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Model Year Start: 2010	Model: RAV4	Prod Date Range: [08/2009 - ]
Title: 2AR-FE ENGINE MECHANICAL: CAMSHAFT: INSTALLATION; 2010 MY RAV4 [08/2009 - ]		

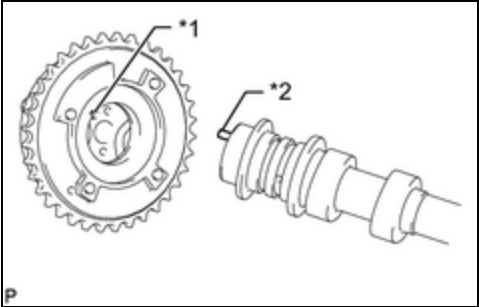
INSTALLATION

1. INSTALL NO. 2 CAMSHAFT BEARING
2. INSTALL NO. 1 CAMSHAFT BEARING
3. INSTALL OIL CONTROL VALVE FILTER
4. INSTALL CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY

(a) Align and attach the knock pin of the No. 2 camshaft with the pin hole of the camshaft timing exhaust gear assembly.

Text in Illustration

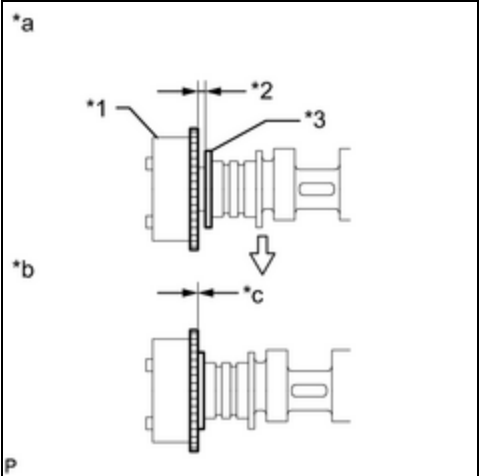
*1	Knock Pin Hole
*2	Knock Pin



(b) Check that there is no clearance between the camshaft timing exhaust gear assembly and camshaft flange.

Text in Illustration

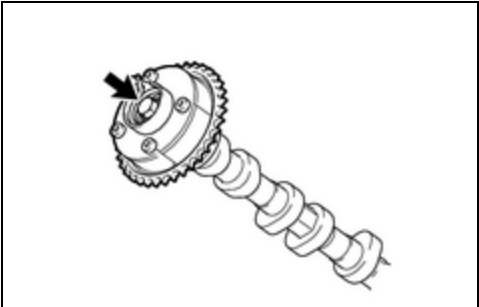
*1	Camshaft Timing Exhaust Gear
*2	Clearance
*3	Camshaft Flange
*a	INCORRECT
*b	CORRECT
*c	No Clearance



(c) Fix the camshaft timing exhaust gear assembly with the bolt.

Torque:  
85 N·m {867 kgf·cm, 63ft·lbf}

NOTICE:  
Do not disassemble the camshaft timing exhaust gear.

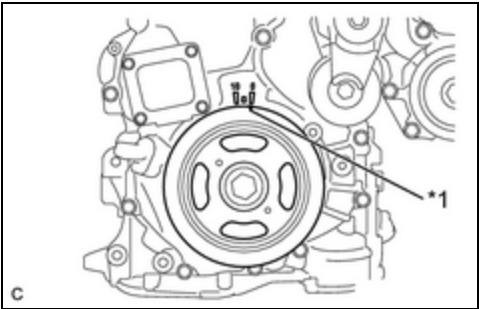


5. SET TDC/COMPRESSION

- (a) Turn the crankshaft pulley until its timing notch (groove) and the timing mark "0" of the timing chain cover are aligned.

Text in Illustration

*1	Timing Notch
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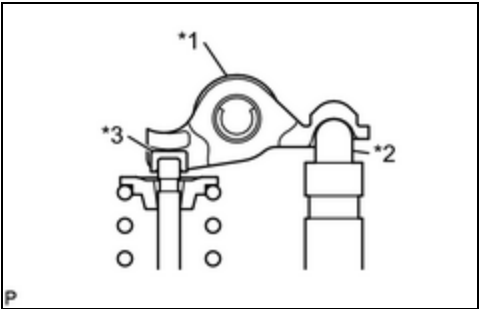


6. INSTALL NO. 2 CAMSHAFT

- (a) Make sure that the valve rocker arms are installed as shown in the illustration.

Text in Illustration

*1	Valve Rocker Arm
*2	Valve Lash Adjuster
*3	Valve Stem Cap

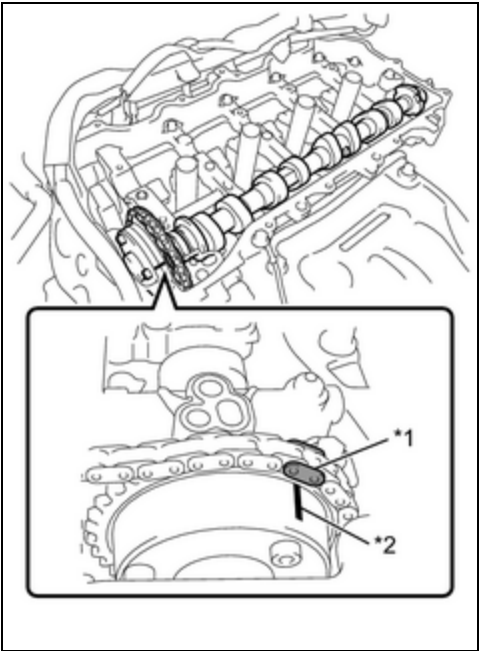


- (b) Clean the camshaft journals.
- (c) Apply a light coat of engine oil to the camshaft journals, camshaft housings and bearing caps.

- (d) Hold up the chain and align the matchmark and the paint mark and install the camshaft.

Text in Illustration

*1	Paint Mark
*2	Matchmark

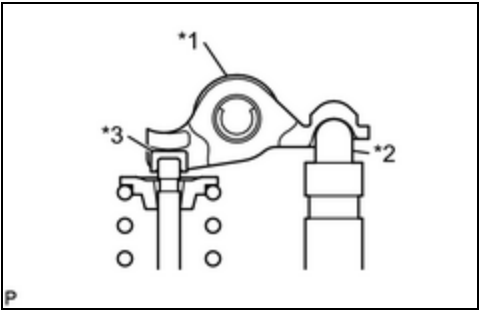


7. INSTALL CAMSHAFT

- (a) Make sure that the valve rocker arms are installed as shown in the illustration.

**Text in Illustration**

*1	Valve Rocker Arm
*2	Valve Lash Adjuster
*3	Valve Stem Cap

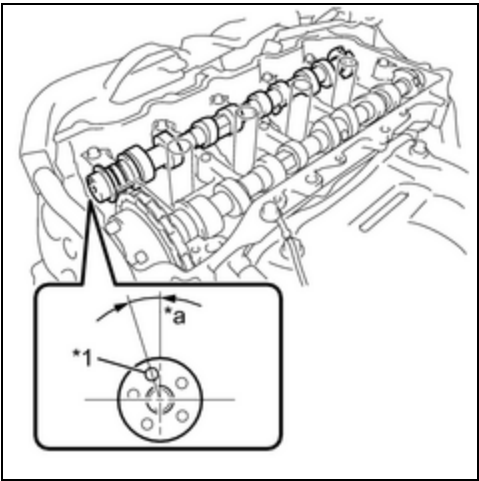


- (b) Clean the camshaft journals.
- (c) Apply a light coat of engine oil to the camshaft journals, camshaft housings and bearing caps.

- (d) Install the camshaft to the camshaft housing as shown in the illustration.

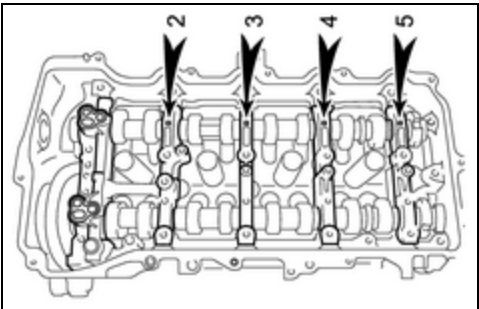
**Text in Illustration**

*1	Knock Pin
*a	Approximately 17°



**8. INSTALL CAMSHAFT BEARING CAP**

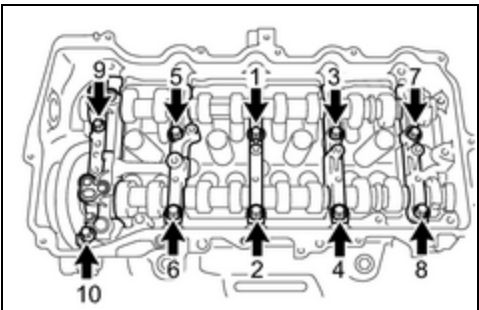
- (a) Confirm the marks and numbers on the camshaft bearing caps and place them in their proper positions and directions.



- (b) Using several steps, uniformly tighten the 10 bolts in the sequence shown in the illustration.

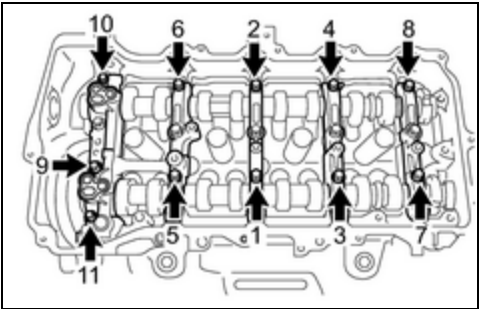
**Torque:**

**27 N·m {275 kgf·cm, 20ft·lbf}**



(c) Using several steps, uniformly tighten the 11 bolts in the sequence shown in the illustration.

**Torque:**  
**16 N·m {163 kgf·cm, 12ft·lbf}**



(d) Check the torque of each bolt again.

**9. INSTALL CAMSHAFT TIMING GEAR ASSEMBLY**

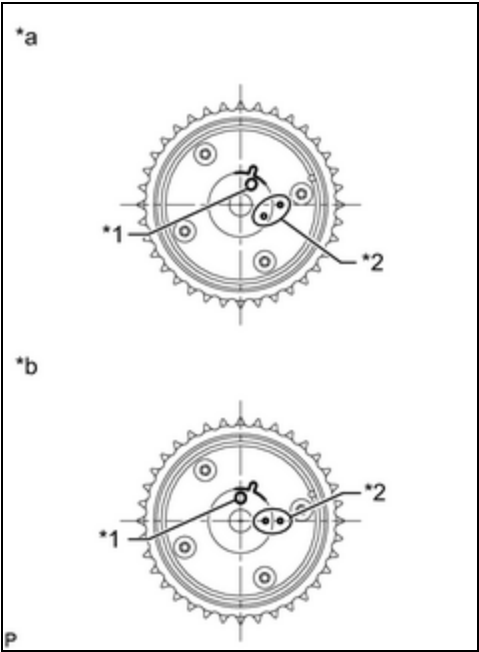
(a) Check the camshaft timing gear position.

**Text in Illustration**

*1	Knock Pin Hole
*2	Alignment Mark
*a	Advanced Position
*b	Retarded Position

**NOTICE:**

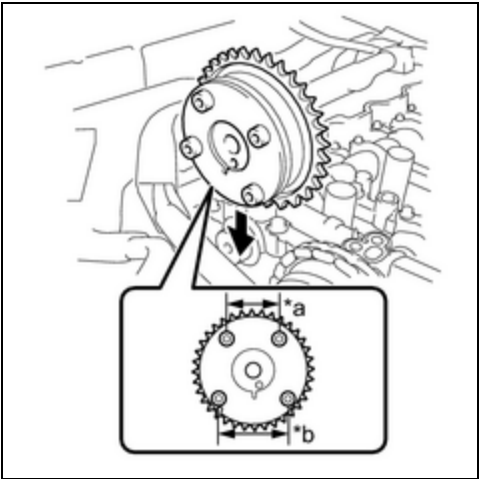
- If the camshaft timing gear is set to the advanced position, do not let the camshaft timing gear rotate clockwise during installation.
- If the camshaft timing gear has rotated to the most retarded position, make sure to release the lock pin and set the camshaft timing gear to the most advanced position before tightening the camshaft timing gear.



(b) Install the camshaft timing gear as shown in the illustration.

**Text in Illustration**

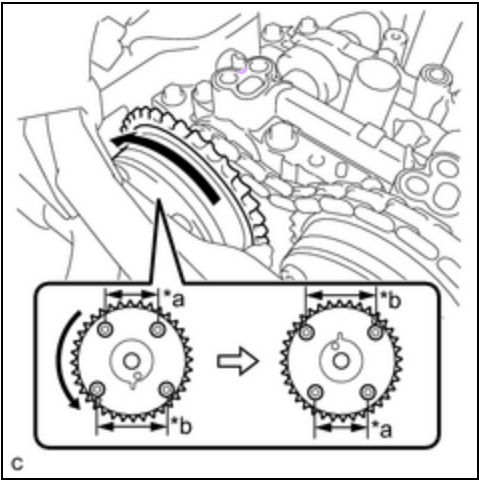
*a	Narrow
*b	Wide



(c) Turn the camshaft timing gear approximately 180° counterclockwise.

Text in Illustration

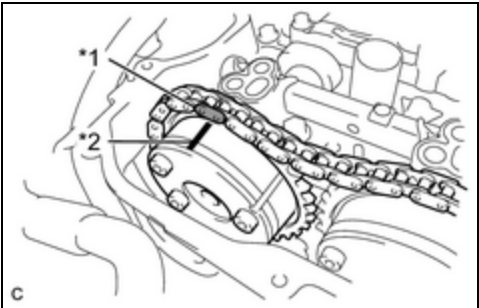
*a	Narrow
*b	Wide



(d) Align the paint mark with the matchmark to install the chain.

Text in Illustration

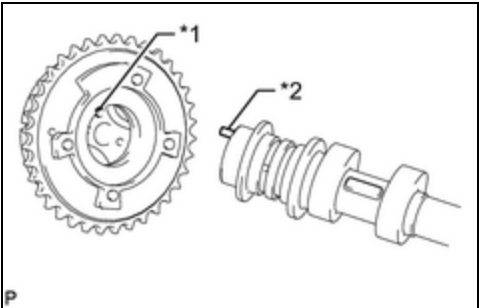
*1	Paint Mark
*2	Matchmark



(e) Align and attach the knock pin of the No. 1 camshaft with the pin hole of the camshaft timing gear.

Text in Illustration

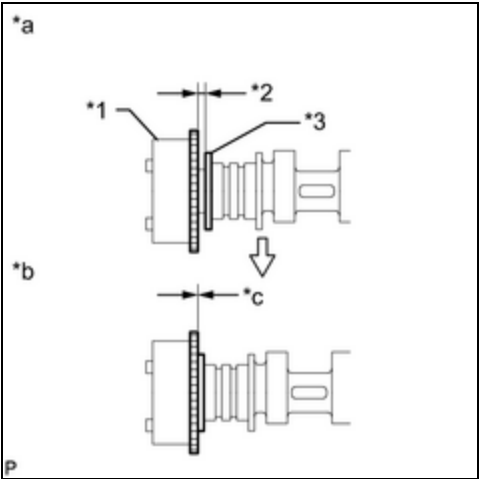
*1	Knock Pin Hole
*2	Knock Pin



(f) Check that there is no clearance between the camshaft timing gear and camshaft flange.

Text in Illustration

*1	Camshaft Timing Gear
*2	Clearance
*3	Camshaft Flange
*a	INCORRECT
*b	CORRECT
*c	No Clearance



(g) Secure the camshaft in place by hand, and then install the installation bolt of the camshaft timing gear by hand.

**NOTICE:**

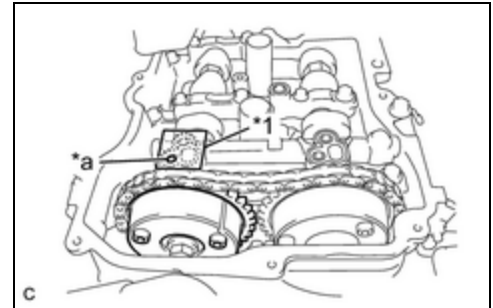
Do not use any tools to install the bolt. If the bolt is installed using a tool, the lock pin will be damaged.

(h) If the lock pin has not been released, release it.

- (1) After cleaning and degreasing the intake side VVT oil hole on the No. 1 camshaft bearing cap, completely seal the oil hole with adhesive tape or equivalent as shown in the illustration to prevent air from leaking.

**Text in Illustration**

*1	Adhesive Tape Sealing Area
*a	Make a Hole

**NOTICE:**

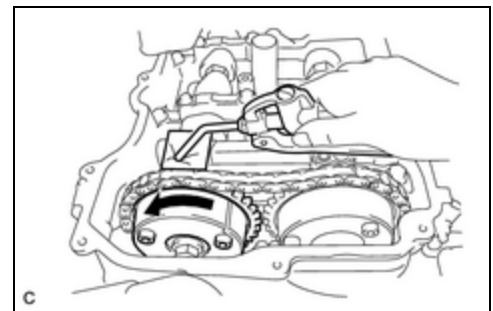
Be sure to seal the oil hole completely because air leaks due to insufficient sealing will prevent the lock pin from being released.

- (2) Make a hole in the adhesive tape covering the oil hole as shown in the illustration. (Procedure A)

- (3) Apply approximately 200 kPa (2.0 kgf/ cm<sup>2</sup> , 29 psi) of air pressure to the hole made in procedure A to release the lock pin.

**NOTICE:**

- If air leaks out, reattach the adhesive tape.
- Cover the oil hole with a piece of cloth when applying air pressure to prevent oil from spraying.



- (4) Forcibly turn the camshaft timing gear in the advance direction (counterclockwise).

**HINT:**

Depending on the air pressure applied, the camshaft timing gear may turn in the advance direction without assistance by hand.

- (5) Remove the adhesive tape from the No. 1 camshaft bearing cap.

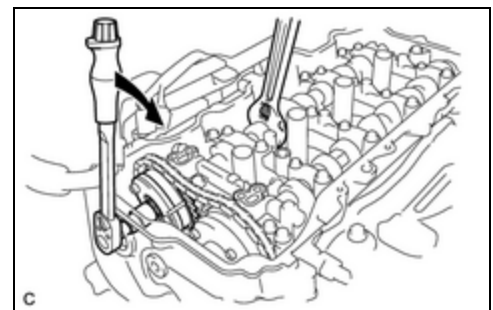
- (i) Using a wrench to hold the hexagonal portion of the No. 1 camshaft, install the bolt.

**Torque:**

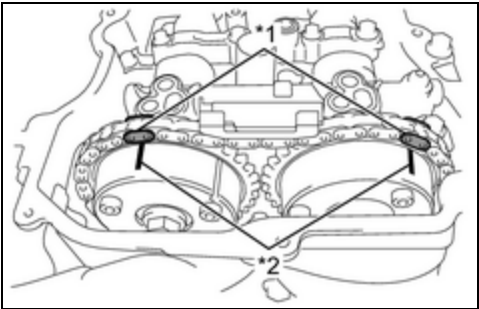
**85 N·m {867 kgf·cm, 63ft·lbf}**

**NOTICE:**

Be careful not to damage the cylinder head or spark plug tube with the wrench.



- (j) Check that each matchmark of the camshaft timing gear and camshaft timing exhaust gear are aligned with each matchmark located as shown in the illustration.



**Text in Illustration**

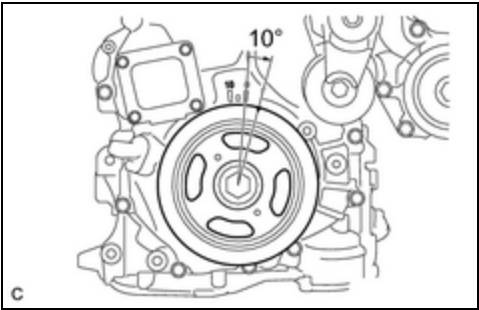
*1	Paint Mark
*2	Matchmark

**10. ADD ENGINE OIL** INFO

**11. INSTALL TIMING CHAIN GUIDE** INFO

**12. INSTALL NO. 1 CHAIN TENSIONER ASSEMBLY**

- (a) Turn the crankshaft approximately 10° clockwise.



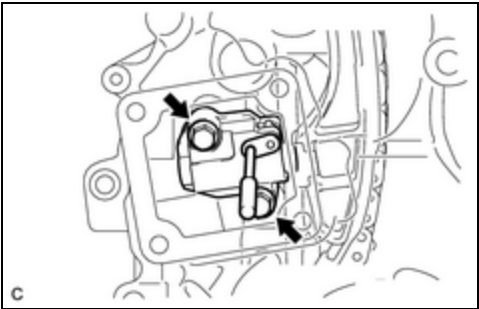
- (b) Install a new gasket and the chain tensioner with the 2 bolts.

**Torque:**

**10 N·m {102 kgf·cm, 7ft·lbf}**

**NOTICE:**

Make sure not to drop the gasket inside the timing chain cover.



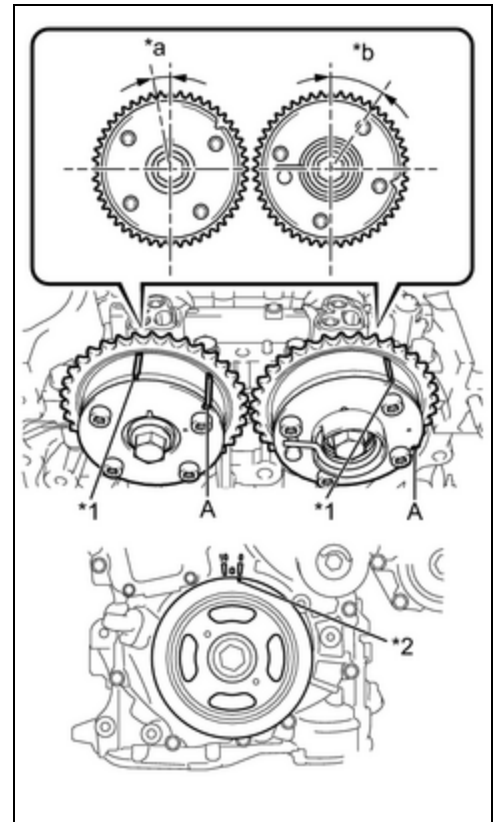
- (c) Remove the pin from the stopper plate.

**13. CHECK NO. 1 CYLINDER TO TDC/COMPRESSION**

- (a) Turn the crankshaft pulley until its timing notch (groove) and the timing mark "0" of the timing chain cover are aligned.

#### Text in Illustration

*1	Timing Mark
*2	Timing Notch
*a	Approximately 7°
*b	Approximately 32°



- (b) Check that the timing marks of the camshaft timing gears are as shown in the illustration. If not, turn the crankshaft 1 revolution (360°) to align the timing marks as shown in the illustration.

#### HINT:

"A" is not a timing mark.

### 14. INSTALL TIMING CHAIN COVER PLATE

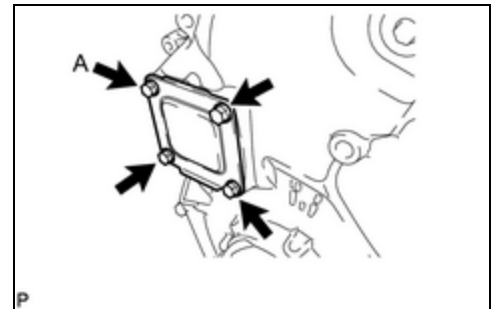
- (a) Install a new gasket and the timing chain cover plate with the 4 bolts.

#### Torque:

**10 N·m {102 kgf·cm, 7ft·lbf}**

#### NOTICE:

Using a 10 mm union nut wrench, tighten the A bolt. Use the torque value compensation formula to calculate the torque value for use when a torque wrench is combined with a tool such as a union nut wrench [INFO](#).



### 15. INSTALL TIMING CHAIN COVER TIGHT PLUG [INFO](#)

### 16. INSTALL CRANKSHAFT POSITION SENSOR [INFO](#)

### 17. INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY [INFO](#)

### 18. INSTALL IGNITION COIL ASSEMBLY [INFO](#)

### 19. INSTALL ENGINE WIRE



- (a) Connect the connectors and clamps, and install the engine wire to the engine with the bolts and nuts.

**Torque:**

**Nut A -**

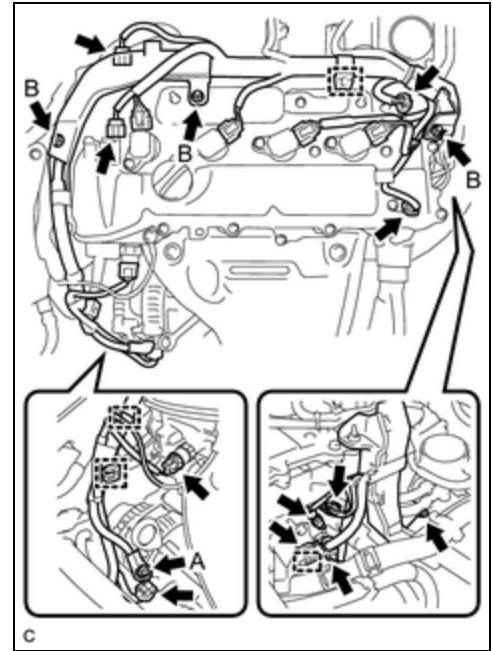
**9.8 N·m {100 kgf·cm, 87in·lbf}**

**Nut B -**

**10 N·m {102 kgf·cm, 7ft·lbf}**

**Bolt -**

**10 N·m {102 kgf·cm, 7ft·lbf}**



**20. INSTALL AIR CLEANER CASE**

[INFO](#)

**21. INSTALL AIR CLEANER ASSEMBLY**

[INFO](#)

**22. CONNECT CABLE TO NEGATIVE BATTERY TERMINAL**

**23. INSPECT FOR OIL LEAK**

**24. INSTALL NO.1 ENGINE COVER SUB-ASSEMBLY**

[INFO](#)

**25. INSTALL ENGINE UNDER COVER REAR RH**

[INFO](#)

**26. INSTALL FRONT WHEEL RH**

