

STARTING & CHARGING SYSTEM

SECTION SC

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PRECAUTIONS

Supplemental Restraint System (SRS) "AIR BAG" and "SEAT BELT PRE-TENSIONER"

Supplemental Restraint System (SRS) "AIR BAG" and "SEAT BELT PRE-TENSIONER"

NGSC0001

The Supplemental Restraint System such as "AIR BAG" and "SEAT BELT PRE-TENSIONER" used along with a seat belt, helps to reduce the risk or severity of injury to the driver and front passenger for certain types of collision. The Supplemental Restraint System consists of driver air bag module (located in the center of the steering wheel), front passenger air bag module (located on the instrument panel on passenger side), seat belt pre-tensioners, a diagnosis sensor unit, warning lamp, wiring harness and spiral cable.

Information necessary to service the system safely is included in the **RS section** of this Service Manual.

WARNING:

- To avoid rendering the SRS inoperative, which could increase the risk of personal injury or death in the event of a collision which would result in air bag inflation, all maintenance should be performed by an authorized NISSAN dealer.
- Improper maintenance, including incorrect removal and installation of the SRS, can lead to personal injury caused by unintentional activation of the system. For removal of Spiral Cable and Air Bag Module, see the RS section.
- Do not use electrical test equipment on any circuit related to the SRS unless instructed to in this Service Manual. Spiral cable and wiring harnesses (except "SEAT BELT PRE-TENSIONER") covered with yellow insulation either just before the harness connectors or for the complete harness are related to the SRS.

Wiring Diagrams and Trouble Diagnosis

NGSC0002

When you read wiring diagrams, refer to the following:

- **GI-10**, "HOW TO READ WIRING DIAGRAMS"
- **EL-11**, "POWER SUPPLY ROUTING" for power distribution circuit

When you perform trouble diagnosis, refer to the following:

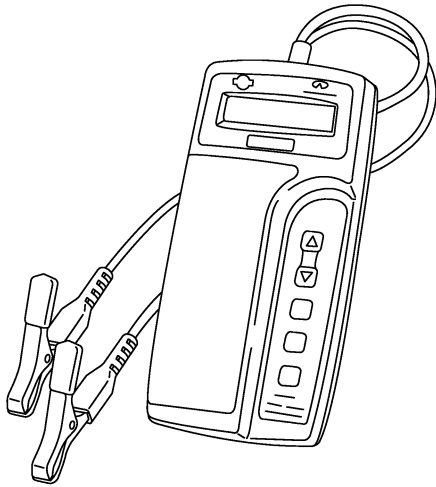
- **GI-33**, "How To Follow Test Group In Trouble Diagnoses"
- **GI-22**, "HOW TO PERFORM EFFICIENT DIAGNOSIS FOR AN ELECTRICAL INCIDENT"

PREPARATION

Special Service Tool

Special Service Tool

NGSC0018

Tool number Tool name	Description
J-44373 Model 620 Battery/Starting/Charging system tester	 SEL403X

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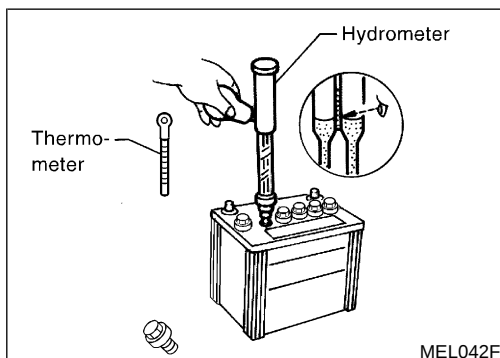
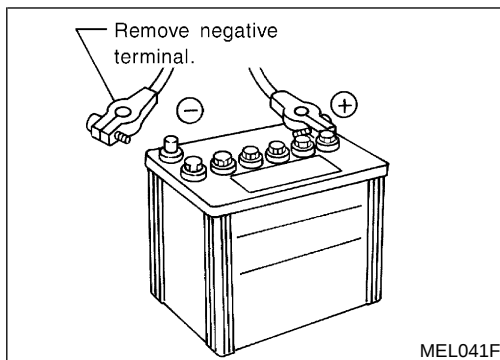
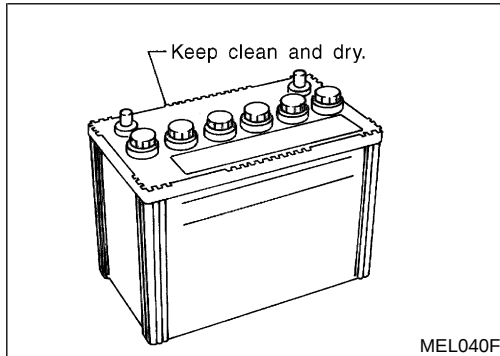
BATTERY

How to Handle Battery

NGSC0003

CAUTION:

- If it becomes necessary to start the engine with a booster battery and jumper cables, use a 12-volt booster battery.
- After connecting battery cables, ensure that they are tightly clamped to battery terminals for good contact.
- Never add distilled water through the hole used to check specific gravity.



METHODS OF PREVENTING OVER-DISCHARGE

NGSC0003S01

The following precautions must be taken to prevent over-discharging a battery.

- The battery surface (particularly its top) should always be kept clean and dry.
- The terminal connections should be clean and tight.
- At every routine maintenance, check the electrolyte level. This also applies to batteries designated as "low maintenance" and "maintenance-free".
- When the vehicle is not going to be used over a long period of time, disconnect the negative battery terminal. (If the vehicle has an extended storage switch, turn it off.)
- Check the charge condition of the battery. Periodically check the specific gravity of the electrolyte. Keep a close check on charge condition to prevent over-discharge.

CHECKING ELECTROLYTE LEVEL

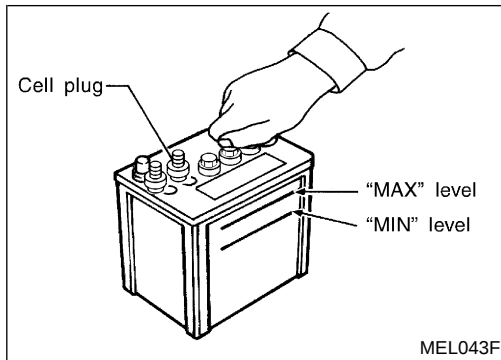
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WARNING:

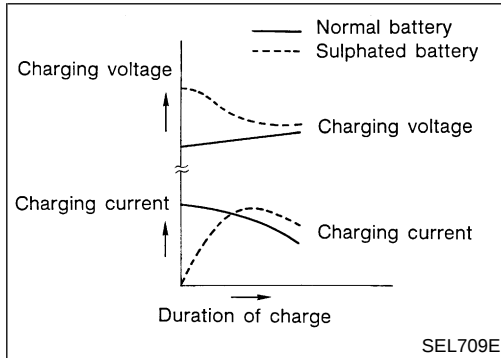
Do not allow battery fluid to come in contact with skin, eyes, fabrics, or painted surfaces. After touching a battery, do not touch or rub your eyes until you have thoroughly washed your hands. If acid contacts eyes, skin or clothing, immediately flush with water for 15 minutes and seek medical attention.

BATTERY

How to Handle Battery (Cont'd)



- Remove the cell plug using a suitable tool.
- Add distilled water up to the MAX level.

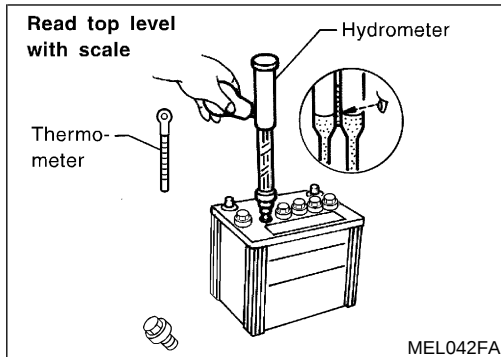


Sulphation

A battery will be completely discharged if it is left unattended for a long time and the specific gravity will become less than 1.100. This may result in sulphation on the cell plates.

To determine if a battery has been "sulphated", note its voltage and current when charging it. As shown in the figure, less current and higher voltage are observed in the initial stage of charging sulphated batteries.

A sulphated battery may sometimes be brought back into service by means of a long, slow charge, 12 hours or more, followed by a battery capacity test.



SPECIFIC GRAVITY CHECK

1. Read hydrometer and thermometer indications at eye level.

2. Use the chart below to correct your hydrometer reading according to electrolyte temperature.

Hydrometer Temperature Correction

Battery electrolyte temperature °C (°F)	Add to specific gravity reading
71 (160)	0.032
66 (150)	0.028
60 (140)	0.024
54 (129)	0.020
49 (120)	0.016
43 (110)	0.012
38 (100)	0.008
32 (90)	0.004
27 (80)	0
21 (70)	-0.004
16 (60)	-0.008
10 (50)	-0.012

BATTERY

How to Handle Battery (Cont'd)

Battery electrolyte temperature °C (°F)	Add to specific gravity reading
4 (39)	-0.016
-1 (30)	-0.020
-7 (20)	-0.024
-12 (10)	-0.028
-18 (0)	-0.032

Corrected specific gravity	Approximate charge condition
1.260 - 1.280	Fully charged
1.230 - 1.250	3/4 charged
1.200 - 1.220	1/2 charged
1.170 - 1.190	1/4 charged
1.140 - 1.160	Almost discharged
1.110 - 1.130	Completely discharged

CHARGING THE BATTERY

NGSC0003S04

CAUTION:

- Do not “quick charge” a fully discharged battery.
- Keep the battery away from open flame while it is being charged.
- When connecting the charger, connect the leads first, then turn on the charger. Do not turn on the charger first, as this may cause a spark.
- If battery electrolyte temperature rises above 60°C (140°F), stop charging. Always charge battery at a temperature below 60°C (140°F).

Charging Rates

NGSC0003S0401

Amps	Time
50	1 hour
25	2 hours
10	5 hours
5	10 hours

Do not charge at more than 50 ampere rate.

NOTE:

The ammeter reading on your battery charger will automatically decrease as the battery charges. This indicates that the voltage of the battery is increasing normally as the state of charge improves. The charging amps indicated above refer to initial charge rate.

- If, after charging, the specific gravity of any two cells varies more than .050, the battery should be replaced.

BATTERY

Trouble Diagnoses with Battery/Starting/Charging System Tester

Trouble Diagnoses with Battery/Starting/Charging System Tester

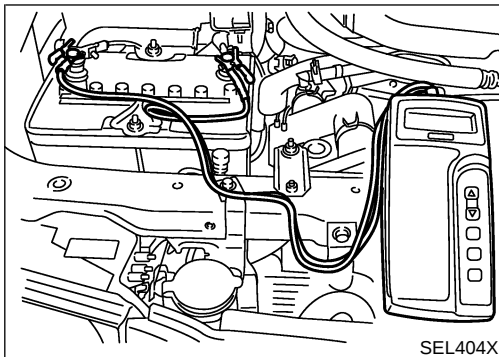
NGSC0019

CAUTION:

When working with batteries, always wear appropriate eye protection.

NOTE:

- To ensure a complete and thorough diagnosis, the battery, starter and generator test segments must be done as a set from start to finish.
- If battery surface charge is detected while testing, the tester will prompt you to turn on the headlights to remove the surface charge.
- If necessary, the tester will prompt you to determine if the battery temperature is above or below 0°C (32°F). Choose the appropriate selection by pressing the up or down arrow button, then press "ENTER" to make the selection.

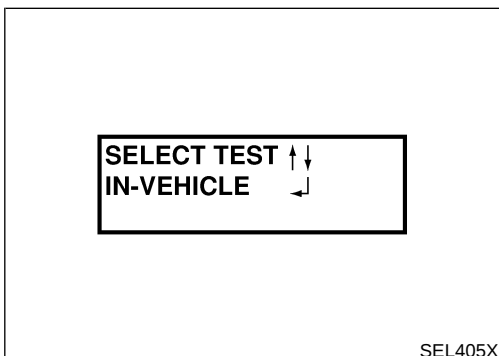


1. Turn off all loads on the vehicle electrical system. Clean or repair as necessary.
2. Visually inspect the battery, battery terminals and cable ends with ignition switch in "OFF" position.

NOTE:

The contact surface between the battery terminals, cable ends and tester leads must be clean for a valid test. A poor connection will prevent testing and a "CHECK CONNECTION" message will appear during the test procedures. If this occurs, clean the battery post and terminals, reconnect them and restart the test.

3. Connect the red tester lead clamp to the positive battery terminal, and the black to the negative terminal.



4. The tester will turn on automatically. Using the arrow keys, select "IN-VEHICLE" on the tester and then press the "ENTER" key.

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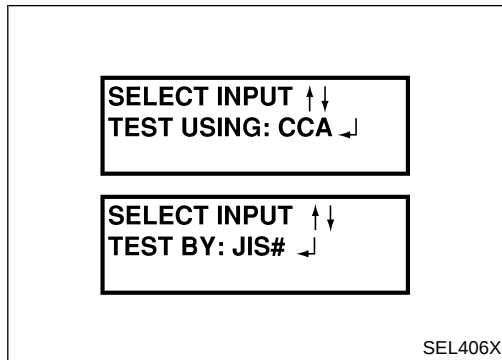
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BATTERY

Trouble Diagnoses with Battery/Starting/Charging System Tester (Cont'd)



5. Locate the battery type and rating stamped or written on the top case of the battery to be tested.

NOTE:

The battery type and rating will have either of the following.

CCA: Cold Cranking Amps (490 CCA, 550 CCA, etc.)

JIS: Japanese Industrial Standard.

Battery is stamped with a number such as:

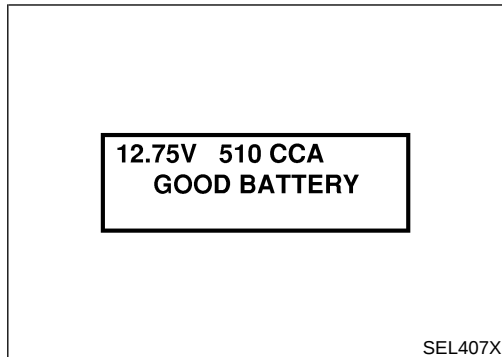
80D26L: 80 (rank of output), D (physical size-depth), 26 (width in cm). The last character L (post configuration) is not input into the tester.

The tester requires the rating for the battery be entered exactly as it is written or stamped on the battery. Do not attempt a CCA conversion for JIS stamped batteries. JIS must be input directly.

6. Using the arrow and "ENTER" keys alternately, select the battery type and rating.

NOTE:

The tester lists five choices; CCA, JIS, IEC, DIN, and EN. Only use CCA or JIS.



7. Press "ENTER" to begin the test. Diagnosis results are displayed on the tester. Refer to "DIAGNOSTIC RESULT ITEM CHART", SC-9.



8. Press "ENTER", then test output code is displayed. Record the test output code on the repair order.
9. Toggle back to the "DIAGNOSTIC SCREEN" for test results.

NOTE:

- If necessary, the tester will ask the user to determine if the battery has just been charged. Choose the appropriate selection by pressing the up or down arrow button and then press the "ENTER" button to make the selection.
- When testing a battery installed in a vehicle that has recently been driven, select "BEFORE CHARGE".
- If the battery has just been slow charged due to a "CHARGE & RETEST" decision by the tester, and the tester asks the user "BEFORE CHARGE/AFTER CHARGE", select "AFTER CHARGE".

BATTERY

Trouble Diagnoses with Battery/Starting/Charging System Tester (Cont'd)

DIAGNOSTIC RESULT ITEM CHART

NGSC0019S01

Diagnostic item	Service procedure
GOOD BATTERY	Battery is OK. Refer to "Trouble Diagnoses with Battery/Starting/Charging System Tester", SC-16.
REPLACE BATTERY	Replace battery. Before replacing battery, clean the battery cable clamps and battery posts. Perform battery test again with Battery/Starting/Charging system tester. If second test result is "Replace Battery", then do so. Perform battery test again to confirm repair.
BAD CELL-REPLACE	Replace the battery. Perform battery test again with Battery/Starting/Charging system tester to confirm repair.
GOOD-RECHARGE	Perform the slow battery charging procedure. (Initial rate of charge is 10A for 12 hours.) Perform battery test again with Battery/Starting/Charging system tester.
CHARGE & RETEST	Perform the slow battery charging. (Initial rate of charge is 10A for 12 hours.) Perform battery test again with Battery/Starting/Charging system tester to confirm repair. NOTE: If the tester asks the user "BEFORE CHARGE/AFTER CHARGE", select "AFTER CHARGE".

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STARTING SYSTEM

System Description

System Description

NGSC0004

NGSC0004S01

KA24DE MODELS

Power is supplied at all times

- through 40A fusible link (letter **e**, located in the fuse and fusible link box)
- to ignition switch terminal B.

With the ignition switch in the START position, power is supplied

- through ignition switch terminal ST
- to clutch interlock relay terminal 5.

With the ignition switch in the ON or START position, power is supplied

- through 10A fuse [No. 11, located in the fuse block (J/B)]
- to clutch interlock relay terminal 2.

With the clutch pedal depressed, ground is supplied

- to clutch interlock relay terminal 1
- through clutch interlock switch terminal 1
- through clutch interlock switch terminal 2
- through body grounds M14 and M68.

The clutch interlock relay is energized and power is supplied

- through clutch interlock relay terminal 3
- to starter motor windings terminal S.

The starter motor plunger closes and provides a closed circuit between the battery and the starter motor. The starter motor is grounded to the cylinder block. With power and ground supplied, the starter motor operates.

VG33E M/T MODELS

=NGSC0004S02

Power is supplied at all times

- through 40A fusible link (letter e, located in the fuse and fusible link box)
- to ignition switch terminal B.

With the ignition switch in the START position, power is supplied

- through ignition switch terminal ST
- to clutch interlock relay terminal 5.

With the ignition switch in the ON or START position, power is supplied

- through 10A fuse [No. 11, located in the fuse block (J/B)]
- to clutch interlock relay terminal 2 and
- through 10A fuse [No. 5, located in the fuse block (J/B)]
- to vehicle security relay terminal 2 (models with power door locks).

If the vehicle security system is not triggered (models with power door locks) and clutch pedal is depressed, ground is supplied

- to clutch interlock relay terminal 1
- through vehicle security relay terminals 3, 4 (models with power door locks) and
- through clutch interlock switch terminal 1
- through clutch interlock switch terminal 2
- through body grounds M14 and M68.

The clutch interlock relay is energized and power is supplied

- through clutch interlock relay terminal 3
- to starter motor windings terminal S.

The starter motor plunger closes and provides a closed circuit between the battery and the starter motor. The starter motor is grounded to the cylinder block. With power and ground supplied, the starter motor operates. If the vehicle security system is triggered (models with power door locks), ground is supplied to vehicle security relay terminal 1 through smart entrance control unit terminal 40, disengaging the clutch interlock relay and preventing starter motor operation.

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STARTING SYSTEM

System Description (Cont'd)

VG33E A/T MODELS

=NGSC0004S03

Power is supplied at all times

- through 40A fusible link (letter e, located in the fuse and fusible link box)
- to ignition switch terminal B.

With the ignition switch in the START position, power is supplied

- through ignition switch terminal ST
- to park/neutral position (PNP) relay terminal 5.

With the ignition switch in the ON or START position, power is supplied

- through 10A fuse [No. 12, located in the fuse block (J/B)]
- to PNP switch terminal 1 and
- through 10A fuse [No. 5, located in the fuse block (J/B)]
- to vehicle security relay terminal 2 (models with power door locks).

With the selector lever in the P or N position, power is supplied

- through PNP switch terminal 2
- to PNP relay terminal 2.

If the vehicle security system is not triggered (models with power door locks), ground is supplied

- to PNP relay terminal 1
- through body grounds E12 and E54 (models without power door locks) or
- through vehicle security relay terminals 3, 4 (models with power door locks) and
- through body grounds M14 and M68.

The PNP relay is energized and power is supplied

- through PNP relay terminal 3
- to starter motor windings terminal S.

The starter motor plunger closes and provides a closed circuit between the battery and the starter motor. The starter motor is grounded to the cylinder block. With power and ground supplied, the starter motor operates. If the vehicle security system is triggered (models with power door locks), ground is supplied to vehicle security relay terminal 1 through smart entrance control unit terminal 40, disengaging the PNP relay and preventing starter motor operation.

STARTING SYSTEM

Wiring Diagram — START —

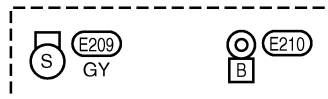
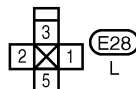
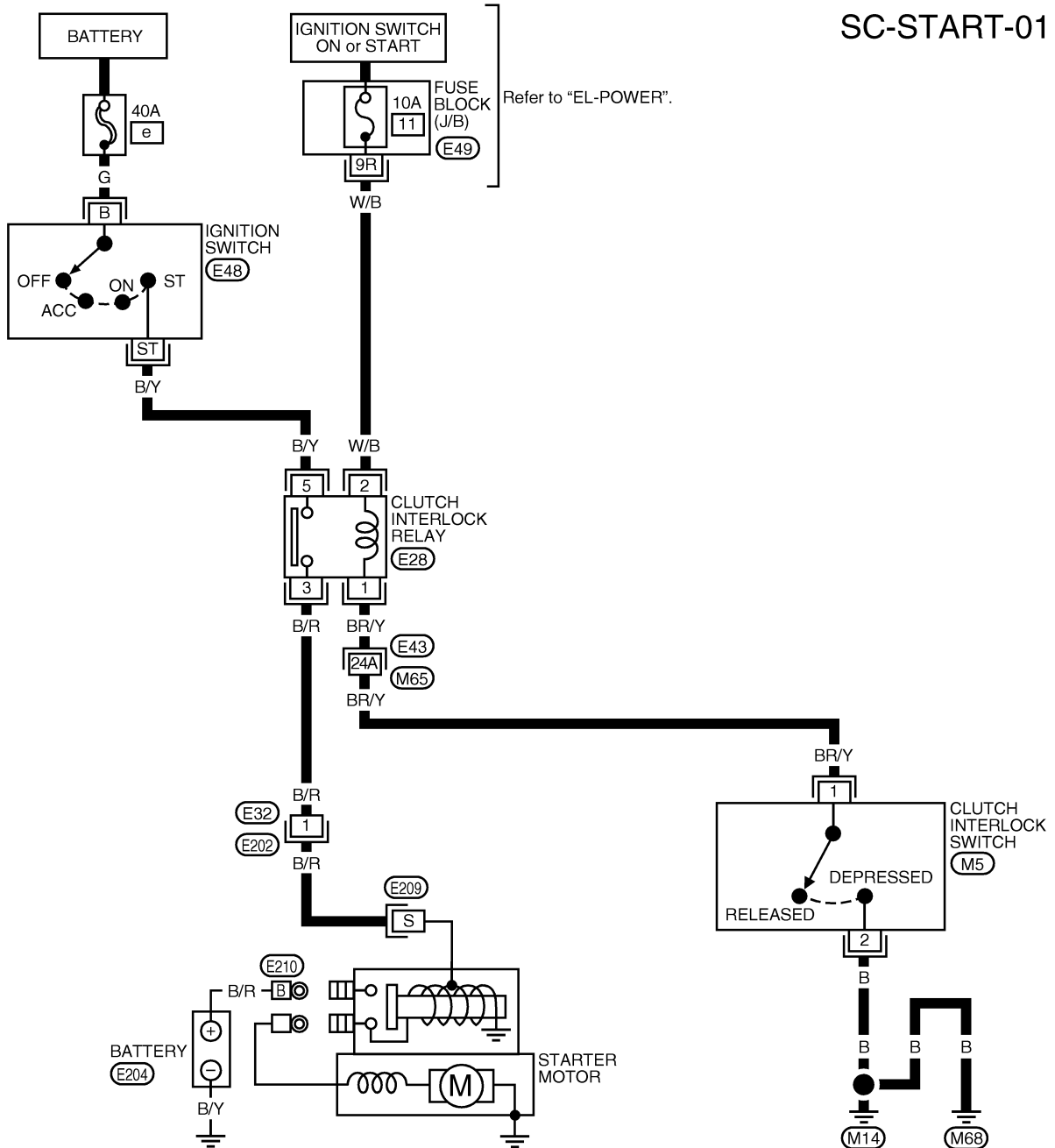
Wiring Diagram — START —

NGSC0005

NGSC0005S01

KA24DE MODELS

SC-START-01



Refer to the following.
(M65), **(E43)** -SUPER MULTIPLE JUNCTION (SMJ)

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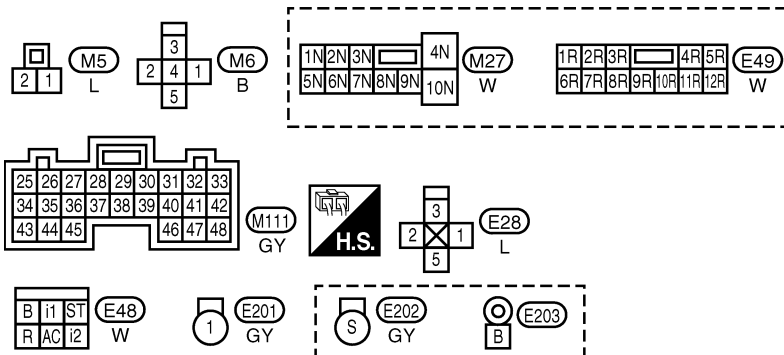
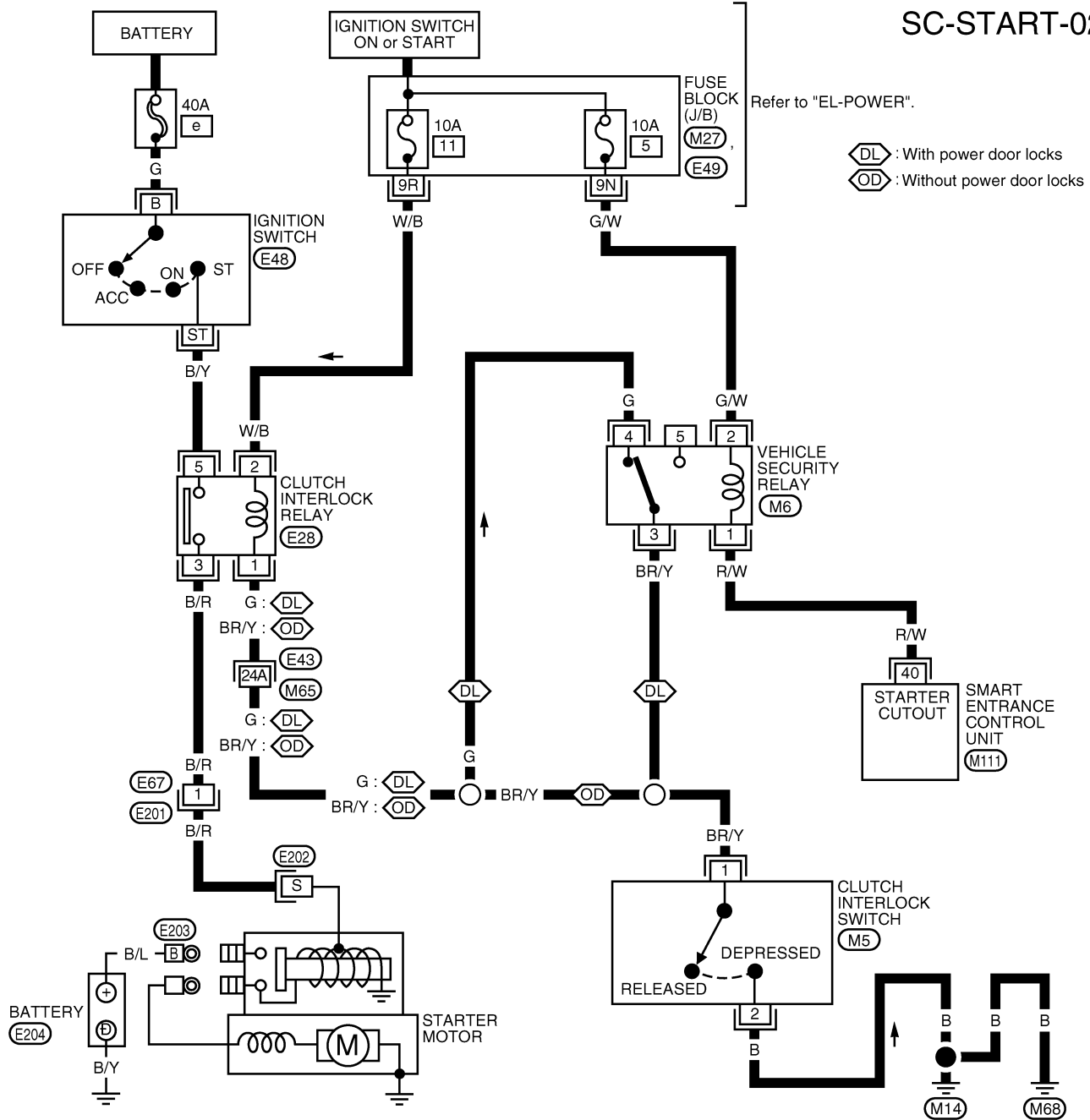
STARTING SYSTEM

Wiring Diagram — START — (Cont'd)

VG33E M/T MODELS

NGSC0005S02

SC-START-02



Refer to the following.
 (M65), (E43) -SUPER MULTIPLE JUNCTION (SMJ)

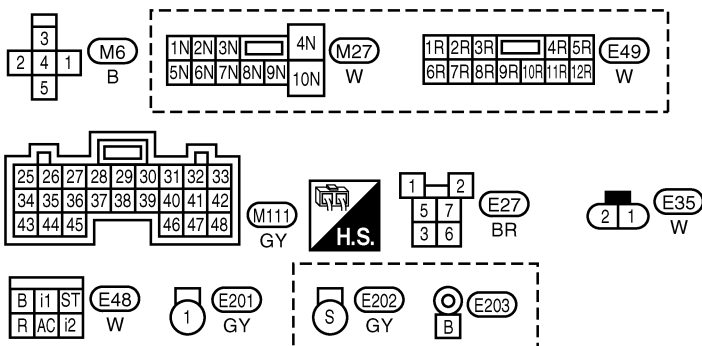
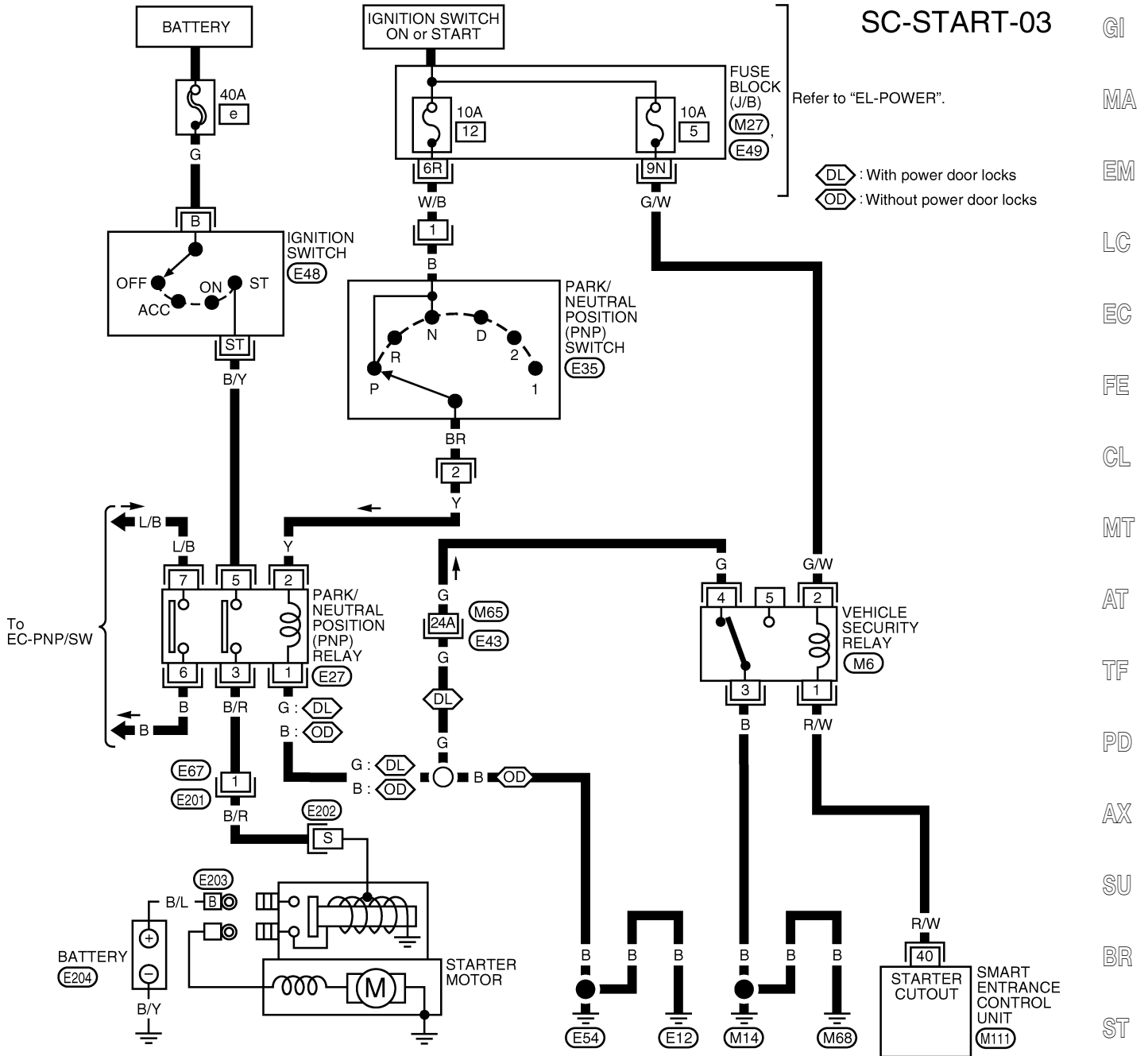
WSC065

Wiring Diagram — START — (Cont'd)

NGSC0005S03

VG33E A/T MODELS

SC-START-03



Refer to the following.
(M65) , **(E43)** - SUPER MULTIPLE
 JUNCTION (SMJ)

STARTING SYSTEM

Trouble Diagnoses with Battery/Starting/Charging System Tester

Trouble Diagnoses with Battery/Starting/Charging System Tester

NGSC0020

NOTE:

To ensure a complete and thorough diagnosis, the battery, starter and generator test segments must be done as a set from start to finish.

PRESS ENTER FOR
STARTER TEST

SEL408X

START ENGINE

SEL409X

CRANKING VOLTAGE
NORMAL 10.21V

SEL410X

1. Turn off all loads on the vehicle electrical system.
2. Perform battery test with Battery/Starting/Charging system tester. Refer to "Trouble Diagnoses with Battery/Starting/Charging System Tester", SC-7.
3. Press "ENTER" to begin the starting system test.

4. Start the engine.

5. Diagnosis result is displayed on the tester. Refer to "DIAGNOSTIC RESULT ITEM CHART", SC-17.

NOTE:

- If the starter performs normally but the engine does not start, perform engine diagnosis.
- For intermittent "NO CRANK" or "NO STARTER OPERATION" incidents, refer to "DIAGNOSTIC PROCEDURE 2", SC-21.

STARTING SYSTEM

Trouble Diagnoses with Battery/Starting/Charging System Tester (Cont'd)

DIAGNOSTIC RESULT ITEM CHART

NGSC0020S01

Diagnostic item	Service procedure
CRANKING VOLTAGE NORMAL	Go to "WORK FLOW", SC-18.
CRANKING VOLTAGE LOW	Go to "WORK FLOW", SC-18.
CHARGE BATTERY	Perform the slow battery charging procedure. (Initial rate of charge is 10A for 12 hours.) Perform battery test again with Battery/Starting/Charging system tester. Refer to "Trouble Diagnoses with Battery/Starting/Charging System Tester", SC-7.
REPLACE BATTERY	Before replacing battery, clean the battery cable clamps and battery posts. Perform battery test again with Battery/Starting/Charging system tester. Refer to "Trouble Diagnoses with Battery/Starting/Charging System Tester", SC-7. If second test result is "REPLACE BATTERY", then do so. Perform battery test again to confirm repair.

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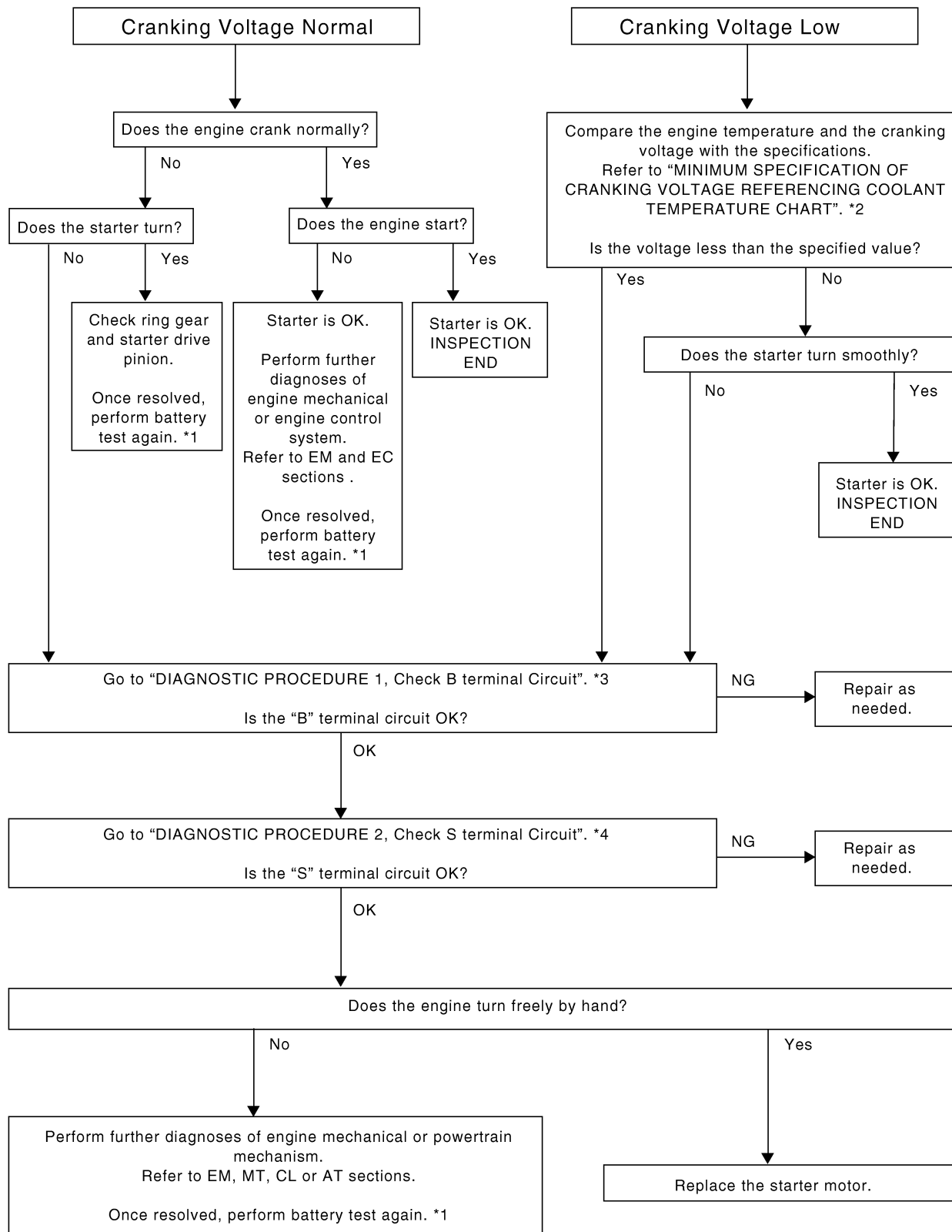
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STARTING SYSTEM

Trouble Diagnoses with Battery/Starting/Charging System Tester (Cont'd)

WORK FLOW

NGSC0020S02



SEL411X

*1 SC-7
*2 SC-22

*3 SC-19

*4 SC-21

STARTING SYSTEM

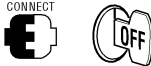
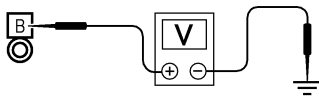
Trouble Diagnoses with Battery/Starting/Charging System Tester (Cont'd)

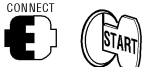
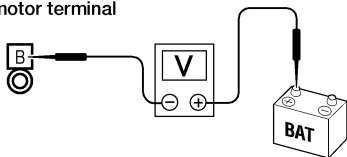
DIAGNOSTIC PROCEDURE 1

Check "B" Terminal Circuit

NGSC0020S03

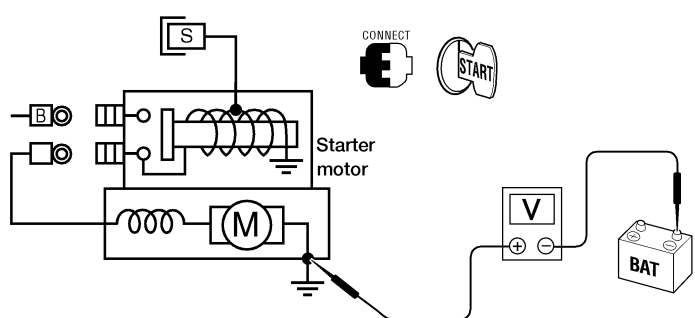
NGSC0020S0301

1	CHECK POWER SUPPLY FOR STARTER MOTOR “B” TERMINAL	
1. Remove the fuel pump fuse. 2. Crank or start the engine (where possible) until the fuel pressure is released. 3. Turn the ignition switch OFF. 4. Check that the starter motor terminal “B” [E210, (B/R) for KA24DE models or E203, (B/L) for VG33E models] connection is clean and tight. 5. Check voltage between starter motor terminal “B” [E210, (B/R) for KA24DE models or E203, (B/L) for VG33E models] and ground using a digital circuit tester. CONNECT  Starter motor terminal  Battery voltage should exist. LSC037 OK or NG		
OK	▶	GO TO 2.
NG	▶	Check harness between the battery and the starter motor for open circuit.

2	CHECK BATTERY CABLE CONNECTION QUALITY (VOLTAGE DROP TEST)	
1. Check voltage between starter motor terminal “B” [E210, (B/R) for KA24DE models or E203, (B/L) for VG33E models] and battery positive terminal using a digital circuit tester.		
CONNECT  Starter motor terminal  When the ignition switch is in START position, Voltage: Less than 0.5V LSC038 OK or NG		
OK	▶	GO TO 3.
NG	▶	Check harness between the battery and the starter motor for poor continuity.

STARTING SYSTEM

Trouble Diagnoses with Battery/Starting/Charging System Tester (Cont'd)

3	CHECK STARTER MOTOR GROUND CIRCUIT (VOLTAGE DROP TEST)	
1. Check voltage between starter motor case and battery negative terminal using a digital circuit tester.		
 When the ignition switch is in START position, Voltage: Less than 0.2V OK or NG		
OK	▶	Starter motor “B” terminal circuit is OK. Further inspection necessary. Refer to “WORK FLOW”, SC-18.
NG	▶	Check the starter motor case and ground for poor continuity.

STARTING SYSTEM

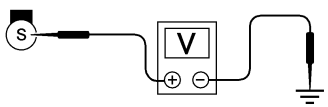
Trouble Diagnoses with Battery/Starting/Charging System Tester (Cont'd)

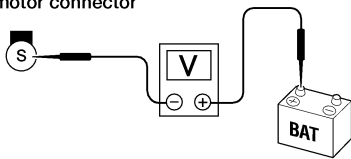
DIAGNOSTIC PROCEDURE 2

Check "S" Terminal Circuit

=NGSC0020S04

NGSC0020S0401

1	CHECK POWER SUPPLY FOR STARTER MOTOR "S" TERMINAL	
1. Remove the fuel pump fuse. 2. Crank or start the engine (where possible) until the fuel pressure is released. 3. Turn the ignition OFF. 4. Disconnect starter motor terminal "S" [E209 (B/R) for KA24DE models or E202 (B/R) for VG33E models] connector. 5. Check voltage between starter motor terminal "S" [E209, (B/R) for KA24DE models or E202, (B/R) for VG33E models] and ground using a digital circuit tester.		
 T.S.  DISCONNECT  START Starter motor connector  When the ignition switch is in START position, Battery voltage should exist. LSC040		
OK or NG		
OK	▶	GO TO 2.
NG	▶	Check the following. ● 40A fusible link (letter e, located in fuse and fusible link box) ● Clutch interlock relay ● Park/neutral position relay ● Harness for open or short

2	CHECK "S" TERMINAL CONNECTION QUALITY (VOLTAGE DROP TEST)	
1. Connect starter motor terminal "S" [E209, (B/R) for KA24DE models or E202, (B/R) for VG33E models] connector. 2. Check voltage between starter motor terminal "S" [E209, (B/R) for KA24DE models or E202, (B/R) for VG33E models] and battery positive terminal using a digital tester.		
 H.S.  CONNECT  START Starter motor connector  When the ignition switch is in START position, Voltage: Less than 1V LSC041 OK or NG		
OK	▶	Starter motor "S" terminal circuit is OK. Further inspection necessary. Refer to "WORK FLOW", SC-18.
NG	▶	Check harness between the battery and the starter motor "S" terminal for poor continuity.

STARTING SYSTEM

Trouble Diagnoses with Battery/Starting/Charging System Tester (Cont'd)

MINIMUM SPECIFICATION OF CRANKING VOLTAGE REFERENCING COOLANT TEMPERATURE

=NGSC0020S05

Engine coolant temperature	Voltage V	
	KA24DE	VG33E
-30°C to -20°C (-22°F to -4°F)	8.0	8.6
-19°C to -10°C (-2°F to 14°F)	9.0	9.3
-9°C to 0°C (16°F to 32°F)	9.9	9.5
More than 1°C (More than 34°F)	10.2	10.2

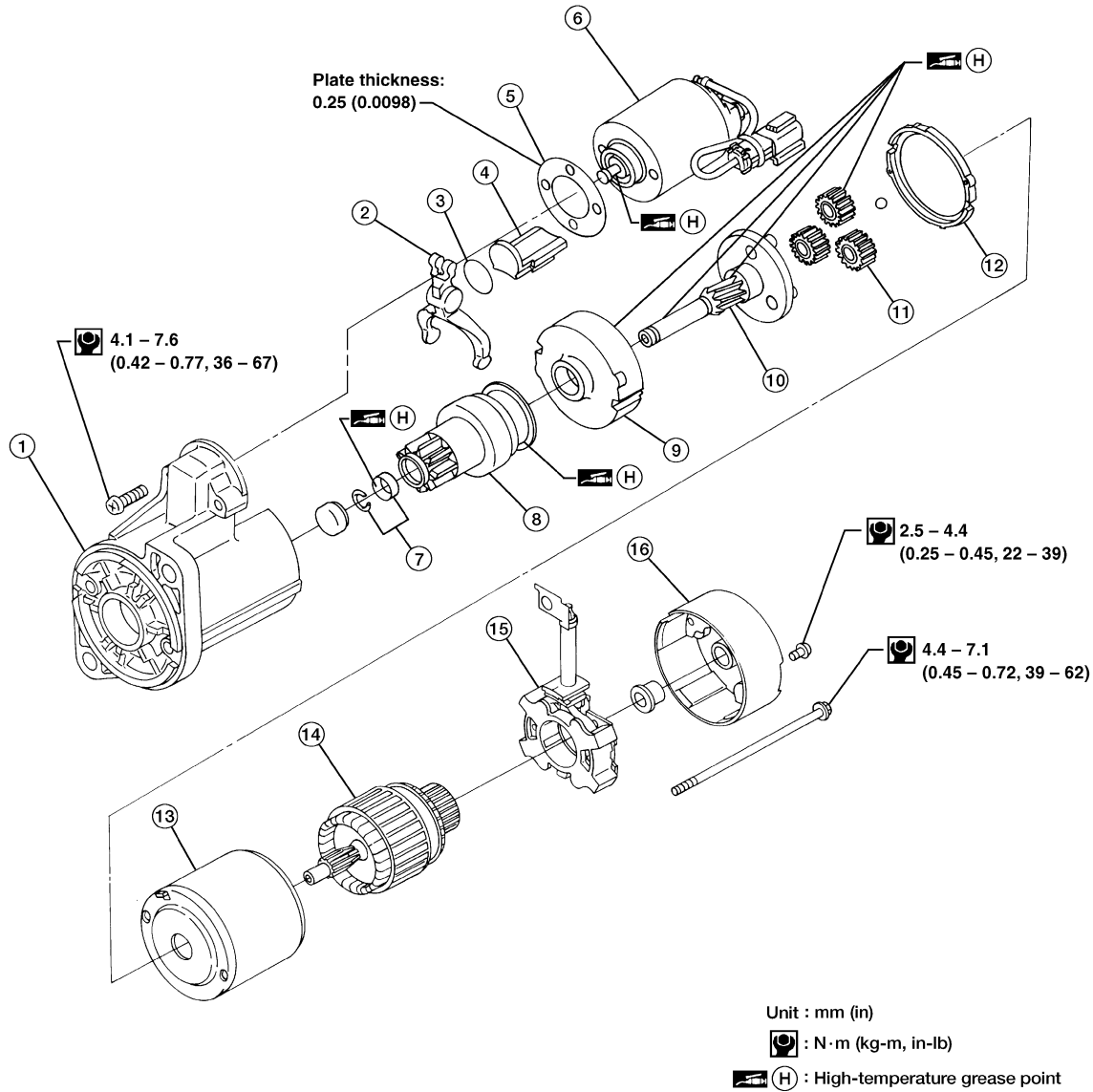
Construction

=NGSC0006

NGSC0006S01

KA24DE MODELS

SEC. 233
M000T60082ZC



LSC053

- | | | |
|-----------------------------|-----------------------|---------------------------|
| 1. Gear case | 7. Pinion stopper set | 12. Packing |
| 2. Shift lever | 8. Pinion assembly | 13. Yoke |
| 3. Plate | 9. Internal gear | 14. Armature |
| 4. Packing | 10. Pinion shaft | 15. Brush holder assembly |
| 5. Adjusting plate | 11. Planetary gear | 16. Rear cover |
| 6. Magnetic switch assembly | | |

STARTING SYSTEM

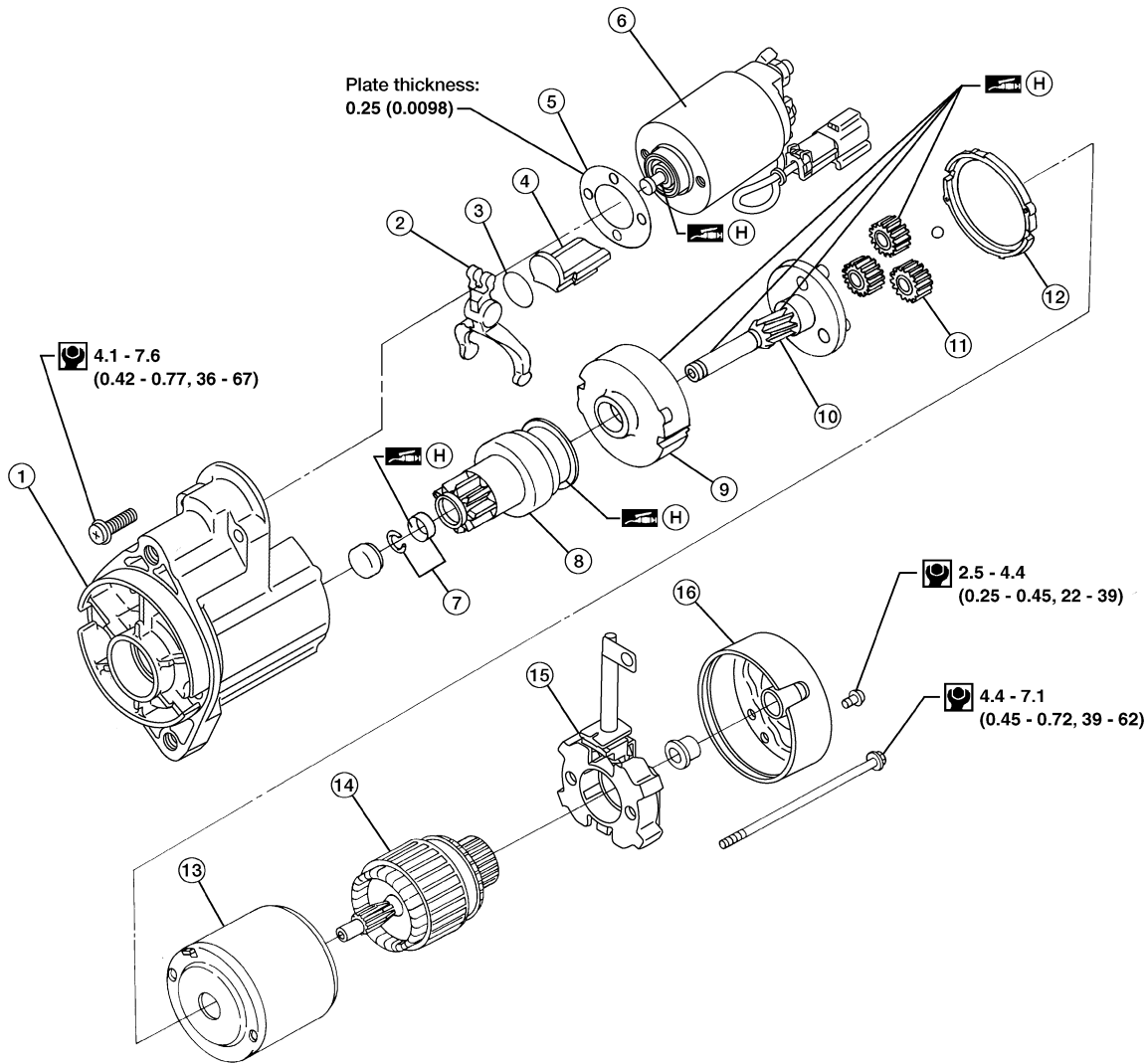
Construction (Cont'd)

VG33E MODELS

NGSC0006S02

SEC. 233

M000T60187ZC



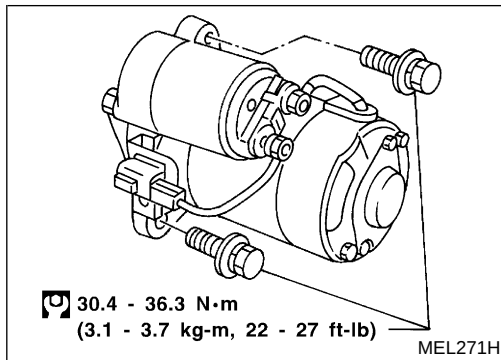
Unit : mm (in)

: N·m (kg-m, in-lb)

(H) : High-temperature grease point

LSC052

- | | | |
|-----------------------|-----------------------------|--------------------|
| 1. Sleeve bearing | 7. Packing | 13. Washer |
| 2. Gear case | 8. Adjusting plate | 14. Brush (-) |
| 3. Pinion stopper set | 9. Magnetic switch assembly | 15. Brush holder |
| 4. Pinion assembly | 10. Yoke | 16. Sleeve bearing |
| 5. Shift lever | 11. Brush (+) | 17. Rear cover |
| 6. Plate | 12. Armature | |



Removal and Installation KA24DE MODELS

Removal

1. Remove engine under cover.
2. Remove two bolts and starter.

Installation

To install, reverse the removal procedure.

NGSC0007

NGSC0007S01

NGSC0007S0101

GI

MA

NGSC0007S0102

EM

LC

NGSC0007S02

NGSC0007S0201

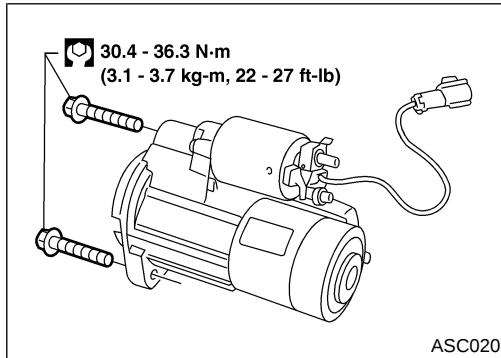
EC

FE

NGSC0007S0202

CL

MT



VG33E MODELS

Removal

1. Remove engine under cover.
2. Remove two bolts and starter.

Installation

To install, reverse the removal procedure.

Pinion/Clutch Check

1. Inspect pinion teeth.
 - Replace pinion if teeth are worn or damaged. (Also check condition of ring gear teeth.)
2. Inspect reduction gear teeth.
 - Replace reduction gear if teeth are worn or damaged. (Also check condition of armature shaft gear teeth.)
3. Check to see if pinion locks in one direction and rotates smoothly in the opposite direction.
 - If it locks or rotates in both directions, or unusual resistance is evident, replace.

NGSC0008

AT

TF

PD

AX

SU

BR

ST

RS

BT

HA

SC

EL

IDX

CHARGING SYSTEM

System Description

System Description

NGSC0009

The generator provides DC voltage to operate the vehicle's electrical system and to keep the battery charged. The voltage output is controlled by the IC regulator.

Power is supplied at all times to generator terminal S through:

- 80A fusible link [letter **a**, located in the fuse and fusible link box (with KA24DE engine)] or
- 100A fusible link [letter **a**, located in the fuse and fusible link box (with VG33E engine)] and
- 7.5A fuse (No. 36, located in the fuse and fusible link box).

Generator terminal B supplies power to charge the battery and operate the vehicle's electrical system. Output voltage is controlled by the IC regulator at generator terminal S detecting the input voltage. The charging circuit is protected by the 80A fusible link (with KA24DE engine) or the 100A fusible link (with VG33E engine). Ground is supplied to generator terminal E through body ground E203 (with KA24DE engine) or body ground A1 (with VG33E engine).

With the ignition switch in the ON or START position, power is supplied

- through 10A fuse [No. 11, located in the fuse block (J/B)]
- to combination meter terminal 17 for the charge warning lamp.

Ground is supplied to combination meter terminal 43 through generator terminal L. With power and ground supplied, the charge warning lamp will illuminate. When the generator is providing sufficient voltage with the engine running, the ground is opened and the charge warning lamp will go off.

If the charge warning lamp illuminates with the engine running, a fault is indicated.

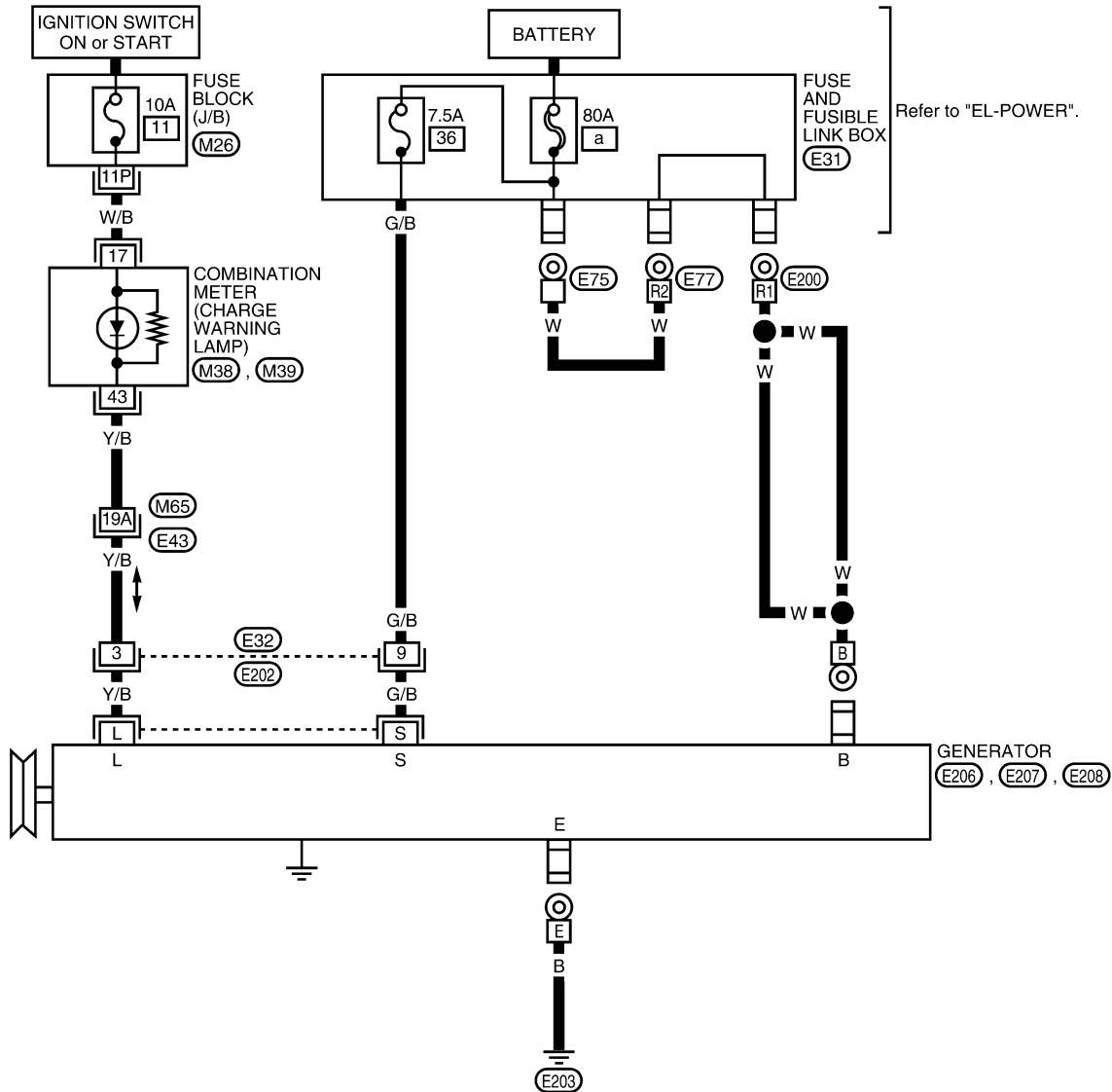
CHARGING SYSTEM

Wiring Diagram — CHARGE —

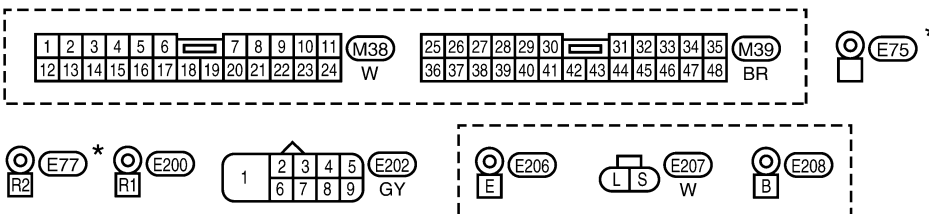
KA24DE MODELS

NGSC0010
NGSC0010S01

SC-CHARGE-01



1P	2P	3P		4P	5P	6P	7P	M26	
8P	9P	10P	11P	12P	13P	14P	15P	16P	W



Refer to the following.
(M65), (E43) - SUPER MULTIPLE JUNCTION (SMJ)
(E31) - FUSE AND FUSIBLE LINK BOX

★ : This connector is not shown in "HARNESS LAYOUT" of EL section.

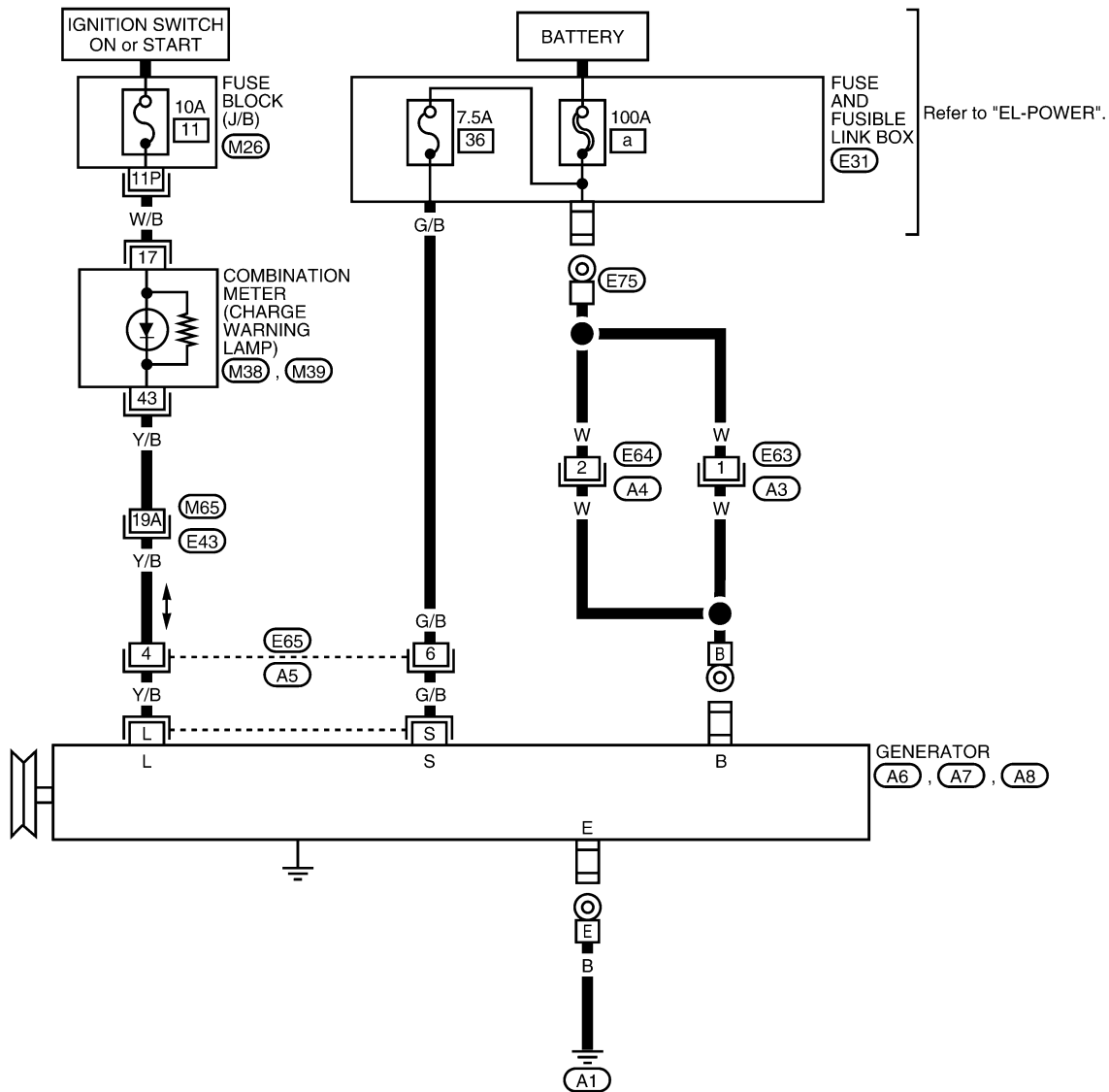
CHARGING SYSTEM

Wiring Diagram — CHARGE — (Cont'd)

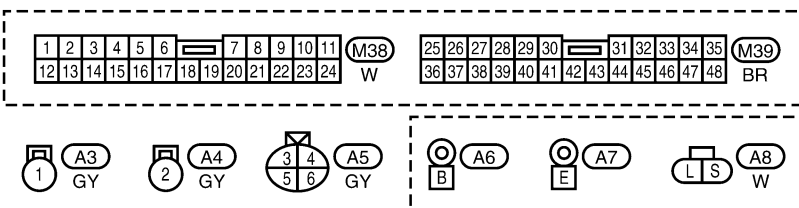
VG33E MODELS

NGSC0010S02

SC-CHARGE-02



1P 2P 3P 4P 5P 6P 7P (M26)
8P 9P 10P 11P 12P 13P 14P 15P 16P W



★ : This connector is not shown in "HARNESS LAYOUT" of EL section.

Refer to the following.
(M65), (E43) - SUPER MULTIPLE JUNCTION (SMJ)
(E31) - FUSE AND FUSIBLE LINK BOX



WSC073

CHARGING SYSTEM

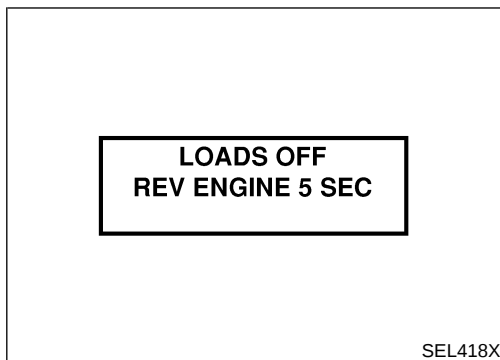
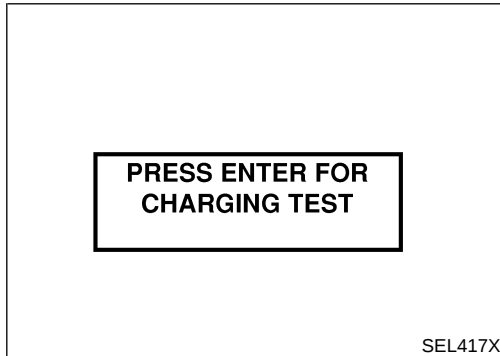
Trouble Diagnoses with Battery/Starting/Charging System Tester

Trouble Diagnoses with Battery/Starting/Charging System Tester

NGSC0021

NOTE:

To ensure a complete and thorough diagnosis, the battery, starter and generator test segments must be done as a set from start to finish.

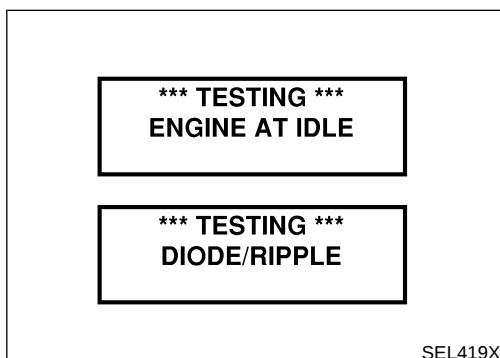


1. Turn off all loads on the vehicle electrical system.
2. Perform battery and starting system test with Battery/Starting/Charging system tester.
3. Press "ENTER" to begin the charging system test.
4. Start engine.

5. Press "ENTER" until "LOADS OFF REV ENGINE 5 SEC" is displayed.
6. Raise and hold the engine speed at 1,500 to 2,000 rpm for about 5 seconds, then return the engine to idle. Once the increase in engine rpm is detected, press "ENTER" to continue.

NOTE:

- If after 30 seconds an increase in engine idle speed is not detected, "RPM NOT DETECTED" will display.
- Some engines may have a higher idle initially after starting, particularly when the engine is cold. The tester may detect this without any other action being taken. If this occurs, continue on with the testing process. The final results will not be affected.



7. The tester now checks the engine at idle and performs the DIODE/RIPPLE check.
8. When complete, the tester will prompt you to turn on the following electrical loads.
 - Heater fan set to highest speed. Do not run the A/C or windshield defroster.
 - Headlamp high beam
 - Rear window defogger

NOTE:

Do not run the windshield wipers or any other cyclical loads.

GI

MA

EM

LC

EC

FE

CL

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AT

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AX

SU

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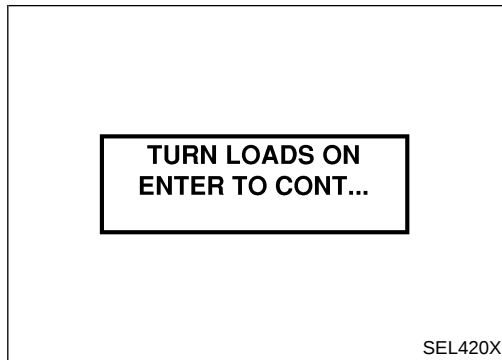
SC

EL

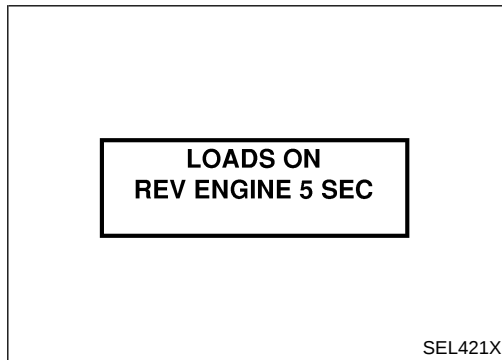
IDX

CHARGING SYSTEM

Trouble Diagnoses with Battery/Starting/Charging System Tester (Cont'd)



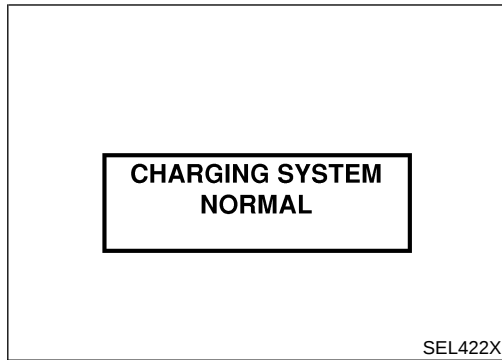
9. Press "ENTER" to continue.



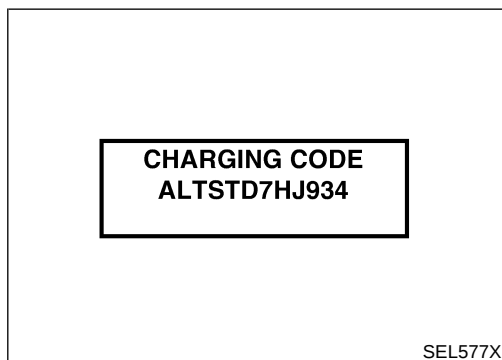
10. Raise and hold the engine speed at 1,500 to 2,000 rpm for about 5 seconds, then return the engine to idle. Once the increase in engine rpm is detected, press "ENTER" to continue.

NOTE:

If after 30 seconds an increase in engine idle speed is not detected, "RPM NOT DETECTED" will be displayed. Press "ENTER" to restart the test.



11. Diagnostic result is displayed on the tester. Refer to "DIAGNOSTIC RESULT ITEM CHART", SC-31.



12. Press "ENTER" then test output code is displayed. Record the test output code on the repair order.

13. Toggle back to the "DIAGNOSTIC SCREEN" for test results.

CHARGING SYSTEM

Trouble Diagnoses with Battery/Starting/Charging System Tester (Cont'd)

DIAGNOSTIC RESULT ITEM CHART

NGSC0021S01

Diagnostic item	Service procedure	
CHARGING SYSTEM NORMAL	Charging system is normal and will also show DIODE RIPPLE test result.	GI
NO CHARGING VOLTAGE	Go to "WORK FLOW", SC-32.	MA
LOW CHARGING VOLTAGE	Go to "WORK FLOW", SC-32.	EM
HIGH CHARGING VOLTAGE	Go to "WORK FLOW", SC-32.	LC
DIODE RIPPLE NORMAL	Diode ripple is OK and will also show CHARGING VOLTAGE test result.	EC
EXCESS RIPPLE DETECTED	Replace the generator. Perform "DIODE RIPPLE" test again using Battery/Starting/Charging system tester to confirm repair.	
DIODE RIPPLE NOT DETECTED	Go to "WORK FLOW", SC-32.	

FE

CL

MT

AT

TF

PD

AX

SU

BR

ST

RS

BT

HA

SC

EL

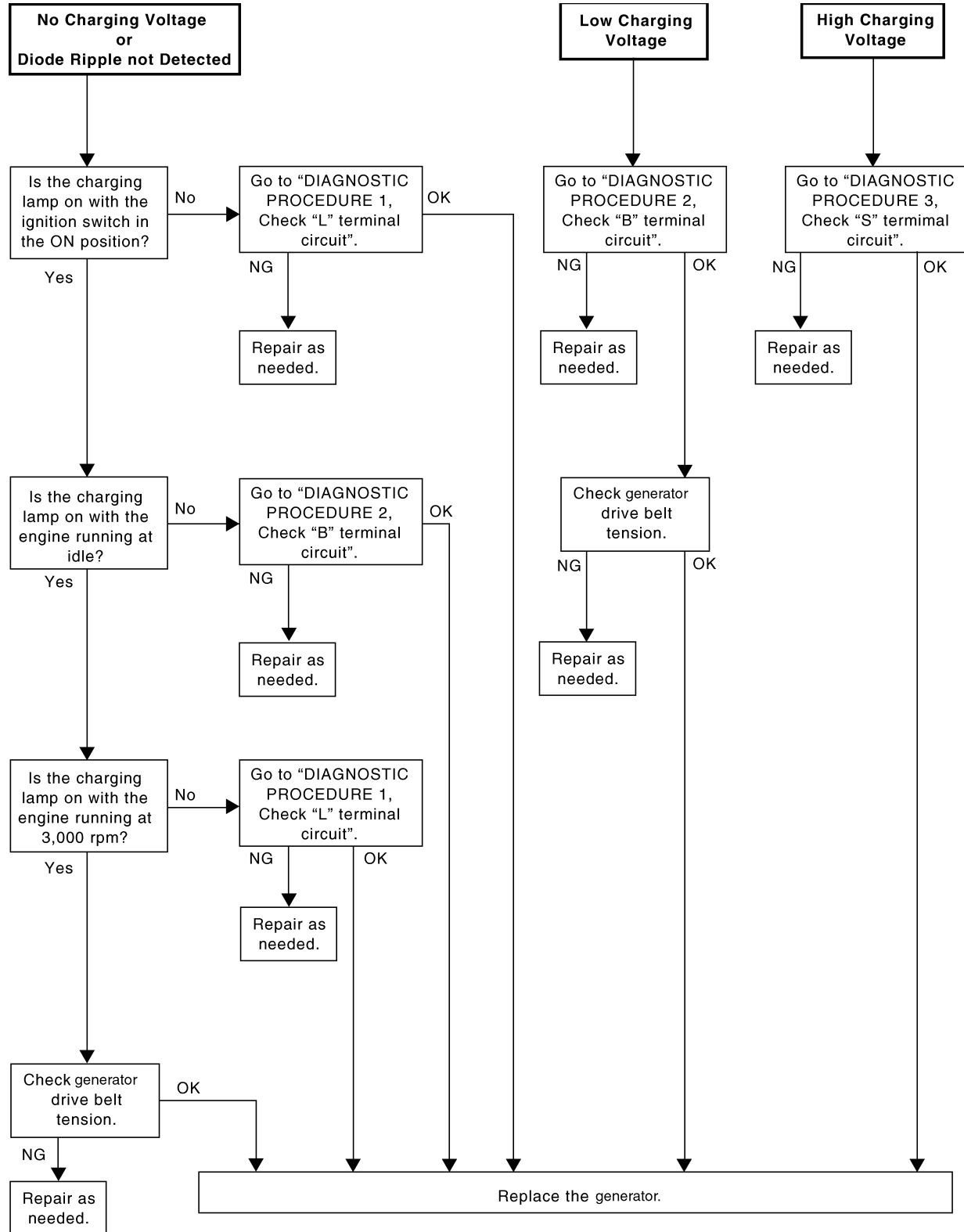
IDX

CHARGING SYSTEM

Trouble Diagnoses with Battery/Starting/Charging System Tester (Cont'd)

WORK FLOW

NGSC0021S02



LSC047

CHARGING SYSTEM

Trouble Diagnoses with Battery/Starting/Charging System Tester (Cont'd)

DIAGNOSTIC PROCEDURE 1

Check "L" Terminal Circuit

NGSC0021S03

NGSC0021S0301

1	CHECK "L" TERMINAL CONNECTION		
Check to see if "L" terminal is clean and tight.			
OK or NG			
OK	▶	GO TO 2.	
NG	▶	Repair "L" terminal connection. Confirm repair by performing complete Battery/Starting/Charging system test.	

2	CHECK "L" TERMINAL CIRCUIT							
1. Disconnect E207 for KA24DE models or A8 for VG33E models connector from generator. 2. Apply ground to terminal "L" [E207, (Y/B) for KA24DE models or A8, (Y/B) for VG33E models] with the ignition switch in the ON position.  Generator connector  CHARGE lamp should light up. LSC042 OK or NG <table><tr><td>OK</td><td>▶</td><td>Replace the generator. Confirm repair by performing complete Battery/Starting/Charging system test.</td></tr><tr><td>NG</td><td>▶</td><td>Check the following. ● 10A fuse [No. 11, located in fuse block (J/B)] ● CHARGE lamp ● Harness for open or short between combination meter and fuse ● Harness for open or short between combination meter and generator </td></tr></table>			OK	▶	Replace the generator. Confirm repair by performing complete Battery/Starting/Charging system test.	NG	▶	Check the following. ● 10A fuse [No. 11, located in fuse block (J/B)] ● CHARGE lamp ● Harness for open or short between combination meter and fuse ● Harness for open or short between combination meter and generator
OK	▶	Replace the generator. Confirm repair by performing complete Battery/Starting/Charging system test.						
NG	▶	Check the following. ● 10A fuse [No. 11, located in fuse block (J/B)] ● CHARGE lamp ● Harness for open or short between combination meter and fuse ● Harness for open or short between combination meter and generator						

CHARGING SYSTEM

Trouble Diagnoses with Battery/Starting/Charging System Tester (Cont'd)

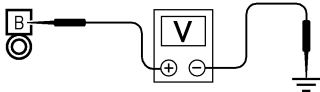
DIAGNOSTIC PROCEDURE 2

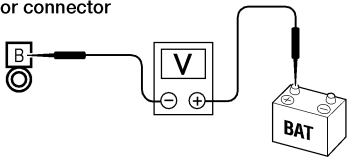
Check "B" Terminal Circuit

=NGSC0021S04

NGSC0021S0401

1	CHECK "B" TERMINAL CONNECTION
Check to see if "B" terminal is clean and tight.	
OK or NG	
OK	▶ GO TO 2. Confirm repair by performing complete Battery/Starting/Charging system test.
NG	▶ Repair "B" terminal connection.

2	CHECK GENERATOR "B" TERMINAL CIRCUIT
Check voltage between generator terminal "B" [E208, (W) for KA24DE models or A6, (W) for VG33E models] and ground using a digital circuit tester.	
 Generator connector  Battery voltage should exist. LSC043	
OK or NG	
OK	▶ GO TO 3.
NG	▶ Check the following. • 80A fusible link (letter a, located in fuse and fusible link box) for KA24DE models • 100A fusible link (letter a, located in fuse and fusible link box) for VG33E models • Harness for open or short between generator and fusible link

3	CHECK "B" TERMINAL CONNECTION QUALITY (VOLTAGE DROP TEST)
Check voltage between generator terminal "B" [E208, (W) for KA24DE models or A6, (W) for VG33E models] and battery positive terminal using a digital tester.	
 Generator connector  With the engine running at idle and warm, Voltage: Less than 0.2V LSC044	
OK or NG	
OK	▶ Replace the generator. Confirm repair by performing complete Battery/Starting/Charging system test.
NG	▶ Check harness between the battery and the generator for poor continuity.

CHARGING SYSTEM

Trouble Diagnoses with Battery/Starting/Charging System Tester (Cont'd)

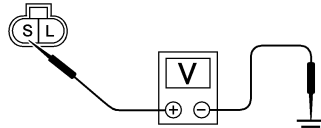
DIAGNOSTIC PROCEDURE 3

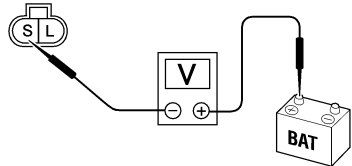
Check "S" Terminal Circuit

=NGSC0021S05

NGSC0021S0501

1	CHECK "S" TERMINAL CONNECTION	
Check to see if "S" terminal is clean and tight.		
OK or NG		
OK	▶	GO TO 2.
NG	▶	Repair "S" terminal connection. Confirm repair by performing complete Battery/Starting/Charging system test.

2	CHECK GENERATOR "S" TERMINAL CIRCUIT	
Check voltage between generator terminal "S" [E207, (G/B) for KA24DE models or A8, (G/B) for VG33E models] and ground using a digital circuit tester.		
  Generator connector  Battery voltage should exist.		
LSC045		
OK or NG		
OK	▶	GO TO 3.
NG	▶	Check the following. ● 7.5A fuse (No. 36, located in fuse and fusible link box) ● Harness for open or short between generator and fuse

3	CHECK "S" TERMINAL CONNECTION QUALITY (VOLTAGE DROP TEST)	
Check voltage between generator terminal "S" [E207, (G/B) for KA24DE models or A8, (G/B) for VG33E models] and battery positive terminal using a digital tester.		
   Generator connector  With the engine running at idle and warm, Voltage: Less than 0.2V		
OK or NG		
OK	▶	Replace the generator. Confirm repair by performing complete Battery/Starting/Charging system test.
NG	▶	Check harness between the battery and the generator for poor continuity.

CHARGING SYSTEM

Trouble Diagnoses with Battery/Starting/Charging System Tester (Cont'd)

MALFUNCTION INDICATOR

The IC regulator warning function activates to illuminate "CHARGE" warning lamp, if any of the following symptoms occur while generator is operating:

- Excessive voltage is produced.
- No voltage is produced.

=NGSC0021S06

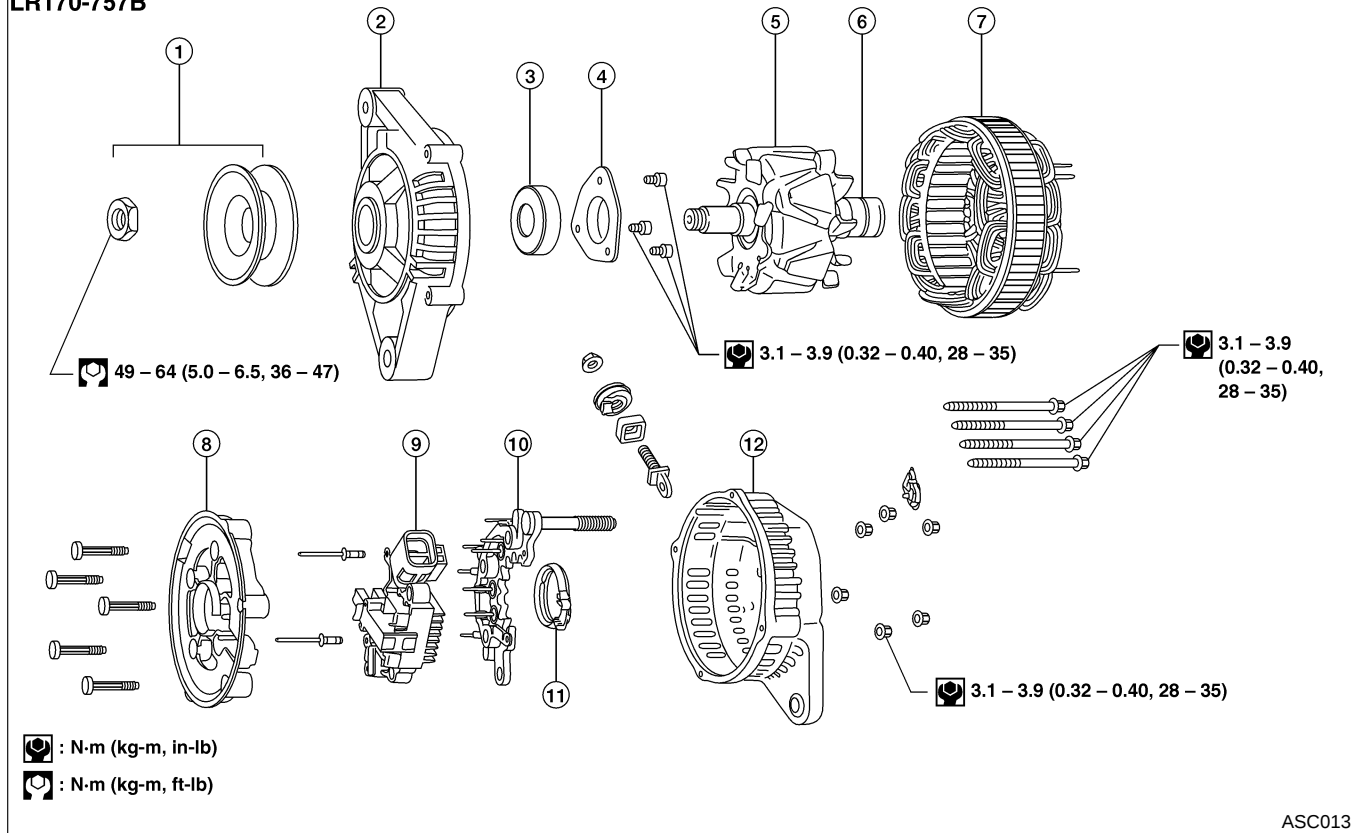
Construction

=NGSC0012

NGSC0012S01

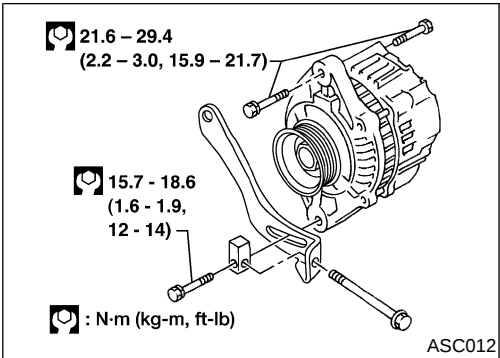
KA24DE MODELS

SEC. 231
LR170-757B



ASC013

- | | | |
|--------------------|--------------|--------------------------|
| 1. Pulley assembly | 5. Rotor | 9. IC regulator assembly |
| 2. Front cover | 6. Slip ring | 10. Diode assembly |
| 3. Front bearing | 7. Stator | 11. Packing |
| 4. Retainer | 8. Fan guide | 12. Rear cover |



VG33E MODELS

Removal

1. Disconnect harness connectors.
2. Remove engine undercover.
3. Loosen adjustment bolt, remove belt.
4. Remove 3 generator bolts and generator.

Installation

To install, reverse the removal procedure.

NGSC0013S02

NGSC0013S0201

GI

MA

NGSC0013S0202

EM

LC

EC

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BT

HA

SC

EL

IDX

SERVICE DATA AND SPECIFICATIONS (SDS)

Battery

Battery		
NGSC0014		
Applied area	USA	Canada
Type	55D23R	65D26R
Capacity V-AH	12-60	12-65
Cold cranking current A (For reference value)	356	413

Starter

NGSC0015		
Engine	KA24DE	VG33E
Type	M000T60082ZC	M000T60187ZC
	MITSUBISHI make	
	Reduction gear type	
System voltage	12 V	
No-load	Terminal voltage	11.0 V
	Current	Less than 90 A
	Revolution	More than 2,500 rpm
Minimum diameter of commutator	29.3 mm (1.154 in)	
Minimum length of brush	7.0 mm (0.276 in)	
Brush spring tension	5.8 - 21.6 N (0.59 - 2.20 kg, 1.30 - 4.86 lb)	
Clearance of bearing metal and armature shaft mm (in)	0.1 (0.004)	
Clearance between pinion front edge and pinion stopper mm (in)	0.2 - 2.0 (0.008 - 0.079)	

Generator

NGSC0016		
Engine	KA24DE	VG33E
Type	LR170-757B	LR180-756B
	HITACHI make	
Nominal rating	12 V-70 A	12 V-80 A
Ground polarity	Negative	
Minimum revolution under no-load (When 13.5 volts are applied)	Less than 1,000 rpm	
Hot output current (When 13.5 volts are applied)	More than 17 A/1,300 rpm More than 54 A/2,500 rpm More than 72 A/5,000 rpm	More than 23 A/1,300 rpm More than 65 A/2,500 rpm More than 77 A/5,000 rpm
Regulated output voltage	14.1 - 14.7 V	
Minimum length of brush	6.0 mm (0.236 in)	
Brush spring pressure	1.000 - 2.452 N (102 - 250 g, 3.60 - 8.82 oz)	
Slip ring minimum outer diameter	26.0 mm (1.024 in)	
Rotor (Field coil) resistance	2.6 Ω	2.7 Ω