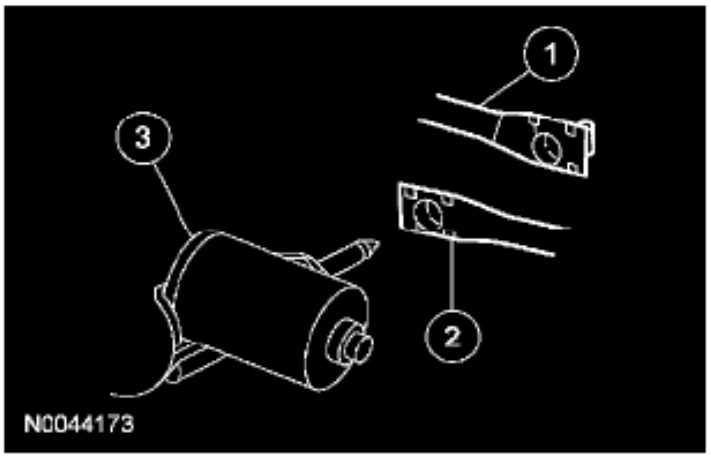
5. Remove the RH access cover.

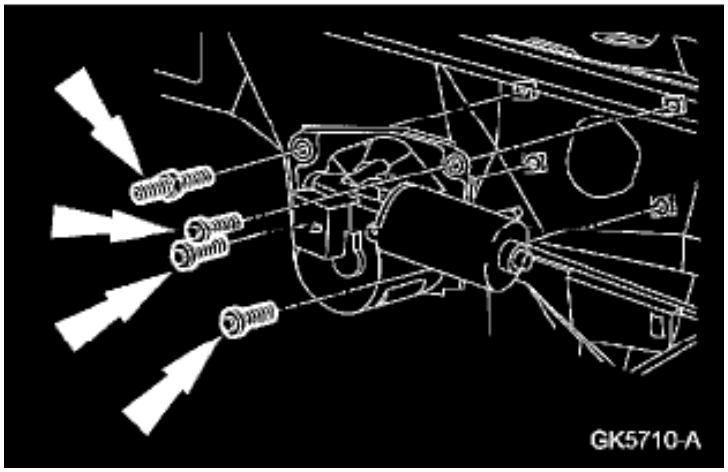
1 Remove the screws.

2 Remove the access cover.

6. Reach through the RH access cover opening and remove the wiper motor clip from the RH mounting arm and pivot shaft.


N0048960


1
3
2
N0044173


GK5710-A

7. Disconnect the (1) RH windshield wiper mounting arm and pivot shaft from the (2) LH windshield wiper mounting arm and pivot shaft, and move

both away from the (3) windshield wiper motor.

8. Remove the windshield wiper motor.

- Remove the stud and bolts. -

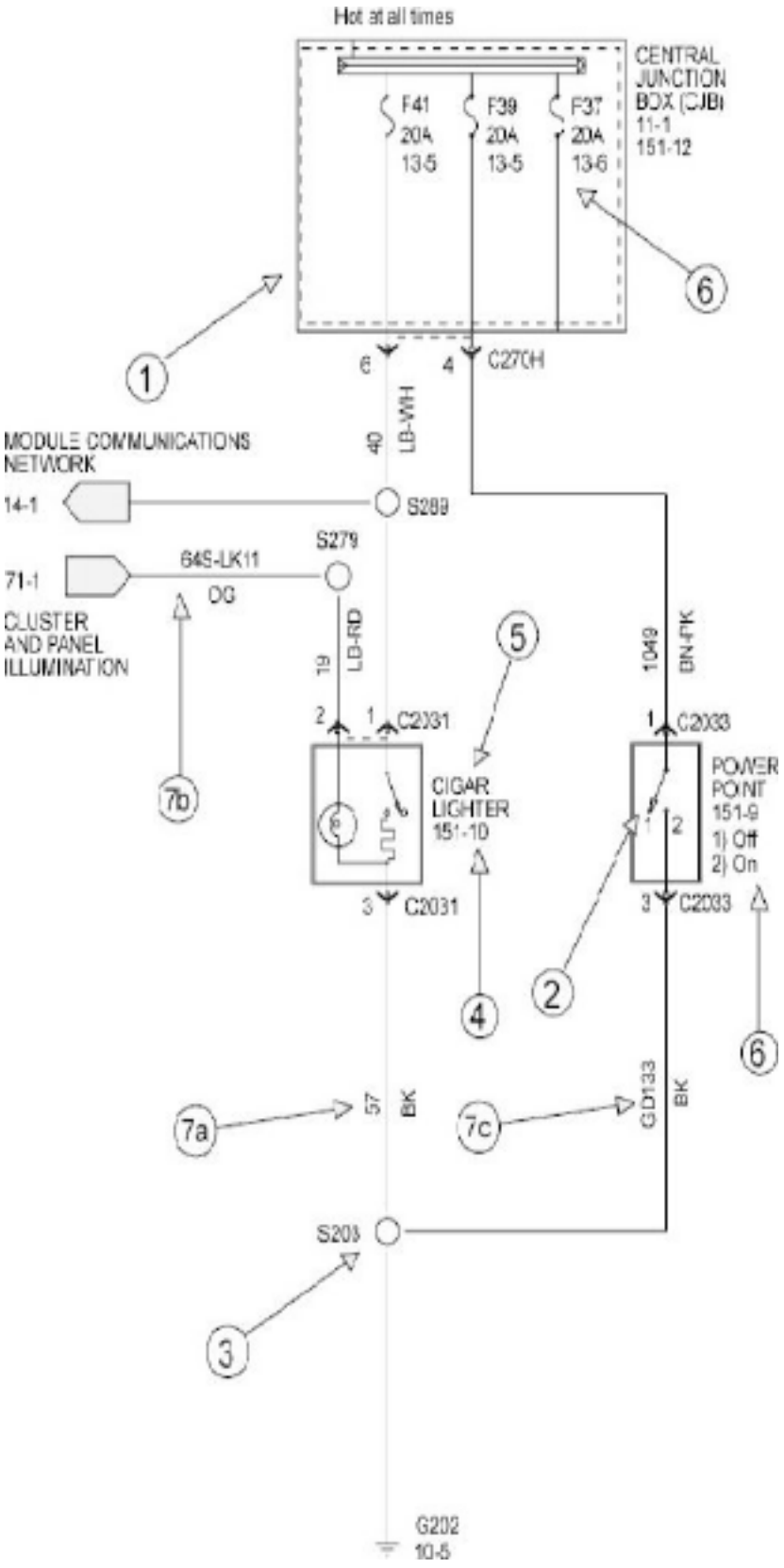
To install, tighten to 9 Nm (80 lb-in).

9. CAUTION: To avoid possible damage to the mounting arm and pivot shaft retainer clip, be sure the clip is fully seated before installing

on the motor crank pin.

NOTE: Install the LH mounting arm and pivot shaft to the motor before installing the RH mounting arm and pivot shaft.

To install, reverse the removal procedure.


Hot at all times
CENTRAL JUNCTION BOX (CJB)
11-1
151-12
F41
20A
13-5
F39
20A
13-5
F37
20A
13-6
6
1
6
4
C270H
40
LB-WH
MODULE COMMUNICATIONS NETWORK
14-1
S289
S279
64S-LK11
71-1
DG
CLUSTER AND PANEL ILLUMINATION
19
LB-RD
5
1049
BN-PK
2
1
C2031
1
C2033
7b
CIGAR LIGHTER
151-10
POWER POINT
151-9
1) Off
2) On
3
C2031
3
C2033
4
2
6
7a
57
BK
7c
GD133
BK
S203
3
G202
10-5

Wiper Relay: Diagram Information and Instructions

Introduction

Note

All wiring connections between components are shown exactly as they exist in the vehicles. It is important to realize, however, that no attempt has been made on the diagrams to represent components and wiring as they physically appear on the vehicle. For example, a 4-foot length of wire is treated no differency in a diagram from one that is only a few inches long. Furthermore, to aid in understanding electrical (electronic) operation, wiring inside complicated components has been simplified.

Complete Circuit Operation

Each circuit is shown completely and independently in one set. Other components that are connected to the circuits may not be shown unless they influence the circuit operation.

Current Flow (1)

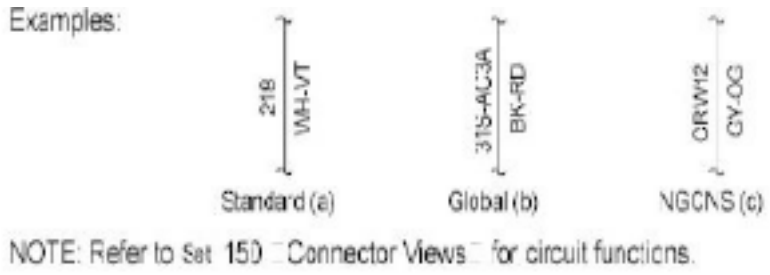
Each set normally starts with the component that powers the circuit, such as a fuse or the ignition switch. Current flow is shown from the power source at the top of the diagram to ground at the bottom of the diagram. A full representation of the power supply of a fuse or the power distribution from a fuse to various components is given in the Power and Ground Distribution Diagrams. Full representation of the ground connections are shown in the Power and Ground Distribution Diagrams.

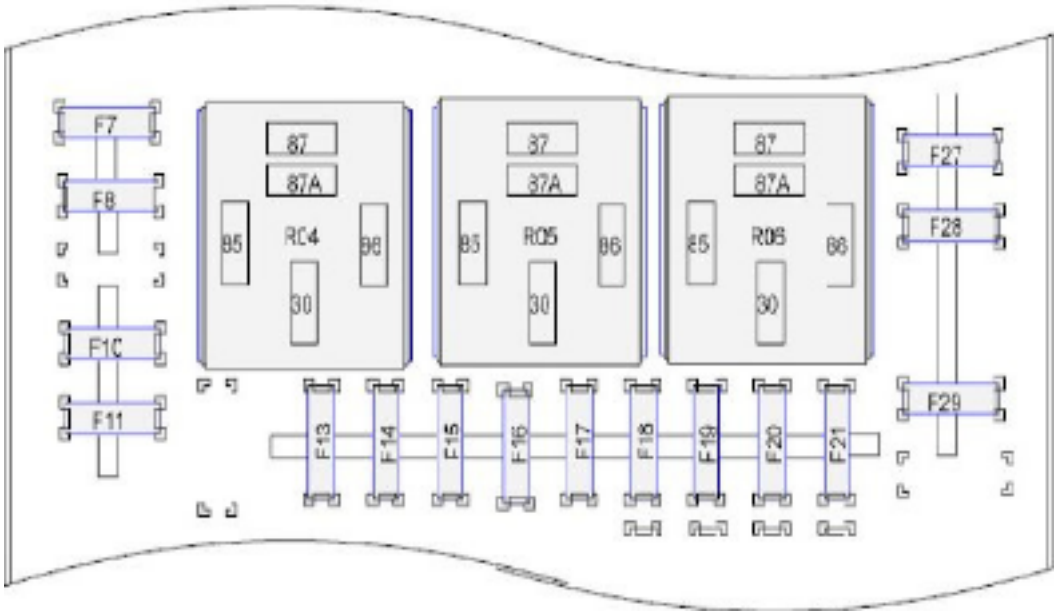
Switch Positions (2)

Within a diagram, all switches, sensors and relays are shown "at rest" (ignition switch OFF).

Splices (3)

Splices directly connecting to the power distribution are best represented on the power distribution diagram in the Power and Ground Distribution Diagrams. Splices connected to grounds can be seen completely in the Power and Ground Distribution Diagrams. For all other splices, a reference is given to each off diagram where that particular splice can be best viewed.





Component Referencing (4)

Components on a diagram have a reference to a component location view or the diagram where it is shown completely. The reference is located to the right of each component.

Component Names (5)

Component names are placed on the right hand side of each component when possible. Descriptions of the internals of the component are also included when available. The diagram where the component appears in full is listed in the Index. The base part number for a component is listed in parentheses next to or under a component.

Internal Name and Function Identification Numbers (6)

Some components on each diagram have internal symbols with an identification number located within it. You can identify the internal symbol or function by finding the corresponding number under the component name.

Circuit Numbering and Wire Identification (7)

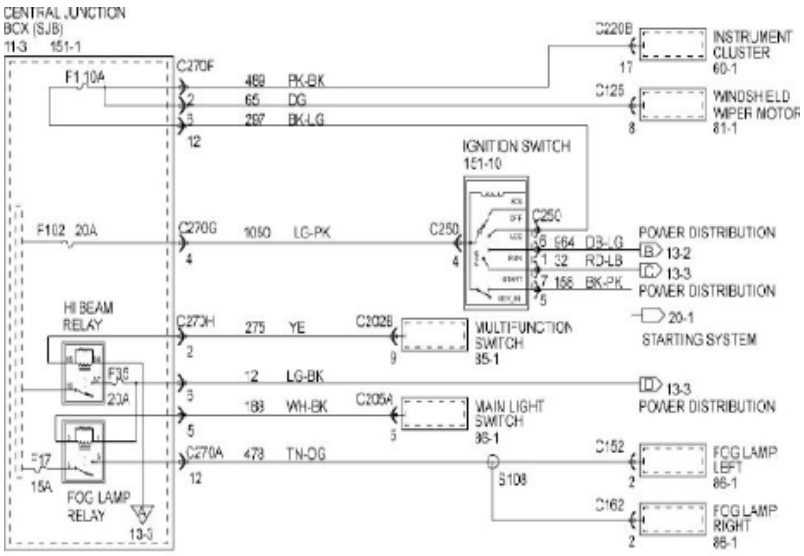
Ford Motor Company uses three different circuit numbering conventions: Standard Circuit Numbering System, Global Circuit Numbering System, and New Global Circuit Numbering System (NGCNS). With each, the circuit number (which identifies a specific circuit function) is followed by the wire color.

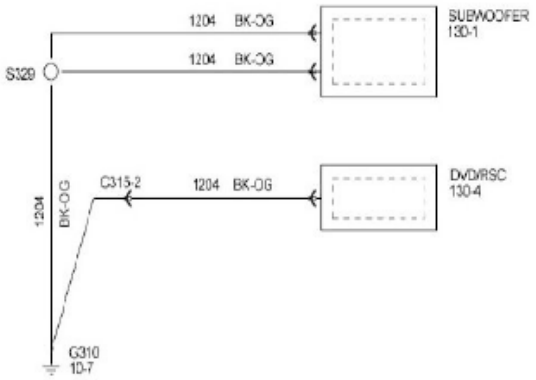
The wire identification consists of a basic color and possibly a stripe, and is determined directly from the wire's circuit number. In the diagrams, the wire colors are indicated next to the wires. The colors are abbreviated using the international norm IEC 757. The abbreviations are listed in set 4 "Symbols".

Fuse and Relay Information

Fuse/Locations and Relay/Locations contains a view of the fuse/relay box, in which all fuses and relays are identified, numbered and named. Fuse and relay numbering and naming follow the indication of the fuse panel cover. In addition, for all removable relays, pin positions are added to illustrate proper orientation.

Power Distribution





C904 (GY)

14290

REAR COMB/MAP LAMP (13M614)

Pin	Circuit	Gauge	Circuit Function	Qualifier
1	53 (BK-LB)	20	Courtesy lamp switch to courtesy lamp	
2	57 (BK)	20	Ground circuit	
3	705 (LG-OG)	20	Battery saver lamp feed	

Power and Ground Distribution Diagrams shows the current feed circuits. The current path is shown from the battery to the ignition switch and to all fuses. It also shows the circuits protected by each fuse. The circuit is traced from the fuse to the component. All details (wires, splices, connectors) between the fuse and the first component are shown.

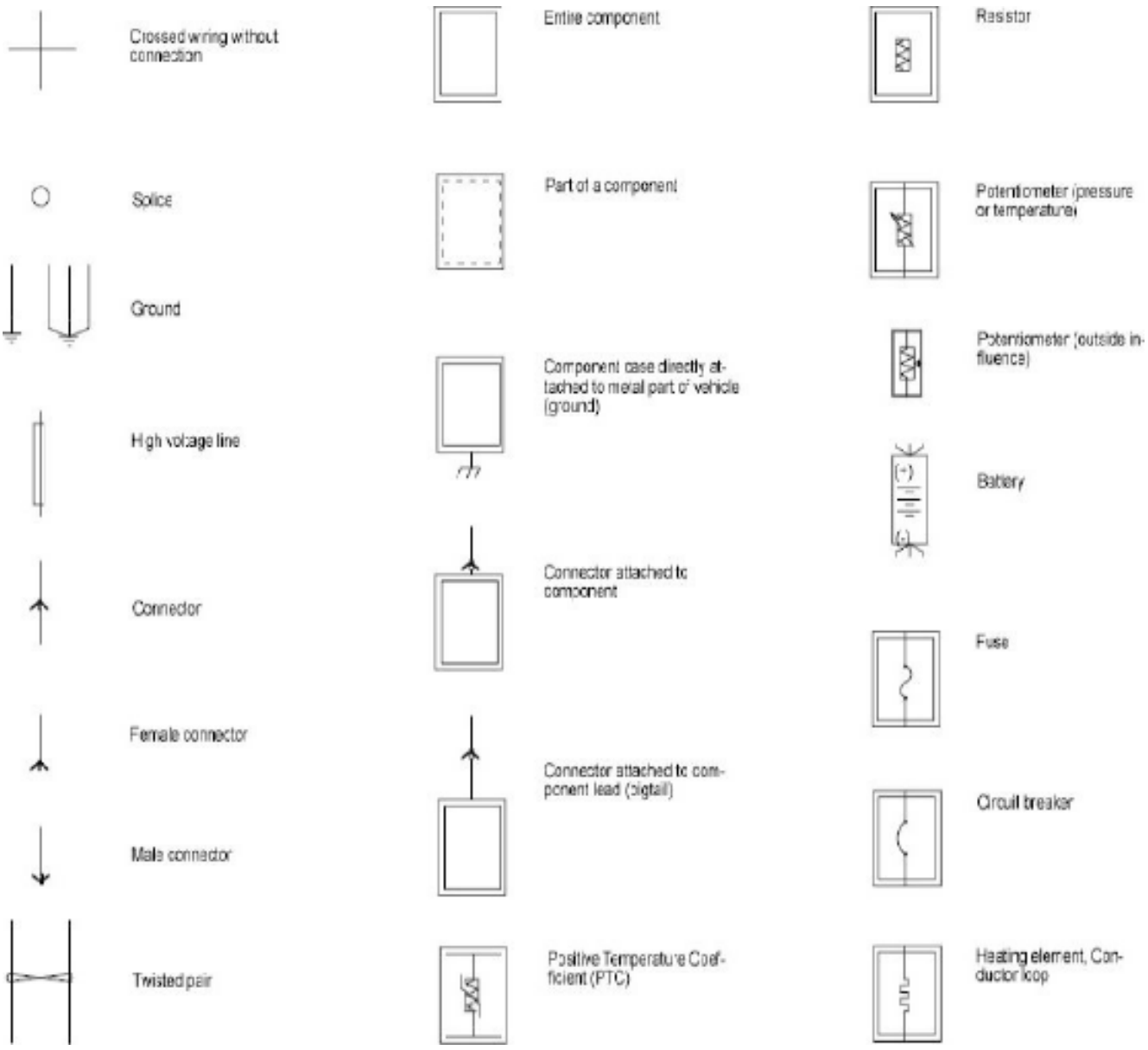
Ground Distribution

Power and Ground Distribution Diagrams contains the diagram that shows the complete details for each ground connection or main ground splice. This is useful in diagnosing a problem affecting several components at once (poor ground connection or ground splice). All details (wires, splices, connectors) between the ground point and the component are shown. These ground connection details are shown here in order to keep the individual set diagrams as uncluttered as possible.

Component and Connector Information

C904

Connector Views show the views of the pins and/or cavities of all connectors. The pin and cavity sides are shown separately as if the connector were disconnected. The color of the connector housing is indicated next to the connector number when available. The harness causal number is located above the connector view and below the connector number. The circuit function charts are located below each connector. The wiring harness designations are listed in Component Location Charts.



Component Location Views show the components and their connecting wires as they can be found on the vehicle.

Locations information that can be found at the vehicle level will help the user find where the various items depicted on the diagram can physically be found on the vehicle. A brief written description of the location is given, along with a reference to the component location views.

WARNINGS

- Always wear safety glasses for eye protection.

- Use safety stands whenever a procedure requires being under a vehicle.

- Be sure that the IGNITION SWITCH is always in the OFF position, unless otherwise required by the procedure.

- Set the parking brake when working on any vehicle. An automatic transmission should be in PARK. A manual transmission should be in NEUTRAL.

- Operate the engine only in a well-ventilated area to avoid danger of carbon monoxide.

- Keep away from moving parts, especially the fan and belts, when the engine is running.

- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.

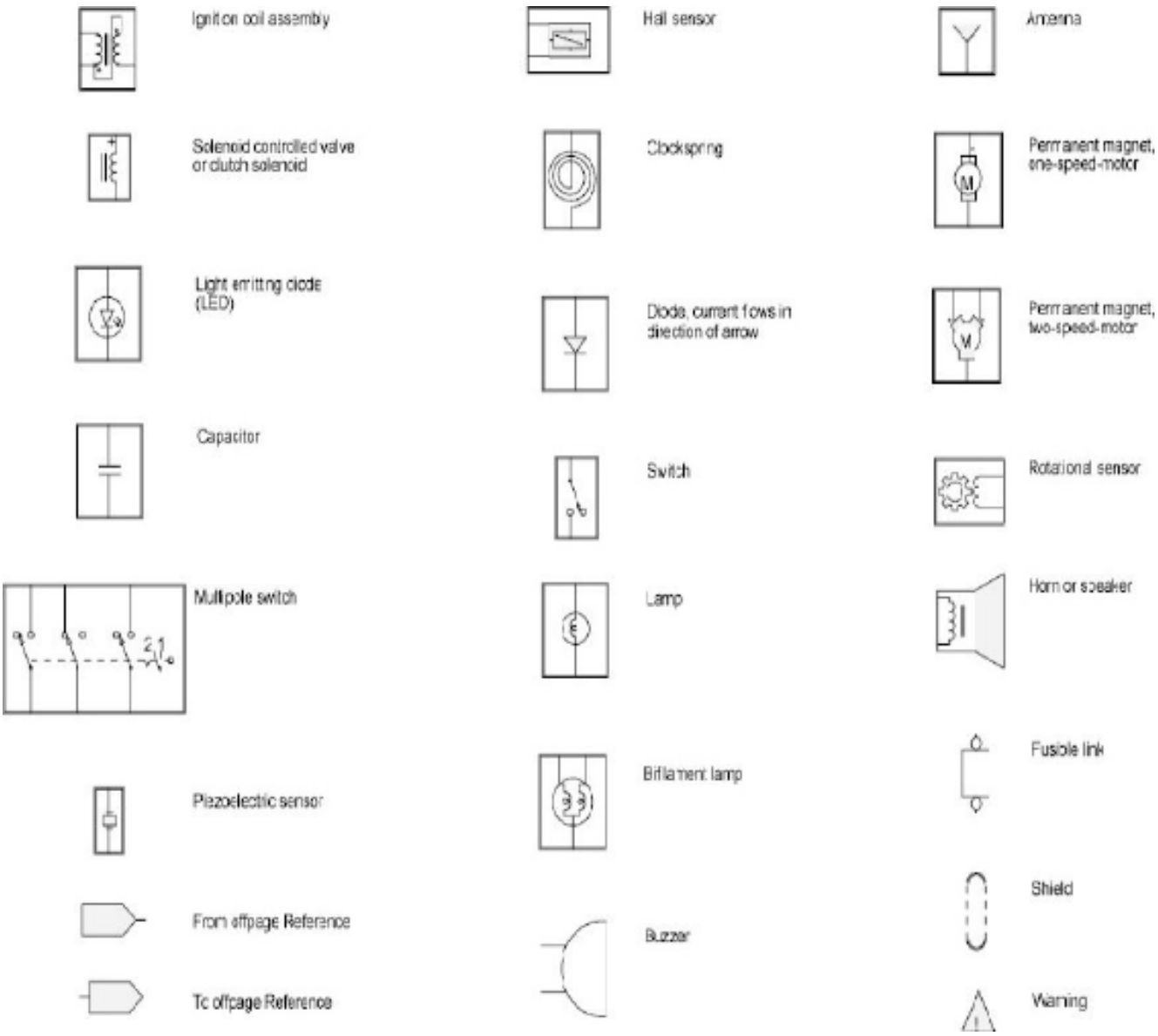
- Do not allow flame or sparks near the battery. Gases are always present in and around the battery set. An explosion could occur.

- Do not smoke when working on a vehicle.

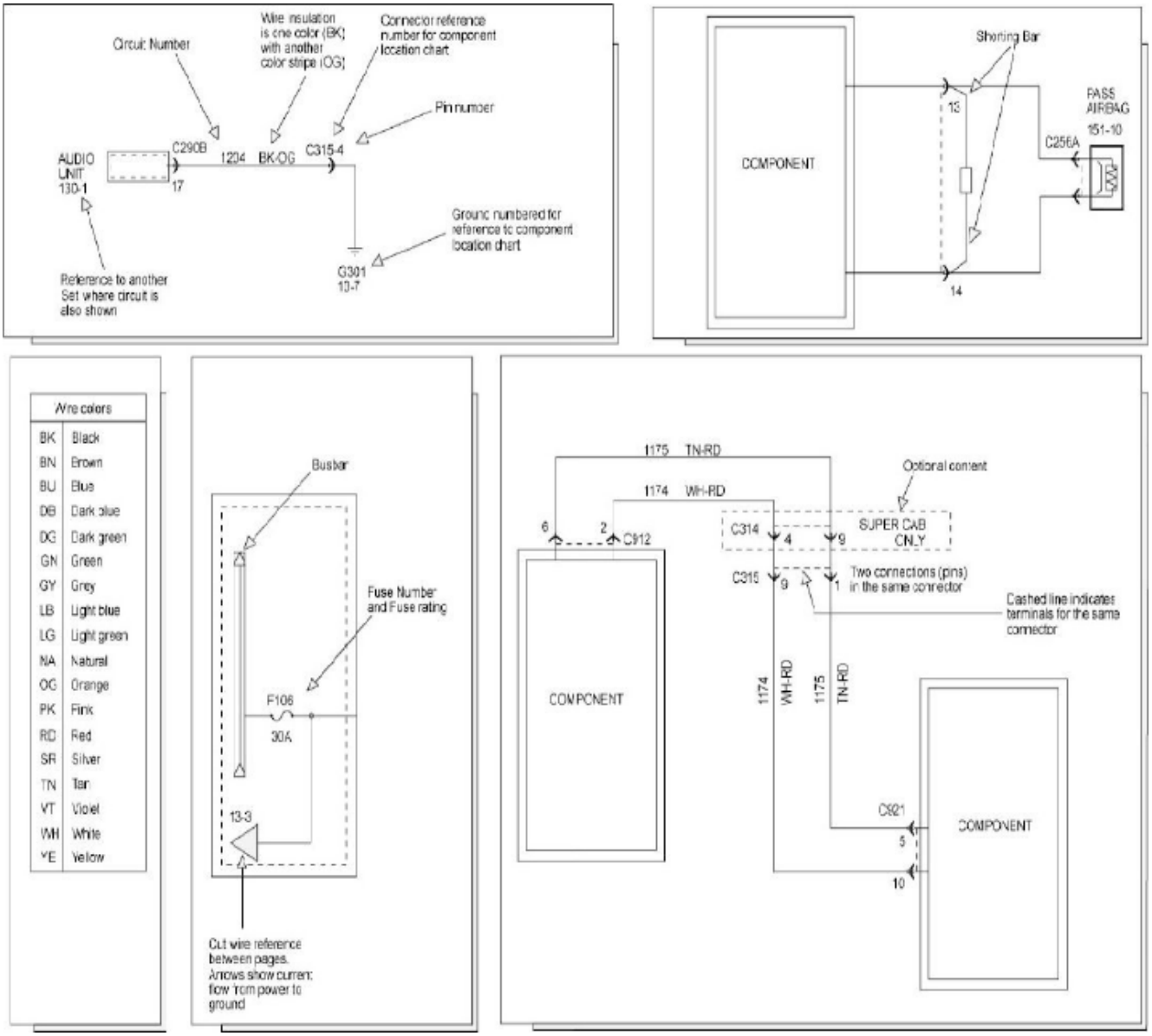
- To avoid injury, always remove rings, watches, loose hanging jewelry and avoid wearing lose clothing

Symbols

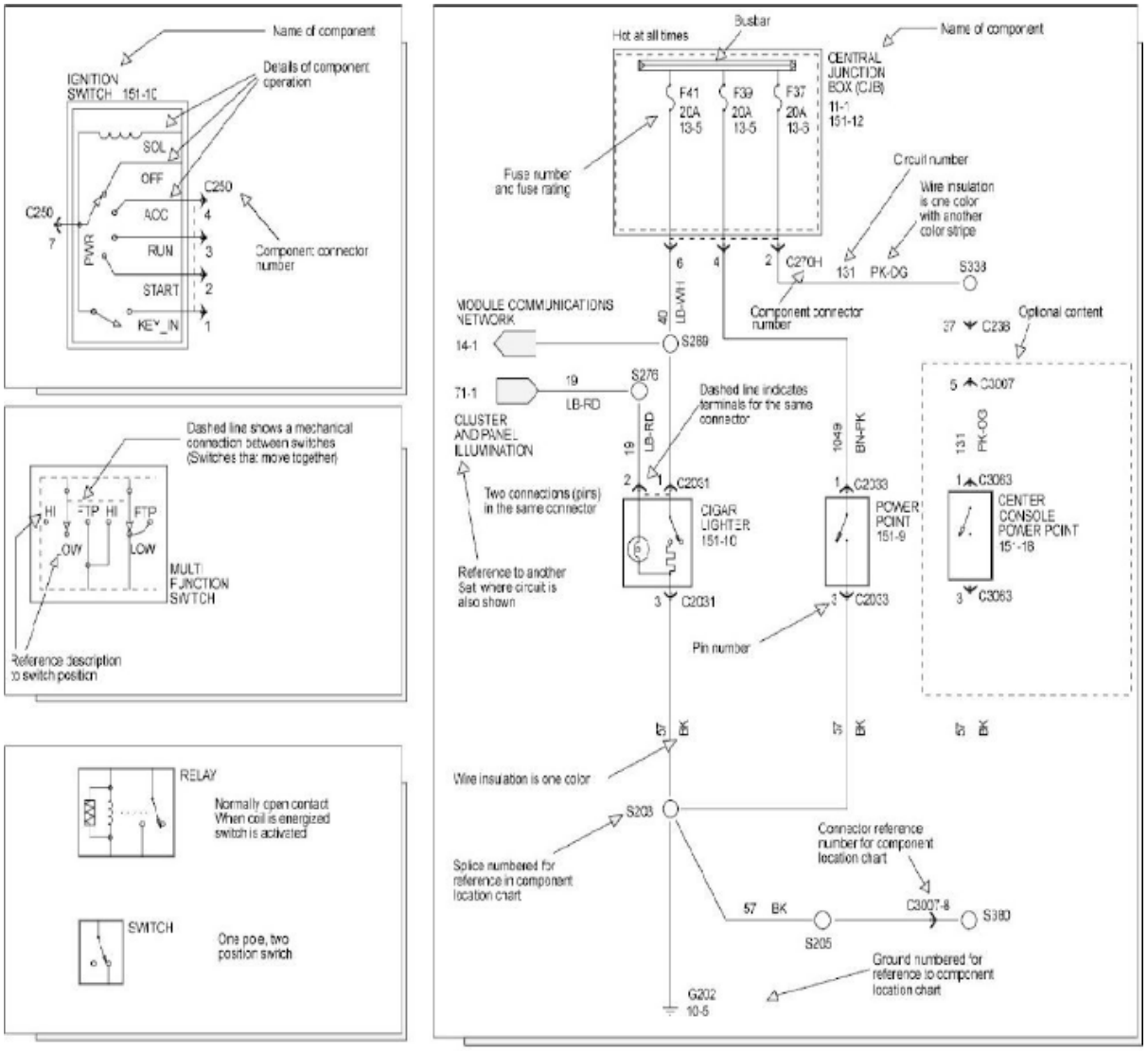
Symbols (Part 1)



Symbols (Part 2)



Symbols (Part 3)

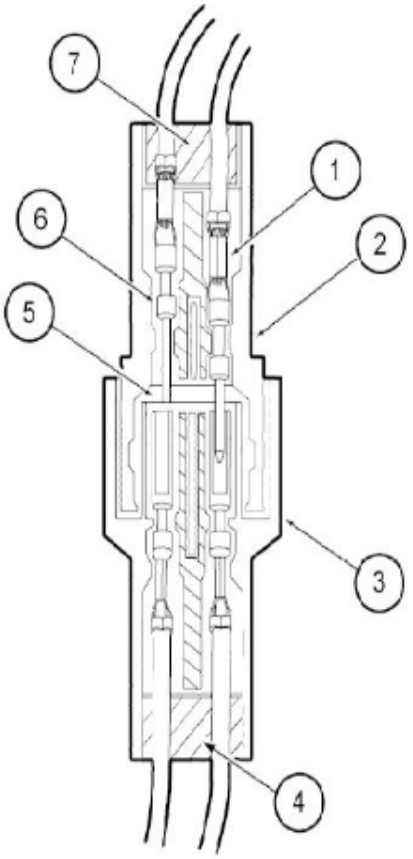


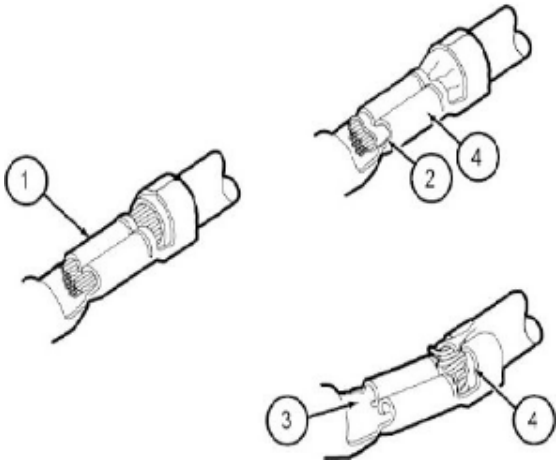
Each connector, ground, and splice number used in this publication references an area of the vehicle. The chart below describes the different areas of the vehicle, and lists the numbers associated with each.

NUMBER	LOCATION
100-199 1000-1999	Engine compartment, powertrain (including transmission and front wheel drive axle/differential)
200-299 2000-2999	Instrument panel and console, steering wheel assembly
300-399 3000-3999	From instrument panel to rear seat, up to, and including, door trim panel
400-499 4000-4999	Behind rear seats to rear bumper, truck bed
500-599	Driver door
600-699	Passenger door, front
700-799	Rear door, left
800-899	Rear door, right
900-999	Above door trim panel and headliner

Symbols (Part 4)

Symbols (Part 5)


7
1
6
2
5
3
4


1
2
4
3
4

Wiper Relay: Diagnostic Aids

Troubleshooting wiring harness and connector hidden concerns

The illustrations are known examples of wiring harness, splices and connectors that will create intermittent electrical concerns. The concerns are hidden and can only be discovered by a physical evaluation as shown in each illustration.

NOTE: Several components, such as the PCM, utilize gold plated terminals in their connections to the wiring harness. If those terminals need to be replaced, they must be replaced with a gold plated terminal.

Terminal not properly seated

1 = Locked terminal

2 = Male half

3 = Female half

4 = Seal

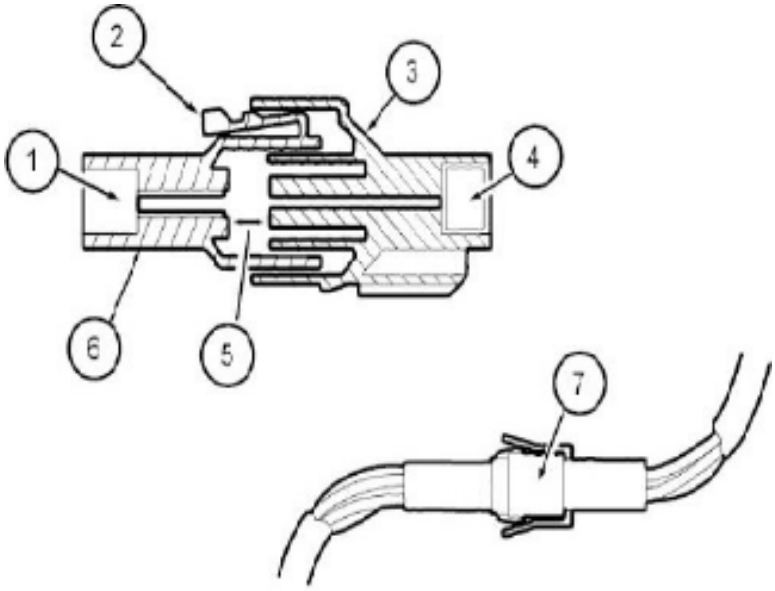
5 = Intermittent contact

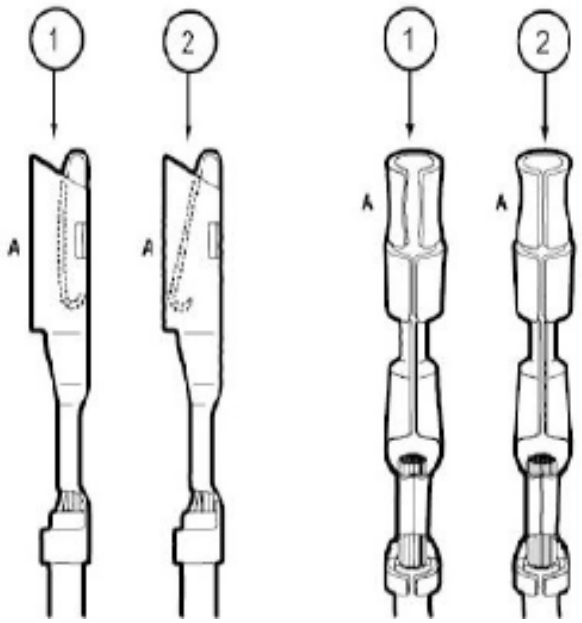
6 = Unlocked terminal (Hidden by wire seal)

7 = Seal

Check for unlocked terminal by pulling each wire at the end of the connector.

Defective insulation stripping


2
3
1
4
6
5
7


1
2
A
A
1
2
A
A

1 = Proper crimp

2 = Insulation not removed

3 = Wire strands missing

4 = Intermittent signals through pierced insulation

Partially mated connectors

1 = Seal

2 = Displaced tab

3 = Female half

4 = Seal

5 = Intermittent contact

6 = Male half

7 = Intermittent contact

Lock may be displaced into an unlocked position; pull on the connector to verify the lock.

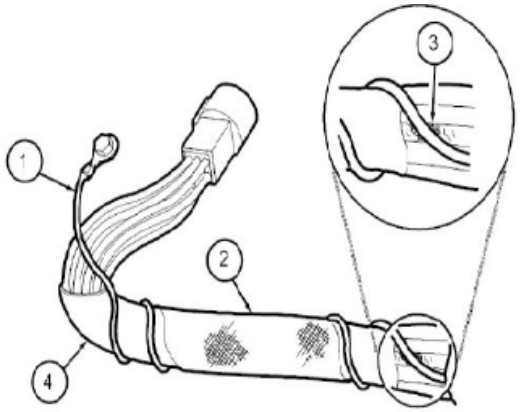
Deformed (enlarged) female terminals

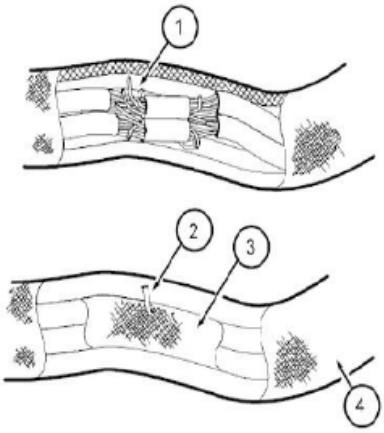
1 = Enlarged

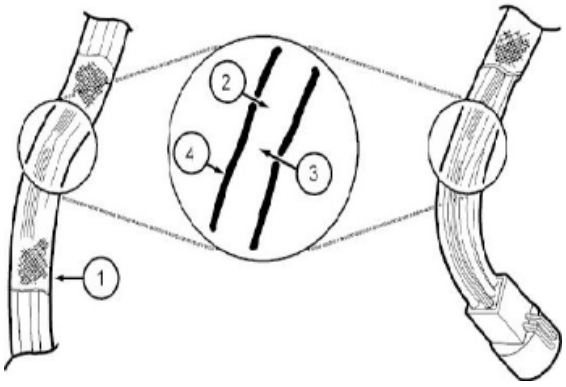
2 = Normal

Any probe entering the terminal may enlarge the contact spring opening creating an intermittent signal.

Insert the correct mating terminal (Location A) from the service kit and feel for a loose fit.


3
1
2
4


1
2
3
4


2
4
3
1

Electrical short inside the harness

1 = Solder coated wire to ground

2 = Harness protective tape

3 = Intermittent short

Solder coated wire pierced through the insulation of another circuit

4 = Grounding foil

Electrical short within the harness

Splice tape removed 1

= Intermittent short

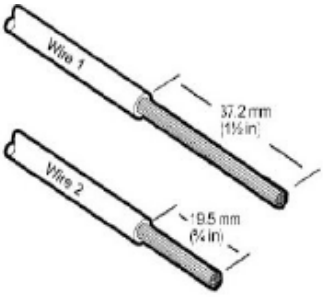
Splice covered 2

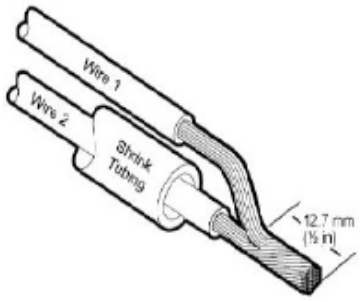
= Wire strand

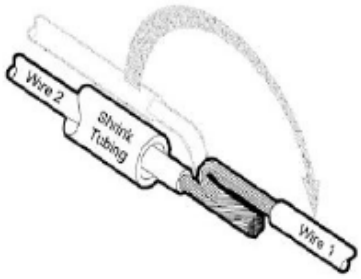
3 = Splice tape

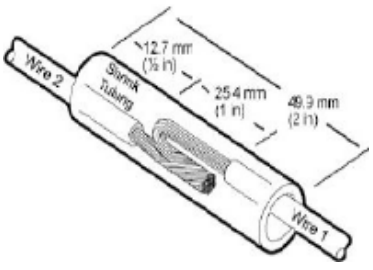
4 = Harness tape

Broken wire strands in harness


Wire 1
37.2 mm
(1½ in)
Wire 2
19.5 mm
(¾ in)


Wire 1
Wire 2
Shrink
Tubing
12.7 mm
(½ in)


Wire 2
Shrink
Tubing
Wire 1


12.7 mm
(½ in)
Wire 2
Shrink
Tubing
25.4 mm
(1 in)
49.3 mm
(2 in)
Wire 1

1 = Wiring harness tape

2 = Wiring strand

3 = Broken strands intermittent signal

4 = Circuit insulation

Remove the tape and flex/feel each circuit for a reduction in diameter at break.

Recommended splicing method - Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect battery ground cable. 2. Strip wires to appropriate length.

3. Install heat shrink tubing. 4. Twist wires together. 5. Solder wires together.

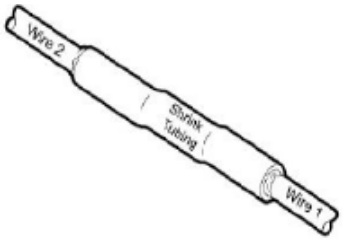
NOTE: -

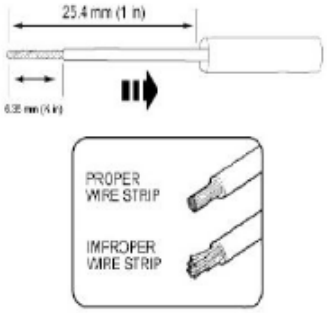
Use rosin core mildly-activated (RMA) solder. Do not use acid core solder.

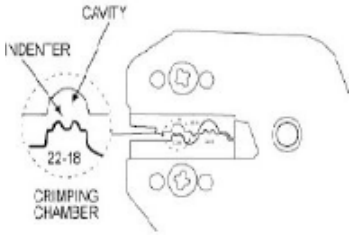
- Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seat wire splice.

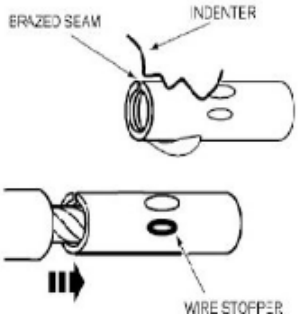
6. Bend wire 1 back in a straight line.

NOTE: Wait for solder to cool before moving wires.


Wire 2
Shrink Tubing
Wire 1


25.4 mm (1 in)
6.35 mm (¼ in)
PROPER WIRE STRIP
IMPROPER WIRE STRIP


CAVITY
INDENTER
22-18
CRIMPING CHAMBER


BRAZED SEAM
INDENTER
WIRE STOPPER

7. Evenly position heat shrink tubing over wire repair.

NOTE: Overlap tubing on both wires.

8. Use shielded heat gun to heat the repaired area until adhesive flows Out of both ends of heat shrink tubing. 9. Reconnect battery ground cable.

Recommended splicing method - Crimp (For 10-22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect battery ground cable. 2. Strip 6.35mm (1/4 in) of insulation from each wire end, taking care not to nick or cut wire strands. 3. Install heat shrink tubing.

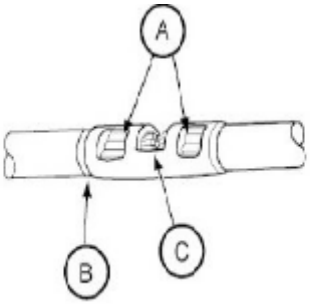
NOTE: Use heat shrinkable tubes marked with ES-1 (16-22 GA) or ES-2 (10-18 GA) to seal wire splice.

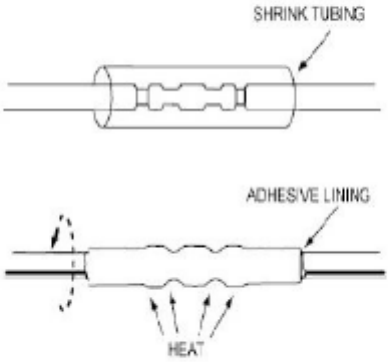
4. Select appropriate wire splice for the wires to be spliced. 5. Identify the appropriate crimping chamber on the Rotunda 164-R5901 Pro-Crimper by matching the wire size on the dies with the wire size

stamped on the butt splice.

NOTE: Rotunda 164-R5901 Pro-Crimper is the only tool that can be used with these splices.

6. Center one end of the wire splice in the appropriate crimping chamber. 7. If visible, be sure to place the brazed seam toward the indenter. 8. Insert stripped wire into the barrel.





This chart is to be used when pigtails or terminals are of different wire gauge than the vehicle harness.

		Wire Gauge Size							
		10	12	14	16	18	20	22	24
Butt Splice as Stamped	22-18	Not Recommended	* 1/4□ strip, cut 9 strands	* 1/4□ strip, cut 2 strands	1/4□ strip, no fold	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip, fold 2x dia.	1□ strip, fold 3x dia.
	16-14	* 1/4□ strip, cut 7 strands	1/4□ strip, no fold	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip fold 2x dia	1□ strip, fold 3x dia.	1 1/4□ strip, fold 4x dia.	Not Recommended
	12-10	1/4□ strip, no fold	1/4□ strip, no fold	5/8□ strip, fold 2x dia.	1□ strip fold 3x cia.	1 1/4□ strip, fold 4x dia	Not Recommended	Not Recommended	Not Recommended

* Pigtail only

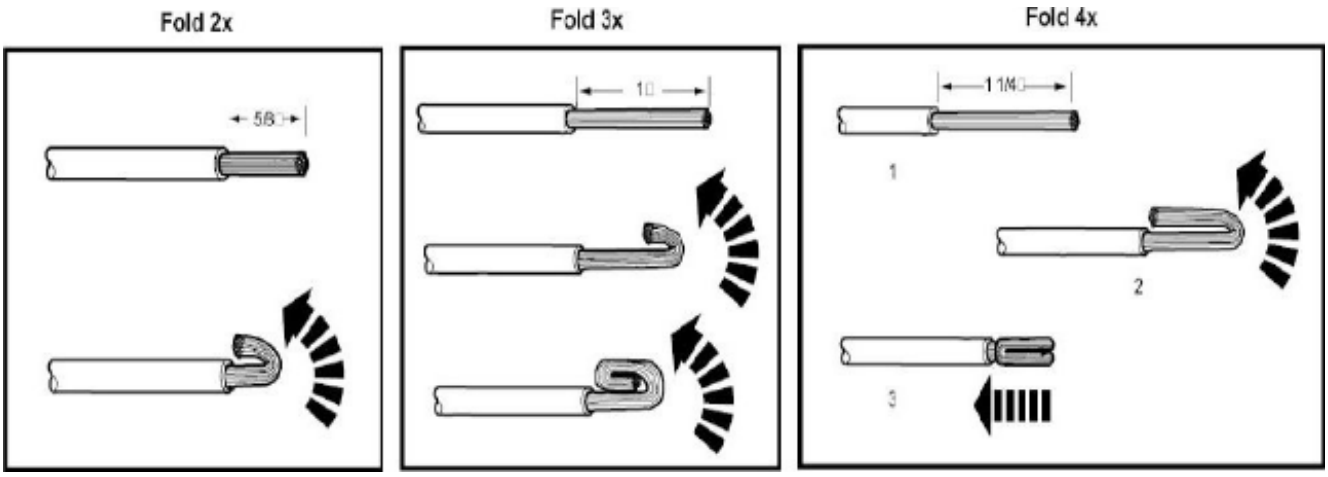
9. Holding the wire in place, barrel squeeze tool handles appropriate ratchet releases.

10. Repeating steps 5-7, crimp the other half of the splice.

11. Check for acceptable crimp.

a. Crimp should be centered on each end of the butt splice b. Wire insulation does not enter butt splice. c. Wire is visible through inspection hole of splices.

12. Evenly position supplied heat shrink tubing over wire repair. 13. Use shielded heat gun to heat the repaired area until adhesive flows out of both ends of the heat shrink tubing. 14. Reconnect battery ground cable.



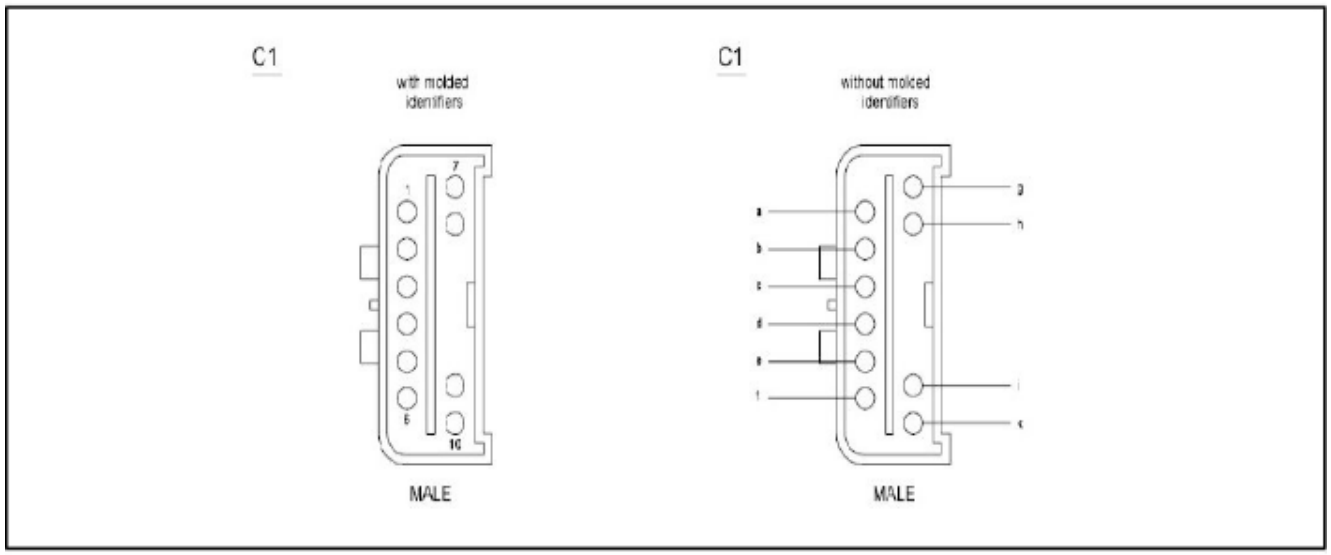
The given chart is to be used when pigtails or terminals are different wire gauge than the vehicle harness.

Introduction

Component testing procedures are provided to determine whether a component is good or bad.

Testing information for each component includes a schematic, a view of the terminal locations and step-by-step test procedures. Terminal locations are identified by numbers or letters that may be on the component or next to it.

Terminals



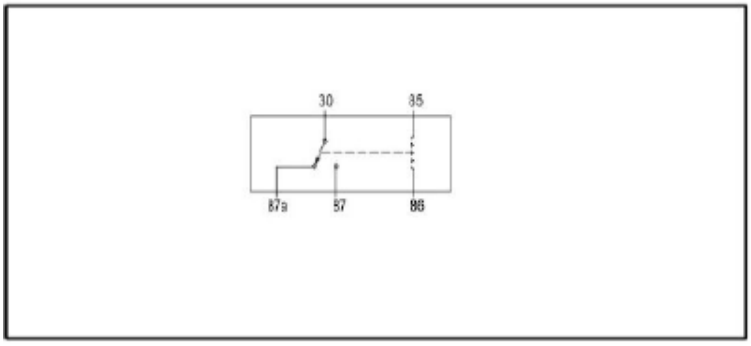
The component connector MUST BE REMOVED before testing. To test a single circuit within the component, select that circuit under the column "Circuit to test". If you wish to test the complete component, perform all tests.

Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

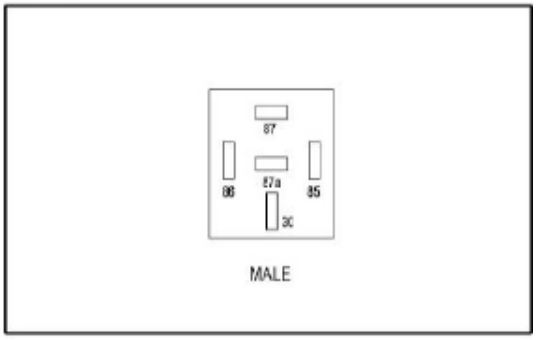
Wiper Relay: Testing and Inspection Mini ISO Relay

Relay □ Mini ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 □ 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.

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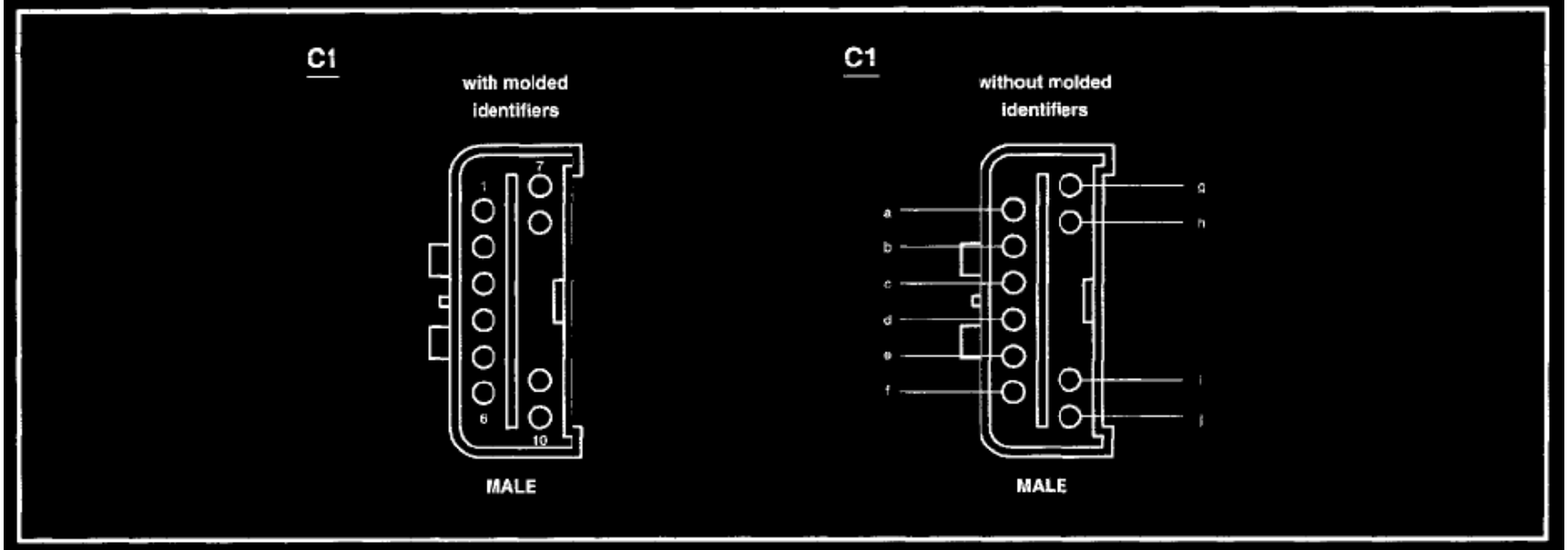

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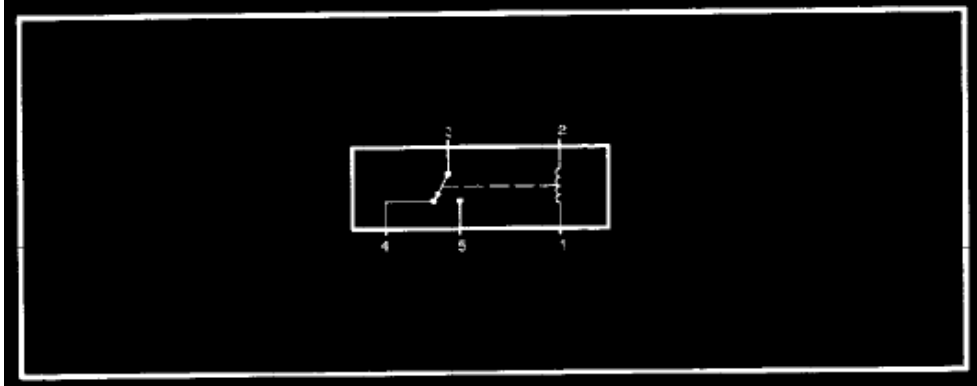
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

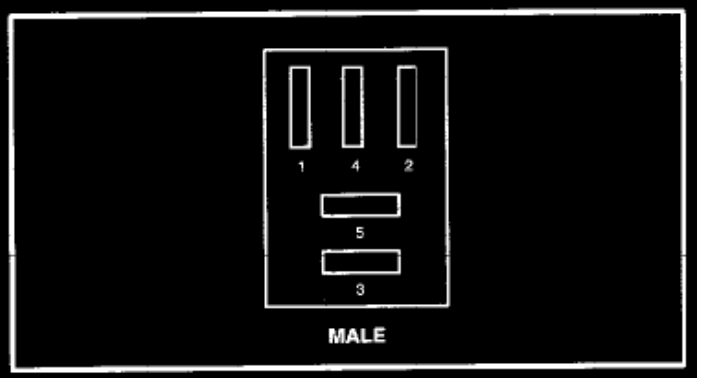
Wiper Relay: Testing and Inspection Micro ISO Relay

Relay – Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63–102Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil – Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

Component testing procedure (voltage applied)

Disconnect the ohmmeter; connect pins 2 and 3 to 12V DC power and pin 1 to ground. Measure voltage between pin 5 and pin 1. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 2 and measure voltage between pin 4 and pin 1. If the voltage is 12V, the relay is okay. If not, replace the relay.

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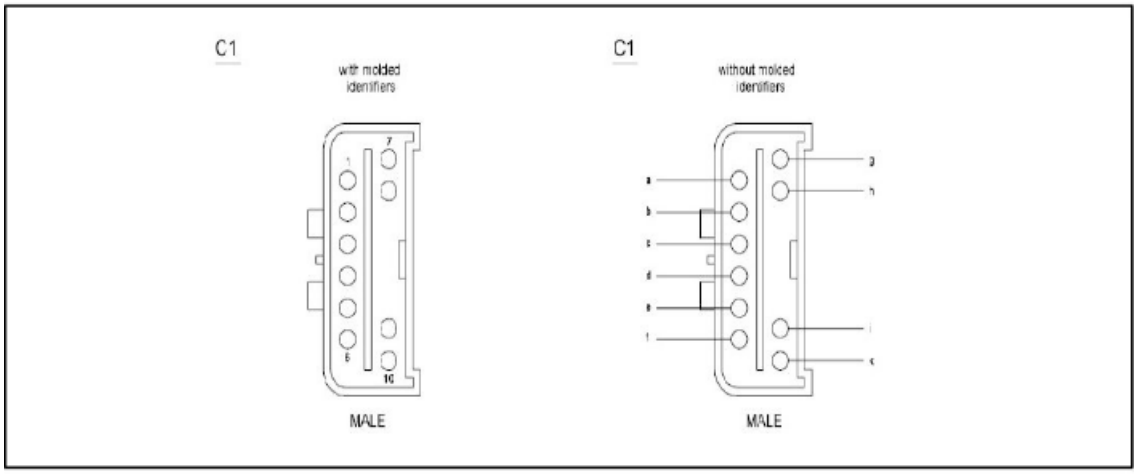

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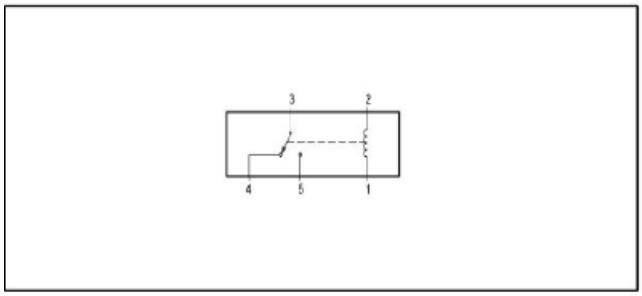
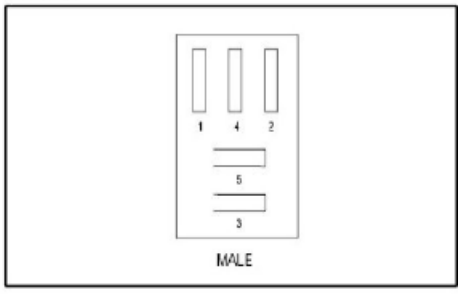
Relay □ Micro ISO

Schematic



Terminals



Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	1 and 2	63□102 Ω
Contact	3 and 4	Closed circuit
	3 and 5	Open circuit
Coil □ Contact	1 and 3	Open circuit
	1 and 4	Open circuit
	1 and 5	Open circuit

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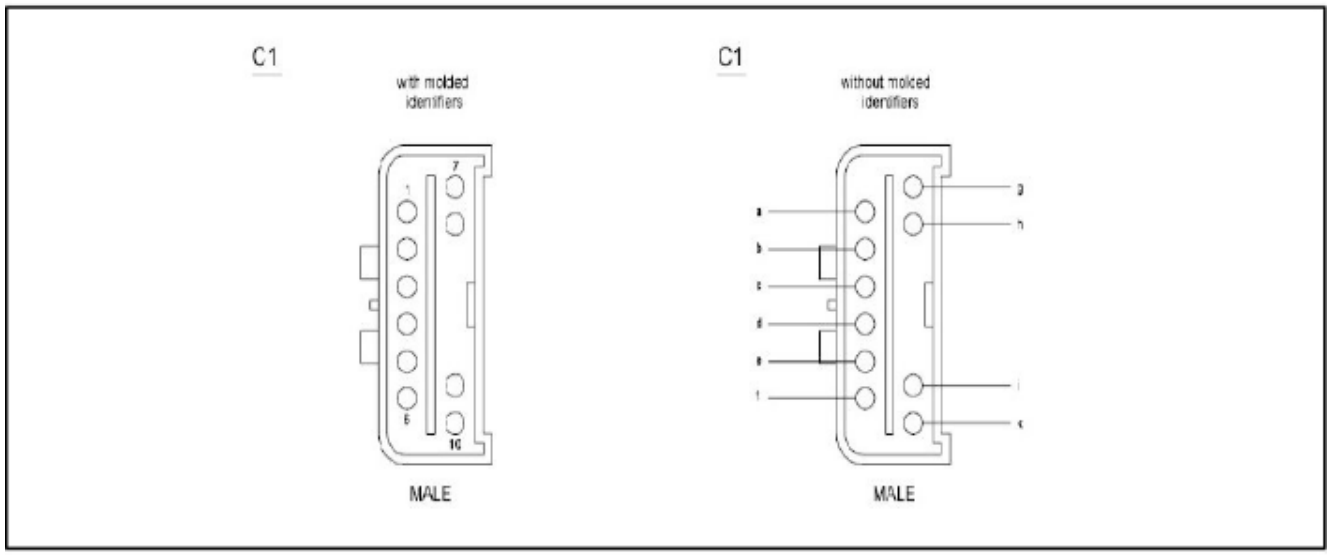

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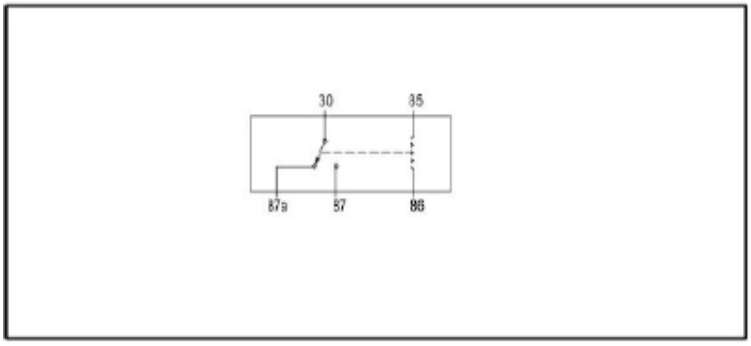
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

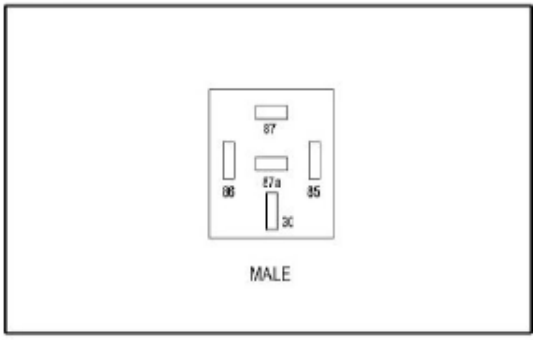
Wiper Relay: Testing and Inspection Wiper Run/Park Relay

Relay □ Mini ISO

Schematic



Terminals

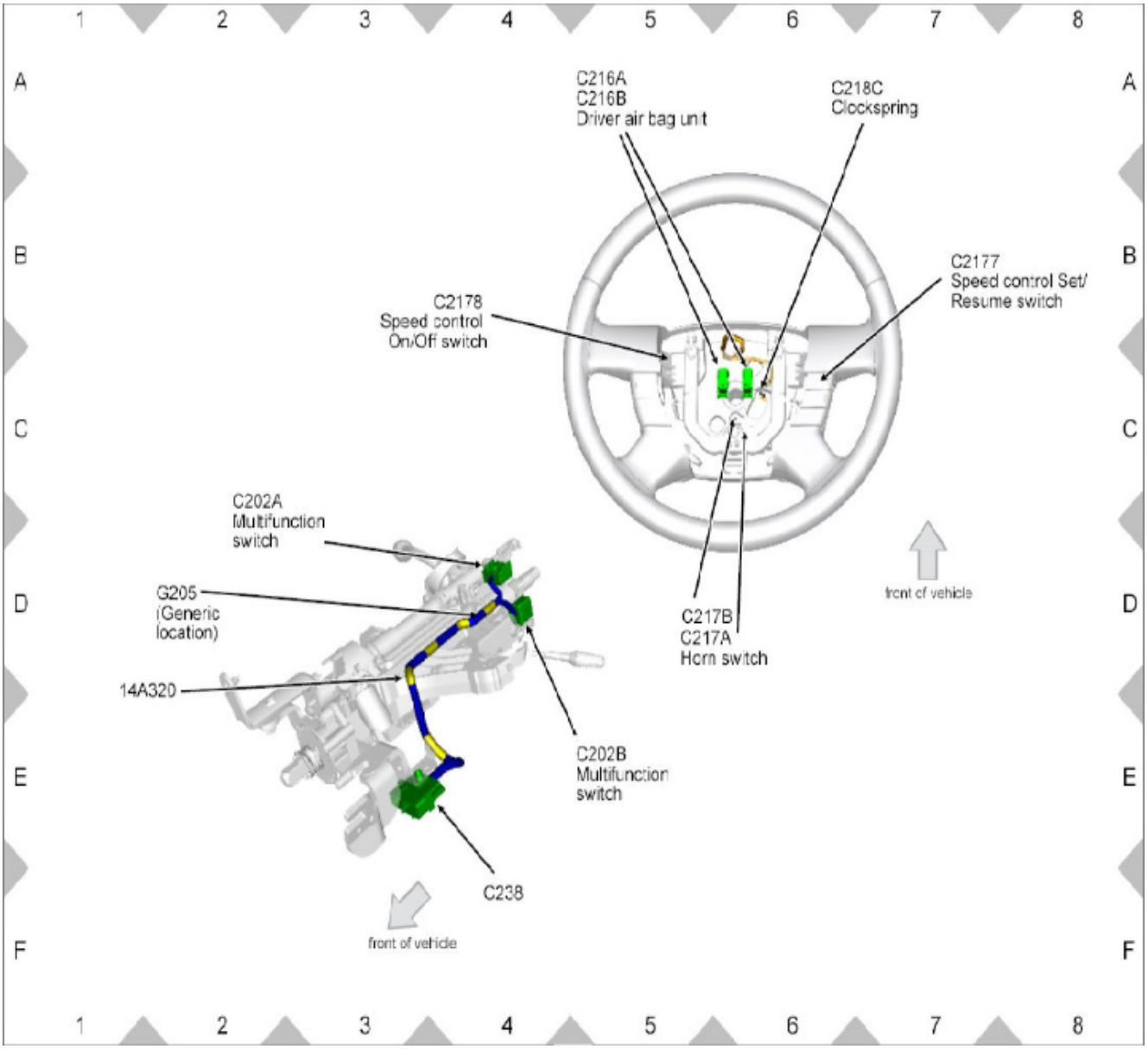


Component testing procedure (no voltage applied)

Circuit to test	Connect ohmmeter to terminals	A good relay will indicate
Coil	85 and 86	46 - 90 Ω
Contact	30 and 87a	Closed circuit
	30 and 87	Open circuit
Coil □ Contact	86 and 30	Open circuit
	86 and 87a	Open circuit
	86 and 87	Open circuit

Component testing procedure (voltage applied)

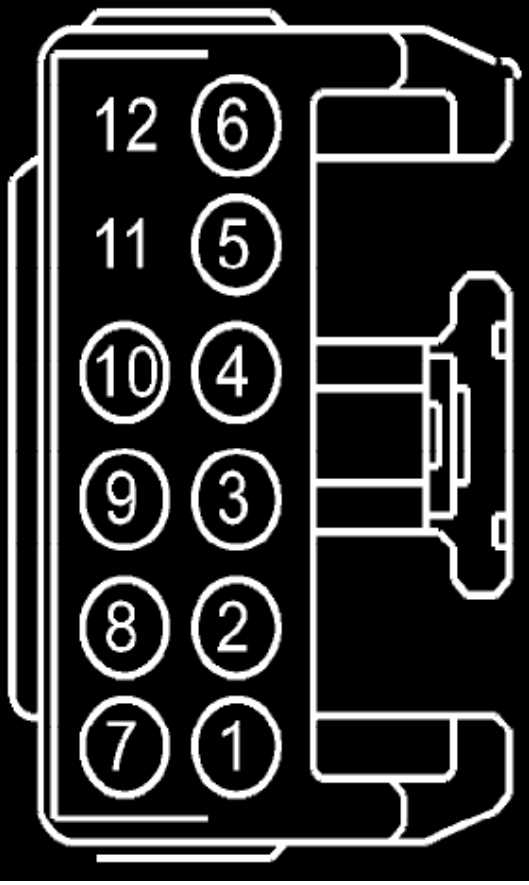
Disconnect the ohmmeter; connect pins 30 and 85 to 12V DC power and pin 86 to ground. Measure voltage between pin 87 and pin 86. If the voltage is 12V, continue with the test. If not, replace the relay. Disconnect power from pin 85 and measure voltage between pin 87a and pin 86. If the voltage is 12V, the relay is okay. If not, replace the relay.


C216A
C216B
Driver air bag unit
C218C
Clockspring
C2177
Speed control Set/
Resume switch
C2178
Speed control
On/Off switch
C202A
Multifunction
switch
G205
(Generic
location)
14A320
C217B
C217A
Horn switch
front of vehicle
C202B
Multifunction
switch
C238
front of vehicle

View 151-13

Connector: C202A

Description:	Harness:	Base Part #:
MULTIFUNCTION SWITCH	14A320	13K359



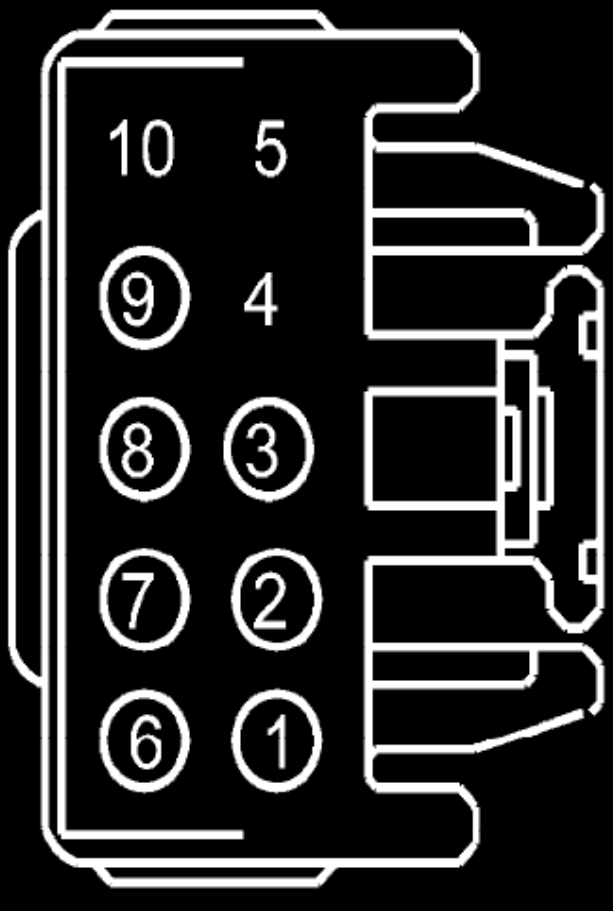
Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CRW17 (GN-VT)	20	SWITCH - FRONT WIPER INTERVAL (A)	
2	CRW19 (BU-OG)	20	SWITCH - FRONT WIPER INTERVAL (C)	
3	CRW18 (VT-WH)	20	SWITCH - FRONT WIPER INTERVAL (B)	
4	CRW15 (BN-WH)	20	CTRL MOD. - FRONT WIPER HIGH	
5	CRW07 (GY-BN)	20	SWITCH - FRONT WASHER	
6	CD161 (BK-YE)	18	GROUND SEAT BRACKET REAR LEFT	
7	CLS41 (GY-YE)	22	SWITCH - TURN RIGHT	
8	CLS36 (YE)	18	SWITCH - PARK LAMPS RIGHT	
9	CLS35 (VT)	18	SWITCH - PARK LAMPS LEFT	
10	CLS39 (VT-WH)	22	SWITCH - TURN LEFT	
11	*	*	not used	
12	*	*	not used	

Wiper Switch: Diagrams

C202A

Connector: C202B

Description:	Harness:	Base Part #:
MULTIFUNCTION SWITCH	14A320	13K359



Pin	Circuit	Gauge	Circuit Function	Qualifier
1	CCB08 (VT-WH)	16	SWITCH - BRAKE PEDAL POSITION (BPP) NORMAL OPEN	
2	CLS42 (VT-BN)	18	INDICATOR FLASHER RELAY - TURN SIGNAL SWITCHED POWER	
3	CLS32 (BN-YE)	18	INDICATOR FLASHER RELAY - HAZARD SWITCHED POWER	
4	*	*	not used	
5	*	*	not used	
6	SBP23 (WH-RD)	14	FUSE - 23 OR CIRCUIT BREAKER	
7	CLF27 (GN-BN)	14	SWITCH - FLASH TO PASS	
8	CLS24 (BN-WH)	16	CTRL MOD. - TURN LAMP RIGHT	
9	CLF18 (BU-WH)	16	SWITCH - BEAM LOW	
10	*	*	not used	

C202B

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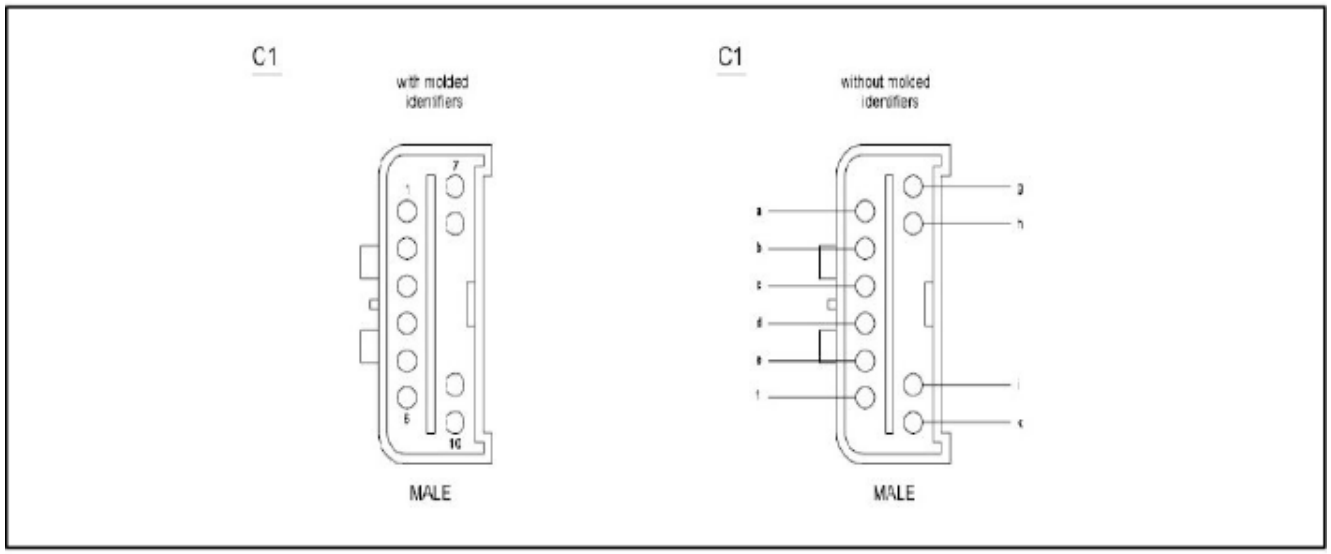
Terminals



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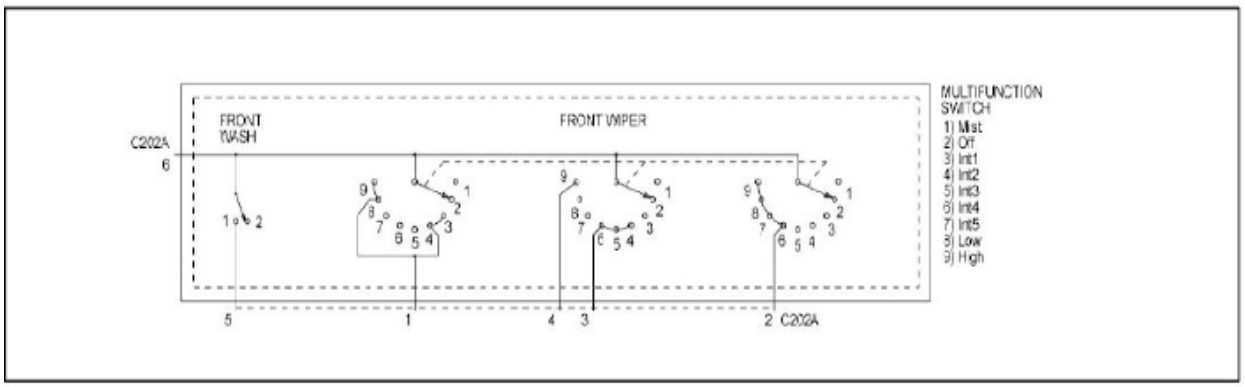
Connect the tester to the terminals shown in the second column and operate the component as shown in the third column.

Wiper Switch: Testing and Inspection

Multifunction Switch, Wiper/Washer Portion

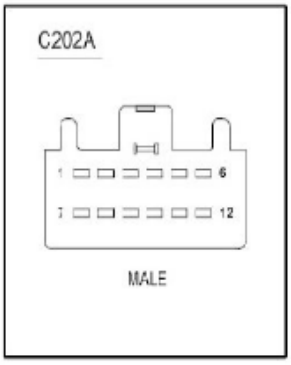
Schematic



Component testing procedure

Circuit to test	Connect self-powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
Front washer switch circuit	5 and 3	Front washer	Closed circuit
		Off	Open circuit
Front wiper switch circuit	1 and 5	Off	Open circuit
		Low	Closed circuit
		High	
	4 and 3	Off	Open circuit
		Low	
		High	Closed circuit
	2 and 3	Off	Open circuit
		Low	Closed circuit
		High	

Terminals

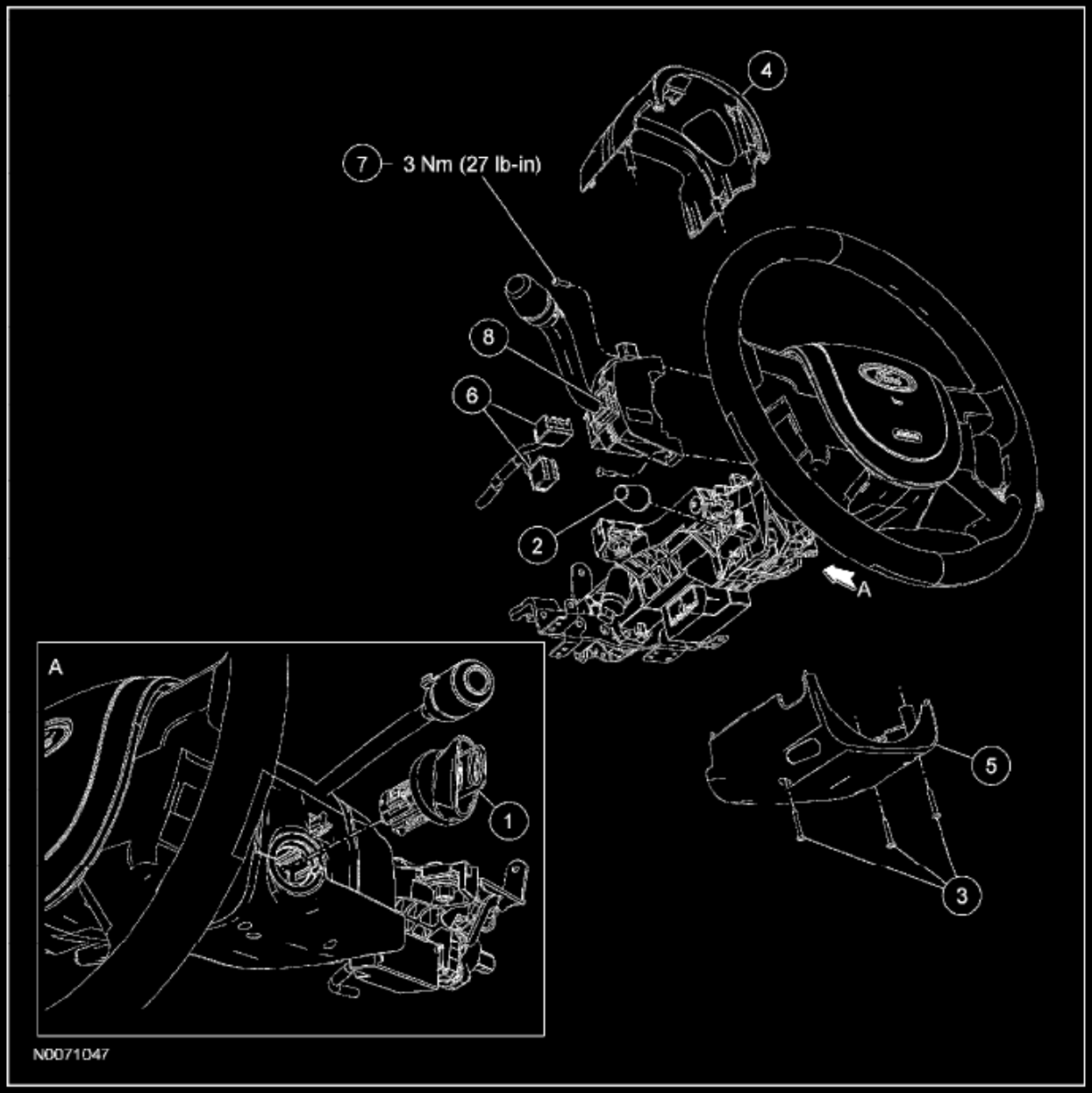


Multifunction Switch, Wiper/Washer Portion (continued)

Component testing procedure

Circuit to test	Connect self-powered test light or ohmmeter to terminals	Move switch to these positions	A good switch will indicate
Intermittent wiper circuit, front	1 and 6	Interval 1	Closed circuit
		Interval 2	
		Interval 3	Open circuit
		Interval 4	
		Interval 5	
	3 and 6	Interval 1	Open circuit
		Interval 2	Closed circuit
		Interval 3	
		Interval 4	
		Interval 5	Open circuit
	2 and 6	Interval 1	Open circuit
		Interval 2	
		Interval 3	
		Interval 4	Closed circuit
		Interval 5	

Steering Column Multifunction Switch



Item	Part Number	Description
1	11582	Ignition switch lock cylinder
2	3F609	Tilt release lever/ handle
3	391727	Steering column shroud screws (3 required)
4	3530	Upper steering column shroud
5	3533	Lower steering column shroud

(Continued)

Item	Part Number	Description
6	—	Steering column multi-function switch electrical connectors (part of 14A320)
7	390345	Steering column multi-function switch screws (2 required)
8	13K359	Steering column multi-function switch

Wiper Switch: Service and Repair

Steering Column Multifunction Switch

Steering Column Multifunction Switch

Removal and Installation

1. Remove the ignition switch lock cylinder.

1 Insert the ignition key into the ignition switch lock cylinder and turn to the RUN position.

2 Push the ignition switch lock cylinder release tab with a punch while pulling out the ignition switch lock cylinder.

2. If equipped, remove the tilt release lever/ handle.